Washington Laboratories, Ltd.
www.wll.com
7560 Lindbergh Drive . Gaithersburg, MD 20879
301.216.1500 . info@wll.com

FCC & Industry Canada Certification Test Report

For the

Cooper Power Systems

RFN420CL (1W, NZ) MODULE

FCC ID: P9X-420CL1WNZ
IC: 6766A-420CL1WNZ

WLL JOB# **12770 Rev.1**
December 13, 2012
Re-issued January 2, 2013

Prepared for:

Cooper Power Systems
910 Clopper Rd. Ste 201S
Gaithersburg, MD, 20878

Prepared By:

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

ACCREDITED TESTING

Testing Certificate AT-1448

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Prepared by:

James Ritter
EMC Compliance Engineer

Reviewed by:

Steven D. Koster
Vice President

Abstract

This report has been prepared on behalf of Cooper Power Systems 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 (10/2010) 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 Cooper Power Systems RFN420CL (1W, NZ) 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 Cooper Power Systems RFN420CL (1W, NZ) Module complies with the limits for a Frequency Hopping Spread Spectrum Transmitter device under FCC Part 15.247 and Industry Canada RSS-210.

Revision History	Description of Change	Date
Rev 0	Initial Release	December 13 , 2012
Rev 1	Table 1 on page 3 corrected to reflect correct emission designator and Highest TX spurious Emission.	January 2, 2013

Table of Contents

List of Tables

List of Figures

1 Introduction

1.1 Compliance Statement

The Cooper Power Systems RFN420CL (1W, NZ) Module complies with the limits for a Frequency Hopping Spread Spectrum Transmitter device under FCC Part 15.247 (10/2010) 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 DA-00-705 "Measurement Guidance for Frequency Hopping Spread Spectrum Systems. The measurement equipment conforms to ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation.

1.3 Contract Information

Customer:	Cooper Power Systems 910 Clopper Rd. Ste 201S Gaithersburg, MD, 20878
Purchase Order Number:	4504981014
Quotation Number:	67208

1.4 Test Dates

Testing was performed on the following date(s):	11/26/2012 to 12/6/2012

1.5 Test and Support Personnel

Washington Laboratories, LTD	James Ritter
Client Representative	Steve Seymour

1.6 Abbreviations

A	**A**mpere
ac	**a**lternating **c**urrent
AM	Amplitude Modulation
Amps	**Amp**ere**s**
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 RFN420CL(1W,NZ) is a radio communications device designed for use in Itron C2SX and C2SXD meters. It enables communication between the meter and a remotely located Gateway or Relay Node device using an RF mesh network. The RFN420CL(1W, NZ) provides a 915 MHz radio interface to an RF mesh network.

Table 1: Device Summary

ITEM	DESCRIPTION
Manufacturer:	Cooper Power Systems
FCC ID:	P9X-420CL1WNZ
IC:	6766A-420CL1WNZ
Model:	RFN420CL (1W,NZ)
FCC Rule Parts:	§15.247
Industry Canada:	RSS210
Frequency Range:	902.75 – 927.25MHz
Maximum Output Power:	29.67dBm (927mW)
Modulation:	FSK
Occupied Bandwidth:	485.3kHz
Keying:	Automatic
Type of Information:	Data
Number of Channels:	50
Power Output Level	Variable from -29.58dBm to 29.67dBm
Antenna Connector	MCX
Antenna Type	3 antennas: HGV-906U- Omnidirectional – 6dBi Gain TRA9023NP - Antenex Phantom 902-928MHz – 3dB Gain Integral wire dipole -1 dBi
Interface Cables:	None (plug in module)
Power Source & Voltage:	120/240VAC
Emission Designator	485KFXD
Highest TX spurious Emission	206.2uV/m@3m- 2781.75MHz
Highest RX Spurious Emission	74.4uV/m @ 3m- 46.6MHz

2.2 Test Configuration

The Cooper Power Systems RFN420CL (1W,NZ), Equipment Under Test (EUT), was operated from a 115Vac power supply. Programming commands were sent from a support laptop via a custom RS232 adaptor board to a header on the EUT module

2.3 Testing Algorithm

The RFN420CL (1W,NZ) was programmed for operation from a support laptop via a custom RS232 adaptor board to a header on the EUT module. UTF TeraTermPro console program was used on the support laptop to enter commands setting the EUT to the desired channel or hopping 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 ACLASS under Certificate AT-1448 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 Methods of Measurement of Radio Noise 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. 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

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

Where u_c = standard uncertainty

a, b, c,.. = individual uncertainty elements

$Div_{a,\ b,\ c}$ = the individual uncertainty element divisor based on the probability distribution

Divisor = 1.732 for rectangular distribution

Divisor = 2 for normal distribution

Divisor = 1.414 for trapezoid distribution

Equation 2: Expanded Uncertainty

$$U = ku_c$$

Where U = expanded uncertainty

k = coverage factor

$k \leq 2$ for 95% coverage (ANSI/NCSL Z540-2 Annex G)

u_c = standard uncertainty

The measurement uncertainty complies with the maximum allowed uncertainty from CISPR 16-4-2. Measurement uncertainty is not used to adjust the measurements to determine compliance. The expanded uncertainty values for the various scopes in the WLL accreditation are provided in Table 2 below.

Table 2: Expanded Uncertainty List

Scope	Standard(s)	Expanded Uncertainty
Conducted Emissions	CISPR11, CISPR22, CISPR14, FCC Part 15	2.63 dB
Radiated Emissions	CISPR11, CISPR22, CISPR14, FCC Part 15	4.55 dB

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**		: **11/28/2012**	
Asset #	**Manufacturer/Model**	**Description**	**Cal. Due**
728	AGILENT - 8564EC	SPECTRUM ANALYZER 30HZ - 40GHZ	3/15/2013
528	AGILENT - E4446A	ANALYZER SPECTRUM	8/30/2013

Test Name: **Radiated Emissions**		Test Date: **12/05/2012**	
Asset #	**Manufacturer/Model**	**Description**	**Cal. Due**
644	SUNOL SCIENCES CORPORATION - JB1 925-833-9936	BICONALOG ANTENNA	1/12/2013
71	HP - 85685A	PRESELECTOR RF	6/27/2013
73	HP - 8568B	ANALYZER SPECTRUM	6/27/2013
69	HP - 85650A	ADAPTER QP	6/27/2013
528	AGILENT - E4446A	ANALYZER SPECTRUM	8/30/2013
626	ARA - DRG-118/A	ANTENNA HORN	6/16/2013
280	ITC - 21C-3A1	WAVEGUIDE 3.45-11.0GHZ	5/29/2014
281	ITC - 21A-3A1	WAVEGUIDE 4.51-10.0GHZ	5/29/2014
283	ITC - 21KU-3A1	WAVEGUIDE 9.8-20.5GHZ	4/19/2014
742	PENN ENGINEERING - WR284	2.2-4.15GHZ BANDPASS FILTER	5/29/2014
627	AGILENT - 8449B	AMPLIFIER 1-26GHZ	5/24/2013

Test Name: **Conducted Emissions Voltage**		Test Date: **12/06/2012**	
Asset #	**Manufacturer/Model**	**Description**	**Cal. Due**
69	HP - 85650A	ADAPTER QP	6/27/2013
73	HP - 8568B	ANALYZER SPECTRUM	6/27/2013
71	HP - 85685A	PRESELECTOR RF	6/27/2013
125	SOLAR - 8028-50-TS-24-BNC	LISN	6/28/2013
126	SOLAR - 8028-50-TS-24-BNC	LISN	6/28/2013

4 Test Summary

The Table Below shows the results of testing for compliance with a Frequency Hopping System in accordance with FCC Part 15.247 10/2010 and RSS210 issue 8. Full results are shown in section 5.

Table 4: Test Summary Table

TX Test Summary (Frequency Hopping Spread Spectrum)			
FCC Rule Part	**IC Rule Part**	**Description**	**Result**
15.247 (a)(1)(i)	RSS-210 [A8. 1 (c)]	20dB Bandwidth	Pass
15.247 (b)(2)	RSS-210 [A8.4 (1)]	Transmit Output Power	Pass
15.247 (a)(1)	RSS-210 [A8.1 (b)]	Channel Separation	Pass
15.247 (a)(1)(i)	RSS-210 [A8. 1 (c)]	Number of Channels =50 minimum	Pass
15.247 (a)(1)(i)	RSS-210 [A8. 1 (c)]	Time of Occupancy	Pass
15.247 (d)	RSS-210 [A8. 5]	Occupied BW / 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	Pass
RX/Digital Test Summary (Frequency Hopping Spread Spectrum)			
FCC Rule Part	**IC Rule Part**	**Description**	**Result**
15.207	RSS-Gen [7.2.2]	AC Conducted Emissions	Pass
15.209	RSS-210 sect 2.5	General Field Strength Limits	Pass

5 Test Results

5.1 Duty Cycle Correction and Time of Occupancy

In accordance with the FCC Public Notice the average spurious radiated emissions measurements may be further adjusted using a duty cycle correction factor if the dwell time per channel of the hopping signal is less than 100 ms.

The duty cycle correction factor is calculated by:

20 x LOG (dwell time/100 ms)

The following figure shows the plot of the dwell time for the transmitter. Based on this plot, the dwell time per hop is 19.5ms. The maximum total dwell time per 100ms is 39ms. This corresponds to a duty cycle correction of -8.1dB for radiated spurious emissions.

The transmitter shall have a time of occupancy for systems having a 20dB bandwidth greater than 250 kHz of no more than 0.4seconds in any 10 second period.

These tests were conducted with the RF output connected through appropriate attenuators to the input of a spectrum analyzer set to zero span mode. The unit was set to hopping mode with the spectrum analyzer set to 902.75MHz. The results are shown in the plots below.

Table 5: Duty Cycle/time of Occupancy Results

Test	Result	Limit	Pass/Fail
Dwell time per Hop	19.5ms	NA	NA
Dwell time per 100ms	39.0ms	NA	NA
Time of Occupancy	0.253 sec per 10 sec	0.4 sec per 10 sec	Pass

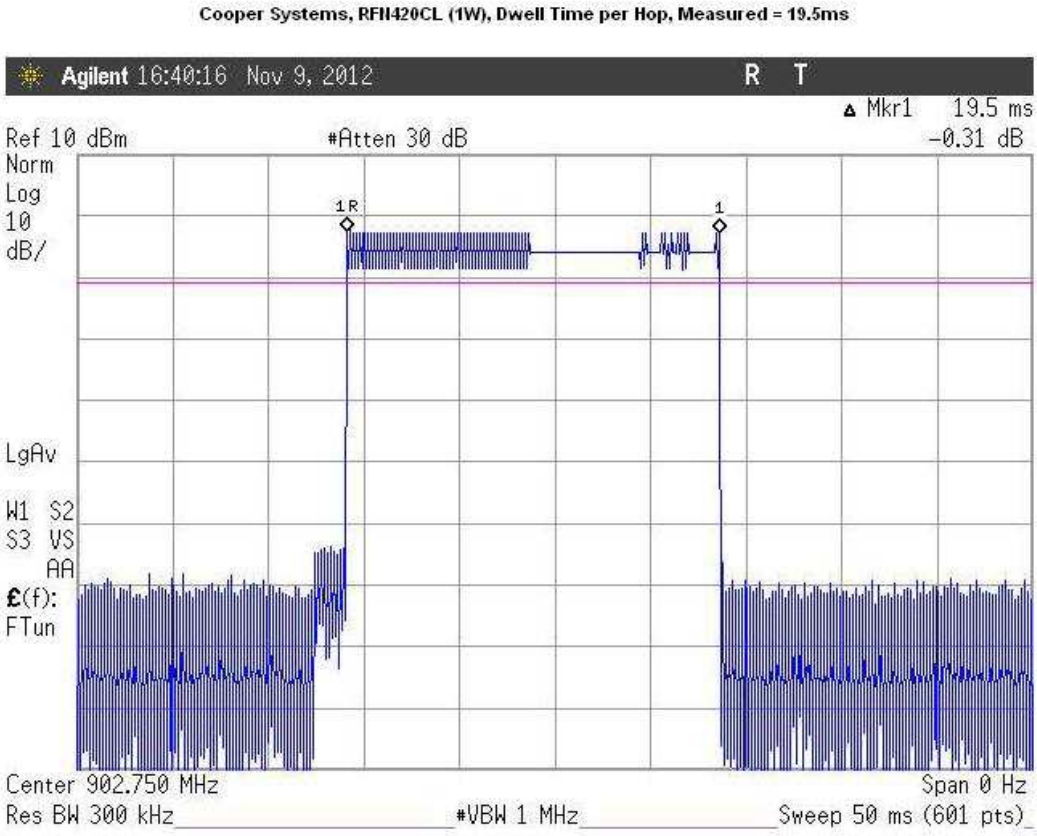

Figure 1: Single Hop Plot

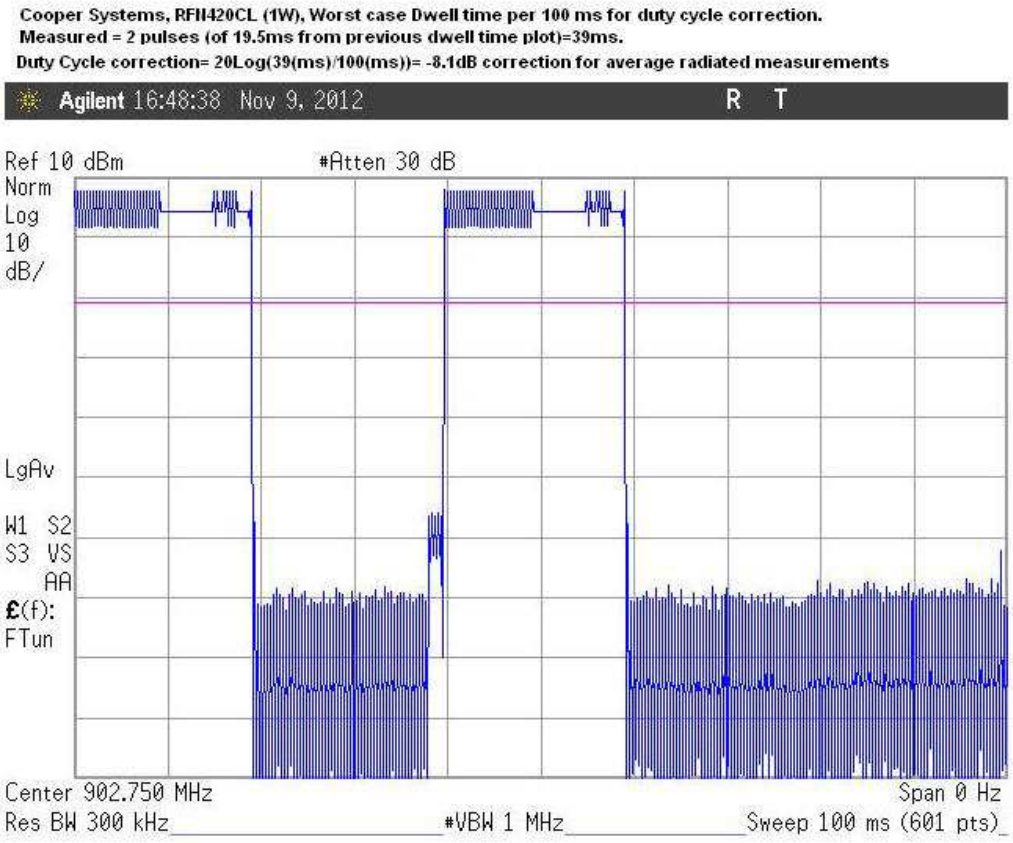

Figure 2: Dwell time per 100ms (Duty Cycle)

Cooper Power Systems, RFN420CL (1W), Time of Occupancy, Limit = 0.4Seconds per 10 Seconds (For systems with a OCC BW > 250kHz). Measured = 13 pulses of 19.5ms= 253.5ms (0.253Seconds) per 10 Second Period

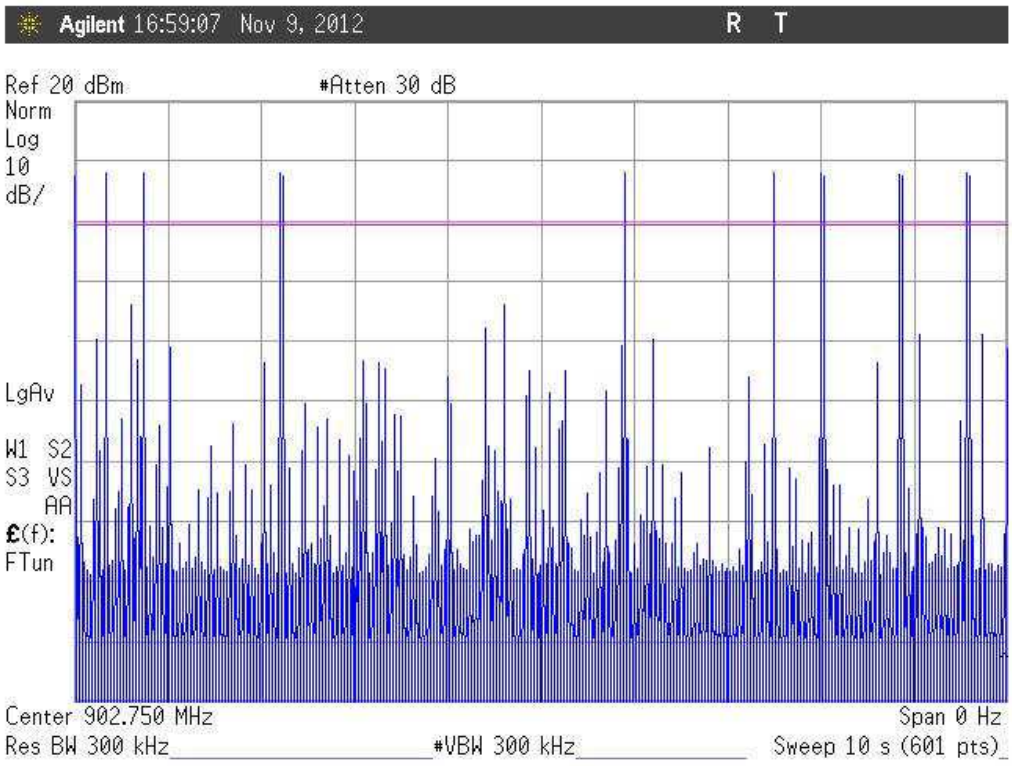

Figure 3: Time of Occupancy

5.2 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 Center 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 EUT has an adjustable output range. The highest and lowest power available is shown below.

Table 6: RF Power Output

Frequency	Power Setting	Level (dBm)	Limit (dBm)	Pass/Fail
Low Channel: 902.75MHz	High	28.67	30	Pass
Center Channel: 914.75MHz	High	29.34	30	Pass
High Channel: 927.25MHz	High	29.67	30	Pass
Low Channel: 902.75MHz	Low	-29.50	30	Pass
Center Channel: 914.75MHz	Low	-29.33	30	Pass
High Channel: 927.25MHz	Low	-29.58	30	Pass

