TEST REPORT

FCC Part 15C Testing in support of an Application for Grant of Equipment Authorisation of an Intermec 730 Handheld Computer Terminal 802.11b Radio Module

FCC ID: EHA-802CFI3

Report Number: OR611453/03 Issue 2 December 2003

TÜV PRODUCT SERVICE

BABT

BABT. Segensworth Road, Titchfield
Fareham, Hampshire, United Kingdom, PO15 5RH
Tel: +44(0)1329 443300, Fax: +44(0)1329 443331
www.babt.com

REPORT ON FCC Part 15C Testing in support of an Application for Grant of Equipment Authorisation of an Intermec 730 Handheld Computer Terminal 802.11b Radio Module

FCC ID: EHA-802CFI3

Report No OR611453/03 Issue 2

December 2003

EQUIPMENT: 802.11b Radio Module

FCC ID: EHA-802CFI3

SPECIFICATION: 47 CFR 15.247

PREPARED FOR: Intermec Technologies Corporation
550 Second Street S.E
Cedar Rapids
IOWA 52401
USA

MANUFACTURERS REPRESENTATIVE: Mr Scott Holub

APPROVED BY:

K W ADSETTS	**M JENKINS**
EMC Signatory	**Radio Signatory**
DATED: 17 December 2003	17 December 2003

DISTRIBUTION

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Total No of Pages 99
(Inclusive of Annex A)

UKAS TESTING 0141 Group

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SECTION 1

REPORT SUMMARY

Document History

This Report replaces Report OR611453-03 Issue 1 and is issued to correct typographical errors and include omitted Test Photographs in the original report.

FCC Part 15C Testing in support of an Application for Grant of Equipment Authorisation of an Intermec 730 Handheld Computer Terminal 802.11b Radio Module
FCC ID: EHA-802CFI3

1.1 STATUS

OBJECTIVE	To undertake measurements to determine the Equipment Under Test's (EUT's) compliance with the specification.
MANUFACTURING DESCRIPTION	802.11b Module for use with host unit 730
APPLICANT	Intermec Technologies 550 Second Street S.E Cedar Rapids IOWA 52401 USA
MANUFACTURERS TYPE NUMBER	ActionTec Compact Flash Type II + 802.11b Card
MANUFACTURERS PART NUMBER	802CF13 (Ver. 1.00B)
HARDWARE REVISION	730A1E4004001
TEST SPECIFICATION NUMBER	FCC Part 15 Subpart C
REGISTRATION NUMBER	OR611453
QUANTITY OF ITEMS TESTED	One
SECURITY CLASSIFICATION OF EUT	Unclassified
INCOMING RELEASE **SERIAL NUMBER** **DATE**	Declaration of Build Status OR611453 2003
DISPOSAL **REFERENCE NUMBER** **DATE**	Held pending disposal N/A N/A
START OF TEST **FINISH OF TEST**	21/10/2003 28/11/2003
TEST ENGINEERS	S Bennett R Henley B Airs M Larkin J Holcombe
RELATED DOCUMENTS	ANSI C63.4 2001. Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz. FCC Public Notice document (DA 00-705 released 30 March 2000)

1.2 INTRODUCTION

The information contained within this report is intended to show verification of compliance of the Intermec Technologies Inc 730 Handheld Computer Terminal RLAN 802.11b Module to the requirements of FCC Specification Part 15.

FCC ID: EHA-802CFI3

1.3 LOCATION OF TESTING

BABT Engineers, Brian Airs, Ryan Henley, Matthew Larkin and Jason Holcombe conducted all testing at the premises BABT, Segensworth Road, Fareham, Hampshire, PO15 5RH. Spurious Radiated Emissions measurements were performed in a 3 metre Anechoic Chamber. A complete site description is on file with the FCC Laboratory Division, Registration Number: 90987. See Annex A.

1.4 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out is shown below.

Test	Spec Clause	Test Description	Result	Levels/Comments
2.1	FCC: Part 15.205, 15.209	Measurement at Band Edge (Marker Delta Method)	Pass	
2.2	FCC: Part 15.247(a)(2)	6dB Bandwidth	Pass	
2.3	FCC: Part 15.247(b)(3)	Maximum Peak Output Power	Pass	
2.4	FCC: Part 15.247(c)	Spurious Conducted Emissions	Pass	
2.5	FCC: Part 15.207	Spurious Conducted Emissions Power Line	Pass	
2.6	FCC: Part 15.247(c)	Spurious Radiated Emissions	Pass	
2.7	FCC: Part 15.247(d)	Peak Power Spectral Density	Pass	

1.5 PRODUCT INFORMATION

1.5.1 Technical Description

The unit supplied for testing was a 730 Handheld Computer Terminal 802.11b Radio Module, which offers 2.4GHz Wireless connectivity with other 802.11b devices.

Manufacturing Description	RLAN 802.11b Module 730 Handheld Computer Terminal
Manufacturer:	Intermec Technologies
Model No:	730
Drawing Revision:	802CF13 (Ver. 1.00B)

1.5.2 Modes of Operation

The test software in the EUT enabled the Test Engineer to select full power and continuous transmit on the following channels;

2.4GHz RLAN functionality

Channel 1: 2412MHz
Channel 6: 2437MHz
Channel 11: 2462MHz

The EUT was set at the Maximum Output Power during testing.

Information on the specific test modes used is detailed in the test procedure for each individual test.

All tests were carried out with the unit powered by its own battery with the exception of the Spurious Conducted Emissions Power Line tests. These tests were performed with the unit connected to its supplied battery charger - ELPAC POWER SYSTEMS Model: FW1812

1.6 DEVIATIONS FROM THE STANDARD

No deviations from the standard were made during testing.

1.7 MODIFICATION RECORD

MODIFICATION STATE 0

EUT as supplied.

MODIFICATION STATE 1

Software Modification made to reduce the output power. The modification was made by Scott Holub of Intermec Technologies.

Spurious Emissions testing was not repeated with this modification as the testing carried out in Modification State 0 was deemed to be worst case.

SECTION 2

TEST DETAILS – MODIFICATION STATE 0

FCC Part 15C Testing in support of an Application for Grant of Equipment Authorisation of an Intermec 730 Handheld Computer Terminal 802.11b Radio Module
FCC ID: EHA-802CFI3

2.1 BAND EDGE MEASUREMENTS

2.1.1 Specification Reference

FCC Part 15.247(c)

2.1.2 Equipment Under Test

730 Handheld Computer Terminal 802.11b Module

2.1.3 Date of Test

23/10/2003

2.1.4 Test Equipment Used

The following major items of test equipment identified in Section 3.1 were used for the above tests.

Items: 17, 19, 21, 22, 23, 24

2.1.5 Test Procedure

Testing to the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.205, for Restricted Bands of Operation was carried out on the Measurement Test Facility detailed in Annex A.
The following Test Results were obtained using the FCC Public Notice document (DA 00-705 released 30 March 2000) for making measurements at the Band Edge, incorporating the 'Marker Delta Method'.

EUT was operating at maximum power at 11Mbps.

Step 1

Bottom Channel Fundamental Field Strength Measurement.

Performed in accordance with ANSI C63.4

Peak measurements performed utilising a Resolution Bandwidth and Video Bandwidth of 1MHz.
Average measurements performed utilising a Resolution Bandwidth of 1MHz and Video Bandwidth of 10Hz.

Freq	Ant Pol	Hgt	Azi	Peak FS	Average FS
GHz	H/V	cm	deg	dBµV/m	dBµV/m
2.412	V	105	170	112.1	104.8

2.1.5 Test Procedure - continued

Step 2

Determine Marker delta amplitude between 2.462GHz fundamental and 2.4835GHz the Band Edge under investigation.

Using a span of 30MHz with Resolution Bandwidth and Video Bandwidth of 300kHz.

The Marker Delta = 57.6dB

Step 3

By subtracting the Marker Delta obtained from Step 2 from the 2.412GHz Field Strength measurement from Step 1, gives following Result

Performed by: J Holcombe, EMC Engineer

2.2.6 Test Results

Peak of 112.1dBµV/m – 57.6dB (Delta) = 54.5dBµV/m (Limit is 74.0dBµV/m = Pass)

Average of 104.8dBµV/m – 57.6dB (Delta) = 47.2dBµV/m (Limit is 54.0dBµV/m = Pass)

2.2 6dB BANDWIDTH

2.2.1 Specification Reference

FCC Part 15.247(a)(2)

2.2.2 Equipment Under Test

730 Handheld Computer Terminal 802.11b Module

2.2.3 Date of Test

28th October 2003

2.2.4 Test Equipment Used

The following major items of test equipment identified in Section 3.1 were used for the above tests.

Items: 1, 2, 3, 4

2.2.5 Test Procedure

Test Performed in accordance with 15.247.

The EUT was transmitted at maximum power at all data rates via a 10dB Attenuator to the Spectrum Analyser. The Analyser settings were adjusted to display the resultant trace on screen. The peak point of the trace was measured and the markers positioned to give the –6dBc points of the displayed spectrum.

The measurement plots can be seen on the following pages.

Performed by: B Airs, Radio Engineer.

2.1.6 Test Results

Frequency (MHz)	Data Rate (Mbps)	6dB Bandwidth (MHz)
2412	1	11.500
2437	1	11.610
2462	1	11.550

Frequency (MHz)	Data Rate (Mbps)	6dB Bandwidth (MHz)
2412	2	11.500
2437	2	11.550
2462	2	11.550

Frequency (MHz)	Data Rate (Mbps)	6dB Bandwidth (MHz)
2412	5.5	11.610
2437	5.5	11.550
2462	5.5	11.550

Frequency (MHz)	Data Rate (Mbps)	6dB Bandwidth (MHz)
2412	11	11.610
2437	11	11.550
2462	11	11.550

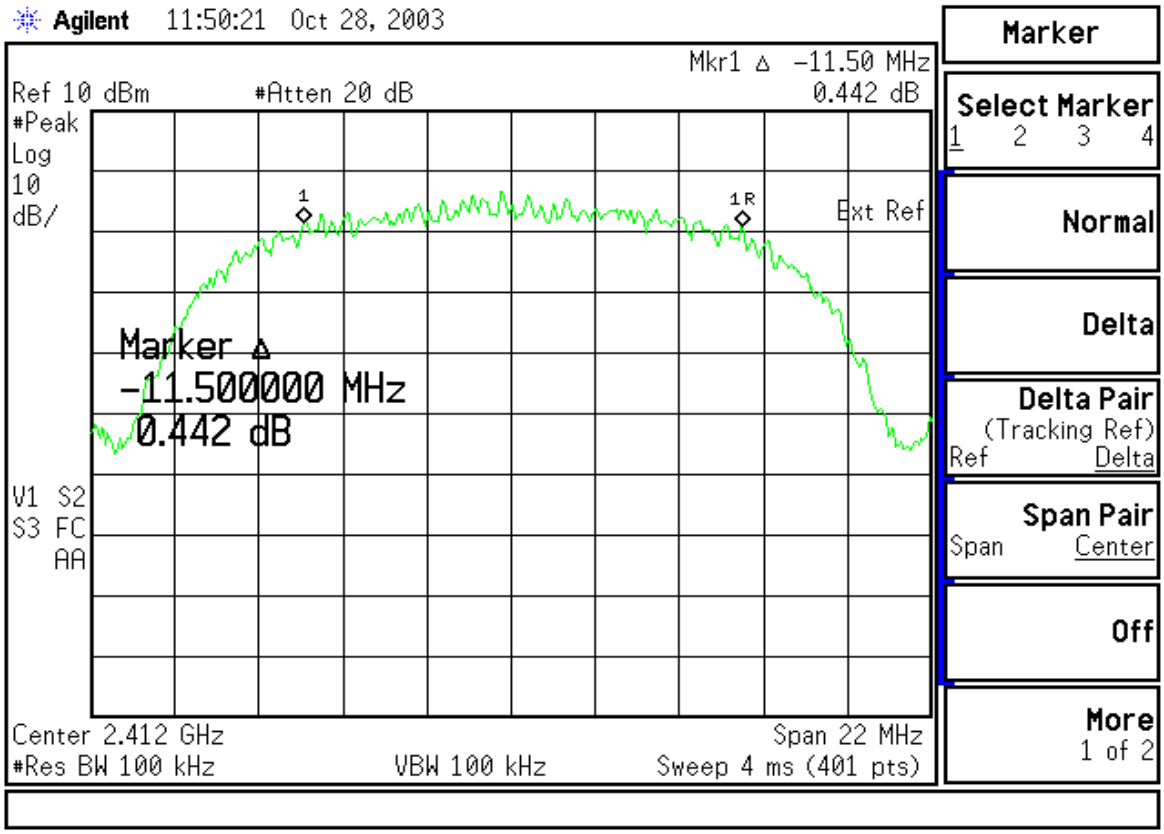
Limit	≥ 500kHz

Remarks

EUT complies with CFR 47 15.247(a)(2). The EUT exceeds the 500kHz requirement at the measured frequencies and data rates.

