Washington Laboratories, Ltd.

FCC Certification Test Report
For the
Proxim Corporation
AP4000MR-LR
(5.8GHz Radio Portion)
FCC ID: HZB-4000LR

WLL JOB# **9176-01**
June 19, 2006

Prepared for:

Proxim Corporation
2115 O'Nel Drive
San Jose, CA 95131

Prepared By:

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

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Prepared by: Brian J. Dettling
Documentation Specialist

Reviewed by: Michael Violette
President

Abstract

This report has been prepared on behalf of Proxim Corporation to support the attached Application for Equipment Authorization. The test report and application are submitted for a digitally modulated transmitter under Part 15.247 of the FCC Rules and Regulations. This Certification Test Report documents the test configuration and test results for a Proxim Corporation AP4000MR-LR.

Testing was performed on an Open Area Test Site (OATS) of Washington Laboratories, Ltd, 7560 Lindbergh Drive, Gaithersburg, MD 20879. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. Washington Laboratories, Ltd. has been accepted by the FCC and approved by NIST NVLAP (NVLAP Lab Code: 200066-0) as an independent FCC test laboratory.

The Proxim Corporation AP4000MR-LR complies with the limits for a Digitally Modulated Transceiver device under FCC Part 15.247.

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1 Introduction

1.1 Compliance Statement

The Proxim Corporation AP4000MR-LR complies with the limits for a Digitally Modulated Transmitter device under FCC Part 15.247.

1.2 Test Scope

Tests for radiated and conducted (at antenna terminal) emissions were performed. All measurements were performed in accordance with 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:	Proxim Corporation 2115 O'Nel Drive San Jose, CA 95131
Quotation Number:	62929

1.4 Test Dates

Testing was performed on the following date(s):	April & May, 2006

1.5 Test and Support Personnel

Washington Laboratories, LTD	James Ritter, Greg Snyder, Steve Dovell, Thuan Ta
Client Representative	Mike Young

2 Equipment Under Test

2.1 EUT Identification & Description

The Proxim Corporation AP4000MR-LR is one configuration of dual band access point product line.

- 2.4GHz + 5.8GHz dual access point

The **5.8 GHz portion** of the radio is reported here.

The other sections are reported separately. Both have separate amplifier boards that are mounted in the metal case with the access point device.

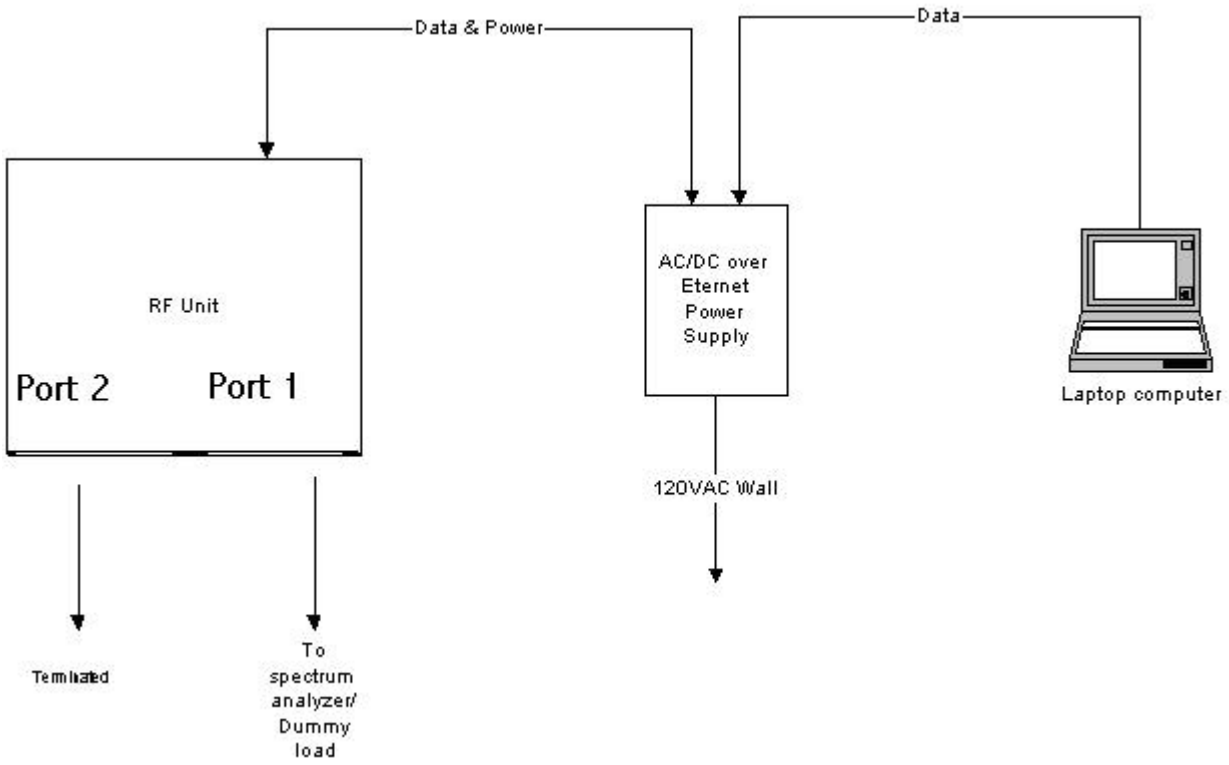
The product is offered with an external connector. External antennas must be professionally installed.

Table 1. Device Summary

ITEM	DESCRIPTION
Manufacturer:	Proxim Corporation
FCC ID:	HZB-4000LR
IC:	None
Model:	AP4000MR-LR
FCC Rule Parts:	§15.247
Frequency Range:	5740 - 5835 MHz
Maximum Output Power:	250mW; Table 3
Modulation:	Digital (QPSK)
Occupied Bandwidth:	See Table 1. Device Summary
Power Spectral Density (max):	-3.2 dBm; See Table 5. RF Power Spectral Density
Keying:	Automatic
Type of Information:	Data
Power Output Level	Stepped
Antenna Connector	SMX
Antenna Type	Three types intended: Linear Omni Array Sector Panel
Interface Cables:	Ethernet Network Connector
Power Source & Voltage:	48Vdc

2.2 Test Configuration

The AP4000MR-LR was provided 48 VDC power mixed with data over a CAT5 RJ-45 (data & power port) from the PW130 Power supply. This power supply accepted AC 100-250 VAC wall power and data from the support laptop (via CAT5 RJ-45) and outputted the above power and data. A support laptop used an ART program and local server to provide power and tuning command to the unit. The EUT was set to 15 and 24 dBm output (9 and 18 dBm on ART program) at hi, mid, & low channels). The following diagram shows the test setup. Port 1 is the RF port under test.



2.3 Testing Algorithm

The EUT was provided with 48 VDC power mixed with data over a CAT5 RJ-45 (data & power port) from the PW130 Power supply. This power supply accepted AC 100-250 VAC wall power and data from the support laptop (via cat5 RJ-45) and outputted the above power and data. A support laptop used an ART program and local server to provide power and tuning command to the unit. The EUT was set to 15 and 24 dBm output (9 and 18 dBm on ART program) at hi, mid, & low channels).

2.4 Test Location

All measurements herein were performed at Washington Laboratories, Ltd. test center in Gaithersburg, MD. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. Washington Laboratories, Ltd. has been accepted by the FCC and approved by NIST NVLAP (NVLAP Lab Code: 200066-0) as an independent FCC test laboratory.

2.5 Measurements

2.5.1 References

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	6/30/2006
0069	HP 85650A	QUASI-PEAK ADAPTER	6/30/2006
0073	HP 8568B	SPECTRUM ANALYZER	6/30/2006
0007	ARA LPB-2520	BICONILOG ANTENNA	12/20/2006
0074	HEWLETT-PACKARD 8593A	SPECTRUM ANALYZER	10/04/2006
0522	HEWLETT-PACKARD 8449B	MICROWAVE PREAMP	5/04/2007
0425	ARA DRG118/A	MICROWAVE HORN ANTENNA	1/17/2007
0026	EMCO 3110B	BICONICAL ANTENNA	12/19/2006
0029	EMCO 3146A	LOG PERIODIC ANTENNA	6/28/2006
0071	HP 85685A	RF PRESELECTOR	6/30/2006
0069	HP 85650A	QUASI-PEAK ADAPTER	6/30/2006

4 Test Results

4.1 RF Power Output: (§15.247(b)

For devices within the scope of FCC §15.247, the peak power conducted from the intentional radiator to the antenna shall not be greater than one watt (30 dBm).

The output from the transmitter was connected to a diode detector and oscilloscope. The peak deflection was measured on the oscilloscope and recorded. A signal generator was then substituted in place of EUT and set to the same frequency as the transmitter. The CW output of the signal generator was increased until the same deflection was noted on the oscilloscope. A power meter was then connected to the output of the signal generator to determine the output power of the signal generator. This level is then recorded as the output power of the EUT at the specified frequency.

The EUT carrier was modulated during this test.

Table 3. RF Power Output

Channel and/or Frequency	Measured Level (dBm)	Rated (dBm)	Limit (dBm)
40 MHz Mode Hi Power			
5760 MHz	24	24	30
5790 MHz	23.85	24	30
5815 MHz	23.67	24	30
20 MHz Mode Hi Power			
5740 MHz	23.8	24	30
5790 MHz	23.5	24	30
5835 MHz	23.8	24	30
40 MHz Mode Low Power			
5760 MHz	15	15	30
5790 MHz	14.8	15	30
5815 MHz	14.8	15	30
20 MHz Mode Low Power			
5740 MHz	15	15	30
5790 MHz	14.67	15	30
5835 MHz	14.8	15	30

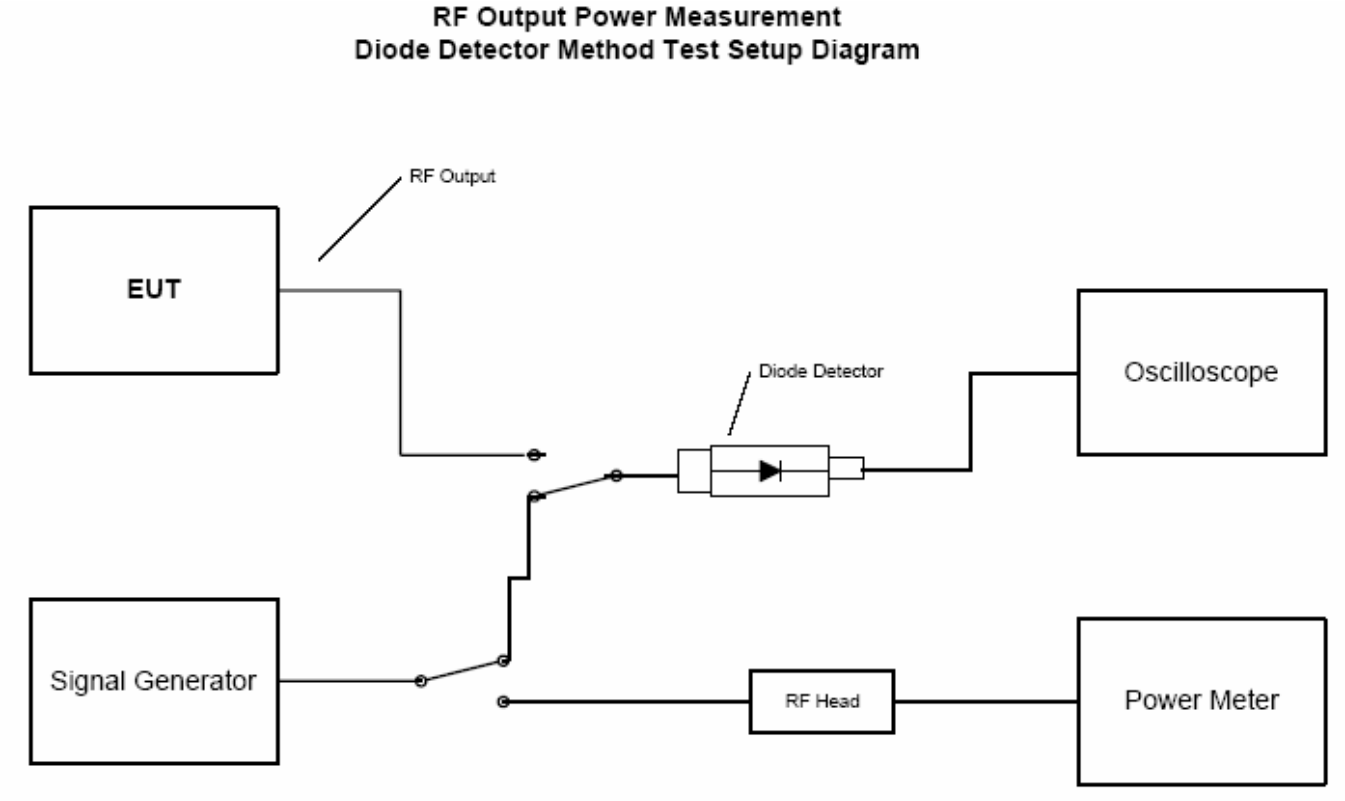


Figure 1. Power Measurement Setup

4.2 Occupied Bandwidth: (§15.247(a)(2)

For systems using digital modulation techniques, FCC Part 15.247 requires that the minimum 6dB bandwidth be at least 500 kHz.

Occupied bandwidth was performed by connecting the RF output of the EUT to the input of a spectrum analyzer. The following plots depict the bandwidth measurements. Table 4 lists the measured bandwidths.

