Washington Laboratories, Ltd.

FCC & Industry Canada Certification Test Report

For the

Nomadio, Inc.

MX-3FHSS

FCC ID: AXYATX039

IC ID: 3514A-90240

WLL REPORT# **9601-01 Rev 0**
June 2007

Prepared for:

Nomadio, Inc.
2400 Market Street, Suite 13
Philadelphia, PA, 19103 USA

Prepared By:

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

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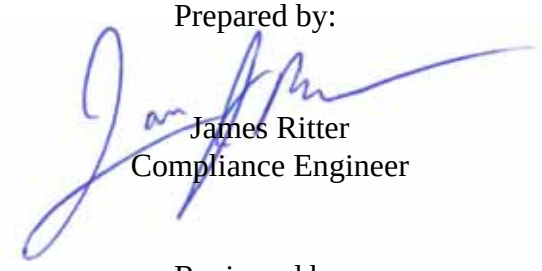

James Ritter
Compliance Engineer

Reviewed by:

Steven D. Koster
EMC operations Manager

Abstract

This report has been prepared on behalf of Nomadio, 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 Nomadio, Inc. MX-3FHSS.

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 Nomadio, Inc. MX-3FHSS 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 Nomadio, Inc. MX-3FHSS 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 2001 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:	Nomadio, Inc. 2400 Market Street, Suite 13 Philadelphia, PA, 19103 USA
Purchase Order Number:	000831
Quotation Number:	63397A

1.4 Test Dates

Testing was performed on the following date(s):	May 21-23, 2007

1.5 Test and Support Personnel

Washington Laboratories, LTD	James Ritter
Client Representative	Alex Gizis

1.6 Abbreviations

A	**A**mpere
ac	**a**lternating **c**urrent
AM	Amplitude Modulation
Amps	**Amp**ere**s**
b/s	**b**its per **s**econd
BW	**B**and**W**idth
CE	**C**onducted **E**mission
cm	**C**enti**m**eter
CW	**C**ontinuous **W**ave
dB	**decibel**
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 Nomadio, Inc. MX3FHSS controller is a wireless 2.4GHz FHSS remote telemetry and control system. Trigger and steering pots are provided for user vehicle control. LCD, Vibe motor, and buzzer are provided for user feedback. The MX3FHSS operates with on eight 1.5Vdc 'AA' Batteries

Table 1. Device Summary

ITEM	DESCRIPTION
Manufacturer:	Nomadio, Inc.
FCC ID:	AXYATX039
IC:	3514A-90240
Model:	MX-3FHSS
FCC Rule Parts:	§15.247
Industry Canada:	RSS210
Frequency Range:	2402-2479MHz
Maximum Output Power:	111mW (20.5dBm)
Modulation:	FHSS
Occupied Bandwidth:	1.11 MHz
Keying:	Automatic
Type of Information:	Data
Number of Channels:	2 modes of operation –each with 39 channels
Power Output Level	Fixed
Antenna Connector	Internal; not accessible
Antenna Type	1.9 dB whip (non detachable)
Interface Cables:	None
Power Source & Voltage:	eight 1.5Vdc 'AA' Batteries
Serial Number of EUT	Radiated – 112

2.2 Test Configuration

The MX-3FHSS was configured as a standalone unit. A temporary antenna was used for conducted emissions testing. The MX3FHSS operates with on eight 1.5Vdc 'AA' Batteries

2.3 Testing Algorithm

The MX-3FHSS had preloaded modes that were switched with front panel +/- menu controls that allowed a low, middle, high channel selection along with hopping functions

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

WLL Asset #	Manufacturer Model/Type	Function	Cal. Due
0073	HP 8568B	SPECTRUM ANALYZER	6/26/2007
0069	HP 85650A	QUASI-PEAK ADAPTER	6/26/2007
0071	HP 85685A	RF PRESELECTOR	6/26/2007
RTL	ARA DRG118/A	MICROWAVE HORN ANTENNA	3/30/2009
0474	HP 8563E	SPECTRUM ANALYZER	9/5/08
0026	EMCO 3110B	BICONICAL ANTENNA	12/19/2007
0029	EMCO 3146A	LOG PERIODIC ANTENNA	7/19/2008
RTL	HEWLETT-PACKARD 8449B	MICROWAVE PREAMP	3/26/2008
00605	Agilent N1911A	P-series Power Meter	4/11/08
00605	Agilent N1921A	Wideband Power Sensor	4/11/08
00389	HP	30dB Attenuator	4/11/08
00528	AGILENT, E4446A	ANALYZER, SPECTRUM	2/15/2008

4 Test Results

4.1 Time of Occupancy and Duty Cycle Correction

FCC Pt15.247 states that for Frequency hopping systems in the 2400-2483.5 MHz band the average time of occupancy on any channel shall not be greater than 0.4 seconds multiplied by the number of hopping channels employed.

The output of the EUT was coupling to the input of a spectrum analyzer. With the spectrum analyzer set to zero span on a single hopping channel, the on time of a single pulse was then captured and recorded as channel dwell time. The sweep time on the Spectrum analyzer was increased to scan a time sufficient to measure “a period equaling the product of 0.4 seconds and the number of channels” and video triggered to start sweeping at the first occurrence of a single channel. The number of times this channel appeared was captured and shown below.

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 following figure shows the plot of the dwell time for the transmitter. Based on this plot, the dwell time per hop is 9.333ms. The total dwell time per 100ms is 18.666ms. This corresponds to a duty cycle correction of 14.5dB.

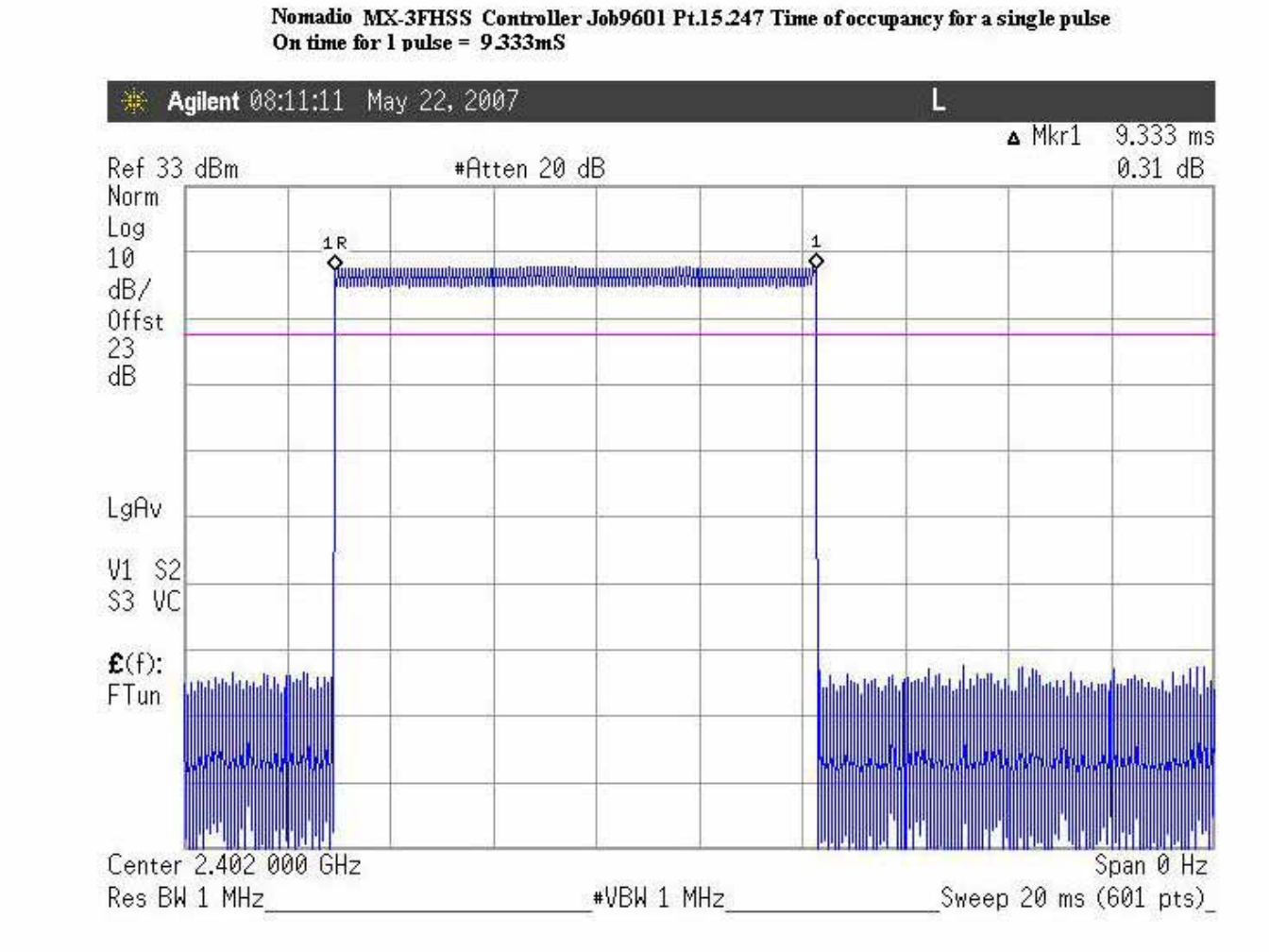

Figure 4-1 Dwell Time of Single Hop

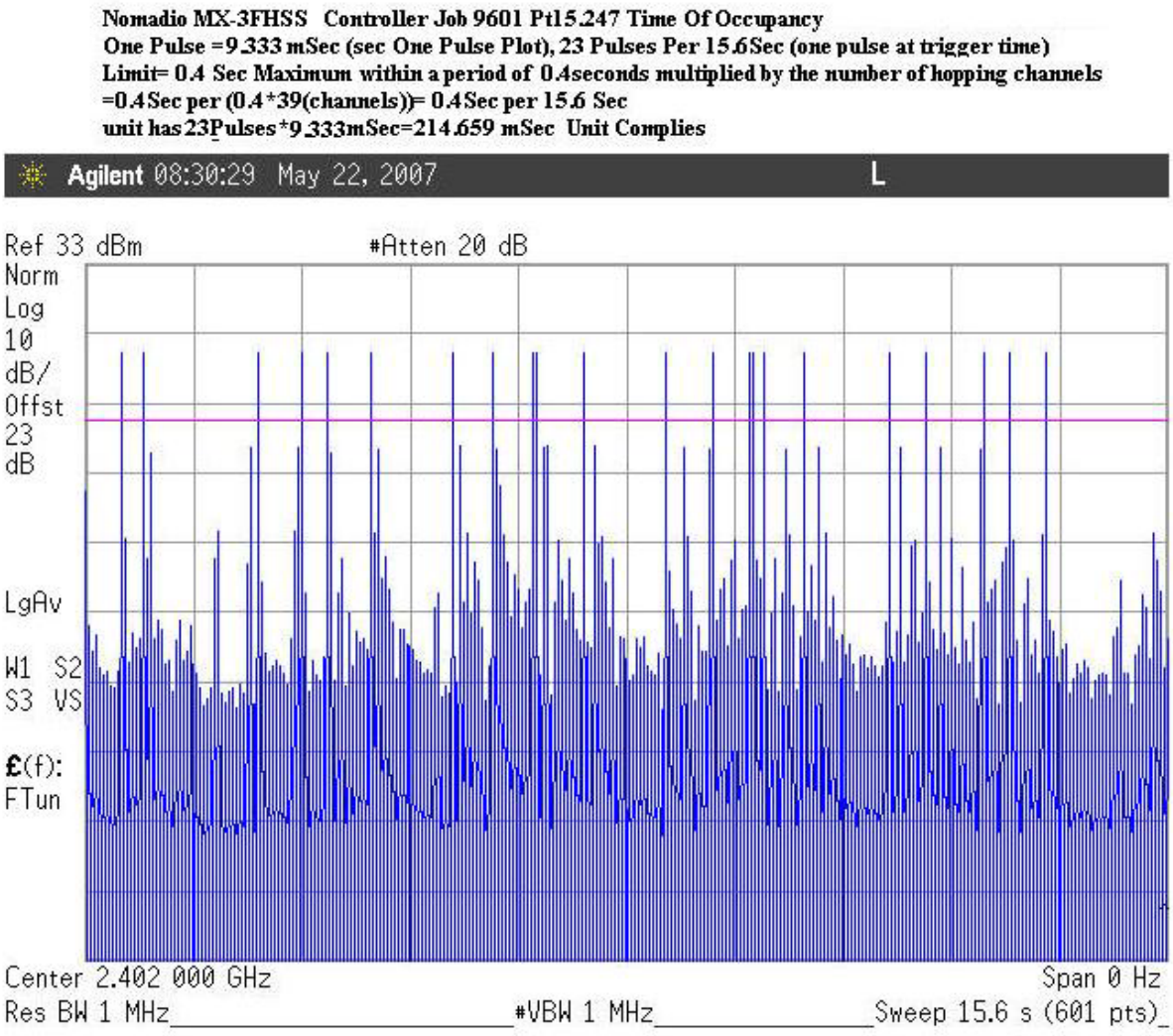

Figure 4-2 Time Of Occupancy

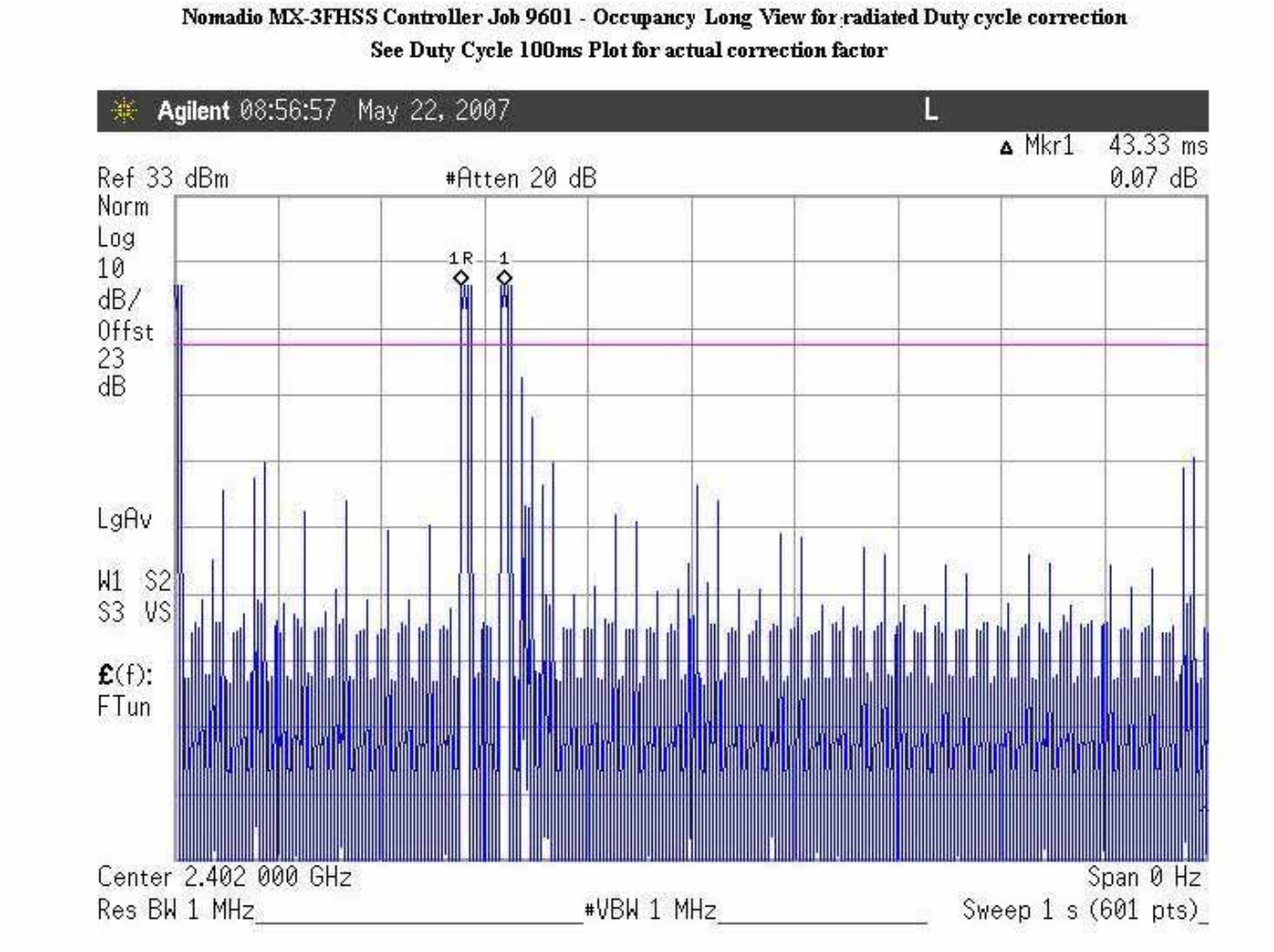

Figure 4-3 1 Second View of 2402 MHz Hopping Dwell time

Nomadio MX-3FHSS Controller Job 9601 - Occupancy per 100mSec for radiated Duty cycle correction
one pulse= 9.333 mSec (see time of occupancy plot) , 2 pulses= 18.666mSec
Duty cycle correction= 20log(dwell time/100ms)=20 log(18.666/100)= -14.5dB correction

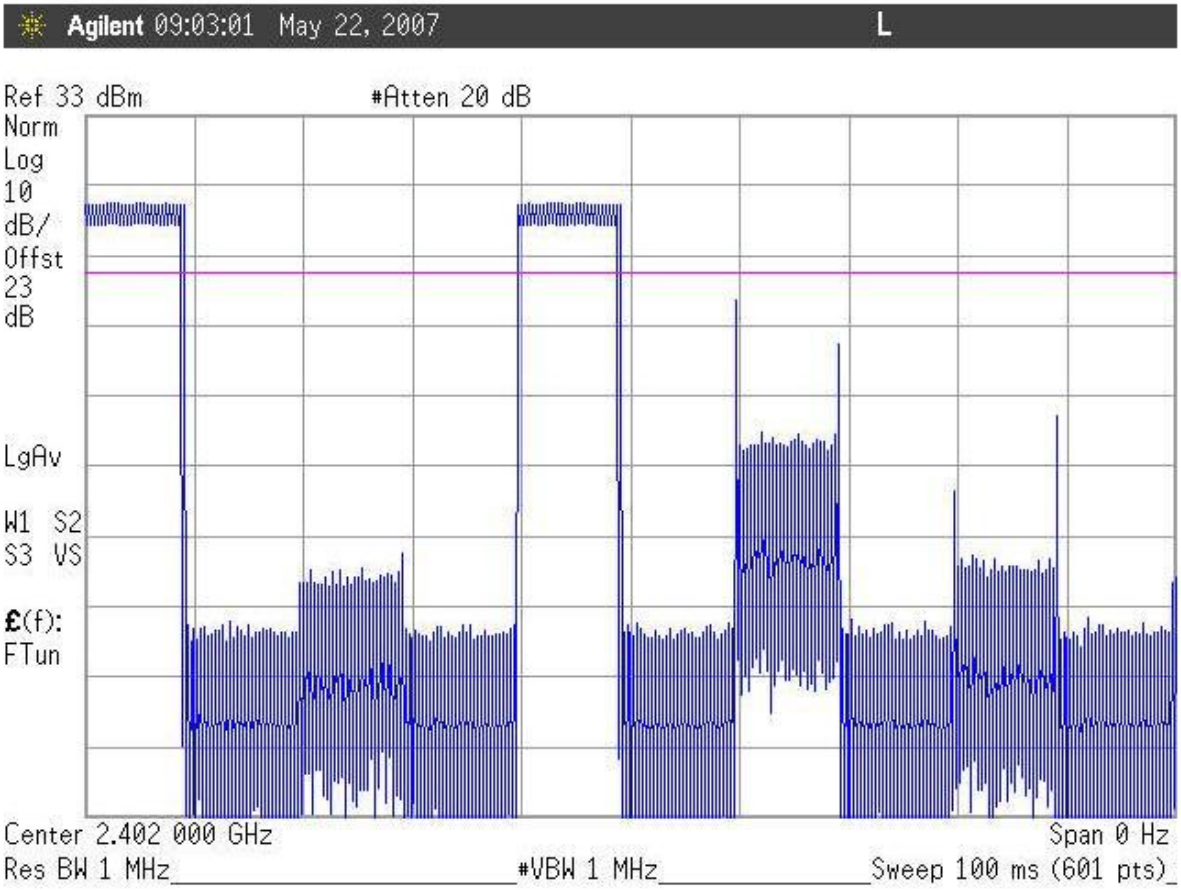

Figure 4-4 Duty Cycle Plot

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 a Peak Power Meter and the resulting power recorded.

