FCC Test Report

FCC Part 15.407 for UNII Devices

For the

Hewlett Packard Company

Notebook PC

Model Number: HSTNN-W26C

FCC ID: QDS-BRCM1022-H

TEST REPORT #: HEWL4_016_07001_15.407n_40MHz_ REDSTORM
DATE: 2007-7-2

ilac-MRA ACCREDITED Certificate # 2135.01

Bluetooth™ Bluetooth Qualification Test Facility (BQTF)

CTIA Authorized Test Lab LAB CODE 20020328-00

FCC listed: A2LA accredited

IC recognized # 3925A

***CETECOM* Inc.**
411 Dixon Landing Road ◆ Milpitas, CA 95035 ◆ U.S.A.
Phone: + 1 (408) 586 6200 ◆ Fax: + 1 (408) 586 6299 ◆ E-mail: info@cetecomusa.com ◆ http://www.cetecom.com
CETECOM Inc. is a Delaware Corporation with Corporation number: 2113686
Board of Directors: Dr. Harald Ansorge, Dr. Klaus Matkey, Hans Peter May

TABLE OF CONTENTS

1 Assessment

The following is in compliance with the applicable criteria specified in FCC rules Part 15.407 of the Code of Federal Regulations.

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

Technical responsibility for area of testing:

Date	Section	Name	Signature
2007-7-2	**EMC & Radio**	**Lothar Schmidt (Director Regulatory and Antenna Services)**	Lothar Schmidt I am approving this document

This report is prepared by:

Date	Section	Name	Signature
2007-7-2	**EMC & Radio**	**Satya Radhakrishna (EMC Project Engineer)**	Satya Radhakrishna I am the author of this document

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

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, 3.9dBi/2.4GHz; 5.6dBi/5GHz
Output Power[1]:	19.59 dBm (0.091 W) 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)
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 (40MHz) mode in the 5150-5350MHz range as specified by requirements listed in FCC rules Part 15.407 of Title 47 of the Code of Federal Regulations. The maximization of portable equipment is conducted in accordance with ANSI C63.4

5 Measurements

5.1 MAXIMUM PEAK OUTPUT POWER § 15.407 (RADIATED)

5.1.1 EIRP 802.11 (n) 40 MHz bandwidth MODE:

TEST CONDITIONS			MAXIMUM PEAK OUTPUT POWER (dBm)		
Frequency (MHz)			5190	5270	5310
Chain AB	T_{nom}(23)°C	V_{nom}VDC	18.96	19.39	19.59
Measurement uncertainty			±0.5dBm		

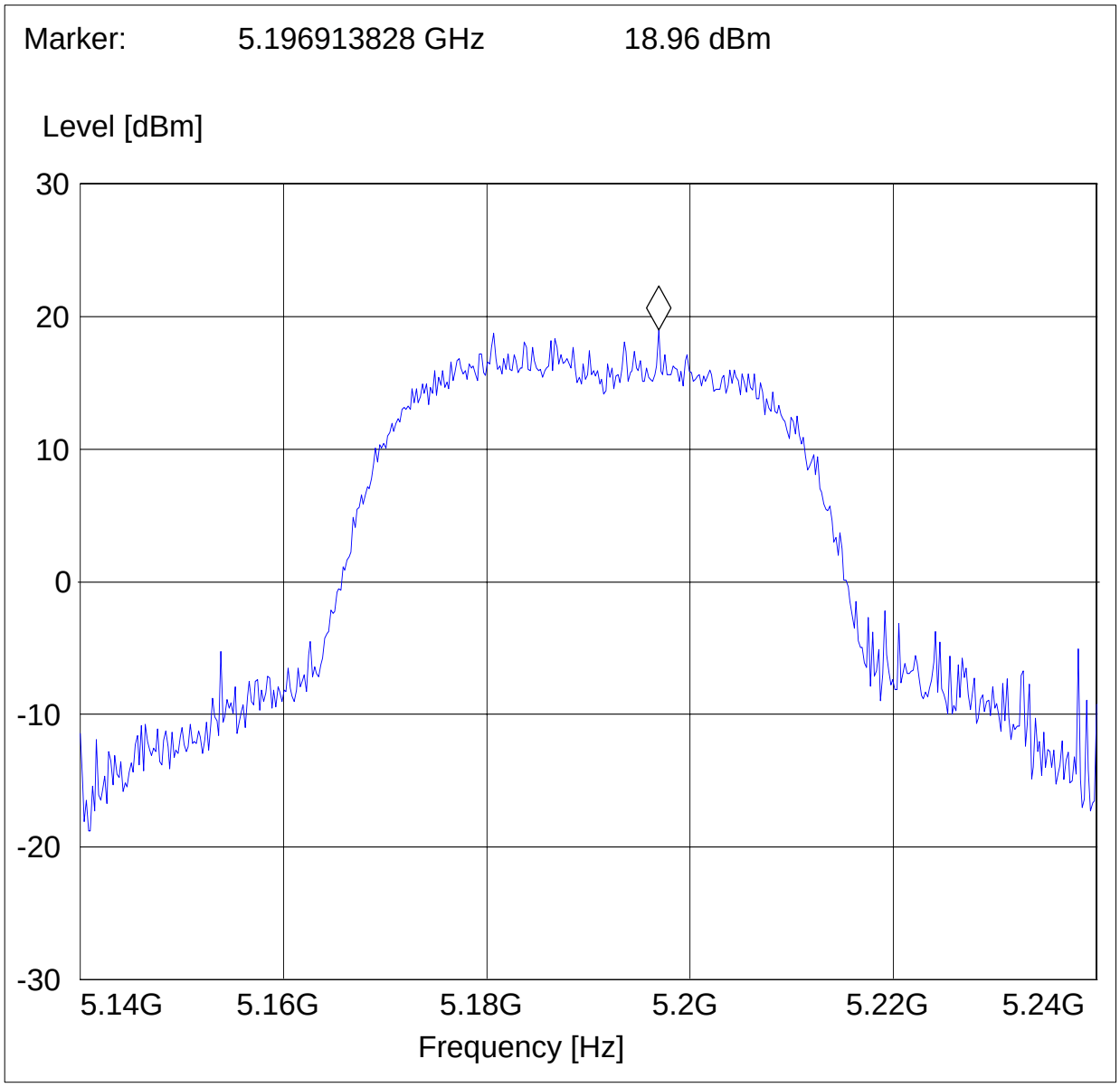
EIRP 802.11 (n) Mode (5190) Chain AB

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

EUT: RedStorm
Customer: HP Texas
Test Mode: 802.11 n, ch 38, 40MHz BW, chain ab
ANT Orientation: H
EUT Orientation: H
Test Engineer: Satya Radhakrishna
Power Supply: AC Adapter

SWEEP TABLE: "EIRP 802.11n 38"

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



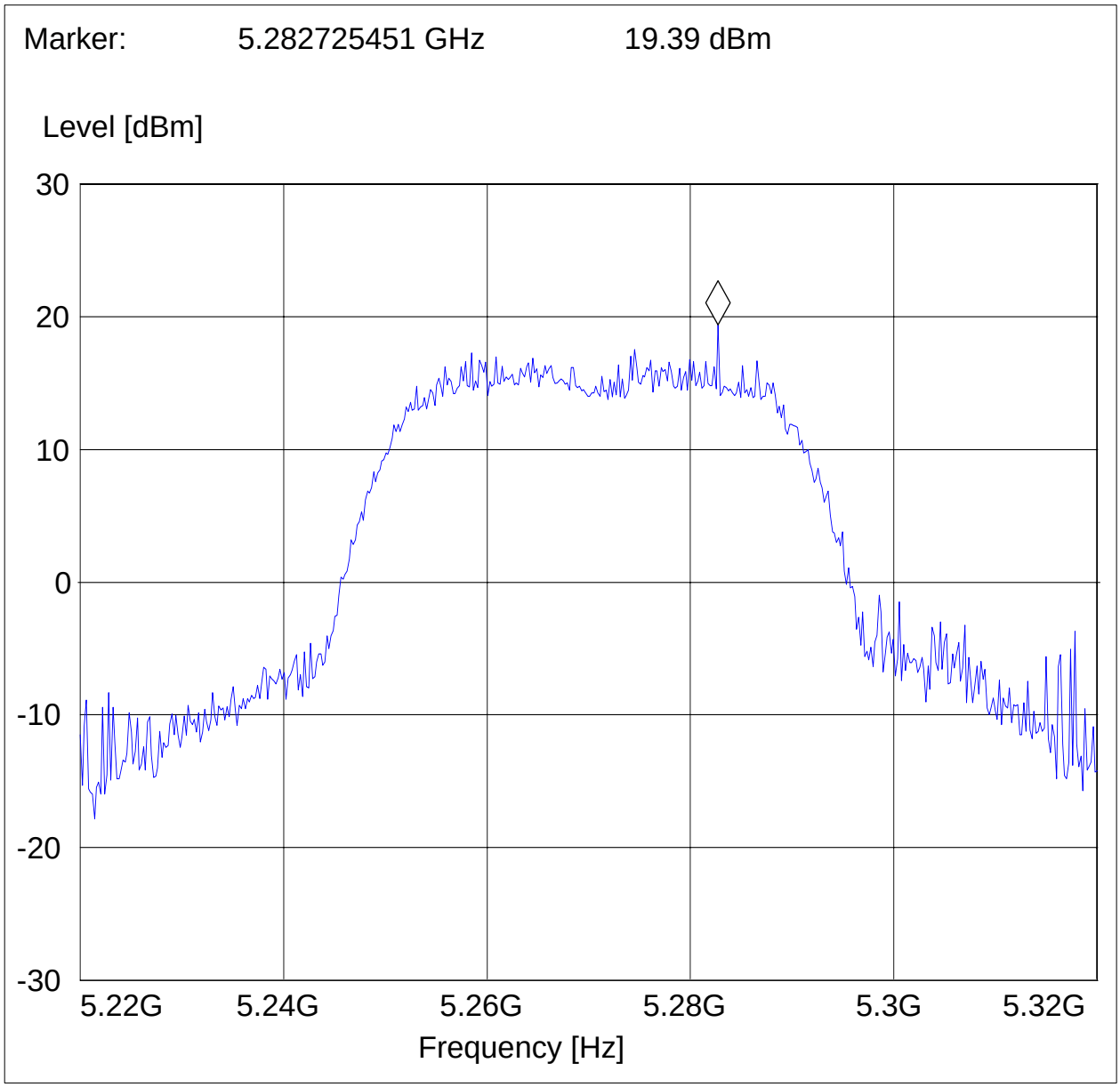
EIRP 802.11 (n) Mode (5270MHz) Chain AB

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

EUT: RedStorm
Customer: HP Texas
Test Mode: 802.11 n, ch 54, 40MHz BW, chain ab
ANT Orientation: H
EUT Orientation: H
Test Engineer: Satya Radhakrishna
Power Supply: AC Adapter

