



Test Report

FCC Part 15.247

Industry Canada RSS210

DTS Devices Operating in range 2400-2483.5MHz

Model #: BCM94312HMG

**Broadcom Corporation
190 Mathilda Place
Sunnyvale, CA 94086**

**FCC ID: QDS-BRCM1030
IC ID: 4324A-BRCM1030**

Report #: EMC_BROAD_071_09001_15.247_2009_rev1

TEST REPORT #: DATE: 2009-3-17



**Bluetooth Qualification
Test Facility
(BQTF)**



**FCC listed:
A2LA
accredited**

**IC recognized #
3462B**

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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 Code of Federal Regulations Title 47: Telecommunication, Part 15—Radio Frequency Devices, Subpart C—Intentional Radiators, Radiated Emission Limits, Additional Provisions, § 15.247 Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz, and in compliance with the applicable criteria specified in Industry Canada Spectrum Management and Telecommunications Radio Standards Specification RSS-210 Issue 7 (June 2007) Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment.

Company	Model #
Broadcom Corp.	BCM94312HMG

This report is reviewed by:

Heiko Strehlow
 (Director Regulatory and
 Antenna Services)

2009-3-17 EMC & Radio

Date	Section	Name	Signature
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This report is prepared by:

Peter Mu
 (EMC Lab Manager)

2009-3-17 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 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:	Heiko Strehlow
Responsible Project Leader:	Peter Mu
Date of test:	2009-3-4

2.2 Identification of the Client

APPLICANT	
Applicant (Company Name)	Broadcom Corp.
Street Address	190 Mathilda Place
City/Zip Code	Sunnyvale, CA 94086
Country	U.S.A.
Contact Person	Dan Lawless
Telephone	408-922-5870
Fax	408-543-3399
e-mail	dlawless@broadcom.com

2.3 Identification of the Manufacturer

Same as applicant

3 Equipment under Test (EUT)

3.1 Specification of the Equipment under Test

EUT	
Marketing Name of EUT (if not same as Model No.):	BCM94312HMG
Model No:	BCM94312HMG
FCC ID:	QDS-BRCM1030
IC ID:	4324A-BRCM1030

Frequency Range:	2412-2472MHz.
Type(s) of Modulation:	OFDM, CCK
Antenna Type:	Main 1.5 / Aux 3.0
Max Output Power:	Sub-band 1, 2400-2483.5MHz 802.11b: Radiated: 20.81dBm (121mW) EIRP Conducted: 17.81dBm (60.4mW) Sub-band 1, 2400-2483.5MHz 802.11g: Radiated: 24.56dBm (286mW) EIRP Conducted: 21.56dBm (143mW)

3.2 Identification of the Equipment under Test (EUT)

EUT #	TYPE	MANF.	MODEL	SERIAL #
1	EUT Test Laptop	Dell	Hepburn6C	MT277

3.3 Identification of Accessory equipment

AE #	TYPE	MANF.	MODEL	SERIAL #
1	Test Fixture	Broadcom	PEX1-MINI	N/A

4 Subject Of Investigation

All testing was performed on the product referred to in Section 3 as EUT. EUT operates in the band 2400-2483.5MHz in legacy 802.11b/g and 802.11n mode, and in 5725-5850 MHz in legacy 802.11a and 802.11n mode.

The objective of the measurements done by Cetecom Inc. was to measure the performance of the EUT as specified by the applicable criteria specified in Code of Federal Regulations Title 47: Telecommunication, Part 15—Radio Frequency Devices, Subpart C—Intentional Radiators, Radiated Emission Limits, Additional Provisions, § 15.247 Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz, and in compliance with the applicable criteria specified in Industry Canada Spectrum Management and Telecommunications Radio Standards Specification RSS-210 Issue 7 (June 2007) Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment. The maximization of portable equipment is conducted in accordance with ANSI C63.4-2003.

This report is as Class II change (Re-assessment) to add channels 12 and 13 to the original approved application

The antenna used in the testing are the highest gain antenna for this part 15 device. Two antennae were evaluated. Main antenna is determined to have worse case emission over auxiliary antenna. All spurious emission testing are conducted with the Main antenna on both 802.11b and 802.11g mode. Findings are reported here.

During testing some emission over the limit at below 1GHz are determined to be from the combination of the supporting laptop and test fixture, not for the EUT itself. After observing these emissions the EUT itself is physically removed from the test fixture and the same test is conducted again immediately. With no other changes to the test fixture the same emissions persist. Therefore it is concluded that the EUT complies.

EIRP is calculated from conducted peak power and antenna gain.

5 Radiated Measurements

5.1 Maximum Peak Output Power § 15.247 (b)(1) (Radiated)

5.1.1 Limits

FCC15.247 (b) (1): 4W (36dBm), with antenna gain < 6dBi.

RSS-210 A8.4 (4): 4W (36dBm)

5.1.2 Results:

EIRP is calculated as $EIRP = \text{Conducted Peak Power} + \text{Antenna Gain}$

EIRP 802.11 b/g Mode:

TEST CONDITIONS $T_{nom}(23)^{\circ}C, V_{nom}VDC$	Channel Frequency	EIRP (dBm)	EIRP (mW)	Verdict
Sub-band 1: 2400-2483.5MHz (802.11b)	2467	19.82	96.2	PASS
	2472	20.81	120.8	PASS
Sub-band 1: 2400-2483.5MHz (802.11g)	2467	23.97	250	PASS
	2472	24.56	286	PASS

The average power levels were set as stated in the operating description document of the module.

5.2 Restricted Band Edge Compliance §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.

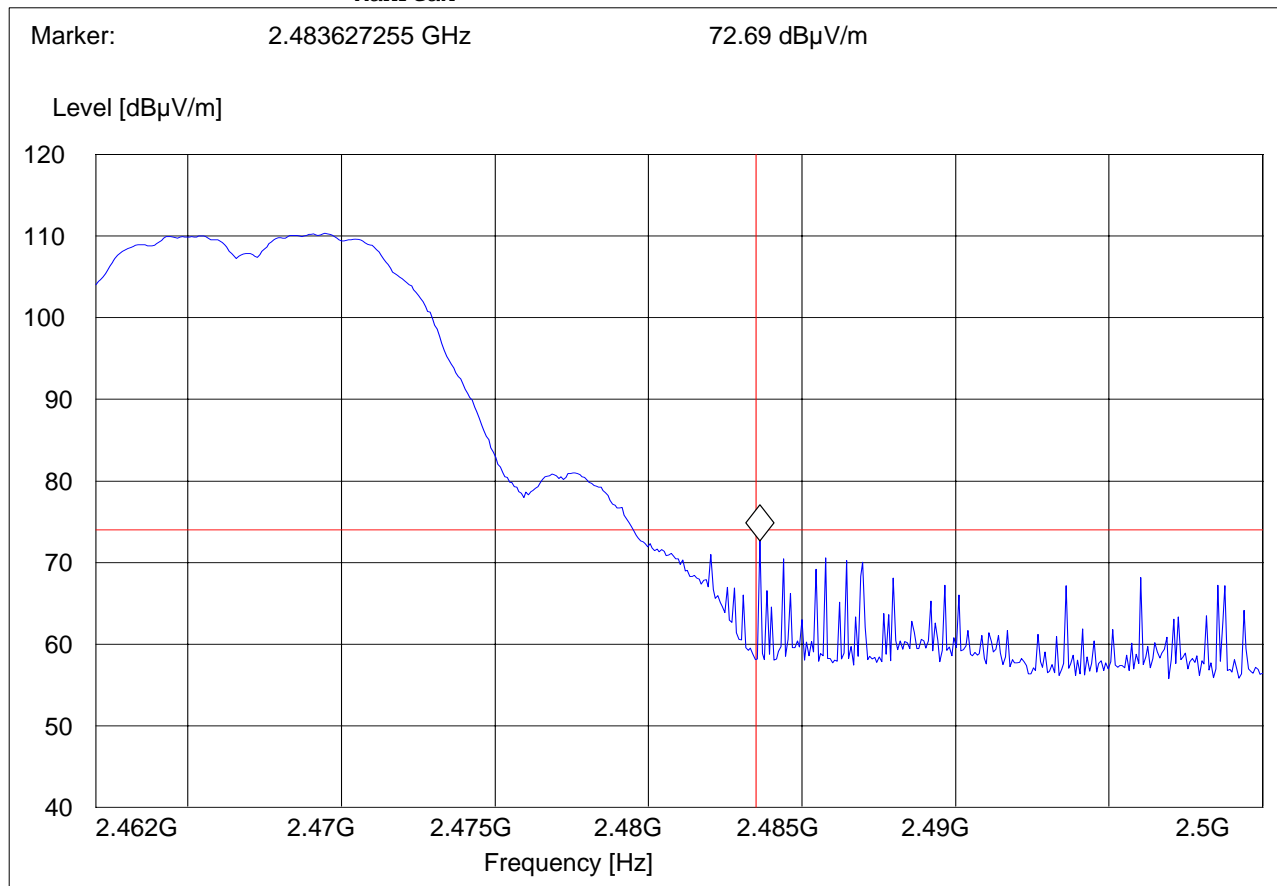
5.2.2 Sub-band 1 2400-2483.5MHz

High band edge PEAK CH12 802.11b Antenna Horizontal

EUT: BCM94312HMG; S/N:37; P#:201
Customer:: Broadcom
Test Mode: 802.11b; Ch.12;
ANT Orientation: H
EUT Orientation: H
Test Engineer: Chris
Voltage: Laptop
Comments: Main

SWEEP TABLE: "FCC15.247 HBE_PK"

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

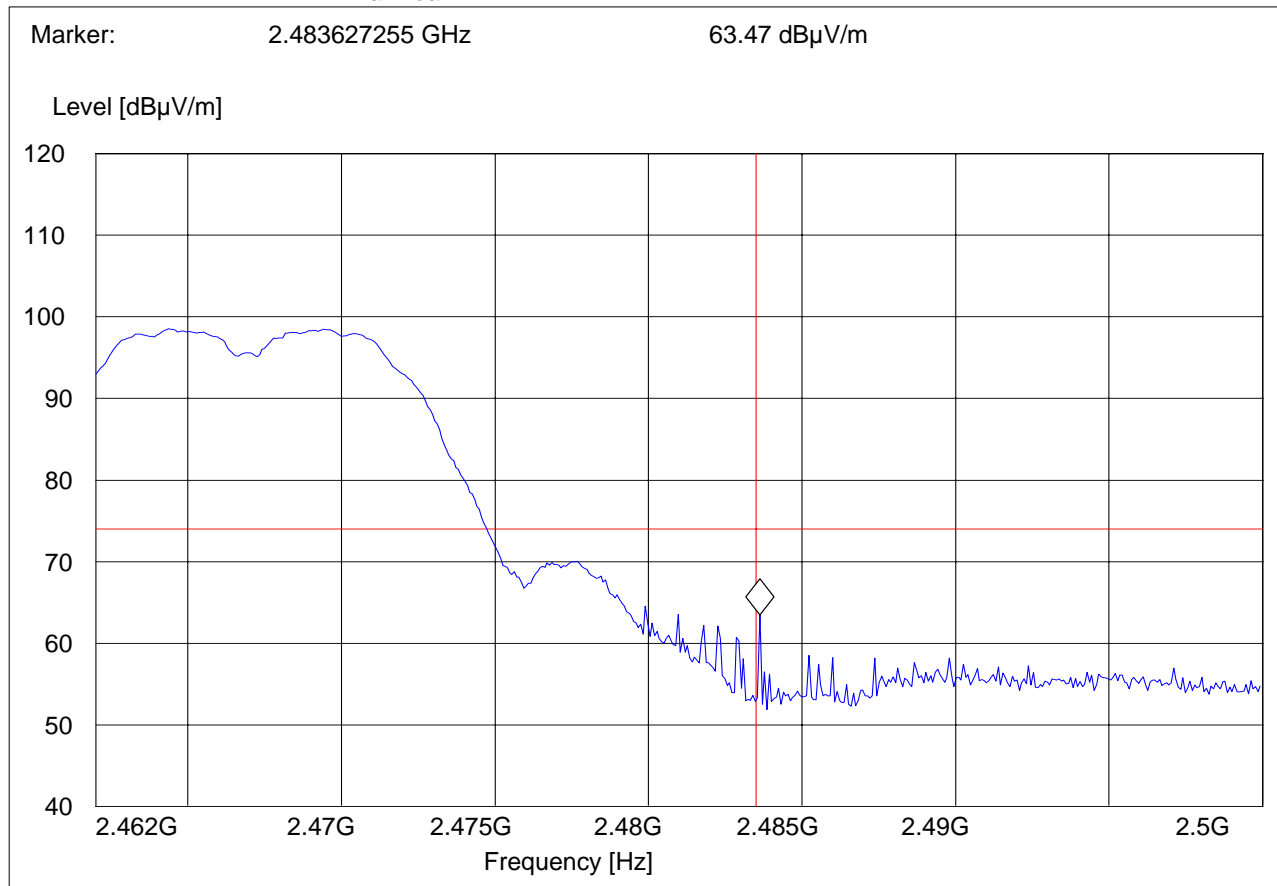


High band edge PEAK CH12 802.11b Antenna Vertical

EUT: BCM94312HMG; S/N:37; P#:201
Customer:: Broadcom
Test Mode: 802.11b; Ch.12;
ANT Orientation: V
EUT Orientation: H
Test Engineer: Chris
Voltage: Laptop
Comments: Main

SWEEP TABLE: "FCC15.247 HBE_PK"

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

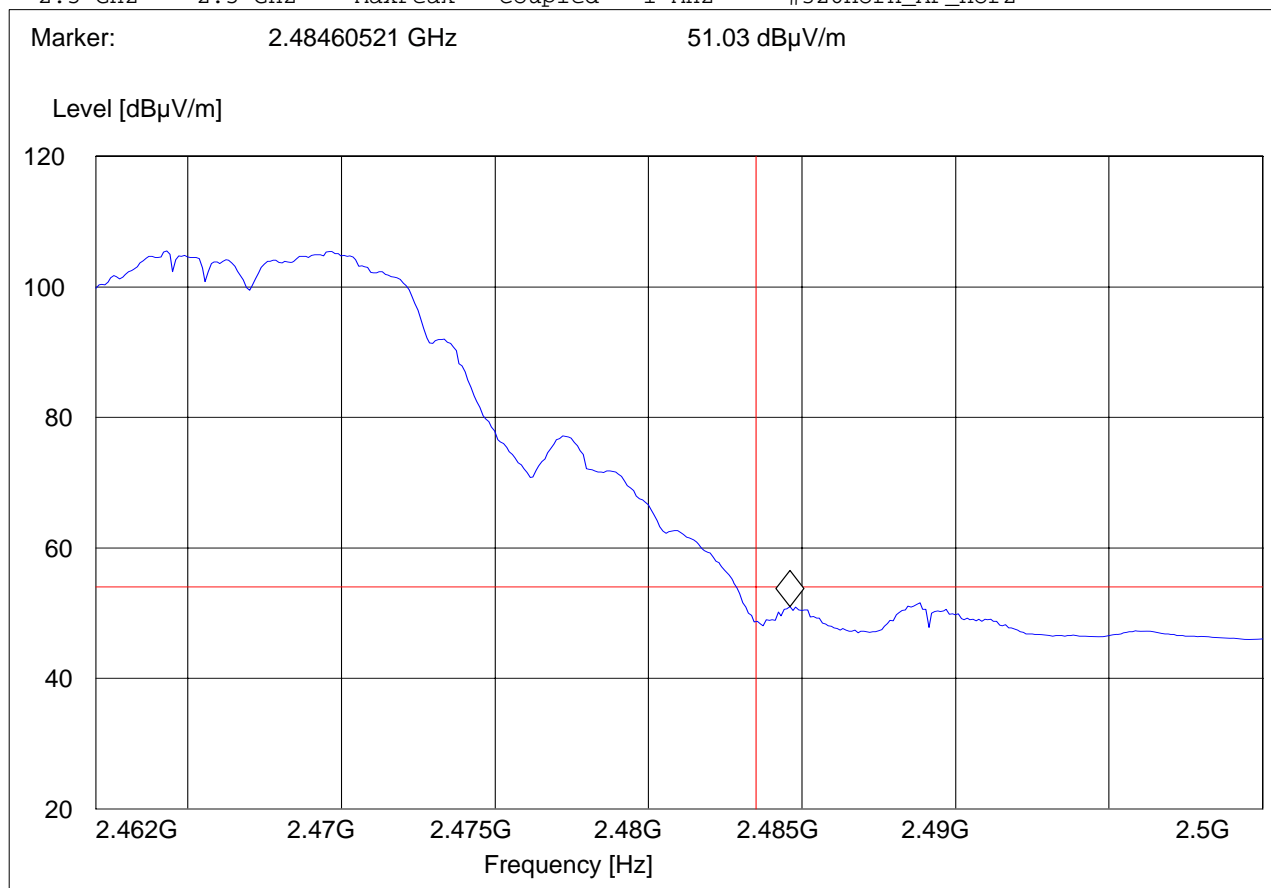


High band edge AVERAGE CH12 802.11b Antenna Horizontal

EUT: BCM94312HMG; S/N:37; P#:201
 Customer:: Broadcom
 Test Mode: 802.11b; Ch.12;
 ANT Orientation: H
 EUT Orientation: H
 Test Engineer: Chris
 Voltage: Laptop
 Comments: Main

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

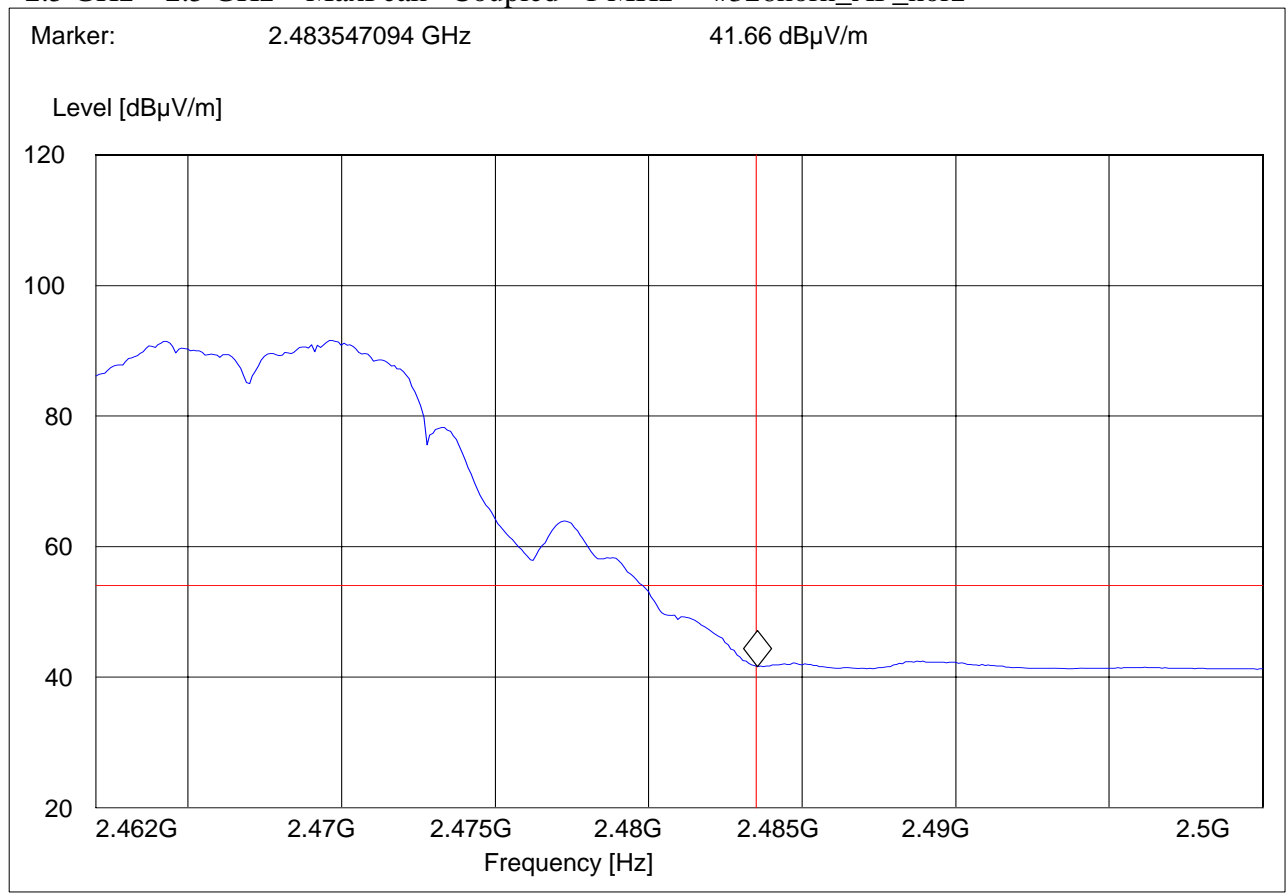


High band edge AVERAGE CH12 802.11b Antenna Vertical

EUT: BCM94312HMG; S/N:37; P#:201
Customer:: Broadcom
Test Mode: 802.11b; Ch.12;
ANT Orientation: V
EUT Orientation: H
Test Engineer: Chris
Voltage: Laptop
Comments: Main

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

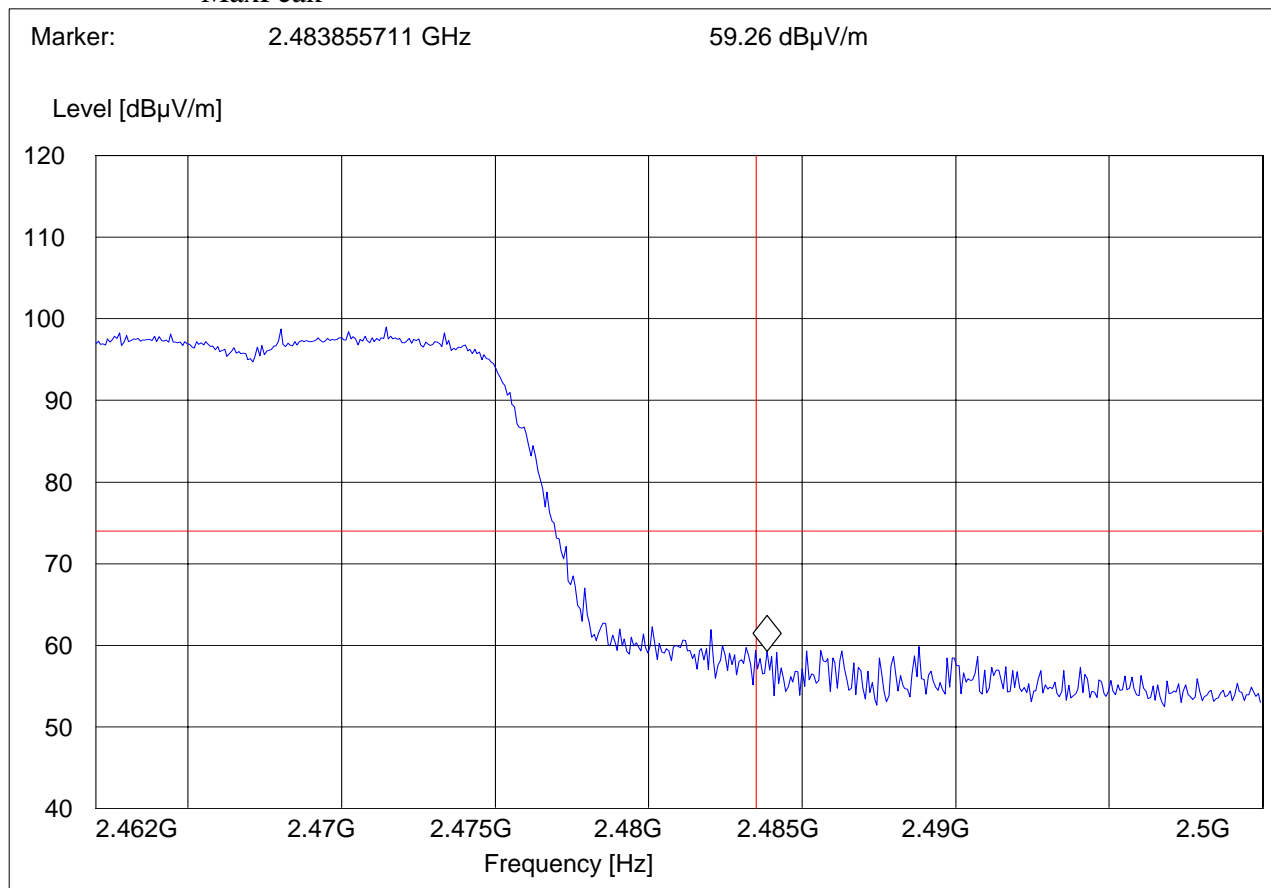


High band edge PEAK CH12 802.11g Antenna Horizontal

EUT: BCM94312HMG; S/N:37; P#:201
Customer:: Broadcom
Test Mode: 802.11g; Ch.12;
ANT Orientation: H
EUT Orientation: H
Test Engineer: Chris
Voltage: Laptop
Comments: Main

SWEEP TABLE: "FCC15.247 HBE_PK"

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

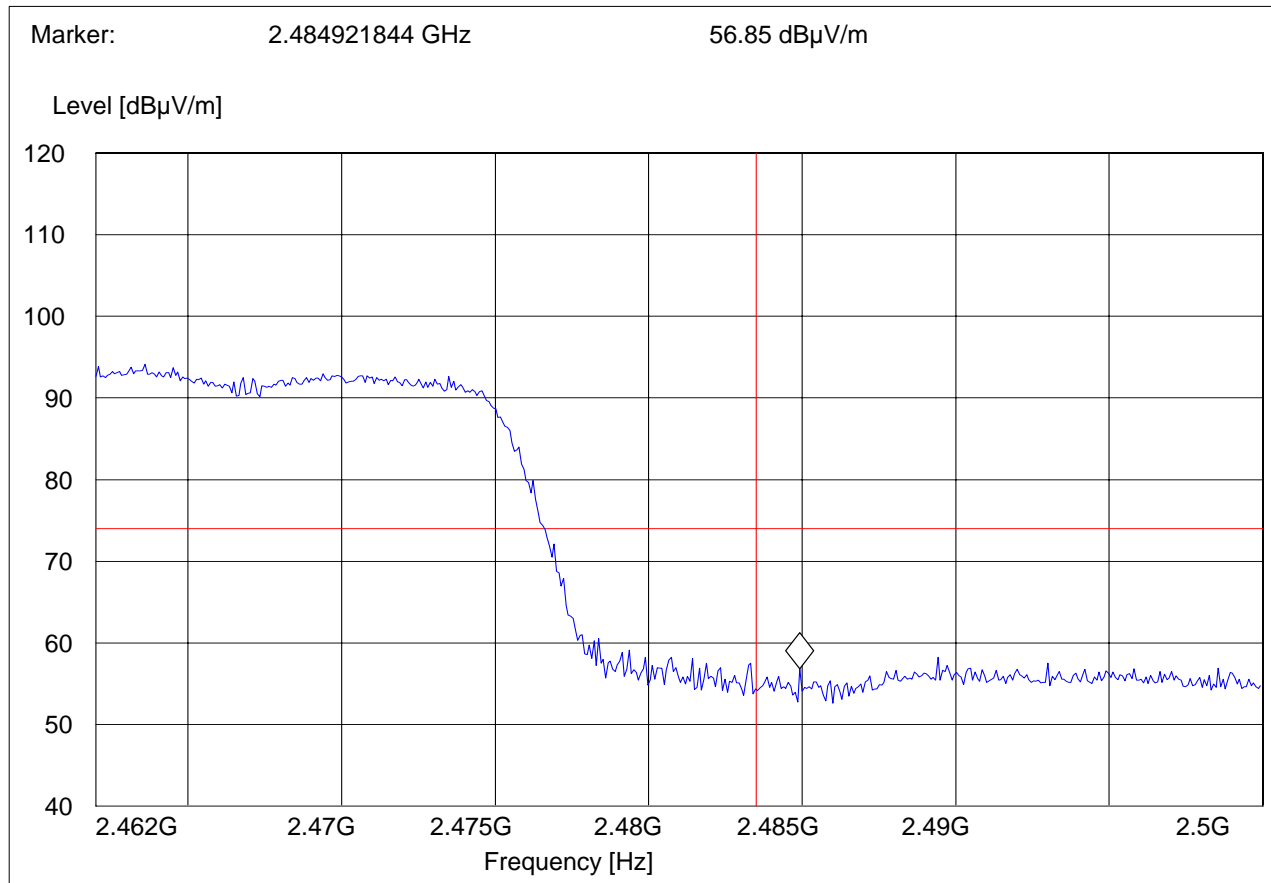


High band edge PEAK CH12 802.11g Antenna Vertical

EUT: BCM94312HMG; S/N:37; P#:201
Customer:: Broadcom
Test Mode: 802.11g; Ch.12;
ANT Orientation: V
EUT Orientation: H
Test Engineer: Chris
Voltage: Laptop
Comments: Main

