



FCC Test Report

FCC Part 15.247 for DSSS systems

For the
Hewlett Packard Company
Notebook PC

Model Number: HSTNN-W26C
FCC ID: QDS-BRCM1022-H

TEST REPORT #: HEWL4_016_07001_FCC15_247n_20MHz_2.4GHz_REDSTORM
DATE: 2007-7-2



FCC listed:
A2LA
accredited

IC recognized #
3925A

CETECOM Inc.

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CETECOM Inc. is a Delaware Corporation with Corporation number: 2113686
Board of Directors: Dr. Harald Ansorge, Dr. Klaus Matkey, Hans Peter May

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1 Assessment

The following is in compliance with the applicable criteria specified in FCC rules Part 15.247 of the Code of Federal Regulations.

Company	Description	Model #
Hewlett Packard Company	Notebook PC	HSTNN-W26C

Technical responsibility for area of testing:

Lothar Schmidt
(Director Regulatory and
Antenna Services)

2007-7-2 EMC & Radio

Date	Section	Name	Signature
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This report is prepared by:

Satya Radhakrishna
(EMC Project Engineer)

2007-7-2 EMC & Radio

Date	Section	Name	Signature
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The test results of this test report relate exclusively to the test item specified in Identification of the Equipment under Test. The CETECOM Inc. USA does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of the CETECOM Inc USA.

2 Administrative Data

2.1 Identification of the Testing Laboratory

Company Name:	CETECOM Inc.
Department:	EMC
Address:	411 Dixon Landing Road Milpitas, CA 95035 U.S.A.
Telephone:	+1 (408) 586 6200
Fax:	+1 (408) 586 6299
Responsible Test Lab Manager:	Lothar Schmidt

2.2 Identification of the Client

Applicant's Name:	Hewlett Packard Company
Address Line 1:	20555 SH 249
Address Line 2:	MS 1208-10
City/ Zip Code	Houston, TX 77070
Country:	U.S.A
Contact Person:	Glenn Meyer
Phone No.:	281-514-9391
Fax:	281-518-0979
e-mail:	Glenn.meyer@hp.com

2.3 Identification of the Manufacturer

Manufacturer's Name:	Hewlett Packard Company
Manufacturer's Address:	20555 SH 249, MS 1208-10, Houston, TX 77070, U.S.A

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3 Equipment under Test (EUT)

3.1 Specification of the Equipment under Test

Product Type	Notebook PC
Marketing Name:	HP Compaq 2701p notebook PC
Model No:	HSTNN-W26C
HW Version:	1.0
SW Version :	N/A
Min/Nominal/Max Voltage:	18.5 V/19 V/ 19 V
Type(s) of Modulation:	OFDM
Antenna Type:	Stamped metal, 3dBi/2.4GHz; 5dBi/5GHz
Output Power ¹ :	26.6 dBm (0.457W) EIRP WLAN 802.11n

4 Subject Of Investigation

All testing was performed on the product referred to in Section 3 as EUT. EUT contains Broadcom BCM94321MC WLAN module, FCC ID: QDS-BRCM1022-H that supports the following mode and frequency bands:

2400-2483.4MHz: 802.11b, 802.11g, 802.11n (20MHz), , 802.11n (40MHz)

5150-5350MHz: 802.11a, 802.11n(20MHz), 802.11n(40MHz)

5725-5850MHz: 802.11a, 802.11n(20MHz), 802.11n(40MHz)

The objective of the measurements done by Cetecom Inc. was to measure the performance of the EUT operating under 802.11n (20MHz) mode in the 2400-2483.4MHz range as specified by requirements listed in FCC rules Part 15.247 of Title 47 of the Code of Federal Regulations. The maximization of portable equipment is conducted in accordance with ANSI C63.4

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5 Measurements

**5.1.1 MAXIMUM PEAK OUTPUT POWER
(RADIATED)**

§ 15.247 (b) (1)

EIRP:

802.11n

TEST CONDITIONS			MAXIMUM PEAK OUTPUT POWER (dBm)		
Frequency (MHz)			2412	2437	2462
Chain AB	T _{nom} (23) [°] C	V _{nom}	25.69	26.13	26.6
Measurement uncertainty			±0.5dBm		

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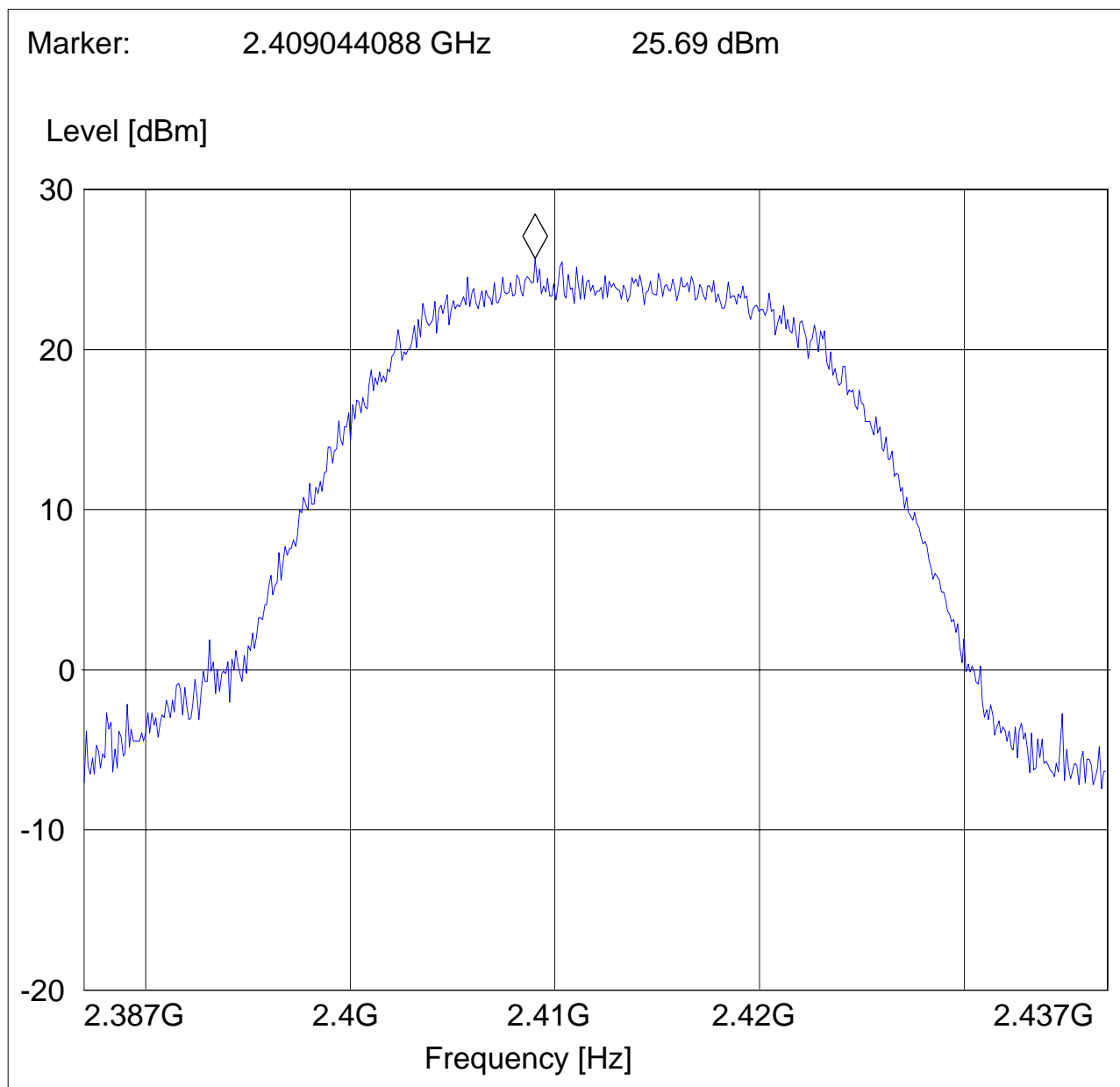
EIRP: 2412MHz (802.11n) Chain AB

CETECOM Inc., 411 Dixon Landing Road, Milpitas CA 95035, USA

EUT: RedStorm
Customer: HP Texas
Test Mode: WLAN 802.11N, 6 Mbps, 20 MHz, ch 1, chain ab
ANT Orientation: H
EUT Orientation: H
Test Engineer: Ed
Power Supply: AC Adapter

SWEEP TABLE: "EIRP RLAN CHI"

Short Description: EIRP
Unit: dBm Detector: MaxPeak RBW: 10MHZ VBW:10MHz



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Report:

