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FCC & Industry Canada
Class II Permissive Change Test Report
For the

MUELLER SYSTEMS

MINODE-WATER3

FCC ID: SM6-MINODE-WATER3

IC ID: 9235A-MINODE3

WLL Report# 13140-01 Rev. 3
September 11, 2013
Revised December 3, 2013

Prepared for:

Mueller Systems
48 Leona Drive
Middleboro, MA 02346

Prepared By:

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

ACLASS ACCREDITED TESTING

Testing Certificate AT-1448

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James Ritter
EMC Compliance Engineer

Reviewed by:

Steven D. Koster
Vice President

Abstract

This report has been prepared on behalf of Mueller Systems to support Application for a Class II Permissive Change to existing certified equipment. The test report and application are submitted for a modular Frequency Hopping Spread Spectrum Transmitter under Part 15.247 (10/2012) of the FCC Rules 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 MINODE-WATER3.

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. Washington Laboratories, Ltd. has been accepted by the FCC and approved by ACLASS under Certificate AT-1448 as an independent FCC test laboratory.

The Mueller Systems MINODE-WATER3 remains in compliance with the limits for a Frequency Hopping Spread Spectrum Transmitter under Part 15.247 (10/2012) and Industry Canada RSS-210 issue 8.

Revision History	Reason	Date
Rev 0	Initial Release	September 11, 2013
Rev 1	Page headers corrected to state September 2013	September 24, 2013 JR
Rev 2	Changed name from MINODE-WATER3RADIO MODULE to MINODE-WATER3. New emission designator added.	October 23, 2013
Rev 3	Limited wording removed from abstract. Figure 35 replaced with correct plot.	December 3, 2013 JR

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1 Introduction

1.1 Reason for Class II Permissive Change

This Class II permissive change is to incorporate the following modifications or additions to the MINODE-WATER3:

Use of a 28.8kbs data rate in data Mode (Hailing mode still operates at 9.6kbs);

Use of a low Power mode ~20dBm.

As the highest authorized power has not changed with this module no new RF exposure report is required.

1.2 Compliance Statement

The Mueller Systems MINODE-WATER3 remains in compliance with the limits for a Frequency Hopping System under Part 15.247 (10/2012) and Industry Canada RSS-210 issue 8.

1.3 Test Scope

Tests for radiated emissions and conducted Peak Power (at antenna terminal) were performed. All measurements were performed in accordance with FCC Public Notice DA 00-705 and the 2003 version of ANSI C63.4. The measurement equipment conforms to ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation unless a different measurement technique is specified by the FCC.

1.4 Contract Information

Customer:	Mueller Systems 48 Leona Drive Middleboro, MA 02346
Purchase Order Number:	877687
Quotation Number:	67451

1.5 Test Dates

Testing was performed on the following date(s):	9/3/2013-9/6/2013

1.6 Test and Support Personnel

Washington Laboratories, LTD	James Ritter, Steve Dovell
Customer Representative	Bruce Ambuter

1.7 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 Mueller Systems device is a MINODE-WATER3.

Table 1: Device Summary

ITEM	DESCRIPTION
Manufacturer:	Mueller Systems
FCC ID: IC ID:	SM6-MINODE-WATER3 9235A-MINODE3
Model:	MINODE-WATER3
FCC Rule Parts:	§15.247
Frequency Range:	902.5MHz – 927.35MHz
Maximum Output Power:	29.1dBm, 18.9dBm minimum power
Antenna Connector	integral
Antenna Type	fixed monopole antenna
Antenna Gain	0dBi
Power Source & Voltage:	3.5VDC
Emission Designator	62K7FXD
Highest TX Spurious Emission	2745MHz 315.3 uV/m @ 3m
Highest RX Spurious Emission	No evaluated –No hardware changes from previous report

2.2 Test Configuration

The MINODE-WATER3 was operated from 3.5VDC power supply. Commands were sent to the MINODE-WATER3 using an RS232 port connected to a support laptop using Windows HyperTerminal program. Radiated Emissions test were performed with the replacement antenna and the module in the worst case orthogonal position.

2.3 Testing Algorithm

The MINODE-WATER3 was programmed for operation via a serial cable connected to a laptop running HyperTerminal. Channel selection and modulation was accomplished using the laptop to set the EUT into a continuous transmit pseudo-random data stream at the Low, Center and High channels. Once the channel was set, the laptop was removed from the setup.

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. 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

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

Measurement uncertainty is <u>not</u> 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
Radiated Emissions	CISPR11, CISPR22, CISPR14, FCC Part 15	±4.55 dB

3 Test Equipment

Table 3 lists the test equipment used for measurements along with the calibration information.

Table 3: Test Equipment List

Test Name:	**Conducted Emissions at Antenna Terminal**	Test Date:	**9/5/2013**
Asset #	**Manufacturer/Model**	**Description**	**Cal. Due**
NA-Rental	AGILENT – 8565EC	ANALYZER SPECTRUM	1/28/2014

Test Name:	**Radiated Emissions**	Test Date:	**9/06/2013**
Asset #	**Manufacturer/Model**	**Description**	**Cal. Due**
528	AGILENT - E4446A	ANALYZER SPECTRUM	2/28/2014
627	AGILENT - 8449B	AMPLIFIER 1-26GHZ	5/13/2014
4	ARA - DRG-118/A	ANTENNA DRG 1-18GHZ	2/20/2015
742	PENN ENGINEERING - WR284	2.2-4.15GHZ BANDPASS FILTER	5/29/2014
280	ITC - 21C-3A1	WAVEGUIDE 3.45-11.0GHZ	5/29/2014
68	HP - 85650A	ADAPTER QP	1/1/2014
72	HP - 8568B	ANALYZER SPECTRUM	1/1/2014
70	HP - 85685A	PRESELECTOR RF W/OPT 8ZE	1/1/2014
644	SUNOL SCIENCES CORPORATION - JB1 925-833-9936	BICONALOG ANTENNA	1/11/2014

4 Test Results

4.1 RF Power Output (FCC Part15.247 (b) & IC RSS-210 [A8.4 (1)])

To measure the output power the output from the transmitter was connected to the input of a spectrum analyzer. The original grant RF power levels and the original report filing levels are reported in the tables below along with the measured RF power levels.

This is applicable for the 902 – 928MHz band of this device.

As the hailing channel data rate has not changed from the original test report (9.6kbs) only the data channels are reported for high power with a 28.8kbs data rate.

TXP is the radio power register.

Table 4: RF Power Output Results @ 28.8kbs, High Power

Grant listed as 0.946 Watts (29.7dBm) for 902 - 928MHz,
Data channels (28.8kbs), TXP setting 26 for High Power

Channel and/or Frequency	Peak Measured Level (dBm)	Peak Measured Level (Watts)	Limit (dBm)
Low Channel (902.5MHz)	29.1	0.813	30
Mid Channel (915MHz)	28.7	0.741	30
High Channel (927MHz)	28.2	0.661	30

Table 5: RF Power Output Results, Low Power

Data channels (28.8kbs), TXP setting 5 for Low Power

Channel and/or Frequency	Peak Measured Level (dBm)	Peak Measured Level (Watts)	Limit (dBm)
Low Channel (902.5MHz)	18.7	0.074	30
Mid Channel (915MHz)	17.9	0.062	30
High Channel (927MHz)	17.1	0.051	30

Hailing channels @ 9.6kbs, TXP setting 5 for Low Power

Channel and/or Frequency	Peak Measured Level (dBm)	Peak Measured Level (Watts)	Limit (dBm)
Low Channel (902.65MHz)	18.9	0.078	30
Mid Channel (915.35MHz)	18.1	0.065	30
High Channel (927.35MHz)	17.1	0.051	30