SWEEP TABLE: "EIRP 802.11n 54"

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



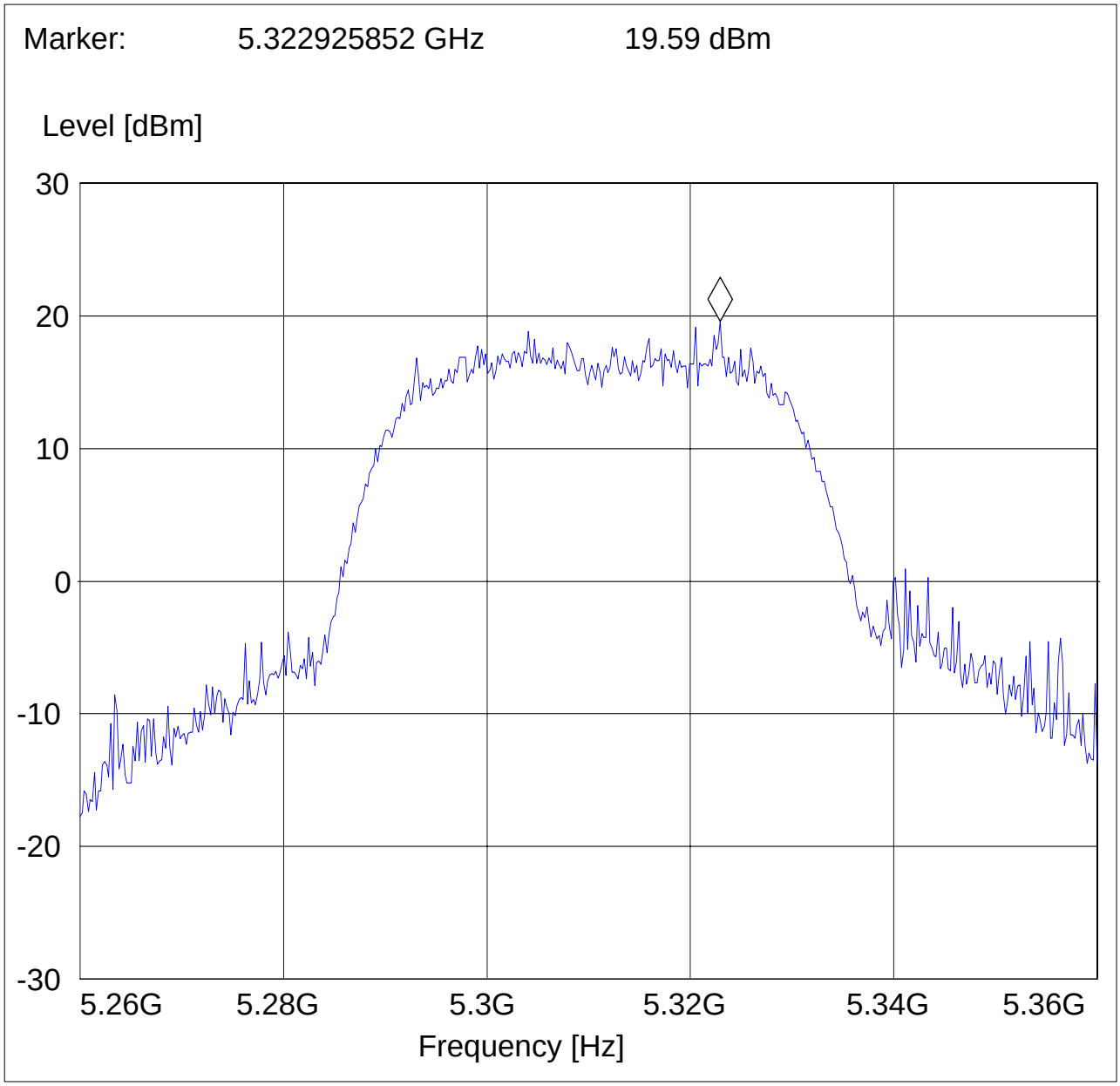
EIRP 802.11 (n) Mode (5310MHz) Chain AB

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

EUT / Description: RedStorm
Manufacturer: HP Texas
Test mode: 802.11n, ch 62, 40MHz BW, chain ab
ANT Orientation: H
EUT Orientation: H
Test Engineer: Satya Radhakrishna
Voltage: AC Adapter
Comments: Marker placed on transmit signal

SWEEP TABLE: "EIRP 802.11n 62"

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



RESTRICTED BAND EDGE COMPLIANCE RADIATED §15.407(b)/15.205

5.1.2 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**

5.1.3 802.11 (n) MODE (5190MHz) Chain AB

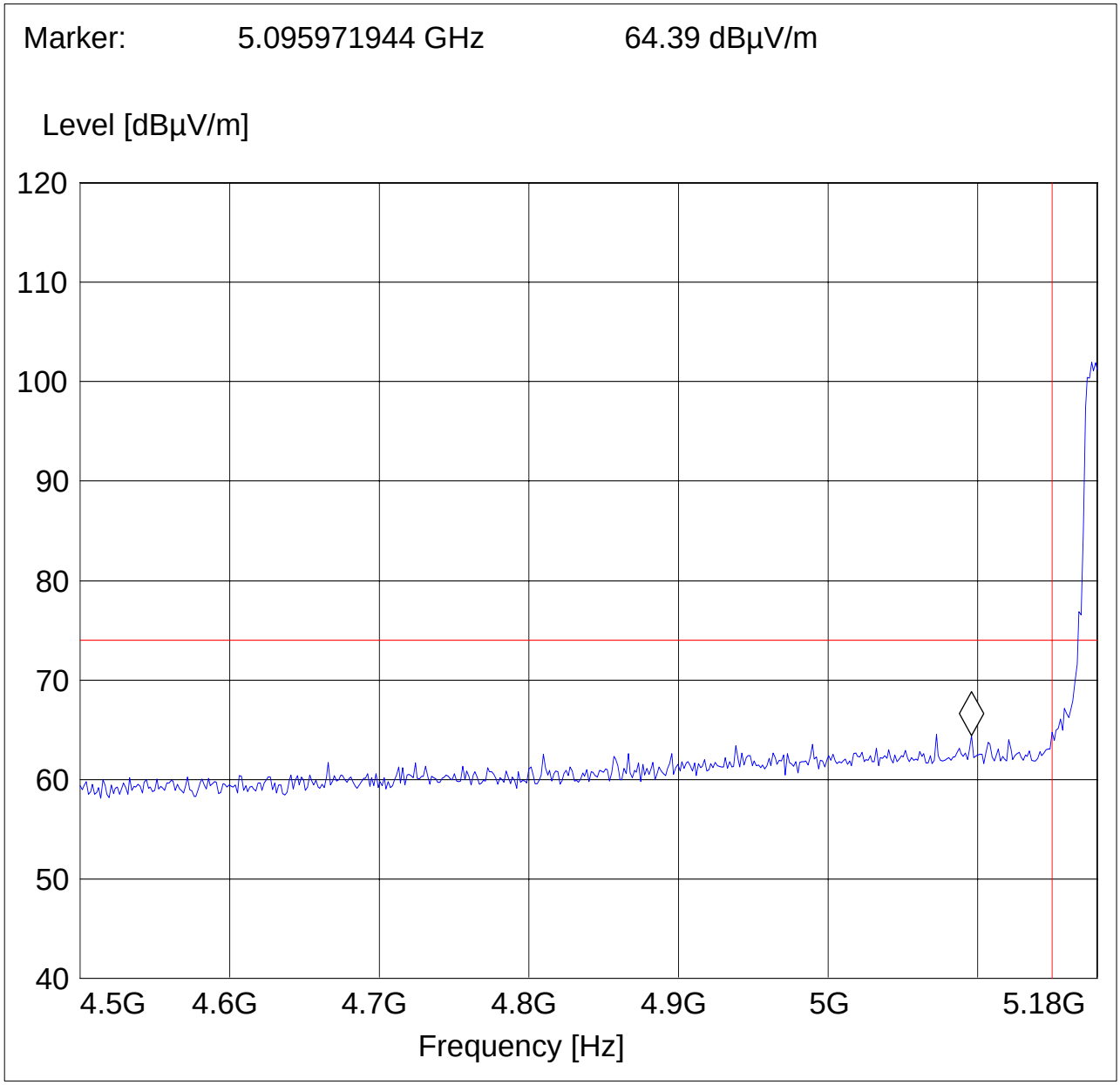
PEAK

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

```
EUT:             RedStorm
Customer:        HP Texas
Test Mode:       802.11n, 40 MHz, ch 38, chain ab
ANT Orientation: H
EUT Orientation: H
Test Engineer:   Peter
Power Supply:    AC Adapter
```

