



**TEST REPORT OF A 2.4 GHZ LOW POWER WLAN
MULTIPOINT CARD, BRAND COMPAQ, TYPE
WA1000, WHEN MOUNTED ON A TEST FIXTURE, IN
CONFORMITY WITH 47 CFR PART 15 (2001-12-18).**

Accredited by : Dutch Council of Accreditation
STERLAB accreditation number L385
FCC listed : 90828
Industry Canada : IC3501

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Test specification(s): 47 CFR Part 15 (2001-12-18)
Description of EUT: 2.4 GHz low power WLAN MultiPort card
Manufacturer: Compaq Computer Corporation
Brand mark: Compaq
Type: WA1000
FCC ID: IMRWA1000

MEASUREMENT/TECHNICAL REPORT

Compaq Computer Corporation

Model : WA1000

FCC ID: IMRWA1000

June 3, 2002

This report concerns:	Original grant/certification	Class 2 change	Verification
Equipment type:	Direct Sequence Spread Spectrum Transceiver		
Deferred grant requested per 47 CFR 0.457(d)(1)(ii) ?	Yes	No	
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The data taken for this test and report herein was done in accordance with 47 CFR Part 15 and the measurement procedures of ANSI C63.4-1992. TNO Electronic Products & Services (EPS) B.V. at Niekerk, The Netherlands, certifies that the data is accurate and contains a true representation of the emission profile of the Equipment Under Test (EUT) on the date of the test as noted in the test report. I have reviewed the test report and find it to be an accurate description of the test(s) performed and the EUT so tested.

Date: June 3, 2002

Signature:

P. de Beer
TNO Electronic Products & Services (EPS) B.V.



Test specification(s): 47 CFR Part 15 (2001-12-18)
Description of EUT: 2.4 GHz low power WLAN MultiPort card
Manufacturer: Compaq Computer Corporation
Brand mark: Compaq
Type: WA1000
FCC ID: IMRWA1000

Description of test item

Test item : 2.4 GHz low power WLAN MultiPort card (mounted on a test fixture)
Manufacturer : Compaq Computer Corporation
Brand : Compaq
Type : WA1000
Serial numbers : 02UT16300000, 02UT15300001, 02UT15300003, 01UT44640010
Revision : n.a.
Receipt number : 4
Receipt date : April 22, 2002

Applicant information

Applicant's representative : Mr. Andy St. Cyr
Company : Compaq Computer Corporation
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Test(s) performed

Location : Niekirk
Test(s) started : April 23, 2002
Test(s) completed : May 17, 2002
Purpose of test(s) : Type approval / certification
Test specification(s) : 47 CFR Part 15 (2001-12-18)

Test engineer : O.H. Hoekstra

Report written by : P.A.J.M. Robben, B.Sc.E.E.

Project leader : P.A.J.M. Robben, B.Sc.E.E.

This report is in conformity with NEN-EN-ISO/IEC 17025.

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The test results relate only to the item(s) tested.



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Test specification(s): 47 CFR Part 15 (2001-12-18)
Description of EUT: 2.4 GHz low power WLAN MultiPort card
Manufacturer: Compaq Computer Corporation
Brand mark: Compaq
Type: WA1000
FCC ID: IMRWA1000

1 General information

1.1 Product description

The 2.4 GHz low power WLAN MultiPort card, brand Compaq, type WA1000, is designed to operate in the 2.4 GHz ISM frequency band, channels 1 to 11 (2412 MHz to 2462 MHz), as specified by the Federal Communications Commission in the USA.

The 2.4 GHz low power WLAN MultiPort card, brand Compaq, type WA1000, utilizes Direct Sequence Spread Spectrum (DSSS) technology.

The 2.4 GHz low power WLAN MultiPort card, brand Compaq, type WA1000, incorporates an integral antenna having a gain of 0 dBi.

1.2 Related submittal(s) and/or Grant(s)

Not applicable.

1.3 Tested system details

Details and an overview of the system and all its components, as it has been tested, can be found in table 1 below. FCC ID's are stated in this overview where applicable. The EUT is listed in the first row of this table 1.

Description	Type number	Serial number	FCC ID	Cable descriptions
2.4 GHz low power WLAN MultiPort card	WA1000	02UT15300001 and 01UT44640010	IMRWA1000	None.
Test fixture	n.a.	n.a.	n.a.	-Shielded USB cable to notebook computer
Compaq notebook computer	Evo N600c	6J22KBSZ J03P	n.a. (DoC)	-Unshielded DC power cord to AC/DC adapter -Shielded parallel cable to printer -Shielded cable to monitor -Shielded cable to keyboard -Shielded USB cable to Webcam -Shielded serial cable with passive termination -Shielded audio/video cable with passive termination
Compaq AC/DC power adapter 100-240 VAC/1.5 Amps to +18.5 VDC/2.7 Amps	PPP005N	1924006A	n.a. (DoC)	-Unshielded DC power cord to notebook computer -Unshielded power cord to AC mains
HP DeskJet 895Cxi	C6410A	ES8B42307H	n.a. (DoC)	-Unshielded DC power cord to AC/DC adapter -Shielded parallel cable to notebook computer
HP AC/DC power adapter 100-240 VAC/1 Amps to +18 VDC/1.1 Amps	C6409-60014	n.a.	n.a. (DoC)	-Unshielded DC power cord to printer -Unshielded power cord to AC mains

Table 1 - Tested system details overview.



Test specification(s):	47 CFR Part 15 (2001-12-18)
Description of EUT:	2.4 GHz low power WLAN MultiPort card
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Brand mark:	Compaq
Type:	WA1000
FCC ID:	IMRWA1000

1.4 Test methodology

The test methodology used is based on the requirements of 47 CFR Part 15 (2001-12-18), sections 15.107, 15.207, 15.109, 15.209, 15.205 and 15.247.

The test methods, which have been used, are based on ANSI C63.4: 1992.

Radiated emission tests above 30 MHz were performed at a measurement distance of 3 meters. Below 30 MHz the radiated emission tests were carried out at measurement distances of 3 and 10 meters. The test results regarding the radiated emission tests on frequencies below 30 MHz have been extrapolated in order to determine the field strength of the measured values at measurement distances of 30 and 300 meters (as required by 47 CFR Part 15).

The bandwidth of the receiver is switching automatically to the right bandwidth in accordance with CISPR 16. This is implemented in the receiver. The antenna factors are programmed in the test receiver. The receiver automatically calculates the appropriate correction factor for the utilized antenna and also the appropriate antenna factor for the cable loss. The total correction is automatically added to the measured value.

Radiated emission tests on frequencies above 1 GHz were performed with appropriate pre-amplifiers, antennas and a spectrum analyzer. At frequencies on which radiated emissions were found the level at the input of the pre-amplifier was reproduced by means of a RF signal generator. The output level of the signal generator was then increased with the antenna factor in order to obtain the actual field strength value for each individual frequency on which radiated emissions were found.

1.5 Test facility

The Federal Communications Commission has reviewed the technical characteristics of the test facilities at TNO Electronic Products & Services (EPS) B.V., located in Niekerk, 9822 TL Smidshornerweg 18, The Netherlands, and has found these test facilities to be in compliance with the requirements of 47 CFR Part 15, section 2.948, per October 23, 2000.

The description of the test facilities has been filed under registration number 90828 at the Office of the Federal Communications Commission. The facility has been added to the list of laboratories performing these test services for the public on a fee basis.

The list of all public test facilities is available on the Internet at <http://www.fcc.gov>.

1.6 Product labeling

In accordance with 47 CFR Part 15.19 (a)(3) the following text shall be placed on a label, which is attached to the EUT:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

In accordance with 47 CFR Part 2.925 (a)(1), the FCC ID shall be placed on a label, which is attached to the EUT.

For further details about the labeling requirements (size, legibility, etc.) as set by the Federal Communications Commission see 47 CFR Part 15.19 (a)(3), 47 CFR Part 15.19 (b)(2), 47 CFR Part 15.19 (b)(4), 47 CFR Part 2.925 and 47 CFR Part 2.926.



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1.7 System test configuration

1.7.1 Justification

The EUT was configured for testing in a typical fashion (as a customer would normally use it).

The justification and manipulation of cables and equipment in order to simulate a worst-case behavior of the test setup has been carried out as prescribed in ANSI C63.4: 1992.

Tests were performed at the lowest operating frequency (channel 1: 2412 MHz), the operating frequency in the middle of the specified frequency band (channel 6: 2437 MHz) and the highest operating frequency (channel 11: 2462 MHz). Further details may be found in table 2 below.

Channel	Operating frequencies (MHz)	Rated output power (dBm)	Test performed
1	2412	+18.0	yes
2	2417	+18.0	no
3	2422	+18.0	no
4	2427	+18.0	no
5	2432	+18.0	no
6	2437	+18.0	yes
7	2442	+18.0	no
8	2447	+18.0	no
9	2452	+18.0	no
10	2457	+18.0	no
11	2462	+18.0	yes

Table 2 - Specification of channels and rated maximum output power (excluding an antenna gain of 0 dBi).

The EUT was tested when mounted on a test fixture and while using the integral antenna (having a gain of 0 dBi) of the EUT. The test fixture enabled the EUT to function as intended and it was connected to a notebook computer by means of a shielded USB cable. The test fixture and EUT were powered from the DC supply voltage which is normally available from a USB port.

The purpose of testing the EUT when mounted on a test fixture is to prove that the EUT complies with the appropriate sections of the FCC Rules when tested in a stand-alone configuration.

1.7.2 EUT exercise software

The EUT could be enabled to transmit or receive continuously on channels 1 (2412 MHz), 6 (2437 MHz) and 11 (2462 MHz) by means of test software (installed on the notebook computer), which was supplied by the manufacturer of the EUT. Furthermore, the utilized test software also enables various transmission bit-rate settings in the range of 1 Mbit/s, 2 Mbit/s, 5.5 Mbit/s and 11 Mbit/s.

1.8 Special accessories

No special accessories are used and/or needed to achieve compliance with the appropriate sections of 47 CFR Part 15.



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Type:	WA1000
FCC ID:	IMRWA1000

1.9 Equipment modifications

No modifications have been made to the equipment in order to achieve compliance with the appropriate sections of 47 CFR Part 15.

1.10 Configuration of the tested system

Not applicable. See table 1 in section 1.3 of this test report.

1.11 Block diagram(s) of the EUT

The block diagram is available as part of the documentation which is to be submitted to the FCC/TCB.



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2 Radiated emission data

2.1 Test results with EUT operating in receive mode on channel 1

The results of the radiated emission tests, carried out in accordance with 47 CFR Part 15.109 and 47 CFR Part 15.209 with the EUT operating in receive mode on channel 1 (2412 MHz), are depicted in table 3.

Frequency (MHz)	Test results quasi peak (dB μ V/m)		Test results average (dB μ V/m)		Test results peak (dB μ V/m)		Resolution bandwidth (kHz)	Quasi peak limits (dB μ V/m)	Average limits (dB μ V/m)	Peak limits (dB μ V/m)
	V	H	V	H	V	H				
73.73	19.7	18.3	-	-	-	-	120	40.0	-	-
64.00	26.5	29.4	-	-	-	-	120	40.0	-	-
240.00	15.2	19.4	-	-	-	-	120	46.0	-	-
336.00	22.1	26.5	-	-	-	-	120	46.0	-	-
639.10	33.5	32.7	-	-	-	-	120	46.0	-	-
671.00	33.0	33.9	-	-	-	-	120	46.0	-	-
1194.00	-	-	n.t.	n.t.	41.0	37.8	1000	-	54.0	74.0
4824.00	-	-	n.t.	n.t.	41.8	36.4	1000	-	54.0	74.0
9648.00	-	-	n.t.	n.t.	35.4	34.0	1000	-	54.0	74.0

Table 3 - Test results with the EUT operating in receive mode on channel 1 (2412 MHz).

Note: Above 1 GHz, all measured values of the spurious emissions with the detector in peak mode, are below the applicable limits, which are valid when using an average detector. Therefore, all spurious emissions above 1 GHz have been measured with the peak detector only (n.t. = not tested).

Note: Field strength values of radiated emissions at frequencies not listed in table 3 are more than 20 dB below the applicable limit.

Test engineer

Signature

: 

Name

: Onno H. Hoekstra

Date

: May 21, 2002



Test specification(s): 47 CFR Part 15 (2001-12-18)
Description of EUT: 2.4 GHz low power WLAN MultiPort card
Manufacturer: Compaq Computer Corporation
Brand mark: Compaq
Type: WA1000
FCC ID: IMRWA1000

2.2 Test results with EUT operating in receive mode on channel 6

The results of the radiated emission tests, carried out in accordance with 47 CFR Part 15.109 and 47 CFR Part 15.209 with the EUT operating in receive mode on channel 6 (2437 MHz), are depicted in table 4.