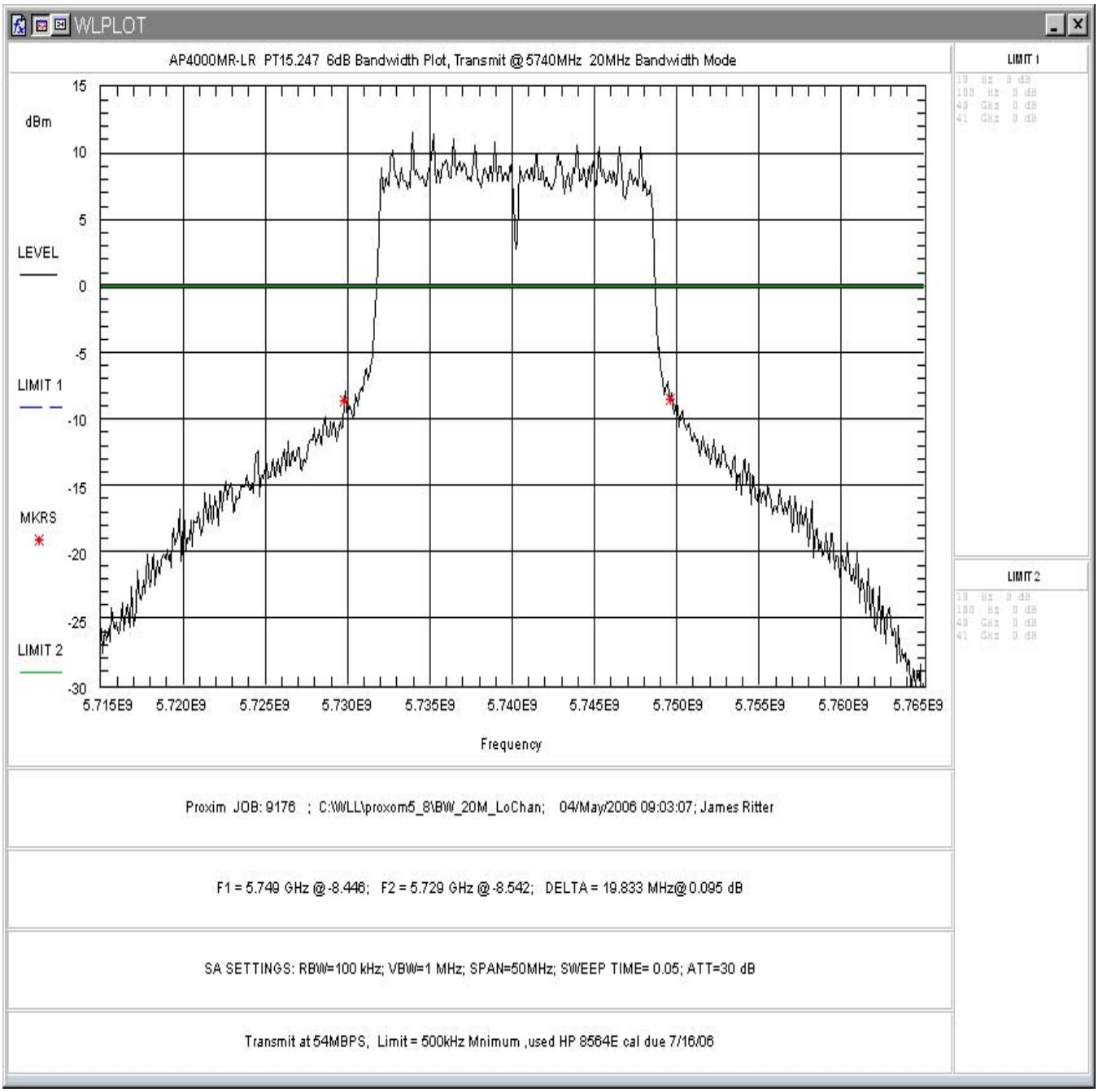


Figure 2. Occupied Bandwidth – 20MHz Bandwidth, Low Channel

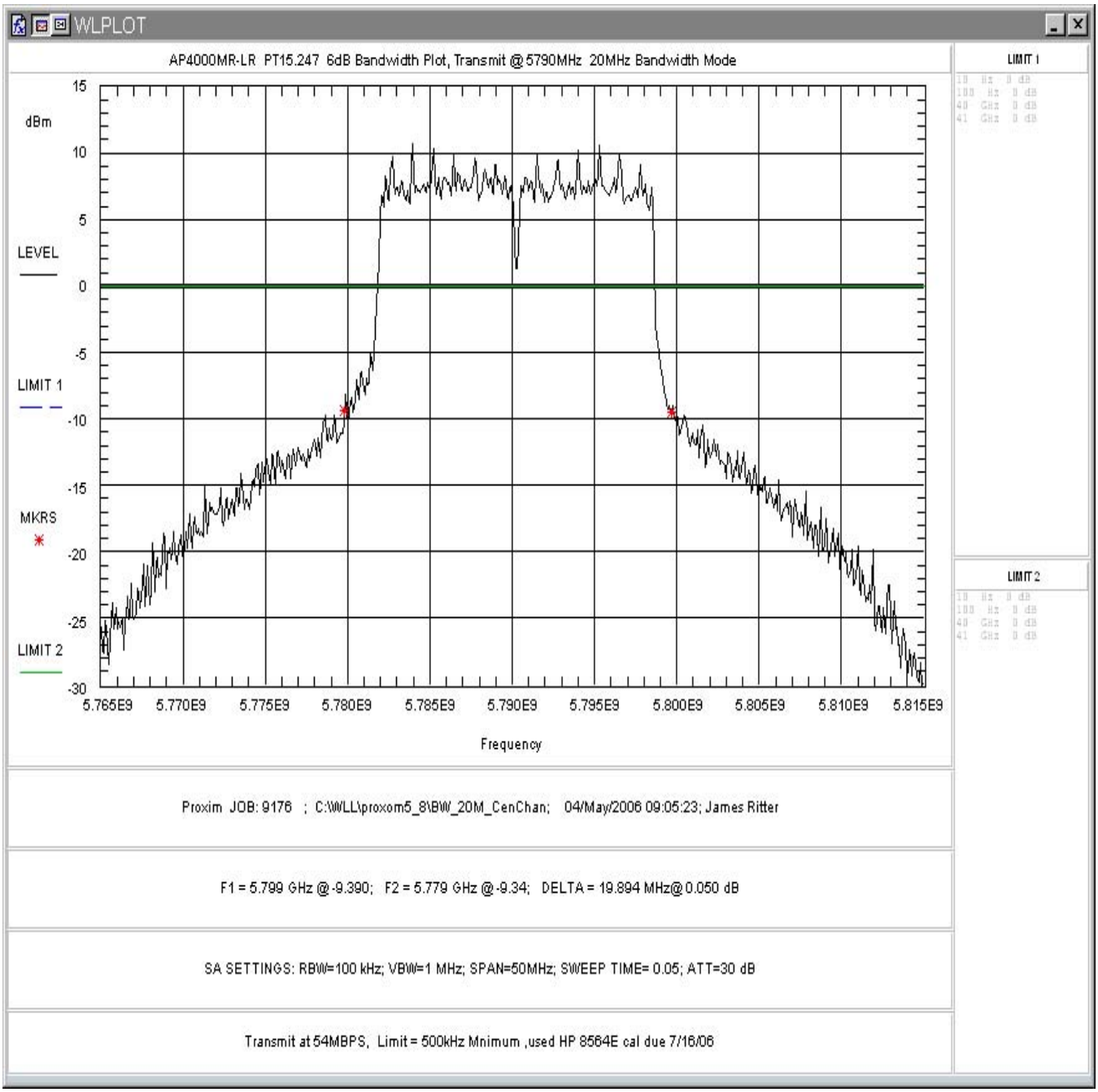


Figure 3. Occupied Bandwidth – 20MHz Bandwidth, Mid Channel

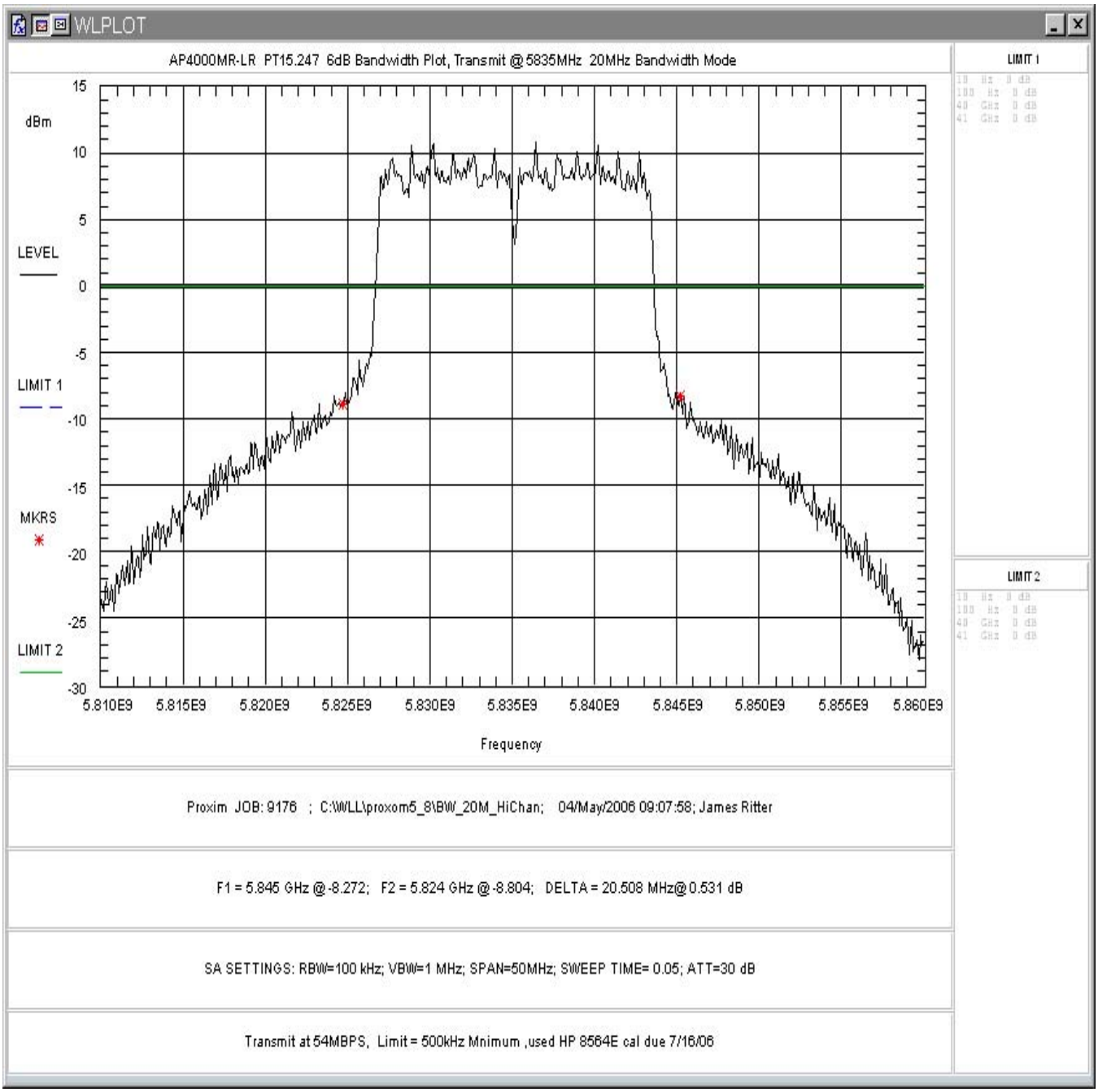


Figure 4. Occupied Bandwidth – 20MHz Bandwidth, High Channel

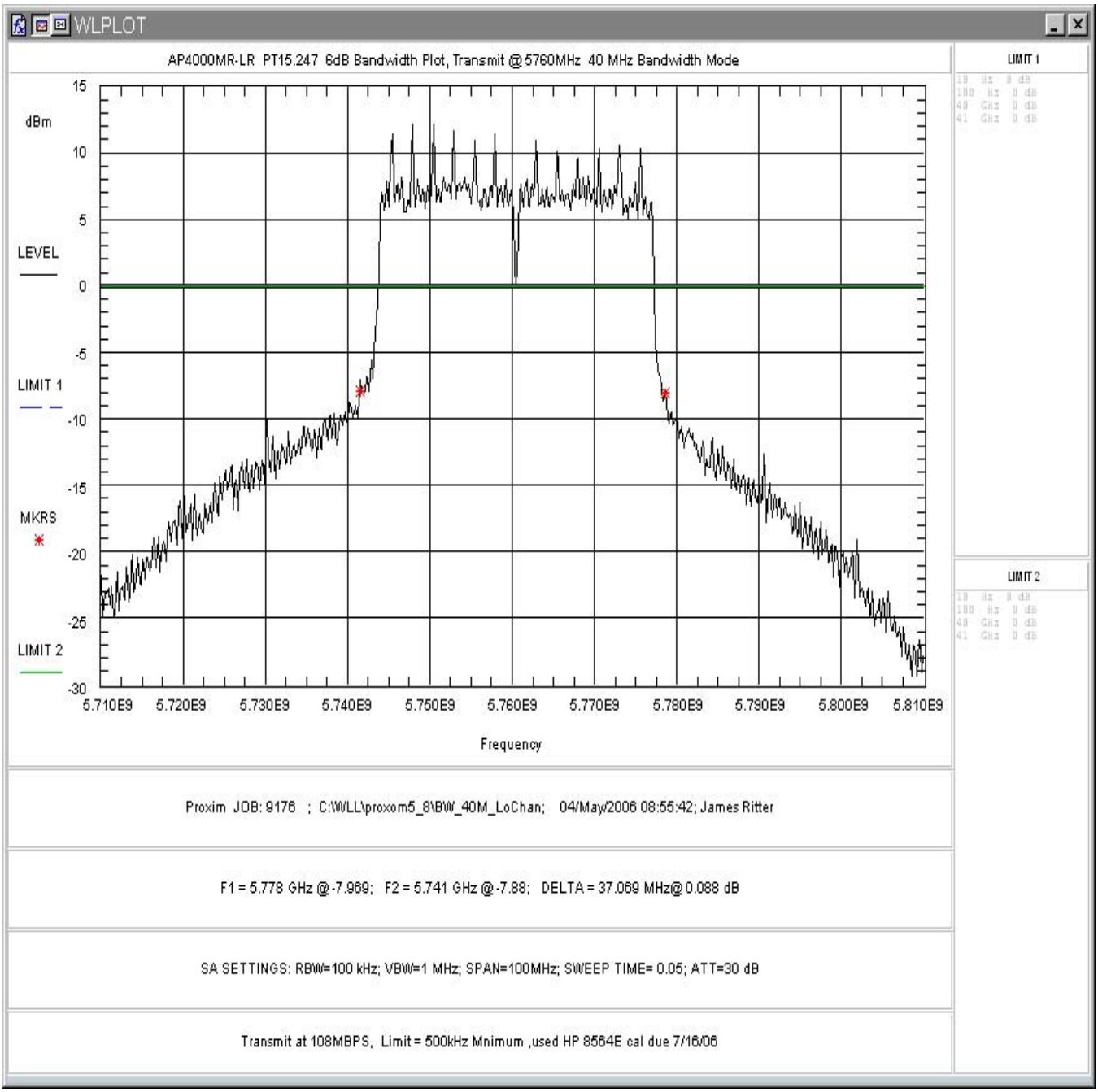


Figure 5. Occupied Bandwidth – 40MHz Bandwidth, Low Channel

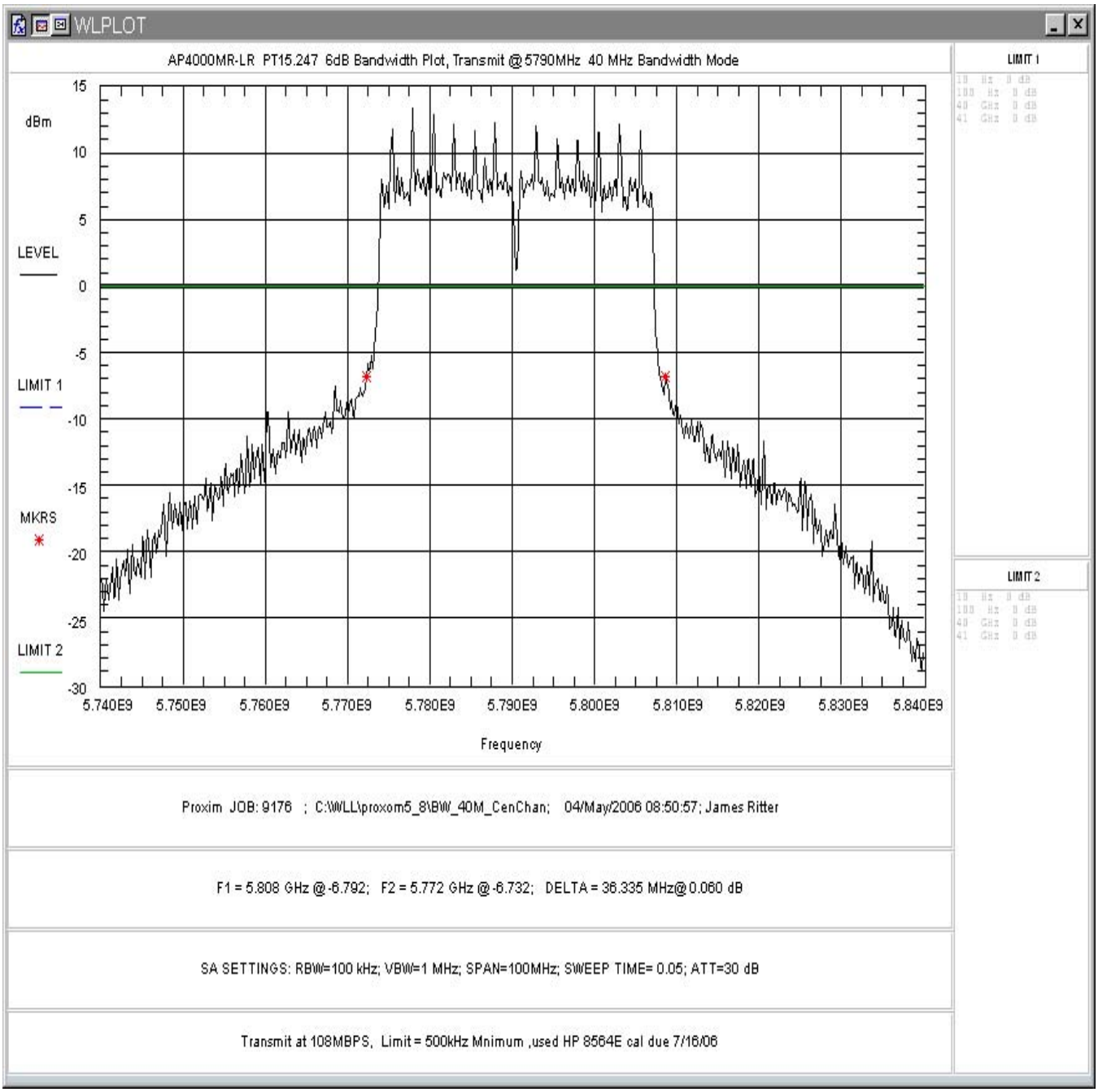


Figure 6. Occupied Bandwidth – 40MHz Bandwidth, Mid Channel

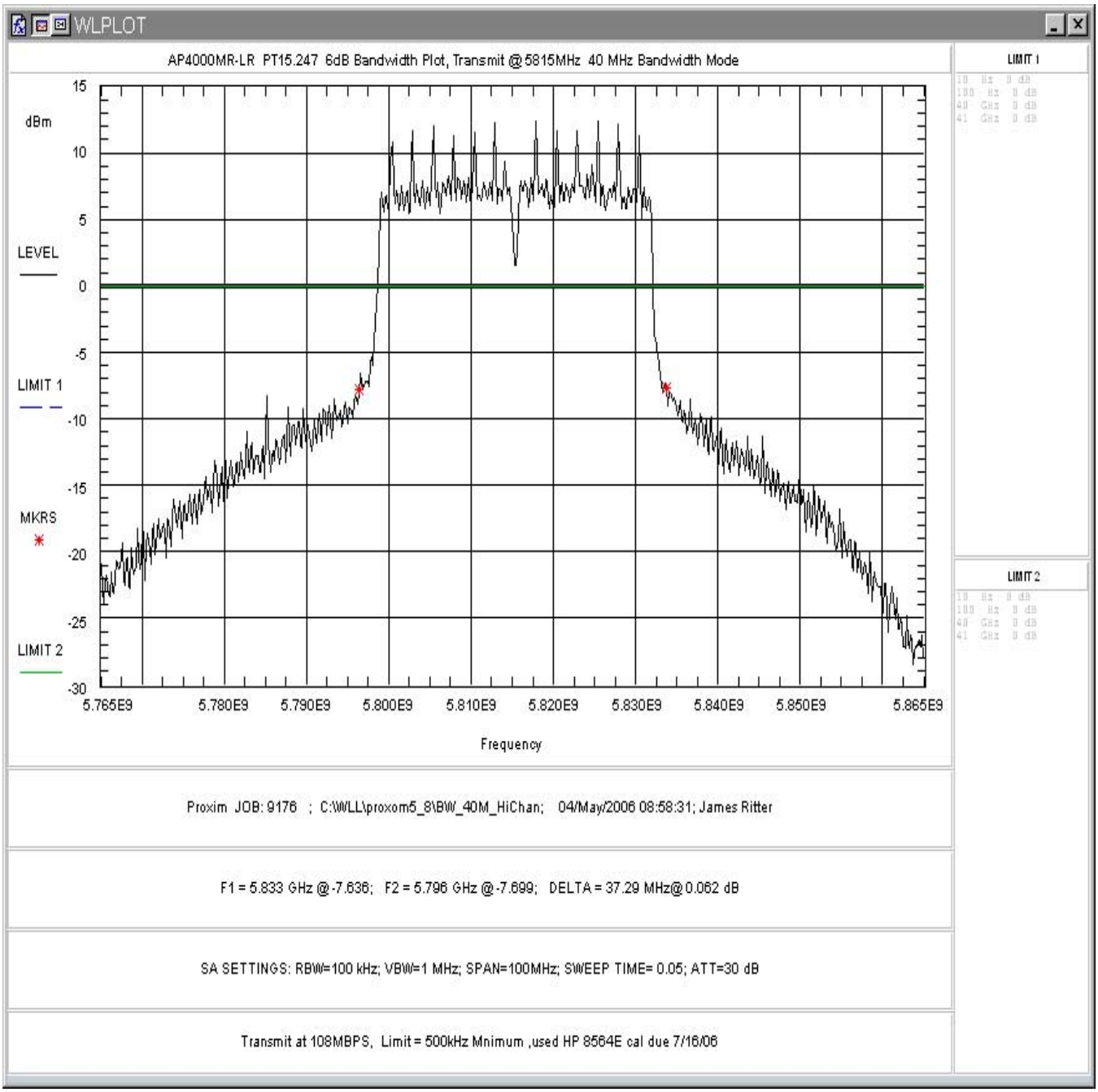


Figure 7. Occupied Bandwidth – 40MHz Bandwidth, High Channel

Table 4 provides a summary of the Occupied Bandwidth Results.

Table 4. Occupied Bandwidth Results

Frequency MHz	Channel BW MHz	Occupied Bandwidth MHz	Limit	Pass/Fail
5740	20	19.8	> 500 kHz	Pass
5790	20	19.9	> 500 kHz	Pass
5835	20	20.5	> 500 kHz	Pass
5760	40	37.1	> 500 kHz	Pass
5790	40	36.3	> 500 kHz	Pass
5815	40	37.3	> 500 kHz	Pass

4.3 RF Peak Power Spectral Density (§15.247(e)

For digitally modulated systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

The output from the transmitter was connected to an attenuator and then to the input of the RF Spectrum Analyzer. The analyzer offset was adjusted to compensate for the attenuator and other losses in the system.

The highest peak within the transmission was located and measured for the upper, middle, and lower channels. Plots of the PSD were taken as shown in Figure 8 through Figure 13 below. Table 5 provides a summary of the data.

