



# FCC Test Report

## FCC Part 15.247 for DSSS systems

**802.11ag Wireless LAN PCI-E Mini Card**

**Model #: BCM94311MCAG**

**Broadcom Corporation  
190 Mathilda Place  
Sunnyvale, CA 94086  
U.S.A  
FCC ID: QDS-BRCM1019**

**TEST REPORT #: EMC\_BROAD\_033\_07002\_FCC15.247\_a\_BRCM1019**

**DATE: 2007-7-23**



**FCC listed:  
A2LA  
accredited**

**IC recognized #  
3925A**

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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 #
Broadcom Coporation	802.11ag Wireless LAN PCI-E Mini Card	BCM94311MCAG

Technical responsibility for area of testing:

**Lothar Schmidt**  
**(Director Regulatory and**  
**Antenna Services)**

**2007-7-23 EMC & Radio**

**Date**

**Section**

**Name**

**Signature**

This report is prepared by:

**Peter Mu**  
**(EMC Project Engineer)**

**2007-7-23 EMC & Radio**

**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**

<b>Company Name:</b>	<b>CETECOM Inc.</b>
<b>Department:</b>	<b>EMC</b>
<b>Address:</b>	<b>411 Dixon Landing Road Milpitas, CA 95035 U.S.A.</b>
<b>Telephone:</b>	<b>+1 (408) 586 6200</b>
<b>Fax:</b>	<b>+1 (408) 586 6299</b>
<b>Director Regulatory and Antenna Services:</b>	<b>Lothar Schmidt</b>

### **2.2 Identification of the Client**

<b>Applicant's Name:</b>	<b>Broadcom Corporation</b>
<b>Address Line 1:</b>	<b>190 Mathilda Place</b>
<b>Address Line 2:</b>	
<b>City/ Zip Code</b>	<b>Sunnyvale, California 94086</b>
<b>Country:</b>	<b>U.S.A</b>
<b>Contact Person:</b>	<b>Daniel Lawless</b>
<b>Phone No.:</b>	<b>408 922 5870</b>
<b>Fax:</b>	<b>408 543 3399</b>
<b>e-mail:</b>	<b>dlawless@broadcom.com</b>

### **2.3 Identification of the Manufacturer**

**Same as above client.**

### **3 Equipment under Test (EUT)**

#### **3.1 Specification of the Equipment under Test**

<b>Product Type</b>	<b>Mini PCI Card</b>
<b>Marketing Name:</b>	<b>802.11ag Wireless LAN PCI-E Mini Card</b>
<b>Model No:</b>	<b>BCM94311MCAG</b>
<b>Operating Frequency:</b>	<b>5725-5850MHz</b>
<b>Date of Test:</b>	<b>2007-6-27 to 2007-7-18</b>
<b>Type(s) of Modulation:</b>	<b>OFDM</b>
<b>Antenna Type:</b>	<b>WDAN-DWDS1-001-DF and Amphenol antenna WT0581-11</b>
<b>Output Power<sup>1</sup>:</b>	<b>23.19 dBm (0.208W) EIRP WLAN 802.11a 2412MHz</b>

#### **3.2 Specification of the Supporting Portable Platform**

<b>Product Type</b>	<b>Notebook PC</b>
<b>Marketing Name:</b>	<b>Dell XPS M1730</b>
<b>Model No:</b>	<b>Dell PP06XA</b>



#### **4 Subject Of Investigation**

All testing was performed on the product referred to in Section 3 as EUT. EUT contains Broadcom BCM94311MCAG WLAN module, FCC ID: QDS-BRCM1019 that supports the following mode and frequency bands:

2400-2483.4MHz: 802.11b, 802.11g

5150-5350MHz: 802.11a

5725-5850MHz: 802.11a

The objective of the measurements done by Cetecom Inc. was to measure the performance of the EUT operating under 802.11a mode in the 5725-5850 MHz 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.

Only the auxiliary antenna is tested for compliance because the distance from the main antenna to the body of the user is greater than 20cm and is therefore not a portable device according to FCC rule 2.1093.

## 5 Measurements

### 5.1 MAXIMUM PEAK OUTPUT POWER § 15.247 (RADIATED)

#### 5.1.1 LIMIT SUB CLAUSE § 15.247 (b) (1) (2) (3) (4)

Frequency range	RF power output
5725-5850 MHz	36dBm EIRP

\*limit is based upon antenna gain of less than or equal to 6dBi.

#### 5.1.2 EIRP a MODE:

TEST CONDITIONS			MAXIMUM PEAK OUTPUT POWER (dBm)		
Frequency (MHz)			5745	5785	5825
Aux	T <sub>nom</sub> (23)°C	V <sub>nom</sub> VDC	23.19	22.13	20.93
Measurement uncertainty			±0.5dBm		

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Report :

**EIRP a Mode (5745) Aux**

EUT: Dell Siberia, BRCM1019

Customer: Broadcom

Test Mode: 801.11a 5.7G

ANT Orientation: V

EUT Orientation: H

Test Engineer: Peter Mu

Power Supply: AC Adaptor

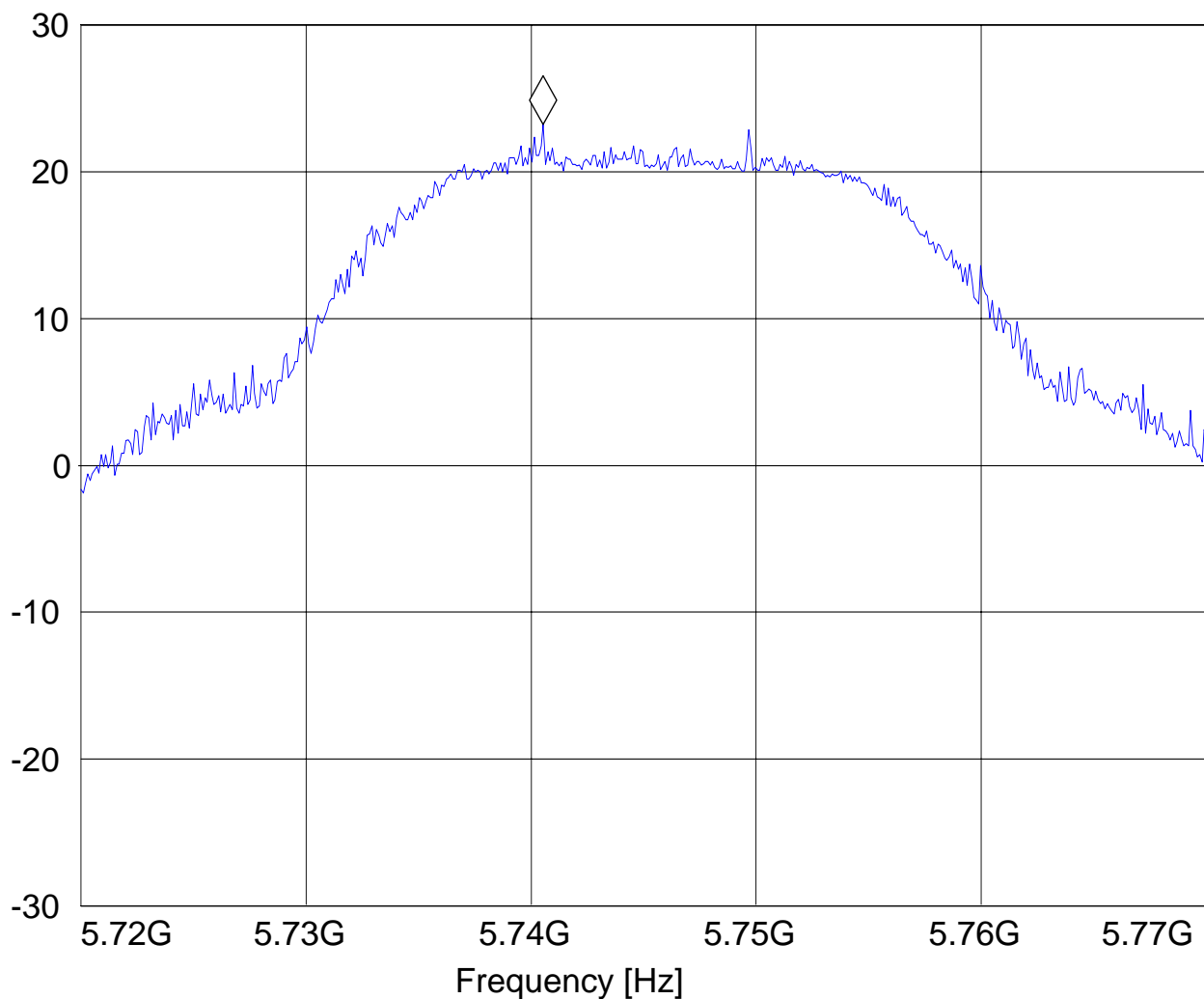
Comments:

***SWEEP TABLE: "EIRP 802.11a\_149"***

Short Description:	EIRP channel-5260 MHz				
Start	Stop	Detector	Meas.	IF	Transducer
Frequency	Frequency	Time	Bandw.		
5.7 GHz	5.8 GHz	MaxPeak	Coupled	10 MHz	DUMMY-DBM

Marker: 5.740541082 GHz 23.19 dBm

Level [dBm]





**EIRP a Mode (5785MHz) Aux**

EUT: Dell Siberia, BRCM1019

Customer: Broadcom

Test Mode: 801.11a 5.7G

ANT Orientation: V

EUT Orientation: H

Test Engineer: Peter Mu

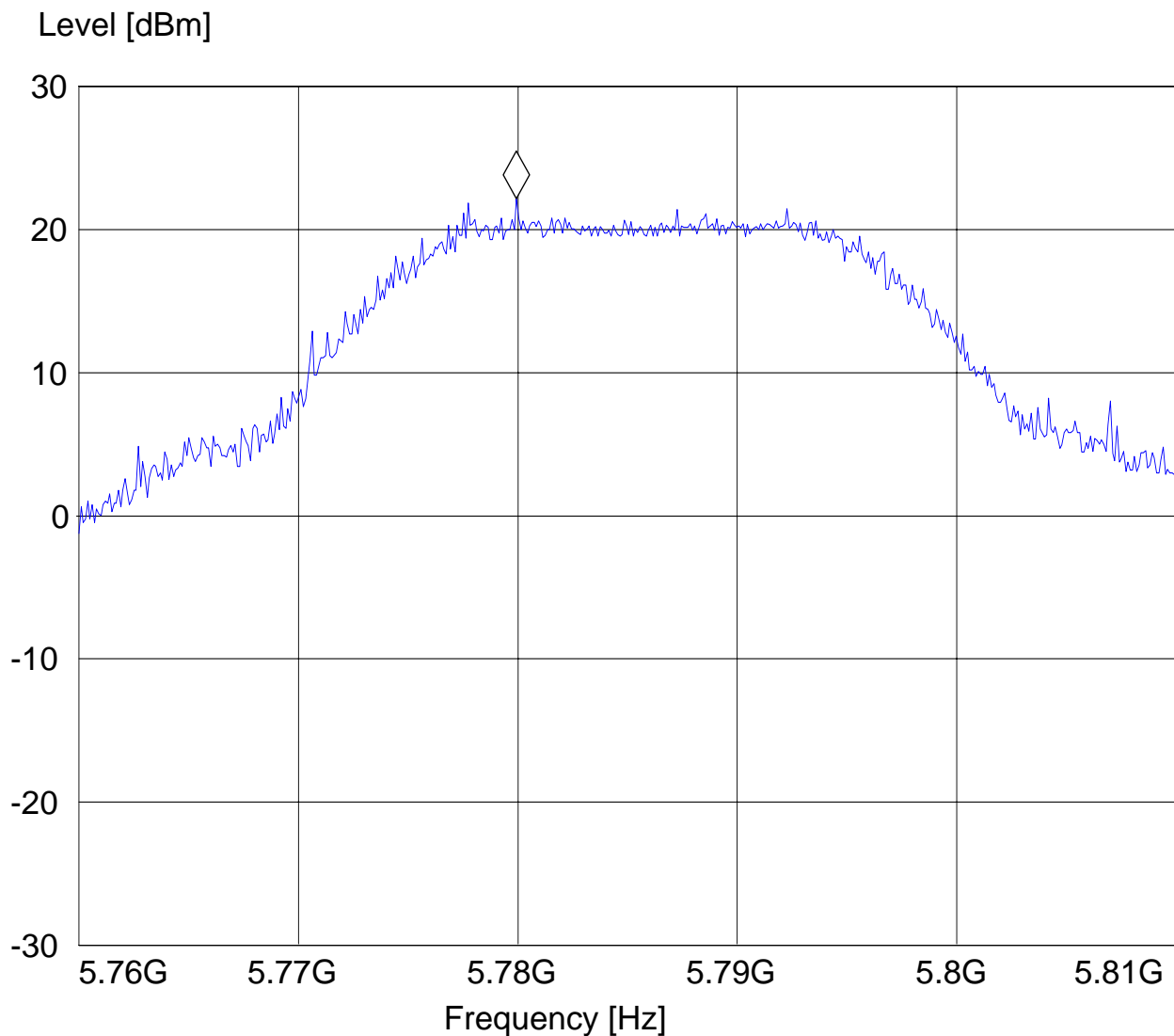
Power Supply: AC Adaptor

Comments:

***SWEEP TABLE: "EIRP 802.11a\_157"***

Short Description:	EIRP channel-5260 MHz				
Start	Stop	Detector	Meas.	IF	Transducer
Frequency	Frequency		Time	Bandw.	
5.8 GHz	5.8 GHz	MaxPeak	Coupled	10 MHz	DUMMY-DBM

Marker: 5.77993988 GHz 22.13 dBm



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Report :

