ZEBRA TECHNOLOGIES CORP.

PORTABLE LABEL PRINTER WITH BLUETOOTH AND WLAN

Model: P4T

28 August 2008
Report No.: SL08041104-ZBR-024(15.247) (P4T with Bluetooth and WLAN)
(This report supersedes NONE)

EMC Test Report

SIEMIC, INC.
Accessing global markets

Modifications made to the product : None

This Test Report is Issued Under the Authority of:	
Choon Sian Ooi Test Engineer	Leslie Bai Engineering Reviewer

SIEMIC ACREDITATION DETAILS: NVLAP Lab Code: 200729-0

United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 200729-0

SIEMIC Laboratories
San Jose, CA

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated 18 June 2005).

2008-01-01 through 2008-12-31
Effective dates

Sally S. Bruce
For the National Institute of Standards and Technology

NVLAP-01C (REV. 2006-09-13)

SIEMIC ACREDITATION DETAILS: FCC Registration No. 783147

FEDERAL COMMUNICATIONS COMMISSION

Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046

December 20, 2007

Registration Number: 783147

SIEMIC Laboratories
2206 Ringwood Avenue,
San Jose, CA 95131

Attention: Leslie Bai

Re: Measurement facility located at San Jose
3 & 10 meter site
Date of Renewal: December 20, 2007

Dear Sir or Madam:

Your request for renewal of the registration of the subject measurement facility has been received. The information submitted has been placed in your file and the registration has been renewed. The name of your organization will remain on the list of facilities whose measurement data will be accepted in conjunction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Please note that the file must be updated for any changes made to the facility and the registration must be renewed at least every three years.

Measurement facilities that have indicated that they are available to the public to perform measurement services on a fee basis may be found on the FCC website www.fcc.gov under E-Filing, OET Equipment Authorization Electronic Filing, Test Firms.

Sincerely,

Phyllis Parrish
Industry Analyst

SIEMIC ACREDITATION DETAILS: Industry of Canada Registration No. 4842-1

Industry Canada Industrie Canada

May 23rd, 2008

OUR FILE: 46405-4842
Submission No: 126429

Siemic Inc.
2205 Ringwood Ave.
San Jose CA 95131
USA

Attention: Leslie Bai

Dear Sir/Madame:

The Bureau has received your application for the registration / renewal of a 3/10m OATS. Be advised that the information received was satisfactory to Industry Canada. The following number(s) is now associated to the site(s) for which registration / renewal was sought **(4842A-1)**. Please reference the appropriate site number in the body of test reports containing measurements performed on the site. In addition, please be informed that the Bureau is now utilizing a **new site numbering scheme** in order to simplify the electronic filing process. Our goal is to reduce the number of secondary codes associated to one particular company. The following changes have been made to your record.

- Your primary code is: **4842**

- The company number associated to the site(s) located at the above address is: **4842A**

- The table below is a summary of the changes made to the unique site registration number(s):

New Site Number	Obsolete Site Number	Description of Site	Expiry Date (YYYY-MM-DD)
4842A-1	4842-1	3m Chamber	2010-05-25

Furthermore, to obtain or renew a unique site number, the applicant shall demonstrate that the site has been accredited to ANSI C63.4-2003 or later. A scope of accreditation indicating the accreditation by a recognized accreditation body to ANSI C63.4-2003 shall be accepted. Please indicate in a letter the previous assigned site number if applicable and the type of site (example: 3 meter OATS or 3 meter chamber). If the test facility is not accredited to ANSI C63.4-2003 or later, the test facility shall submit test data demonstrating full compliance with the ANSI standard. The Bureau will evaluate the filing to determine if recognition shall be granted.

The frequency for re-validation of the test site and the information that is required to be filed or retained by the testing party shall comply with the requirements established by the accrediting organization. However, in all cases, test site re-validation shall occur on an interval not to exceed two years. There is no fee or form associated with an OATS filing. OATS submissions are encouraged to be submitted electronically to the Bureau using the following URL:
http://strategis.ic.gc.ca/epic/internet/inceb-bhst.nsf/en/h_rr00052e.html.

If you have any questions, you may contact the Bureau by e-mail at certification.bureau@ic.gc.c
Please reference our file and submission number above for all correspondence.

Yours sincerely,

S. Proulx
Test & Measurement Specialist
Certification and Engineering Bureau
3701 Carling Ave., Building 94
Ottawa, Ontario K2H 8S2

SIEMIC ACREDITATION DETAILS: Japan VCCI Registration No. 2195

VCCI

Voluntary Control Council for Interference
by Information Technology Equipment
7F NDA Bldg. 2-3-5, Azabudai
Minato-Ku, Tokyo, Japan, 106-0041
Tel:+81-3-5575-3138
Fax:+81-3-5575-3137
http://www.vcci.or.jp

February 12 , 2004

TO: SIEMIC, INC.

Membership NO: 2195

We confirmed your payment for annual membership fee and admission fee. Thank you very much for your remitting.

Please find enclosed VCCI documents. As admission fee and annual membership fee were confirmed, your company registered as VCCI official member.

From now on, it is possible for your company to submit conformity verification report or/and application for registration of measurement facilities.

Please find necessary forms for your submission from VCCI web-site.
www.vcci.or.jp

When you submit conformity verification report, please submit to Ms. Yoko Inagaki / inagaki@vcci.or.jp and application for registration of measurement facilities, please submit to Mr. Masaru Denda / denda@vcci.or.jp

Their address, phone and fax number are absolutly same as I. Please refer address indicated on top right-hand corner of this page.

If you have any other questions regarding membership, feel free to contact me.
Thank you very much.

Best Regards,

Naoko Hori (Ms.)
VCCI
hori@vcci.or.jp

Enclosure

SIEMIC ACREDITATION DETAILS: Japan RF Technologies Accreditation No. MRF050927

RFT

Certificate

This is to certify that the
Quality Management System
of

SIEMIC , Inc.

2206 Ringwood Avenue
San Jose, California 95131 U.S.A

has been authorized to carry out Japan Specified Radio Equipment test by order and under supervision of RF Technologies Co., Ltd. according to Notification No.88 of Radio Law.

An assessment of the laboratory was conducted according to the "Procedure and Conditions for Appointments of 2.4GHz Band Low power data communications system that Bluetooth and Wireless LAN test with reference to ISO/IEC 17025 by an RF Technologies Co., Ltd. auditor.

Audit Report No. MRF050927

Kazuyuki Sarashina
Auditor
RF Technologies Co., Ltd.

Toshihiro Kegami
President
RF Technologies Co., Ltd.

Audit Date
September 27th, 2005

Issued Date
October 5th, 2005

This Certificate is valid until **September 26th 2006 or next schedule audit.**

No:006 Registered Certification Body
RF Technologies Co., Ltd.
472, Nippa-cho,Kohoku-ku, Yokohama, 223-0057, Japan

SIEMIC ACREDITATION DETAILS: Korea MIC Lab Code: KR0032

시 험 기 관 지 정 서

Certificate

of Designated Testing Laboratory

지정번호(No.) : KR0032

시험기관명 : (주)현대교정인증기술원

(Name of Lab.) (Hyundai Calibration & Certification Technologies Co., Ltd)

주 소 : 경기도 이천시 부발읍 아미리 산136-1

(Address) (136-1, Ami-ri, Bubal-eup, Icheon-si, Kyunggi-Do, Korea)

2206 Ringwood Avenue San Jose, CA, USA.

시험분야 및 범위 : 유선(Telecommunication Part)

(Area & Category) 무선(Radio Communication Part)

전자파장해(EMI) : 미국지사 포함

전자파내성(EMS) : 미국지사 포함

전기안전(Safety)

전자파흡수율(SAR)

위 기관을 정보통신기기시험기관지정및관리등에관한규칙에 의해 정보통신기기시험기관으로 지정합니다.

This is to certify that the above mentioned laboratory is designated as the testing laboratory in accordance with the Regulations on Designation of Testing Laboratory for Information and Communication Equipment.

2005년(Year) 7월(Month) 5일(Date)

전 파 연 구 소 장

Director General of Radio Research Laboratory
Ministry of Information and Communication
Republic of Korea

SIEMIC ACREDITATION DETAILS: Korea CAB ID: US0160

UNITED STATES DEPARTMENT OF COMMERCE
National Institute of Standards and Technology
Gaithersburg, Maryland 20899-

April 17, 2006

Mr. Leslie Bai
SIEMIC Laboratories
2206 Ringwood Avenue
San Jose, CA 95131

Dear Mr. Bai:

I am pleased to inform you that your laboratory has been recognized by the Ministry of Information and Communication's Radio Research Laboratory (RRL) under the Asia Pacific Economic Cooperation (APEC) Mutual Recognition Arrangement (MRA). Your laboratory is now designated to act as a Conformity Assessment Body (CAB) under Appendix B, **Phase I** Procedures, of the APEC Tel MRA. The pertinent information about your laboratory's designation is as follows:

CAB Name: **SIEMIC Laboratories**
Identification No.: **US0160**
Scope:

Coverage	Standards	Date of Recognition
Electro Magnetic Interference	1. RRL Notice No. 2005-82: Technical Requirements for Electromagnetic Interference 2. Annex 8(KN-22), RRL Notice No. 2005-131: Conformity Assessment Procedure for Electromagnetic Interference	April 13, 2006
Electro Magnetic Susceptibility	1. RRL Notice No. 2005-130: Technical Requirements for Electromagnetic Susceptibility 2. Annex 1~7(KN-61000-4-2, -4-3, -4-4, -4-5, -4-6, -4-8, -4-11), RRL Notice No. 2005-132: Conformity Assessment Procedure for Electromagnetic Susceptibility	April 13, 2006

You may submit test data to RRL to verify that the equipment to be imported into Korea satisfies the applicable requirements. The designation of your organization will remain in force as long as its accreditation for the designated scope remains valid and comply with the designation requirements.

The names of all recognized CABs will be posted on the NIST website at http://ts.nist.gov/mra. If you have any questions please contact Mr. Jogindar (Joe) Dhillon at (301) 975-5521. We appreciate your continued interest in our international conformity assessment activities.

Sincerely,

David F. Alderman
Group Leader, Standards Coordination and Conformity Group

cc: Jogindar Dhillon

NIST

SIEMIC ACREDITATION DETAILS: Taiwan BSMI Accreditation No. SL2-IN-E-1130R

UNITED STATES DEPARTMENT OF COMMERCE
National Institute of Standards and Technology
Gaithersburg, Maryland 20899

May 3, 2006

Mr. Leslie Bai
SIEMIC Laboratories
2206 Ringwood Avenue
San Jose, CA 95131

Dear Mr. Bai:

I am pleased to inform you that your laboratory has been recognized by the Chinese Taipei's Bureau of Standards, Metrology, and Inspection (BSMI) under the Asia Pacific Economic Cooperation (APEC) Mutual Recognition Arrangement (MRA). Your laboratory is now designated to act as a Conformity Assessment Body (CAB) under Appendix B, **Phase I** Procedures, of the APEC Tel MRA. You may submit test data to BSMI to verify that the equipment to be imported into Chinese Taipei satisfies the applicable requirements. The designation of your organization will remain in force as long as its accreditation for the designated scope remains valid and comply with the designation requirements. The pertinent designation information is as follows:

- BSMI number: **SL2-IN-E-1130R** (Must be applied to the test reports)
- U.S Identification No: **US0160**
- Scope of Designation: **CNS 13438**
- Authorized signatory: **Mr. Leslie Bai**

The names of all recognized CABs will be posted on the NIST website at http://ts.nist.gov/mra. If you have any questions, please contact Mr. Dhillon at 301-975-5521. We appreciate your continued interest in our international conformity assessment activities.

Sincerely,

David F. Alderman
Group Leader, Standards Coordination and Conformity Group

cc: Jogindar Dhillon

NIST

SIEMIC ACREDITATION DETAILS: Taiwan NCC CAB ID: US0160

UNITED STATES DEPARTMENT OF COMMERCE
National Institute of Standards and Technology
Gaithersburg, Maryland 20899

August 8, 2006

Mr. Leslie Bai
SIEMIC Laboratories
2206 Ringwood Avenue
San Jose, CA 95131

Dear Mr. Bai:

I am pleased to inform you that SIEMIC Laboratories has been recognized by the Chinese Taipei's National Communications Commission (NCC) under the Asia Pacific Economic Cooperation for Telecommunications and Information, Mutual Recognition Arrangement (APEC Tel MRA). Your laboratory is now designated to act as a Conformity Assessment Body (CAB) under Appendix B, **Phase I** Procedures, of the APEC Tel MRA.

You may submit test data to NCC to verify that the equipment to be imported into Chinese Taipei satisfies their applicable requirements using the following guidelines:

- Your laboratory's assigned 6-digit U.S. identification number is **US0160**. You should reference this number in your correspondence.
- The scope of designation is limited to **LP0002**. Your designation will remain in force as long as your accreditation remains valid for the scope of designation.

If you have any questions please contact Mr. Jogindar Dhillon via email at dhillon@nist.gov or via fax at 301-975-5414. The names of all recognized laboratories will be posted on the NIST website at http://ts.nist.gov/mra. We appreciate your continued interest in our international conformity assessment activities.

Sincerely,

David F. Alderman
Group Leader, Standards Coordination and Conformity Group

cc: Jogindar Dhillon

NIST

SIEMIC ACREDITATION DETAILS: Mexico NOM Recognition

CANIETI

CAMARA NACIONAL DE LA INDUSTRIA ELECTRONICA, DE TELECOMUNICACIONES E INFORMATICA

Laboratorio Valentín V. Rivero

México D.F. a 18 de octubre de 2006.

LESLIE BAI
DIRECTOR OF CERTIFICATION
SIEMIC LABORATORIES, INC.
ACCESSING GLOBAL MARKETS
P R E S E N T E

En contestación a su escrito de fecha 5 de septiembre del año en curso, le comento que estamos muy interesados en su intención de firmar un Acuerdo de Reconocimiento Mutuo, para lo cual adjunto a este escrito encontrara el Acuerdo en idioma ingles y español prellenado de los cuales le pido sea revisado y en su caso corregido, para que si esta de acuerdo poder firmarlo para mandarlo con las autoridades Mexicanas para su visto bueno y así poder ejercer dicho acuerdo.

Aprovecho este escrito para mencionarle que nuestro intermediario gestor será la empresa Isatel de México, S. A. de C. V., empresa que ha colaborado durante mucho tiempo con nosotros en lo relacionado a la evaluación de la conformidad y que cuenta con amplia experiencia en la gestoría de la certificación de cumplimiento con Normas Oficiales Mexicanas de producto en México.

Me despido de usted enviándole un cordial saludo y esperando sus comentarios al Acuerdo que nos ocupa.

Atentamente:

Ing. Faustino Gómez González
Gerente Técnico del Laboratorio de CANIETI.

Cuitlahuac 71
Hipódromo Condesa
06100 México, D.F.
Tel. 5264-9305 con 12 líneas
Fax 5264-9498
www.canieti.org

SIEMIC ACREDITATION DETAILS: Hong Kong OFTA Recognition No. D23/16V

OFTA
電訊管理局

Your Ref 來函檔號 :
Our Ref 本局檔號 : D23/16 V

Telephone 電話 : (852) 2961 6320
Fax No 圖文傳真 : (852) 2838 5004
E-mail 電郵地址 :

20 July 2005

Mr. Leslie Bai
Director of Certification,
SIEMIC Laboratories
2206 Ringwood Avenue
San Jose, California 95131
USA

Dear Mr. Bai,

Application of Recognised Testing Agency (RTA)

Referring your subenission of 28 June 2005 in relation to the application of RTA, I am pleased to inform you that OFTA has appointed SIEMIC Laboratories (SIEMIC) as a Recognised Testing Agency (RTA) :

Please note that, under the Hong Kong Telecommunications Equipment Evaluation and Certification (HKTEC) Scheme, SIEMIC is authorized to conduct evaluation tests on telecommunications equipment against the following HKTA specifications :

Scope of recognition (HKTA Specifications) :
1001, 1002, 1004, 1006, 1007, 1008
1010, 1015, 1016
1022, 1026, 1027, 1029
1030, 1031, 1032, 1033, 1034, 1035, 1039
1041, 1042, 1043, 1045, 1047, 1048
2001

You are requested to refer to and comply with the code of practice and guidelines for RTA as given in the Information Note OFTA I 411 "Recognised Testing Agency (RTA) for Conducting Evaluation Test of Telecommunications Equipment", which can be downloaded from OFTA's homepage at http://www.ofta.gov.hk/tec/information-notes.html.

If you have any queries, please do not hesitate to contact me.

Yours sincerely,

(K K Sin)
for Director-General
of Telecommunications

Office of the Telecommunications Authority
29/F Wu Chung House 213 Queen's Road East Wan Chai Hong Kong
電 訊 管 理 局
香港灣仔皇后大道東 213 號胡忠大廈 29 字樓
http://www.ofta.gov.hk

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CONTENTS

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1 Executive Summary & EUT information

The purpose of this test programme was to demonstrate compliance of the Zebra Technologies Corp., model: P4T against the current Stipulated Standards. The Bluetooth and WLAN radio have demonstrated compliance with the FCC 15.247 2008 & IC RSS210 Issue 7: 2007.

EUT Information

EUT Description	:	This is a Zebra Host Printer, primarily with P4T WLAN radio and Bluetooth radio. Those radios will be installed inside the product and will not be user accessible. The antenna is an internal antenna and will not be user accessible. 802.11b/g radios is designed to operate in the international ISM Band from 2.412 to 2.462 GHz. and Bluetooth radio is designed to operate form 2402MHz to 2480MHz.
Model No	:	P4T
Serial No	:	XXXPZ08-16-5012
Input Power	:	100~240 VAC, 50~60Hz 12 VDC , 4A Power Supply ➔ Model : FSP048-DBCA2
Classification Per Stipulated Test Standard	:	Frequency Hopping Spread Spectrum / Device & Spread Spectrum System /Device

2 TECHNICAL DETAILS

Purpose	Compliance testing of RFID Encoder & WLAN radio with stipulated standard
Applicant / Client	ZEBRA TECHNOLOGIES CORP.
Manufacturer	Zebra Technologies Corp. 333 Corporate Woods Parkway Vernon Hills, IL 60061 USA
Laboratory performing the tests	SIEMIC Laboratories
Test report reference number	SL08041104-ZBR-024(15.247) (P4T with Bluetooth and WLAN)
Date EUT received	10 July 2008
Standard applied	47 CFR §15.247: 2008 & RSS 210 Issue 7: 2007
Dates of test (from – to)	Test Date : July 14-August 25 2008
No of Units:	1
Equipment Category:	DSS & DTS
Trade Name:	Zebra Technologies Corp.
Model :	P4T
RF Operating Frequency (ies)	Bluetooth (2402 MHz to 2480 MHz,), WLAN (2412MHZ-2462MHz)
Number of Channels :	Bluetooth (79 Channels), WLAN (11 Channels)
Modulation :	GFSK / Pi/4DPSK / 8DPSK (BT), CCK / OFDM (WLAN)
FCC ID :	I28-ZB4LAN-01
IC ID :	3798B-ZB4LAN01

3 MODIFICATION

NONE

4 TEST SUMMARY

The product was tested in accordance with the following specifications. All testing has been performed according to below product classification:

Frequency Hopping Spread Spectrum / Device

Test Results Summary

Test Standard		Description	Pass / Fail
47 CFR Part 15.247: 2008	RSS 210 Issue 7: 2007		
15.203		Antenna Requirement	Pass
15.205	RSS210(A8.5)	Restricted Band of Operation	Pass
15.207(a)	RSS Gen (7.2.2)	AC Line Conducted Emissions Voltage	Pass
15.247(a) (1)	RSS210(A8.1)	Channel Separation	Pass
15.247(a)(1)	RSS210(A8.1)	Occupied Bandwidth	Pass
15.247(a) (2)	RSS210 (A8.2)	6dB Bandwidth	N/A
15.247(a) (1) (i)	RSS210(A8.1)	Number of Hopping Channels	Pass
15.247(a) (1) (i)	RSS210(A8.1)	Time of Occupancy	Pass
15.247(b) (2)	RSS210(A8.4)	Output Power	Pass
15.247(c)	RSS210(A8.4)	Antenna Gain > 6dBi	N/A
15.247(d)	RSS210(A8.5)	Antenna Port Conducted Spurious Emissions	Pass
15.209; 15.247(d)	RSS210(A8.5)	Radiated Spurious Emissions	Pass
15.247(e)	RSS210(A8.3)	Power Spectral Density	N/A
15.247(f)	RSS210(A8.3)	Hybrid System Requirement	N/A
15.247(g)	RSS210(A8.1)	Hopping Capability	Pass
15.247(h)	RSS210(A8.1)	Hopping Coordination Requirement	Pass
15.247(i) §2.1091& §2.1093	RSS Gen(5.5)	Maximum Permissible Exposure	Pass
15.247 (d)		100 kHz Bandwidth of Frequency Band Edge	Pass
	RSS Gen(4.8)	Receiver Spurious Emissions	Pass
ANSI C63.4: 2003/ RSS-Gen Issue 2: 2007 PS: All measurement uncertainties are not taken into consideration for all presented test result.			

Spread Spectrum System / Device

Test Results Summary

Test Standard		Description	Pass / Fail
CFR 47 Part 15.247: 2007	RSS 210 Issue 7: 2007		
15.203		Antenna Requirement	Pass
15.205	RSS210(A8.5)	Restricted Band of Operation	Pass
15.207(a)	RSSGen(7.2.2)	Conducted Emissions Voltage	Pass
15.247(a)(1)	RSS210(A8.1)	Channel Separation	N/A
15.247(a)(1)	RSS210(A8.1)	Occupied Bandwidth	Pass
15.247(a)(2)	RSS210 (A8.2)	Bandwidth	Pass
15.247(a)(1)	RSS210(A8.1)	Number of Hopping Channels	N/A
15.247(a)(1)	RSS210(A8.1)	Time of Occupancy	N/A
15.247(b)	RSS210(A8.4)	Output Power	Pass
15.247(c)	RSS210(A8.4)	Antenna Gain > 6 dBi	N/A
15.247(d)	RSS210(A8.5)	Conducted Spurious Emissions	Pass
15.209; 15.247(d)	RSS210(A8.5)	Radiated Spurious Emissions	Pass
15.247(e)	RSS210(A8.3)	Power Spectral Density	Pass
15.247(f)	RSS210(A8.3)	Hybrid System Requirement	N/A
15.247(g)	RSS210(A8.1)	Hopping Capability	N/A
15.247(h)	RSS210(A8.1)	Hopping Coordination Requirement	N/A
15.247(i)	RSSGen(5.5)	RF Exposure requirement	Pass
	RSSGen(4.8)	Receiver Spurious Emissions	Pass
ANSI C63.4: 2003/ RSS-Gen Issue 2: 2007 PS: All measurement uncertainties are not taken into consideration for all presented test result.			

5 MEASUREMENTS, EXAMINATION AND DERIVED RESULTS

5.1 Antenna Requirement

Requirement(s): 47 CFR §15.203

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

Antenna requirement must meet at least one of the following:

a) Antenna must be permanently attached to the device.
b) Antenna must use a unique type of connector to attach to the device.
c) Device must be professionally installed. Installer shall be responsible for ensuring that the correct antenna is employed with the device.

1) The antenna is printed inverted antenna (CQ 18673-G1M). Antenna maximum gain is 2dBi for 2400–2483.5 MHz band
2) The WLAN antenna (CQ18050-G1) has unique connector and installed inside chassis with a gain 3.76dBi which meet the requirement.

5.2 Conducted Emissions Voltage

Requirement:

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 the logarithm of the frequency.

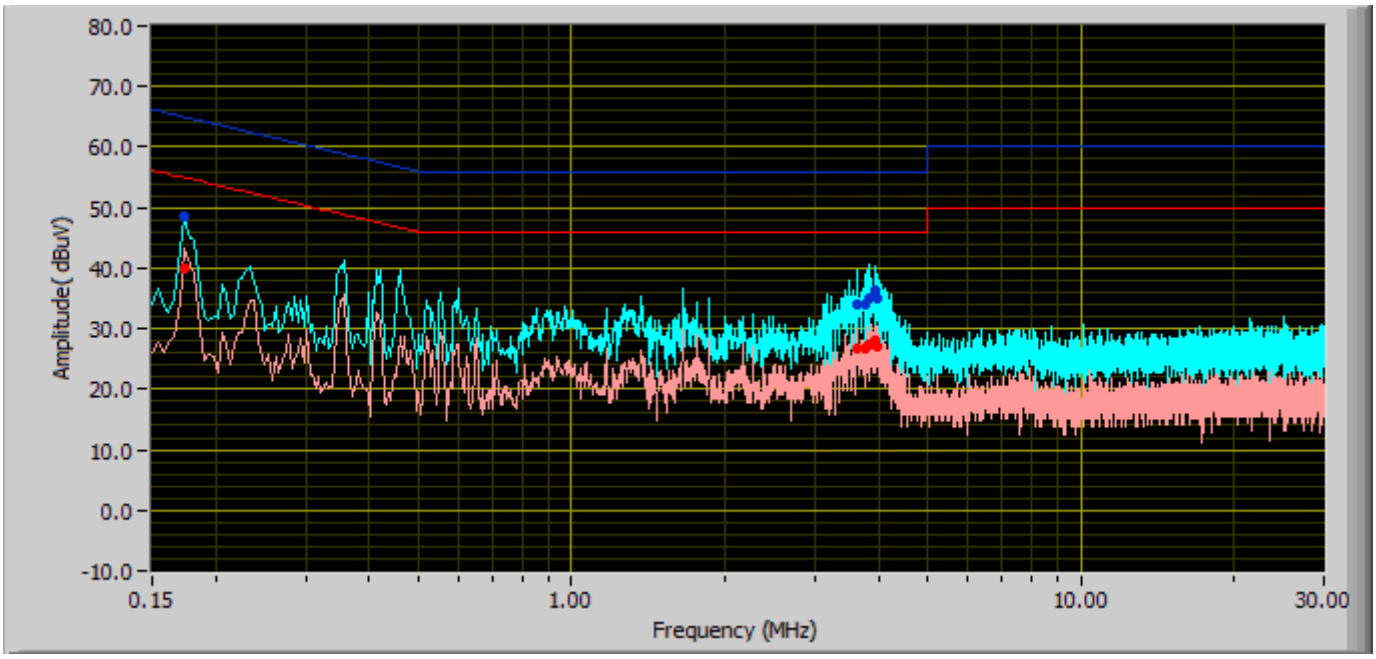
Procedures:

1. All possible modes of operation were investigated. Only the 6 worst case emissions measured, using the correct CISPR and Average detectors, are reported. All other emissions were relatively insignificant.
2. A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
3. Conducted Emissions Measurement Uncertainty
   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 9kHz – 30MHz (Average & Quasi-peak) is ±3.5dB.
4. Environmental Conditions

Temperature	23ºC - 25ºC
Relative Humidity	50%
Atmospheric Pressure	1019mbar

   Test Date : July 14- August 25 2008
   Tested By :Choon Sian Ooi

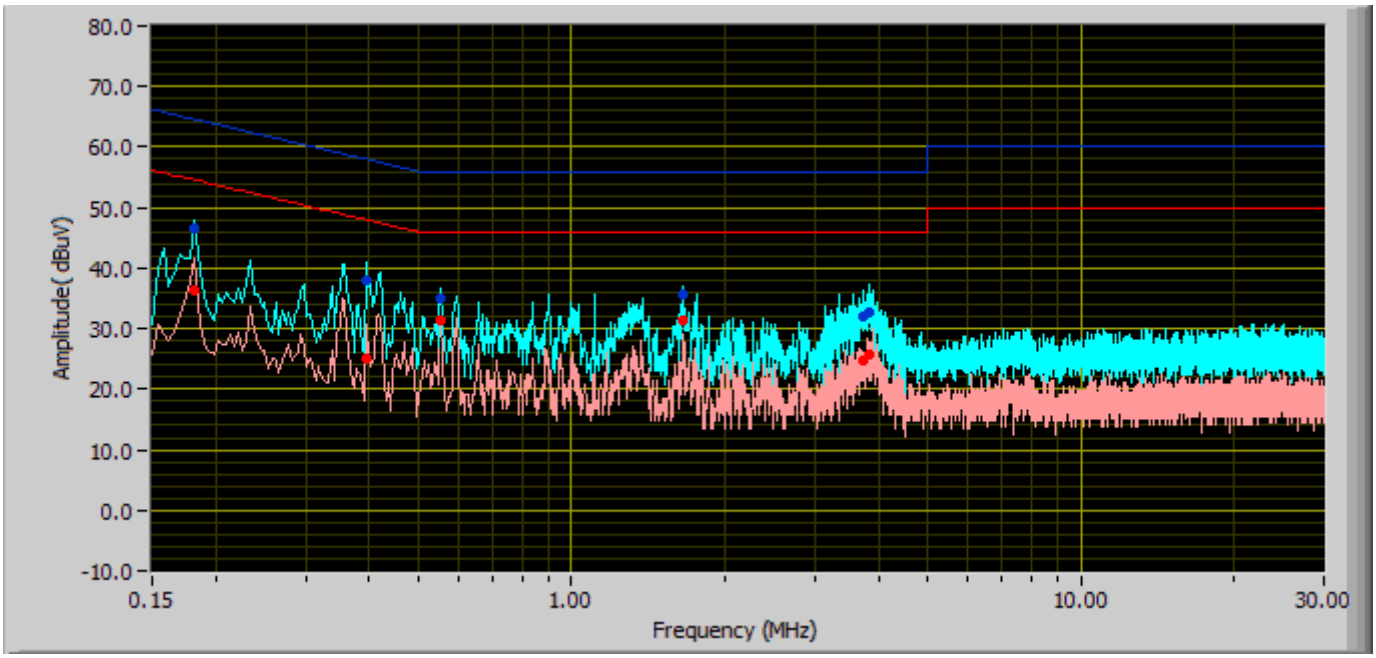
Results: Note – Average Limit Quasi-Peak Limit



Phase Line Plot at 120Vac, 60Hz

Line Under Test	Frequency (MHz)	Corrected Amplitude (dBuV) QP	Limit (dBuV) QP	Margin (dB) QP	Corrected Amplitude (dBuV) AVG	Limit (dBuV) AVG	Margin (dB) AVG
Phase	3.85	35.14	56.00	-20.86	27.24	46.00	-18.76
Phase	3.94	36.42	56.00	-19.58	27.99	46.00	-18.01
Phase	3.64	34.13	56.00	-21.87	26.69	46.00	-19.31
Phase	0.17	48.59	64.93	-16.34	39.92	54.93	-15.01
Phase	3.99	34.93	56.00	-21.07	26.97	46.00	-19.03
Phase	3.78	34.01	56.00	-21.99	26.69	46.00	-19.31

Results: Note – Average Limit Quasi-Peak Limit



Neutral Line Plot at 120Vac, 60Hz

Line Under Test	Frequency (MHz)	Corrected Amplitude (dBuV) QP	Limit (dBuV) QP	Margin (dB) QP	Corrected Amplitude (dBuV) AVG	Limit (dBuV) AVG	Margin (dB) AVG
Neutral	0.18	46.71	64.55	-17.84	36.44	54.55	-18.11
Neutral	0.39	38.06	58.01	-19.95	25.11	48.01	-22.91
Neutral	3.85	32.52	56.00	-23.48	25.62	46.00	-20.38
Neutral	1.65	35.71	56.00	-20.29	31.21	46.00	-14.79
Neutral	0.55	34.97	56.00	-21.03	31.40	46.00	-14.60
Neutral	3.75	31.95	56.00	-24.05	24.64	46.00	-21.36

5.3 Channel Separation

1. Conducted Measurement
   EUT was set for low , mid, high channel with modulated mode and highest RF output power.
   The spectrum analyzer was connected to the antenna terminal.
2. Environmental Conditions — Temperature 23ºC - 25ºC; Relative Humidity 50%; Atmospheric Pressure 1019mbar
3. Conducted Emissions Measurement Uncertainty
   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 20GHz is ±1.5dB.
4. Test Date : July 14- August 25 2008
   Tested By :Choon Sian Ooi

Requirement(s): 47 CFR §15.247(a)(1)(i)

Procedures: The Channel Separation was measured conducted using a spectrum analyzer at low, mid, and hi channels.

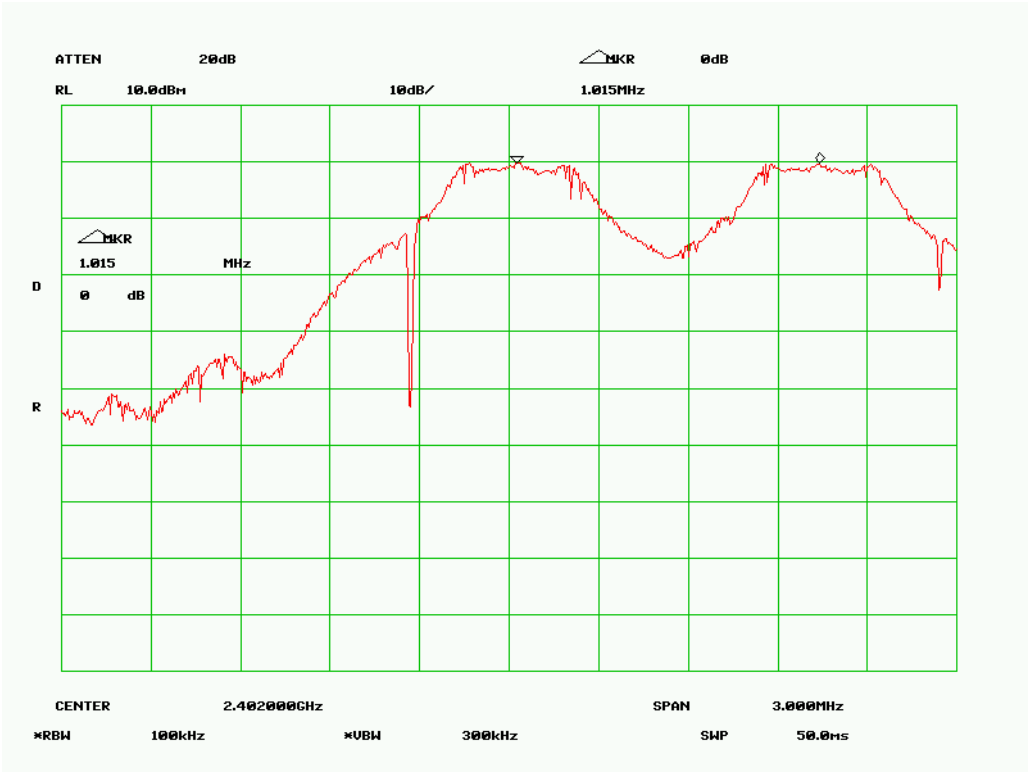
Frequency hopping systems in the 2400~2483.5 MHz shall have, hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies.

