

FCC & Industry Canada Certification Test Report
For the
Cervis, Inc.
LOBSRF304 Module

FCC ID: LOBSRF304
IC: 7955A-SRF304

WLL JOB# 11992-01 Rev 1
June 17, 2011
Re-issued June 22, 2011

Prepared for:

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

Prepared By:

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



Testing Certificate AT-1448

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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 Direct Sequence Spread Spectrum Transmitter under Part 15.247 (10/2009) of the FCC Rules and Regulations and Spectrum Management and Telecommunications Policy RSS-210 issue 8 of Industry Canada. This Certification Test Report documents the test configuration and test results for the Cervis, Inc. LOBSRF304 Module.

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

The Cervis, Inc. LOBSRF304 Module complies with the limits for a Direct Sequence Spread Spectrum Transmitter under FCC Part 15.247 and Industry Canada RSS-210.

Revision History	Description of Change	Date
Rev 0	Initial Release	June 17, 2011
Rev 1	Correct Table 1 and Figure 19	June 22, 2011

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1 Introduction

1.1 Compliance Statement

The Cervis, Inc. LOBSRF304 Module complies with the limits for a Direct Sequence Spread Spectrum Transmitter device under FCC Part 15.247 (10/2009) and Industry Canada RSS-210 issue 8.

1.2 Test Scope

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

1.3 Contract Information

Customer:	Cervis, Inc. 170 Thorn Hill Road, Warrendale, PA, 15086 USA
Purchase Order Number:	55327
Quotation Number:	66139A

1.4 Test Dates

Testing was performed on the following date(s):	6/3/2011 to 6/14/2011
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1.5 Test and Support Personnel

Washington Laboratories, LTD	James Ritter
Client Representative	John Rose, Anthony Di Tommaso

1.6 Abbreviations

A	A mpere
ac	a lternating current
AM	A mplitude Modulation
Amps	A mperes
b/s	b its per second
BW	B and W idth
CE	C onducted E mission
cm	c ent m eter
CW	C ontinuous W ave
dB	d eci B el
dc	d irect current
EMI	E lectromagnetic 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 LOBSRF304 is a low power 906-924MHz Zigbee transceiver module for use in various Cervis host units.

Table 1: Device Summary

ITEM	DESCRIPTION
Manufacturer:	Cervis, Inc.
FCC ID:	LOBSRF304
IC:	7955A-SRF304
Model:	LOBSRF304
FCC Rule Parts:	§15.247
Industry Canada:	RSS210 issue 8
Frequency Range:	906 - 924MHz
Maximum Output Power:	9.66 dBm (9.25mW)
Modulation:	DSSS(BPSK, O-QPSK)
Occupied Bandwidth:	696.3kHz
Maximum Spurious TX:	445.6uV/m, 3696MHz @ 3m, TX @ 924MHz w/ 2dBi whip antenna
Maximum Spurious RX:	60.2uV/m, 80.03MHz @ 3m
Emission Designator:	696KG1D
Keying:	Automatic
Type of Information:	Data
Number of Channels:	10
Antenna Connector	Ultra-small SMT for whip antenna
Antenna Type	1.44dBi ant-916-SP integral splatch antenna or 2dBi Nearson model 467 whip antenna
Power Output Level	Fixed by Manufacturer
Interface Cables:	None (plug- in board)
Power Source & Voltage:	12VDC

2.2 Test Configuration

The Cervis, Inc. LOBSRF304 Module, Equipment Under Test (EUT), was operated from a 12Vdc power supply via a test panel and BU-9H16AF Base unit (module attached to host base unit). Programming commands were sent via control knobs on the test panel to the EUT module (via the base unit).

2.3 Testing Algorithm

The LOBSRF304 Module was programmed for DSSS operation via control knobs on a customer provided test panel to the EUT module (via the base unit). These commands allowed the EUT to operate at maximum power on the low, center, and high operating channels.

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

2.4 Test Location

All measurements herein were performed at Washington Laboratories, Ltd. test center in Gaithersburg, MD. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. The Industry Canada OATS numbers are 3035A-1 and 3035A-2 for Washington Laboratories, Ltd. Site 1 and Site 2, respectively. Washington Laboratories, Ltd. has been accepted by the FCC and approved by ACLASS under Certificate AT-1448 as an independent FCC test laboratory.

2.5 Measurements

2.5.1 References

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

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

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

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

2.6 Measurement Uncertainty

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

Equation 1: Standard Uncertainty

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

Where u_c = standard uncertainty

$a, b, c, \dots$ = 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

3 Test Equipment

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

Table 3: Test Equipment List

Test Name:	Bench Conducted RF Tests		
Asset #	Manufacturer/Model	Description	Cal. Due
618	HP – 8563A	ANALYZER SPECTRUM	8/1/2011

Test Name:	Radiated Emissions		
Asset #	Manufacturer/Model	Description	Cal. Due
528	AGILENT - E4446A	ANALYZER SPECTRUM	9/27/2011
627	AGILENT - 8449B	AMPLIFIER 1-26GHZ	5/4/2012
767	MEGAPHASE - EM18-NK5NK-600	LOW LOSS ARMORED CABLE DC-18GHZ N-N FACTORY FORMED RA	6/1/2012
337	WLL - 1.2-5GHZ	FILTER BAND PASS	3/24/2012
280	ITC - 21C-3A1	WAVEGUIDE 3.45-11.0GHZ	3/24/2012
282	ITC - 21X-3A1	WAVEGUIDE 6.8-15GHZ	3/24/2012
4	ARA - DRG-118/A	ANTENNA DRG 1-18GHZ	2/15/2013
644	SUNOL SCIENCES CORPORATION - JB1 925- 833-9936	BICONALOG ANTENNA	12/20/2011
68	HP - 85650A	ADAPTER QP	6/22/2011
72	HP - 8568B	ANALYZER SPECTRUM	6/22/2011
70	HP - 85685A	PRESELECTOR RF W/OPT 8ZE	6/22/2011

4 Test Results

4.1 Test Summary

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

Table 4: Test Summary

TX Test Summary (Direct Sequence Spread Spectrum)			
FCC Rule Part	IC Rule Part	Description	Result
15.247 (2)	RSS-210 [A8. 2 (a)]	6dB Bandwidth	Pass
15.247 (2)(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 Sect.2.2 RSS-Gen 7.2.2	General Field Strength Limits (Restricted Bands & RE Limits)	Pass
15.207	RSS-Gen 7.2.4	AC Conducted Emissions	N/A
RX/Digital Test Summary (Direct Sequence Spread Spectrum)			
FCC Rule Part	IC Rule Part	Description	Result
15.207	RSS-Gen 7.2.4	AC Conducted Emissions	N/A
15.209	RSS-210 sect 2.5	General Field Strength Limits	Pass

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

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

For Direct Sequence Spread Spectrum Systems, FCC Part 15.247 requires the minimum 6 dB bandwidth using a 100 kHz Resolution bandwidth be greater than 500 kHz.

Table 5 provides a summary of the Occupied Bandwidth Results.

Table 5: Occupied Bandwidth Results

Frequency	Bandwidth	Limit	Pass/Fail
Low Channel (1): 906MHz	674.7kHz	>500kHz	Pass
Mid Channel (5): 914MHz	683.0kHz	>500kHz	Pass
High Channel (10): 924MHz	696.3kHz	>500kHz	Pass