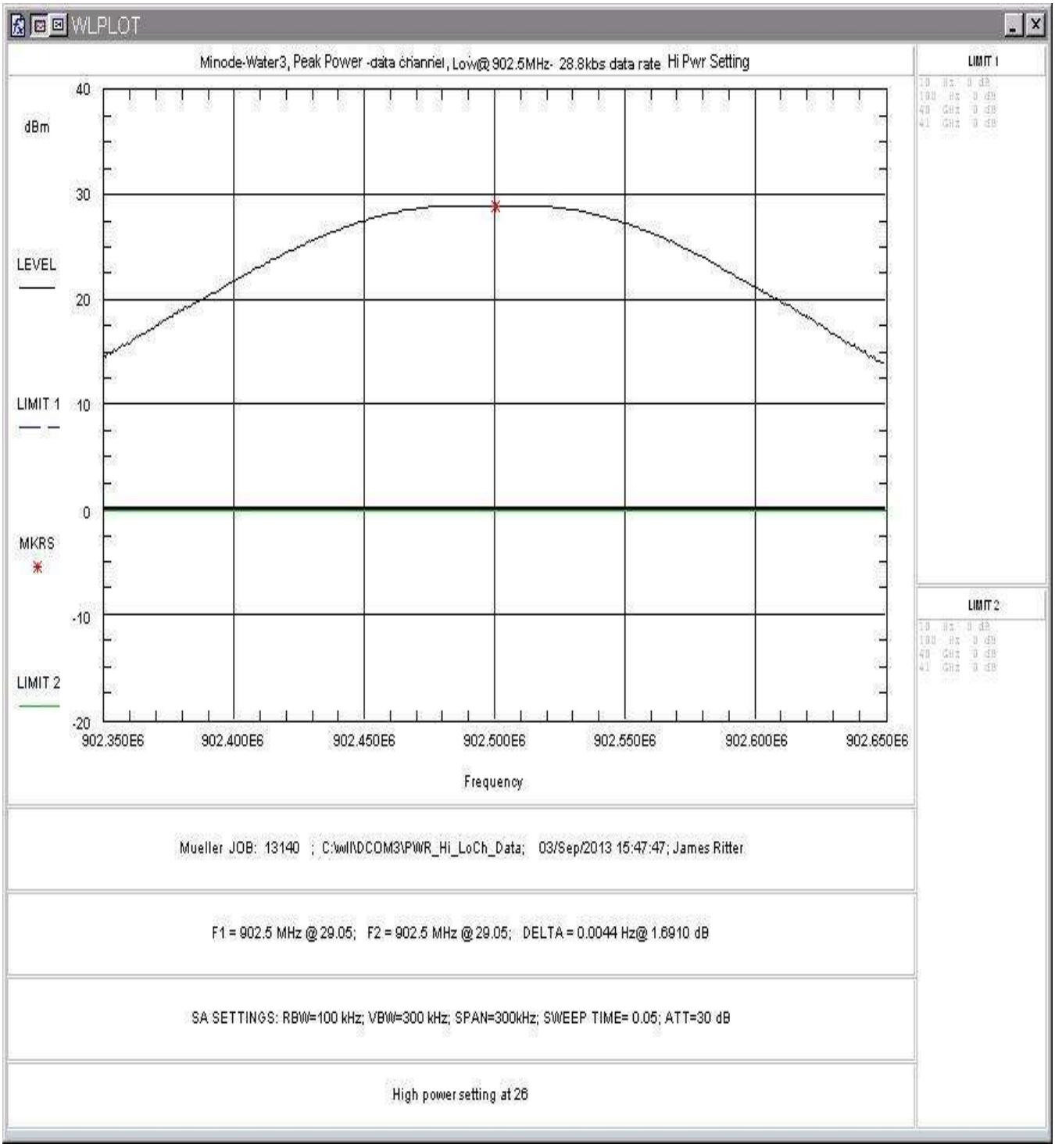

Figure 1: Conducted Peak Power, 902.5MHz, Hi Pwr, 28.8kbs, Data channel

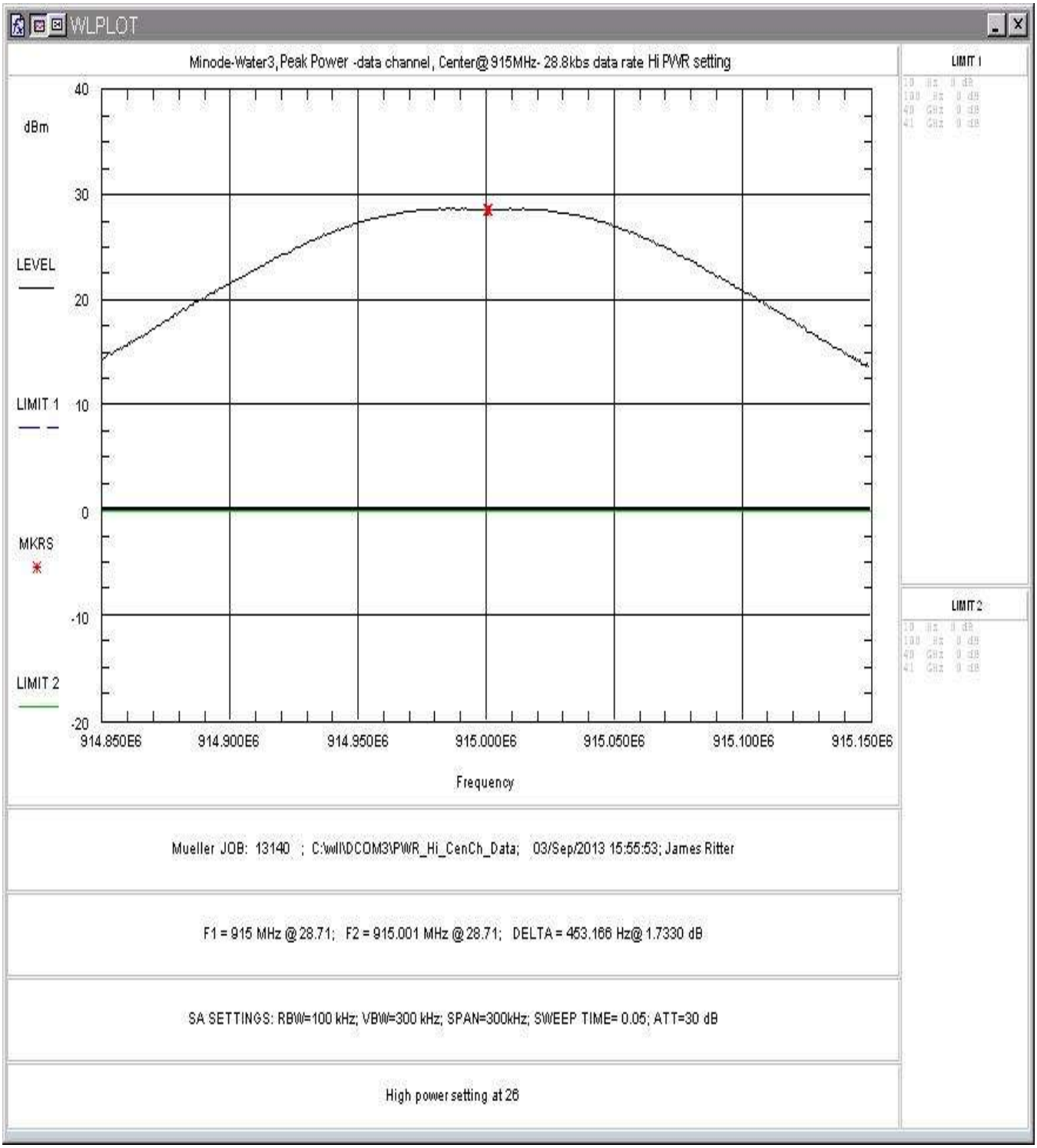

Figure 2: Conducted Peak Power, 915MHz, Hi Pwr, 28.8kbs, Data channel

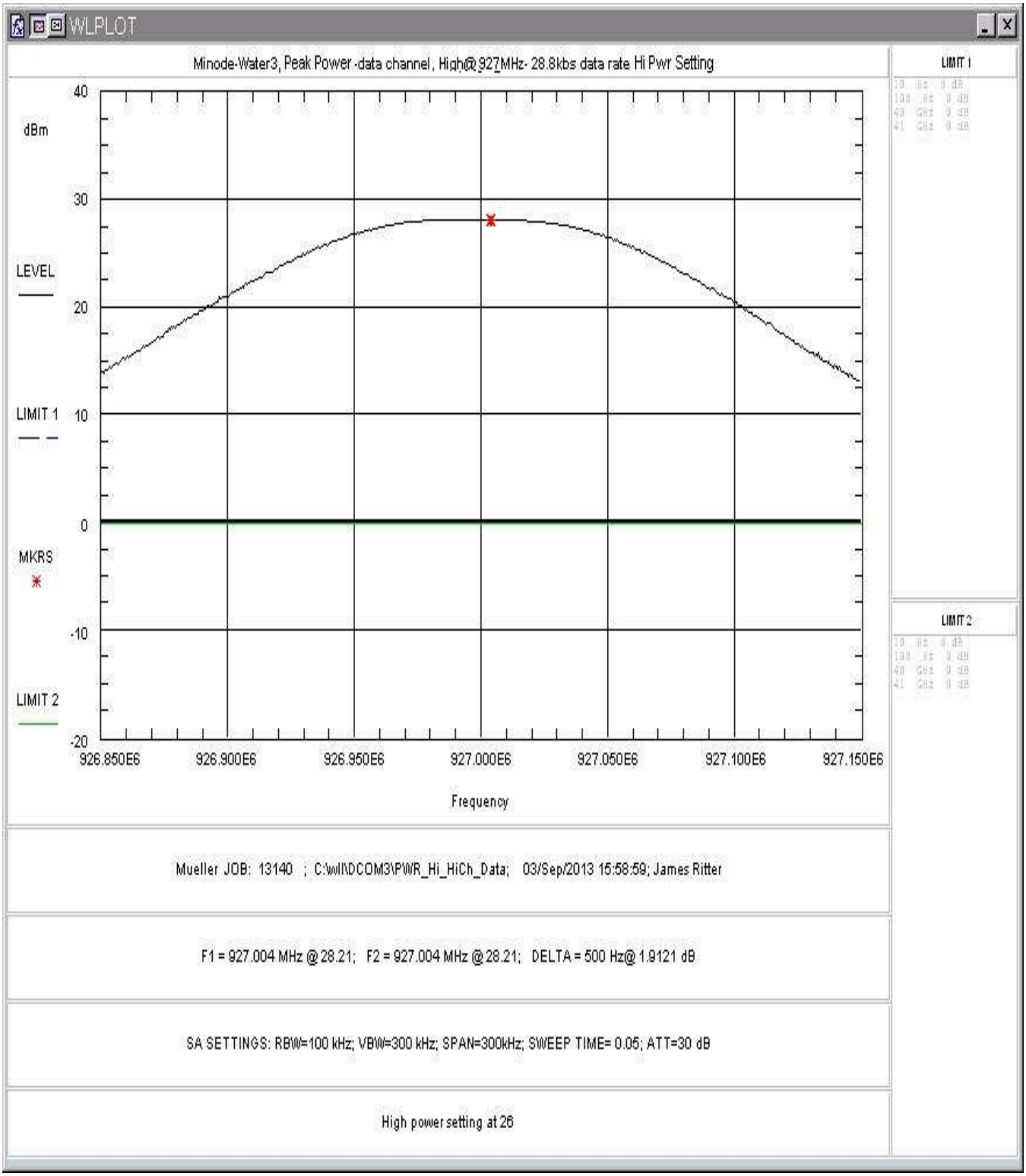

Figure 3: Conducted Peak Power, 927MHz, Hi Pwr, 28.8kbs, Data channel

Figure 4: Conducted Peak Power, 902.5MHz, Low Pwr, 28.8kbs, Data channel

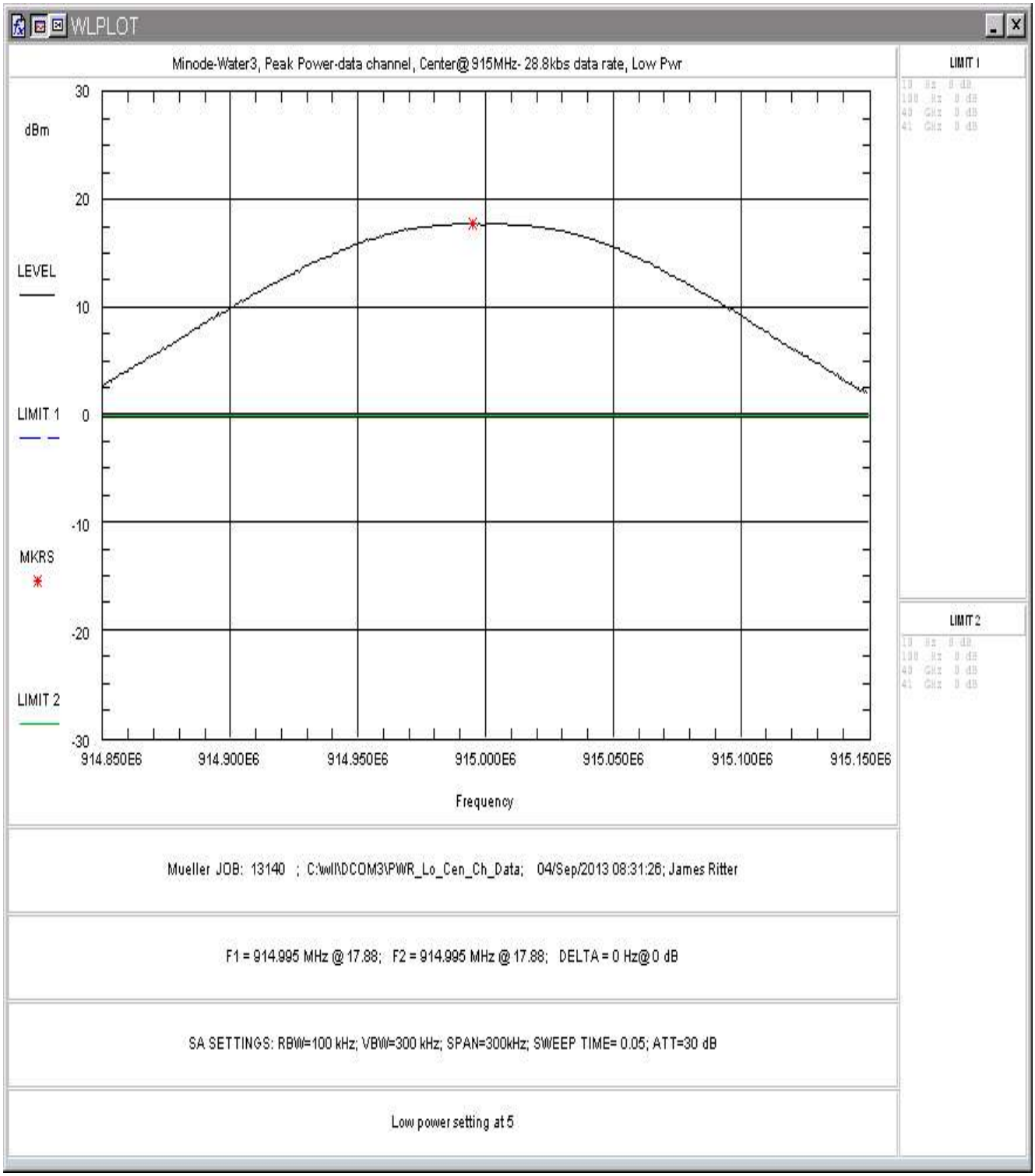

Figure 5: Conducted Peak Power, 915MHz, Low Pwr, 28.8kbs, Data channel

Figure 6: Conducted Peak Power, 927MHz, Low Pwr, 28.8kbs, Data channel

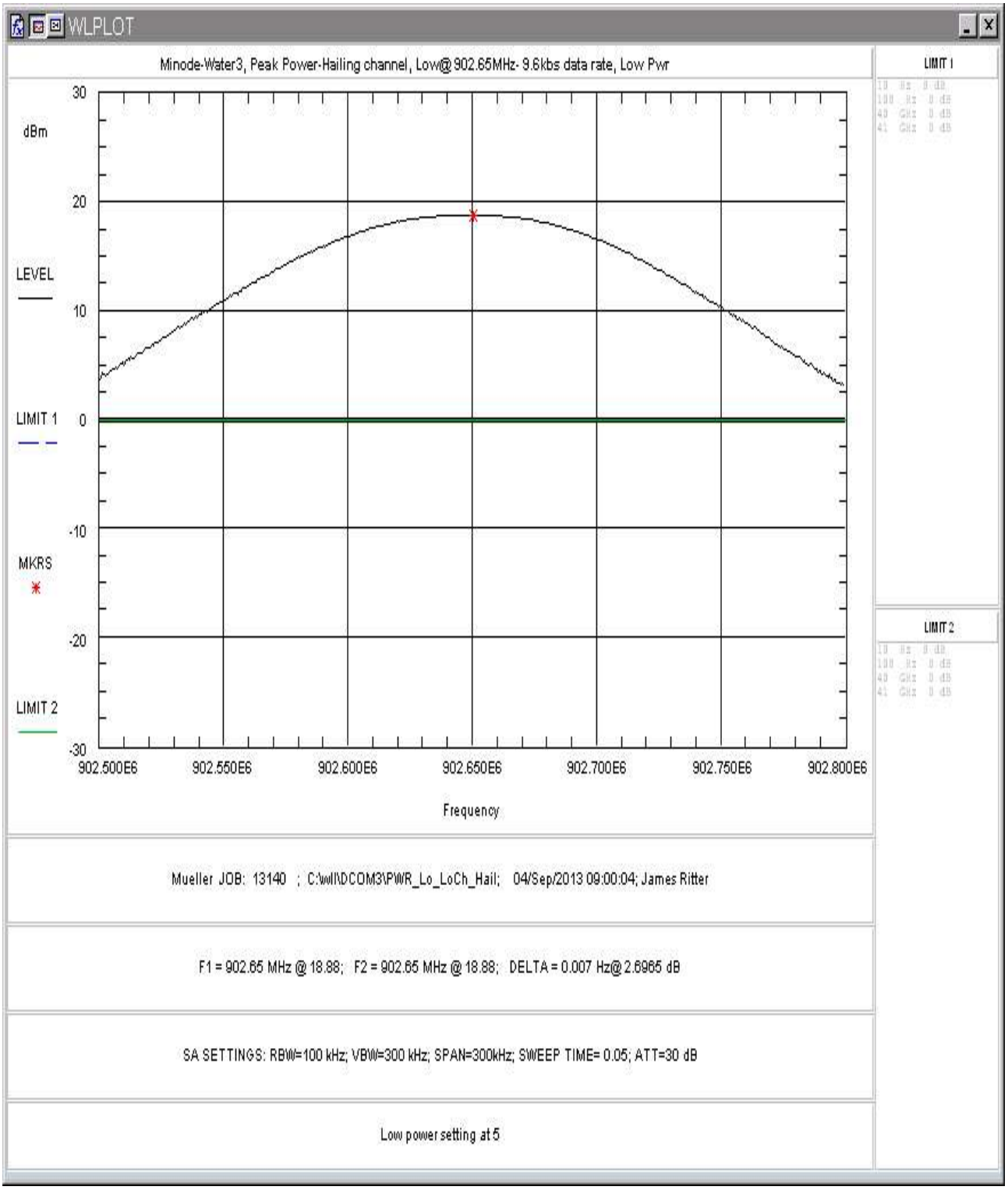

Figure 7: Conducted Peak Power, 902.65MHz, Hi Pwr, 9.6kbs, Hailing channel

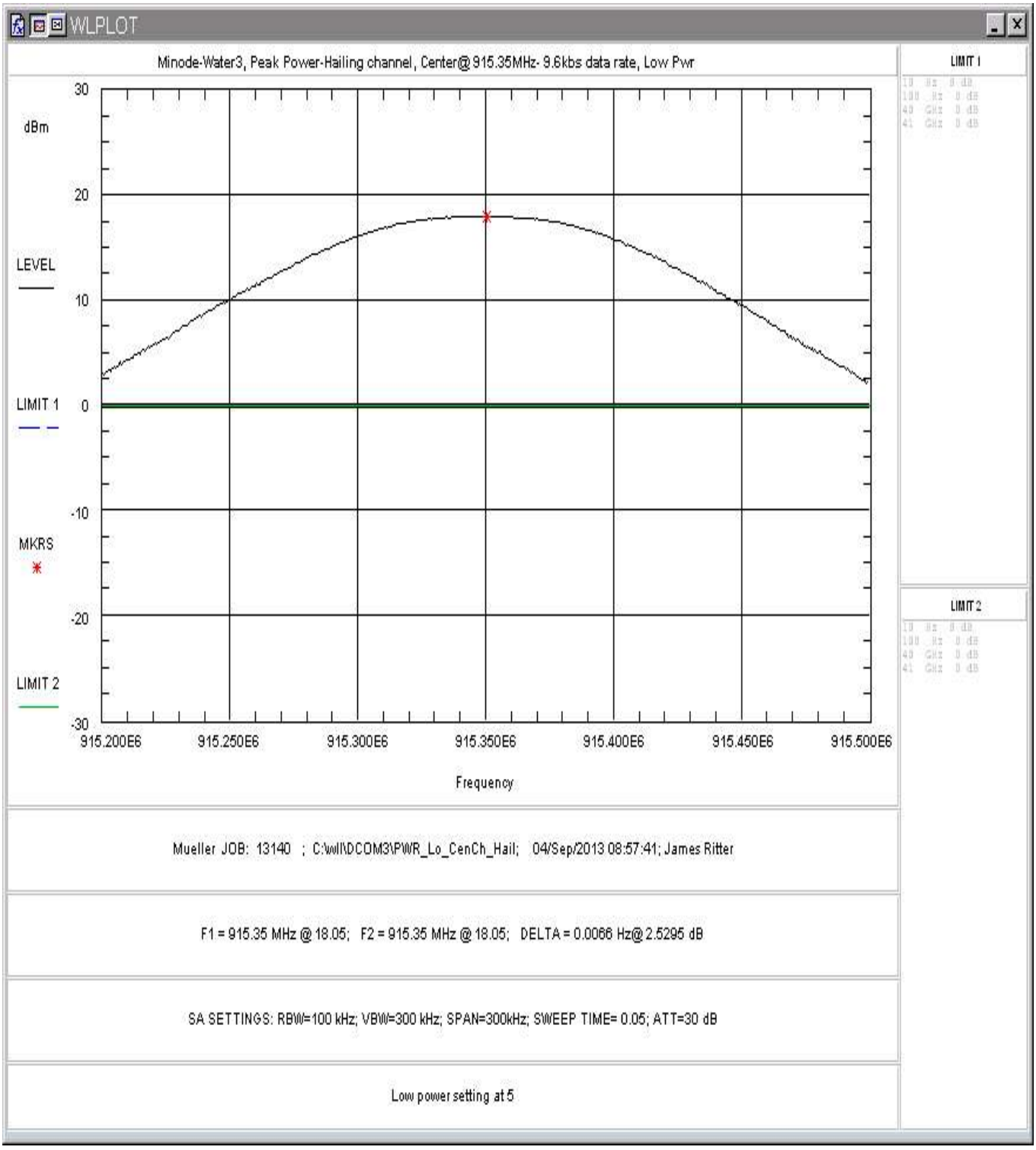

Figure 8: Conducted Peak Power, 915.35MHz, Hi Pwr, 9.6kbs, Hailing channel

Figure 9: Conducted Peak Power, 927.35MHz, Hi Pwr, 9.6kbs, Hailing channel

4.1 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, operating in the 902-928MHz frequency range, FCC Part 15.247 requires that Frequency hopping devices have a bandwidth less than 500kHz.

As the new 28.8kbs data rate only applies to the data channels (not hailing) only data channels were tested for this.

The below tables provide a summary of the Occupied Bandwidth Results.

Table 6. Data Channel Occupied Bandwidth Results (28.8kbs data rate)

Frequency	Bandwidth	Limit	Pass/Fail
Low Channel: 902.5MHz	61.7kHz	500kHz Maximum	Pass
Center Channel: 915.0MHz	62.2kHz	500kHz Maximum	Pass
High Channel: 927.0MHz	62.7kHz	500kHz Maximum	Pass

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

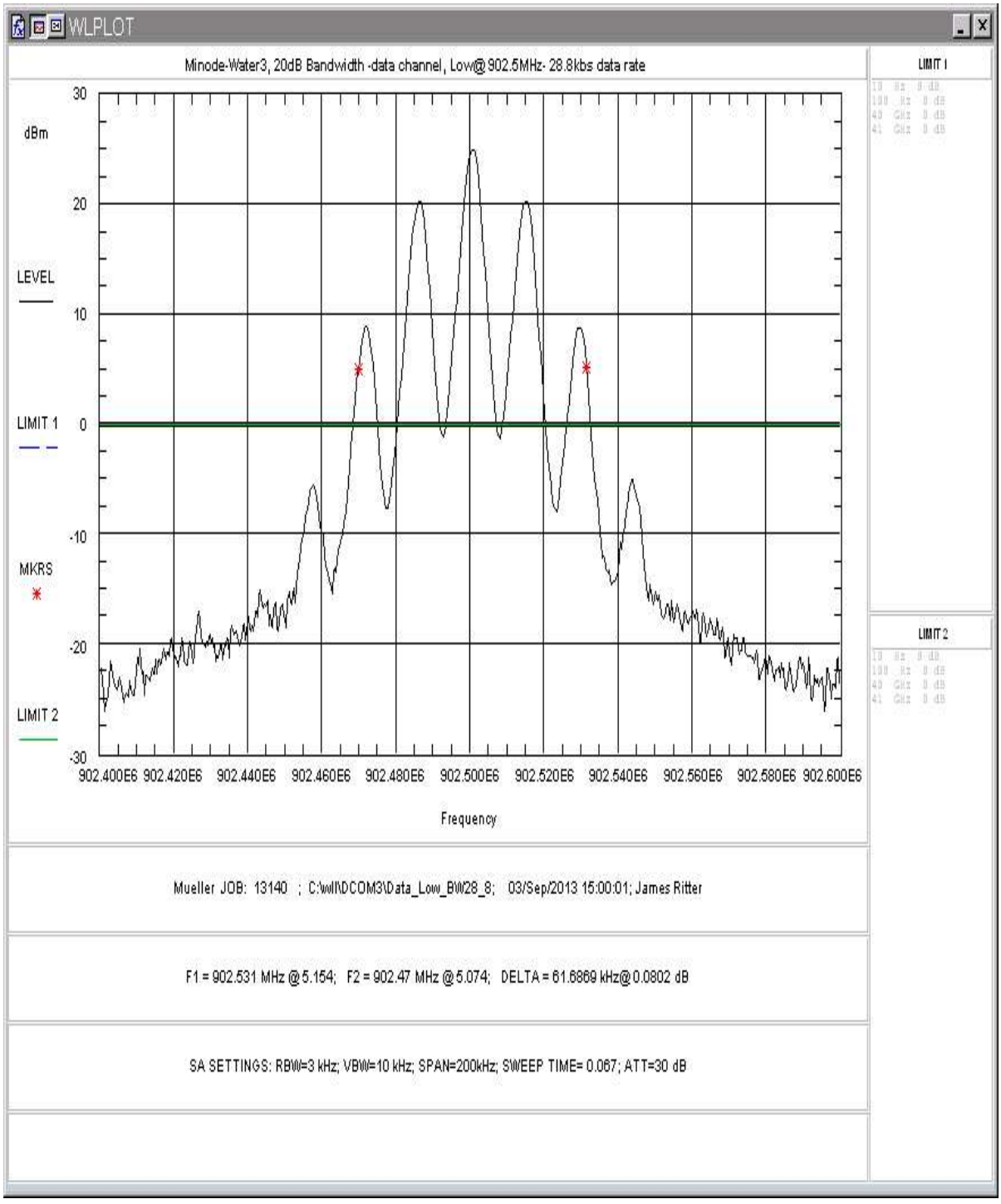

Figure 10. Data Channel Occupied Bandwidth, Low Channel (28.8kbs)

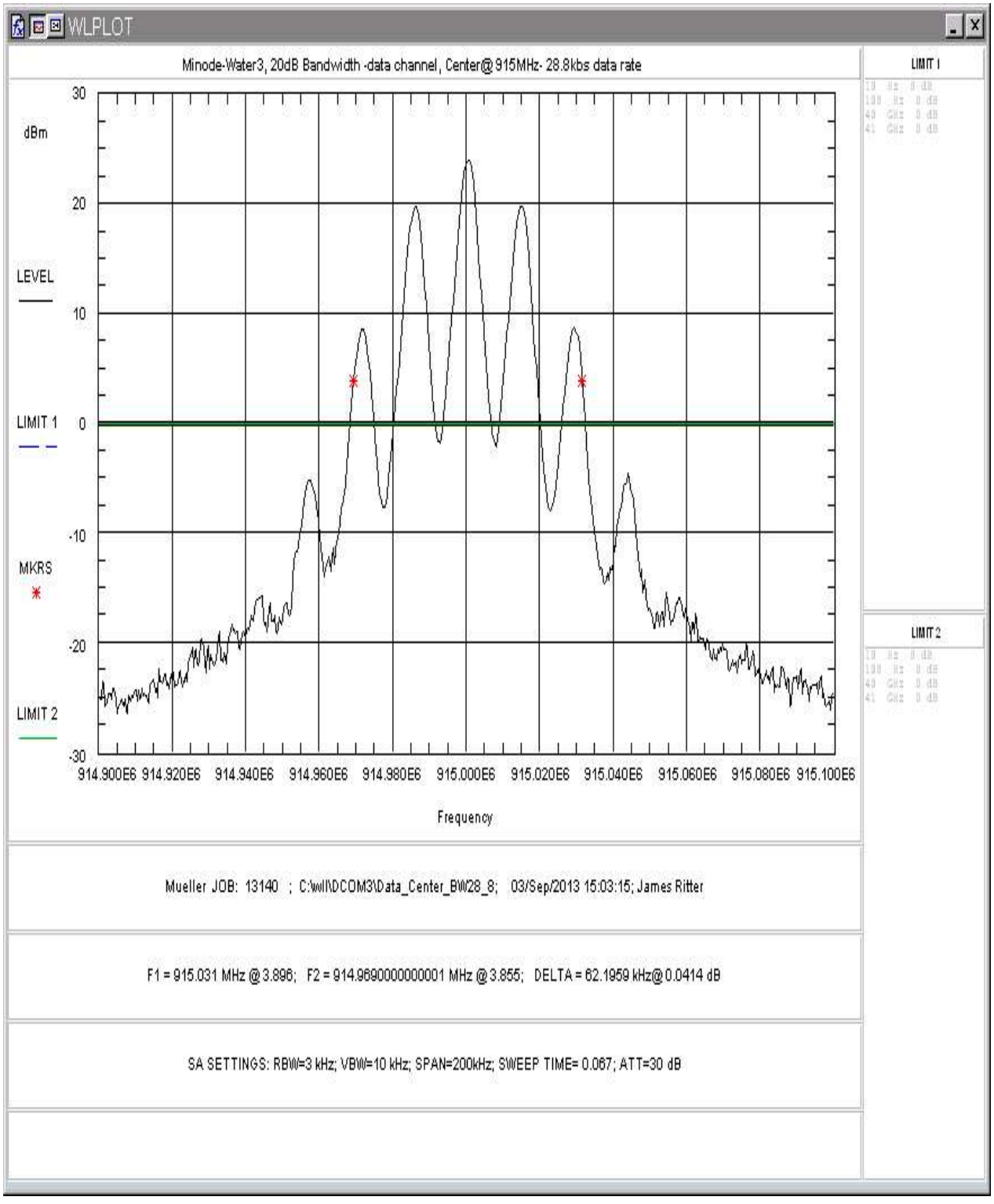

Figure 11. Data Channel Occupied Bandwidth, Center Channel (28.8kbs)

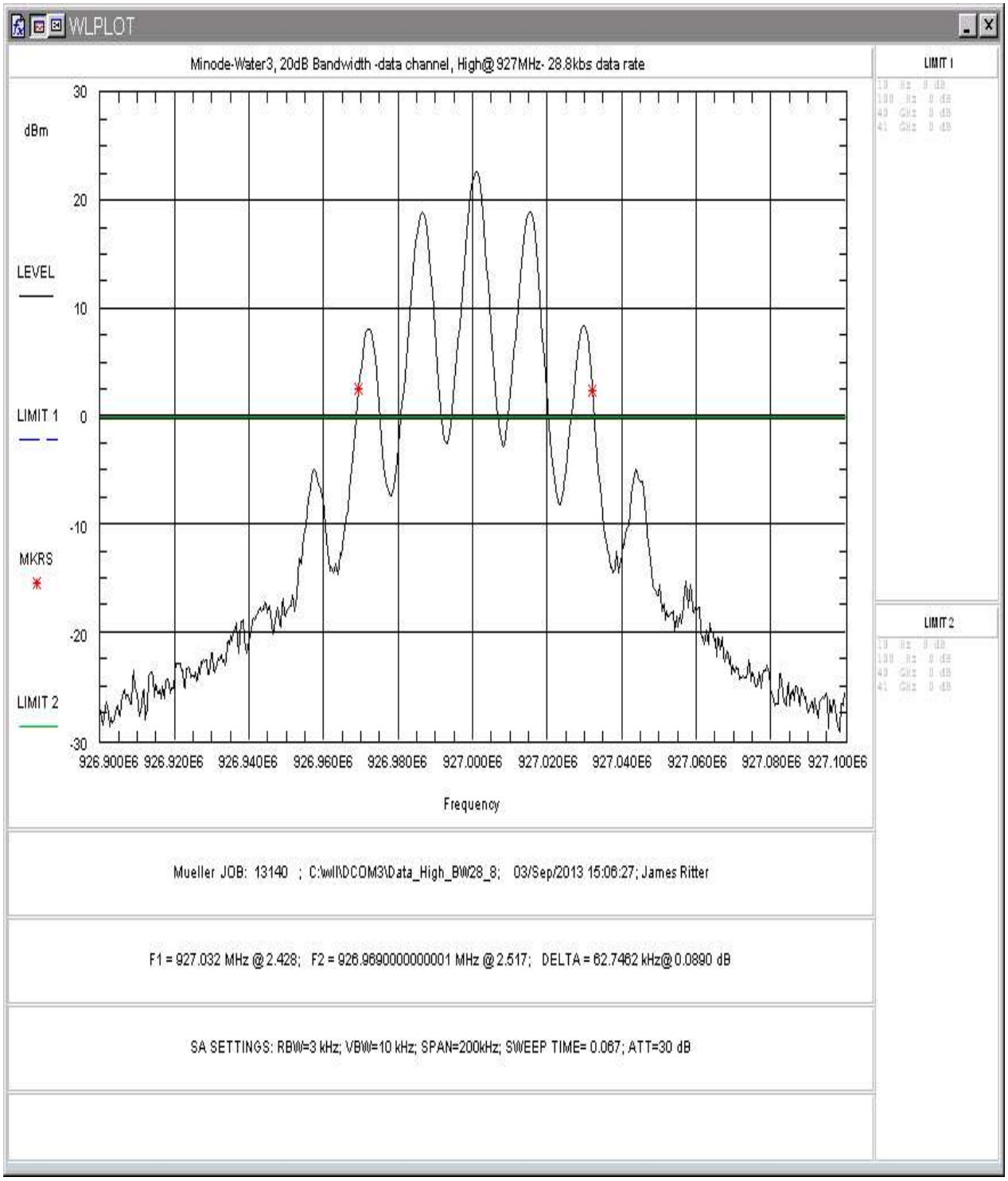

Figure 12. Data Channel Occupied Bandwidth, High Channel (28.8kbs)

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

The EUT must comply with requirements for spurious emissions at the antenna terminal. Per §15.247(c) all spurious emissions in any 100 kHz bandwidth outside the frequency band in which the device is operating shall be attenuated 20 dB below the highest power level in any 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 suitable 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 maximum modulated transmit frequency amplitude). The emissions outside of the allocated frequency band were then scanned from 30 MHz up to the tenth harmonic of the carrier.

Close-up plots of the 902-928MHz band edges are provided in both the hopping and non-hopping modes for Data modes High power @ 28.8kbs and low power all modes of operation to show compliance at both of these points.

Based on the results of the previous tests & band-edge tests plus the fact that both the hailing & data channels have the same power and share the same RF circuitry the full conducted tests will be performed as follows:

High Power setting at 28kbs (data channels only) @ 902.5MHz, 915MHz, & 927MHz

Low Power setting: 902.5MHz (28.8kbs), 915MHz (28.8kbs), & 927.65MHz (9.6kbs)
(this is the low, center & highest channels of both modes combined)

The EUT complied with all requirements of FCC Part15.247 for the conducted spurious measurements performed in sections 5.5.1 and 5.5.2 of this test report.

4.2.1 Conducted Band Edge Plots

4.2.1.1 Results

The EUT complied with the requirements at the band edges for the following modes:

Data mode @ 28.8kbs High Power
Data mode @ 28.8kbs Low Power
Hailing mode @ 9.6kbs Low Power
all other modes were covered in the original test report.