Bluetooth

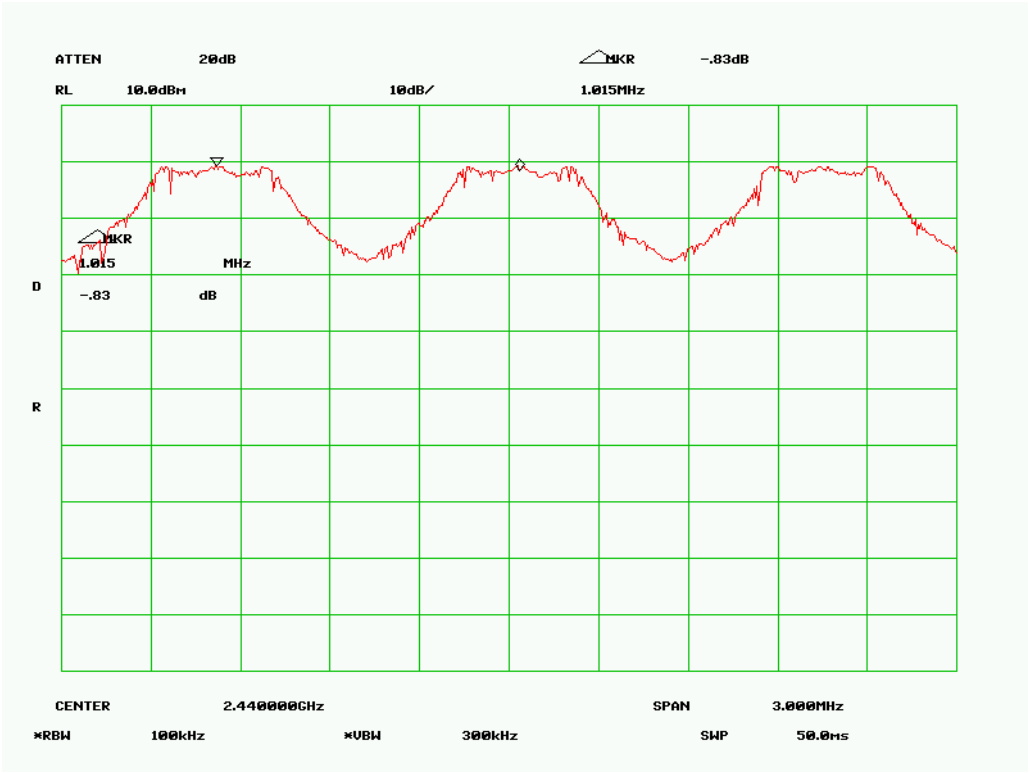
Channel	Channel Frequency (MHz)	Channel Separation (MHz)	20 dB Channel Bandwidth (KHz)	99% Channel Bandwidth (KHz)
Low	2402	1.015	875	845
Mid	2441	1.015	870	855
High	2480	1.015	875	860

Bluetooth

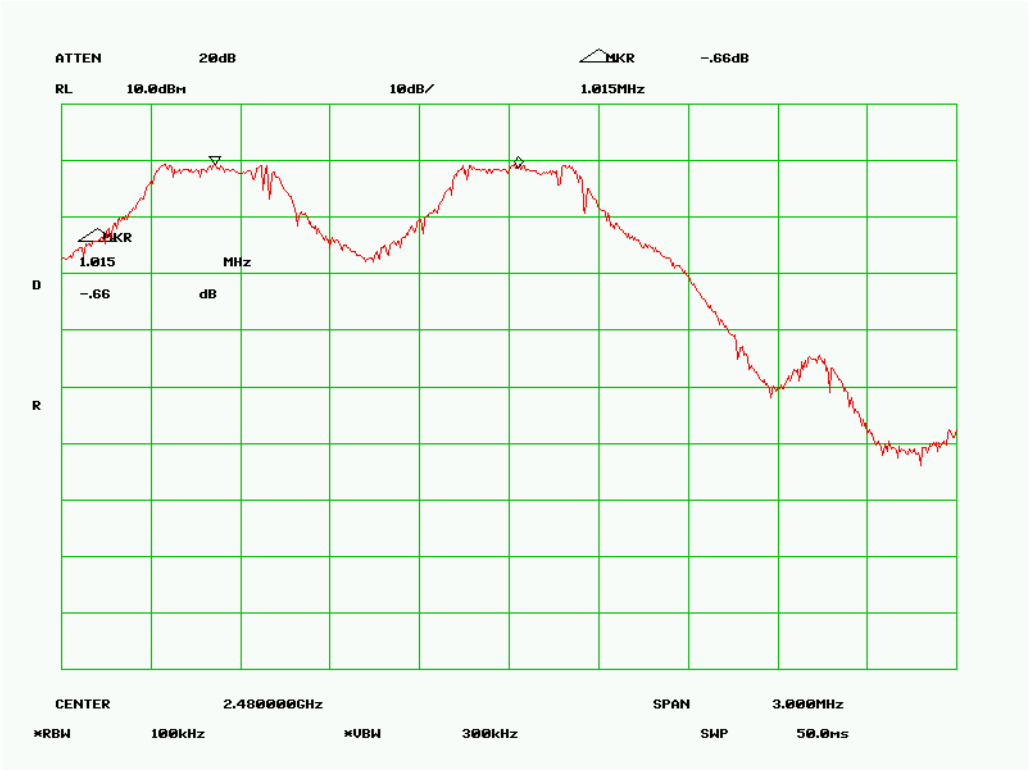
Channel Separation - Low Channel



Channel Separation – Mid Channel



Channel Separation – High Channel



5.4 20dB Occupied Bandwidth

1. Conducted Measurement
EUT was set for low, mid, high channel with modulated mode and highest RF output power.
The spectrum analyzer was connected to the antenna terminal.

2 Environmental Conditions

Temperature	23ºC - 25ºC
Relative Humidity	50%
Atmospheric Pressure	1019mbar

3 Conducted Emissions Measurement Uncertainty
All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 20GHz is ±1.5dB.

4 Test Date : July 14- August 25 2008
Tested By :Choon Sian Ooi

Requirement(s): 47 CFR §15.247(a)(1)(i)

Procedures: The 20dB bandwidths were measured conducted using a spectrum analyzer at low, mid, and hi channels.

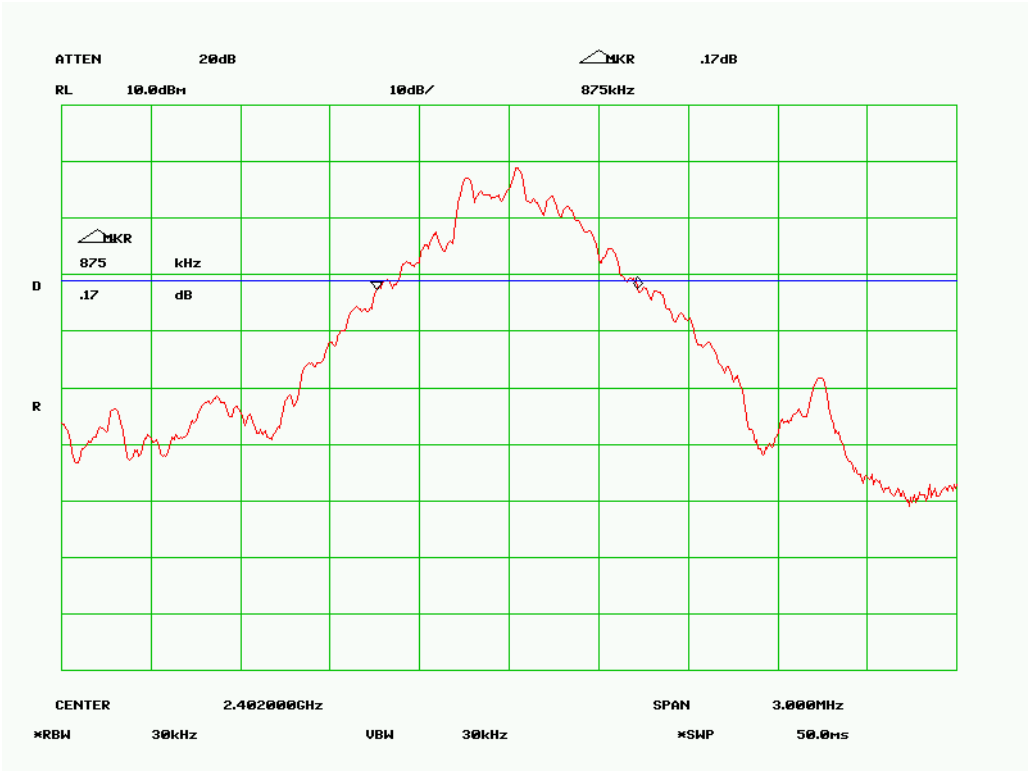
Note: The maximum allowed 20 dB bandwidth of the hopping is 500 kHz.

Channel	Channel Frequency (MHz)	20 dB Channel Bandwidth (KHz)	99% Channel Bandwidth (KHz)
Low	2402	875	845
Mid	2441	870	855
High	2480	875	860

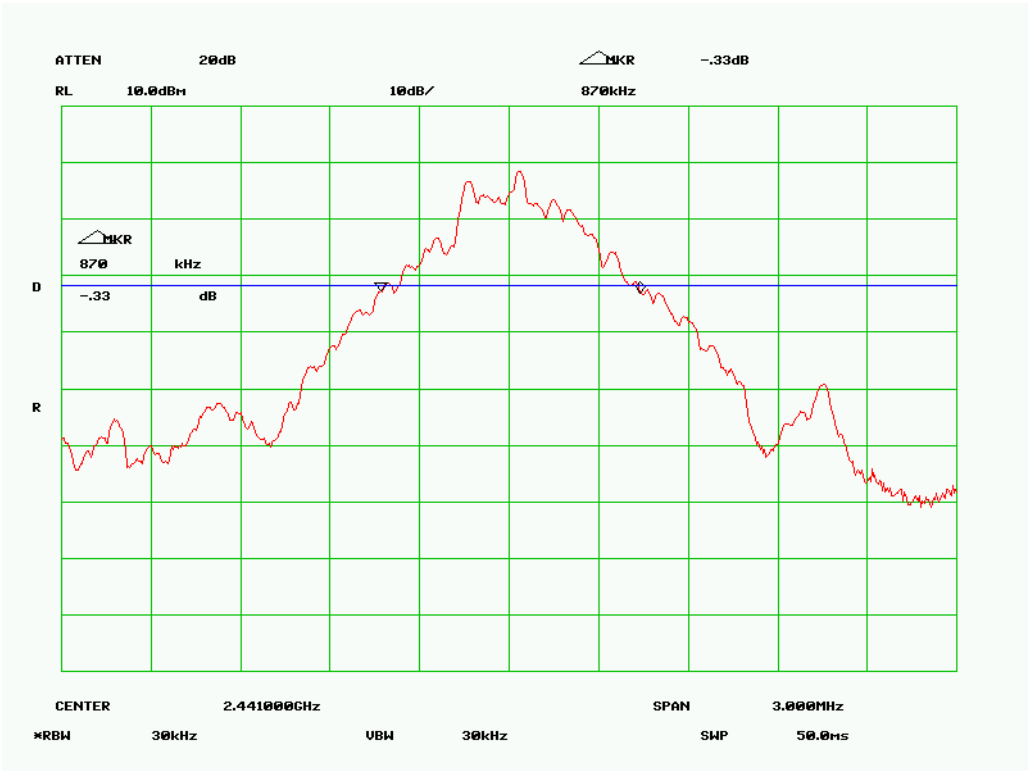
Refer to the attached plots.

Bluetooth

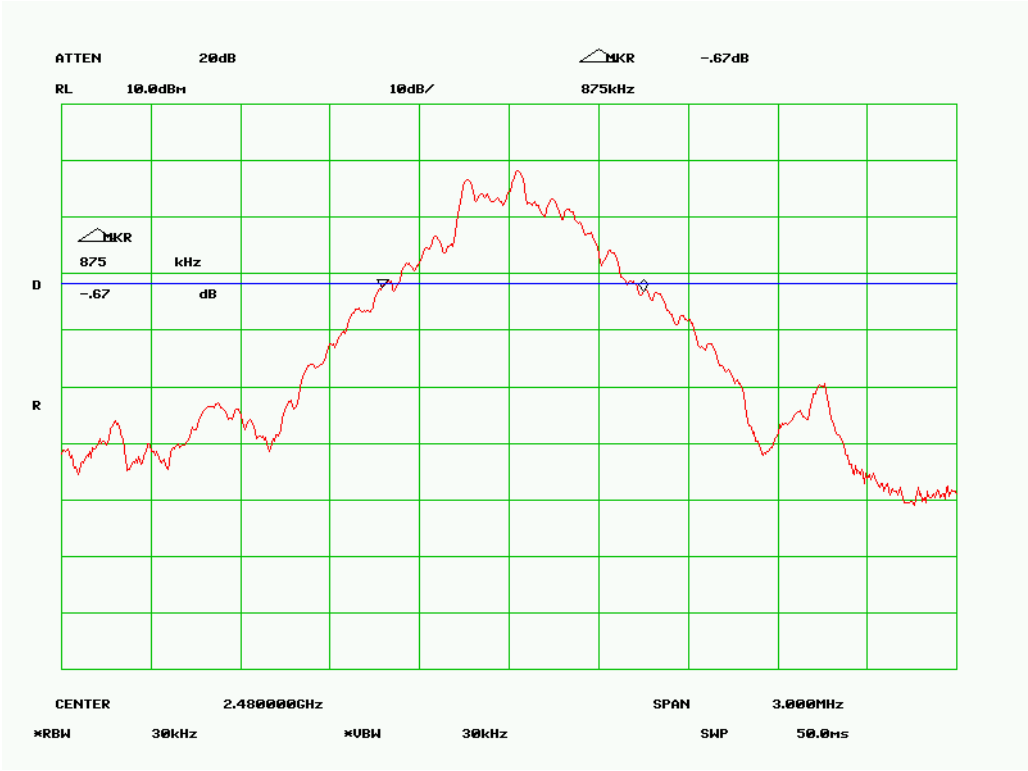
20 dB Bandwidth - Low Channel



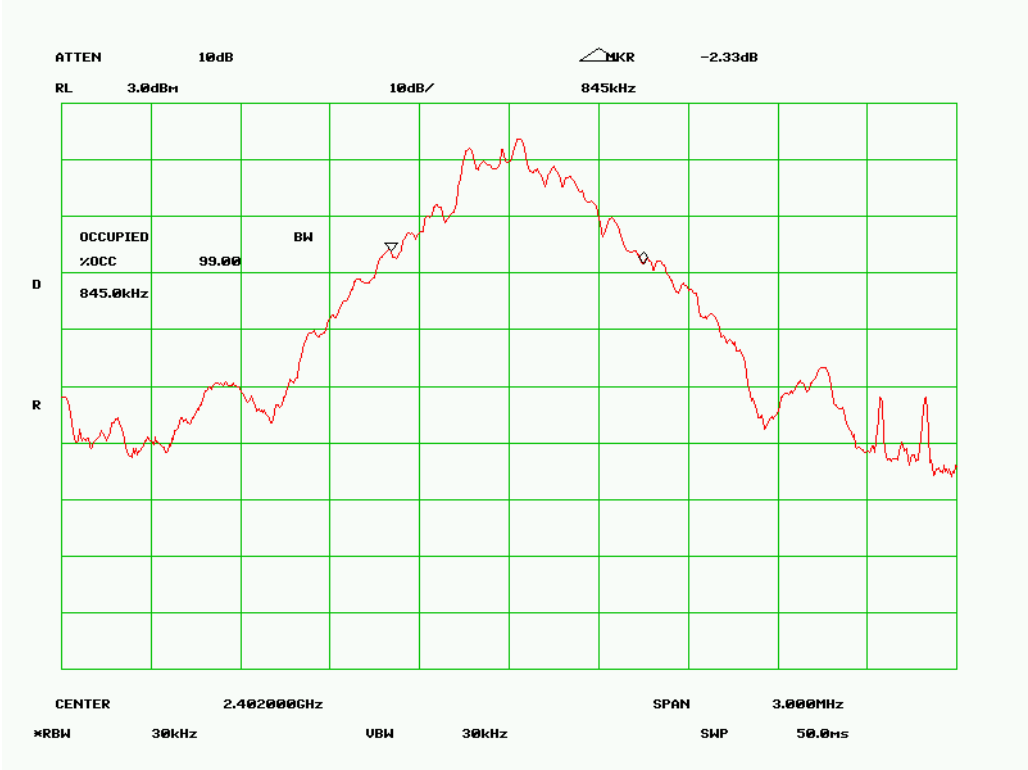
20 dB Bandwidth - Mid Channel



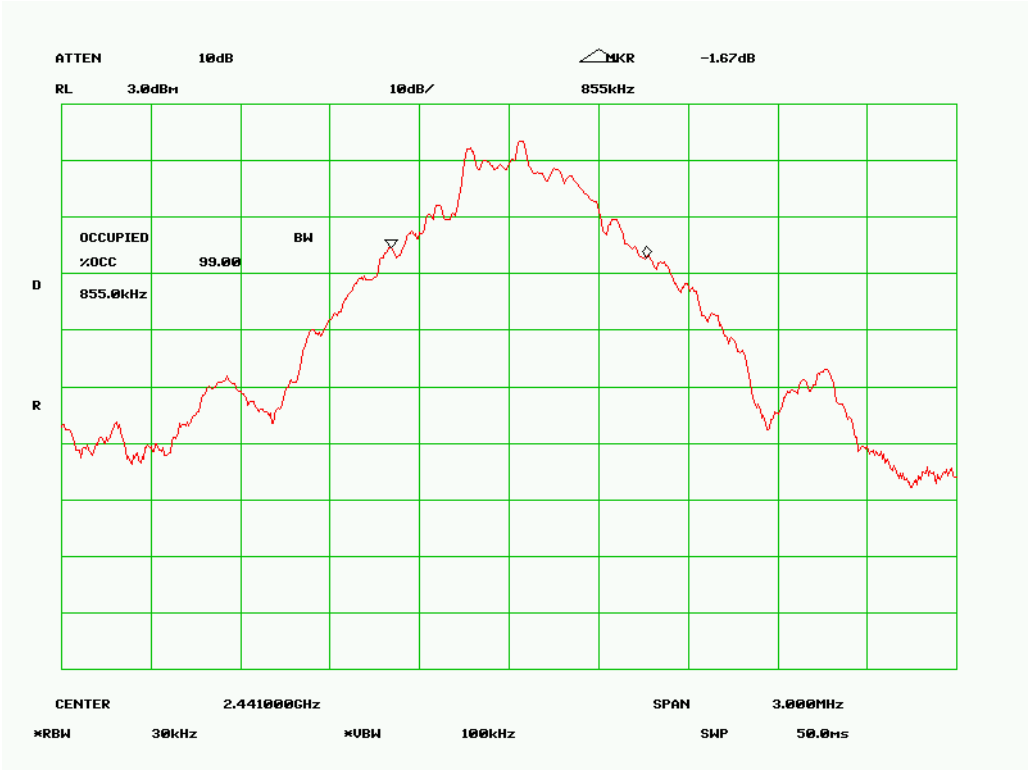
20 dB Bandwidth - High Channel



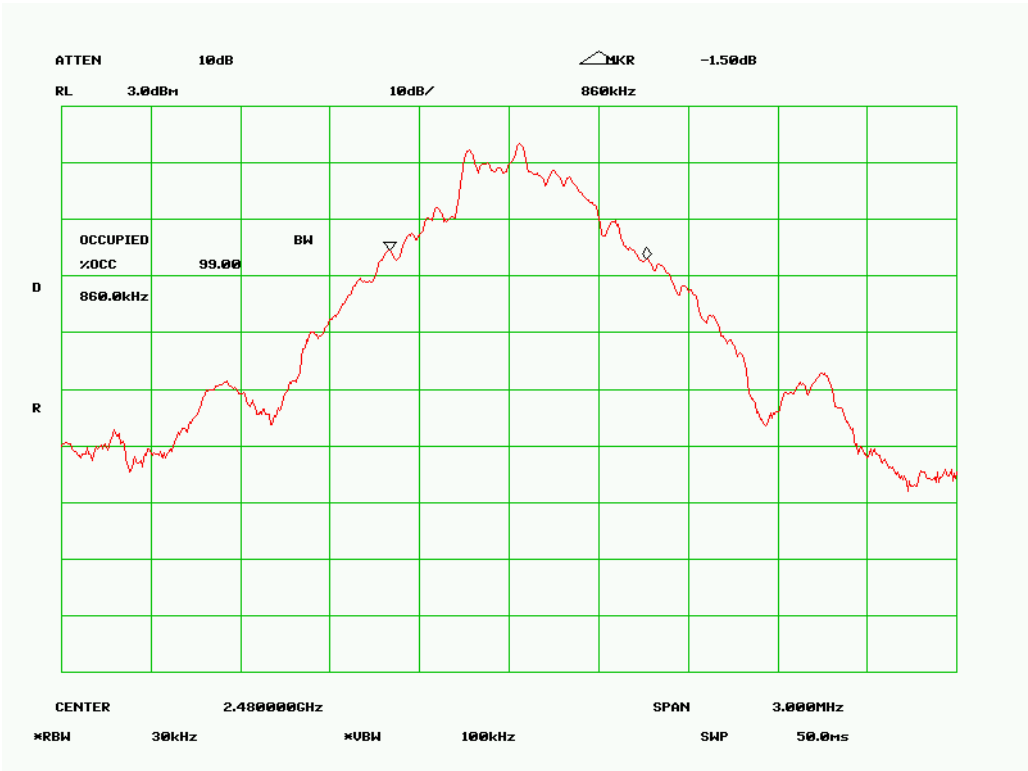
99% Bandwidth - Low Channel



99% Bandwidth - Mid Channel



99% Bandwidth - High Channel



5.5 Number of Hopping Channel

1. Conducted Measurement
   EUT was set for low , mid, high channel with modulated mode and highest RF output power.
   The spectrum analyzer was connected to the antenna terminal.
2. Conducted Emissions Measurement Uncertainty
   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 20GHz is ±1.5dB.
3. Environmental Conditions

Temperature	23ºC - 25ºC
Relative Humidity	50%
Atmospheric Pressure	1019mbar

4. Test Date : July 14- August 25 2008
   Tested By :Choon Sian Ooi

Standard Requirement: 47 CFR §15.247(a)(1)(iii)

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

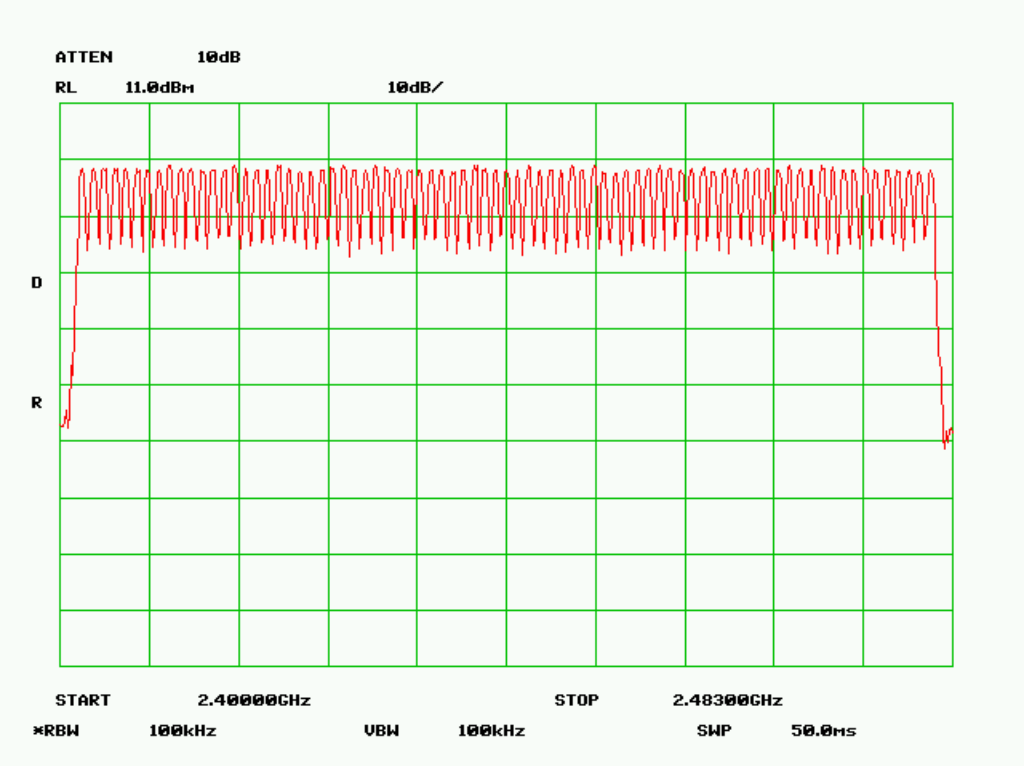
Procedures: The Number of Hopping Channel measurement was taken conducted using a spectrum analyzer.

RBW=30 KHz, VBW > RBW

Test Result:

Number of Hopping Channel

2402 – 2480 MHz: 79 Channels



5.6 Time of Occupancy

1. Conducted Measurement
   EUT was set for low , mid, high channel with modulated mode and highest RF output power.
   The spectrum analyzer was connected to the antenna terminal.
2. Conducted Emissions Measurement Uncertainty
   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 20GHz is ±1.5dB.
3. Environmental Conditions

Temperature	23ºC - 25ºC
Relative Humidity	50%
Atmospheric Pressure	1019mbar

4. Test Date : July 14- August 25 2008
   Tested By :Choon Sian Ooi

Standard Requirement: 47 CFR §15.247(a)(1)

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

Procedures: The Time of Occupancy measurement was taken conducted using a spectrum analyzer.

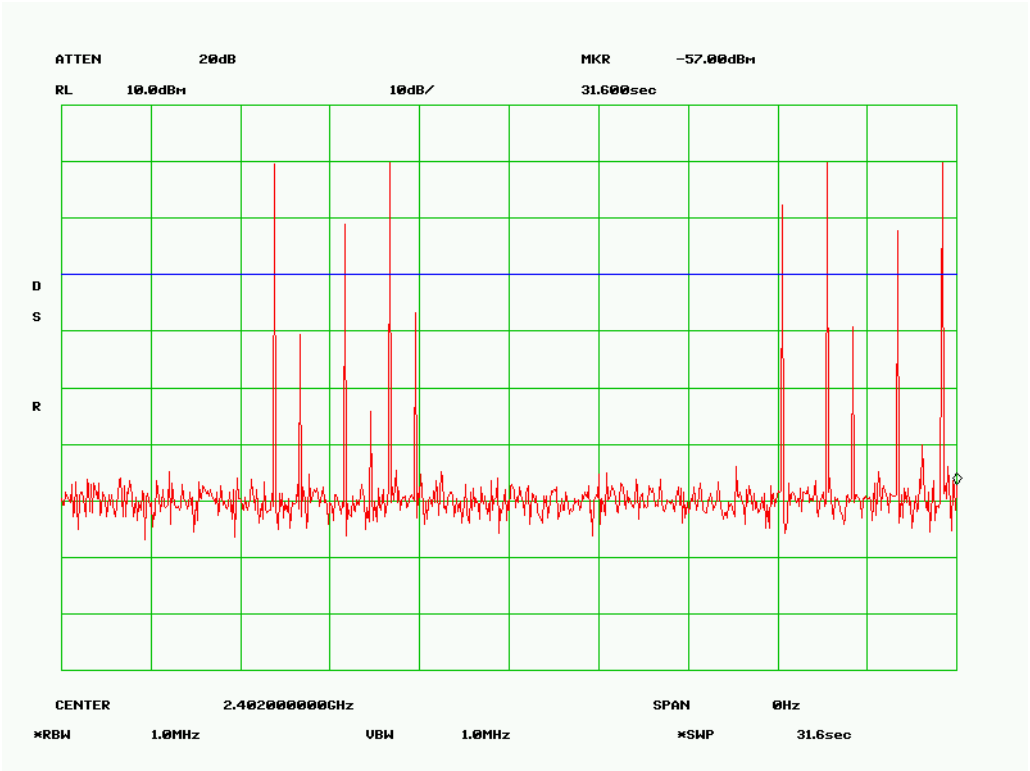
Test Result:

Bluetooth

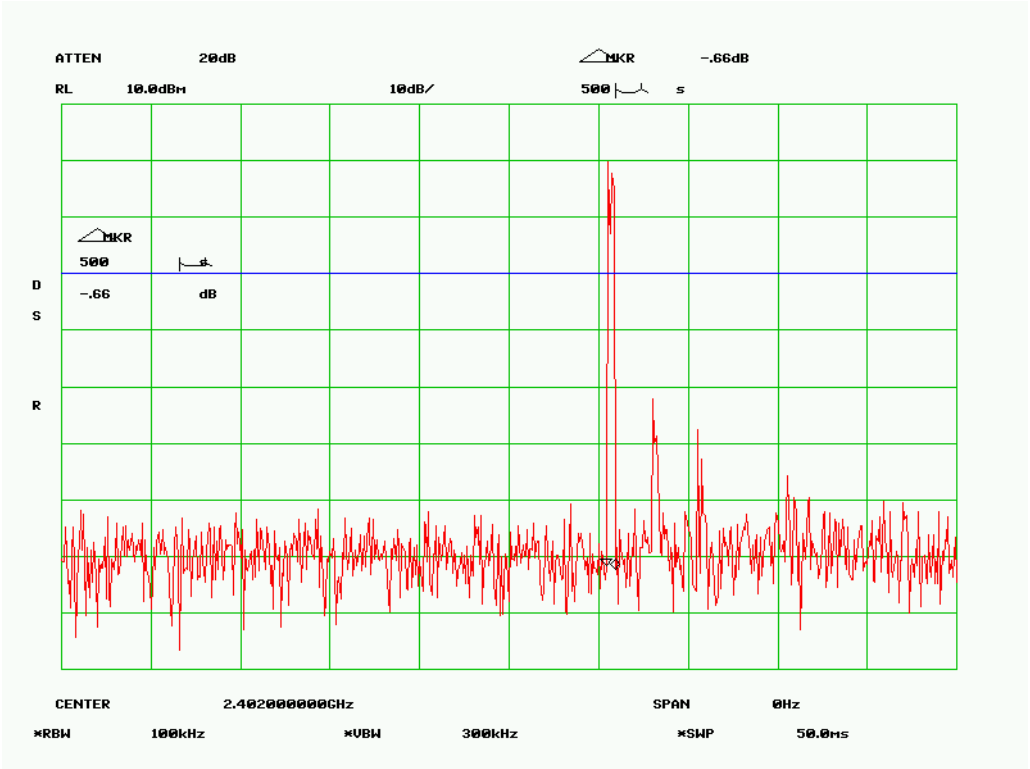
Channel	Channel Frequency (MHz)	Dwell Time (sec)	Limit (sec)
Low	2402	0.002	0.4
Mid	2441	0.0015	0.4
High	2480	0.002	0.4

Note: *Dwell Time* = 0.5msec * number of times the specific channel on during 31.6sec sweep.