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

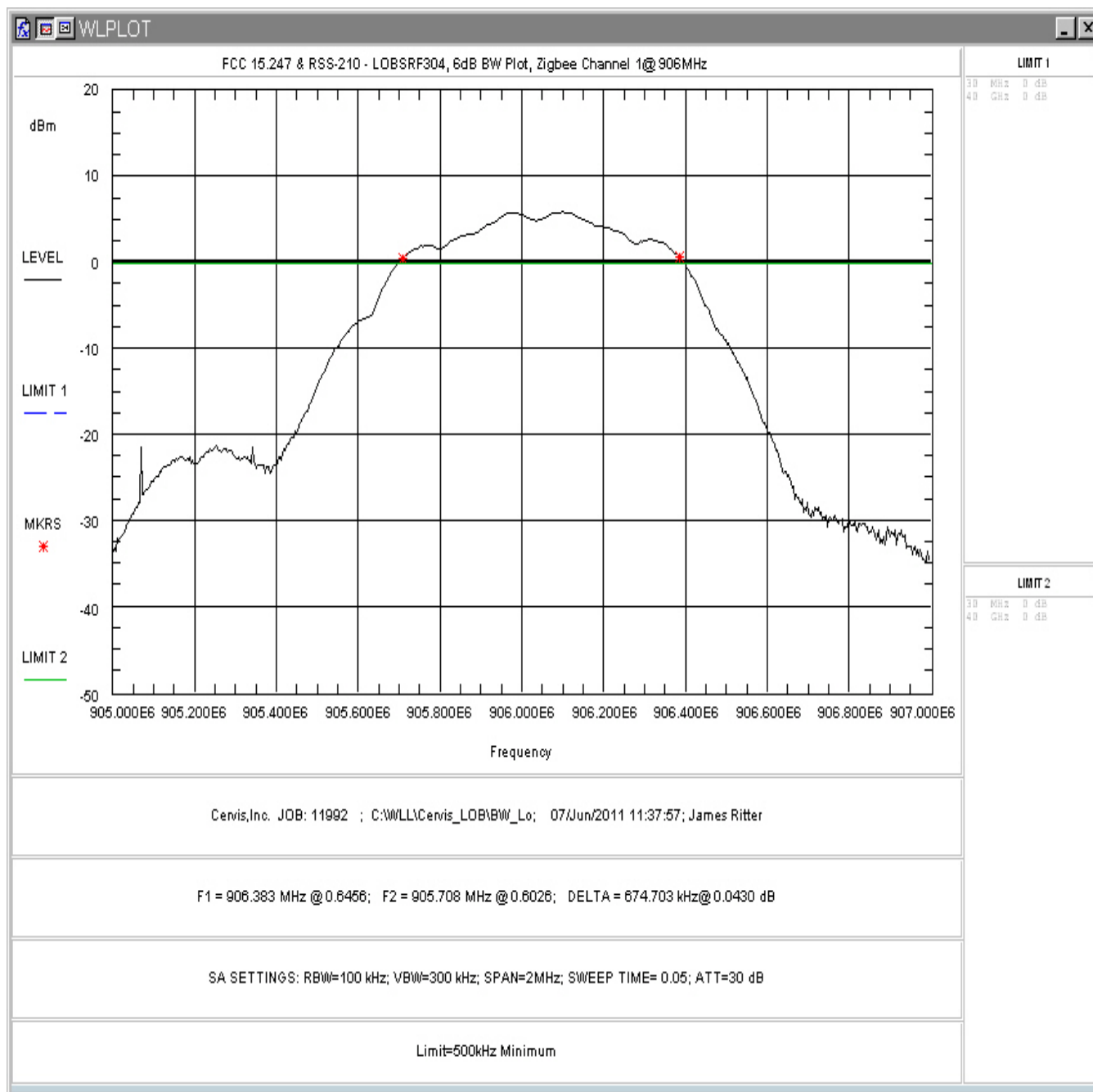


Figure 1: Occupied Bandwidth, Low Channel

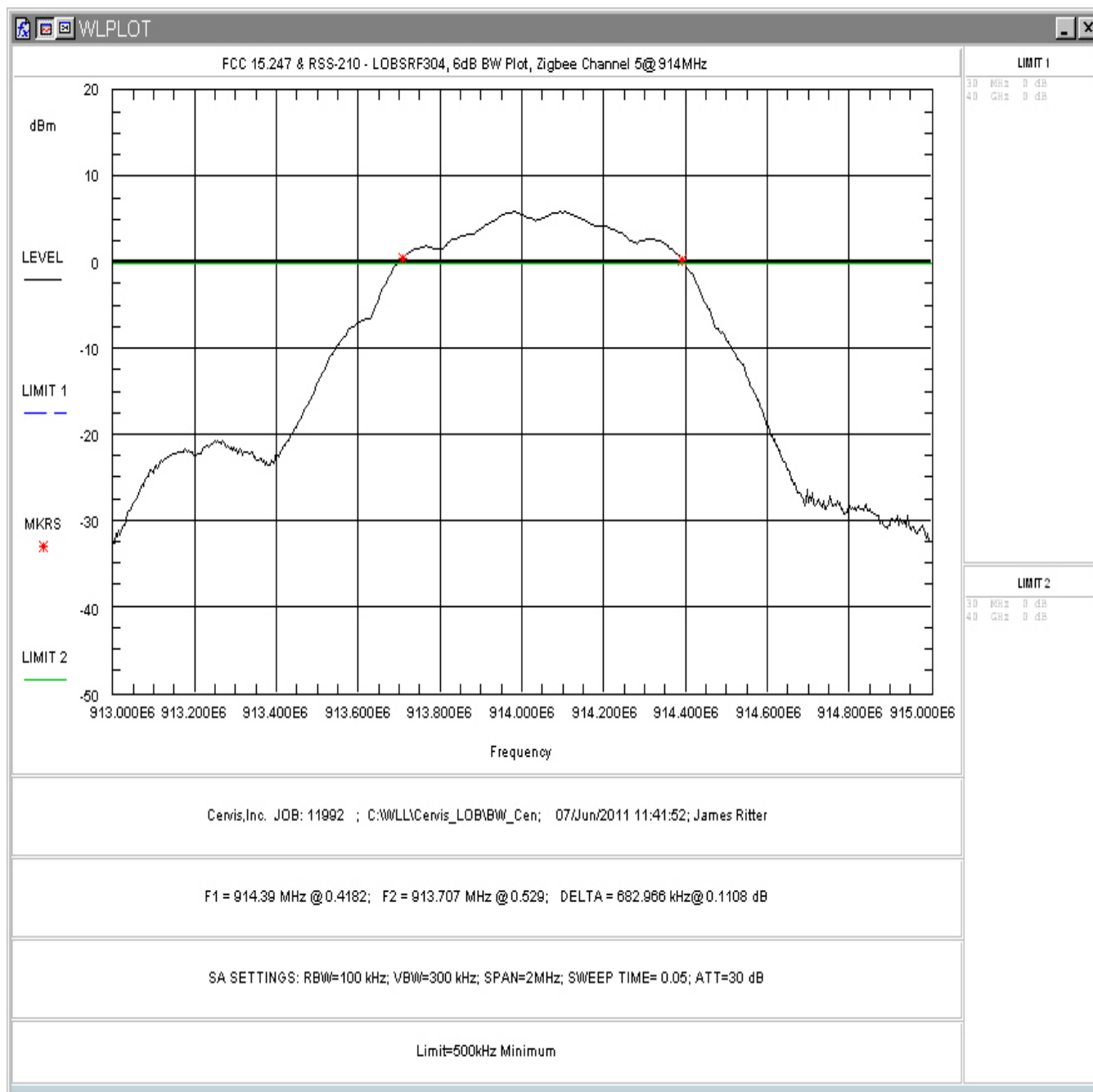


Figure 2: Occupied Bandwidth, Center Channel

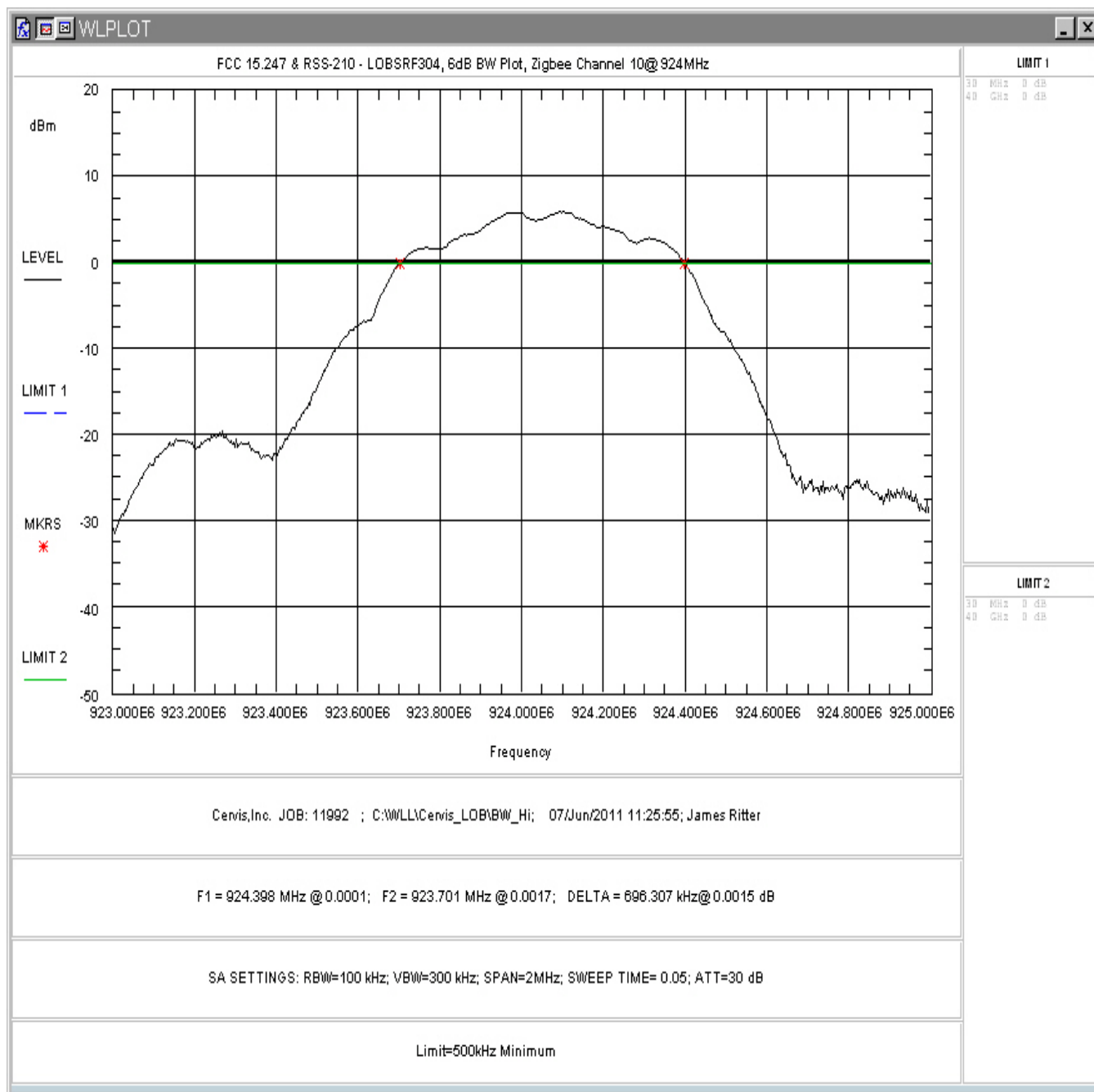


Figure 3: Occupied Bandwidth, High Channel

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

To measure the output power the modulation was started while the frequency dwelled on a low, center and high channels. The output from the transmitter was connected to an attenuator and then to the input of an RF spectrum analyzer. The analyzer offset was adjusted to compensate for the attenuator and other losses in the system. Peak Power was measured.

Table 6: RF Power Output

Frequency	Level	Limit	Pass/Fail
Low Channel (1): 906MHz	9.57dBm	30 dBm	Pass
Mid Channel (5): 914MHz	9.57dBm	30 dBm	Pass
High Channel (10): 924MHz	9.66dBm	30 dBm	Pass

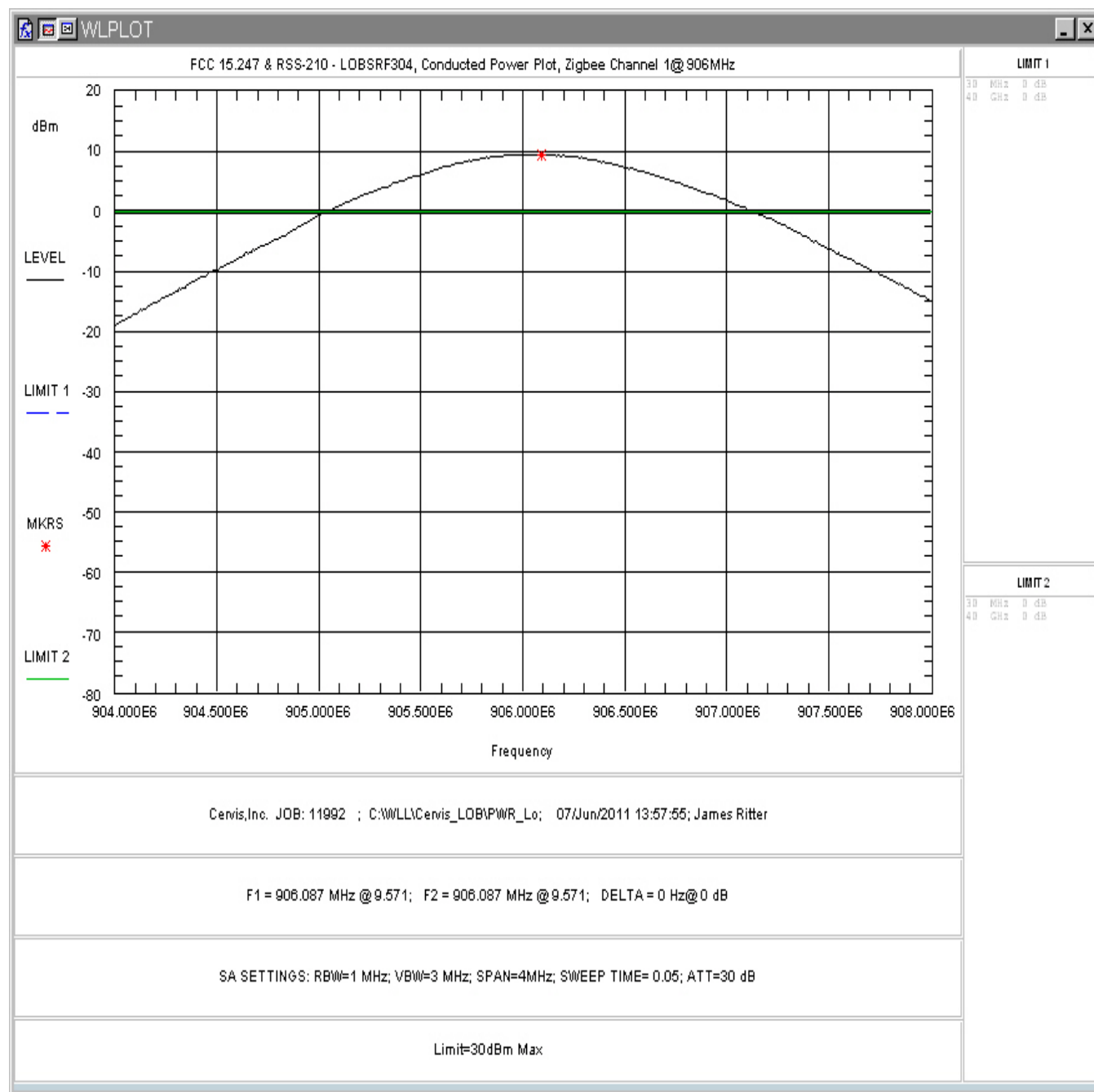


Figure 4: RF Peak Power, Low Channel

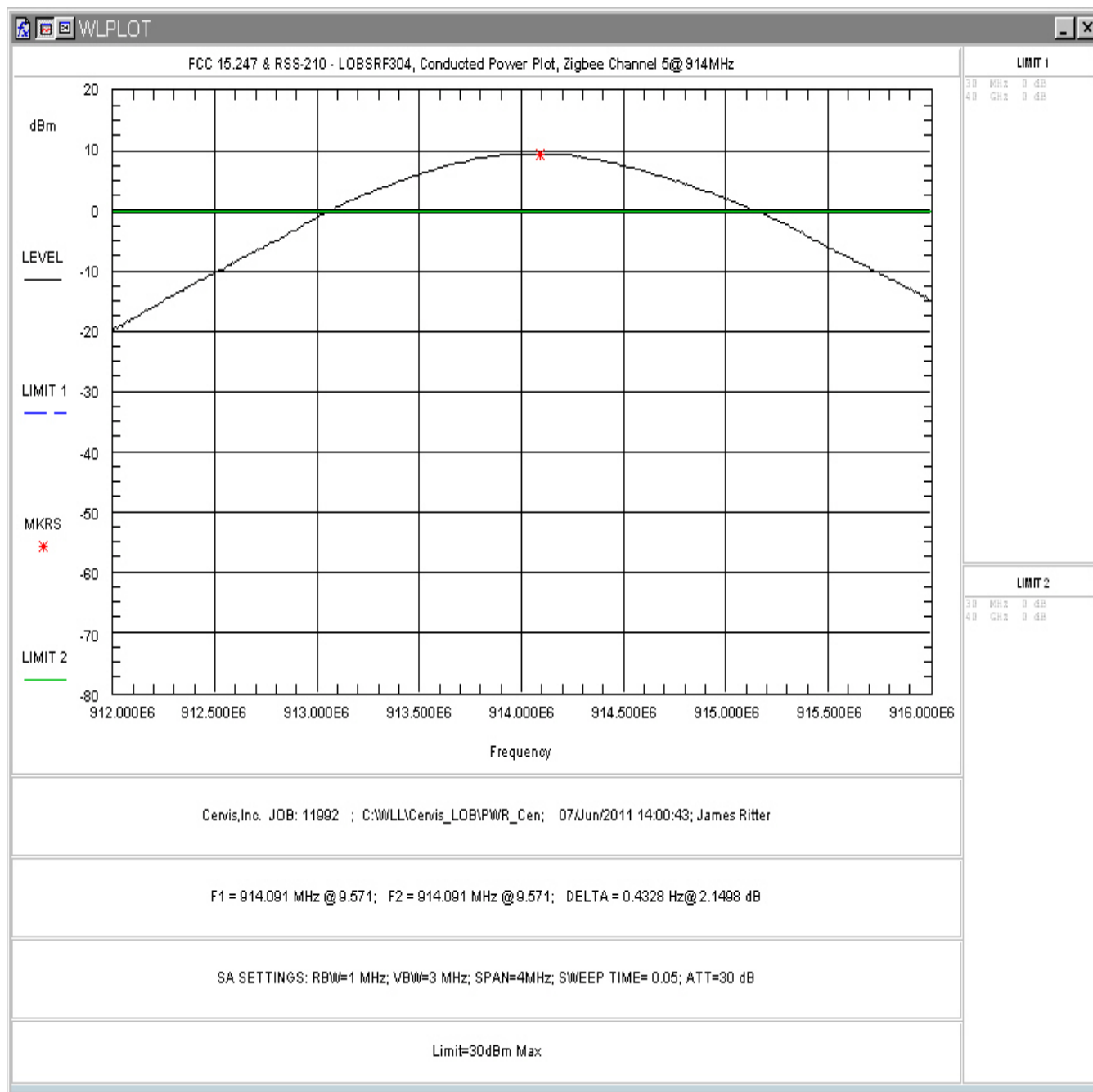


Figure 5: RF Peak Power, Center Channel

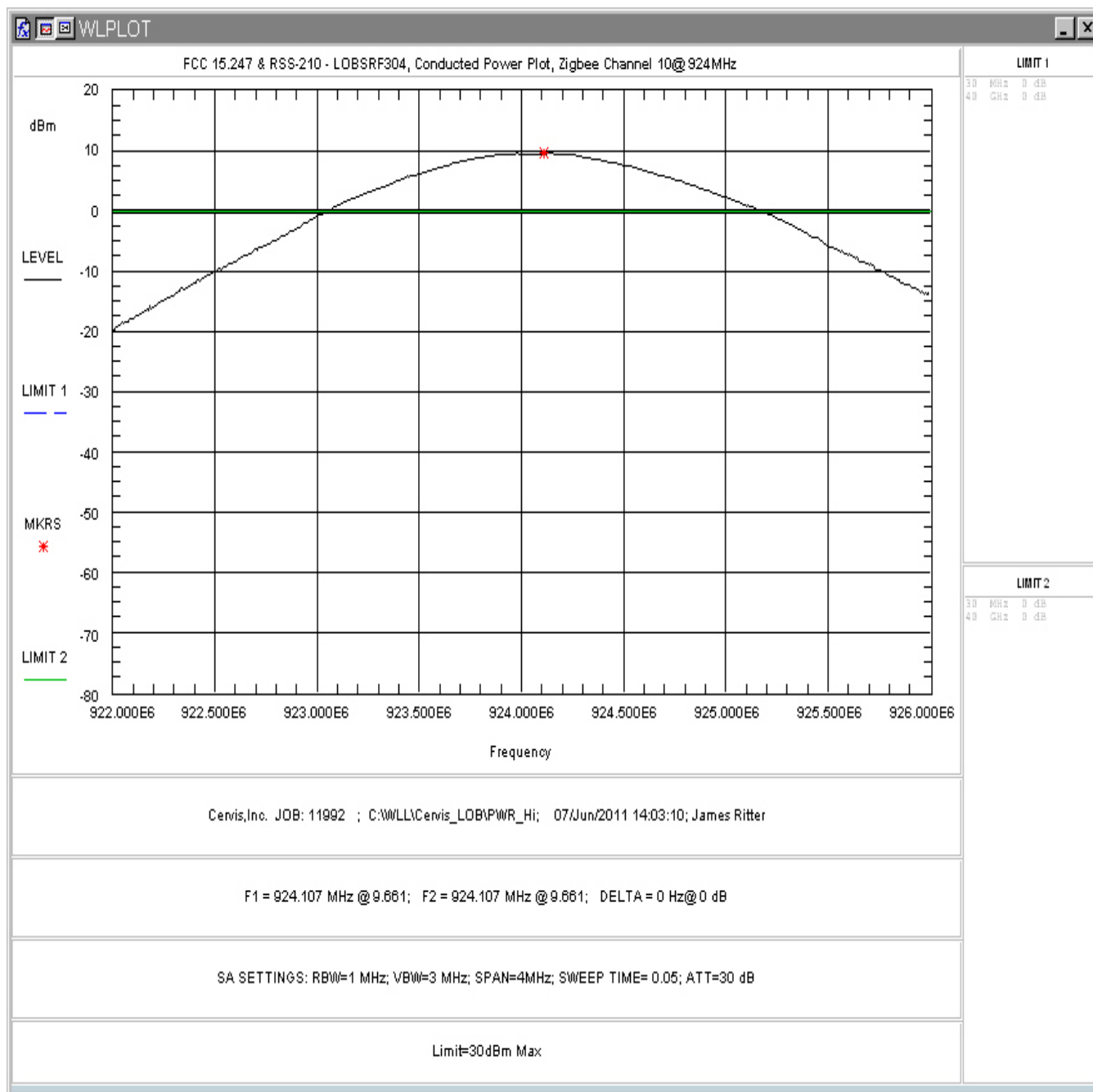


Figure 6: RF Peak Power, High Channel

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

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

The spectrum analyzer was set to peak detect mode with a RBW of 3kHz ,VBW of 10kHz across a 1.5MHz span using a 500 second sweep-time. The highest level detected across any 3kHz band for continuous transmission was then recorded and compared to the limit 8dBm. The following table and plots give the results for power spectral density testing.