Table 3. RF Power Output

Frequency	Measured Level (dBm)	Measured Level (mWatts)	Limit (mWatts)
Low Channel: 2402MHz	20.5	111	125
Mid Channel: 2440MHz	20.0	100	125
High Channel: 2479MHz	20.1	102	125

4.3 Occupied Bandwidth: (FCC Part §2.1049)

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

For Frequency Hopping Spread Spectrum Systems, FCC Part 15.247 requires the maximum 20 dB bandwidth be recorded.

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

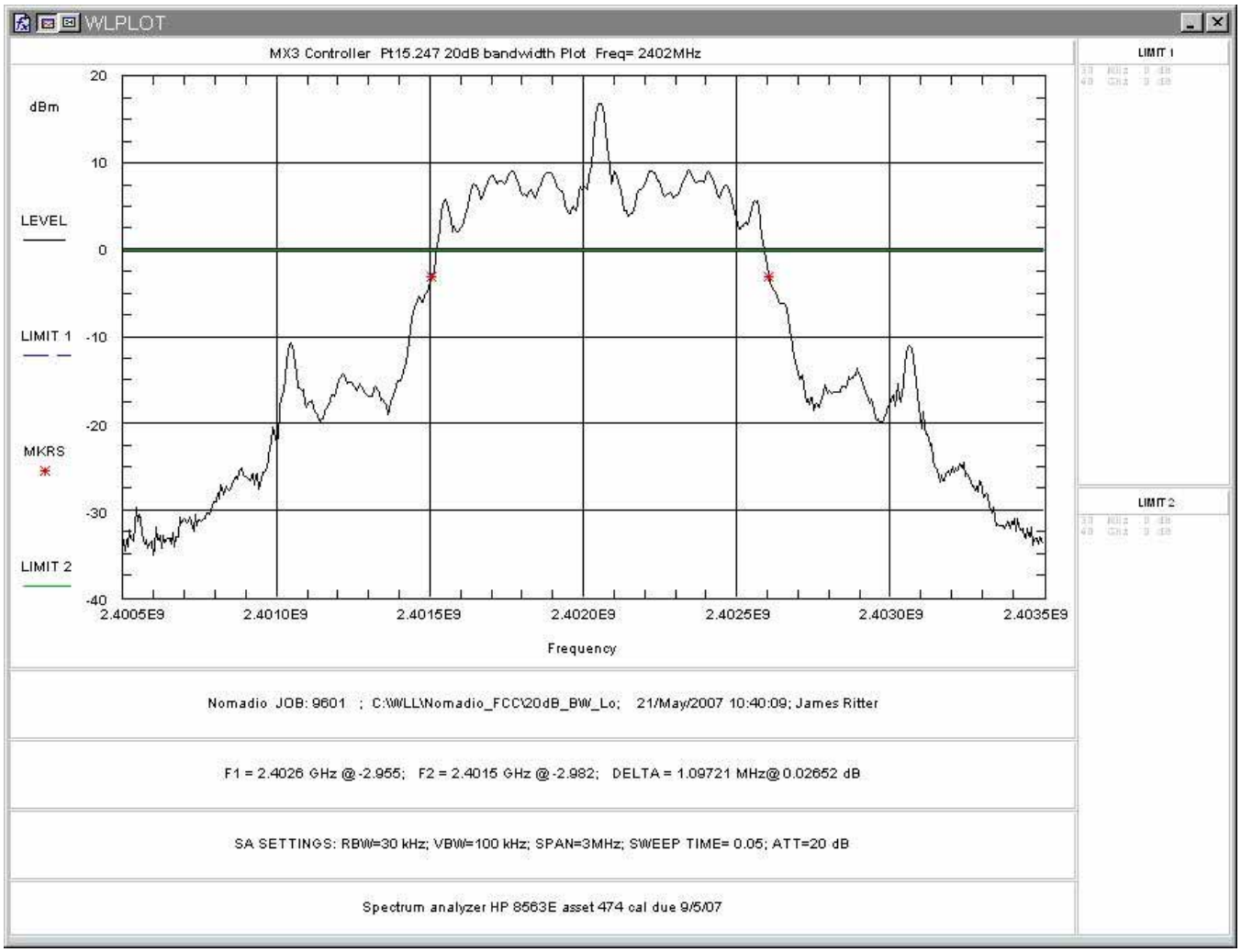

Figure 4-5. Occupied Bandwidth, Low Channel

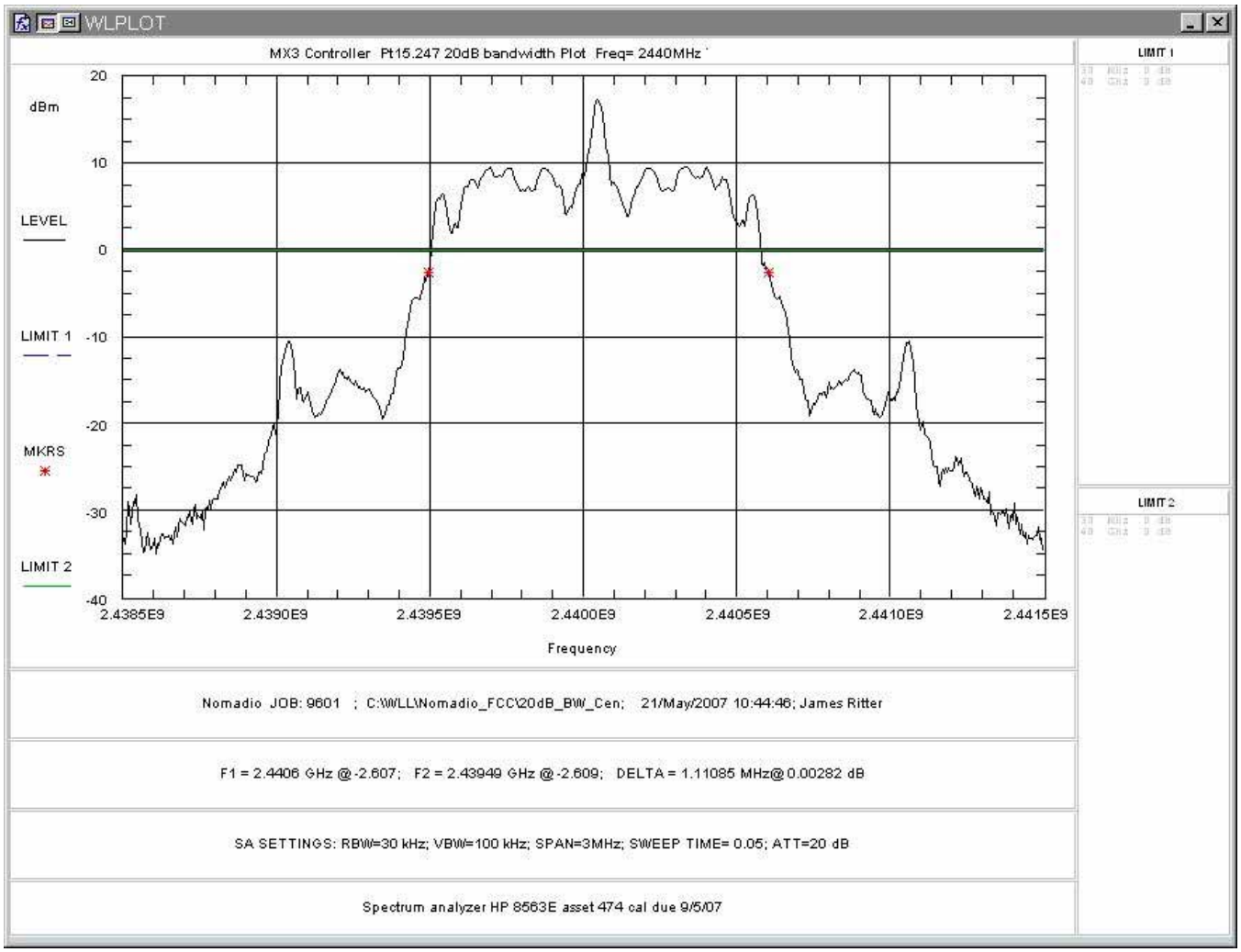

Figure 4-6. Occupied Bandwidth, Mid Channel

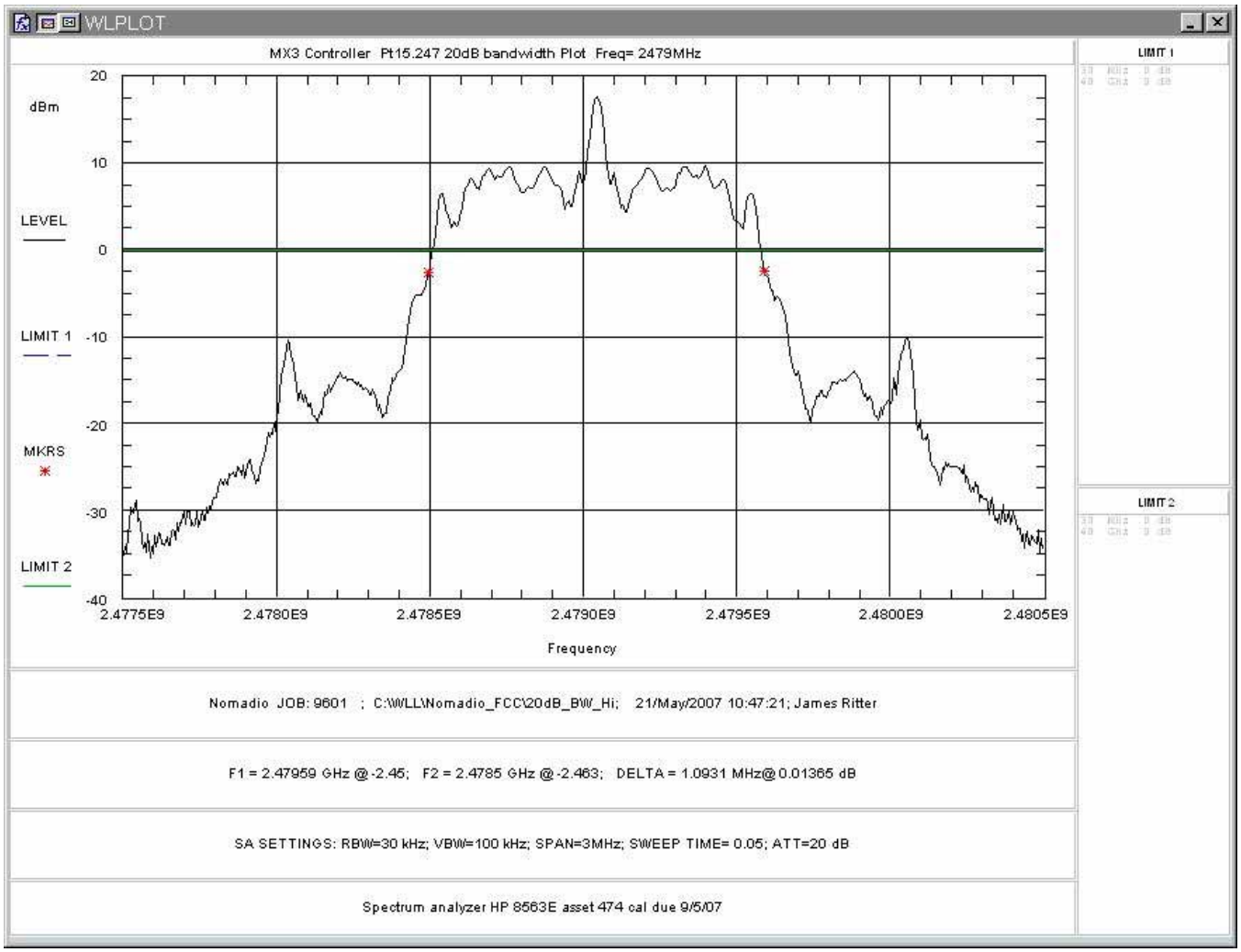

Figure 4-7. Occupied Bandwidth, High Channel

Table 4 provides a summary of the Occupied Bandwidth Results.

Table 4. Occupied Bandwidth Results

Frequency	Bandwidth	Limit	Pass/Fail
Low Channel: 2402MHz	1.09MHz	NA	Pass
Mid Channel: 2440MHz	1.11MHz	NA	Pass
High Channel: 2479MHz	1.09MHz	NA	Pass

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

Per the FCC requirements, frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth, whichever is greater. The maximum 20dB bandwidth measured is 1.11MHz so the channel spacing must be more than 734kHz. In addition, for a 2.4GHz the number of hopping channels shall be stated.

The EUT antenna was removed and the cable was connected directly into a spectrum analyzer through a 10 dB attenuator. An offset was programmed into the spectrum analyzer to compensate for the loss of the external attenuator. The spectrum analyzer resolution bandwidth was set to 100 kHz and the video bandwidth was set to 100 kHz. The channel spacing of 2 adjacent channels was measured using a spectrum analyzer span setting of 4MHz. Also, the number of hopping channels was measured from 2.4GHz to 2.5GHz.

The following are plots of the channel spacing and number of hopping channels data. The channel spacing was measured to be 2MHz . This system will be configured by the manufacturer to operate in one of two modes: the first mode will operate with 39 channels from 2402 to 2478 MHz (even channels Mode) with 2 MHz spacing, the second mode will operate with 39 channels from 2403 to 2479MHz (odd channels mode) with 2MHz spacing. The end user will not be able to switch between these modes.

