Section 5

Test Report

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5.1 Test Strategy

Verification of the performance of the Motorola, Inc. OSU-2510-R transmitter was accomplished by implementation of the procedures contained within TIA/EIA-603 and FCC requirements. Performance results contained within this Test Report and Appendix documents represent operational modes that are considered to be worst case within a functional system. Verification of product performance is presented for three frequencies across the RF bandwidth, two channel bandwidths, and four modulation levels available within an operational system. The Motorola, Inc. OSU-2510-R product has been tested with equipment that is generally available in the open market. The primary requirement for the measurement of the OSU-2510-R product is that the spectrum analyzer contain a time gating function to facilitate the measurement of the channel power and emissions mask. The time gating function is configured to only allow the spectrum analyzer to sweep when the transmitter is active. Measurements performed on the OSU-2510-R product were performed with an Agilent E4440A spectrum analyzer with the time gating capability.

The Expedience system protocol utilizes all sub-channel carriers on each transmission burst. The Expedience system protocol does not make use of subchannelization. All carriers are utilized for each transmission. The Expedience system protocol does not allow for a mixed transmission within a single burst, i.e. all data within a single burst or transmission is one modulation type (4-QAM, 16-QAM, or 64-QAM). The same modulation is transmitted for the entire burst. To facilitate the product development, a test mode configuration was developed. The test mode allows for the selection of channel frequency, modulation bandwidth, and modulation type (4-QAM, 16-QAM, 64-QAM, …). Within the test mode, a pseudo random bit sequence is used to generate the transmitted data.

The Motorola, Inc. Expedience system is based on a proprietary protocol. As such there are no existing standards that are applicable. The Motorola, Inc. Expedience system protocol makes use of Time Division Duplex (TDD) operation as allowed by the FCC rules contained in Part 2 and Part 27 for devices operating in the BRS and EBS frequency spectrum. Within the BRS and EBS frequency spectrum, channels are allocated in 5.5 MHz and 6.0 MHz single frequency blocks. Additional information is contained in the Technical Description document.

The Motorola, Inc. OSU-2510-R product does not contain smart antenna technology. The integral antenna contained within the OSU-2510-R product is a 4 element patch array antenna. This antenna has a fixed gain and radiation pattern.

5.2 Test Equipment List

Test Equipment	Description
DUT	Motorola Outdoor Subscriber Unit (OSU) Model No. OSU-2510-R Board No. 0083-0300-7050048 Serial Number: 0049X057SCCX00789496
Spectrum Analyzer	Agilent E4440A S/N: MY44022791 Calibrated: 05/23/2006 Calibration due: 05/23/2007
Test Cable Assembly	MCE/Weinshel Attenuators, Model 23-xx-34 10 dB, 10W S/N BS5614 (to PC Card) 20 dB, 10W S/N BT2061 (to log det bd) 20 dB, 10 W S/N BP4391 (to analyzer) Broadband Resistive Power Splitter Weinschel Model 1870A, S/N 7892 (Above Equipment Calibrated By User) Log Detector Board, Analog Devices AD8319 (provides external trigger signal to analyzer)
Laptop Computer (NN1303)	Dell Precision M65 S/N: CRFK 381 Calibration not required
Ethernet Switch	D-Link Model: DSS-5+ 5-port 10/100Mbps S/N: DT8615B009993 Calibration not required
OSU Power Supply 19.5 Vdc, 2.56 A	ITE Part No. GS-741 Model GT-21097-5024-4.5 S/N RoHS00900519/06
AC Power Source (Used for freq stability tests)	Instek Model APS-9501 S/N EF844094 Calibrated with following digital voltmeter
Digital Voltmeter	HP 34401A S/N: MY45001201 Calibrated: 4-9-2005 / Calibration due: 4-9-2007
Temperature Chamber	Test Equity 2 (W) Model: 1007C S/N: 10294 Temperature verified with thermocouple listed below
Temperature Sensor	Fluke 89 IV True RMS Multimeter S/N 87180024, with K-Type Thermocouple

5.3 RF Power Output

FCC Rules: 2.1046, 27.4, 27.50(h)(2), 27.50(i)

FCC Requirement: Temporary fixed broadband station. A broadband station used for the transmission of material from temporary unspecified points to a broadband station.

All user stations are limited to 2.0 watts transmitter output power. (5.5 MHz or 6.0 MHz channel BW)

Standard: TIA-603-C
TIA Standard, Land Mobile FM or PM Communications Equipment, Measurement and Performance Standards

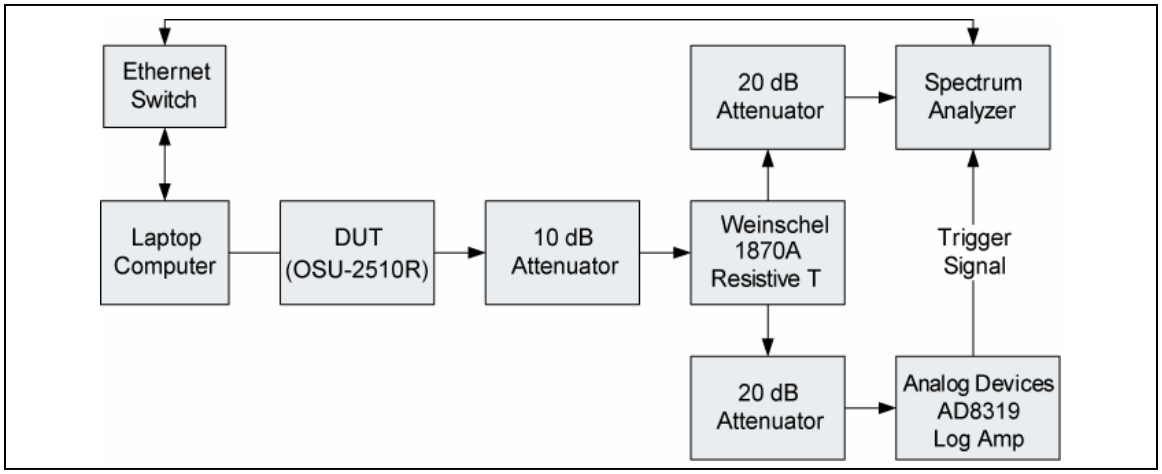
Test Procedure: The peak conducted RF output power is measured over an interval of continuous transmission using a spectrum analyzer that has been calibrated in terms of rms-equivalent voltage. The peak power was recorded by utilizing the power measurement function within the spectrum analyzer. The power measurement function of this spectrum analyzer, when using a 100 kHz resolution bandwidth, has been compared against measurements performed with a power meter. The power measurements obtained from the spectrum analyzer and the power meter comparison produced the same value. As such, no additional correction factors were applied to the measured data.

The RF output of the transmitter was measured at J501, RF connector located on the main board. The antenna coax plugs into J501. This signal is applied to an attenuator that is connected to a resistive splitter T. One path of the "T" is applied to the spectrum analyzer input and the other path is applied to the log amplifier through appropriate attenuation. The spectrum analyzer is time gated to only capture the RF transmission during the burst. The time gating signal is produced by the Analog Devices log amplifier. This device produces a dc output level that is proportional to the RF level applied to the amplifier input. The trigger level on the spectrum analyzer is set to respond at a voltage level that is not influenced by the modulation peaks or to the noise peaks when there is no signal applied.

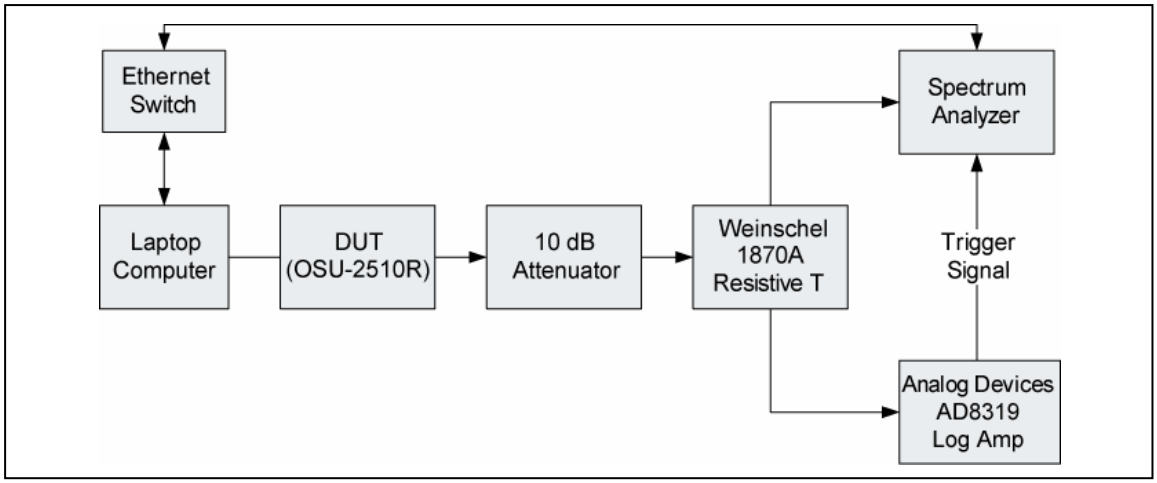
The transmitter is enabled in test mode and set to the minimum and maximum power level with the host computer. The RF loss of the attenuator(s) and coax was measured and is included in the spectrum analyzer offset level for the maximum and minimum RF power measurements. Attenuation was removed for the 1 mW

measurements which resulted in different offset levels for that measured data. Measurements are performed at frequencies across the band and for each of the modulation formats available (4-, 16-, 64-, 16L-QAM) and channel bandwidths (5.5 and 6.0 MHz).

Test Conditions: **Test Frequencies:** 2499, 2593, 2687 MHz (5.5 and 6.0 MHz bandwidth)
Temperature: 22°C
Supply Voltage: 120 VAC / 60 Hz nominal to DUT power supply



Conducted RF Power Test Setup – Maximum Power



Conducted RF Power Test Setup – Minimum Power

Using AD8319 Log Detector To Provide Analyzer Trigger Signal

AD8319 Data Sheet

ANALOG DEVICES

1 MHz to 10 GHz, 40 dB Log Detector/Controller

AD8319

FEATURES

Wide bandwidth: 1 MHz to 10 GHz
High accuracy: ±1.0 dB over temperature
>40 dB dynamic range up to 8 GHz
Stability over temperature ±0.5 dB
Low noise measurement/controller output VOUT
Pulse response time: 8/10 ns (fall/rise)
Small footprint 2 mm x 3 mm CSP package
Supply operation: 3.0V to 5.5V @ 22 mA
Fabricated using high speed SiGe process

APPLICATIONS

RF transmitter PA setpoint control and level monitoring
Power monitoring in radiolink transmitters
RSSI measurement in base stations, WLAN, WiMAX, radar

FUNCTIONAL BLOCK DIAGRAM

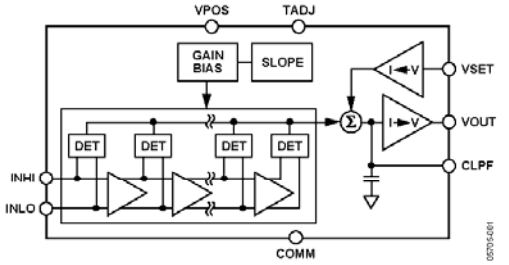


Figure 1.

GENERAL DESCRIPTION

The AD8319 is a demodulating logarithmic amplifier, capable of accurately converting an RF input signal to a corresponding decibel-scaled output. It employs the progressive compression technique over a cascaded amplifier chain, each stage of which is equipped with a detector cell. The device can be used in either measurement or controller modes. The AD8319 maintains accurate log conformance for signals of 1 MHz to 8 GHz and provides useful operation to 10 GHz. The input dynamic range is typically 40 dB (re: 50 Ω) with error less than ±1 dB. The AD8319 has 8/10 ns response time (fall time/rise time) that enables RF burst detection to a pulse rate of beyond 50 MHz. The device provides unprecedented logarithmic intercept stability vs. ambient temperature conditions. A supply of 3.0 V to 5.5 V is required to power the device. Current consumption is typically 22 mA, and it decreases to 200 μA when the device is disabled.

The AD8319 can be configured to provide a control voltage to a power amplifier or a measurement output from the VOUT pin. Because the output can be used for controller applications, special attention has been paid to minimize wideband noise. In this mode, the setpoint control voltage is applied to the VSET pin.

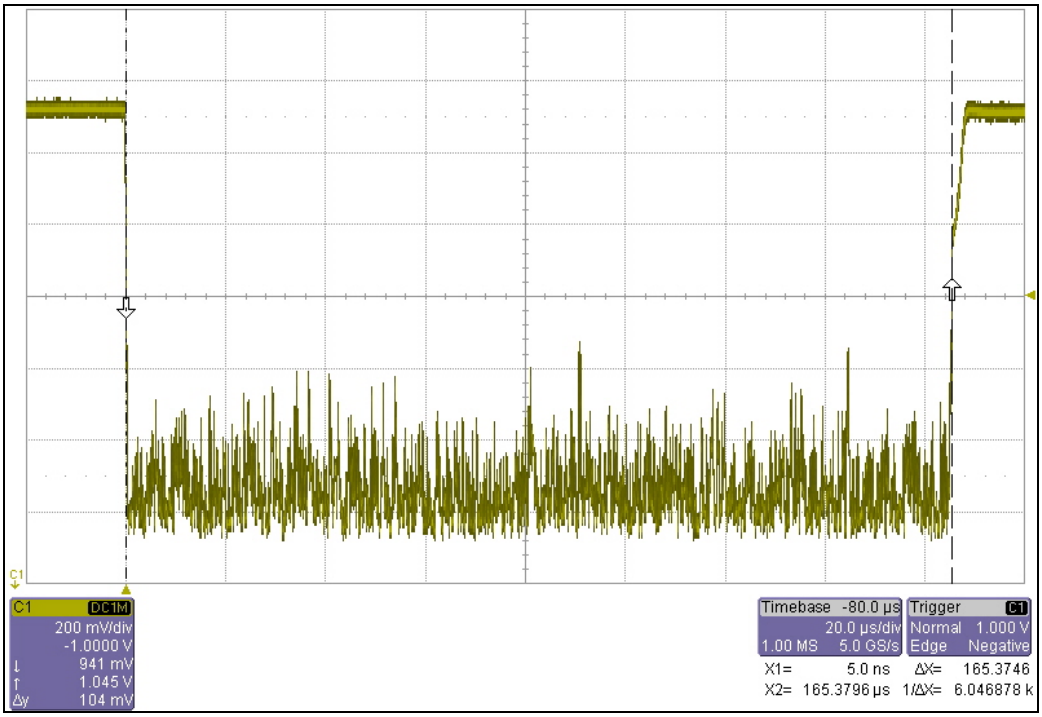
The feedback loop through an RF amplifier is closed via VOUT, the output of which regulates the amplifier's output to a magnitude corresponding to V_{SET}. The AD8319 provides 0 V to (V_{POS} – 0.1 V) output capability at the VOUT pin, suitable for controller applications. As a measurement device, VOUT is externally connected to VSET to produce an output voltage V_{OUT} that is a decreasing linear-in-dB function of the RF input signal amplitude.

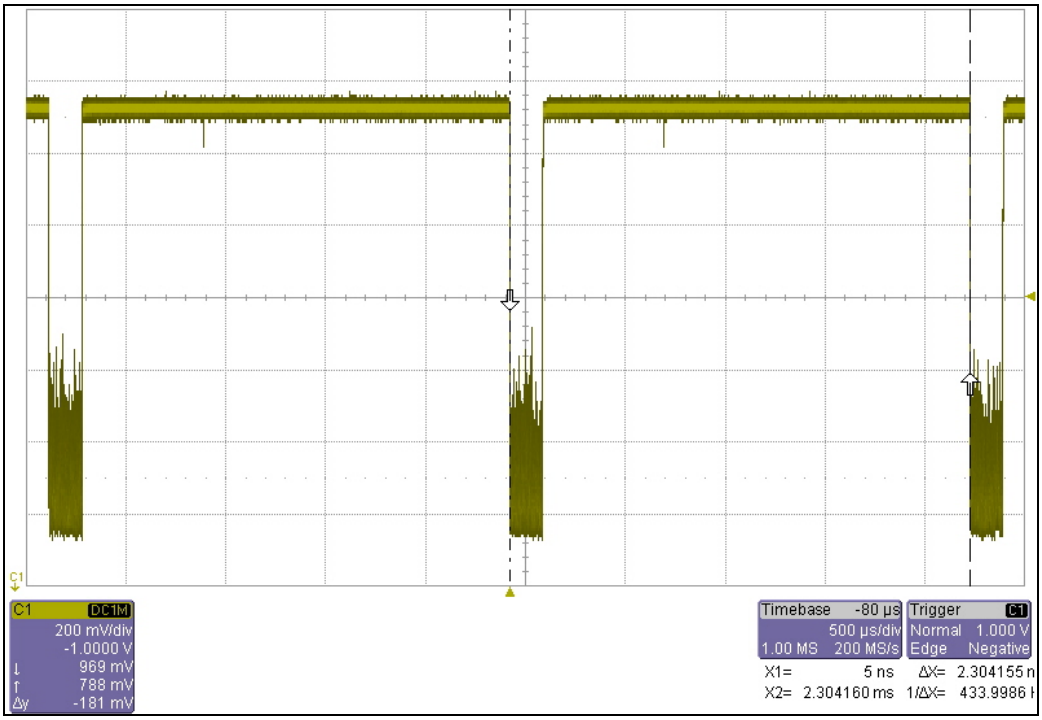
The logarithmic slope is –22 mV/dB, determined by the VSET interface. The intercept is +15 dBm (re: 50 Ω, CW input) using the INHI input. These parameters are very stable against supply and temperature variations.

The AD8319 is fabricated on a SiGe bipolar IC process and is available in a 2 mm × 3 mm, 8-lead LFCSP_VD package for an operating temperature range of –40°C to +85°C.

Gating Description

The output signal from the AD8319 Log Detector is used to time gate the spectrum analyzer by triggering on the negative edge of the Vout signal. The following screen plots show the output signal from the AD8319 that is applied to the gate input of the spectrum analyzer.





5.3.1. Conducted RF Power Output Test Results

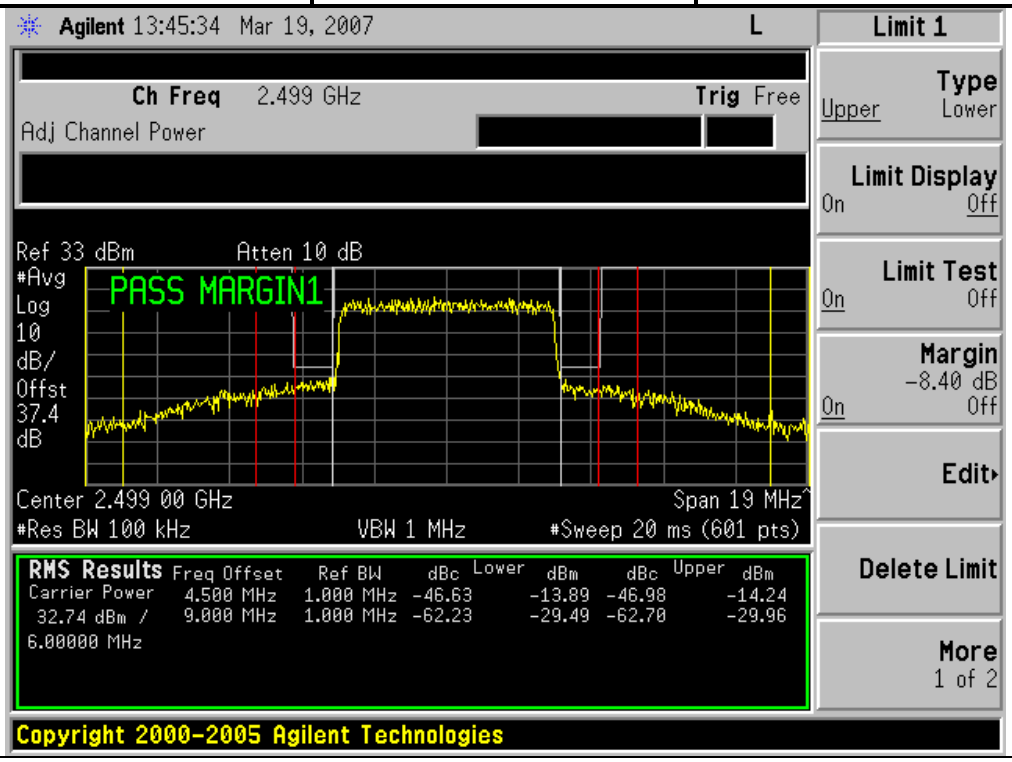
Maximum (2 W) Power setting									
Freq (MHz)	Bandwidth (MHz)	4 QAM		16 QAM		64 QAM		16 QAM Lite	
		(dBm)	(Watts)	(dBm)	(Watts)	(dBm)	(Watts)	(dBm)	(Watts)
2499	6.0	32.74	1.88	32.75	1.88	32.86	1.93	32.88	1.94
2593	6.0	32.71	1.87	32.88	1.94	32.83	1.92	32.88	1.94
2687	6.0	32.95	1.97	32.96	1.98	32.95	1.97	32.92	1.96
2499	5.5	32.82	1.91	32.72	1.87	32.81	1.91	32.72	1.87
2593	5.5	32.83	1.92	32.75	1.88	32.78	1.90	32.88	1.94
2687	5.5	33.00	2.00	32.88	1.94	32.93	1.96	32.83	1.92

Minimum (1 mW) Power setting									
Freq (MHz)	Bandwidth (MHz)	4 QAM		16 QAM		64 QAM		16 QAM Lite	
		(dBm)	(Watts)	(dBm)	(Watts)	(dBm)	(Watts)	(dBm)	(Watts)
2499	6.0	0.16	0.0010	0.04	0.0010	0.17	0.0010	0.24	0.0011
2593	6.0	0.36	0.0011	0.45	0.0011	0.48	0.0011	0.41	0.0011
2687	6.0	0.38	0.0011	0.41	0.0011	0.55	0.0011	0.55	0.0011
2499	5.5	0.35	0.0011	0.33	0.0011	0.45	0.0011	0.48	0.0011
2593	5.5	0.13	0.0010	0.35	0.0011	0.44	0.0011	0.37	0.0011
2687	5.5	0.13	0.0010	0.37	0.0011	0.26	0.0011	0.40	0.0011

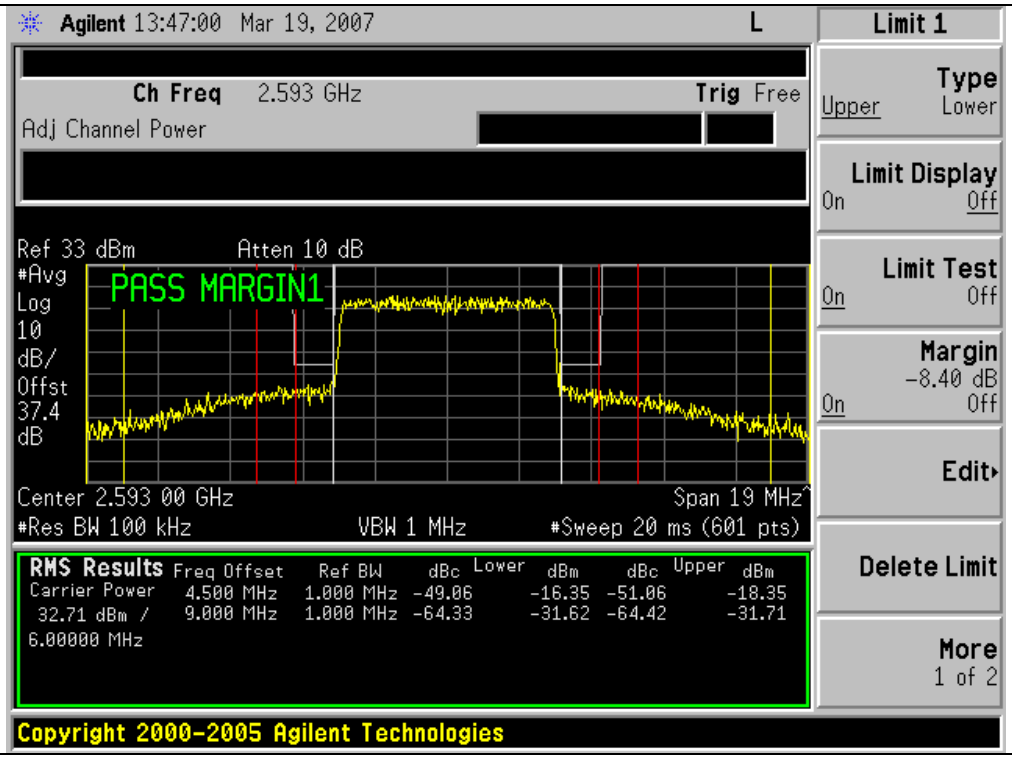
5.3.2. Conducted RF Power Output Plots

The spectrum analyzer data for the 4-QAM peak power measurements is displayed on the following pages. The conducted power level is indicated in the lower part of the screen under “Carrier Power”. The plots for the 16, 64, and 16 LT QAM modulation levels are located in the Appendix (refer to “Conducted Power and Modulation Characteristics Plots”).