Table 7: Power Spectral Density

Frequency	Peak Level	Limit	Pass/Fail
Low Channel (1): 906MHz	-1.43dBm	8 dBm	Pass
Mid Channel (5): 914MHz	-1.43dBm	8 dBm	Pass
High Channel (10): 924MHz	-1.43dBm	8 dBm	Pass

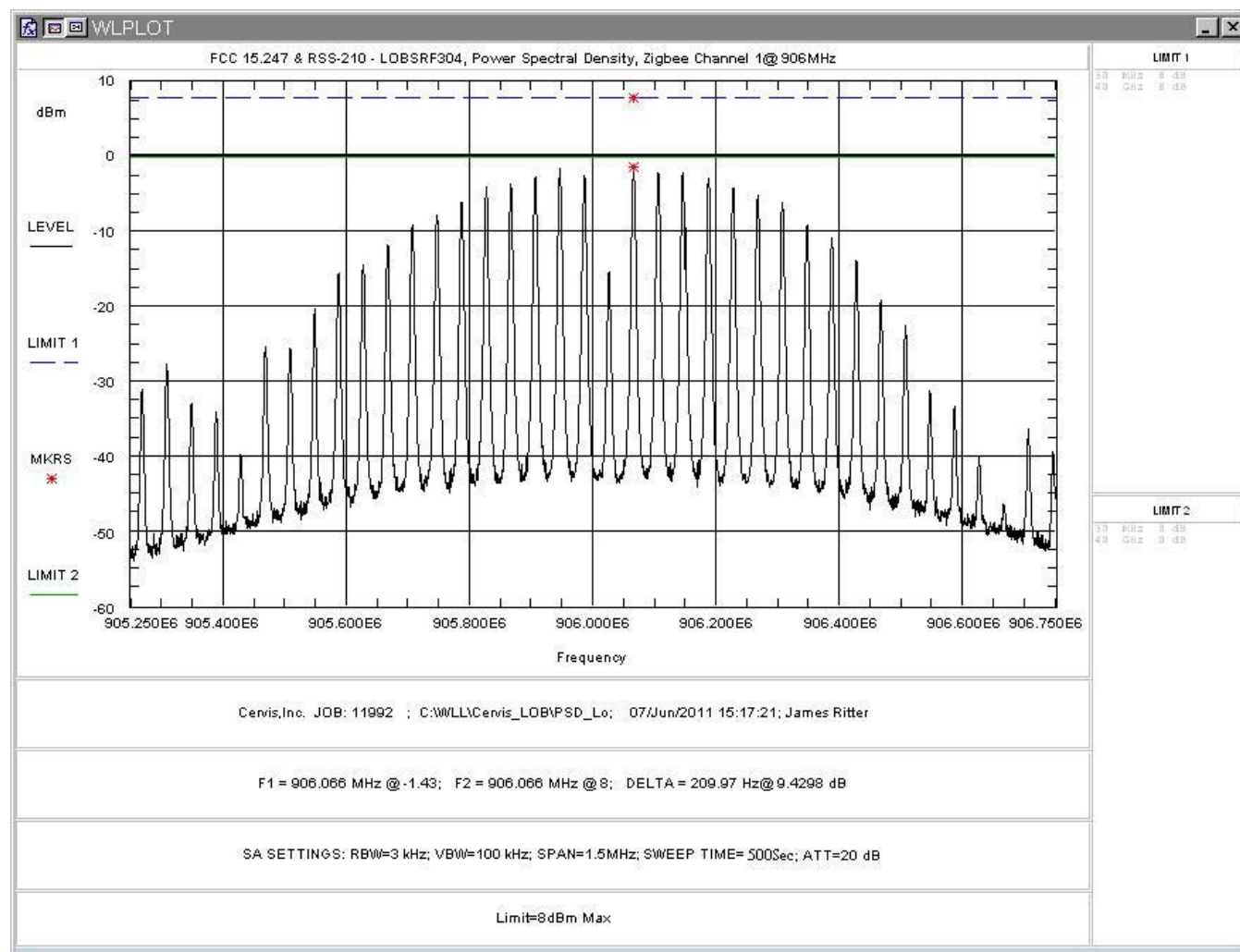


Figure 7: Power Spectral Density, Low Channel

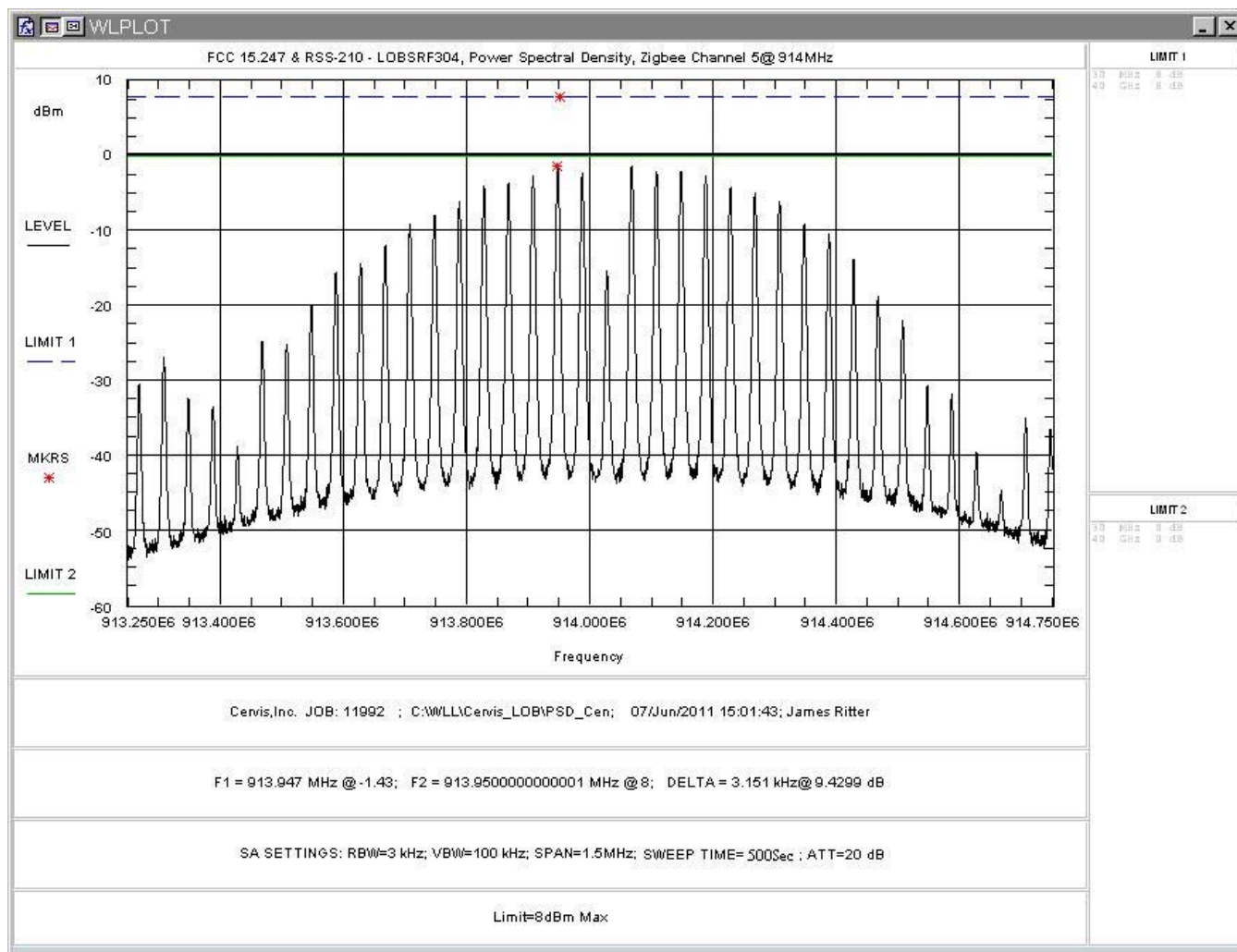


Figure 8: Power Spectral Density, Center Channel

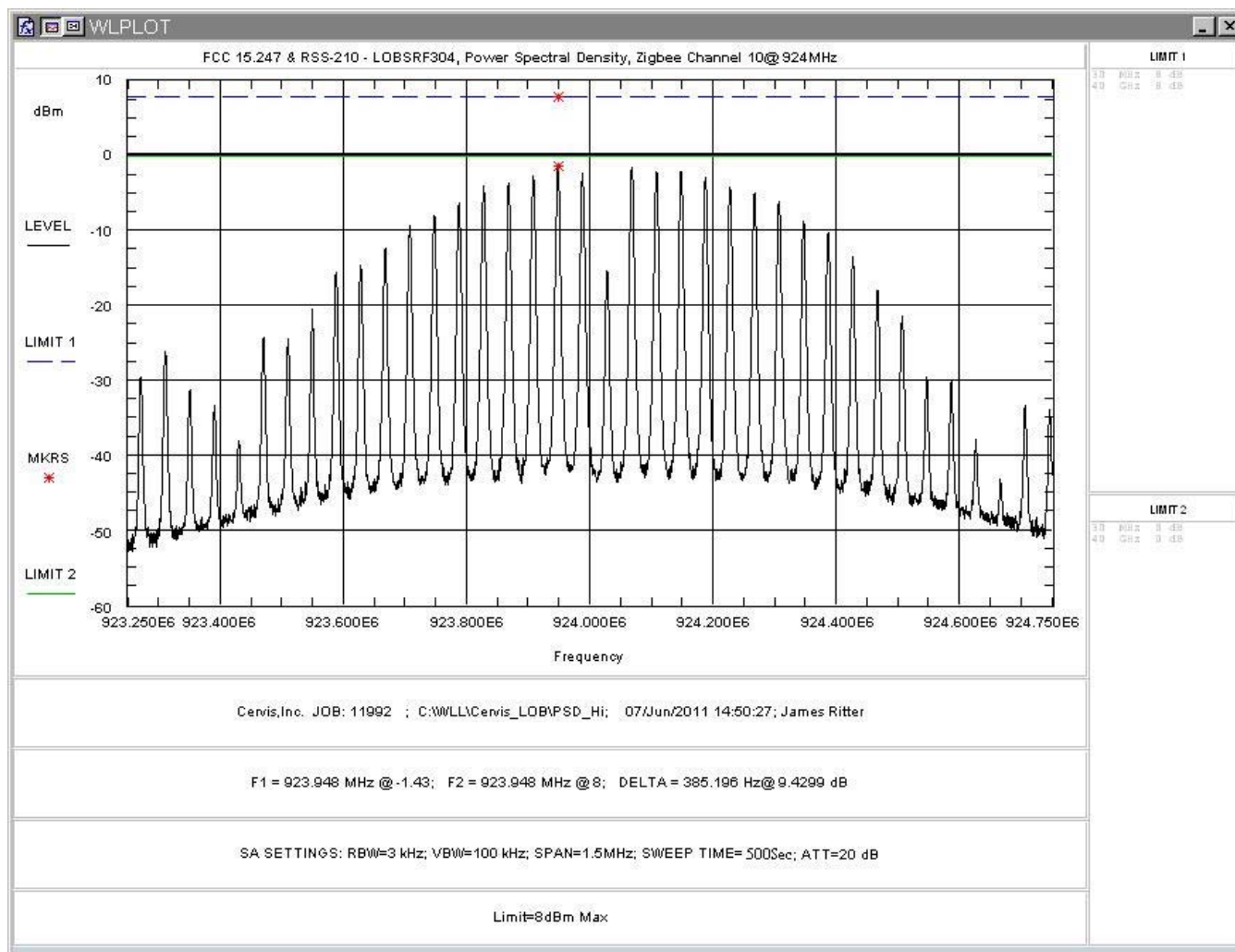


Figure 9: Power Spectral Density, High Channel

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

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

The EUT antenna was removed and the cable was connected directly into a spectrum analyzer through a 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 300 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.