4.2.1.2 Data Mode (28.8kbs) -High Power

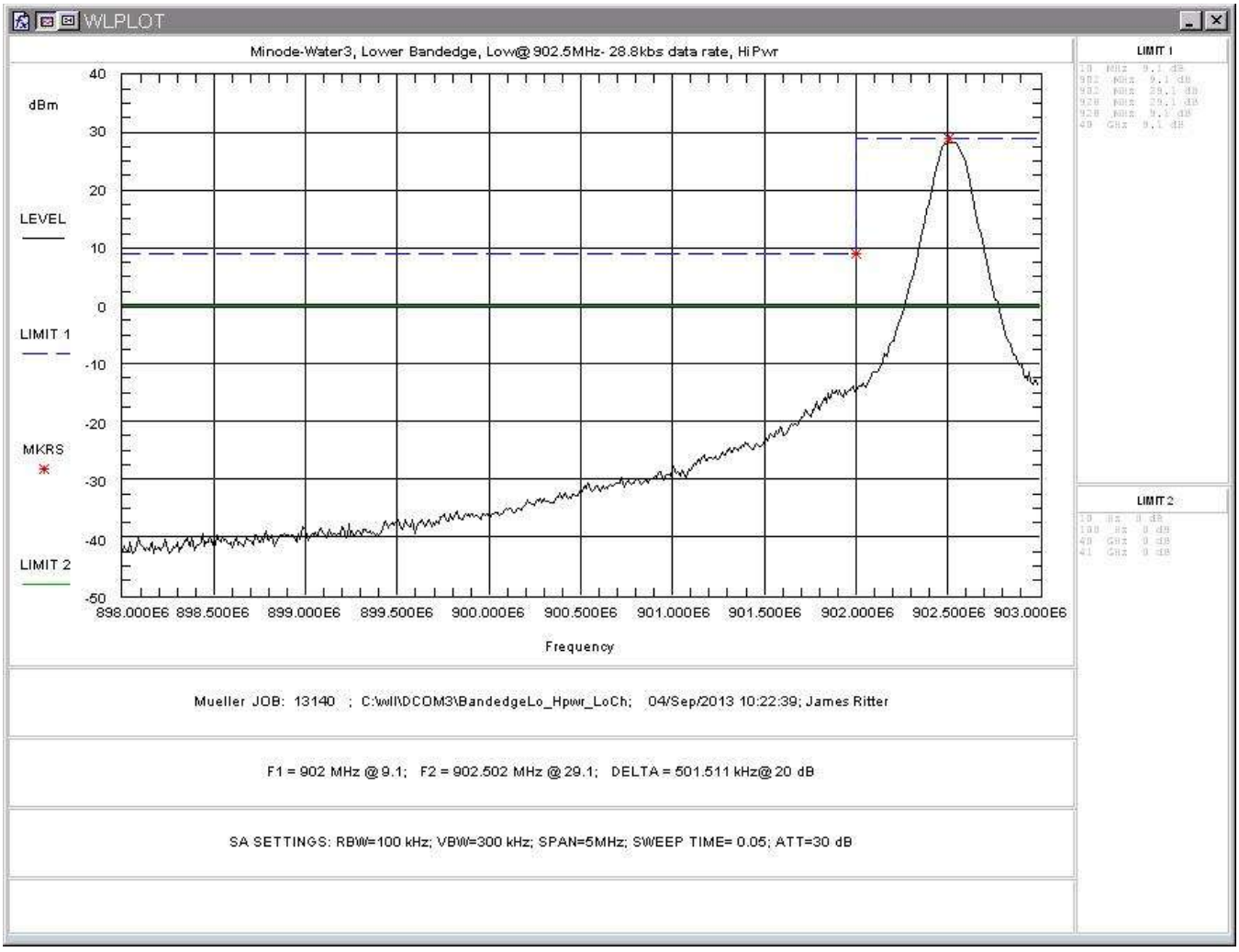

Figure 13: Lower Band-edge, Data Mode, High Pwr, 28.8kbps, TX-902.5MHz

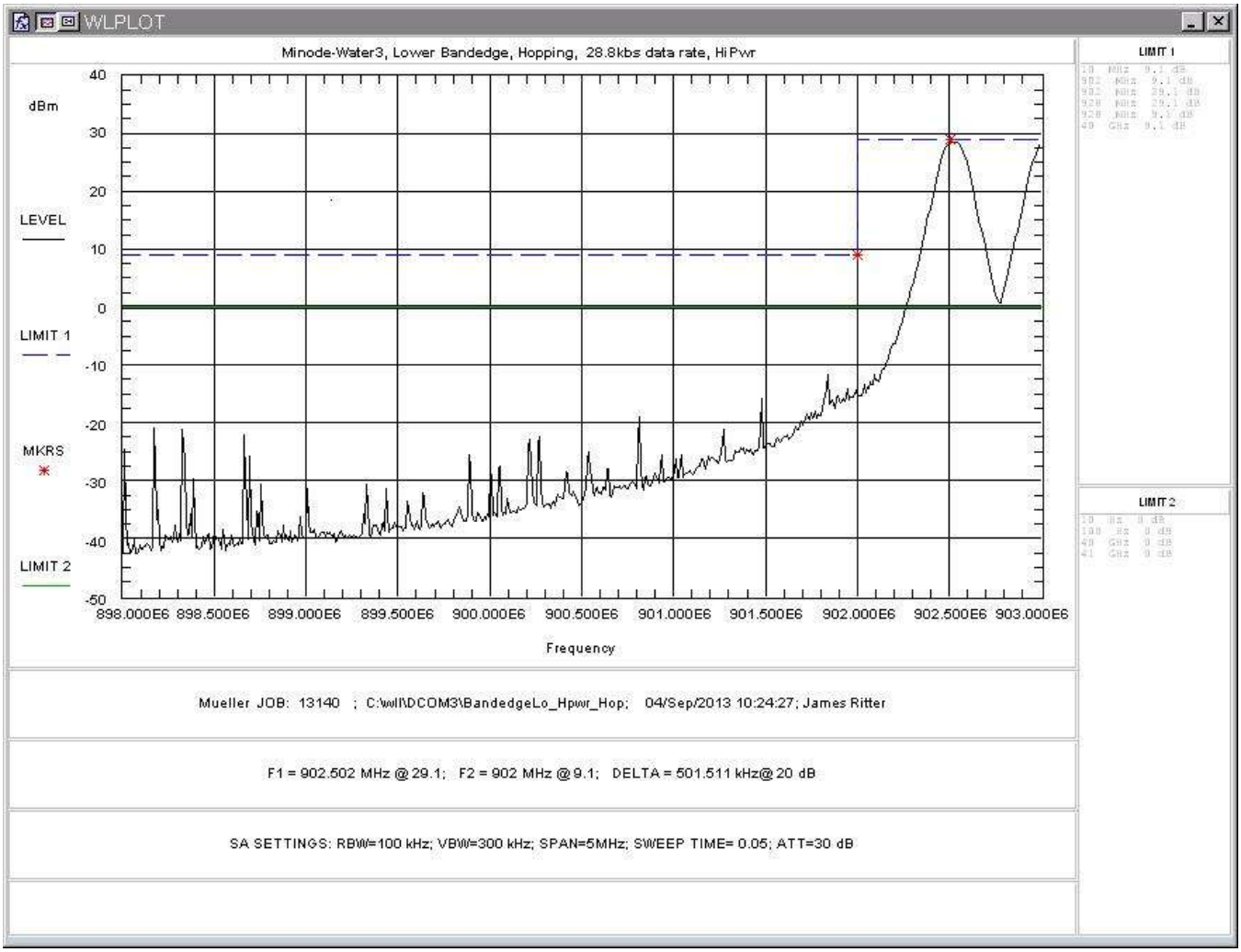

Figure 14: Lower Band-edge, Data Mode, High Pwr, 28.8kbps, TX-Hopping

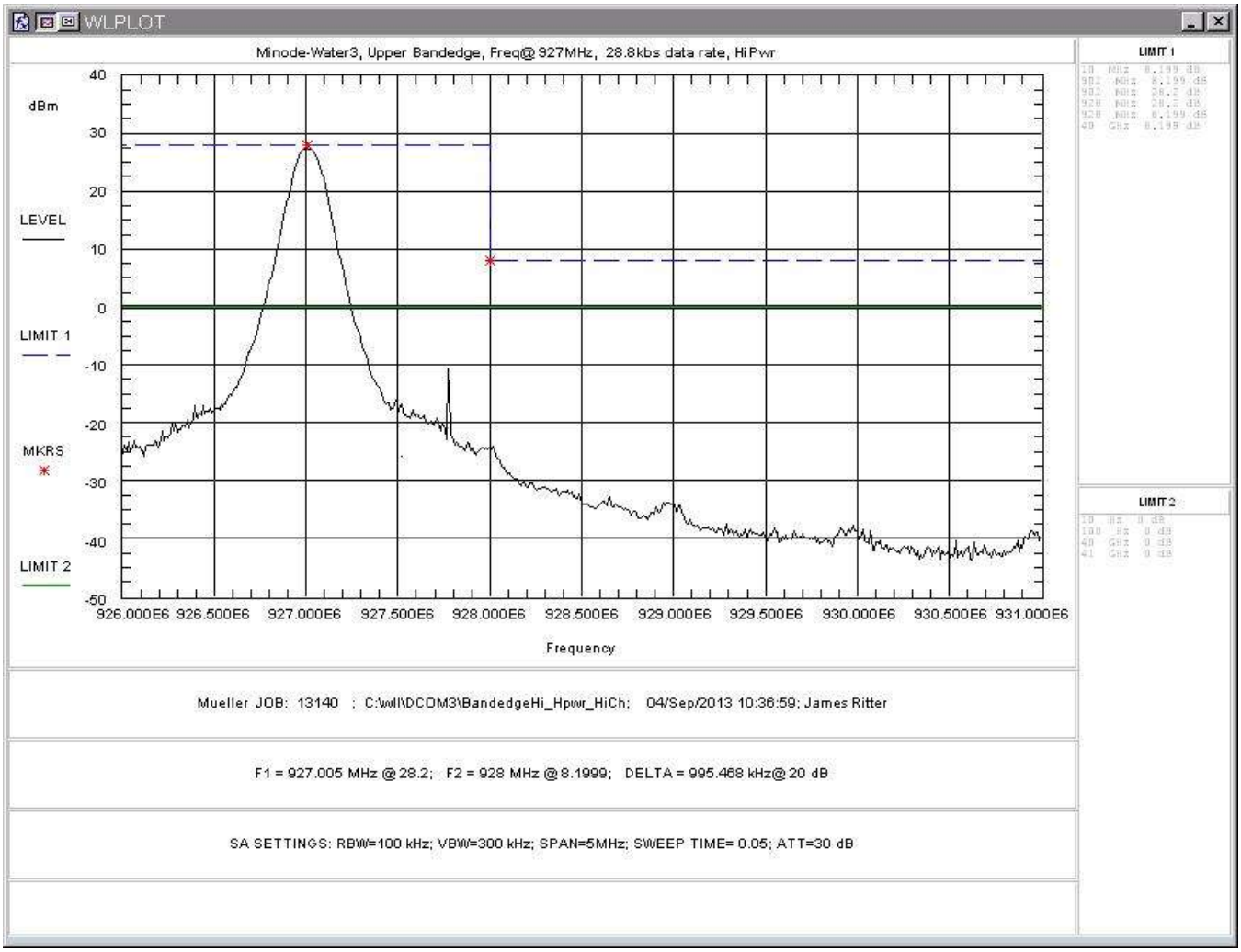

Figure 15: Upper Band-edge, Data Mode, High Pwr, 28.8kbps, TX-927MHz

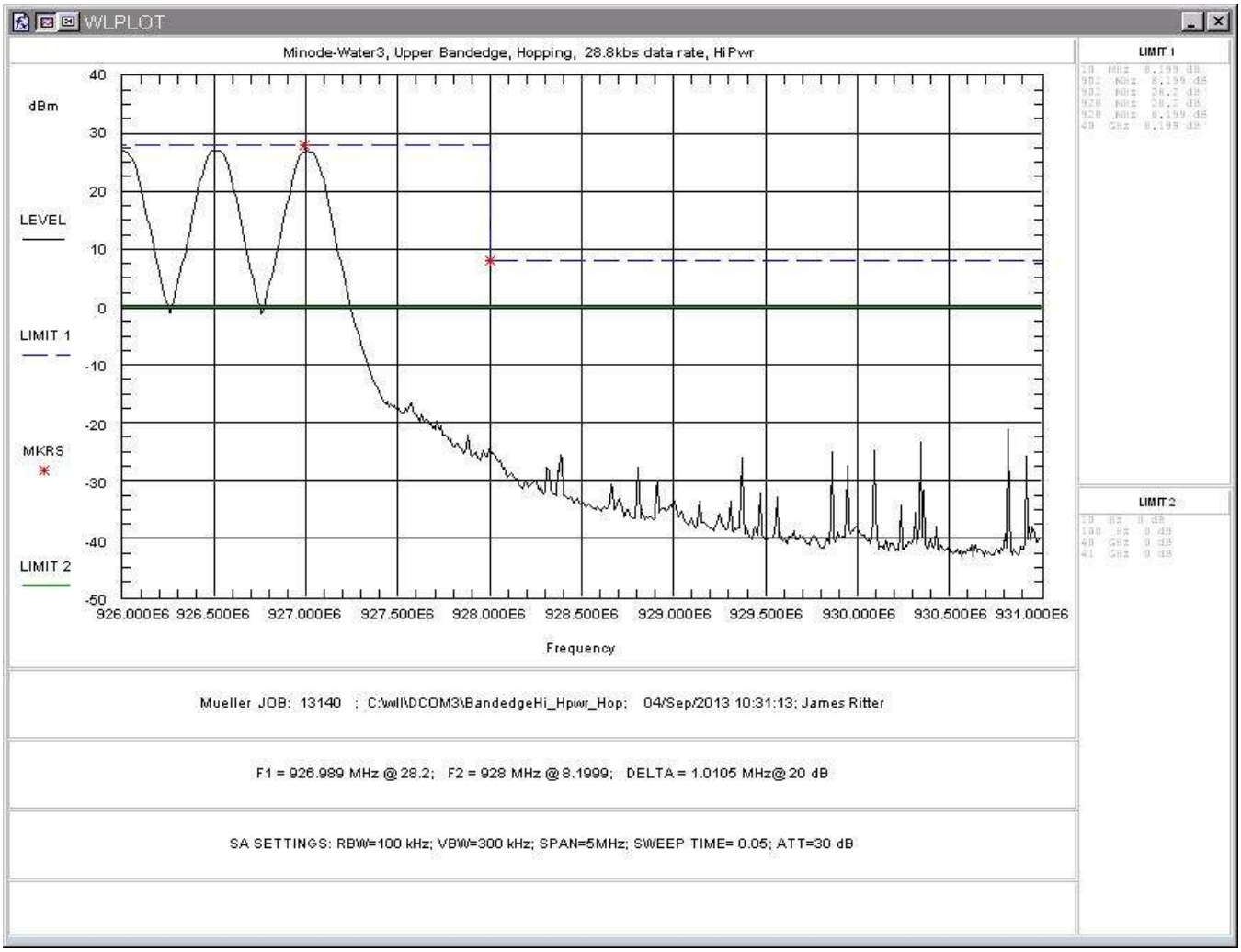

Figure 16: Upper Band-edge, Data Mode, High Pwr, 28.8kbps, TX-Hopping

4.2.1.3 Data Mode- Low Power

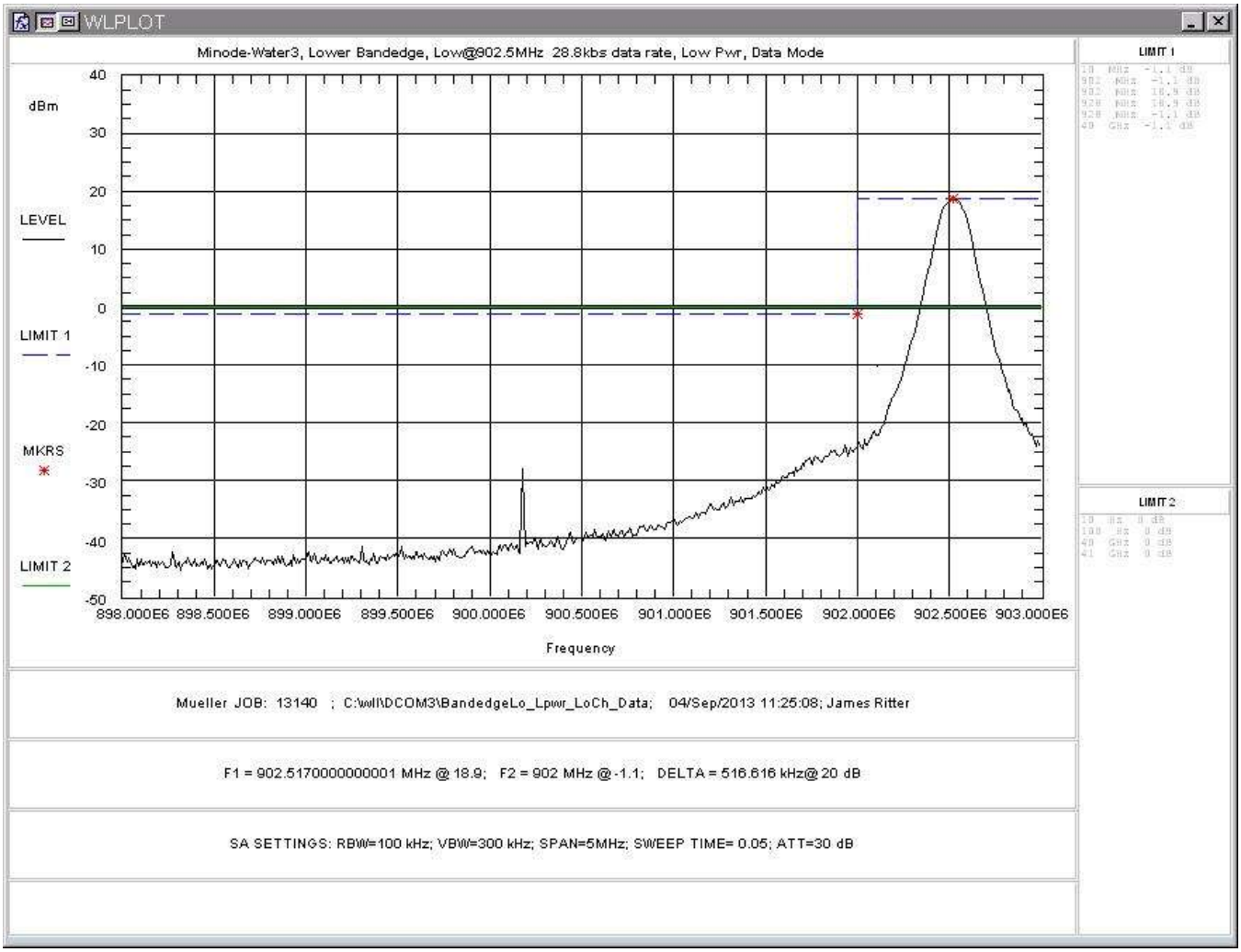

Figure 17: Lower Band-edge, Data Mode, Low Pwr, 28.8kbps, TX-902.5MHz

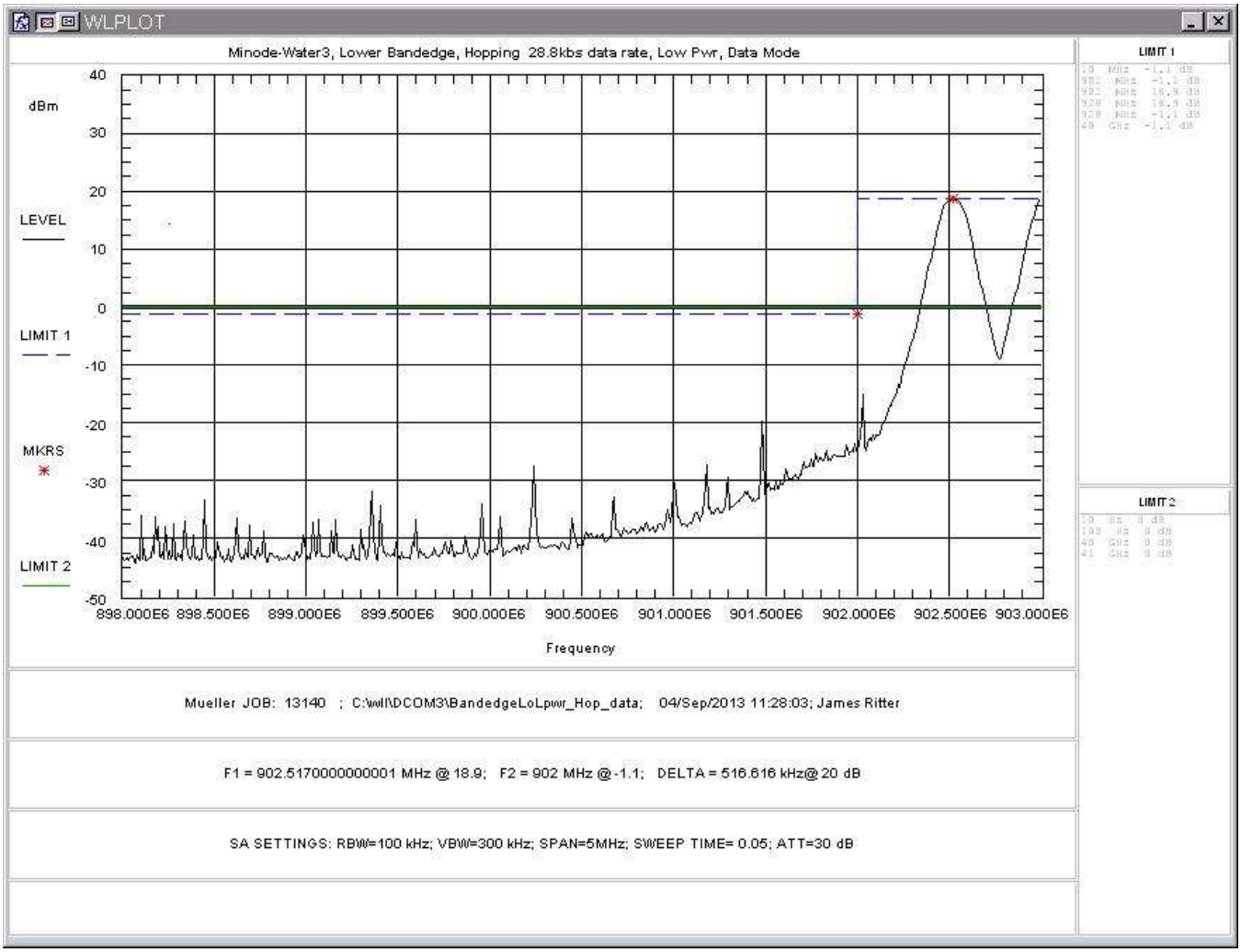

Figure 18: Lower Band-edge, Data Mode, Low Pwr, 28.8kbps, TX-Hopping

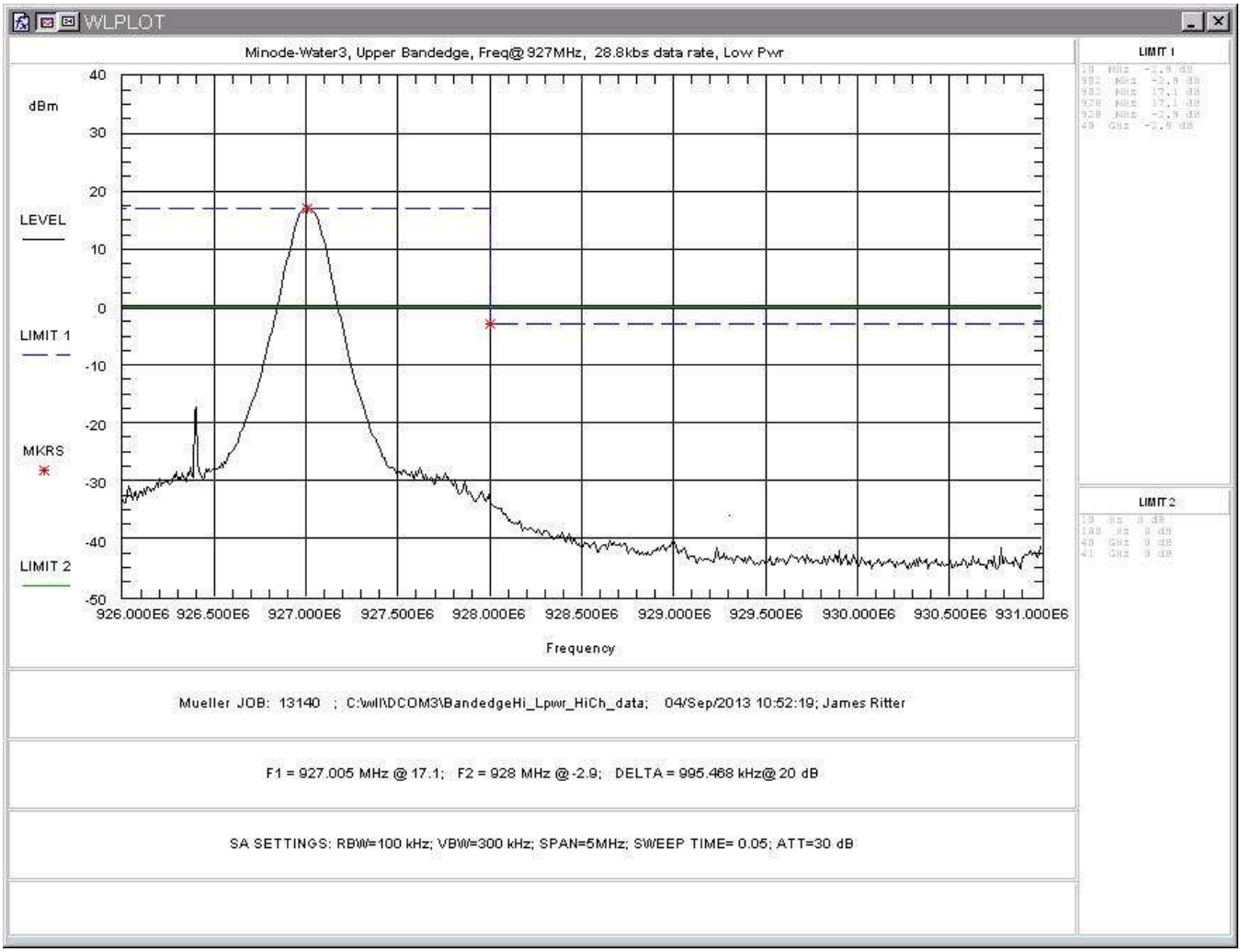

Figure 19: Upper Band-edge, Data Mode, Low Pwr, 28.8kbps, TX-927MHz

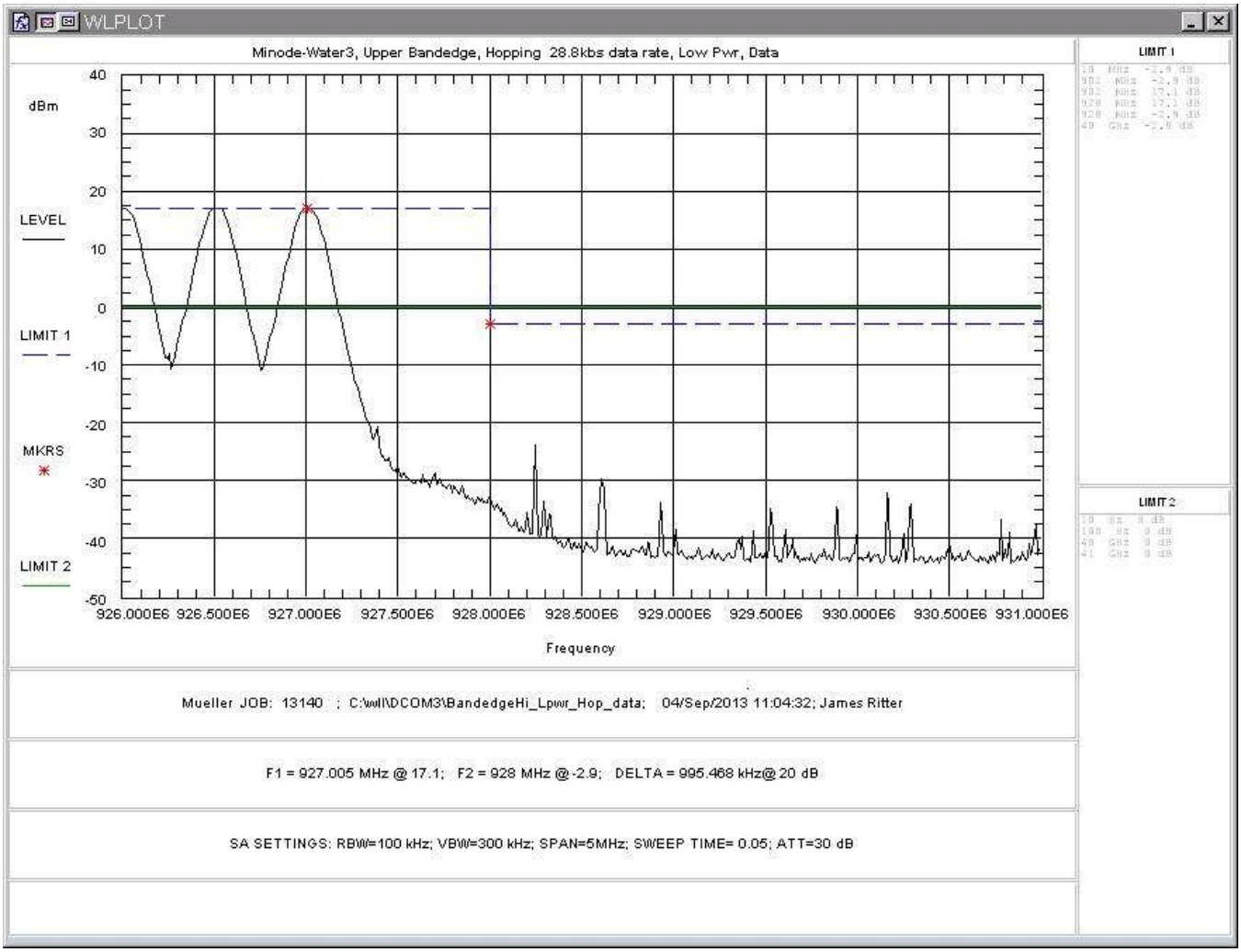

Figure 20: Upper Band-edge, Data Mode, Low Pwr, 28.8kbps, TX-Hopping