SWEEP TABLE: "FCC15.407 A_LBE_PK"

```
Unit:     dBµV/m
          Detector:         Mode:
Curve 1:  MaxPeak           MaxHold  VBW: 1MHz  RBW: 1MHz
```



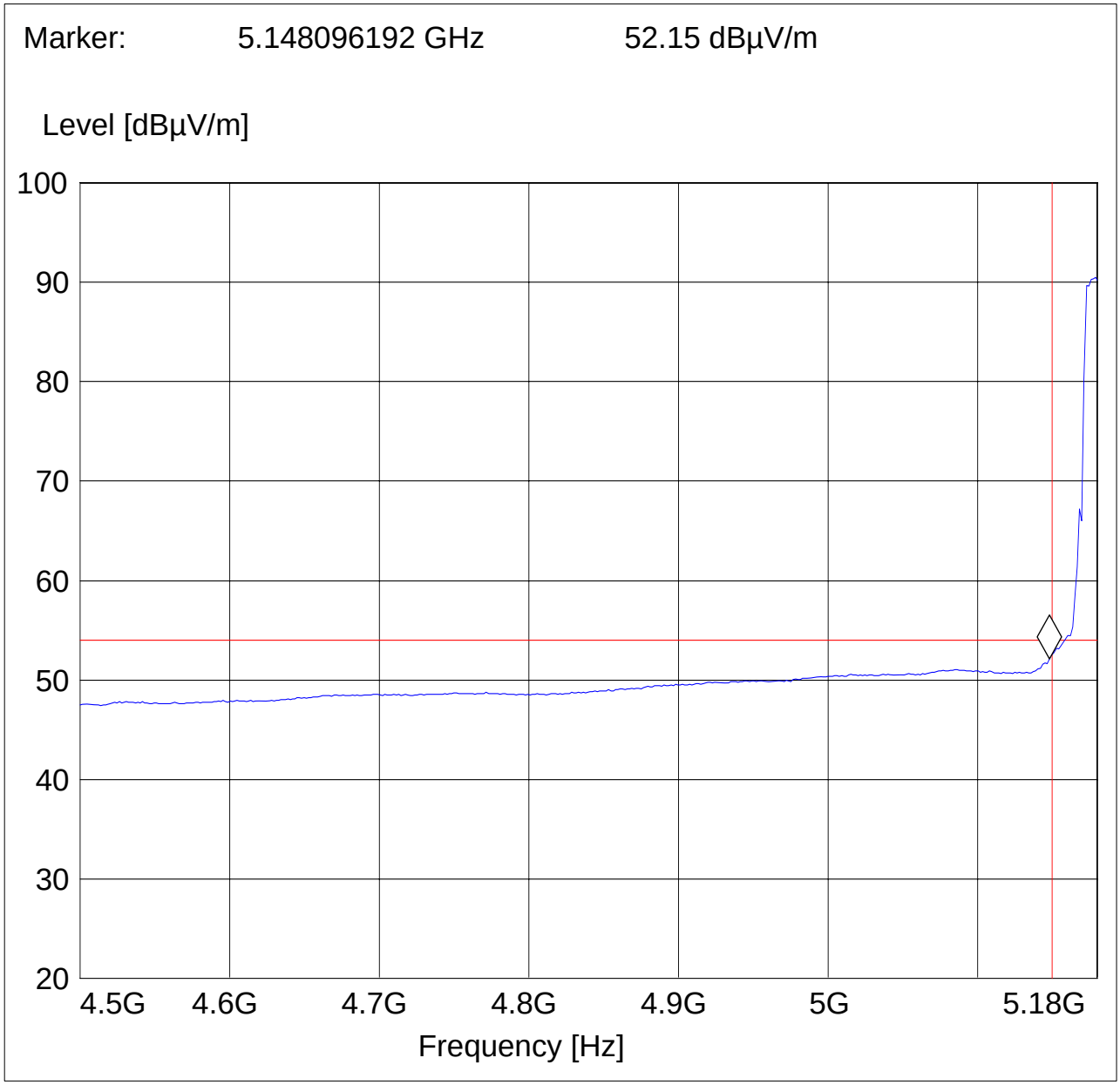
802.11 (n) MODE (5190MHz) Chain AB
AVG

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

```
EUT:             RedStorm
Customer:        HP Texas
Test Mode:       802.11n, 40 MHz, ch 38, chain ab
ANT Orientation: H
EUT Orientation: H
Test Engineer:   Peter
Power Supply:    AC Adapter
```

SWEEP TABLE: "FCC15.407 A_LBE_AVG"

```
Unit:     dBµV/m
          Detector:         Mode:
Curve 1:  MaxPeak           MaxHold  VBW: 1MHz  RBW: 1MHz
```



5.1.4 802.11 (n) MODE (5310MHz) Chain AB

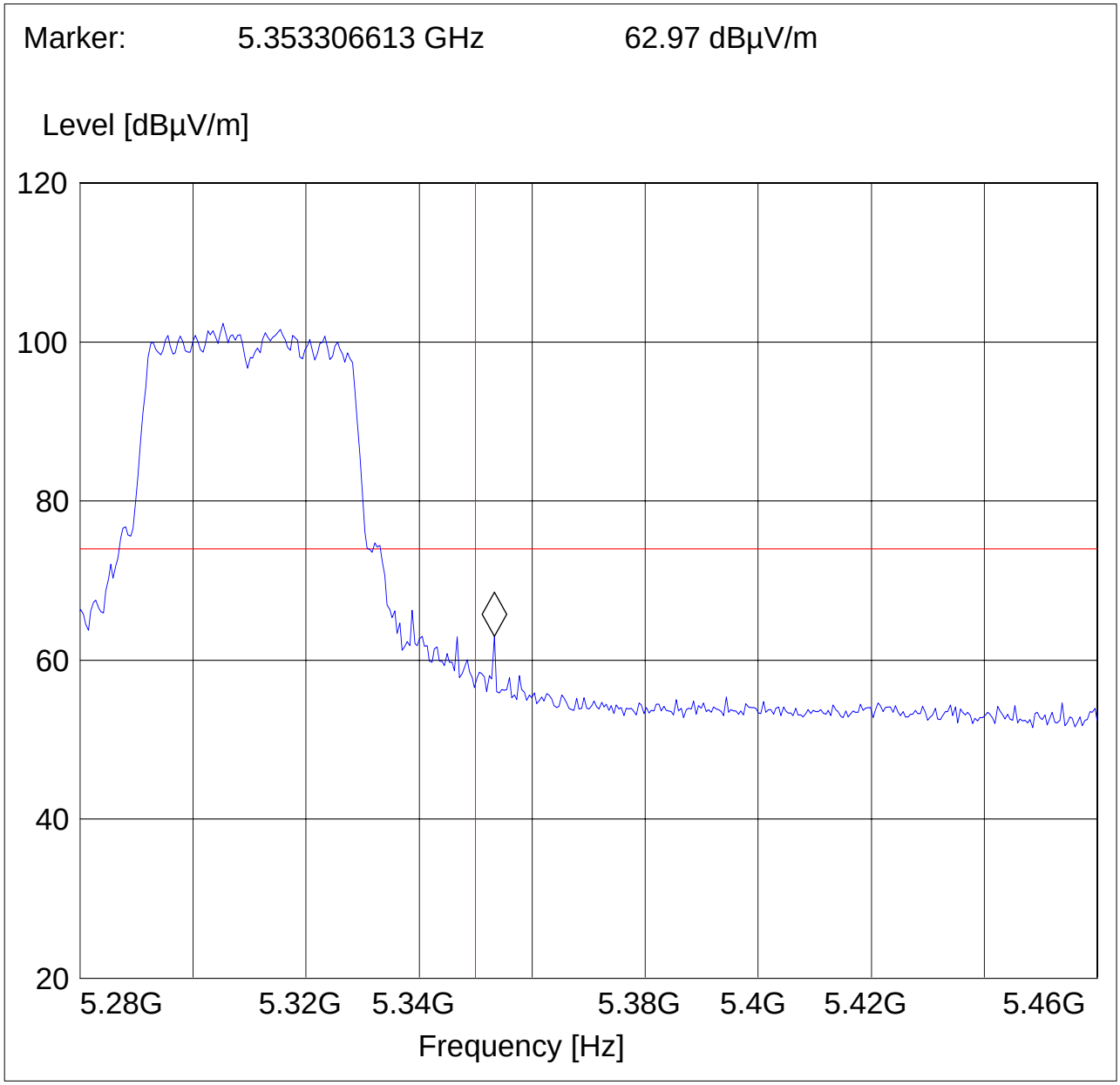
PEAK

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

```
EUT:              RedStorm
Customer:         HP Texas
Test Mode:        802.11n, 40 MHz, ch 62, chain ab
ANT Orientation:  H
EUT Orientation:  H
Test Engineer:    Peter
Power Supply:     AC Adapter
```