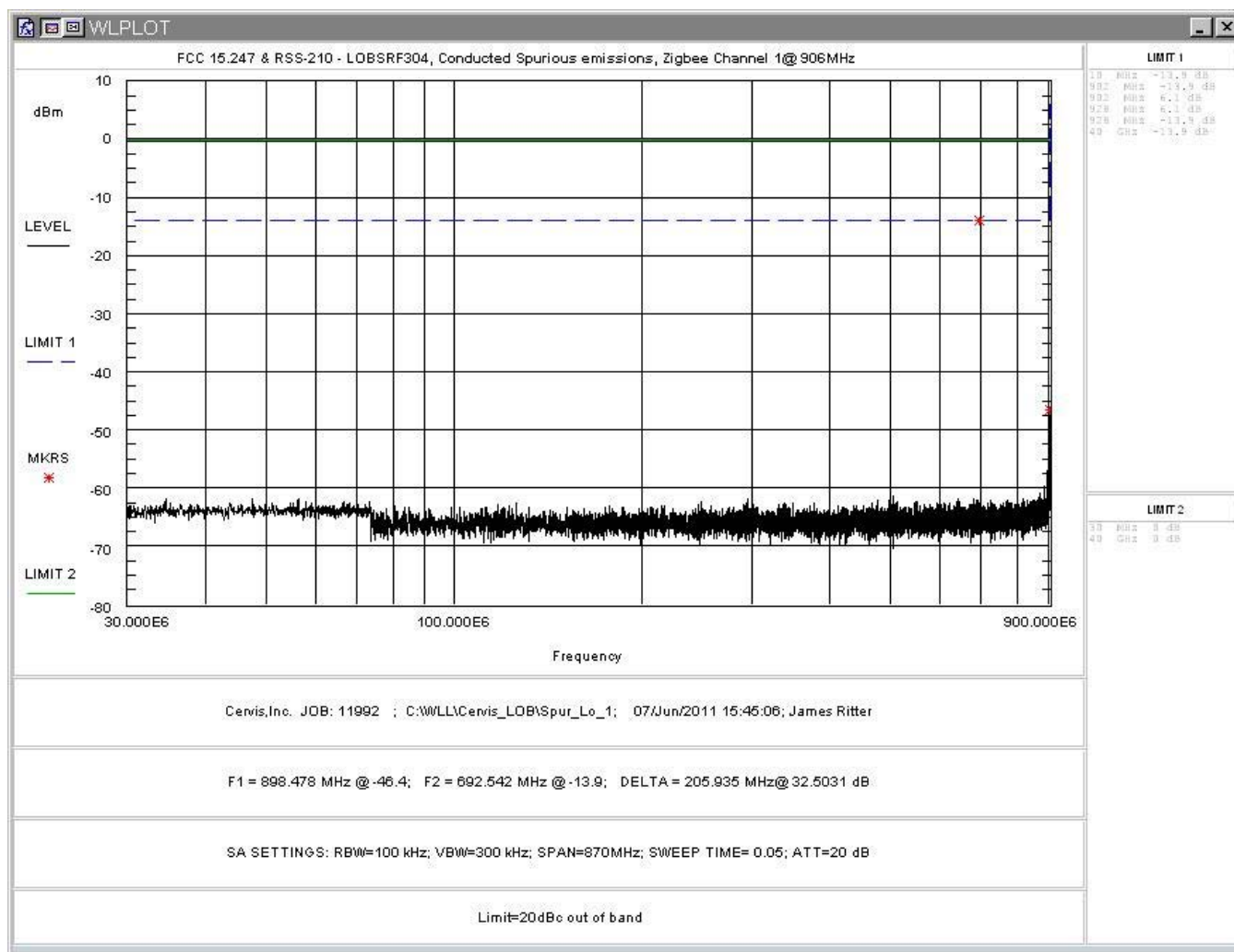


Figure 10: Conducted Spurious Emissions, Channel 1- 906MHz, 30 - 900MHz

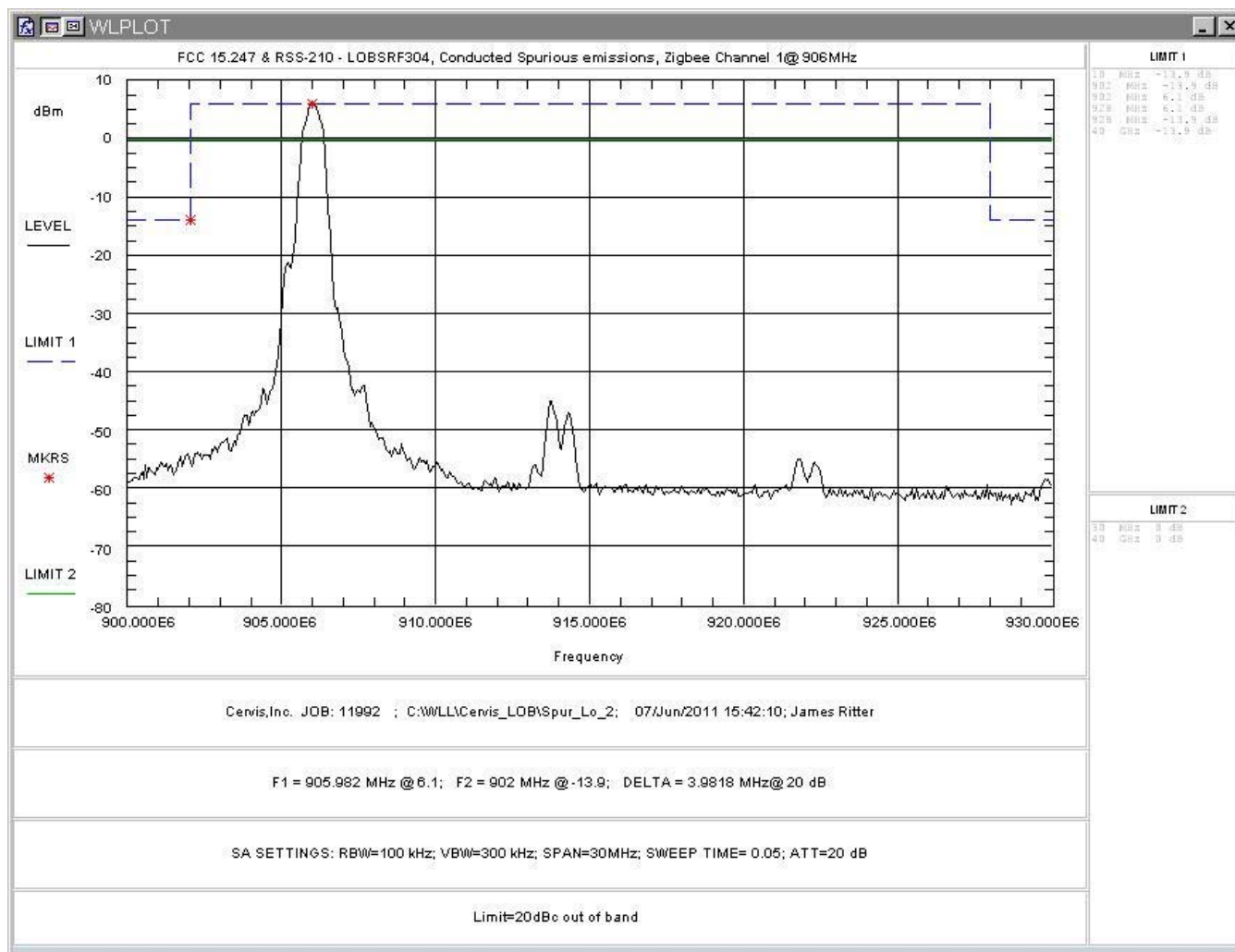


Figure 11: Conducted Spurious Emissions, Channel 1- 906MHz, 900 – 930MHz

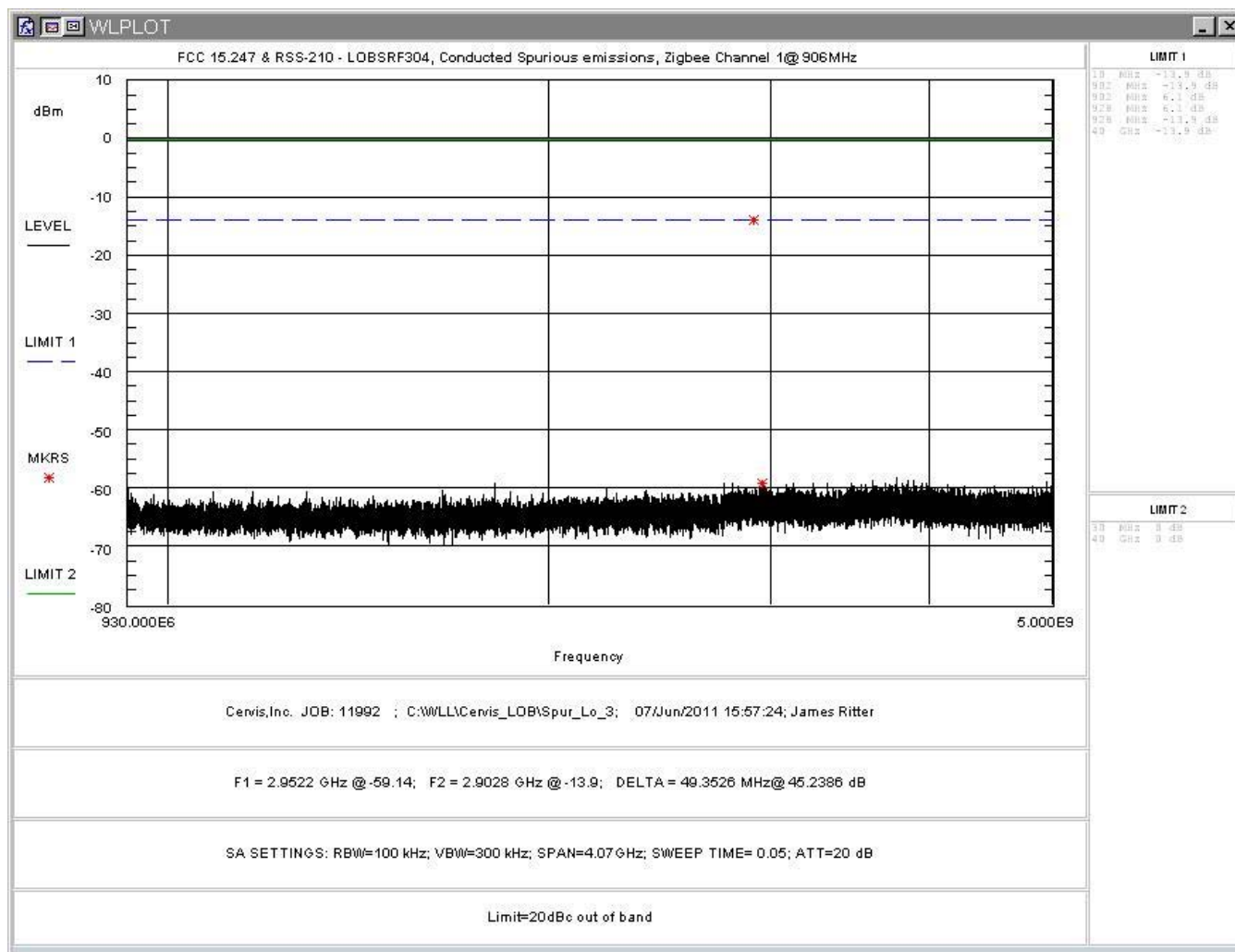


Figure 12: Conducted Spurious Emissions, Channel 1- 906MHz, 930MHz - 5GHz

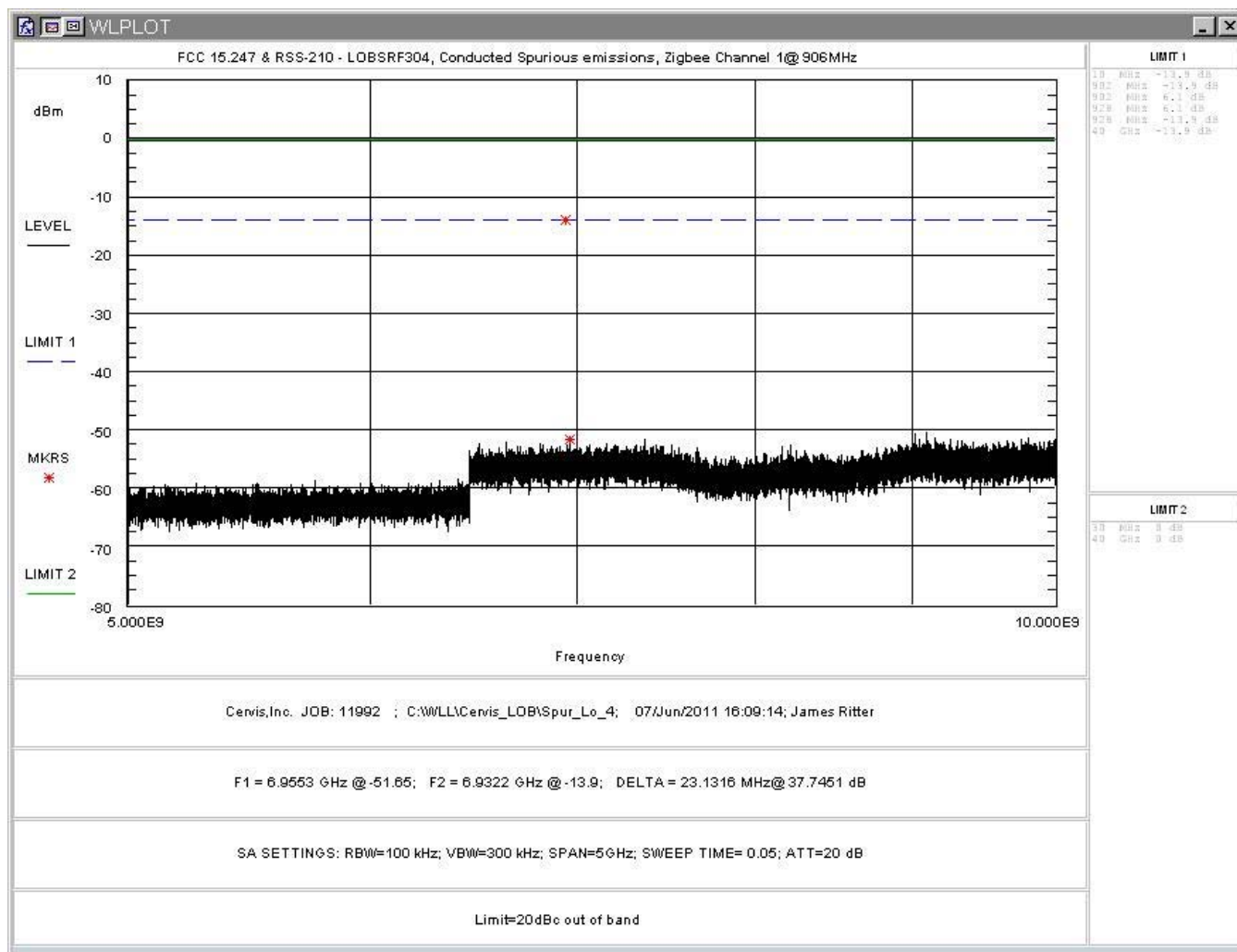


Figure 13: Conducted Spurious Emissions, Channel 1- 906MHz, 5 - 10GHz

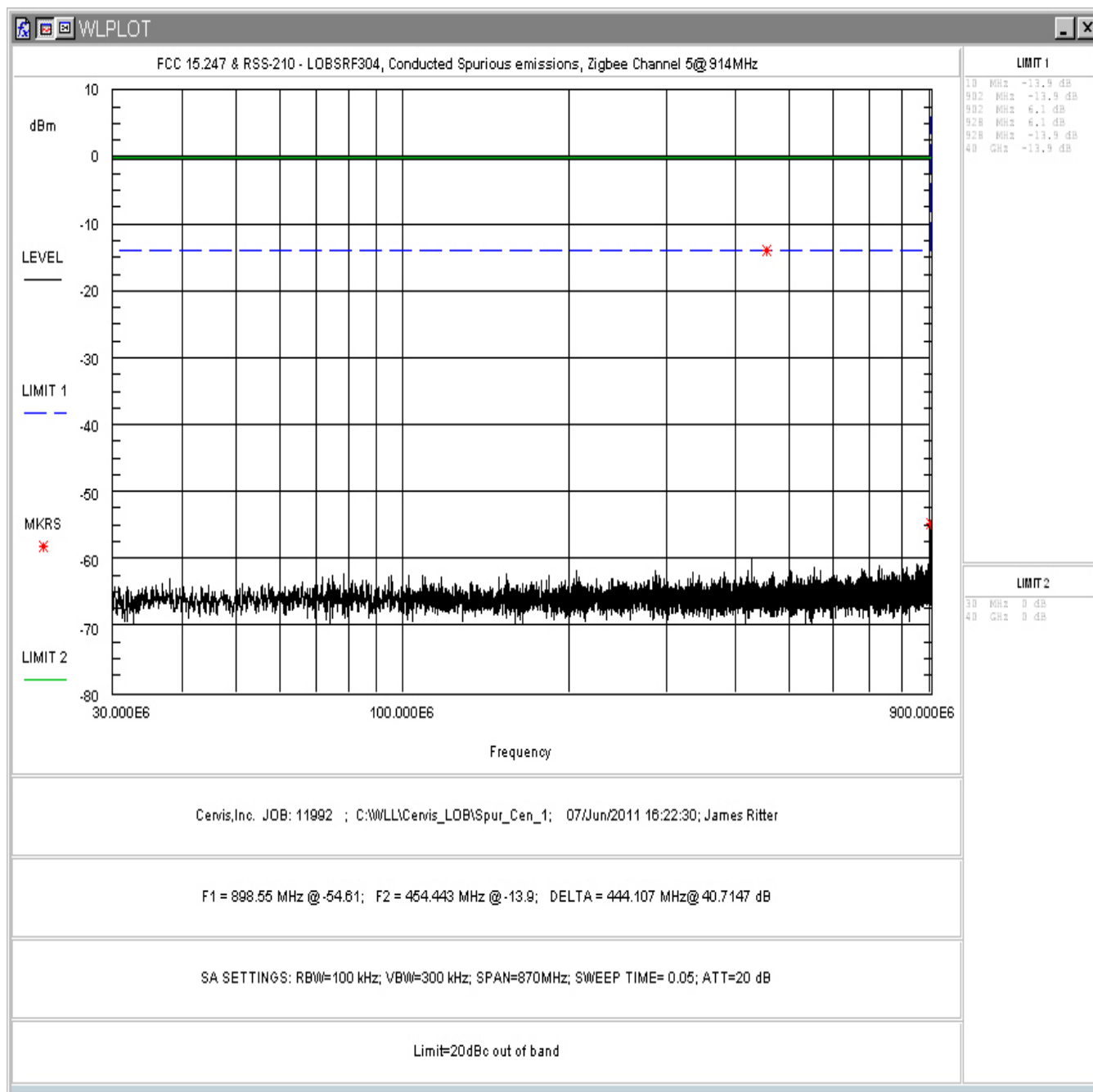


