Class II Permissive Change Test Report

FCC Part 15.407 and RSS-210, Issue 7

for the

Broadcom, Inc.

802.11a/g Wireless LAN PCI-E Mini Card

Model Number: BCM94311MCAG

FCC ID: QDS-BRCM1019

TEST REPORT #:EMC_BROAD_041_07001_AG_UNII
DATE: August 29, 2007

ilac-MRA A2LA ACCREDITED Certificate # 2135.01

Bluetooth™ **Bluetooth Qualification Test Facility (BQTF)**

CTIA Authorized Test Lab LAB CODE 20020328-00

FCC listed#
A2LA Certified

IC recognized # 3462B

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Board of Directors: Dr. Harald Ansorge, Dr. Klaus Matkey, Hans Peter May

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Assessment

The following is in compliance with the applicable criteria specified in FCC rules Part 15.247 of the Code of Federal Regulations and IC RSS-210, Issue 7 Standards.

Company	Description	Model #
Broadcom, Inc.	**Wireless LAN PCI-E Mini Card**	**BCM94311MCAG**

Technical responsibility for area of testing:

Date	Section	Name	Signature
August 29, 2007	**EMC & Radio**	Lothar Schmidt **(Test Lab Manager)**	Lothar Schmidt I am approving this document

Responsible for test report and project leader:

Date	Section	Name	Signature
August 29, 2007	**EMC & Radio**	Juan Martinez **(Project Engineer)**	Juan Martinez I am the author of this document

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.

Administrative Data

Identification of the Testing Laboratory Issuing the Radio Assessment Report

Company Name:	CETECOM, Inc.
Department:	EMC
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Telephone:	+1 (408) 586 6200
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Project Leader:	Juan Martinez
Responsible Test Lab Manager:	Lothar Schmidt

Identification of the Client

Applicant's Name:	Broadcom, Inc.
Address:	190 Mathilda Place Sunnyvale, CA 94086, USA
Contact Person:	Daniel Lawless
Phone No.	408-922-5870
Fax:	408-543-3399
e-mail:	dlawless@broadcom.com

Identification of the Manufacturer

Manufacturer's Name:	Broadcom, Inc.
Manufacturer's Address:	190 Mathilda Place, Sunnyvale, California 94086 USA

1 Equipment under Test (EUT)

1.1 Specification of the Equipment under Test

Product Type	Wireless LAN PCI-E Mini Card
Marketing Name:	802.11a/g Wireless LAN PCI-E Mini Card
Model No:	BCM94311MCAG
FCC-ID:	QDS-BRCM1019
Frequency Range:	5180 – 5320MHz
Number of Channels	8
Type(s) of Modulation:	OFDM
Antenna Type:	Spears = PIFA Antenna Aux (-0.4dBi) Hawke = PIFA Antenna Aux (0.1dBi)
Output Power:	14.2dBm, 0.0264 W @ 5180 MHz 15.3dBm, 0.0338 W @ 5260 MHz 11.7dBm, 0.0147 W @ 5320 MHz

1.2 Class II permissive change laptops to be added

AE #	TYPE	MANF.	MODEL	SERIAL #
1	Laptop	Dell	PP28L (Hawke)	N/A
1	Laptop	Dell	PP29L (Spears)	N/A

Subject Of Investigation

All testing were performed on the PP28L (Hawke) laptop with the BCM94311MCAG pre-approved module. Although the Spears laptop was not tested it has the same type of antenna installed, but with a lower gain then the Hawke Aux antenna. Data, presented in this report, was collected for a Class II permissive change to add the laptops to the BCM94311MCAG (FCC ID: QDS-BRCM1019) module application.

The objective of the measurements done by Cetecom Inc. was to measure the performance of the EUT as specified by requirements listed in FCC rules Part 15.247 of Title 47 of the Code of Federal Regulations and to Industry Canada RSS-210, Issue 7. The maximization of portable equipment is conducted in accordance with ANSI C63.4.

Measurements

1.3 MAXIMUM PEAK OUTPUT POWER § 15.407 & RSS-210 (RADIATED)

1.3.1 LIMIT SUB CLAUSE § 15.407 (a) & RSS-210 (A9.2)(2)

Frequency range	RF power output limit
5180MHz	23dBm EIRP
5260MHz	30dBm EIRP
5320MHz	30dBm EIRP

1.3.2 EIRP 802.11 (a) MODE:

TEST CONDITIONS		MAXIMUM PEAK OUTPUT POWER (dBm)		
Frequency (MHz)		5180	5260	5320
T_{nom}(23)°C	V_{nom}VDC	14.23	15.28	11.7
Measurement uncertainty		±0.5dBm		

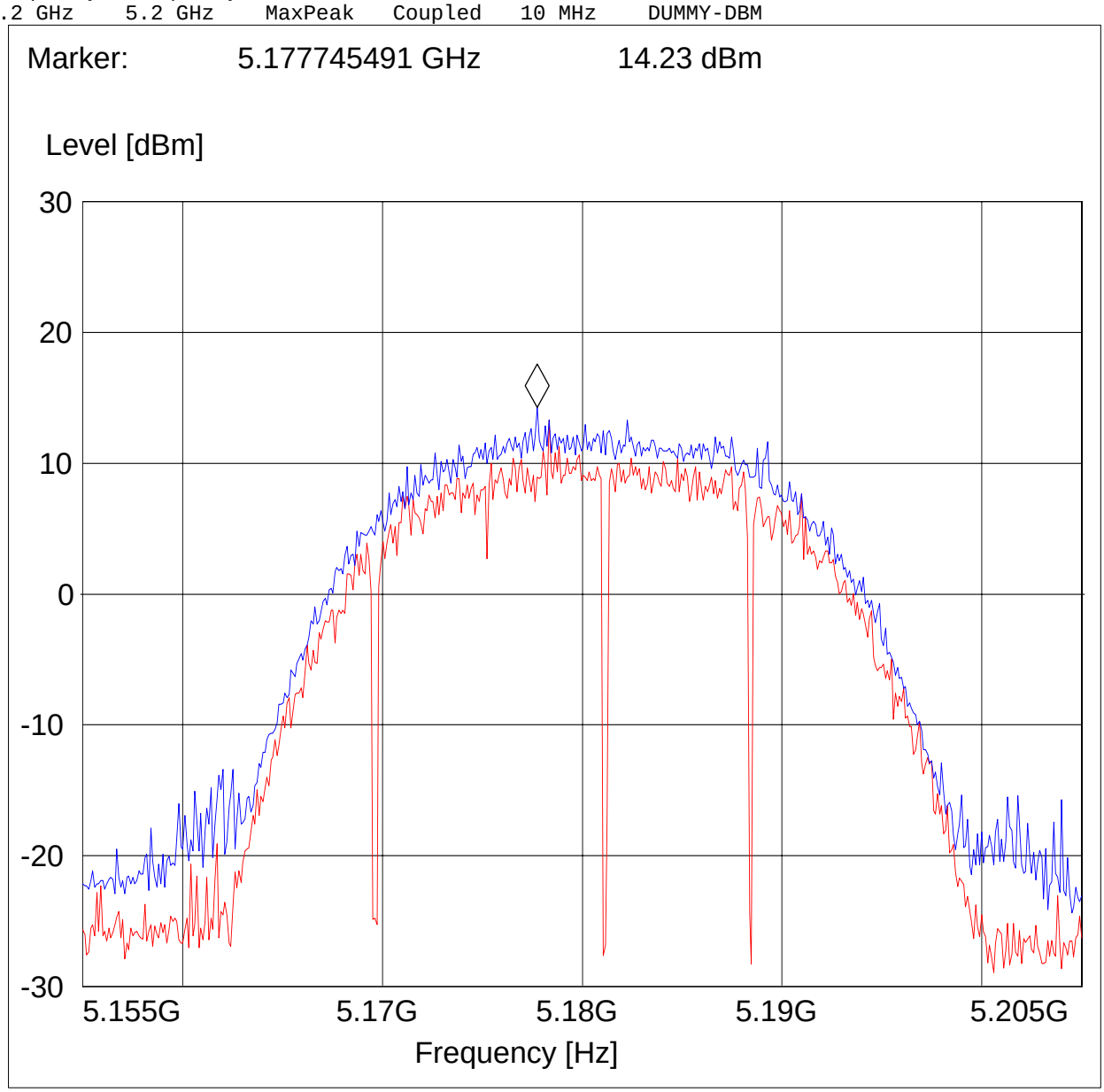
Note 1: For 802.11a powers were set to transmit at the specified average output power. Only the Hawke laptop was tested since the antenna gain was higher then the Spears, which uses the same antenna, but the antenna gain on the Spears is lower.
Note 2: Measurements were done on the Aux antenna. EIRP values shown in this report are with the device transmitting on the Aux antenna. Both vertical and horizontal were measured. Worst case polarization was vertical for Auxiliary.