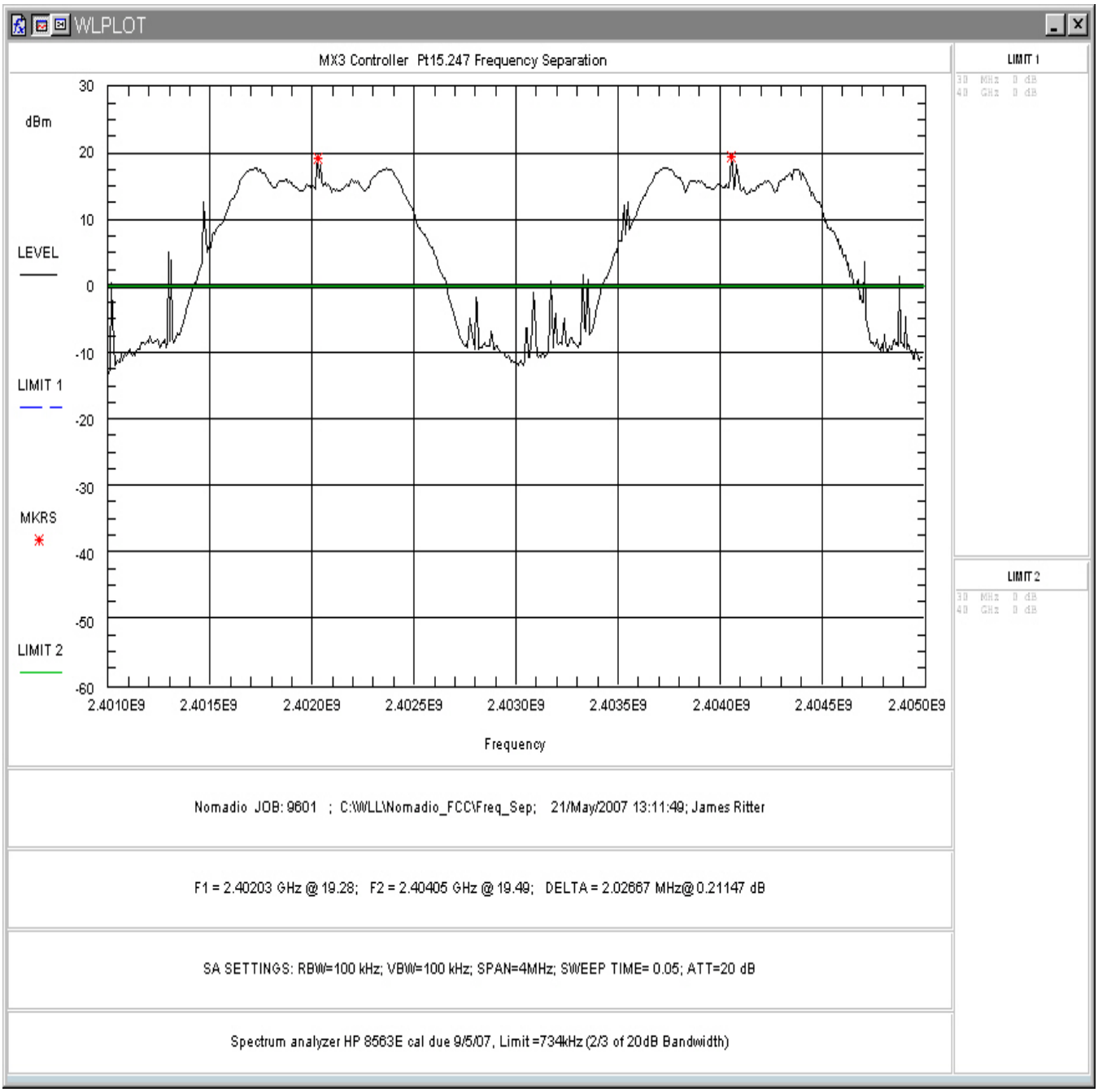

Figure 4-8, Channel Spacing

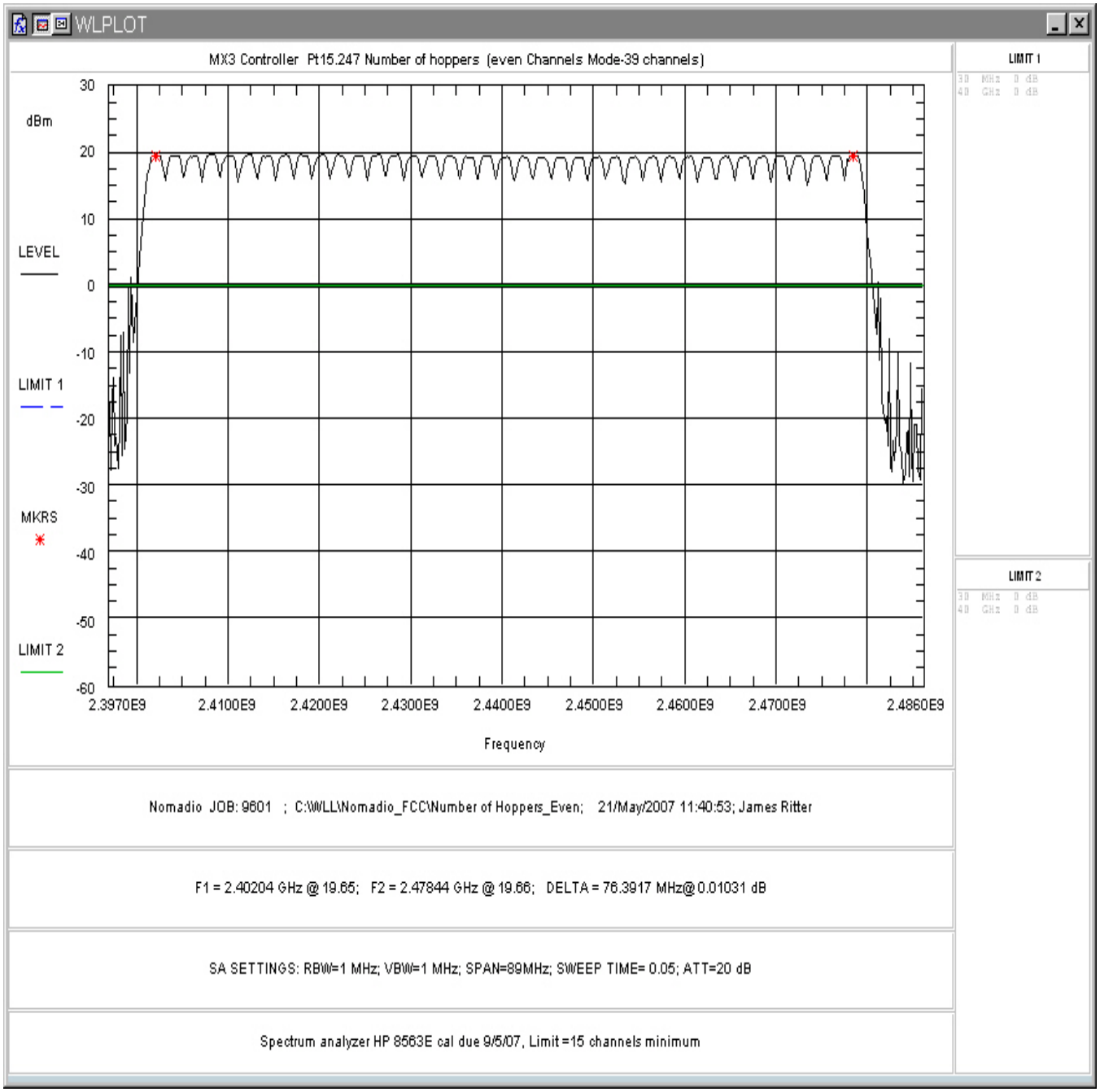

Figure 4-9 Number of Channels, 2402-2478MHz Mode

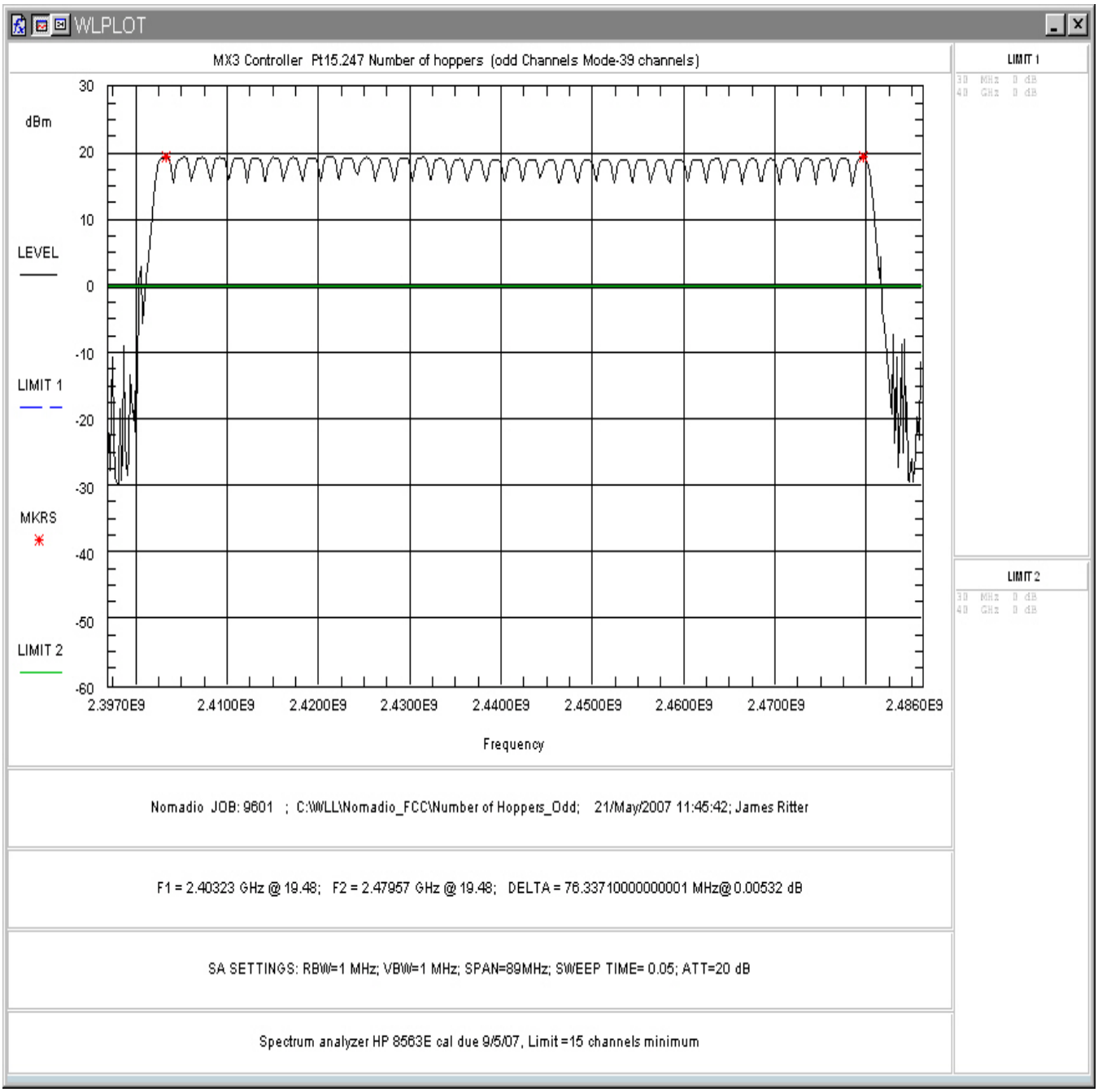

Figure 4-10, Number of Channels, 2403-2479 MHz Mode

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

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

The EUT antenna was removed and the cable was connected directly into a spectrum analyzer through a 10 dB attenuator. An offset was programmed into the spectrum analyzer to compensate for the loss of the external attenuator. The spectrum analyzer resolution bandwidth was set to 100 kHz and the video bandwidth was set to 100 kHz. The amplitude of the EUT carrier frequency was measured to determine the emissions limit (20 dB below the carrier frequency amplitude). The emissions outside of the allocated frequency band were then scanned from 30 MHz up to the tenth harmonic of the carrier.

The following are plots of the conducted spurious emissions data.

