FCC & IC Certification Test Report

FCC & Industry Canada Certification Test Report
for
Symbol Technologies, Inc.
FCC ID: H9PRD11320
IC ID: 1549D-RD11320

April 11, 2005

Prepared for:

Symbol Technologies, Inc.
1 Symbol Plaza
Holtsville, NY 11742

Prepared By:

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

FCC & Industry Canada Certification Test Report
for the
Symbol Technologies, Inc.
RD11320-16114121US XR-400
FCC ID: H9PRD11320
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April 11, 2005

WLL JOB# 8608-9

Prepared by: Brian J. Dettling
Documentation Specialist

Reviewed by: Gregory M. Snyder
Chief EMC Engineer

Abstract

This report has been prepared on behalf of Symbol Technologies, Inc. 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 of the FCC Rules and Regulations and Spectrum Management and Telecommunications Policy RSS-210 of Industry Canada. This Certification Test Report documents the test configuration and test results for a Symbol Technologies, Inc. RD11320-16114121US XR-400.

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 NIST NVLAP (NVLAP Lab Code: 200066-0) as an independent FCC test laboratory.

The Symbol Technologies, Inc. RD11320-16114121US XR-400 complies with the limits for a Frequency Hopping Spread Spectrum Transmitter device under FCC Part 15.247 and Industry Canada RSS-210.

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1 Introduction

1.1 Compliance Statement

The Symbol Technologies, Inc. RD11320-16114121US XR-400 complies with the limits for a Frequency Hopping Spread Spectrum Transmitter device under FCC Part 15.247 and Industry Canada RSS-210.

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 and the 2003 version of ANSI C63.4. The measurement equipment conforms to ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation.

1.3 Contract Information

Customer:	Symbol Technologies, Inc. 1 Symbol Plaza Holtsville, NY 11742
Quotation Number:	62196-A

1.4 Test Dates

Testing was performed from March 3 to March 31, 2005.

1.5 Test and Support Personnel

Washington Laboratories, LTD	Greg Snyder, Steve Koster, James Ritter
Client Representative	Amit Asthana

2 Equipment Under Test

2.1 EUT Identification & Description

The Symbol Technologies, Inc. RD11320-16114121US XR-400 is an advanced RFID Reader that supports Class 0, Class 1 and GEN 2 Electronic Product Code (EPC) protocol, in the UHF frequency band. The reader consists of two modules within the housing assembly:

- RF Transceiver Module (RFTM)
- Digital Control Module (DCM)

Two antennas are approved with the he XR 400. Both antennas are circularly polarized panel antennas with the highest gain being 6dBi.

Table 1. Device Summary

ITEM	DESCRIPTION
Manufacturer:	Symbol Technologies, Inc.
FCC ID:	H9PRD11320
IC:	1549D-RD11320
EUT Name:	XR-400
Model:	RD11320-16114121US
FCC Rule Parts:	§15.247
Industry Canada:	RSS210
Frequency Range:	902.75M – 927.25MHz
Maximum Output Power:	959.4mW (29.82dBm)
Modulation:	ASK
Occupied Bandwidth:	227.3kHz
Keying:	Automatic
Type of Information:	Data
Number of Channels:	50
Power Output Level	Variable from 14.78dBm to 29.82dBm
Antenna Connector	Reverse TNC
Antenna Type	6dBi panel (Circularly polarized)
Power Source & Voltage:	24Vdc from converter

2.2 Test Configuration

The XR400 unit was powered by 24Vdc power provided from an external 100-240Vac power adapter. For radiated emissions testing the RD11320-16114121US XR 400 unit was connected via TX1 and RX1 ports to a 6dBi panel antenna. For conducted spurious emissions testing the TX1 port was connected via an appropriate sized attenuator to the input of the spectrum analyzer. A laptop PC containing the required software and commands was connected via the LAN (RJ45) port and a DB9 com port.

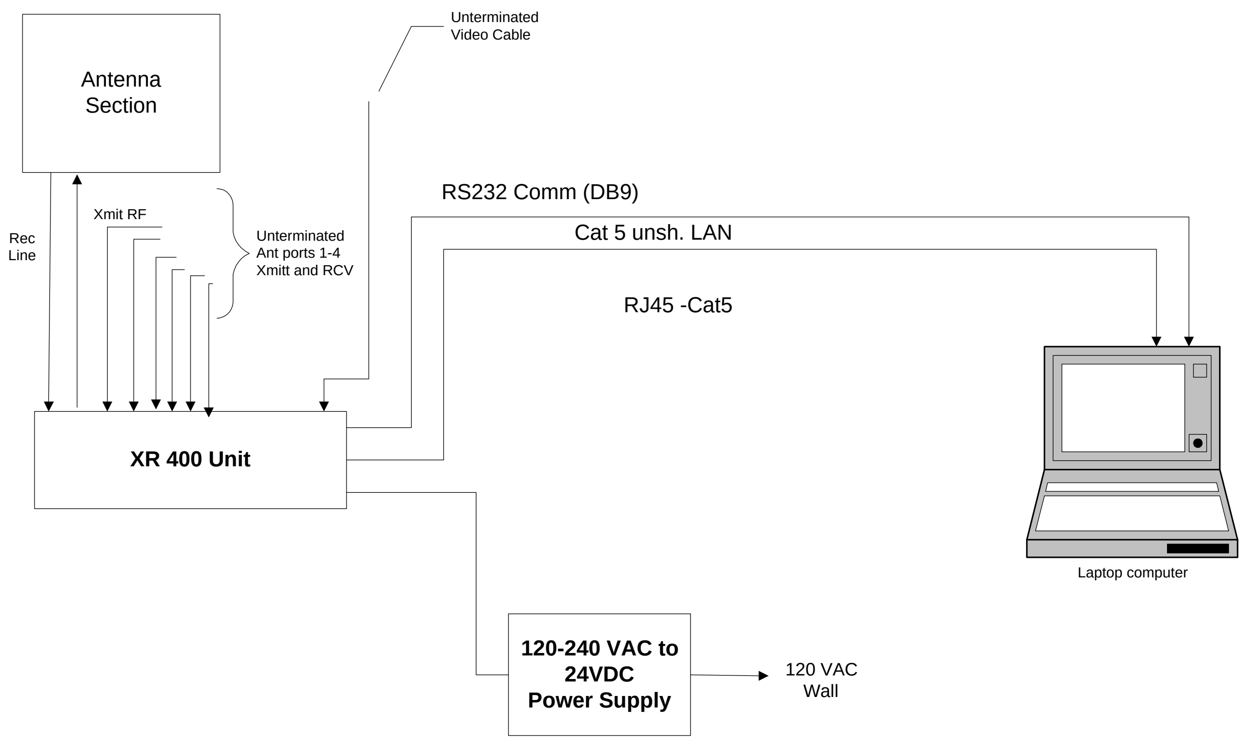

Figure 2-1. Test Configuration

2.3 Testing Algorithm

For the tests requiring the frequency hopping to be active the Symbol supplied "Matrics Tag Tracker ver. 4.0.2" software program was used. For tests requiring the hopping be suspended the "ART" commands via Hyperterminal were used to control the radio.

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 NIST NVLAP (NVLAP Lab Code: 200066-0) 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 American National Standard for Methods of Measurement of Radio-Noise Emissions 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. For the purposes of the measurements performed by Washington Laboratories, the measurement uncertainty is ±2.3 dB. This has been calculated for a *worst-case situation* (radiated emissions measurements performed on an open area test site).

The following measurement uncertainty calculation is provided:

$$\text{Total Uncertainty} = (A^2 + B^2 + C^2)^{1/2}/(n-1)$$

where:

A = Antenna calibration uncertainty, in dB = 2 dB

B = Spectrum Analyzer uncertainty, in dB = 1 dB

C = Site uncertainty, in dB = 4 dB

n = number of factors in uncertainty calculation = 3

Thus, Total Uncertainty = $0.5\,(2^2 + 1^2 + 4^2)^{1/2} = \pm 2.3$ dB.

3 Test Equipment

Table 2 shows a list of the test equipment used for measurements along with the calibration information.

Table 2: Test Equipment List

Site 2 List:

Equipment	**WLL Asset #**	**Calibration Due**
Hewlett-Packard 8568B Spectrum Analyzer	0073	7/08/05
Hewlett-Packard 85650A Quasi-Peak Adapter	0069	7/08/05
Hewlett-Packard 8593A Spectrum Analyzer	0074	8/17/05
Hewlett-Packard 8449B Microwave Preamp	0312	9/29/05
Solar Electronics 8012-50-R-24BNC LISN	0125	10/01/05
Solar Electronics 8012-50-R-24-BNC LISN	0126	10/01/05
ARA LPB-2520 BiconiLog Antenna	0007	9/14/05
ARA DRG118/A Microwave Horn Antenna	0425	4/17/05
Hewlett-Packard 85685A RF Preselector	0071	7/08/05
EMCO 3110B Biconical Antenna	0026	6/22/05
EMCO 3146A Log Periodic Antenna	0029	6/24/05

4 Test Results

4.1 Occupied Bandwidth: (FCC Part §2.1049)

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

For Frequency Hopping Spread Spectrum Systems operating in the 902M – 928MHz band the maximum 20 dB channel bandwidth shall not exceed 500kHz.

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

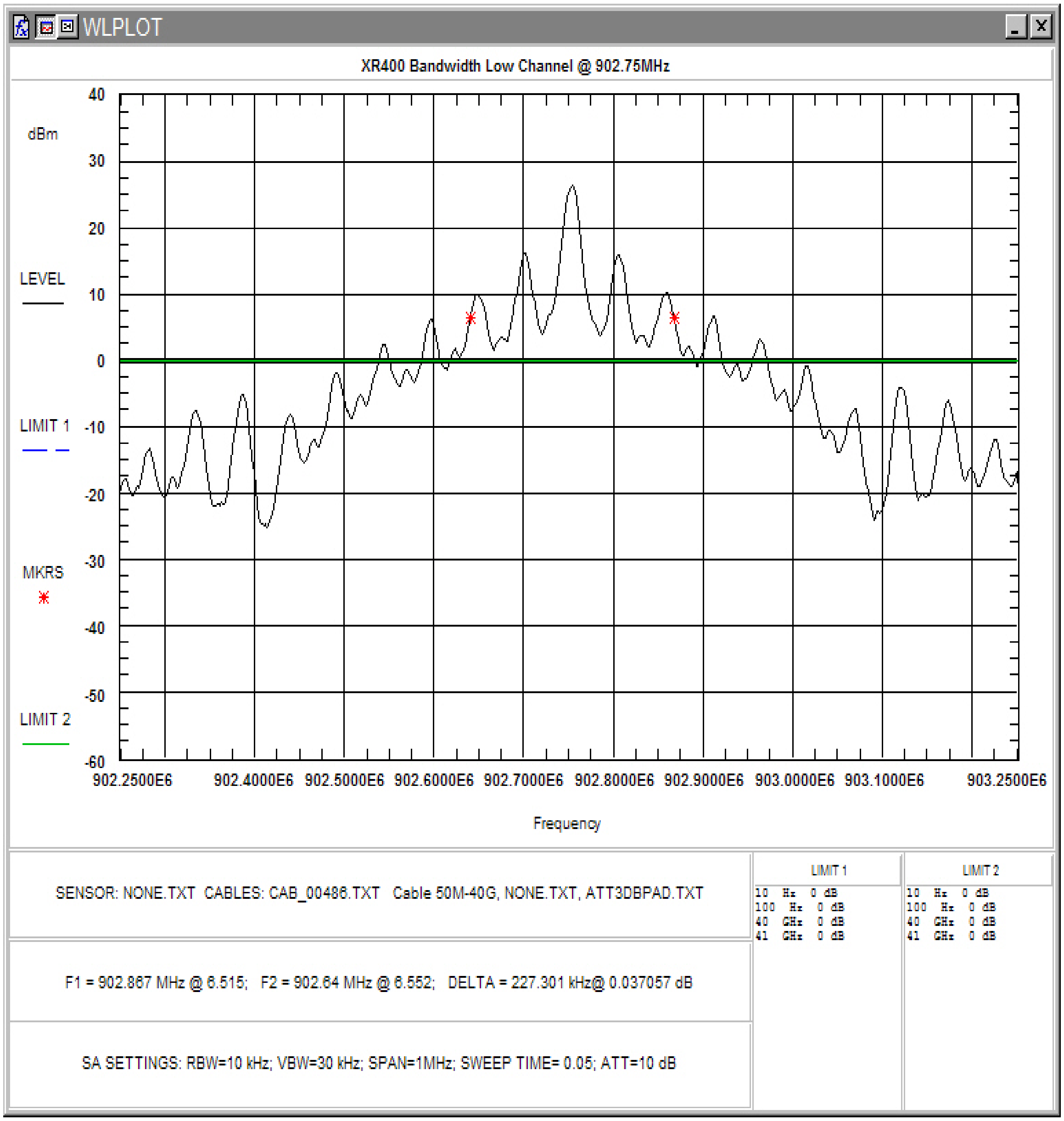

Figure 4-1. Occupied Bandwidth, Low Channel

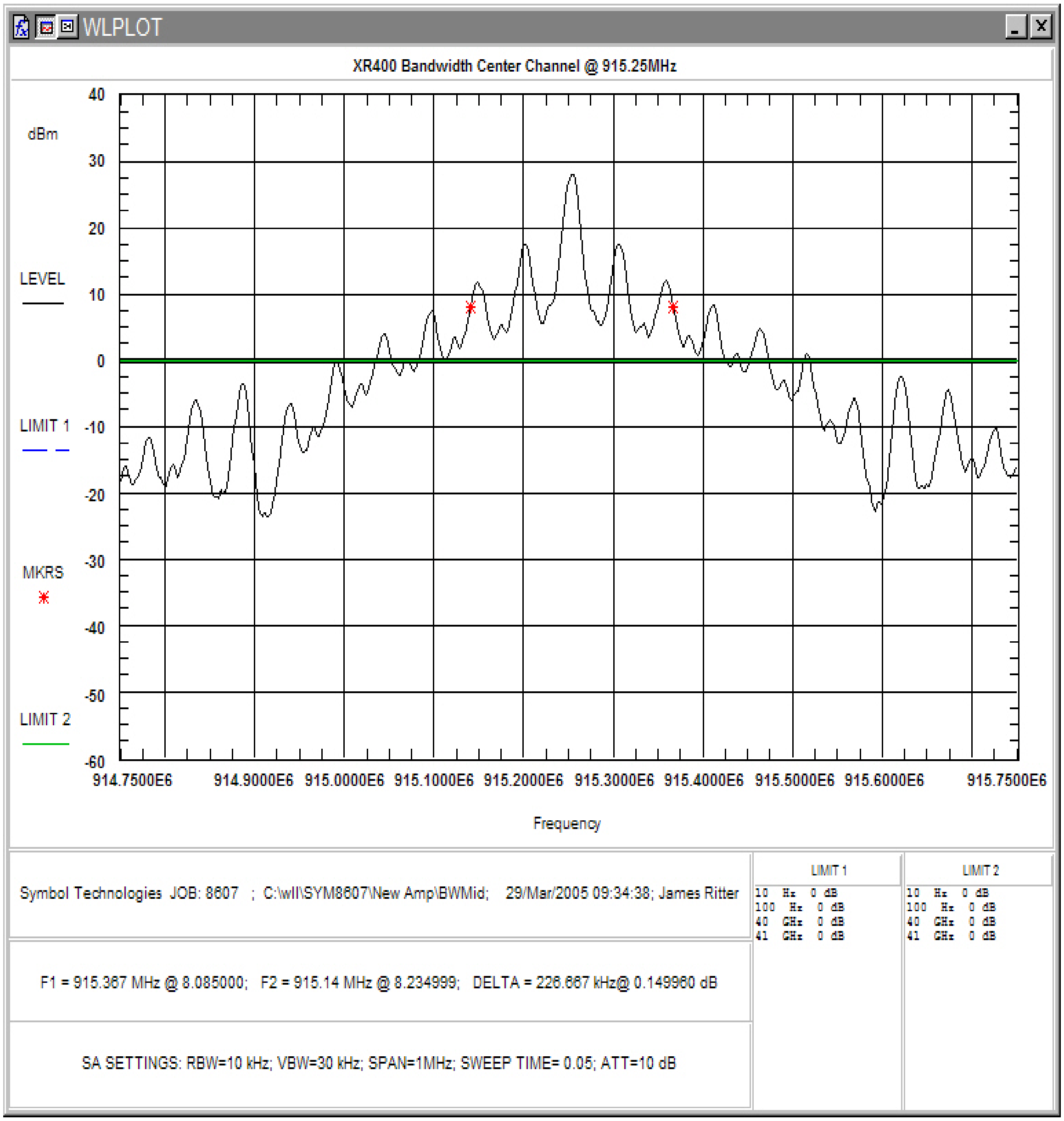

Figure 4-2. Occupied Bandwidth, Mid Channel

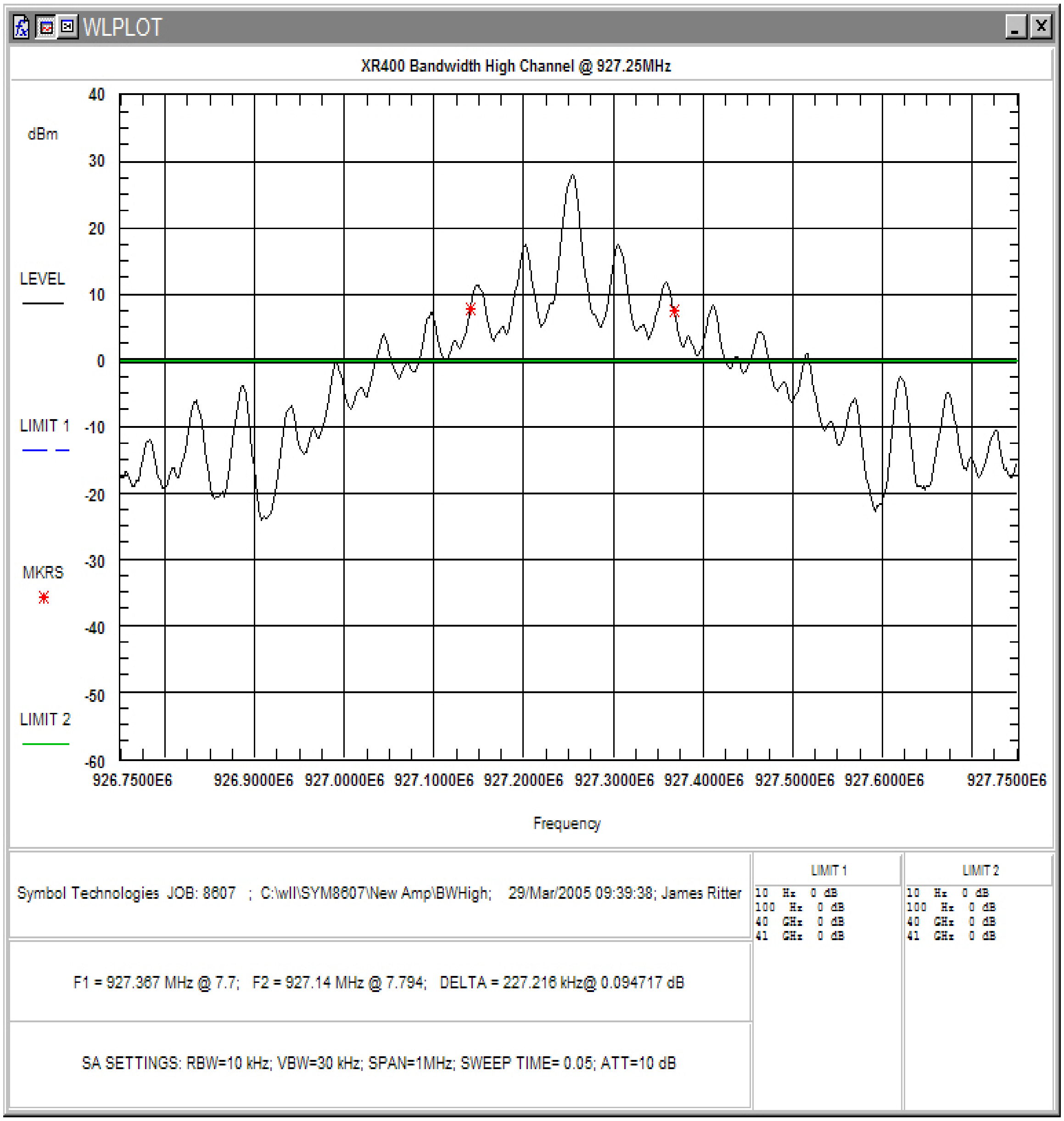

Figure 4-3. Occupied Bandwidth, High Channel

Table 3 provides a summary of the Occupied Bandwidth Results.