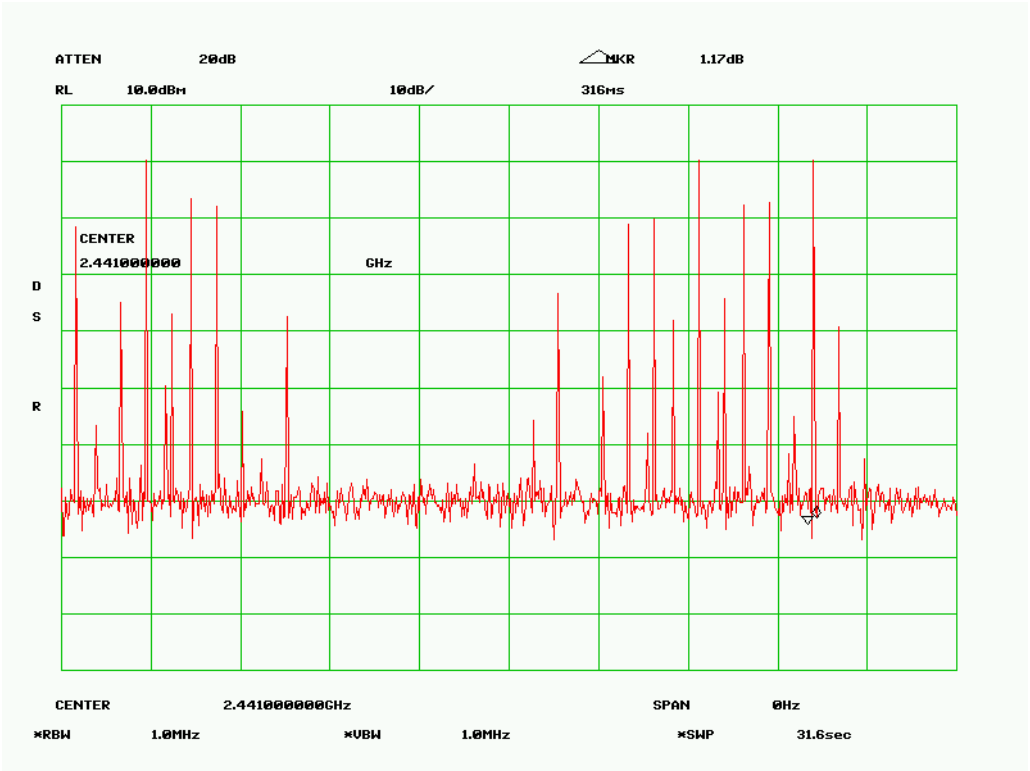
Low Channel (Sweep in 31.6sec)



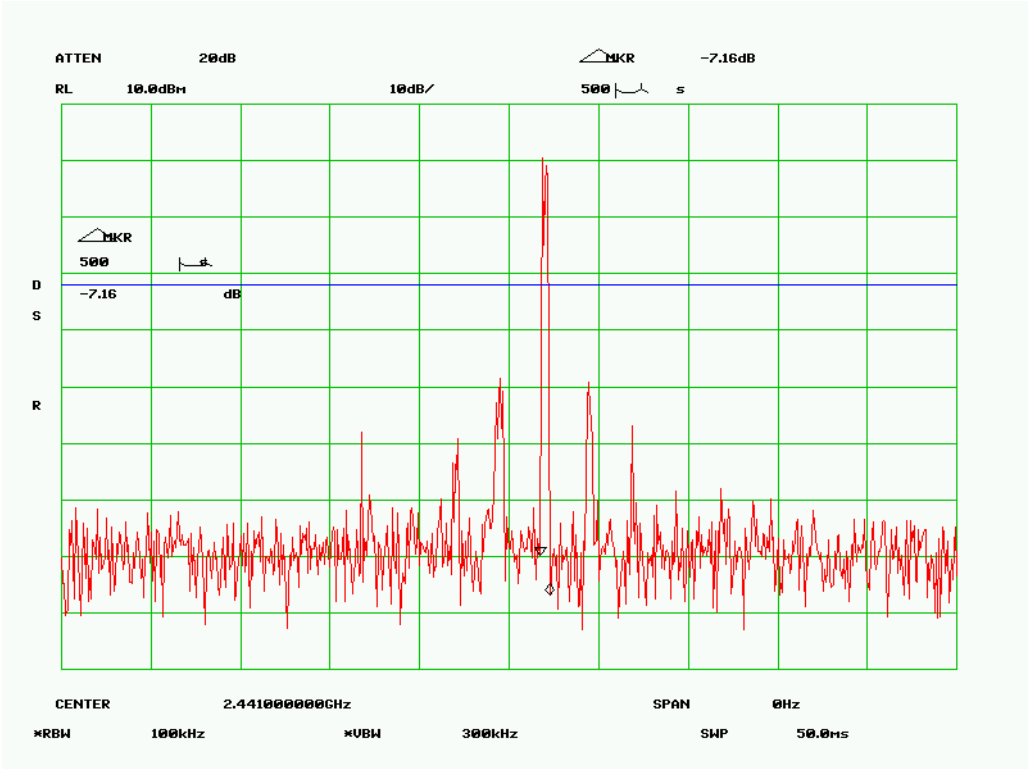
Low Channel (Sweep in 50msec)



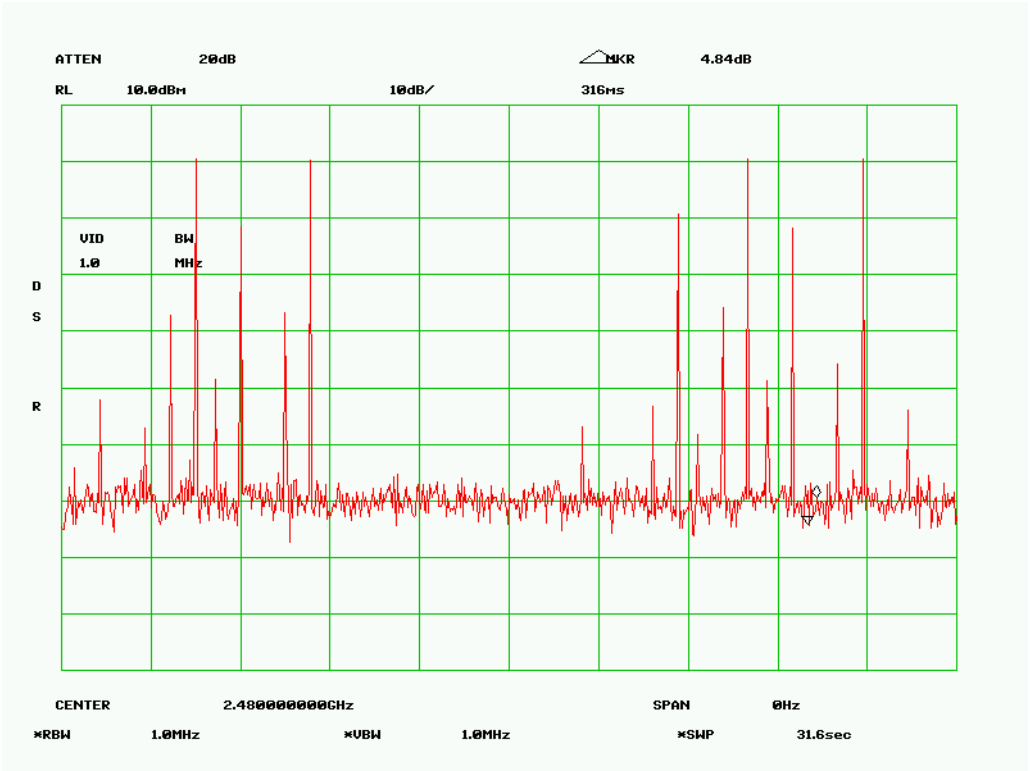
Mid Channel (Sweep in 31.6sec)



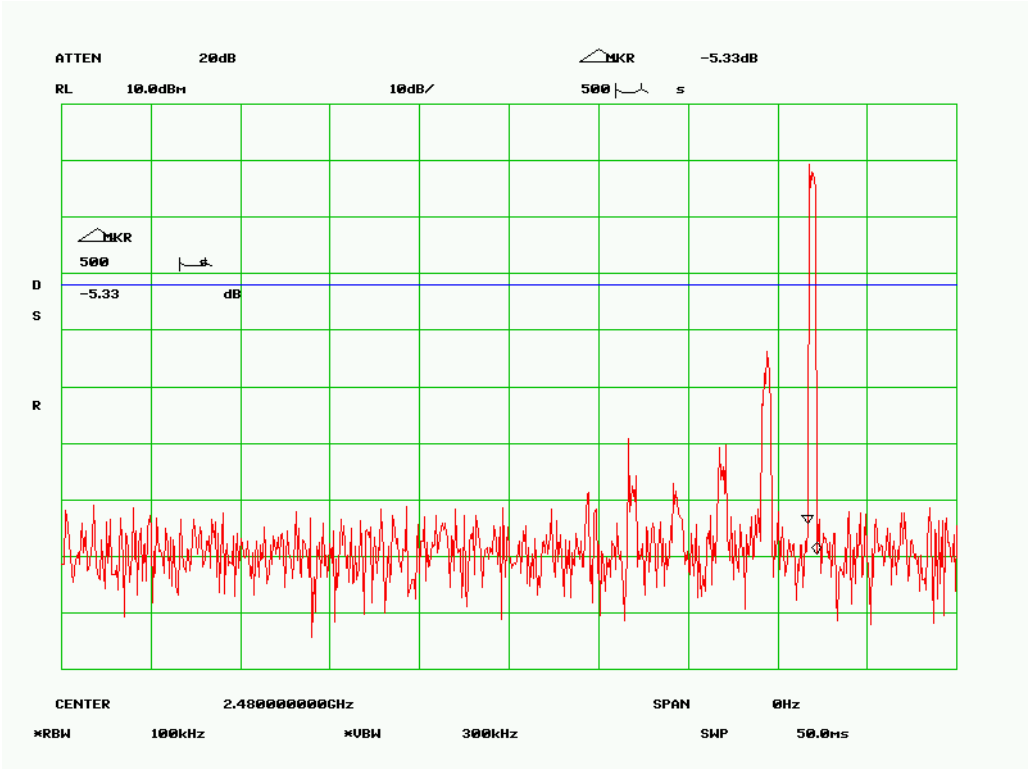
Mid Channel (Sweep in 50msec)



High Channel (Sweep in 31.6sec)



High Channel (Sweep in 50msec)



5.7 Peak Output Power

1. Conducted Measurement
   EUT was set for low , mid, high channel with modulated mode and highest RF output power.
   The spectrum analyzer was connected to the antenna terminal.
2. Conducted Emissions Measurement Uncertainty
   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 40GHz is ±1.5dB.
3. Environmental Conditions

Temperature	23ºC - 25ºC
Relative Humidity	50%
Atmospheric Pressure	1019mbar

4. Test Date : July 14- August 25 2008
   Tested By :Choon Sian Ooi

Standard Requirement : 47 CFR §15.247(b)

Procedures: The peak output power was measured conducted using a spectrum analyzer at low, mid, and hi channels. Peak detector was set to measure the power output. The power is converted from watt to dBm, therefore, 1 watt = 30 dBm.

Test Result :

WLAN

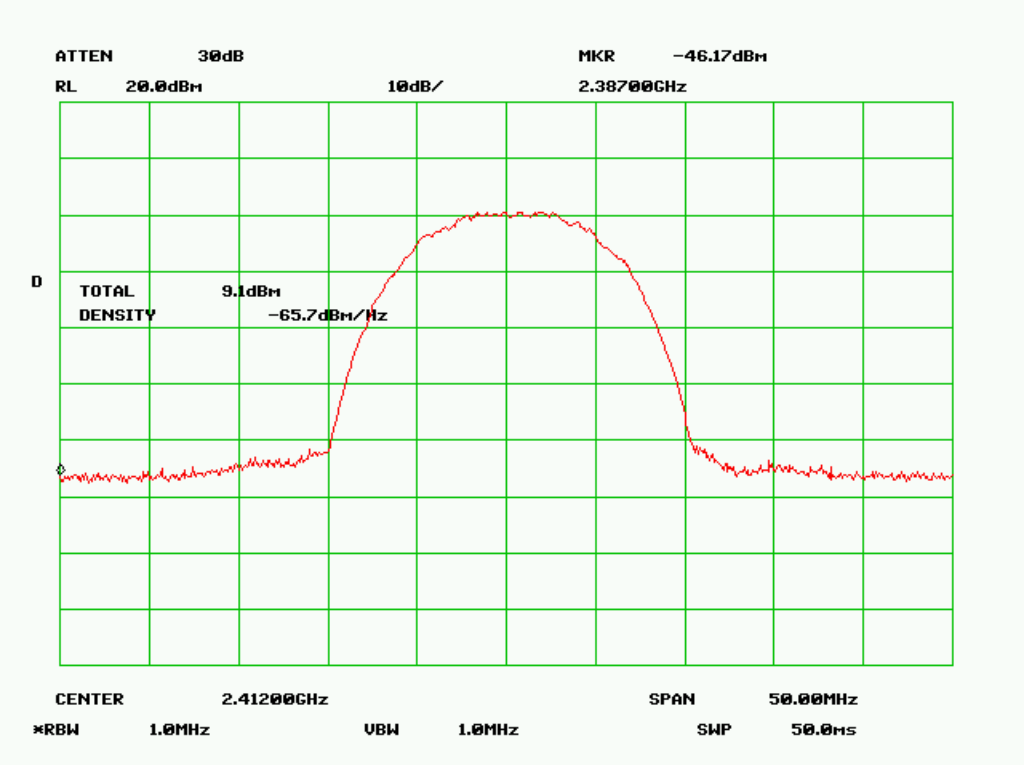
Protocol	Channel	Channel Frequency (MHz)	Peak Output Power Limit (dBm)	Measured Output Power(dBm)
802.11b	Low	2412	30	9.1
802.11b	Mid	2437	30	9.6
802.11b	High	2462	30	10.0
802.11g	Low	2412	30	10.1
802.11g	Mid	2437	30	10.0
802.11g	High	2462	30	10.1

Bluetooth

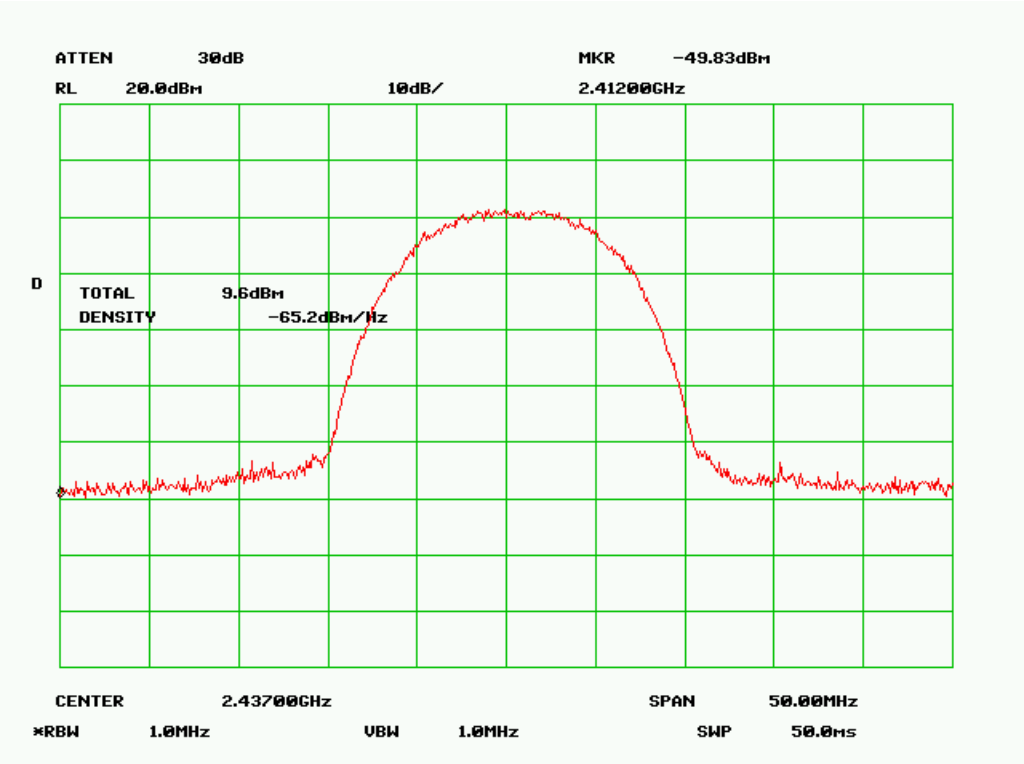
Channel	Channel Frequency (MHz)	Measured Output Power (dBm)	Peak Output Power Limit (dBm)
Low	2402	-1.00	30
Mid	2441	-1.50	30
High	2480	-1.50	30

WLAN

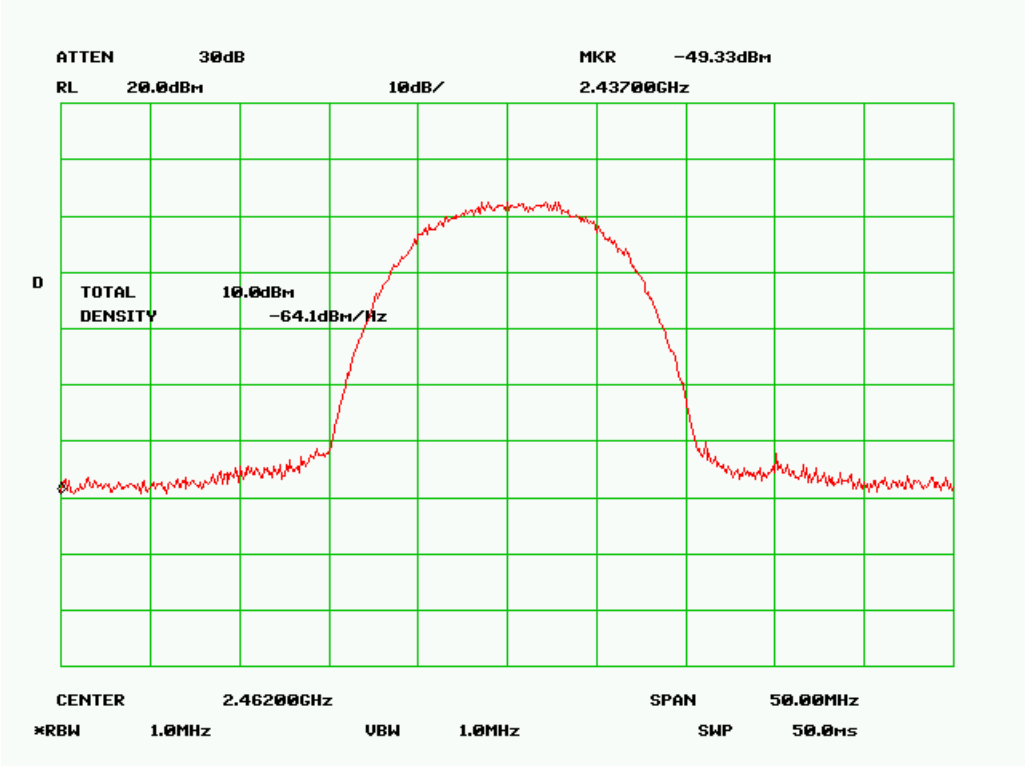
Output Power Low Channel (802.11b)



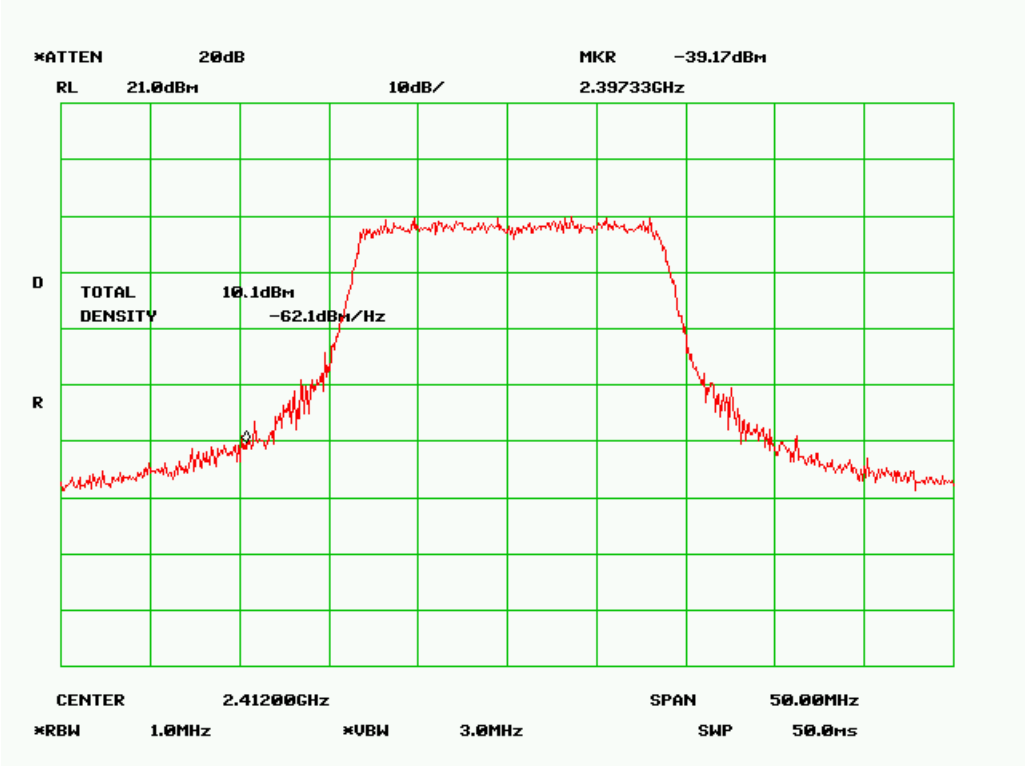
Output Power Mid Channel (802.11b)



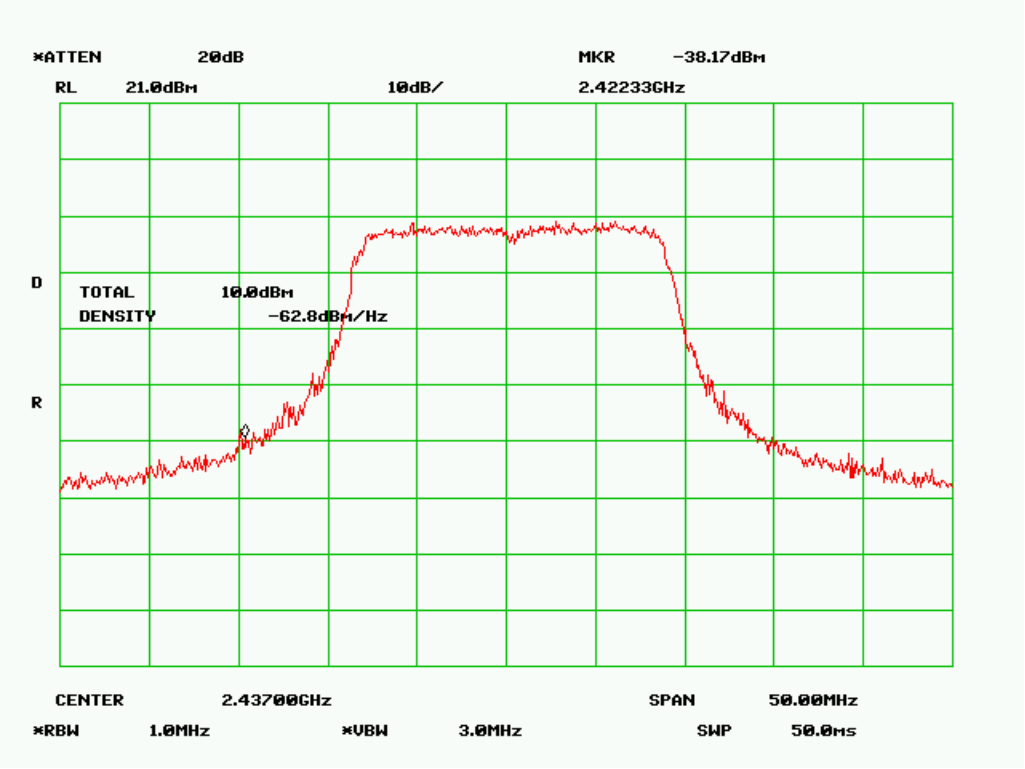
Output Power High Channel (802.11b)



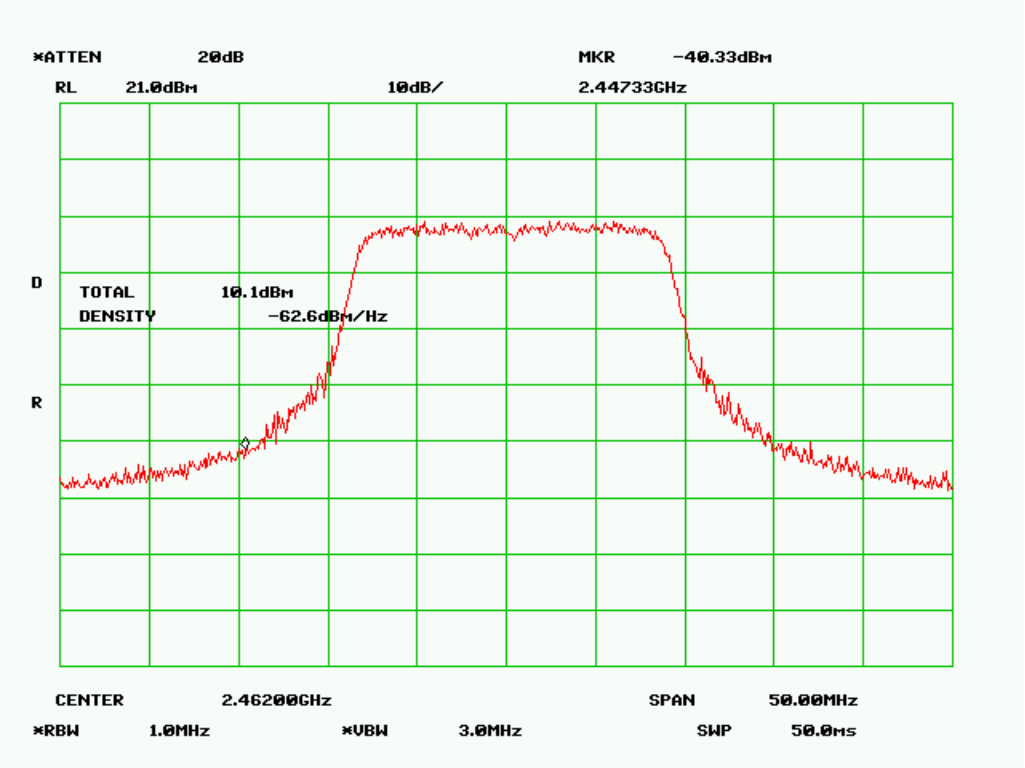
Output Power Low Channel (802.11g)



Output Power Mid Channel (802.11g)

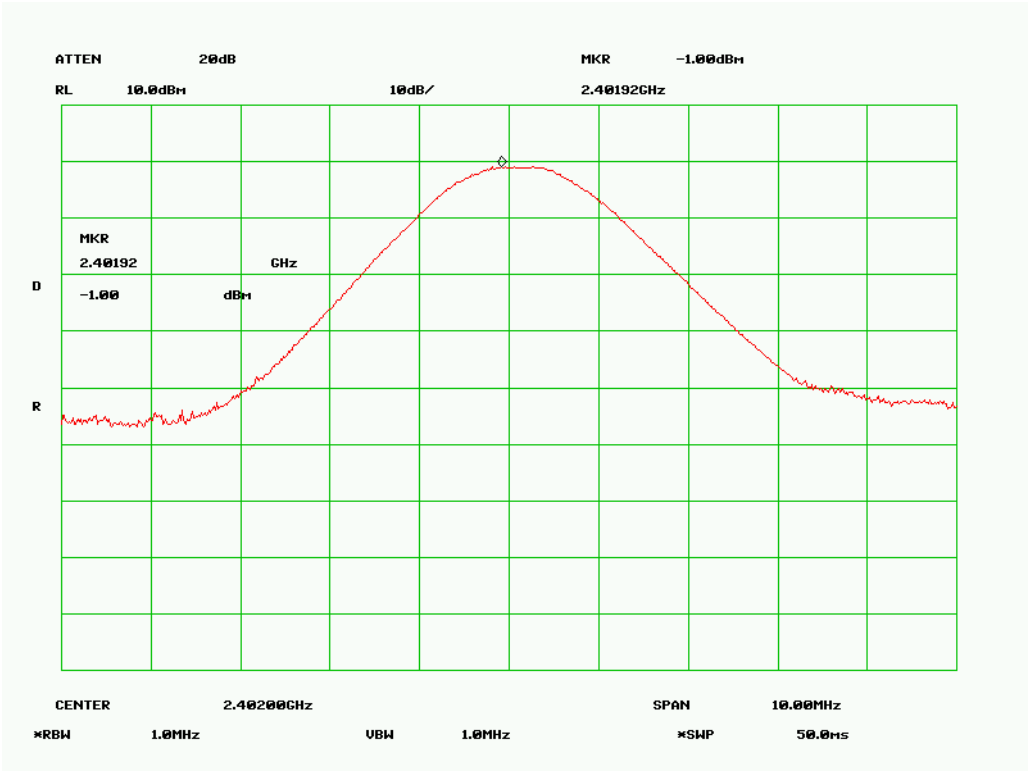


Output Power High Channel (802.11g)

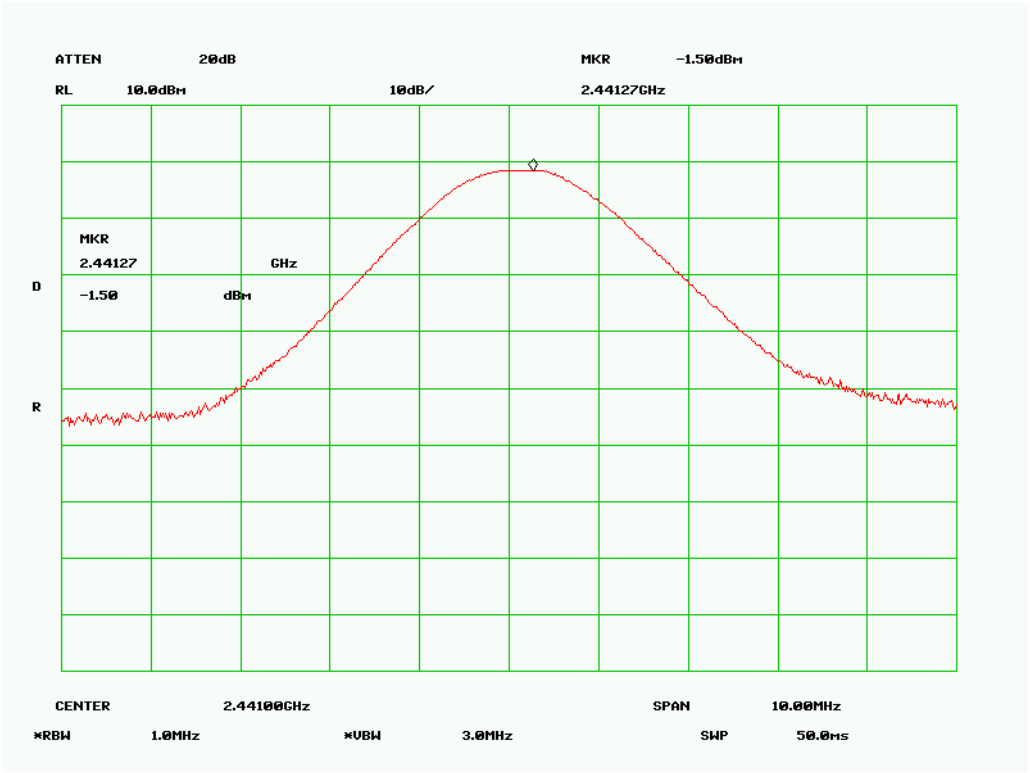


Bluetooth

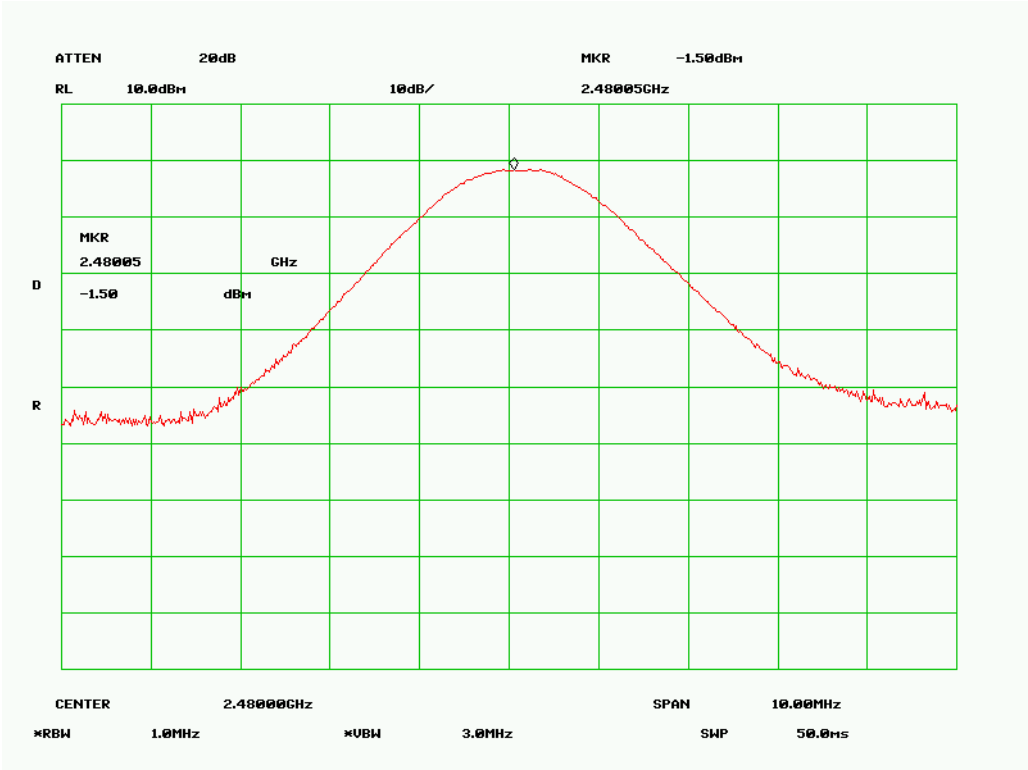
Output Power Low Channel



Output Power Mid Channel



Output Power High Channel



5.8 6dB & 99% Occupied Bandwidth

1. Conducted Measurement
EUT was set for low , mid, high channel with modulated mode and highest RF output power.
The spectrum analyzer was connected to the antenna terminal.

2 Environmental Conditions

Temperature	23°C
Relative Humidity	50%
Atmospheric Pressure	1019mbar

3 Conducted Emissions Measurement Uncertainty
All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 40GHz is ±1.5dB.

4 Test Date : July 14- August 25 2008
Tested By :Choon Sian Ooi

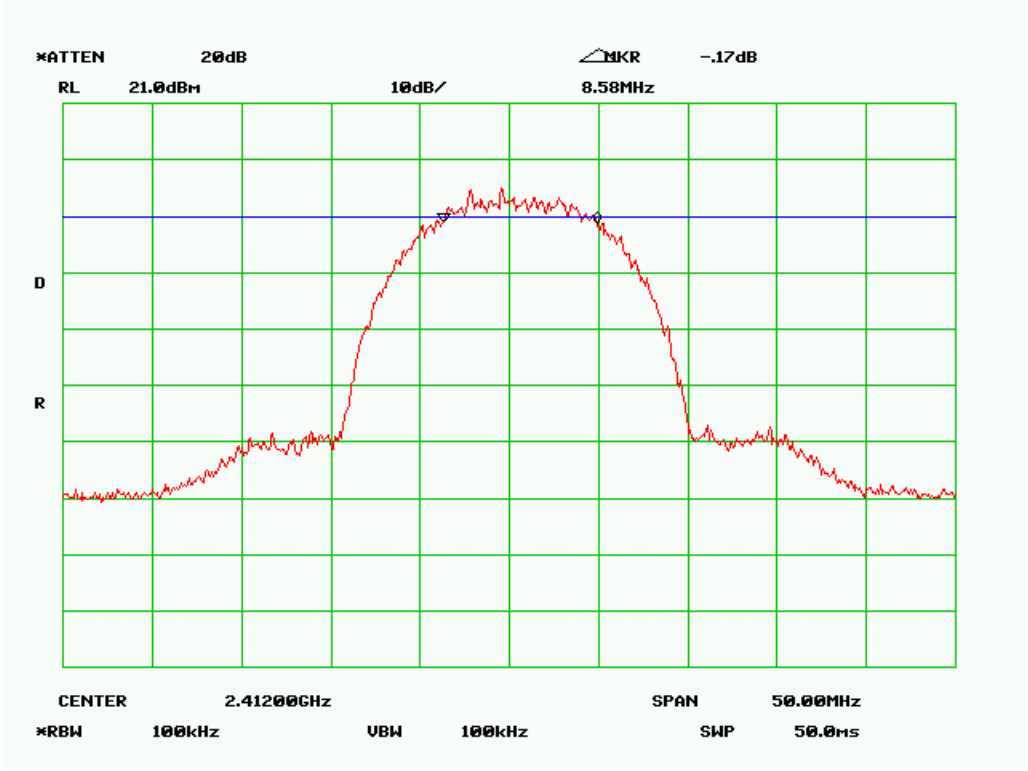
Requirement(s): 47 CFR §15.247(a)(1)

Procedures: The 6dB bandwidths were measured conducted using a spectrum analyzer at low, mid, and hi channels. 6 dB Bandwidth Limit: > 500 kHz.

