

Permissive Class II Change FCC Test Report

FCC Part 15.407 for UNII Devices/
IC RSS-210, Issue 7

FOR:

802.11a/g Wireless LAN PCI-E Mini Card

MODEL #: BCM94311MCAG

**Broadcom Corporation
190 Mathilda Place
Sunnyvale, CA 94086
U.S.A**

FCC ID: QDS-BRCN1019

TEST REPORT #: EMC_BROAD_038_07001_AG_15.407A



FCC listed#
A2LA Certified
IC recognized #
3462B

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1 Assessment

The following is in compliance with the applicable criteria specified in FCC rules Part 15.407 of the Code of Federal Regulations and in compliance with the applicable criteria specified in Industry Canada rules RSS-210.

Company	Description	Model #
Broadcom	802.11a/g Wireless LAN PCI-E Mini Card	BCM94311MCAG

Technical responsibility for area of testing:

08/01/2007 EMC & Radio **Lothar Schmidt**
(Test Lab Manager)

Date **Section** **Name** **Signature**

Responsible for test report and project leader:

08/01/2007 EMC & Radio **Juan Martinez**
(Project Engineer)

Date **Section** **Name** **Signature**

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 Issuing the EMC Test Report

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
Test Report Prepared by:	Juan Martinez, EMC Project Engineer
Dates of test:	2007-07-30 to 2007-08-01

2.2 Identification of the Client

Applicant's Name:	Broadcom Corporation
Street Address:	190 Mathilda Place
City/Zip Code	Sunnyvale, California 94086
Country	USA
Contact Person:	Daniel Lawless
Phone No.	408 922 5870
Fax:	408 543 3399
e-mail:	dlawless@broadcom.com

2.3 Identification of the Manufacturer

Manufacturer's Name:	Broadcom Corporation
Manufacturers Address:	190 Mathilda Place
City/Zip Code	Sunnyvale, California 94086
Country	USA

3 Equipment under Test (EUT)

3.1 Specification of the Equipment under Test

Marketing Name:	802.11a/g Wireless LAN PCI-E Mini Card
Description:	Wireless LAN PCI-E Mini Card
Model No:	BCM94311MCAG
FCC ID:	QDS-BRCM1019
Frequency Range:	5180 – 5320 MHz
*Type(s) of Modulation:	OFDM
Number of Channels:	8
Antenna Type:	Acon (Model: AMP6P-700000), Stamped metal sheet (0.7dBi) Amphenol (Model: WT541-22-003), Stamped metal sheet (3.21 dBi)
Output Power:	802.11 (a) mode: 0.066 W EIRP @ 5180MHz 802.11 (a) mode: 0.055 W EIRP @ 5260MHz 802.11 (a) mode: 0.041 W EIRP @ 5320MHz
Test standards:	FCC Part 15 §15.407 & RSS-210, Issue 7

3.2 Class II permissive change laptops to be added

EUT #	TYPE	MANF.	MODEL	SERIAL #
1	Laptop	Dell	PP12S	UNIT 1

3.3 Identification of Accessory equipment

TYPE	MANF.	MODEL
AC ADAPTOR	Dell	DA65NS0-00

4 Subject Of Investigation

All testing were performed on the PP12S (Parker) laptop with the BCM94311MCAG pre-approved module. Measurements were performed on the Amphenol antenna. This report is to also cover the Acon antenna which has a lower gain antenna, but same type of antenna. Data, presented in this report, was collected for a Class II permissive change to add the laptop to the BCM94311MCAG (FCC ID: QDS-BRCM1019) module application.

During the testing process the EUT was tested in “a” mode with 6Mbps data rate which yielded the worst case results. All testing was performed on main antenna which yielded the highest gain, all data in this report shows the worst case between horizontal and vertical polarization for above 1GHz.

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 15.407 of Title 47 of the Code of Federal Regulations and Industry Canada rules RSS-210.

5 Measurements

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

5.1.1 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

5.1.2 EIRP 802.11 (a) MODE:

TEST CONDITIONS		MAXIMUM PEAK OUTPUT POWER (dBm)		
		5180	5260	5320
T _{nom} (23)°C	V _{nom} VDC	18.17	17.4	16.09
Measurement uncertainty		±0.5dBm		

Note 1: For 802.11a power were set to transmit at the specified conducted average output power

Note 2: EIRP measurements were performed on the Main and Auxiliary. Results showed that the Main antenna produced the highest EIRP level. All measurements were performed on the Main antenna.
Note 3: Both vertical and horizontal were measured. Worst case polarization was horizontal for all modes.

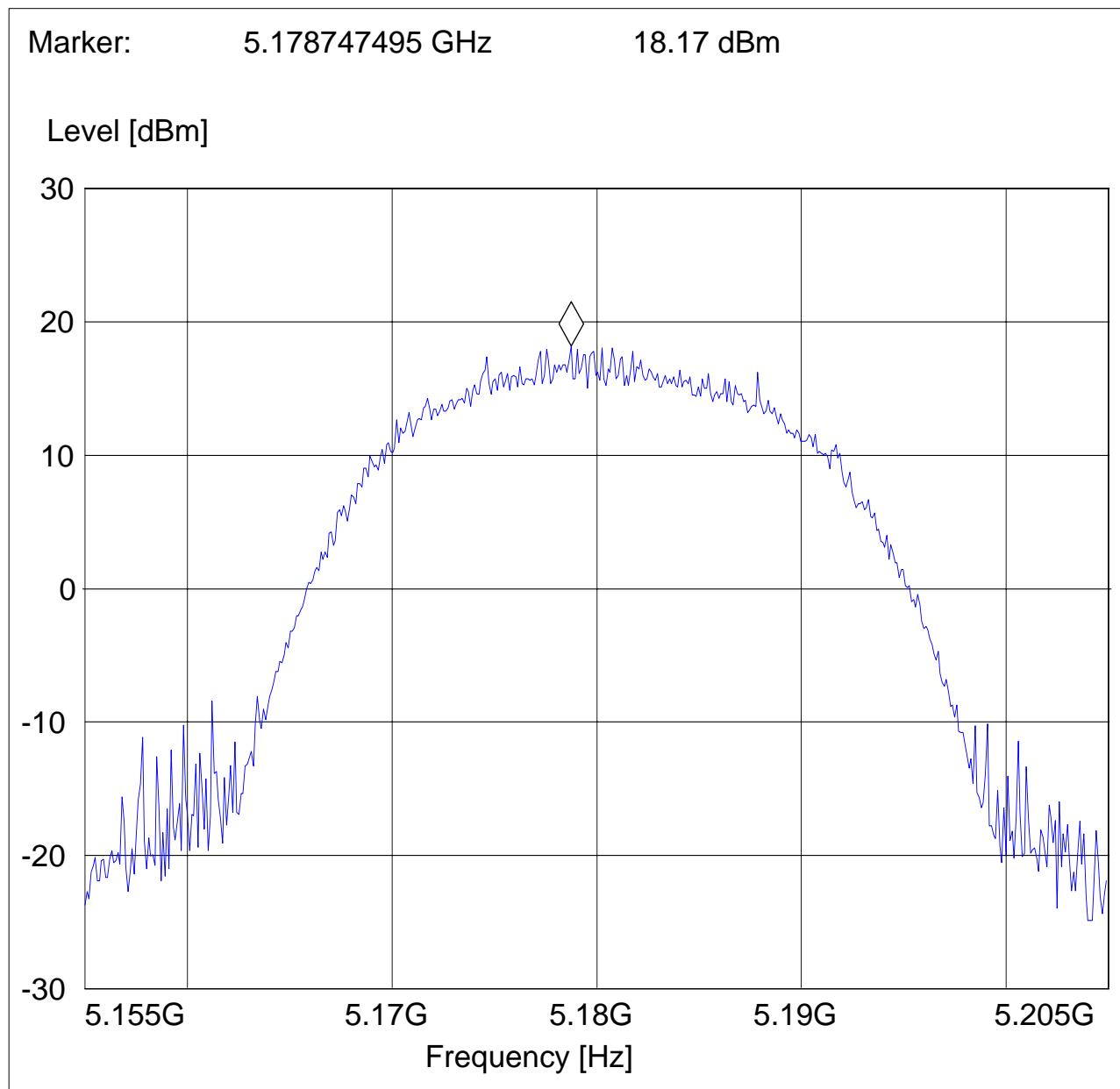
EIRP 802.11 (a) Mode (5180)

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

EUT / Description: Dell PP12S with BCM94311MCAG

SWEET TABLE: "EIRP 802.11a 36"

