

Test of Texas Instruments NAV-AP -US 802.11
b/g Wireless AP

To: FCC 47 CFR Part15.247 & IC RSS-210

Test Report Serial No.: TXAS01-A3 Rev A



TEST REPORT
FROM
MiCOMLabs

Test of Texas Instruments NAV-AP -US 802.11 b/g Wireless AP
to
To FCC 47 CFR Part15.247 & IC RSS-210

Test Report Serial No.: TXAS01-A3 Rev A

This report supersedes: None

Applicant: Texas Instruments
PO Box 650311
MS3931
Dallas, Texas 75265 USA

Product Function: Wireless Access Point

Copy No: pdf **Issue Date:** 16th May 2008

This Test Report is Issued Under the Authority of:

MiCOM Labs, Inc.
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CERTIFICATE #2381.01

MiCOM Labs is an ISO 17025 Accredited Testing Laboratory



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To: FCC 47 CFR Part15.247 & IC RSS-210
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ACCREDITATION & LISTINGS

MiCOM Labs, Inc. an accredited laboratory complies with the international standard BS EN ISO/IEC 17025. The company is accredited by the American Association for Laboratory Accreditation (A2LA) www.a2la.org test laboratory number 2381.01. MiCOM Labs test schedule is available at the following URL; <http://www.a2la.org/scopepdf/2381-01.pdf>



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LISTINGS

MiCOM Labs test facilities are listed by the following organizations;

North America

United States of America

Federal Communications Commission (FCC) Listing #: 102167

Canada

Industry Canada (IC) Listing #: 4143A-2

RECOGNITION

APEC MRA (Asia-Pacific Economic Community Mutual Recognition Agreement)

Conformity Assessment Body (CAB) – MiCOM Labs

Test data generated by MiCOM Labs is accepted in the following countries under the APEC MRA.

Country	Recognition Body	Phase	CAB Identification No.
Australia	Australian Communications and Media Authority (ACMA)	I	US0159
Hong Kong	Office of the Telecommunication Authority (OFTA)	I	
Korea	Ministry of Information and Communication Radio Research Laboratory (RRL)	I	
Singapore	Infocomm Development Authority (IDA)	I	
Taiwan	Directorate General of Telecommunications (DGT) Bureau of Standards, Metrology and Inspection (BSMI)	I	

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DOCUMENT HISTORY

Document History		
Revision	Date	Comments
Draft		
Rev A	16 th May 2008	Initial Release

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1. TEST RESULT CERTIFICATE

Manufacturer	Texas Instruments	Tested By:	MiCOM Labs, Inc.
:	PO Box 650311		440 Boulder Court
	MS3931		Suite 200
	Dallas, Texas 75265 USA		Pleasanton
			California, 94566, USA
EUT:	802.11b/g Navigator Access Point	Telephone:	+1 925 462 0304
Model:	NAV-AP-US	Fax:	+1 925 462 0306
S/N:	001		
Test Date(s):	23rd to 30th April '08	Website:	www.micomlabs.com

STANDARD(S)	TEST RESULTS
FCC 47 CFR Part15.247 & IC RSS-210	EQUIPMENT COMPLIES

MiCOM Labs, Inc. tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report.

Notes:

1. This document reports conditions under which testing was conducted and the results of testing performed.
2. Details of test methods used have been recorded and kept on file by the laboratory.
3. Test results apply only to the item(s) tested.

Approved & Released for MiCOM Labs, Inc. by:



CERTIFICATE #2381.01



Graeme Grieve
Quality Manager MiCOM Labs,



Gordon Hurst
President & CEO MiCOM Labs, Inc.

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2. REFERENCES AND MEASUREMENT UNCERTAINTY

2.1. Normative References

Ref.	Publication	Year	Title
(i)	FCC 47 CFR Part 15.247	2007	Code of Federal Regulations
(ii)	Industry Canada RSS-210	Issue 7 June 2007	Low Power License-Exempt Radiocommunication Devices (All Frequency Bands)
(iii)	Industry Canada RSS-Gen	Issue 2 June 2007	General Requirements and Information for the Certification of Radiocommunication Equipment.
(iv)	ANSI C63.4	2003	American National Standards for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
(v)	CISPR 22/ EN 55022	1997 1998	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
(vi)	M 3003	Edition 1 Dec. 1997	Expression of Uncertainty and Confidence in Measurements
(vii)	LAB34	Edition 1 Aug 2002	The expression of uncertainty in EMC Testing
(viii)	ETSI TR 100 028	2001	Parts 1 and 2 Electromagnetic compatibility and Radio Spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics
(ix)	A2LA	14 th September 2005	Reference to A2LA Accreditation Status – A2LA Advertising Policy

2.2. Test and Uncertainty Procedures

Conducted and radiated emission measurements were conducted in accordance with American National Standards Institute ANSI C63.4, listed in the Normative References section of this report.

Measurement uncertainty figures are calculated in accordance with ETSI TR 100 028 Parts 1 and 2.

Measurement uncertainties stated are based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95 % in accordance with UKAS document M 3003 listed in the Normative References section of this report.



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3. PRODUCT DETAILS AND TEST CONFIGURATIONS

3.1. Technical Details

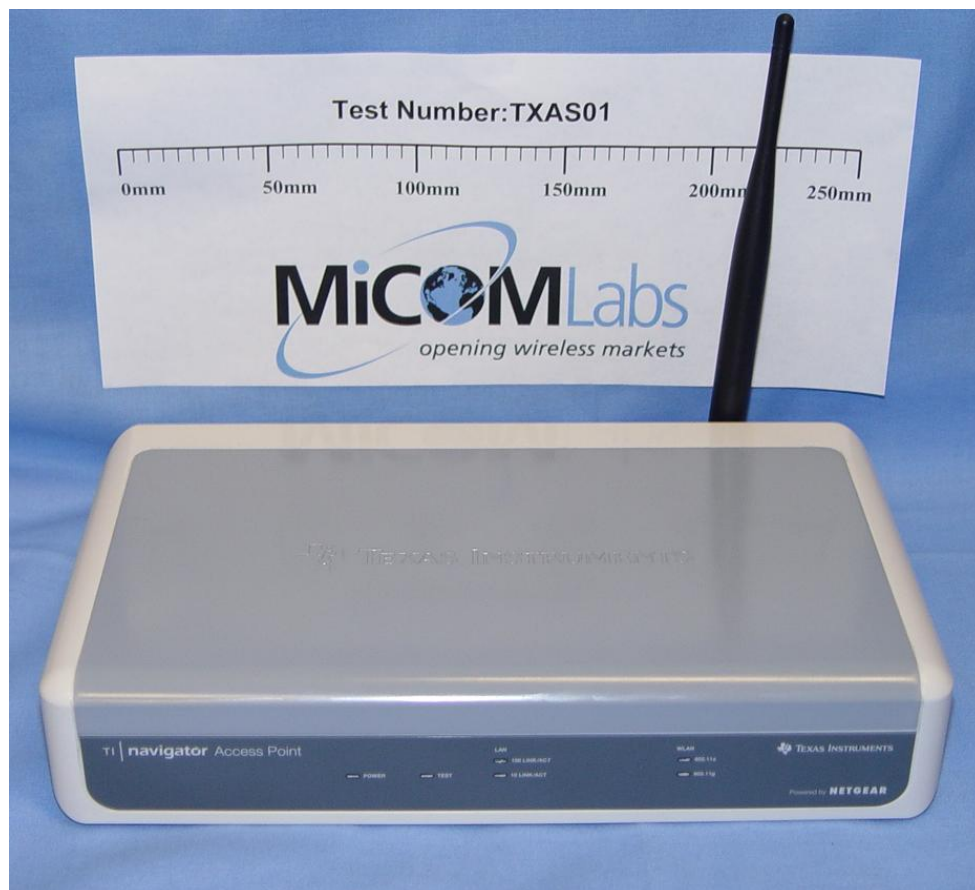
Details	Description
Purpose:	Test of the NAV-AP -US 802.11 b/g Wireless AP to FCC Part 15.247 and Industry Canada RSS-210 regulations.
Applicant:	Texas Instruments PO Box 650311 MS3931 Dallas, Texas 75265 USA
Manufacturer:	As applicant.
Laboratory performing the tests:	MiCOM Labs, Inc. 440 Boulder Court, Suite 200 Pleasanton, California 94566 USA
Test report reference number:	TXAS01-A3 Rev A
Date EUT received:	23 rd April 2008
Standard(s) applied:	FCC 47 CFR Part15.247 & IC RSS-210
Dates of test (from - to):	23rd to 30th April '08
No of Units Tested:	1
Type of Equipment:	802.11b/g Wireless Access Point
Manufacturers Trade Name:	TI Navigator Access Point
Model:	NAV-AP-US
Location for use:	Indoor
Declared Frequency Range(s):	2400 - 2483.5 MHz
Type of Modulation:	Per 802.11 – CCK, OFDM
Declared Nominal Output Power:	802.11b: +20 dBm 802.11g: +20 dBm
EUT Modes of Operation:	802.11b/g
Transmit/Receive Operation:	Time Division Duplex
Rated Input Voltage:	12 V dc, 2A
Operating Temperature Range:	Client declared range 0 to +45°C
Software Release	Controller: 1.0 , WW Radio Section: 2.07
Hardware Release:	1.0
ITU Emission Designator:	802.11b – 15M6D1D 802.11g – 18M7G1D
Microprocessor(s) Model:	TMS320DM6441, Atheros AR5312
Clocks & Processor Frequencies:	24, 25, 27, 40, 162, 297, 480 MHz
Frequency Stability:	±20 ppm max
Memory:	Logic Board: DDR2 RAM (51Mb - 16Mx32bits) NOR Flash (128Mb - 4Mx16bits) Radio Section: NOR Flash (32Mb - 2Mx16bits) SDRAM (128Mb – 8Mx16bits)
Equipment Dimensions:	10" X 6 ⁷ / ₈ " X 2"
Weight:	1.21 kg
Primary function of equipment:	Data communication

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3.2. Scope of Test Program

The scope of the test program was to test the Texas Instruments Navigator wireless Access Point in the frequency range 2400 - 2483.5 MHz for compliance against FCC 47 CFR Part 15.247 and Industry Canada RSS-210 specifications.

Texas Instruments Navigator 802.11 b/g Wireless Access Point



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3.3. Equipment Model(s) and Serial Number(s)

Type (EUT/Support)	Equipment Description (Including Brand Name)	Mfr	Model No.	Serial No.
EUT	TI Navigator Access Point	Texas Instruments	NAV-AP-US	001
Support	Power Supply 100-240 V AC, 50/60Hz, 1000mA 12 V DC, 2000mA	Texas Instruments	AC9930	N/A
Support	Laptop PC	IBM	ThinkPad	None

3.4. Antenna Details

Dipole antenna manufactured by;

WHA YU INDUSTRIAL CO.,LTD.(headquarter)
NO.326,Sec 2,Kung Tao5 Road, Hsinchu City,Taiwan,R.O.C.

Model #: C147-510161-A

Gain @ 2400 – 2483.5 MHz: 5dBi

3.5. Cabling and I/O Ports

Number and type of I/O ports

1. USB 2.0 High Speed mode
2. Antenna Connector (RP-SMA)
3. Vdc, 4mm supply connector

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3.6. Test Configurations

Matrix of Channel test configurations.

Operational Mode (802.11)	Frequencies (MHz)
b, g	2,412 2,437 2,462

3.7. Equipment Modifications

The following modifications were required to bring the equipment into compliance:

1. NONE.

3.8. Deviations from the Test Standard

The following deviations from the test standard were required in order to complete the test program:

1. NONE

3.9. Subcontracted Testing or Third Party Data

1. NONE

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4. TEST SUMMARY

List of Measurements

The following table represents the list of measurements required under the **FCC CFR47 Part 15.247** and **Industry Canada RSS-210** and **Industry Canada RSS-Gen**.

Section(s)	Test Items	Description	Condition	Result	Test Report Section
15.247(a)(2) A8.2(1) 4.4	6 dB and 99 % Bandwidths	≥500 kHz	Conducted	Complies	5.1.1
15.247(b)(3) 15.31(e) A8.4(4)	Peak Output Power Voltage Variation	Shall not exceed 1W Variation of supply voltage 85 % -115 %	Conducted	Complies	5.1.2
15.247(e) A8.2	Peak Power Spectral Density	Shall not be greater than +8 dBm in any 3 kHz band	Conducted	Complies	5.1.3
15.247(i) 5.5	Maximum Permissible Exposure	Exposure to radio frequency energy levels	Conducted	Complies	5.1.4
15.247(d) 15.205 / 15.209 A8.5 2.2 4.7	Spurious Emissions (30MHz - 26 GHz)	The radiated emission in any 100 kHz of out-band shall be at least 20 dB below the highest in-band spectral density	Conducted	Complies	5.1.5

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List of Measurements (continued)

The following table represents the list of measurements required under the **FCC CFR47 Part 15.247**, **Industry Canada RSS-210**, and **Industry Canada RSS-Gen**.

Section(s)	Test Items	Description	Condition	Result	Test Report Section
15.247(d) 15.205 / 15.209 A8.5 2.2 2.6 4.7	Radiated Emissions	Restricted Bands	Radiated	Complies	5.1.6
Industry Canada only RSS-Gen §4.8, §6	Transmitter Radiated Spurious Emissions	Emissions above 1 GHz		Complies	5.1.6.1
	Receiver Radiated Spurious Emissions	Emissions above 1 GHz		Complies	5.1.6.2
	Radiated Band Edge	Band edge results		Complies	5.1.6.2.1
15.205 / 15.209 2.2	Radiated Spurious Emissions	Emissions <1 GHz (30M-1 GHz)	Radiated	Complies	5.1.6.3
15.207 7.2.2	AC Wireline Conducted Emissions 150 kHz– 30 MHz	Conducted Emissions	Conducted	Complies	5.1.7

Note 1: Test results reported in this document relate only to the items tested

Note 2: The required tests demonstrated compliance as per client declaration of test configuration, monitoring methodology and associated pass/fail criteria

Note 3: Appendix A - Equipment Modifications highlights the equipment modifications that were required to bring the product into compliance with the above test matrix

5. TEST RESULTS

5.1. Device Characteristics

5.1.1. 6 dB and 99 % Bandwidth

FCC, Part 15 Subpart C §15.247(a)(2)

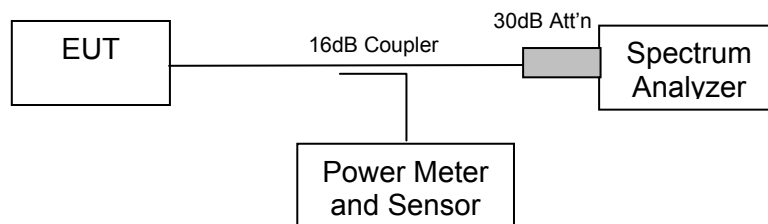
Industry Canada RSS-210 §A8.2

Industry Canada RSS-Gen §4.4

Test Procedure

The bandwidth at 6 dB and 99 % is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency. The analyzer was set for a 6 dB resolution bandwidth filter during this measurement.

Test Measurement Set up



Measurement set up for 6 dB and 99 % bandwidth test



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Measurement Results for 6 dB and 99 % Operational Bandwidth(s)

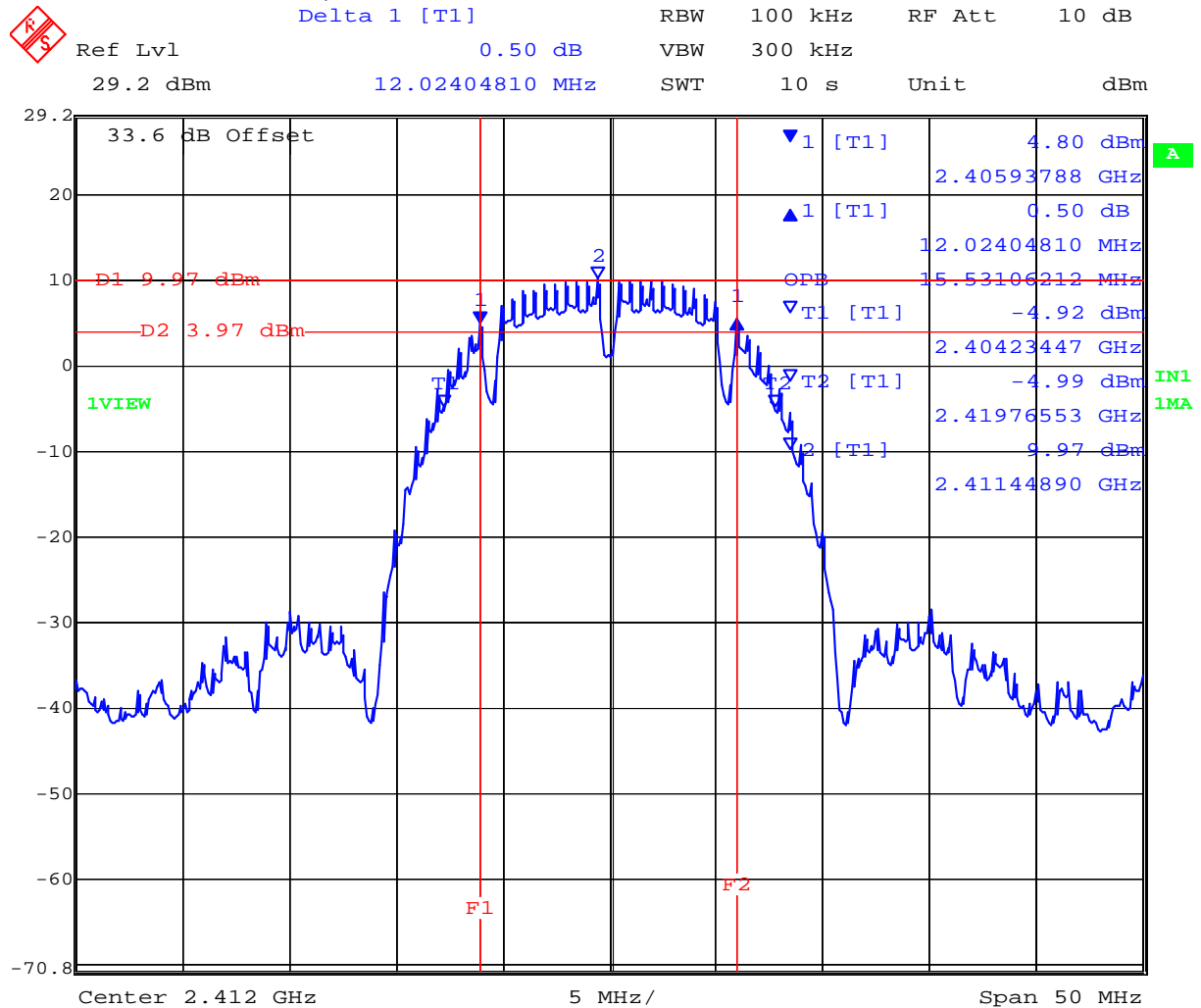
Ambient conditions.

Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

TABLE OF RESULTS – 802.11b - 1 Mb/s

Center Frequency (MHz)	6 dB Bandwidth (MHz)	99 % BW (MHz)
2,412	12.024	15.531
2,437	12.024	15.431
2,462	11.523	15.531

2,412 MHz 802.11b 6 dB and 99% Bandwidth



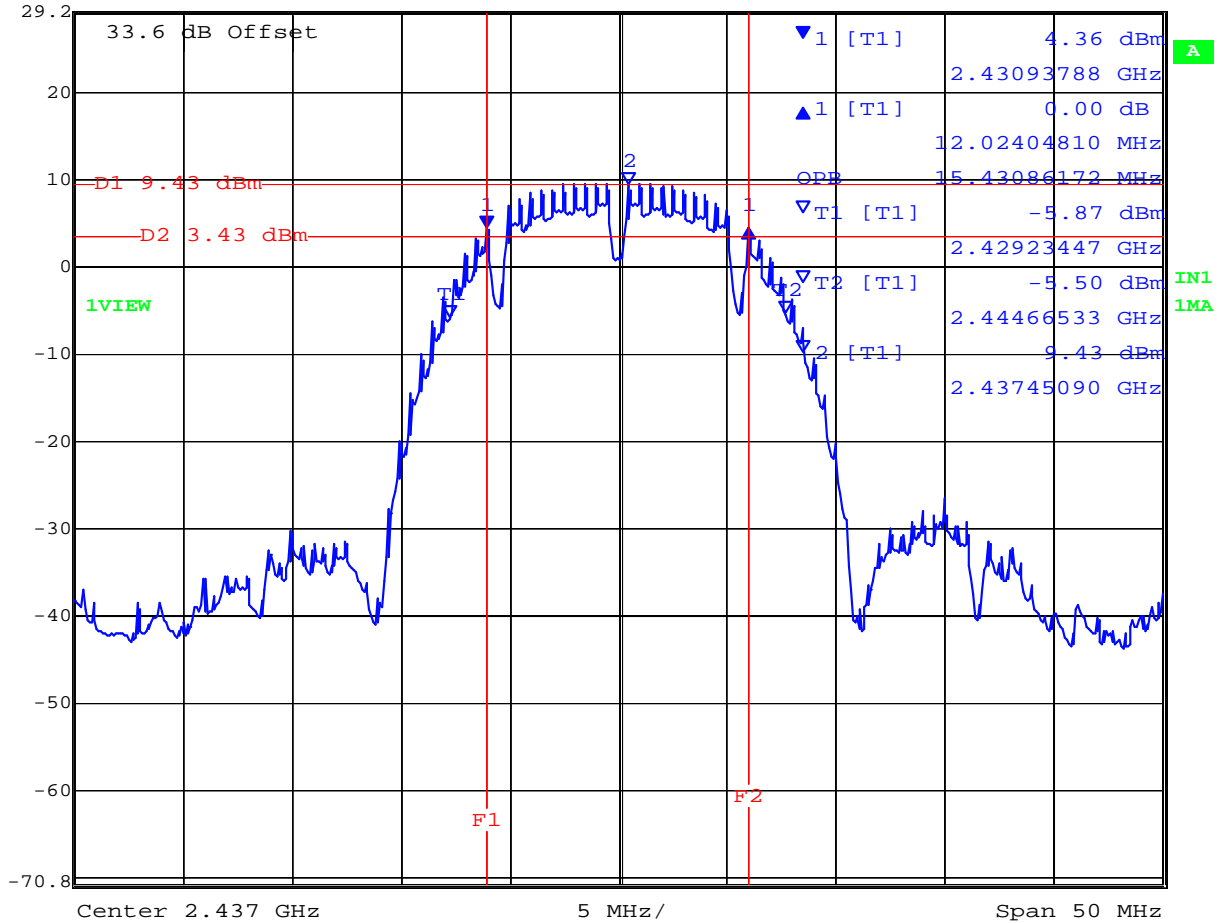
Date: 23.APR.2008 13:35:46

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2,437 MHz 802.11b 6 dB and 99% Bandwidth

Ref Lvl 29.2 dBm
 Delta 1 [T1] 0.00 dB
 RBW 100 kHz
 RF Att 10 dB
 VBW 300 kHz
 Unit dBm
 SWT 10 s



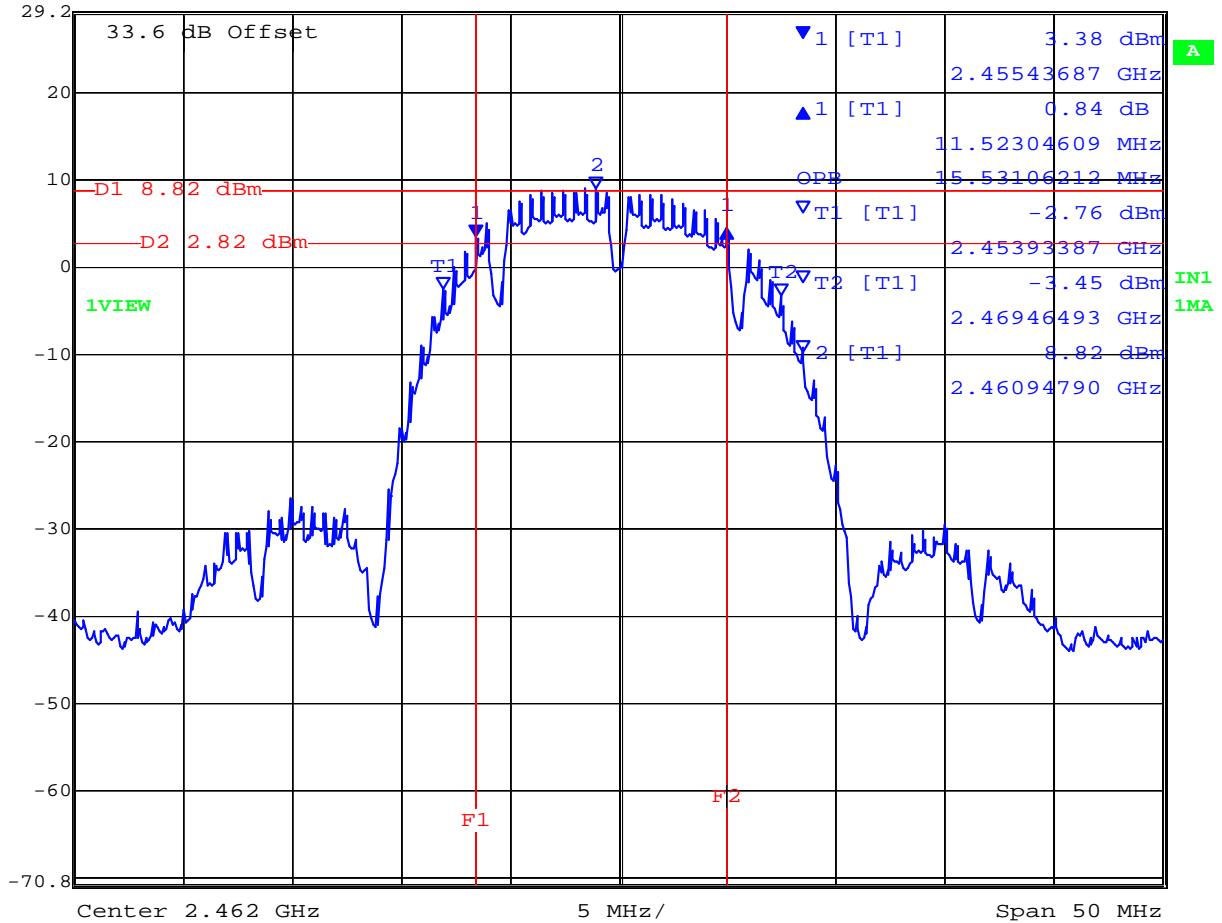
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2,462 MHz 802.11b 6 dB and 99% Bandwidth

