Washington Laboratories, Ltd.

FCC Certification Test Report
For the
Wireless Highways, Inc.
PC701

THQ-PC701

WLL JOB# **8837**
September 2005

Prepared for:

Wireless Highways, Inc.
1964 Gallows Road Suite 350
Vienna, Virginia 22182

Prepared By:

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Gaithersburg, Maryland 20879

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Wireless Highways, Inc.
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FCC ID: THQ-PC701

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Prepared by: Brian J. Dettling
Documentation Specialist

Reviewed by: Gregory M. Snyder
Chief EMC Engineer

Abstract

This report has been prepared on behalf of Wireless Highways, Inc. to support the attached Application for Equipment Authorization. The test report and application are submitted for a Transmitter under Part 15 Subpart E of the FCC Rules and Regulations. This Certification Test Report documents the test configuration and test results for a Wireless Highways, Inc. PC701.

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 Wireless Highways, Inc. PC701 complies with the limits for a Transmitter device under FCC Part 15 Subpart E.

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1 Introduction

1.1 Compliance Statement

The Wireless Highways, Inc. PC701 complies with the limits for a Transmitter device under FCC Part 15 Subpart E.

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 02-2138 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:	Wireless Highways, Inc. 1964 Gallows Road Suite 350 Vienna, Virginia 22182
Purchase Order Number:	184
Quotation Number:	62431

1.4 Test Dates

Testing was performed on the following date(s):	July 18 to August 26, 2005

1.5 Test and Support Personnel

Washington Laboratories, LTD	Steve Koster, James Ritter, John Repella

2 Equipment Under Test

2.1 EUT Identification & Description

The Wireless Highways, Inc. PC701 employs a 5.7GHz OFDM Transceiver and a COFDM PTMC modem daughter card. The EUT is a UNII device which operates in the frequency range 5724-5769MHz. The unit can operate in the following modes, QPSK, QAM-16, and QAM-64. The DIT (radio) is installed in the 5 ¼" drive bay of the PC. This system also includes an off-the-shelf carrier card which is also installed in the PC.

The system is designed to bridge or backhaul Voice-TDM, Wireless-CDMA, or Data traffic for a large variety of carrier class service providers. In its most fundamental configuration a bi-directional wireless link is facilitated between two nodes in a point to point architecture.

Table 1. Device Summary

ITEM	DESCRIPTION
Manufacturer:	Wireless Highways, Inc.
FCC ID:	THQ-PC701
Model:	PC701
FCC Rule Parts:	§15 Subpart E
Frequency Range:	5724-5769MHz
Maximum Output Power:	11.56 dBm
Modulation:	QPSK, QAM-16, and QAM-64
Occupied Bandwidth:	7296 MHz
Keying:	Automatic
Type of Information:	Data
Power Output Level	Fixed
Antenna Connector	N-Type
Antenna Type	5.8GHz Parabolic, 22.5dBi
Power Source & Voltage:	12Vdc from host PC 120Vac

2.2 Test Configuration

The PC701 was configured internally in the host PC for all conducted emissions measurements. For the radiated emissions testing the unit was removed from the PC and placed externally to ensure that the PC would not provide additional shielding properties. The antenna used for radiated spurious emissions testing was a Radio Waves Model: SP1-5.8, 22.5dBi parabolic antenna.

2.3 Testing Algorithm

The PC701 was programmed for maximum power at the low, middle and high channels of operation. For the conducted emissions testing at the antenna terminal the unit was set to all three modes of modulation. The PC uses Linux OS and Mozilla browser which has Bladerunner software to setup 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. 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 02-2138, Measurement Procedure Updated for Peak Transmit Power in the Unlicensed National Information Infrastructure (U-NII) Bands

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:

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
0125	SOLAR 8028-50-TS-BNC	LISN	10/1/2005
0126	SOLAR 8028-50-TS-BNC	LISN	10/1/2005
0073	HP 8568B	SPECTRUM ANALYZER	6/30/2006
0007	ARA LPB-2520	BICONILOG ANTENNA	9/14/2005
0522	HEWLETT-PACKARD 8449B	MICROWAVE PREAMP	4/11/2006
0425	ARA DRG118/A	MICROWAVE HORN ANTENNA	10/31/2005
0026	EMCO 3110B	BICONICAL ANTENNA	12/10/2005
0029	EMCO 3146A	LOG PERIODIC ANTENNA	6/28/2006
0209	NARDA V637	26.5 – 40 GHz ANTENNA	12/25/2008
0210	NARDA V638	18 – 26.5 ANTENNA	12/25/2008
0071	HP 85685A	RF PRESELECTOR	6/30/2006
0069	HP 85650A	QUASI-PEAK ADAPTER	6/30/2006

4 Test Results

4.1 Emission Bandwidth: (FCC Part §15.401(i))

The emissions bandwidth measurement was performed by connecting the output of the EUT to the input of a spectrum analyzer.

The method described in FCC Public Notice DA 02-2138 was used to measure the emission bandwidth (26dBc) at full modulation. The emission bandwidth was recorded for QPSK, 16-QAM and 64-QAM modes of operation.