SWEEP TABLE: "FCC15.247 HBE_PK"

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

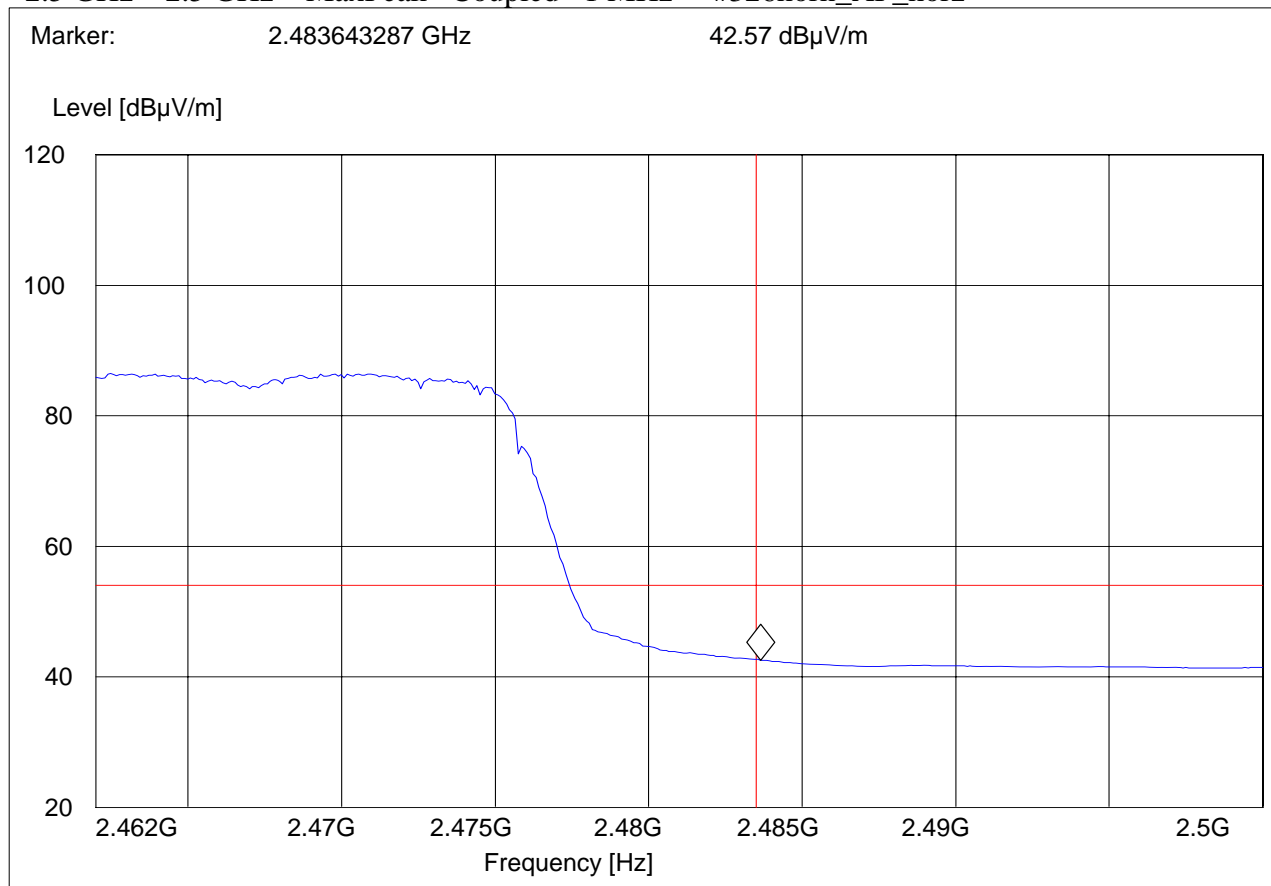


High band edge AVERAGE CH12 802.11g Antenna Horizontal

EUT: BCM94312HMG; S/N:37; P#:201
Customer:: Broadcom
Test Mode: 802.11g; Ch.12;
ANT Orientation: H
EUT Orientation: H
Test Engineer: Chris
Voltage: Laptop
Comments: Main

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

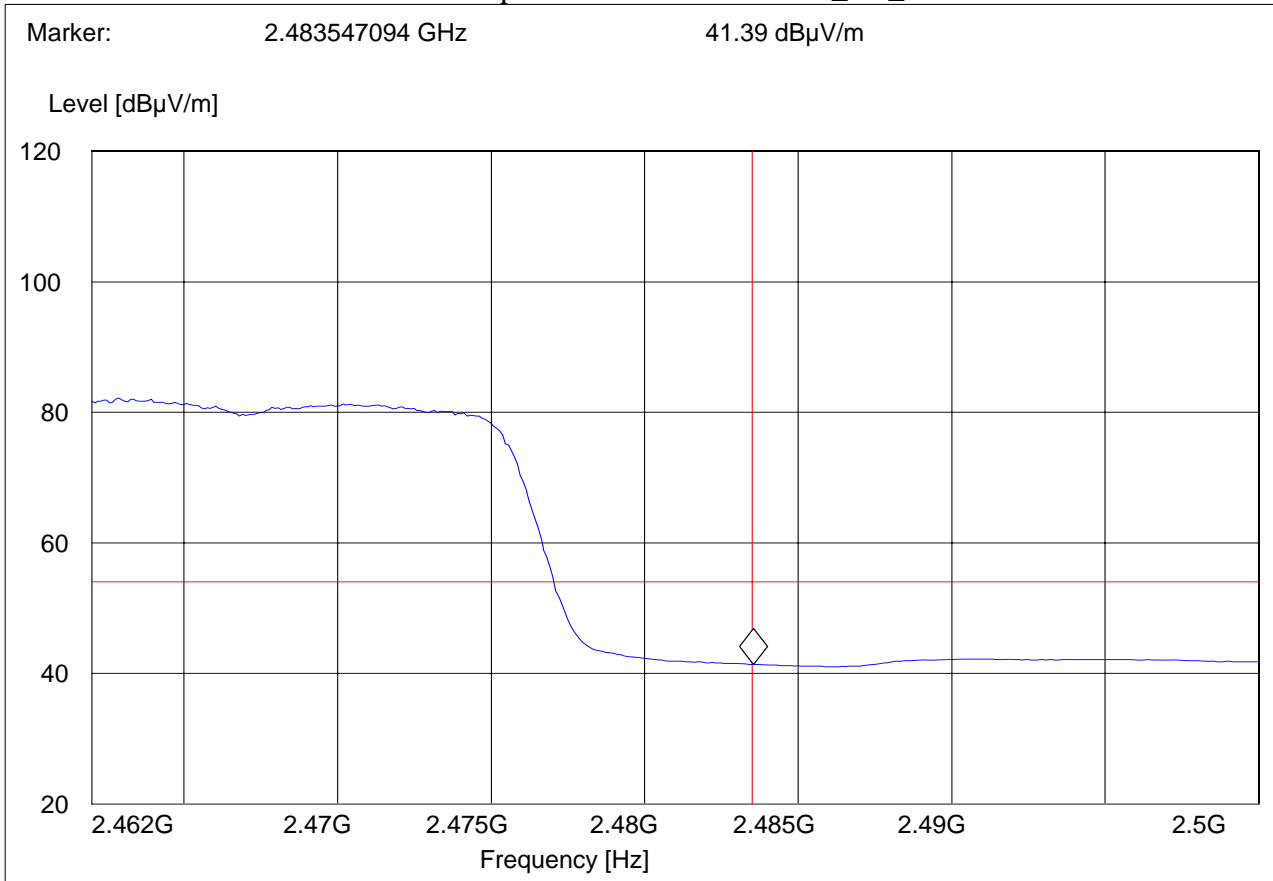


High band edge AVERAGE CH12 802.11g Antenna Vertical

EUT: BCM94312HMG; S/N:37; P#:201
Customer:: Broadcom
Test Mode: 802.11g; Ch.12;
ANT Orientation: V
EUT Orientation: H
Test Engineer: Chris
Voltage: Laptop
Comments: Main

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

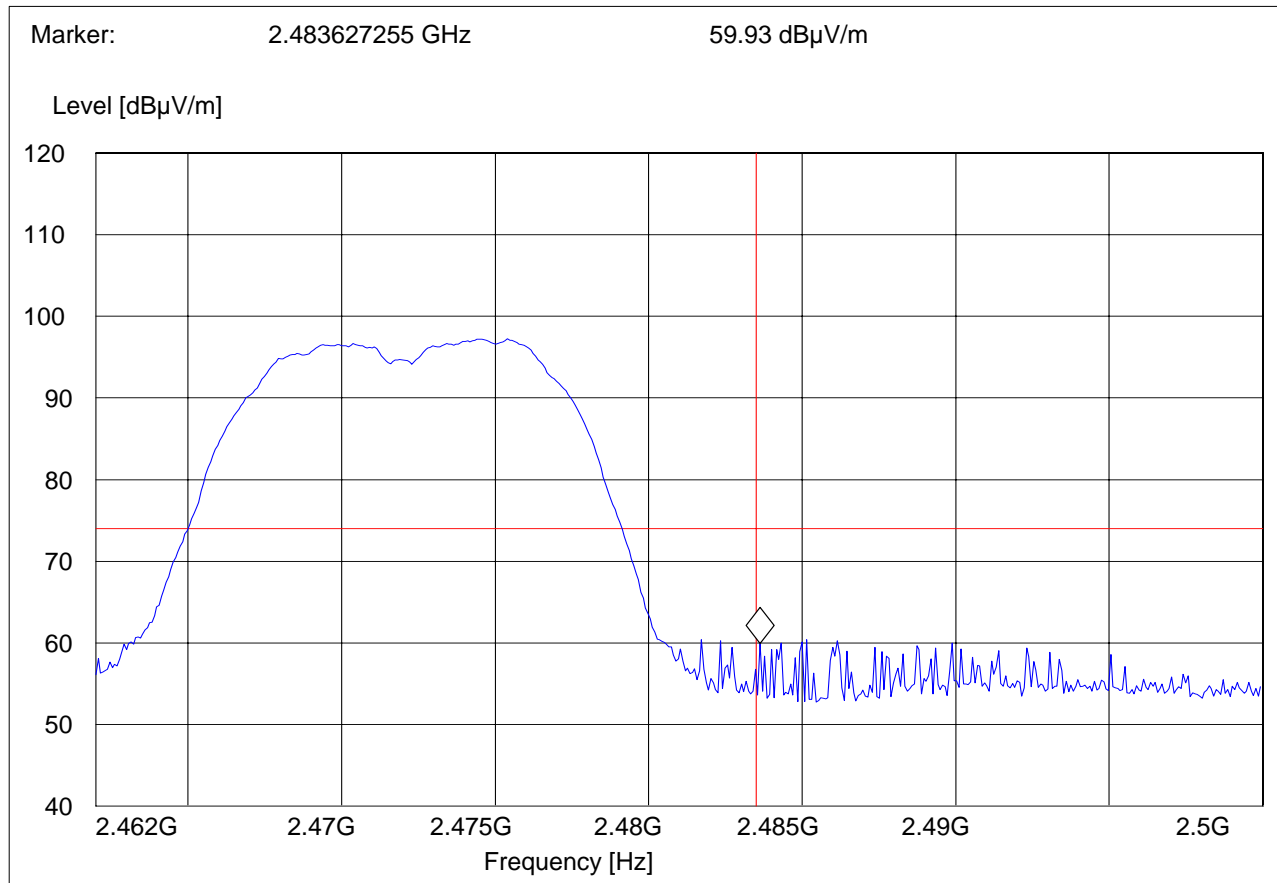


High band edge PEAK CH13 802.11b Antenna Horizontal

EUT: BCM94312HMG; S/N:37; P#:201
Customer:: Broadcom
Test Mode: 802.11b; Ch.13;
ANT Orientation: H
EUT Orientation: H
Test Engineer: Chris
Voltage: Laptop
Comments: Main

SWEEP TABLE: "FCC15.247 HBE_PK"

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

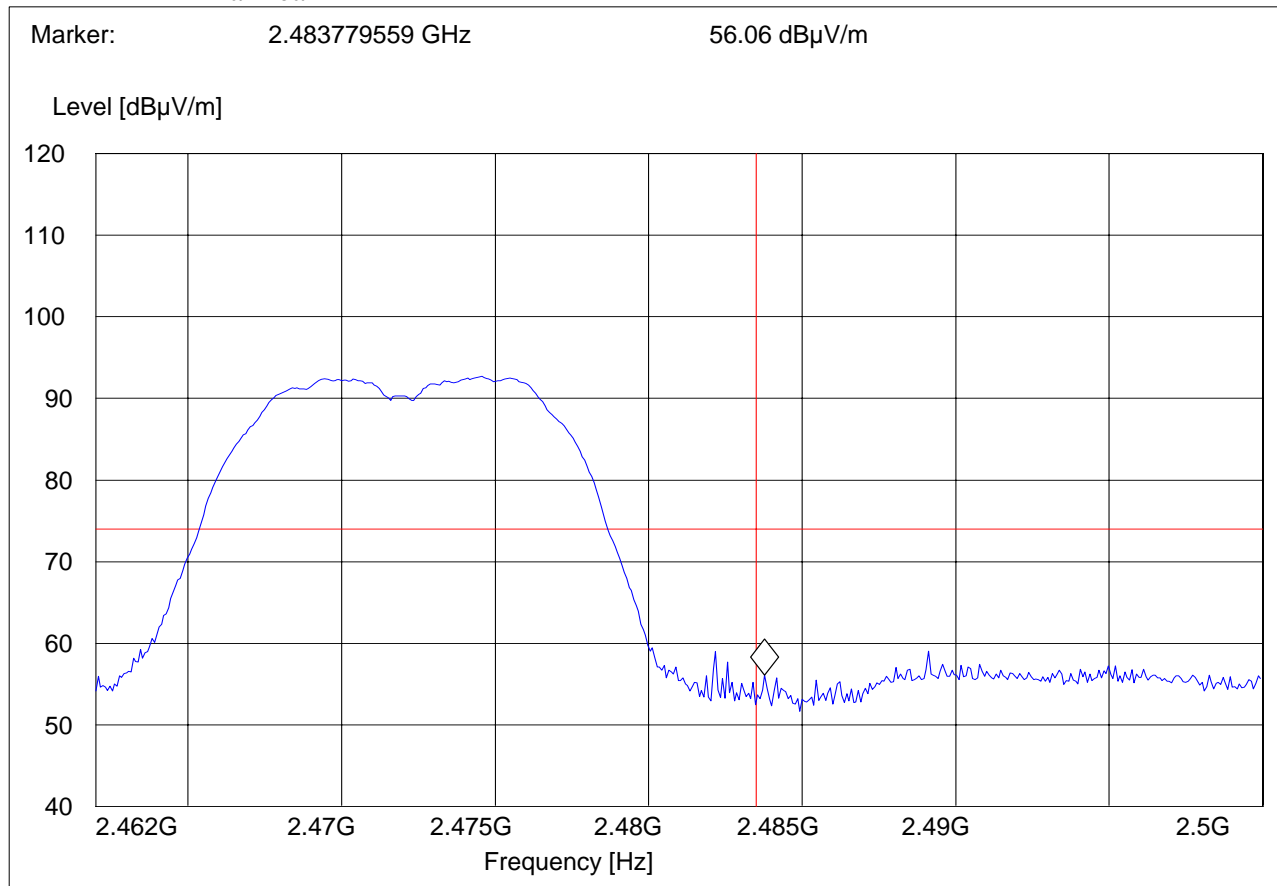


High band edge PEAK CH13 802.11b Antenna Vertical

EUT: BCM94312HMG; S/N:37; P#:201
Customer:: Broadcom
Test Mode: 802.11b; Ch.13;
ANT Orientation: V
EUT Orientation: H
Test Engineer: Chris
Voltage: Laptop
Comments: Main

SWEEP TABLE: "FCC15.247 HBE_PK"

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

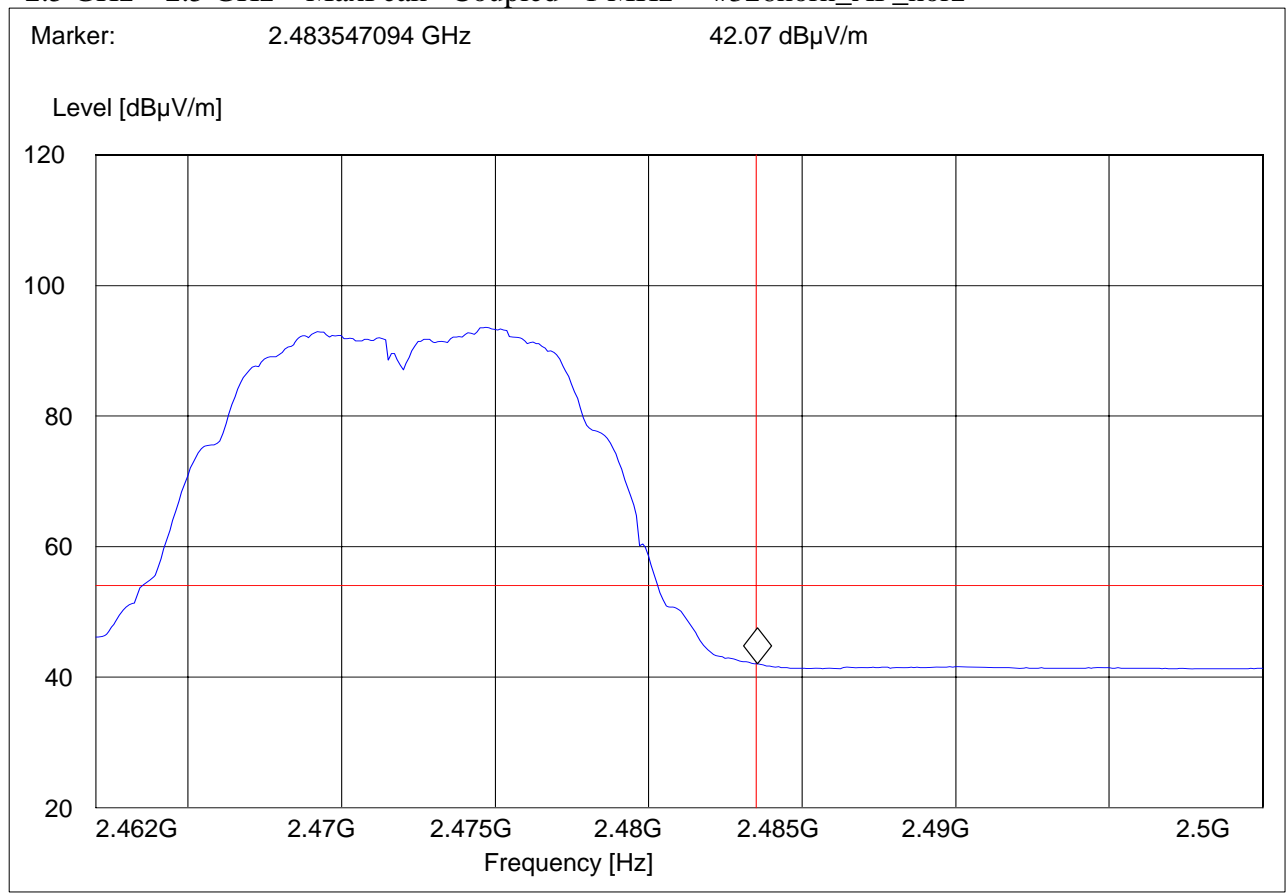


High band edge AVERAGE CH13 802.11b Antenna Horizontal

EUT: BCM94312HMG; S/N:37; P#:201
Customer:: Broadcom
Test Mode: 802.11b; Ch.13;
ANT Orientation: H
EUT Orientation: H
Test Engineer: Chris
Voltage: Laptop
Comments: Main

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

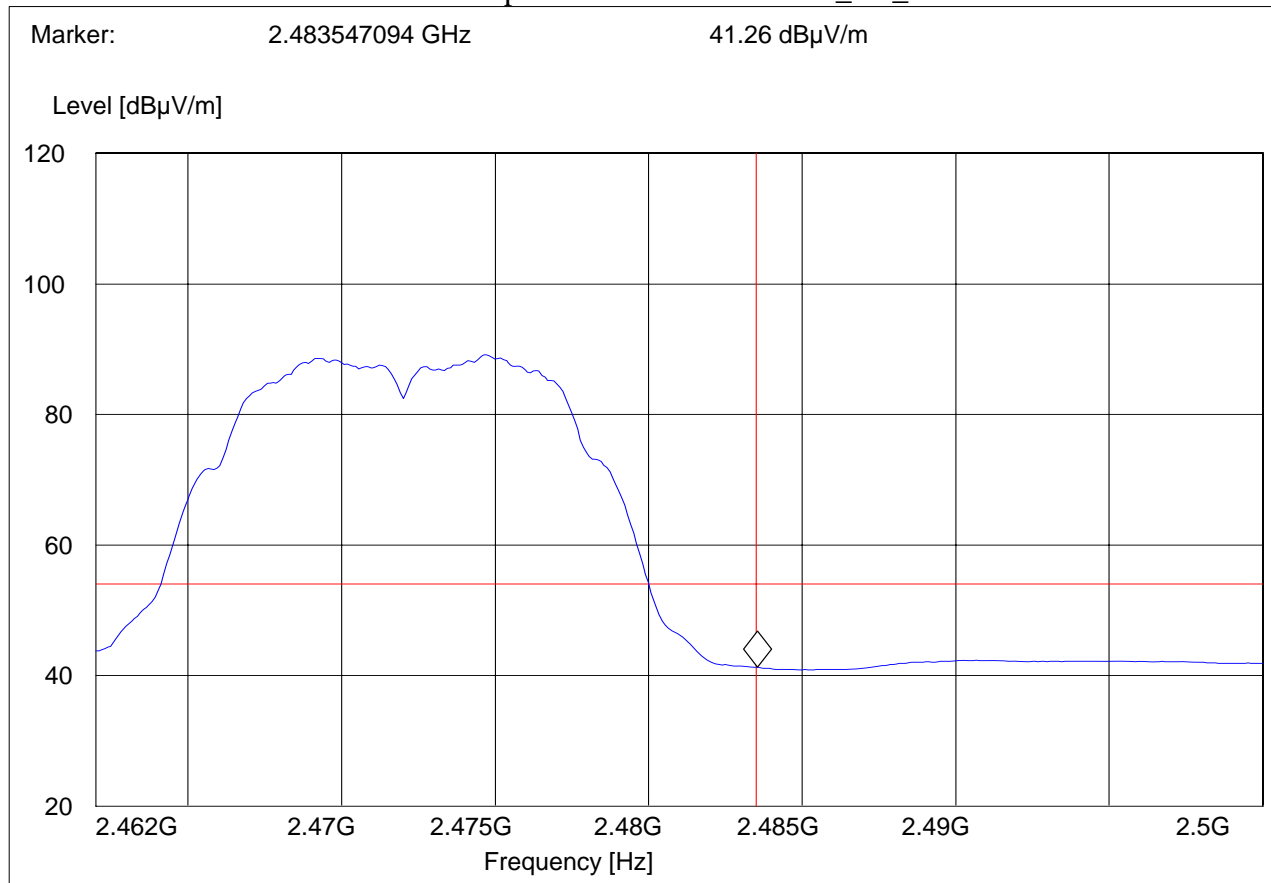


High band edge AVERAGE CH13 802.11b Antenna Vertical

EUT: BCM94312HMG; S/N:37; P#:201
Customer:: Broadcom
Test Mode: 802.11b; Ch.13;
ANT Orientation: V
EUT Orientation: H
Test Engineer: Chris
Voltage: Laptop
Comments: Main

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

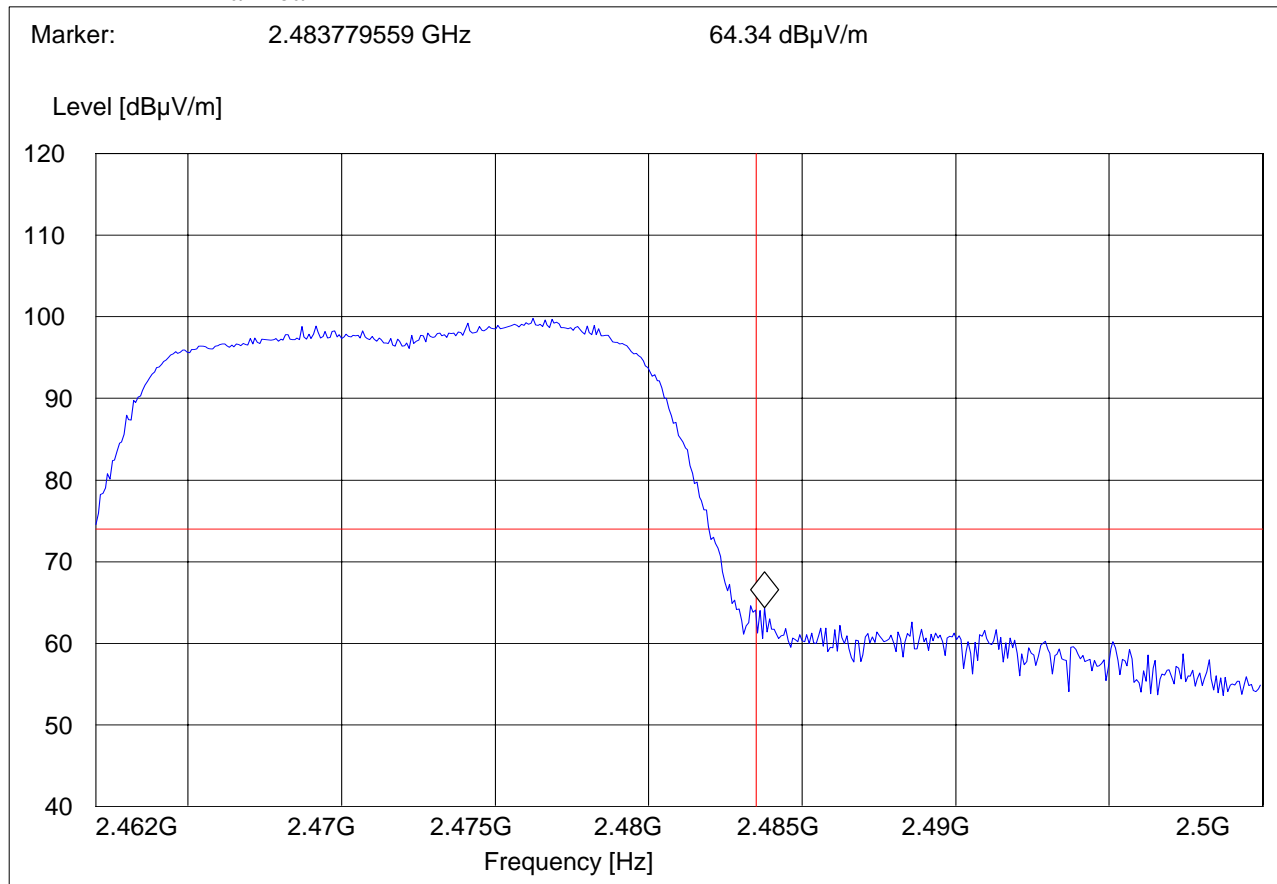


High band edge PEAK CH13 802.11g Antenna Horizontal

EUT: BCM94312HMG; S/N:37; P#:201
Customer:: Broadcom
Test Mode: 802.11g; Ch.13;
ANT Orientation: H
EUT Orientation: H
Test Engineer: Chris
Voltage: Laptop
Comments: Main

