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FCC Class II Permissive Change Test Report

For the

Mueller Systems

UGM-L Radio Module

FCC ID: SM6-UGM-L-NS

WLL JOB# **11970-01**

April 29, 2011

Prepared for:

Mueller Systems
48 Leona Drive
Middleboro, MA, 02346 USA

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
EMC Operations Manager

Abstract

This report has been prepared on behalf of Mueller Systems to support the attached Class 2 permissive change. This Class 2 Permissive Change Test Report is for a modular Frequency Hopping Spread Spectrum Transmitter operating under Part 15.247 (10/2009) of the FCC Rules. This Test Report documents the test configuration and test results for a Mueller Systems UGM-L Radio 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 Mueller Systems UGM-L Radio Module remains in compliance with the limits for a Frequency Hopping Spread Spectrum Transmitter device under FCC Part 15.247.

Revision History	Description of Change	Date
Rev 0	Initial Release	April 29, 2011

Table of Contents

List of Tables

List of Figures

1 Introduction

1.1 Reason for Class 2 Permissive Change

This class 2 permissive change is being generated to incorporate an additional "Frequency Hopping Spread Spectrum (FHSS)" mode. This mode will be utilized to initiate communications between mesh network nodes that have a sleep mode. This mode of operation utilizes a different set of RF channels from the previously certified data channels within the 902-928 MHz band but shares the same power and bandwidth as the data channels. This mode of operation was implemented via EUT manufacturer software code and does not include any hardware modifications. See the theory of operation for details of this mode of operation.

1.2 Compliance Statement

The Mueller Systems UGM-L Radio Module remains in compliance with the limits for a limited modular Frequency Hopping Spread Spectrum Transmitter device under FCC Part 15.247 (10/2009).

1.3 Test Scope

Tests for radiated and conducted (at antenna terminal) emissions were performed with the device outside of any hosts. All measurements were performed in accordance with FCC Public Notice DA 00-705, "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems". The measurement equipment conforms to ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation.

1.4 Contract Information

Customer:	Mueller Systems 48 Leona Drive Middleboro, MA, 02346 USA
Purchase Order Number:	751436
Quotation Number:	66201

1.5 Test Dates

Testing was performed on the following date(s):	4/26/2011 to 4/29/2011

1.6 Test and Support Personnel

Washington Laboratories, LTD	James Ritter
Client Representative	David Splitz

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 UGM-L radio module is a DC powered transceiver using 902.5-927.35MHz FHSS technology. The system uses 2 modes of operation data mode which uses 50 channels from 902.5 to 927MHz. The system also has a hailing mode to awaken units that are sleeping (these units go into a sleep mode when inactive). The hailing frequencies consist of 50 hailing channels from 902.65 to 927.35MHz. Both of these modes use FHSS technology. The characteristics (power & bandwidth) of the hailing channels are identical to the data channels and are produced from the same RF circuitry. For more detailed information refer to the theory of operation.

Table 1. Device Summary

(this table shows the previously granted data channels compared to the new hailing channels)

ITEM	Data channels	Hailing Channels
Frequency Range:	902.5-927.0MHz	902.65- 927.35MHz
Maximum Output Power: (conducted at antenna port)	25.7mW (14.1dBm)	28.2mW (14.5dBm)
Modulation:	FM	FM
Occupied Bandwidth:	44.8 kHz	40.95kHz
Keying:	Automatic	Automatic
Type of Information:	Data	Data
Number of Channels:	50	50
Power Output Level	Fixed	Fixed
Antenna Type	2.7dBi dipole	2.7dBi dipole
Power Source & Voltage:	120VAC	120VAC

2.2 Test Configuration

The UGM-L Radio Module was operated from a 5VDC lab power supply. Commands were sent to the UGM-L Radio Module using a programming to a support laptop using Windows HyperTerminal program. This connection was disconnected after the test mode was set (radiated tests).

2.3 Testing Algorithm

The UGM-L Radio Module was programmed via an internal 3 pin programming port on the EUT to a Serial port on the support laptop. The support laptop used HyperTerminal to command the EUT to transmit on the lowest, center, and highest channels. Commands were also sent to allow the unit to transmit in a hopping fashion. The unit was preloaded with a typical data payload to transmit.

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

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 ≤ 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: **Conducted Antenna Port**		Test Date:	**2/28-3/1/2011**
Asset #	**Manufacturer/Model**	**Description**	**Cal. Due**
474	HP, 8563E	ANALYZER, SPECTRUM	3/28/2011
528	AGILENT, E4446A	ANALYZER, SPECTRUM	08/27/2011

Test Name: **Radiated Emissions**		Test Date:	**04/28/2011**
Asset #	**Manufacturer/Model**	**Description**	**Cal. Due**
528	AGILENT - E4446A	ANALYZER SPECTRUM	9/27/2011
522	HP - 8449B	PRE-AMPLIFIER 1-26.5GHZ	7/27/2011
626	ARA - DRG-118/A	ANTENNA HORN	6/3/2011
337	WLL - 1.2-5GHZ	FILTER BAND PASS	3/24/2012
281	ITC - 21A-3A1	WAVEGUIDE 4.51-10.0GHZ	3/24/2012
68	HP - 85650A	ADAPTER QP	6/22/2011
70	HP - 85685A	PRESELECTOR RF W/OPT 8ZE	6/22/2011
72	HP - 8568B	ANALYZER SPECTRUM	6/22/2011
644	SUNOL SCIENCES CORPORATION - JB1 925-833-9936	BICONALOG ANTENNA	12/20/2011

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. Full results are shown in section 5.

Table 4. Test Summary Table

FCC Rule Part	Description	Result
15.247 (a)(1)(i)	20dB Bandwidth	Pass
15.247 (b)(2)	Transmit Output Power	Pass
15.247 (a)(1)	Channel Separation	Pass
15.247 (a)(1)(i)	Number of Channels =50 minimum	Pass
15.247 (a)(1)(i)	Time of Occupancy	Pass
15.247 (d)	Occupied BW / Out-of-Band Emissions (Band Edge @ 20dB below)	Pass
15.205	General Field Strength Limits (Restricted Bands)	Pass
15.207	AC Conducted Emissions	NA

5 Test Results

5.1.1 Hailing Mode Timing

As the Maximum Dwell time of this device in hailing mode is 400ms no duty cycle correction is allowed.

FCC part 15.247 requires that for hopping signals with an occupied bandwidth less than 250 kHz the limit is 0.4 seconds dwell time per 20 seconds

The following figures show the plot of the dwell time and time of occupancy for the transmitter. Based on this plot, the dwell time per hop is 396.7ms. As the unit is on a hailing channel once in a 20 second period the time of occupancy is 396.7ms per 20 seconds, thus complying with the 0.4 second requirement.

Mueller Systems, Job 11970, UGM-L Module, Single Channel on time for one hop in hopping mode.
Measured = 396.7 mSec per hop

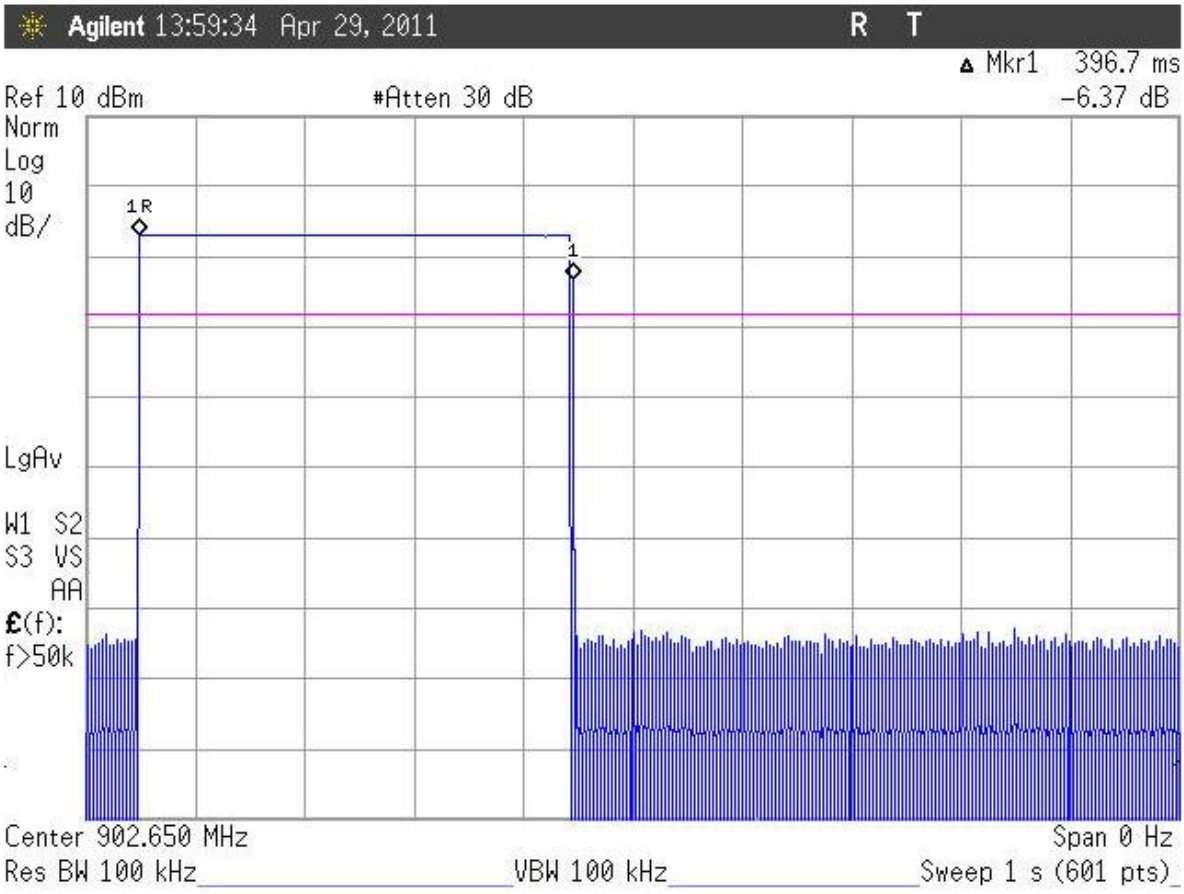

Figure 1. Hailing Channel Duty Cycle Plot

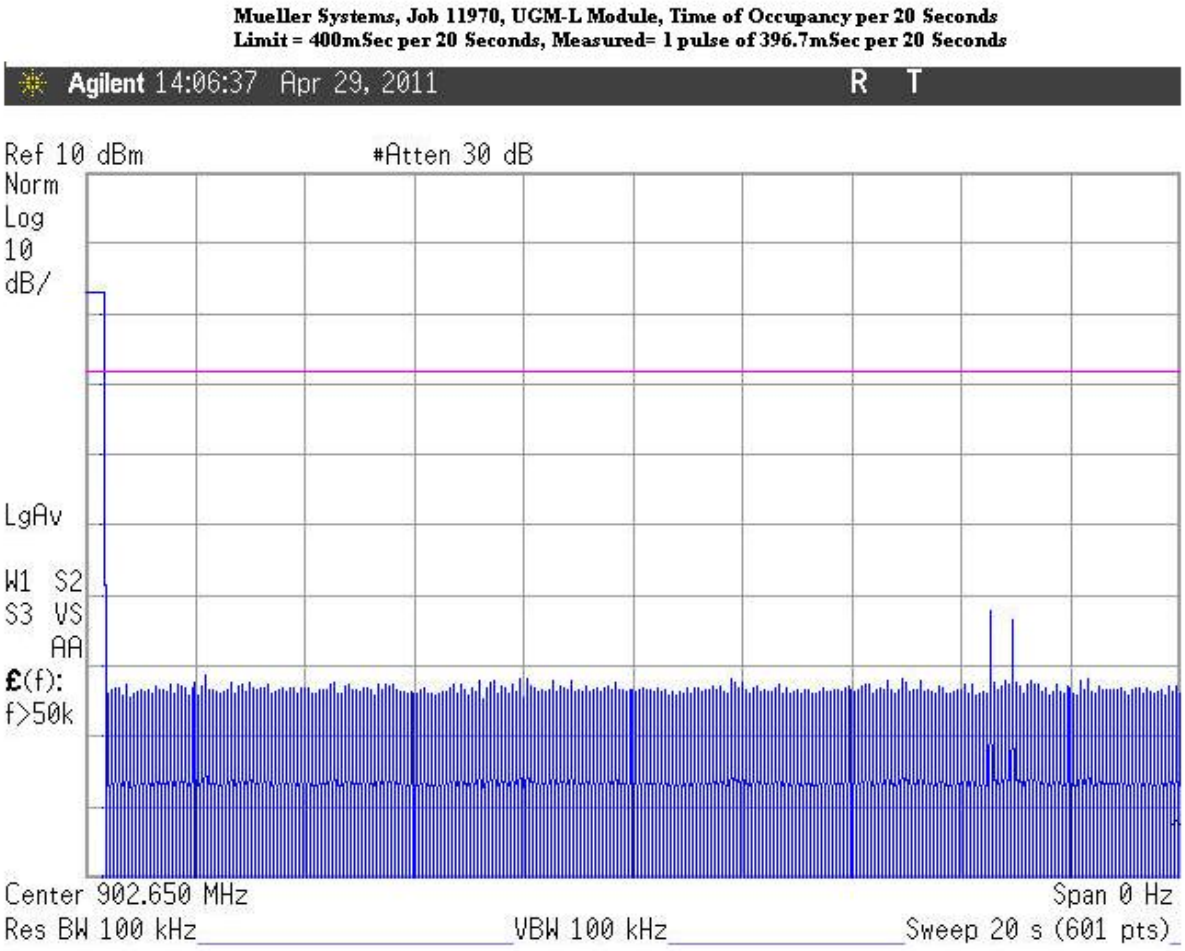

Figure 2. Hailing Channel Time of Occupancy Plot

5.2 RF Power Output: (FCC Part §2.1046)

To measure the output power the hopping sequence was stopped while the frequency dwelled on the lowest, Center, and highest 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, cable, and other losses in the system.