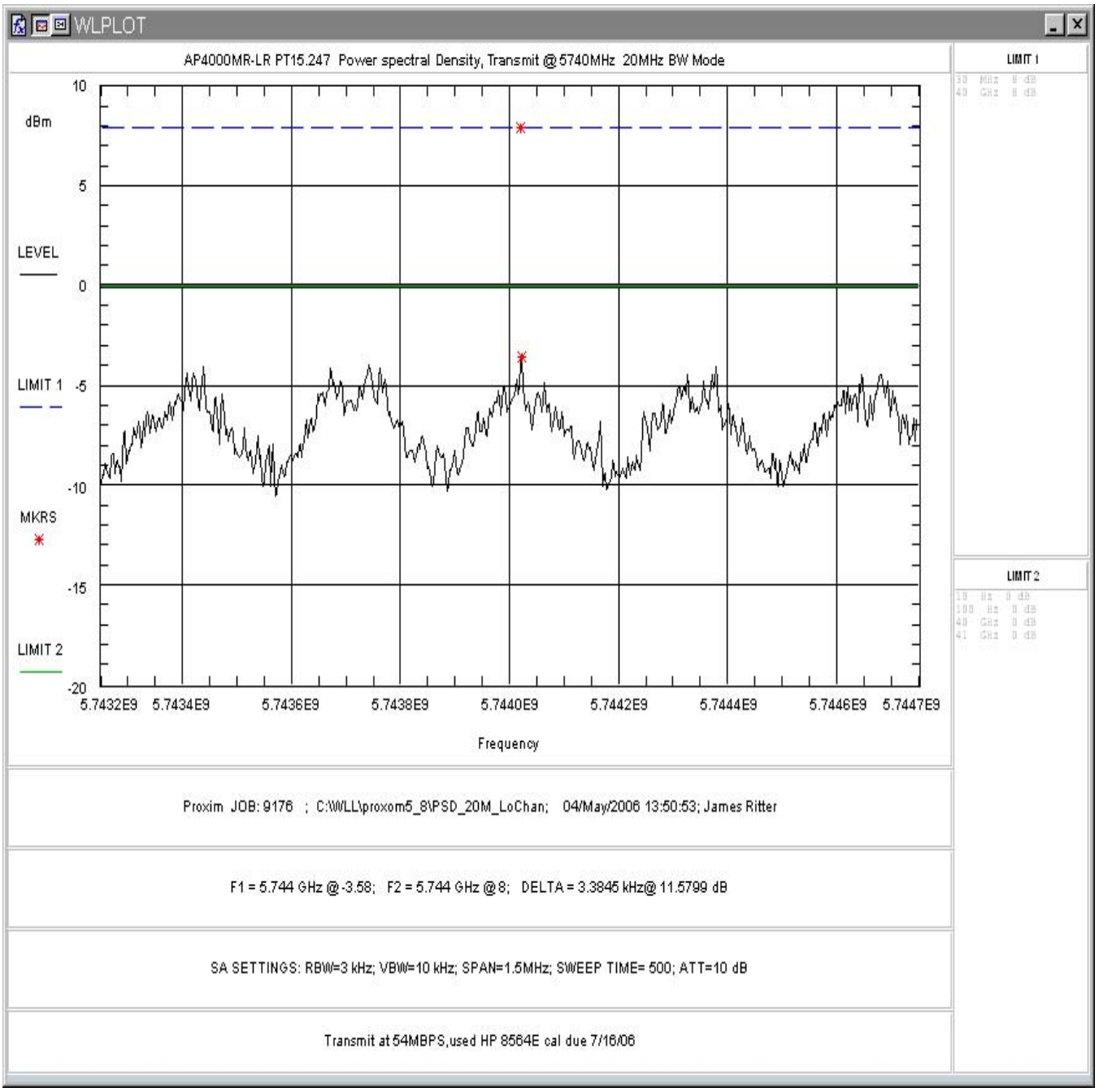


Figure 8. Power Spectral Density – 20MHz Bandwidth, Low Channel

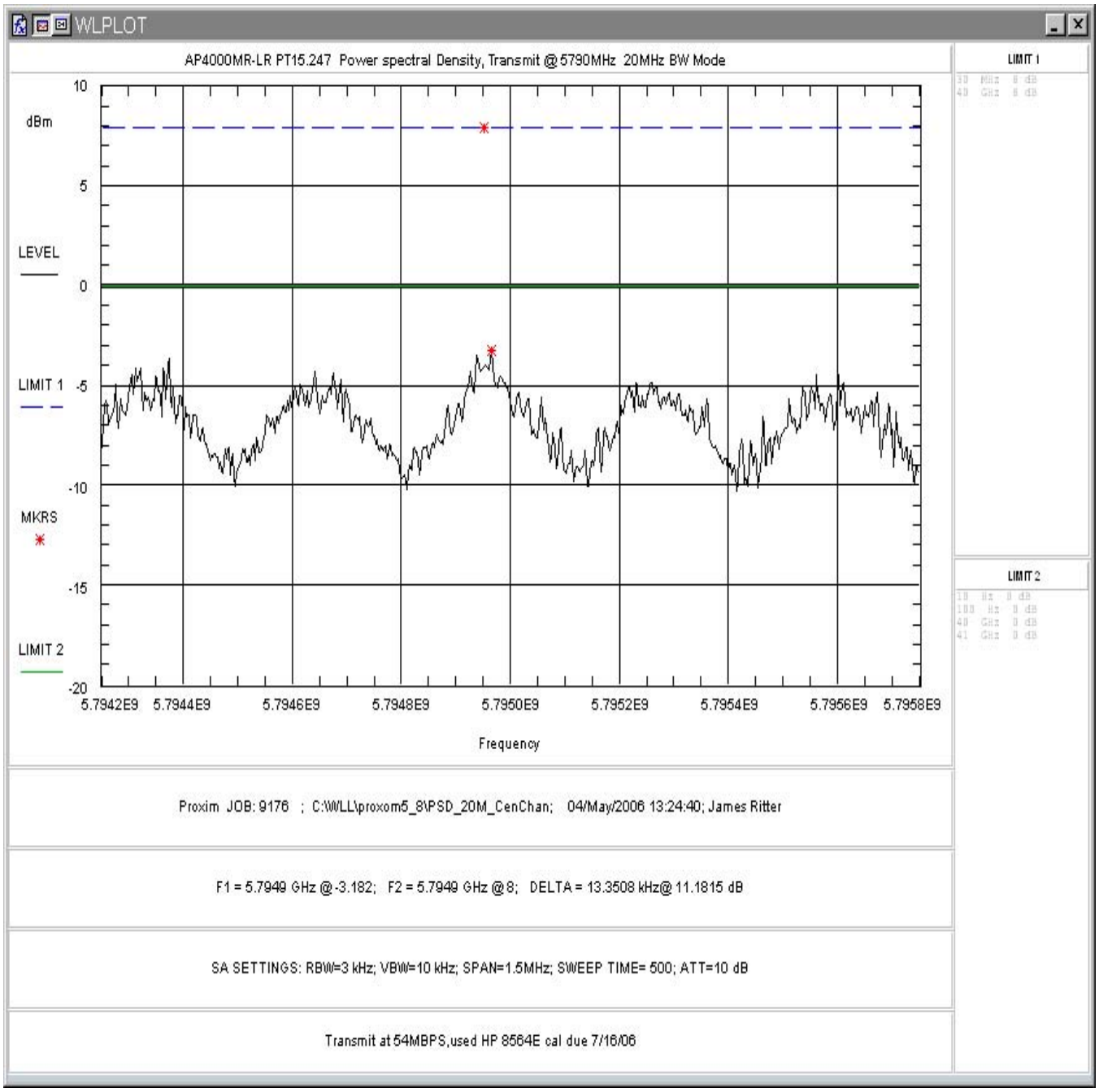


Figure 9. Power Spectral Density – 20MHz Bandwidth, Mid Channel

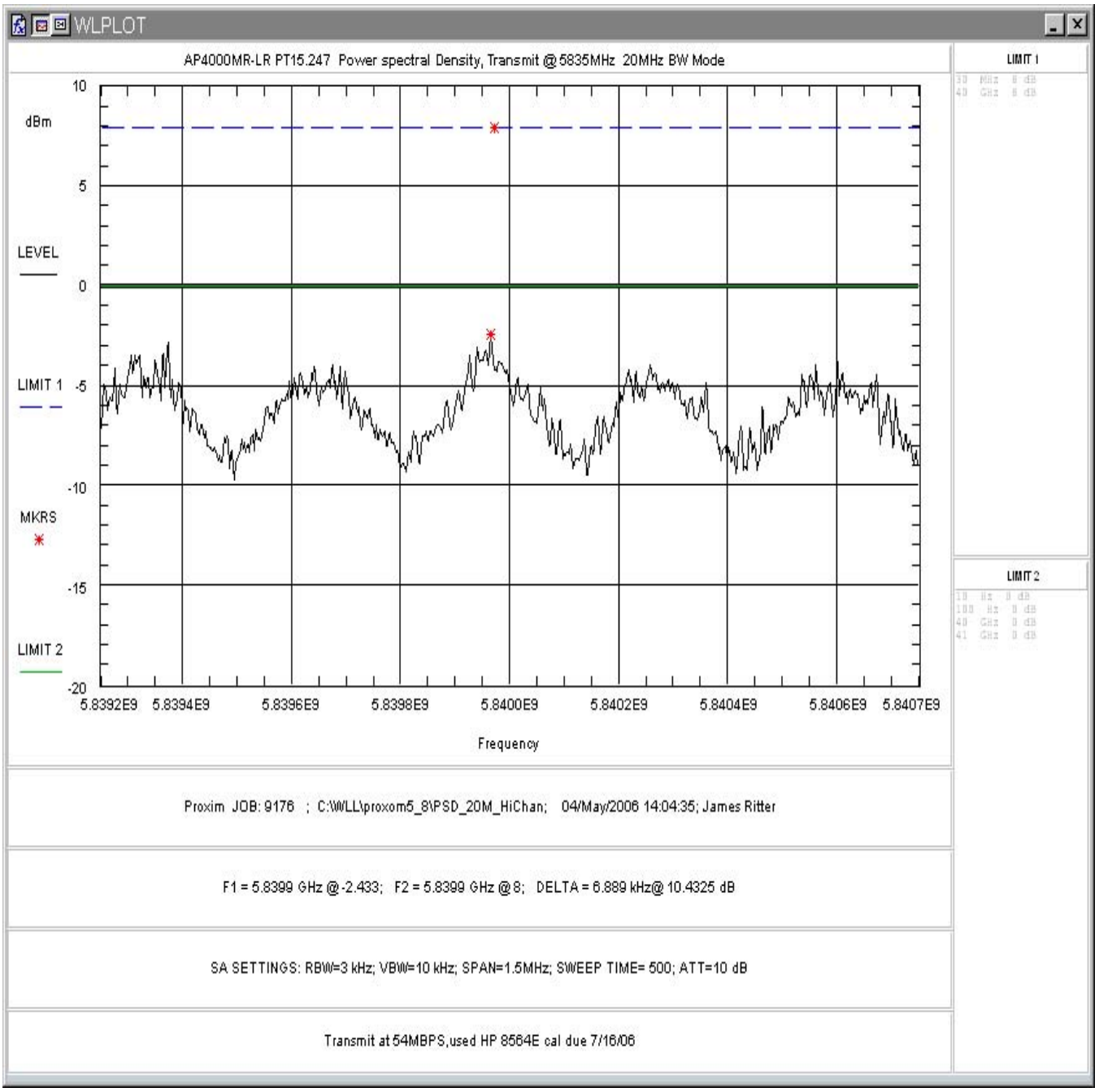


Figure 10. Power Spectral Density – 20MHz Bandwidth, High Channel

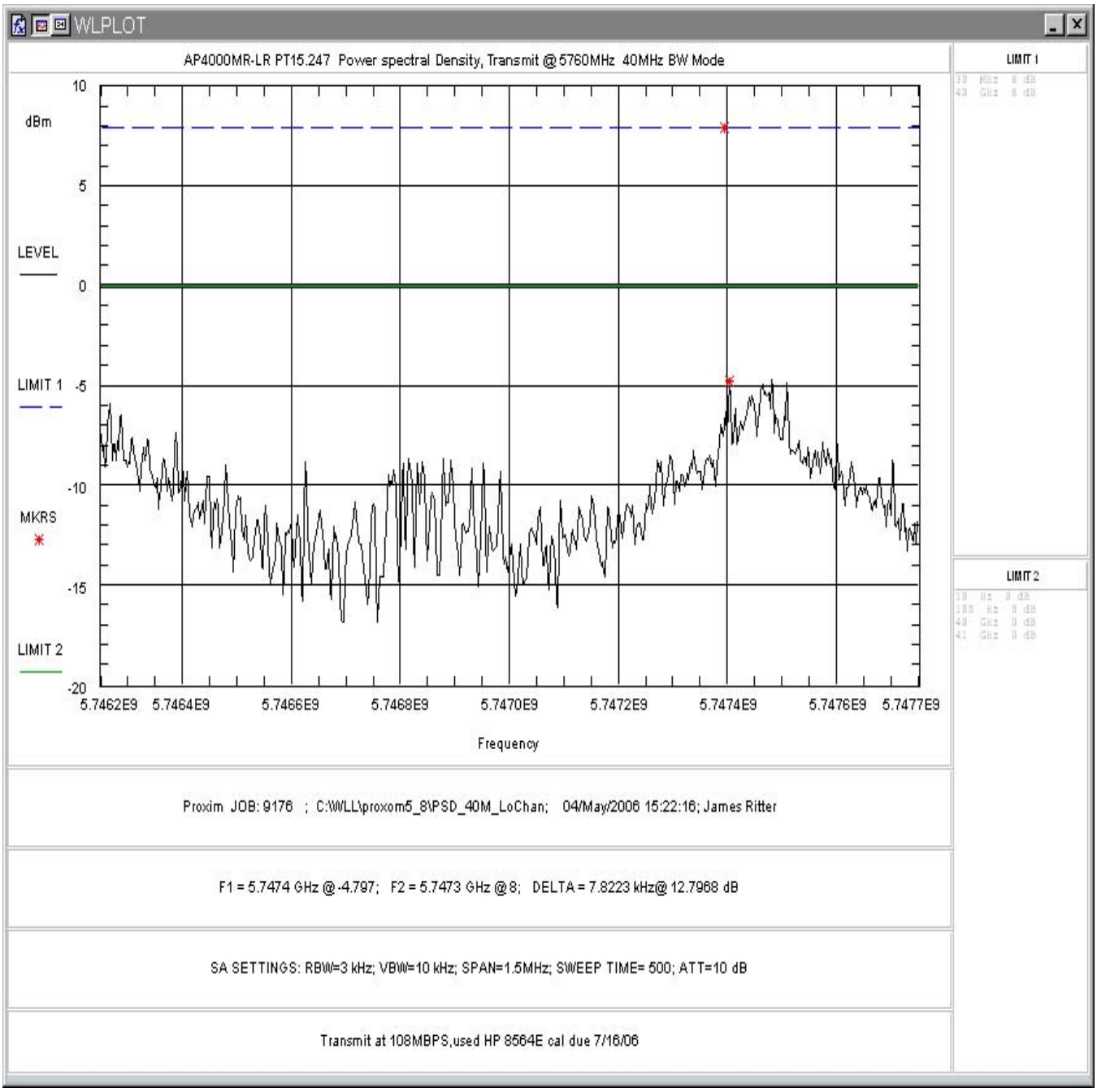


Figure 11. Power Spectral Density – 40MHz Bandwidth, Low Channel

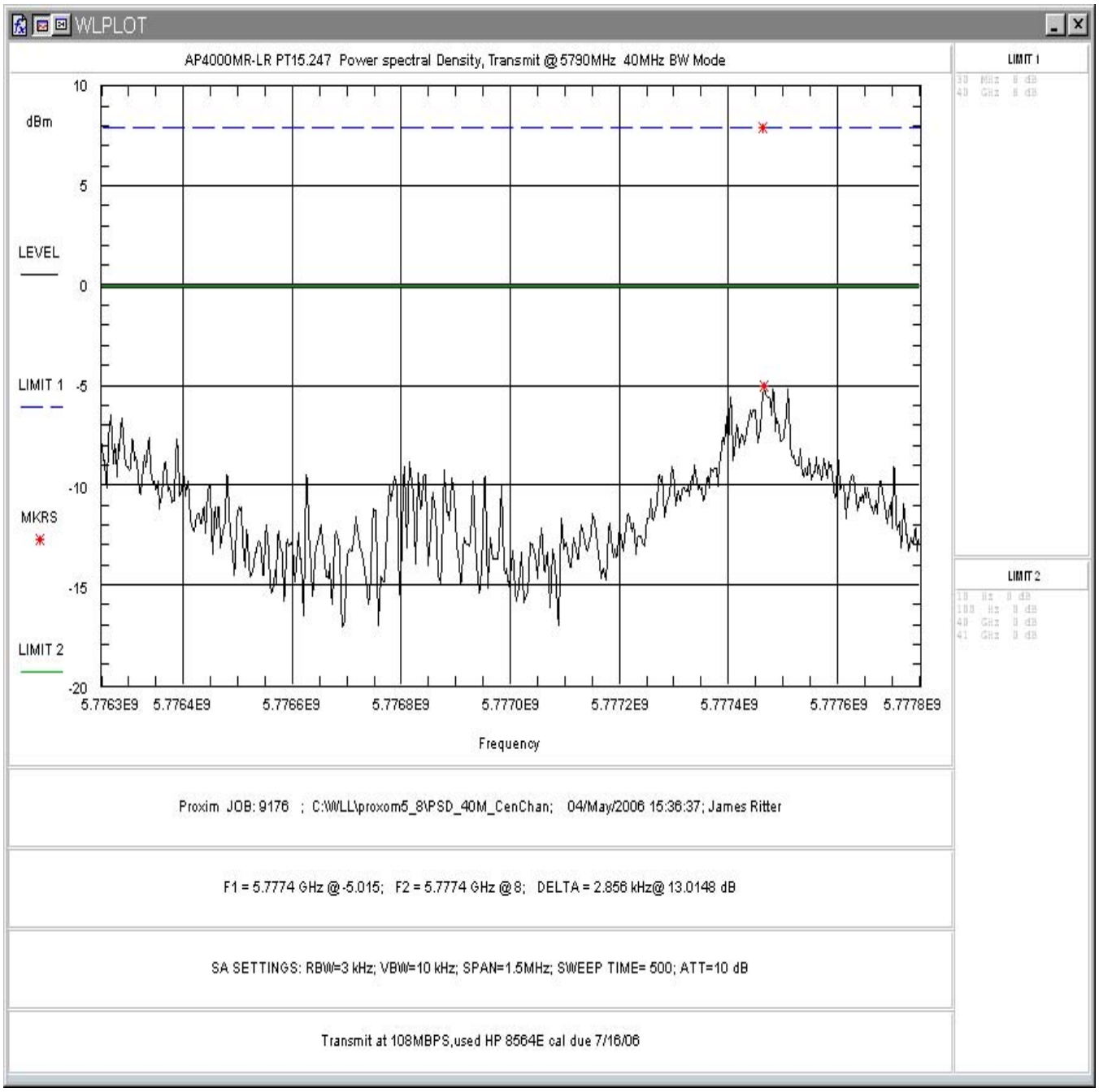


Figure 12. Power Spectral Density – 40MHz Bandwidth, Mid Channel

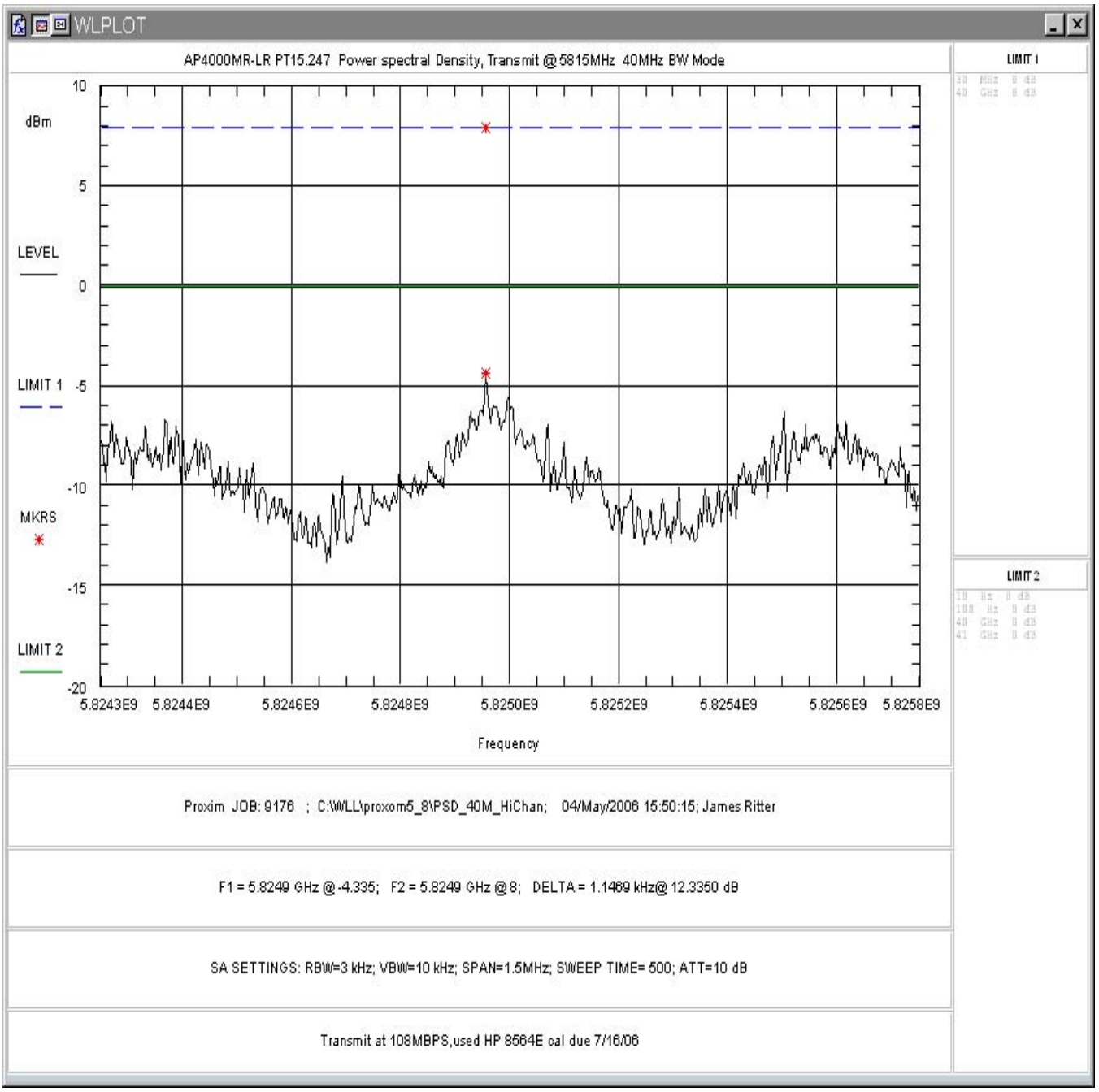


Figure 13. Power Spectral Density – 40MHz Bandwidth, High Channel

Table 5. RF Power Spectral Density

Frequency	Level (dBm)	Limit (dBm)	Pass/Fail