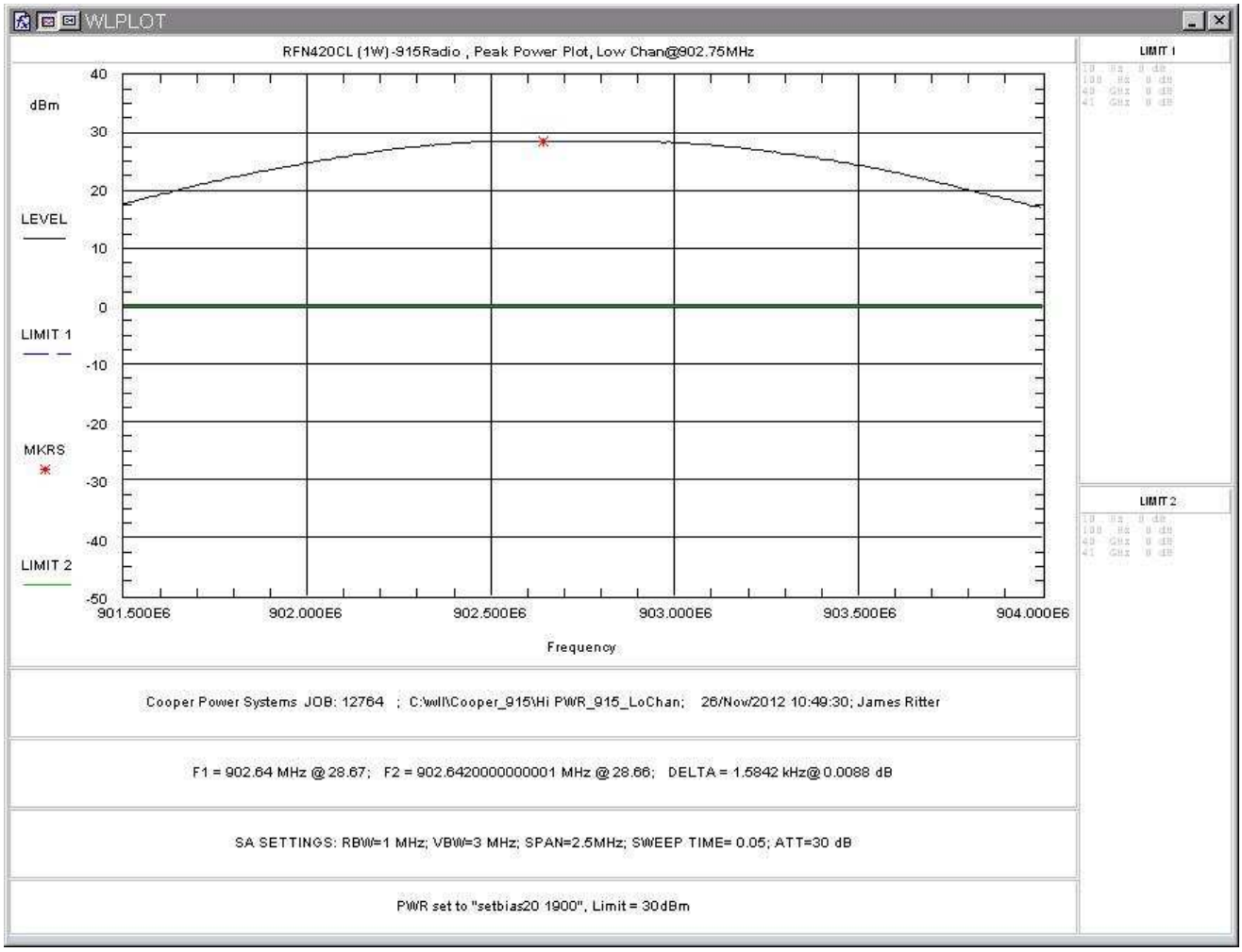

Figure 4: RF Peak Power, High Power, Low Channel

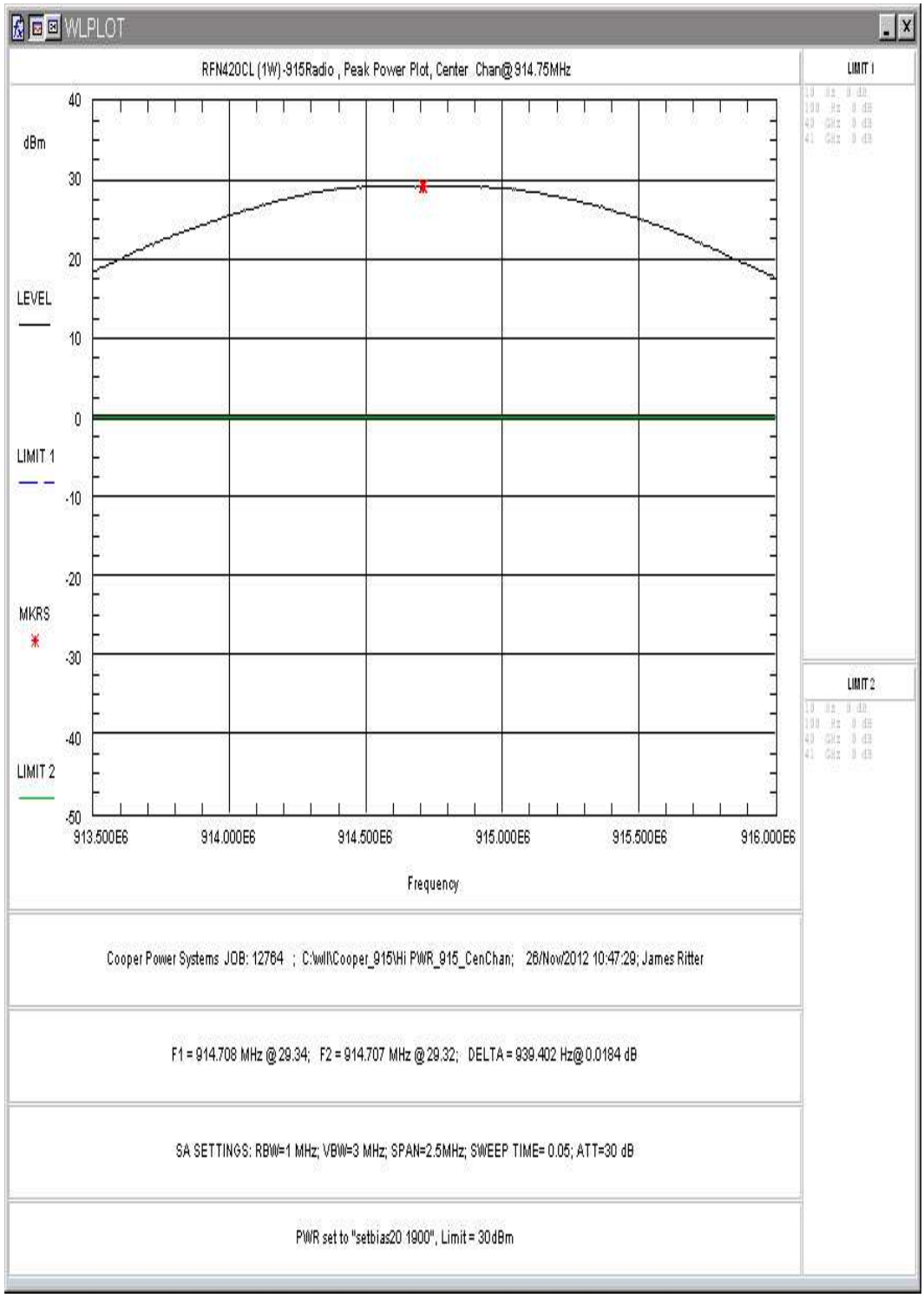

Figure 5: RF Peak Power, High Power, Center Channel

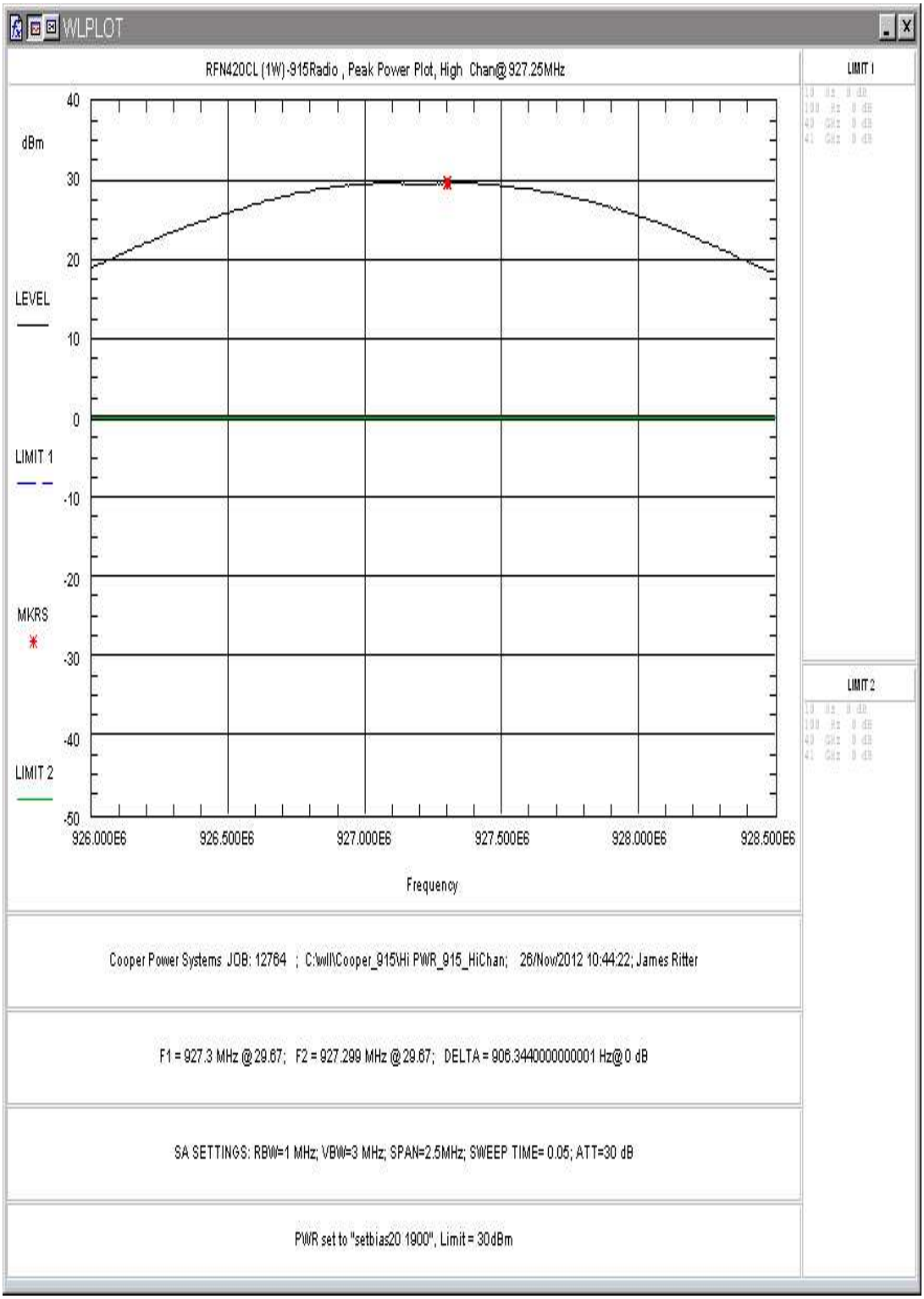

Figure 6: RF Peak Power, High Power, High Channel

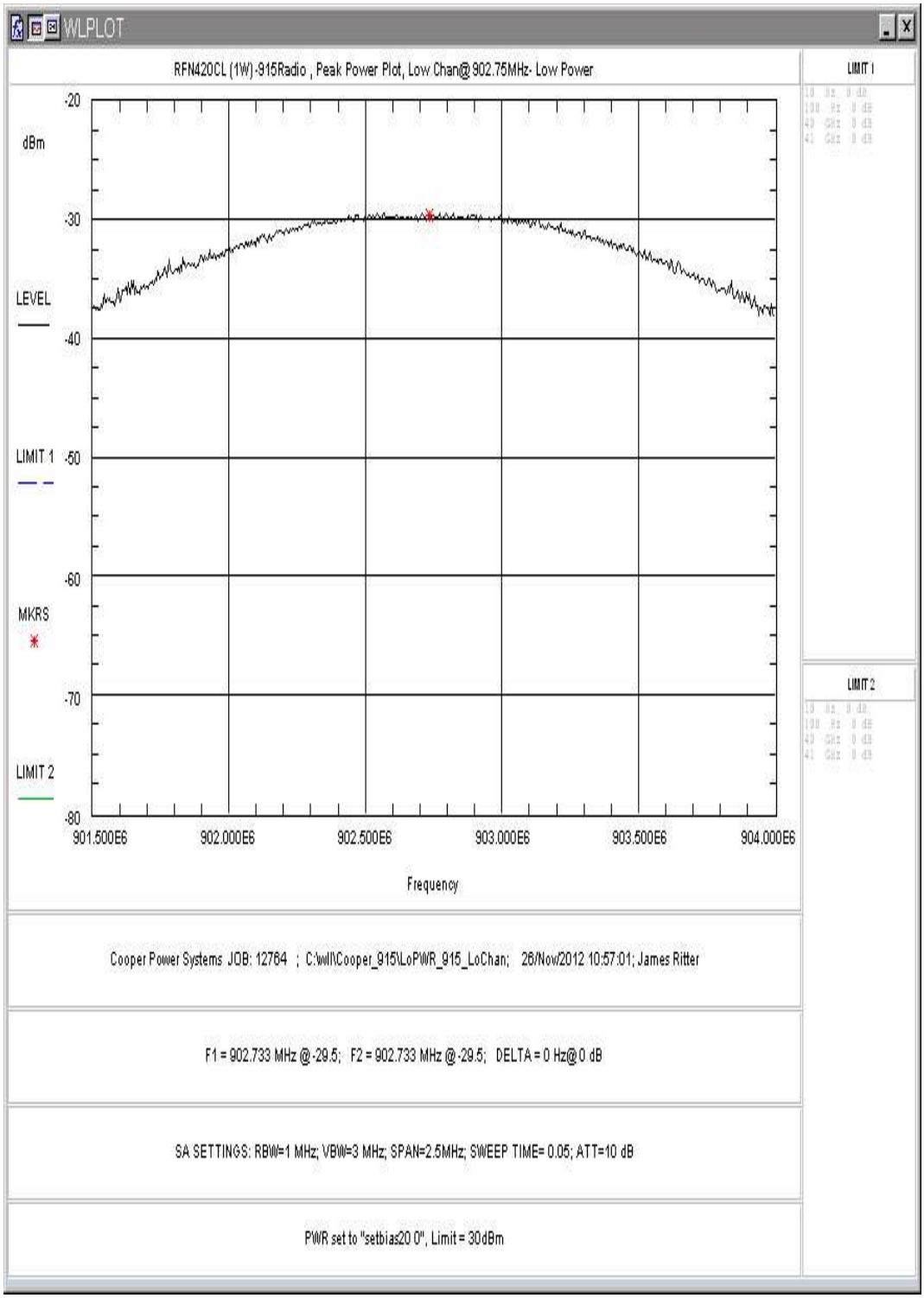

Figure 7: RF Peak Power, Low Power, Low Channel

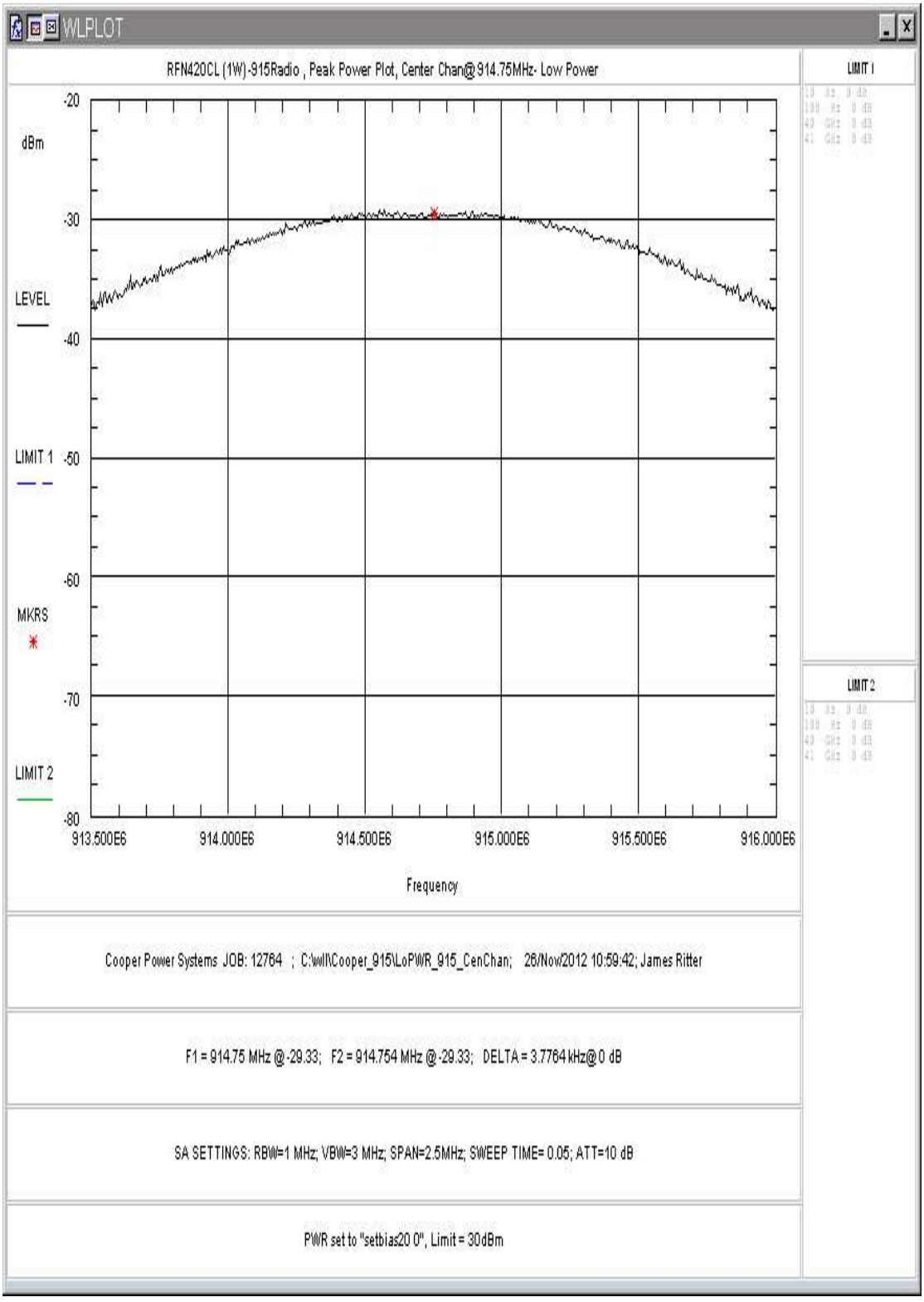

Figure 8: RF Peak Power, Low Power, Center Channel

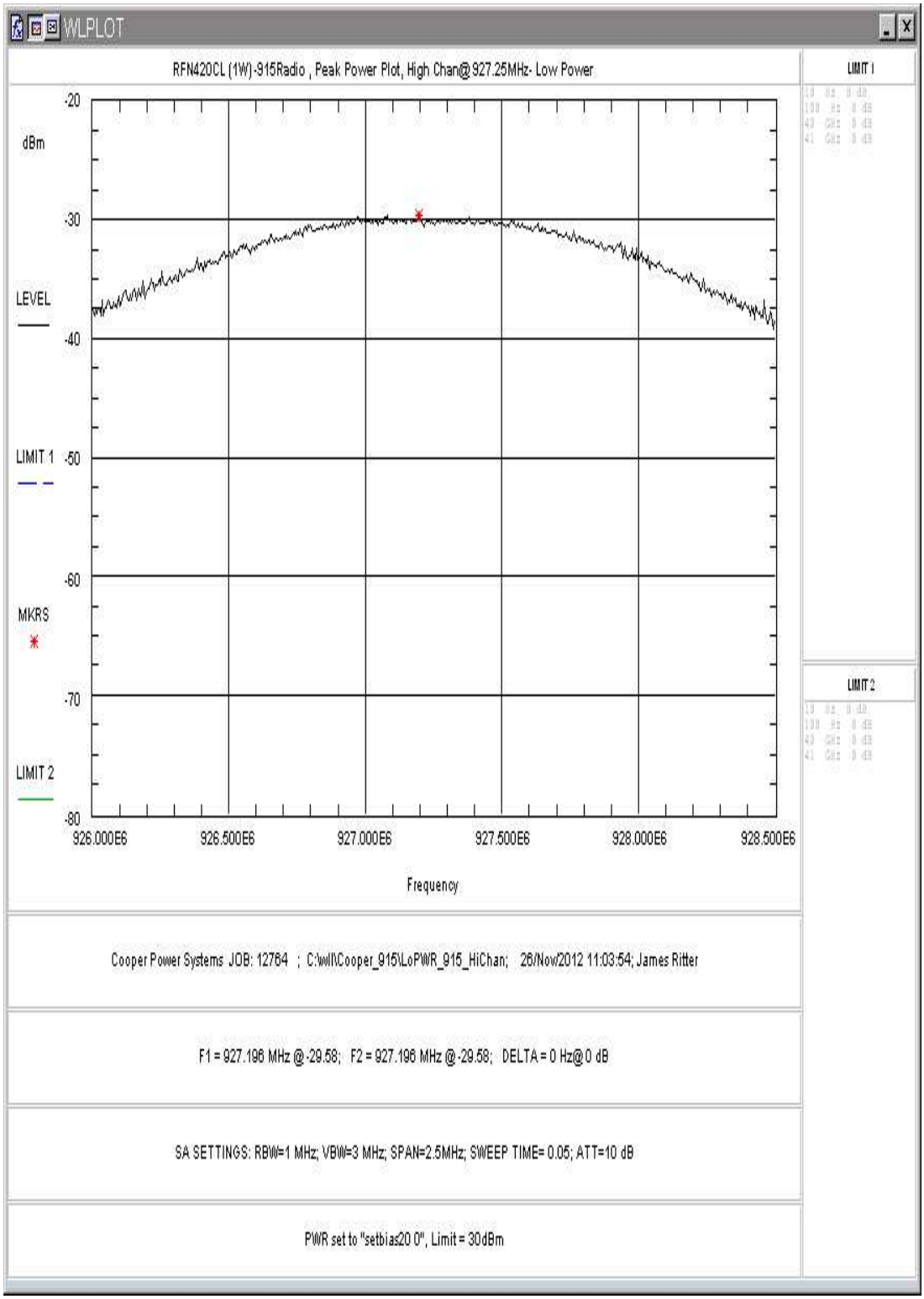

Figure 9: RF Peak Power, Low Power, High Channel

5.3 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 maximum 20 dB bandwidth not exceed 500kHz.

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

Table 7 provides a summary of the Occupied Bandwidth Results.

Table 7: Occupied Bandwidth Results

Frequency	Bandwidth (kHz)	Limit (kHz)	Pass/Fail
Low Channel: 902.75MHz	457.0	500	Pass
Center Channel: 914.75MHz	475.6	500	Pass
High Channel: 927.25MHz	485.3	500	Pass

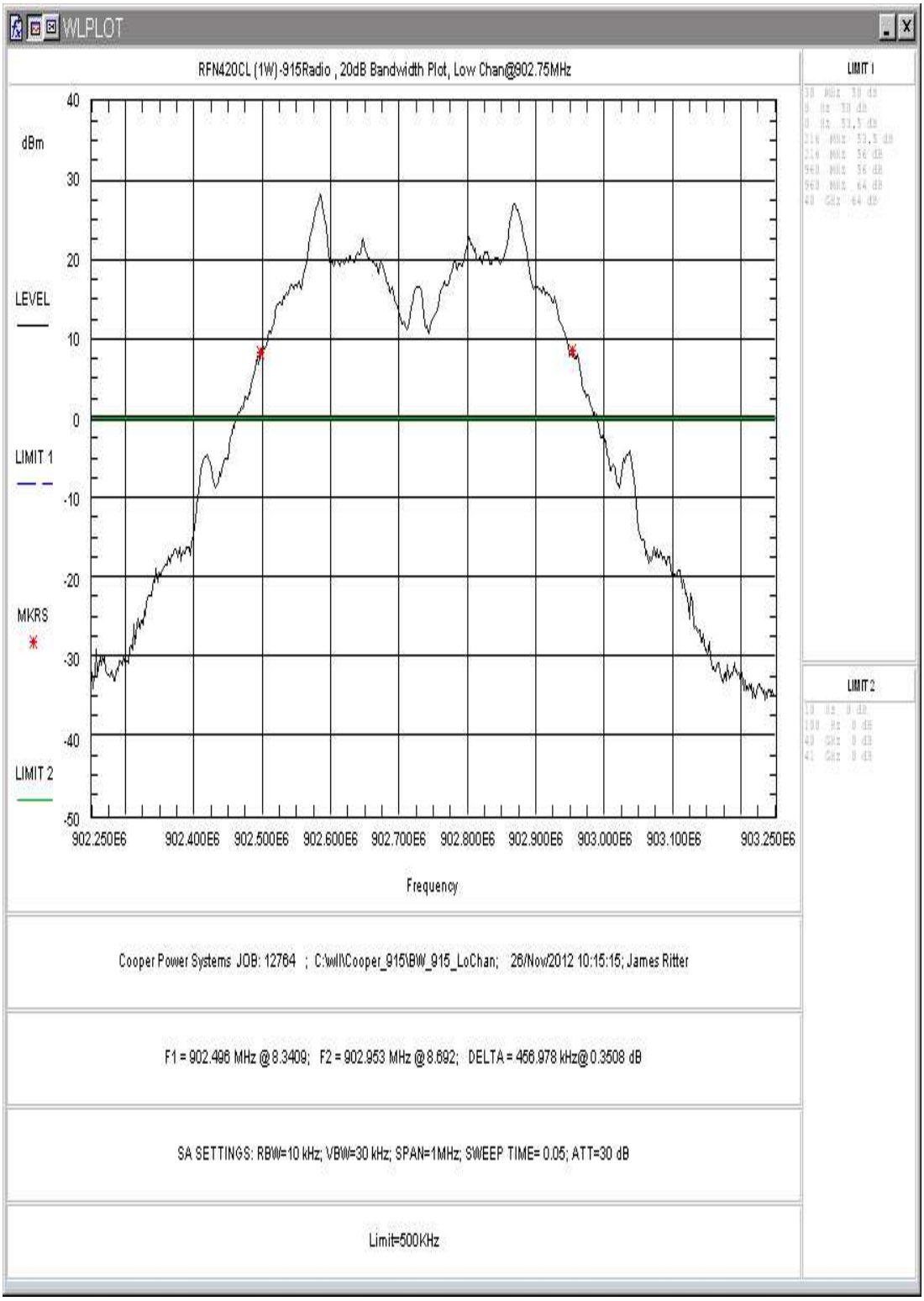

Figure 10: Occupied Bandwidth, Low Channel

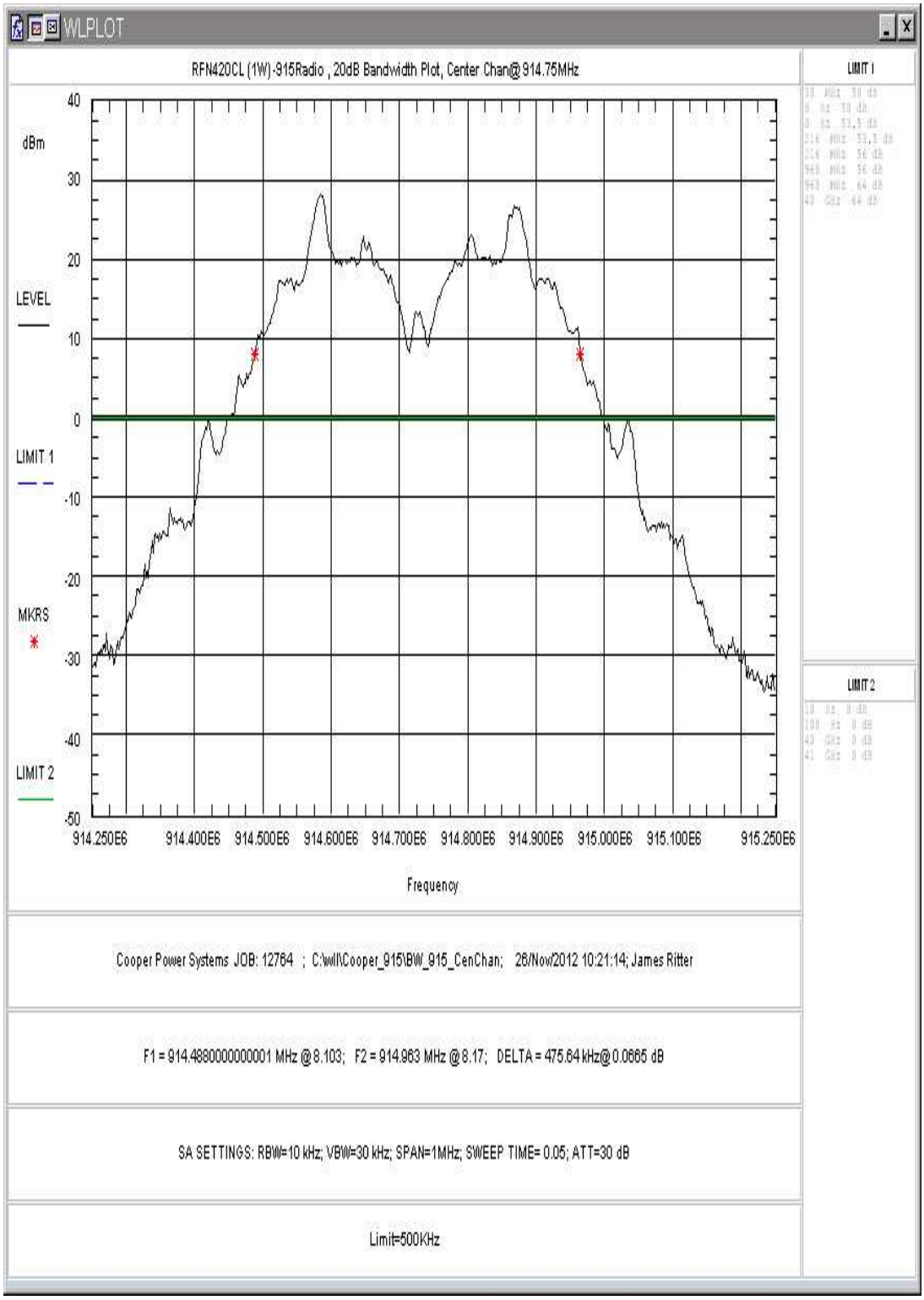

Figure 11: Occupied Bandwidth, Center Channel

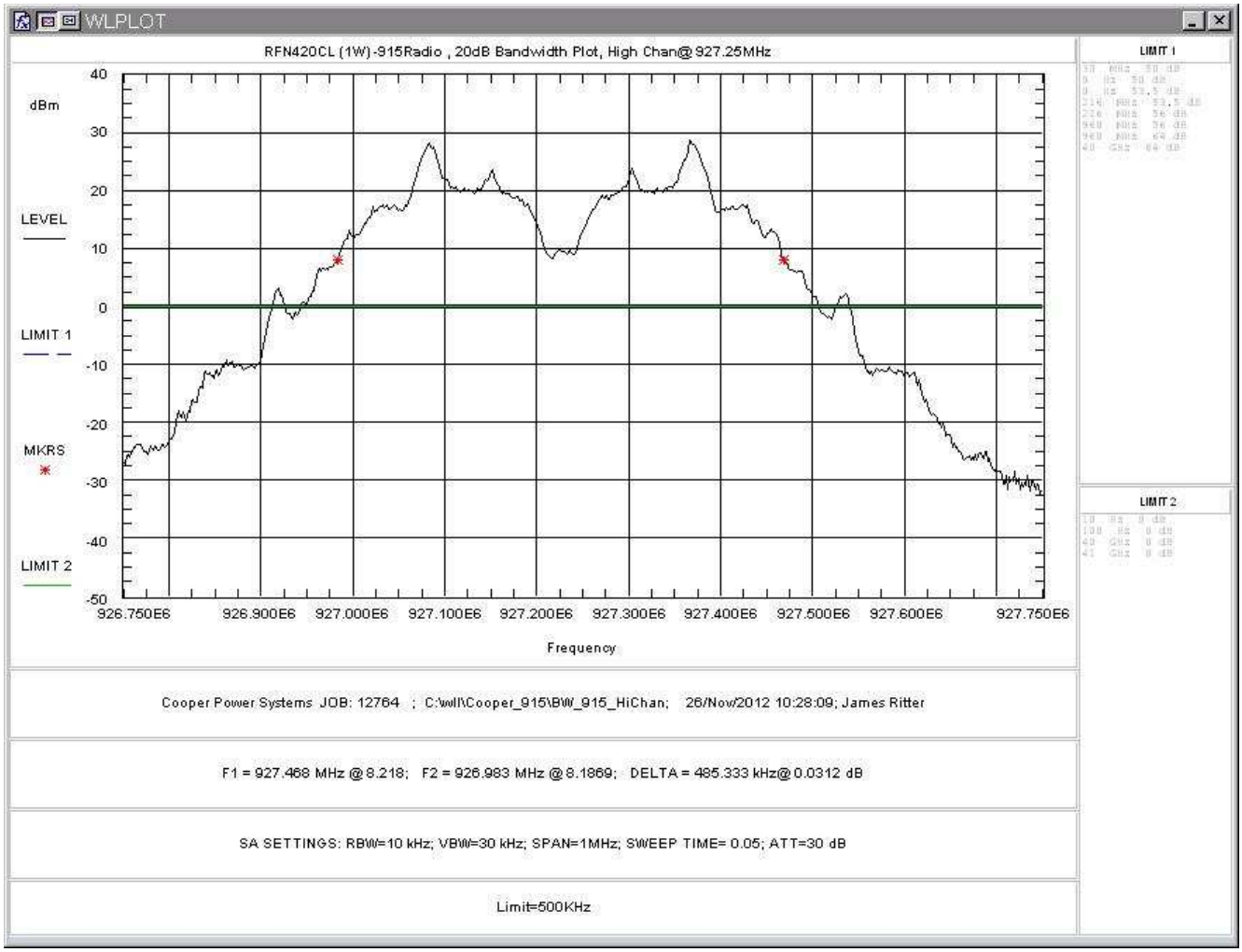

Figure 12: Occupied Bandwidth, High Channel

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

Per the FCC requirements, frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the 20 dB bandwidth, whichever is greater. The maximum 20dB bandwidth measured is 485.3kHz so the channel spacing must be more than 485.3kHz. In addition, for a 902-928MHz transmitter with an occupied bandwidth greater than 250kHz the minimum number of hopping channels shall be 25.