RF Power: 2 Watts	Bandwidth: 6.0 MHz	Modulation: 4 QAM

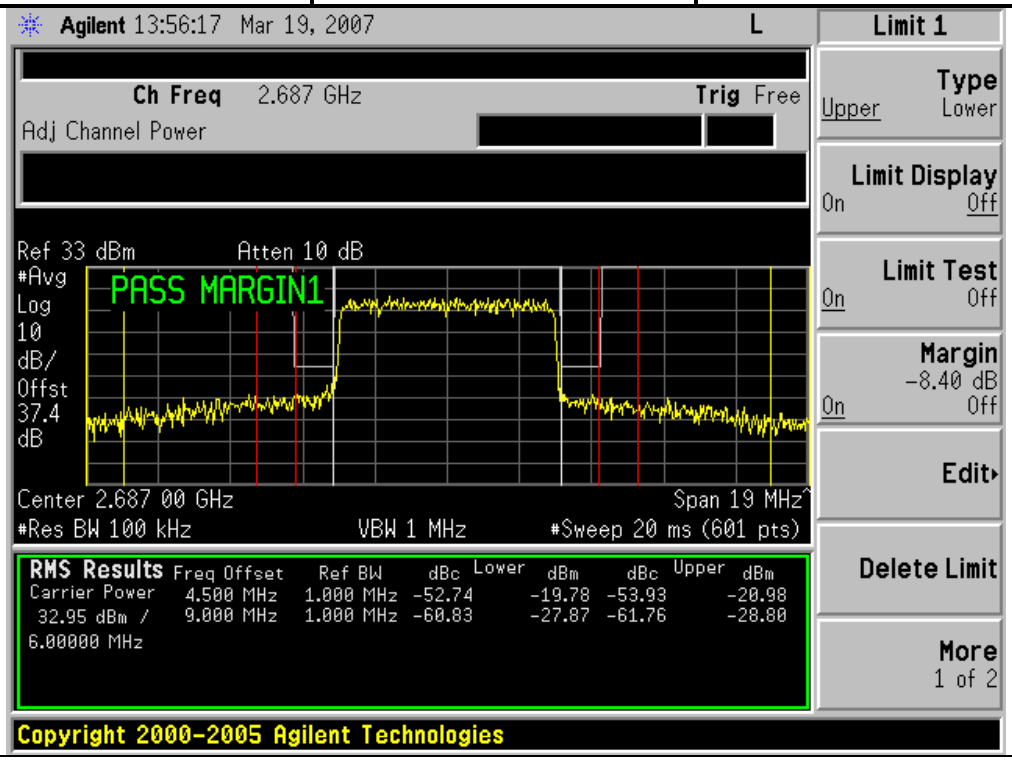


2499 MHz



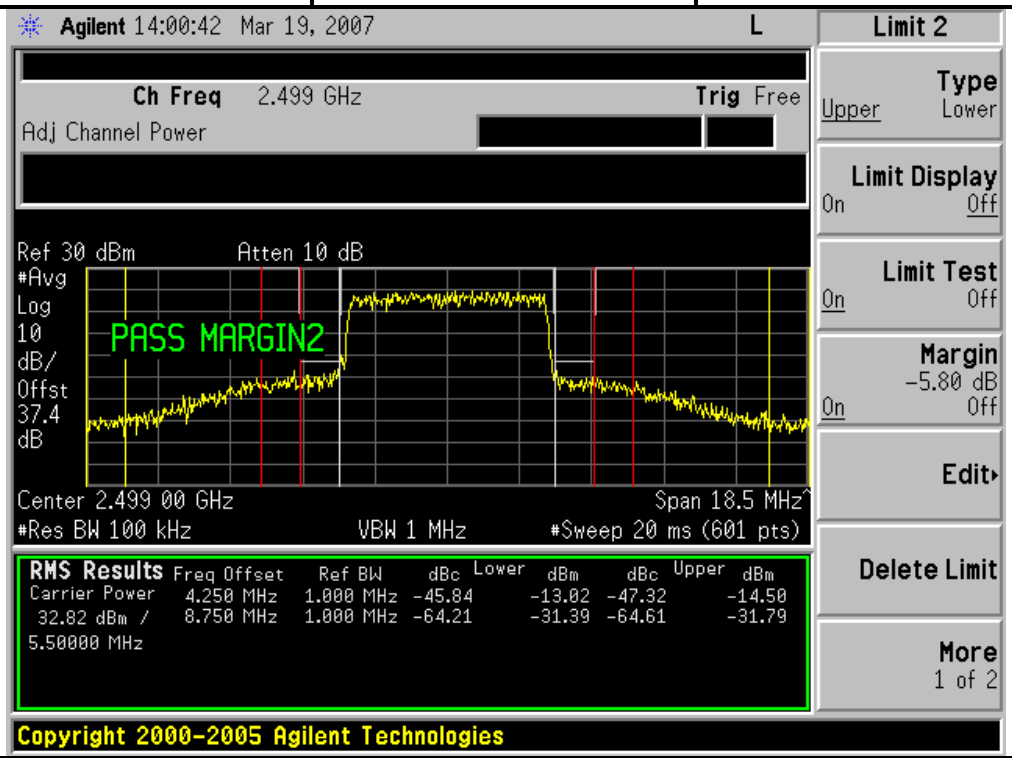
2593 MHz

RF Power: 2 Watts	Bandwidth: 6.0 MHz	Modulation: 4 QAM



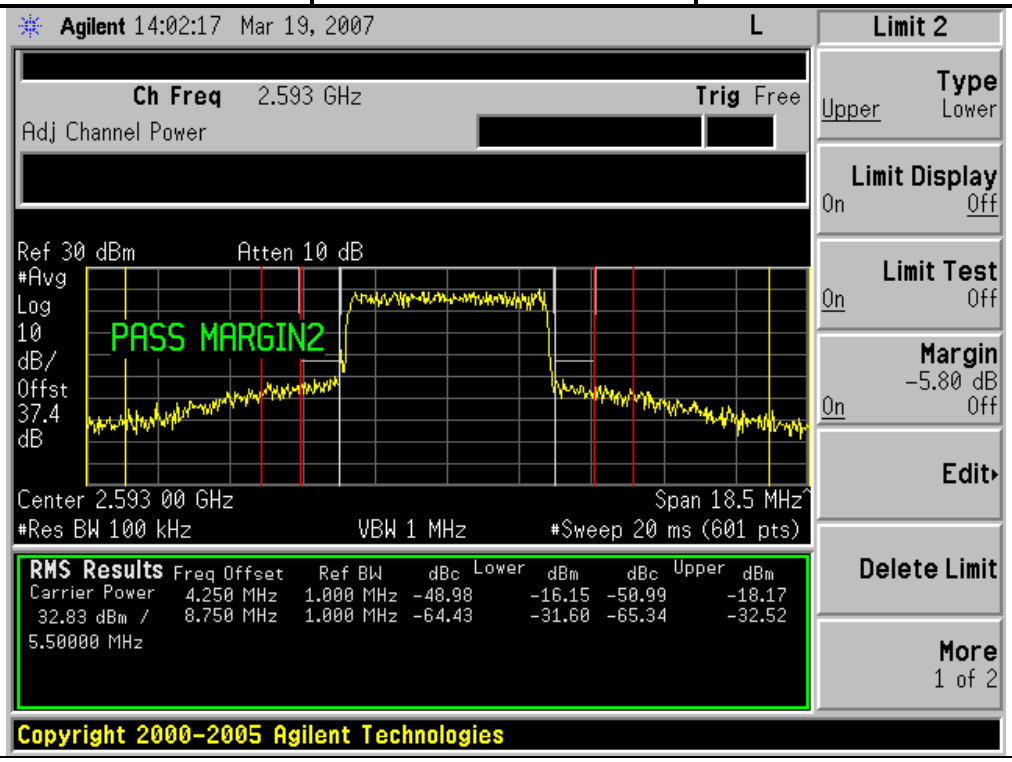
2687 MHz

RF Power: 2 Watts	Bandwidth: 5.5 MHz	Modulation: 4 QAM

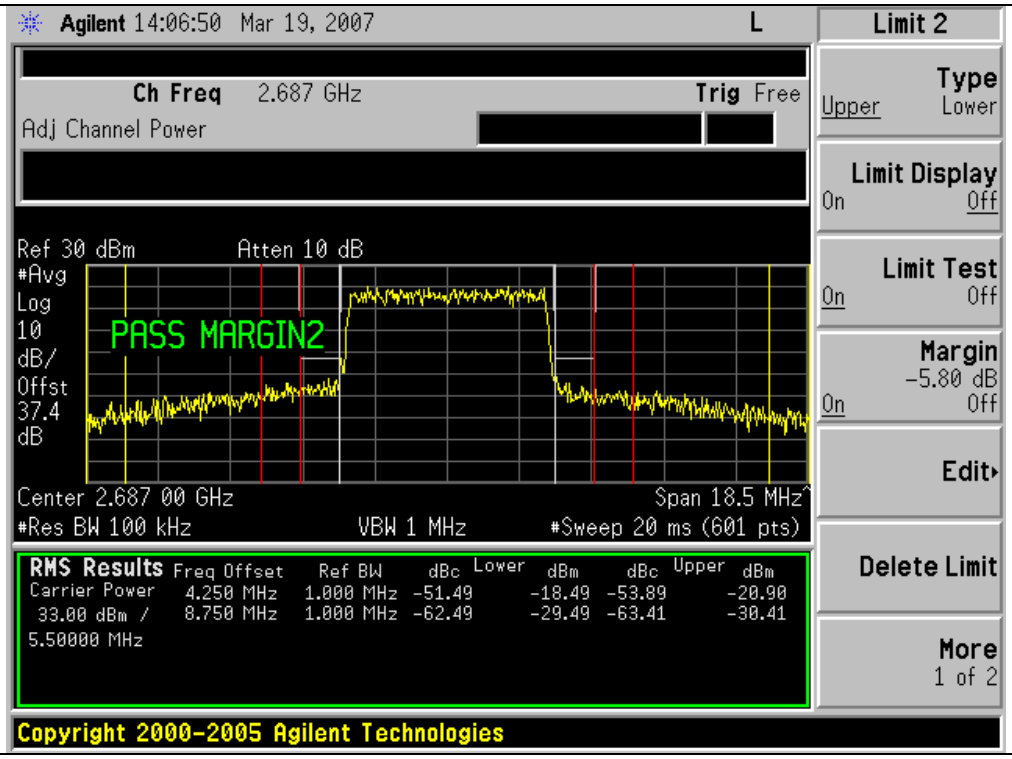


2499 MHz

RF Power: 2 Watts	Bandwidth: 5.5 MHz	Modulation: 4 QAM

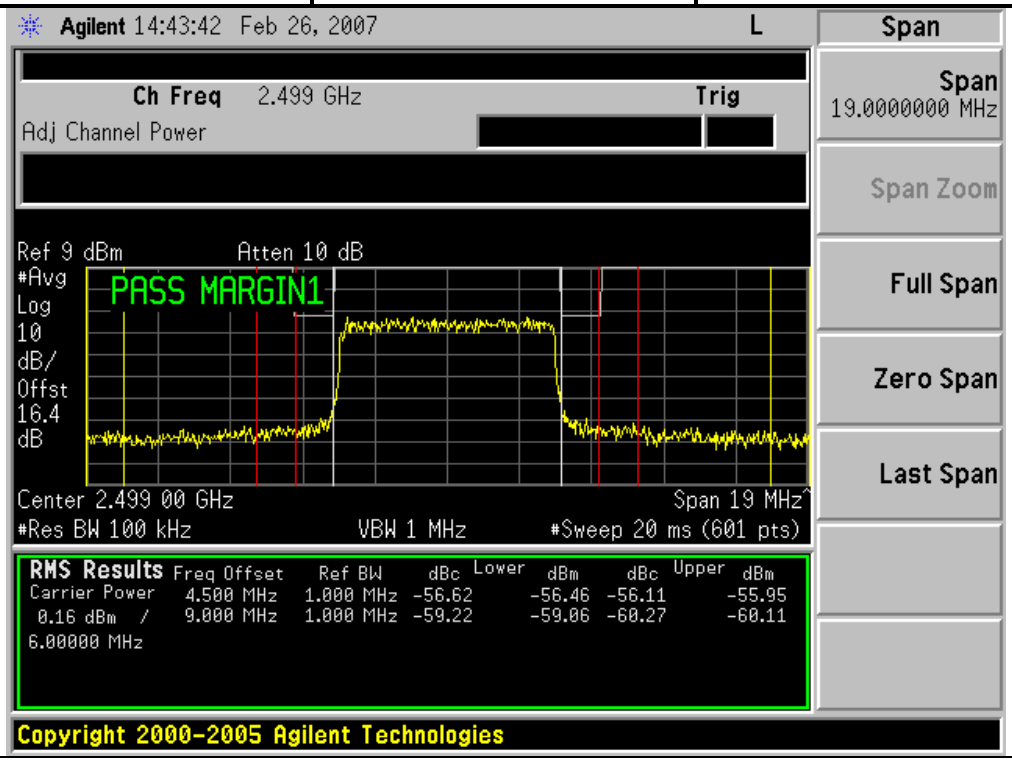


2593 MHz

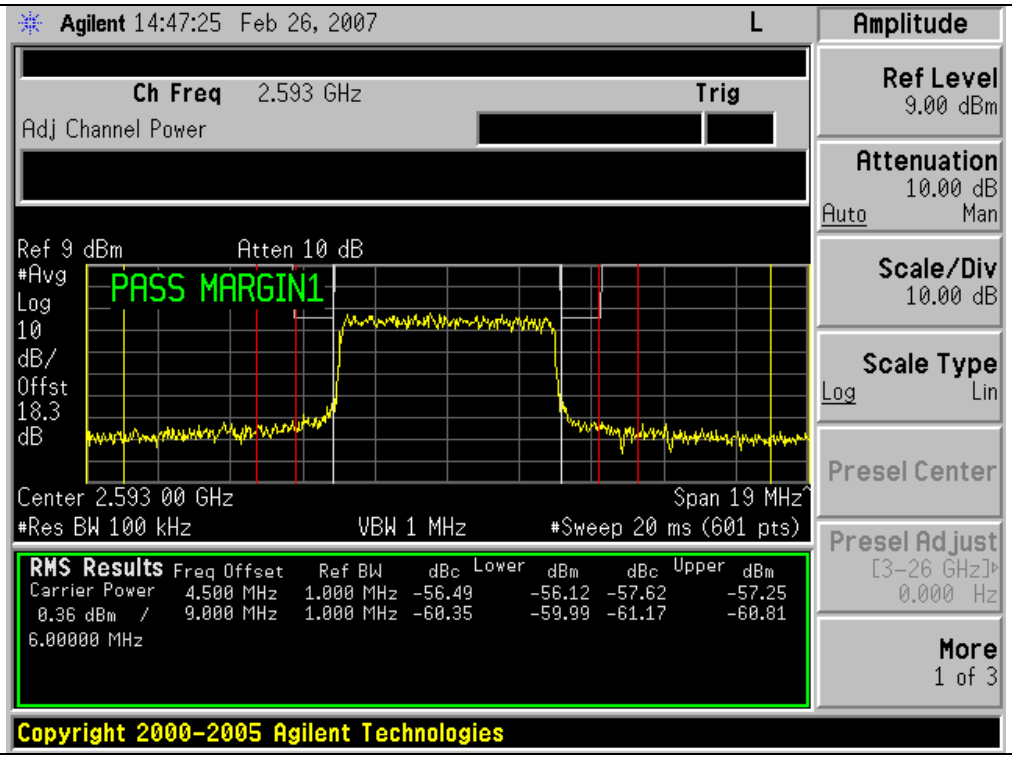


2687 MHz

RF Power: 1 Milliwatt	Bandwidth: 6.0 MHz	Modulation: 4 QAM

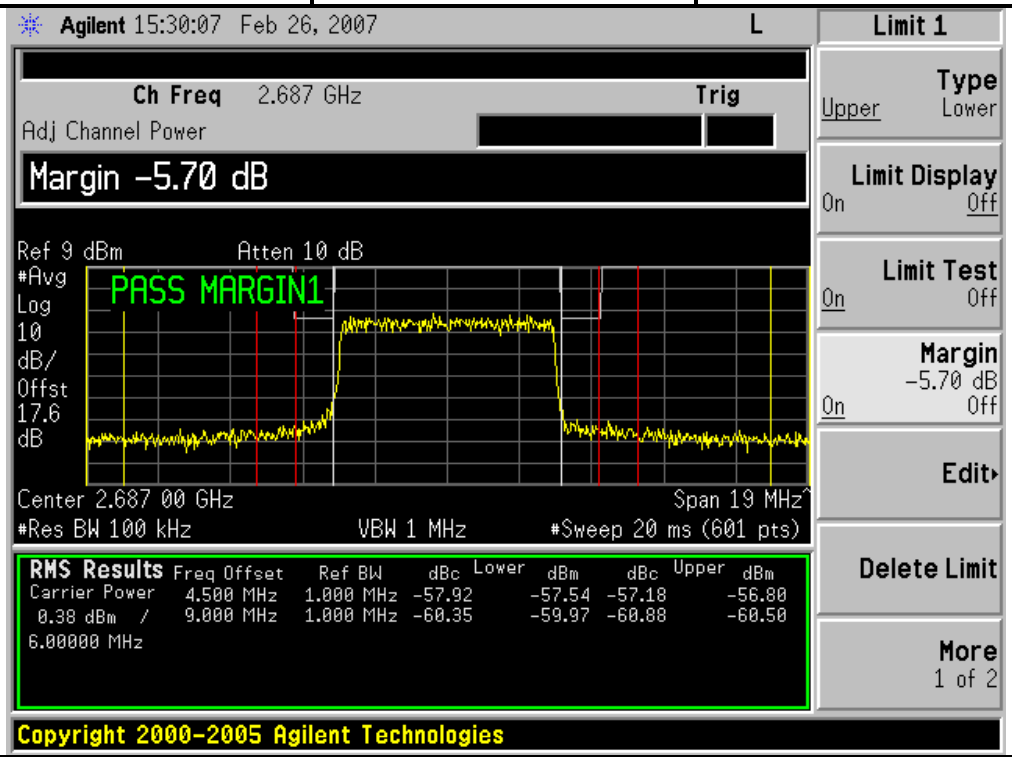


2499 MHz



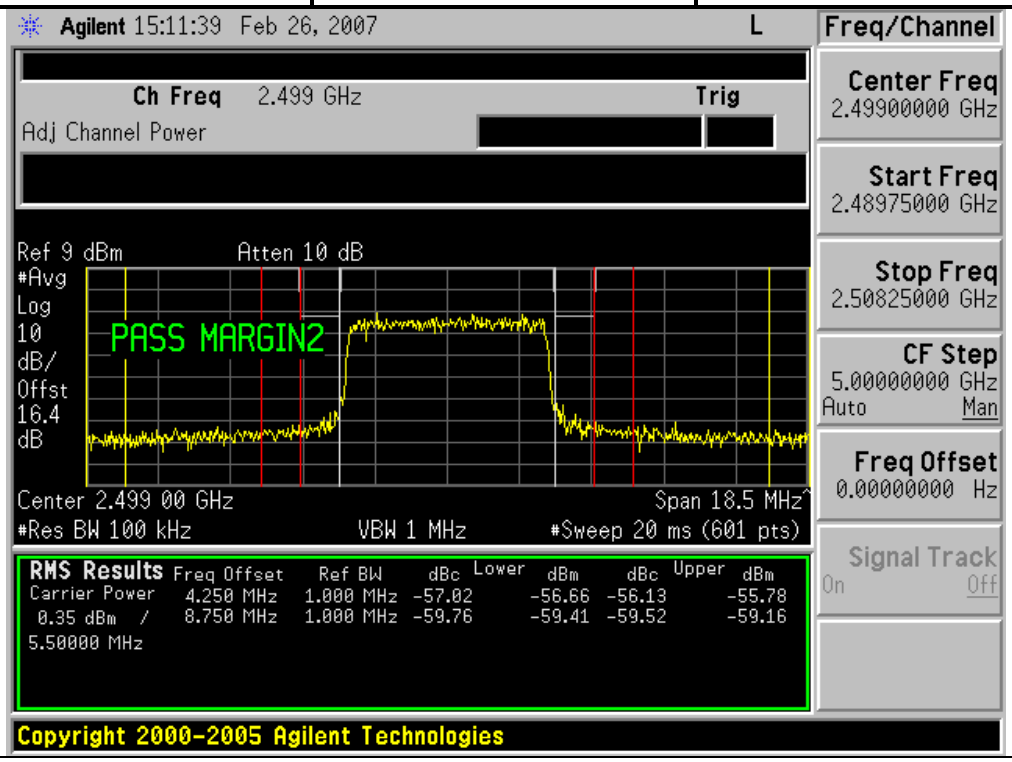
2593 MHz

RF Power: 1 Milliwatt	Bandwidth: 6.0 MHz	Modulation: 4 QAM



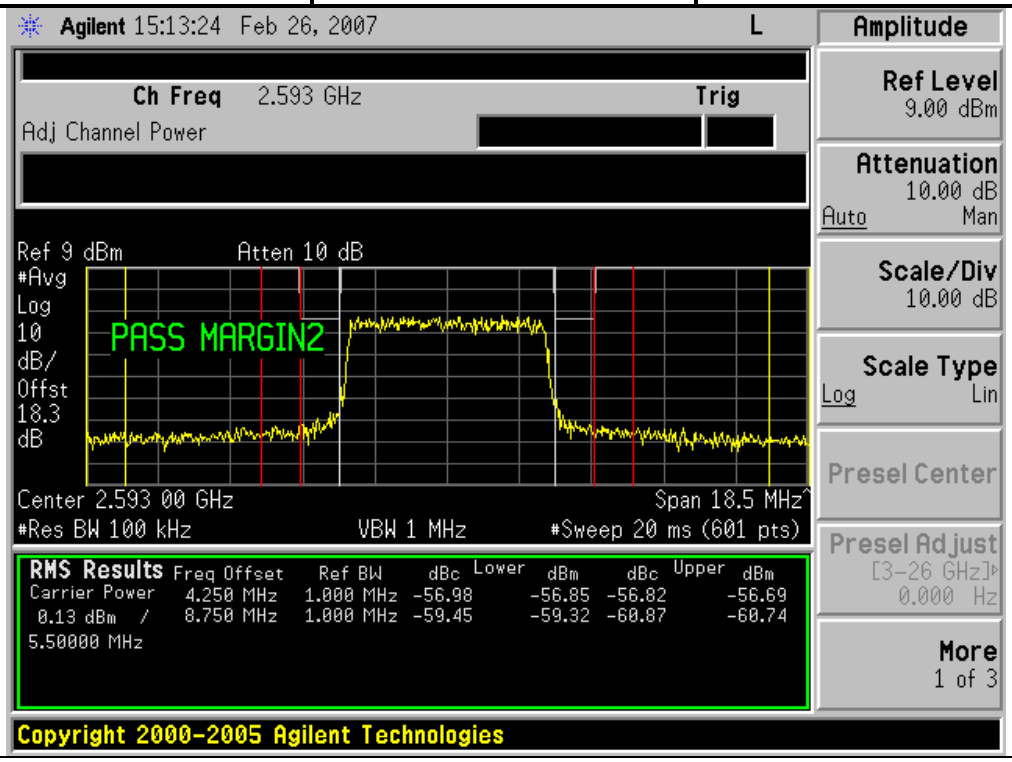
2687 MHz

RF Power: 1 Milliwatt	Bandwidth: 5.5 MHz	Modulation: 4 QAM

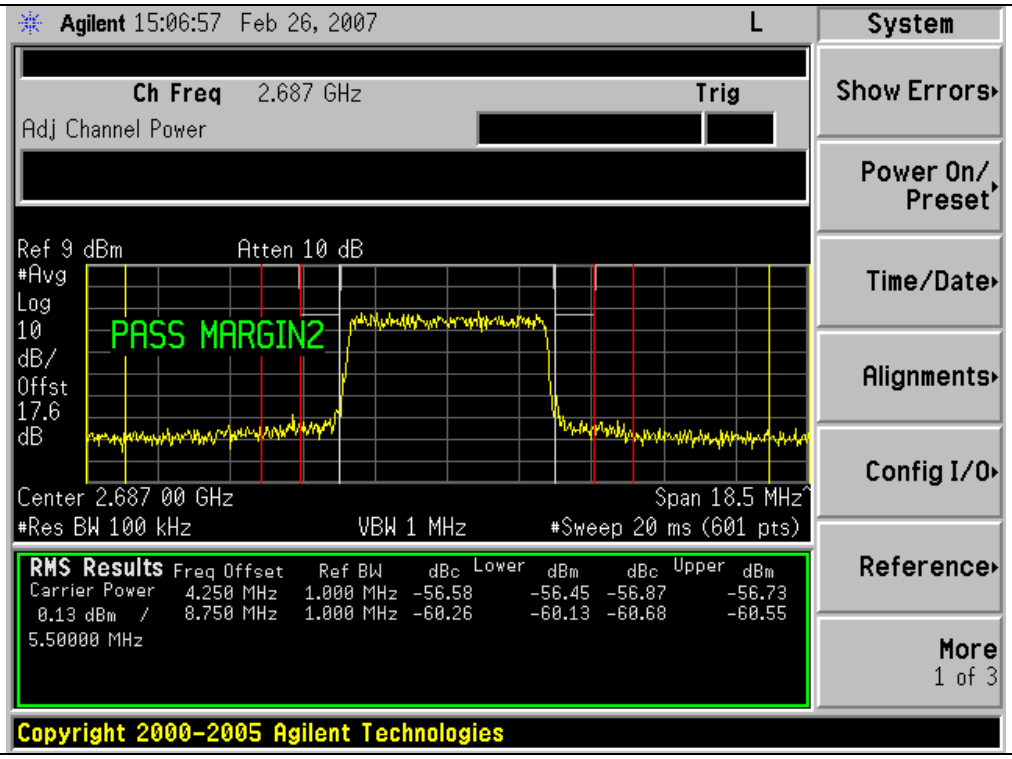


2499 MHz

RF Power: 1 Milliwatt	Bandwidth: 5.5 MHz	Modulation: 4 QAM



2593 MHz



2687 MHz

5.4 Modulation Characteristics

FCC Rules: 2.1047(d), 27.53(l)(2), 27.53(l)(6)

FCC requirement: Temporary Fixed
Attenuation at band edge = 43 + 10*log(P), P= 2 watts
Attenuation at band edge = 43 + 10*log(2) = 43 + 3
Attenuation at band edge = 46 dB (equates to –13 dBm)

Standard: 47CFR27.53(l)(2)

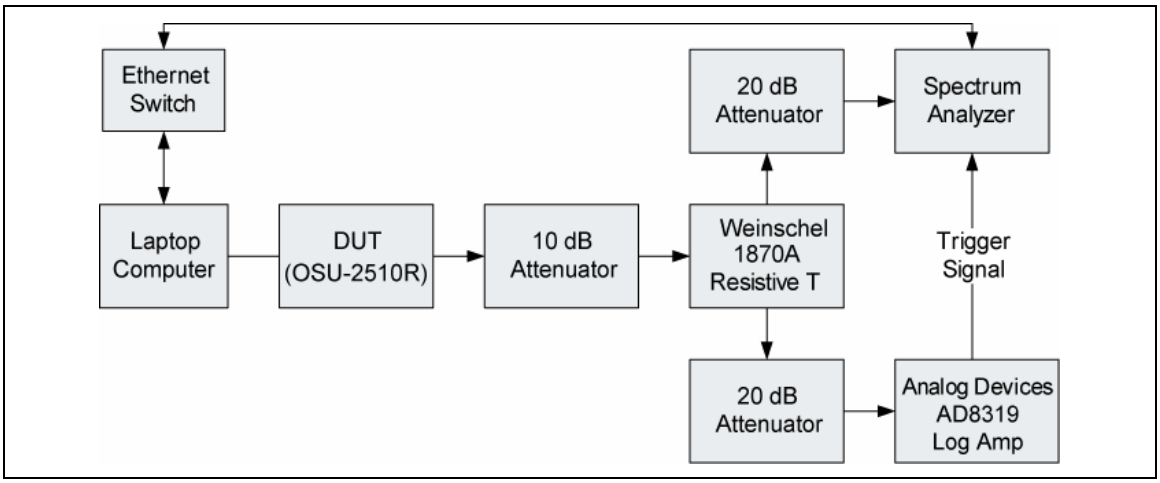
Test Procedure: The Orthogonal Frequency Division Multiplexing (OFDM) modulated Time Division Duplex (TDD) RF signal from the test unit is applied to a spectrum analyzer. A detector that has been calibrated in terms of rms-equivalent voltage is used to measure the power of the out of band emission. The emissions have been recorded and show compliance to the –13 dBm requirement. As allowed per the FCC rules, a measurement bandwidth of 100 kHz (1% or greater of the emissions bandwidth) was used for the test.

Compliance is shown on the plot by establishing a limit line at the –13 dBm level such that any emissions that would be above the limit within the first 1 MHz of spectrum outside of the channel would produce a “FAIL MARGIN1” (6 MHz channel) or “FAIL MARGIN2” (5.5 MHz channel) message on the spectrum analyzer display.

The next 1 MHz of spectrum is shown to comply with the –13 dBm limit by use of the integrated power function of the spectrum analyzer. The appropriate offset for the 1 MHz of spectrum being measured is shown on the plots. Compliance to the second 1 MHz of spectrum is shown by reviewing the lower and upper integrated power measurement information on the spectrum analyzer display.

The OSU-2510R transmitter is enabled in test mode by the attached computer. The RF loss of the attenuators and coax was measured and is included in the spectrum analyzer amplitude offset and is noted in the block diagram which follows. Measurements are performed at several frequencies across the band, for each of the modulation formats available (4-, 16-, 64-, 16LT- QAM) and channel bandwidths (5.5 and 6.0 MHz). The test frequencies are at the low, mid, and high band points.

Test Conditions: **Test Frequencies**: 2499, 2593, 2687 MHz (5.5 and 6.0 MHz bandwidth)
Temperature: 22°C
Supply Voltage: 120 VAC / 60 Hz Nominal to DUT Power Supply



Modulation Characteristics Test Setup

5.4.1. Modulation Characteristics Test Results Summary

Modulation Characteristics Test Results					
