Washington Laboratories, Ltd.

FCC Certification Test Report
For the
Hughes Network Systems

FCC ID: K3YHNS9250

WLL REPORT# **9508-01 Rev 0**

December 22, 2006

Prepared for:

Hughes Network Systems
11717 Exploration Lane
Germantown, MD 20876

Prepared By:

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

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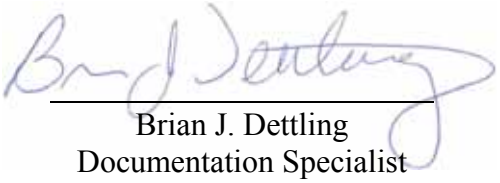

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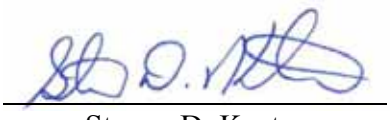

Steven D. Koster
EMC Lab Operations Manager

Abstract

This report has been prepared on behalf of Hughes Network Systems HUGHES 9250 Transceiver to support the attached Application for Equipment Authorization. The test report and application are submitted for an L-Band Satellite Earth Station under Part 25 of the FCC Rules. This Certification Test Report documents the test configuration and test results for a Hughes Network Systems HUGHES 9250 Transceiver.

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 Hughes Network Systems HUGHES 9250 Transceiver complies with the limits for an L-Band Satellite Earth Station device under FCC Part 25.

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1 Introduction

1.1 Compliance Statement

The Hughes Network Systems HUGHES 9250 Transceiver complies with the limits for an L-Band Satellite Earth Station device under FCC Part 25.

1.2 Test Scope

Tests for radiated and conducted (at antenna terminal) emissions were performed. The measurement equipment conforms to ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation.

1.3 Contract Information

Customer:	Hughes Network Systems 20430 Century Blvd Germantown, MD 20876
Quotation Number:	63196

1.4 Test Dates

Testing was performed on the following date(s):	December 15 through December 19, 2006

1.5 Test and Support Personnel

Washington Laboratories, LTD	James Ritter
Client Representative	Norbert Owona

1.6 Abbreviations

A	**A**mpere
ac	**a**lternating **c**urrent
AM	Amplitude Modulation
Amps	**Amp**eres
b/s	**b**its per **s**econd
BW	**B**and**W**idth
CE	**C**onducted **E**mission
cm	**C**enti**m**eter
CW	**C**ontinuous **W**ave
dB	**decibel**
dc	**d**irect **c**urrent
EMI	**E**lectro**m**agnetic **I**nterference
EUT	**E**quipment **U**nder **T**est
FM	**F**requency **M**odulation
G	**g**iga - prefix for 10^9 multiplier
Hz	**H**ertz
IF	**I**ntermediate **F**requency
k	**k**ilo - prefix for 10^3 multiplier
LISN	**L**ine **I**mpedance **S**tabilization **N**etwork
M	**M**ega - prefix for 10^6 multiplier
m	**M**eter
µ	**m**icro - prefix for 10^{-6} multiplier
NB	**N**arrow**b**and
QP	**Q**uasi-**P**eak
RE	**R**adiated **E**missions
RF	**R**adio **F**requency
rms	**r**oot-**m**ean-**s**quare
SN	**S**erial **N**umber
S/A	**S**pectrum **A**nalyzer
V	**V**olt

2 Equipment Under Test

The Hughes Network Systems HUGHES 9250 is a broadband Satellite IP terminal and WLAN access point with an external Spacecom C10 antenna made for mobile applications. It allows IP packet data via Ethernet or WLAN interfaces to the Immarsat BGAN network

Table 1. Device Summary

ITEM	DESCRIPTION
Manufacturer:	Hughes Network Systems
FCC ID:	K3YHNS9250
Model:	Hughes 9250
FCC Rule Parts:	§25
Frequency Range:	1626.595-1660.405
Maximum Output Power:	39.14dBm
Modulation:	π/4 QPSK- 4 bandwidths: T0.5 (21kHz), T1 (42kHz), T2 (84kHz), T4.5 (189kHz)— 16-QAM- 3 bandwidths: T1 (42kHz), T2 (84kHz), T4.5 (189kHz)
Occupied Bandwidth:	183.67kHz
Keying:	Automatic
Type of Information:	Data
Power Output Level	Fixed
Antenna Connector	SMA
Antenna Type	Spacecom C10
Interface Cables:	Serial, RS232, ISDN, Power, Antenna
Power Source & Voltage:	13.5 VDC Vehicle accessory adaptor

2.1 Test Configuration

The HUGHES 9250 was configured with the following components:

Description	Manufacturer	Model	S/N
Satellite Modem	HNS	HUGHES 9250	
Antenna	Spacecom	AS BGAN C10 HNS	06110001
Control box	HNS	9250 Control Box	
DC/DC Power adapter	EDAC Power electric	ED1010	54

The System was provided 14VDC from a lab power supply to the Vehicle accessory plug. All conducted readings were taken at the output of the High power amp in Spacecom C10 antenna assembly. For Case radiated emissions this output was terminated.

The following ports and cable I/Os are available on the HUGHES 9250:

Port ID	Connector Type	Cable Length	Shielded (Y/N)	Connected To/From
Serial Port	USB to DB9	1	Y	BGAN9250 Transceiver to 9250 control box
Power in	Minijack			9250 Control Box to Transceiver
Ethernet	RG45	<2m cat5	N	BGAN9250 Transceiver to Laptop
ISDN	RG45	2m cat5	N	BGAN9250 Transceiver to unterminated
RF	SMA	1.5m	Y	BGAN9250 Transceiver to 9250 control box
ANT	SMA	5m	Y	9250 control box to Spacecom C10 Antenna
Power	Vehicle accessory plug	50cm	N	Lab Power supply to DC/DC converter
Power	Miniplug	1.5m	N	DC/DC converter to 9250 control box

The following diagram shows the test configuration:

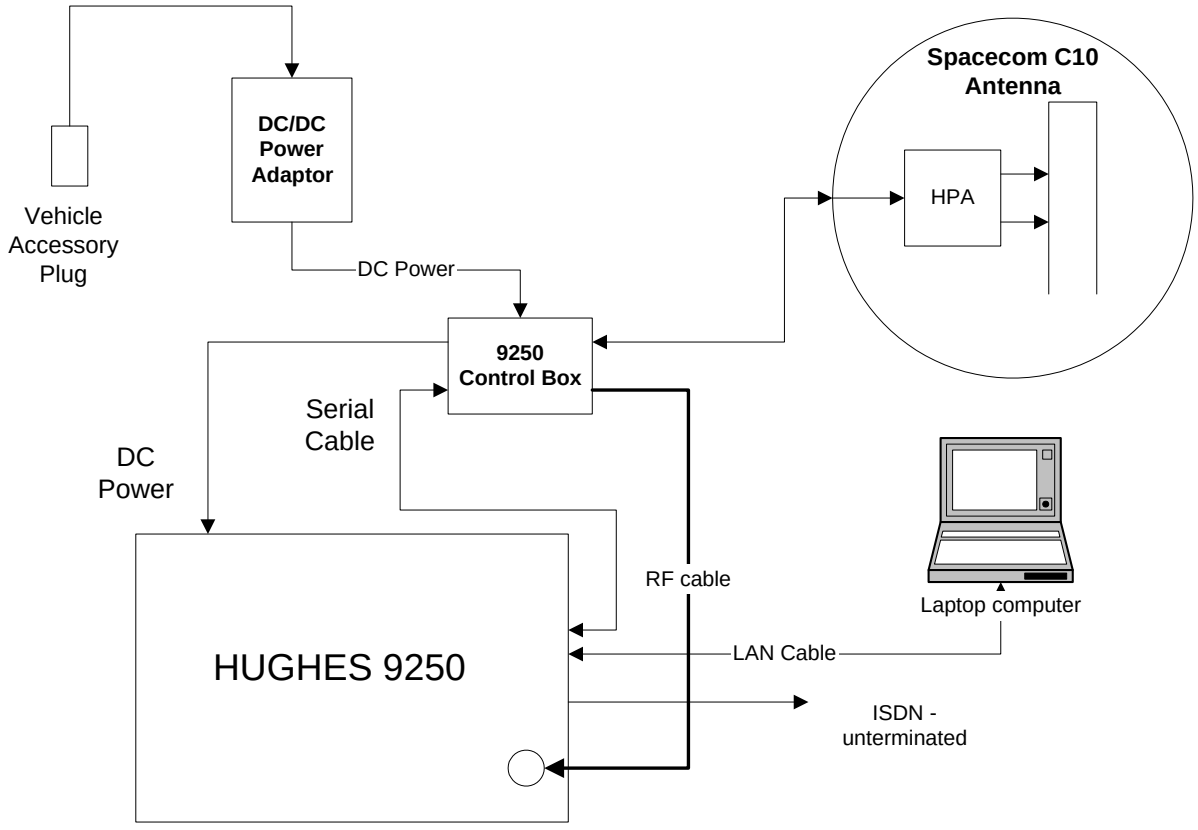

Figure 1: HUGHES 9250 Test Configuration

2.2 Testing Algorithm

During testing of the HUGHES 9250 a batch script file was provided for each Low, Center, and High channel in each modulation mode to place the EUT in transmit.