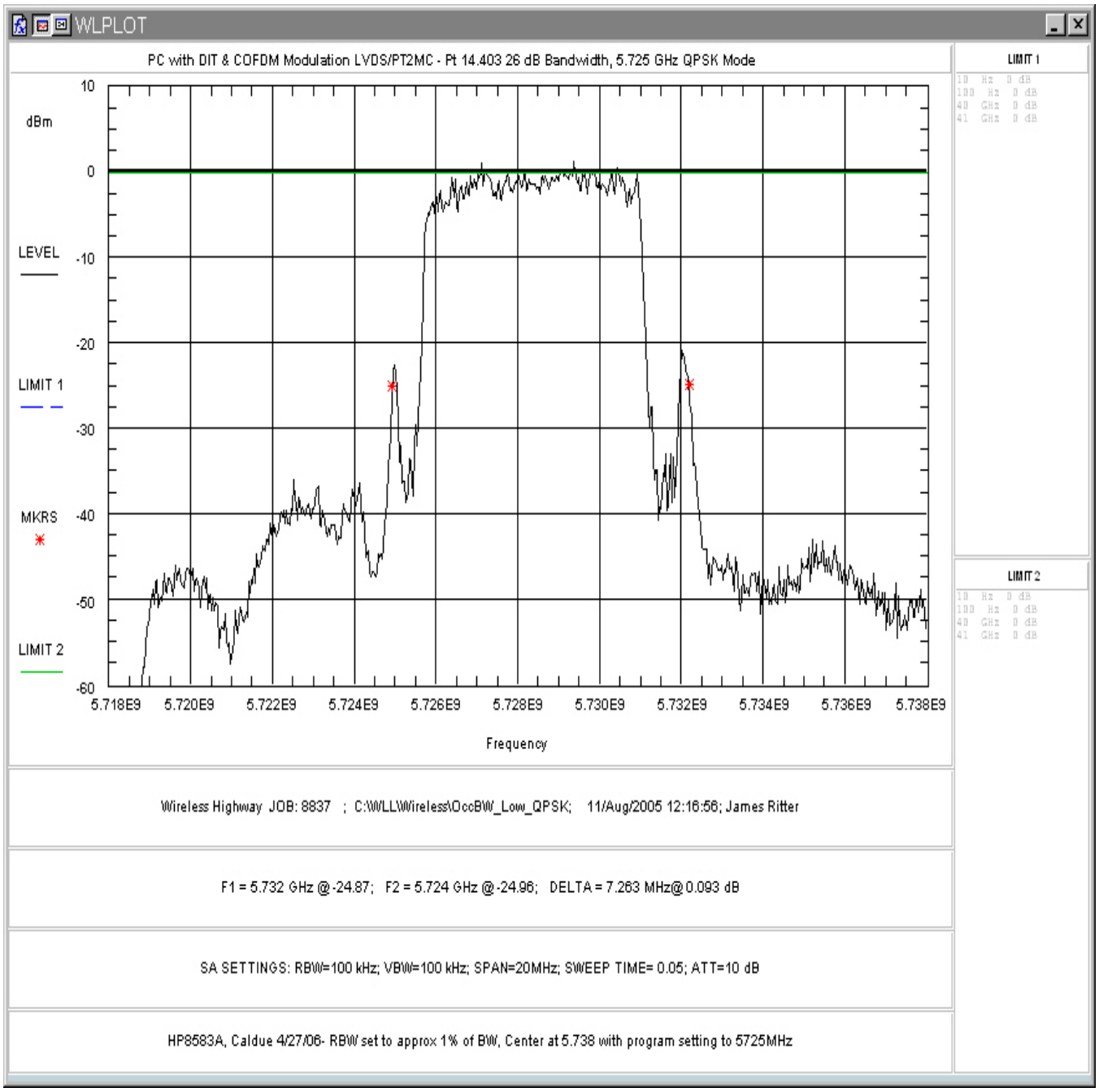

Figure 4-1. Occupied Bandwidth, Low Channel - QPSK

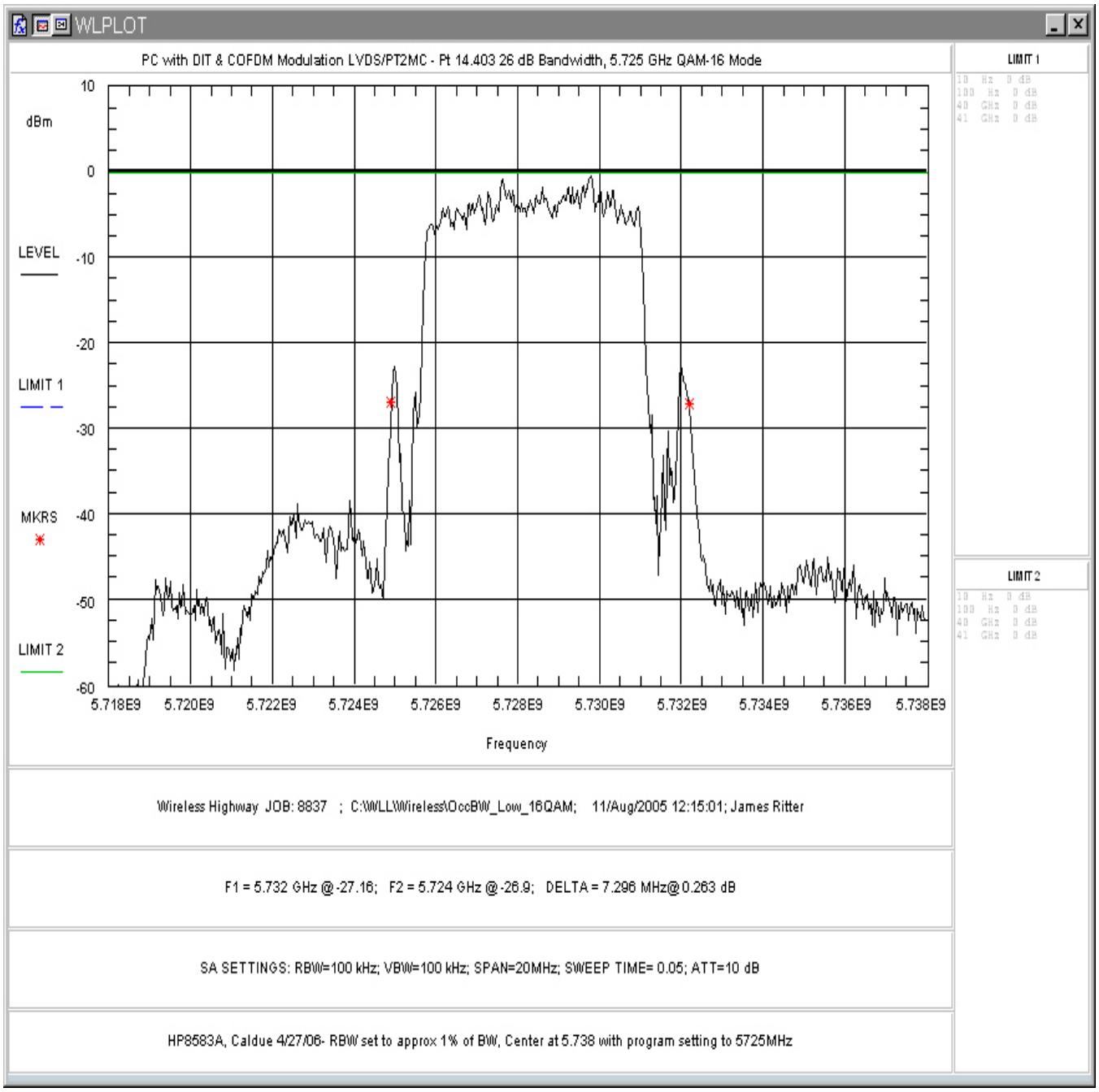

Figure 4-2. Occupied Bandwidth, Low Channel – QAM-16

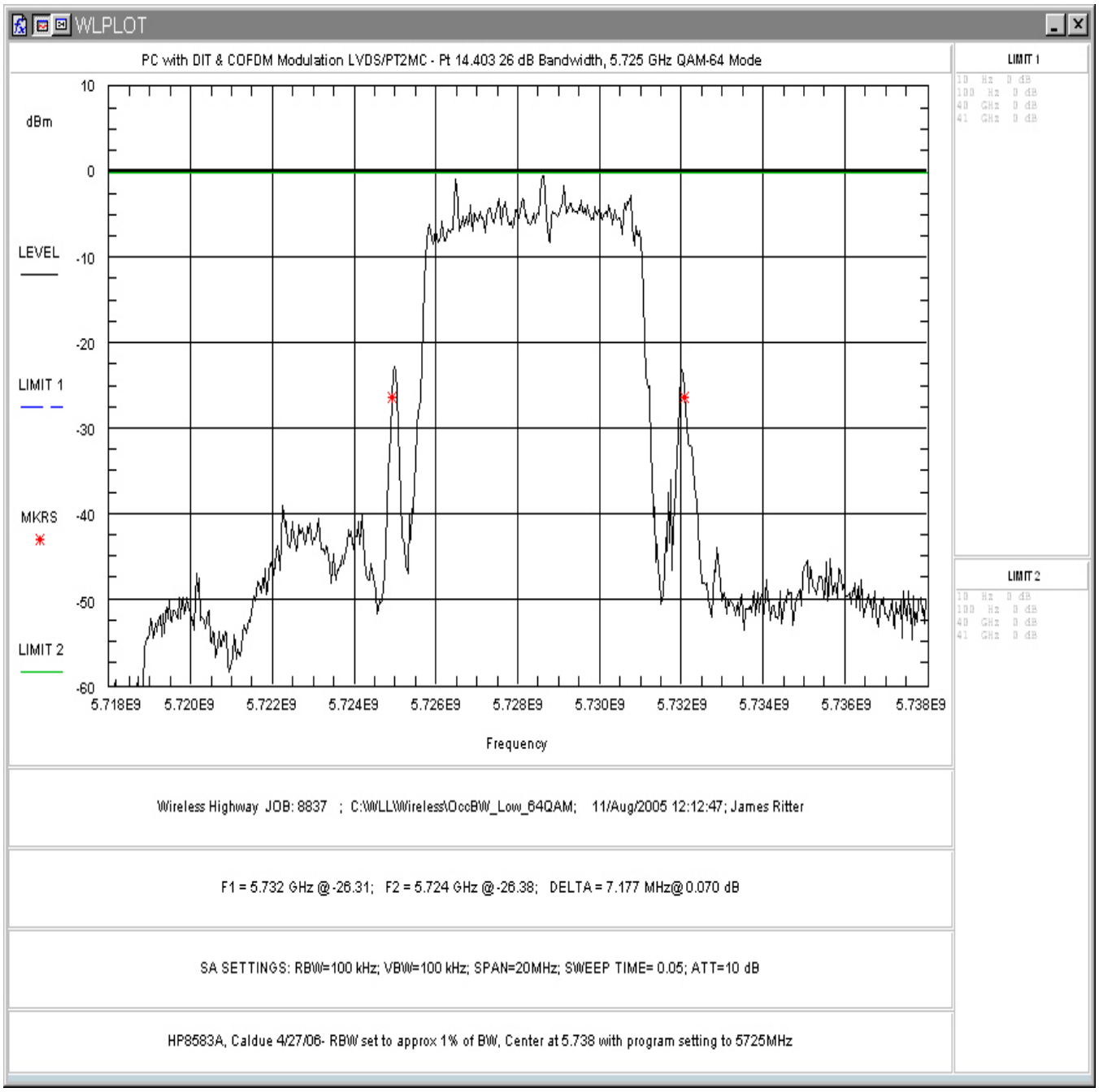

Figure 4-3. Occupied Bandwidth, Low Channel – QAM-64

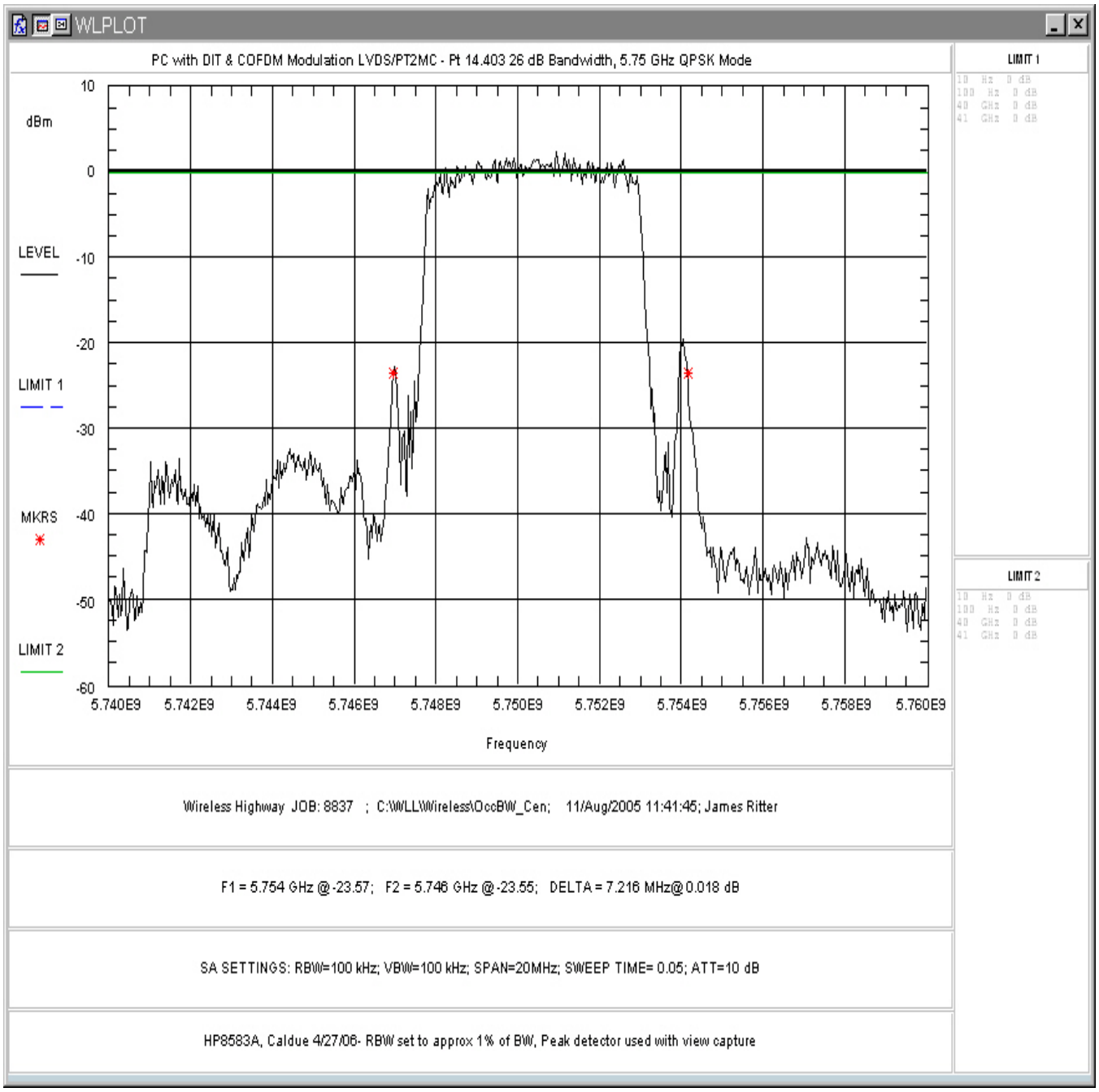

Figure 4-4. Occupied Bandwidth, Mid Channel – QPSK

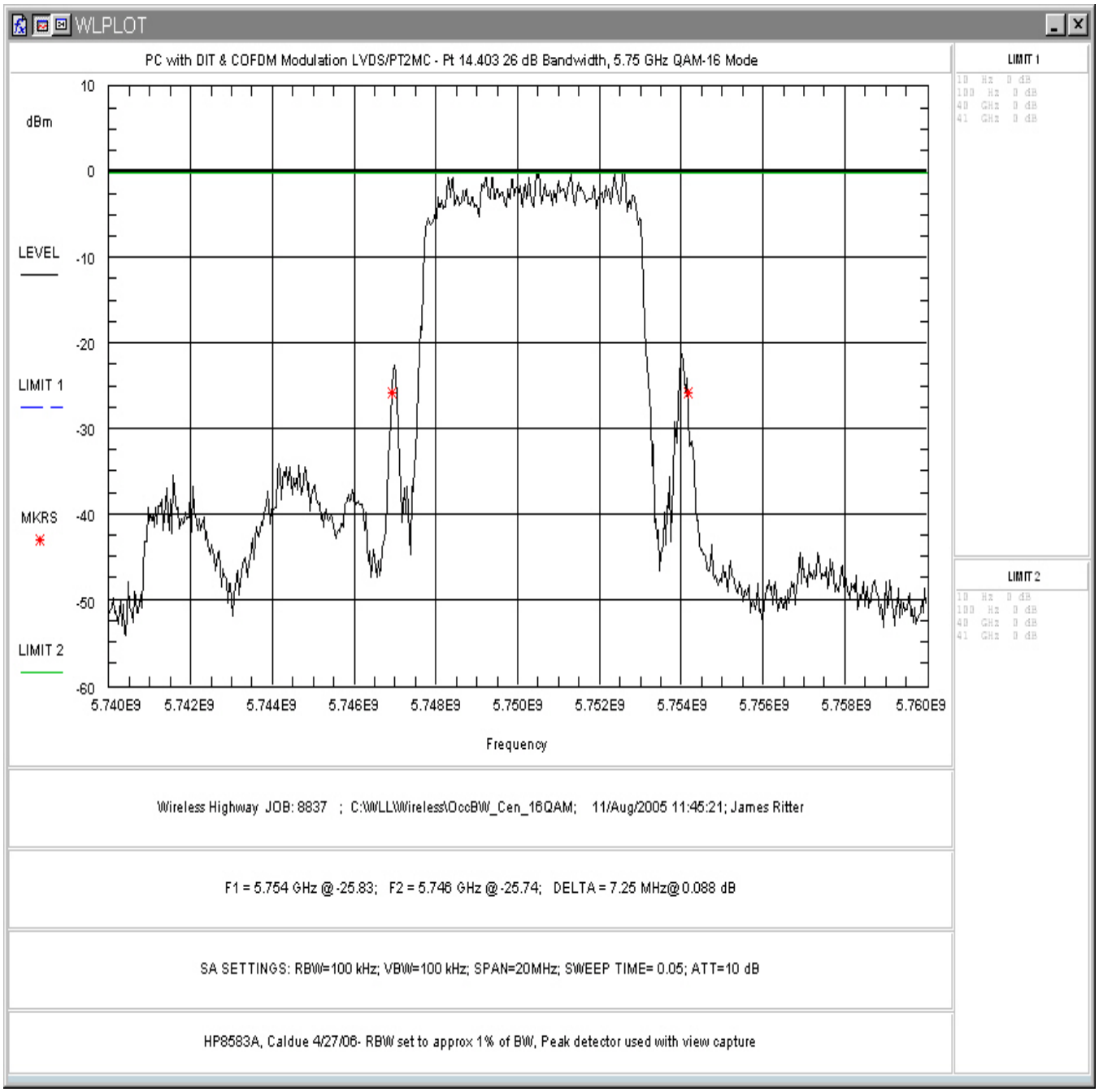

Figure 4-5. Occupied Bandwidth, Mid Channel – QAM16

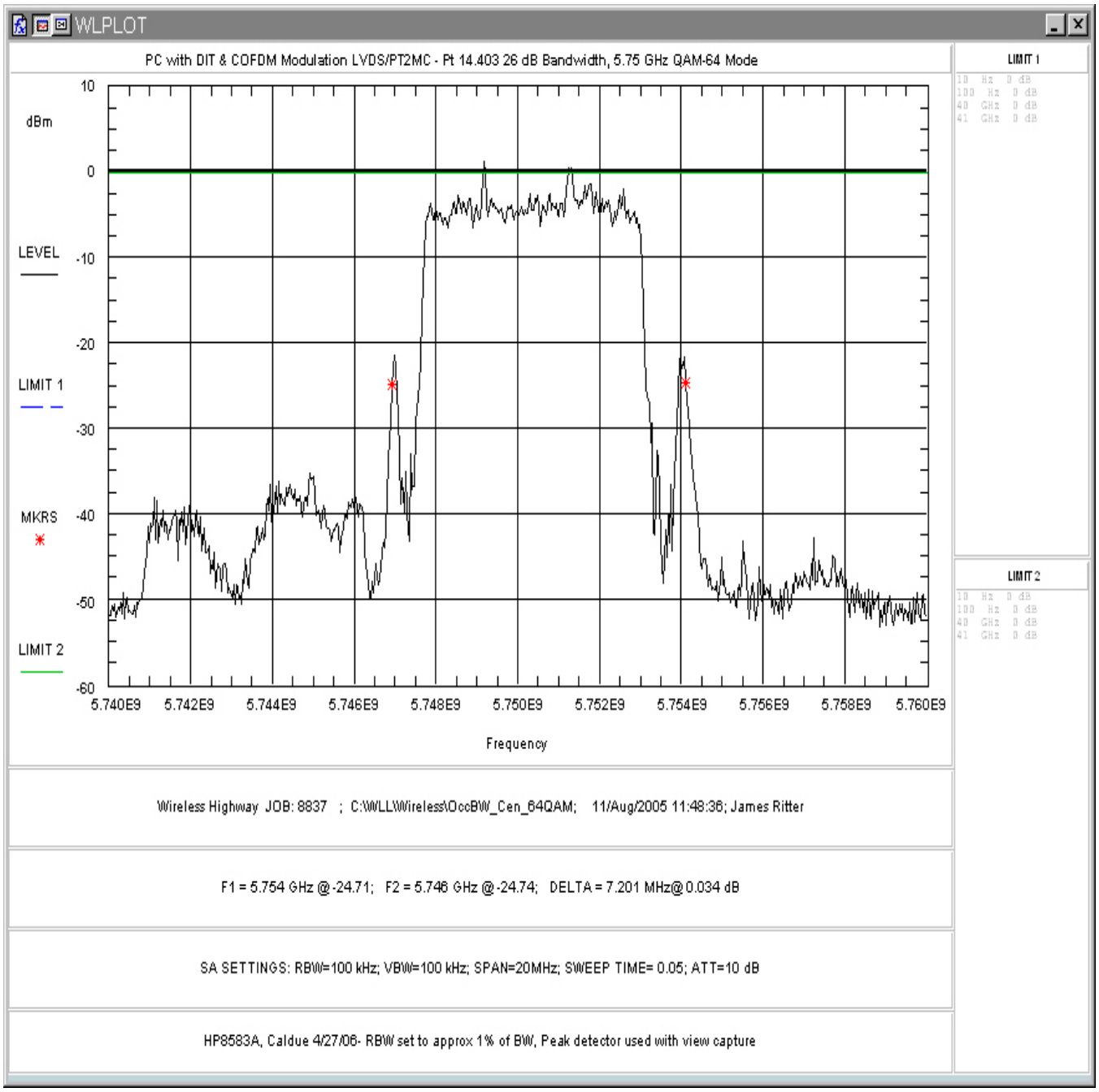

Figure 4-6. Occupied Bandwidth, Mid Channel – QAM-64

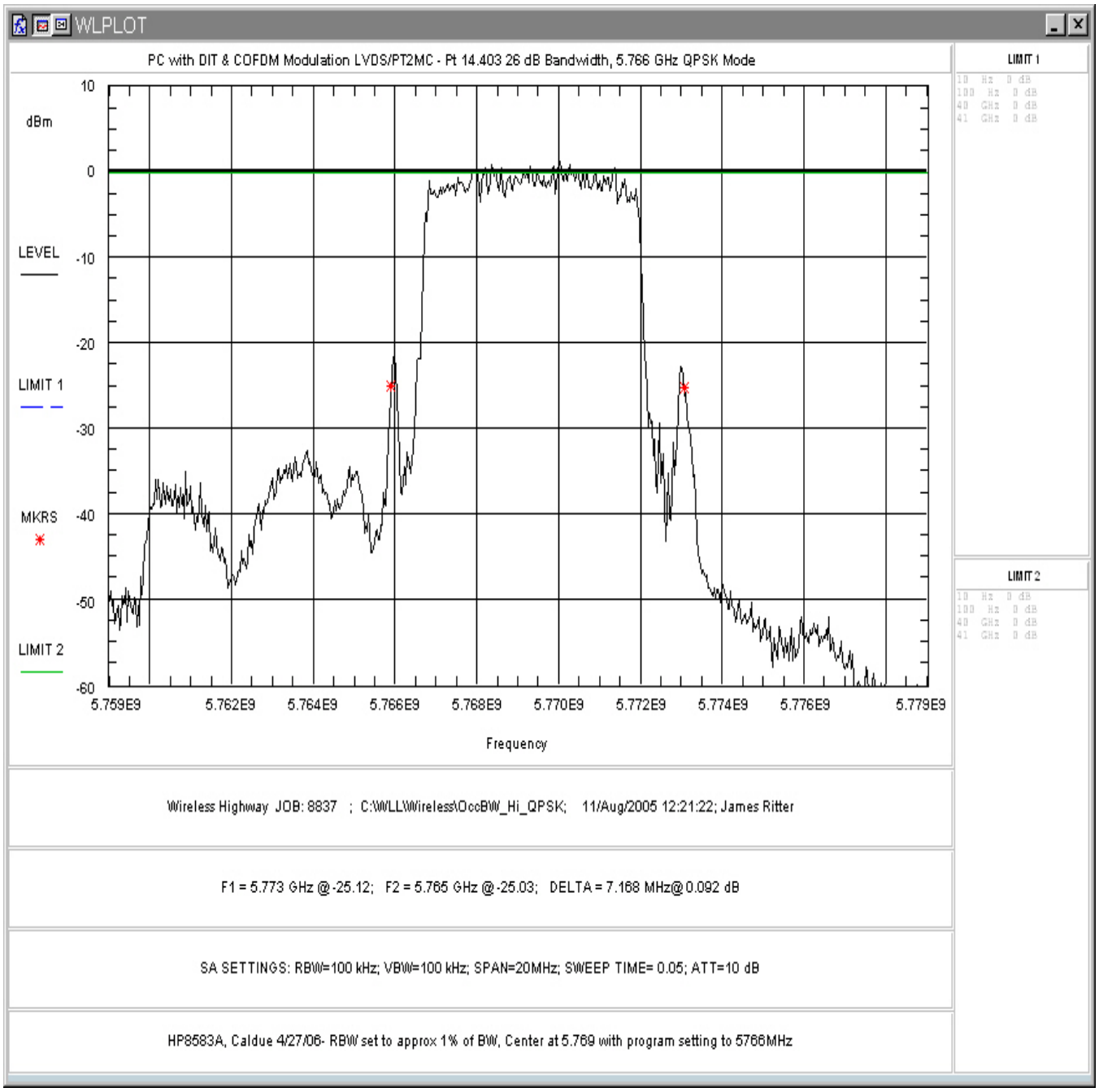

Figure 4-7. Occupied Bandwidth, High Channel – QPSK

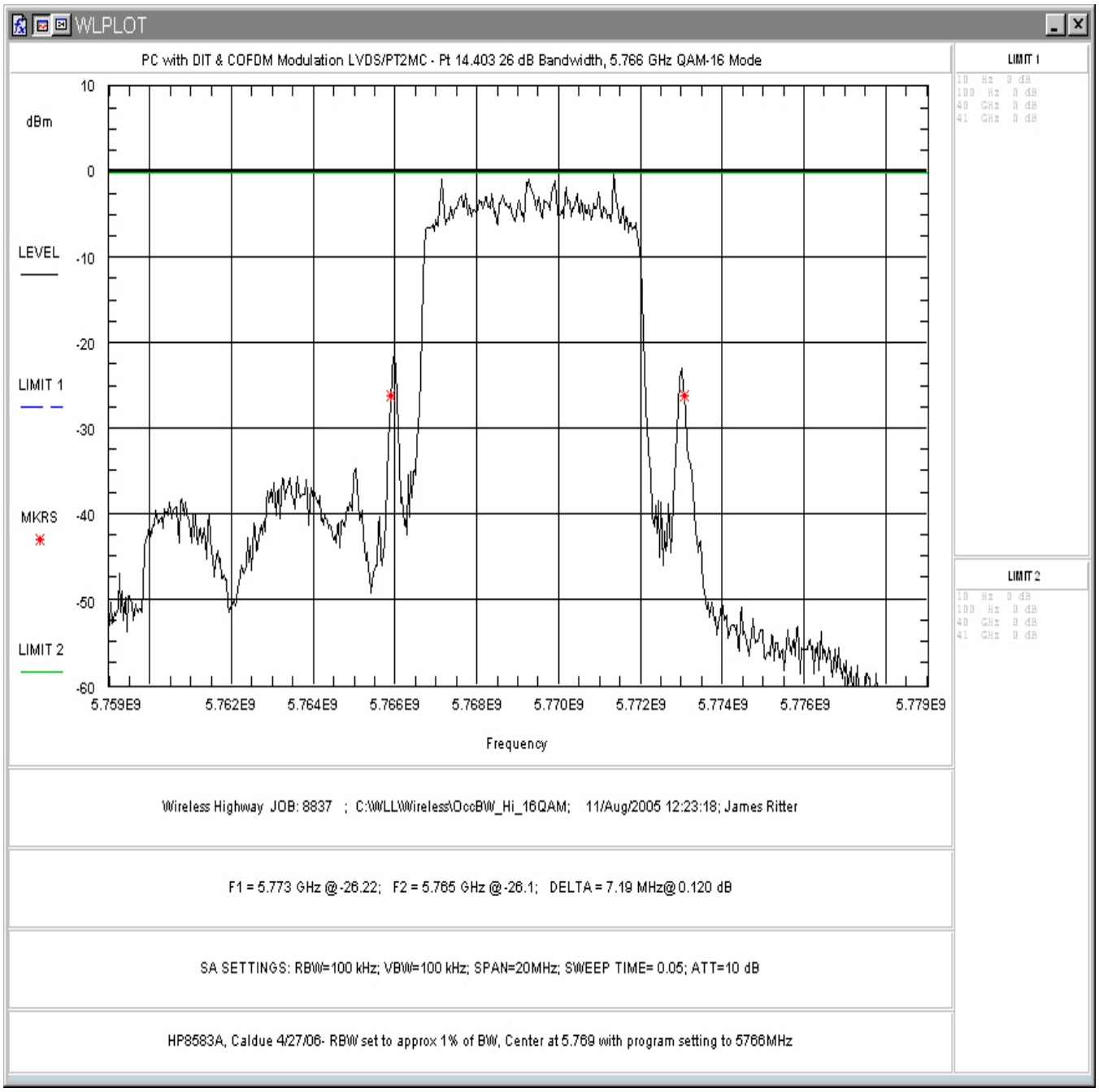

Figure 4-8. Occupied Bandwidth, High Channel – QAM-16

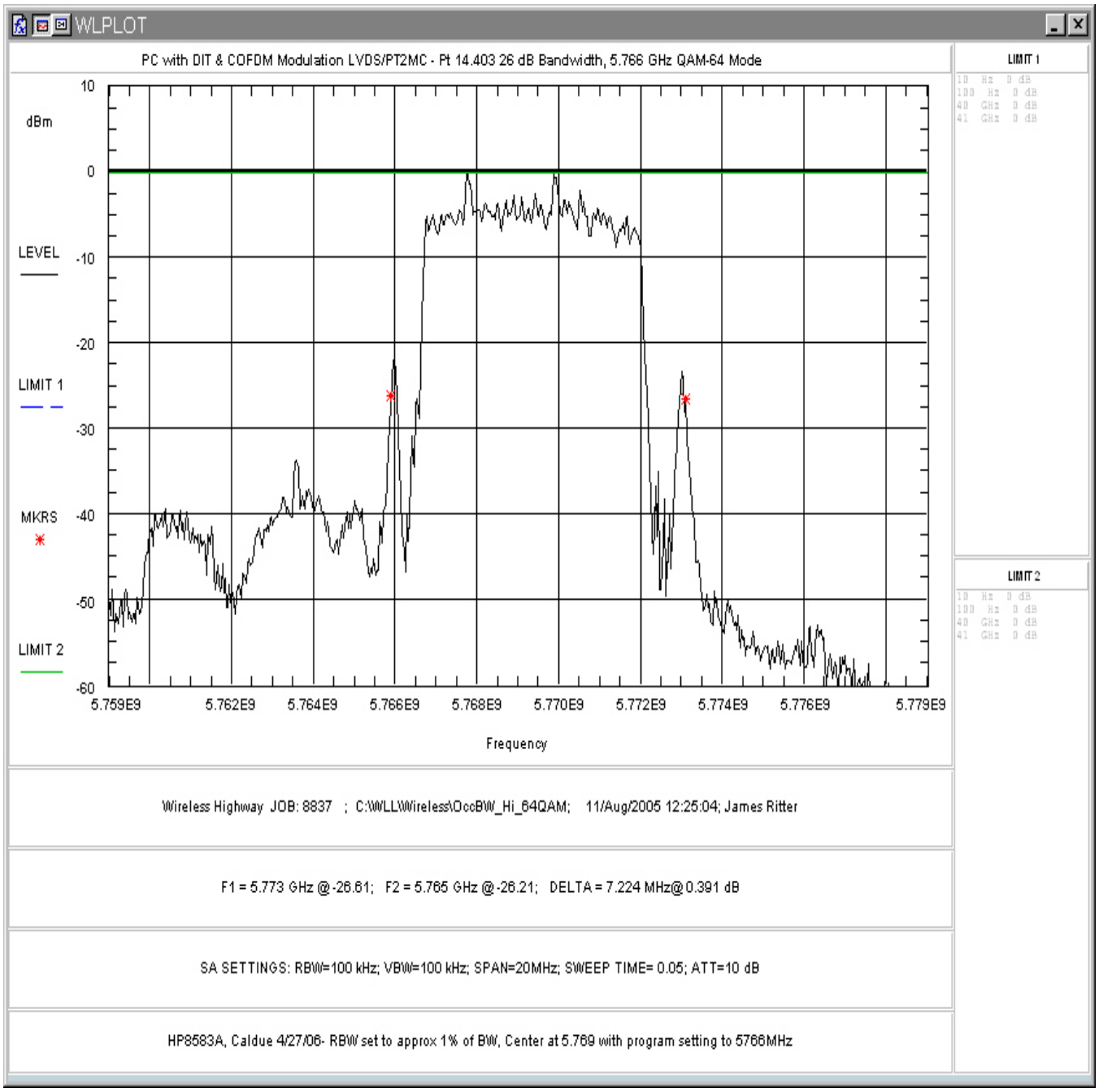

Figure 4-9. Occupied Bandwidth, High Channel – QAM-64

The following tables provide a summary of the Emission Bandwidth Results.

Table 3. Occupied Bandwidth Results - QPSK

Frequency	Bandwidth
Low Channel 5728MHz	7.263MHz
Mid Channel 5753MHz	7.216 MHz
High Channel 5769MHz	7.169 MHz

Table 4. Occupied Bandwidth Results – QAM-16

Frequency	Bandwidth
Low Channel 5728MHz	7.296 MHz
Mid Channel 5753MHz	7.250 MHz
High Channel 5769MHz	7.190 MHz

Table 5. Occupied Bandwidth Results – QAM-64

Frequency	Bandwidth
Low Channel 5728MHz	7.177 MHz
Mid Channel 5753MHz	7.201 MHz
High Channel 5769MHz	7.224 MHz

4.2 RF Power Output: (FCC Part §15.407(a)3)

For the band 5.725-5.825 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 1 W or 17 dBm + 10log B, where B is the 26-dB emission bandwidth in MHz.