EIRP 802.11 (a) Mode (5180)

```
EUT:              BCM94311MAG
Customer:         Broadcom
Test Mode:        802.11 a, Ch. 36, Aux antenna
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    Juan
Power Supply:     AC Power Supply
```

SWEEP TABLE: "EIRP 802.11a 36"

```
  Short Description:            EIRP channel-5180 MHz
  Start      Stop       Detector  Meas.     IF         Transducer
  Frequency  Frequency            Time      Bandw.
  5.2 GHz    5.2 GHz    MaxPeak   Coupled   10 MHz     DUMMY-DBM
```

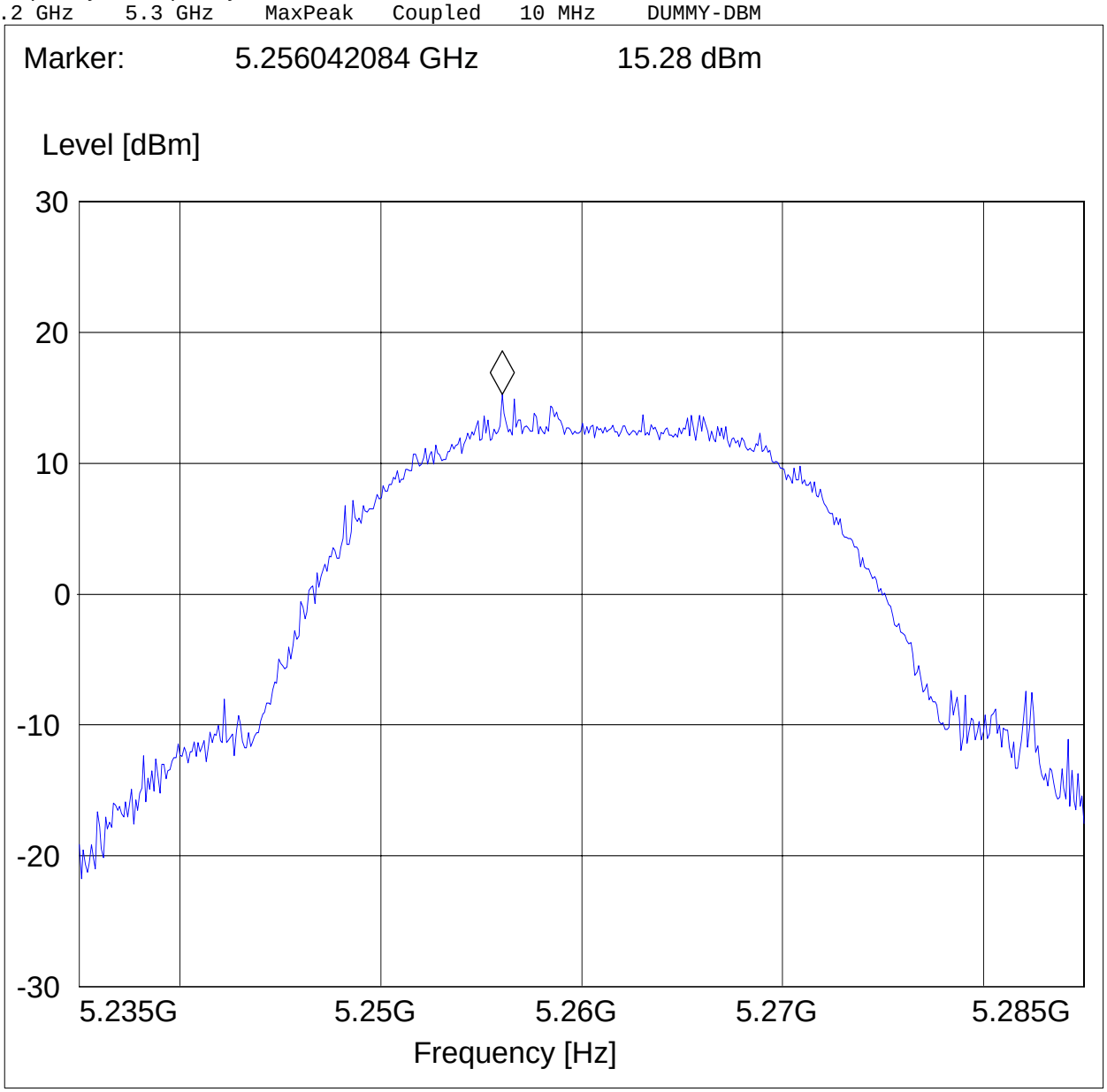


EIRP 802.11 (a) Mode (5260MHz)

```
EUT:             BCM94311MAG
Customer:        Broadcom
Test Mode:       802.11 a, Ch. 52, Aux antenna
ANT Orientation: V
EUT Orientation: H
Test Engineer:   Juan
Power Supply:    AC Power Supply
```

SWEEP TABLE: "EIRP 802.11a 52"

```
Short Description:            EIRP  channel-5260 MHz
Start      Stop       Detector  Meas.     IF         Transducer
Frequency  Frequency            Time      Bandw.
5.2 GHz    5.3 GHz    MaxPeak   Coupled   10 MHz     DUMMY-DBM
```

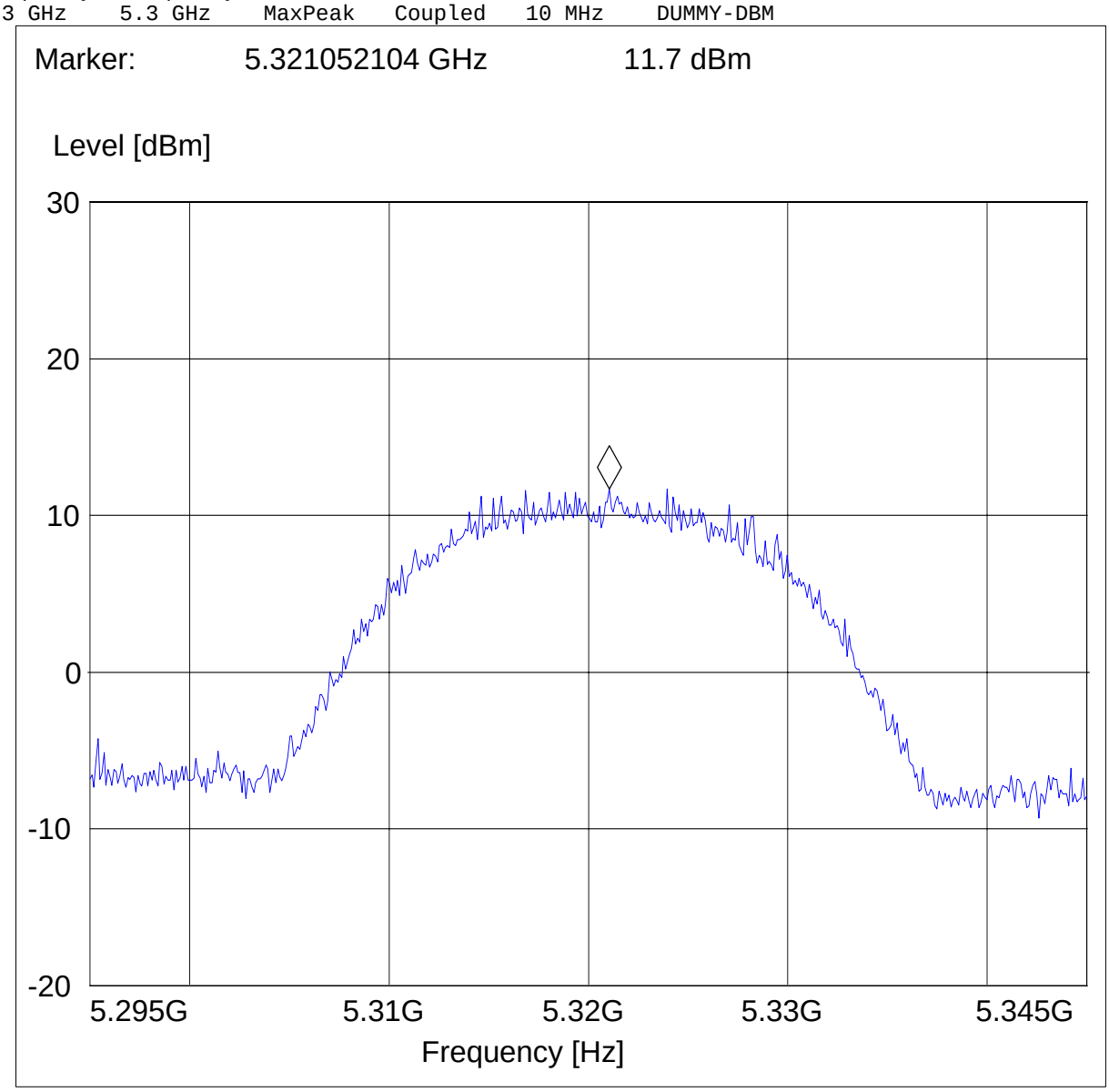


EIRP 802.11 (a) Mode (5320MHz)

```
EUT:              BCM94311MAG
Customer:         Broadcom
Test Mode:        802.11 a, Ch. 64, Aux antenna
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    Juan
Power Supply:     AC Power Supply
```

SWEEP TABLE: "EIRP 802.11a 64"

```
  Short Description:            EIRP  channel-5320 MHz
  Start      Stop       Detector  Meas.     IF         Transducer
  Frequency  Frequency            Time      Bandw.
  5.3 GHz    5.3 GHz    MaxPeak   Coupled   10 MHz     DUMMY-DBM
```



