



Washington Laboratories, Ltd.

---

**FCC Class II Permissive Change Report**  
**For the**  
**Wireless Highways, Inc.**  
**PC701**

**FCC ID: THQ-PC701**

WLL JOB# 8837-2  
January 2006

Prepared for:

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

Prepared By:

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

**FCC Class II Permissive Change Report**  
**for the**  
**Wireless Highways, Inc.**  
**PC701**  
**FCC ID: THQ-PC701**

**January 2006**

WLL JOB# 8837-2

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 an FCC Class II Permissive Change to FCC ID: THQ-PC701 for a Transmitter under Part 15 Subpart E. This Test Report documents the test configuration and test results for a Plan B configuration of the Wireless Highways, Inc. PC701.

The original PC701 as tested for Plan A frequency band (5724M – 5769M). This Class II Permissive Change is to add the Plan B frequency band (5780M – 5818M). The Plan B frequency band has always been a part of the PC-701 and no changes to the hardware have occurred since the original application.

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 Plan B complies with the limits for a Transmitter device under FCC Part 15 Subpart E.

## Table of Contents

Abstract .....	ii
1 Introduction .....	1
1.1 Compliance Statement .....	1
1.2 Test Scope .....	1
1.3 Contract Information .....	1
1.4 Test Dates .....	1
1.5 Test and Support Personnel .....	1
2 Equipment Under Test .....	2
2.1 EUT Identification & Description .....	2
2.2 Test Configuration .....	2
2.3 Testing Algorithm .....	2
2.4 Test Location .....	3
2.5 Measurements .....	3
2.5.1 References .....	3
2.6 Measurement Uncertainty .....	3
3 Test Equipment .....	4
4 Test Results .....	5
4.1 Emission Bandwidth: (FCC Part §15.401(i)) .....	5
4.2 RF Power Output: (FCC Part §15.407(a)(3)) .....	14
4.3 Peak Power Spectral Density: (FCC Part §15.407(a)(3)) .....	24
4.4 Peak Excursion (FCC Part §15.407(a)(5)) .....	34
4.5 Radiated Spurious Emissions: (FCC Part §15.209 and 15.407(b)(4)) .....	45
<b>4.5.1 Test Procedure</b> .....	45
4.6 AC Powerline Conducted Emissions: (FCC Part §15.207) .....	51

## List of Tables

Table 1. Device Summary .....	2
Table 2: Test Equipment List .....	4
Table 3. RF Power Output - QPSK .....	15
Table 4. RF Power Output – QAM-16 .....	15
Table 5. RF Power Output – QAM-64 .....	15
Table 6. Occupied Bandwidth Results - QPSK .....	13
Table 7. Occupied Bandwidth Results – QAM-16 .....	14
Table 8. Occupied Bandwidth Results – QAM-64 .....	14
Table 9: Radiated Emission Test Data, Low Frequency Data (<1GHz) .....	46
Table 10: Radiated Emission Test Data, High Frequency Data (>1GHz): Low Channel .....	48
Table 11: Radiated Emission Test Data, High Frequency Data (>1GHz): Mid Channel .....	49
Table 12: Radiated Emission Test Data, High Frequency Data (>1GHz): High Channel .....	50
Table 13. Conducted Emissions Test Data Sheet .....	51

## List of Figures

Figure 4-19. Occupied Bandwidth, Low Channel - QPSK.....	5
Figure 4-20. Occupied Bandwidth, Low Channel – QAM-16 .....	6
Figure 4-21. Occupied Bandwidth, Low Channel – QAM-64 .....	7
Figure 4-22. Occupied Bandwidth, Mid Channel – QPSK.....	8
Figure 4-23. Occupied Bandwidth, Mid Channel – QAM16 .....	9
Figure 4-24. Occupied Bandwidth, Mid Channel – QAM-64 .....	10
Figure 4-25. Occupied Bandwidth, High Channel – QPSK .....	11
Figure 4-26. Occupied Bandwidth, High Channel – QAM-16.....	12
Figure 4-27. Occupied Bandwidth, High Channel – QAM-64.....	13
Figure 4-1. RF Peak Power, Low Channel - QPSK.....	16
Figure 4-2. RF Peak Power, Mid Channel - QPSK .....	17
Figure 4-3. RF Peak Power, High Channel - QPSK.....	18
Figure 4-4. RF Peak Power, Low Channel – QAM-16.....	19
Figure 4-5. RF Peak Power, Mid Channel – QAM-16 .....	20
Figure 4-6. RF Peak Power, High Channel – QAM-16.....	21
Figure 4-7. RF Peak Power, Low Channel – QAM-64.....	22
Figure 4-8. RF Peak Power, Mid Channel – QAM-64 .....	23
Figure 4-9. RF Peak Power, High Channel – QAM-64.....	24
Figure 4-10. Peak Power Spectral Density, Low Channel – QPSK .....	26
Figure 4-11. Peak Power Spectral Density, Mid Channel – QPSK.....	27
Figure 4-12. Peak Power Spectral Density, High Channel – QPSK.....	28
Figure 4-13. Peak Power Spectral Density, Low Channel – QAM-16.....	29
Figure 4-14. Peak Power Spectral Density, Mid Channel – QAM-16 .....	30
Figure 4-15. Peak Power Spectral Density, High Channel – QAM-16.....	31
Figure 4-16. Peak Power Spectral Density, Low Channel – QAM-64.....	32
Figure 4-17. Peak Power Spectral Density, Mid Channel – QAM-64 .....	33
Figure 4-18. Peak Power Spectral Density, High Channel – QAM-64 .....	34
Figure 4-28. Peak Excursion, Low Channel – QPSK.....	36
Figure 4-29. Peak Excursion, Mid Channel – QPSK .....	37
Figure 4-30. Peak Excursion, High Channel – QPSK .....	38
Figure 4-31. Peak Excursion, Low Channel – QAM-16 .....	39
Figure 4-32. Peak Excursion, Mid Channel – QAM-16 .....	40
Figure 4-33. Peak Excursion, High Channel – QAM-16.....	41
Figure 4-34. Peak Excursion, Low Channel – QAM-64 .....	42
Figure 4-35. Peak Excursion, Mid Channel – QAM-64 .....	43
Figure 4-36. Peak Excursion, High Channel – QAM-64.....	44

## **1 Introduction**

### **1.1 Compliance Statement**

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

The original PC701 as tested for Plan A frequency band (5724M – 5769M). This Class II Permissive Change is to add the Plan B frequency band (5780M – 5818M). The Plan B frequency band has always been a part of the PC-701 and no changes to the hardware have occurred since the original application.

### **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 & January 6 through January 10, 2006
---	--

### **1.5 Test and Support Personnel**

Washington Laboratories, LTD	James Ritter
------------------------------	--------------

## 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 5724-5825MHz. The Band B portion, and the focus of this report, operates in the 5780MHz – 5818MHz range. 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:	Plan A: 5724 – 5769MHz Plan B: 5780 – 5818MHz (Covered in this report)
Maximum Output Power:	10.91 dBm
Modulation:	QPSK, QAM-16, and QAM-64
Occupied Bandwidth:	7.14 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 Plan B 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 Plan B 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  $\pm 2.3$  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	1/31/2006
0126	SOLAR 8028-50-TS-BNC	LISN	1/31/2006
0067	HEWLETT-PACKARD 8564E	SPECTRUM ANALYZER	7/16/2006
0066	HEWLETT-PACKARD 8449B	MICROWAVE PREAMP	6/14/2006
----	PAM 1840	AMPLIFIER, 26.5 – 40GHz	2/14/2006
0478	ROHDE & SCHWARTZ SMT06	SIGNAL GENERATOR	11/30/2006
0080	HEWLETT-PACKARD 8672A	SIGNAL GENERATOR	3/06/2006
0257	HEWLETT-PACKARD 8672A K22	SIG GEN FREQUENCY EXTENDER	3/06/2006
0007	ARA LPB-2520	BICONILOG ANTENNA	12/20/2006
0001	A.H.SYSTEMS SAS-200/518	LOG PERIODIC ANTENNA 1-18GHz	3/11/2006
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
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.