Table 3. Occupied Bandwidth Results

Frequency	Bandwidth	Limit	Pass/Fail
Low Channel 902.75MHz	227.301kHz	500kHz	Pass
Mid Channel 915.14MHz	226.667kHz	500kHz	Pass
High Channel 927.25MHz	227.216kHz	500kHz	Pass

4.2 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 middle channel. The output from the transmitter was connected to an attenuator and then to the input of the RF Spectrum Analyzer. The analyzer was set to the center frequency of the selected channel with a span greater than 5 times the 20dB bandwidth. The RBW was set to a value greater than the 20dB bandwidth while the VBW was set much higher than the RBW. The analyzer offset was adjusted to compensate for the attenuator and other losses in the system.

The limit for systems operating in the 902M – 928MHz band with at least 50 hopping channels is 1 watt. Output power was measured at both the maximum setting and the lowest setting.

Table 4. RF Power Output

Frequency	Level	Limit	Pass/Fail
Low Channel 902.725MHz	High 29.82 dBm Low 14.74 dBm	30 dBm	Pass
Mid Channel 915.247MHz	High 29.82 dBm Low 14.78 dBm	30 dBm	Pass
High Channel 927.33MHz	High 29.66 dBm Low 14.54dBm	30 dBm	Pass

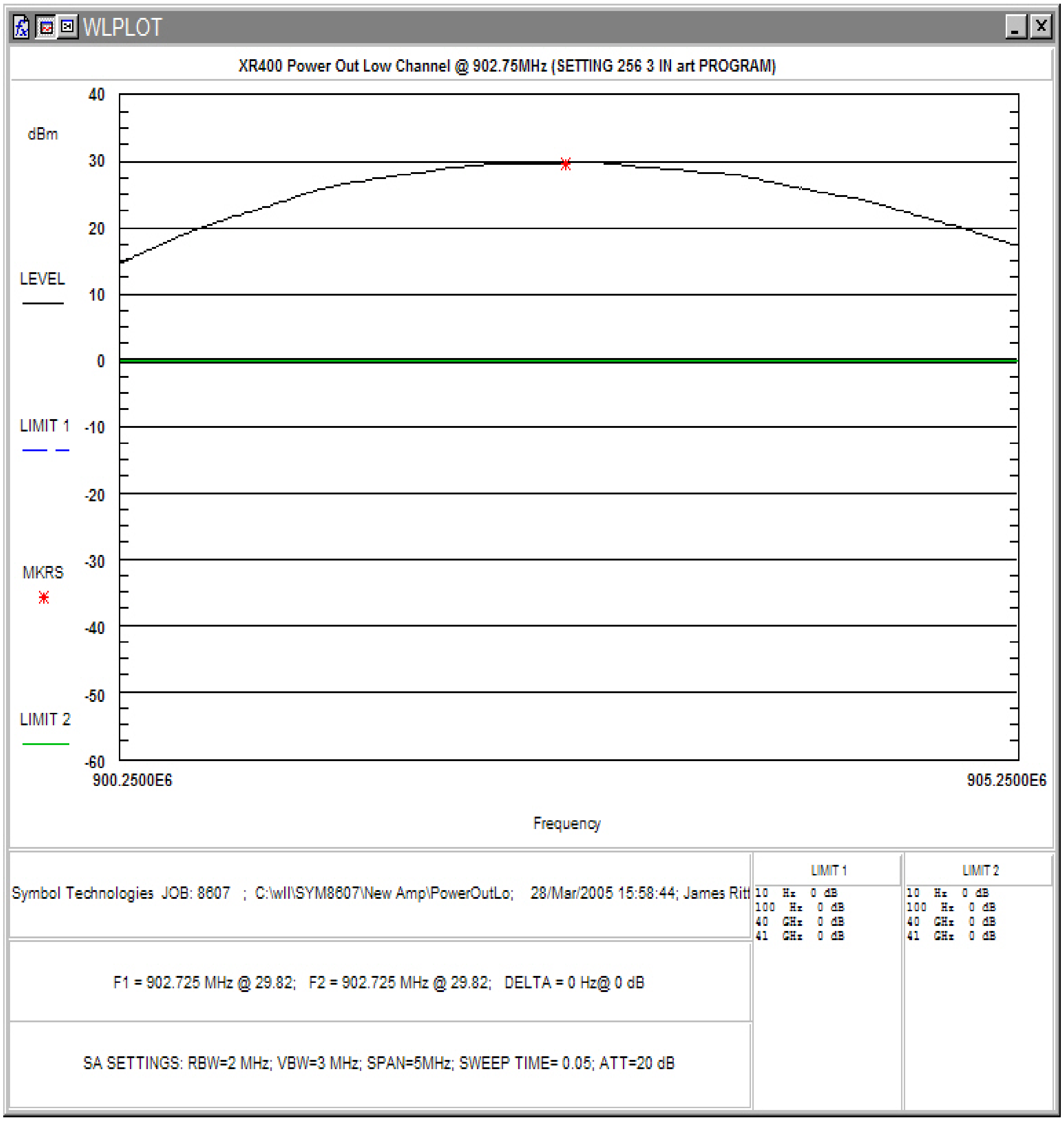

Figure 4-4. RF Peak Power, Low Channel

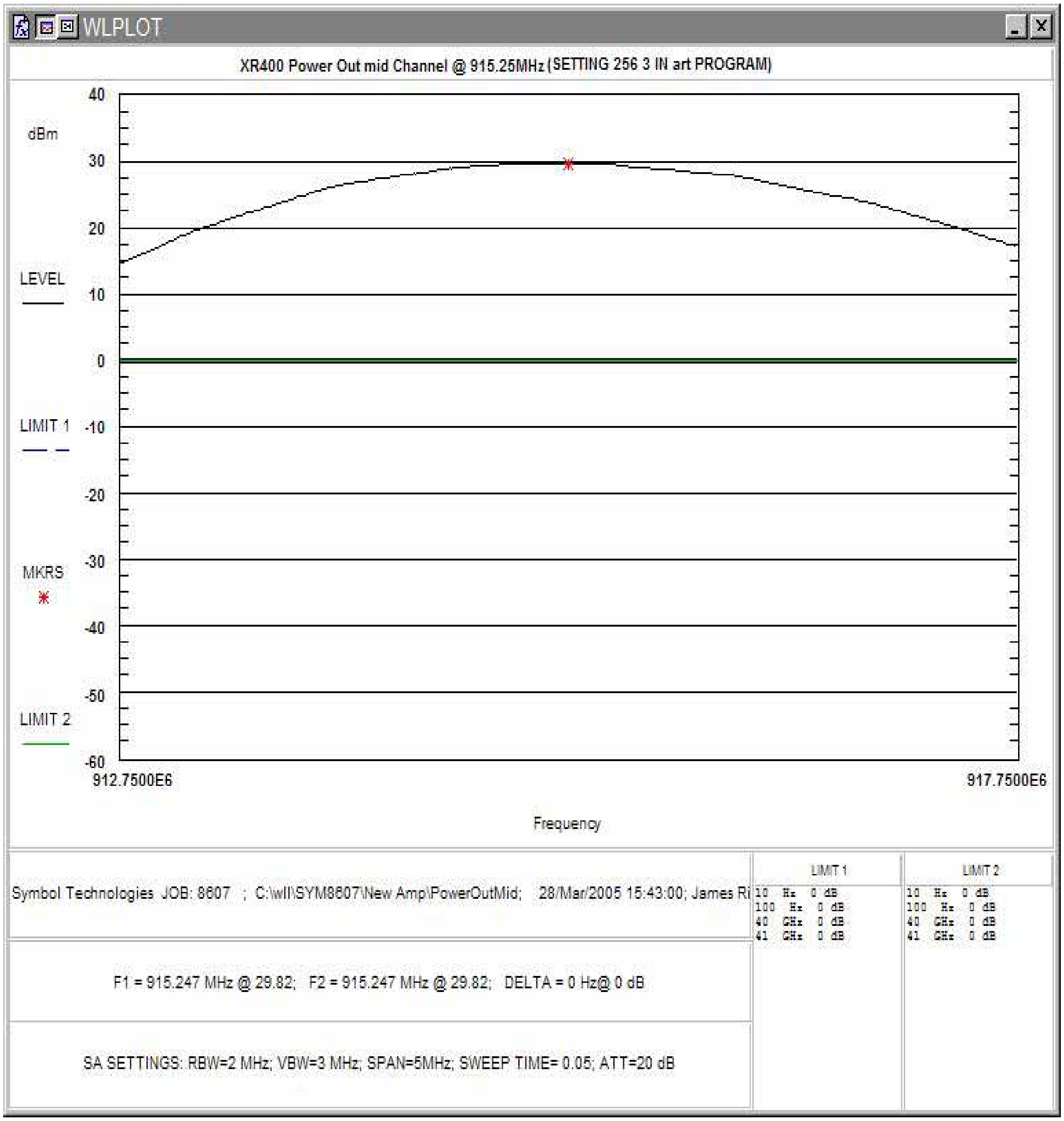

Figure 4-5. RF Peak Power, Mid Channel

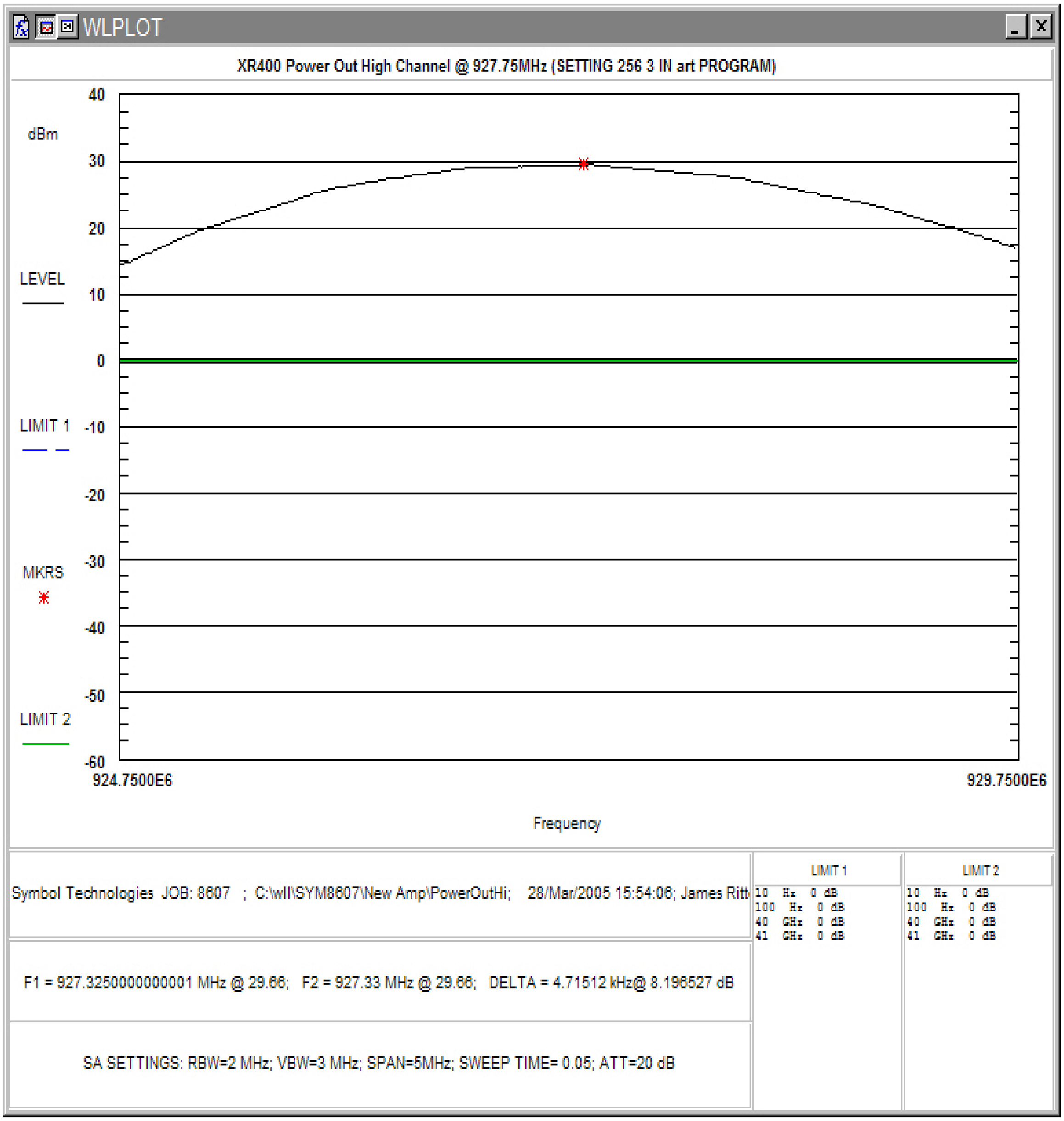

Figure 4-6. RF Peak Power, High Channel

4.3 Carrier Frequency Separation: (FCC Part §15.247(a)(1))

In accordance with the FCC Rules a frequency hopping system shall have hopping channel carriers frequencies separated by a minimum of 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater.

As the maximum 20dB channel bandwidth of the EUT was measured at 227.301kHz the channel spacing must also be greater than 227.301kHz.

Figure 4-7 is a plot of the EUT in the hopping mode which shows the spacing between adjacent channels. The carrier frequency separation was measured at 497.11kHz and therefore is compliant with the requirements.

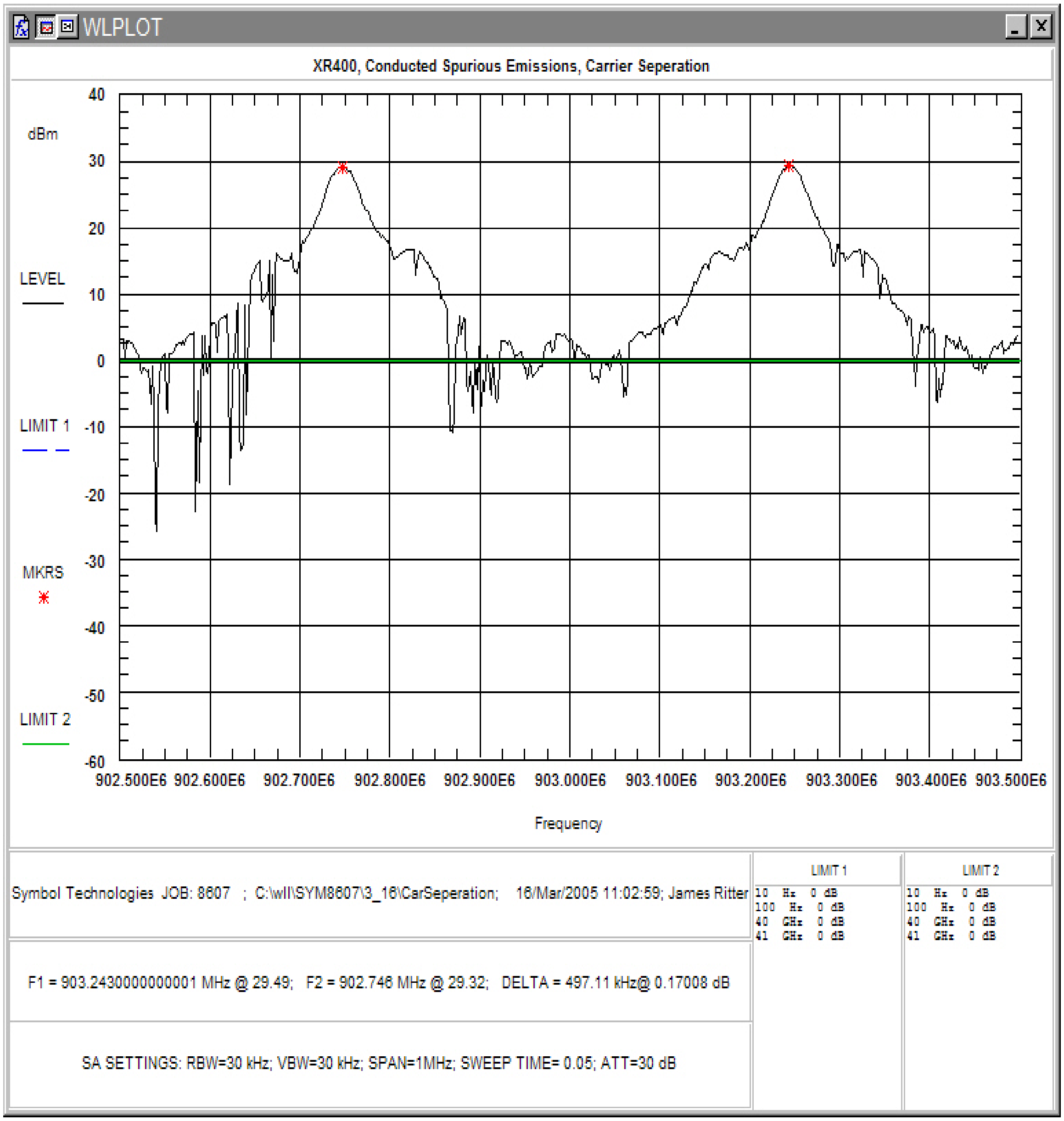

Figure 4-7. Carrier Frequency Separation

4.4 Time of Occupancy and Duty Cycle Correction: (FCC Part §15.247(a)(1)(i))

Per FCC Part 15.247(a)(1)(i), the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period.

Additionally, in accordance with the FCC Public Notice the spurious radiated emissions measurements may be adjusted if 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 "normal" dwell time of the transmitter was measured and is shown in Figure 4-8. This operation occurs only when no tags are present. However, the pulse width increases as the number of tags being read are increased. The worst case duty cycle is measured as 50 tags are presented to the reader. This dwell time measured to be 108.377ms as shown in Figure 4-9. During emissions testing the unit was set to continuous transmit and no duty cycle correction was applied.

The signal was then observed for a period of 20 seconds to determine the total channel occupancy time. With all channels being used equally the occupancy time can be determined form the time the hop occurs on a channel and the time it takes to return to that channel. As with the dwell time, the average time of occupancy also changes with the number of tags being read. In normal operation with no tags present a channel will be used (on) for 2.7ms every 2.9 sec as shown in Figure 4-10. This figure shows that the channel will used every 2.9 seconds (7 times/20 seconds) for a total occupancy time of 18.9ms. As the dwell time increases the hop time decreases. Figure 4-11 shows the worst case channel occupancy time. This occurs when 50 tags are in the field with a dwell time of 108.377ms every 15.85sec (2 times/20 seconds) for a total occupancy time of 216.754ms.