**EIRP a Mode (5825MHz) Aux**

EUT: Dell Siberia, BRCM1019

Customer: Broadcom

Test Mode: 801.11a 5.7G

ANT Orientation: V

EUT Orientation: H

Test Engineer: Peter Mu

Power Supply: AC Adaptor

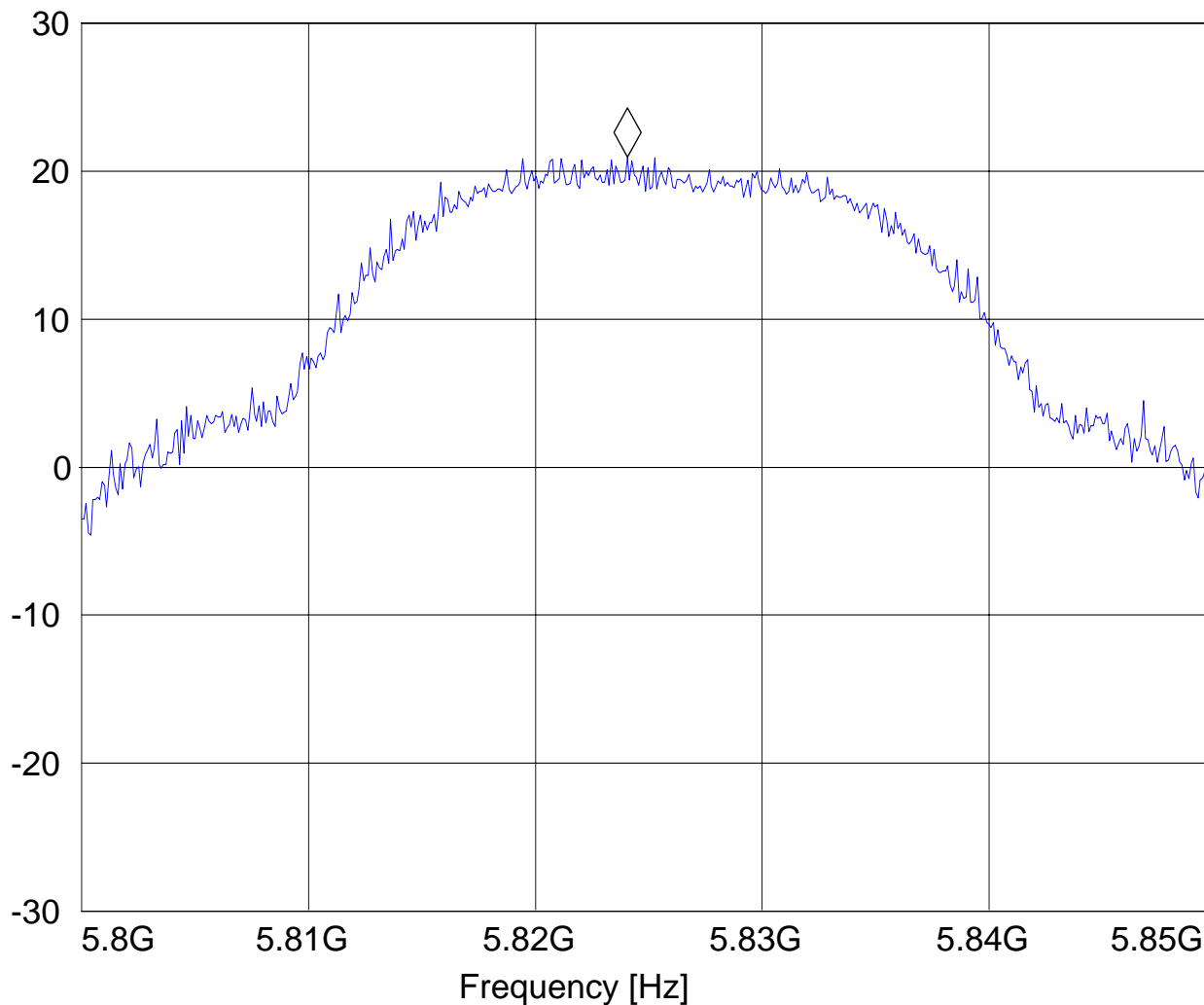
Comments:

***SWEEP TABLE: "EIRP 802.11a\_165"***

Short Description:	EIRP channel-5260 MHz				
Start	Stop	Detector	Meas.	IF	Transducer
Frequency	Frequency	Time	Bandw.		
5.8 GHz	5.9 GHz	MaxPeak	Coupled	10 MHz	DUMMY-DBM

Marker: 5.824048096 GHz 20.93 dBm

Level [dBm]



**5.2 TRANSMITTER SPURIOUS EMISSIONS RADIATED § 15.247/15.205/15.209****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
<sup>1</sup> 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	( <sup>2</sup> )
13.36 - 13.41			

\*PEAK LIMIT= 74dBuV/m

\*AVG. LIMIT= 54dBuV/m

**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 (a) MODE**

30MHz – 1GHz Aux Antenna: vertical

**Note:** This plot is valid for low, mid, high channels as well as for polarizations (worst-case plot) **Note:** Peak reading vs. Quasi-peak limit

EUT: Dell Siberia, BRCM1019

Customer: Broadcom

Test Mode: 801.11a 5.7G

ANT Orientation: V

EUT Orientation: H

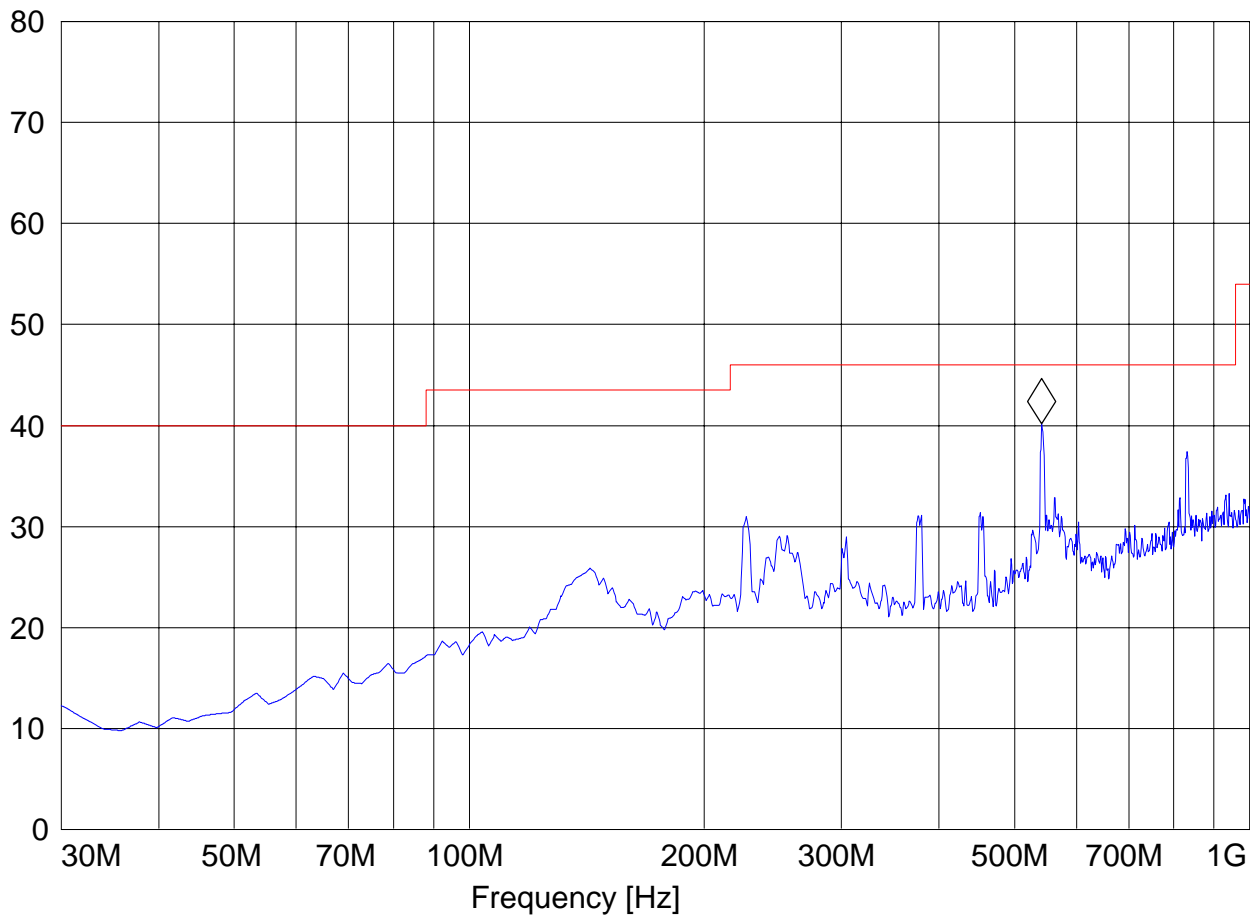
Test Engineer: Peter Mu

Power Supply: AC Adaptor

Comments:

**SWEEP TABLE: "FCC15.247\_30M-1G\_Ver"**

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

Marker: 541.242485 MHz 40.15 dB $\mu$ V/mLevel [dB $\mu$ V/m]

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Report :

**30MHz – 1GHz Aux Antenna: Horizontal**

**Note:** This plot is valid for low, mid, high channels as well as for polarizations (worst-case plot) **Note:** Peak reading vs. Quasi-peak limit

EUT: Dell Siberia, BRCM1019

Customer: Broadcom

Test Mode: 801.11a 5.7G

ANT Orientation: V

EUT Orientation: H

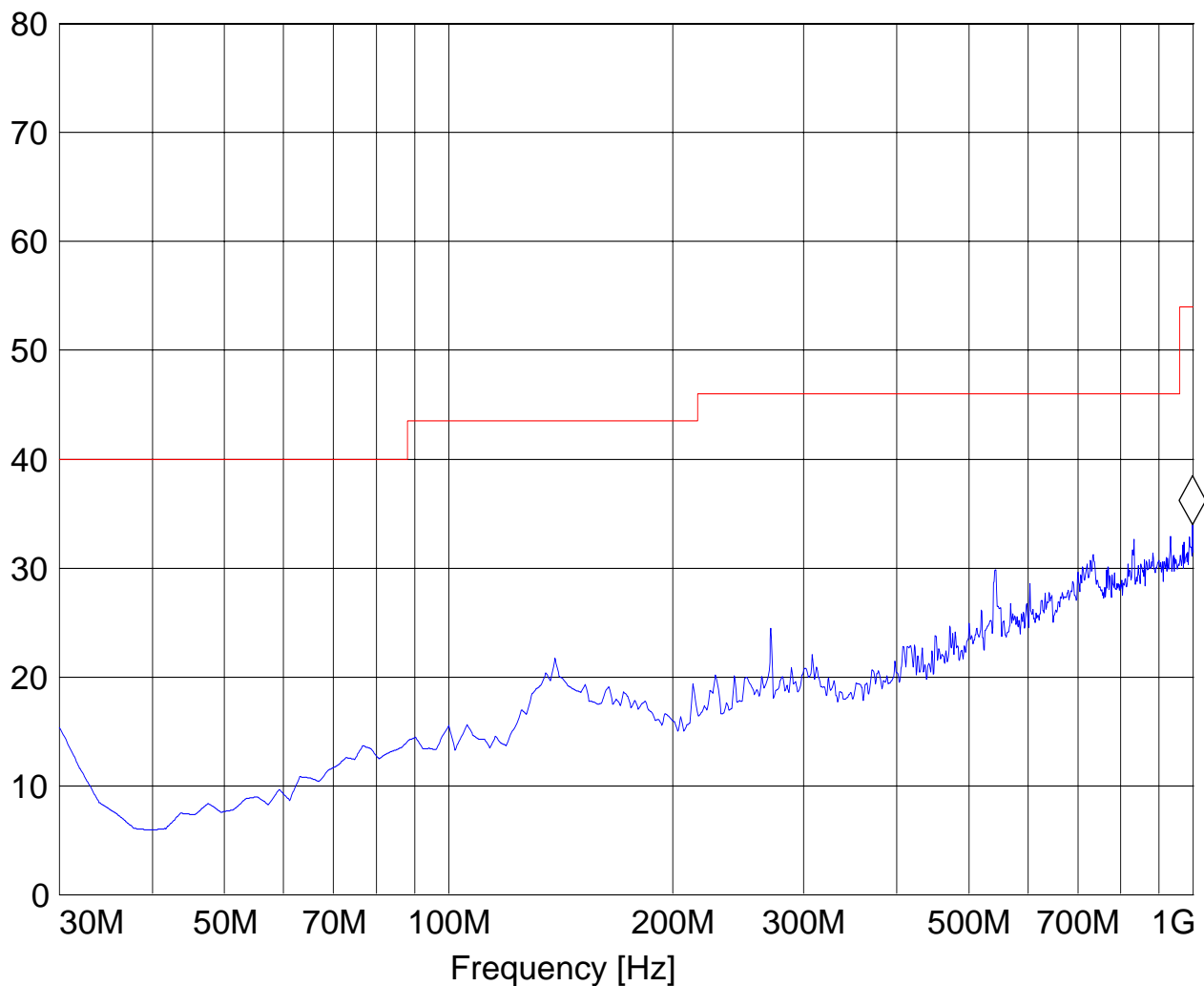
Test Engineer: Peter Mu

Power Supply: AC Adaptor

Comments:

**SWEEP TABLE: "FCC15.247\_30M-1G\_Hor"**

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

Marker: 998.056112 MHz 33.97 dB $\mu$ V/mLevel [dB $\mu$ V/m]