Figure 14: Conducted Spurious Emissions, Channel 5- 914MHz, 30 – 900MHz

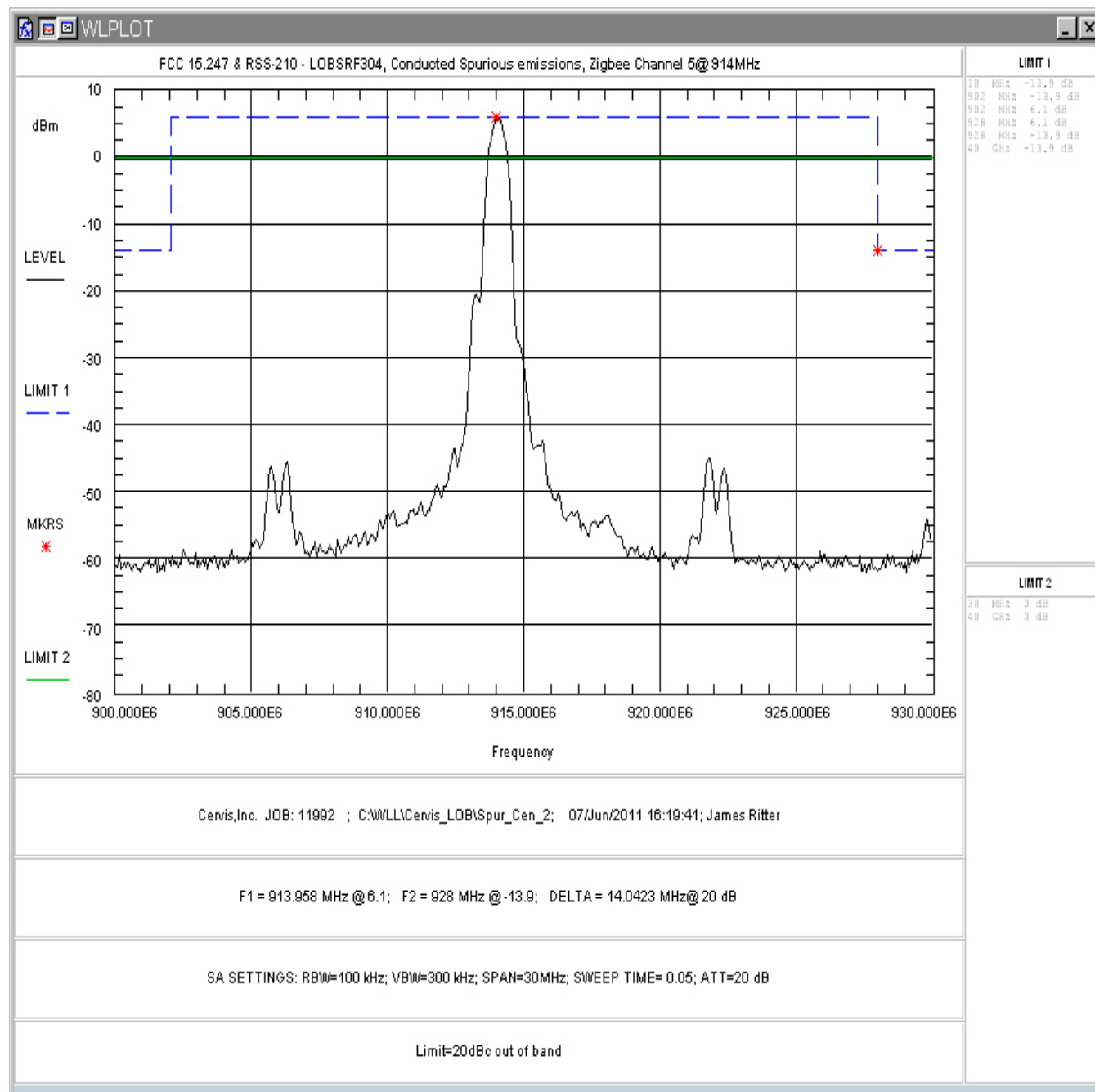


Figure 15: Conducted Spurious Emissions, Channel 5- 914MHz, 900-930MHz

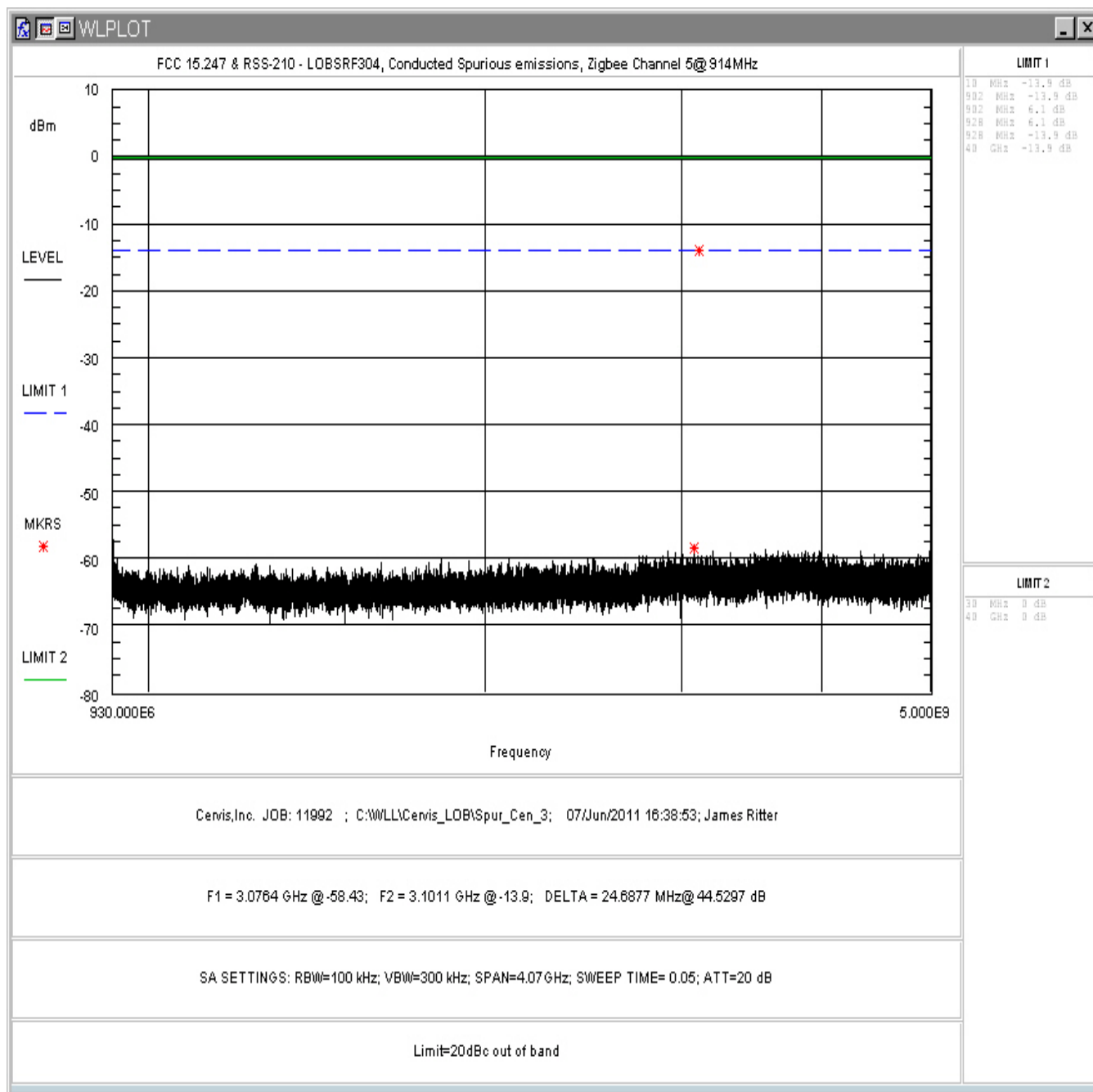


Figure 16: Conducted Spurious Emissions, Channel 5- 914MHz, 930MHz – 5GHz

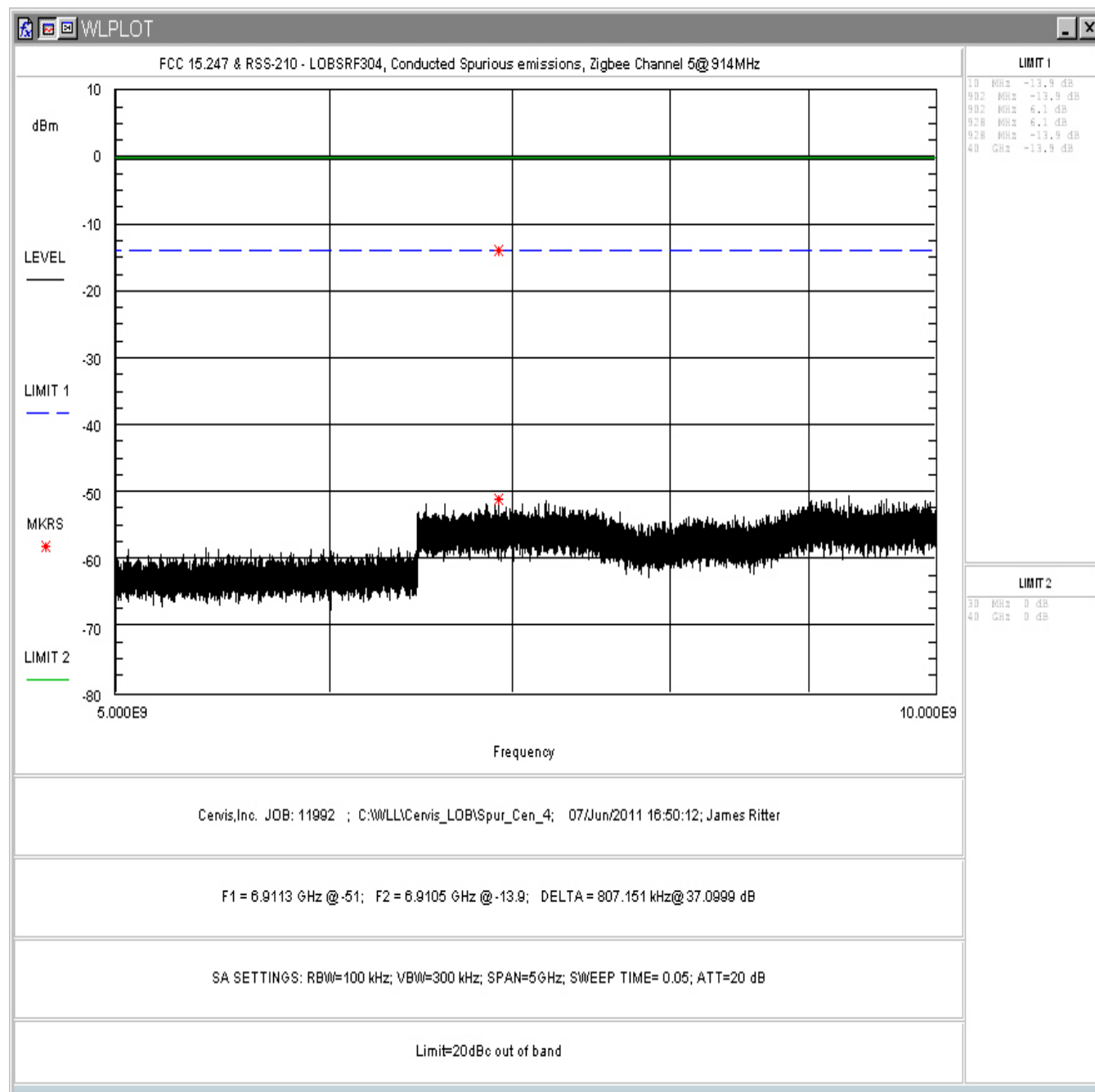


Figure 17: Conducted Spurious Emissions, Channel 5- 914MHz, 5 – 10GHz

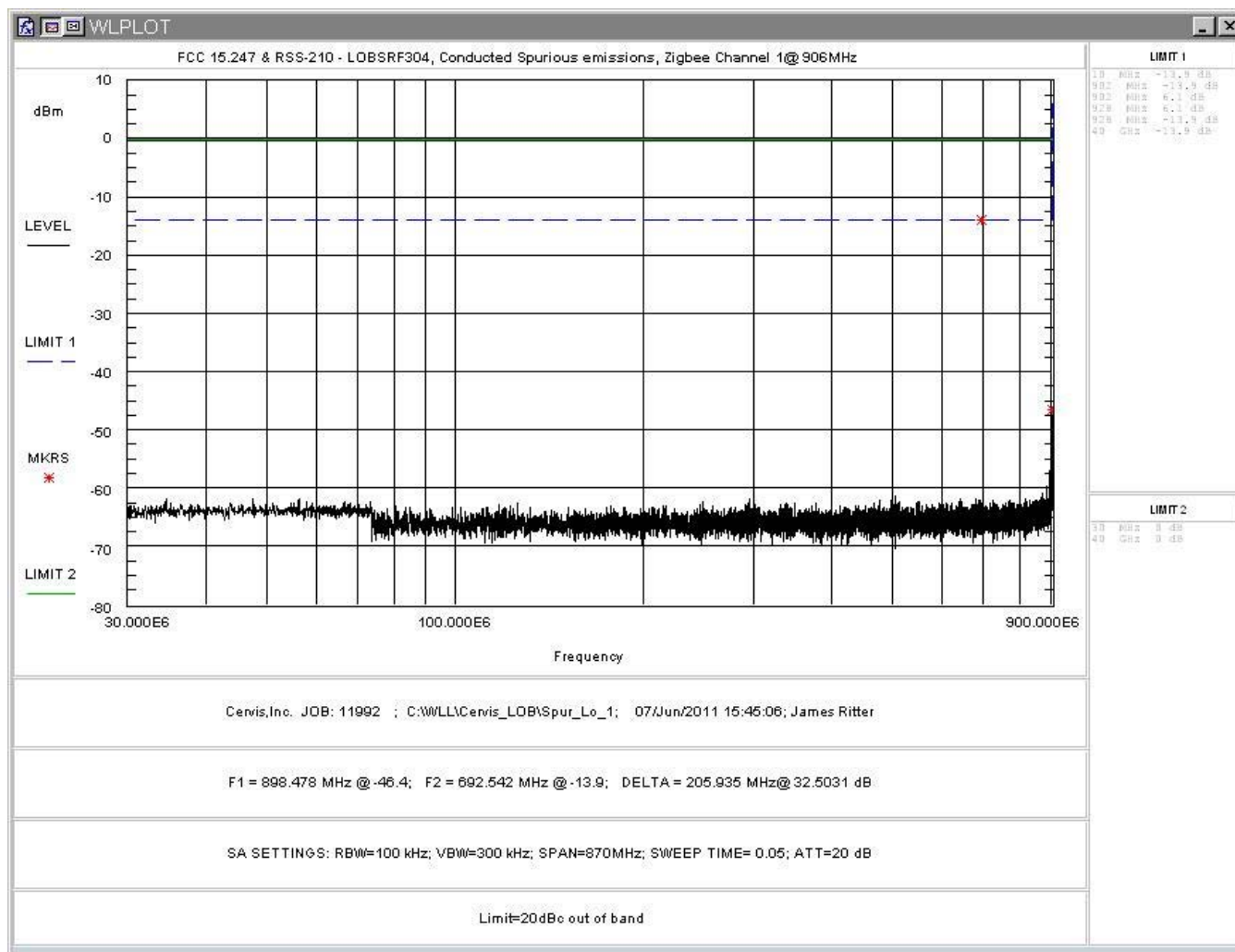


Figure 18: Conducted Spurious Emissions, Channel 10- 924MHz, 30 - 900MHz

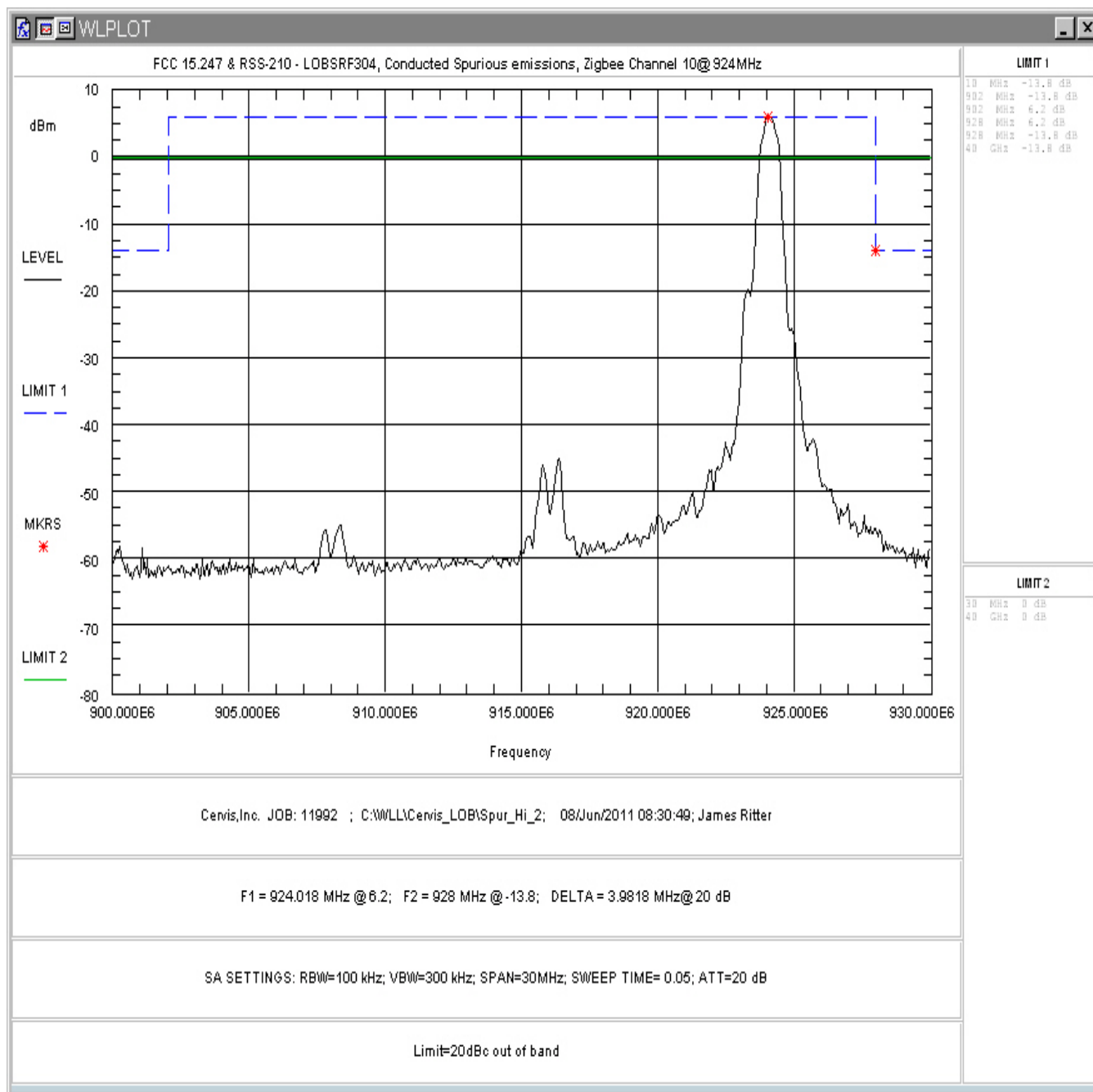