The EUT antenna was removed and the cable was connected directly into a spectrum analyzer through a 20 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 30 kHz and the video bandwidth was set to 100 kHz. The channel spacing of 2 adjacent channels was measured using a spectrum analyzer span setting of 1MHz. Also, the number of hopping channels was measured from 902-928MHz using a RBW of 30kHz and a VBW setting of 100kHz.

The following are plots of the channel spacing and number of hopping channels data. The channel spacing was measured to be 500kHz and the number of channels used is 50.

Note: in the following plots each channel is composed of 2 distinct peaks.

Table 8: Channel Spacing and Number of Channels Results

Frequency	Result	Limit	Pass/Fail
Channel Spacing	500kHz	484.5kHz minimum	Pass
Number of channels	50 channels	25 channels minimum	Pass

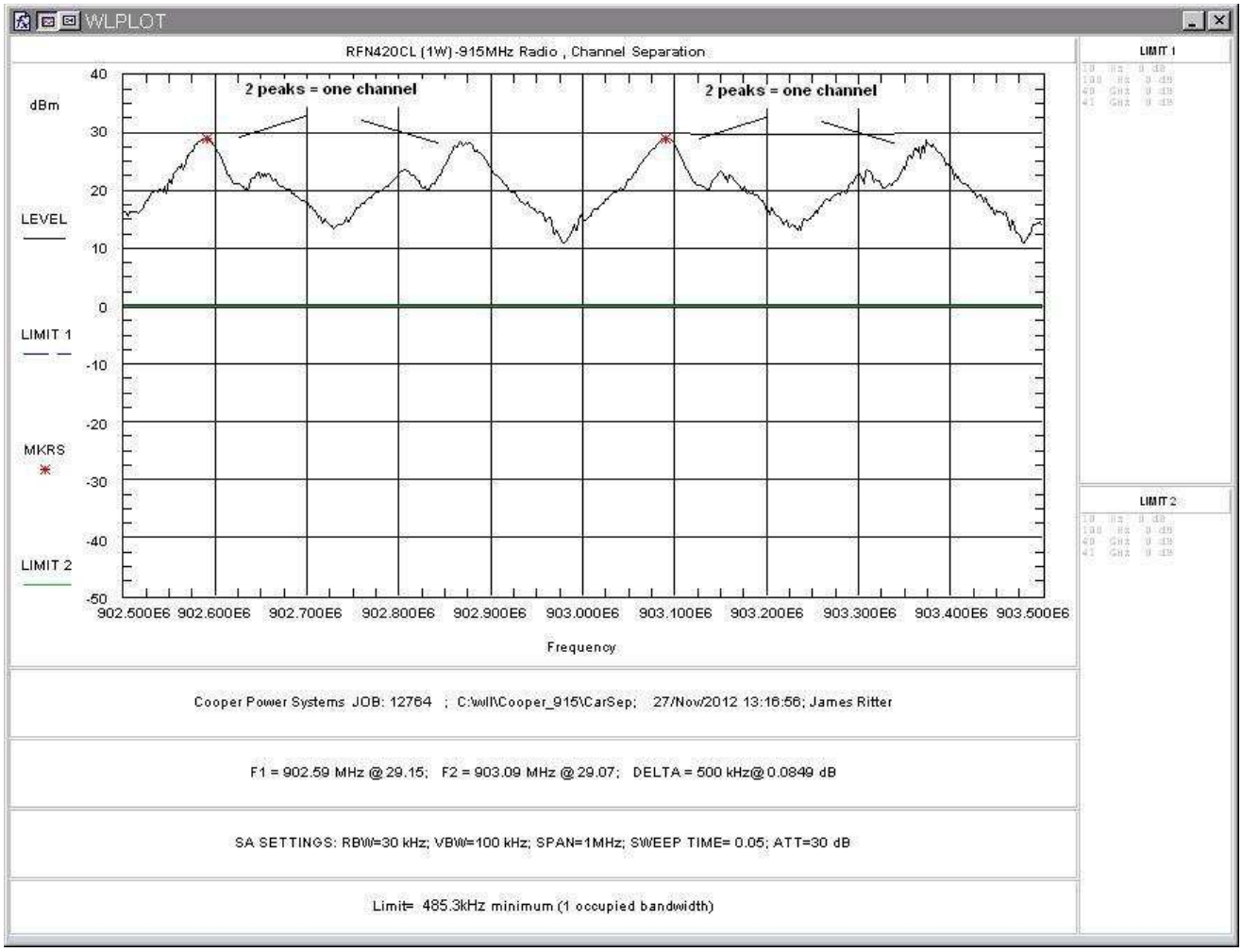

Figure 13: Channel Spacing

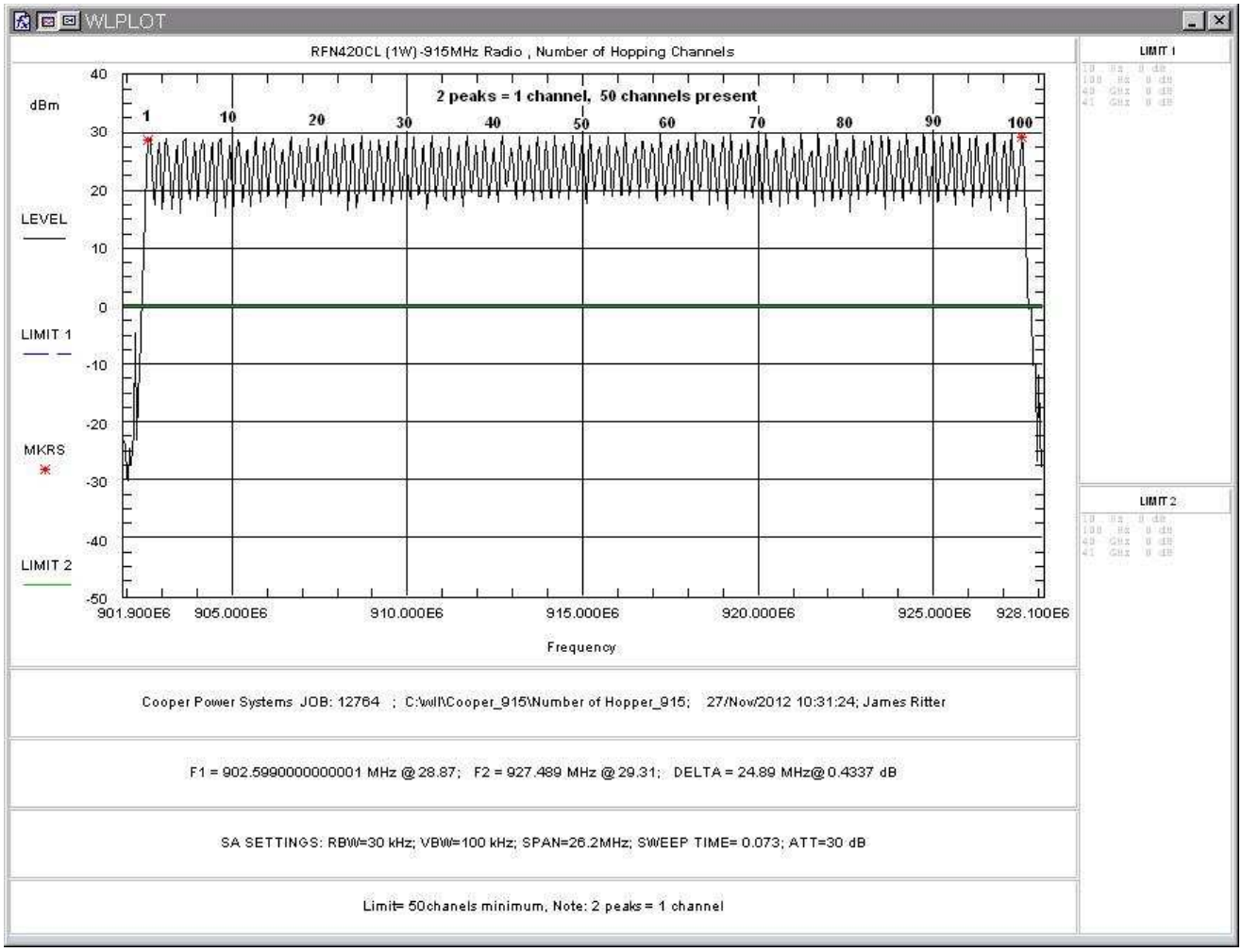

Figure 14: Number of Hopping Channels

5.5 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 20 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 1 MHz. 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.