Table 5, Hailing Channel RF Power Output

Frequency	Level	Limit	Pass/Fail
Low Channel: 902.65MHz	14.50dBm	30dBm	Pass
Center Channel: 915.35MHz	13.93dBm	30dBm	Pass
High Channel: 927.35MHz	13.84dBm	30dBm	Pass

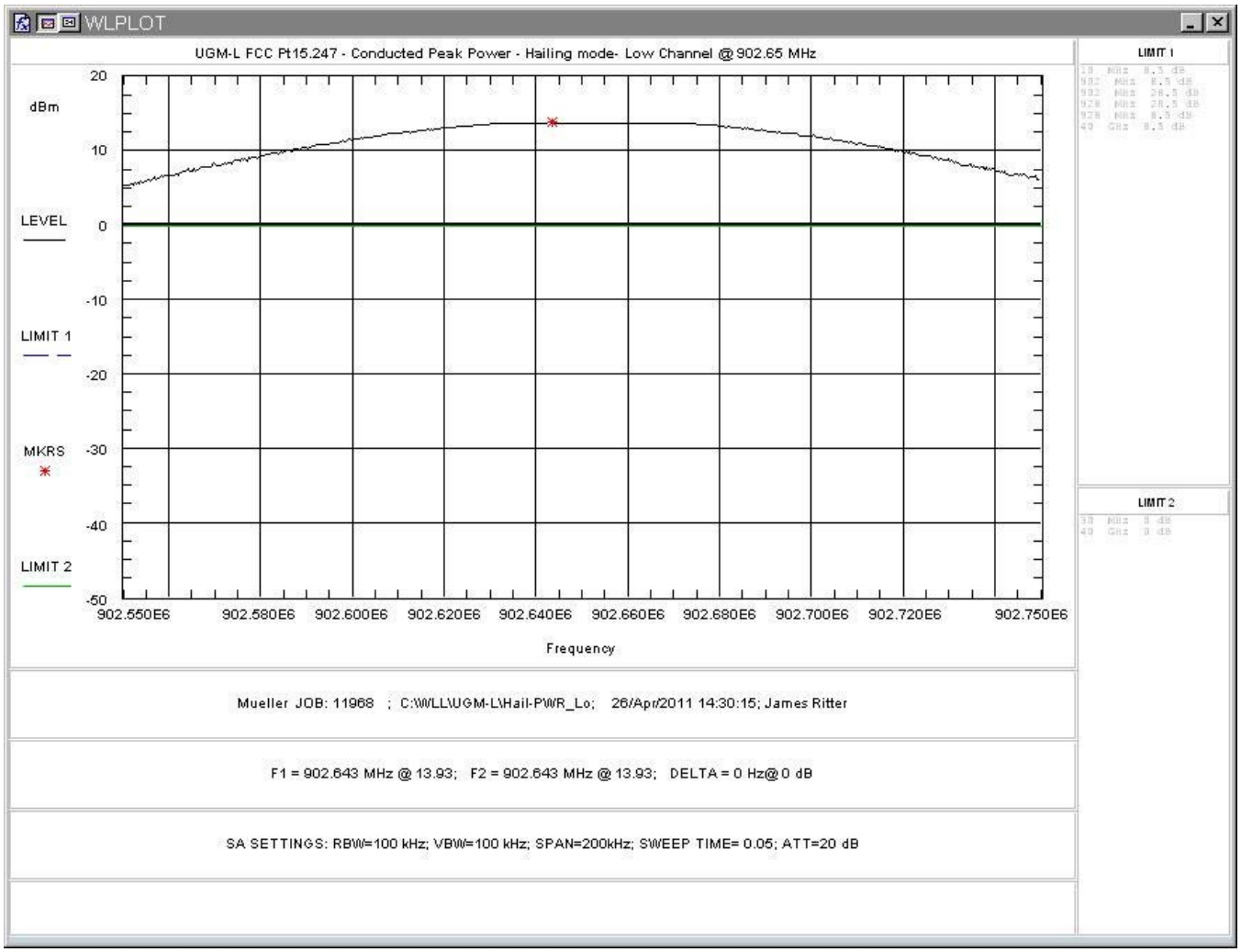

Figure 3. Hailing Channel RF Peak Power, Low Channel

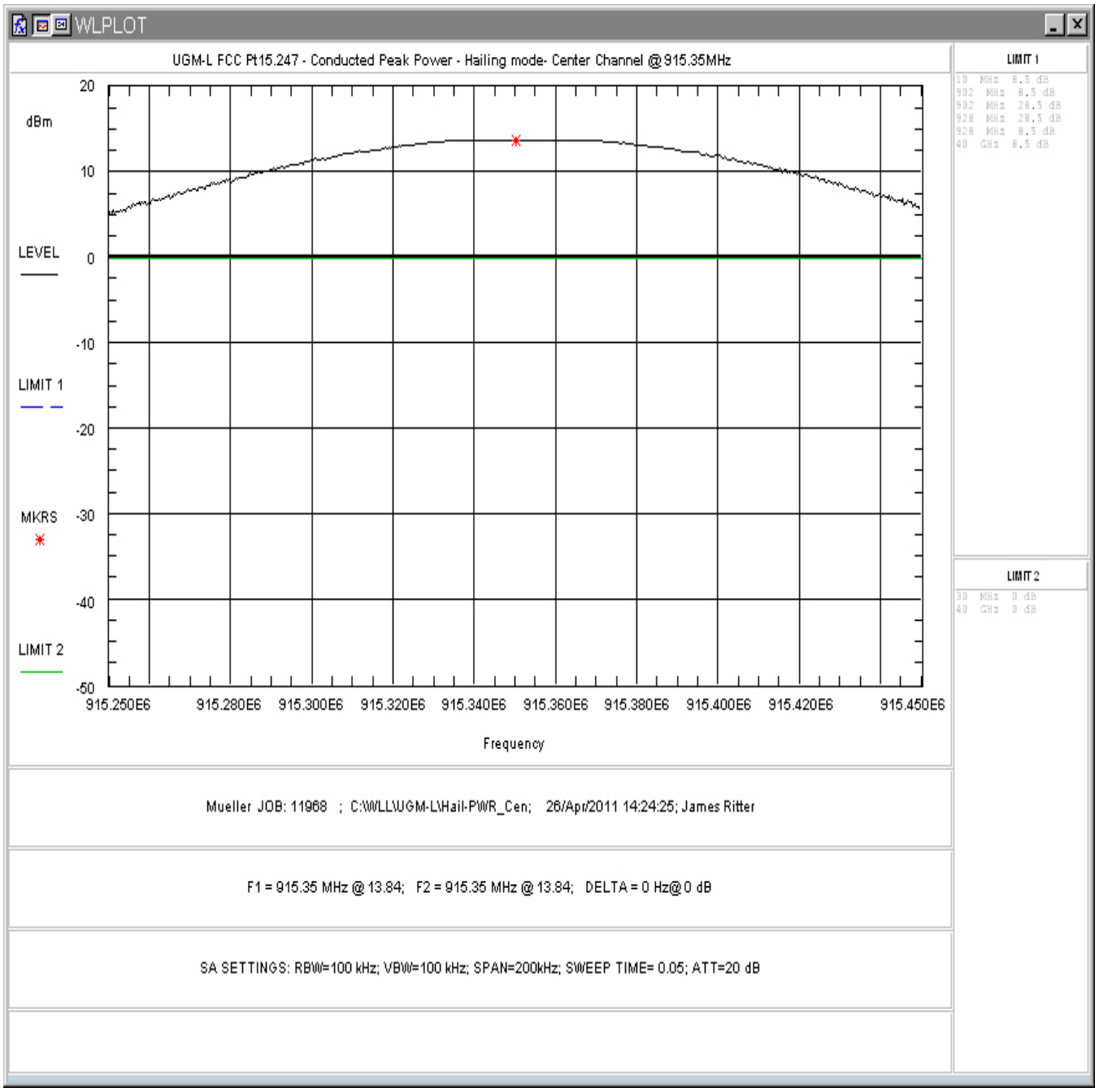

Figure 4. Hailing Channel RF Peak Power, Center Channel

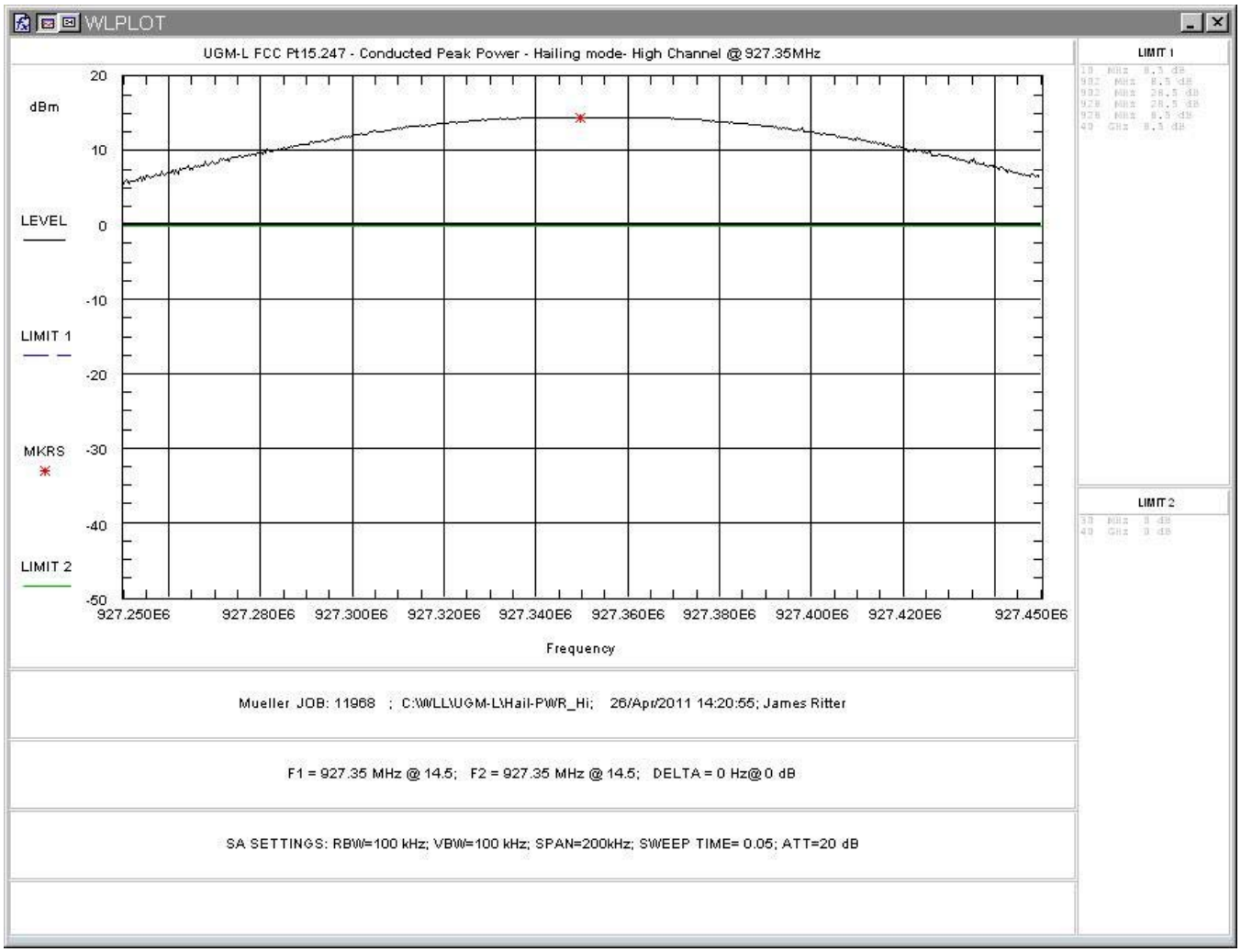

Figure 5. Hailing Channel RF Peak Power, High Channel

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, operating in the 902-928MHz frequency range, FCC Part 15.247 requires that devices with occupied bandwidths less than 250kHz have a minimum of 50 hopping channels.

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

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

Table 6. Hailing Channel Occupied Bandwidth Results

Frequency	Bandwidth	Limit	Pass/Fail
Low Channel: 902.65MHz	40.95kHz	500kHz Maximum	Pass
Center Channel: 915.35MHz	39.78kHz	500kHz Maximum	Pass
High Channel: 927.35MHz	40.65kHz	500kHz Maximum	Pass