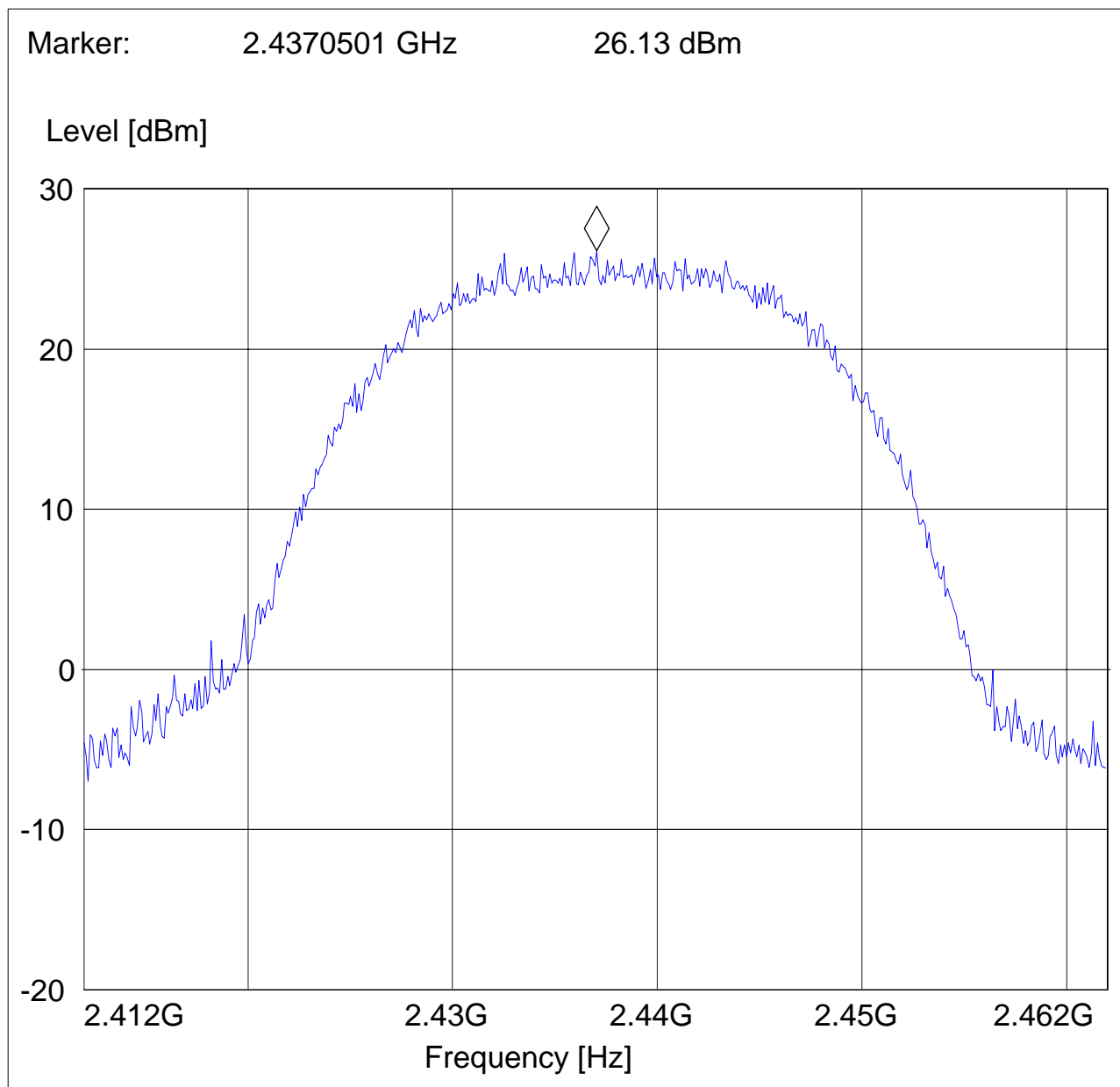
EIRP: 2437MHz (802.11n) Chain AB

CETECOM Inc., 411 Dixon Landing Road, Milpitas CA 95035, USA

EUT: RedStorm
Customer: HP Texas
Test Mode: WLAN 802.11N, 6 Mbps, 20 MHz, ch 6, chain ab
ANT Orientation: H
EUT Orientation: H
Test Engineer: Ed
Power Supply: AC Adapter

SWEEP TABLE: "EIRP RLAN CH6"

Short Description: EIRP
Unit: dBm Detector: MaxPeak RBW: 10MHZ VBW:10MHz



Report #:

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Report:

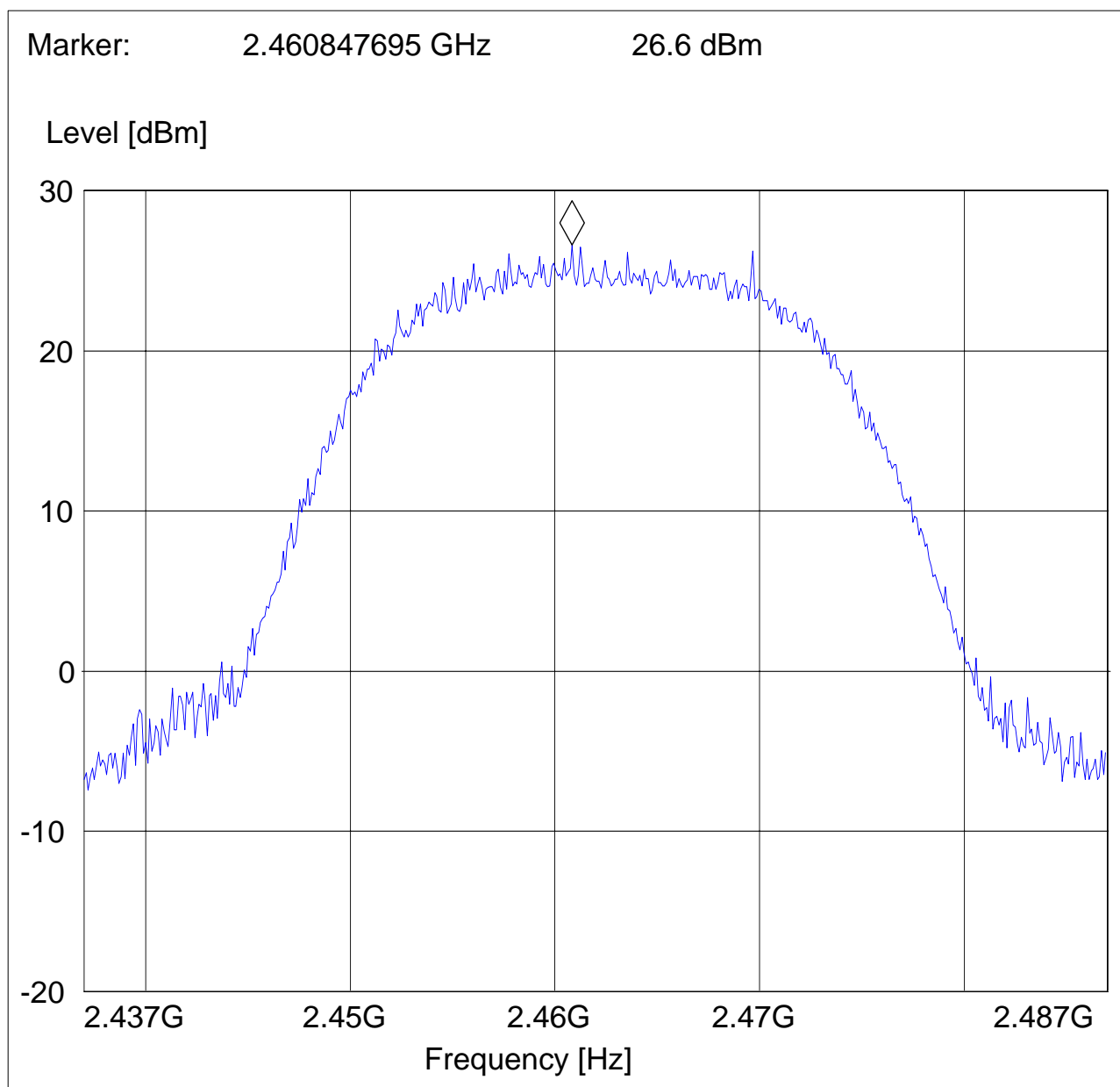
EIRP: 2462MHz (802.11n) Chain A

CETECOM Inc., 411 Dixon Landing Road, Milpitas CA 95035, USA

EUT: RedStorm
Customer: HP Texas
Test Mode: WLAN 802.11n, 6 Mbps, 20 MHz, ch 11, chain ab
ANT Orientation: H
EUT Orientation: H
Test Engineer: Ed
Power Supply: AC Adapter

SWEEP TABLE: "EIRP RLAN CH11"

Short Description: EIRP
Unit: dBm Detector: MaxPeak RBW: 10MHZ VBW:10MHz



5.2 RESTRICTED BAND EDGE COMPLIANCE RADIATED §15.247/15.205

5.2.1 LIMITS

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(²)
13.36 - 13.41			

*PEAK LIMIT= 74dBuV/m

*AVG. LIMIT= 54dBuV/m

Notes:

1. Radiated emissions are maximized by rotating the EUT 360° at 0.5 meter height increments between 1 and 4 meters.
2. Measurements were performed with the EUT in X, Y and Z orientations with the measurement antenna in both horizontal and vertical polarity. The plots below show the results of the worst case orientation and polarity.