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



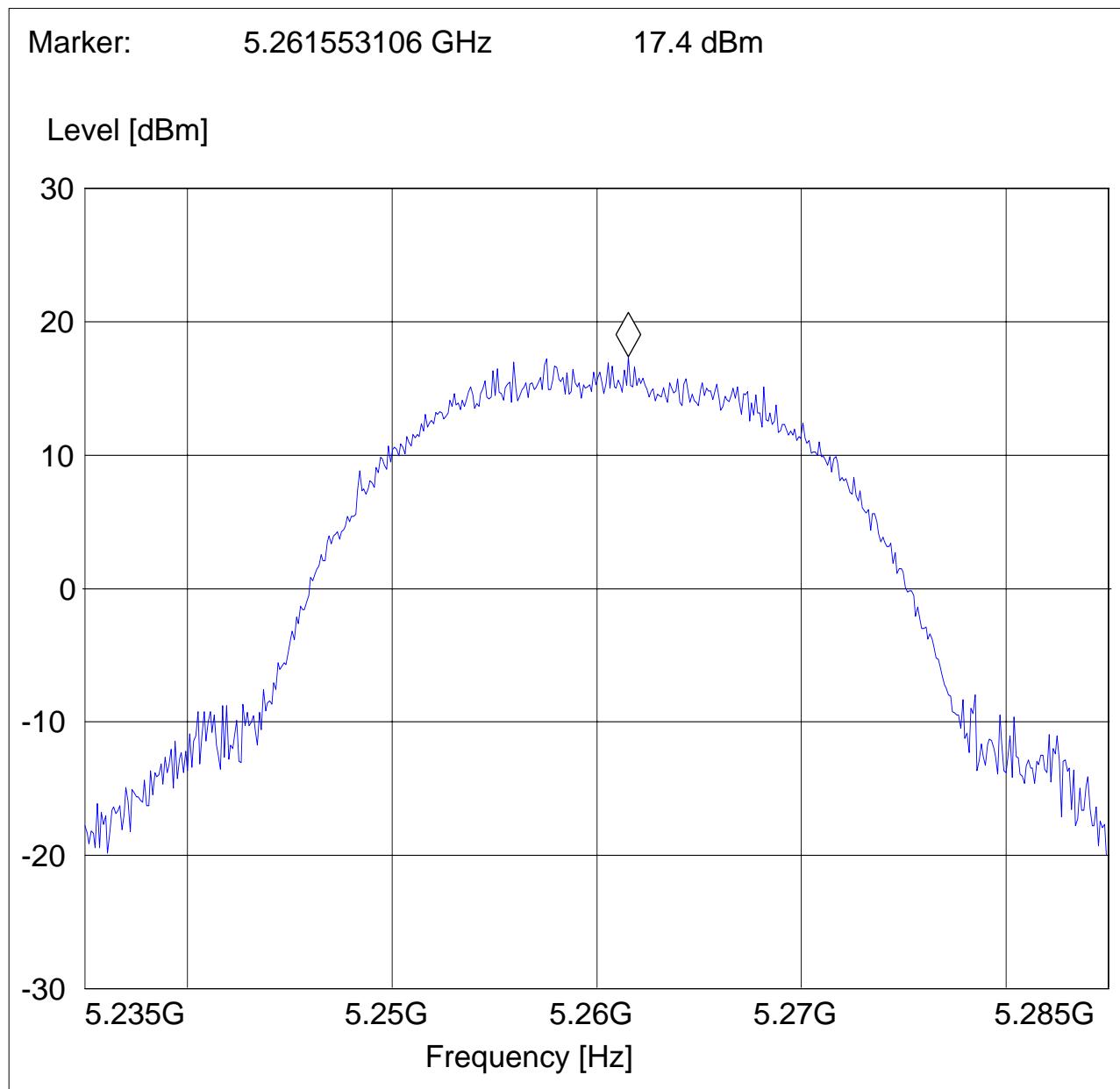
EIRP 802.11 (a) Mode (5260MHz)

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

EUT / Description: Dell PP12S with BCM94311MCAG

SWEEP TABLE: "EIRP 802.11a 52"

Short Description:		EIRP channel1-5260 MHz			
Start Frequency	Stop Frequency	Detector	Meas.	IF	
Frequency	Frequency	Time	Bandw.	Transducer	
5.2 GHz	5.3 GHz	MaxPeak	Coupled	10 MHz	DUMMY-DBM



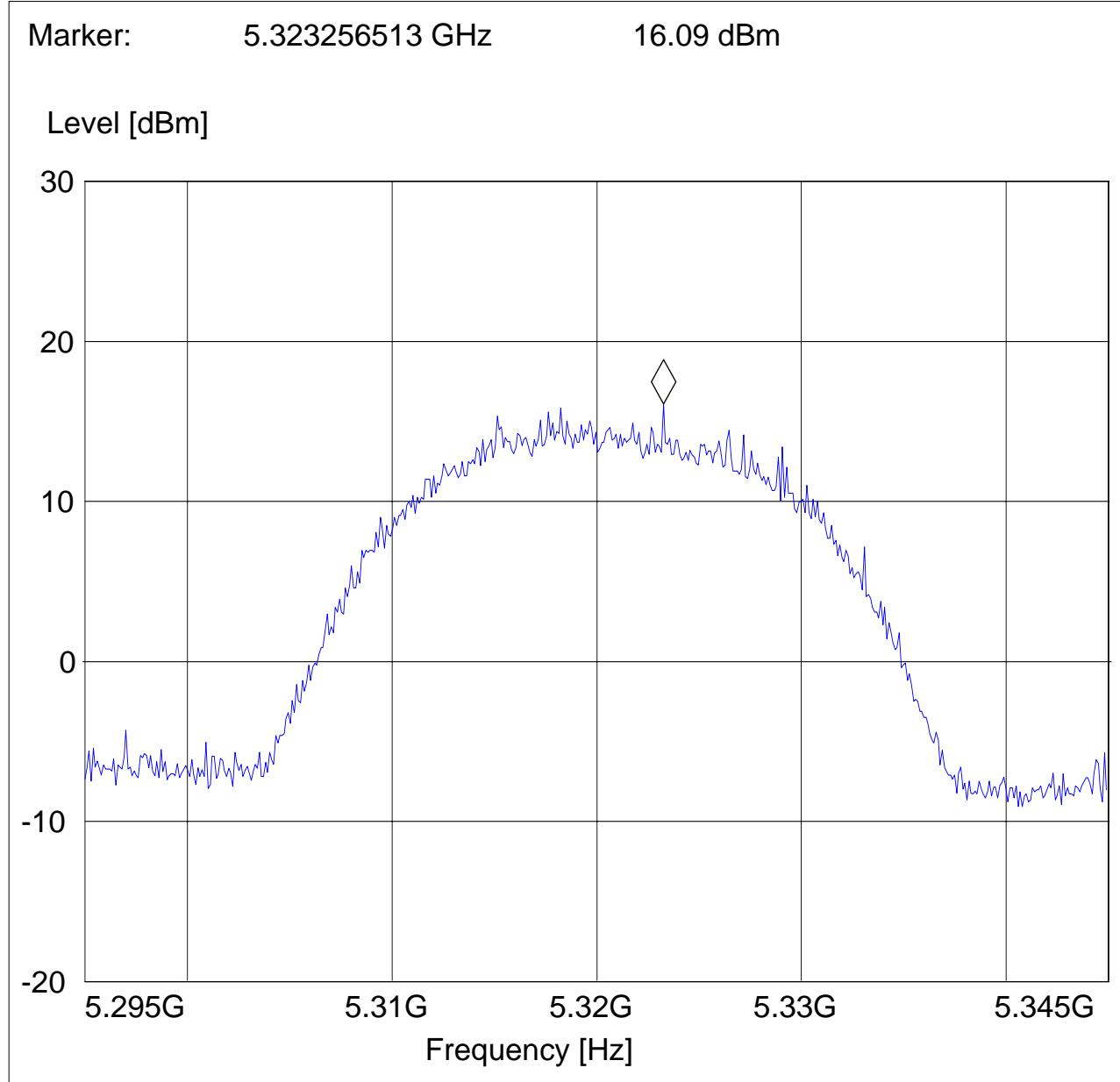
EIRP 802.11 (a) Mode (5320MHz)

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

EUT / Description: Dell PP12S with BCM94311MCAG

SWEEP TABLE: "EIRP 802.11a 64"

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



5.2 RESTRICTED BAND EDGE COMPLIANCE RADIATED §15.407(b)/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= 74dB_{UV}/m**