Frequency (MHz)	Test results quasi peak (dBμV/m)		Test results average (dBμV/m)		Test results peak (dBμV/m)		Resolution bandwidth (kHz)	Quasi peak limits (dBμV/m)	Average limits (dBμV/m)	Peak limits (dBμV/m)
	V	H	V	H	V	H				
73.73	19.7	18.3	-	-	-	-	120	40.0	-	-
64.00	26.5	29.4	-	-	-	-	120	40.0	-	-
240.00	15.2	19.4	-	-	-	-	120	46.0	-	-
336.00	22.1	26.5	-	-	-	-	120	46.0	-	-
639.10	33.5	32.7	-	-	-	-	120	46.0	-	-
671.00	33.0	33.9	-	-	-	-	120	46.0	-	-
1194.00	-	-	n.t.	n.t.	41.0	37.5	1000	-	54.0	74.0
4874.00	-	-	n.t.	n.t.	42.5	33.3	1000	-	54.0	74.0
9748.00	-	-	n.t.	n.t.	36.7	34.0	1000	-	54.0	74.0

Table 4 - Test results with the EUT operating in receive mode on channel 6 (2437 MHz).

Note: Above 1 GHz, all measured values of the spurious emissions with the detector in peak mode, are below the applicable limits, which are valid when using an average detector. Therefore, all spurious emissions above 1 GHz have been measured with the peak detector only (n.t. = not tested).

Note: Field strength values of radiated emissions at frequencies not listed in table 4 are more than 20 dB below the applicable limit.

Test engineer

Signature : 

Name : Onno H. Hoekstra

Date : May 21, 2002



Test specification(s): 47 CFR Part 15 (2001-12-18)
Description of EUT: 2.4 GHz low power WLAN MultiPort card
Manufacturer: Compaq Computer Corporation
Brand mark: Compaq
Type: WA1000
FCC ID: IMRWA1000

2.3 Test results with EUT operating in receive mode on channel 11

The results of the radiated emission tests, carried out in accordance with 47 CFR Part 15.109 and 47 CFR Part 15.209 with the EUT operating in receive mode on channel 11 (2462 MHz), are depicted in table 5.

Frequency (MHz)	Test results quasi peak (dBµV/m)		Test results average (dBµV/m)		Test results peak (dBµV/m)		Resolution bandwidth (kHz)	Quasi peak limits (dBµV/m)	Average limits (dBµV/m)	Peak limits (dBµV/m)
	V	H	V	H	V	H				
73.73	19.7	18.3	-	-	-	-	120	40.0	-	-
64.00	26.5	29.4	-	-	-	-	120	40.0	-	-
240.00	15.2	19.4	-	-	-	-	120	46.0	-	-
336.00	22.1	26.5	-	-	-	-	120	46.0	-	-
639.10	33.5	32.7	-	-	-	-	120	46.0	-	-
671.00	33.0	33.9	-	-	-	-	120	46.0	-	-
1199.00	-	-	n.t.	n.t.	40.8	38.2	1000	-	54.0	74.0
4924.00	-	-	n.t.	n.t.	43.0	34.2	1000	-	54.0	74.0
9848.00	-	-	n.t.	n.t.	34.5	34.0	1000	-	54.0	74.0

Table 5 - Test results with the EUT operating in receive mode on channel 11 (2462 MHz).

Note: Above 1 GHz, all measured values of the spurious emissions with the detector in peak mode, are below the applicable limits, which are valid when using an average detector. Therefore, all spurious emissions above 1 GHz have been measured with the peak detector only (n.t. = not tested).

Note: Field strength values of radiated emissions at frequencies not listed in table 5 are more than 20 dB below the applicable limit.

Test engineer

Signature

: 

Name : Onno H. Hoekstra

Date : May 21, 2002



Test specification(s): 47 CFR Part 15 (2001-12-18)
 Description of EUT: 2.4 GHz low power WLAN MultiPort card
 Manufacturer: Compaq Computer Corporation
 Brand mark: Compaq
 Type: WA1000
 FCC ID: IMRWA1000

2.4 Test results with EUT operating in transmit mode on channel 1.

The results of the radiated emission tests, carried out in accordance with 47 CFR Part 15.109, 47 CFR Part 15.209 and 47 CFR Part 15.205 (restricted bands of operation) with the EUT operating in transmit mode on channel 1 (2412 MHz), are depicted in table 6.

Frequency (MHz)	Test results quasi peak (dB μ V/m)		Test results average (dB μ V/m)		Test results peak (dB μ V/m)		Resolution bandwidth (kHz)	Quasi peak limits (dB μ V/m)	Average limits (dB μ V/m)	Peak limits (dB μ V/m)
	V	H	V	H	V	H				
73.73	17.2	18.8	-	-	-	-	120	40.0	-	-
64.00	27.7	28.0	-	-	-	-	120	40.0	-	-
240.00	15.2	19.7	-	-	-	-	120	46.0	-	-
336.00	25.1	27.4	-	-	-	-	120	46.0	-	-
639.10	35.5	33.7	-	-	-	-	120	46.0	-	-
671.00	34.5	33.6	-	-	-	-	120	46.0	-	-
1066.00	-	-	n.t.	n.t.	40.6	34.6	1000	-	54.0	74.0
1194.00	-	-	n.t.	n.t.	40.4	36.7	1000	-	54.0	74.0
2002.00	-	-	n.t.	n.t.	41.3	34.0	1000	-	54.0	74.0
2330.00	-	-	30.0	30.0	49.1	47.0	1000	-	54.0	74.0
2562.00	-	-	30.0	30.0	50.4	49.3	1000	-	54.0	74.0
4824.00	-	-	47.0	44.0	47.2	44.0	1000	-	54.0	74.0
7236.00	-	-	n.t.	44.0	43.7	44.0	1000	-	54.0	74.0
9648.00	-	-	48.4	39.8	49.9	44.0	1000	-	54.0	74.0

Table 6 - Test results with the EUT operating in transmit mode on channel 1 (2412 MHz).

Note: Radiated emission tests have been performed with all possible transmission bit-rates (1 Mbit/s, 2 Mbit/s, 5.5 Mbit/s and 11 Mbit/s) in transmit mode. The highest values measured of the spurious emission components are reported by means of table 6.

Note: Above 1 GHz, most measured values of the spurious emissions with the detector in peak mode, are below the applicable limits, which are valid when using an average detector. Therefore, most spurious emissions above 1 GHz have been measured with the peak detector only (n.t. = not tested), unless otherwise noted.

Note: Field strength values of radiated emissions at frequencies not listed in table 6 are more than 20 dB below the applicable limit.

Test engineer

Signature :

Name : Onno H. Hoekstra

Date : May 21, 2002



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 Description of EUT: 2.4 GHz low power WLAN MultiPort card
 Manufacturer: Compaq Computer Corporation
 Brand mark: Compaq
 Type: WA1000
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2.5 Test results with EUT operating in transmit mode on channel 6.

The results of the radiated emission tests, carried out in accordance with 47 CFR Part 15.109, 47 CFR Part 15.209 and 47 CFR Part 15.205 (restricted bands of operation) with the EUT operating in transmit mode on channel 6 (2437 MHz), are depicted in table 7.

Frequency (MHz)	Test results quasi peak (dB μ V/m)		Test results average (dB μ V/m)		Test results peak (dB μ V/m)		Resolution bandwidth (kHz)	Quasi peak limits (dB μ V/m)	Average limits (dB μ V/m)	Peak limits (dB μ V/m)
	V	H	V	H	V	H				
73.73	17.2	18.8	-	-	-	-	120	40.0	-	-
64.00	27.7	28.0	-	-	-	-	120	40.0	-	-
240.00	15.2	19.7	-	-	-	-	120	46.0	-	-
336.00	25.1	27.4	-	-	-	-	120	46.0	-	-
639.10	35.5	33.7	-	-	-	-	120	46.0	-	-
671.00	34.5	33.6	-	-	-	-	120	46.0	-	-
1066.00	-	-	n.t.	n.t.	39.2	35.1	1000	-	54.0	74.0
1194.00	-	-	n.t.	n.t.	40.2	37.3	1000	-	54.0	74.0
2339.00	-	-	30.0	30.0	49.5	46.4	1000	-	54.0	74.0
2567.00	-	-	30.0	30.0	49.8	49.9	1000	-	54.0	74.0
4874.00	-	-	44.1	n.t.	45.4	44.0	1000	-	54.0	74.0
7311.00	-	-	n.t.	n.t.	43.0	44.0	1000	-	54.0	74.0
9748.00	-	-	48.7	39.2	50.5	44.0	1000	-	54.0	74.0


Table 7 - Test results with the EUT operating in transmit mode on channel 6 (2437 MHz).

Note: Radiated emission tests have been performed with all possible transmission bit-rates (1 Mbit/s, 2 Mbit/s, 5.5 Mbit/s and 11 Mbit/s) in transmit mode. The highest values measured of the spurious emission components are reported by means of table 7.

Note: Above 1 GHz, most measured values of the spurious emissions with the detector in peak mode, are below the applicable limits, which are valid when using an average detector. Therefore, most spurious emissions above 1 GHz have been measured with the peak detector only (n.t. = not tested), unless otherwise noted.

Note: Field strength values of radiated emissions at frequencies not listed in table 7 are more than 20 dB below the applicable limit.

Test engineer

Signature : 

Name : Onno H. Hoekstra

Date : May 21, 2002



Test specification(s): 47 CFR Part 15 (2001-12-18)
 Description of EUT: 2.4 GHz low power WLAN MultiPort card
 Manufacturer: Compaq Computer Corporation
 Brand mark: Compaq
 Type: WA1000
 FCC ID: IMRWA1000

2.6 Test results with EUT operating in transmit mode on channel 11.

The results of the radiated emission tests, carried out in accordance with 47 CFR Part 15.109, 47 CFR Part 15.209 and 47 CFR Part 15.205 (restricted bands of operation) with the EUT operating in transmit mode on channel 11 (2462 MHz), are depicted in table 8.

Frequency (MHz)	Test results quasi peak (dBμV/m)		Test results average (dBμV/m)		Test results peak (dBμV/m)		Resolution bandwidth (kHz)	Quasi peak limits (dBμV/m)	Average limits (dBμV/m)	Peak limits (dBμV/m)
	V	H	V	H	V	H				
73.73	17.2	18.8	-	-	-	-	120	40.0	-	-
64.00	27.7	28.0	-	-	-	-	120	40.0	-	-
240.00	15.2	19.7	-	-	-	-	120	46.0	-	-
336.00	25.1	27.4	-	-	-	-	120	46.0	-	-
639.10	35.5	33.7	-	-	-	-	120	46.0	-	-
671.00	34.5	33.6	-	-	-	-	120	46.0	-	-
1066.00	-	-	n.t.	n.t.	40.0	35.0	1000	-	54.0	74.0
1194.00	-	-	n.t.	n.t.	39.3	36.5	1000	-	54.0	74.0
2339.00	-	-	30.0	30.0	49.4	45.4	1000	-	54.0	74.0
2562.00	-	-	30.0	30.0	49.7	49.9	1000	-	54.0	74.0
4924.00	-	-	45.1	n.t.	46.5	44.0	1000	-	54.0	74.0
7386.00	-	-	n.t.	n.t.	44.4	44.0	1000	-	54.0	74.0
9848.00	-	-	50.4	41.8	52.9	44.0	1000	-	54.0	74.0

Table 8 - Test results with the EUT operating in transmit mode on channel 11 (2462 MHz).

Note: Radiated emission tests have been performed with all possible transmission bit-rates (1 Mbit/s, 2 Mbit/s, 5.5 Mbit/s and 11 Mbit/s) in transmit mode. The highest values measured of the spurious emission components are reported by means of table 8.

Note: Above 1 GHz, most measured values of the spurious emissions with the detector in peak mode, are below the applicable limits, which are valid when using an average detector. Therefore, most spurious emissions above 1 GHz have been measured with the peak detector only (n.t. = not tested), unless otherwise noted.

Note: Field strength values of radiated emissions at frequencies not listed in table 8 are more than 20 dB below the applicable limit.

Test engineer

Signature :

Name : Onno H. Hoekstra

Date : May 21, 2002



Test specification(s): 47 CFR Part 15 (2001-12-18)
Description of EUT: 2.4 GHz low power WLAN MultiPort card
Manufacturer: Compaq Computer Corporation
Brand mark: Compaq
Type: WA1000
FCC ID: IMRWA1000

3 Conducted emission data

3.1 Emission in restricted bands nearest to the band 2400 - 2483.5 MHz

The results of the conducted emission tests, carried out in accordance with 47 CFR Part 15.205 (restricted bands of operation, with the emphasis on the emission in restricted bands nearest to the band 2400-2483.5 MHz) with the EUT operating in transmit mode, are depicted in table 9.

Frequency (MHz)	Test results quasi peak (dBμV/m)	Test results average (dBμV/m)	Test results peak (dBμV/m)	Resolution bandwidth (kHz)	Quasi peak limits (dBμV/m)	Average limits (dBμV/m)	Peak limits (dBμV/m)
2386.20	-	39.3	n.a.	1000	-	54.0	74.0
2388.60	-	n.a.	54.3	1000	-	54.0	74.0
2483.50	-	39.6	n.a.	1000	-	54.0	74.0
2484.10	-	n.a.	54.2	1000	-	54.0	74.0

Table 9 - Test results with the EUT operating in transmit mode.