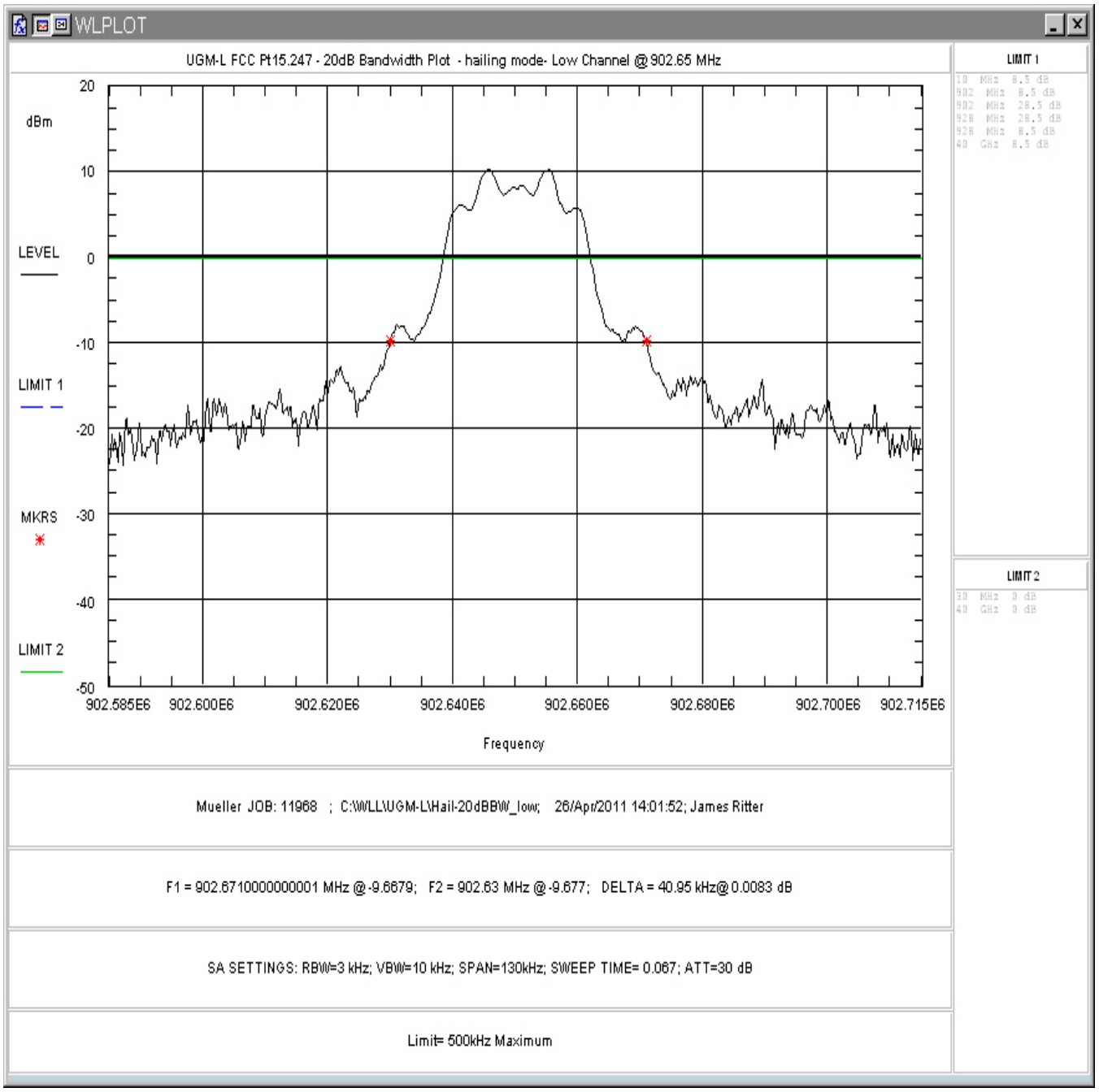

Figure 6. Hailing Channel Occupied Bandwidth, Low Channel

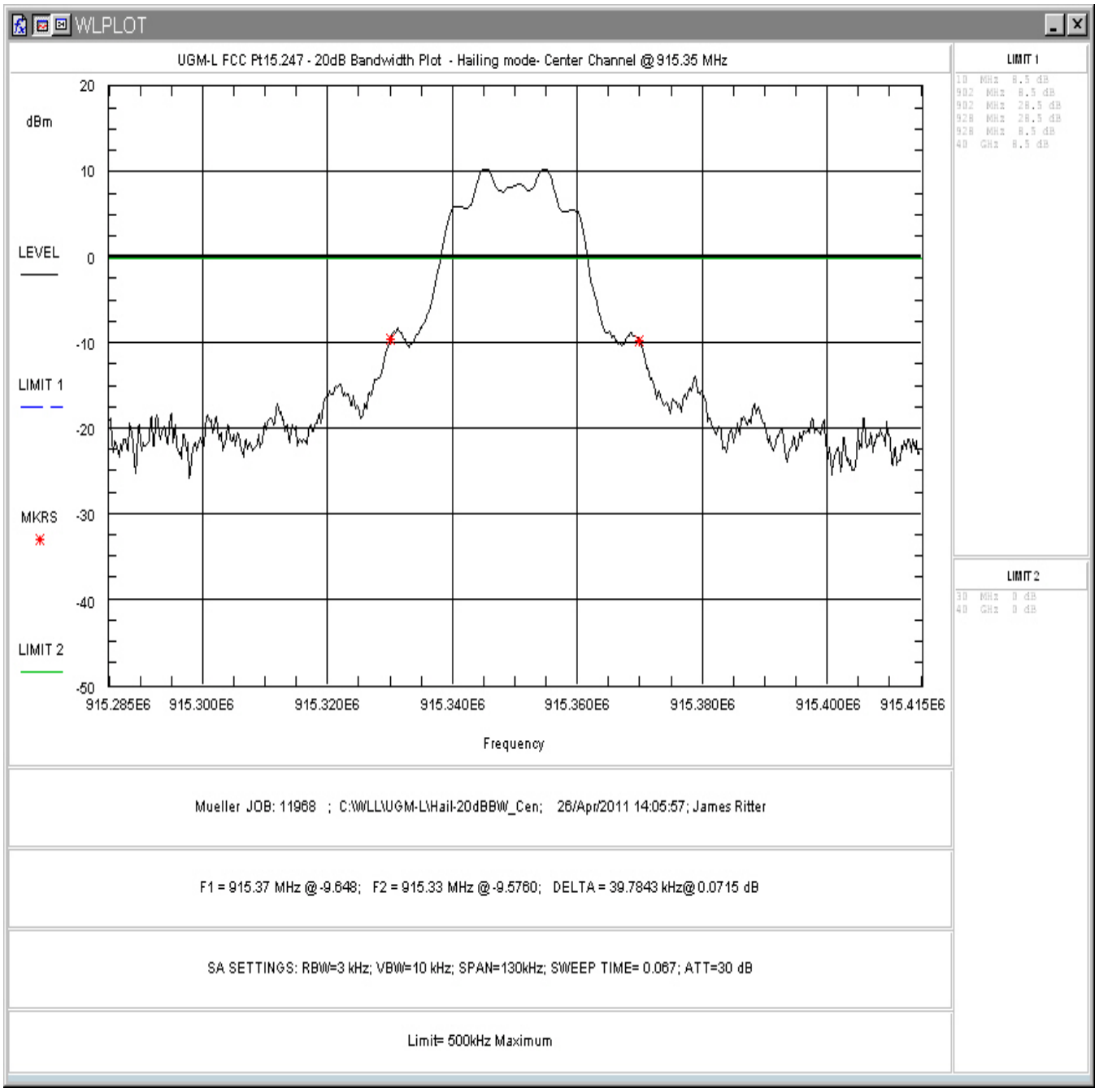

Figure 7. Hailing Channel Occupied Bandwidth, Center Channel

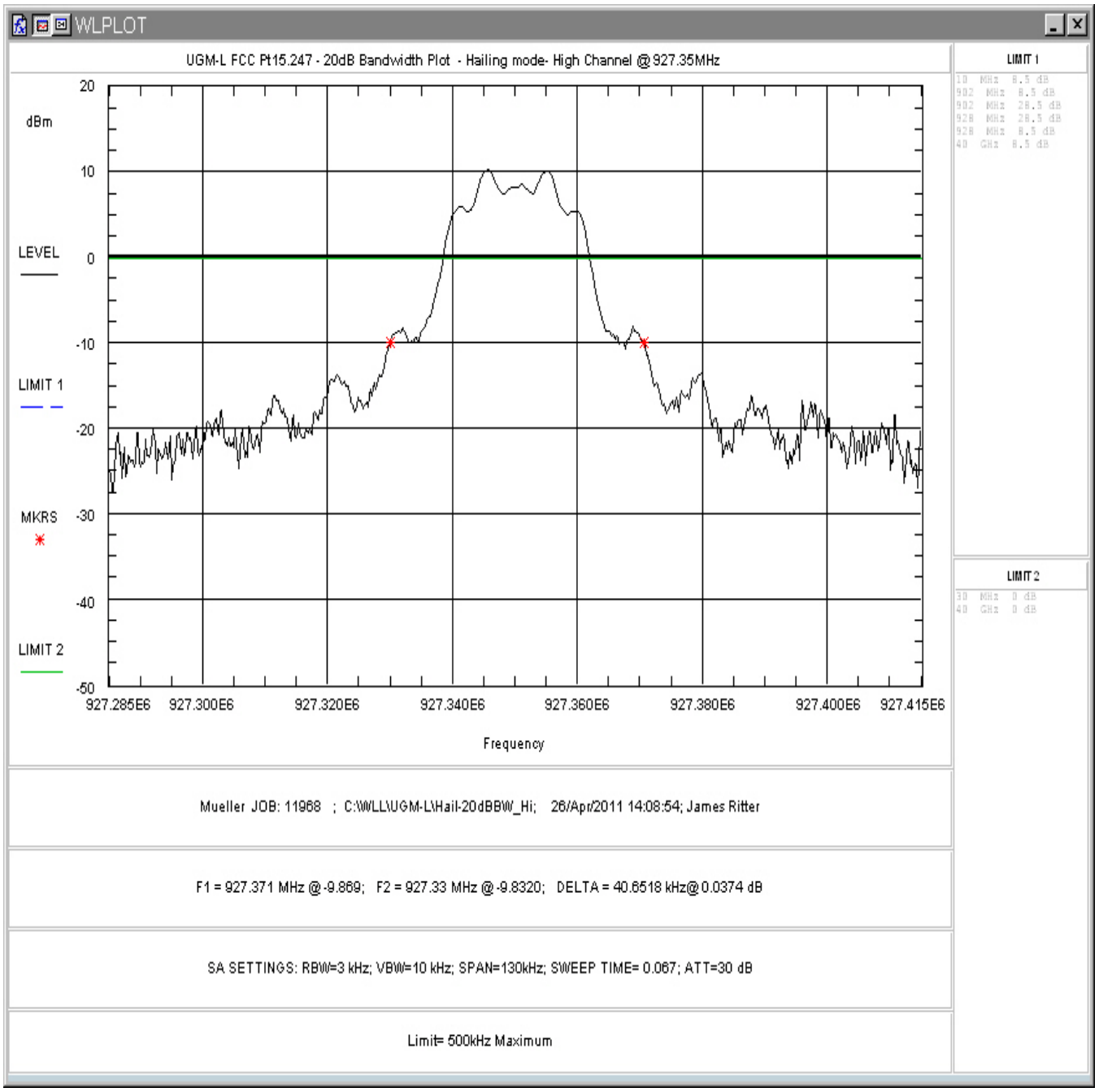

Figure 8. Hailing Channel Occupied Bandwidth, High Channel

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

Per the FCC requirements, frequency hopping systems operating in the 902-928MHz 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 40.95 kHz so the channel spacing must be more than 40.95 kHz. In addition, Part 15.247 requires that devices with occupied bandwidths less than 250kHz have a minimum of 50 hopping channels.

The EUT antenna was removed and the cable was connected directly into a spectrum analyzer through a calibrated cable and attenuator. An offset was programmed into the spectrum analyzer to compensate for the loss of the external attenuator/cable. The spectrum analyzer resolution bandwidth was set to 30 kHz and the video bandwidth was set to 30 kHz. The channel spacing of 2 adjacent channels was measured using a spectrum analyzer span setting of 410 kHz. Also, the number of hopping channels was measured within the 902-928MHz frequency range.

The following are plots of the channel spacing and number of hopping channels data. The channel spacing was measured to be 150kHz for hailing channels and the number of hopping channels is 50 for the hailing channels.

The hailing channels are not evenly dispersed within the band with the closest hailing channels spaced 150 kHz apart. This still remains in compliance.

Table 7 Channel spacing and number of hopping channels summary

Test	Result	Limit	Pass/Fail
Hailing Channel Spacing	The closest channels are spaced 150kHz	43.16kHz Minimum	Pass
Number of Hailing Channels	50 channels	50 channels minimum	Pass

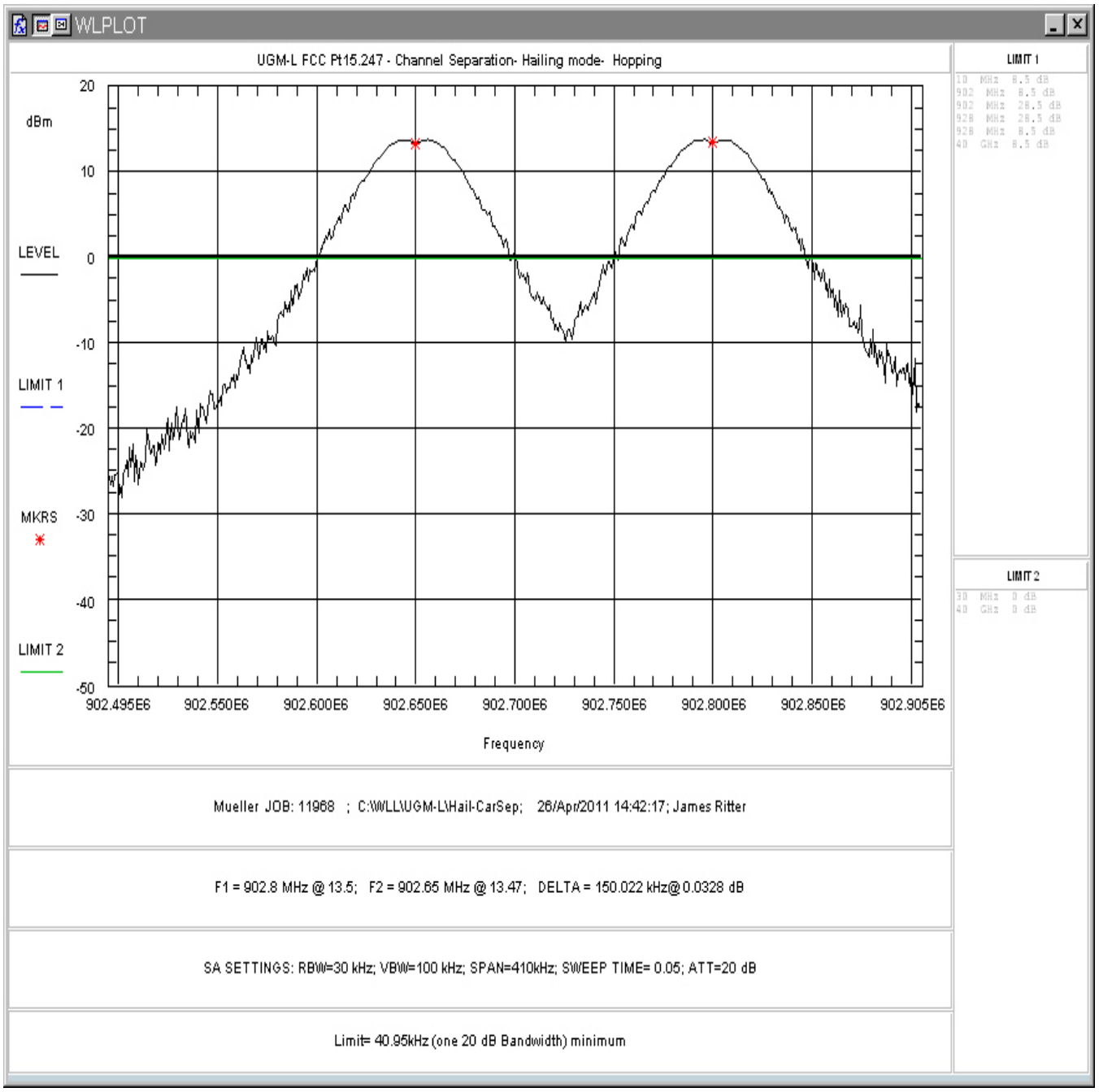

Figure 9. Hailing Channel Spacing

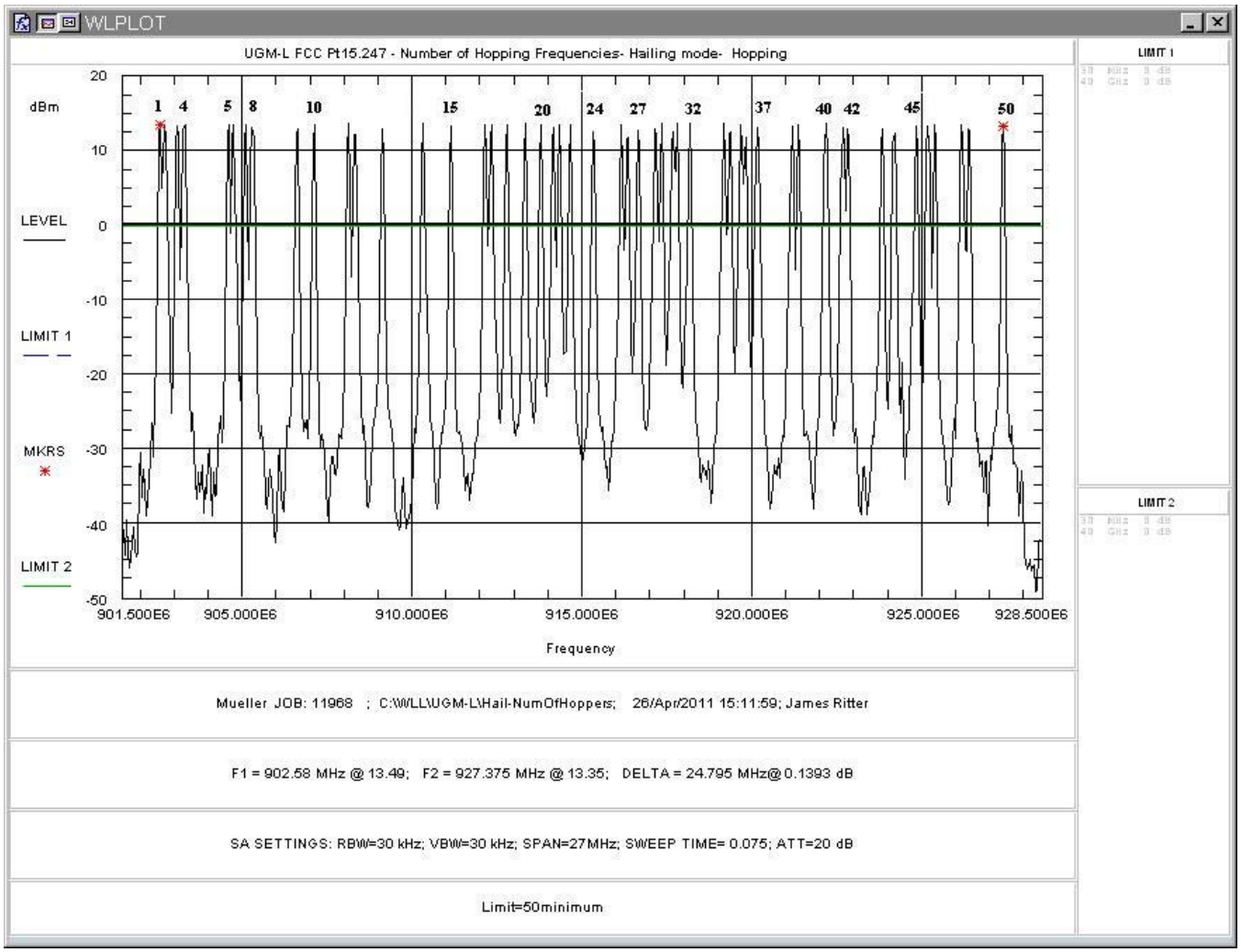

Figure 10. Number of Hailing Channels

5.5 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 to show compliance at both of these points.