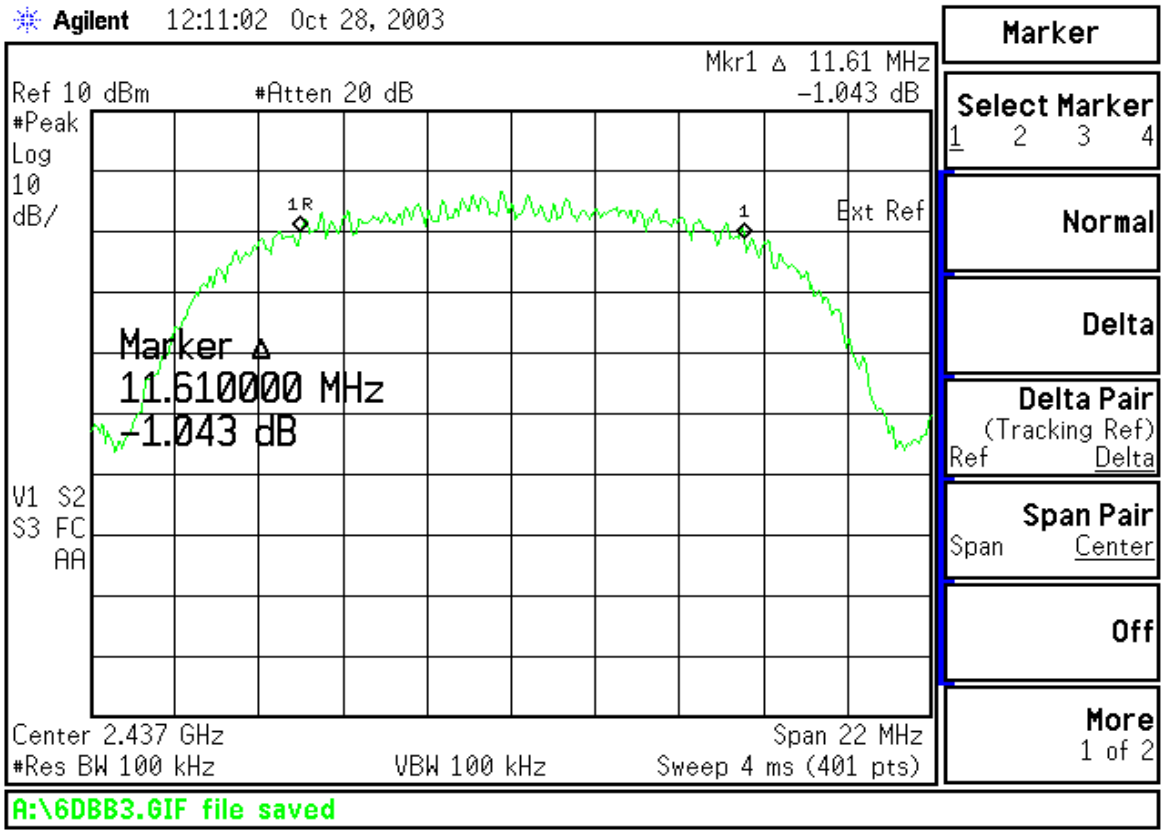
2.2.6 Test Results - Continued

Channel 1, (2412.0MHz) – Maximum Power 1Mbps



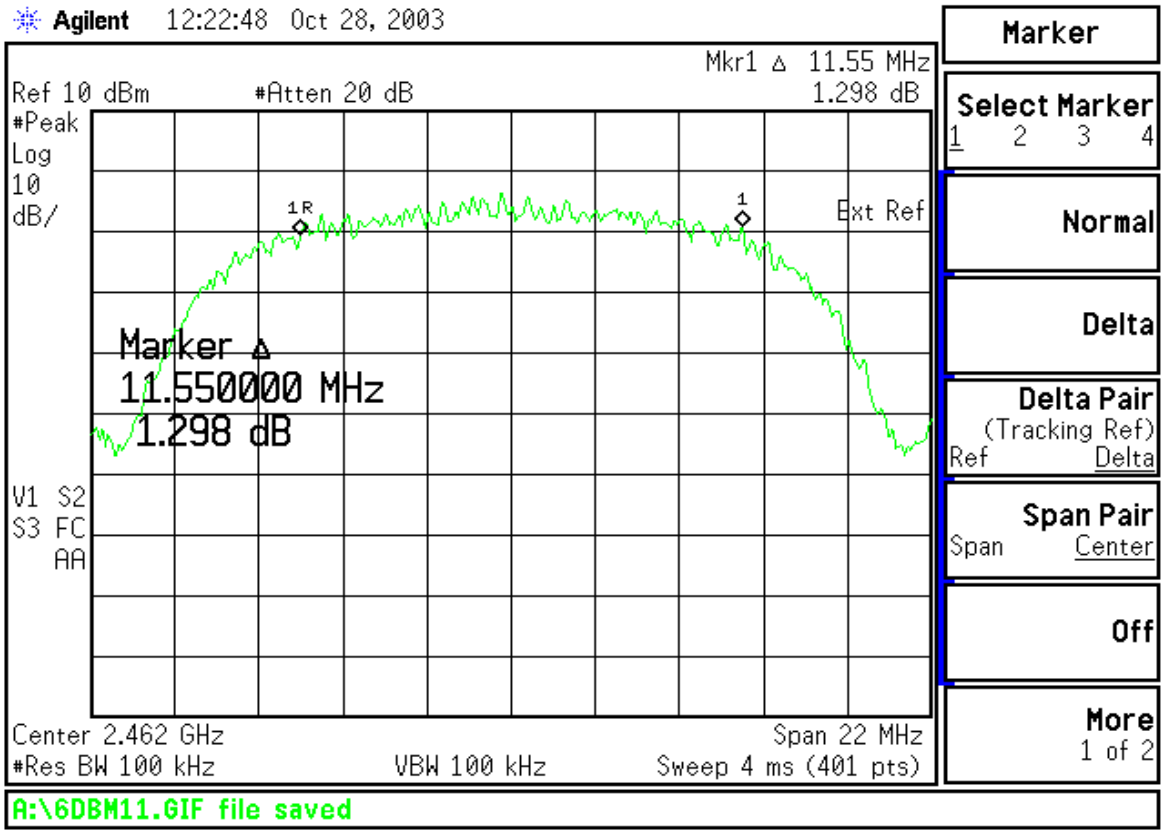
2.2.6 Test Results - Continued

Channel 6, (2437.0MHz) – Maximum Power 1Mbps



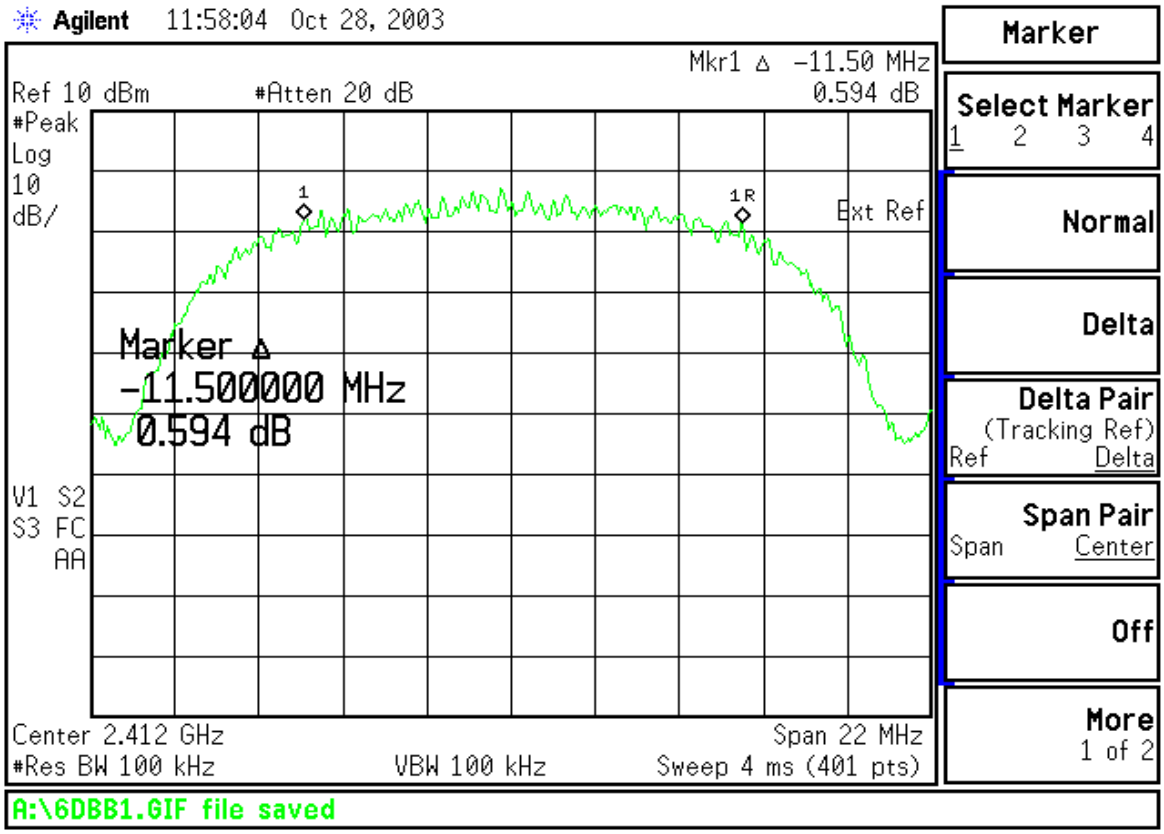
2.2.6 Test Results - Continued

Channel 11, (2462.0MHz) – Maximum Power 1Mbps



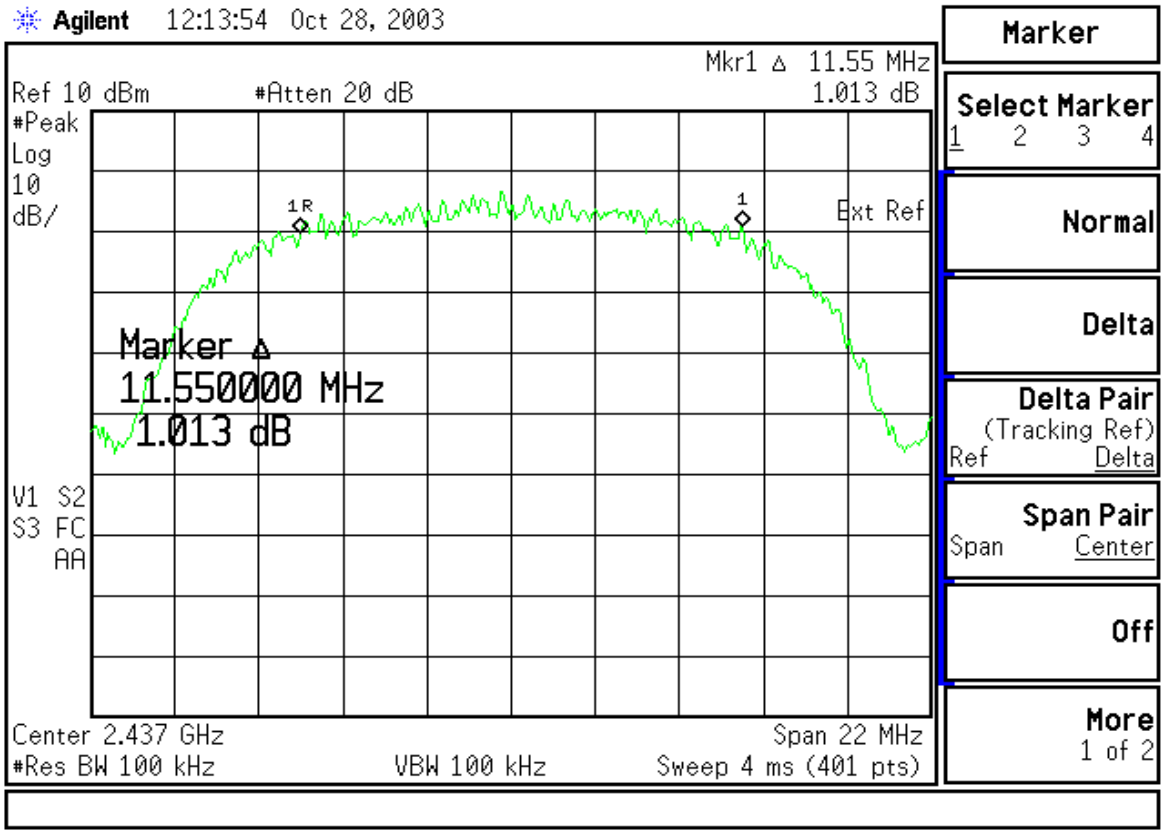
2.2.6 Test Results - Continued

Channel 1, (2412.0MHz) – Maximum Power 2Mbps



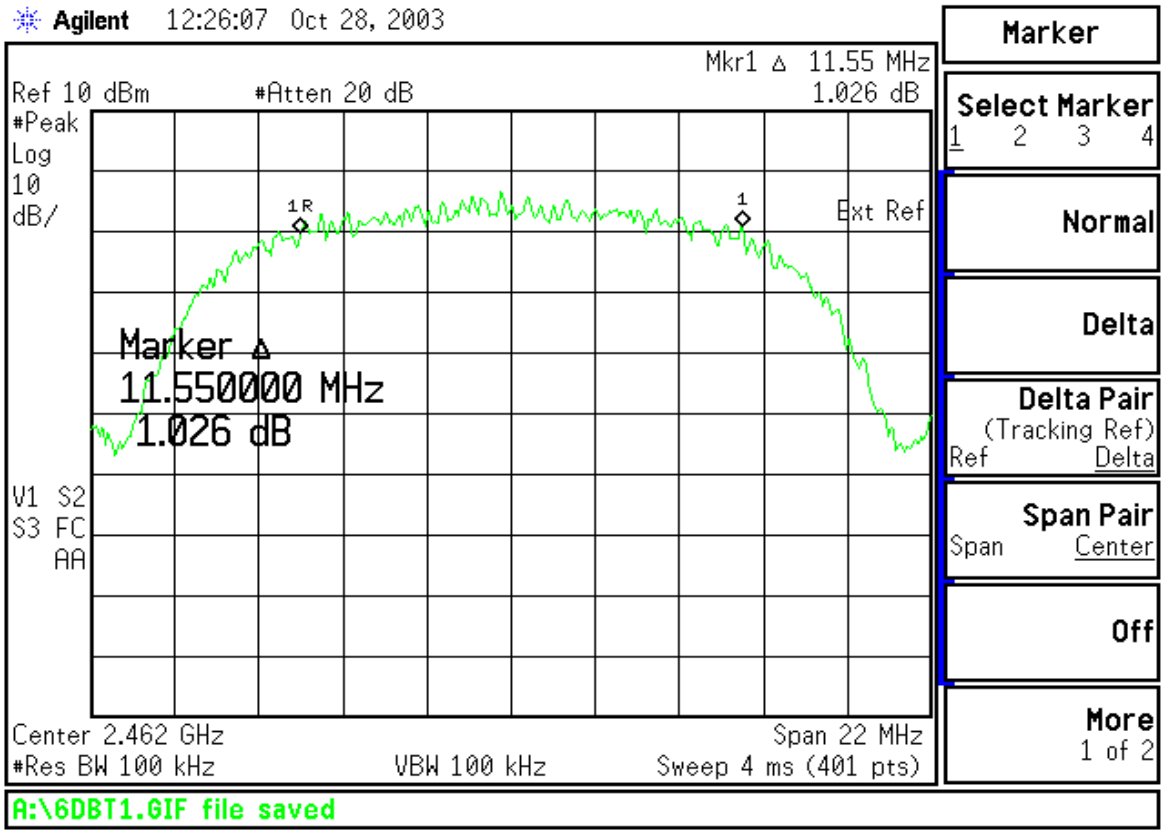
2.2.6 Test Results - Continued

Channel 6, (2437.0MHz) – Maximum Power 2Mbps



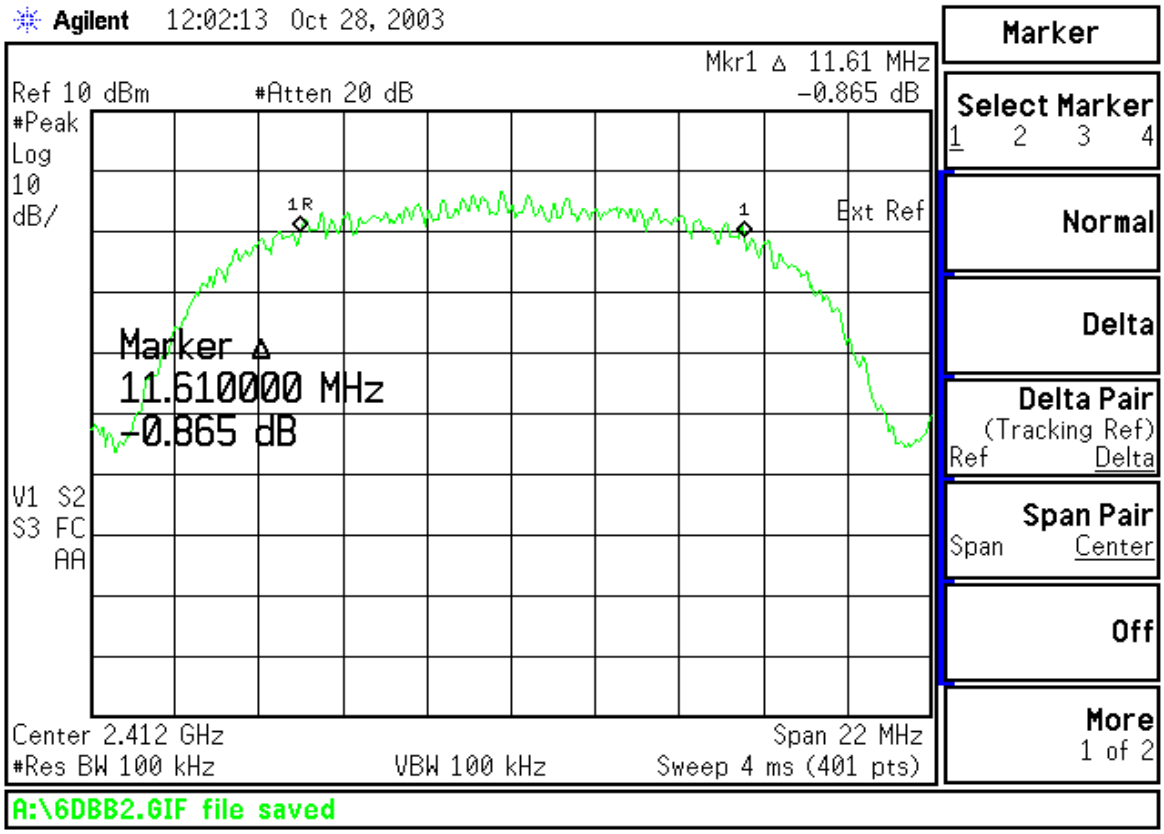
2.2.6 Test Results - Continued

Channel 11, (2462.0MHz) – Maximum Power 2Mbps



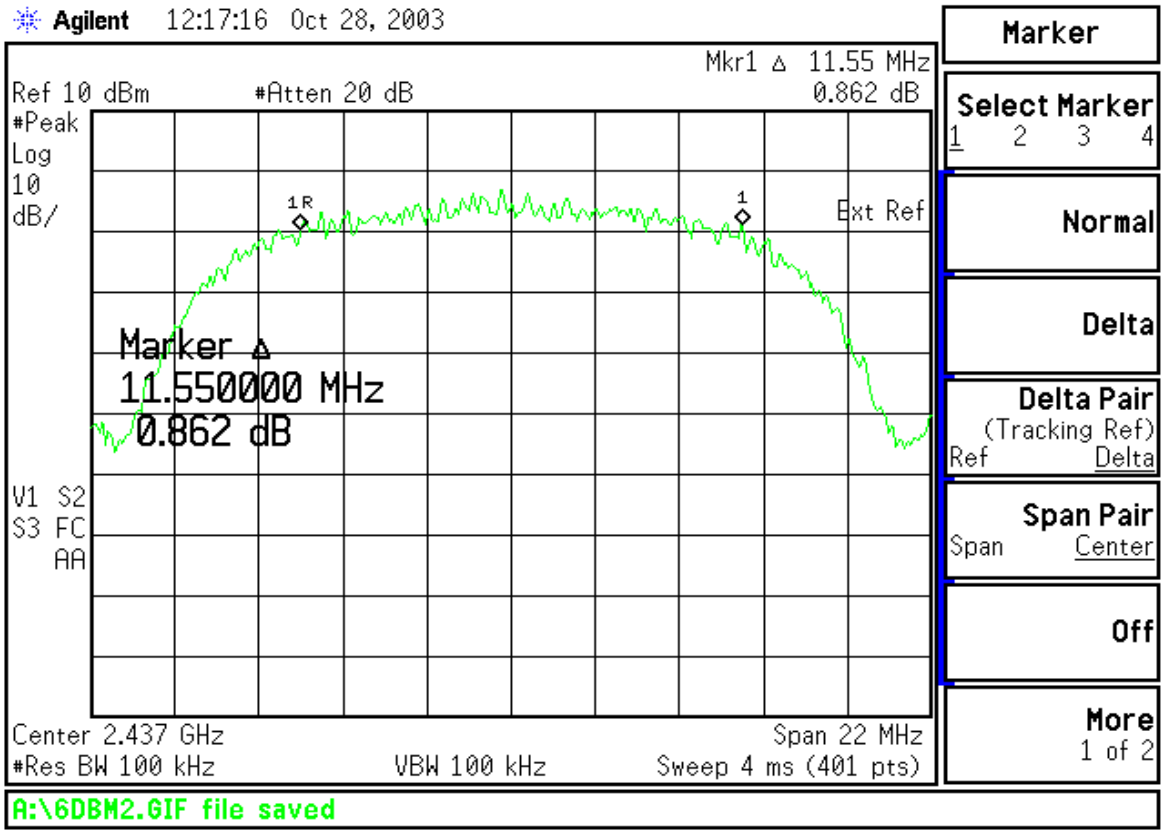
2.2.6 Test Results - Continued

Channel 1, (2412.0MHz) – Maximum Power 5.5Mbps



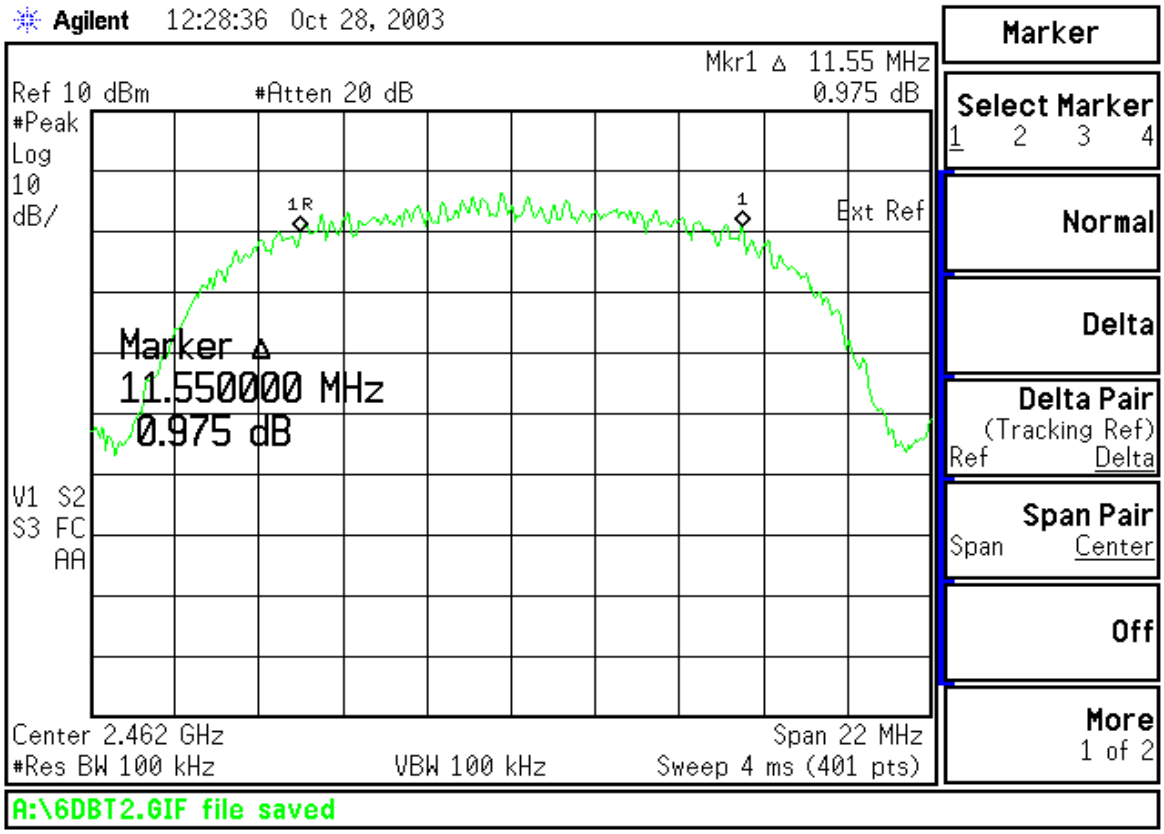
2.2.6 Test Results - Continued

Channel 6, (2437.0MHz) – Maximum Power 5.5Mbps



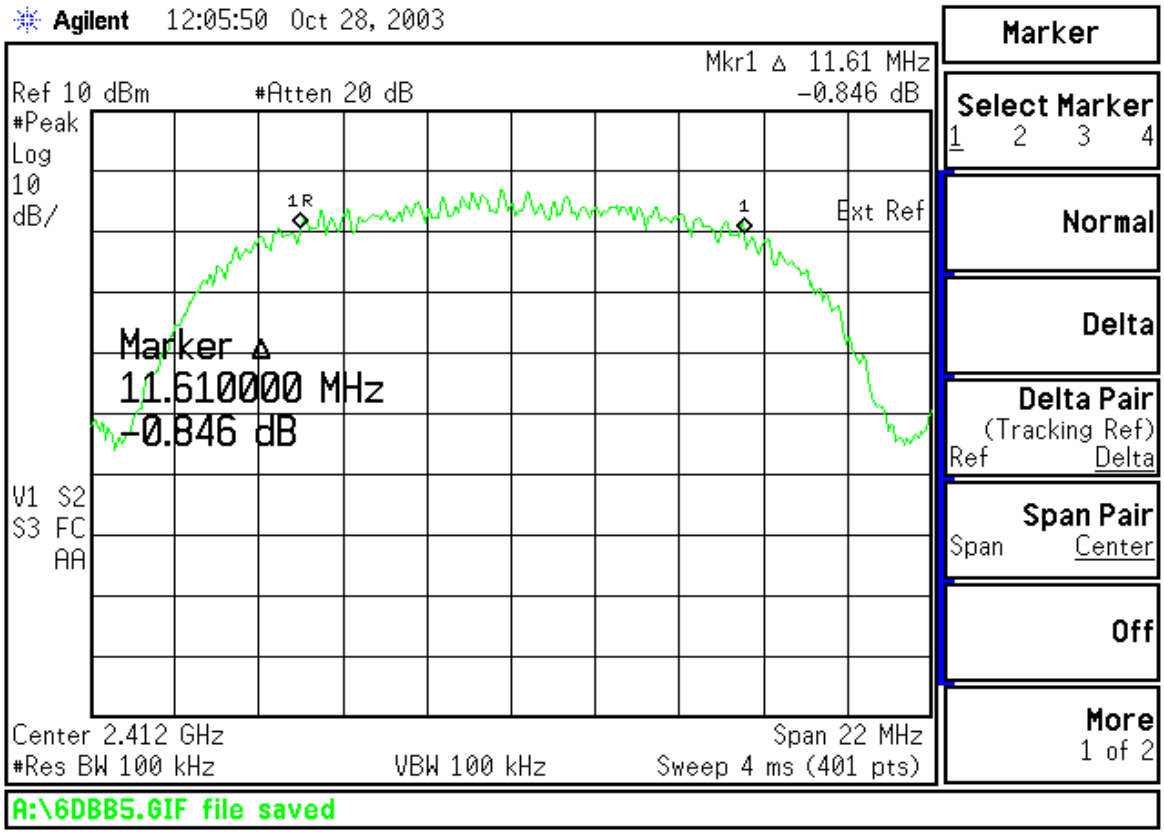
2.2.6 Test Results - Continued

Channel 11, (2462.0MHz) – Maximum Power 5.5Mbps



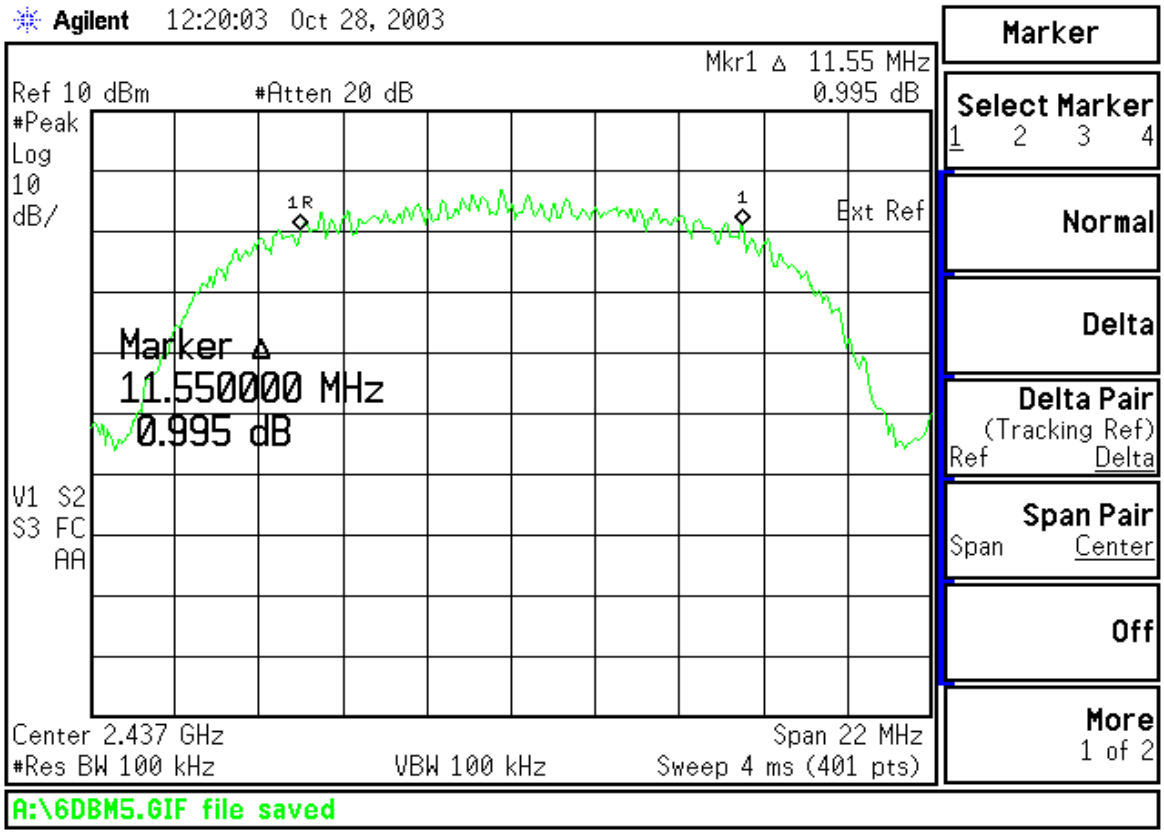
2.2.6 Test Results - Continued

Channel 1, (2412.0MHz) – Maximum Power 11Mbps



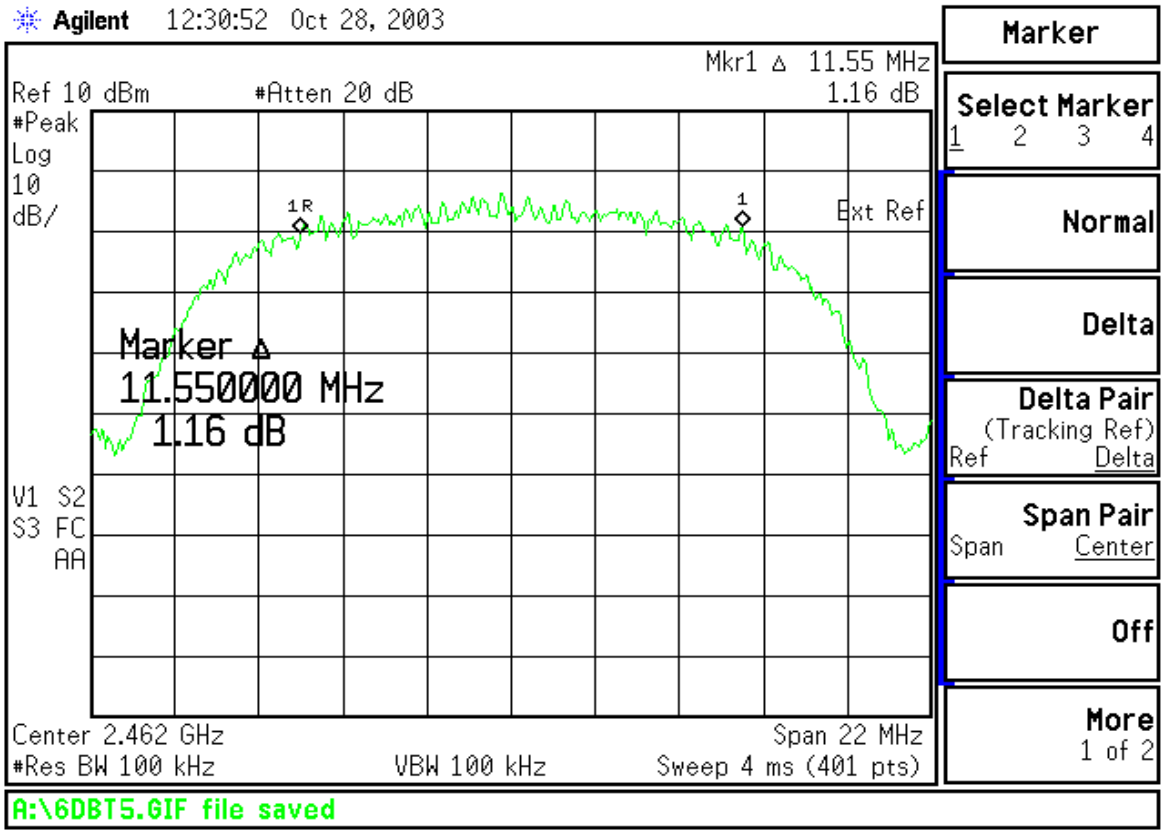
2.2.6 Test Results - Continued

Channel 6, (2437.0MHz) – Maximum Power 11Mbps



2.2.6 Test Results - Continued

Channel 11, (2462.0MHz) – Maximum Power 11Mbps



2.3 MAXIMUM PEAK OUTPUT POWER

2.3.1 Specification Reference

FCC Part 15.247(b)(3)

2.3.2 Equipment Under Test

730 Handheld Computer Terminal 802.11b Module

2.3.3 Date of Test

29th October 2003

2.3.4 Test Equipment Used

The following major items of test equipment identified in Section 3.1 were used for the above tests.

Items: 1, 2, 3, 4, 8, 9

2.3.5 Test Procedure

The EUT was connected to a Digital Storage Oscilloscope via an attenuator and Crystal Detector. The DC output from the Crystal Detector was measured on the Oscilloscope. The EUT was then substituted for a Signal Generator. The generators frequency was adjusted to that of the EUT and the amplitude increased to give the same DC level as measured from the EUT. The level was read from the Signal Generator and gave the maximum output power.

Performed by : B Airs, Radio Engineer

2.3.6 Test Results

1Mbps

Frequency (MHz)	Output Power (dBm)	Result (mW)
2412.0	+18.57	71.94
2437.0	+18.15	65.31
2462.0	+18.10	64.37

2Mbps

Frequency (MHz)	Output Power (dBm)	Result (mW)
2412.0	+18.60	72.44
2437.0	+18.50	70.79
2462.0	+17.85	60.95

2.3.6 Test Results - Continued

5.5Mbps

Frequency (MHz)	Output Power (dBm)	Result (mW)
2412.0	+18.57	71.94
2437.0	+18.40	69.18
2462.0	+18.05	63.83

11Mbps

Frequency (MHz)	Output Power (dBm)	Result (mW)
2412.0	+18.45	69.98
2437.0	+18.50	70.79
2462.0	+18.05	63.83

Limit	<1W or <+30dBm

Remarks

EUT complies with CFR 47 15.247(b)(1). The EUT does not exceed 1W or +30dBm at the measured frequencies.

2.4 SPURIOUS CONDUCTED EMISSIONS

2.4.1 Specification Reference

FCC Part 15.247(c)

2.4.2 Equipment Under Test

730 Handheld Computer Terminal 802.11b Module

2.4.3 Date of Test

29th October 2003

2.4.4 Test Equipment Used

The following major items of test equipment identified in Section 3.1 were used for the above tests.

Items: 1, 2, 3, 4, 5, 6, 7

2.4.5 Test Procedure

In accordance with Part 15.247(c), the Spurious Conducted Emissions from the antenna terminal were measured. The transmitter output power was attenuated using a combination of filters and attenuators and the frequency spectrum investigated from 9kHz to 25 GHz. The EUT was set to transmit on full power at all data rates. The EUT was tested on Bottom, Middle and Top channels. The resolution and video bandwidths were set to 100kHz in accordance with Part 15.247. The spectrum analyser detector was set to Max Hold.

For measuring the range 9kHz to 18GHz, a 10dB attenuator was used. From 18 to 25GHz a piece of waveguide was used as a high pass filter.

With the EUT transmitting at maximum power, the Spectrum Analyser was set to Max Hold and the fundamental peak measured in a RBW and VBW of 100kHz. This level was used to determine the limit line as displayed on the plots of -20dBc.

The maximum path loss across each measurement band was used as the reference level offset to ensure worst case

The EUT passed the requirements laid out in 15.247(c).