Ref Lvl 29.2 dBm
 Delta 1 [T1] 0.84 dB
 RBW 100 kHz
 RF Att 10 dB
 VBW 300 kHz
 Unit dBm
 SWT 10 s



Date: 23.APR.2008 13:42:45

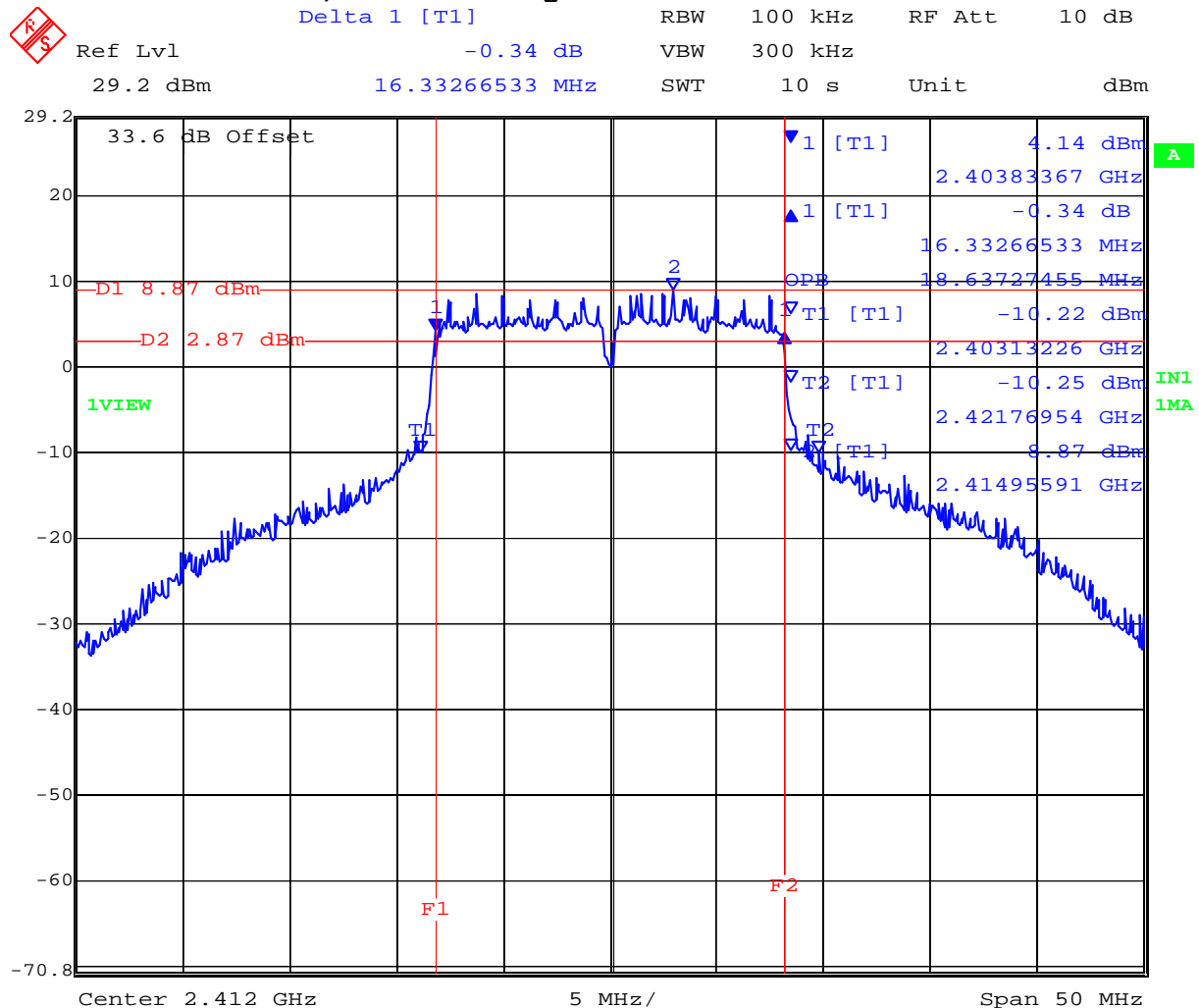
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TABLE OF RESULTS – 802.11g - 6 Mb/s

Center Frequency (MHz)	6 dB Bandwidth (MHz)	99 % BW (MHz)
2,412	16.333	18.637
2,437	16.433	18.136
2,462	16.032	17.435

2,412 MHz 802.11g 6 dB and 99% Bandwidth



Date: 23.APR.2008 13:58:07

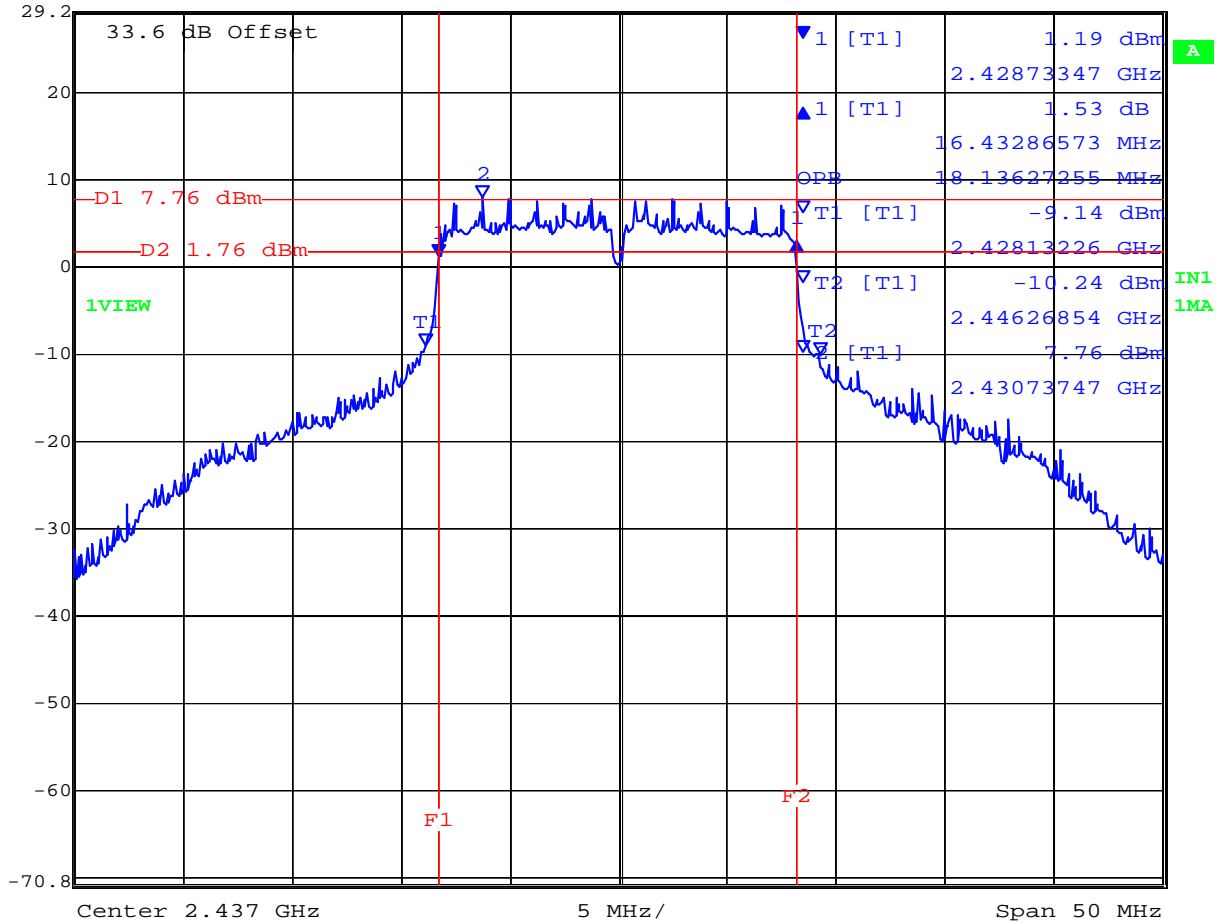
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2,437 MHz 802.11g 6 dB and 99% Bandwidth



Delta 1 [T1] RBW 100 kHz RF Att 10 dB
 Ref Lvl 1.53 dB VBW 300 kHz
 29.2 dBm 16.43286573 MHz SWT 10 s Unit dBm



Date: 23.APR.2008 13:55:55

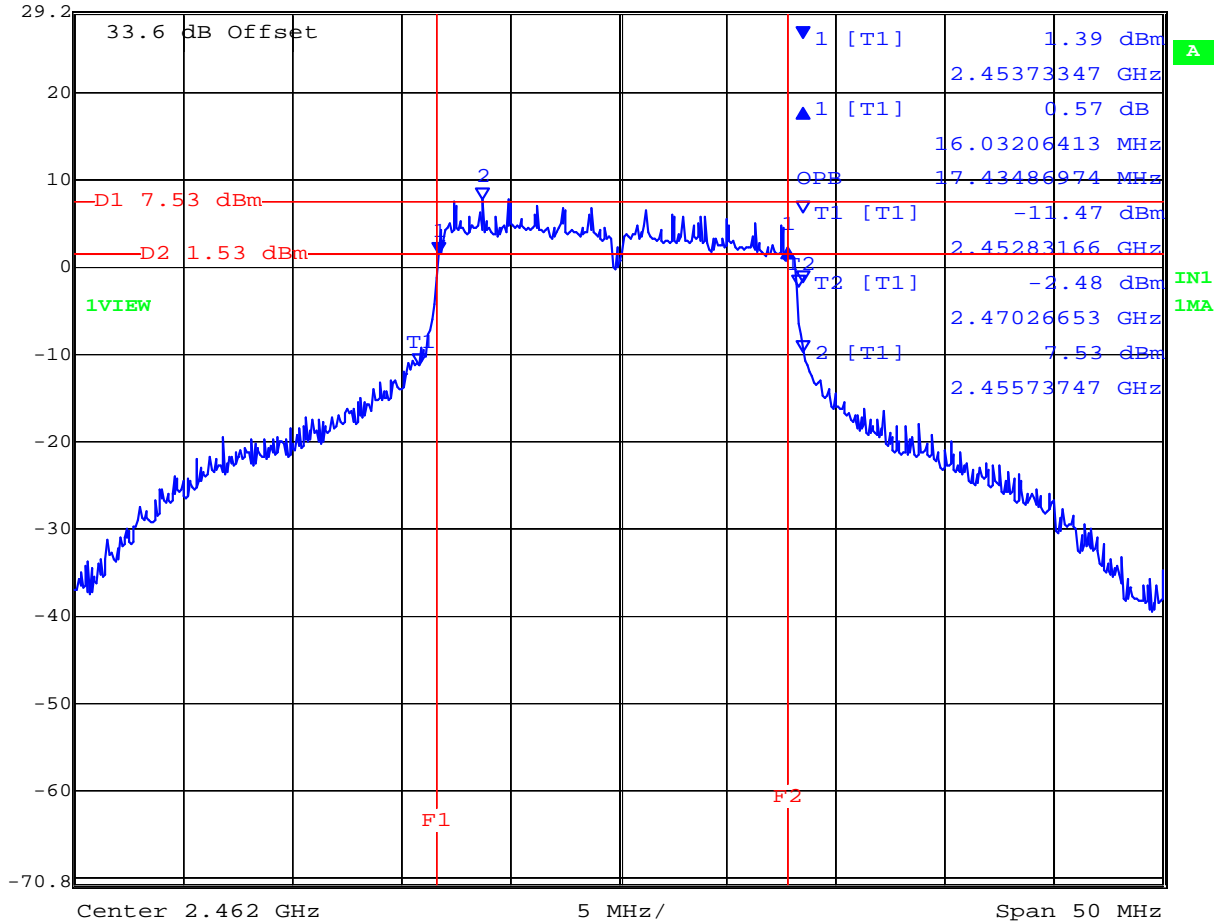
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2,462 MHz 802.11g 6 dB and 99% Bandwidth



Delta 1 [T1] RBW 100 kHz RF Att 10 dB
 Ref Lvl 0.57 dB VBW 300 kHz
 29.2 dBm 16.03206413 MHz SWT 10 s Unit dBm



Date: 23.APR.2008 13:52:31

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Specification

Limits

§15.247 (a)(2) & RSS-210 §A8.2(1)

The minimum 6 dB bandwidth shall be at least 500 kHz.

§ IC RSS-Gen 4.4.1 Occupied Bandwidth When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured.

§ IC RSS-Gen 4.4.2 6 dB Bandwidth Where indicated, the 6 dB bandwidth is measured at the points when the spectral density of the signal is 6 dB down from the in –band spectral density of the modulated signal, with the transmitter modulated by a representative signal.

Laboratory Measurement Uncertainty for Spectrum Measurement

Measurement uncertainty	±2.81 dB
-------------------------	----------

Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-03 'Measurement of RF Spectrum Mask'	0158, 0193, 0252, 0313, 0314, 0070, 0116, 0117

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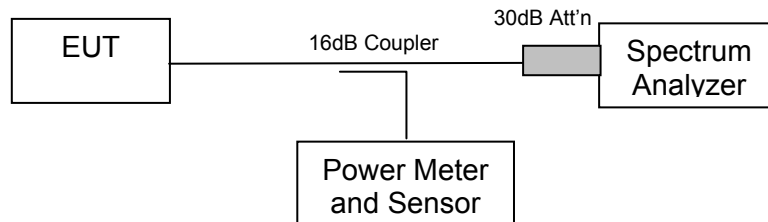
5.1.2. Peak Output Power

FCC, Part 15 Subpart C §15.247(b)(3), §15.31(e)
Industry Canada RSS-210 §A8.4(4)

Test Procedure

The transmitter terminal of EUT was connected to the input of the spectrum analyzer set to measure peak power. The Peak output power was measured using an average power meter.

Test Measurement Set up



Measurement set up for Transmitter Peak Output Power

Ambient conditions.

Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

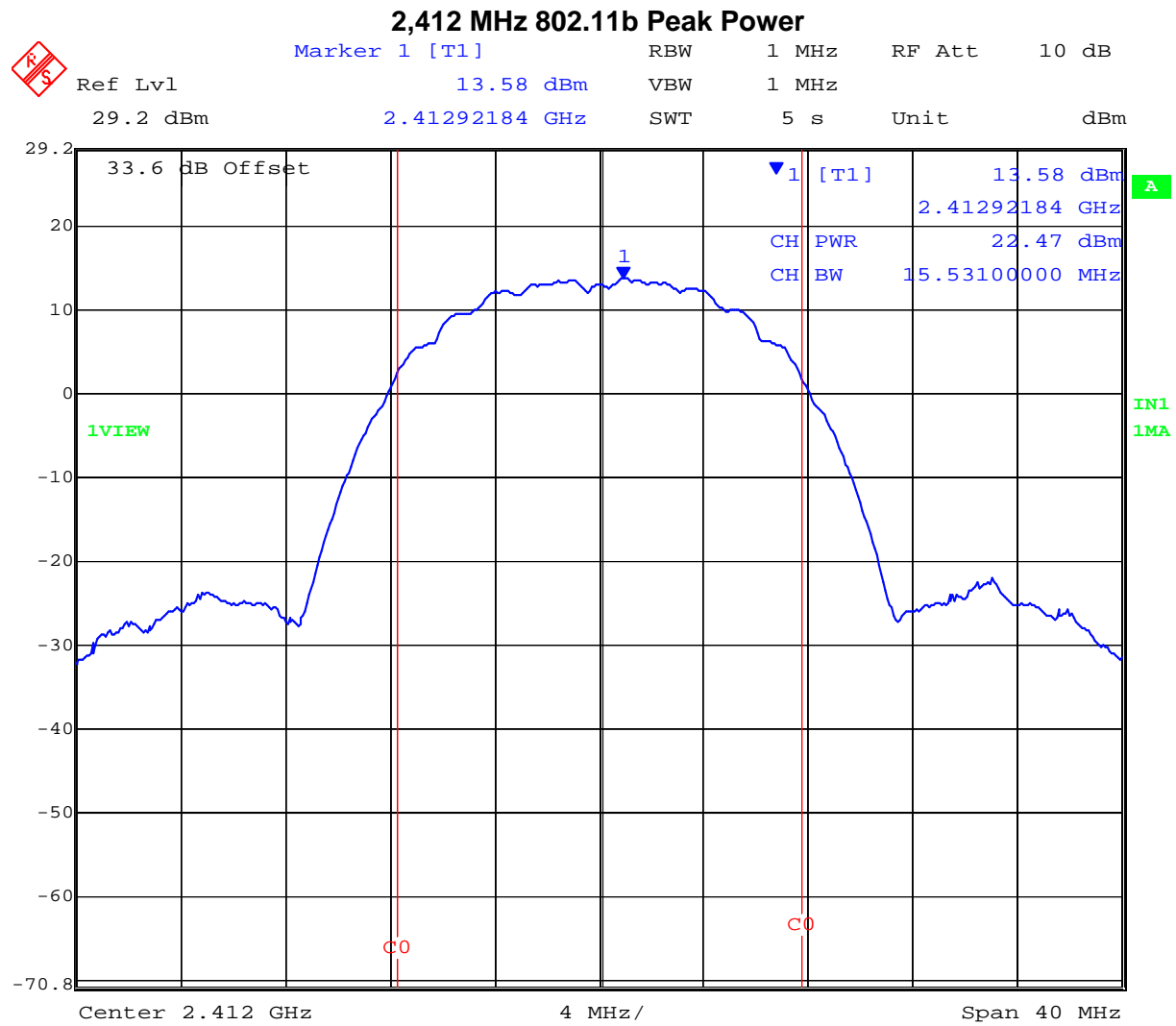
b/g (2.4 GHz) Maximum Antenna Gain = +5 dBi



NOTE: The peak power measurements were taken using an average power meter.

TABLE OF RESULTS – 802.11b – 1Mb/s

Center Frequency (MHz)	99% Measurement Bandwidth (MHz)	Peak Power (dBm)	Peak Power EIRP (dBm)
2,412	15.531	+22.47	+27.47
2,437	15.431	+22.10	+27.10
2,462	15.531	+20.69	+25.69




Date: 23.APR.2008 16:31:37

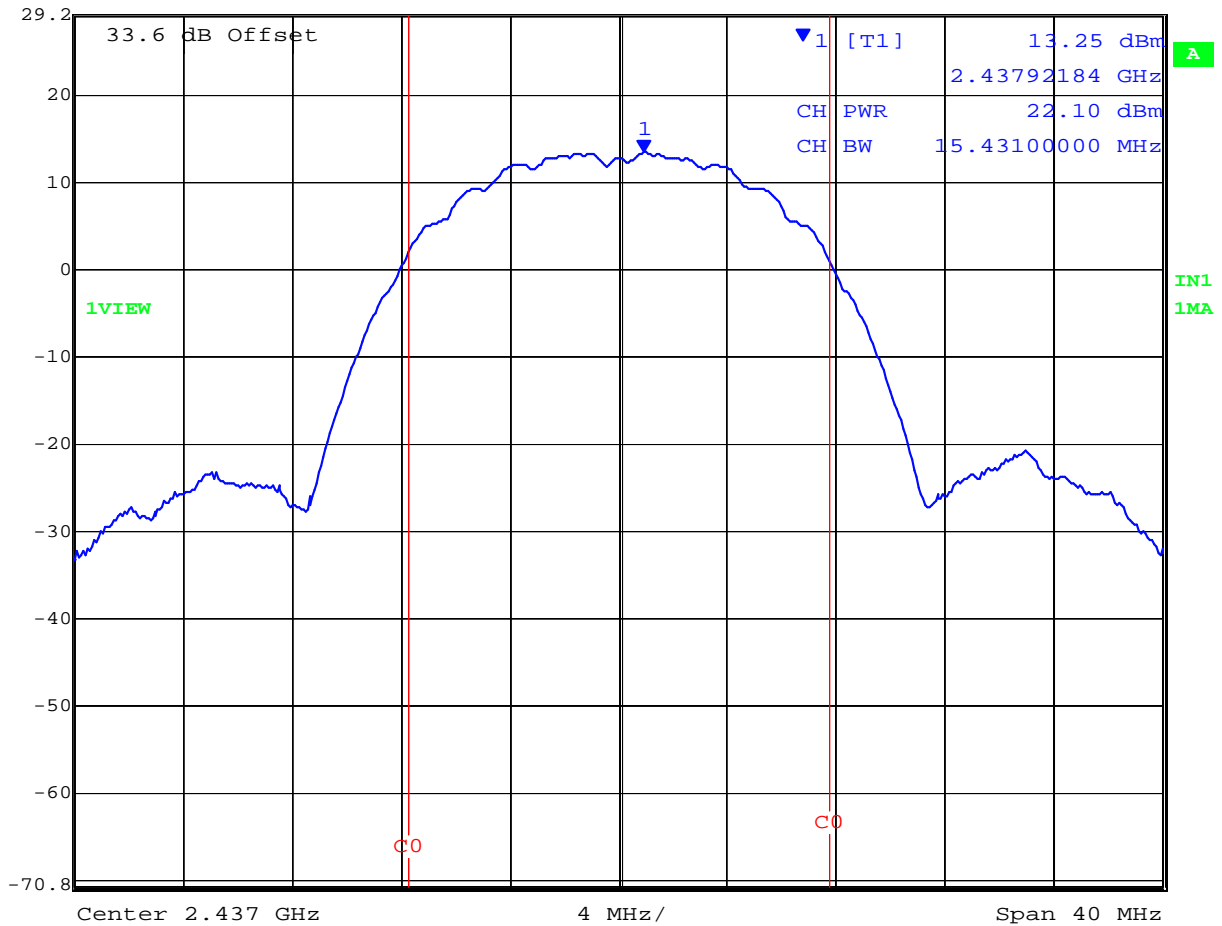
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2,437 MHz 802.11b Peak Power