The following are plots of the conducted spurious emissions data.

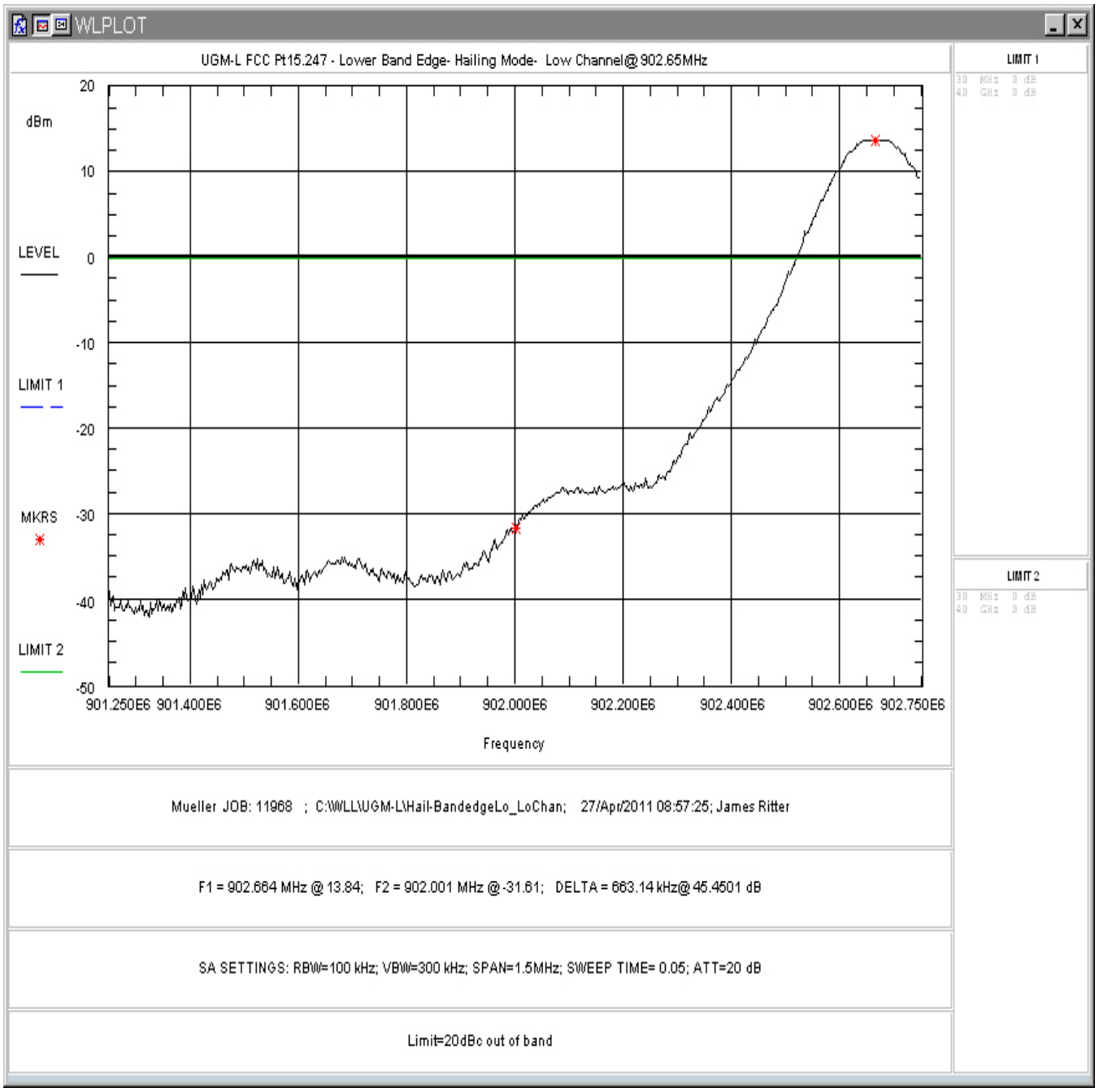

Figure 11. Low Band Edge Plot, Low Hailing Channel

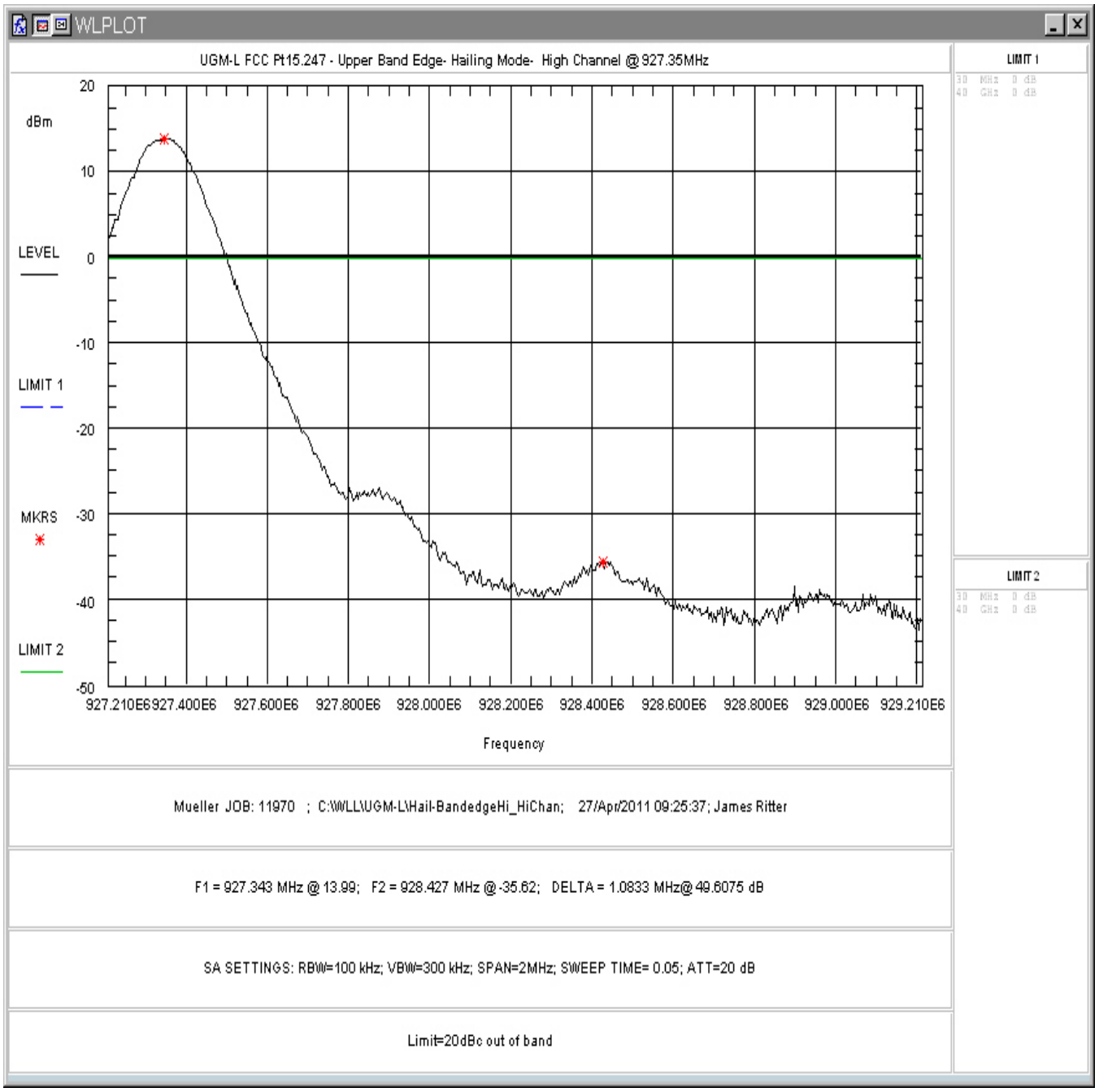

Figure 12. Upper Band Edge Plot, High Hailing Channel

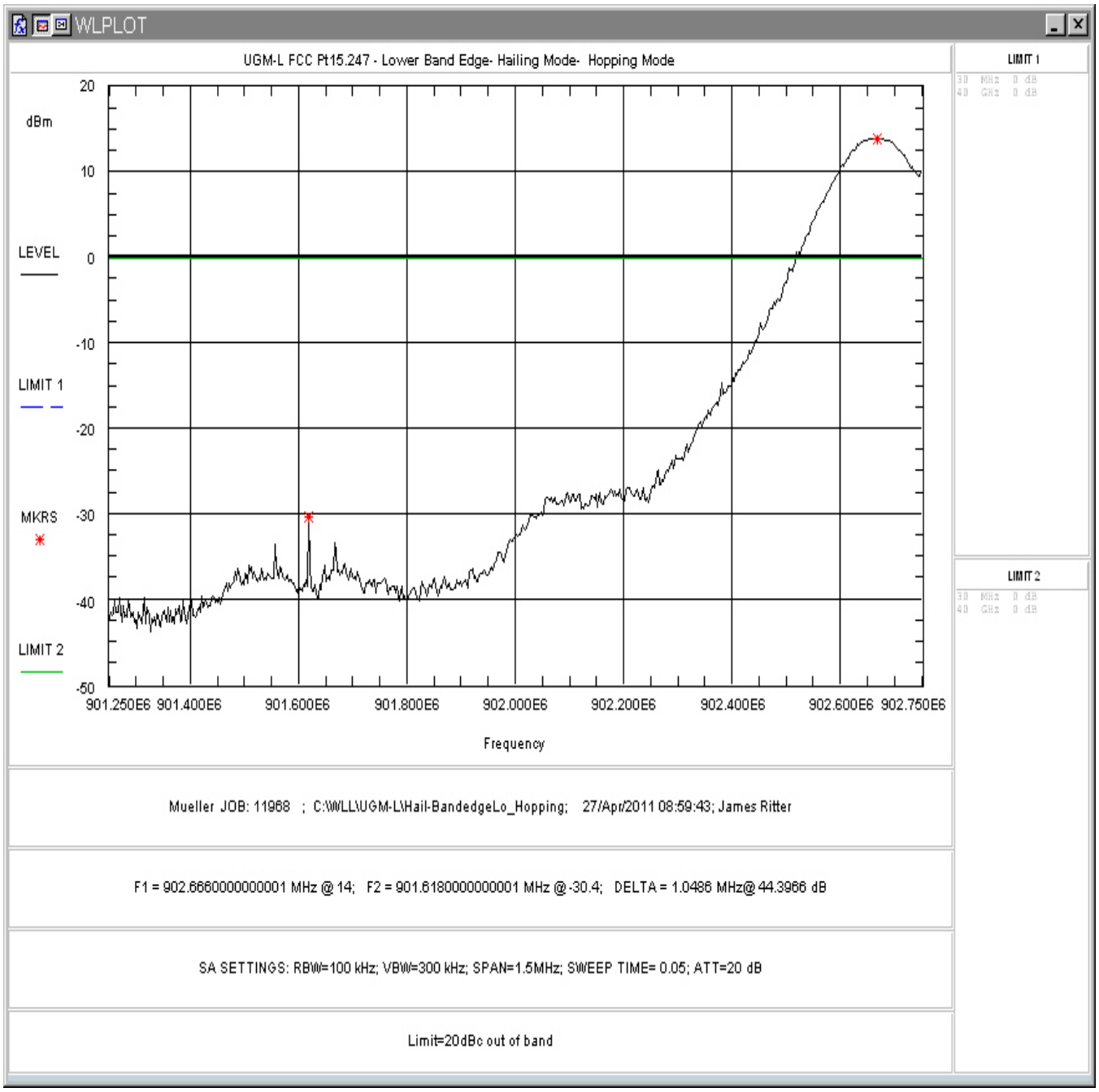

Figure 13. Low Band Edge Plot, Hopping Hailing Channel

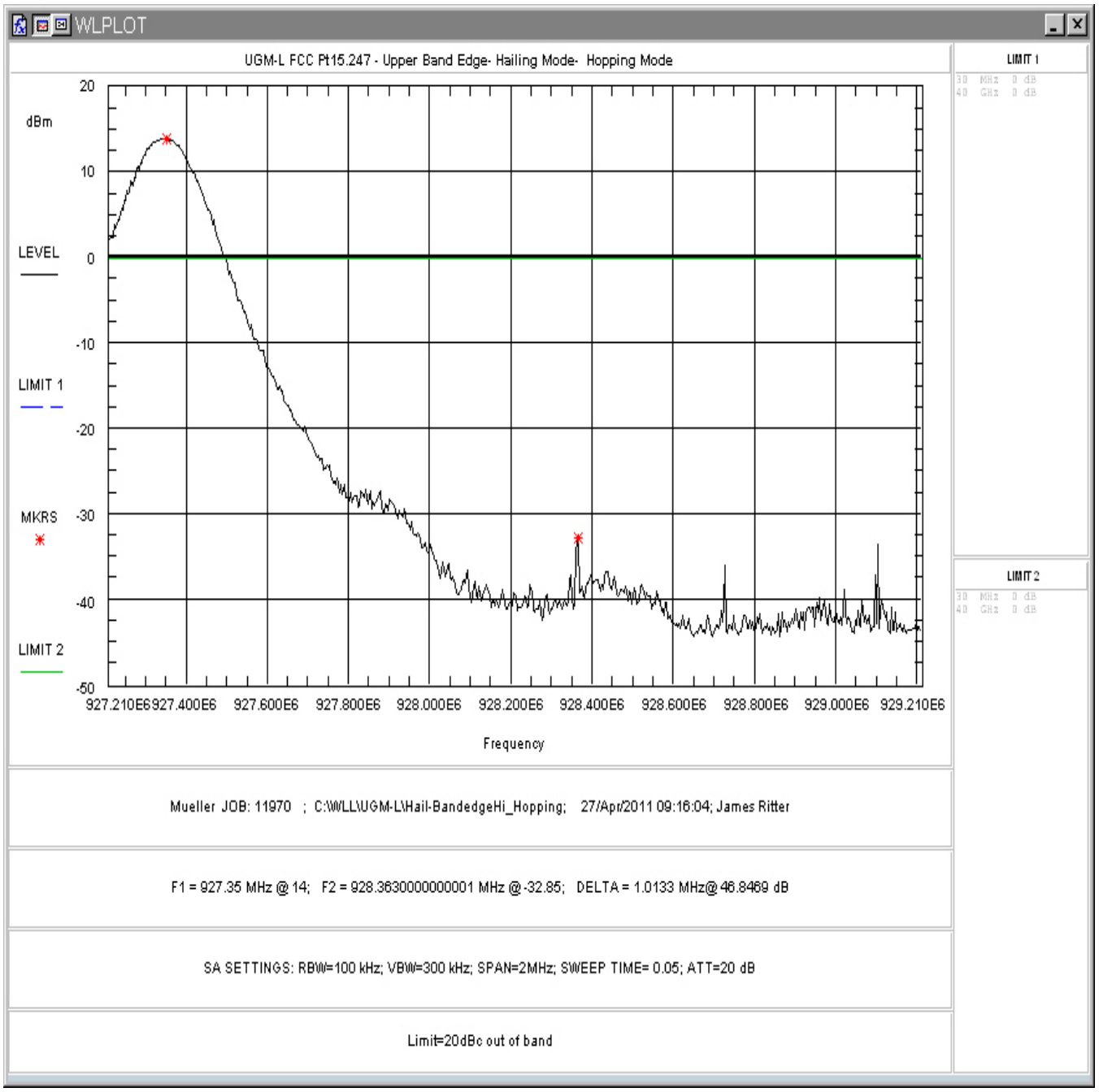

Figure 14. High Band Edge Plot, Hopping Hailing Channel

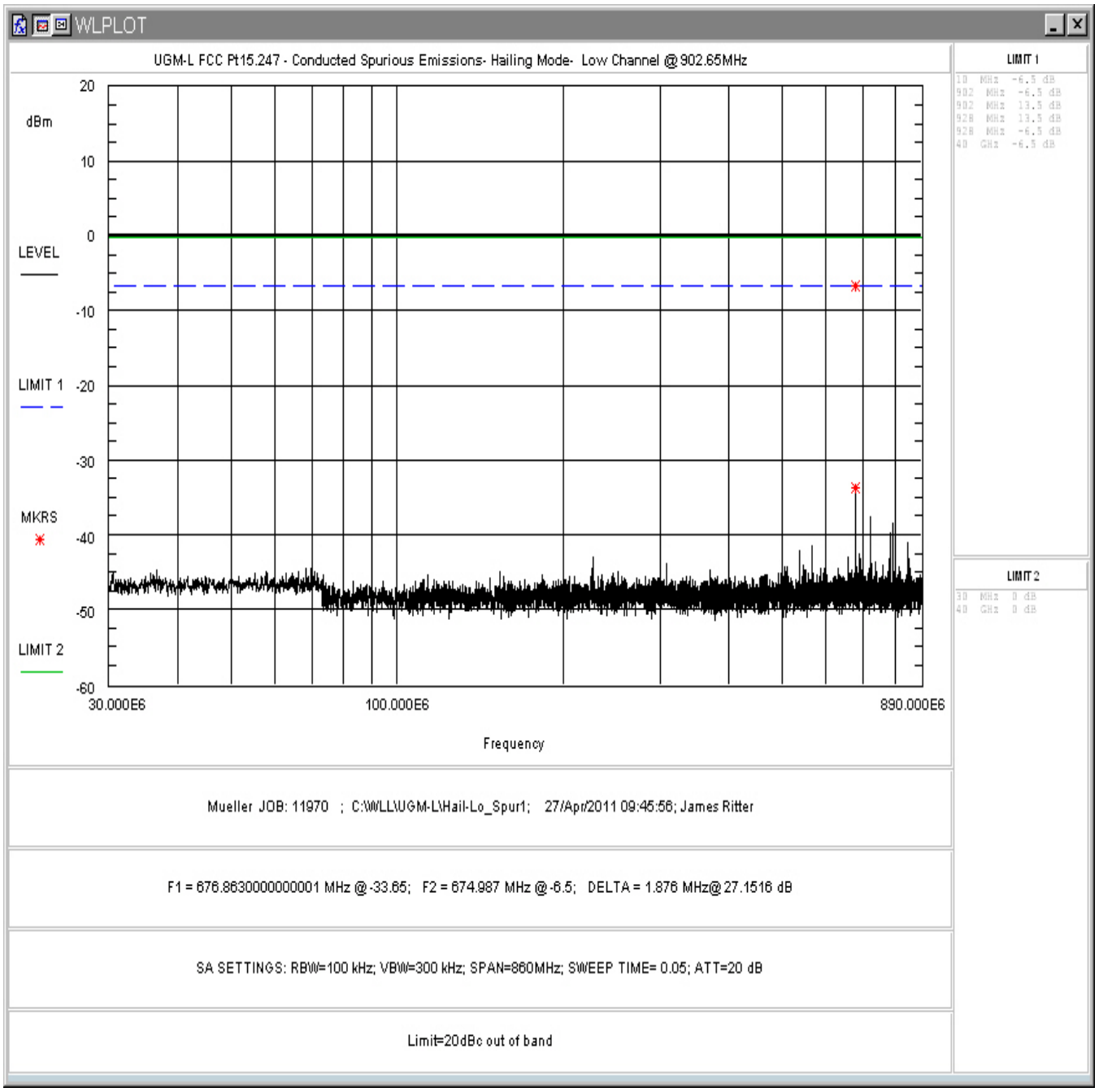

Figure 15. Conducted Spurious, Low Channel, 30- 890MHz

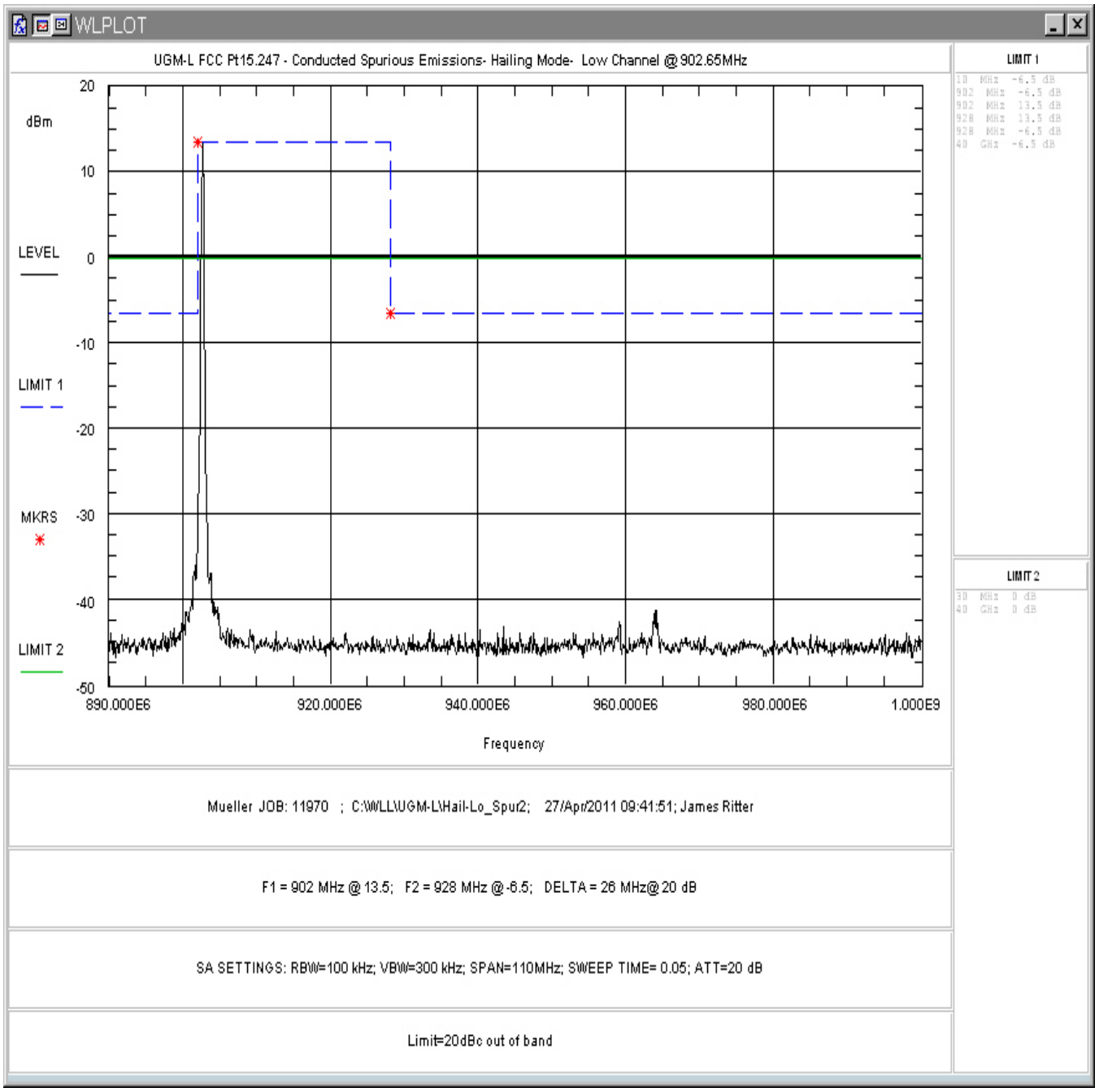

Figure 16. Conducted Spurious, Low Channel, 890 - 1000MHz

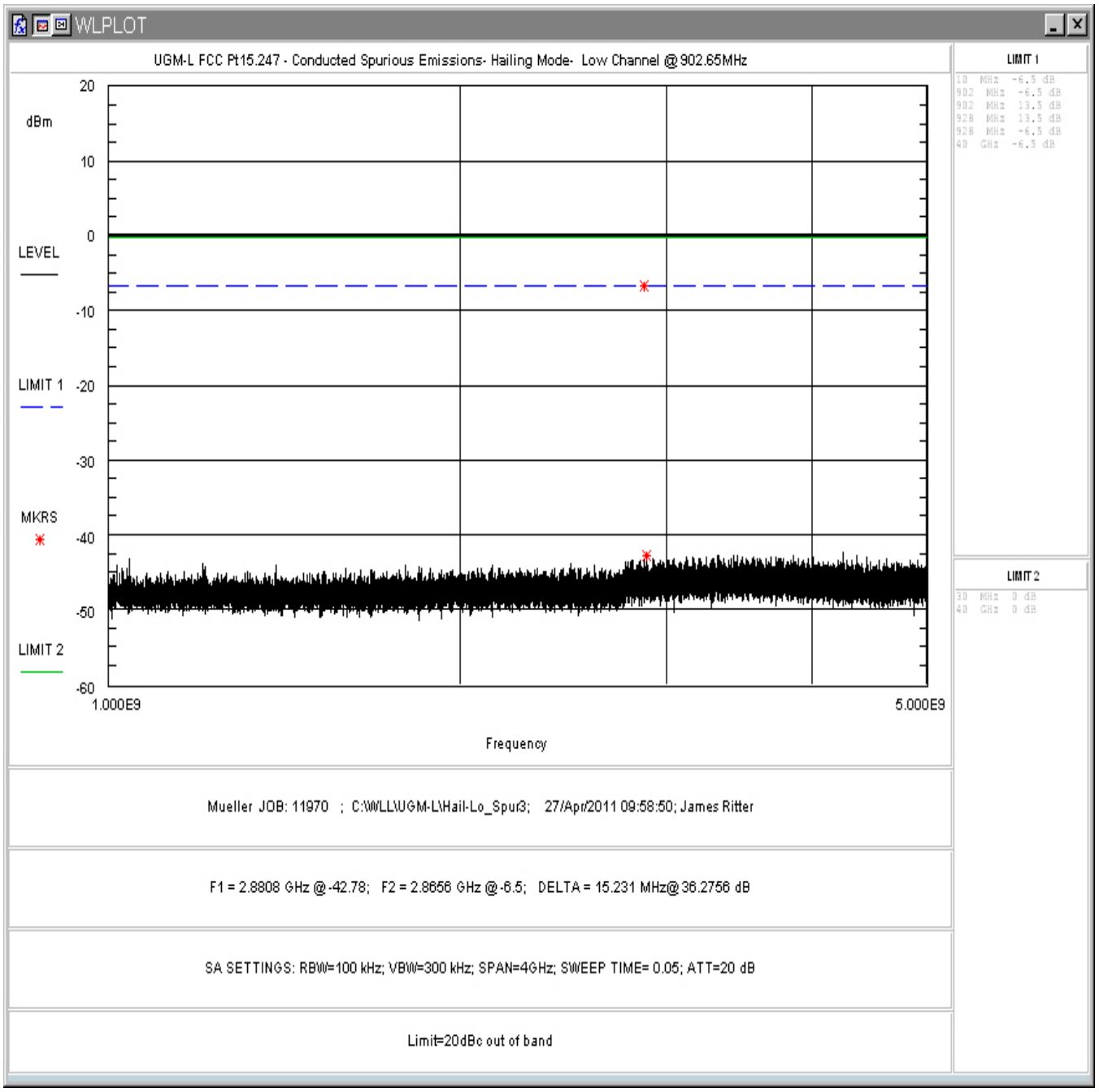

Figure 17. Conducted Spurious, Low Channel, 1-5GHz

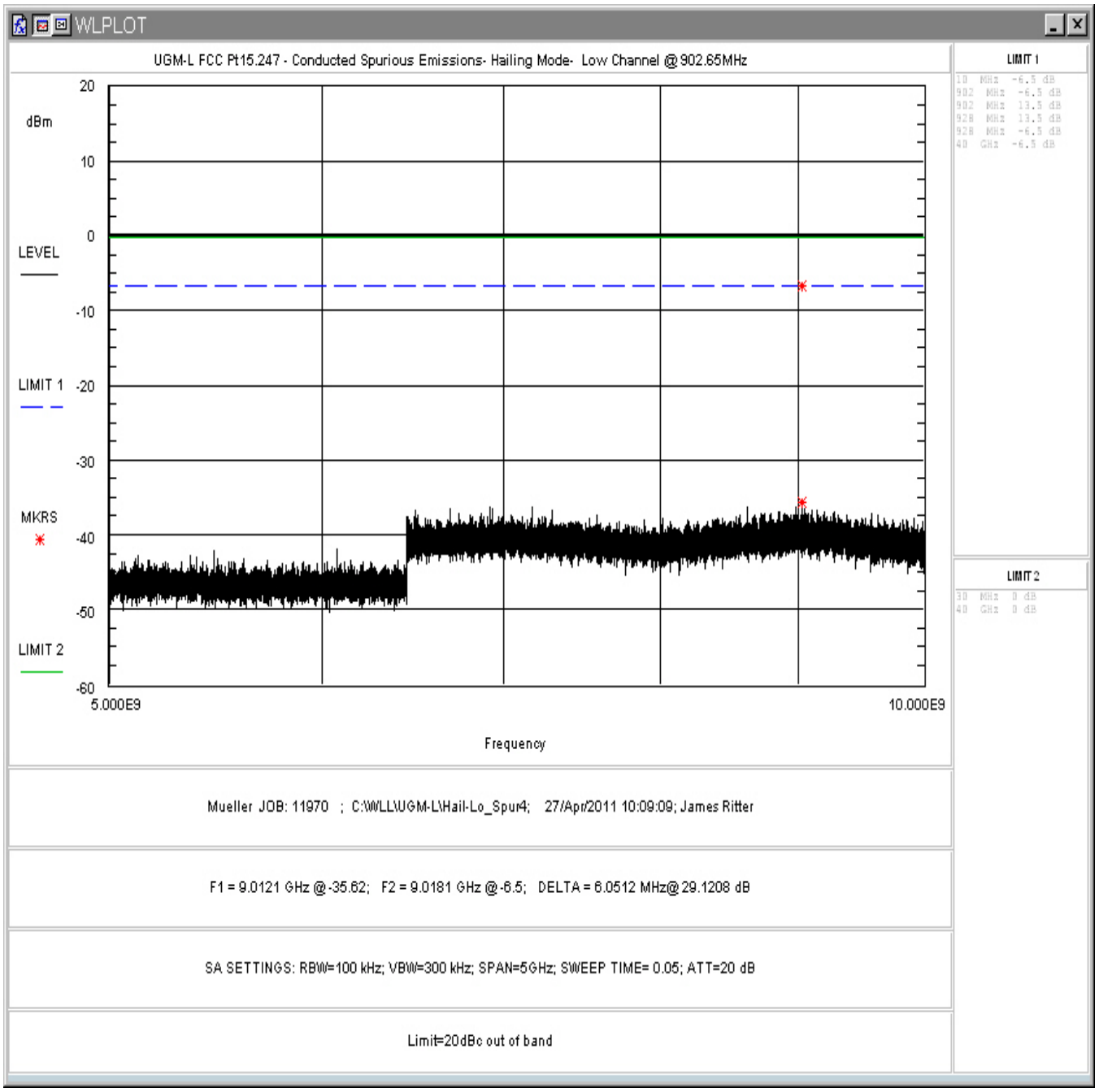

Figure 18. Conducted Spurious, Low Channel, 5-10GHz

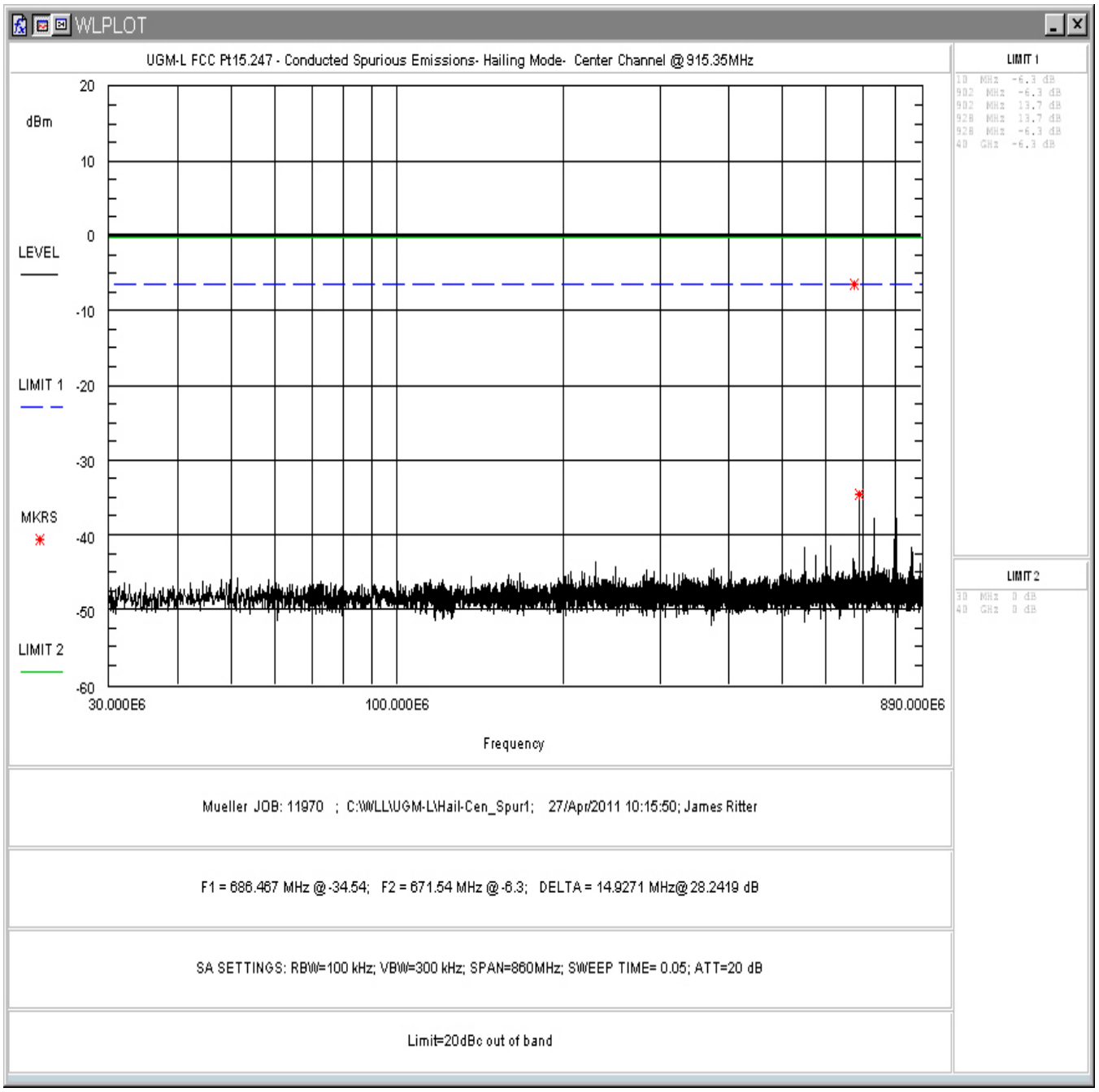

Figure 19. Conducted Spurious, Center Channel, 30- 890MHz

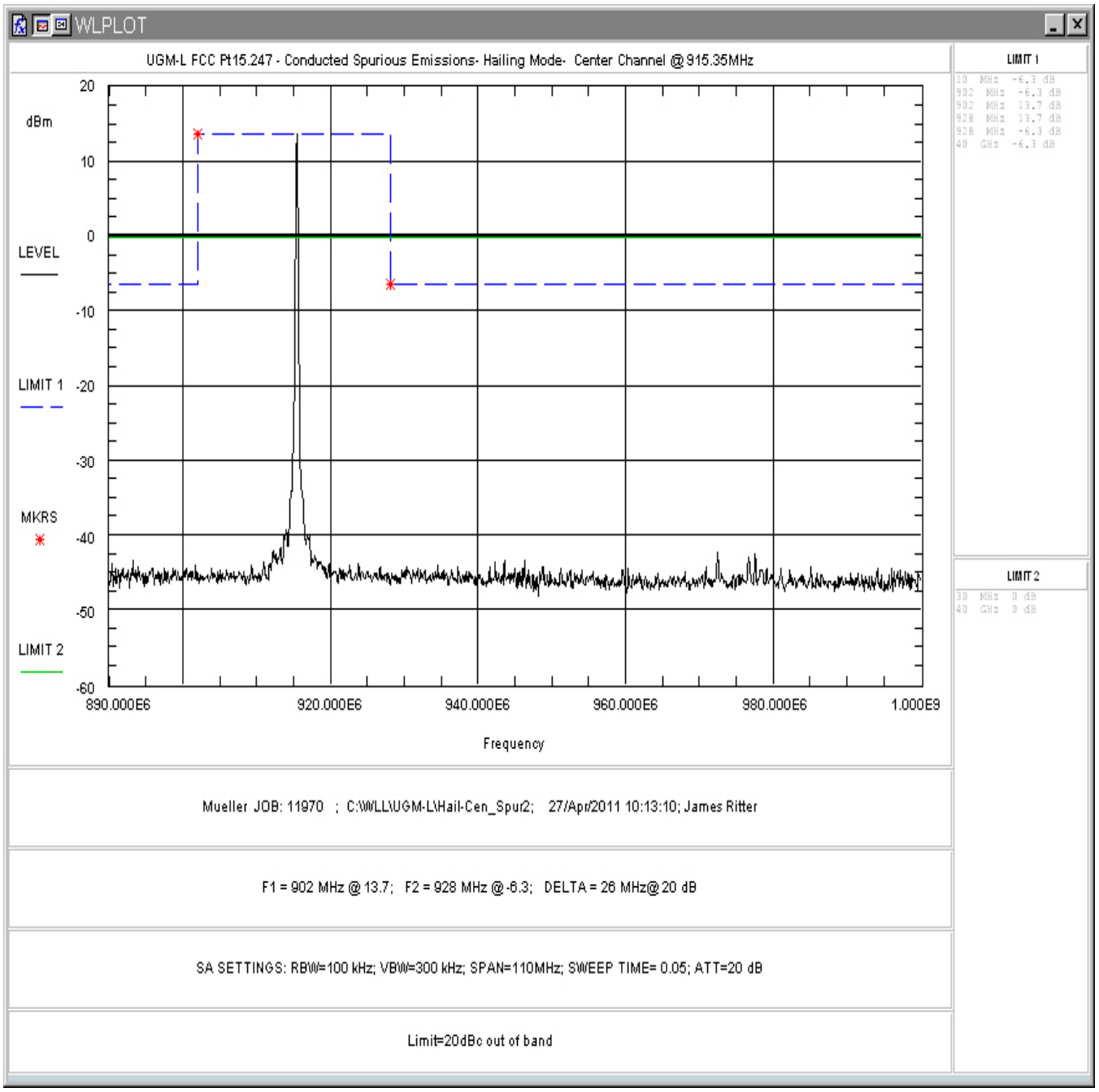

Figure 20. Conducted Spurious, Center Channel, 890 - 1000MHz

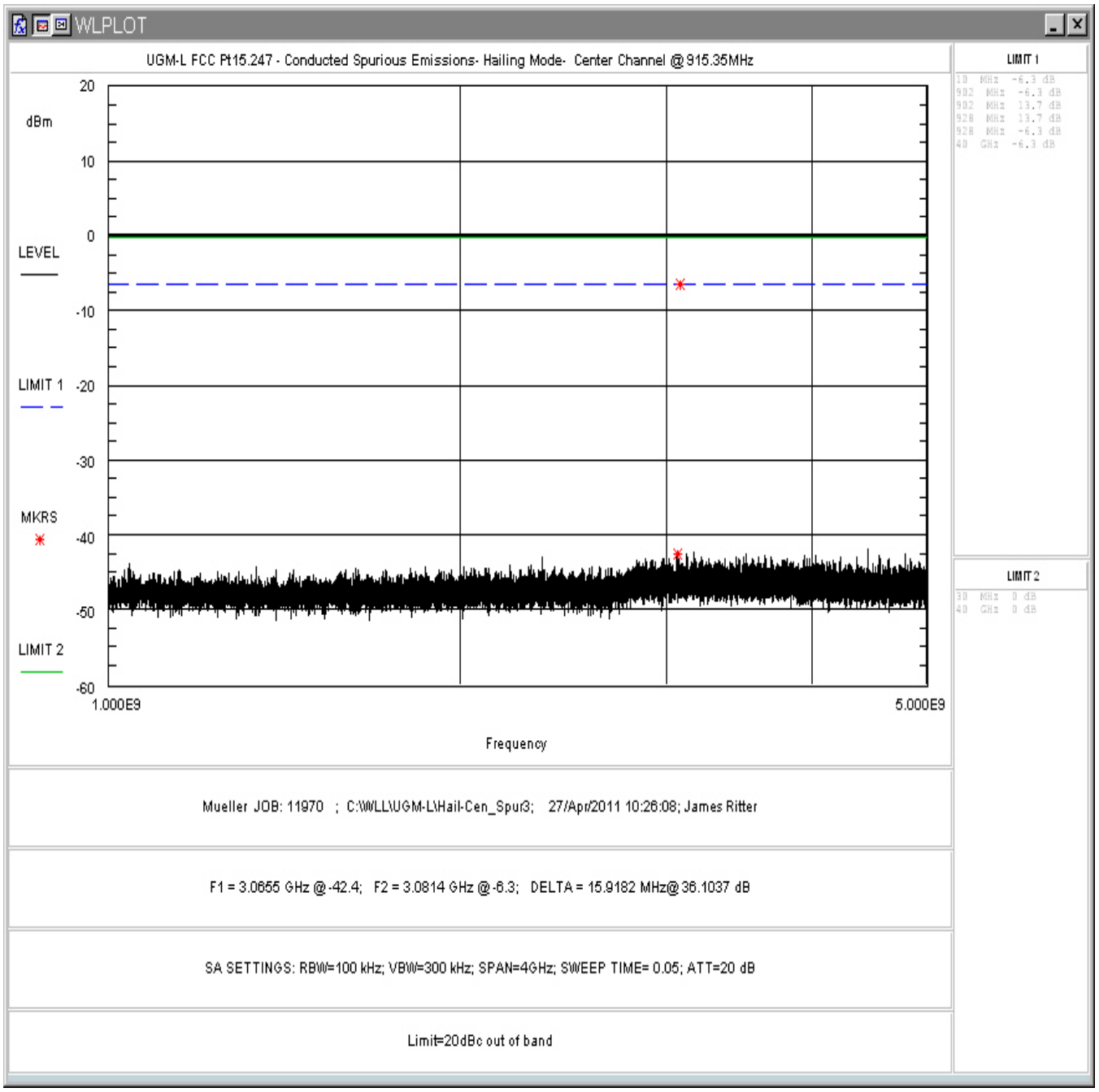

Figure 21. Conducted Spurious, Center Channel, 1-5GHz

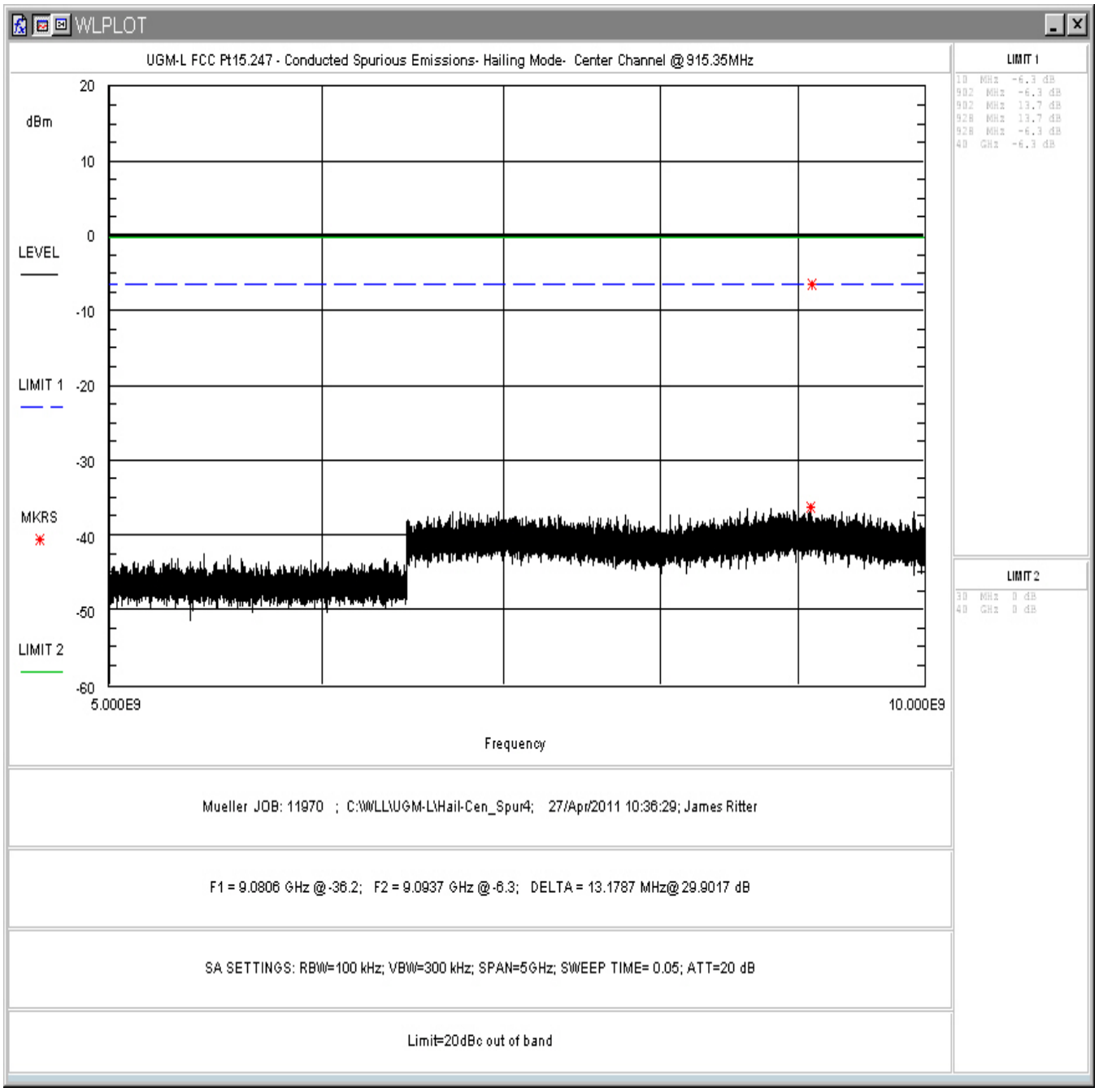

Figure 22. Conducted Spurious, Center Channel, 5-10GHz

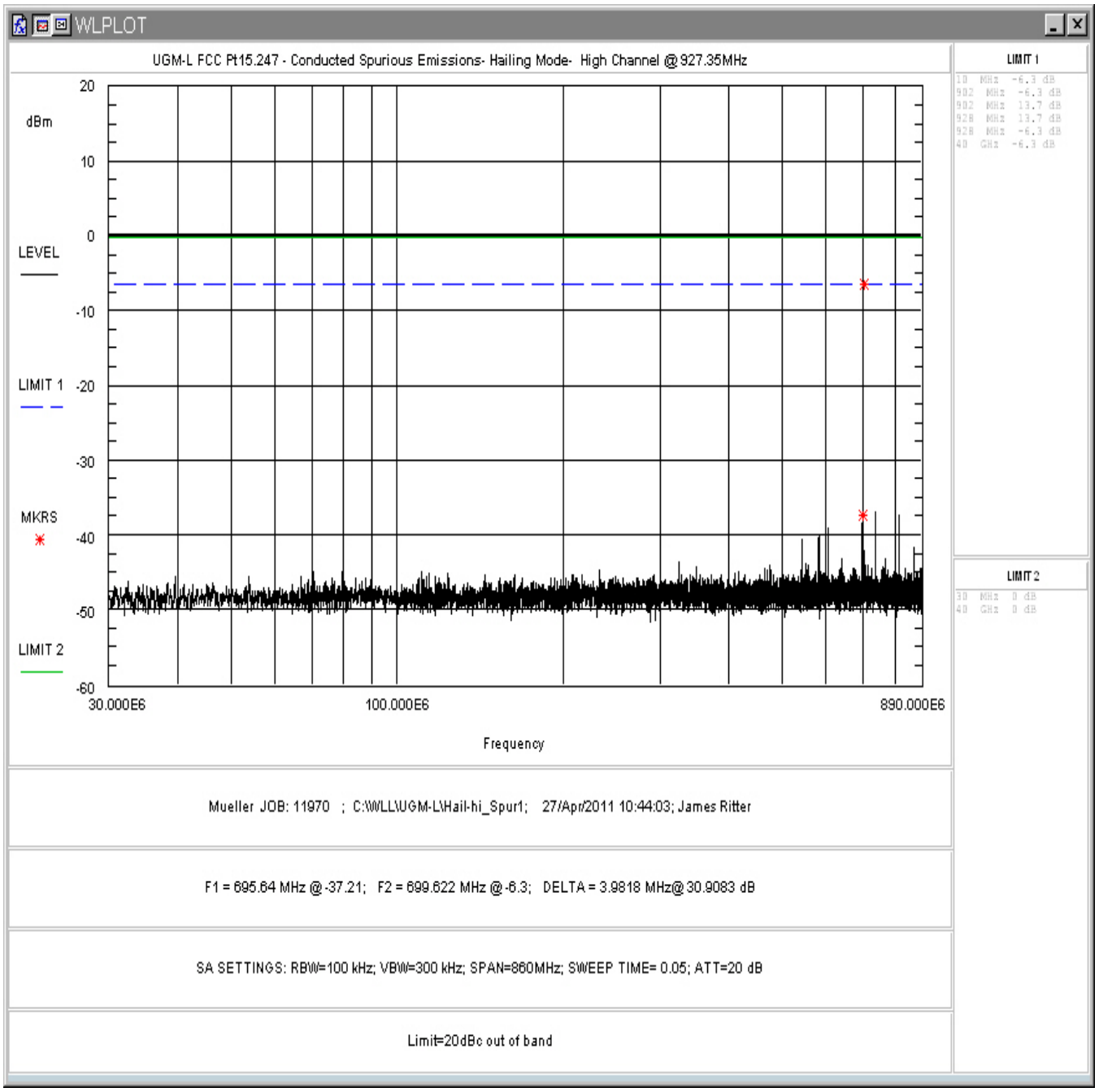

Figure 23. Conducted Spurious, High Channel, 30- 890MHz

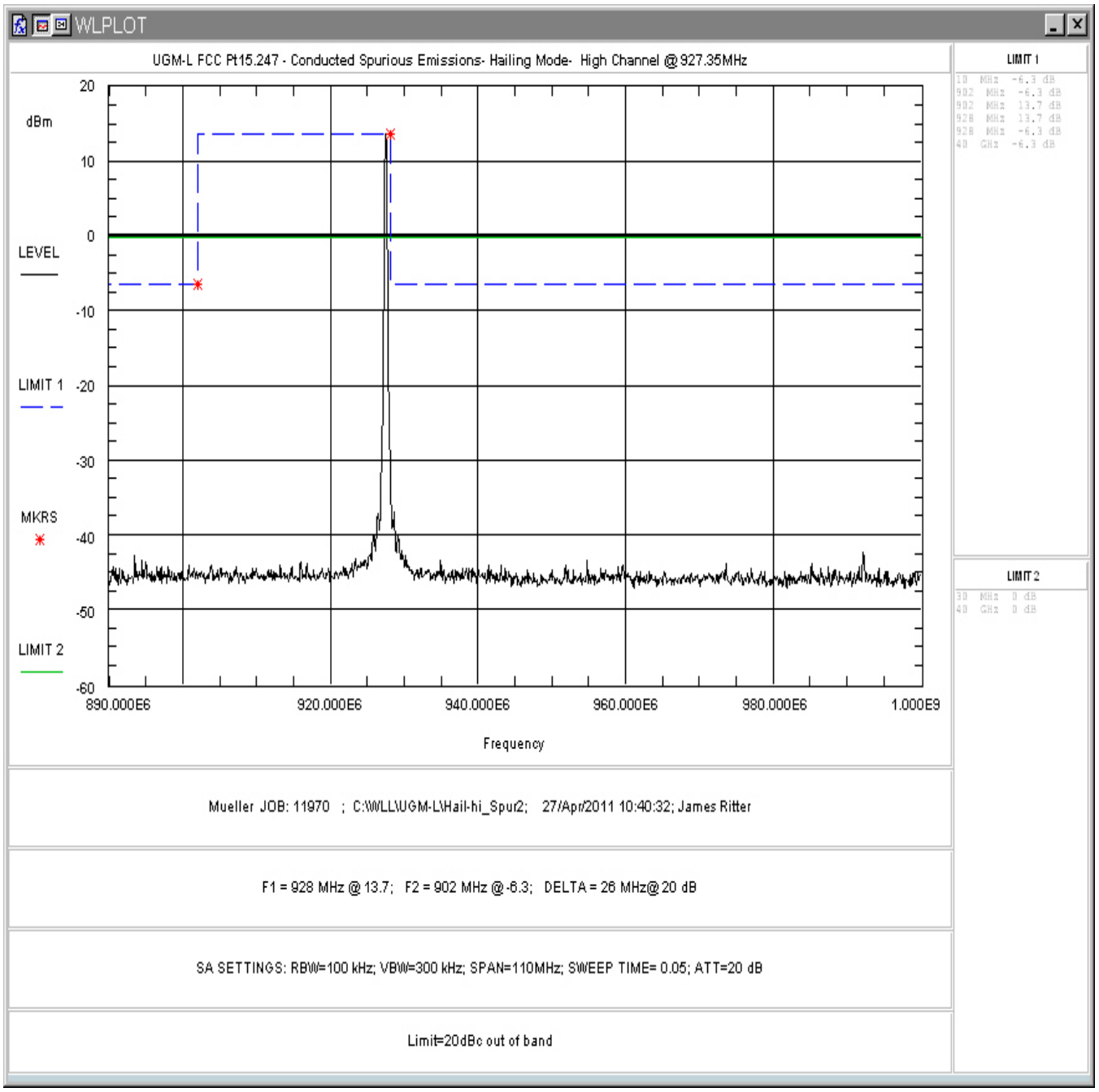

Figure 24. Conducted Spurious, High Channel, 890 - 1000MHz

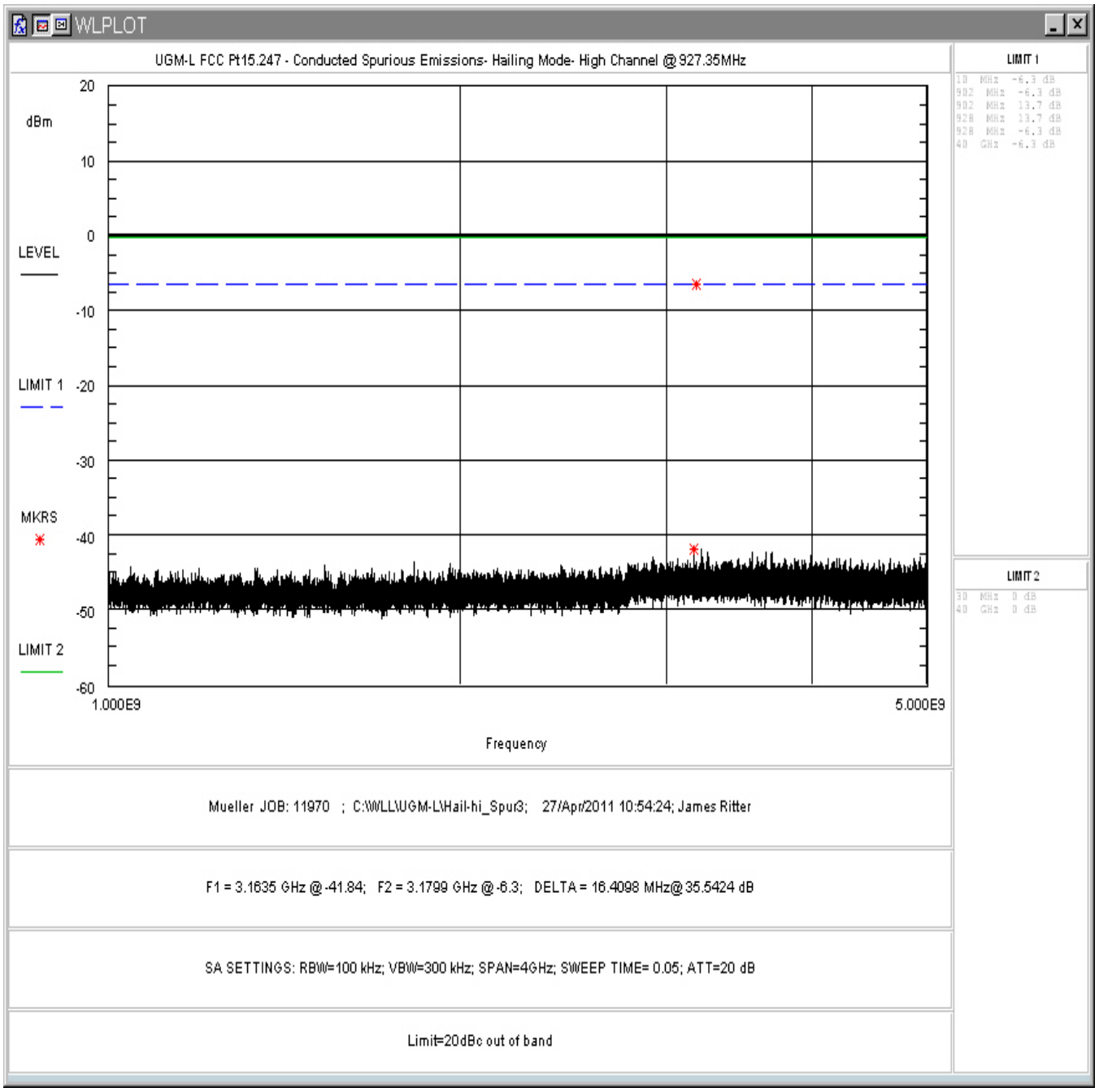

Figure 25. Conducted Spurious, High Channel, 1-5GHz

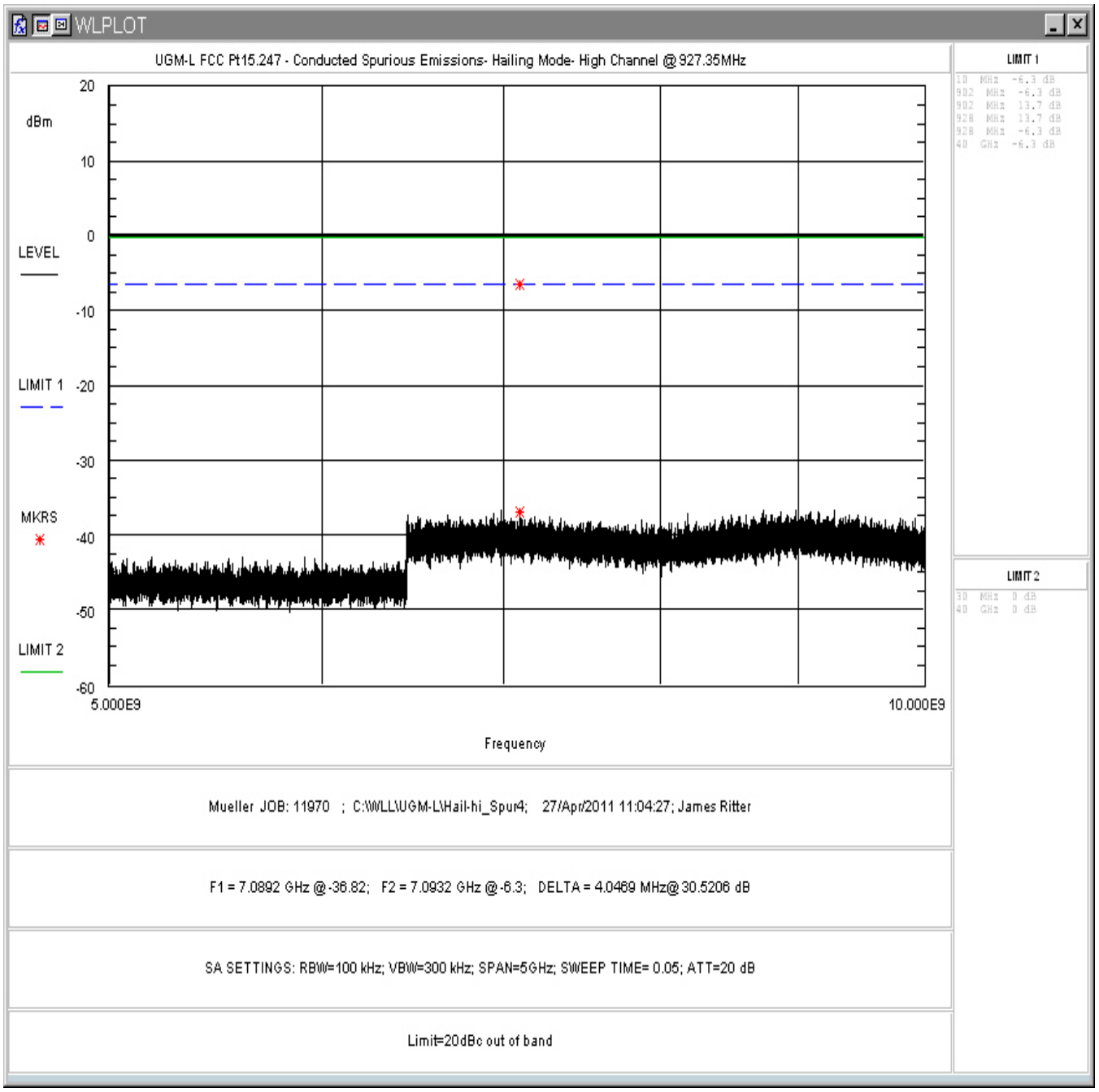

Figure 26. Conducted Spurious, High Channel, 5-10GHz

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 a 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 EUT was tested in 3 orthogonals with the worst case readings provided. Both the horizontal and vertical field components were measured. 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)