SWEEP TABLE: "FCC15.407 A_HBE_PK"

```
Unit:      dBµV/m
           Detector:          Mode:
Curve 1:   MaxPeak            MaxHold  VBW: 1MHz  RBW: 1MHz
```



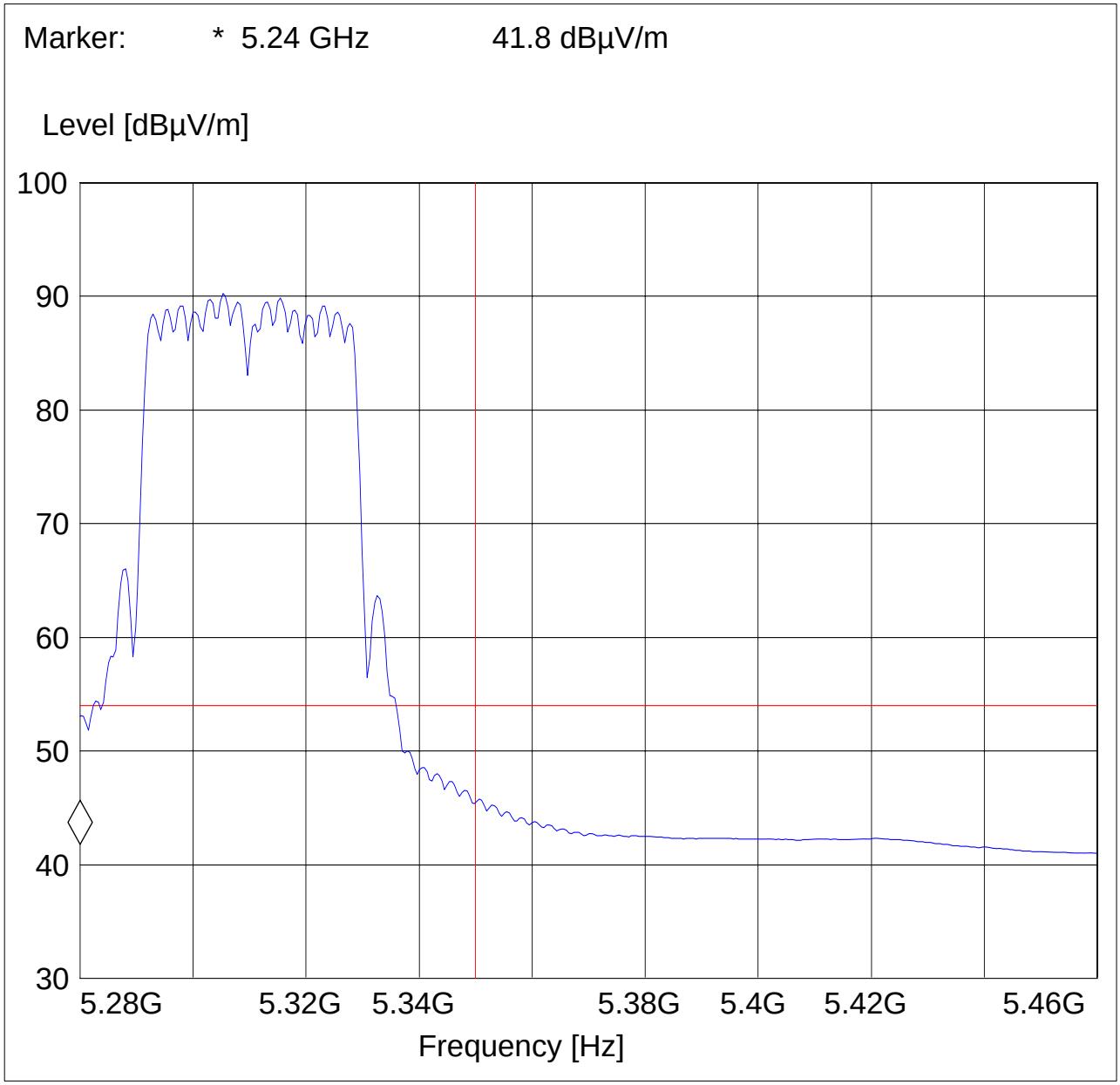
802.11 (n) MODE (5310MHz) Chain AB
AVG

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

```
EUT:              RedStorm
Customer:         HP Texas
Test Mode:        802.11n, 40 MHz, ch 62, chain ab
ANT Orientation:  H
EUT Orientation:  H
Test Engineer:    Peter
Power Supply:     AC Adapter
```

SWEEP TABLE: "FCC15.407 A_HBE_AVG"

```
Unit:      dBµV/m
           Detector:          Mode:
Curve 1:   MaxPeak            MaxHold  VBW: 1MHz  RBW: 1MHz
```



5.2 TRANSMITTER SPURIOUS EMISSIONS RADIATED § 15.407(b)/15.205/15.209

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 for spurious in restricted bands**
***AVG. LIMIT= 54dBuV/m for spurious in restricted bands**
***PEAK LIMIT= 68.2dBuV/m for spurious NOT in restricted bands**

NOTE:
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.

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

5.2.2 RESULTS 802.11 (n) MODE Chain AB

30MHz – 1GHz

Antenna: Horizontal

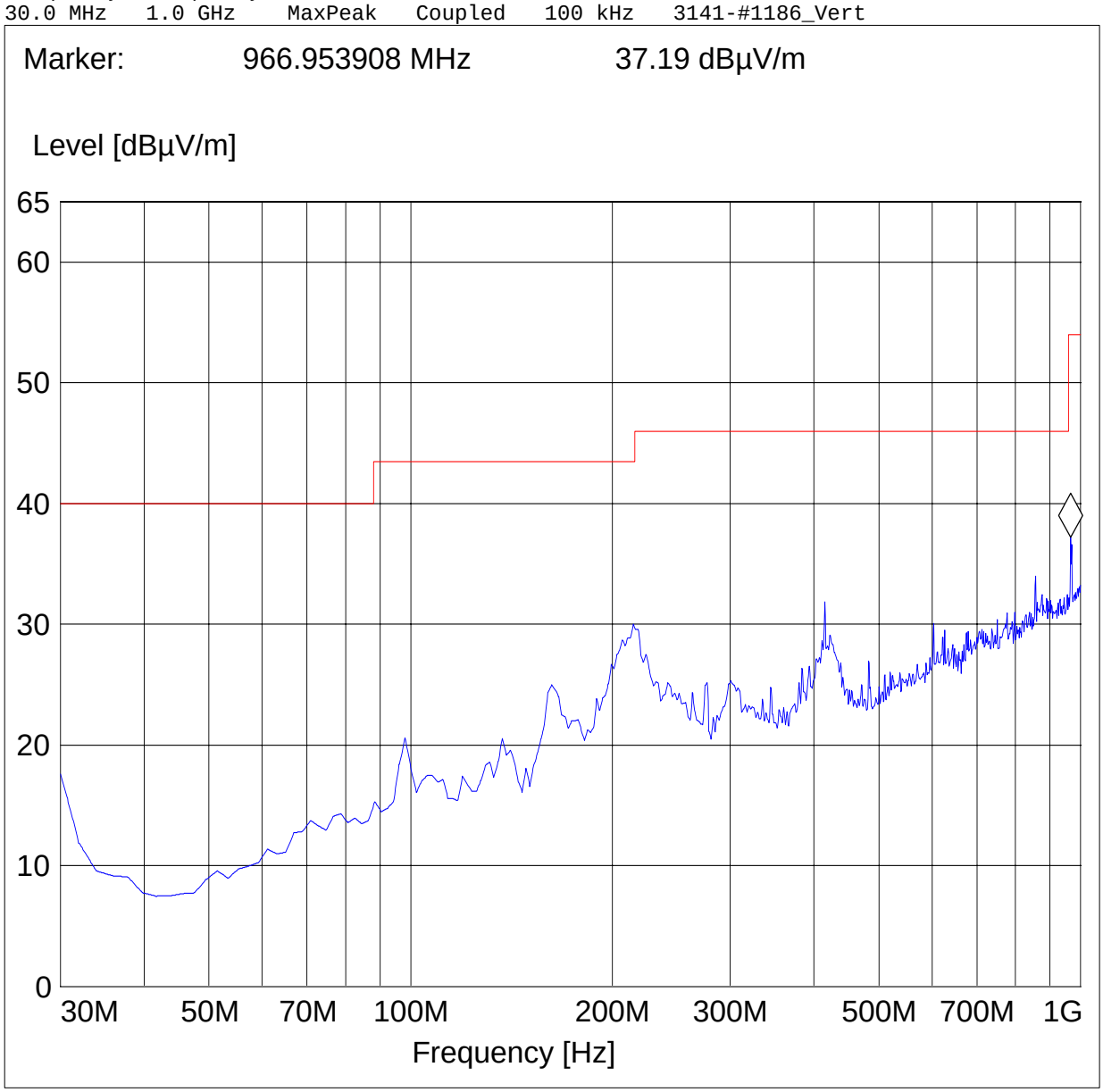
Note: This plot is valid for low, mid, high channels horizontal and vertical polarities (worst-case plot).