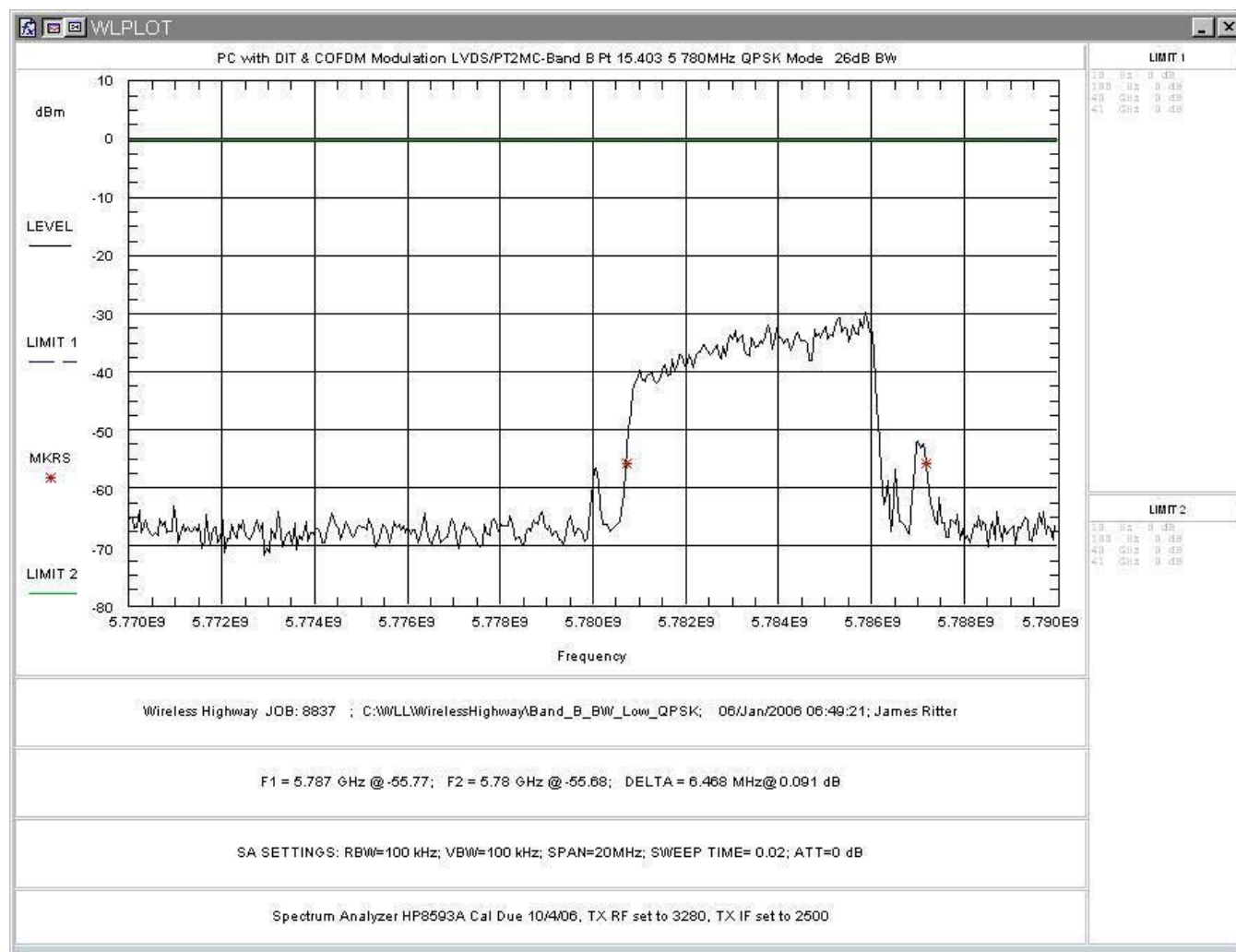


Figure 4-1. Occupied Bandwidth, Low Channel - QPSK

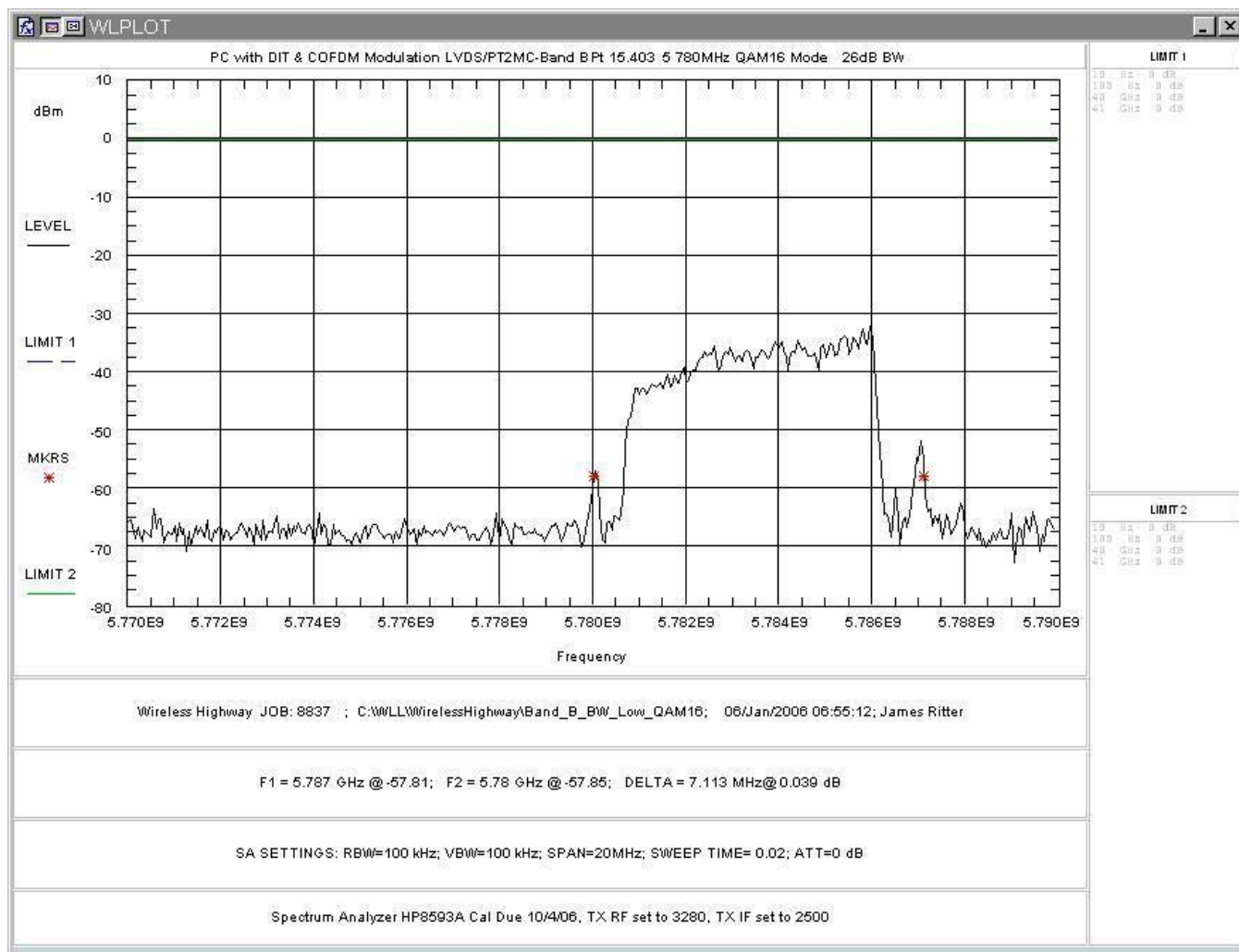


Figure 4-2. Occupied Bandwidth, Low Channel – QAM-16

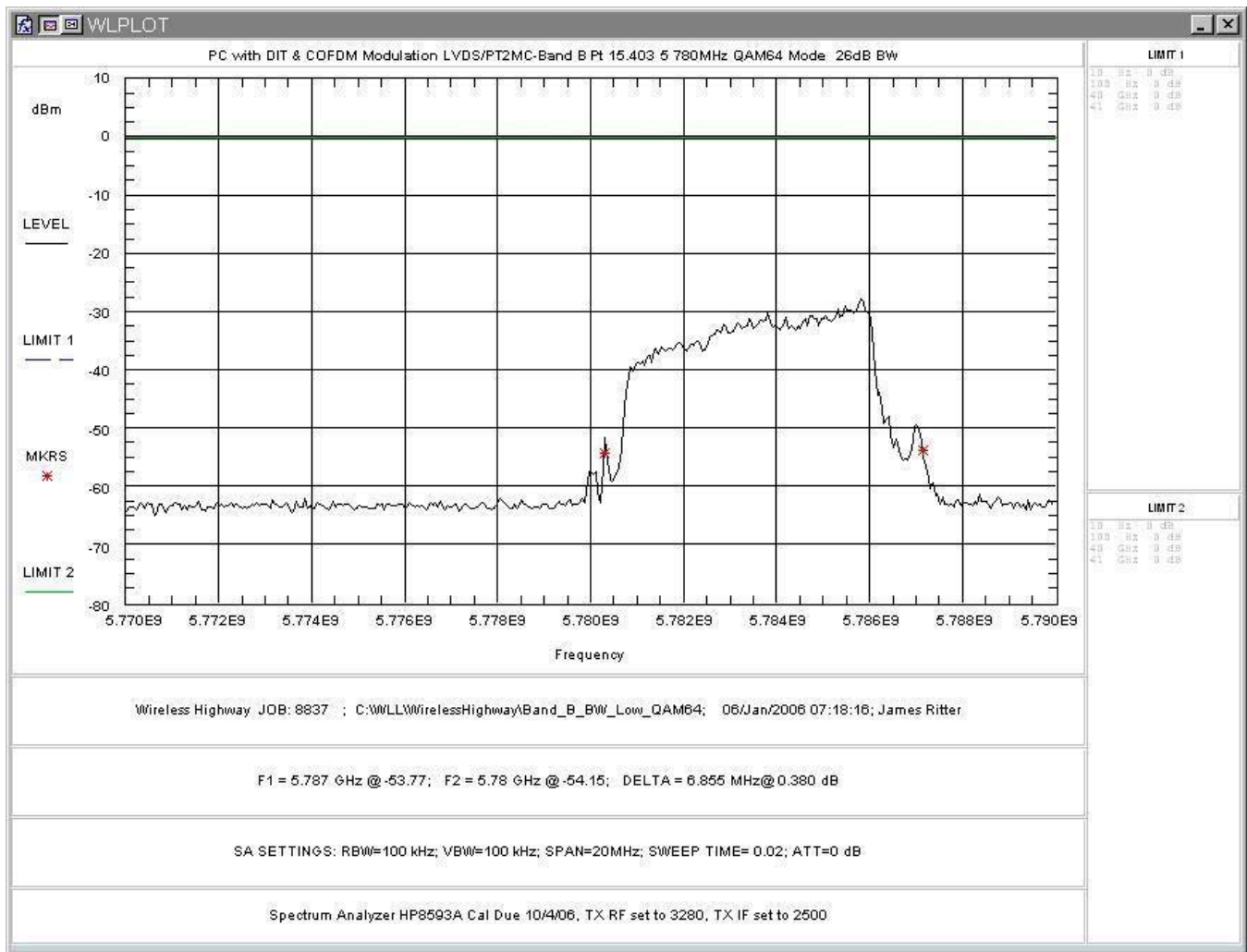


Figure 4-3. Occupied Bandwidth, Low Channel – QAM-64

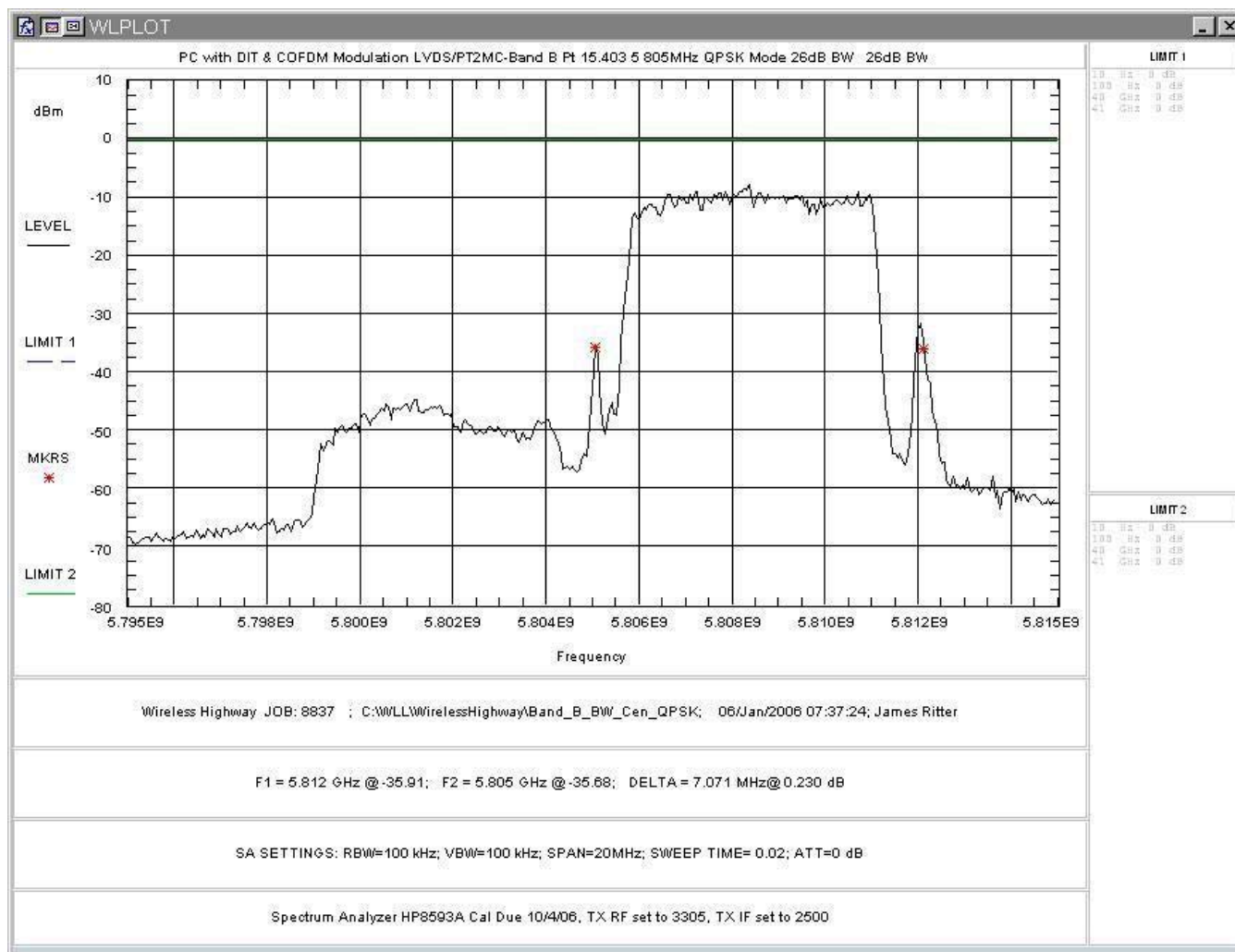


Figure 4-4. Occupied Bandwidth, Mid Channel – QPSK

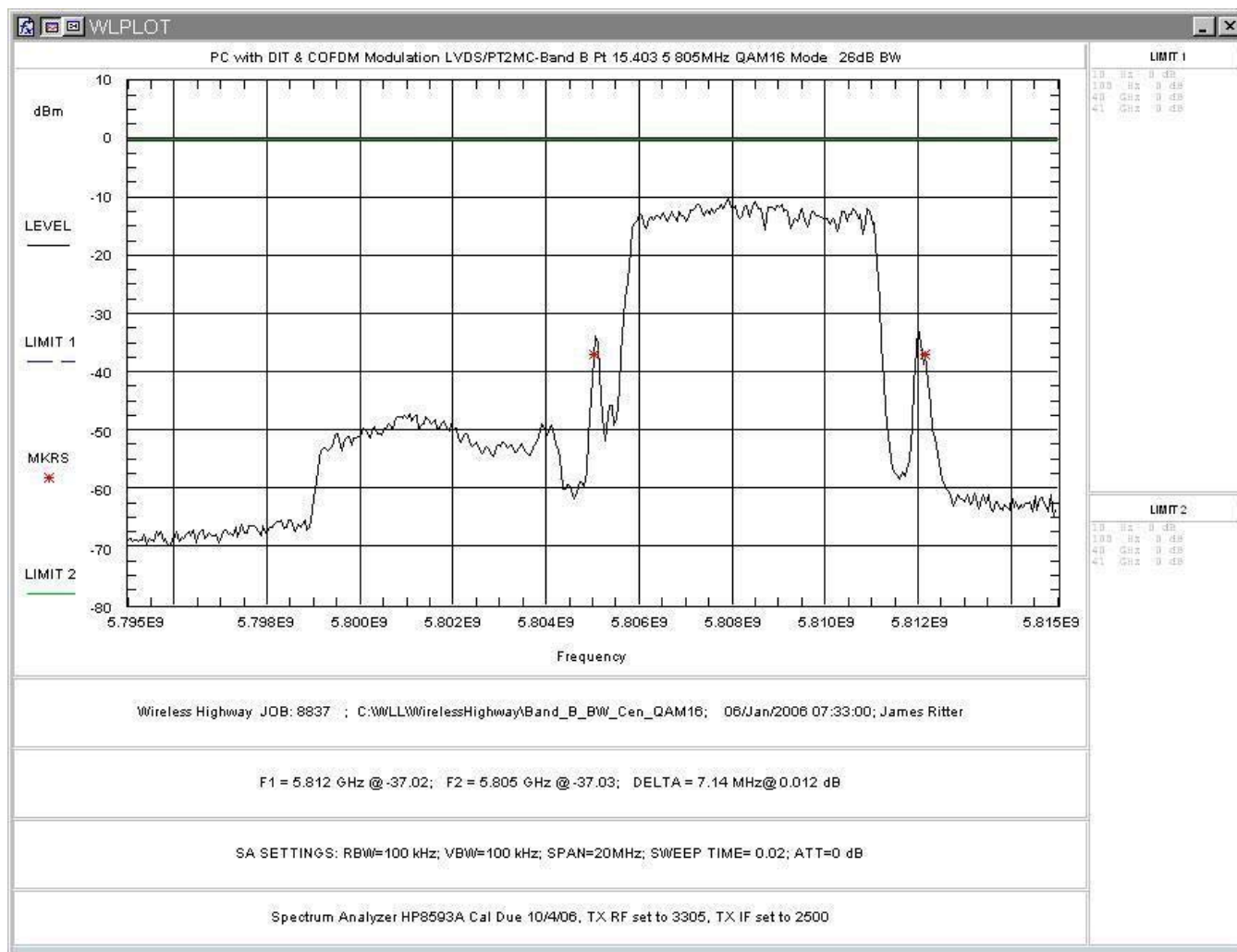


Figure 4-5. Occupied Bandwidth, Mid Channel – QAM16

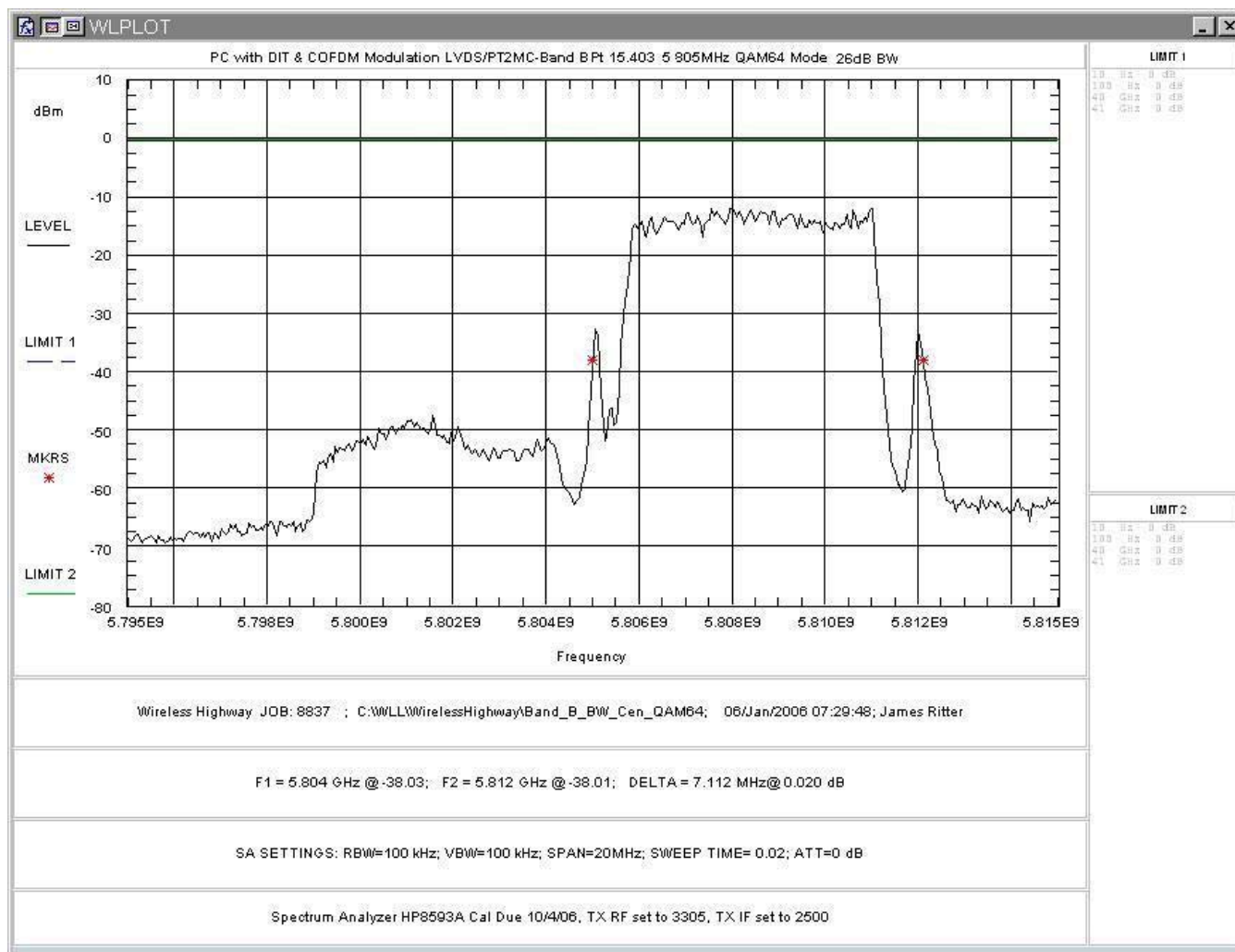


Figure 4-6. Occupied Bandwidth, Mid Channel – QAM-64

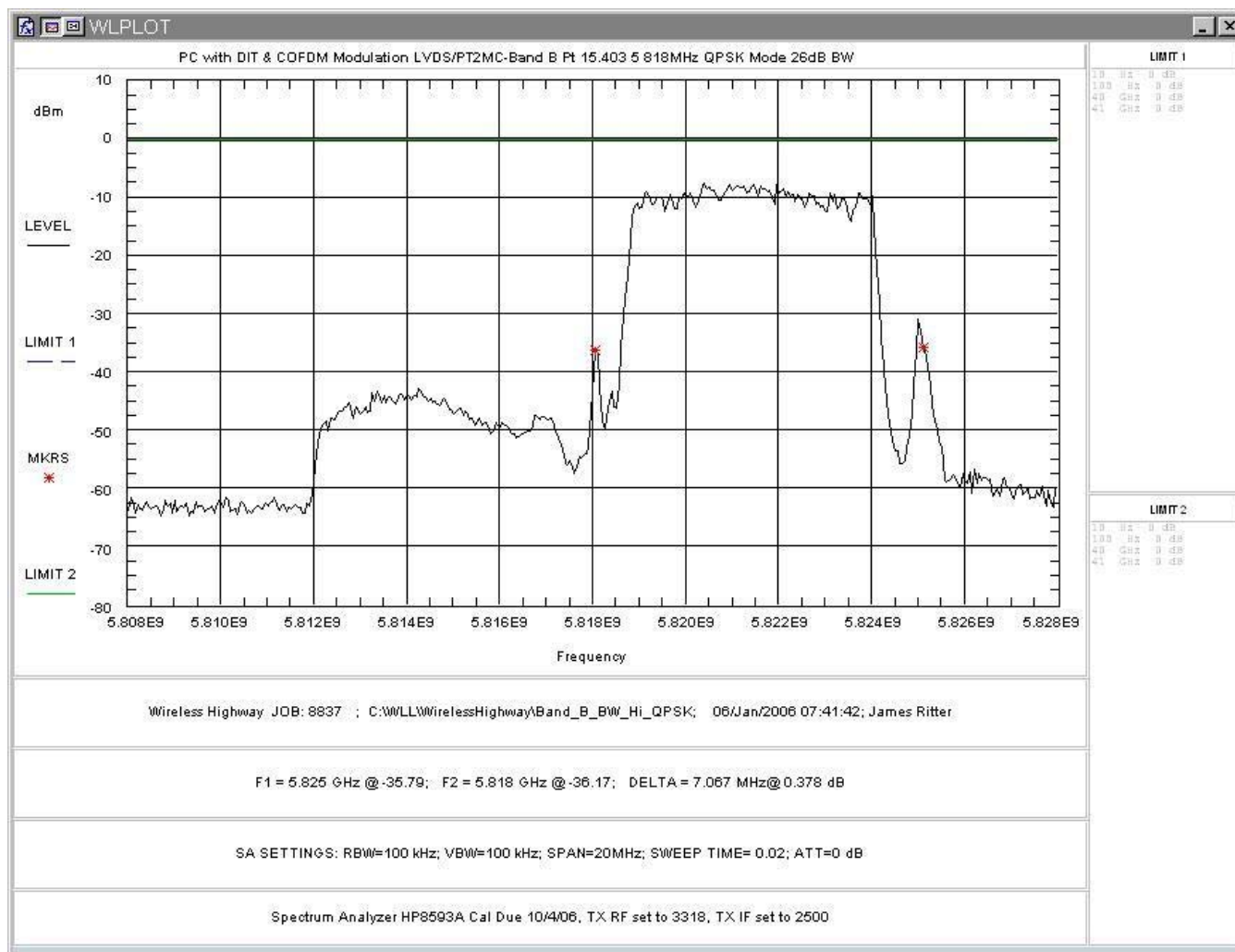


Figure 4-7. Occupied Bandwidth, High Channel – QPSK



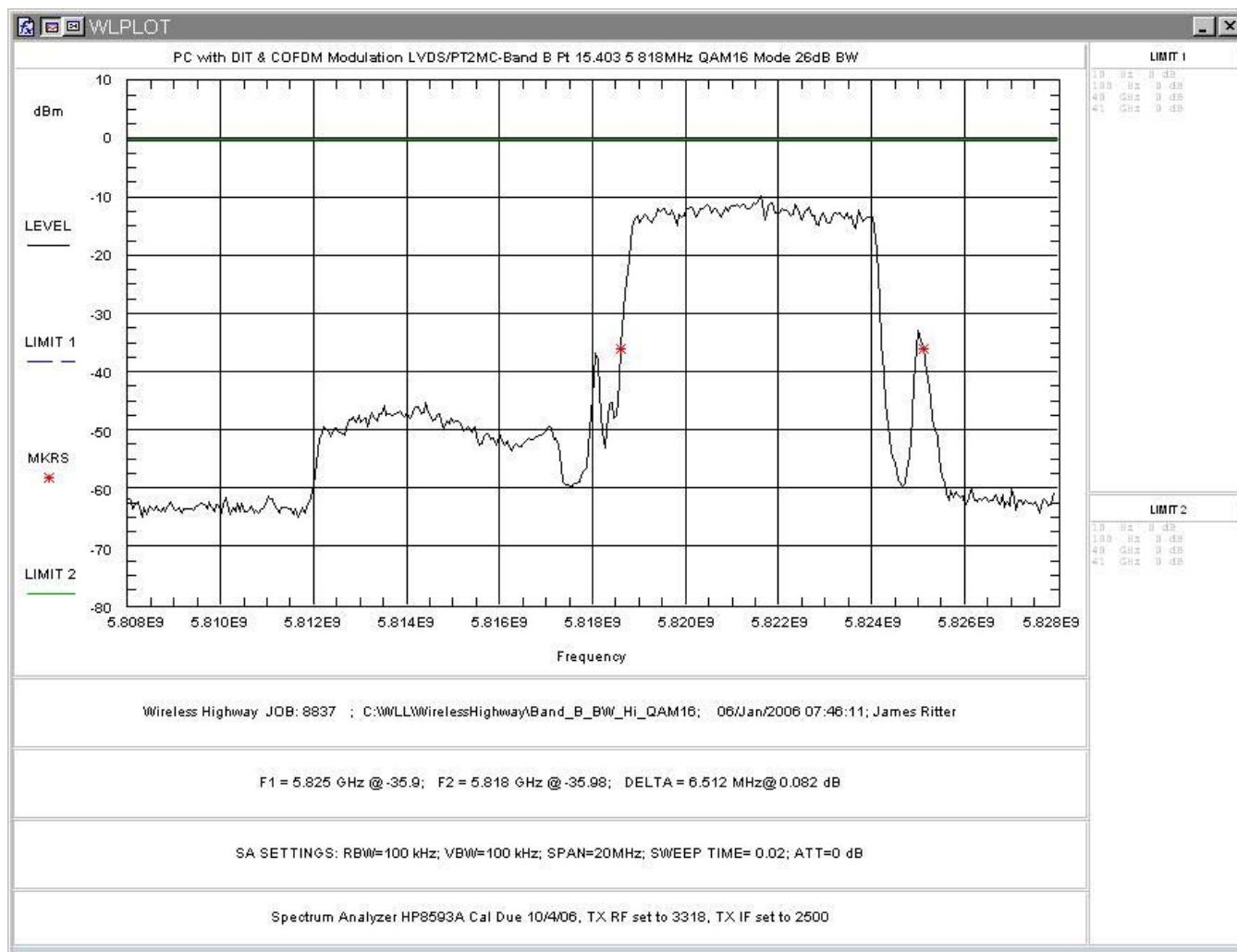
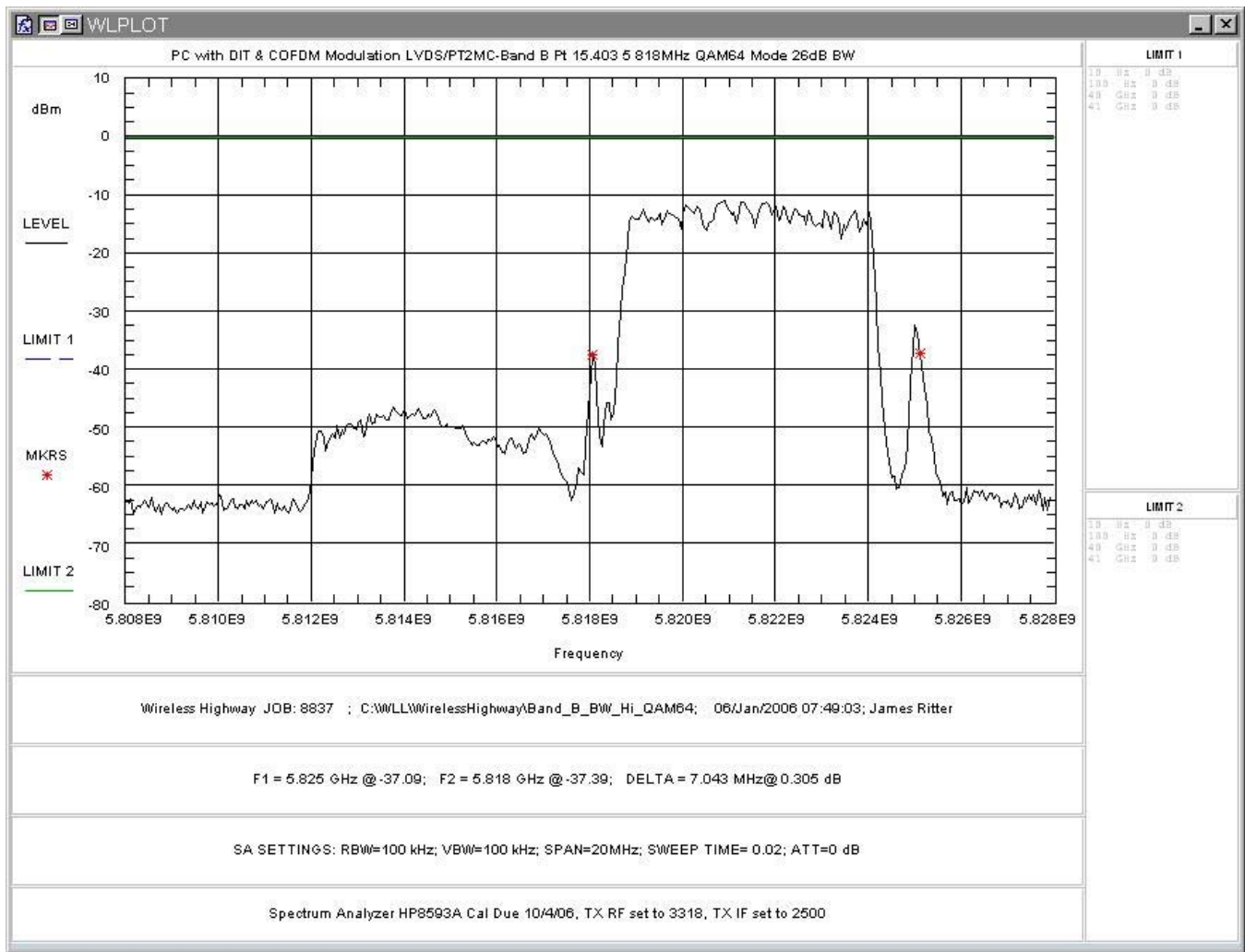


Figure 4-8. Occupied Bandwidth, High Channel – QAM-16



**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 5780MHz	6.468MHz
Mid Channel 5805MHz	7.071 MHz
High Channel 5818MHz	7.067 MHz

**Table 4. Occupied Bandwidth Results – QAM-16**

Frequency	Bandwidth
Low Channel 5780MHz	7.113MHz
Mid Channel 5805MHz	7.140 MHz
High Channel 5818MHz	6.512 MHz

**Table 5. Occupied Bandwidth Results – QAM-64**

Frequency	Bandwidth
Low Channel 5780MHz	6.855MHz
Mid Channel 5805MHz	7.112 MHz
High Channel 5818MHz	7.043 MHz

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

For the band 5780MHz – 5818MHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 1 W or  $17 \text{ dBm} + 10\log B$ , where B is the 26-dB emission bandwidth in MHz.