 **Marker 1 [T1]** RBW 1 MHz RF Att 10 dB
Ref Lvl 13.25 dBm VBW 1 MHz
29.2 dBm 2.43792184 GHz SWT 5 s Unit dBm




Date: 23.APR.2008 16:35:07

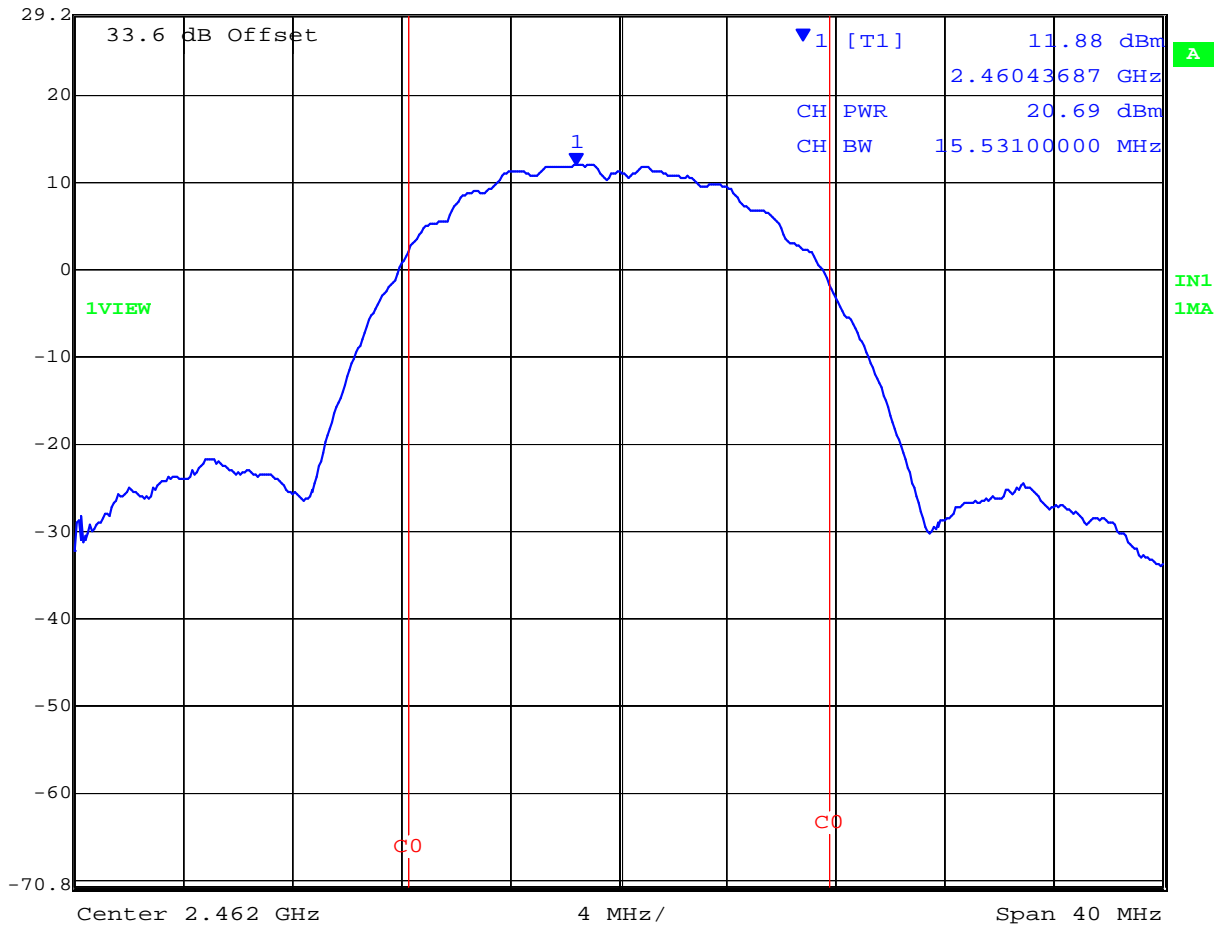
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2,462 MHz 802.11b Peak Power

 **Marker 1 [T1]** RBW 1 MHz RF Att 10 dB
Ref Lvl 11.88 dBm VBW 1 MHz
29.2 dBm 2.46043687 GHz SWT 5 s Unit dBm



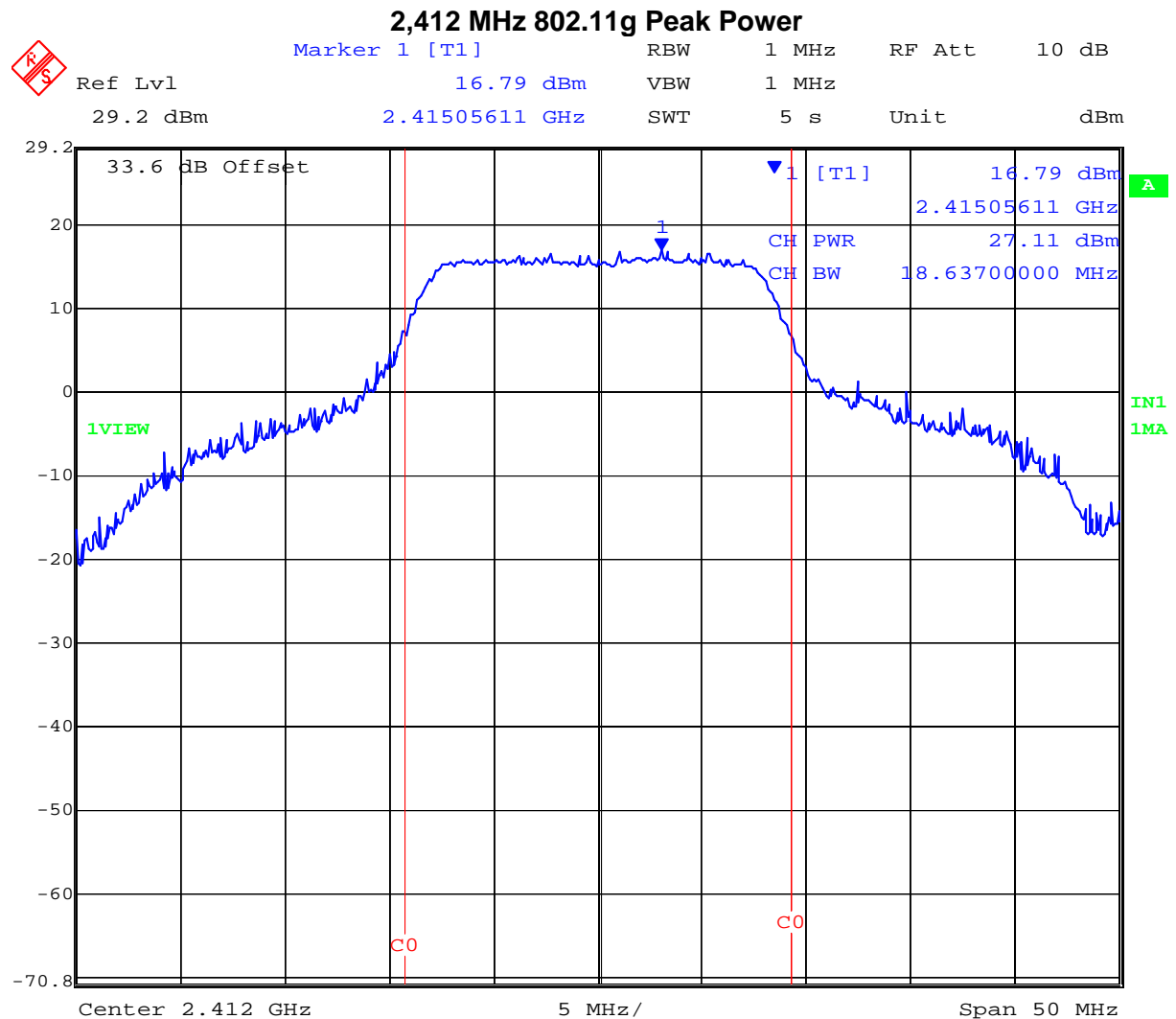
Date: 23.APR.2008 16:33:28

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TABLE OF RESULTS – 802.11g – 6 Mb/s

Center Frequency (MHz)	99% Measurement Bandwidth (MHz)	Peak Power (dBm)	Peak Power EIRP (dBm)
2,412	18.637	+27.11	+32.11
2,437	18.136	+26.56	+31.56
2,462	17.435	+25.61	+30.61



Date: 23.APR.2008 16:36:43

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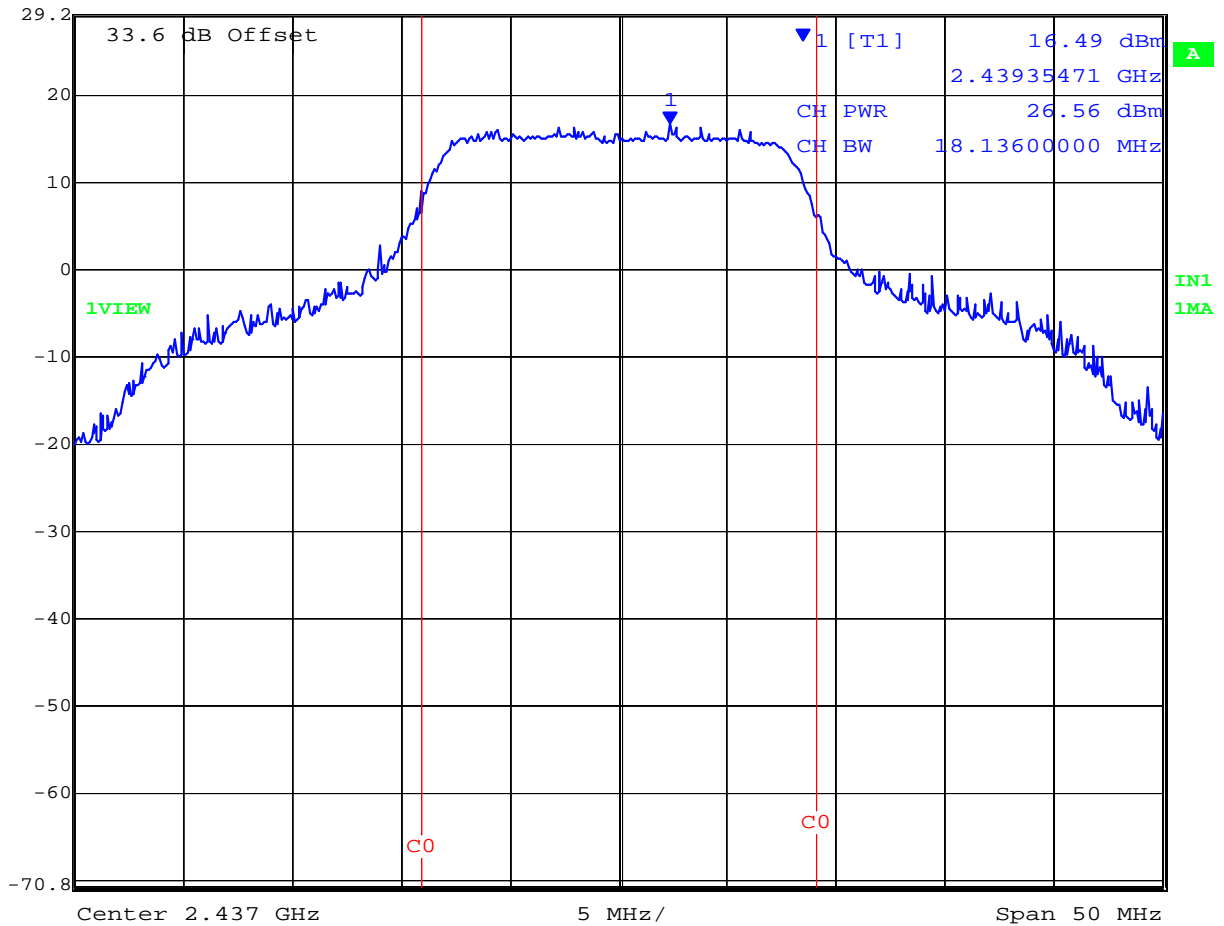


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2,437 MHz 802.11g Peak Power



Marker 1 [T1] RBW 1 MHz RF Att 10 dB
Ref Lvl 16.49 dBm VBW 1 MHz
29.2 dBm 2.43935471 GHz SWT 5 s Unit dBm



Date: 23.APR.2008 16:38:24

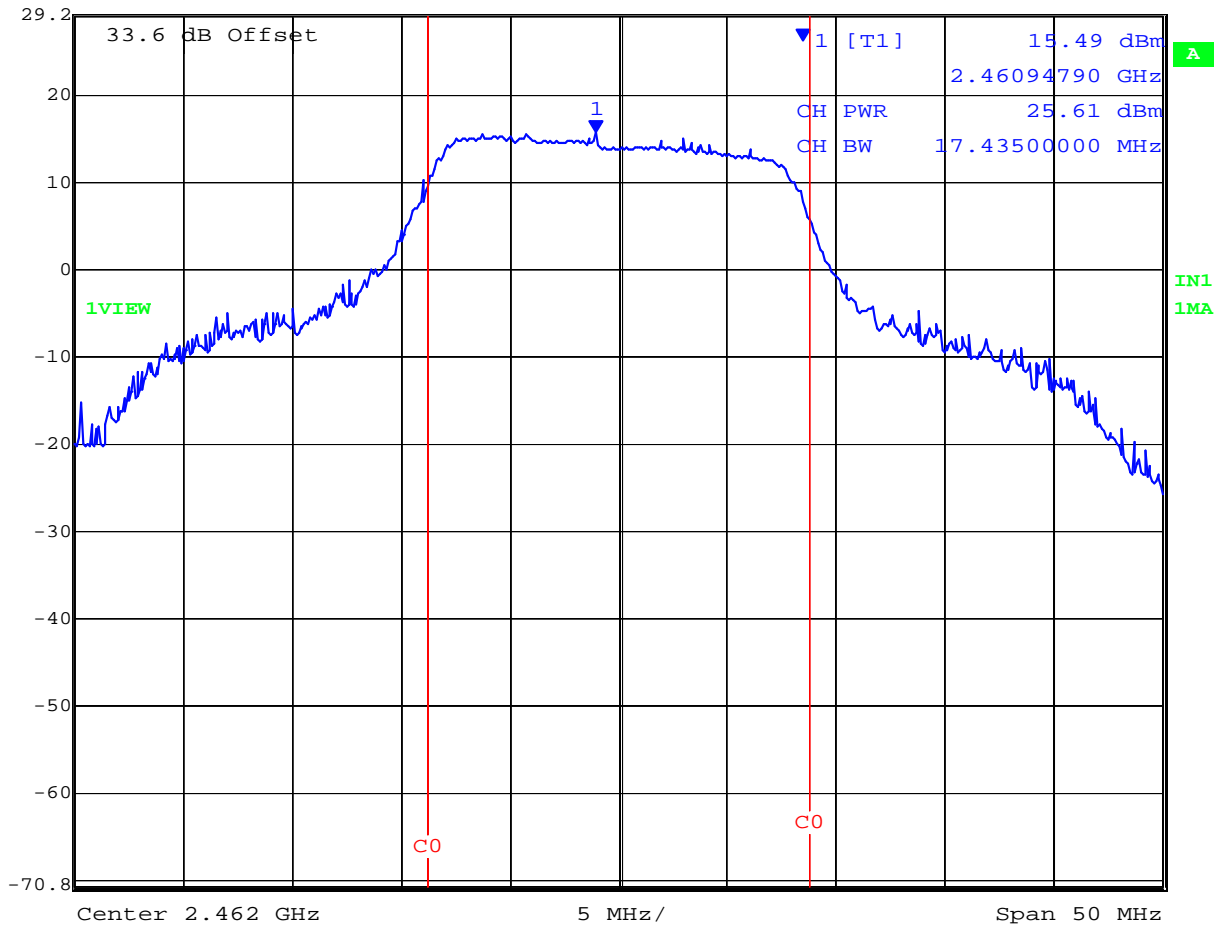
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2,462 MHz 802.11g Peak Power



Marker 1 [T1] RBW 1 MHz RF Att 10 dB
Ref Lvl 15.49 dBm VBW 1 MHz
29.2 dBm 2.46094790 GHz SWT 5 s Unit dBm



Date: 23.APR.2008 16:39:59

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Specification

Limits

§15.247 (b) The maximum peak output power of the intentional radiator shall not exceed the following:

§15.247 (b) (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz bands: 1.0 watt.

§15.31 (e) For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

§ RSS-210 A8.4(4) For systems employing digital modulation techniques operating in the 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz bands the maximum peak conducted power shall not exceed 1 watt.

Laboratory Measurement Uncertainty for Power Measurements

Measurement uncertainty	±1.33 dB
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Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-01 'Measuring RF Output Power'	0158, 0193, 0252, 0313, 0314, 0070, 0116, 0117

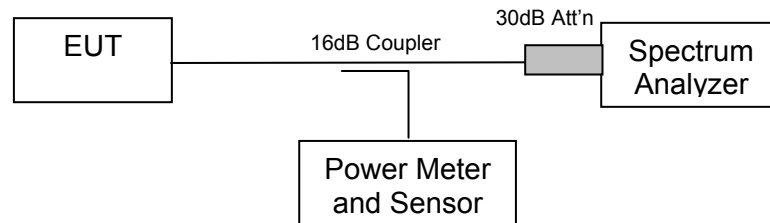
5.1.3. Peak Power Spectral Density

FCC, Part 15 Subpart C §15.247(e)
Industry Canada RSS-210 §A8.2

Test Procedure

The transmitter output was connected to a spectrum analyzer and the maximum level in a 3 kHz bandwidth was measured. A peak value was found over the full emission bandwidth and the frequency span reduced to obtain enhanced resolution. Sweep time \geq span / 3 kHz with video averaging turned off. The Peak Power Spectral Density is the highest level found across the emission in a 3 kHz resolution bandwidth.

Test Measurement Set up



Measurement set up for Peak Power Spectral Density

Measurement Results for Peak Power Spectral Density

Ambient conditions.

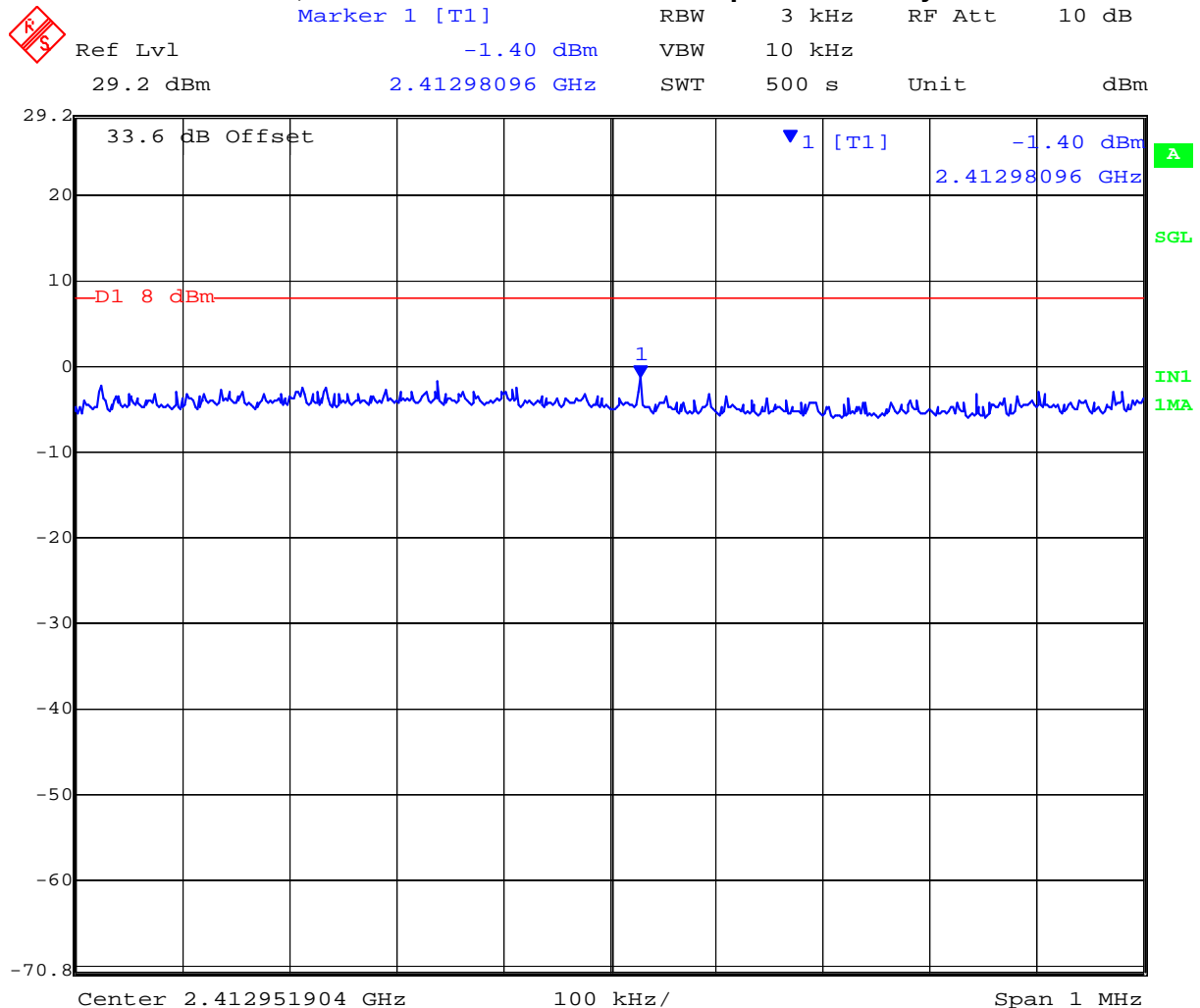
Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar



TABLE OF RESULTS – 802.11b – 1Mb/s

Center Frequency (MHz)	Peak Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dBm)
2,412	2412.98096	-1.40	+8	-9.40
2,437	2437.84469	-2.51	+8	-10.51
2,462	2461.97996	-3.03	+8	-11.03

2,412 MHz 802.11b Peak Power Spectral Density




Date: 23.APR.2008 14:21:54

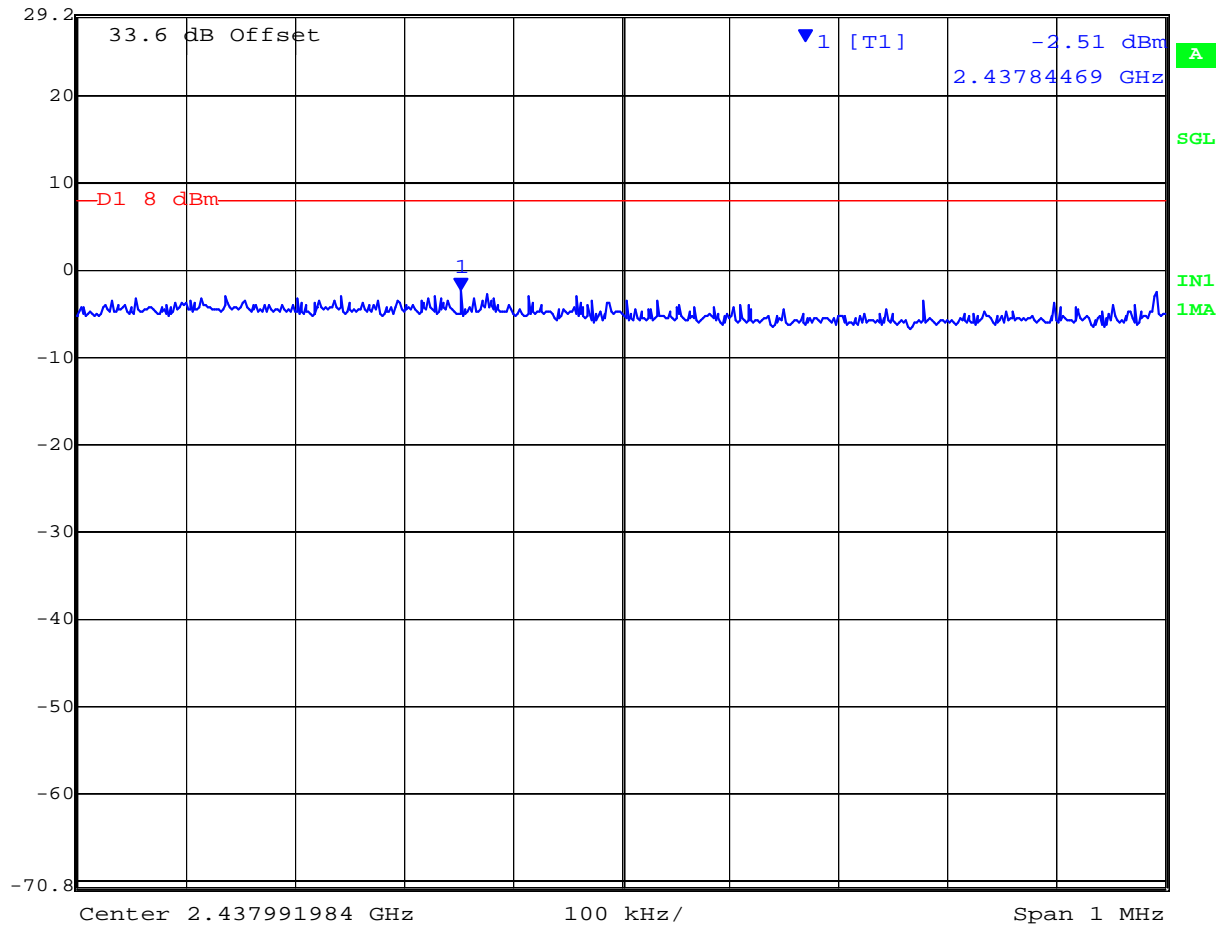
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Title: NAV-AP -US 802.11 b/g Wireless AP
To: FCC 47 CFR Part15.247 & IC RSS-210
Serial #: TXAS01-A3 Rev A
Issue Date: 16th May 2008
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2,437 MHz 802.11b Peak Power Spectral Density