Freq (MHz)	**Bandwidth (MHz)**	**4 QAM**	**16 QAM**	**64 QAM**	**16 QAM Lite**
2499	6.0	Pass	Pass	Pass	Pass
2593	6.0	Pass	Pass	Pass	Pass
2687	6.0	Pass	Pass	Pass	Pass
2499	5.5	Pass	Pass	Pass	Pass
2593	5.5	Pass	Pass	Pass	Pass
2687	5.5	Pass	Pass	Pass	Pass

5.4.2. Modulation Characteristics Data Plots

The spectrum analyzer plots for the 2-watt, 4-QAM data is shown in the Conducted Power plots on the preceding pages pages starting on page 5. The plots for the 16, 64, and 16 LT QAM modulation levels are located in the Appendix (refer to “RF Power Output and Modulation Characteristics Plots”).

5.5 Occupied and Emission Bandwidth

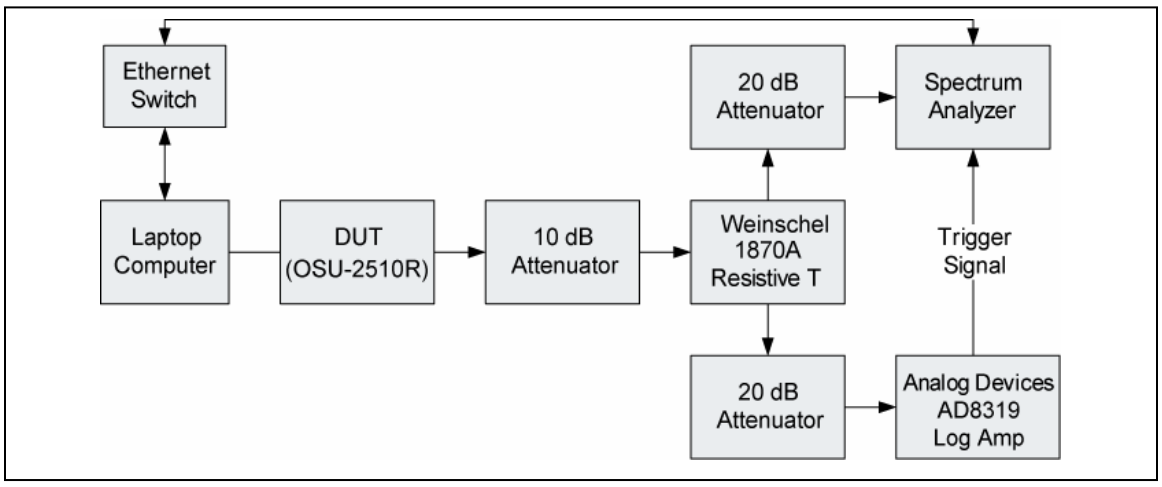
FCC Rules: 2.1049, 27.53(l)(6)

FCC Requirements: Report Results

Standard: ANSI C63.4-2003
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.

Test Procedure: The Orthogonal Frequency Division Multiplexing (OFDM) modulated Time Division Duplex (TDD) RF signal from the test unit is applied to a spectrum analyzer. The bandwidth of the signal is recorded by measuring the modulation bandwidth with the built in measurement function in the spectrum analyzer. The transmitter is enabled in test mode with the attached computer. The RF loss of the attenuators and coax has been measured and is included in the spectrum analyzer offset level. Measurements are performed at frequencies at the low, mid, and high points the band, for each of the modulation formats available (4, 16, 64, and 16L QAM), and channel bandwidths (5.5 and 6 MHz).

Test Conditions: **Test Frequencies**: 2499, 2593, 2687 MHz (5.5 and 6.0 MHz bandwidth)
Temperature: 22°C
Supply Voltage: 120 VAC / 60 Hz nominal to DUT power supply



Occupied/Emission Bandwidth Test Setup

5.5.1. Occupied and Emission Bandwidth Test Results Summary

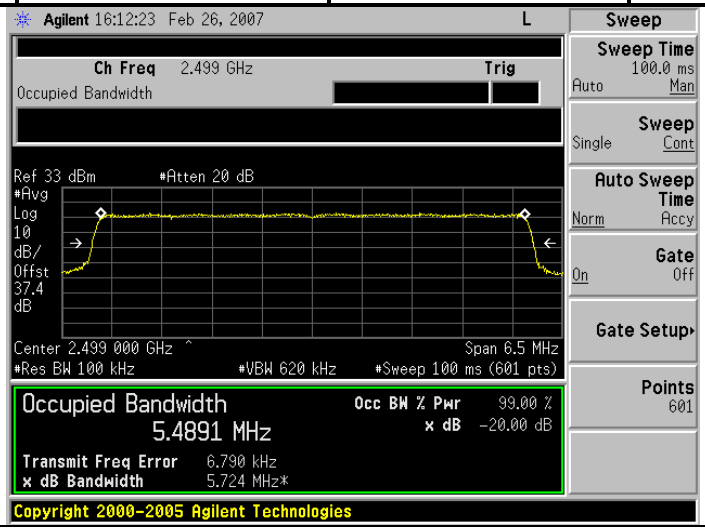
Occupied Bandwidth (MHz) for 99.0% (-20 dB)					
Freq (MHz)	**Bandwidth (MHz)**	**4 QAM**	**16 QAM**	**64 QAM**	**16 QAM Lite**
2499	6.0	5.489	5.490	5.487	5.488
2593	6.0	5.487	5.488	5.487	5.489
2687	6.0	5.487	5.490	5.490	5.489
2499	5.5	4.970	4.969	4.969	4.972
2593	5.5	4.972	4.971	4.971	4.970
2687	5.5	4.969	4.971	4.968	4.968

Emission Bandwidth (MHz) for 99.75% (-26 dB)					
Freq (MHz)	**Bandwidth (MHz)**	**4 QAM**	**16 QAM**	**64 QAM**	**16 QAM Lite**
2499	6.0	5.584	5.580	5.581	5.581
2593	6.0	5.580	5.581	5.581	5.581
2687	6.0	5.579	5.580	5.578	5.056
2499	5.5	5.057	5.061	5.057	5.060
2593	5.5	5.058	5.059	5.058	5.057
2687	5.5	5.058	5.055	5.061	5.058

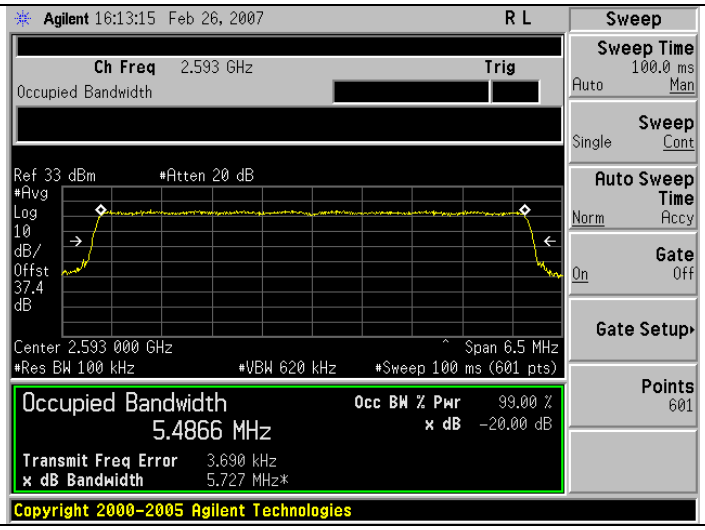
5.5.2. Occupied Bandwidth Spectrum Analyzer Plots

The following are spectrum analyzer plots of the 4 QAM data in the preceding tables. The plots for the 16 QAM, 64 QAM, and 16 QAM Lite modulation levels are similar and are shown in the Appendix (refer to “Occupied/Emission Bandwidth Plots”).

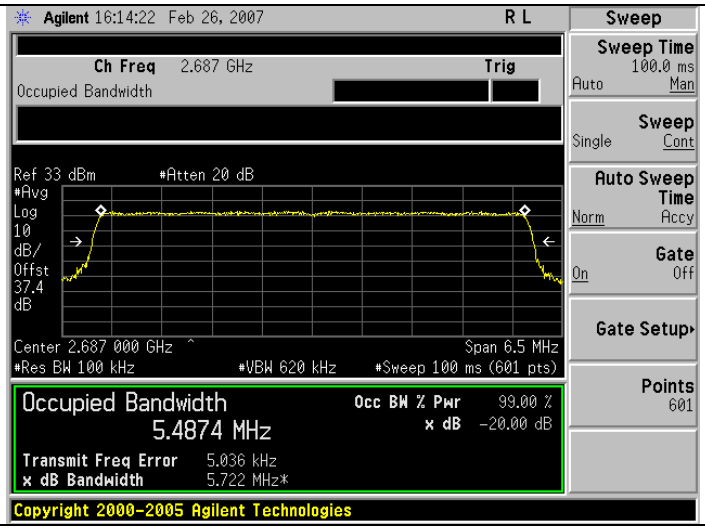
Occupied BW	Bandwidth: 6.0 MHz	RF Power: 2 Watts	Modulation: 4 QAM



2499 MHz

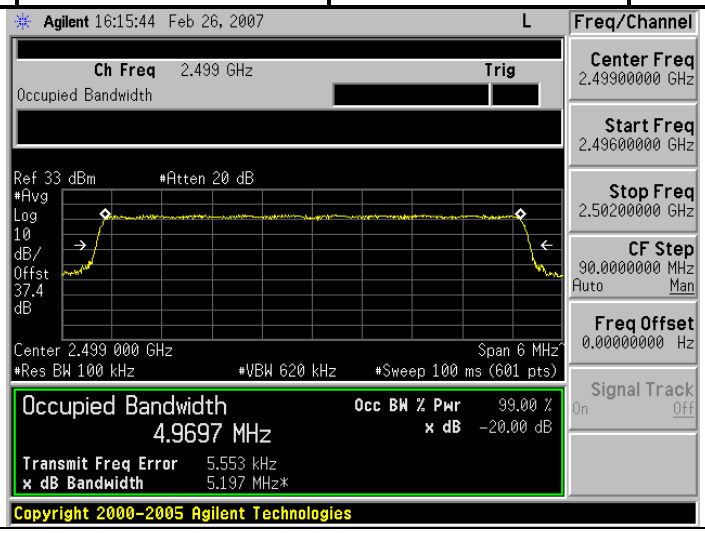


2593 MHz

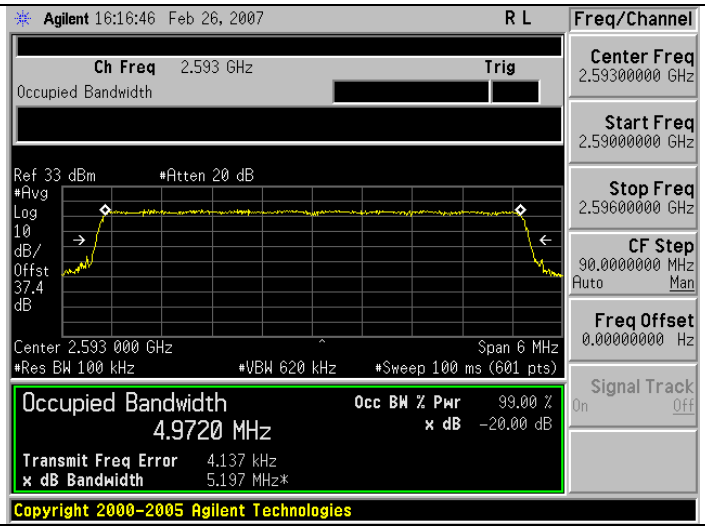


2687 MHz

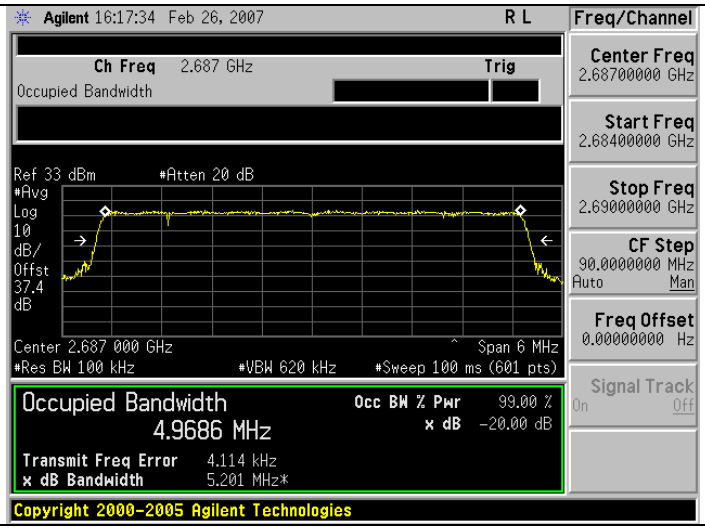
Occupied BW	Bandwidth: 5.5 MHz	RF Power: 2 Watts	Modulation: 4 QAM



2499 MHz

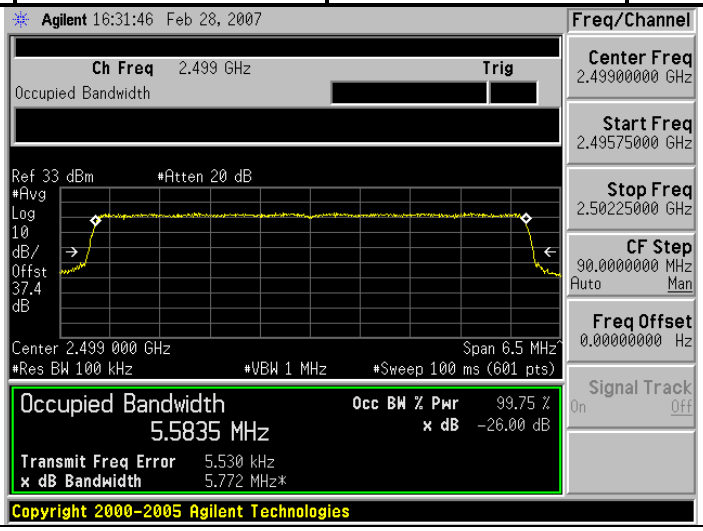


2593 MHz

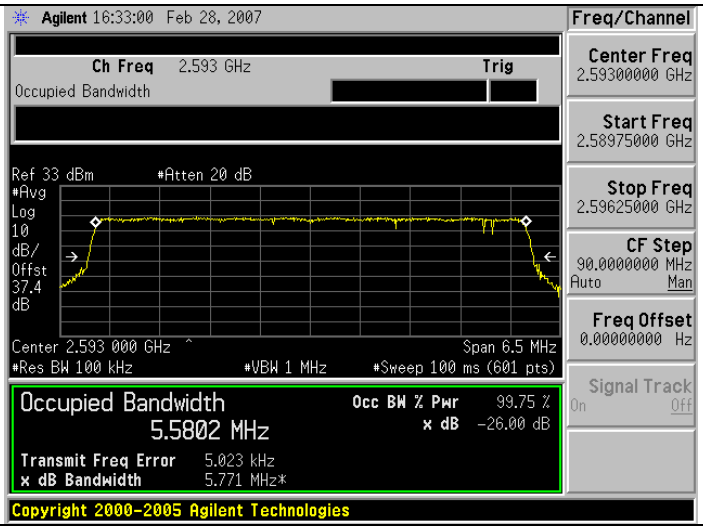


2687 MHz

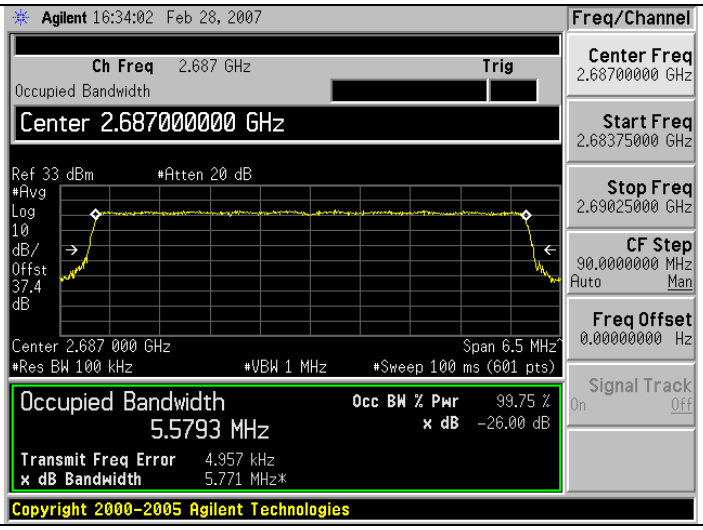
Emission BW	Bandwidth: 6.0 MHz	RF Power: 2 Watts	Modulation: 4 QAM



