Test of Access One Network OWS 2400-10

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

Test Report Serial No.: STRX01-A14 OWS 2400-10 Rev A

TEST REPORT

FROM

Test of Access One Network OWS 2400-10
to
FCC 47 CFR Part15.247 & IC RSS-210

Test Report Serial No.: STRX01-A14 OWS 2400-10 Rev A

Note: this report only contains data with regard to the 2.4 and 5.8 GHz operational modes of the radio module. 5250-5350 MHz test data is reported in MiCOM Labs test report STRX01-A15 OWS 2400-10.

This report supersedes: None

Manufacturer: Strix Systems, Inc
26610 Agoura Road
Calabasas
California 91302, USA

Product Function: 2.4 and 5 GHz Wireless Access Point

Copy No: pdf **Issue Date:** 5th September 2006

This Test Report is Issued Under the Authority of;

MiCOM Labs, Inc.
3922 Valley Avenue, Suite B
Pleasanton, CA 94566 USA
Phone: +1 (925) 462-0304
Fax: +1 (925) 462-0306
www.micomlabs.com

CERTIFICATE #2381.01

MiCOM Labs is an ISO 17025 Accredited Testing Laboratory

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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

THE AMERICAN
ASSOCIATION
FOR LABORATORY
ACCREDITATION

ACCREDITED LABORATORY

A2LA has accredited

MICOM LABS
Pleasanton, CA

for technical competence in the field of

Electrical Testing

The accreditation covers the specific tests and types of tests listed on the agreed scope of accreditation. This laboratory meets the requirements of ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration Laboratories" and any additional program requirements in the identified field of testing.

Presented this 14th day of September 2005.

American Association for Laboratory Accreditation
Corporate SEAL 1978 District of Columbia
A2LA

President
For the Accreditation Council
Certificate Number 2381.01
Valid to: November 30, 2007

For tests or types of tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

LISTINGS

MiCOM Labs test facilities are listed by the following organizations;

North America

United States of America
Federal Communications Commission (FCC) Listing #: 102167

DOCUMENT HISTORY

Document History		
Revision	Date	Comments
Draft		
Rev A	5th September 2006	First issue.

1. TEST RESULT CERTIFICATE

Manufacturer:	Strix Systems, Inc 26610 Agoura Road Calabasas California 91302, USA	Tested By:	MiCOM Labs, Inc. 3922 Valley Avenue 'B' Pleasanton California, 94566, USA
EUT:	Wireless Access Point	Telephone:	+1 925 462 0304
Model:	OWS 2400	Fax:	+1 925 462 0306
S/N:	200816		
Test Date(s):	6th Dec to 26th Jan '06	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.

ACCREDITED
CERTIFICATE #2381.01

Approved & Released for MiCOM Labs, Inc. by:

Graeme Grieve
Quality Manager MiCOM Labs,

Gordon Hurst
President & CEO MiCOM Labs, Inc.

2. REFERENCES AND MEASUREMENT UNCERTAINTY

2.1. Normative References

Ref.	Publication	Year	Title
(i)	FCC 47 CFR Part 15.247	2005	Code of Federal Regulations
(ii)	Industry Canada RSS-210	Issue 6 Sept. 2005	Low Power License-Exempt Radiocommunication Devices (All Frequency Bands)
(iii)	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
(iv)	CISPR 22/ EN 55022	1997 1998	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
(v)	M 3003	Edition 1 Dec. 1997	Expression of Uncertainty and Confidence in Measurements
(vi)	LAB34	Edition 1 Aug 2002	The expression of uncertainty in EMC Testing
(vii)	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
(viii)	A2LA	14th 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.