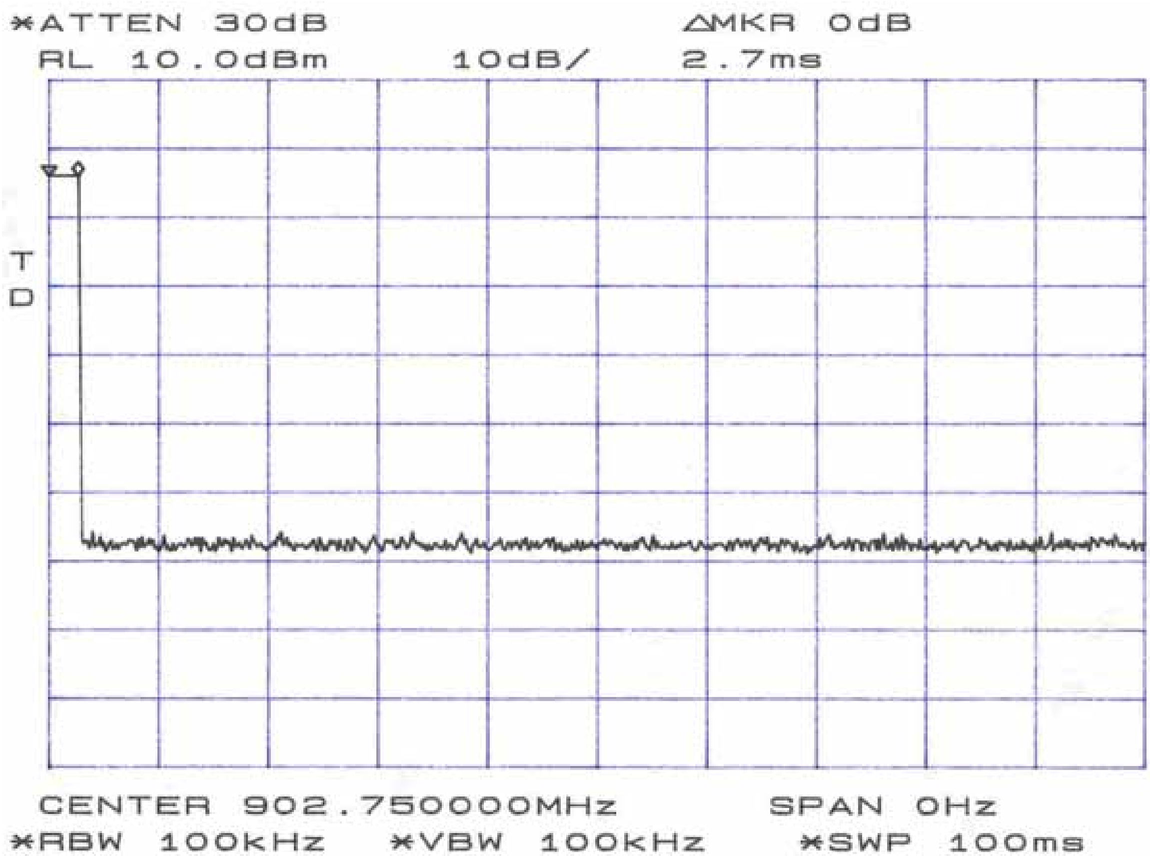

Figure 4-8. Dwell Time, No Tags: 100ms Sweep Time

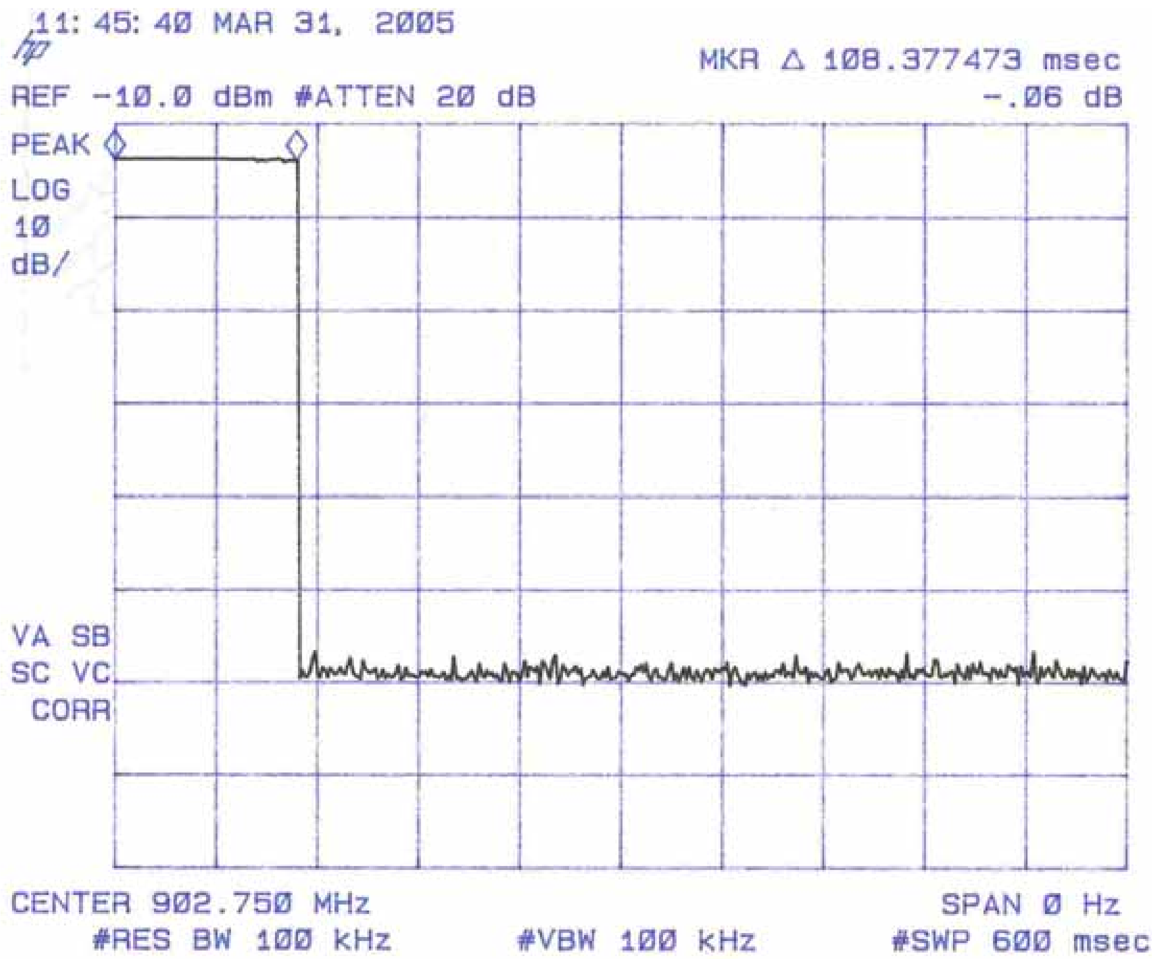

Figure 4-9. Dwell Time, 50Tags: 600ms Sweep Time

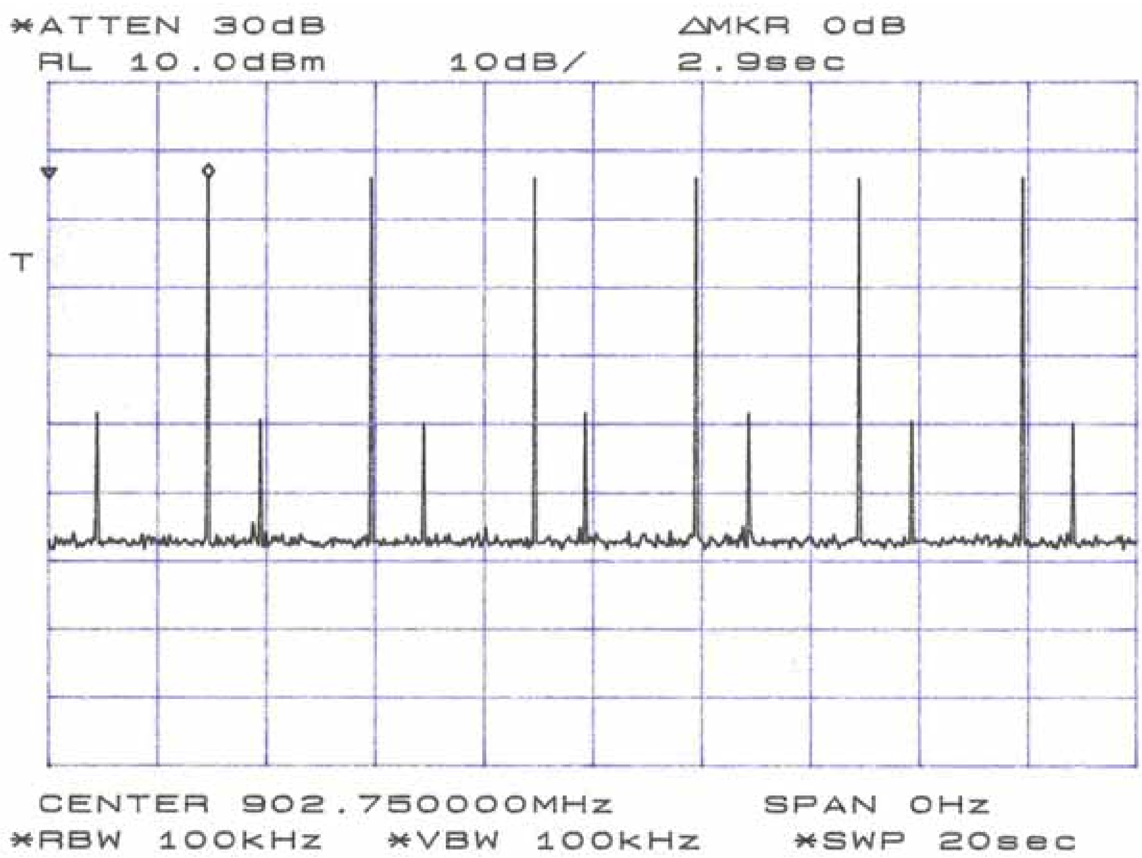

Figure 4-10. Occupancy Time, No Tags: 20sec Sweep Time

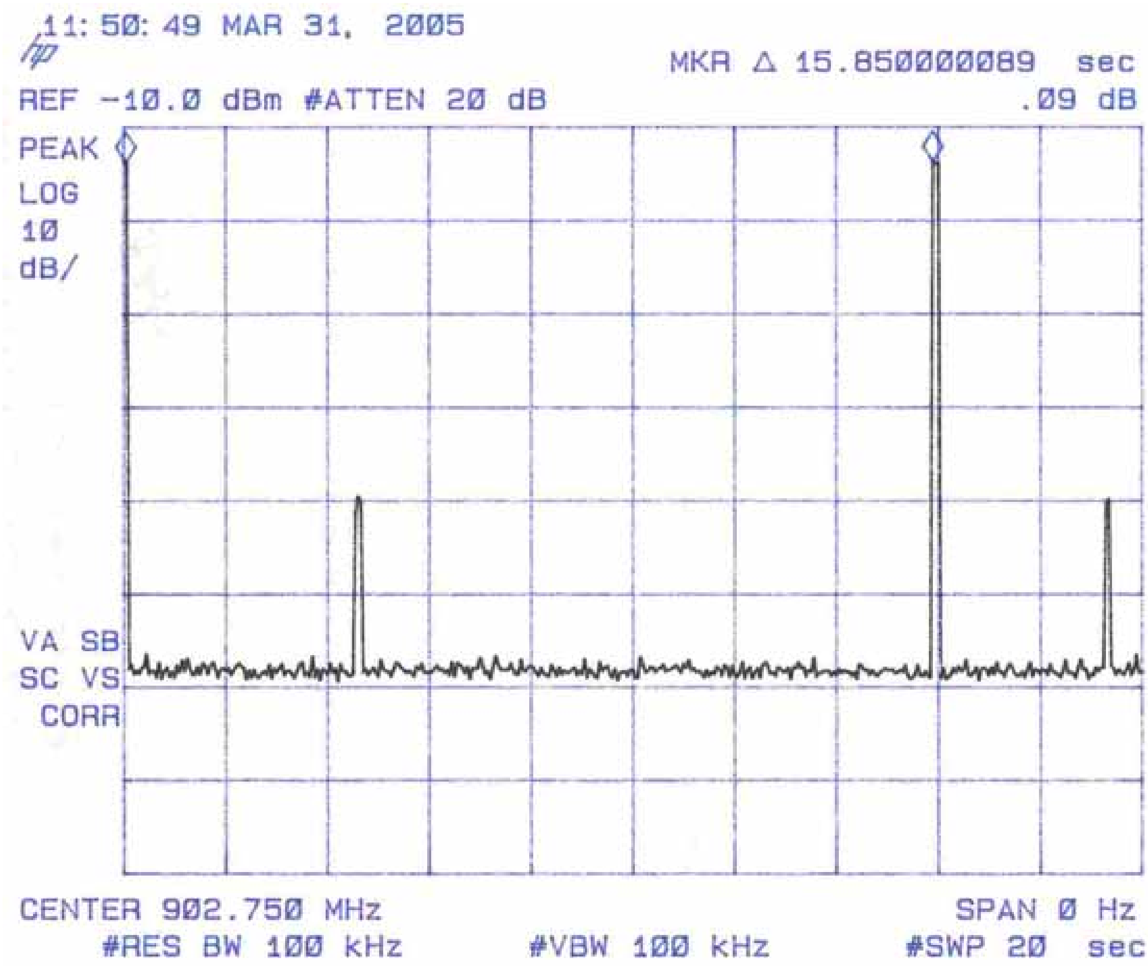

Figure 4-11. Occupancy Time, 50 Tags: 20sec Sweep Time

4.5 Number of Hopping Frequencies: (FCC Part §15.247(a)(1)(i))

In accordance with §15.247(a)(1)(i) a frequency hopping system in the 902M – 928MHz band with a 20dB bandwidth less than 250kHz shall use at least 50 hopping frequencies.

With the unit set to the hopping mode, the number of hopping frequencies were measured. As shown in Figure 4-12 the unit uses 50 channels.

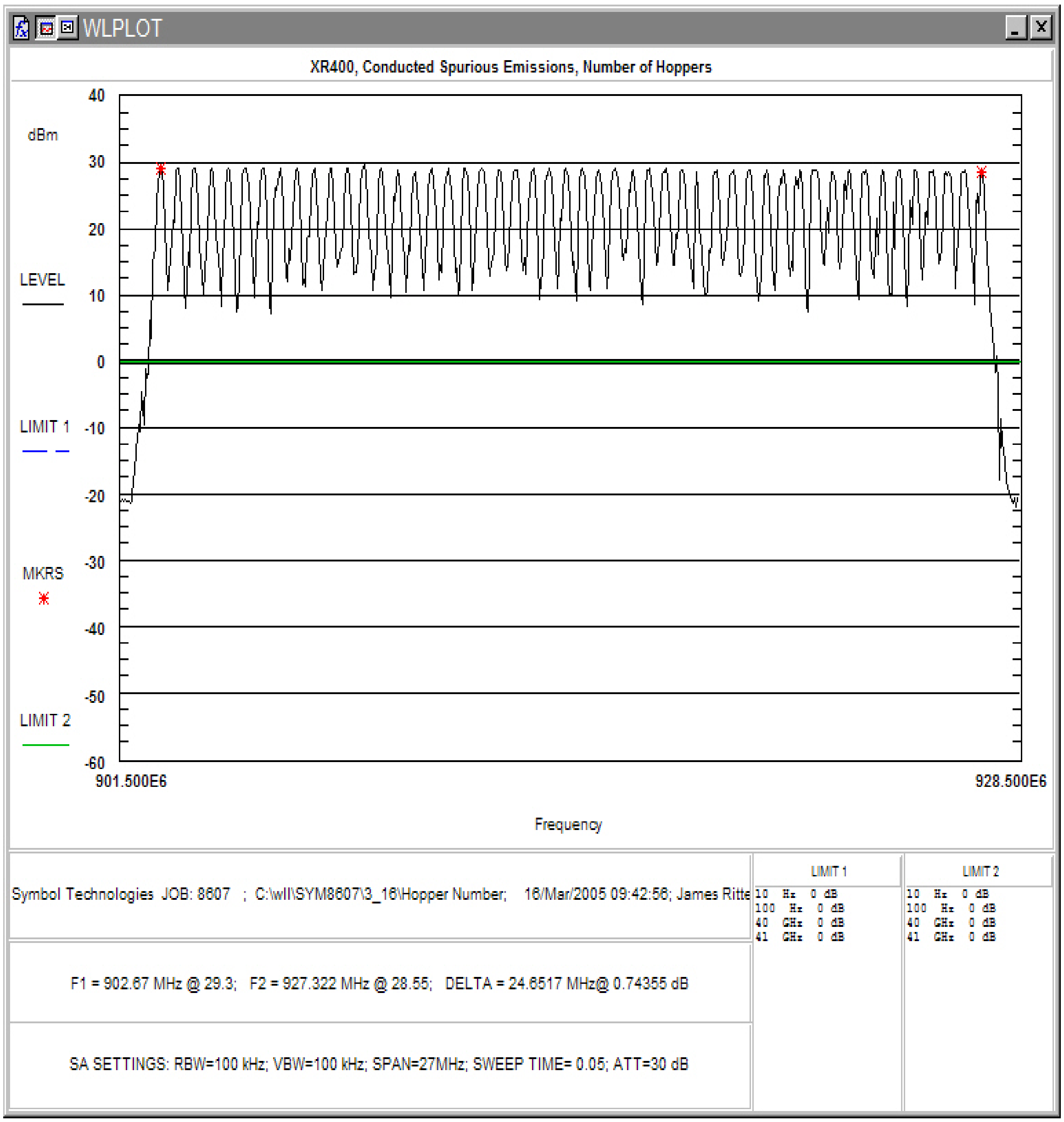

Figure 4-12. Number of Channels Plot, 50 Hopping Channel

4.6 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(d) 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.

To perform the conducted spurious emissions testing, the EUT antenna was removed and the cable was connected directly into a spectrum analyzer through an attenuator. The correction for the external attenuator and test cable(s) are corrected in the data collection software. The spectrum analyzer resolution bandwidth was set to 100 kHz and the video bandwidth was set to 1 MHz. To determine the limit, the amplitude of the EUT carrier frequency was measured using the same settings. The limit was then set to 20 dB below the carrier frequency amplitude. The emissions outside of the allocated frequency band of 902M – 928MHz were then scanned from 30 MHz up to the tenth harmonic of the carrier. Both the Low Power and High Power settings were tested.

The following are plots of the conducted spurious emissions data.