Worst case emission levels are provided in the test results data.

2.3 Test Location

All measurements herein were performed at Washington Laboratories, Ltd. test center in Gaithersburg, MD. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. The Industry Canada OATS numbers are 3035A-1 and 3035A-2 for Washington Laboratories, Ltd. Site 1 and Site 2, respectively. Washington Laboratories, Ltd. has been accepted by the FCC and approved by NIST NVLAP (NVLAP Lab Code: 200066-0) as an independent FCC test laboratory.

2.4 Measurements

2.4.1 References

TIA-603-B Land Mobile FM or PM Communications Equipment Measurement and Performance Standard

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

2.5 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
00029	EMCO, 3146A	ANTENNA, LOG PERIODIC	07/19/2008
00034	EMCO, BIA-30	ANTENNA, BICONICAL	01/23/2007
00382	SUNOL, JB1	BICONLOG	01/25/2007
00068	HP, 85650A	ADAPTER, QP	07/03/2007
00070	HP, 85685A	PRESELECTOR, RF W/OPT 8ZE	07/03/2007
00072	HP, 8568B	ANALYZER, SPECTRUM	07/03/2007
00528	AGILENT, E4446A	ANALYZER, SPECTRUM	6/27/2007
00361	GLOBAL SPECIALTIES 1337	POWER SUPPLY	N/A
00001	A.H., SYSTEMS, SAS-200/518	ANTENNA, LP, 1-18GHZ	03/11/2007
00425	ARA, DRG-118/A	ANTENNA, DRG, 1-18GHZ	01/17/2007
HNS	HP, 83640B	GENERATOR, SWEPT SIGNAL	8/31/2007 verified
00282	ITC, 21X-3A1	WAVEGUIDE 6.8-15GHZ	02/07/2007
00075	HP, 8648C	GENERATOR, RF SIGNAL	05/15/2008
00080	HP, 8672A	GENERATOR, RF SIGNAL	03/22/2007
00257	HP, 8672A-K22	FREQUENCY EXTENTION UNIT	03/22/2007
00066	HP, 8449B	PRE-AMPLIFIER, RF. 1-26.5GHZ	06/22/2007
00453	A.H., SYSTEMS, PAM1840	PRE-AMPLIFIER, 18GHZ-40 GHZ	03/03/2007
00209	NARDA	HORN, STANDARD, GAIN	12/25/2008
00210	NARDA, V638	HORN, STANDARD, GAIN	12/25/2008
00283	ITC, 21KU-3A1	WAVEGUIDE; 9.8-20.5GHZ	06/12/2008
00280	ITC, 21C-3A1	WAVEGUIDE 3.45-11.0GHZ	06/12/2008

4 Test Results

4.1 RF Power Output (FCC 25.204)

FCC 25.204 specifies the limits for Satellite Earth Stations.

4.1.1 Power measurement

The power was measured conducted into a spectrum analyzer. The RBW and VBW were set to 1MHz. The results are in the following table and figure.

Table 3: RF Power Output

Mode	Frequency	Power Output (dBm)	Power Output (W)
QAM 1	1.647 MHz	39.14	8.2
QAM 2	1.647 MHz	38.97	7.8
QAM 4.5	1.647 MHz	39.14	8.2
QPSK 0.5	1.647 MHz	36.5	4.5
QPSK 1	1.647 MHz	36.14	4.1
QPSK 2	1.647 MHz	36.09	4.1
QPSK 4.5	1.647 MHz	36.47	4.4