3. PRODUCT DETAILS AND TEST CONFIGURATIONS

3.1. Technical Details

Details	Description
Purpose:	Test of the Strix Systems Inc Access One Network OWS 2400-10 to FCC Part 15.247 and Industry Canada RSS-210 regulations
Applicant:	As Manufacturer
Manufacturer:	Strix Systems, Inc 26610 Agoura Road Calabasas California 91302, USA
Laboratory performing the tests:	MiCOM Labs, Inc. 3922 Valley Avenue, Suite "B" Pleasanton, California 94566 USA
Test report reference number:	STRX01-A14 OWS 2400-10 Rev A
Date EUT received:	6TH December 2005
Standard(s) applied:	FCC 47 CFR Part15.247 & IC RSS-210
Dates of test (from - to):	6th Dec to 26th Jan '06
No of Units Tested:	1
Type of Equipment:	802.11a/b/g Wireless Access Point
Manufacturers Trade Name:	Access One Network
Model:	OWS 2400-10
Location for use:	Outdoor use only.
Declared Frequency Range(s):	2400 - 2483.5 MHz 5725 – 5850 MHz
Type of Modulation:	BPSK, QPSK, CCK, 16QAM, 64QAM, DBPSK, DQPSK, CCK
Declared Nominal Output Power:	802.11b: +27 dBm 802.11g: +26 dBm, g Turbo: +26 dBm 802.11a: +26 dBm, a Turbo: +23 dBm
EUT Modes of Operation:	Per 802.11 – DBPSK, DQPSK, CCK, OFDM
Transmit/Receive Operation:	Simplex
Rated Input Voltage and Current:	100 to 240 VAC. Single Phase, 50-60 Hz, 1 amp max.
Operating Temperature Range:	Declared range -30 to +55ºC
ITU Emission Designator:	802.11b – 15M9W7D 802.11g - 19M5W7D, g Turbo - 33M8W7D 802.11a - 19M5W7D, a Turbo - 34M5W7D
Microprocessor(s) Model:	Atheros AR5312
Clock/Oscillator(s):	25 MHz, 40 MHz.
Frequency Stability:	±20 ppm
Equipment Dimensions:	14"x11"x6½""
Weight:	12 lbs
Primary function of equipment:	Wireless Access Point

3.2. Scope of Test Program

The scope of the test program was to test the Strix Systems, Inc Access One Network OWS 2400 802.11a/b/g access point in the frequency ranges 2400 - 2483.5 MHz, and 5725 – 5850 MHz for compliance against FCC 47 CFR Part 15.247 and Industry Canada RSS-210 specifications.

The Strix Systems, Inc Access One OWS 2400 employs per 802.11 – DBPSK, DQPSK, CCK, OFDM modulation modes of operation.

The OWS 2400 shares all of its RF assemblies with the OWS 3600 and as a result the test results used in this test report with the exception of Radiated Emissions below 1 GHz (which were measured on fully equipped model 2400-30) are reproduced from the data used in test report STRIX-A4 for the fully equipped model OWS 3600-30. These results represent the worst case and are valid for partially equipped models i.e. 2400-10.

Strix Systems Inc
Access One Network OWS 2400-30

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

Type (EUT/ Support)	Equipment Description (Including Brand Name)	Mfr	Model No.	Serial No.
EUT	Access One Network Microwave Radio	Strix Systems Inc	OWS 2400	200816
Support	AC Power Cord 115/240V			

3.4. Antenna Details

Antenna Type	Gain (dBi)	Manufacturer	Model No.	Serial No.
2.4GHz 3ft Omni Dipole	12	Strix Systems Inc	OWS-ANTG-OMNI-12	None
2.4GHz 120° Sector	16.4	Strix Systems Inc	OWS-ANTG-SEC3-16	04450183
5.8GHz 2ft Omni Dipole	12	Strix Systems Inc	OWS-ANTA-OMNI-12	0521083 0536020
5.8GHz Patch Panel	23	Strix Systems Inc	OWS-ANTA-PNL-23	None

3.5. Cabling and I/O Ports

Number and type of I/O ports

1. 10/100 Ethernet non-shielded cable (2 meters)
2. 115/240Vac 50/60Hz Power

3.6. Test Configurations

Matrix of test configurations

Operational Mode (802.11)	Operating Channel	Nominal Tx Pwr (dBm)	Frequencies (MHz)	Maximum Data Rates (MBit/s)	Data Rate(s) Selected for Test Purposes (Mbit/s)	
					Conducted	Radiated
b, g	1, 6, 11	b +27 g +26	2,412 2,437 2,462	b 11 g 54	b 11 g 6	b 11 g 6
g Turbo	6	+23	2,437	108	108	108
a	149, 157, 165	+26	5,745 5,785 5,825	54	6	6
a Turbo	160	+23	5,800	108	108	108

Only worst case plots are provided for each test parameter are identified within this report. Plots not included are held on file by the test laboratory and available upon request with client permission.