SWEEP TABLE: "FCC15.247 HBE_PK"

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

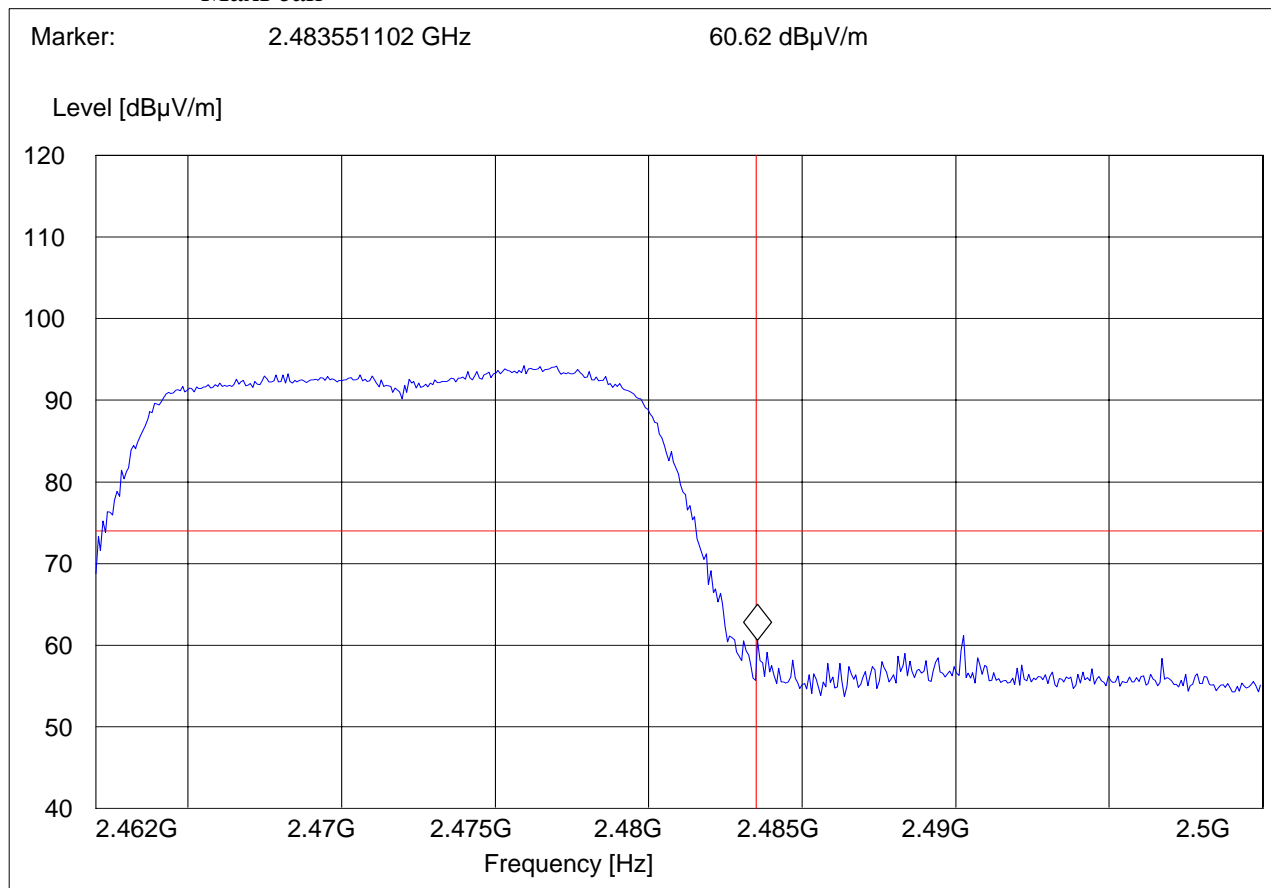


High band edge PEAK CH13 802.11g Antenna Vertical

EUT: BCM94312HMG; S/N:37; P#:201
Customer:: Broadcom
Test Mode: 802.11g; Ch.13;
ANT Orientation: V
EUT Orientation: H
Test Engineer: Chris
Voltage: Laptop
Comments: Main

SWEEP TABLE: "FCC15.247 HBE_PK"

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

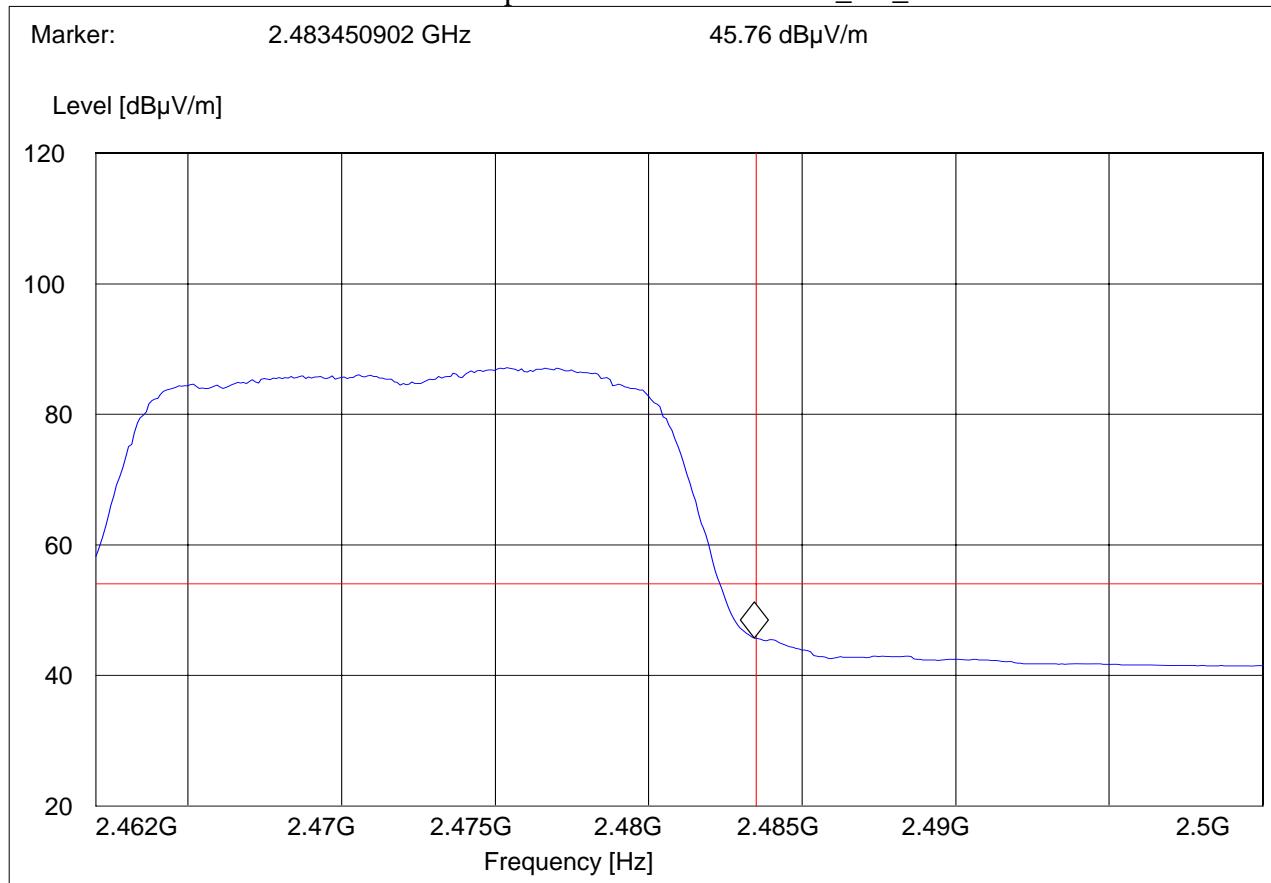


High band edge AVERAGE CH13 802.11g Antenna Horizontal

EUT: BCM94312HMG; S/N:37; P#:201
Customer:: Broadcom
Test Mode: 802.11g; Ch.13;
ANT Orientation: H
EUT Orientation: H
Test Engineer: Chris
Voltage: Laptop
Comments: Main

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



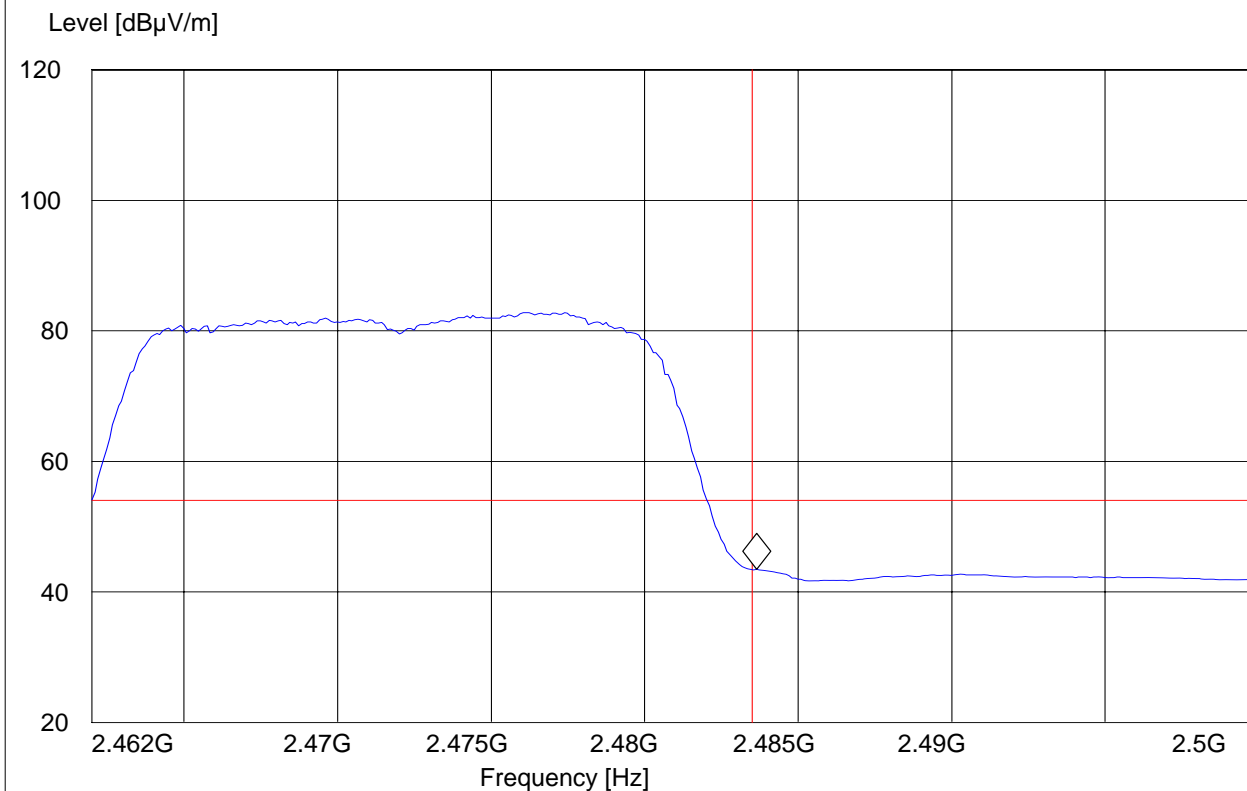
High band edge AVERAGE CH13 802.11g Antenna Vertical

EUT: BCM94312HMG; S/N:37; P#:201
Customer:: Broadcom
Test Mode: 802.11g; Ch.13
ANT Orientation: V
EUT Orientation: H
Test Engineer: Chris
Voltage: Laptop
Comments: Main

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: 2.483643287 GHz 43.43 dBμV/m



5.3 Transmitter Spurious Emission § 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
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 Sub-band 1 2400-2483.5MHz

30MHz – 1GHz, Antenna: Vertical

Note: This plot is valid for channels 12 and 13 (worst-case plot).

Note: Worse case emission for all operating modes 802.11b/g.

EUT: BCM94312HMG; S/N:37; P#:201

Customer:: Broadcom

Test Mode: 802.11g; Ch.12;

ANT Orientation: H

EUT Orientation: H

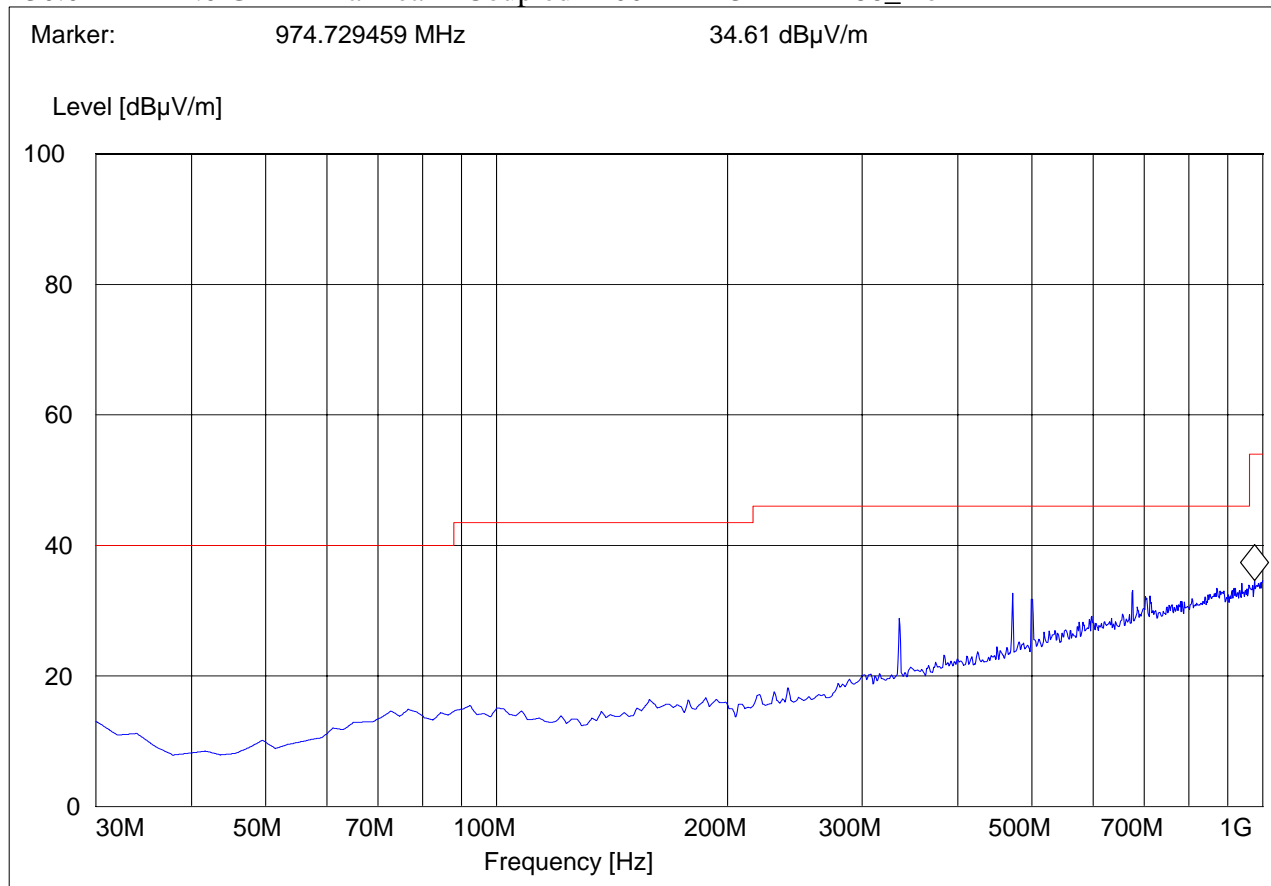
Test Engineer: Chris

Voltage: Laptop

Comments: Main

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_Horz



30MHz – 1GHz, Antenna: Horizontal

Note: This plot is valid for channels 12 and 13 (worst-case plot).

Note: Worse case emission for all operating modes 802.11b/g.

EUT: BCM94312HMG; S/N:37; P#:201

Customer:: Broadcom

Test Mode: 802.11g; Ch.12;

ANT Orientation: H

EUT Orientation: H

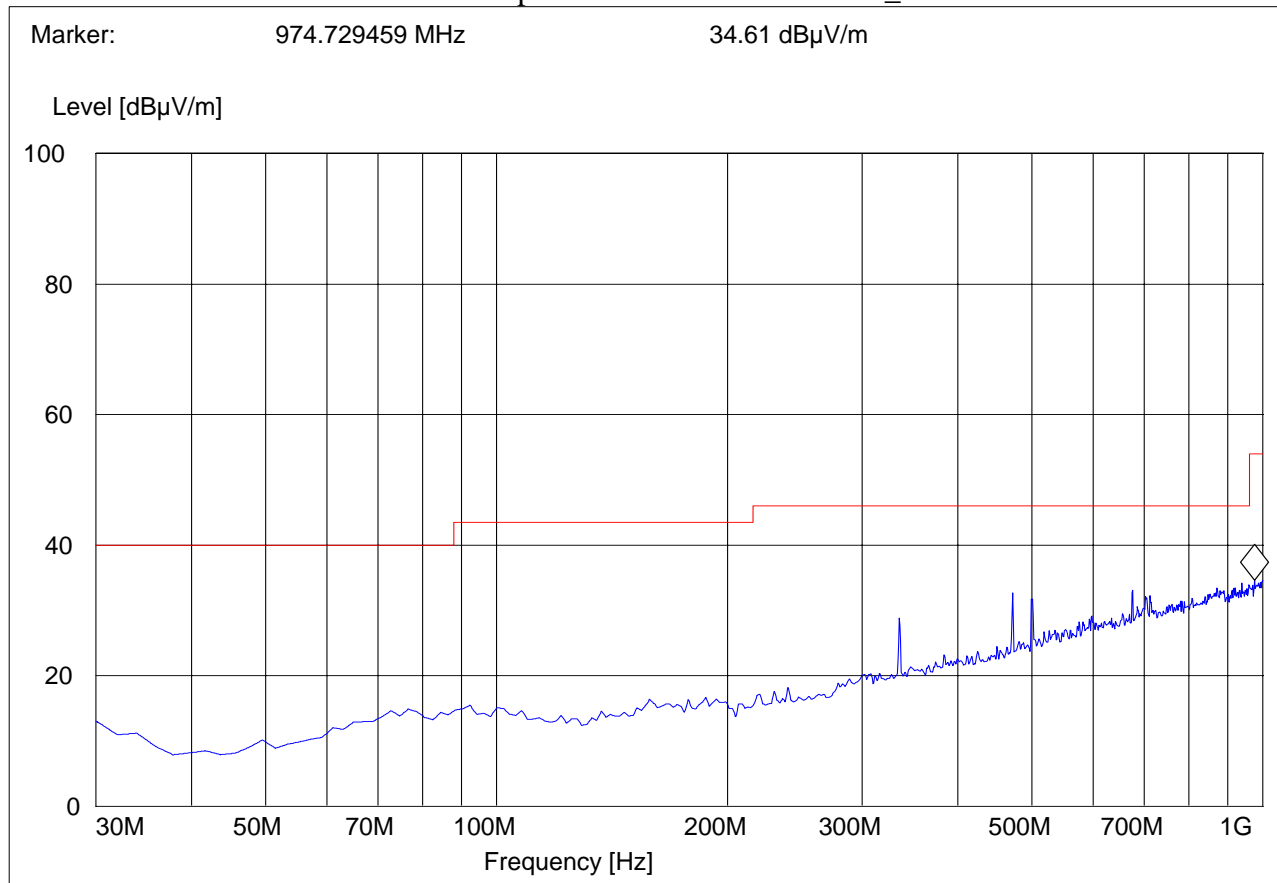
Test Engineer: Chris

Voltage: Laptop

Comments: Main

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_Horz



1-3GHz (2467MHz Ch 12) Antenna Horizontal

Note: Marked peak is the carrier freq.

Note: Peak Reading vs. Average limit

Note: Worse case emission for all operating modes 802.11b/g.

EUT: BCM94312HMG; S/N:37; P#:201

Customer:: Broadcom

Test Mode: 802.11g; Ch.12;

ANT Orientation: H

EUT Orientation: H

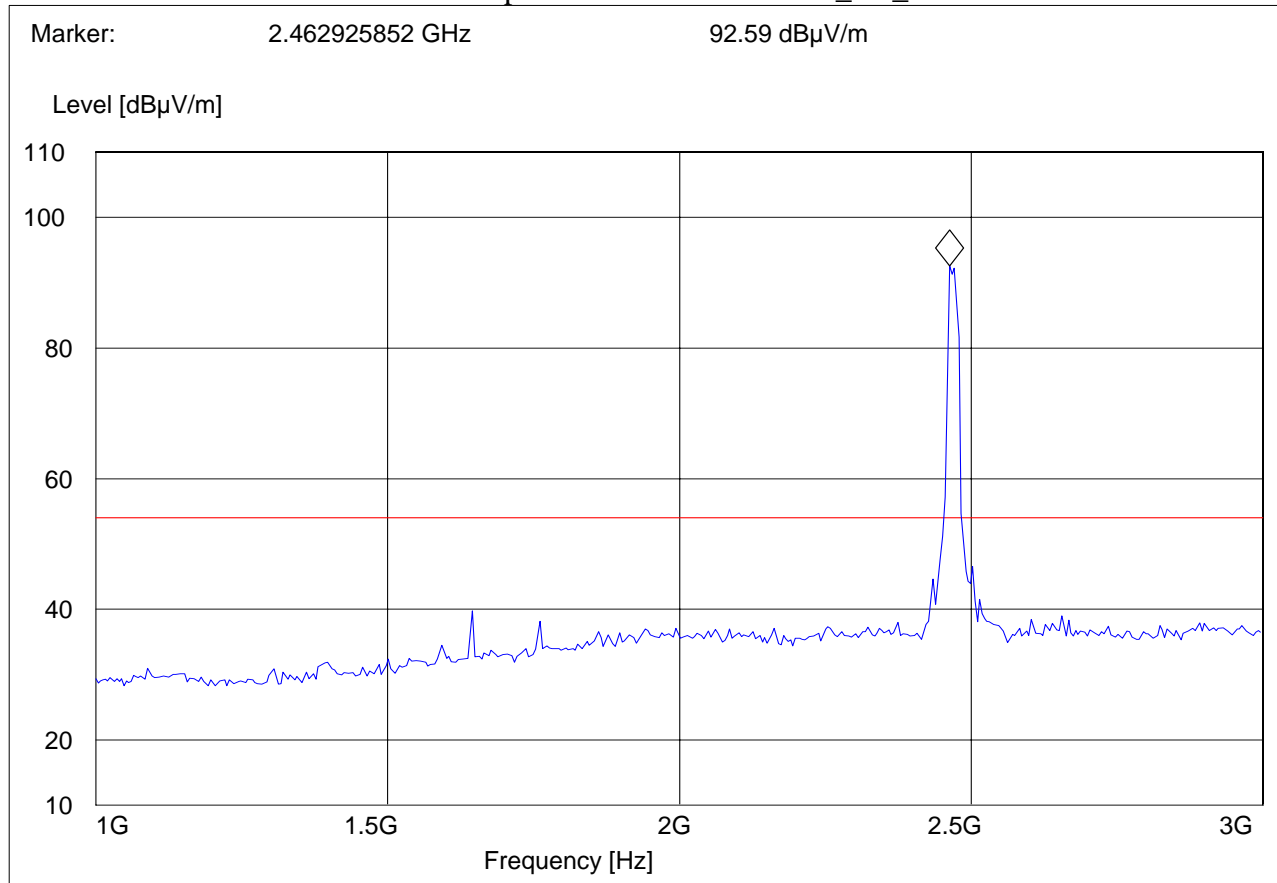
Test Engineer: Chris

Voltage: Laptop

Comments: Main

SWEEP TABLE: "FCC15.247_1-3G"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
1.0 GHz	3.0 GHz	MaxPeak	Coupled	1 MHz	#326horn_AF_vert



1-3GHz (2467MHz, Ch 12) Antenna Vertical

Note: Marked peak is the carrier freq.

Note: Peak Reading vs. Average limit

Note: Worse case emission for all operating modes 802.11b/g.