The largest emission bandwidth measured is 7.140MHz thus the maximum power shall not exceed 25.5dBm (0.358W).

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. Note that due to the diplexer filtering the power of the lower channel at 5780MHz is limited.

**Table 6. RF Power Output - QPSK**

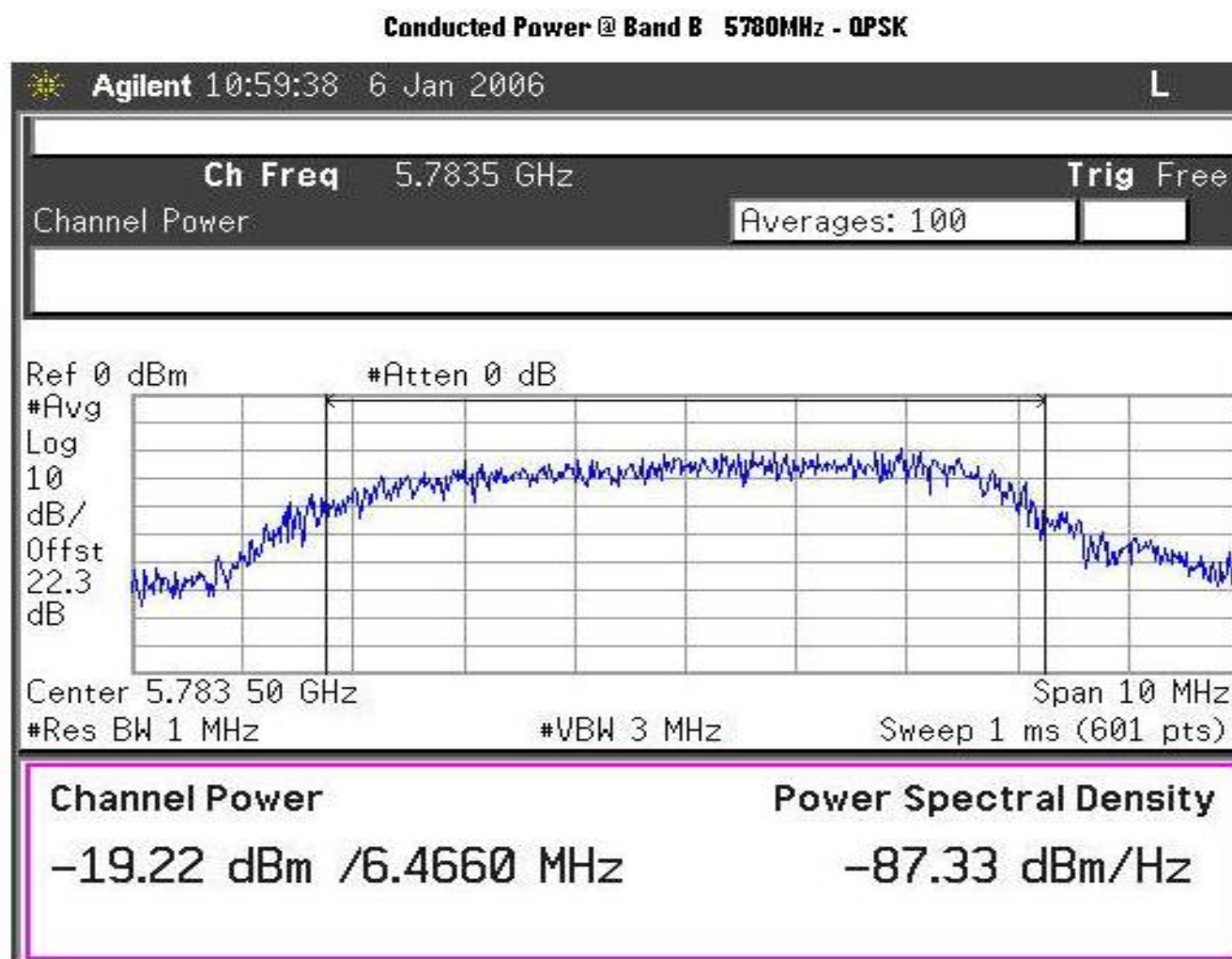
Frequency	Level	Limit	Pass/Fail
Low Channel 5780MHz	-19.22 dBm	25.5 dBm	Pass
Mid Channel 5805MHz	10.42 dBm	25.5 dBm	Pass
High Channel 5818MHz	10.91 dBm	25.5 dBm	Pass

**Table 7. RF Power Output – QAM-16**

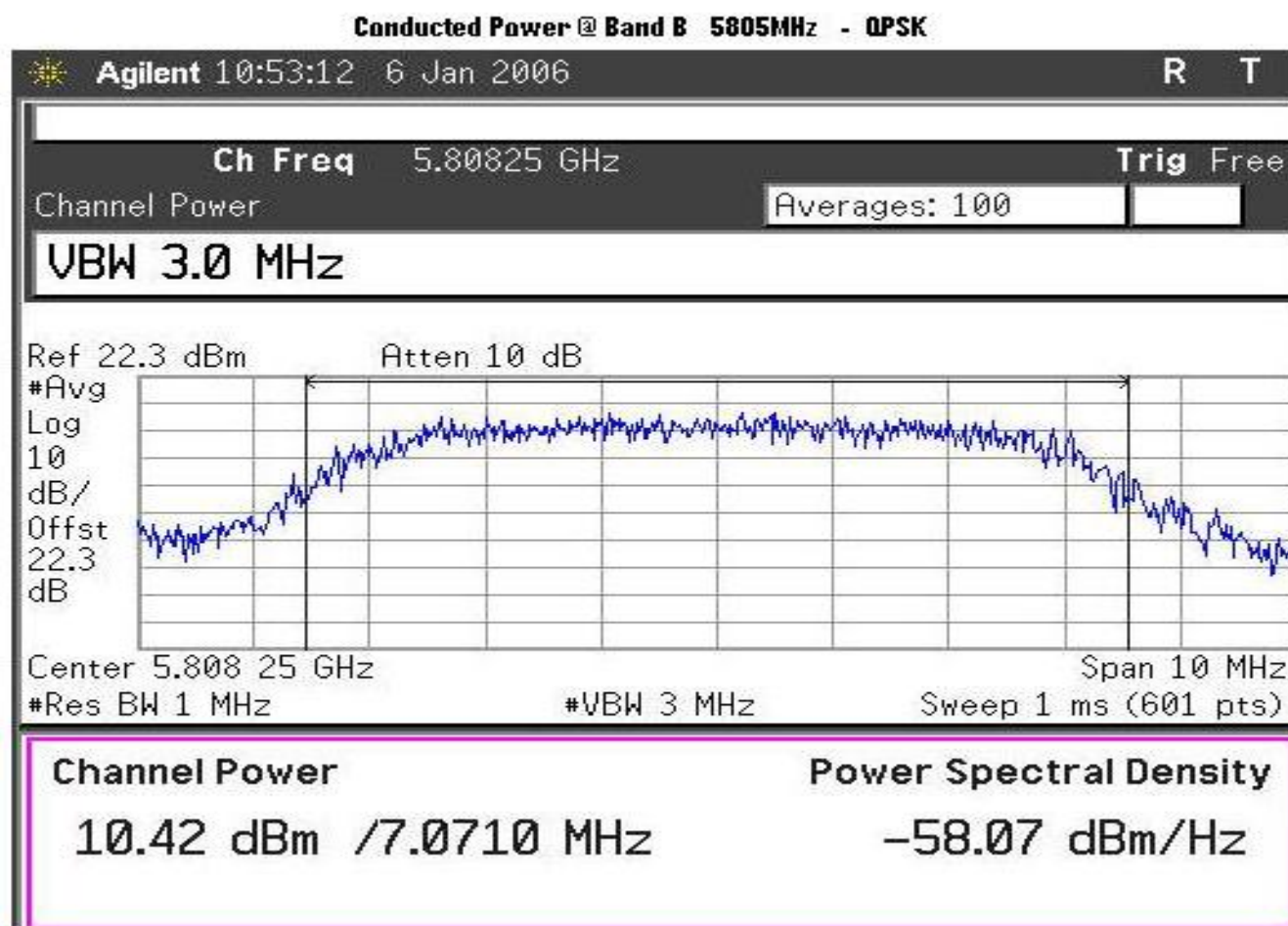
Frequency	Level	Limit	Pass/Fail
Low Channel 5780MHz	-21.39 dBm	25.5 dBm	Pass
Mid Channel 5805MHz	8.15 dBm	25.5 dBm	Pass
High Channel 5818MHz	8.61 dBm	25.5 dBm	Pass

**Table 8. RF Power Output – QAM-64**

Frequency	Level	Limit	Pass/Fail
Low Channel 5780MHz	-22.38 dBm	25.5 dBm	Pass
Mid Channel 5805MHz	7.10 dBm	25.5 dBm	Pass
High Channel 5818MHz	7.65 dBm	25.5 dBm	Pass