Figure 19: Conducted Spurious Emissions, Channel 10- 924MHz, 900 -930MHz

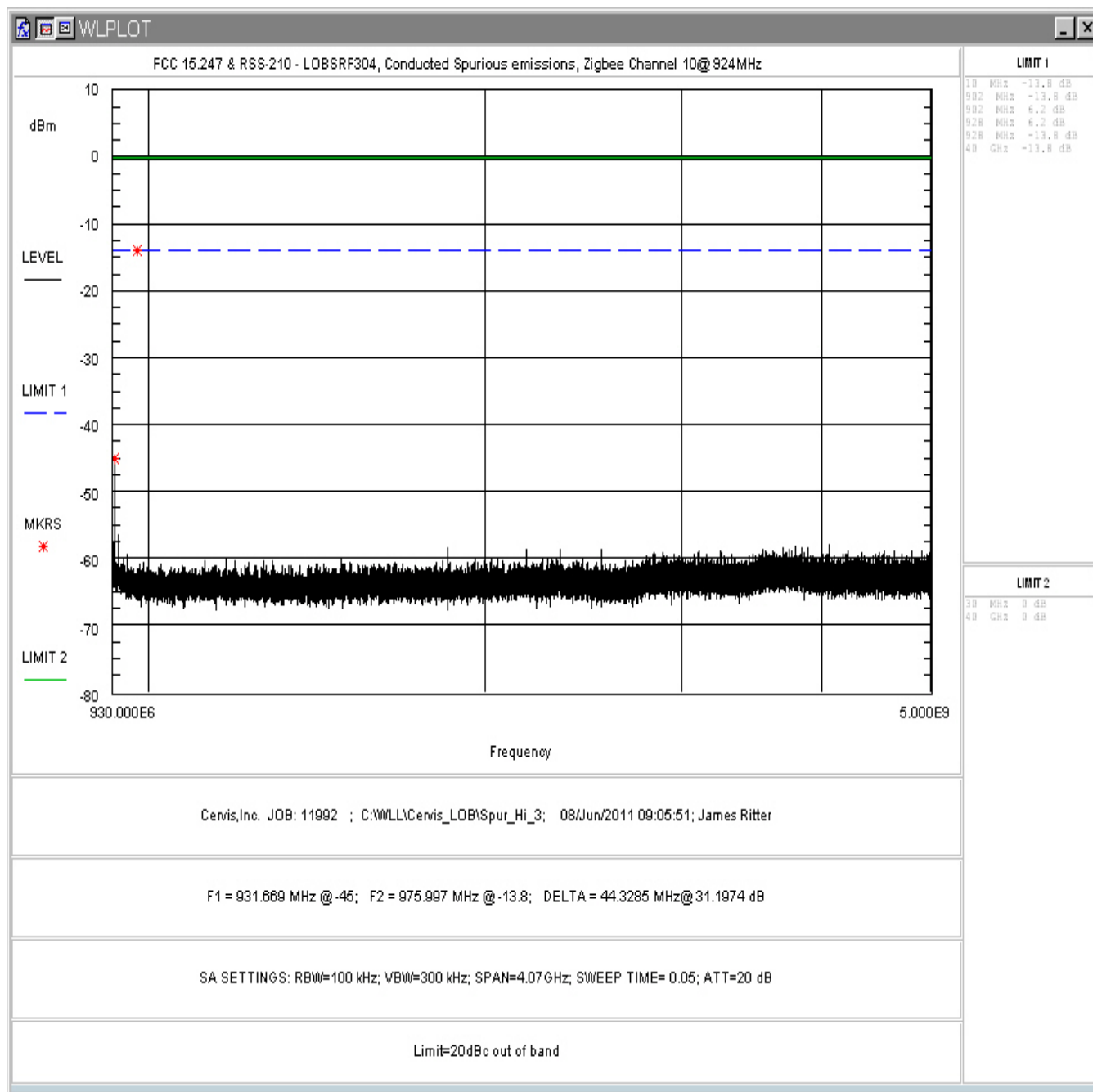


Figure 20: Conducted Spurious Emissions, Channel 10- 924MHz, 930MHz -5GHz

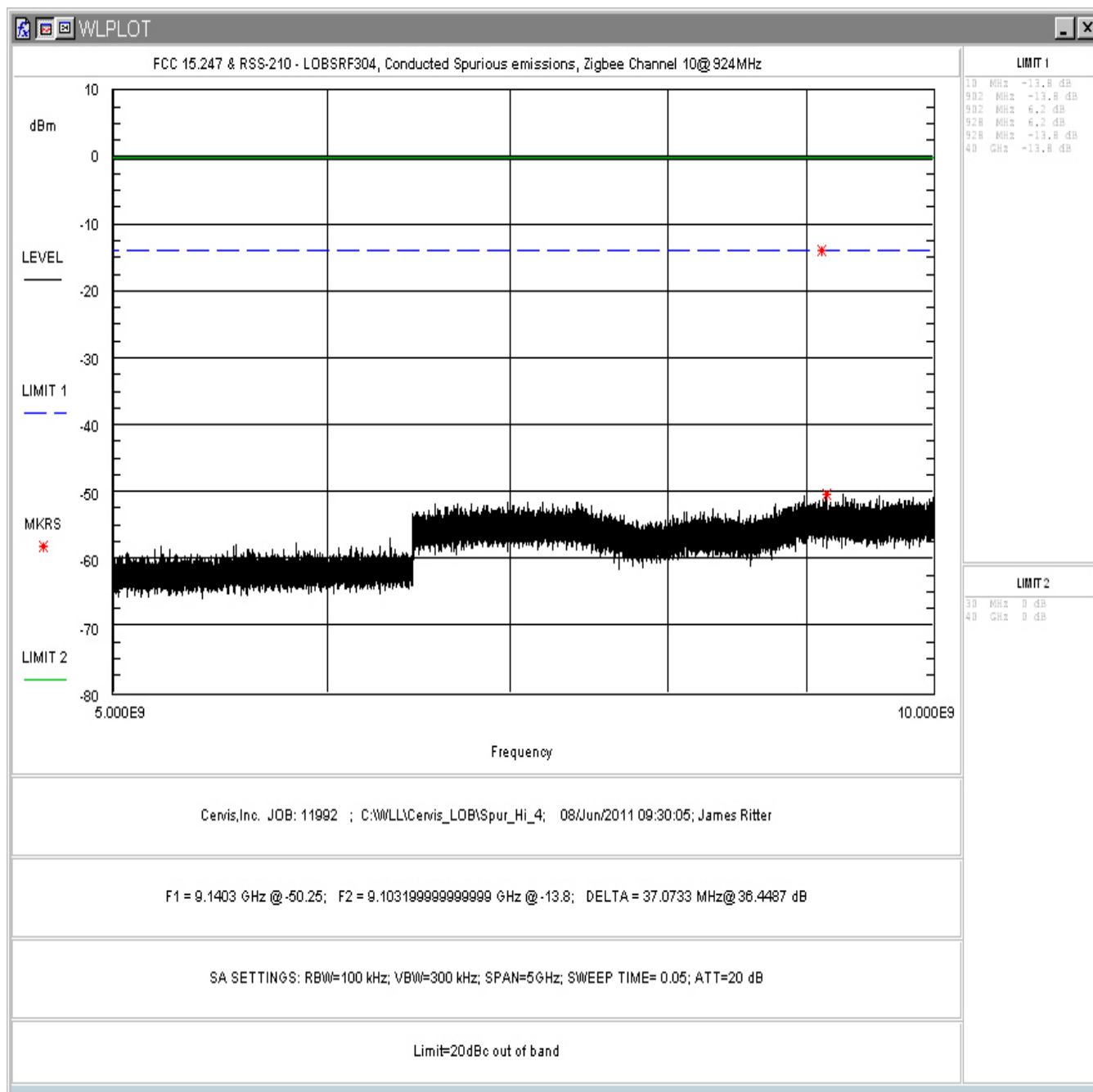


Figure 21: Conducted Spurious Emissions, Channel 10- 924MHz, 5 - 10GHz

4.5.1 Band Edge Compliance

Close-up plots of the upper and lower channels with respect to the nearest authorized band-edges are provided below. The tests were performed in the same manner as the above conducted spurious emissions tests