The largest emission bandwidth measured is 7.296MHz thus the maximum power shall not exceed 25.6dBm (0.365W).

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. To measure the output power the channel power function of the spectrum analyzer was used per Method 1 described in FCC DA 02-2138. The RBW was set to 1MHz and the VBW was set to 3MHz. Power was measured across the appropriate channel bandwidth for each mode.

Following are tables and spectrum analyzer plots of the RF Power data.

Table 6. RF Power Output - QPSK

Frequency	Level	Limit	Pass/Fail
Low Channel 5728MHz	11.03 dBm	25.6 dBm	Pass
Mid Channel 5753MHz	11.56 dBm	25.6 dBm	Pass
High Channel 5769MHz	10.75 dBm	25.6 dBm	Pass

Table 7. RF Power Output – QAM-16

Frequency	Level	Limit	Pass/Fail
Low Channel 5728MHz	8.81 dBm	25.6 dBm	Pass
Mid Channel 5753MHz	9.29 dBm	25.6 dBm	Pass
High Channel 5769MHz	8.36 dBm	25.6 dBm	Pass

Table 8. RF Power Output – QAM-64

Frequency	Level	Limit	Pass/Fail
Low Channel 5728MHz	7.71 dBm	25.6 dBm	Pass
Mid Channel 5753MHz	8.30 dBm	25.6 dBm	Pass
High Channel 5769MHz	7.66 dBm	25.6 dBm	Pass