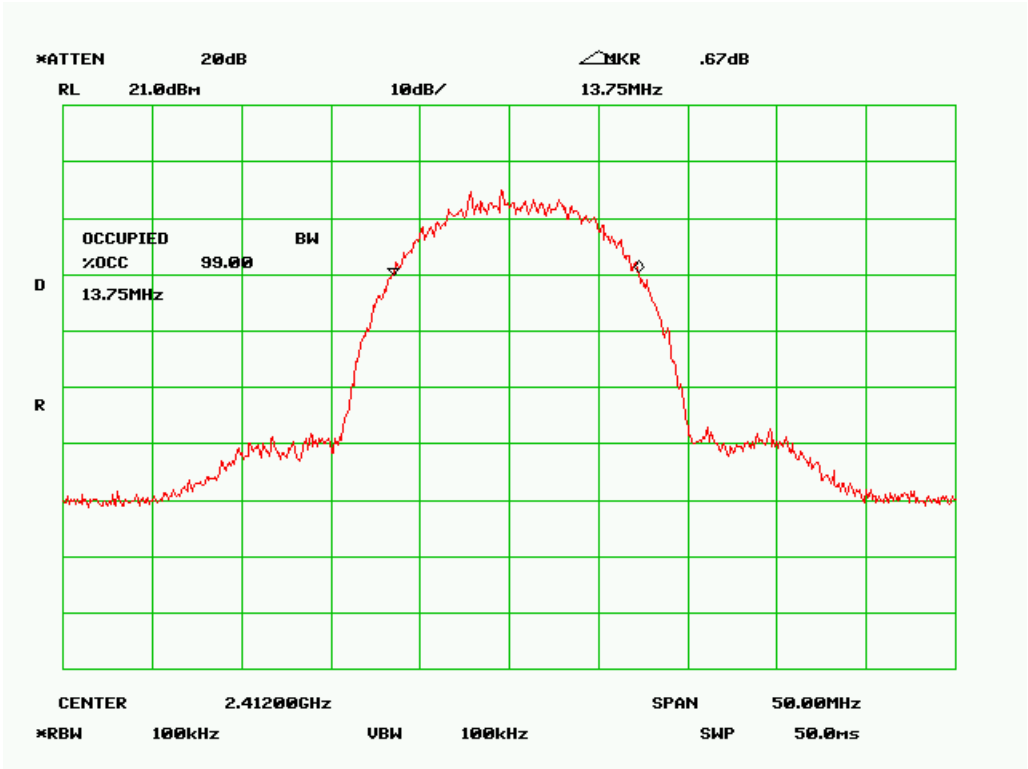
Protocol	Channel	Channel Frequency (MHz)	6 dB Channel Bandwidth (MHz)	99% Channel Bandwidth (MHz)	6 dB Occupied Bandwidth Limit (MHz)
802.11b	Low	2412	8.58	13.75	0.5
802.11b	Mid	2437	8.92	13.75	0.5
802.11b	High	2462	8.92	13.75	0.5
802.11g	Low	2412	16.75	16.65	0.5
802.11g	Mid	2437	16.75	16.75	0.5
802.11g	High	2462	16.67	16.67	0.5

Refer to the attached plots.

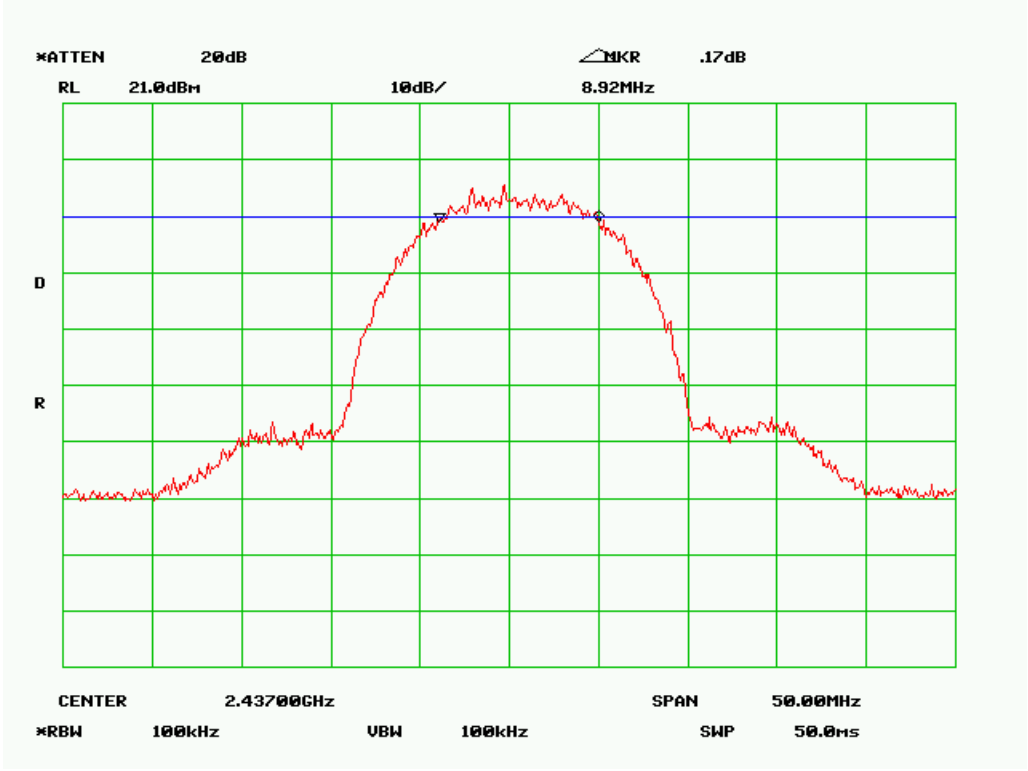
6 dB Bandwidth - Low Channel (802.11b)



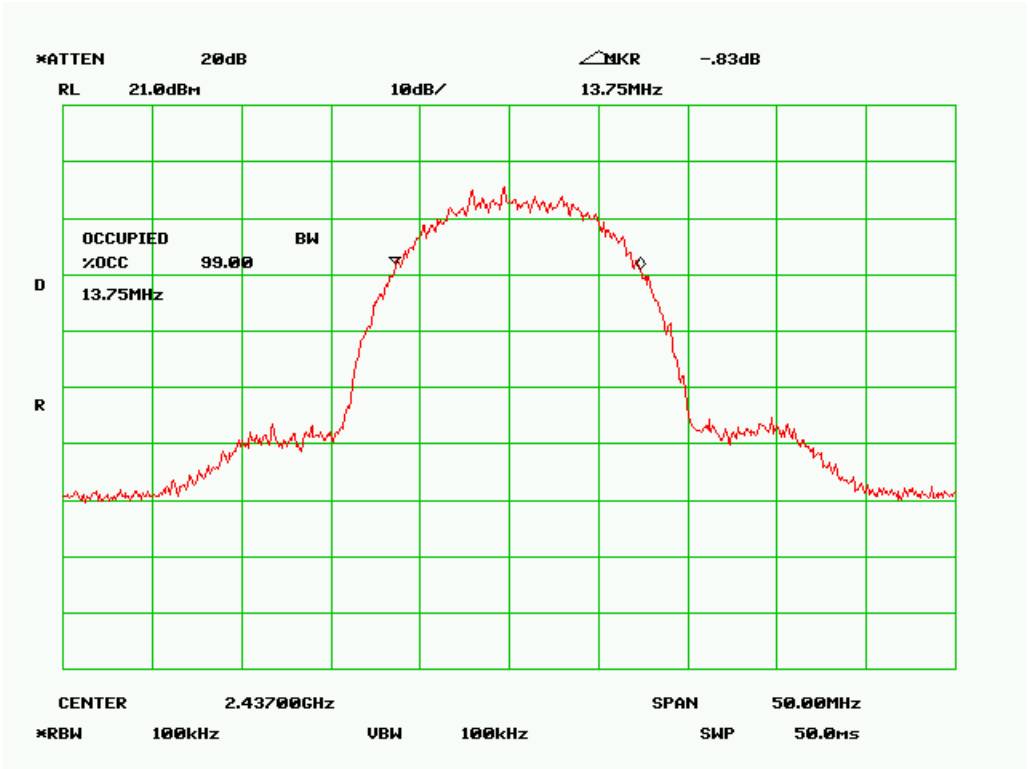
99% Bandwidth - Low Channel (802.11b)



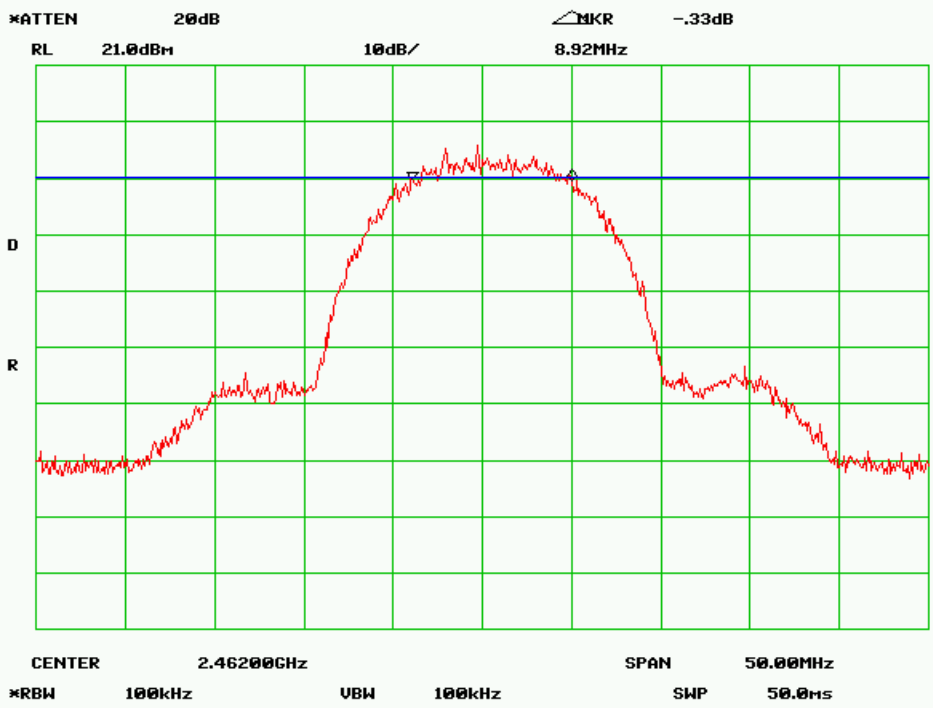
6 dB Bandwidth - Mid Channel (802.11b)



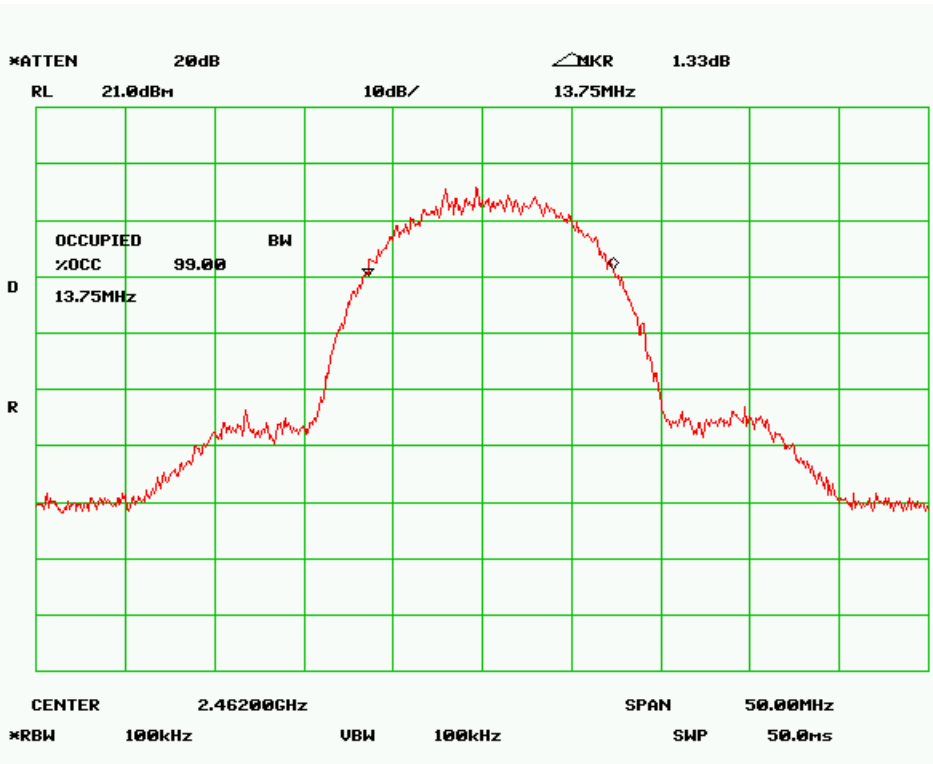
99% Bandwidth - Mid Channel (802.11b)



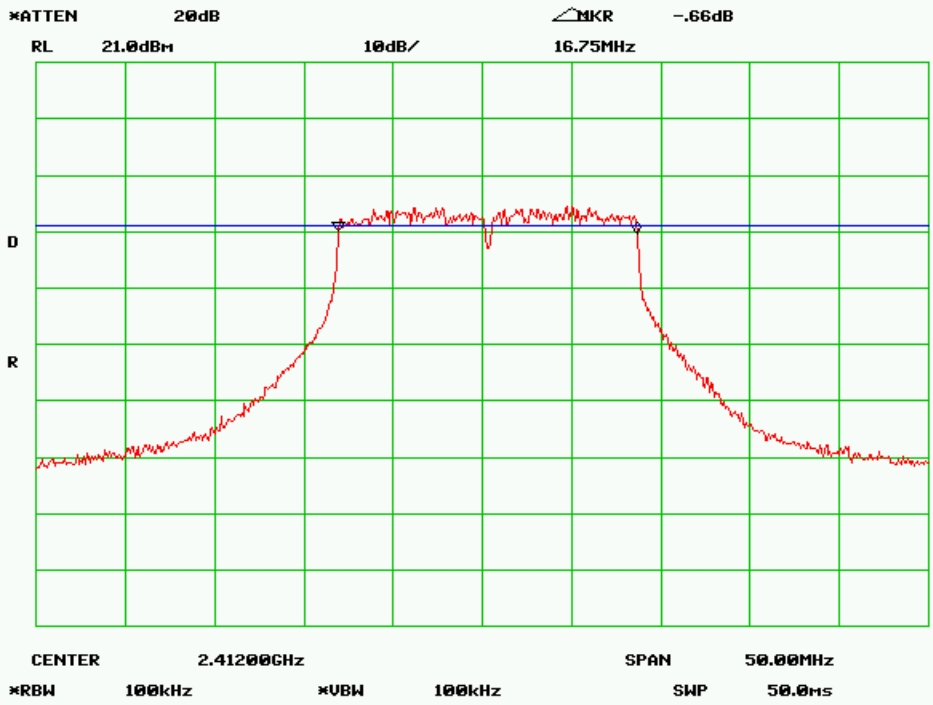
6 dB Bandwidth – High Channel (802.11b)



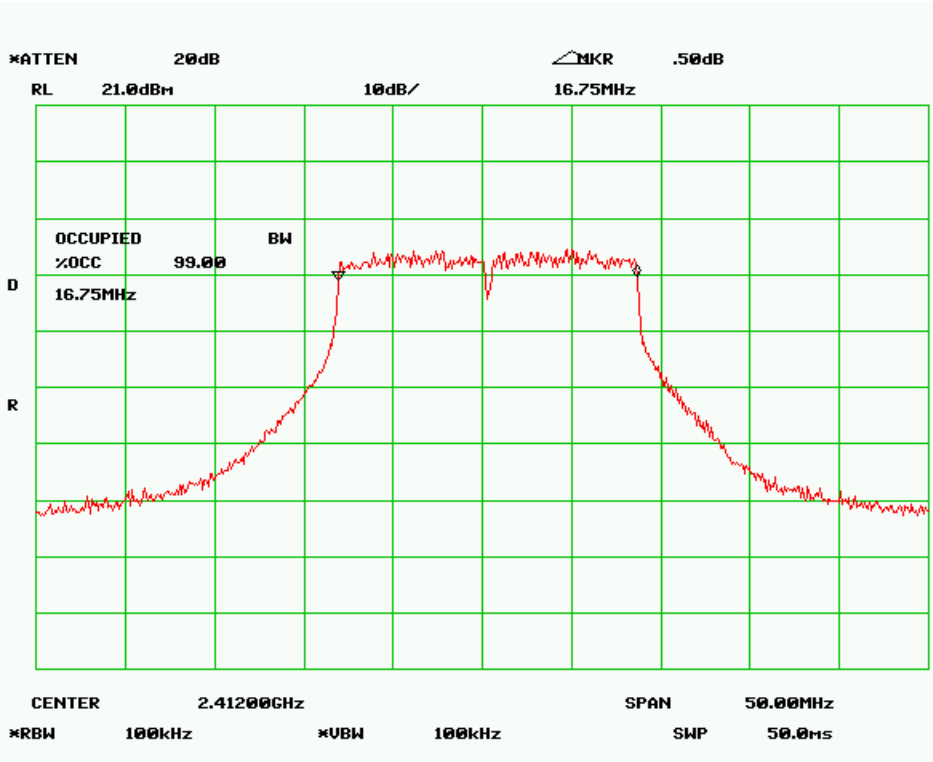
99% Bandwidth - High Channel (802.11b)



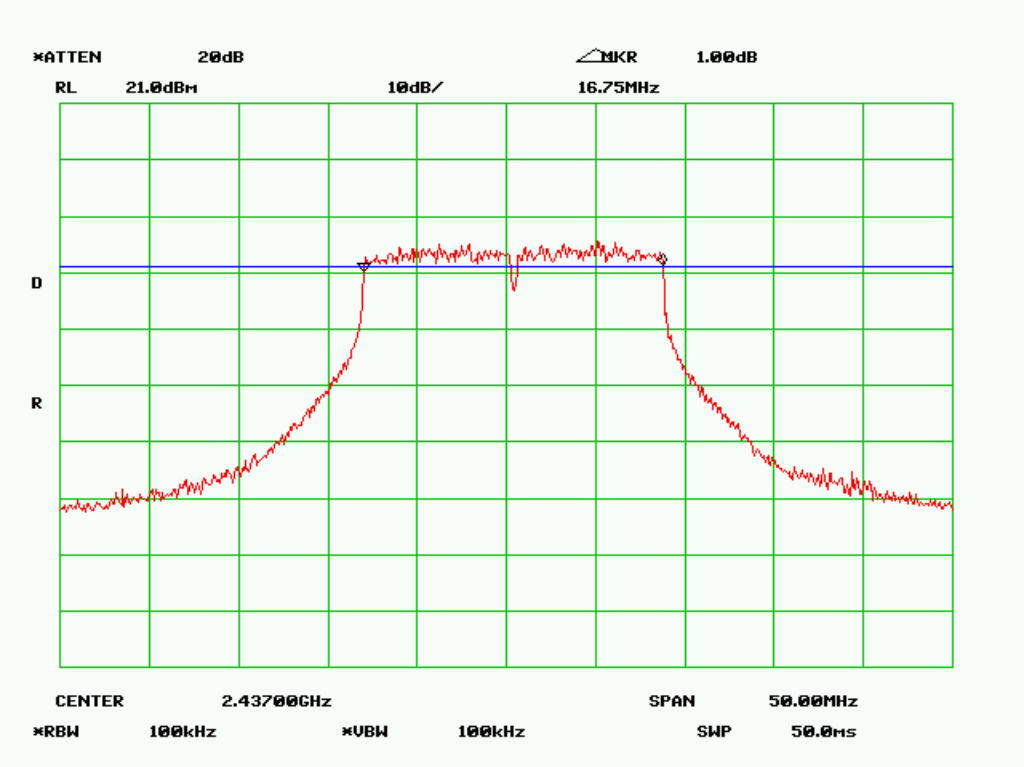
6 dB Bandwidth - Low Channel (802.11g)



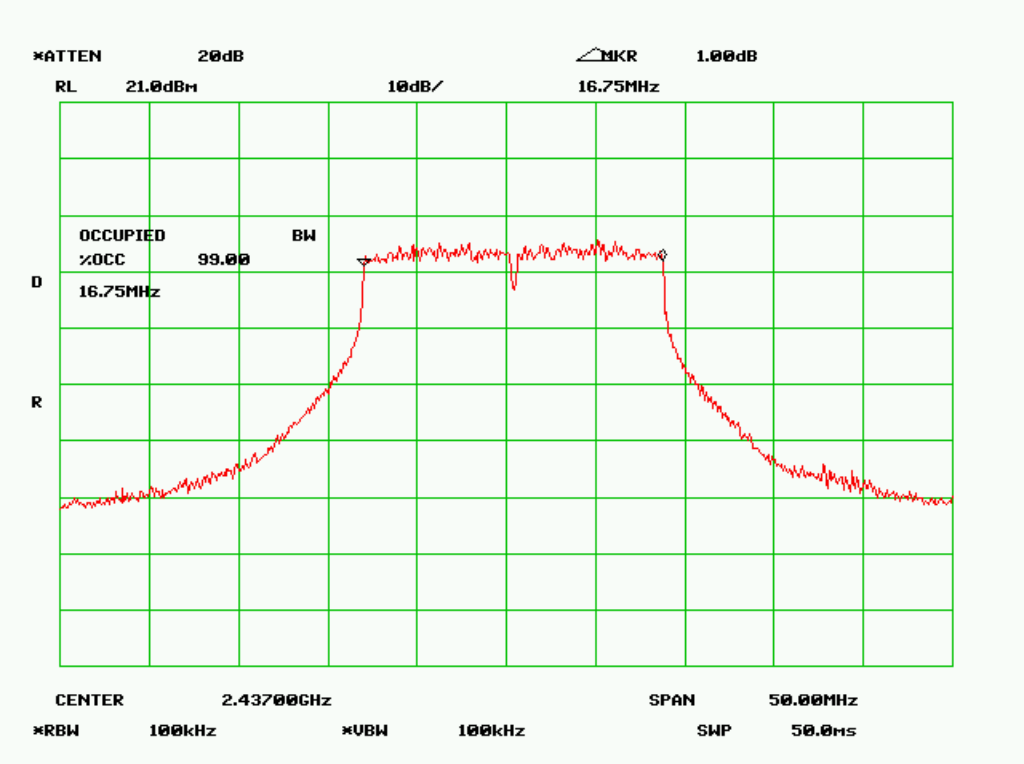
99% Bandwidth - Low Channel (802.11g)



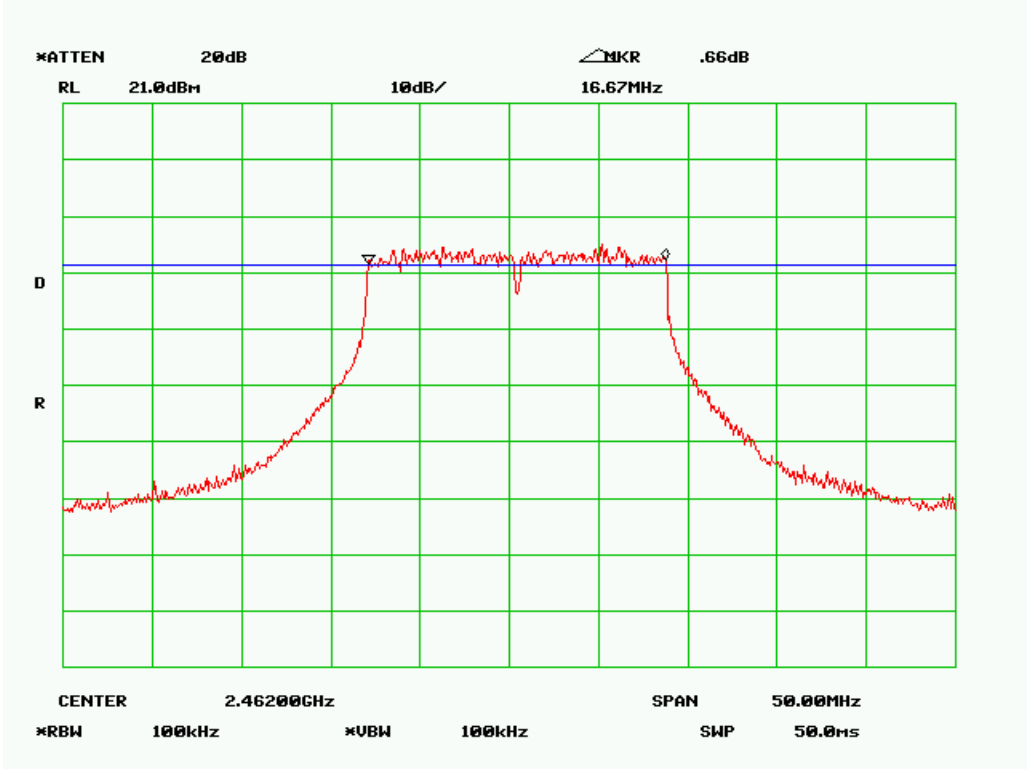
6 dB Bandwidth - Mid Channel (802.11g)



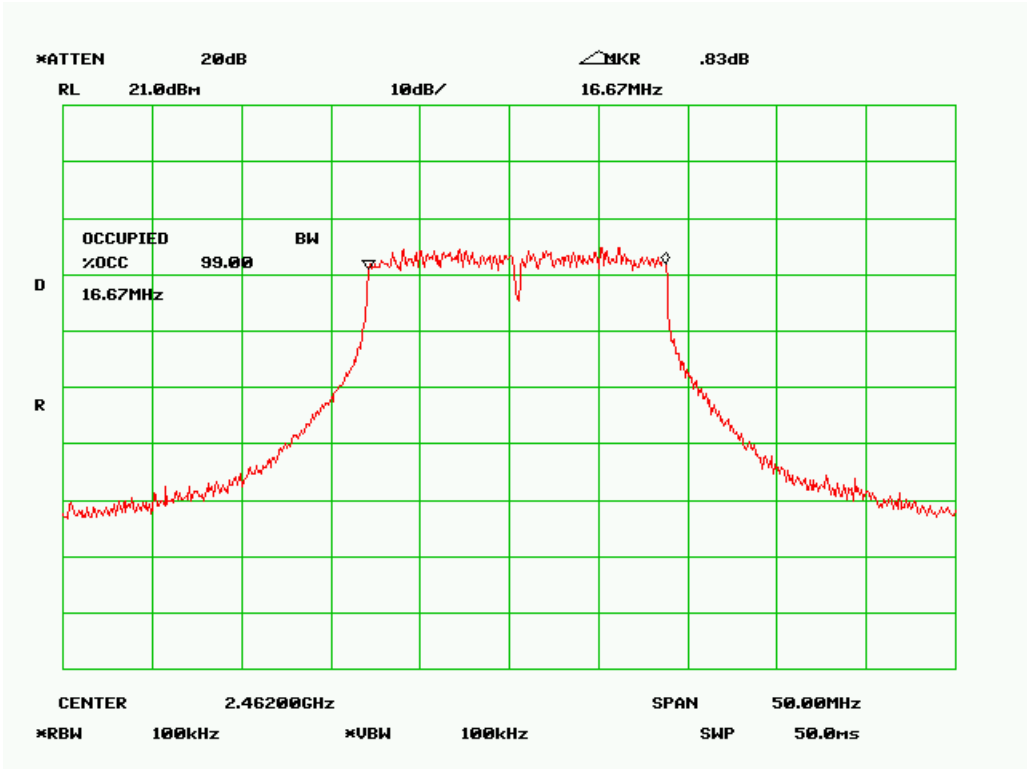
99% Bandwidth - Mid Channel (802.11g)



6 dB Bandwidth – High Channel (802.11g)



99% Bandwidth – High Channel (802.11g)



5.9 Peak Spectral Density

1. Conducted Measurement
   EUT was set for low , mid, high channel with modulated mode and highest RF output power.
   The spectrum analyzer was connected to the antenna terminal.
2. Conducted Emissions Measurement Uncertainty
   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 40GHz is ±1.5dB.
3. Environmental Conditions

Temperature	23°C
Relative Humidity	50%
Atmospheric Pressure	1019mbar

4. Test Date : July 14- August 25 2008
   Tested By :Choon Sian Ooi

Standard Requirement : 47 CFR §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

Procedures: The Peak Spectral density measurement was taken conducted using a spectrum analyzer.

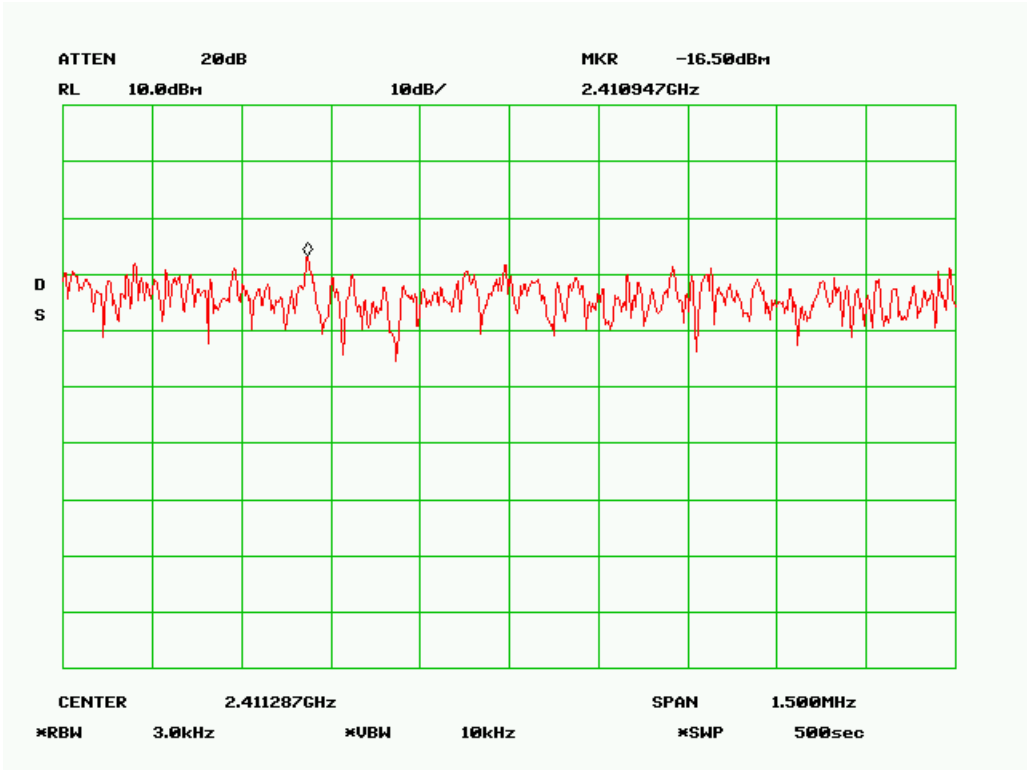
RBW=3KHz, VBW > RBW , Sweep time to SPAN/RBW (sec)

Test Result :

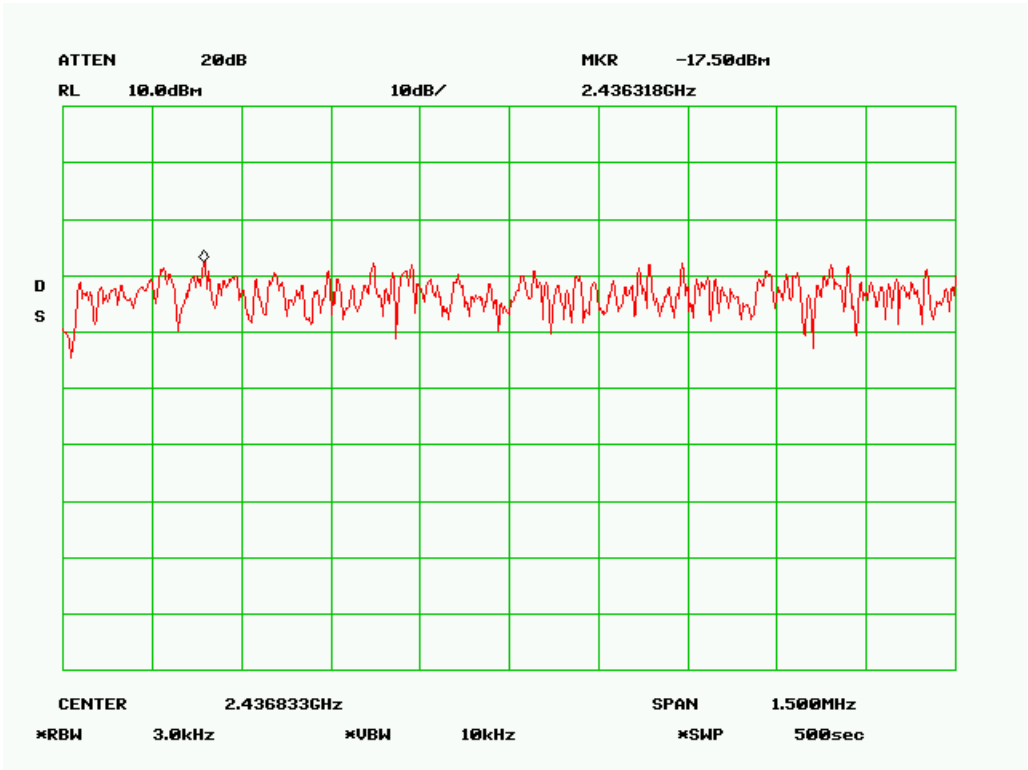
Protocol	Channel	Channel Frequency (MHz)	Peak Spectral Density Limit (dBm/3KHz)	Peak Spectral Density (dBm/3KHz)
802.11b	Low	2412	8	-16.50
802.11b	Mid	2437	8	-17.50
802.11b	High	2462	8	-16.83
802.11g	Low	2412	8	-18.67
802.11g	Mid	2437	8	-17.83
802.11g	High	2462	8	-16.83

Refer to the attached plots.