Note: Conducted emission tests have been performed with all possible transmission bit-rates (1 Mbit/s, 2 Mbit/s, 5.5 Mbit/s and 11 Mbit/s) in transmit mode. The highest values measured of the spurious emission components are reported by means of table 9.

Note: Field strength values of conducted emissions at frequencies not listed in table 9 are more than 20 dB below the applicable limit.

Test engineer

Signature : 

Name : Onno H. Hoekstra

Date : May 21, 2002



Test specification(s): 47 CFR Part 15 (2001-12-18)
Description of EUT: 2.4 GHz low power WLAN MultiPort card
Manufacturer: Compaq Computer Corporation
Brand mark: Compaq
Type: WA1000
FCC ID: IMRWA1000

4 Test results of measurements in conformity with 47 CFR Part 15.247

4.1 Minimum 6 dB bandwidth

The results of tests on the EUT, carried out in accordance with 47 CFR Part 15.247 (a)(2), are depicted in table 10.

Transmission bitrate (Mbit/s)	Minimum 6 dB bandwidth (kHz)			Limit (kHz)
	Channel 1 (2412 MHz)	Channel 6 (2437 MHz)	Channel 11 (2462 MHz)	
1	10200	11100	11180	>500
2	11100	10280	10200	>500
5.5	11700	11250	11330	>500
11	10580	11100	10350	>500

Table 10 - Minimum 6 dB bandwidth.

Test engineer

Signature : 

Name : Onno H. Hoekstra

Date : May 21, 2002



Test specification(s): 47 CFR Part 15 (2001-12-18)
Description of EUT: 2.4 GHz low power WLAN MultiPort card
Manufacturer: Compaq Computer Corporation
Brand mark: Compaq
Type: WA1000
FCC ID: IMRWA1000

4.2 Maximum peak output power


The results of tests on the EUT, carried out in accordance with 47 CFR Part 15.247 (b)(1), are depicted in table 11.

Transmission bitrate (Mbit/s)	Maximum peak output power (dBm)			Limit (dBm) Antenna gain < 6 dBi
	Channel 1 (2412 MHz)	Channel 6 (2437 MHz)	Channel 11 (2462 MHz)	
1	18.2	18.0	18.1	30.0
2	18.2	18.0	18.1	30.0
5.5	17.6	17.5	17.6	30.0
11	18.1	17.8	18.0	30.0

Table 11 - Maximum peak output power.

Note: During the measurements, the DC supply voltage of the test fixture on which the EUT was mounted was varied between 85% and 115% of the nominal value. The maximum measured values are depicted in table 11. No differences in measurement results, due to the DC supply voltage variations between 85% and 115% from the nominal value, have been observed. As the antenna gain does not exceed 6 dBi, no reduction of the maximum peak output power is required.

Test engineer

Signature : 

Name : Onno H. Hoekstra

Date : May 21, 2002



Test specification(s): 47 CFR Part 15 (2001-12-18)
Description of EUT: 2.4 GHz low power WLAN MultiPort card
Manufacturer: Compaq Computer Corporation
Brand mark: Compaq
Type: WA1000
FCC ID: IMRWA1000

4.3 Radiated emission data outside restricted bands

The results of tests on the EUT, carried out in accordance with 47 CFR Part 15.247 (c), are depicted in table 12.


Radiated emission data outside restricted bands in a 100 kHz bandwidth shall be at least 20 dB below the highest level in a 100 kHz bandwidth within the band.

Frequency (MHz)	Level below working channel based on field strength (dB)	Limit (dB)
2399.60	-33.4	< -20.0
all frequencies	<40.0	< -20.0

Table 12 - Radiated emission data outside restricted bands.

Note: Worst case measurement values for transmissions with all possible transmission bit-rates (1 Mbit/s, 2 Mbit/s, 5.5 Mbit/s and 11 Mbit/s) and channel 1 (2412 MHz), channel 6 (2437 MHz) and channel 11 (2462 MHz) combinations.

Test engineer

Signature : 

Name : Onno H. Hoekstra

Date : May 21, 2002



Test specification(s): 47 CFR Part 15 (2001-12-18)
Description of EUT: 2.4 GHz low power WLAN MultiPort card
Manufacturer: Compaq Computer Corporation
Brand mark: Compaq
Type: WA1000
FCC ID: IMRWA1000

4.4 Conducted emission data outside restricted bands

The results of tests on the EUT, carried out in accordance with 47 CFR Part 15.247 (c), are depicted in table 13.

Conducted emission data outside restricted bands in a 100 kHz bandwidth shall be at least 20 dB below the highest level in a 100 kHz bandwidth within the band.

Frequency (MHz)	Level below working channel based on field strength (dB)	Limit (dB)
2399.60	-33.4	< -20.0
other frequencies	< -40.0	< -20.0

Table 13 - Conducted emission data outside restricted bands.

Note: Worst case measurement values for transmissions with all possible transmission bit-rates (1 Mbit/s, 2 Mbit/s, 5.5 Mbit/s and 11 Mbit/s) and channel 1 (2412 MHz), channel 6 (2437 MHz) and channel 11 (2462 MHz) combinations.

Test engineer

Signature : 

Name : Onno H. Hoekstra

Date : May 21, 2002



Test specification(s): 47 CFR Part 15 (2001-12-18)
Description of EUT: 2.4 GHz low power WLAN MultiPort card
Manufacturer: Compaq Computer Corporation
Brand mark: Compaq
Type: WA1000
FCC ID: IMRWA1000


4.5 Peak power spectral density

The results of the tests on the EUT, carried out in accordance with 47 CFR Part 15.247 (d), are depicted in table 14.

Transmission bitrate (Mbit/s)	Peak power spectral density (conducted) in any 3 kHz band (dBm)			Limit (dBm)
	Channel 1 (2412 MHz)	Channel 6 (2437 MHz)	Channel 11 (2462 MHz)	
1	-10.3	-10.3	-10.2	<8.0
2	-10.3	-10.4	-10.4	<8.0
5.5	-9.9	-10.8	-11.0	<8.0
11	-8.6	-8.6	-8.6	<8.0

Table 14 - Peak power spectral density.

Test engineer

Signature : 

Name : Onno H. Hoekstra

Date : May 21, 2002



Test specification(s): 47 CFR Part 15 (2001-12-18)
Description of EUT: 2.4 GHz low power WLAN MultiPort card
Manufacturer: Compaq Computer Corporation
Brand mark: Compaq
Type: WA1000
FCC ID: IMRWA1000

5 Plots of measurement data

For reference purposes and visualization of spectrum analyzer settings during the measurements, a selection of plots of measurement data is included in this test report.

Test engineer

Signature

: 

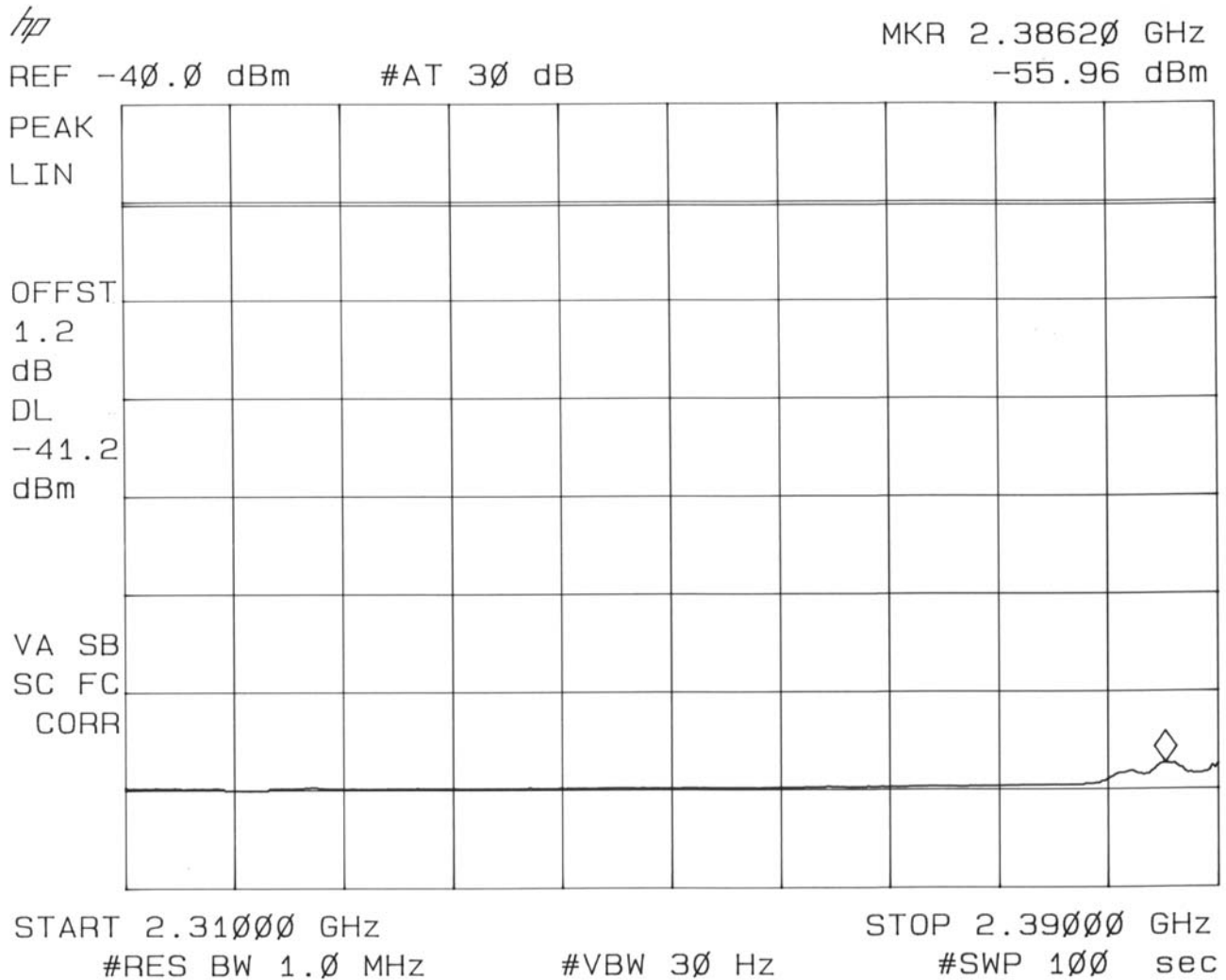
Name

: Onno H. Hoekstra

Date

: May 21, 2002

5.1 Emission in restricted bands nearest to the band 2400 - 2483.5 MHz



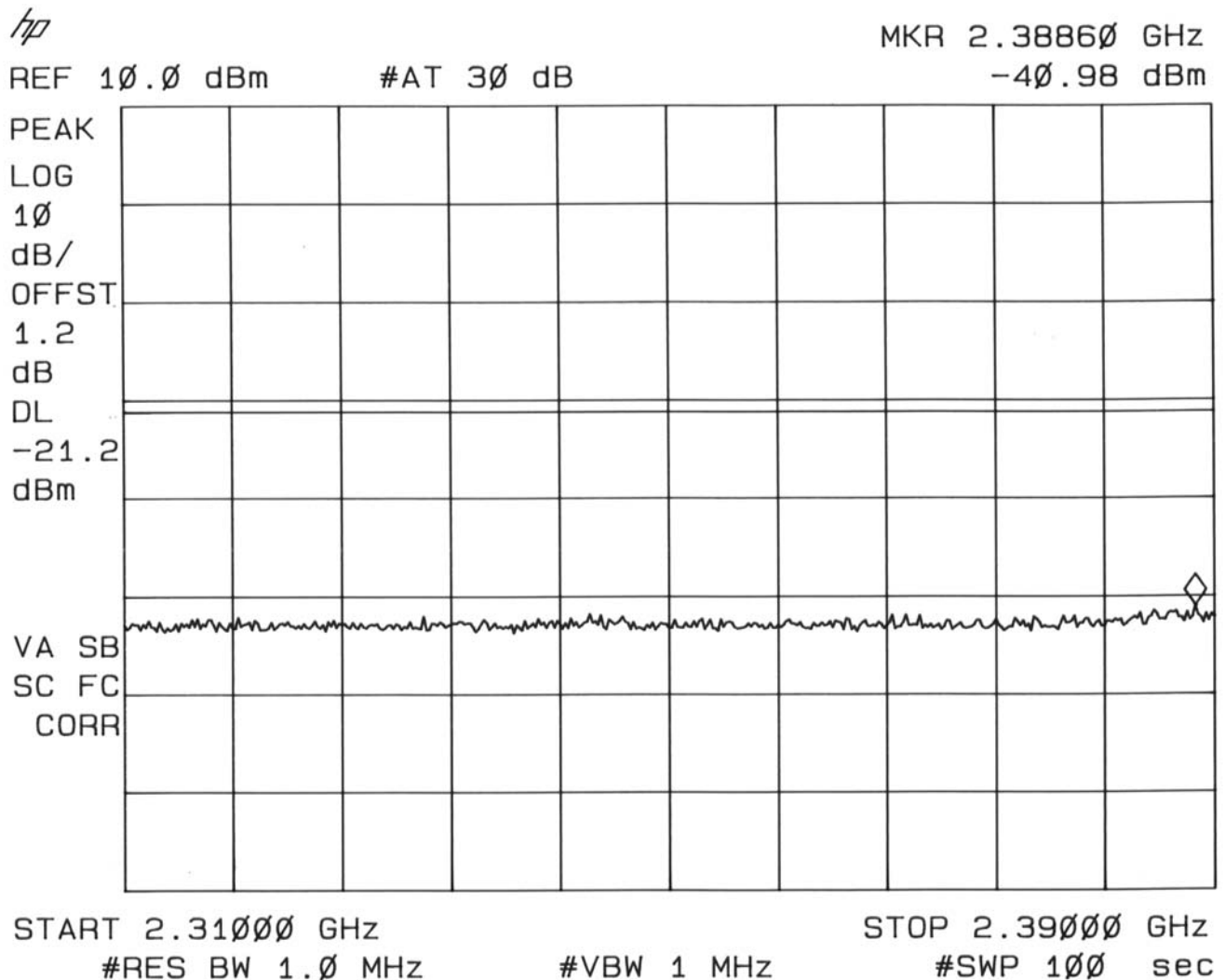
Plot 1 - Average measurement values in restricted band 2310 - 2390 MHz.