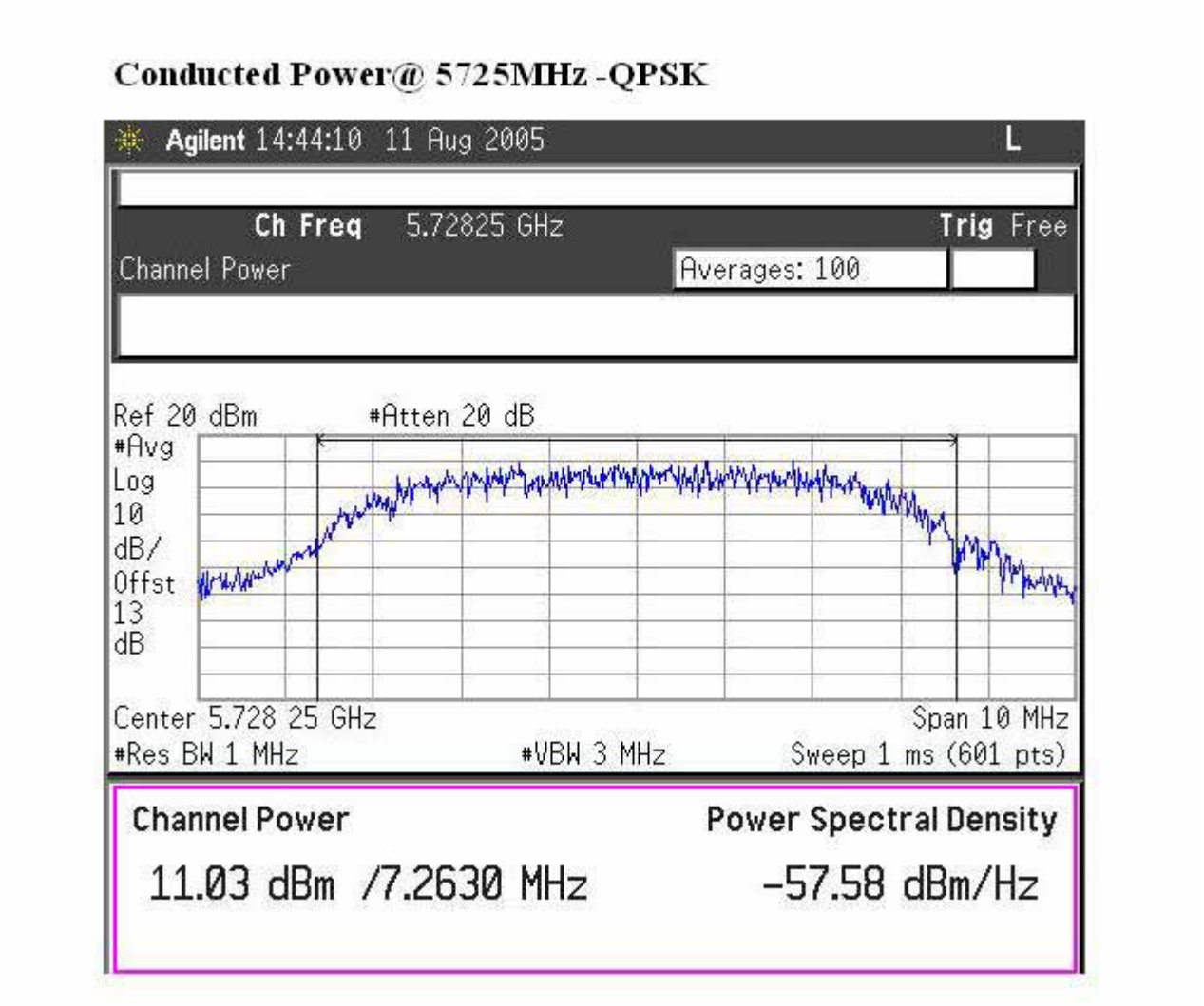

Figure 4-10. RF Peak Power, Low Channel - QPSK

Conducted Power @ 5750 MHz -QPSK

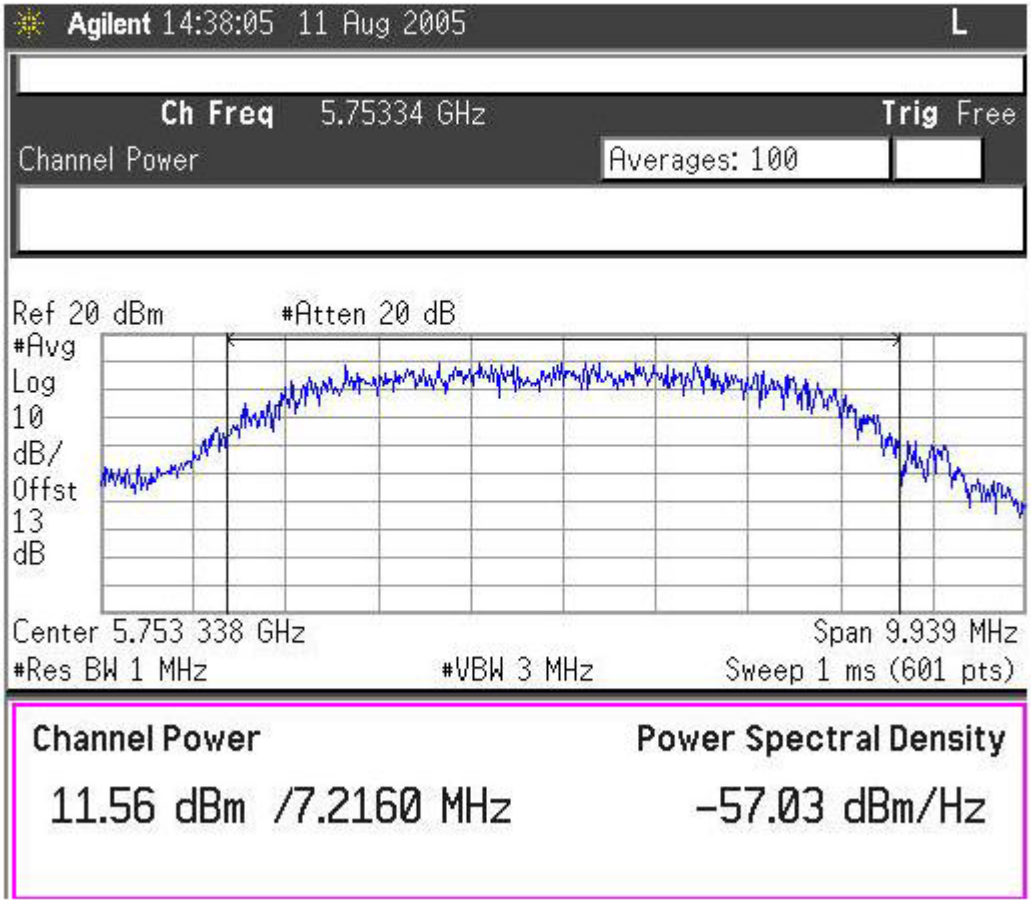

Figure 4-11. RF Peak Power, Mid Channel - QPSK

Conducted Power @ 5766MHz - QPSK

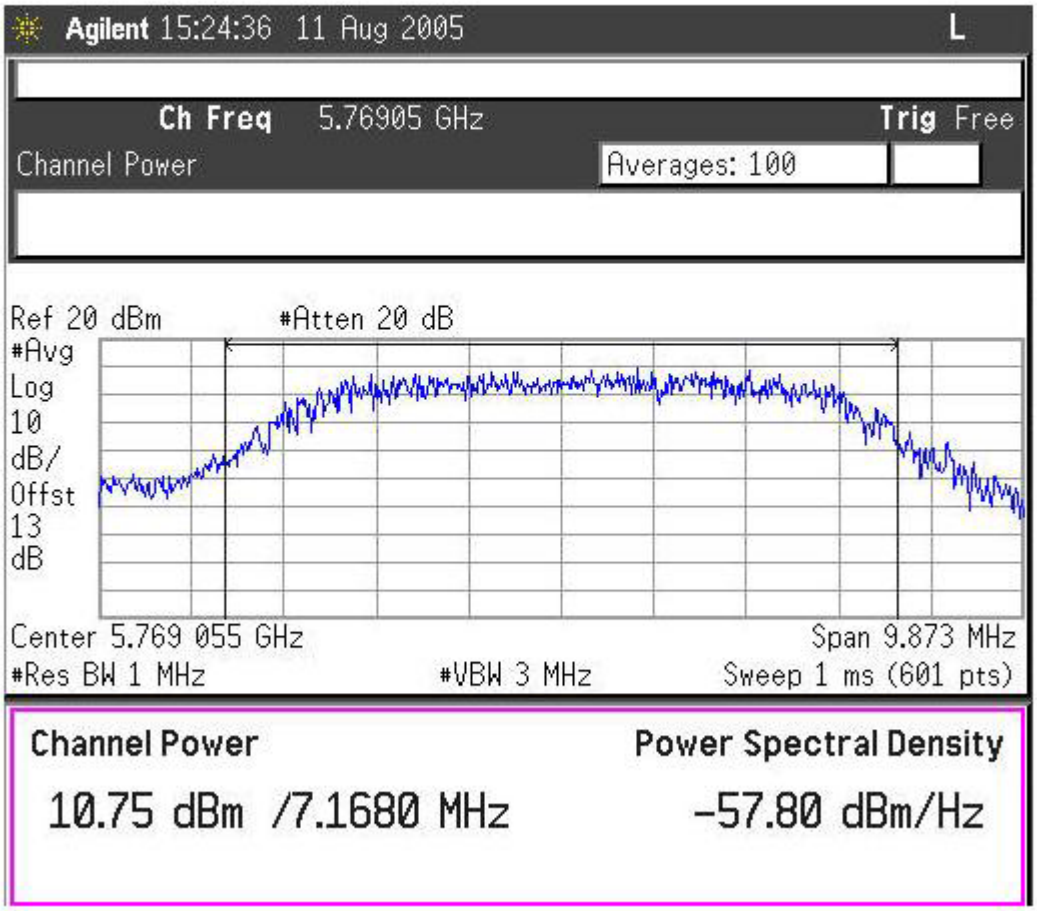

Figure 4-12. RF Peak Power, High Channel - QPSK

Conducted Power@ 5725 MHz-16QAM

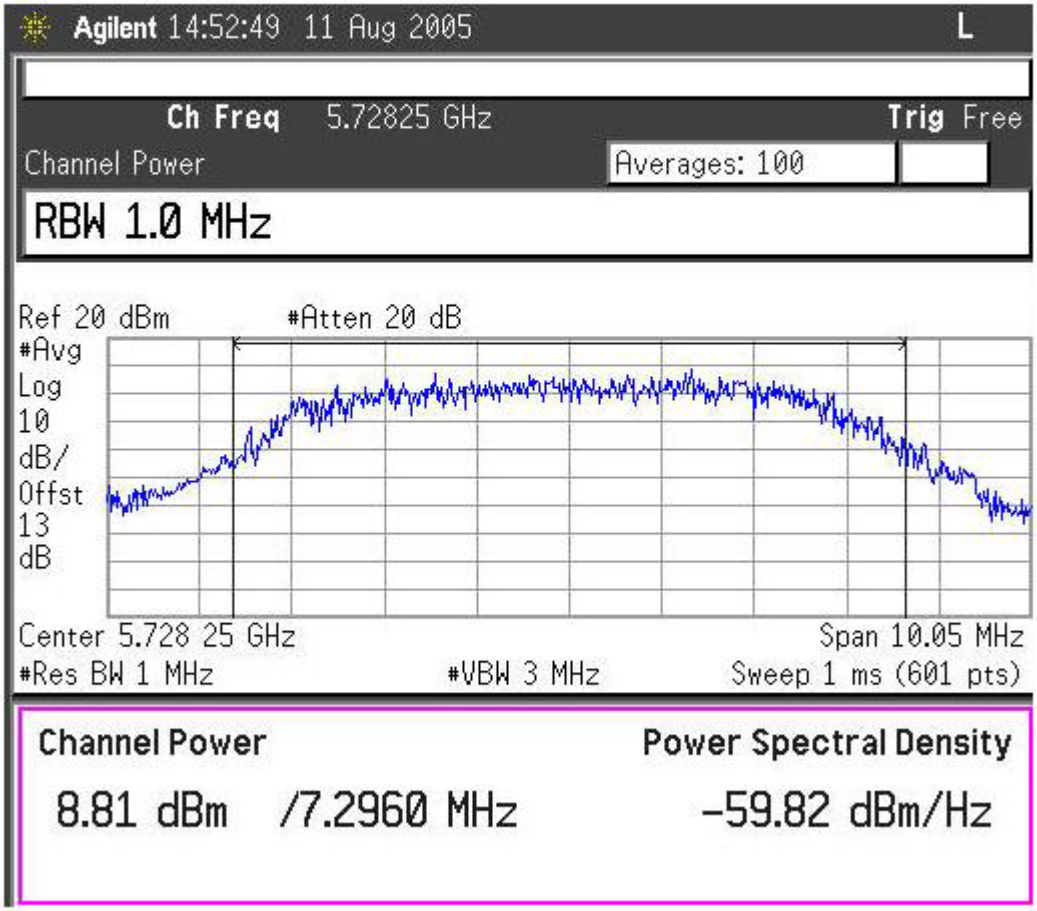

Figure 4-13. RF Peak Power, Low Channel – QAM-16

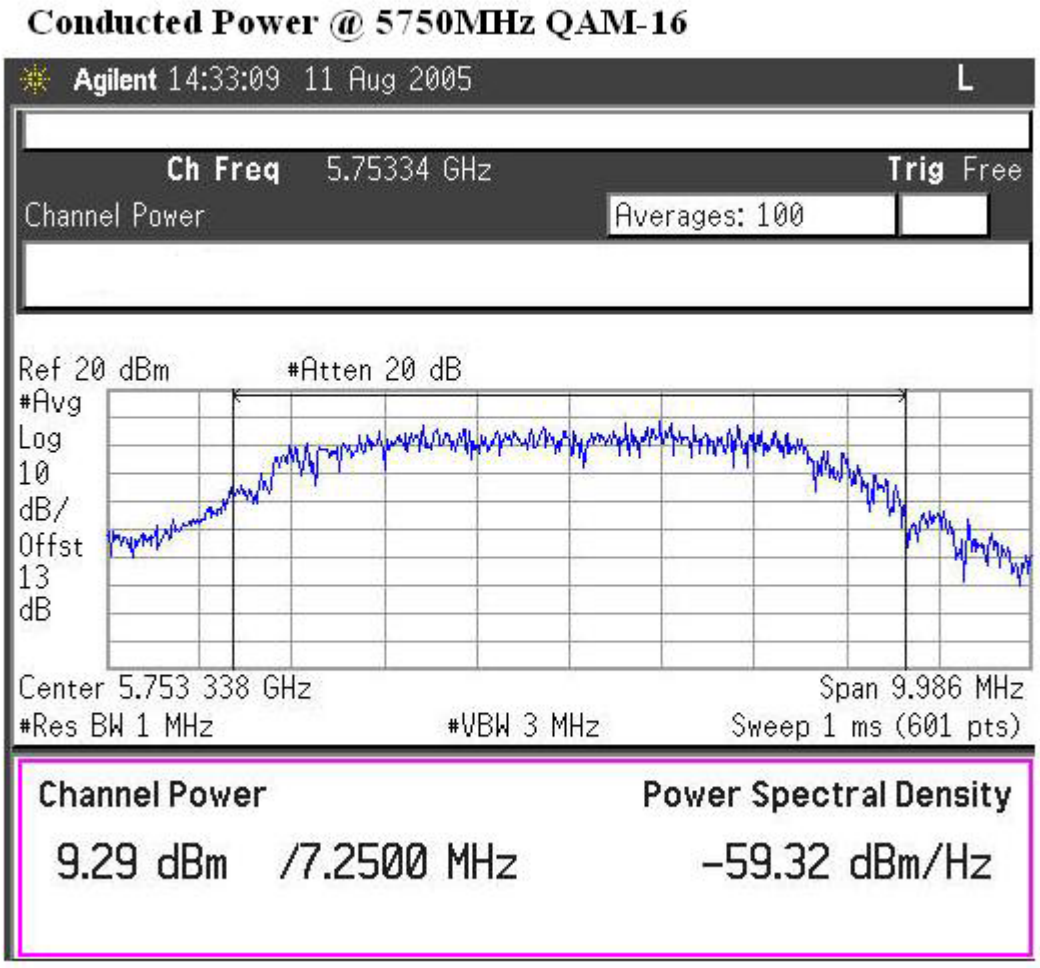

Figure 4-14. RF Peak Power, Mid Channel – QAM-16

Conducted Power@ 5766MHz-QAM-16

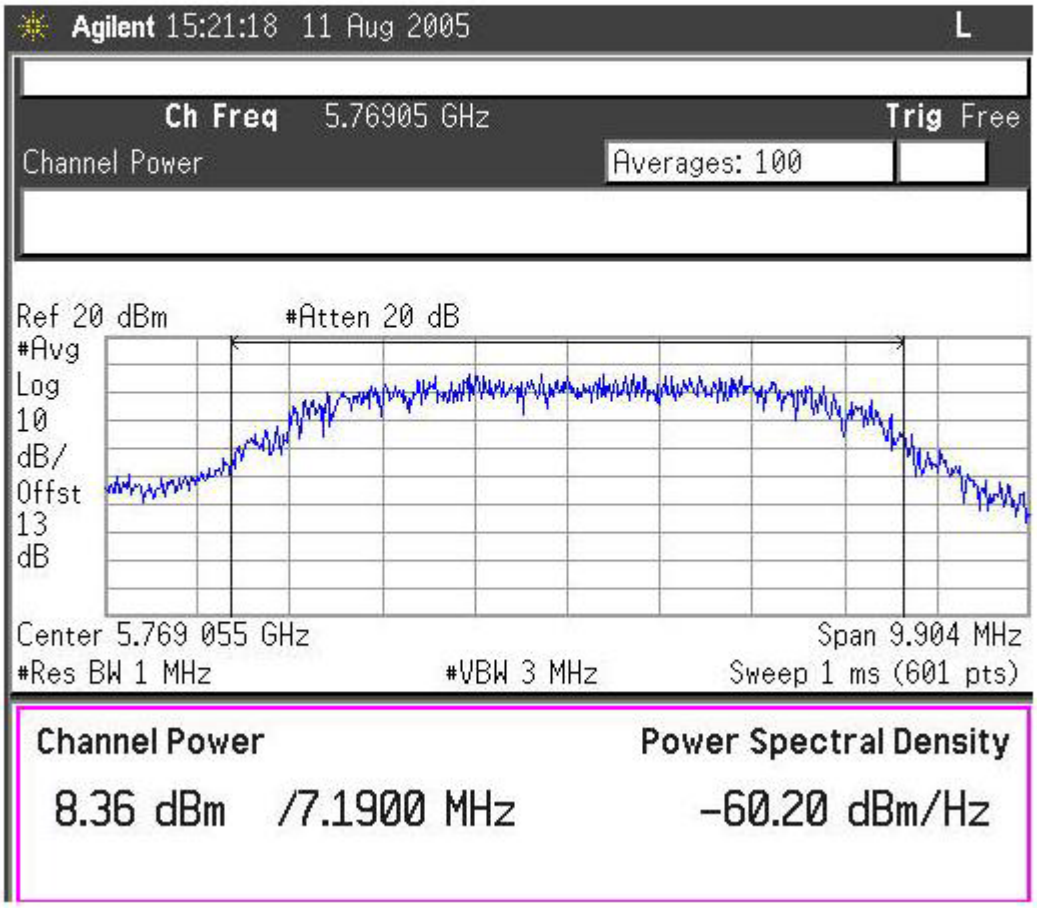

Figure 4-15. RF Peak Power, High Channel – QAM-16

Conducted Power@ 5725MHz-64QAM

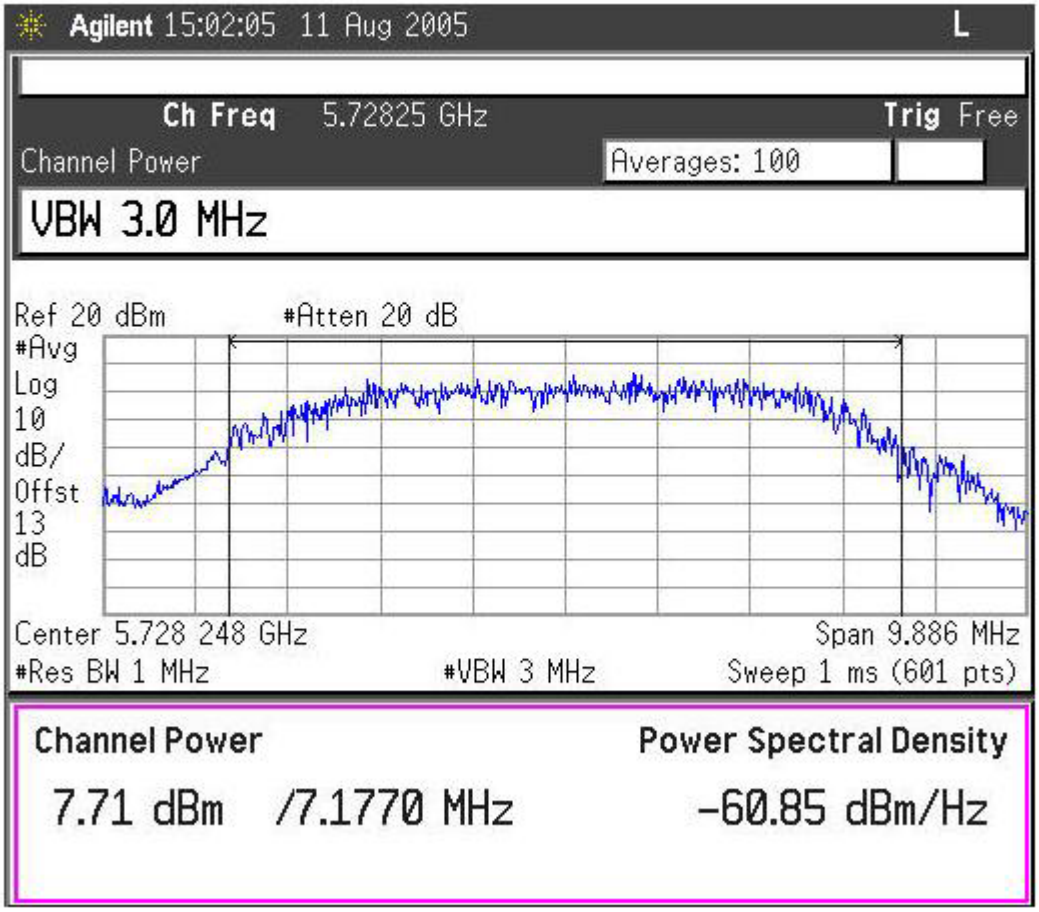

Figure 4-16. RF Peak Power, Low Channel – QAM-64

Conducted Power @ 5.750 GHz QAM-64 Mode

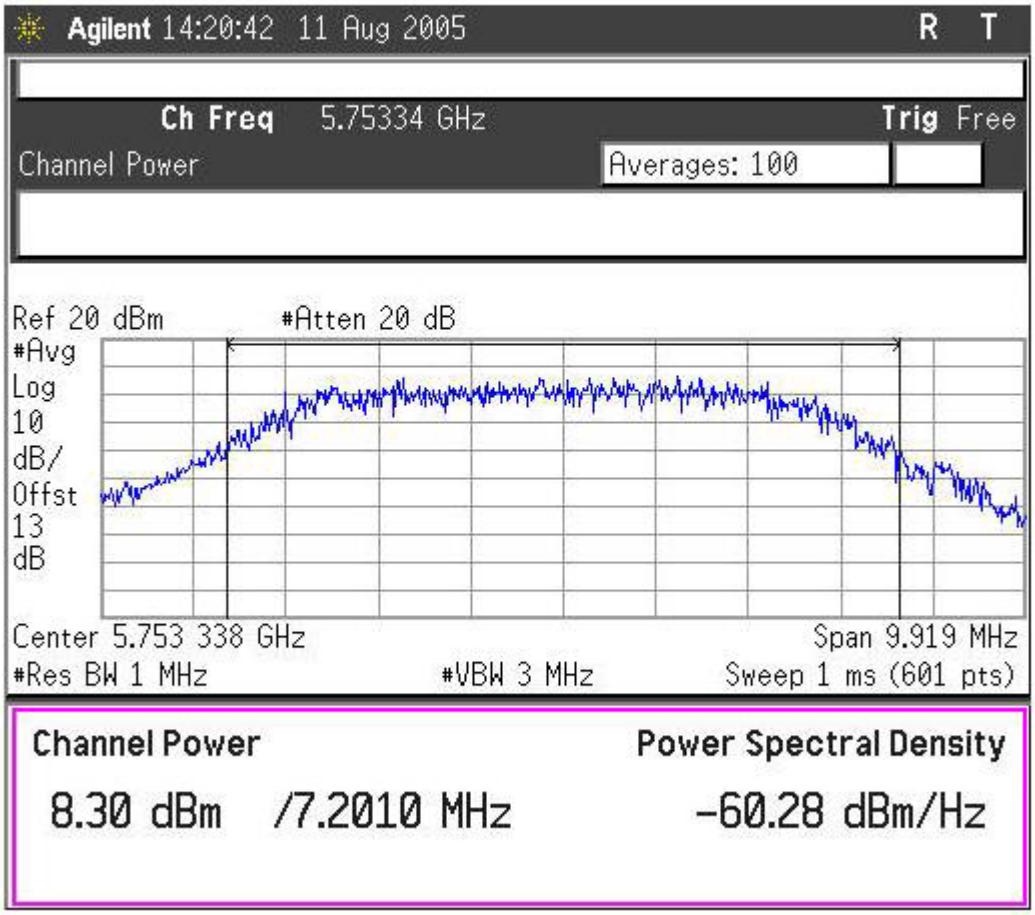

Figure 4-17. RF Peak Power, Mid Channel – QAM-64

Conducted Power@5766MHz -QAM64

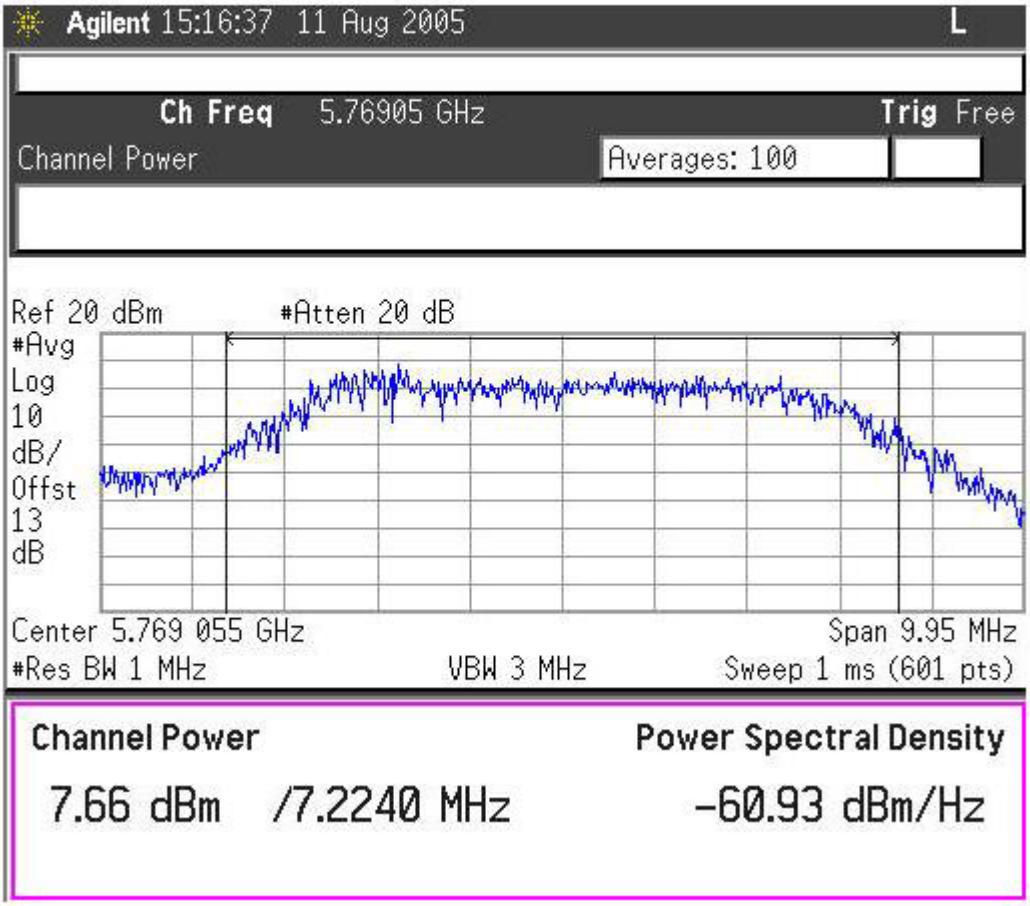

Figure 4-18. RF Peak Power, High Channel – QAM-64

4.3 Peak Power Spectral Density: (FCC Part §15.407(a)3)

Measurements for peak power spectral density were taken in accordance with 15.407(a)(3). The measurements were performed using Method 1 of FCC Public Notice DA 02-2138.

The spectrum analyzer was set to peak detect mode with a RBW of 1MHz and a VBW of 3MHz. The highest level detected across any 1MHz band was then recorded and compared to the limit 17dBm.

The following table and plots give the results for power spectral density testing.

Table 9. Peak Power Spectral Density - QPSK

Frequency	Level	Limit	Pass/Fail
Low Channel 5728MHz	14.92 dBm	17 dBm	Pass
Mid Channel 5753MHz	15.93 dBm	17 dBm	Pass
High Channel 5769MHz	15.13 dBm	17 dBm	Pass

Table 10. Peak Power Spectral Density – QAM-16

Frequency	Level	Limit	Pass/Fail
Low Channel 5728MHz	12.74 dBm	17 dBm	Pass
Mid Channel 5753MHz	13.67 dBm	17 dBm	Pass
High Channel 5769MHz	13.66 dBm	17 dBm	Pass

Table 11. Peak Power Spectral Density – QAM-64

Frequency	Level	Limit	Pass/Fail
Low Channel 5728MHz	14.09 dBm	17 dBm	Pass
Mid Channel 5753MHz	14.01 dBm	17 dBm	Pass
High Channel 5769MHz	13.18 dBm	17 dBm	Pass