5.6.2 Areas of concern

None

Table 8: Radiated Emission Test Data, Restricted Bands, Low Hailing Channel @ 902.35

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								
2707.95	V	45.00	1.50	54.71	-3.9	345.2	5000.0	-23.2
3610.60	V	10.00	2.28	47.73	-1.2	211.6	5000.0	-27.5
4513.25	V	90.00	2.58	46.67	0.5	228.2	5000.0	-26.8
5415.90	V	110.00	2.39	46.45	2.9	293.4	5000.0	-24.6
8123.85	V	45.00	3.45	42.82	7.1	315.1	5000.0	-24.0
9026.50	V	10.00	1.91	43.41	8.7	401.2	5000.0	-21.9
AVG								
2707.95	V	45.00	1.50	50.75	-3.9	218.8	500.0	-7.2
3610.60	V	10.00	2.28	39.60	-1.2	83.0	500.0	-15.6
4513.25	V	90.00	2.58	37.96	0.5	83.7	500.0	-15.5
5415.90	V	110.00	2.39	35.02	2.9	78.7	500.0	-16.1
8123.85	V	45.00	3.45	31.85	7.1	89.1	500.0	-15.0
9026.50	V	10.00	1.91	31.95	8.7	107.2	500.0	-13.4
Non-harmonics								
74.03	V	20.00	1.15	8.50	9.3	7.8	100.0	-22.2
117.87	V	180.00	1.00	6.50	14.2	10.8	150.0	-22.8
123.98	V	90.00	1.00	3.30	14.7	7.9	150.0	-25.6
240.00	V	270.00	1.17	11.30	13.6	17.5	200.0	-21.2
246.03	V	190.00	2.25	16.70	13.7	33.0	200.0	-15.7
322.00	V	280.00	2.53	12.50	16.6	28.4	200.0	-17.0
405.78	V	190.00	1.60	10.20	18.6	27.7	200.0	-17.2
257.21	V	170.00	2.39	9.20	14.1	14.6	200.0	-22.7
Peak								
2707.95	H	15.00	2.29	56.88	-3.9	443.2	5000.0	-21.0
3610.60	H	110.00	2.83	48.20	-1.2	223.3	5000.0	-27.0
4513.25	H	0.00	2.19	47.24	0.5	243.7	5000.0	-26.2
5415.90	H	340.00	3.13	45.17	2.9	253.2	5000.0	-25.9
8123.85	H	10.00	2.80	43.73	7.1	349.9	5000.0	-23.1
9026.50	H	20.00	2.65	43.10	8.7	387.1	5000.0	-22.2
	H							
AVG								
2707.95	H	15.00	2.29	53.67	-3.9	306.3	500.0	-4.3
3610.60	H	110.00	2.83	43.07	-1.2	123.7	500.0	-12.1
4513.25	H	0.00	2.19	33.80	0.5	51.9	500.0	-19.7
5415.90	H	340.00	3.13	32.34	2.9	57.8	500.0	-18.7
