FCC Test Report

FCC Part 15.247 for DSSS systems

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-BRCM1019

Test report no.: EMC_BROAD_025_06002_FCC15.247_WLAN_rev1

ilac-MRA ACCREDITED Certificate # 2135.01

Bluetooth™ Bluetooth Qualification Test Facility (BQTF)

CTIA Authorized Testing Laboratory

FCC listed# 101450

IC recognized # 3925

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

Table of Contents

1 General information

1.1 Notes

The test results of this test report relate exclusively to the test item specified in 1.5. 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.

TEST REPORT PREPARED BY:
EMC Engineer: Pete Krebill

1.2 Testing laboratory

CETECOM Inc.
411 Dixon Landing Road, Milpitas, CA-95035, USA
Phone: +1 408 586 6200 Fax: +1 408 586 6299
E-mail: lothar.schmidt@cetecomusa.com
Internet: www.cetecom.com

1.3 Details of applicant

Name	:	**Broadcom Corporation**
Street	:	**190 Mathilda Place**
City / Zip Code	:	**Sunnyvale, California 94086**
Country	:	**USA**
Contact	:	**Daniel Lawless**
Telephone	:	**408 922 5870**
Tele-fax	:	**408 543 3399**
e-mail	:	**dlawless@broadcom.com**

1.4 Application details

Date of receipt test item	:	**12/13/2006**
Date of test	:	**12/18/2006**

1.5 Test item

Manufacturer	:	**Applicant**
Marketing Name	:	**802.11a/g Wireless LAN PCI-E Mini Card**
Model No.	:	**BCM94311MCAG**
Description	:	**802.11g Wireless LAN PCI-E Mini Card**
FCC-ID	:	**QDS-BRCM10190**

Additional information

Frequency	:	**2412MHz – 2462MHz**
Type of modulation	:	**DSSS**
Number of channels	:	**11**
Antenna	:	**External**
Output power	:	**19.0dBm (0.08W) conducted average power**

1.6 Test standards: FCC Part 15 §15.247

2. Technical test

2.1 Summary of test results

No deviations from the technical specification(s) were ascertained in the course of the tests Performed	
Final Verdict: (Only “passed” if all single measurements are “passed”)	**Passed**

Technical responsibility for area of testing:

Date	Section	Name	Signature
1/2/2007	EMC & Radio	Lothar Schmidt (Manager)	

2.2 Test report

TEST REPORT

Test report no.: EMC_BROAD_025_06002_FCC15.247_WLAN

TEST REPORT REFERENCE

LIST OF MEASUREMENTS PAGE

1.1 MAXIMUM PEAK OUTPUT POWER § 15.247 (b) (1)
1.2 (RADIATED)

EIRP:

802.11b

TEST CONDITIONS		MAXIMUM PEAK OUTPUT POWER (dBm)		
Frequency (MHz)		2412	2437	2462
T_{nom}(23)°C	V_{nom}	20.10	19.10	19.65
Measurement uncertainty		±0.5dBm		

802.11g

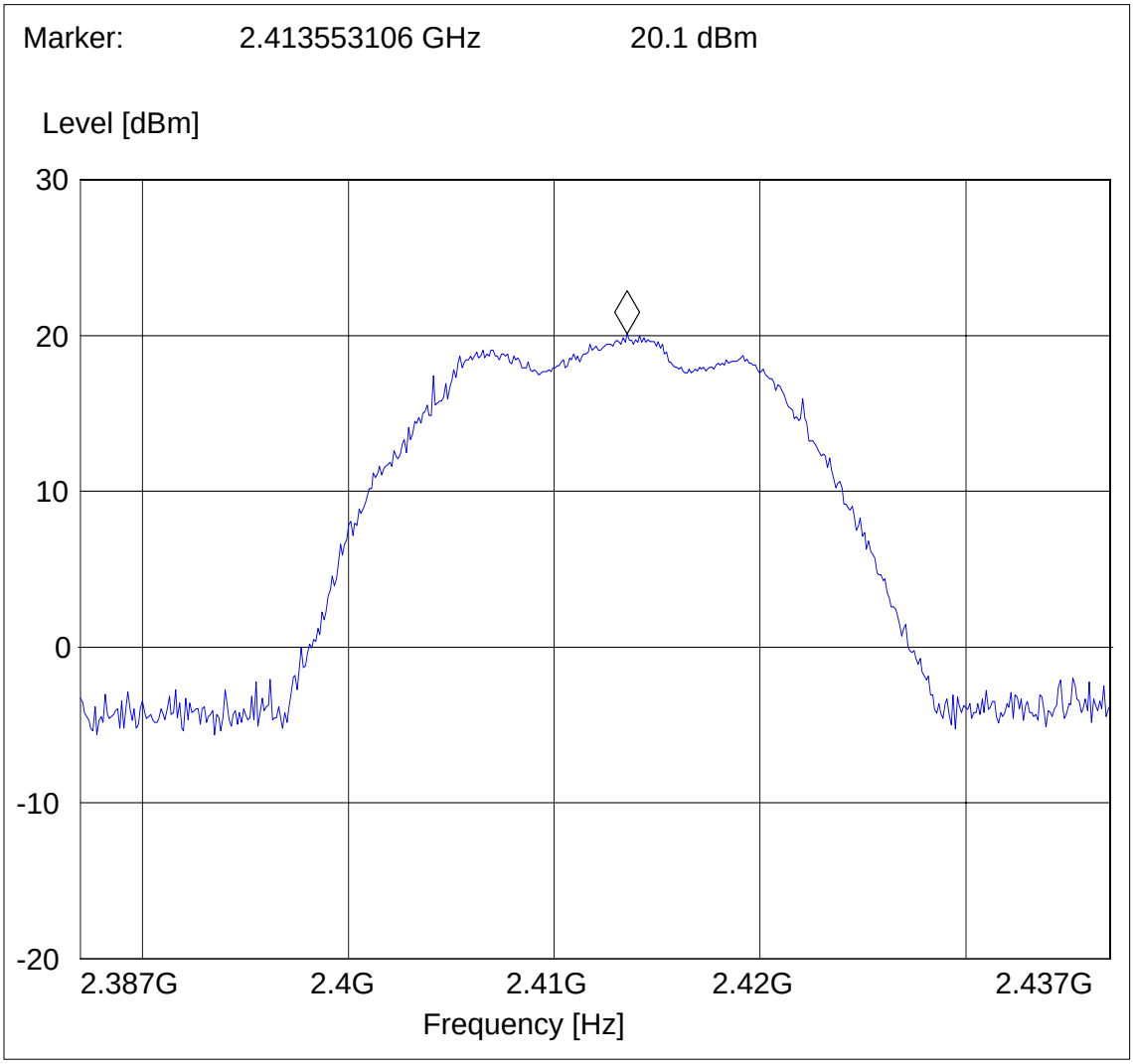
TEST CONDITIONS		MAXIMUM PEAK OUTPUT POWER (dBm)		
Frequency (MHz)		2412	2437	2462
T_{nom}(23)°C	V_{nom}	24.61	22.72	23.68
Measurement uncertainty		±0.5dBm		

Notes:
1. All channels were set to transmit with 19.0 dBm conducted average output power. These power settings were used for all tests shown in this report.
2. EIRP was measured with the device transmitting on both the auxiliary and the main antenna. The EIRP was highest when transmitting on the auxiliary antenna. EIRP values shown in this report are with the device transmitting on the auxiliary antenna.

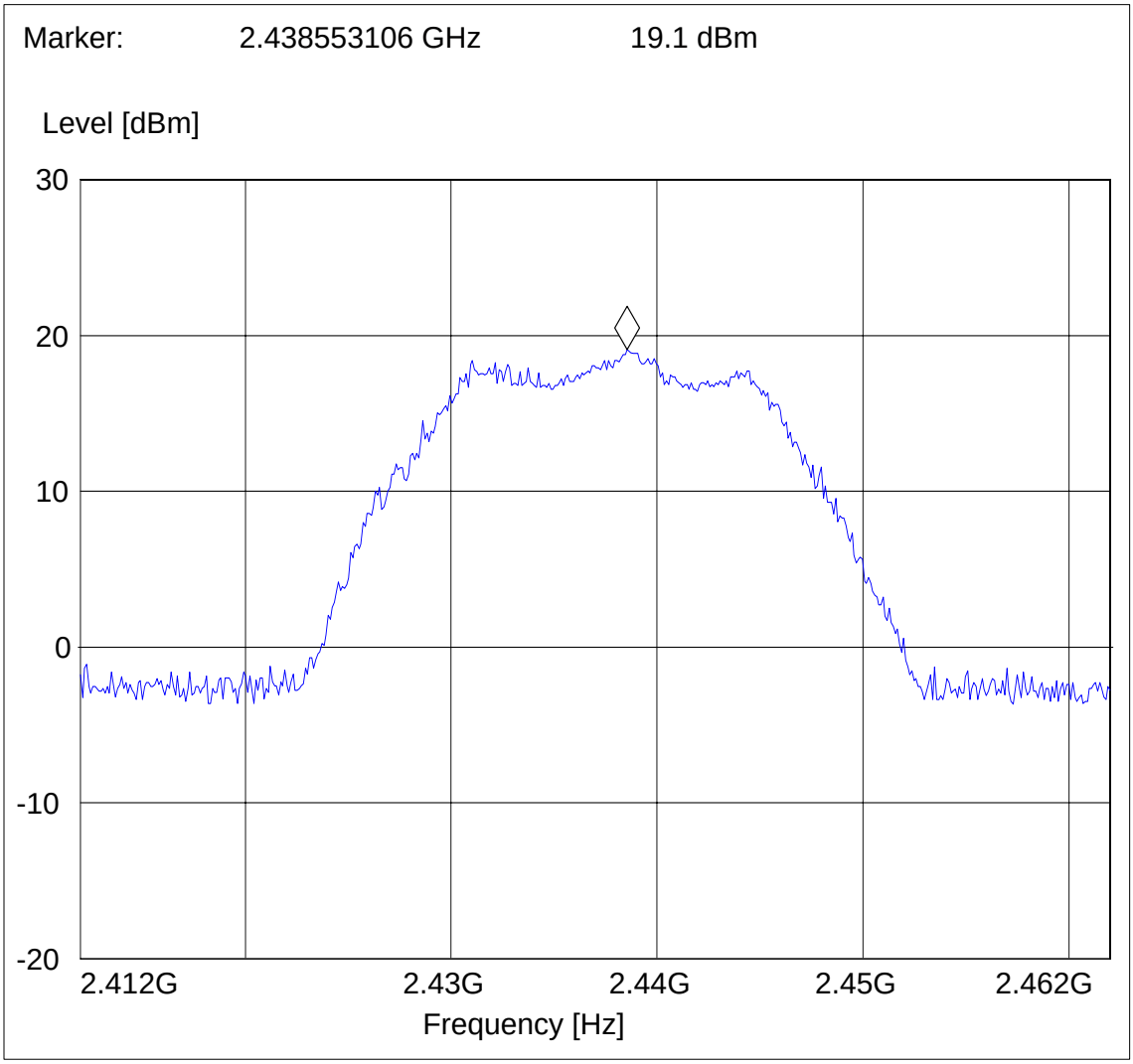
LIMIT **SUBCLAUSE § 15.247 (b) (1)**

Frequency range	RF power output
2400-2483.5 MHz	30dBm on Conducted

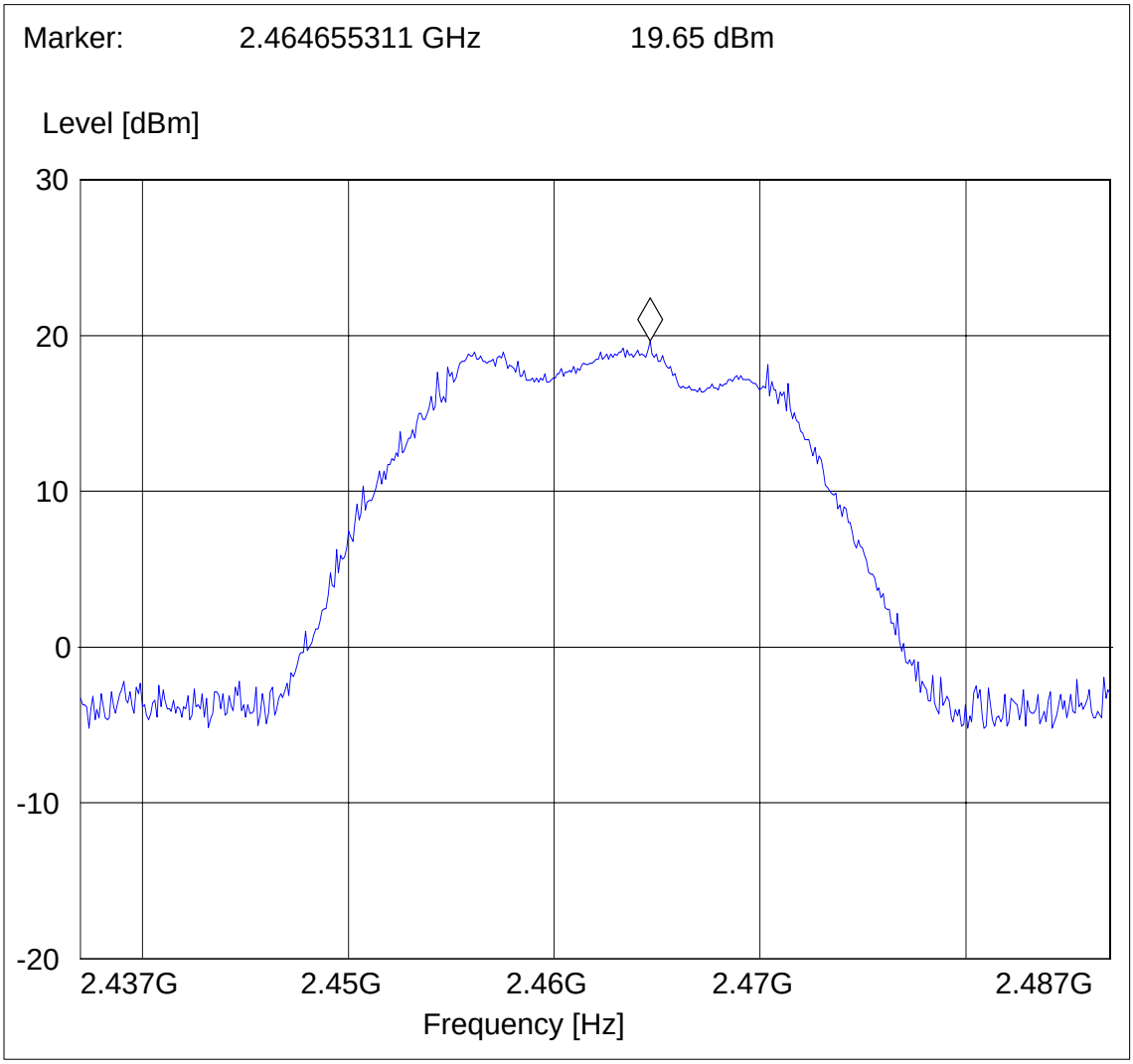
EIRP: 2412MHz (802.11b)
CETECOM Inc.
411 Dixon Landing Road, Milpitas CA 95035, USA
EUT:: 4311 MCAG modem
Customer:: Broadcom
Test Mode: RLAN, 802.11b, tch ch 1
Ant Orientation: H
EUT Orientation: H, auxilary antenna.
Test Engineer: Ed
Voltage:: AC Adapter
Sweep: EIRP RLAN CH1