5.2.2 Results Lower Restricted Band 2310 MHz to 2390 MHz

802.11n (2412MHz) PEAK Chain AB

CETECOM Inc., 411 Dixon Landing Road, Milpitas CA 95035, USA

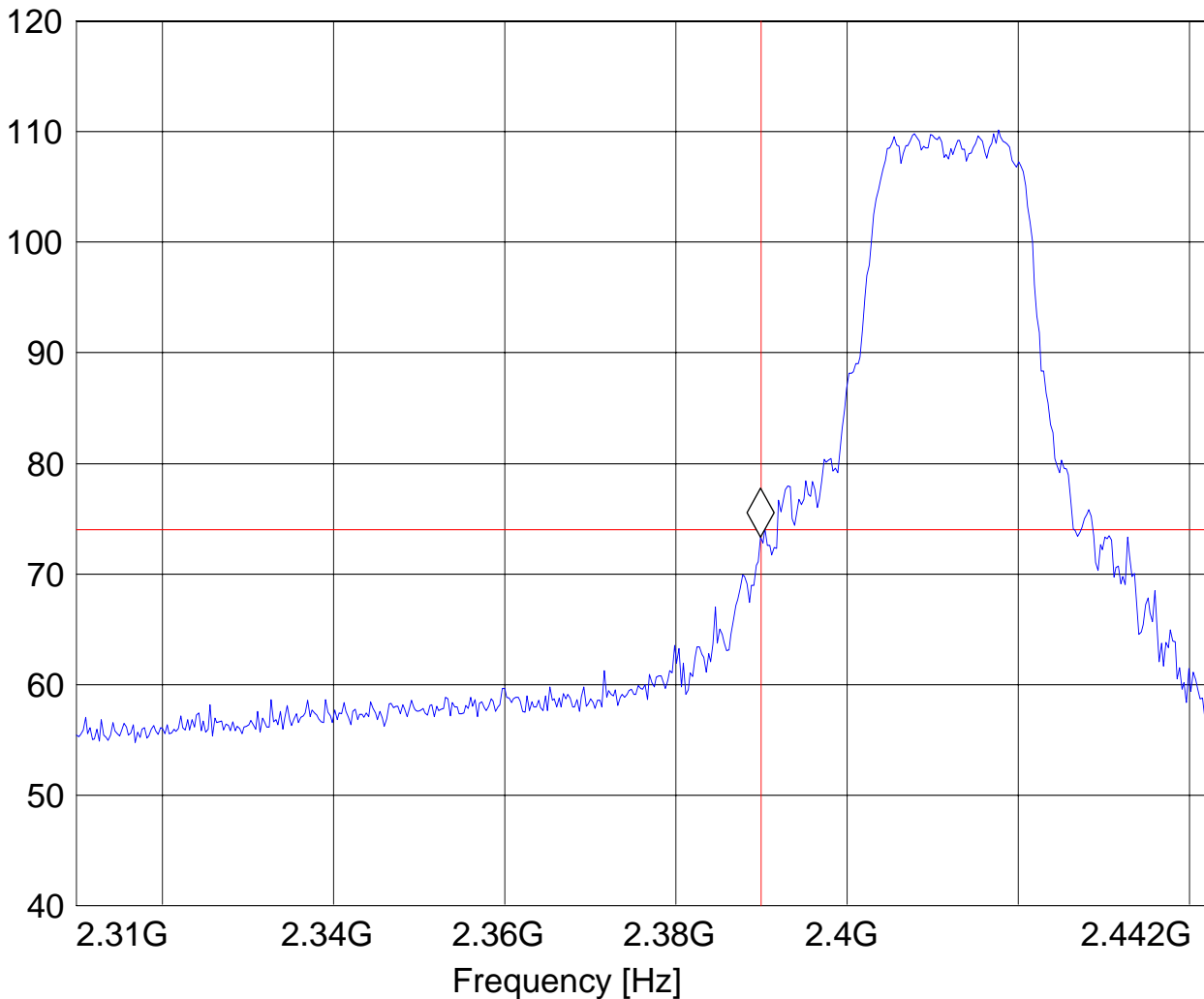
EUT: RedStorm
 Customer: HP Texas
 Test Mode: 802.11n, 20 MHz, ch 1, chain ab
 ANT Orientation: H
 EUT Orientation: H
 Test Engineer: Ed
 Power Supply: AC Adapter

SWEEP TABLE: "FCC15.247 LBE_PK"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
2.3 GHz	2.4 GHz	MaxPeak	Coupled	1 MHz	#326horn_AF_vert

Marker: 2.389887776 GHz 73.34 dBµV/m

Level [dBµV/m]



802.11n (2412MHz) AVG Chain AB

CETECOM Inc., 411 Dixon Landing Road, Milpitas CA 95035, USA

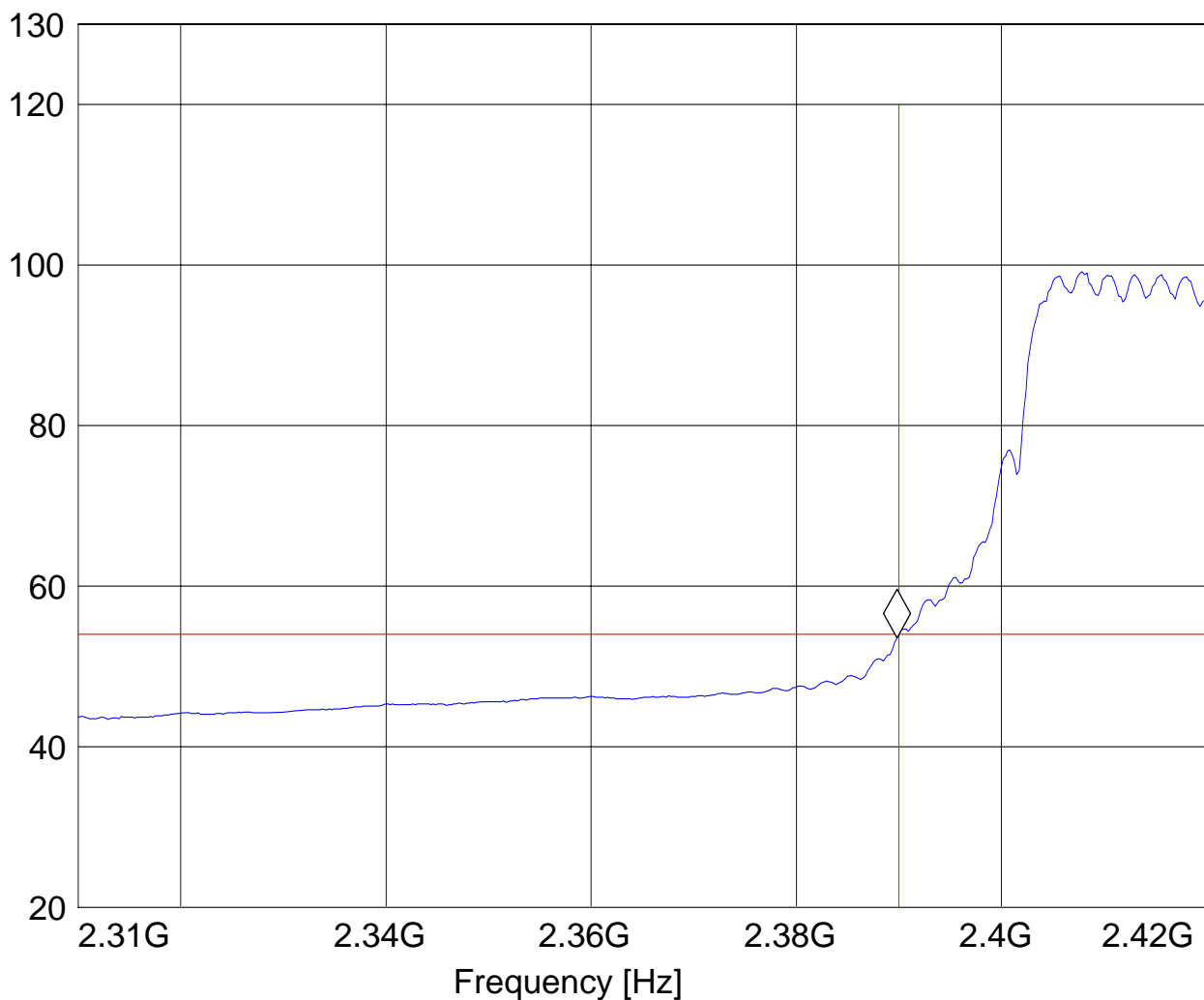
EUT: RedStorm
 Customer: HP Texas
 Test Mode: 802.11n, 20 MHz, ch 1, chain ab
 ANT Orientation: H
 EUT Orientation: H
 Test Engineer: Satya Radhakrishna
 Power Supply: AC Adapter

SWEEP TABLE: "FCC15.247 LBE_AVG"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
2.3 GHz	2.4 GHz	MaxPeak	Coupled	1 MHz	#326horn_AF_vert

Marker: 2.389799599 GHz 53.6 dBµV/m

Level [dBµV/m]