8123.85	H	10.00	2.80	32.10	7.1	91.7	500.0	-14.7
9026.50	H	20.00	2.65	32.02	8.7	108.1	500.0	-13.3

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)
Non-harmonics								
74.89	H	270.00	4.00	7.10	9.6	6.8	100.0	-23.3
117.87	H	190.00	4.00	9.10	14.2	14.6	150.0	-20.2
124.77	H	45.00	3.90	5.30	14.6	9.9	150.0	-23.6
136.50	H	50.00	4.00	4.60	14.6	9.1	150.0	-24.3
241.08	H	180.00	3.67	5.90	13.6	9.4	200.0	-26.5
323.33	H	170.00	3.07	24.10	16.6	108.4	200.0	-5.3
405.78	H	280.00	2.19	15.50	18.6	50.9	200.0	-11.9
964.04	H	10.00	1.20	23.50	27.3	347.8	500.0	-3.2
963.10	H	10.00	1.20	22.80	27.3	319.5	500.0	-3.9
964.60	H	10.00	1.20	21.60	27.3	280.2	500.0	-5.0

Table 9: Radiated Emission Test Data, Restricted Bands, Center Hailing Channel @ 915.35MHz

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								
2746.05	V	290.00	2.04	53.76	-4.0	308.2	5000.0	-24.2
3661.40	V	95.00	2.10	50.46	-1.2	291.3	5000.0	-24.7
4576.75	V	45.00	2.46	46.07	0.5	212.9	5000.0	-27.4
7322.80	V	80.00	2.50	44.64	6.8	371.3	5000.0	-22.6
8238.15	V	10.00	2.35	45.84	7.2	450.1	5000.0	-20.9
9153.50	V	90.00	2.47	44.90	10.1	561.4	5000.0	-19.0
AVG								
2746.05	V	290.00	2.04	49.12	-4.0	180.6	500.0	-8.8
3661.40	V	95.00	2.10	45.45	-1.2	163.6	500.0	-9.7
4576.75	V	45.00	2.46	36.23	0.5	68.6	500.0	-17.3
7322.80	V	80.00	2.50	32.17	6.8	88.3	500.0	-15.1
8238.15	V	10.00	2.35	32.29	7.2	94.6	500.0	-14.5
9153.50	V	90.00	2.47	32.24	10.1	130.7	500.0	-11.7
Non-harmonics								
74.03	V	20.00	1.15	8.50	9.3	7.8	100.0	-22.2
117.87	V	180.00	1.00	6.50	14.2	10.8	150.0	-22.8
123.98	V	90.00	1.00	3.30	14.7	7.9	150.0	-25.6
240.00	V	270.00	1.17	11.30	13.6	17.5	200.0	-21.2
246.03	V	190.00	2.25	16.70	13.7	33.0	200.0	-15.7
322.00	V	280.00	2.53	12.50	16.6	28.4	200.0	-17.0
405.78	V	190.00	1.60	10.20	18.6	27.7	200.0	-17.2
257.21	V	170.00	2.39	9.20	14.1	14.6	200.0	-22.7
Peak								

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)