2499 MHz

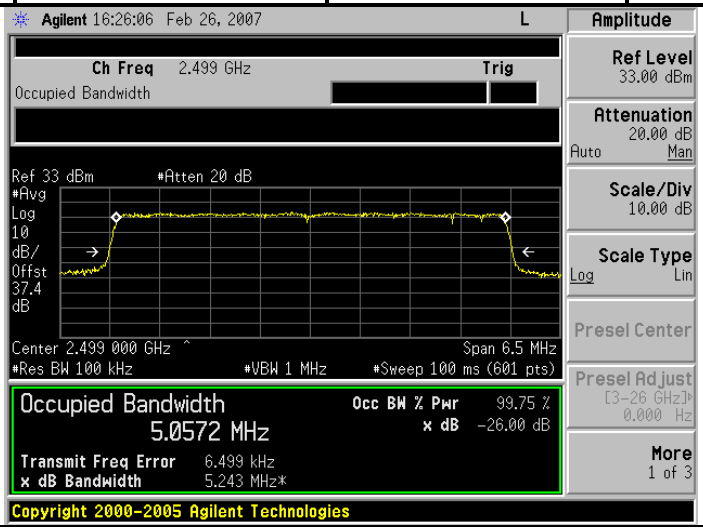


2593 MHz

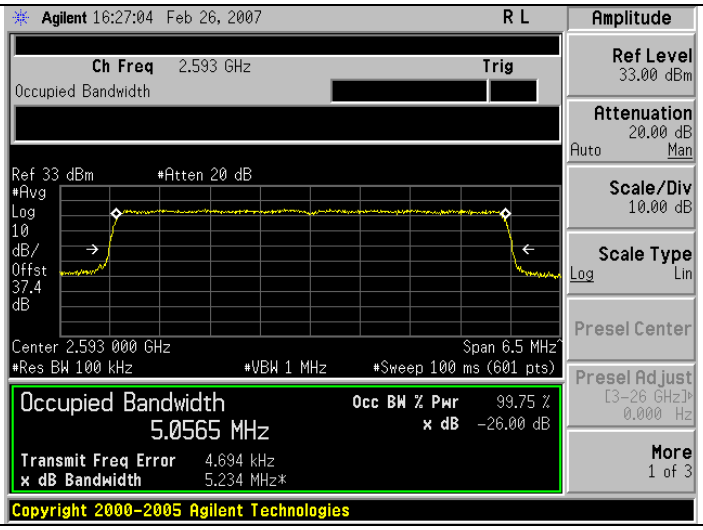


2687 MHz

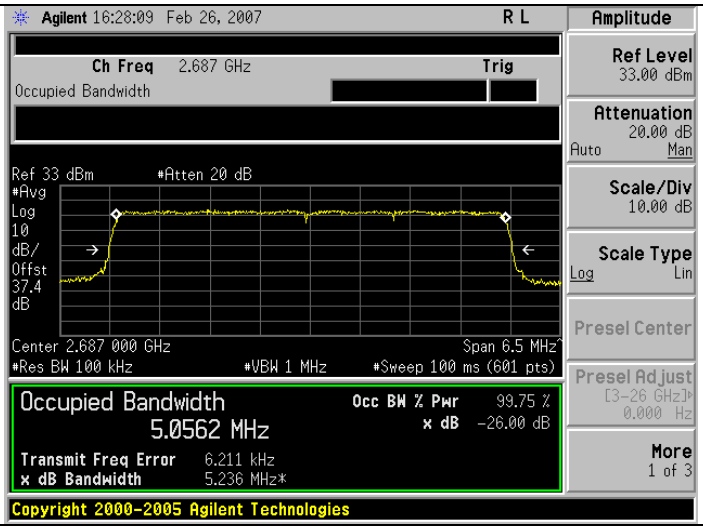
Emission BW	Bandwidth: 5.5 MHz	RF Power: 2 Watts	Modulation: 4 QAM



2499 MHz



2593 MHz



2687 MHz

5.6 Transmitter Spurious Emissions

FCC Rules: 2.1051, 2.1049, 2.1057

Standard: TIA-603-C
TIA Standard, Land Mobile FM or PM Communications Equipment, Measurement and Performance Standards

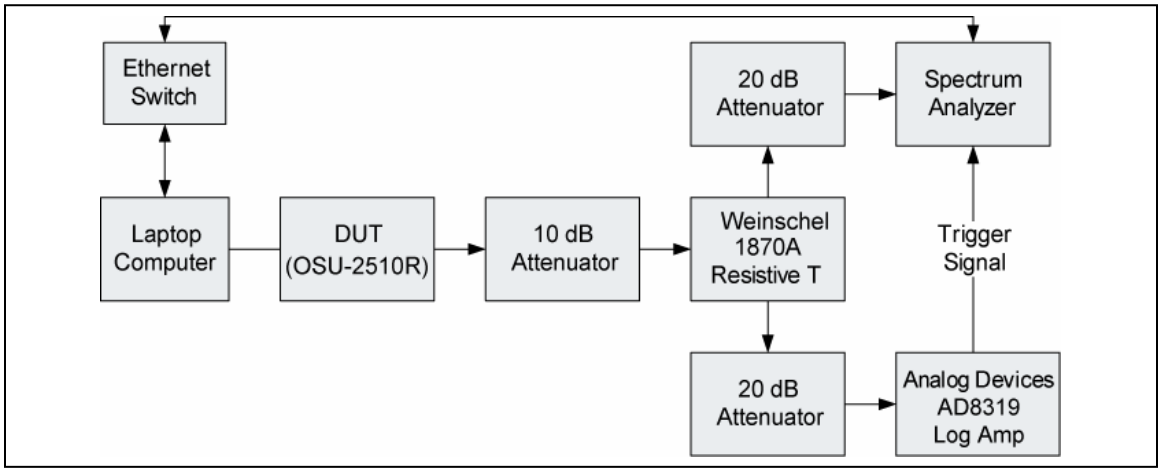
Test Procedure: The RF output of the transmitter was measured at the output to the integral antenna. This signal is applied to an attenuator that is connected to a resistive splitter "T". One path of the "T" is applied to the spectrum analyzer input and the other path is applied to the log amplifier through appropriate attenuation. The spectrum analyzer is time gated to only capture the RF transmission during the burst. The time gating signal is produced by the Analog Devices log amplifier. This device produces a dc output level that is proportional to the RF level applied to the amplifier input. The trigger level on the spectrum analyzer is set to respond at a voltage level that is not influenced by the modulation peaks or to the noise peaks when there is no signal applied.

The transmitter is enabled in test mode and set to the maximum power level with the attached computer. The transmission is recorded from 9 kHz to 26.5 GHz in multiple plots. The RF loss of the attenuators and coax is included in the spectrum analyzer offset level. Measurements are performed at frequencies across the band and both channel bandwidths (5.5 MHz and 6 MHz). A modulation level of 4 QAM was used for all measurements. One data plot from each channel bandwidth is included for measurements below the BRS/EBS frequency band (below 2.48 GHz). All other channels measured had similar-looking spectral plots. For tests above the BRS/EBS frequency (2.7-26.5 GHz), plots for all channels are included.

For harmonic tests, plots are shown for the second and third harmonic of all test channels. Plots above harmonic 3 are not shown because there were no detectable harmonics measured for harmonics 4-10.

Test Conditions:
Channels: 2499, 2593, and 2687 MHz (5.5 and 6.0 MHz bandwidth)
Temperature: 22°C
Supply Voltage: 120 VAC / 60 Hz nominal to the DUT power supply

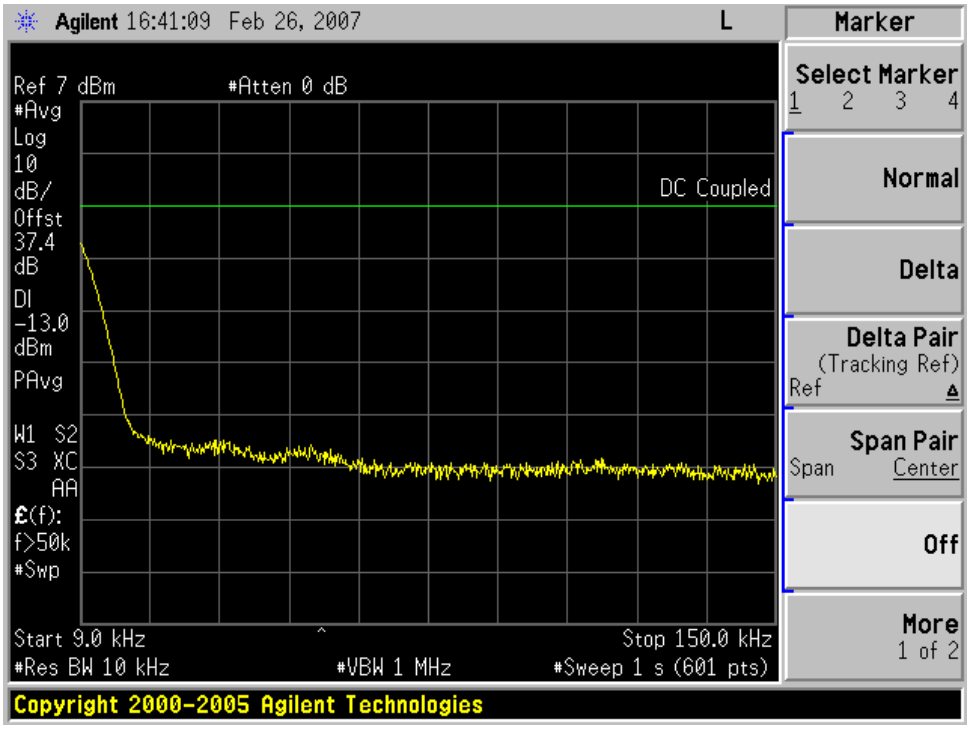
Test Results: Passes conducted emissions from 9 kHz to 26.86 MHz. There were no measurable harmonic emissions above the third harmonic on any test channel.



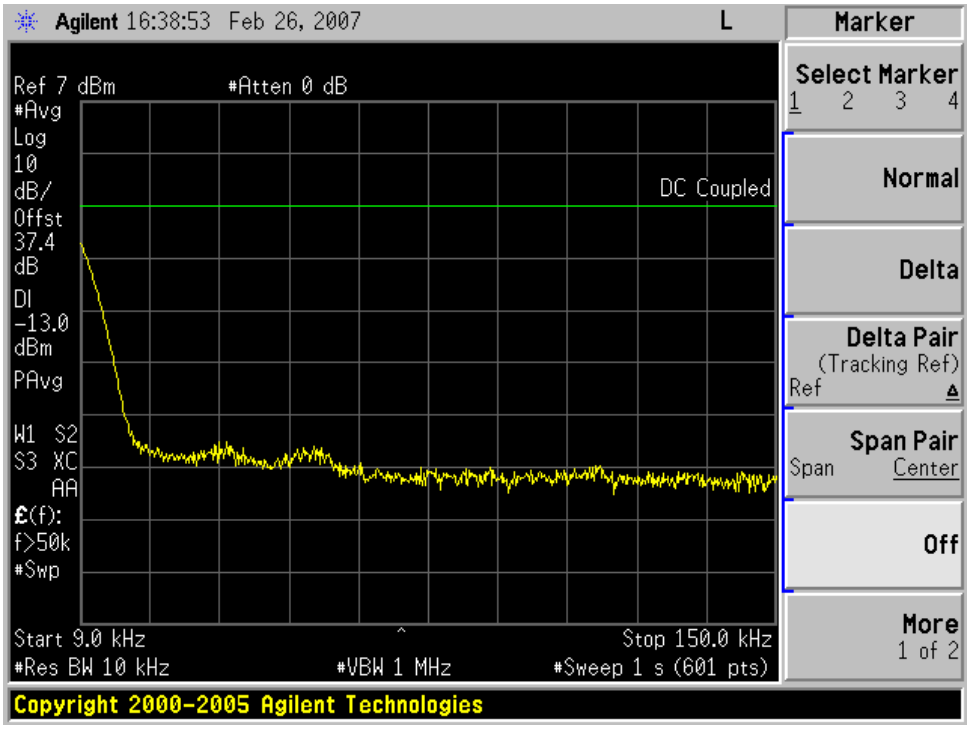
Spurious and Harmonic Emissions Test Setup

5.6.1. Transmitter Spurious Emissions Plots

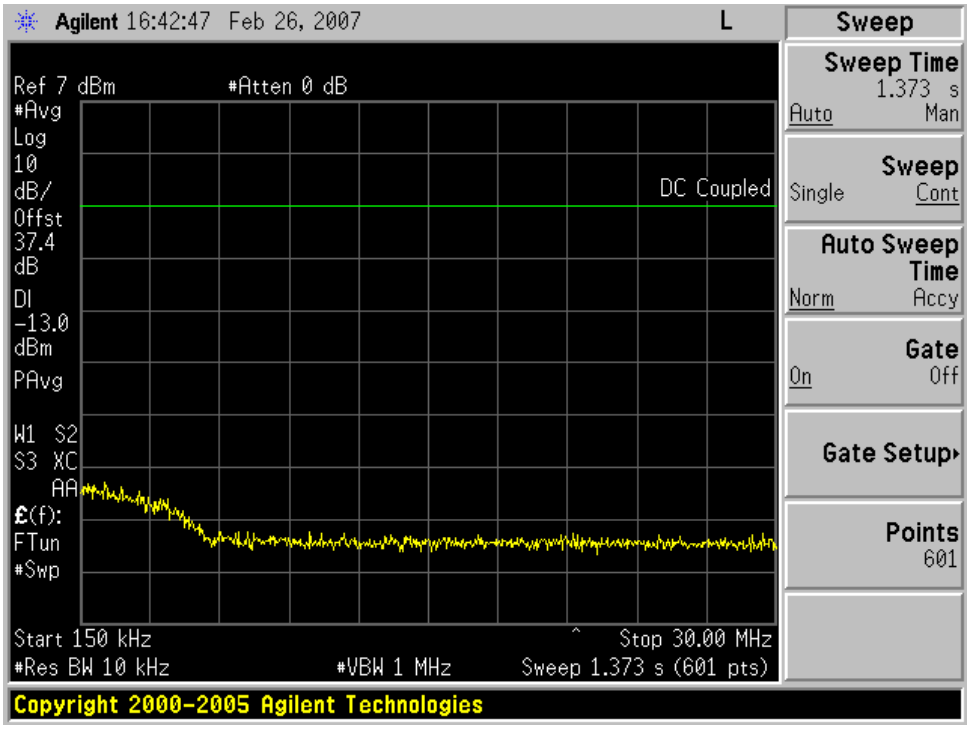
For frequencies below 2.48 GHz, plots for only the 2499 MHz (6.0 and 5.5 MHz bandwidth) channels are shown on the pages which follow. The plots for the other channels are similar and are located in the Appendix. For frequencies above 2.48 GHz, plots for all test channels are shown.



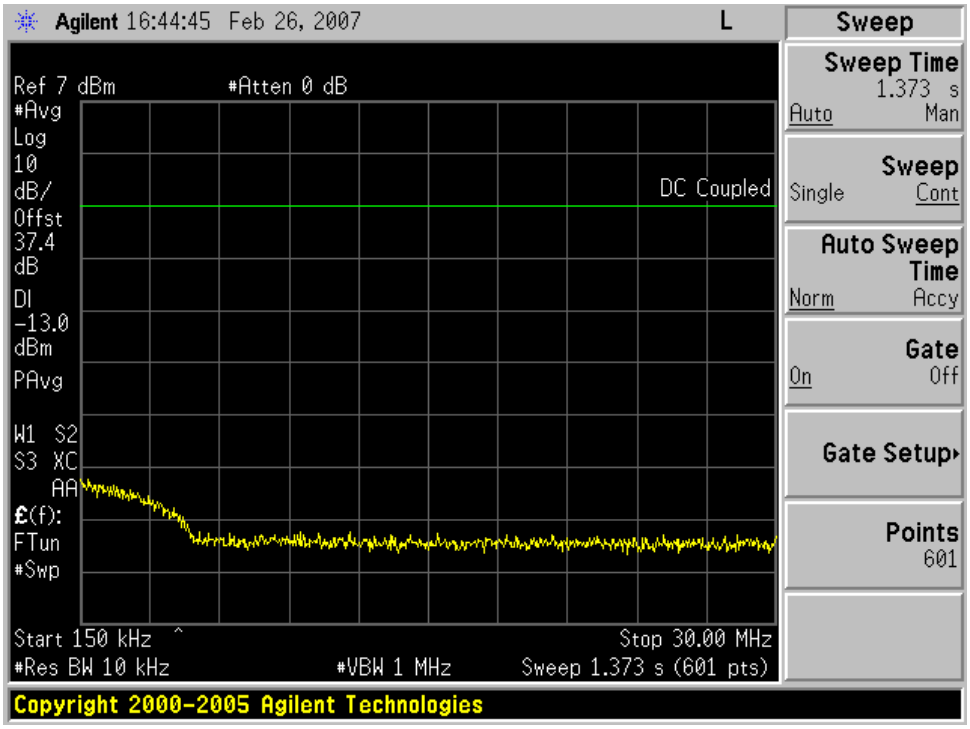
9 kHz – 150 kHz (2499 MHz, 6 MHz Channel)



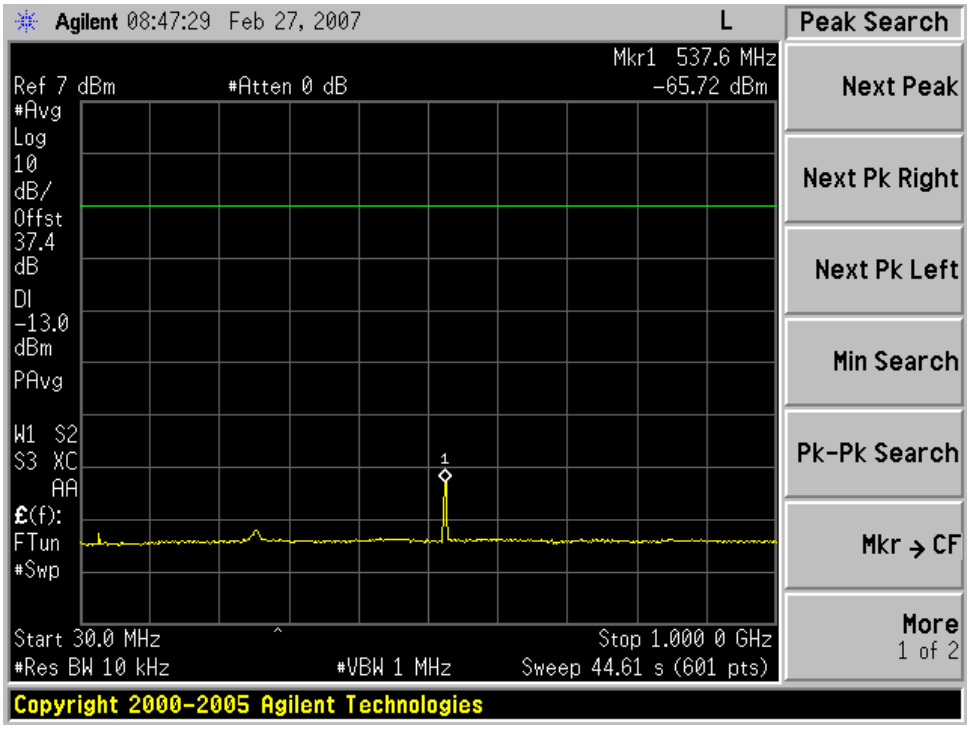
9 kHz – 150 kHz (2499 MHz, 5.5 MHz Channel)



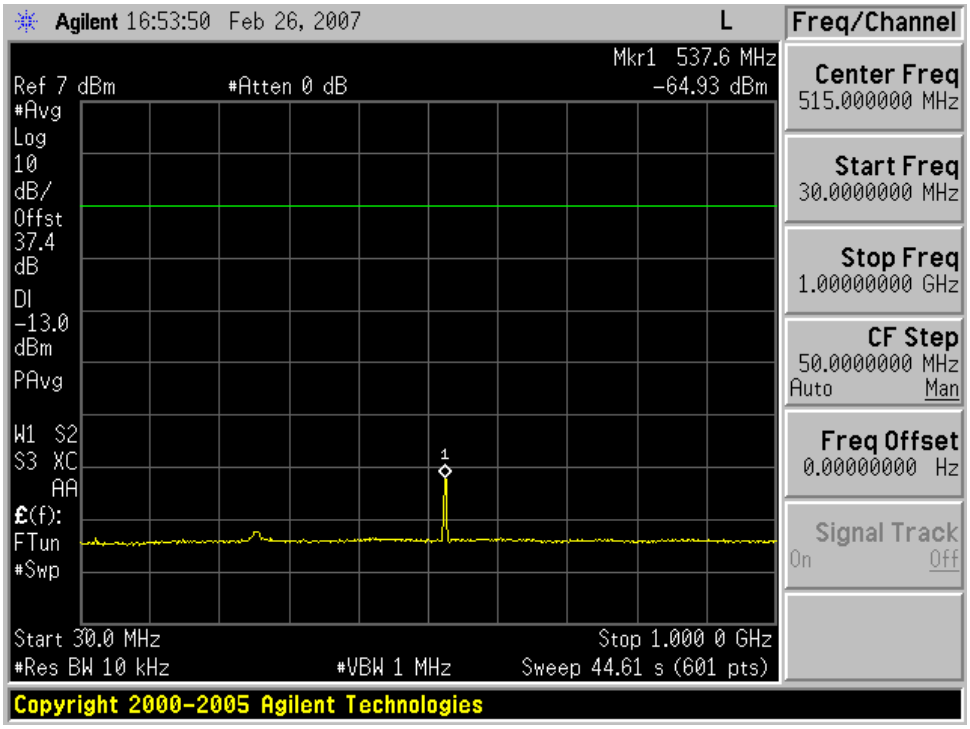
150 kHz – 30 MHz (2499 MHz, 6 MHz Channel)