Average measurement values in restricted band. All possible transmission bit-rates (1 Mbit/s, 2 Mbit/s, 5.5 Mbit/s and 11 Mbit/s), conducted measurement, corrected for 0 dBi antenna gain (including antenna cable losses) and 1.2 dB cable losses (measurement cable)

Note: 54 dBμV/m :: -41.2 dBm display line setting.



Test specification(s): 47 CFR Part 15 (2001-12-18)
Description of EUT: 2.4 GHz low power WLAN MultiPort card
Manufacturer: Compaq Computer Corporation
Brand mark: Compaq
Type: WA1000
FCC ID: IMRWA1000



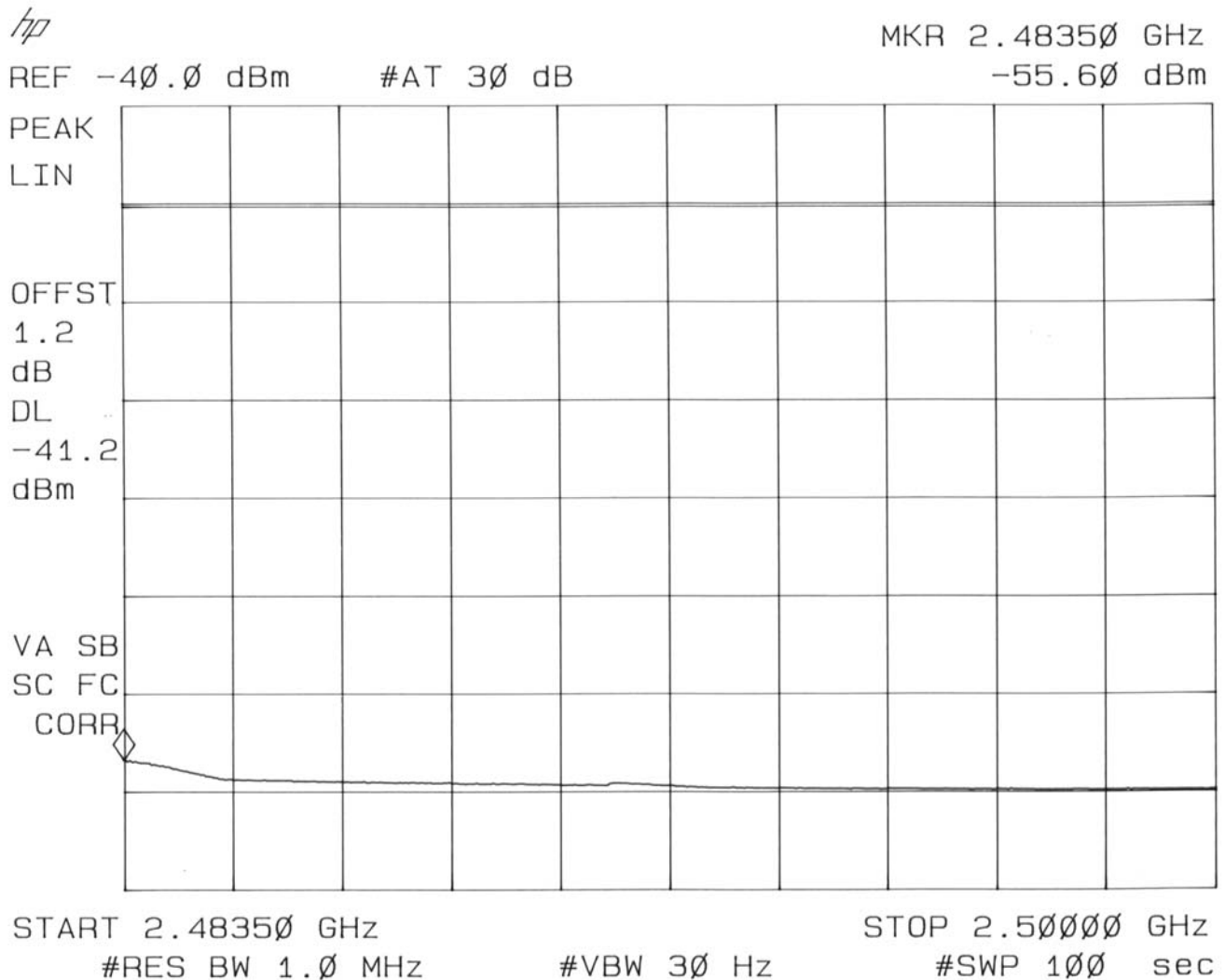
Plot 2 - Peak measurement values in restricted band 2310 - 2390 MHz.

Peak measurement values in restricted band. All possible transmission bit-rates (1 Mbit/s, 2 Mbit/s, 5.5 Mbit/s and 11 Mbit/s), conducted measurement, corrected for 0 dBi antenna gain (including antenna cable losses) and 1.2 dB cable losses (measurement cable).

Note: 74 dB μ V/m :: -21.2 dBm display line setting.



Test specification(s): 47 CFR Part 15 (2001-12-18)
Description of EUT: 2.4 GHz low power WLAN MultiPort card
Manufacturer: Compaq Computer Corporation
Brand mark: Compaq
Type: WA1000
FCC ID: IMRWA1000



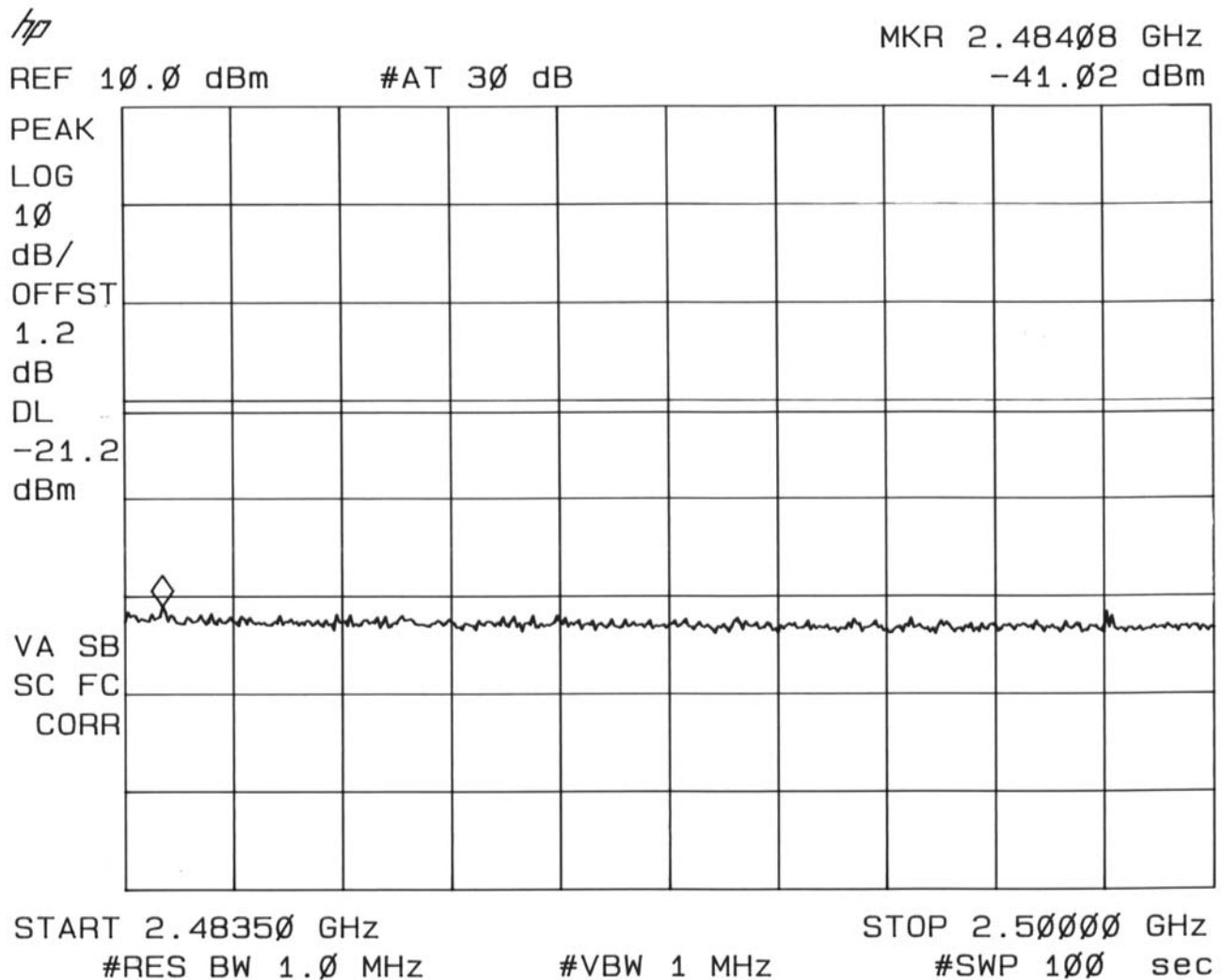
Plot 3 - Average measurement values in restricted band 2483.5 - 2500 MHz.

Average measurement values in restricted band. All possible transmission bit-rates (1 Mbit/s, 2 Mbit/s, 5.5 Mbit/s and 11 Mbit/s), conducted measurement, corrected for 0 dBi antenna gain (including antenna cable losses) and 1.2 dB cable losses (measurement cable).

Note: 54 dBμV/m :: -41.2 dBm display line setting.



Test specification(s): 47 CFR Part 15 (2001-12-18)
Description of EUT: 2.4 GHz low power WLAN MultiPort card
Manufacturer: Compaq Computer Corporation
Brand mark: Compaq
Type: WA1000
FCC ID: IMRWA1000



Plot 4 - Peak measurement values in restricted band 2483.5 - 2500 MHz.