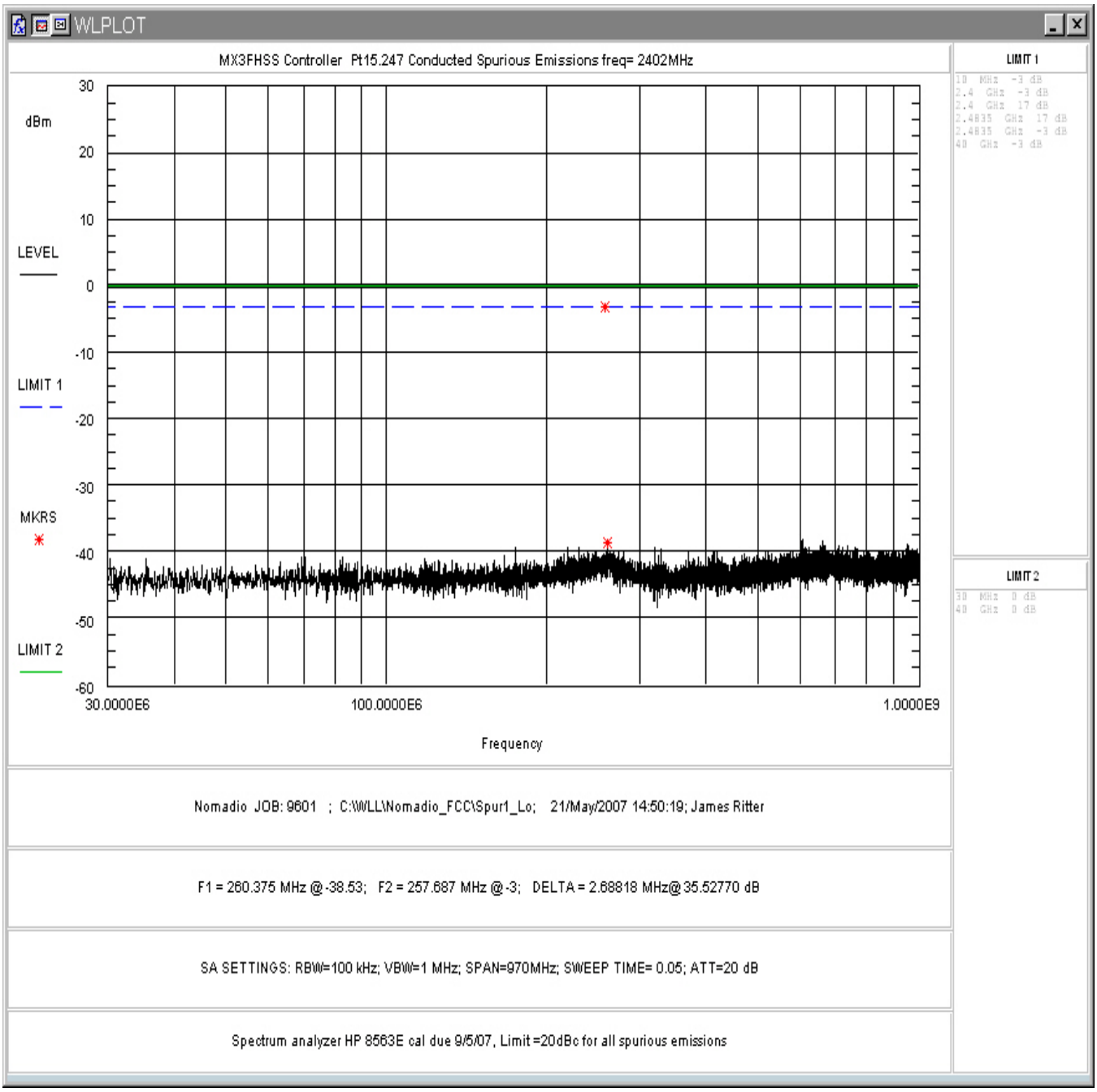

Figure 4-11. Conducted Spurious Emissions, Low Channel 30 - 1000MHz

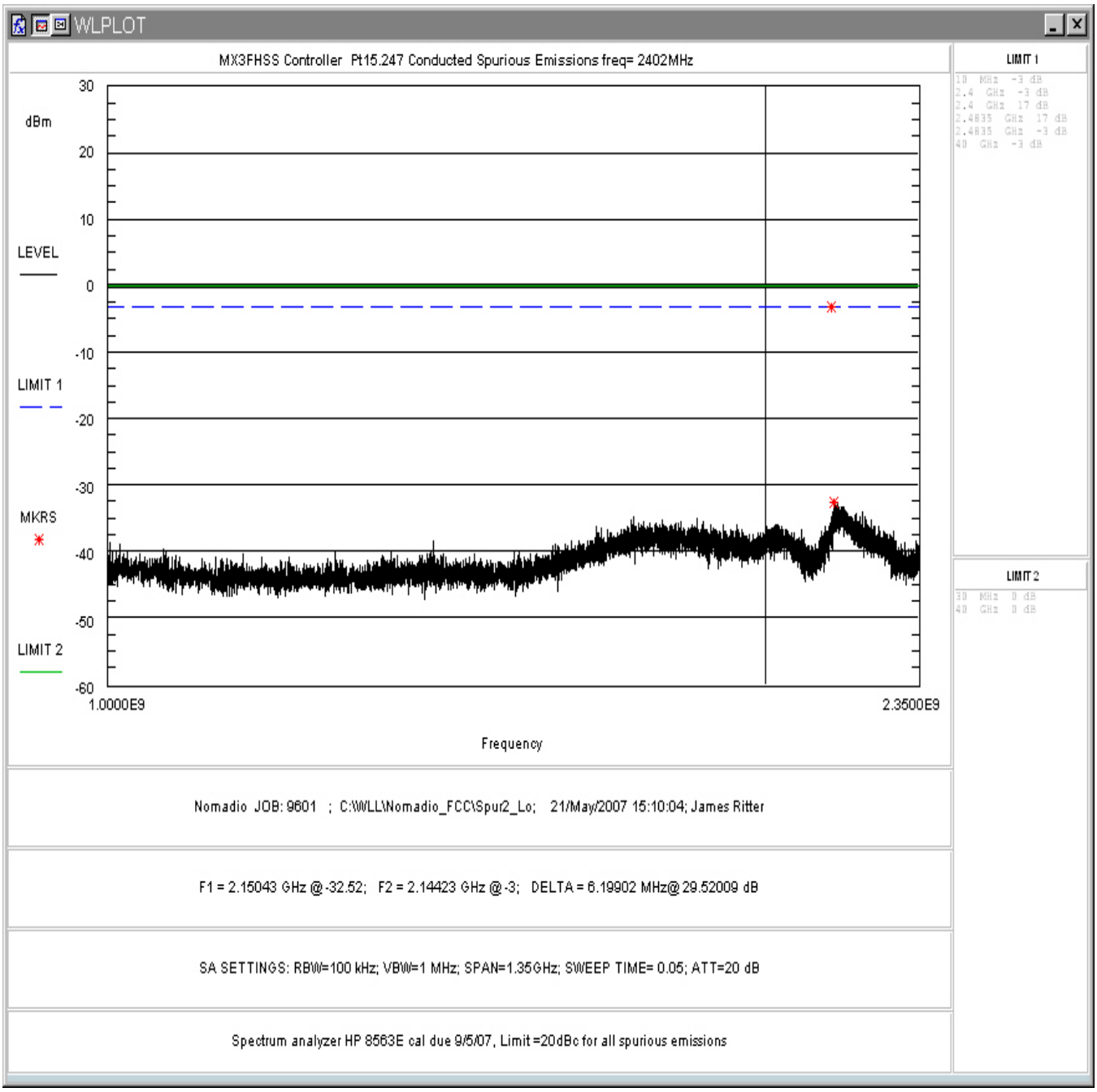

Figure 4-12. Conducted Spurious Emissions, Low Channel 1 – 2.35GHz

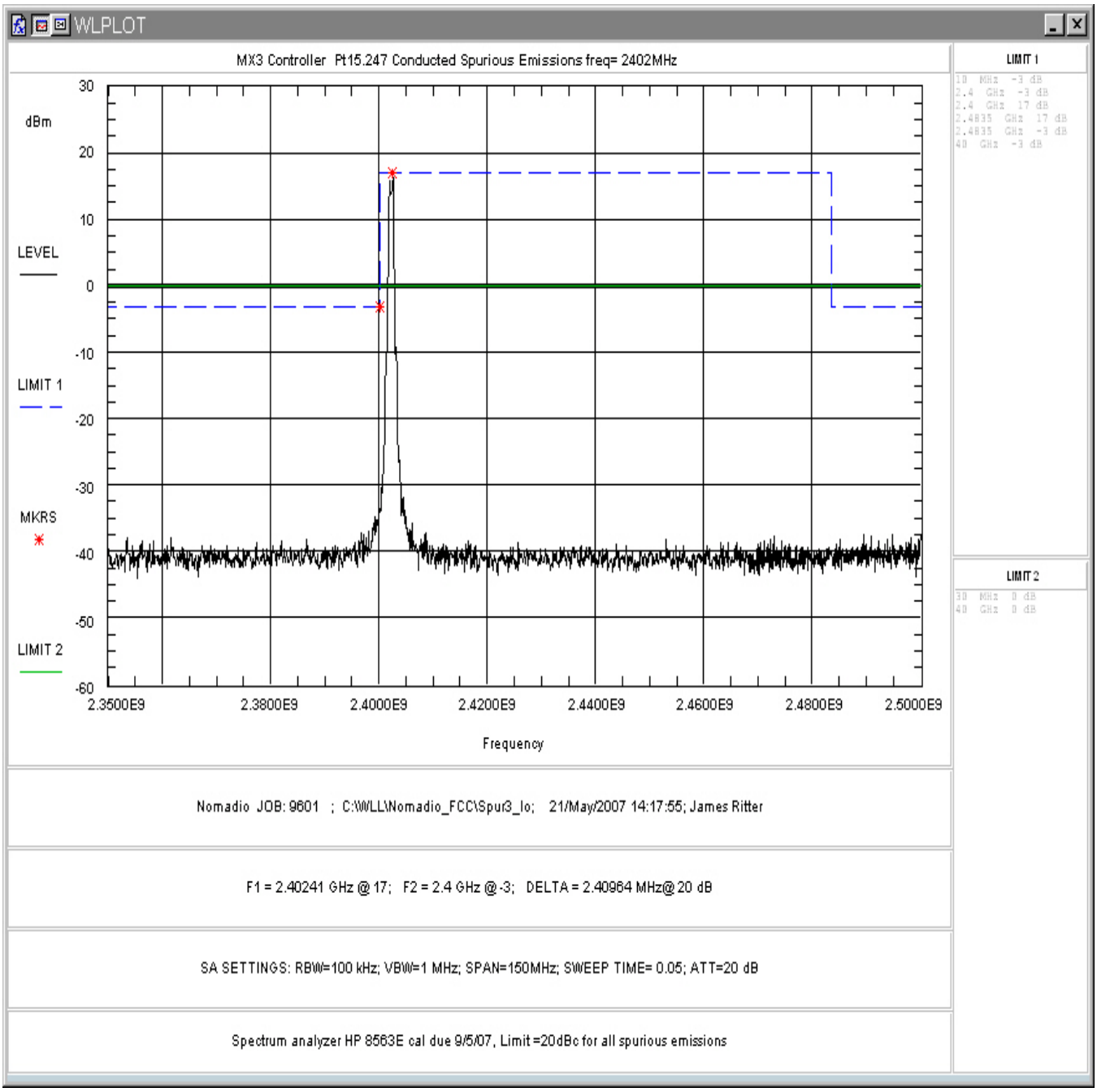

Figure 4-13. Conducted Spurious Emissions, Low Channel 2.35 – 2.5GHz

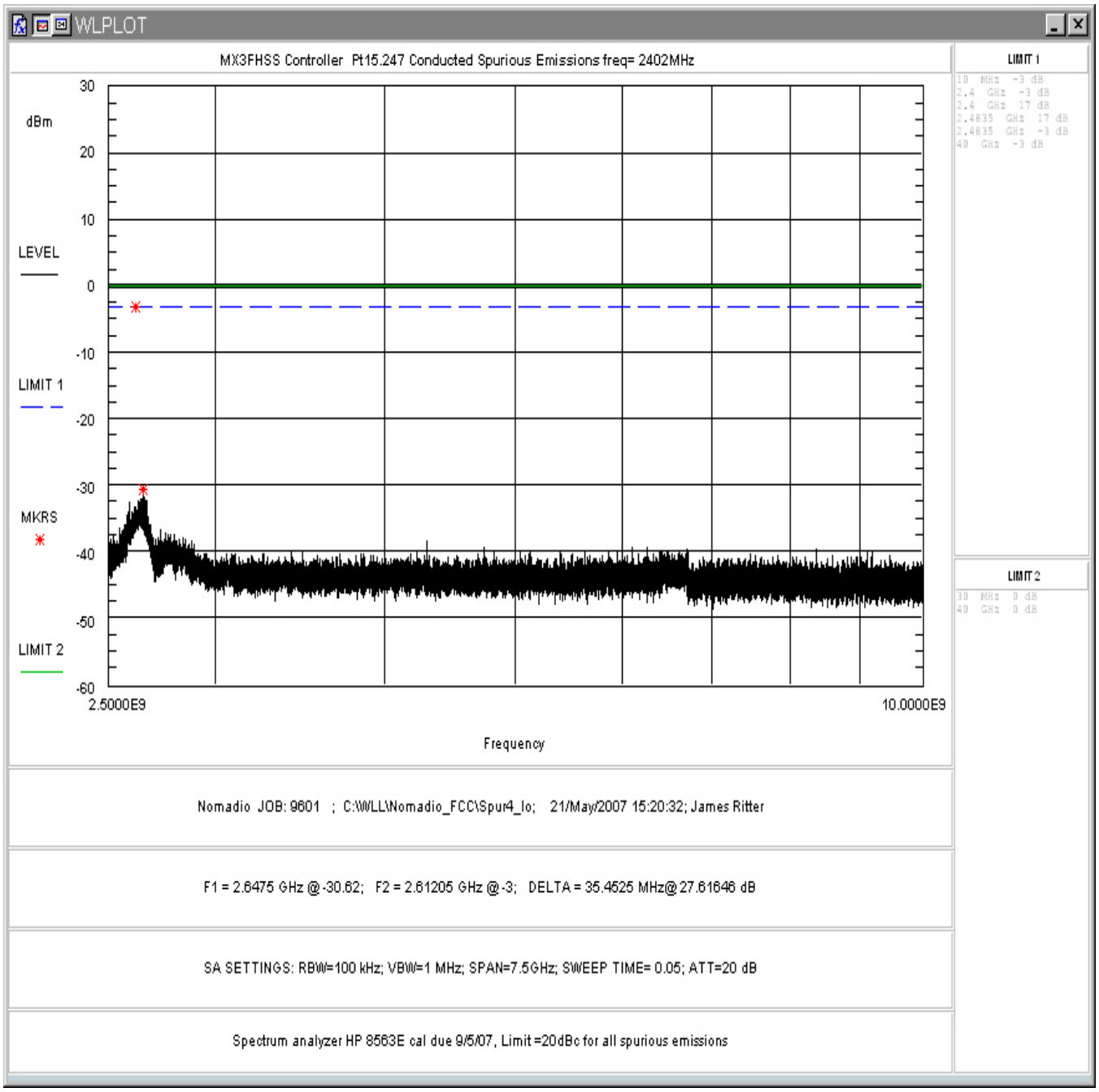

Figure 4-14. Conducted Spurious Emissions, Low Channel 2.5 - 10GHz

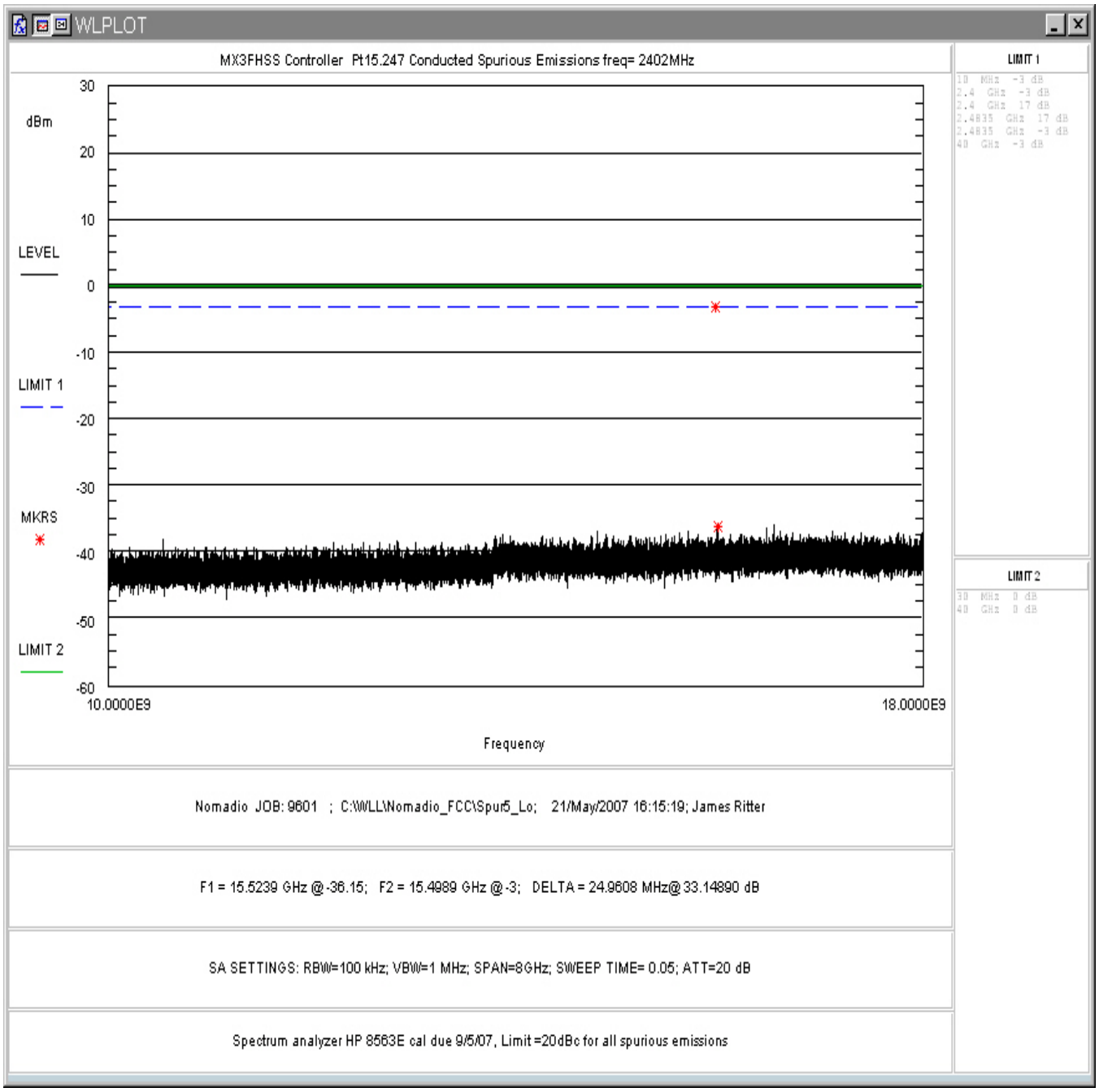

Figure 4-15. Conducted Spurious Emissions, Low Channel 10 - 18GHz

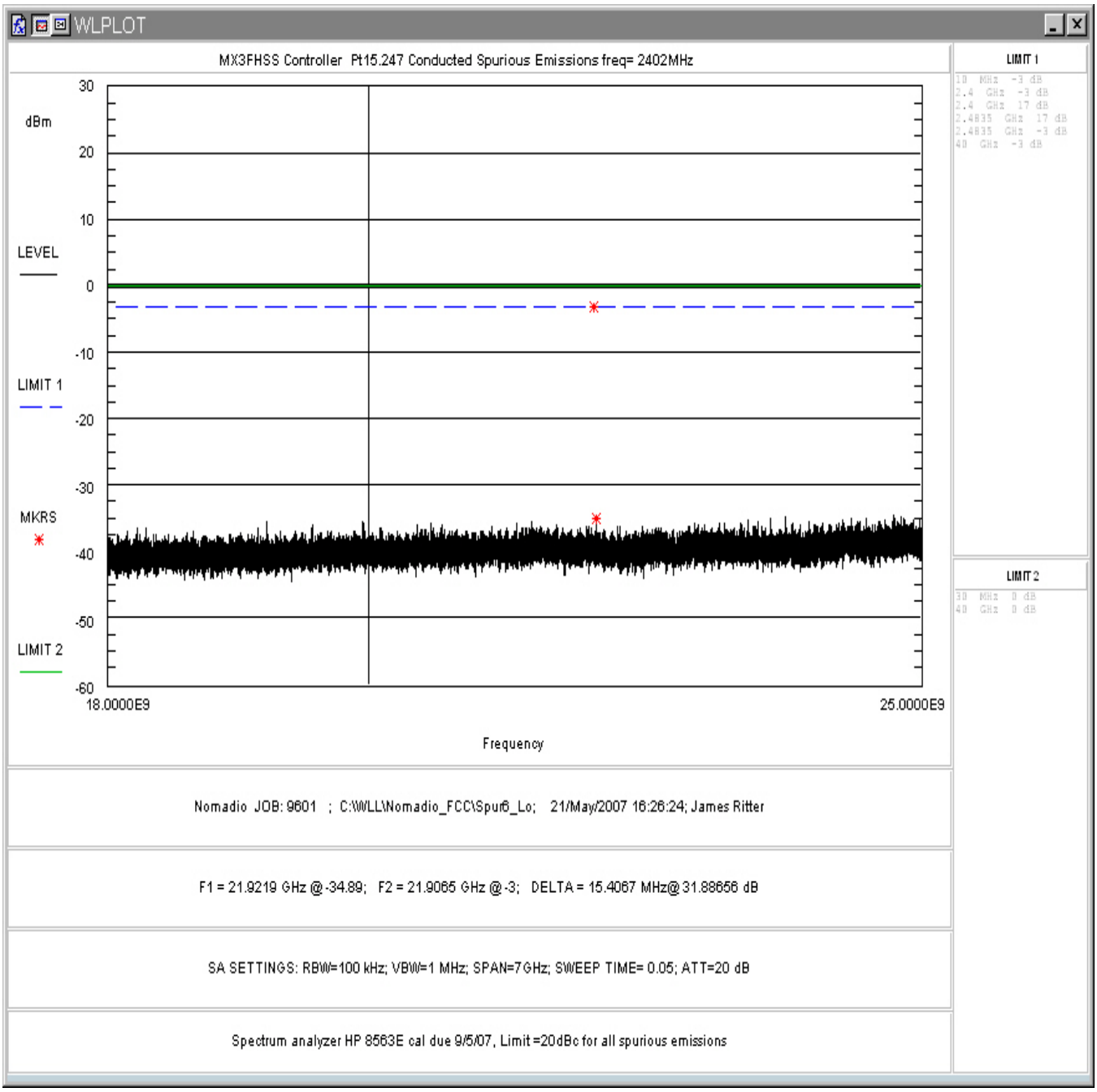

Figure 4-16. Conducted Spurious Emissions, Low Channel 18 - 25GHz

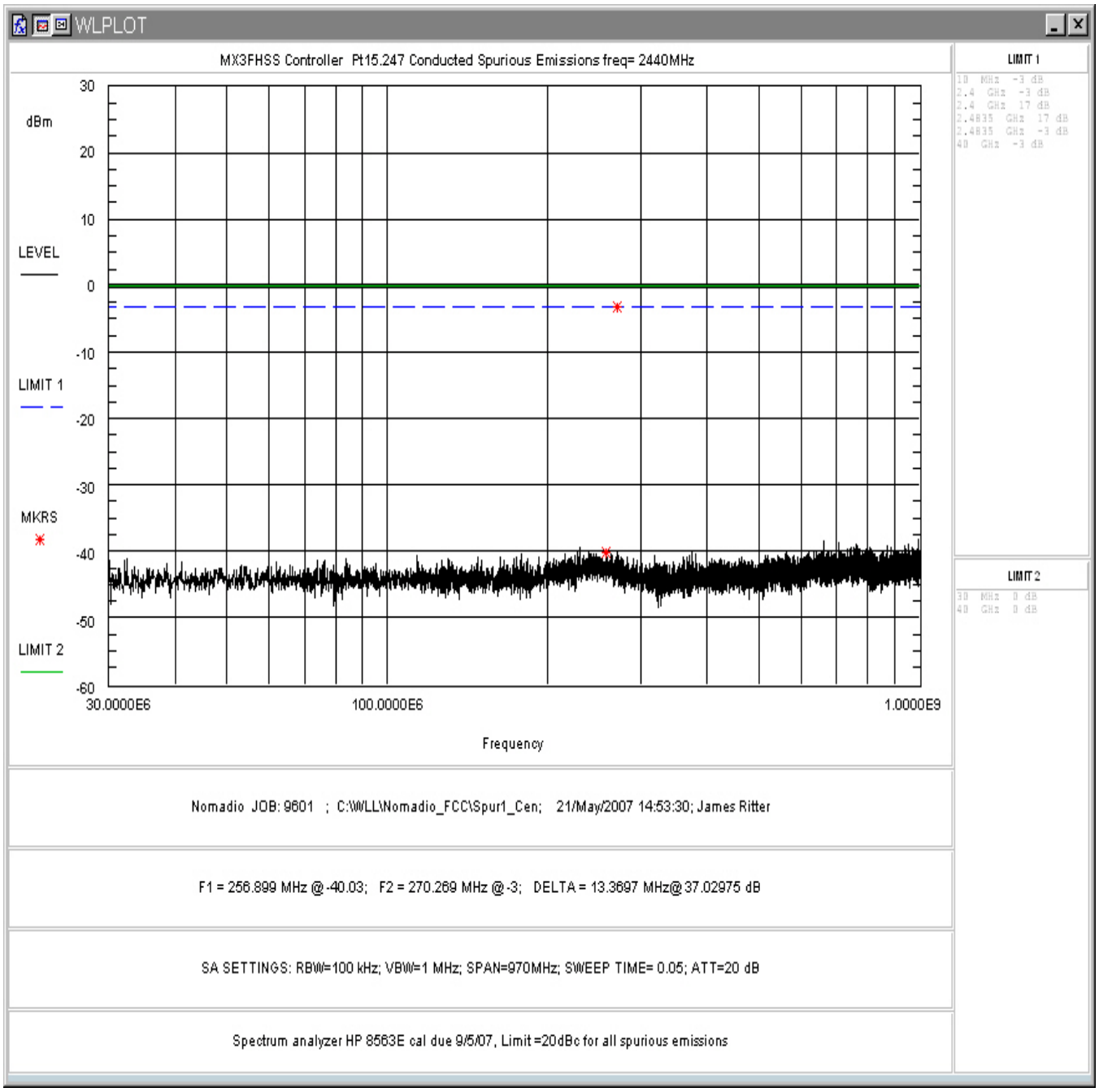

Figure 4-17. Conducted Spurious Emissions, Mid Channel 30 - 1000MHz

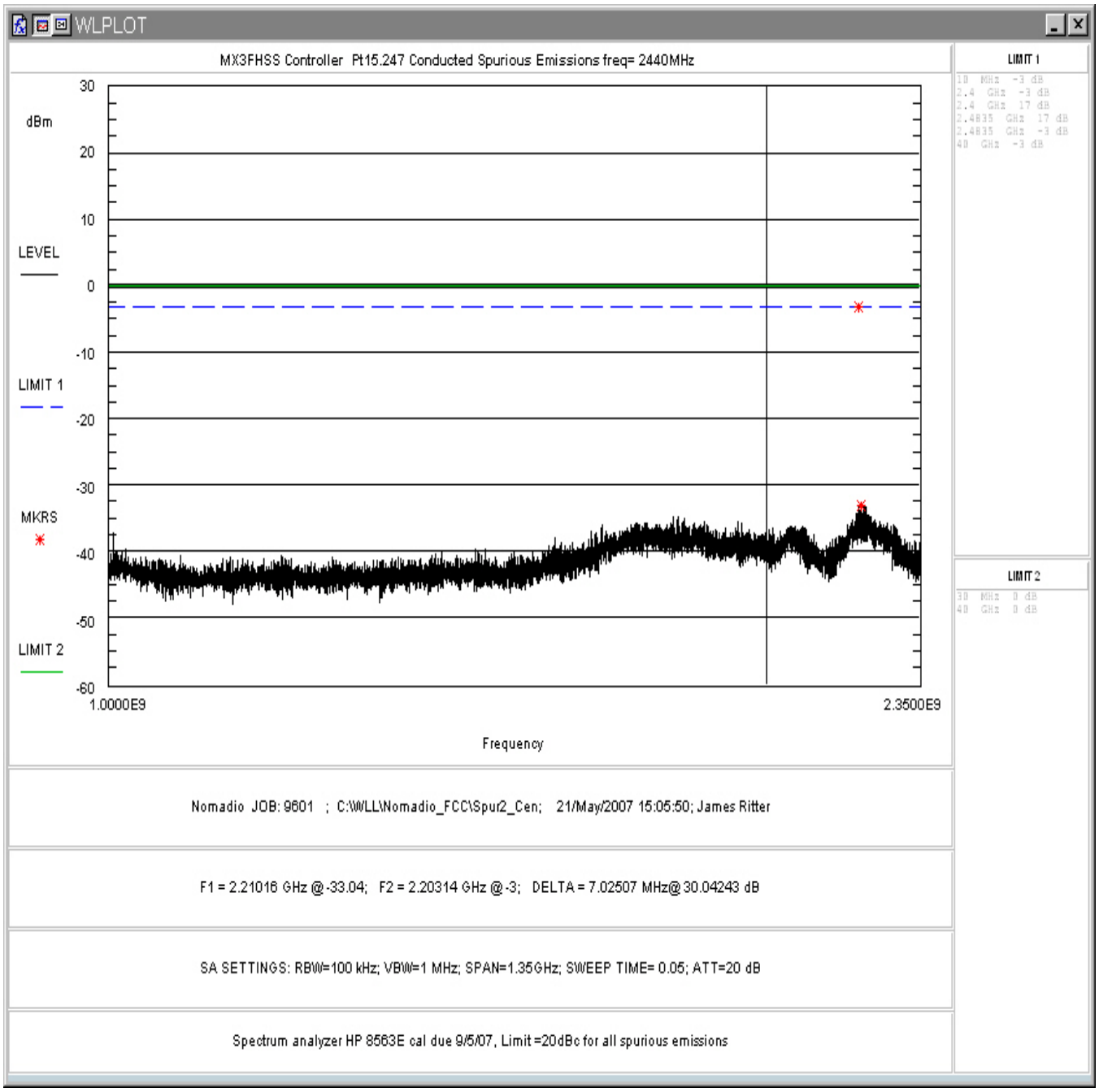

Figure 4-18. Conducted Spurious Emissions, Mid Channel 1 – 2.35GHz

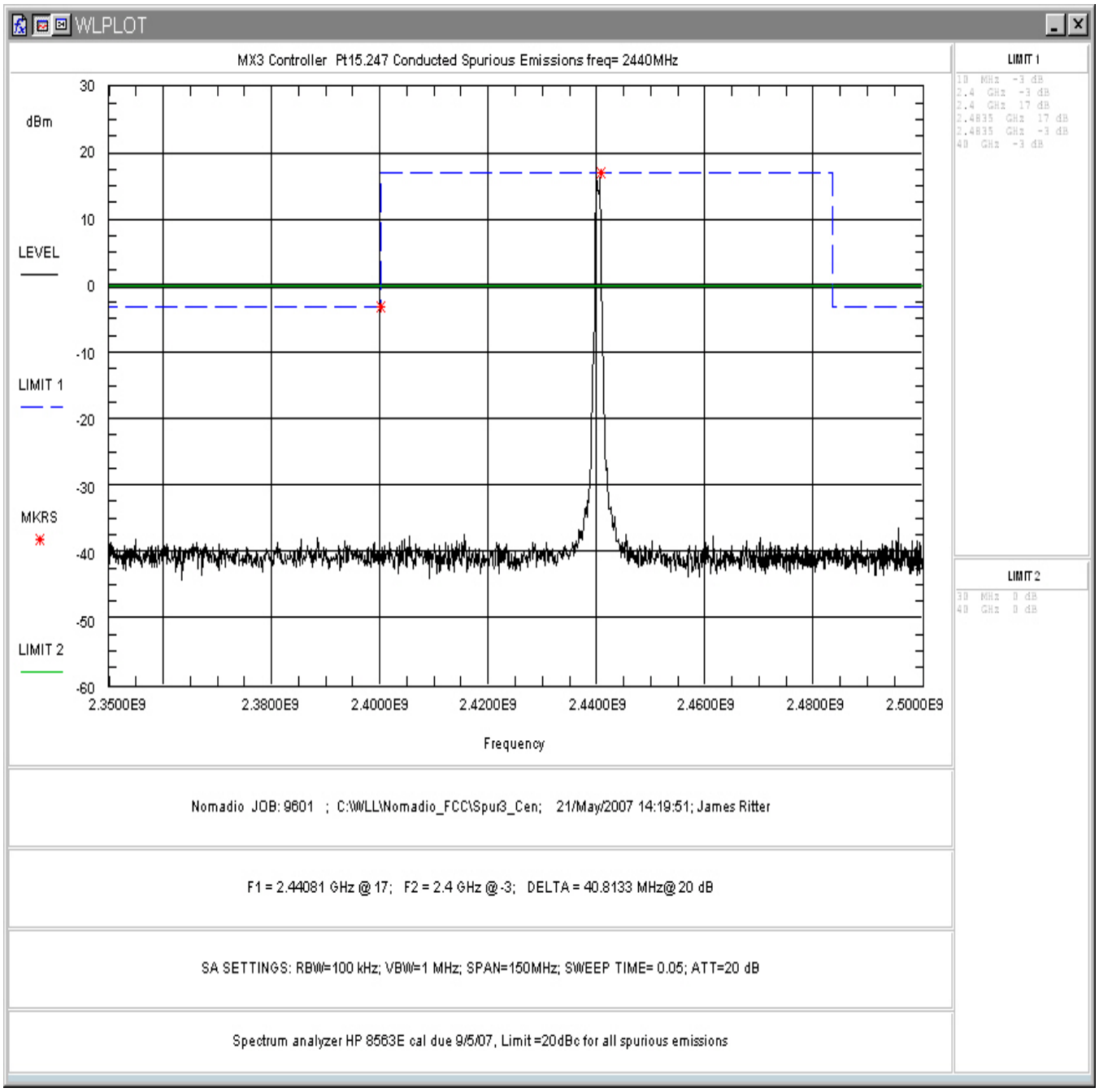

Figure 4-19. Conducted Spurious Emissions, Mid Channel 2.35 – 2.5GHz

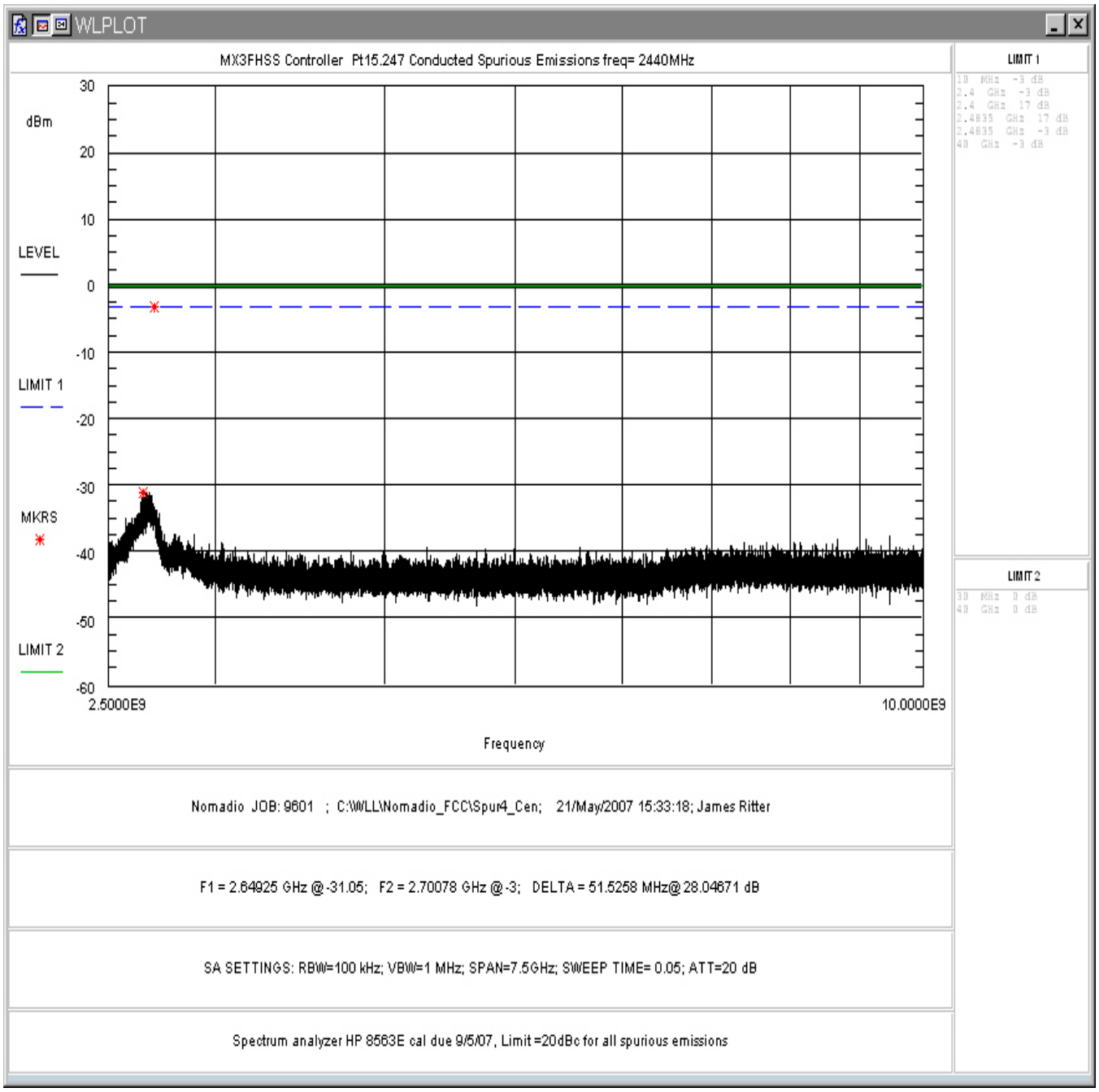

Figure 4-20. Conducted Spurious Emissions, Mid Channel 2.5 - 10GHz

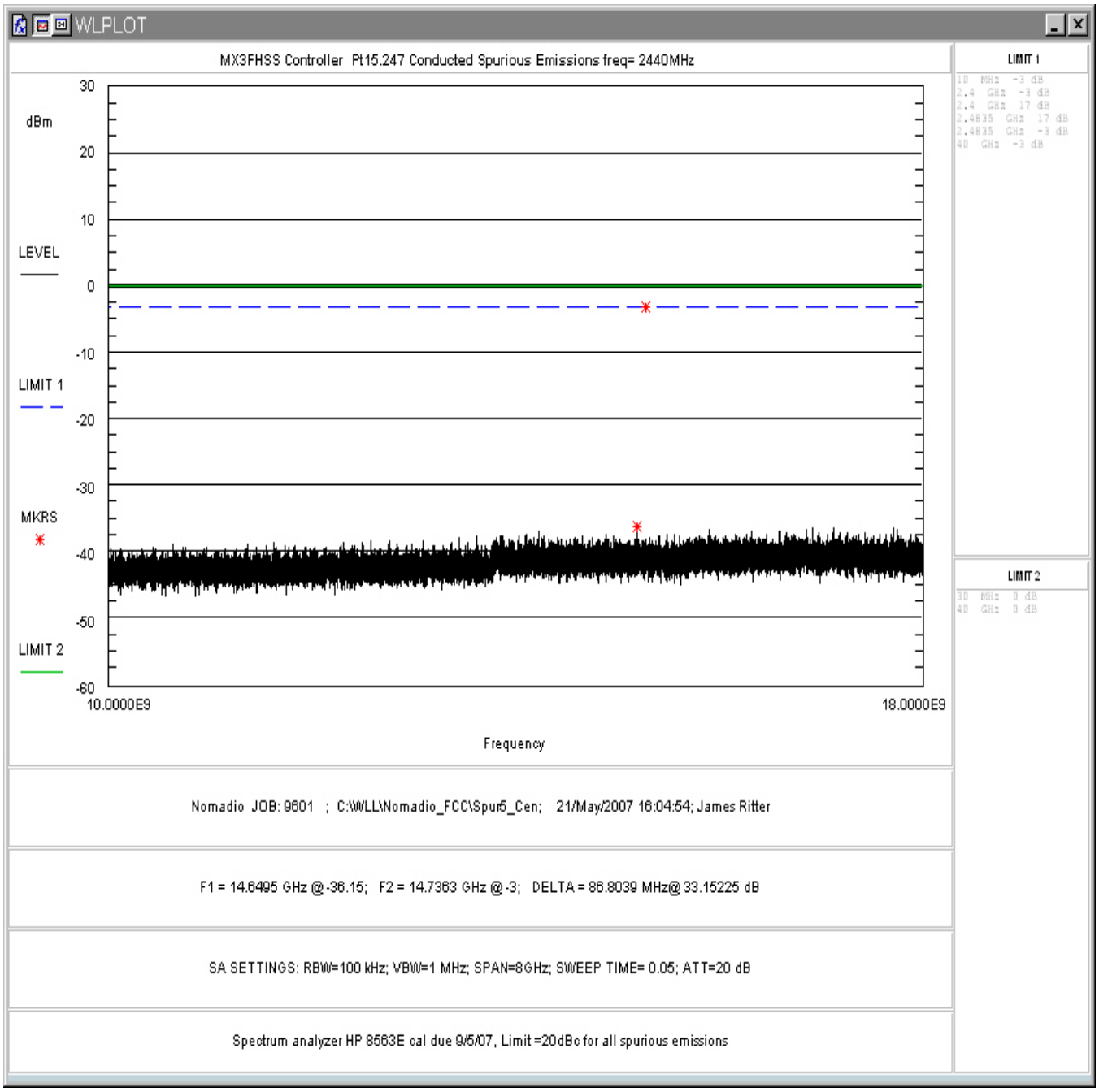

Figure 4-21. Conducted Spurious Emissions, Mid Channel 10 - 18GHz

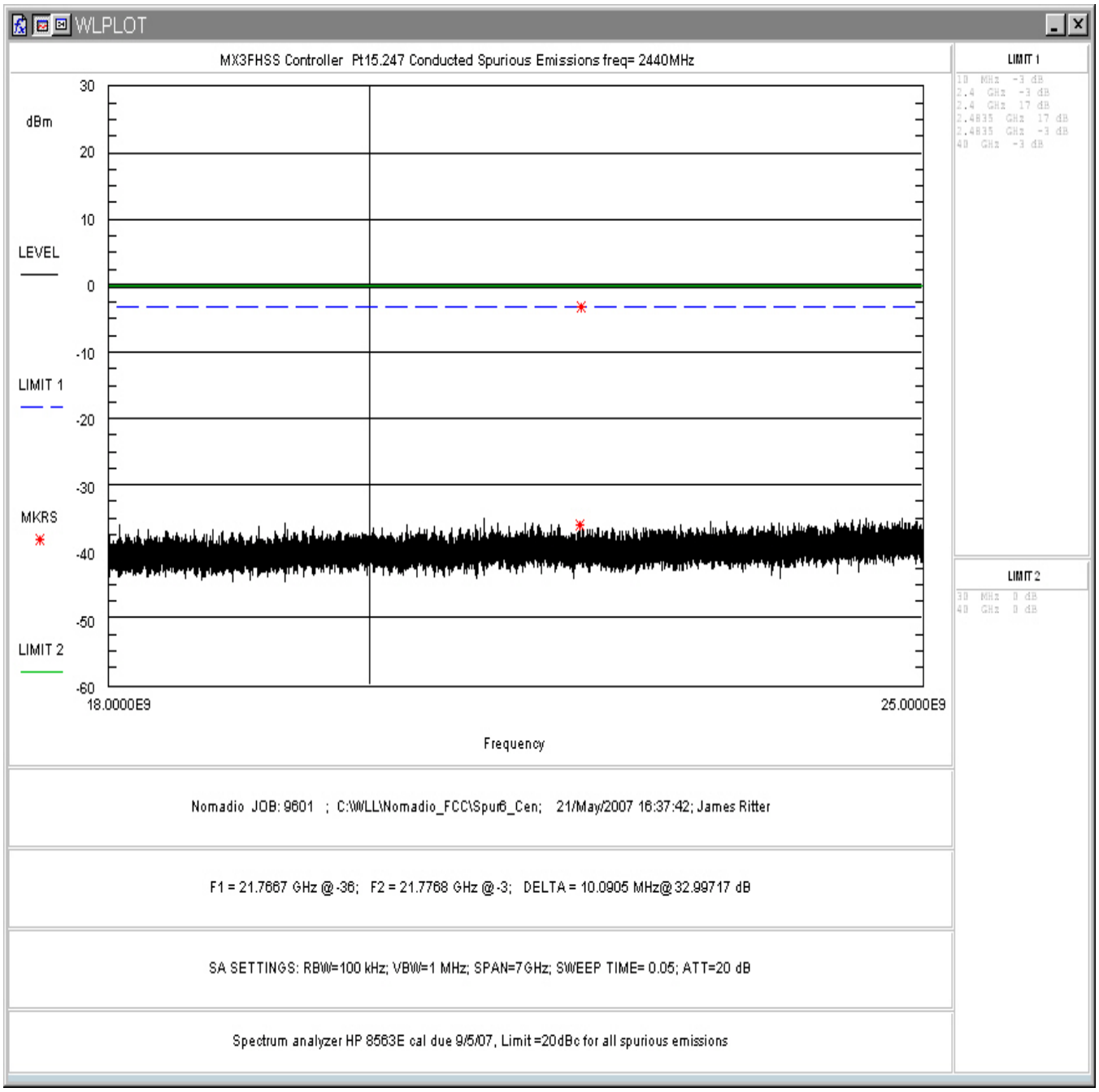

Figure 4-22. Conducted Spurious Emissions, Mid Channel 18 - 25GHz

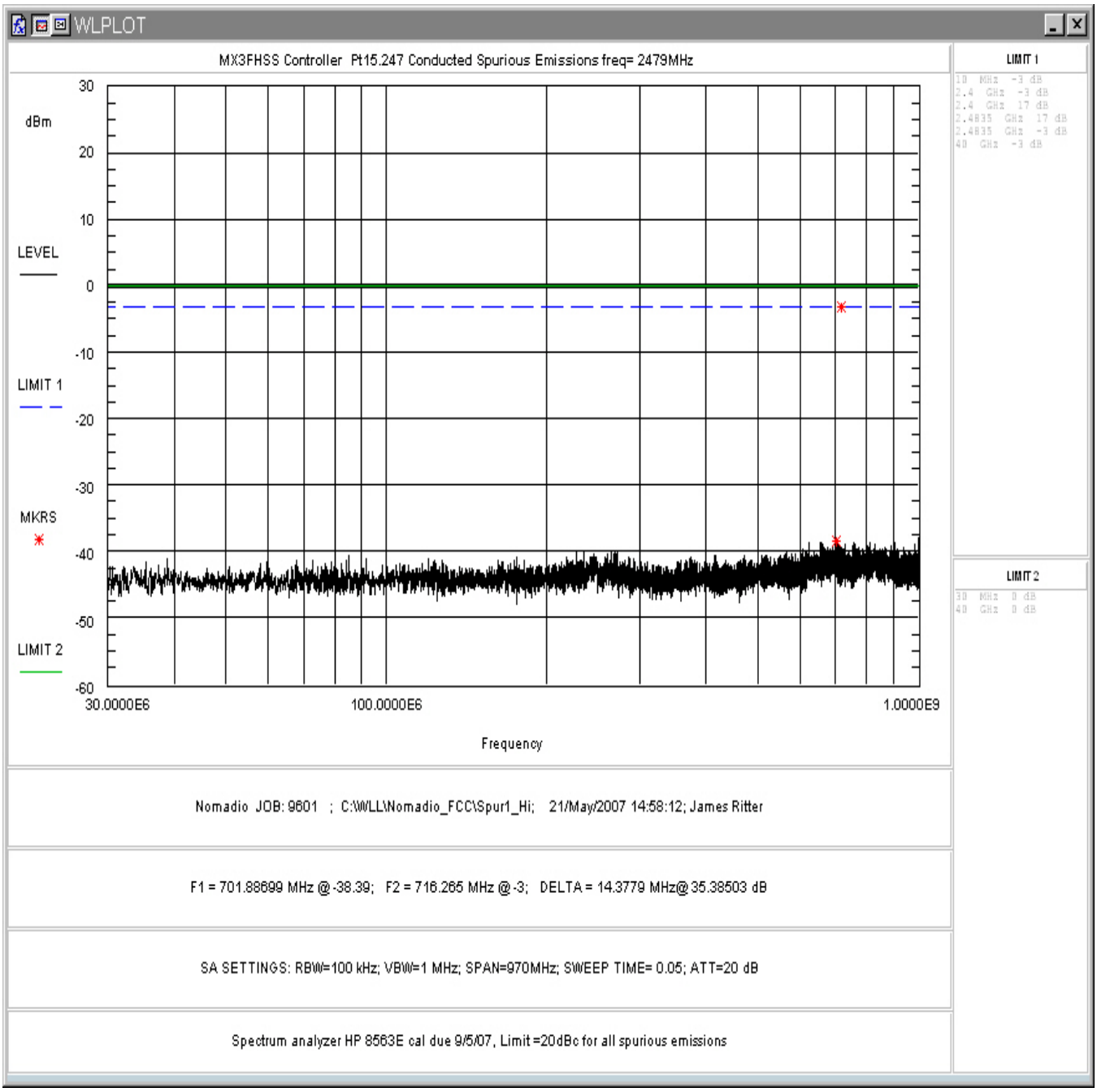

Figure 4-23. Conducted Spurious Emissions, High Channel 30 - 1000MHz

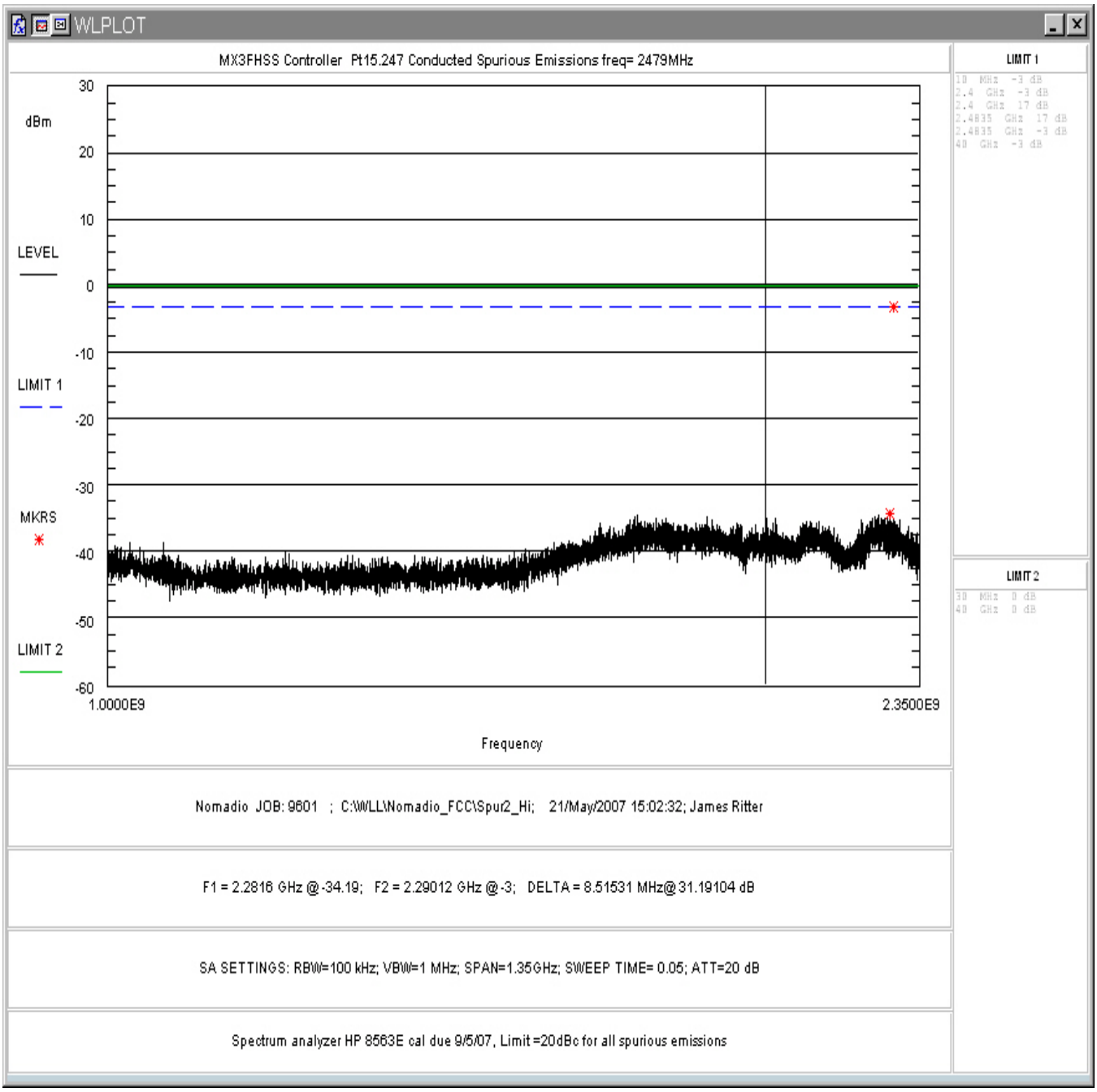

Figure 4-24. Conducted Spurious Emissions, High Channel 1 – 2.35GHz

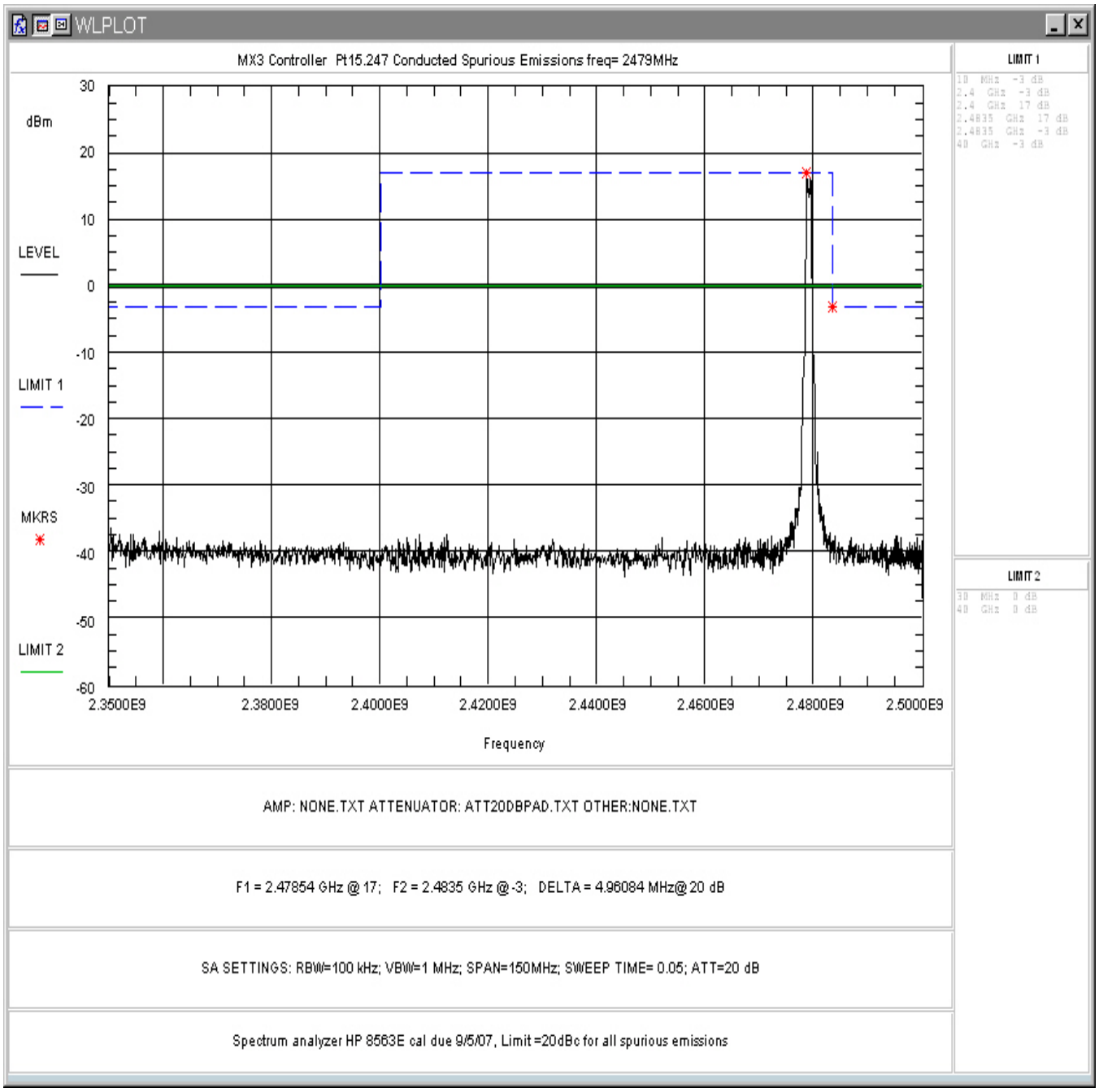

Figure 4-25. Conducted Spurious Emissions, High Channel 2.35 – 2.5GHz

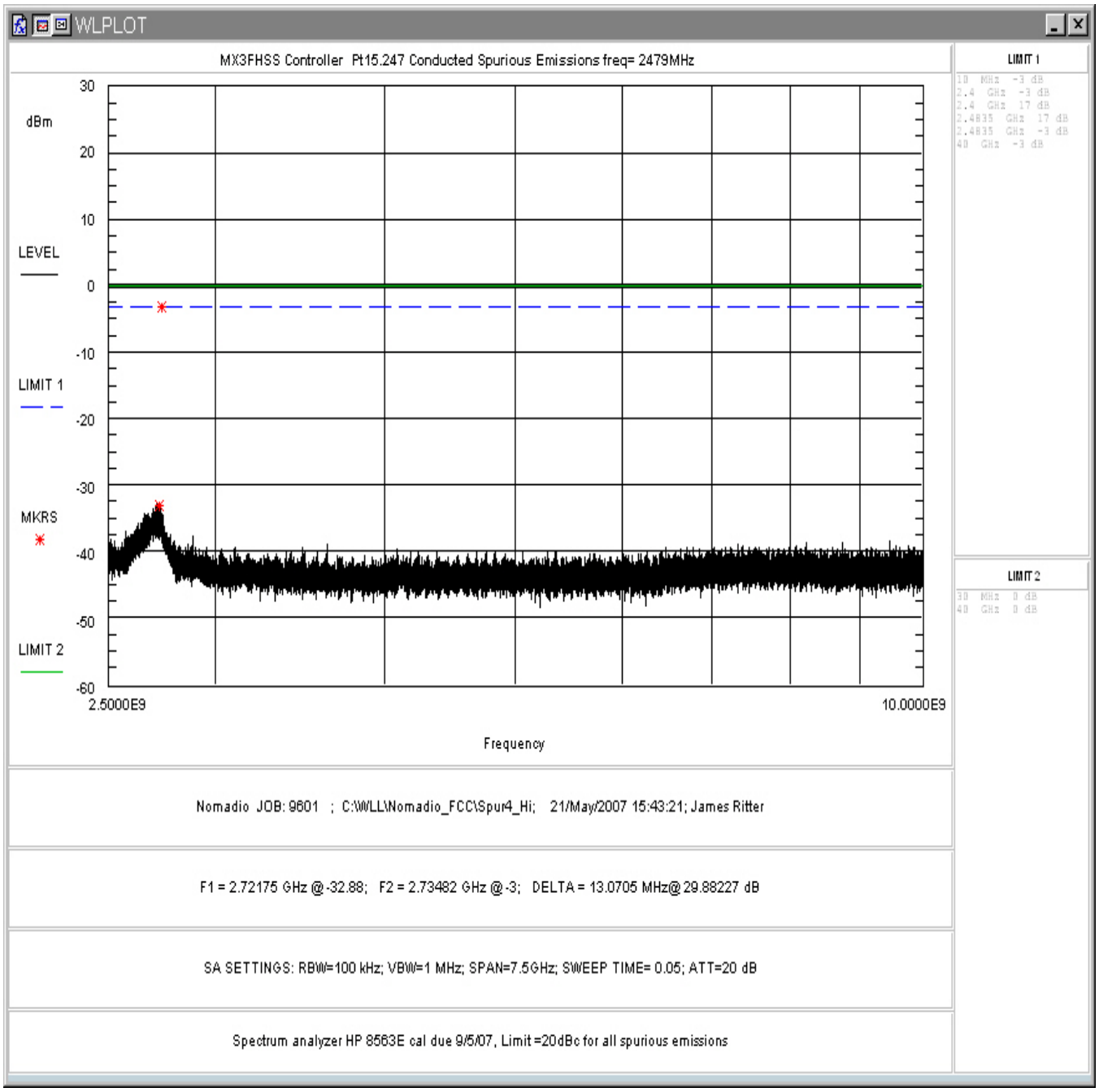

Figure 4-26. Conducted Spurious Emissions, High Channel 2.5 - 10GHz

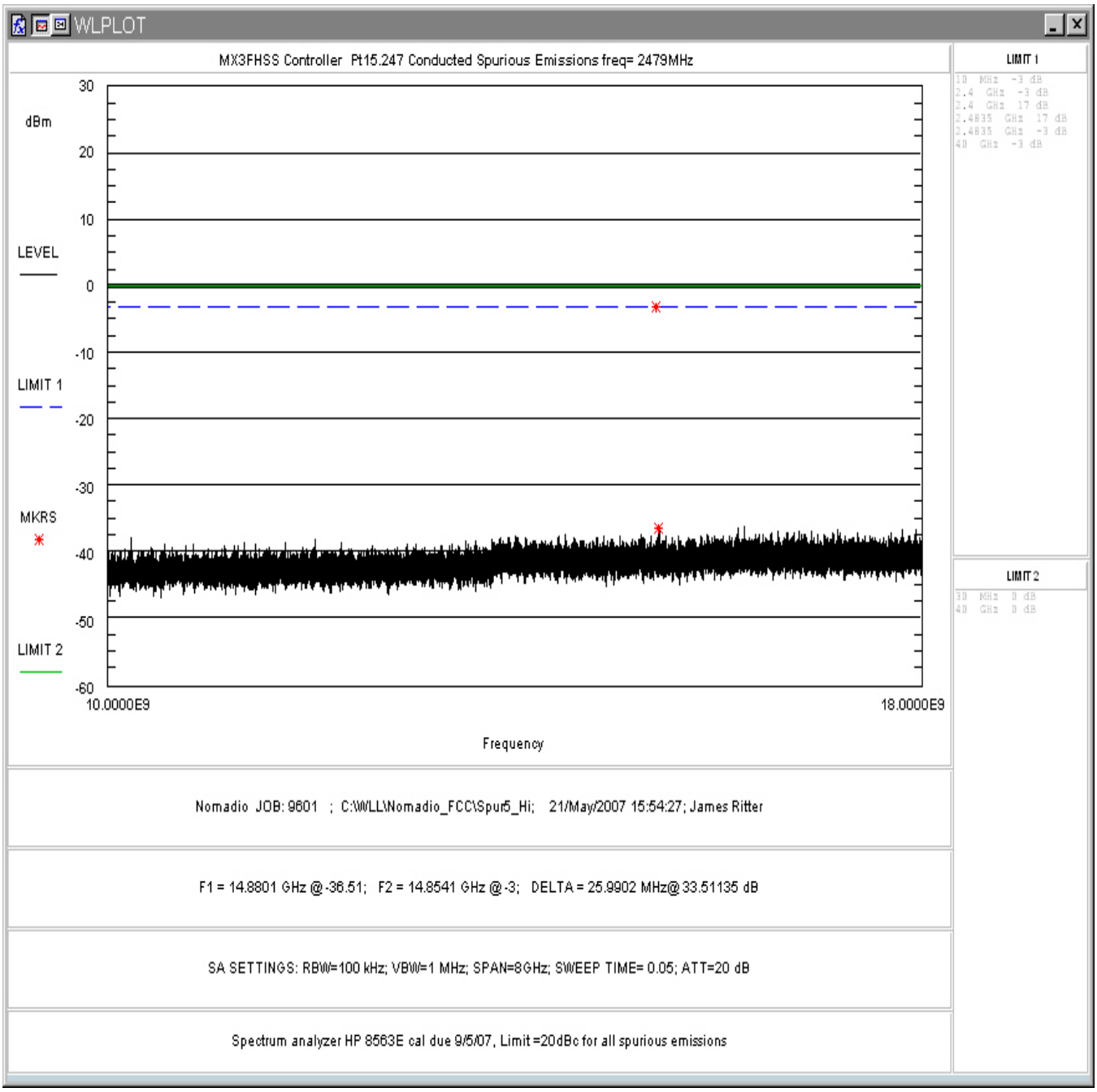

Figure 4-27. Conducted Spurious Emissions, High Channel 10 - 18GHz

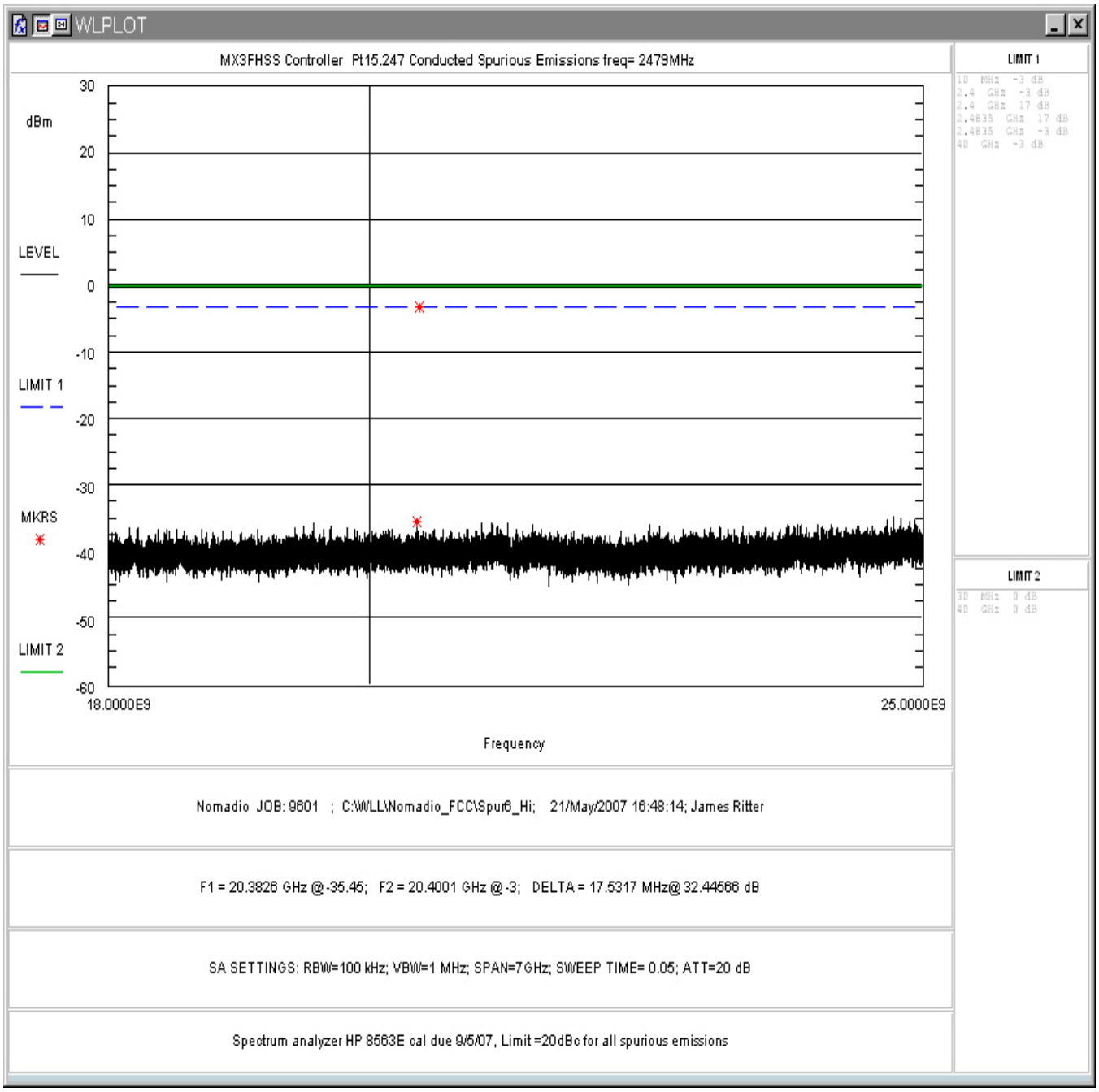

Figure 4-28. Conducted Spurious Emissions, High Channel 18 - 25GHz

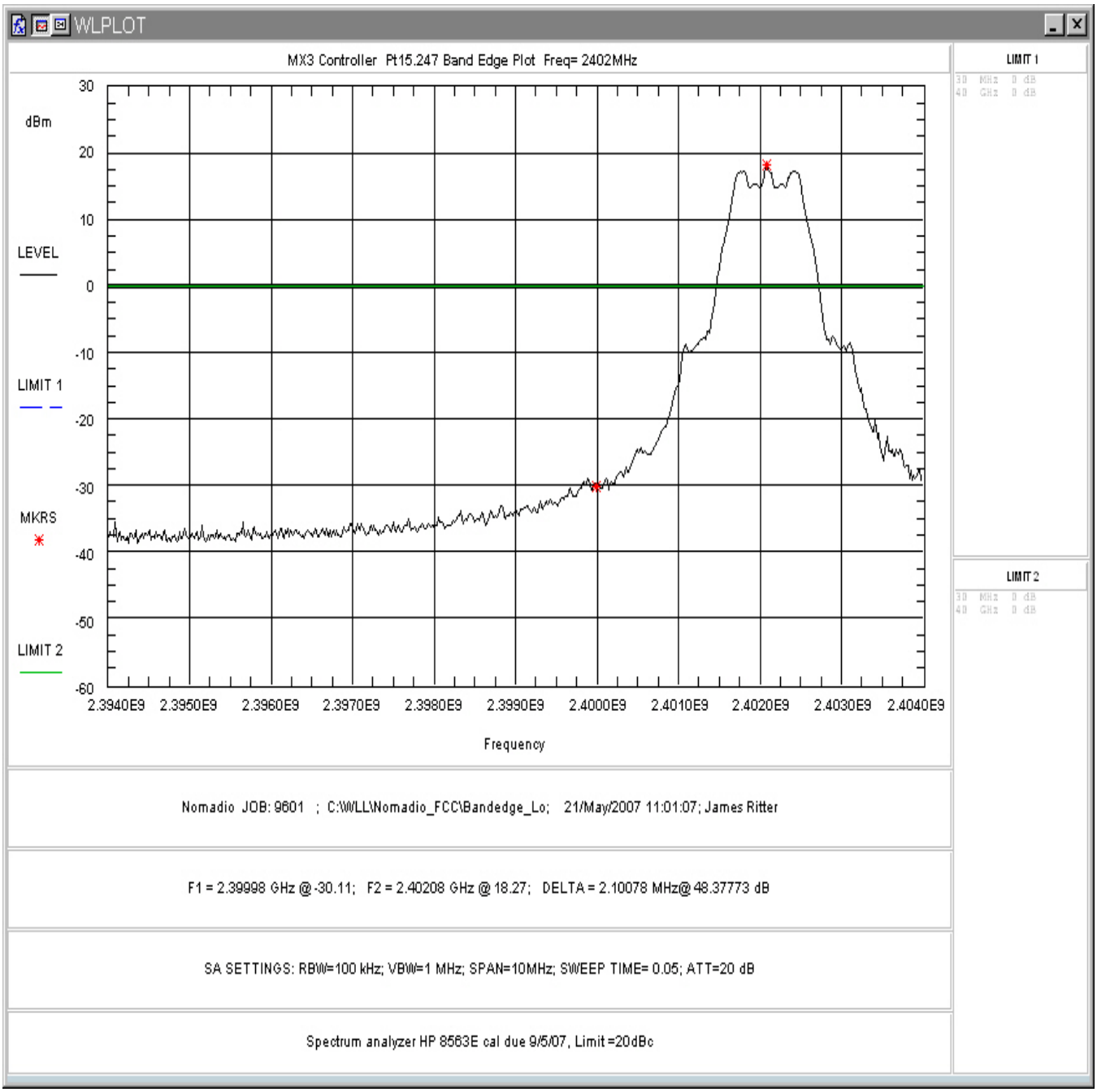

Figure 4-29 Lower Band Edge, Low Channel

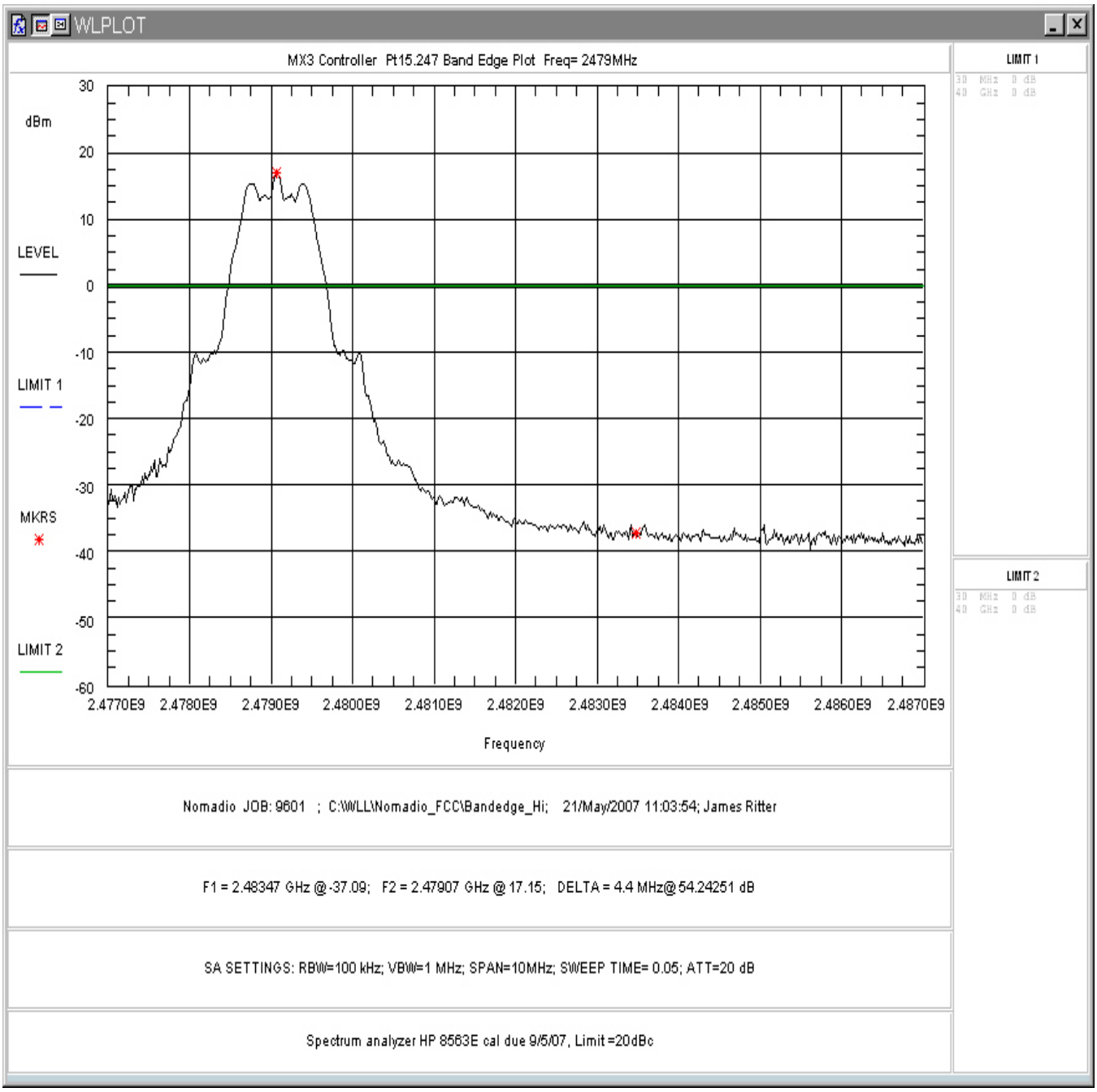

