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1279 Quarry Lane • Suite B, Pleasanton, CA 94566-8499 USA
Phone: +1.925.462.9105 Fax: +1.925.280.7751

EMC Test Report

Report No.: 127-0205006-CON
Model No. Azure
Issued Date: July 31, 2002

Applicant: Microsoft Corporation
One Microsoft Way
Redmond, WA 98052-6399, USA
Phone: +1.425.703.0383 Fax: +1.425.936.7329

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Certificate Number 1708-1

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QCD0004

Signature Page

The below listed Hyper Corporation Personnel takes responsibility for the contents of this Test Report.

Signatures

Test Engineer(s):

	Original signed	**07.29.02**
	Swati Bakshi	**Date**

Reviewed by Technical Manager:

	Original signed	**07.29.02**
	Kevin Marquess	**Date**

1. List of Revisions

Version	Date	Author(s)	Description
001	July 29 2002	Jean Chin	Initial Version
002	July 31, 2002	Jean Chin	Adding Plots of test results

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2. Disclaimer Notice

This test report applies only to the EUT (Equipment Under Test) and the results of the specifications called out in this report.

The test results contained herein relate only to the model(s) identified. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical characteristics.

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4. General Information

4.1 Identification of the EUT

Manufacturer: Microsoft Corporation

Model No.: Azure

Series No:
0005F27D047C

Hardware Version: 0.07

Software Version: 0.07

FCC ID: C3KMS10

Frequency Range: 2402 MHz ~ 2480 MHz

Channel Number: 79

Frrequency of Each Channel: 2402 + k (MHz), k=0~78

Type of Modulation: GFSK

Sample Received Date: June 13, 2002

Test Dates: July 24, 2002 – July 29, 2002

Test Facility: Hyper Corporation
1279 Quarry Lane, Suite B
Pleasanton, CA 94566, USA

4.2 Antenna Description

Antenna Gain: Peak Gain: -0.1dBi
Ave. Gain: -0.9dBi

5. Test Summary

This test report is prepared for the project of Microsoft Azure (Bluetooth-enabled Keyboard).

5.1 Summary of Test Results

Test	Reference	Results
Carrier Frequency Separation	FCC 15.247(a)(1) IC RSS210 6.2.2(o)(a1)	Compliant
Number of Hopping Frequencies	FCC 15.247(a)(1)(ii) IC RSS210 6.2.2(o)(a3)	Compliant
Time of Occupancy (Dwell Time)	FCC 15.247(a)(1)(ii) IC RSS210 6.2.2(o)(a3)	Compliant
20 dB Bandwidth	FCC 15.247(a)(1)(ii) IC RSS210 6.2.2(o)(a1)	Compliant
Peak Output Power	FCC 15.247(b)(1) IC RSS210 6.2.2(o)(a3)	Compliant
Band-edge Compliance of RF Conducted Emissions	FCC 15.247(c) IC RSS210 6.2.2(o)(d1)	Compliant
Spurious RF Conducted Emissions	FCC 15.247(c) IC RSS210 6.2.2(o)(e1)	Compliant

5.2 Test Specifications

The EUT was performed according to the procedures in FCC Part 15 Subpart C section 15.247 and ANSI C63.4/1992, and also compliance with Industry Canada RSS-210 6.2.2 (O).

5.3 Operation Mode

Connect the EUT to personal computer via a 1.5 meter length USB cable. The EUT transmitted continuously during all the tests.

5.4 Documentation of test device

Documentation of the tested device has been reviewed by Hyper Corporation Engineers and found to be in compliance with applicable test specifications. All documentation is kept at Hyper Corporation's Quality Department in the Microsoft Azure EMC Test Folder.

5.5 General and Special Conditions

The EUT was tested using a fully charged battery. Battery voltages were checked often and changed if not at full capacity. All testing was done in an indoor controlled environment with an average temperature of 24º C and relative humidity of 40%.

5.6 Equipment and Cable Configurations

The EUT was tested in a stand-alone configuration that is representative of typical use. As a stand-alone device there are no cabling considerations.

Manufacturer	**Description**	**Model Number**	**Serial Number**	**CAL Due Date**
Agilent Technology	PSA Series Spec. Analyzer	E4440A	US40420768	04/23/03
Agilent Technology	E1852B Bluetooth Test Set	E1852B	DK42050128	01/02/03
Agilent Technology	ESA E Series Spec. Analyzer	44078	US41192572	04/23/03
Dell	PC	Precision	N/A	N/A
CSR	Development Kit	Casira	4837	N/A

6. Test Setup

6.1 Carrier Frequency Separation

6.1.1 Operation Environment

Temperature: 25.8°C

Relative Humidity: 45%

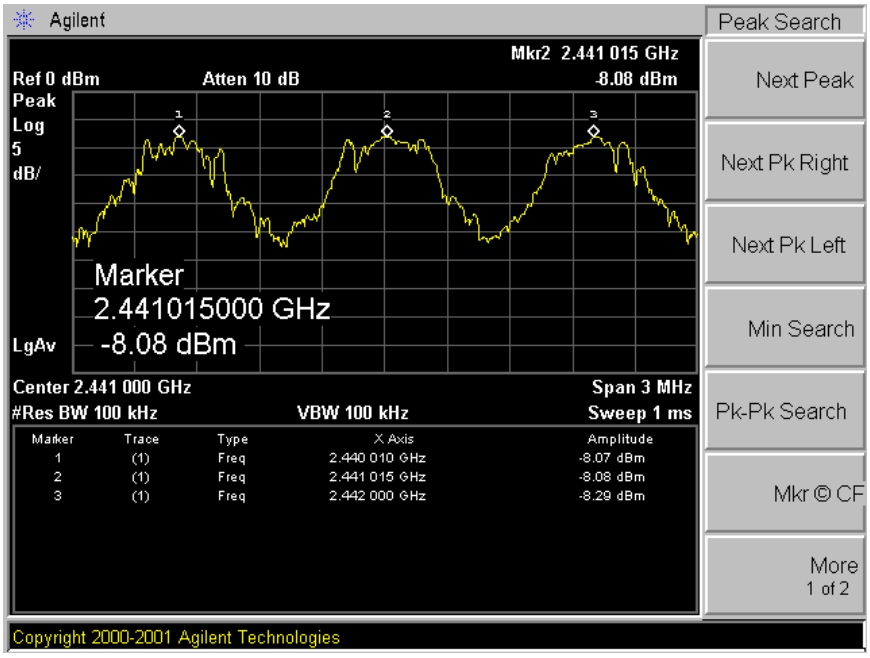
6.1.2 Test procedure

The carrier frequency separation per FCC 15.247(a)(1)/ IC RSS210 6.2.2(o)(a1) was measured using a spectrum analyzer with the resolution (or IF) bandwidth (RBW) ≥ 1% of the span, the span should be wide enough to capture the peaks of two adjacent channels, and the video (or average) bandwidth (VBW) should be ≥ RBW. The carrier frequency separation result is described as below:

6.1.3 Measured data

Channel	Frequency (MHz)	Measurement Frequency Separation (MHz)
1	2440.010	
2	2441.015	1.005
3	2442.000	0.085

Figure 6.1-1: Carrier Frequency Spearation



6.2 Number of Hopping Frequencies

6.2.1 Operation Environment

Temperature: 25.8°C

Relative Humidity: 45%

6.2.2 Test procedure

The carrier frequency separation per FCC 15.247(a)(1)(ii)/ IC RSS210 6.2.2(o)(a3) was measured using a spectrum analyzer with RBW ≥ 1% of the span. The VBW is ≥ RBW and the span shall be equal to the frequency band of operation. The number of hopping frequencies measured data is shown below.