***AVG. LIMIT= 54dB_{UV}/m**

**5.2.2 802.11 (a) MODE (5180MHz)
PEAK**

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

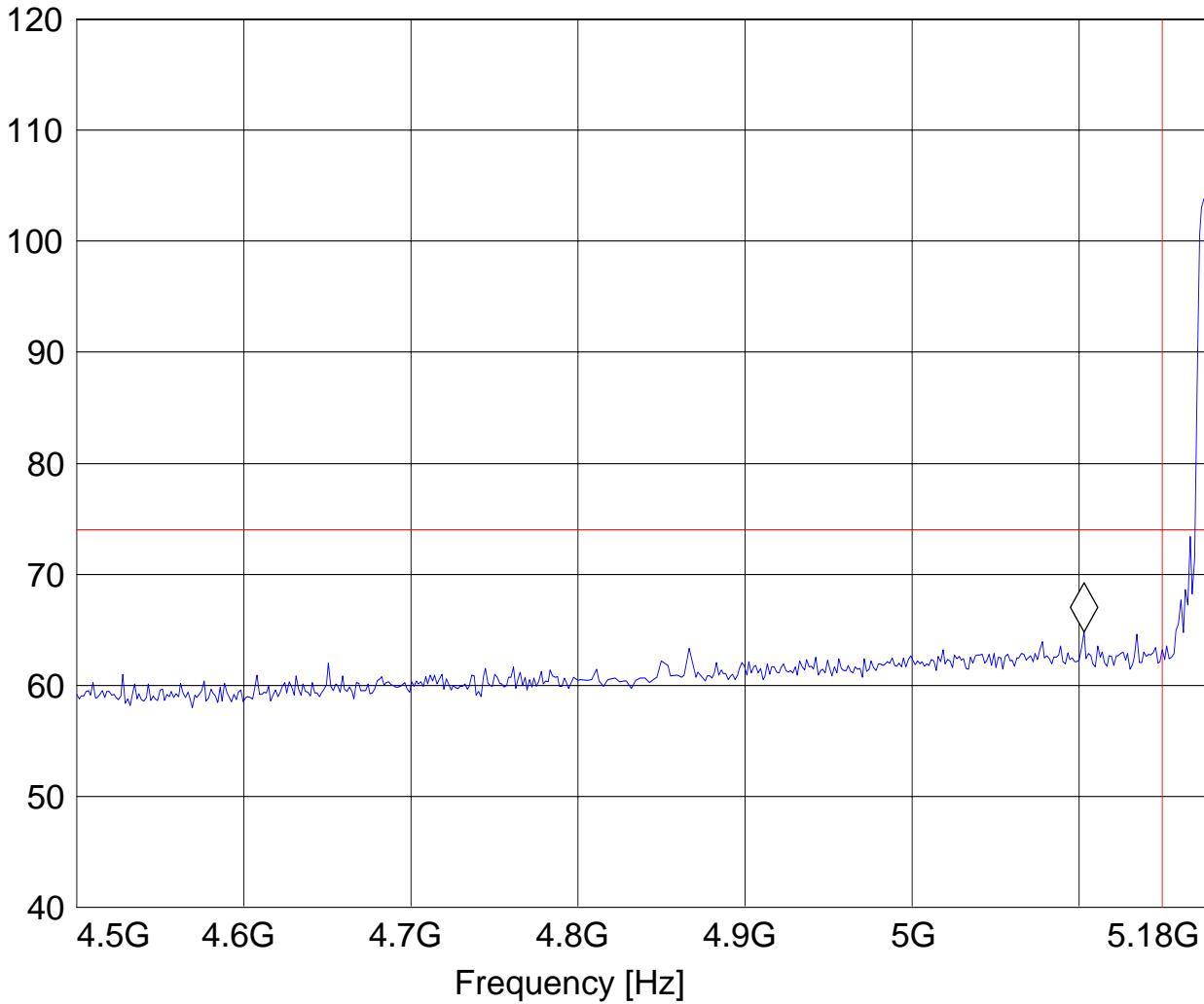
EUT / Description: Dell PP12S with BCM94311MCAG

SWEET TABLE: "FCC15.407_A_LBE_PK"

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

Marker: 5.102885772 GHz 64.82 dB μ V/m

Level [dB μ V/m]



AVG

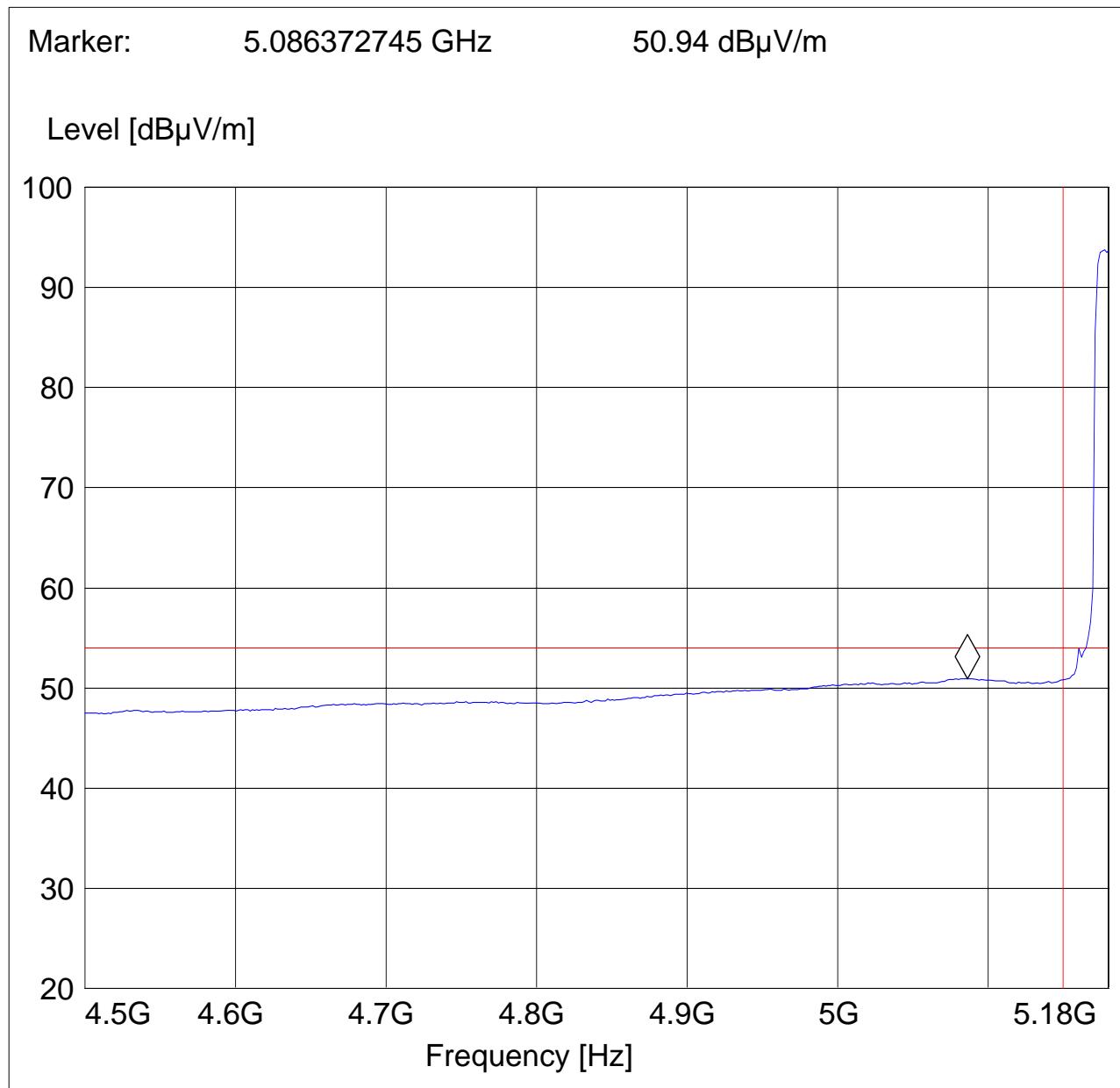
CETECOM Inc.

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

EUT / Description: Dell PP12S with BCM94311MCAG

SWEET TABLE: "FCC15.407 A_LBE_AVG"