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

1.4.1 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**

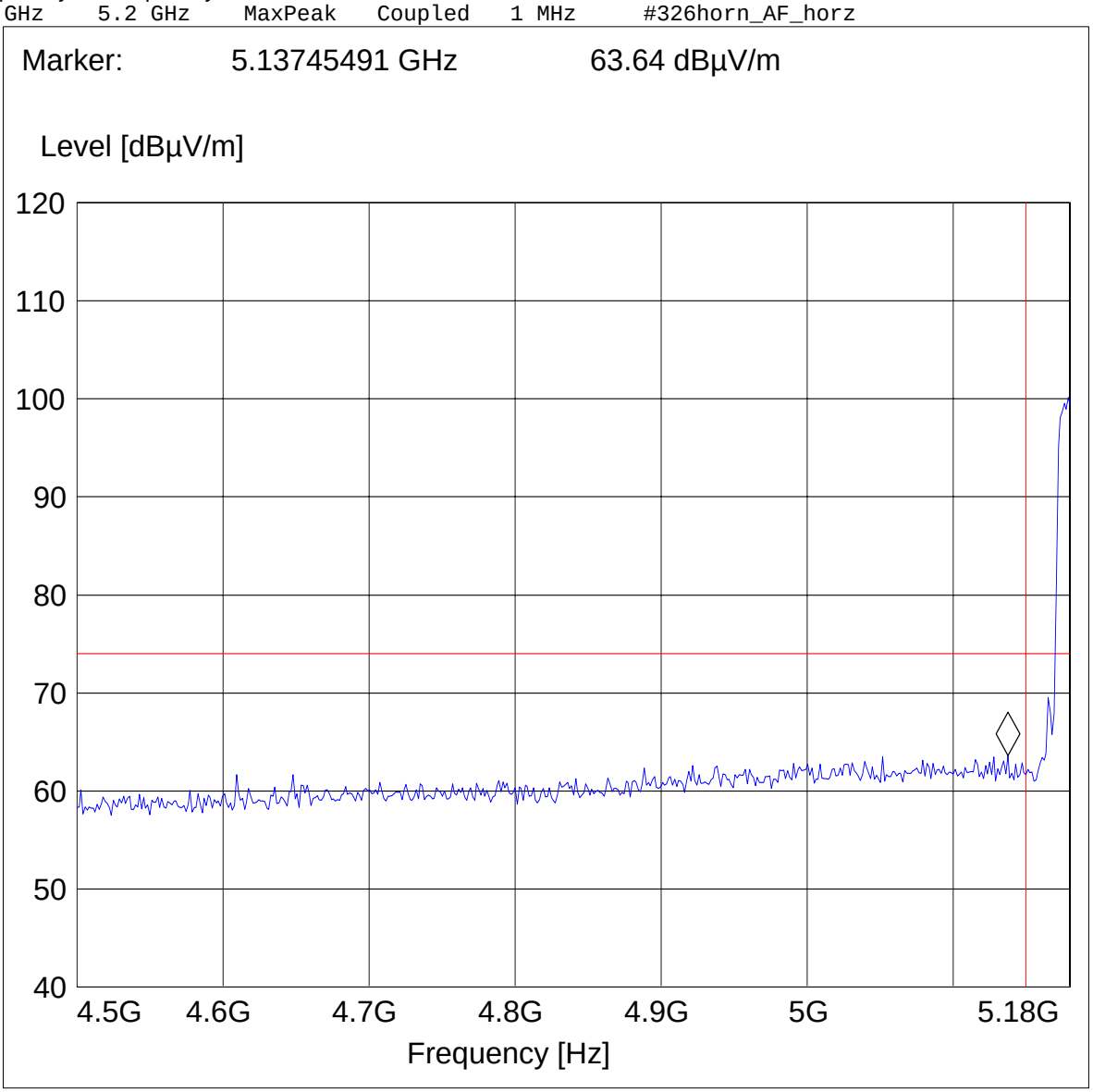
1.4.2 802.11 (a) MODE (5180MHz)
PEAK

411 Dixon Landing Road, Milpitas CA 95035, USA

```
EUT:             BCM94311MAG
Customer:        Broadcom
Test Mode:       802.11 a, Ch. 36, Aux antenna
ANT Orientation: V
EUT Orientation: H
Test Engineer:   Juan
Power Supply:    AC Power Supply
```

SWEEP TABLE: "FCC15.407 A_LBE_PK"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
4.5 GHz	5.2 GHz	MaxPeak	Coupled	1 MHz	#326horn_AF_horz

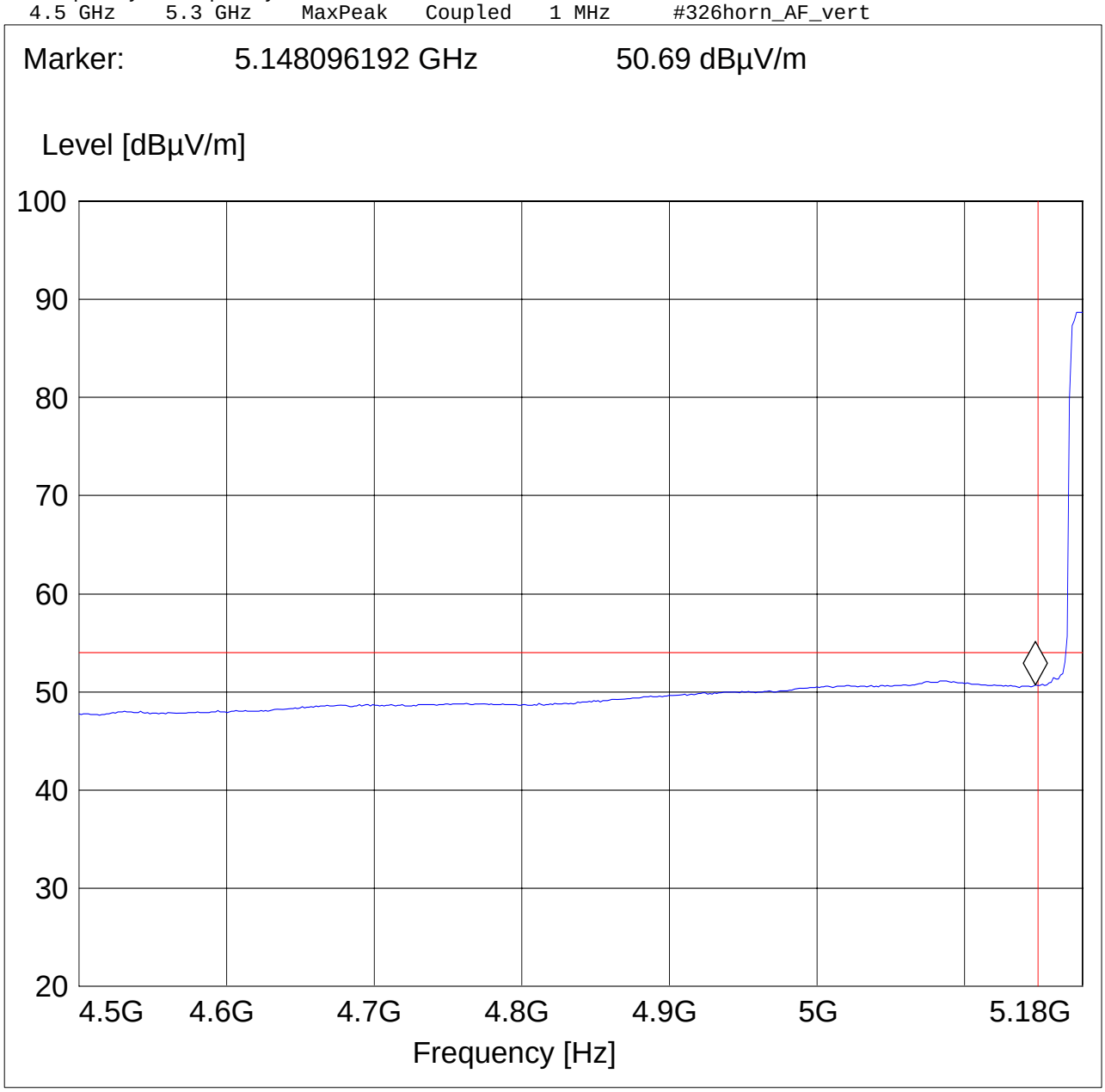


AVG

```
EUT:              BCM94311MAG
Customer:         Broadcom
Test Mode:        802.11 a, Ch. 36, Aux antenna
ANT Orientation: V
EUT Orientation: H
Test Engineer:    Juan
Power Supply:     AC Power Supply
```

SWEEP TABLE: "FCC15.407 A_LBE_AVG"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
4.5 GHz	5.3 GHz	MaxPeak	Coupled	1 MHz	#326horn_AF_vert