Performed by : B Airs, Radio Engineer

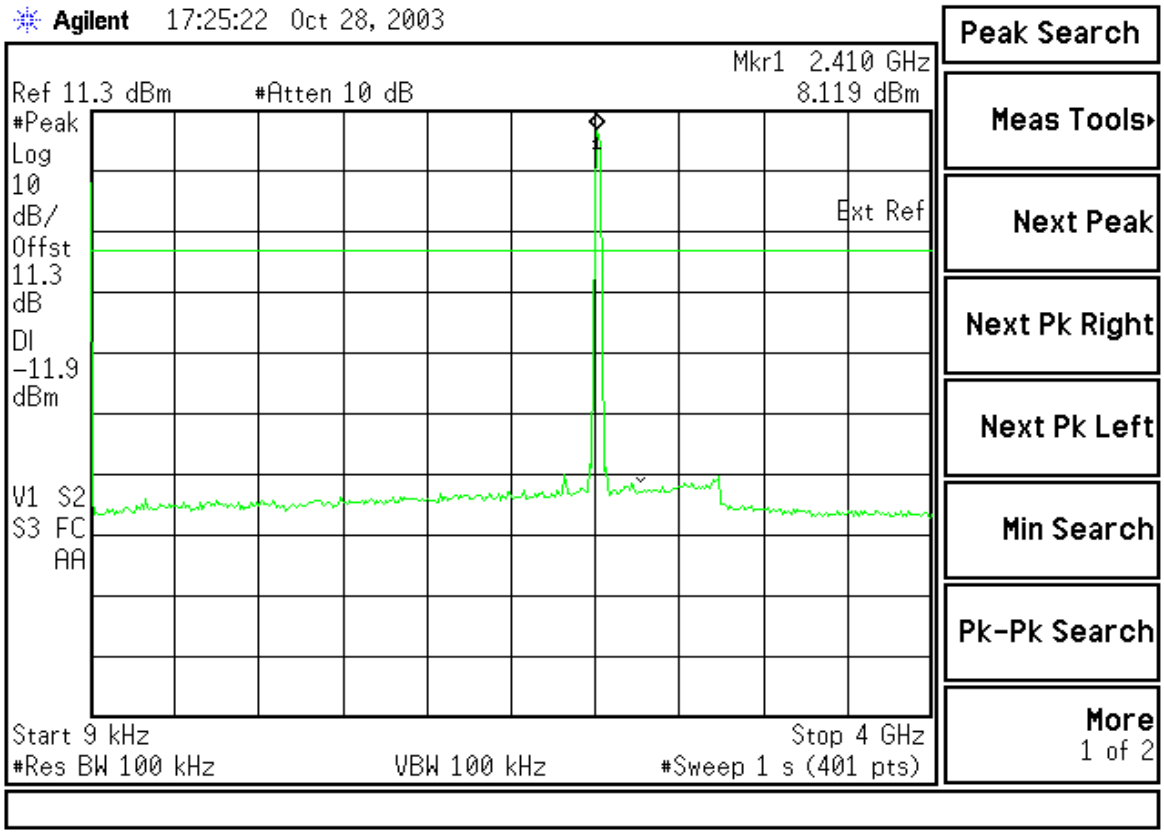
2.4.6 Test Results

The plots on the following pages show the frequency spectrum from 9kHz to 25GHz of the EUT.

2.4.6 Test Results – Continued

Spurious Conducted Emissions (9kHz – 4GHz)

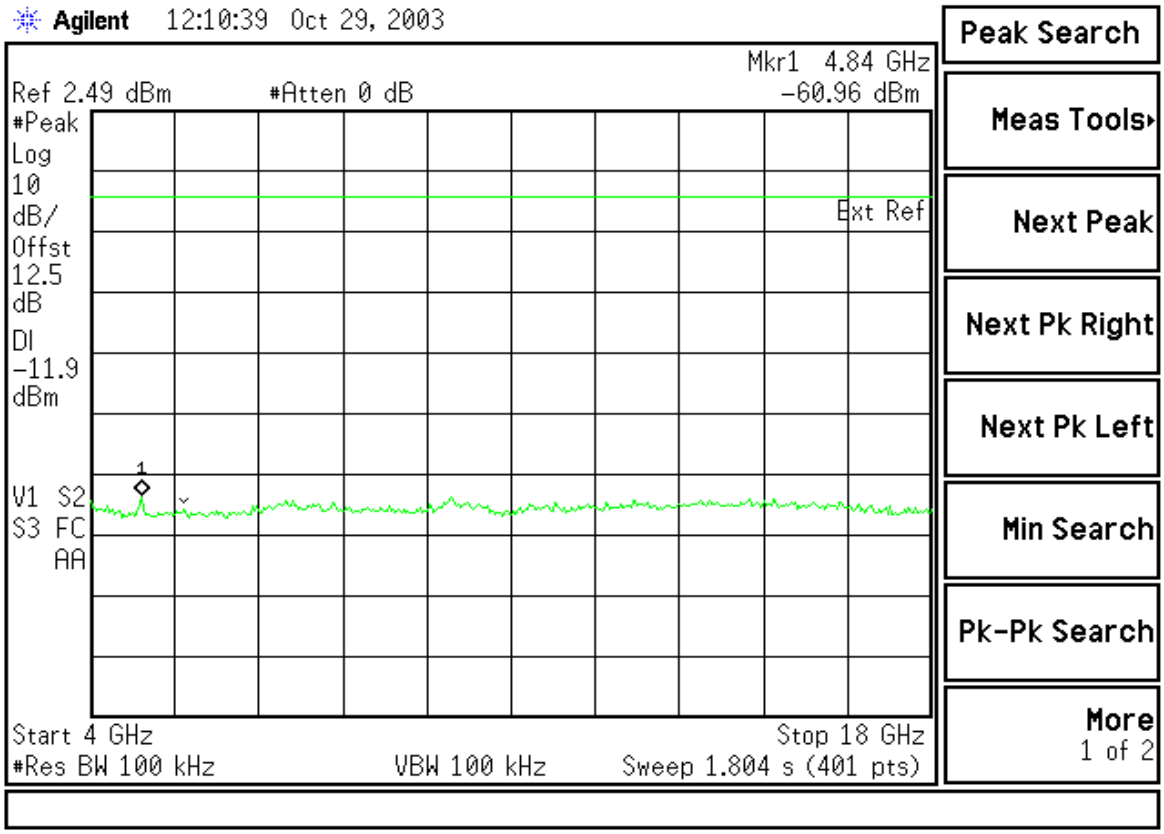
Channel 1, (2412.0MHz) – Maximum Power 1Mbps



2.4.6 Test Results - Continued

Spurious Conducted Emissions (4GHz – 18GHz)

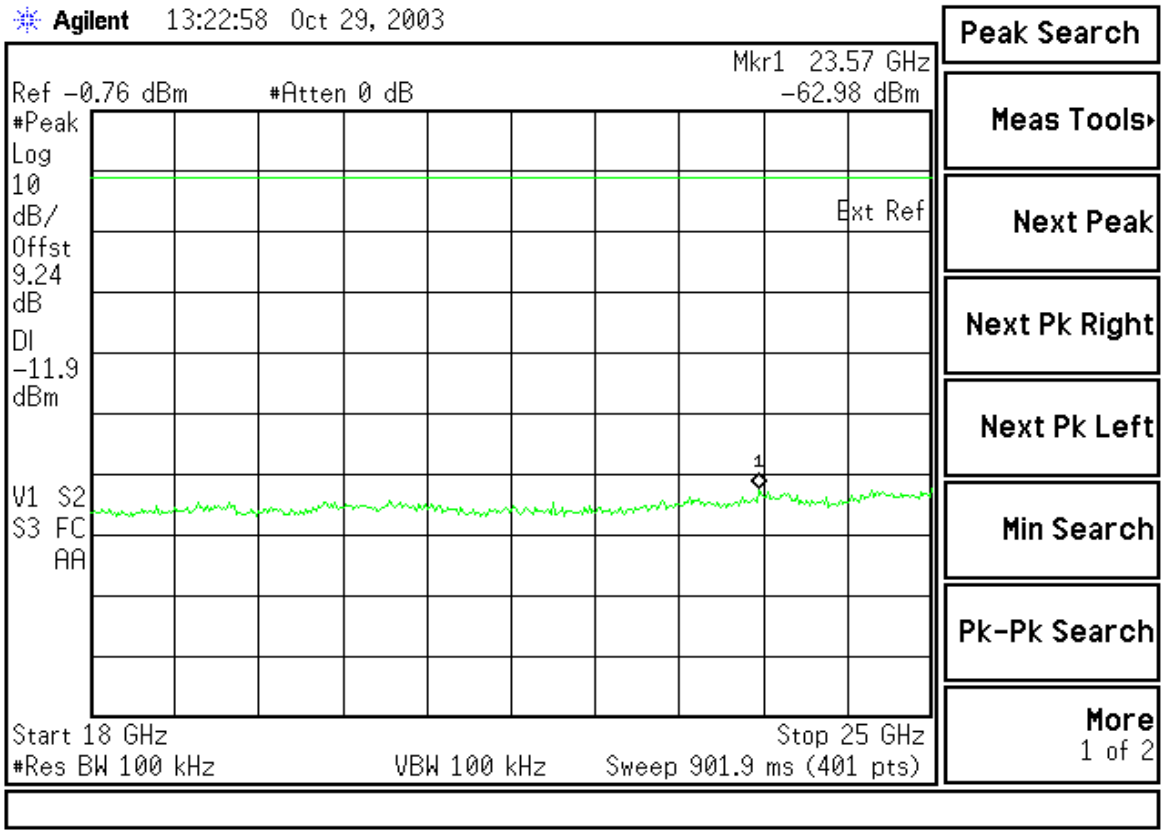
Channel 1, (2412.0MHz) – Maximum Power 1Mbps



2.4.6 Test Results - Continued

Spurious Conducted Emissions (18GHz – 25GHz)

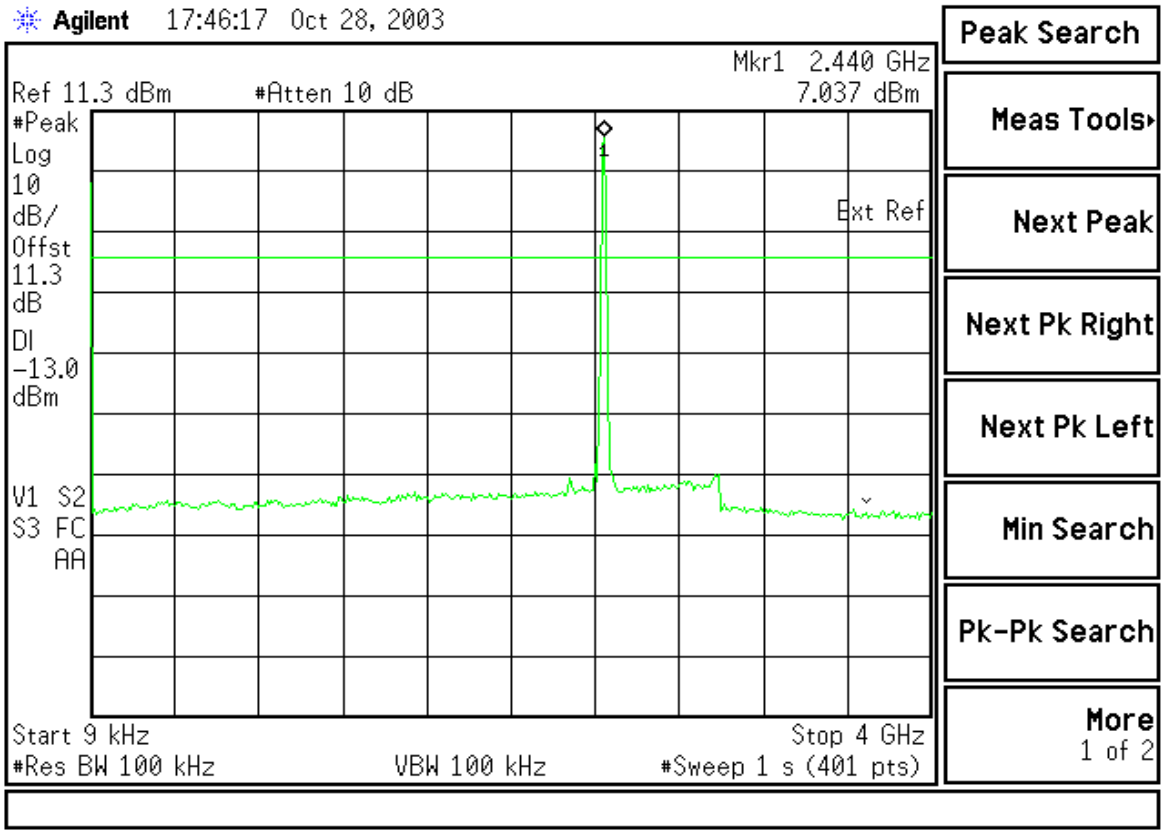
Channel 1, (2412.0MHz) – Maximum Power 1Mbps



2.4.6 Test Results - Continued

Spurious Conducted Emissions (9kHz – 4GHz)

Channel 6, (2437.0MHz) – Maximum Power 1Mbps

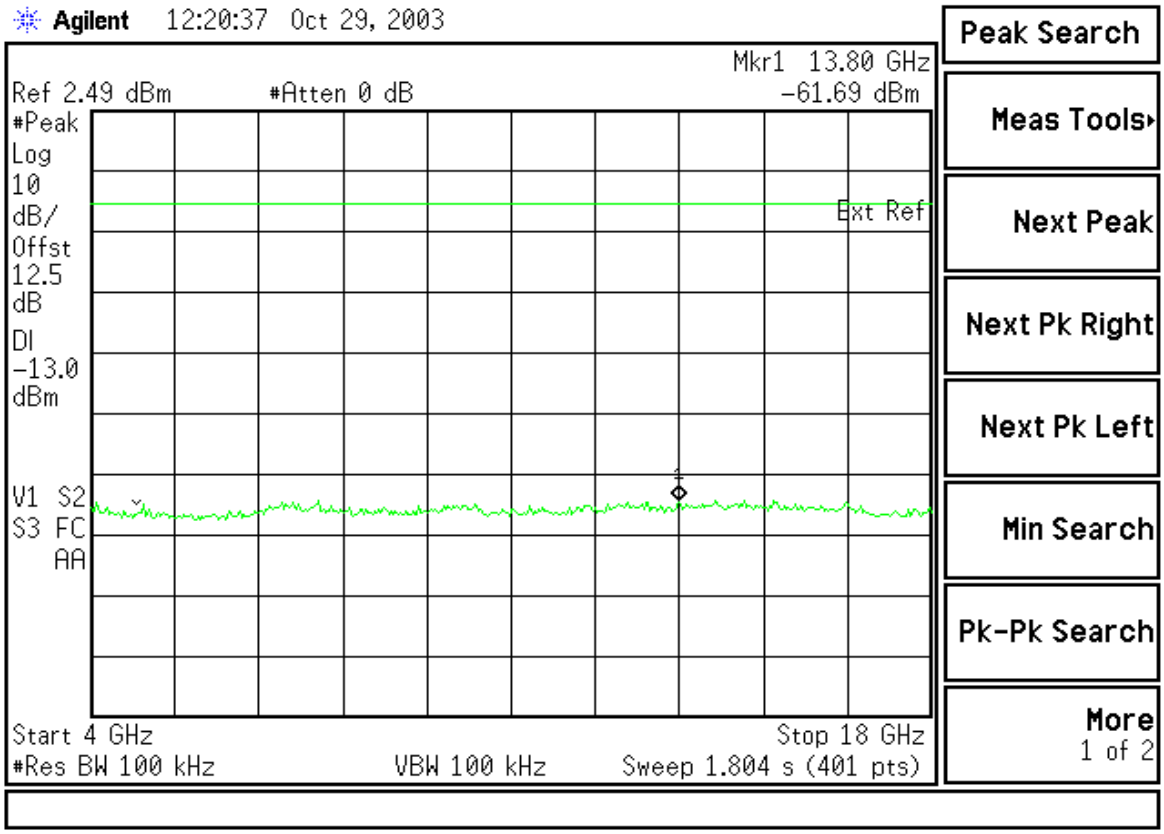


2.4.6 Test Results – Continued

Spurious Conducted Emissions (4GHz – 18GHz)

Channel 6, (2437.0MHz) – Maximum Power 1Mbps

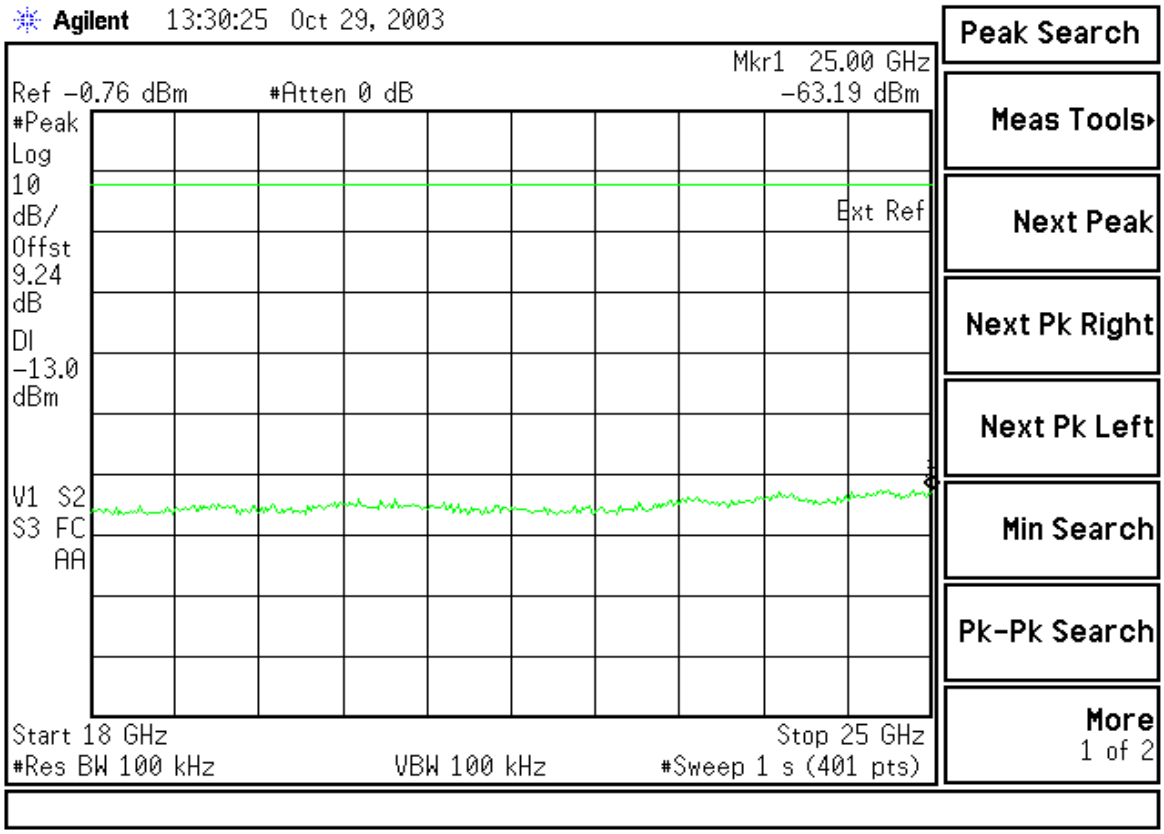
3



2.4.6 Test Results - Continued

Spurious Conducted Emissions (18GHz – 25GHz)

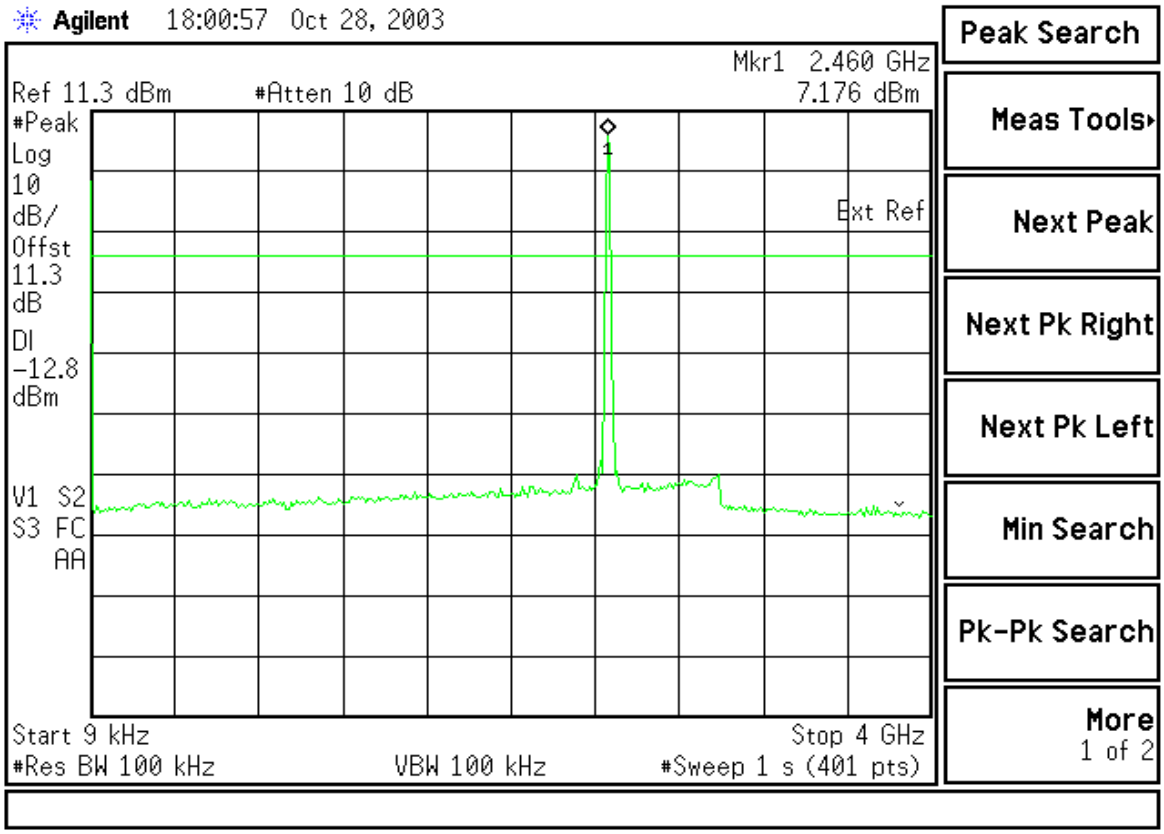
Channel 6, (2437.0MHz) – Maximum Power 1Mbps



2.4.6 Test Results - Continued

Spurious Conducted Emissions (9kHz – 4GHz)

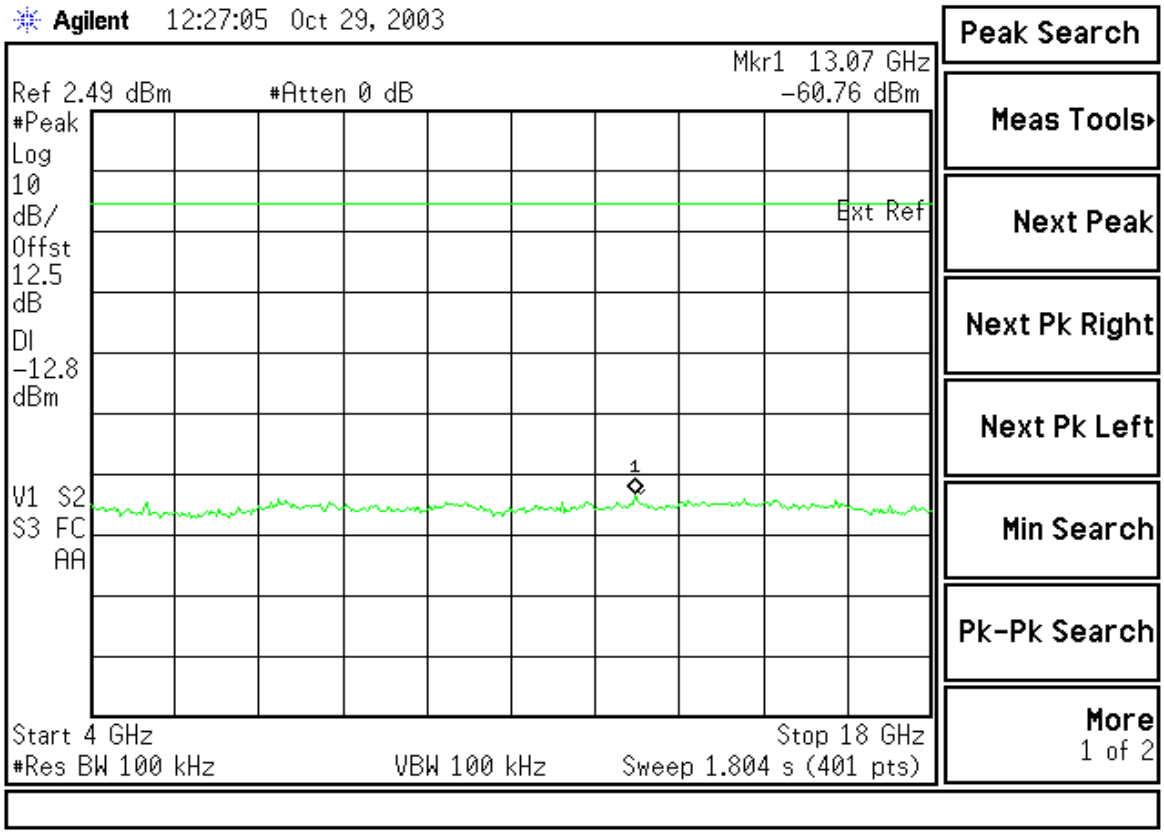
Channel 11, (2462.0MHz) – Maximum Power 1Mbps