EUT: BCM94312HMG; S/N:37; P#:201

Customer:: Broadcom

Test Mode: 802.11g; Ch.12;

ANT Orientation: V

EUT Orientation: H

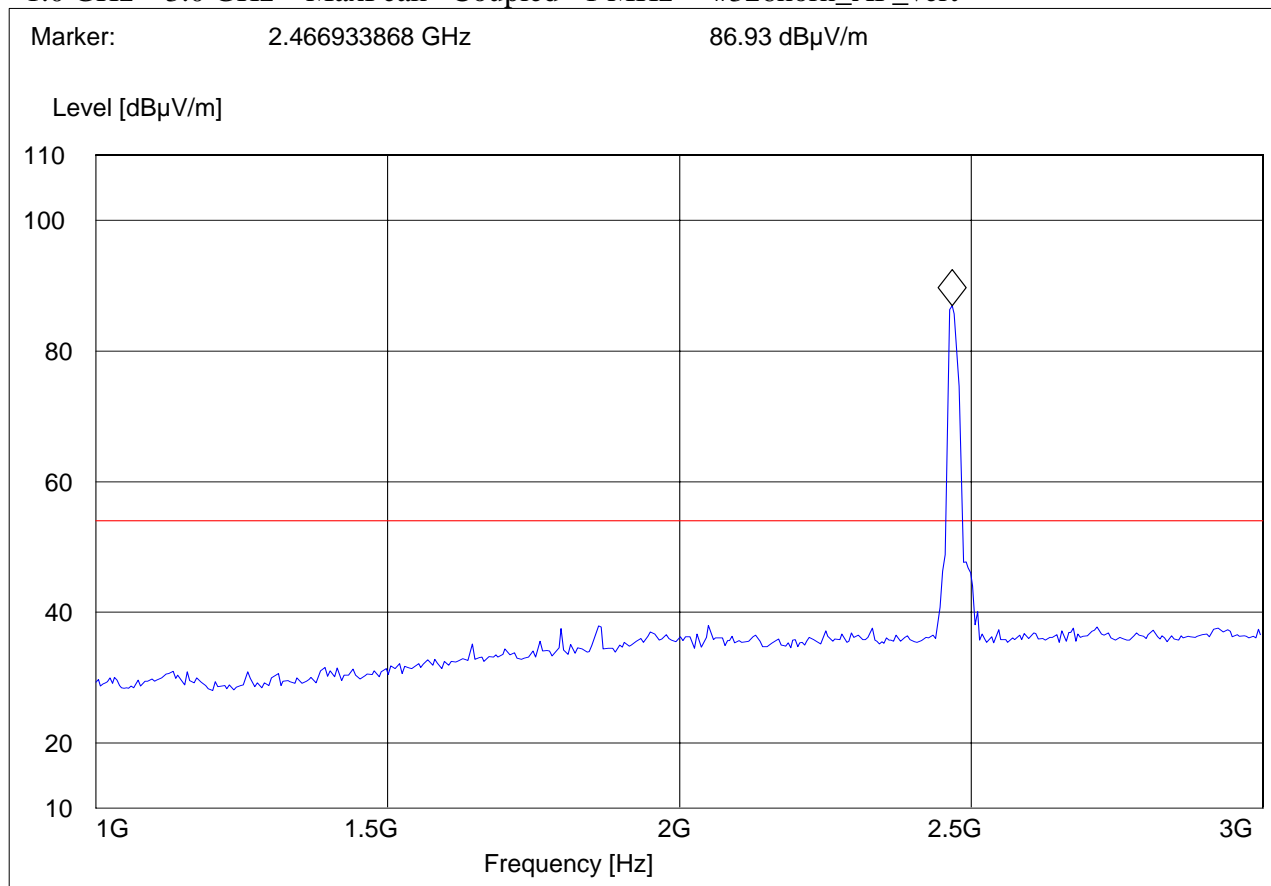
Test Engineer: Chris

Voltage: Laptop

Comments: Main

SWEEP TABLE: "FCC15.247_1-3G"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
1.0 GHz	3.0 GHz	MaxPeak	Coupled	1 MHz	#326horn_AF_vert



1-3GHz (2472MHz Ch13) Antenna Horizontal

Note: Marked peak is the carrier freq.

Note: Peak Reading vs. Average limit

Note: Worse case emission for all operating modes 802.11b/g.

EUT: BCM94312HMG; S/N:37; P#:201

Customer:: Broadcom

Test Mode: 802.11g; Ch.13;

ANT Orientation: H

EUT Orientation: H

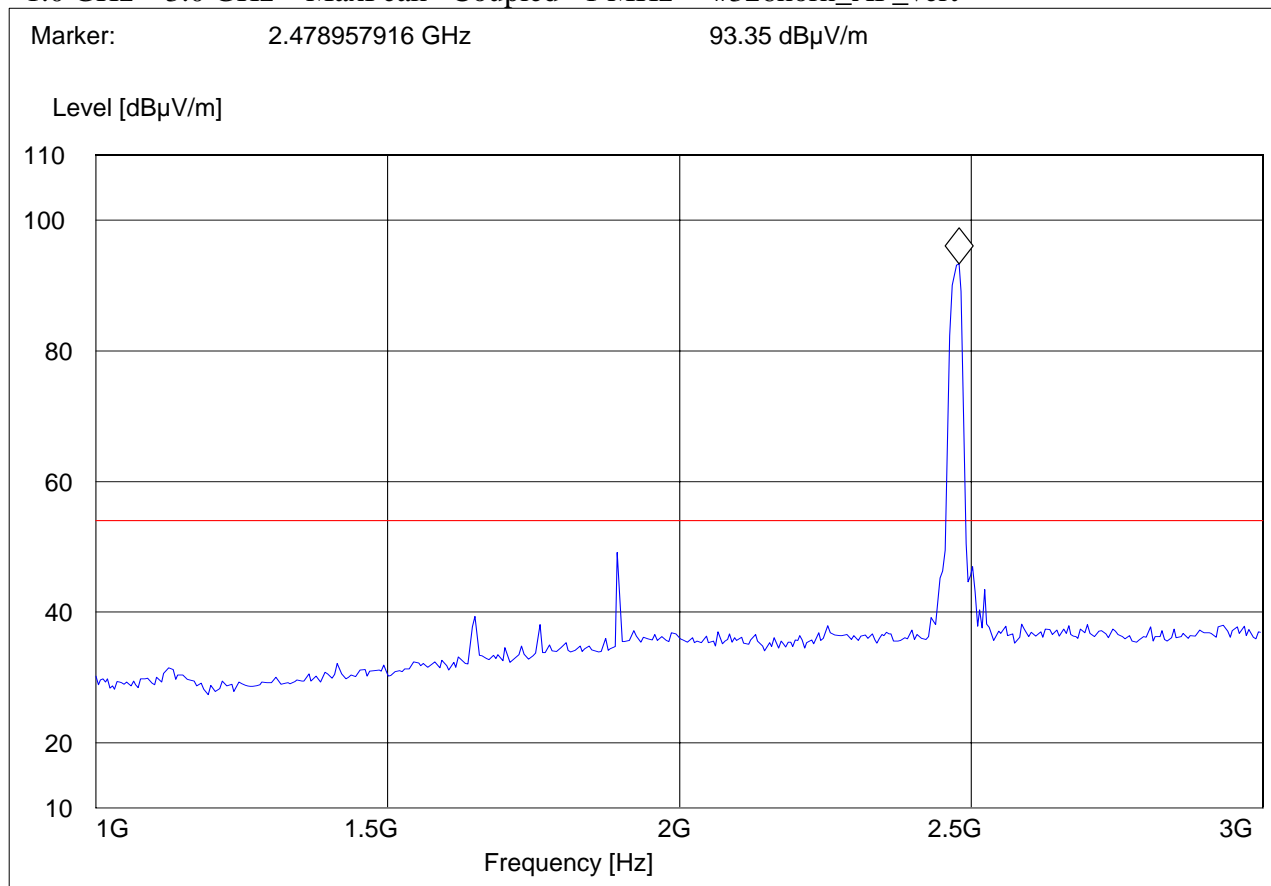
Test Engineer: Chris

Voltage: Laptop

Comments: Main

SWEEP TABLE: "FCC15.247_1-3G"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
1.0 GHz	3.0 GHz	MaxPeak	Coupled	1 MHz	#326horn_AF_vert



1-3GHz (2472MHz Ch13) Antenna Vertical

Note: Marked peak is the carrier freq.

Note: Peak Reading vs. Average limit

Note: Worse case emission for all operating modes 802.11b/g.

EUT: BCM94312HMG; S/N:37; P#:201

Customer:: Broadcom

Test Mode: 802.11g; Ch.13;

ANT Orientation: V

EUT Orientation: H

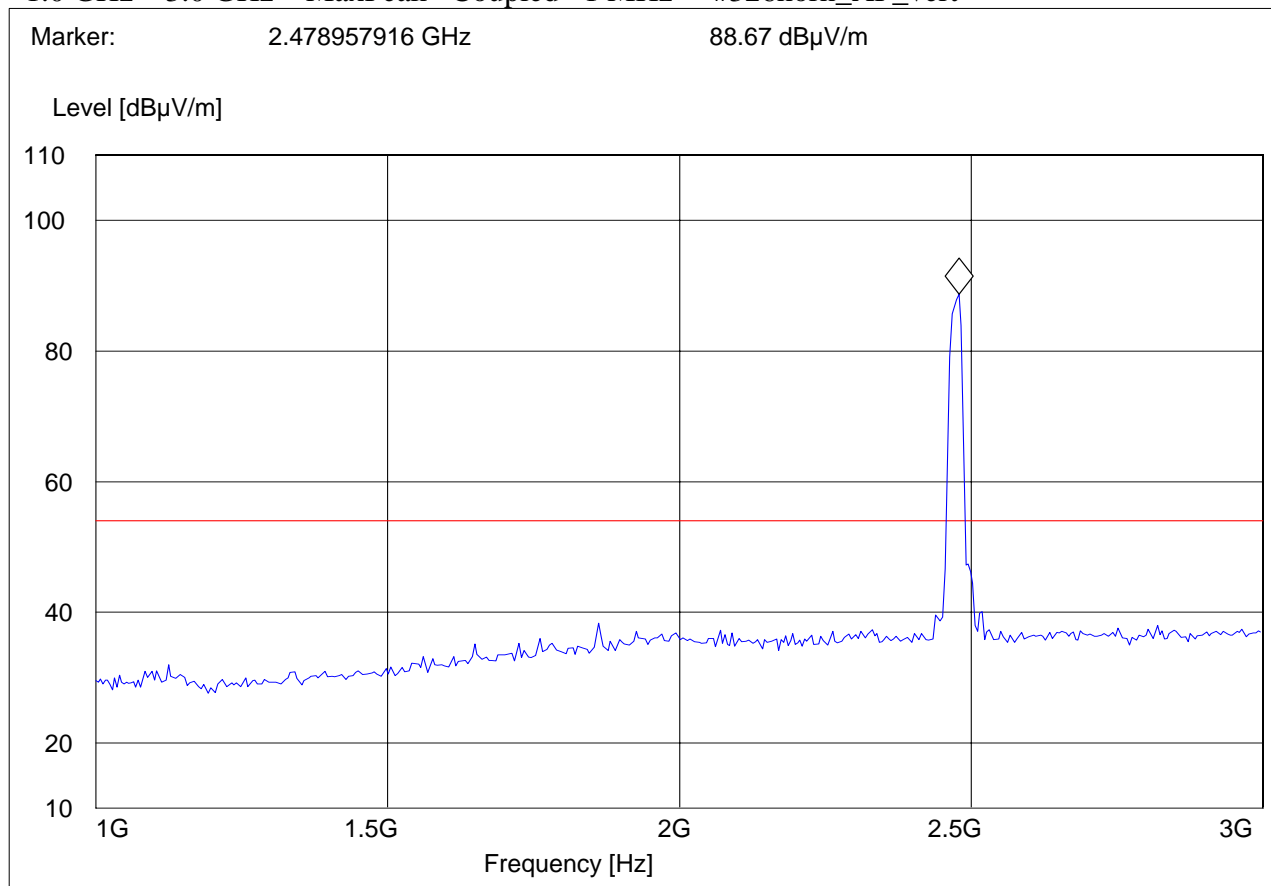
Test Engineer: Chris

Voltage: Laptop

Comments: Main

SWEEP TABLE: "FCC15.247_1-3G"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
1.0 GHz	3.0 GHz	MaxPeak	Coupled	1 MHz	#326horn_AF_vert



3-18GHz (2472MHz Ch12) Antenna Horizontal

Note: Peak Reading vs. Average limit

Note: Worse case emission for all operating modes 802.11b/g.

EUT: BCM94312HMG; S/N:37; P#:201

Customer:: Broadcom

Test Mode: 802.11g; Ch.12;

ANT Orientation: H

EUT Orientation: H

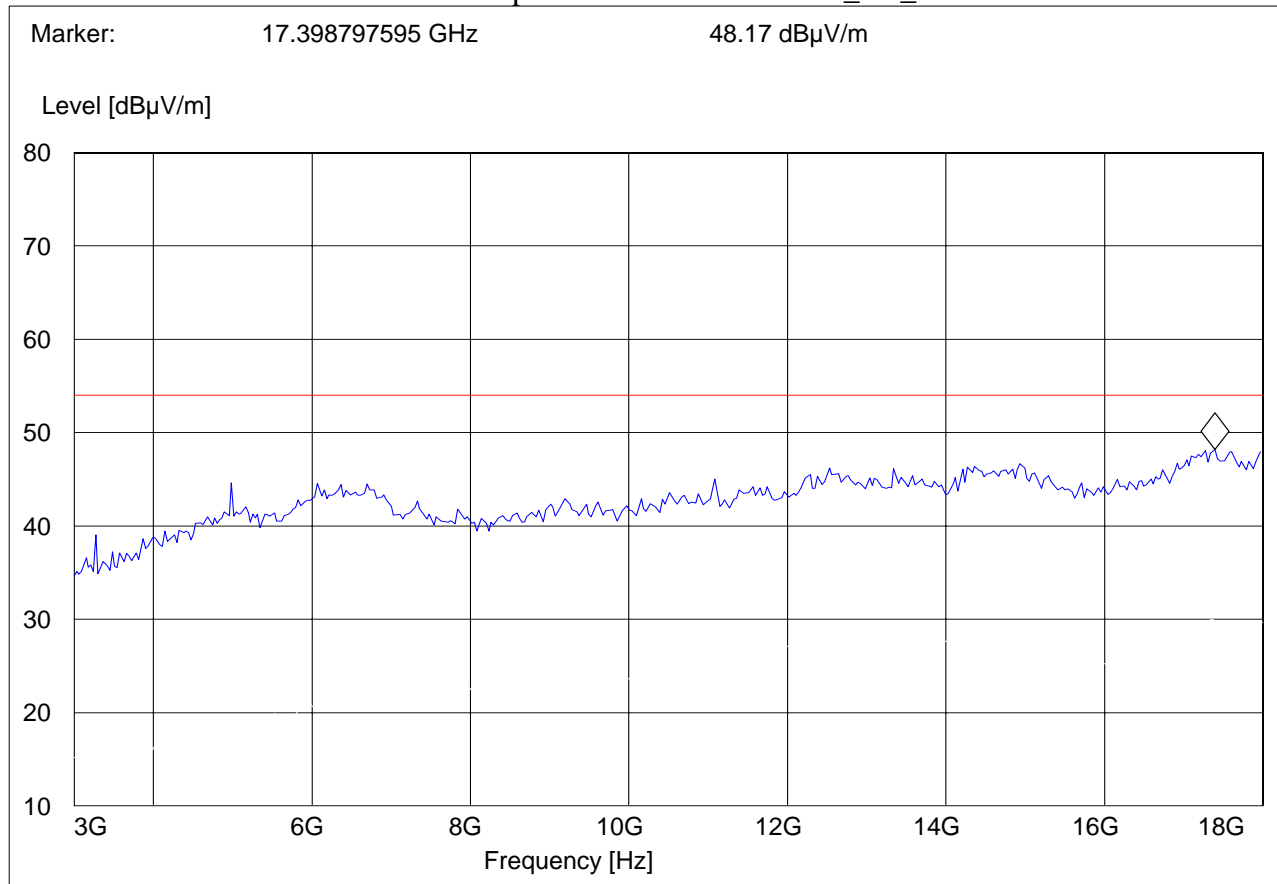
Test Engineer: Chris

Voltage: Laptop

Comments: Main

SWEEP TABLE: "FCC15.247_3-18G"

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



3-18GHz (2472MHz Ch12) Antenna Vertical

Note: Peak Reading vs. Average limit

Note: Worse case emission for all operating modes 802.11b/g.

EUT: BCM94312HMG; S/N:37; P#:201

Customer:: Broadcom

Test Mode: 802.11g; Ch.12;

ANT Orientation: V

EUT Orientation: H

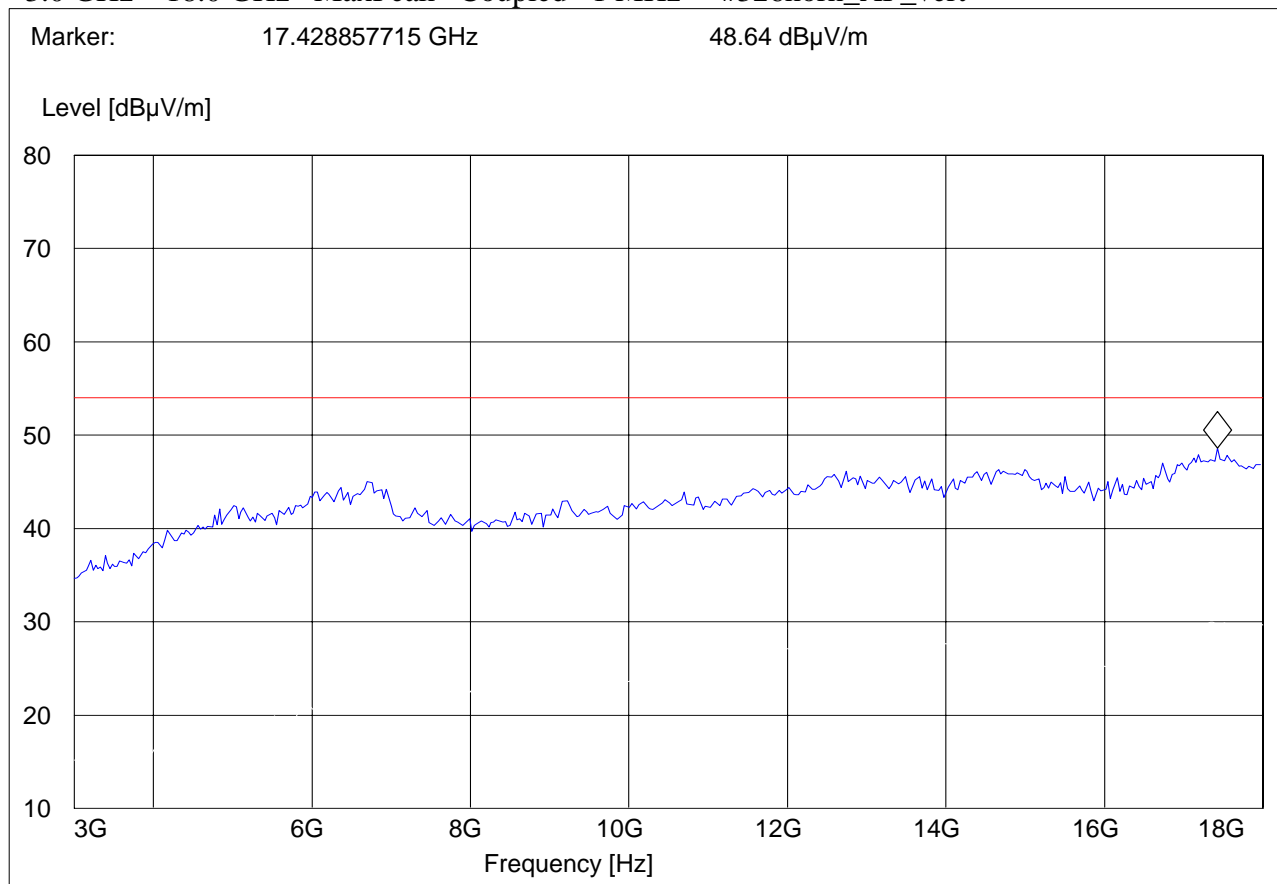
Test Engineer: Chris

Voltage: Laptop

Comments: Main

SWEEP TABLE: "FCC15.247_3-18G"

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



3-18GHz (2472MHz Ch32) Antenna Horizontal

Note: Peak Reading vs. Average limit

Note: Worse case emission for all operating modes 802.11b/g.

EUT: BCM94312HMG; S/N:37; P#:201

Customer:: Broadcom

Test Mode: 802.11g; Ch.13;

ANT Orientation: H

EUT Orientation: H

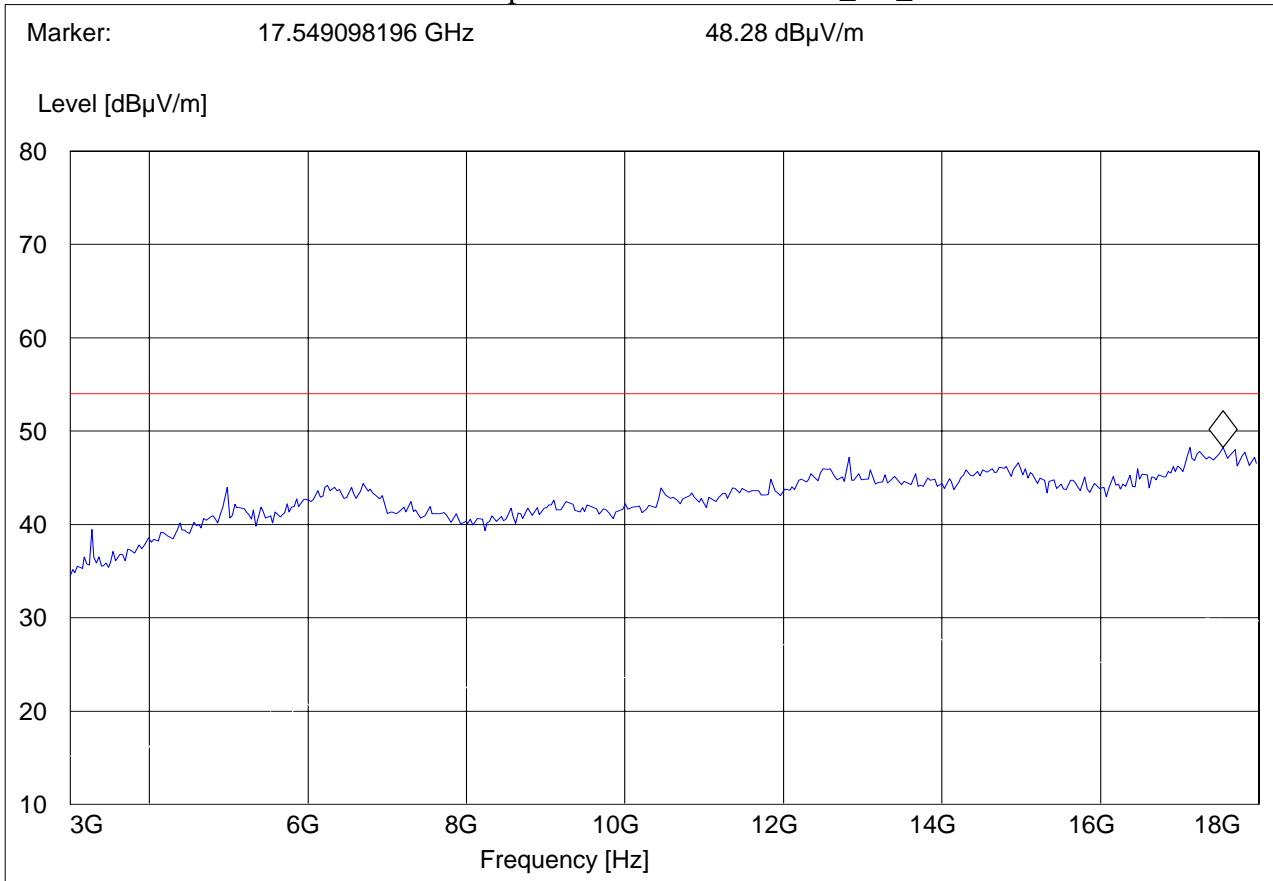
Test Engineer: Chris

Voltage: Laptop

Comments: Main

SWEEP TABLE: "FCC15.247_3-18G"

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



3-18GHz (2472MHz Ch13) Antenna Vertical

Note: Peak Reading vs. Average limit

Note: Worse case emission for all operating modes 802.11b/g.

EUT: BCM94312HMG; S/N:37; P#:201

Customer:: Broadcom

Test Mode: 802.11g; Ch.13;

ANT Orientation: V

EUT Orientation: H

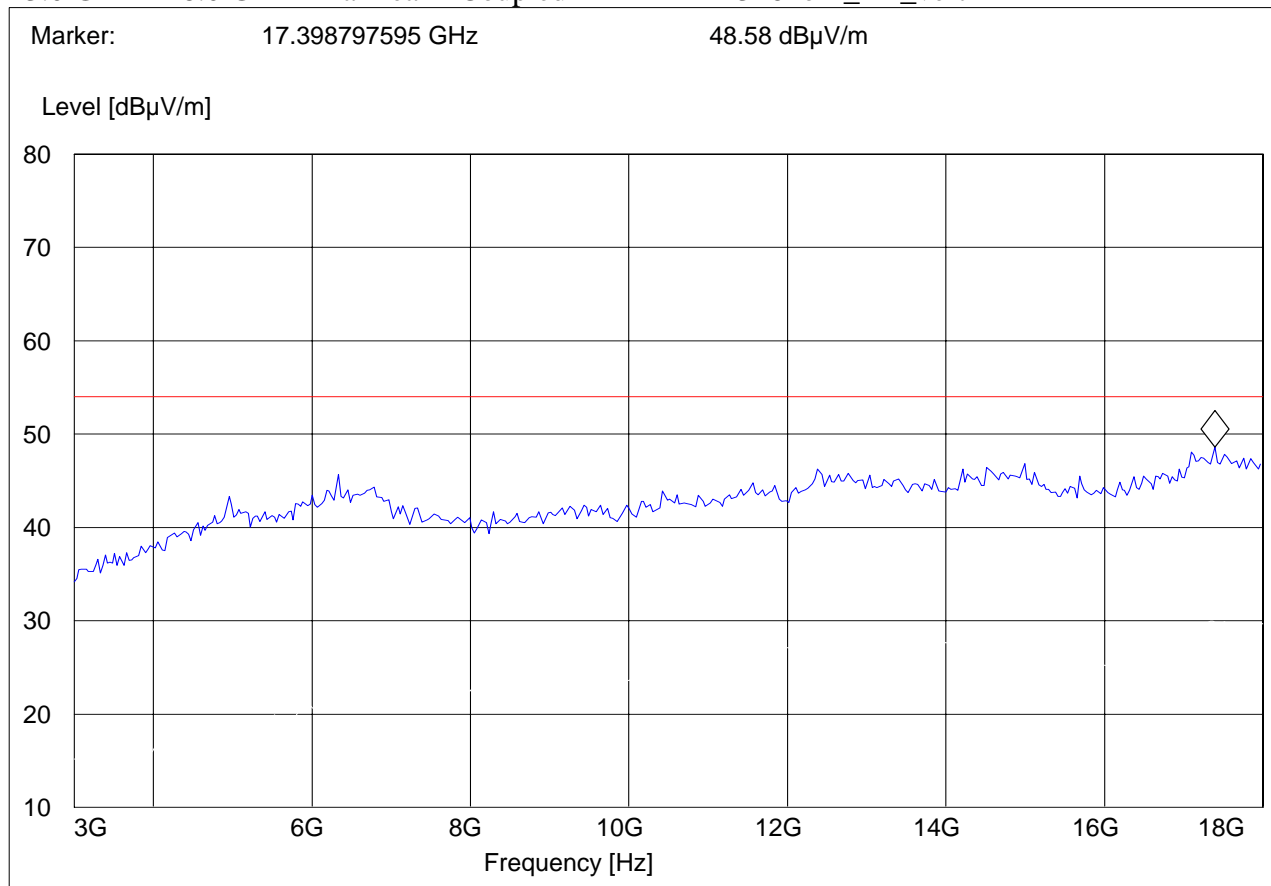
Test Engineer: Chris

Voltage: Laptop

Comments: Main

SWEEP TABLE: "FCC15.247_3-18G"

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



18-26.5GHz

Note: Peak Reading vs. Average limit

Note: Worse case emission for both channel 12 and 13.

Note: Worse case emission for all operating modes 802.11b/g.