4.2.1.3 Hailing Mode- Low Power

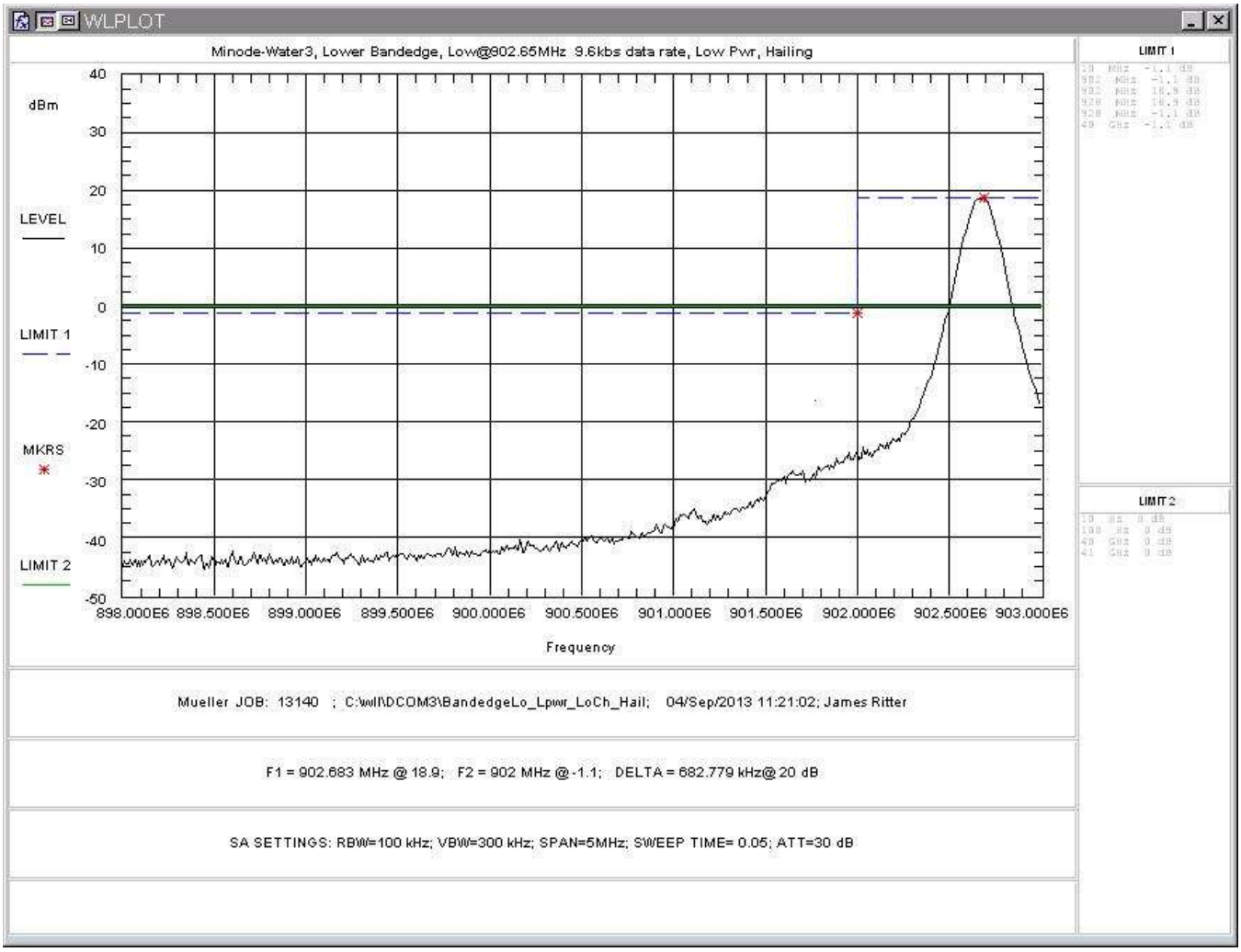

Figure 21: Lower Band-edge, Hailing, Low Pwr, 9.6kbps, TX-902.65MHz

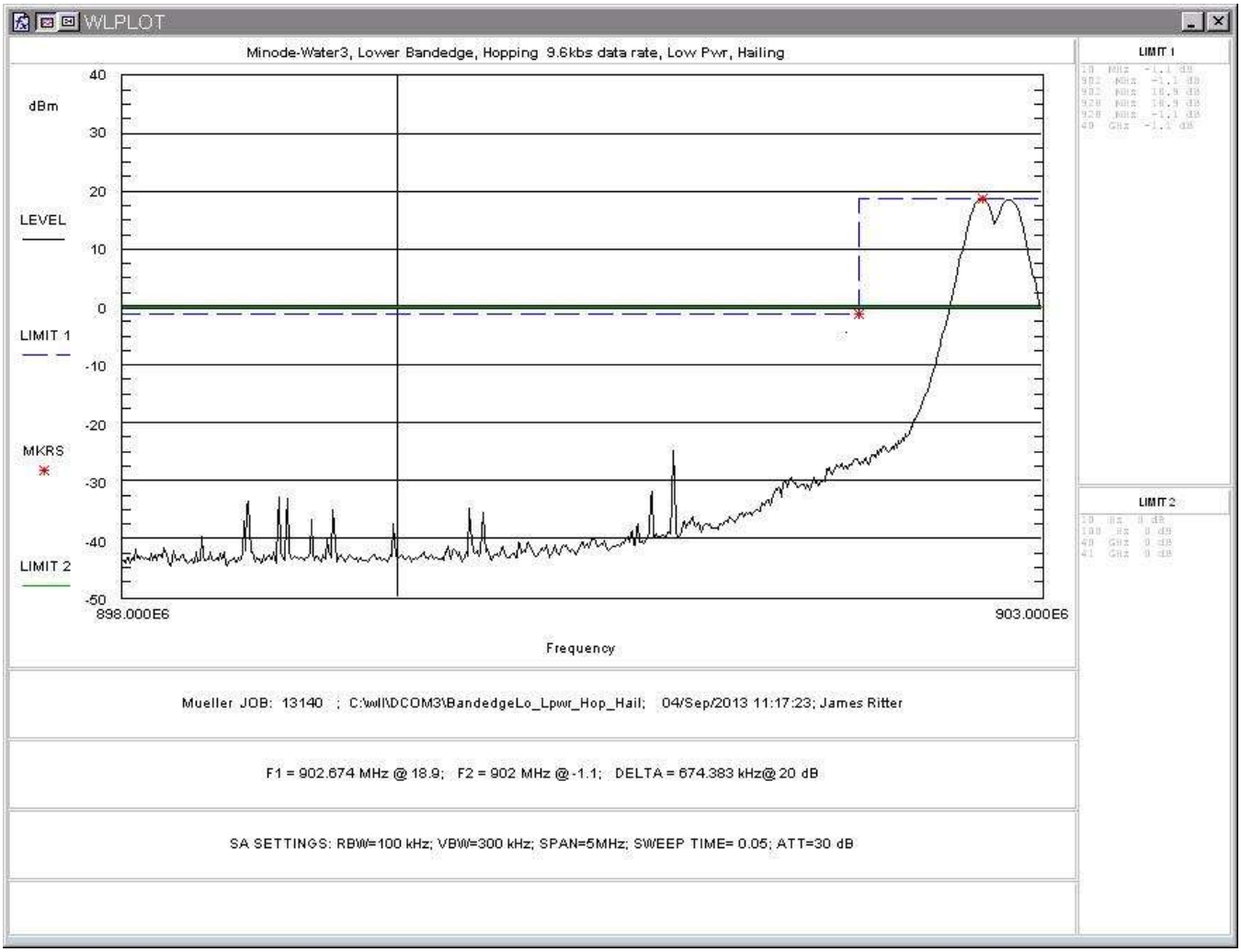

Figure 22: Lower Band-edge, Hailing, Low Pwr, 9.6kbps, TX-Hopping

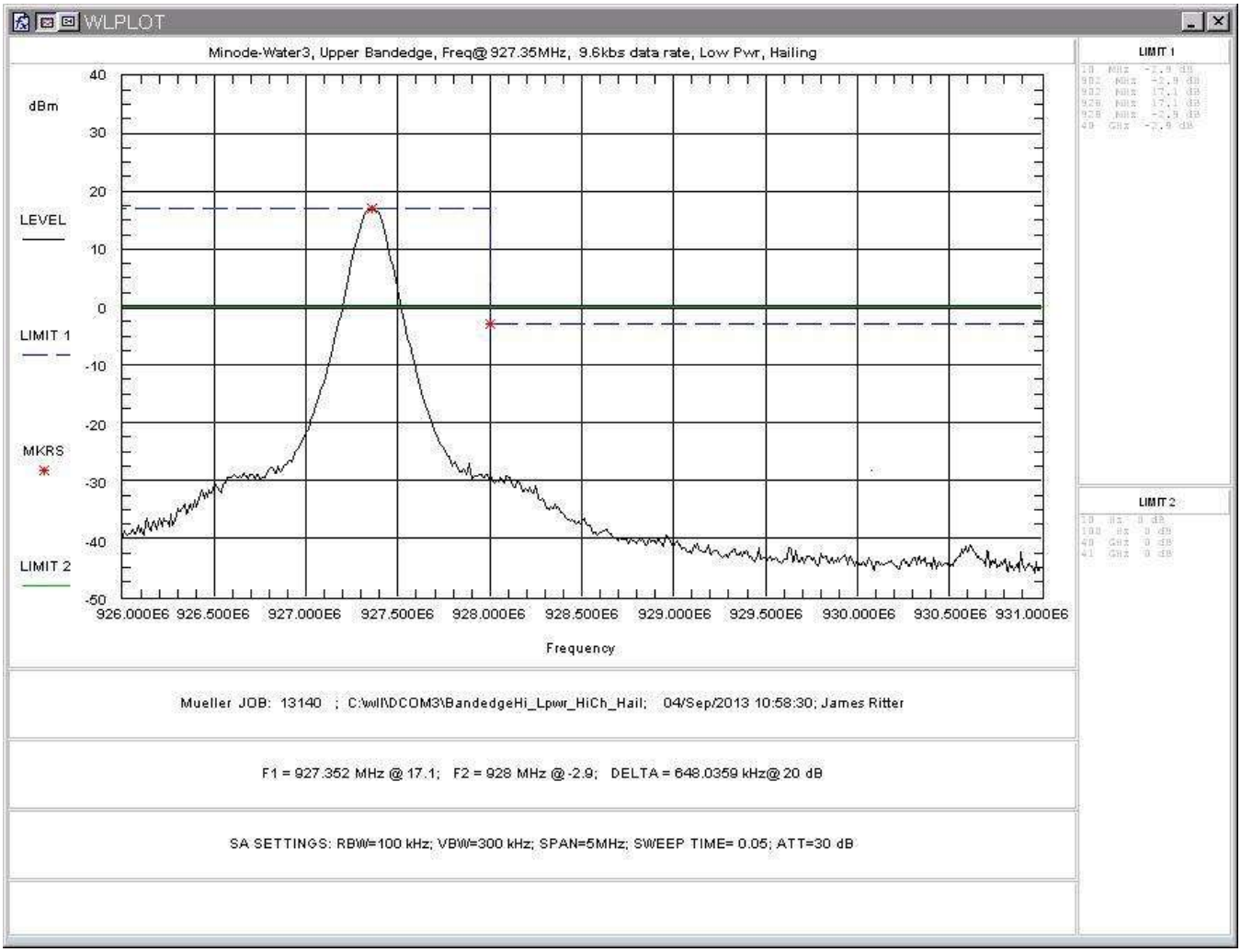

Figure 23: Upper Band-edge, Hailing, Low Pwr, 9.6kbps, TX-927.35MHz

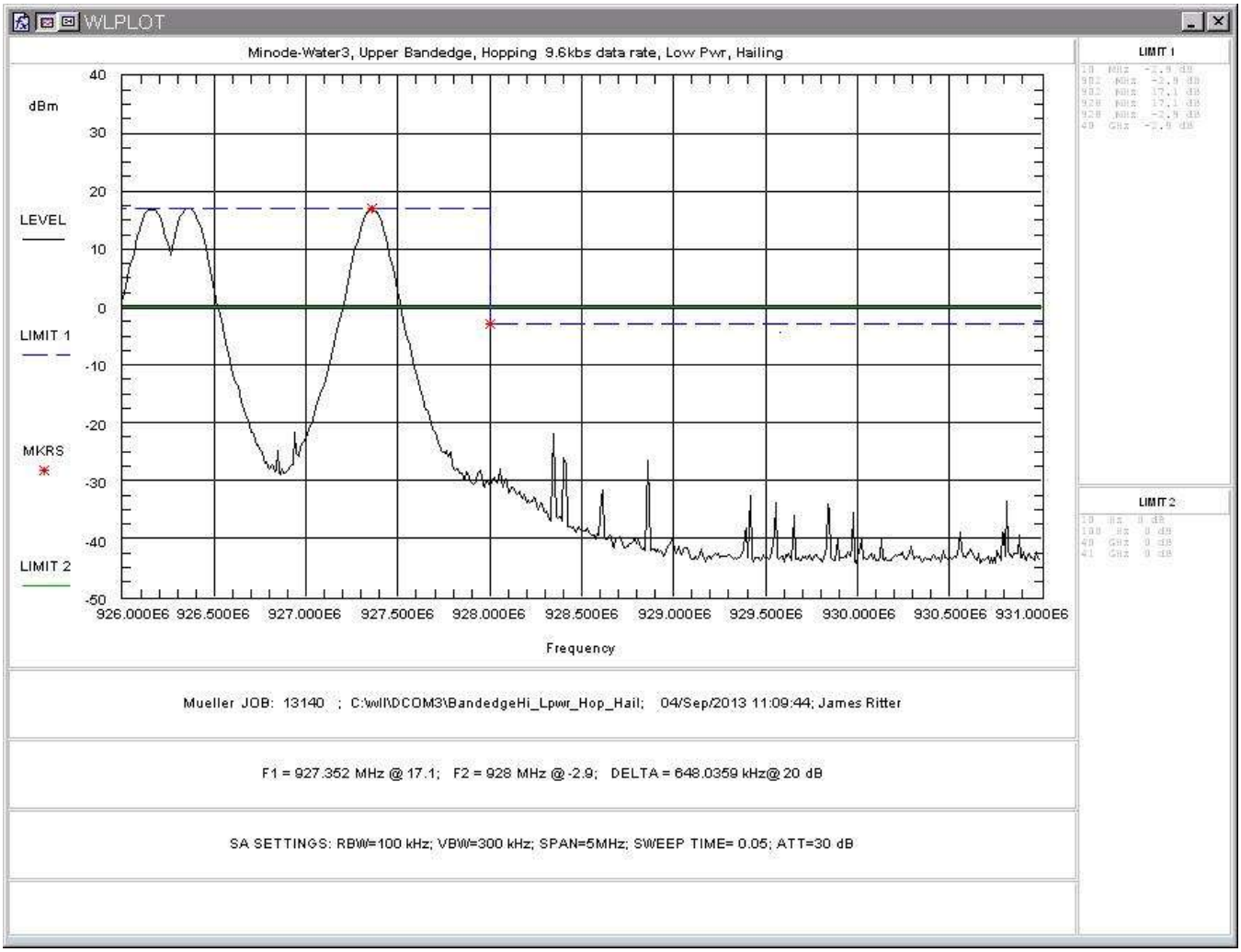

Figure 24: Upper Band-edge, Hailing, Low Pwr, 9.6kbps, TX- Hopping

4.2.2 Full-Band Conducted Spurious Emissions

4.2.1.1 Results

The EUT complied with the requirements for spurious emissions in the following modes:

High Power setting at 28kbs (data channels only) @ 902.5MHz, 915MHz, & 927MHz

Low Power setting: 902.5MHz (28.8kbs), 915MHz (28.8kbs), & 927.65MHz (9.6kbs) (this is the low, center & highest channels of both modes combined)

All other modes were covered in the original test report.