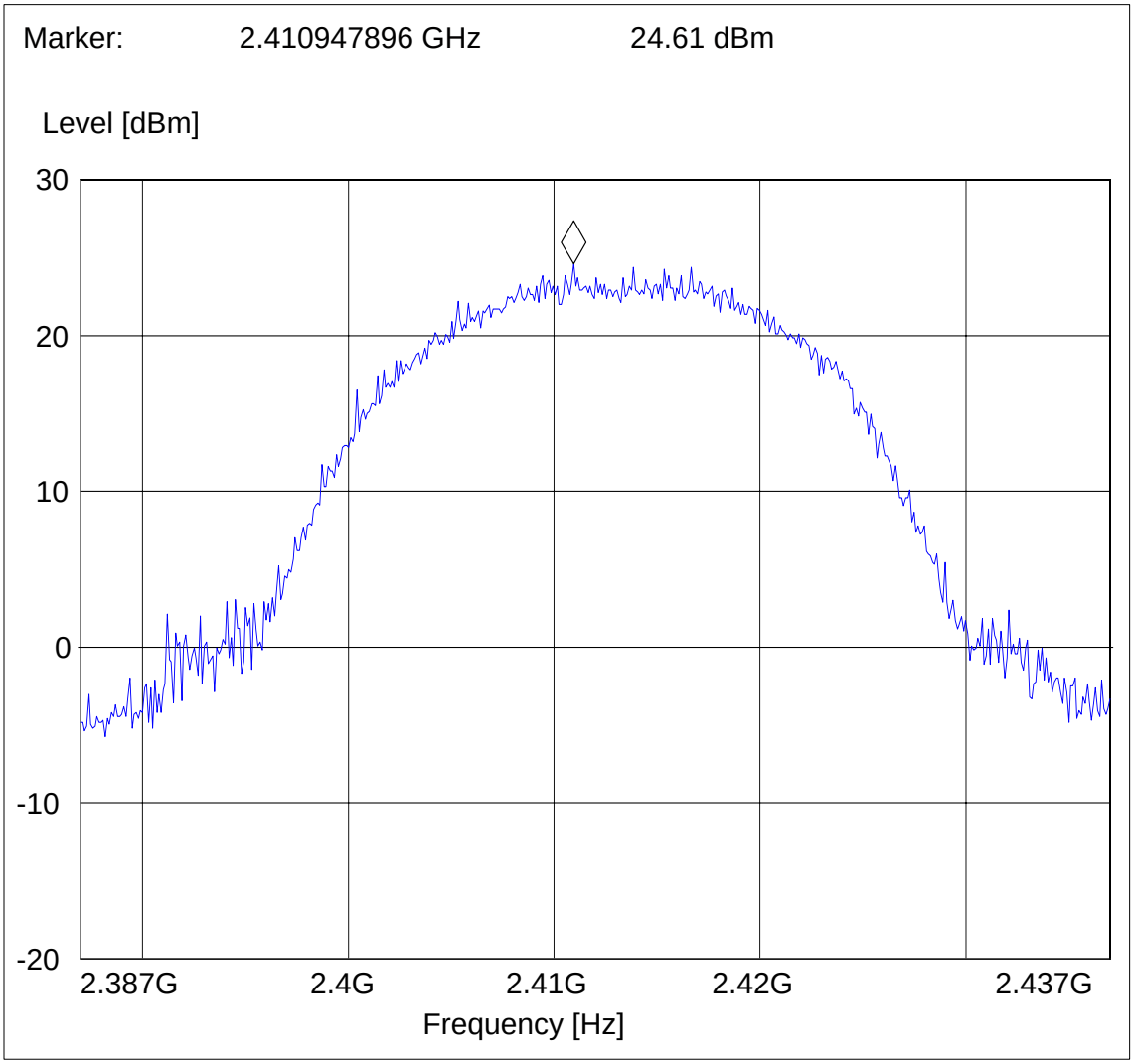
EIRP: 2437MHz (802.11b)
CETECOM Inc.
411 Dixon Landing Road, Milpitas CA 95035, USA
EUT:: 4311 MCAG modem
Customer:: Broadcom
Test Mode: RLAN, 802.11b, tch ch 6
Ant Orientation: H
EUT Orientation: H, auxilary antenna.
Test Engineer: Ed
Voltage:: AC Adapter
Sweep: EIRP RLAN CH6



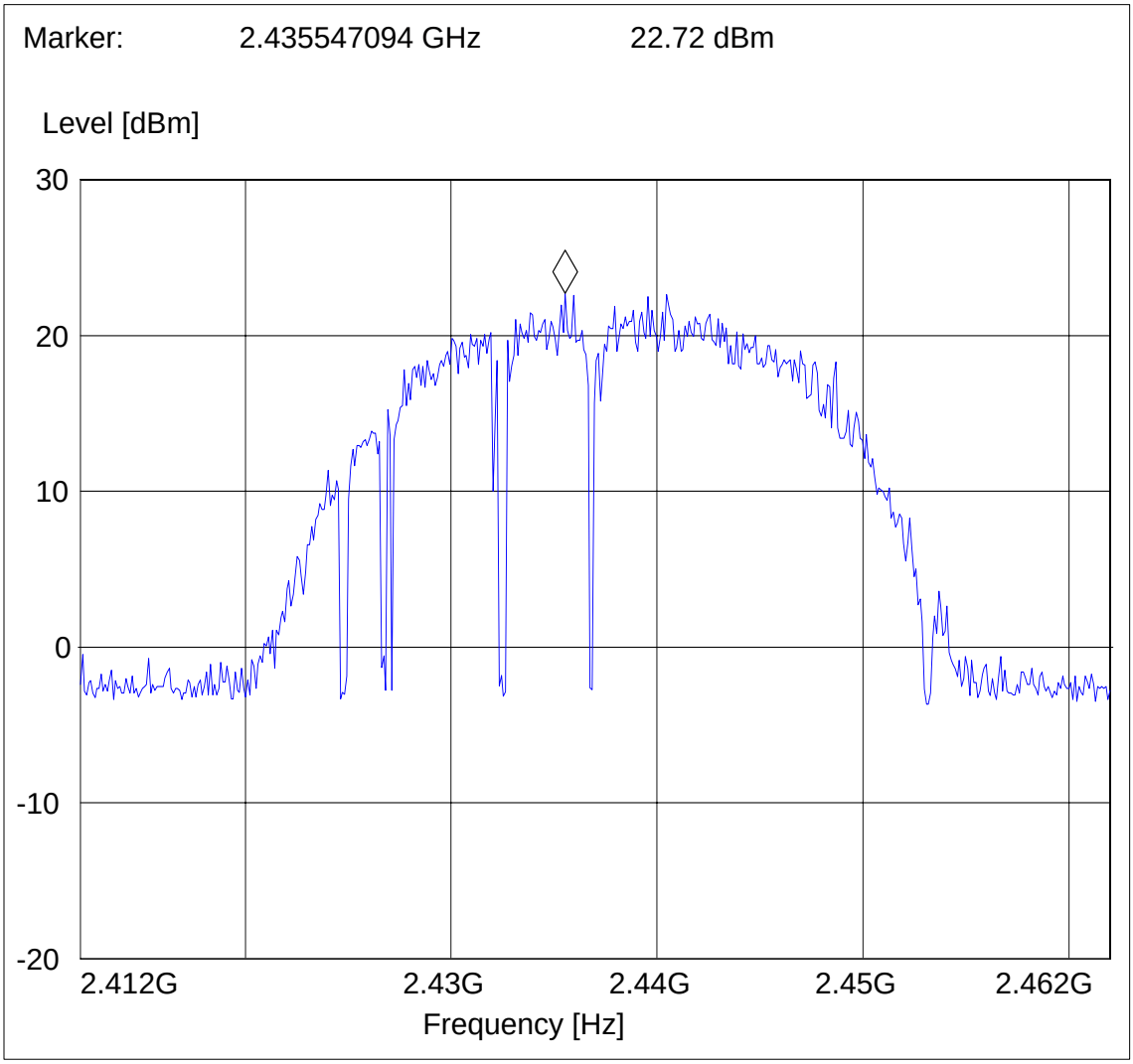
EIRP: 2462MHz (802.11b)
CETECOM Inc.
411 Dixon Landing Road, Milpitas CA 95035, USA
EUT:: 4311 MCAG modem
Customer:: Broadcom
Test Mode: RLAN, 802.11b, tch ch 11
Ant Orientation: H
EUT Orientation: H, auxilary antenna.
Test Engineer: Ed
Voltage:: AC Adapter
Sweep: EIRP RLAN CH11



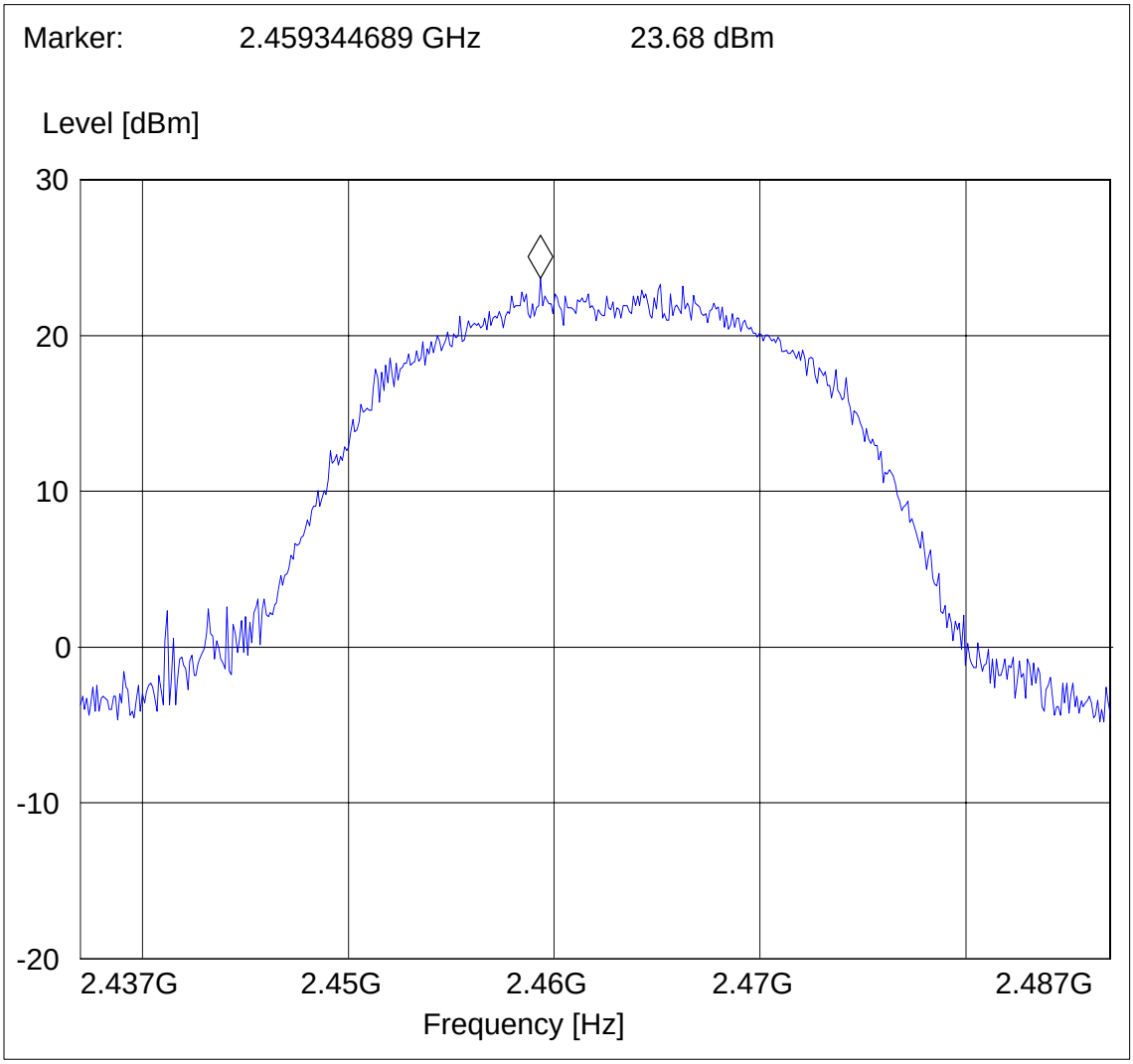
EIRP: 2412MHz (802.11g)
CETECOM Inc.
411 Dixon Landing Road, Milpitas CA 95035, USA
EUT:: 4311 MCAG modem
Customer:: Broadcom
Test Mode: RLAN, 802.11g, tch ch 1
Ant Orientation: H
EUT Orientation: H, auxilary antenna.
Test Engineer: Ed
Voltage:: AC Adapter
Comments::



EIRP: 2437MHz (802.11g)
CETECOM Inc.
411 Dixon Landing Road, Milpitas CA 95035, USA
EUT:: 4311 MCAG modem
Customer:: Broadcom
Test Mode: RLAN, 802.11g, tch ch 6
Ant Orientation: H
EUT Orientation: H, auxilary antenna.
Test Engineer: Ed
Voltage:: AC Adapter
Comments::