 **Marker 1 [T1]** RBW 3 kHz RF Att 10 dB
Ref Lvl -2.51 dBm VBW 10 kHz
29.2 dBm 2.43784469 GHz SWT 500 s Unit dBm




Date: 23.APR.2008 14:59:38

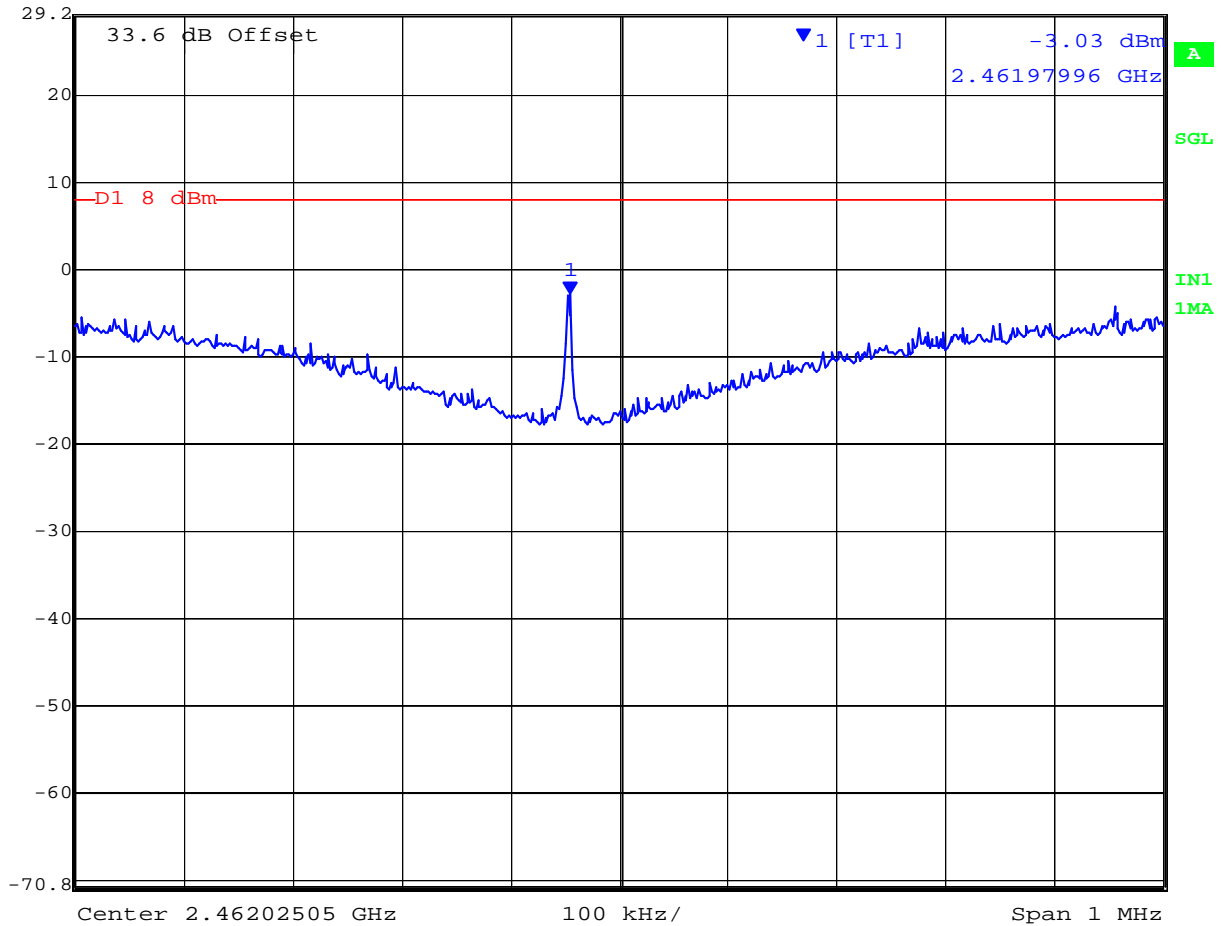
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Title: NAV-AP -US 802.11 b/g Wireless AP
To: FCC 47 CFR Part15.247 & IC RSS-210
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2,462 MHz 802.11b Peak Power Spectral Density

 Ref Lvl 29.2 dBm
Marker 1 [T1] 2.46197996 GHz
RBW 3 kHz
RF Att 10 dB
VBW 10 kHz
SWT 500 s
Unit dBm



Date: 23.APR.2008 15:11:18

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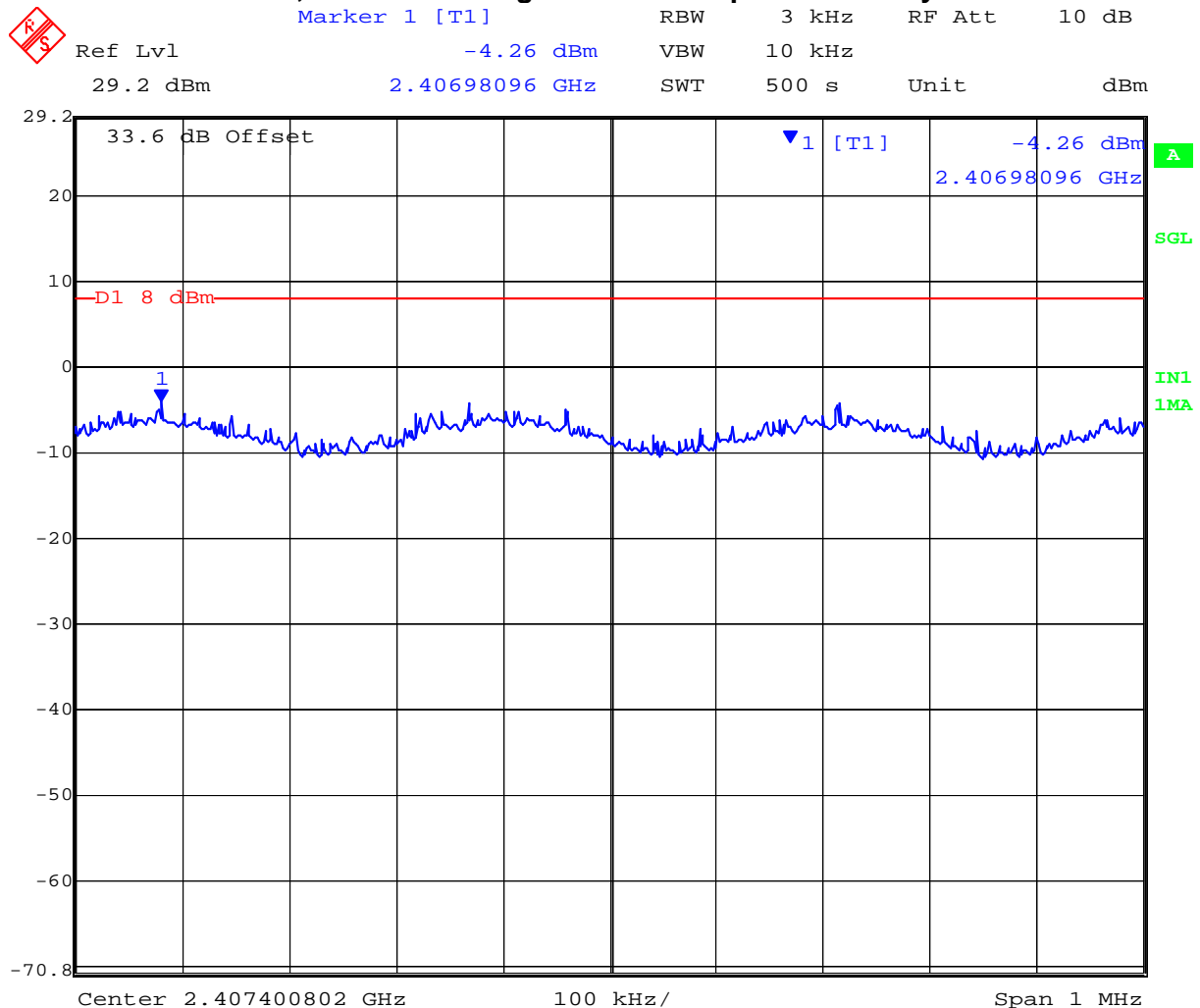


Title: NAV-AP -US 802.11 b/g Wireless AP
To: FCC 47 CFR Part15.247 & IC RSS-210
Serial #: TXAS01-A3 Rev A
Issue Date: 16th May 2008
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TABLE OF RESULTS – 802.11g – 6 Mb/s

Center Frequency (MHz)	Peak Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dBm)
2,412	2406.98096	-4.26	+8	-12.26
2,437	2433.99499	-1.87	+8	-9.87
2,462	2455.74449	-4.55	+8	-12.55

2,412 MHz 802.11g Peak Power Spectral Density




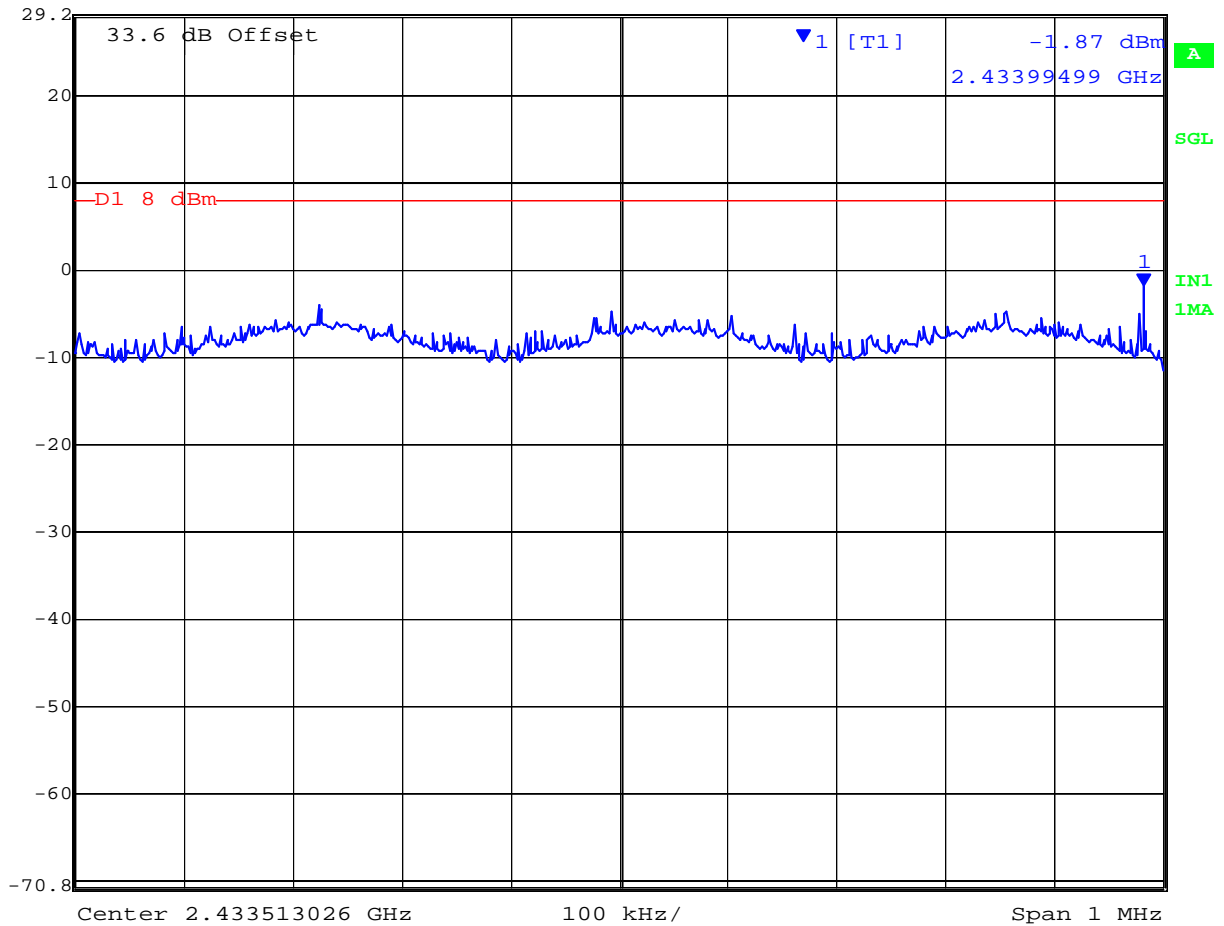
Date: 23.APR.2008 15:22:48

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2,437 MHz 802.11g Peak Power Spectral Density

 **Marker 1 [T1]** RBW 3 kHz RF Att 10 dB
Ref Lvl -1.87 dBm VBW 10 kHz
29.2 dBm 2.43399499 GHz SWT 500 s Unit dBm




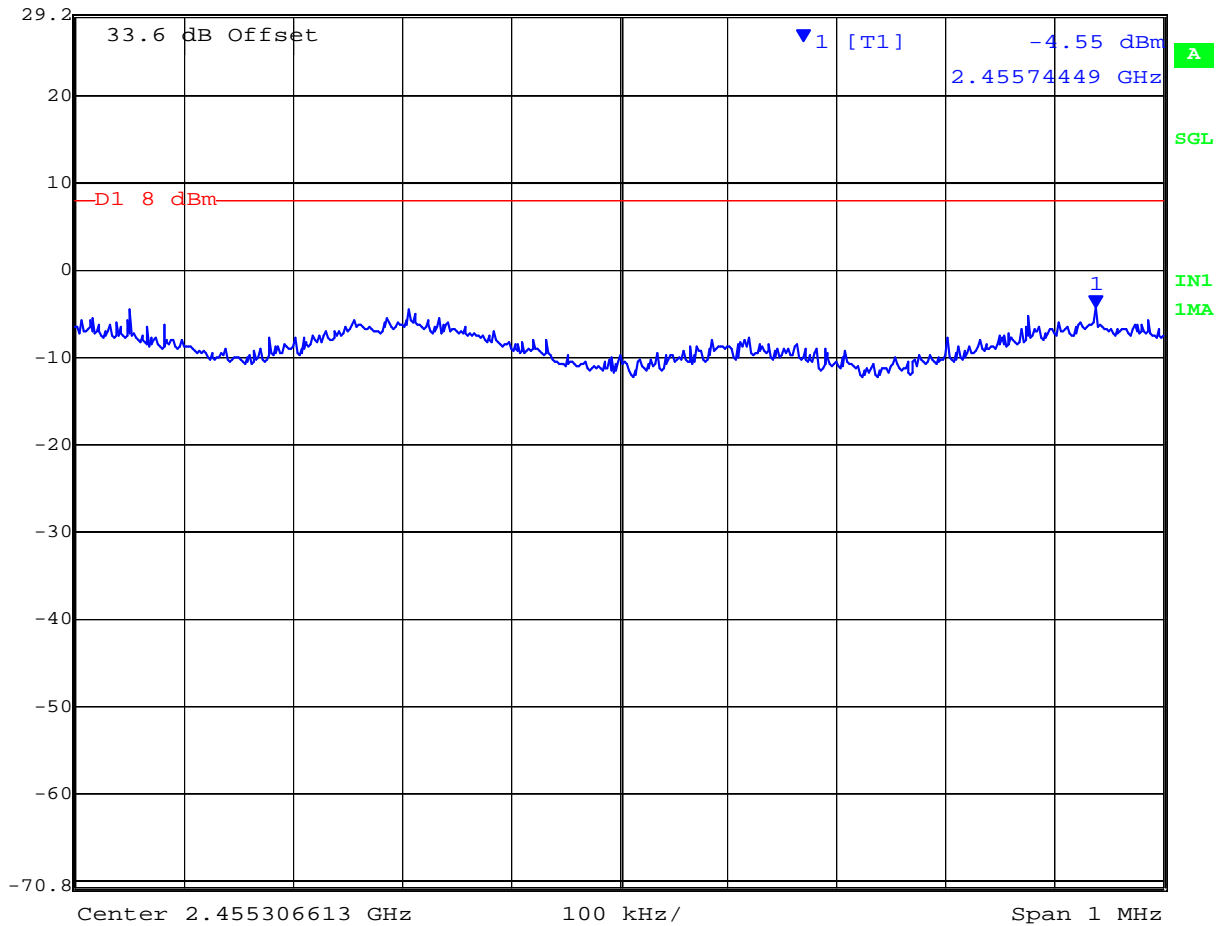
Date: 23.APR.2008 15:35:49

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2,462 MHz 802.11g Peak Power Spectral Density

 Ref Lvl 29.2 dBm
Marker 1 [T1] -4.55 dBm
2.45574449 GHz
RBW 3 kHz RF Att 10 dB
VBW 10 kHz
SWT 500 s Unit dBm



Date: 23.APR.2008 15:48:07

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Title: NAV-AP -US 802.11 b/g Wireless AP
To: FCC 47 CFR Part15.247 & IC RSS-210
Serial #: TXAS01-A3 Rev A
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Specification
Peak Power Spectral Density Limits

§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

RSS-210 §A8.2(2) The transmitter power spectral density (into the antenna) shall not be greater than +8 dBm in any 3 kHz band during any time interval of continuous transmission or over 1.0 second if the transmission exceeds 1.0 second duration.

Laboratory Measurement Uncertainty for Spectral Density

Measurement uncertainty	±1.33 dB
-------------------------	----------

Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-01 'Measuring RF Output Power'	0158, 0193, 0252, 0313, 0314, 0070, 0116, 0117

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5.1.4. Maximum Permissible Exposure

FCC, Part 15 Subpart C §15.247(i)
Industry Canada RSS-Gen §5.5

Calculations for Maximum Permissible Exposure Levels

Power Density = Pd (mW/cm²) = EIRP/(4πd²)

EIRP = P * G

P = Peak output power (mW)

G = Antenna numeric gain (numeric)

d = Separation distance (cm)

Numeric Gain = 10 ^ (G (dBi)/10)

Because the EUT belongs to the General Population/Uncontrolled Exposure the limit of power density is 1.0 mW/cm²

Freq. Band (GHz)	Antenna Gain (dBi)	Numeric Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Calculated Safe Distance @ 1mW/cm ² Limit(cm)	Minimum Separation Distance (cm)
2.4	5.0	3.17	+27.11	514.1	11.4	20.0

Note: for mobile or fixed location transmitters the minimum separation distance is 20cm, even if calculations indicate the MPE distance to be less.

Specification

Maximum Permissible Exposure Limits

§15.247(i) Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency levels in excess of the Commission’s guidelines.

FCC §1.1310 Limit = 1mW / cm² from 1.310 Table 1

RSS-Gen §5.5 Before equipment certification is granted, the applicable requirements of RSS-102 shall be met.

Laboratory Measurement Uncertainty for Power Measurements

Measurement uncertainty	±1.33 dB
-------------------------	----------

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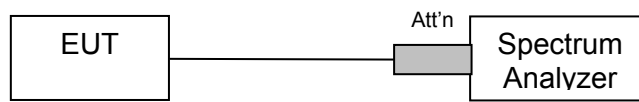
5.1.5. Conducted Spurious Emissions

FCC, Part 15 Subpart C §15.247(d); 15.205; 15.209
Industry Canada RSS-210 §A8.5, §2.2
Industry Canada RSS-Gen 4.7

Test Procedure

Conducted emissions were measured at a limit of 20 dB below the highest in-band spectral density measured with a spectrum analyzer connected to the antenna terminal. Emissions at the band edge were measured and recorded. Measurements were made while EUT was operating in transmit mode of operation at the appropriate center frequency.

Test Measurement Set up



Band-edge measurement test configuration

Measurement Results of Conducted Spurious Emissions

Ambient conditions.

Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar



Conducted Band-Edge Results

Measurements were performed with the transmitter tuned to the channel closest to the band-edge being measured. All emissions were maximized during measurement.

TABLE OF RESULTS – 802.11b – 1 Mbit/s

Center Frequency (MHz)	Band edge Frequency (MHz)	Limit (20 dB below peak of fundamental)	Amplitude @ Band edge (dBm)	Margin (dB)
2,412	2,400	-9.98	-33.70	-23.72
2,462	2,483.5	-11.49	-43.45	-31.96

2,412 MHz 802.11b Band-Edge @ 2,400 MHz



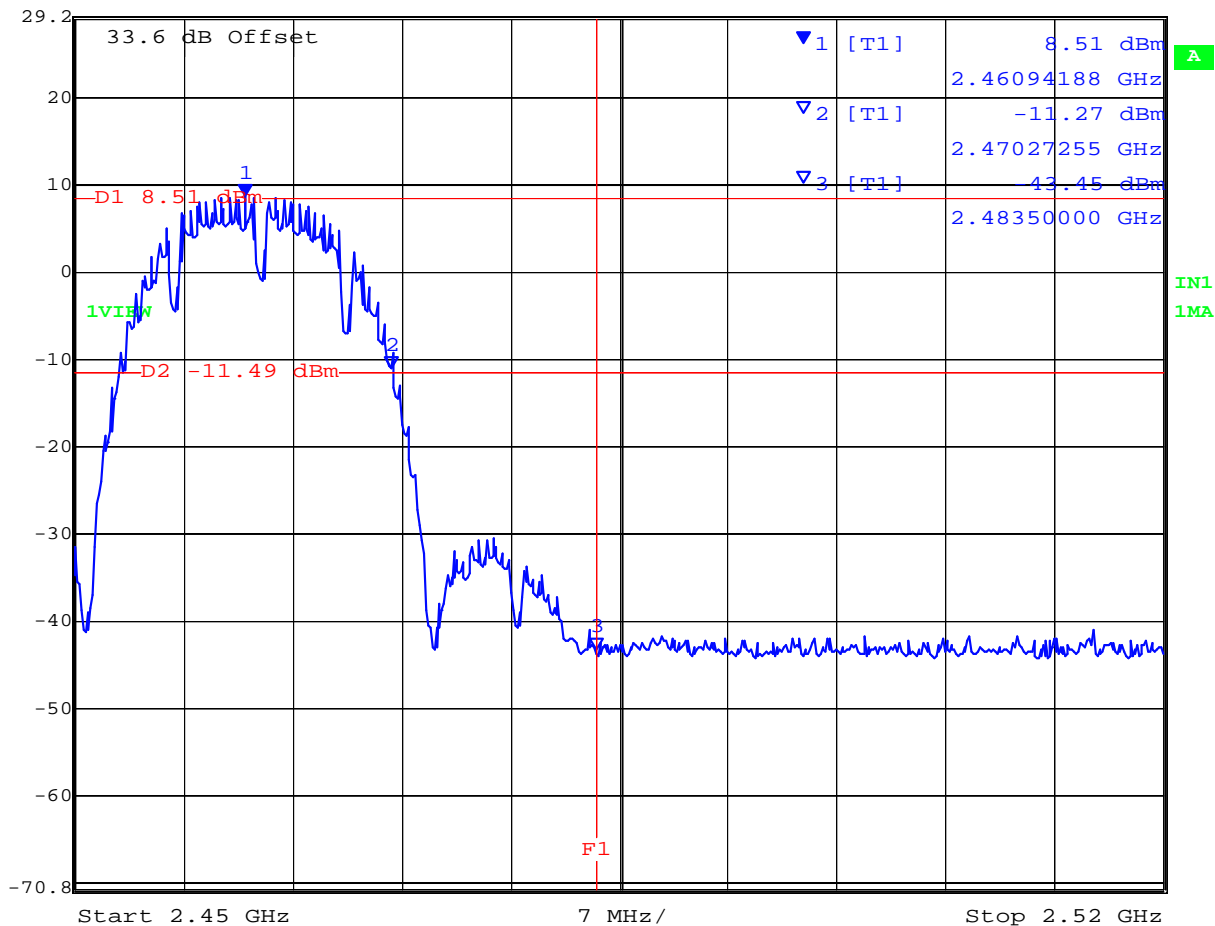
Date: 23.APR.2008 16:04:32

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2,462 MHz 802.11b Band-Edge @ 2,483.5 MHz

Marker 1 [T1] RBW 100 kHz RF Att 10 dB
Ref Lvl 8.51 dBm VBW 300 kHz
29.2 dBm 2.46094188 GHz SWT 10 s Unit dBm



Date: 23.APR.2008 16:24:42

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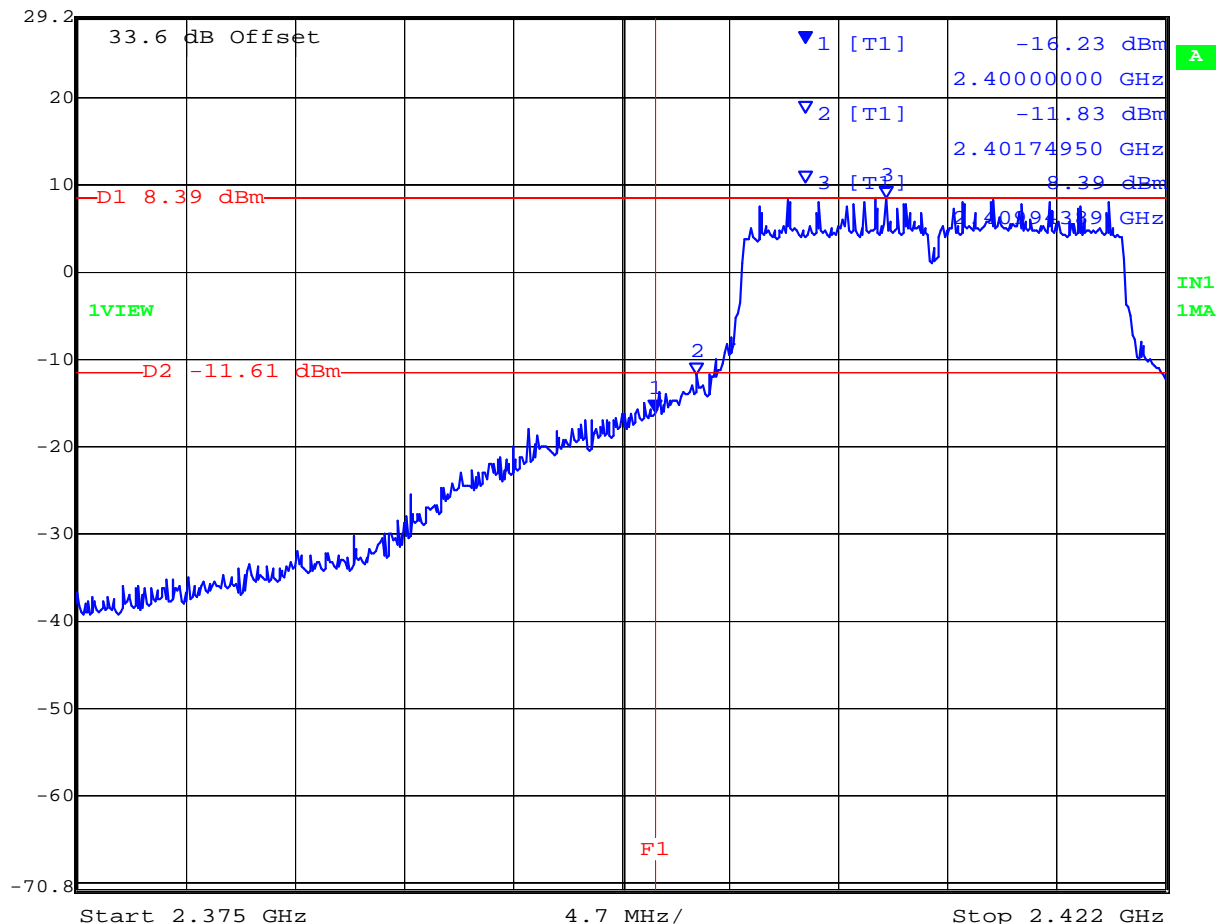
Title: NAV-AP -US 802.11 b/g Wireless AP
To: FCC 47 CFR Part15.247 & IC RSS-210
Serial #: TXAS01-A3 Rev A
Issue Date: 16th May 2008
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TABLE OF RESULTS – 802.11g – 6 Mbit/s