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



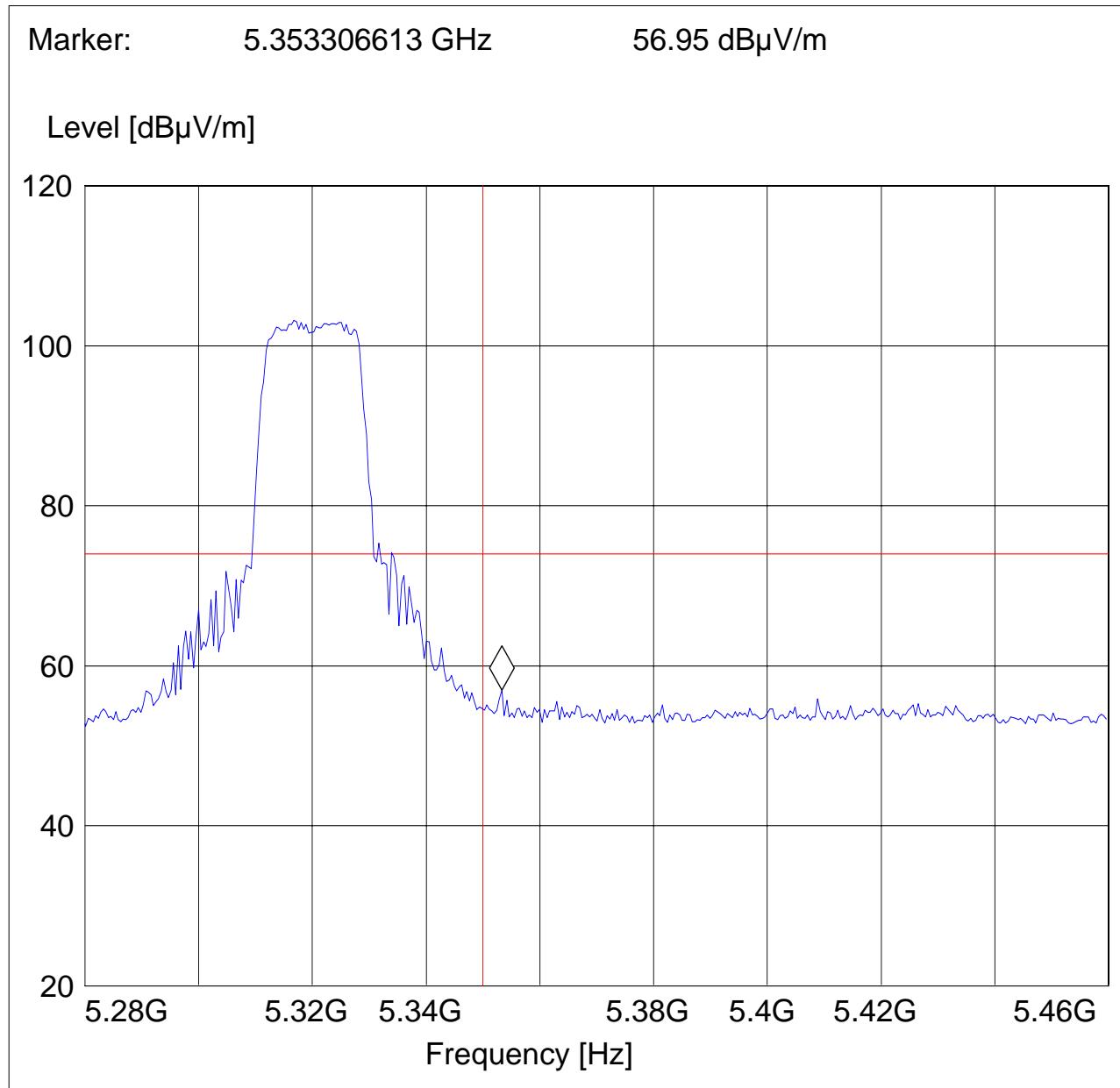
5.2.3 802.11 (a) MODE (5320MHz) PEAK

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

EUT / Description: Dell PP12S with BCM94311MCAG

SWEET TABLE: "FCC15.407 A_HBE_PK"

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



AVG

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

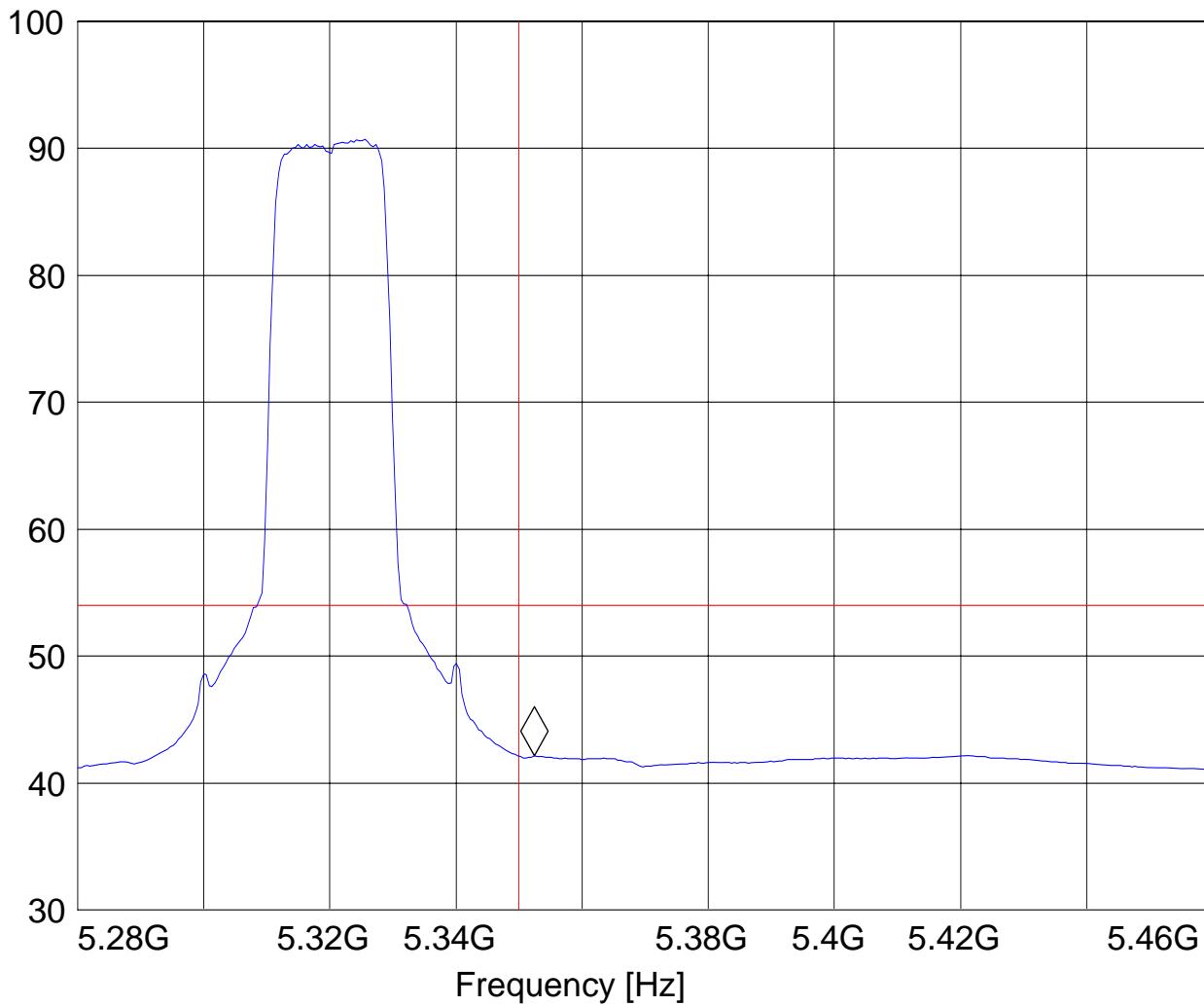
EUT / Description: Dell PP12S with BCM94311MCAG

SWEET TABLE: "FCC15.407 A_HBE_AVG"

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

Marker: 5.35242485 GHz 42.13 dB μ V/m

Level [dB μ V/m]



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

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
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= 74dB_{UV}/m for spurious in restricted bands**

***AVG. LIMIT= 54dB_{UV}/m for spurious in restricted bands**

***AVG. LIMIT= 68.2dB_{UV}/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

5.3.2 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).