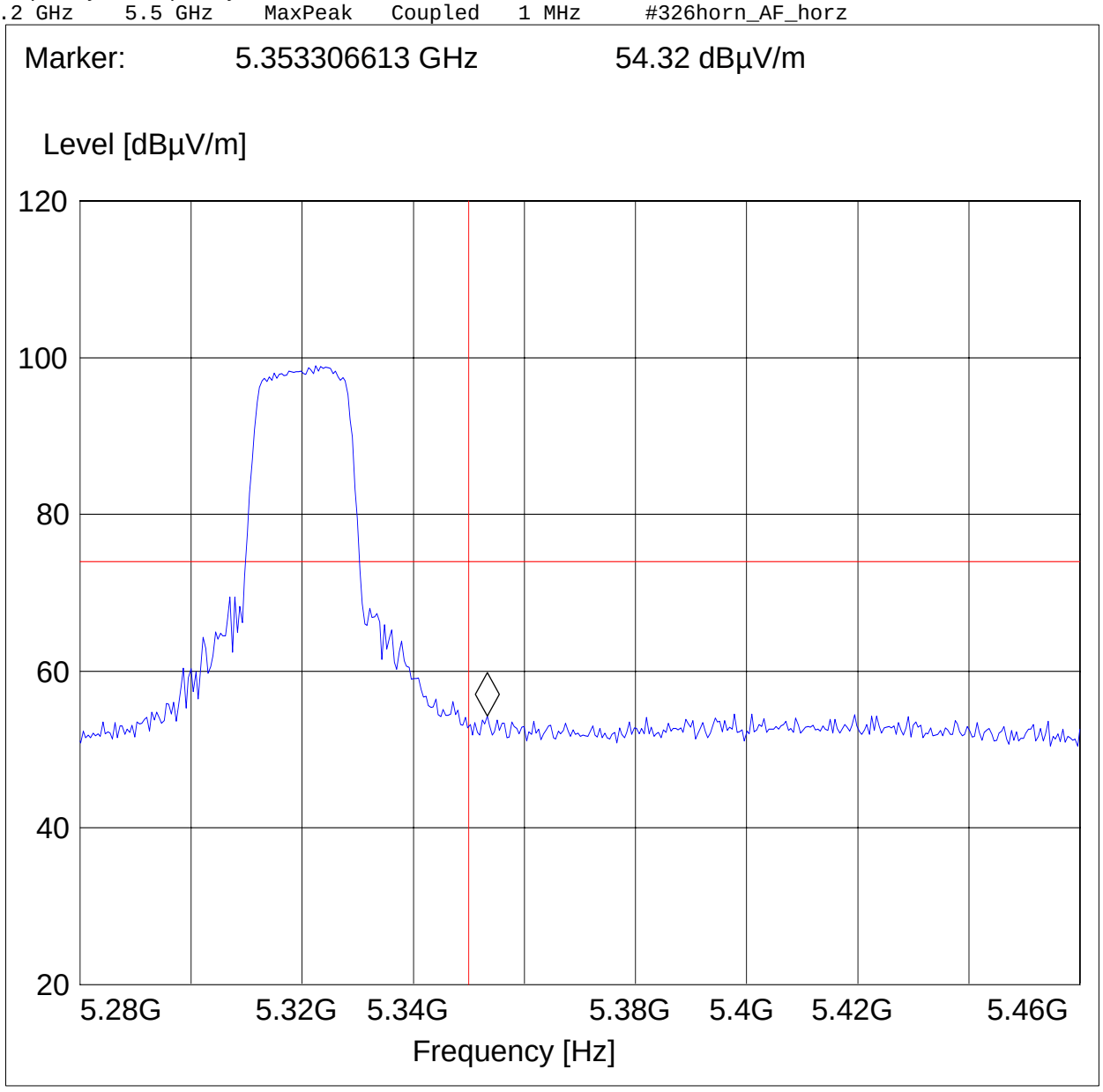
1.4.3 802.11 (a) MODE (5320MHz)

PEAK

```
EUT:              BCM94311MAG
Customer:         Broadcom
Test Mode:        802.11 a, Ch. 64, Aux antenna
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    Juan
Power Supply:     AC Power Supply
```

SWEEP TABLE: "FCC15.407 A_HBE_PK"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
5.2 GHz	5.5 GHz	MaxPeak	Coupled	1 MHz	#326horn_AF_horz

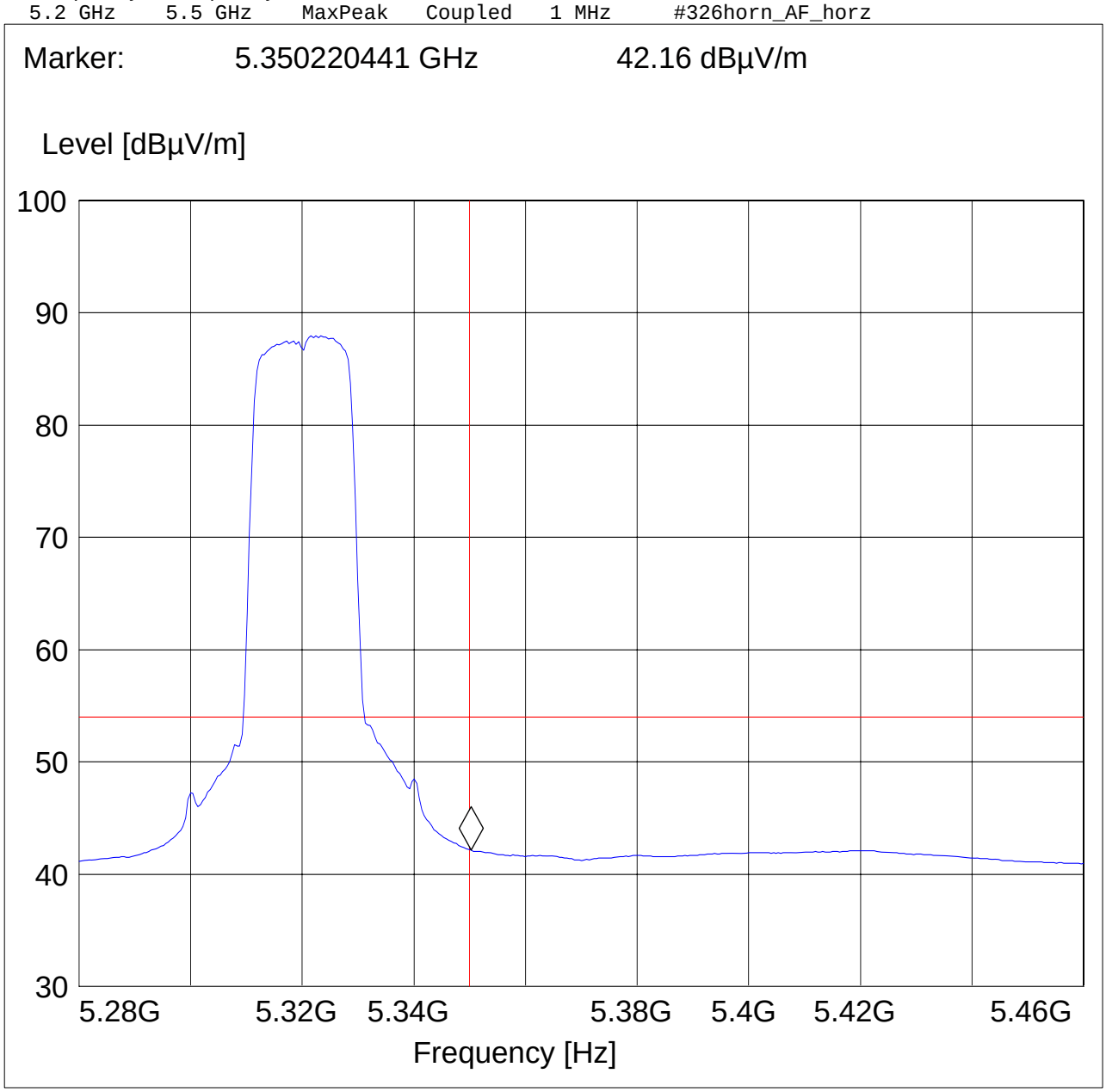


AVG

```
EUT:             BCM94311MAG
Customer:        Broadcom
Test Mode:       802.11 a, Ch. 64, Aux antenna
ANT Orientation: V
EUT Orientation: H
Test Engineer:   Juan
Power Supply:    AC Power Supply
```

SWEEP TABLE: "FCC15.407 A_HBE_AVG"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
5.2 GHz	5.5 GHz	MaxPeak	Coupled	1 MHz	#326horn_AF_horz



1.5 TRANSMITTER SPURIOUS EMISSIONS RADIATED § 15.407(b)/15.205/15.209 & RSS-210 (A9.3)

1.5.1 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**
***AVG. 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