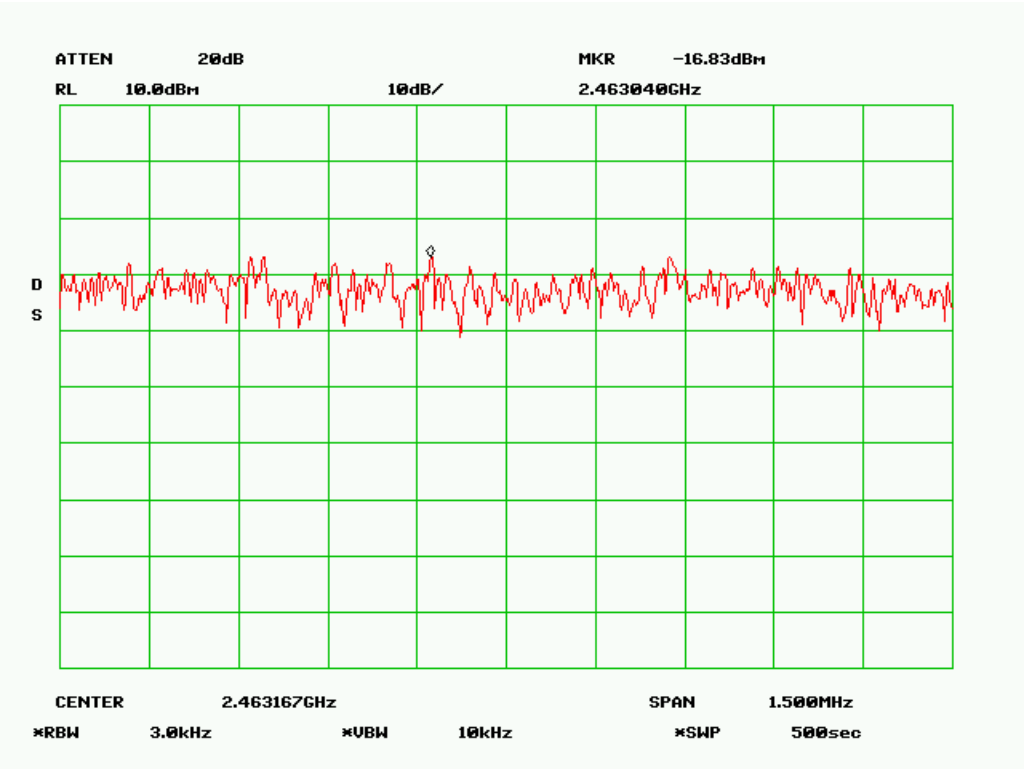
PSD Low Channel (802.11b)



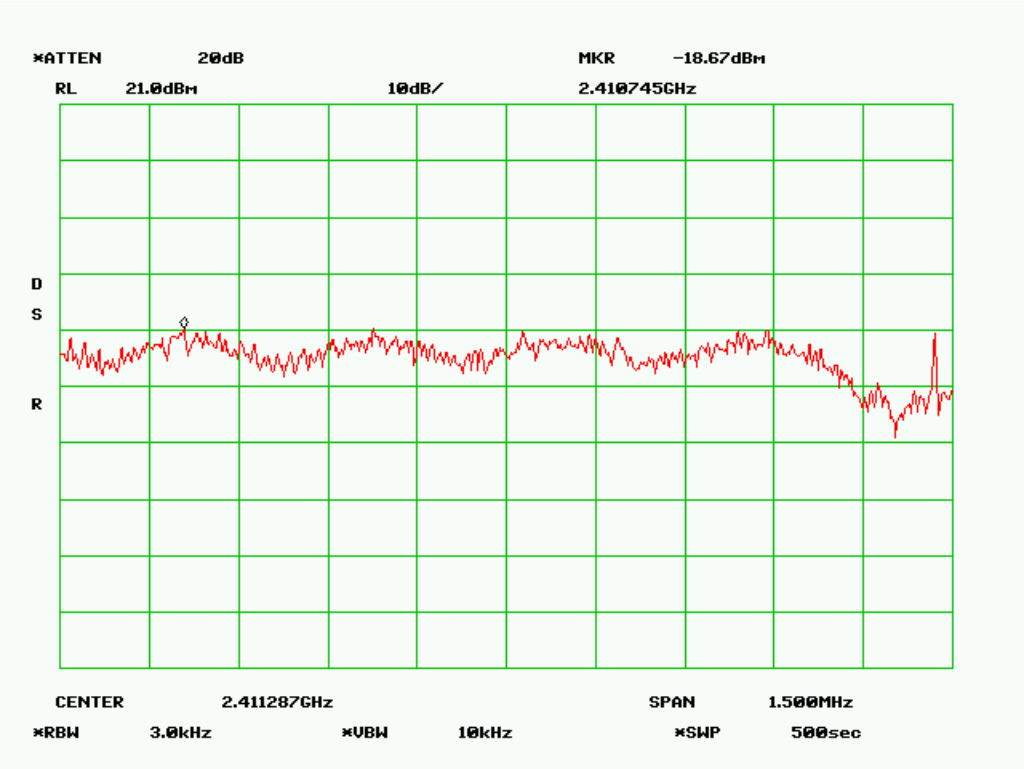
PSD Mid Channel (802.11b)



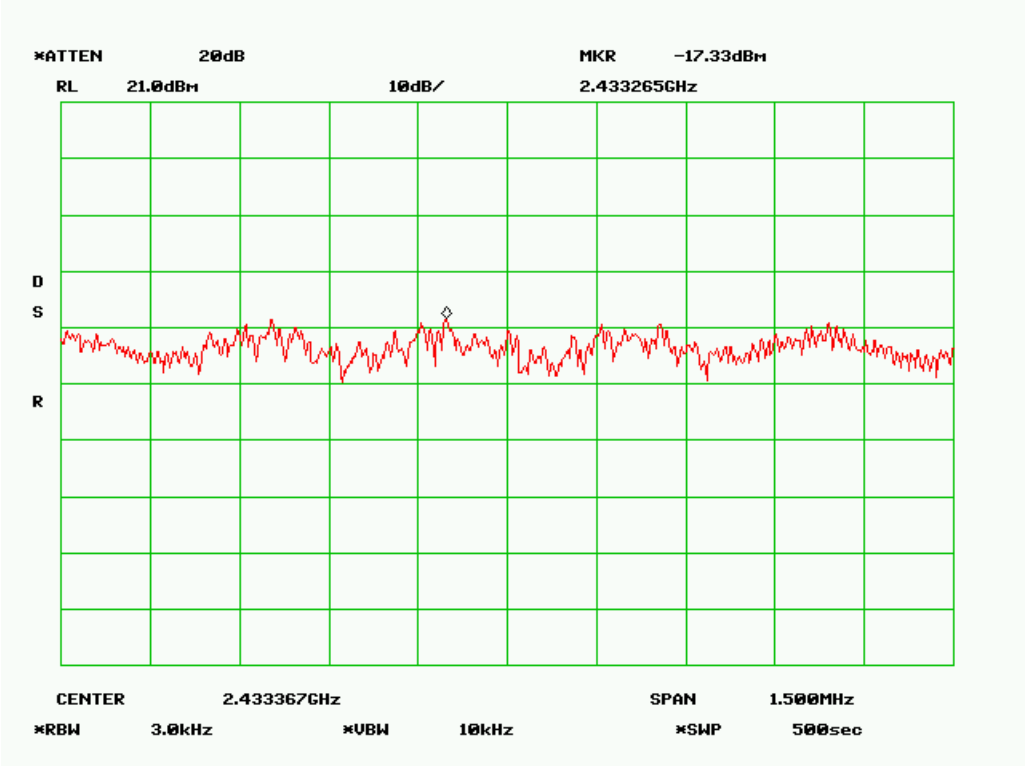
PSD High Channel (802.11b)



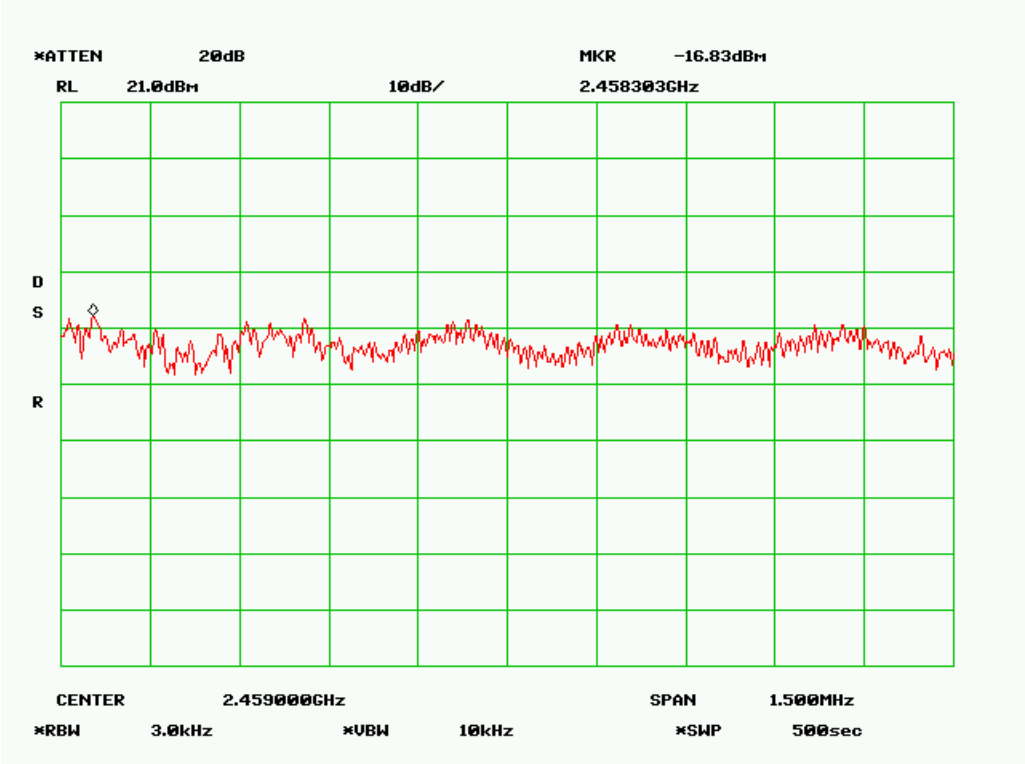
PSD Low Channel (802.11g)



PSD Mid Channel (802.11g)



PSD High Channel (802.11g)



5.10 Antenna Port Emission

1. Conducted Measurement
   EUT was set for low , mid, high channel with modulated mode and highest RF output power.
   The spectrum analyzer was connected to the antenna terminal.
2. Conducted Emissions Measurement Uncertainty
   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 20GHz is ±1.5dB.
3. Environmental Conditions

Temperature	23ºC - 25ºC
Relative Humidity	50%
Atmospheric Pressure	1019mbar

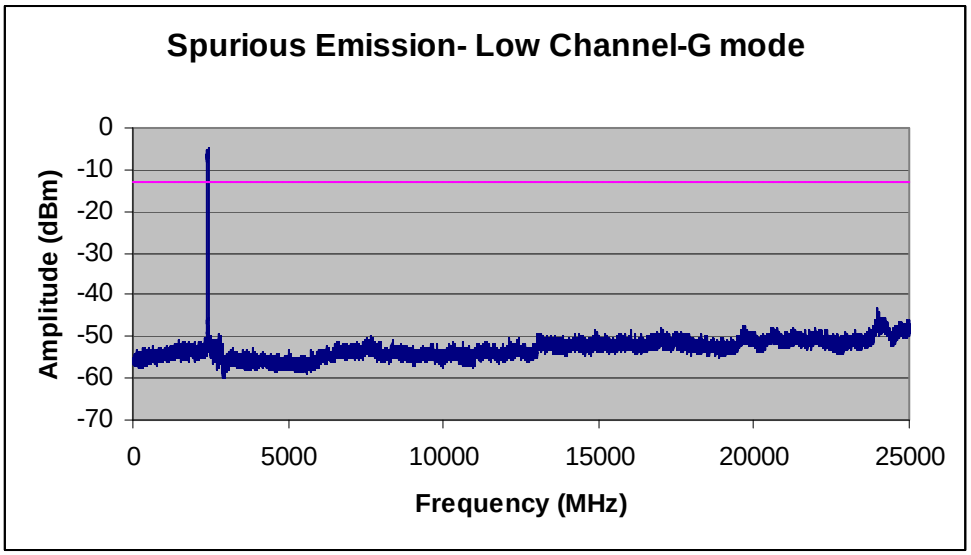
4. Test Date : July 14- August 25 2008
   Tested By :Choon Sian Ooi

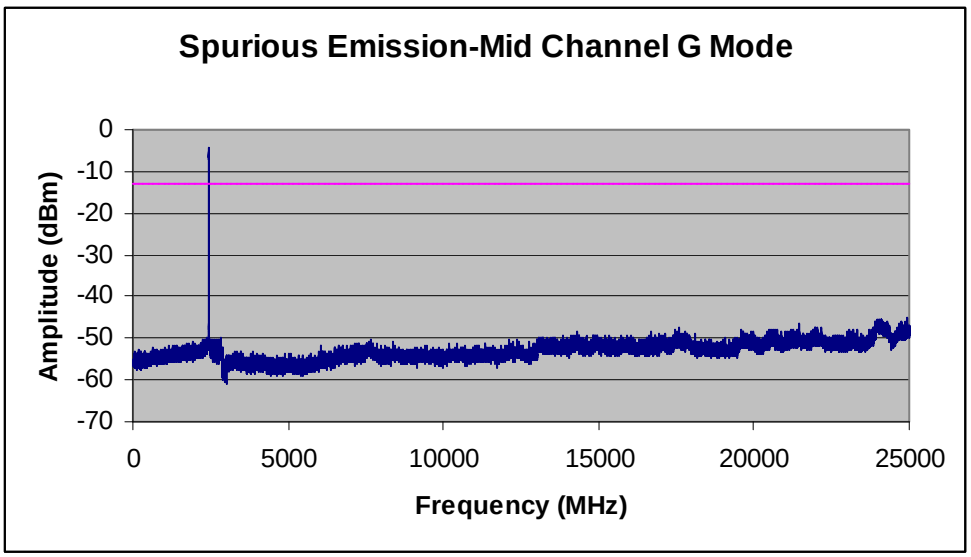
Standard Requirement : 47 CFR §15.247(c)

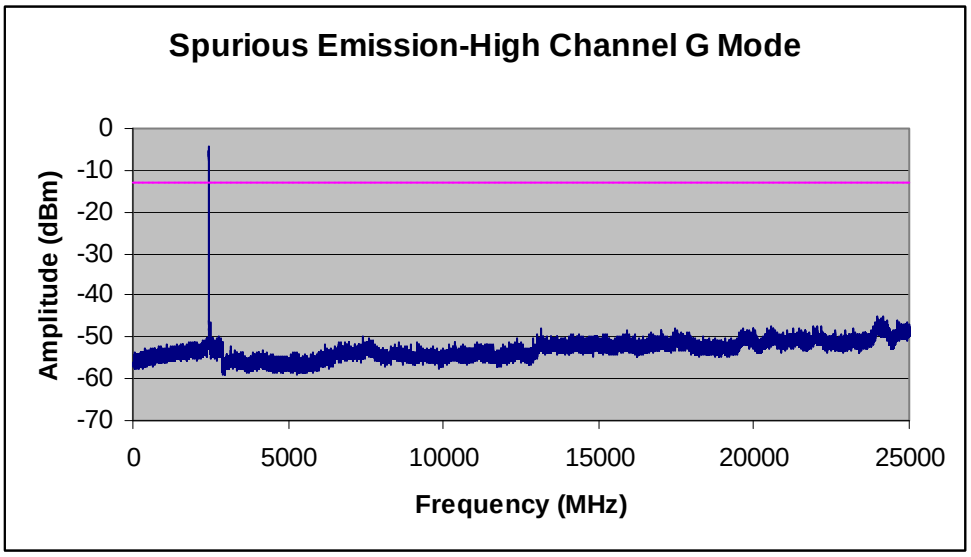
Procedures: The conducted spurious emissions were measured conducted using a spectrum analyzer at low, mid, and hi channels. The limit was determined by attenuating 20 dB of the RF peak power output

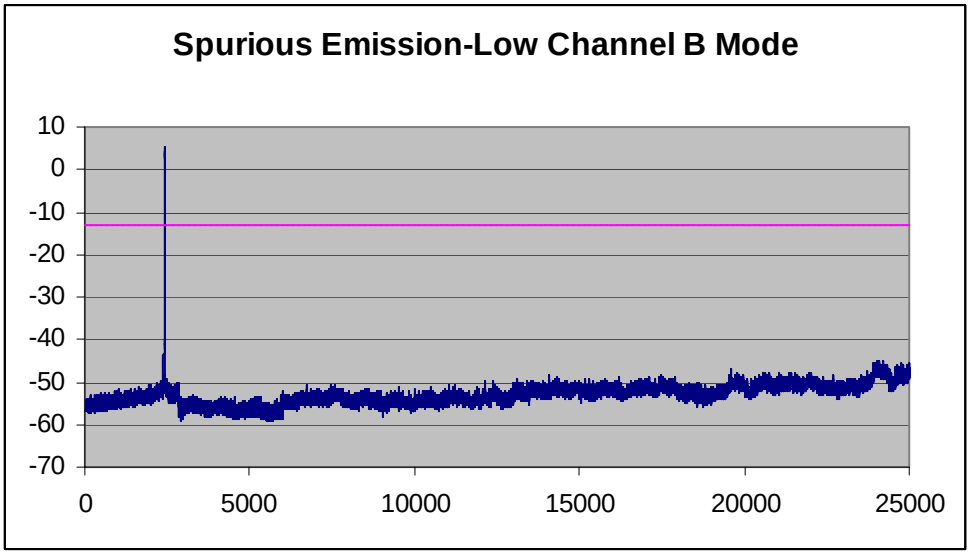
Test Result:

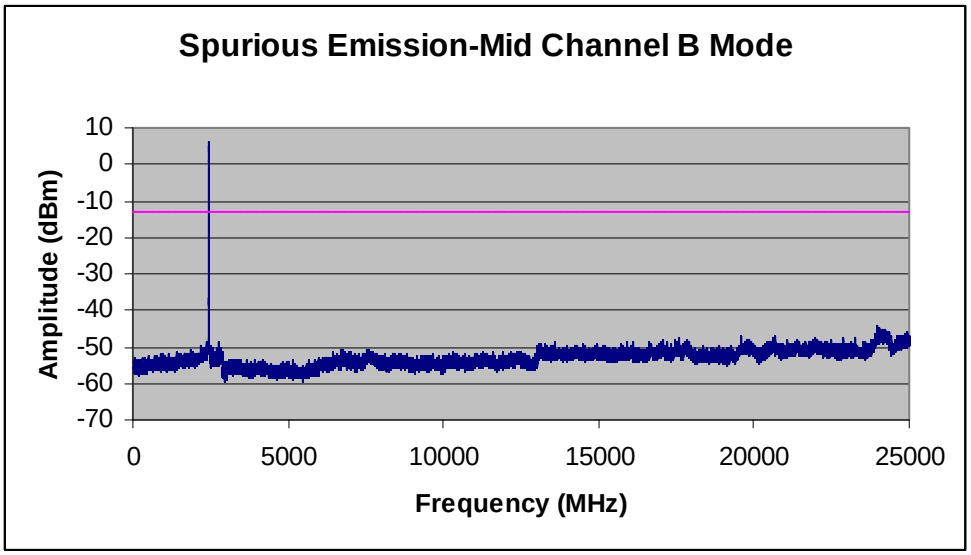
802.11b/g

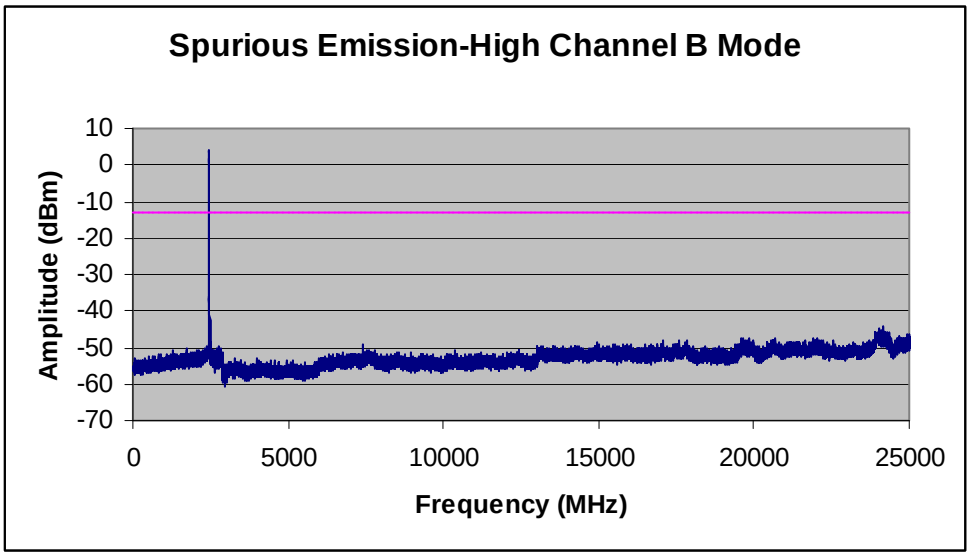

Spurious Emission- Low Channel-G mode
Amplitude (dBm)
0
-10
-20
-30
-40
-50
-60
-70
0
5000
10000
15000
20000
25000
Frequency (MHz)


Spurious Emission-Mid Channel G Mode
Amplitude (dBm)
0
-10
-20
-30
-40
-50
-60
-70
0
5000
10000
15000
20000
25000
Frequency (MHz)


Spurious Emission-High Channel G Mode
Amplitude (dBm)
0
-10
-20
-30
-40
-50
-60
-70
0
5000
10000
15000
20000
25000
Frequency (MHz)

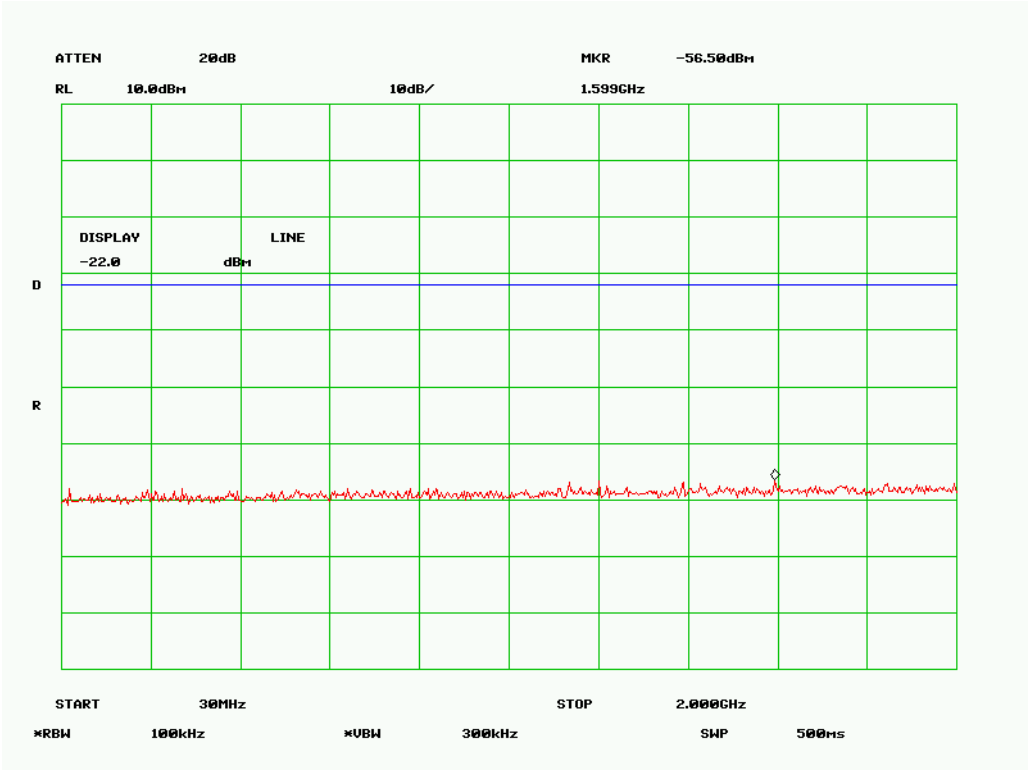

Spurious Emission-Low Channel B Mode
10
0
-10
-20
-30
-40
-50
-60
-70
0
5000
10000
15000
20000
25000


Spurious Emission-Mid Channel B Mode
Amplitude (dBm)
10
0
-10
-20
-30
-40
-50
-60
-70
0
5000
10000
15000
20000
25000
Frequency (MHz)

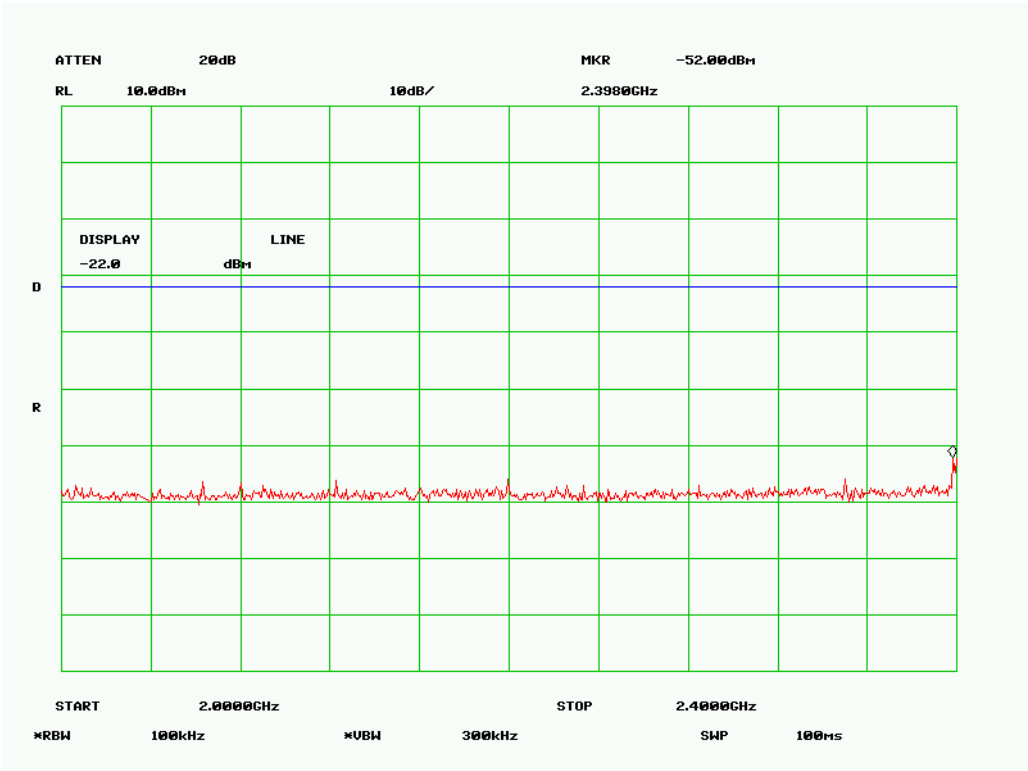

Spurious Emission-High Channel B Mode
Amplitude (dBm)
10
0
-10
-20
-30
-40
-50
-60
-70
0
5000
10000
15000
20000
25000
Frequency (MHz)