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

EUT: Redstorm
Customer: HP Texas
Test Mode: 802.11n, ch 62, 40MHz BW, chain ab
ANT Orientation: H
EUT Orientation: H
Test Engineer: Ed
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



1-18GHz (5190MHz) Chain AB

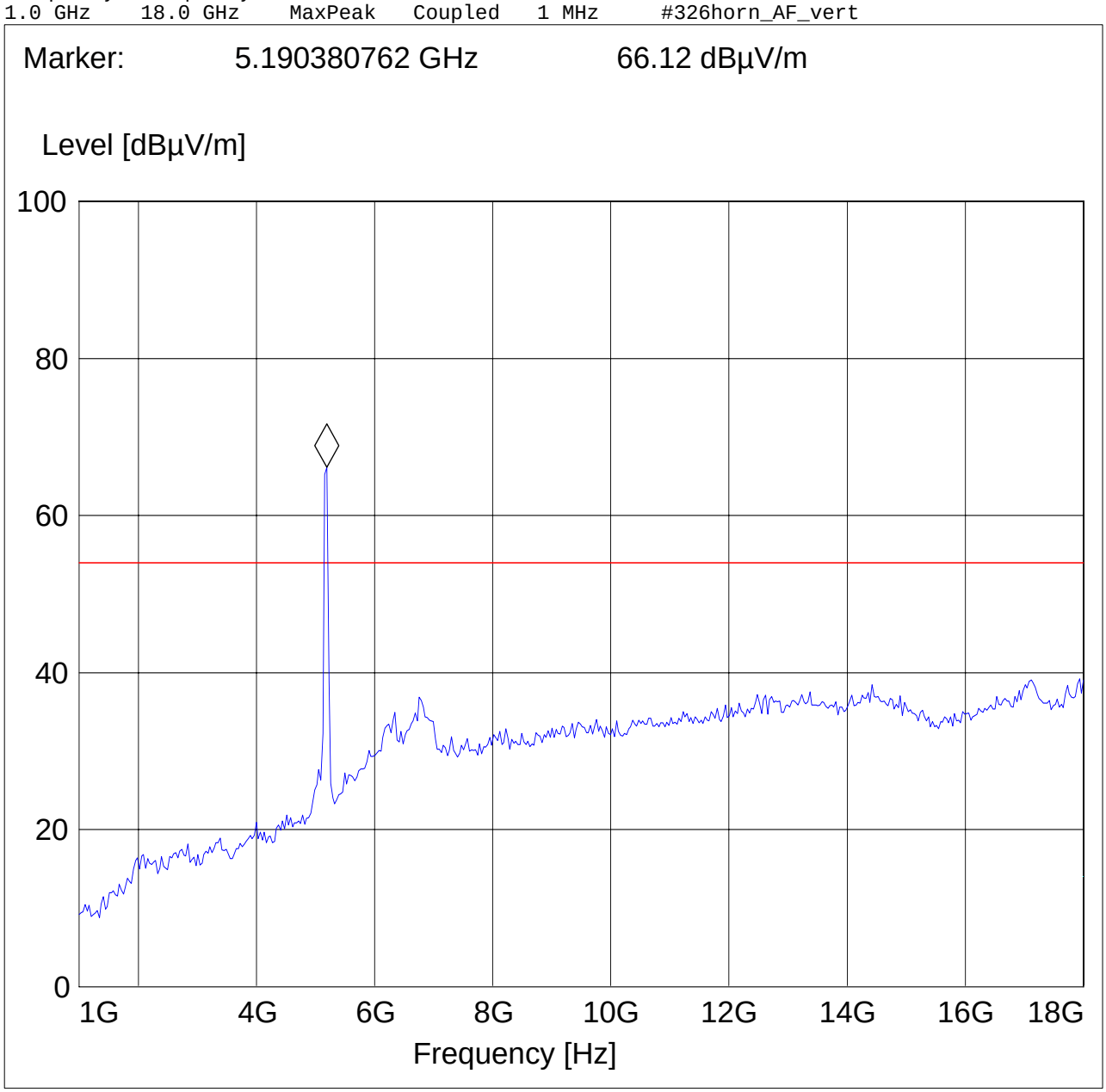
Note: The peaks above the limit line is the carrier freq.Note: Peak Reading vs. Average limit

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

EUT / Description: RedStorm
Manufacturer: HP Texas
Test mode: 802.11n, ch 38, 40MHz BW, chain ab
ANT Orientation: H
EUT Orientation: H
Test Engineer: Satya Radhakrishna
Voltage: AC Adapter
Comments: Marker 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



1-18GHz (5270MHz) Chain AB

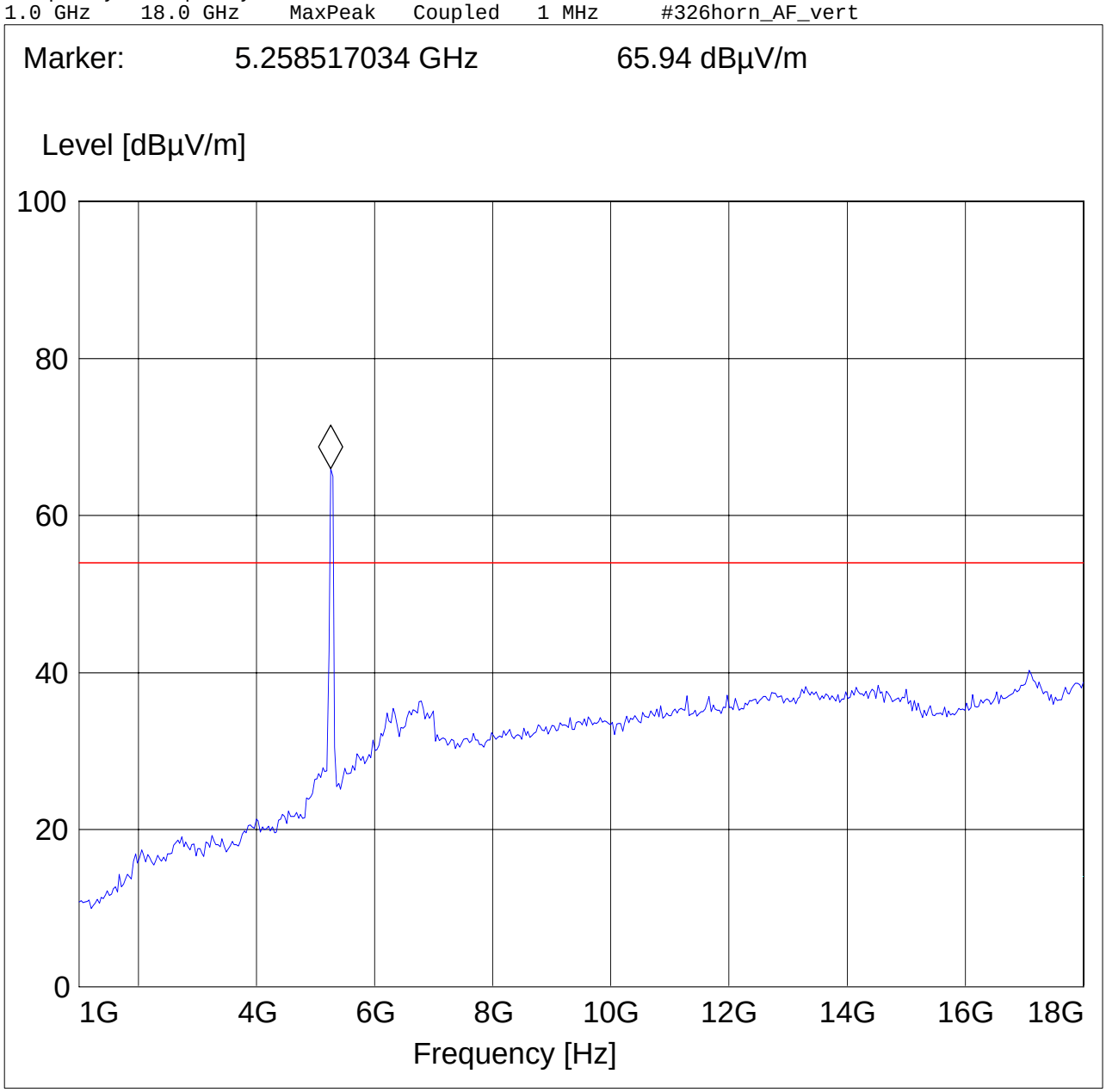
Note:The peaks above the limit line is the carrier freq.Note:Peak Reading vs. Average limit

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

EUT / Description: RedStorm
Manufacturer: HP Texas
Test mode: 802.11n, ch 54, 40MHz BW, chain ab
ANT Orientation: H
EUT Orientation: H
Test Engineer: Satya Radhakrishna
Voltage: AC Adapter
Comments: Marker 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