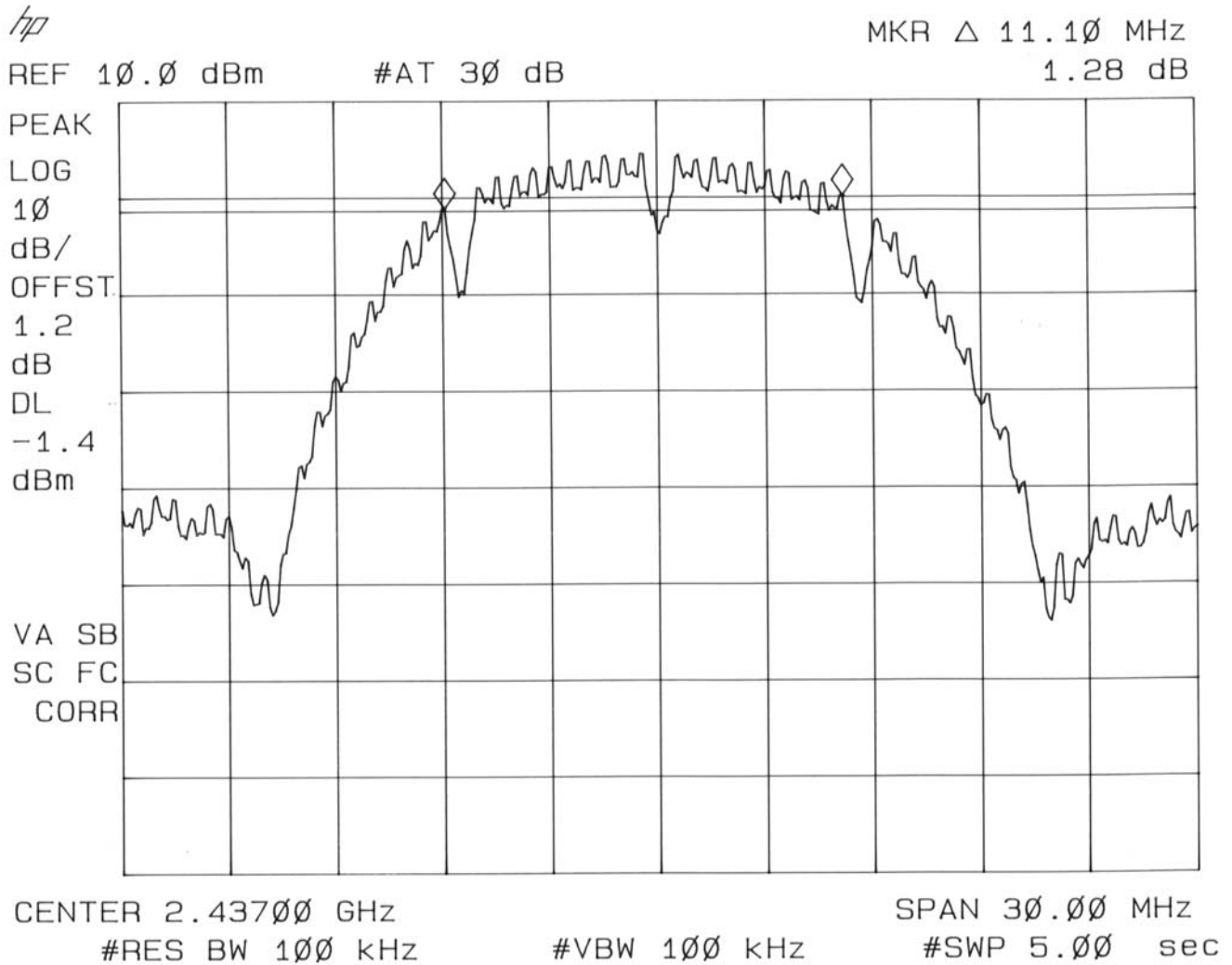
Peak measurement values in restricted band. All possible transmission bit-rates (1 Mbit/s, 2 Mbit/s, 5.5 Mbit/s and 11 Mbit/s), conducted measurement, corrected for 0 dBi antenna gain (including antenna cable losses) and 1.2 dB cable losses (measurement cable).

Note: 74 dBμV/m :: -21.2 dBm display line setting.



Test specification(s): 47 CFR Part 15 (2001-12-18)
Description of EUT: 2.4 GHz low power WLAN MultiPort card
Manufacturer: Compaq Computer Corporation
Brand mark: Compaq
Type: WA1000
FCC ID: IMRWA1000

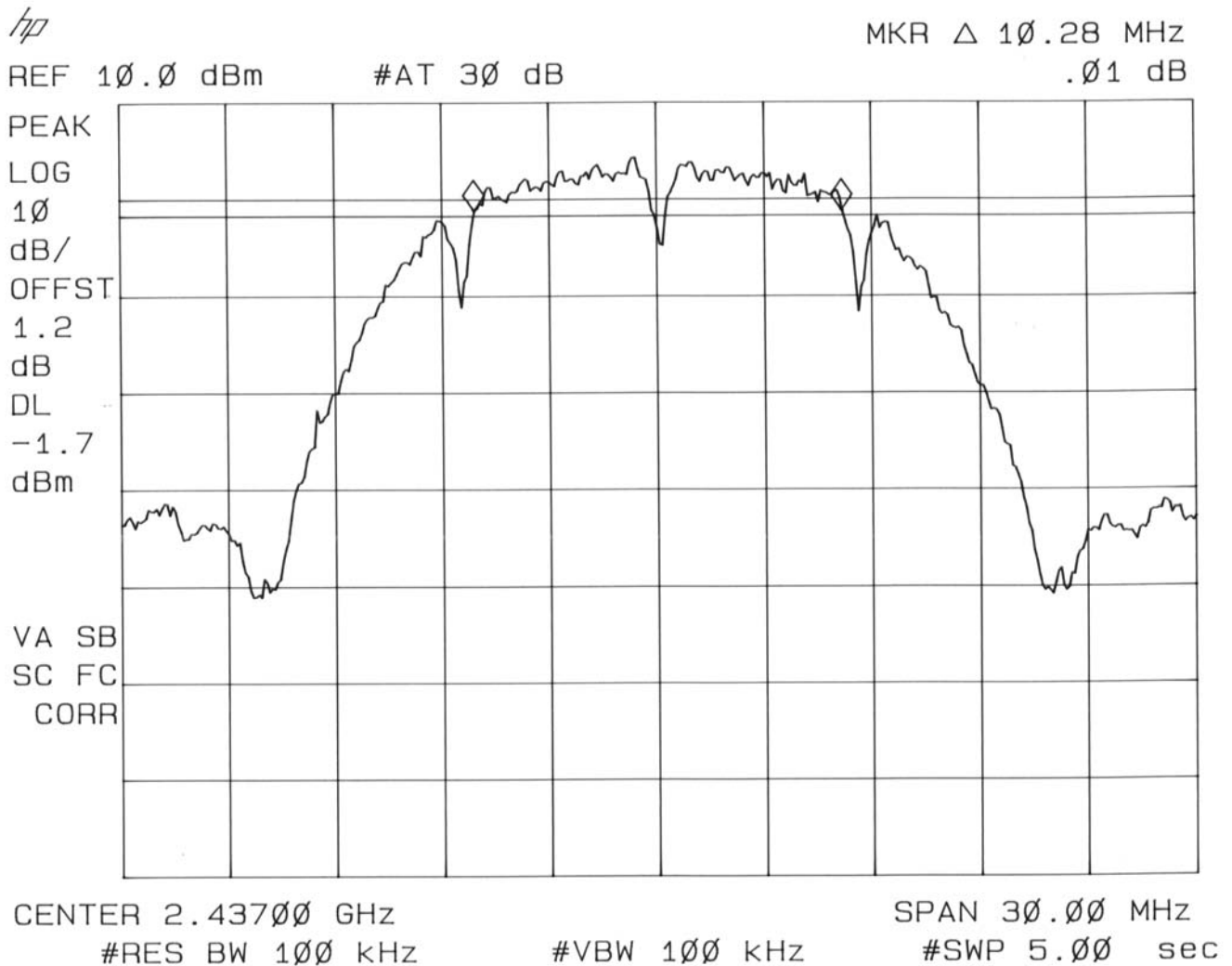
5.2 Minimum 6 dB bandwidth



Plot 5 - Minimum 6 dB bandwidth at a transmission bit-rate of 1 Mbit/s.



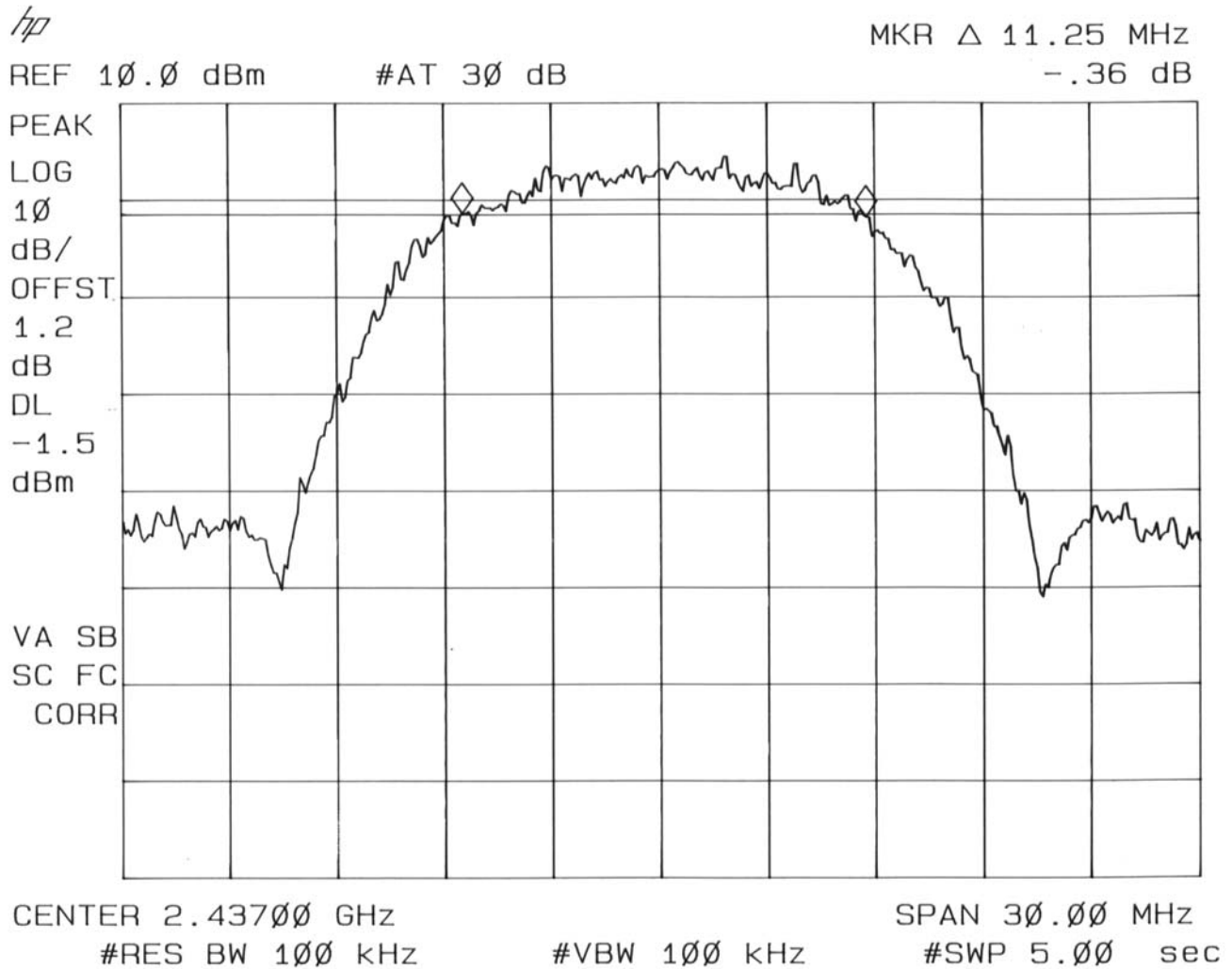
Test specification(s): 47 CFR Part 15 (2001-12-18)
Description of EUT: 2.4 GHz low power WLAN MultiPort card
Manufacturer: Compaq Computer Corporation
Brand mark: Compaq
Type: WA1000
FCC ID: IMRWA1000



Plot 6 - Minimum 6 dB bandwidth at a transmission bit-rate of 2 Mbit/s.



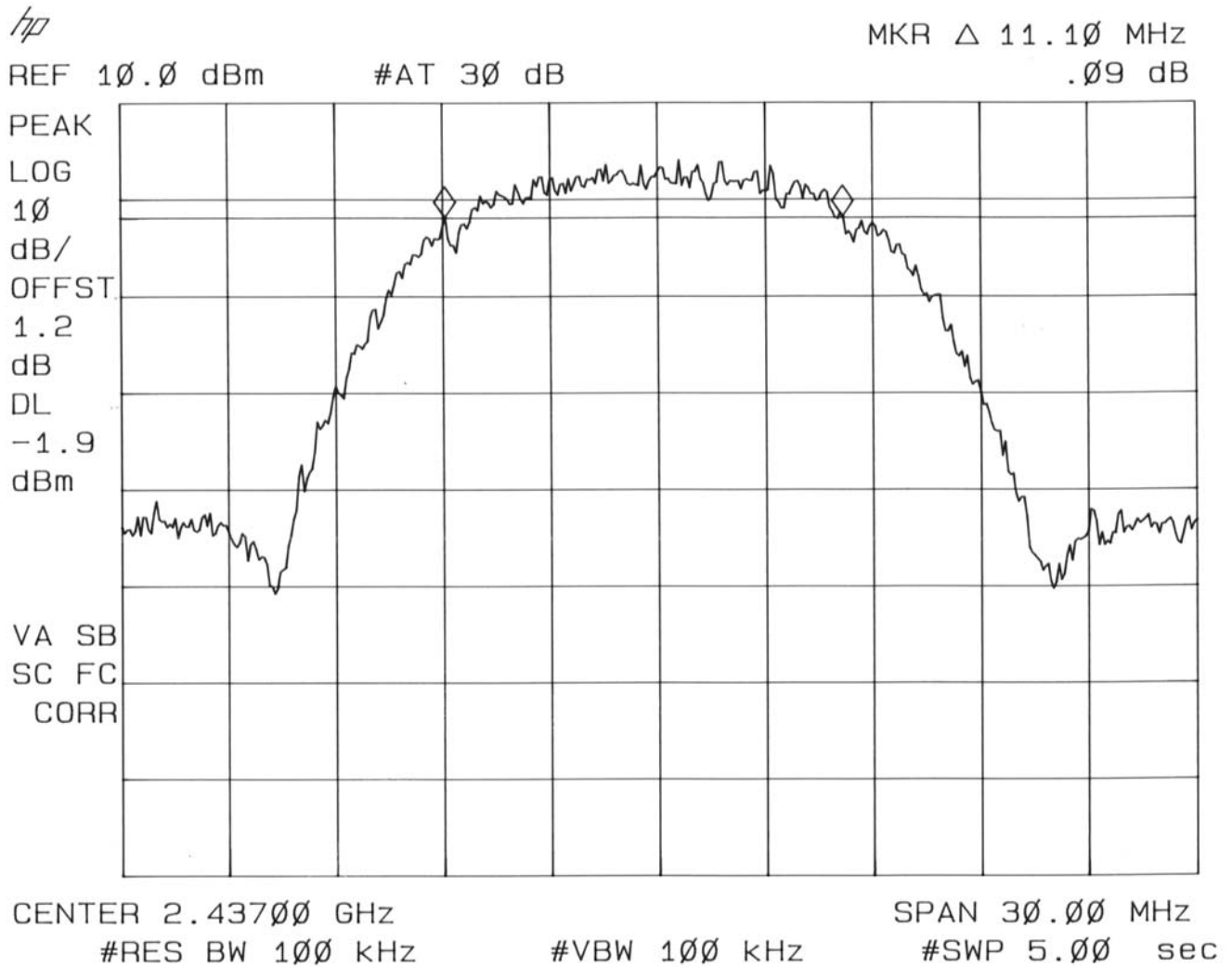
Test specification(s): 47 CFR Part 15 (2001-12-18)
Description of EUT: 2.4 GHz low power WLAN MultiPort card
Manufacturer: Compaq Computer Corporation
Brand mark: Compaq
Type: WA1000
FCC ID: IMRWA1000



Plot 7 - Minimum 6 dB bandwidth at a transmission bit-rate of 5.5 Mbit/s.