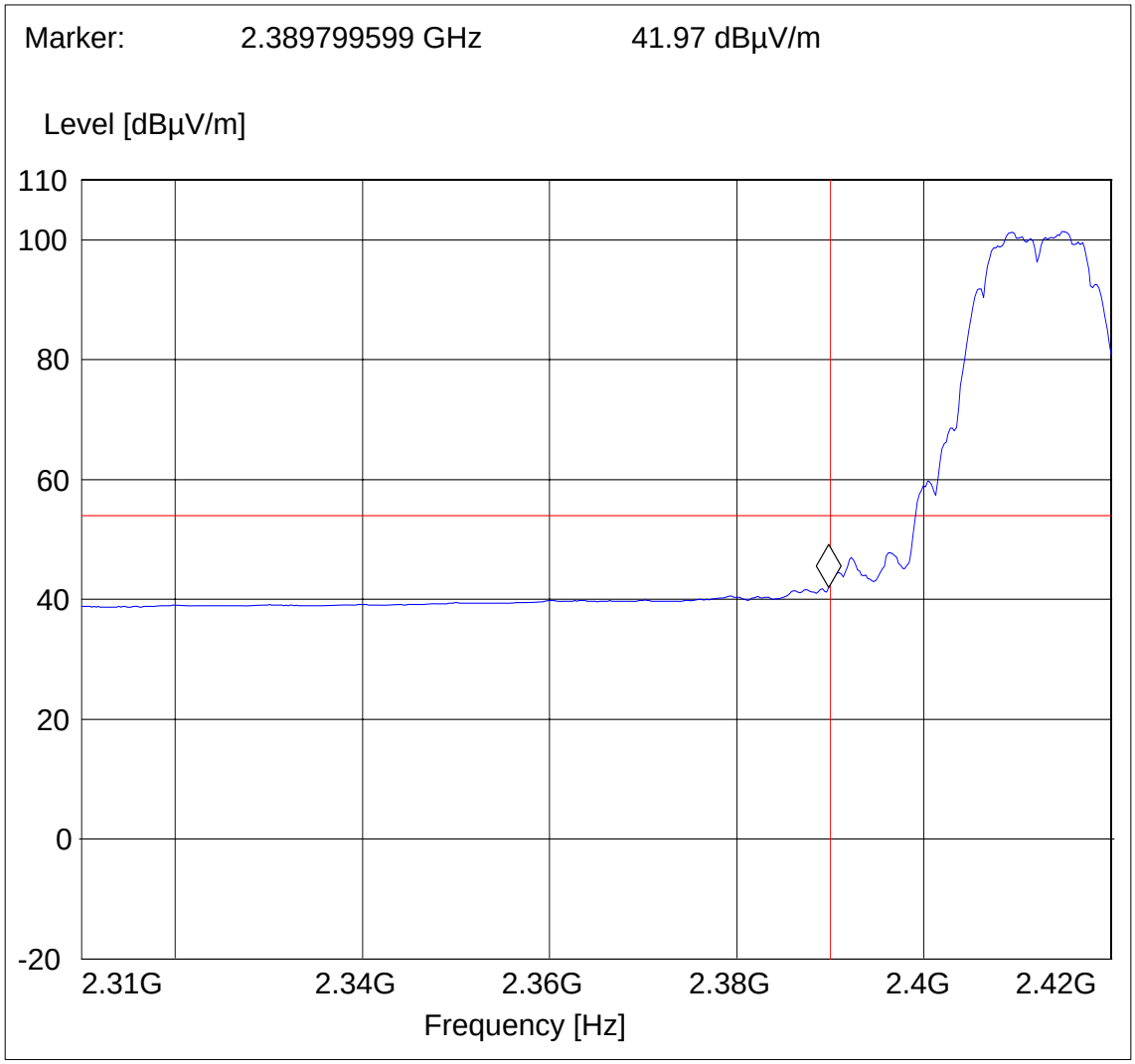


EIRP: 2462MHz (802.11g)
CETECOM Inc.
411 Dixon Landing Road, Milpitas CA 95035, USA
EUT:: 4311 MCAG modem
Customer:: Broadcom
Test Mode: RLAN, 802.11g, tch ch 11
Ant Orientation: H
EUT Orientation: H, auxilary antenna.
Test Engineer: Ed
Voltage:: AC Adapter
Comments::



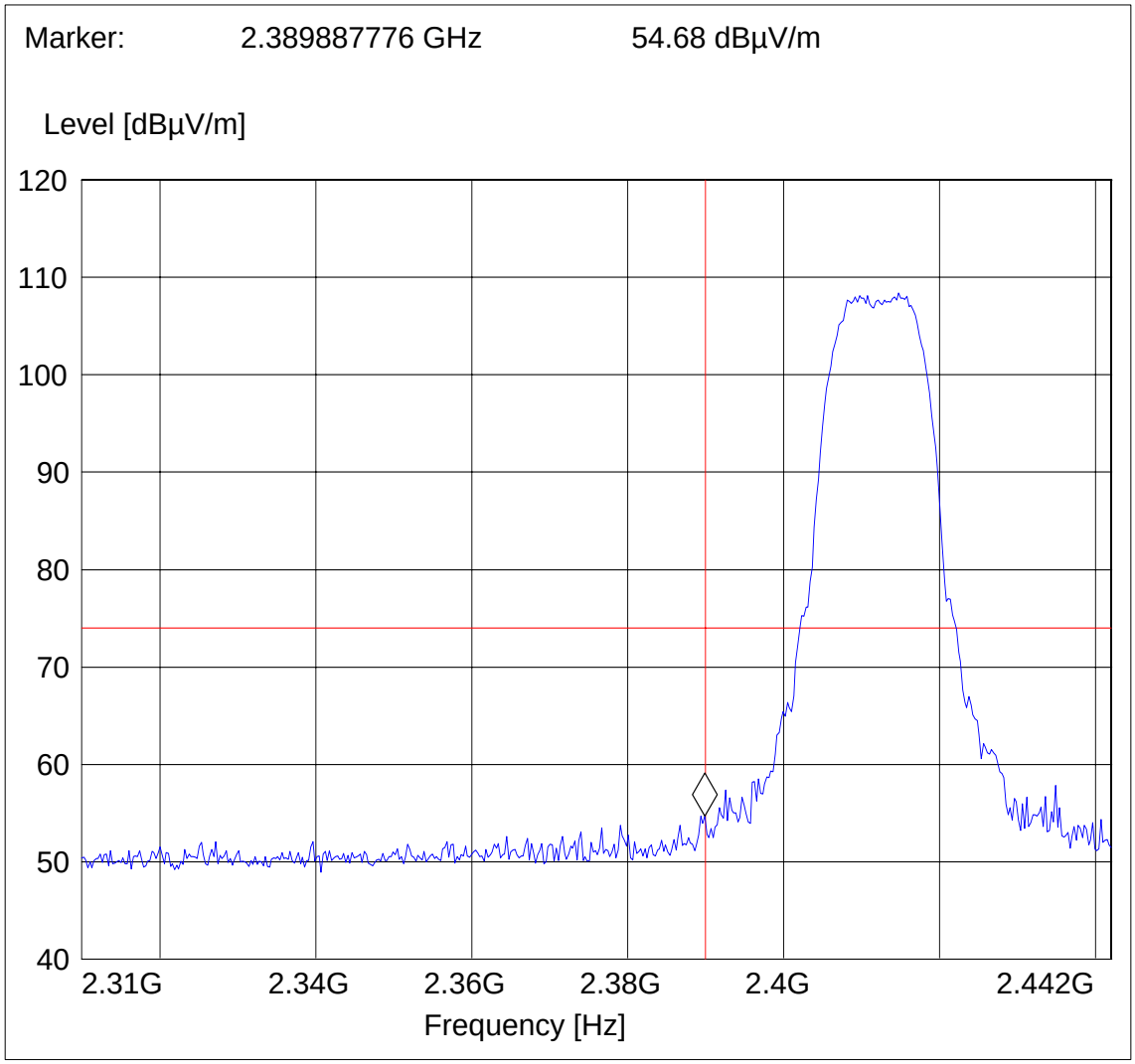
1.3 BAND EDGE COMPLIANCE §15.247 (c)

802.11b Low frequency section (spurious in the restricted band 2310 – 2390 MHz)
(Average measurement)
CETECOM Inc.
411 Dixon Landing Road, Milpitas CA 95035, USA
EUT:: 4311 MCAG modem
Customer:: Broadcom
Test Mode: RLAN, 802.11b, tch ch 1
Ant Orientation: H
EUT Orientation: H, auxilary antenna.
Test Engineer: Ed
Voltage:: AC Adapter
Comments::



1.4 BAND EDGE COMPLIANCE §15.247 (c)

802.11b Low frequency section (spurious in the restricted band 2310 – 2390 MHz)
(Peak measurement)
CETECOM Inc.
411 Dixon Landing Road, Milpitas CA 95035, USA
EUT:: 4311 MCAG modem
Customer:: Broadcom
Test Mode: RLAN, 802.11b, tch ch 1
Ant Orientation: H
EUT Orientation: H, auxilary antenna.
Test Engineer: Ed
Voltage:: Battery
Comments::



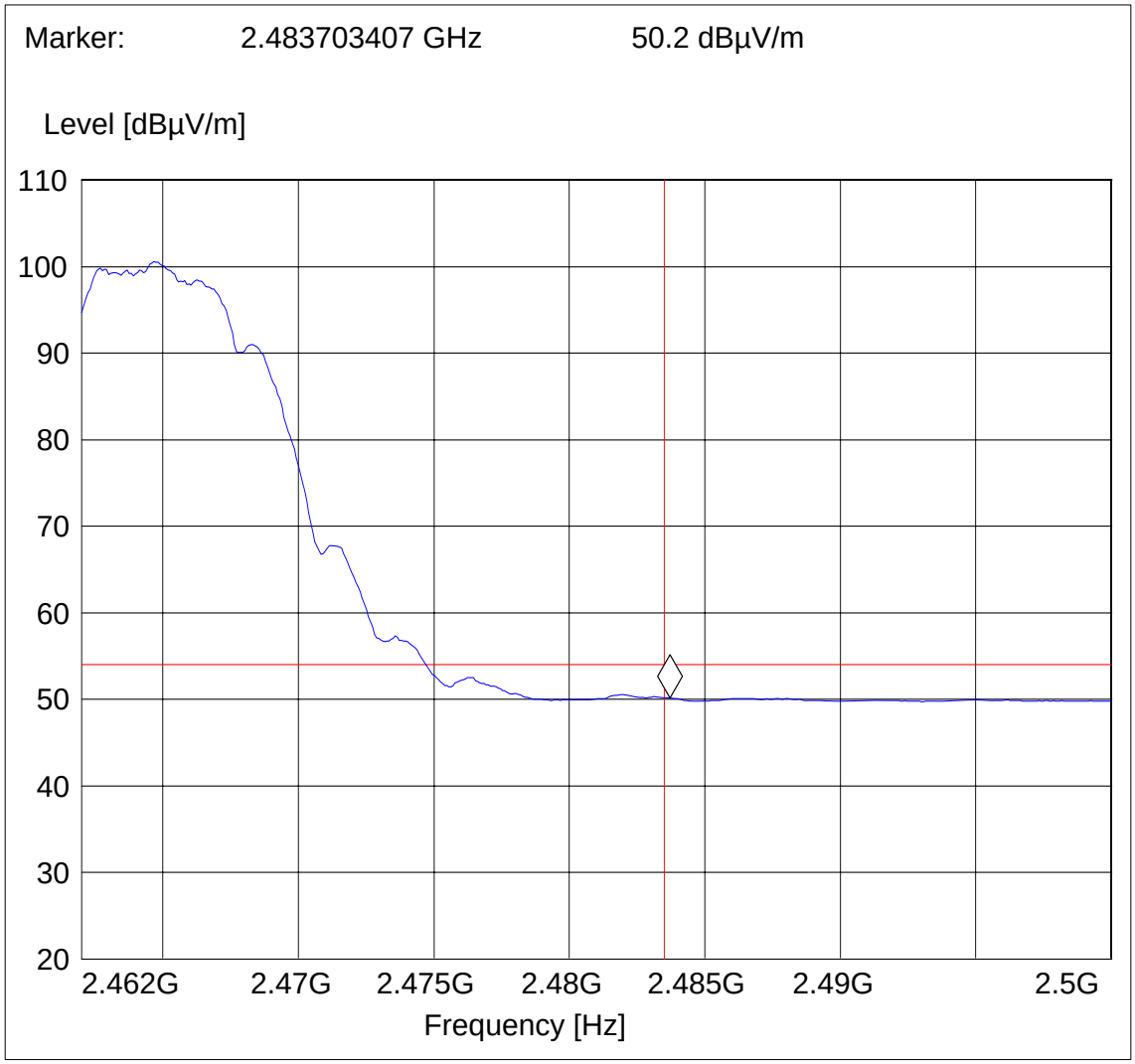
1.5 BAND EDGE COMPLIANCE §15.247 (c)

802.11b High frequency section (spurious in the restricted band 2483.5 – 2500 MHz) (Average measurement)

CETECOM Inc.