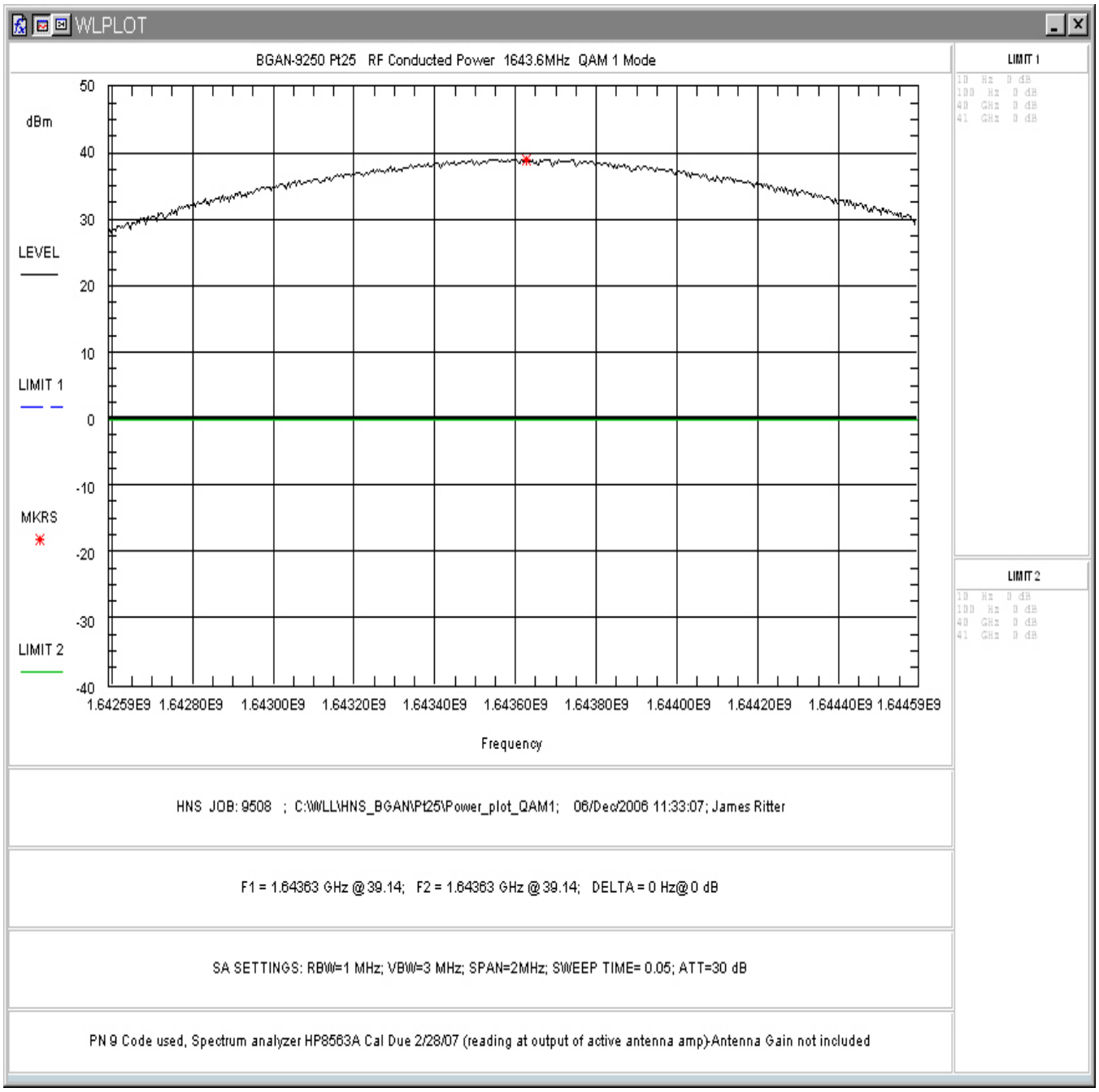

Figure 1: RF Peak Power, Mid Channel, QAM 1 Mode

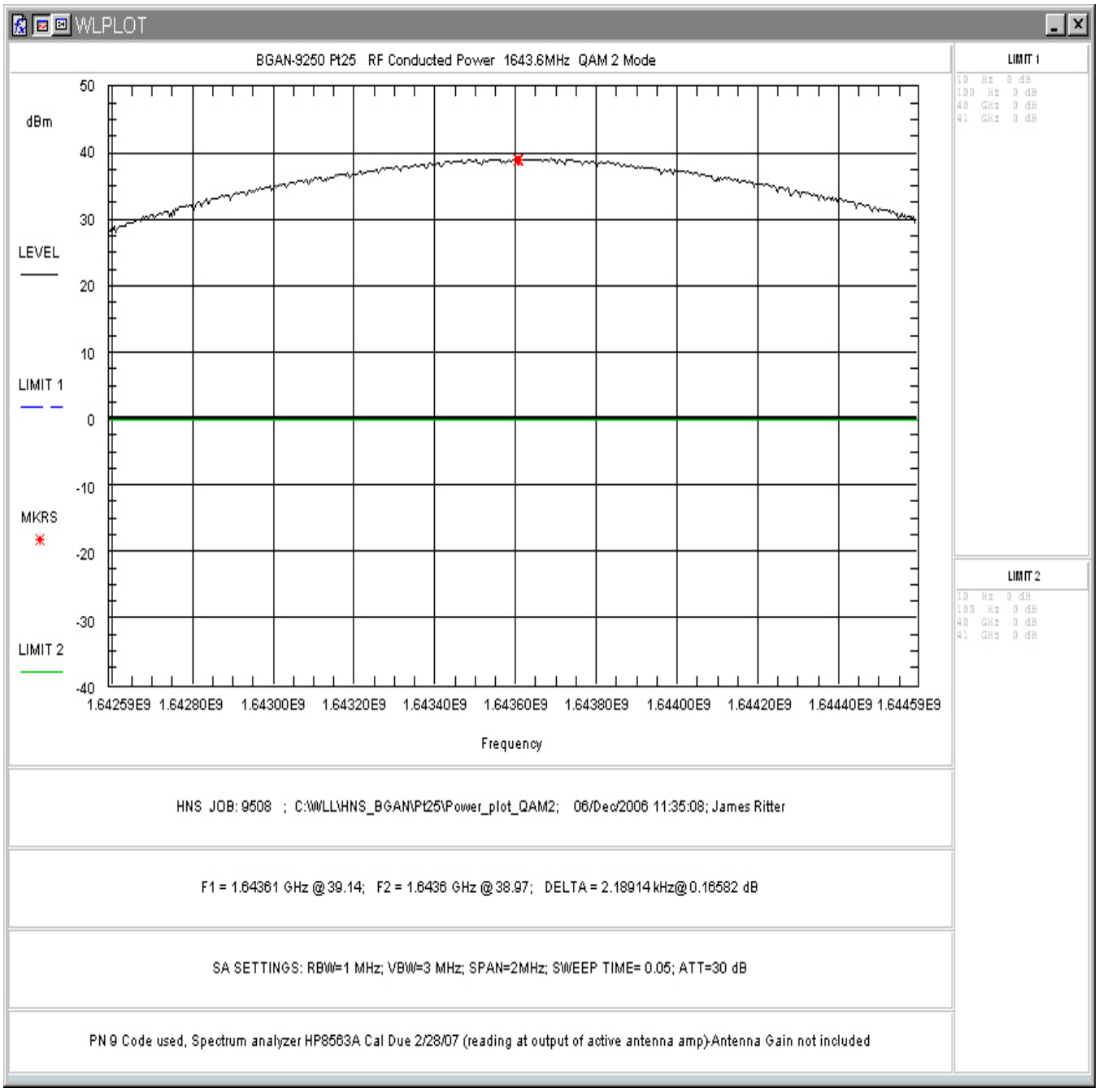

Figure 2: RF Peak Power, Mid Channel, QAM 2 Mode

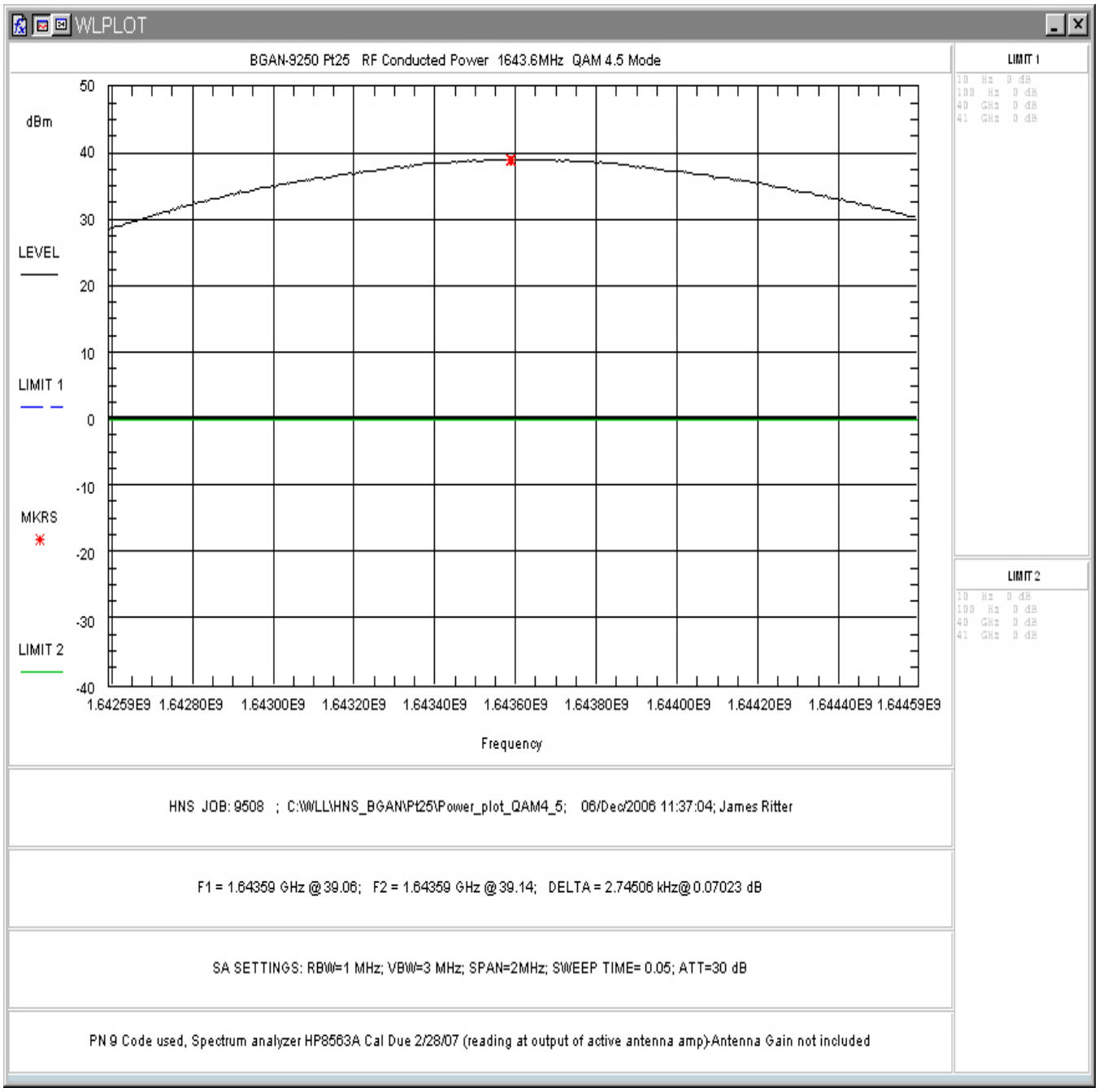

Figure 3: RF Peak Power, Mid Channel, QAM 4.5 Mode

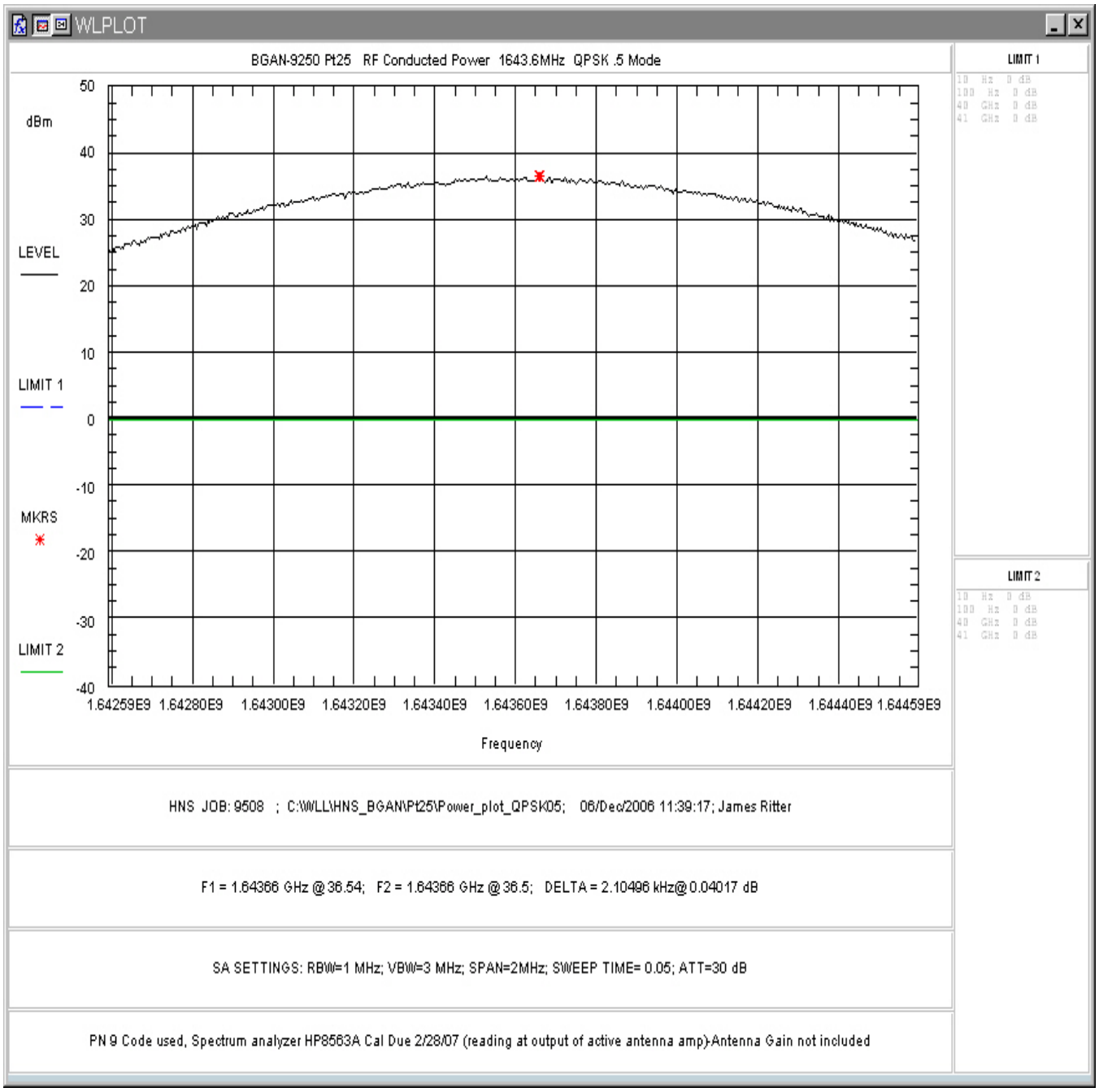

Figure 4: RF Peak Power, Mid Channel, QPSK 0.5 Mode