4.2.2.1 Low Channel 902.5MHz- Data Mode, 28.8kbs, High Power

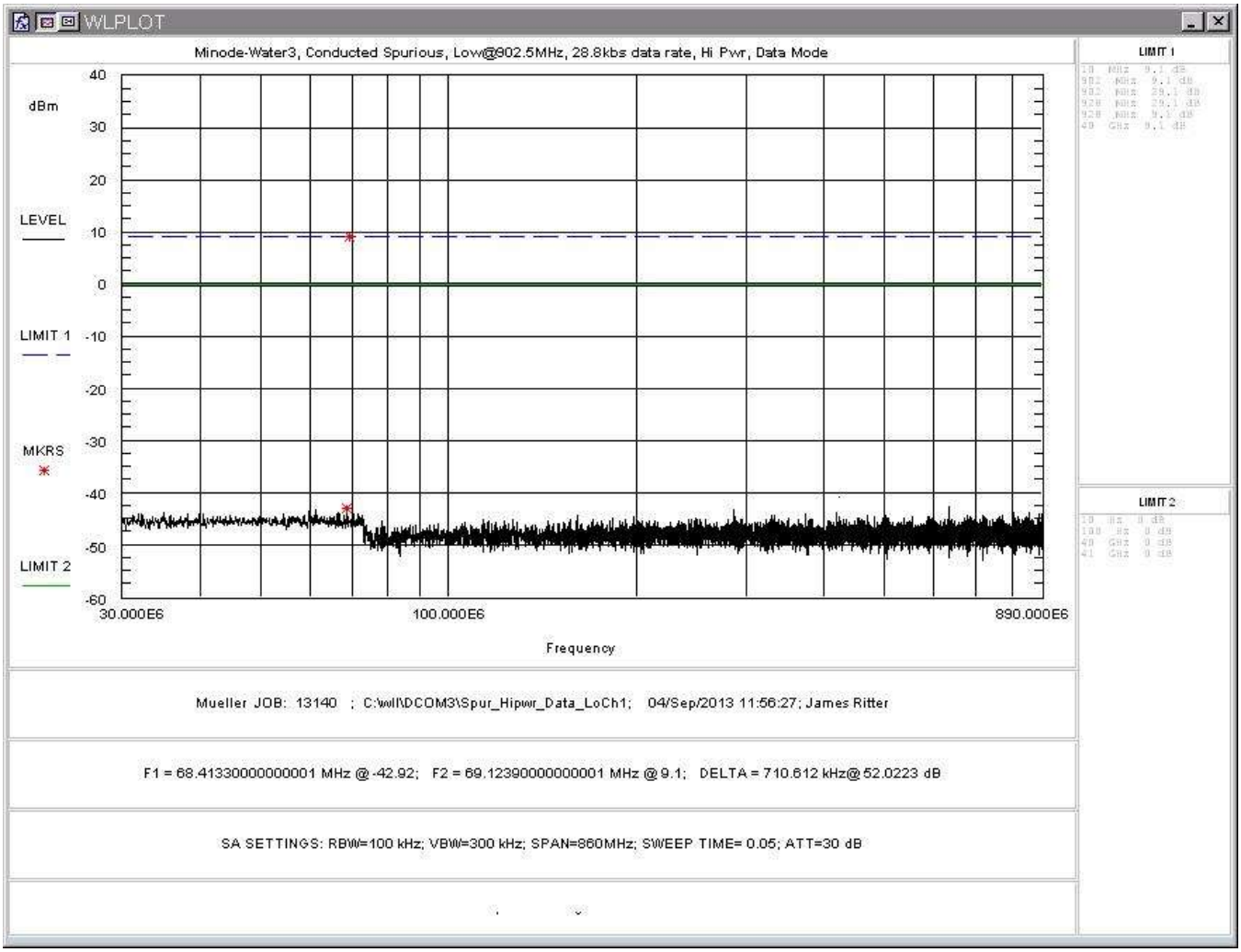

Figure 25: Spurious Emissions, Hi Pwr, TX-902.5MHz, 30-890MHz

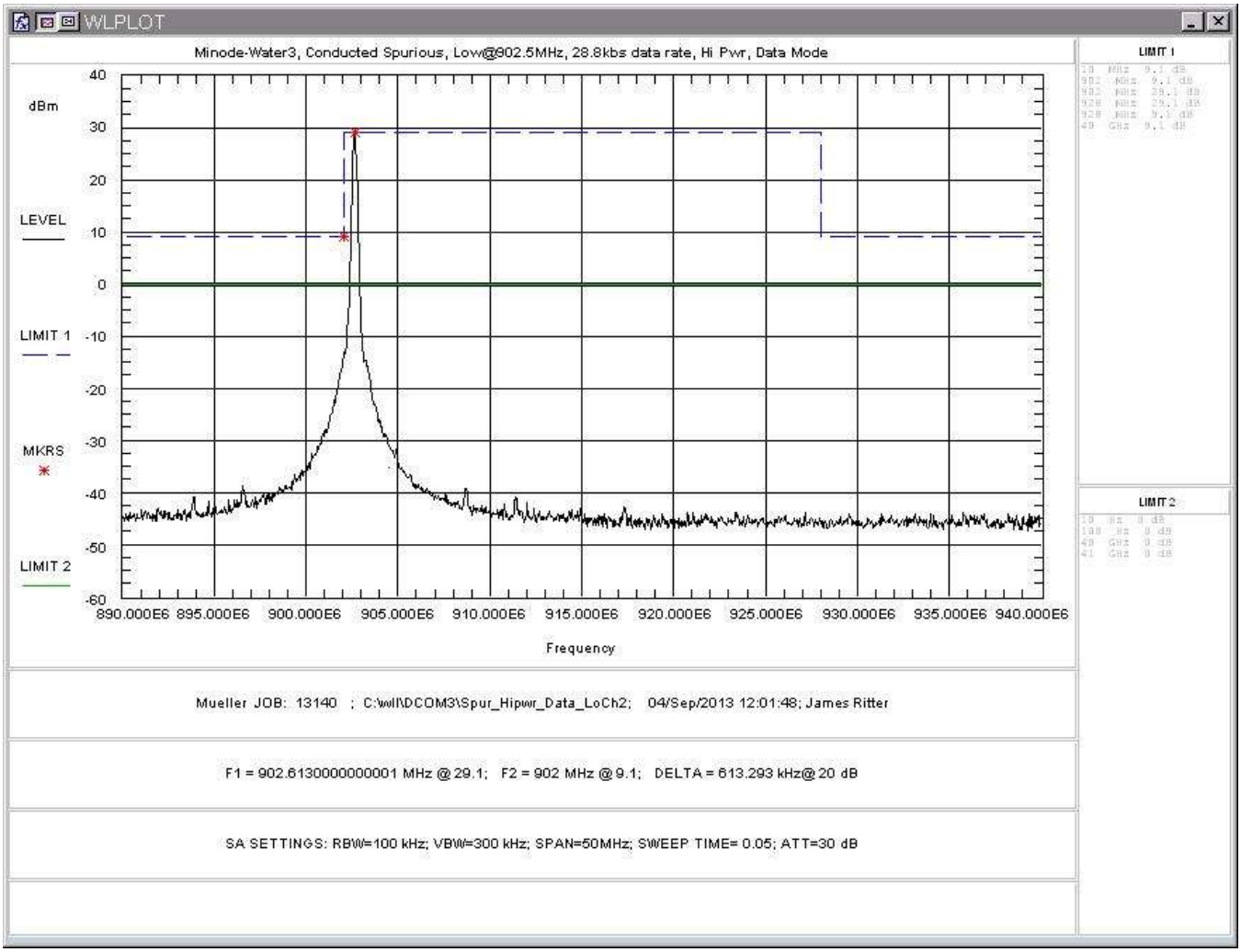

Figure 26: Spurious Emissions, High Pwr, TX-902.5MHz, 890-940MHz

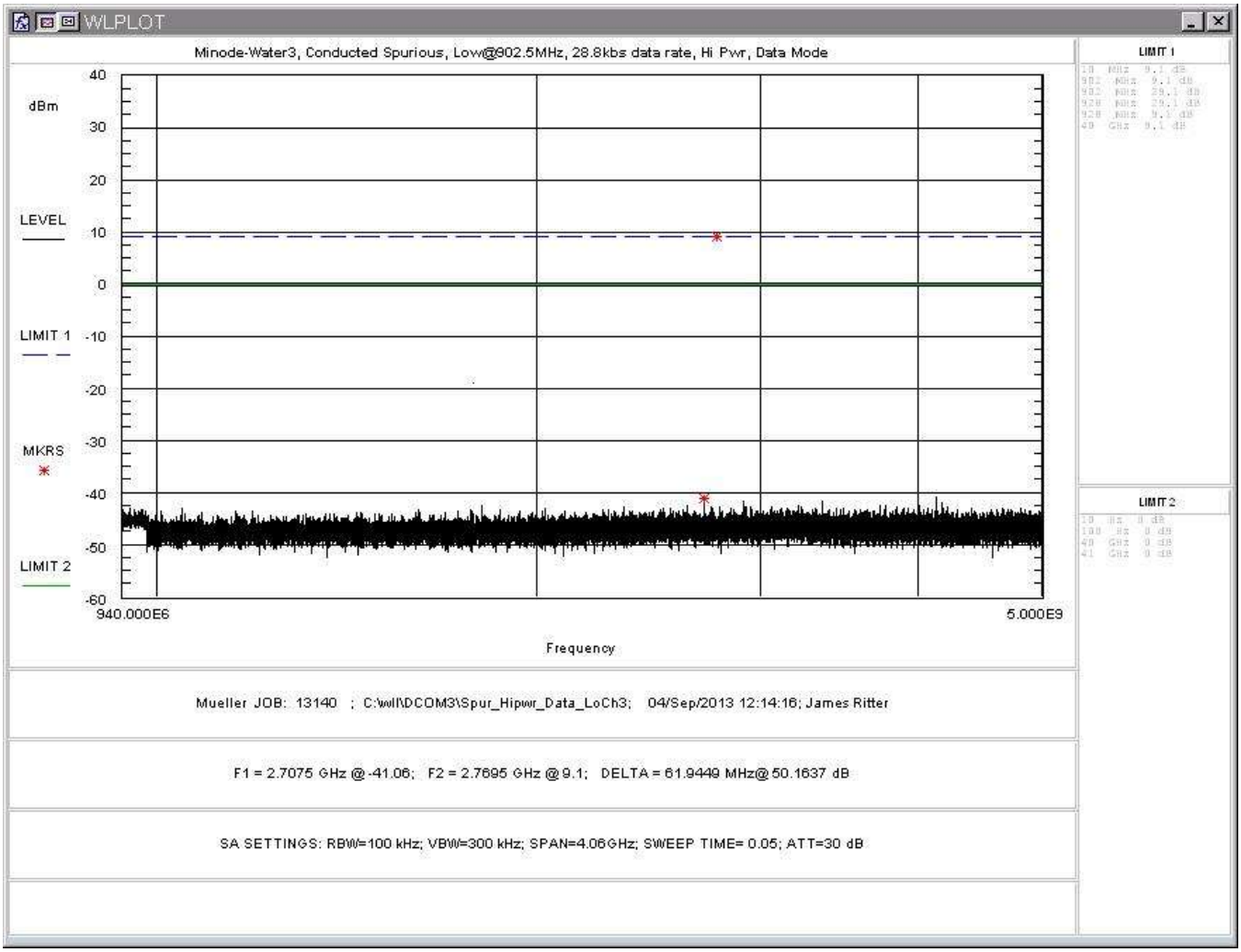

Figure 27: Spurious Emissions, High Pwr, TX-902.5MHz, 940-5000MHz

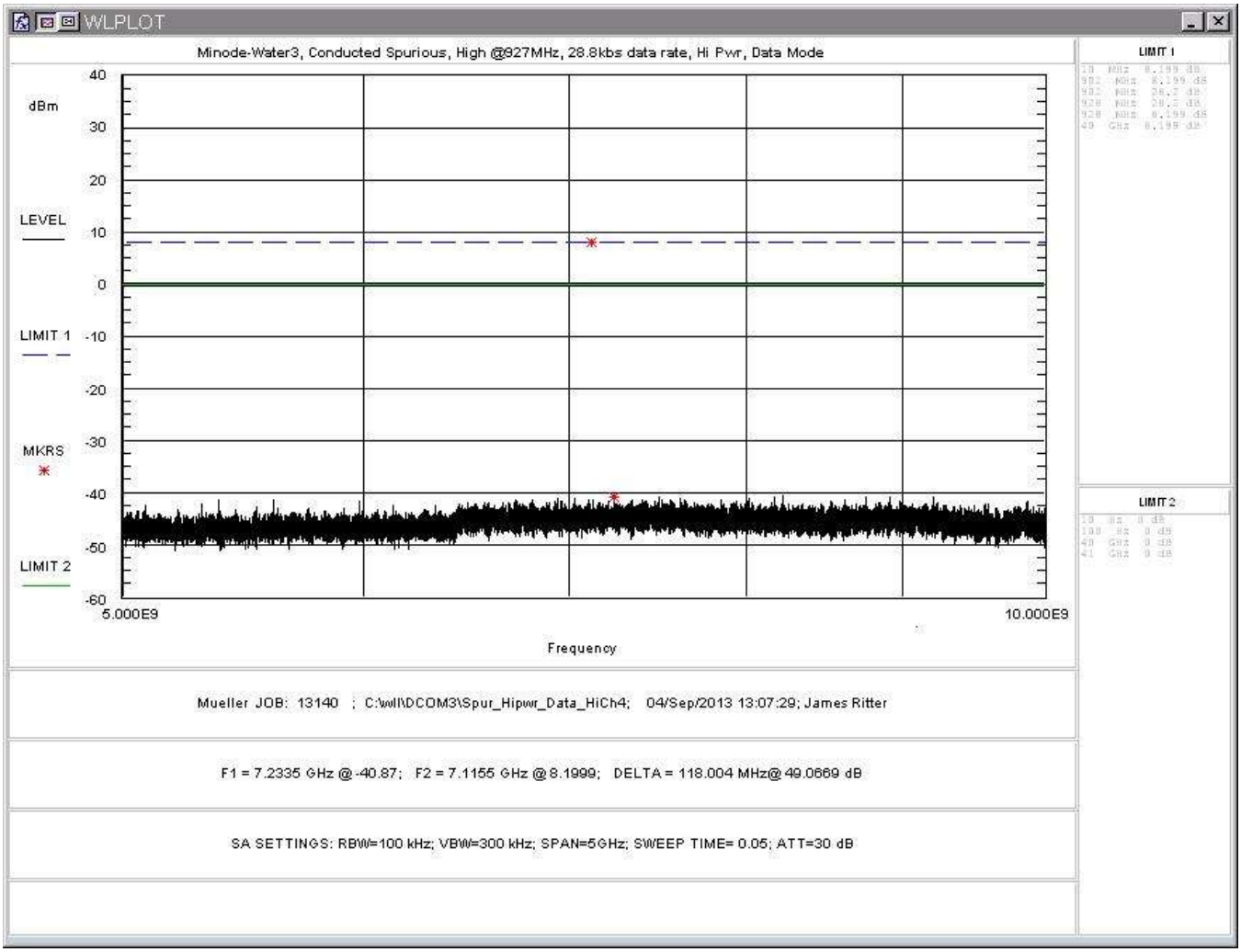

Figure 28: Spurious Emissions, High Pwr, TX-902.5MHz, 5 – 10GHz

4.2.2.2 Center Channel 915MHz- Data Mode, 28.8kbs, High Power

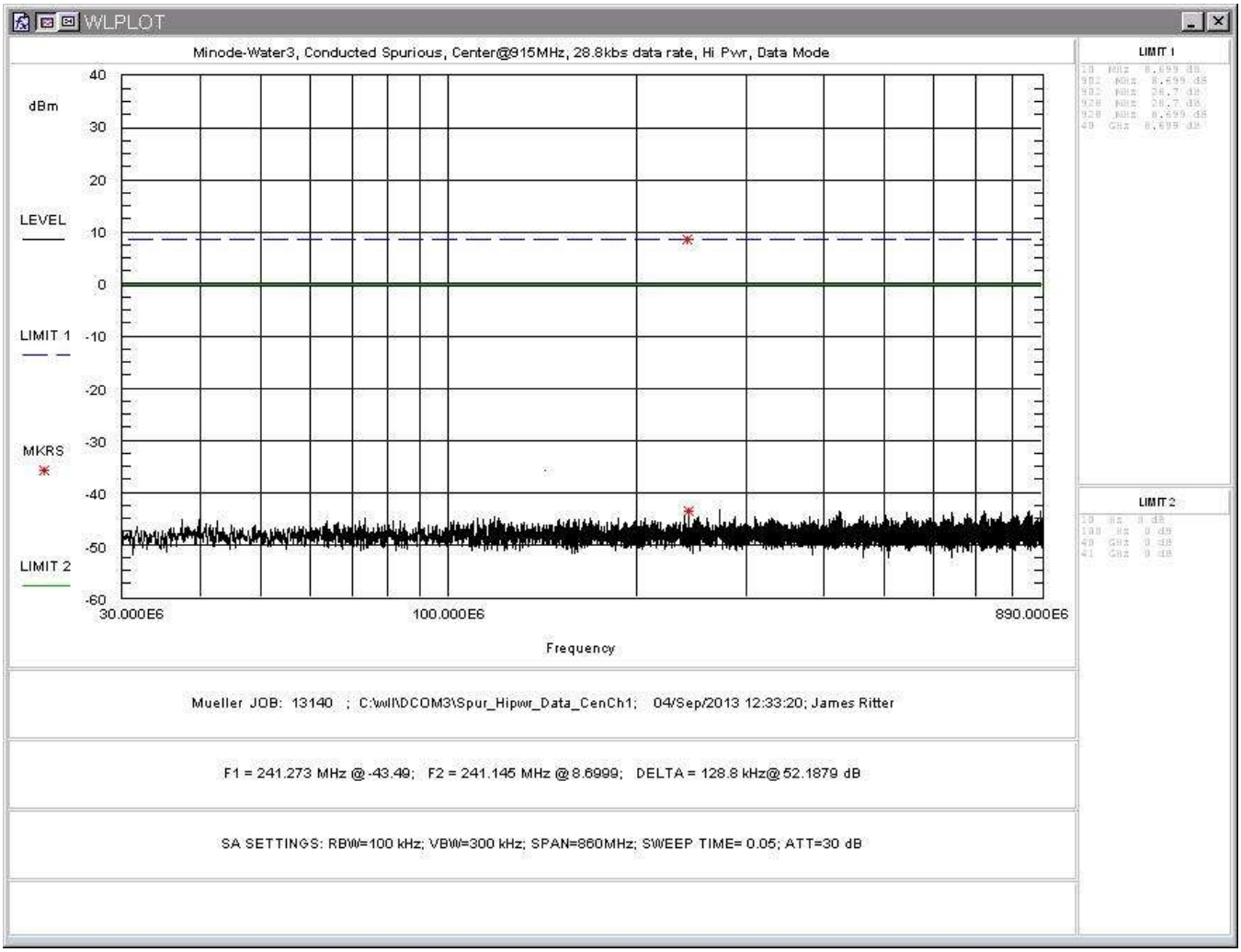

Figure 29: Spurious Emissions, High Pwr, TX-915MHz, 30-890MHz

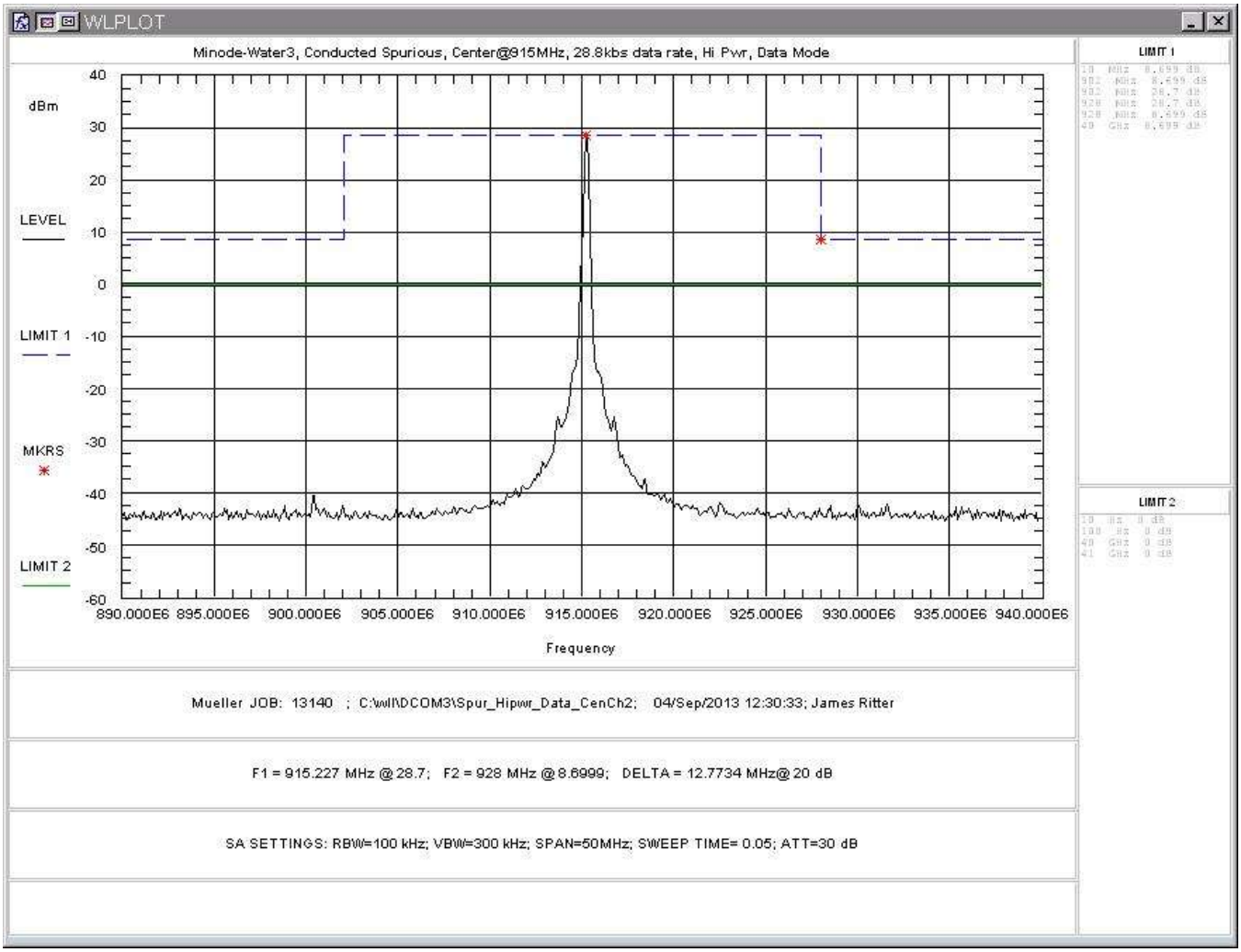

Figure 30: Spurious Emissions, High Pwr, TX-915MHz, 890-940MHz

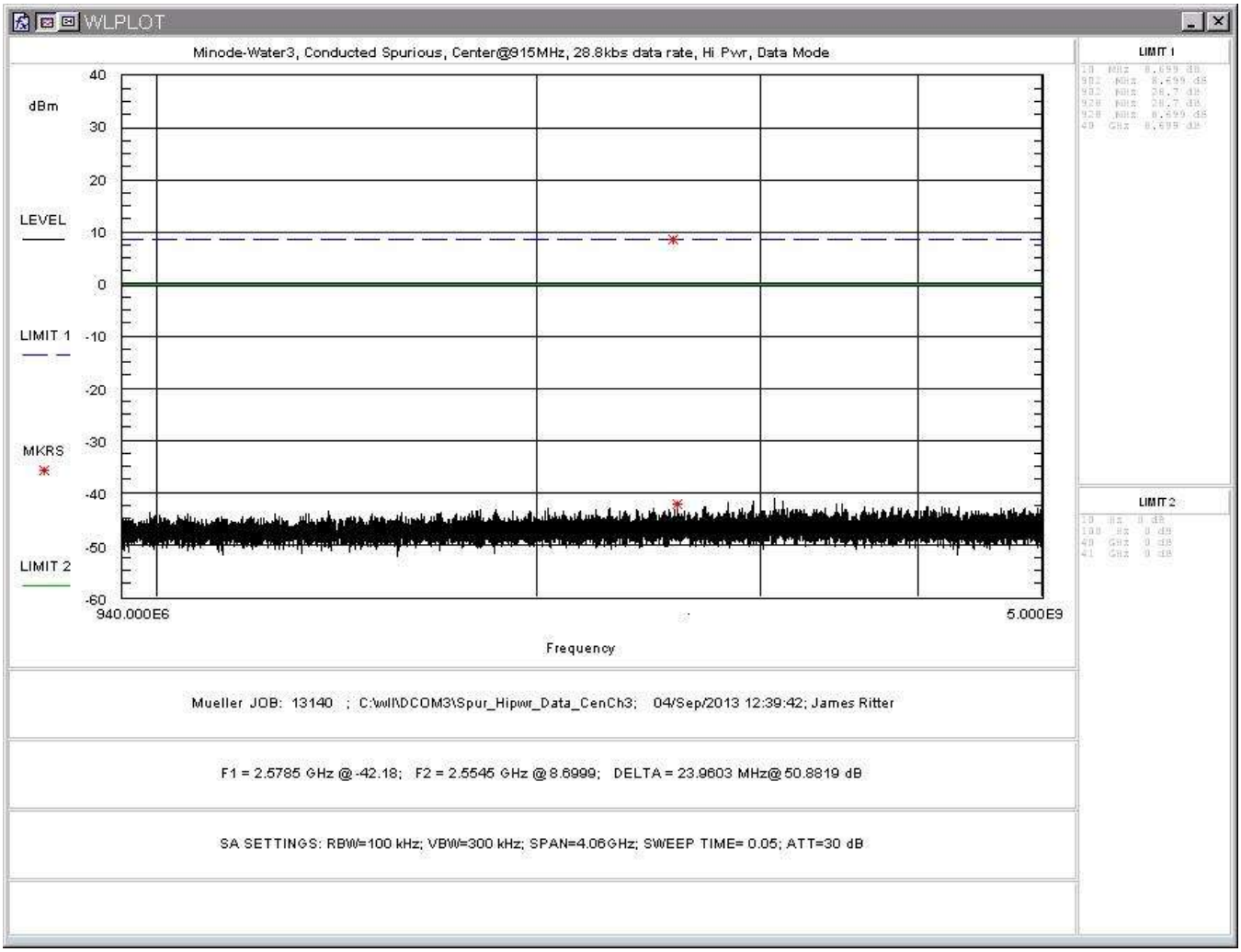

Figure 31: Spurious Emissions, High Pwr, TX-915MHz, 940-5000MHz

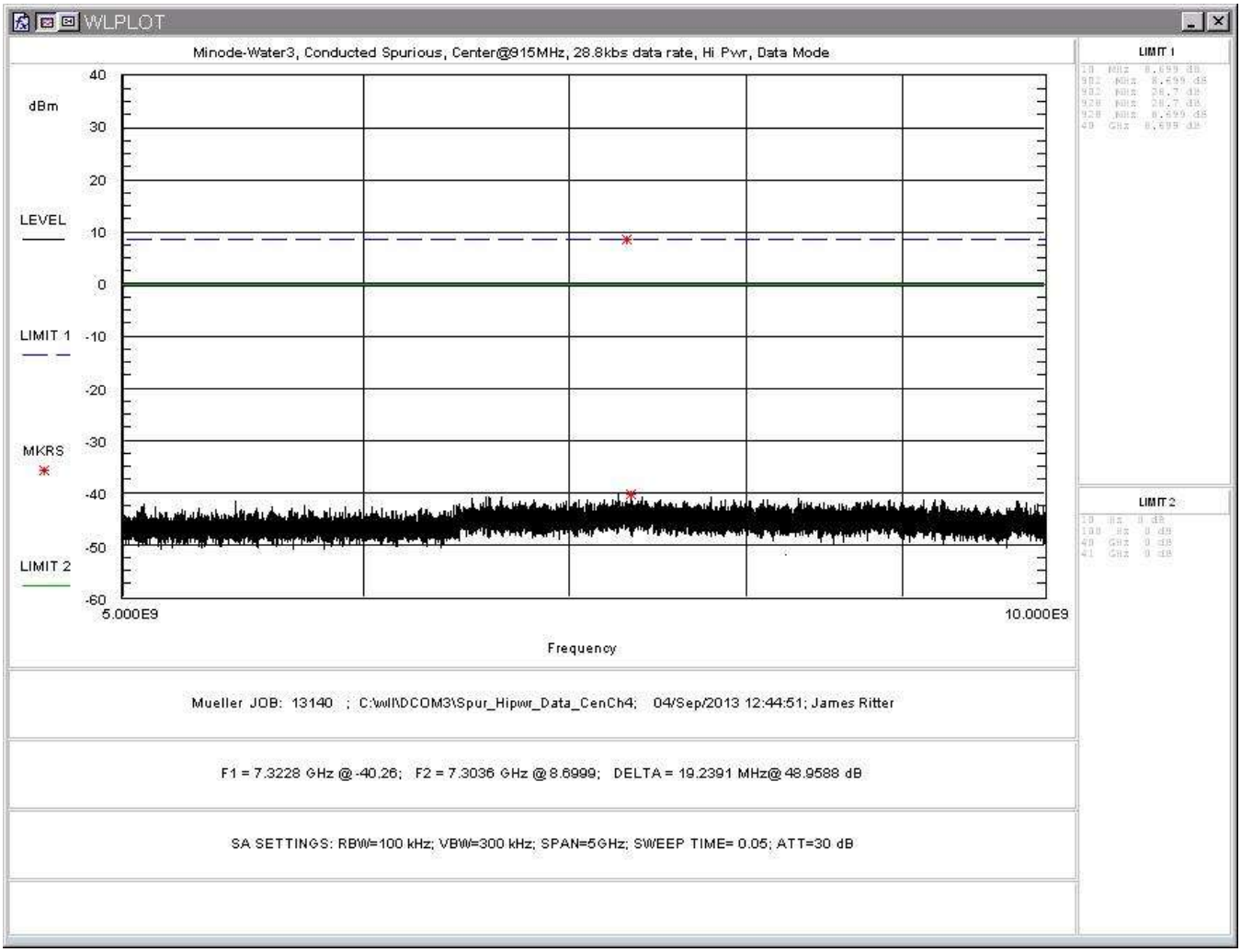

Figure 32: Spurious Emissions, High Pwr, TX-915MHz, 5-10GHz

4.2.2.3 High Channel 927MHz- Data Mode, 28.8kbs, High Power

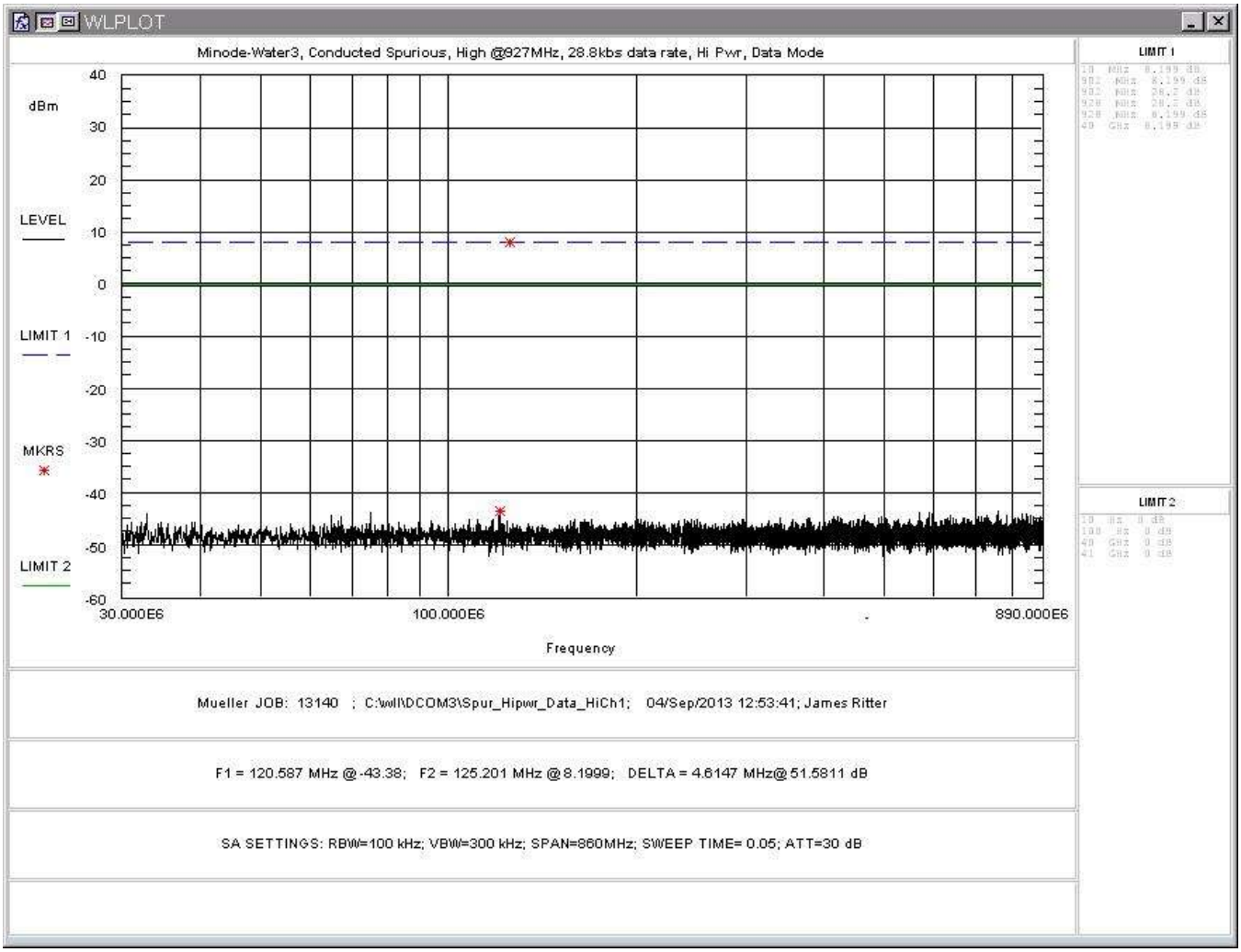

Figure 33: Spurious Emissions, Hi Pwr, TX-927MHz, 30-890MHz

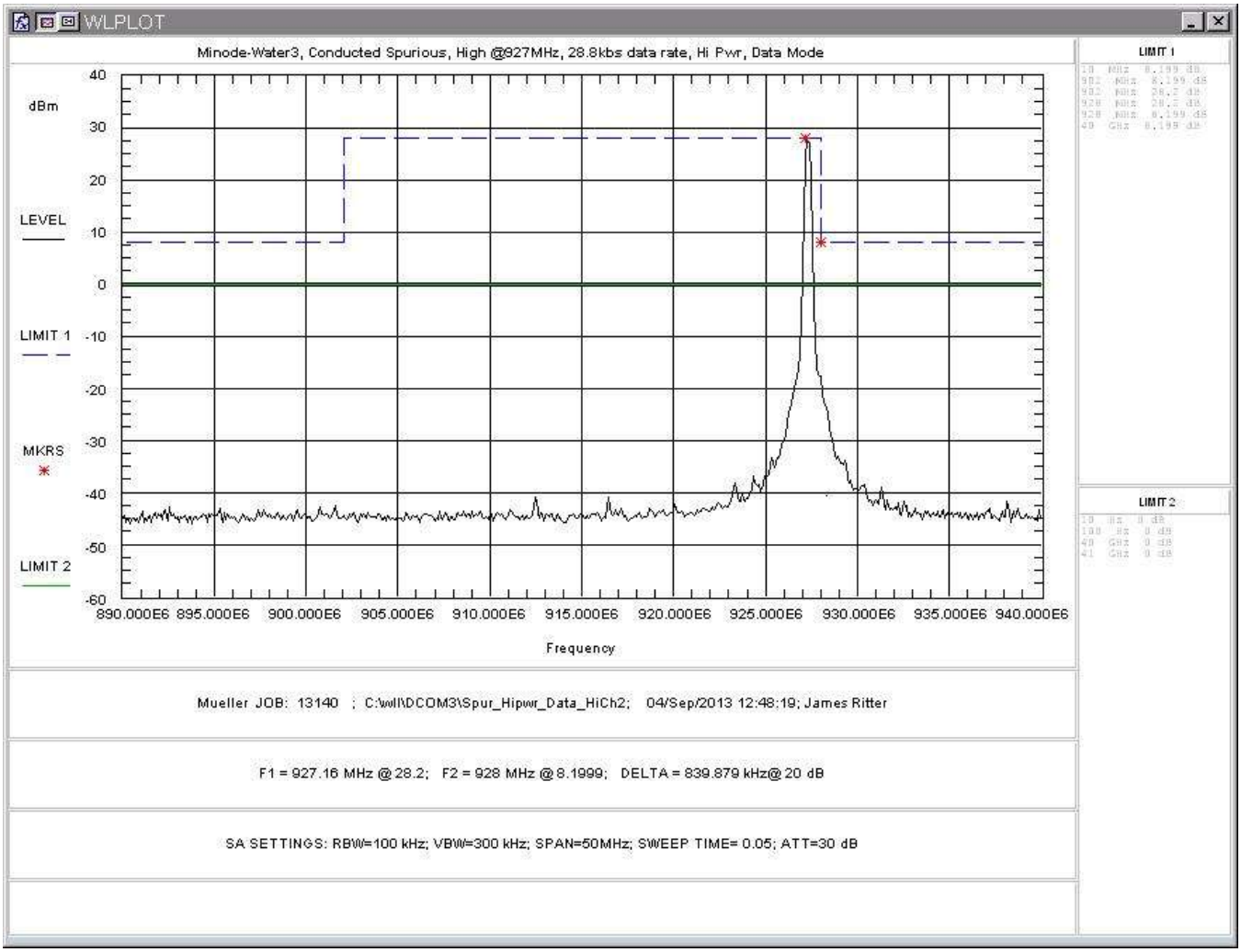

Figure 34: Spurious Emissions, High Pwr, TX-927MHz, 890-940MHz

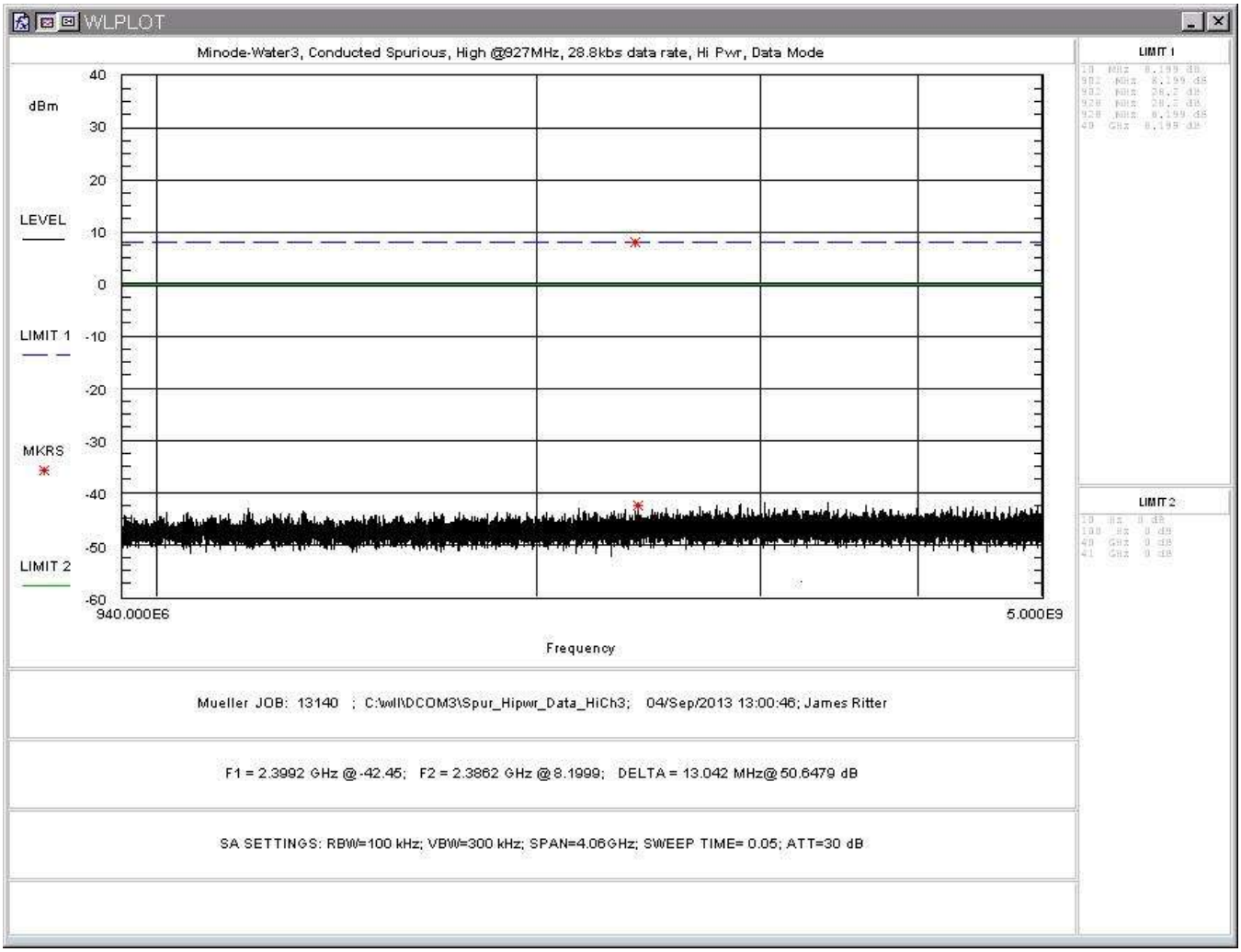

Figure 35: Spurious Emissions, High Pwr, TX-927MHz, 940-5000MHz

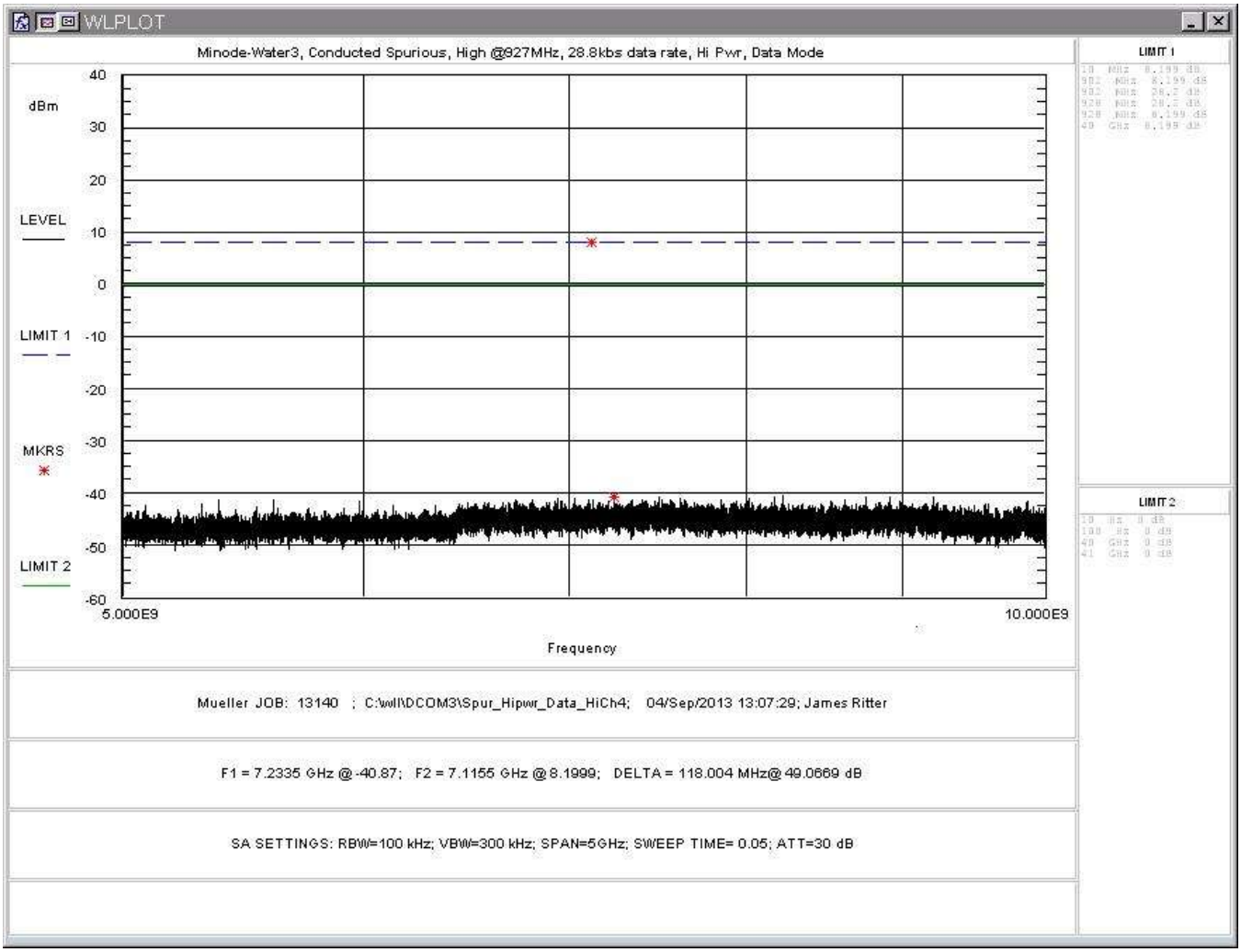

Figure 36: Spurious Emissions, High Pwr, TX-927MHz, 5-10GHz

4.2.2.4 Low Channel 902.5MHz- Data Mode, 28.8kbs, Low Power

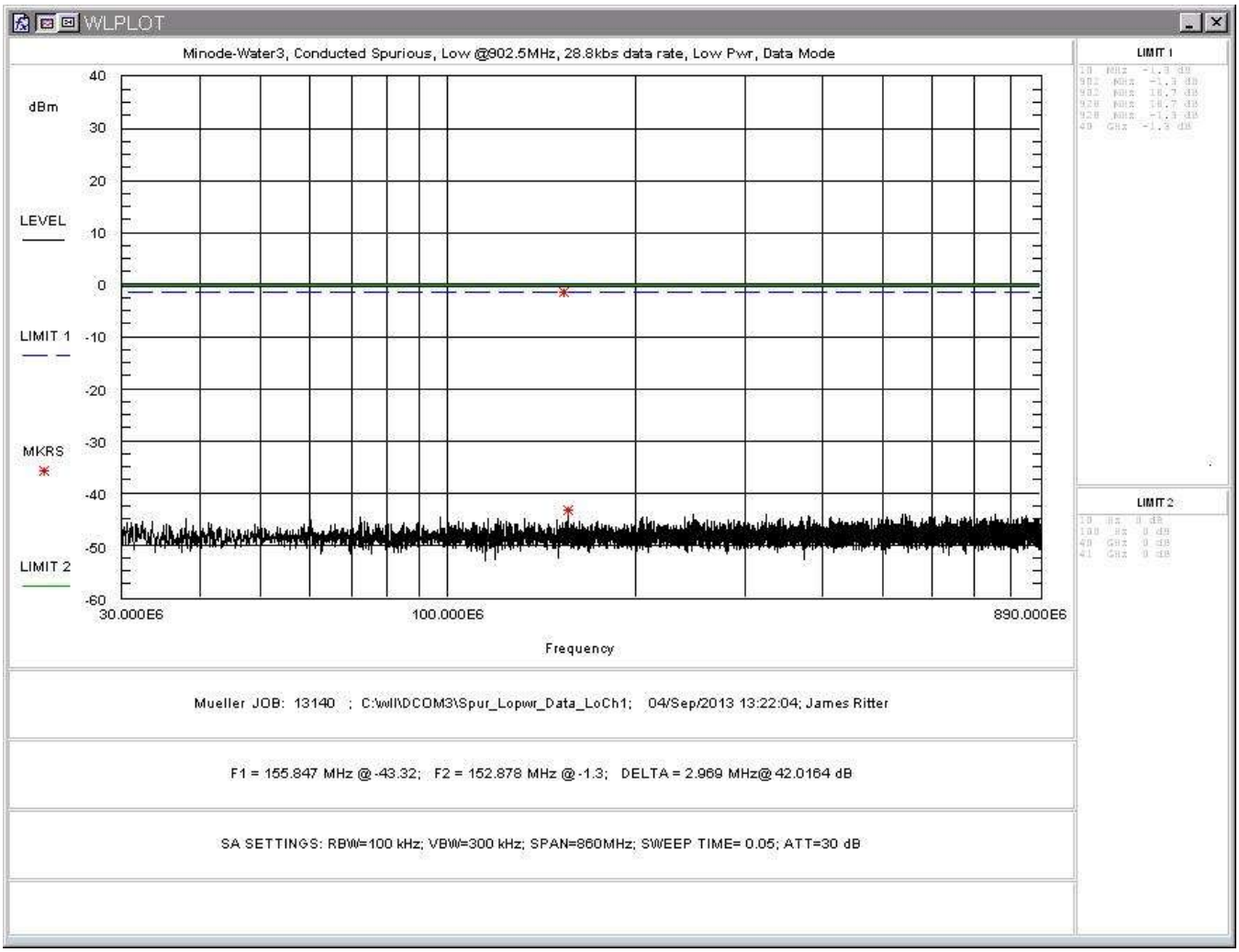

Figure 37: Spurious Emissions, Low Pwr, TX-902.5MHz, 30-890MHz

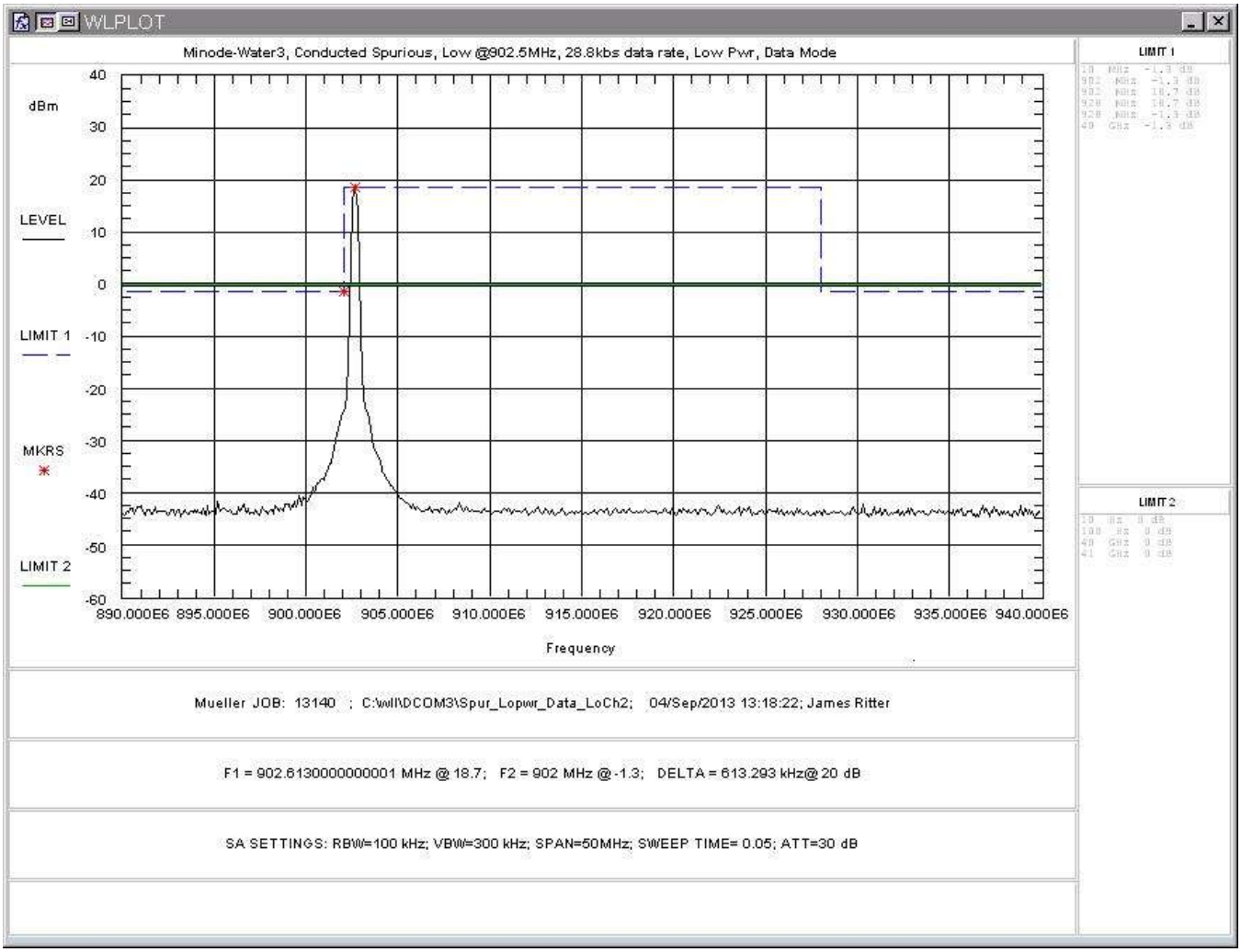

Figure 38: Spurious Emissions, Low Pwr, TX-902.5MHz, 890-940MHz

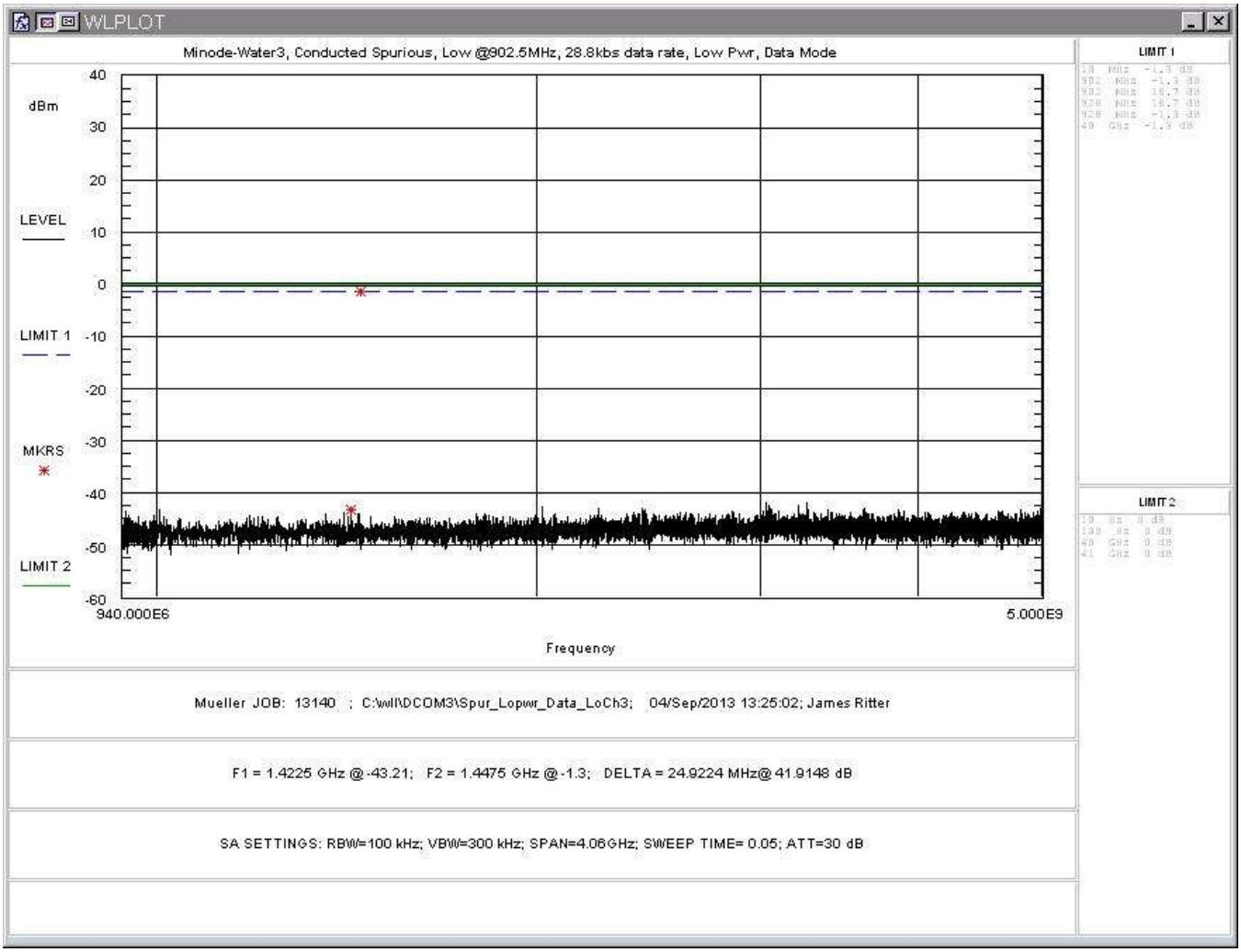

Figure 39: Spurious Emissions, Low Pwr, TX-902.5MHz, 940-5000MHz

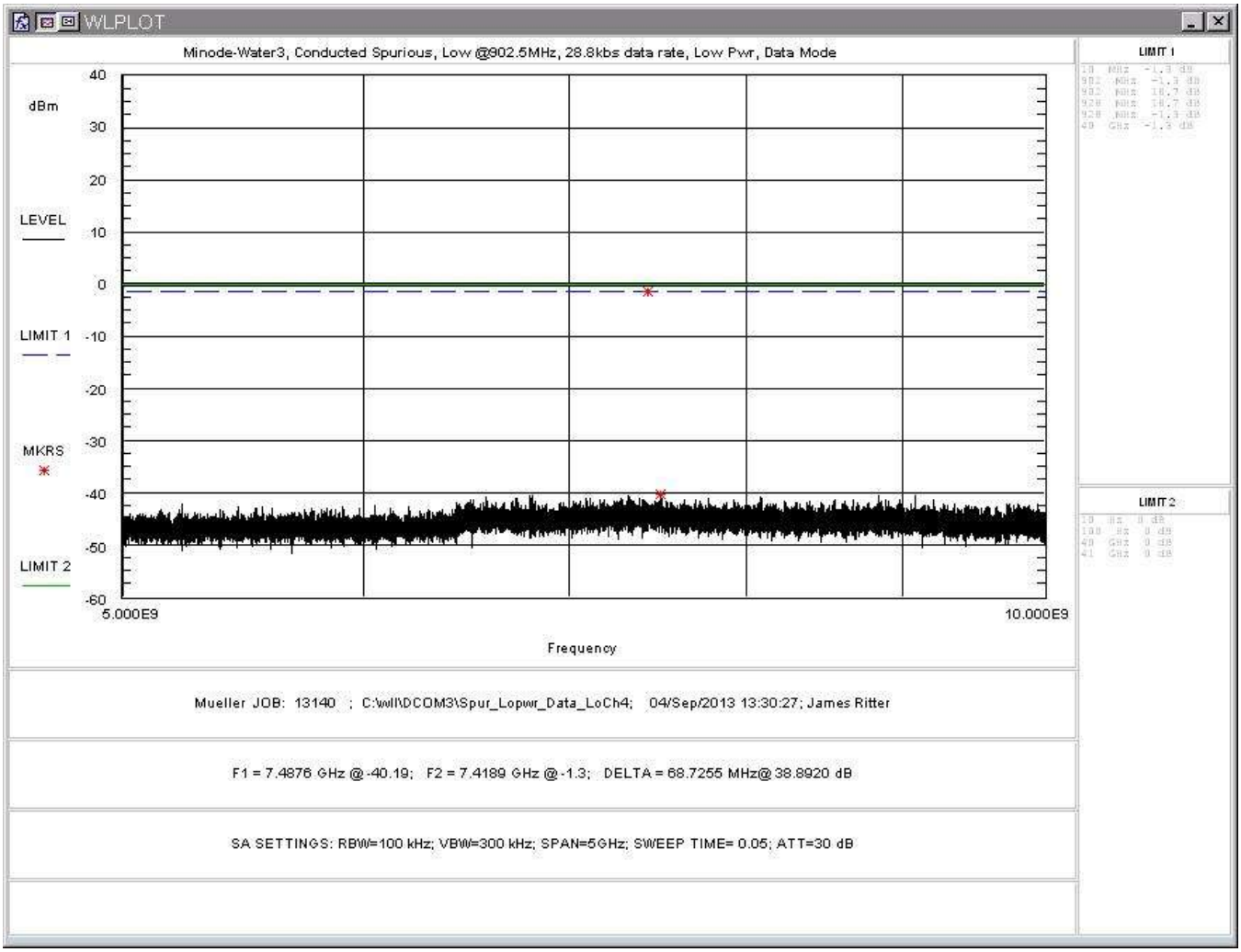