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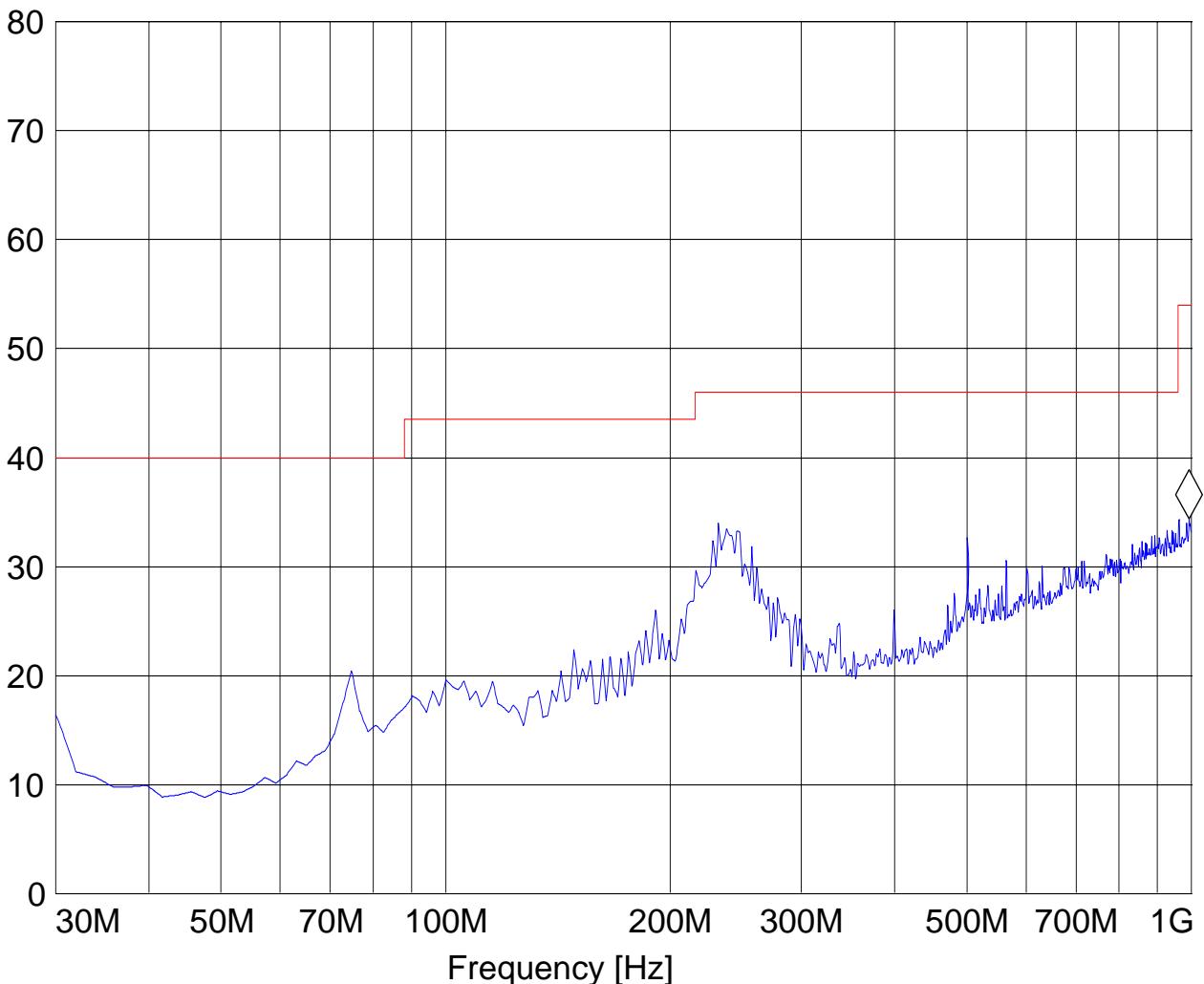
EUT / Description: Dell PP12S with BCM94311MCAG

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

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

Marker: 992.224449 MHz 34.4 dB μ V/m

Level [dB μ V/m]



1-18GHz (5180MHz)

Note: The peaks above the limit line is the carrier freq.

Note: Peak Reading vs. Average limit (54 dB μ V/m)

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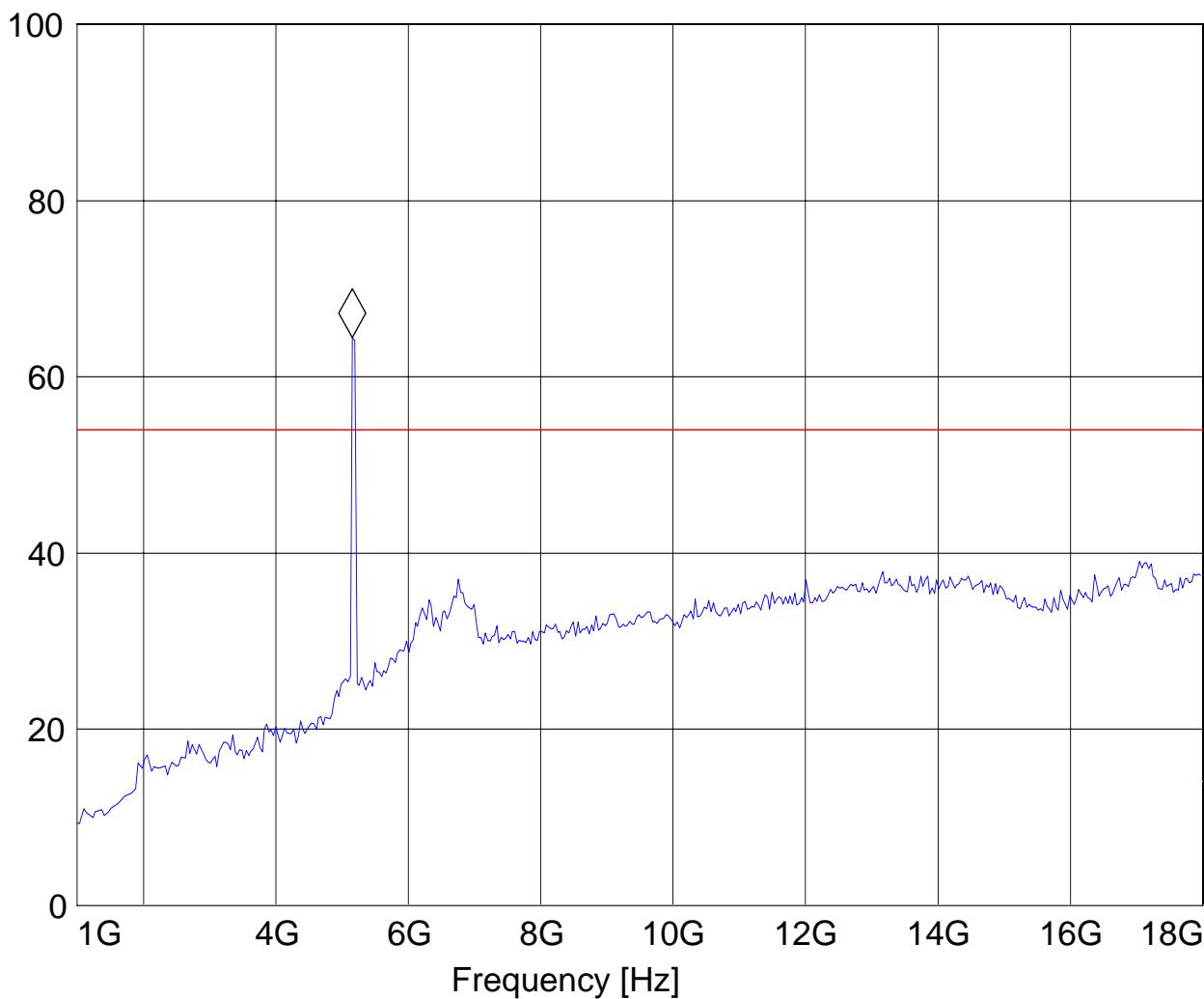
EUT / Description: Dell PP12S with BCM94311MCAG

SWEEP TABLE: "FCC 15.407 1-18G"

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

Marker: 5.156312625 GHz 64.48 dB μ V/m

Level [dB μ V/m]



1-18GHz (5260MHz)

Note: The peaks above the limit line is the carrier freq.

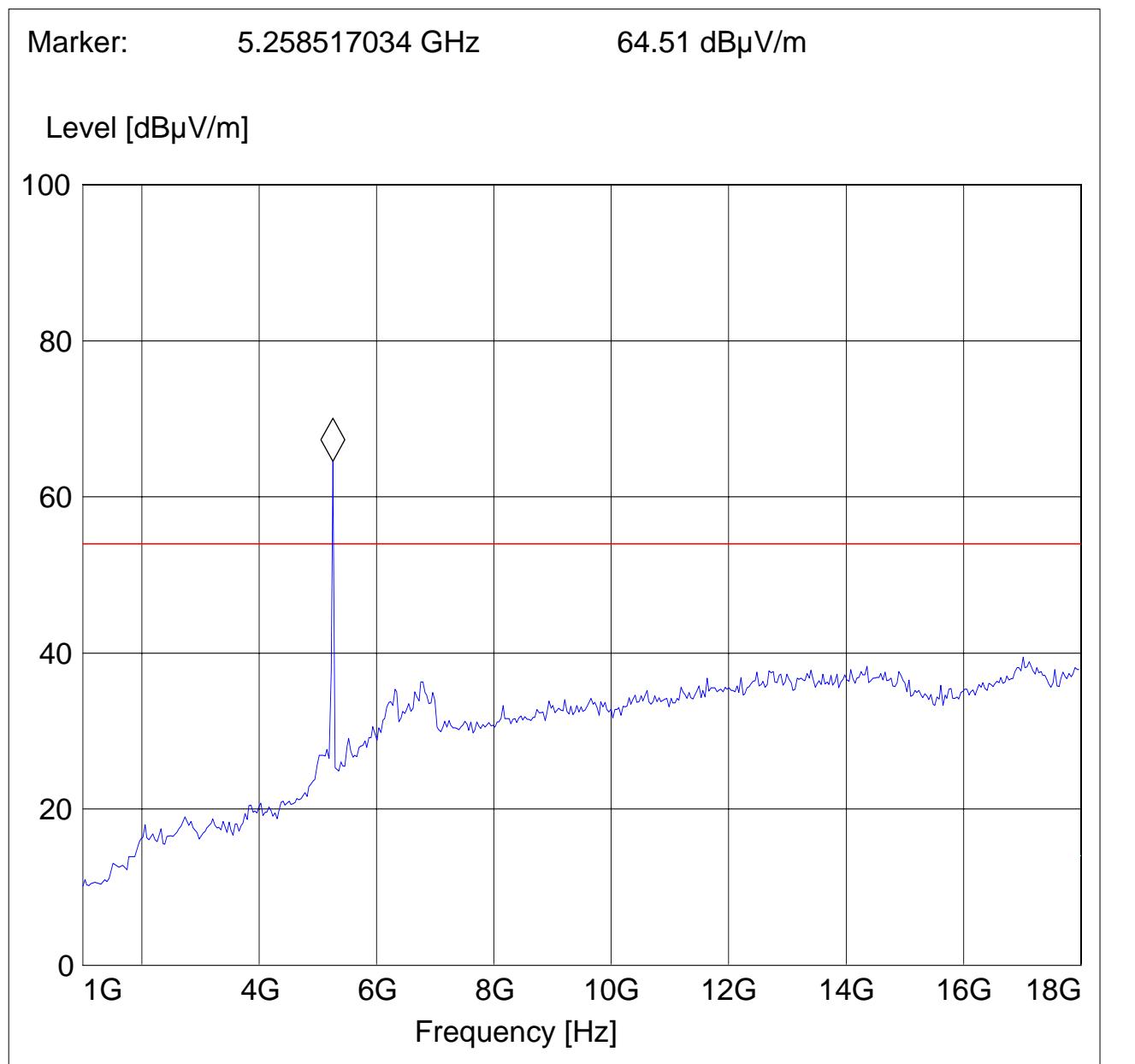
Note: Peak Reading vs. Average limit (54 dBuV/m)