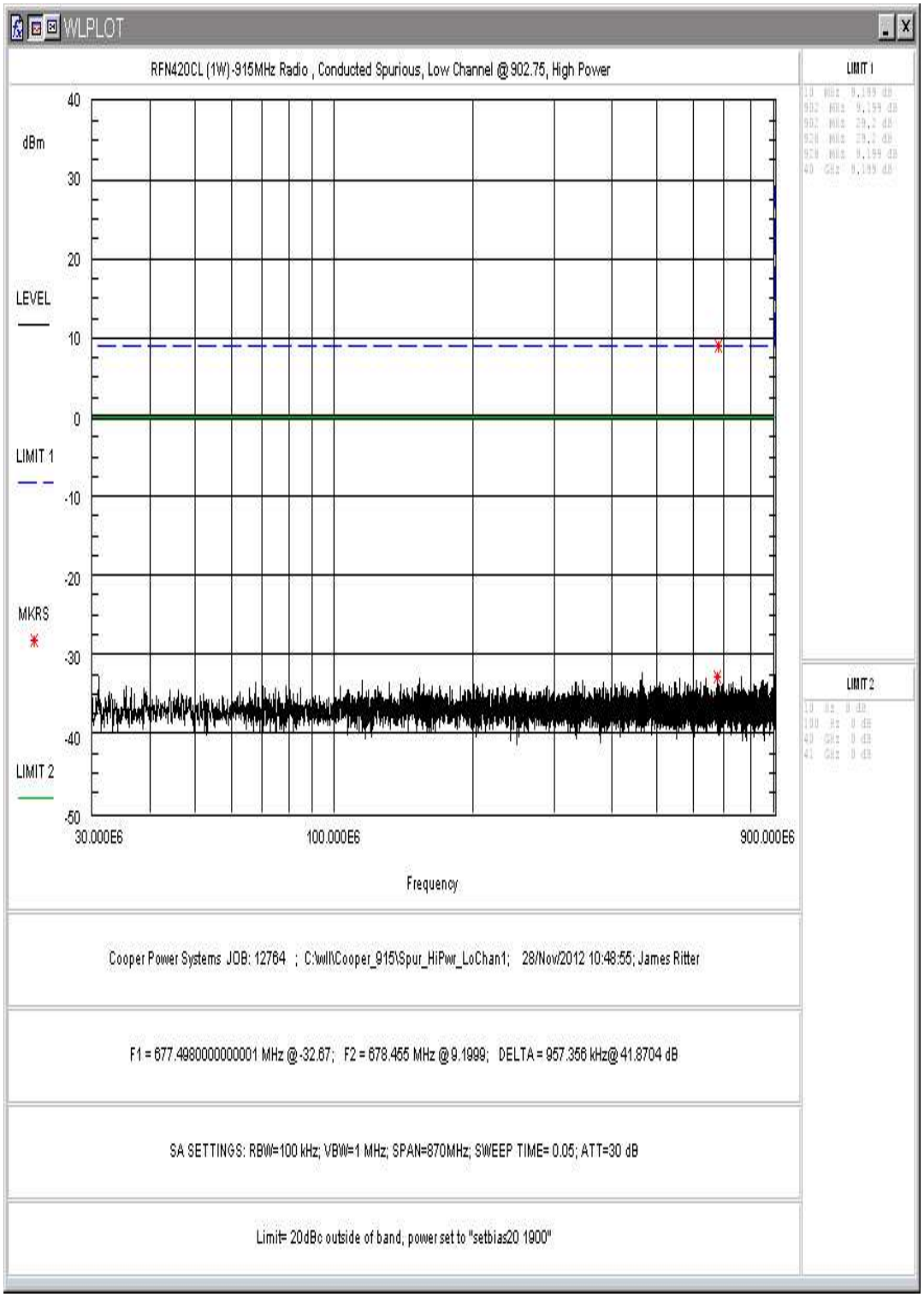

Figure 15: Conducted Spurious Emissions, High Power, Low Channel 30 - 900MHz

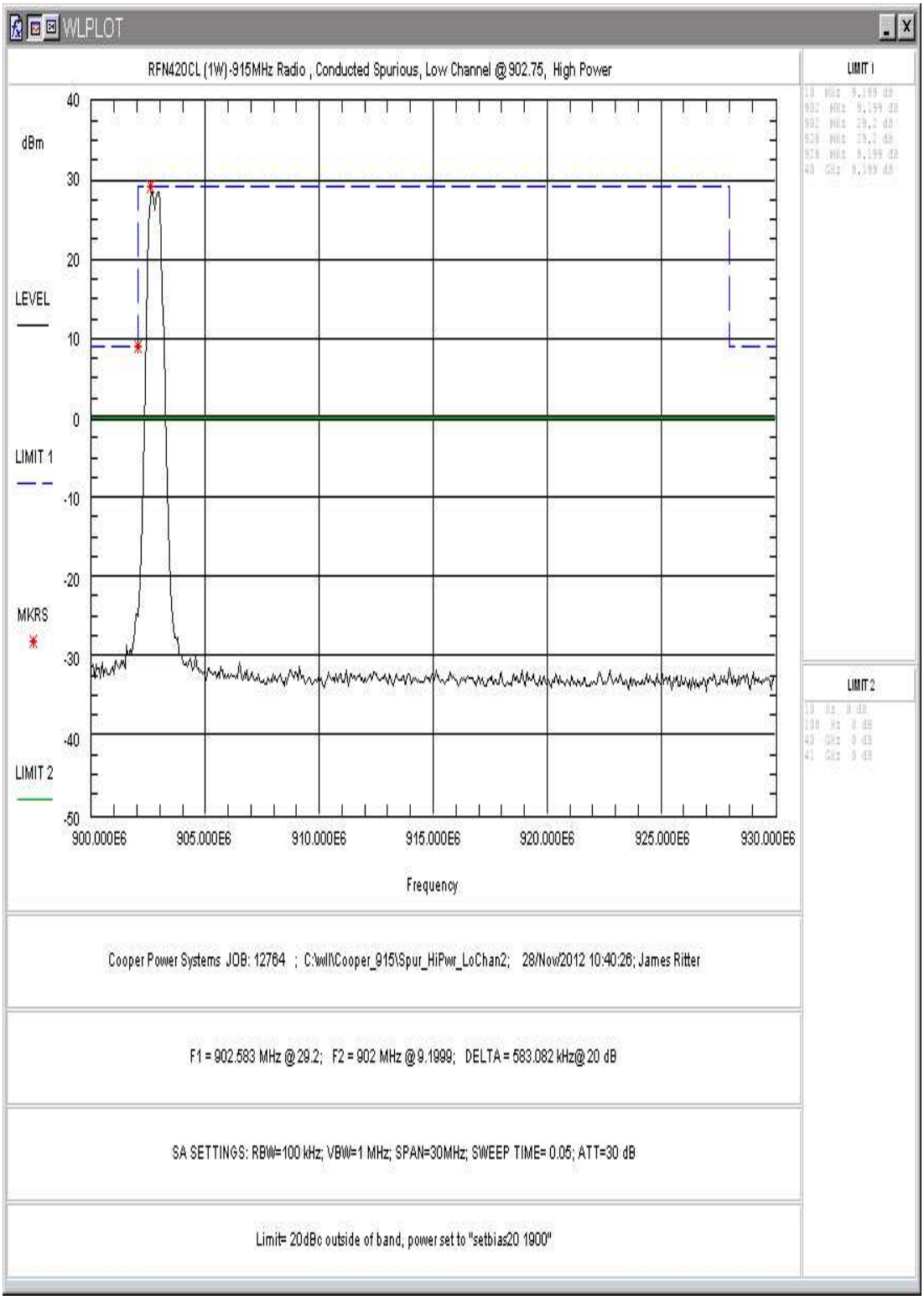

Figure 16: Conducted Spurious Emissions, High Power, Low Channel 900 – 930MHz

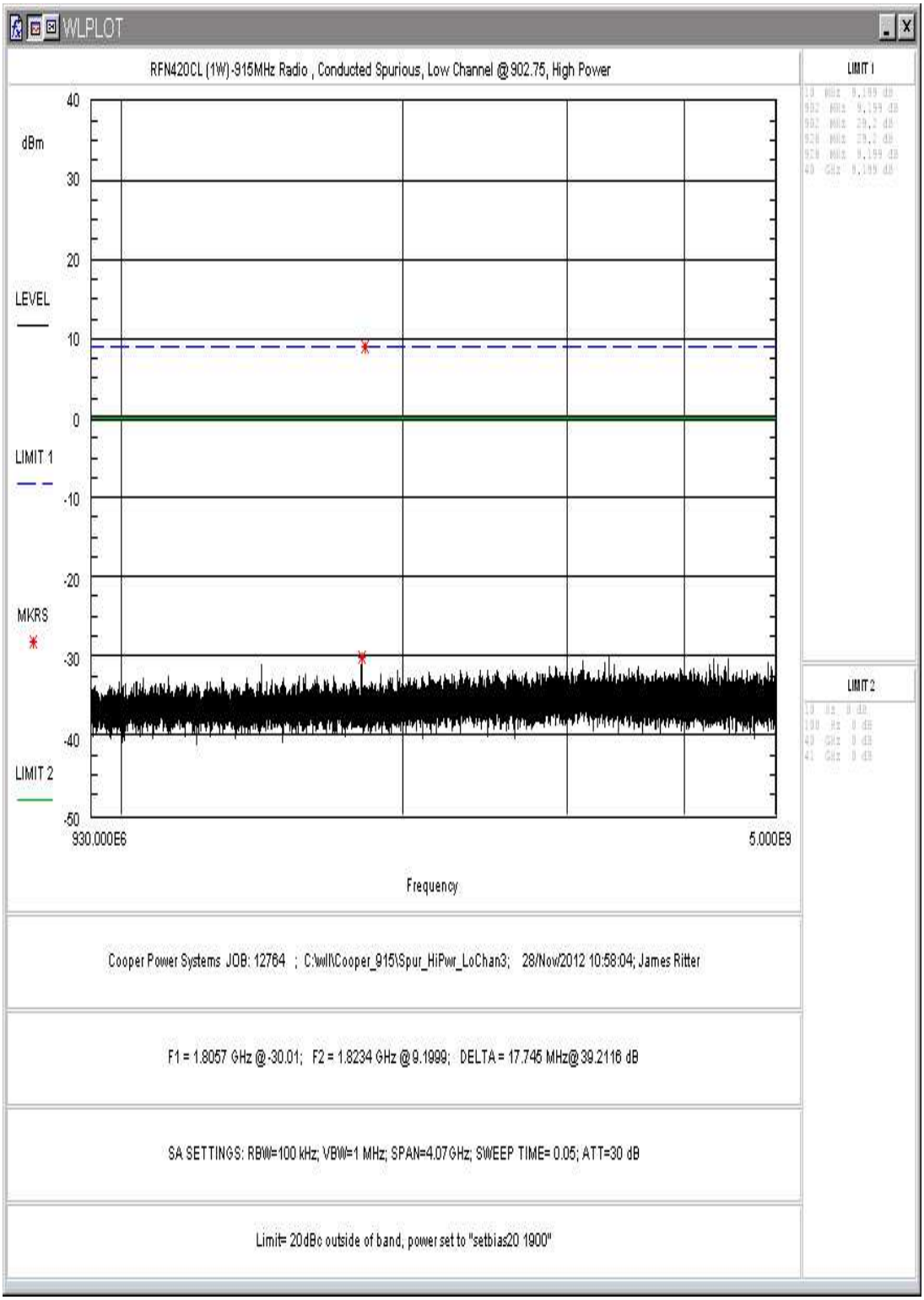

Figure 17: Conducted Spurious Emissions, High Power, Low Channel 930-5000MHz

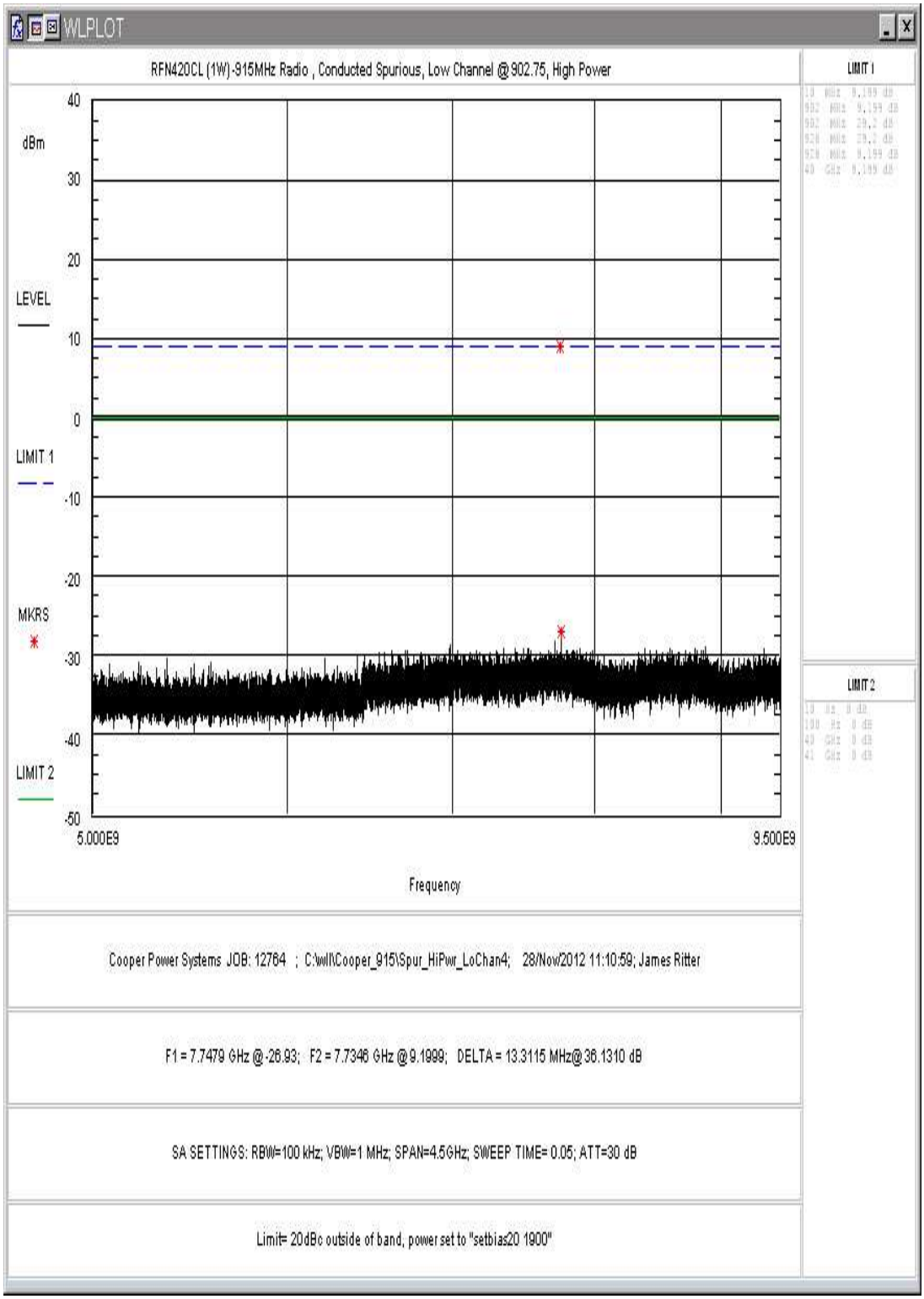

Figure 18: Conducted Spurious Emissions, High Power, Low Channel 5-9.5GHz

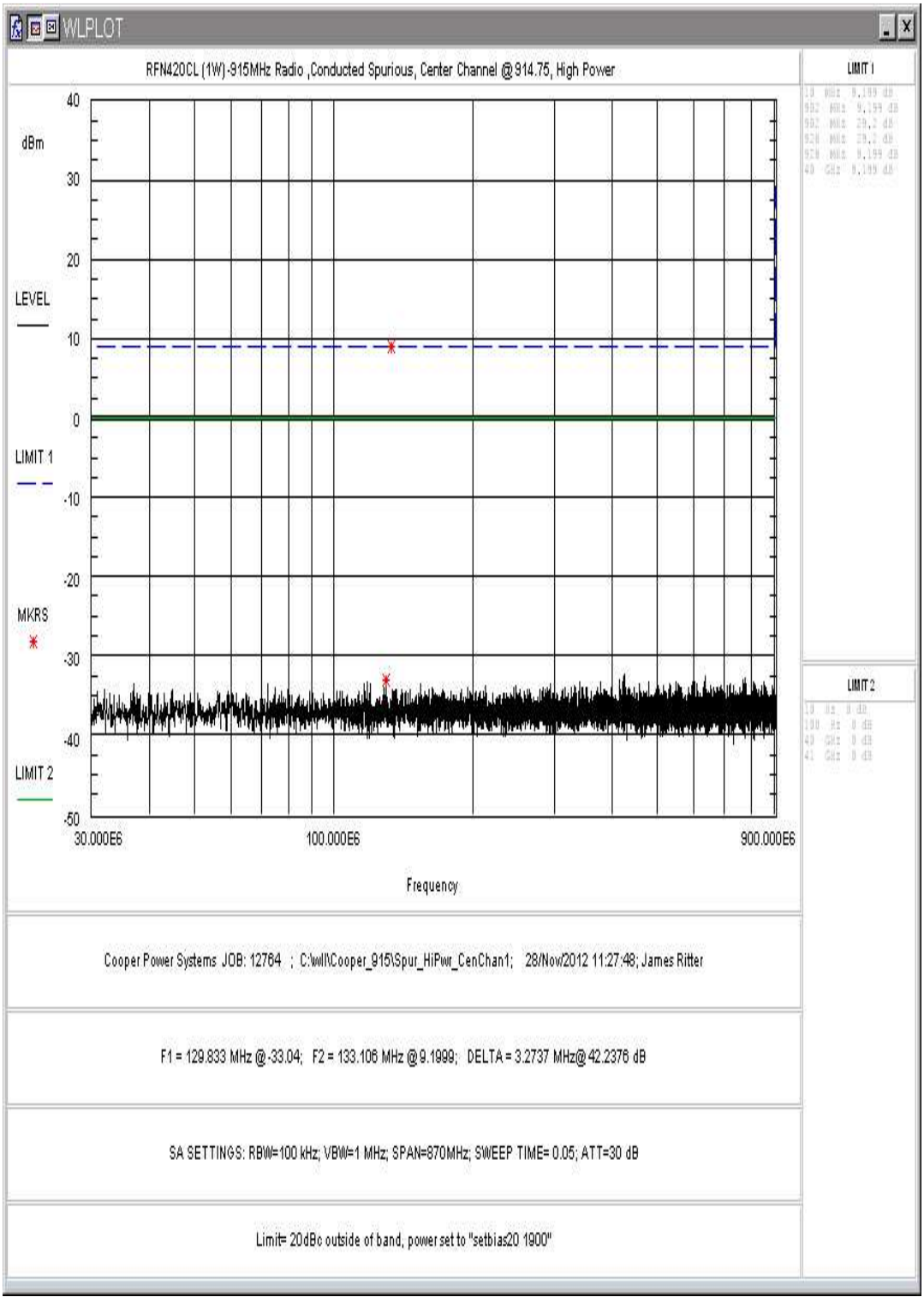

Figure 19: Conducted Spurious Emissions, High Power, Center Channel 30 - 900MHz

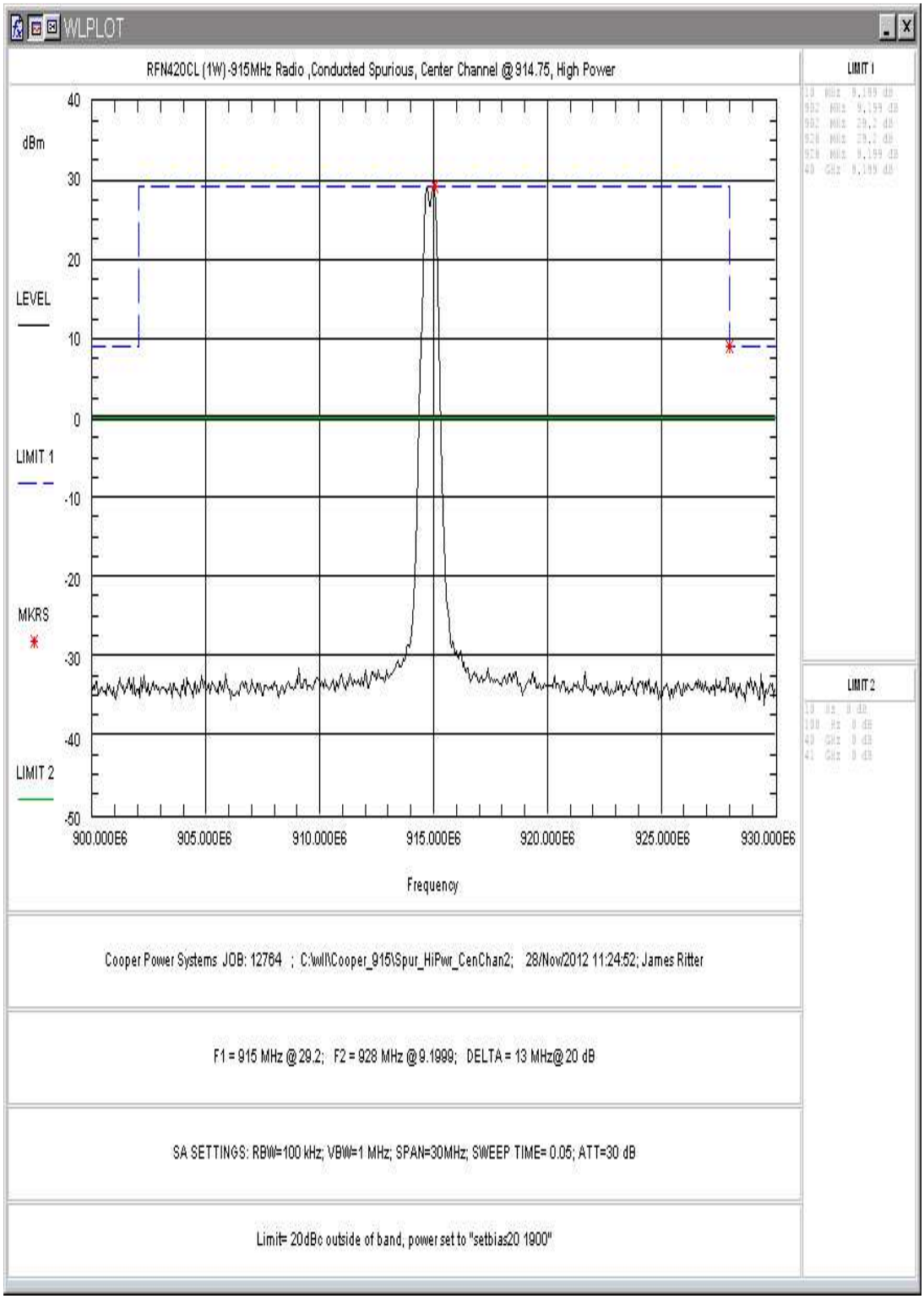

Figure 20: Conducted Spurious Emissions, High Power, Center Channel 900 – 930MHz

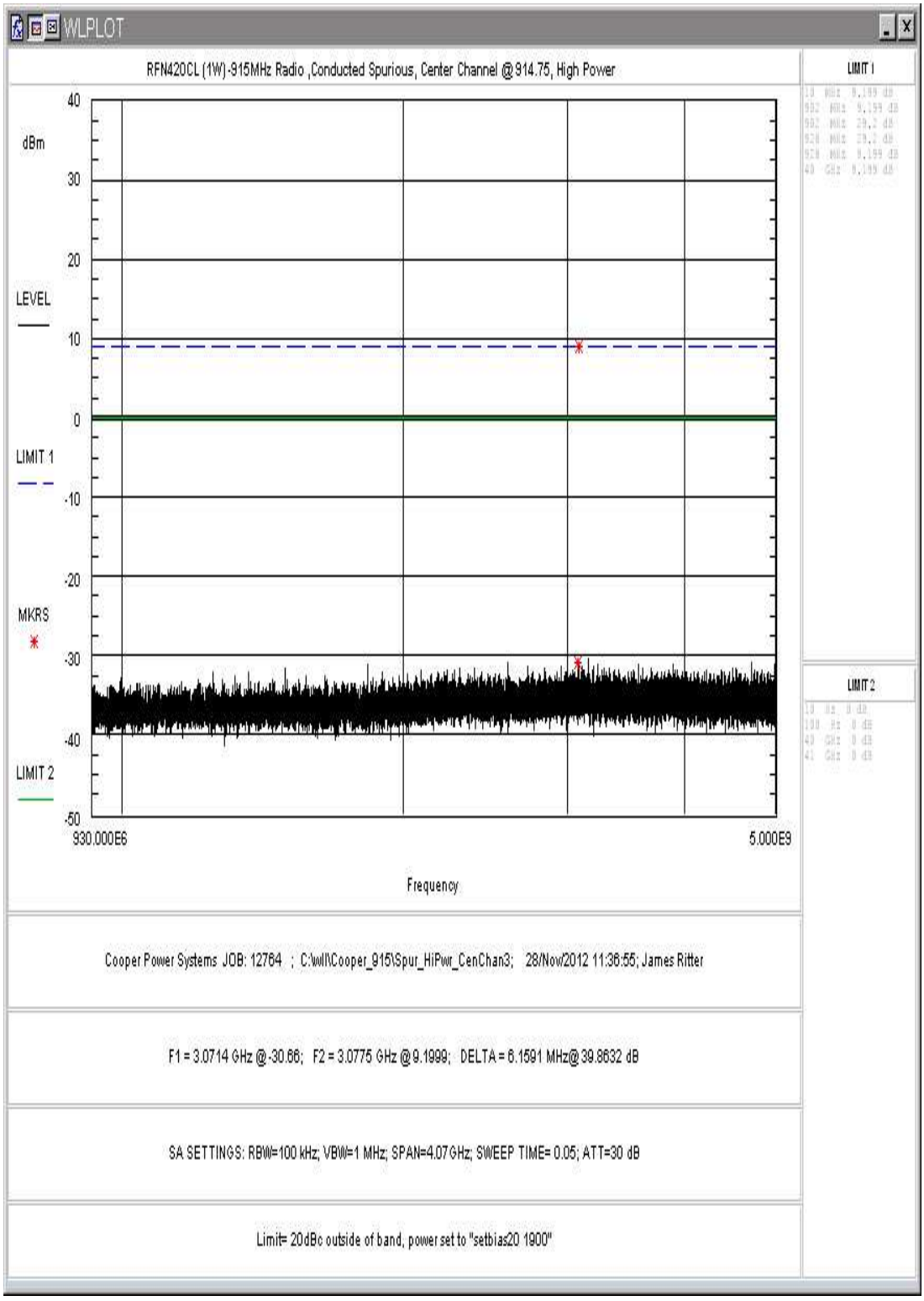

Figure 21: Conducted Spurious Emissions, High Power, Center Channel 930-5000MHz

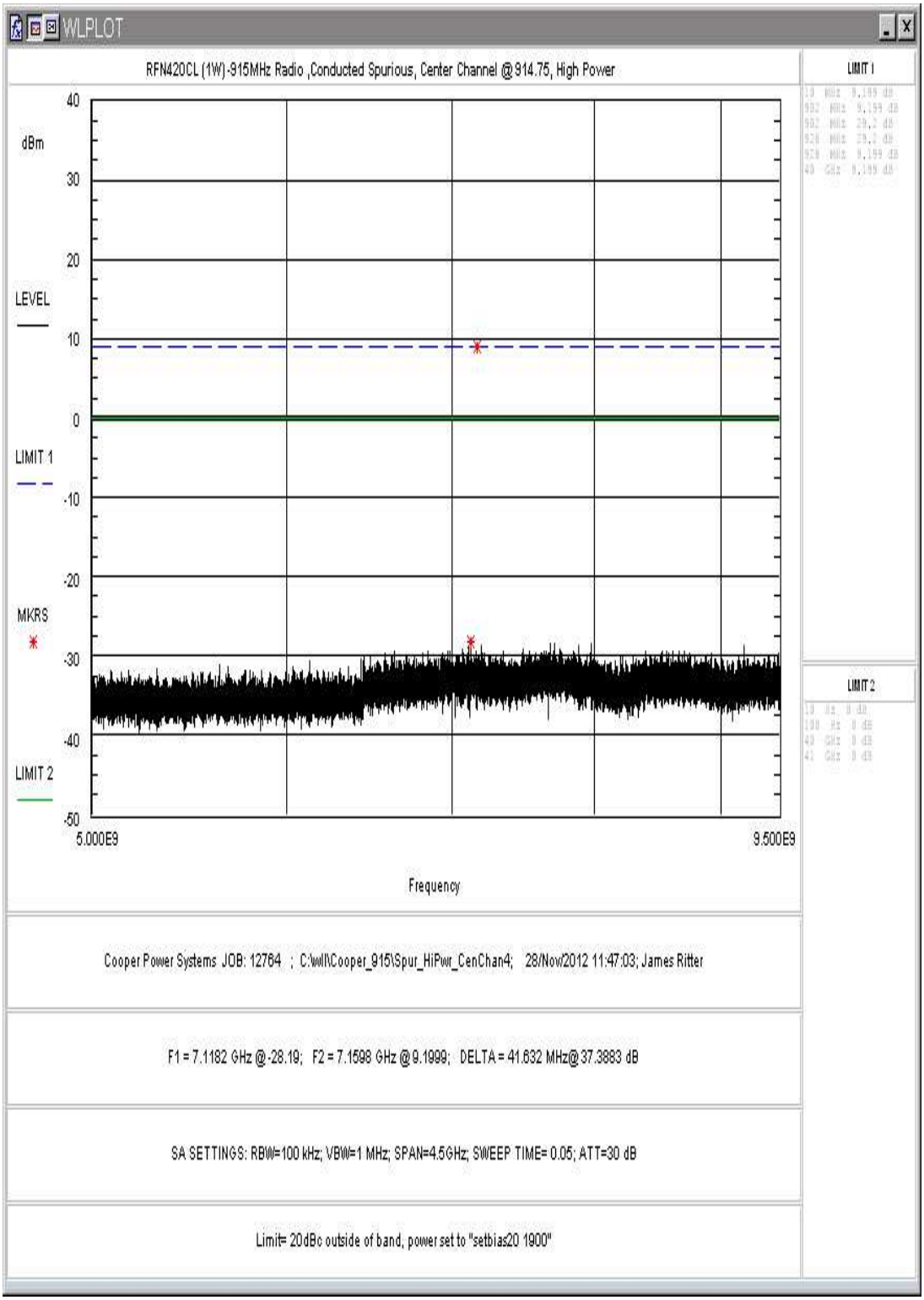

Figure 22: Conducted Spurious Emissions, High Power, Center Channel 5-9.5GHz

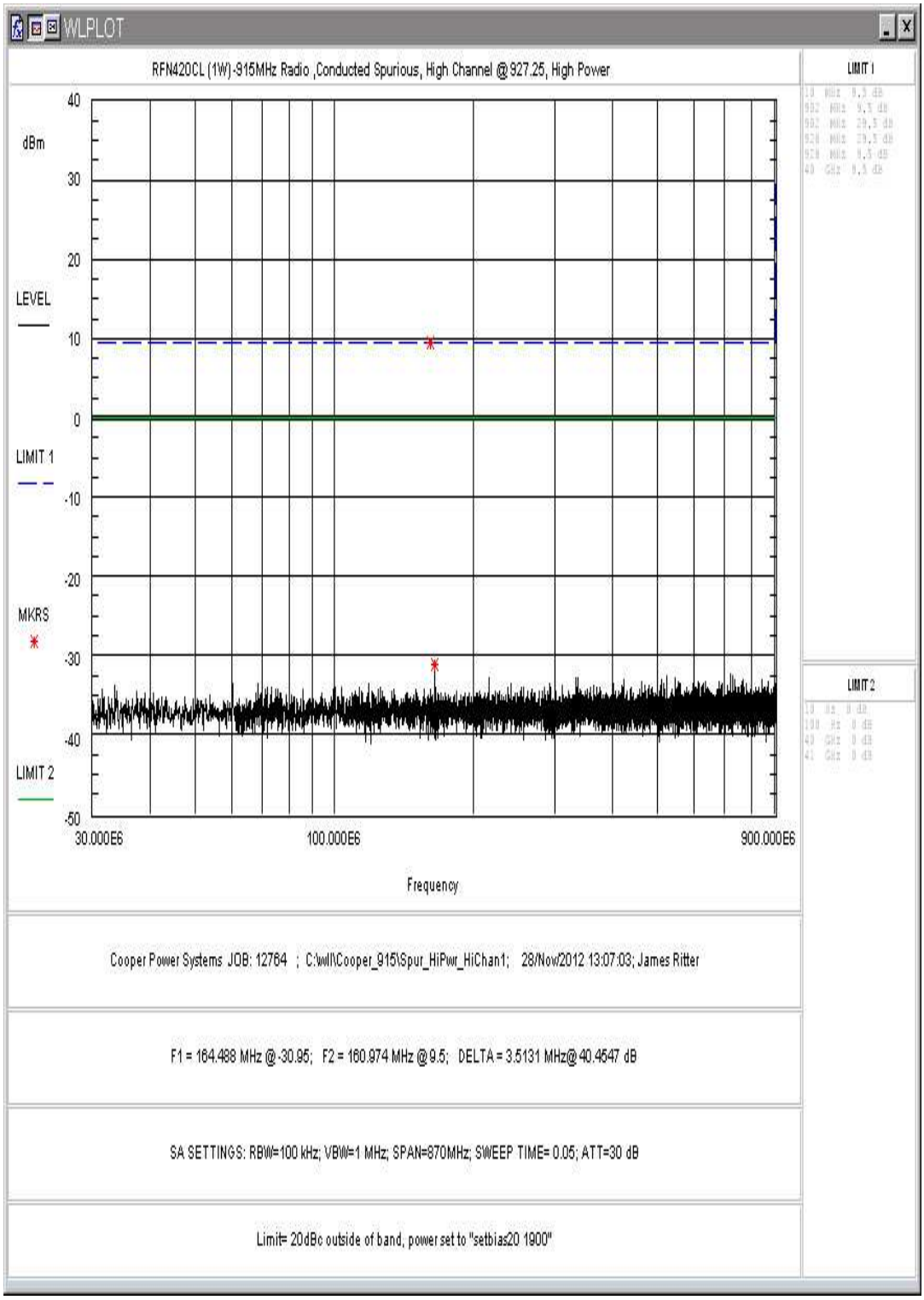