1.5.2 RESULTS 802.11 (a) MODE

30MHz – 1GHz

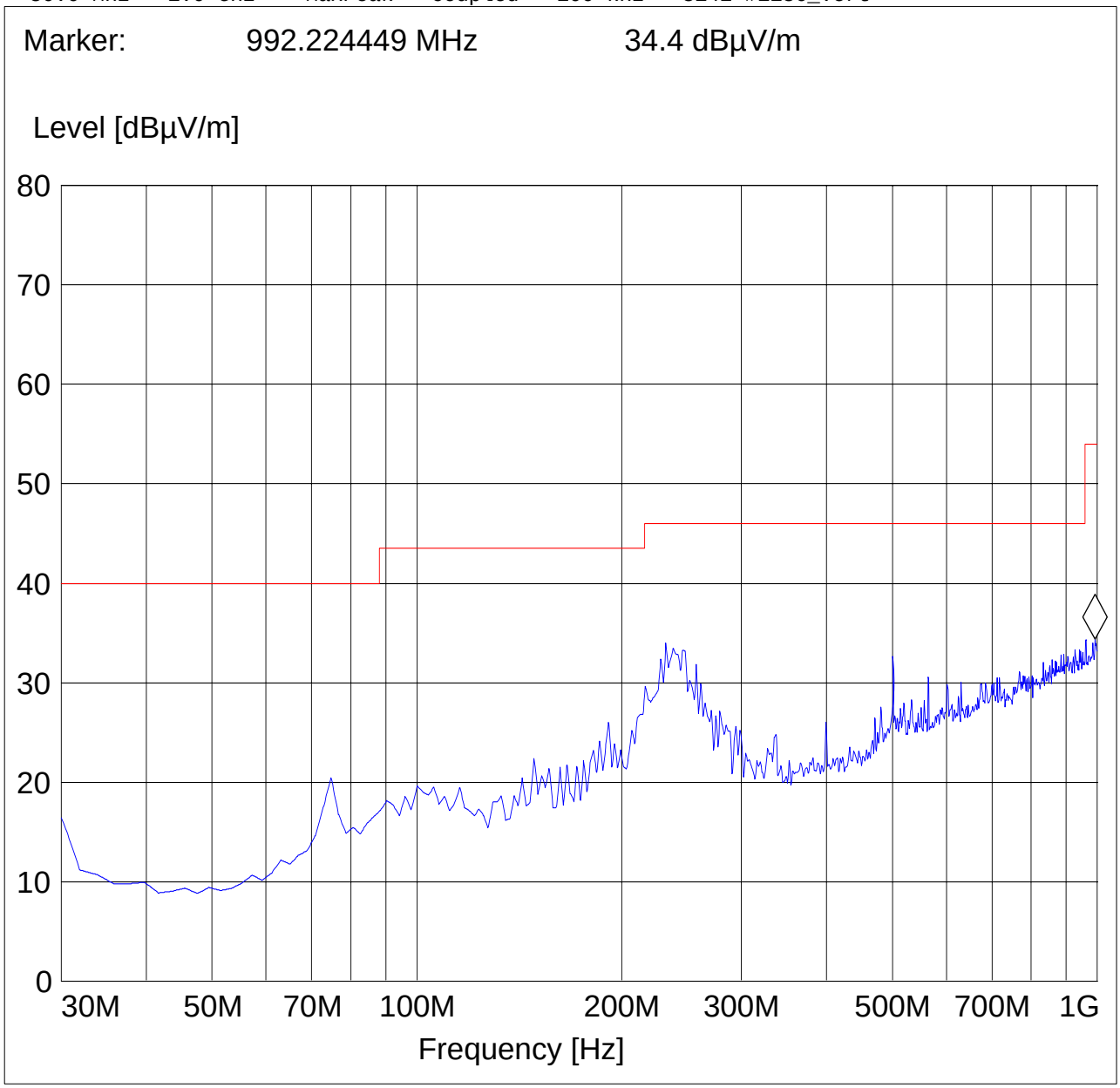
Antenna: Horizontal

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

EUT / Description: BCM94311MCAG

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

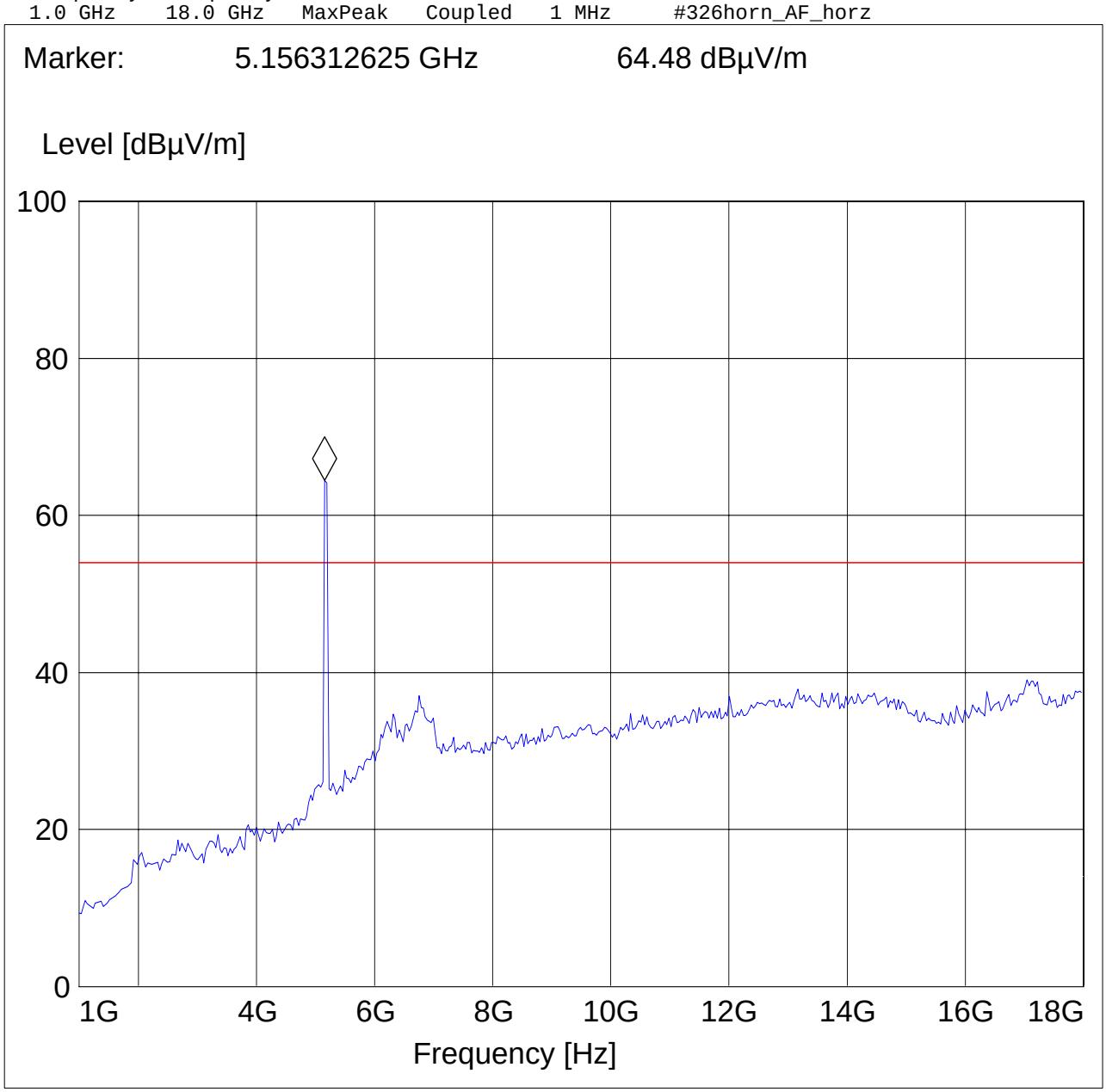


1-18GHz (5180MHz)
Note: The peaks above the limit line is the carrier freq.
Note: Peak Reading vs. Average limit (54 dBuV/m)