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

EUT / Description: Dell PP12S with BCM94311MCAG

SWEEP TABLE: "FCC 15.407 1-18G"

Start Frequency	Stop Frequency	Detector	Meas.	IF	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 dB μ V/m)

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

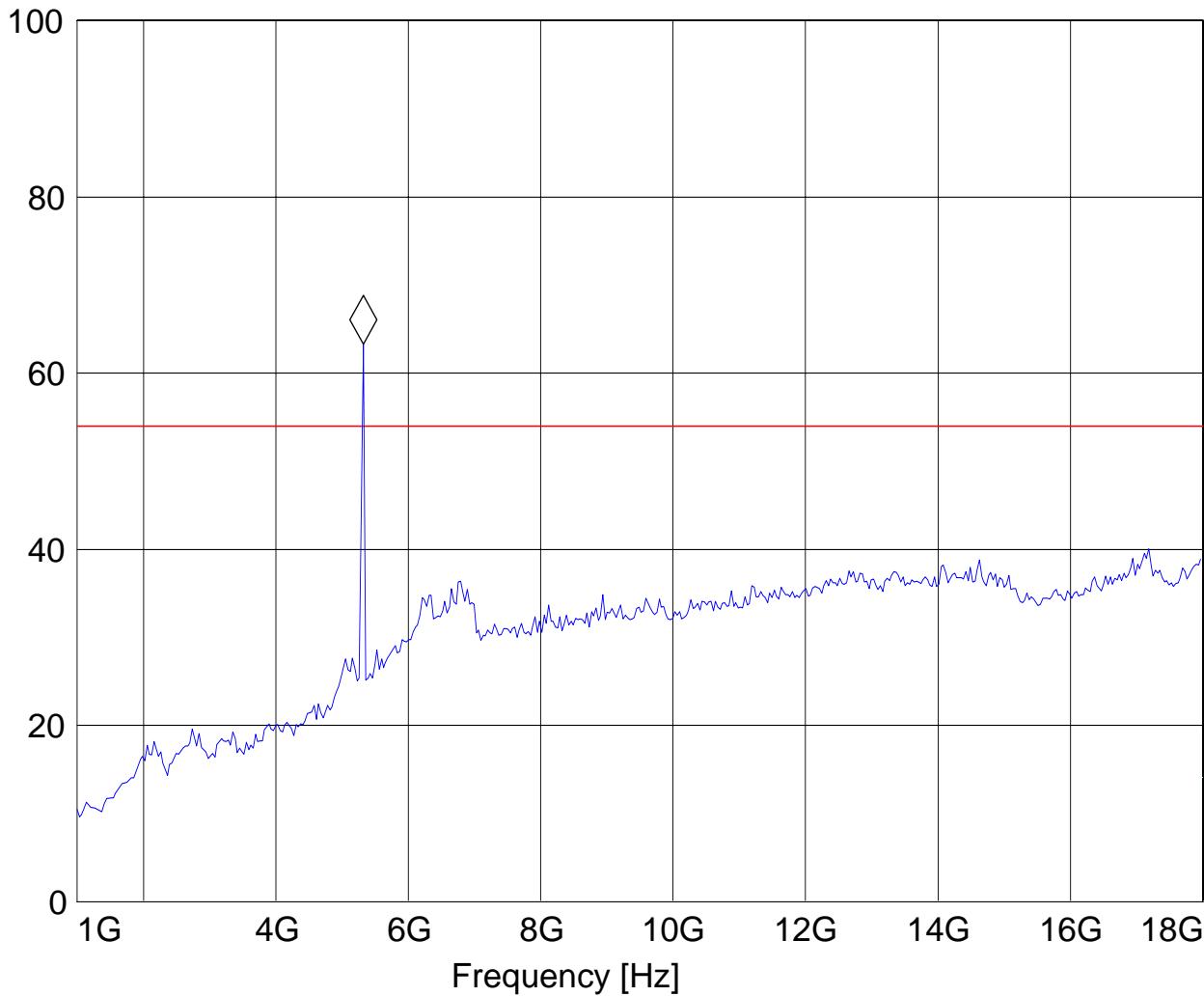
EUT / Description: Dell PP12S with BCM94311MCAG

SWEEP TABLE: "FCC 15.407 1-18G"

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

Marker: 5.326653307 GHz 63.3 dB μ V/m

Level [dB μ V/m]



18-26.5GHz (5180MHz)

Note: Peak Reading vs. Average limit (54 dB μ V/m)

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

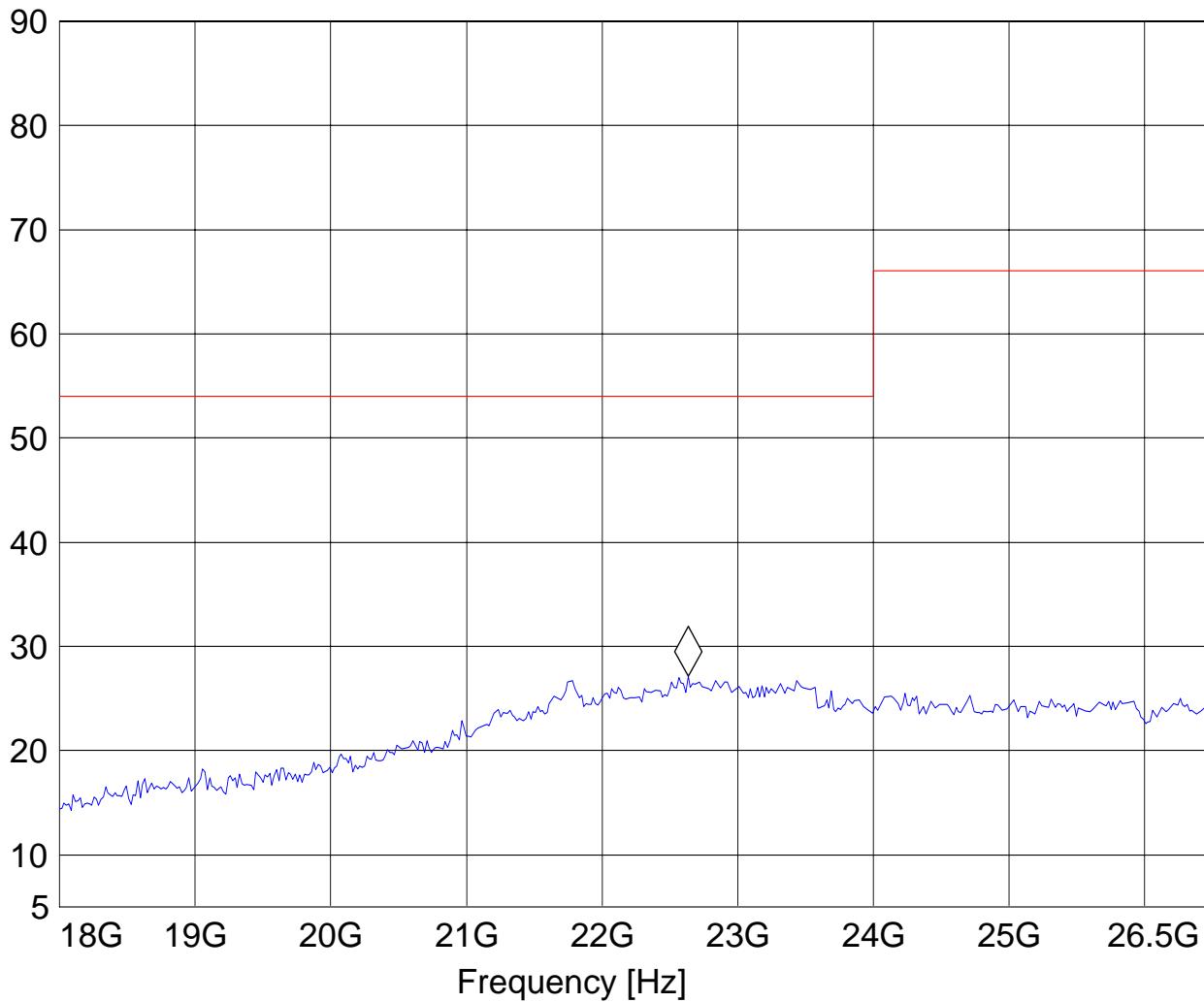
EUT / Description: Dell PP12S with BCM94311MCAG