Figure 4-30 Upper Band Edge, High Channel

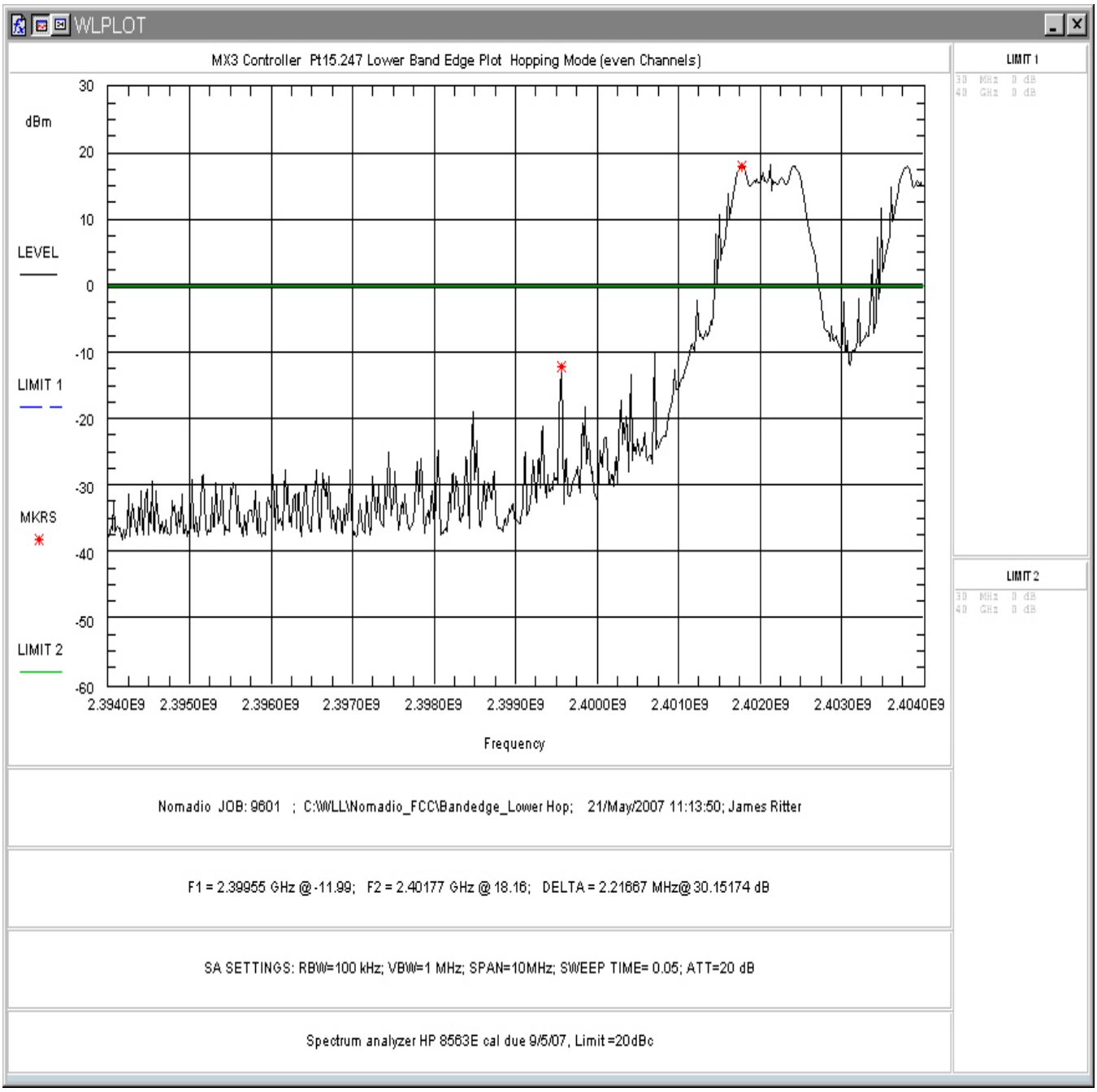

Figure 4-31 Lower Band Edge, Hopping Mode

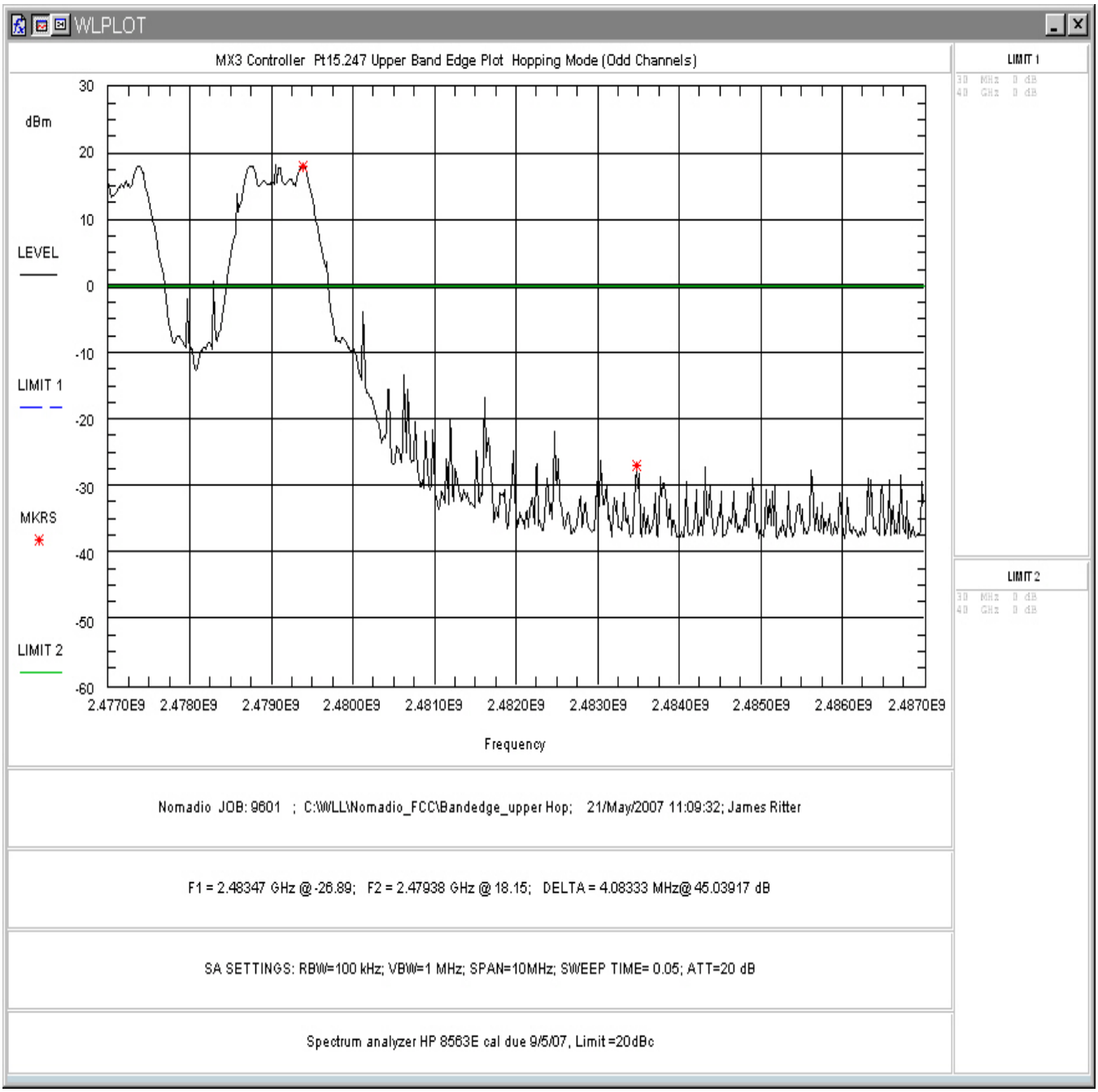

Figure 4-32 Upper Band Edge, Hopping Mode

4.6 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 and average measurements.

4.6.1 Test Procedure

The EUT was placed on motorized turntable for radiated testing on a 3-meter open field test site. The emissions from the EUT were measured continuously at every azimuth by rotating the turntable. Receiving antennas were mounted on an antenna mast to determine the height of maximum emissions. The height of the antenna was varied between 1 and 4 meters. The unit was tested in all 3 orthogonal planes because it is hand held. 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)

Table 5: Radiated Emission Test Data, Low Frequency Data (<1GHz)

Frequency (MHz)	Polarity H/V	Azimuth Degree	Ant. Height (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)
EUT Upright										
33.390	V	0.0	1.0	5.6	13.0	0.7	19.3	9.2	100.0	-20.7
64.819	V	270.0	1.0	8.1	9.5	1.3	19.0	8.9	100.0	-21.0
258.648	V	0.0	2.4	3.6	18.1	2.9	24.6	17.1	200.0	-21.4
360.030	V	200.0	1.6	9.4	15.4	3.4	28.2	25.8	200.0	-17.8
386.500	V	270.0	1.5	10.3	16.6	3.4	30.3	32.6	200.0	-15.8
421.700	V	270.0	1.5	10.5	17.5	3.8	31.8	38.7	200.0	-14.3
483.780	V	270.0	1.4	4.4	17.1	3.9	25.4	18.7	200.0	-20.6
647.180	V	180.0	1.4	3.1	19.4	4.7	27.2	23.0	200.0	-18.8
930.980	V	180.0	1.6	4.0	23.6	6.5	34.1	51.0	200.0	-11.9
989.100	V	90.0	1.5	10.3	24.0	6.8	41.1	112.9	500.0	-12.9
33.390	H	0.0	4.0	4.3	13.0	0.7	18.0	8.0	100.0	-22.0
64.819	H	180.0	4.0	13.1	9.5	1.3	24.0	15.8	100.0	-16.0
258.648	H	180.0	2.5	1.2	18.1	2.9	22.2	12.9	200.0	-23.8
360.030	H	180.0	3.0	4.9	15.4	3.4	23.7	15.3	200.0	-22.3
386.500	H	190.0	3.1	3.1	16.6	3.4	23.1	14.2	200.0	-23.0
421.700	H	0.0	3.2	2.8	17.5	3.8	24.1	16.0	200.0	-22.0
930.980	H	90.0	1.4	2.7	23.6	6.5	32.8	43.9	200.0	-13.2
989.100	H	0.0	1.4	3.0	24.0	6.8	33.8	48.7	500.0	-20.2
EUT On side										
33.390	V	0.0	1.0	5.0	13.0	0.7	18.7	8.6	100.0	-21.3
64.819	V	180.0	1.2	10.3	9.5	1.3	21.2	11.4	100.0	-18.8
258.648	V	20.0	2.0	2.1	18.1	2.9	23.1	14.4	200.0	-22.9