2.4.6 Test Results - Continued

Spurious Conducted Emissions (4GHz – 18GHz)

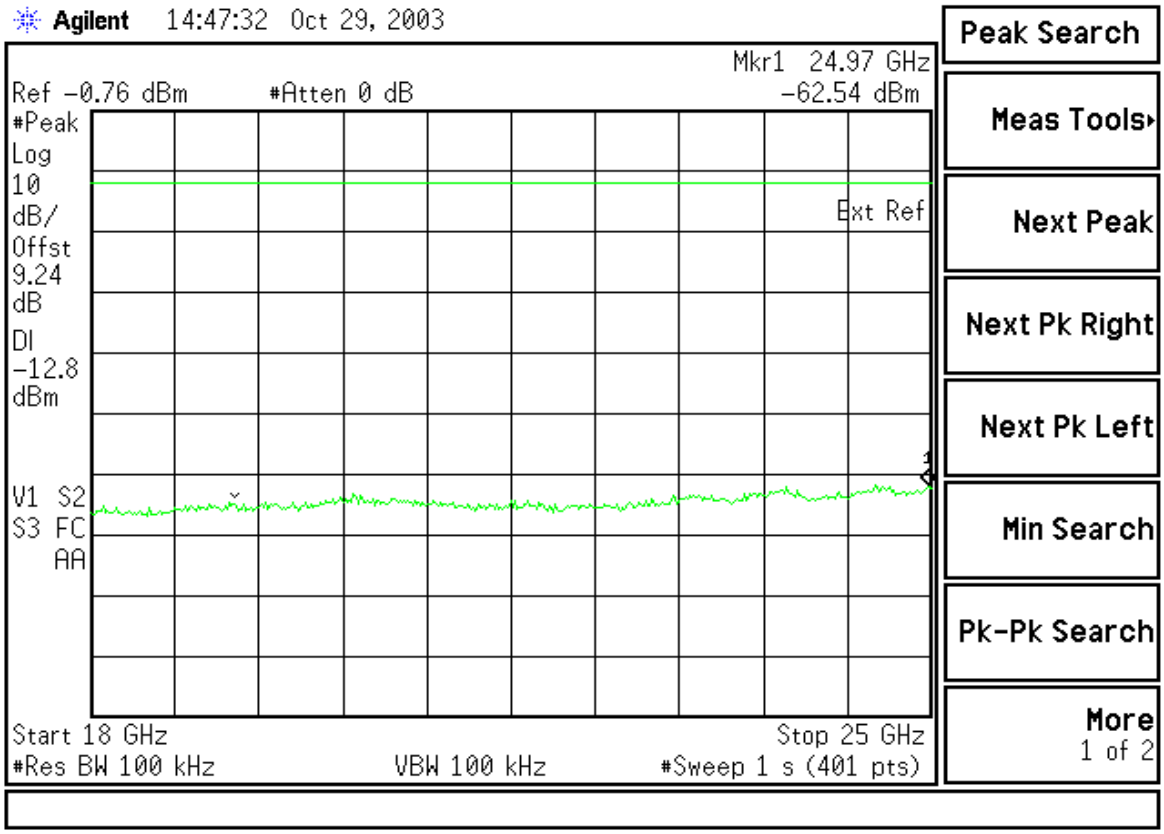
Channel 11, (2462.0MHz) – Maximum Power 1Mbps



2.4.6 Test Results - Continued

Spurious Conducted Emissions (18GHz – 25GHz)

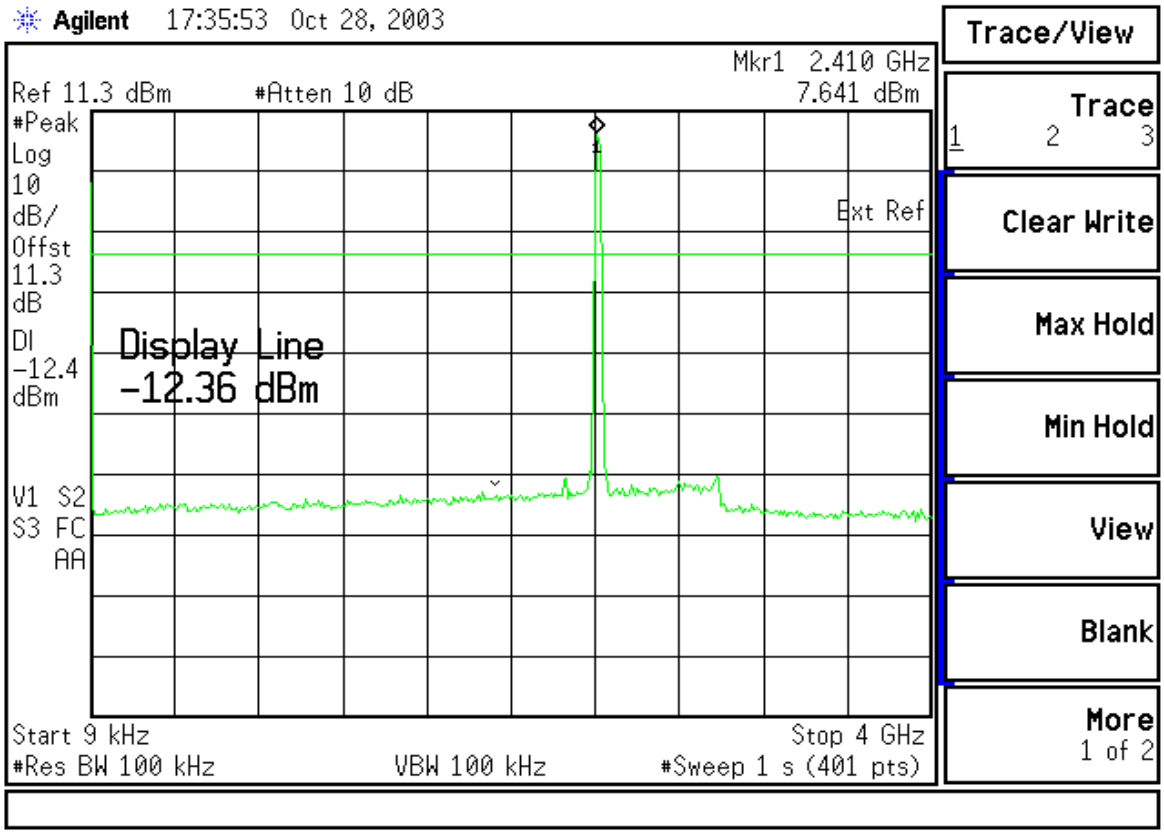
Channel 11, (2462.0MHz) – Maximum Power 1Mbps



2.4.6 Test Results - Continued

Spurious Conducted Emissions (9kHz – 4GHz)

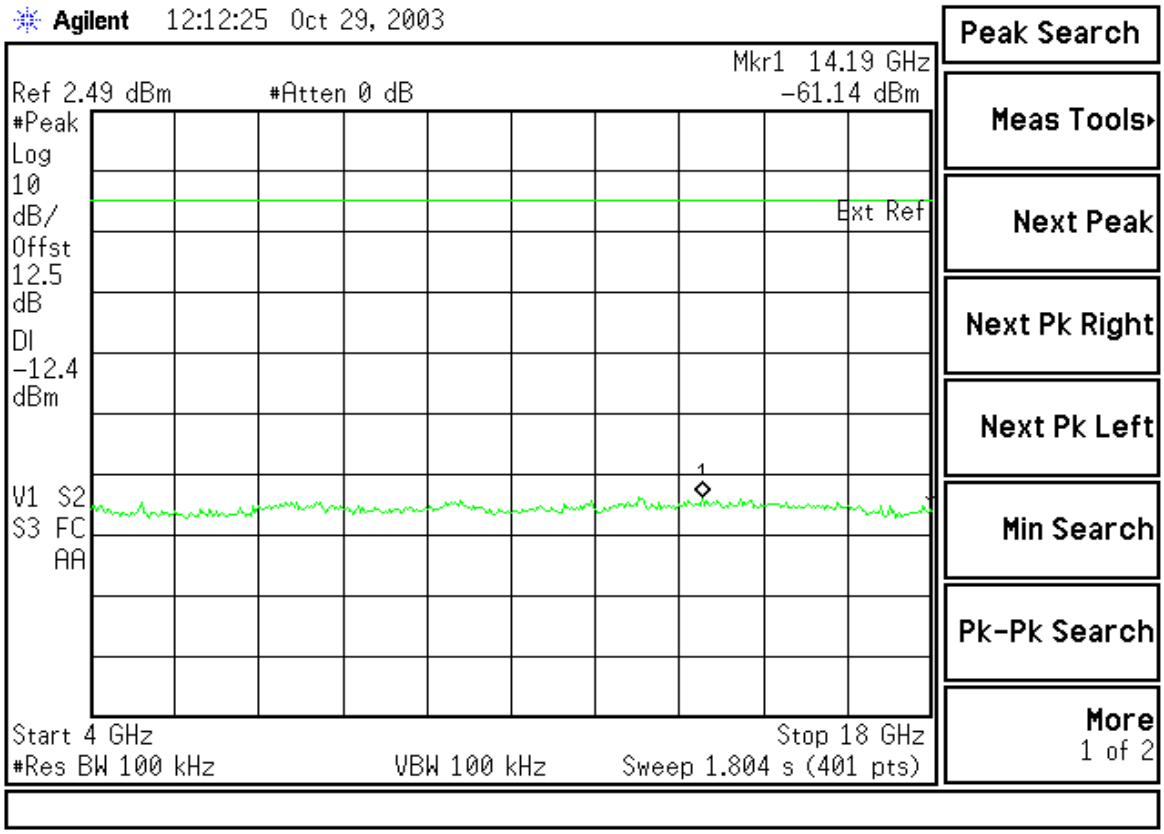
Channel 1, (2412.0MHz) – Maximum Power 2Mbps



2.4.6 Test Results - Continued

Spurious Conducted Emissions (4GHz – 18GHz)

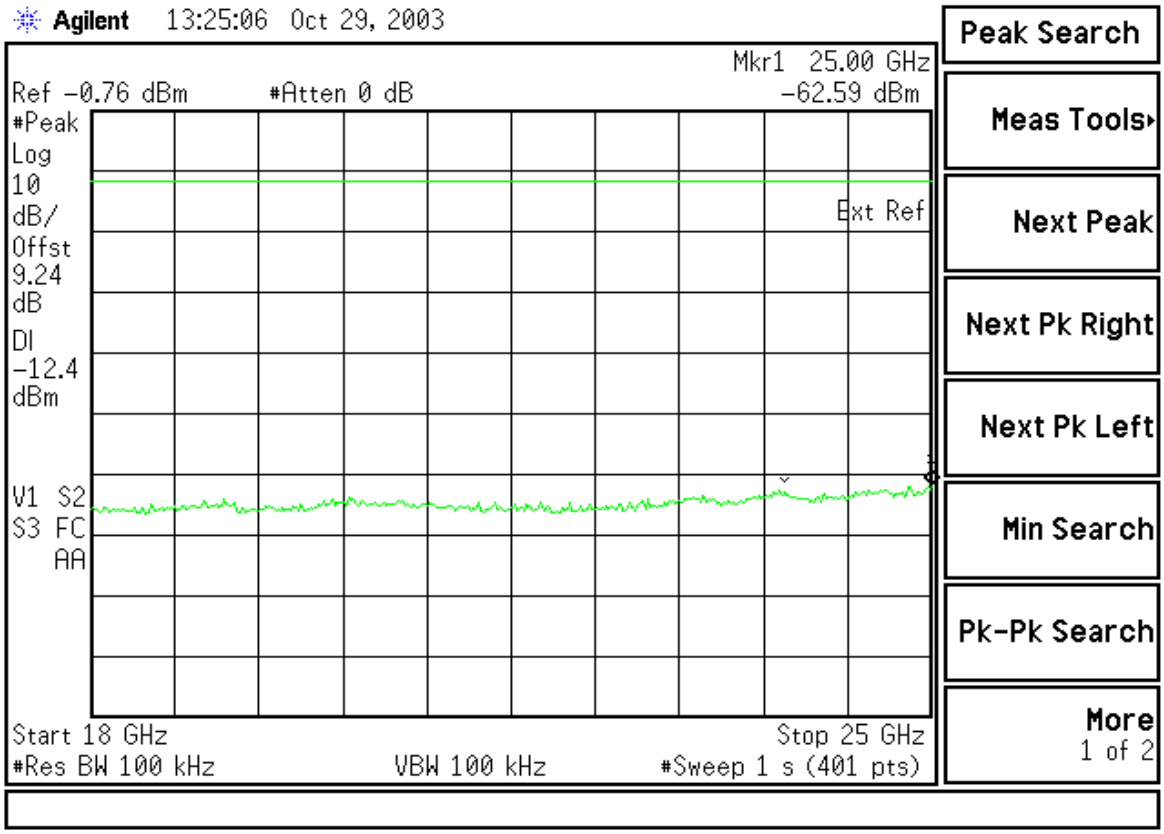
Channel 1, (2412.0MHz) – Maximum Power 2Mbps



2.4.6 Test Results - Continued

Spurious Conducted Emissions (18GHz – 25GHz)

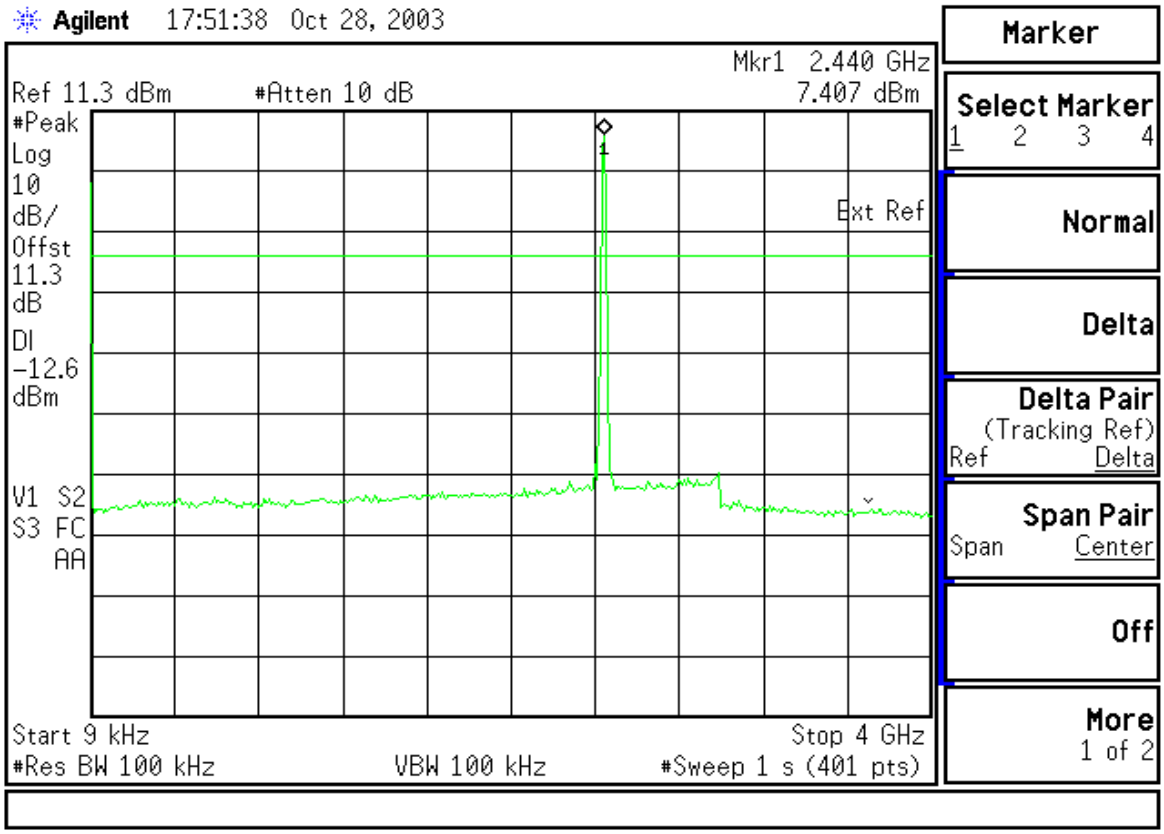
Channel 1, (2412.0MHz) – Maximum Power 2Mbps



2.4.6 Test Results - Continued

Spurious Conducted Emissions (9kHz – 4GHz)

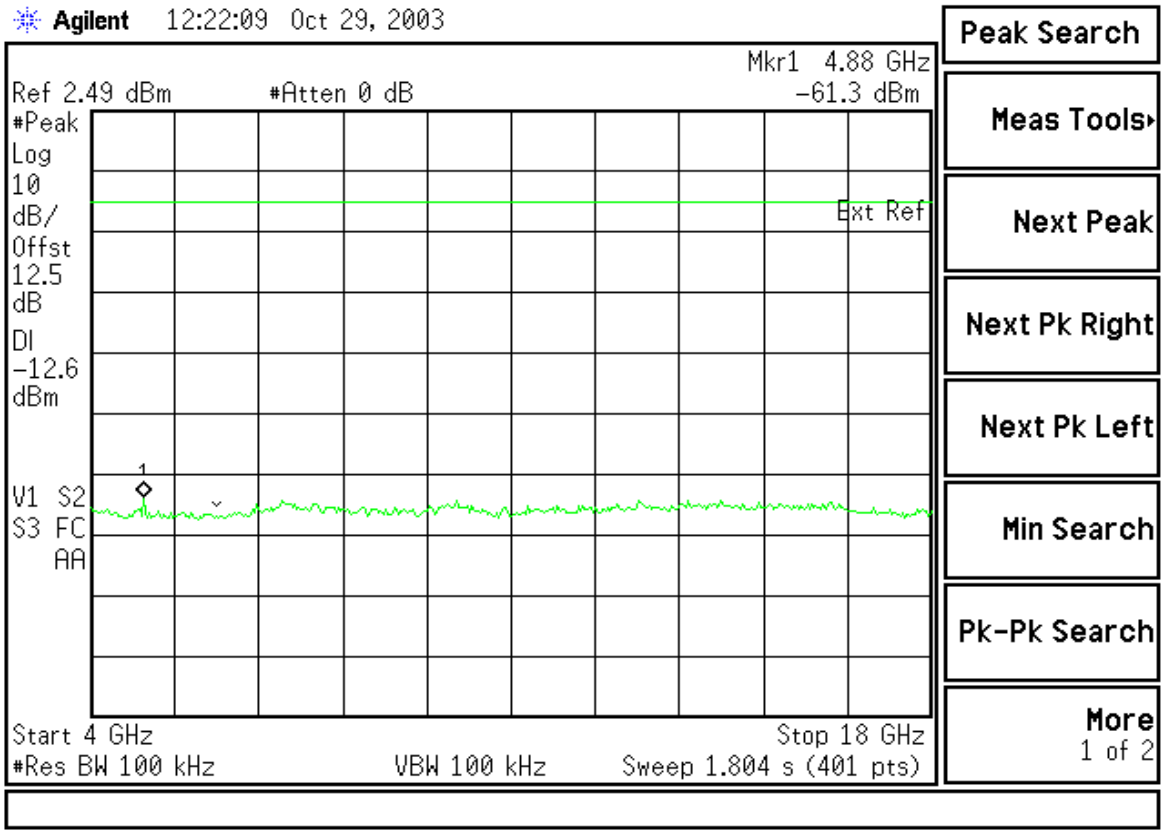
Channel 6, (2437.0MHz) – Maximum Power 2Mbps



2.4.6 Test Results - Continued

Spurious Conducted Emissions (4GHz – 18GHz)

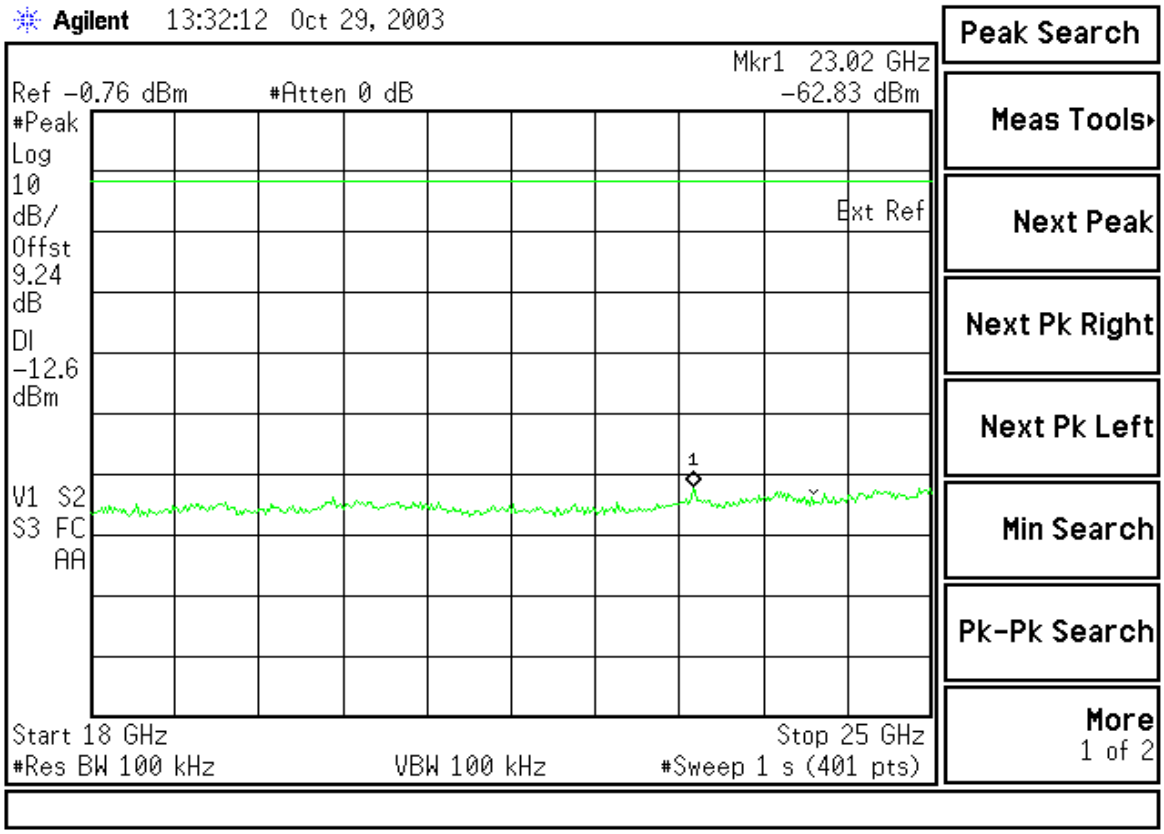
Channel 6, (2437.0MHz) – Maximum Power 2Mbps



2.4.6 Test Results - Continued

Spurious Conducted Emissions (18GHz – 25GHz)

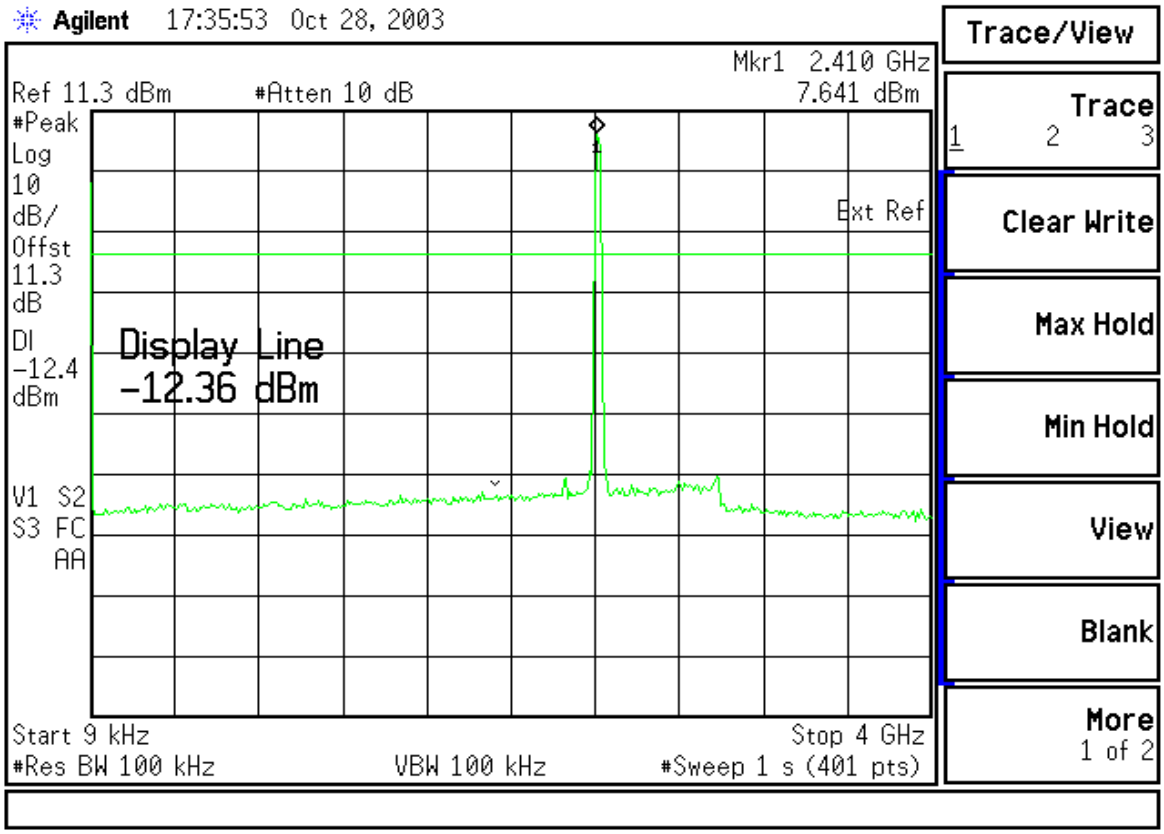
Channel 6, (2437.0MHz) – Maximum Power 2Mbps