**5.2.3 Results Upper Restricted Band 2483.5 MHz to 2500 MHz
 802.11n (2462MHz) PEAK Chain AB**

CETECOM Inc., 411 Dixon Landing Road, Milpitas CA 95035, USA

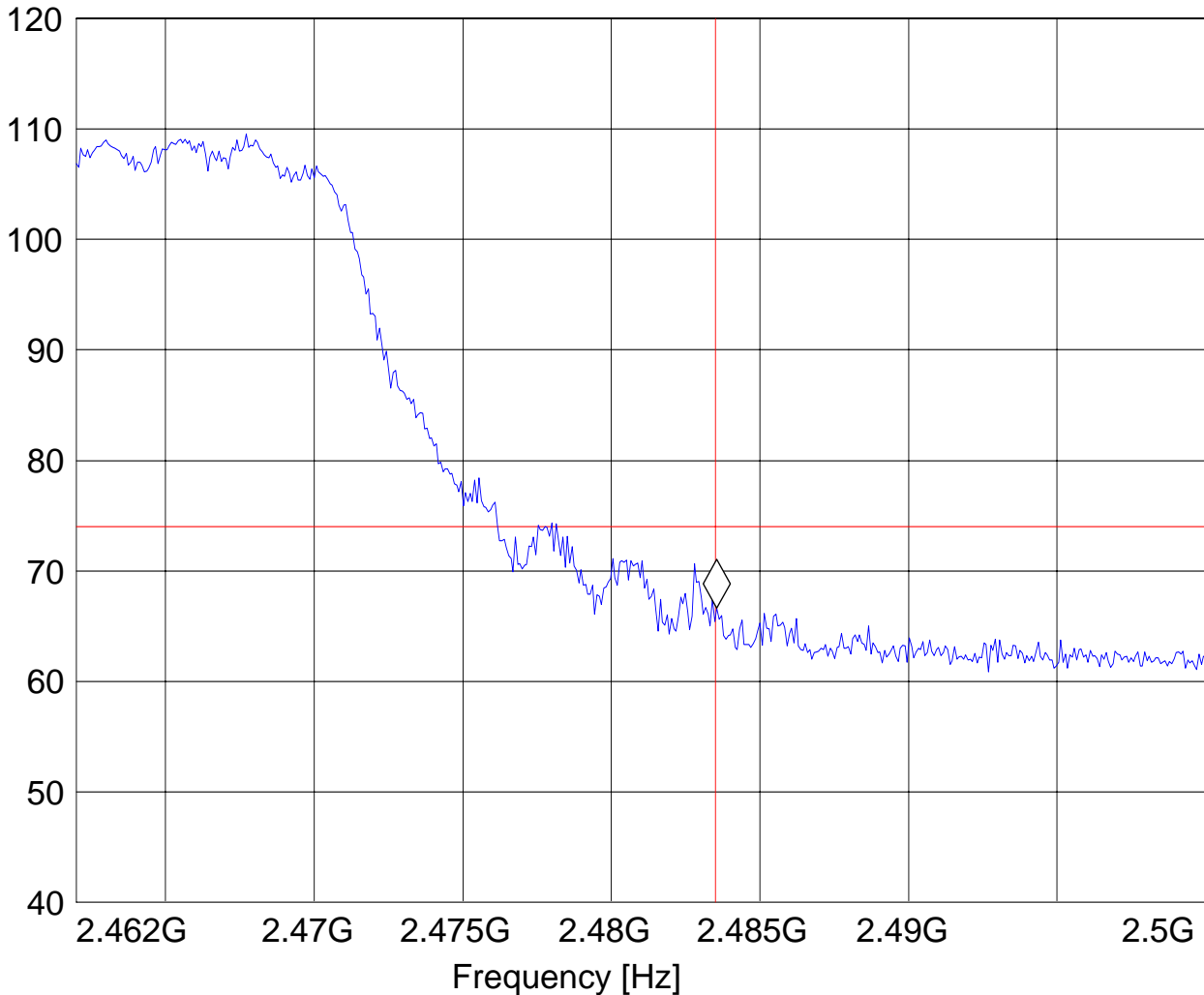
EUT: RedStorm
 Customer: HP Texas
 Test Mode: 802.11n, 20 MHz, ch 11, chain ab
 ANT Orientation: H
 EUT Orientation: H
 Test Engineer: Ed
 Power Supply: AC Adapter

SWEEP TABLE: "FCC15.247 HBE_PK"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
2.3 GHz	2.4 GHz	MaxPeak	Coupled	1 MHz	#326horn_AF_vert

Marker: 2.483551102 GHz 66.62 dBμV/m

Level [dBμV/m]



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802.11n (2462MHz) AVG Chain AB

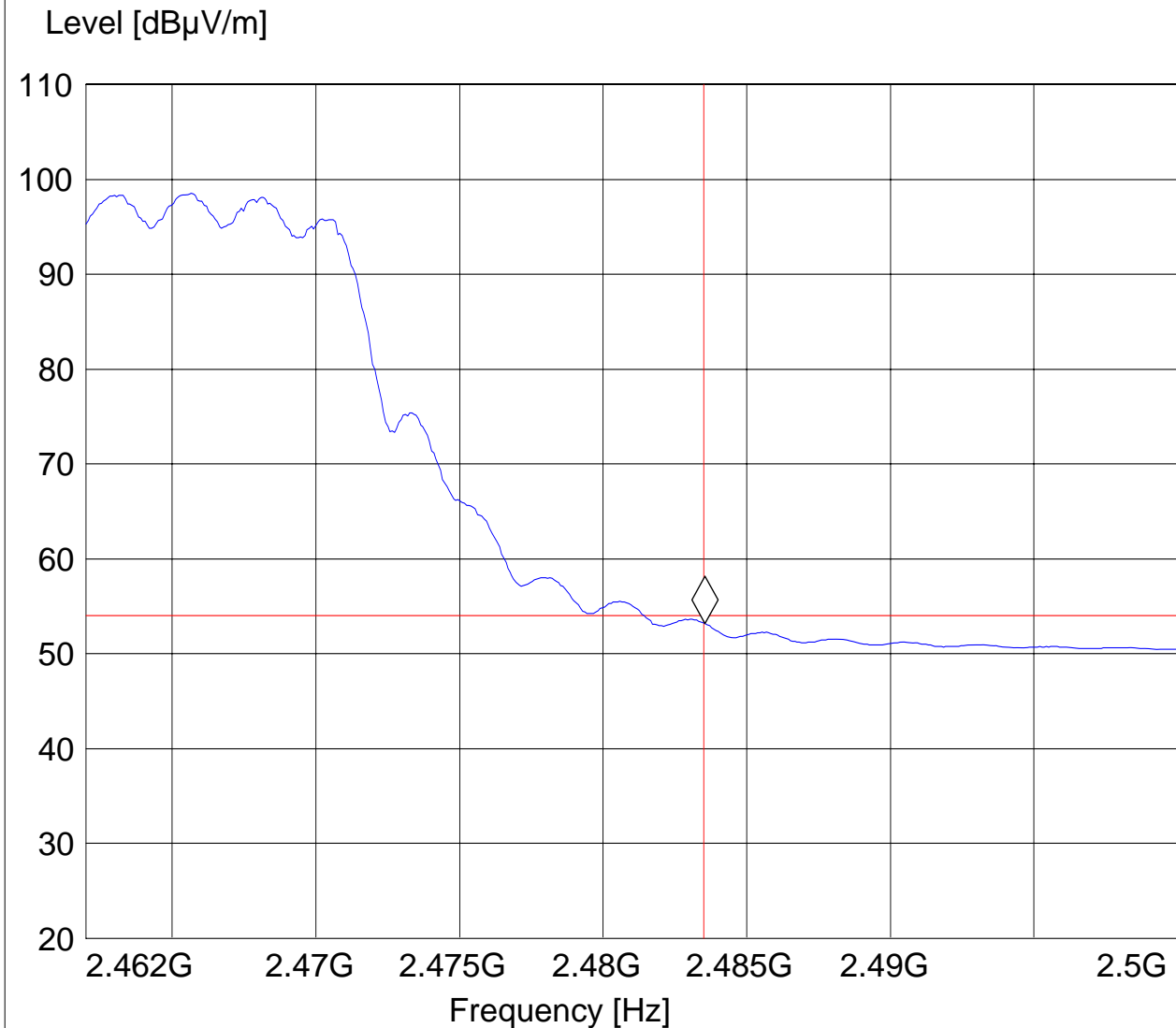
CETECOM Inc., 411 Dixon Landing Road, Milpitas CA 95035, USA

EUT: RedStorm
 Customer: HP Texas
 Test Mode: 802.11n, 20 MHz, ch 11, chain ab
 ANT Orientation: H
 EUT Orientation: H
 Test Engineer: Ed
 Power Supply: AC Adapter

SWEEP TABLE: "FCC15.247 HBE_AVG"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
2.5 GHz	2.5 GHz	MaxPeak	Coupled	1 MHz	#326horn_AF_horz

Marker: 2.483551102 GHz 53.19 dBμV/m



5.3 TRANSMITTER SPURIOUS EMISSIONS RADIATED § 15.247/15.205/15.209

5.3.1 LIMITS

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(²)
13.36 - 13.41			

*PEAK LIMIT= 74dBuV/m

*AVG. LIMIT= 54dBuV/m

Notes:

1. The radiated emissions were done with different settings, using the relevant pre-amplifiers for the relevant frequency ranges. This is the reason that the graphs show different noise levels. In the range between 3 and 25 GHz very short cable connections to the antenna was used to minimize the noise level.
2. All measurements are done in peak mode using an average limit, unless specified with the plots.
3. Radiated emissions are maximized by rotating the EUT 360° at 0.5 meter height increments between 1 and 4 meters.
4. Measurements were performed with the EUT in X, Y and Z orientations with the measurement antenna in both horizontal and vertical polarity. The plots below show the results of the worst case orientation and polarity

Results for the radiated measurements below 30MHz according § 15.33

Frequency	Measured values	Remarks
9KHz – 30MHz	No emissions found, caused by the EUT	This is valid for all the tested channels