**1-18GHz (5745MHz) Aux**

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

EUT / Description: Dell Siberia, BRCM1019

Manufacturer: Broadcom

Test mode: 801.11a 5.7G

ANT Orientation: : V

EUT Orientation:: H

Test Engineer: Peter Mu

Voltage: AC Adaptor

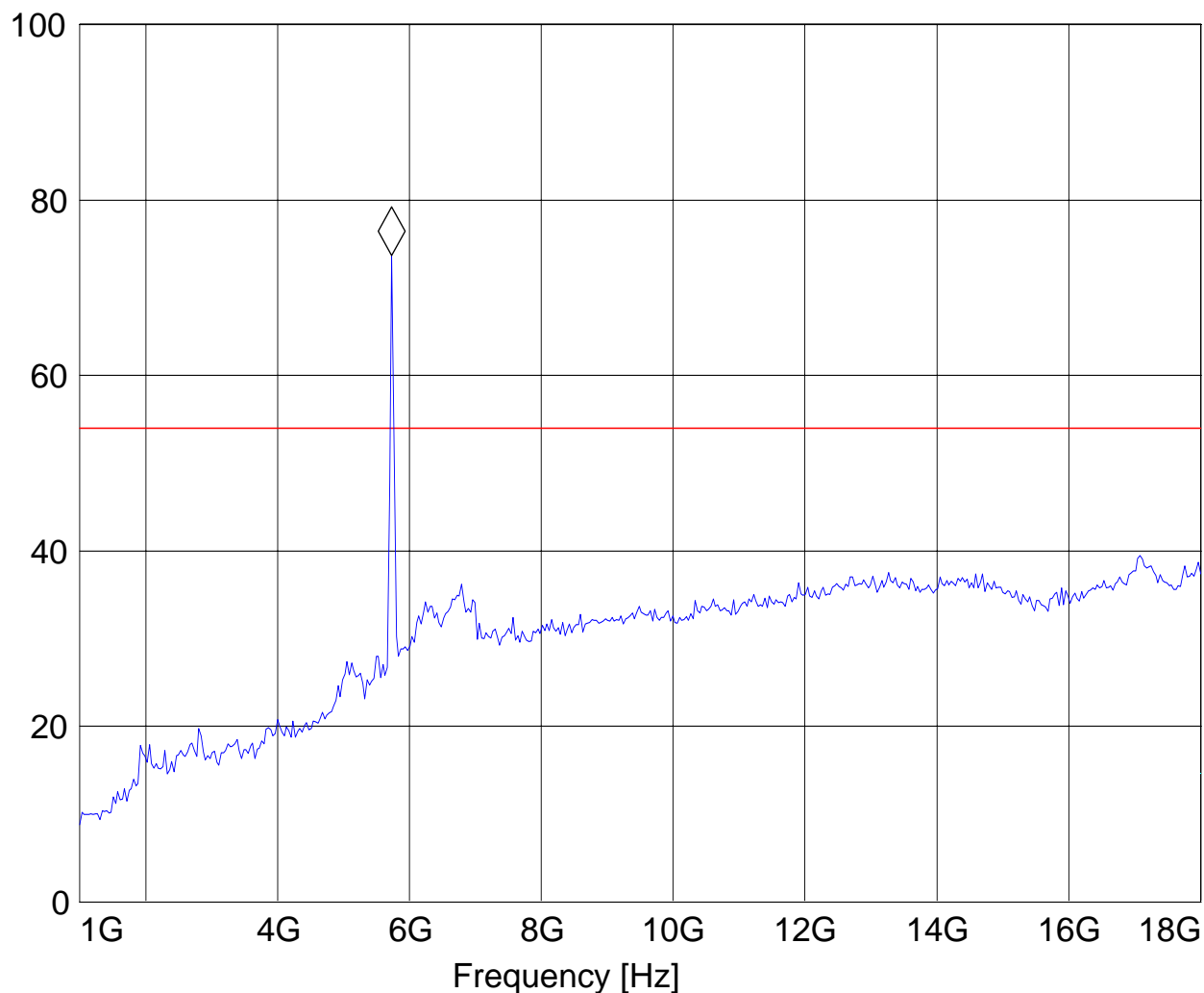
Comments::

***SWEEP TABLE: "FCC 15.407 1-18G"***

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

Marker: 5.735470942 GHz 73.65 dB $\mu$ V/m

Level [dB $\mu$ V/m]



**1-18GHz (5785MHz) Aux**

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

EUT / Description: Dell Siberia, BRCM1019

Manufacturer: Broadcom

Test mode: 801.11a 5.7G

ANT Orientation: : V

EUT Orientation:: H

Test Engineer: Peter Mu

Voltage: AC Adaptor

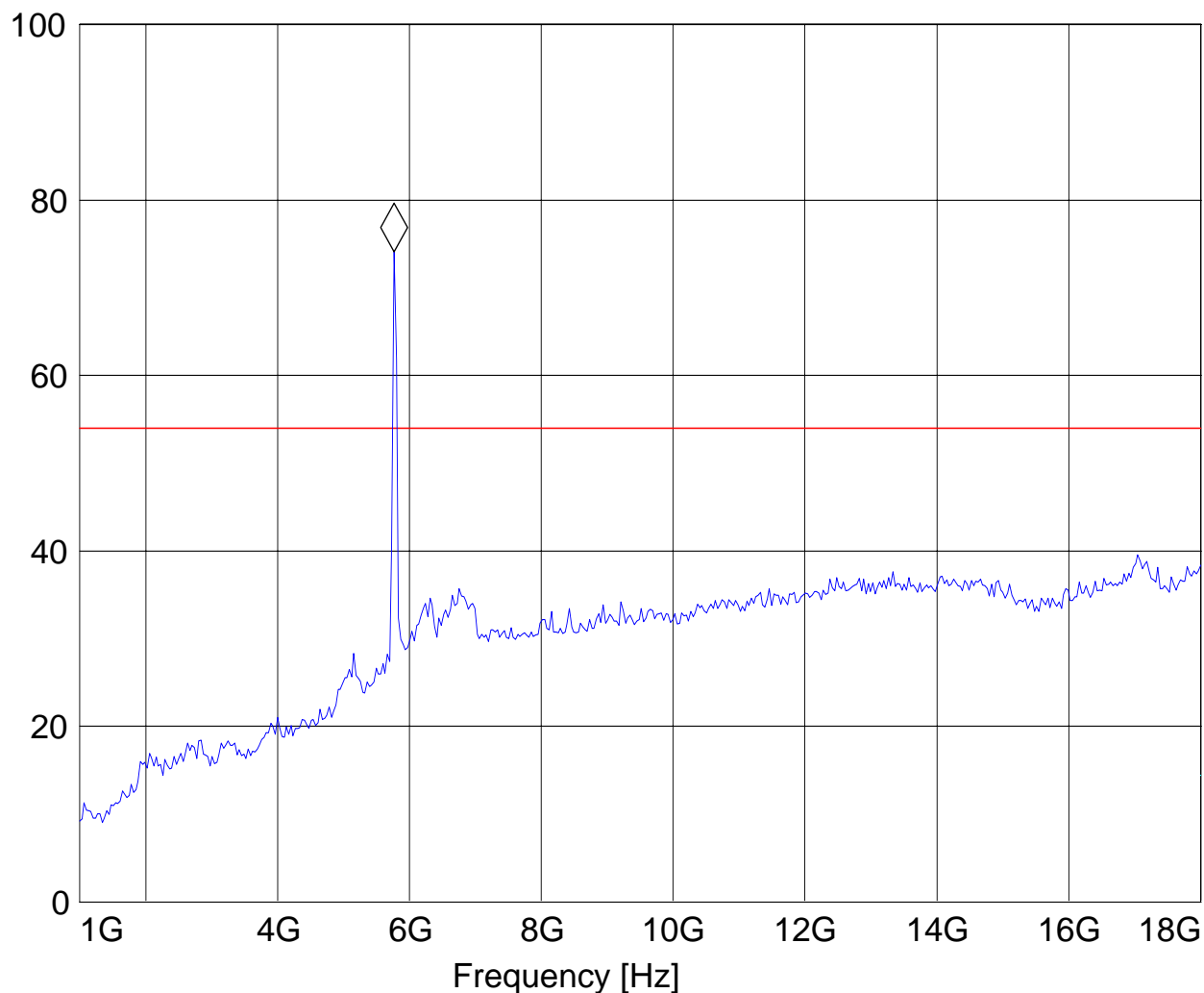
Comments::

**SWEEP TABLE: "FCC 15.407 1-18G"**

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

Marker: 5.769539078 GHz 74.13 dB $\mu$ V/m

Level [dB $\mu$ V/m]