Figure 23: Conducted Spurious Emissions, High Power, High Channel 30 - 900MHz

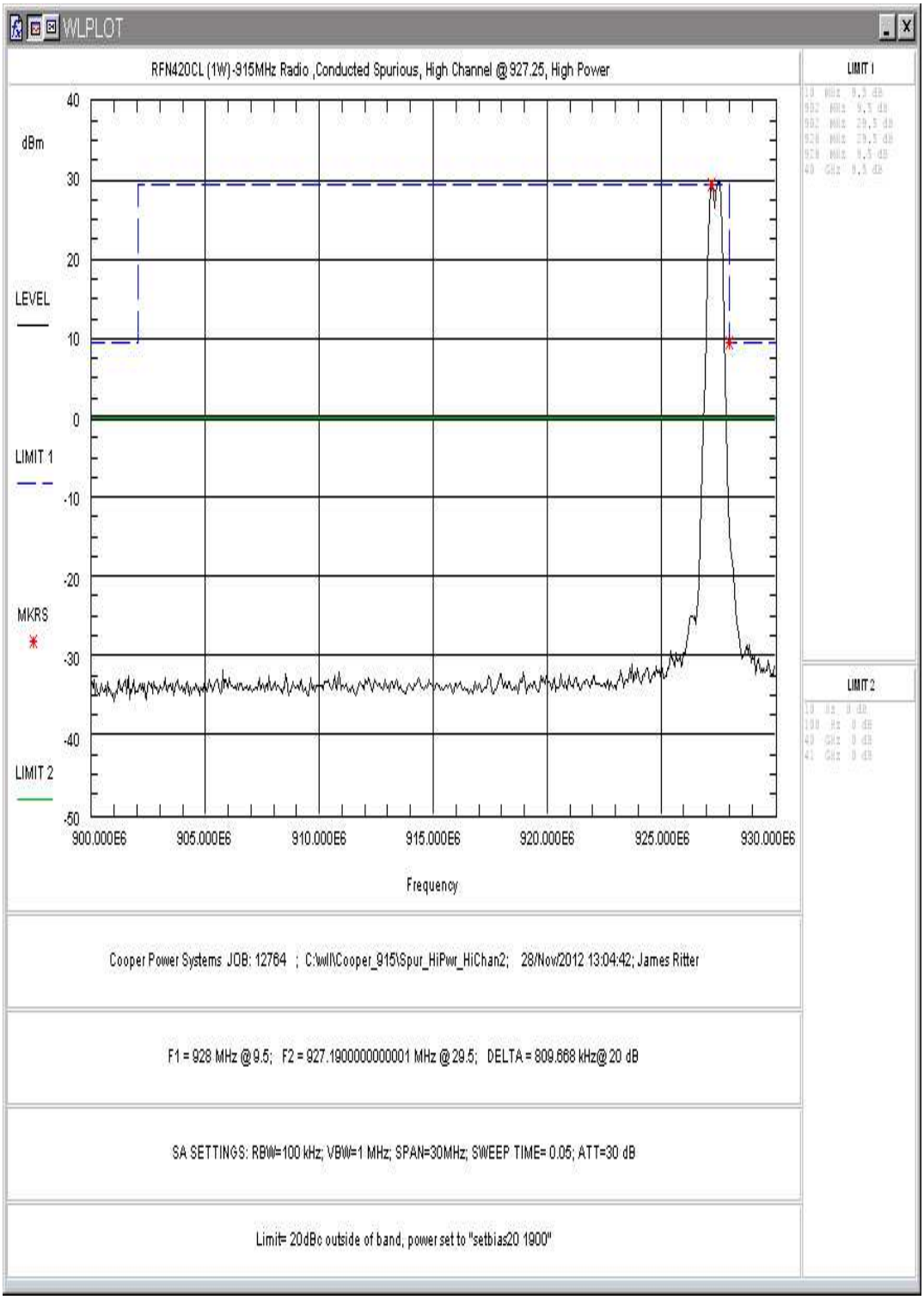

Figure 24: Conducted Spurious Emissions, High Power, High Channel 900 – 930MHz

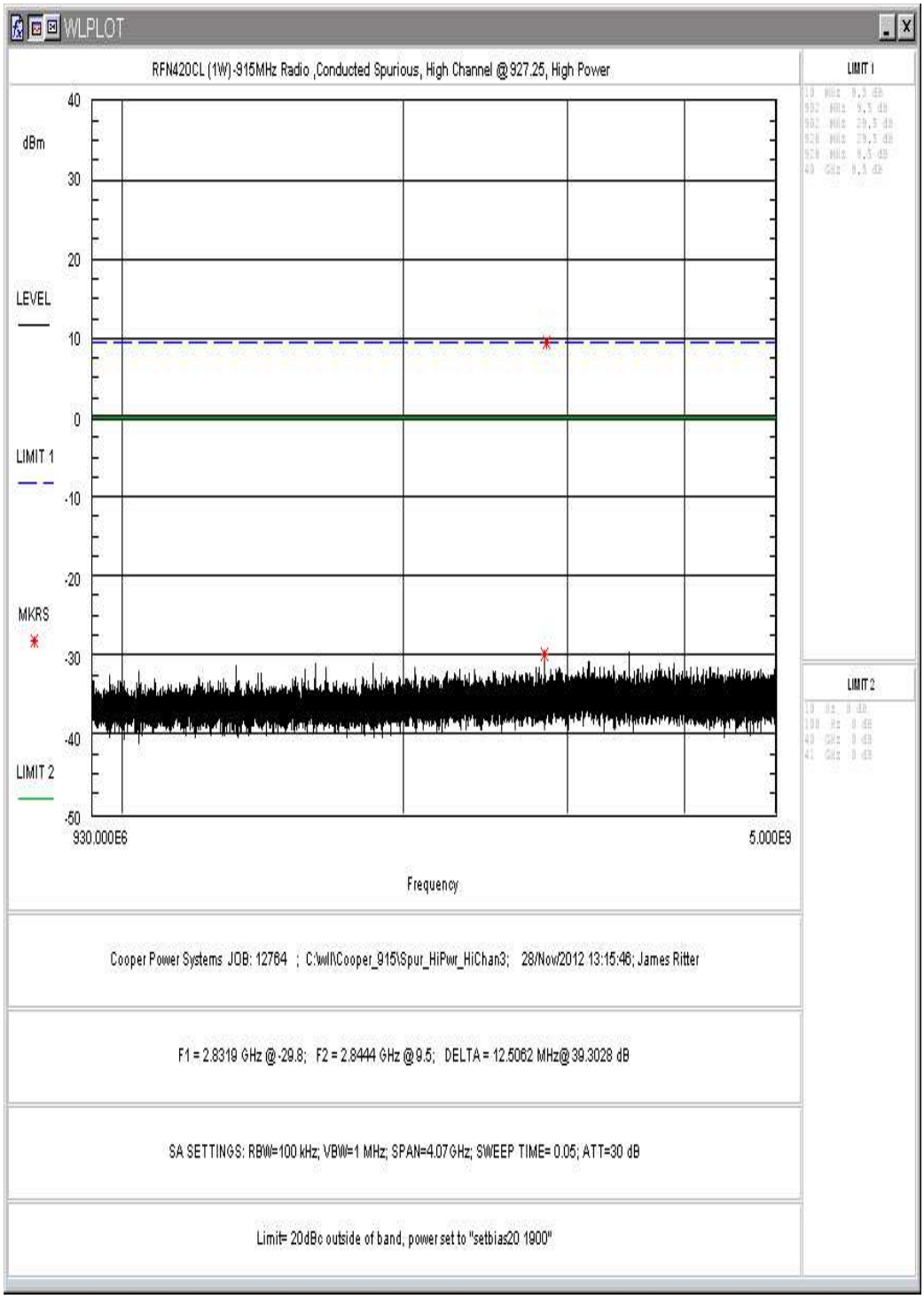

Figure 25: Conducted Spurious Emissions, High Power, High Channel 930-5000MHz

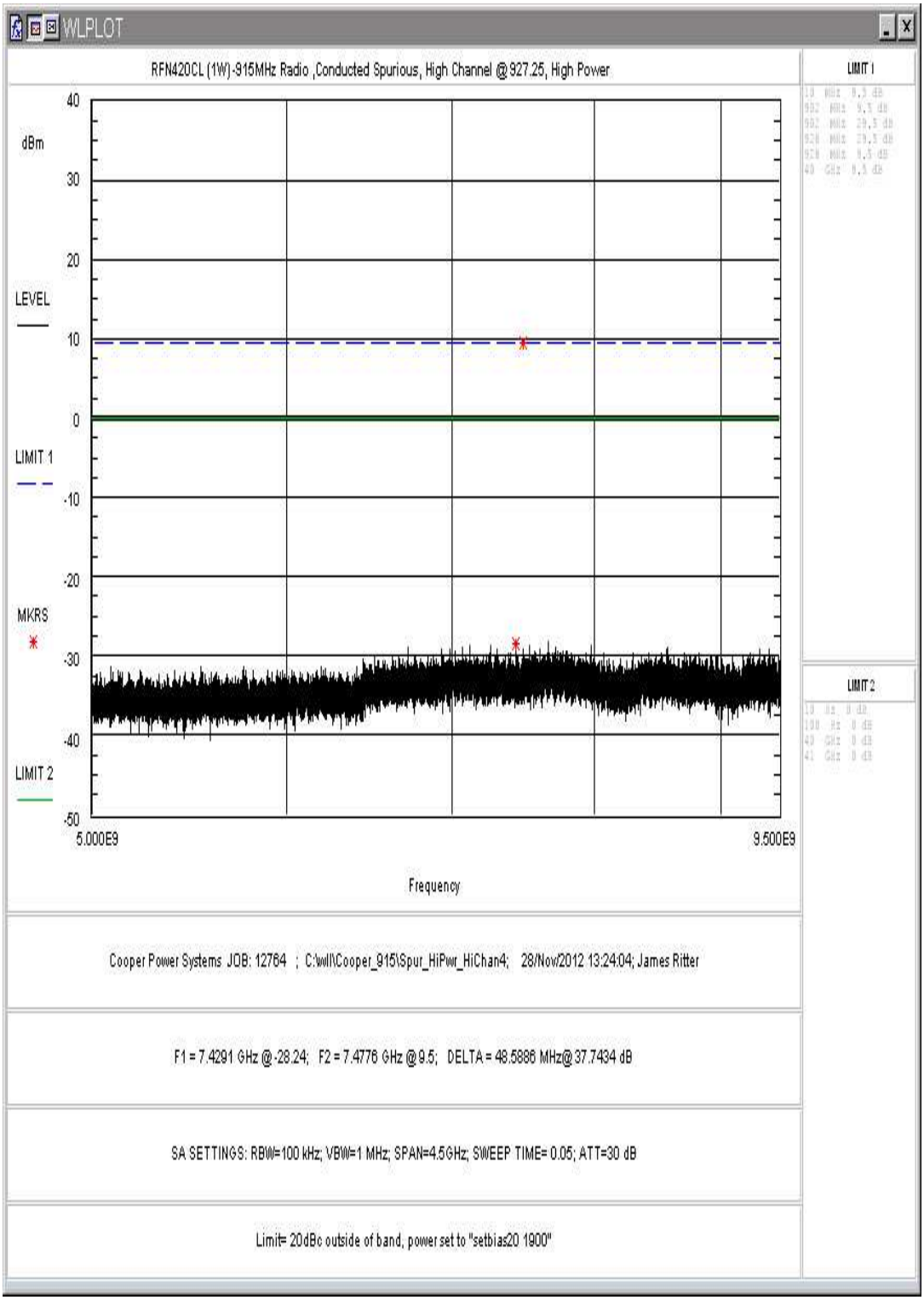

Figure 26: Conducted Spurious Emissions, High Power, High Channel 5-9.5GHz

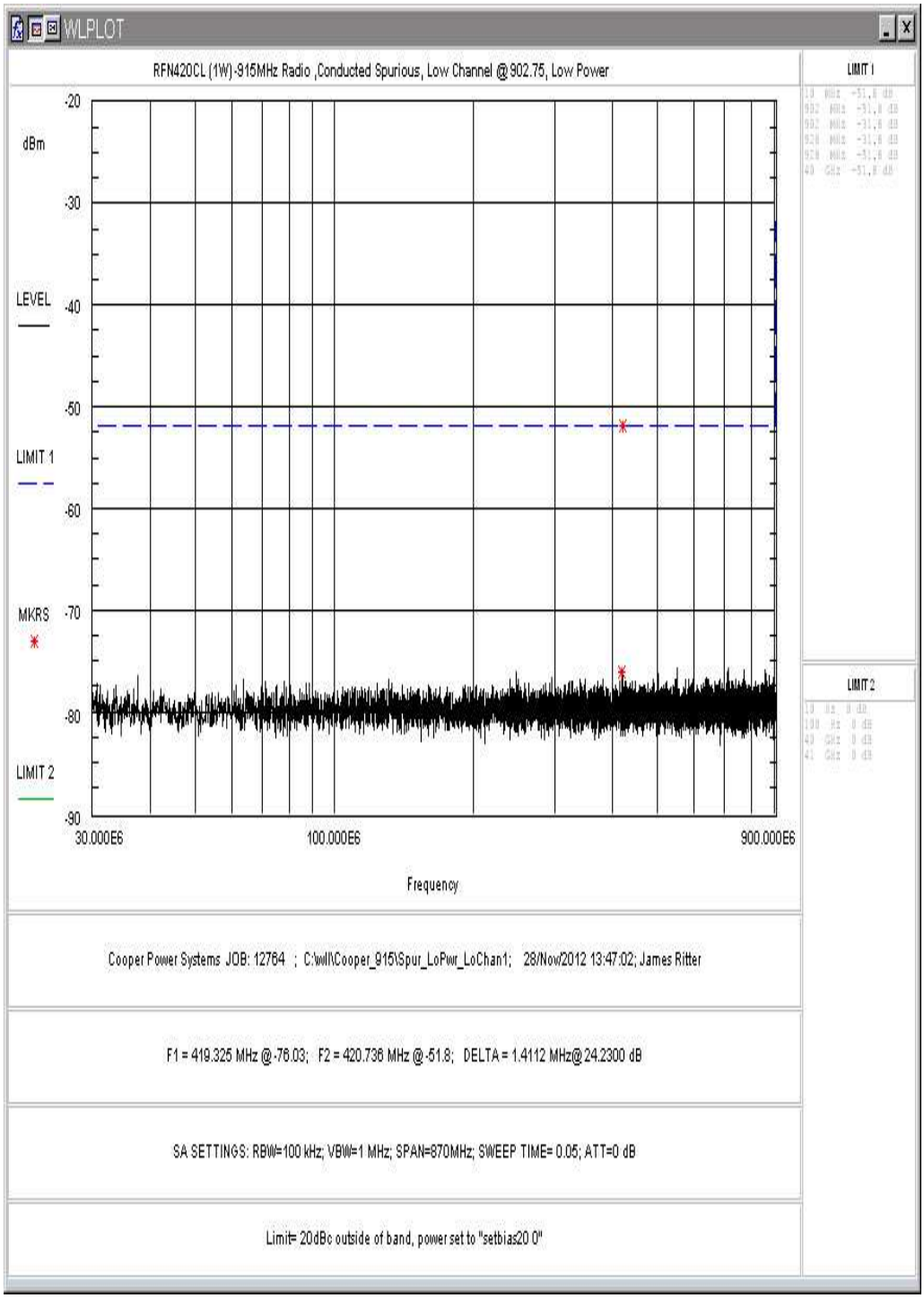

Figure 27: Conducted Spurious Emissions, Low Power, Low Channel 30 - 900MHz

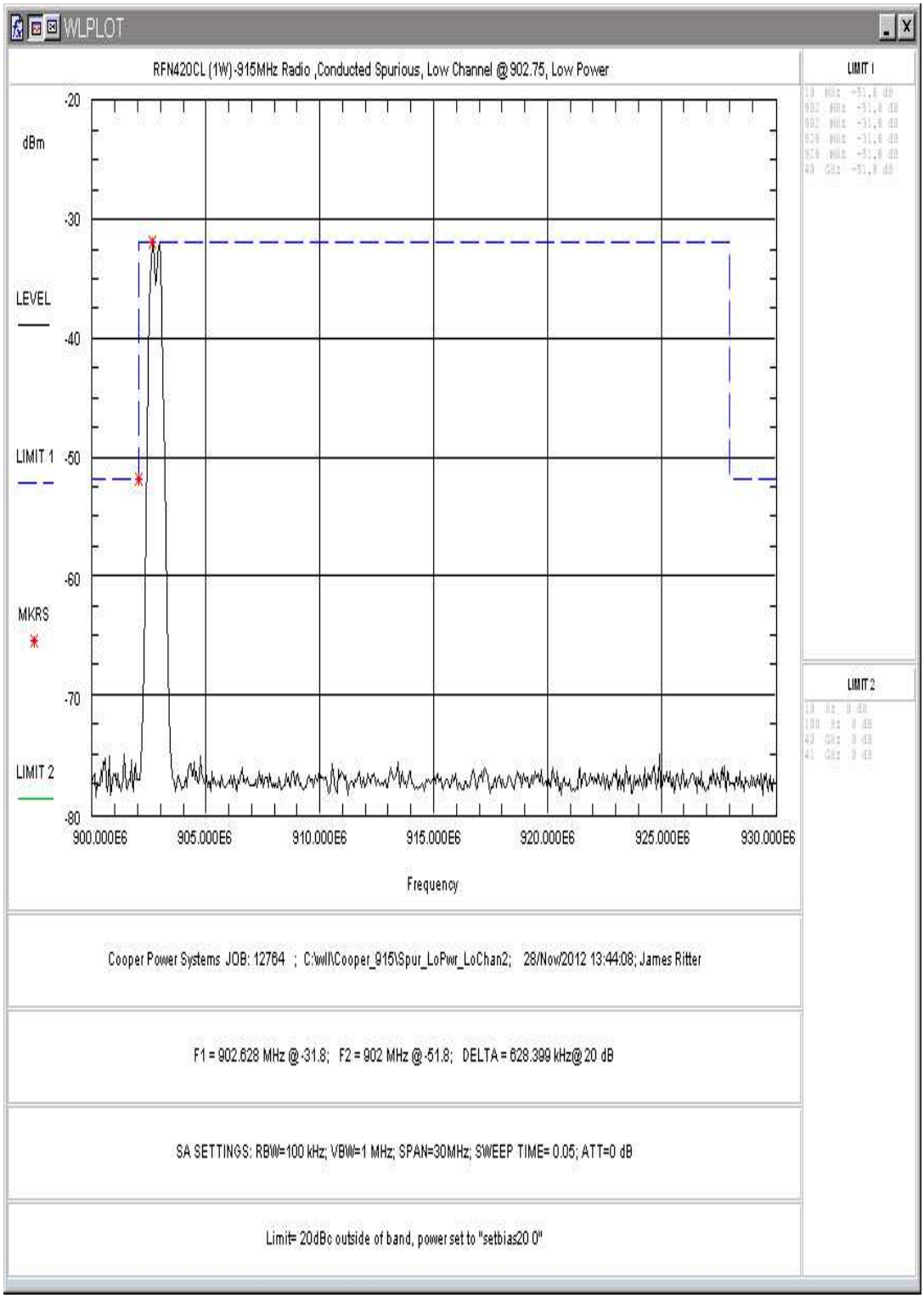

Figure 28: Conducted Spurious Emissions, Low Power, Low Channel 900 – 930MHz

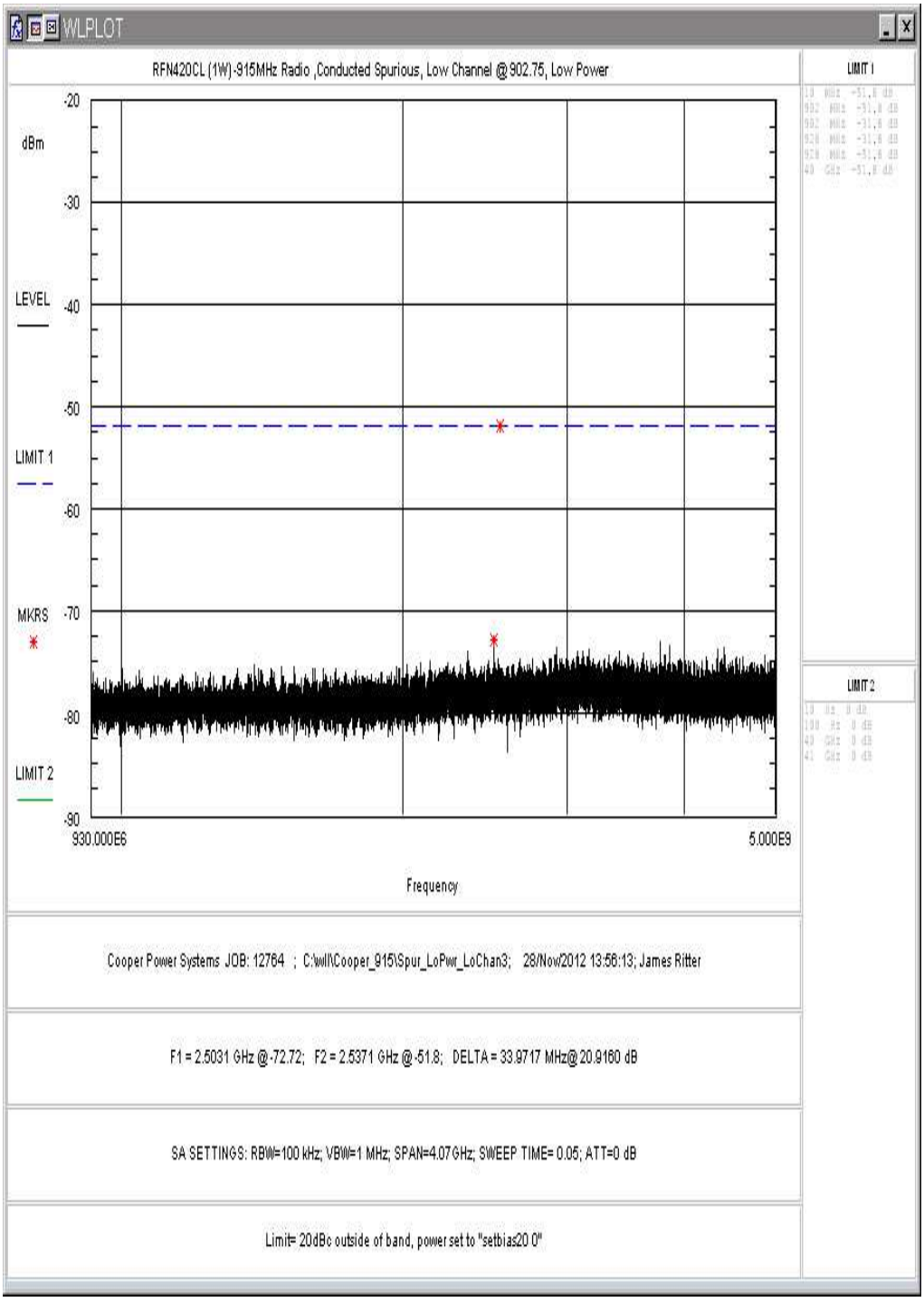

Figure 29: Conducted Spurious Emissions, Low Power, Low Channel 930-5000MHz

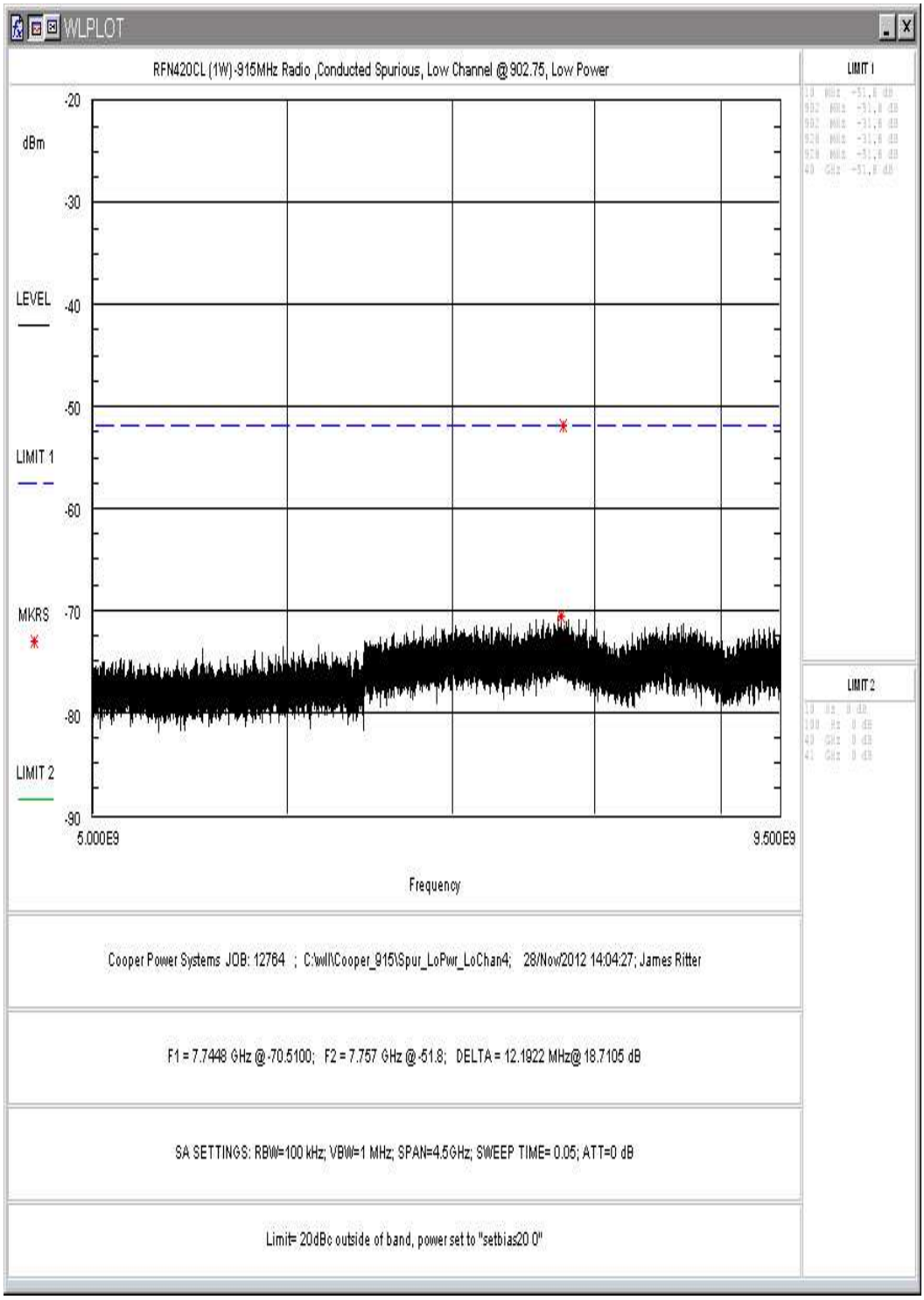

Figure 30: Conducted Spurious Emissions, Low Power, Low Channel 5-9.5GHz

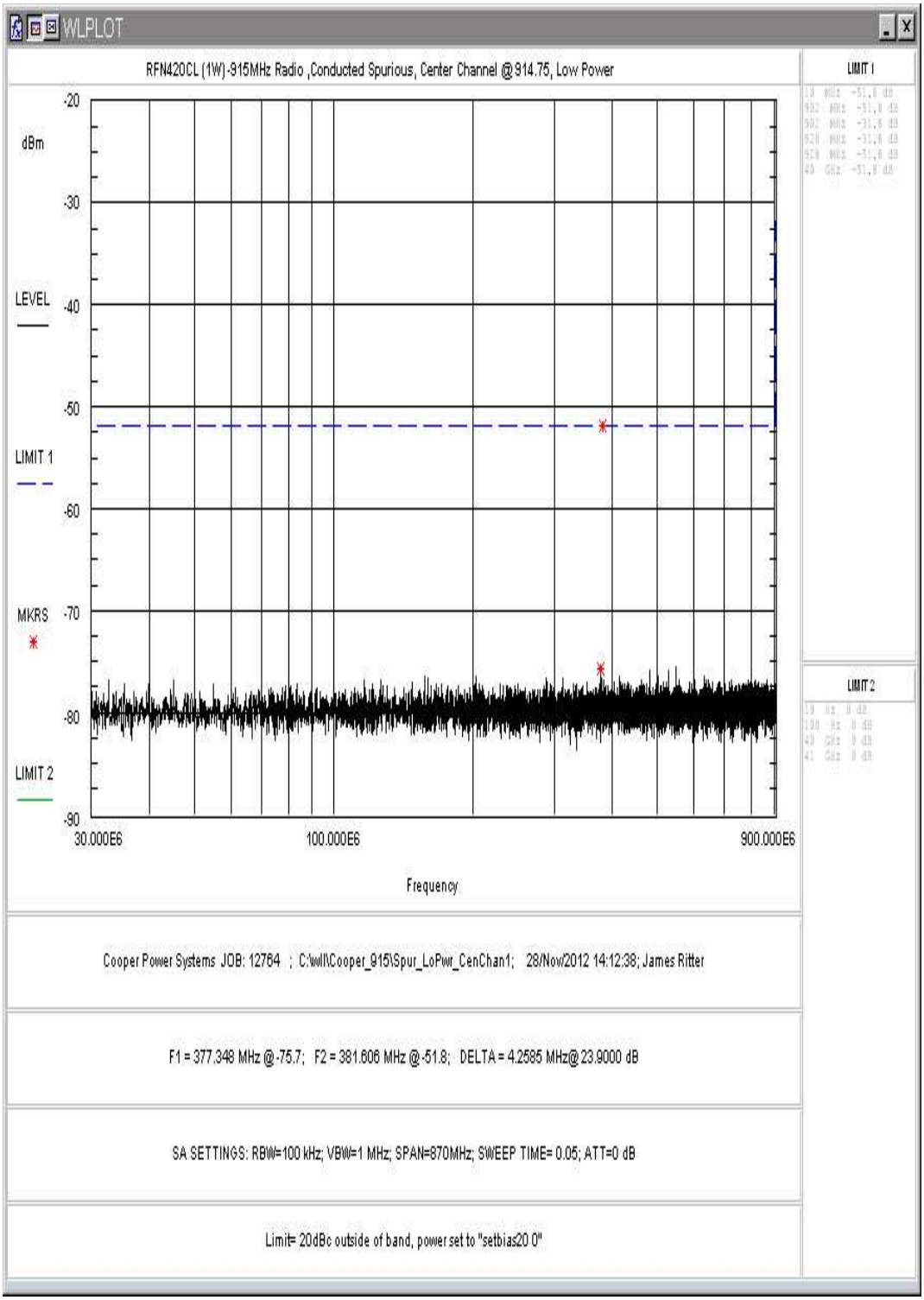

Figure 31: Conducted Spurious Emissions, Low Power, Center Channel 30 - 900MHz

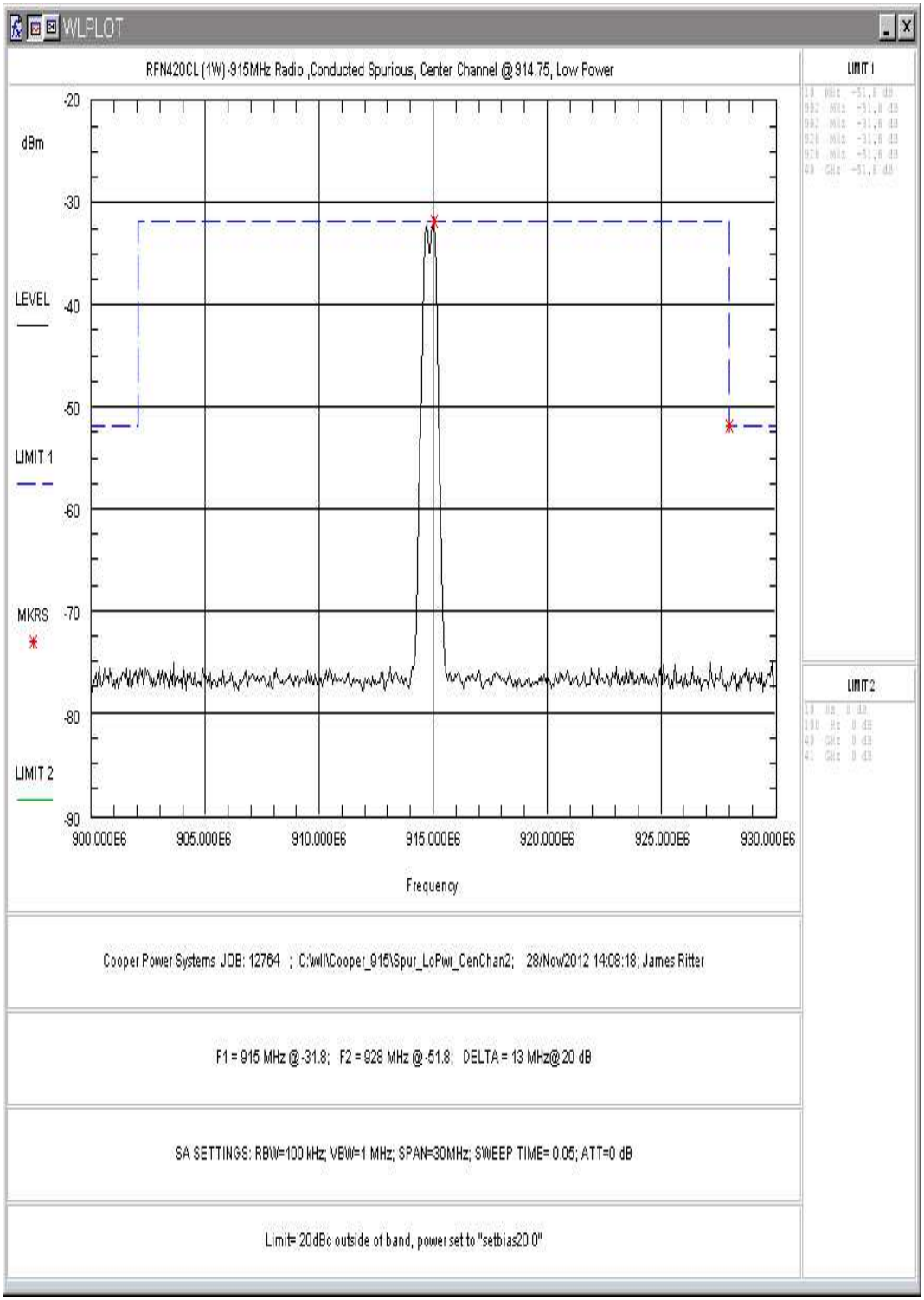