3.7. Deviations from the Test Standard

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

1. NONE

3.8. Subcontracted Testing or Third Party Data

Radiated emissions are tested below and verified above 1 GHz at TUV Rheinland of North America's 10m chamber located at the following address;-

2305 Mission College Blvd.
Santa Clara
California 95054
USA

TUV Rheinland of North America IC Registration Number: IC 4453-1

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

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
	Transmitter Radiated Spurious Emissions	Emissions above 1 GHz		Complies	*5.1.6.1*
Industry Canada only **RSS-Gen §4.8, §6**	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

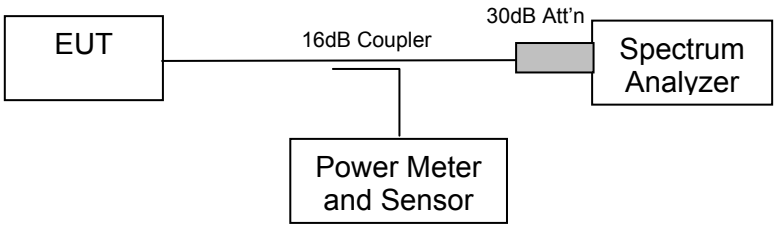
5.1. Device Characteristics

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

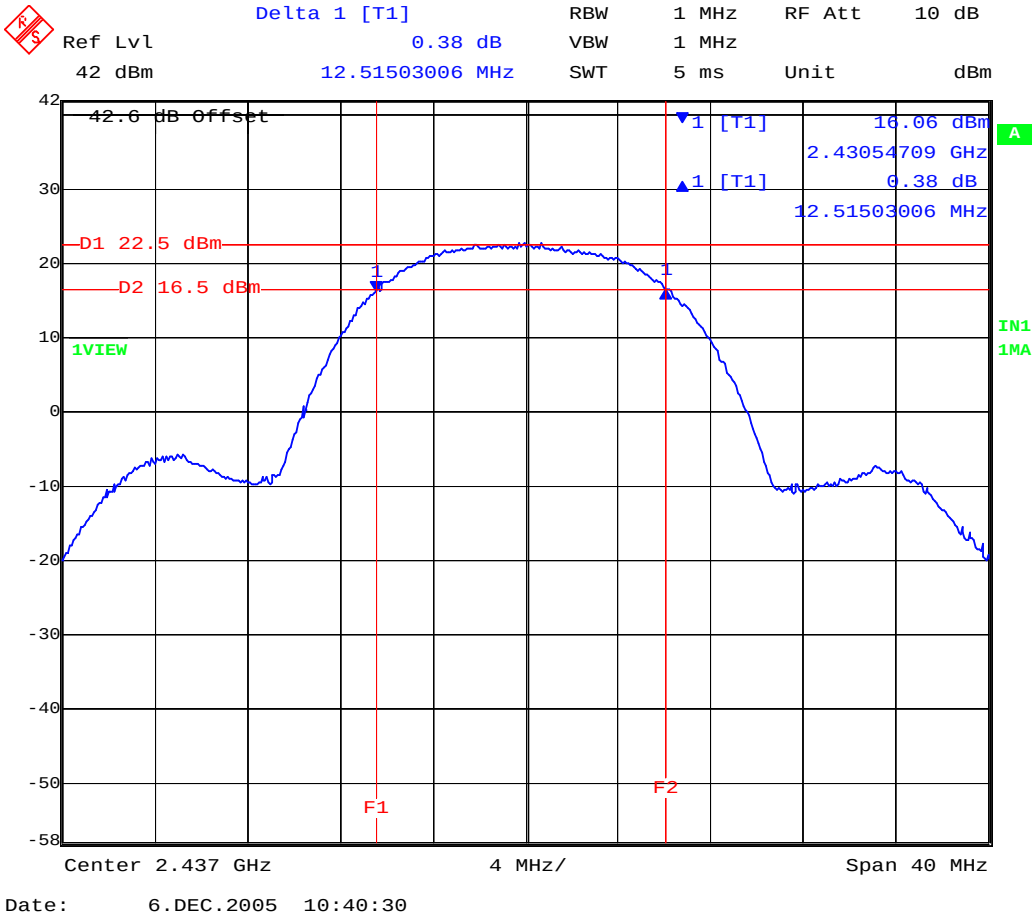
Measurement Results for 6 dB and 99 % Operational Bandwidth(s)