EUT: BCM94312HMG; S/N:37; P#:201

Customer:: Broadcom

Test Mode: 802.11g; Ch.12;

ANT Orientation: H

EUT Orientation: H

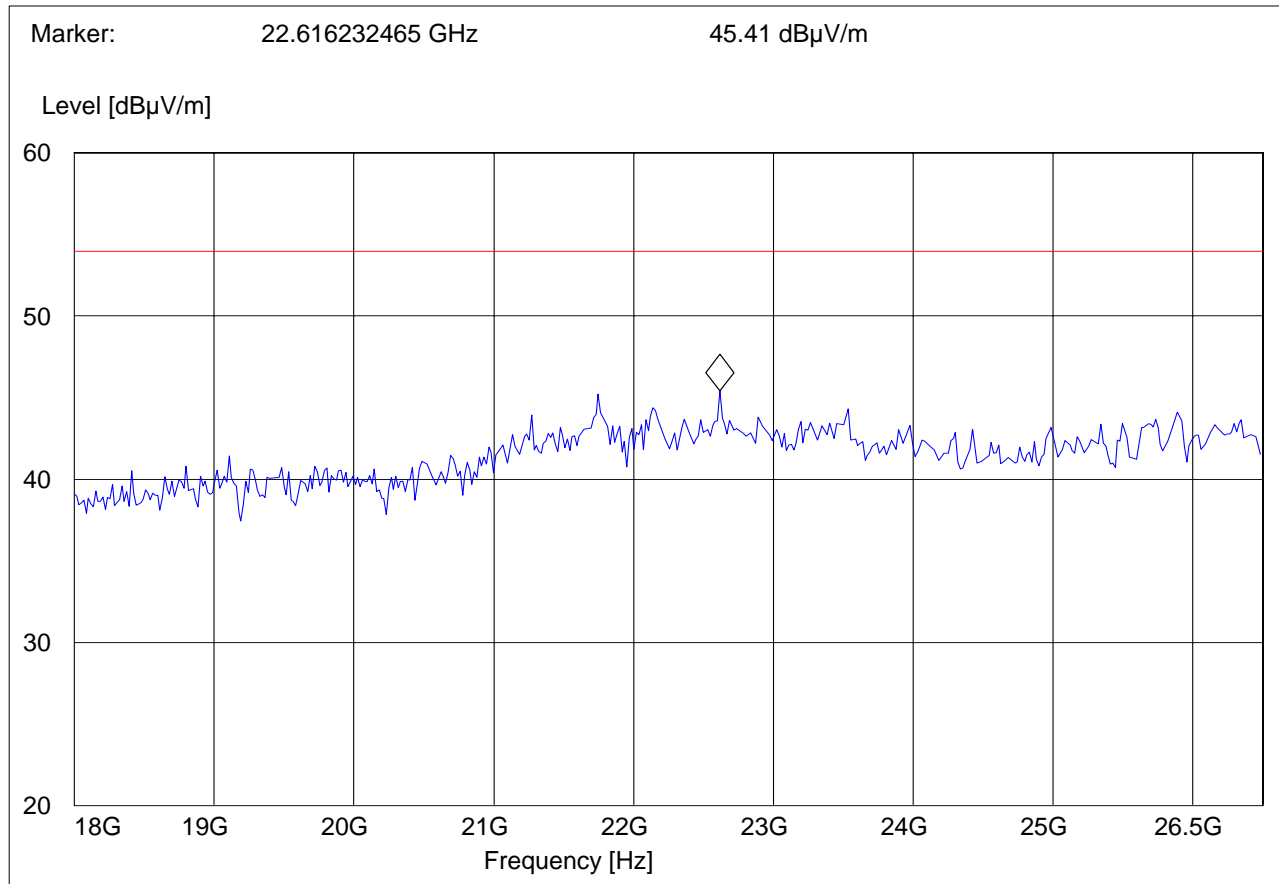
Test Engineer: Chris

Voltage: Laptop

Comments: Main

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	100 kHz	Horn # 3116_18-40G



5.4 Receiver Spurious Emission § 15.209/RSS210

5.4.1 Limits

Frequency (MHz)	Field strength ($\mu\text{V/m}$)	Measurement distance (m)
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
above 960	500	3

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.
3. There are no measurable emissions up to 18GHz in Rx mode.
4. Receiver spurious emissions reported here are the worse case emissions for all receiver modes and between two receiving chains.

5.4.2 RESULTS

30MHz – 1GHz, Antenna: Vertical

Note: This plot is valid for channels 12 and 13 (worst-case plot).

Note: Emissions over the limits are caused by the test fixture and the laptop. This is demonstrated by removing of the module and the emissions persist. See plots on next page.

EUT: BCM94312HMG; S/N:37; P#:201

Customer:: Broadcom

Test Mode: 802.11b; Ch.12; Rx

ANT Orientation: V

EUT Orientation: H

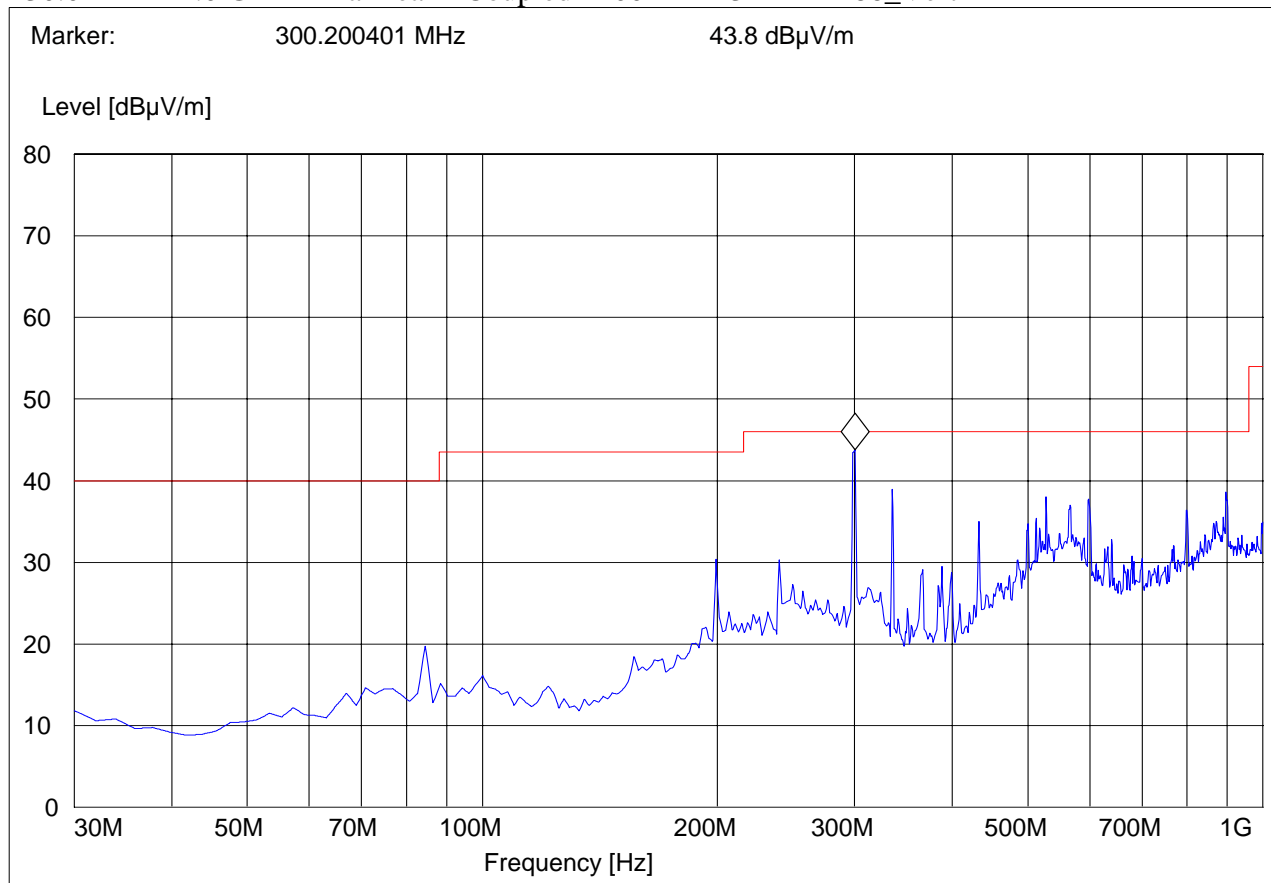
Test Engineer: Chris

Voltage: Laptop

Comments:

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

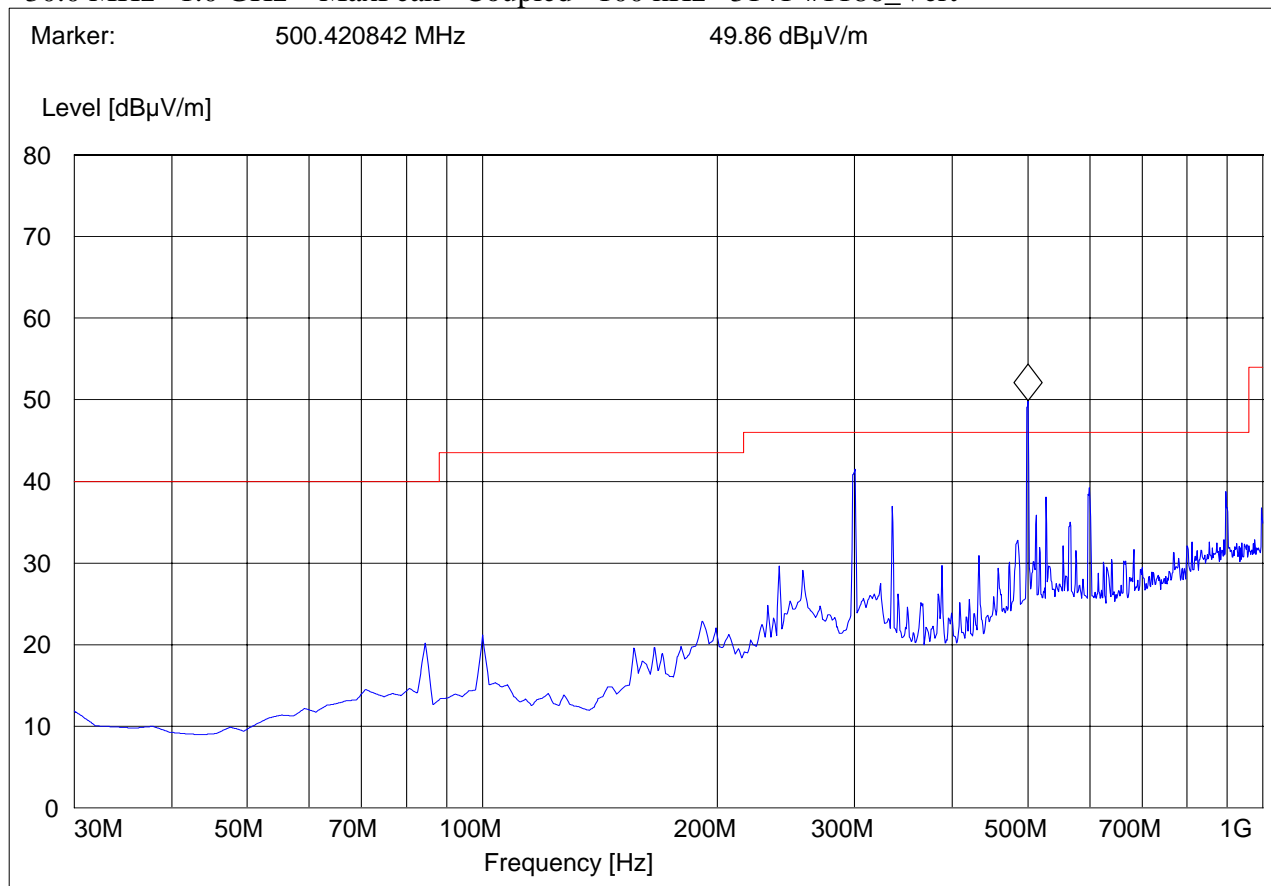


**30MHz – 1GHz, Antenna: Vertical with EUT removed.
Test fixture and supporting laptop only.**

EUT: BCM94312HMG; S/N:37; P#:201
Customer:: Broadcom
Test Mode: Card removed
ANT Orientation: V
EUT Orientation: H
Test Engineer: Chris
Voltage: Laptop
Comments:

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, Antenna: Horizontal

Note: This plot is valid for channels 12 and 13 (worst-case plot).

Note: Emissions over the limits are caused by the test fixture and the laptop. This is demonstrated by removing of the module and the emissions persist. See plots on next page.

EUT: BCM94312HMG; S/N:37; P#:201

Customer:: Broadcom

Test Mode: 802.11b; Ch.12; Rx

ANT Orientation: H

EUT Orientation: H

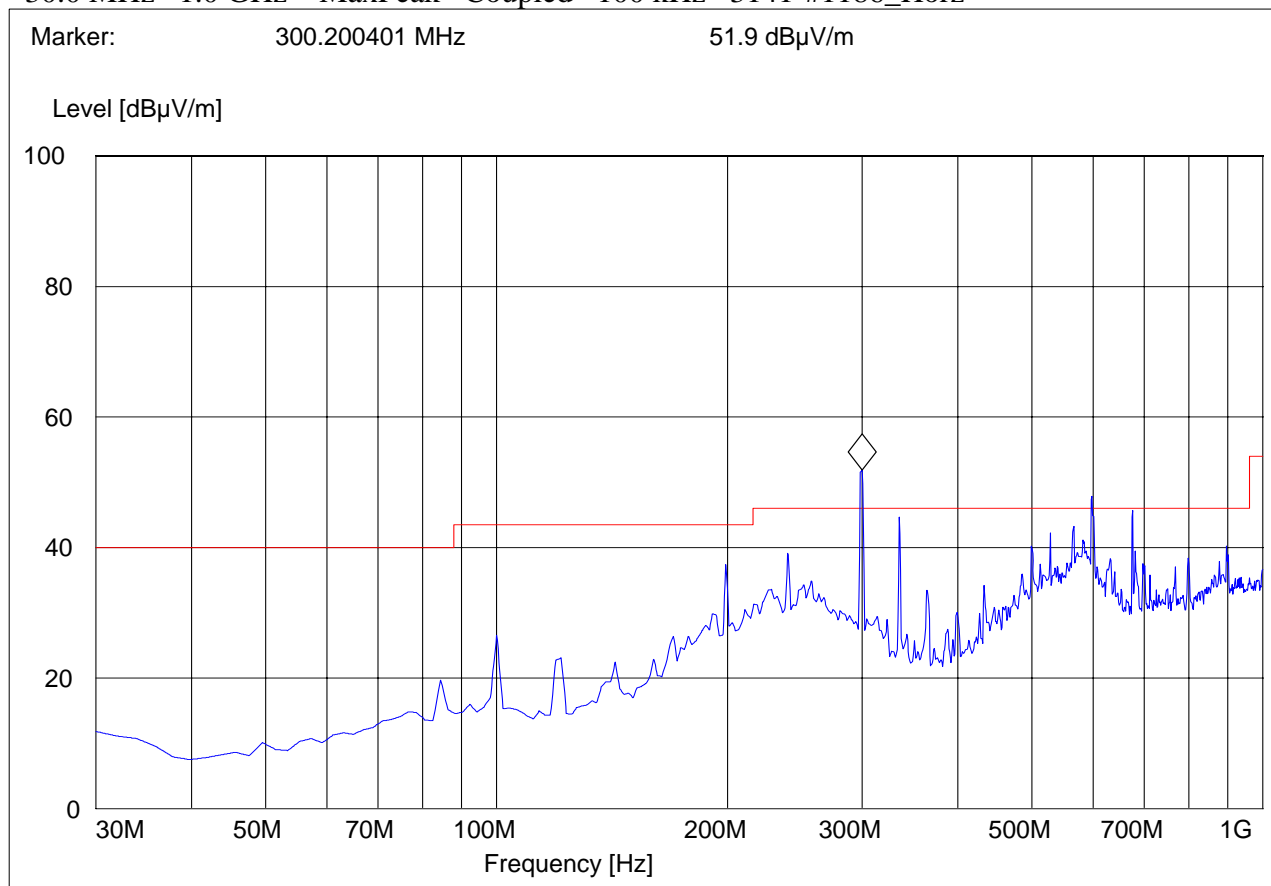
Test Engineer: Chris

Voltage: Laptop

Comments:

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_Horz

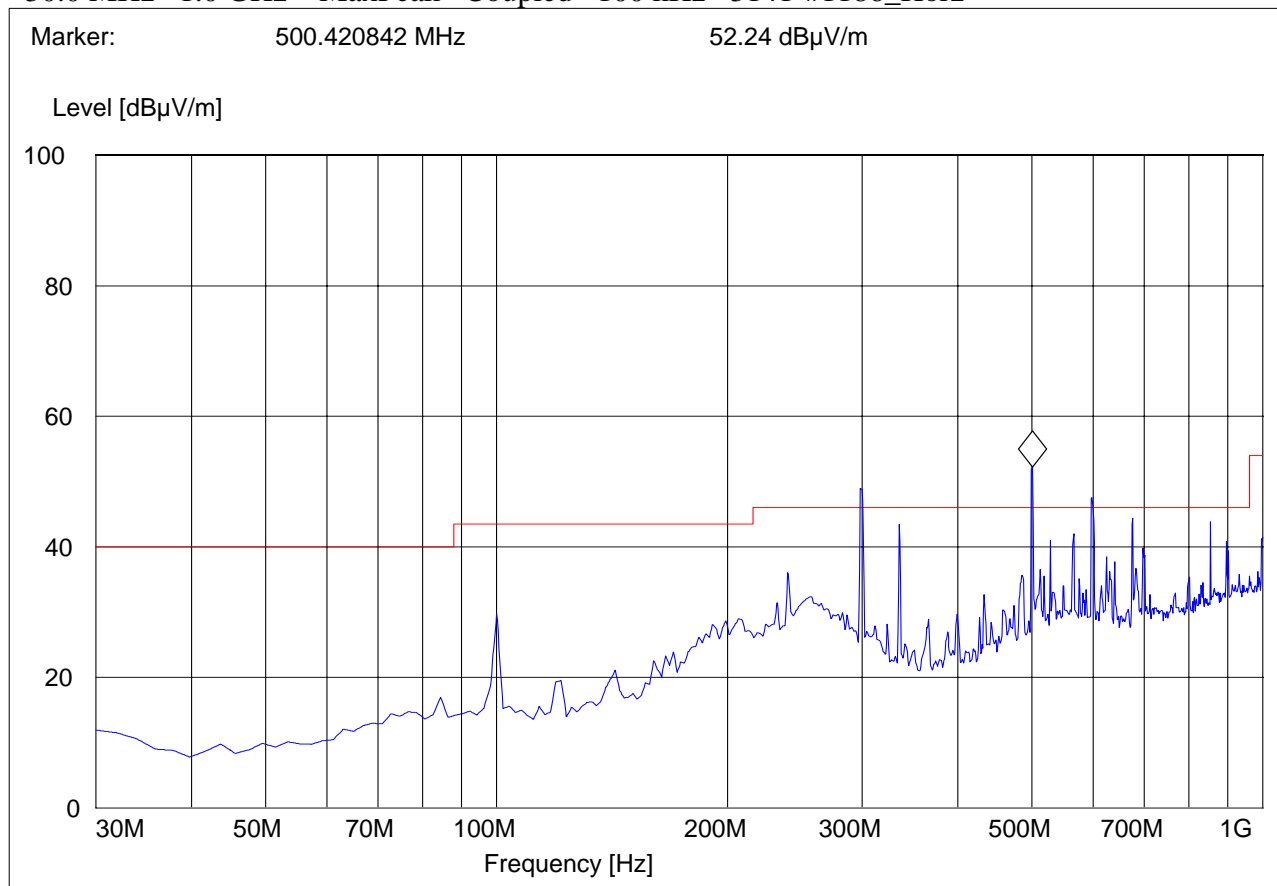


**30MHz – 1GHz, Antenna: Horizontal with EUT removed.
Test fixture and supporting laptop only.**

EUT: BCM94312HMG; S/N:37; P#:201
Customer:: Broadcom
Test Mode: Card removed
ANT Orientation: H
EUT Orientation: H
Test Engineer: Chris
Voltage: Laptop
Comments:

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_Horz



1-18GHz

Note: Peak Reading vs. Average limit

Note: This plot is valid for channels 12 and 13 (worst-case plot).

EUT / Description: BCM94312HMG; S/N:37; P#:201

Customer: Broadcom

Operation Mode: 802.11b; Ch.12; RX

ANT Orientation: : H

EUT Orientation:: V

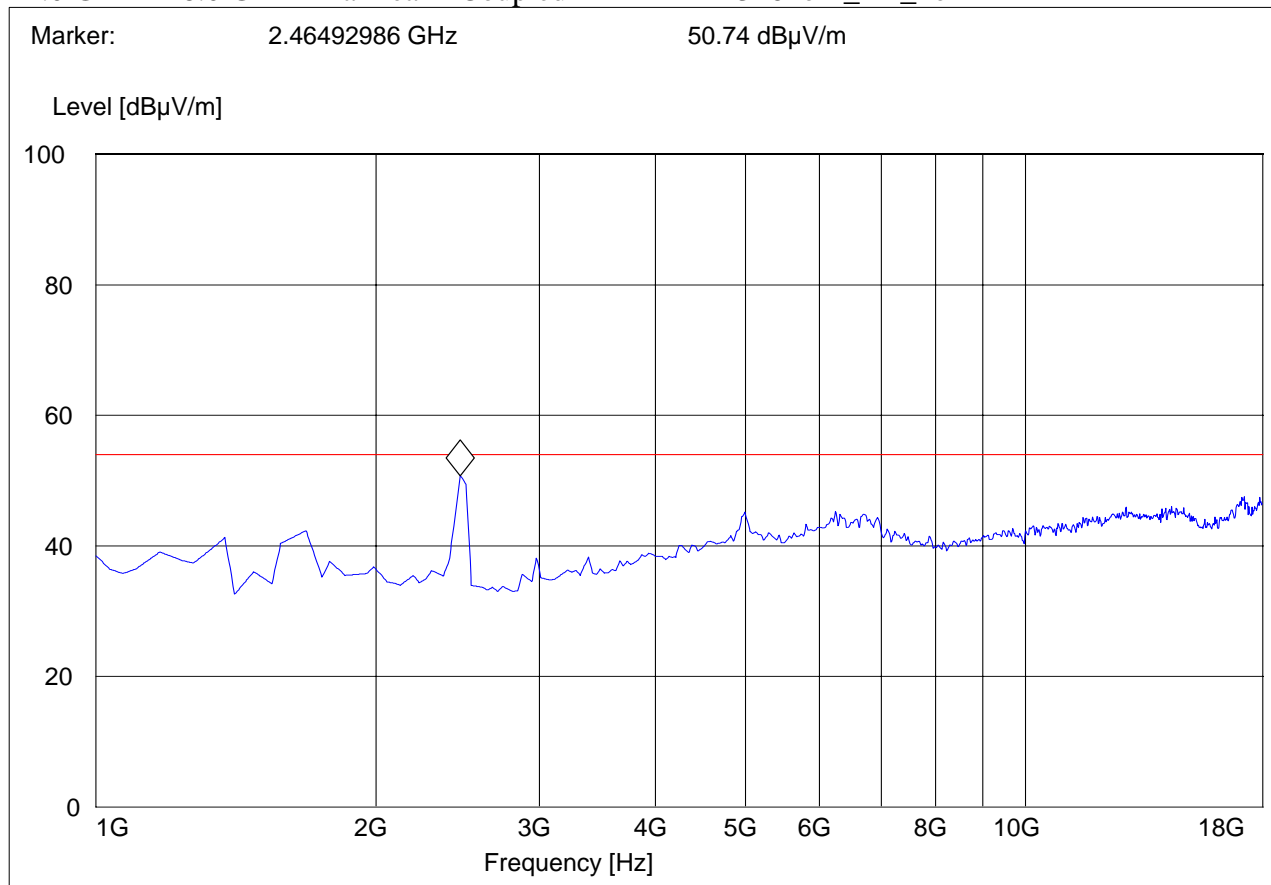
Test Engineer: Chris

Voltage: AC

Comments::

SWEEP TABLE: "FCC15.247_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

Note: Peak Reading vs. Average limit

Note: This plot is valid for channels 12 and 13 (worst-case plot).

EUT / Description: BCM94312HMG; S/N:37; P#:201

Customer: Broadcom

Operation Mode: 802.11b; Ch.12; RX

ANT Orientation: : H

EUT Orientation:: V

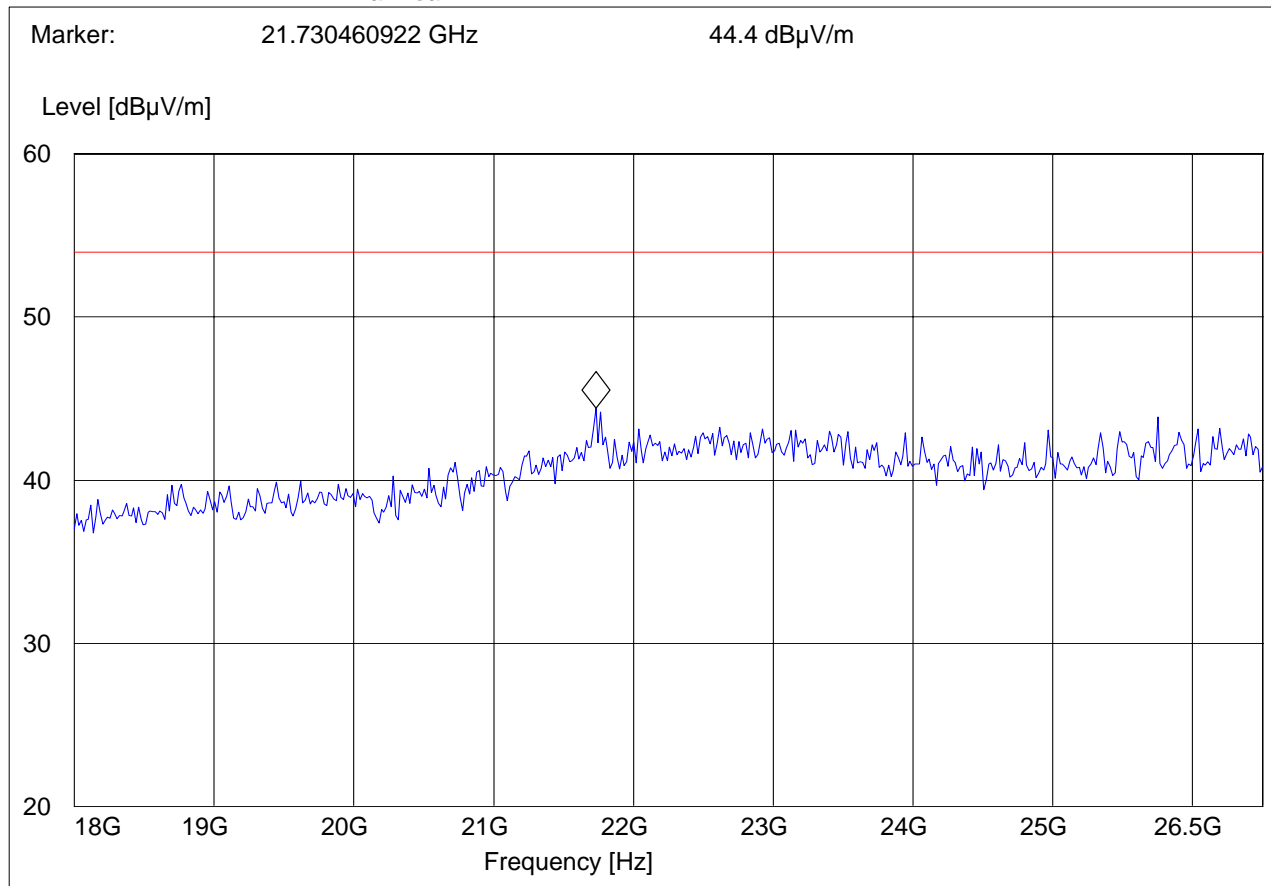
Test Engineer: Chris

Voltage: AC

Comments::

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

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
18.0 GHz	26.5 GHz	MaxPeak MaxPeak	Coupled	100 kHz	Horn # 3116_18-40G



6 Conducted Measurements

6.1 6dB bandwidth and 99% bandwidth.