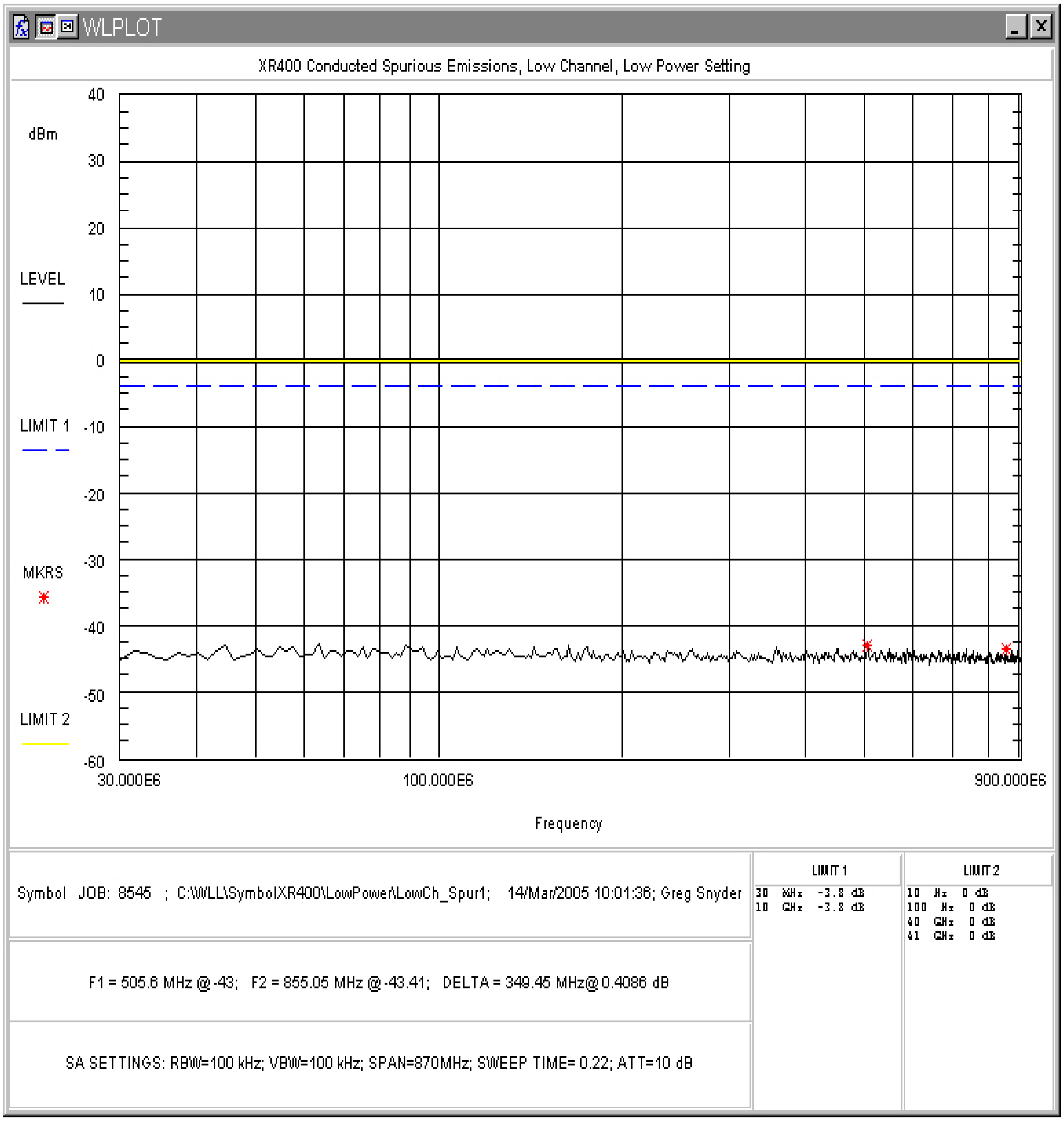

Figure 4-13. Conducted Spurious Emissions, Low Power, Low Channel 30 - 900MHz

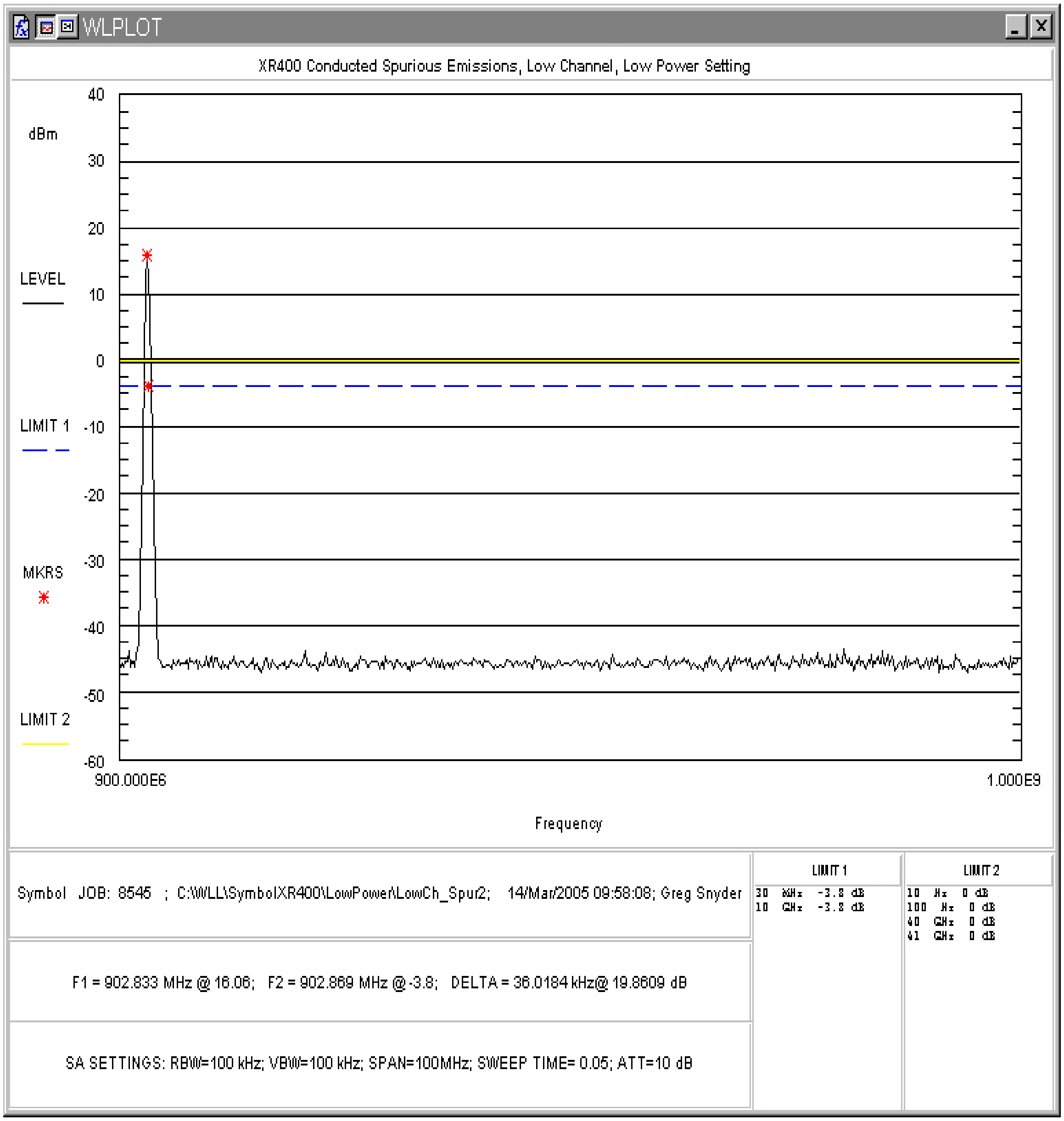

Figure 4-14. Conducted Spurious Emissions, Low Power, Low Channel 900-1000MHz

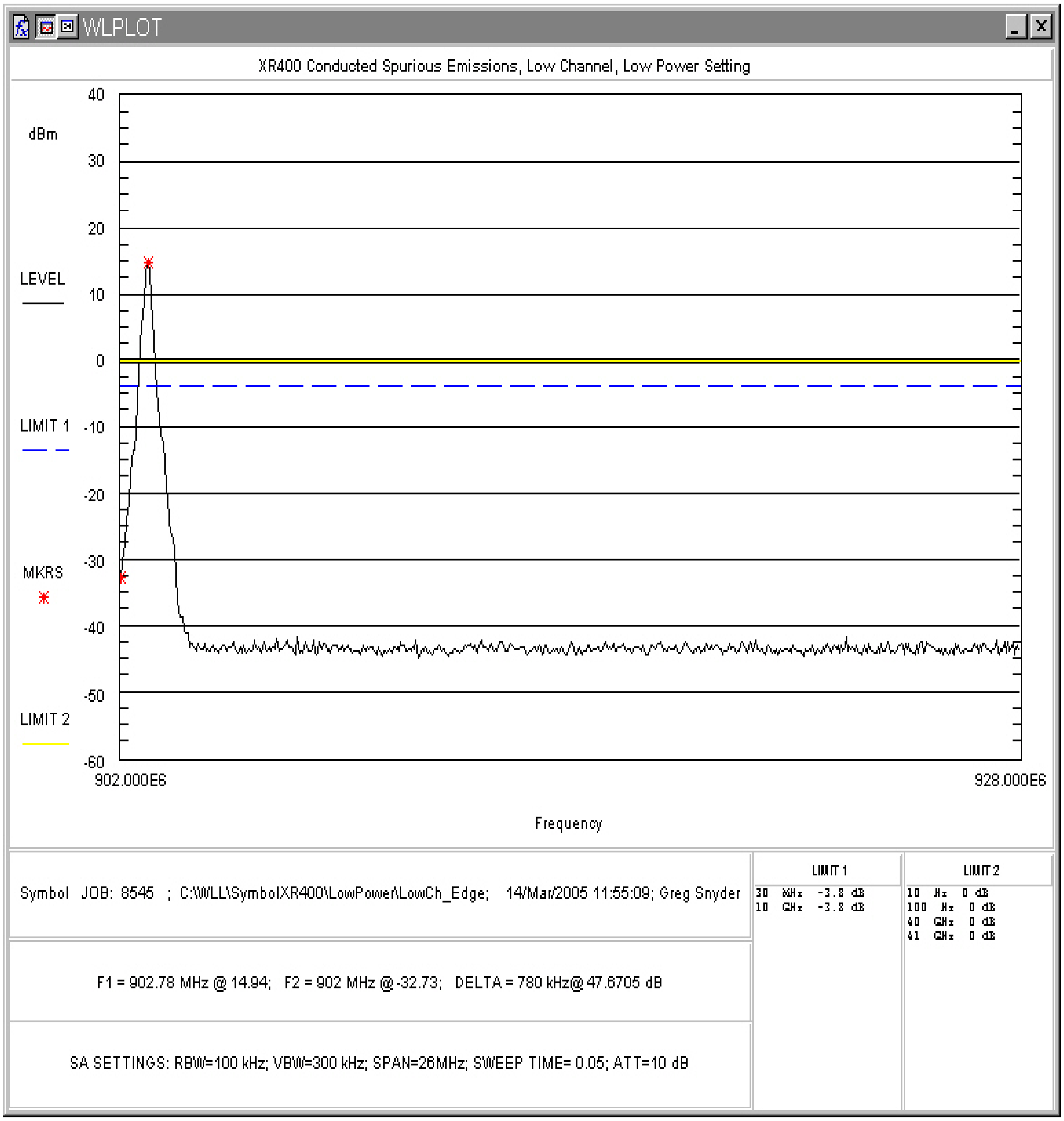

Figure 4-15. Conducted Spurious Emissions, Low Power, Low Channel 902 - 928MHz

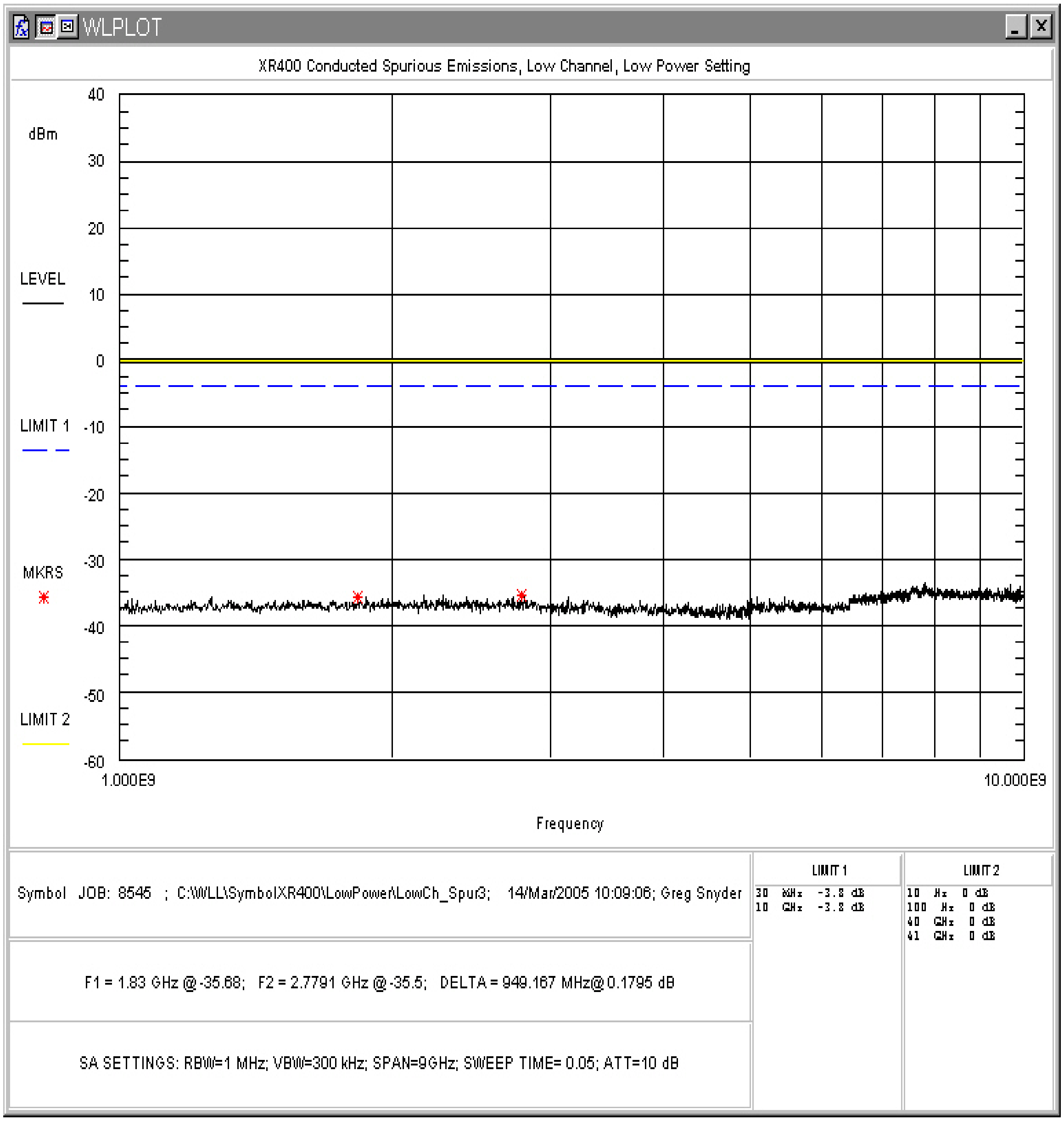

Figure 4-16. Conducted Spurious Emissions, Low Power, Low Channel 1G – 10GHz

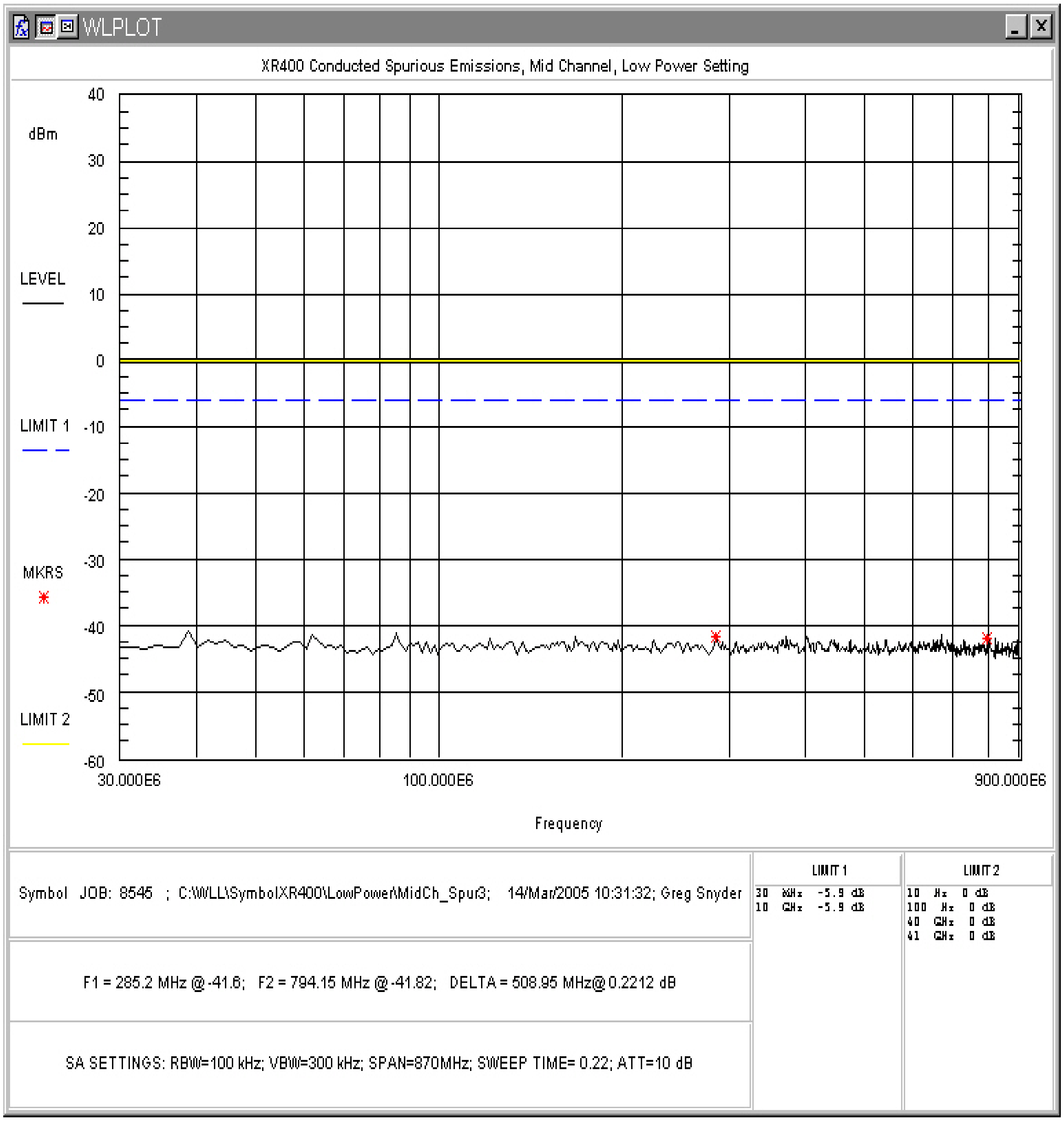

Figure 4-17. Conducted Spurious Emissions, Low Power, Mid Channel 30 - 900MHz

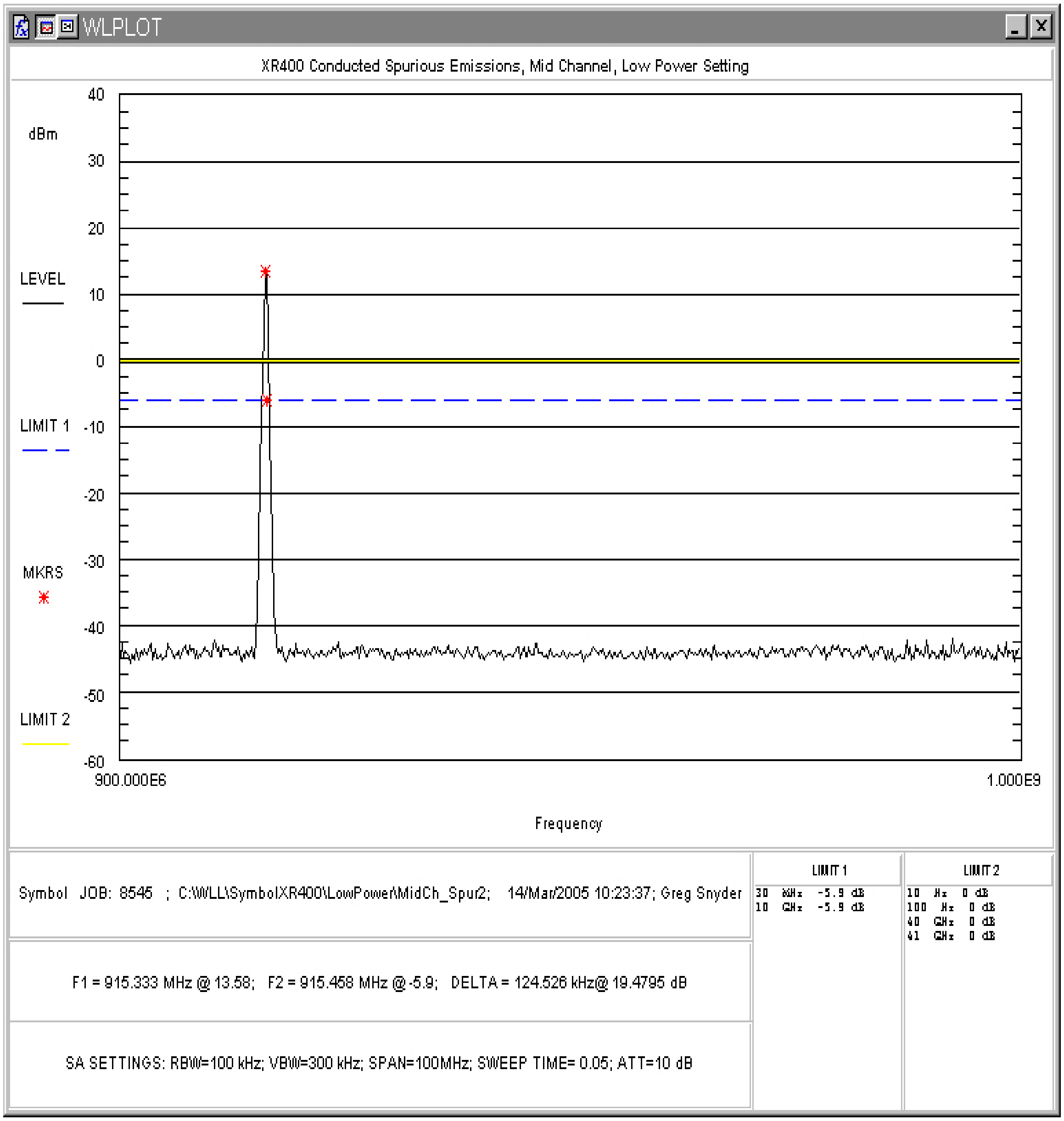

Figure 4-18. Conducted Spurious Emissions, Low Power, Mid Channel 900-1000MHz