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

TABLE OF RESULTS – **802.11b**

Center Frequency (MHz)	6 dB Bandwidth (MHz)	6 dB Plot #	99 % BW (MHz)	99 % BW Plots
2,412	12.26452906	On File	15.79158317	On File
2,437	12.51503006	01	15.87174349	02
2,462	12.34468938	On File	15.87174349	On File

Plot 01
2,437 MHz 802.11b 6 dB Bandwidth



Plot 02
2,437 MHz 802.11b 99% Bandwidth

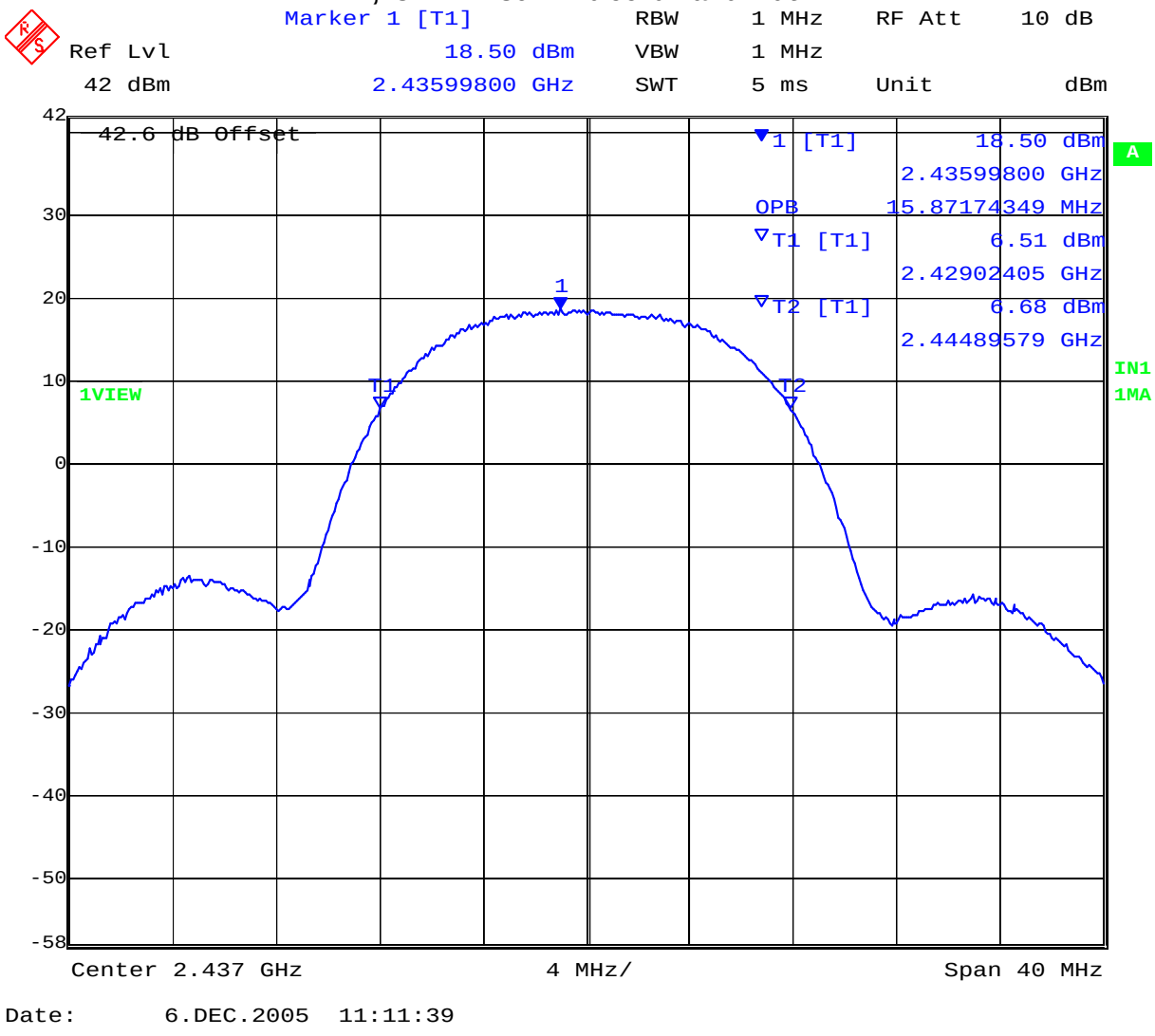
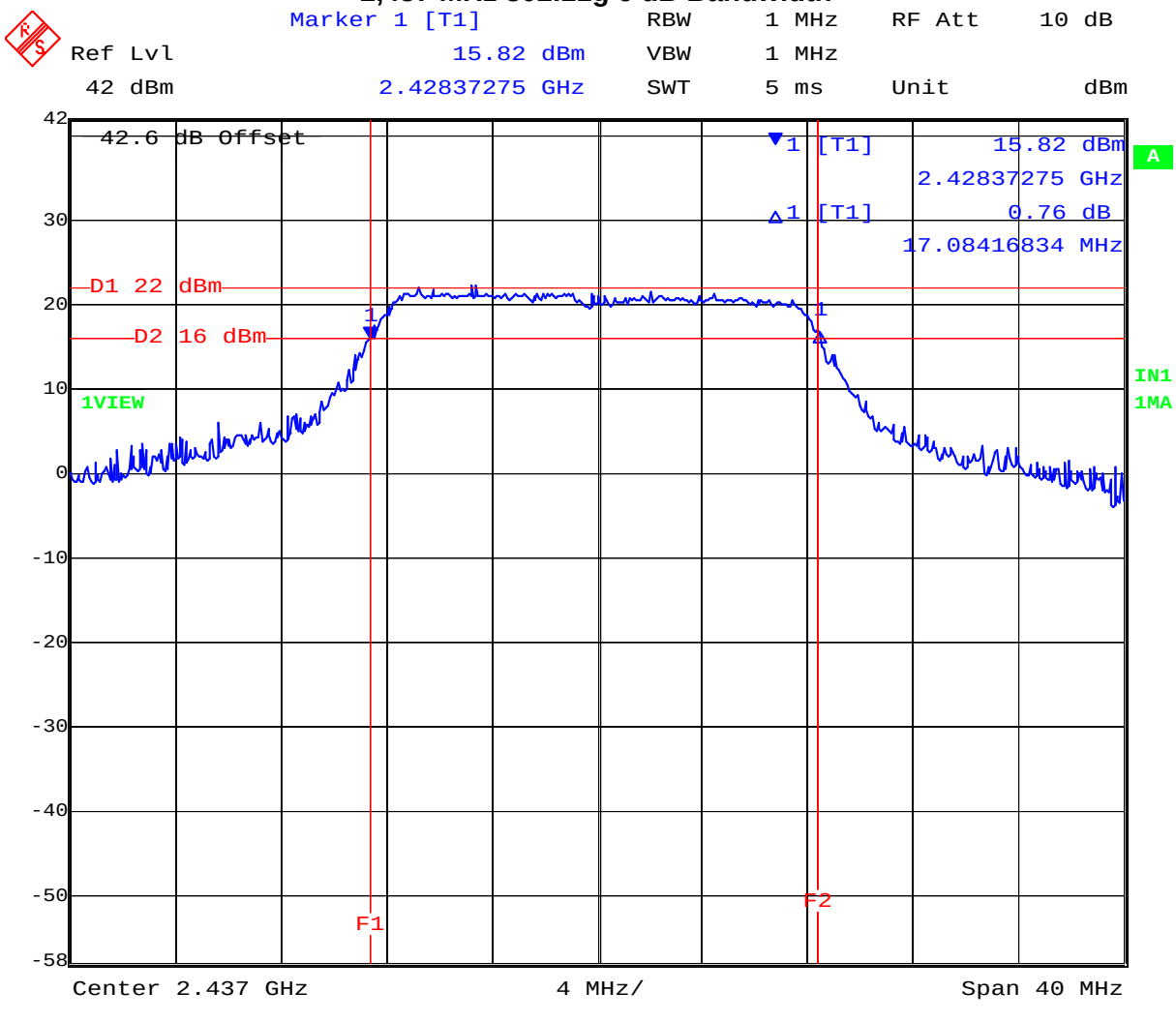