2.4.6 Test Results - Continued

Spurious Conducted Emissions (9kHz – 4GHz)

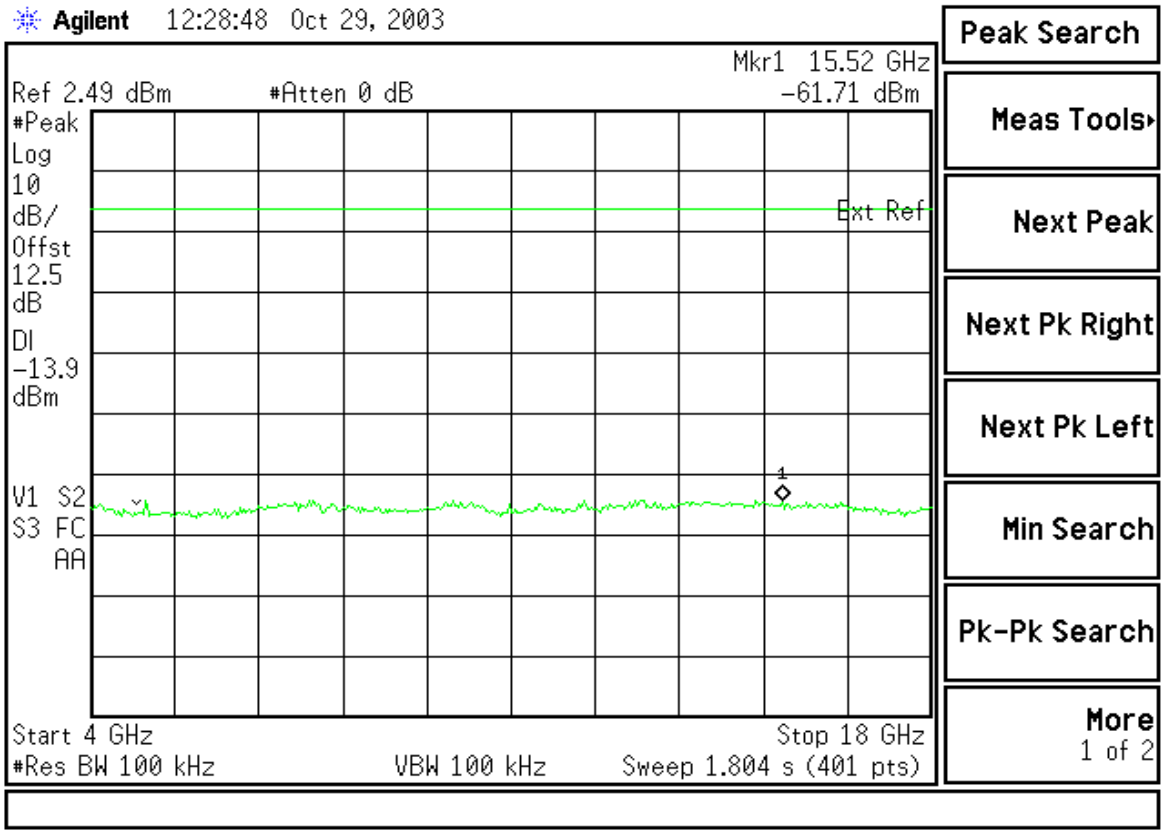
Channel 11, (2462.0MHz) – Maximum Power 2Mbps



2.4.6 Test Results - Continued

Spurious Conducted Emissions (4GHz – 18GHz)

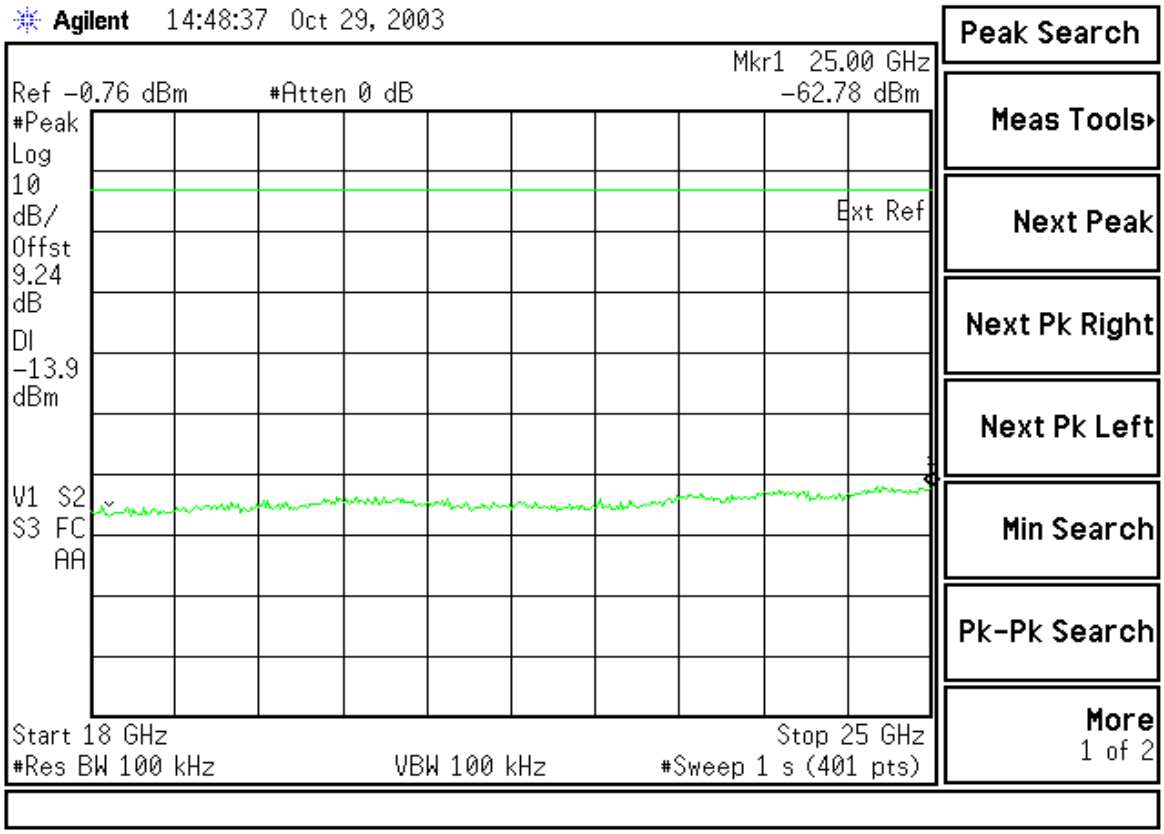
Channel 11, (2462.0MHz) – Maximum Power 2Mbps



2.4.6 Test Results - Continued

Spurious Conducted Emissions (18GHz – 25GHz)

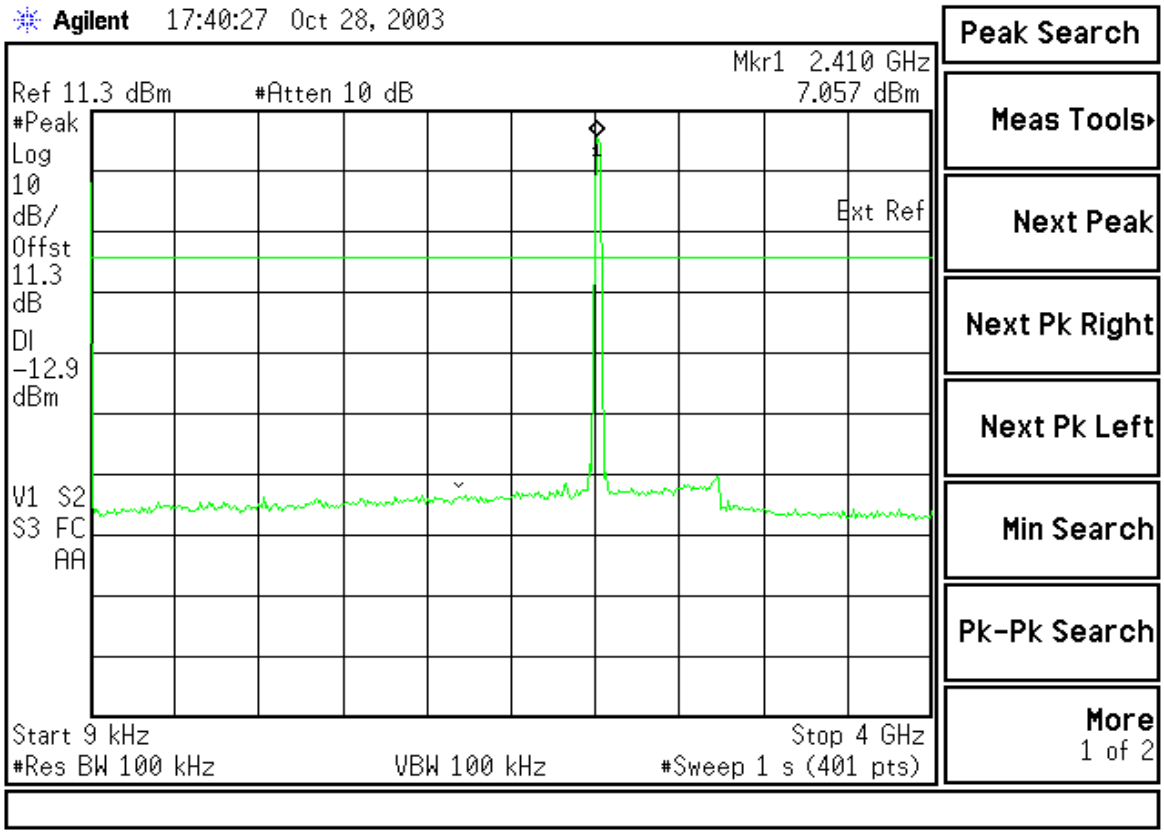
Channel 11, (2462.0MHz) – Maximum Power 2Mbps



2.4.6 Test Results - Continued

Spurious Conducted Emissions (9kHz – 4GHz)

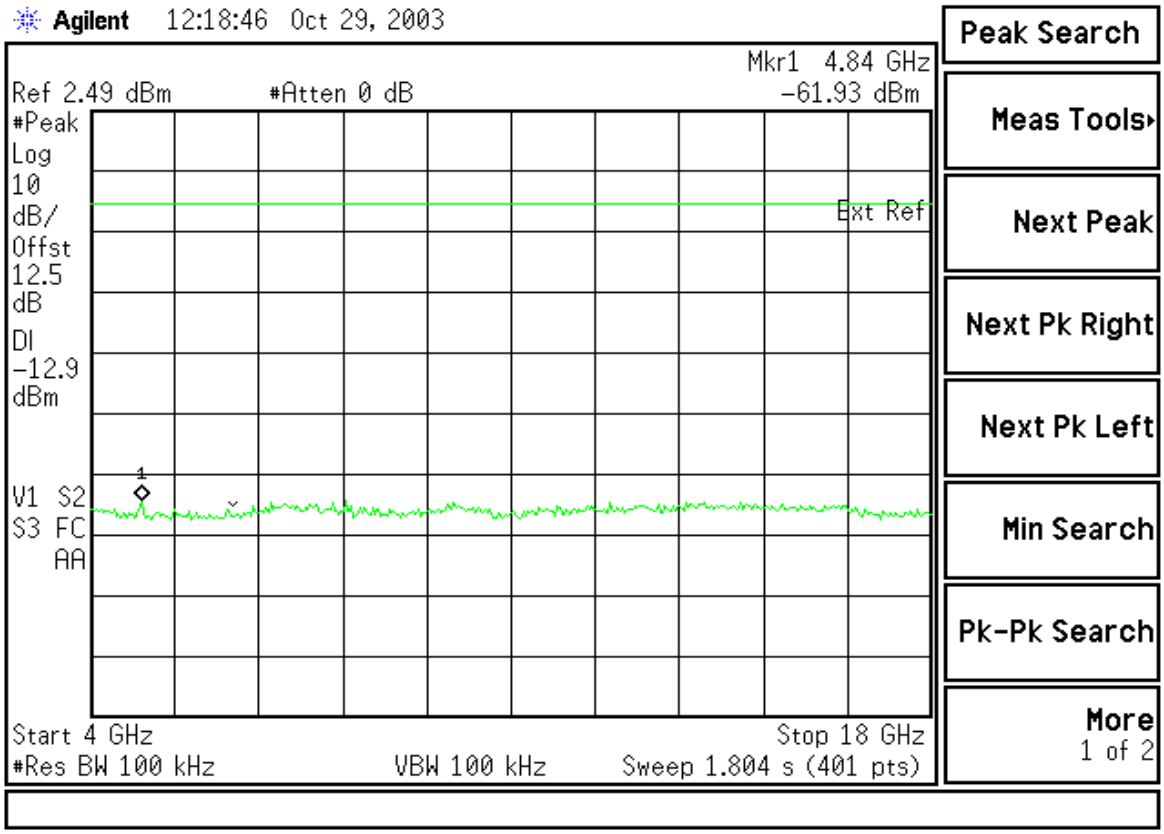
Channel 1, (2412.0MHz) – Maximum Power 5.5Mbps



2.4.6 Test Results - Continued

Spurious Conducted Emissions (4GHz – 18GHz)

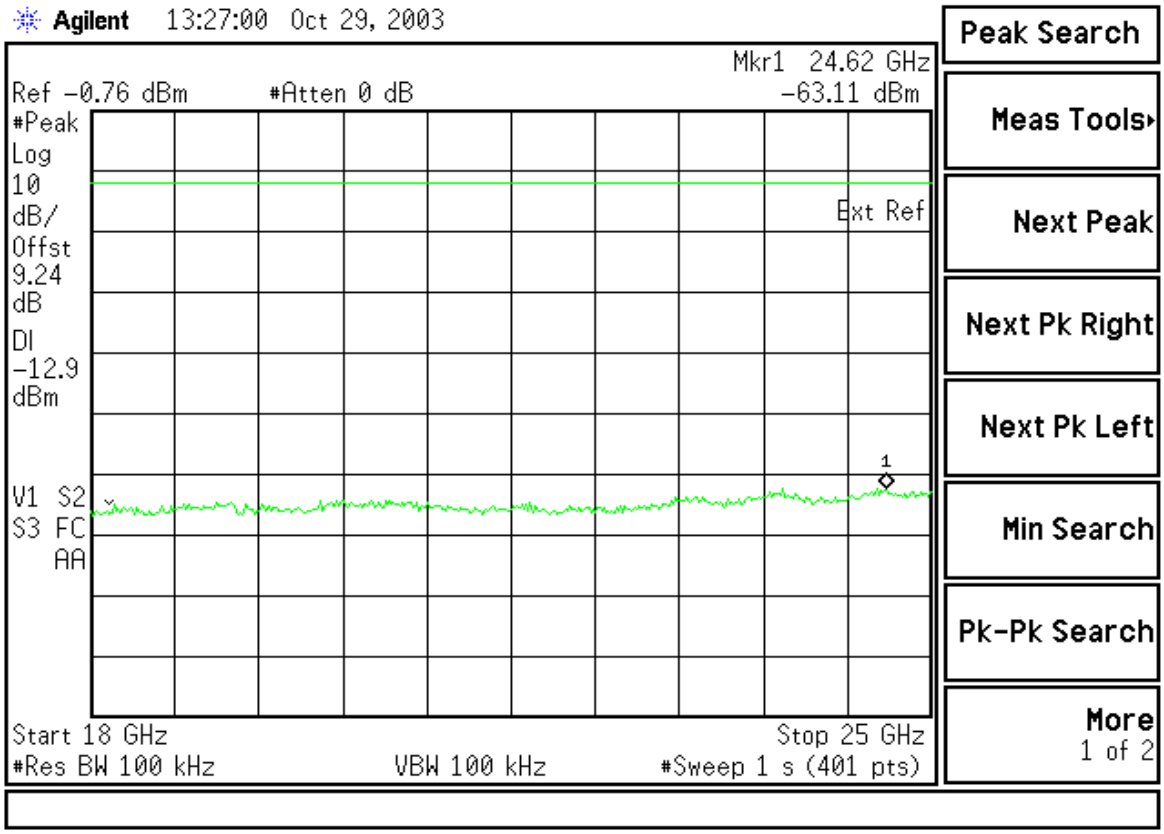
Channel 1, (2412.0MHz) – Maximum Power 5.5Mbps



2.4.6 Test Results - Continued

Spurious Conducted Emissions (18GHz – 25GHz)

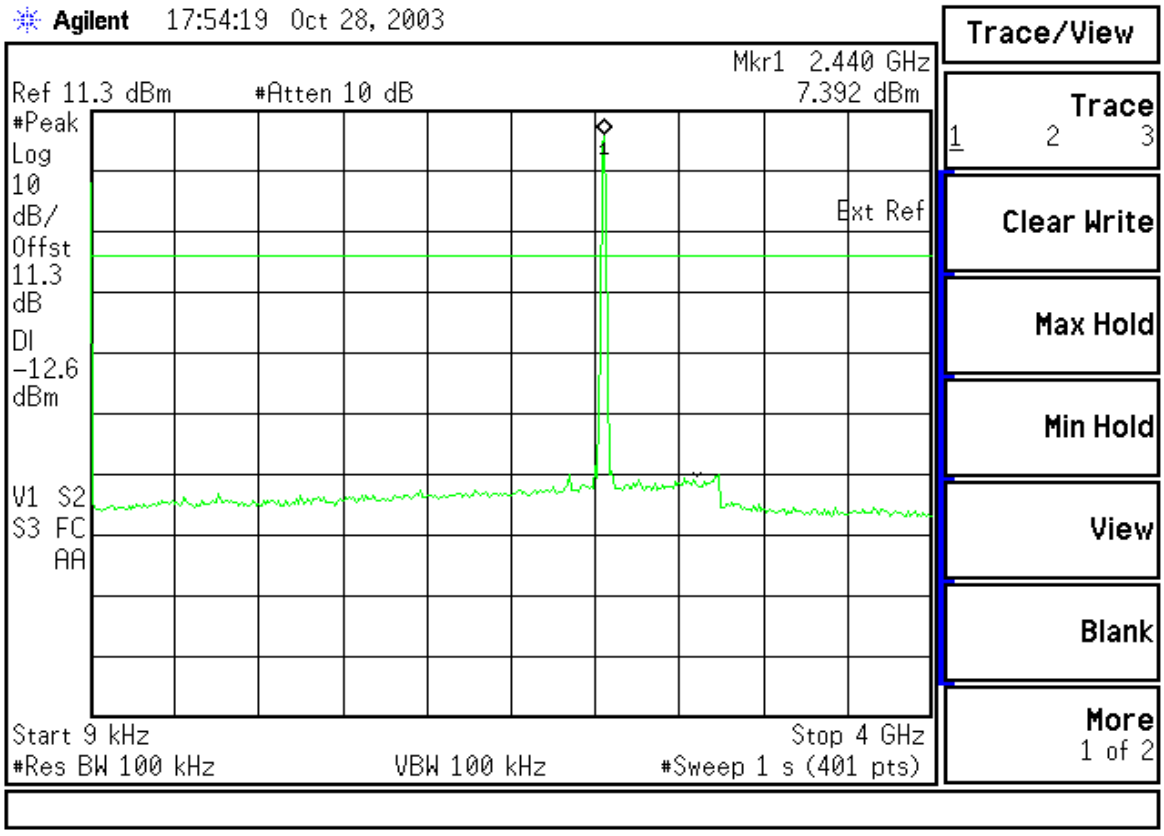
Channel 1, (2412.0MHz) – Maximum Power 5.5Mbps



2.4.6 Test Results - Continued

Spurious Conducted Emissions (9kHz – 4GHz)

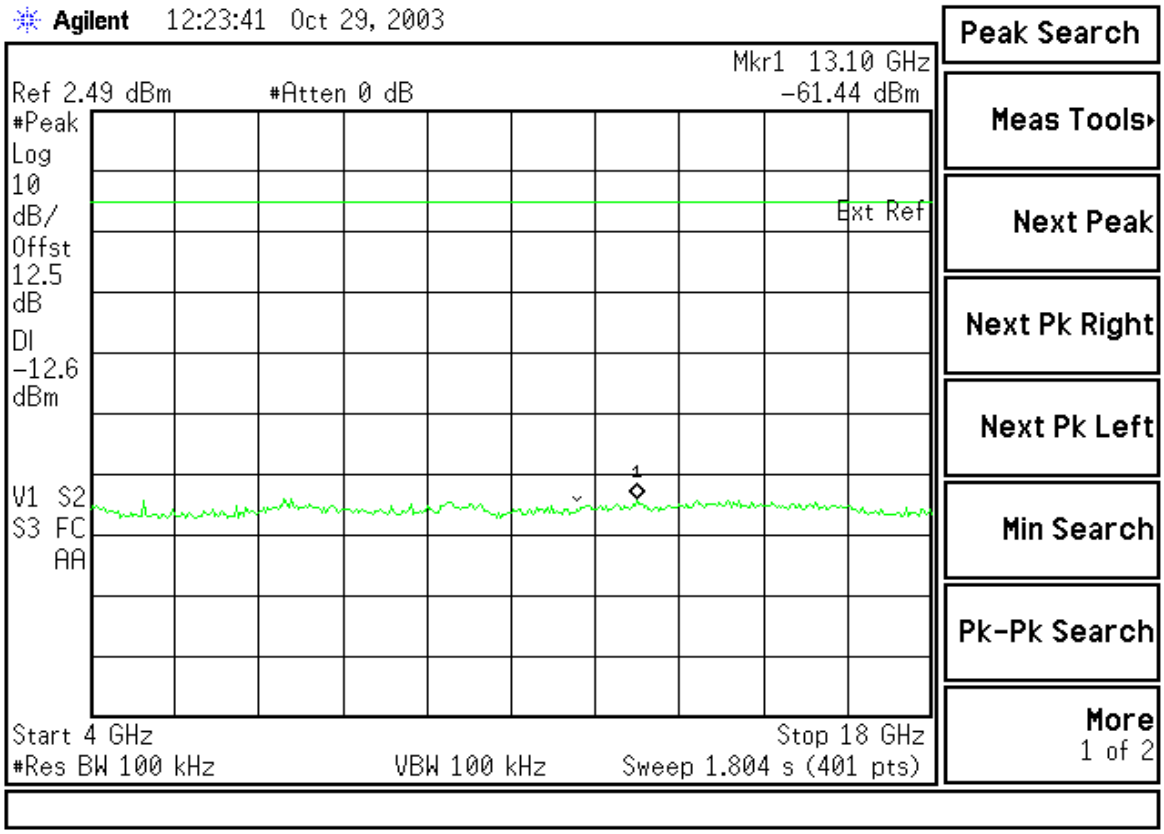
Channel 6, (2437.0MHz) – Maximum Power 5.5Mbps



2.4.6 Test Results - Continued

Spurious Conducted Emissions (4GHz – 18GHz)

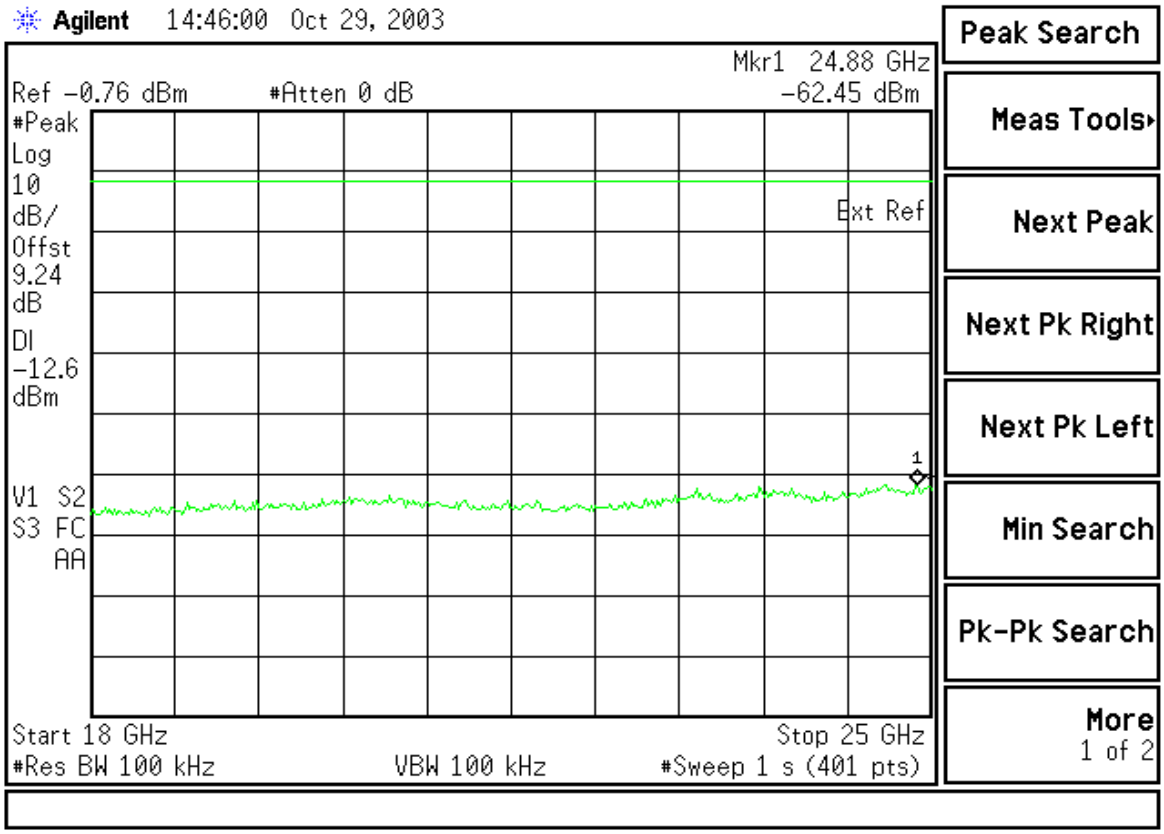
Channel 6, (2437.0MHz) – Maximum Power 5.5Mbps