411 Dixon Landing Road, Milpitas CA 95035, USA

EUT:: 4311 MCAG modem
Customer:: Broadcom
Test Mode: RLAN, 802.11b, tch ch 11
Ant Orientation: H
EUT Orientation: H, auxilary antenna.
Test Engineer: Ed
Voltage:: AC Adapter
Comments::



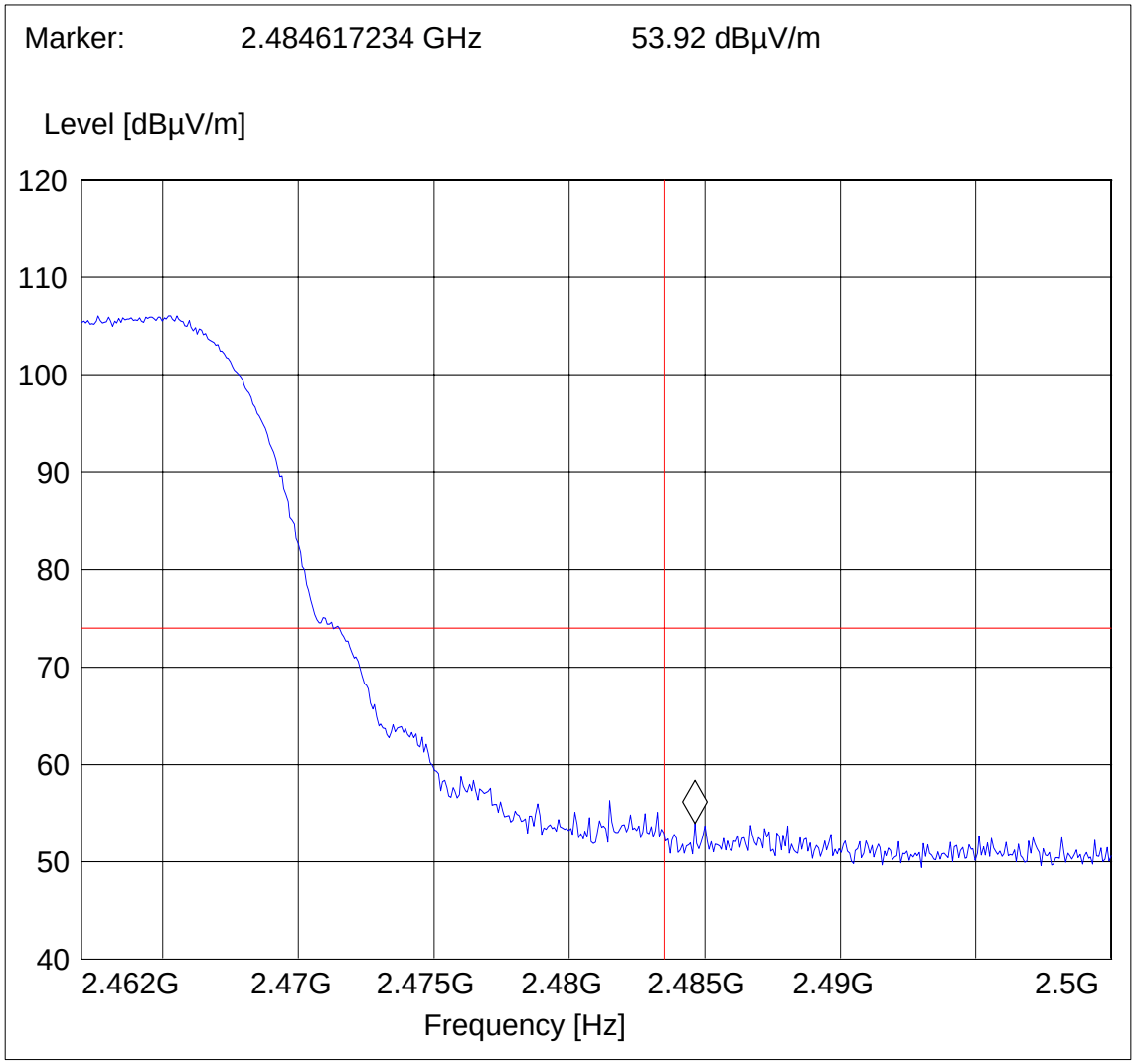
1.6 BAND EDGE COMPLIANCE §15.247 (c)

802.11b High frequency section (spurious in the restricted band 2483.5 – 2500 MHz) (Peak measurement)

CETECOM Inc.

411 Dixon Landing Road, Milpitas CA 95035, USA

EUT:: 4311 MCAG modem
Customer:: Broadcom
Test Mode: RLAN, 802.11b, tch ch 11
Ant Orientation: H
EUT Orientation: H, auxilary antenna.
Test Engineer: Ed
Voltage:: Battery
Comments::



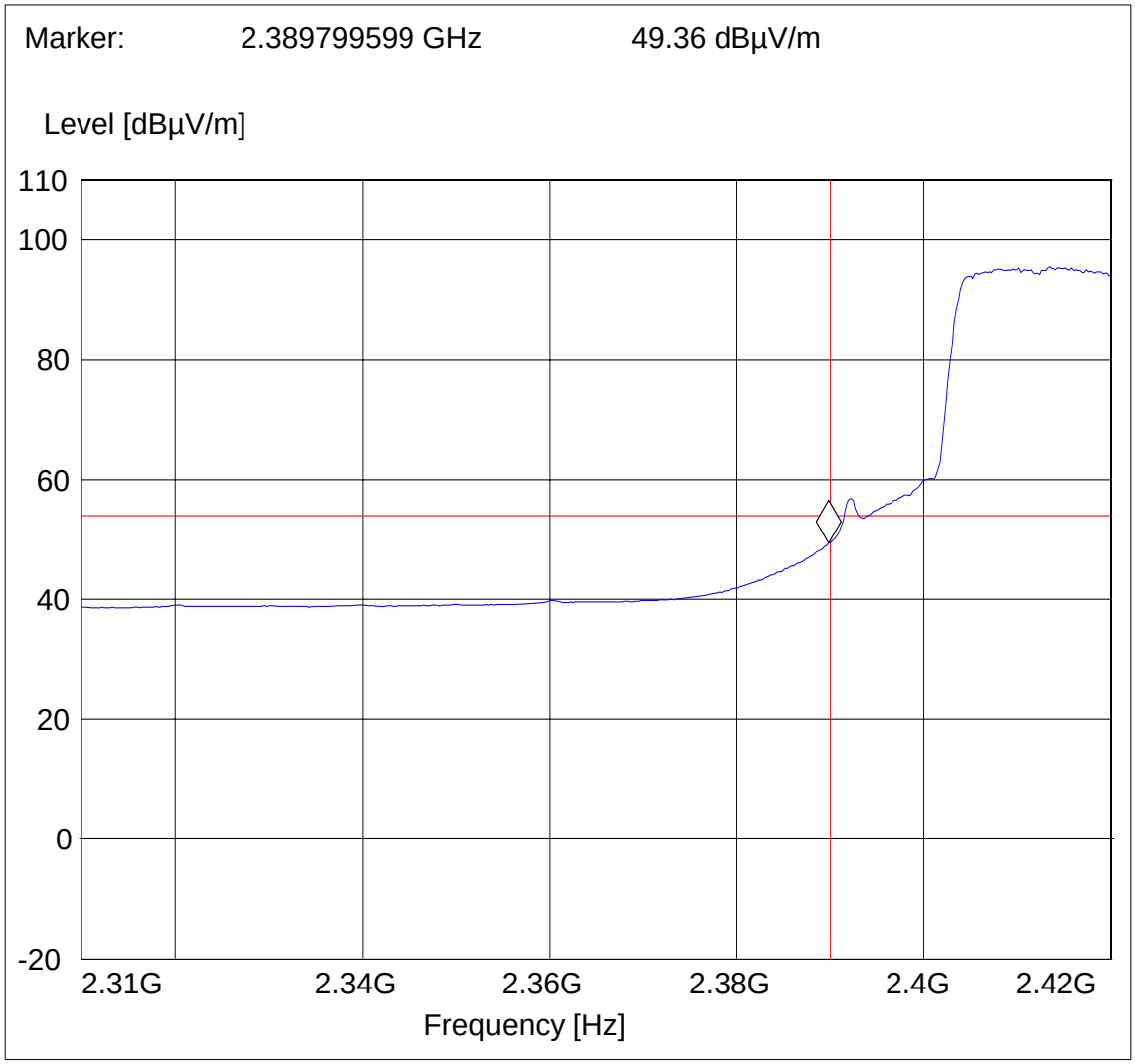
BAND EDGE COMPLIANCE §15.247 (c)

802.11g Low frequency section (spurious in the restricted band 2310 – 2390 MHz) (Average measurement)

CETECOM Inc.

411 Dixon Landing Road, Milpitas CA 95035, USA

EUT:: 4311 MCAG modem
Customer:: Broadcom
Test Mode: RLAN, 802.11g, tch ch 1
Ant Orientation: H
EUT Orientation: H, auxilary antenna.
Test Engineer: Ed
Voltage:: AC Adapter
Comments::



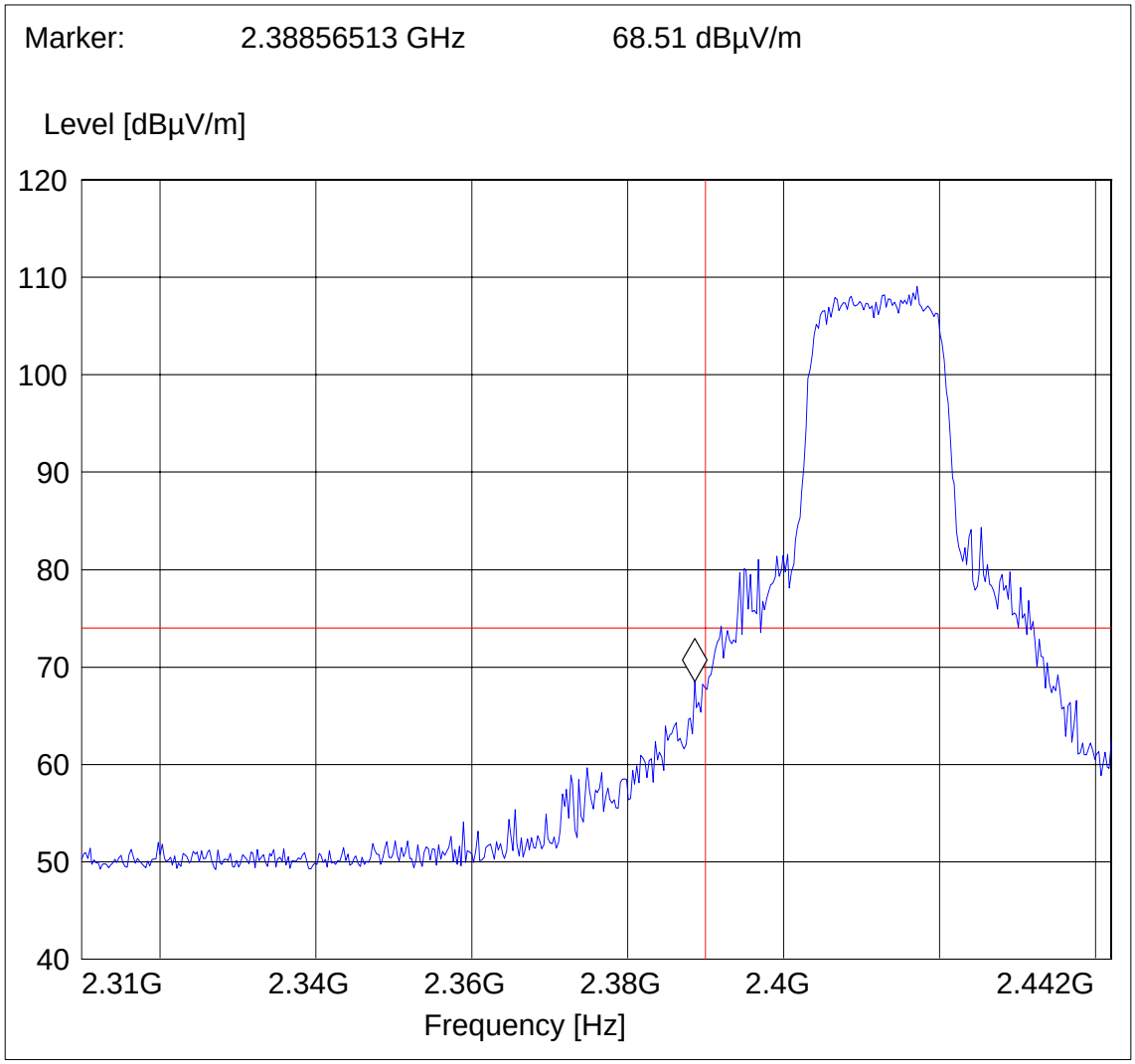
BAND EDGE COMPLIANCE §15.247 (c)

802.11g Low frequency section (spurious in the restricted band 2310 – 2390 MHz) (Peak measurement)

CETECOM Inc.

411 Dixon Landing Road, Milpitas CA 95035, USA

EUT:: 4311 MCAG modem
Customer:: Broadcom
Test Mode: RLAN, 802.11g, tch ch 1
Ant Orientation: H
EUT Orientation: H, auxilary antenna.
Test Engineer: Ed
Voltage:: Battery
Comments::



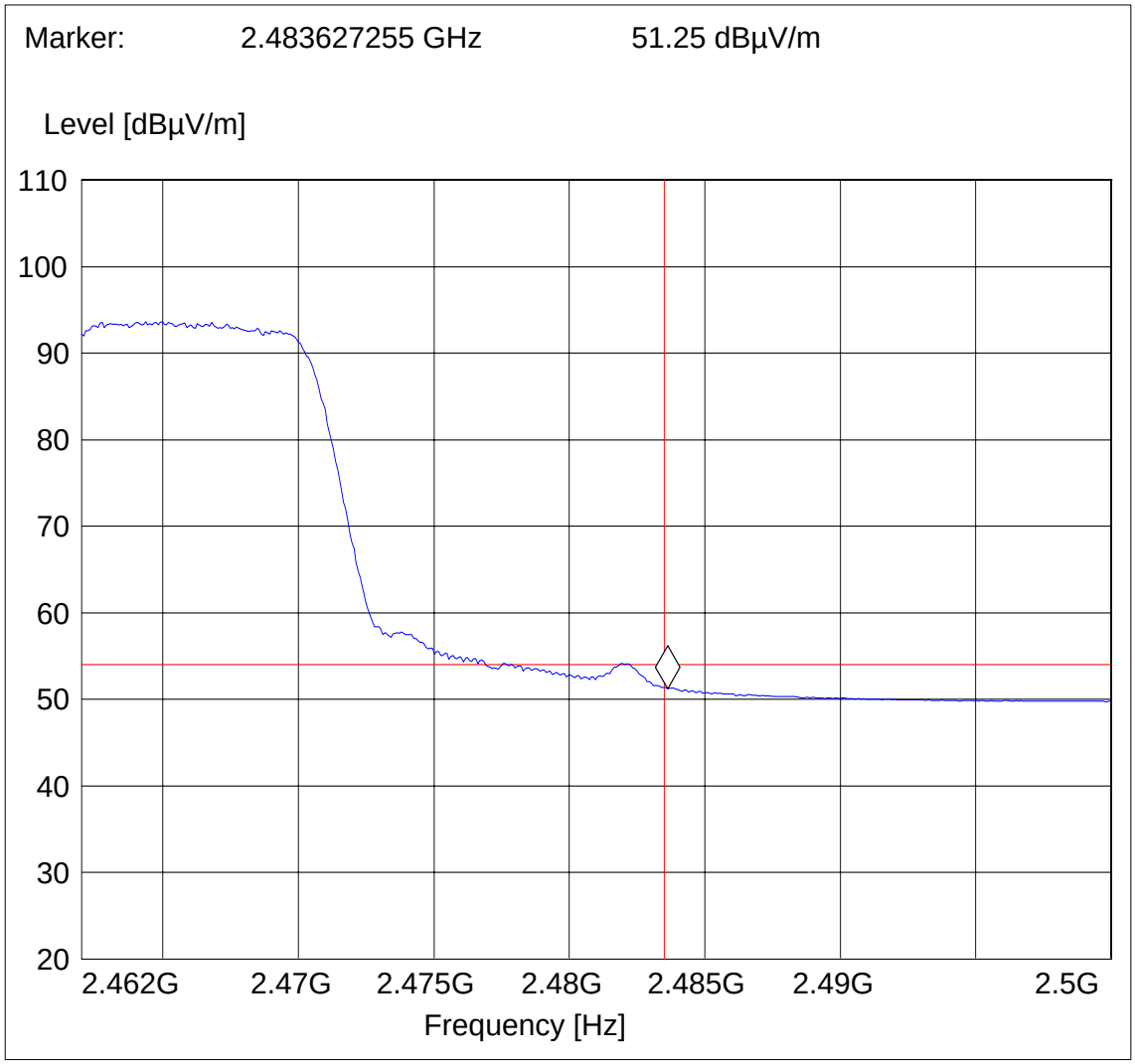
BAND EDGE COMPLIANCE §15.247 (c)

802.11g High frequency section (spurious in the restricted band 2483.5 – 2500 MHz) (Average measurement)

CETECOM Inc.