Test specification(s): 47 CFR Part 15 (2001-12-18)
Description of EUT: 2.4 GHz low power WLAN MultiPort card
Manufacturer: Compaq Computer Corporation
Brand mark: Compaq
Type: WA1000
FCC ID: IMRWA1000

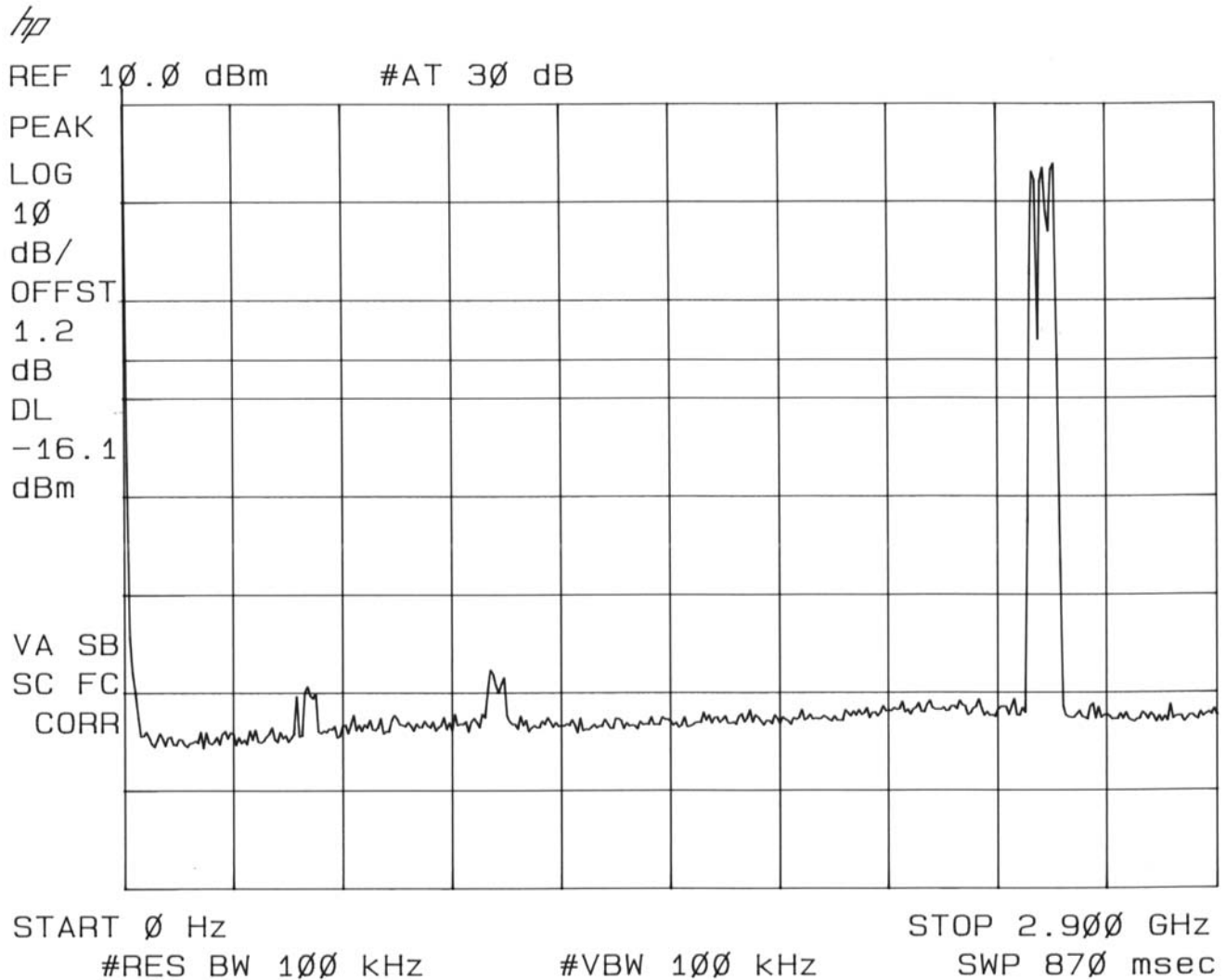


Plot 8 - Minimum 6 dB bandwidth at a transmission bit-rate of 11 Mbit/s.



Test specification(s): 47 CFR Part 15 (2001-12-18)
Description of EUT: 2.4 GHz low power WLAN MultiPort card
Manufacturer: Compaq Computer Corporation
Brand mark: Compaq
Type: WA1000
FCC ID: IMRWA1000

5.3 Conducted emission data outside restricted bands

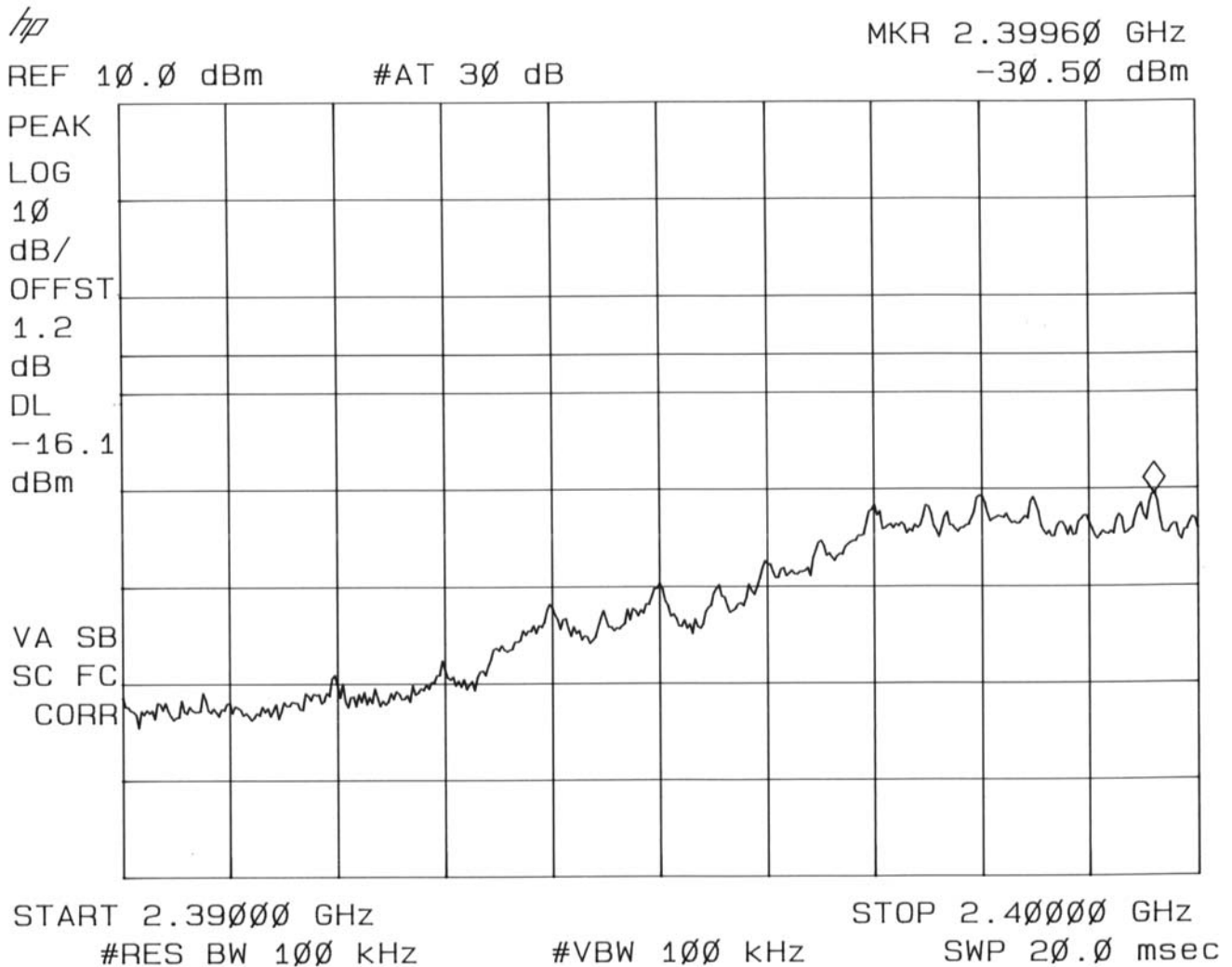


Plot 9 - Conducted emission outside restricted bands.

Conducted emission data outside restricted bands in a 100 kHz bandwidth shall be at least 20 dB below the highest level in a 100 kHz bandwidth within the band. Display line :: -20 dB limit line. Corrected (offset) for cable losses.



Test specification(s): 47 CFR Part 15 (2001-12-18)
Description of EUT: 2.4 GHz low power WLAN MultiPort card
Manufacturer: Compaq Computer Corporation
Brand mark: Compaq
Type: WA1000
FCC ID: IMRWA1000

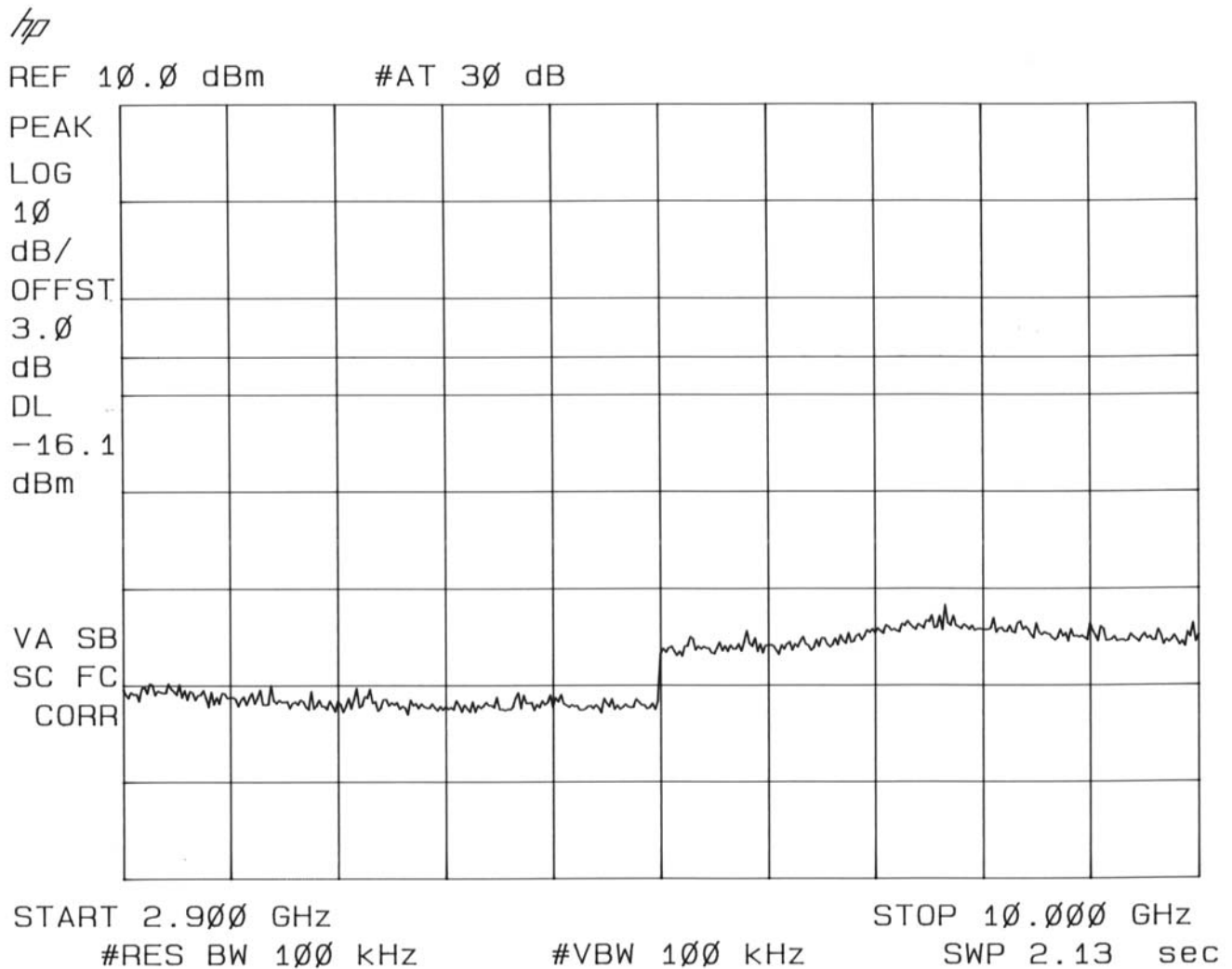


Plot 10 - Conducted emission outside restricted bands.