5740	-3.6	8	Pass
5190	-3.2	8	Pass
5835	-2.4	8	Pass
5760	-4.8	8	Pass
5790	-5.0	8	Pass
5815	-4.3	8	Pass

4.4 Conducted Spurious Emissions at Antenna Terminals (FCC Part §15.247(d)

In any 100 kHz band outside the frequency band in which the system is operating, the RF power shall be at least 20dB below that in the 100 kHz bandwidth that contain the highest level of the desired power.

All measurements were performed with a measurement bandwidth of 100kHz. The video bandwidth was set to 3MHz during the testing.

See the plots of conducted emissions plots below.

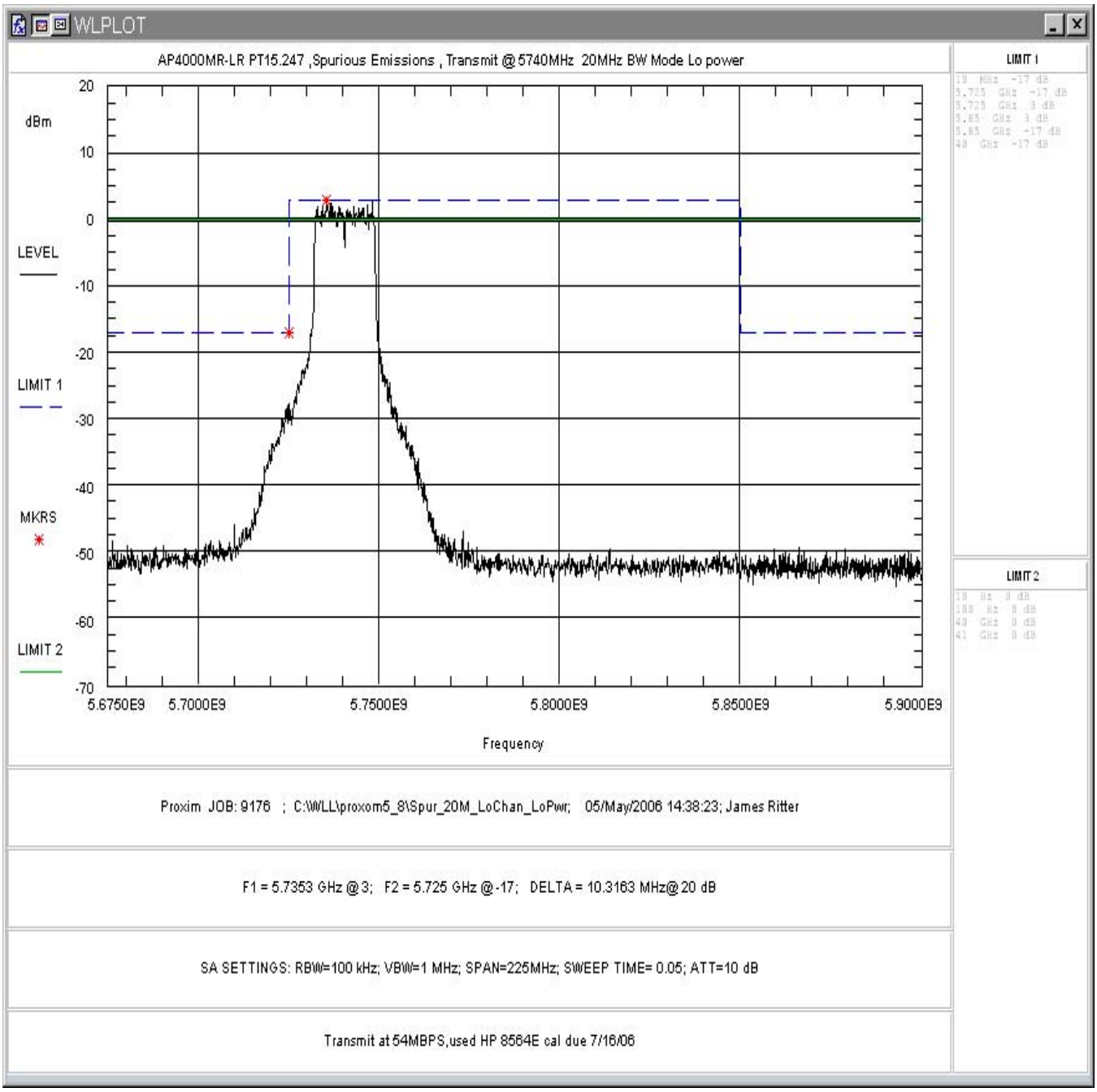


Figure 14. Conducted Spurious Emissions: 20MHz BW, Low Channel, Low Power, In-Band