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



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

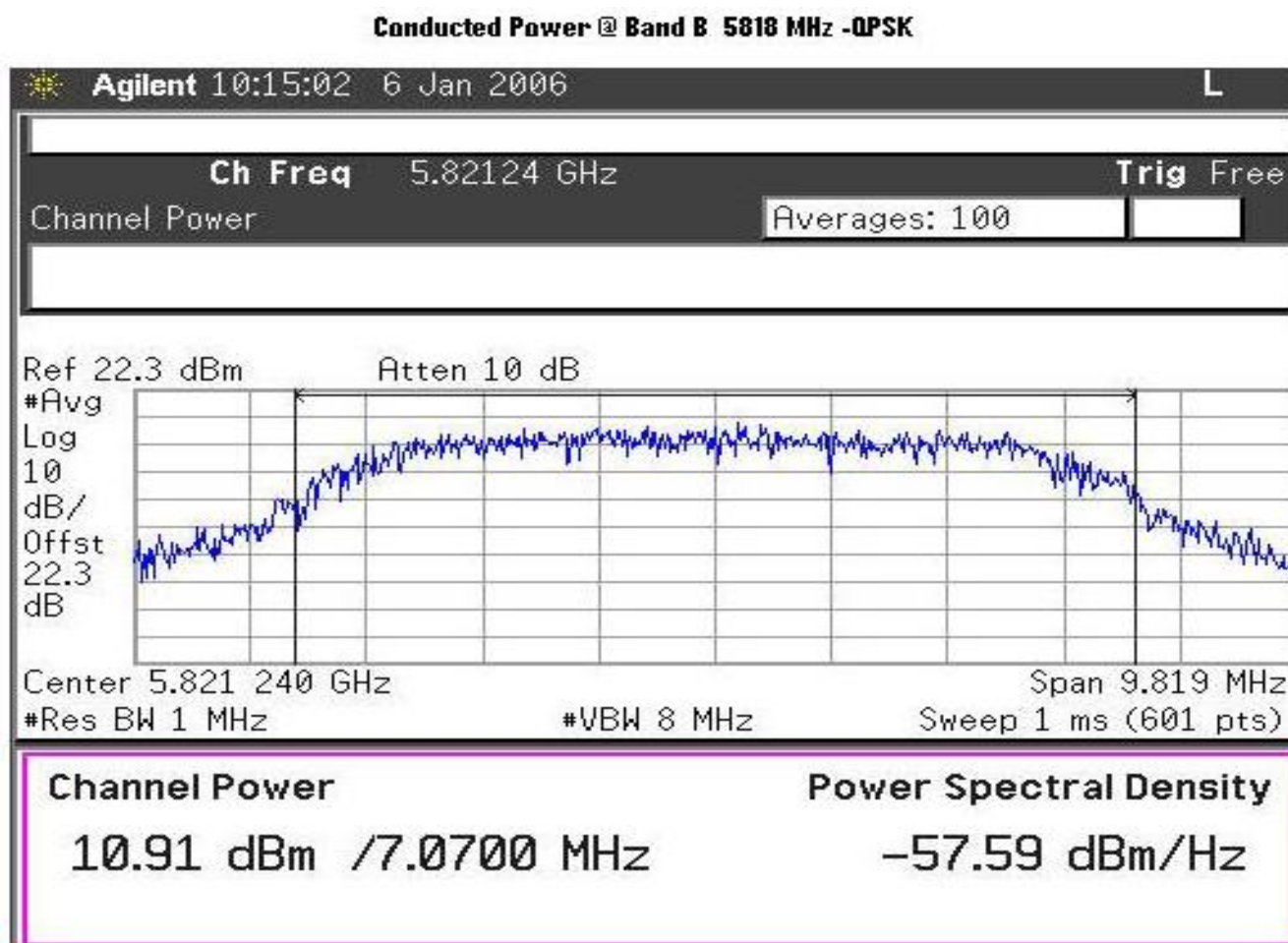


Figure 4-12. RF Peak Power, High Channel - QPSK



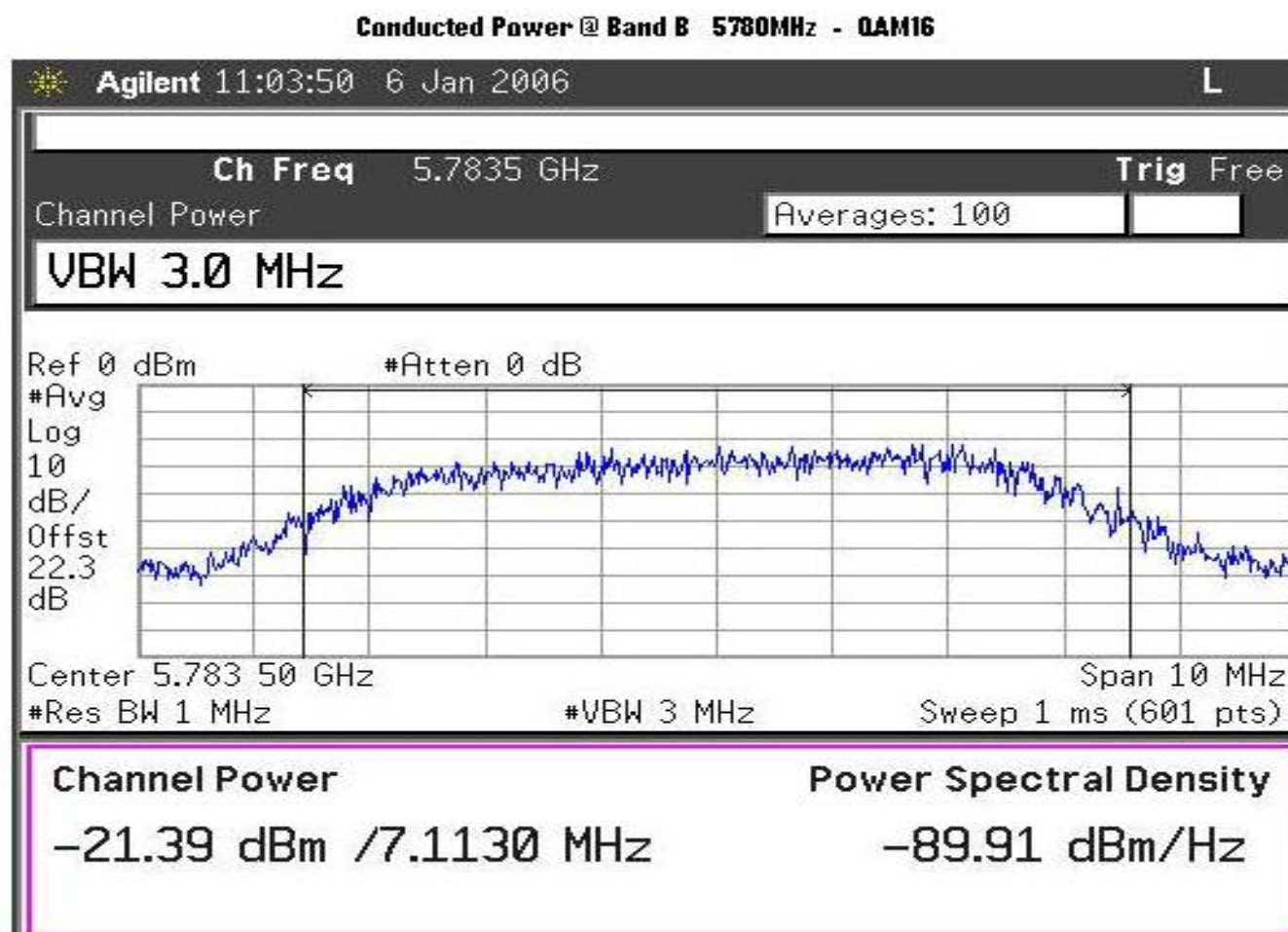


Figure 4-13. RF Peak Power, Low Channel – QAM-16



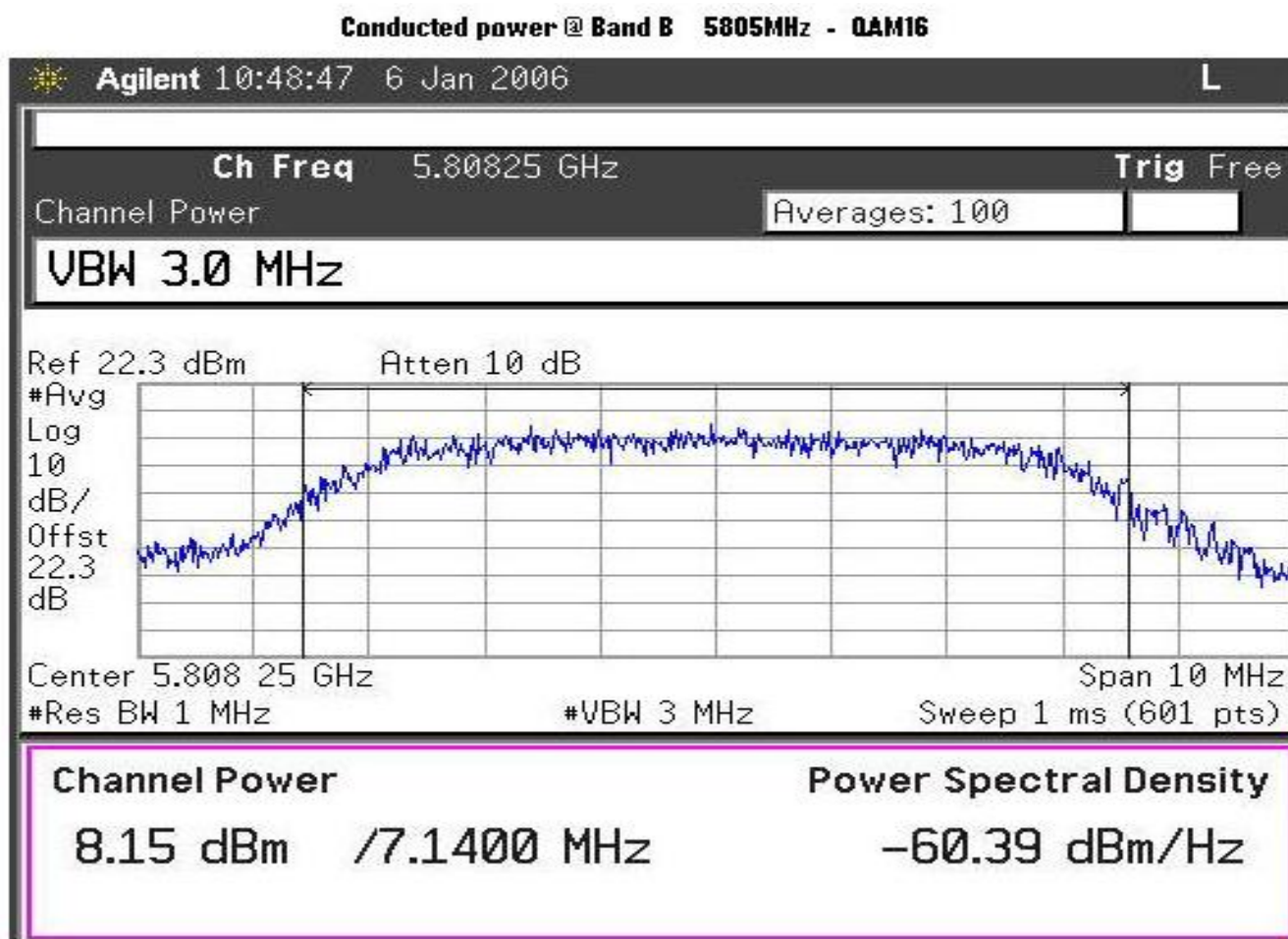


Figure 4-14. RF Peak Power, Mid Channel – QAM-16

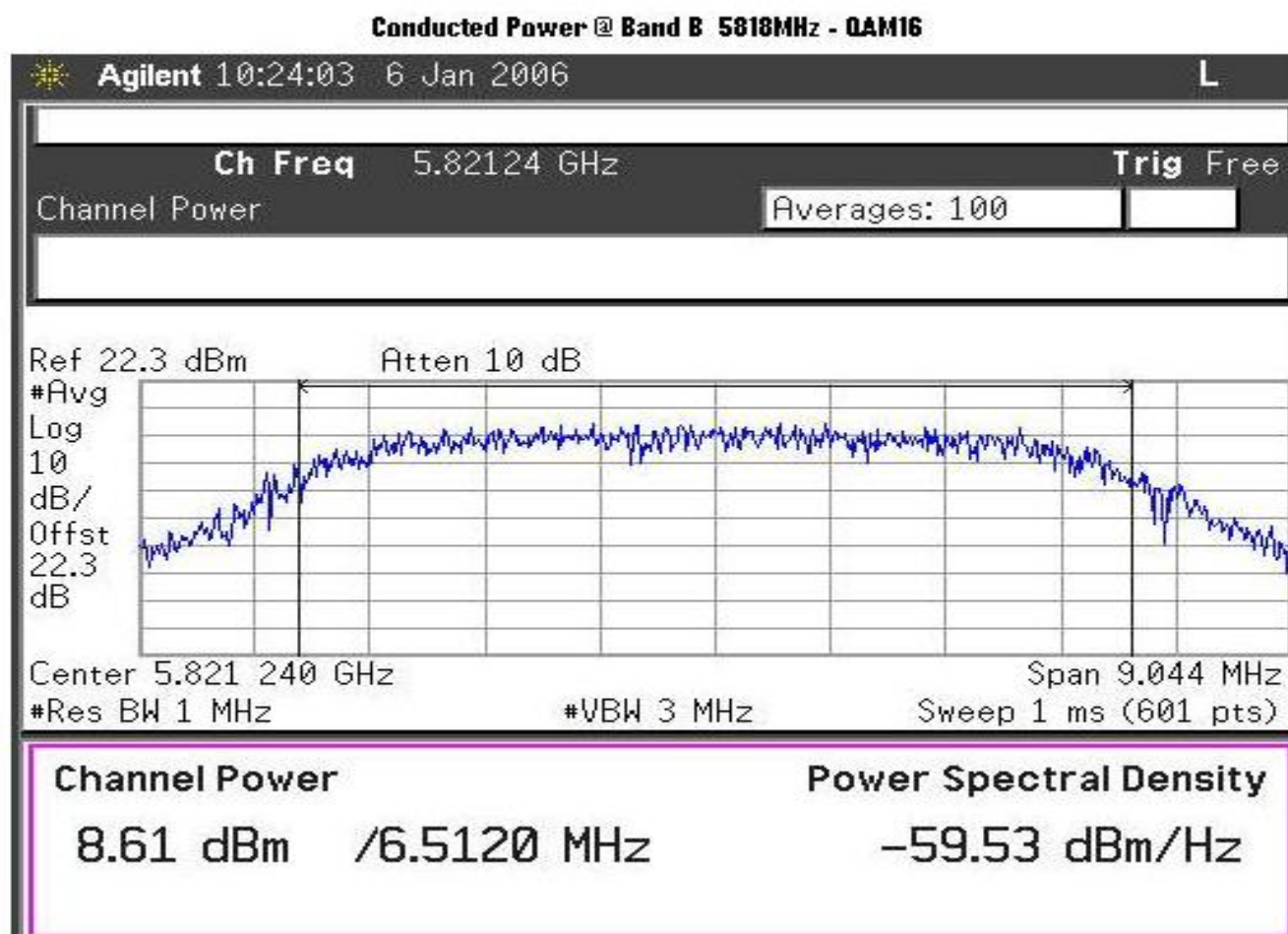


Figure 4-15. RF Peak Power, High Channel – QAM-16

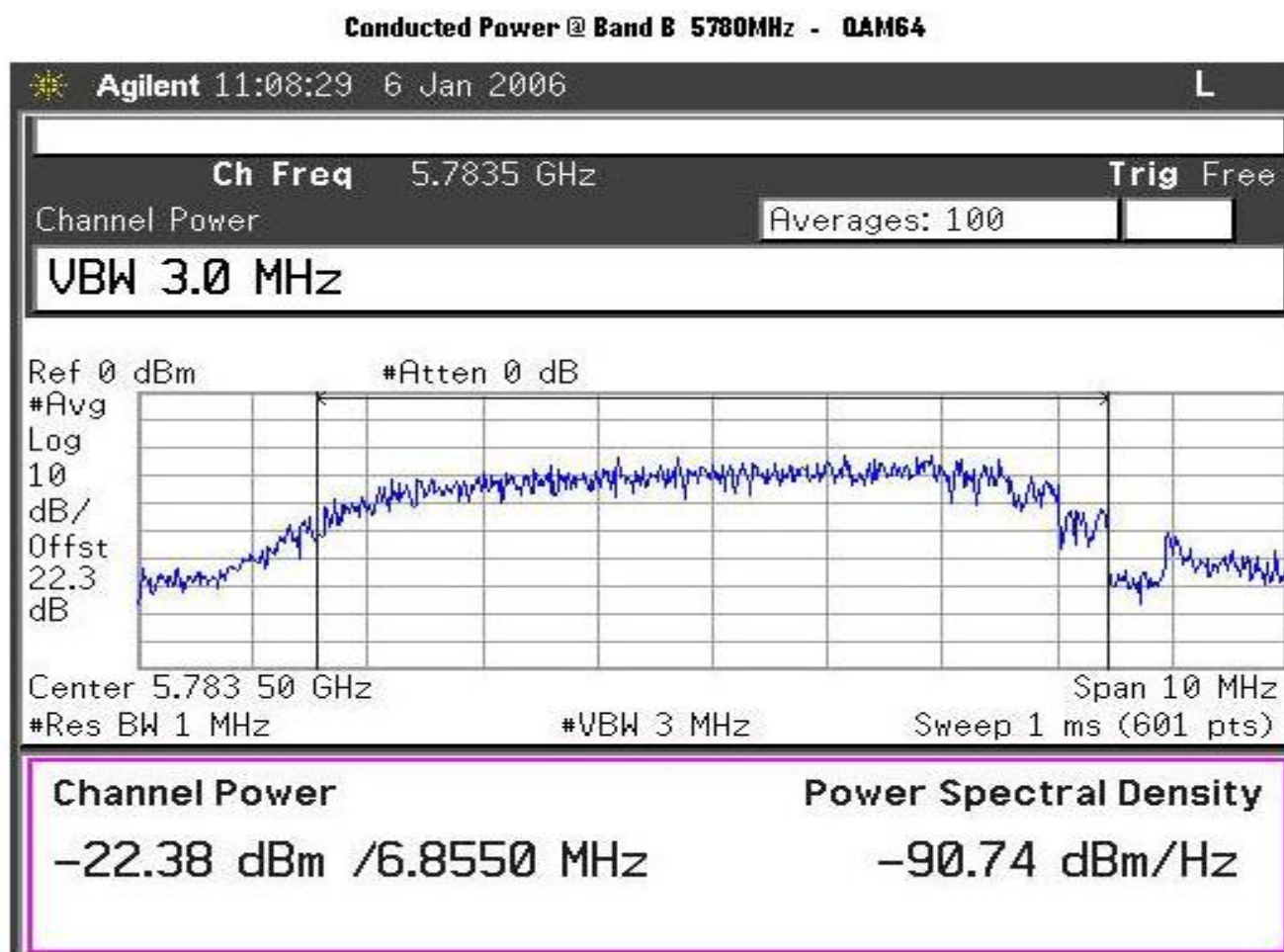


Figure 4-16. RF Peak Power, Low Channel – QAM-64

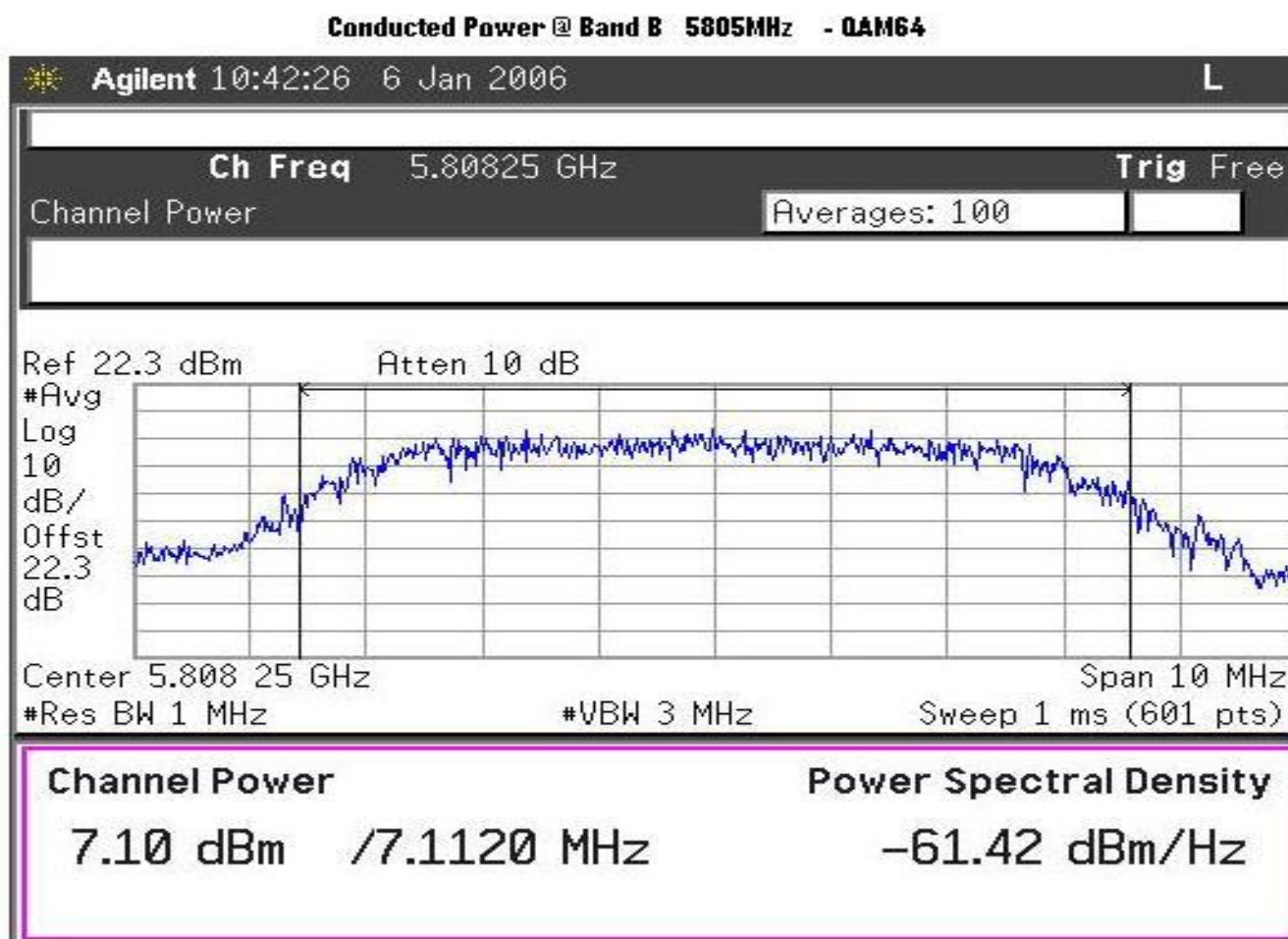


Figure 4-17. RF Peak Power, Mid Channel – QAM-64

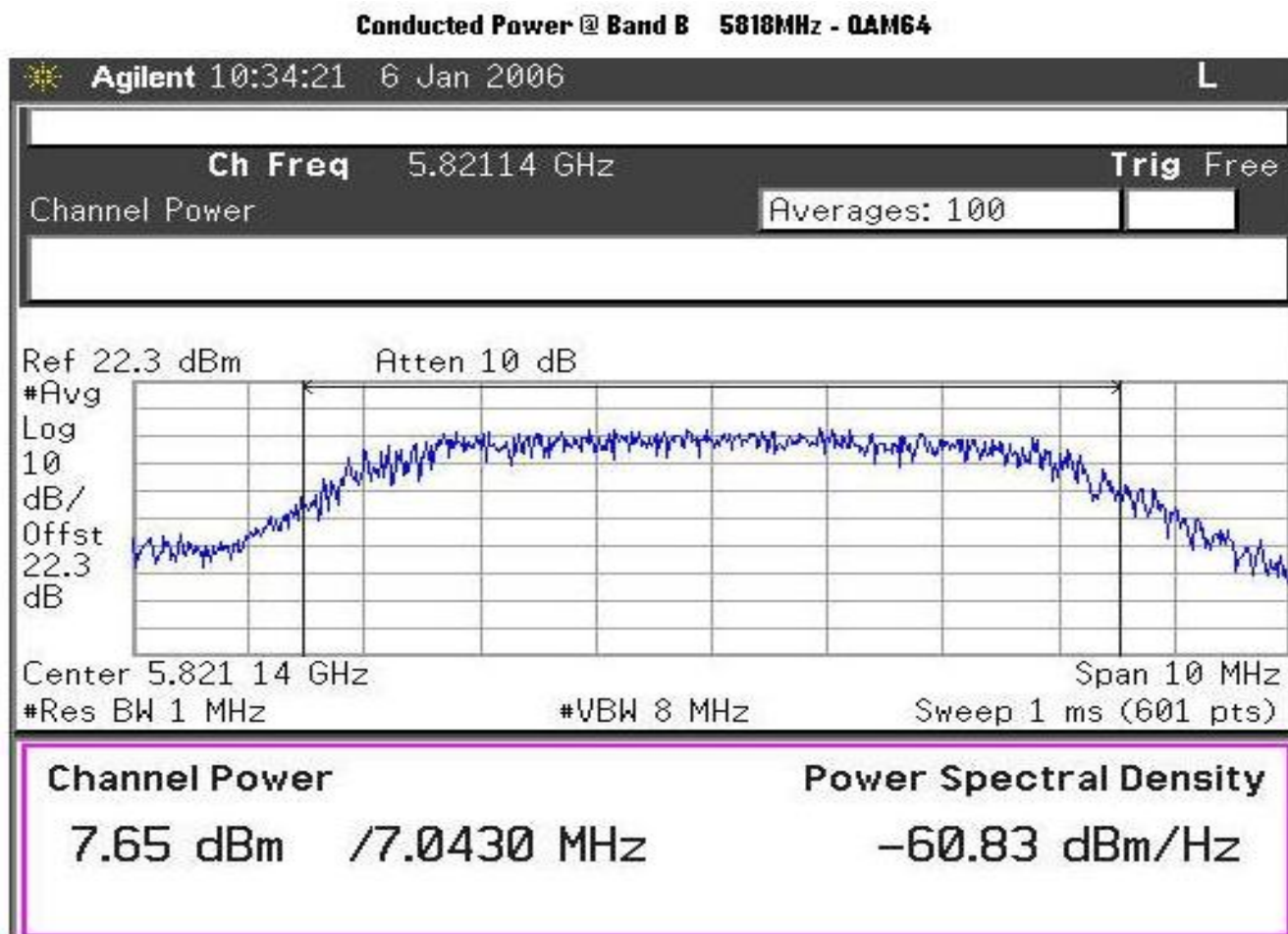


Figure 4-18. RF Peak Power, High Channel – QAM-64

#### 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 5780MHz	-14.14 dBm	17 dBm	Pass
Mid Channel 5805MHz	15.6 dBm	17 dBm	Pass
High Channel 5818MHz	16.0 dBm	17 dBm	Pass