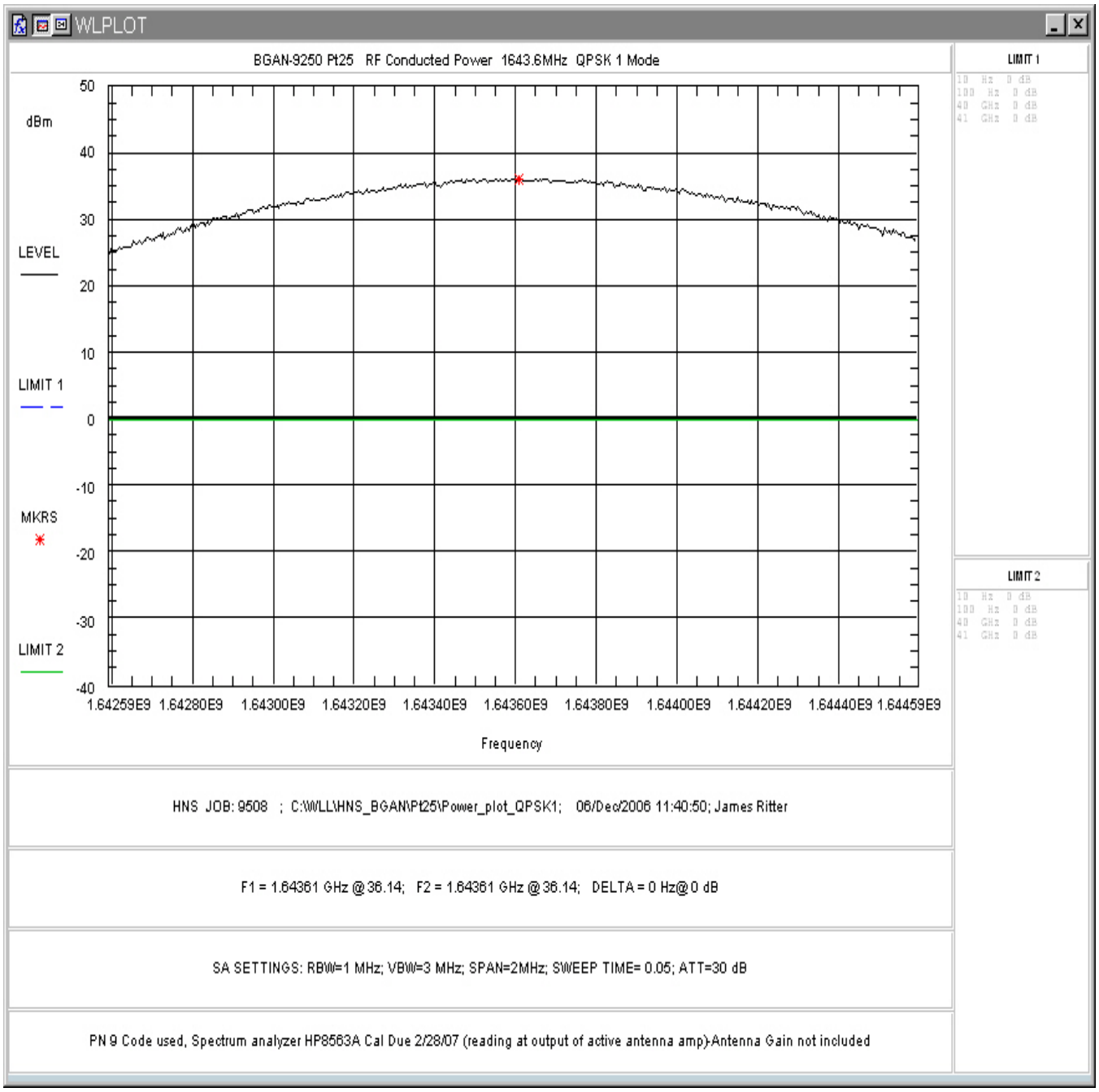

Figure 5: RF Peak Power, Mid Channel, QPSK 1 Mode

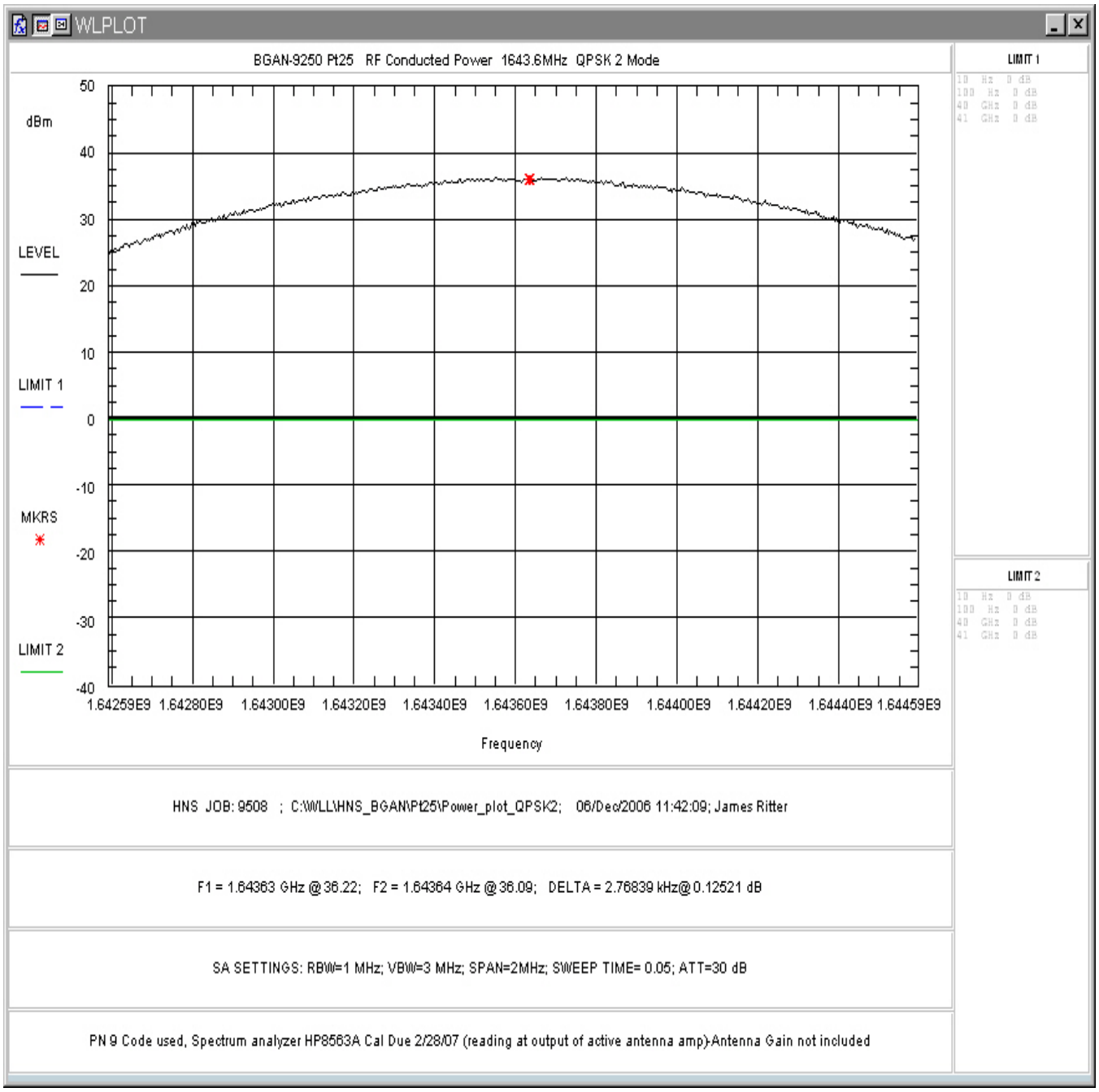

Figure 6: RF Peak Power, Mid Channel, QPSK 2 Mode

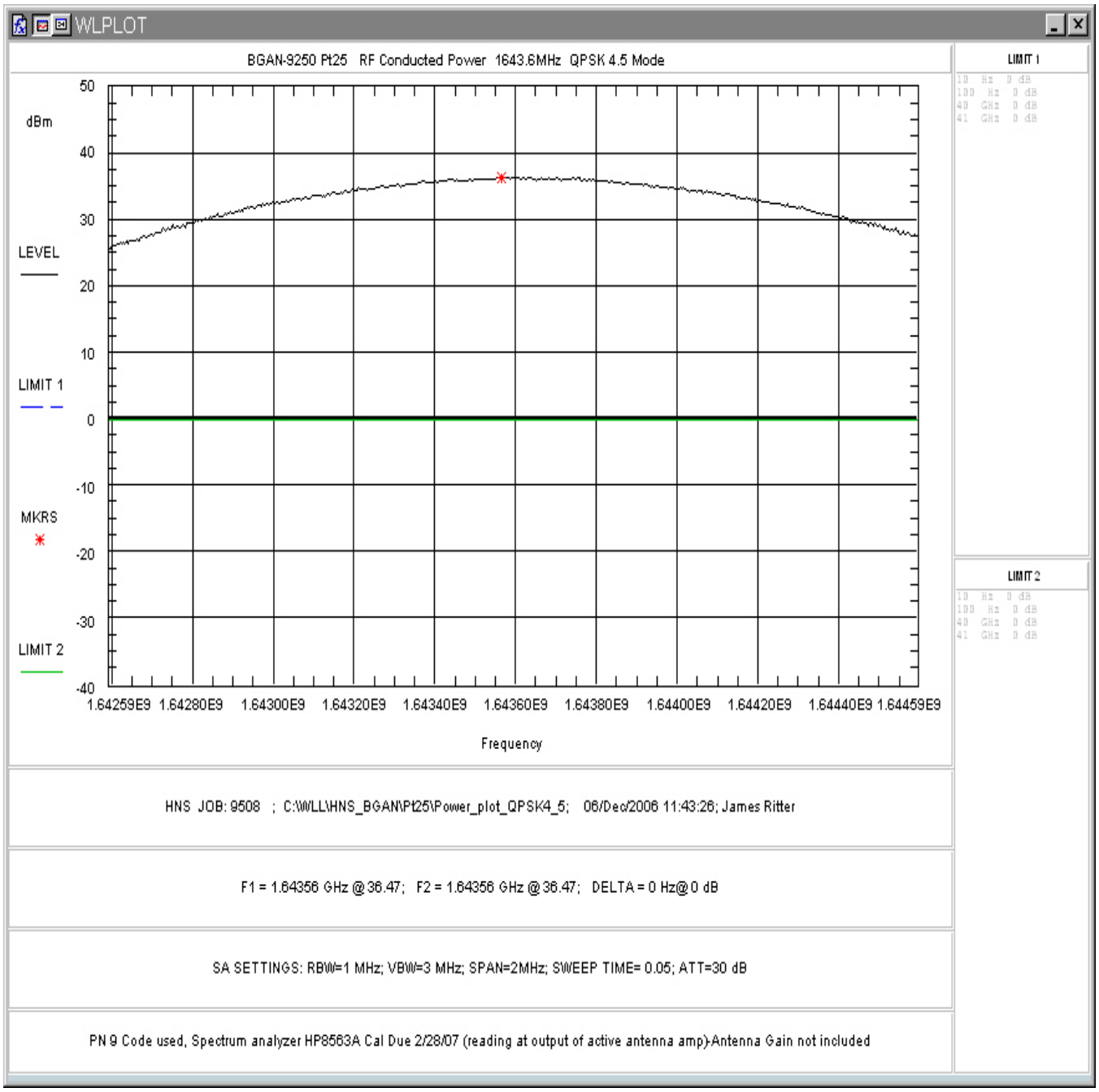

Figure 7: RF Peak Power, Mid Channel, QPSK 4.5 Mode

4.2 Occupied Bandwidth

Occupied bandwidth (20dB) was performed by coupling the output of the EUT via an antenna to the input of a spectrum analyzer.

Table 4: Occupied Bandwidth Results

Frequency/Mode	Bandwidth	Limit	Pass/Fail
1647MHz: QAM 1	41.73kHz	1 MHz	Pass
1647MHz: QAM 2	82.34kHz	1 MHz	Pass
1647MHz: QAM 4.5	183.67kHz	1 MHz	Pass
1647MHz: QPSK 0.5	21.52kHz	1 MHz	Pass
1647MHz: QPSK 1	41.33kHz	1 MHz	Pass
1647MHz: QPSK 2	82.25kHz	1 MHz	Pass
1647MHz: QPSK 4.5	183.04kHz	1 MHz	Pass