1-18GHz (5310MHz) Chain AB

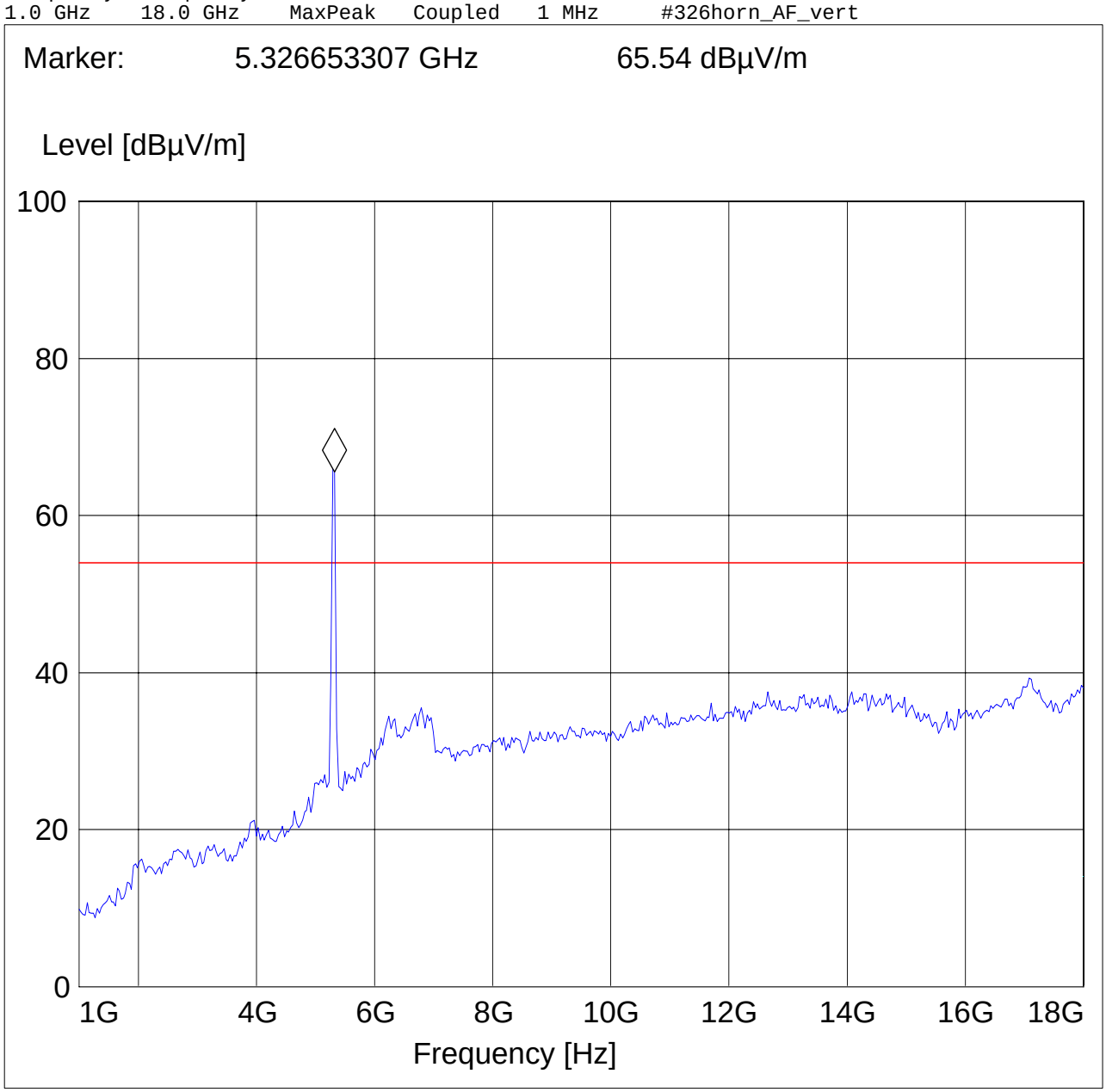
Note:The peaks above the limit line is the carrier freq.Note:Peak Reading vs. Average limit

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

EUT / Description: RedStorm
Manufacturer: HP Texas
Test mode: 802.11n, ch 62, 40MHz BW, chain ab
ANT Orientation: H
EUT Orientation: H
Test Engineer: Satya Radhakrishna
Voltage: AC Adapter
Comments: Marker 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



18-26.5GHz (5190MHz) Chain AB

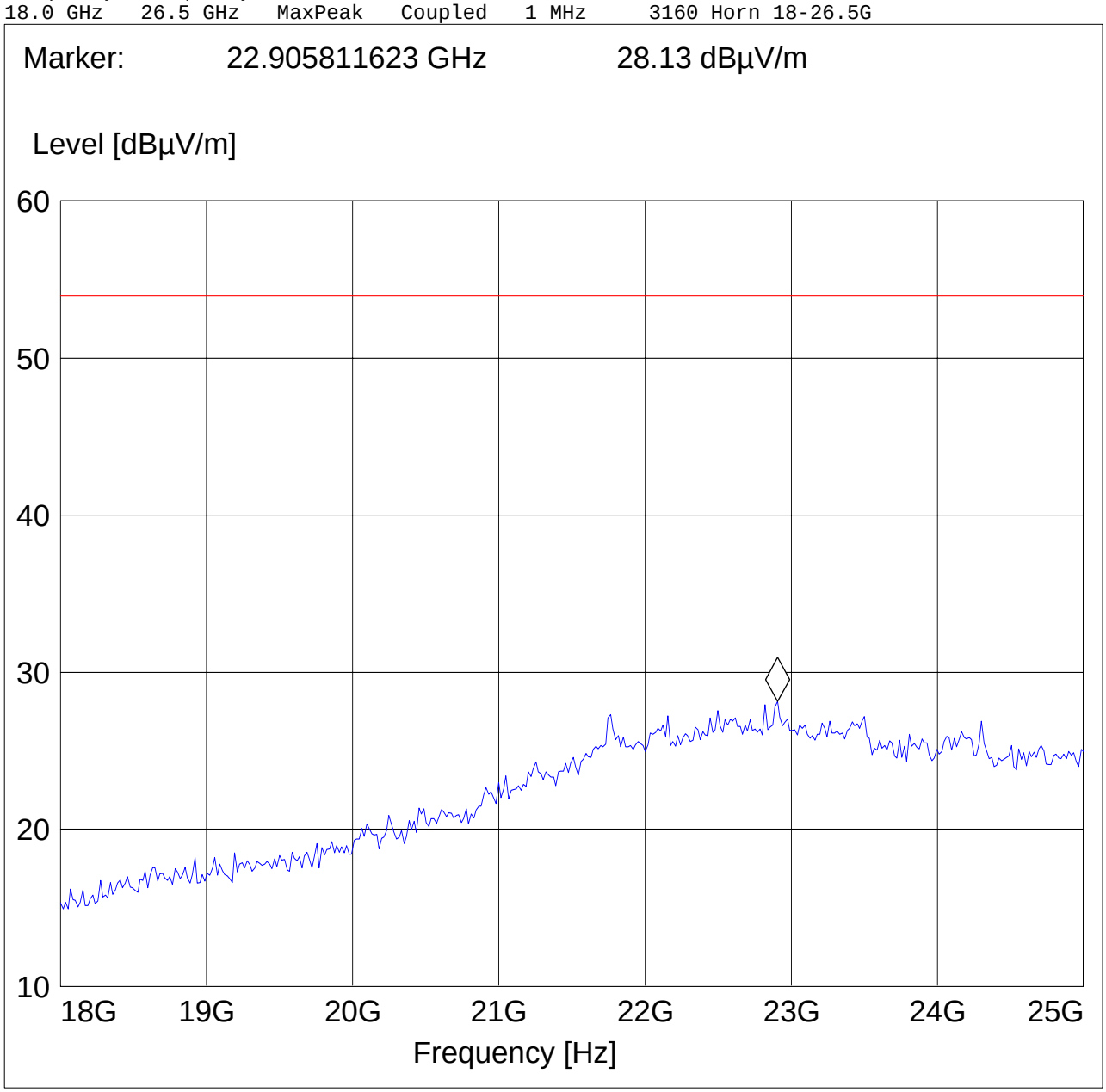
Note:Peak Reading vs. Average limit

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

EUT: Redstorm
Customer: HP Texas
Test Mode: 802.11n, 40MHz, ch 38, chain ab
ANT Orientation: H
EUT Orientation: H
Test Engineer: Satya Radhakrishna
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