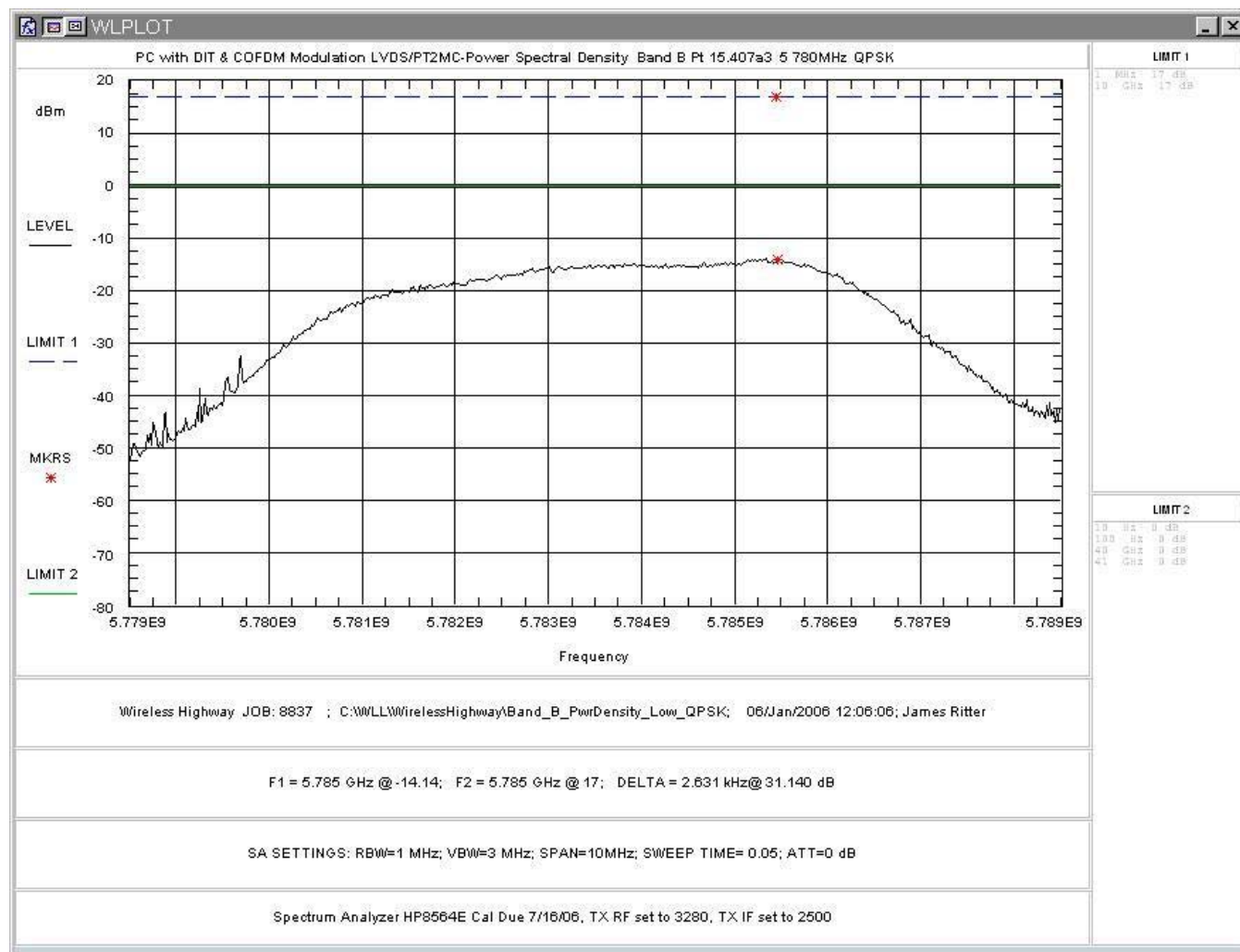
**Table 10. Peak Power Spectral Density – QAM-16**

Frequency	Level	Limit	Pass/Fail
Low Channel 5780MHz	-14.64 dBm	17 dBm	Pass
Mid Channel 5805MHz	13.7 dBm	17 dBm	Pass
High Channel 5818MHz	14.83 dBm	17 dBm	Pass

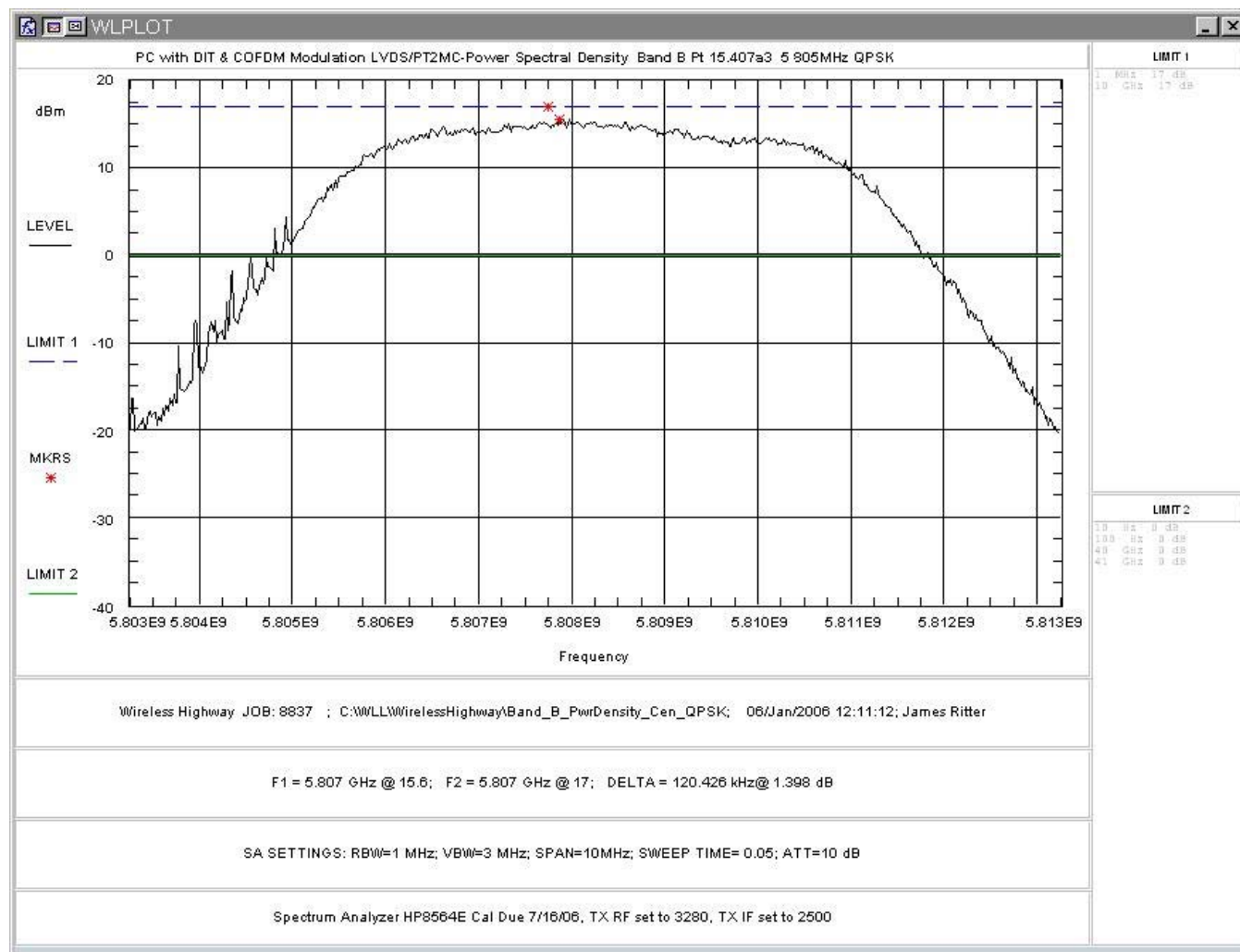
**Table 11. Peak Power Spectral Density – QAM-64**

Frequency	Level	Limit	Pass/Fail
Low Channel 5780MHz	-13.92 dBm	17 dBm	Pass
Mid Channel 5805MHz	14.66 dBm	17 dBm	Pass
High Channel 5818MHz	14.83 dBm	17 dBm	Pass





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



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



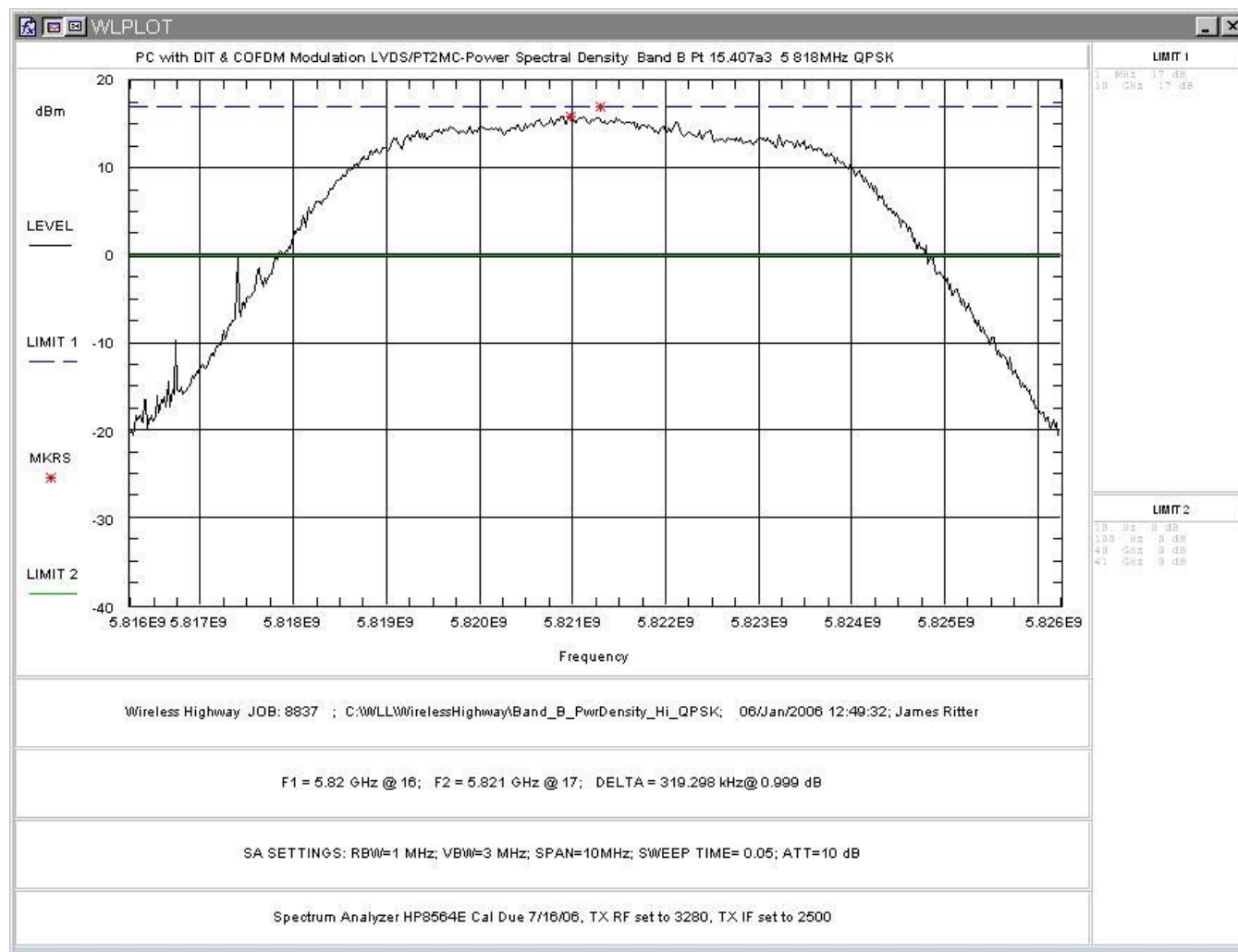


Figure 4-21. Peak Power Spectral Density, High Channel – QPSK

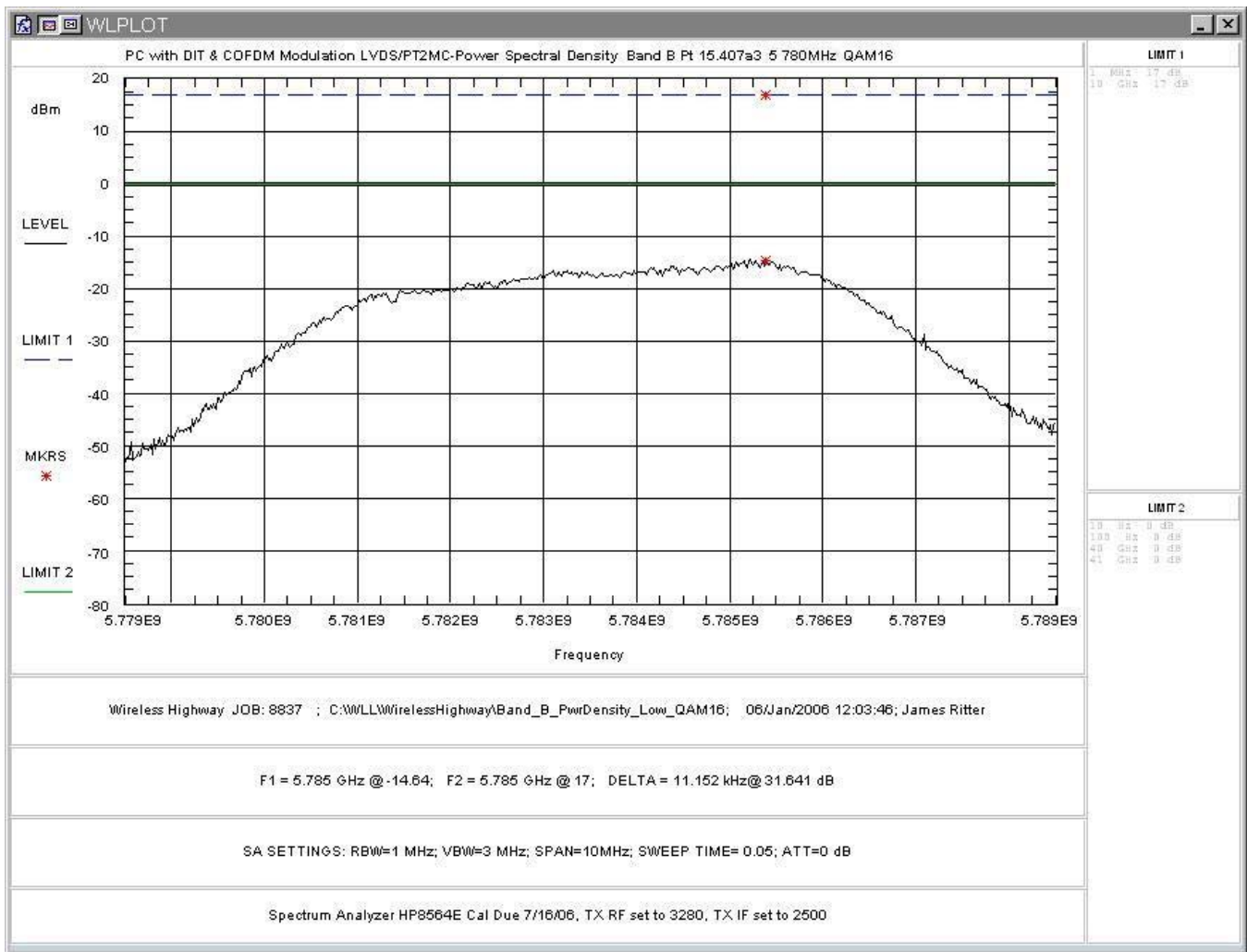
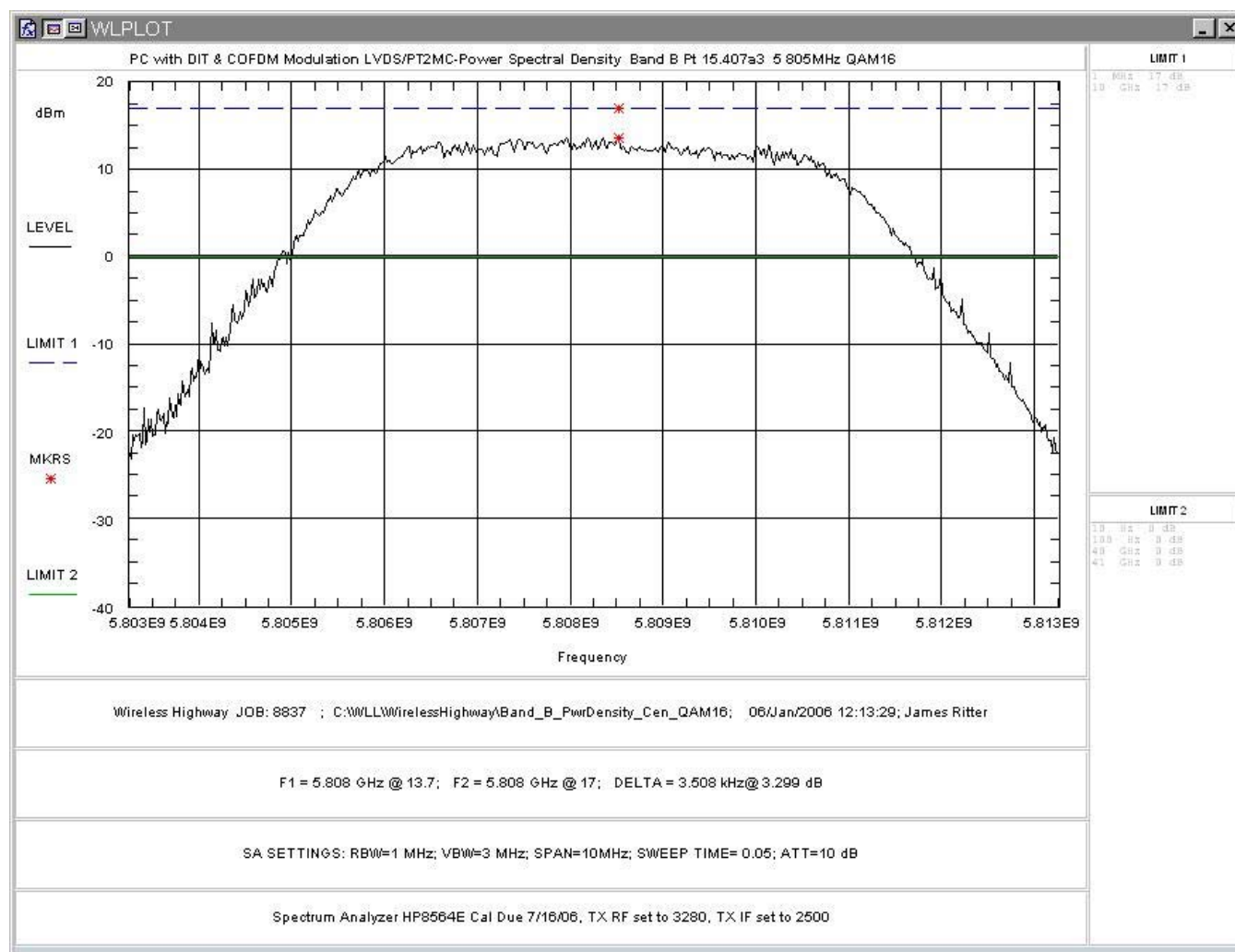
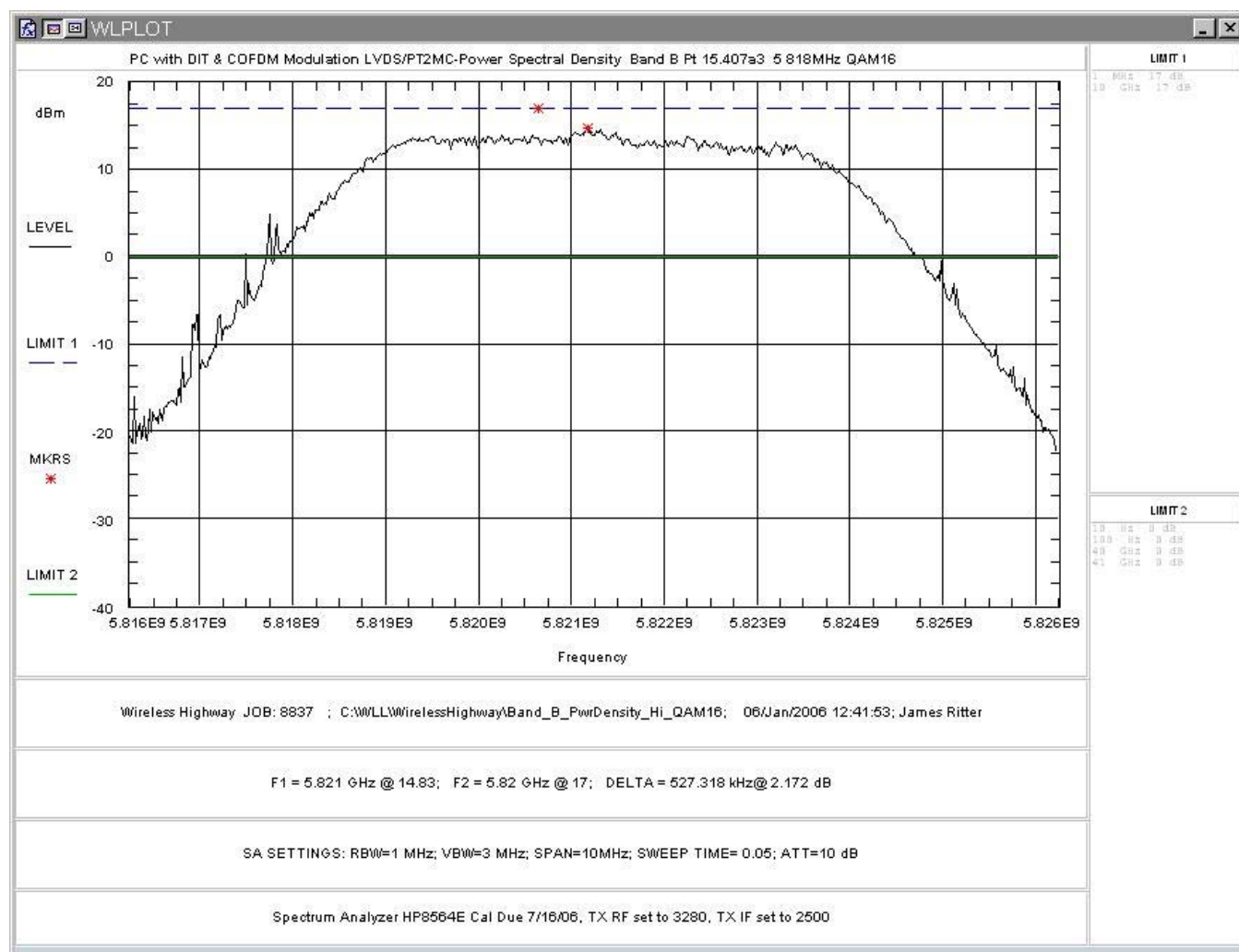