5.3.2 RESULTS

30MHz – 1GHz Chain AB

Antenna: vertical

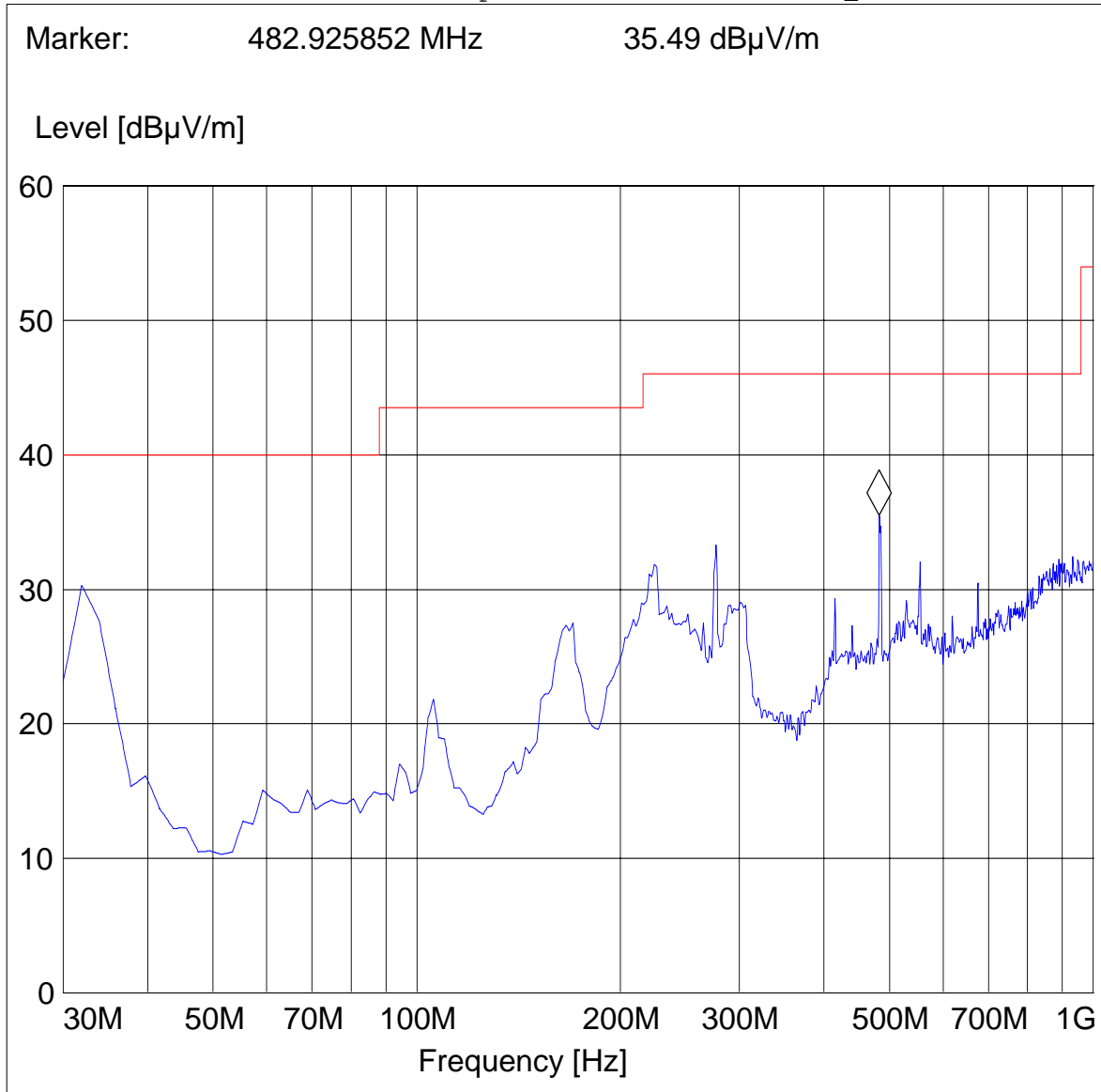
Note: This plot is valid for low, mid, high channels (worst-case plot)

CETECOM Inc., 411 Dixon Landing Road, Milpitas CA 95035, USA

EUT: Redstorm
 Customer: HP Texas
 Test Mode: WLAN 802.11n, 20MHz, ch 11, chain ab
 ANT Orientation: V
 EUT Orientation: H
 Test Engineer: Satya Radhakrishna
 Power Supply: AC Adapter

SWEEP TABLE: "FCC15.247_30M-1G_Ver"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	3141-#1186_Vert



30MHz – 1GHz Chain AB

Antenna: horizontal

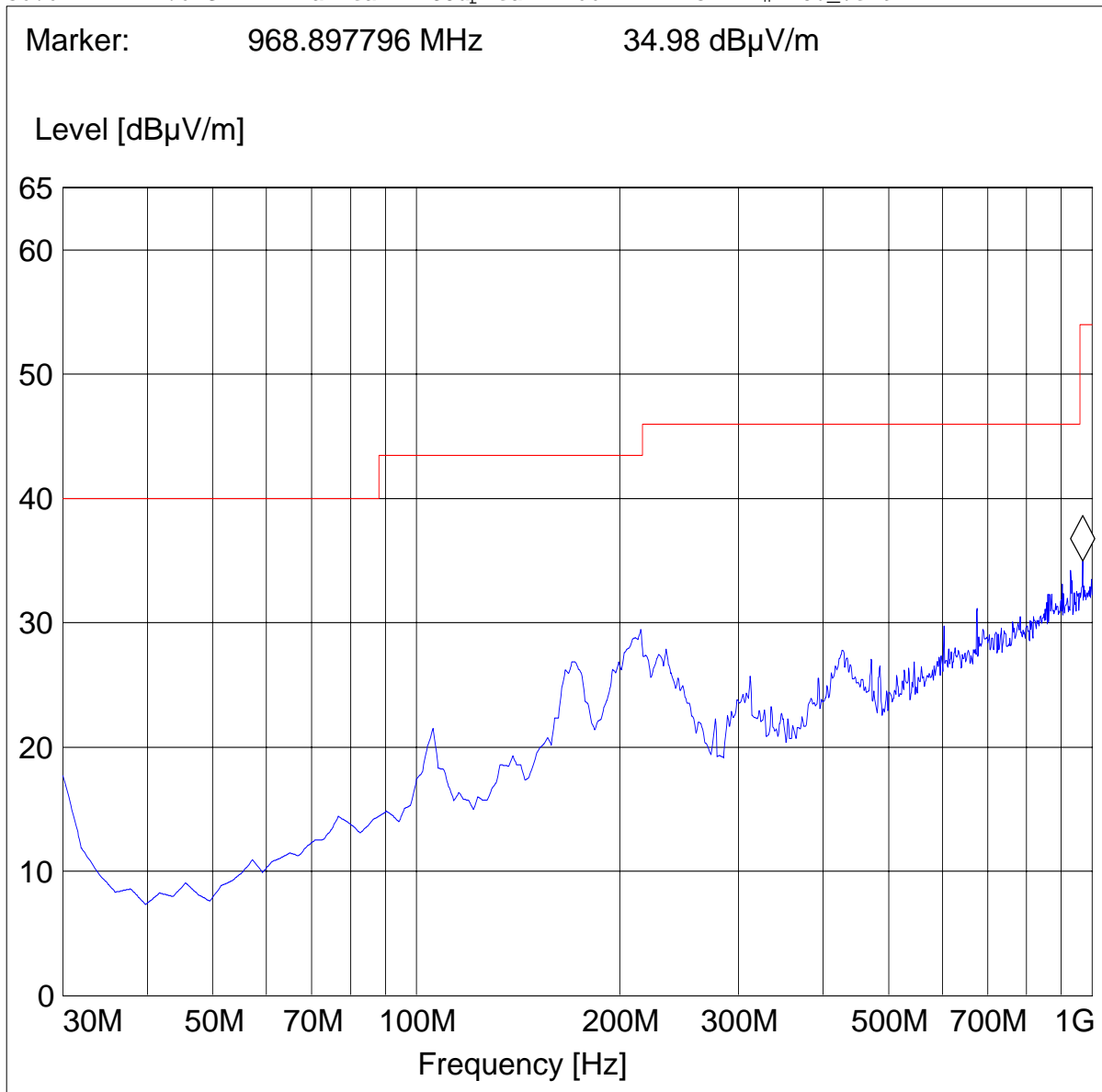
Note: This plot is valid for low, mid, high channels (worst-case plot)

CETECOM Inc., 411 Dixon Landing Road, Milpitas CA 95035, USA

EUT: Redstorm
Customer: HP Texas
Test Mode: WLAN 802.11n, 20MHz, ch 11, chain ab
ANT Orientation: H
EUT Orientation: H
Test Engineer: Satya Radhakrishna
Power Supply: AC Adapter

SWEEP TABLE: "FCC15.247_30M-1G_Hor"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	3141-#1186_Vert



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1-18GHz (2412MHz) Chain AB

Note: The peaks above the limit line is the carrier freq. Note: Peak Reading vs. Average limit
 CETECOM Inc., 411 Dixon Landing Road, Milpitas CA 95035, USA