6.2.3 Measured data of test results

Frequency Range (GHz)	Number of hopping frequencies	Total hopping channels
2.400 ~ 2.430	28	79
2.430 ~ 2.460	30	
2.460 ~ 2.480	21	

Figure 6.2-1 Channels in the Frequency range 2.400-2.430GHz

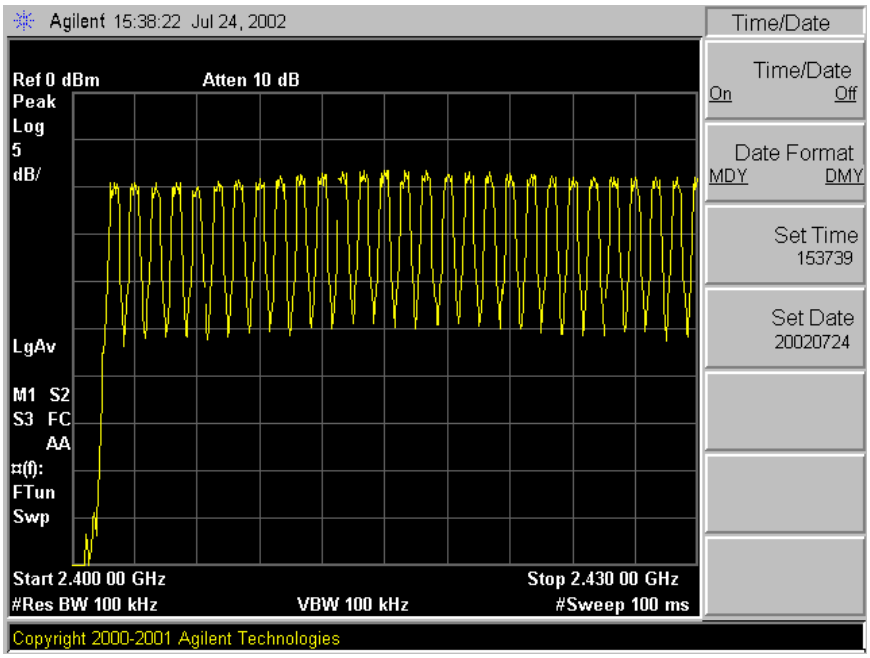


Figure 6.2-2 Channels in the Frequency range 2.430-2.460GHz

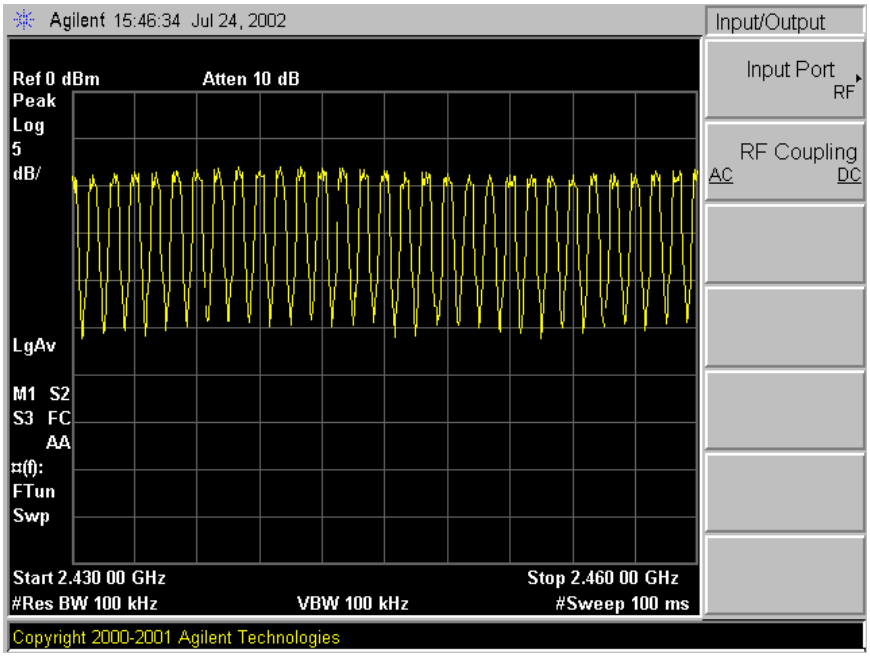
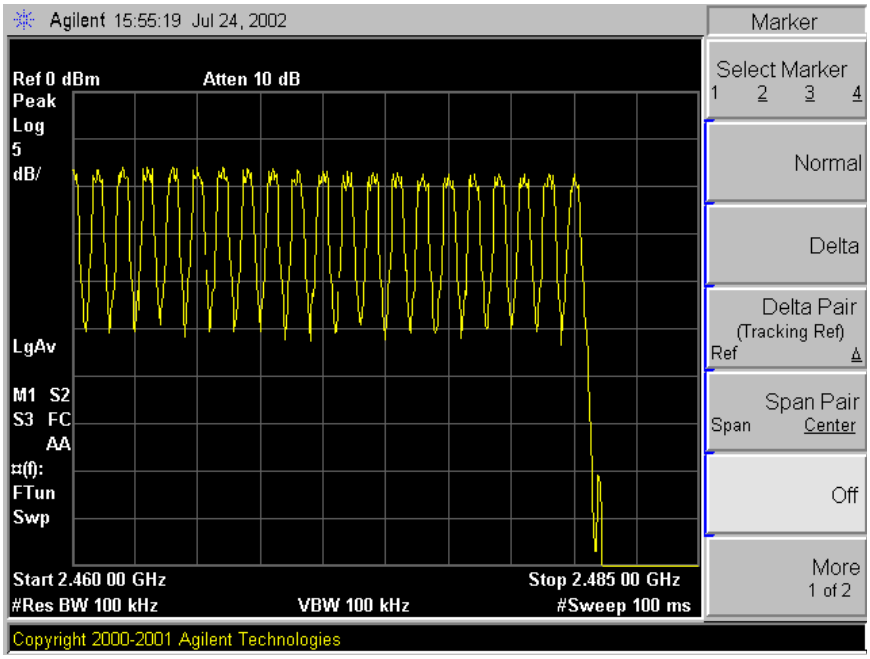


Figure 6.2-3 Channels in frequency range 2.460-2.485GHz



6.3 Time of Occupancy (Dwell Time)

6.3.1 Operation Environment

Temperature: 25.8°C

Relative Humidity: 46%

6.3.2 Test procedure

The Time of Occupancy test case per FCC 15.247(a)(1)(ii)/ IC RSS210 6.2.2(o)(a3) was measured using a spectrum analyzer with RBW = 1 MHz. The VBW ≥ RBW and the zero span function of spectrum analyzer was enabled.

The time of occupancy (Dwell Time) is (7 X 2.914 ms) (dwell time in 2 sec) X 15 = 305.97 ms = 0.30597 sec < 0.4s in 30 sec.