Figure 40: Spurious Emissions, Low Pwr, TX-902.5MHz, 5 -10GHz

4.2.2.5 Center Channel 915MHz- Data Mode, 28.8kbs, Low Power

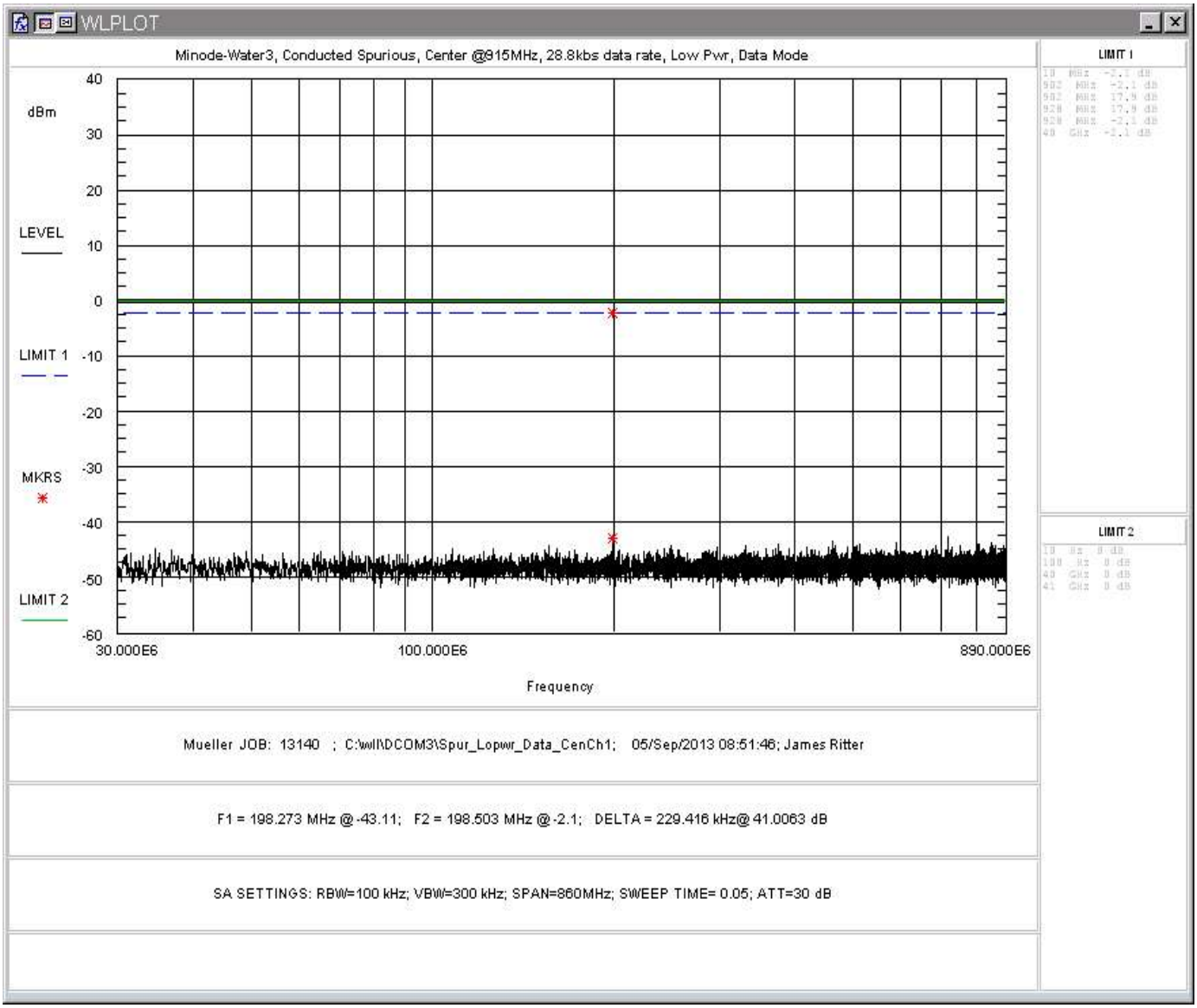

Figure 41: Spurious Emissions, Low Pwr, TX-915MHz, 30-890MHz

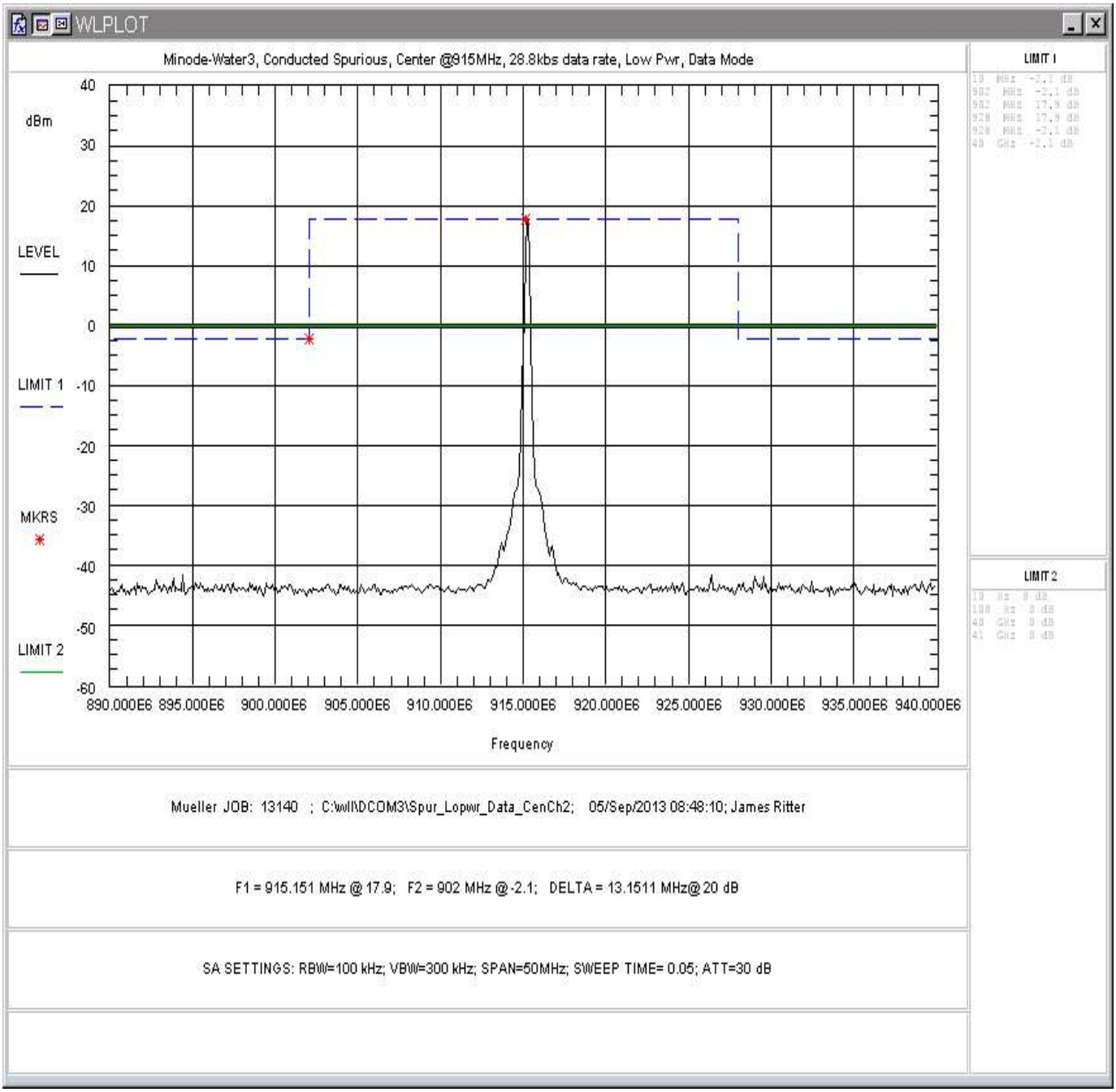

Figure 42: Spurious Emissions, Low Pwr, TX-915MHz, 890-940MHz

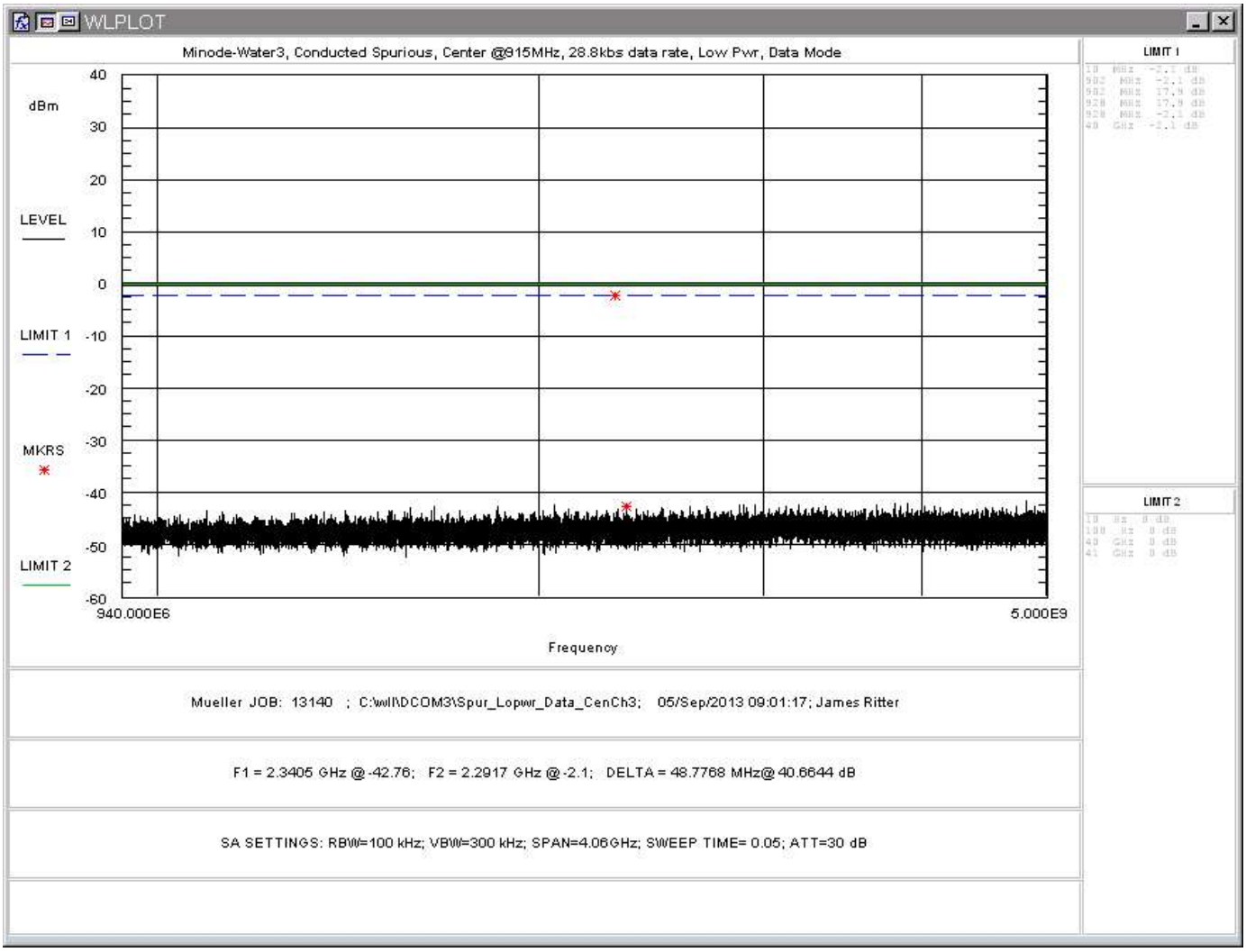

Figure 43: Spurious Emissions, Low Pwr, TX-915MHz, 940-5000MHz

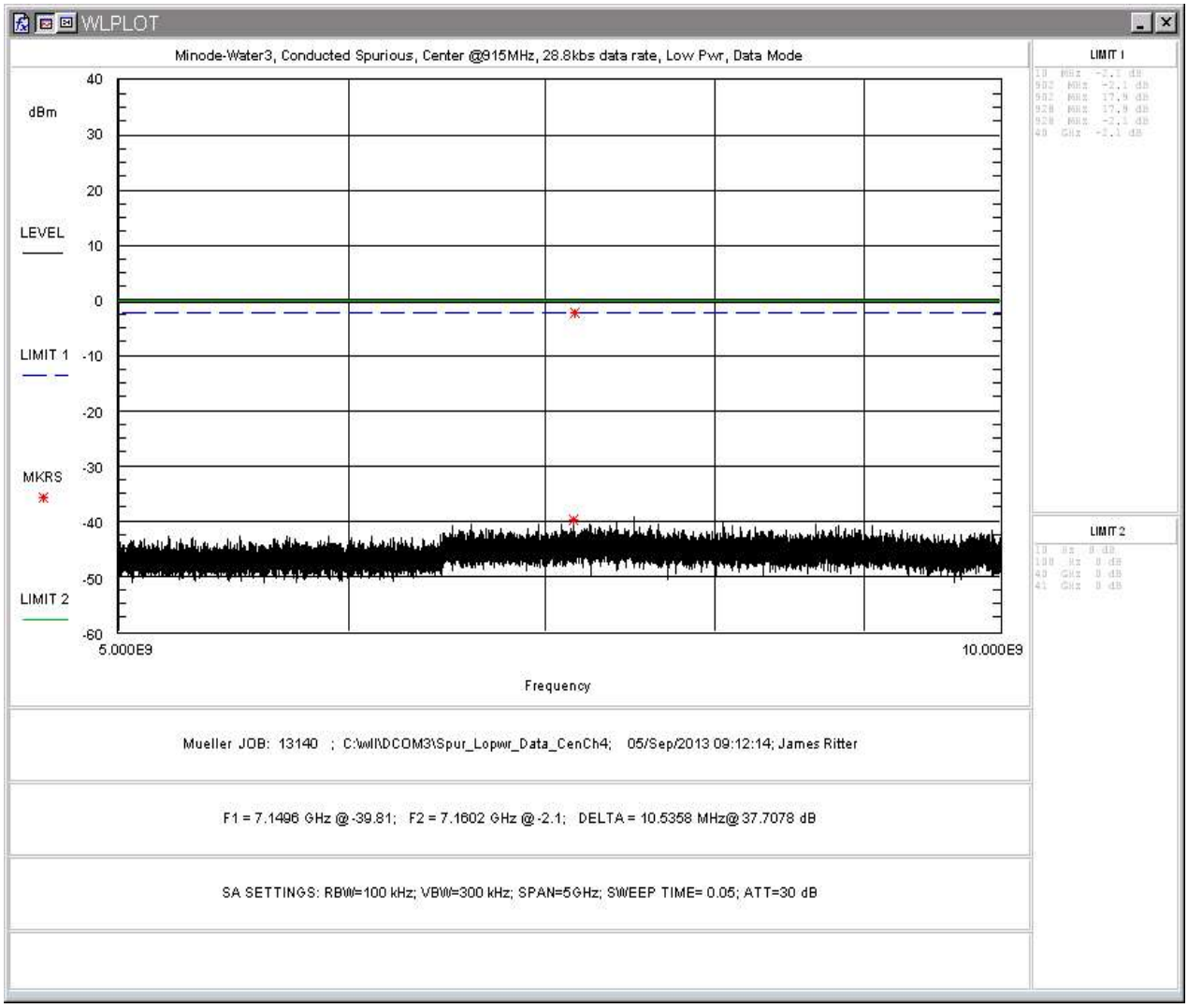

Figure 44: Spurious Emissions, Low Pwr, TX-915MHz, 5 -10GHz

4.2.2.6 High Channel 927.35MHz- Hailing Mode, 9.6kbs, Low Power

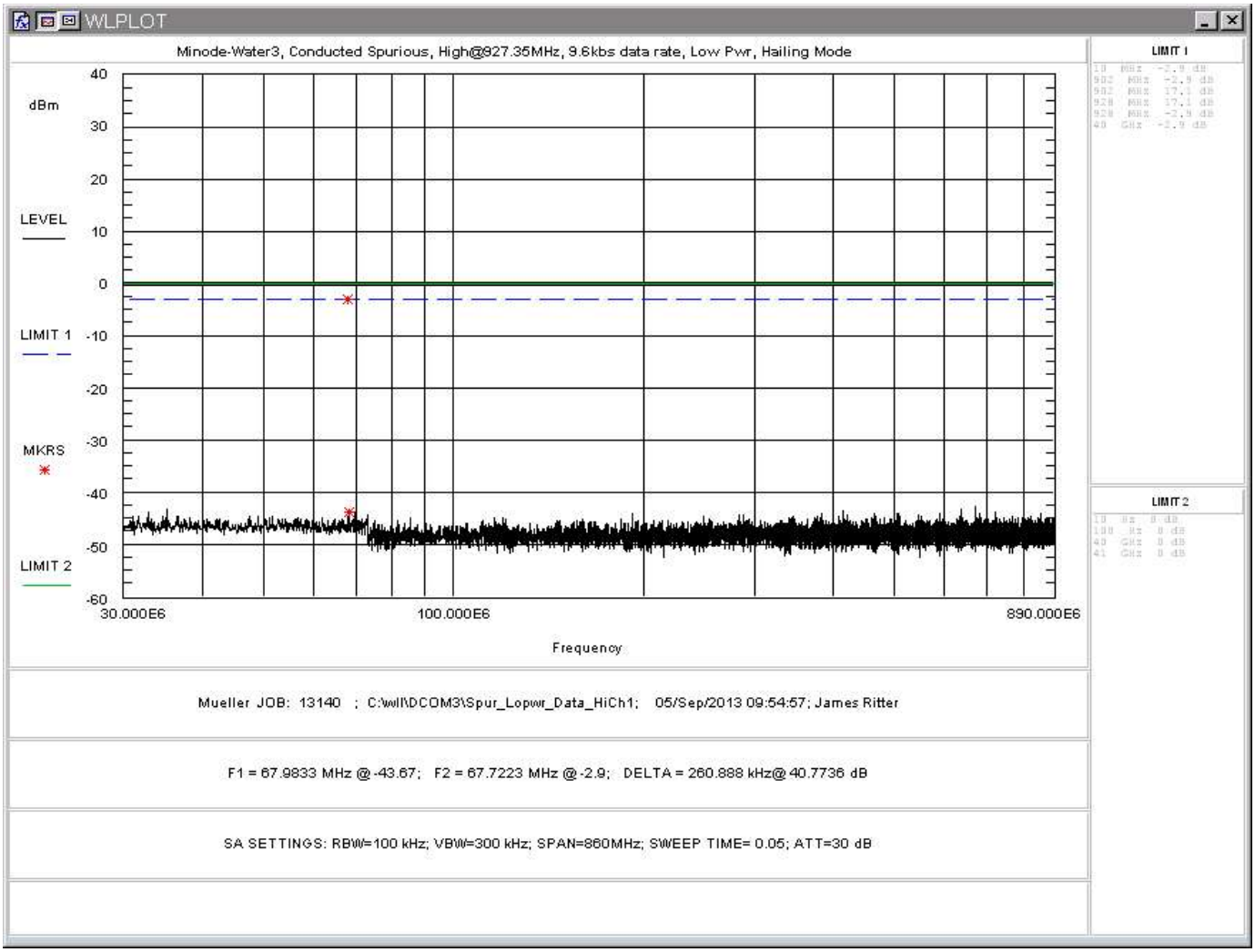

Figure 45: Spurious Emissions, Low Pwr, TX-927MHz, 30-890MHz

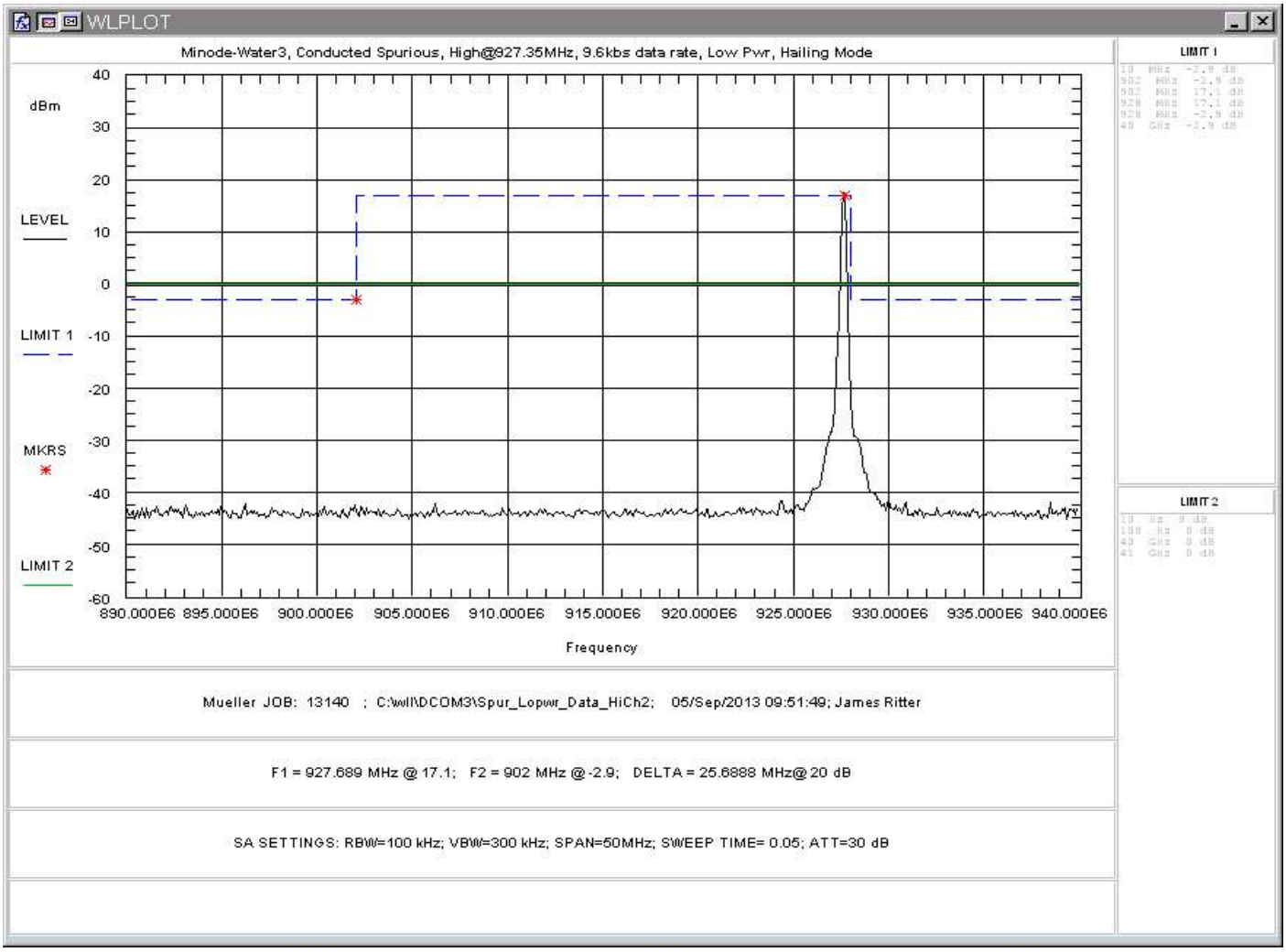

Figure 46: Spurious Emissions, Low Pwr, TX-927MHz, 890-940MHz

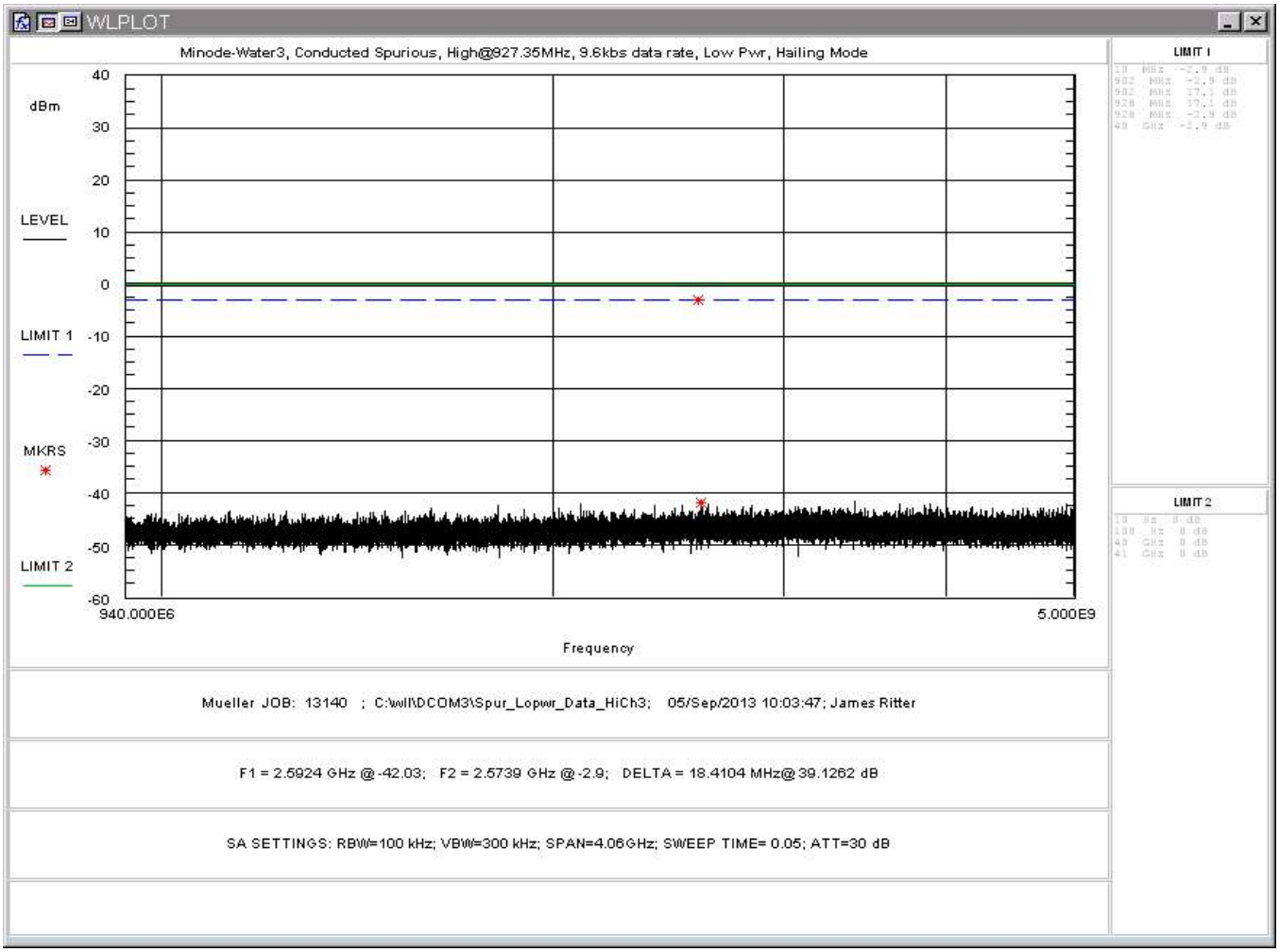

Figure 47: Spurious Emissions, Low Pwr, TX-927MHz, 940-5000MHz

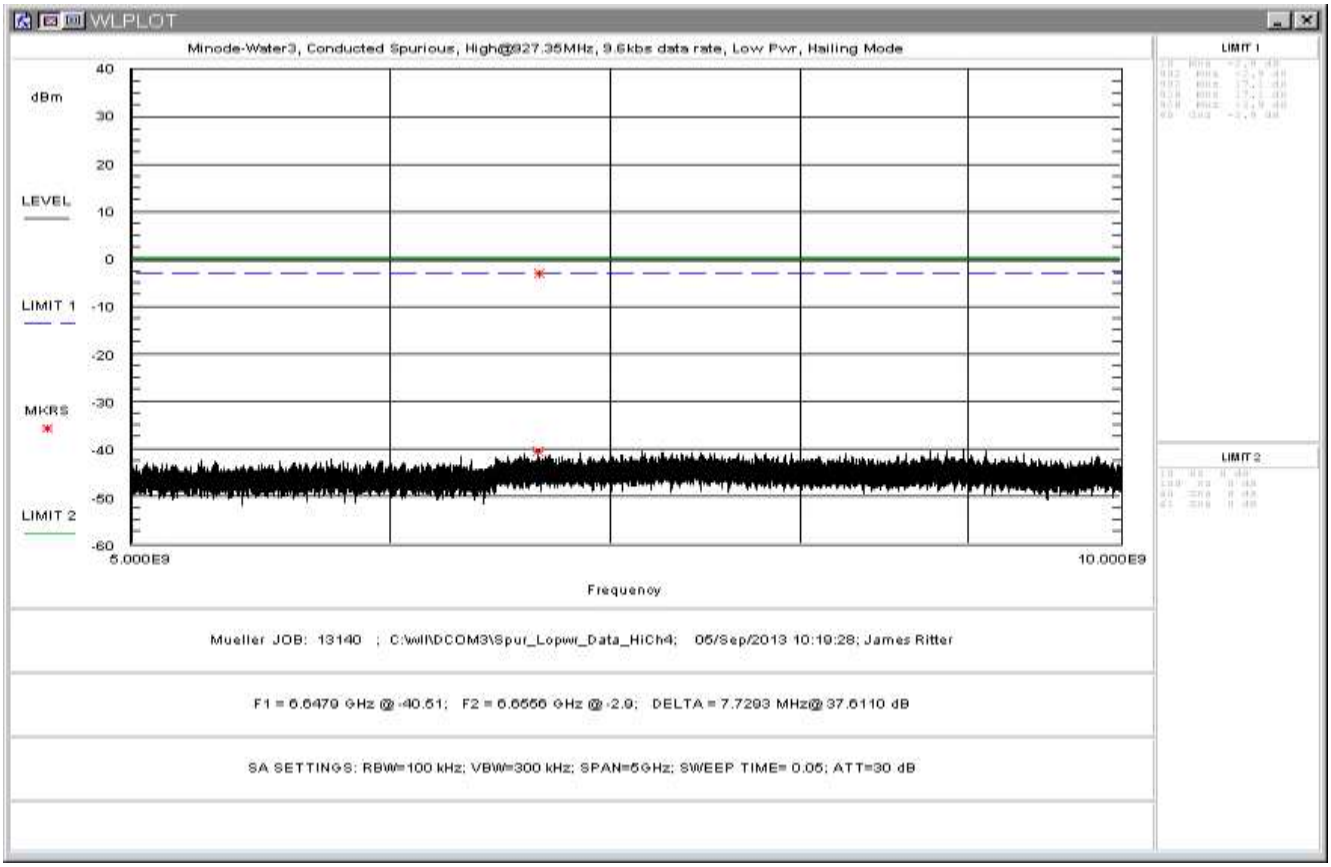

Figure 48: Spurious Emissions, Low Pwr, TX-927MHz, 5 -10GHz

4.3 Radiated Spurious Emissions: (FCC Part §15.247 & IC RSS-210 Sect.2.2)

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.

4.3.1 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.

Average readings were taken by optimizing the signal for maximum strength then setting the analyzer to 0-span linear mode. The video bandwidth was then reduced to 10Hz. The resulting reading was the converted mathematically back to a log scale (dBuV) and placed in the result spreadsheet SA reading column. All harmonics and spurious signals were continuous in nature.

3 Orthogonals of the EUT were scanned in the restricted bands up to the 10^{th} harmonic with the worst case readings shown.

As the data rate change only applies to data channels only they were tested for RE:

High Power setting at 28kbs (data channels only) @ 902.5MHz, 915MHz, & 927MHz