411 Dixon Landing Road, Milpitas CA 95035, USA

EUT:: 4311 MCAG modem
Customer:: Broadcom
Test Mode: RLAN, 802.11g, tch ch 11
Ant Orientation: H
EUT Orientation: H, auxilary antenna.
Test Engineer: Ed
Voltage:: AC Adapter
Comments::



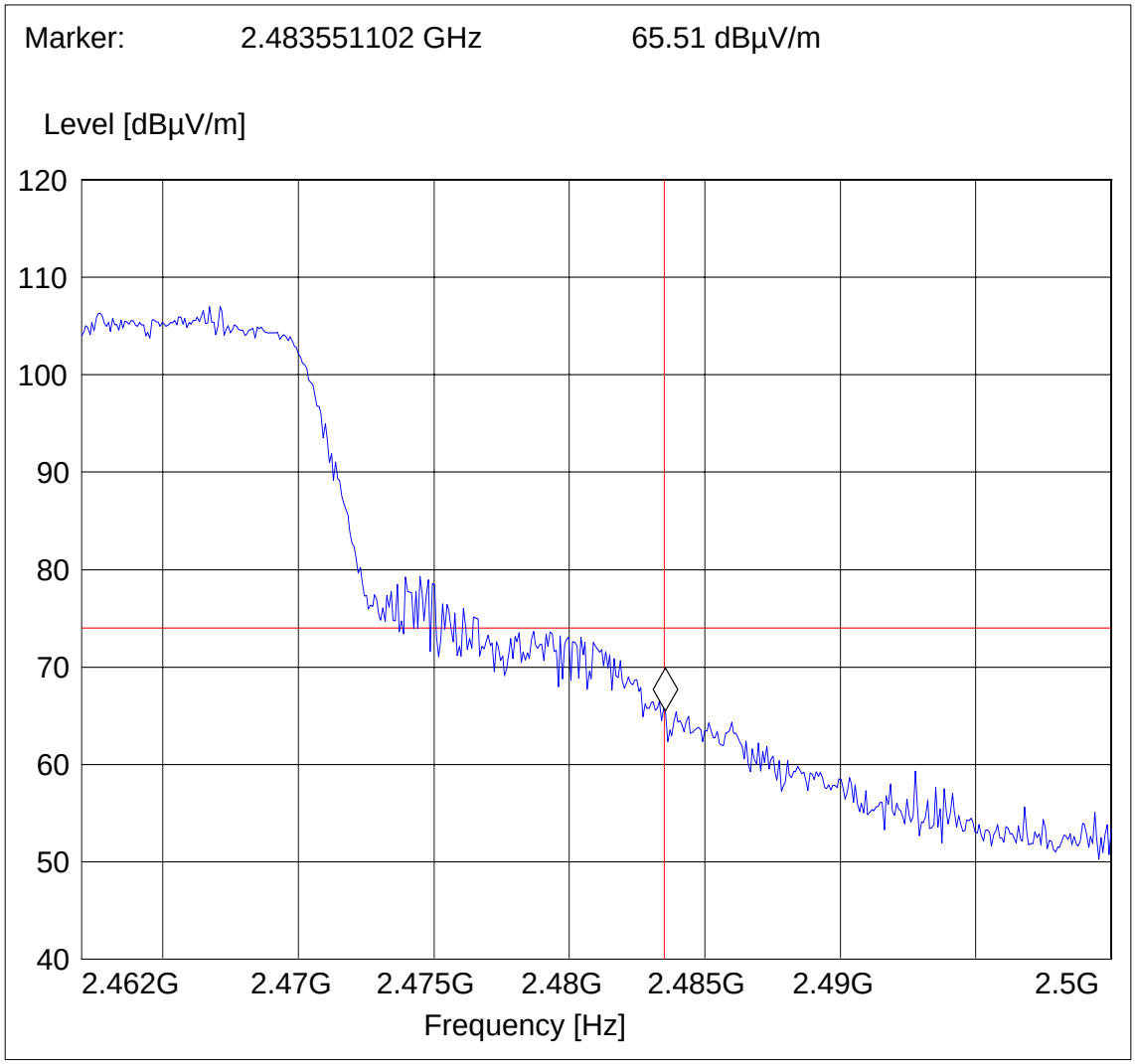
BAND EDGE COMPLIANCE §15.247 (c)

802.11g High frequency section (spurious in the restricted band 2483.5 – 2500 MHz) (Peak measurement)

CETECOM Inc.

411 Dixon Landing Road, Milpitas CA 95035, USA

EUT:: 4311 MCAG modem
Customer:: Broadcom
Test Mode: RLAN, 802.11g, tch ch 11
Ant Orientation: H
EUT Orientation: H, auxilary antenna.
Test Engineer: Ed
Voltage:: AC Adapter
Comments::



EMISSION LIMITATIONS **§ 15.247 (c) (1)**
Transmitter (Radiated)

LIMITS

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions, which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

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 26.5 GHz very short cable connections to the antenna was used to minimize the noise level.

2. All measurements are done in peak mode unless specified with the plots.

3. Emissions were measured with the device in 802.11b mode and 802.11g mode. Emissions were highest in 802.11g mode. All emissions shown below are for 802.11g mode.

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

1.7 EMISSION LIMITATIONS - Radiated (Transmitter) § 15.247 (c) (1)

Transmit at Lowest channel Frequency 2412MHz			
Frequency (MHz)	**Level (dBµV/m)**		
	Peak	**Quasi-Peak**	**Average**
SEE PLOTS			
Transmit at Middle channel Frequency 2437MHz			
Frequency (MHz)	**Level (dBµV/m)**		
	Peak	**Quasi-Peak**	**Average**
SEE PLOTS			
Transmit at Highest channel Frequency 2462MHz			
Frequency (MHz)	**Level (dBµV/m)**		
	Peak	**Quasi-Peak**	**Average**
SEE PLOTS			

1.8 EMISSION LIMITATIONS - Radiated (Transmitter) § 15.247 (c) (1)

Lowest Channel (2412MHz): 30MHz – 1GHz

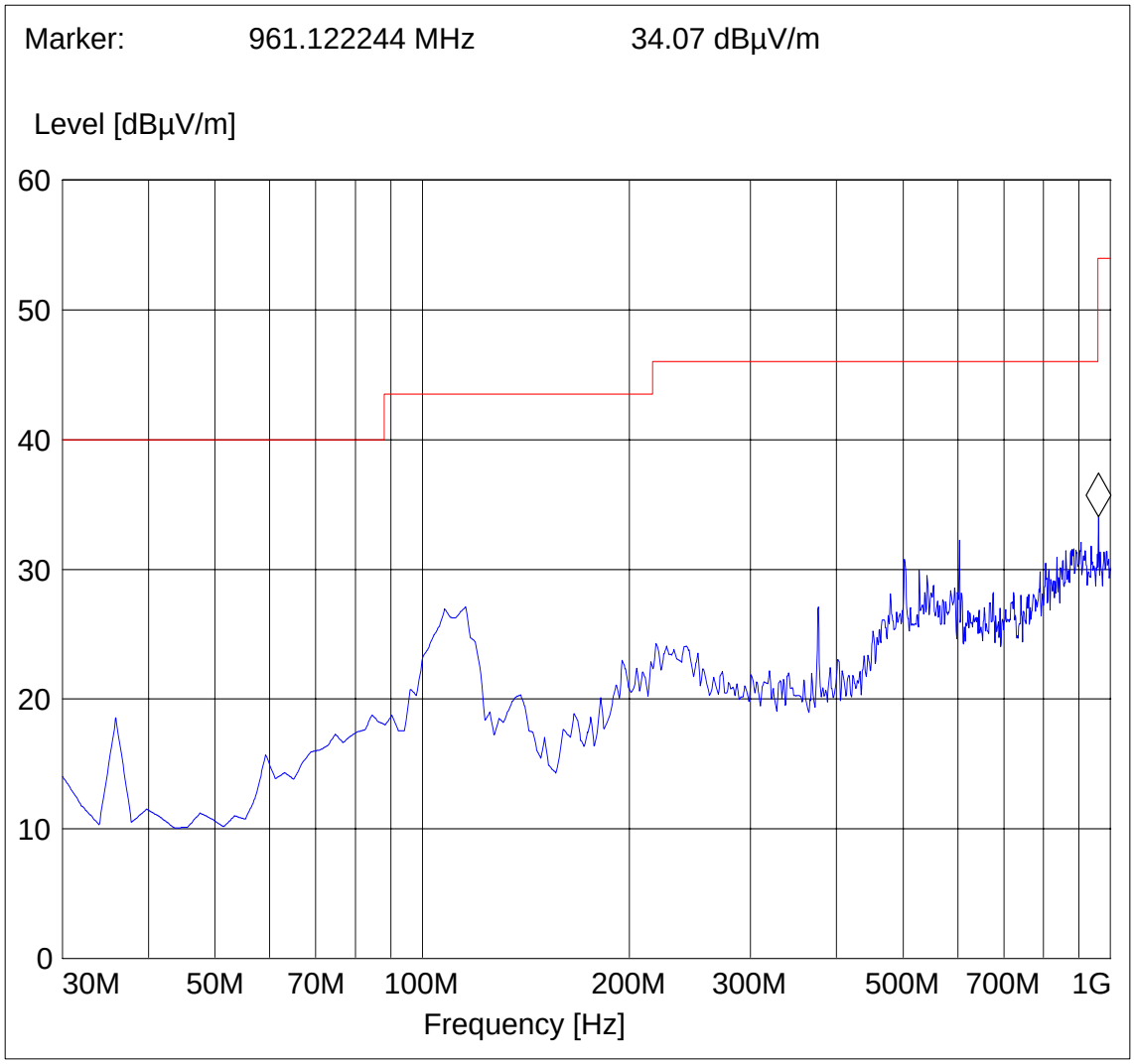
Antenna: Vertical

Note: This plot is valid for low, mid, high channels (worst-case plot)

CETECOM Inc.

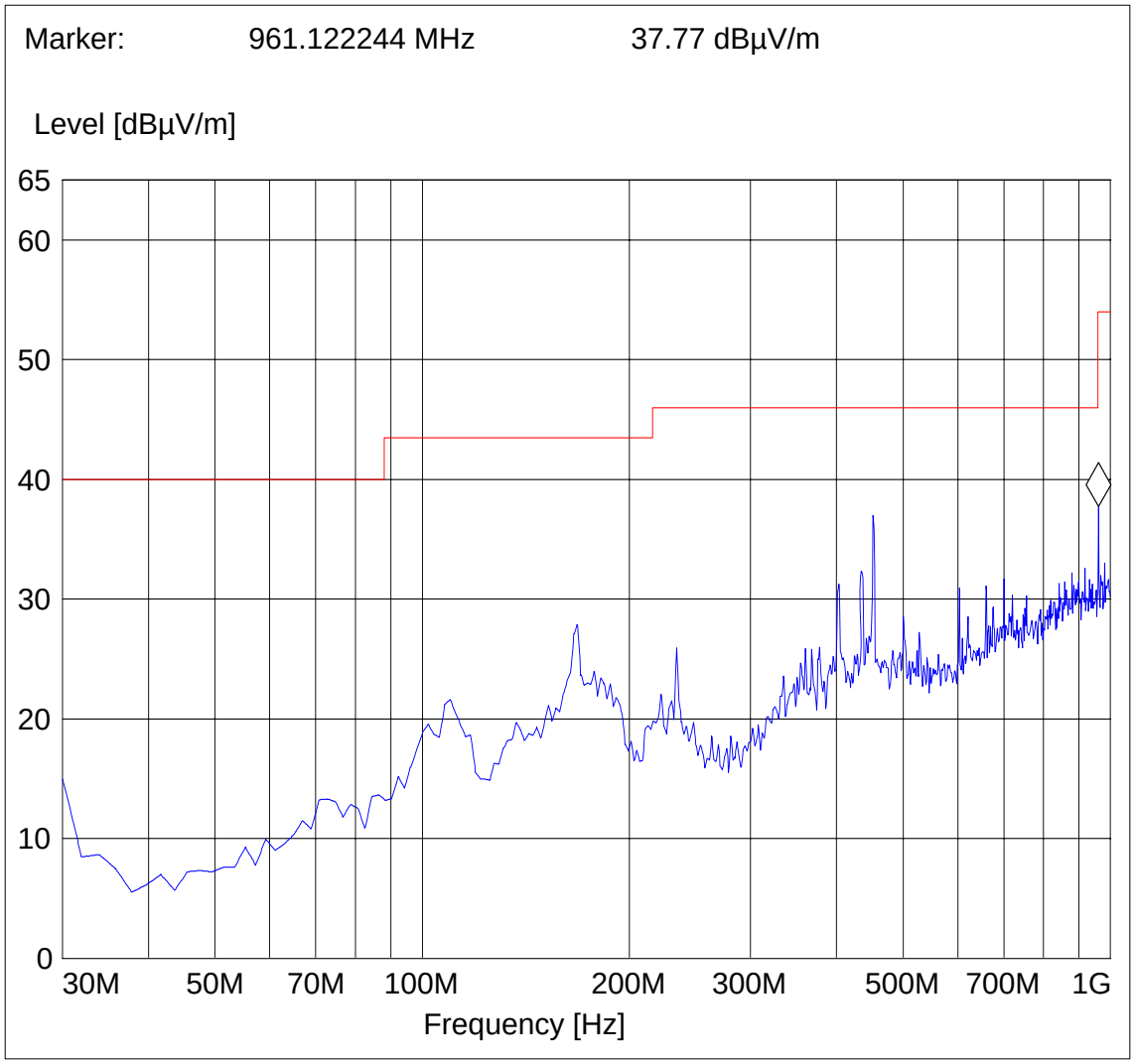
411 Dixon Landing Road, Milpitas CA 95035, USA