Figure 4-22. Peak Power Spectral Density, Low Channel – QAM-16



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



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

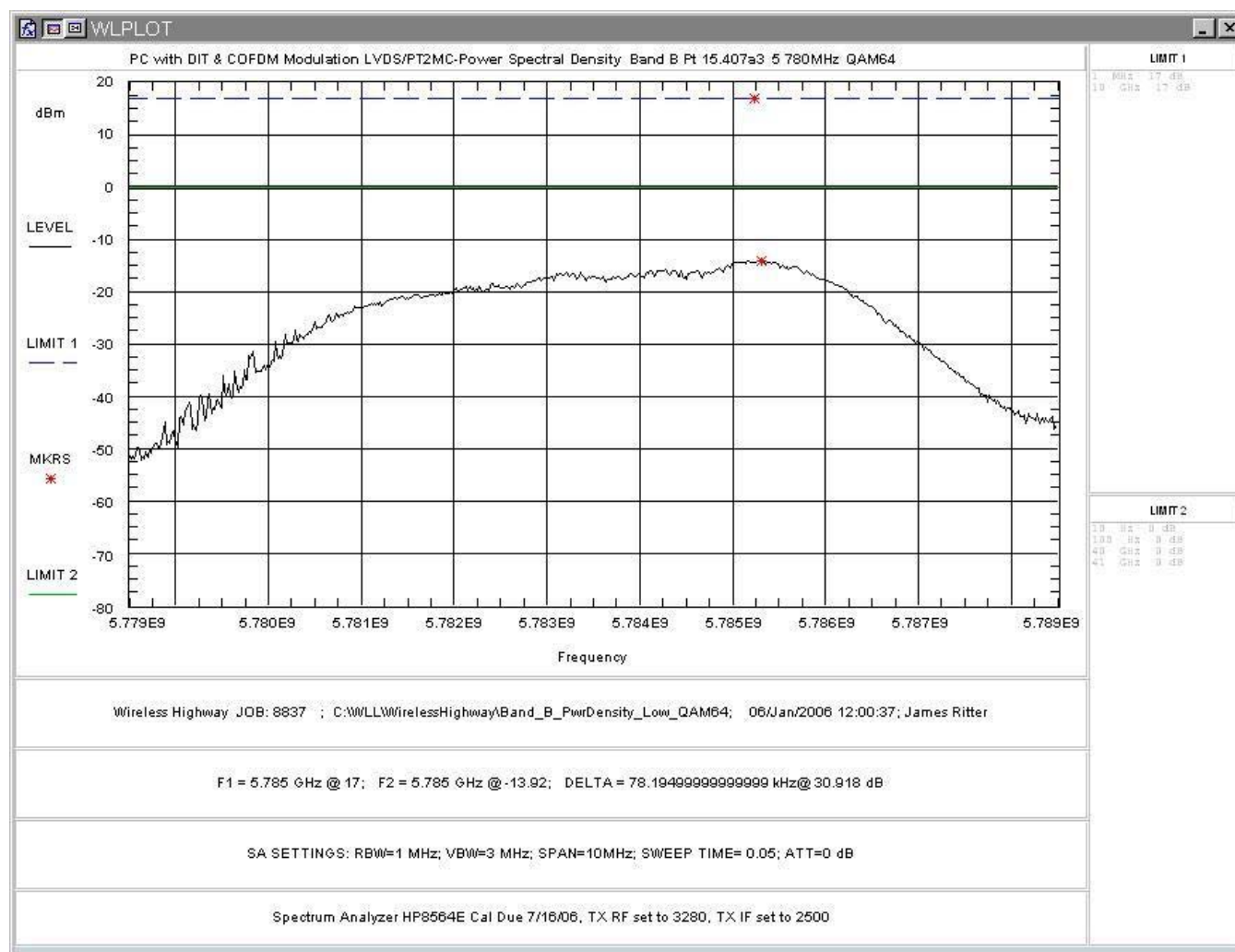
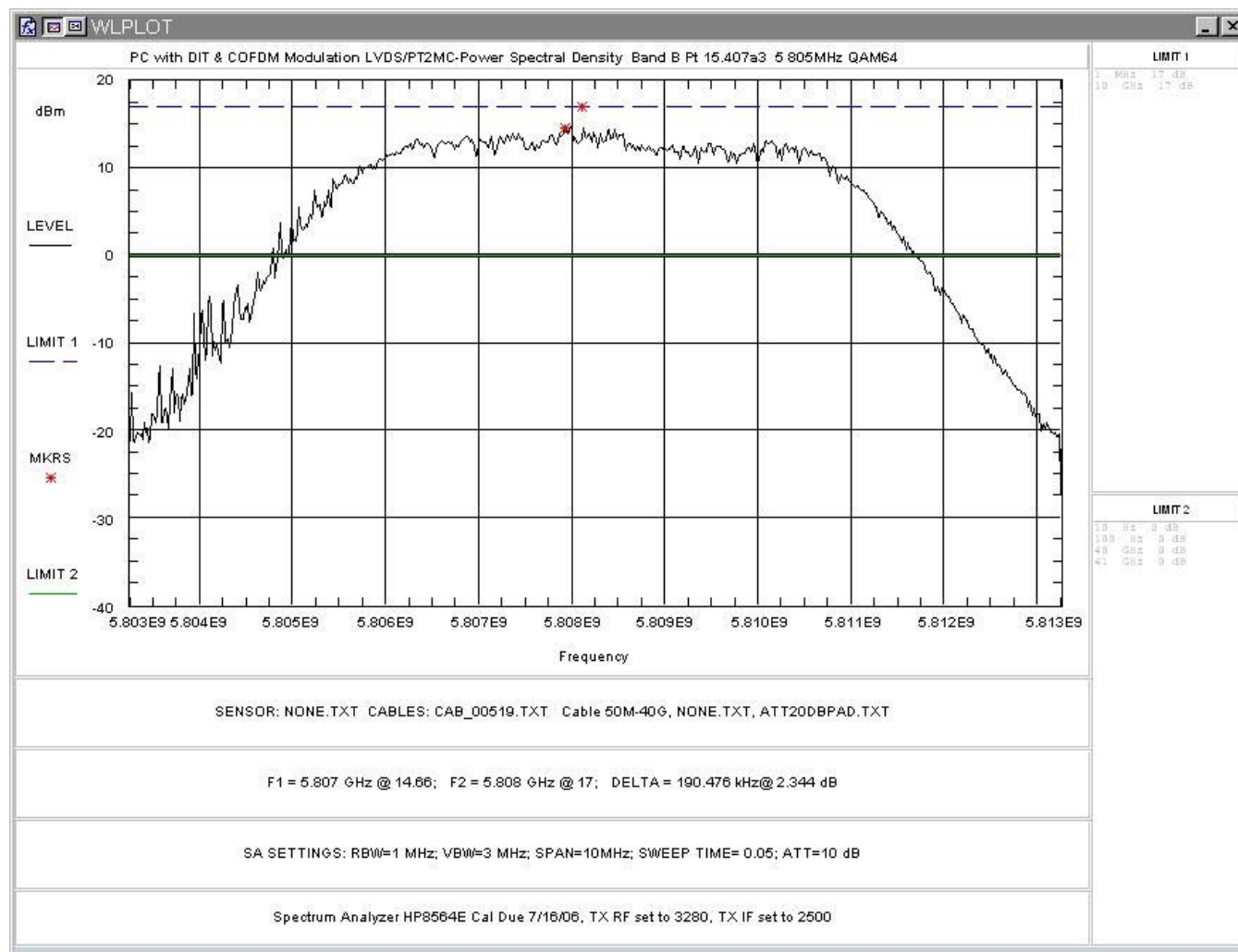
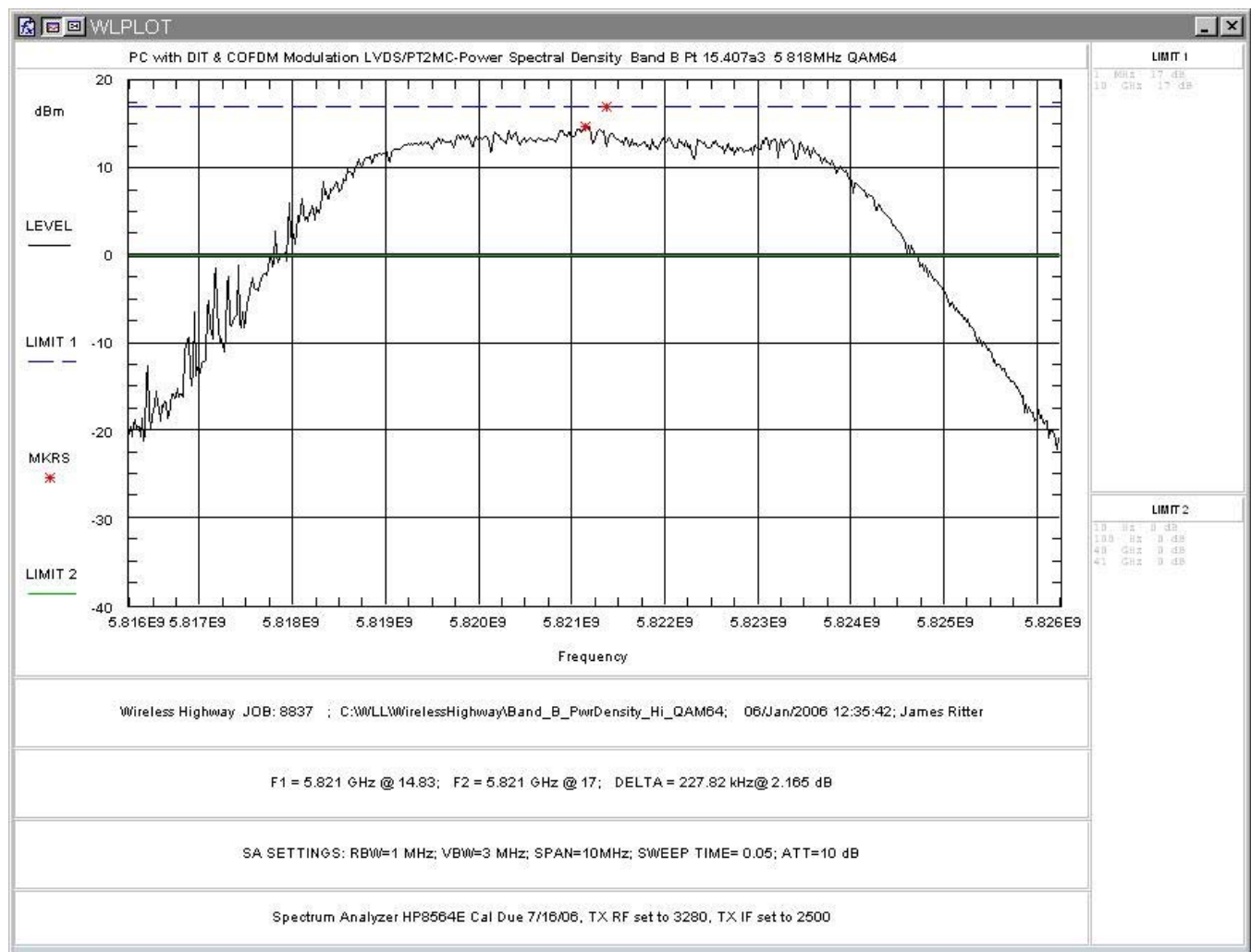


Figure 4-25. Peak Power Spectral Density, Low Channel – QAM-64



**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 5780MHz	10.16 dB	13 dB	Pass
Mid Channel 5805MHz	10.64 dB	13 dB	Pass
High Channel 5818MHz	12.56 dB	13 dB	Pass

**Table 13. Peak Excursion – QAM-16**

Frequency	Level	Limit	Pass/Fail
Low Channel 5780MHz	11.45 dB	13 dB	Pass
Mid Channel 5805MHz	12.19 dB	13 dB	Pass
High Channel 5818MHz	11.08 dB	13 dB	Pass

**Table 14. Peak Excursion – QAM-64**

Frequency	Level	Limit	Pass/Fail
Low Channel 5780MHz	10.93 dB	13 dB	Pass
Mid Channel 5805MHz	11.54 dB	13 dB	Pass
High Channel 5818MHz	10.91 dB	13 dB	Pass