Bluetooth

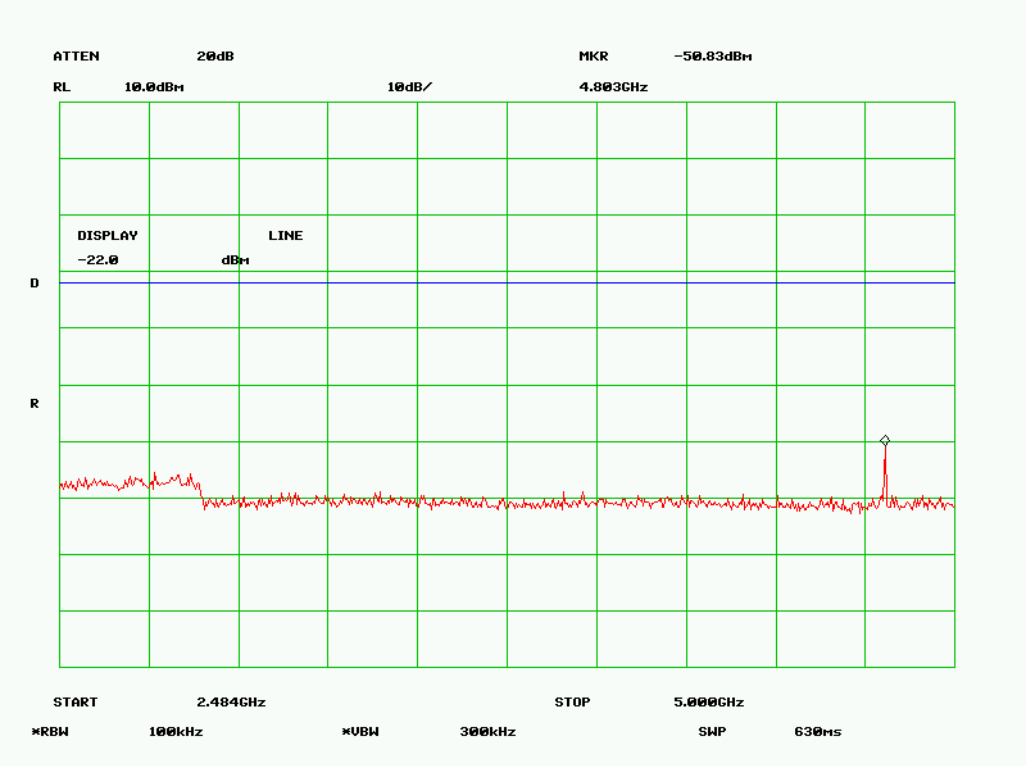
Low Channel -1



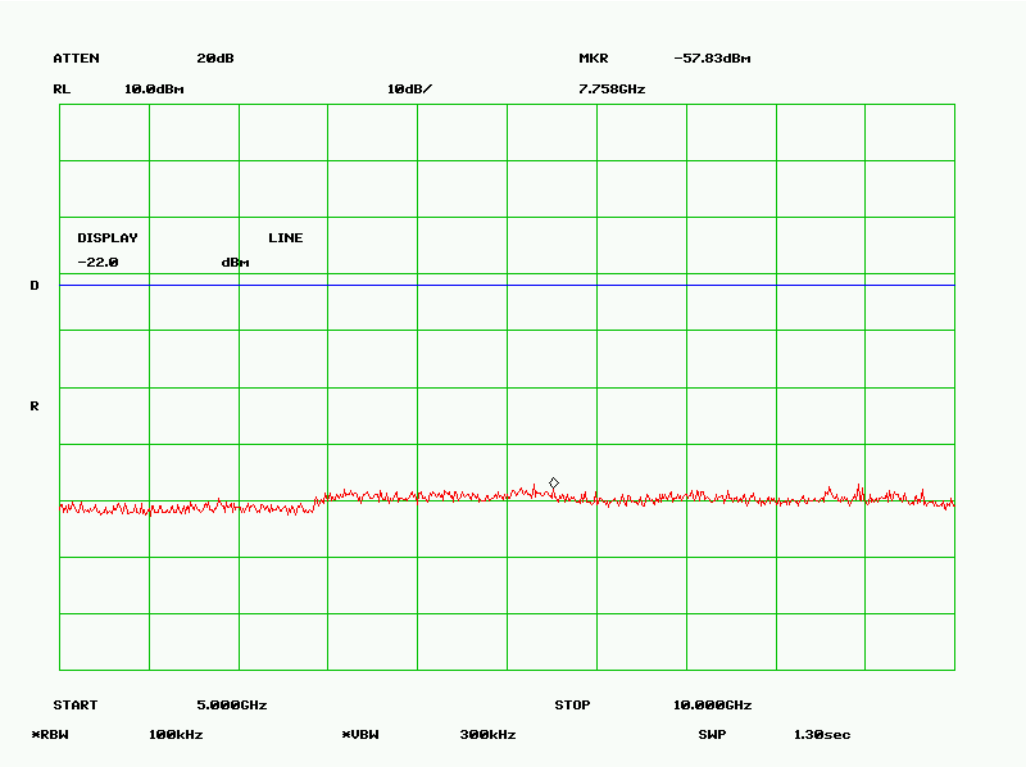
Low Channel -2



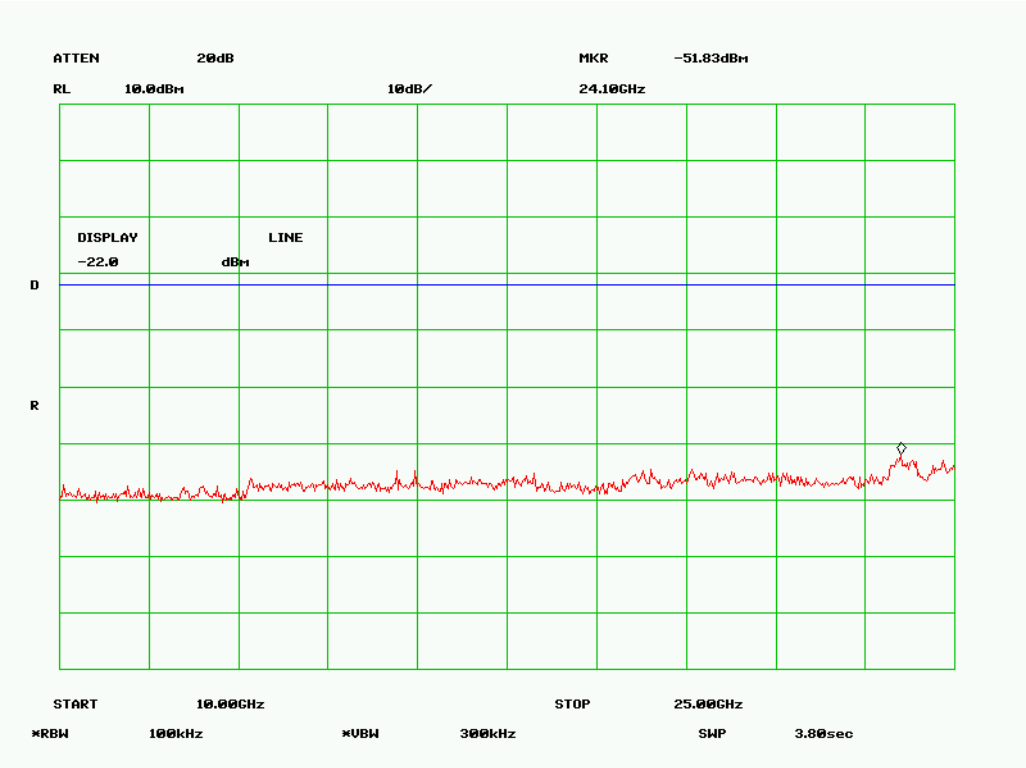
Low Channel -3



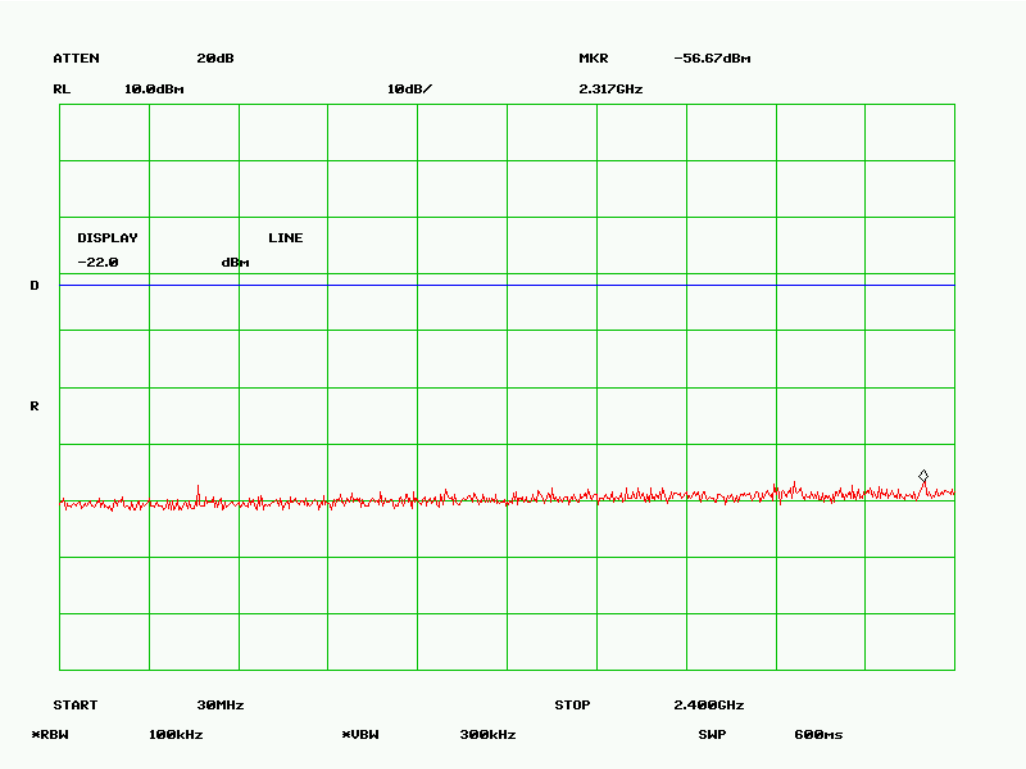
Low Channel -4



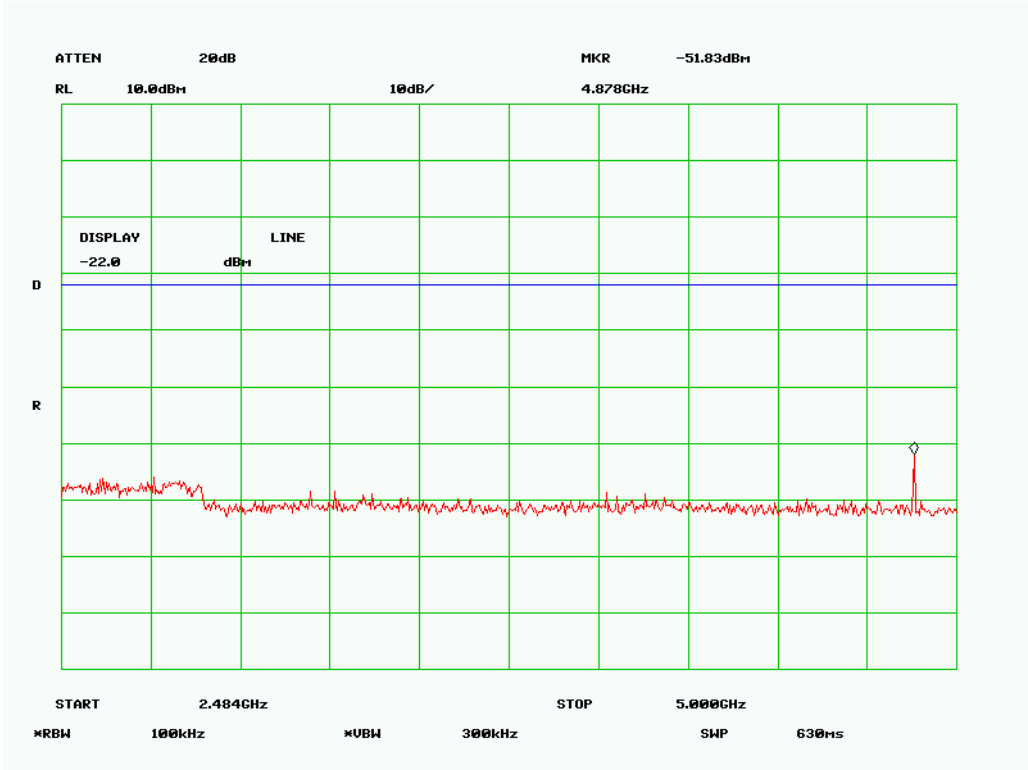
Low Channel -5



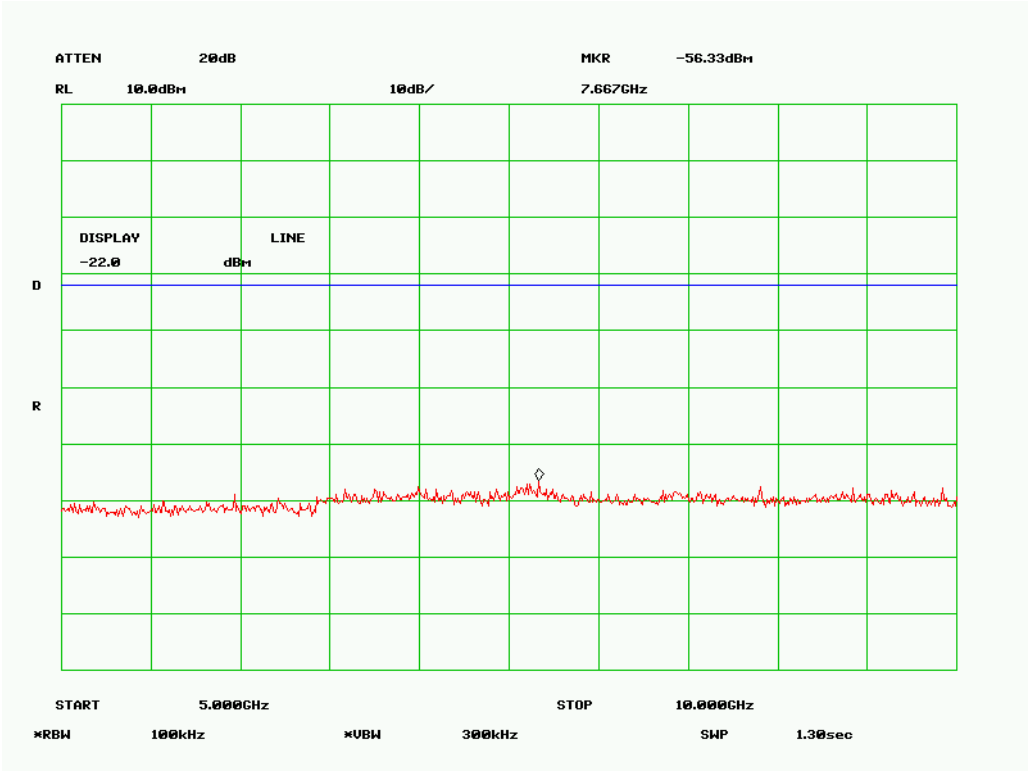
Mid Channel -1



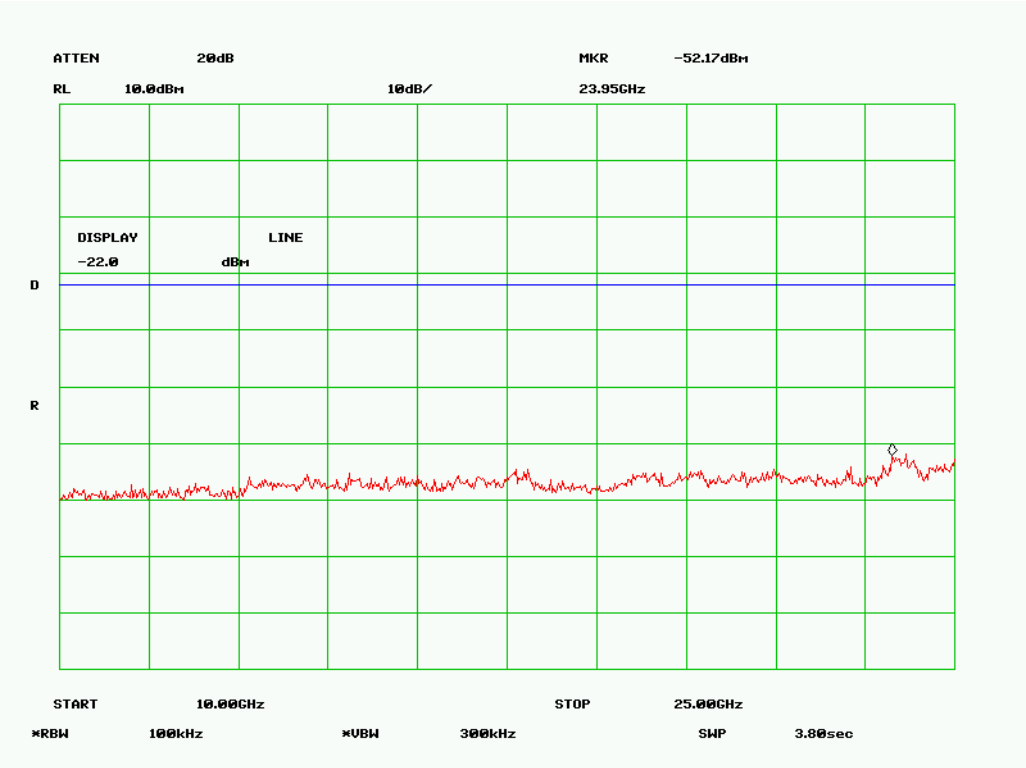
Mid Channel -2



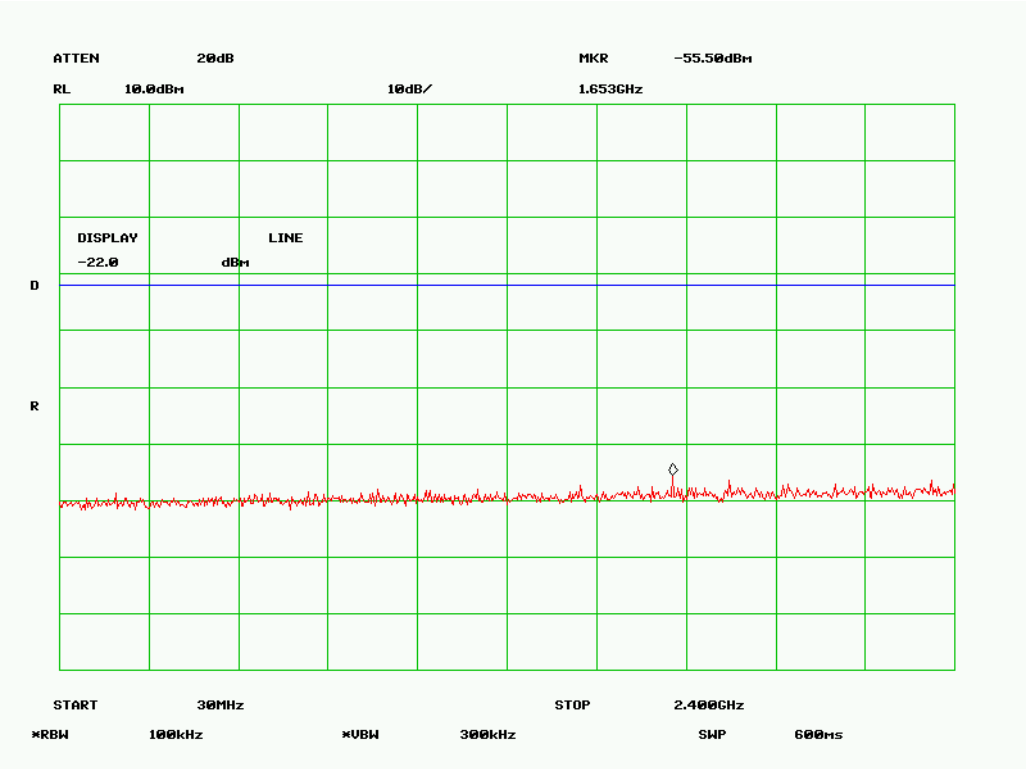
Mid Channel -3



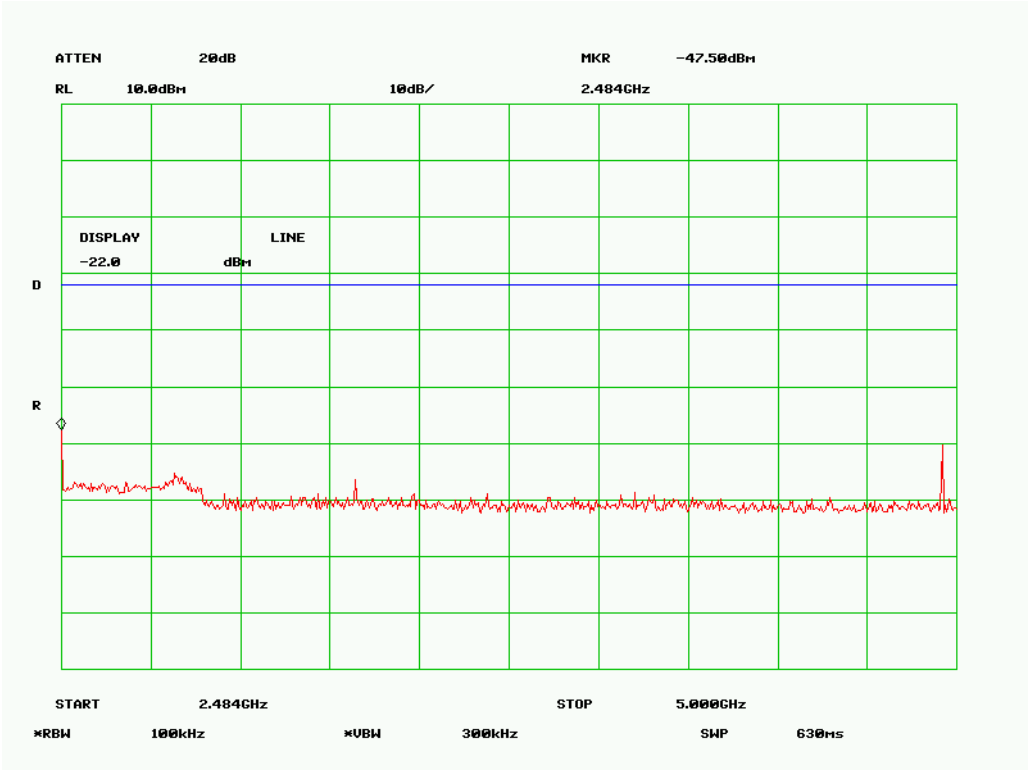
Mid Channel -4



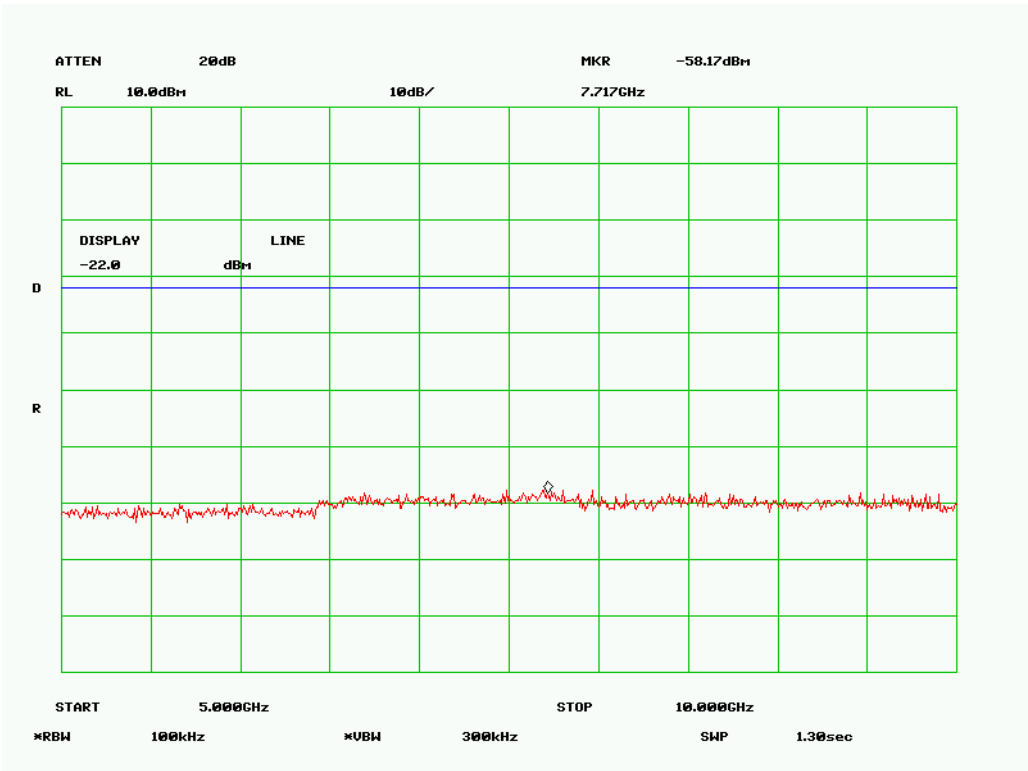
High Channel -1



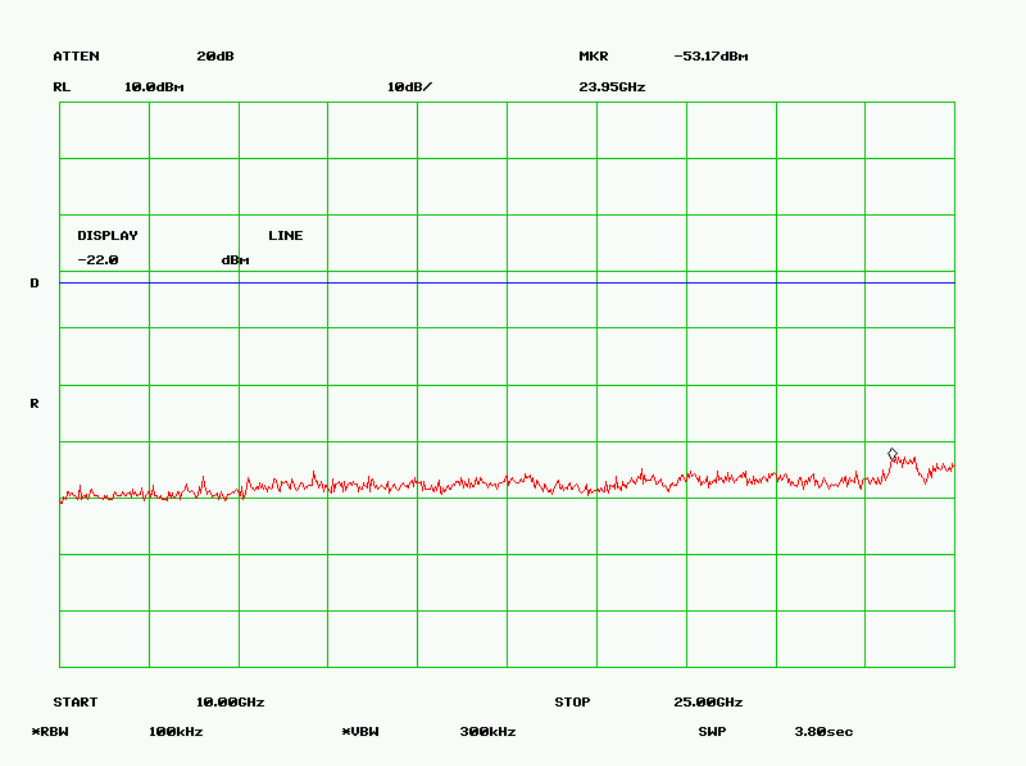
High Channel -2



High Channel -3



High Channel -4



5.11 Radiated Spurious Emission < 1GHz

1. All possible modes of operation were investigated. Only the 6 worst case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
2. A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
3. Radiated Emissions Measurement Uncertainty
   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 1GHz (QP only @ 3m & 10m) is +5.6dB/-4.5dB (for EUTs < 0.5m X 0.5m X 0.5m).
4. Environmental Conditions

Temperature	23ºC - 25ºC
Relative Humidity	50%
Atmospheric Pressure	1019mbar

Test Date : July 14- August 25 2008
Tested By :Choon Sian Ooi

Standard Requirement : 47 CFR §15.247(c)

Procedures: Radiated emissions were measured according to ANSI C63.4. The EUT was set to transmit at the highest output power. The EUT was set to transmit at mid channel. Note that setting the channel other than mid, the spurious emissions are the same.

The limit is converted from microvolts/meter to decibel microvolts/meter.

Sample Calculation: Corrected Amplitude = Raw Amplitude (dBµV/m) + ACF(dB) + Cable Loss(dB)

NOTE: *A Separate test was done when both radios was turn on for IM and not presented in this report. But available upon request.*

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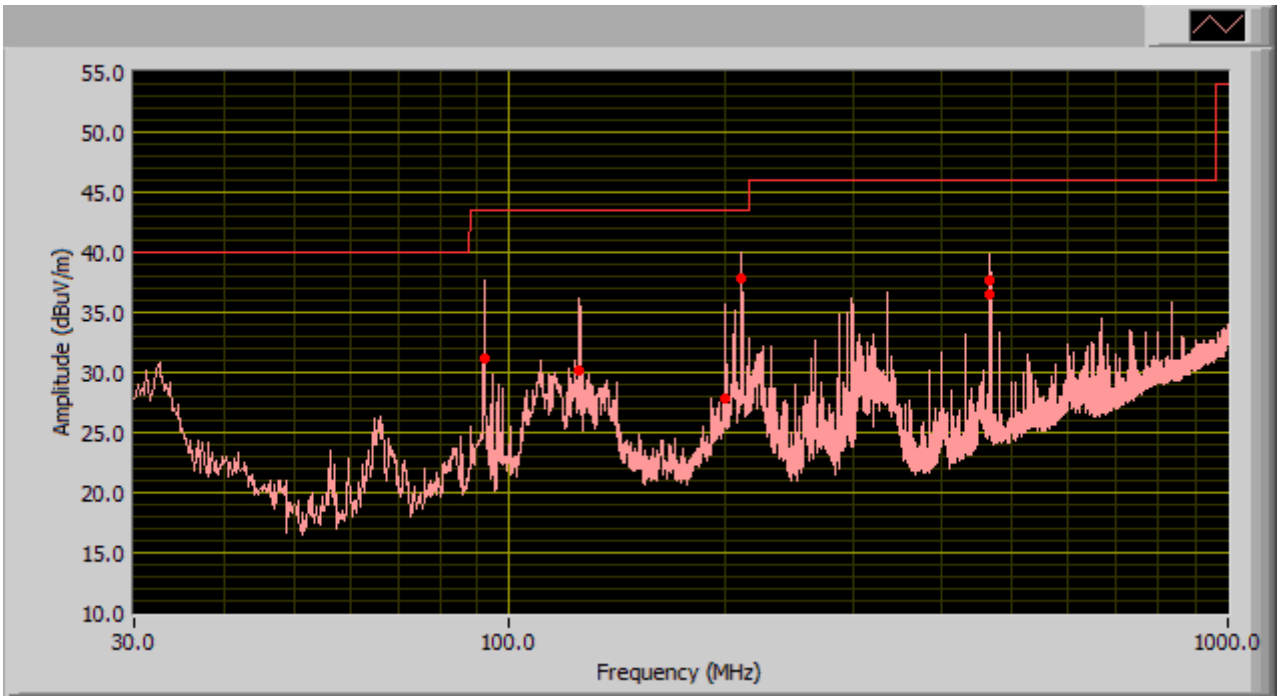
Test Result:

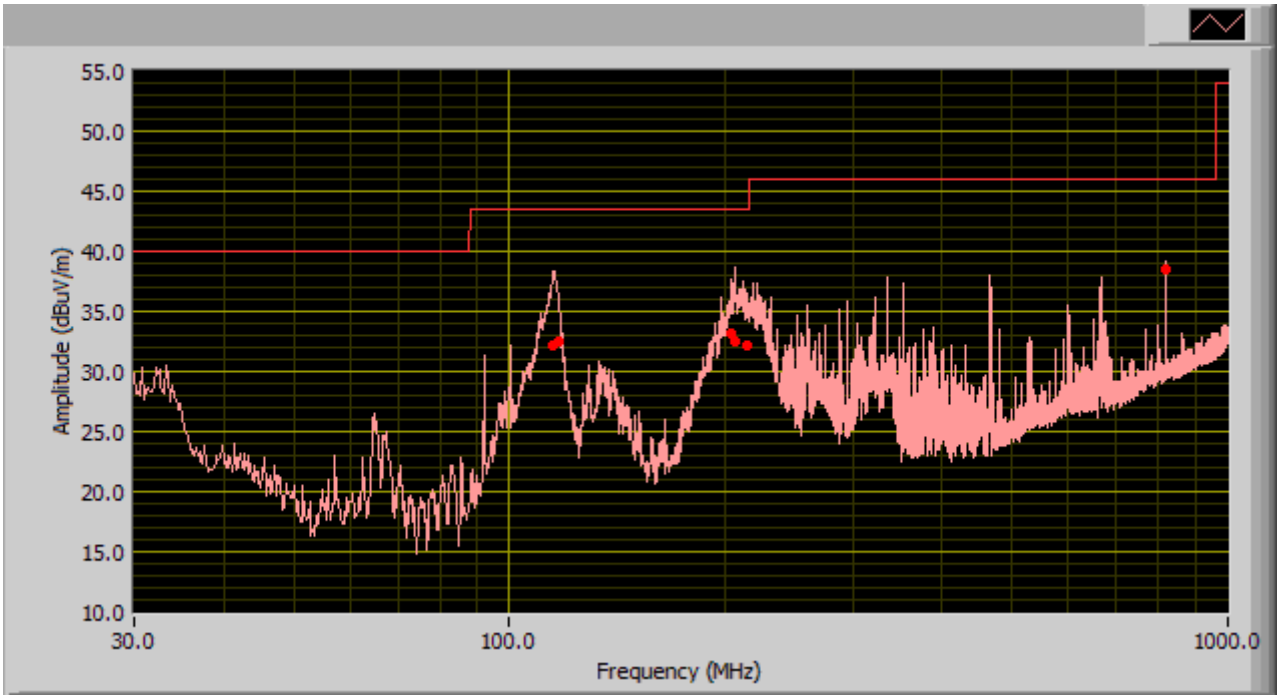
Radiated Emission Plot (Receive mode)



Test Data

Frequency (MHz)	Quasi-Peak (dBµV/m)	Antenna height (cm)	Polarity	Turntable position (deg)	Limit (dBµV/m)	Margin (dB)
210.71	37.91	109.00	H	101.00	43.50	-5.59
92.23	31.20	102.00	V	123.00	43.50	-12.30
465.26	37.63	169.00	H	85.00	46.00	-8.37
467.20	36.53	168.00	H	77.00	46.00	-9.47
125.01	30.18	227.00	H	201.00	43.50	-13.32
200.01	27.87	100.00	H	111.00	43.50	-15.63

Radiated Emission Plot (Transmit mode)



Test Data

Frequency (MHz)	Quasi-Peak (dBµV/m)	Antenna height (cm)	Polarity	Turntable position (deg)	Limit (dBµV/m)	Margin (dB)
205.33	32.55	131.00	H	112.00	43.50	-10.95
114.90	32.16	235.00	H	74.00	43.50	-11.34
203.34	33.20	217.00	H	86.00	43.50	-10.30
820.57	38.56	397.00	V	113.00	46.00	-7.44
214.32	32.24	158.00	H	108.00	43.50	-11.26
117.27	32.58	252.00	H	96.00	43.50	-10.92

5.12 Radiated Spurious Emissions > 1GHz

1. All possible modes of operation were investigated. Only the 6 worst case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
2. A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
3. Radiated Emissions Measurement Uncertainty
   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 1GHz – 20GH is +5.6dB/-4.5dB (for EUTs < 0.5m X 0.5m X 0.5m).
4. Environmental Conditions

	Temperature	23ºC - 25ºC
	Relative Humidity	50%
	Atmospheric Pressure	1019mbar

Test Date : July 14- August 25 2008
Tested By :Choon Sian Ooi

Standard Requirement : 47 CFR §15.247(d)

Procedures: Equipment was setup in a semi-anechoic chamber. For measurements above 1 GHz an average measurement was taken with a 10Hz video bandwidth. The EUT was tested at low, mid and high with the highest output power. Investigated up to 10th harmonics of the operating frequency.

Sample Calculation:

EUT Field Strength = Raw Amplitude(dBµV/m) – Amplifier Gain(dB) + Antenna Factor(dB) + Cable Loss(dB) + Filter Attenuation(dB, if used)

NOTE: NOTE: *A Separate test was done when both radios was turn on for IM and not presented in this report. But available upon request.*

Test Result:

Bluetooth

Low Channel

Frequency	Reading	Direction	Height	Polar	Antenna Loss	Cable loss	Amplifier	Corrected Reading	15.247/15.209	15.247/15.209	
GHz	(dBuV/m)	Degree	Meter	H / V	(dB)	(dB)	(dB)	(dBuV/m)	Limit (dBuV/m)	Margin	Comments
4.804	36.67	154	243	v	33	4.125	32.49	41.305	74	-32.695	Peak
4.804	37.5	134	145	h	33	4.125	32.49	42.135	74	-31.865	Peak
4.804	23.33	178	111	v	33	4.125	32.49	27.965	54	-26.035	Ave
4.804	23.17	20	167	h	33	4.125	32.49	27.805	54	-26.195	Ave
7.206	34.32	69	321	v	35.5	5.22	32.39	42.65	74	-31.35	Peak
7.206	33.12	45	111	h	35.5	5.22	32.39	41.45	74	-32.55	Peak
7.206	24.17	241	133	v	35.5	5.22	32.39	32.5	54	-21.5	Ave
7.206	24.02	321	167	h	35.5	5.22	32.39	32.35	54	-21.65	Ave
9.608	36.67	122	376	v	39.2	6.255	32.32	49.805	74	-24.195	Peak
9.608	35.23	167	103	h	39.2	6.255	32.32	48.365	74	-25.635	Peak
9.608	23.12	171	131	v	39.2	6.255	32.32	36.255	54	-17.745	Ave
9.608	23.12	111	155	h	39.2	6.255	32.32	36.255	54	-17.745	Ave

Emission was scanned up to 25GHz.

Mid Channel

Frequency	Reading	Direction	Height	Polar	Antenna Loss	Cable loss	Amplifier	Corrected Reading	15.247/15.209	15.247/15.209	
GHz	(dBuV/m)	Degree	Meter	H / V	(dB)	(dB)	(dB)	(dBuV/m)	Limit (dBuV/m)	Margin	Comments
4.882	35.1	156	123	v	33	4.125	32.49	39.735	74	-34.265	Peak
4.882	34.81	134	178	h	33	4.125	32.49	39.445	74	-34.555	Peak
4.882	24.81	167	367	v	33	4.125	32.49	29.445	54	-24.555	Ave
4.882	23.91	189	145	h	33	4.125	32.49	28.545	54	-25.455	Ave
7.323	35.71	111	231	v	35.5	5.22	32.39	44.04	74	-29.96	Peak
7.323	34.12	81	167	h	35.5	5.22	32.39	42.45	74	-31.55	Peak
7.323	24.91	67	178	v	35.5	5.22	32.39	33.24	54	-20.76	Ave
7.323	24.51	78	267	h	35.5	5.22	32.39	32.84	54	-21.16	Ave
9.764	36.41	341	111	v	39.2	6.255	32.32	49.545	74	-24.455	Peak
9.764	35.91	155	189	h	39.2	6.255	32.32	49.045	74	-24.955	Peak
9.764	24.81	121	190	v	39.2	6.255	32.32	37.945	54	-16.055	Ave
9.764	23.71	111	156	h	39.2	6.255	32.32	36.845	54	-17.155	Ave

Emission was scanned up to 25GHz.