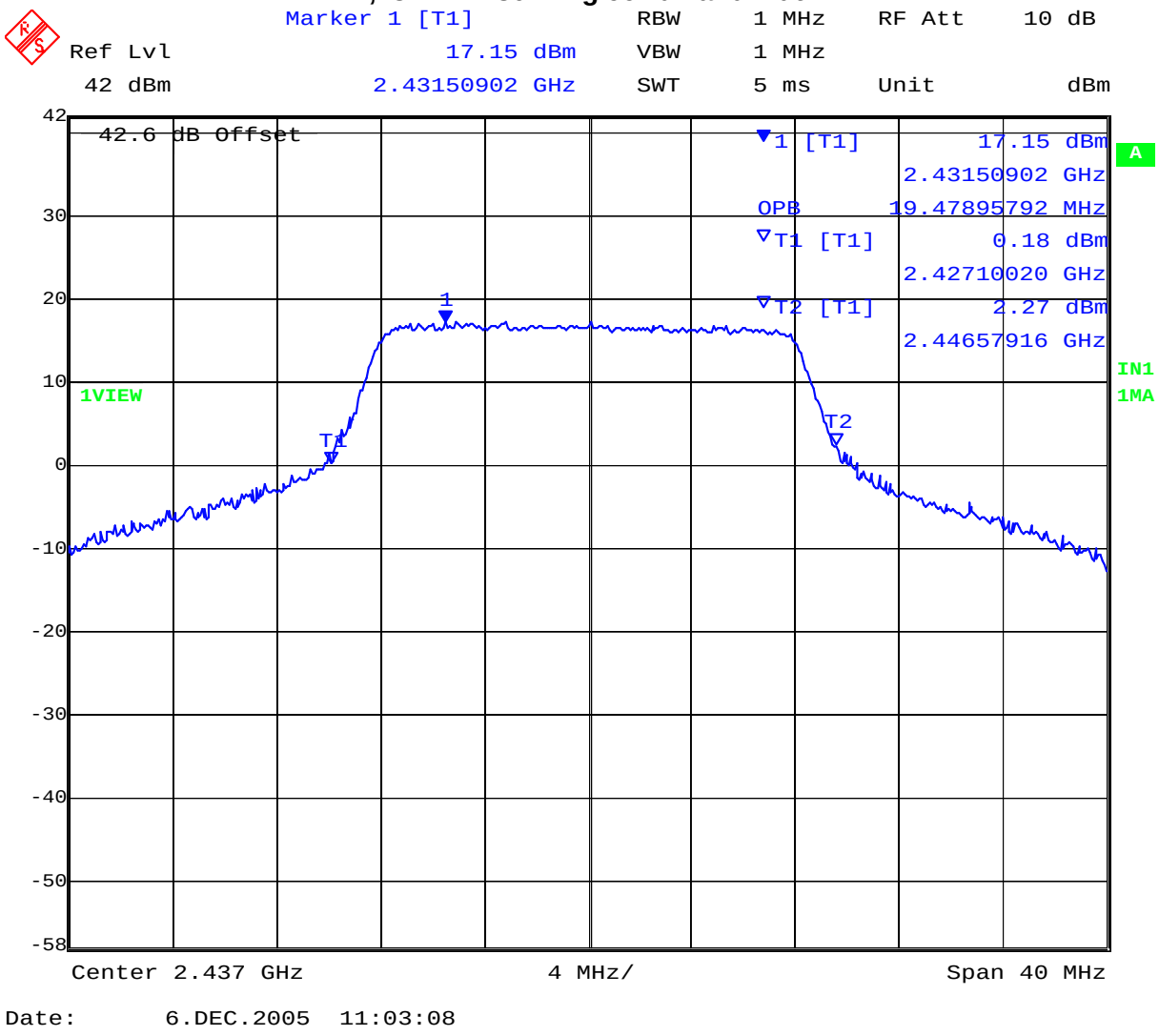
TABLE OF RESULTS – **802.11g**

Center Frequency (MHz)	6 dB Bandwidth (MHz)	6 dB Plot #	99 % BW (MHz)	99 % BW Plots
2,412	17.17434870	On File	18.43687375	On File
2,437	17.08416834	03	19.47895792	04
2,462	17.15430862	On File	19.39879760	On File
2,437 Turbo	33.26653307	05	33.74749499	06