Center Frequency (MHz)	Band edge Frequency (MHz)	Limit (20 dB below peak of fundamental)	Amplitude @ Band edge (dBm)	Margin (dB)
2,412	2,400	-11.61	-16.23	-4.62
2,462	2,483.5	-11.49	-31.77	-20.28

2,412 MHz 802.11g Band-Edge @ 2,400 MHz


 Marker 1 [T1] RBW 100 kHz RF Att 10 dB
 Ref Lvl -16.23 dBm VBW 300 kHz
 29.2 dBm 2.40000000 GHz SWT 10 s Unit dBm



Date: 23.APR.2008 16:09:40

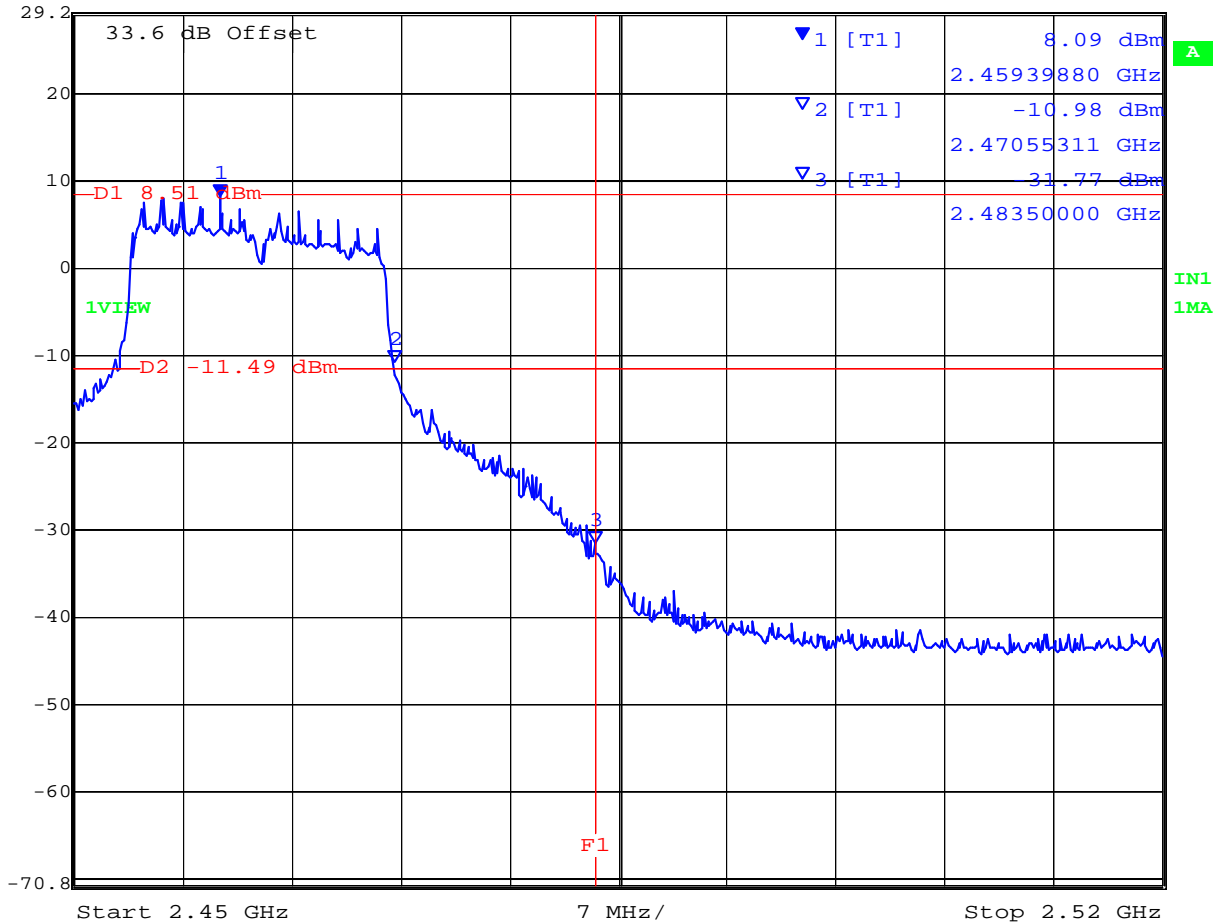
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2,462 MHz 802.11g Band-Edge @ 2,483.5 MHz



Marker 1 [T1] RBW 100 kHz RF Att 10 dB
Ref Lvl 8.09 dBm VBW 300 kHz
29.2 dBm 2.45939880 GHz SWT 10 s Unit dBm



Date: 23.APR.2008 16:28:44

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Spurious Emissions (30 - 26,000 MHz)

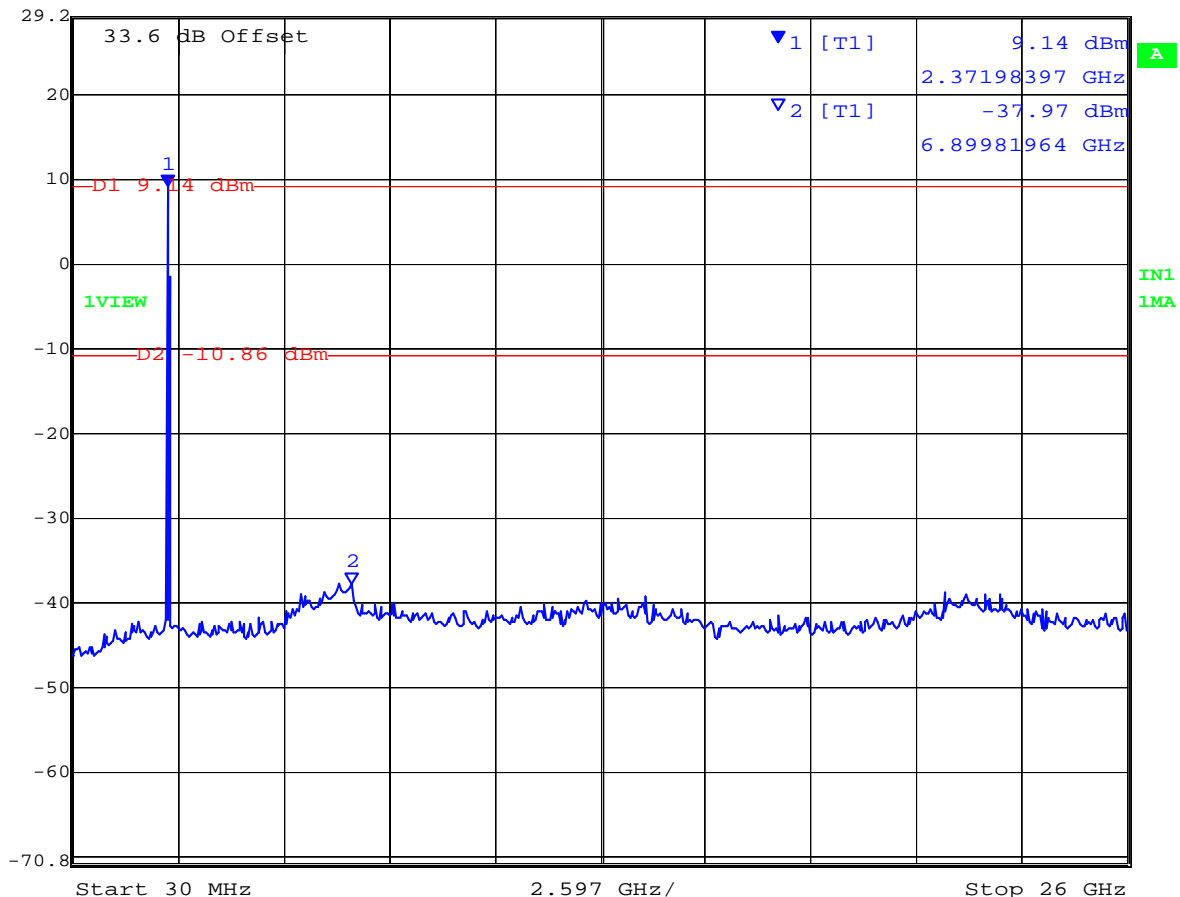
TABLE OF RESULTS – 802.11b – 1 Mbit/s

Channel Centre Frequency (MHz)	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Margin (dB)
2,412	30	26,000	-37.97	-10.86	-27.11

802.11b – 1 Mbit/s

2,412 MHz Conducted Spurious Emissions 30 MHz to 26,000 MHz

Marker 1 [T1] RBW 100 kHz RF Att 10 dB
 Ref Lvl 9.14 dBm VBW 300 kHz
 29.2 dBm 2.37198397 GHz SWT 6.6 s Unit dBm



Date: 23.APR.2008 16:52:31

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Spurious Emissions (30 - 26,000 MHz)

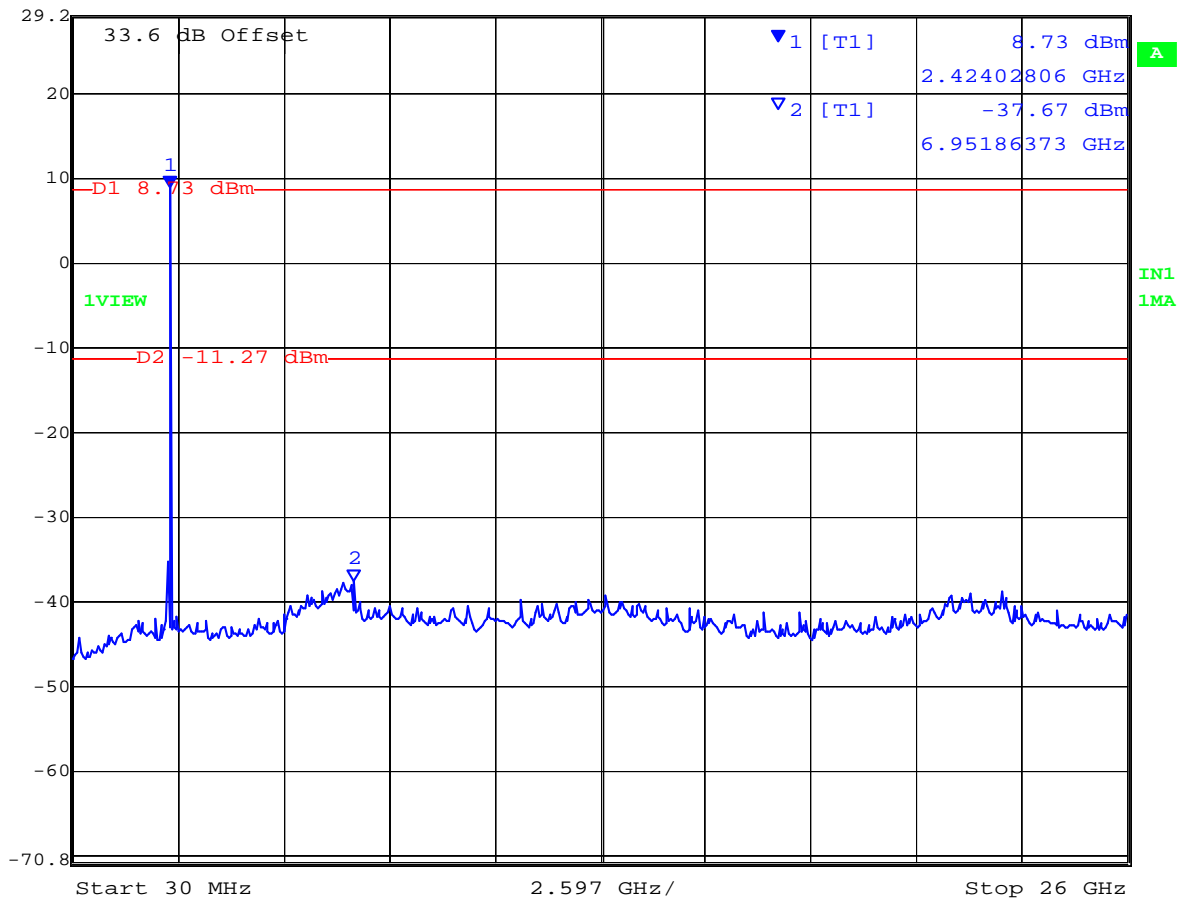
TABLE OF RESULTS – 802.11b – 1 Mbit/s

Channel Centre Frequency (MHz)	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Margin (dB)
2,437	30	26,000	-37.67	-11.27	-26.40

802.11b – 1 Mbit/s

2,437 MHz Conducted Spurious Emissions 30 MHz to 26,000 MHz


 Marker 1 [T1] RBW 100 kHz RF Att 10 dB
 Ref Lvl 8.73 dBm VBW 300 kHz
 29.2 dBm 2.42402806 GHz SWT 6.6 s Unit dBm



Date: 23.APR.2008 16:58:58

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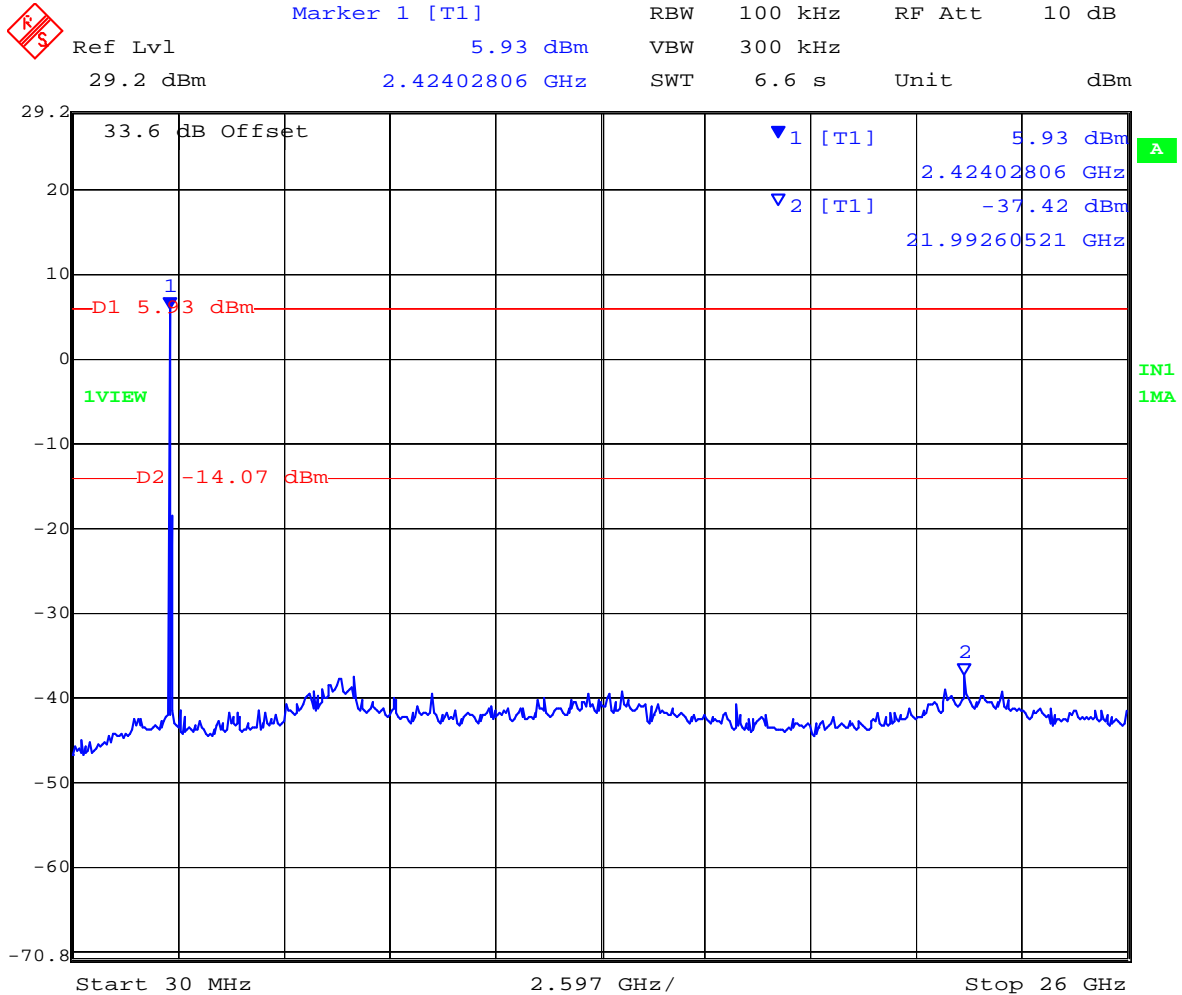
Spurious Emissions (30 - 26,000 MHz)

TABLE OF RESULTS – 802.11b – 1 Mbit/s

Channel Centre Frequency (MHz)	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Margin (dB)
2,462	30	26,000	-37.42	-14.07	-23.35

802.11b – 1 Mbit/s

2,462 MHz Conducted Spurious Emissions 30 MHz to 26,000 MHz



Date: 23.APR.2008 16:57:24

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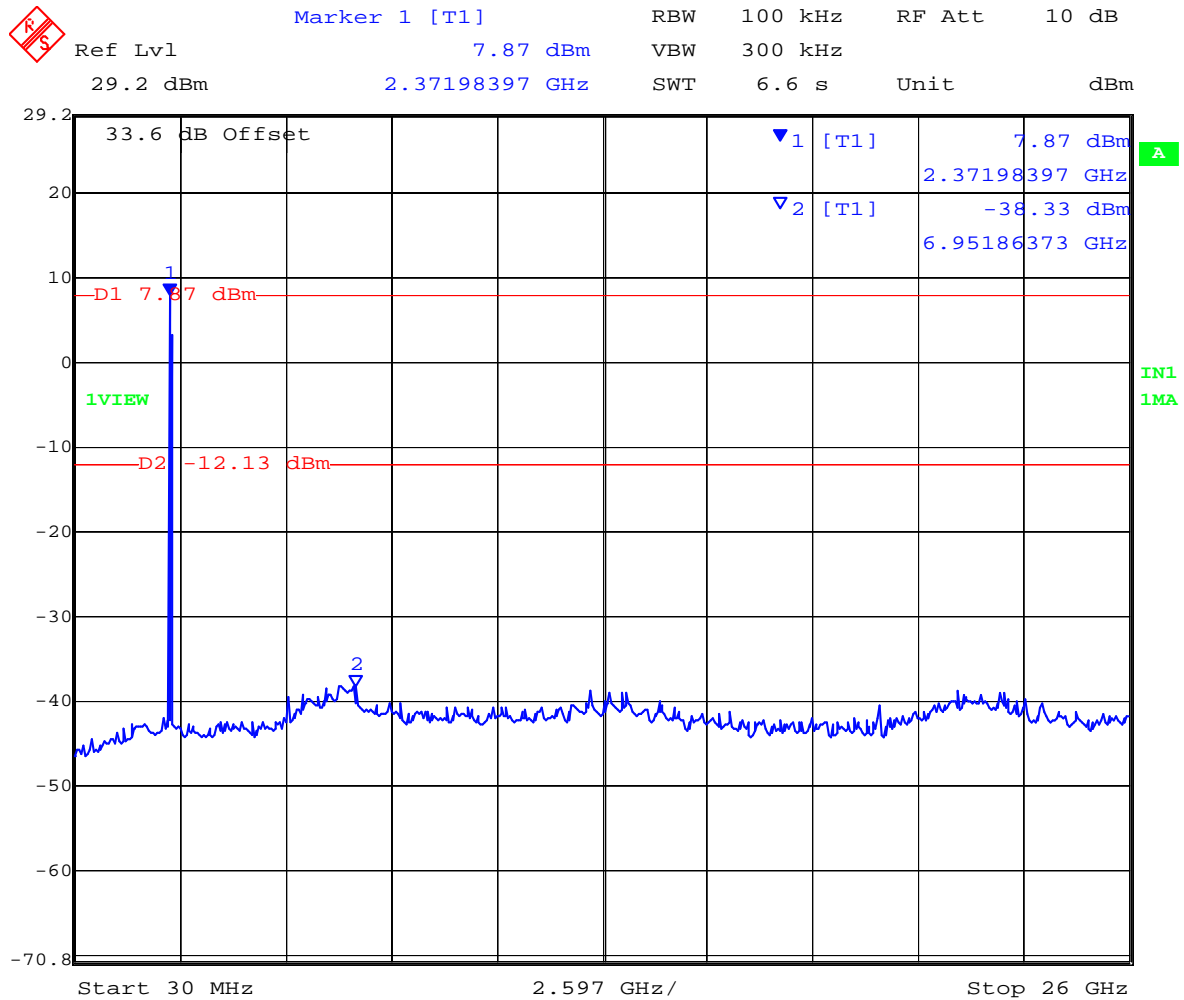
Spurious Emissions (30 - 26,000 MHz)

TABLE OF RESULTS – 802.11g – 6 Mbit/s

Channel Centre Frequency (MHz)	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Margin (dB)
2,412	30	26,000	-38.33	-12.13	-26.2

802.11g – 6 Mbit/s

2,412 MHz Conducted Spurious Emissions 30 MHz to 26,000 MHz



Date: 23.APR.2008 17:01:11

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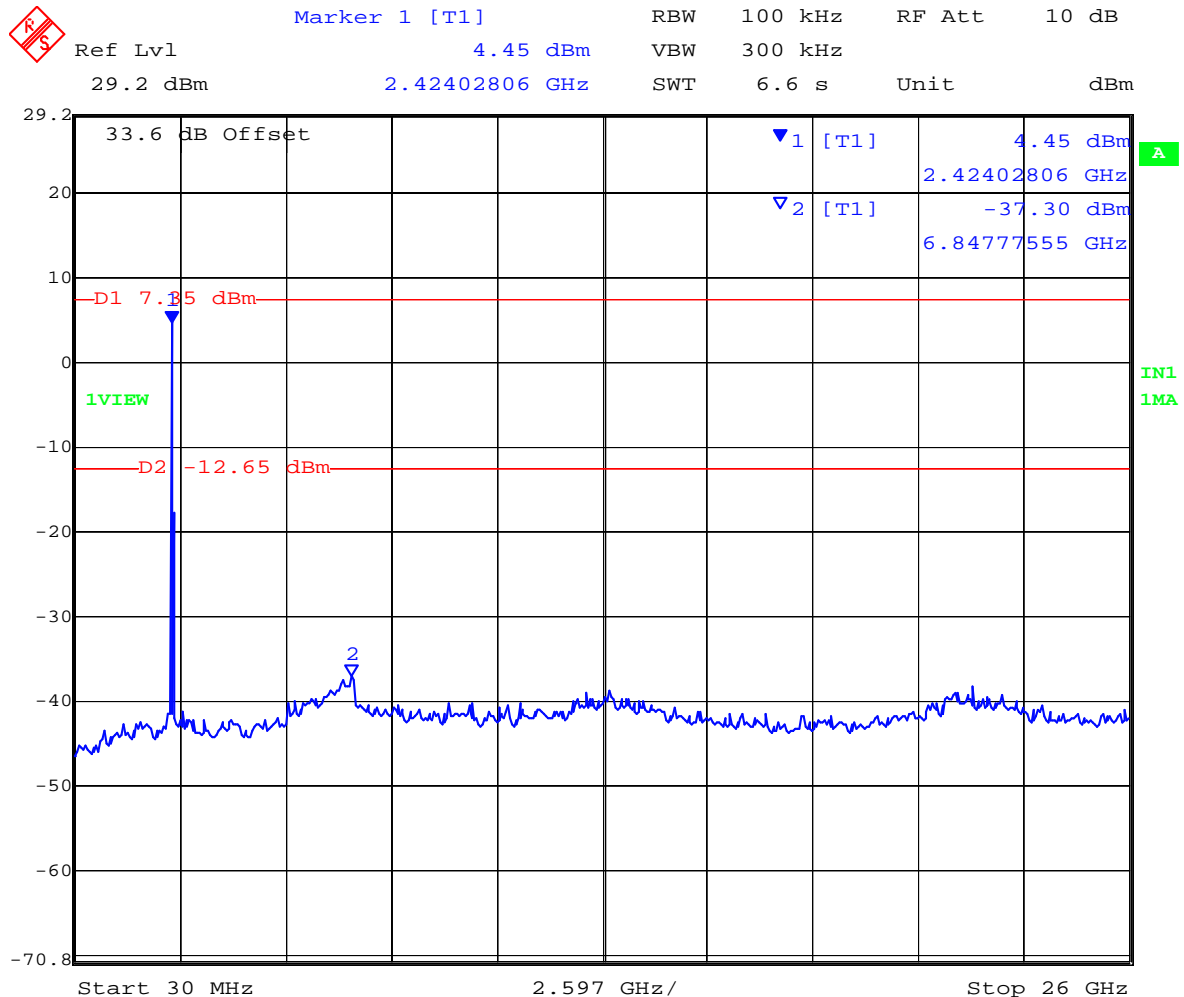
Spurious Emissions (30 - 26,000 MHz)