**1-18GHz (5825MHz) Aux**

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

EUT / Description: Dell Siberia, BRCM1019

Manufacturer: Broadcom

Test mode: 801.11a 5.7G

ANT Orientation: : V

EUT Orientation:: H

Test Engineer: Peter Mu

Voltage: AC Adaptor

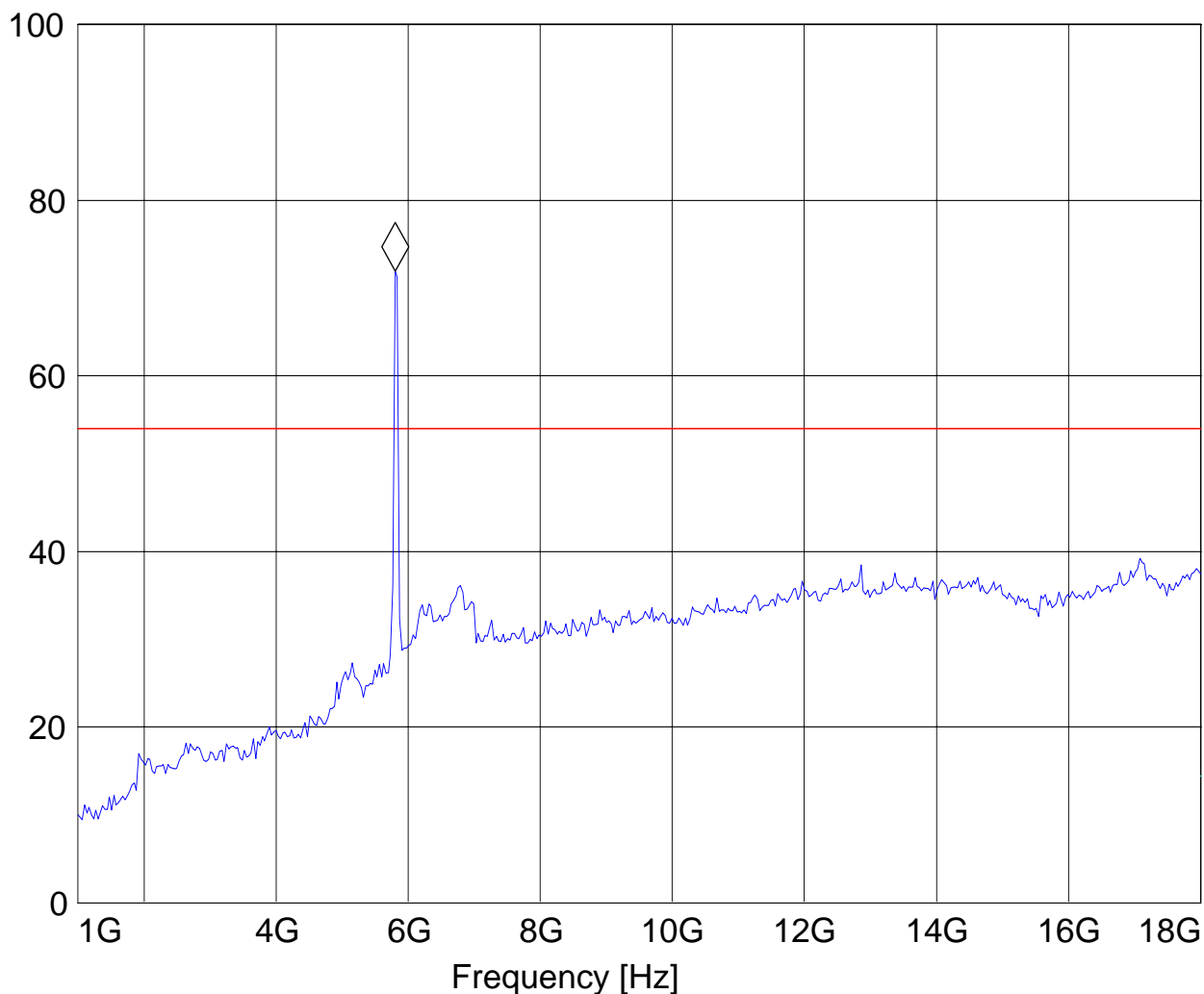
Comments::

***SWEEP TABLE: "FCC 15.407 1-18G"***

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

Marker: 5.803607214 GHz 71.9 dBμV/m

Level [dBμV/m]





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Report :

**18-26.5GHz (5745MHz) Aux**

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

EUT: Dell Siberia, BRCM1019

Customer: Broadcom

Test Mode: 801.11a 5.7G

ANT Orientation: V

EUT Orientation: H

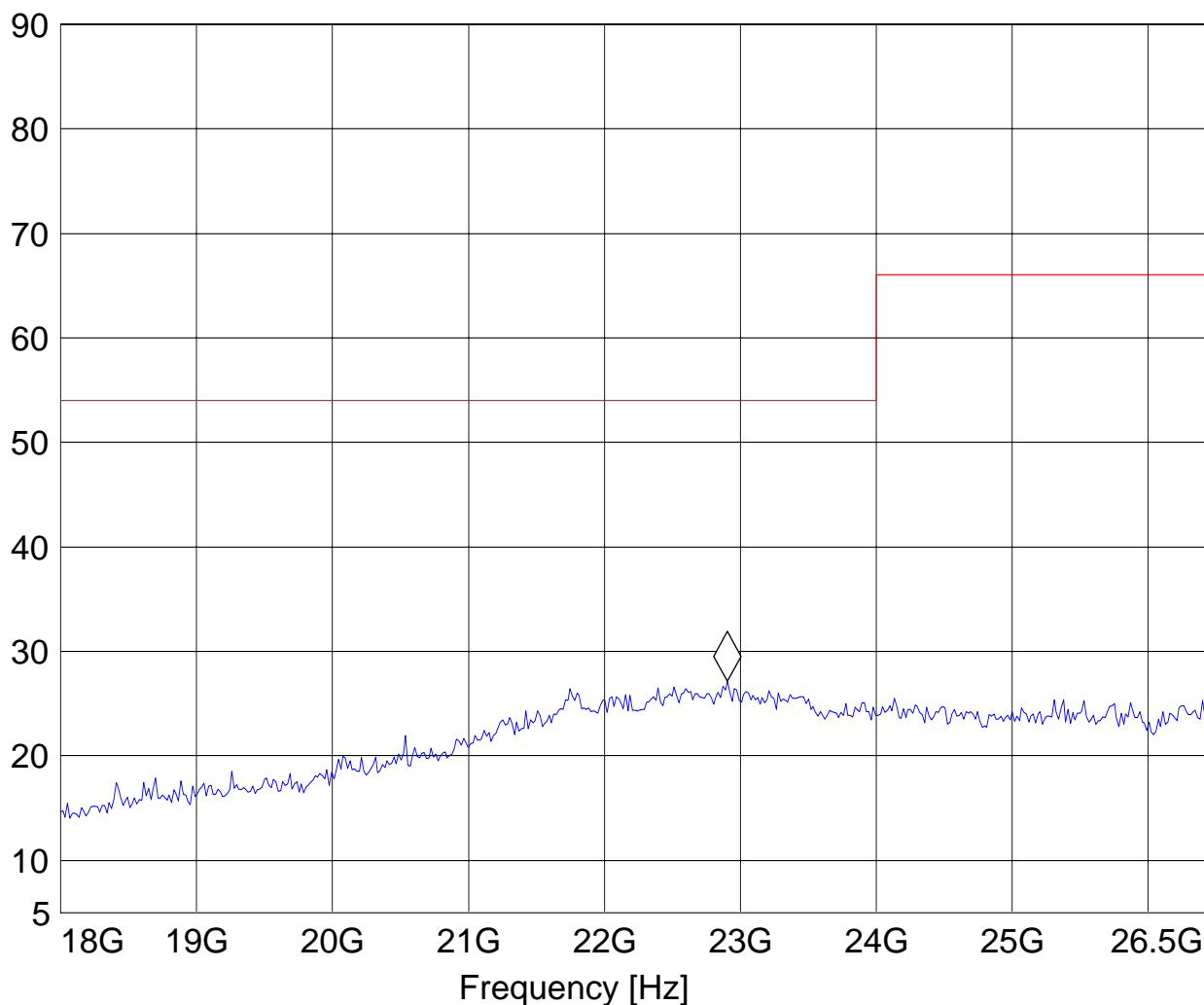
Test Engineer: Peter Mu

Power Supply: AC Adaptor

Comments:

**SWEEP TABLE: "FCC 15.407 18-26.5G"**

Start	Stop	Detector	Meas.	IF	Transducer
Frequency	Frequency		Time	Bandw.	
18.0 GHz	26.5 GHz	MaxPeak	10.0 s	1 MHz	#572 horn AF

Marker: 22.905811623 GHz 27.19 dB $\mu$ V/mLevel [dB $\mu$ V/m]

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Report :

**26-40GHz Aux**

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

EUT: Dell Siberia, BRCM1019

Customer: Broadcom

Test Mode: 801.11a 5.7G

ANT Orientation: V

EUT Orientation: H

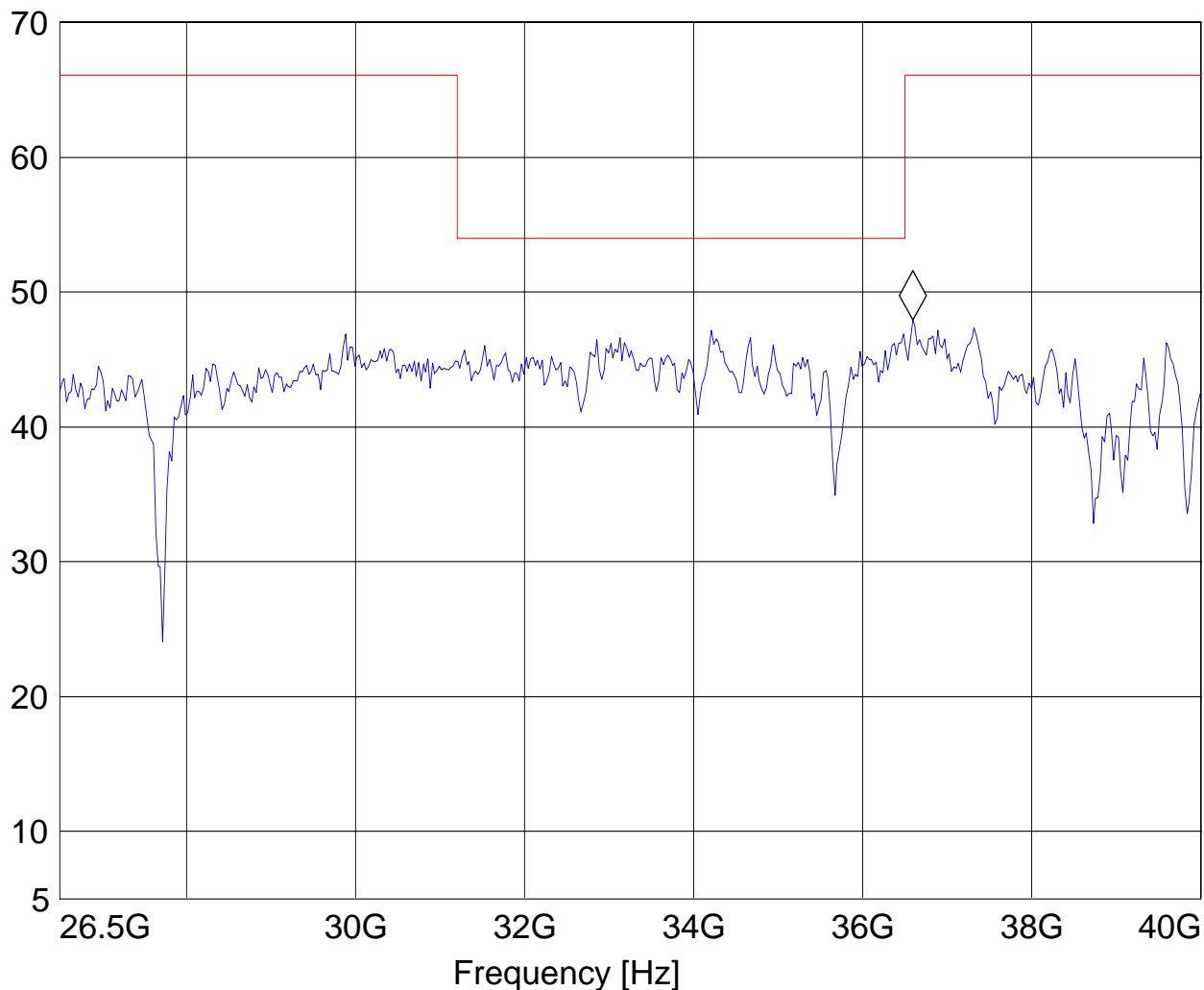
Test Engineer: Peter Mu

Power Supply: AC Adaptor

Comments:

**SWEEP TABLE: "FCC 15.407 26.5-40G"**

Start	Stop	Detector	Meas.	IF	Transducer
Frequency	Frequency		Time	Bandw.	
26.5 GHz	40.0 GHz	MaxPeak	Coupled	1 MHz	3160 Horn 26.5-40G

Marker: 36.591182365 GHz 47.94 dB $\mu$ V/mLevel [dB $\mu$ V/m]

**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)**

§15.107 (a) Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

**Limit**

Frequency of Emission (MHz)	Conducted Limit (dB $\mu$ 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**

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Report :

**5.3.2 Results Line:**

EUT: Dell Siberia  
Manufacturer: Broadcom  
Operating Condition: WLAN  
ANT Orientation:: CONDUCTED  
EUT Orientation:: H  
Test Engineer:: Peter Mu  
Power Supply: : AC Adaptor  
Comments: : LINE