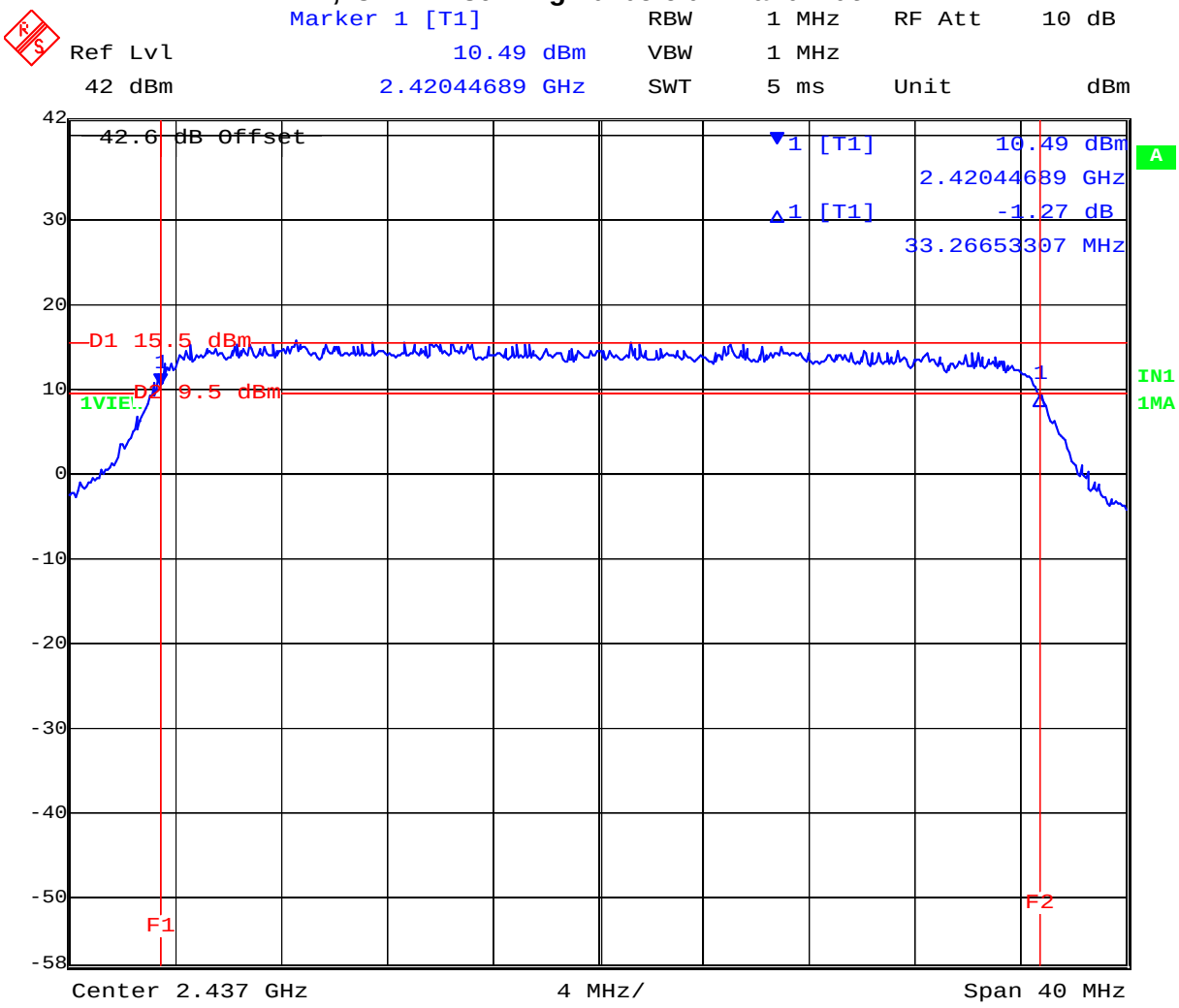
Plot 03
2,437 MHz 802.11g 6 dB Bandwidth