Figure 6.3-1: DH1 Mode Dwell Time

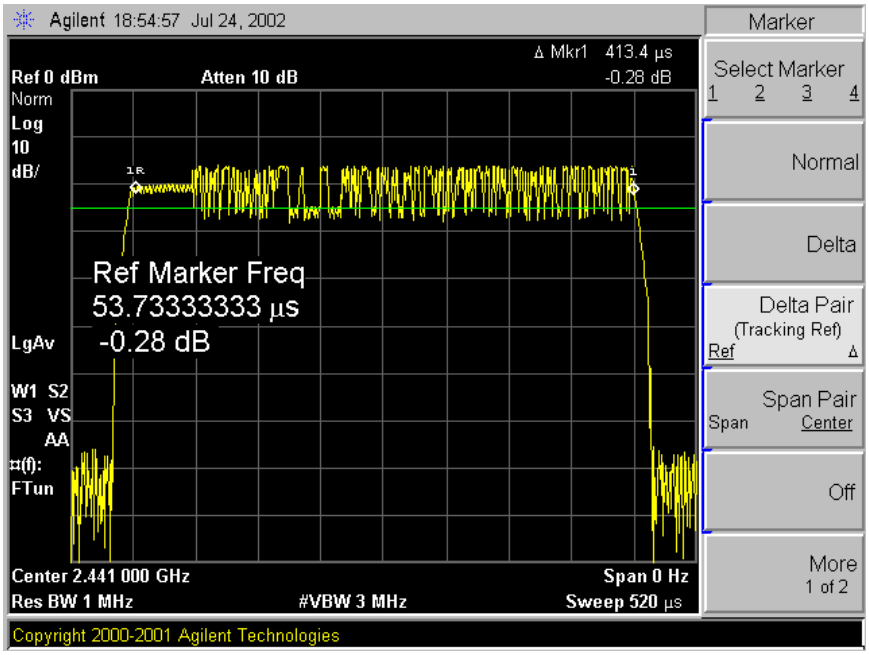


Figure 6.3-2: Plot showing numbers of pulses in 2 seconds in DH5 Mode

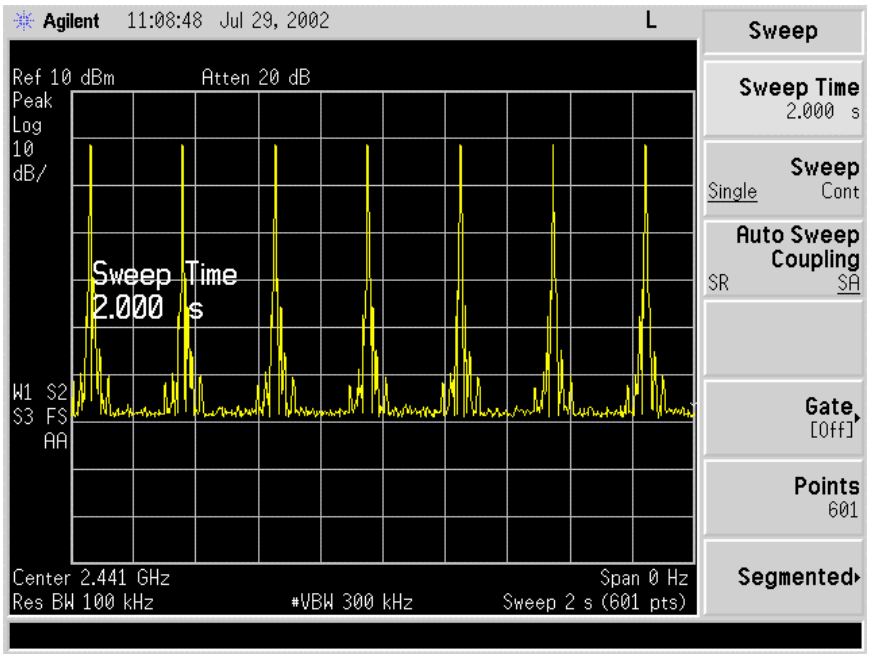
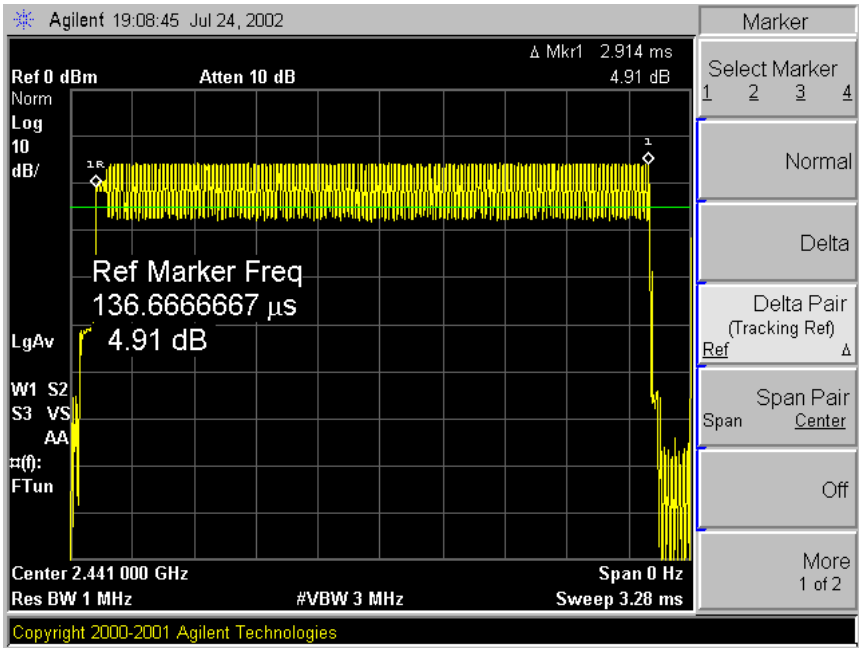


Figure 6.3-3: DH5 Mode Dwell Time



6.4 20 dB Bandwidth

6.4.1 Operation Environment

Temperature: 26°C

Relative Humidity: 40%

6.4.2 Test procedure

The 20dB bandwidth per FCC 15.247(a)(1)(ii)/
IC RSS210 6.2.2(o)(a1) was measured using spectrum analyzer with the resolution bandwidth set at 100 kHz. The VBW shall be ≥ RBW, and the span shall equal to approximately 2 to 3 times the 20 dB bandwidth. This test was performed at 3 different channels (low, mid and high), and the maximum 20dB modulation bandwidth is listed below:

6.4.3 Measured data

Channel	Frequency (MHz)	Bandwidth (MHz)
Low	2402	0.810
Middle	2441	0.806
High	2480	0.795