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

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

Marker: 22.633266533 GHz 27.15 dB μ V/m

Level [dB μ V/m]



18-26.5GHz (5260MHz)

Note: Peak Reading vs. Average limit (54 dB μ V/m)

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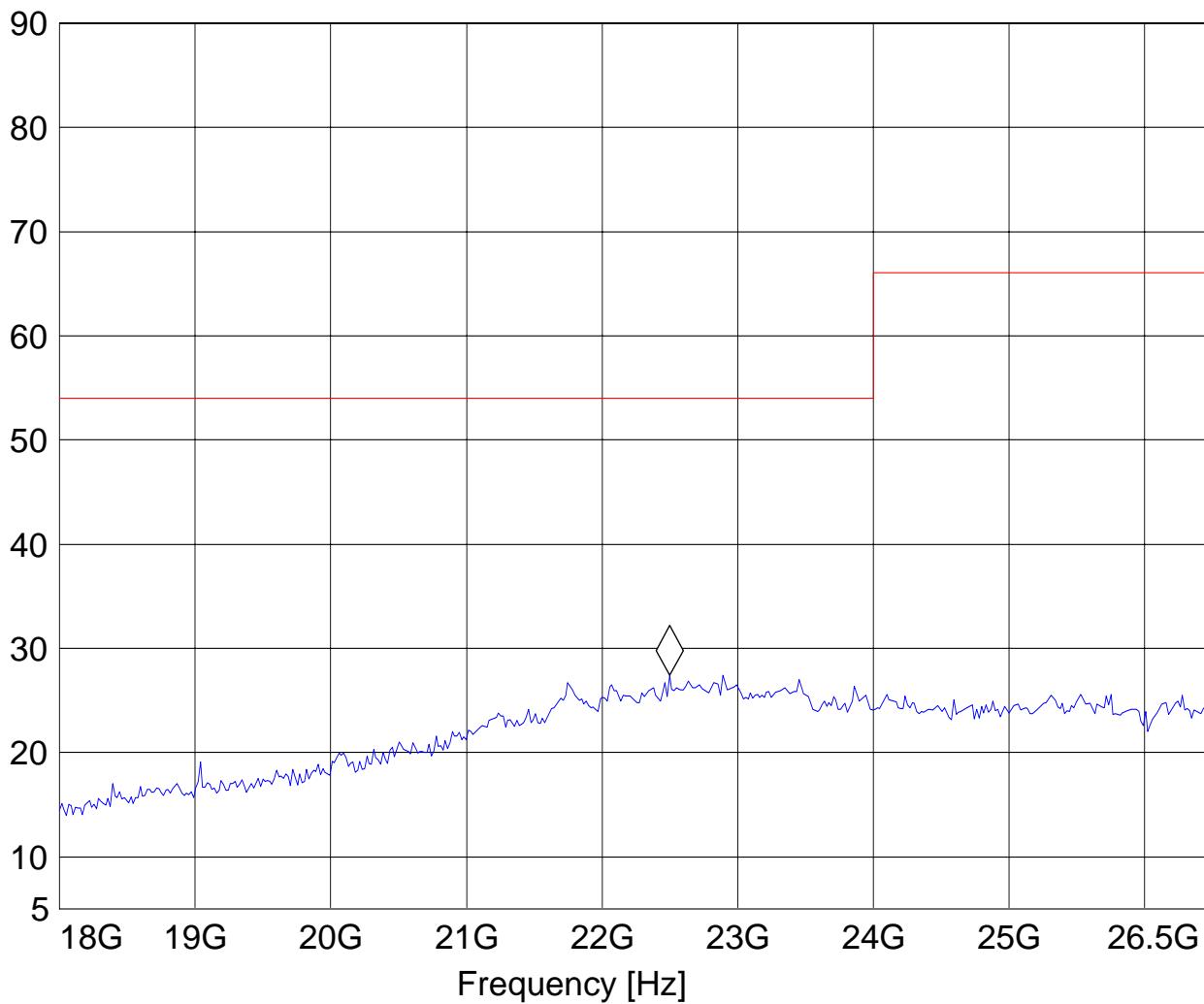
EUT / Description: Dell PP12S with BCM94311MCAG

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

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

Marker: 22.496993988 GHz 27.46 dB μ V/m

Level [dB μ V/m]



18-26.5GHz (5320MHz)

Note: Peak Reading vs. Average limit (54 dB μ V/m)

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

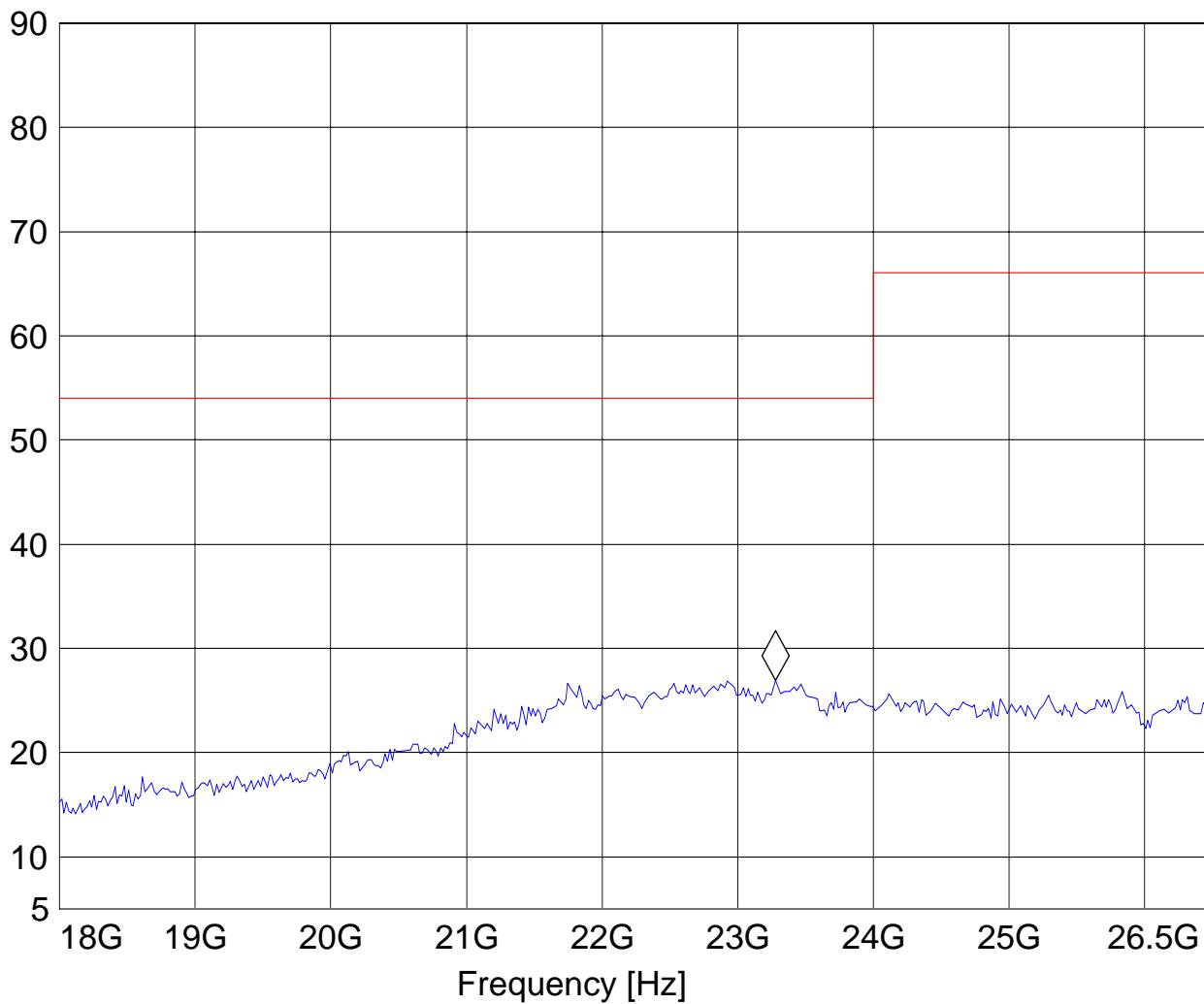
EUT / Description: Dell PP12S with BCM94311MCAG

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

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

Marker: 23.280561122 GHz 26.92 dB μ V/m

Level [dB μ V/m]



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.