Figure 32: Conducted Spurious Emissions, Low Power, Center Channel 900 – 930MHz

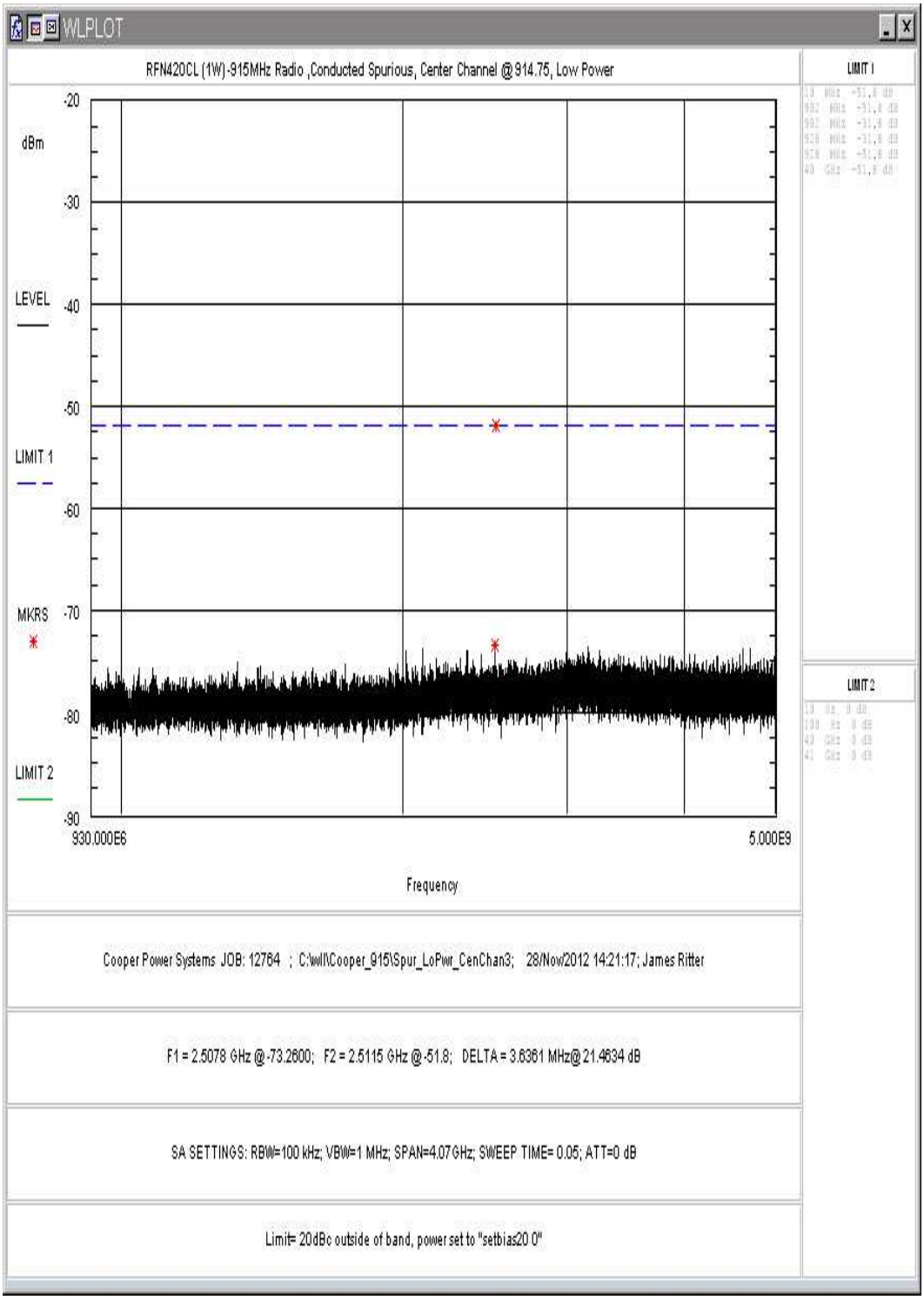

Figure 33: Conducted Spurious Emissions, Low Power, Center Channel 930-5000MHz

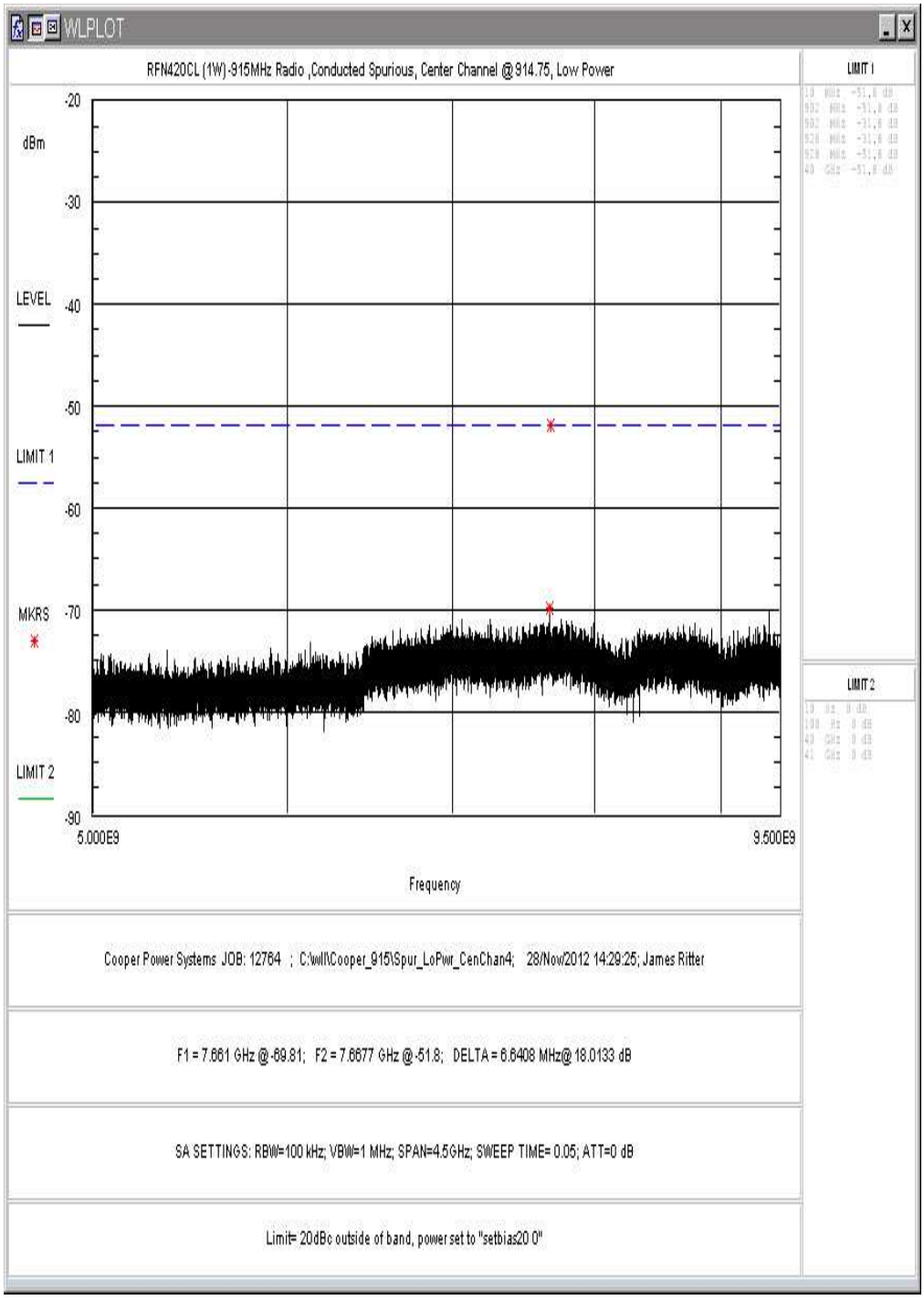

Figure 34: Conducted Spurious Emissions, Low Power, Center Channel 5-9.5GHz

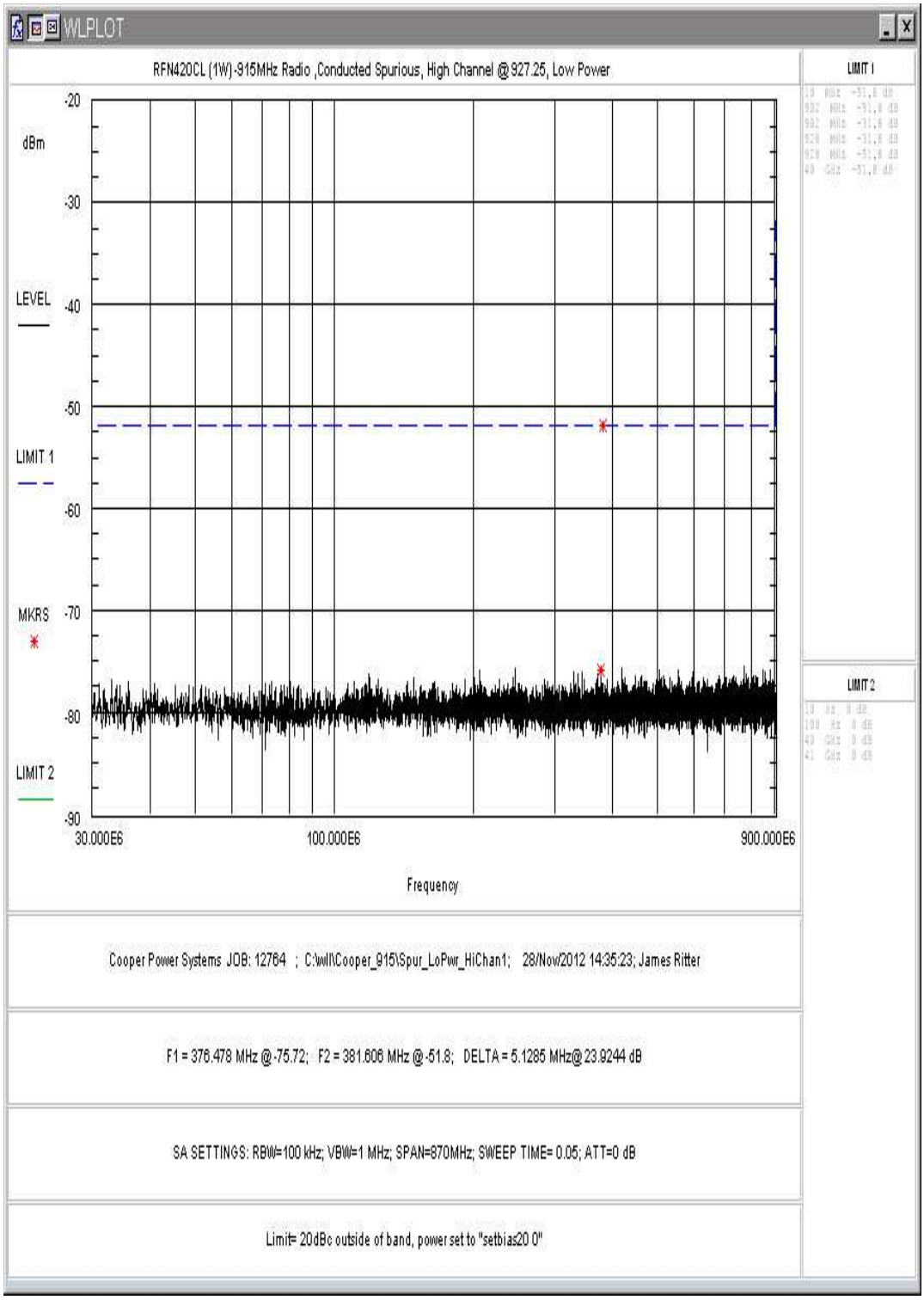

Figure 35: Conducted Spurious Emissions, Low Power, High Channel 30 - 900MHz

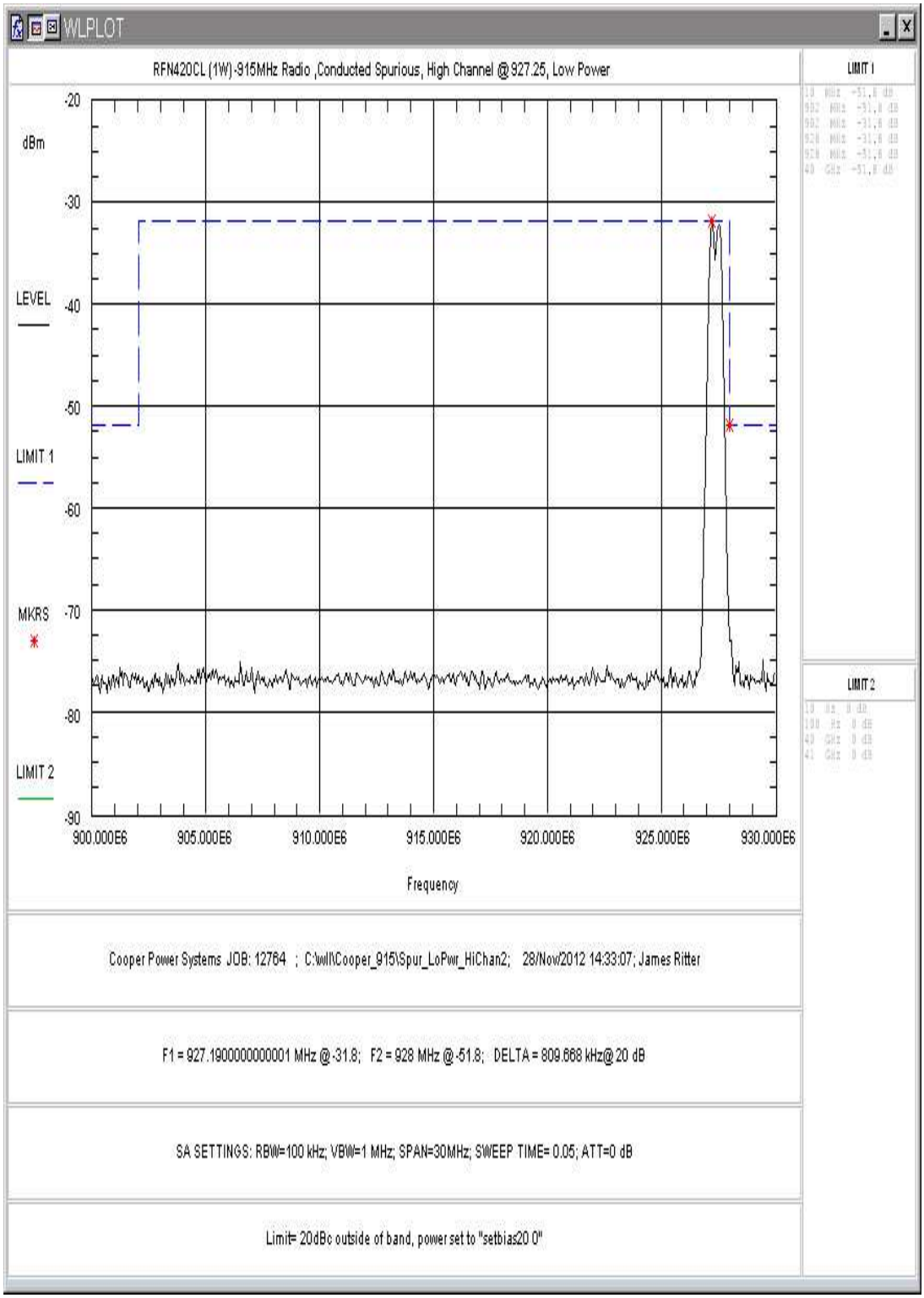

Figure 36: Conducted Spurious Emissions, Low Power, High Channel 900 – 930MHz

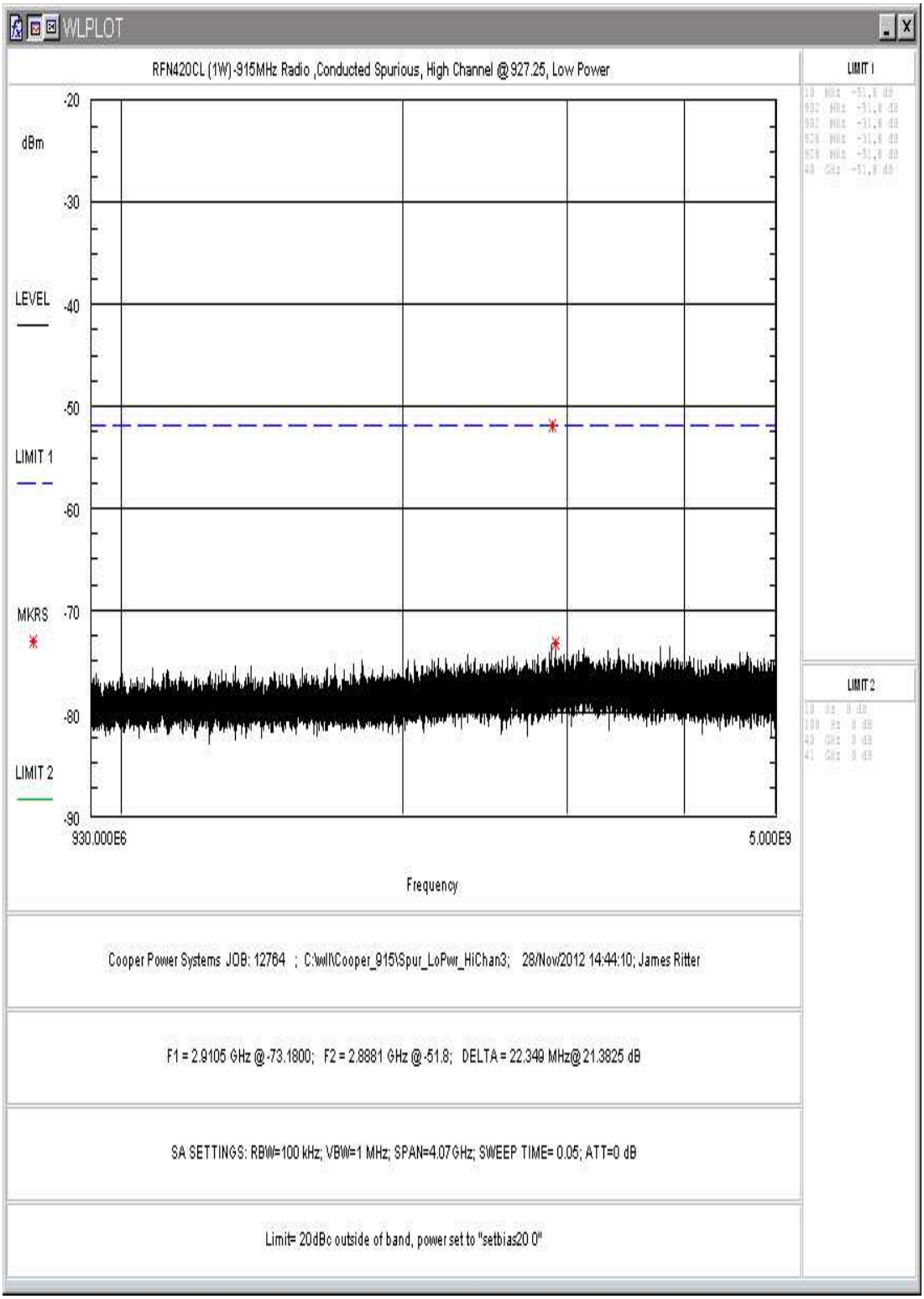

Figure 37: Conducted Spurious Emissions, Low Power, High Channel 930-5000MHz

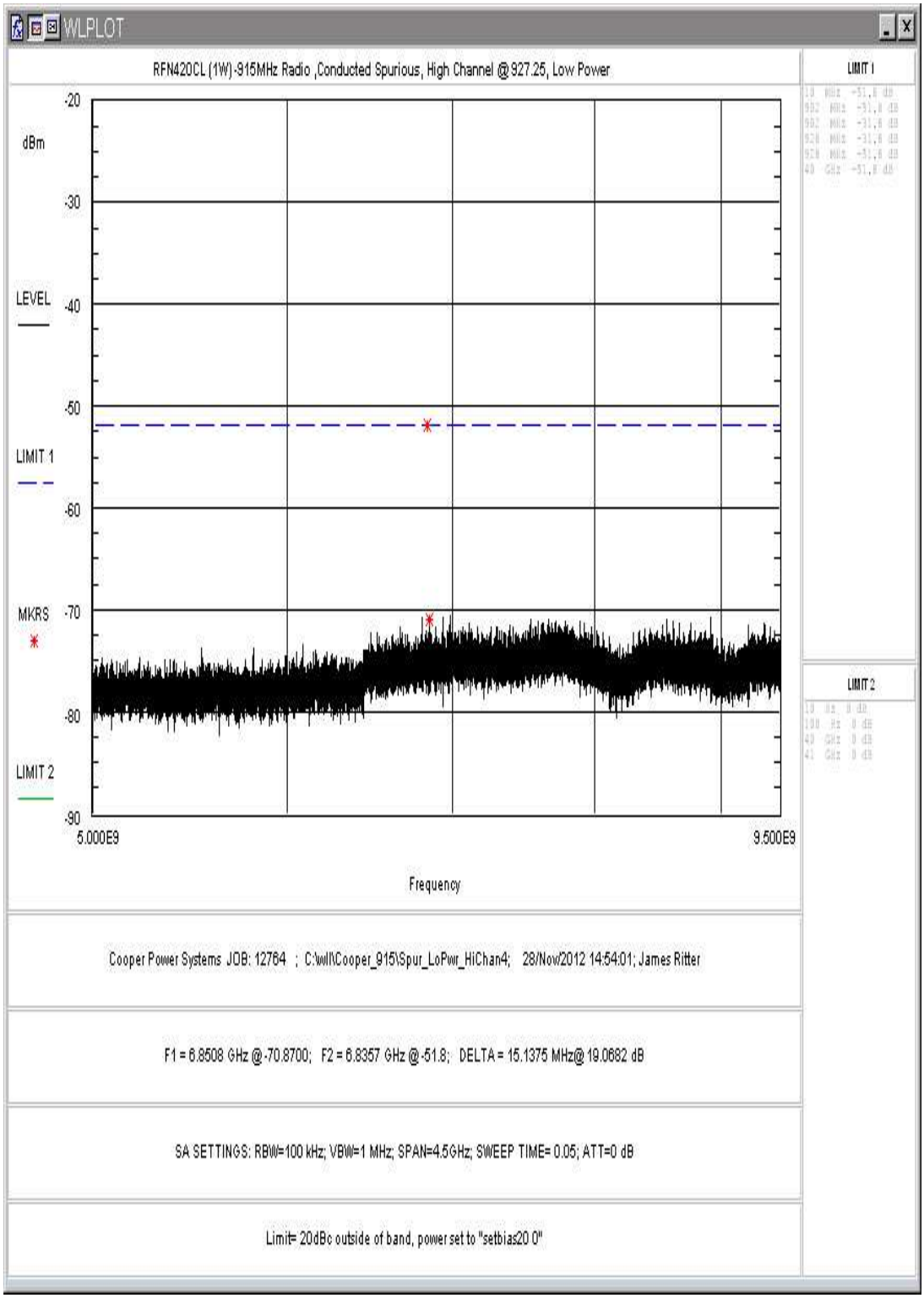

Figure 38: Conducted Spurious Emissions, Low Power, High Channel 5-9.5GHz

5.5.1 Band Edge Compliance

In accordance with FCC Public Notice DA-00-705 close-up plots of the upper and lower channels in both hopping and non-hopping modes 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.