EUT:: 4311 MCAG modem
Customer:: Broadcom
Test Mode: RLAN, 802.11g, tch ch 1
Ant Orientation: V
EUT Orientation: H, auxilary antenna.
Test Engineer: Ed
Voltage:: Battery
Comments::



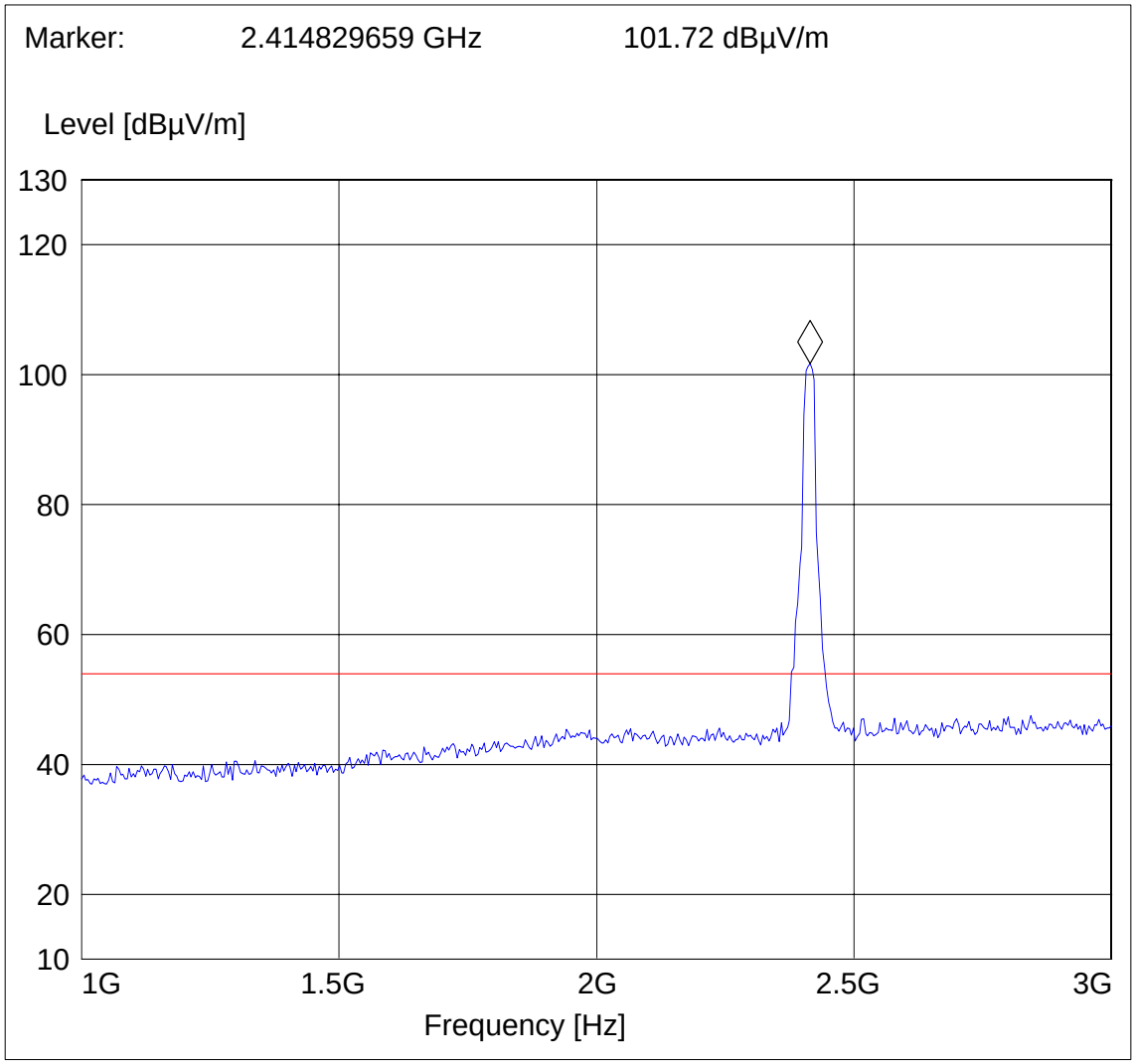
EMISSION LIMITATIONS - Radiated (Transmitter) **§ 15.247 (c) (1)**
Lowest Channel (2412MHz): 30MHz – 1GHz
Antenna: Horizontal

Note: This plot is valid for low, mid, high channels (worst-case plot)
CETECOM Inc.
411 Dixon Landing Road, Milpitas CA 95035, USA
EUT:: 4311 MCAG modem
Customer:: Broadcom
Test Mode: RLAN, 802.11g, tch ch 1
Ant Orientation: H
EUT Orientation: H, auxilary antenna.
Test Engineer: Ed
Voltage:: Battery
Comments::



EMISSION LIMITATIONS - Radiated (Transmitter) § 15.247 (c) (1)
Lowest Channel (2412MHz): 1GHz – 3GHz

Note: Peak above the limit line is the carrier freq.
CETECOM Inc.
411 Dixon Landing Road, Milpitas CA 95035, USA
EUT:: 4311 MCAG modem
Customer:: Broadcom
Test Mode: RLAN, 802.11g, tch ch 1
Ant Orientation: H
EUT Orientation: H, auxilary antenna.
Test Engineer: Ed
Voltage:: AC Adapter
Comments:: marker is on uplink sig.



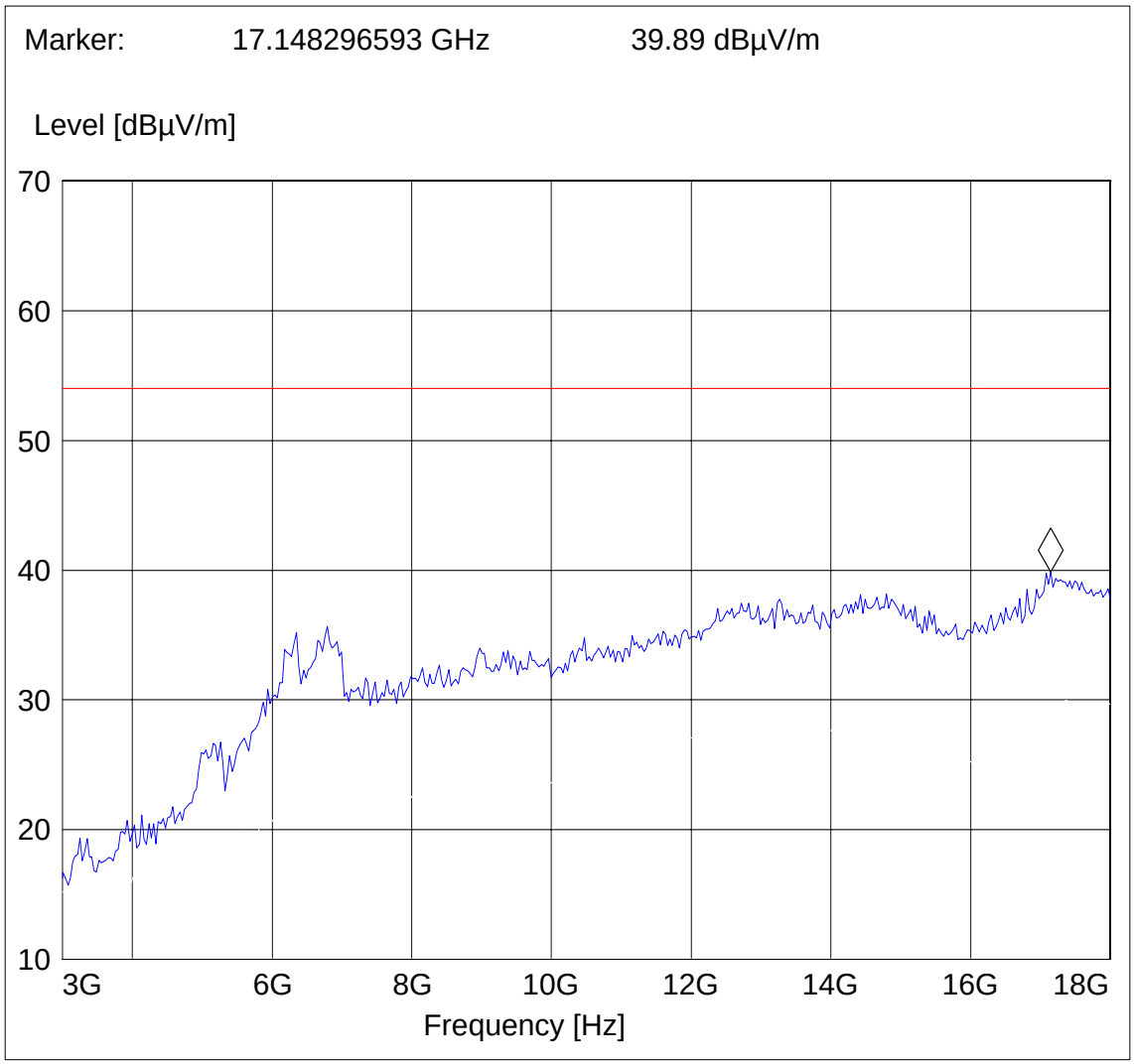
EMISSION LIMITATIONS - Radiated (Transmitter) **§ 15.247 (c) (1)**

Lowest Channel (2412MHz): 3GHz – 18GHz

CETECOM Inc.

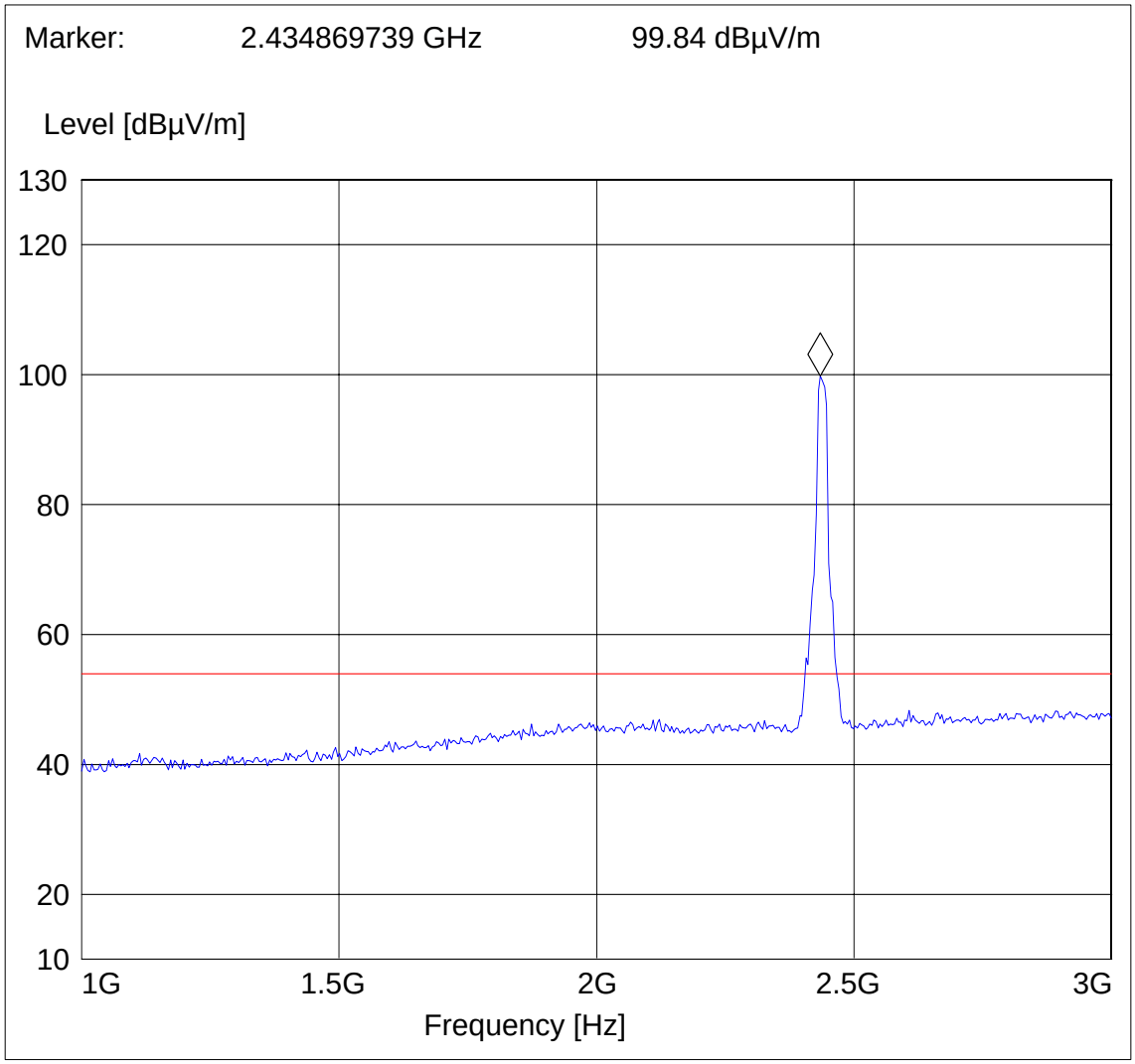
411 Dixon Landing Road, Milpitas CA 95035, USA