Conducted emission data outside restricted bands in a 100 kHz bandwidth shall be at least 20 dB below the highest level in a 100 kHz bandwidth within the band. Display line :: -20 dB limit line. Corrected (offset) for cable losses.



Test specification(s): 47 CFR Part 15 (2001-12-18)
Description of EUT: 2.4 GHz low power WLAN MultiPort card
Manufacturer: Compaq Computer Corporation
Brand mark: Compaq
Type: WA1000
FCC ID: IMRWA1000

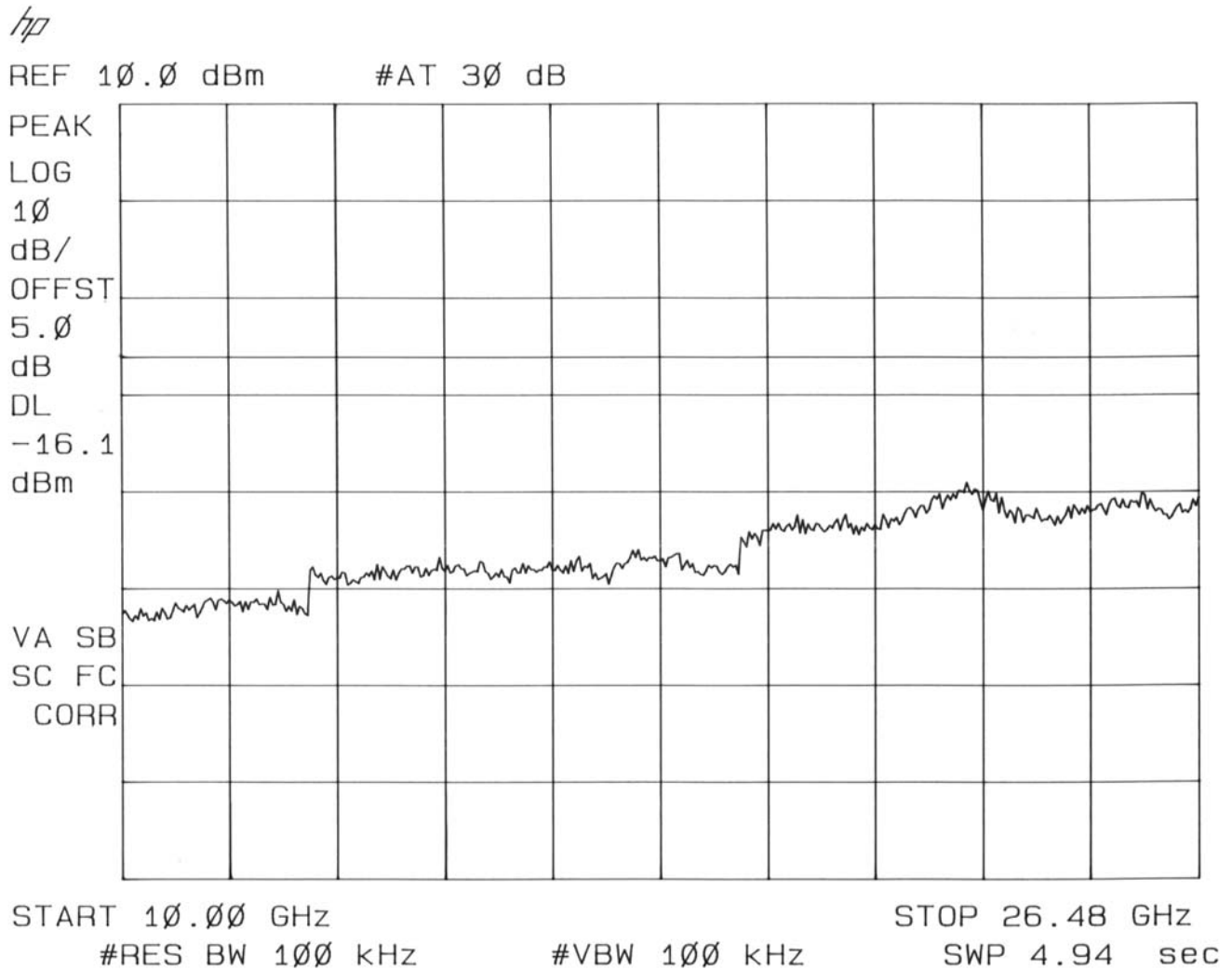


Plot 11 - Conducted emission outside restricted band.

Conducted emission data outside restricted bands in a 100 kHz bandwidth shall be at least 20 dB below the highest level in a 100 kHz bandwidth within the band. Display line :: -20 dB limit line. Corrected (offset) for cable losses.



Test specification(s): 47 CFR Part 15 (2001-12-18)
Description of EUT: 2.4 GHz low power WLAN MultiPort card
Manufacturer: Compaq Computer Corporation
Brand mark: Compaq
Type: WA1000
FCC ID: IMRWA1000



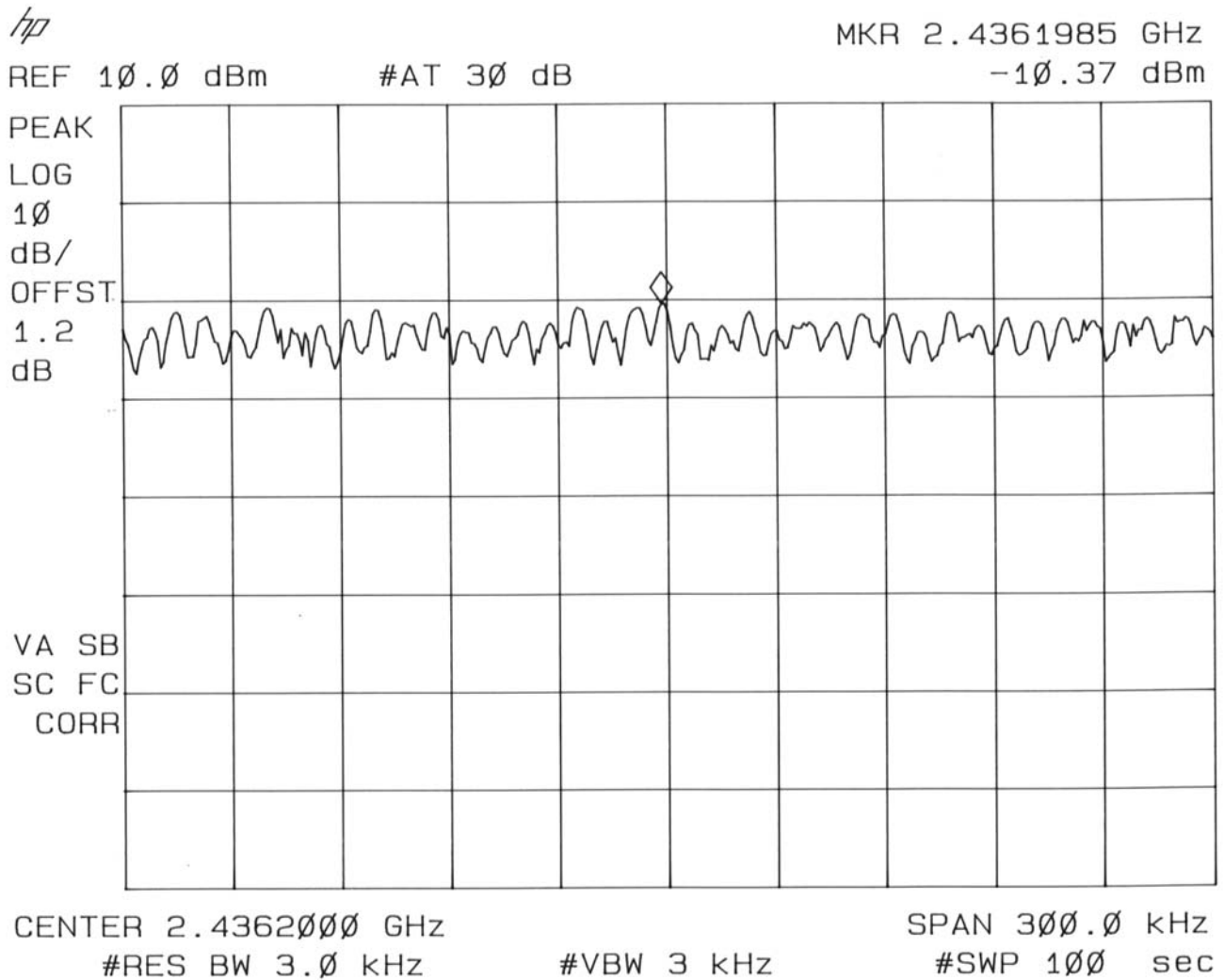
Plot 12 - Conducted emission outside restricted band.

Conducted emission data outside restricted bands in a 100 kHz bandwidth shall be at least 20 dB below the highest level in a 100 kHz bandwidth within the band. Display line :: -20 dB limit line. Corrected (offset) for cable losses.



Test specification(s): 47 CFR Part 15 (2001-12-18)
Description of EUT: 2.4 GHz low power WLAN MultiPort card
Manufacturer: Compaq Computer Corporation
Brand mark: Compaq
Type: WA1000
FCC ID: IMRWA1000

5.4 Peak power spectral density

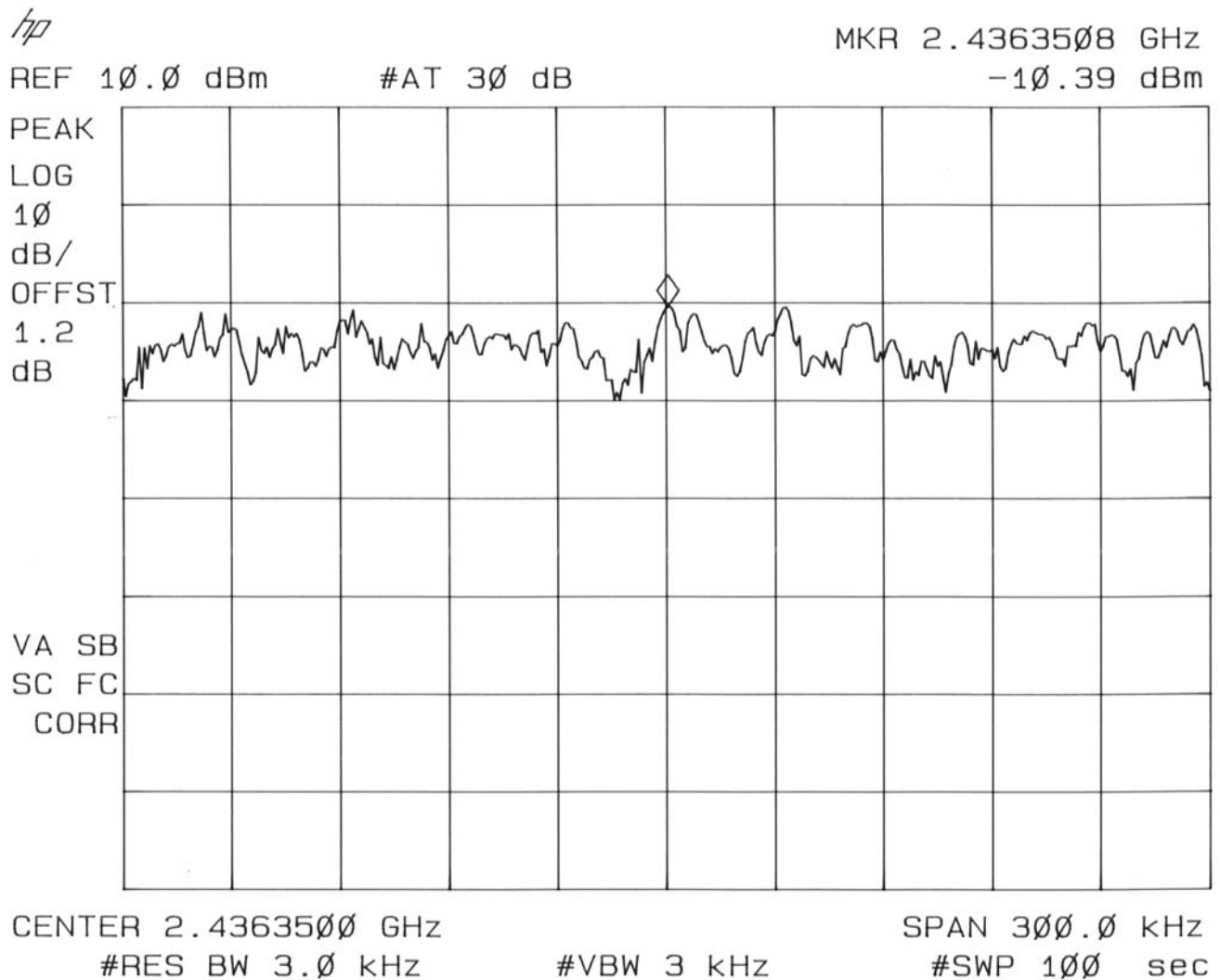


Plot 13 - Peak power spectral density (conducted) from the intentional radiator in any 3 kHz band.