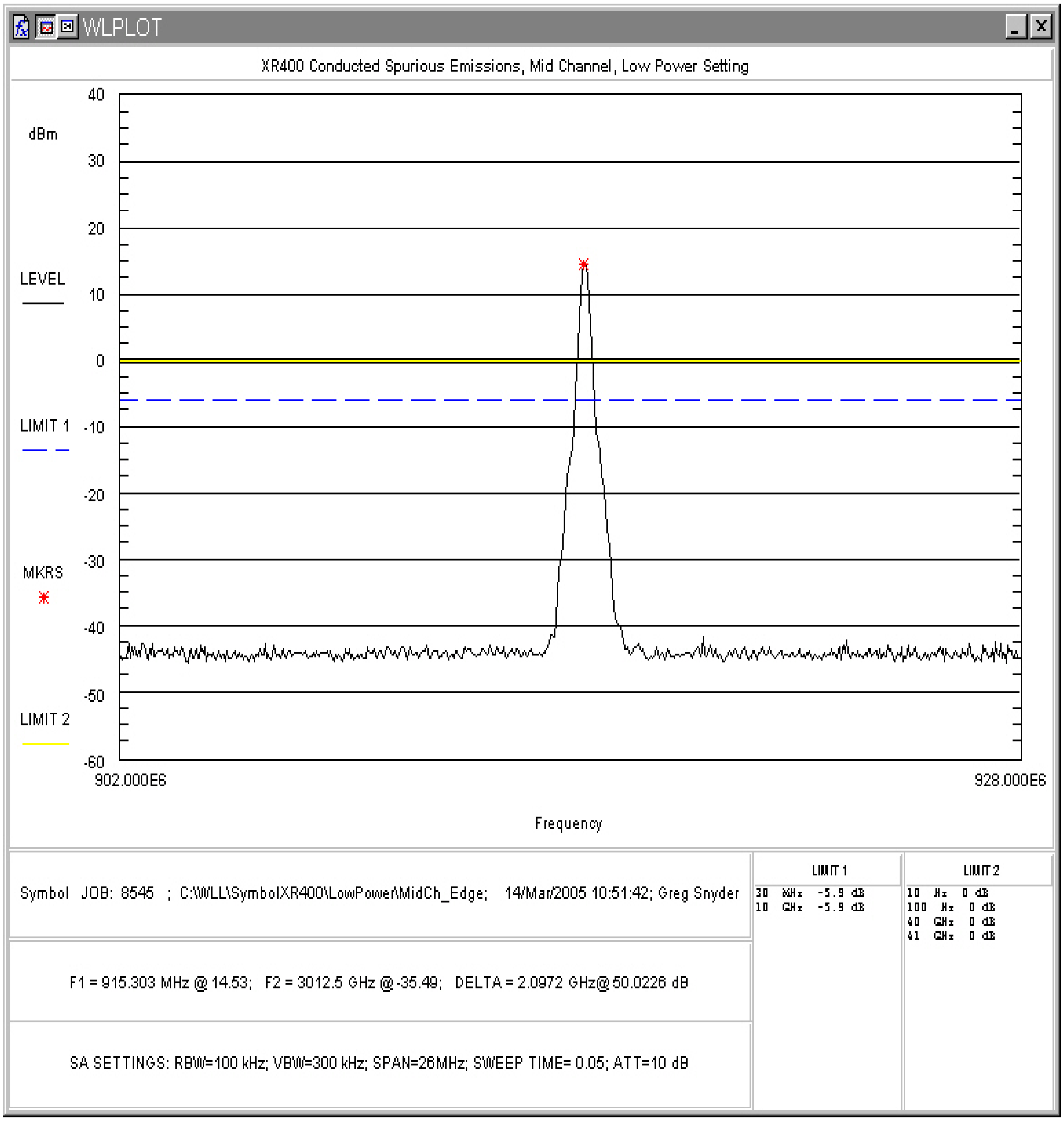

Figure 4-19. Conducted Spurious Emissions, Low Power, Mid Channel 902-928MHz

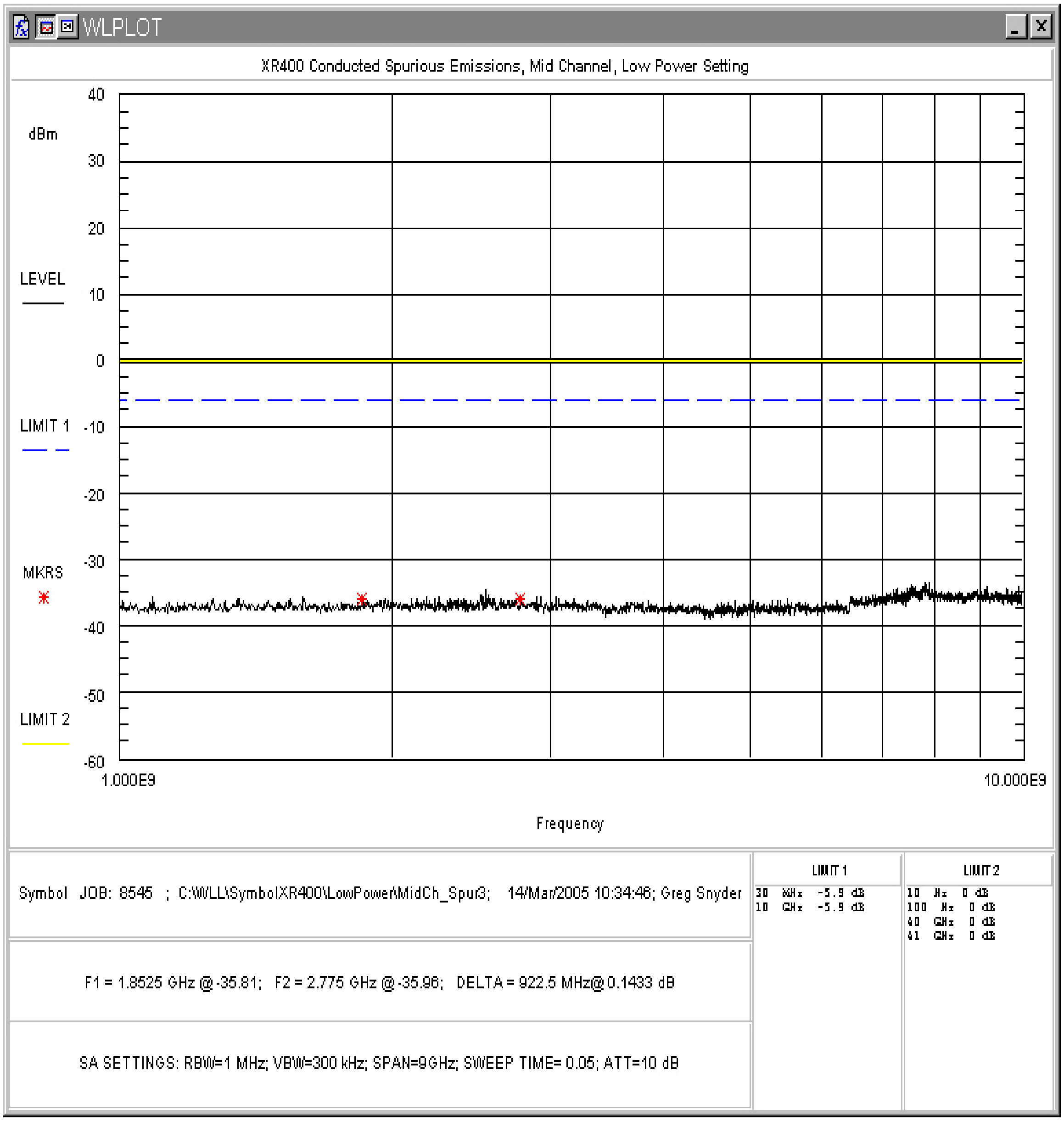

Figure 4-20. Conducted Spurious Emissions, Low Power, Mid Channel 1 – 10GHz

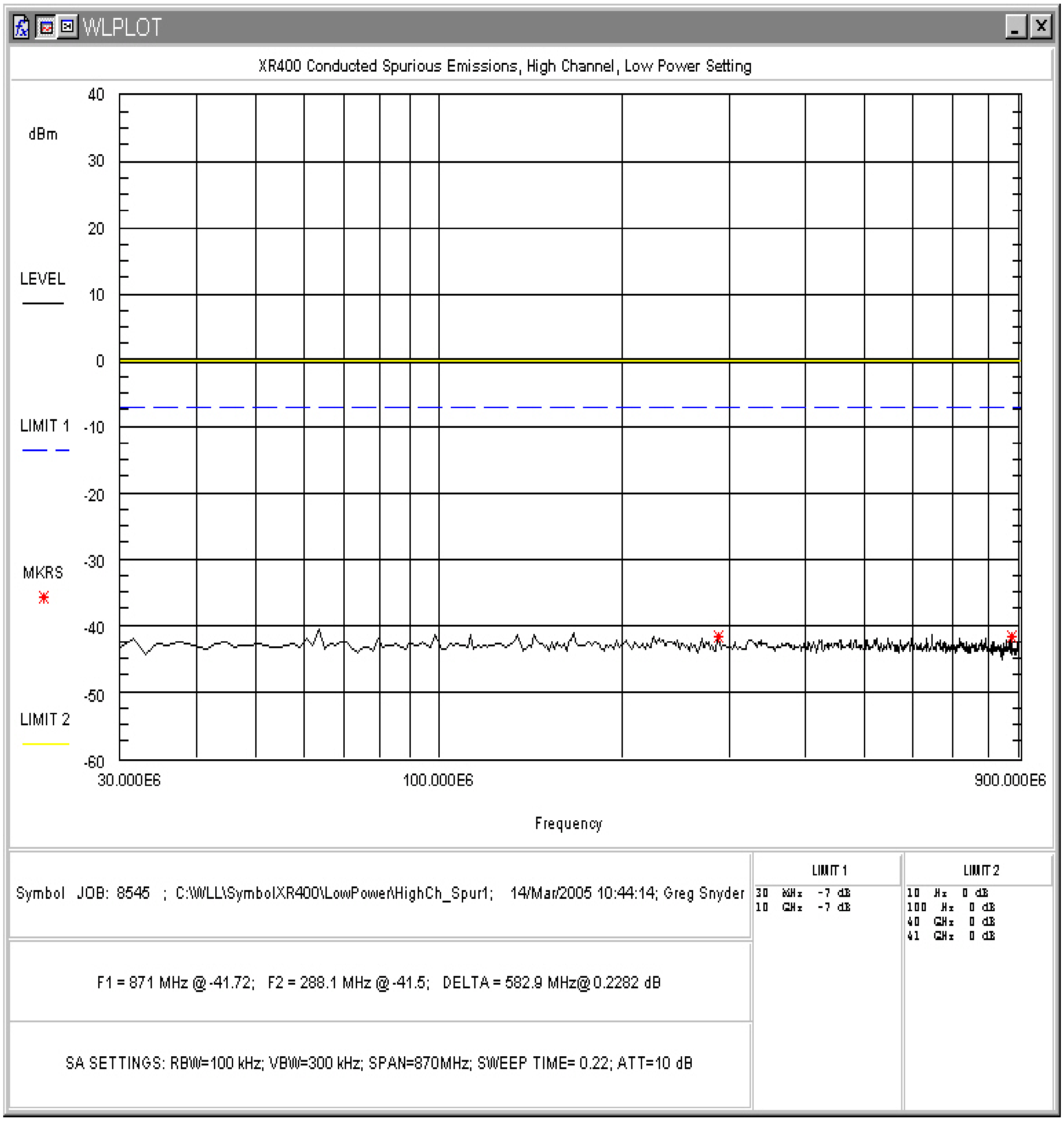

Figure 4-21. Conducted Spurious Emissions, Low Power, High Channel 30 - 900MHz

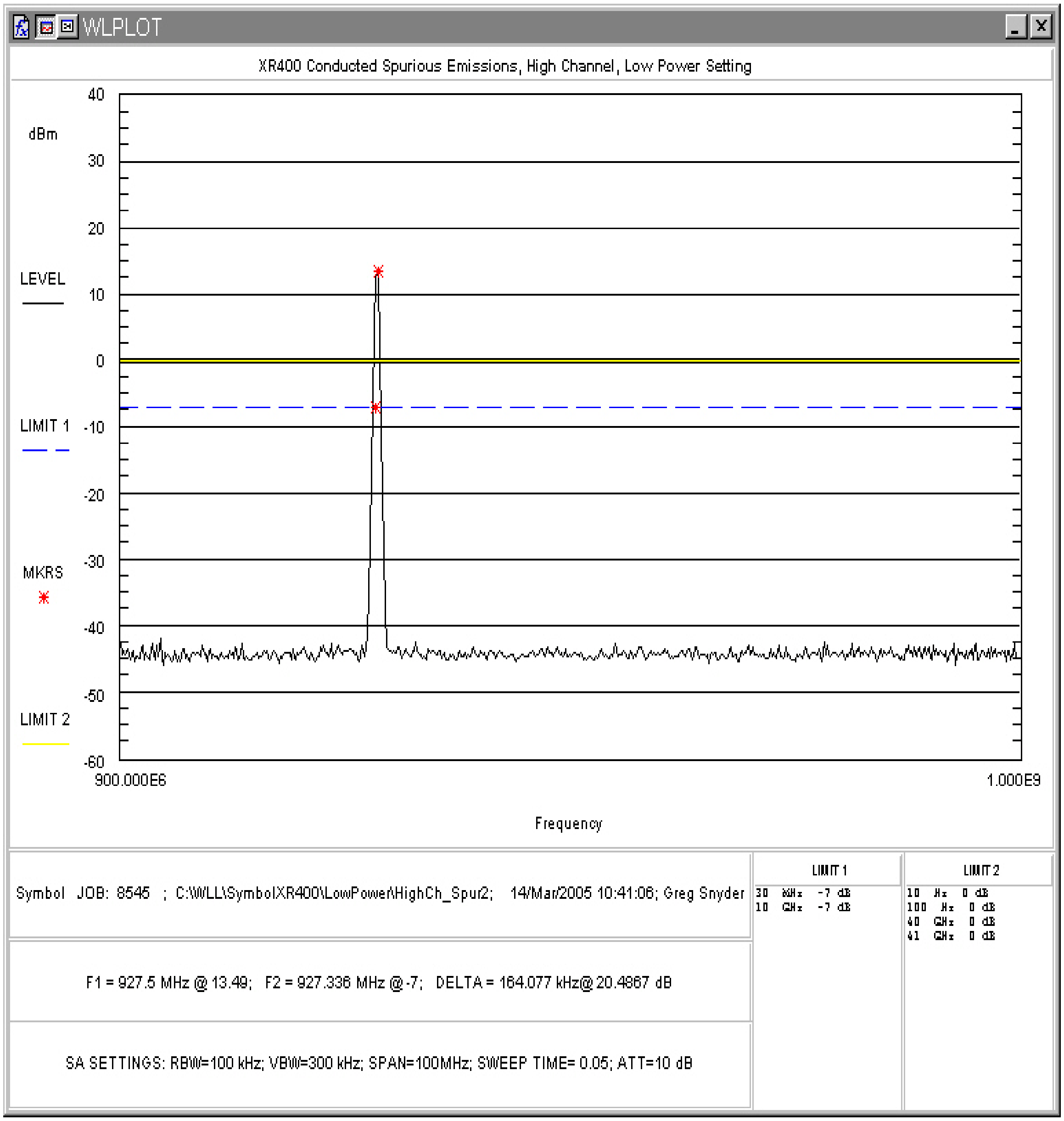

Figure 4-22. Conducted Spurious Emissions, Low Power, High Channel 900-1000MHz

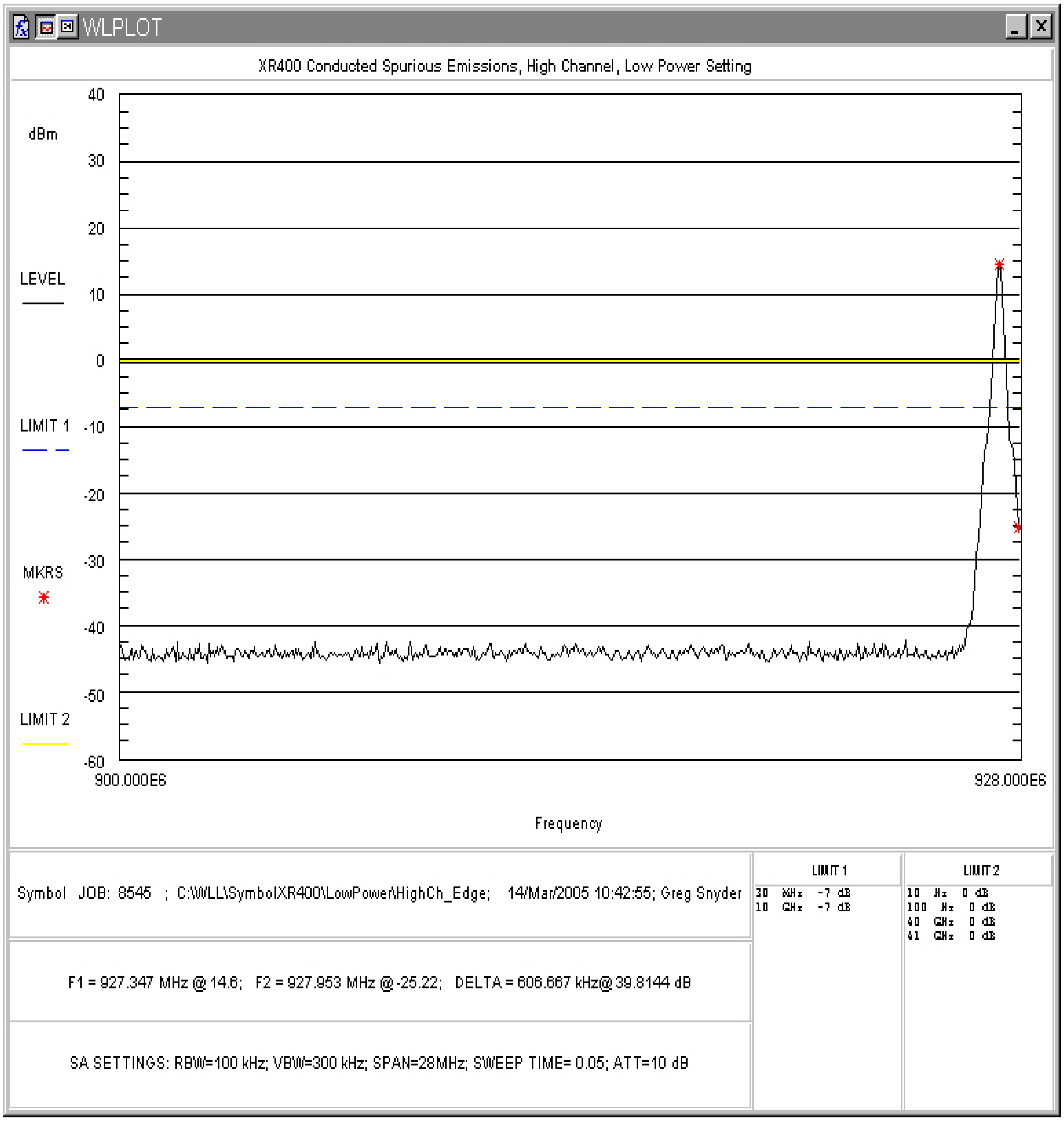

Figure 4-23. Conducted Spurious Emissions, Low Power, High Channel 902-928MHz

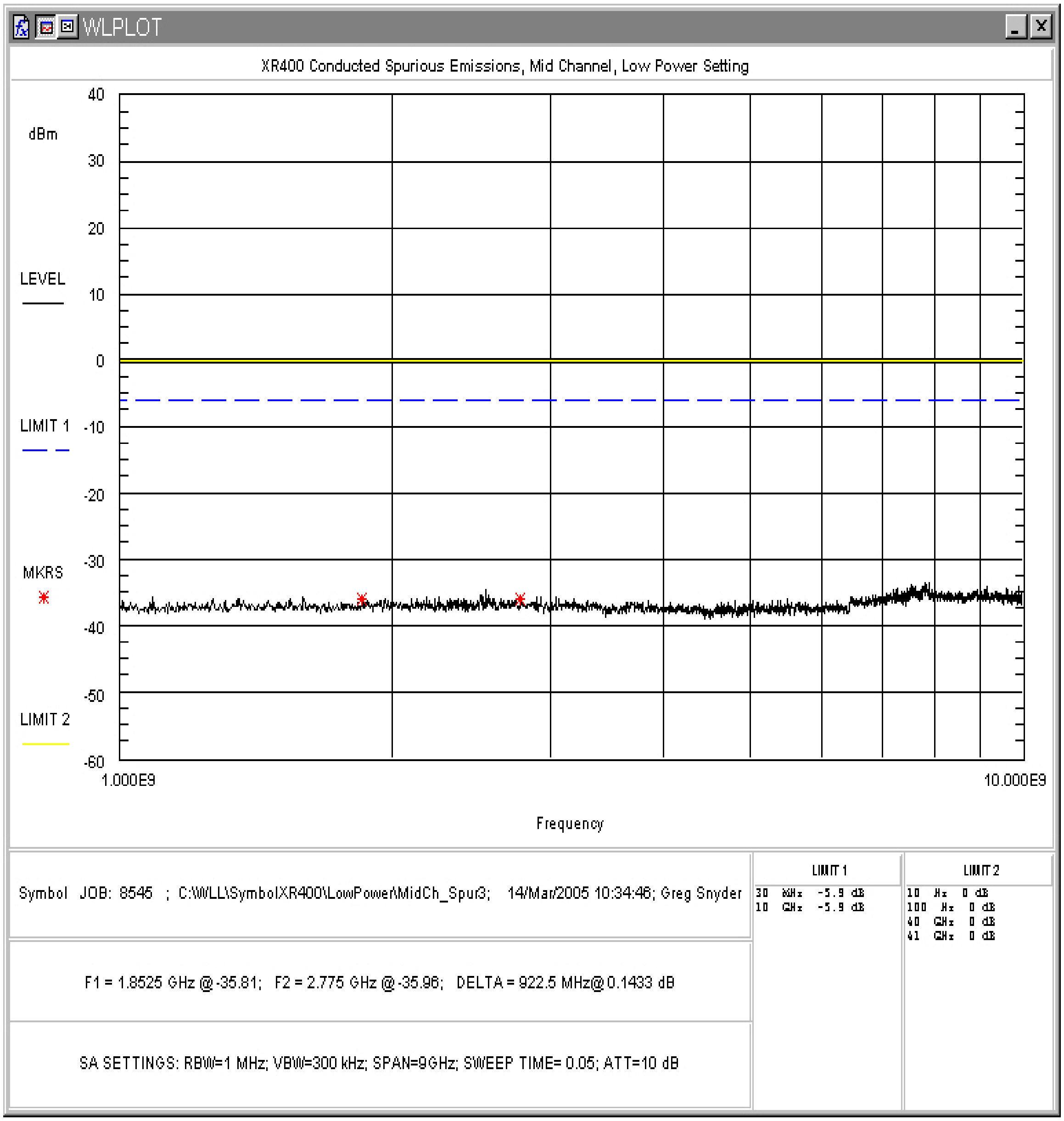

Figure 4-24. Conducted Spurious Emissions, Low Power, High Channel 1 – 10GHz