EUT / Description: BCM94311MCAG

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_horz

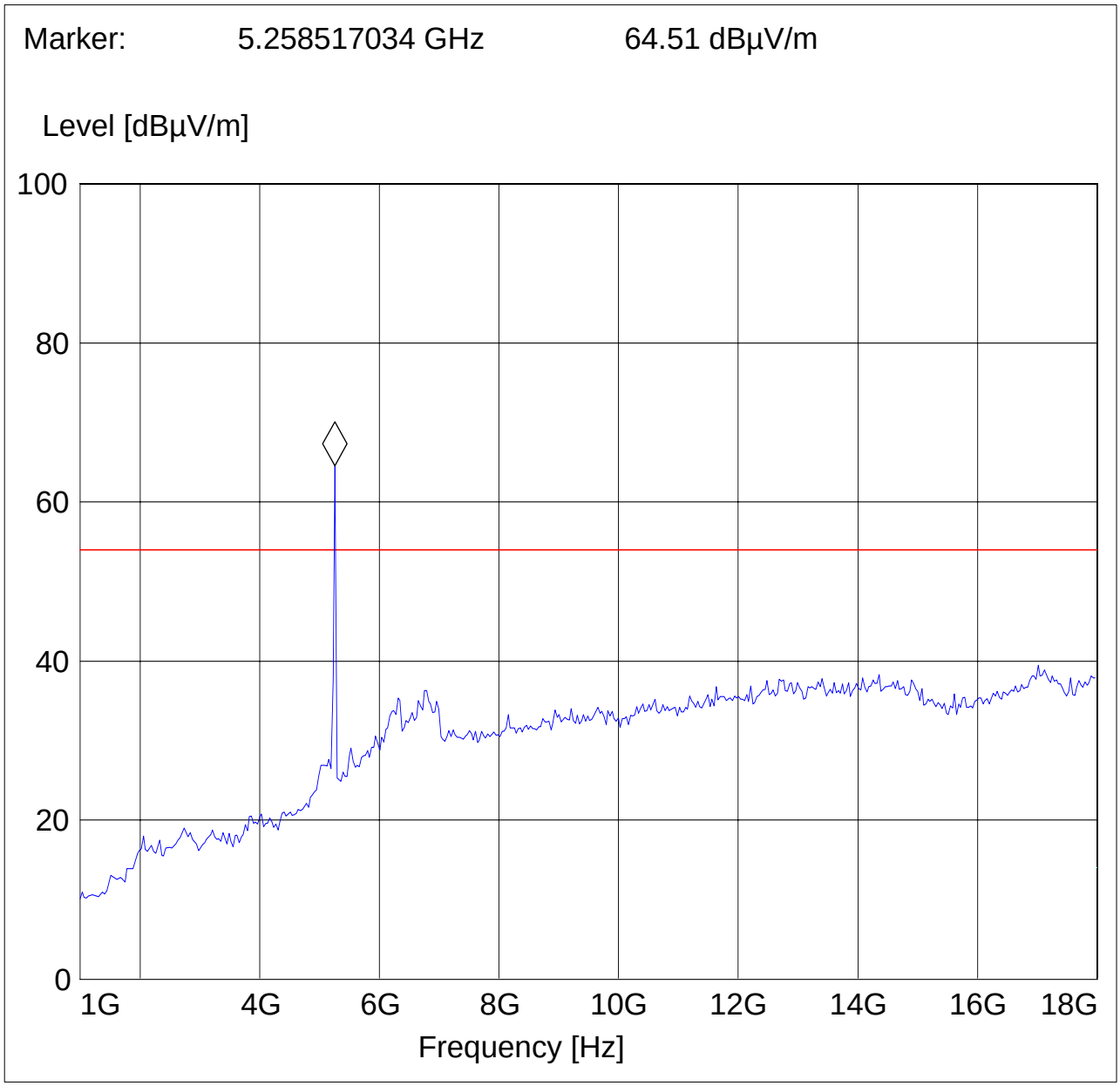


1-18GHz (5260MHz)
Note: The peaks above the limit line is the carrier freq.
Note: Peak Reading vs. Average limit (54 dBuV/m)

EUT / Description: BCM94311MCAG

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_horz

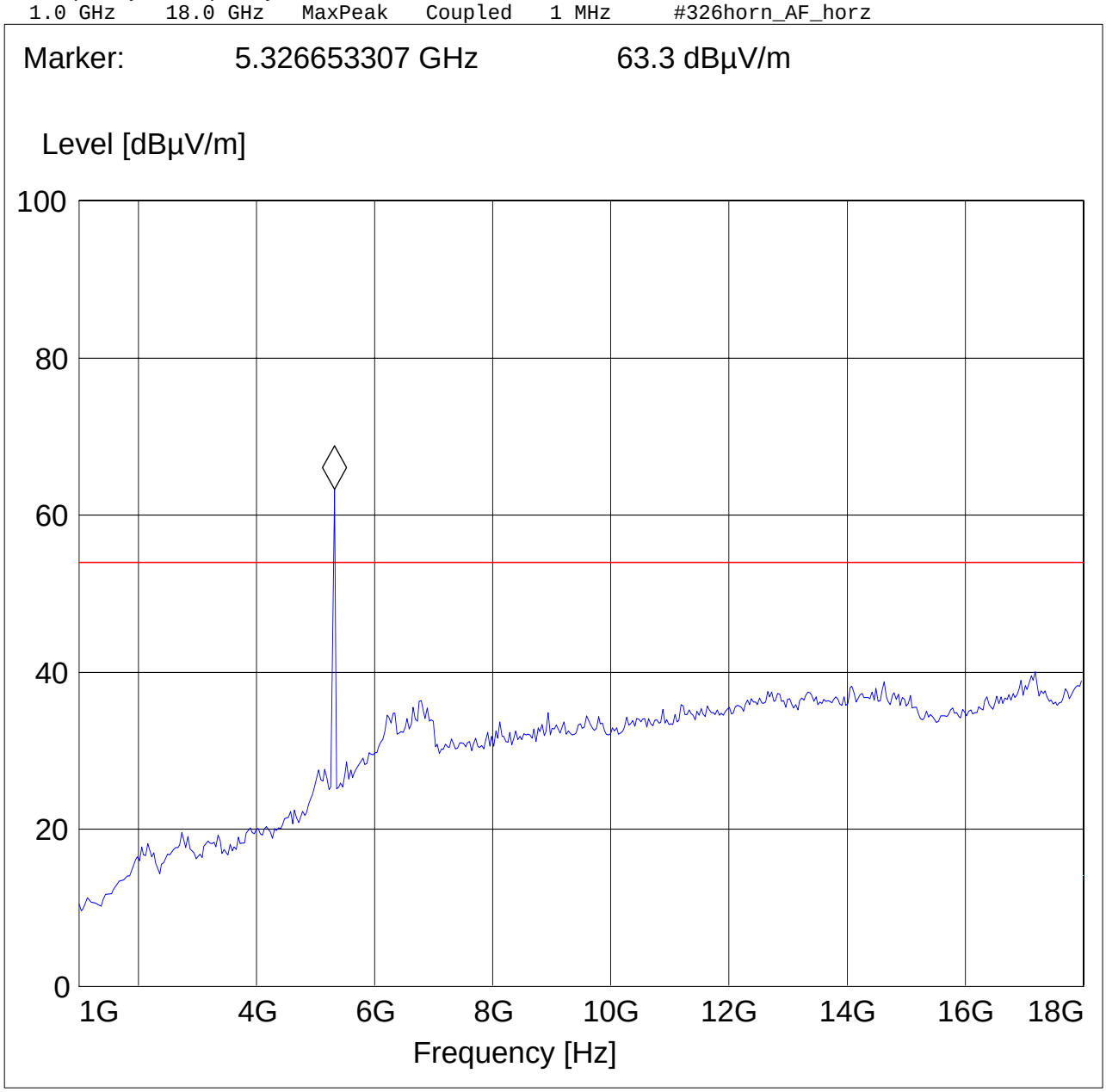


1-18GHz (5320MHz)
Note: The peaks above the limit line is the carrier freq.
Note: Peak Reading vs. Average limit (54 dBuV/m)

EUT / Description: BCM94311MCAG

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_horz

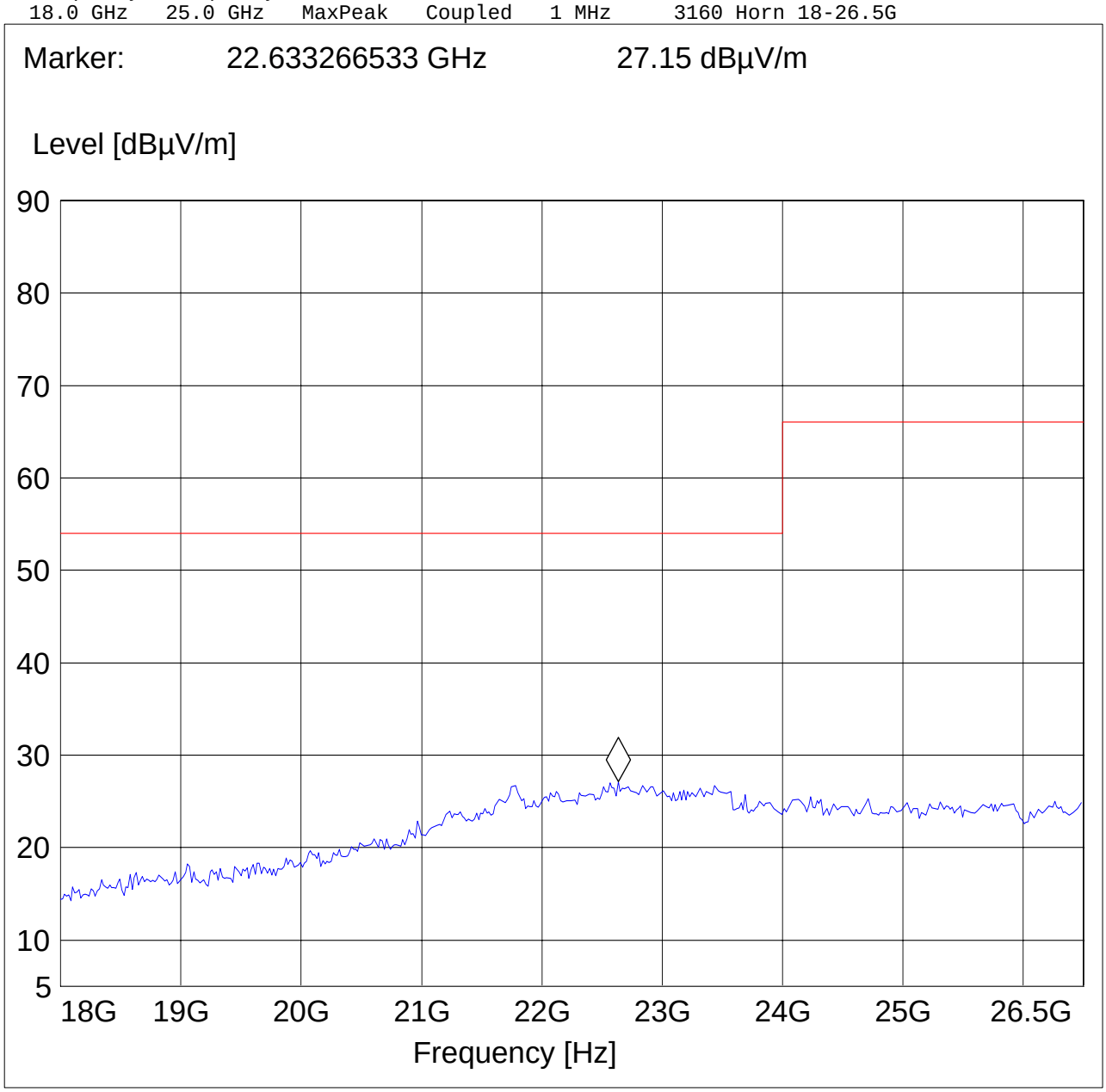


18-26.5GHz (5180MHz)
Note: Peak Reading vs. Average limit (54 dBuV/m)