360.030	V	0.0	1.0	6.0	15.4	3.4	24.8	17.4	200.0	-21.2
386.500	V	0.0	1.0	6.1	16.6	3.4	26.1	20.1	200.0	-20.0
421.700	V	0.0	1.5	3.0	17.5	3.8	24.3	16.3	200.0	-21.8
483.780	V	180.0	1.7	2.1	17.1	3.9	23.1	14.3	200.0	-22.9
647.180	V	90.0	1.3	3.0	19.4	4.7	27.1	22.7	200.0	-18.9
930.980	V	260.0	2.0	2.7	23.6	6.5	32.8	43.9	200.0	-13.2
989.100	V	180.0	2.0	2.4	24.0	6.8	33.2	45.5	500.0	-20.8
33.390	H	270.0	4.0	4.4	13.0	0.7	18.1	8.0	100.0	-21.9
64.819	H	180.0	4.0	12.2	9.5	1.3	23.1	14.2	100.0	-16.9
258.648	H	10.0	2.4	2.9	18.1	2.9	23.9	15.7	200.0	-22.1
360.030	H	0.0	3.2	4.0	15.4	3.4	22.8	13.8	200.0	-23.2
386.500	H	0.0	3.4	4.7	16.6	3.4	24.7	17.1	200.0	-21.4
421.700	H	245.0	3.4	5.2	17.5	3.8	26.5	21.0	200.0	-19.6
930.980	H	180.0	3.0	3.0	23.6	6.5	33.1	45.4	200.0	-12.9
989.100	H	100.0	2.5	4.1	24.0	6.8	34.9	55.3	500.0	-19.1

Frequency (MHz)	Polarity H/V	Azimuth Degree	Ant. Height (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)
EUT FLAT										
33.390	V	270.0	1.0	6.0	13.0	0.7	19.7	9.7	100.0	-20.3
64.819	V			10.2	9.5	1.3	21.1	11.3	100.0	-18.9
258.648	V	90.0	2.4	1.8	18.1	2.9	22.8	13.9	200.0	-23.2
360.030	V	270.0	1.4	8.7	15.4	3.4	27.5	23.8	200.0	-18.5
386.500	V	90.0	1.6	5.7	16.6	3.4	25.7	19.2	200.0	-20.4
421.700	V	250.0	2.0	3.2	17.5	3.8	24.5	16.7	200.0	-21.6
483.780	V	270.0	1.3	1.9	17.1	3.9	22.9	14.0	200.0	-23.1
647.180	V	90.0	1.6	4.0	19.4	4.7	28.1	25.5	200.0	-17.9
930.980	V	245.0	2.4	2.2	23.6	6.5	32.3	41.4	200.0	-13.7
989.100	V	180.0	2.0	2.3	24.0	6.8	33.1	45.0	500.0	-20.9
33.390	H	180.0	4.0	3.0	13.0	0.7	16.7	6.8	100.0	-23.3
64.819	H	180.0	3.6	9.8	9.5	1.3	20.7	10.8	100.0	-19.3
258.648	H	90.0	2.5	1.9	18.1	2.9	22.9	14.0	200.0	-23.1
360.030	H	190.0	3.2	4.2	15.4	3.4	23.0	14.2	200.0	-23.0
386.500	H	190.0	3.2	6.8	16.6	3.4	26.8	21.8	200.0	-19.3
421.700	H	180.0	3.0	6.6	17.5	3.8	27.9	24.7	200.0	-18.2
930.980	H	190.0	2.5	2.5	23.6	6.5	32.6	42.9	200.0	-13.4
989.100	H	90.0	3.0	6.4	24.0	6.8	37.2	72.1	500.0	-16.8

Table 6: Radiated Emission Test Data, High Frequency Data (>1GHz)

(Restricted Bands)

Low Channel 2402MHz