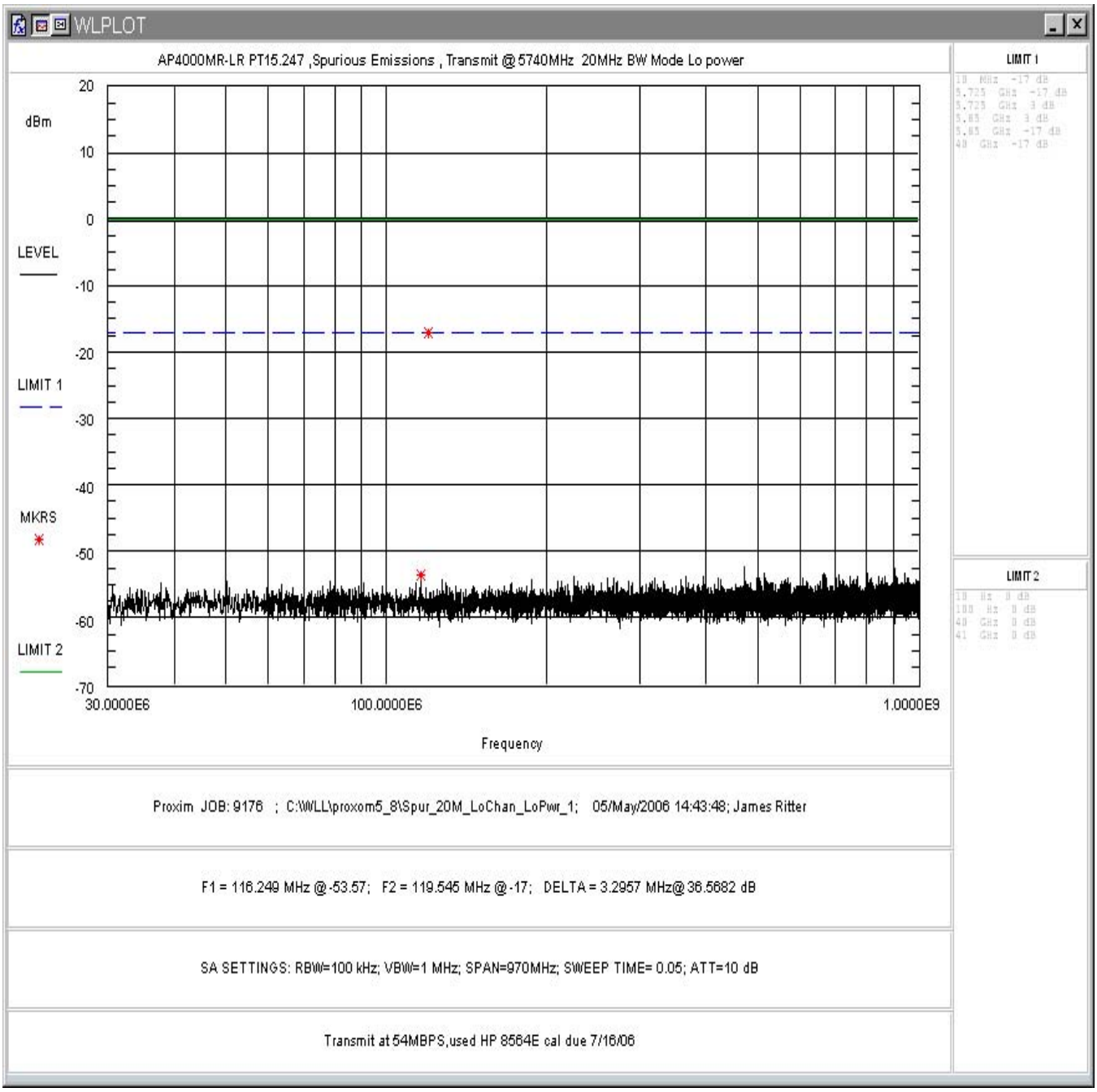


Figure 15. Conducted Spurious Emissions: 20MHz BW, Low Channel, Low Power, 30MHz – 1GHz

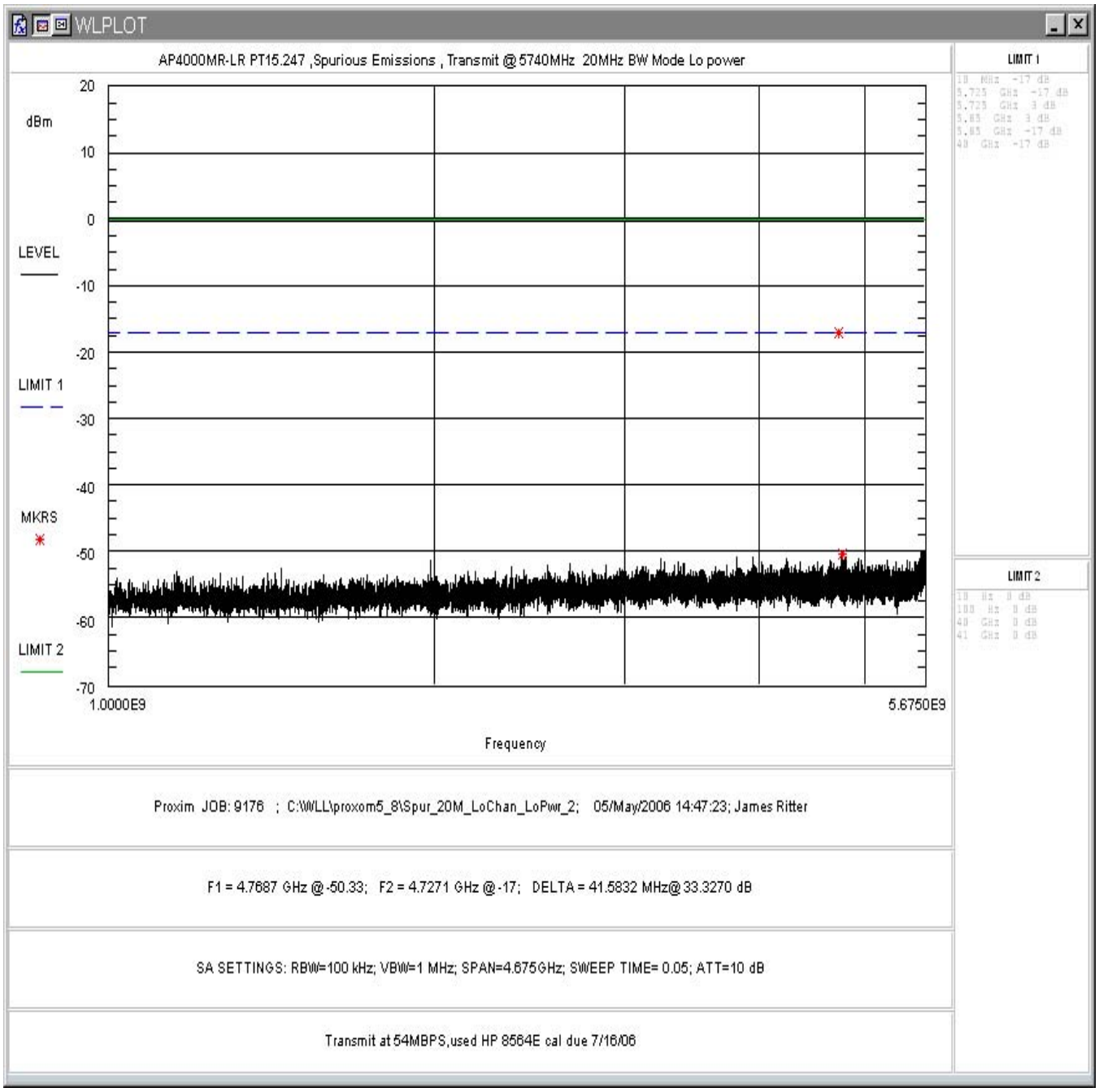


Figure 16. Conducted Spurious Emissions: 20MHz BW, Low Channel, Low Power, 1GHz – 5.675GHz

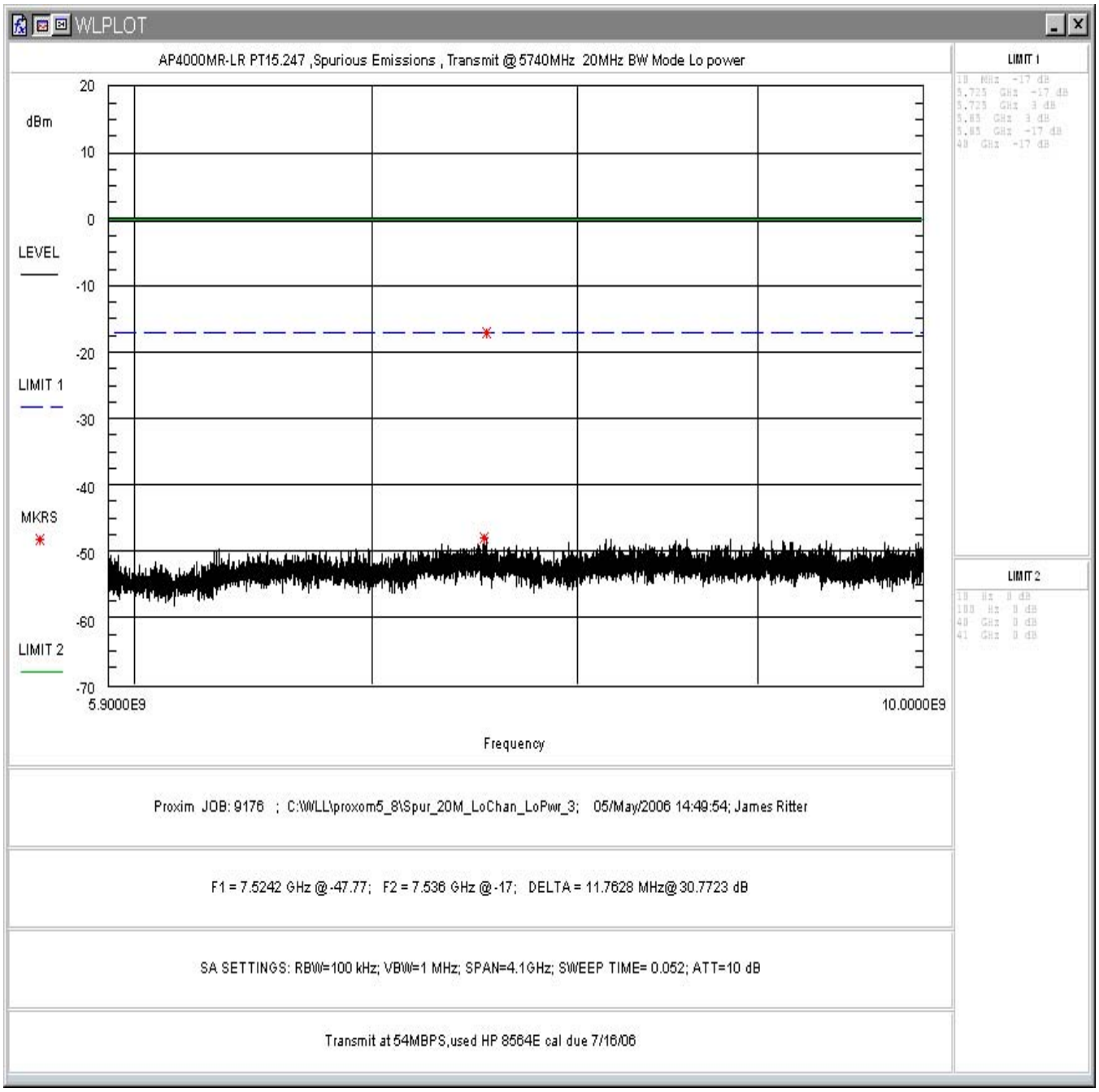


Figure 17. Conducted Spurious Emissions: 20MHz BW, Low Channel, Low Power, 5.9GHz – 10GHz

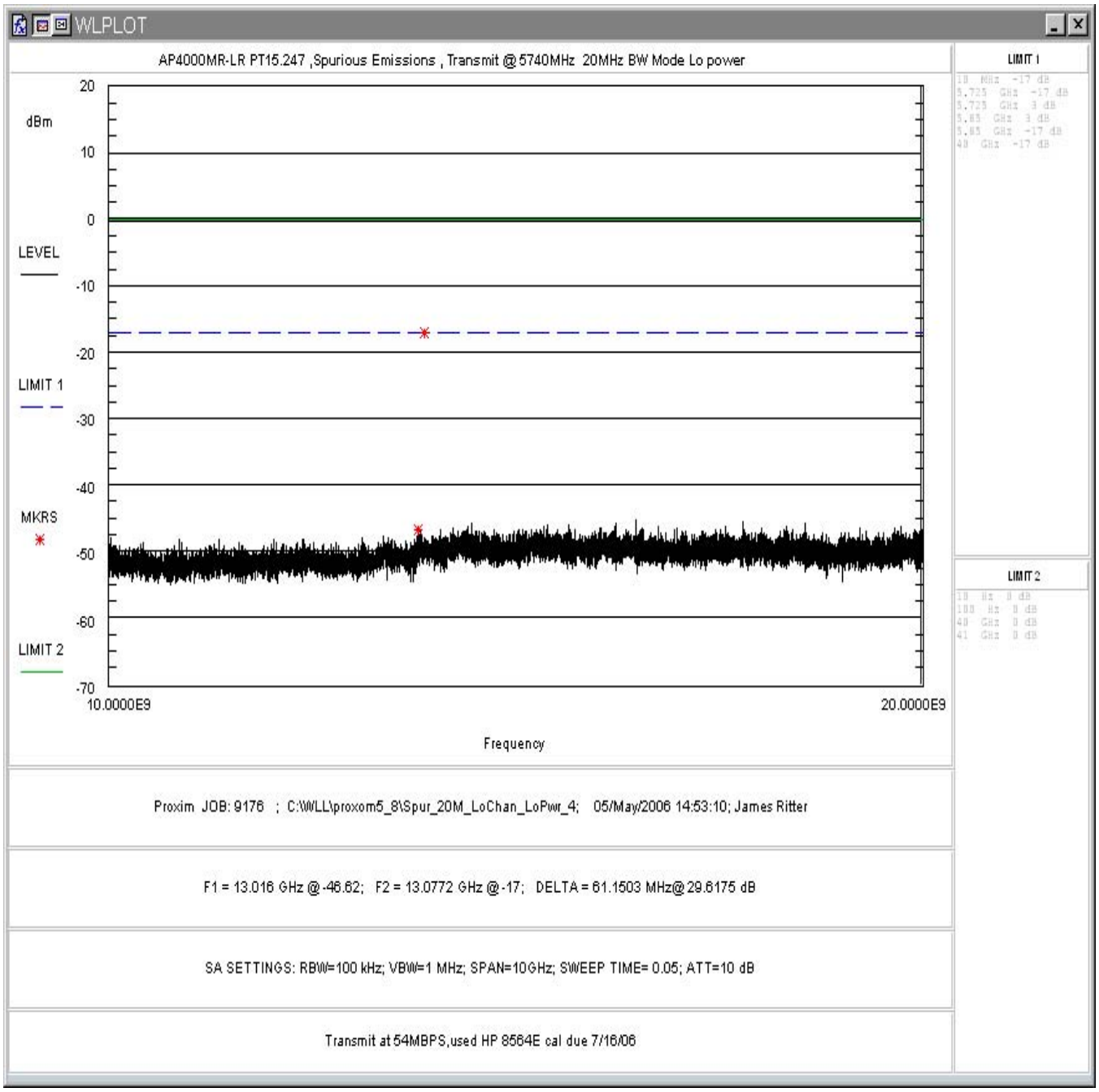


Figure 18. Conducted Spurious Emissions: 20MHz BW, Low Channel, Low Power, 10GHz – 20GHz