EUT / Description: BCM94311MCAG

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

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
18.0 GHz	25.0 GHz	MaxPeak	Coupled	1 MHz	3160 Horn 18-26.5G

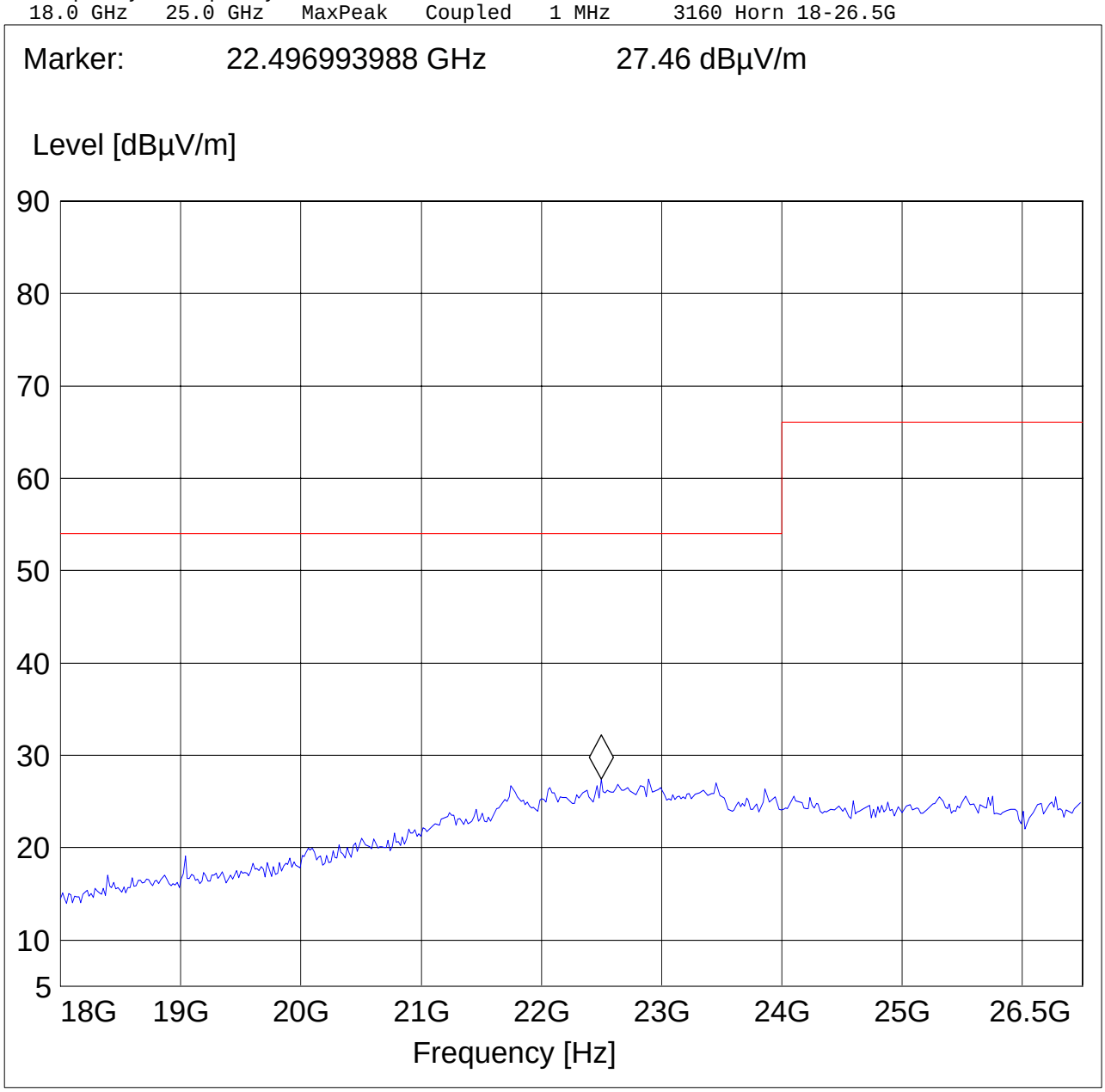


18-26.5GHz (5260MHz)
Note: Peak Reading vs. Average limit (54 dBuV/m)

EUT / Description: BCM94311MCAG

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

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
18.0 GHz	25.0 GHz	MaxPeak	Coupled	1 MHz	3160 Horn 18-26.5G

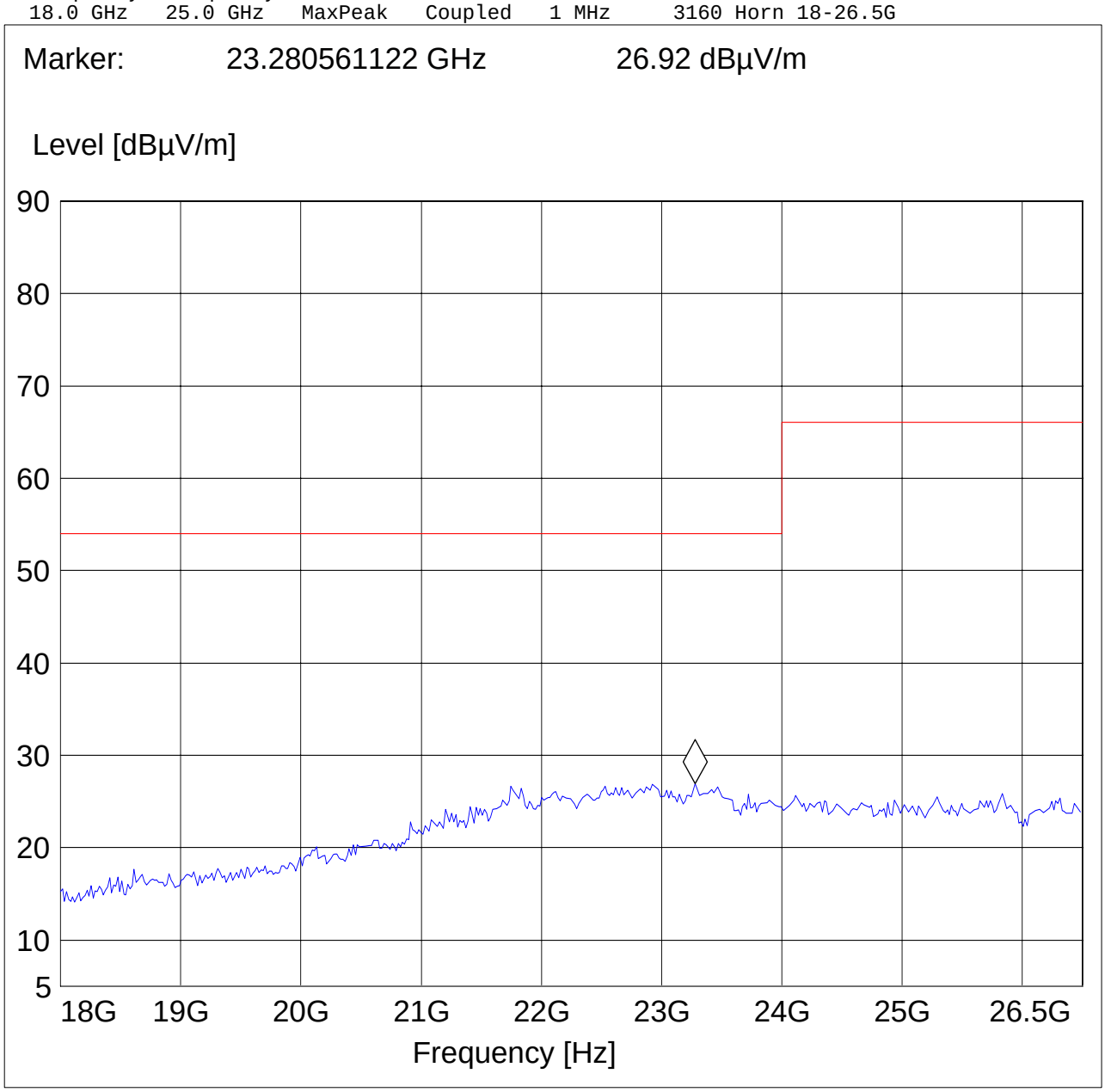


18-26.5GHz (5320MHz)
Note: Peak Reading vs. Average limit (54 dBuV/m)

EUT / Description: BCM94311MCAG

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

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
18.0 GHz	25.0 GHz	MaxPeak	Coupled	1 MHz	3160 Horn 18-26.5G



26-40GHz

Note: Since no harmonic emissions were detected 20-dB of the limit for scans 18 – 26GHz it was determine that no emissions will be detected from 26 – 40 GHz, so no scans were captured.

1.6 RECEIVER SPURIOUS RADIATION § 15.109/RSS-GEN (4.10)

Note: Receiver emissions are exempt from testing per FCC 15.101(b) if it operated below 30 MHz and/or above 960 MHz. But, testing is required for Industry Canada approval for all receivers, which only needs to be tested on the middle channel of the radios operating band.

The radio being tested receives at 2.4GHz therefore exempting it from testing to the FCC part 15 rules.