Figure 6.4-1: Bandwidth of the 2402 MHz channel

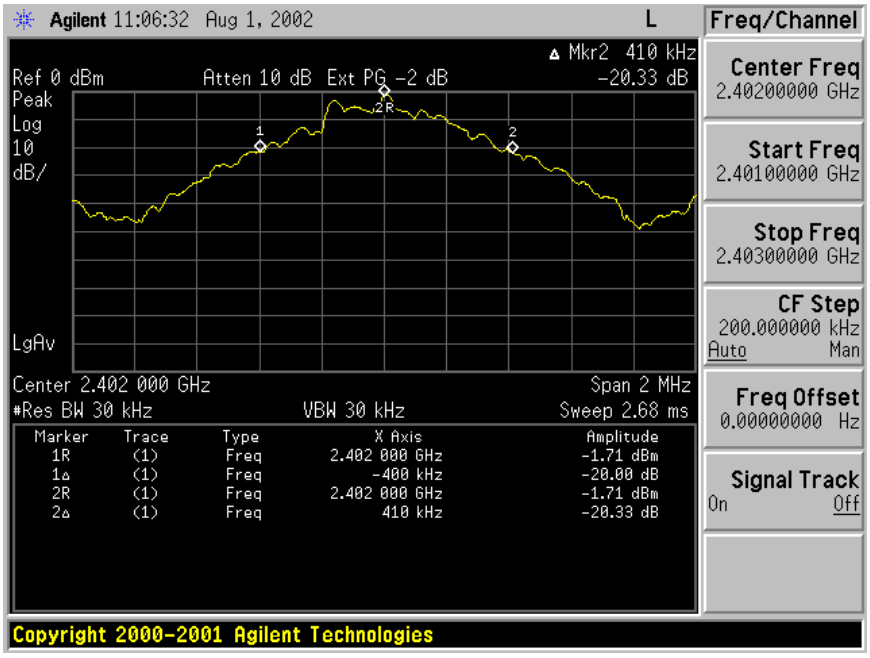


Figure 6.4-2: Bandwidth of the 2441 MHz channel

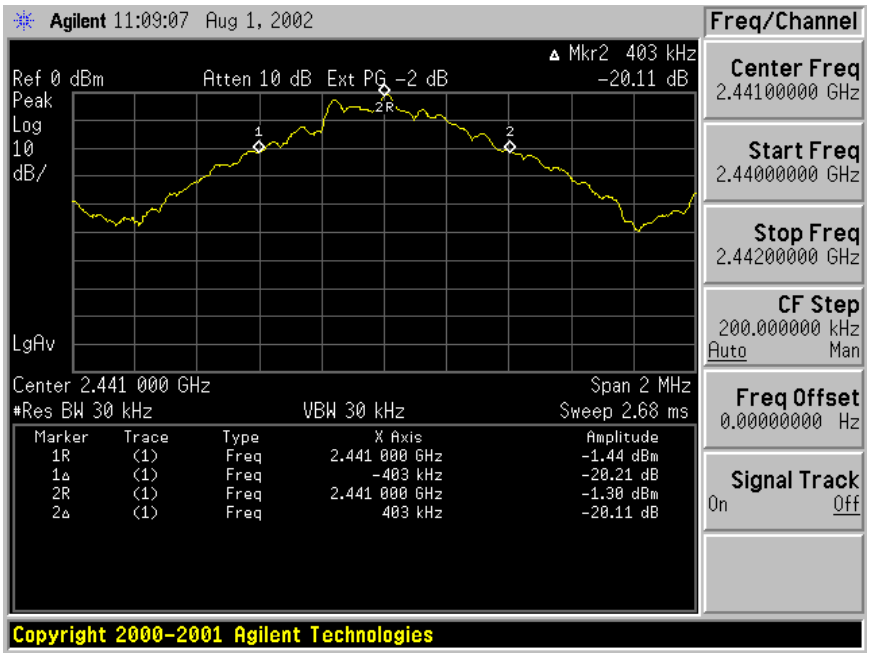
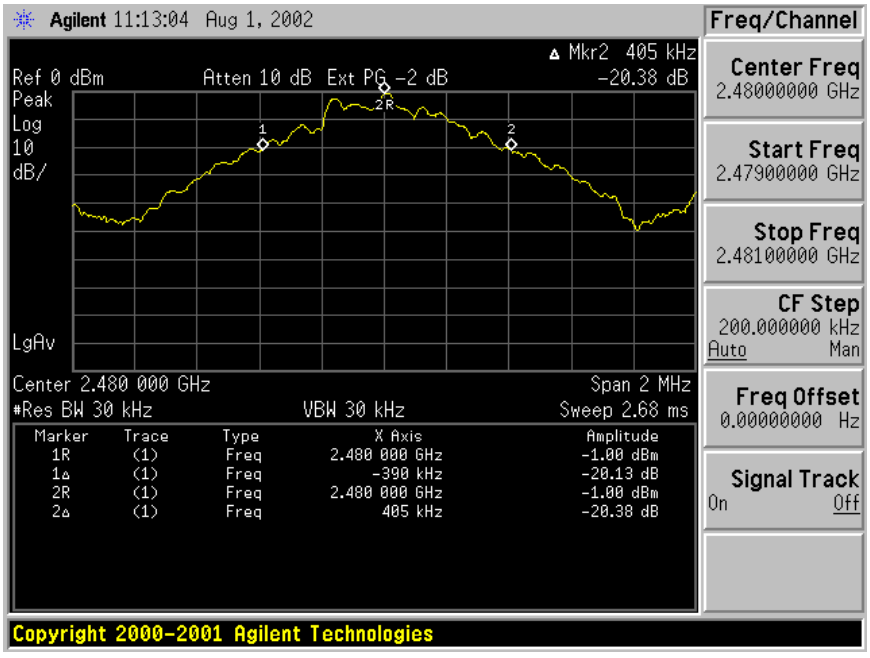


Figure 6.4-1: Bandwidth of the 2480 MHz channel



6.5 Peak Output Power

6.5.1 Operation Environment

Temperature: 26°C

Relative Humidity: 46%

6.5.2 Test procedure

The Peak Output Power per FCC 15.247(b)(1)/
IC RSS210 6.2.2(o)(a3) was measured on the EUT using a 50 Ohm SMA cable connected to the spectrum analyzer.

6.5.3 Measured data of test results

Channel	Frequency (MHz)	Transmitter Peak Output Power (dBm)
Low	2402	-1.59
Middle	2441	-1.07
High	2480	-0.74