EUT:: 4311 MCAG modem
Customer:: Broadcom
Test Mode: RLAN, 802.11g, tch ch 1
Ant Orientation: H
EUT Orientation: H, auxilary antenna.
Test Engineer: Ed
Voltage:: AC Adapter
Comments::

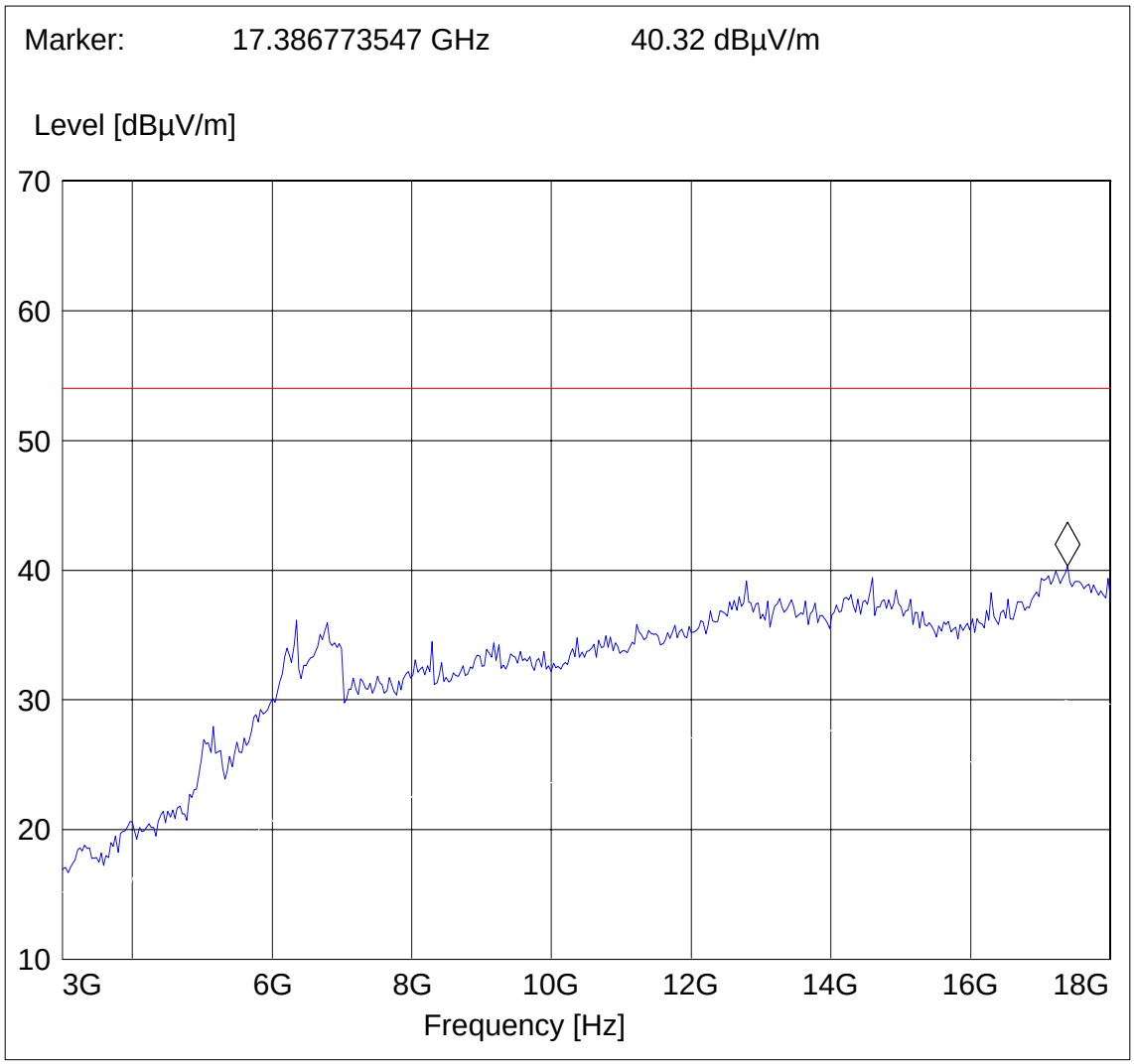


EMISSION LIMITATIONS - Radiated (Transmitter) **§ 15.247 (c) (1)**
Mid Channel (2437MHz): 1GHz – 3GHz

Note: The peak above the limit line is the carrier freq.
CETECOM Inc.
411 Dixon Landing Road, Milpitas CA 95035, USA
EUT:: 4311 MCAG modem
Customer:: Broadcom
Test Mode: RLAN, 802.11g, tch ch 6
Ant Orientation: H
EUT Orientation: H, auxilary antenna.
Test Engineer: Ed
Voltage:: AC Adapter
Comments:: marker is on uplink sig.

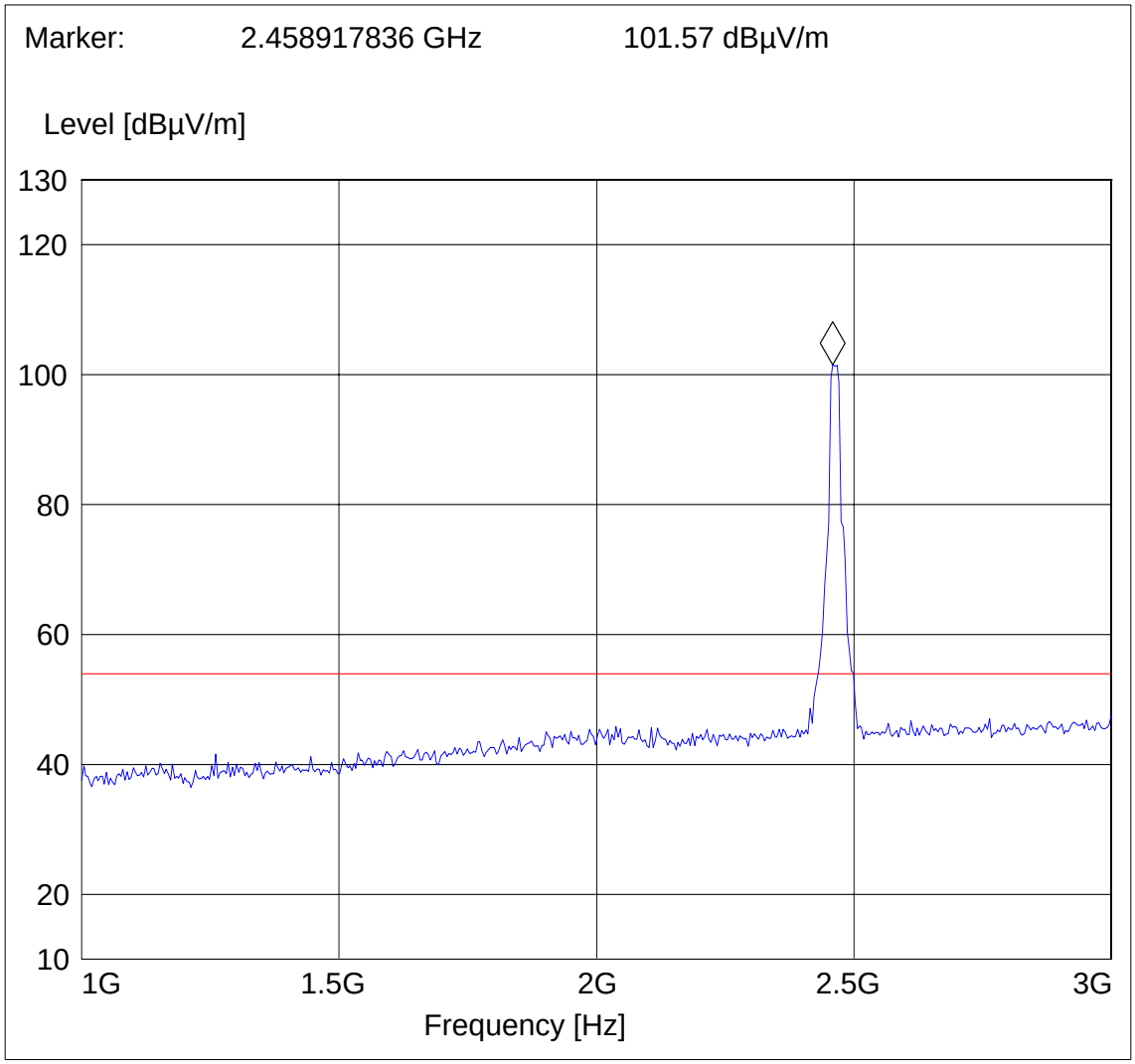


EMISSION LIMITATIONS - Radiated (Transmitter) **§ 15.247 (c) (1)**
Mid Channel (2437MHz): 3GHz – 18GHz
CETECOM Inc.
411 Dixon Landing Road, Milpitas CA 95035, USA
EUT:: 4311 MCAG modem
Customer:: Broadcom
Test Mode: RLAN, 802.11g, tch ch 6
Ant Orientation: H
EUT Orientation: H, auxilary antenna.
Test Engineer: Ed
Voltage:: AC Adapter
Comments::

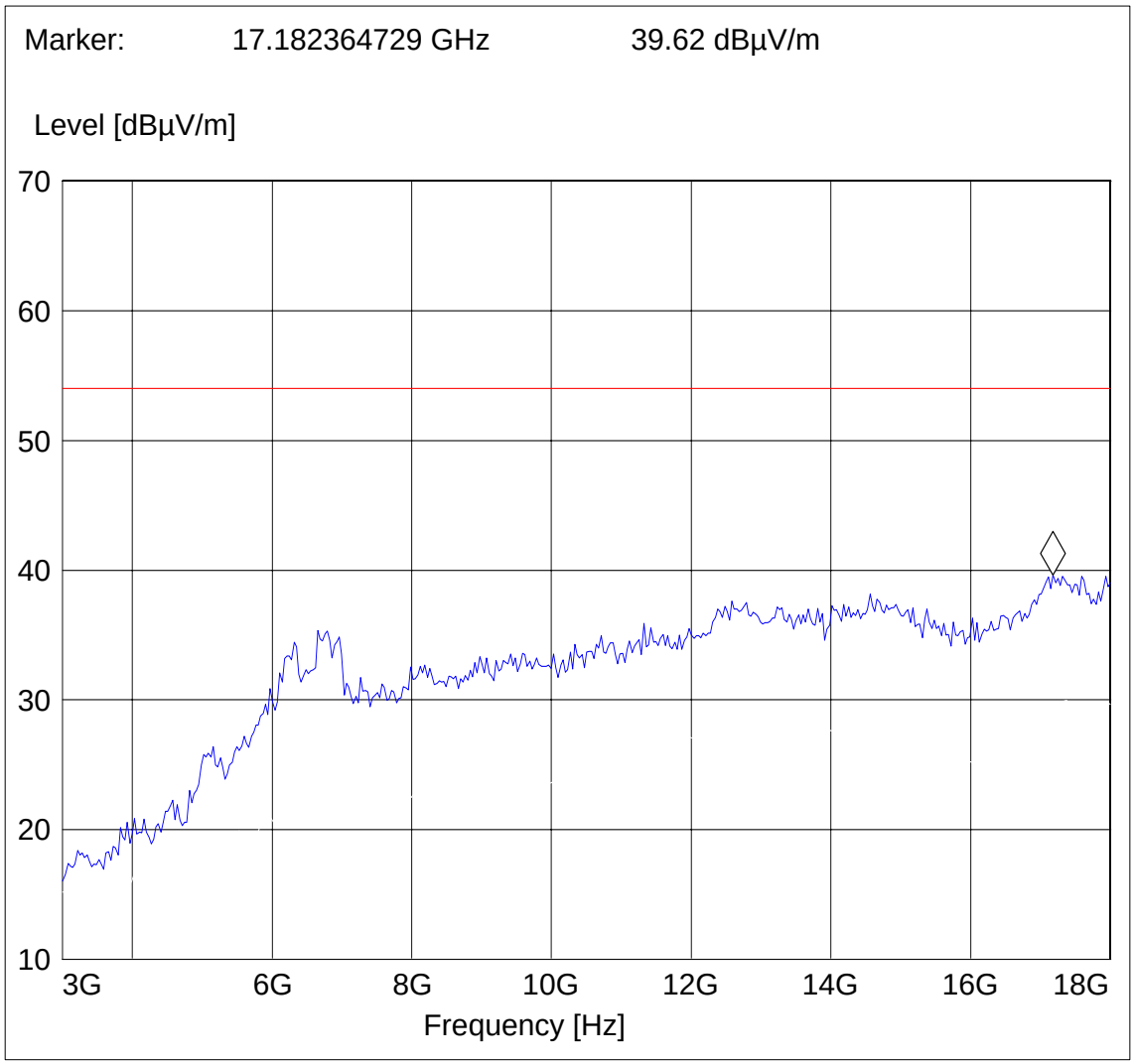


EMISSION LIMITATIONS - Radiated (Transmitter) **§ 15.247 (c) (1)**
Highest Channel (2462MHz): 1GHz – 3GHz