6.1.1 Limit

FCC15.247(a)(2) Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

RSS210 A8.2 (a): The minimum 6 dB bandwidth shall be at least 500 kHz.

6.1.2 Measurement Result:

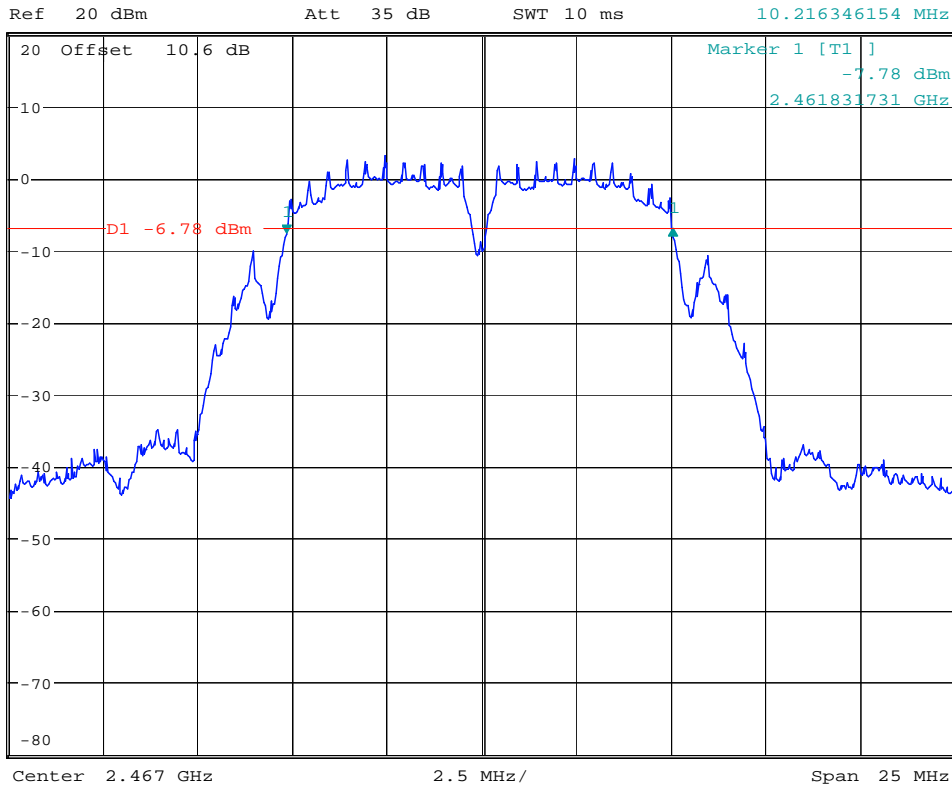
6dB bandwidth and 99% bandwidth

TEST CONDITIONS T _{nom} (23)°C, V _{nom} VDC	Channel Frequency	6dB bandwidth (MHz)	99% bandwidth (MHz)	Verdict
Sub-band 1: 2400-2483.5MHz (802.11b)	2467	10.2	10.8	PASS
	2472	10.2	10.8	PASS
Sub-band 1: 2400-2483.5MHz (802.11g)	2467	16.5	16.3	PASS
	2472	16.6	16.6	PASS

6dB BW Ch 12 2467MHz 802.11b



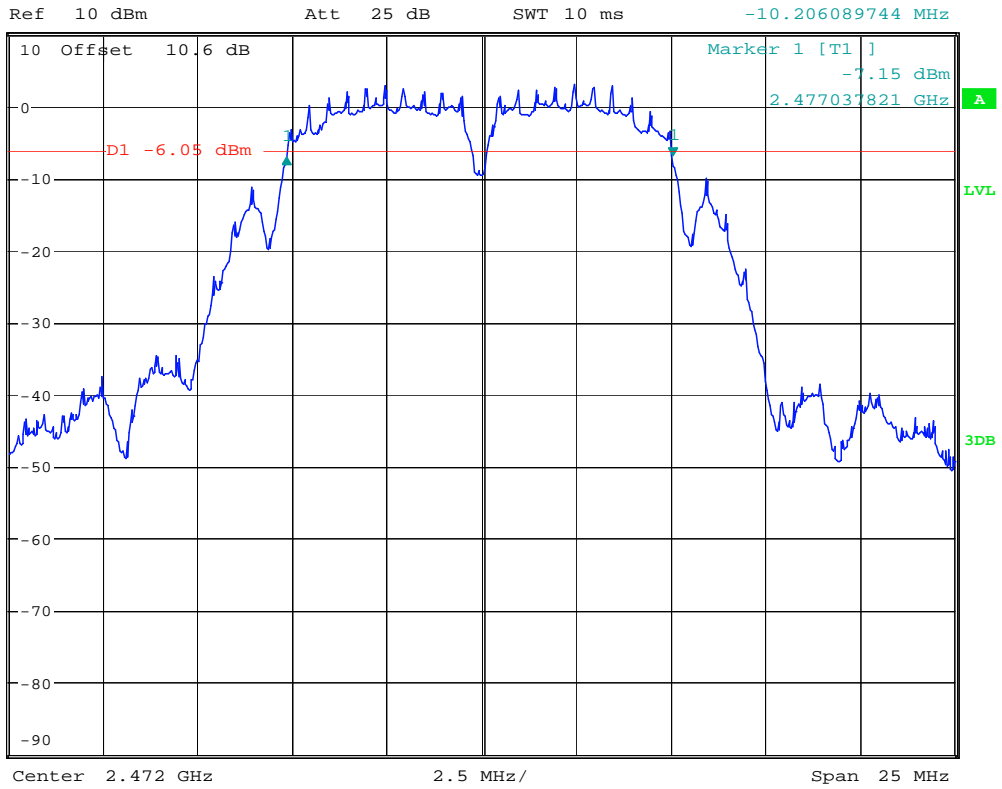
*RBW 100 kHz Delta 1 [T1]
*VBW 100 kHz 0.52 dB
SWT 10 ms 10.216346154 MHz



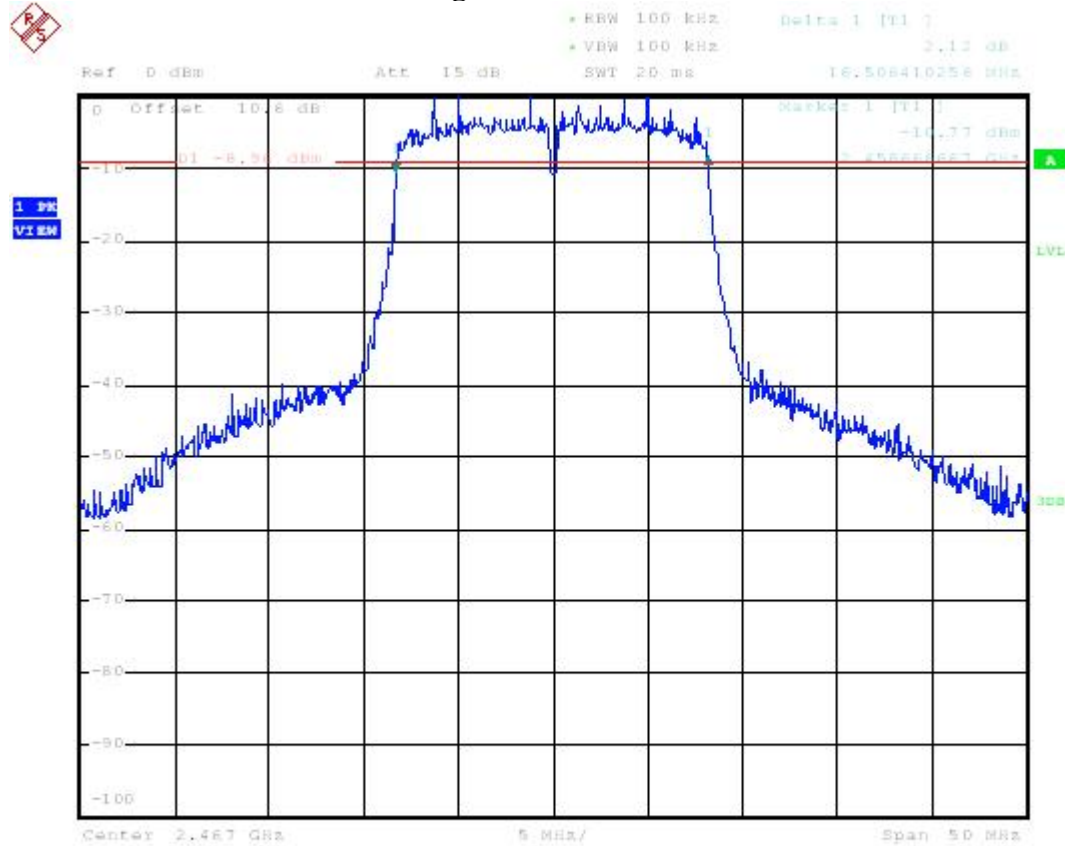
6dB BW Ch 13 2467MHz 802.11b



*RBW 100 kHz Delta 1 [T1]
*VBW 100 kHz -0.28 dB
SWT 10 ms -10.206089744 MHz



6dB BW Ch 12 2467MHz 802.11g



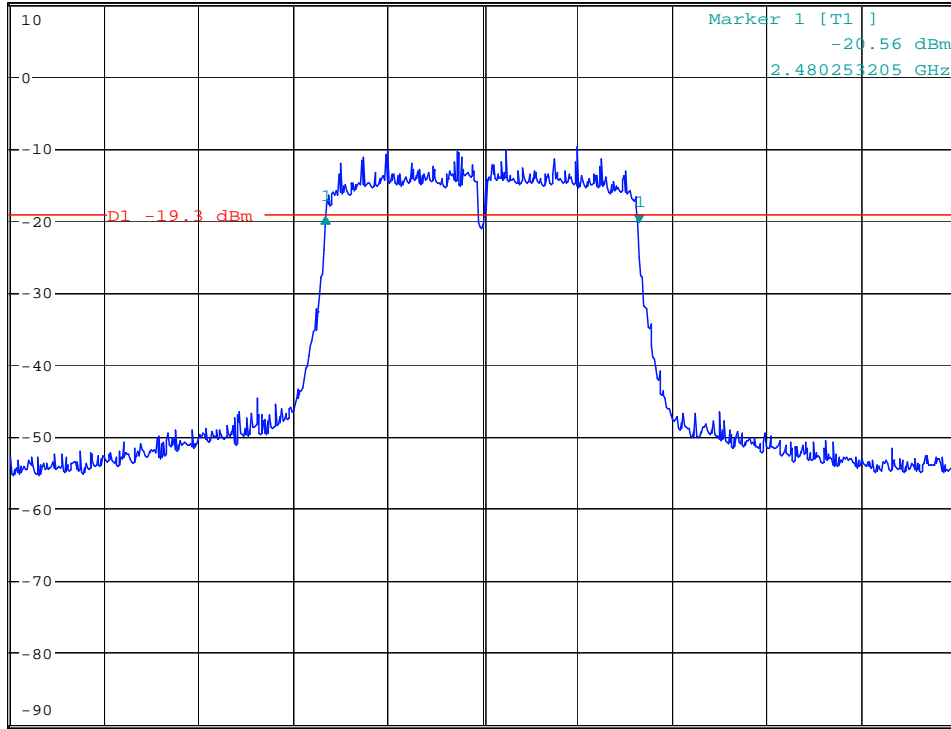
Date: 22.SEP.2008 18:34:40

6dB BW Ch 13 2467MHz 802.11g



*RBW 100 kHz Delta 1 [T1]
*VBW 100 kHz 0.90 dB
Ref 10 dBm Att 35 dB SWT 20 ms -16.586538462 MHz

1 PK
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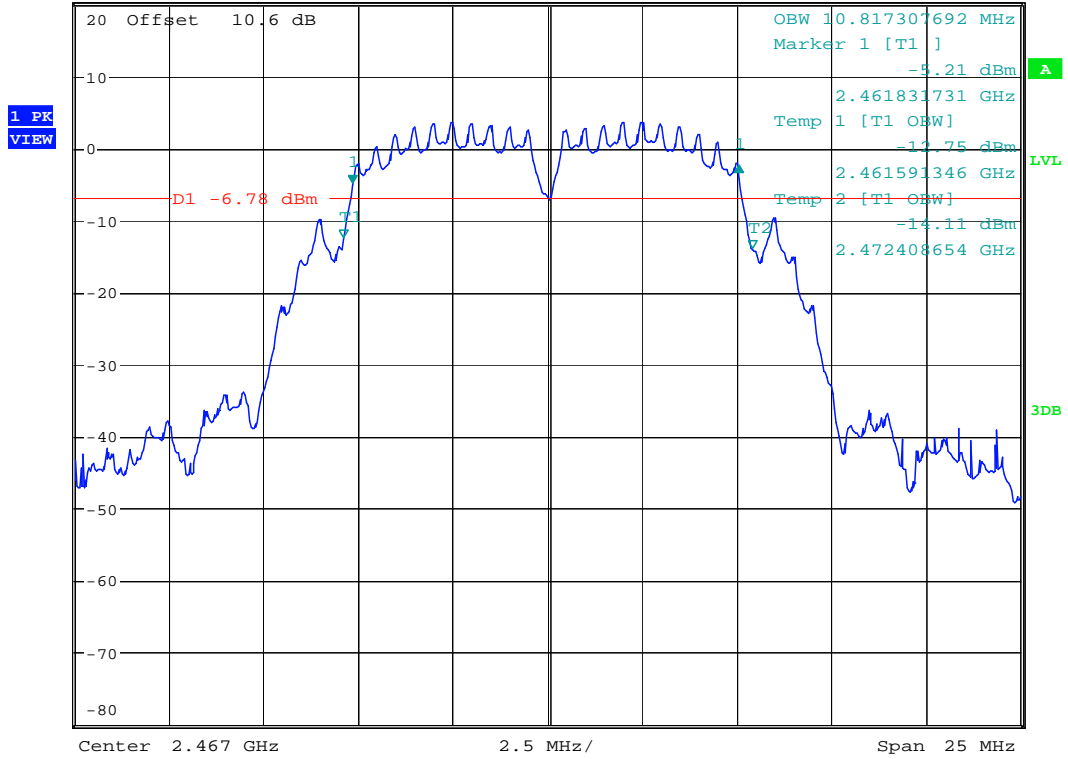


Center 2.472 GHz 5 MHz/ Span 50 MHz

99% BW Ch 12 2467MHz 802.11b



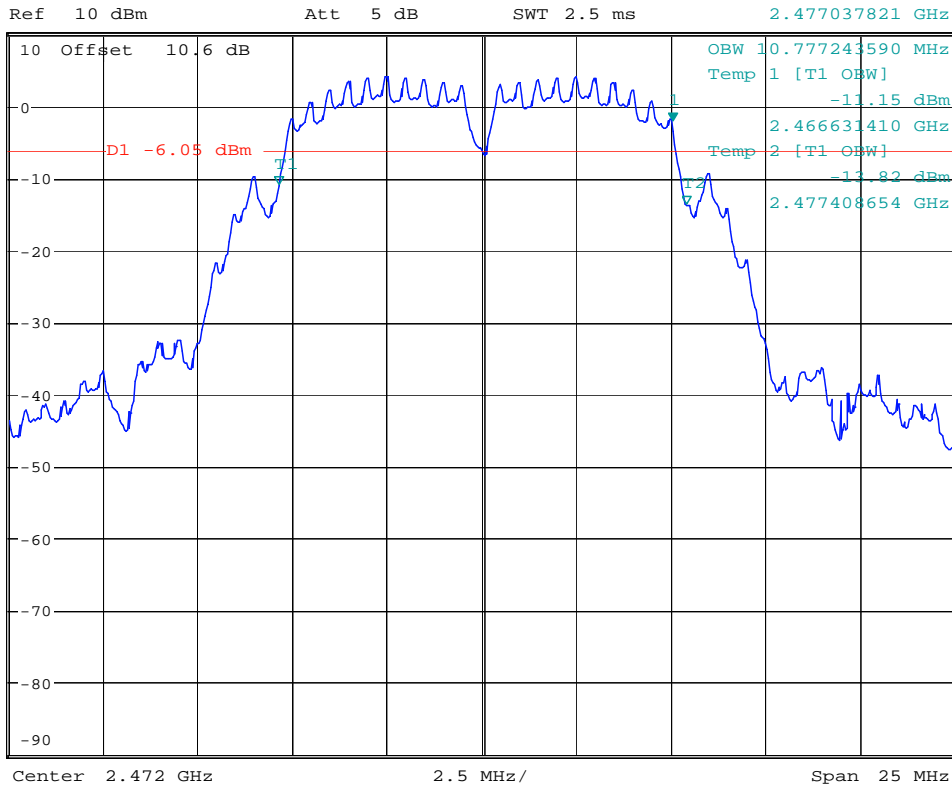
*RBW 200 kHz Delta 1 [T1]
*VBW 500 kHz 2.68 dB
Ref 20 dBm Att 15 dB SWT 2.5 ms 10.216346154 MHz



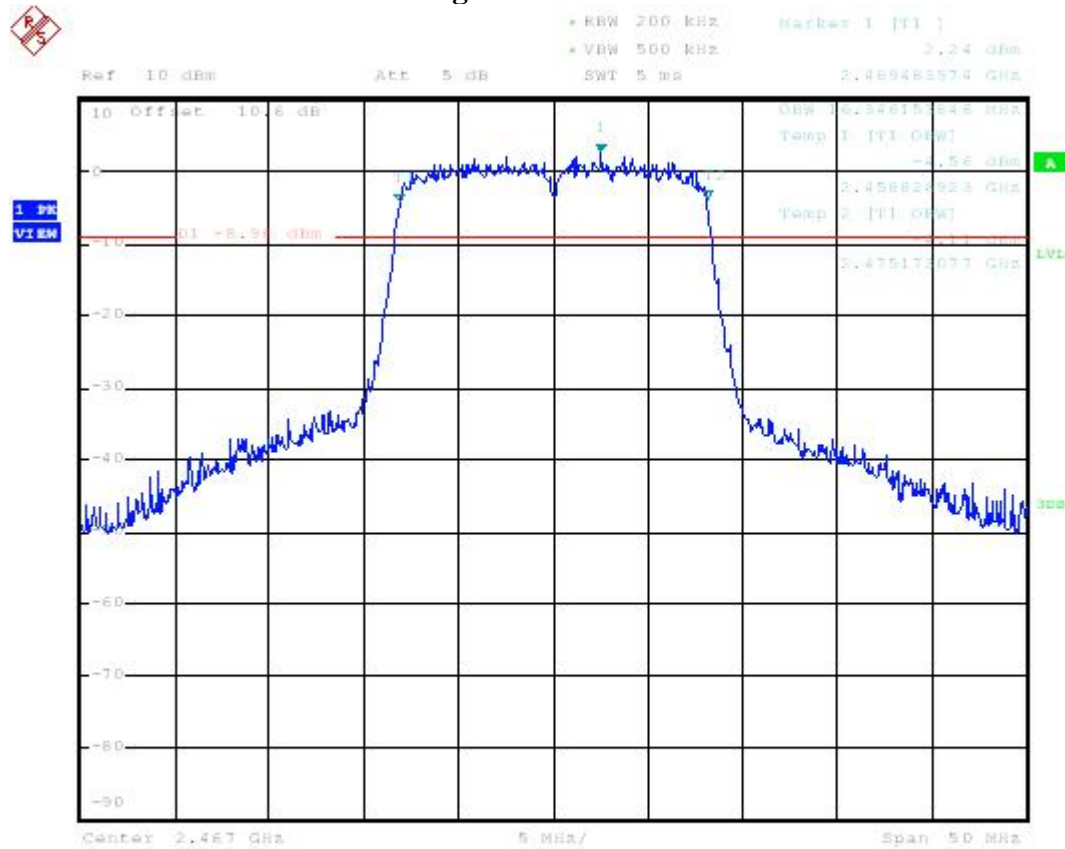
99%BW Ch 13 2467MHz 802.11b



*RBW 200 kHz Marker 1 [T1]
*VBW 500 kHz -2.33 dBm
SWT 2.5 ms 2.477037821 GHz

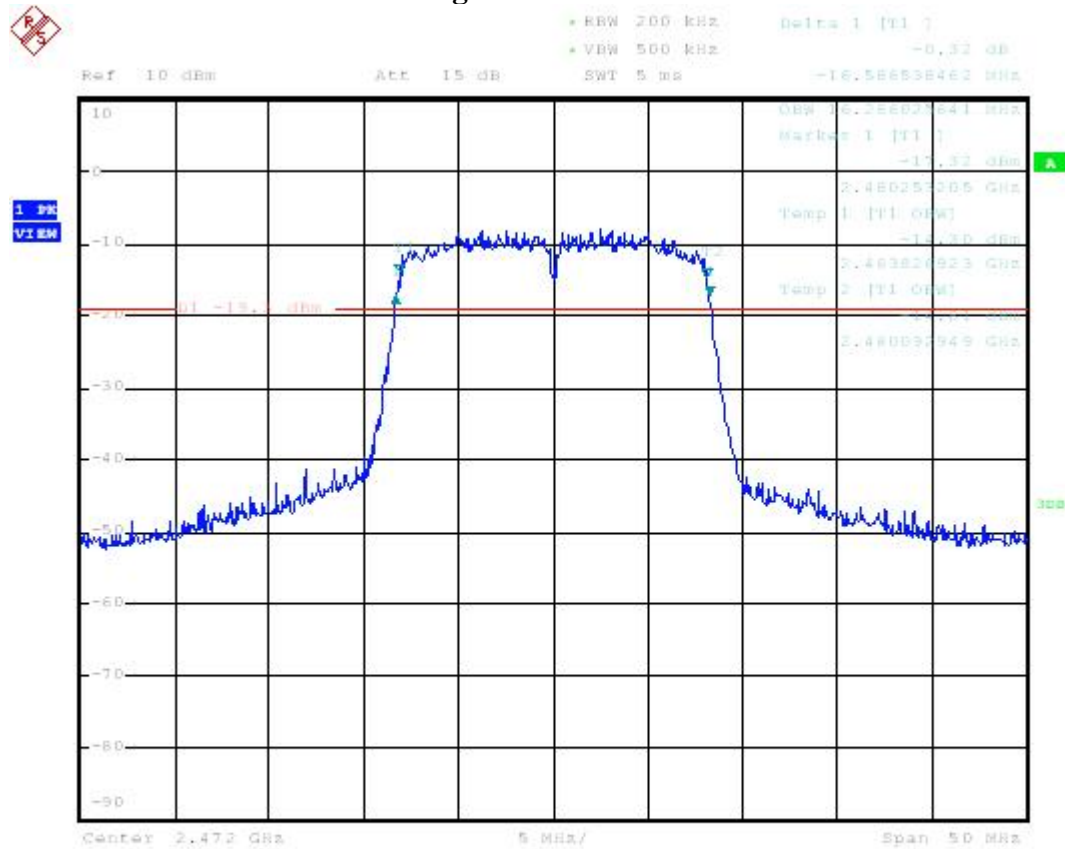


99%BW Ch 12 2467MHz 802.11g



Date: 22.SEP.2008 18:37:32

99%BW Ch 13 2467MHz 802.11g



Date: 22.SEP.2008 18:59:48

6.2 Conducted Power Measurement

6.2.1 Limit

FCC15.247 (b)(3): For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt

RSS210 A8.4(4): For systems employing digital modulation techniques operating in the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz, the maximum peak conducted output power shall not exceed 1 W. Except as provided in Section A8.4(5), the e.i.r.p. shall not exceed 4 W.