Figure 6.5-1: Power Output on 2402 MHz

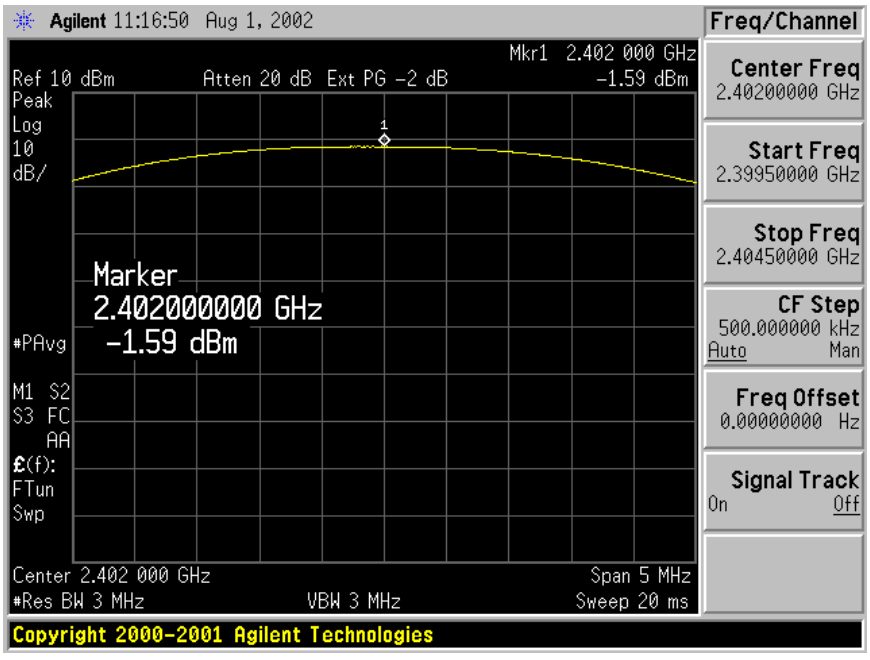


Figure 6.5-1: Power Output on 2441 MHz

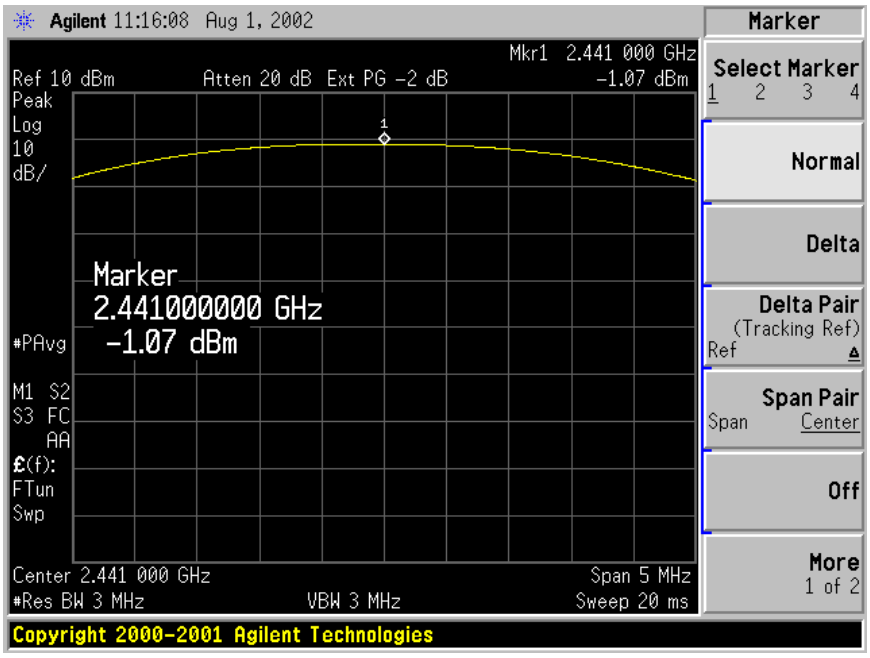
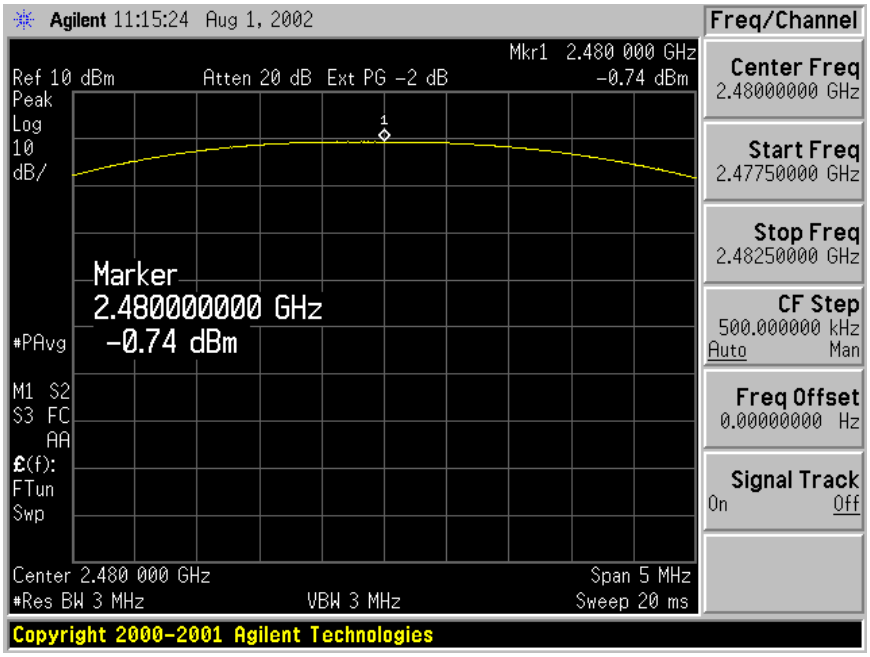


Figure 6.5-1: Power Output on 2480 MHz



6.6 Band-edge Compliance of RF Conducted Emissions

6.6.1 Operation Environment

Temperature: 26°C

Relative Humidity: 46%

6.6.2 Test procedure

The band-edge compliance of RF conducted emissions of the EUT was measured per FCC 15.247(c)/IC RSS210 6.2.2(o)(d1). The EUT was set to operate on the lowest operating frequency and the level at the lower band-edge was measured. The upper band-edge level was then measured with the EUT operating on the highest operating frequency.

6.6.3 Measured data of test results

Band-edge Frequency (MHz)	Attenuation (dB) Relative to Peak Carrier Power
2400	-33.76
2483.5	-41.61

Figure 6.6-1: Lower Bad-edge measurement

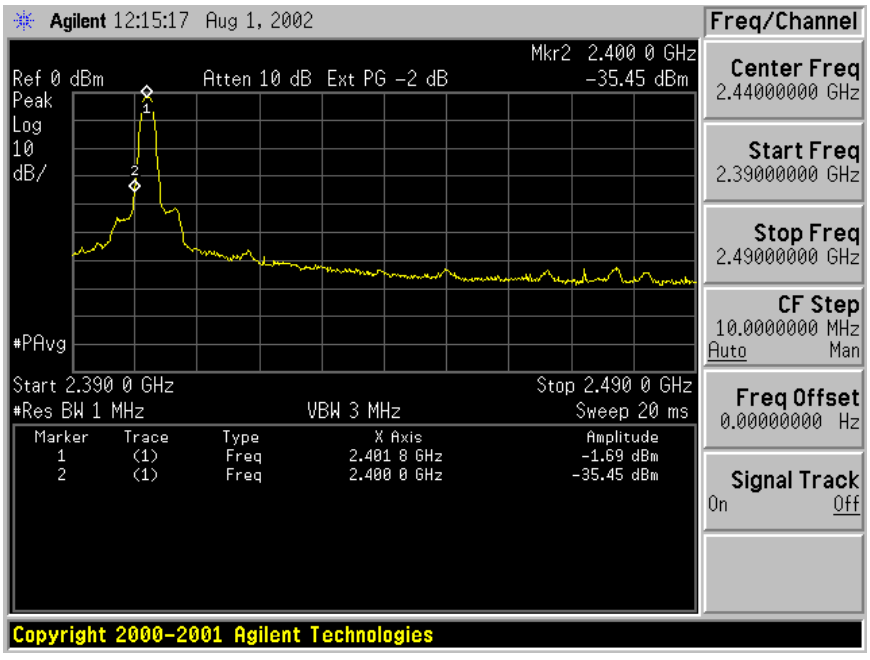


Figure 6.6-2: Upper Band-edge measurement

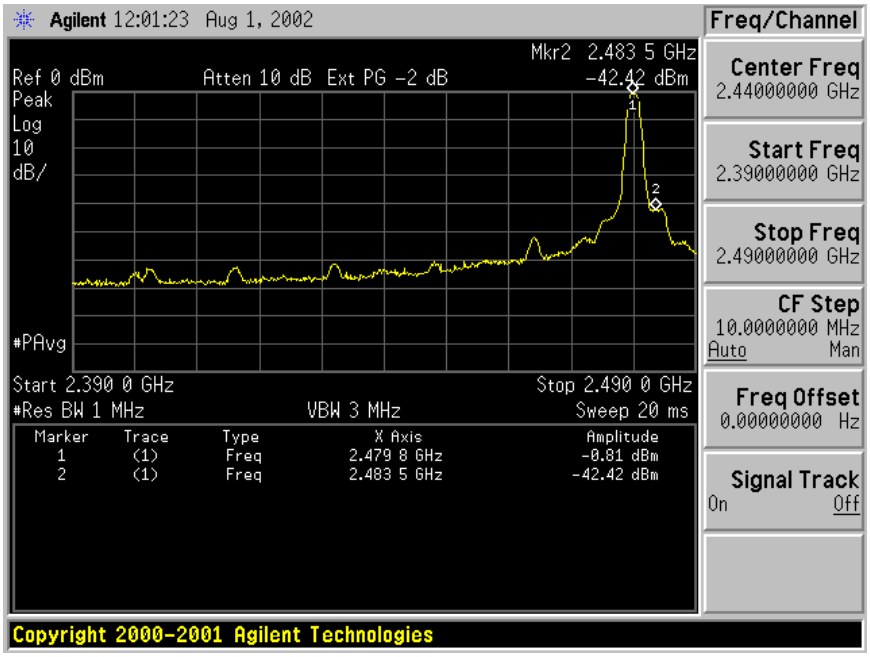
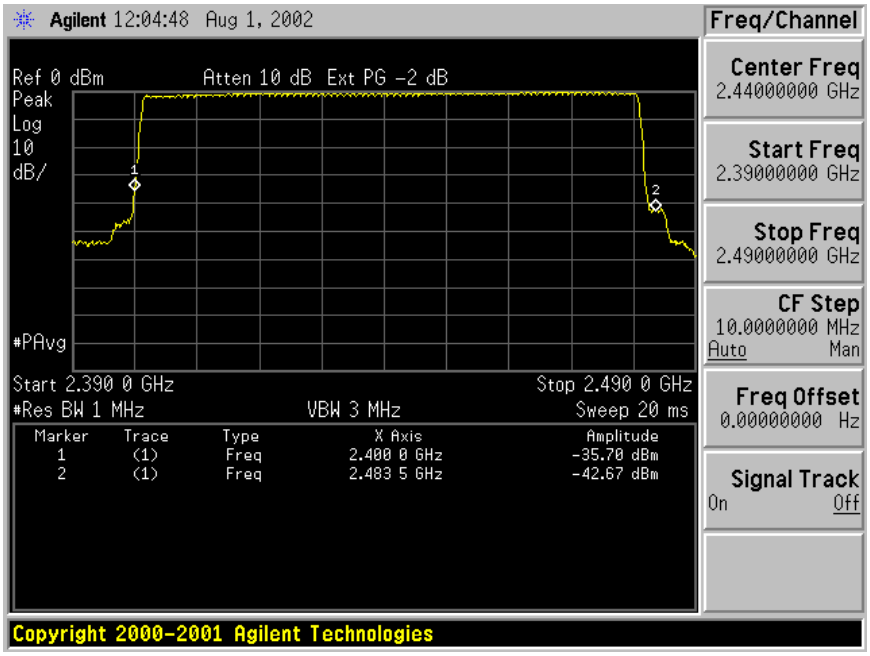