TABLE OF RESULTS – 802.11g – 6 Mbit/s

Channel Centre Frequency (MHz)	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Margin (dB)
2,437	30	26,000	-37.30	-12.65	-24.65

802.11g – 6 Mbit/s

2,437 MHz Conducted Spurious Emissions 30 MHz to 26,000 MHz



Date: 23.APR.2008 17:05:11

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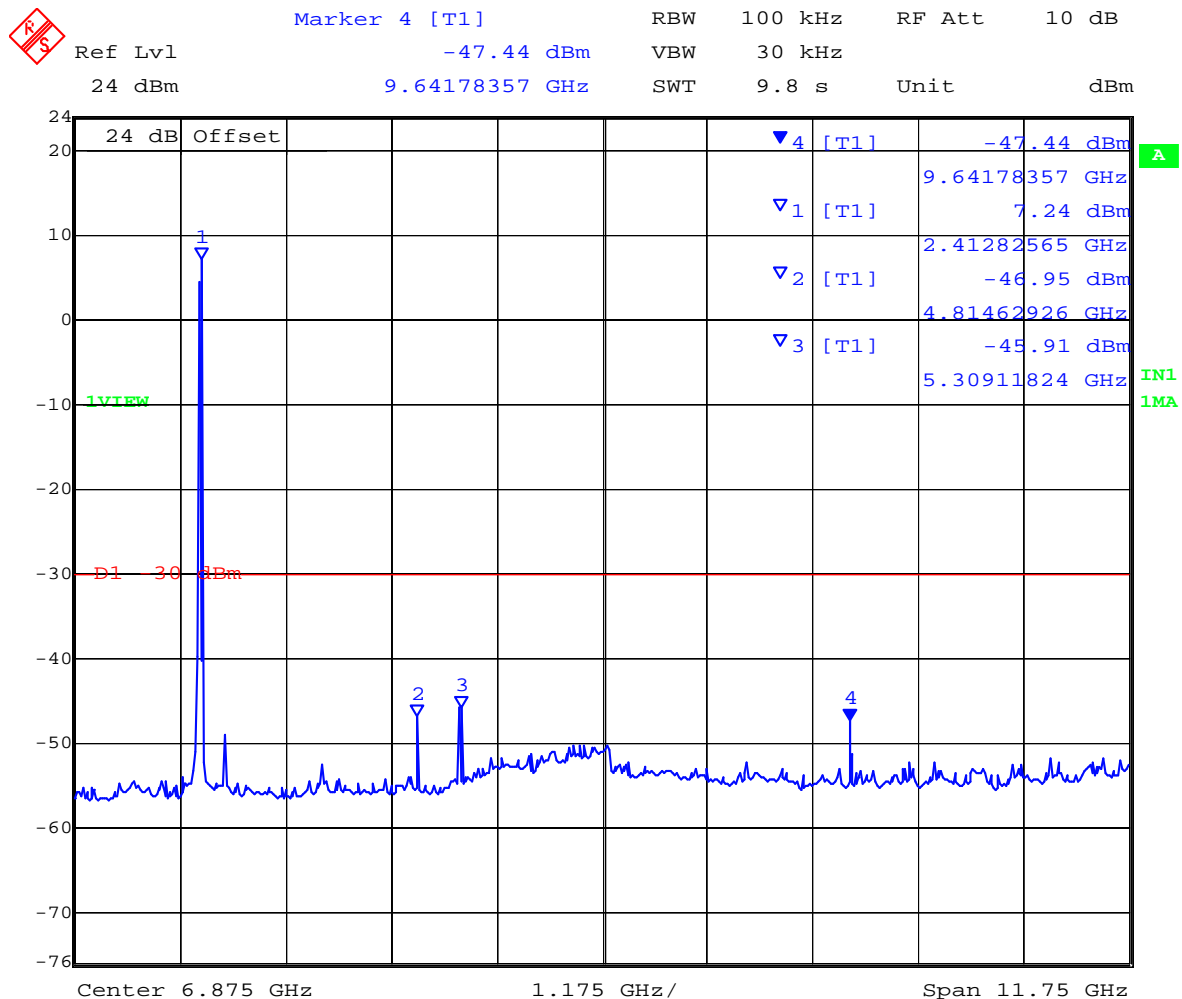
Spurious Emissions (30 - 26,000 MHz)

TABLE OF RESULTS – 802.11g – 6 Mbit/s

Channel Centre Frequency (MHz)	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Margin (dB)
2,462	30	26,000	-45.91	-12.76	-33.15

802.11g – 6 Mbit/s

2,462 MHz Conducted Spurious Emissions 30 MHz to 26,000 MHz



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Specification

Limits Band-Edge

Lower Limit Band-edge	Upper Limit Band-edge	Limit below highest level of desired power
2,400 MHz	2,483.5 MHz	≥ 20 dB

§15.247(d) and RSS-210 §A8.5 In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

§15.247(d)

If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section §15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(a)).

RSS-210 §A8.5 If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Tables 2 and 3 is not required. In addition, radiated emissions which fall in the restricted bands of Table 1 must also comply with the radiated emission limits specified in Tables 2 and 3.

RSS-Gen §4.7

The search for unwanted emissions shall be from the lowest frequency internally generated or used in the device (local oscillator, intermediate of carrier frequency), or from 30 MHz , whichever is the lowest frequency, to the 5th harmonic of the highest frequency generated without exceeding 40 GHz.

Laboratory Measurement Uncertainty for Conducted Spurious Emissions

Measurement uncertainty	±2.37 dB
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Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-05 'Measurement of Spurious Emissions'	0287, 0158, 0193, 0252, 0313, 0314, 0070, 0116, 0117.

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5.1.6. Radiated Emissions

5.1.6.1. Transmitter Radiated Spurious Emissions (above 1 GHz)

FCC, Part 15 Subpart C §15.247(d) 15.205; 15.209

Industry Canada RSS-210 §A8.5, §2.2, §2.6

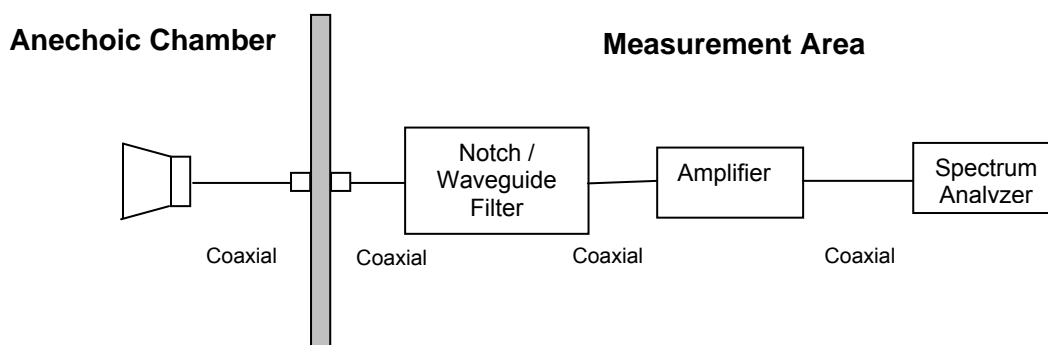
Industry Canada RSS-Gen §4.7

Test Procedure

Radiated emissions above 1 GHz are measured in the anechoic chamber at a 3-meter distance on every azimuth in both horizontal and vertical polarities. The emissions are recorded and maximized as a function of azimuth by rotation through 360° with a spectrum analyzer in peak hold mode. Depending on the frequency band spanned a notch filter and waveguide filter was used to remove the fundamental frequency. The highest emissions relative to the limit are listed for each frequency spanned.

All measurements on any frequency or frequencies over 1 MHz are based on the use of measurement instrumentation employing an average detector function. All measurements above 1 GHz were performed using a minimum resolution bandwidth of 1 MHz.

Test Measurement Set up



Measurement set up for Radiated Emission Test

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting Amplifier Gain from the measured reading. All factors are included in the reported data.

$$FS = R + AF + CORR - FO$$

where: FS = Field Strength

R = Measured Spectrum analyzer Input Amplitude

AF = Antenna Factor

CORR = Correction Factor = CL – AG + NFL

CL = Cable Loss

AG = Amplifier Gain

FO = Distance Falloff Factor

NFL = Notch Filter Loss or Waveguide Loss



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For example:

Given receiver input reading of 51.5 dB μ V; Antenna Factor of 8.5 dB; Cable Loss of 1.3 dB; Falloff Factor of 0 dB, an Amplifier Gain of 26 dB and Notch Filter Loss of 1 dB. The Field Strength of the measured emission is:

$$FS = 51.5 + 8.5 + 1.3 - 26.0 + 1 = 36.3 \text{ dB}\mu\text{V/m}$$

Conversion between dB μ V/m (or dB μ V) and μ V/m (or μ V) are done as:

$$\text{Level (dB}\mu\text{V/m)} = 20 * \text{Log (level (\mu\text{V/m}))}$$

$$40 \text{ dB}\mu\text{V/m} = 100 \mu\text{V/m}$$

$$48 \text{ dB}\mu\text{V/m} = 250 \mu\text{V/m}$$

Maximum Emissions

It was found that the AP lying flat on the polystyrene table in the Radiated Emissions chamber was the worst case orientation for radiated emissions.

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Radiated Spurious Emissions above 1 GHz

Test Setup - 802.11b – 1Mb/s

TABLE OF RESULTS – 802.11b, 1Mb/s Channel 1 (2,412 MHz) Antenna 5 dBi

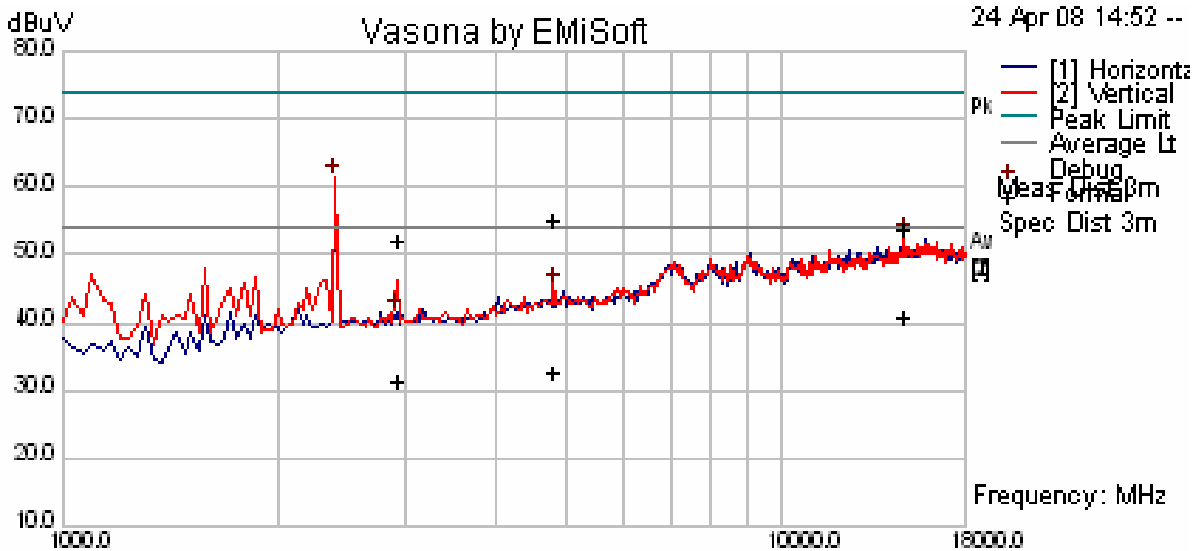
Peak

Freq. (MHz)	Pol. (H/V)	Raw Reading (dB μ V)	Correction Factor (dB)	Corrected Field Strength (dB μ V/m)	Peak Limit (dB μ V/m)	Margin (dB)
14797.600	V	44.96	6.90	51.86	74	-22.14
4824.082	H	57.22	-4.28	52.94	74	-21.06
2930.661	V	57.60	-7.63	49.97	74	-24.03

Average

Freq. (MHz)	Pol. (H/V)	Raw Reading (dB μ V)	Correction Factor (dB)	Corrected Field Strength (dB μ V/m)	Average Limit (dB μ V/m)	Margin (dB)
14797.6	V	31.93	6.90	38.83	54	-15.17
4824.082	H	34.81	-4.28	30.53	54	-23.47
2930.661	V	37.09	-7.63	29.46	54	-24.54

Radiated Emissions



Radiated Emissions
 Template: 18Amp_RE 1-18 GHz Mitec 30 Aug
 Filename: k:\compliance management\texas instruments\txas01 - 2.4 ghz fcc, eu\test program\



Radiated Spurious Emissions above 1 GHz

Test Setup - 802.11b – 1Mb/s

TABLE OF RESULTS – 802.11b, 1Mb/s Channel 6 (2,437 MHz) Antenna 5 dBi

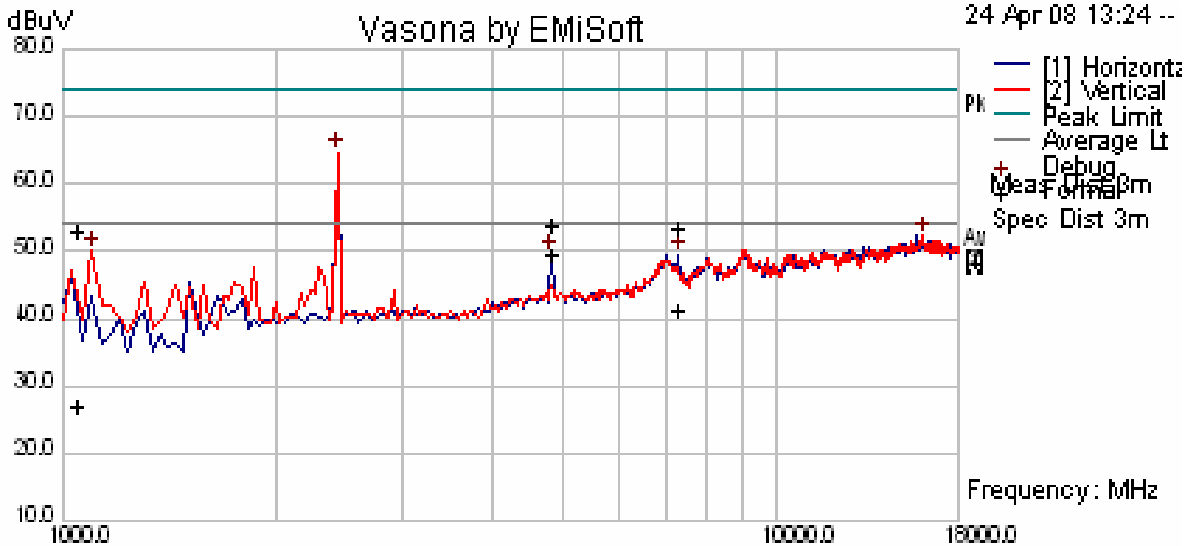
Peak

Freq. (MHz)	Pol. (H/V)	Raw Reading (dB μ V)	Correction Factor (dB)	Corrected Field Strength (dB μ V/m)	Peak Limit (dB μ V/m)	Margin (dB)
1061.573	V	64.64	-13.64	51.00	74	-23.00
4873.980	H	55.93	-4.24	51.69	74	-22.31
7314.966	H	48.58	2.59	51.17	74	-22.83

Average

Freq. (MHz)	Pol. (H/V)	Raw Reading (dB μ V)	Correction Factor (dB)	Corrected Field Strength (dB μ V/m)	Average Limit (dB μ V/m)	Margin (dB)
1061.573	V	38.75	-13.64	25.11	54	-28.89
4873.980	H	51.8	-4.24	47.56	54	-6.44
7314.966	H	36.69	2.59	39.28	54	-14.72

Radiated Emissions



Radiated Emissions Template: 18Amp RE 1-18 GHz Mitec 30 Aug
 Filename: k:\compliance management\texas instruments\txas01 - 2.4 ghz fcc, eu\test program\

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Test Setup - 802.11b – 1Mb/s

TABLE OF RESULTS – 802.11b, 1Mb/s Channel 11 (2,462 MHz) Antenna 5 dBi

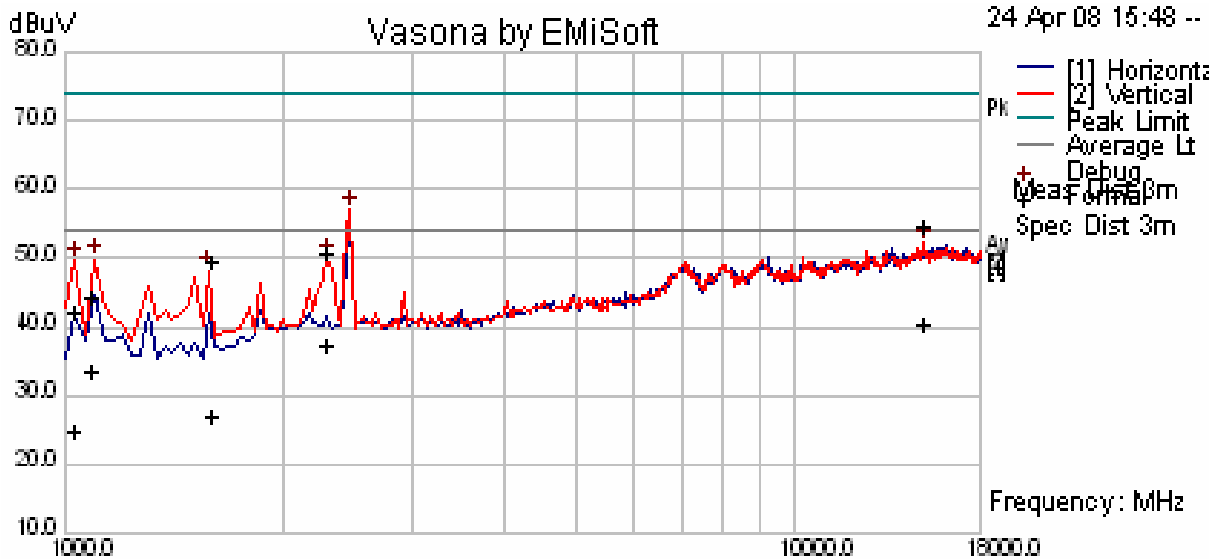
Peak

Freq. (MHz)	Pol. (H/V)	Raw Reading (dB μ V)	Correction Factor (dB)	Corrected Field Strength (dB μ V/m)	Peak Limit (dB μ V/m)	Margin (dB)
15036.07	V	45.64	6.91	52.55	74	-21.45
2291.904	V	56.32	-7.66	48.66	74	-25.34
1100.09	V	55.80	-13.53	42.27	74	-31.73
1036.698	V	53.69	-13.69	40.00	74	-34.00
1599.439	V	58.78	-11.44	47.34	74	-26.66

Average

Freq. (MHz)	Pol. (H/V)	Raw Reading (dB μ V)	Correction Factor (dB)	Corrected Field Strength (dB μ V/m)	Average Limit (dB μ V/m)	Margin (dB)
15036.07	V	31.42	6.91	38.34	54	-15.66
2291.904	V	43.19	-7.66	35.54	54	-18.46
1100.09	V	45.15	-13.53	31.62	54	-22.38
1036.698	V	36.60	-13.69	22.91	54	-31.09
1599.439	V	36.46	-11.44	25.02	54	-28.98

Radiated Emissions



Radiated Emissions Template: 18Amp RE 1-18 GHz Mitec 30 Aug
 Filename: k:\compliance management\texas instruments\texas01 - 2.4 ghz fcc, eu\test program\

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Radiated Spurious Emissions above 1 GHz

Test Setup - 802.11g – 6Mb/s

TABLE OF RESULTS – 802.11g, 6Mb/s Channel 1 (2,412 MHz) Antenna 5 dBi

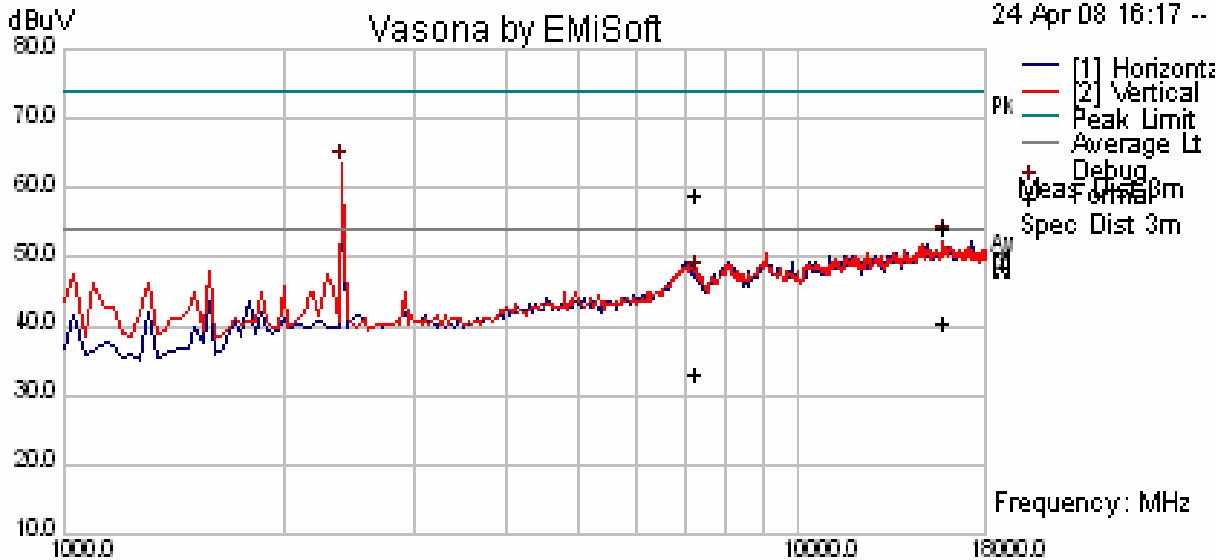
Peak

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBμV)	Correction Factor (dB)	Corrected Field Strength (dBμV/m)	Peak Limit (dBμV/m)	Margin (dB)
15751.5	H	44.29	8.04	52.33	74	-21.67
7235.39	H	53.82	2.97	56.79	74	-17.21

Average

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBμV)	Correction Factor (dB)	Corrected Field Strength (dBμV/m)	Average Limit (dBμV/m)	Margin (dB)
15751.5	H	30.23	8.04	38.27	54	-15.73
7235.39	V	27.88	2.97	30.85	54	-23.15

Radiated Emissions



Radiated Emissions
 Template: 18Amp RE 1-18 GHz Mitec 30 Aug
 Filename: k:\compliance management\texas instruments\texas01 - 2.4 ghz fcc, eu\test program\

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Radiated Spurious Emissions above 1 GHz