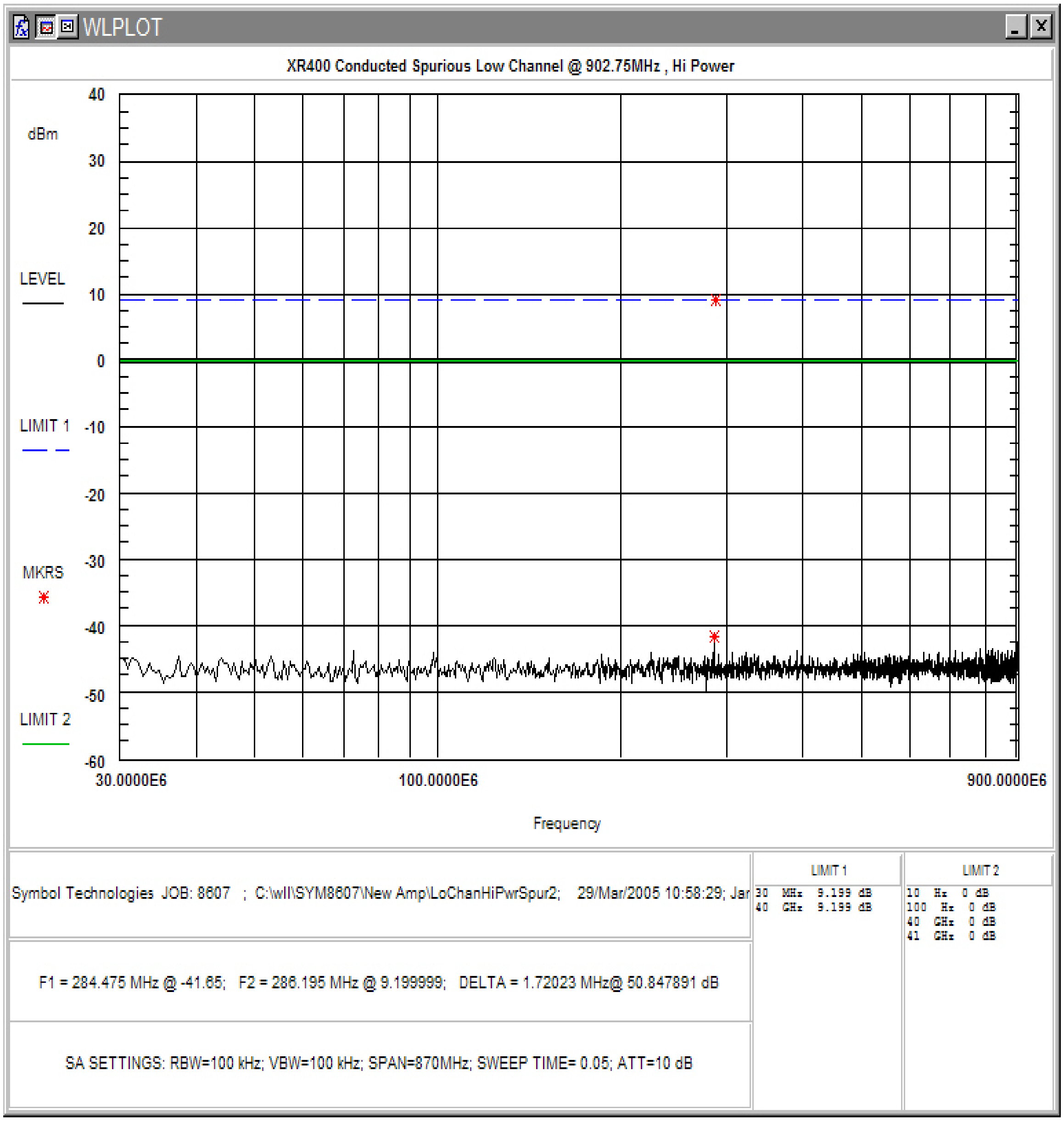

Figure 4-25. Conducted Spurious Emissions, High Power, Low Channel 30 - 900MHz

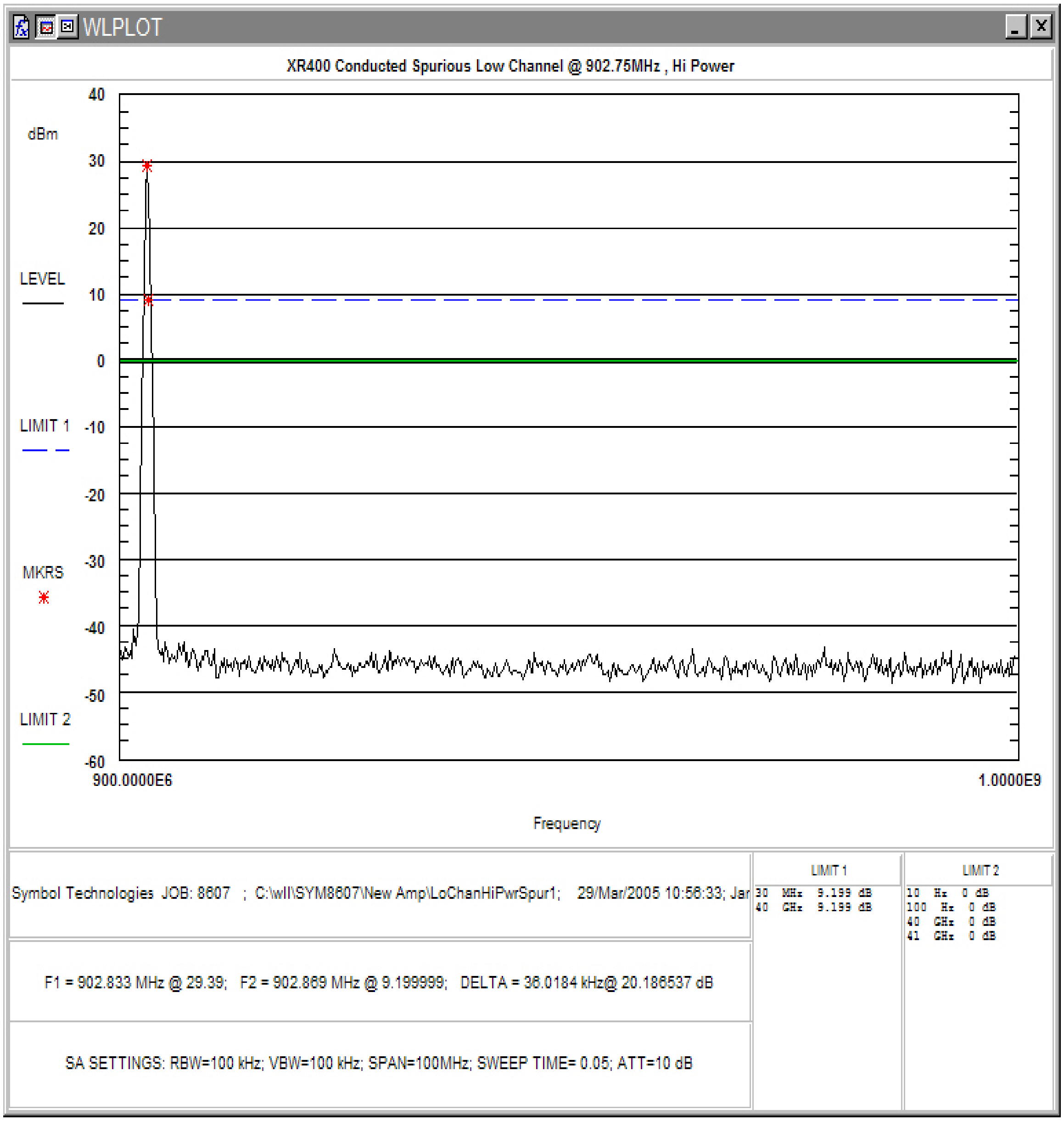

Figure 4-26. Conducted Spurious Emissions, High Power, Low Channel 900-1000MHz

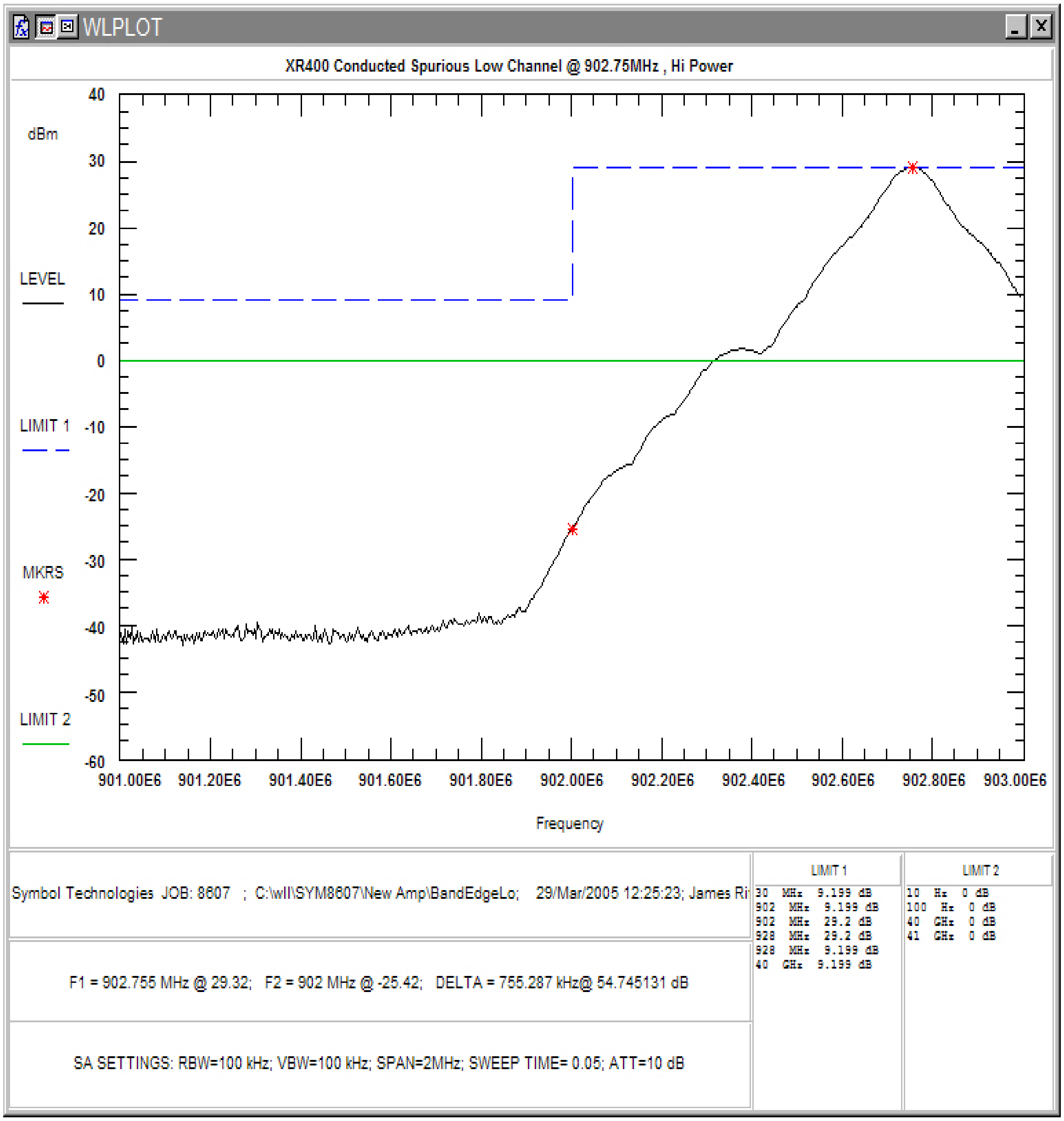

Figure 4-27. Conducted Spurious Emissions, High Power, Low Channel 901-903MHz

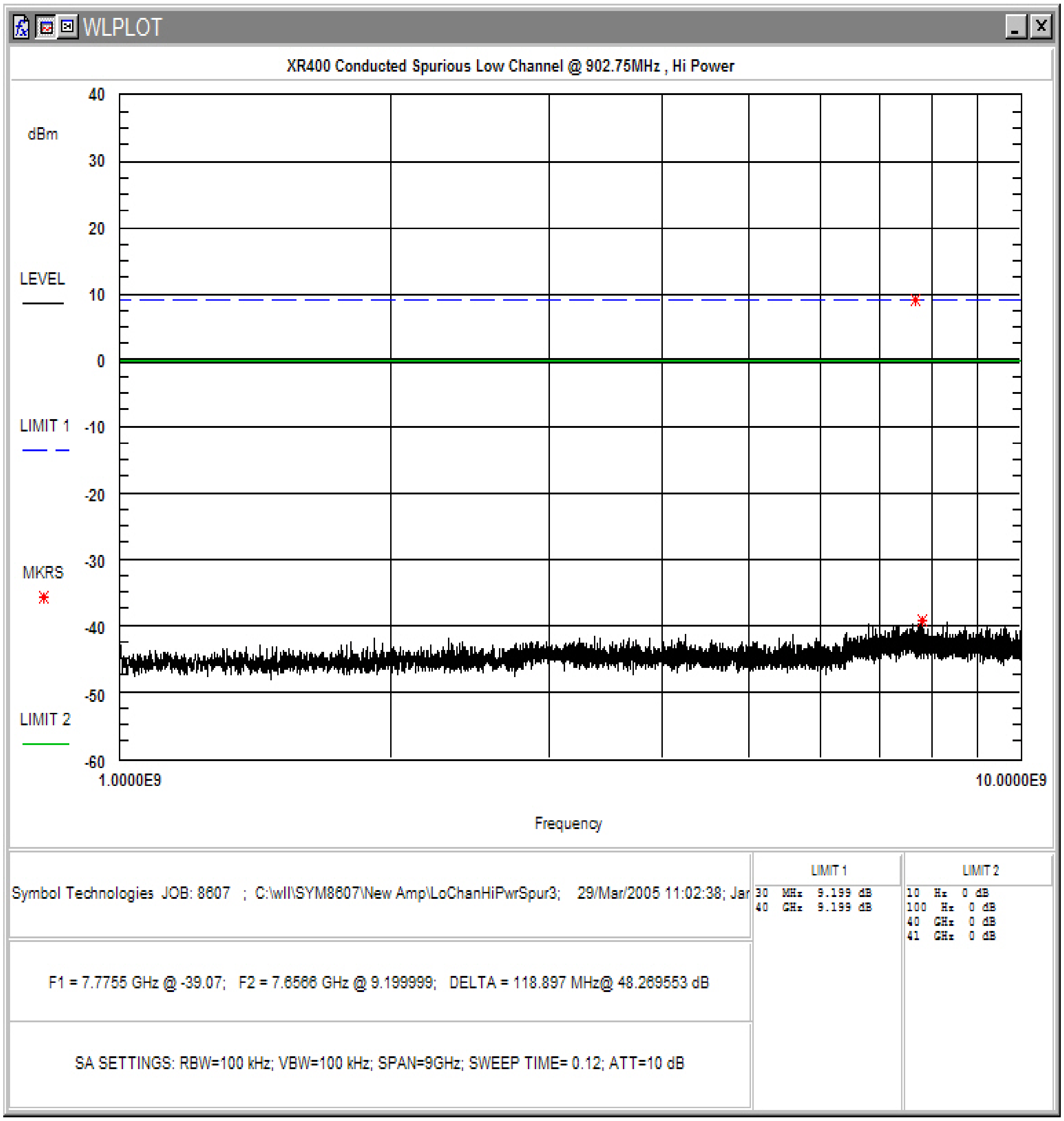

Figure 4-28. Conducted Spurious Emissions, High Power, Low Channel 1 – 10GHz

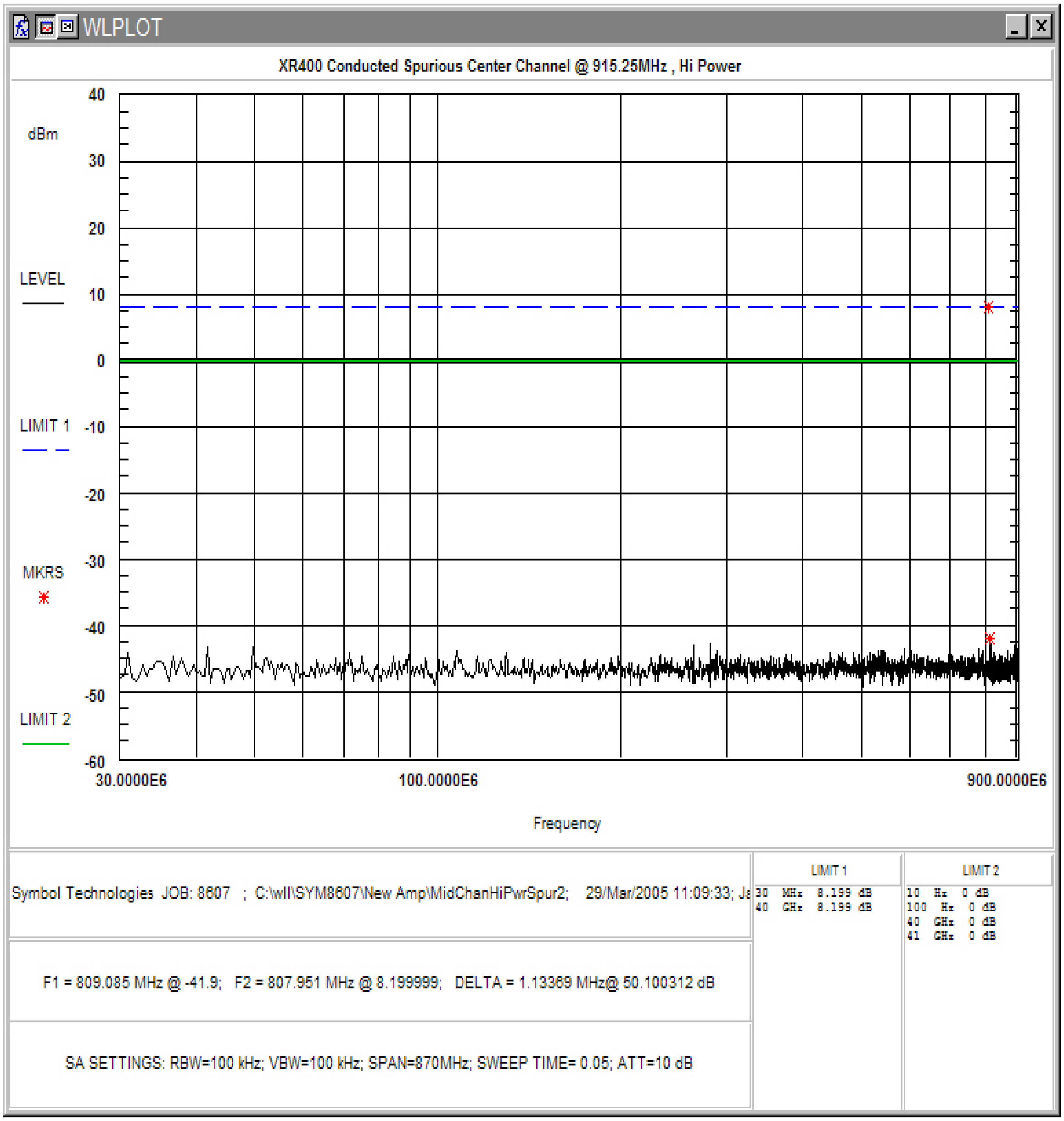

Figure 4-29. Conducted Spurious Emissions, High Power, Mid Channel 30 - 900MHz

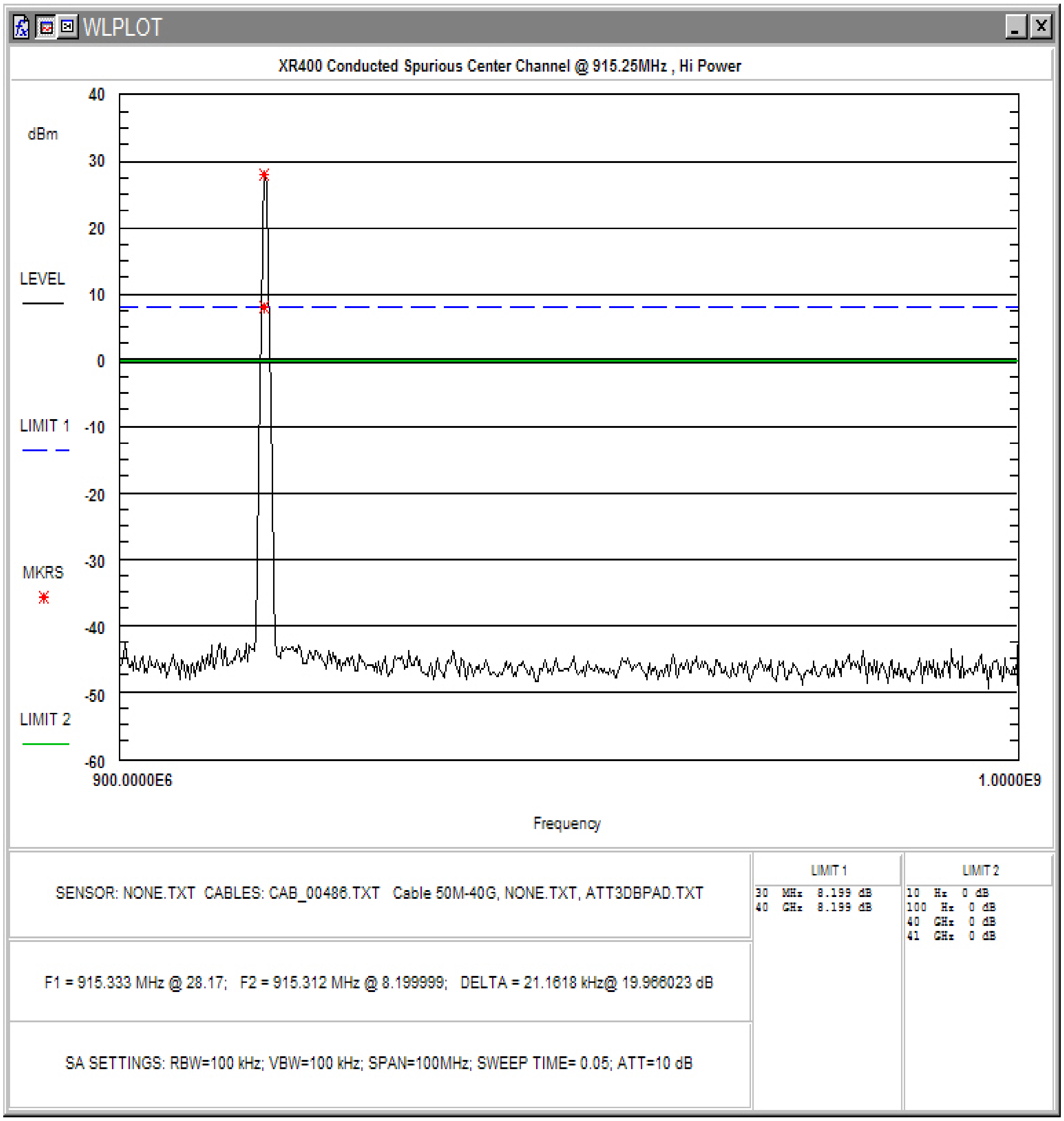