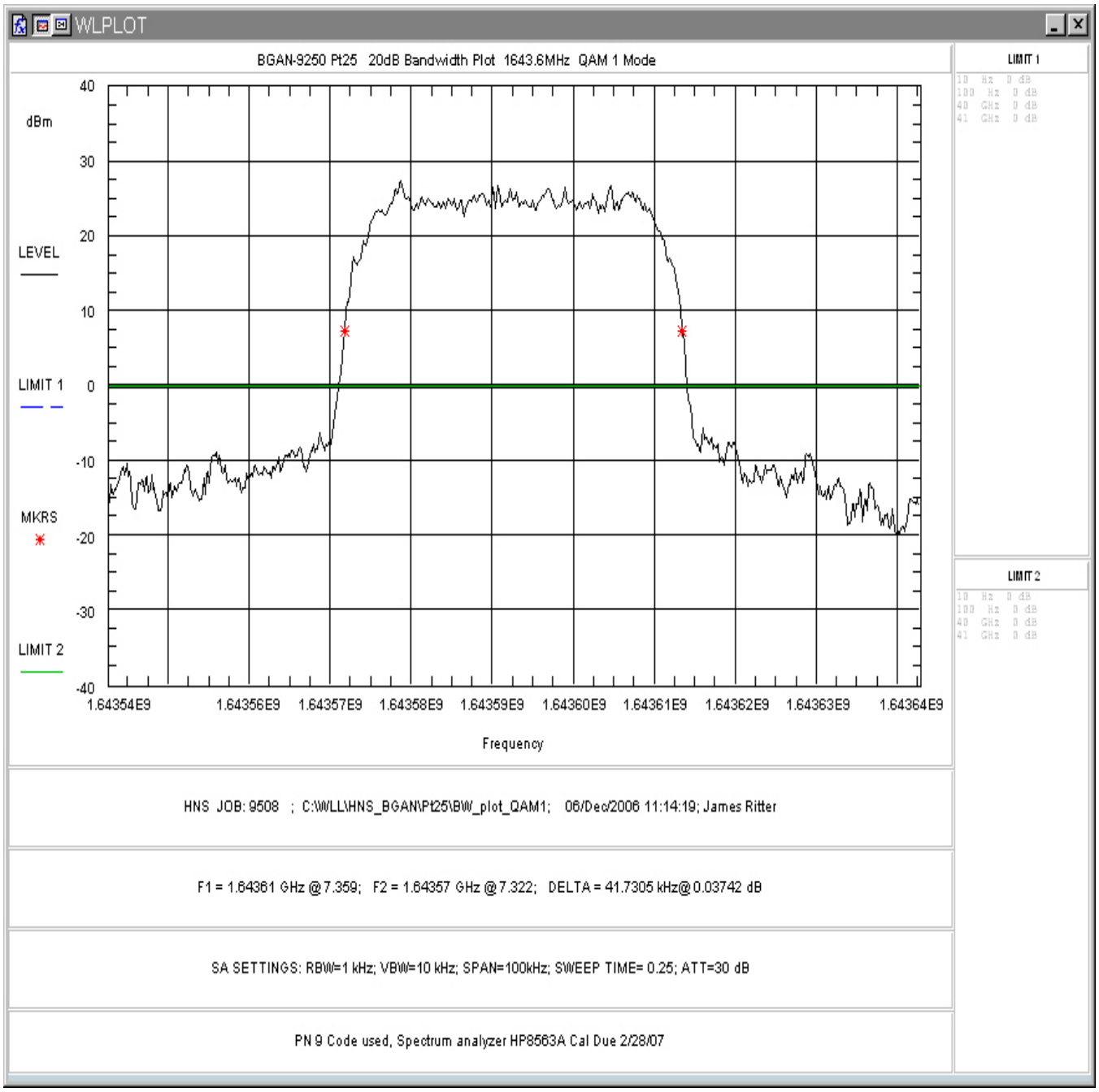

Figure 8: Occupied Bandwidth, Mid Channel, QAM 1 Mode

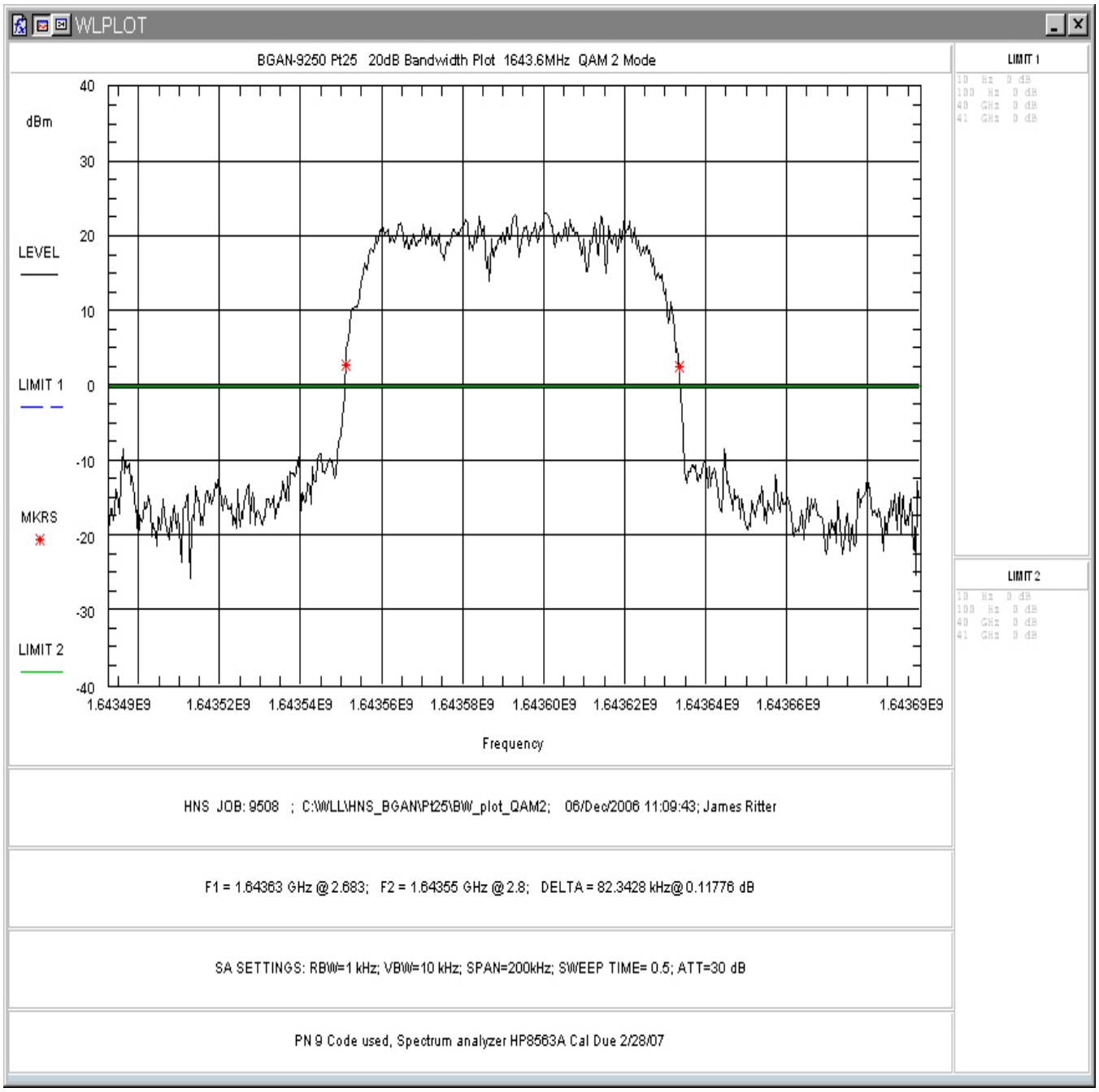

Figure 9: Occupied Bandwidth, Mid Channel, QAM 2 Mode

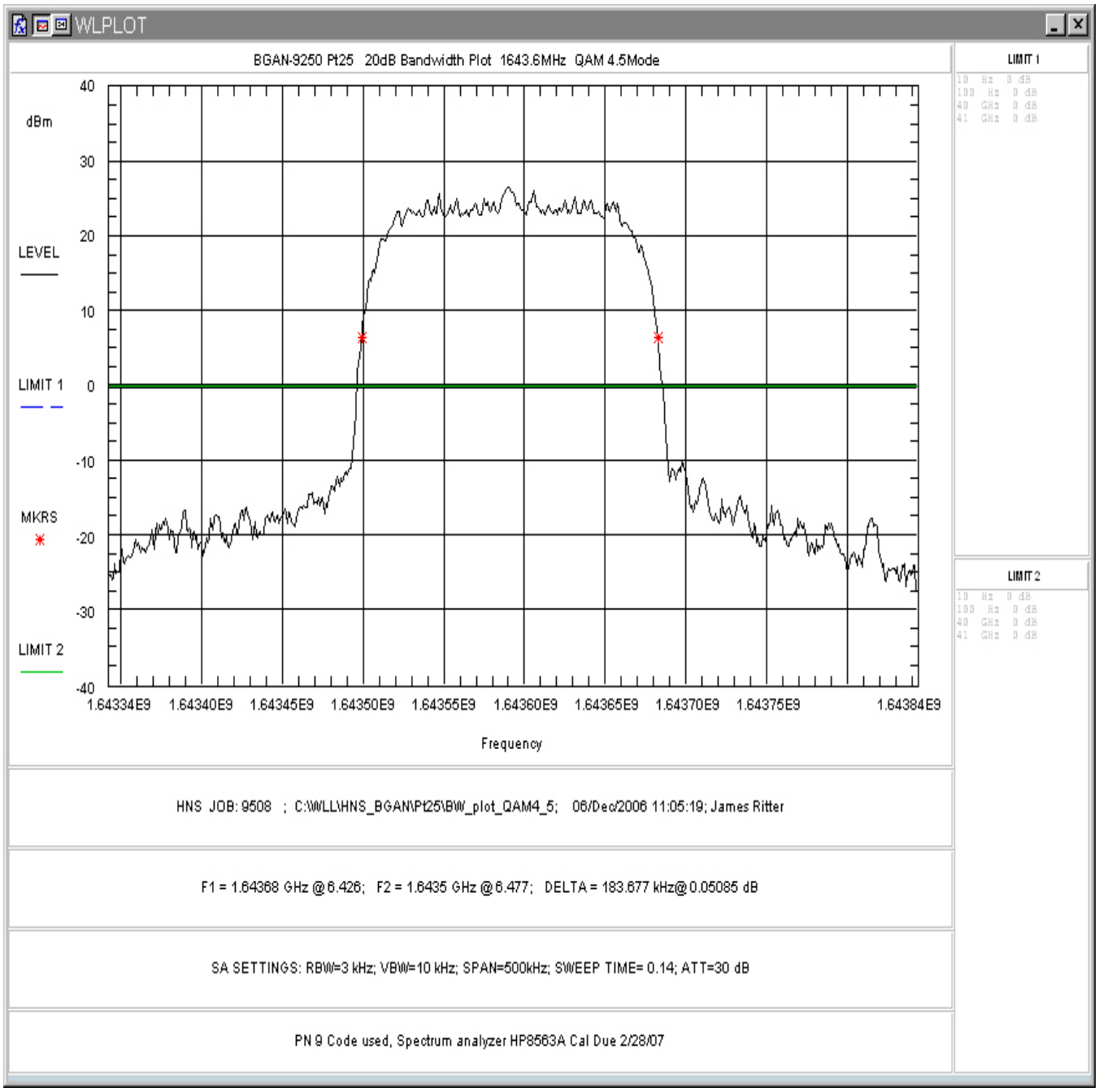