Frequency (MHz)	Polarity H/V	Azimuth Degree	Ant. Ht (m)	SA Level (QP) (dBµV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Duty Cycle Corr. (dB)	Amp Gain (dB)	Corr. Level (dBµV/m)	Corr. Level (µV/m)	Limit (µV/m)	Margin (dB)
Peak	**Unit upright**											
4804.000	H	270.0	1.0	50.8	32.5	3.5	0.0	31.8	55.0	562.3	5000.0	-19.0
12010.000	H	180.0	1.0	43.2	40.0	5.0	0.0	30.6	57.6	759.7	5000.0	-16.4
4804.000	V	180.0	1.0	48.8	32.5	3.5	0.0	31.8	53.0	446.7	5000.0	-21.0
12010.000	V	180.0	1.0	43.8	40.0	5.0	0.0	30.6	58.2	814.0	5000.0	-15.8
	Unit Flat											
4804.000	V	0.0	1.0	46.8	32.5	3.5	0.0	31.8	51.0	354.8	5000.0	-23.0
12010.000	V	180.0	1.0	46.0	40.0	5.0	0.0	30.6	60.4	1048.6	5000.0	-13.6
4804.000	H	90.0	1.0	44.0	32.5	3.5	0.0	31.8	48.2	256.2	5000.0	-25.8
12010.000	H	180.0	1.0	44.8	40.0	5.0	0.0	30.6	59.2	913.3	5000.0	-14.8
	Unit On Side											
4804.000	V	90.0	1.0	46.1	32.5	3.5	0.0	31.8	50.3	326.2	5000.0	-23.7
12010.000	V	100.0	1.0	45.4	40.0	5.0	0.0	30.6	59.8	978.6	5000.0	-14.2
4804.000	H	120.0	1.0	42.1	32.5	3.5	0.0	31.8	46.3	205.8	5000.0	-27.7
12010.000	H	270.0	1.0	44.6	40.0	5.0	0.0	30.6	59.0	892.5	5000.0	-15.0
Average	**Unit upright**											
4804.000	H	270.0	1.0	38.7	32.5	3.5	14.5	31.8	28.3	26.1	500.0	-25.6
12010.000	H	180.0	1.0	33.1	40.0	5.0	14.5	30.6	33.0	44.7	500.0	-21.0
4804.000	V	180.0	1.0	36.9	32.5	3.5	14.5	31.8	26.6	21.3	500.0	-27.4
12010.000	V	180.0	1.0	33.4	40.0	5.0	14.5	30.6	33.3	46.3	500.0	-20.7
	Unit Flat											
4804.000	V	0.0	1.0	36.2	32.5	3.5	14.5	31.8	25.8	19.6	500.0	-28.1
12010.000	V	180.0	1.0	33.8	40.0	5.0	14.5	30.6	33.7	48.5	500.0	-20.3
4804.000	H	90.0	1.0	34.0	32.5	3.5	14.5	31.8	23.7	15.3	500.0	-30.3
12010.000	H	180.0	1.0	33.0	40.0	5.0	14.5	30.6	32.9	44.2	500.0	-21.1
	Unit On Side											
4804.000	V	90.0	1.0	36.4	32.5	3.5	14.5	31.8	26.1	20.1	500.0	-27.9
12010.000	V	100.0	1.0	33.4	40.0	5.0	14.5	30.6	33.3	46.3	500.0	-20.7
4804.000	H	120.0	1.0	33.6	32.5	3.5	14.5	31.8	23.3	14.6	500.0	-30.7
12010.000	H	270.0	1.0	33.2	40.0	5.0	14.5	30.6	33.1	45.3	500.0	-20.9
NON- Harmonic emissions												
Peak												
1036.000	V	3.0	1.0	67.5	25.3	1.2	0.0	37.6	56.4	658.4	5000.0	-17.6
1720.000	V	3.0	1.0	71.4	27.3	1.5	0.0	36.8	63.4	1479.6	5000.0	-10.6