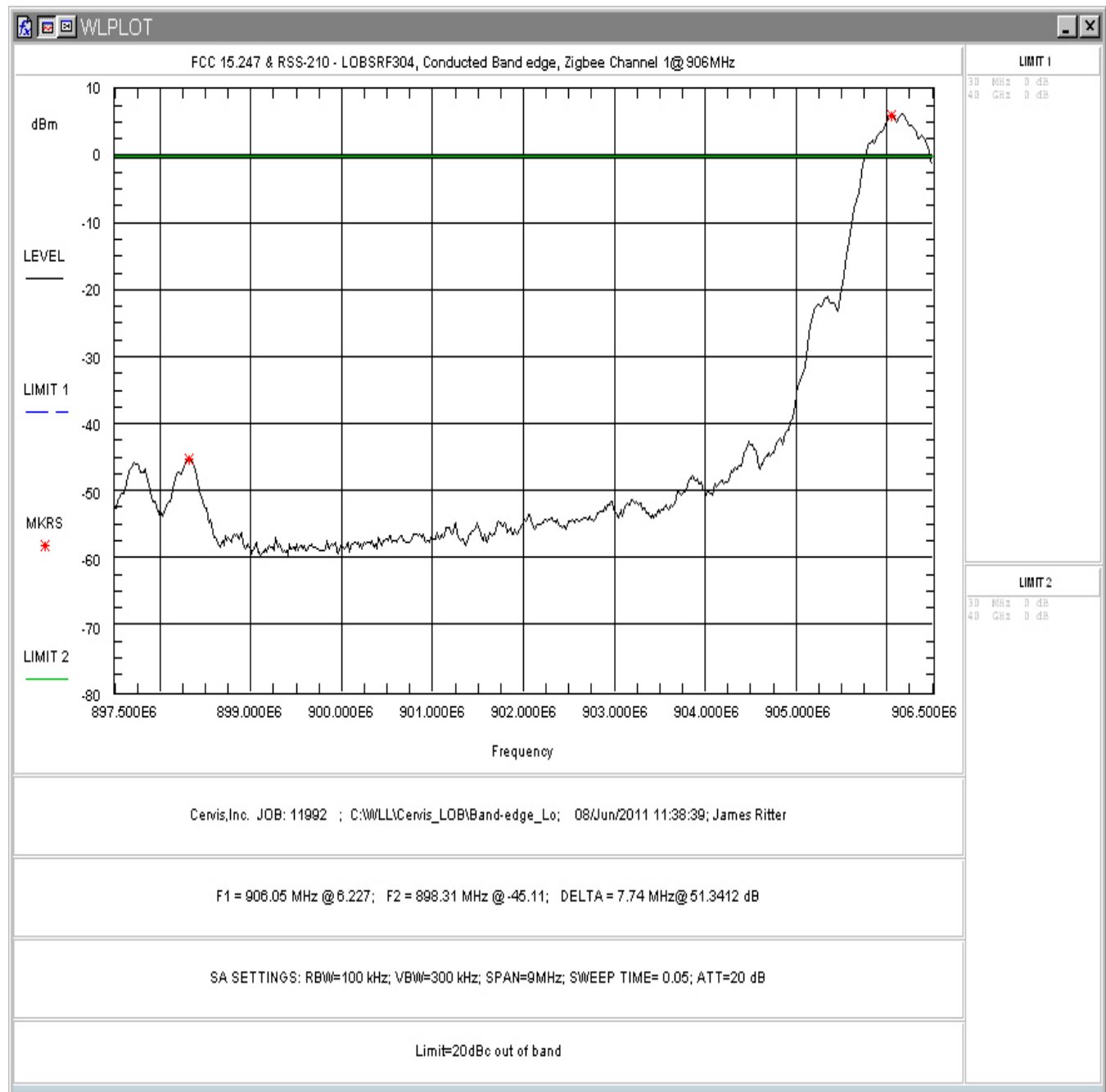


Figure 22: Lower Band-edge, Low Channel

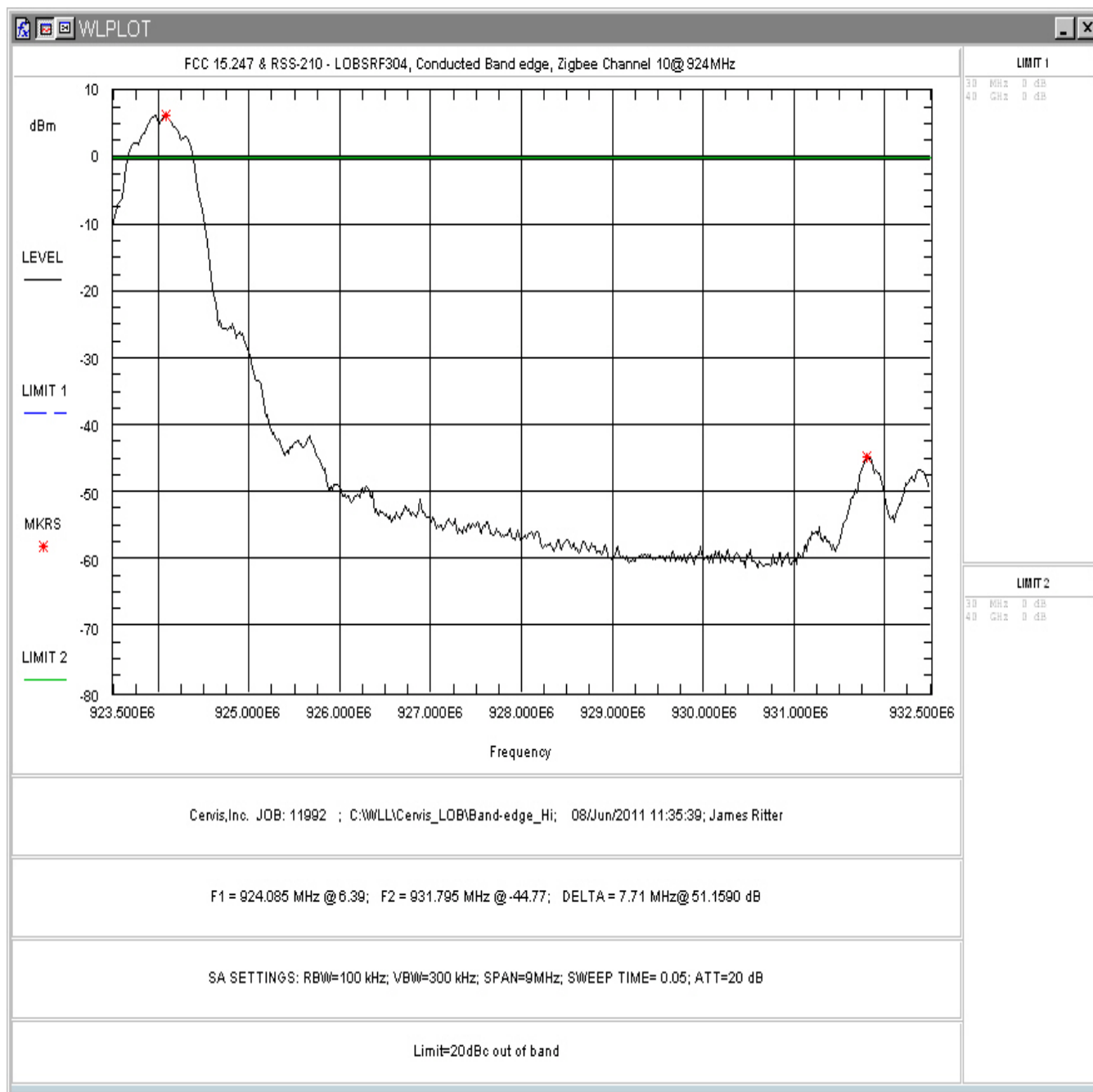


Figure 23: Upper band-edge, High Channel

4.6 AC Conducted Emissions (FCC Part §15.207)

4.6.1 Requirements

Test Arrangement: Table Top

Compliance Standard: FCC Class B

FCC Compliance Limits		
Frequency	Quasi-peak	Average
0.15 - 0.5MHz	66 to 56dB μ V	56 to 46dB μ V
0.5 - 5MHz	56dB μ V	46dB μ V
5 - 30MHz	60dB μ V	50dB μ V

4.6.2 Test Data

As this module is to be powered from battery powered units AC conducted tests are not applicable.

4.7 Radiated Spurious Emissions: (FCC Part §15.205 & §15.209)

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 unit was pre-scanned in 3 orthogonal positions with full testing performed in the worst case position. The data was scanned for 2 antenna configurations.

The emissions were measured using the following resolution bandwidths:

Table 8: Spectrum Analyzer Settings

Frequency Range	Resolution Bandwidth	Video Bandwidth
30MHz-1000 MHz	120kHz	>100 kHz
>1000 MHz	1 MHz	10 Hz (Avg.), 1MHz (Peak)

Worst case emissions are presented.

Table 9: Radiated Emission Test Data, Restricted Bands Below 1GHz

(Common to all channels and configurations)

Frequency (MHz)	Polarity H/V	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)
110.00	V	180.00	1.00	11.90	13.4	18.4	150.0	-18.2
120.00	V	45.00	1.30	16.00	14.4	33.1	150.0	-13.1
130.00	V	45.00	1.53	19.10	14.7	48.7	150.0	-9.8
150.00	V	170.00	1.16	17.10	13.6	34.3	150.0	-12.8
170.00	V	0.00	1.26	16.00	13.5	29.7	150.0	-14.1
270.00	V	90.00	1.84	9.80	16.0	19.6	200.0	-20.2
110.00	H	190.00	3.12	8.30	13.4	12.2	150.0	-21.8
120.00	H	45.00	2.98	17.60	14.4	39.8	150.0	-11.5
130.00	H	180.00	2.65	15.90	14.7	33.7	150.0	-13.0
150.00	H	180.00	2.30	22.80	13.6	66.1	150.0	-7.1
170.00	H	45.00	2.15	16.60	13.5	31.8	150.0	-13.5
250.00	H	180.00	1.70	12.90	13.6	21.1	200.0	-19.5
270.00	H	190.00	1.49	17.30	16.0	46.4	200.0	-12.7

Table 10: Radiated Emission Test Data, 2dBi Whip Antenna, Low Channel (Restricted Bands)
TX channel 1 @ 906MHz

Frequency (MHz)	Polarity H/V	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)
Peak								
2718.00	H	170.00	1.58	46.63	-2.6	159.2	5000.0	-29.9
3624.00	H	300.00	2.28	56.80	-0.5	654.1	5000.0	-17.7
4530.00	H	290.00	2.26	46.18	0.7	221.3	5000.0	-27.1
5436.00	H	180.00	2.46	47.17	3.3	335.7	5000.0	-23.5
7248.00	H	0.00	2.71	43.35	7.9	366.4	5000.0	-22.7
8154.00	H	180.00	2.80	41.89	7.5	293.2	5000.0	-24.6
9060.00	H	10.00	2.90	42.74	9.1	389.2	5000.0	-22.2
Avg								
2718.00	H	170.00	1.58	33.54	-2.6	35.3	500.0	-23.0
3624.00	H	300.00	2.28	51.36	-0.5	349.7	500.0	-3.1
4530.00	H	290.00	2.26	34.05	0.7	54.8	500.0	-19.2
5436.00	H	180.00	2.46	35.19	3.3	84.5	500.0	-15.4
7248.00	H	0.00	2.71	30.82	7.9	86.6	500.0	-15.2
8154.00	H	180.00	2.80	30.80	7.5	81.8	500.0	-15.7
9060.00	H	10.00	2.90	30.62	9.1	96.4	500.0	-14.3
Non-Harmonics								
None								
Peak								
2718.00	V	270.00	2.03	39.75	-2.6	72.1	5000.0	-36.8
3624.00	V	290.00	2.78	55.12	-0.5	539.1	5000.0	-19.3
4530.00	V	280.00	2.49	45.03	0.7	193.9	5000.0	-28.2
5436.00	V	0.00	2.03	45.72	3.3	284.1	5000.0	-24.9
7248.00	V	10.00	2.20	45.32	7.9	459.7	5000.0	-20.7
8154.00	V	90.00	2.45	43.00	7.5	333.2	5000.0	-23.5
9060.00	V	180.00	2.71	42.31	9.1	370.4	5000.0	-22.6
Avg								
2718.00	V	270.00	2.03	34.77	-2.6	40.6	500.0	-21.8
3624.00	V	290.00	2.78	50.00	-0.5	299.0	500.0	-4.5
4530.00	V	280.00	2.49	34.00	0.7	54.4	500.0	-19.3
5436.00	V	0.00	2.03	33.02	3.3	65.8	500.0	-17.6
7248.00	V	10.00	2.20	30.66	7.9	85.0	500.0	-15.4
8154.00	V	90.00	2.45	30.74	7.5	81.2	500.0	-15.8
9060.00	V	180.00	2.71	31.14	9.1	102.4	500.0	-13.8
Non-Harmonics								
None								

Table 11: Radiated Emission Test Data, 2dBi Whip Antenna, Center Channel (Restricted Bands)
TX Channel 5 @ 914MHz