1.7 AC POWER LINE CONDUCTED EMISSIONS § 15.207 & RSS-GEN (7.2.2)

1.7.1 LIMITS

Technical specification: 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

OPERATING MODE

Conducted AC emissions testing were performed with 120 VAC @ 60 Hz with the EUT in 802.11g mode.

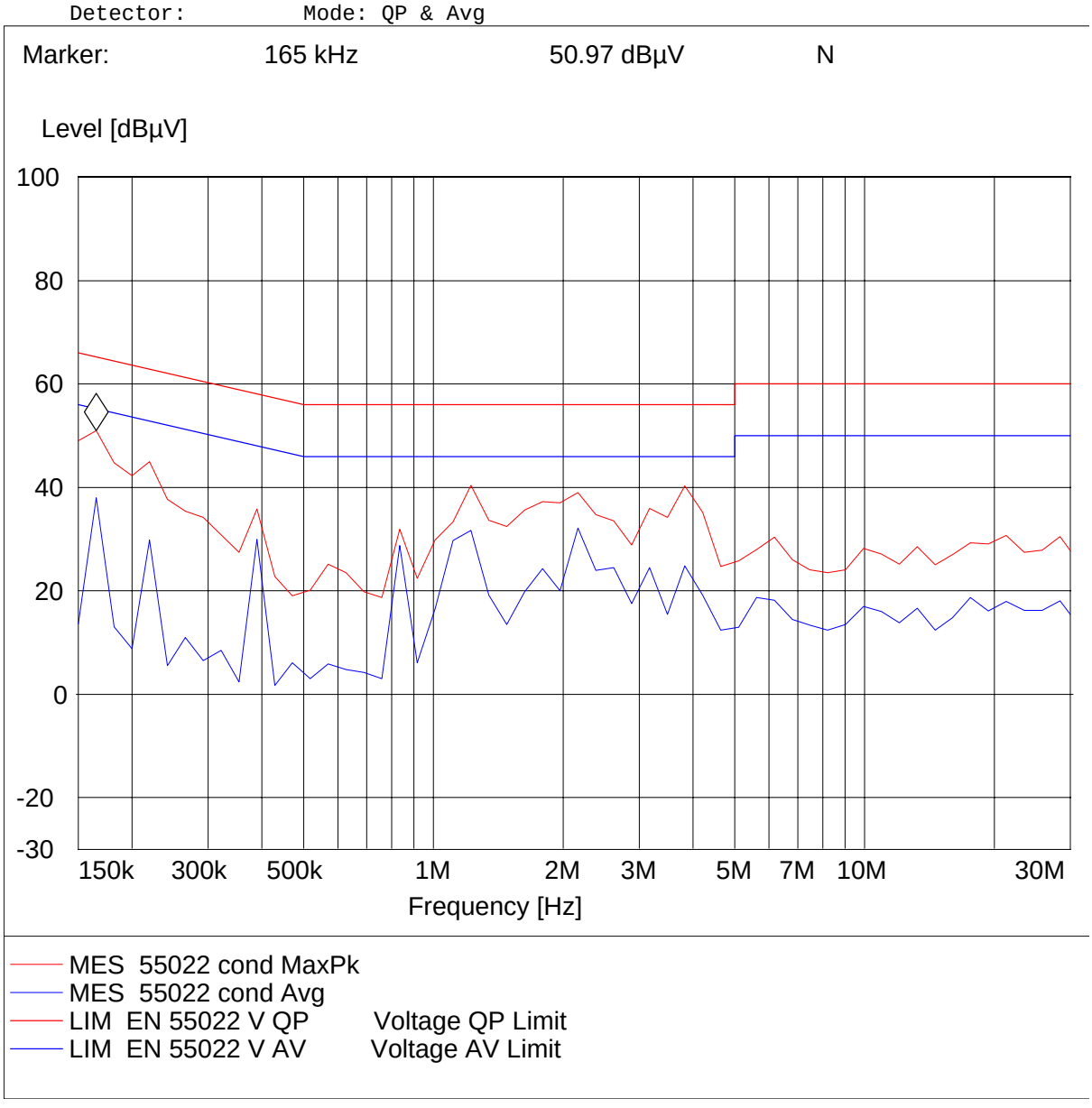
1.7.2 RESULTS

```
EUT:                  BCM94311MCAG
Manufacturer:         Broadcom
Operating Condition:  Tx Mode
ANT Orientation:      CONDUCTED
EUT Orientation:      H
Test Engineer:        Juan M.
Power Supply:         AC Adaptor
Comments:             120V,60Hz (Line)
```

SWEEP TABLE: "55022 cond"

```
  Short Description:            EN 55022 for 150KHz-30MHz
Unit:     dBµV

          Detector:         Mode: QP & Avg
```

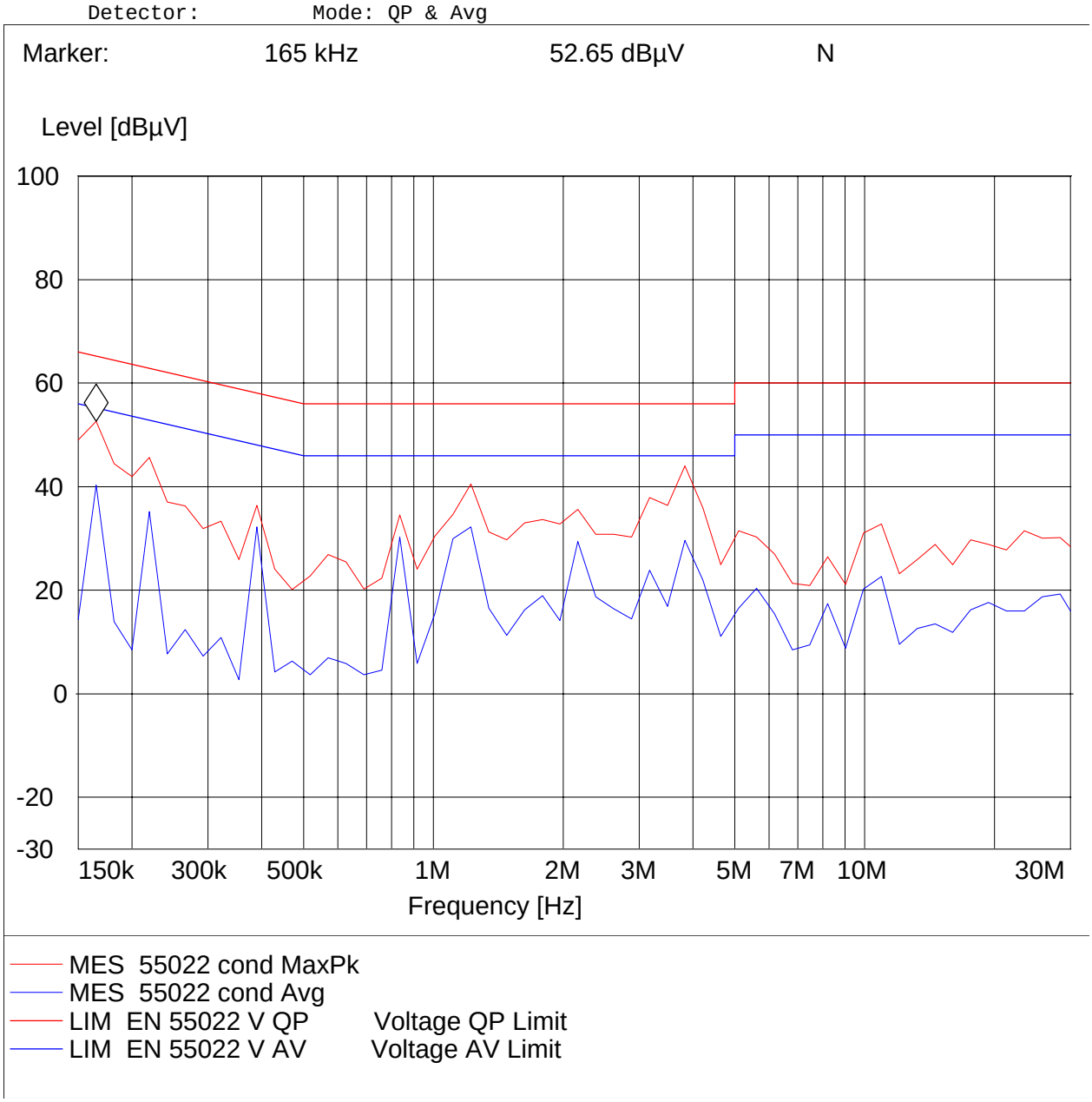


EUT: BCM94311MCAG
Manufacturer: Broadcom
Operating Condition: Tx Mode
ANT Orientation: CONDUCTED
EUT Orientation: H
Test Engineer:: Juan M.
Power Supply: AC Adaptor
Comments: 120V,60Hz (Neutral)

SWEEP TABLE: "55022 cond"

Short Description: EN 55022 for 150KHz-30MHz
Unit: dBµV

Detector: Mode: QP & Avg



2 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
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
10	High Pass Filter	5HC2700	Trilithic Inc.	9926013	n/a	n/a
11	High Pass Filter	4HC1600	Trilithic Inc.	9922307	n/a	n/a
16	LISN	ESH3-Z5	Rohde & Schwarz	836679/003	May 2008	1 year

Radiated Testing