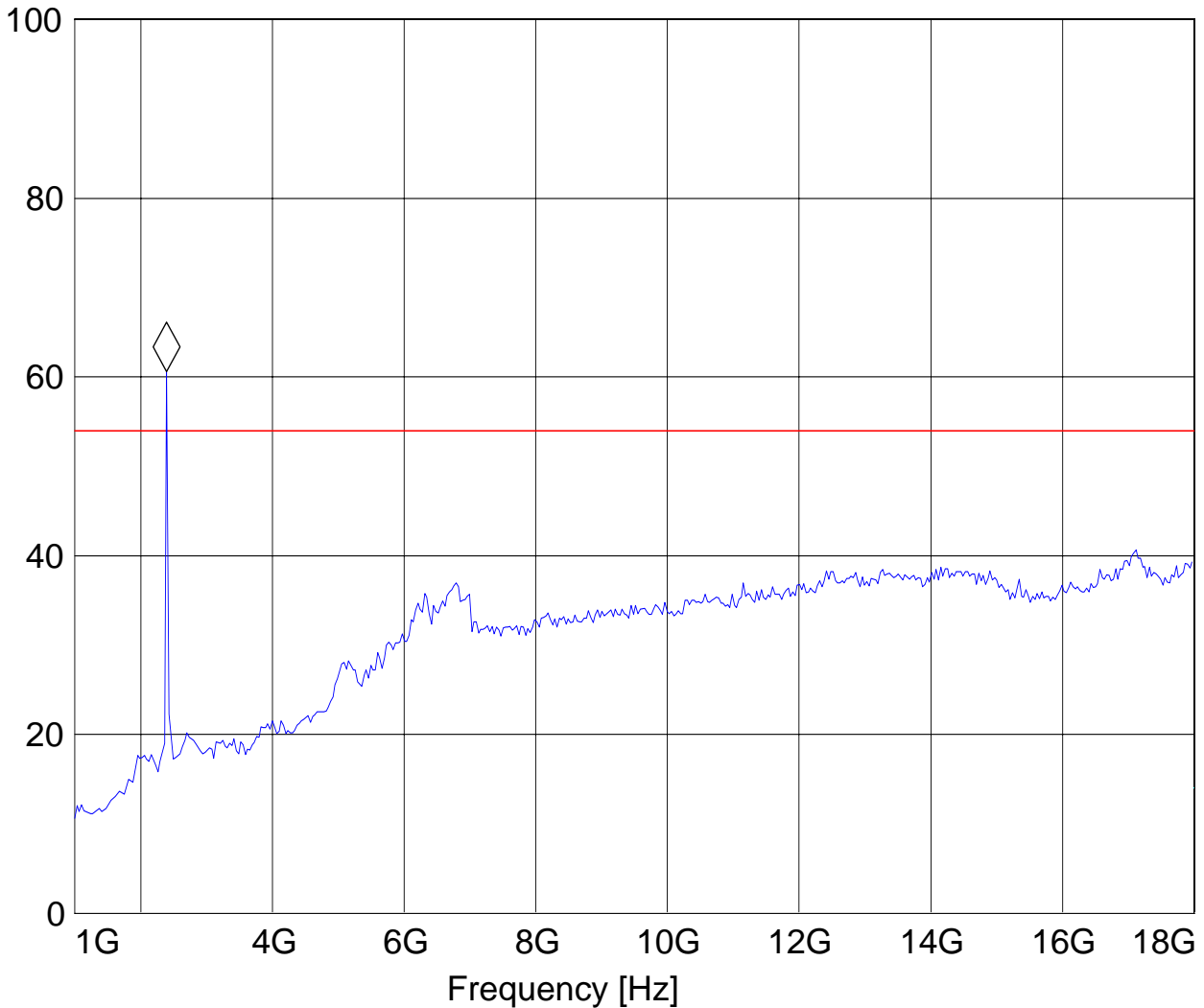
EUT / Description: RedStorm
 Manufacturer: HP Texas
 Test mode: WLAN 802.11n, 20MHz, ch 1, chain ab
 ANT Orientation: H
 EUT Orientation: H
 Test Engineer: Satya Radhakrishna
 Voltage: AC Adapter
 Comments: Marker is placed on transmit signal

SWEEP TABLE: "FCC 15.407 1-18G"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
1.0 GHz	18.0 GHz	MaxPeak	Coupled	1 MHz	#326horn_AF_vert

Marker: 2.396793587 GHz 60.57 dBµV/m

Level [dBµV/m]



1-18GHz (2437MHz) Chain AB

Note: The peaks above the limit line is the carrier freq. Note: Peak Reading vs. Average limit
CETECOM Inc., 411 Dixon Landing Road, Milpitas CA 95035, USA

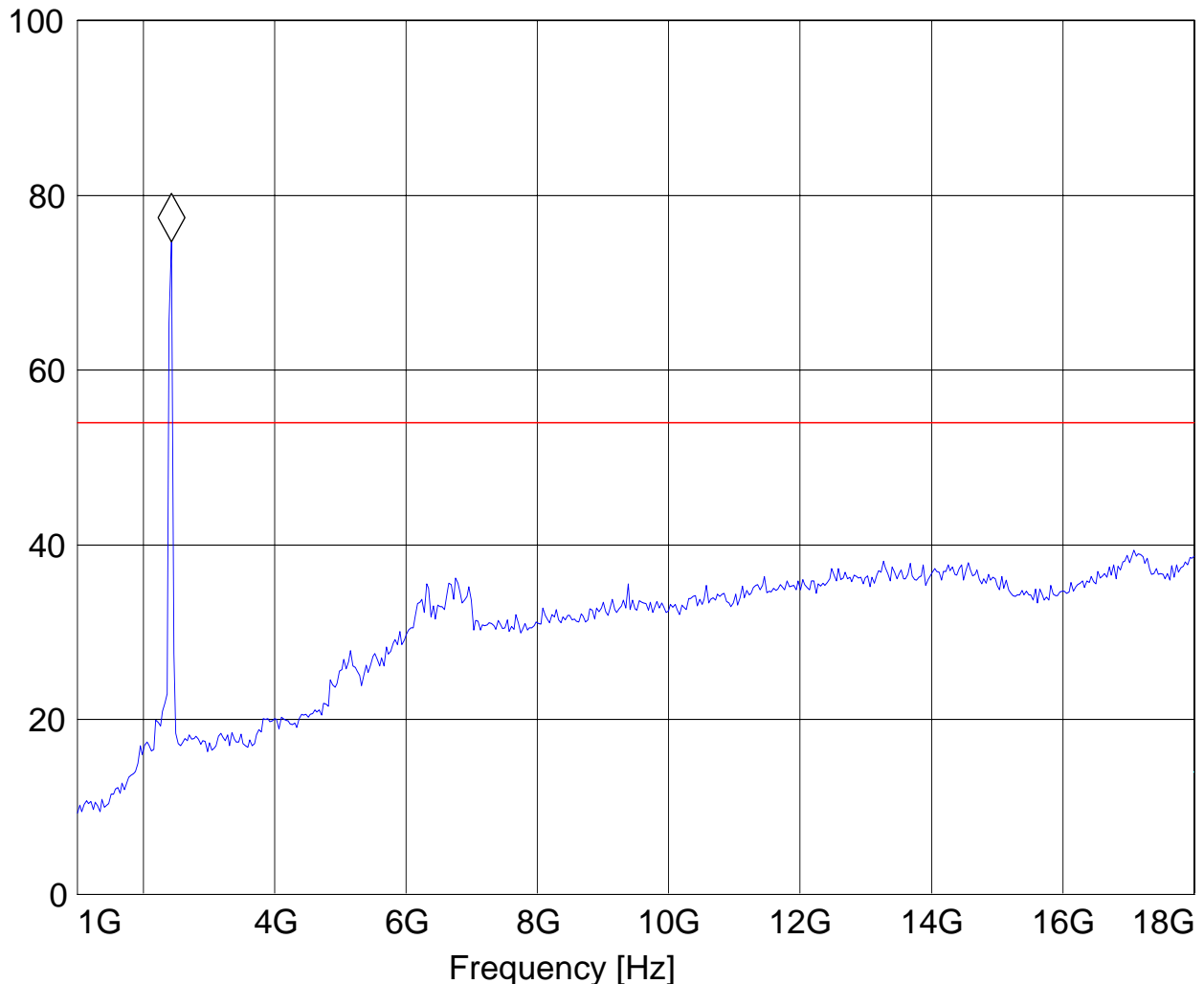
EUT: Redstorm
Customer: HP Texas
Test Mode: WLAN 802.11n, 20MHz, ch 6, chain ab
ANT Orientation: H
EUT Orientation: H
Test Engineer: Ed
Power Supply: AC Adapter

SWEEP TABLE: "FCC 15.407 1-18G"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
1.0 GHz	18.0 GHz	MaxPeak	Coupled	1 MHz	#326horn_AF_vert

Marker: 2.430861723 GHz 74.71 dB μ V/m

Level [dB μ V/m]



1-18GHz (2462MHz) Chain AB

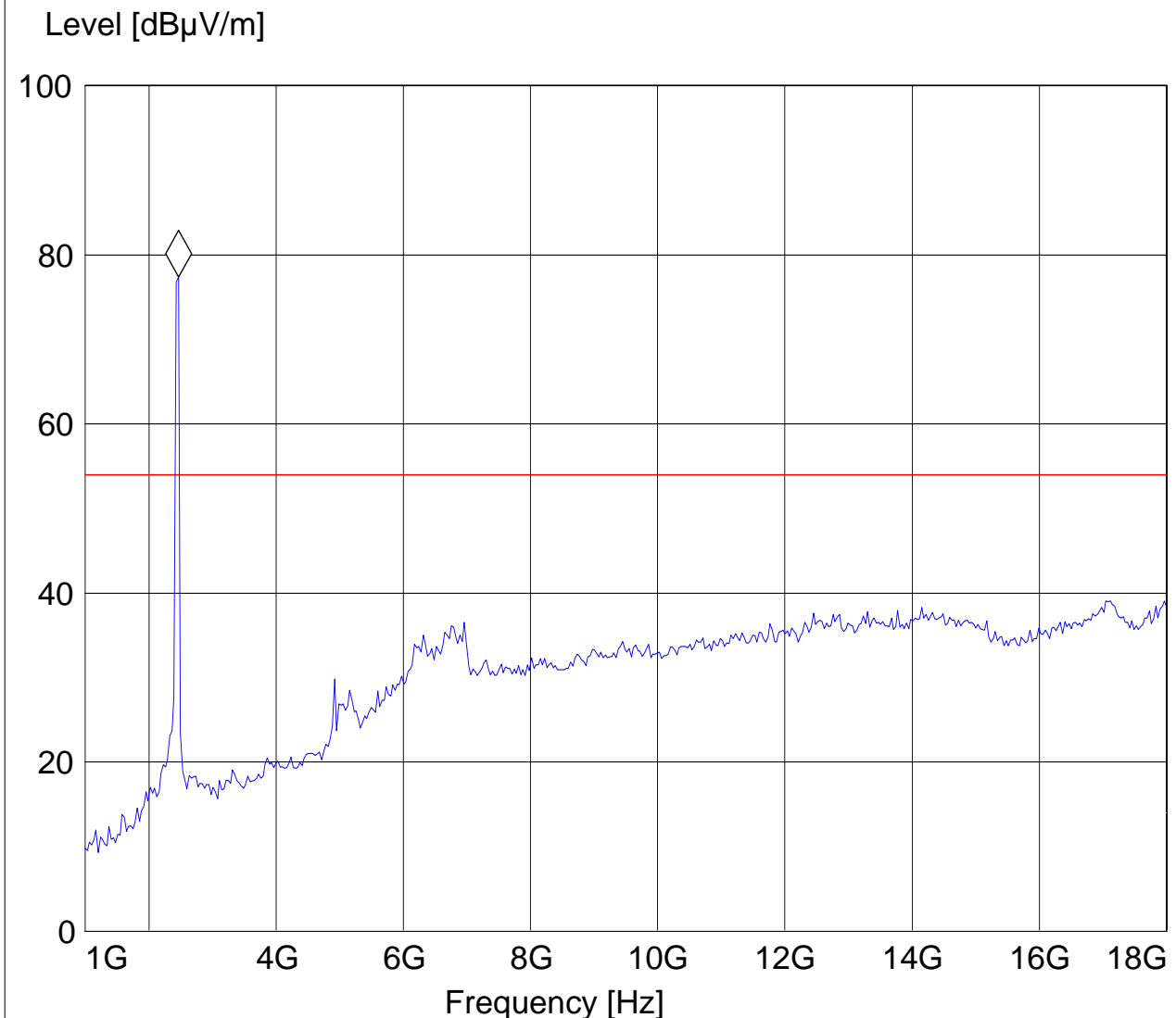
Note: The peaks above the limit line is the carrier freq. Note: Peak Reading vs. Average limit
 CETECOM Inc., 411 Dixon Landing Road, Milpitas CA 95035, USA