Frequency (MHz)	Polarity H/V	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)
Peak								
2742.00	H	280.00	2.32	46.95	-2.6	165.7	5000.0	-29.6
3656.00	H	95.00	2.15	50.56	-0.5	319.3	5000.0	-23.9
4570.00	H	90.00	1.95	43.49	0.8	163.2	5000.0	-29.7
7312.00	H	170.00	2.52	41.45	7.6	282.9	5000.0	-24.9
8226.00	H	170.00	2.50	42.04	7.7	306.4	5000.0	-24.3
9140.00	H	190.00	2.70	43.40	9.2	425.3	5000.0	-21.4
Avg								
2742.00	H	280.00	2.32	33.50	-2.6	35.2	500.0	-23.0
3656.00	H	95.00	2.15	43.40	-0.5	140.0	500.0	-11.1
4570.00	H	90.00	1.95	31.89	0.8	42.9	500.0	-21.3
7312.00	H	170.00	2.52	30.08	7.6	76.4	500.0	-16.3
8226.00	H	170.00	2.50	30.85	7.7	84.5	500.0	-15.4
9140.00	H	190.00	2.70	30.82	9.2	99.9	500.0	-14.0
Non-Harmonics								
None								
Peak								
2742.00	V	45.00	1.80	47.48	-2.6	176.1	5000.0	-29.1
3656.00	V	180.00	2.13	58.10	-0.5	760.7	5000.0	-16.4
4570.00	V	180.00	2.25	44.42	0.8	181.6	5000.0	-28.8
7312.00	V	200.00	2.49	42.41	7.6	315.9	5000.0	-24.0
8226.00	V	190.00	2.45	42.53	7.7	324.2	5000.0	-23.8
9140.00	V	180.00	2.50	42.51	9.2	383.9	5000.0	-22.3
Avg								
2742.00	V	45.00	1.80	35.01	-2.6	41.9	500.0	-21.5
3656.00	V	180.00	2.13	52.98	-0.5	421.9	500.0	-1.5
4570.00	V	180.00	2.25	32.77	0.8	47.5	500.0	-20.4
7312.00	V	200.00	2.49	30.44	7.6	79.6	500.0	-16.0
8226.00	V	190.00	2.45	31.19	7.7	87.9	500.0	-15.1
9140.00	V	180.00	2.50	30.91	9.2	101.0	500.0	-13.9
Non-Harmonics								
None								

Table 12: Radiated Emission Test Data, 2dBi Whip Antenna, Center Channel (Restricted Bands)**TX Channel 10 @924MHz**

Frequency (MHz)	Polarity H/V	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)
Peak								
2772.00	H	100.00	2.09	44.56	-2.5	126.3	5000.0	-32.0
3696.00	H	270.00	1.80	56.44	-0.5	629.4	5000.0	-18.0
4620.00	H	290.00	1.78	45.48	0.8	206.3	5000.0	-27.7
7392.00	H	190.00	2.14	42.44	7.1	300.9	5000.0	-24.4
8316.00	H	190.00	2.30	42.57	8.0	336.5	5000.0	-23.4
Avg								
2772.00	H	100.00	2.09	31.93	-2.5	29.5	500.0	-24.6
3696.00	H	270.00	1.80	52.16	-0.5	384.5	500.0	-2.3
4620.00	H	290.00	1.78	31.96	0.8	43.5	500.0	-21.2
7392.00	H	190.00	2.14	30.82	7.1	79.0	500.0	-16.0
8316.00	H	190.00	2.30	31.27	8.0	91.6	500.0	-14.7
Non-Harmonics								
None								
Peak								
2772.00	V	90.00	1.64	45.21	-2.5	136.1	5000.0	-31.3
3696.00	V	180.00	2.14	58.20	-0.5	770.8	5000.0	-16.2
4620.00	V	170.00	2.13	44.08	0.8	175.6	5000.0	-29.1
7392.00	V	180.00	2.40	42.76	7.1	312.2	5000.0	-24.1
8316.00	V	200.00	2.38	42.15	8.0	320.6	5000.0	-23.9
9240.00								
Avg								
2772.00	V	90.00	1.64	32.43	-2.5	31.2	500.0	-24.1
3696.00	V	180.00	2.14	53.44	-0.5	445.6	500.0	-1.0
4620.00	V	170.00	2.13	33.09	0.8	49.5	500.0	-20.1
7392.00	V	180.00	2.40	31.06	7.1	81.2	500.0	-15.8
8316.00	V	200.00	2.38	31.46	8.0	93.6	500.0	-14.5
Non-Harmonics								
None								

Table 13: Radiated Emission Test Data, Splat Antenna, Low Channel (Restricted Bands)**TX Channel 1 @906MHz**

Frequency (MHz)	Polarity H/V	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)
Peak								
2718.00	H	165.00	1.69	46.33	-2.6	153.8	5000.0	-30.2
3624.00	H	0.00	1.93	49.56	-0.5	284.2	5000.0	-24.9
4530.00	H	90.00	2.19	43.99	0.7	172.0	5000.0	-29.3
5436.00	H	290.00	2.20	45.81	3.3	287.1	5000.0	-24.8
8154.00	H	180.00	2.30	42.24	7.5	305.3	5000.0	-24.3
9060.00	H	170.00	2.35	43.13	9.1	407.0	5000.0	-21.8
Avg								
2718.00	H	165.00	1.69	33.66	-2.6	35.8	500.0	-22.9
3624.00	H	0.00	1.93	43.97	-0.5	149.3	500.0	-10.5
4530.00	H	90.00	2.19	33.80	0.7	53.2	500.0	-19.5
5436.00	H	290.00	2.20	36.40	3.3	97.2	500.0	-14.2
8154.00	H	180.00	2.30	30.41	7.5	78.2	500.0	-16.1
9060.00	H	170.00	2.35	31.26	9.1	103.8	500.0	-13.7
Non-Harmonics								
None								
Peak								
2718.00	V	50.00	1.72	45.13	-2.6	133.9	5000.0	-31.4
3624.00	V	90.00	2.73	51.79	-0.5	367.4	5000.0	-22.7
4530.00	V	45.00	2.72	45.32	0.7	200.4	5000.0	-27.9
5436.00	V	45.00	2.16	48.36	3.3	385.0	5000.0	-22.3
8154.00	V	170.00	2.25	42.07	7.5	299.3	5000.0	-24.5
9060.00	V	45.00	2.45	42.37	9.1	372.9	5000.0	-22.5
Avg								
2718.00	V	50.00	1.72	31.92	-2.6	29.3	500.0	-24.7
3624.00	V	90.00	2.73	47.41	-0.5	221.9	500.0	-7.1
4530.00	V	45.00	2.72	35.87	0.7	67.5	500.0	-17.4
5436.00	V	45.00	2.16	39.52	3.3	139.2	500.0	-11.1
8154.00	V	170.00	2.25	30.40	7.5	78.1	500.0	-16.1
9060.00	V	45.00	2.45	31.33	9.1	104.6	500.0	-13.6
Non-Harmonics								
None								

Table 14: Radiated Emission Test Data, Splatch Antenna, Center Channel (Restricted Bands)**TX Channel 5 @914MHz**

Frequency (MHz)	Polarity H/V	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)
Peak								
2742.00	H	170.00	1.98	44.95	-2.6	131.6	5000.0	-31.6
3656.00	H	45.00	2.35	49.48	-0.5	282.0	5000.0	-25.0
4570.00	H	270.00	2.32	44.96	0.8	193.3	5000.0	-28.3
7312.00	H	45.00	2.31	41.60	7.6	287.8	5000.0	-24.8
8226.00	H	200.00	2.41	42.14	7.7	310.0	5000.0	-24.2
9140.00	H	180.00	2.30	42.91	9.2	402.0	5000.0	-21.9
Avg								
2742.00	H	170.00	1.98	32.36	-2.6	30.9	500.0	-24.2
3656.00	H	45.00	2.35	44.08	-0.5	151.4	500.0	-10.4
4570.00	H	270.00	2.32	33.52	0.8	51.8	500.0	-19.7
7312.00	H	45.00	2.31	29.50	7.6	71.5	500.0	-16.9
8226.00	H	200.00	2.41	30.65	7.7	82.6	500.0	-15.6
9140.00	H	180.00	2.30	30.71	9.2	98.7	500.0	-14.1
Non-Harmonics								
None								
Peak								
2742.00	V	270.00	1.98	44.71	-2.6	128.0	5000.0	-31.8
3656.00	V	260.00	2.08	49.85	-0.5	294.3	5000.0	-24.6
4570.00	V	45.00	2.49	45.71	0.8	210.7	5000.0	-27.5
7312.00	V	270.00	2.54	41.58	7.6	287.1	5000.0	-24.8
8226.00	V	270.00	2.35	41.39	7.7	284.3	5000.0	-24.9
9140.00	V	190.00	2.54	42.15	9.2	368.3	5000.0	-22.7
Avg								
2742.00	V	270.00	1.98	32.20	-2.6	30.3	500.0	-24.3
3656.00	V	260.00	2.08	44.65	-0.5	161.7	500.0	-9.8
4570.00	V	45.00	2.49	34.32	0.8	56.8	500.0	-18.9
7312.00	V	270.00	2.54	29.84	7.6	74.3	500.0	-16.6
8226.00	V	270.00	2.35	30.64	7.7	82.5	500.0	-15.7
9140.00	V	190.00	2.54	30.68	9.2	98.3	500.0	-14.1
Non-Harmonics								
None								

Table 15: Radiated Emission Test Data, Splatch Antenna, High Channel (Restricted Bands)**TX Channel 10 @924MHz**

Frequency (MHz)	Polarity H/V	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)
Peak								
2772.00	H	45.00	1.74	46.96	-2.5	166.5	5000.0	-29.6
3696.00	H	45.00	1.80	50.81	-0.5	329.2	5000.0	-23.6
4620.00	H	90.00	1.75	44.83	0.8	191.4	5000.0	-28.3
7392.00	H	100.00	2.20	42.74	7.1	311.5	5000.0	-24.1
8316.00	H	270.00	2.25	42.13	8.0	319.9	5000.0	-23.9
Avg								
2772.00	H	45.00	1.74	33.00	-2.5	33.4	500.0	-23.5
3696.00	H	45.00	1.80	45.04	-0.5	169.4	500.0	-9.4
4620.00	H	90.00	1.75	32.64	0.8	47.0	500.0	-20.5
7392.00	H	100.00	2.20	30.83	7.1	79.1	500.0	-16.0
8316.00	H	270.00	2.25	30.93	8.0	88.1	500.0	-15.1
Non-Harmonics								
None								
Peak								
2772.00	V	180.00	2.05	43.80	-2.5	115.7	5000.0	-32.7
3696.00	V	270.00	1.75	50.11	-0.5	303.7	5000.0	-24.3
4620.00	V	100.00	2.11	46.42	0.8	229.9	5000.0	-26.8
7392.00	V	270.00	2.15	42.46	7.1	301.6	5000.0	-24.4
8316.00	V	190.00	2.20	43.07	8.0	356.4	5000.0	-22.9
Avg								
2772.00	V	180.00	2.05	31.83	-2.5	29.2	500.0	-24.7
3696.00	V	270.00	1.75	44.29	-0.5	155.4	500.0	-10.2
4620.00	V	100.00	2.11	35.11	0.8	62.5	500.0	-18.1
7392.00	V	270.00	2.15	30.87	7.1	79.4	500.0	-16.0
8316.00	V	190.00	2.20	30.92	8.0	88.0	500.0	-15.1
Non-Harmonics								
None								

4.8 Receiver Radiated Spurious Emissions: (FCC Part §15.205 & §15.209)

The EUT must comply with the class 'B' requirements for radiated spurious emissions. These emissions must meet the limits specified in §15.209 and §15.35(b) for peak measurements.

4.8.1 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 unit was pre-scanned in 3 orthogonal positions with full testing performed in the worst case position.

The emissions were measured using the following resolution bandwidths:

Table 16: Spectrum Analyzer Settings

Frequency Range	Resolution Bandwidth	Video Bandwidth
30MHz-1000 MHz	120kHz	>100 kHz
>1000 MHz	1 MHz	10 Hz (Avg.), 1MHz (Peak)

Worst case emissions are presented.

Table 17: Receiver Radiated Emission Test Data

Frequency (MHz)	Polarity H/V	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)
33.43	V	290.00	1.00	10.20	18.2	26.4	100.0	-11.6
58.70	V	270.00	1.00	13.10	8.2	11.7	100.0	-18.7
69.73	V	40.00	1.10	10.70	8.9	9.5	100.0	-20.4
80.03	V	300.00	1.53	25.90	9.7	60.2	100.0	-4.4
83.26	V	170.00	1.18	17.60	9.2	22.0	100.0	-13.2
100.00	V	10.00	1.20	19.50	11.7	36.3	150.0	-12.3
60.00	V	90.00	1.00	17.90	8.1	20.0	100.0	-14.0
40.00	V	180.00	1.00	14.00	13.5	23.7	100.0	-12.5
70.00	V	0.00	1.00	13.00	8.9	12.4	100.0	-18.1
90.00	V	180.00	1.20	10.50	9.5	10.0	150.0	-23.5
110.00	V	180.00	1.00	11.90	13.4	18.4	150.0	-18.2
120.00	V	45.00	1.30	16.00	14.4	33.1	150.0	-13.1
130.00	V	45.00	1.53	19.10	14.7	48.7	150.0	-9.8
140.00	V	180.00	1.22	16.20	14.6	34.7	150.0	-12.7
150.00	V	170.00	1.16	17.10	13.6	34.3	150.0	-12.8
160.00	V	190.00	1.20	15.80	14.0	30.9	150.0	-13.7
170.00	V	0.00	1.26	16.00	13.5	29.7	150.0	-14.1
215.00	V	90.00	2.04	11.10	13.2	16.3	150.0	-19.3
270.00	V	90.00	1.84	9.80	16.0	19.6	200.0	-20.2
290.00	V	90.00	2.10	7.20	15.8	14.2	200.0	-23.0
49.88	H	90.00	4.00	21.30	8.5	31.0	100.0	-10.2
52.03	H	90.00	4.00	17.00	8.3	18.5	100.0	-14.7
60.01	H	120.00	3.60	17.90	8.1	20.0	100.0	-14.0
70.00	H	180.00	3.80	19.30	8.9	25.7	100.0	-11.8
80.00	H	20.00	3.67	18.10	9.7	24.5	100.0	-12.2
100.00	H	180.00	3.40	18.10	11.7	30.9	150.0	-13.7
110.00	H	190.00	3.12	8.30	13.4	12.2	150.0	-21.8
120.00	H	45.00	2.98	17.60	14.4	39.8	150.0	-11.5
130.00	H	180.00	2.65	15.90	14.7	33.7	150.0	-13.0
140.00	H	180.00	2.79	17.70	14.6	41.2	150.0	-11.2
150.00	H	180.00	2.30	22.80	13.6	66.1	150.0	-7.1
160.00	H	0.00	2.10	18.30	14.0	41.2	150.0	-11.2
170.00	H	45.00	2.15	16.60	13.5	31.8	150.0	-13.5
194.87	H	30.00	1.80	12.00	13.8	19.4	150.0	-17.8
250.00	H	180.00	1.70	12.90	13.6	21.1	200.0	-19.5
270.00	H	190.00	1.49	17.30	16.0	46.4	200.0	-12.7
290.00	H	190.00	1.60	12.80	15.8	27.1	200.0	-17.4