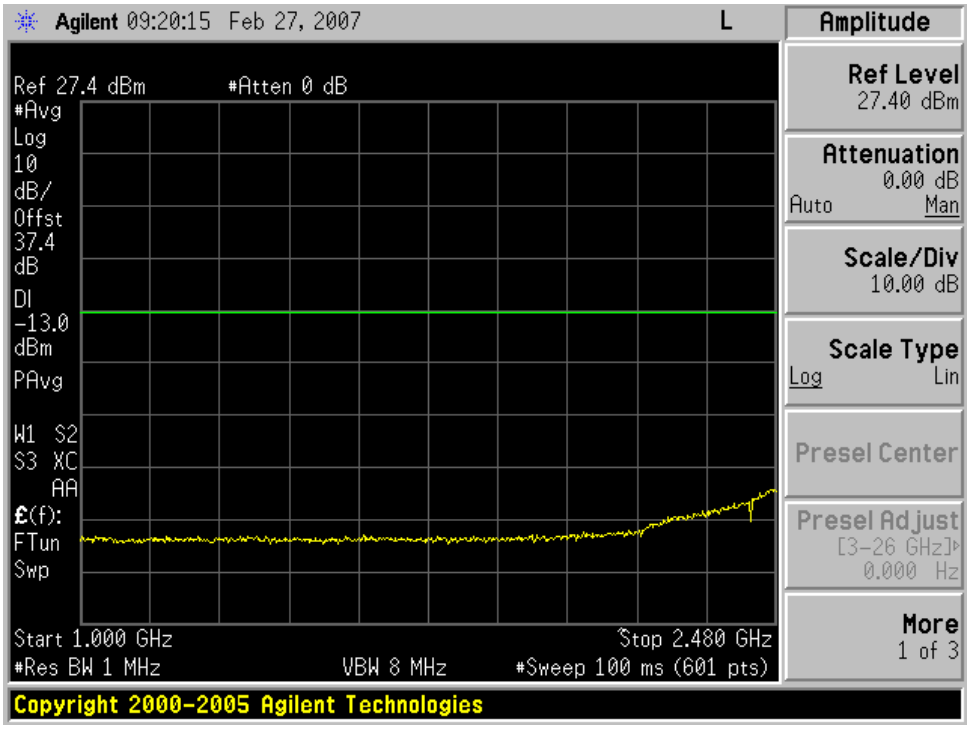
150 kHz – 30 MHz (2499 MHz, 5.5 MHz Channel)



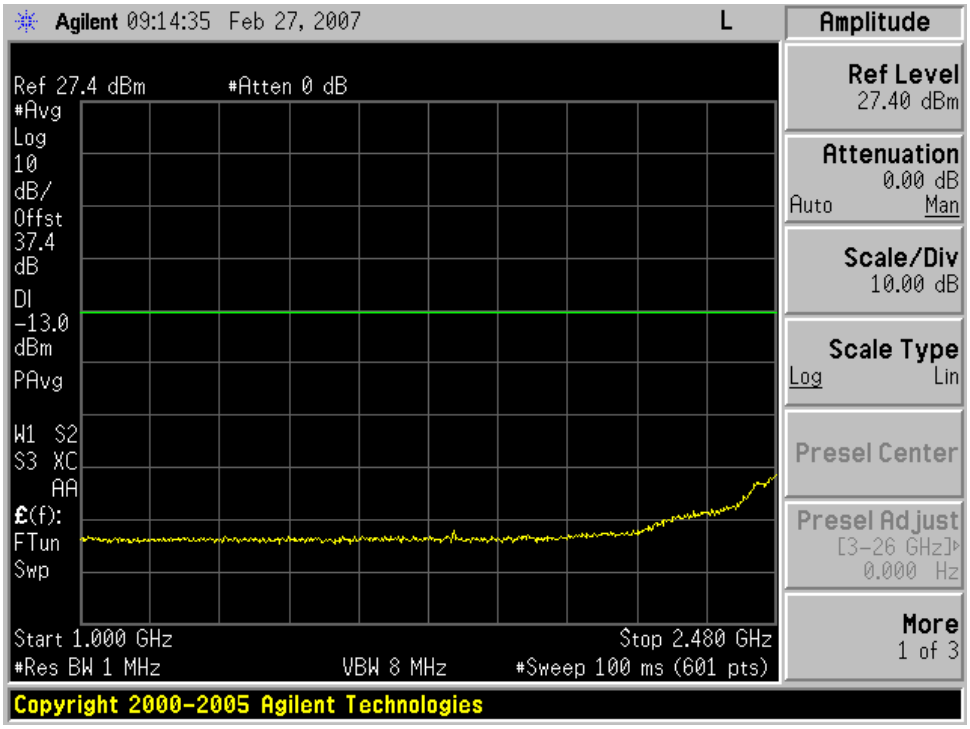
30 MHz – 1 GHz (2499 MHz, 6 MHz Channel)



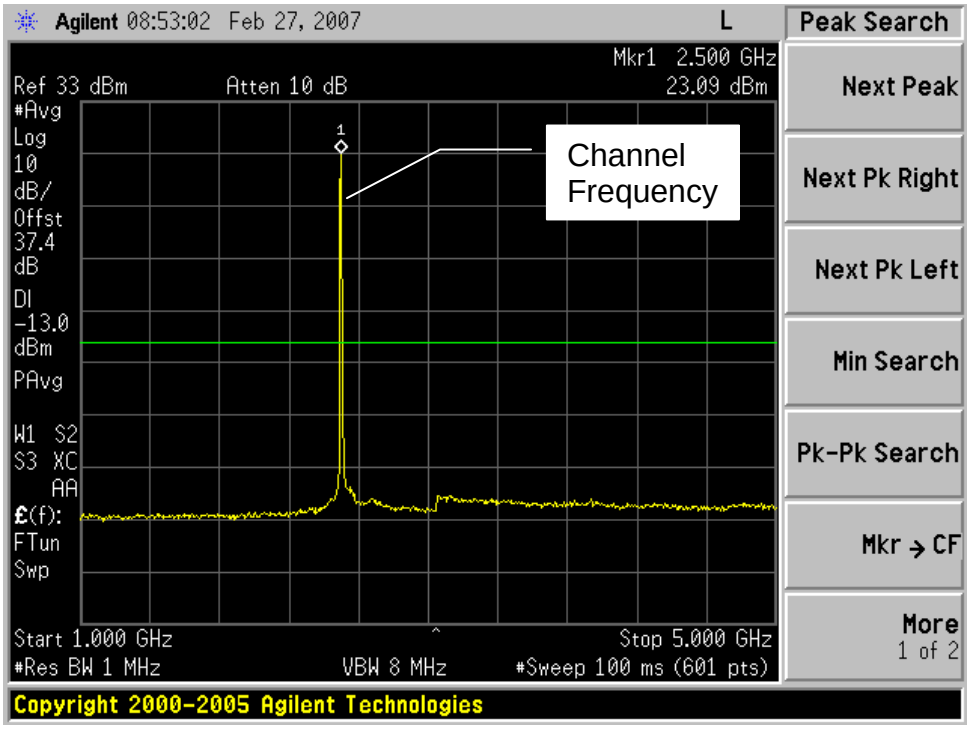
30 MHz – 1 GHz (2499 MHz, 5.5 MHz Channel)



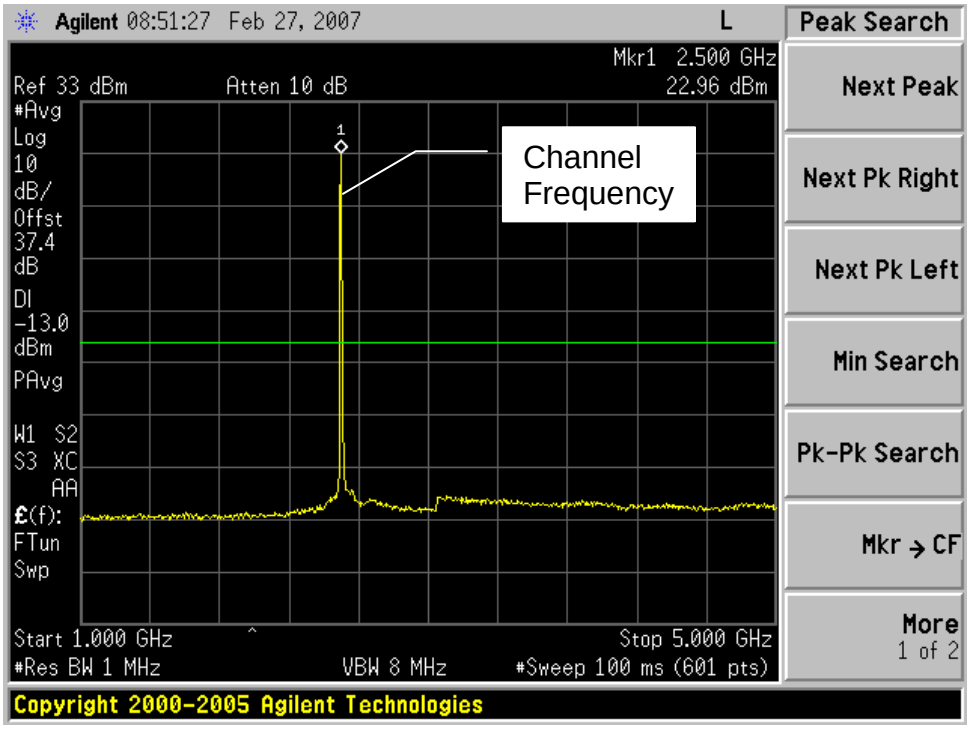
1 GHz – 2.48 GHz (2499 MHz, 6 MHz Channel)



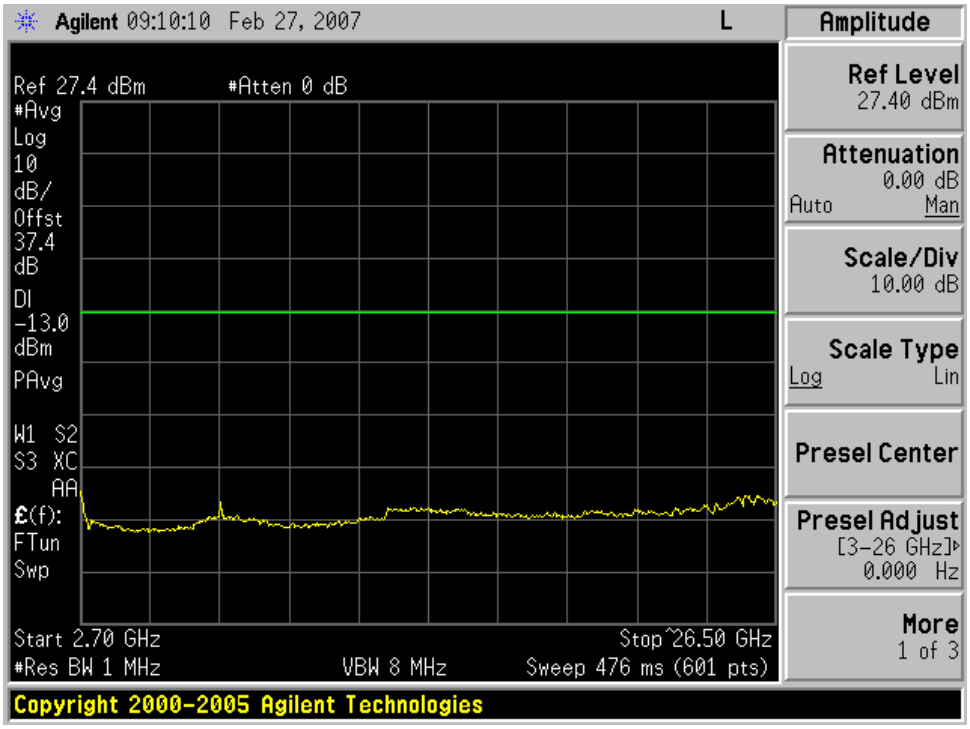
1 GHz – 2.48 GHz (2499 MHz, 5.5 MHz Channel)



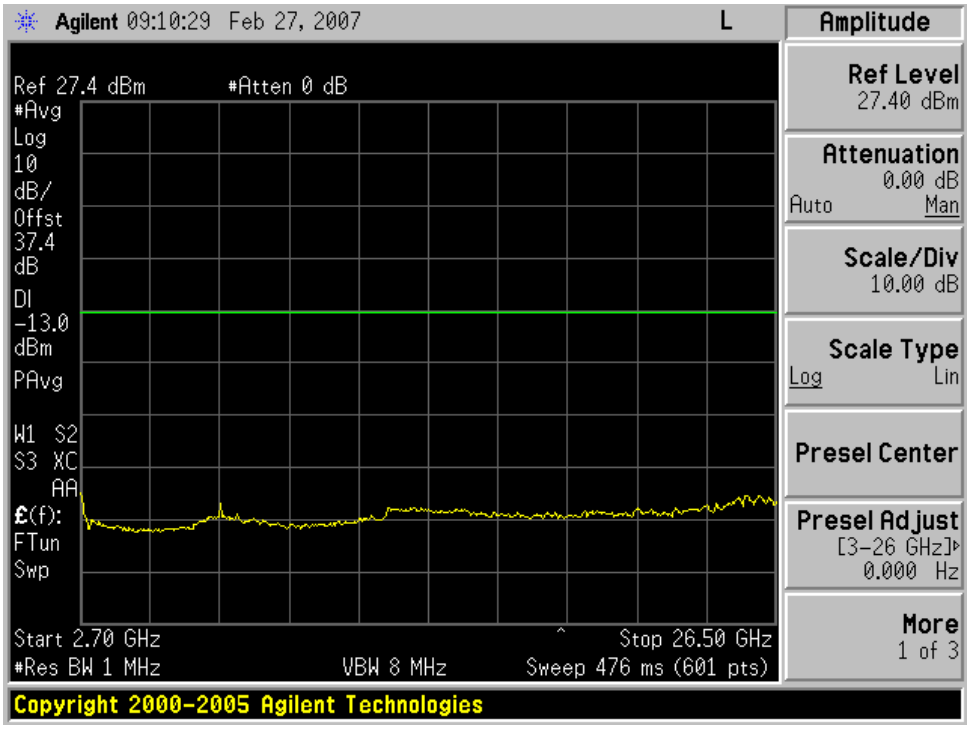
1 – 5 GHz (2499 MHz, 6 MHz Channel)



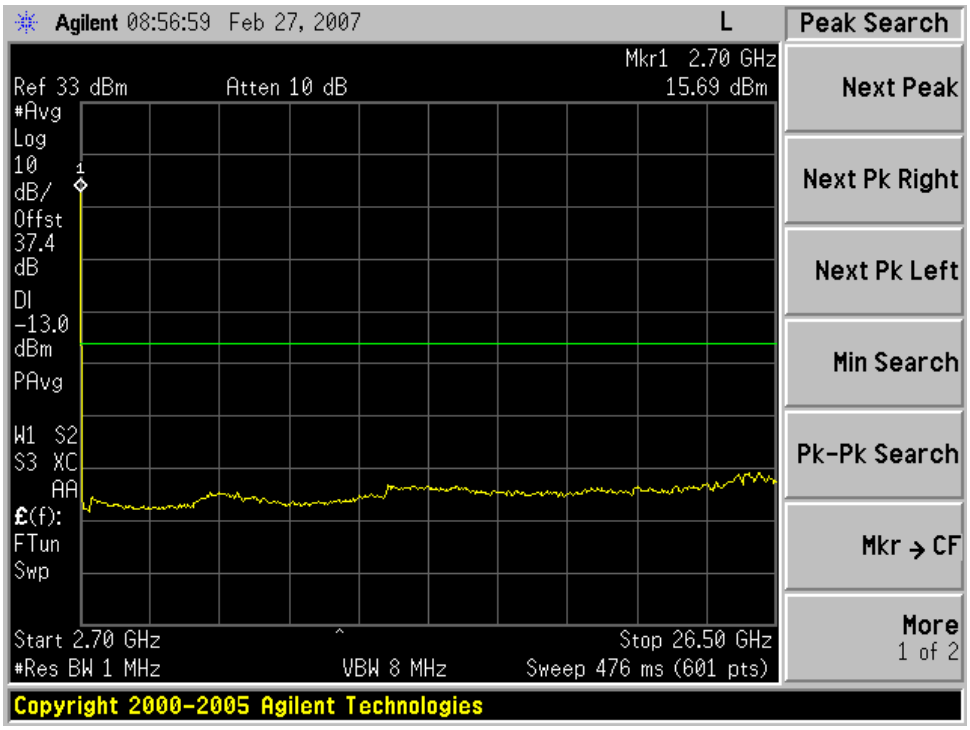
1 – 5 GHz (2499 MHz, 5.5 MHz Channel)



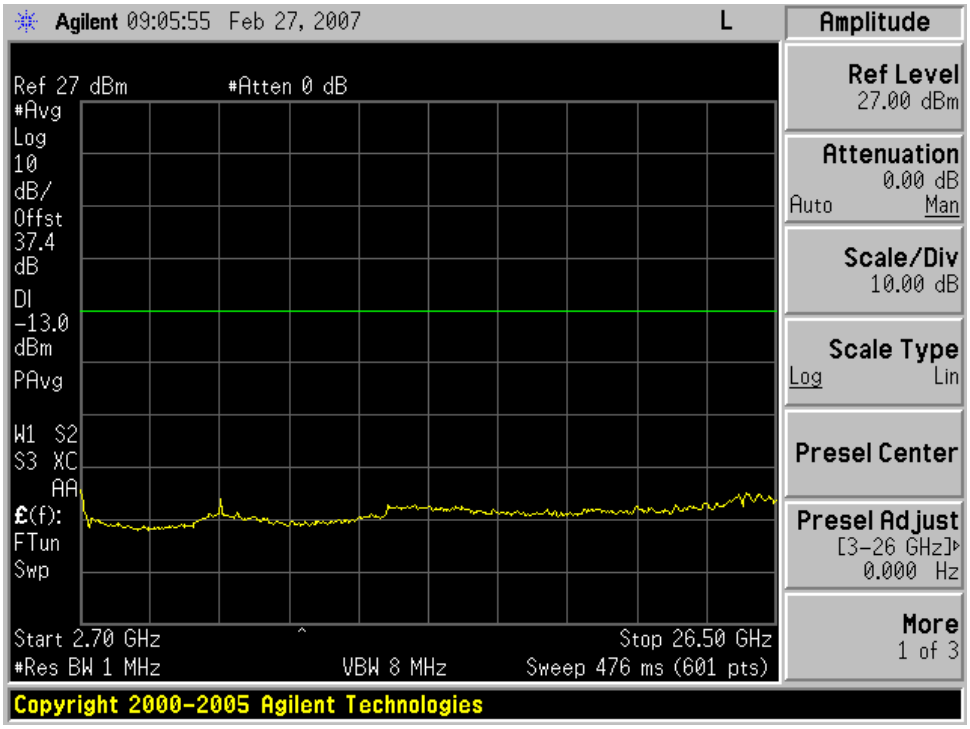
2.7 GHz – 26.5 GHz (2499 MHz, 6 MHz Channel)



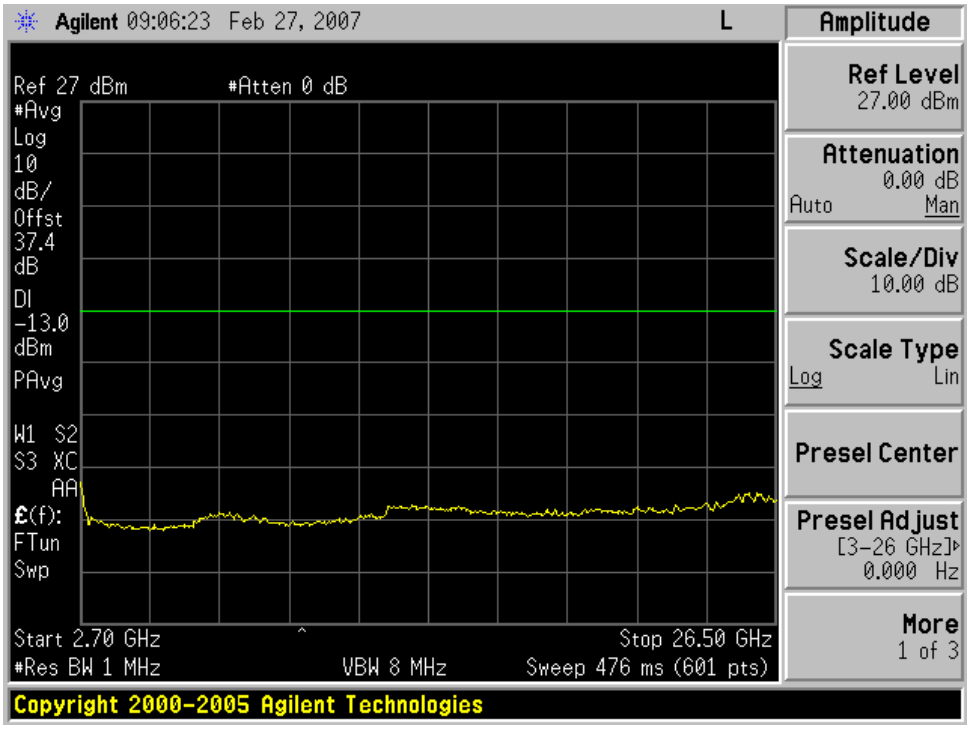
2.7 GHz – 26.5 GHz (2593 MHz, 6 MHz Channel)



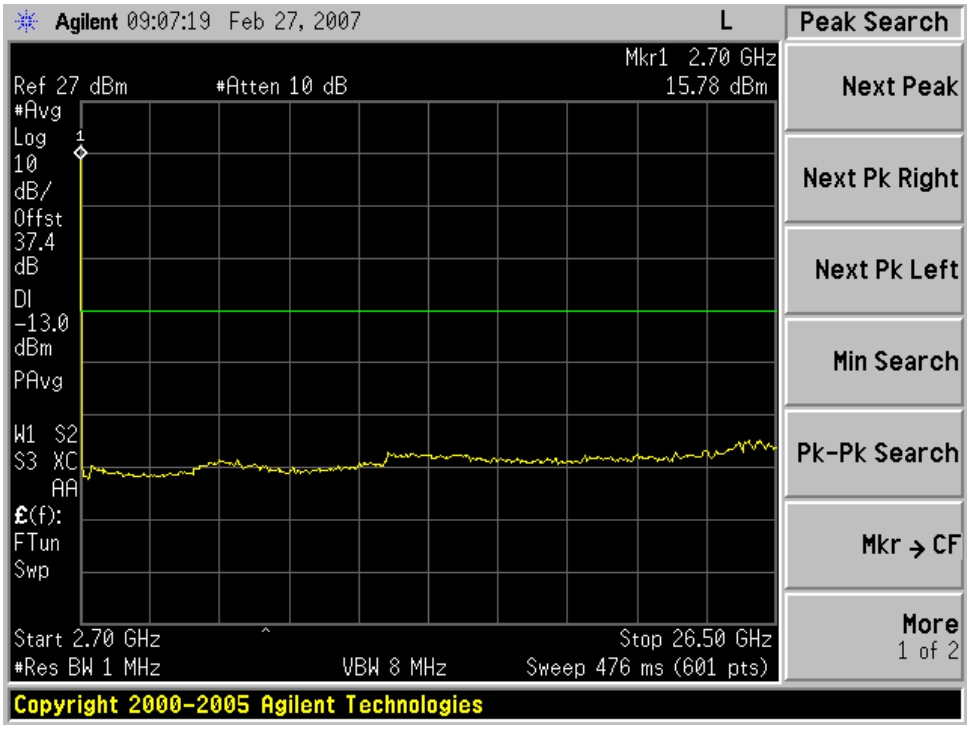
2.7 GHz – 26.5 GHz (2687 MHz, 6 MHz Channel)