High Channel

Frequency	Reading	Direction	Height	Polar	Antenna Loss	Cable loss	Amplifier	Corrected Reading	15.247/15.209	15.247/15.209	
GHz	(dBuV/m)	Degree	Meter	H / V	(dB)	(dB)	(dB)	(dBuV/m)	Limit (dBuV/m)	Margin	Comments
4.96	36.2	356	178	v	33	4.125	32.49	40.835	74	-33.165	Peak
4.96	35.34	378	213	h	33	4.125	32.49	39.975	74	-34.025	Peak
4.96	25.13	256	289	v	33	4.125	32.49	29.765	54	-24.235	Ave
4.96	24.12	145	279	h	33	4.125	32.49	28.755	54	-25.245	Ave
7.44	35.99	121	211	v	35.5	5.22	32.39	44.32	74	-29.68	Peak
7.44	34.71	196	392	h	35.5	5.22	32.39	43.04	74	-30.96	Peak
7.44	25.21	148	156	v	35.5	5.22	32.39	33.54	54	-20.46	Ave
7.44	24.11	134	132	h	35.5	5.22	32.39	32.44	54	-21.56	Ave
9.92	37.11	389	321	v	39.2	6.255	32.32	50.245	74	-23.755	Peak
9.92	36.11	143	214	h	39.2	6.255	32.32	49.245	74	-24.755	Peak
9.92	25.11	190	289	v	39.2	6.255	32.32	38.245	54	-15.755	Ave
9.92	24.41	145	267	h	39.2	6.255	32.32	37.545	54	-16.455	Ave

Emission was scanned up to 25GHz.

Band Edge

Channel	Polarity	Detector	Frequency	Result	Limit	Margin
Low Channel	V	Peak	2400	35.15	74	-38.85
Low Channel	H	Peak	2400	37.49	74	-36.51
Low Channel	V	Avg	2400	22.82	54	-31.18
Low Channel	H	Avg	2400	23.99	54	-30.01

Channel	Polarity	Detector	Frequency	Result	Limit	Margin
High Channel	V	Peak	2483.5	31.82	74	-42.18
High Channel	H	Peak	2483.5	37.33	74	-36.67
High Channel	V	Avg	2483.5	19.82	54	-34.18
High Channel	H	Avg	2483.5	24.83	54	-29.17

WLAN

B-Mode
@ 2412MHz @ 3 Meter

Frequency	Reading	Direction	Height	Polar	Antenna Loss	Cable loss	Amplifier	Corrected Reading	15.247/15.209	15.247/15.209	
GHz	(dBuV/m)	Degree	Meter	H / V	(dB)	(dB)	(dB)	(dBuV/m)	Limit (dBuV/m)	Margin	Comments
4.82	40.30	150.00	100.00	v	33.00	4.13	32.49	44.94	74.00	-29.07	Peak
4.82	41.00	175.00	155.00	h	33.00	4.13	32.49	45.64	74.00	-28.37	Peak
4.82	32.00	150.00	100.00	v	33.00	4.13	32.49	36.64	54.00	-17.37	Ave
4.82	33.00	175.00	155.00	h	33.00	4.13	32.49	37.64	54.00	-16.37	Ave
7.24	46.17	155.00	110.00	v	35.50	5.22	32.39	54.50	74.00	-19.50	Peak
7.24	46.23	180.00	165.00	h	35.50	5.22	32.39	54.56	74.00	-19.44	Peak
7.24	32.56	155.00	110.00	v	35.50	5.22	32.39	40.89	54.00	-13.11	Ave
7.24	33.45	190.00	165.00	h	35.50	5.22	32.39	41.78	54.00	-12.22	Ave
9.65	45.34	185.00	115.00	v	39.20	6.26	32.32	58.48	74.00	-15.53	Peak
9.65	44.87	175.00	165.00	h	39.20	6.26	32.32	58.01	74.00	-16.00	Peak
9.65	33.13	185.00	115.00	v	39.20	6.26	32.32	46.27	54.00	-7.73	Ave
9.65	32.19	175.00	165.00	h	39.20	6.26	32.32	45.33	54.00	-8.68	Ave

Emission was scanned up to 25GHz.

@ 2437MHz @ 3Meter

Frequency	Reading	Direction	Height	Polar	Antenna Loss	Cable loss	Amplifier	Corrected Reading	15.247/15.209	15.247/15.209	
GHz	(dBuV/m)	Degree	Meter	H / V	(dB)	(dB)	(dB)	(dBuV/m)	Limit (dBuV/m)	Margin	Comments
4.87	49.33	156.00	100.00	v	33.00	4.13	32.49	53.97	74.00	-20.04	Peak
4.87	49.12	177.00	155.00	h	33.00	4.13	32.49	53.76	74.00	-20.25	Peak
4.87	36.16	156.00	100.00	v	33.00	4.13	32.49	40.80	54.00	-13.21	Ave
4.87	36.55	177.00	155.00	h	33.00	4.13	32.49	41.19	54.00	-12.82	Ave
7.31	45.23	155.00	110.00	v	35.50	5.22	32.39	53.56	74.00	-20.44	Peak
7.31	44.67	188.00	165.00	h	35.50	5.22	32.39	53.00	74.00	-21.00	Peak
7.31	33.92	155.00	110.00	v	35.50	5.22	32.39	42.25	54.00	-11.75	Ave
7.31	32.14	188.00	165.00	h	35.50	5.22	32.39	40.47	54.00	-13.53	Ave
9.74	45.71	185.00	115.00	v	39.20	6.26	32.32	58.85	74.00	-15.16	Peak
9.74	45.22	175.00	165.00	h	39.20	6.26	32.32	58.36	74.00	-15.65	Peak
9.74	33.45	185.00	115.00	v	39.20	6.26	32.32	46.59	54.00	-7.42	Ave
9.74	32.92	175.00	165.00	h	39.20	6.26	32.32	46.06	54.00	-7.95	Ave

Emission was scanned up to 25GHz.

@ 2462MHz @ 3Meter

Frequency	Reading	Direction	Height	Polar	Antenna Loss	Cable loss	Amplifier	Corrected Reading	15.247/15.209	15.247/15.209	
GHz	(dBuV/m)	Degree	Meter	H / V	(dB)	(dB)	(dB)	(dBuV/m)	Limit (dBuV/m)	Margin	Comments
4.93	47.83	145.00	100.00	v	33.00	4.13	32.49	52.47	74.00	-21.54	Peak
4.93	48.17	173.00	155.00	h	33.00	4.13	32.49	52.81	74.00	-21.20	Peak
4.93	35.33	145.00	100.00	v	33.00	4.13	32.49	39.97	54.00	-14.04	Ave
4.93	35.17	173.00	155.00	h	33.00	4.13	32.49	39.81	54.00	-14.20	Ave
7.40	45.34	156.00	110.00	v	35.50	5.22	32.39	53.67	74.00	-20.33	Peak
7.40	44.78	180.00	165.00	h	35.50	5.22	32.39	53.11	74.00	-20.89	Peak
7.40	32.78	156.00	110.00	v	35.50	5.22	32.39	41.11	54.00	-12.89	Ave
7.40	32.56	180.00	165.00	h	35.50	5.22	32.39	40.89	54.00	-13.11	Ave
9.86	45.23	188.00	115.00	v	39.20	6.26	32.32	58.37	74.00	-15.64	Peak
9.86	45.12	175.00	165.00	h	39.20	6.26	32.32	58.26	74.00	-15.75	Peak
9.86	32.56	188.00	115.00	v	39.20	6.26	32.32	45.70	54.00	-8.31	Ave
9.86	32.21	175.00	165.00	h	39.20	6.26	32.32	45.35	54.00	-8.66	Ave

Emission was scanned up to 25GHz.

G-Mode

@ 2412MHz @ 3 Meter

Frequency	Reading	Direction	Height	Polar	Antenna Loss	Cable loss	Amplifier	Corrected Reading	15.247/15.209	15.247/15.209	
GHz	(dBuV/m)	Degree	Meter	H / V	(dB)	(dB)	(dB)	(dBuV/m)	Limit (dBuV/m)	Margin	Comments
4.82	45.21	160.00	100.00	v	33.00	4.13	32.49	49.85	74.00	-24.16	Peak
4.82	47.17	186.00	155.00	h	33.00	4.13	32.49	51.81	74.00	-22.20	Peak
4.82	31.23	160.00	100.00	v	33.00	4.13	32.49	35.87	54.00	-18.14	Ave
4.82	33.50	186.00	155.00	h	33.00	4.13	32.49	38.14	54.00	-15.87	Ave
7.24	43.56	160.00	110.00	v	35.50	5.22	32.39	51.89	74.00	-22.11	Peak
7.24	44.12	175.00	165.00	h	35.50	5.22	32.39	52.45	74.00	-21.55	Peak
7.24	32.71	160.00	110.00	v	35.50	5.22	32.39	41.04	54.00	-12.96	Ave
7.24	32.92	175.00	165.00	h	35.50	5.22	32.39	41.25	54.00	-12.75	Ave
9.65	46.12	182.00	115.00	v	39.20	6.26	32.32	59.26	74.00	-14.75	Peak
9.65	46.21	190.00	165.00	h	39.20	6.26	32.32	59.35	74.00	-14.66	Peak
9.65	32.83	182.00	115.00	v	39.20	6.26	32.32	45.97	54.00	-8.04	Ave
9.65	32.91	190.00	165.00	h	39.20	6.26	32.32	46.05	54.00	-7.96	Ave

Emission was scanned up to 25GHz.

@ 2437MHz @ 3Meter

Frequency	Reading	Direction	Height	Polar	Antenna Loss	Cable loss	Amplifier	Corrected Reading	15.247/15.209	15.247/15.209	
GHz	(dBuV/m)	Degree	Meter	H / V	(dB)	(dB)	(dB)	(dBuV/m)	Limit (dBuV/m)	Margin	Comments
4.87	44.50	260.00	100.00	v	33.00	4.13	32.49	49.14	74.00	-24.87	Peak
4.87	46.47	186.00	155.00	h	33.00	4.13	32.49	51.11	74.00	-22.90	Peak
4.87	30.33	260.00	100.00	v	33.00	4.13	32.49	34.97	54.00	-19.04	Ave
4.87	33.33	186.00	155.00	h	33.00	4.13	32.49	37.97	54.00	-16.04	Ave
7.31	46.17	160.00	110.00	v	35.50	5.22	32.39	54.50	74.00	-19.50	Peak
7.31	46.12	275.00	165.00	h	35.50	5.22	32.39	54.45	74.00	-19.55	Peak
7.31	33.00	160.00	110.00	v	35.50	5.22	32.39	41.33	54.00	-12.67	Ave
7.31	33.21	275.00	165.00	h	35.50	5.22	32.39	41.54	54.00	-12.46	Ave
9.74	45.45	182.00	115.00	v	39.20	6.26	32.32	58.59	74.00	-15.42	Peak
9.74	45.17	190.00	165.00	h	39.20	6.26	32.32	58.31	74.00	-15.70	Peak
9.74	32.67	182.00	115.00	v	39.20	6.26	32.32	45.81	54.00	-8.20	Ave
9.74	32.17	190.00	165.00	h	39.20	6.26	32.32	45.31	54.00	-8.70	Ave

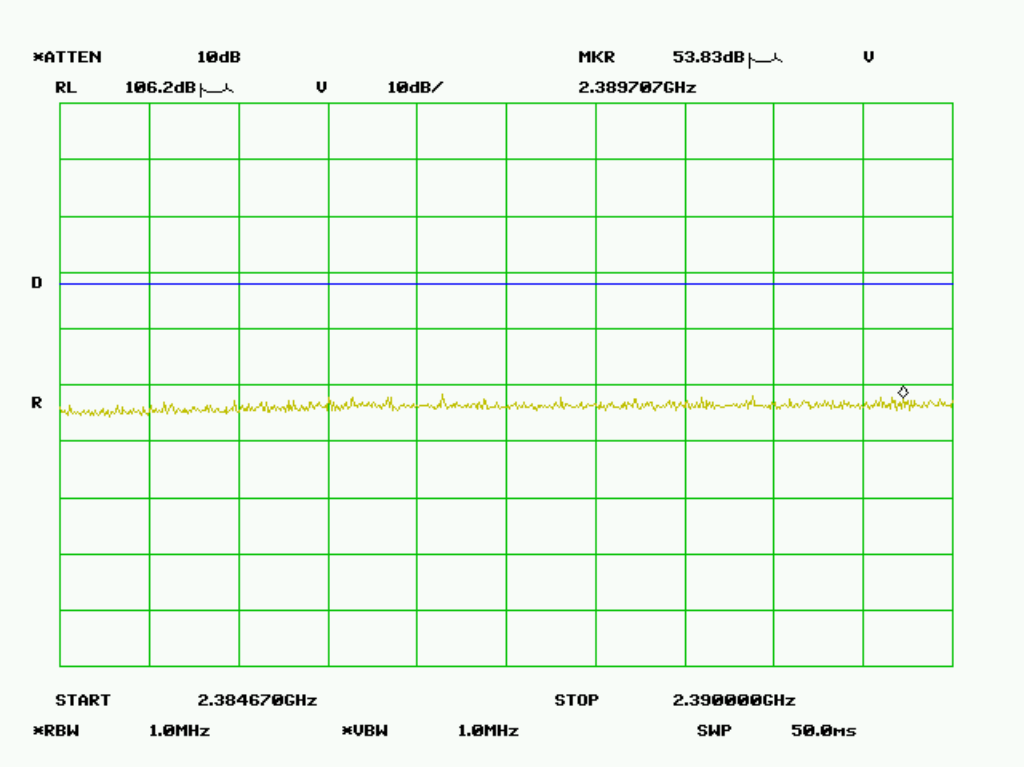
Emission was scanned up to 25GHz.

@ 2462MHz @ 3Meter

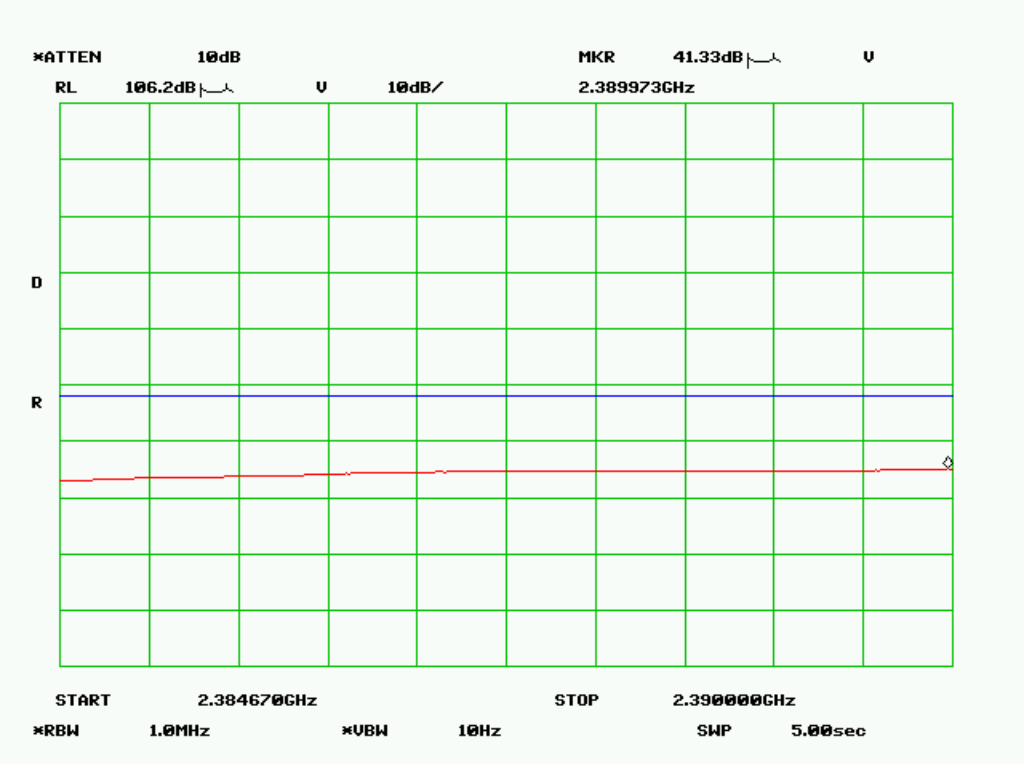
Frequency	Reading	Direction	Height	Polar	Antenna Loss	Cable loss	Amplifier	Corrected Reading	15.247/15.209	15.247/15.209	
GHz	(dBuV/m)	Degree	Meter	H / V	(dB)	(dB)	(dB)	(dBuV/m)	Limit (dBuV/m)	Margin	Comments
4.93	44.00	215.00	100.00	v	33.00	4.13	32.49	48.64	74.00	-25.37	Peak
4.93	43.21	220.00	155.00	h	33.00	4.13	32.49	47.85	74.00	-26.16	Peak
4.93	30.93	215.00	100.00	v	33.00	4.13	32.49	35.57	54.00	-18.44	Ave
4.93	31.00	220.00	155.00	h	33.00	4.13	32.49	35.64	54.00	-18.37	Ave
7.40	46.32	130.00	110.00	v	35.50	5.22	32.39	54.65	74.00	-19.35	Peak
7.40	46.17	175.00	165.00	h	35.50	5.22	32.39	54.50	74.00	-19.50	Peak
7.40	33.56	130.00	110.00	v	35.50	5.22	32.39	41.89	54.00	-12.11	Ave
7.40	33.11	175.00	165.00	h	35.50	5.22	32.39	41.44	54.00	-12.56	Ave
9.86	45.81	182.00	115.00	v	39.20	6.26	32.32	58.95	74.00	-15.06	Peak
9.86	45.22	190.00	165.00	h	39.20	6.26	32.32	58.36	74.00	-15.65	Peak
9.86	32.13	182.00	115.00	v	39.20	6.26	32.32	45.27	54.00	-8.73	Ave
9.86	32.11	190.00	165.00	h	39.20	6.26	32.32	45.25	54.00	-8.76	Ave

Emission was scanned up to 25GHz.

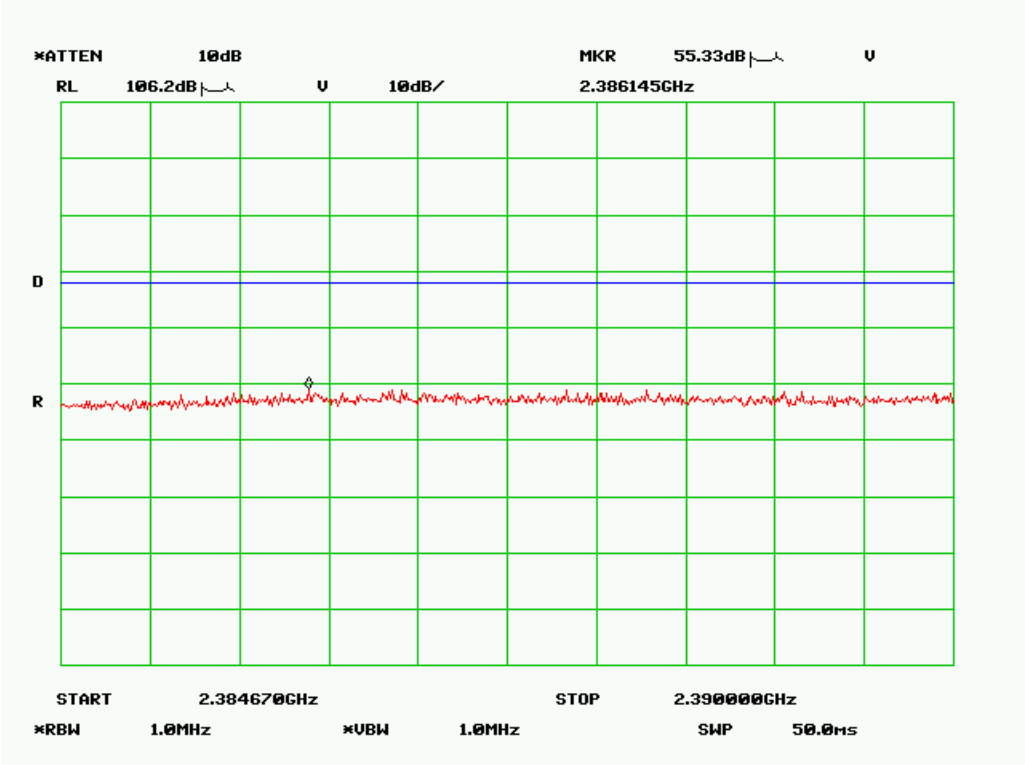
Band Edge Plots



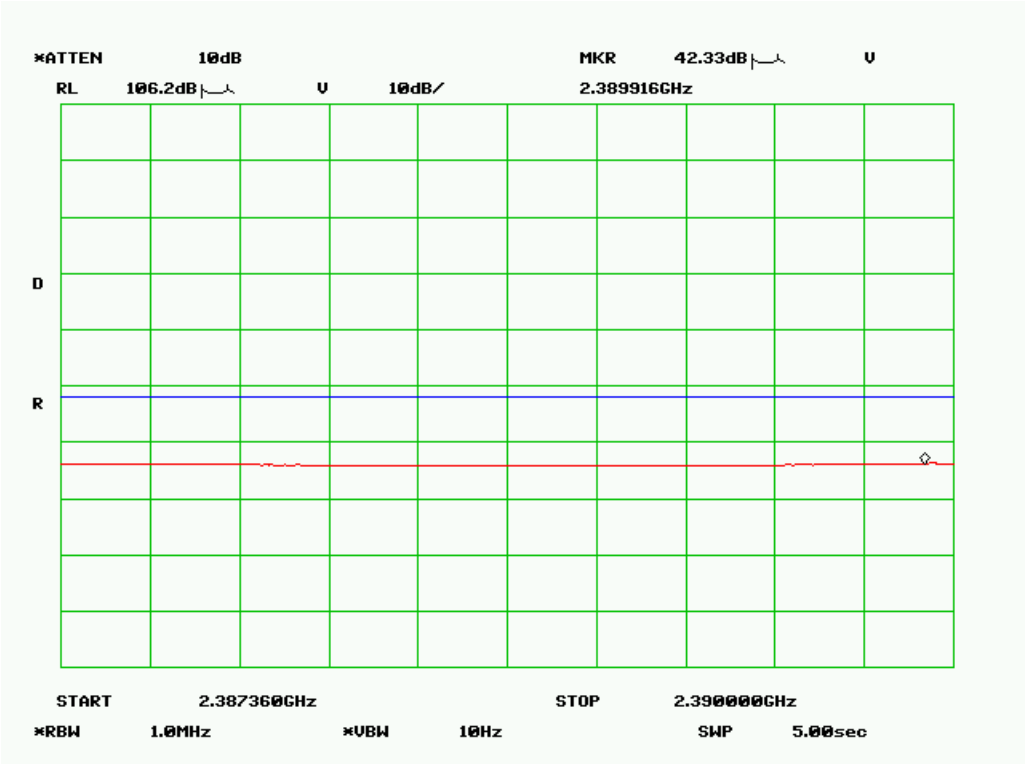
Low Channel –Vertical-Peak (802.11b)



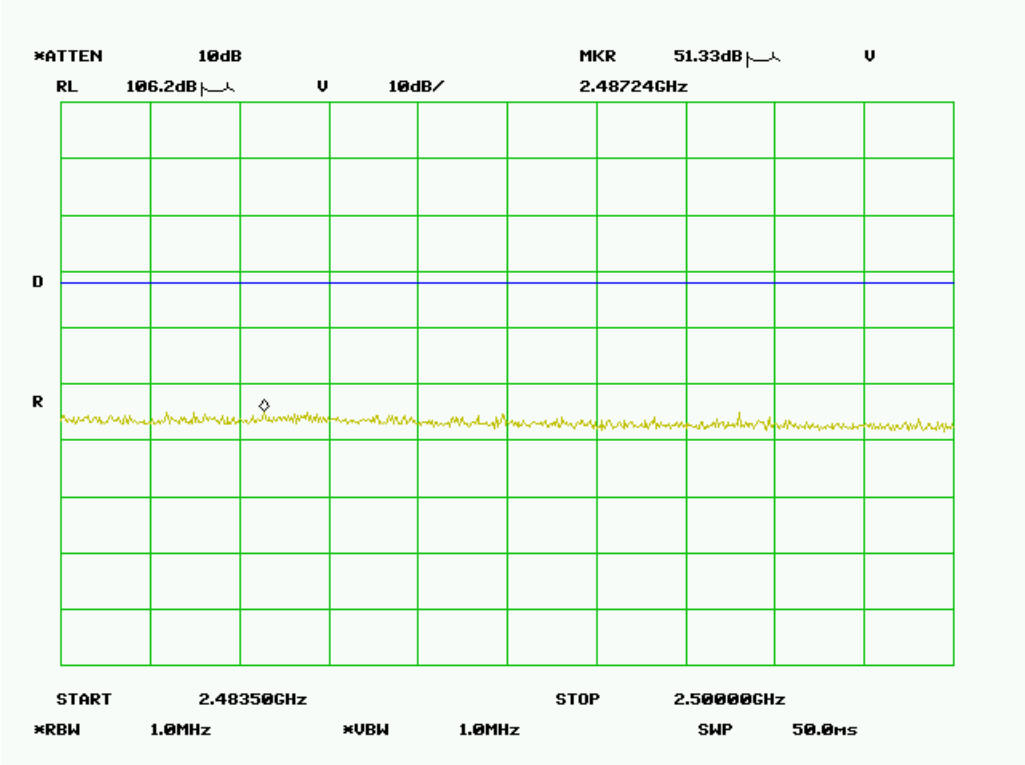
Low Channel –Vertical-Average (802.11b)



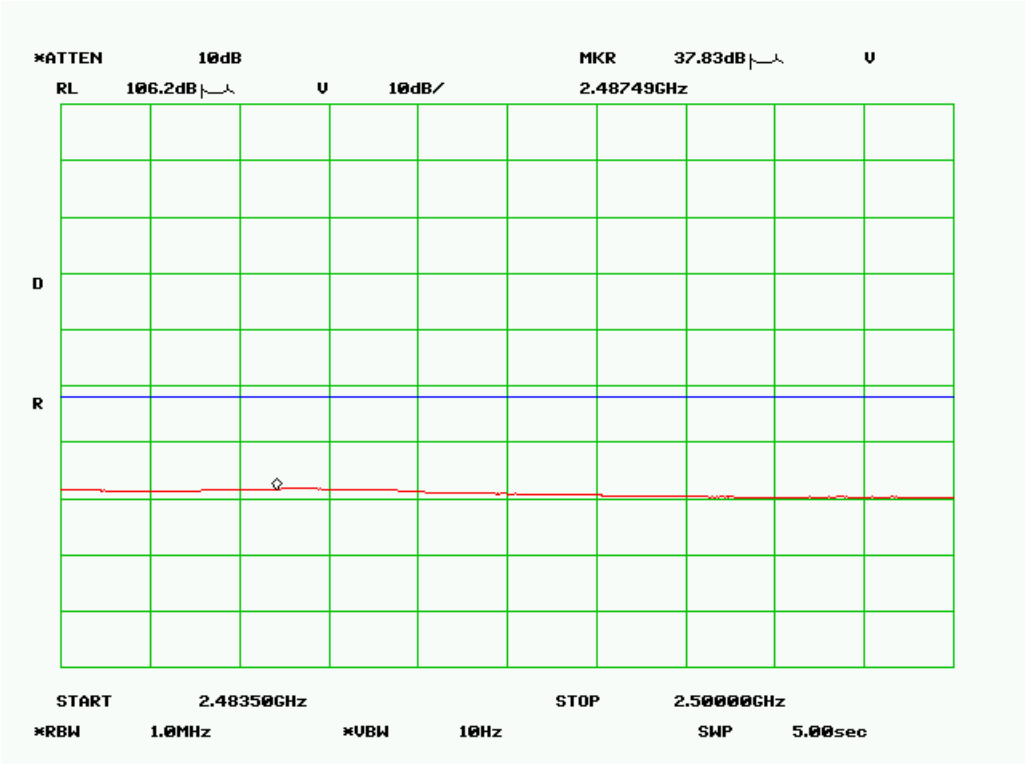
Low Channel –Horizontal-Peak (802.11b)



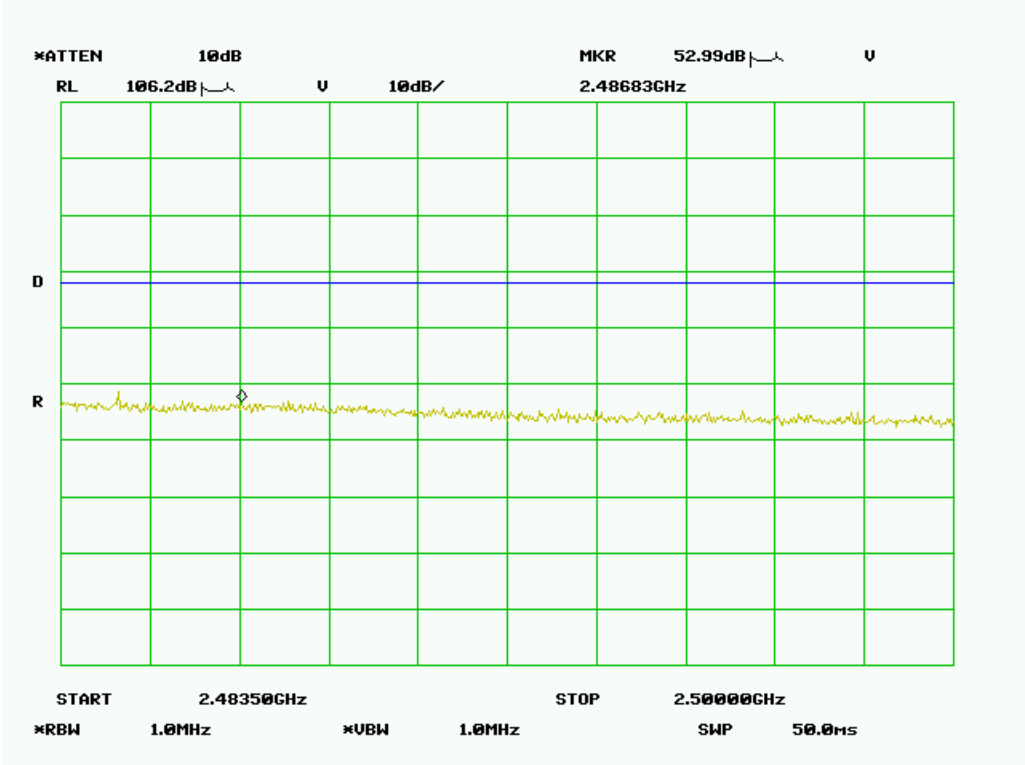
Low Channel –Horizontal-Average (802.11b)



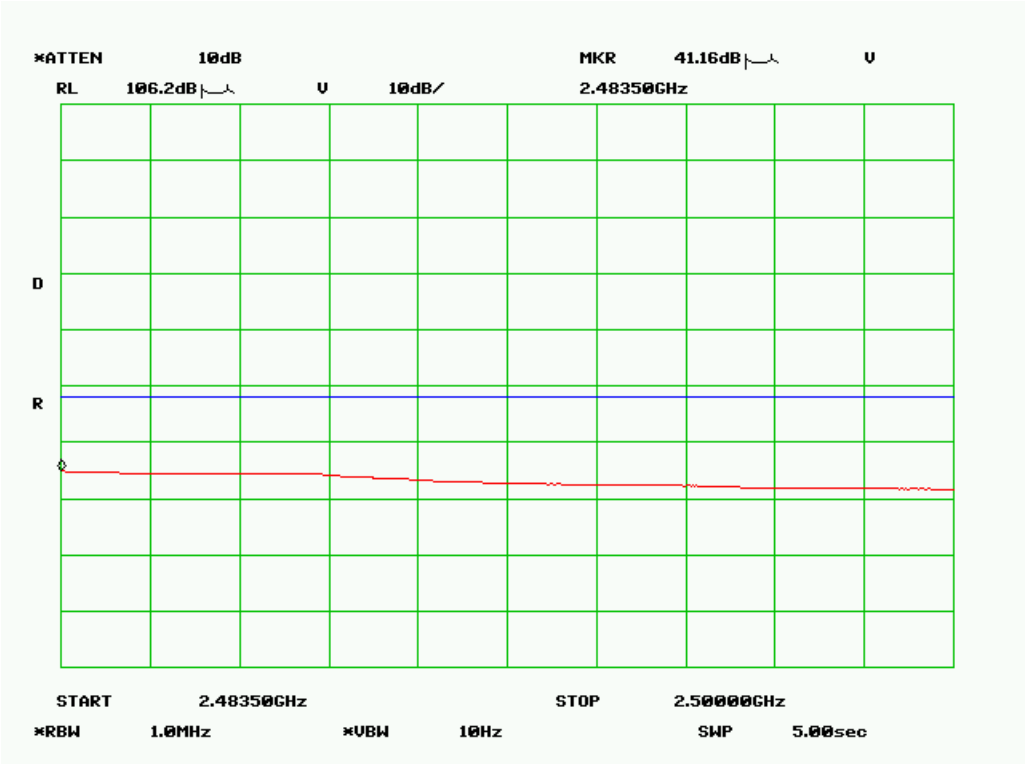
High Channel –Vertical-Peak (802.11b)



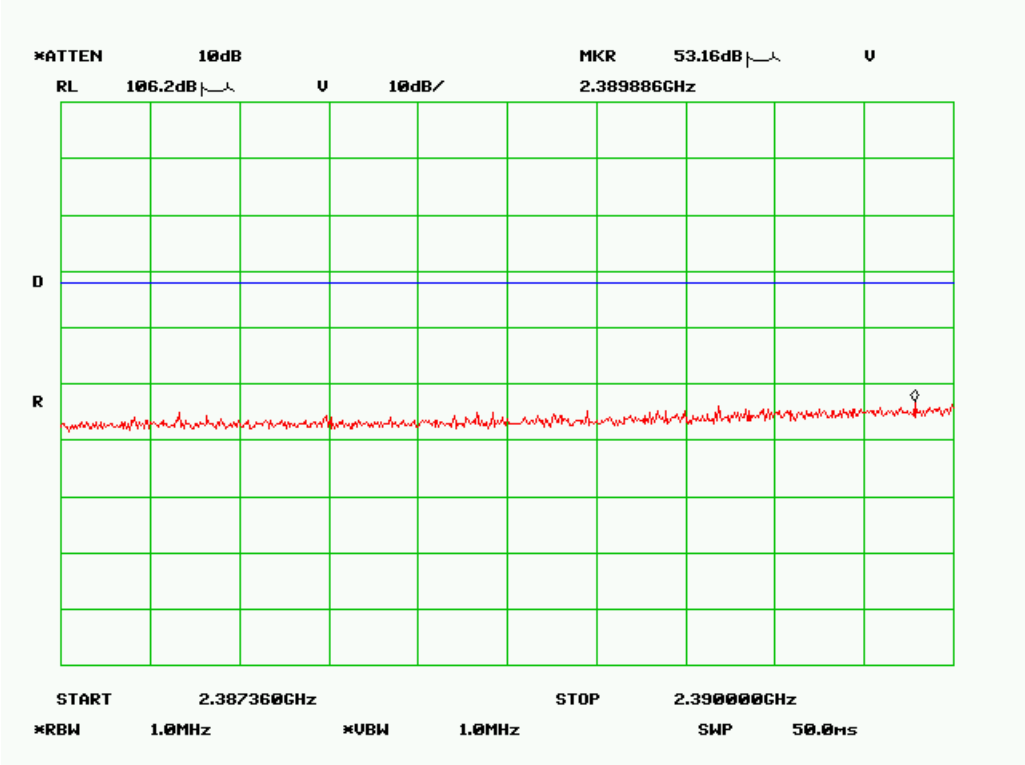
High Channel –Vertical-Average (802.11b)