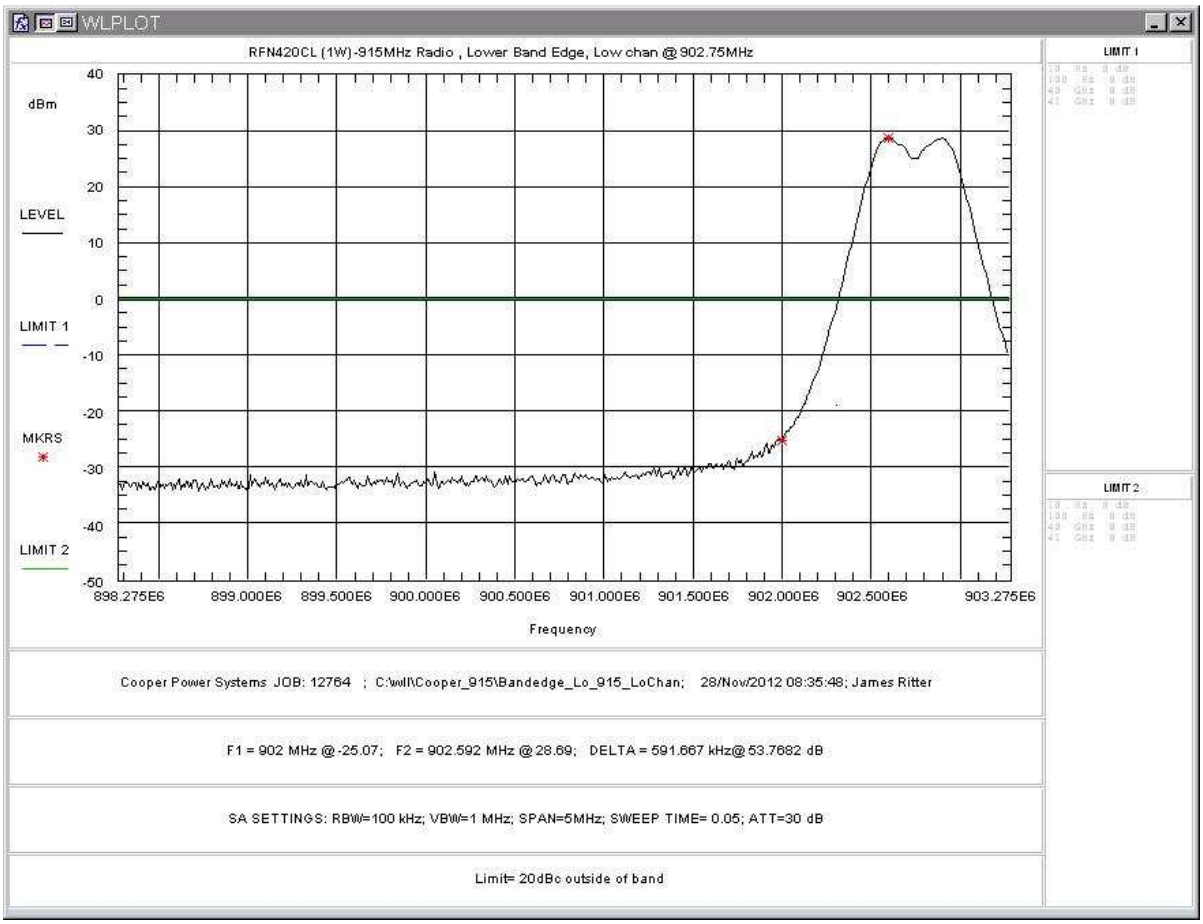

Figure 39: Lower Band-edge, Low Channel, High Power

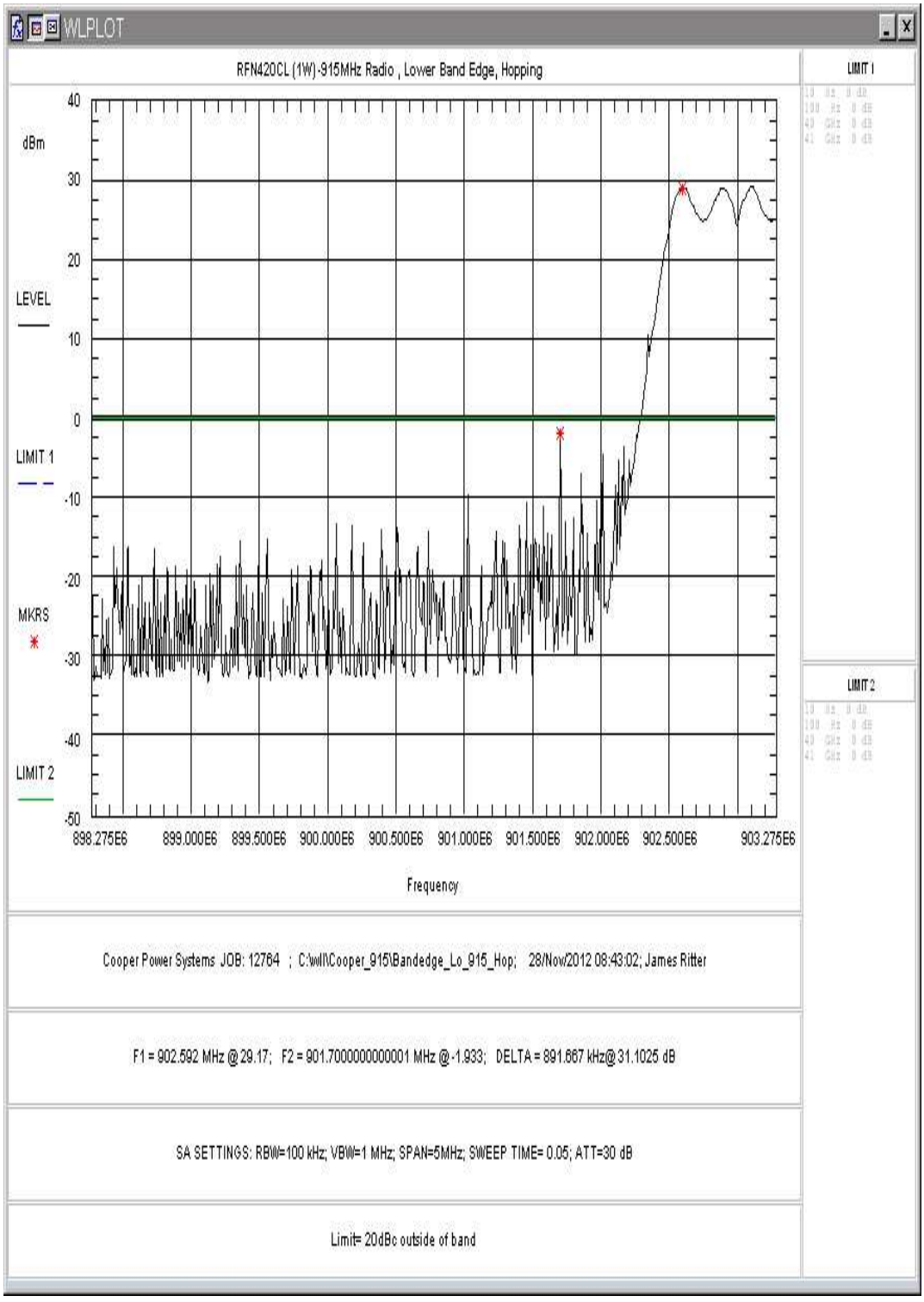

Figure 40: Lower Band-edge, Hopping Mode, High Power

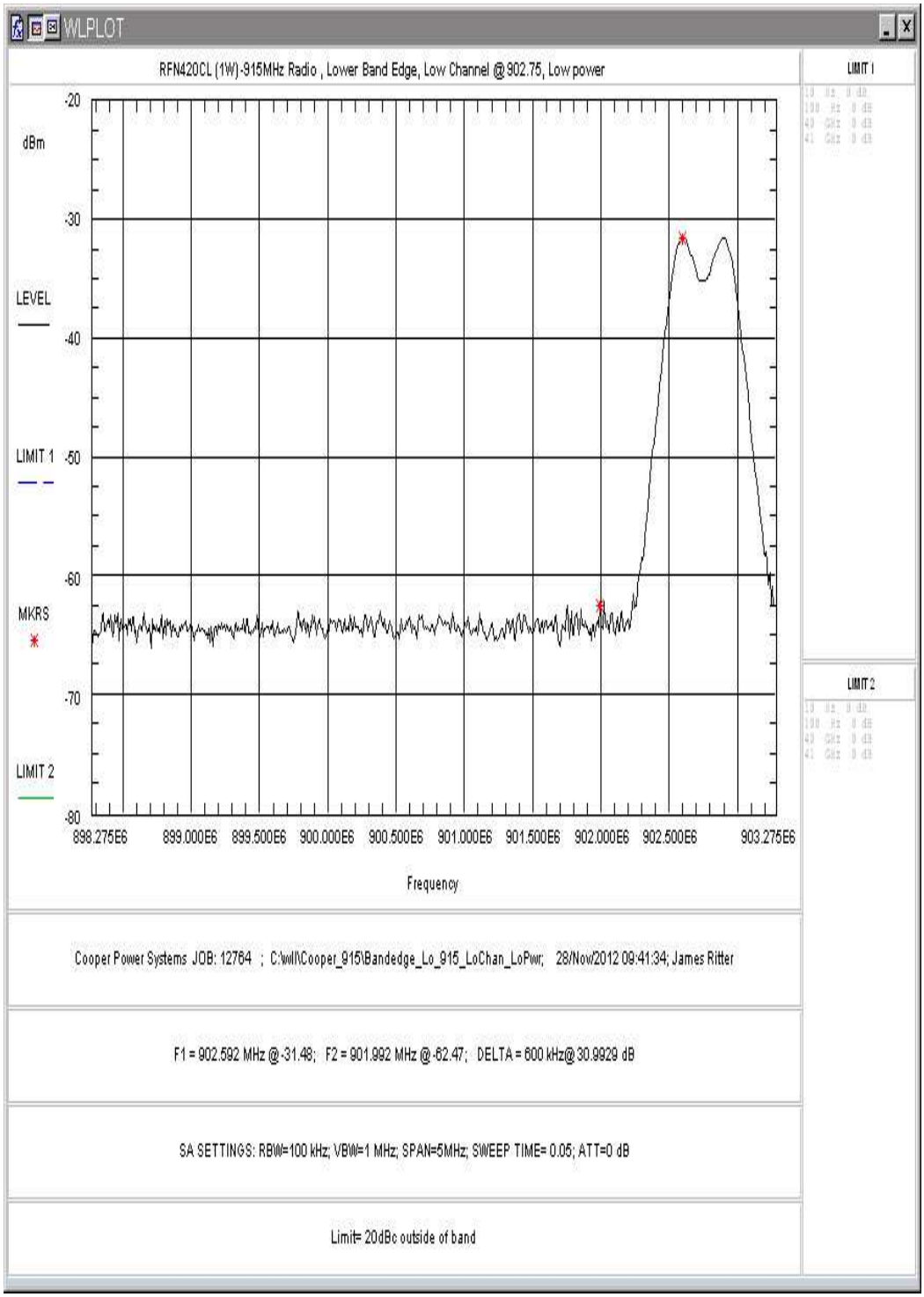

Figure 41: Lower Band-edge, Low Channel, Low Power

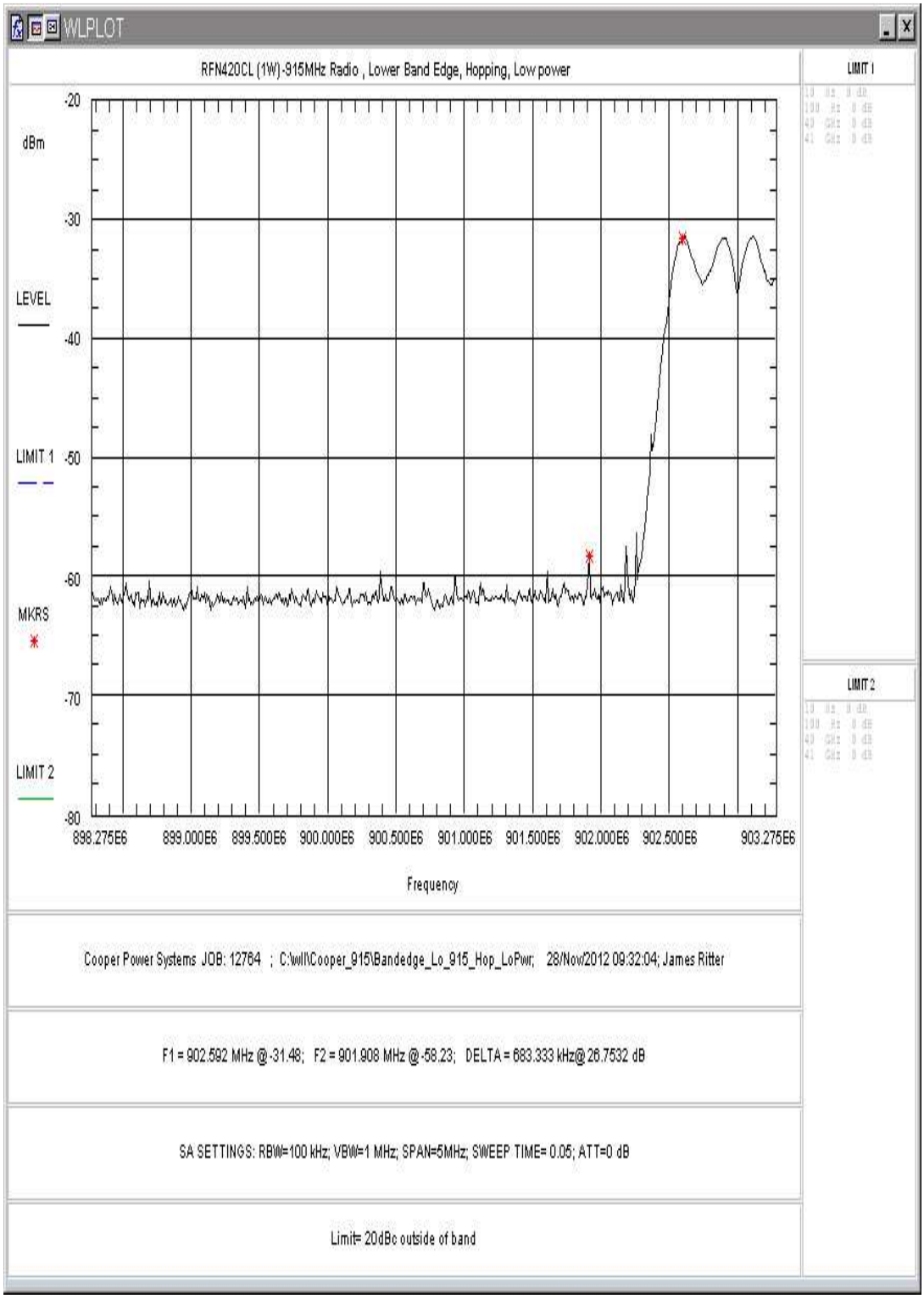

Figure 42: Lower Band-edge, Hopping Mode, Low Power

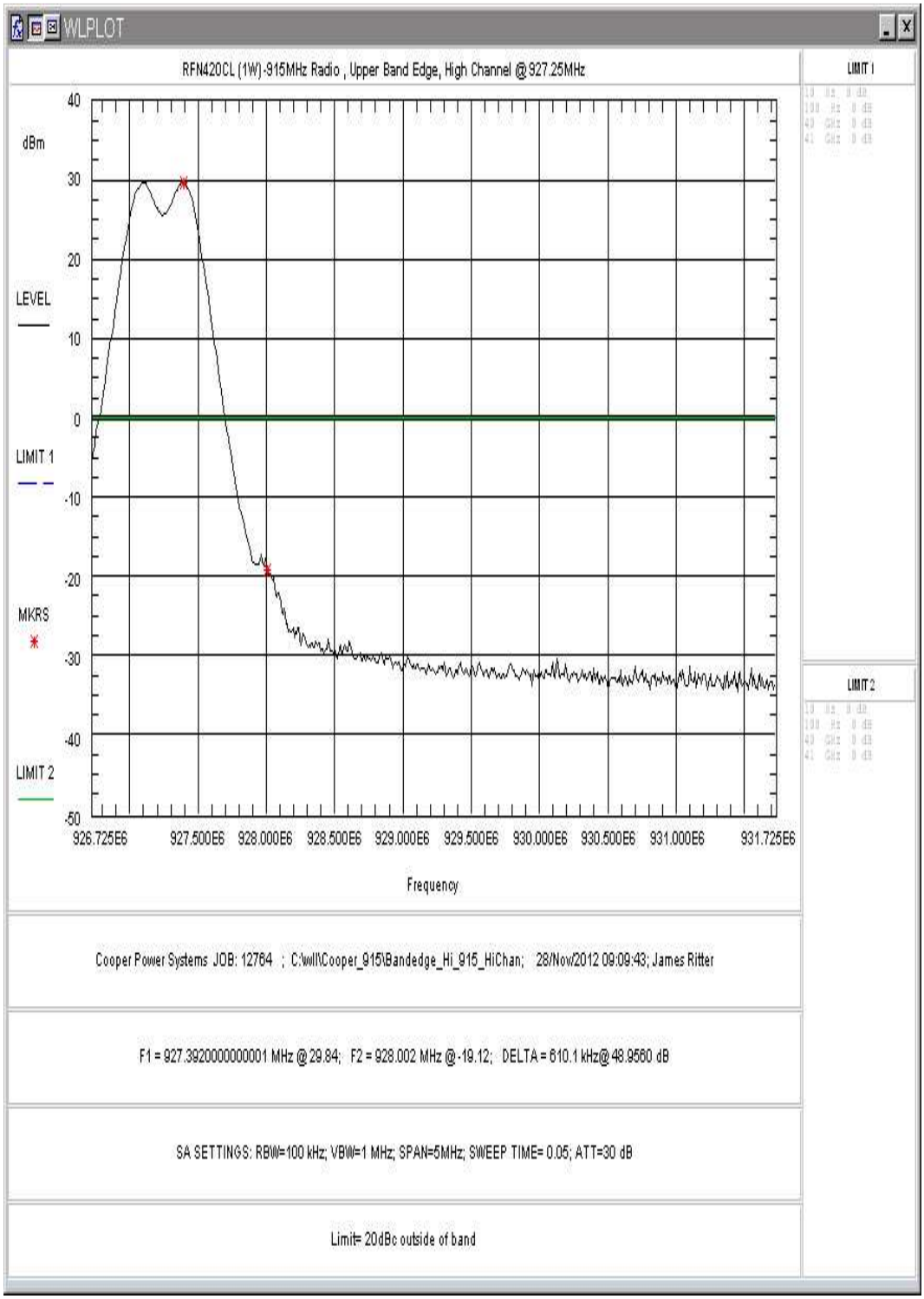

Figure 43: Upper Band-edge, High Channel, High Power

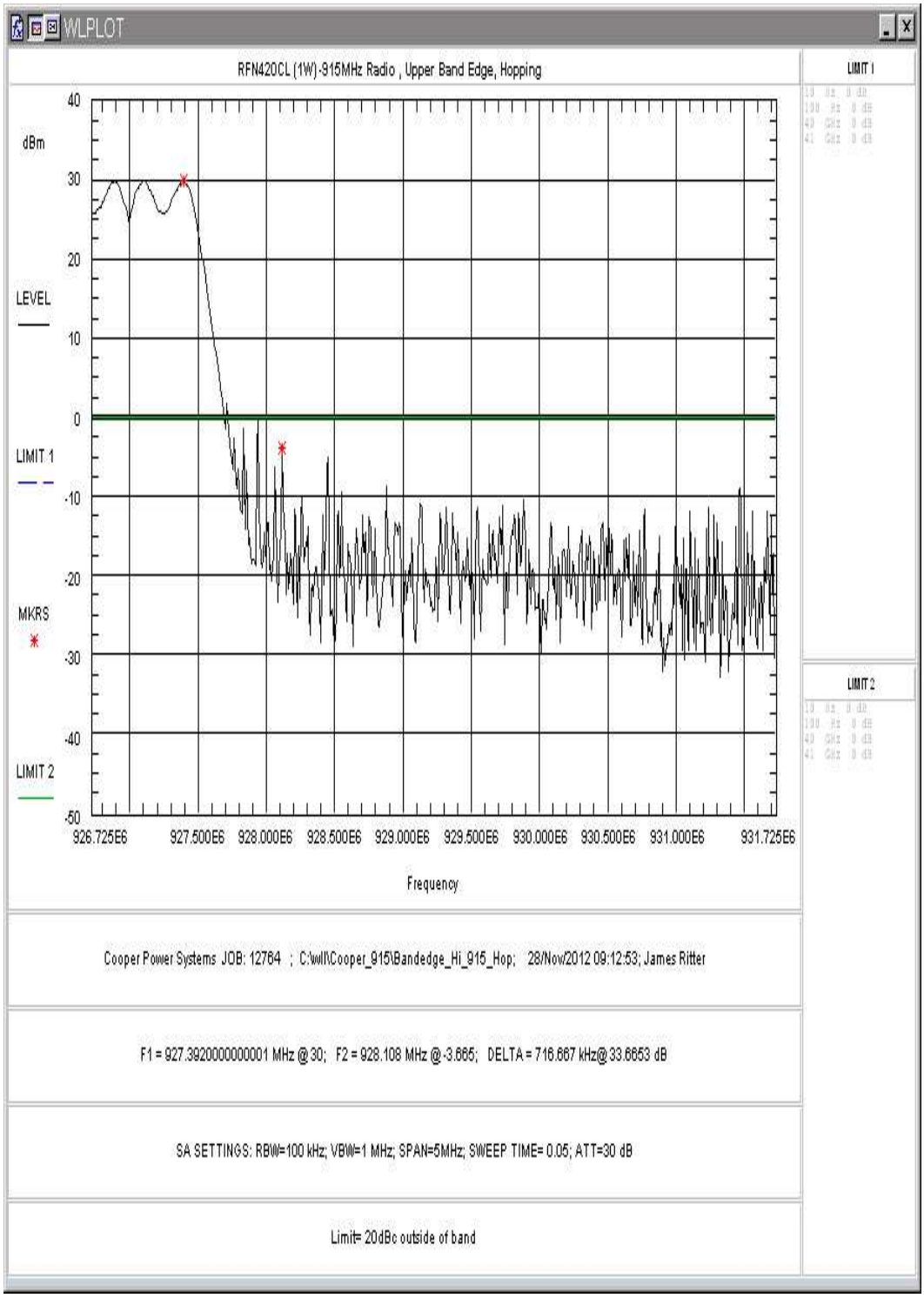

Figure 44: Upper Band-edge, Hopping Mode, High Power

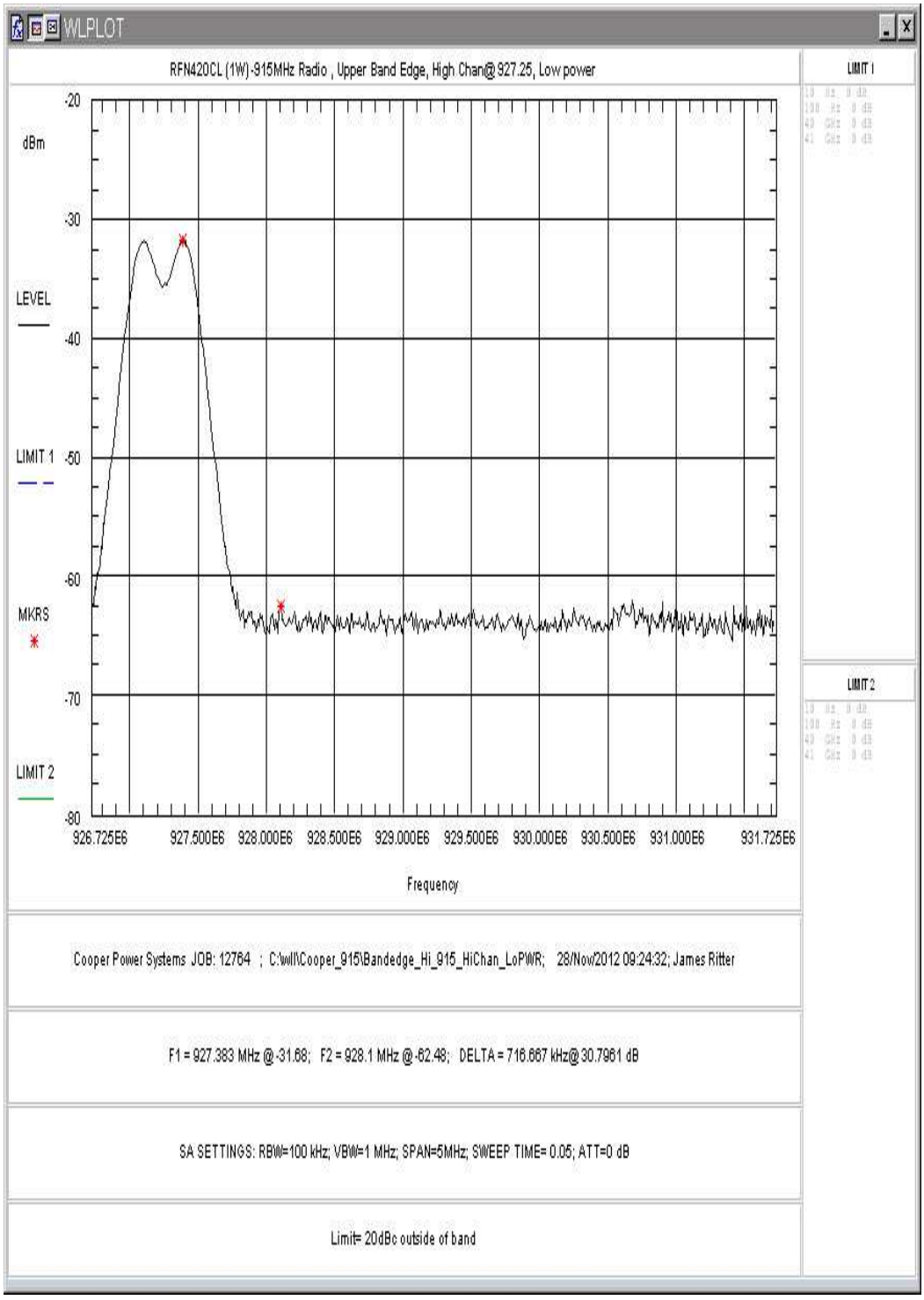

Figure 45: Upper Band-edge, High Channel, Low Power

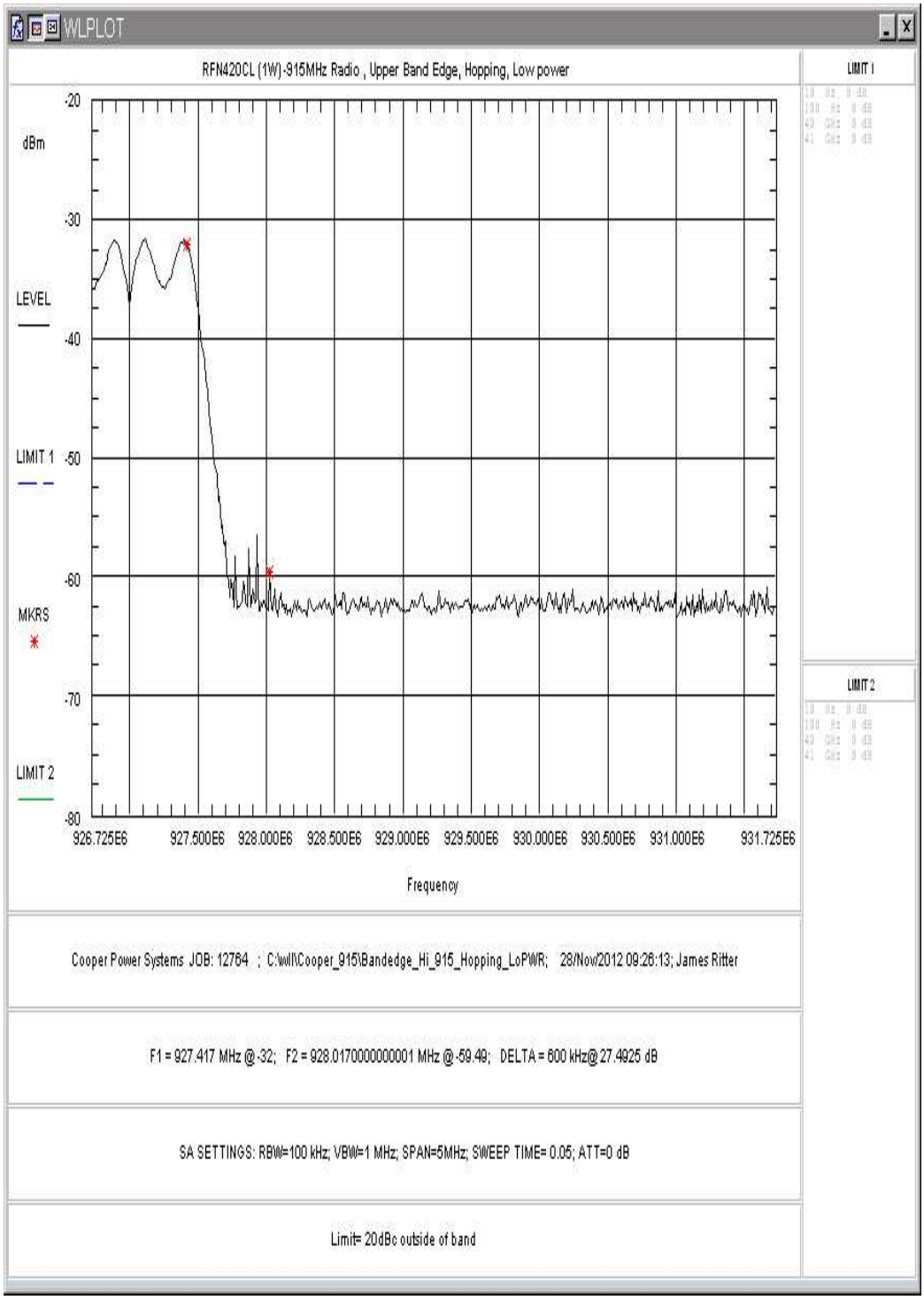

Figure 46: Upper Band-edge, Hopping Mode, Low Power

5.6 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.

5.6.1 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 8.1dBi duty cycle correction allowed for this radio was not used for these tests as the unit was compliant without any addition coorections.

The emissions were measured using the following resolution bandwidths:

Table 9: Spectrum Analyzer Settings

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

5.6.2 Test Summary

The EUT was compliant in all antennal configurations while testing the low, center, and high channels.