18-26.5GHz (5270MHz) Chain AB

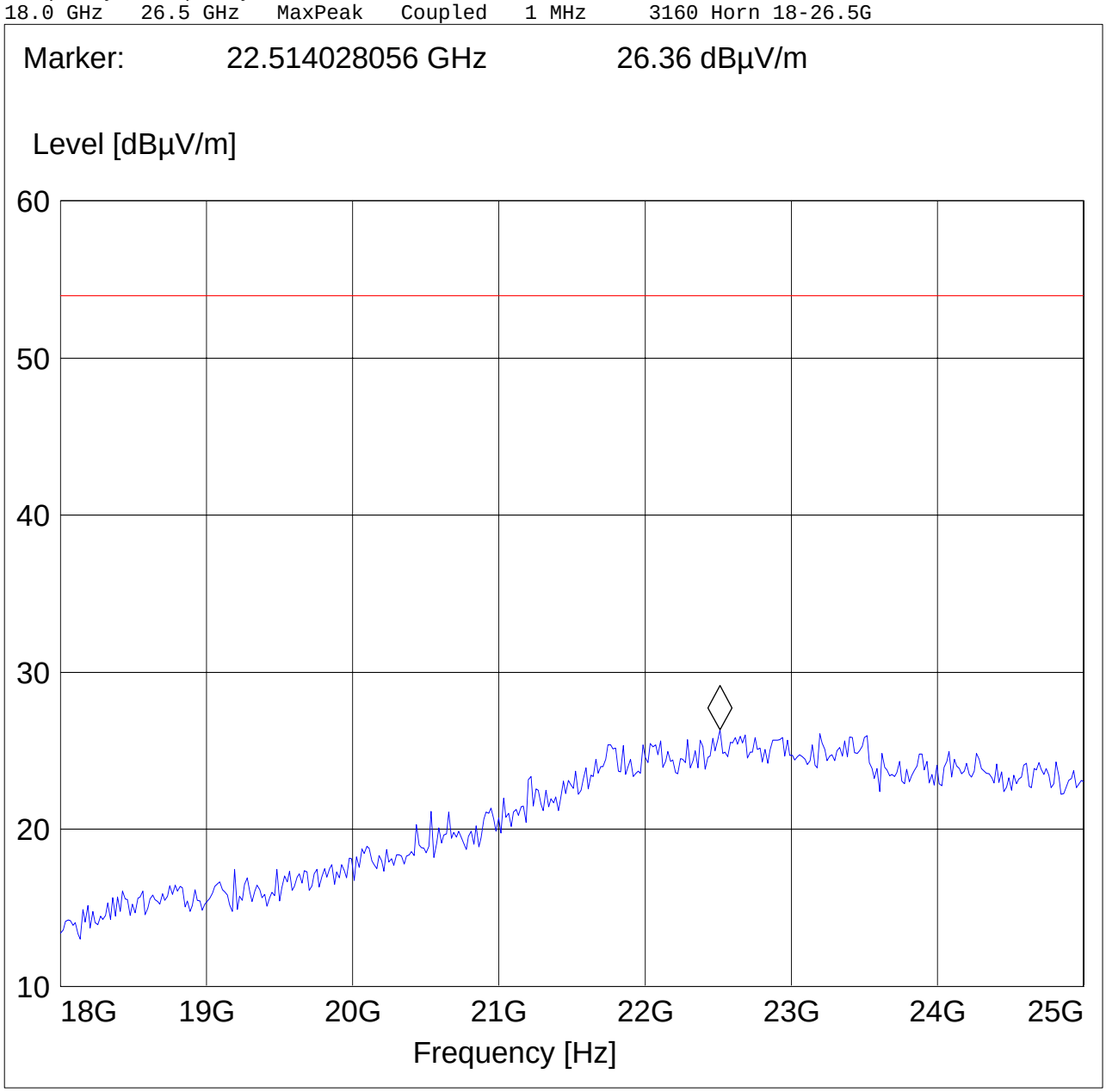
Note: Peak Reading vs. Average limit

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

EUT: Redstorm
Customer: HP Texas
Test Mode: 802.11n, 40MHz, ch 54, chain ab
ANT Orientation: H
EUT Orientation: H
Test Engineer: Satya Radhakrishna
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



18-26.5GHz (5310MHz) Chain AB

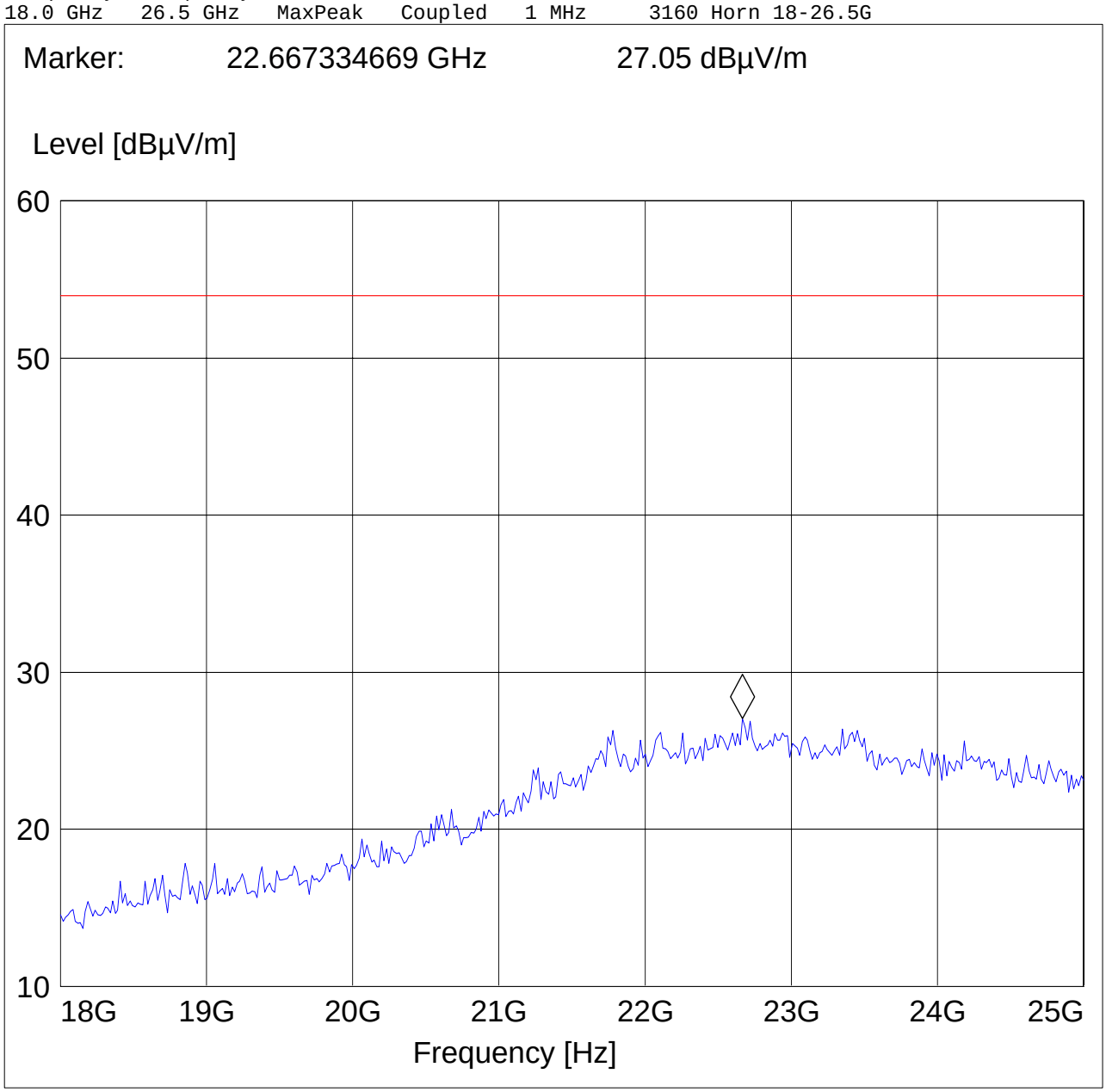
Note: Peak Reading vs. Average limit

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

EUT: Redstorm
Customer: HP Texas
Test Mode: 802.11n, 40MHz, ch 62, chain ab
ANT Orientation: H
EUT Orientation: H
Test Engineer: Satya Radhakrishna
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



26-40GHz Chain AB

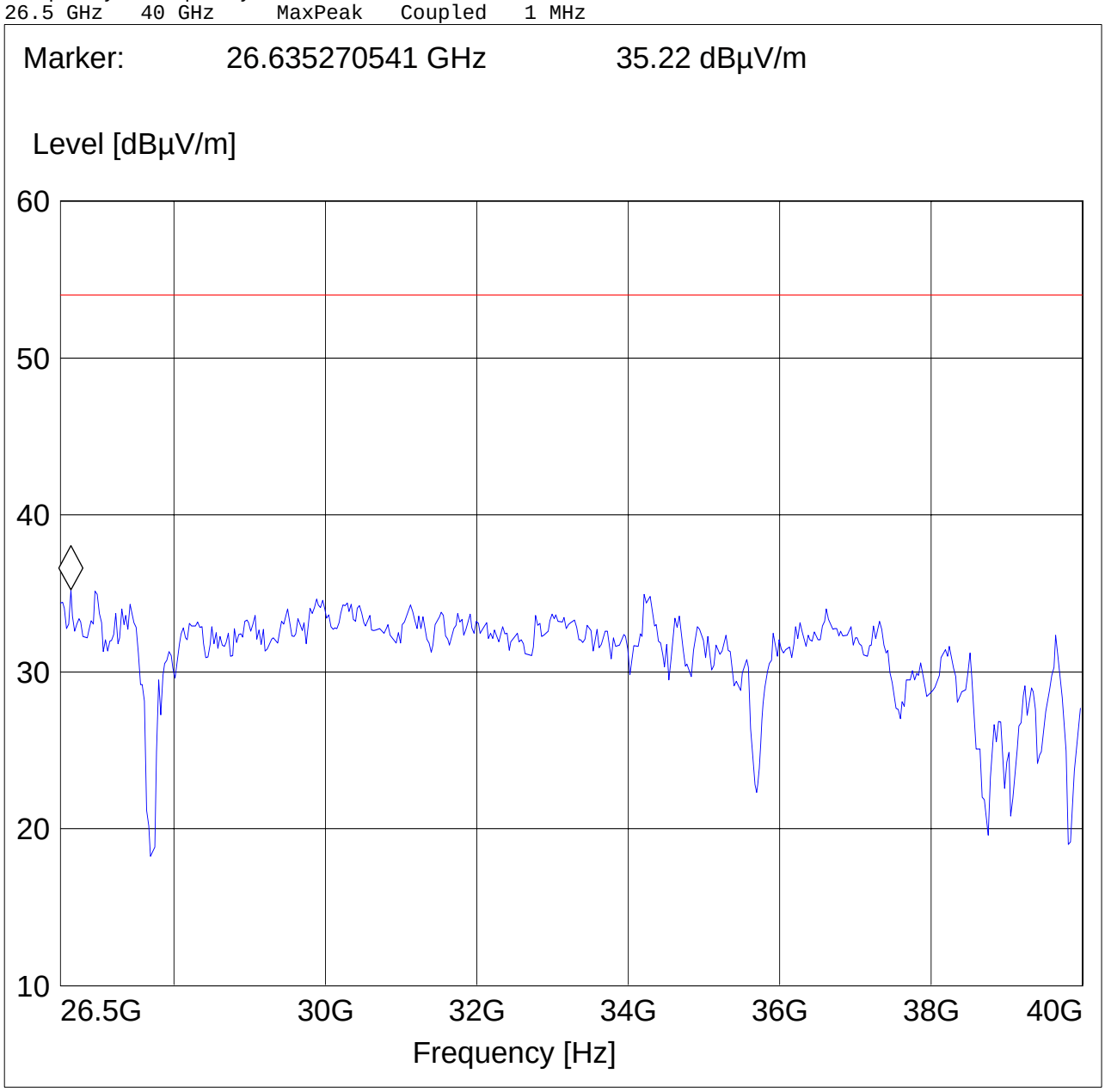
Note:This plot is valid for low, mid, high channels (worst-case plot)Note:Peak Reading vs. Average limit