Hailing channels were covered in the original test report.

The emissions were measured using the following resolution bandwidths:

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

Table 7: Radiated Emission Test Data below 1GHz (Restricted Bands)

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)
37.60	V	190.00	1.00	4.50	15.4	9.9	100.0	-20.1
45.70	V	180.00	1.00	8.20	10.6	8.7	100.0	-21.2
51.64	V	175.00	1.00	16.70	8.6	18.4	100.0	-14.7
80.00	V	125.00	1.00	15.10	8.4	14.9	100.0	-16.5
110.89	V	195.00	1.00	3.70	14.7	8.3	150.0	-25.1
127.35	V	200.00	1.00	8.10	14.9	14.1	150.0	-20.5
209.79	V	180.00	1.00	18.80	13.5	41.0	150.0	-11.3
217.57	V	100.00	1.69	12.40	13.3	19.4	200.0	-20.3
36.86	H	0.00	4.00	7.80	15.8	15.1	100.0	-16.4
43.16	H	0.00	4.00	12.30	12.1	16.6	100.0	-15.6
60.00	H	90.00	4.00	13.00	8.7	12.2	100.0	-18.3
80.00	H	0.00	4.00	13.00	8.4	11.7	100.0	-18.6
110.98	H	85.00	4.00	9.00	14.8	15.4	150.0	-19.8
124.47	H	125.00	4.00	16.40	14.9	36.6	150.0	-12.3
168.84	H	120.00	2.50	8.50	13.5	12.6	150.0	-21.5
219.33	H	300.00	2.50	12.60	13.5	20.1	200.0	-20.0
450.05	H	300.00	1.20	5.00	21.1	20.1	200.0	-20.0

Frequencies Common to all TX channels

Table 8: Radiated Emission Test Data, TX@ 902.5MHz

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
2707.98	V	180.00	2.30	46.50	2.4	279.7	5000.0	-25.0	Peak
2707.98	V	180.00	2.30	42.40	2.4	174.4	500.0	-9.1	Average
3610.60	V	300.00	2.27	45.90	4.7	339.0	5000.0	-23.4	Peak
3610.60	V	300.00	2.27	37.90	4.7	134.9	500.0	-11.4	Average
4513.25	V	0.00	1.83	44.10	8.0	403.4	5000.0	-21.9	Peak
4513.25	V	0.00	1.83	34.10	8.0	127.6	500.0	-11.9	Average
5415.00	V	180.00	1.82	41.30	11.1	415.1	5000.0	-21.6	Peak
5415.00	V	180.00	1.82	35.56	11.1	214.4	500.0	-7.4	Average
2707.98	V	180.00	1.84	47.70	2.4	321.1	5000.0	-23.8	Peak
2707.98	V	180.00	1.84	44.30	2.4	217.1	500.0	-7.2	Average