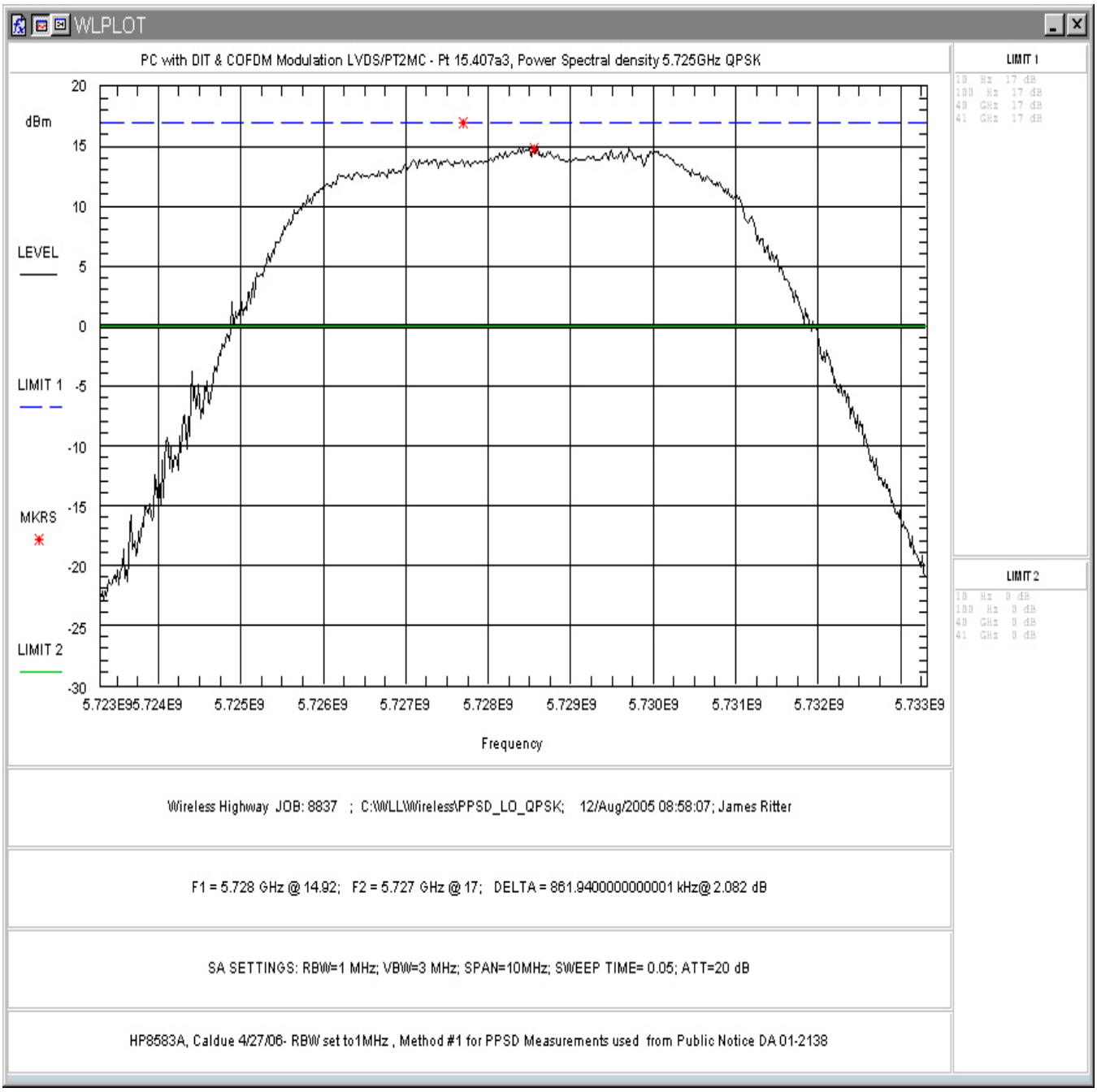

Figure 4-19. Peak Power Spectral Density, Low Channel – QPSK

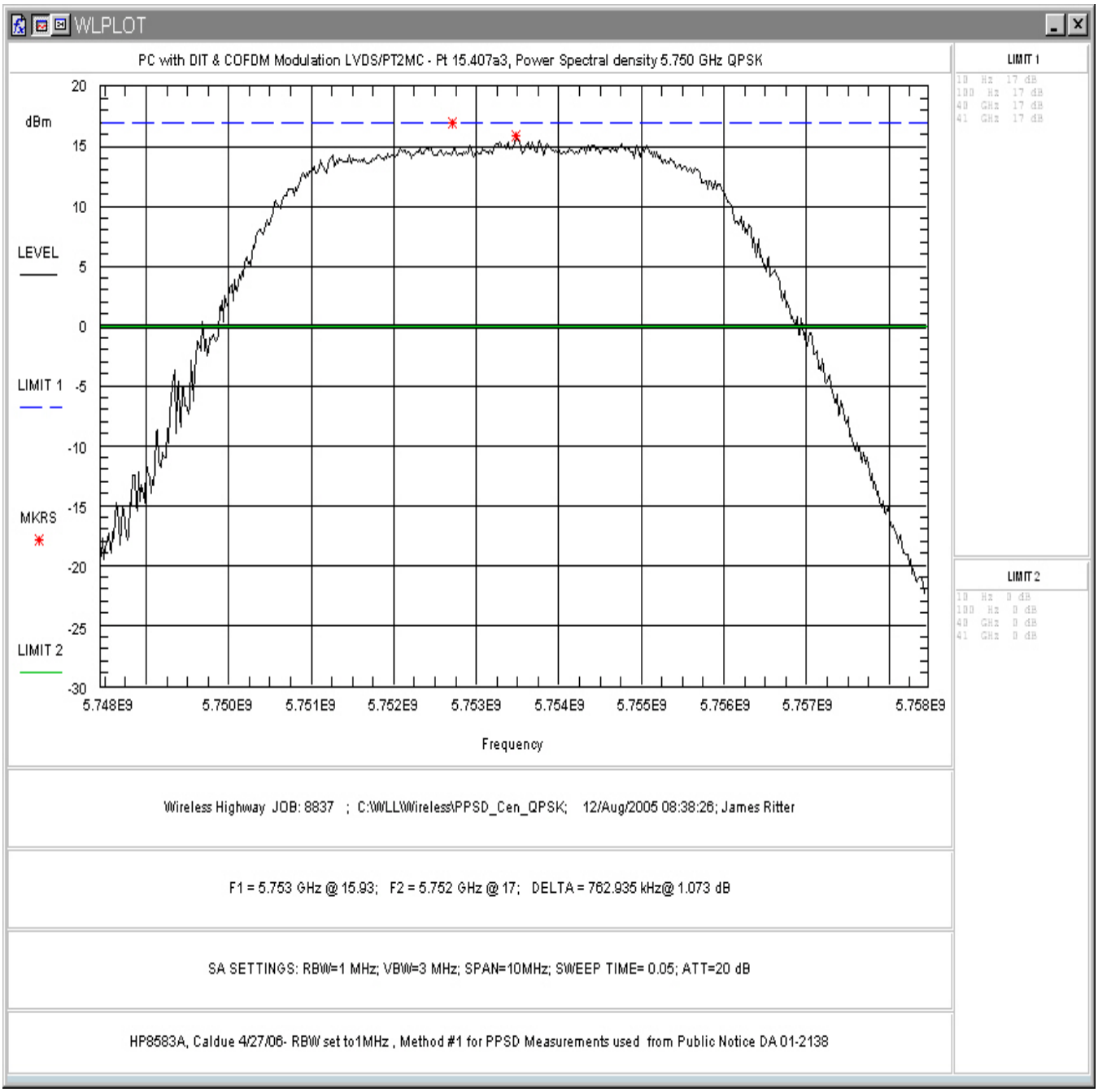

Figure 4-20. Peak Power Spectral Density, Mid Channel – QPSK

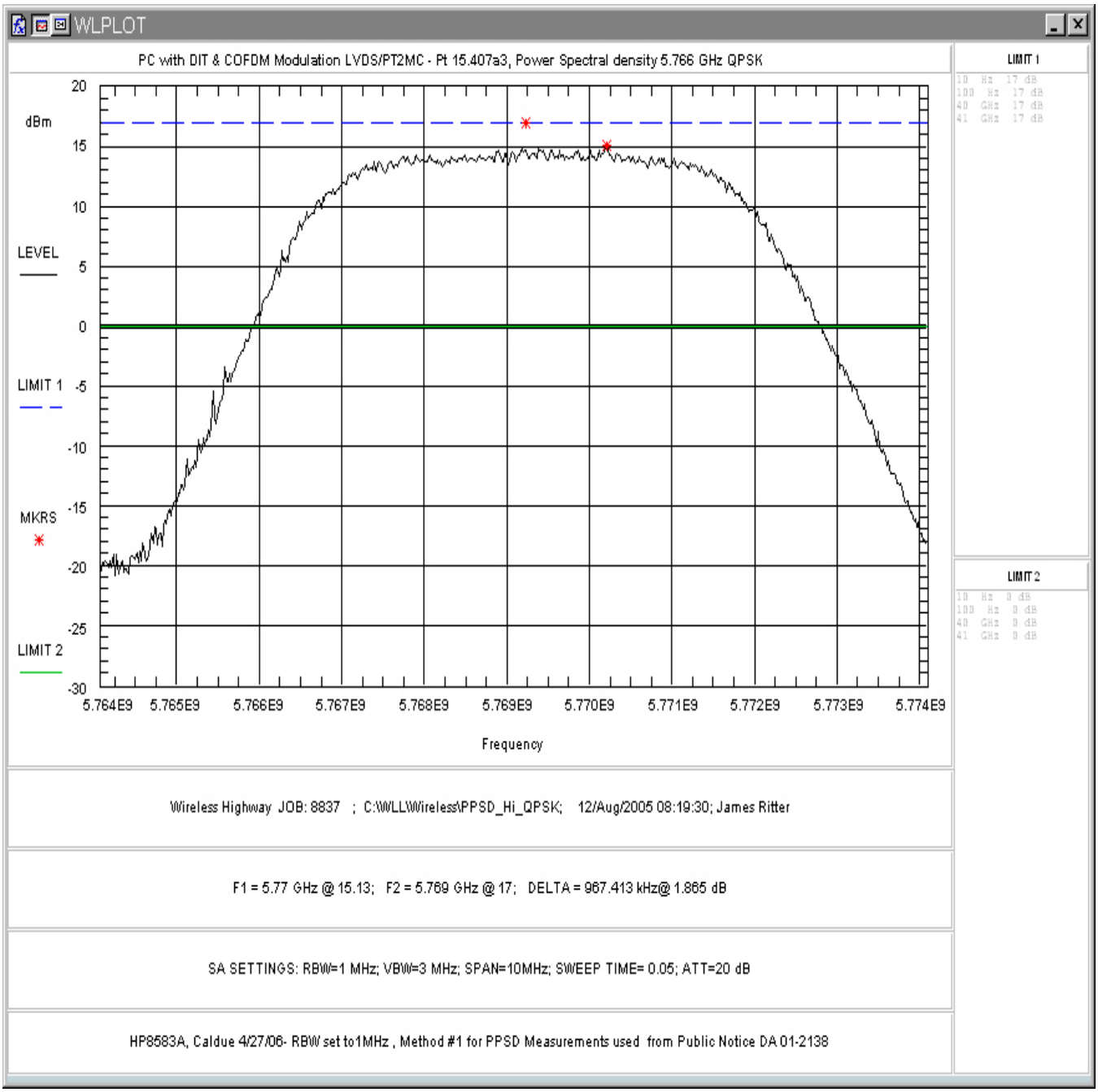

Figure 4-21. Peak Power Spectral Density, High Channel – QPSK

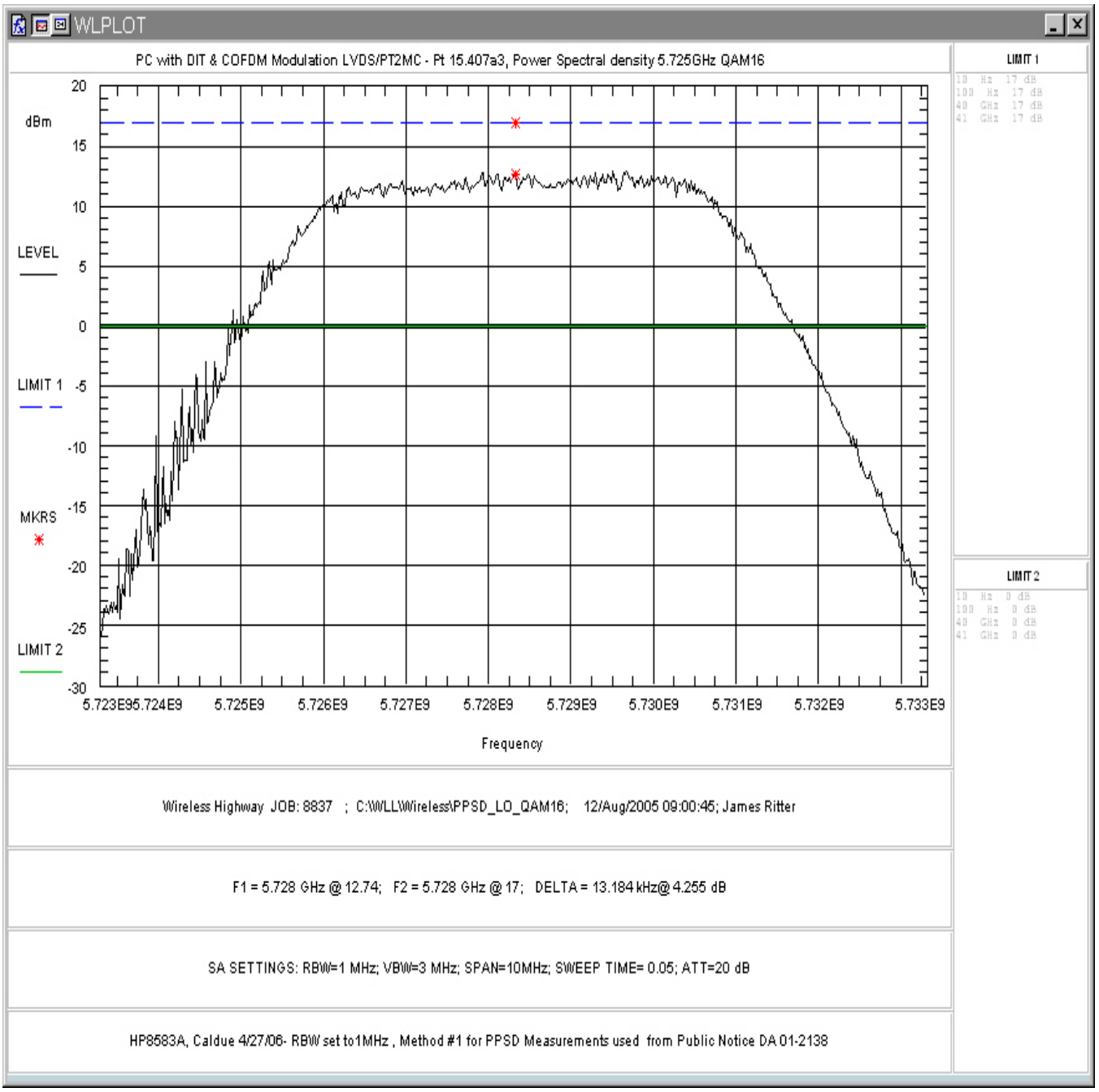

Figure 4-22. Peak Power Spectral Density, Low Channel – QAM-16

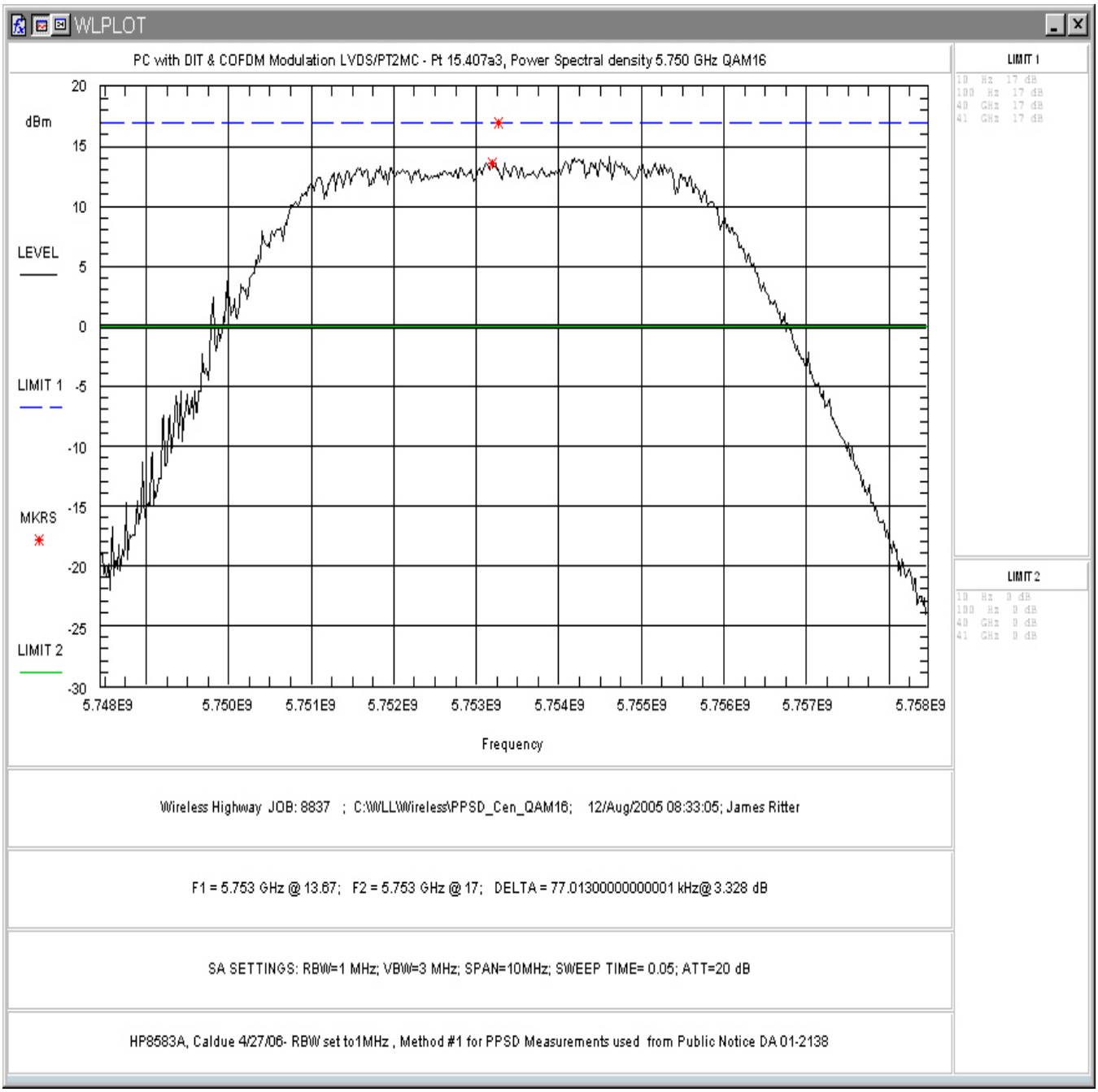

Figure 4-23. Peak Power Spectral Density, Mid Channel – QAM-16

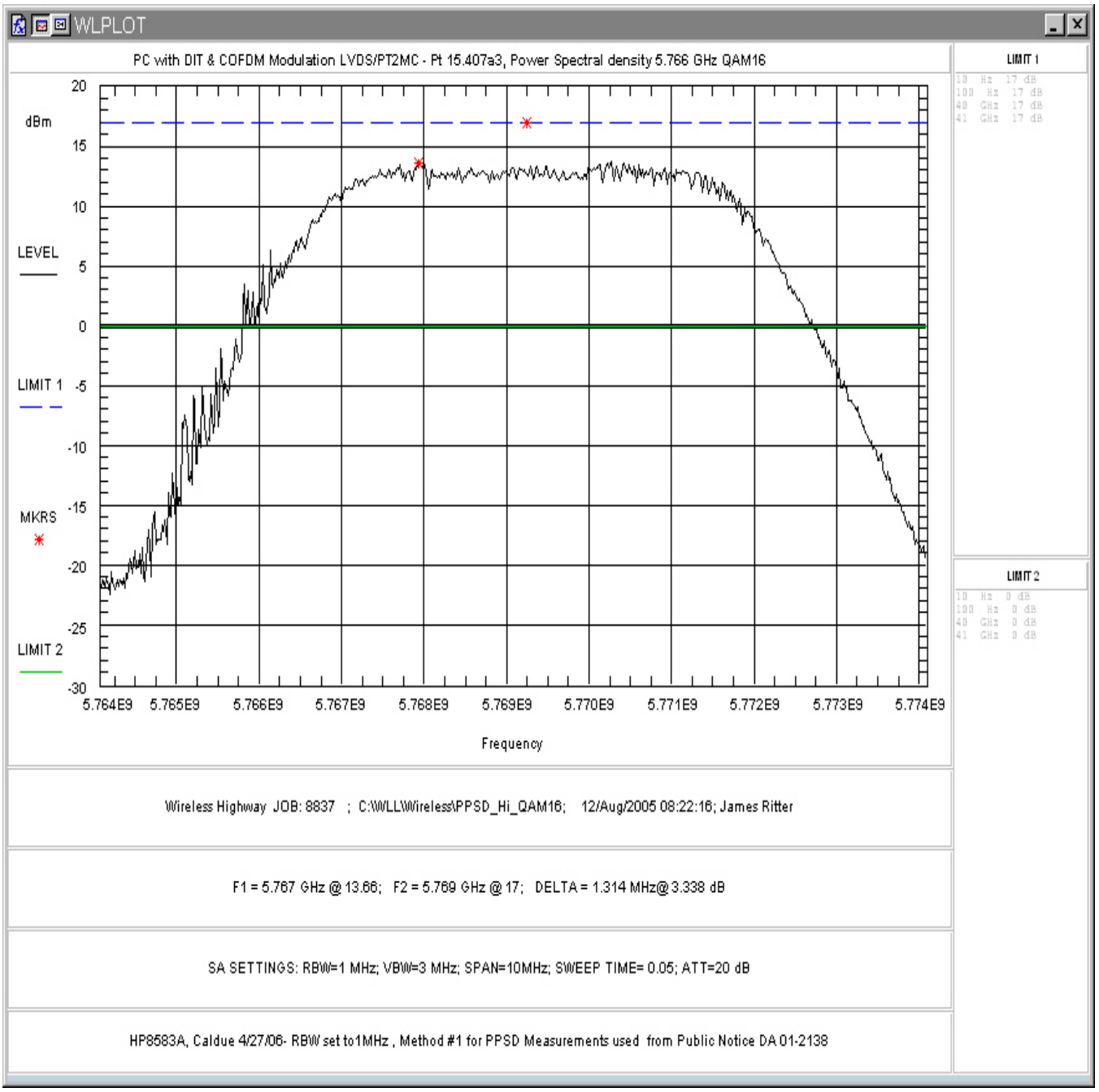

Figure 4-24. Peak Power Spectral Density, High Channel – QAM-16

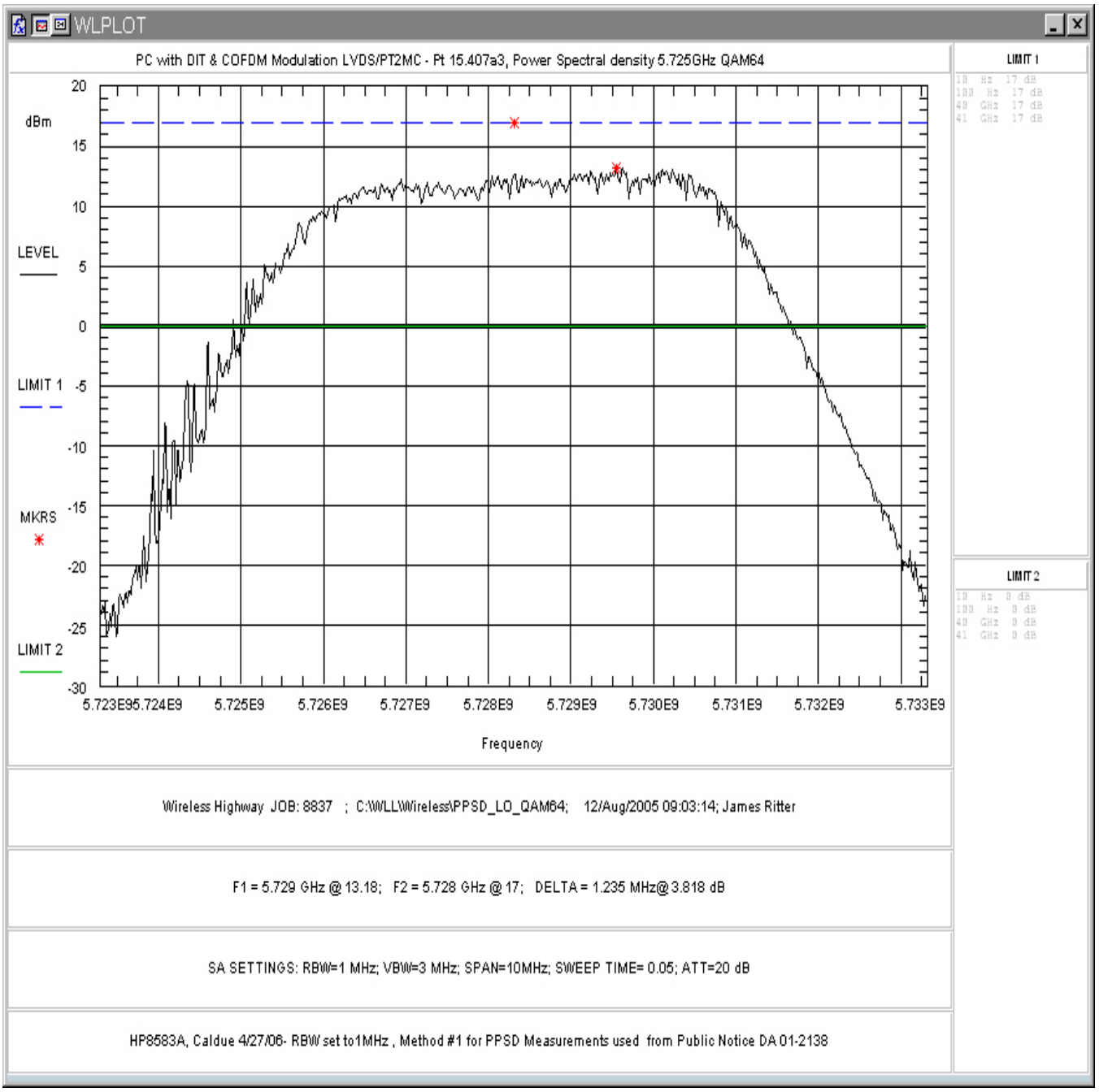

Figure 4-25. Peak Power Spectral Density, Low Channel – QAM-64

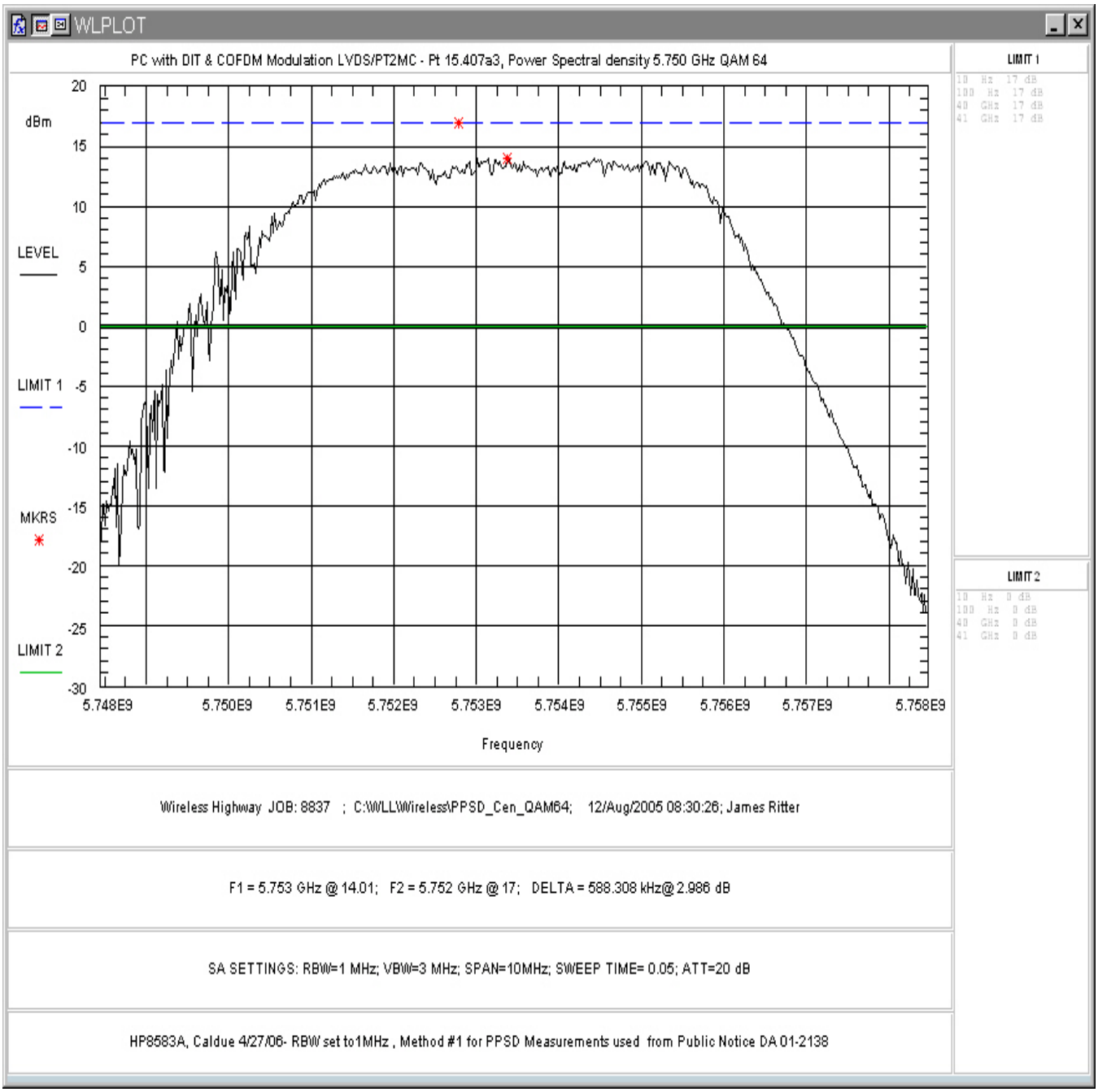

Figure 4-26. Peak Power Spectral Density, Mid Channel – QAM-64

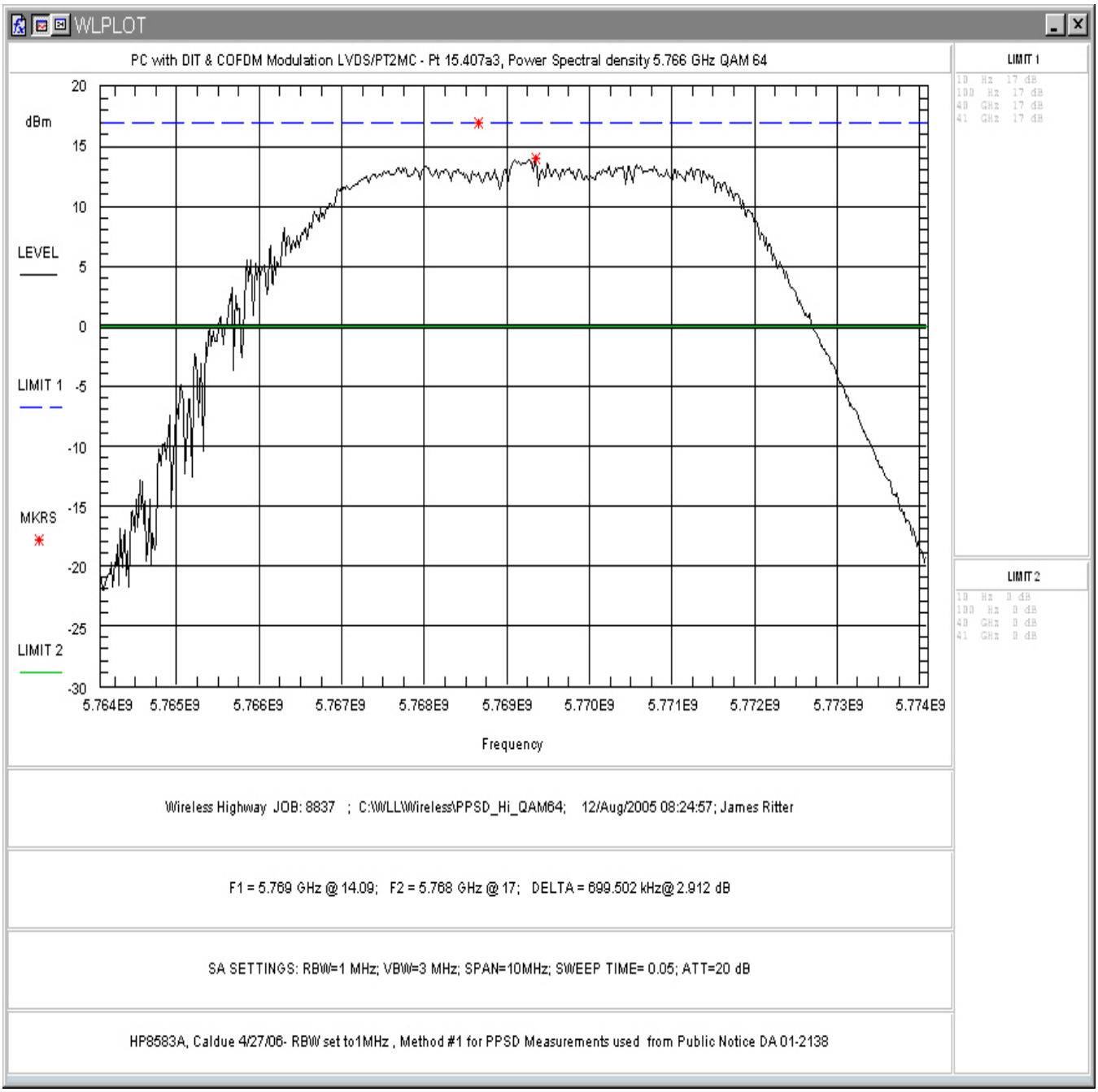

Figure 4-27. Peak Power Spectral Density, High Channel – QAM-64

4.4 Peak Excursion (FCC Part §15.407(a)(5))