Test Setup - 802.11g – 6Mb/s

TABLE OF RESULTS – 802.11g, 6Mb/s Channel 6 (2,437 MHz) Antenna 5 dBi

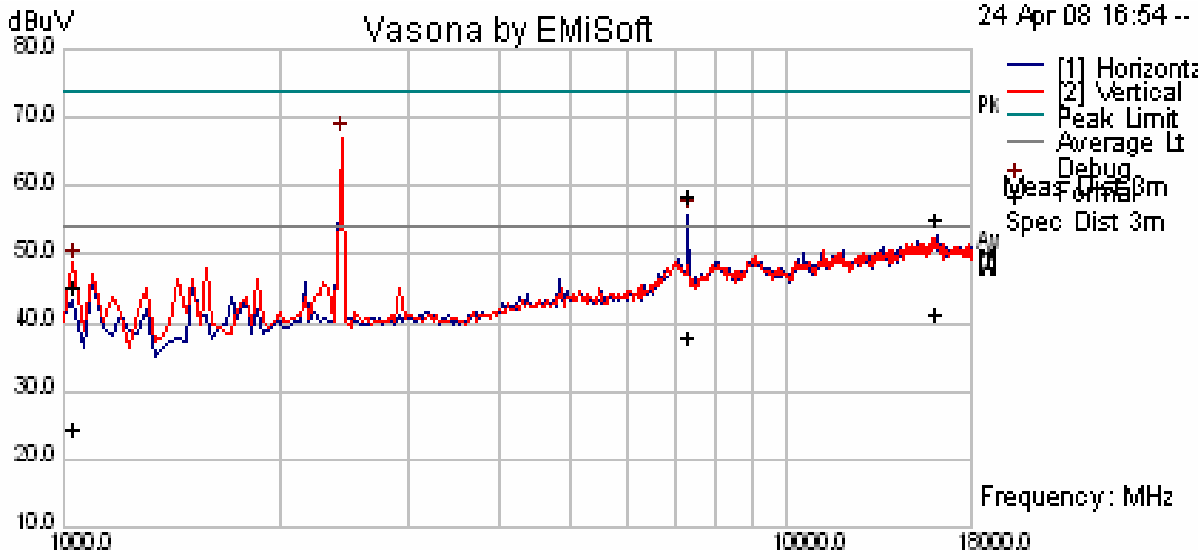
Peak

Freq. (MHz)	Pol. (H/V)	Raw Reading (dB μ V)	Correction Factor (dB)	Corrected Field Strength (dB μ V/m)	Peak Limit (dB μ V/m)	Margin (dB)
7309.178	H	53.96	2.61	56.57	74	-17.43
16126.25	H	44.69	8.46	53.15	74	-20.85
1034.068	V	56.83	-13.70	43.13	74	-30.87

Average

Freq. (MHz)	Pol. (H/V)	Raw Reading (dB μ V)	Correction Factor (dB)	Corrected Field Strength (dB μ V/m)	Average Limit (dB μ V/m)	Margin (dB)
16126.25	H	30.8	2.61	39.22	54	-14.80
1034.068	V	36.22	8.46	22.52	54	-31.48
7309.894	H	33.3	-13.70	35.89	54	-18.10

Radiated Emissions



Radiated Emissions Template: 18Amp RE 1-18 GHz Mitec 30 Aug
 Filename: k:\compliance management\texas instruments\texas01 - 2.4 ghz fcc, eu\test program\

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Test Setup - 802.11g – 6Mb/s

TABLE OF RESULTS – 802.11g, 6Mb/s Channel 11 (2,462 MHz) Antenna 5 dBi

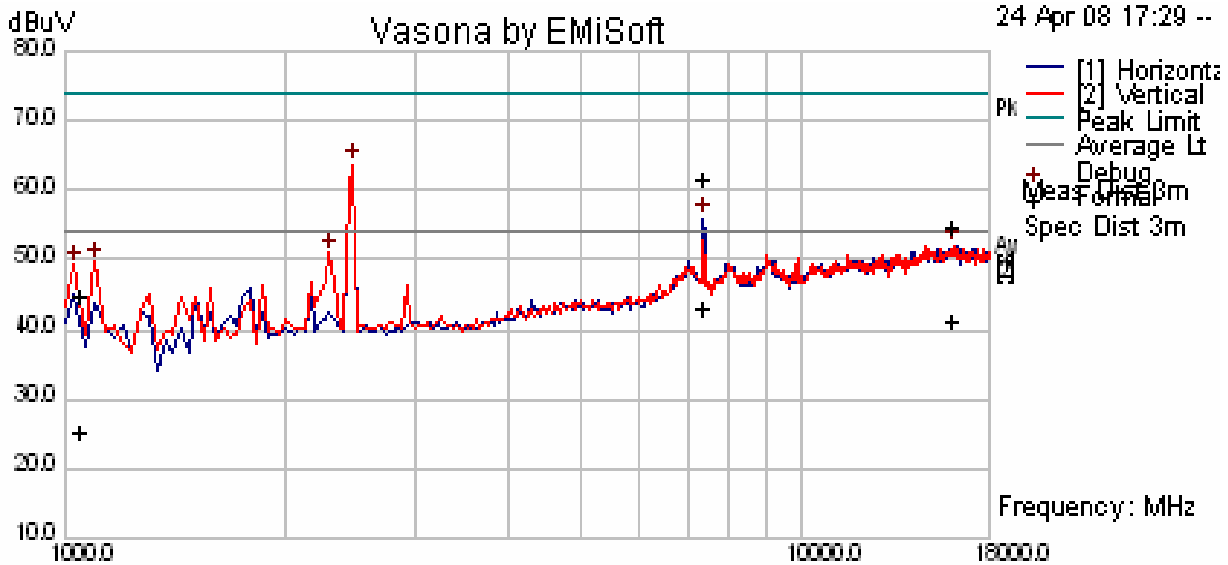
Peak

Freq. (MHz)	Pol. (H/V)	Raw Reading (dB μ V)	Correction Factor (dB)	Corrected Field Strength (dB μ V/m)	Peak Limit (dB μ V/m)	Margin (dB)
7382.224	H	57.22	2.25	59.47	74	-14.53
16160.32	V	44.03	8.49	52.52	74	-21.48
1053.156	V	56.32	-13.66	42.66	74	-31.34

Average

Freq. (MHz)	Pol. (H/V)	Raw Reading (dB μ V)	Correction Factor (dB)	Corrected Field Strength (dB μ V/m)	Average Limit (dB μ V/m)	Margin (dB)
7382.224	H	38.75	2.25	41.00	54	-13.00
16160.32	V	30.83	8.49	39.32	54	-14.68
1053.156	V	36.91	-13.66	23.25	54	-30.75

Radiated Emissions



Radiated Emissions Template: 18Amp RE 1-18 GHz Mitec 30 Aug
 Filename: k:\compliance management\texas instruments\texas01 - 2.4 ghz fcc, eu\test program\

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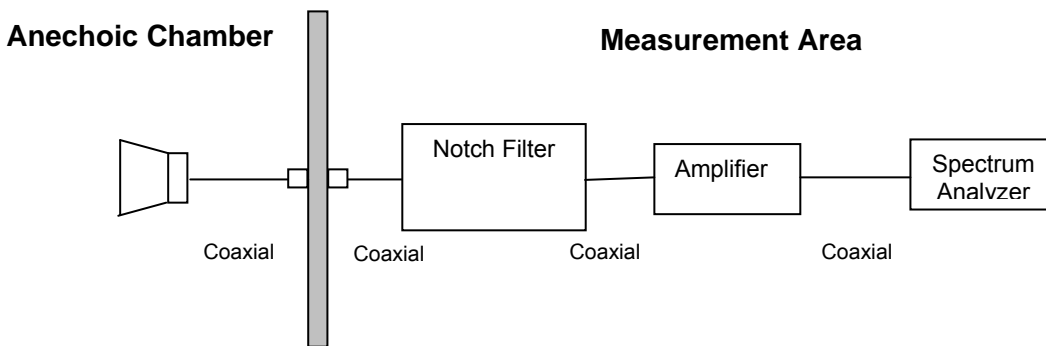
5.1.6.1.1. Peak Field Strength Measurements

Test Procedure

Radiated emissions above 1 GHz are measured in the anechoic chamber at a 3-meter distance on every azimuth in both horizontal and vertical polarities. The emissions are recorded and maximized as a function of azimuth by rotation through 360° with a spectrum analyzer in peak hold mode. The highest emissions relative to the limit are listed for each frequency scanned.

All measurements on any frequency or frequencies over 1 MHz are based on the use of measurement instrumentation employing an average detector function. All measurements above 1 GHz were performed using a minimum resolution bandwidth of 1 MHz.

Test Measurement Set up



Measurement set up for Radiated Emission Test

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting Amplifier Gain from the measured reading. All factors are included in the reported data.

$$FS = R + AF + CORR - FO$$

where: FS = Field Strength

R = Measured Spectrum analyzer Input Amplitude

AF = Antenna Factor

CORR = Correction Factor = CL – AG + NFL

CL = Cable Loss

AG = Amplifier Gain

FO = Distance Falloff Factor

NFL = Band-stop Filter Loss or Waveguide Loss



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For example:

Given receiver input reading of 51.5 dB μ V; Antenna Factor of 8.5 dB; Cable Loss of 1.3 dB; Falloff Factor of 0 dB, an Amplifier Gain of 26 dB and Notch Filter Loss of 1 dB. The Field Strength of the measured emission is:

$$FS = 51.5 + 8.5 + 1.3 - 26.0 + 1 = 36.3 \text{ dB}\mu\text{V/m}$$

Conversion between dB μ V/m (or dB μ V) and μ V/m (or μ V) are done as:

$$\text{Level (dB}\mu\text{V/m)} = 20 * \text{Log (level (\mu\text{V/m}))}$$

$$40 \text{ dB}\mu\text{V/m} = 100 \mu\text{V/m}$$

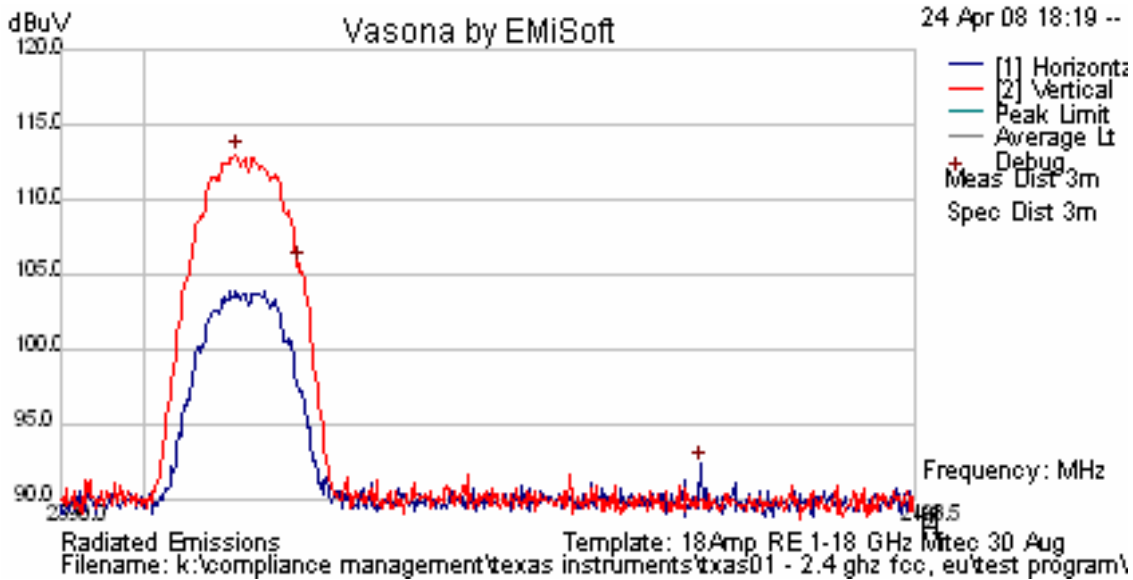
$$48 \text{ dB}\mu\text{V/m} = 250 \mu\text{V/m}$$

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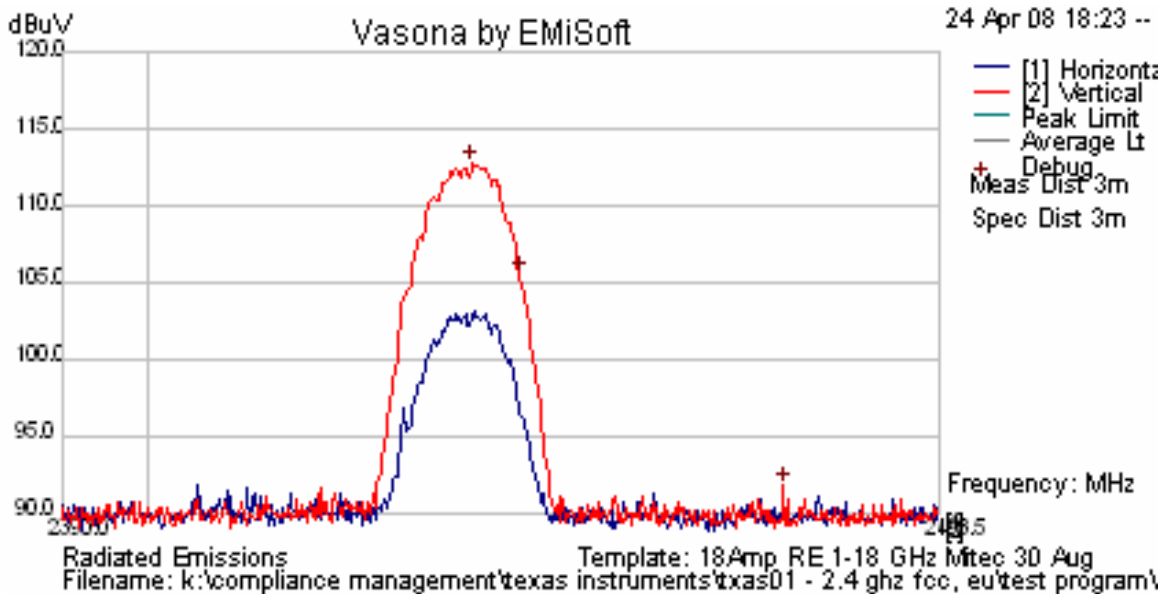
RESULTS – 802.11b 1 MBit/S 5 dBi Antenna

Channel 1 (2,412 MHz) – Peak Field Strength = 113.07 dBuV



RESULTS – 802.11b 1 MBit/S 5 dBi Antenna

Channel 6 (2,437 MHz) – Peak Field Strength = 112.71 dBuV



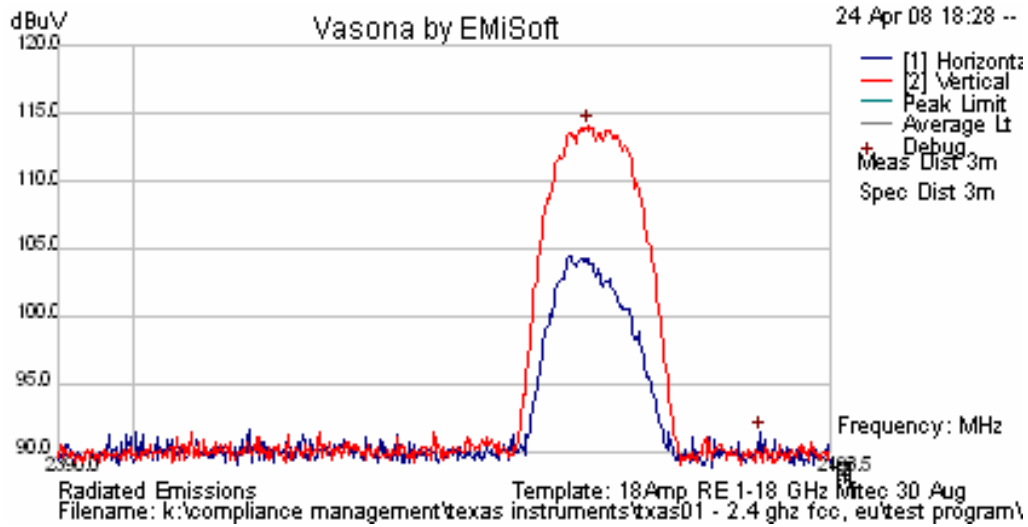
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RESULTS – 802.11b 1 MBit/S 5 dBi Antenna

Channel 11 (2,462 MHz) – Peak Field Strength = 114.03 dBuV

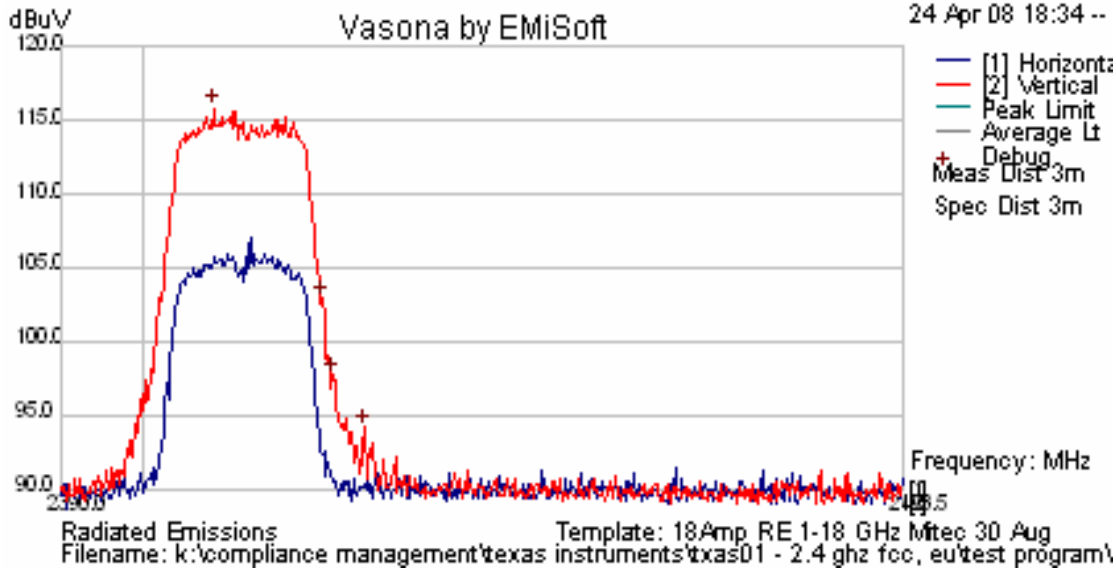


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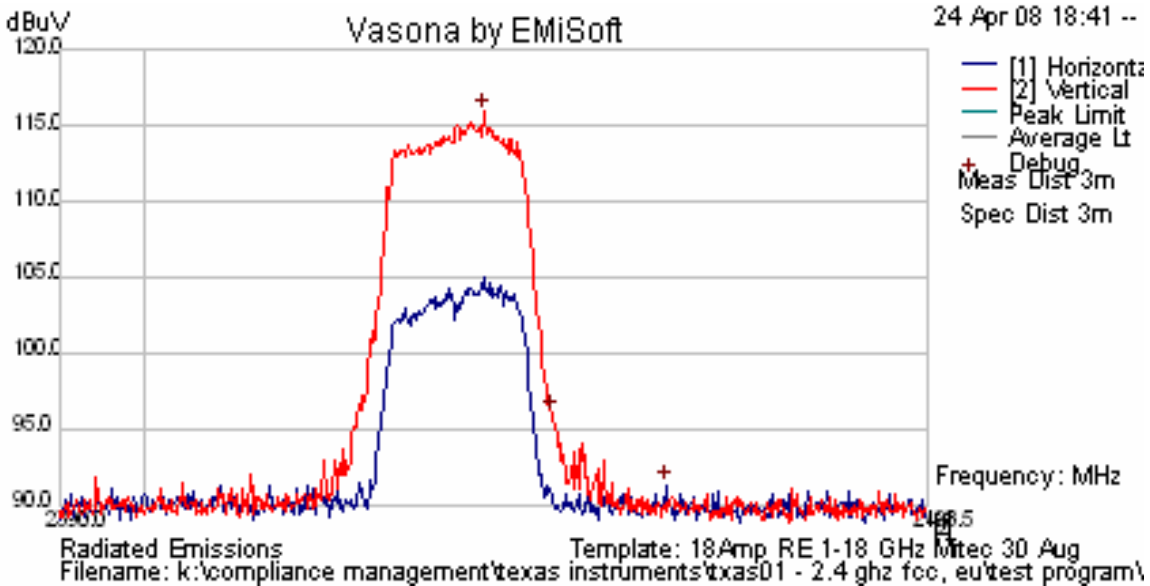
RESULTS – 802.11g 6 MBit/S 5 dBi Antenna

Channel 1 (2,412 MHz) – Peak Field Strength = 115.84 dBuV



RESULTS – 802.11g 6 MBit/S 5 dBi Antenna

Channel 6 (2,437 MHz) – Peak Field Strength = 115.88 dBuV



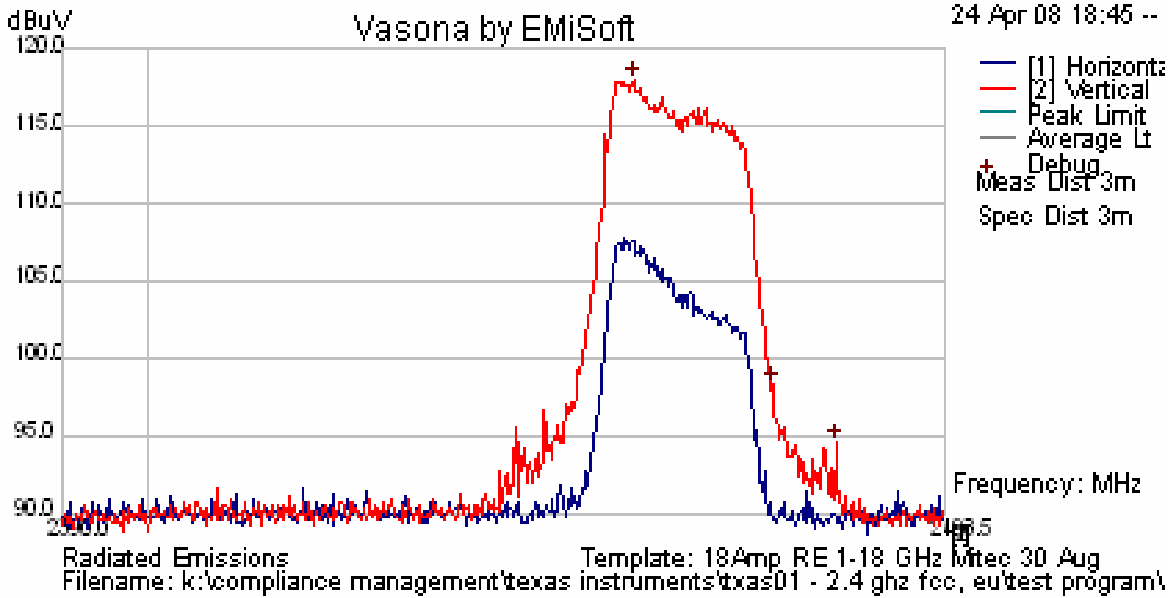
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RESULTS – 802.11g 6 MBit/S 5 dBi Antenna

Channel 11 (2,462 MHz) – Peak Field Strength = 117.93 dBuV



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Specification Limits

FCC §15.247(d) and RSS-210 §A8.5 In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

FCC §15.247(d)

If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section §15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(a)).

IC RSS-210 §A8.5 If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Tables 2 and 3 is not required. In addition, radiated emissions which fall in the restricted bands of Table 1 must also comply with the radiated emission limits specified in Tables 2 and 3.

IC RSS-Gen §4.7

The search for unwanted emissions shall be from the lowest frequency internally generated or used in the device (local oscillator, intermediate or carrier frequency), or from 30 MHz , whichever is the lowest frequency, to the 5th harmonic of the highest frequency generated without exceeding 40 GHz.

FCC §15.205 (a) Except as shown in paragraph (d) of 15.205 (a), only spurious emissions are permitted in any of the frequency bands listed.

FCC §15.205 (a) Except as shown in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

FCC §15.209 (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table.

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Frequency (MHz)	Field Strength ($\mu\text{V/m}$)	Field Strength ($\text{dB}\mu\text{V/m}$)	Measurement Distance (meters)
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3

Laboratory Measurement Uncertainty for Radiated Emissions

Measurement uncertainty	+5.6/ -4.5 dB
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Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-03 'Measurement of Radiated Emissions'	0287, 0158, 0134, 0304, 0311, 0315, 0310, 0312

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5.1.6.2. Radiated Spurious Emissions (30M-1 GHz)

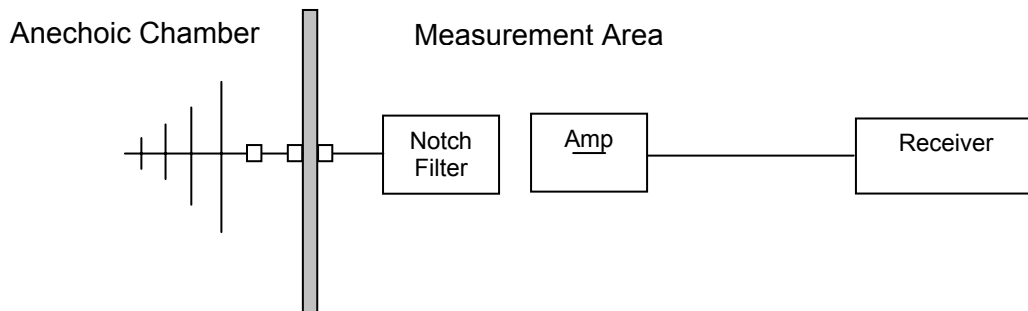
FCC, Part 15 Subpart C §15.205/ §15.209
Industry Canada RSS-210 §2.2

Test Procedure

Testing 30M-1 GHz was performed in a 3-meter anechoic chamber using a CISPR compliant receiver. Preliminary radiated emissions were measured on every azimuth and with the receiving antenna in both horizontal and vertical polarizations. To further maximize emissions the receive antenna was varied between 1 and 4 meters. The emissions are recorded with receiver in peak hold mode. Emissions closest to the limits are measured in the quasi-peak mode with the tuned receiver using a bandwidth of 120 kHz. Only the highest emissions relative to the limit are listed. The anechoic chamber test set-up is identified in Section 6 Test Set-Up Photographs.