Figure 4-30. Conducted Spurious Emissions, High Power, Mid Channel 900-1000MHz

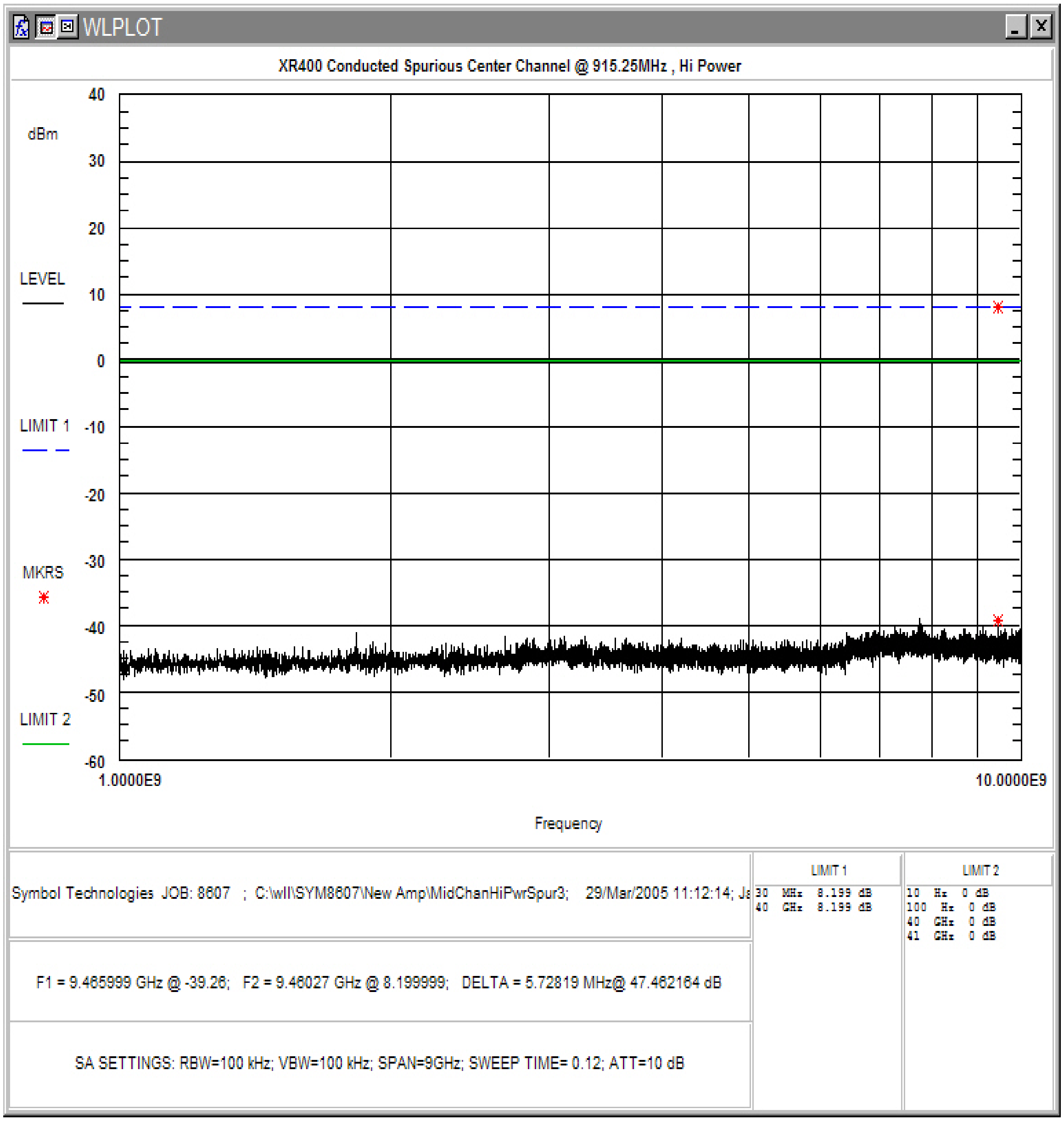

Figure 4-31. Conducted Spurious Emissions, High Power, Mid Channel 1 – 10GHz

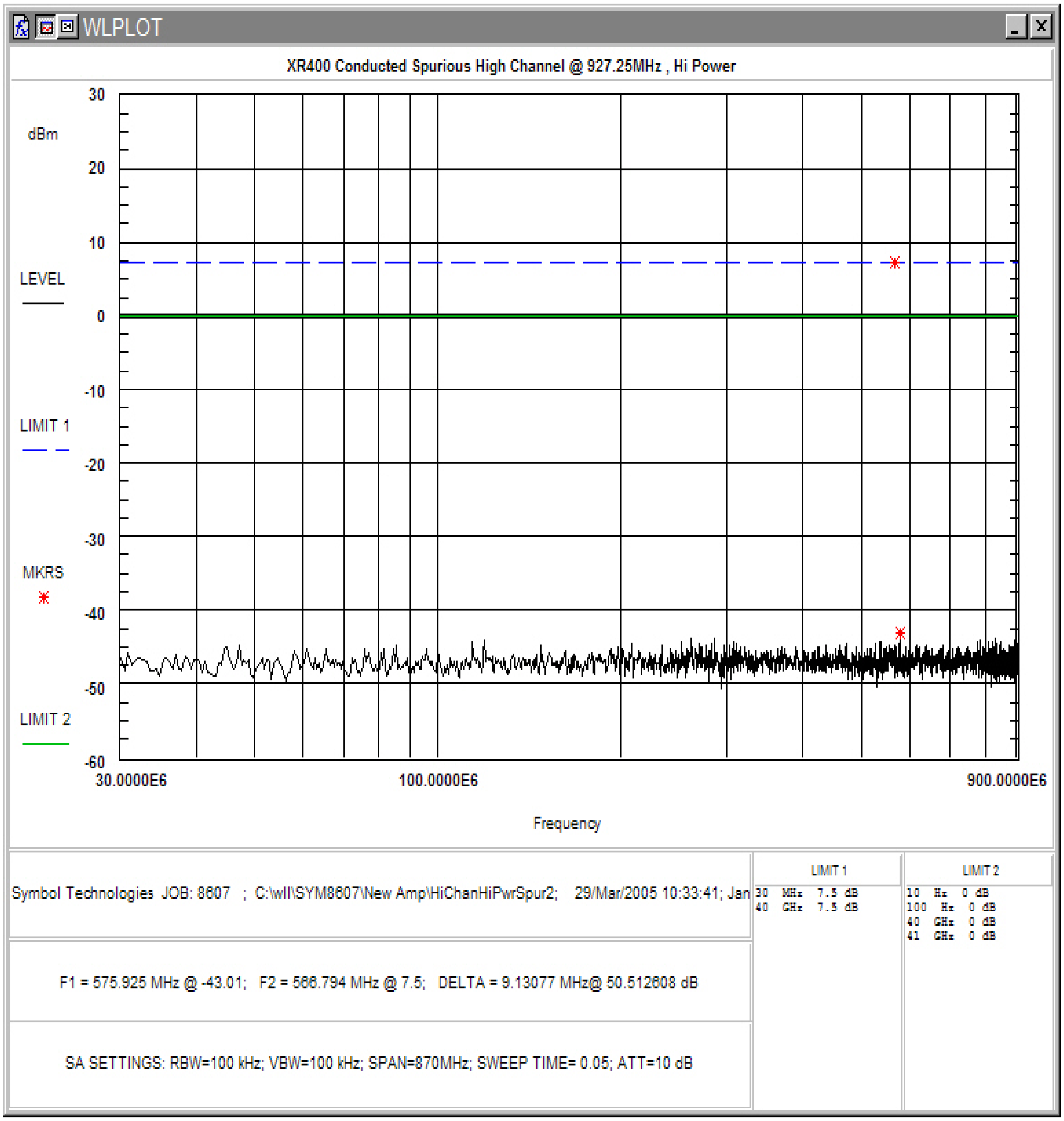

Figure 4-32. Conducted Spurious Emissions, High Power, High Channel 30 - 900MHz

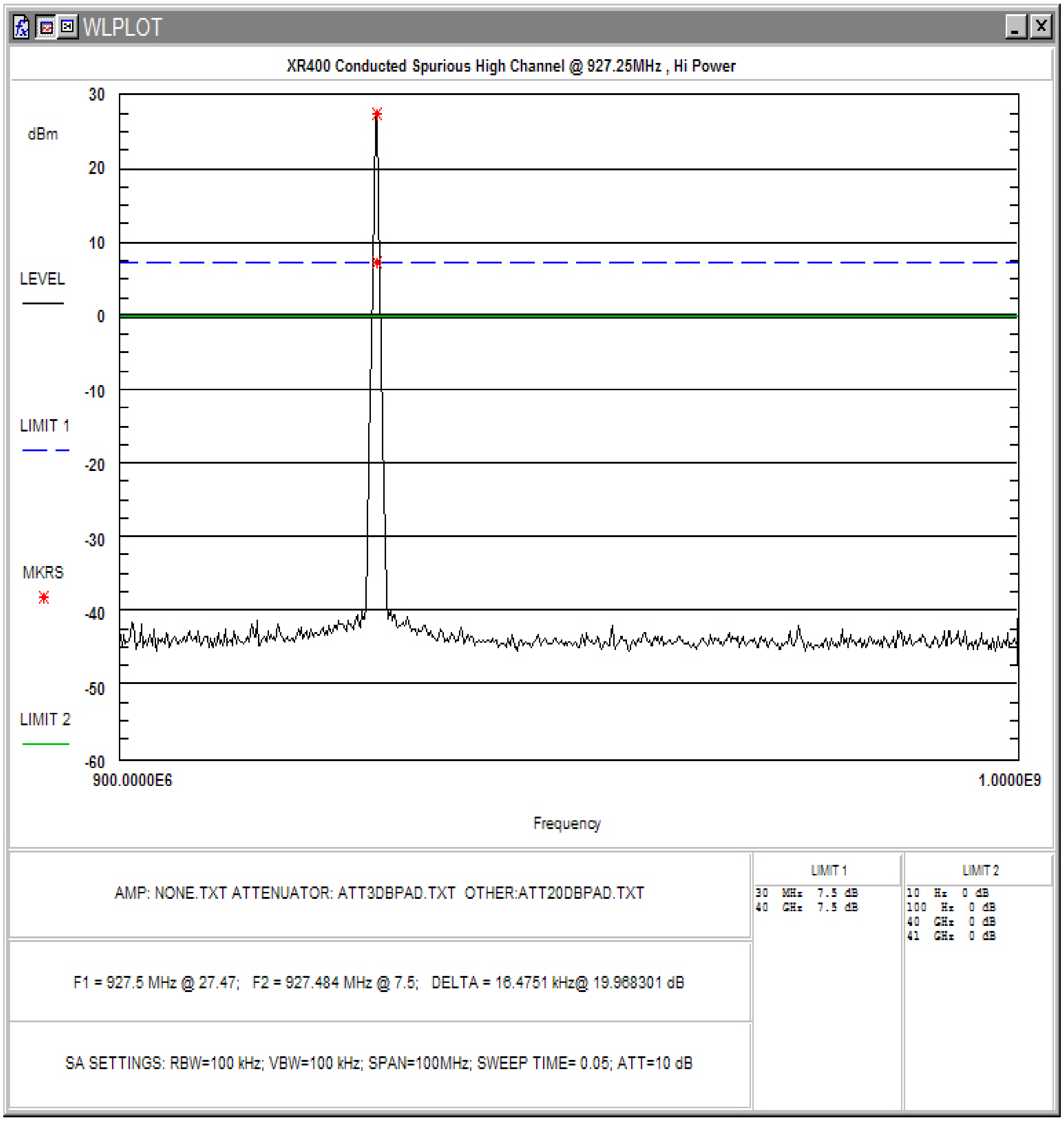

Figure 4-33. Conducted Spurious Emissions, High Power, High Channel 900-1000MHz

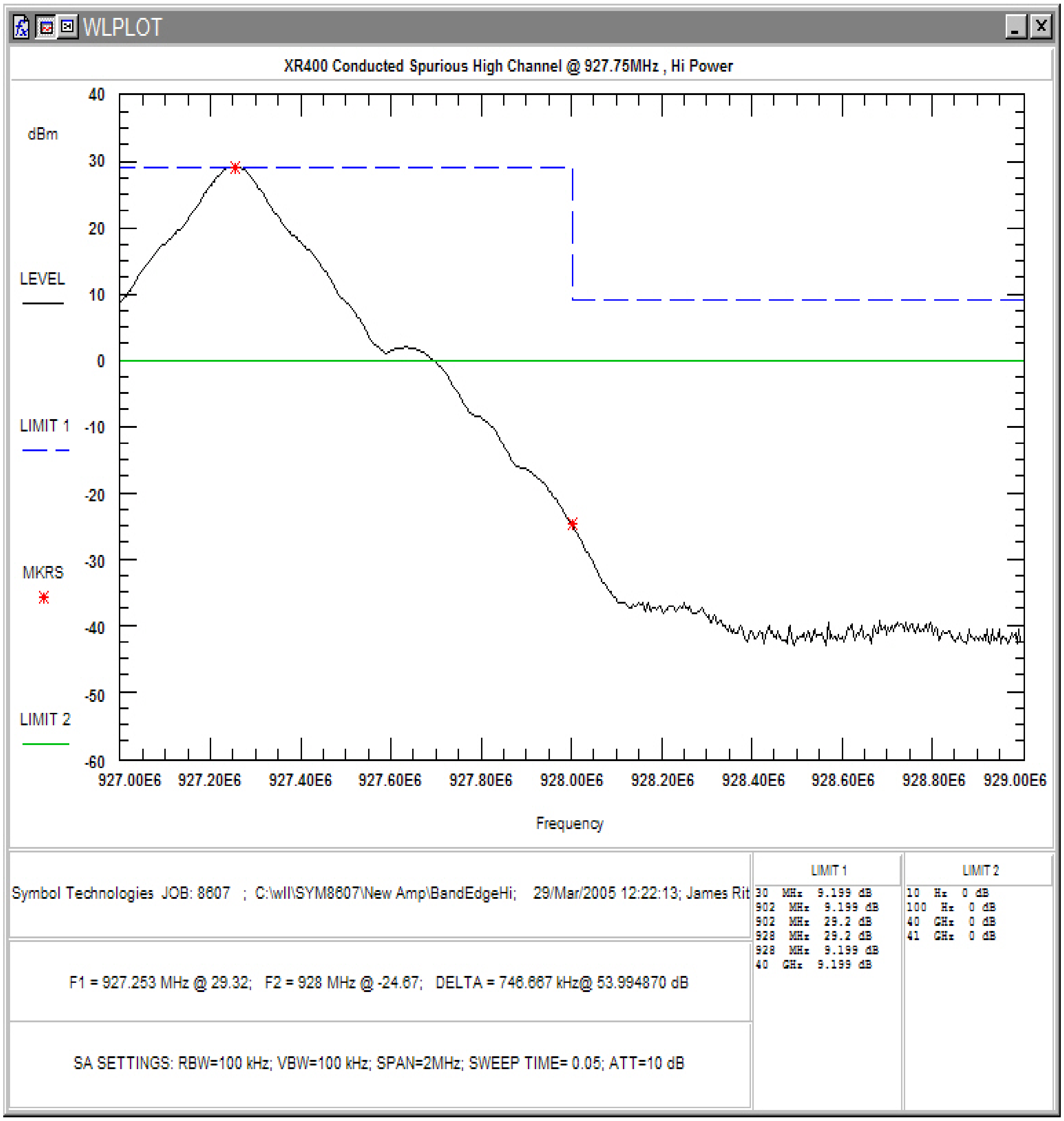

Figure 4-34. Conducted Spurious Emissions, High Power, High Channel 927-929MHz

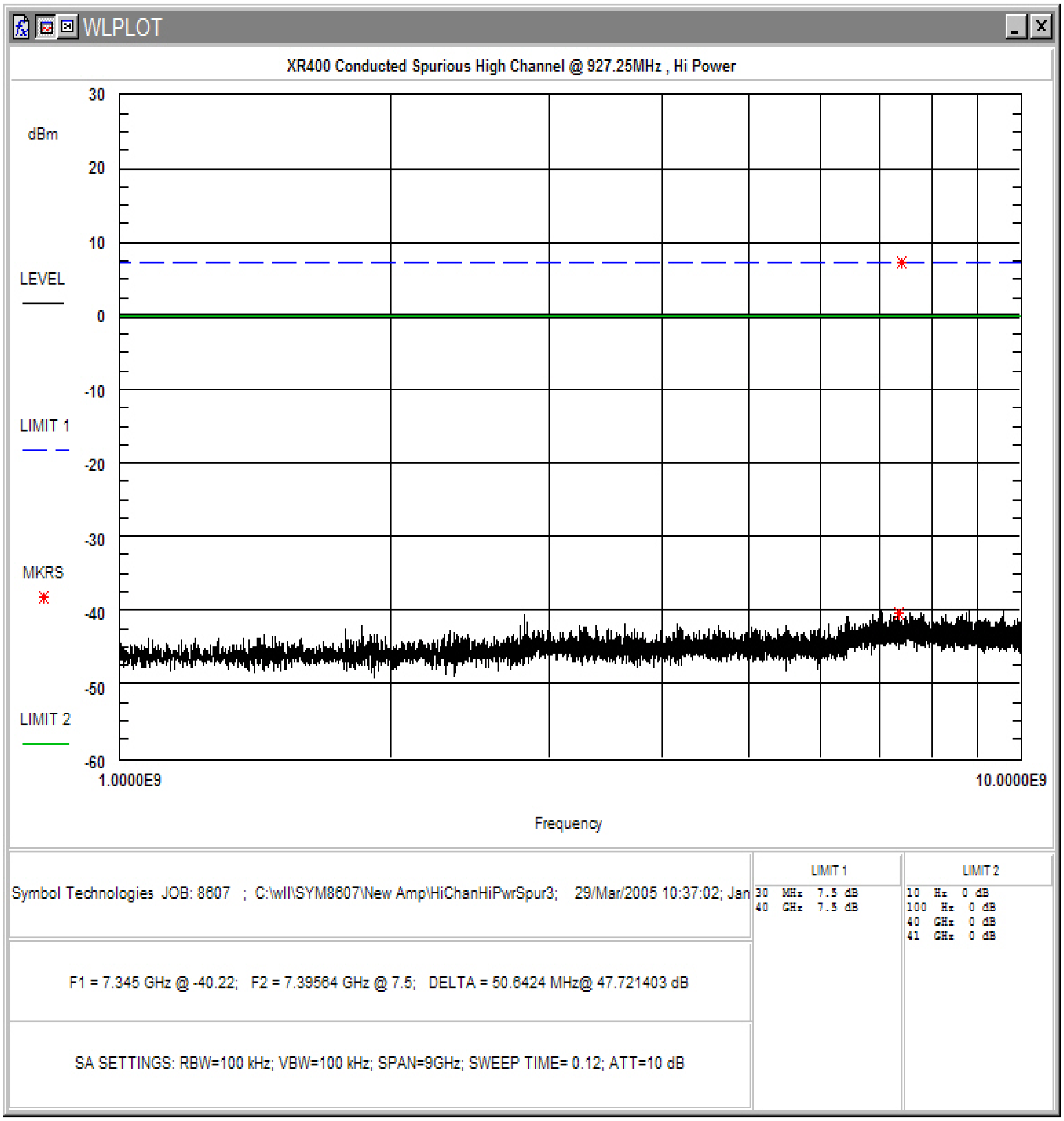

Figure 4-35. Conducted Spurious Emissions, High Power, High Channel 1 – 10GHz

4.7 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.