Per 15.407(a)(5) the peak excursion shall not exceed 13 dB across any 1MHz bandwidth or the emission bandwidth whichever is less.

A spectrum analyzer with a RBW of 1MHz and VBW of 3MHz and a span greater than the emissions bandwidth was used for these measurements. The first trace was captured using the peak detector mode while the second trace was used using a sample detector mode as described in FCC DA 02-2138.

The following tables and plots of the peak excursion test results.

Table 12. Peak Excursion - QPSK

Frequency	Level	Limit	Pass/Fail
Low Channel 5728MHz	10.55 dB	13 dB	Pass
Mid Channel 5753MHz	10.01 dB	13 dB	Pass
High Channel 5769MHz	10.81 dB	13 dB	Pass

Table 13. Peak Excursion – QAM-16

Frequency	Level	Limit	Pass/Fail
Low Channel 5728MHz	11.36 dB	13 dB	Pass
Mid Channel 5753MHz	11.52 dB	13 dB	Pass
High Channel 5769MHz	11.51 dB	13 dB	Pass

Table 14. Peak Excursion – QAM-64

Frequency	Level	Limit	Pass/Fail
Low Channel 5728MHz	11.39 dB	13 dB	Pass
Mid Channel 5753MHz	12.26 dB	13 dB	Pass
High Channel 5769MHz	11.50 dB	13 dB	Pass