Figure 6.6-3: Plot of Hopping function enabled



6.7 Spurious RF Conducted Emissions

6.7.1 Operation Environment

Temperature: 25.8°C

Relative Humidity: 46%

6.7.2 Test procedure

The spurious RF conducted emissions were measured with the EUT set to low, middle and high transmit frequencies per FCC 15.247(c) IC RSS210 6.2.2(o)(e1). The EUT was transmitting at its maximum data rate with the maximum channel occupancy time. At each frequency the spectrum was scanned from 0 MHz to 26.5 GHz.

Spectrum plots with transmitter operating on 2.402GHz non hopping:

Figure 6.7-1: 0 - 3.0GHz Spectrum

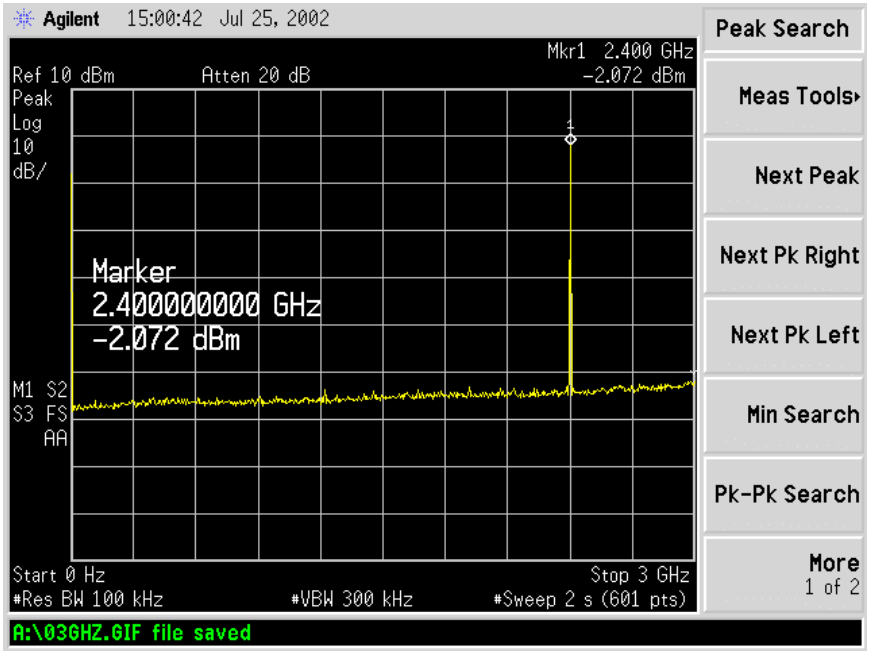


Figure 6.7-2: 3.0 – 8.5GHz Spectrum

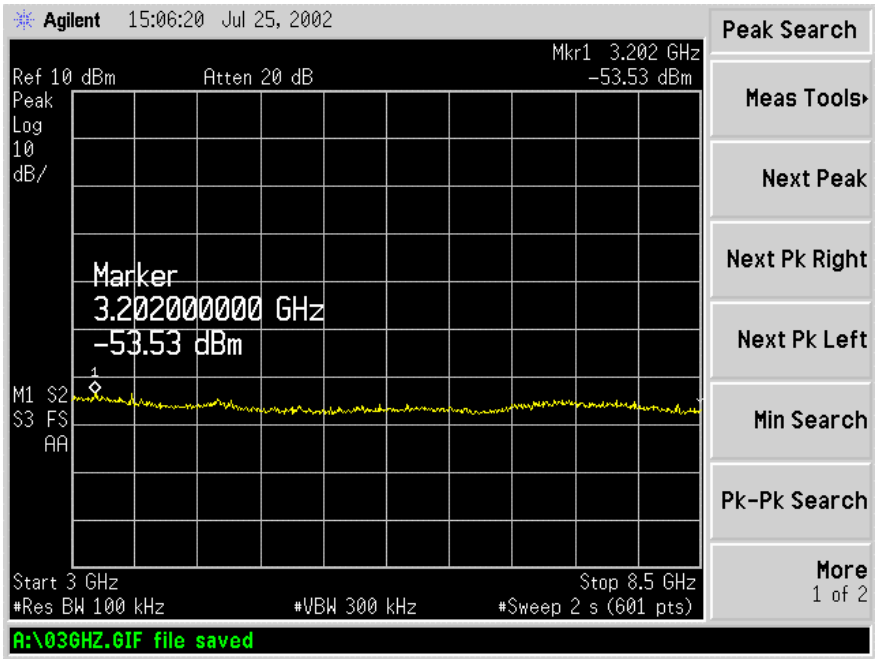


Figure 6.7-3: 6.5 – 15.0GHz Spectrum

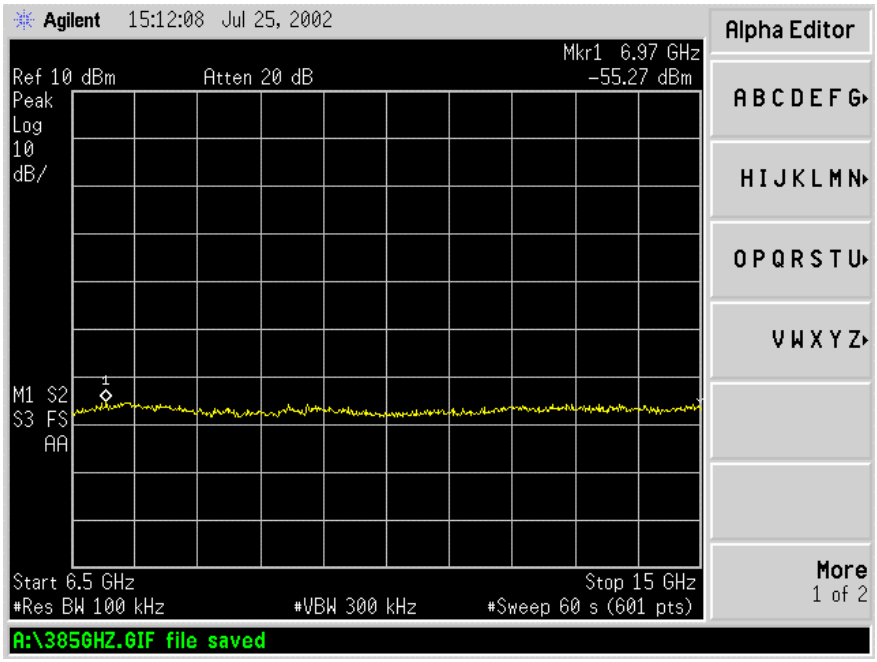
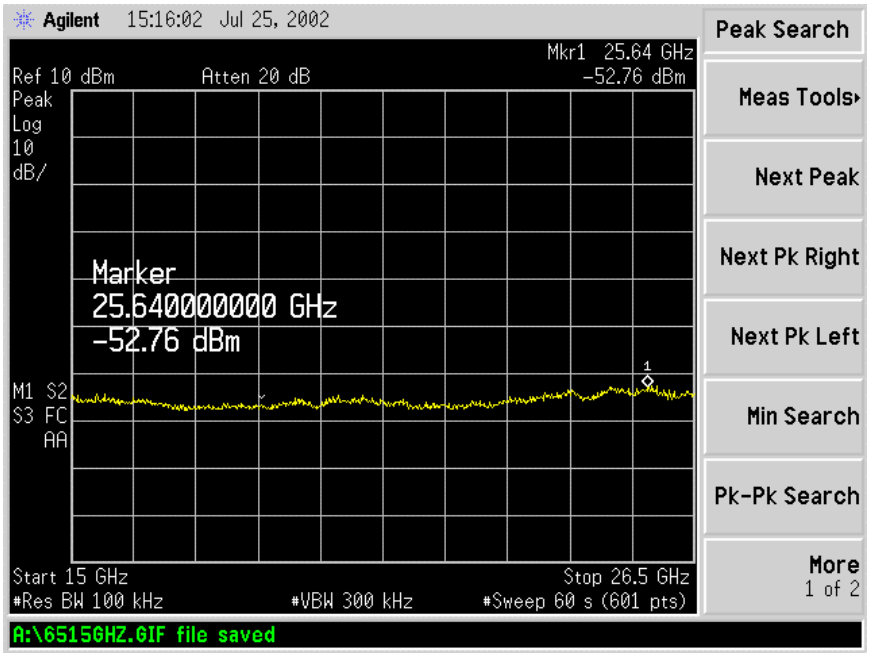