2.4.6 Test Results - Continued

Spurious Conducted Emissions (18GHz – 25GHz)

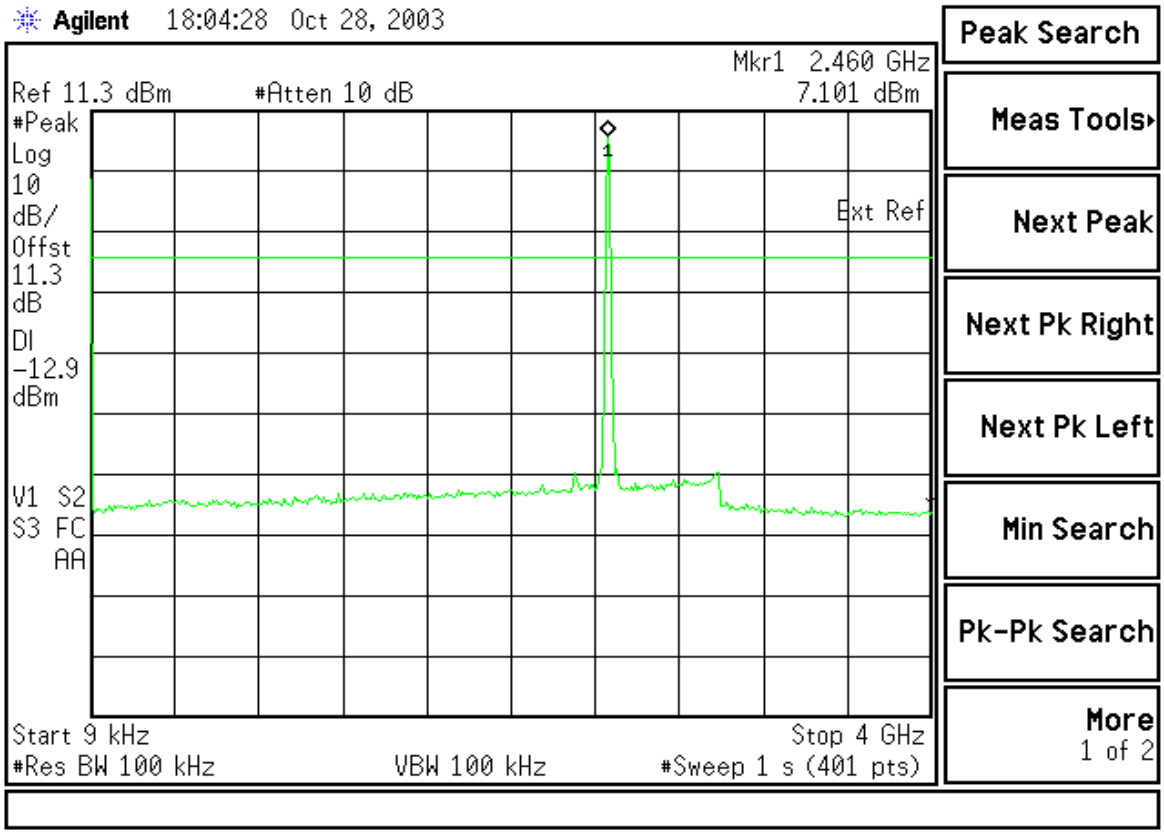
Channel 6, (2437.0MHz) – Maximum Power 5.5Mbps



2.4.6 Test Results - Continued

Spurious Conducted Emissions (9kHz – 4GHz)

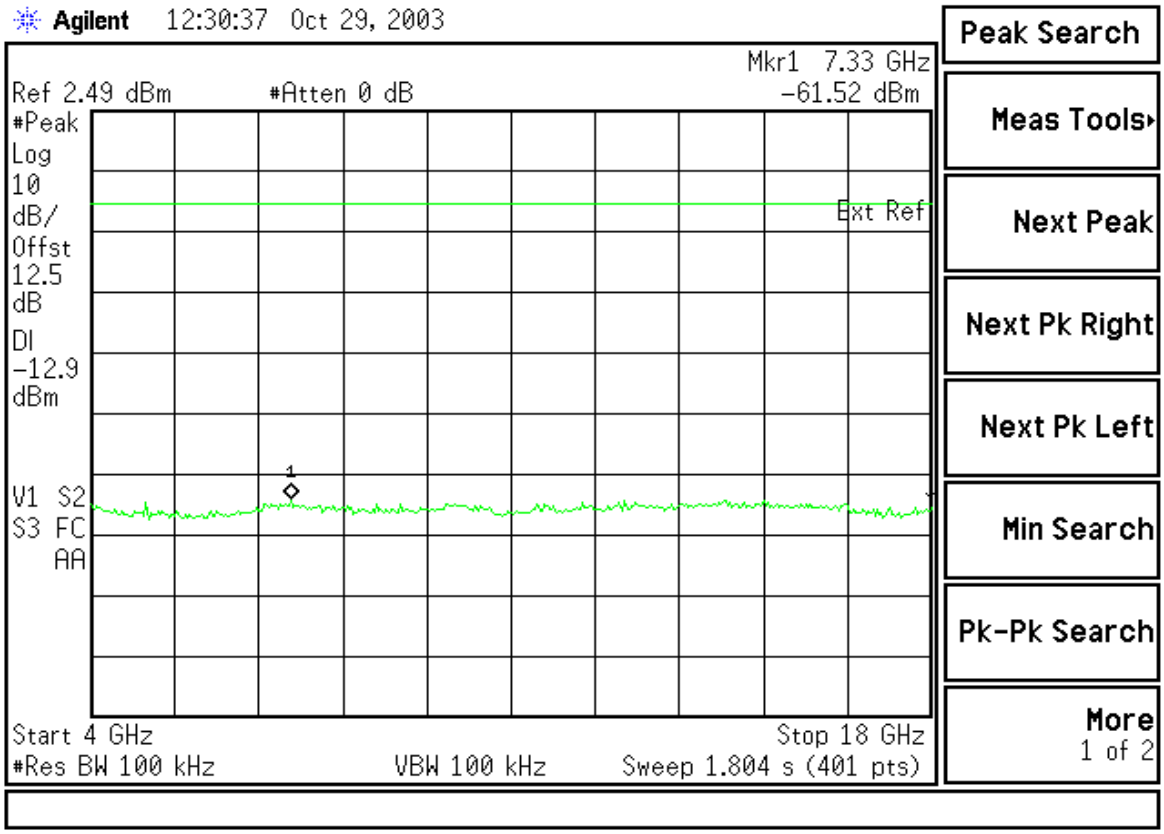
Channel 11, (2462.0MHz) – Maximum Power 5.5Mbps



2.4.6 Test Results - Continued

Spurious Conducted Emissions (4GHz – 18GHz)

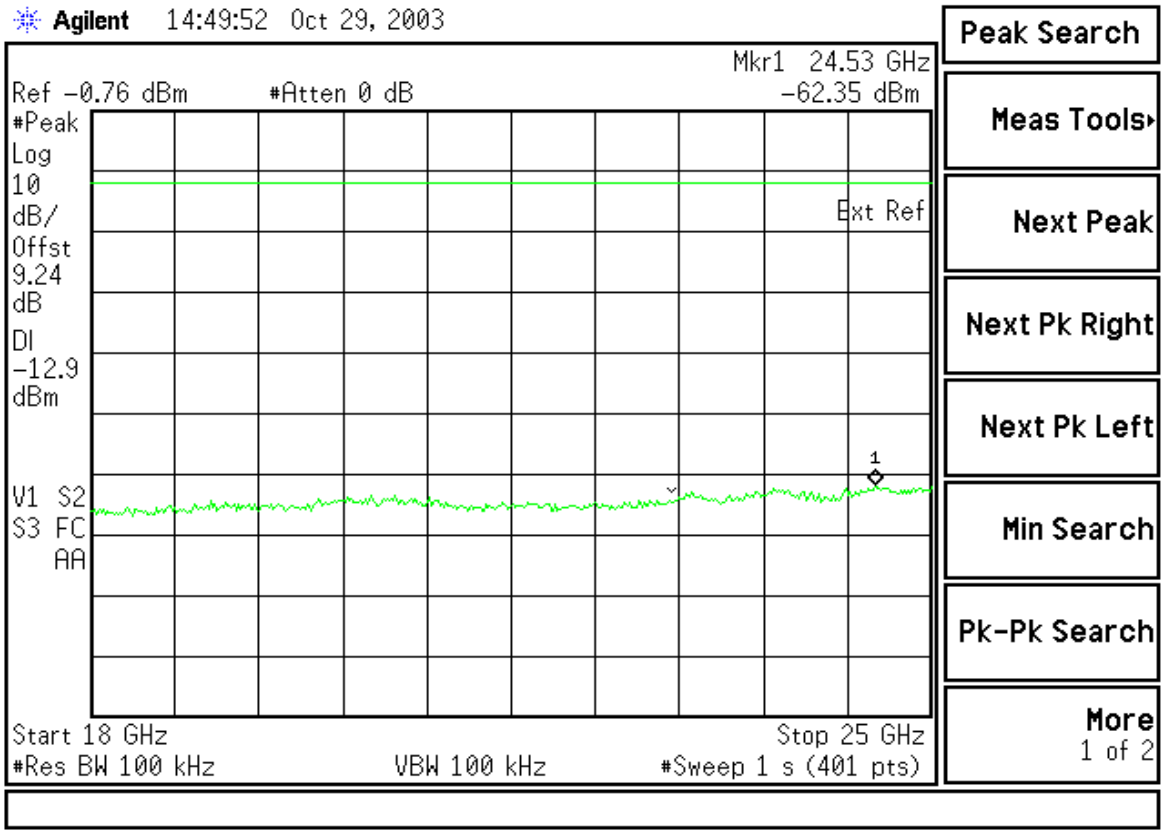
Channel 11, (2462.0MHz) – Maximum Power 5.5Mbps



2.4.6 Test Results - Continued

Spurious Conducted Emissions (18GHz – 25GHz)

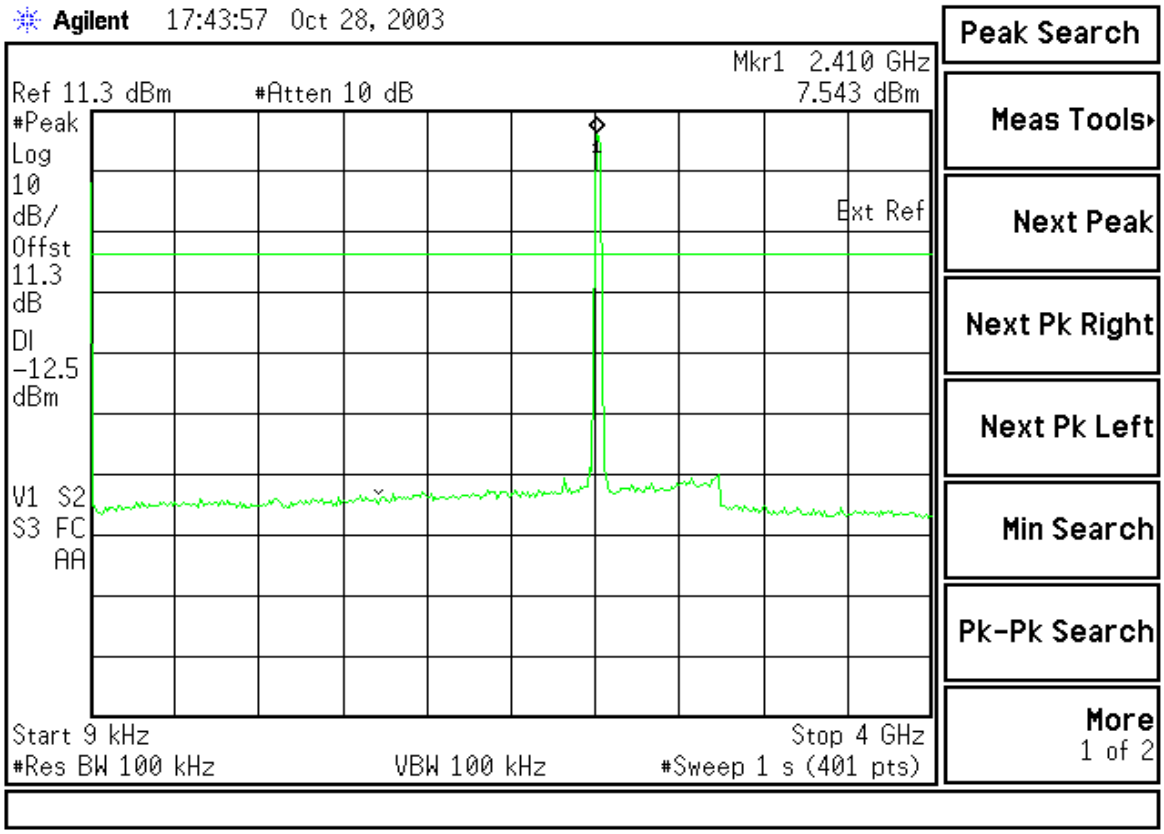
Channel 11, (2462.0MHz) – Maximum Power 5.5Mbps



2.4.6 Test Results - Continued

Spurious Conducted Emissions (9kHz – 4GHz)

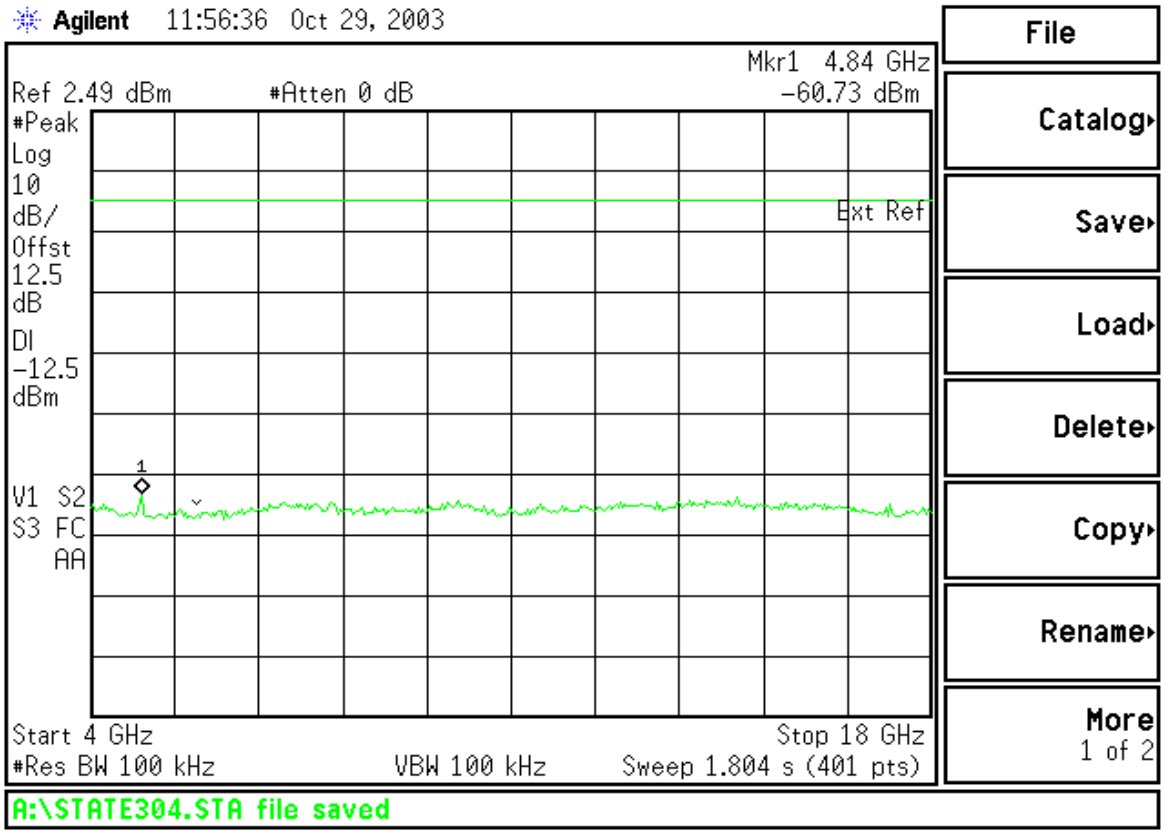
Channel 1, (2412.0MHz) – Maximum Power 11Mbps



2.4.6 Test Results - Continued

Spurious Conducted Emissions (4GHz – 18GHz)

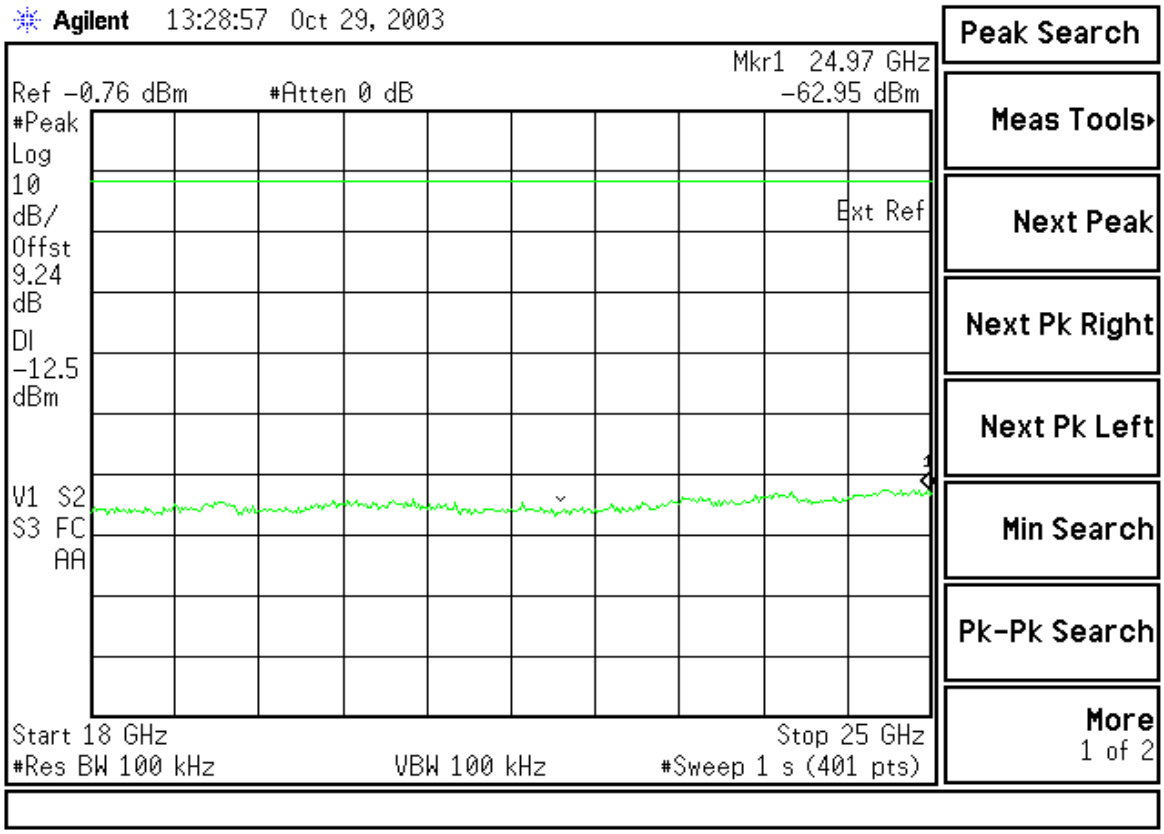
Channel 1, (2412.0MHz) – Maximum Power 11Mbps



2.4.6 Test Results - Continued

Spurious Conducted Emissions (18GHz – 25GHz)

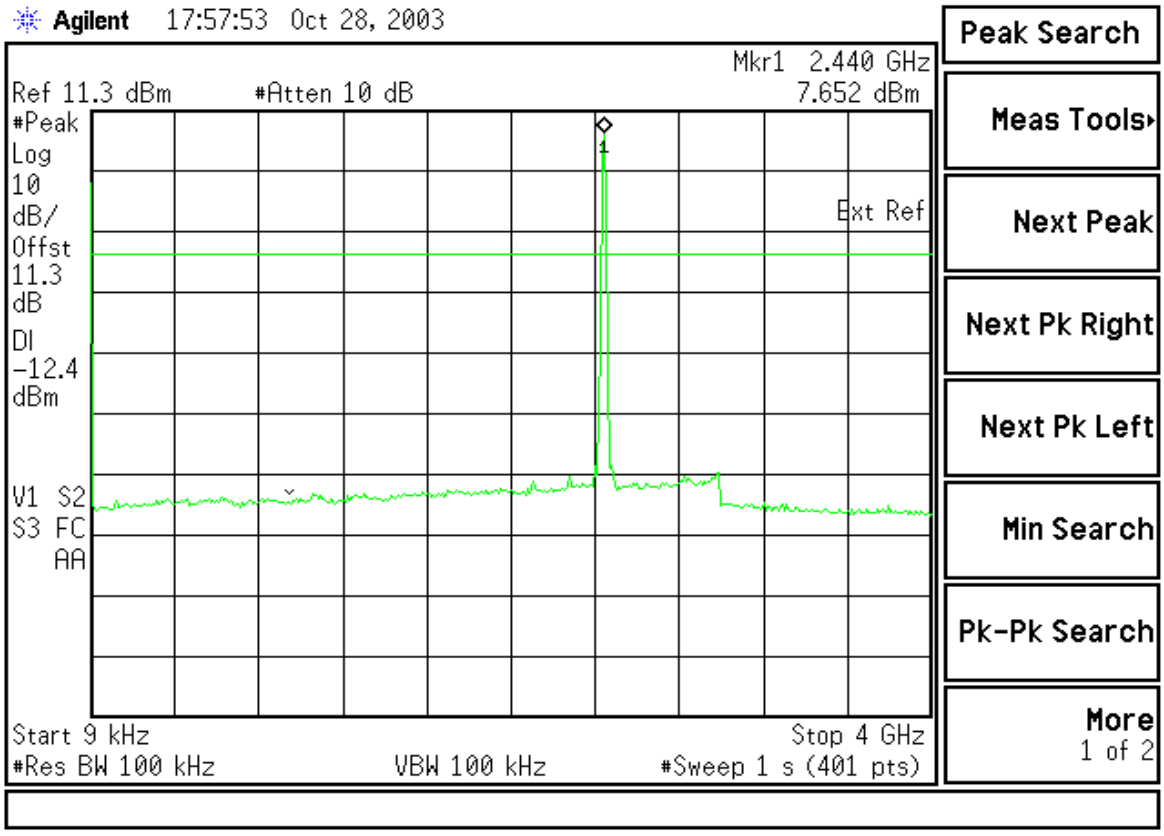
Channel 1, (2412.0MHz) – Maximum Power 11Mbps



2.4.6 Test Results - Continued

Spurious Conducted Emissions (9kHz – 4GHz)

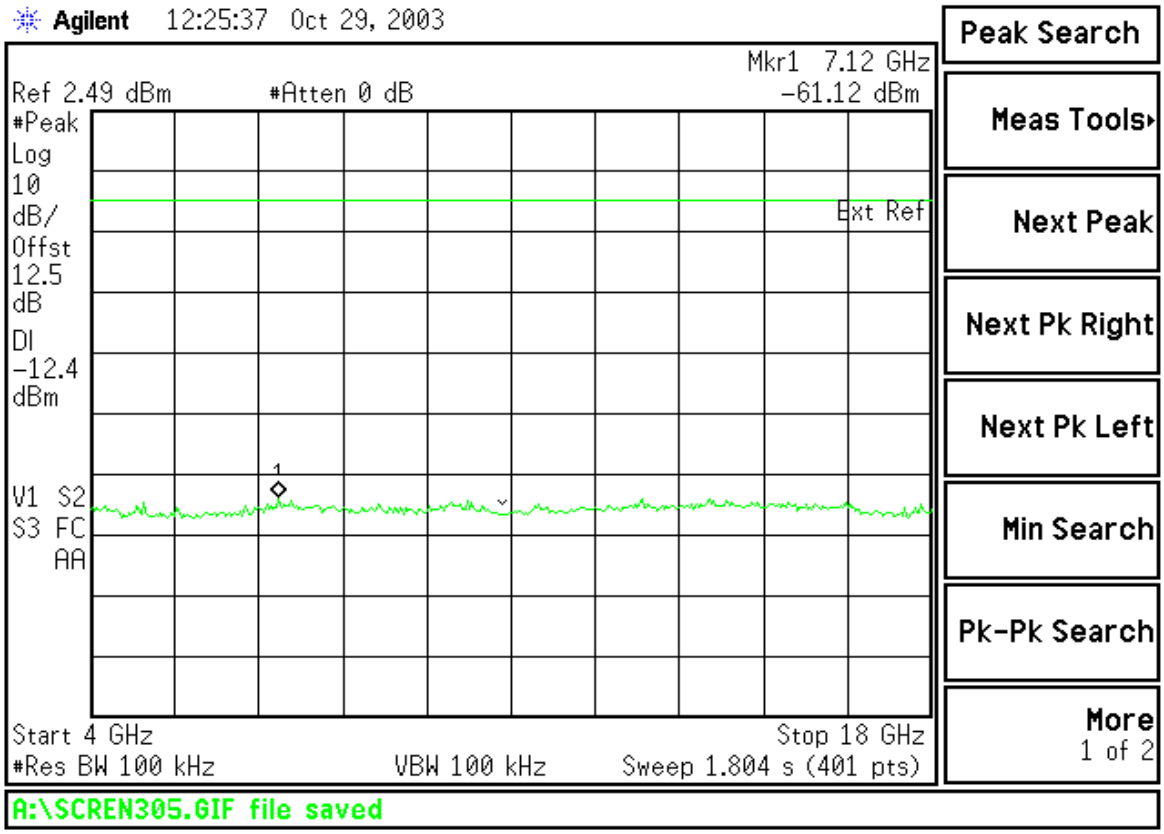
Channel 6, (2437.0MHz) – Maximum Power 11Mbps