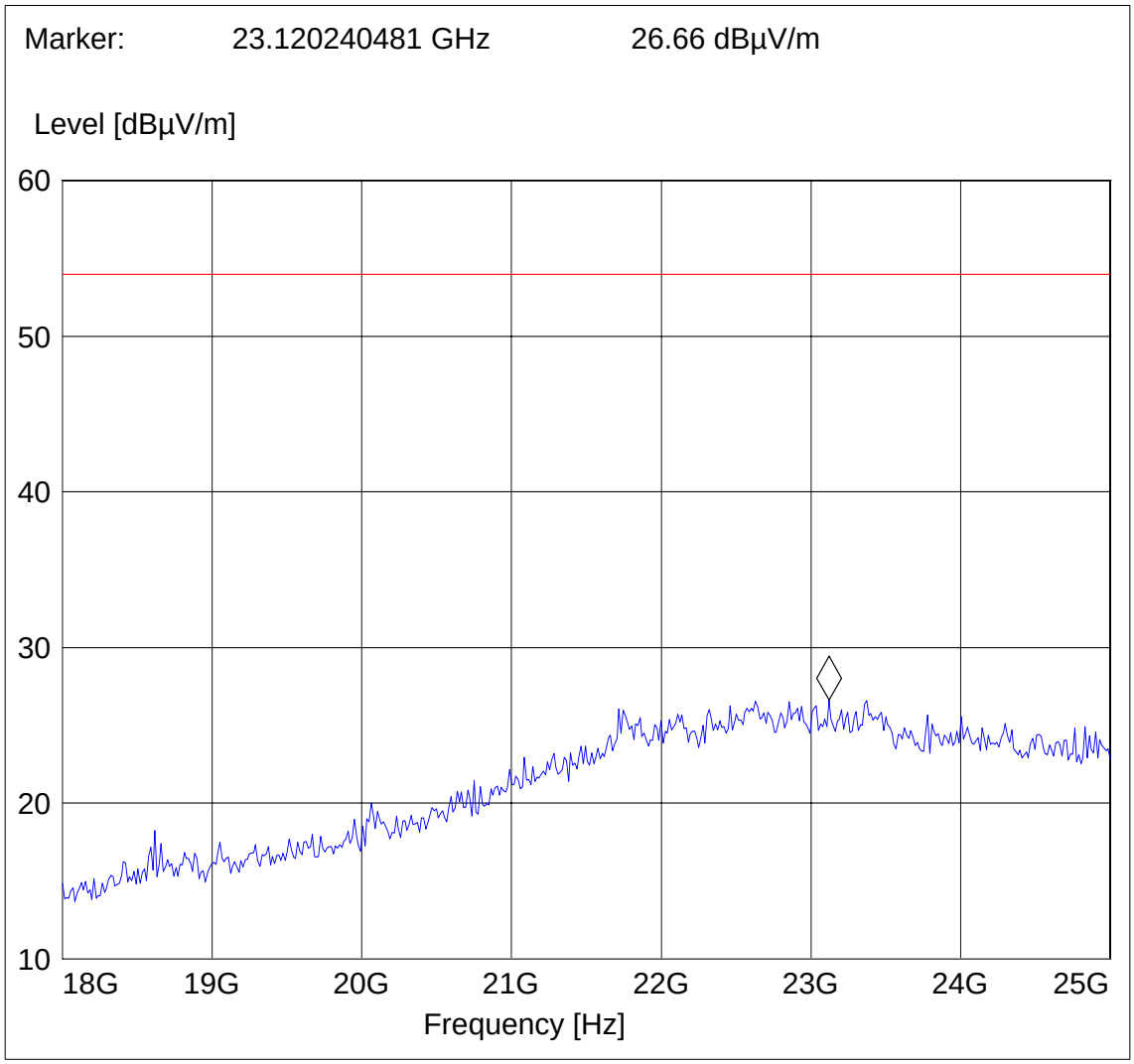
Note: The peak above the limit line is the carrier freq.
CETECOM Inc.
411 Dixon Landing Road, Milpitas CA 95035, USA
EUT:: 4311 MCAG modem
Customer:: Broadcom
Test Mode: RLAN, 802.11g, tch ch 11
Ant Orientation: H
EUT Orientation: H, auxilary antenna.
Test Engineer: Ed
Voltage:: AC Adapter
Comments:: marker is on uplink sig.



EMISSION LIMITATIONS - Radiated (Transmitter) **§ 15.247 (c) (1)**
Highest Channel (2462MHz): 3GHz – 18GHz
CETECOM Inc.
411 Dixon Landing Road, Milpitas CA 95035, USA
EUT:: 4311 MCAG modem
Customer:: Broadcom
Test Mode: RLAN, 802.11g, tch ch 11
Ant Orientation: H
EUT Orientation: H, auxilary antenna.
Test Engineer: Ed
Voltage:: AC Adapter
Comments::



EMISSION LIMITATIONS - Radiated (Transmitter) § 15.247 (c) (1)
18GHz – 26.5GHz
Note: This plot is valid for low, mid, high channels (worst-case plot)
CETECOM Inc.
411 Dixon Landing Road, Milpitas CA 95035, USA
EUT:: 4311 MCAG modem
Customer:: Broadcom
Test Mode: RLAN, 802.11g, tch ch 1
Ant Orientation: H
EUT Orientation: H, auxilary antenna.
Test Engineer: Ed
Voltage:: AC Adapter
Comments::



1.9 AC POWER LINE CONDUCTED EMISSIONS § 15.107/207

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.

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		

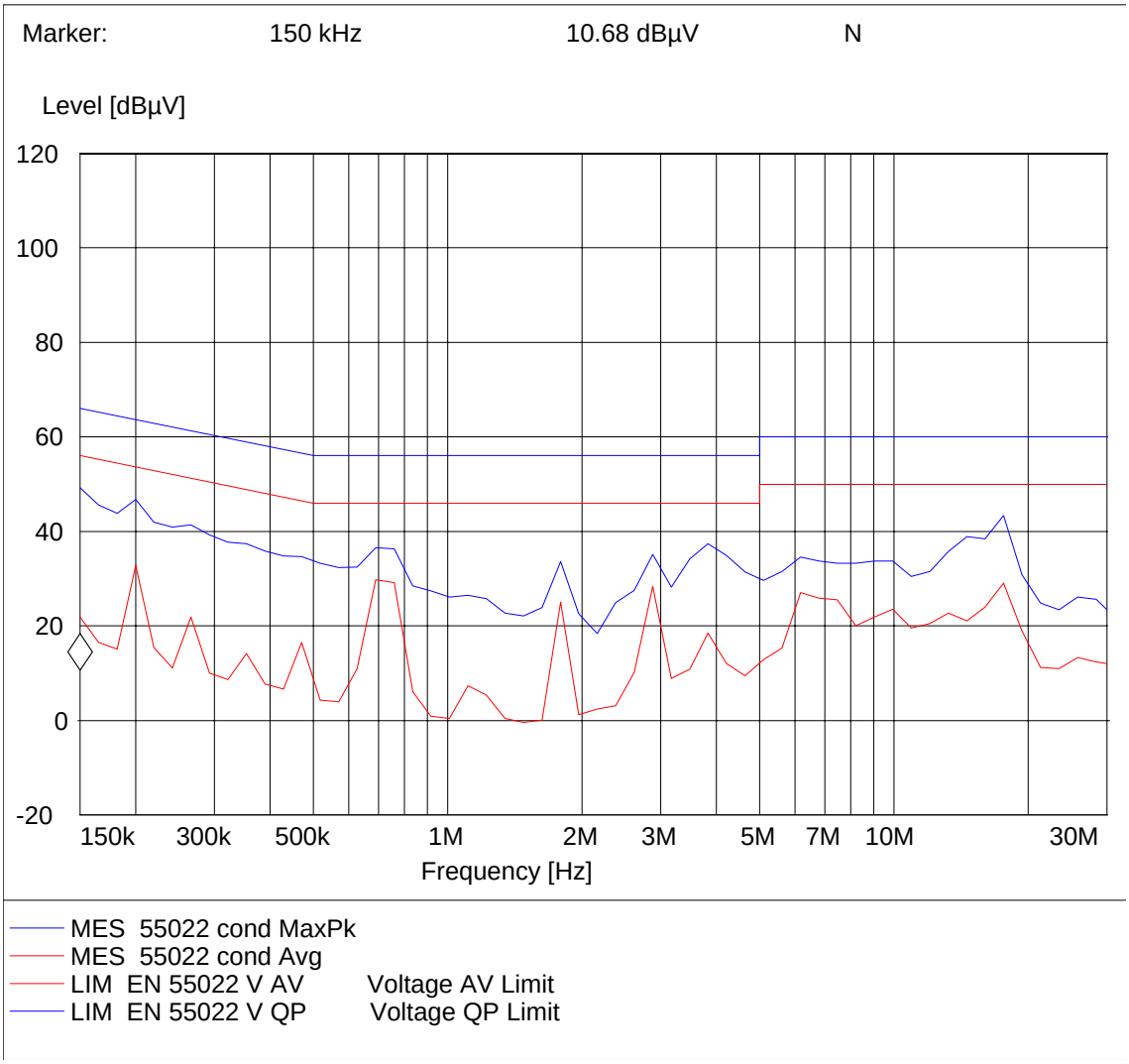
ANALYZER SETTINGS: RBW = 10KHz VBW = 10KHz

OPERATING MODE
Conducted AC emissions testing was performed with 110 VAC @ 60 Hz with the EUT in 802.11g mode.

Voltage Mains Test (Line)

EUT: E.u.T.
Manufacturer: BROADCOM
Operating Condition: 802.11g
Test Site: CETECOM USA. MILPITAS
Operator: SATYA R
Test Specification: 55022 Conducted Emissions
Comment: CONNECTED TO 110V L
Start of Test: 1/9/2007 / 8:11:40AM

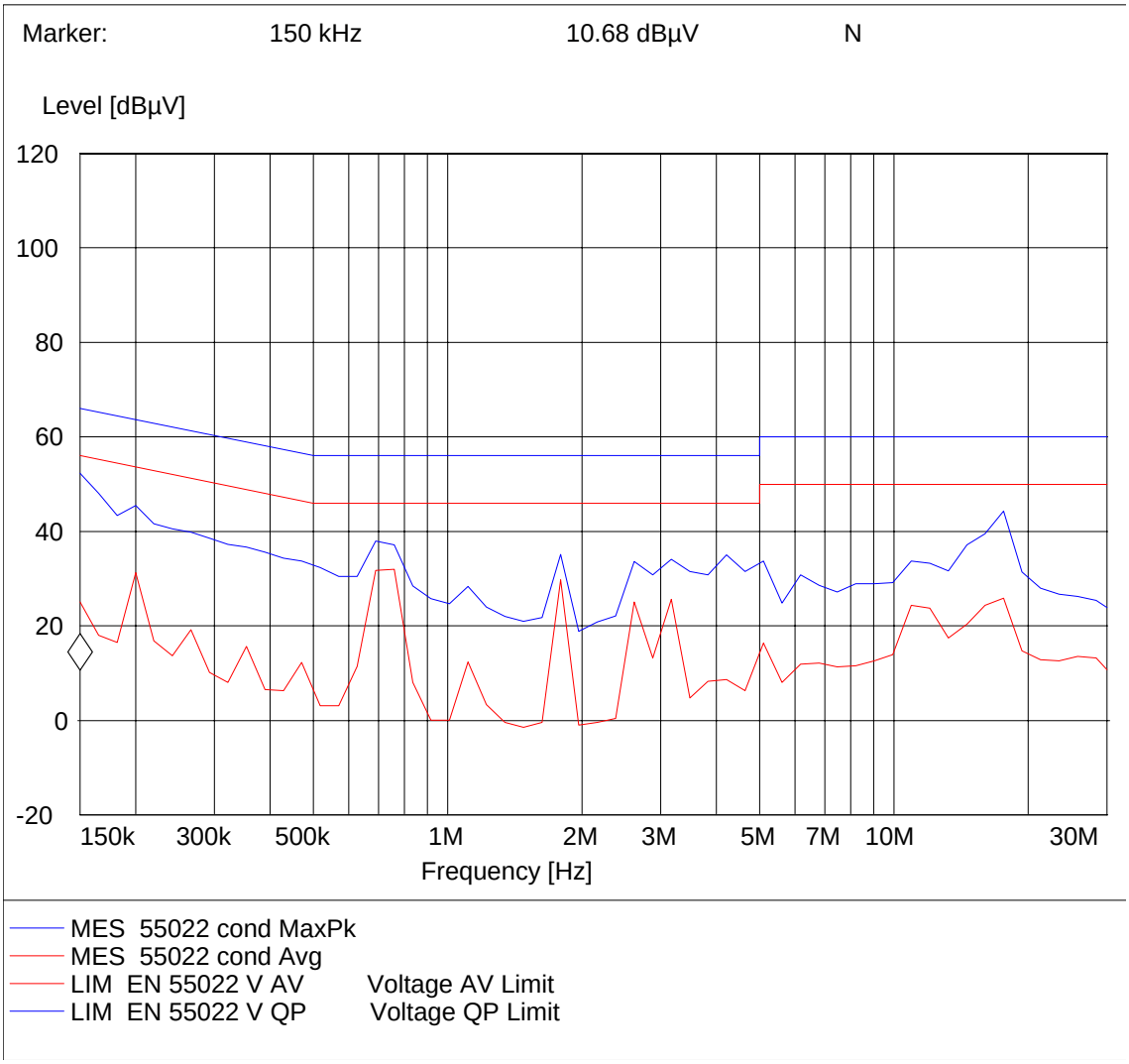
SWEEP TABLE: "55022 cond"



Voltage Mains Test (Neutral)

EUT: MCG
Manufacturer: BROADCOM
Operating Condition: 802.11g
Test Site: CETECOM USA. MILPITAS
Operator: SATYA R
Test Specification: 55022 Conducted Emissions
Comment: CONNECTED TO 110V N
Start of Test: 1/9/2007 / 8:01:01AM

SWEEP TABLE: "55022 cond"



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 2007	1 year
02	Spectrum Analyzer	FSEM 30	Rohde & Schwarz	100017	August 2007	1 year
03	Signal Generator	SMY02	Rohde & Schwarz	836878/011	May 2007	1 year
04	Power-Meter	NRVD	Rohde & Schwarz	0857.8008.02	May 2007	1 year
05	Biconilog Antenna	3141	EMCO	0005-1186	June 2007	1 year
06	Horn Antenna (1-18GHz)	SAS-200/571	AH Systems	325	June 2007	1 year
07	Horn Antenna (18-26.5GHz)	3160-09	EMCO	1240	June 2007	1 year
08	Power Splitter	11667B	Hewlett Packard	645348	n/a	n/a
09	Climatic Chamber	VT4004	Voltsch	G1115	May 2007	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 2007	1 year
13	Power Sensor	URV5-Z2	Rohde & Schwarz	DE30807	May 2007	1 year
14	Digital Radio Comm. Tester	CMD-55	Rohde & Schwarz	847958/008	May 2007	1 year
15	Universal Radio Comm. Tester	CMU 200	Rohde & Schwarz	832221/06	May 2007	1 year
16	LISN	ESH3-Z5	Rohde & Schwarz	836679/003	May 2007	1 year
17	Loop Antenna	6512	EMCO	00049838	July 2007	2 years

3 BLOCK DIAGRAMS

Radiated Testing