2.7 GHz – 26.5 GHz (2499 MHz, 5.5 MHz Channel)



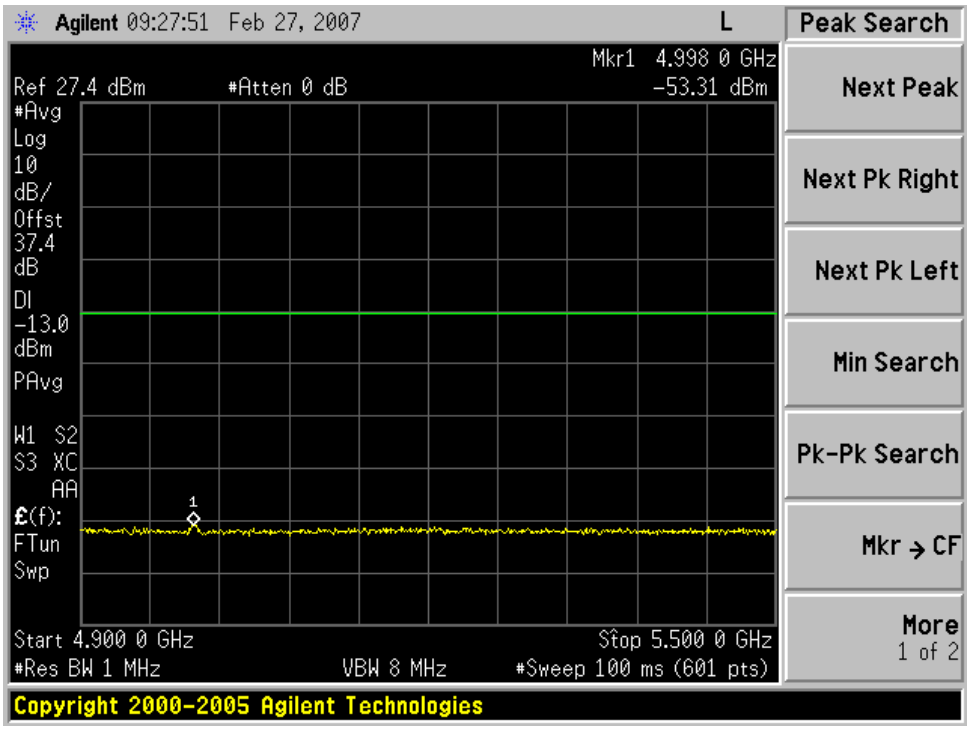
2.7 GHz – 26.5 GHz (2593 MHz, 5.5 MHz Channel)



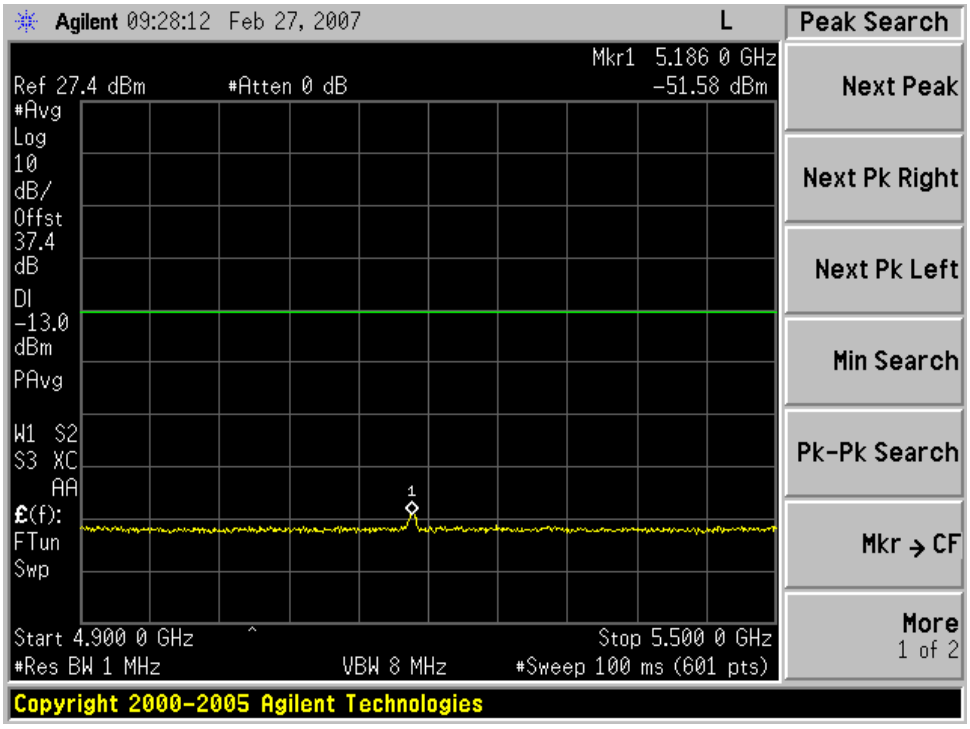
2.7 GHz – 26.5 GHz (2687 MHz, 5.5 MHz Channel)

5.6.2. Second Harmonic Emissions Plots

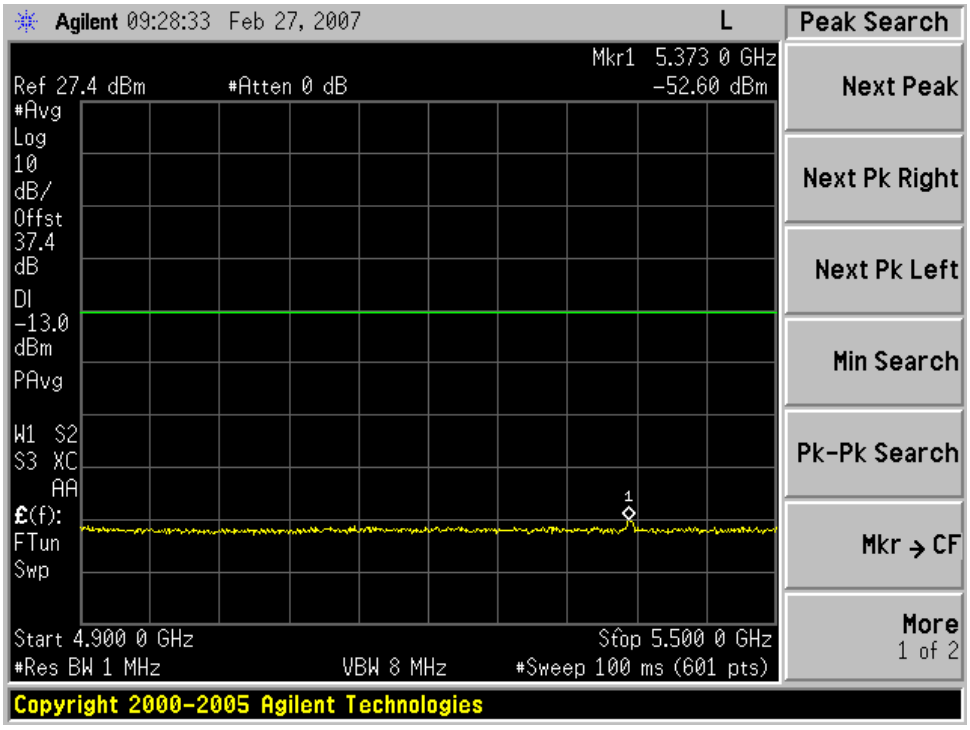
Plots are shown for the second harmonic of all test channels.



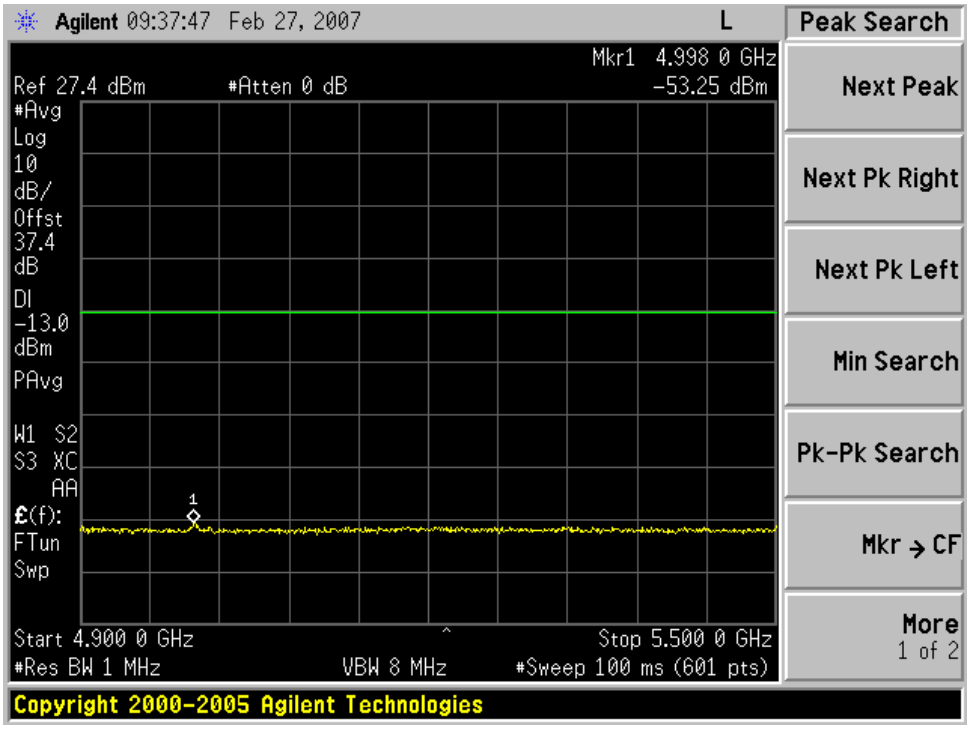
2nd Harmonic of 2499 MHz (6 MHz Channel)



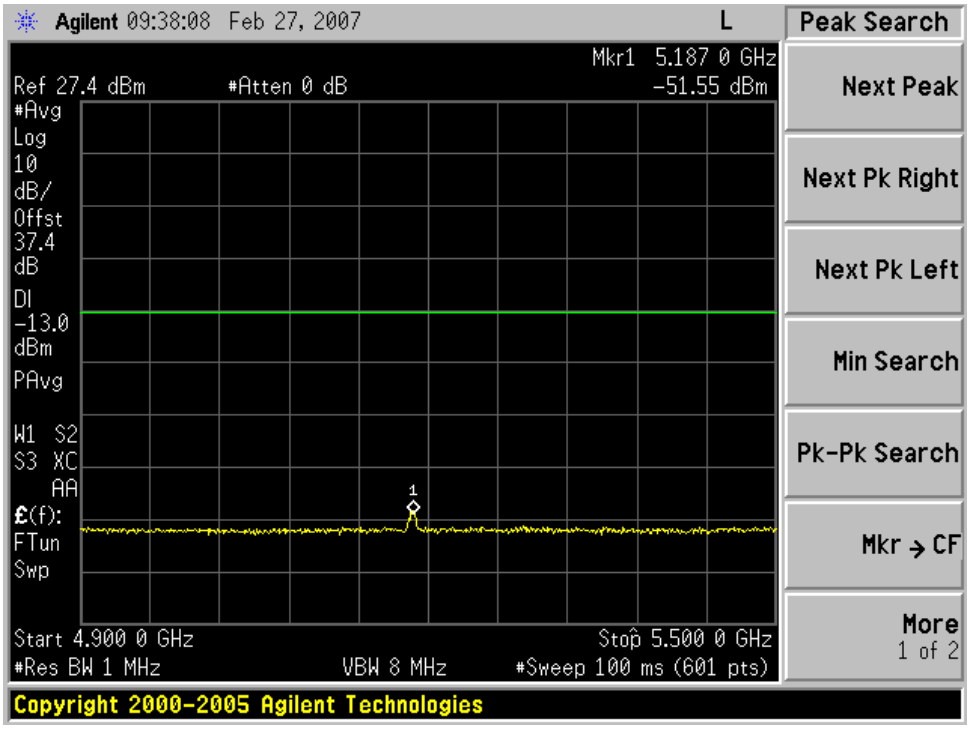
2nd Harmonic of 2593 MHz (6 MHz Channel)



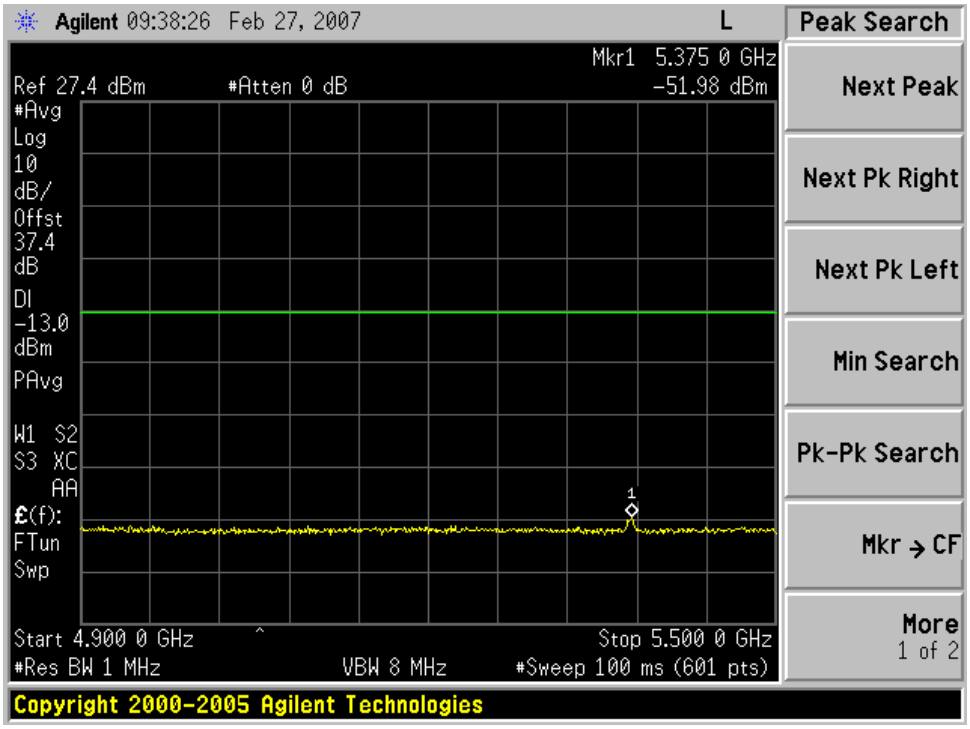
2nd Harmonic of 2687 MHz (6 MHz Channel)



2nd Harmonic of 2499 MHz (5.5 MHz Channel)



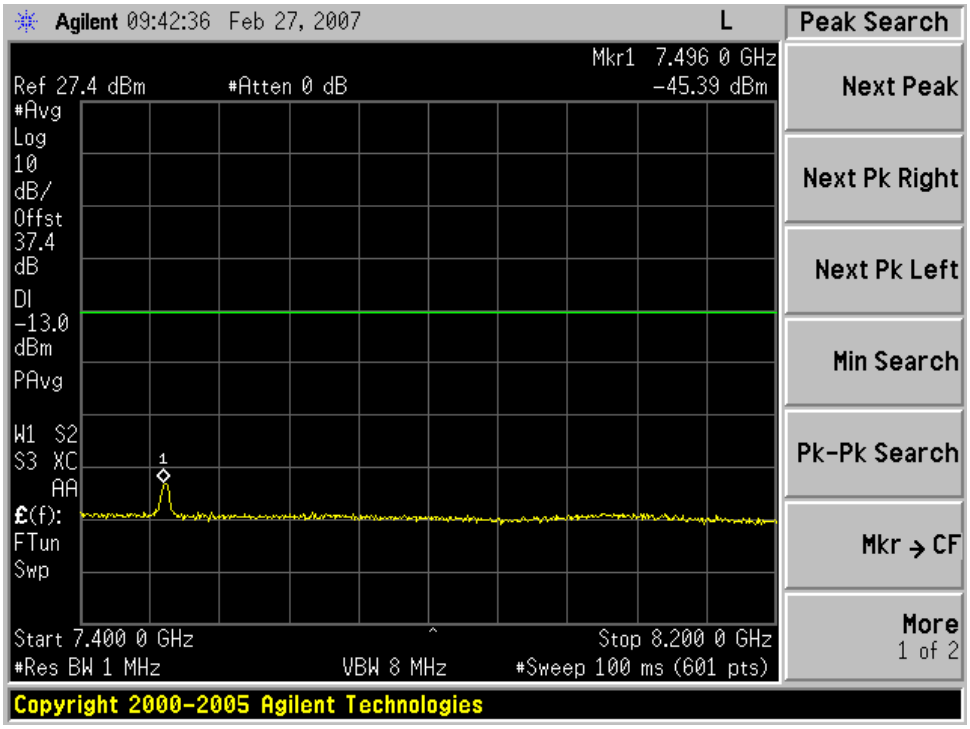
2nd Harmonic of 2593 MHz (5.5 MHz Channel)



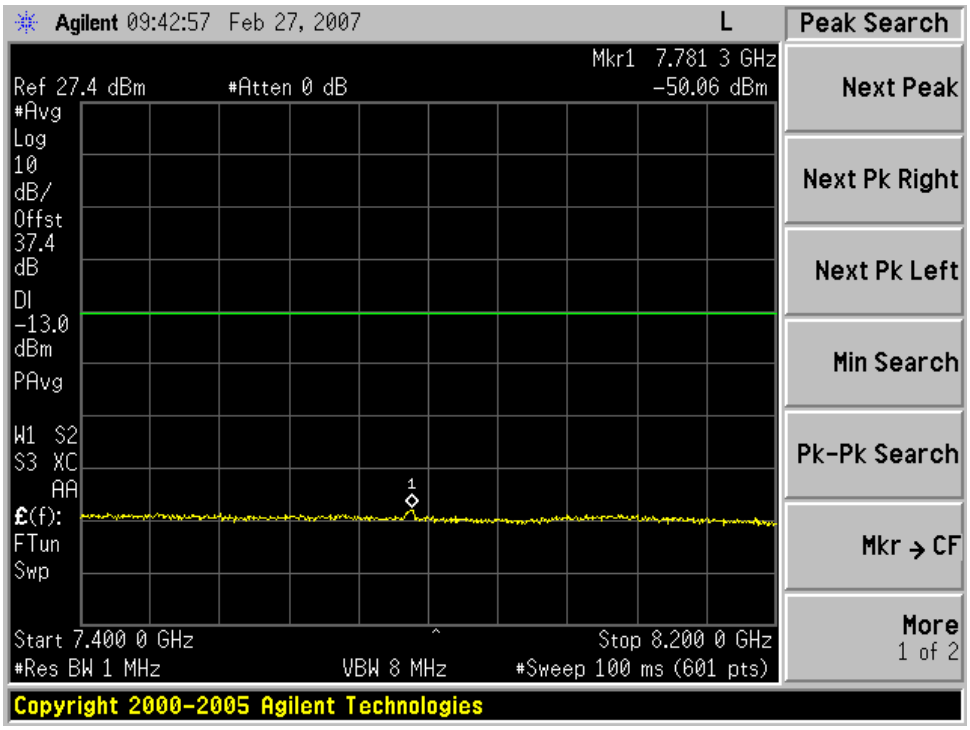
2nd Harmonic of 2687 MHz (5.5 MHz Channel)

5.6.3. Harmonic 3 Emissions Plots

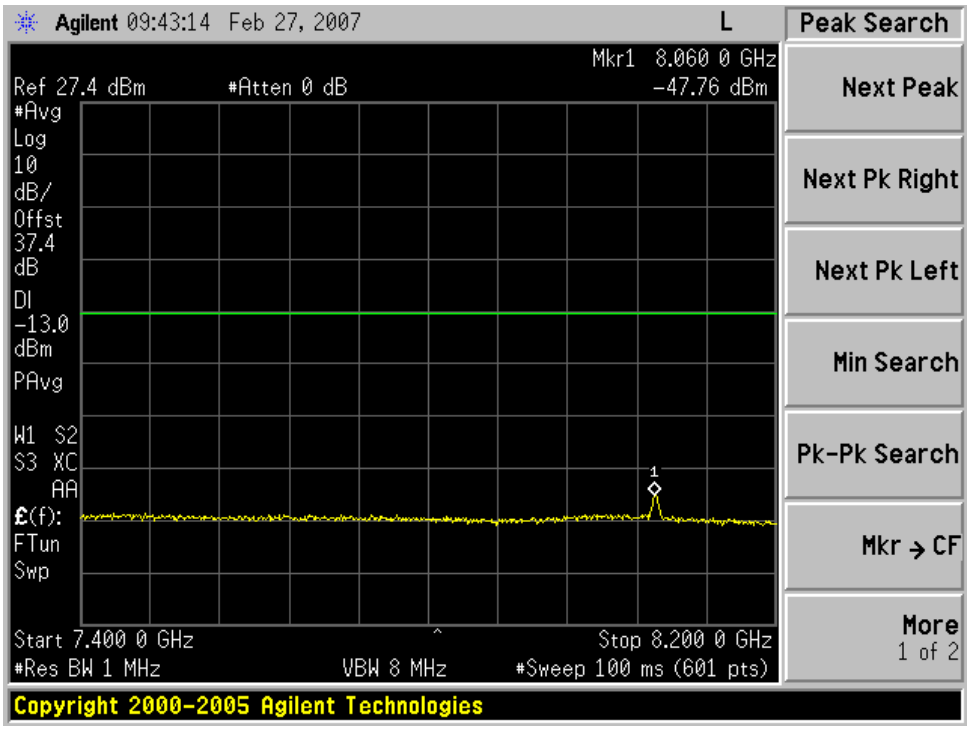
Plots are shown for the third harmonic of all test channels.