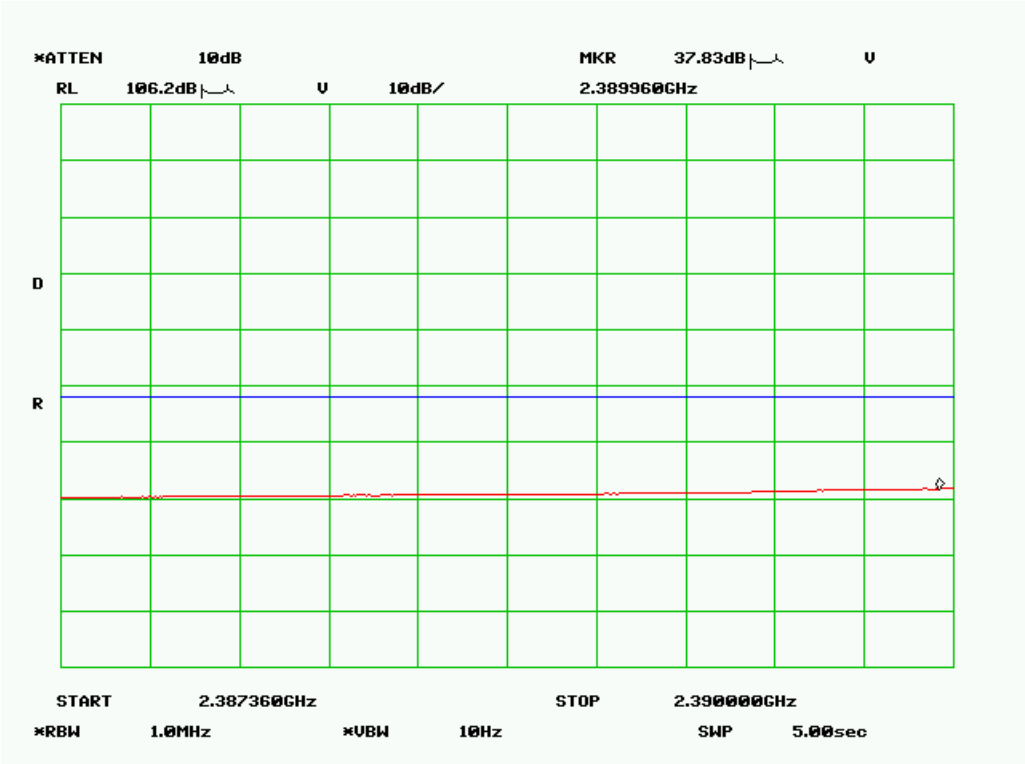
High Channel –Horizontal-Peak (802.11b)



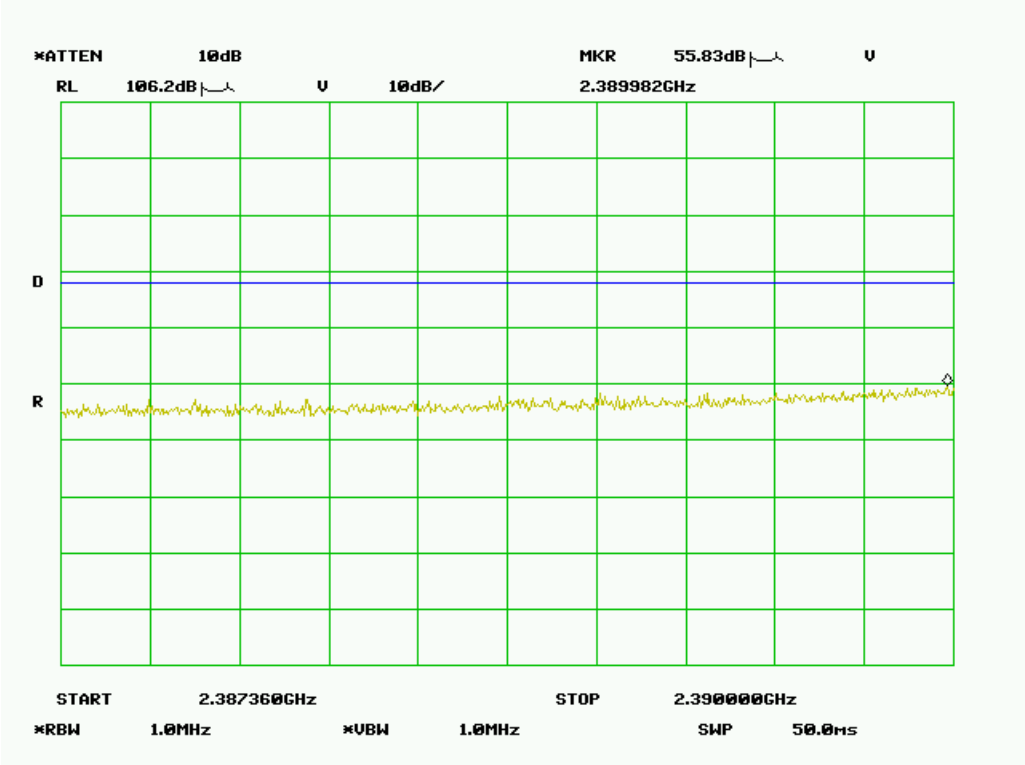
High Channel –Horizontal-Average (802.11b)



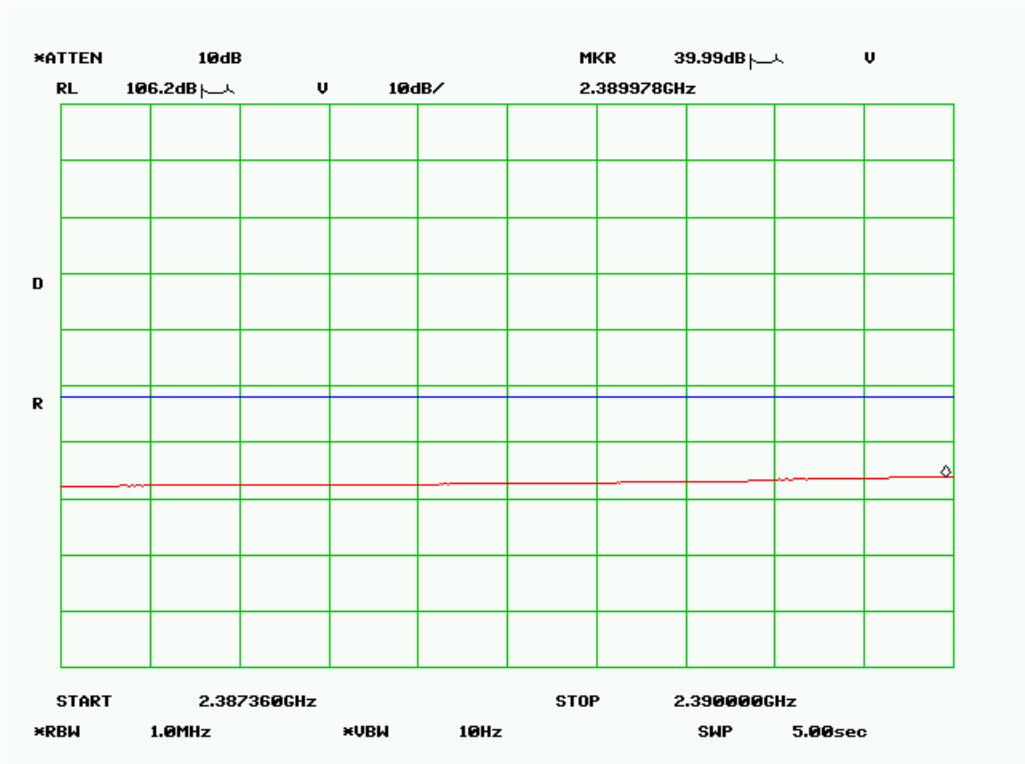
Low Channel –Vertical-Peak (802.11g)



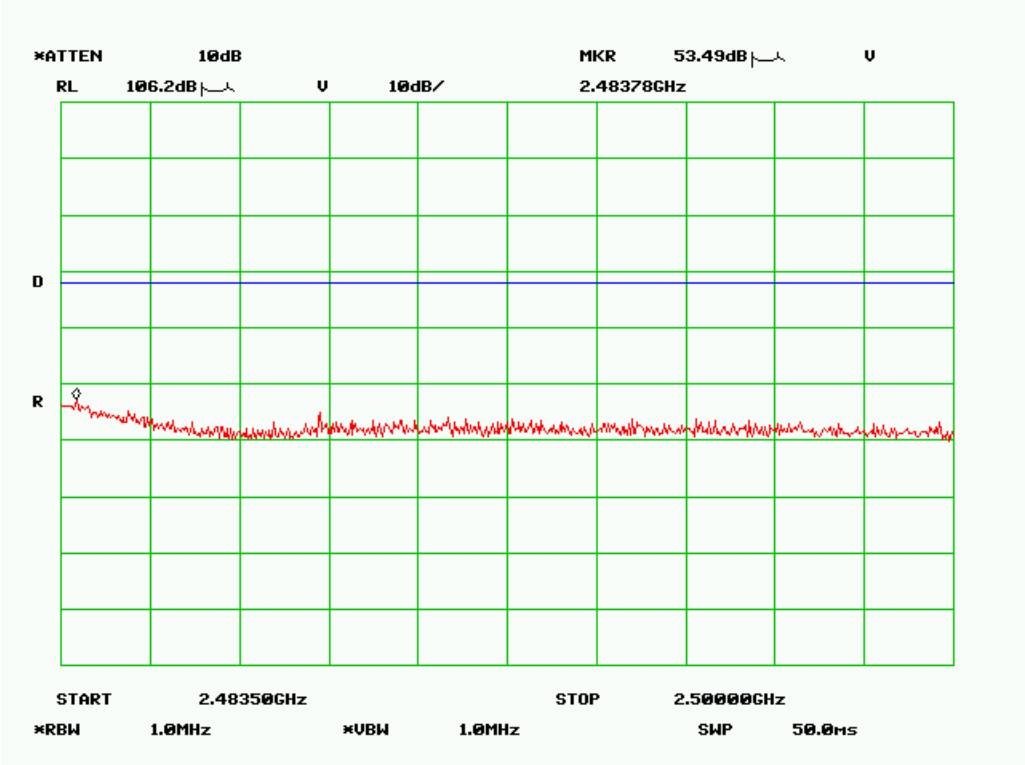
Low Channel –Vertical-Average (802.11g)



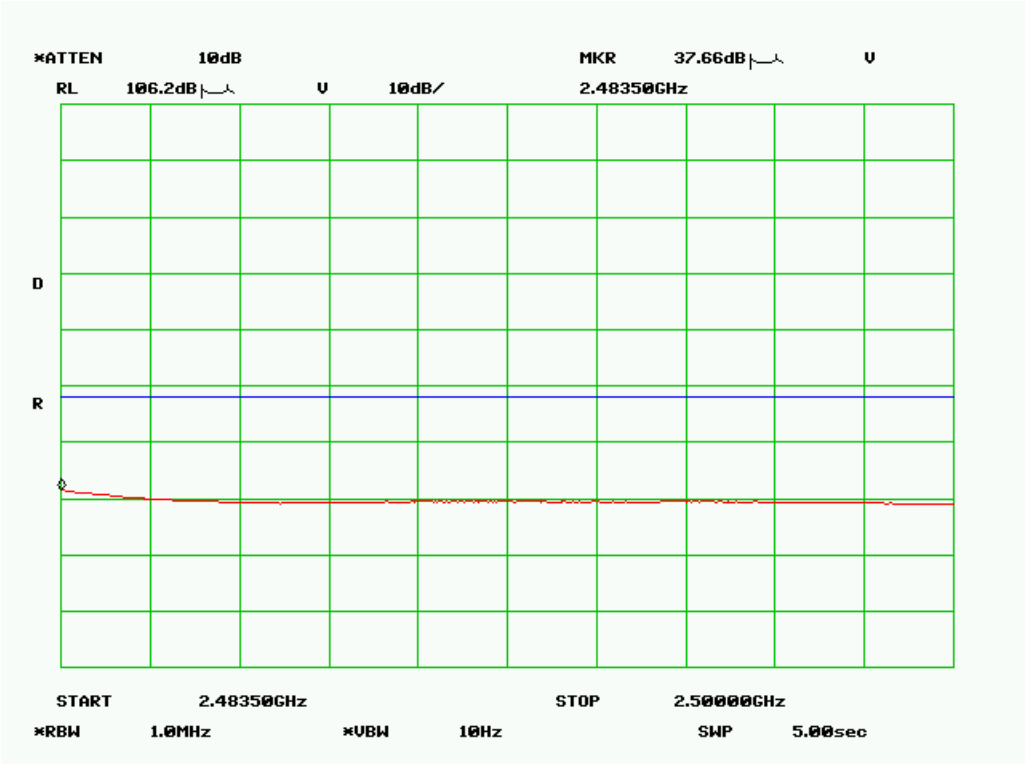
Low Channel –Horizontal-Peak (802.11g)



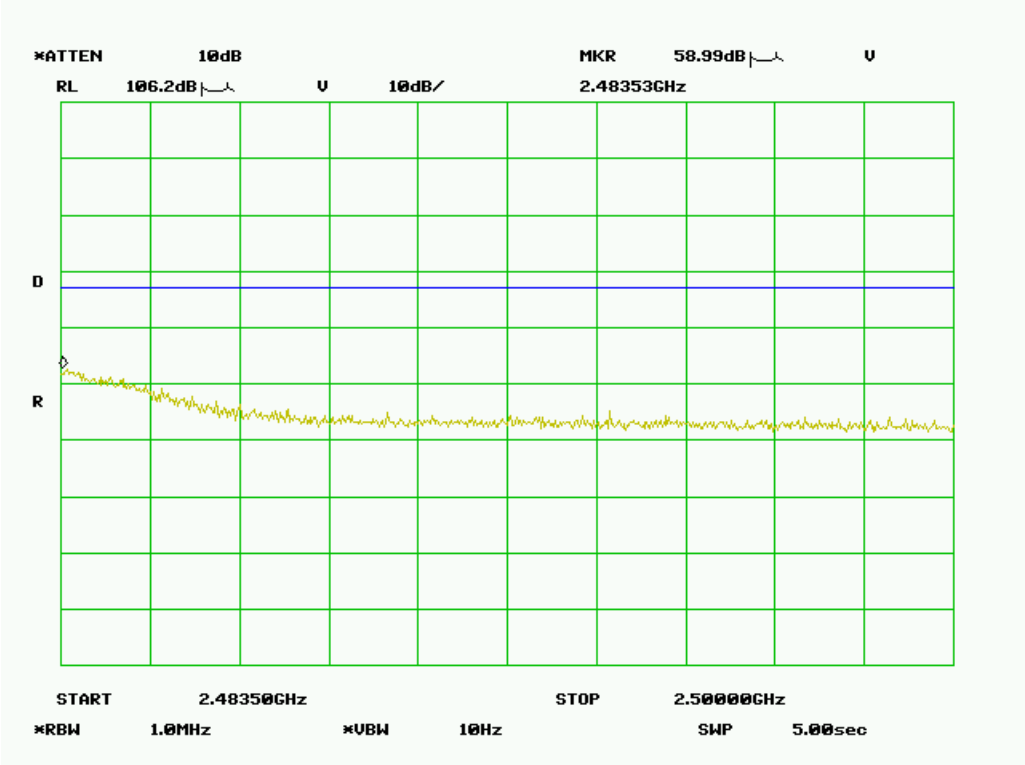
Low Channel –Horizontal-Average (802.11g)



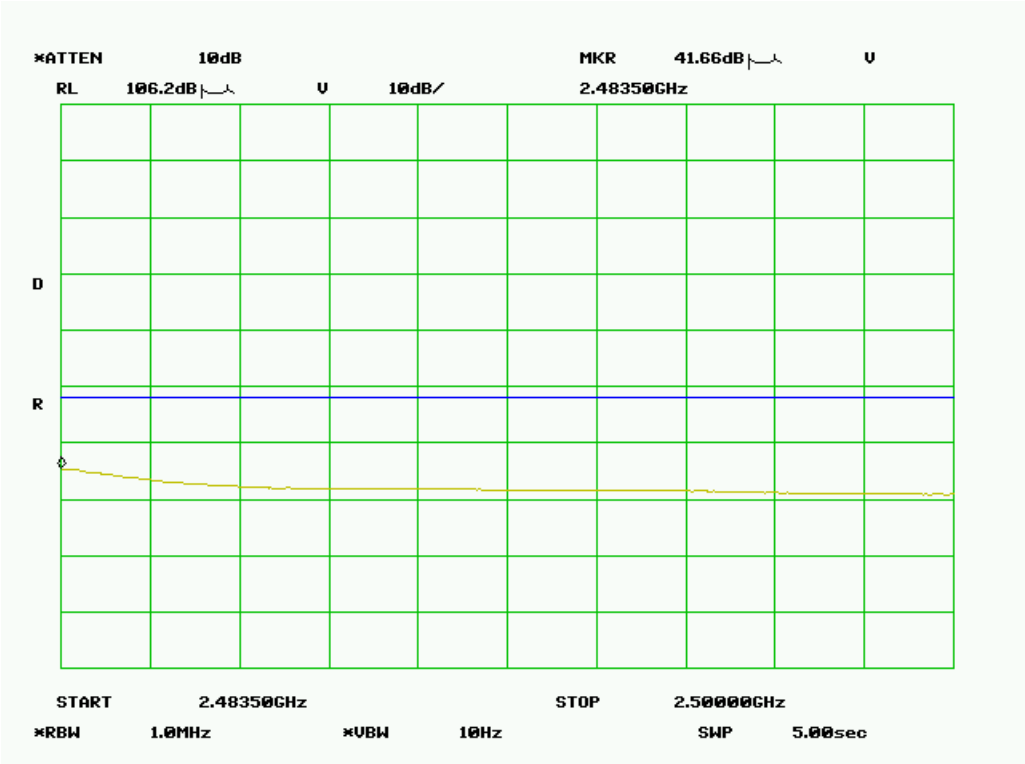
High Channel –Vertical-Peak (802.11g)



High Channel –Vertical-Average (802.11g)



High Channel –Horizontal-Peak (802.11g)



High Channel –Horizontal-Average (802.11g)

Annex A. TEST INSTRUMENT & METHOD

Annex A.i. TEST INSTRUMENTATION & GENERAL PROCEDURES

Instrument	Manufacturer	Model	CAL Due Date
Spectrum Analyzer	HP	8564E	04/26/2009
EMI Receiver	Rohde & Schwarz	ESIB 40	4/25/2009
R&S LISN	R&S	ESH2-Z5	04/24/2009
CHASE LISN	Chase	MN2050B	04/24/2009
Antenna(1 ~18GHz)	Emco	3115	10/04/2008
Antenna (30MHz~2GHz)	Sunol Sciences	JB1	10/04/2008
Chamber	Lingren	3m	04/18/2009
Pre-Amplifier(1 ~ 26GHz)	HP	8449	04/24/2009
Horn Antenna (18~40GHz)	Com Power	AH-840	5/21/2009
Microwave Pre-Amp (18~40GHz)	Com Power	PA-840	5/21/2009

Note: No calibration required.

Annex A.ii. CONDUCTED EMISSIONS TEST DESCRIPTION

Test Set-up

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table, as shown in Annex B.

2. The power supply for the EUT was fed through a 50Ω/50μH EUT LISN, connected to filtered mains.

3. The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable.

4. All other supporting equipments were powered separately from another main supply.

Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition.

2. A scan was made on the NEUTRAL line (for AC mains) or Earth line (for DC power) over the required frequency range using an EMI test receiver.

3. High peaks, relative to the limit line, were then selected.

4. The EMI test receiver was then tuned to the selected frequencies and the necessary measurements made with a receiver bandwidth setting of 10 KHz. For FCC tests, only Quasi-peak measurements were made; while for CISPR/EN tests, both Quasi-peak and Average measurements were made.

5. Steps 2 to 4 were then repeated for the LIVE line (for AC mains) or DC line (for DC power).

Sample Calculation Example

At 20 MHz limit = 250 μV = 47.96 dBμV

Transducer factor of LISN, pulse limiter & cable loss at 20 MHz = 11.20 dB

Q-P reading obtained directly from EMI Receiver = 40.00 dBμV
(Calibrated for system losses)

Therefore, Q-P margin = 47.96 – 40.00 = 7.96 i.e. **7.96 dB below limit**

Annex A. iii RADIATED EMISSIONS TEST DESCRIPTION

EUT Characterisation

EUT characterisation, over the frequency range from 30MHz to 10th Harmonic , was done in order to minimise radiated emissions testing time while still maintaining high confidence in the test results.

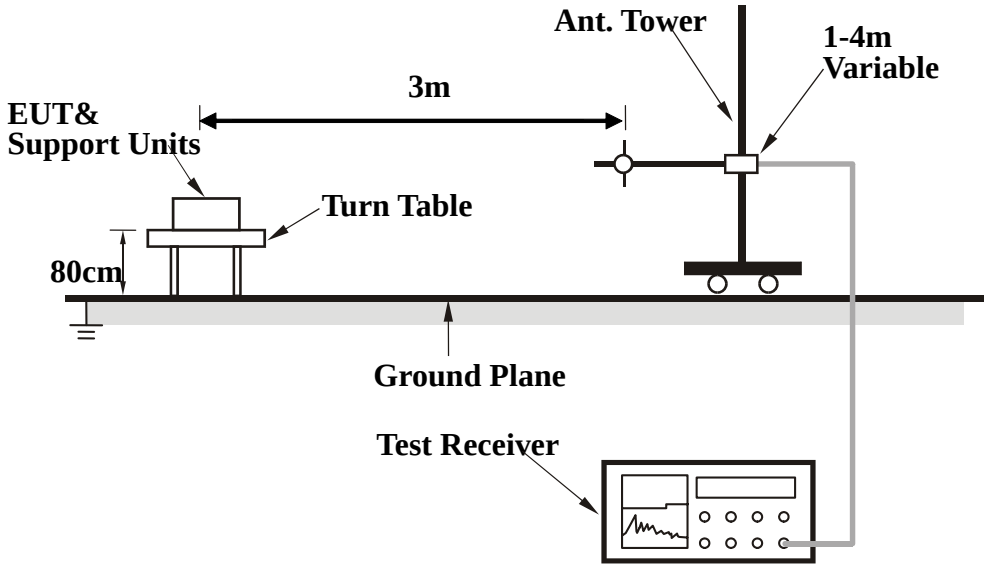
The EUT was placed in the chamber, at a height of about 0.8m on a turntable. Its radiated emissions frequency profile was observed, using a spectrum analyzer /receiver with the appropriate broadband antenna placed 3m away from the EUT. Radiated emissions from the EUT were maximised by rotating the turntable manually, changing the antenna polarisation and manipulating the EUT cables while observing the frequency profile on the spectrum analyzer / receiver. Frequency points at which maximum emissions occurred, clock frequencies and operating frequencies were then noted for the formal radiated emissions test at the Open Area Test Site (OATS).

Test Set-up

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m X 1.0m X 0.8m high, non-metallic table.

2. The filtered power supply for the EUT and supporting equipment were tapped from the appropriate power sockets located on the turntable.

3. The relevant broadband antenna was set at the required test distance away from the EUT and supporting equipment boundary.



Test Method

The following procedure was performed to determine the maximum emission axis of EUT:
1. With the receiving antenna is H polarization, rotate the EUT in turns with three orthogonal axes to determine the axis of maximum emission.
2. With the receiving antenna is V polarization, rotate the EUT in turns with three orthogonal axes to determine the axis of maximum emission.
3. Compare the results derived from above two steps. So, the axis of maximum emission from EUT was determined and the configuration was used to perform the final measurement.

Final Radiated Emission Measurement
1. Setup the configuration according to figure 1. Turn on EUT and make sure that it is in normal function.

2. For emission frequencies measured below 1 GHz, a pre-scan is performed in a shielded chamber to determine the accurate frequencies of higher emissions will be checked on a open test site. As the same purpose, for emission frequencies measured above 1 GHz, a pre-scan also be performed with a 1 meter measuring distance before final test.

3. For emission frequencies measured below and above 1 GHz, set the spectrum analyzer on a 100 kHz and 1 MHz resolution bandwidth respectively for each frequency measured in step 2.

4. The search antenna is to be raised and lowered over a range from 1 to 4 meters in horizontally polarized orientation. Position the highness when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from 0 ◦ to 360 ◦ with a speed as slow as possible, and keep the azimuth that highest emission is indicated on the spectrum analyzer. Vary the antenna position again and record the highest value as a final reading.

5. Repeat step 4 until all frequencies need to be measured were complete.

6. Repeat step 5 with search antenna in vertical polarized orientations.

During the radiated emission test, the Spectrum Analyzer was set with the following configurations:

Frequency Band (MHz)	Function	Resolution bandwidth	Video Bandwidth
30 to 1000	Peak	100 kHz	100 kHz
Above 1000	Peak	1 MHz	1 MHz
	Average	1 MHz	10 Hz

Sample Calculation Example

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. For the limit is employed average value, therefore the peak value can be transferred to average value by subtracting the duty factor. The basic equation with a sample calculation is as follows:

Peak = Reading + Corrected Factor

where
Corr. Factor = Antenna Factor + Cable Factor - Amplifier Gain (if any)
And the average value is

Average = Peak Value + Duty Factor or
Set RBW = 1MHz, VBW = 10Hz.

Note :
If the measured frequencies are fall in the restricted frequency band, the limit employed must be quasi peak value when frequencies are below or equal to 1 GHz. And the measuring instrument is set to quasi peak detector function.

Annex B EUT AND TEST SETUP PHOTOGRAPHS

Please see the attachment

Annex C. TEST SETUP AND SUPPORTING EQUIPMENT

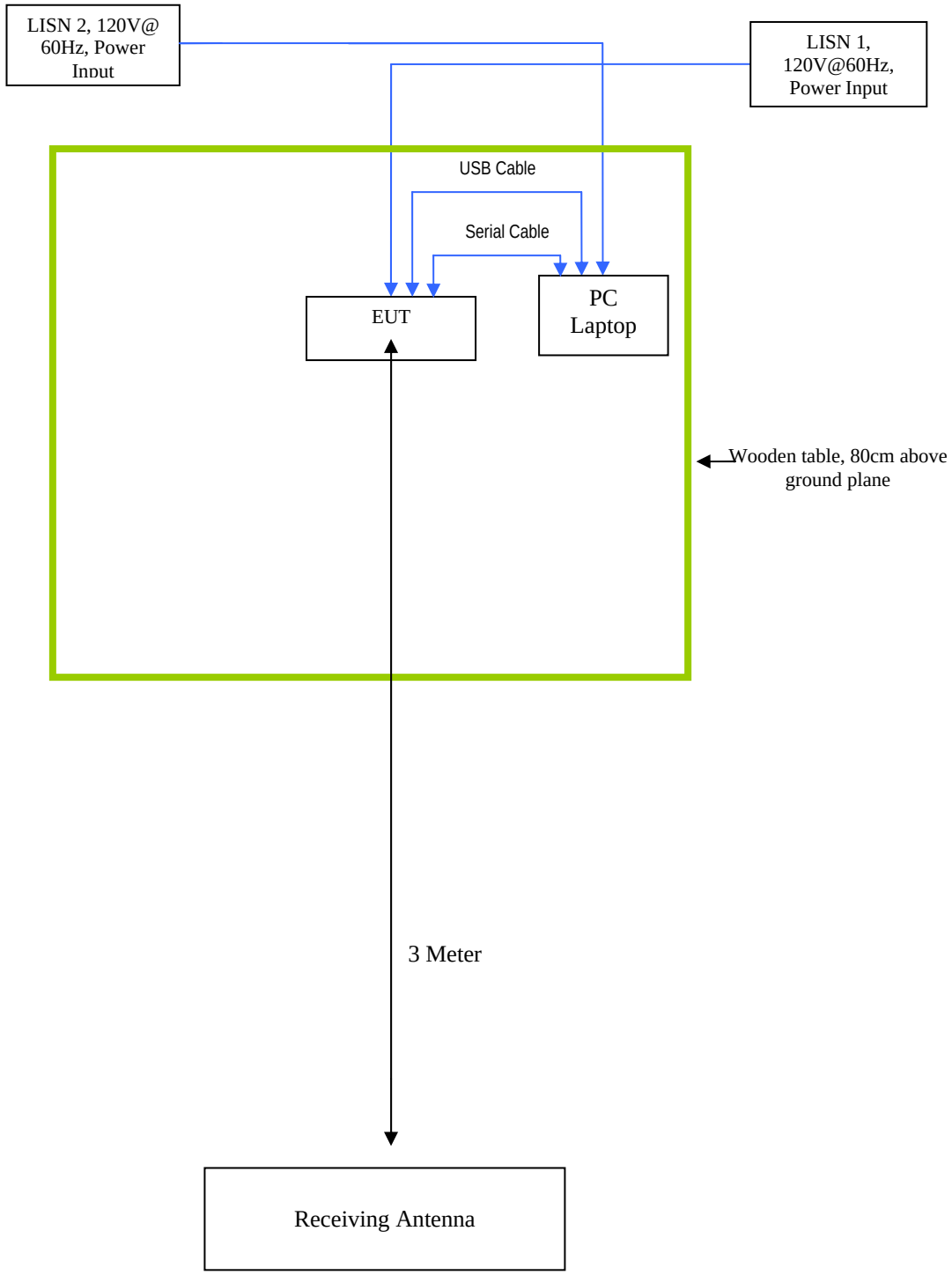
EUT TEST CONDITIONS

Annex C. i. SUPPORTING EQUIPMENT DESCRIPTION

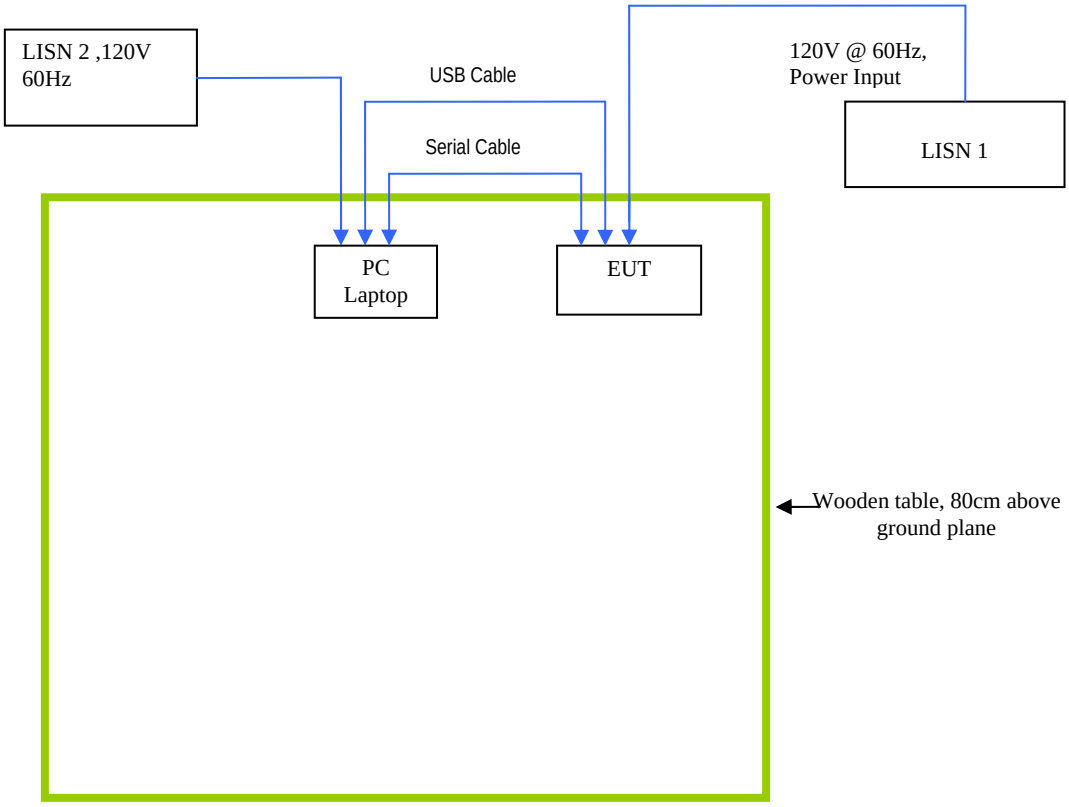
The following is a description of supporting equipment and details of cables used with the EUT.

Equipment Description (Including Brand Name)	Model & Serial Number	Cable Description (List Length, Type & Purpose)
PC Laptop / DELL	Latitude DS520	Serial Cable , 1meter From PC Laptop to EUT

Block Configuration Diagram for Radiated Emission



Block Configuration Diagram for Conducted Emission



Annex C.ii. EUT OPERATING CONDITIONS

The following is the description of how the EUT is exercised during testing.

Test	Description Of Operation
Emissions Testing	The EUT was controlled via PC Laptop using Agency Testing Program provided by applicant.
Others Testing	The EUT was controlled via PC Laptop using Agency Testing Program provided by applicant.

Annex D USER MANUAL, BLOCK & CIRCUIT DIAGRAM

Please see attachment