EUT / Description: Redstorm
 Manufacturer: HP Texas
 Test mode: 802.11n, ch 11, 20MHz, chain ab
 ANT Orientation: H
 EUT Orientation: H
 Test Engineer: Satya Radhakrishna
 Voltage: AC Adapter

SWEEP TABLE: "FCC 15.407 1-18G"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
1.0 GHz	18.0 GHz	MaxPeak	Coupled	1 MHz	#326horn_AF_vert

Marker: 2.46492986 GHz 77.36 dBµV/m



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18-25GHz Chain AB

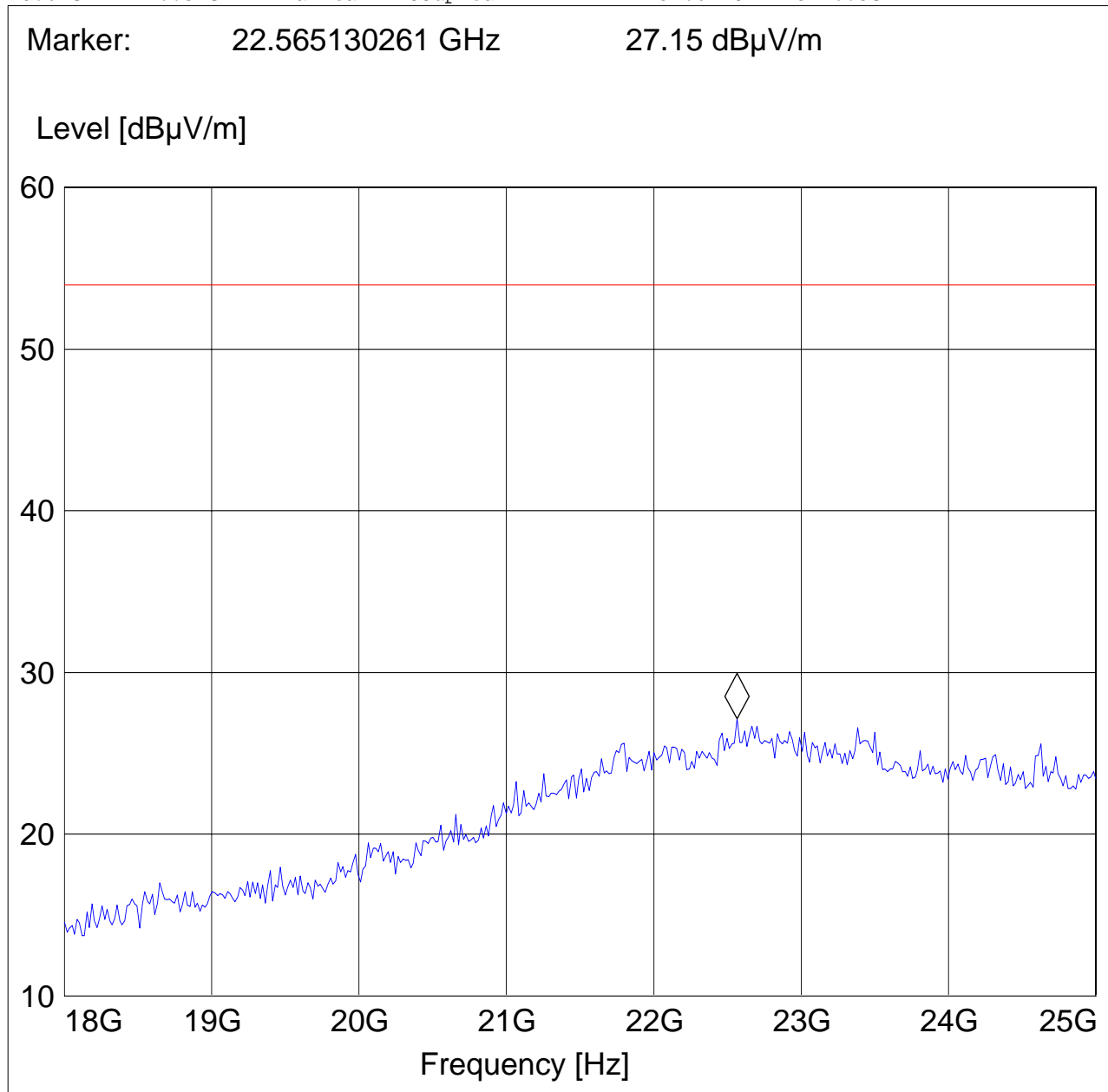
Note: This plot is valid for low, mid, high channels (worst-case plot). **Note:** Peak Reading vs. Average limit

CETECOM Inc., 411 Dixon Landing Road, Milpitas CA 95035, USA

EUT: Redstorm
 Customer: HP Texas
 Test Mode: WLAN 802.11n, 20 MHz, ch 11, chain ab
 ANT Orientation: H
 EUT Orientation: H
 Test Engineer: Ed
 Power Supply: AC Adapter

SWEEP TABLE: "FCC15.247_18-26.5G"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
18.0 GHz	26.5 GHz	MaxPeak	Coupled	1 MHz	3160 Horn 18-26.5G



5.4 AC POWER LINE CONDUCTED EMISSIONS § 15.107/207

5.4.1 LIMITS

Technical specification: 15.107 / 15.207 (Revised as of August 20, 2002)

Limit

Frequency of Emission (MHz)	Conducted Limit (dBµV)	
	Quasi-Peak	Average
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30	60	50