Radiated Spurious emissions were maximized by operating all three transmitters simultaneously

Test Measurement Set up



Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting Amplifier Gain from the measured reading. In this test facility, the Antenna Factor, Cable Loss, and Amplifier Gains are loaded into the Rohde & Schwarz Receiver and the corrected field strength can be read directly on the receiver.

$$FS = R + AF + CORR$$

where:

- FS = Field Strength
- R = Measured Receiver Input Amplitude
- AF = Antenna Factor
- CORR = Correction Factor = CL – AG + NFL
- CL = Cable Loss
- AG = Amplifier Gain



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For example:

Given a Receiver input reading of 51.5dB μ V; Antenna Factor of 8.5dB; Cable Loss of 1.3dB; Falloff Factor of 0dB, an Amplifier Gain of 26dB and Notch Filter Loss of 1dB. The Field Strength of the measured emission is:

$$FS = 51.5 + 8.5 + 1.3 - 26.0 + 1 = 36.3\text{dB}\mu\text{V/m}$$

Conversion between dB μ V/m (or dB μ V) and μ V/m (or μ V) are done as:

$$\text{Level (dB}\mu\text{V/m)} = 20 * \text{Log (level (\mu\text{V/m}))}$$

$$40 \text{ dB}\mu\text{V/m} = 100\mu\text{V/m}$$

$$48 \text{ dB}\mu\text{V/m} = 250\mu\text{V/m}$$

Measurement Results for Spurious Emissions (30 MHz – 1 GHz)

Ambient conditions.

Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

EUT parameters.

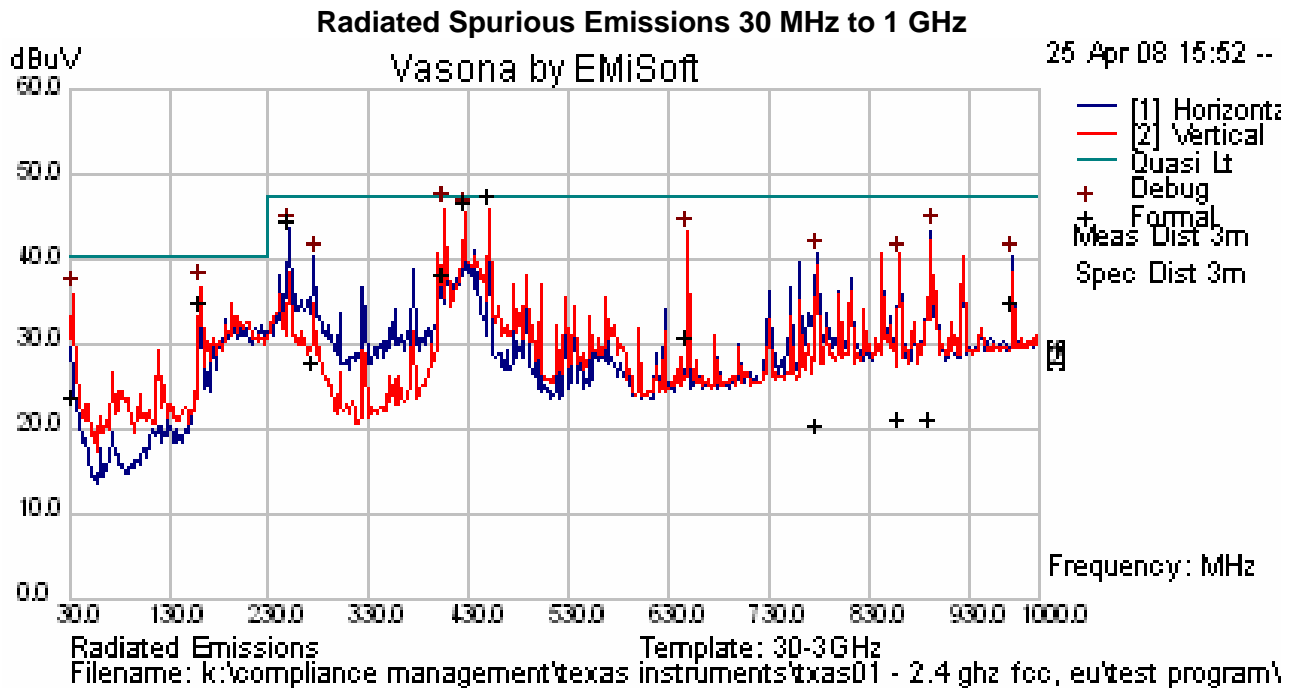
Data Rate(s): 6 MBit/s

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TABLE OF RESULTS

Freq. (MHz)	Peak (dBuV/m)	QP (dBuV/m)	QP Lmt (dBuV/m)	QP Margin (dB)	Angle (deg)	Height (cm)	Polarity
33.888	36.03	21.99	40.5	-18.51	305	261	V
161.997	36.85	33.06	40.5	-7.44	251	98	V
250.004	43.67	42.83	47.5	-4.67	276	103	H
274.485	40.22	26.24	47.5	-21.26	287	99	H
405.010	46.08	36.58	47.5	-10.92	270	165	V
424.974	45.52	45.28	47.5	-2.22	265	126	V
449.989	45.87	45.73	47.5	-1.77	246	124	V
647.955	43.27	29.06	47.5	-18.44	40	99	V
778.494	40.83	18.60	47.5	-28.9	126	149	H
859.48	40.11	19.39	47.5	-28.11	299	201	V
890.968	43.49	19.37	47.5	-28.13	125	187	H
971.973	40.42	33.20	47.5	-14.30	14	161	V



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Specification

Limits

§15.205 (a) Except as shown in paragraph (d) of 15.205 (a), only spurious emissions are permitted in any of the frequency bands listed.

§15.205 (a) Except as shown in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

§15.209 (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table.

§15.209 (a) and RSS-Gen §2.2 Limit Matrix

Frequency(MHz)	Field Strength (μV/m)	Field Strength (dBμV/m)	Measurement Distance (meters)
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3

Laboratory Measurement Uncertainty for Radiated Emissions

Measurement uncertainty	+5.6/ -4.5 dB
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Traceability

Method	Test Equipment Used
Measurements were made per Sanmina work instruction	8546A HP Receiver and RF Filter, HP Pre-amp, Antenna EMCO Biconilog

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5.1.6.3. Receiver Radiated Spurious Emissions (above 1 GHz)

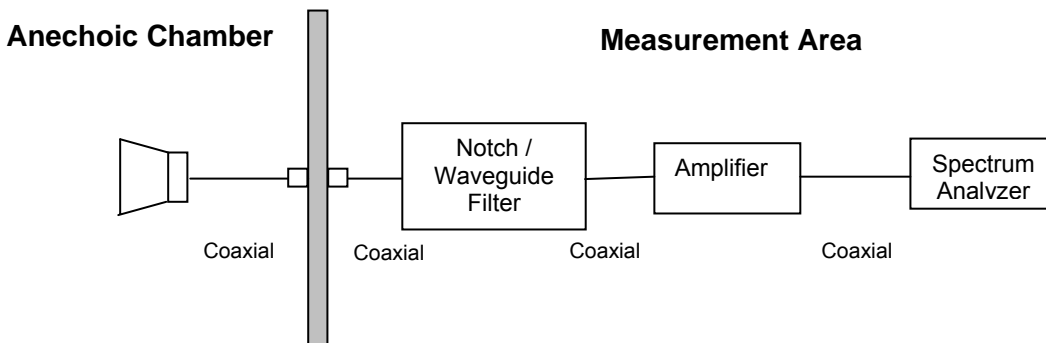
Industry Canada RSS-Gen §4.8, §6

Test Procedure

Radiated emissions above 1 GHz are measured in the anechoic chamber at a 3-meter distance on every azimuth in both horizontal and vertical polarities. The emissions are recorded and maximized as a function of azimuth by rotation through 360° with a spectrum analyzer in peak hold mode. Depending on the frequency band spanned a notch filter and waveguide filter was used to remove the fundamental frequency. The highest emissions relative to the limit are listed for each frequency spanned.

All measurements on any frequency or frequencies over 1 MHz are based on the use of measurement instrumentation employing an average detector function. All measurements above 1 GHz were performed using a minimum resolution bandwidth of 1 MHz.

Test Measurement Set up



Measurement set up for Radiated Emission Test

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting Amplifier Gain from the measured reading. All factors are included in the reported data.

$$FS = R + AF + CORR - FO$$

where: FS = Field Strength
R = Measured Spectrum analyzer Input Amplitude
AF = Antenna Factor
CORR = Correction Factor = CL – AG + NFL
CL = Cable Loss
AG = Amplifier Gain
FO = Distance Falloff Factor
NFL = Notch Filter Loss or Waveguide Loss



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For example:

Given receiver input reading of 51.5 dB μ V; Antenna Factor of 8.5 dB; Cable Loss of 1.3 dB; Falloff Factor of 0 dB, an Amplifier Gain of 26 dB and Notch Filter Loss of 1 dB. The Field Strength of the measured emission is:

$$FS = 51.5 + 8.5 + 1.3 - 26.0 + 1 = 36.3 \text{ dB}\mu\text{V/m}$$

Conversion between dB μ V/m (or dB μ V) and μ V/m (or μ V) are done as:

$$\text{Level (dB}\mu\text{V/m)} = 20 * \text{Log (level (\mu\text{V/m}))}$$

$$40 \text{ dB}\mu\text{V/m} = 100 \mu\text{V/m}$$

$$48 \text{ dB}\mu\text{V/m} = 250 \mu\text{V/m}$$

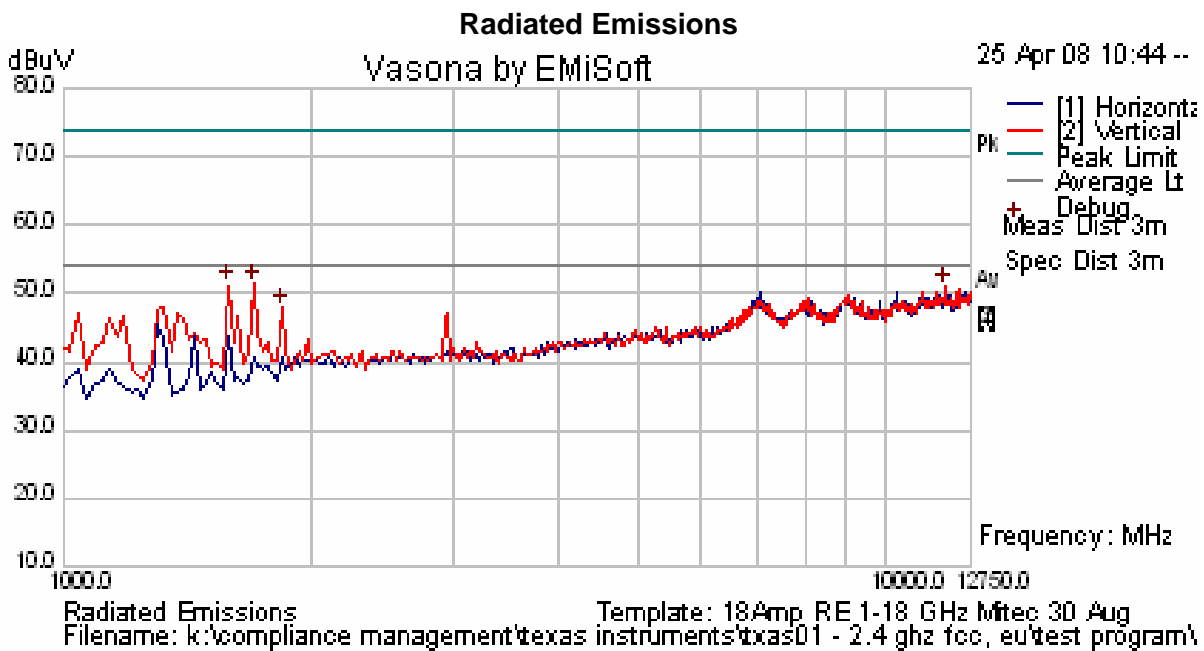
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Test Setup – 2.4 GHz channel 2437 GHz,

TABLE OF RESULTS –

Freq. (MHz)	Pol. (H/V)	Raw Reading (dB μ V/m)	Correction Factor (dB)	Corrected Field Strength (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
1706.413	V	61.82	-10.43	51.39	74	-22.61
1588.677	V	62.76	-11.55	51.21	74	-22.79
11855.210	V	45.53	5.57	51.10	74	-22.90
1847.695	V	57.34	-9.22	48.12	74	-25.88



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Issue Date: 16th May 2008
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Specification

Receiver Radiated Spurious Emissions

Industry Canada RSS-Gen §4.8,

The search for spurious emissions shall be from the lowest frequency internally generated or used in the receiver (e.g. local oscillator, intermediate or carrier frequency), or 30 MHz, whichever is the higher, to at least 3 times the highest tunable or local oscillator frequency, whichever is the higher, without exceeding 40 GHz.

RSS-Gen §6

The following receiver spurious emission limits shall be complied with;

(a) If a radiated measurement is made, all spurious emissions shall comply with the limits of Table 1.

Frequency (MHz)	Field Strength ($\mu\text{V/m}$)	Field Strength ($\text{dB}\mu\text{V/m}$)	Measurement Distance (meters)
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3

Laboratory Measurement Uncertainty for Radiated Emissions

Measurement uncertainty	+5.6/ -4.5 dB
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Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-03 'Measurement of Radiated Emissions'	0287, 0158, 0134, 0304, 0311, 0315, 0310, 0312

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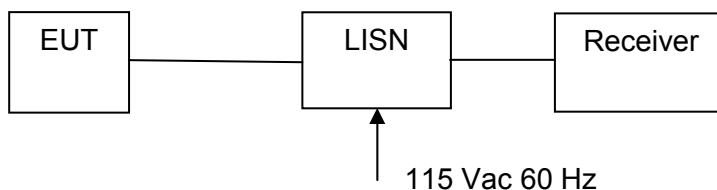
5.1.7. AC Wireline Conducted Emissions (150 kHz – 30 MHz)

FCC, Part 15 Subpart C §15.207
Industry Canada RSS-Gen §7.2.2

Test Procedure

The EUT is configured in accordance with ANSI C63.4. The conducted emissions are measured in a shielded room with a spectrum analyzer in peak hold in the first instance. Emissions closest to the limit are measured in the quasi-peak mode (QP) with the tuned receiver using a bandwidth of 9 kHz. The emissions are maximized further by cable manipulation. The highest emissions relative to the limit are listed.

Test Measurement Set up



Measurement set up for AC Wireline Conducted Emissions Test

Measurement Results for AC Wireline Conducted Emissions (150 kHz – 30 MHz)

Ambient conditions.

Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

EUT parameters.

Data Rate(s): 6 MBit/s

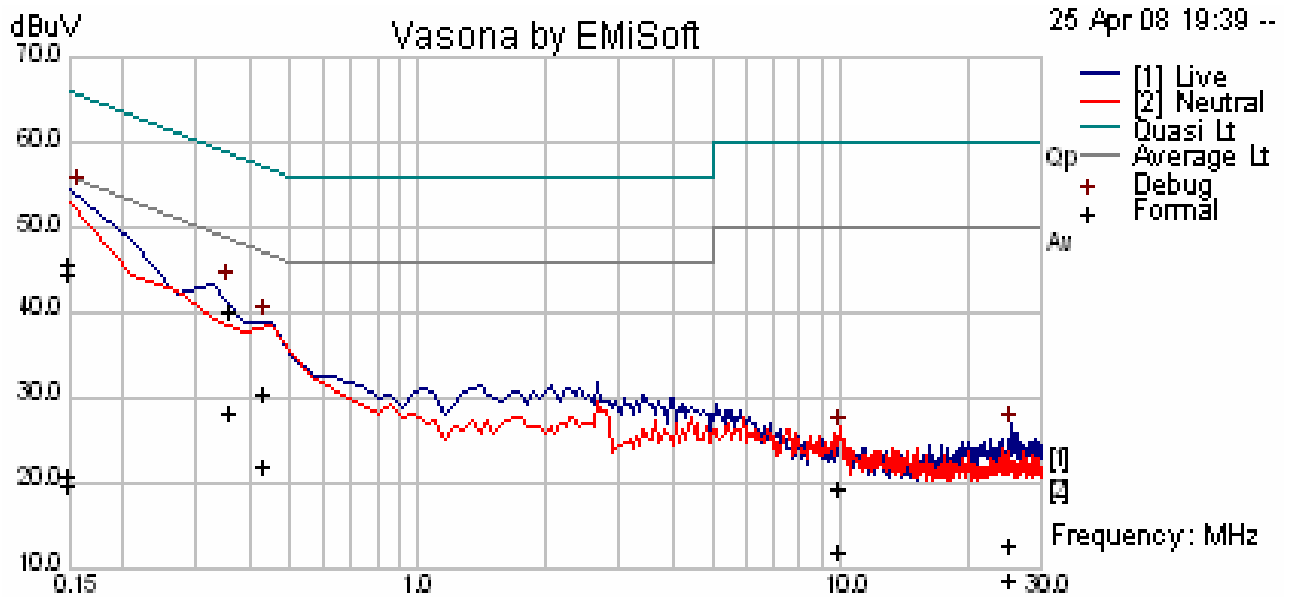
Power Level: Maximum



TABLE OF RESULTS –

Freq (MHz)	LIne	Peak (dBµV)	QP (dBµV)	QP Limit (dBµV)	QP Margin (dB)	Ave. (dBµV)	Ave. Limit (dBµV)	Ave. Margin (dB)
0.150	L	54.39	43.88	66	-22.12	17.87	56	-38.13
0.150	N	53.18	42.73	66	-23.27	19.07	56	-36.93
0.359	L	43.15	38.41	58.74	-20.33	26.62	48.74	-22.12
0.436	N	39.06	28.66	57.14	-28.48	20.27	47.14	-26.87
10.029	N	26.14	17.60	60	-42.4	10.24	50	-39.76
25.083	N	26.71	11.14	60	-48.86	6.86	50	-43.14

AC Wireline Conducted Emissions – 150 kHz – 30 MHz



Power Line Conducted Emissions
 Template: Conducted Emissions
 +Filename: k:\compliance management\texas instruments\texas01 - 2.4 ghz fcc, eu\test program\

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Specification

Limit

§15.207 (a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 $\mu\Omega$ line impedance stabilization network (LISN), see §15.207 (a) matrix below. 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.

RSS-Gen §7.2.2

The radio frequency voltage that is conducted back into the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in the table below. The tighter limit applies at the frequency range boundaries.

§15.207 (a) and **RSS-Gen §7.2.2** Limit Matrix

The lower limit applies at the boundary between frequency ranges

Frequency of Emission (MHz)	Conducted Limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency

Laboratory Measurement Uncertainty for Conducted Emissions

Measurement uncertainty	± 2.64 dB
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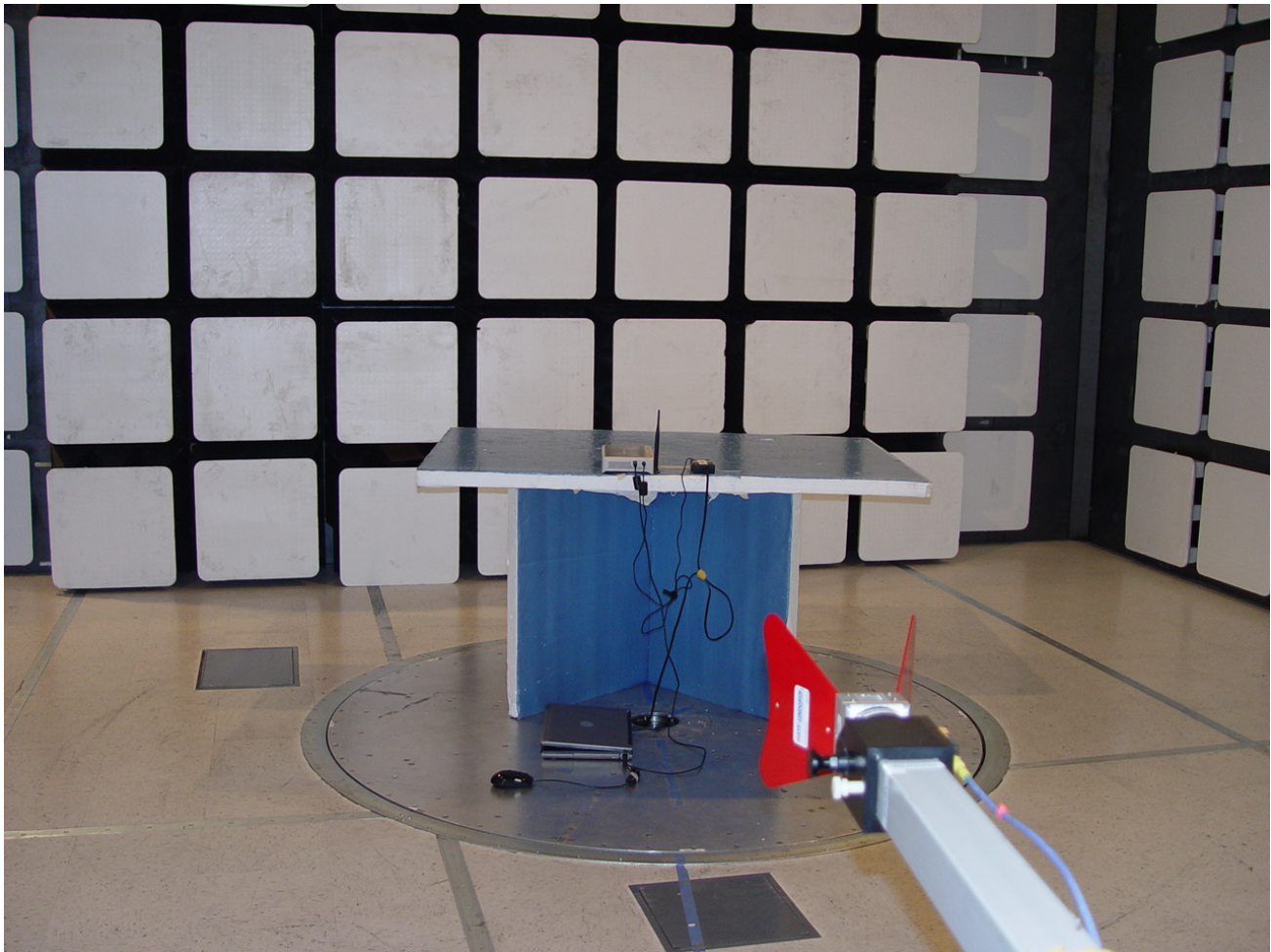
Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-EMC-01 'Measurement of Conducted Emissions'	0158, 0184, 0193, 0190, 0293, 0307

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6. PHOTOGRAPHS

6.1. Radiated Emissions (>1 GHz)



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6.2. AC Wireline Emissions (150 kHz - 30 MHz)



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6.3. General Measurement Test Set-Up



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7. TEST EQUIPMENT DETAILS

Asset #	Instrument	Manufacturer	Part #	Serial #
0287	EMI Receiver	Rhode & Schwartz	ESIB 40	100201
0134	Amplifier	Com Power	PA 122	181910
0158	Barometer /Thermometer	Control Co.	4196	E2846
0193	EMI Receiver	Rhode & Schwartz	ESI 7	838496/007
0252	SMA Cable	Megaphase	Sucoflex 104	None
0310	2m SMA Cable	Micro-Coax	UFA210A-0-0787- 3G03G0	209089-001
0312	3m SMA Cable	Micro-Coax	UFA210A-1-1181- 3G0300	209092-001
0313	Coupler	Hewlett Packard	86205A	3140A01285
0314	30dB N-Type Attenuator	ARRA	N9444-30	1623
0070	Power Meter	Hewlett Packard	437B	3125U11552
0116	Power Sensor	Hewlett Packard	8485A	3318A19694
0117	Power Sensor	Hewlett Packard	8487D	3318A00371
0184	Pulse Limiter	Rhode & Schwartz	ESH3Z2	357.8810.52
0190	LISN	Rhode & Schwartz	ESH3Z5	836679/006
0293	BNC Cable	Megaphase	1689 1GVT4	15F50B001
0304	2.4GHzHz Notch Filter	Micro-Tronics	--	001
0307	BNC Cable	Megaphase	1689 1GVT4	15F50B002
0335	1-18GHz Horn Antenna	ETS- Lindgren	3117	00066580
0337	Amplifier	MiCOM Labs	--	--
0338	Antenna	Sunol Sciences	JB-3	A052907
Dipole	20MHz-1GHz Dipole Antennas	EMCO	3121C	9009-505
0072	Signal Generator	Hewlett Packard	HP 83640A	2927A00105
0075	Environmental Chamber	Thermatron	SE-300-2-2	27946
0083	Coupler	Hewlett Packard	HP 87301D	3116A00389

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