Peak power spectral density (conducted) in a 3 kHz bandwidth at a transmission bit-rate of 1 Mbit/s. Corrected (offset) for cable losses.



Test specification(s): 47 CFR Part 15 (2001-12-18)
Description of EUT: 2.4 GHz low power WLAN MultiPort card
Manufacturer: Compaq Computer Corporation
Brand mark: Compaq
Type: WA1000
FCC ID: IMRWA1000

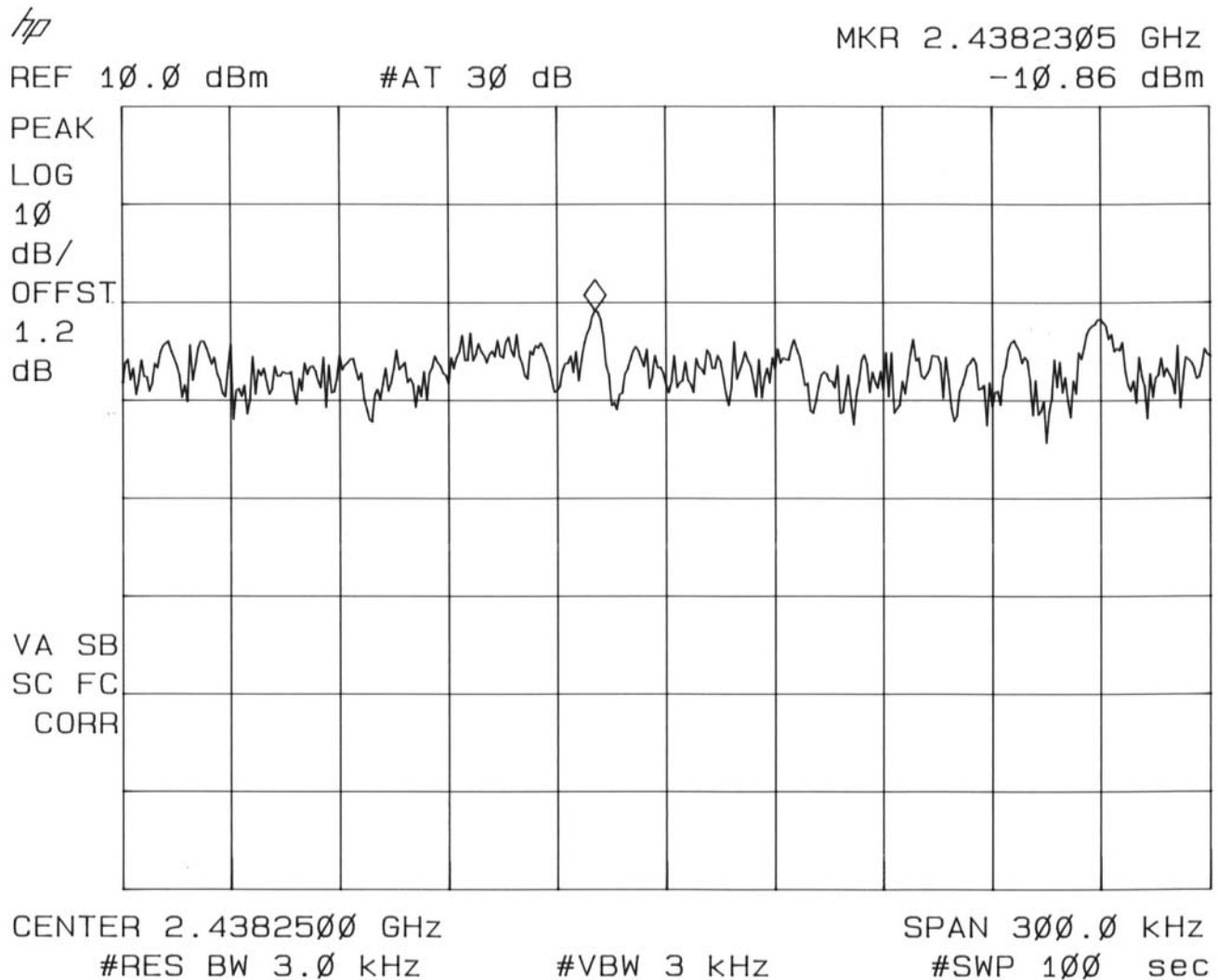


Plot 14 - Peak power spectral density (conducted) from the intentional radiator in any 3 kHz band.

Peak power spectral density (conducted) in a 3 kHz bandwidth at a transmission bit-rate of 2 Mbit/s. Corrected (offset) for cable losses.



Test specification(s): 47 CFR Part 15 (2001-12-18)
Description of EUT: 2.4 GHz low power WLAN MultiPort card
Manufacturer: Compaq Computer Corporation
Brand mark: Compaq
Type: WA1000
FCC ID: IMRWA1000

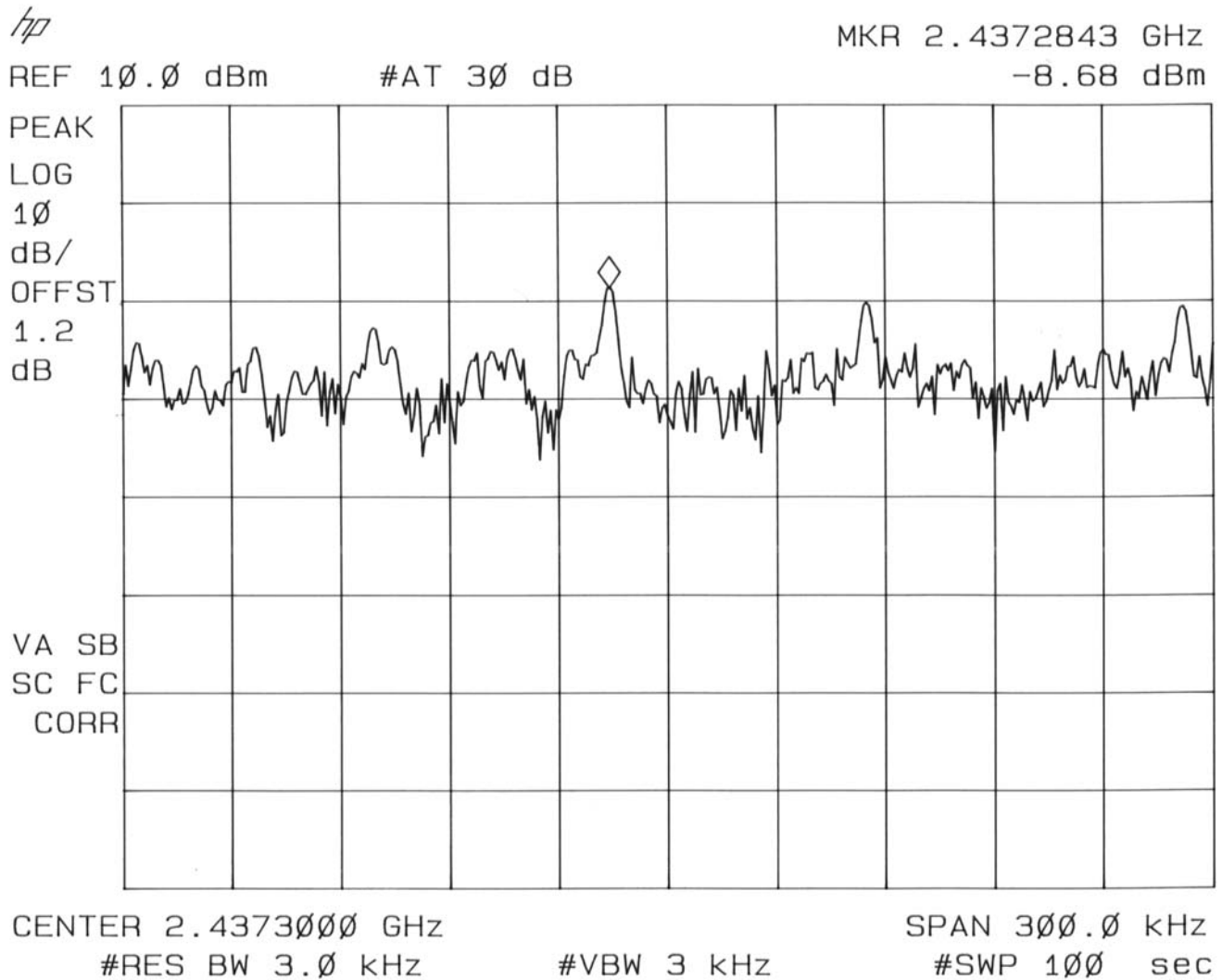


Plot 15 - Peak power spectral density (conducted) from the intentional radiator in any 3 kHz band.

Peak power spectral density (conducted) in a 3 kHz bandwidth at a transmission bit-rate of 5.5 Mbit/s. Corrected (offset) for cable losses.



Test specification(s): 47 CFR Part 15 (2001-12-18)
Description of EUT: 2.4 GHz low power WLAN MultiPort card
Manufacturer: Compaq Computer Corporation
Brand mark: Compaq
Type: WA1000
FCC ID: IMRWA1000



Plot 16 - Peak power spectral density (conducted) from the intentional radiator in any 3 kHz band.

Peak power spectral density (conducted) in a 3 kHz bandwidth at a transmission bit-rate of 11 Mbit/s. Corrected (offset) for cable losses.



Test specification(s): 47 CFR Part 15 (2001-12-18)
Description of EUT: 2.4 GHz low power WLAN MultiPort card
Manufacturer: Compaq Computer Corporation
Brand mark: Compaq
Type: WA1000
FCC ID: IMRWA1000

6 List of utilized test equipment

Inventory number	Description	Brand	Type
12471	Biconical antenna 20MHz-200MHz	EATON	94455-1
12473	Log-per antenna 200-1000MHz	EATON	96005
12476	Antenna mast	EMCO	TR3
12477	Antenna mast 1-4 mtr	Poelstra	--
12482	Loop antenna	EMCO	6507
12483	Guidehorn	EMCO	3115
12484	Guidehorn	EMCO	3115
12488	Guidehorn 18 - 26.5 GHz	EMCO	RA42-K-F-4B-C
12533	Signalgenerator	MARCONI	2032
12559	Digital storage oscilloscope	Le Croy	9310M
12561	DC Power Supply 20A/70V	DELTA	SM7020D
12567	Plotter	HP	7440A
12605	calibrated dipole 28MHz-1GHz	Emco	3121c
12608	HF milliwattmeter	Hewlett Packard	HP435a
12609	Power sensor 10MHz-18GHz	Hewlett Packard	HP8481A
12636	Polyester chamber	Polyforce	--
12640	Temperature chamber	Heraeus	VEM03/500
13664	Spectrum analyzer	HP	HP8593E
13078	Preamplifier 0.1 GHz - 12 GHz	Miteq	AMF-3D-001120-35-14p
13452	Digital multi meter	HP	34401A
13526	Signalgenerator 20 GHz	Hewlett & Packard	83620A
13594	Preamplifier 10 GHz - 25 GHz	Miteq	AMF-6D-100250-10p
13886	Open Area testsite	Comtest	--
14051	Anechoic room	Comtest	--
14450	2.4 GHz bandrejectfilter	BSC	XN-1783
15633	Biconilog Testantenna	Chase	CBL 6111B
15667	Measuring receiver	R&S	ESCS 30
99045	DC Power Supply 3A/30V	DELTA	E030/3
99055	Non-conducting support	NMi	--
99061	Non-conducting support 150cm	NMi	--
99068	Detector N-F/BNC-F	Radiall	R451576000
99069	Cable 5m RG214	NMi	--
99071	Cable 10m RG214	NMi	--
99076	Bandpassfilter 4 - 10 GHz	Reactel	7AS-7G-6G-511
99077	Regulating trafo	RFT	LTS006
99112	Tripod	Chase	--
99136	Bandpassfilter 10 - 26.5 GHz	Reactel	9HS-10G/26.5G-S11