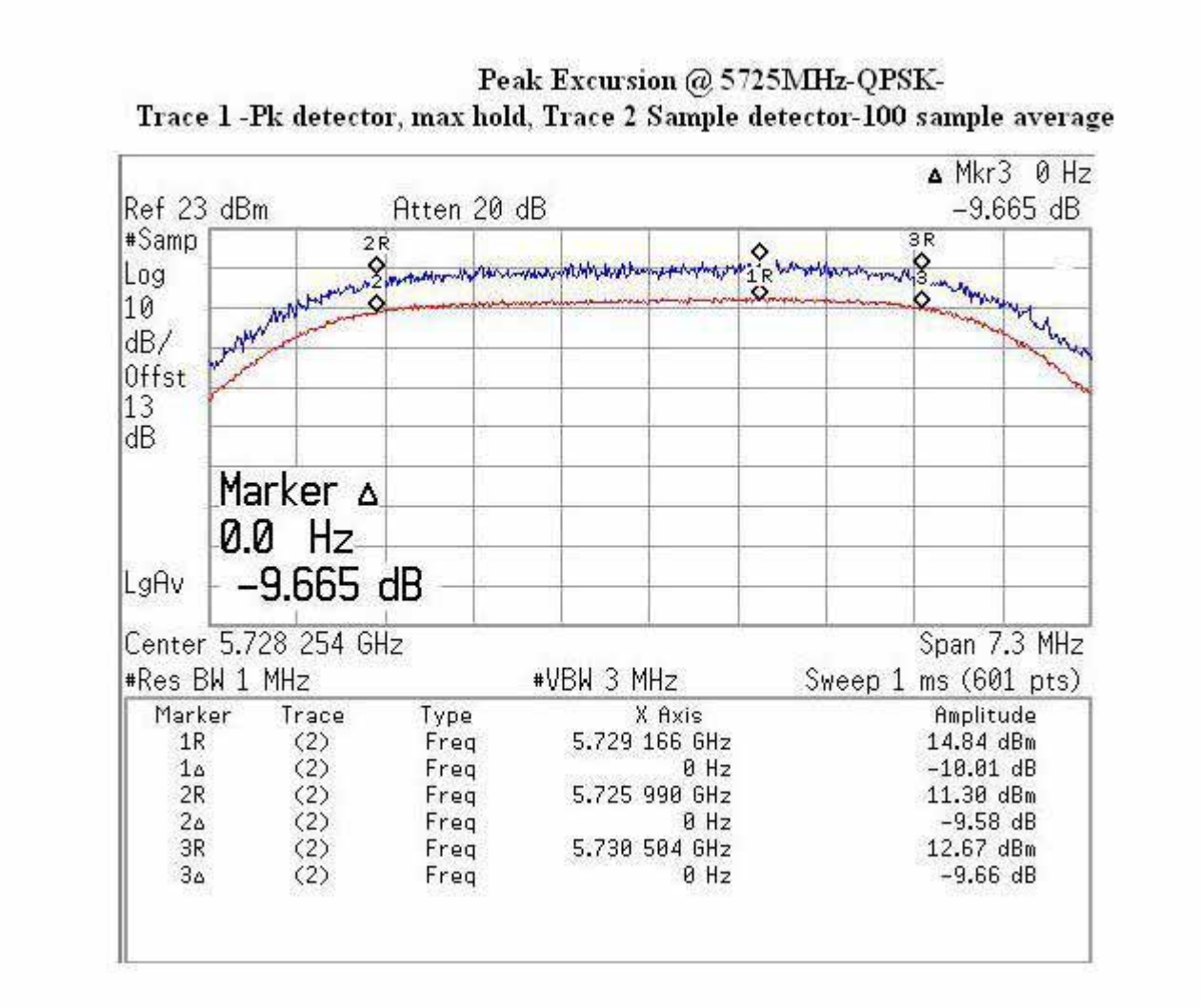

Figure 4-28. Peak Excursion, Low Channel – QPSK

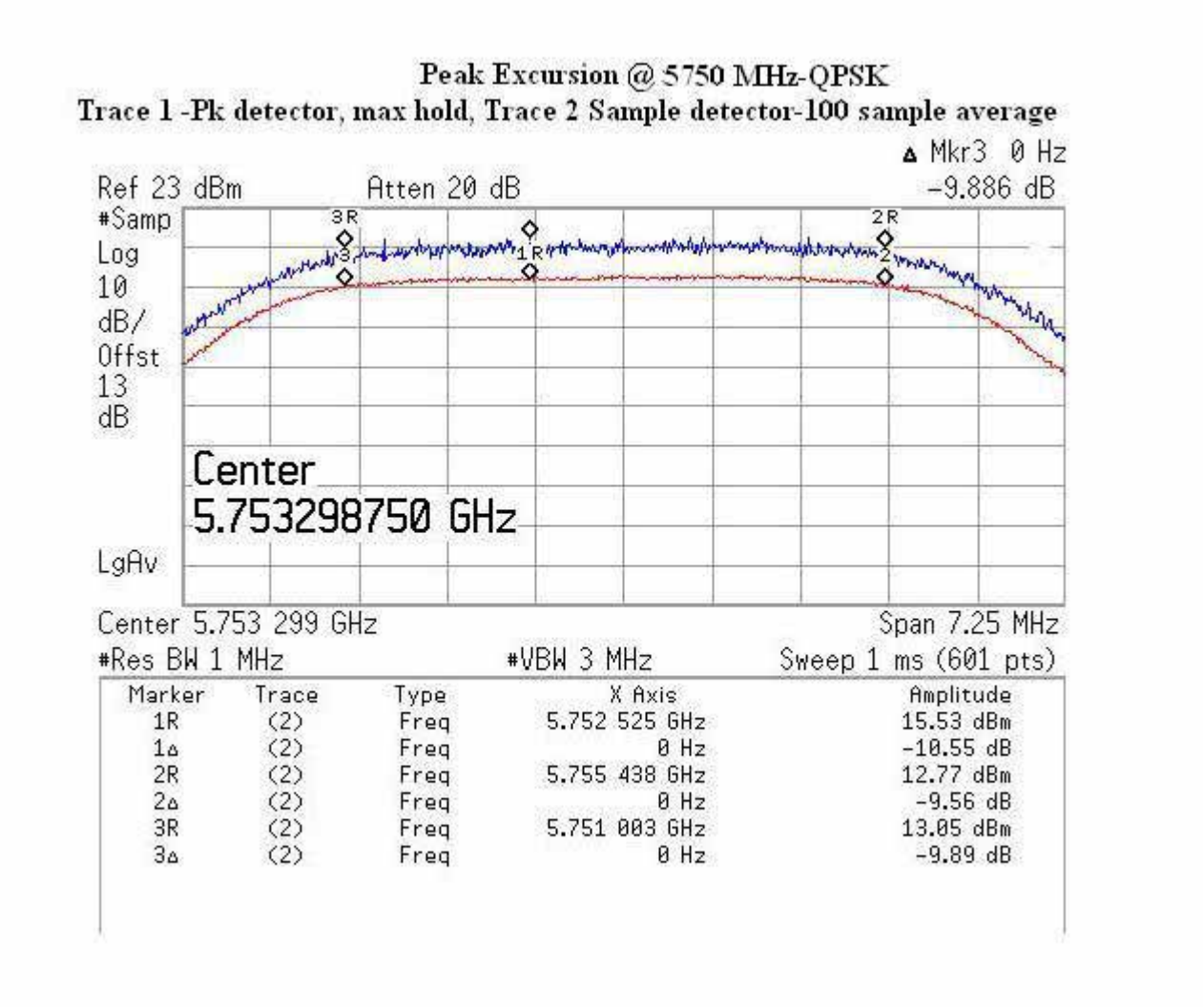

Figure 4-29. Peak Excursion, Mid Channel – QPSK

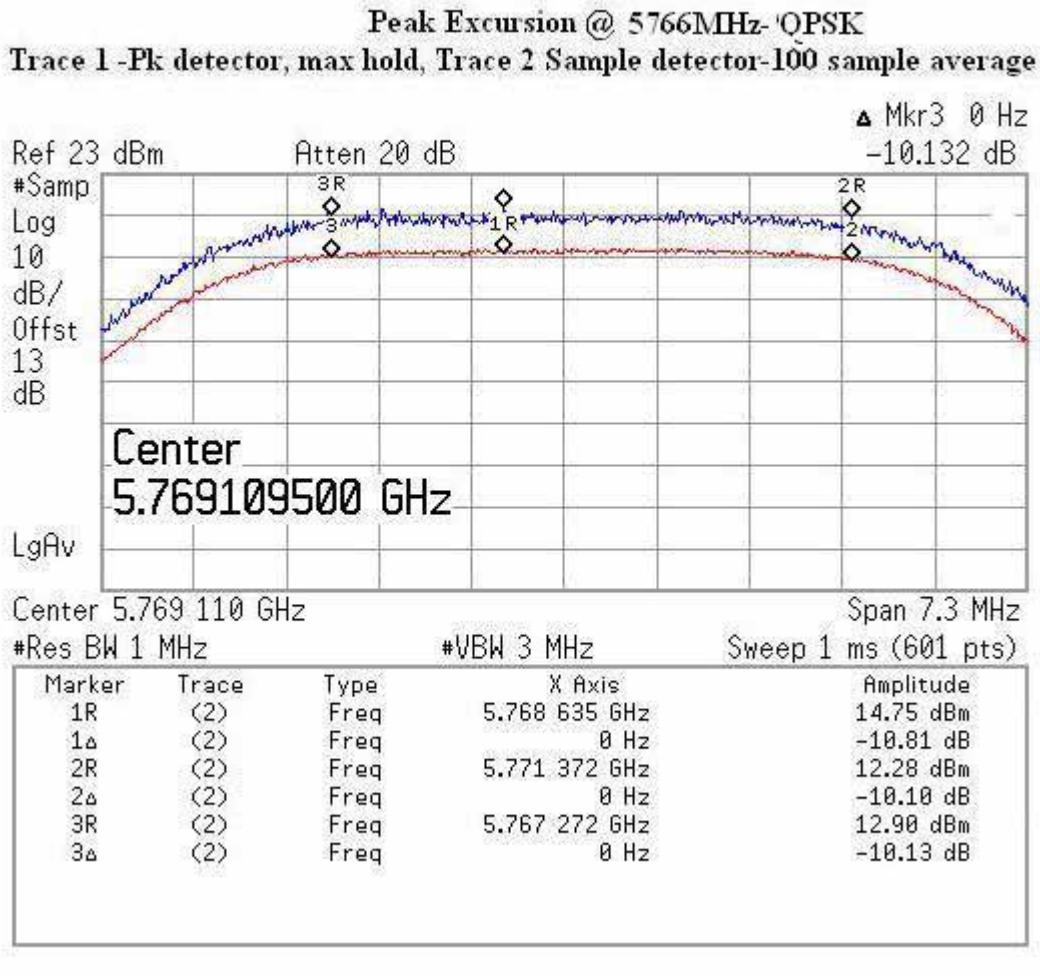

Figure 4-30. Peak Excursion, High Channel – QPSK

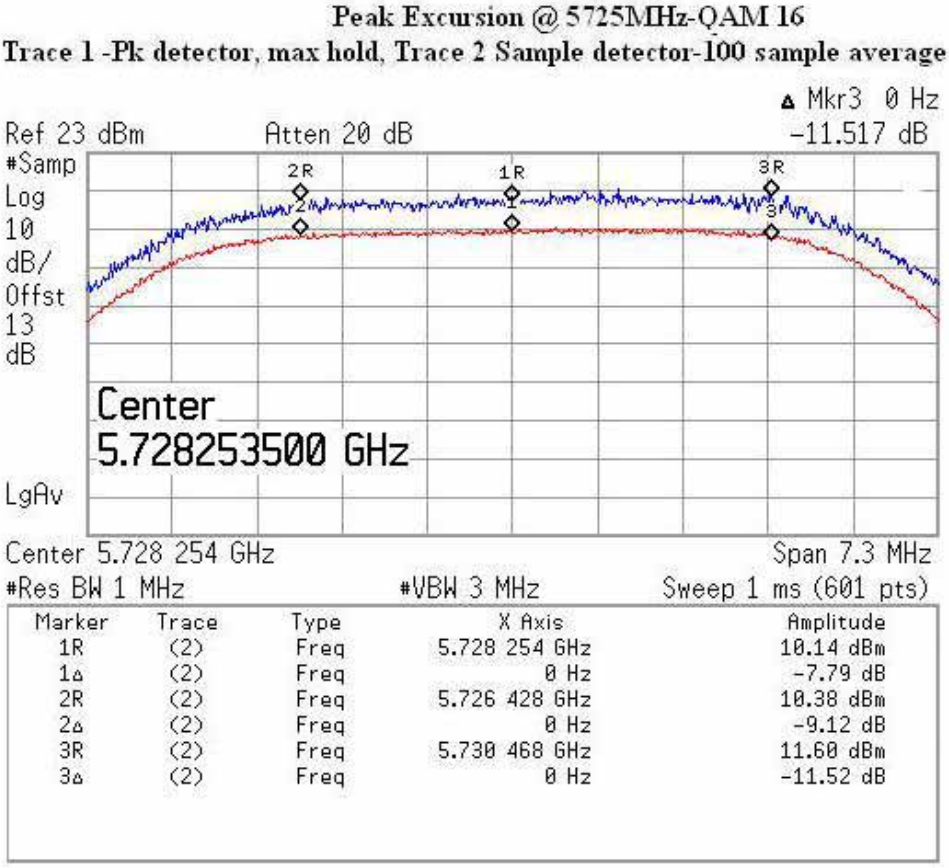

Figure 4-31. Peak Excursion, Low Channel – QAM-16

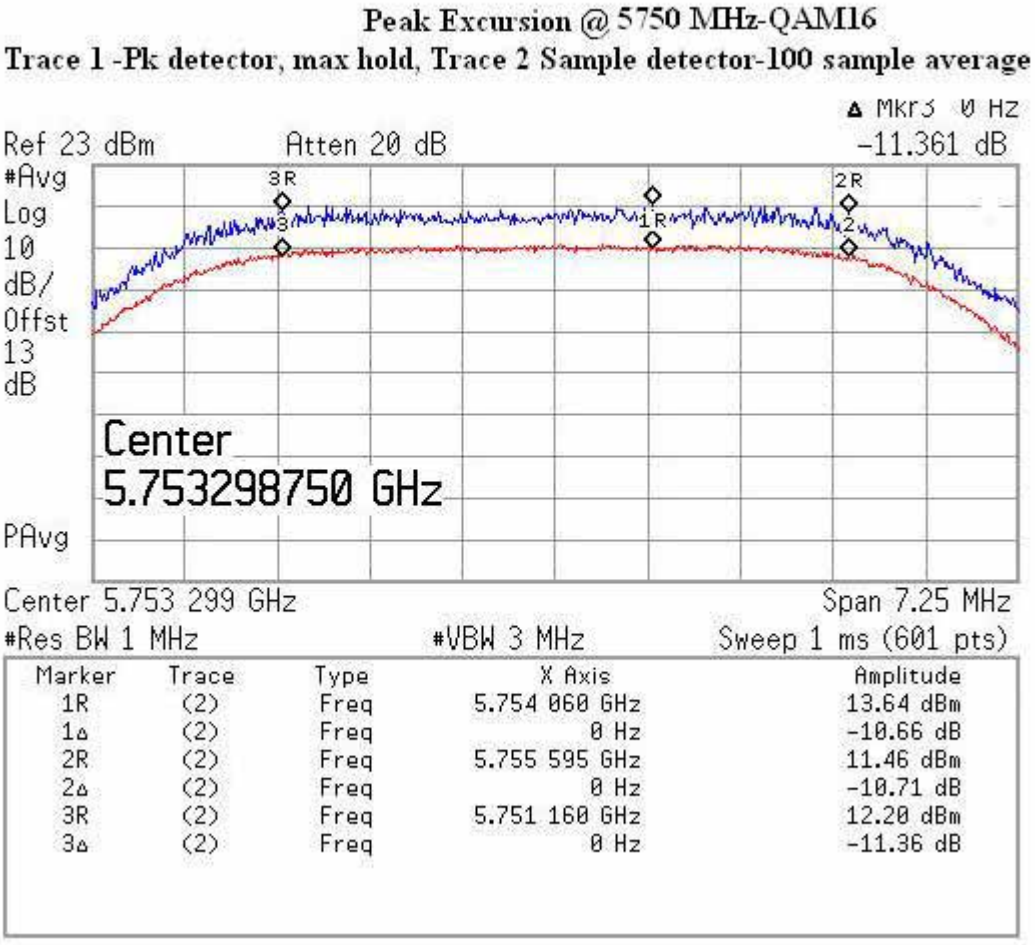

Figure 4-32. Peak Excursion, Mid Channel – QAM-16

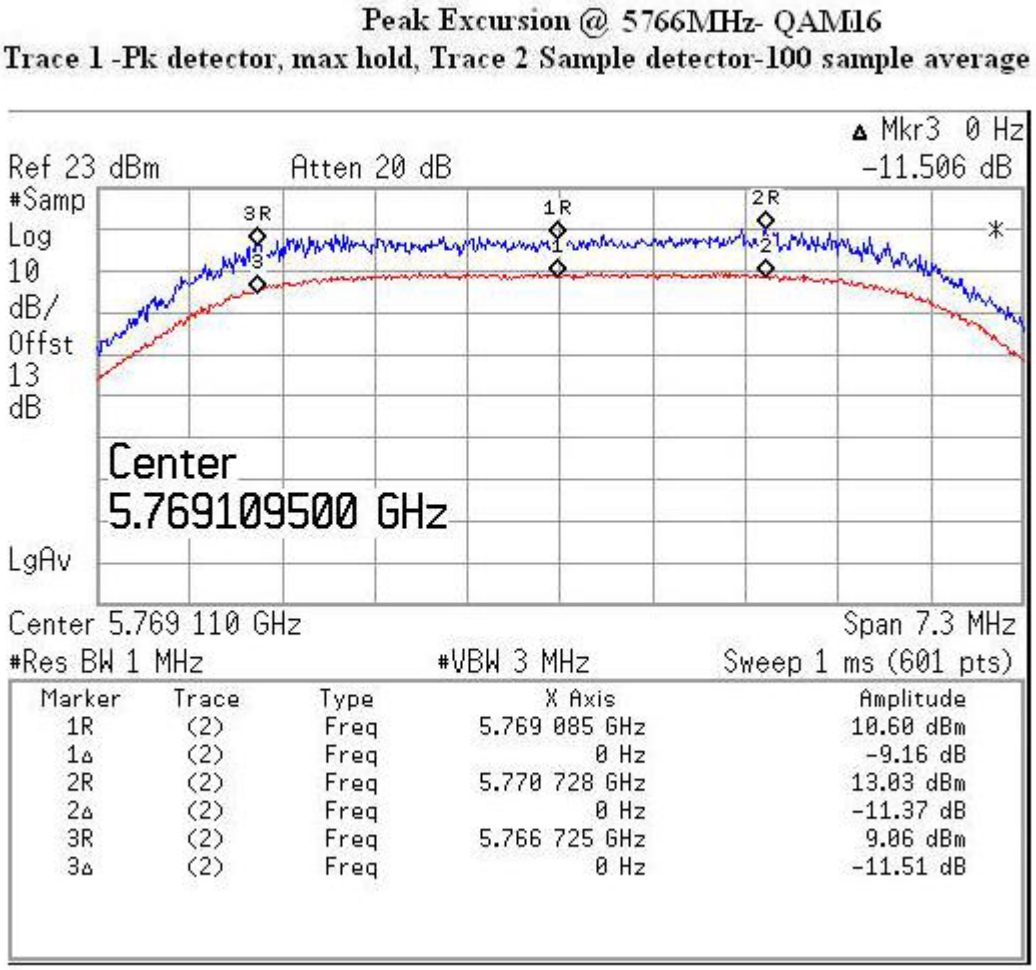

Figure 4-33. Peak Excursion, High Channel – QAM-16

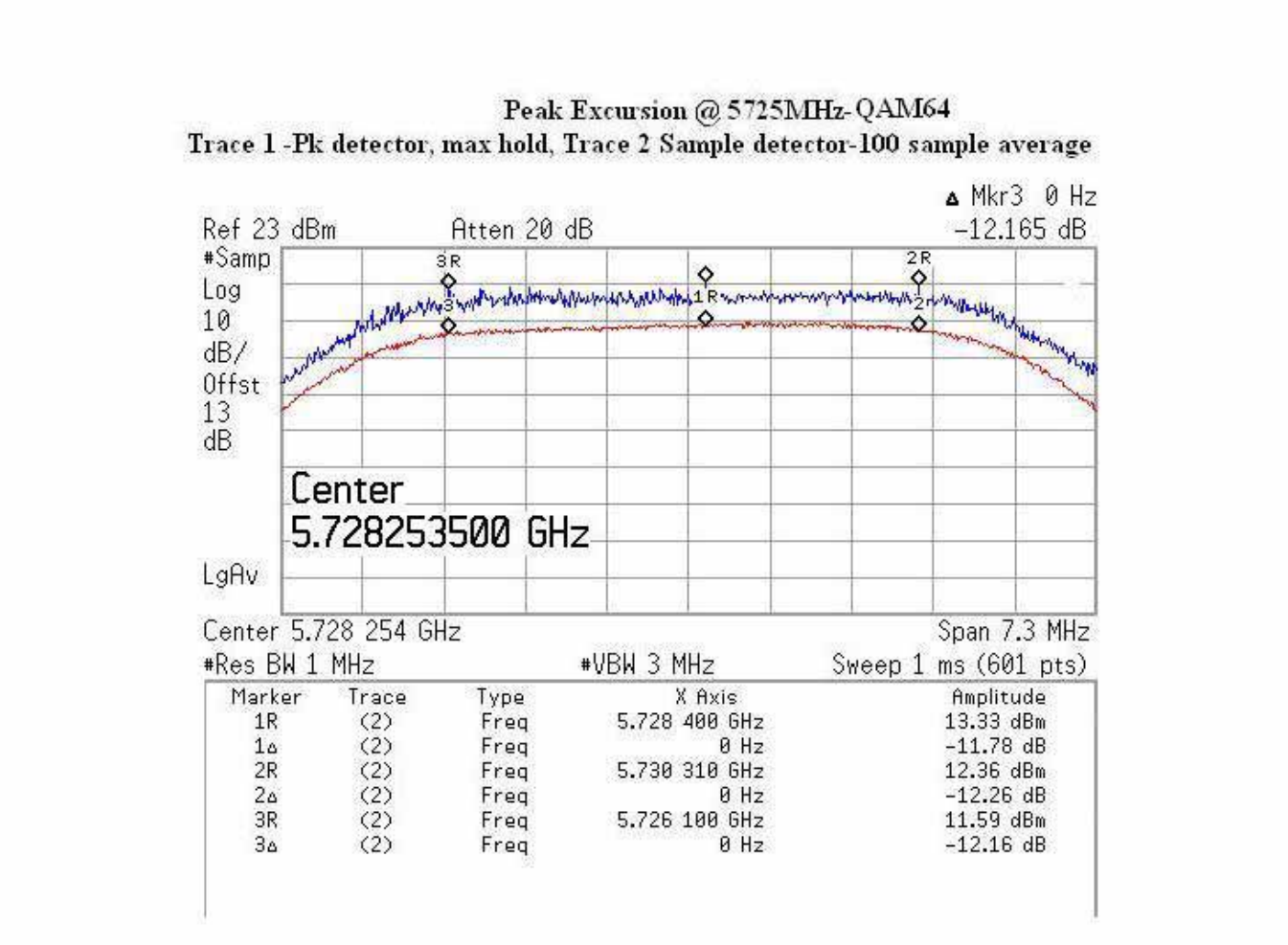

Figure 4-34. Peak Excursion, Low Channel – QAM-64

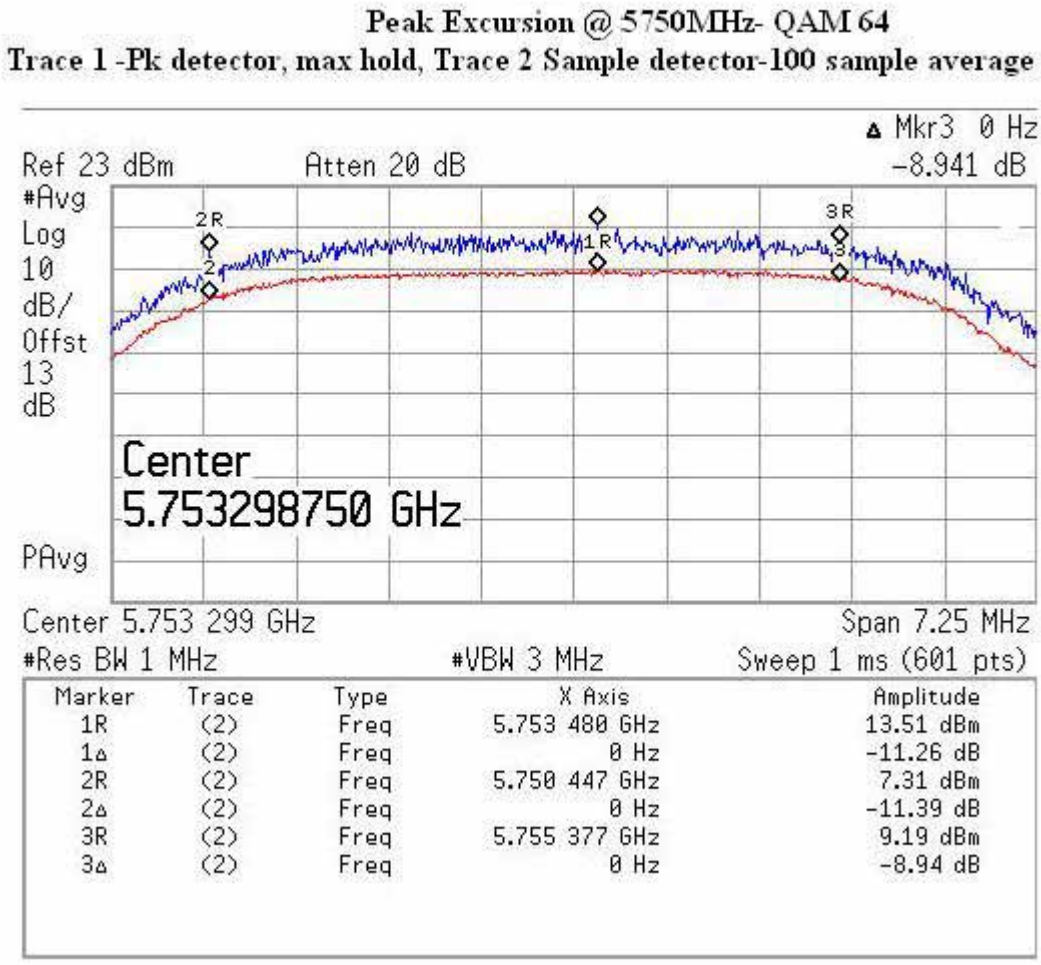

Figure 4-35. Peak Excursion, Mid Channel – QAM-64

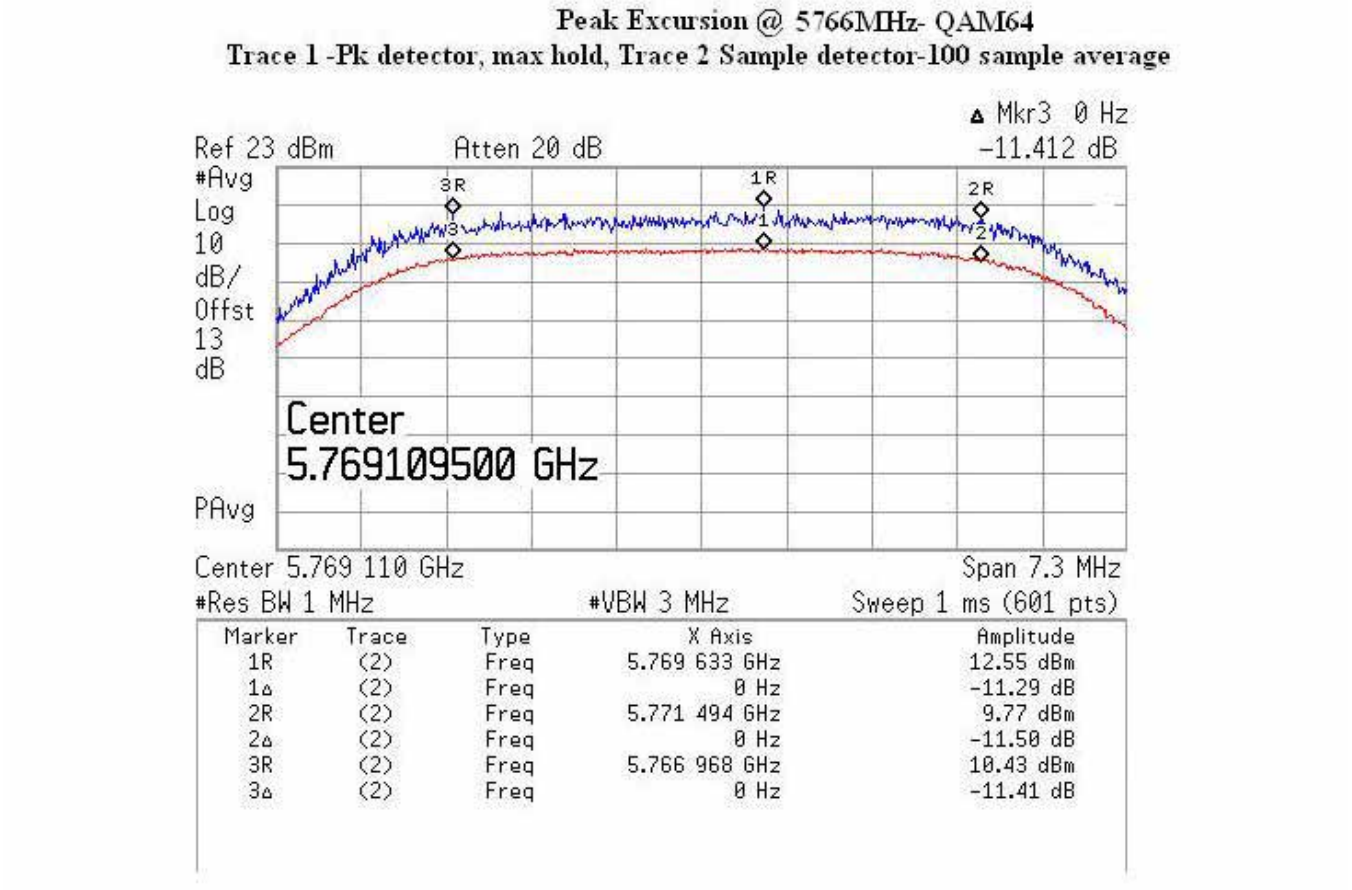

Figure 4-36. Peak Excursion, High Channel – QAM-64

4.5 Radiated Spurious Emissions: (FCC Part §15.209 and 15.407(b)(4))

The EUT must comply with the requirements for radiated spurious emissions per 15.407(b)(4). These emissions must meet the limits specified for peak measurements.

4.5.1 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)

Emissions detected from the band edge to 10MHz above or below the band edge are to meet the specification EIRP limit of -17dBm/MHz while emissions removed from the band edge by more than 10MHz are to comply with an EIRP of -27dBm/MHz. Emissions detected below 1GHz are to comply with the limits specified in 15.209.

EIRP levels were obtained using the signal substitution method.