2.4.6 Test Results - Continued

Spurious Conducted Emissions (4GHz – 18GHz)

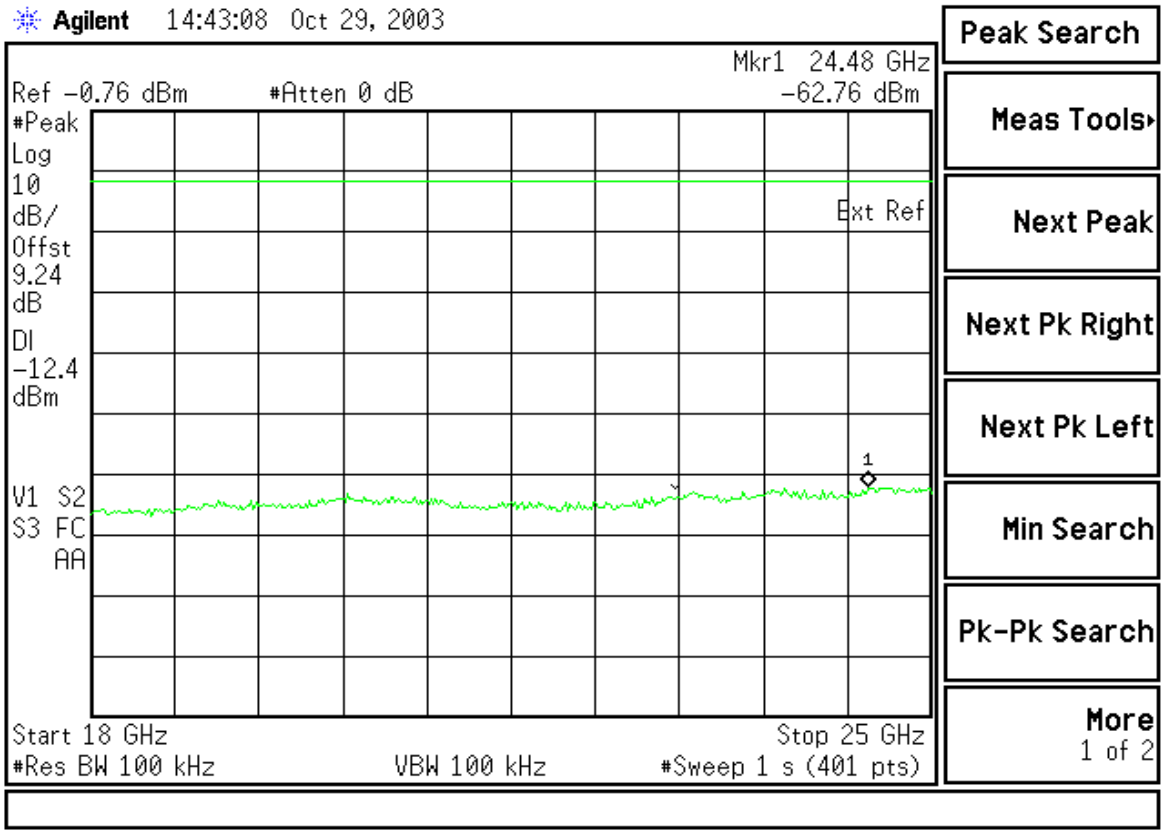
Channel 6, (2437.0MHz) – Maximum Power 11Mbps



2.4.6 Test Results - Continued

Spurious Conducted Emissions (18GHz – 25GHz)

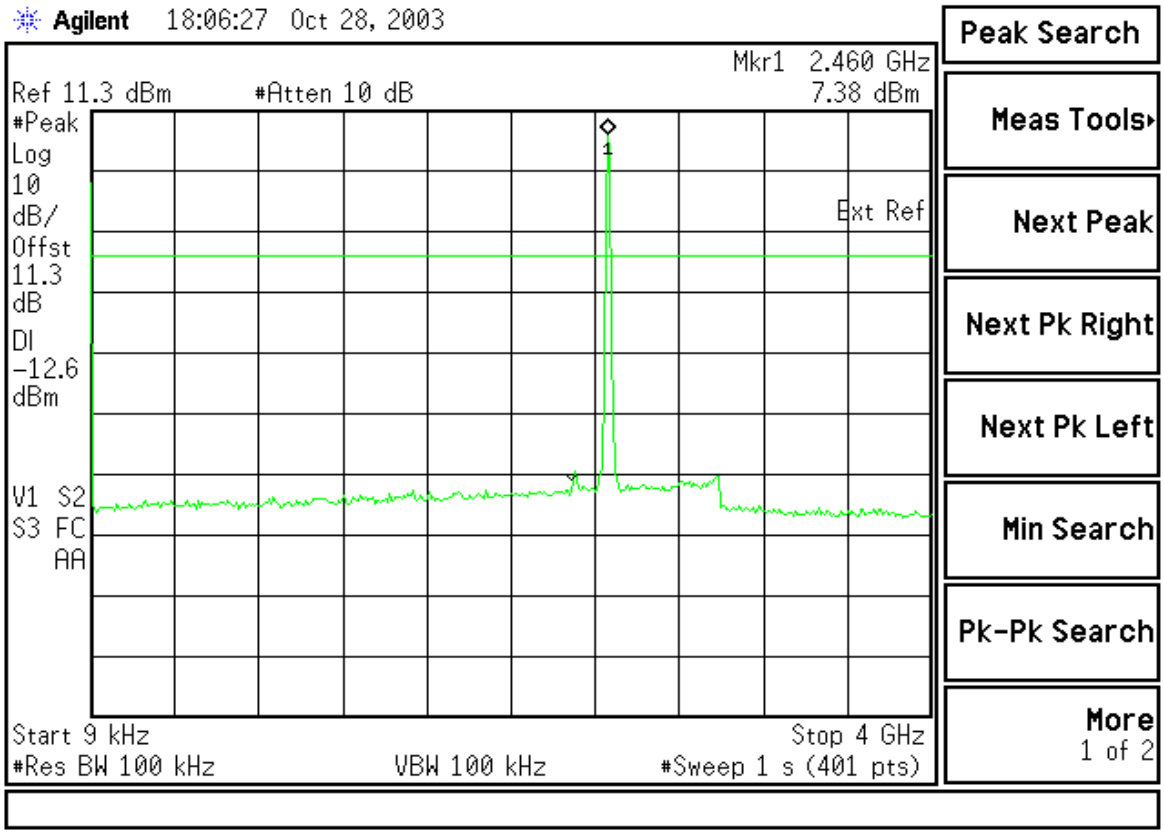
Channel 6, (2437.0MHz) – Maximum Power 11Mbps



2.4.6 Test Results - Continued

Spurious Conducted Emissions (9kHz – 4GHz)

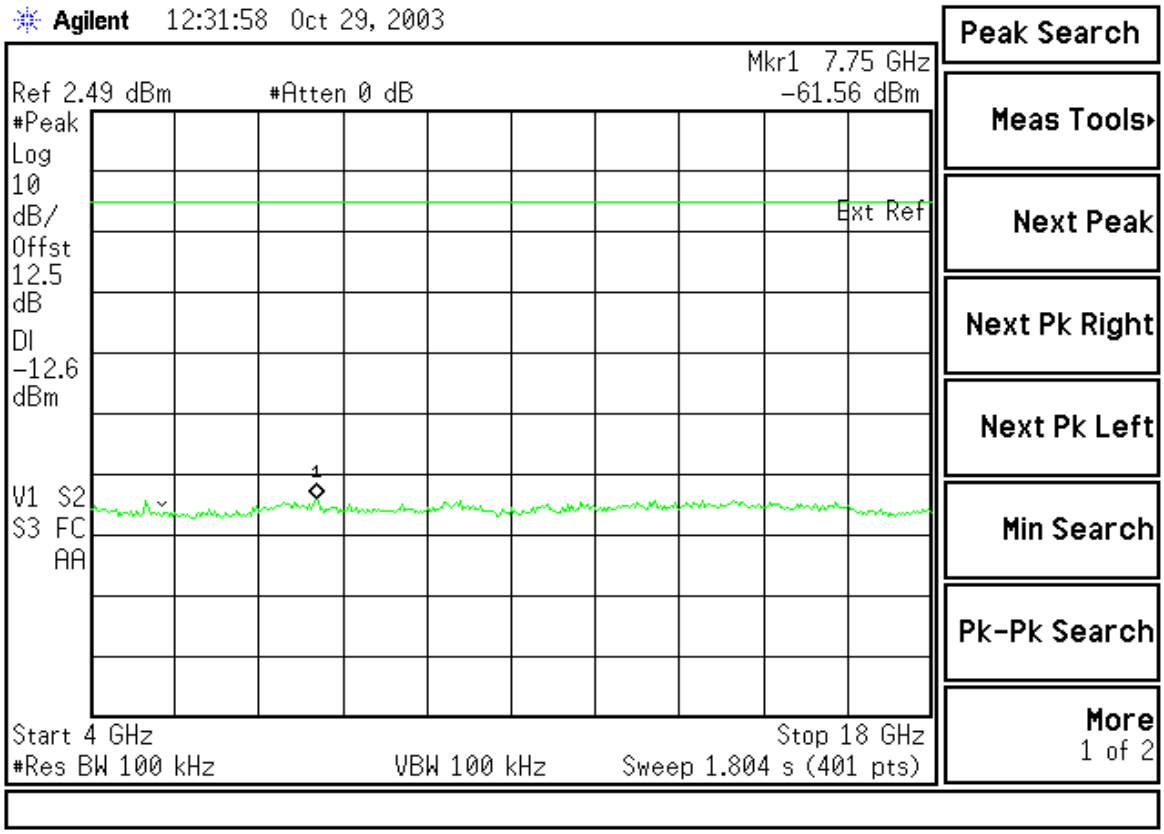
Channel 11, (2462.0MHz) – Maximum Power 11Mbps



2.4.6 Test Results - Continued

Spurious Conducted Emissions (4GHz – 18GHz)

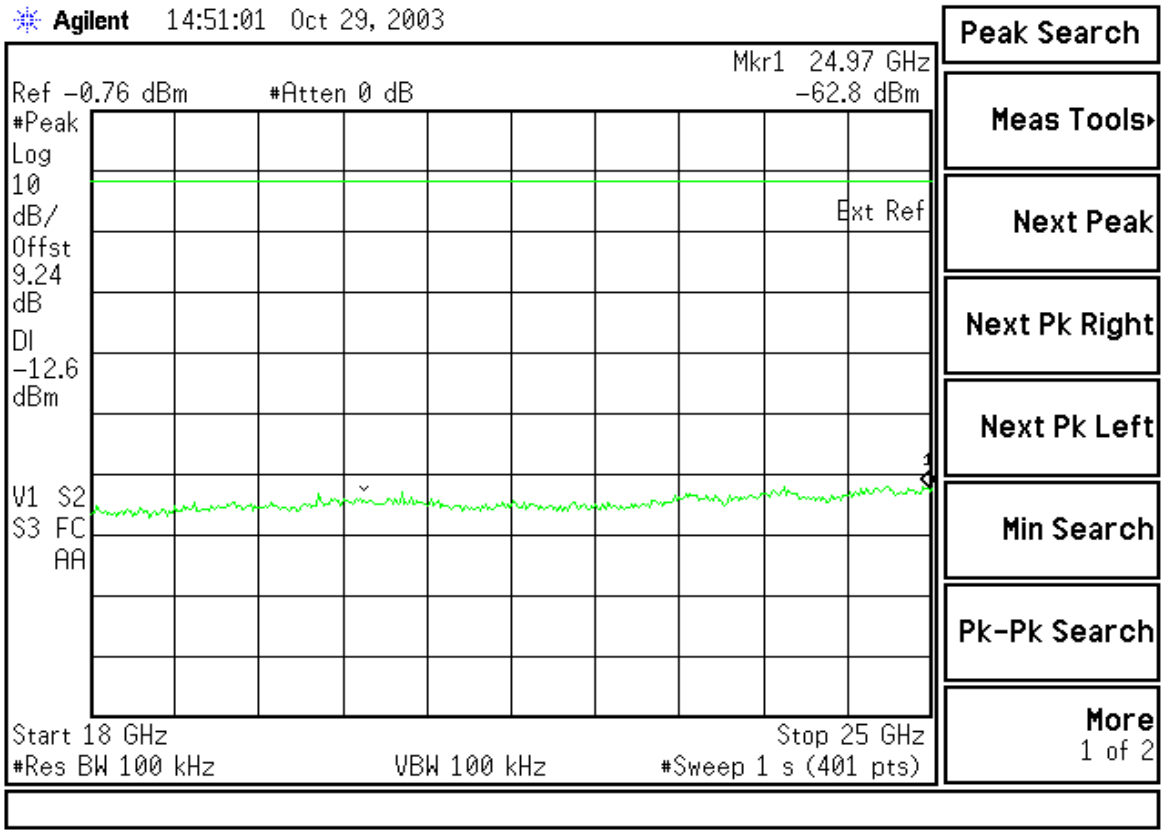
Channel 11, (2462.0MHz) – Maximum Power 11Mbps



2.4.6 Test Results - Continued

Spurious Conducted Emissions (18GHz – 25GHz)

Channel 11, (2462.0MHz) – Maximum Power 11Mbps



2.5 SPURIOUS CONDUCTED EMISSIONS ON POWER LINES

2.5.1 Specification Reference

FCC Part 15.207

2.5.2 Equipment Under Test

730 Handheld Computer Terminal 802.11b Module

2.5.3 Date of Test

28th November 2003

2.5.4 Test Equipment Used

The following major items of test equipment identified in Section 3.1 were used for the above tests.

Items: 25, 26, 27, 28, 29, 30, 31

2.5.5 Test Procedure

Testing to the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.207, for Conducted Emissions was carried out on the Measurement Test Facility detailed in Annex A.

Conducted Emission Measurements were undertaken within the semi-anechoic chamber. Emissions were measured on the Live and Neutral Lines.

Emissions were formally measured using Quasi-Peak and Average Detectors, which meet the CISPR requirements. The details of the worst-case emissions for the Live and Neutral Lines are presented in Tables below respectively.

The EUT was connected to a 120V 60Hz supply.

The Conducted Emission measurements were made using a Hewlett Packard 8542E EMI Receiver.

The test was performed in accordance with ANSI C63.4.

Performed by: M Larkin EMC Engineer

2.5.6 Test Results

The EUT met the Class B requirements of 47 CFR 15.207 for Conducted Emissions on the Live and Neutral Lines.

EUT Tx on Bottom Channel (2412MHz)

Conducted Emissions - Live Line

Emission Frequency (MHz)	Quasi-Peak Level (dBµV)	Quasi-Peak Limit (dBµV)	Average Level (dBµV)	Average Limit (dBµV)
0.21	51.8	56	41.9	46
0.18	43.9	56	23.2	46
0.21	51.6	56	41.7	46
0.28	46.1	56	39.2	46
0.35	37.3	56	32.9	46
3.09	36.8	56	35.2	46

The margin between the specification requirements and all other emissions were 20.6dB or more below the specified Quasi-Peak limit and 18.9dB or more below the Average limit.

Conducted Emissions Neutral Line :

Emission Frequency (MHz)	Quasi-Peak Level (dBµV)	Quasi-Peak Limit (dBµV)	Average Level (dBµV)	Average Limit (dBµV)
0.21	49.7	56	41.1	46
0.28	45.2	56	39.9	46
0.42	39.4	56	37.8	46
3.14	28.1	56	25.8	46
24.8	38.6	56	36.2	50

The margin between the specification requirements and all other emissions were 27.7dB or more below the specified Quasi-peak limit and 20.1dB or more below the specified Average limit.

2.5.6 Test Results - Continued

The EUT met the Class B requirements of 47 CFR 15.207 for Conducted Emissions on the Live and Neutral Lines.

EUT Tx on Middle Channel (2437MHz)

Conducted Emissions - Live Line

Emission Frequency (MHz)	Quasi-Peak Level (dBµV)	Quasi-Peak Limit (dBµV)	Average Level (dBµV)	Average Limit (dBµV)
0.16	46.2	56	24.4	46
0.21	48.1	56	39.6	46
0.28	43.0	56	36.9	46
0.35	40.0	56	37.9	46
3.23	35.8	56	34.2	46
24.80	36.9	60	35.5	50

The margin between the specification requirements and all other emissions were 23.1dB or more below the specified Quasi-Peak limit and 31.1dB or more below the Average limit.

Conducted Emissions Neutral Line :

Emission Frequency (MHz)	Quasi-Peak Level (dBµV)	Quasi-Peak Limit (dBµV)	Average Level (dBµV)	Average Limit (dBµV)
0.16	46.9	56	25.0	46
0.21	47.8	56	39.8	46
0.28	43.5	56	38.7	46
0.35	40.7	56	38.2	46
2.88	37.3	56	36.3	46
24.88	30.9	60	25.5	50

The margin between the specification requirements and all other emissions was 29.1dB or more below the specified Quasi-peak limit and 39.8dB or more below the specified Average limit.

2.5.6 Test Results - Continued

The EUT met the Class B requirements of 47 CFR 15.207 for Conducted Emissions on the Live and Neutral Lines.

EUT Tx on Top Channel (2462MHz)

Conducted Emissions - Live Line

Emission Frequency (MHz)	Quasi-Peak Level (dBµV)	Quasi-Peak Limit (dBµV)	Average Level (dBµV)	Average Limit (dBµV)
0.18	51.4	56	29.5	46
0.19	48.6	56	25.5	46
0.21	48.7	56	39.3	46
0.28	42.8	56	37.0	46
3.23	35.8	56	34.2	46
24.87	36.6	60	35.3	50

The margin between the specification requirements and all other emissions was 23.4dB or more below the specified Quasi-Peak limit and 39.3dB or more below the Average limit.

Conducted Emissions Neutral Line :

Emission Frequency (MHz)	Quasi-Peak Level (dBµV)	Quasi-Peak Limit (dBµV)	Average Level (dBµV)	Average Limit (dBµV)
0.16	46.2	56	24.4	46
0.17	44.2	56	23.8	46
0.21	47.6	56	39.6	46
0.28	43.4	56	38.6	46
2.81	37.6	56	35.9	46
24.59	38.6	60	37.1	50

The margin between the specification requirements and all other emissions was 21.4dB or more below the specified Quasi-peak limit and 39.6dB or more below the specified Average limit.

2.6 SPURIOUS RADIATED EMISSIONS

2.6.1 Specification Reference

FCC Part 15.247 (c)

2.6.2 Equipment Under Test

730 Handheld Computer Terminal 802.11b Module

2.6.3 Date of Test

23/10/2003

2.6.4 Test Equipment Used

The following major items of test equipment identified in Section 3.1 were used for the above tests.

Items: 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22

2.6.5 Test Procedure

Testing to the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.247(c), for Radiated Electric Field Emissions was carried out on the Measurement Test Facility detailed in Annex A. Section 15.247(c) which also requires Rule parts 15.205 and 15.209 to be applied.

A preliminary profile of the Spurious Radiated Emissions was obtained by operating the Equipment Under Test (EUT) on a remotely controlled turntable within a semi-anechoic chamber; measurements were taken at a 3m distance unless otherwise stated. Measurements of emissions from the EUT were obtained with the Measurement Antenna in both Horizontal and Vertical Polarisations. The profiling produced a list of the worst-case emissions together with the EUT azimuth and antenna polarisation.

Using the information from the preliminary profiling of the EUT, a search was made in the frequency range 30MHz to 25GHz. The list of worst-case emissions was then confirmed or updated under Open Site conditions. Emission levels were maximised by adjusting the antenna height, antenna polarisation and turntable azimuth.

30MHz – 1GHz emissions levels were then formally measured using a CISPR Quasi-Peak detector.
1GHz – 25GHz emissions levels were then formally measured using Peak and Average detectors.

(Note: Peak measurements performed using a Resolution and Video Bandwidth of 1MHz, Average measurements performed using a Resolution Bandwidth of 1MHz and a Video Bandwidth of 10Hz)

The EUT was operating via the internal power supply of the Host.

Measurements were made with the EUT transmitting on the following channels.

Channel 1: 2412MHz
Channel 6: 2437MHz
Channel 11: 2462MHz

Spurious Radiated Emissions from 30MHz to 1GHz were made using a Hewlett Packard 8542E EMI Receiver.

Spurious Radiated Emissions from 1GHz to 25GHz were made using a Rhode and Schwarz ESIB 26 Test Receiver and performed on an Alternative Open Area Test Site.

The test was performed in accordance with ANSI C63.4.

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: Part 15.247(c), 15.205 and 15.209 for Radiated Emissions (30MHz – 1GHz).

Performed by M Larkin EMC Engineer.

2.6.6 Test Results

EUT Tx on Bottom Channel (2412MHz)

30MHz – 1GHz Test Site Results: The levels of the six highest emissions measured in accordance with the specification are presented below: -

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
MHz	H/V	cm	deg	dBµV/m	µV/m	dBµV/m	µV/m
66.2	V	100	300	24.2	16.2	40.0	100.0
298.6	H	100	158	29.2	28.8	46.0	200
895.8	V	100	164	35.4	58.9	46.0	200
895.8	H	144	200	36.2	64.6	46.0	200

The margin between the specification requirements and all other emissions was 16.8dB below the specified limit

EUT Tx on Middle Channel (2437MHz)

30MHz – 1GHz Test Site Results: The levels of the six highest emissions measured in accordance with the specification are presented below: -

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
MHz	H/V	cm	deg	dBµV/m	µV/m	dBµV/m	µV/m
66.1	V	100	300	26.0	20.2	40.0	100.0
120.9	V	100	80	24.4	16.6	43.5	150
298.6	H	100	170	29.6	30.2	46.0	200
497.7	V	100	330	30.6	33.9	46.0	200
895.8	H	143	215	36.5	66.8	46.0	200
895.8	V	100	180	33.7	48.4	46.0	200

The margin between the specification requirements and all other emissions was 19.1dB below the specified limit

2.6.6 Test Results - Continued

EUT Tx on Top Channel (2462MHz)

30MHz – 1GHz Test Site Results: The levels of the six highest emissions measured in accordance with the specification are presented below: -

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
MHz	H/V	cm	deg	dBµV/m	µV/m	dBµV/m	µV/m
66.1	V	100	280	26.0	20.0	40.0	100.0
122.9	V	100	45	26.2	20.4	43.5	150
298.6	H	110	170	29.3	29.2	46.0	200
497.7	V	100	329	30.4	33.1	46.0	200
895.8	V	100	179	32.9	44.2	46.0	200
895.8	H	139	219	35.7	60.9	46.0	200

The margin between the specification requirements and all other emissions was 17.3dB below the specified limit

ABBREVIATIONS FOR ABOVE TABLES

H	Horizontal Polarisation	V	Vertical Polarisation
Pol	Polarisation	Hgt	Height
deg	degree	Azm	Azimuth

2.6.6 Test Results - Continued

EUT Tx on Bottom Channel (2412MHz)

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Filed Strength	Average Limit
	Polarisation	Height	Azimuth				
GHz	H/V	Cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
2.38	H	100	222	56.2	74.0	44.7	54.0
4.82	V	103	176	39.5	74.0	35.3	54.0
*9.65	H	100	176	54.8	84.0	43.5	64.0

EUT Tx on Middle Channel (2437MHz)

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Filed Strength	Average Limit
	Polarisation	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
4.87	V	103	173	46.8	74.0	38.2	54.0
*9.74	H	100	178	53.8	84.0	44.5	64.0

EUT Tx on Top Channel (2462MHz)

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Filed Strength	Average Limit
	Polarisation	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
4.92	V	103	175	47.3	74.0	39.6	54.0
*9.85	H	100	178	54.8	84.0	46.3	64.0

* Measured at 1m. The limits have been increased by 10dB.

2.7 PEAK POWER SPECTRAL DENSITY

2.7.1 Specification Reference

FCC Part 15.247 (d)

2.7.2 Equipment Under Test

730 Handheld Computer Terminal 802.11b Module

2.7.3 Date of Test

28th October 2003

2.7.4 Test Equipment Used

The following major items of test equipment identified in Section 3.1 were used for the above tests.

Items: 1, 2, 3, 4

2.7.5 Test Procedure

The EUT was connected to the Spectrum Analyser via a 10dB Attenuator. The EUT was set to transmit at maximum power on all three channels and at all data rates.

With the EUT transmitting, the trace was adjusted to display the whole of the fundamental. The RBW and VBW were initially set to 100kHz. Using the Max Hold function on the Spectrum Analyser, the peak response of the fundamental was established. This point was then centred on the display screen and the span adjusted to 600kHz and the RBW and VBW changed to 3kHz. The sweep time was set at 200 seconds, ($600x10^3$ / $3 x10^3$), and Max Hold selected. The peak response was then measured and recorded.