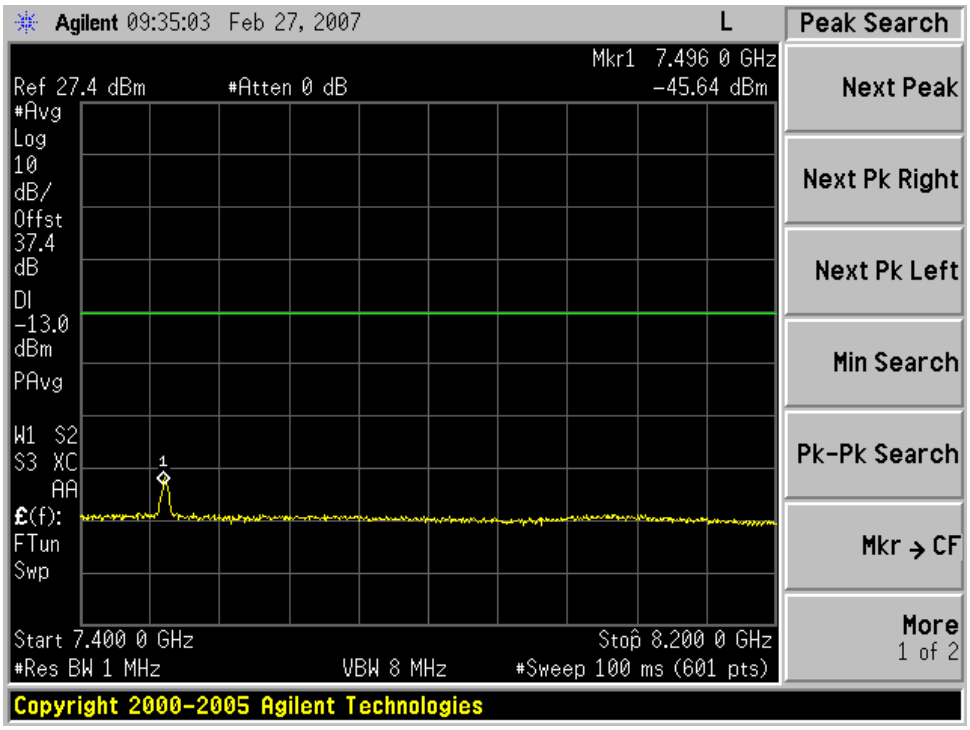
3rd Harmonic of 2499 MHz (6.0 MHz Channel)



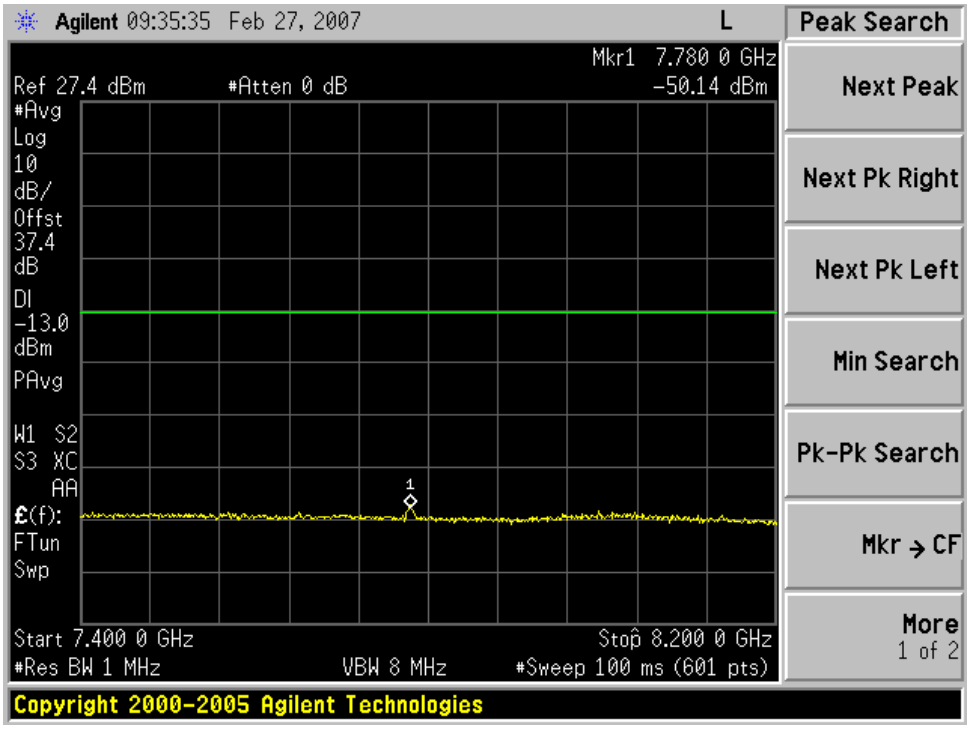
3rd Harmonic of 2593 MHz (6.0 MHz Channel)



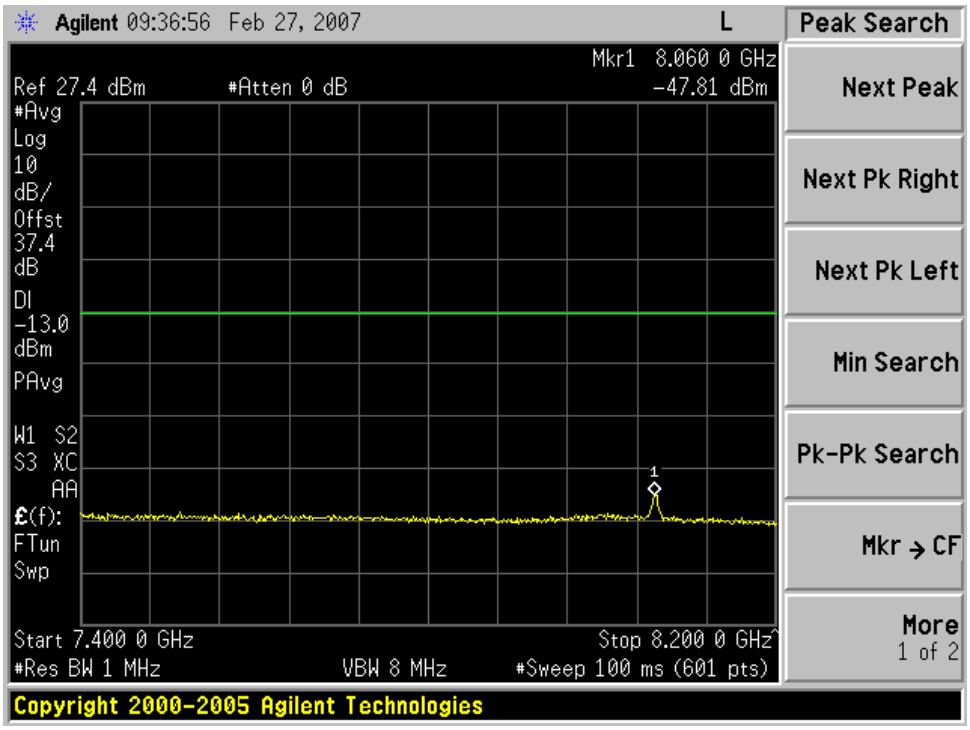
3rd Harmonic of 2687 MHz (6.0 MHz Channel)



3rd Harmonic of 2499 MHz (5.5 MHz Channel)



3rd Harmonic of 2593 MHz (5.5 MHz Channel)



3rd Harmonic of 2687 MHz (5.5 MHz Channel)

5.7 Field Strength of Spurious Radiation

FCC Rules:	2.1053, 2.1049, 2.1057
FCC Requirement:	Emissions to be 43+10log(P) below the channel power or an absolute level of –13 dBm Frequency Range = 30 MHz to 26.86 GHz Case Radiation Attenuation = 43+10logP = -13 dBm maximum
Standards:	TIA-603-C TIA Standard, Land Mobile FM or PM Communications Equipment, Measurement and Performance Standards ANSI C63.4-2001 clause 5.4 Radiated Emissions Tests. 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.
Test Procedure:	The field strength of spurious radiation was measured at an open area test site with the applicable measurement antennas, low noise amplifiers, and spectrum analyzers. This test was performed with the transmitter/receiver port terminated with its integral antenna(s). Measurements were performed by TUV America located in Taylors Falls, Minnesota on April 4th and 5th, 2007. Spurious signals were maximized for peak level by rotation of the test unit and elevation of the measurement antenna. Verification of compliance to the emissions limit was accomplished by antenna substitution as detailed in the TIA-603-C specification. TUV America-Product Service FCC registration number: 90983
Test Conditions:	**Frequency:** 2499, 2593, 2687 MHz **Channel bandwidths**: 5.5 MHz and 6.0 MHz **Temperature:** 25°C **Supply Voltage:** 120 VAC / 60 Hz nominal to DUT power supply
Test Results:	Passes Field Strength of Spurious Radiation Refer to attached TUV Test Report: 5B EMC Test Report.pdf

5.8 Frequency Stability Test

FCC Rules: 2.1055, 27.53(l)(2), 27.53(l)(6), 27.54

FCC Requirement: The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

Standard: TIA-603-C

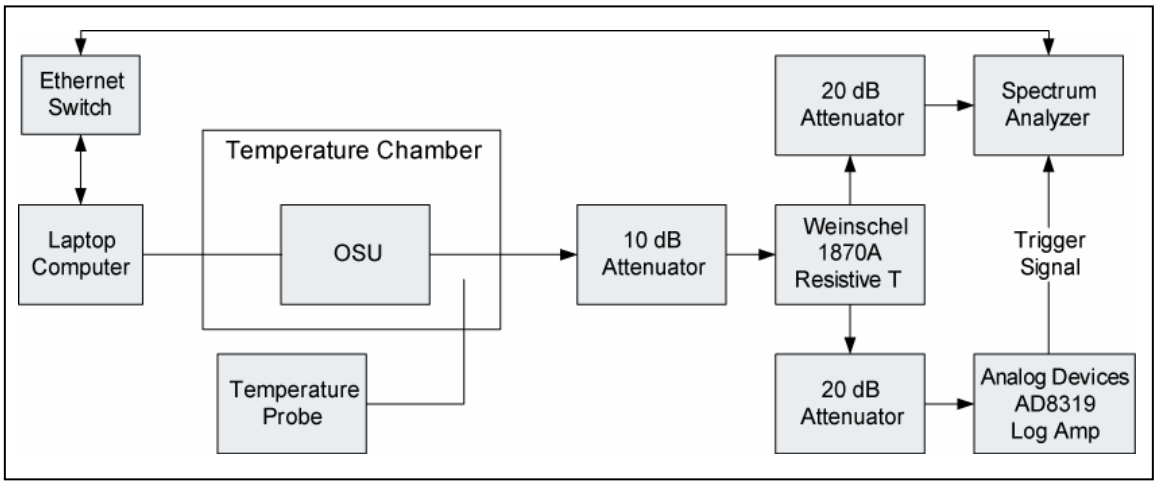
Test Procedure: The frequency stability of the Motorola, Inc. Temporary Fixed Subscriber Unit fundamental oscillator is derived from the on board 40 MHz TCXO. Since each radio channel operating frequency is synthesized and referenced to the 40 MHz TCXO, only one channel will be reported for frequency stability as all channels will have the same frequency characteristics.

The emissions contained within the 2 MHz below and above the channel bandwidth were recorded to show compliance to the emission limit of 47CFR27.53(l)(2).

The emissions have been recorded and show compliance to the –13 dBm limit for emissions outside of the channel bandwidth. As allowed per the FCC rules, a measurement bandwidth of 1% or greater of the emissions bandwidth was used for the test. Compliance was shown on the plot by establishing a limit line at the –13 dBm level such that any emissions that would be above the limit within the first 1 MHz of spectrum outside of the channel would produce a “FAIL MARGIN1” (6 MHz channel) or “FAIL MARGIN2” (5.5 MHz channel) message on the spectrum analyzer display.

The next 1 MHz of spectrum is shown to comply with the –13 dBm limit by use of the integrated power function of the spectrum analyzer. The appropriate offset for the 1 MHz of spectrum being measured is shown on the plots. Compliance to the second 1 MHz of spectrum is shown by reviewing the lower and upper integrated power measurement information on the spectrum analyzer display. This information is listed in the test results table.

Test Set-Up:



Frequency Stability Test Setup

5.8.1. Temperature Variation Test Results

Test Conditions: **Frequency**: 2593 MHz (5.5 and 6.0 MHz channel bandwidths)
Supply Voltage: 120 VAC / 60 Hz nominal to DUT power supply
Temperature: –30º C to +50º C in 10º C increments

Test Results: Pass Temperature Variation
The tables below summarize the information from the plots contained in this section and in the Appendix.

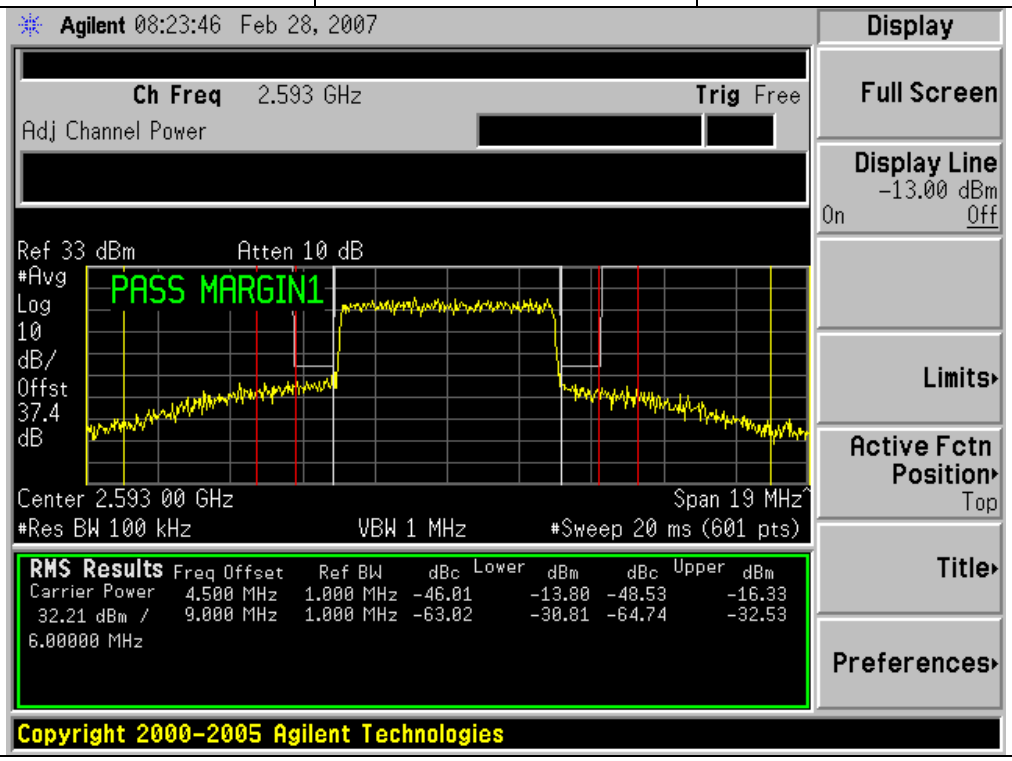
Adjacent and Alternate 1 MHz Emissions 2.593 GHz 6.0 MHz Bandwidth									
Temp ° C	Lower Alternate 1 MHz Bin Power (dBm)	Upper Alternate 1 MHz Bin Power (dBm)	Spec (dBm/MHz)	Lower Margin (dB)	Upper Margin (dB)	Result: Lower Alternate 1 MHz Bin	Result: Upper Alternate 1 MHz Bin	Result: Lower Adjacent 1 MHz Bin	Result: Upper Adjacent 1 MHz Bin
-30	-13.80	-16.33	-13	-.80	-3.33	Complies	Complies	Complies	Complies
-20	-14.28	-17.01	-13	-1.28	-4.01	Complies	Complies	Complies	Complies
-10	-14.94	-16.19	-13	-1.94	-3.19	Complies	Complies	Complies	Complies
0	-14.96	-16.66	-13	-1.96	-3.66	Complies	Complies	Complies	Complies
10	-14.83	-16.90	-13	-1.83	-3.90	Complies	Complies	Complies	Complies
20	-16.89	-18.77	-13	-3.89	-5.77	Complies	Complies	Complies	Complies
30	-17.00	-18.78	-13	-4.00	-5.78	Complies	Complies	Complies	Complies
40	-17.30	-19.19	-13	-4.30	-6.19	Complies	Complies	Complies	Complies
50	-19.19	-20.05	-13	-6.19	-7.05	Complies	Complies	Complies	Complies

Adjacent and Alternate 1 MHz Emissions 2.593 GHz 5.5 MHz Bandwidth									
Temp ° C	Lower Alternate 1 MHz Bin Power (dBm)	Upper Alternate 1 MHz Bin Power (dBm)	Spec (dBm/MHz)	Lower Margin (dB)	Upper Margin (dB)	Result: Lower Alternate 1 MHz Bin	Result: Upper Alternate 1 MHz Bin	Result: Lower Adjacent 1 MHz Bin	Result: Upper Adjacent 1 MHz Bin
-30	-13.88	-16.74	-13	-.88	-3.74	Complies	Complies	Complies	Complies
-20	-16.03	-18.31	-13	-3.03	-5.31	Complies	Complies	Complies	Complies
-10	-14.30	-17.03	-13	-1.30	-4.03	Complies	Complies	Complies	Complies
0	-14.78	-16.88	-13	-1.78	-3.88	Complies	Complies	Complies	Complies
10	-14.83	-17.35	-13	-1.83	-4.35	Complies	Complies	Complies	Complies
20	-17.58	-19.10	-13	-4.58	-6.10	Complies	Complies	Complies	Complies
30	-16.77	-19.16	-13	-3.77	-6.16	Complies	Complies	Complies	Complies
40	-17.23	-18.71	-13	-4.23	-5.71	Complies	Complies	Complies	Complies
50	-19.55	-20.70	-13	-6.55	-7.70	Complies	Complies	Complies	Complies

5.8.2. Temperature Variation Spectrum Analyzer Plots

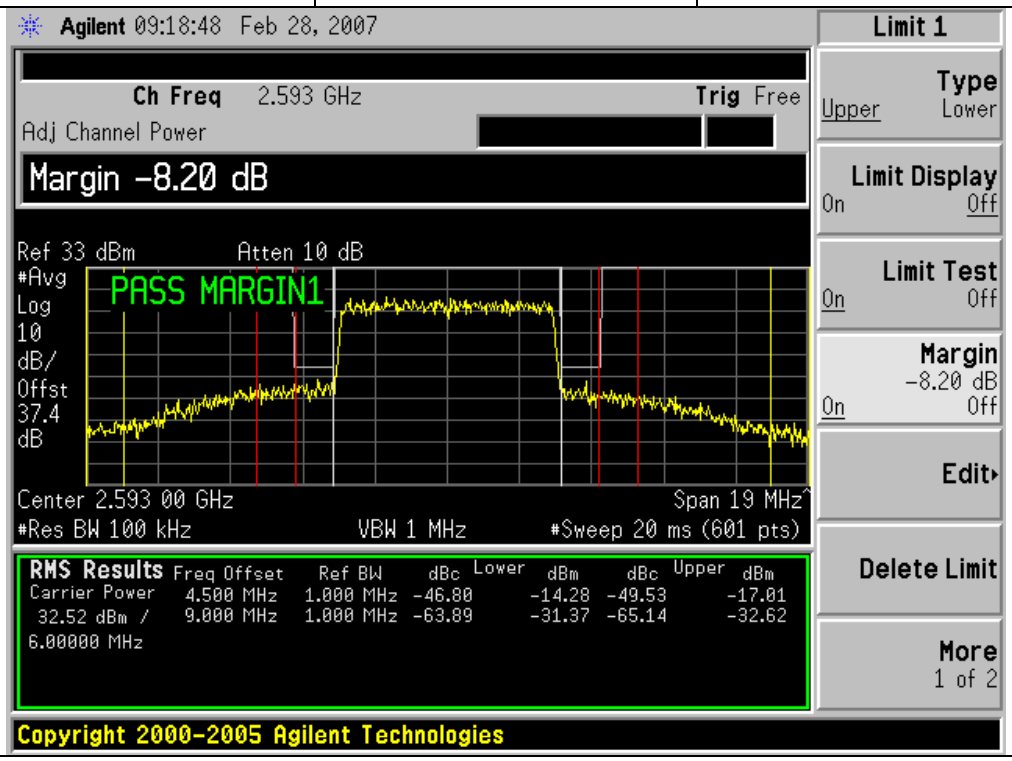
Spectrum analyzer plots of the 6.0 MHz bandwidth measurements follow. The plots for the 5.5 MHz bandwidth channels are similar and are located in the Appendix.