Figure 10: Occupied Bandwidth, Mid Channel, QAM 4.5 Mode

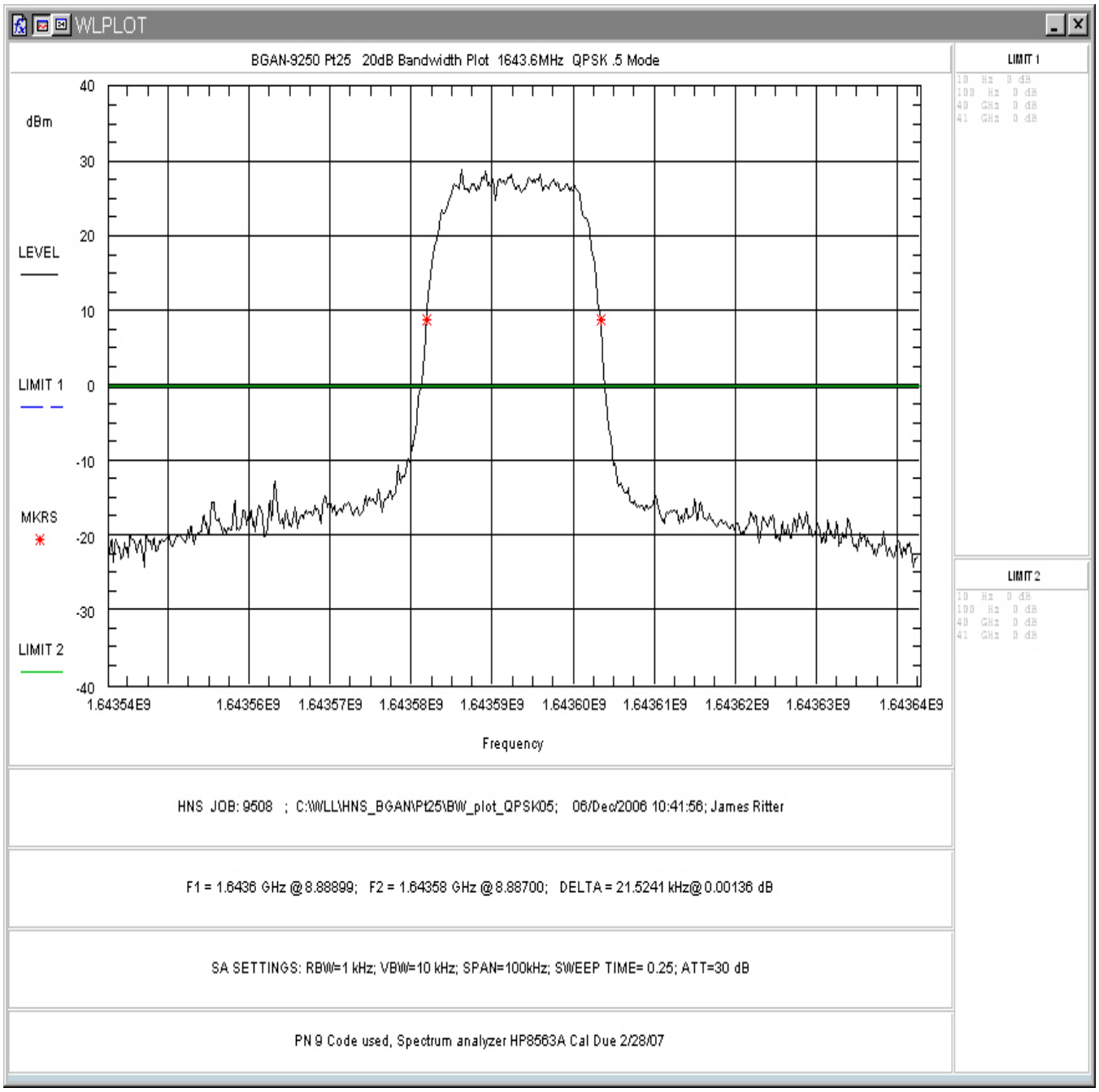

Figure 11: Occupied Bandwidth, Mid Channel, QPSK 0.5 Mode

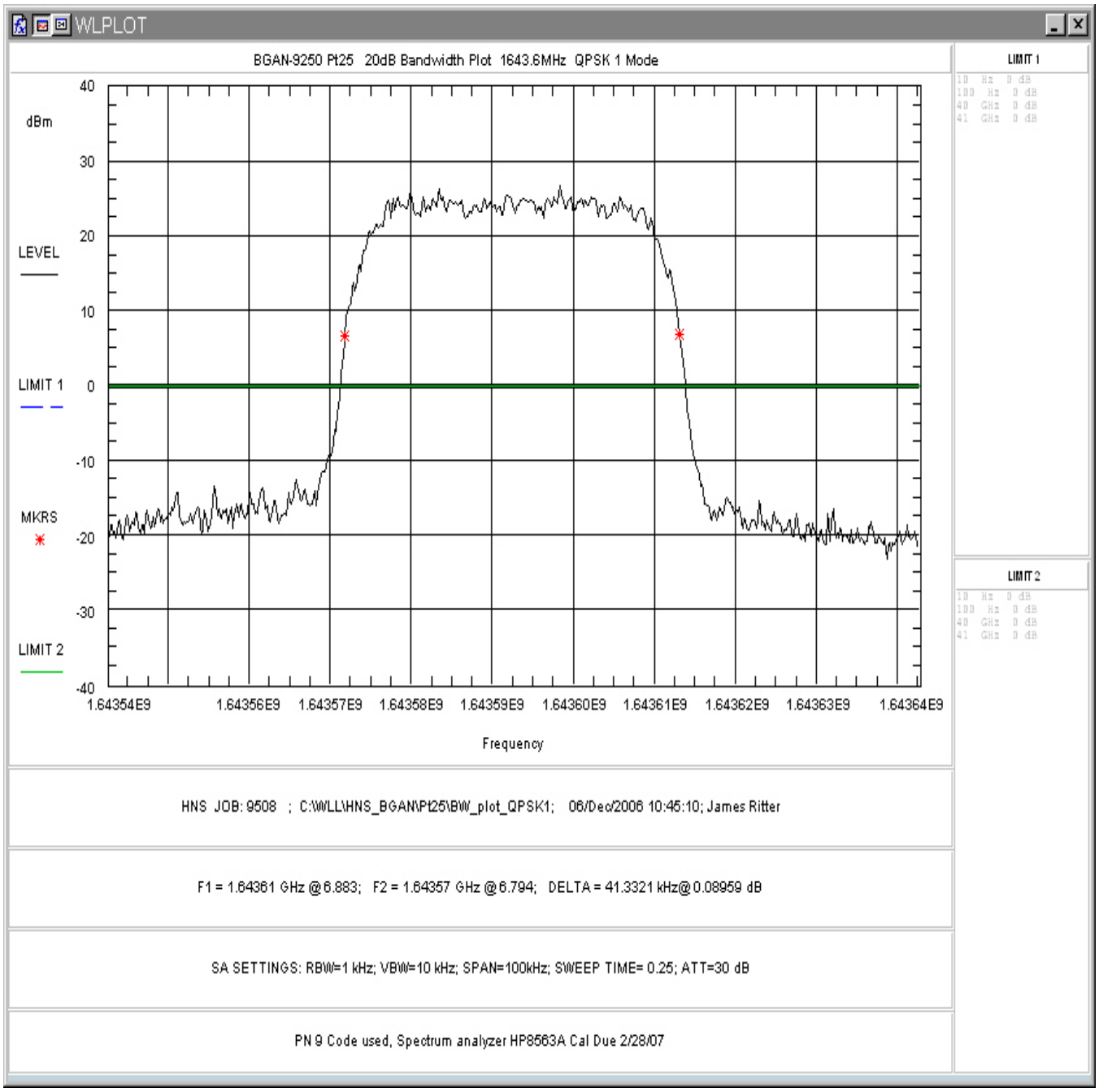