Performed by: B Airs, Radio Engineer

2.7.6 Test Results

Frequency (MHz)	Data Rate (Mbps)	Measurement Bandwidth (kHz)	Result (dBm)
2412	1	3	-7.38
2437	1	3	-7.84
2462	1	3	-8.16
2412	2	3	-7.53
2437	2	3	-7.88
2462	2	3	-8.09
2412	5.5	3	-7.47
2437	5.5	3	-7.98
2462	5.5	3	-8.16
2412	11	3	-7.58
2437	11	3	-7.79
2462	11	3	-7.69

Limit	≤ +8dBm/kHz, or 12.77dBm/3kHz

Remarks

The EUT met the requirements specified in Clause 15.247(d). The Peak Power Spectral Density was below the +8dBm/kHz limit.

SECTION 3

TEST DETAILS – MODIFICATION STATE 1

FCC Part 15C Testing in support of an Application for Grant of Equipment Authorisation of an Intermec 730 Handheld Computer Terminal 802.11b Radio Module
FCC ID: EHA-802CFI3

3.1 MAXIMUM PEAK OUTPUT POWER

3.1.1 Specification Reference

FCC Part 15.247(B)(3)

3.1.2 Equipment Under Test

730 Handheld Computer Terminal 802.11b Module

3.1.3 Date of Test

21st November 2003

3.1.4 Test Equipment Used

The following major items of test equipment identified in Section 3.1 were used for the above tests.

Items: 1, 2, 3, 4, 8, 9

3.1.5 Test Procedure

The EUT was connected to a Digital Storage Oscilloscope via an attenuator and Crystal Detector. The DC output from the Crystal Detector was measured on the Oscilloscope. The EUT was then substituted for a Signal Generator. The generators frequency was adjusted to that of the EUT and the amplitude increased to give the same DC level as measured from the EUT. The level was read from the Signal Generator and gave the maximum output power.

Performed by : B Airs, Radio Engineer

3.1.6 Test Results

1Mbps

Frequency (MHz)	Output Power (dBm)	Result (mW)
2412.0	+16.50	44.67
2437.0	+16.35	43.15
2462.0	+16.20	41.69

2Mbps

Frequency (MHz)	Output Power (dBm)	Result (mW)
2412.0	+16.50	44.67
2437.0	+16.35	43.15
2462.0	+16.20	41.69

3.1.6 Test Results - Continued

5.5Mbps

Frequency (MHz)	Output Power (dBm)	Result (mW)
2412.0	+16.50	44.67
2437.0	+16.35	43.15
2462.0	+16.20	41.69

11Mbps

Frequency (MHz)	Output Power (dBm)	Result (mW)
2412.0	+16.50	44.67
2437.0	+16.35	43.15
2462.0	+16.20	41.69

Limit	<1W or <+30dBm

Remarks

EUT complies with CFR 47 15.247(b)(1). The EUT does not exceed 1W or +30dBm at the measured frequencies.

3.2 PEAK POWER SPECTRAL DENSITY

3.2.1 Specification Reference

FCC Part 15.247 (d)

3.2.2 Equipment Under Test

730 Handheld Computer Terminal 802.11b Module

3.2.3 Date of Test

21st November 2003

3.2.4 Test Equipment Used

The following major items of test equipment identified in Section 3.1 were used for the above tests.

Items: 1, 2, 3, 4

3.2.5 Test Procedure

The EUT was connected to the Spectrum Analyser via a 10dB Attenuator. The EUT was set to transmit at maximum power on all three channels and at all data rates.

With the EUT transmitting, the trace was adjusted to display the whole of the fundamental. The RBW and VBW were initially set to 100kHz. Using the Max Hold function on the Spectrum Analyser, the peak response of the fundamental was established. This point was then centred on the display screen and the span adjusted to 600kHz and the RBW and VBW changed to 3kHz. The sweep time was set at 200 seconds, ($600x10^3$ / $3 x10^3$), and Max Hold selected. The peak response was then measured and recorded.

Performed by: B Airs, Radio Engineer

3.2.6 Test Results

Frequency (MHz)	Data Rate (Mbps)	Measurement Bandwidth (kHz)	Result (dBm)
2412	1	3	-9.187
2437	1	3	-9.74
2462	1	3	-9.72
2412	2	3	-9.06
2437	2	3	-9.74
2462	2	3	-9.57
2412	5.5	3	-9.51
2437	5.5	3	-9.74
2462	5.5	3	-9.67
2412	11	3	-9.40
2437	11	3	-9.50
2462	11	3	-9.82

Limit	≤ +8dBm/kHz, or 12.77dBm/3kHz

Remarks

The EUT met the requirements specified in Clause 15.247(d). The Peak Power Spectral Density was below the +8dBm/kHz limit.

SECTION 4

TEST EQUIPMENT USED & MEASUREMENT UNCERTAINTIES

4.1 TEST EQUIPMENT USED

Item	Instrument	Manufacturer	Type No	Serial No	EMC / INV No	Cal. Due
1	Hygrometers	Rotronic	I-1000	1826-15	INV 3227	04/10/04
2	Attenuator	Suhner	6810-17.B	7409	INV 4622	10/07/03
3	Analyser	Hewlett Packard	EE4407B	US41442853	2783	18/03/04
4	Signal Generator	Hewlett Packard	8673B	2823A01302	2551	14/06/04
5	Signal Generator	Rohde & Schwarz	SMY01	839957/052	2185	11/10/04
6	Signal Source	Hewlett Packard	ESG4000A	GB37040125	INV 3709	21/01/04
7	Waveguide Filter					
8	Detector	Hewlett Packard	8470B	1822A15821	INV 4209	18/10/01
9	Oscilloscope	Lecroy	LC534L	LC5341147	INV 4005	18/12/03
10	Antenna Mast	EMCO	2070	-	-	TU
11	Antenna Mast Controller	EMCO	2090	-	-	TU
12	Screened Room 5	Siemens	EAC54300	-	2533	TU
13	Low Noise Amplifier (1-8GHz)	Miteq	AMF-3D-001080-18-13P	UNK	2457	TU
14	Low Noise Amplifier (8-18GHz)	Miteq	AMF-4E-080180-15-10P	492562	2430	TU
15	Antenna	EMCO	3115	96964848	2297	04/07/04
16	Antenna	EMCO	3115	97015079	2397	04/07/04
17	Signal Generator	Hewlett Packard	8673B	2147A00421	953	TU
18	Hygromer	Rotronic	Hygromer	-	4066	28/11/03
19	3dB Pad	Hewlett Packard	8419B	15108	-	TU
20	Antenna	Link Microtek Ltd	AM180HA-K-TU2	2007	2945	15/08/04
21	Amplifier	Avanteck	AMT-26177-33	6669	2072	26/06/04
22	Amplifier	Avanteck	AWT-18036	F13365 8452	1081	26/06/04
23	EMI Test Rx	Rhode + Schwarz	ESIB26	100163/026	2958	05/08/04
24	Horn	Link Microtech Ltd	AM180HA –K – TUZ	2007	2945	15/04/05

25	Test Receiver	Rohde & Schwarz	ESH3	8727842/002	1020	16/08/04
26	Spectrum Monitor	Rohde & Schwarz	EZM	892242-023	1416	-
27	Plotter	Hewlett Packard	7500A	-	-	TU
28	Transient Limiter	Hewlett Packard	11947A	3107A01649	2244	07/05/04
29	LISN	Rohde & Schwarz	ESH2-25	892107-019	1584	02/06/04
30	Hygrometer	Rotronic	A1	643 37	3156	15/02/04
31	Barometer	Diplex	Diplex	B05/1-04B04	1938	TU

4.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are: -

In the frequency range 30MHz to 1000MHz

For 20dB Bandwidth

Frequency	±210.894kHz
Amplitude	±0.5dB

For Maximum Output Power

Amplitude	±0.5dB

For Spurious Radiated Emissions, Quasi-Peak Measurements

Antenna: - Frequency ±5ppm + 500Hz Amplitude ±4.1dB

In the frequency range 1GHz to 25GHz

For Spurious Radiated Emissions measurements: -

Frequency	$\pm 2 \times 10^{-7}$ x Centre Frequency
Amplitude	±3.4dB

For Peak Power Spectral Density

Amplitude	±1.8dB

For Spurious Conducted Emissions

Amplitude	±3.0dB

SECTION 5

PHOTOGRAPHS OF TEST SAMPLE

5.1 PHOTOGRAPHS OF EQUIPMENT

Front view of 730 Unit

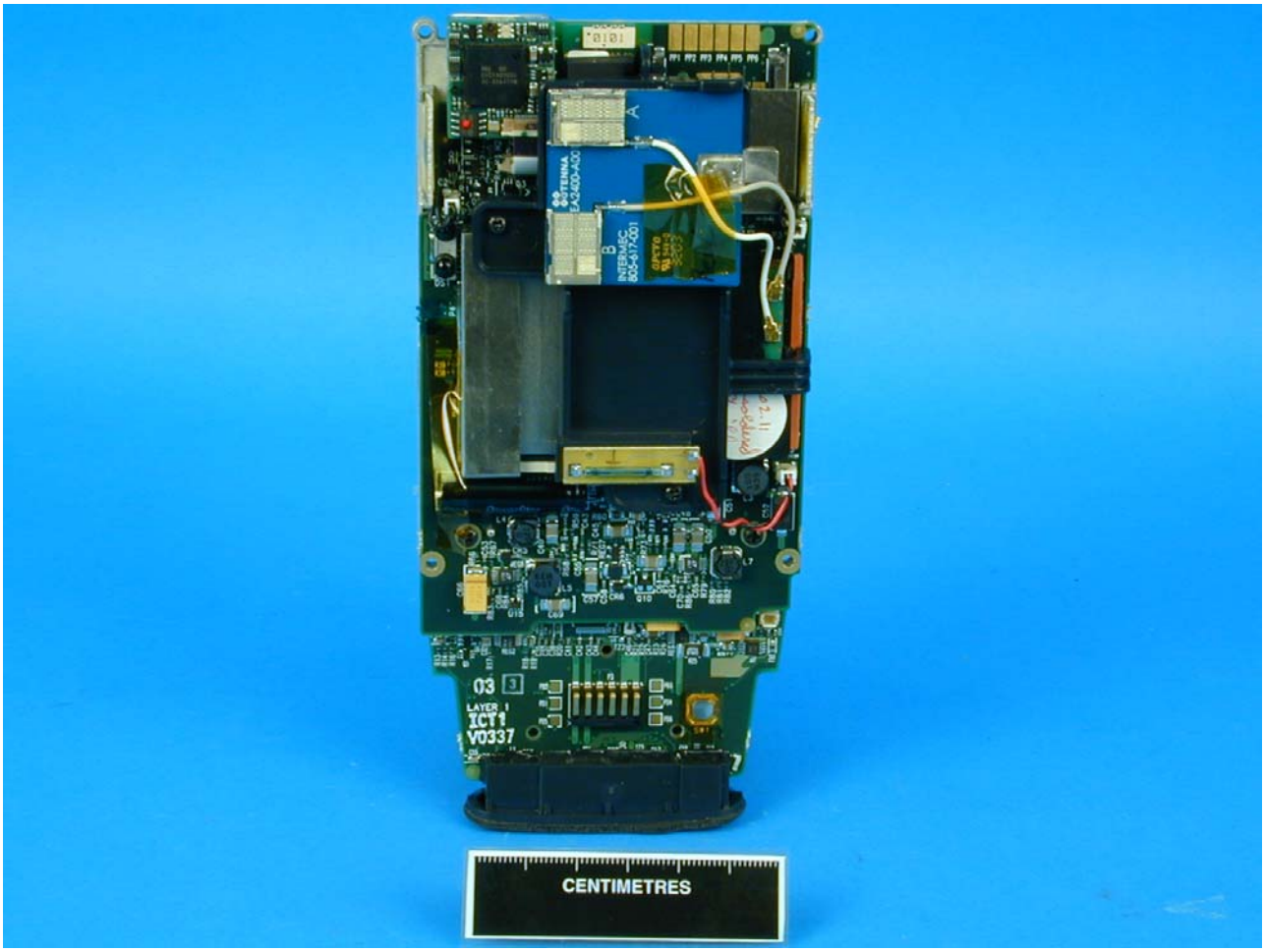
5.1 PHOTOGRAPHS OF EQUIPMENT - Continued

Rear view of 730 Unit

5.1 PHOTOGRAPHS OF EQUIPMENT - Continued

Internal front view of 730 Unit

5.1 PHOTOGRAPHS OF EQUIPMENT - Continued

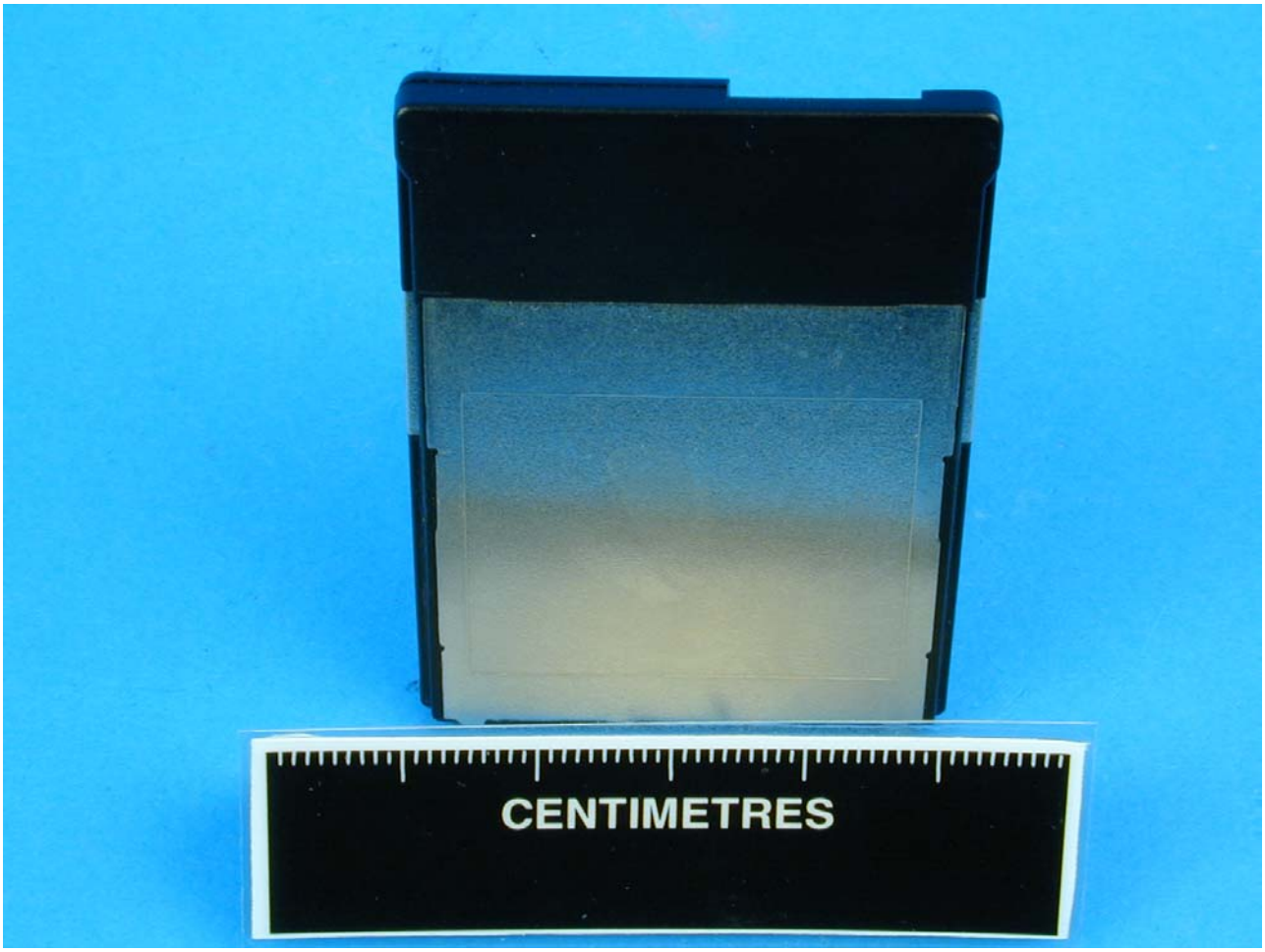


Internal rear view of 730 Unit

5.1 PHOTOGRAPHS OF EQUIPMENT - Continued

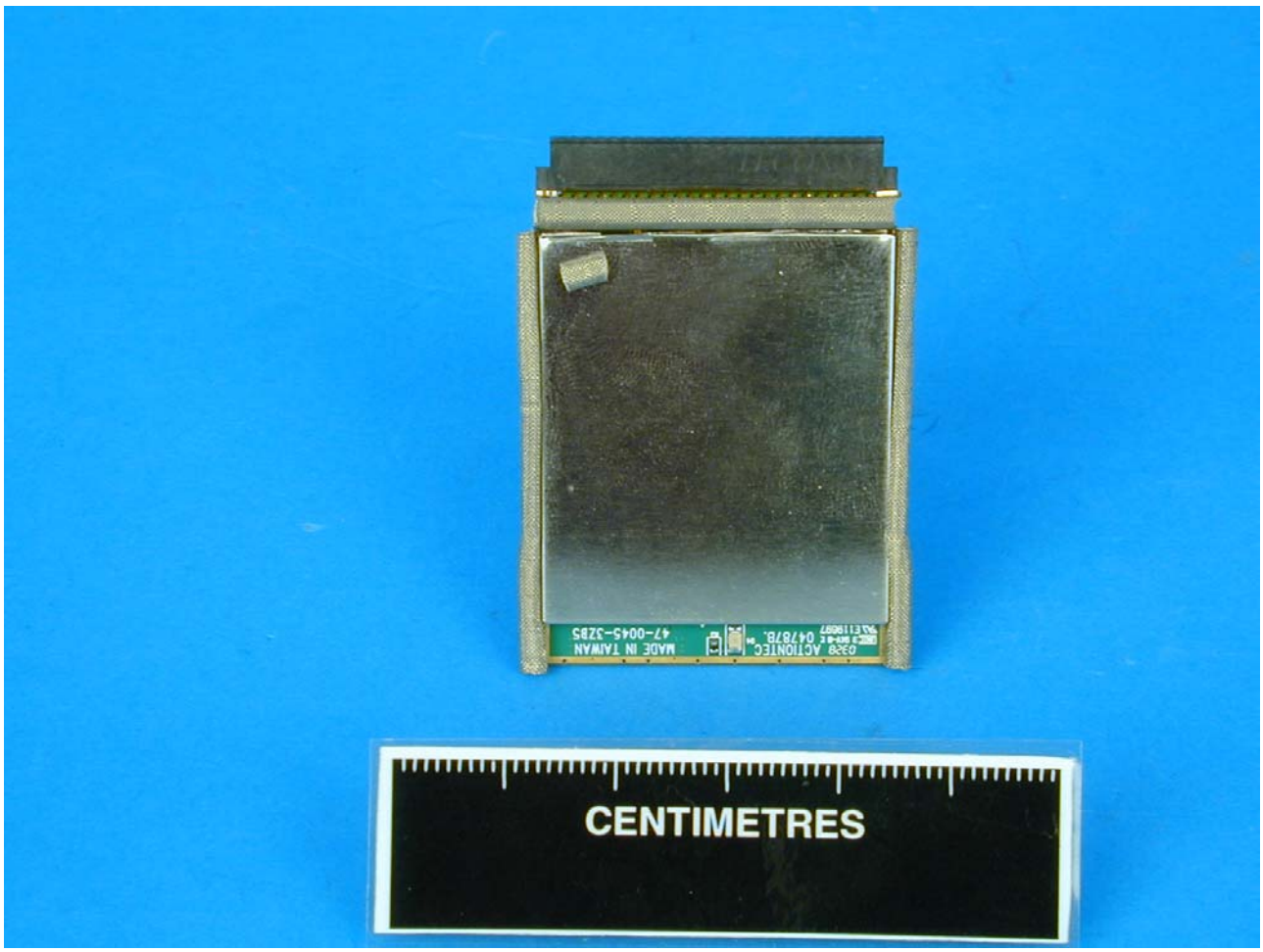
Top view of 802.11b Radio Module

5.1 PHOTOGRAPHS OF EQUIPMENT - Continued



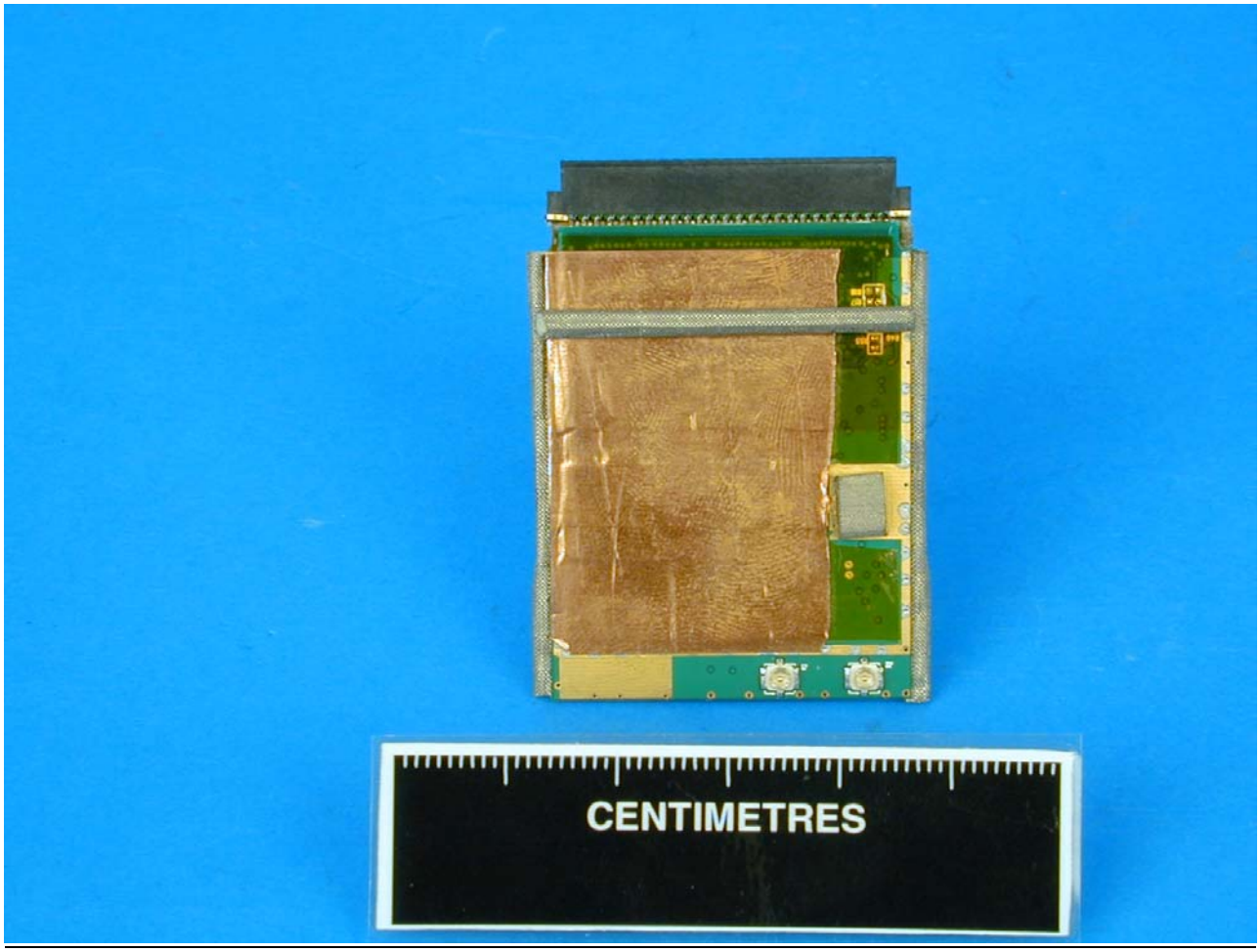
Bottom view of 802.11b Radio Module

5.1 PHOTOGRAPHS OF EQUIPMENT – Continued



Bottom view of 802.11b Radio Module With Main Cover Removed

5.1 PHOTOGRAPHS OF EQUIPMENT - Continued



Top view of 802.11b Radio Module With Main Cover Removed

5.1 PHOTOGRAPHS OF EQUIPMENT - Continued

Bottom view of 802.11b Radio Module With Internal Cover Removed

5.1 PHOTOGRAPHS OF EQUIPMENT - Continued

Top view of 802.11b Radio Module With Added Shielding Removed

SECTION 6

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

6.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

This report relates only to the actual item/items tested.

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation.

Results of tests not covered by our UKAS Accreditation Schedule are marked NUA (Not UKAS Accredited).

ANNEX A

FCC SITE COMPLIANCE LETTER
(comprising 1 Page)

FEDERAL COMMUNICATIONS COMMISSION

Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046

October 18, 2002

Registration Number: 90987

TUV Product Service Ltd
Segensworth Road
Titchfield
Fareham, Hampshire, PO15 5RH
United Kingdom
Attention: Kevan Adsetts

Re: Measurement facility located at Titchfield
Anechoic chamber (3 meters) and 3 & 10 meter OATS
Date of Listing: October 18, 2002

Gentlemen:

Your request for registration of the subject measurement facility has been reviewed and found to be in compliance with the requirements of Section 2.948 of the FCC rules. The information has, therefore, been placed on file and the name of your organization added to the list of facilities whose measurement data will be accepted in conjunction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Please note that the file must be updated for any changes made to the facility and the registration must be renewed at least every three years.

Measurement facilities that have indicated that they are available to the public to perform measurement services on a fee basis may be found on the FCC website www.fcc.gov under E-Filing, OET Equipment Authorization Electronic Filing, Test Firms.

Sincerely,

Thomas W. Phillips

Thomas W Phillips
Electronics Engineer