4.7.1 Test Procedure

The EUT was placed on motorized turntable for radiated testing on a 3-meter open field test site. The emissions from the EUT were measured continuously at every azimuth by rotating the turntable. Receiving antennas were mounted on an antenna mast to determine the height of maximum emissions. The height of the antenna was varied between 1 and 4 meters. The peripherals were placed on the table in accordance with ANSI C63.4-2003. Cables were varied in position to produce maximum emissions. Both the horizontal and vertical field components were measured.

The emissions were measured using the following resolution bandwidths:

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

The following is a sample calculation used in the data tables for calculating the final field strength of spurious emissions and comparing these levels to the specified limits.

<u>Sample Calculation:</u>

Spectrum Analyzer Voltage (SA Level): V dBμV

Antenna Factor (Ant Corr): AFdB/m

Cable Loss Correction (Cable Corr): CCdB

Amplifier Gain: GdB

Duty Cycle Correction Factor: DCCFdB (if applicable)

Electric Field (Corr Level): EdBμV/m = VdBμV + AFdB/m + CCdB – GdB-DCCFdB

To convert to linear units: EμV/m = antilog (EdBμV/m/20)

Worst case data are supplied in the following tables. Testing was performed to the tenth harmonic at the highest power setting. Both peak and average measurements are listed.

Table 5: Radiated Emission Test Data, Low Frequency Data

CLIENT:	Symbol Technologies	DATE:	3/30/2005
TESTER:	James Ritter	JOB #:	8607
EUT Information:		**Test Requirements:**	
EUT:	XR400	TEST STANDARD:	FCC Part 15
CONFIGURATION:	TX port 1 with panel ant	DISTANCE:	3m
CLASS:	B		
Test Equipment/Limit:			
ANTENNA:	A_00007	LIMIT:	LFCC_3m_Class_B
CABLE:	CSITE2_3m	AMPLIFIER (dB)	None

Frequency (MHz)	Polarity H/V	Az Deg	Ant. Hght (m)	SA Level (QP) (dBμV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Corr. Level (dBμV/m)	Corr. Level (μV/m)	Limit (μV/m)	Margin dB
38.900	V	270.0	1.0	5.5	16.2	1.2	22.9	14.0	100.0	-17.1
47.987	V	180.0	1.0	5.6	14.3	1.3	21.2	11.5	100.0	-18.8
84.654	V	90.0	1.0	12.3	7.2	1.6	21.1	11.4	100.0	-18.9 **a**
110.720	V	270.0	1.0	16.9	10.1	1.7	28.8	27.4	150.0	-14.8 **a**
122.280	V	190.0	1.0	13.8	10.7	1.8	26.3	20.7	150.0	-17.2 **a**
125.000	V	270.0	1.5	10.4	10.5	1.8	22.7	13.7	150.0	-20.8
143.310	V	180.0	1.2	12.9	8.1	1.9	23.0	14.1	150.0	-20.6 **a**
148.118	V	0.0	1.0	13.0	8.1	1.9	23.0	14.1	150.0	-20.5
172.774	V	45.0	1.2	11.2	9.3	2.0	22.6	13.5	150.0	-20.9
250.000	V	100.0	1.0	21.1	11.7	2.4	35.2	57.7	200.0	-10.8
300.000	V	180.0	1.3	16.1	12.9	2.6	31.6	38.1	200.0	-14.4
375.000	V	90.0	2.0	12.8	15.0	2.9	30.7	34.1	200.0	-15.4
433.312	V	190.0	1.5	9.8	15.4	3.0	28.3	25.9	200.0	-17.8
464.600	V	270.0	1.7	9.9	16.8	3.2	29.8	31.1	200.0	-16.2 **a**
500.000	V	180.0	1.0	9.5	16.6	3.3	29.4	29.4	200.0	-16.7
525.000	V	45.0	1.5	7.8	16.7	3.4	27.9	24.9	200.0	-18.1
600.000	V	170.0	2.4	6.0	17.5	3.6	27.1	22.6	200.0	-19.0
725.000	V	170.0	3.0	7.5	19.9	4.0	31.4	37.2	200.0	-14.6
900.000	V	0.0	2.7	6.7	20.8	4.5	32.0	39.8	200.0	-14.0
934.560	V	0.0	1.8	9.3	21.3	4.6	35.1	57.2	200.0	-10.9 **a**
1000.000	V	180.0	2.5	8.3	21.7	4.7	34.7	54.2	500.0	-19.3
84.654	H	190.0	3.6	9.8	7.2	1.6	18.6	8.5	100.0	-21.4 **a**
110.720	H	220.0	2.9	13.2	10.1	1.7	25.1	17.9	150.0	-18.5 **a**
125.000	H	180.0	3.2	12.8	10.5	1.8	25.1	18.0	150.0	-18.4
143.310	H	190.0	2.0	16.4	8.1	1.9	26.5	21.1	150.0	-17.1 **a**
148.118	H	180.0	2.5	15.7	8.1	1.9	25.7	19.2	150.0	-17.8
172.774	H	190.0	2.3	12.7	9.3	2.0	24.1	16.0	150.0	-19.4
250.000	H	225.0	2.0	25.1	11.7	2.4	39.2	91.5	200.0	-6.8
257.420	H	270.0	1.6	17.6	11.9	2.5	31.9	39.6	200.0	-14.1
300.000	H	180.0	1.6	18.1	12.9	2.6	33.6	48.0	200.0	-12.4
305.117	H	90.0	2.4	13.3	13.2	2.7	29.2	28.9	200.0	-16.8

Frequency (MHz)	Polarity H/V	Az Deg	Ant. Hght (m)	SA Level (QP) (dBµV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Corr. Level (dBµV/m)	Corr. Level (µV/m)	Limit (µV/m)	Margin dB
375.000	H	190.0	1.7	16.0	15.0	2.9	33.9	49.3	200.0	-12.2
500.000	H	270.0	1.8	9.6	16.6	3.3	29.5	29.7	200.0	-16.6
525.000	H	290.0	1.8	8.2	16.7	3.4	28.3	26.0	200.0	-17.7
600.000	H	190.0	2.4	11.2	17.5	3.6	32.3	41.1	200.0	-13.8
725.000	H	200.0	2.4	10.5	19.9	4.0	34.4	52.5	200.0	-11.6
750.000	H	180.0	1.3	5.4	19.8	4.1	29.3	29.1	200.0	-16.7
900.000	H	0.0	1.6	8.5	20.8	4.5	33.8	49.0	200.0	-12.2
933.000	H	0.0	1.5	7.6	21.2	4.6	33.3	46.4	200.0	-12.7
1000.000	H	270.0	1.3	8.4	21.7	4.7	34.8	54.9	500.0	-19.2

a = broadband emission

Table 6: Radiated Emission Test Data, High Frequency Data (Restricted Bands)

Test Equipment/Limit:
ANTENNA: A_00425 LIMIT: LFCC_3m_Class_B
CABLE: CSITE2_HF AMPLIFIER (dB) ser# 3008A01402 cal due 3/24/06
used Spec Anal #74 cal due 8/17/05

Frequency	Polarity	Az	Ant. Hght	SA Level	Ant. Corr.	Cable Corr.	Amp Gain	Duty Cycle	Corr. Level	Corr. Level	Limit	Margin
(MHz)	H/V	Deg	(m)	(dBμV)	(dB/m)	(dB)	(dB)	dB	(dBμV/m)	(μV/m)	(μV/m)	dB
902.75 (Low Ch)				**Peak**								
1199.50	H	165.0	1.0	60.1	26.2	1.7	41.3	0.0	46.7	215.7	5000.0	-27.3
2708.25	H	170.0	1.0	58.3	30.3	2.9	40.2	0.0	51.4	370.4	5000.0	-22.6
3611.00	H	180.0	1.0	56.7	31.0	2.8	40.0	0.0	50.5	334.4	5000.0	-23.5
4513.75	H	180.0	1.0	46.7	32.6	3.7	39.3	0.0	43.7	152.3	5000.0	-30.3
5416.50	H	180.0	1.0	42.6	34.4	4.3	39.4	0.0	41.9	124.0	5000.0	-32.1 **a**
8124.75	H	180.0	1.0	43.7	38.4	4.9	39.8	0.0	47.1	227.4	5000.0	-26.8 **a**
9027.50	H	180.0	1.0	45.5	39.0	4.9	39.8	0.0	49.6	302.2	5000.0	-24.4 **a**
1199.50	V	165.0	1.0	53.4	26.2	1.7	41.3	0.0	40.0	99.9	5000.0	-34.0
2708.25	V	180.0	1.0	56.2	30.3	2.9	40.2	0.0	49.2	289.8	5000.0	-24.7
3611.00	V	190.0	1.0	59.3	31.0	2.8	40.0	0.0	53.1	451.1	5000.0	-20.9
4513.75	V	170.0	1.0	45.2	32.6	3.7	39.3	0.0	42.1	127.7	5000.0	-31.9
5416.50	V	180.0	1.0	44.9	34.4	4.3	39.4	0.0	44.1	160.5	5000.0	-29.9 **a**
8124.75	V	180.0	1.0	45.0	38.4	4.9	39.8	0.0	48.4	262.9	5000.0	-25.6 **a**
9027.50	V	180.0	1.0	45.6	39.0	4.9	39.8	0.0	49.7	306.4	5000.0	-24.3 **a**
				AVG								
1199.50	H	165.0	1.0	49.1	26.2	1.7	41.3	0.0	35.7	60.9	500.0	-18.3
2708.25	H	170.0	1.0	50.5	30.3	2.9	40.2	0.0	43.5	150.4	500.0	-10.4
3611.00	H	180.0	1.0	51.7	31.0	2.8	40.0	0.0	45.5	188.0	500.0	-8.5
4513.75	H	180.0	1.0	35.3	32.6	3.7	39.3	0.0	32.3	41.0	500.0	-21.7
5416.50	H	180.0	1.0	33.3	34.4	4.3	39.4	0.0	32.5	42.2	500.0	-21.5 **a**
8124.75	H	180.0	1.0	32.8	38.4	4.9	39.8	0.0	36.2	64.7	500.0	-17.8 **a**
9027.50	H	180.0	1.0	35.1	39.0	4.9	39.8	0.0	39.2	90.9	500.0	-14.8 **a**
1199.50	V	165.0	1.0	47.8	26.2	1.7	41.3	0.0	34.4	52.5	500.0	-19.6
2708.25	V	180.0	1.0	49.9	30.3	2.9	40.2	0.0	43.0	140.7	500.0	-11.0
3611.00	V	190.0	1.0	54.8	31.0	2.8	40.0	0.0	48.6	268.7	500.0	-5.4
4513.75	V	170.0	1.0	35.2	32.6	3.7	39.3	0.0	32.1	40.5	500.0	-21.8
5416.50	V	180.0	1.0	34.6	34.4	4.3	39.4	0.0	33.8	49.2	500.0	-20.1
8124.75	V	180.0	1.0	34.9	38.4	4.9	39.8	0.0	38.3	82.5	500.0	-15.7 **a**
9027.50	V	180.0	1.0	34.9	39.0	4.9	39.8	0.0	39.0	89.1	500.0	-15.0 **a**
915.25 MHz (Mid CH.)				**Peak**								
2745.75	V	180.0	1.0	58.6	30.4	2.9	40.2	0.0	51.6	381.5	5000.0	-22.3

Frequency (MHz)	Polarity H/V	Az Deg	Ant. Hght (m)	SA Level (dBμV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Amp Gain (dB)	Duty Cycle dB	Corr. Level (dBμV/m)	Corr. Level (μV/m)	Limit (μV/m)	Margin dB
3661.00	V	190.0	1.0	58.4	31.0	2.8	40.0	0.0	52.2	409.3	5000.0	-21.7
4576.25	V	170.0	1.0	48.0	32.7	3.8	39.3	0.0	45.2	182.3	5000.0	-28.8
7322.00	V	165.0	1.0	47.6	37.7	4.6	39.6	0.0	50.3	326.4	5000.0	-23.7
8237.25	V	180.0	1.0	47.6	38.5	4.9	39.8	0.0	51.1	358.0	5000.0	-22.9 **a**
9152.50	V	180.0	1.0	47.8	39.2	5.0	40.0	0.0	52.0	396.2	5000.0	-22.0 **a**
2745.75	H	170.0	1.0	58.3	30.4	2.9	40.2	0.0	51.4	370.3	5000.0	-22.6
3661.00	H	180.0	1.0	56.7	31.0	2.8	40.0	0.0	50.5	334.2	5000.0	-23.5
4576.25	H	170.0	1.0	48.5	32.7	3.8	39.3	0.0	45.7	192.6	5000.0	-28.3
7322.00	H	165.0	1.0	47.5	37.7	4.6	39.6	0.0	50.1	321.2	5000.0	-23.8
8237.25	H	180.0	1.0	46.0	38.5	4.9	39.8	0.0	49.5	299.5	5000.0	-24.5 **a**
9152.50	H	180.0	1.0	45.9	39.2	5.0	40.0	0.0	50.0	317.6	5000.0	-23.9 **a**
				AVG								
2745.75	V	180.0	1.0	49.8	30.4	2.9	40.2	0.0	42.9	139.7	500.0	-11.1
3661.00	V	190.0	1.0	52.2	31.0	2.8	40.0	0.0	46.0	198.8	500.0	-8.0
4576.25	V	170.0	1.0	35.8	32.7	3.8	39.3	0.0	33.0	44.7	500.0	-21.0
7322.00	V	165.0	1.0	36.8	37.7	4.6	39.6	0.0	39.5	94.1	500.0	-14.5
8237.25	V	180.0	1.0	35.9	38.5	4.9	39.8	0.0	39.4	93.4	500.0	-14.6 **a**
9152.50	V	180.0	1.0	35.7	39.2	5.0	40.0	0.0	39.8	98.3	500.0	-14.1 **a**
2745.75	H	170.0	1.0	48.0	30.4	2.9	40.2	0.0	41.1	112.9	500.0	-12.9
3661.00	H	180.0	1.0	49.1	31.0	2.8	40.0	0.0	42.9	139.8	500.0	-11.1
4576.25	H	170.0	1.0	37.0	32.7	3.8	39.3	0.0	34.2	51.4	500.0	-19.8
7322.00	H	165.0	1.0	35.6	37.7	4.6	39.6	0.0	38.2	81.5	500.0	-15.8
8237.25	H	180	1.0	35.9	38.5	4.9	39.8	0.0	39.4	93.6	500.0	-14.6 **a**
9152.50	H	180.0	1.0	35.5	39.2	5.0	40.0	0.0	39.6	95.7	500.0	-14.4 **a**
927.25MHz (High Ch)				**Peak**								
2781.80	V	190.0	1.0	60.0	30.4	2.9	40.2	0.0	53.1	453.8	5000.0	-20.8
3709.00	V	180.0	1.0	57.9	31.1	2.8	40.0	0.0	51.7	386.1	5000.0	-22.2
4636.25	V	180.0	1.0	46.9	32.9	3.9	39.4	0.0	44.3	163.3	5000.0	-29.7
7418.00	V	170.0	1.0	47.9	37.8	4.6	39.7	0.0	50.6	339.0	5000.0	-23.4
8345.25	V	180.0	1.0	44.1	38.6	4.9	39.8	0.0	47.7	242.9	5000.0	-26.3 **a**
2781.80	H	180	1.0	57.1	30.4	2.9	40.2	0.0	50.2	323.5	5000.0	-23.8
3709.00	H	190	1.0	55.62	31.1	2.8	40.0	0.0	49.5	296.9	5000.0	-24.5
4636.25	H	190.0	1.0	45.6	32.9	3.9	39.4	0.0	43.0	140.6	5000.0	-31.0
7418.00	H	180.0	1.0	45.4	37.8	4.6	39.7	0.0	48.1	254.2	5000.0	-25.9
8345.25	H	180.0	1.0	46.0	38.6	4.9	39.8	0.0	49.6	303.0	5000.0	-24.4 **a**
				AVG								
2781.80	V	190.0	1.0	51.5	30.4	2.9	40.2	0.0	44.6	169.8	500.0	-9.4
3709.00	V	180.0	1.0	49.8	31.1	2.8	40.0	0.0	43.6	151.6	500.0	-10.4

Frequency (MHz)	Polarity H/V	Az Deg	Ant. Hght (m)	SA Level (dBµV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Amp Gain (dB)	Duty Cycle dB	Corr. Level (dBµV/m)	Corr. Level (µV/m)	Limit (µV/m)	Margin dB
4636.25	V	180.0	1.0	35.7	32.9	3.9	39.4	0.0	33.1	45.0	500.0	-20.9
7418.00	V	170.0	1.0	36.6	37.8	4.6	39.7	0.0	39.3	92.3	500.0	-14.7
8345.25	V	180.0	1.0	35.6	38.6	4.9	39.8	0.0	39.2	91.1	500.0	-14.8 **a**
2781.80	H	180.0	1.0	45.9	30.4	2.9	40.2	0.0	39.0	89.1	500.0	-15.0
3709.00	H	190.0	1.0	47.1	31.1	2.8	40.0	0.0	40.9	111.3	500.0	-13.0
4636.25	H	190.0	1.0	34.5	32.9	3.9	39.4	0.0	31.9	39.2	500.0	-22.1
7418.00	H	180.0	1.0	35.3	37.8	4.6	39.7	0.0	38.0	79.5	500.0	-16.0
8345.25	H	180.0	1.0	35.1	38.6	4.9	39.8	0.0	38.7	86.3	500.0	-15.3 **a**

a = ambient

4.8 AC Powerline Conducted Emissions: (FCC Part §15.207)

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 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 or peak, 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.

Data is recorded in Table 7.

Table 7. Conducted Emissions Test Data

CLIENT: Symbol Technologies DATE: 3/29/2005
TESTER: James Ritter JOB #: 7/25/1923
EUT: XR400
CONFIGURATION: Unit freq hopping /reading 2 tags
TEST STANDARD: FCC_B LISN 1: A_00125
TEST SITE: CSITE2_CE
VOLTAGE: 120 VAC LISN 2: A_00126

LINE 1 – NEUTRAL (LISN 1)

Frequency MHz	Level QP dBuV	Cable Loss dB	LISN Corr dB	Corr Level dBuV	Limit QP dBuV	Margin QP dB	Level AVG dBuV	Corr Level dBuV	Limit AVG dBuV	Margin AVG dB
0.157	39.4	10.7	1.8	51.9	65.6	-13.7	28.2	40.7	55.6	-14.9
0.207	34.0	10.7	1.3	46.0	63.3	-17.4	34.0	46.0	53.3	-7.4
0.417	30.0	10.7	0.8	41.5	57.5	-16.0	27.4	38.9	47.5	-8.6
1.934	29.2	11.2	0.3	40.7	56.0	-15.3	25.9	37.4	46.0	-8.6
2.459	29.4	11.2	0.4	41.0	56.0	-15.0	24.3	35.9	46.0	-10.1
3.245	29.3	11.3	0.4	41.0	56.0	-15.0	27.2	38.9	46.0	-7.1
19.674	21.9	12.6	1.1	35.6	60.0	-24.4	21.9	35.6	50.0	-14.4
24.440	21.4	12.8	1.9	36.1	60.0	-23.9	21.4	36.1	50.0	-13.9

LINE 2 - PHASE (LISN 2)

Frequency MHz	Level QP dBuV	Cable Loss dB	LISN Corr dB	Corr Level dBuV	Limit QP dBuV	Margin QP dB	Level AVG dBuV	Corr Level dBuV	Limit AVG dBuV	Margin AVG dB
0.157	37.7	10.7	1.4	49.8	65.6	-15.8	25.7	37.8	55.6	-17.8
0.207	32.0	10.7	0.8	43.5	63.3	-19.8	32.0	43.5	53.3	-9.8
0.417	28.1	10.7	0.7	39.5	57.5	-18.0	28.1	39.5	47.5	-8.0
1.934	26.6	11.2	0.3	38.1	56.0	-17.9	26.6	38.1	46.0	-7.9
2.459	27.2	11.2	0.4	38.8	56.0	-17.2	27.2	38.8	46.0	-7.2
3.245	25.6	11.3	0.4	37.3	56.0	-18.7	25.6	37.3	46.0	-8.7
19.674	27.7	12.6	0.9	41.2	60.0	-18.8	27.7	41.2	50.0	-8.8
24.440	23.9	12.8	1.9	38.6	60.0	-21.4	23.9	38.6	50.0	-11.4