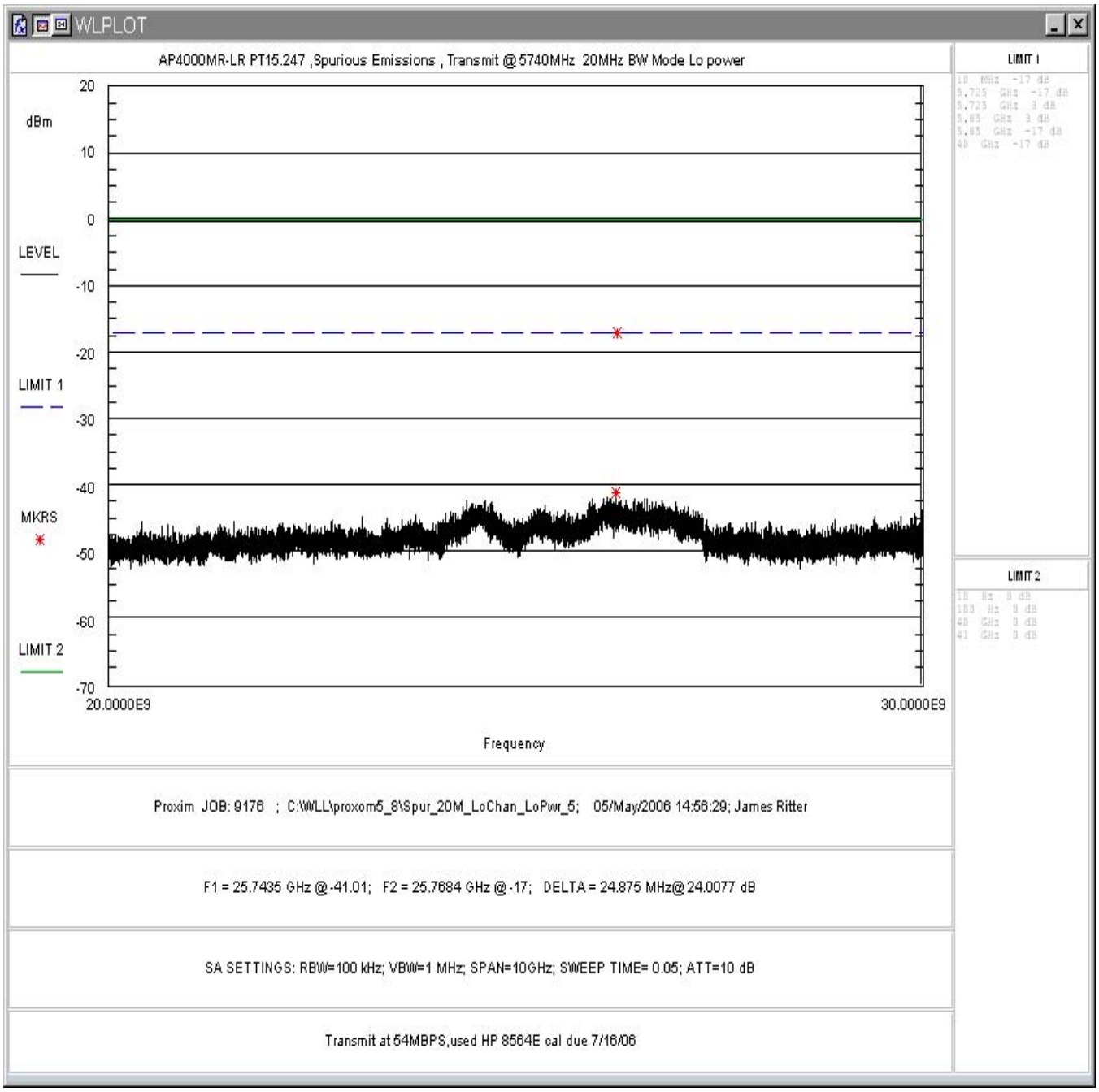


Figure 19. Conducted Spurious Emissions: 20MHz BW, Low Channel, Low Power, 20GHz – 30GHz

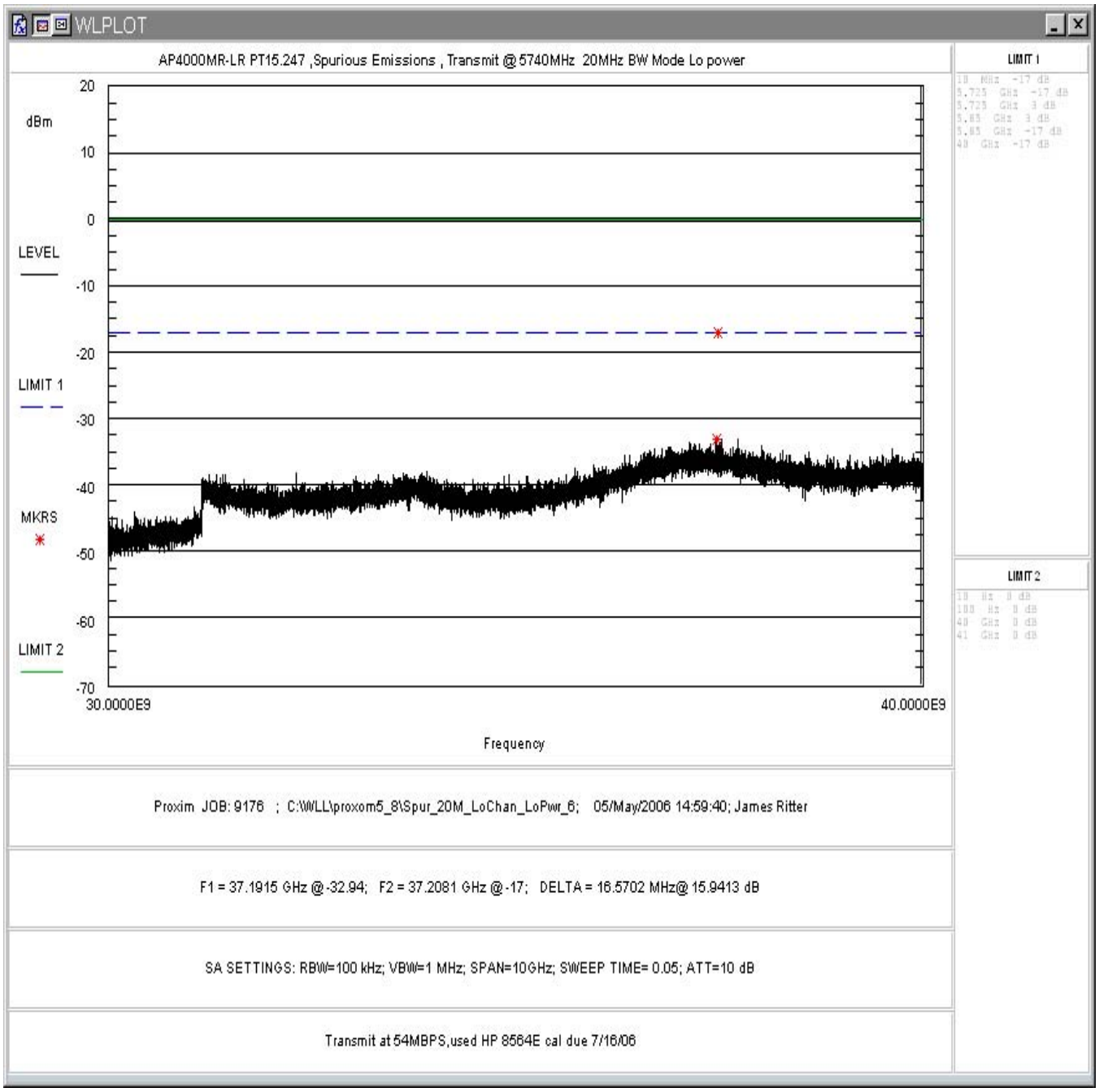


Figure 20. Conducted Spurious Emissions: 20MHz BW, Low Channel, Low Power, 30GHz – 40GHz

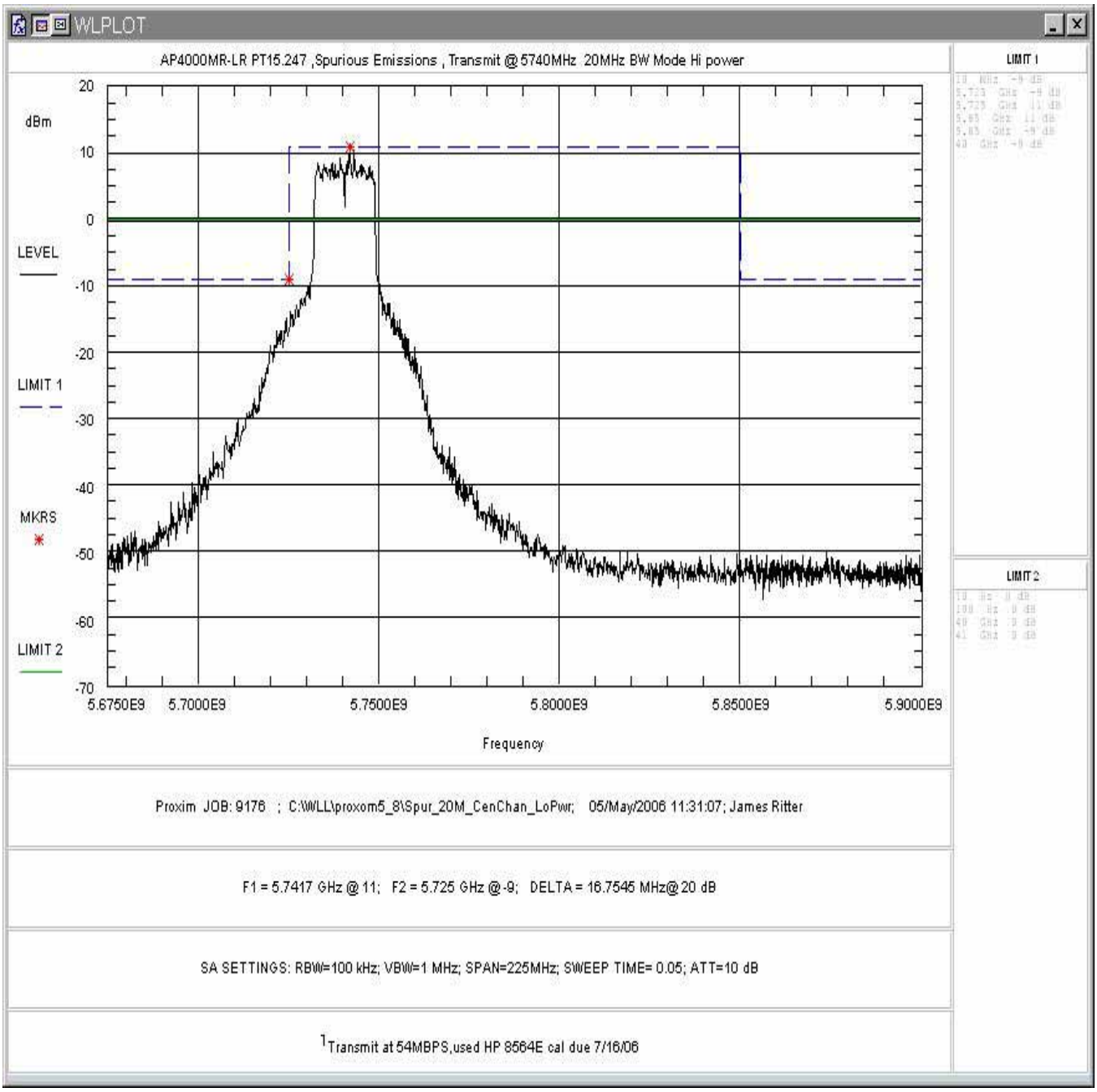


Figure 21. Conducted Spurious Emissions: 20MHz BW, Low Channel, High Power, In-Band

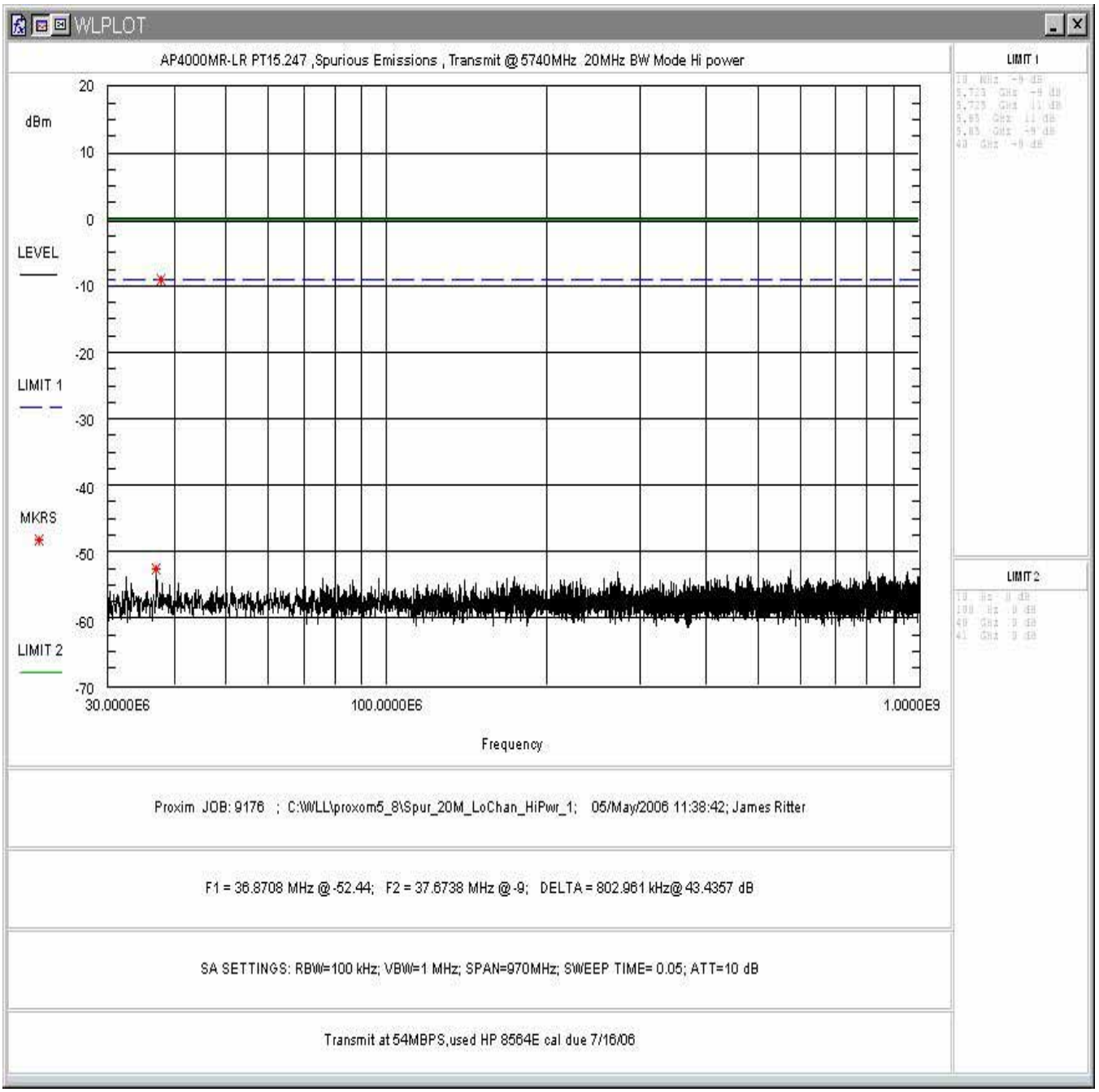


Figure 22. Conducted Spurious Emissions: 20MHz BW, Low Channel, High Power, 30MHz – 1GHz

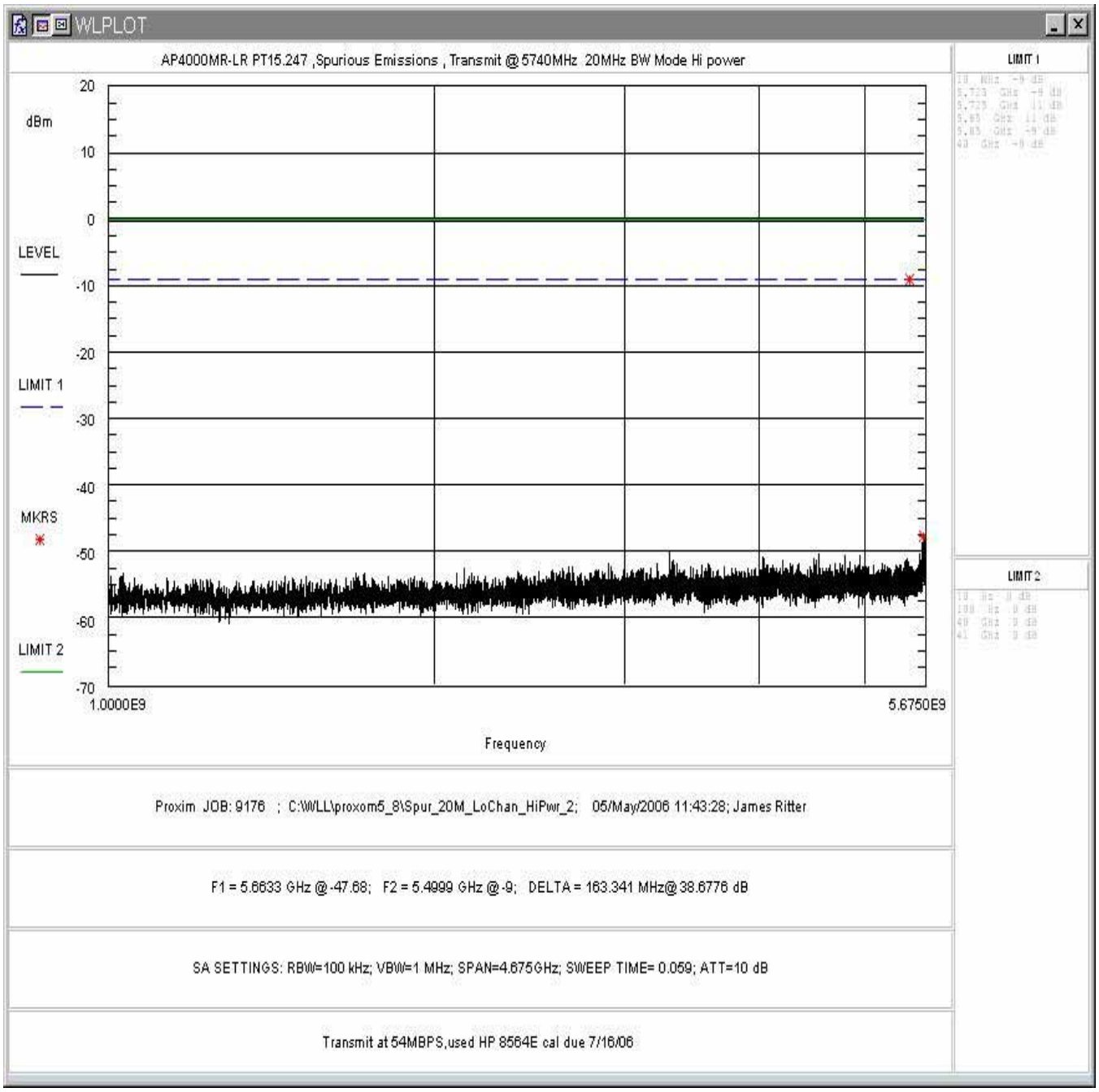


Figure 23. Conducted Spurious Emissions: 20MHz BW, Low Channel, High Power, 1GHz – 5.675GHz