Table 15: Radiated Emission Test Data, Low Frequency Data (<1GHz)

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
43.820	H	135.0	3.2	1.5	15.4	1.5	18.4	8.3	100.0	-21.6
63.930	H	270.0	3.2	13.7	8.7	1.8	24.2	16.1	100.0	-15.8
75.925	H	315.0	3.0	15.8	6.1	1.9	23.8	15.5	100.0	-16.2
110.585	H	90.0	3.0	12.8	10.1	2.2	25.1	17.9	150.0	-18.4
114.415	H	270.0	3.0	4.9	10.8	2.2	17.9	7.8	150.0	-25.6
127.325	H	90.0	3.0	3.0	10.2	2.3	15.5	6.0	150.0	-28.0
147.200	H	45.0	3.0	10.4	8.0	2.4	20.9	11.1	150.0	-22.7
149.981	H	45.0	2.0	22.9	8.1	2.4	33.4	47.0	150.0	-10.1
153.596	H	135.0	2.0	17.2	8.2	2.5	27.9	24.8	150.0	-15.6
157.168	H	90.0	3.0	16.3	8.5	2.5	27.3	23.2	150.0	-16.2
164.237	H	135.0	3.0	20.7	9.5	2.5	32.7	43.2	150.0	-10.8
164.341	H	135.0	3.0	22.7	9.5	2.5	34.7	54.5	150.0	-8.8
167.057	H	135.0	3.0	24.0	9.5	2.6	36.1	63.6	150.0	-7.5
172.022	H	90.0	3.0	18.4	9.4	2.6	30.3	32.9	150.0	-13.2
184.312	H	90.0	3.0	11.1	9.4	2.7	23.1	14.4	150.0	-20.4
208.890	H	315.0	2.5	17.5	10.2	2.8	30.5	33.6	150.0	-13.0
230.379	H	315.0	2.5	15.2	11.7	3.0	29.9	31.1	200.0	-16.2
240.017	H	315.0	2.5	10.2	11.7	3.0	24.9	17.6	200.0	-21.1
243.187	H	270.0	2.0	8.6	11.7	3.0	23.3	14.7	200.0	-22.7
249.982	H	225.0	3.0	14.9	11.7	3.1	29.7	30.4	200.0	-16.4
255.989	H	270.0	3.0	14.4	11.8	3.1	29.3	29.1	200.0	-16.7
268.767	H	315.0	3.0	16.2	13.3	3.2	32.7	42.9	200.0	-13.4
307.197	H	90.0	3.0	15.1	13.2	3.4	31.6	38.2	200.0	-14.4
349.967	H	90.0	3.0	19.0	13.9	3.6	36.5	67.0	200.0	-9.5
356.360	H	90.0	2.0	14.2	14.1	3.7	32.0	39.6	200.0	-14.1
380.097	H	45.0	2.0	23.2	15.1	3.8	42.1	126.9	200.0	-4.0
405.497	H	225.0	2.0	17.8	14.5	3.9	36.2	64.9	200.0	-9.8
430.087	H	225.0	2.0	18.6	15.5	4.0	38.1	80.4	200.0	-7.9
447.987	H	180.0	2.0	16.1	15.2	4.1	35.5	59.2	200.0	-10.6
449.977	H	90.0	2.0	23.4	15.3	4.1	42.8	138.7	200.0	-3.2
575.961	H	180.0	2.0	14.0	18.1	5.3	37.4	74.1	200.0	-8.6
652.783	H	90.0	2.5	15.2	18.9	5.7	39.8	98.2	200.0	-6.2
672.097	H	90.0	2.5	14.9	18.9	5.8	39.6	95.3	200.0	-6.4
43.820	V	135.0	1.0	3.9	15.4	1.5	20.8	11.0	100.0	-19.2
46.245	V	135.0	1.0	6.9	14.8	1.6	23.3	14.6	100.0	-16.7
63.480	V	90.0	1.0	7.5	8.9	1.8	18.1	8.1	100.0	-21.9
110.585	V	90.0	1.0	9.0	10.1	2.2	21.3	11.6	150.0	-22.2
114.415	V	270.0	1.0	13.4	10.8	2.2	26.4	20.9	150.0	-17.1
127.325	V	90.0	1.0	8.2	10.2	2.3	20.7	10.9	150.0	-22.8
147.200	V	90.0	1.0	14.6	8.0	2.4	25.1	17.9	150.0	-18.5
149.981	V	90.0	1.0	27.8	8.1	2.4	38.3	82.6	150.0	-5.2
153.596	V	90.0	1.0	19.9	8.2	2.5	30.6	33.9	150.0	-12.9

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
157.168	V	90.0	1.0	23.7	8.5	2.5	34.7	54.3	150.0	-8.8
164.225	V	90.0	1.0	26.8	9.5	2.5	38.8	87.2	150.0	-4.7
164.345	V	90.0	1.0	26.4	9.5	2.5	38.4	83.4	150.0	-5.1
167.057	V	90.0	1.0	28.6	9.5	2.6	40.7	108.0	150.0	-2.9
172.022	V	90.0	1.0	20.9	9.4	2.6	32.8	43.9	150.0	-10.7
184.307	V	90.0	1.0	7.9	9.4	2.7	19.9	9.9	150.0	-23.6
200.567	V	90.0	1.0	10.9	9.4	2.8	23.1	14.3	150.0	-20.4
208.890	V	0.0	1.0	14.1	10.2	2.8	27.1	22.7	150.0	-16.4
230.379	V	0.0	1.0	13.7	11.7	3.0	28.4	26.2	200.0	-17.7
240.017	V	0.0	1.0	11.2	11.7	3.0	25.9	19.7	200.0	-20.1
243.187	V	0.0	1.0	17.4	11.7	3.0	32.1	40.4	200.0	-13.9
249.963	V	0.0	1.0	23.2	11.7	3.1	38.0	79.2	200.0	-8.1
255.990	V	0.0	1.0	13.2	11.8	3.1	28.1	25.4	200.0	-17.9
268.767	V	0.0	1.0	17.3	13.3	3.2	33.8	48.7	200.0	-12.3
307.197	V	0.0	1.0	11.5	13.2	3.4	28.0	25.3	200.0	-18.0
349.967	V	90.0	1.0	17.5	13.9	3.6	35.0	56.3	200.0	-11.0
356.360	V	270.0	1.0	14.5	14.1	3.7	32.3	41.0	200.0	-13.8
380.097	V	45.0	1.0	22.0	15.1	3.8	40.9	110.5	200.0	-5.2
405.497	V	225.0	1.0	16.1	14.5	3.9	34.5	53.4	200.0	-11.5
430.087	V	225.0	1.0	17.2	15.5	4.0	36.7	68.4	200.0	-9.3
447.987	V	180.0	1.0	14.6	15.2	4.1	34.0	49.8	200.0	-12.1
449.977	V	135.0	1.0	22.3	15.3	4.1	41.7	122.2	200.0	-4.3
575.961	V	45.0	1.0	15.3	18.1	5.3	38.7	86.1	200.0	-7.3
652.783	V	90.0	1.0	10.7	18.9	5.7	35.3	58.5	200.0	-10.7
672.097	V	90.0	1.0	15.1	18.9	5.8	39.8	97.5	200.0	-6.2

Table 16: Radiated Emission Test Data, High Frequency Data (>1GHz): Low Channel

Frequency (MHz)	Pol H/V	Az Deg	Ant. Hght (m)	Spurious Level dBµV	Sub. Sig. Gen. Level dBm	Sub. Power Level dBm	Sub. Ant. Factor dB/m	Sub. Ant. Gain dBi	EIRP Level dBm	Limit dBm	Margin dB
band edge											
5725.00	H	0.0	1.0	73.33	-23.0	-27.83	38.1	7.2	-20.6	-17	-3.6
5715.00	H	0.0	1.0	57.50	-38.8	-44.67	38.1	7.2	-37.4	-17	-20.4
5722.00	H	0.0	1.0	72.83	-23.5	-28.50	38.1	7.2	-21.3	-17	-4.3
5825.00	H	10.0	1.0	54.50	-38.7	-44.17	38.3	7.3	-36.9	-17	-19.9
5835.00	H	10.0	1.0	54.50	-37.3	-42.50	38.3	7.3	-35.2	-17	-18.2
non edge											
1071.08	H	270.0	1.0	52.00	-47.8	-49.17	24.6	6.2	-43	-27	-16
1088.25	H	270.0	1.0	49.67	-46.5	-47.83	24.8	6.2	-41.7	-27	-14.7
1201.90	H	90.0	1.0	54.67	-52.5	-54.00	25.7	6.1	-47.9	-27	-20.9
1337.67	H	0.0	1.0	53.67	-56.0	-57.67	26.7	6.0	-51.7	-27	-24.7
1600.20	H	180.0	1.0	63.67	-35.0	-37.00	28.4	5.9	-31.1	-27	-4.1
1499.99	H	180.0	1.0	58.33	-46.2	-48.17	27.8	5.9	-42.2	-27	-15.2
1868.90	H	180.0	1.0	59.17	-48.8	-50.67	29.9	5.8	-44.9	-27	-17.9
2004.90	H	180.0	1.0	62.67	-44.5	-45.83	30.5	5.7	-40.1	-27	-13.1
2140.22	H	180.0	1.0	54.83	-40.0	-41.67	31.3	5.6	-36.1	-27	-9.1
2400.02	H	0.0	1.0	59.10	-46.0	-48.00	32.5	5.3	-42.7	-27	-15.7
11532.00	H	0.0	1.0	44.20	-34.0	-44.17	47.0	4.4	-39.8	-27	-12.8
band edge											
5725.00	V	0.0	1.0	53.83	-42.0	-48.00	38.1	7.2	-40.8	-17	-23.8
5715.00	V	0.0	1.0	45.00	-51.2	-56.83	38.1	7.2	-49.6	-17	-32.6
5722.00	V	0.0	1.0	44.87	-51.0	-55.83	38.1	7.2	-48.6	-17	-31.6
5825.00	V	0.0	1.0	44.67	-50.5	-55.83	38.3	7.3	-48.6	-17	-31.6
5835.00	V	0.0	1.0	43.17	-51.0	-56.50	38.3	7.3	-49.2	-17	-32.2
non edge											
1071.08	V	270.0	1.0	45.00	-75.0	-76.17	24.6	6.2	-70	-27	-43
1088.25	V	270.0	1.0	58.83	-64.0	-65.33	24.8	6.2	-59.2	-27	-32.2
1201.90	V	90.0	1.0	46.33	-68.0	-69.50	25.7	6.1	-63.4	-27	-36.4
1337.67	V	0.0	1.0	50.17	-52.5	-53.83	26.7	6.0	-47.8	-27	-20.8
1600.20	V	180.0	1.0	54.17	-54.8	-56.50	28.4	5.9	-50.6	-27	-23.6
1499.99	V	180.0	1.0	46.17	-69.0	-70.67	27.8	5.9	-64.7	-27	-37.7
1868.90	V	180.0	1.0	47.17	-54.5	-56.50	29.9	5.8	-50.7	-27	-23.7
2004.90	V	180.0	1.0	48.33	-59.5	-60.67	30.5	5.7	-54.9	-27	-27.9
2140.22	V	180.0	1.0	45.00	-66.5	-67.83	31.3	5.6	-62.3	-27	-35.3
2400.02	V	0.0	1.0	53.33	-46.2	-47.67	32.5	5.3	-42.4	-27	-15.4
11532.00	V	0.0	1.0	45.00	-42.0	-51.50	47.0	4.4	-47.1	-27	-20.1

Table 17: Radiated Emission Test Data, High Frequency Data (>1GHz): Mid Channel

Frequency (MHz)	Pol H/V	Az Deg	Ant. Hght (m)	Spurious Level dBµV	Sub. Sig. Gen. Level dBm	Sub. Power Level dBm	Sub. Ant. Factor dB/m	Sub. Ant. Gain dBi	EIRP Level dBm	Limit dBm	Margin dB
band edge											
5725.00	H	0.0	1.0	64.50	-31.7	-36.50	38.1	7.2	-29.3	-17	-12.3
5715.00	H	0.0	1.0	57.33	-38.7	-44.50	38.1	7.2	-37.3	-17	-20.3
5722.00	H	0.0	1.0	69.17	-27.1	-32.00	38.1	7.2	-24.8	-17	-7.8
5825.00	H	10.0	1.0	54.50	-39.2	-44.67	38.3	7.3	-37.4	-17	-20.4
5835.00	H	10.0	1.0	55.33	-36.5	-42.55	38.3	7.3	-35.3	-17	-18.3
non edge											
1071.08	H	270.0	1.0	55.17	-45.0	-46.33	24.6	6.2	-40.2	-27	-13.2
1088.25	H	270.0	1.0	58.50	-38.0	-39.50	24.8	6.2	-33.3	-27	-6.3
1201.90	H	90.0	1.0	57.17	-49.9	-51.17	25.7	6.1	-45.1	-27	-18.1
1337.67	H	0.0	1.0	58.17	-51.5	-53.00	26.7	6.0	-47.0	-27	-20.0
1600.20	H	180.0	1.0	63.83	-35.0	-37.00	28.4	5.9	-31.1	-27	-4.1
1499.99	H	180.0	1.0	57.50	-46.8	-48.67	27.8	5.9	-42.7	-27	-15.7
1868.90	H	180.0	1.0	61.00	-47.0	-49.00	29.9	5.8	-43.2	-27	-16.2
2004.90	H	180.0	1.0	61.33	-46.0	-47.50	30.5	5.7	-41.8	-27	-14.8
2140.22	H	180.0	1.0	56.33	-38.5	-40.17	31.3	5.6	-34.6	-27	-7.6
2400.02	H	0.0	1.0	63.17	-42.0	-44.00	32.5	5.3	-38.7	-27	-11.7
11532.00	H	0.0	1.0	55.83	-24.5	-34.40	47.0	4.4	-30.0	-27	-3.0
band edge											
5725.00	V	0.0	1.0	64.67	-31.5	-36.83	38.1	7.2	-29.6	-17	-12.6
5715.00	V	0.0	1.0	57.67	-38.5	-43.33	38.1	7.2	-36.1	-17	-19.1
5722.00	V	0.0	1.0	63.00	-33.0	-38.67	38.1	7.2	-31.4	-17	-14.4
5825.00	V	10.0	1.0	58.50	-37.3	-42.83	38.3	7.3	-35.6	-17	-18.6
5835.00	V	10.0	1.0	56.33	-38.5	-43.67	38.3	7.3	-36.4	-17	-19.4
non edge											
1071.08	V	270.0	1.0	65.33	-48.0	-49.33	24.6	6.2	-43.2	-27	-16.2
1088.25	V	270.0	1.0	68.33	-47.0	-48.33	24.8	6.2	-42.2	-27	-15.2
1201.90	V	180.0	1.0	58.17	-52.0	-54.17	25.7	6.1	-48.1	-27	-21.1
1337.67	V	0.0	1.0	59.50	-40.0	-41.83	26.7	6.0	-35.8	-27	-8.8
1600.20	V	180.0	1.0	64.17	-44.0	-45.67	28.4	5.9	-39.8	-27	-12.8
1499.99	V	180.0	1.0	55.50	-54.5	-56.00	27.8	5.9	-50.1	-27	-23.1
1868.90	V	180.0	1.0	58.17	-41.5	-43.50	29.9	5.8	-37.7	-27	-10.7
2004.90	V	180.0	1.0	60.00	-44.5	-45.67	30.5	5.7	-39.9	-27	-12.9
2140.22	V	180.0	1.0	57.67	-46.5	-47.83	31.3	5.6	-42.3	-27	-15.3
2400.02	V	0.0	1.0	61.50	-35.9	-37.50	32.5	5.3	-32.2	-27	-5.2
11532.00	V	0.0	1.0	55.50	-25.5	-35.33	47.0	4.4	-30.9	-27	-3.9

Table 18: Radiated Emission Test Data, High Frequency Data (>1GHz): High Channel

Frequency (MHz)	Pol H/V	Az Deg	Ant. Hght (m)	Spurious Level dBµV	Sub. Sig. Gen. Level dBm	Sub. Power Level dBm	Sub. Ant. Factor dB/m	Sub. Ant. Gain dBi	EIRP Level dBm	Limit dBm	Margin dB
band edge											
5725.00	H	0.0	1.0	73.3	-23.0	-27.17	38.1	7.2	-19.9	-17	-2.9
5715.00	H	0.0	1.0	57.5	-39.0	-44.67	38.1	7.2	-37.4	-17	-20.4
5722.00	H	0.0	1.0	72.8	-23.5	-28.87	38.1	7.2	-21.6	-17	-4.6
5825.00	H	10.0	1.0	54.5	-39.0	-44.83	38.3	7.3	-37.6	-17	-20.6
5835.00	H	10.0	1.0	54.5	-37.0	-42.17	38.3	7.3	-34.9	-17	-17.9
non edge											
1071.08	H	270.0	1.0	52.0	-47.8	-49.00	24.6	6.2	-42.8	-27	-15.8
1088.25	H	270.0	1.0	49.7	-46.8	-48.17	24.8	6.2	-42.0	-27	-15.0
1201.90	H	90.0	1.0	54.7	-52.5	-53.83	25.7	6.1	-47.7	-27	-20.7
1337.67	H	0.0	1.0	53.7	-56.0	-57.83	26.7	6.0	-51.8	-27	-24.8
1600.20	H	180.0	1.0	63.7	-35.0	-37.00	28.4	5.9	-31.1	-27	-4.1
1499.99	H	180.0	1.0	58.3	-46.0	-47.83	27.8	5.9	-41.9	-27	-14.9
1868.90	H	180.0	1.0	59.2	-48.5	-50.50	29.9	5.8	-44.7	-27	-17.7
2004.90	H	180.0	1.0	62.7	-44.5	-46.00	30.5	5.7	-40.3	-27	-13.3
2140.22	H	180.0	1.0	54.8	-40.0	-41.67	31.3	5.6	-36.1	-27	-9.1
2400.02	H	0.0	1.0	59.1	-45.8	-48.30	32.5	5.3	-43.0	-27	-16.0
11532.00	H	0.0	1.0	44.2	-34.2	-44.33	47.0	4.4	-39.9	-27	-12.9
band edge											
5725.00	V	0.0	1.0	61.8	-34.0	-39.67	38.1	7.2	-32.4	-17	-15.4
5715.00	V	0.0	1.0	57.8	-38.5	-43.83	38.1	7.2	-36.6	-17	-19.6
5722.00	V	0.0	1.0	59.3	-34.5	-40.00	38.1	7.2	-32.8	-17	-15.8
5825.00	V	10.0	1.0	57.5	-38.0	-43.50	38.3	7.3	-36.2	-17	-19.2
5835.00	V	10.0	1.0	57.2	-37.3	-42.67	38.3	7.3	-35.4	-17	-18.4
non edge											
1071.08	V	45.0	1.0	49.5	-71.5	-72.83	24.6	6.2	-66.7	-27	-39.7
1088.25	V	0.0	1.0	51.1	-71.0	-71.33	24.8	6.2	-65.2	-27	-38.2
1200.35	V	0.0	1.0	61.8	-46.7	-48.00	25.7	6.1	-41.9	-27	-14.9
1337.67	V	180.0	1.0	59.5	-39.7	-41.67	26.7	6.0	-35.7	-27	-8.7
1600.20	V	180.0	1.0	62.0	-45.5	-47.17	28.4	5.9	-41.3	-27	-14.3
1499.99	V	190.0	1.0	54.3	-54.5	-56.00	27.8	5.9	-50.1	-27	-23.1
1868.90	V	45.0	1.0	56.5	-42.0	-44.00	29.9	5.8	-38.2	-27	-11.2
2004.90	V	180.0	1.0	57.5	-46.0	-47.33	30.5	5.7	-41.6	-27	-14.6
2140.22	V	180.0	1.0	51.5	-54.0	-55.33	31.3	5.6	-49.8	-27	-22.8
2400.02	V	0.0	1.0	58.3	-49.5	-50.83	32.5	5.3	-45.6	-27	-18.6
11532.00	V	0.0	1.0	45.5	-41.0	-50.50	47.0	4.4	-46.1	-27	-19.1

4.6 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 19.

Table 19. Conducted Emissions Test Data Sheet

LINE 1 - NEUTRAL

Level QP dBuV	Cable Loss dB	Limit QP dBuV	Level Corr dBuV	Margin QP dB	Level AVG dBuV	Cable Loss dB	Level Corr dBuV	Limit AVG dBuV	Margin AVG dB
30.5	10.1	64.4	40.6	-23.8	30.2	10.1	40.3	54.4	-14.1
17.6	10.2	63.1	27.8	-35.3	16.7	10.2	26.9	53.1	-26.2
21.5	10.2	61.1	31.7	-29.4	20.8	10.2	31.0	51.1	-20.1
35.9	11.9	60.0	47.8	-12.2	34.9	11.9	46.8	50.0	-3.2
19.7	12.0	60.0	31.7	-28.3	19.7	12.0	31.7	50.0	-18.3
22.3	12.6	60.0	34.9	-25.1	22.3	12.6	34.9	50.0	-15.1
25.6	12.6	60.0	38.2	-21.8	25.6	12.6	38.2	50.0	-11.8
13.7	12.6	60.0	26.3	-33.7	13.7	12.6	26.3	50.0	-23.7

LINE 2 – PHASE

Level QP dBuV	Cable Loss dB	Limit QP dBuV	Level Corr dBuV	Margin QP dB	Level AVG dBuV	Cable Loss dB	Level Corr dBuV	Limit AVG dBuV	Margin AVG dB
30.9	10.1	64.4	41.0	-23.4	30.6	10.1	40.7	54.4	-13.7
17.5	10.2	63.1	27.7	-35.4	16.9	10.2	27.1	53.1	-26.0
22.1	10.2	61.1	32.3	-28.8	21.1	10.2	31.3	51.1	-19.8
35.2	11.9	60.0	47.1	-12.9	34.7	11.9	46.6	50.0	-3.4
19.4	12.0	60.0	31.4	-28.6	19.4	12.0	31.4	50.0	-18.6
18.9	12.6	60.0	31.5	-28.5	18.9	12.6	31.5	50.0	-18.5
25.1	12.6	60.0	37.7	-22.3	24.2	12.6	36.8	50.0	-13.2
12.2	12.6	60.0	24.8	-35.2	12.2	12.6	24.8	50.0	-25.2