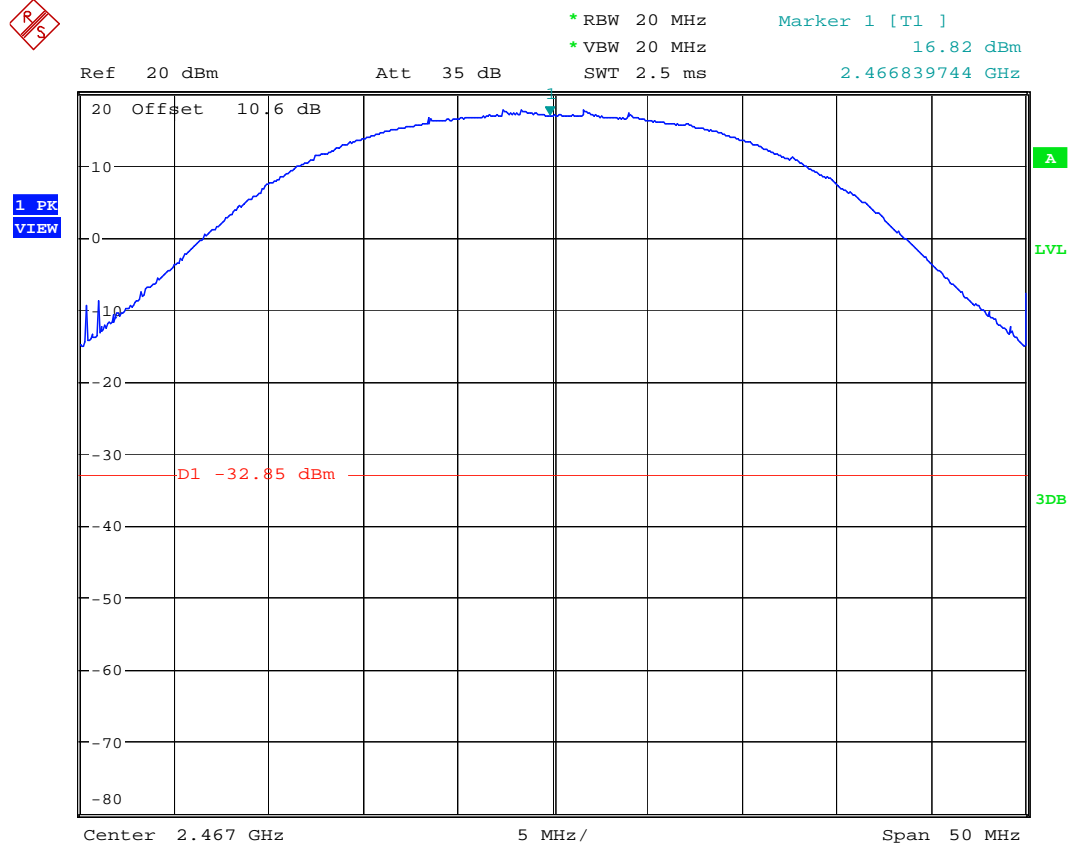
6.2.2 Results:

Conducted Peak Power 802.11 b/g Mode:

TEST CONDITIONS T _{nom} (23)°C, V _{nom} VDC	Channel Frequency	(dBm)	(mW)	Verdict
Sub-band 1: 2400-2483.5MHz (802.11b)	2467	16.82	48.1	PASS
	2472	17.81	60.4	PASS
Sub-band 1: 2400-2483.5MHz (802.11g)	2467	20.97	125	PASS
	2472	21.56	143	PASS

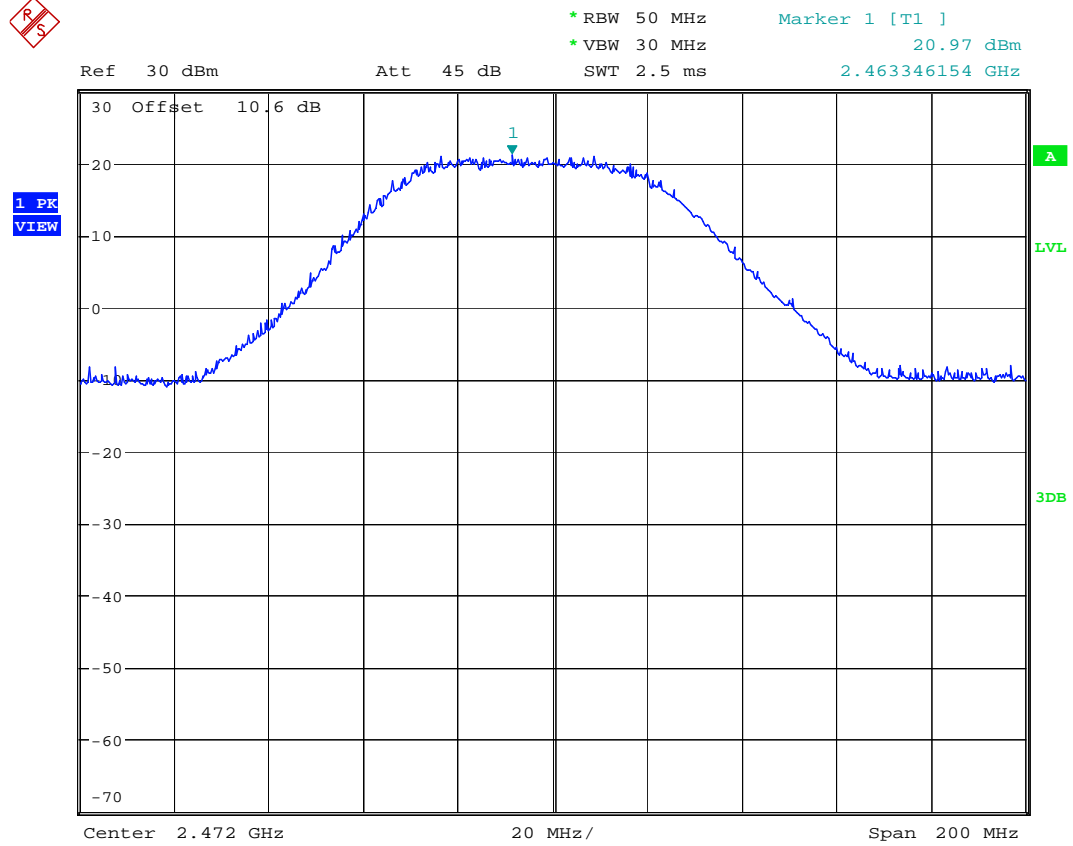
The average power levels were set as stated in the operating description document of the module.

Conducted Peak Power Ch12 802.11b



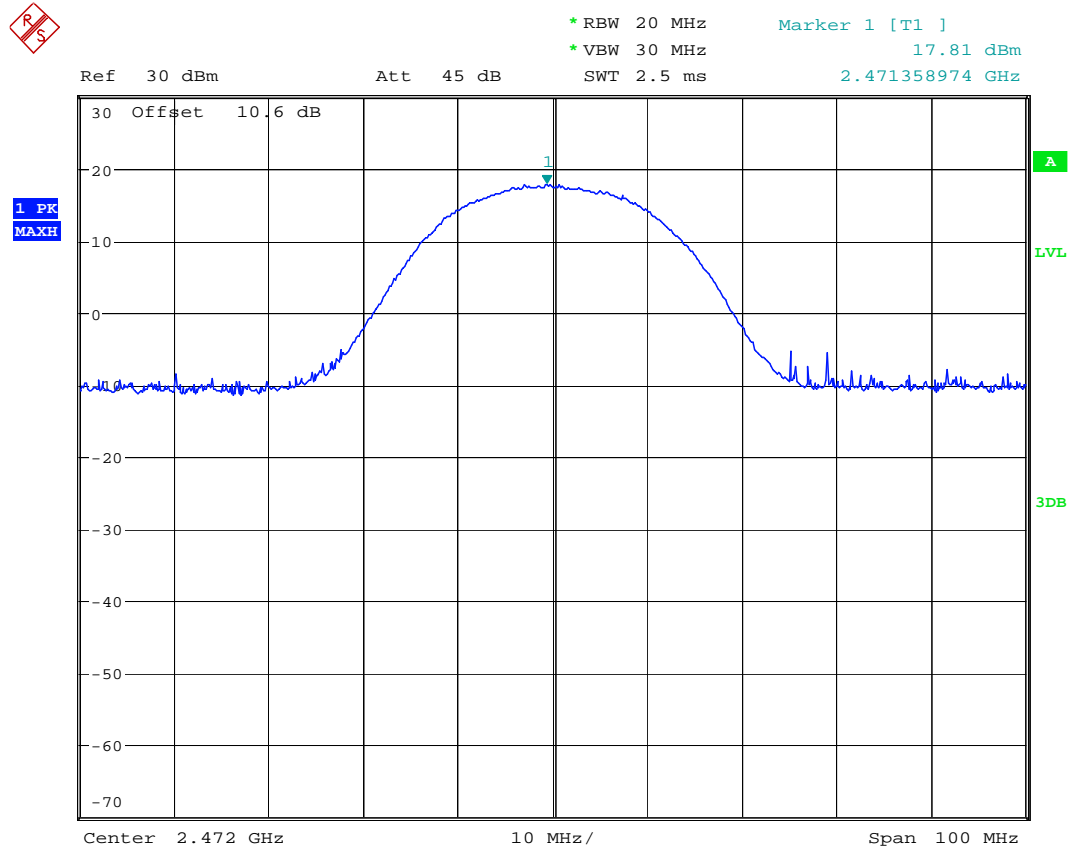
Date: 22.SEP.2008 19:15:05

Conducted Peak Power Ch13 802.11b



Date: 22.SEP.2008 18:29:13

Conducted Peak Power Ch12 802.11g

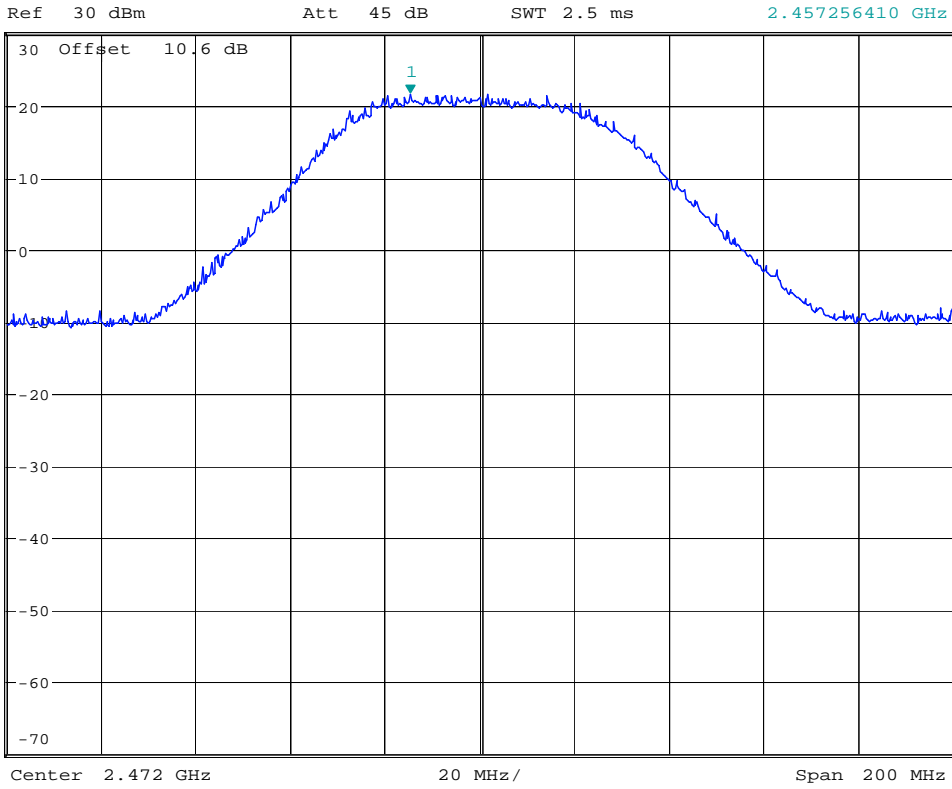


Date: 22.SEP.2008 19:48:37

Conducted Peak Power Ch13 802.11g



*RBW 50 MHz Marker 1 [T1]
*VBW 30 MHz 21.56 dBm
SWT 2.5 ms 2.457256410 GHz



6.3 Power Spectral Density

6.3.1 Limit

FCC 15.247 (e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

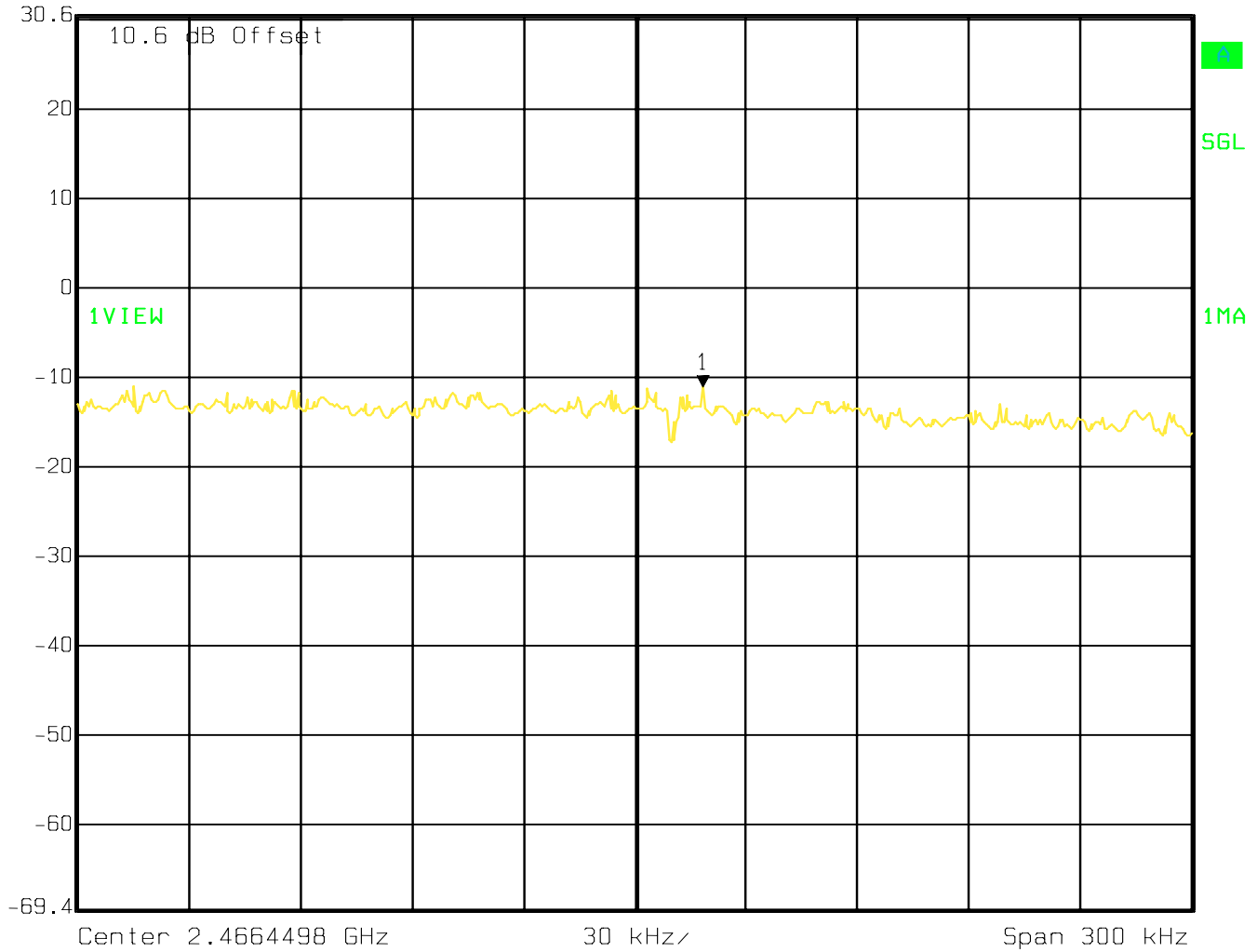
6.3.2 Results

Power Spectral Density:

TEST CONDITIONS $T_{nom}(23)^{\circ}C, V_{nom}VDC$	Channel Frequency	PSD (dBm)	Verdict
Sub-band 1: 2400-2483.5MHz (802.11b)	2467	-11.0	PASS
	2472	-10.1	PASS
Sub-band 1: 2400-2483.5MHz (802.11g)	2467	-12.6	PASS
	2472	-12.9	PASS

Power Spectral Density Ch12 802.11b

 Ref Lvl 30.6 dBm Marker 1 [T1] -10.98 dBm RBW 3 kHz RF Att 50 dB
Unit dBm VBW 10 kHz SWT 100 s



Date: 17.MAR.2009 11:02:33

Power Spectral Density Ch13 802.11b

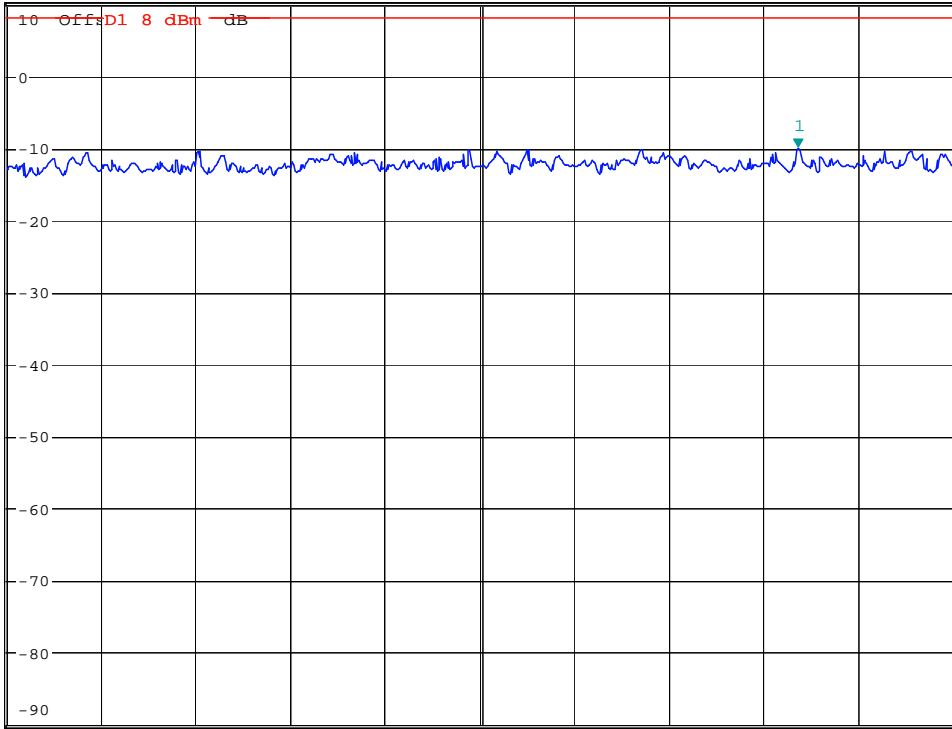


* RBW 3 kHz Marker 1 [T1]
* VBW 10 kHz -10.10 dBm
* SWT 100 s 2.474538462 GHz

Ref 10 dBm

Att 25 dB

1 PK
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Center 2.4744375 GHz

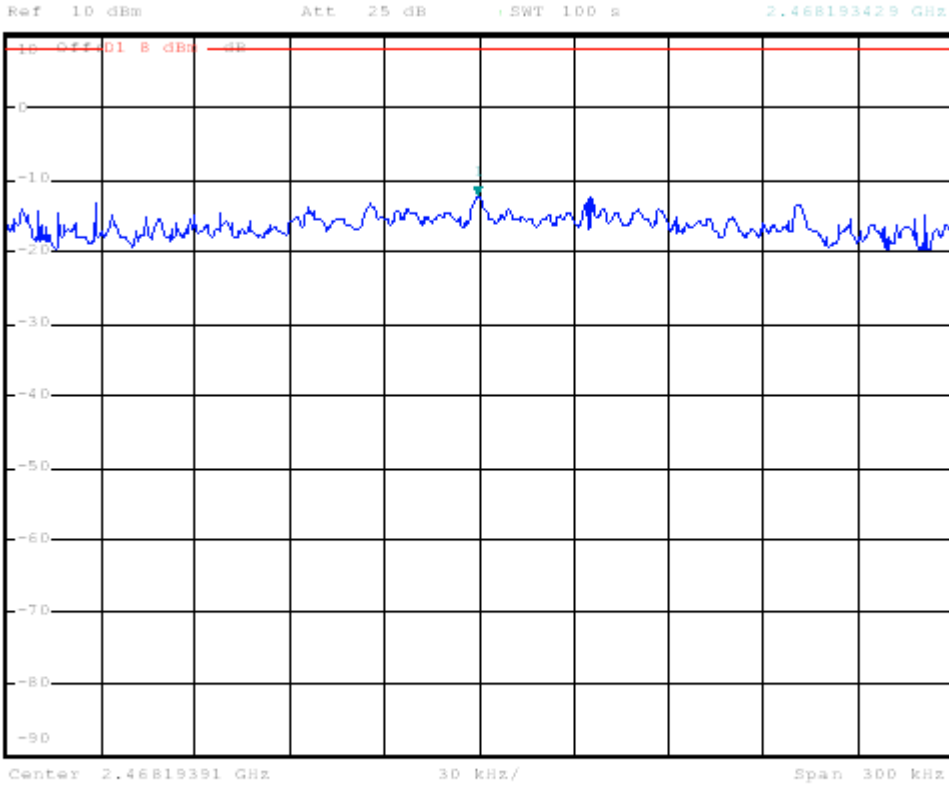
30 kHz/

Span 300 kHz

Power Spectral Density Ch12 802.11g



RBW 3 kHz Marker 1 [T1]
VBW 10 kHz -12.56 dBm
SWT 100 s 2.468193429 GHz

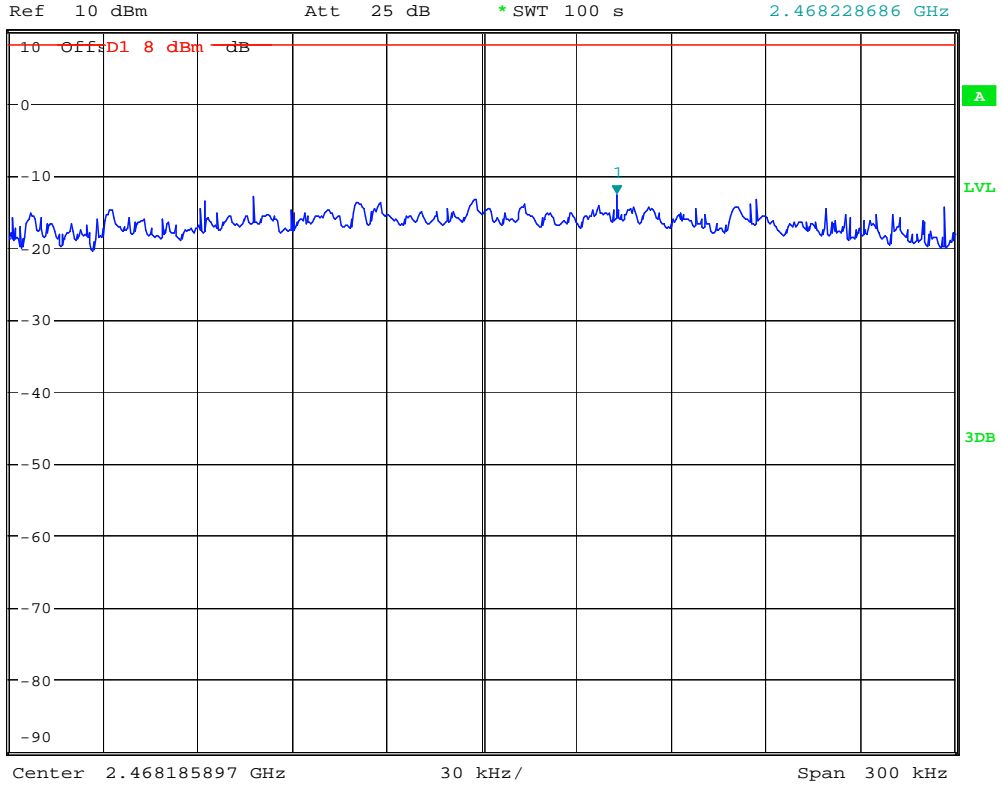


Date: 22.SEP.2008 18:45:45

Power Spectral Density Ch13 802.11g



* RBW 3 kHz Marker 1 [T1]
* VBW 10 kHz -12.89 dBm
* SWT 100 s 2.468228686 GHz



6.4 Conducted Spurious Emission

6.4.1 Limit

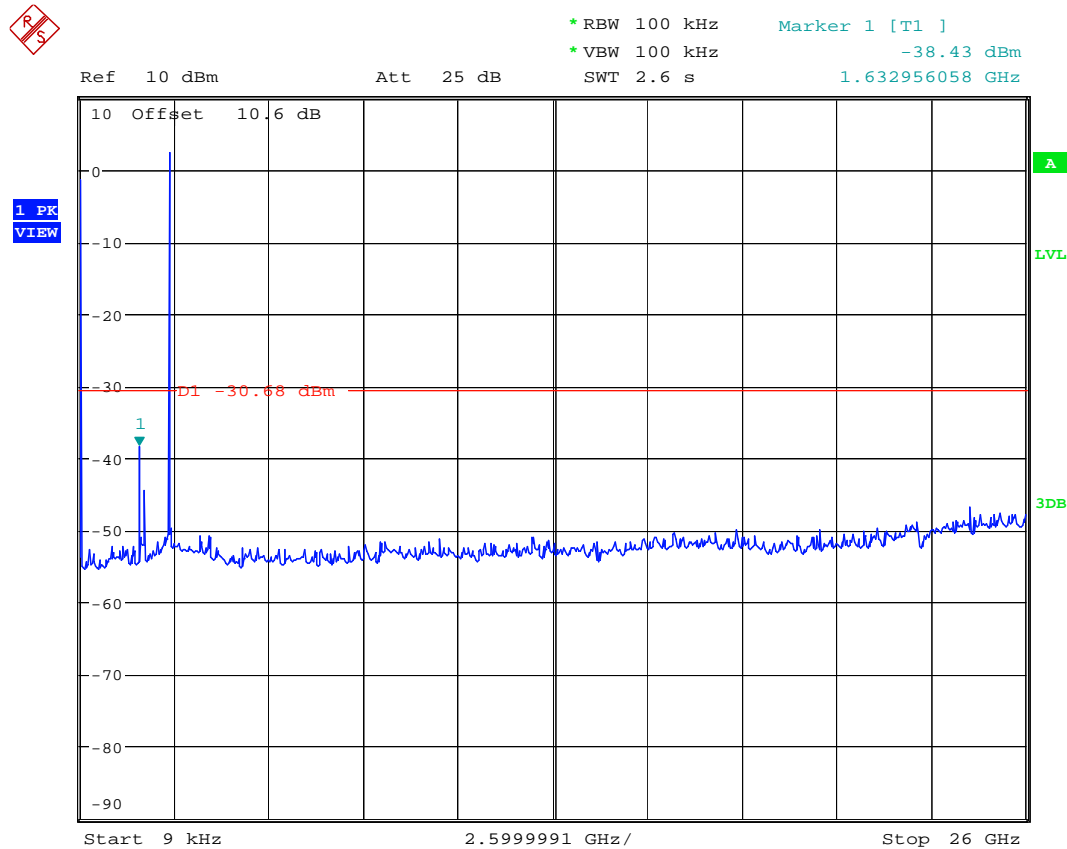
§15.247(d) & RSS-210 (A8.5): -30dBc

6.4.2 Results:

See plots for details.

Conducted Emission Ch12 802.11b

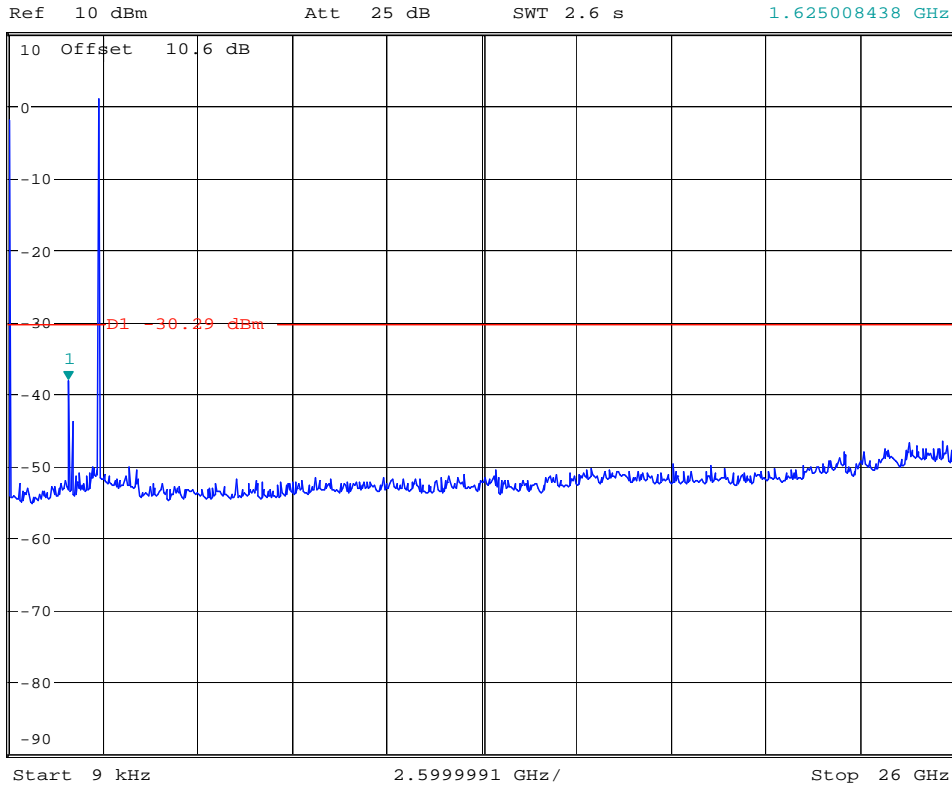
Emission over the limit line is Tx wanted emission.