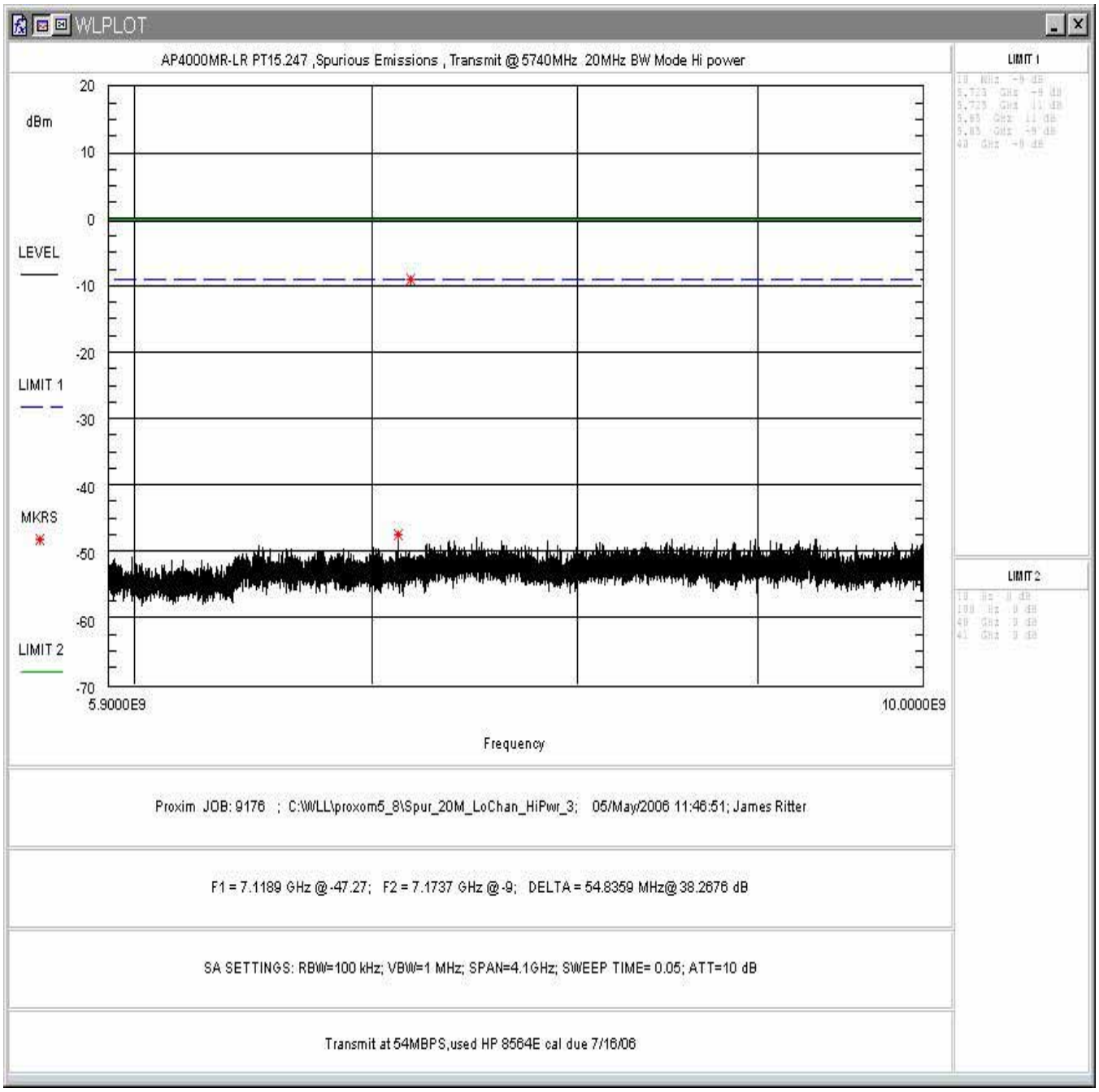


Figure 24. Conducted Spurious Emissions: 20MHz BW, Low Channel, High Power, 5.9GHz – 10GHz

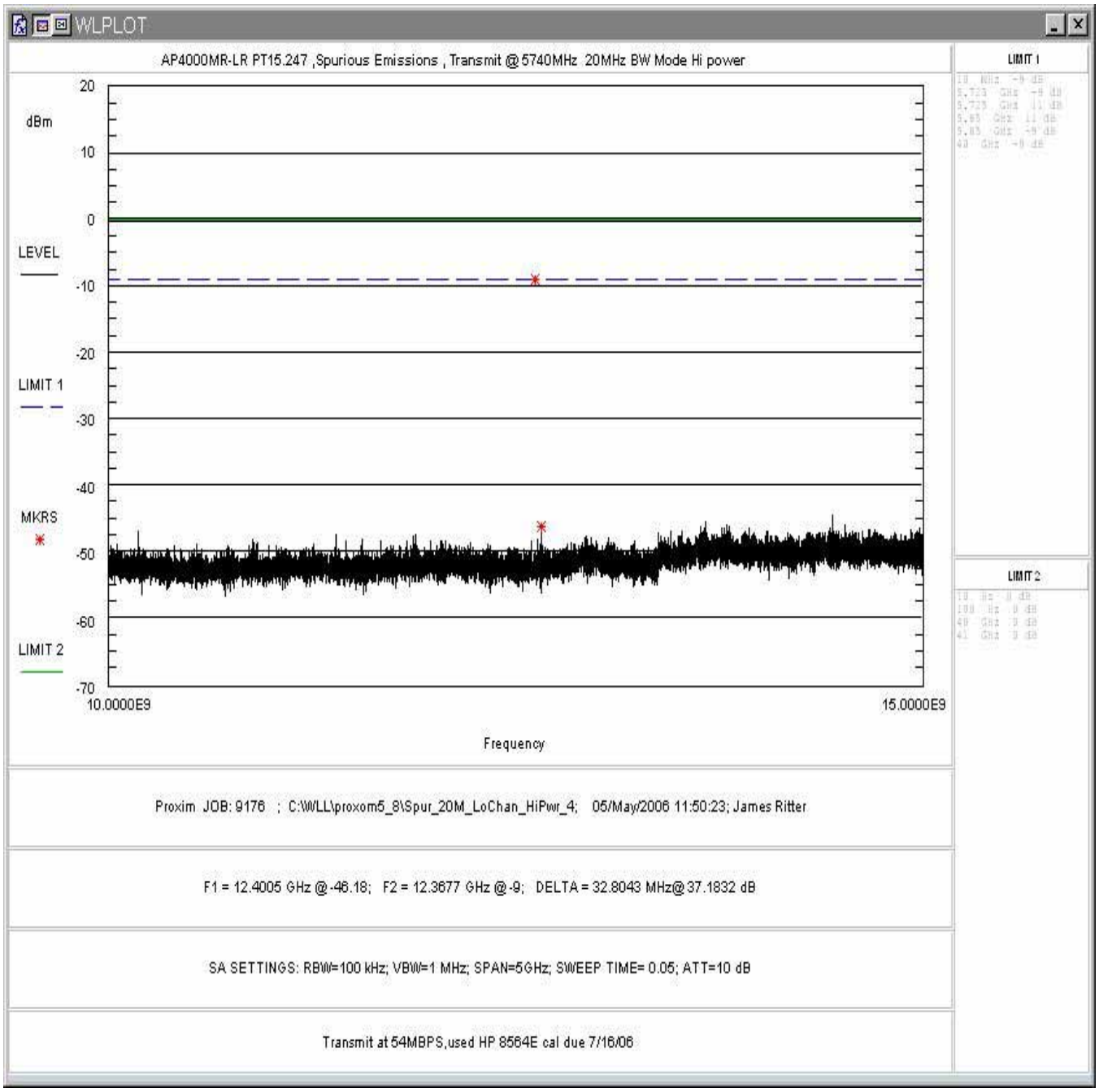


Figure 25. Conducted Spurious Emissions: 20MHz BW, Low Channel, High Power, 10GHz – 15GHz

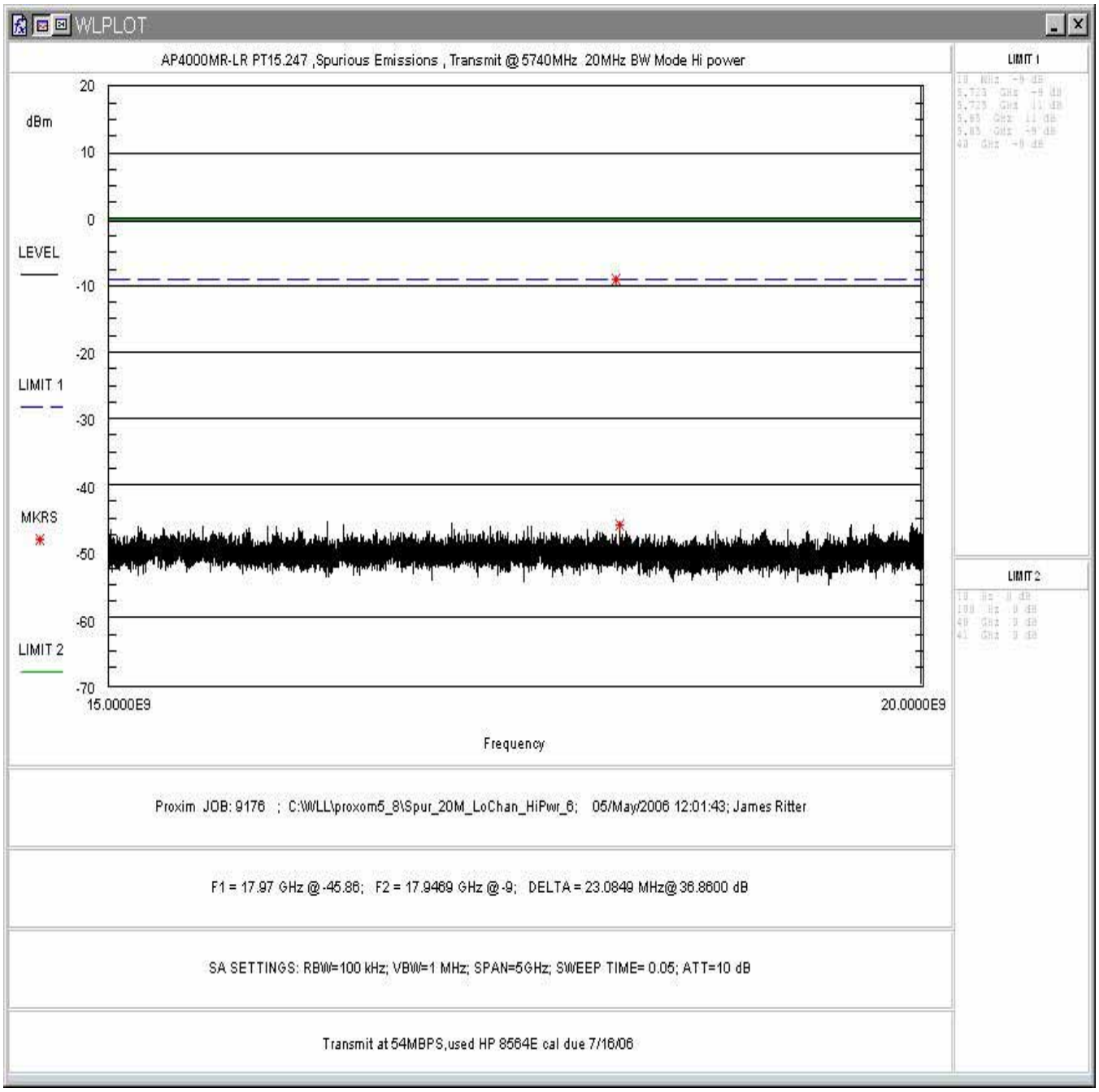


Figure 26. Conducted Spurious Emissions: 20MHz BW, Low Channel, High Power, 15GHz – 20GHz

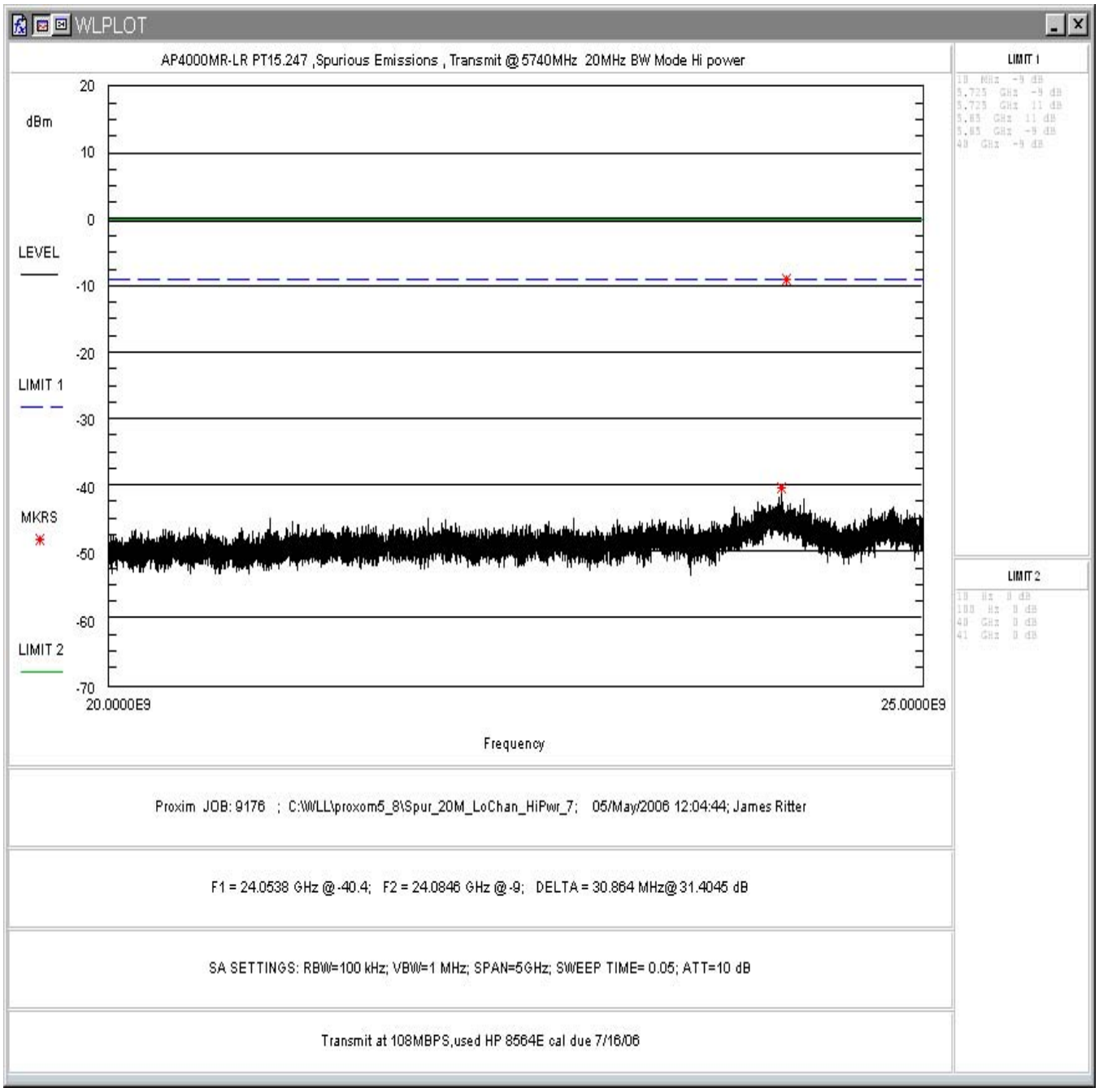


Figure 27. Conducted Spurious Emissions: 20MHz BW, Low Channel, High Power, 20GHz – 25GHz