Frequency (MHz)	Polarity H/V	Azimuth Degree	Ant. Ht (m)	SA Level (QP) (dBµV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Duty Cycle Corr. (dB)	Amp Gain (dB)	Corr. Level (dBµV/m)	Corr. Level (µV/m)	Limit (µV/m)	Margin (dB)
2008.300	V	188.0	1.0	67.8	28.1	1.6	0.0	36.5	61.0	1116.7	5000.0	-13.0
2390.000	V	245.0	1.0	65.4	28.7	1.6	0.0	36.2	59.5	940.4	5000.0	-14.5
2500.000	V	277.0	1.0	64.2	28.8	1.5	0.0	36.1	58.4	836.1	5000.0	-15.5
2691.000	V	282.0	1.0	70.2	29.3	1.5	0.0	36.0	65.0	1779.7	5000.0	-9.0
1036.000	H	323.0	1.0	59.9	25.3	1.2	0.0	37.6	48.8	276.7	5000.0	-25.1
1720.000	H	300.0	1.0	66.3	27.3	1.5	0.0	36.8	58.3	822.5	5000.0	-15.7
2008.300	H	280.0	1.0	69.5	28.1	1.6	0.0	36.5	62.7	1364.4	5000.0	-11.3
2390.000	H	119.0	1.0	64.8	28.7	1.6	0.0	36.2	58.9	878.6	5000.0	-15.1
2500.000	H	309.0	1.0	66.3	28.8	1.5	0.0	36.1	60.5	1064.8	5000.0	-13.4
2691.000	H	123.0	1.0	65.9	29.3	1.5	0.0	36.0	60.8	1091.0	5000.0	-13.2
Average												
1036.000	V	3.0	1.0	56.9	25.3	1.2	0.0	37.6	45.8	195.9	500.0	-8.1
1720.000	V	3.0	1.0	59.2	27.3	1.5	0.0	36.8	51.2	362.8	500.0	-2.8
2008.300	V	188.0	1.0	55.3	28.1	1.6	0.0	36.5	48.5	265.7	500.0	-5.5
2390.000	V	245.0	1.0	53.8	28.7	1.6	0.0	36.2	47.9	248.2	500.0	-6.1
2500.000	V	277.0	1.0	53.3	28.8	1.5	0.0	36.1	47.5	237.5	500.0	-6.5
2691.000	V	282.0	1.0	56.4	29.3	1.5	0.0	36.0	51.2	364.2	500.0	-2.8
1036.000	H	323.0	1.0	49.6	25.3	1.2	0.0	37.6	38.5	84.0	500.0	-15.5
1720.000	H	300.0	1.0	53.7	27.3	1.5	0.0	36.8	45.7	192.2	500.0	-8.3
2008.300	H	280.0	1.0	55.2	28.1	1.6	0.0	36.5	48.3	261.5	500.0	-5.6
2390.000	H	119.0	1.0	51.4	28.7	1.6	0.0	36.2	45.4	186.6	500.0	-8.6
2500.000	H	309.0	1.0	52.4	28.8	1.5	0.0	36.1	46.6	214.4	500.0	-7.4
2691.000	H	123.0	1.0	52.3	29.3	1.5	0.0	36.0	47.1	226.4	500.0	-6.9

Center Channel 2440MHz

Frequency (MHz)	Polarity H/V	Azimuth Degree	Ant. Ht (m)	SA Level (QP) (dBµV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Duty Cycle Corr. (dB)	Amp Gain (dB)	Corr. Level (dBµV/m)	Corr. Level (µV/m)	Limit (µV/m)	Margin (dB)
Peak	**Unit upright**											
4880.000	H	250.0	1.0	48.4	32.6	3.5	0.0	31.8	52.7	433.4	5000.0	-21.2
7320.000	H	180.0	1.0	48.2	37.1	4.5	0.0	31.3	58.4	835.8	5000.0	-15.5
12200.000	H	180.0	1.0	43.6	40.0	5.2	0.0	30.5	58.2	817.3	5000.0	-15.7
4880.000	V	180.0	1.0	50.8	32.6	3.5	0.0	31.8	55.2	573.4	5000.0	-18.8
7320.000	V	190.0	1.0	50.2	37.1	4.5	0.0	31.3	60.4	1052.2	5000.0	-13.5
12200.000	V	270.0	1.0	44.0	40.0	5.2	0.0	30.5	58.6	855.8	5000.0	-15.3
	Unit Flat											
4880.000	V	180.0	1.0	48.1	32.6	3.5	0.0	31.8	52.4	418.7	5000.0	-21.5

7320.000	V	90.0	1.0	48.3	37.1	4.5	0.0	31.3	58.6	848.4	5000.0	-15.4
12200.000	V	180.0	1.0	44.0	40.0	5.2	0.0	30.5	58.6	855.8	5000.0	-15.3
4880.000	H	300.0	1.0	48.3	32.6	3.5	0.0	31.8	52.6	428.5	5000.0	-21.3
7320.000	H	0.0	1.0	47.5	37.1	4.5	0.0	31.3	57.8	773.7	5000.0	-16.2
12200.000	H	180.0	1.0	44.1	40.0	5.2	0.0	30.5	58.7	865.7	5000.0	-15.2
	Unit On Side											
4880.000	V	280.0	1.0	46.3	32.6	3.5	0.0	31.8	50.6	340.4	5000.0	-23.3
7320.000	V	270.0	1.0	46.1	37.1	4.5	0.0	31.3	56.4	658.5	5000.0	-17.6
12200.000	V	180.0	1.0	44.1	40.0	5.2	0.0	30.5	58.7	865.7	5000.0	-15.2
4880.000	H	270.0	1.0	46.3	32.6	3.5	0.0	31.8	50.6	340.4	5000.0	-23.3
7320.000	H	270.0	1.0	46.5	37.1	4.5	0.0	31.3	56.8	689.6	5000.0	-17.2
12200.000	H	0.0	1.0	44.2	40.0	5.2	0.0	30.5	58.8	875.8	5000.0	-15.1
Average	**Unit upright**		1.0									
4880.000	H	250.0	1.0	38.0	32.6	3.5	14.5	31.8	27.8	24.7	500.0	-26.1
7320.000	H	180.0	1.0	35.2	37.1	4.5	14.5	31.3	30.9	35.2	500.0	-23.0
12200.000	H	180.0	1.0	33.2	40.0	5.2	14.5	30.5	33.3	46.5	500.0	-20.6
4880.000	V	180.0	1.0	40.8	32.6	3.5	14.5	31.8	30.7	34.2	500.0	-23.3
7320.000	V	190.0	1.0	37.7	37.1	4.5	14.5	31.3	33.4	47.0	500.0	-20.5
12200.000	V	270.0	1.0	34.2	40.0	5.2	14.5	30.5	34.3	52.0	500.0	-19.7
	Unit Flat											
4880.000	V	180.0	1.0	36.8	32.6	3.5	14.5	31.8	26.6	21.5	500.0	-27.3
7320.000	V	90.0	1.0	35.5	37.1	4.5	14.5	31.3	31.3	36.6	500.0	-22.7
12200.000	V	180.0	1.0	33.2	40.0	5.2	14.5	30.5	33.3	46.5	500.0	-20.6
4880.000	H	300.0	1.0	36.9	32.6	3.5	14.5	31.8	26.7	21.7	500.0	-27.2
7320.000	H	0.0	1.0	35.2	37.1	4.5	14.5	31.3	31.0	35.4	500.0	-23.0
12200.000	H	180.0	1.0	33.4	40.0	5.2	14.5	30.5	33.5	47.6	500.0	-20.4
	Unit On Side											
4880.000	V	280.0	1.0	34.6	32.6	3.5	14.5	31.8	24.4	16.7	500.0	-29.5
7320.000	V	270.0	1.0	34.6	37.1	4.5	14.5	31.3	30.4	33.0	500.0	-23.6
12200.000	V	180.0	1.0	33.3	40.0	5.2	14.5	30.5	33.4	47.0	500.0	-20.5
4880.000	H	270.0	1.0	34.2	32.6	3.5	14.5	31.8	24.0	15.9	500.0	-29.9
7320.000	H	270.0	1.0	33.5	37.1	4.5	14.5	31.3	29.3	29.1	500.0	-24.7
12200.000	H	0.0	1.0	33.2	40.0	5.2	14.5	30.5	33.3	46.5	500.0	-20.6
NON- Harmonic emissions												
Peak												
1036.000	V	3.0	1.0	67.5	25.3	1.2	0.0	37.6	56.4	658.4	5000.0	-17.6
1720.000	V	3.0	1.0	71.4	27.3	1.5	0.0	36.8	63.4	1479.6	5000.0	-10.6
2008.300	V	188.0	1.0	67.8	28.1	1.6	0.0	36.5	61.0	1116.7	5000.0	-13.0
2390.000	V	245.0	1.0	65.4	28.7	1.6	0.0	36.2	59.5	940.4	5000.0	-14.5
2500.000	V	277.0	1.0	64.2	28.8	1.5	0.0	36.1	58.4	836.1	5000.0	-15.5

2691.000	V	282.0	1.0	70.2	29.3	1.5	0.0	36.0	65.0	1779.7	5000.0	-9.0
1036.000	H	323.0	1.0	59.9	25.3	1.2	0.0	37.6	48.8	276.7	5000.0	-25.1
1720.000	H	300.0	1.0	66.3	27.3	1.5	0.0	36.8	58.3	822.5	5000.0	-15.7
2008.300	H	280.0	1.0	69.5	28.1	1.6	0.0	36.5	62.7	1364.4	5000.0	-11.3
2390.000	H	119.0	1.0	64.8	28.7	1.6	0.0	36.2	58.9	878.6	5000.0	-15.1
2500.000	H	309.0	1.0	66.3	28.8	1.5	0.0	36.1	60.5	1064.8	5000.0	-13.4
2691.000	H	123.0	1.0	65.9	29.3	1.5	0.0	36.0	60.8	1091.0	5000.0	-13.2
Average												
1036.000	V	3.0	1.0	56.9	25.3	1.2	0.0	37.6	45.8	195.9	500.0	-8.1
1720.000	V	3.0	1.0	59.2	27.3	1.5	0.0	36.8	51.2	362.8	500.0	-2.8
2008.300	V	188.0	1.0	55.3	28.1	1.6	0.0	36.5	48.5	265.7	500.0	-5.5
2390.000	V	245.0	1.0	53.8	28.7	1.6	0.0	36.2	47.9	248.2	500.0	-6.1
2500.000	V	277.0	1.0	53.3	28.8	1.5	0.0	36.1	47.5	237.5	500.0	-6.5
2691.000	V	282.0	1.0	56.4	29.3	1.5	0.0	36.0	51.2	364.2	500.0	-2.8
1036.000	H	323.0	1.0	49.6	25.3	1.2	0.0	37.6	38.5	84.0	500.0	-15.5
1720.000	H	300.0	1.0	53.7	27.3	1.5	0.0	36.8	45.7	192.2	500.0	-8.3
2008.300	H	280.0	1.0	55.2	28.1	1.6	0.0	36.5	48.3	261.5	500.0	-5.6
2390.000	H	119.0	1.0	51.4	28.7	1.6	0.0	36.2	45.4	186.6	500.0	-8.6
2500.000	H	309.0	1.0	52.4	28.8	1.5	0.0	36.1	46.6	214.4	500.0	-7.4
2691.000	H	123.0	1.0	52.3	29.3	1.5	0.0	36.0	47.1	226.4	500.0	-6.9

High Channel 2479MHz

Frequency (MHz)	Polarity H/V	Azimuth Degree	Ant. Ht (m)	SA Level (QP) (dBµV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Duty Cycle Corr. (dB)	Amp Gain (dB)	Corr. Level (dBµV/m)	Corr. Level (µV/m)	Limit (µV/m)	Margin (dB)
Peak	**Unit upright**											
4958.000	H	270.0	1.0	50.9	32.7	3.6	0.0	31.8	55.4	589.5	5000.0	-18.6
7437.000	H	180.0	1.0	47.5	37.1	4.8	0.0	31.3	58.2	811.6	5000.0	-15.8
12395.000	H	180.0	1.0	43.0	40.0	5.3	0.0	30.4	57.9	783.9	5000.0	-16.1
4958.000	V	250.0	1.0	52.7	32.7	3.6	0.0	31.8	57.2	722.7	5000.0	-16.8
7437.000	V	190.0	1.0	50.5	37.1	4.8	0.0	31.3	61.2	1146.5	5000.0	-12.8
12395.000	V	250.0	1.0	43.2	40.0	5.3	0.0	30.4	58.1	799.4	5000.0	-15.9
	Unit Flat											
4958.000	V	0.0	1.0	47.2	32.7	3.6	0.0	31.8	51.7	385.0	5000.0	-22.3
7437.000	V	90.0	1.0	46.3	37.1	4.8	0.0	31.3	57.0	706.9	5000.0	-17.0
12395.000	V	0.0	1.0	44.0	40.0	5.3	0.0	30.4	58.9	879.6	5000.0	-15.1
4958.000	H	0.0	1.0	46.0	32.7	3.6	0.0	31.8	50.5	335.3	5000.0	-23.5
7437.000	H	90.0	1.0	45.7	37.1	4.8	0.0	31.3	56.4	659.7	5000.0	-17.6
12395.000	H	0.0	1.0	44.2	40.0	5.3	0.0	30.4	59.1	900.1	5000.0	-14.9
	Unit On Side											
4958.000	V	270.0	1.0	45.2	32.7	3.6	0.0	31.8	49.7	305.8	5000.0	-24.3

Frequency (MHz)	Polarity H/V	Azimuth Degree	Ant. Ht (m)	SA Level (QP) (dBµV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Duty Cycle Corr. (dB)	Amp Gain (dB)	Corr. Level (dBµV/m)	Corr. Level (µV/m)	Limit (µV/m)	Margin (dB)
7437.000	V	245.0	1.0	46.0	37.1	4.8	0.0	31.3	56.7	682.9	5000.0	-17.3
12395.000	V	0.0	1.0	44.0	40.0	5.3	0.0	30.4	58.9	879.6	5000.0	-15.1
4958.000	H	90.0	1.0	46.1	32.7	3.6	0.0	31.8	50.6	339.2	5000.0	-23.4
7437.000	H	260.0	1.0	44.6	37.1	4.8	0.0	31.3	55.3	581.3	5000.0	-18.7
12395.000	H	0.0	1.0	44.0	40.0	5.3	0.0	30.4	58.9	879.6	5000.0	-15.1
Average	**Unit upright**											
4958.000	H	270.0	1.0	41.1	32.7	3.6	14.5	31.8	31.1	35.9	500.0	-22.9
7437.000	H	180.0	1.0	36.2	37.1	4.8	14.5	31.3	32.4	41.6	500.0	-21.6
12395.000	H	180.0	1.0	34.0	40.0	5.3	14.5	30.4	34.4	52.4	500.0	-19.6
4958.000	V	250.0	1.0	43.3	32.7	3.6	14.5	31.8	33.3	46.4	500.0	-20.6
7437.000	V	190.0	1.0	38.7	37.1	4.8	14.5	31.3	34.9	55.5	500.0	-19.1
12395.000	V	250.0	1.0	33.8	40.0	5.3	14.5	30.4	34.2	51.2	500.0	-19.8
	Unit Flat											
4958.000	V	0.0	1.0	35.2	32.7	3.6	14.5	31.8	25.2	18.2	500.0	-28.8
7437.000	V	90.0	1.0	33.5	37.1	4.8	14.5	31.3	29.7	30.5	500.0	-24.3
12395.000	V	0.0	1.0	34.0	40.0	5.3	14.5	30.4	34.4	52.4	500.0	-19.6
4958.000	H	0.0	1.0	35.0	32.7	3.6	14.5	31.8	25.0	17.8	500.0	-29.0
7437.000	H	90.0	1.0	34.1	37.1	4.8	14.5	31.3	30.3	32.7	500.0	-23.7
12395.000	H	0.0	1.0	33.7	40.0	5.3	14.5	30.4	34.1	50.6	500.0	-19.9
	Unit On Side											
4958.000	V	270.0	1.0	33.8	32.7	3.6	14.5	31.8	23.8	15.5	500.0	-30.2
7437.000	V	245.0	1.0	33.4	37.1	4.8	14.5	31.3	29.6	30.2	500.0	-24.4
12395.000	V	0.0	1.0	33.5	40.0	5.3	14.5	30.4	33.9	49.5	500.0	-20.1
4958.000	H	90.0	1.0	34.8	32.7	3.6	14.5	31.8	24.8	17.4	500.0	-29.2
7437.000	H	260.0	1.0	34.0	37.1	4.8	14.5	31.3	30.2	32.3	500.0	-23.8
12395.000	H	0.0	1.0	33.2	40.0	5.3	14.5	30.4	33.6	47.8	500.0	-20.4
NON- Harmonic emissions												
Peak												
1036.000	V	3.0	1.0	67.5	25.3	1.2	0.0	37.6	56.4	658.4	5000.0	-17.6
1720.000	V	3.0	1.0	71.4	27.3	1.5	0.0	36.8	63.4	1479.6	5000.0	-10.6
2008.300	V	188.0	1.0	67.8	28.1	1.6	0.0	36.5	61.0	1116.7	5000.0	-13.0
2390.000	V	245.0	1.0	65.4	28.7	1.6	0.0	36.2	59.5	940.4	5000.0	-14.5
2500.000	V	277.0	1.0	64.2	28.8	1.5	0.0	36.1	58.4	836.1	5000.0	-15.5
2691.000	V	282.0	1.0	70.2	29.3	1.5	0.0	36.0	65.0	1779.7	5000.0	-9.0
1036.000	H	323.0	1.0	59.9	25.3	1.2	0.0	37.6	48.8	276.7	5000.0	-25.1
1720.000	H	300.0	1.0	66.3	27.3	1.5	0.0	36.8	58.3	822.5	5000.0	-15.7
2008.300	H	280.0	1.0	69.5	28.1	1.6	0.0	36.5	62.7	1364.4	5000.0	-11.3
2390.000	H	119.0	1.0	64.8	28.7	1.6	0.0	36.2	58.9	878.6	5000.0	-15.1

Frequency (MHz)	Polarity H/V	Azimuth Degree	Ant. Ht (m)	SA Level (QP) (dBµV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Duty Cycle Corr. (dB)	Amp Gain (dB)	Corr. Level (dBµV/m)	Corr. Level (µV/m)	Limit (µV/m)	Margin (dB)
2500.000	H	309.0	1.0	66.3	28.8	1.5	0.0	36.1	60.5	1064.8	5000.0	-13.4
2691.000	H	123.0	1.0	65.9	29.3	1.5	0.0	36.0	60.8	1091.0	5000.0	-13.2
Average												
1036.000	V	3.0	1.0	56.9	25.3	1.2	0.0	37.6	45.8	195.9	500.0	-8.1
1720.000	V	3.0	1.0	59.2	27.3	1.5	0.0	36.8	51.2	362.8	500.0	-2.8
2008.300	V	188.0	1.0	55.3	28.1	1.6	0.0	36.5	48.5	265.7	500.0	-5.5
2390.000	V	245.0	1.0	53.8	28.7	1.6	0.0	36.2	47.9	248.2	500.0	-6.1
2500.000	V	277.0	1.0	53.3	28.8	1.5	0.0	36.1	47.5	237.5	500.0	-6.5
2691.000	V	282.0	1.0	56.4	29.3	1.5	0.0	36.0	51.2	364.2	500.0	-2.8
1036.000	H	323.0	1.0	49.6	25.3	1.2	0.0	37.6	38.5	84.0	500.0	-15.5
1720.000	H	300.0	1.0	53.7	27.3	1.5	0.0	36.8	45.7	192.2	500.0	-8.3
2008.300	H	280.0	1.0	55.2	28.1	1.6	0.0	36.5	48.3	261.5	500.0	-5.6
2390.000	H	119.0	1.0	51.4	28.7	1.6	0.0	36.2	45.4	186.6	500.0	-8.6
2500.000	H	309.0	1.0	52.4	28.8	1.5	0.0	36.1	46.6	214.4	500.0	-7.4
2691.000	H	123.0	1.0	52.3	29.3	1.5	0.0	36.0	47.1	226.4	500.0	-6.9