Conducted Emission Ch13 802.11b
Emission over the limit line is Tx wanted emission.



*RBW 100 kHz Marker 1 [T1]
*VBW 100 kHz -38.20 dBm
SWT 2.6 s 1.625008438 GHz



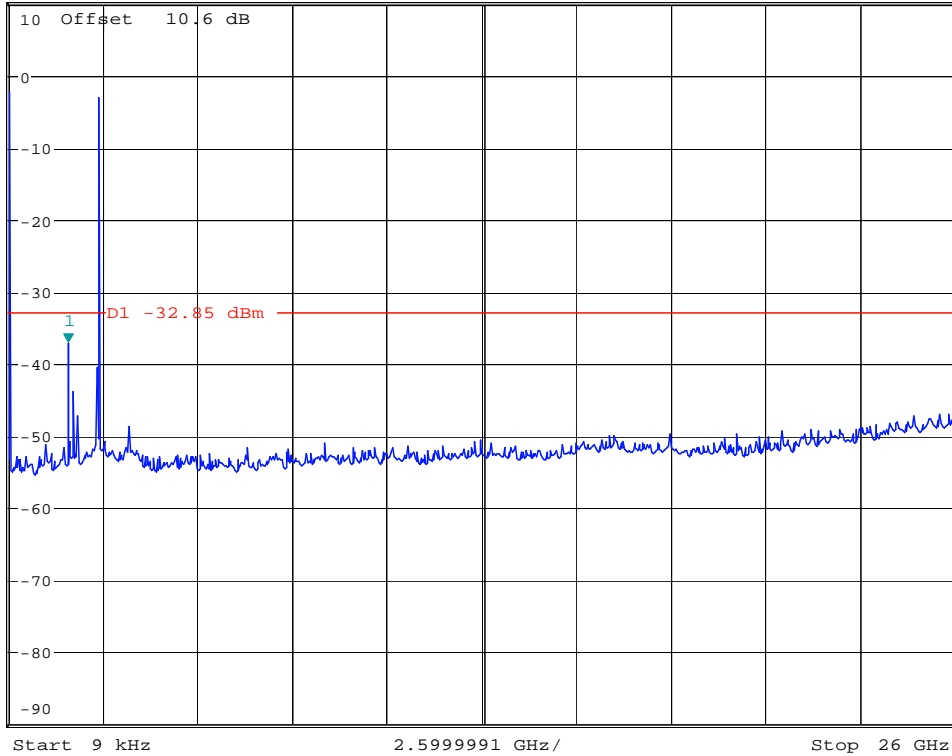
Conducted Emission Ch12 802.11g
Emission over the limit line is Tx wanted emission.



*RBW 100 kHz Marker 1 [T1]
*VBW 100 kHz -37.16 dBm
SWT 2.6 s 1.632903494 GHz

Ref 10 dBm

Att 25 dB

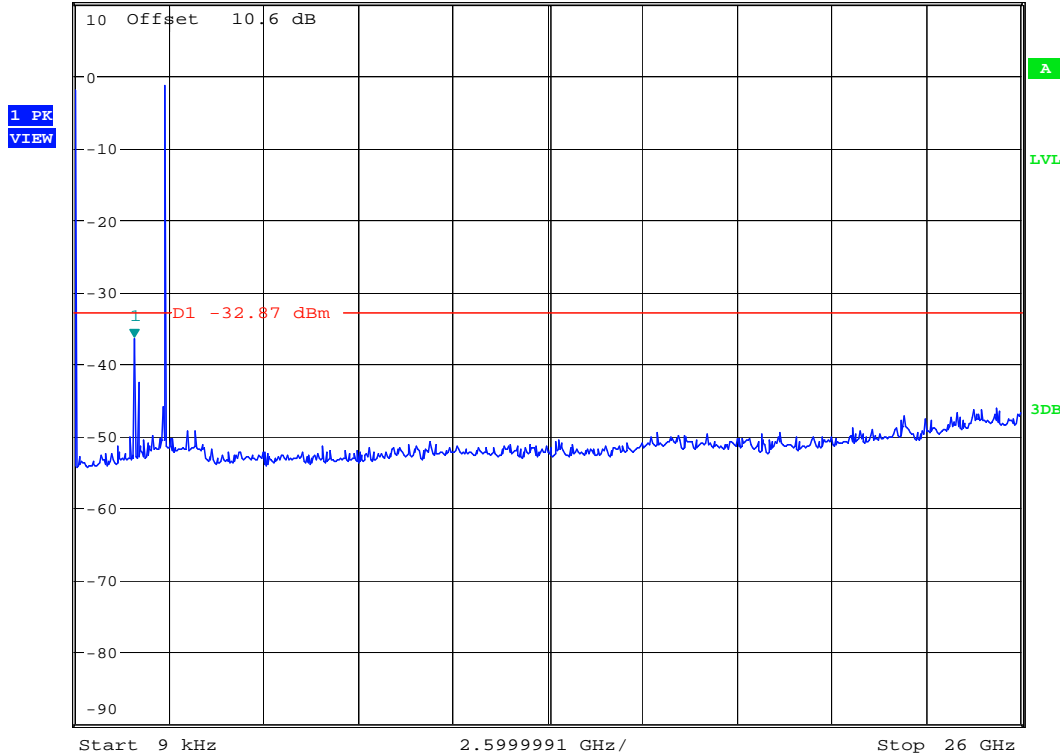


Conducted Emission Ch13 802.11g
Emission over the limit line is Tx wanted emission.



*RBW 100 kHz Marker 1 [T1]
*VBW 100 kHz -36.56 dBm
SWT 2.6 s 1.625008438 GHz

Ref 10 dBm Att 25 dB



6.5 AC POWER LINE CONDUCTED EMISSIONS § 15.107/207

6.5.1 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 µH/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 (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

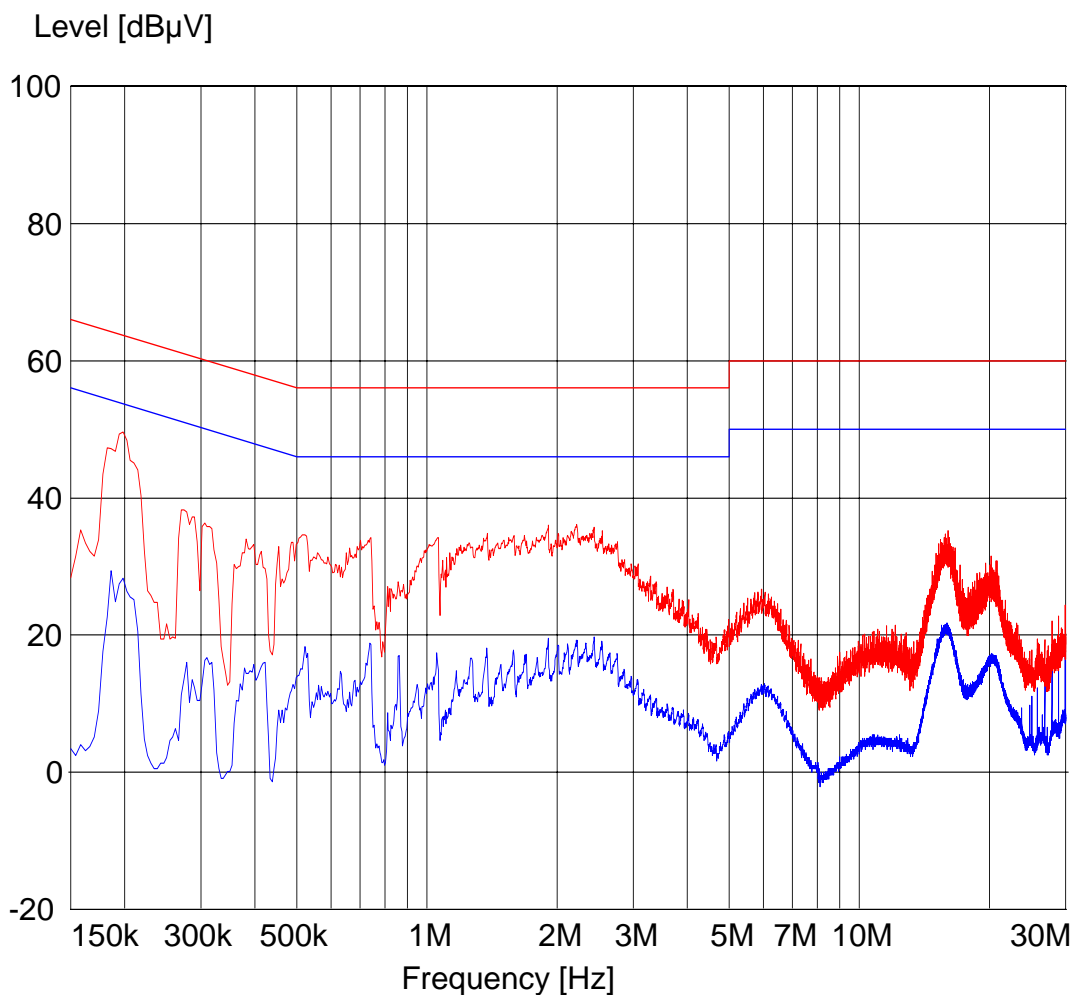
ANALYZER SETTINGS: RBW = 10KHz VBW = 10KHz

Note: AC Line Conducted Emission reported here are the worse cases among all operating modes.

6.5.2 RESULTS Tx mode, Line

Note: Worse case emission for all operating modes.

Manufacturer: Broadcom
Test Mode: 802.11g; Ch.12
ANT Orientation: N/A
EUT Orientation: H
Test Engineer: Chris
Power Supply: AC
Comments: Line

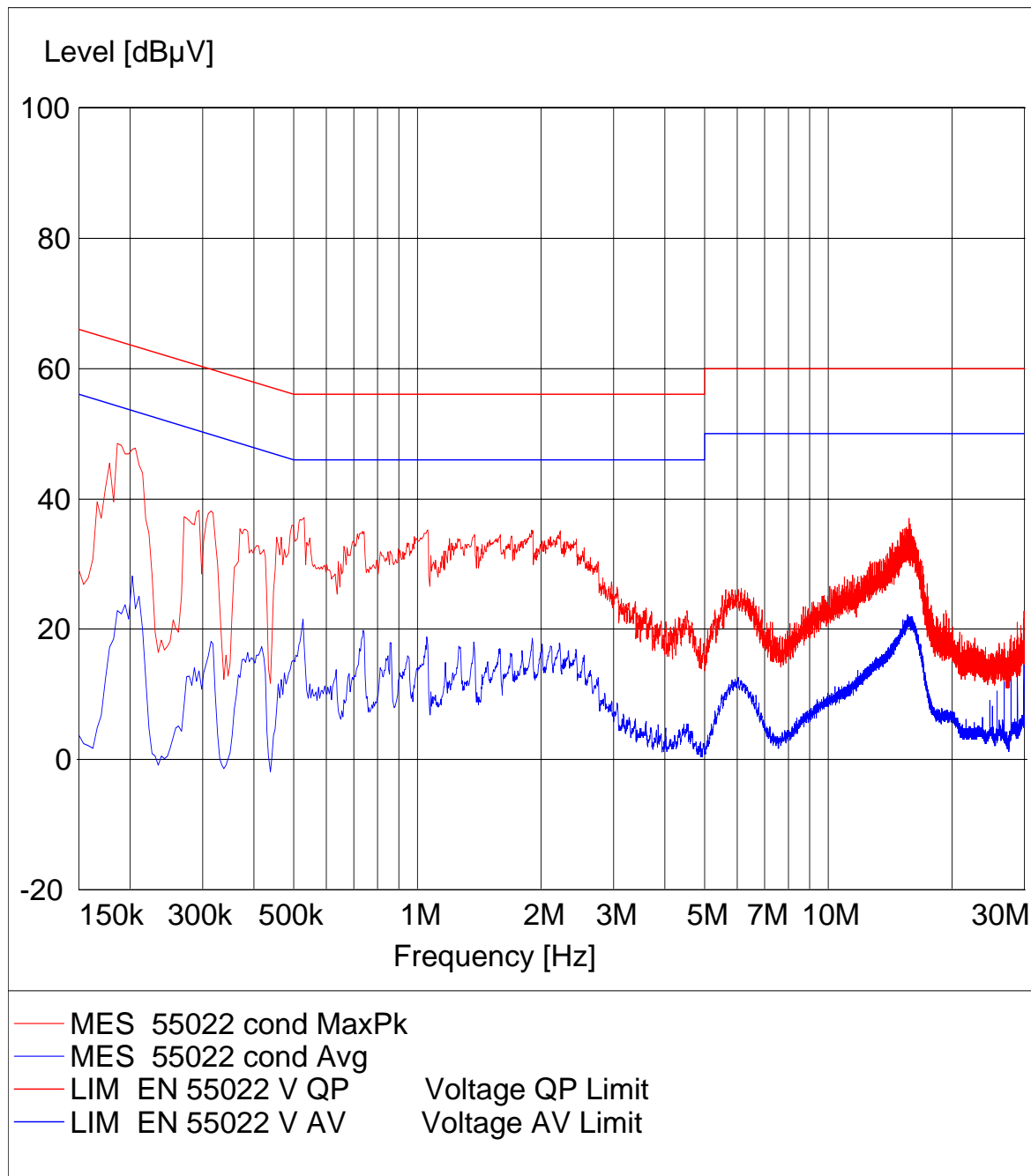


— MES 55022 cond MaxPk
— MES 55022 cond Avg
— LIM EN 55022 V QP Voltage QP Limit
— LIM EN 55022 V AV Voltage AV Limit

6.5.3 RESULTS Tx mode, Neutral

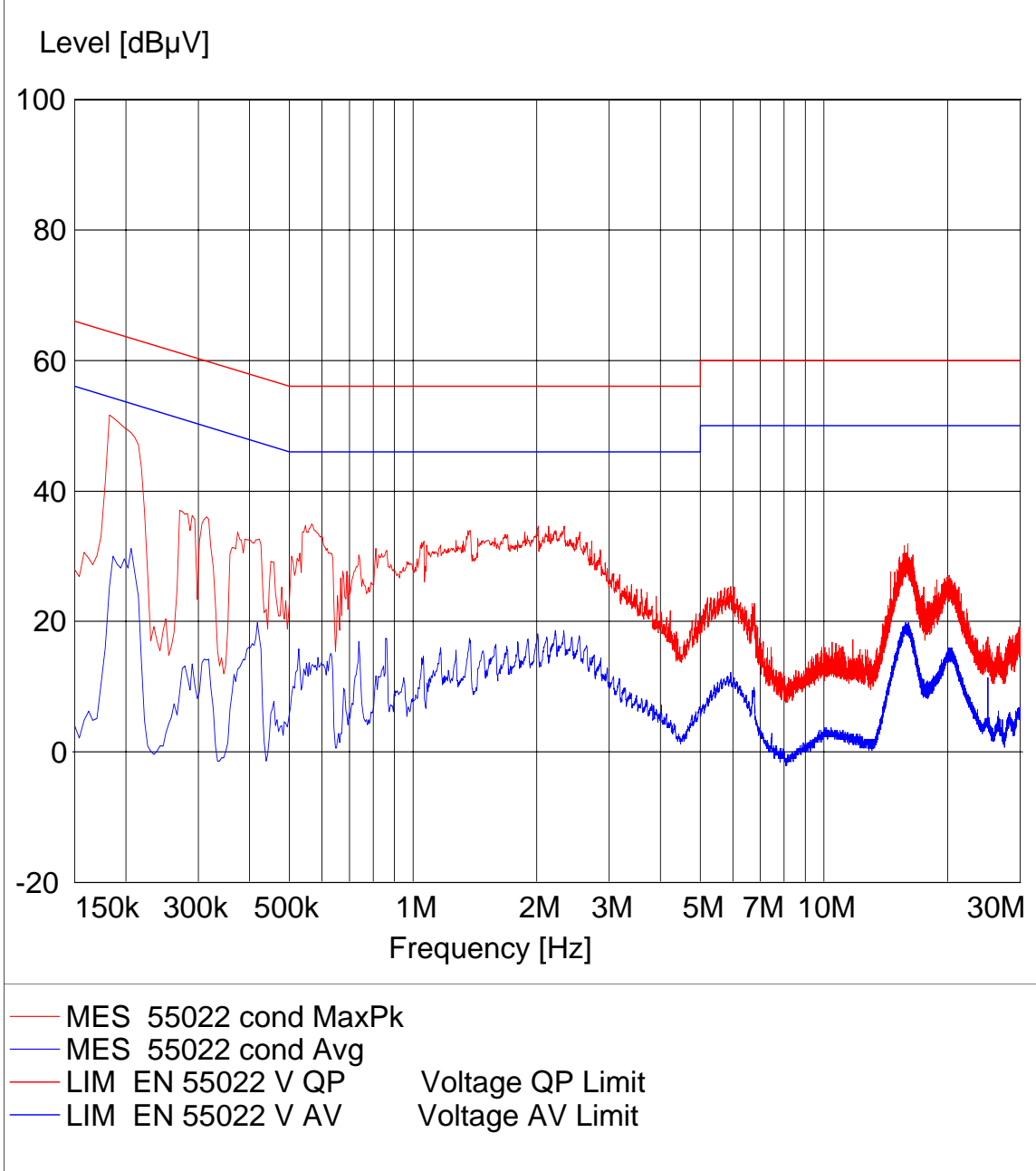
Note: Worse case emission for all operating modes.

Manufacturer: Broadcom
Test Mode: 802.11g; Ch.13
ANT Orientation: N/A
EUT Orientation: H
Test Engineer: Chris
Power Supply: AC
Comments: Neutral



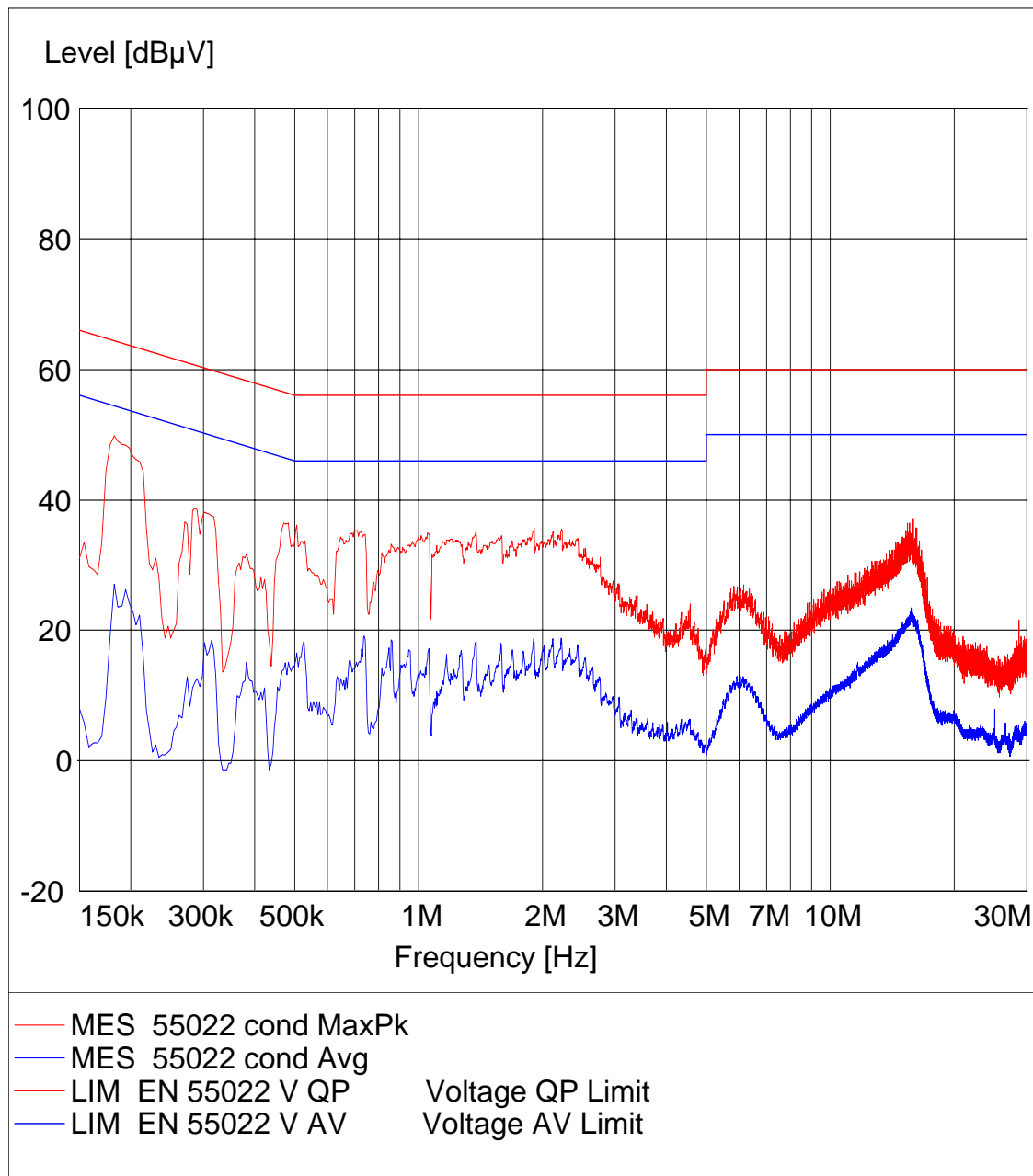
6.5.4 RESULTS Rx mode, Line

Manufacturer: Broadcom
Test Mode: RX
ANT Orientation: N/A
EUT Orientation: H
Test Engineer: Chris
Power Supply: AC
Comments: Line



6.5.5 RESULTS Rx mode, Neutral

Manufacturer: Broadcom
Test Mode: RX
ANT Orientation: N/A
EUT Orientation: H; tablet
Test Engineer: Chris
Power Supply: AC
Comments: Neutral



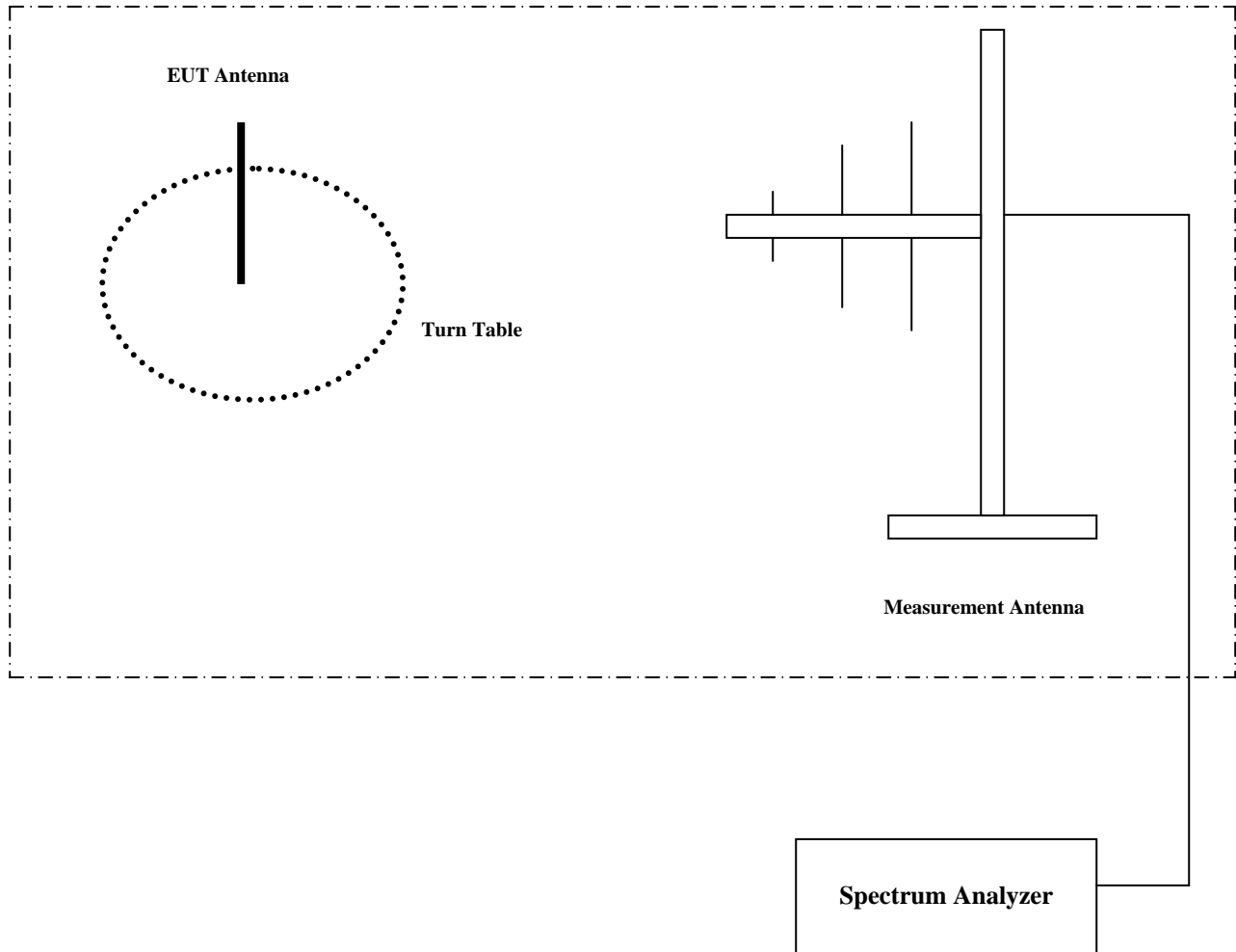
7 TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

No	Instrument/Ancillary	Type	Manufacturer	Serial No.	Cal Due	Interval
01	Spectrum Analyzer	ESIB 40	Rohde & Schwarz	100107	May 2009	1 year
02	Spectrum Analyzer	FSEM 30	Rohde & Schwarz	100017	August 2009	1 year
03	Signal Generator	SMY02	Rohde & Schwarz	836878/011	May 2009	1 year
04	Power-Meter	NRVD	Rohde & Schwarz	0857.8008.02	May 2009	1 year
05	Biconilog Antenna	3141	EMCO	0005-1186	June 2009	1 year
06	Horn Antenna (1-18GHz)	SAS-200/571	AH Systems	325	June 2009	1 year
07	Horn Antenna (18-26.5GHz)	3160-09	EMCO	1240	June 2009	1 year
08	Power Splitter	11667B	Hewlett Packard	645348	n/a	n/a
09	Climatic Chamber	VT4004	Voltsch	G1115	May 2009	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 2009	1 year
13	Power Sensor	URV5-Z2	Rohde & Schwarz	DE30807	May 2009	1 year
14	Digital Radio Comm. Tester	CMD-55	Rohde & Schwarz	847958/008	May 2009	1 year
15	Universal Radio Comm. Tester	CMU 200	Rohde & Schwarz	832221/06	May 2009	1 year
16	LISN	ESH3-Z5	Rohde & Schwarz	836679/003	May 2009	1 year
17	Loop Antenna	6512	EMCO	00049838	July 2009	2 years

8 BLOCK DIAGRAMS

Radiated Testing

ANECHOIC CHAMBER



9 Revision History

2009-3-12: First Issue

2009-3-17: Rev 1. Replaced one plot showing Power Spectral Density. Added table to summarize PSD results. Corrected misc. typos. Replaces original titled *EMC_BROAD_071_09001_15.247_2009* and dated 2009-3-12.