Figure 12: Occupied Bandwidth, Mid Channel, QPSK 1 Mode

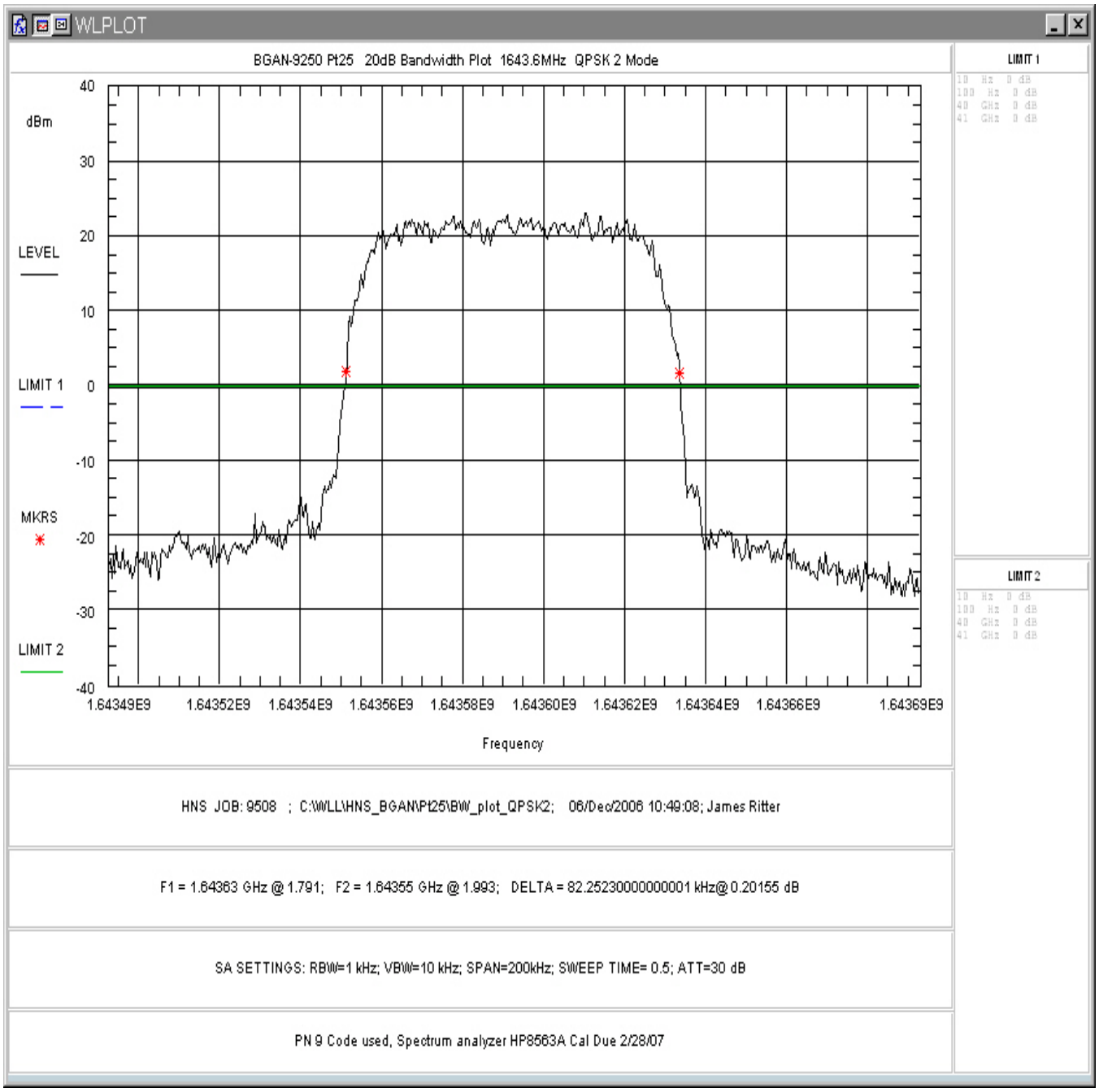

Figure 13: Occupied Bandwidth, Mid Channel, QPSK 2 Mode

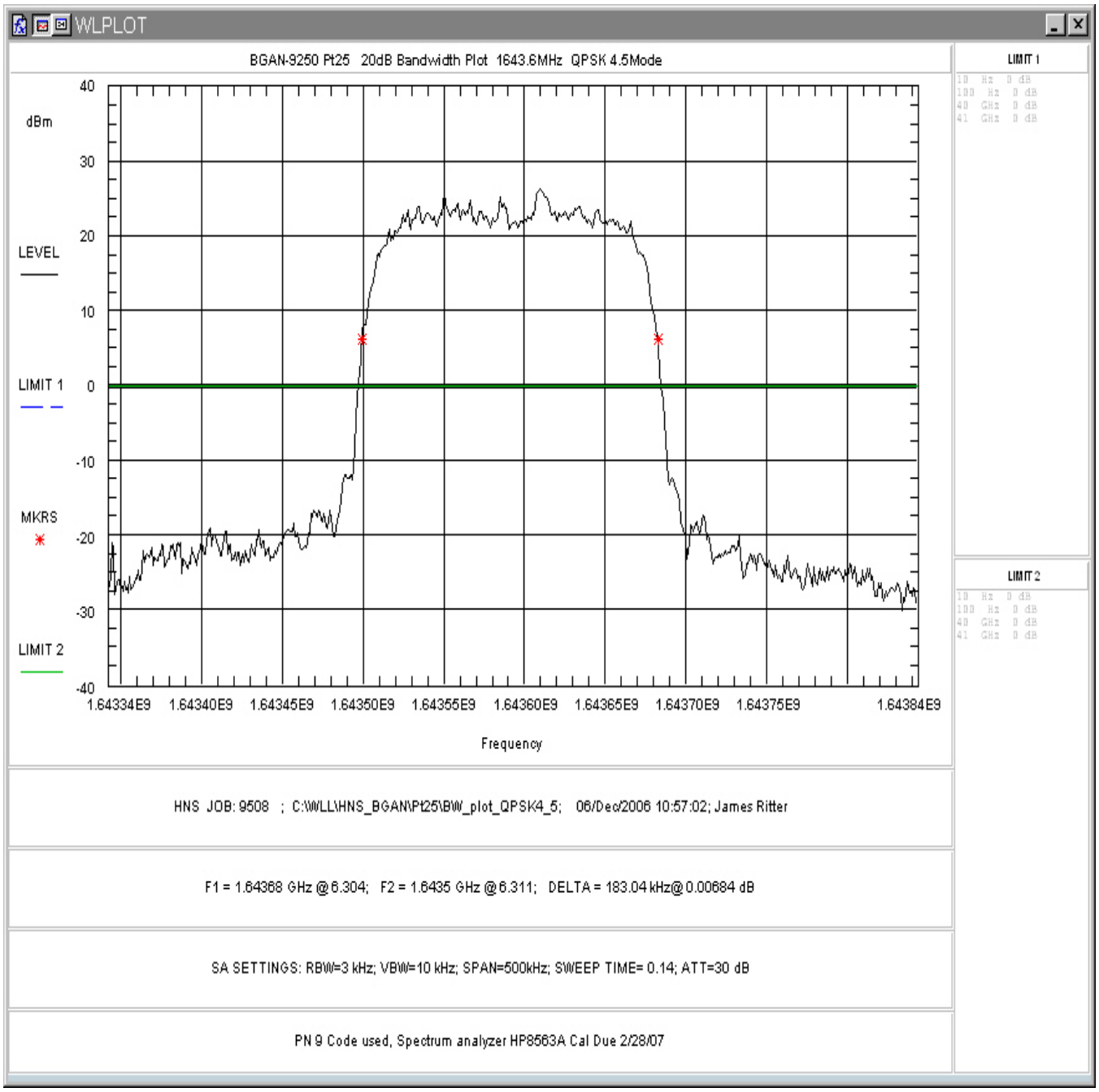

Figure 14: Occupied Bandwidth, Mid Channel, QPSK 4.5 Mode