* Decreases with logarithm of the frequency

ANALYZER SETTINGS: RBW = 10KHz

VBW = 10KHz

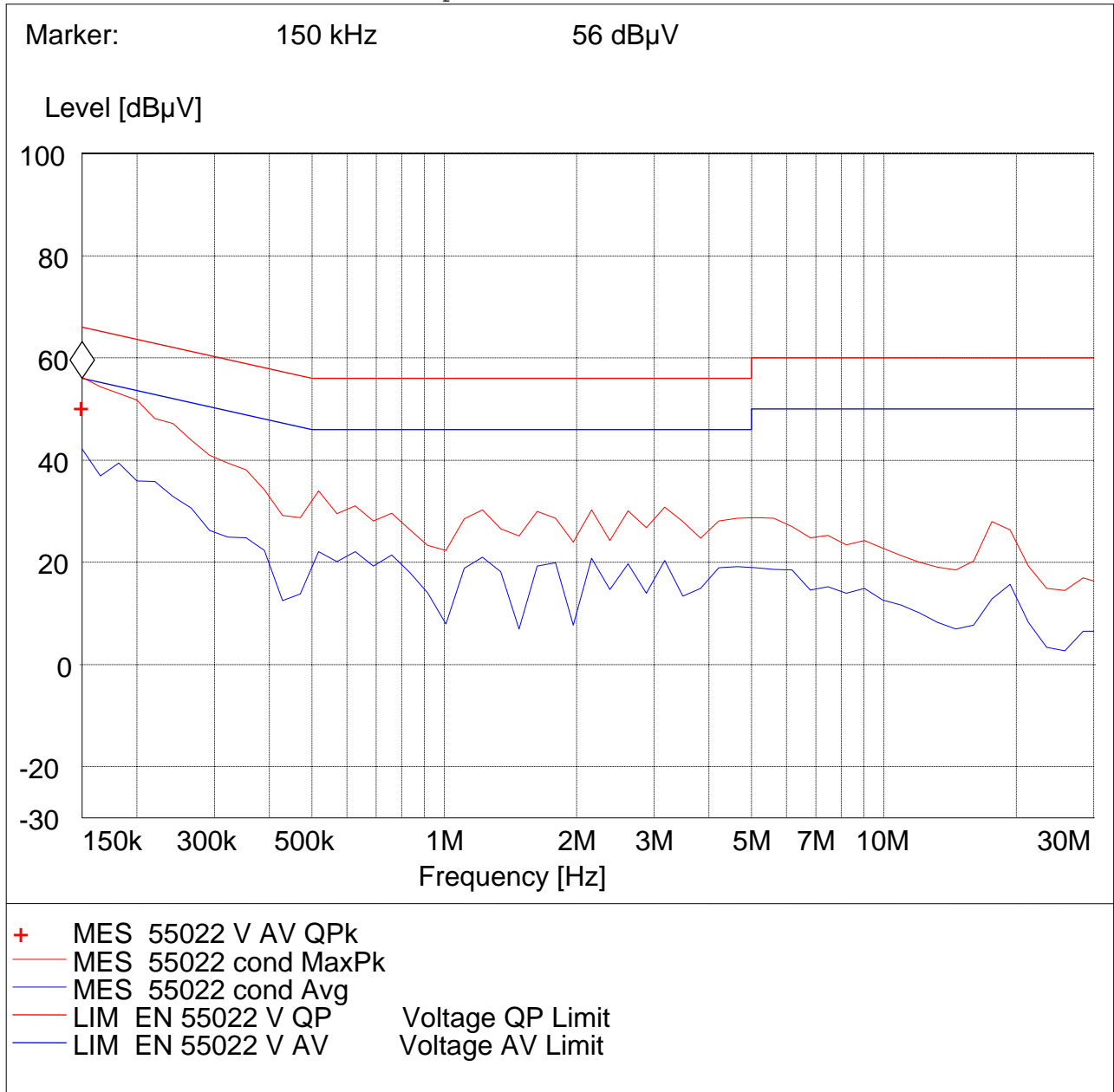
5.4.2 RESULTS

Line:

EUT: Redstorm
 Manufacturer: HP
 Operating Condition: WLAN
 Test Engineer: Peter Mu
 ANT Orientation: H
 EUT Orientation: H
 Voltage: AC Adapter

SWEEP TABLE: "55022 cond"

Short Description: EN 55022 for 150KHz-30MHz
 Start Stop Detector Meas. IF Transducer
 Frequency Frequency Time Bandw.
 150.0 kHz 30.0 MHz MaxPeak Coupled 10 kHz None





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MEASUREMENT RESULT: "55022 V AV QPk"

6/29/2007 9:02AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.150000	50.90	0.0	66	15.1	---	---

LIMIT LINE: "EN 55022 V AV"

Short Description: Voltage AV Limit
4/27/1998 2:24PM

Frequency MHz	Level dBµV
0.150000	56.00
0.500000	46.00
5.000000	46.00
5.000000	50.00
30.000000	50.00

LIMIT LINE: "EN 55022 V QP"

Short Description: Voltage QP Limit
4/27/1998 2:24PM

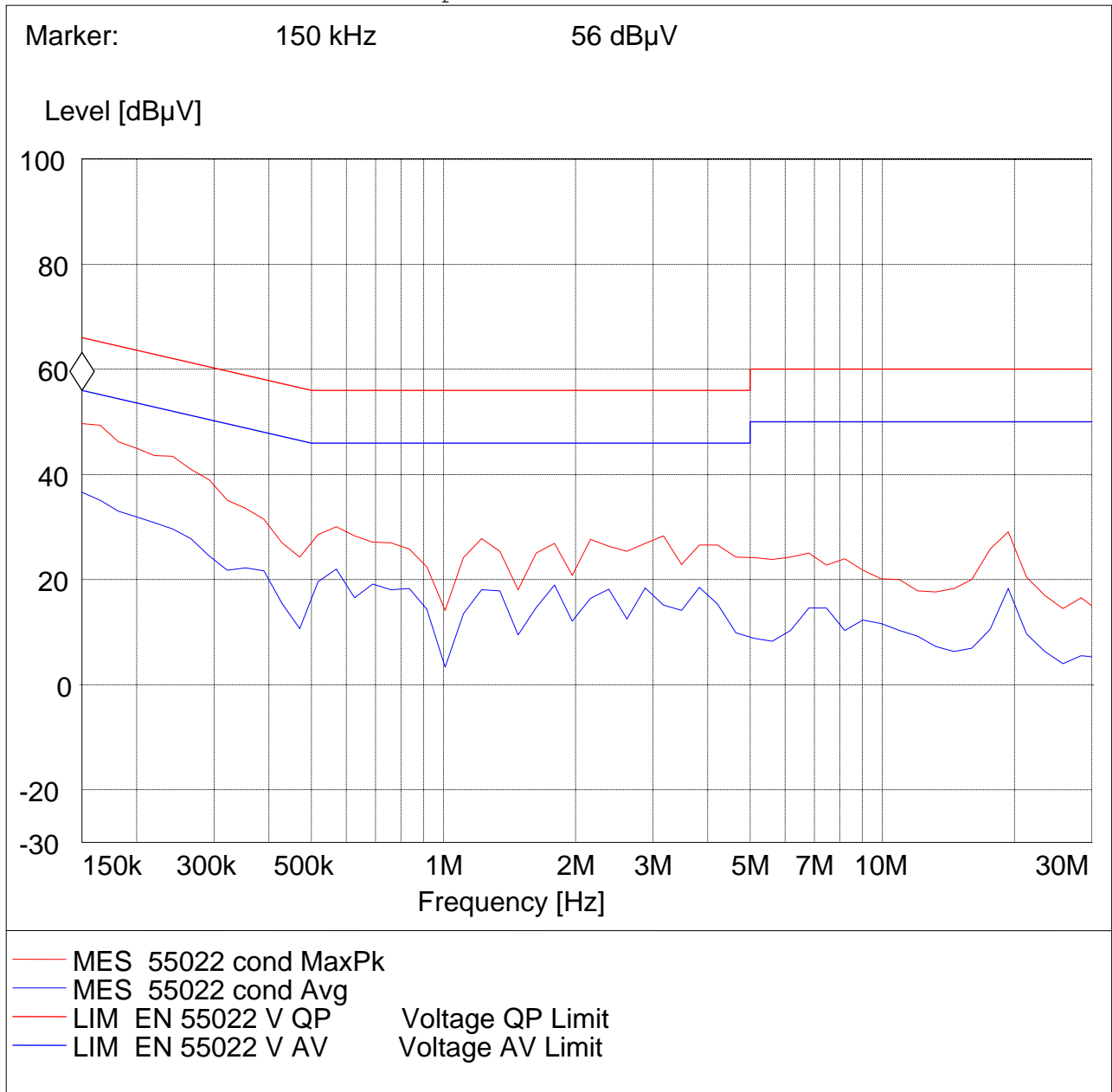
Frequency MHz	Level dBµV
0.150000	66.00
0.500000	56.00
5.000000	56.00
5.000000	60.00
30.000000	60.00

Neutral:

EUT: Redstorm
 Manufacturer: HP
 Operating Condition: WLAN
 Test Engineer: Peter Mu
 ANT Orientation: H
 EUT Orientation: H
 Voltage: AC Adapter

SWEEP TABLE: "55022 cond"

Short Description: EN 55022 for 150KHz-30MHz
 Start Stop Detector Meas. IF Transducer
 Frequency Frequency Time Bandw.
 150.0 kHz 30.0 MHz MaxPeak Coupled 10 kHz None



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LIMIT LINE: "EN 55022 V AV"

Short Description:		Voltage AV Limit
4/27/1998 2:24PM		
Frequency	Level	
MHz	dBµV	
0.150000	56.00	
0.500000	46.00	
5.000000	46.00	
5.000000	50.00	
30.000000	50.00	

LIMIT LINE: "EN 55022 V QP"

Short Description:		Voltage QP Limit
4/27/1998 2:24PM		
Frequency	Level	
MHz	dBµV	
0.150000	66.00	
0.500000	56.00	
5.000000	56.00	
5.000000	60.00	
30.000000	60.00	

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6 TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

No	Instrument/Ancillary	Type	Manufacturer	Serial No.	Cal Due	Interval
01	Spectrum Analyzer	ESIB 40	Rohde & Schwarz	100107	May 2008	1 year
02	Spectrum Analyzer	FSEM 30	Rohde & Schwarz	100017	August 2008	1 year
03	Signal Generator	SMY02	Rohde & Schwarz	836878/011	May 2008	1 year
04	Power-Meter	NRVD	Rohde & Schwarz	0857.8008.02	May 2008	1 year
05	Biconilog Antenna	3141	EMCO	0005-1186	June 2008	1 year
06	Horn Antenna (1-18GHz)	SAS-200/571	AH Systems	325	June 2008	1 year
07	Horn Antenna (18-26.5GHz)	3160-09	EMCO	1240	June 2008	1 year
08	Power Splitter	11667B	Hewlett Packard	645348	n/a	n/a
09	Climatic Chamber	VT4004	Voltsch	G1115	May 2008	1 year
10	High Pass Filter	5HC2700	Trilithic Inc.	9926013	n/a	n/a
11	High Pass Filter	4HC1600	Trilithic Inc.	9922307	n/a	n/a
12	Pre-Amplifier	JS4-00102600	Miteq	00616	May 2008	1 year
13	Power Sensor	URV5-Z2	Rohde & Schwarz	DE30807	May 2008	1 year
14	Digital Radio Comm. Tester	CMD-55	Rohde & Schwarz	847958/008	May 2008	1 year
15	Universal Radio Comm. Tester	CMU 200	Rohde & Schwarz	832221/06	May 2008	1 year
16	LISN	ESH3-Z5	Rohde & Schwarz	836679/003	May 2008	1 year
17	Loop Antenna	6512	EMCO	00049838	July 2008	2 years

7 BLOCK DIAGRAMS
Radiated Testing

ANECHOIC CHAMBER