**SWEEP TABLE: "55022 cond"**

Short Description: EN 55022 for 150KHz-30MHz

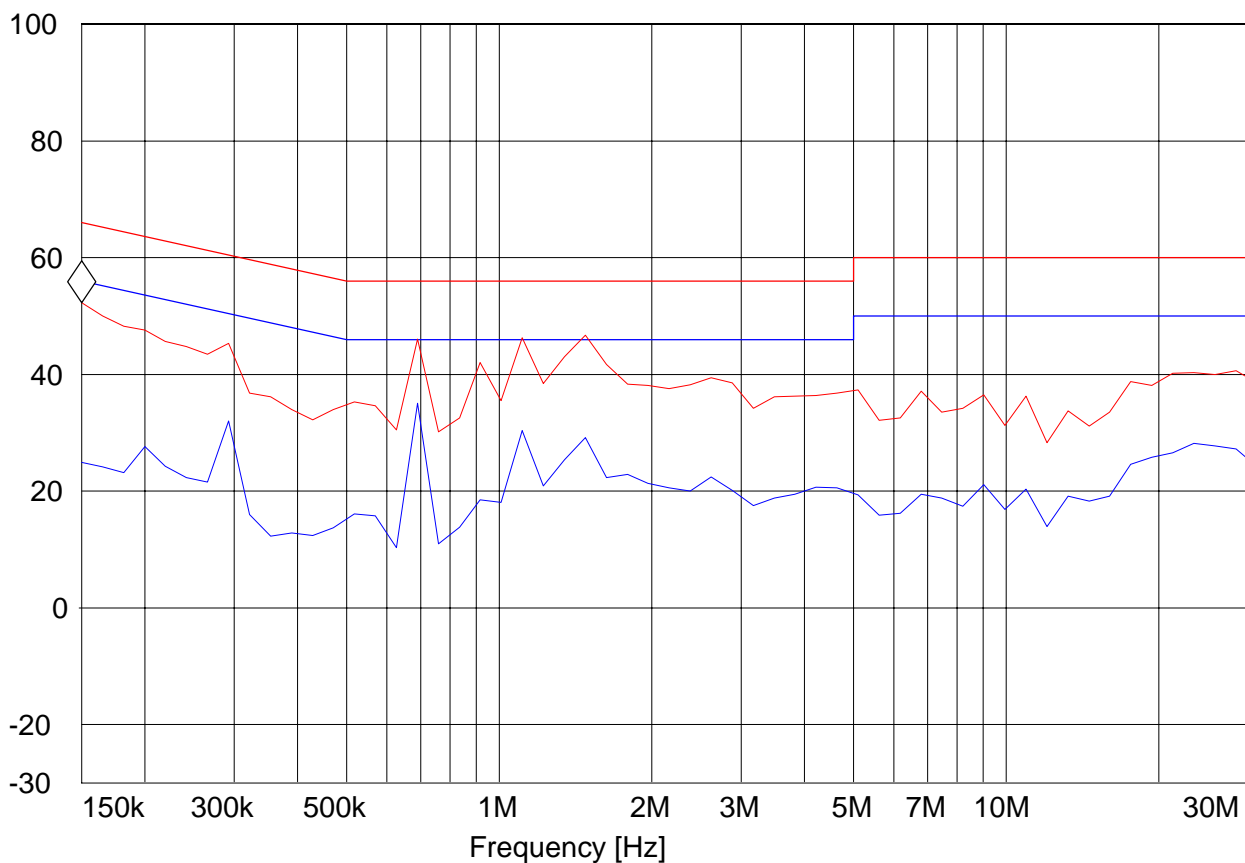
Unit: dBμV

Detector:

Mode:

Marker: 150 kHz 52.27 dBμV N

Level [dBμV]



— MES 55022 cond MaxPk

— MES 55022 cond Avg

— LIM EN 55022 V QP

— LIM EN 55022 V AV

Voltage QP Limit

Voltage AV Limit

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Report :

**Neutral:**

EUT: Dell Siberia  
Manufacturer: Broadcom  
Operating Condition: WLAN  
ANT Orientation:: CONDUCTED  
EUT Orientation:: H  
Test Engineer:: Peter Mu  
Power Supply: : AC Adaptor  
Comments: : N

**SWEEP TABLE: "55022 cond"**

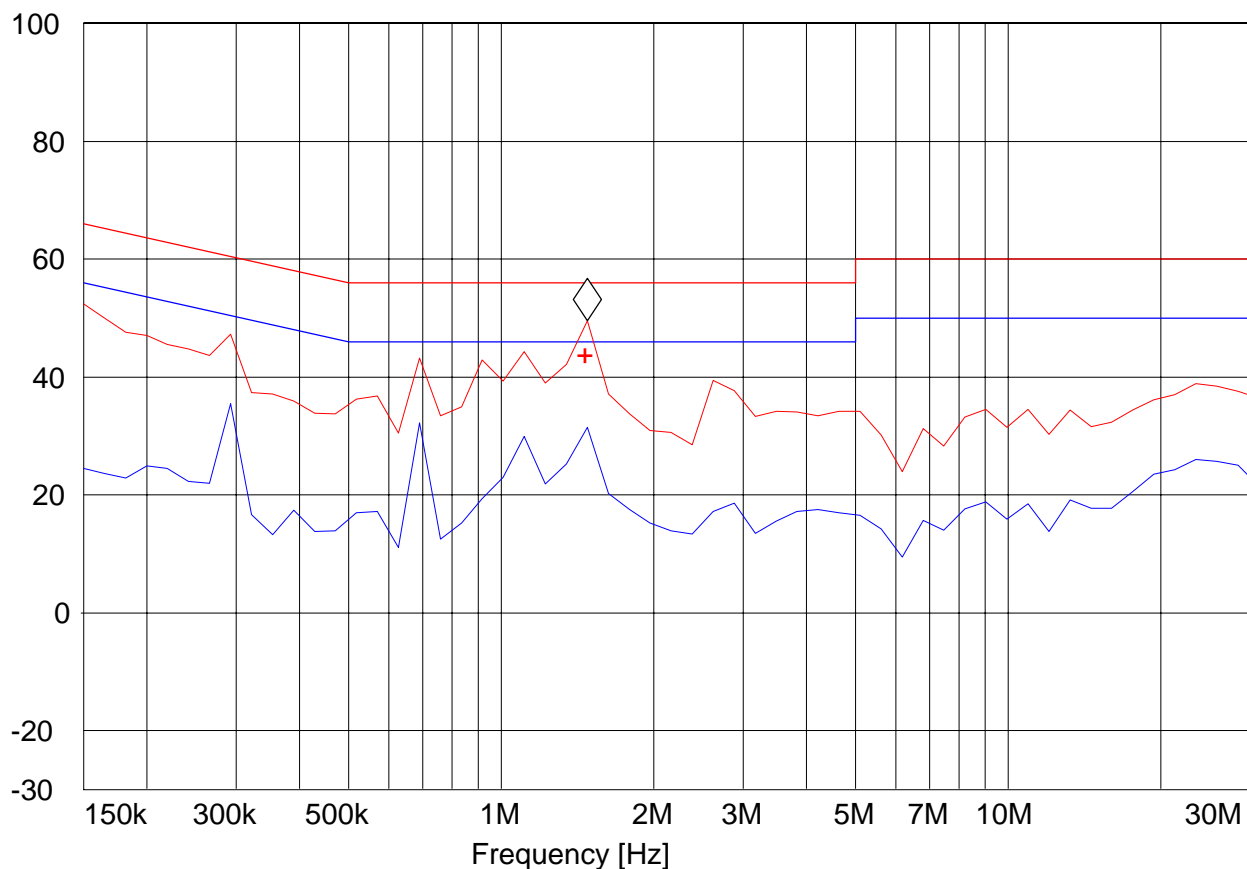
Short Description: EN 55022 for 150KHz-30MHz

Unit: dBμV

Detector: Mode:

Marker: 1.47746 MHz 49.54 dBμV N

Level [dBμV]



+ MES 55022 V AV QPk  
— MES 55022 cond MaxPk  
— MES 55022 cond Avg  
— LIM EN 55022 V QP Voltage QP Limit  
— LIM EN 55022 V AV Voltage AV Limit

## 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