2746.05	H	190.00	2.78	53.55	-4.0	300.8	5000.0	-24.4
3661.40	H	45.00	2.38	50.23	-1.2	283.7	5000.0	-24.9
4576.75	H	100.00	2.11	45.79	0.5	206.1	5000.0	-27.7
7322.80	H	90.00	2.33	44.56	6.8	367.9	5000.0	-22.7
8238.15	H	20.00	2.64	43.20	7.2	332.1	5000.0	-23.6
9153.50	H	90.00	2.64	43.56	10.1	481.2	5000.0	-20.3
AVG								
2746.05	H	190.00	2.78	49.51	-4.0	188.9	500.0	-8.5
3661.40	H	45.00	2.38	45.41	-1.2	162.9	500.0	-9.7
4576.75	H	100.00	2.11	34.20	0.5	54.3	500.0	-19.3
7322.80	H	90.00	2.33	31.02	6.8	77.4	500.0	-16.2
8238.15	H	20.00	2.64	32.28	7.2	94.5	500.0	-14.5
9153.50	H	90.00	2.64	31.92	10.1	126.0	500.0	-12.0
Non-harmonics								
74.89	H	270.00	4.00	7.10	9.6	6.8	100.0	-23.3
117.87	H	190.00	4.00	9.10	14.2	14.6	150.0	-20.2
124.77	H	45.00	3.90	5.30	14.6	9.9	150.0	-23.6
136.50	H	50.00	4.00	4.60	14.6	9.1	150.0	-24.3
241.08	H	180.00	3.67	5.90	13.6	9.4	200.0	-26.5
323.33	H	170.00	3.07	24.10	16.6	108.4	200.0	-5.3
405.78	H	280.00	2.19	15.50	18.6	50.9	200.0	-11.9
977.40	H	0.00	1.60	22.60	27.9	336.0	500.0	-3.5
976.72	H	0.00	1.60	23.00	27.9	351.2	500.0	-3.1
978.17	H	0.00	1.60	20.80	27.9	273.6	500.0	-5.2

Table 10: Radiated Emission Test Data, Restricted Bands, Center Hailing Channel @ 927.35MHz

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								
2782.05	V	180.00	2.37	52.99	-3.8	289.1	5000.0	-24.8
3709.40	V	80.00	2.38	49.13	-1.1	253.3	5000.0	-25.9
4636.75	V	350.00	2.90	46.40	1.1	238.2	5000.0	-26.4
7418.80	V	90.00	2.88	45.15	6.8	397.9	5000.0	-22.0
8346.15	V	100.00	2.75	44.10	6.8	350.8	5000.0	-23.1
9273.50	V	90.00	2.61	42.55	9.3	390.5	5000.0	-22.1
AVG								
2782.05	V	180.00	2.37	48.10	-3.8	164.6	500.0	-9.6
3709.40	V	80.00	2.38	42.49	-1.1	118.0	500.0	-12.5
4636.75	V	350.00	2.90	36.90	1.1	79.8	500.0	-15.9
7418.80	V	90.00	2.88	32.09	6.8	88.5	500.0	-15.0

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)