5.4 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.

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

5.5.1 LIMITS

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

Limit

Frequency of Emission (MHz)	Conducted Limit (dB μ V)	
	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 110 VAC @ 60 Hz with the EUT in mode that produce the highest power.

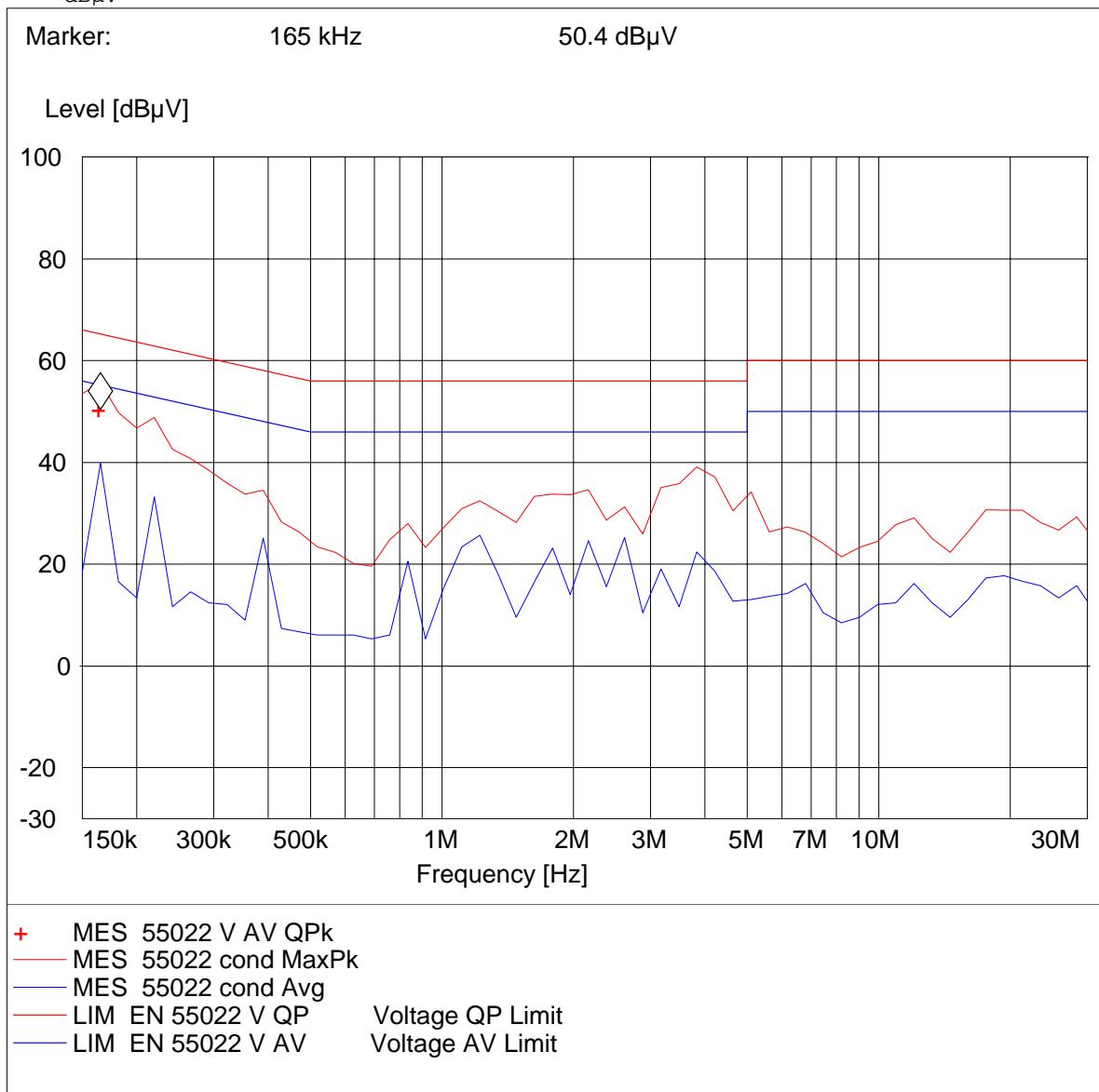
Voltage Mains Test (Line)

CETECOM Inc. Milpitas, USA

EUT: Dell PP12S with BCM94311MCG
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: dB μ V

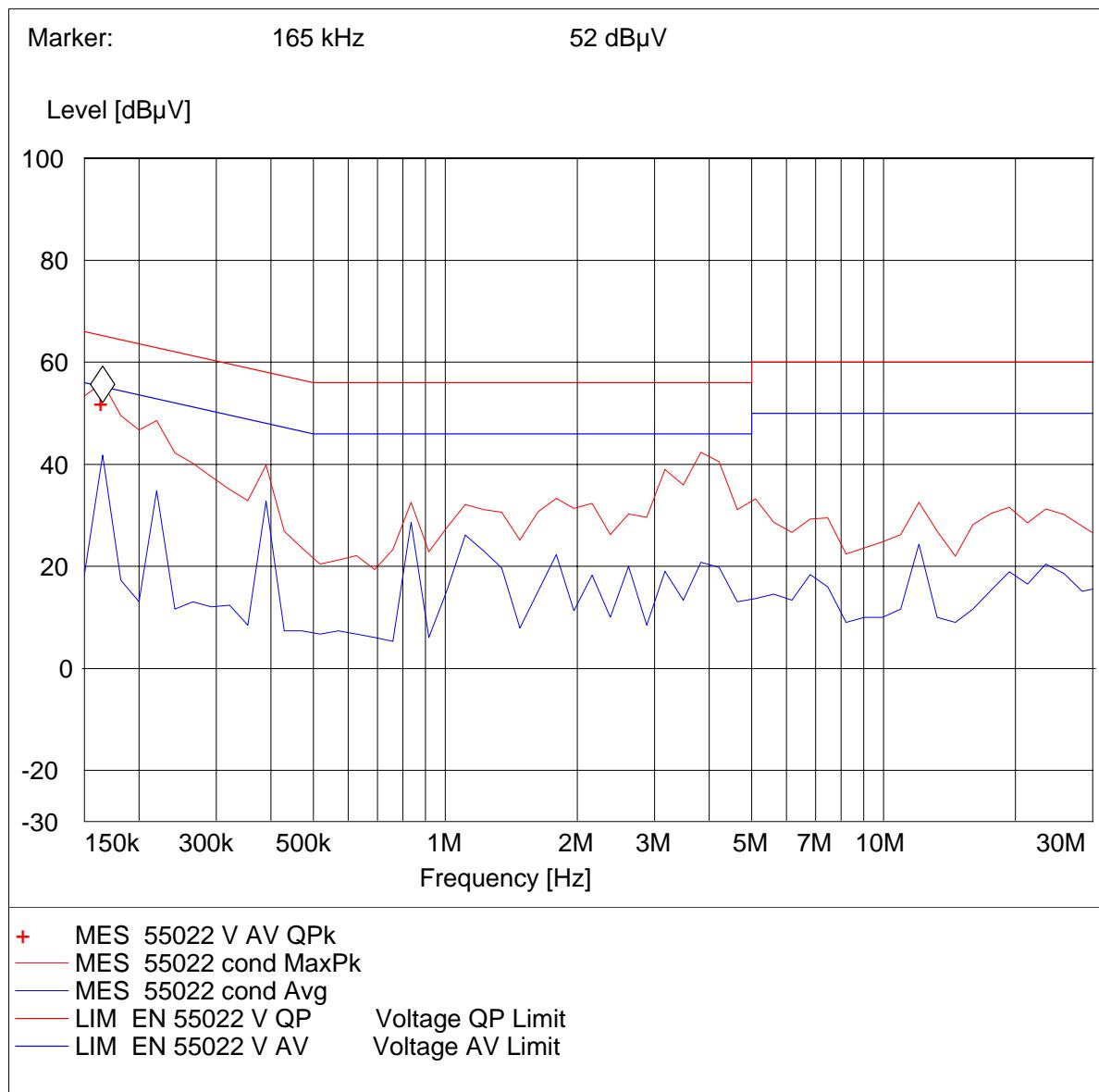


Voltage Mains Test (Neutral)

EUT: Dell PP12S with BCM94311MCG
Manufacturer: Broadcom
Operating Condition: Tx Mode
ANT Orientation:: CONDUCTED
EUT Orientation:: H
Test Engineer:: Juan M.
Power Supply: AC Adaptor
Comments: 120V, 60Hz (Neutral)

SWEET TABLE: "55022 cond"

Short Description: EN 55022 for 150KHz-30MHz
Unit: dB μ V



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
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

ANECHOIC CHAMBER