Figure 6.7-4: 15.0 – 26.5GHz Spectrum



Spectrum plots with transmitter operating on 2.440GHz non hopping:

Figure 6.7-5: 0 - 3.0GHz Spectrum

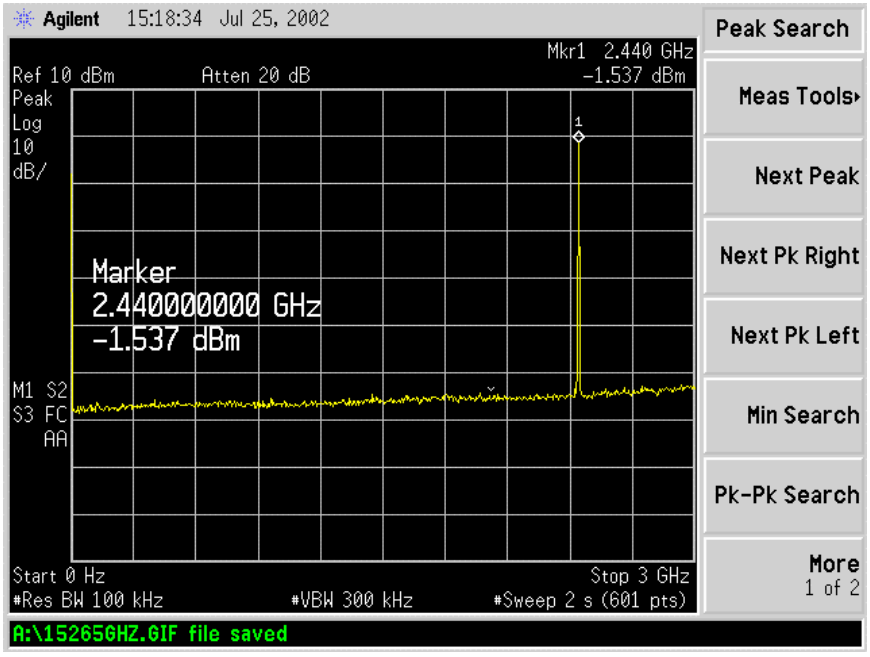


Figure 6.7-6: 3.0 – 8.5GHz Spectrum

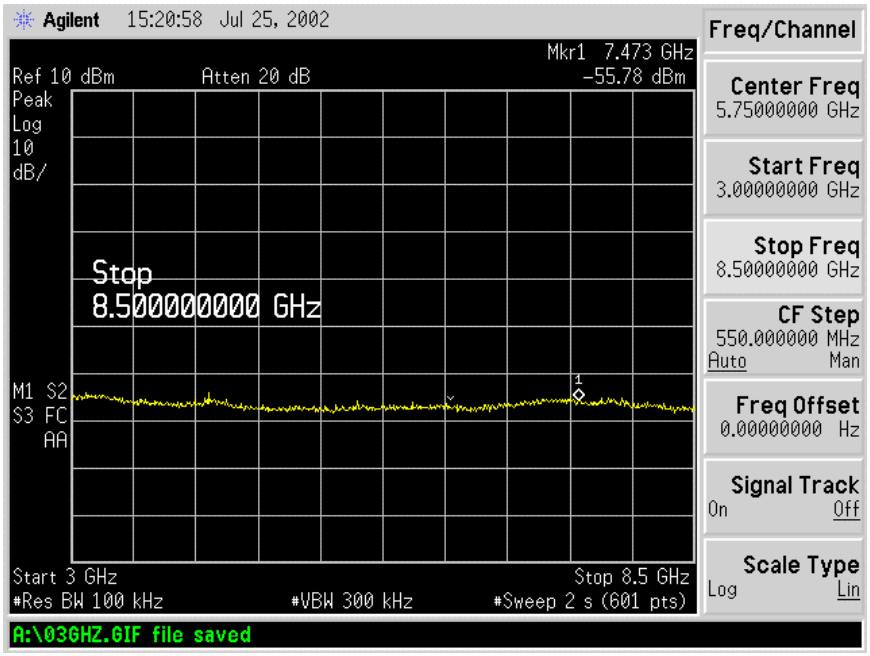


Figure 6.7-7: 6.5 – 15.0GHz Spectrum

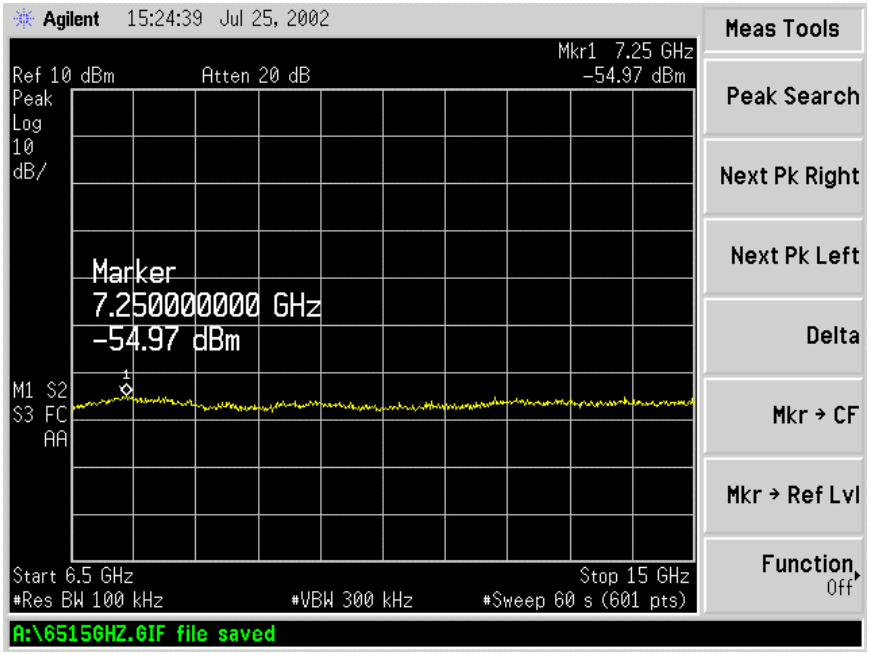
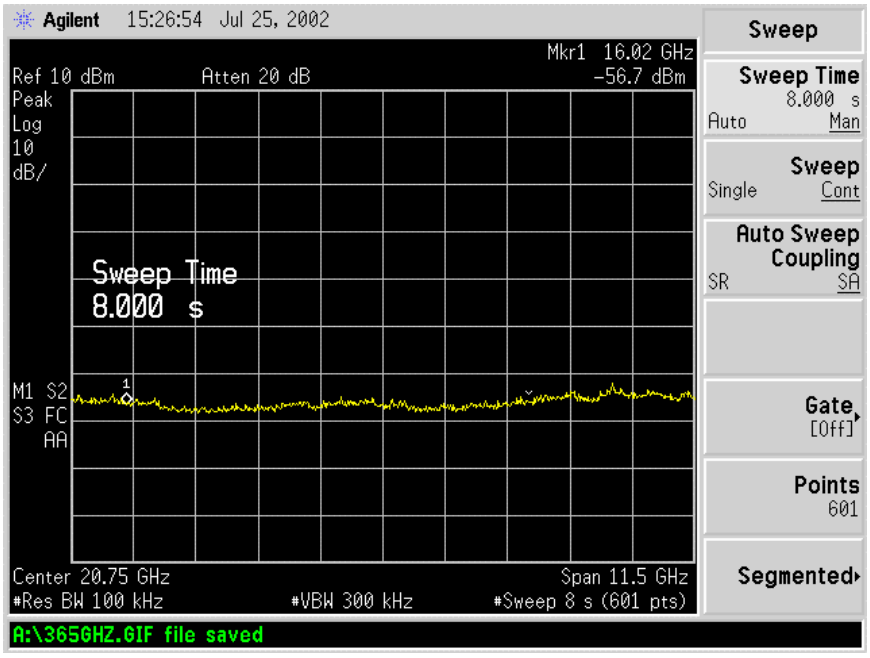