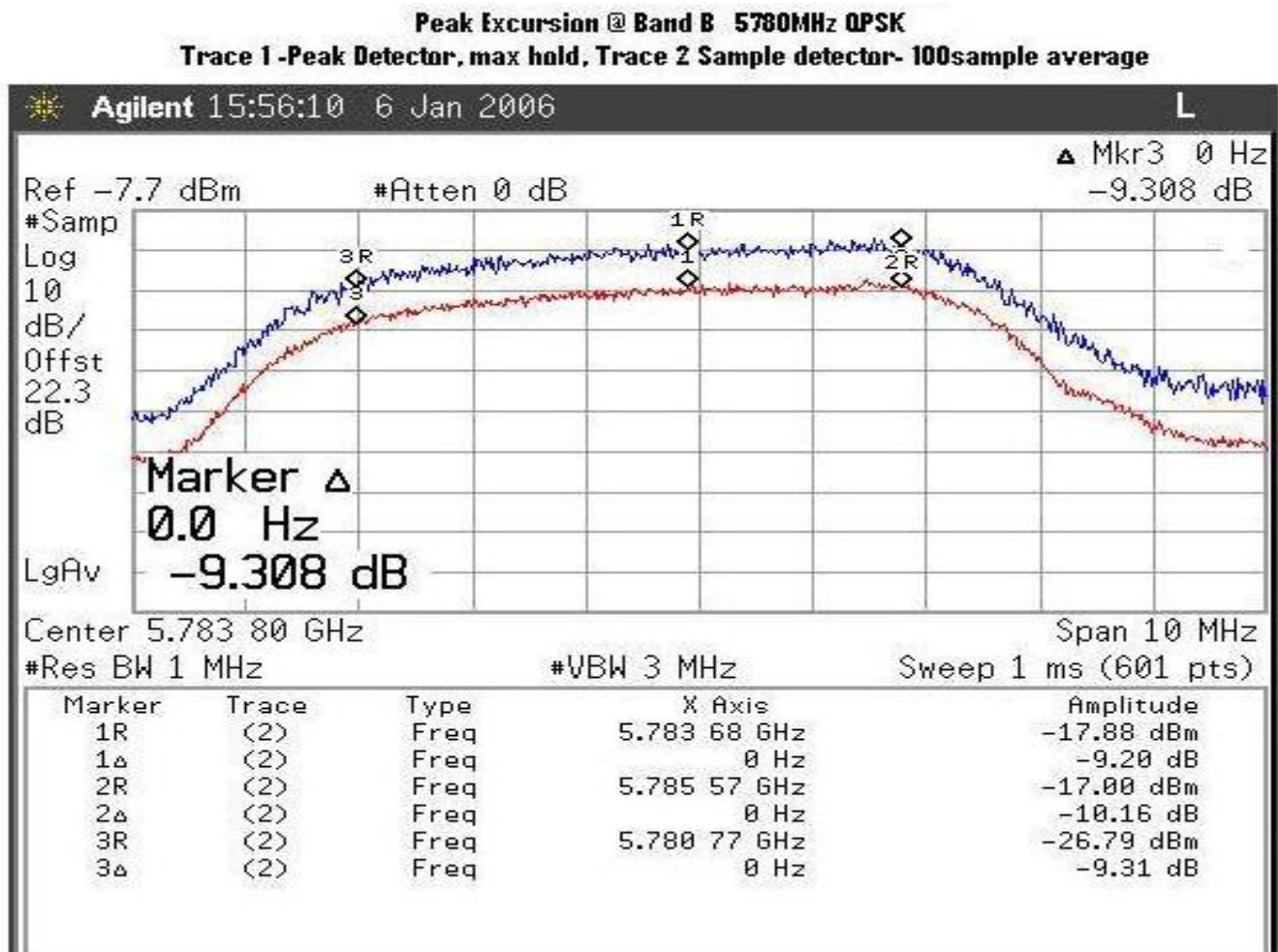


Figure 4-28. Peak Excursion, Low Channel – QPSK

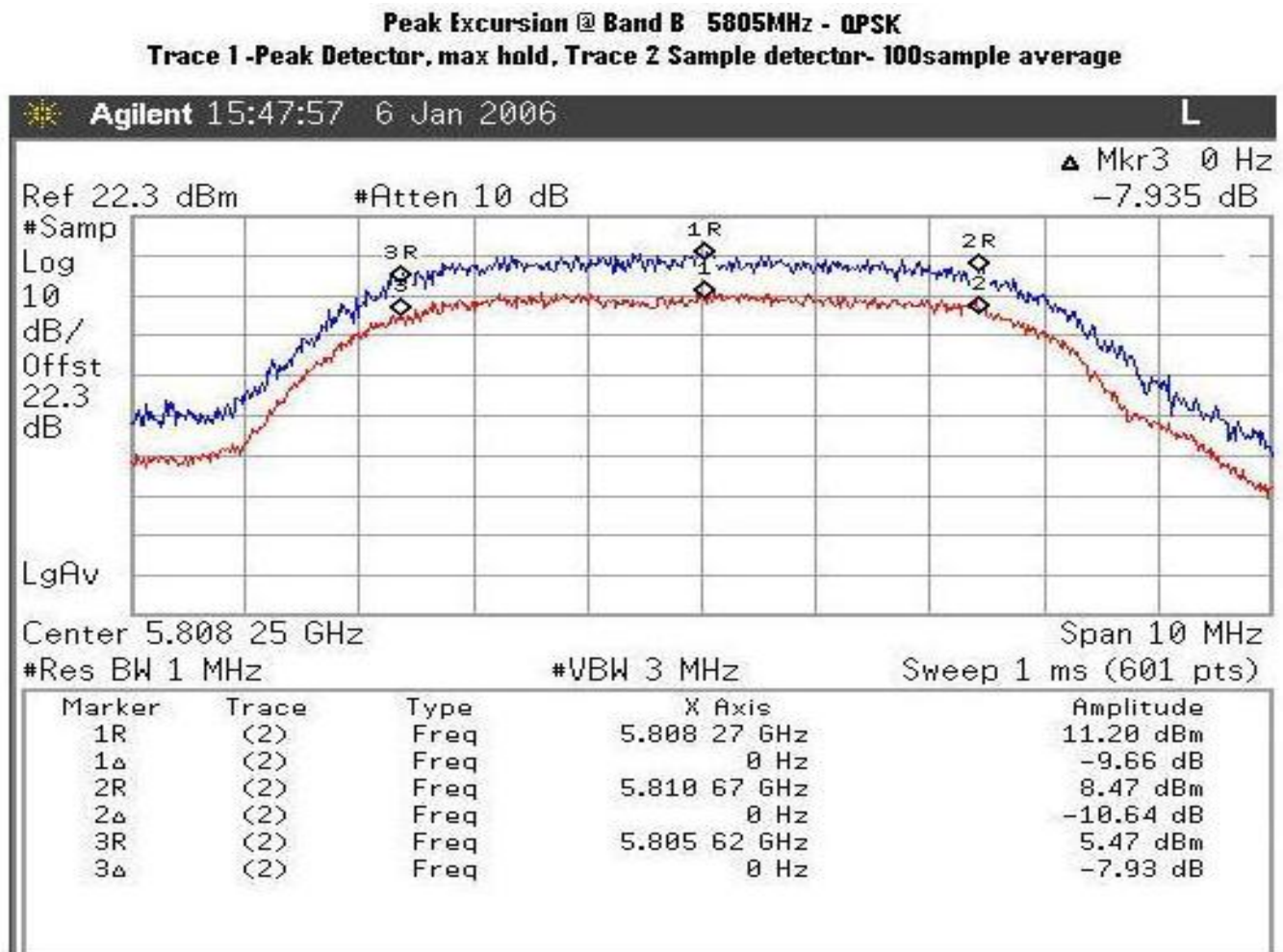


Figure 4-29. Peak Excursion, Mid Channel – QPSK

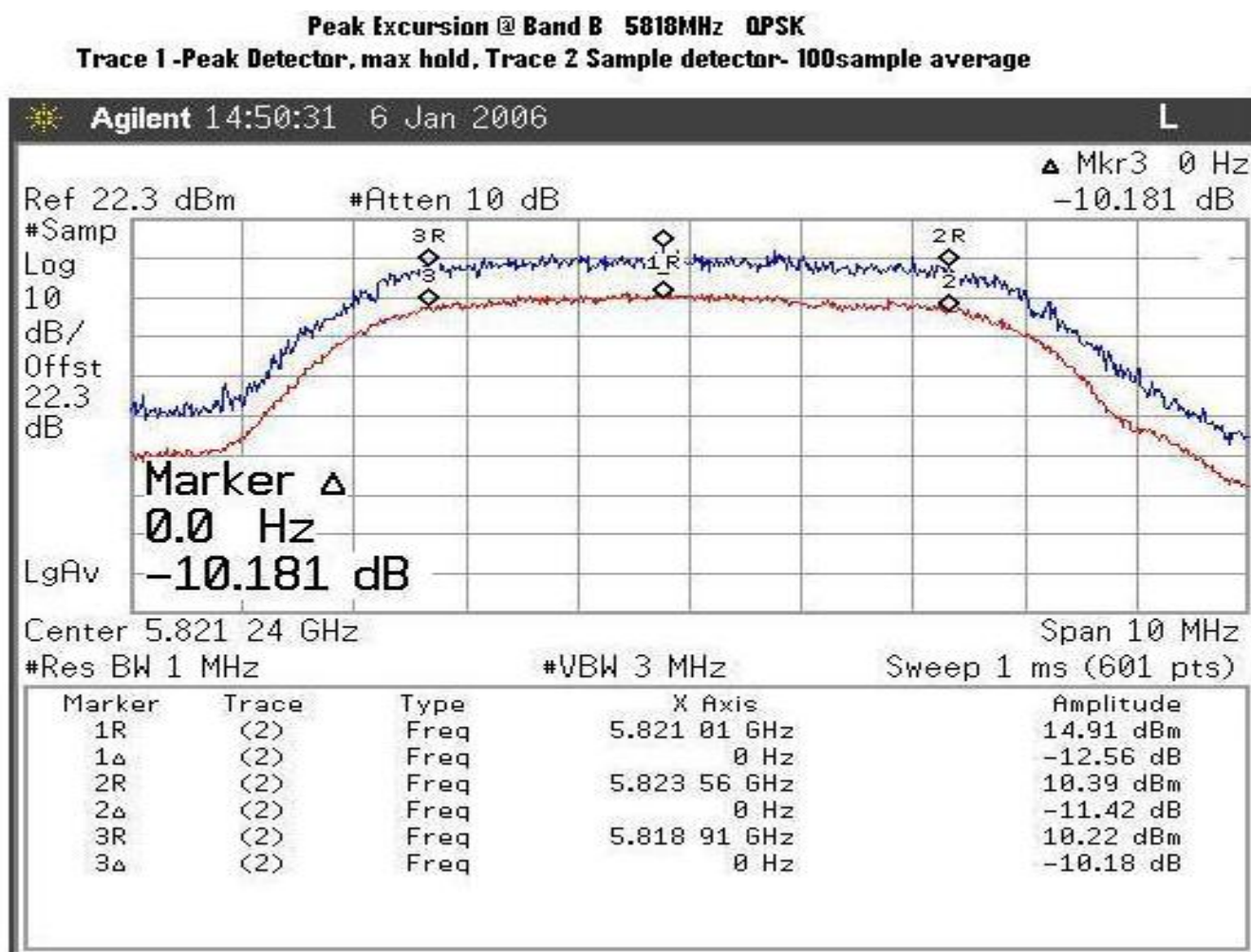


Figure 4-30. Peak Excursion, High Channel – QPSK

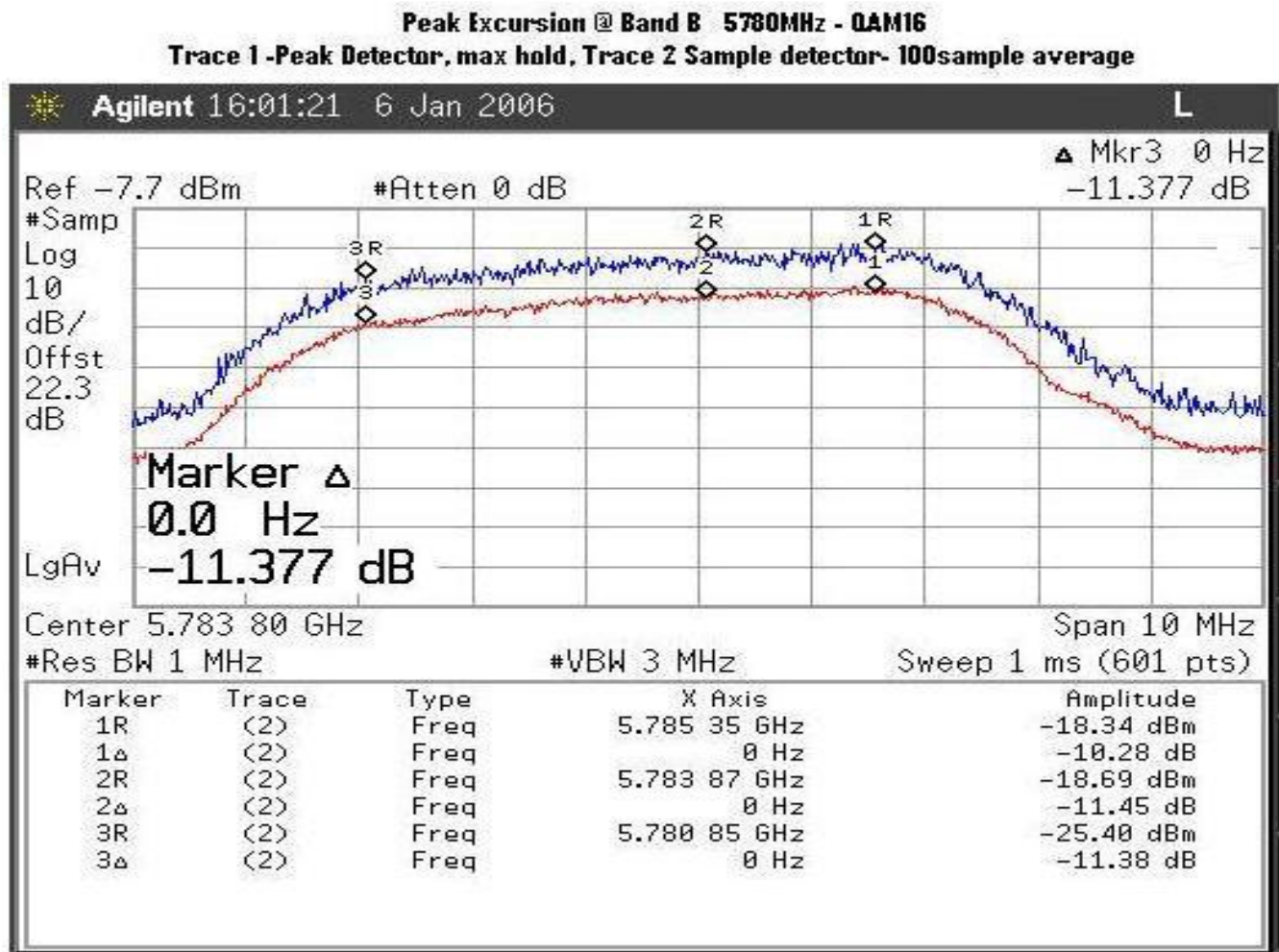


Figure 4-31. Peak Excursion, Low Channel – QAM-16

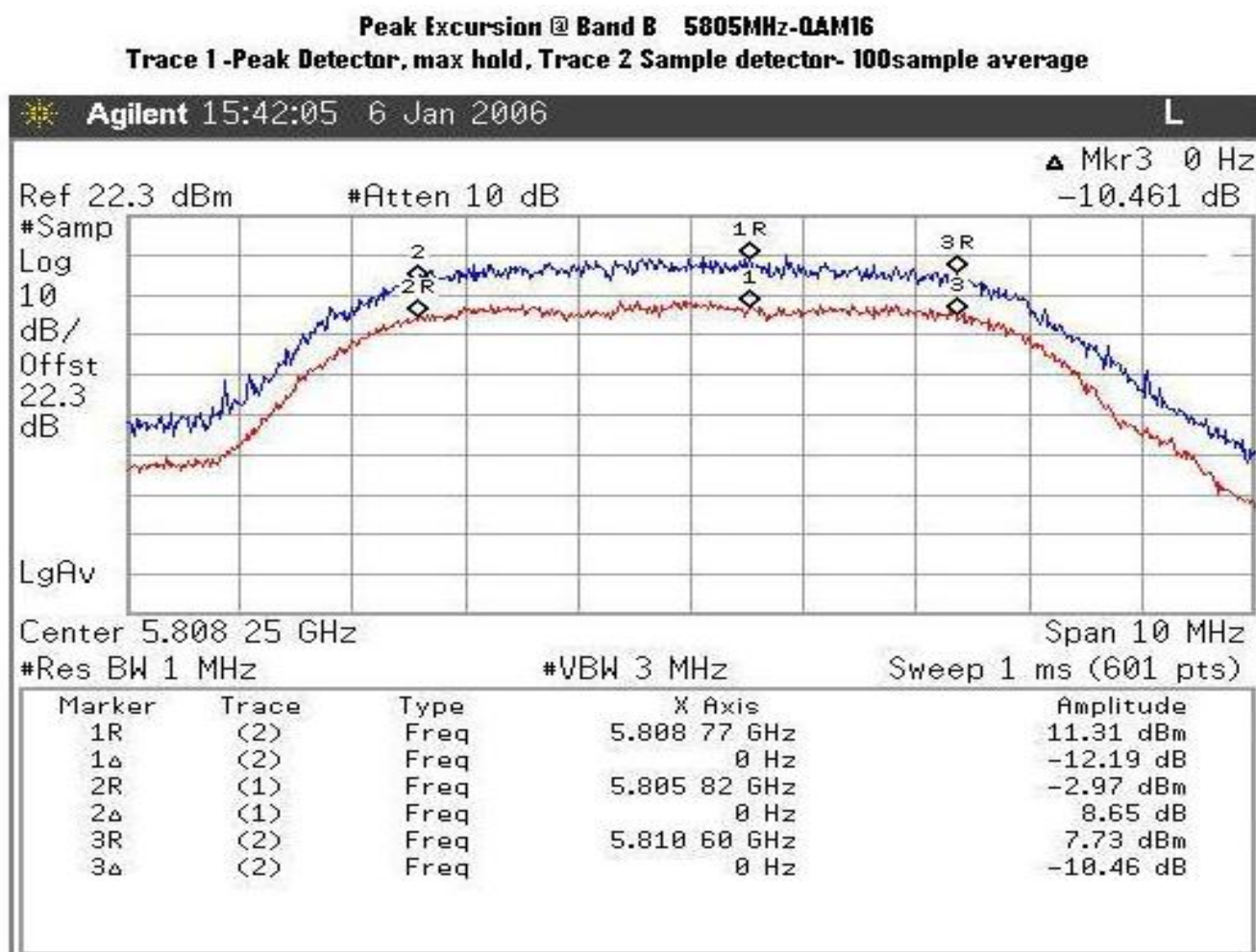


Figure 4-32. Peak Excursion, Mid Channel – QAM-16



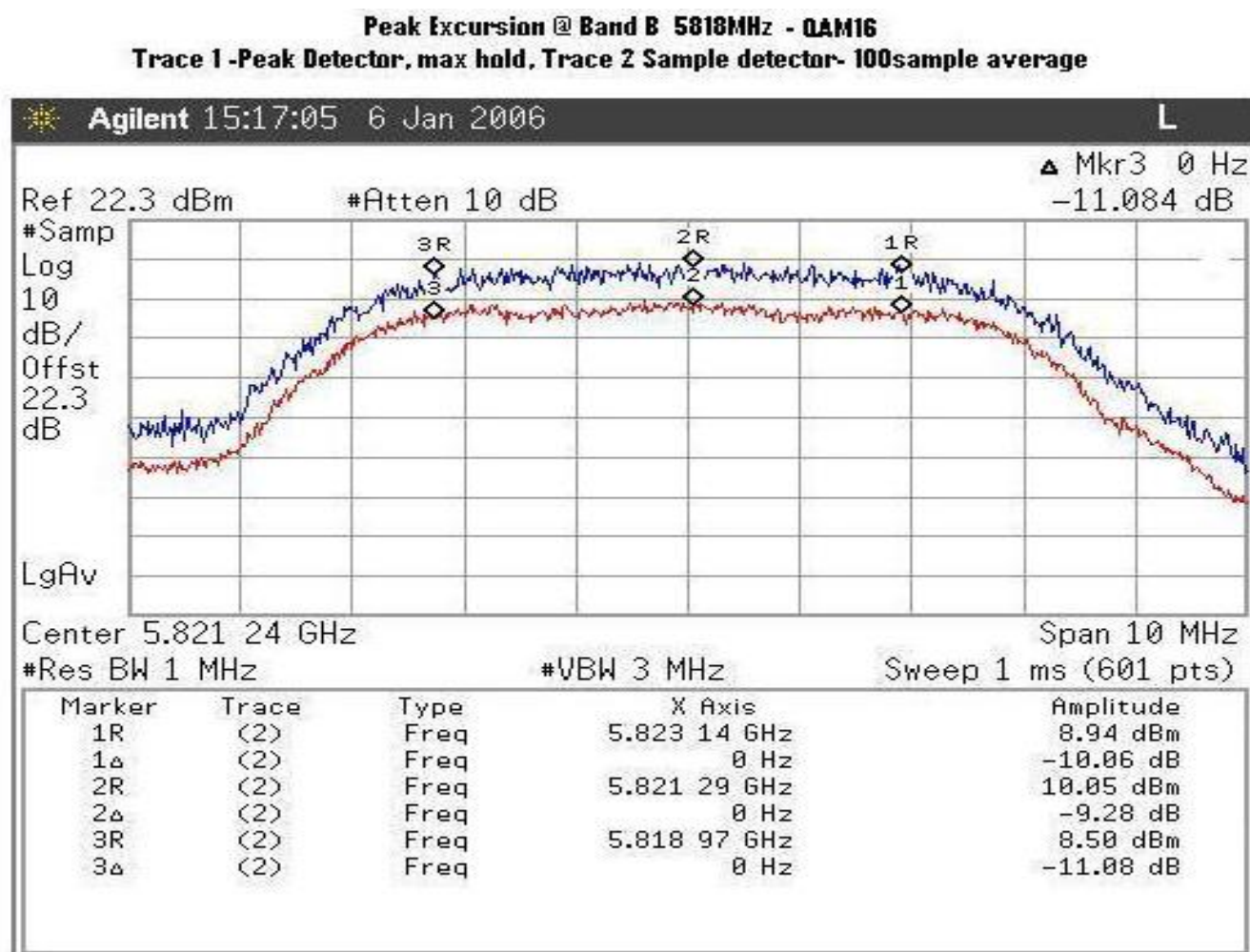


Figure 4-33. Peak Excursion, High Channel – QAM-16

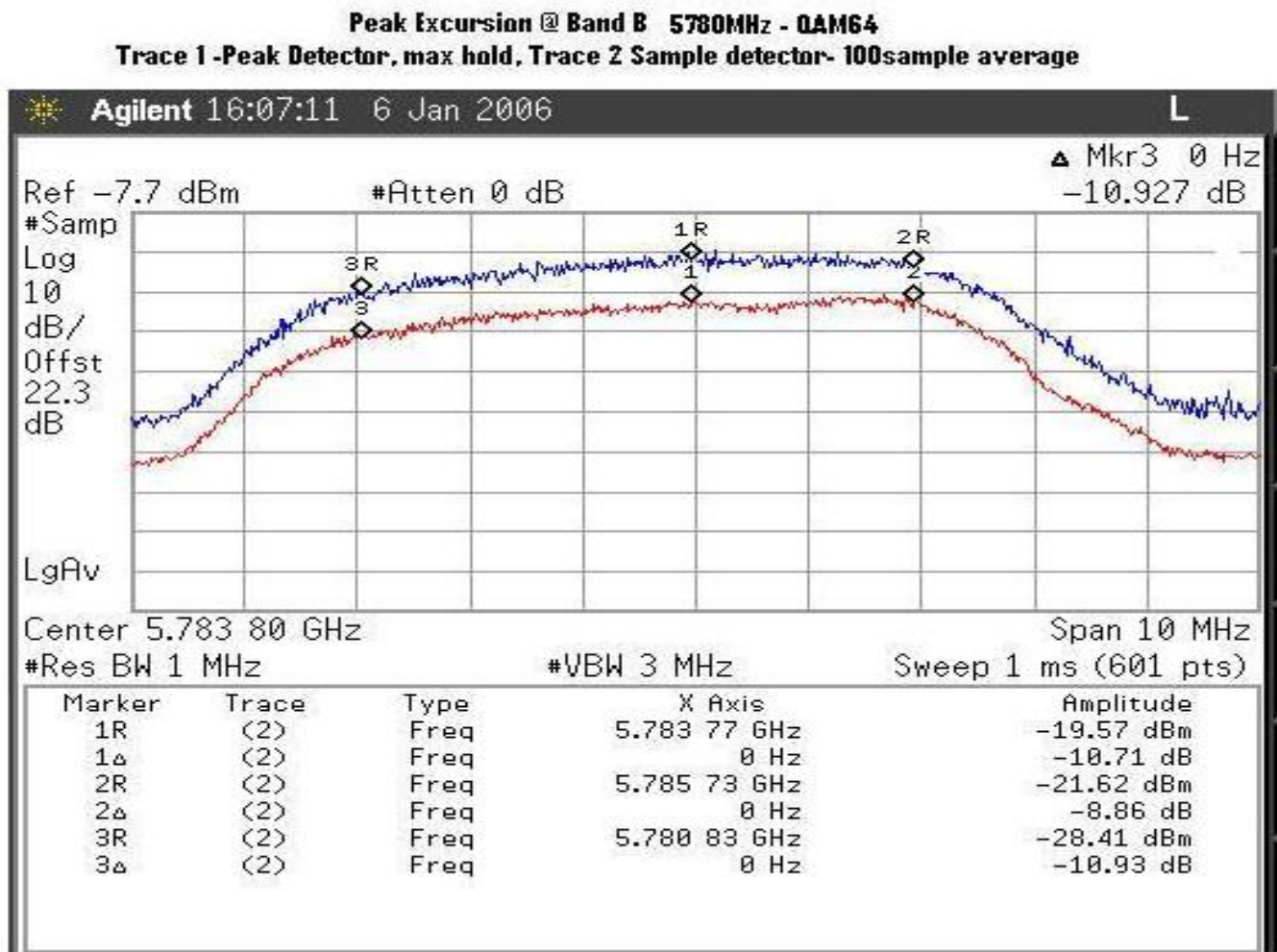
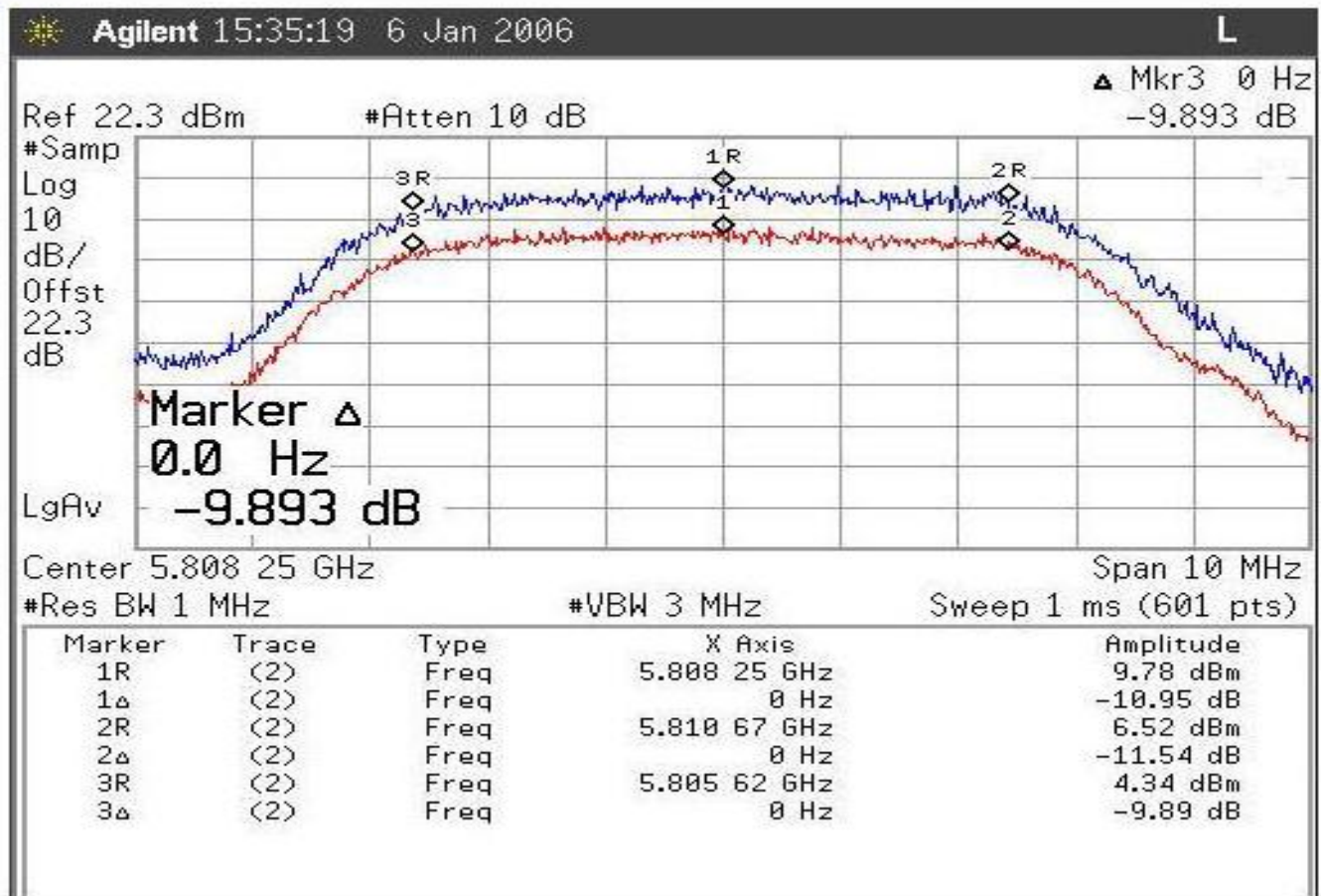