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

EUT / Description: RedStorm
Manufacturer: HP Texas
Test mode: 802.11n, ch 54, 40MHz BW, chain ab
ANT Orientation: H
EUT Orientation: H
Test Engineer: Ed
Voltage: AC Adapter

SWEEP TABLE: "FCC15.247_26.5-40G"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
26.5 GHz	40 GHz	MaxPeak	Coupled	1 MHz	



5.3 AC POWER LINE CONDUCTED EMISSIONS § 15.107/207

5.3.1 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

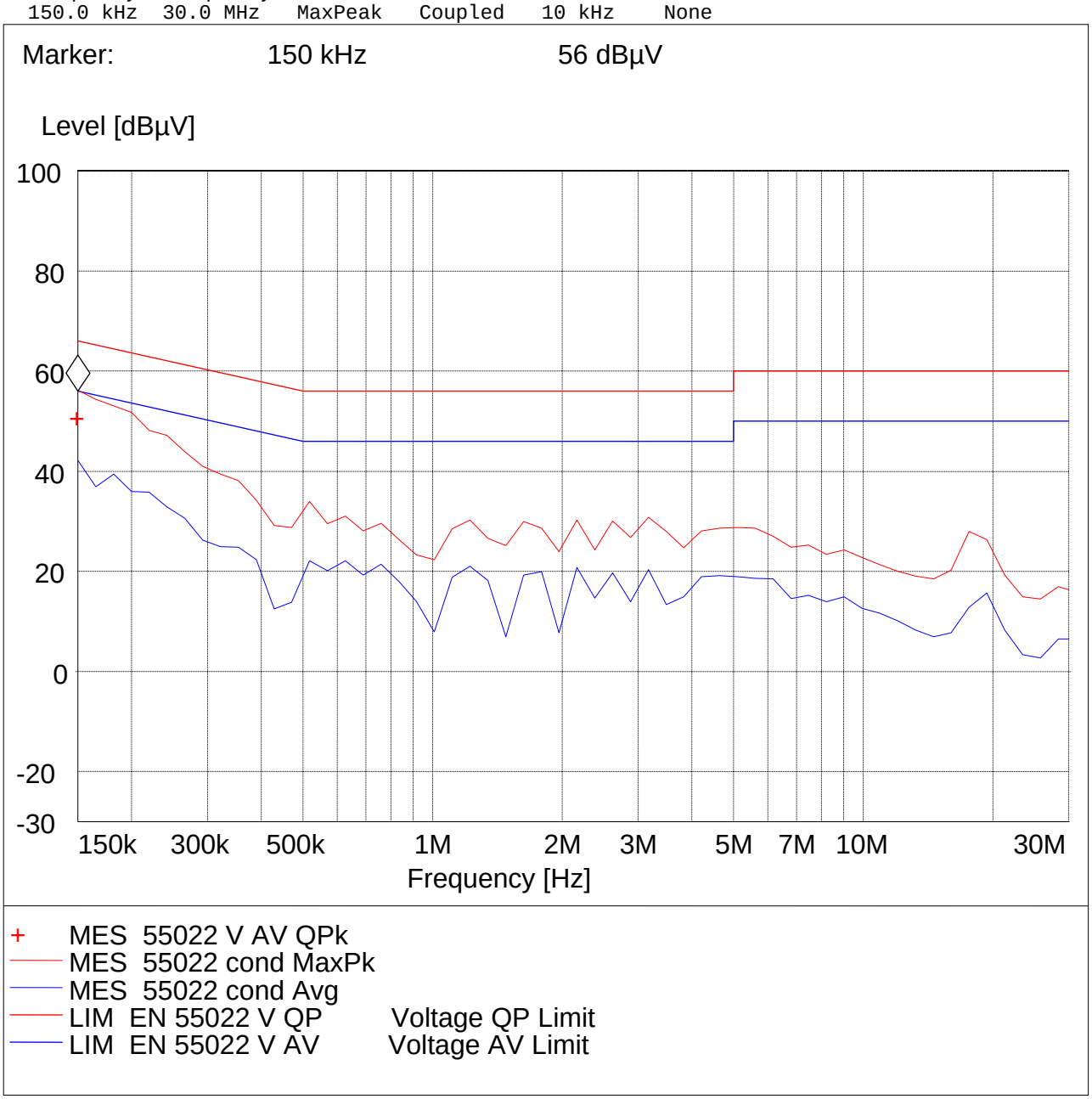
5.3.2 RESULTS

Line:

```
EUT:                RedStorm
Manufacturer:       HP
Operating Condition: WLAN
Test Engineer:      Peter Mu
EUT Orientation:    H
Voltage:            AC Adaptor
```

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
```



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

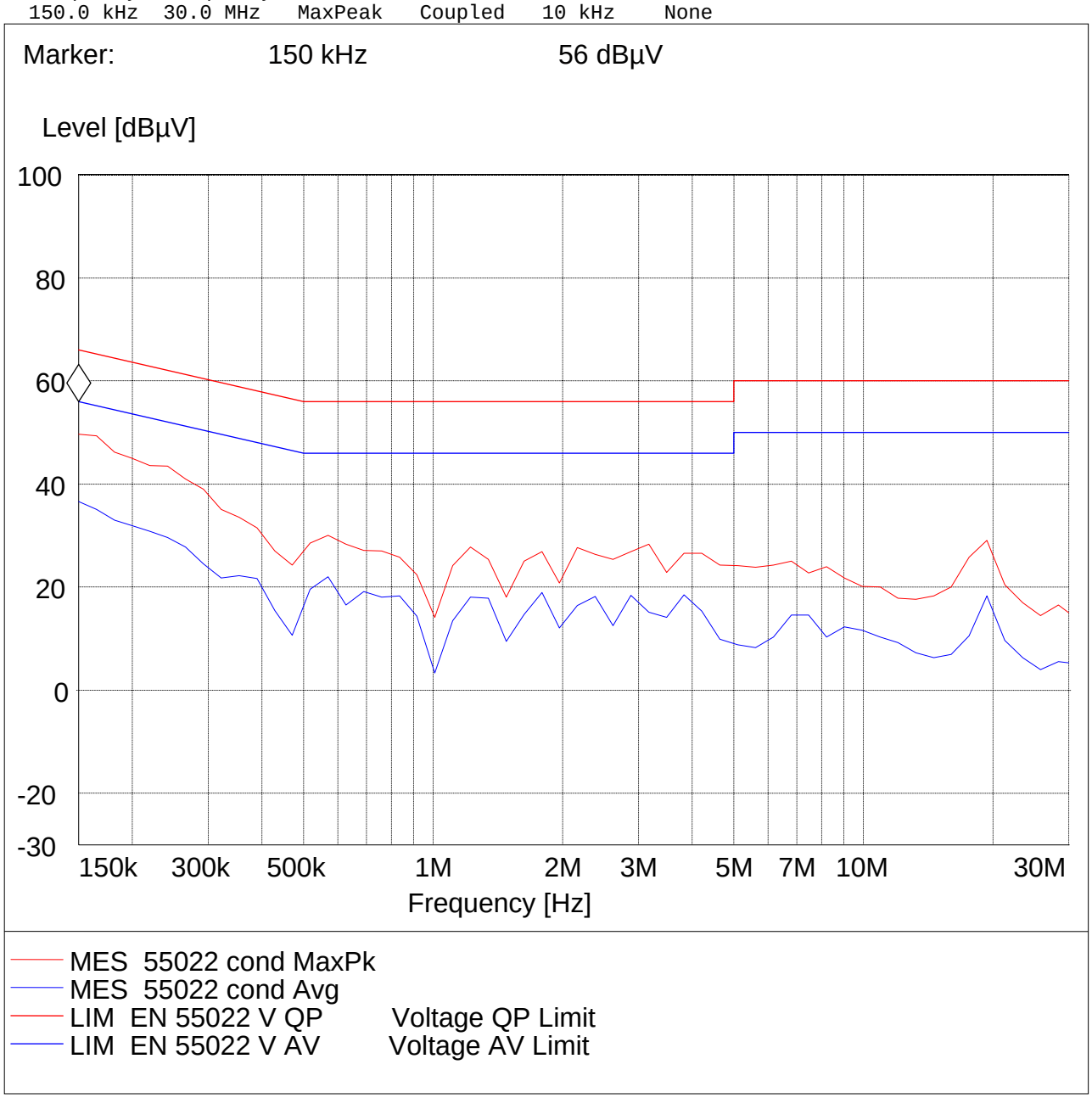
Frequency MHz	Level dBµV
0.150000	66.00
0.500000	56.00
5.000000	56.00
5.000000	60.00
30.000000	60.00

Neutral:

```
EUT:                  RedStorm
Manufacturer:         HP
Operating Condition:  WLAN
Test Engineer:        Peter Mu
EUT Orientation:      H
Voltage:              AC Adaptr
```

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
```



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
```

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

6.1 BLOCK DIAGRAMS

Radiated Testing