3610.60	V	90.00	1.83	44.10	4.7	275.5	5000.0	-25.2	Peak
3610.60	V	90.00	1.83	37.90	4.7	134.9	500.0	-11.4	Average
4513.25	V	0.00	2.30	42.70	8.0	343.3	5000.0	-23.3	Peak
4513.25	V	0.00	2.30	35.60	8.0	151.6	500.0	-10.4	Average
5415.90	V	180.00	1.92	43.20	11.1	516.8	5000.0	-19.7	Peak
5415.90	V	180.00	1.92	33.00	11.1	159.7	500.0	-9.9	Average

Table 9: Radiated Emission Test Data, TX@ 915MHz

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
2745.00	V	180.00	1.21	51.40	2.5	494.0	5000.0	-20.1	Peak
2745.00	V	180.00	1.21	47.50	2.5	315.3	500.0	-4.0	Average
3660.00	V	125.00	1.28	44.69	5.1	307.6	5000.0	-24.2	Peak
3660.00	V	125.00	1.28	35.80	5.1	110.5	500.0	-13.1	Average
4575.00	V	0.00	1.25	43.47	7.9	369.0	5000.0	-22.6	Peak
4575.00	V	0.00	1.25	35.70	7.9	150.8	500.0	-10.4	Average
2745.00	H	85.00	1.87	49.50	2.5	396.9	5000.0	-22.0	Peak
2745.00	H	85.00	1.87	43.20	2.5	192.2	500.0	-8.3	Average
3660.00	H	270.00	1.84	43.50	5.1	268.2	5000.0	-25.4	Peak
3660.00	H	270.00	1.84	36.79	5.1	123.9	500.0	-12.1	Average
4575.00	H	0.00	1.80	43.50	7.9	370.3	5000.0	-22.6	Peak
4575.00	H	0.00	1.80	34.90	7.9	137.6	500.0	-11.2	Average

Table 10: Radiated Emission Test Data, TX@ 927MHz

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
2781.00	V	160.00	1.96	53.86	2.5	658.8	5000.0	-17.6	Peak
2781.00	V	160.00	1.96	48.20	2.5	343.3	500.0	-3.3	Average
3708.00	V	170.00	2.08	43.90	5.4	292.5	5000.0	-24.7	Peak
3708.00	V	170.00	2.08	34.50	5.4	99.1	500.0	-14.1	Average
4635.00	V	165.00	2.00	41.50	8.0	297.4	5000.0	-24.5	Peak
4635.00	V	165.00	2.00	35.60	8.0	150.8	500.0	-10.4	Average
2781.00	H	85.00	1.68	52.30	2.5	550.5	5000.0	-19.2	Peak
2781.00	H	85.00	1.68	48.50	2.5	355.4	500.0	-3.0	Average
3708.00	H	125.00	1.81	42.50	5.4	249.0	5000.0	-26.1	Peak
3708.00	H	125.00	1.81	36.50	5.4	124.8	500.0	-12.1	Average
4635.00	H	90.00	1.80	42.90	8.0	349.4	5000.0	-23.1	Peak
4635.00	H	90.00	1.80	33.00	8.0	111.8	500.0	-13.0	Average