8346.15	V	100.00	2.75	31.57	6.8	82.9	500.0	-15.6
9273.50	V	90.00	2.61	31.72	9.3	112.2	500.0	-13.0
Non-harmonics								
74.03	V	20.00	1.15	8.50	9.3	7.8	100.0	-22.2
117.87	V	180.00	1.00	6.50	14.2	10.8	150.0	-22.8
123.98	V	90.00	1.00	3.30	14.7	7.9	150.0	-25.6
240.00	V	270.00	1.17	11.30	13.6	17.5	200.0	-21.2
246.03	V	190.00	2.25	16.70	13.7	33.0	200.0	-15.7
322.00	V	280.00	2.53	12.50	16.6	28.4	200.0	-17.0
405.78	V	190.00	1.60	10.20	18.6	27.7	200.0	-17.2
257.21	V	170.00	2.39	9.20	14.1	14.6	200.0	-22.7
Peak								
2782.05	H	0.00	2.17	53.37	-3.8	302.0	5000.0	-24.4
3709.40	H	90.00	2.13	48.76	-1.1	242.8	5000.0	-26.3
4636.75	H	90.00	2.49	45.32	1.1	210.3	5000.0	-27.5
7418.80	H	50.00	2.65	44.75	6.8	380.0	5000.0	-22.4
8346.15	H	180.00	2.46	44.17	6.8	353.6	5000.0	-23.0
9273.50	H	190.00	2.48	44.30	9.3	477.7	5000.0	-20.4
AVG								
2782.05	H	0.00	2.17	49.68	-3.8	197.5	500.0	-8.1
3709.40	H	90.00	2.13	39.45	-1.1	83.1	500.0	-15.6
4636.75	H	90.00	2.49	34.68	1.1	61.8	500.0	-18.2
7418.80	H	50.00	2.65	32.60	6.8	93.8	500.0	-14.5
8346.15	H	180.00	2.46	31.52	6.8	82.4	500.0	-15.7
9273.50	H	190.00	2.48	31.70	9.3	112.0	500.0	-13.0
Non-harmonics								
74.89	H	270.00	4.00	7.10	9.6	6.8	100.0	-23.3
117.87	H	190.00	4.00	9.10	14.2	14.6	150.0	-20.2
124.77	H	45.00	3.90	5.30	14.6	9.9	150.0	-23.6
136.50	H	50.00	4.00	4.60	14.6	9.1	150.0	-24.3
241.08	H	180.00	3.67	5.90	13.6	9.4	200.0	-26.5
323.33	H	170.00	3.07	24.10	16.6	108.4	200.0	-5.3
405.78	H	280.00	2.19	15.50	18.6	50.9	200.0	-11.9
74.89	H	270.00	4.00	7.10	9.6	6.8	100.0	-23.3
992.04	H	0.00	2.10	19.93	28.4	261.9	500.0	-5.6

5.7 AC Conducted Emissions (FCC Pt.15.207)

As the EUT hardware has not changed from the initial grant this test has not been applied.

5.8 Receiver Radiated Emissions

As the EUT hardware has not changed from the initial grant this test has not been applied.