Figure 6.7-8: 15.0 – 26.5GHz Spectrum



Spectrum plots with transmitter operating on 2.480GHz non hopping:

Figure 6.7-9: 0 - 3.0GHz Spectrum

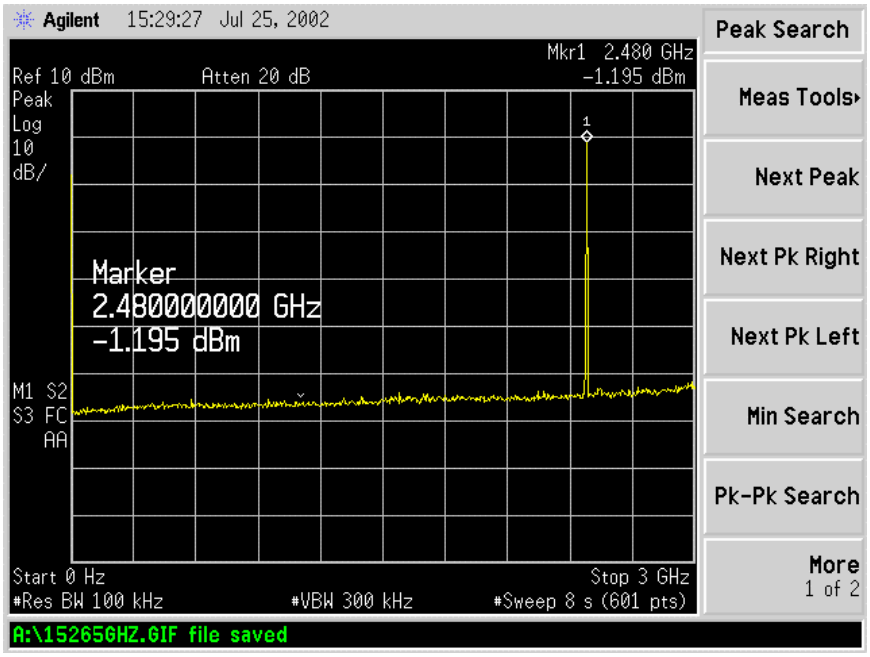


Figure 6.7-10: 3.0 – 6.5GHz Spectrum

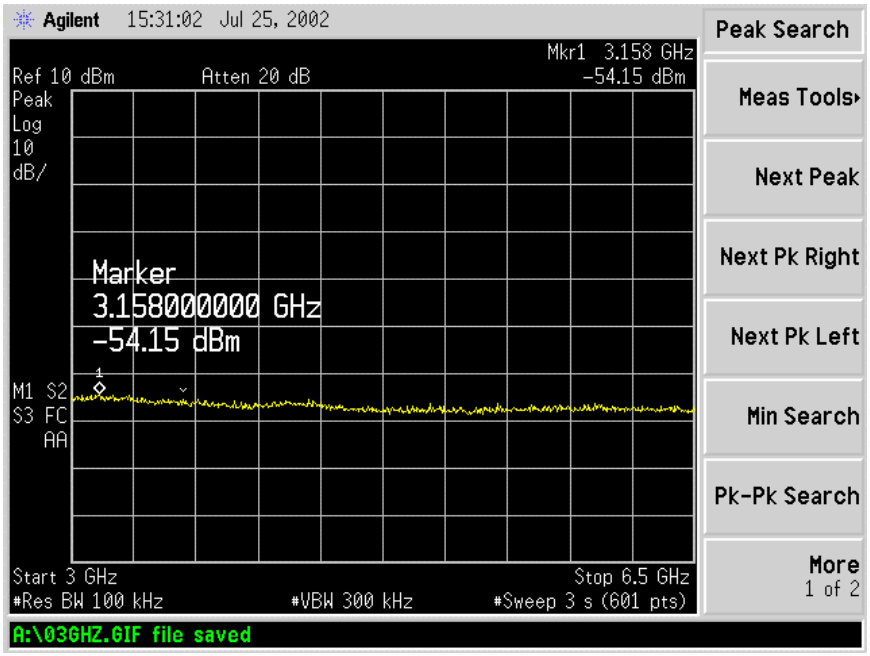


Figure 6.7-11: 6.5 – 15.0GHz Spectrum

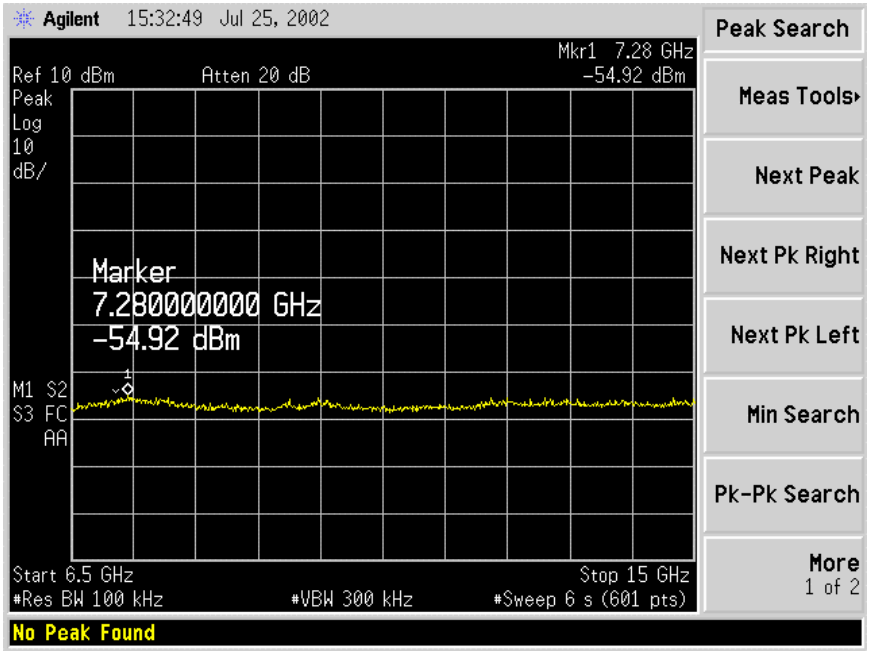


Figure 6.7-12: 15.0 – 26.5GHz Spectrum