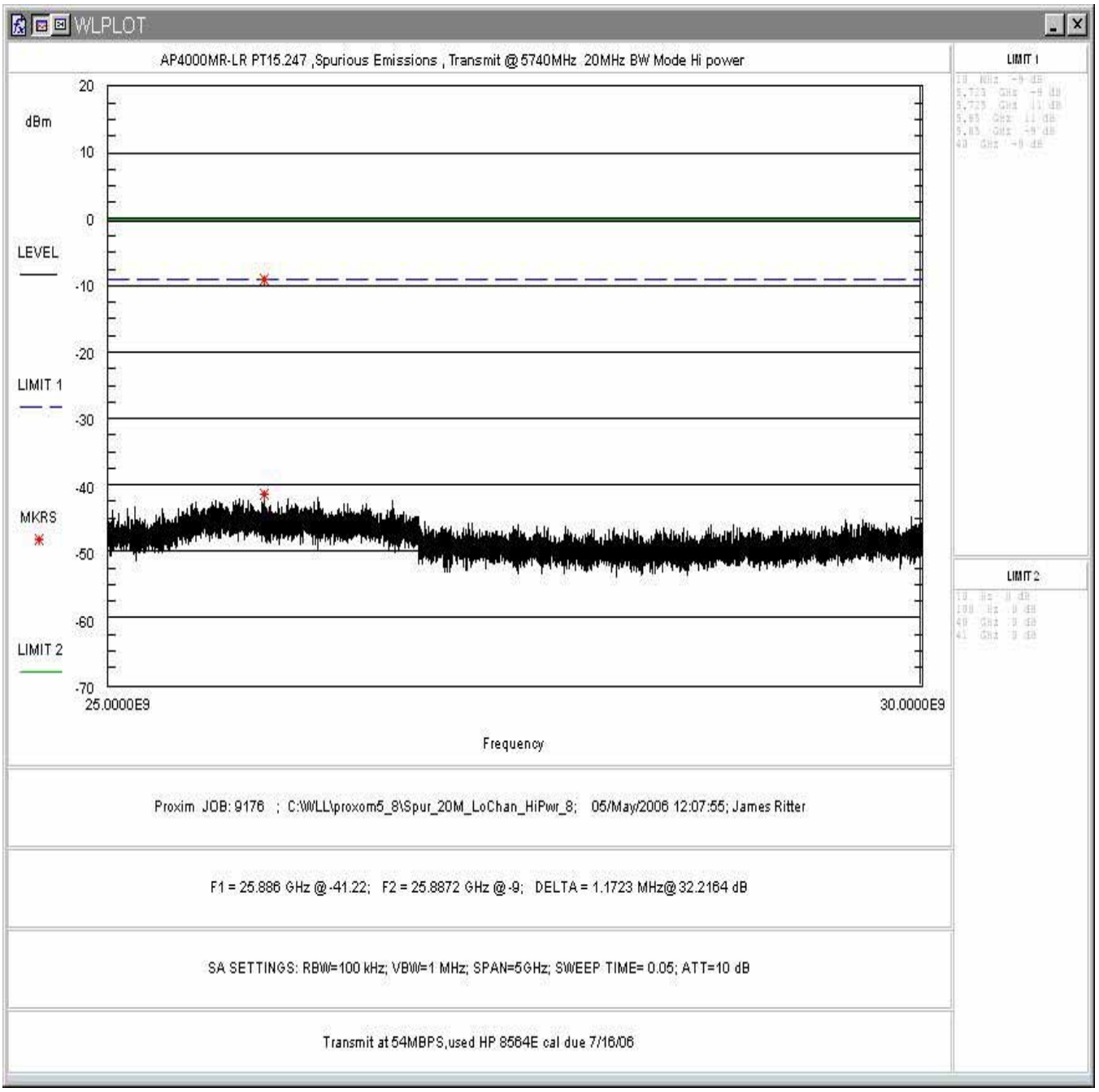


Figure 28. Conducted Spurious Emissions: 20MHz BW, Low Channel, High Power, 25GHz – 30GHz

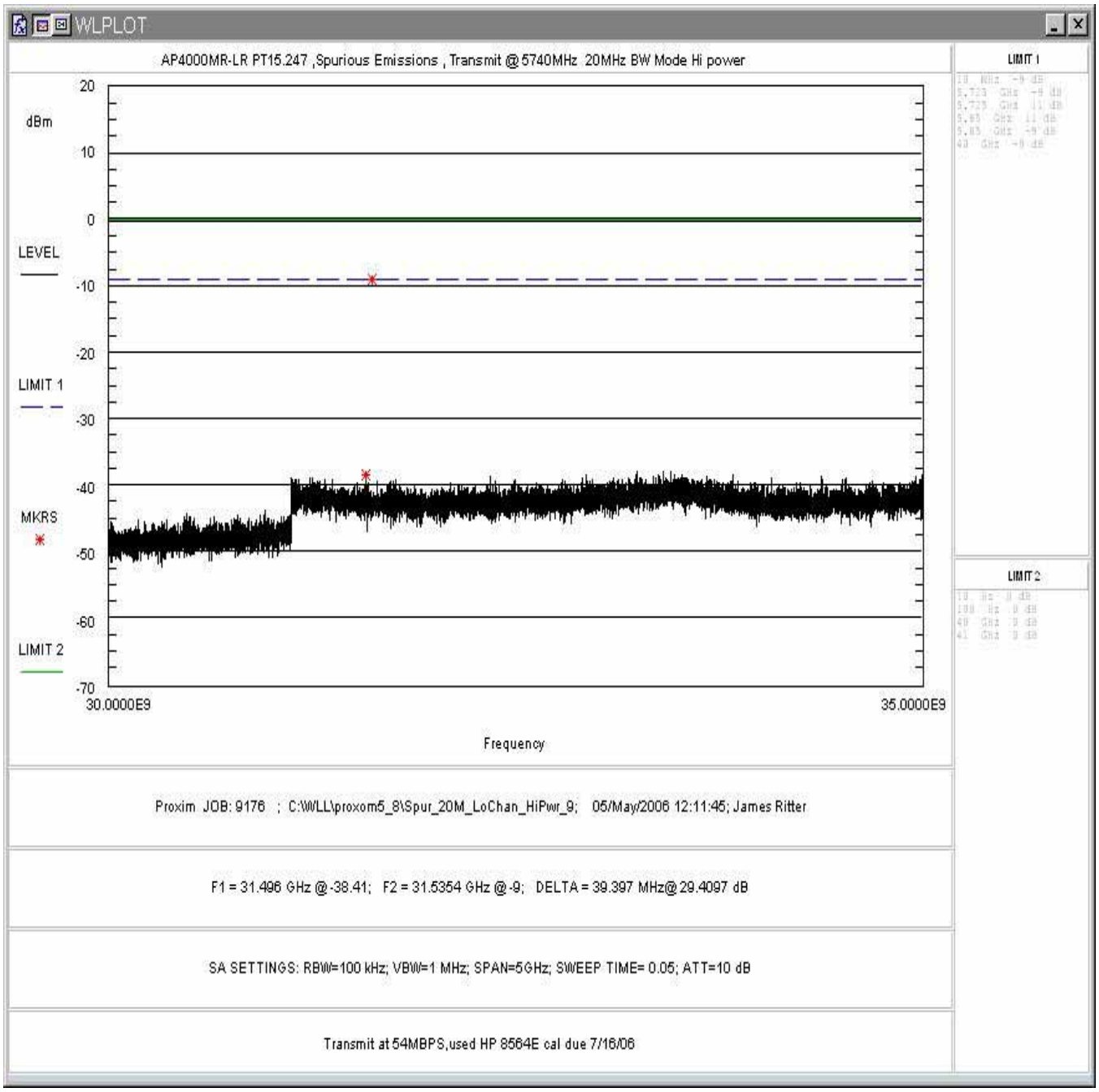


Figure 29. Conducted Spurious Emissions: 20MHz BW, Low Channel, High Power, 30GHz – 35GHz

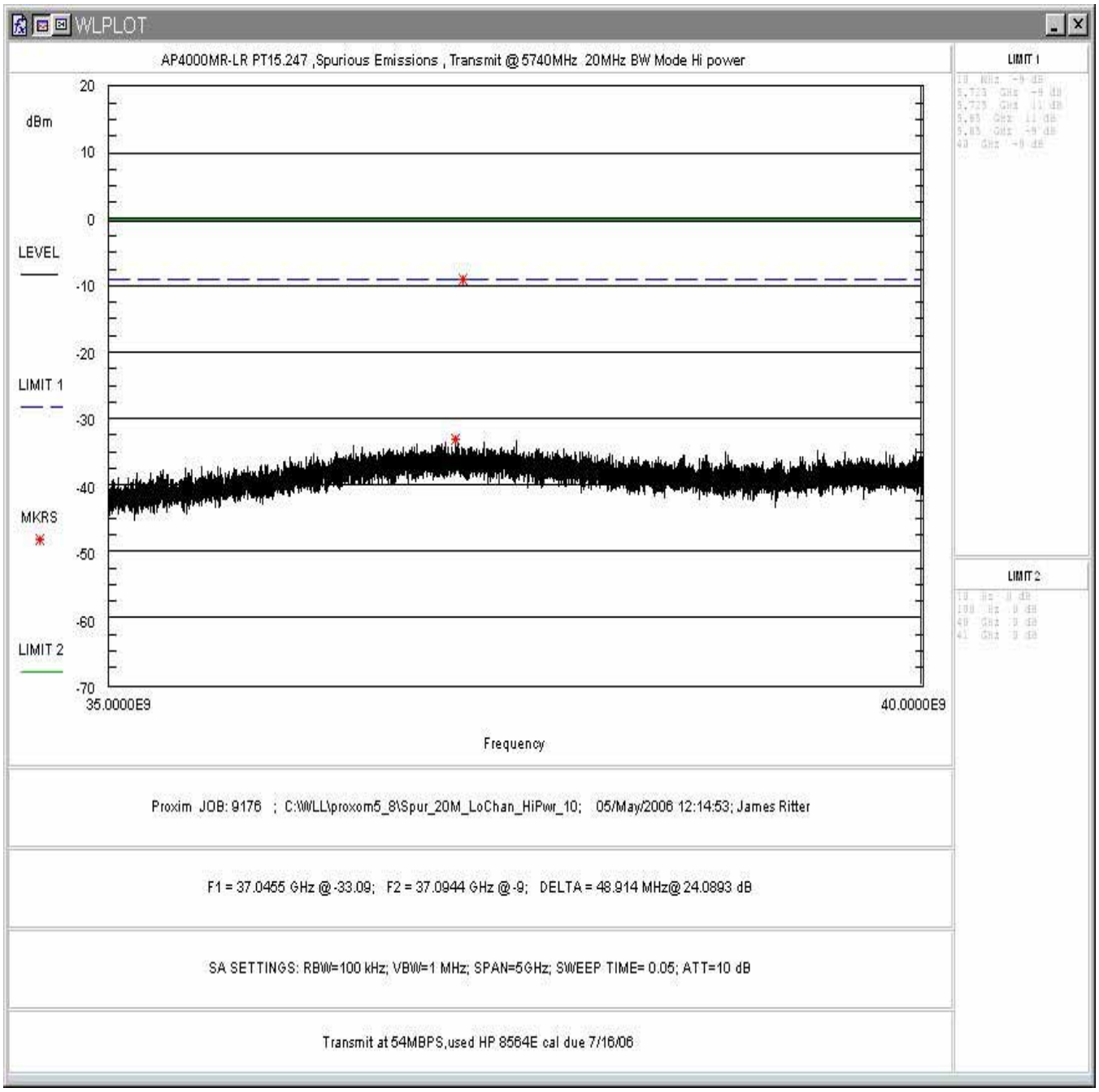


Figure 30. Conducted Spurious Emissions: 20MHz BW, Low Channel, High Power, 35GHz – 40GHz

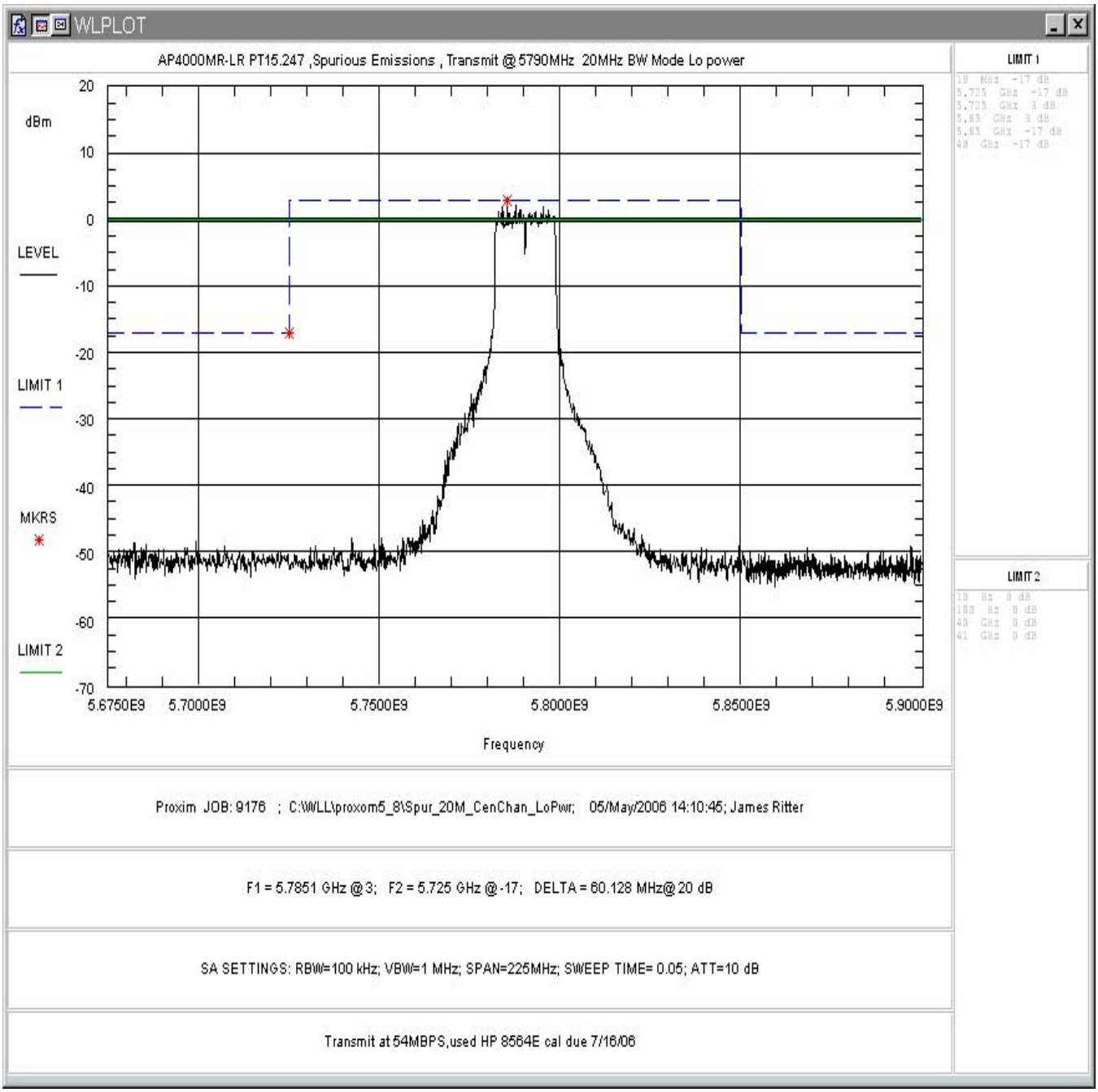


Figure 31. Conducted Spurious Emissions: 20MHz BW, Mid Channel, Low Power, In-Band