Bandwidth: 6.0 MHz	RF Power: 2 Watts	Frequency: 2593 MHz

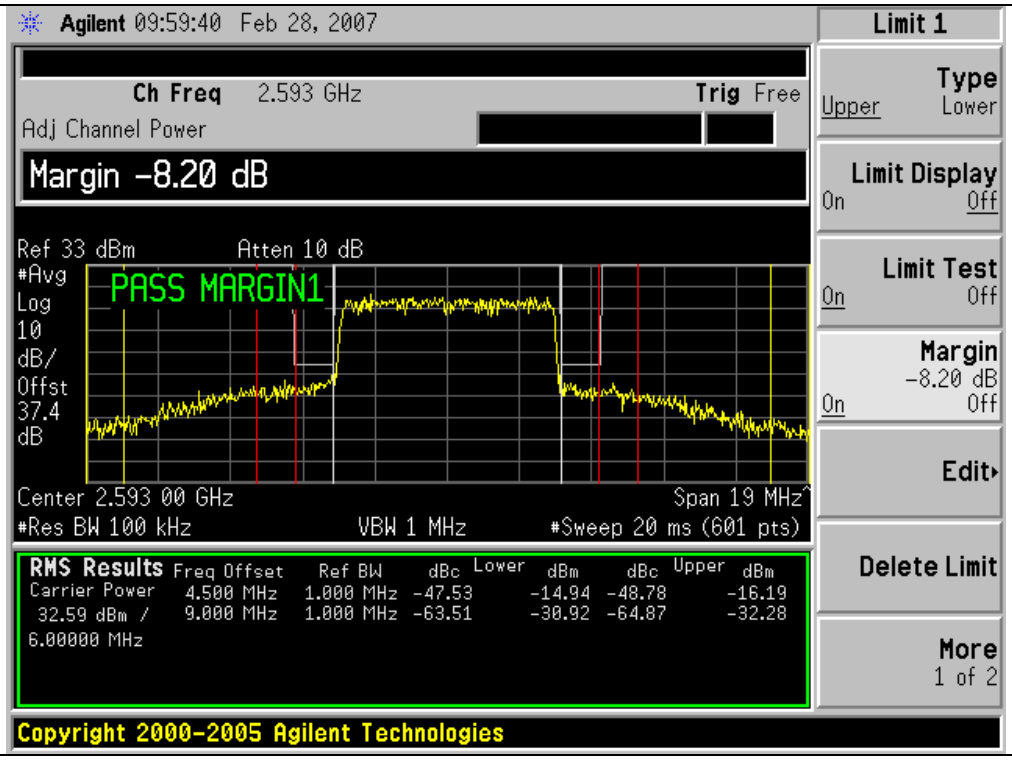


–30° C

Bandwidth: 6.0 MHz	RF Power: 2 Watts	Frequency: 2593 MHz

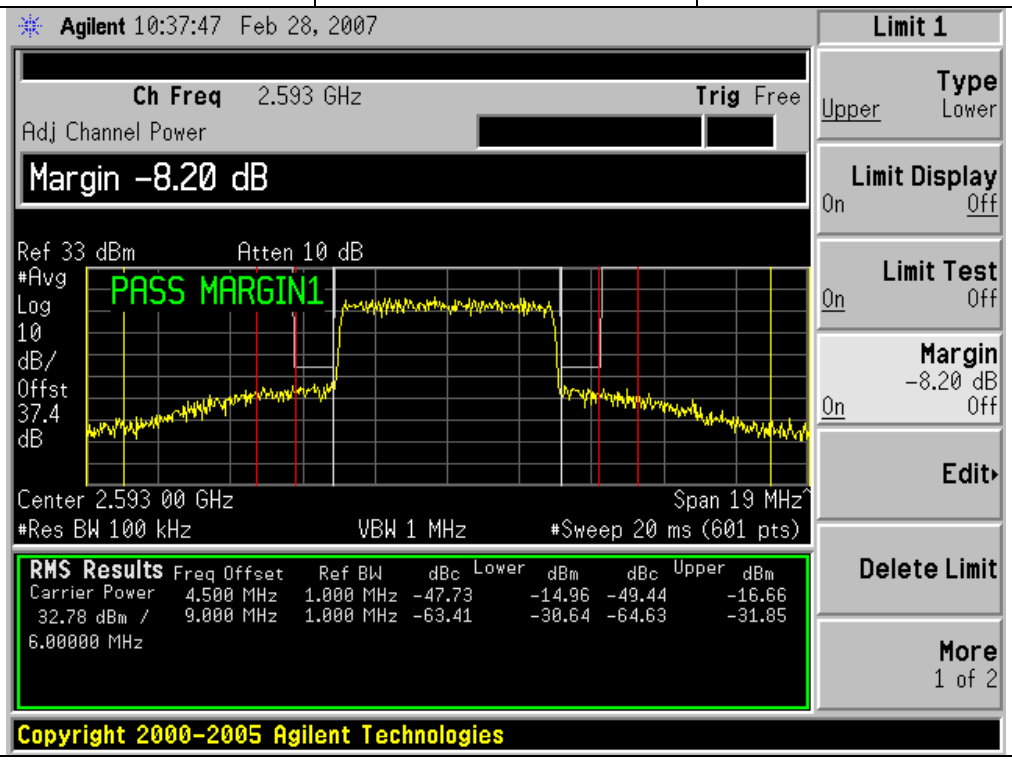


–20° C

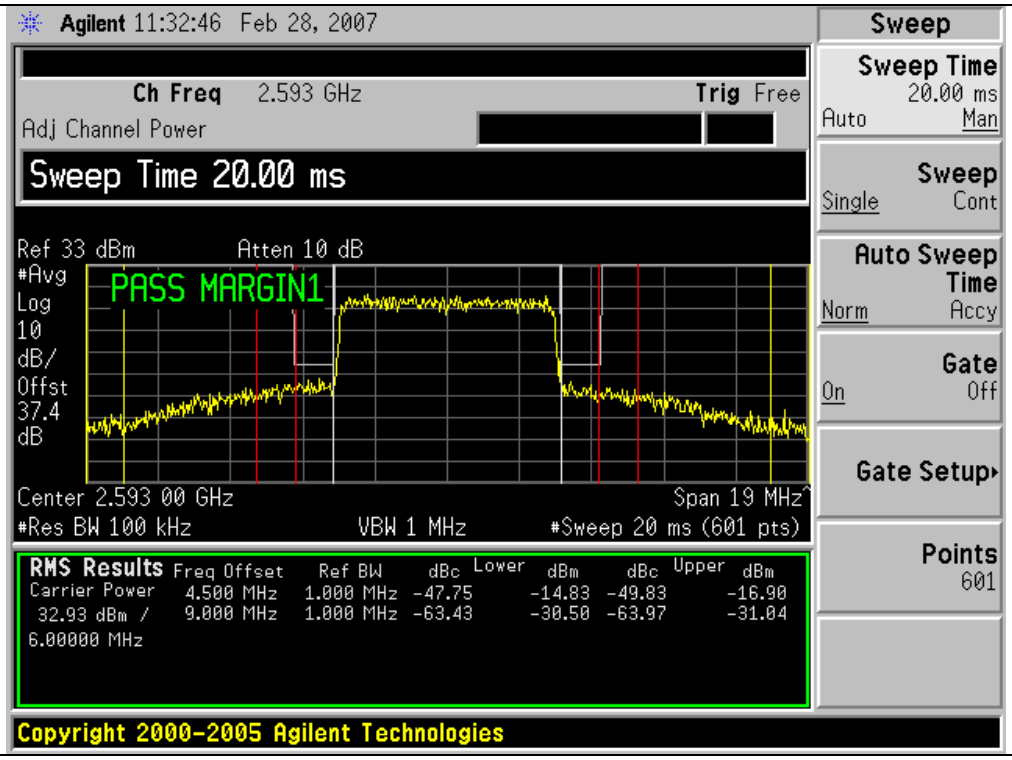


–10° C

Bandwidth: 6.0 MHz	RF Power: 2 Watts	Frequency: 2593 MHz

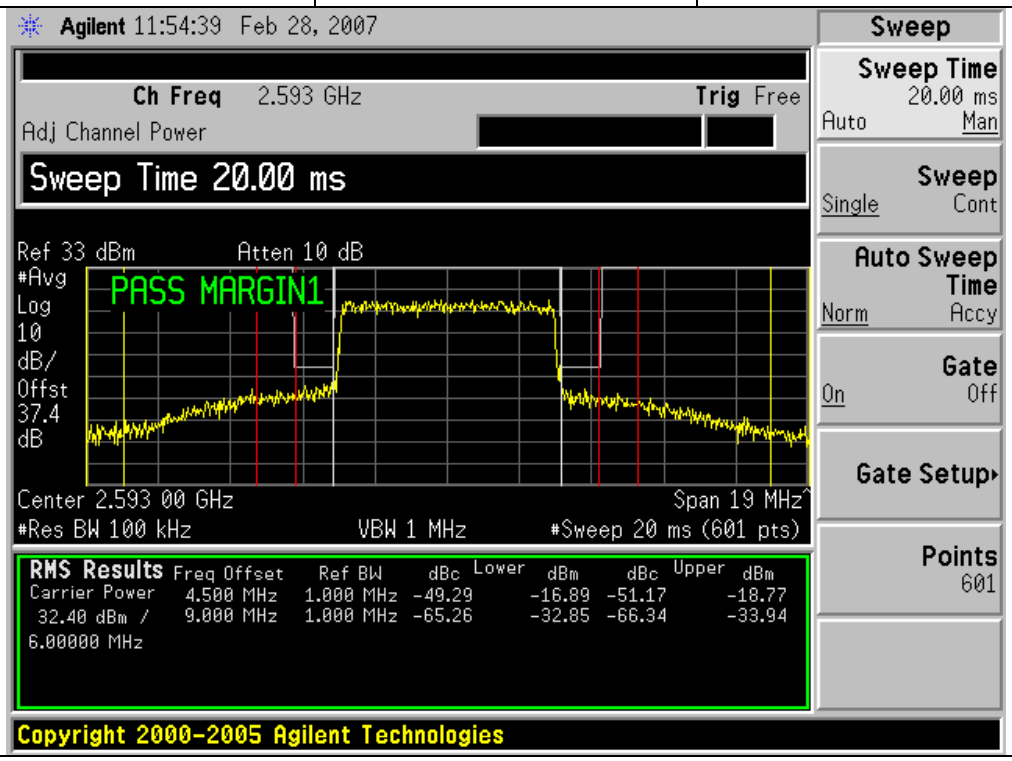


0° C

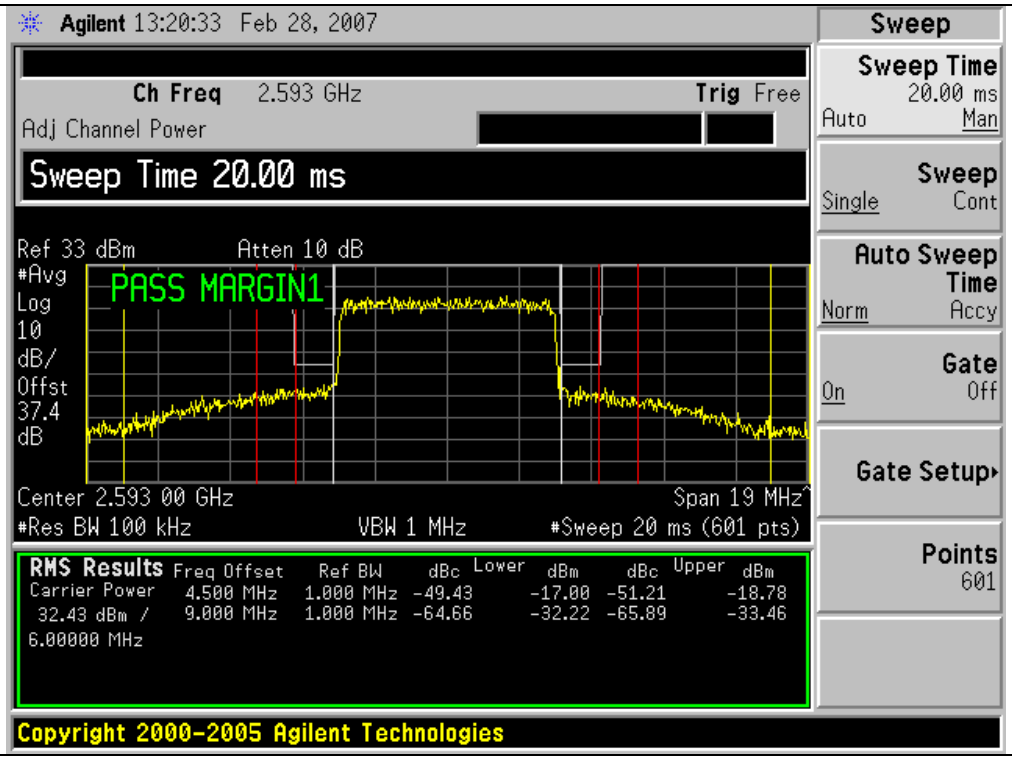


+10° C

Bandwidth: 6.0 MHz	RF Power: 2 Watts	Frequency: 2593 MHz

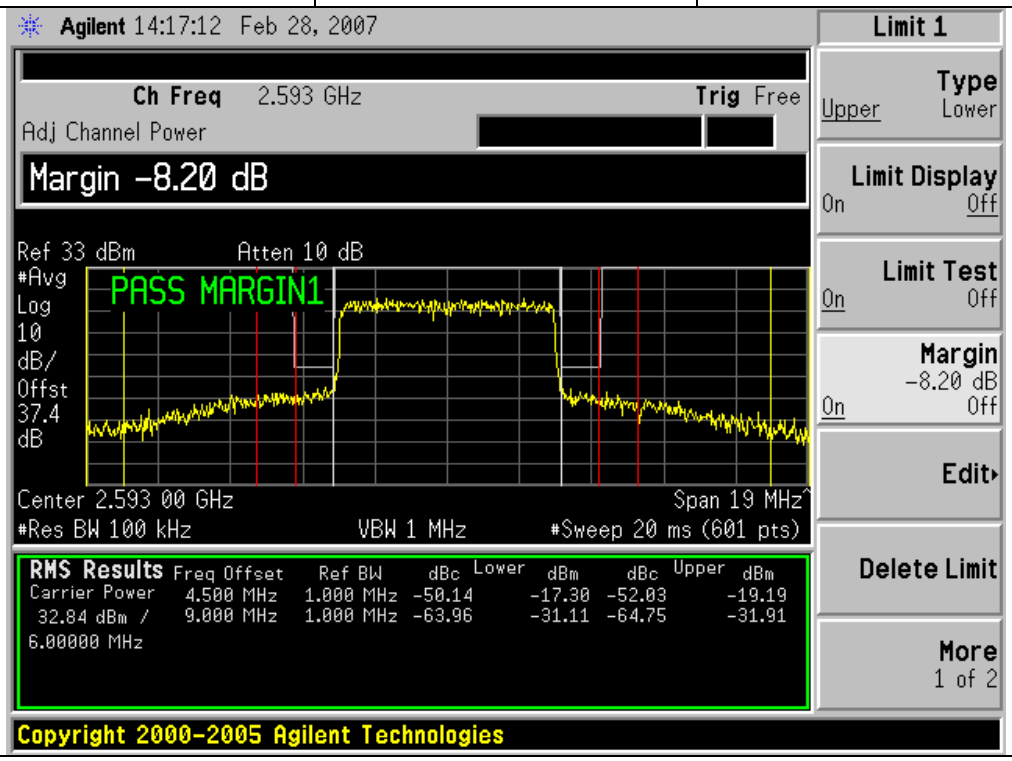


+20° C

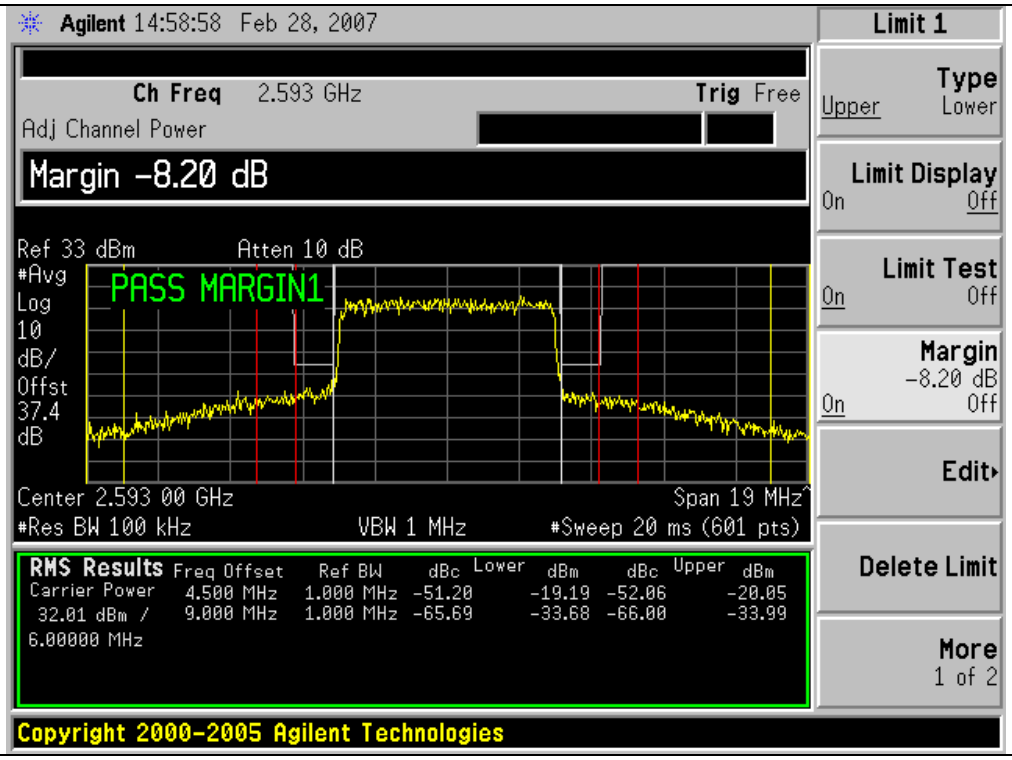


+30° C

Bandwidth: 6.0 MHz	RF Power: 2 Watts	Frequency: 2593 MHz



+40° C



+50° C

5.8.3. Supply Voltage Variation Test Results

Test Conditions: **Frequency:** 2593 MHz
Temperature: 22°C
Source Input Voltage Specification: 120.0 VAC / 60 Hz Nominal
Test Voltage Range: 0.85 x 120 = 102 VAC / 60 Hz lower limit
1.15 x 120 = 138 VAC / 60 Hz upper limit

Test Results: Supply Voltage Variation
The tables below summarize the information from the plots contained in this section and in the Appendix.

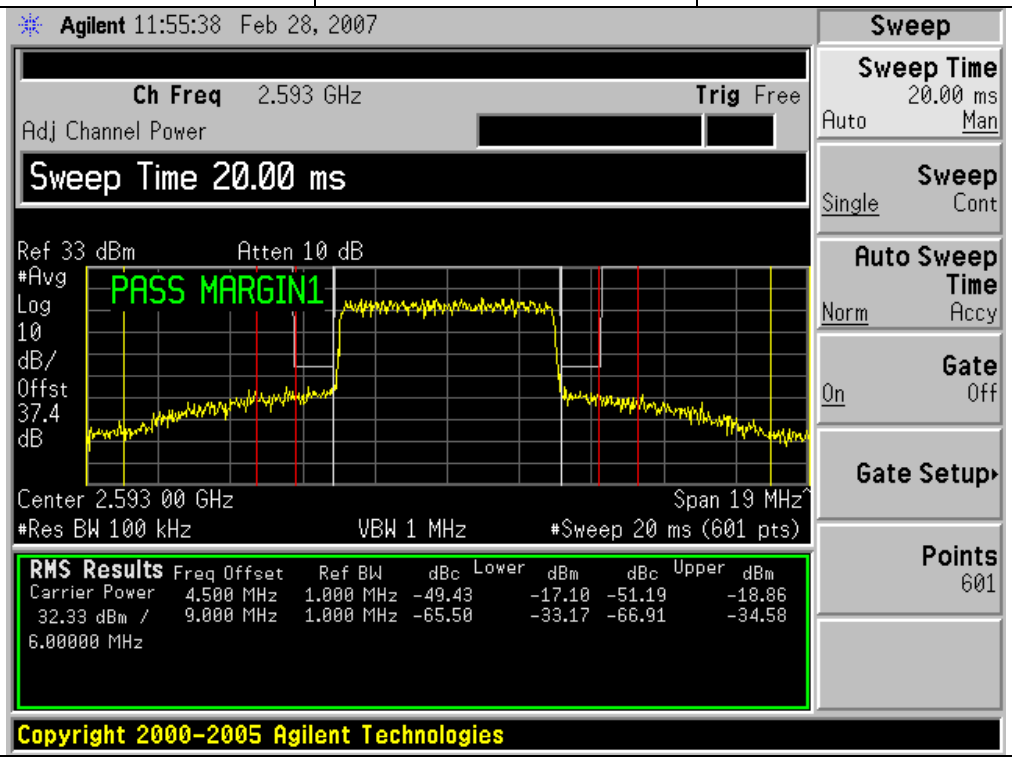
Source Voltage (Vdc)	Lower Alternate 1 MHz Bin Power (dBm)	Upper Alternate 1 MHz Bin Power (dBm)	Spec (dBm/MHz)	Lower Margin (dB)	Upper Margin (dB)	Result: Lower Alternate 1 MHz Bin	Result: Upper Alternate 1 MHz Bin	Result: Lower Adjacent 1 MHz Bin	Result: Upper Adjacent 1 MHz Bin
102	-17.10	-18.86	-13	-4.10	-5.86	Complies	Complies	Complies	Complies
120	-17.57	-19.03	-13	-4.57	-6.03	Complies	Complies	Complies	Complies
138	-17.34	-18.87	-13	-4.34	-5.87	Complies	Complies	Complies	Complies

Adjacent and Alternate 1 MHz Emissions 20° C 2.593 GHz 5.5 MHz Bandwidth									
Source Voltage (Vdc)	Lower Alternate 1 MHz Bin Power (dBm)	Upper Alternate 1 MHz Bin Power (dBm)	Spec (dBm/MHz)	Lower Margin (dB)	Upper Margin (dB)	Result: Lower Alternate 1 MHz Bin	Result: Upper Alternate 1 MHz Bin	Result: Lower Adjacent 1 MHz Bin	Result: Upper Adjacent 1 MHz Bin
102	-16.60	-19.32	-13	-3.60	-6.32	Complies	Complies	Complies	Complies
120	-17.12	-19.07	-13	-4.12	-6.07	Complies	Complies	Complies	Complies
138	-17.39	-19.50	-13	-4.39	-6.50	Complies	Complies	Complies	Complies

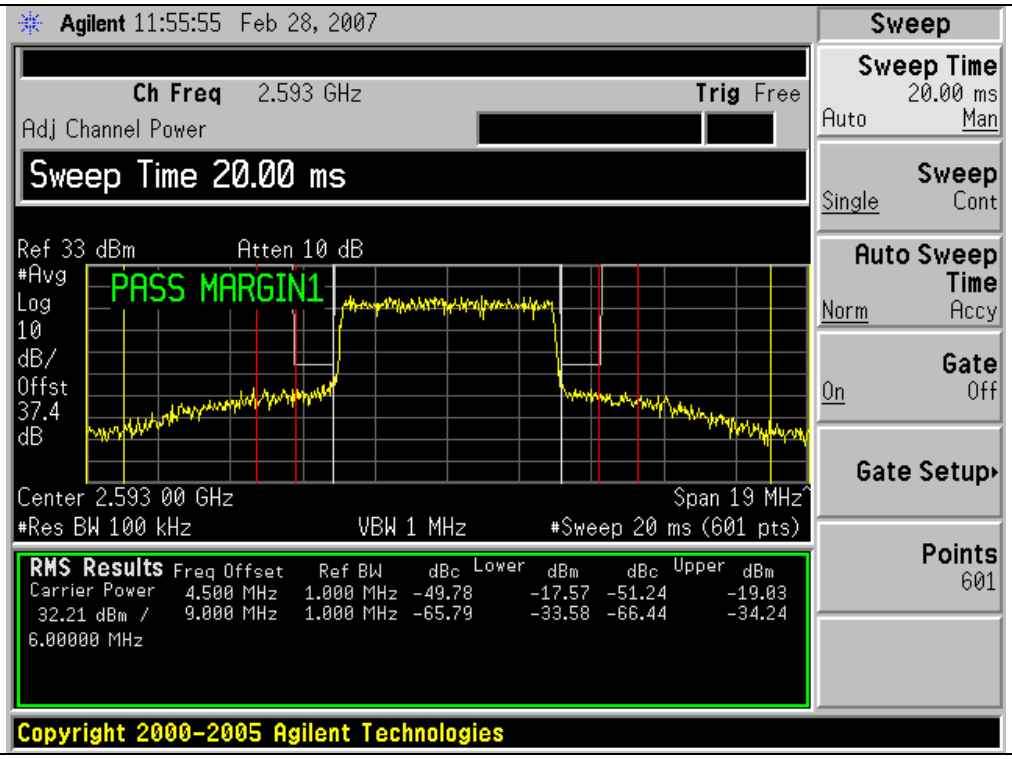
5.8.4. Supply Voltage Variation Spectrum Analyzer Plots

Spectrum analyzer plots of the 6.0 MHz bandwidth measurements follow. The plots for the 5.5 MHz bandwidth channels are similar and are located in the Appendix.

Bandwidth: 6.0 MHz	RF Power: 2 Watts	Frequency: 2593 MHz

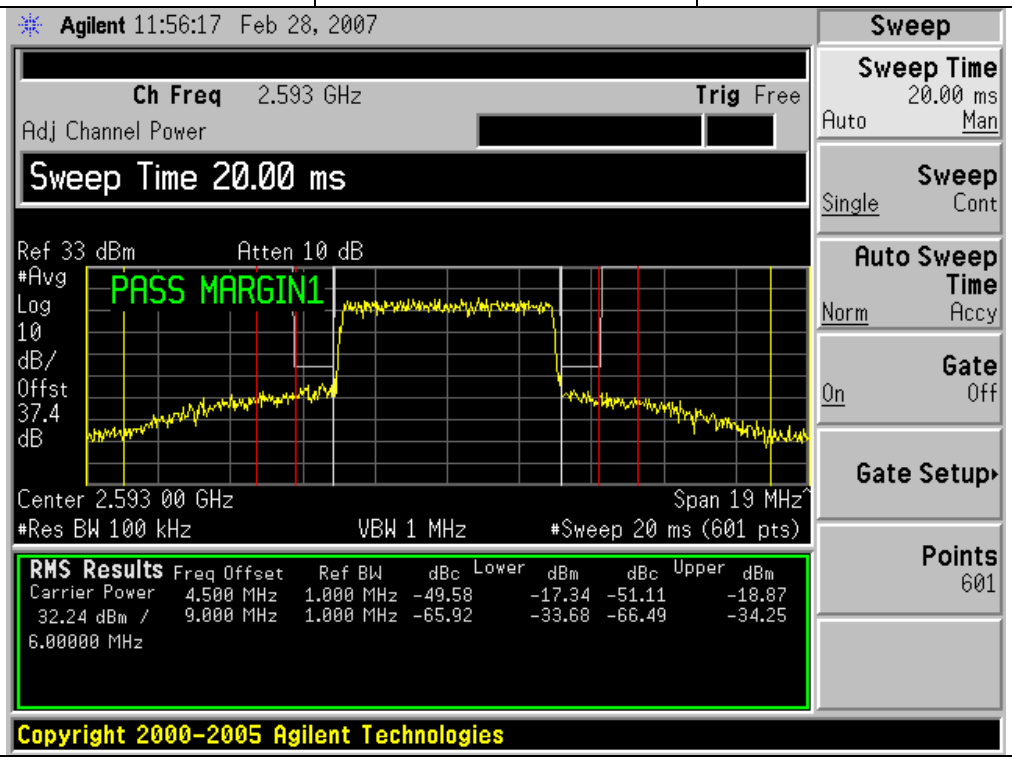


102 VDC / +20° C



120 VDC / +20° C

Bandwidth: 6.0 MHz	RF Power: 2 Watts	Frequency: 2593 MHz



138 VDC / +20° C