Figure 4-34. Peak Excursion, Low Channel – QAM-64

**Peak Excursion @ Band B 5805MHz - QAM64**  
**Trace 1 -Peak Detector, max hold, Trace 2 Sample detector- 100sample average**



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



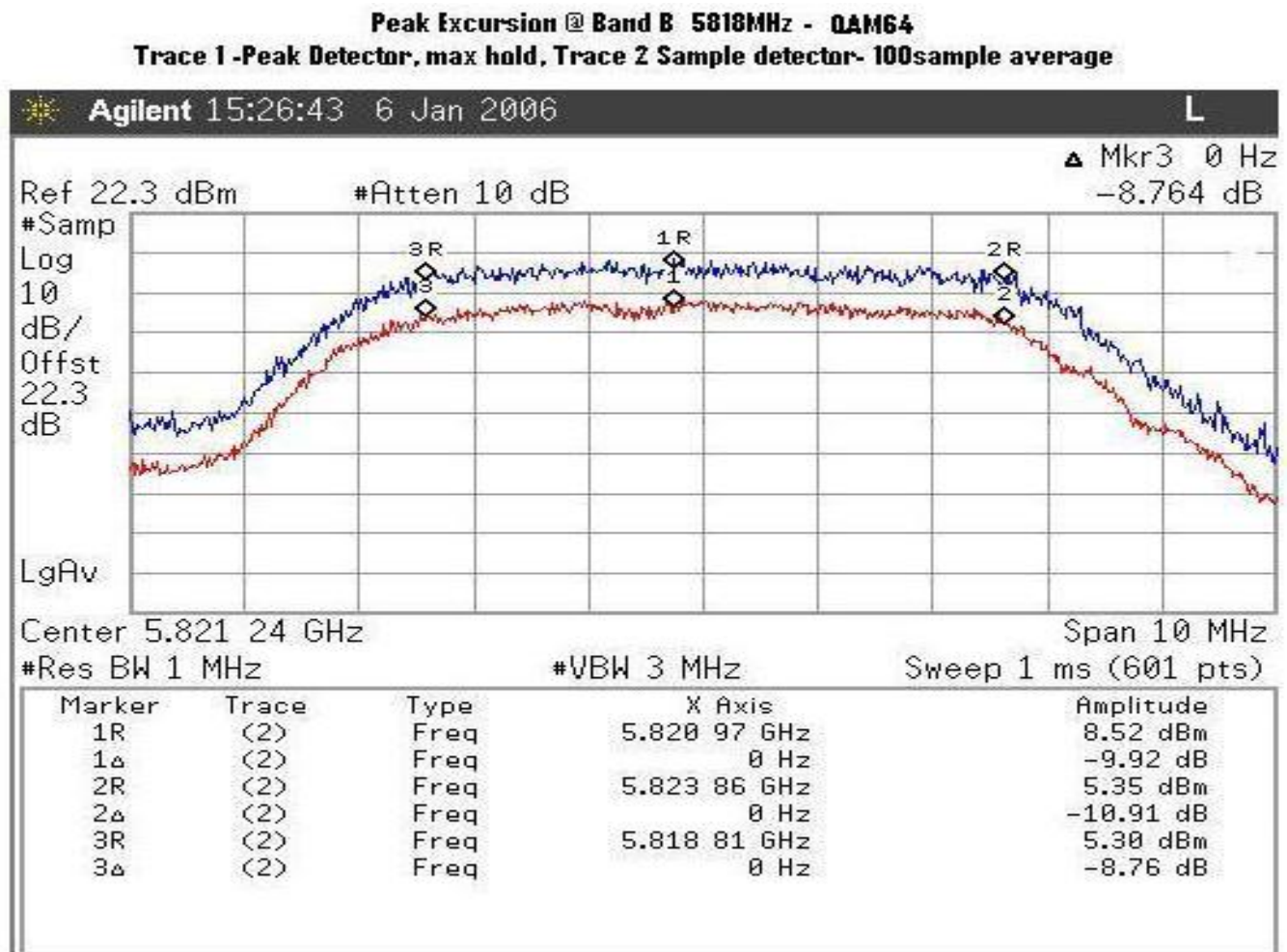


Figure 4-36. Peak Excursion, High Channel – QAM-64

#### 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	Polarity	Az	Ant. Hght	SA Level (QP)	Ant. Corr.	Cable Corr.	Corr. Level	Corr. Level	Limit	Margin
(MHz)	H/V	Deg	(m)	(dBμV)	(dB/m)	(dB)	(dBμV/m)	(μV/m)	(μV/m)	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	Pol	Az	Ant. Hght	Spurious Level	Sub. Sig. Gen. Level	Sub. Power Level	Sub. Ant. Factor	Sub. Ant. Gain	EIRP Level	Limit	Margin
(MHz)	H/V	Deg	(m)	dBμV	dBm	dBm	dB/m	dBi	dBm	dBm	dB
<b>band edge</b>											
5715.00	H	10.0	1.0	48.1	-33.5	-48.50	38.1	7.2	-41.3	-27.0	-14.3
5725.00	H	25.0	1.0	47.5	-35.3	-50.50	38.1	7.2	-43.3	-17.0	-26.3
5825.00	H	0.0	1.0	47.5	-34.7	-50.00	38.3	7.3	-42.7	-17.0	-25.7
5828.16	H	10.0	1.0	49.2	-32.6	-48.00	38.3	7.3	-40.7	-17.0	-23.7
5835.00	H	0.0	1.0	48.8	-32.4	-47.60	38.3	7.3	-40.3	-27.0	-13.3
<b>non edge</b>											
1100.75	H	180.0	1.0	52.5	-51.4	-55.80	24.9	6.1	-49.7	-27.0	-22.7
1113.67	H	90.0	1.0	53.9	-50.0	-54.50	25.0	6.1	-48.4	-27.0	-21.4
1450.12	H	180.0	1.0	50.3	-50.5	-55.80	27.5	6.0	-49.8	-27.0	-22.8
1599.90	H	200.0	1.0	54.5	-49.7	-55.30	28.4	5.9	-49.4	-27.0	-22.4
1664.08	H	190.0	1.0	52.3	-53.5	-59.30	28.8	5.9	-53.4	-27.0	-26.4
1801.13	H	165.0	1.0	51.7	-54.7	-61.00	29.5	5.8	-55.2	-27.0	-28.2
2417.07	H	22.0	1.0	54.5	-39.9	-47.50	32.6	5.3	-42.2	-27.0	-15.2
2500.00	H	180.0	1.0	59.2	-36.3	-44.10	33.0	5.2	-38.9	-27.0	-11.9
11564.00	H	0.0	1.0	48.2	NA	NA	NA	NA	NA	-27.0	<b>amb</b>
<b>band edge</b>											
5715.00	V	180.0	1.0	48.3	-33.9	-49.00	38.1	7.2	-41.8	-27.0	-14.8
5725.00	V	25.0	1.0	48.7	-34.4	-49.50	38.1	7.2	-42.3	-17.0	-25.3
5825.00	V	10.0	1.0	51.7	-30.0	-45.33	38.3	7.3	-38.1	-17.0	-21.1
5828.16	V	10.0	1.0	46.2	-35.6	-51.10	38.3	7.3	-43.8	-17.0	-26.8
5835.00	V	12.0	1.0	50.7	-29.9	-45.33	38.3	7.3	-38.1	-27.0	-11.1
<b>non edge</b>											
1100.75	V	10.0	1.0	54.2	-53.2	-57.60	24.9	6.1	-51.5	-27.0	-24.5
1113.67	V	15.0	1.0	53.2	-54.3	-58.80	25.0	6.1	-52.7	-27.0	-25.7
1450.12	V	170.0	1.0	51.8	-50.8	-56.00	27.5	6.0	-50.0	-27.0	-23.0
1599.90	V	10.0	1.0	49.3	-57.1	-62.60	28.4	5.9	-56.7	-27.0	-29.7
1664.08	V	180.0	1.0	52.3	-53.9	-59.80	28.8	5.9	-53.9	-27.0	-26.9
1801.13	V	0.0	1.0	57.3	-41.8	-48.00	29.5	5.8	-42.2	-27.0	-15.2
2417.07	V	270.0	1.0	54.2	-43.2	-50.80	32.6	5.3	-45.5	-27.0	-18.5
2500.00	V	180.0	1.0	57.3	-40.0	-47.83	33.0	5.2	-42.7	-27.0	-15.7
11564.00	V	0.0	1.0	49.0	NA	NA	NA	NA	NA	-27.0	<b>amb</b>

**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
<b>band edge</b>											
5715.00	H	0.0	1.0	46.2	-36.5	-51.40	38.1	7.2	-44.2	-27.0	-17.2
5725.00	H	0.0	1.0	46.5	-36.9	-51.60	38.1	7.2	-44.4	-17.0	-27.4
5825.00	H	10.0	1.0	49.1	-32.9	-47.00	38.3	7.3	-39.7	-17.0	-22.7
5826.16	H	0.0	1.0	52.5	-29.3	-43.50	38.3	7.3	-36.2	-17.0	-19.2
5835.00	H	10.0	1.0	48.5	-32.8	-48.33	38.3	7.3	-41.1	-27.0	-14.1
<b>non edge</b>											
1100.75	H	180.0	1.0	54.3	-50.3	-55.00	24.9	6.1	-48.9	-27.0	-21.9
1114.11	H	180.0	1.0	54.7	-49.9	-54.30	25.0	6.1	-48.2	-27.0	-21.2
1139.38	H	110.0	1.0	52.6	-53.8	-58.50	25.2	6.1	-52.4	-27.0	-25.4
1450.12	H	190.0	1.0	50.3	-51.4	-56.50	27.5	6.0	-50.5	-27.0	-23.5
1599.90	H	180.0	1.0	49.6	-55.0	-60.60	28.4	5.9	-54.7	-27.0	-27.7
1664.08	H	190.0	1.0	52.1	-53.9	-59.60	28.8	5.9	-53.7	-27.0	-26.7
1843.45	H	180.0	1.0	51.3	-54.1	-60.80	29.7	5.8	-55.0	-27.0	-28.0
2417.07	H	145.0	1.0	52.1	-41.5	-49.00	32.6	5.3	-43.7	-27.0	-16.7
2500.00	H	0.0	1.0	59.7	-33.6	-41.33	33.0	5.2	-36.2	-27.0	-9.2
11612.50	H	0.0	1.0	48.9	NA	NA	NA	NA	NA	-27.0	<b>amb</b>
<b>band edge</b>											
5715.00	V	10.0	1.0	46.3	-35.9	-51.10	38.1	7.2	-43.9	-27.0	-16.9
5725.00	V	10.0	1.0	46.7	-35.8	-50.83	38.1	7.2	-43.6	-17.0	-26.6
5825.00	V	0.0	1.0	50.0	-32.1	-46.10	38.3	7.3	-38.8	-17.0	-21.8
5826.16	V	0.0	1.0	53.7	-28.5	-42.60	38.3	7.3	-35.3	-17.0	-18.3
5835.00	V	0.0	1.0	51.8	-29.8	-45.33	38.3	7.3	-38.1	-27.0	-11.1
<b>non edge</b>											
1100.75	V	165.0	1.0	56.0	-51.8	-56.80	24.9	6.1	-50.7	-27.0	-23.7
1114.11	V	45.0	1.0	53.2	-54.3	-58.50	25.0	6.1	-52.4	-27.0	-25.4
1139.38	V	0.0	1.0	53.3	-55.2	-60.00	25.2	6.1	-53.9	-27.0	-26.9
1450.12	V	220.0	1.0	51.4	-51.5	-56.60	27.5	6.0	-50.6	-27.0	-23.6
1599.90	V	180.0	1.0	49.2	-57.1	-62.60	28.4	5.9	-56.7	-27.0	-29.7
1664.08	V	190.0	1.0	48.6	-57.5	-63.30	28.8	5.9	-57.4	-27.0	-30.4
1843.45	V	10.0	1.0	50.3	-47.8	-54.17	29.7	5.8	-48.4	-27.0	-21.4
2417.07	V	25.0	1.0	53.5	-44.3	-51.80	32.6	5.3	-46.5	-27.0	-19.5
2500.00	V	10.0	1.0	58.8	-38.8	-46.60	33.0	5.2	-41.4	-27.0	-14.4
11612.50	V	10.0	1.0	47.2	NA	NA	NA	NA	NA	-27.0	<b>amb</b>

**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
<b>band edge</b>											
5715.00	H	10.0	1.0	46.8	-36.5	-51.50	38.1	7.2	-44.3	-27.0	-17.3
5725.00	H	20.0	1.0	46.9	-36.8	-51.60	38.1	7.2	-44.4	-17.0	-27.4
5825.00	H	0.0	1.0	68.1	-15.0	-29.50	38.3	7.3	-22.2	-17.0	-5.2
5826.90	H	0.0	1.0	51.1	-30.5	-45.50	38.3	7.3	-38.2	-17.0	-21.2
5835.00	H	0.0	1.0	48.0	-32.8	-48.00	38.3	7.3	-40.7	-27.0	-13.7
<b>non edge</b>											
1100.75	H	190.0	1.0	52.4	-52.1	-56.50	24.9	6.1	-50.4	-27.0	-23.4
1113.67	H	170.0	1.0	54.3	-49.5	-54.70	25.0	6.1	-48.6	-27.0	-21.6
1342.30	H	190.0	1.0	57.0	-50.6	-55.70	26.8	6.0	-49.7	-27.0	-22.7
1599.90	H	180.0	1.0	54.2	-49.2	-55.60	28.4	5.9	-49.7	-27.0	-22.7
1650.07	H	190.0	1.0	51.1	-55.0	-60.80	28.7	5.9	-54.9	-27.0	-27.9
1899.97	H	180.0	1.0	52.7	-49.1	-55.60	30.0	5.8	-49.8	-27.0	-22.8
2417.07	H	190.0	1.0	54.2	-39.8	-47.60	32.6	5.3	-42.3	-27.0	-15.3
2500.00	H	190.0	1.0	60.9	-37.4	-45.33	33.0	5.2	-40.2	-27.0	-13.2
11638.30	H	0.0	1.0	48.1	NA	NA	NA	NA	NA	-27.0	<b>amb</b>
<b>band edge</b>											
5715.00	V	10.0	1.0	46.2	-35.8	-50.83	38.1	7.2	-43.6	-27.0	-16.6
5725.00	V	0.0	1.0	46.2	-36.0	-51.00	38.1	7.2	-43.8	-17.0	-26.8
5825.00	V	10.0	1.0	70.3	-14.0	-28.33	38.3	7.3	-21.1	-17.0	-4.1
5826.90	V	0.0	1.0	58.8	-24.0	-39.33	38.3	7.3	-32.1	-17.0	-15.1
5835.00	V	12.0	1.0	53.0	-27.9	-43.30	38.3	7.3	-36.0	-27.0	-9.0
<b>non edge</b>											
1100.75	V	15.0	1.0	52.3	-55.1	-59.80	24.9	6.1	-53.7	-27.0	-26.7
1113.67	V	180.0	1.0	54.0	-53.1	-57.50	25.0	6.1	-51.4	-27.0	-24.4
1342.30	V	190.0	1.0	47.3	-58.4	-63.50	26.8	6.0	-57.5	-27.0	-30.5
1599.90	V	180.0	1.0	50.2	-56.2	-61.50	28.4	5.9	-55.6	-27.0	-28.6
1650.07	V	190.0	1.0	49.3	-56.6	-62.50	28.7	5.9	-56.6	-27.0	-29.6
1899.97	V	10.0	1.0	52.0	-47.5	-54.00	30.0	5.8	-48.2	-27.0	-21.2
2417.07	V	10.0	1.0	53.1	-44.6	-52.17	32.6	5.3	-46.9	-27.0	-19.9
2500.00	V	190.0	1.0	55.1	-42.1	-50.10	33.0	5.2	-44.9	-27.0	-17.9
11638.30	V	0.0	1.0	46.8	NA	NA	NA	NA	NA	-27.0	<b>amb</b>

**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  $\Omega$ /50  $\mu$ H 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  $\Omega$  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	Cable	Limit	Level	Margin	Level	Cable	Level	Limit	Margin
QP	Loss	QP	Corr	QP	AVG	Loss	Corr	AVG	AVG
dBuV	dB	dBuV	dBuV	dB	dBuV	dB	dBuV	dBuV	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	Cable	Limit	Level	Margin	Level	Cable	Level	Limit	Margin
QP	Loss	QP	Corr	QP	AVG	Loss	Corr	AVG	AVG
dBuV	dB	dBuV	dBuV	dB	dBuV	dB	dBuV	dBuV	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