Table 10: Radiated Emission Test Data: Non-Harmonics (Restricted Bands-covers all 3 antenna configurations)

Same for all channels

Frequency (MHz)	Polarity H/V	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Duty Cycle Correction (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)
108.59	V	170.00	1.30	10.10	14.2	0.0	16.3	150.0	-19.3
166.30	V	180.00	1.90	11.50	14.0	0.0	18.8	150.0	-18.0
240.00	V	190.00	1.78	11.30	14.7	0.0	19.9	200.0	-20.0
166.30	H	90.00	2.73	5.80	14.0	0.0	9.8	150.0	-23.7
240.00	H	100.00	2.11	12.70	14.7	0.0	23.4	200.0	-18.6

No other non-harmonics were noted in the restricted bands

Table 11: Radiated Emission Test Data, Low Channel (1dbi –Integral Wire Antenna)

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)	Comments
2708.25	V	0.00	229.00	51.52	-1.7	311.1	5000.0	-24.1	Peak
3611.00	V	190.00	225.00	46.87	-0.2	214.4	5000.0	-27.4	Peak
4513.75	V	290.00	2.58	46.01	2.2	258.4	5000.0	-25.7	Peak
5416.50	V	90.00	2.46	46.91	4.8	383.3	5000.0	-22.3	Peak
8124.75	V	190.00	2.54	43.69	9.5	457.8	5000.0	-20.8	Peak
9027.50	V	180.00	2.77	44.43	12.0	660.2	5000.0	-17.6	Peak
2708.25	V	0.00	229.00	42.41	-1.7	109.0	500.0	-13.2	Average
3611.00	V	190.00	225.00	34.80	-0.2	53.4	500.0	-19.4	Average
4513.75	V	290.00	2.58	33.84	2.2	63.7	500.0	-17.9	Average
5416.50	V	90.00	2.46	32.19	4.8	70.4	500.0	-17.0	Average
8124.75	V	190.00	2.54	30.87	9.5	104.6	500.0	-13.6	Average
9027.50	V	180.00	2.77	31.35	12.0	146.5	500.0	-10.7	Average
2708.25	H	90.0	2.4	51.5	-1.7	308.6	5000.0	-24.2	Peak
3611.00	H	180.00	2.08	45.54	-0.2	184.0	5000.0	-28.7	Peak
4513.75	H	270.00	2.81	43.43	2.2	192.0	5000.0	-28.3	Peak
5416.50	H	180.00	2.19	45.05	4.8	309.4	5000.0	-24.2	Peak
8124.75	H	190.00	2.88	43.75	9.5	461.0	5000.0	-20.7	Peak
9027.50	H	180.00	2.95	44.43	12.0	660.2	5000.0	-17.6	Peak
2708.25	H	90.0	2.4	41.14	-1.7	94.2	500.0	-14.5	Average
3611.00	H	180.00	2.08	35.50	-0.2	57.9	500.0	-18.7	Average
4513.75	H	270.00	2.81	32.80	2.2	56.5	500.0	-18.9	Average
5416.50	H	180.00	2.19	33.09	4.8	78.1	500.0	-16.1	Average
8124.75	H	190.00	2.88	32.80	9.5	130.7	500.0	-11.7	Average
9027.50	H	180.00	2.95	31.37	12.0	146.8	500.0	-10.6	Average

Table 12: Radiated Emission Test Data, Low Channel (3dbi –Phantom Antenna)

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)	Comments
2708.25	V	200.00	2.50	49.10	-1.7	235.5	5000.0	-26.5	Peak
3611.00	V	180.00	2.95	44.30	-0.2	159.5	5000.0	-29.9	Peak
4513.75	V	270.00	2.95	45.10	2.2	232.7	5000.0	-26.6	Peak
5416.50	V	180.00	2.85	44.20	4.8	280.5	5000.0	-25.0	Peak
8124.75	V	180.00	3.10	41.90	9.5	372.6	5000.0	-22.6	Peak
9027.50	V	190.00	2.65	42.00	12.0	499.1	5000.0	-20.0	Peak
2708.25	V	200.00	2.50	38.50	-1.7	69.5	500.0	-17.1	Average
3611.00	V	180.00	2.95	33.98	-0.2	48.6	500.0	-20.2	Average
4513.75	V	270.00	2.95	31.52	2.2	48.7	500.0	-20.2	Average
5416.50	V	180.00	2.85	31.90	4.8	68.1	500.0	-17.3	Average
8124.75	V	180.00	3.10	32.60	9.5	127.7	500.0	-11.9	Average
9027.50	V	190.00	2.65	31.84	12.0	155.0	500.0	-10.2	Average
2708.25	H	180.00	2.98	48.20	-1.7	212.3	5000.0	-27.4	Peak
3611.00	H	190.00	2.81	46.00	-0.2	194.0	5000.0	-28.2	Peak
4513.75	H	180.00	2.95	43.10	2.2	184.9	5000.0	-28.6	Peak
5416.50	H	180.0	2.71	43.90	4.8	271.0	5000.0	-25.3	Peak
8124.75	H	180.00	3.10	43.50	9.5	447.9	5000.0	-21.0	Peak
9027.50	H	170.00	3.10	43.00	12.0	560.0	5000.0	-19.0	Peak
2708.25	H	180.00	2.98	37.10	-1.7	59.1	500.0	-18.5	Average
3611.00	H	190.00	2.81	35.20	-0.2	56.0	500.0	-19.0	Average
4513.75	H	180.00	2.95	32.10	2.2	52.1	500.0	-19.6	Average
5416.50	H	180.0	2.71	32.10	4.8	69.7	500.0	-17.1	Average
8124.75	H	180.00	3.10	31.90	9.5	117.8	500.0	-12.6	Average
9027.50	H	170.00	3.10	31.20	12.0	143.9	500.0	-10.8	Average

Table 13: Radiated Emission Test Data, Low Channel (6dbi –Omni directional Antenna)

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)	Comments
2708.25	V	180.00	2.67	48.69	-1.7	224.6	5000.0	-27.0	Peak
3611.00	V	180.00	3.00	47.45	-0.2	229.3	5000.0	-26.8	Peak
4513.75	V	290.00	2.55	45.85	2.2	253.7	5000.0	-25.9	Peak
5416.50	V	180.00	2.94	46.66	4.8	372.4	5000.0	-22.6	Peak
8124.75	V	190.00	3.10	42.63	9.5	405.2	5000.0	-21.8	Peak
9027.50	V	180.00	2.80	43.93	12.0	623.3	5000.0	-18.1	Peak
2708.25	V	180.00	2.67	38.17	-1.7	66.9	500.0	-17.5	Average
3611.00	V	180.00	3.00	35.90	-0.2	60.6	500.0	-18.3	Average
4513.75	V	290.00	2.55	31.80	2.2	50.3	500.0	-19.9	Average
5416.50	V	180.00	2.94	32.60	4.8	73.8	500.0	-16.6	Average
8124.75	V	190.00	3.10	31.52	9.5	112.8	500.0	-12.9	Average
9027.50	V	180.00	2.80	31.92	12.0	156.4	500.0	-10.1	Average
2708.25	H	120.00	2.98	51.42	-1.7	307.5	5000.0	-24.2	Peak
3611.00	H	180.00	3.10	46.86	-0.2	214.2	5000.0	-27.4	Peak
4513.75	H	180.00	2.83	44.87	2.2	226.6	5000.0	-26.9	Peak
5416.50	H	90.0	2.87	43.23	4.8	250.9	5000.0	-26.0	Peak
8124.75	H	180.00	3.10	42.73	9.5	409.9	5000.0	-21.7	Peak
9027.50	H	150.00	2.99	44.56	12.0	670.2	5000.0	-17.5	Peak
2708.25	H	120.00	2.98	41.89	-1.7	102.7	500.0	-13.8	Average
3611.00	H	180.00	3.10	33.90	-0.2	48.2	500.0	-20.3	Average
4513.75	H	180.00	2.83	32.66	2.2	55.6	500.0	-19.1	Average
5416.50	H	90.0	2.87	32.94	4.8	76.7	500.0	-16.3	Average
8124.75	H	180.00	3.10	31.50	9.5	112.5	500.0	-13.0	Average
9027.50	H	150.00	2.99	31.90	12.0	156.0	500.0	-10.1	Average

Table 14: Radiated Emission Test Data, Center Channel (1dbi –Integral Wire Antenna)

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)	Comments
2744.25	V	180.00	2.17	52.58	-1.7	350.2	5000.0	-23.1	Peak
3659.00	V	190.00	3.05	50.65	0.0	340.9	5000.0	-23.3	Peak
4573.75	V	180.00	3.16	46.41	2.1	267.0	5000.0	-25.4	Peak
7318.00	V	0.00	2.99	43.41	9.6	444.8	5000.0	-21.0	Peak
8232.75	V	180.00	3.20	43.75	9.7	471.7	5000.0	-20.5	Peak
9147.50	V	190.00	2.60	44.09	12.7	689.1	5000.0	-17.2	Peak
2744.25	V	180.00	2.17	43.48	-1.7	122.8	500.0	-12.2	Average
3659.00	V	190.00	3.05	40.43	0.0	105.1	500.0	-13.5	Average
4573.75	V	180.00	3.16	34.50	2.1	67.8	500.0	-17.4	Average
7318.00	V	0.00	2.99	33.80	9.6	147.1	500.0	-10.6	Average
8232.75	V	180.00	3.20	31.30	9.7	112.5	500.0	-13.0	Average
9147.50	V	190.00	2.60	31.31	12.7	158.2	500.0	-10.0	Average
2744.25	H	270.00	2.60	51.45	-1.7	307.5	5000.0	-24.2	Peak
3659.00	H	165.00	2.77	49.61	0.0	302.5	5000.0	-24.4	Peak
4573.75	H	270.0	2.9	45.0	2.1	228.1	5000.0	-26.8	Peak
7318.00	H	90.00	2.65	43.58	9.6	453.5	5000.0	-20.8	Peak
8232.75	H	170.00	2.60	43.49	9.7	457.8	5000.0	-20.8	Peak
9147.50	H	180.00	2.37	44.12	12.7	691.4	5000.0	-17.2	Peak
2744.25	H	270.00	2.60	42.33	-1.7	107.6	500.0	-13.3	Average
3659.00	H	165.00	2.77	38.21	0.0	81.4	500.0	-15.8	Average
4573.75	H	270.0	2.9	32.57	2.1	54.3	500.0	-19.3	Average
7318.00	H	90.00	2.65	30.96	9.6	106.1	500.0	-13.5	Average
8232.75	H	170.00	2.60	31.38	9.7	113.5	500.0	-12.9	Average
9147.50	H	180.00	2.37	31.44	12.7	160.6	500.0	-9.9	Average

Table 15: Radiated Emission Test Data, Center Channel (3dbi –Phantom Antenna)

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)	Comments
2744.25	V	190.00	2.35	50.10	-1.7	263.2	5000.0	-25.6	Peak
3659.00	V	180.00	2.50	45.90	0.0	197.3	5000.0	-28.1	Peak
4573.75	V	290.00	2.69	45.10	2.1	229.7	5000.0	-26.8	Peak
7318.00	V	160.00	3.10	44.50	9.6	504.2	5000.0	-19.9	Peak
8232.75	V	180.00	3.00	41.60	9.7	368.3	5000.0	-22.7	Peak
9147.50	V	180.00	2.90	42.20	12.7	554.3	5000.0	-19.1	Peak
2744.25	V	190.00	2.35	40.12	-1.7	83.4	500.0	-15.6	Average
3659.00	V	180.00	2.50	33.80	0.0	49.0	500.0	-20.2	Average
4573.75	V	290.00	2.69	31.52	2.1	48.1	500.0	-20.3	Average
7318.00	V	160.00	3.10	31.20	9.6	109.0	500.0	-13.2	Average
8232.75	V	180.00	3.00	32.10	9.7	123.4	500.0	-12.2	Average
9147.50	V	180.00	2.90	31.90	12.7	169.3	500.0	-9.4	Average
2744.25	H	200.00	3.00	49.10	-1.7	234.6	5000.0	-26.6	Peak
3659.00	H	270.00	2.85	46.50	0.0	211.4	5000.0	-27.5	Peak
4573.75	H	180.00	2.85	43.90	2.1	200.0	5000.0	-28.0	Peak
7318.00	H	180.0	2.96	43.90	9.6	470.6	5000.0	-20.5	Peak
8232.75	H	190.00	2.95	43.10	9.7	437.7	5000.0	-21.2	Peak
9147.50	H	190.00	3.10	43.10	12.7	614.8	5000.0	-18.2	Peak
2744.25	H	200.00	3.00	37.90	-1.7	64.6	500.0	-17.8	Average
3659.00	H	270.00	2.85	35.90	0.0	62.4	500.0	-18.1	Average
4573.75	H	180.00	2.85	31.80	2.1	49.7	500.0	-20.1	Average
7318.00	H	180.0	2.96	32.10	9.6	121.0	500.0	-12.3	Average
8232.75	H	190.00	2.95	31.20	9.7	111.2	500.0	-13.1	Average
9147.50	H	190.00	3.10	31.60	12.7	163.6	500.0	-9.7	Average

Table 16: Radiated Emission Test Data, Center Channel (6dbi –Omni directional Antenna)

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)	Comments
2744.25	V	290.00	3.00	48.41	-1.7	216.7	5000.0	-27.3	Peak
3659.00	V	190.00	2.88	45.97	0.0	198.9	5000.0	-28.0	Peak
4573.75	V	180.00	2.87	46.41	2.1	267.0	5000.0	-25.4	Peak
7318.00	V	180.00	2.78	44.58	9.6	508.9	5000.0	-19.8	Peak
8232.75	V	180.00	2.71	43.41	9.7	453.6	5000.0	-20.8	Peak
9147.50	V	190.00	2.56	44.16	12.7	694.6	5000.0	-17.1	Peak
2744.25	V	290.00	3.00	35.35	-1.7	48.2	500.0	-20.3	Average
3659.00	V	190.00	2.88	35.58	0.0	60.1	500.0	-18.4	Average
4573.75	V	180.00	2.87	32.78	2.1	55.6	500.0	-19.1	Average
7318.00	V	180.00	2.78	31.57	9.6	113.8	500.0	-12.9	Average
8232.75	V	180.00	2.71	32.10	9.7	123.4	500.0	-12.2	Average
9147.50	V	190.00	2.56	31.95	12.7	170.3	500.0	-9.4	Average
2744.25	H	190.00	2.96	49.53	-1.7	246.5	5000.0	-26.1	Peak
3659.00	H	90.00	3.32	47.57	0.0	239.2	5000.0	-26.4	Peak
4573.75	H	190.00	2.91	43.86	2.1	199.1	5000.0	-28.0	Peak
7318.00	H	180.0	3.00	40.93	9.6	334.3	5000.0	-23.5	Peak
8232.75	H	180.00	2.80	43.10	9.7	437.7	5000.0	-21.2	Peak
9147.50	H	190.00	2.90	42.43	12.7	569.2	5000.0	-18.9	Peak
2744.25	H	190.00	2.96	36.67	-1.7	56.1	500.0	-19.0	Average
3659.00	H	90.00	3.32	36.61	0.0	67.7	500.0	-17.4	Average
4573.75	H	190.00	2.91	32.68	2.1	55.0	500.0	-19.2	Average
7318.00	H	180.0	3.00	34.47	9.6	158.9	500.0	-10.0	Average
8232.75	H	180.00	2.80	32.10	9.7	123.4	500.0	-12.2	Average
9147.50	H	190.00	2.90	31.90	12.7	169.3	500.0	-9.4	Average

Table 17: Radiated Emission Test Data, High Channel (1dbi –Integral Wire Antenna)

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)	Comments
2781.75	V	270.00	2.42	53.07	-1.7	369.1	5000.0	-22.6	Peak
3709.00	V	240.00	2.47	49.75	0.3	316.7	5000.0	-24.0	Peak
4636.25	V	90.00	2.78	45.43	2.4	245.3	5000.0	-26.2	Peak
7418.00	V	200.00	2.77	44.46	9.5	498.5	5000.0	-20.0	Peak
8345.25	V	90.00	1.70	42.83	9.8	430.0	5000.0	-21.3	Peak
2781.75	V	270.00	2.42	44.95	-1.7	144.9	500.0	-10.8	
3709.00	V	240.00	2.47	40.63	0.3	110.8	500.0	-13.1	Average
4636.25	V	90.00	2.78	33.47	2.4	61.9	500.0	-18.1	Average
7418.00	V	200.00	2.77	31.37	9.5	110.4	500.0	-13.1	Average
8345.25	V	90.00	1.70	30.90	9.8	108.9	500.0	-13.2	Average
2781.75	H	290.00	2.69	55.15	-1.7	469.0	5000.0	-20.6	Peak
3709.00	H	90.0	2.6	47.95	0.3	257.5	5000.0	-25.8	Peak
4636.25	H	180.00	3.10	45.10	2.4	236.2	5000.0	-26.5	Peak
7418.00	H	190.00	2.70	43.75	9.5	459.4	5000.0	-20.7	Peak
8345.25	H	180.00	2.60	42.47	9.8	412.6	5000.0	-21.7	Peak
2781.75	H	290.00	2.69	48.01	-1.7	206.2	500.0	-7.7	Average
3709.00	H	90.0	2.6	38.48	0.3	86.5	500.0	-15.2	Average
4636.25	H	180.00	3.10	31.51	2.4	49.4	500.0	-20.1	Average
7418.00	H	190.00	2.70	31.17	9.5	107.9	500.0	-13.3	Average
8345.25	H	180.00	2.60	30.93	9.8	109.3	500.0	-13.2	Average

Table 18: Radiated Emission Test Data, High Channel (3dbi –Phantom Antenna)

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)	Comments
2781.75	V	180.00	2.29	49.28	-1.7	238.6	5000.0	-26.4	Peak
3709.00	V	180.00	2.37	46.09	0.3	207.8	5000.0	-27.6	Peak
4636.25	V	250.00	2.53	45.92	2.4	259.6	5000.0	-25.7	Peak
7418.00	V	170.00	2.90	44.87	9.5	522.6	5000.0	-19.6	Peak
8345.25	V	190.00	2.74	41.06	9.8	350.7	5000.0	-23.1	Peak
2781.75	V	180.00	2.29	39.12	-1.7	74.1	500.0	-16.6	Average
3709.00	V	180.00	2.37	34.20	0.3	52.9	500.0	-19.5	Average
4636.25	V	250.00	2.53	31.95	2.4	52.0	500.0	-19.7	Average
7418.00	V	170.00	2.90	31.85	9.5	116.7	500.0	-12.6	Average
8345.25	V	190.00	2.74	31.38	9.8	115.1	500.0	-12.8	Average
2781.75	H	250.00	3.18	48.75	-1.7	224.5	5000.0	-27.0	
3709.00	H	90.00	3.21	46.35	0.3	214.1	5000.0	-27.4	Peak
4636.25	H	160.00	2.97	44.23	2.4	213.7	5000.0	-27.4	Peak
7418.00	H	180.0	2.80	43.10	9.5	426.2	5000.0	-21.4	Peak
8345.25	H	200.00	3.10	45.29	9.8	570.8	5000.0	-18.8	Peak
2781.75	H	250.00	3.18	37.64	-1.7	62.5	500.0	-18.1	Average
3709.00	H	90.00	3.21	35.43	0.3	60.9	500.0	-18.3	Average
4636.25	H	160.00	2.97	31.94	2.4	51.9	500.0	-19.7	Average
7418.00	H	180.0	2.80	31.72	9.5	115.0	500.0	-12.8	Average
8345.25	H	200.00	3.10	31.65	9.8	118.7	500.0	-12.5	Average

Table 19: Radiated Emission Test Data, High Channel (6dbi –Omni directional Antenna)

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)	Comments
2781.75	V	180.00	2.97	50.33	-1.7	269.3	5000.0	-25.4	Peak
3709.00	V	170.00	3.04	44.79	0.3	178.9	5000.0	-28.9	Peak
4636.25	V	195.00	3.32	44.31	2.4	215.6	5000.0	-27.3	Peak
7418.00	V	180.00	2.90	43.53	9.5	447.9	5000.0	-21.0	Peak
8345.25	V	180.00	2.85	43.85	9.8	483.6	5000.0	-20.3	Peak
2781.75	V	180.00	2.97	42.17	-1.7	105.2	500.0	-13.5	Average
3709.00	V	170.00	3.04	33.87	0.3	50.9	500.0	-19.8	Average
4636.25	V	195.00	3.32	32.55	2.4	55.7	500.0	-19.1	Average
7418.00	V	180.00	2.90	31.85	9.5	116.7	500.0	-12.6	Average
8345.25	V	180.00	2.85	31.42	9.8	115.6	500.0	-12.7	Average
2781.75	H	90.00	3.01	50.10	-1.7	262.2	5000.0	-25.6	
3709.00	H	190.00	2.68	43.92	0.3	161.9	5000.0	-29.8	Peak
4636.25	H	220.00	3.04	42.51	2.4	175.3	5000.0	-29.1	Peak
7418.00	H	170.0	3.10	43.59	9.5	451.0	5000.0	-20.9	Peak
8345.25	H	180.00	2.94	44.03	9.8	493.7	5000.0	-20.1	Peak
2781.75	H	90.00	3.01	42.05	-1.7	103.8	500.0	-13.7	Average
3709.00	H	190.00	2.68	32.63	0.3	44.1	500.0	-21.1	Average
4636.25	H	220.00	3.04	31.94	2.4	51.9	500.0	-19.7	Average
7418.00	H	170.0	3.10	31.86	9.5	116.9	500.0	-12.6	Average
8345.25	H	180.00	2.94	31.50	9.8	116.7	500.0	-12.6	Average

5.7 Receiver Radiated Spurious Emissions: (RSS-210 sect 2.6)

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.

5.7.1 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:

Table 20: Spectrum Analyzer Settings

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

Table 21: Radiated Emission Test Data, Receiver

Frequency (MHz)	Polarity H/V	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Duty Cycle Correction (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)
33.39	V	45.00	1.20	10.90	19.0		31.2	100.0	-10.1
46.60	V	180.00	1.00	19.60	10.7	0.0	32.8	100.0	-9.7
66.73	V	0.00	1.15	12.50	8.5	0.0	11.3	100.0	-19.0
79.11	V	190.00	1.10	12.10	8.7	0.0	11.0	100.0	-19.2
85.81	V	270.00	1.40	17.90	9.0	0.0	22.1	100.0	-13.1
108.59	V	170.00	1.30	10.10	14.2	0.0	16.3	150.0	-19.3
166.30	V	180.00	1.90	11.50	14.0	0.0	18.8	150.0	-18.0
230.55	V	190.00	1.26	9.50	14.2	0.0	15.3	200.0	-22.4
240.00	V	190.00	1.78	11.30	14.7	0.0	19.9	200.0	-20.0
287.97	V	290.00	2.21	16.10	17.3	0.0	46.9	200.0	-12.6
335.96	V	160.00	2.23	11.00	18.1	0.0	28.4	200.0	-16.9
431.98	V	180.00	2.05	7.70	20.0	0.0	24.3	200.0	-18.3
575.95	V	160.00	2.32	6.50	23.4	0.0	31.3	200.0	-16.1
380.00	V	10.00	1.47	14.70	19.2	0.0	49.5	200.0	-12.1
43.50	H	180.00	3.60	9.50	12.3	0.0	12.4	100.0	-18.2
66.73	H	10.0	3.78	10.00	8.5	0.0	8.4	100.0	-21.5
85.81	H	270.00	3.50	7.30	9.0	0.0	6.5	100.0	-23.7
166.30	H	90.00	2.73	5.80	14.0	0.0	9.8	150.0	-23.7
230.55	H	270.00	2.54	5.50	14.2	0.0	9.6	200.0	-26.4
240.00	H	100.00	2.11	12.70	14.7	0.0	23.4	200.0	-18.6
287.97	H	270.0	1.87	14.50	17.3	0.0	39.0	200.0	-14.2
335.96	H	90.00	1.34	14.60	18.1	0.0	43.1	200.0	-13.3
380.00	H	10.00	1.34	7.80	19.2	0.0	22.4	200.0	-19.0

No frequencies were noted above those listed

5.8 AC Conducted Emissions (FCC Part §15.207)

5.8.1 Requirements

Test Arrangement: Table Top

Compliance Standard: FCC Class B

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

5.8.2 Test Procedure

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

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

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

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

Example:

Spectrum Analyzer Voltage: VdBµV

LISN Correction Factor: LISN dB

Cable Correction Factor: CF dB

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

5.8.3 Test Data

The EUT complied with the Class B Conducted Emissions requirements. This system runs off of 120VAC or 230VAC. The following tables provide the test results for phase and neutral line power line conducted emissions.

Conducted Emissions was tested with both the 915MHz radio and the Zigbee radio in the "transmit on" state.

Table 22: Conducted Emissions Data 120VAC, Transmit On

NEUTRAL- 120V

Frequency (MHz)	Level QP (dBµV)	Level AVG (dBµV)	Cable Loss (dB)	LISN Corr (dB)	Level QP Corr (dBµV)	Level Corr Avg (dBµV)	Limit QP (dBµV)	Limit AVG (dBµV)	Margin QP (dB)	Margin AVG (dB)
0.156	22.0	2.2	10.1	1.0	33.1	13.3	65.7	55.7	-32.5	-42.3
0.273	19.5	10.8	10.1	0.7	30.2	21.5	61.0	51.0	-30.8	-29.5
0.415	20.9	10.5	10.1	0.5	31.5	21.1	57.5	47.5	-26.0	-26.4
1.239	18.0	5.2	10.2	0.7	28.9	16.1	56.0	46.0	-27.1	-29.9
5.220	28.8	6.9	10.8	1.2	40.7	18.8	60.0	50.0	-19.3	-31.2
9.500	26.5	5.2	11.1	1.2	38.8	17.5	60.0	50.0	-21.2	-32.5

Phase-120V

Frequency (MHz)	Level QP (dBµV)	Level AVG (dBµV)	Cable Loss (dB)	LISN Corr (dB)	Level QP Corr (dBµV)	Level Corr Avg (dBµV)	Limit QP (dBµV)	Limit AVG (dBµV)	Margin QP (dB)	Margin AVG (dB)
0.156	22.8	1.2	10.1	0.6	33.5	11.9	65.7	55.7	-32.1	-43.7
0.273	17.5	10.5	10.1	0.5	28.1	21.1	61.0	51.0	-33.0	-30.0
0.415	16.7	7.1	10.1	0.4	27.2	17.6	57.5	47.5	-30.4	-30.0
1.239	12.3	3.1	10.2	0.5	23.0	13.8	56.0	46.0	-33.0	-32.2
5.220	8.9	2.2	10.8	0.8	20.5	13.8	60.0	50.0	-39.5	-36.2
9.500	9.1	1.6	11.1	1.0	21.2	13.7	60.0	50.0	-38.8	-36.3

Table 23: Conducted Emissions Data 230VAC, Transmit On

NEUTRAL-230V

Frequency (MHz)	Level QP (dBµV)	Level AVG (dBµV)	Cable Loss (dB)	LISN Corr (dB)	Level QP Corr (dBµV)	Level Corr Avg (dBµV)	Limit QP (dBµV)	Limit AVG (dBµV)	Margin QP (dB)	Margin AVG (dB)
0.150	27.0	4.7	10.1	1.1	38.2	15.9	66.0	56.0	-27.8	-40.1
0.276	24.1	13.1	10.1	0.6	34.8	23.8	60.9	50.9	-26.1	-27.1
0.411	25.6	11.6	10.1	0.5	36.2	22.2	57.6	47.6	-21.4	-25.4
1.689	20.5	4.3	10.4	1.0	31.9	15.7	56.0	46.0	-24.1	-30.3
7.450	25.9	6.8	11.2	1.3	38.4	19.3	60.0	50.0	-21.6	-30.7
15.190	22.0	3.7	11.5	1.0	34.4	16.1	60.0	50.0	-25.6	-33.9

Phase-230V

Frequency (MHz)	Level QP (dBµV)	Level AVG (dBµV)	Cable Loss (dB)	LISN Corr (dB)	Level QP Corr (dBµV)	Level Corr Avg (dBµV)	Limit QP (dBµV)	Limit AVG (dBµV)	Margin QP (dB)	Margin AVG (dB)
0.150	28.0	6.2	10.1	0.7	38.8	17.0	66.0	56.0	-27.2	-39.0
0.276	25.3	14.0	10.1	0.5	35.9	24.6	60.9	50.9	-25.1	-26.4
0.411	22.8	9.2	10.1	0.4	33.3	19.7	57.6	47.6	-24.3	-27.9
1.689	15.2	1.5	10.4	0.8	26.4	12.7	56.0	46.0	-29.6	-33.3
7.450	20.3	0.5	11.2	0.8	32.3	12.5	60.0	50.0	-27.7	-37.5
15.190	19.7	3.9	11.5	0.8	32.0	16.2	60.0	50.0	-28.0	-33.8