Plot 04
2,437 MHz 802.11g 99 % Bandwidth



Plot 05
2,437 MHz 802.11g Turbo 6 dB Bandwidth



Plot 06
2,437 MHz 802.11g Turbo 99% Bandwidth

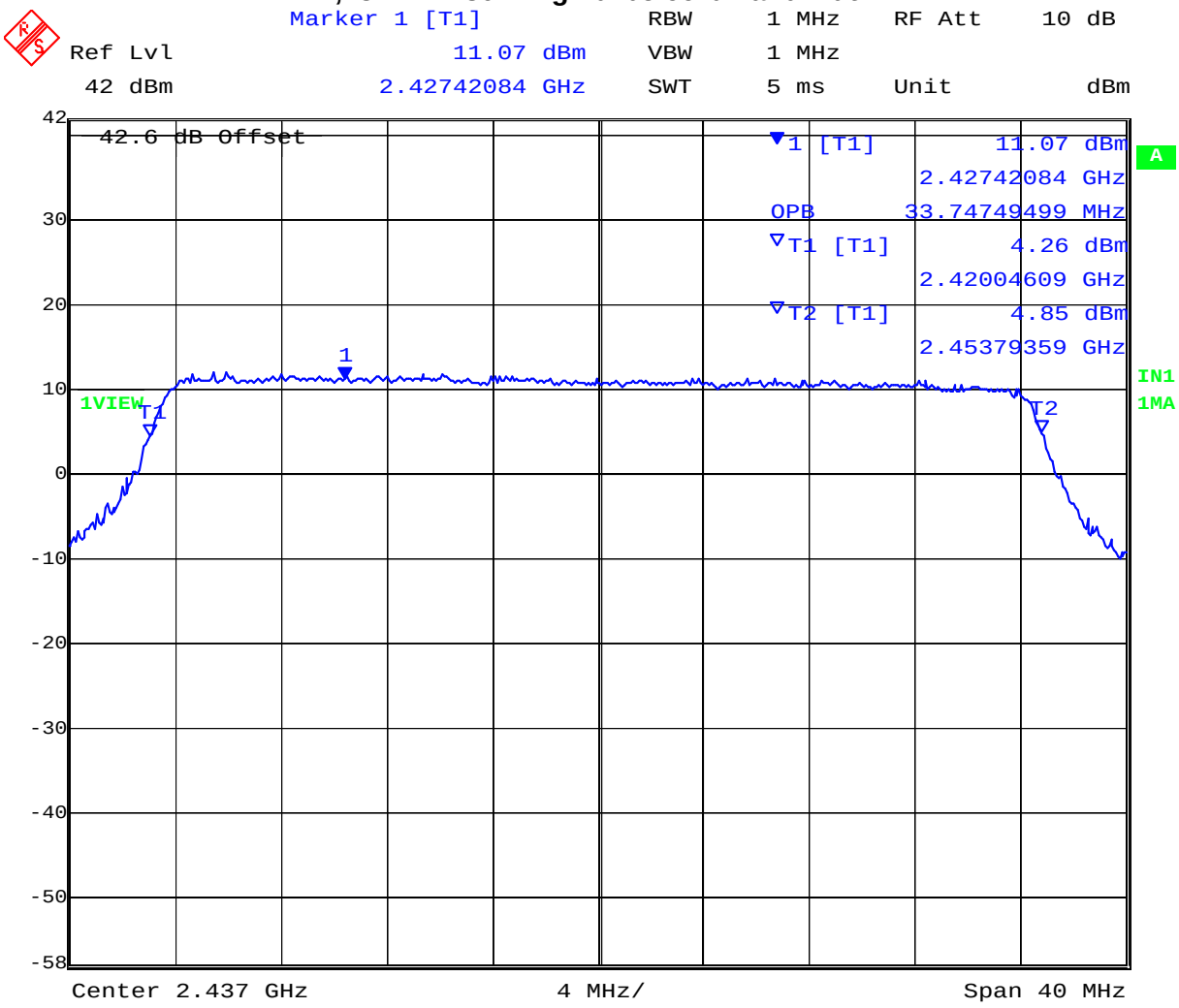
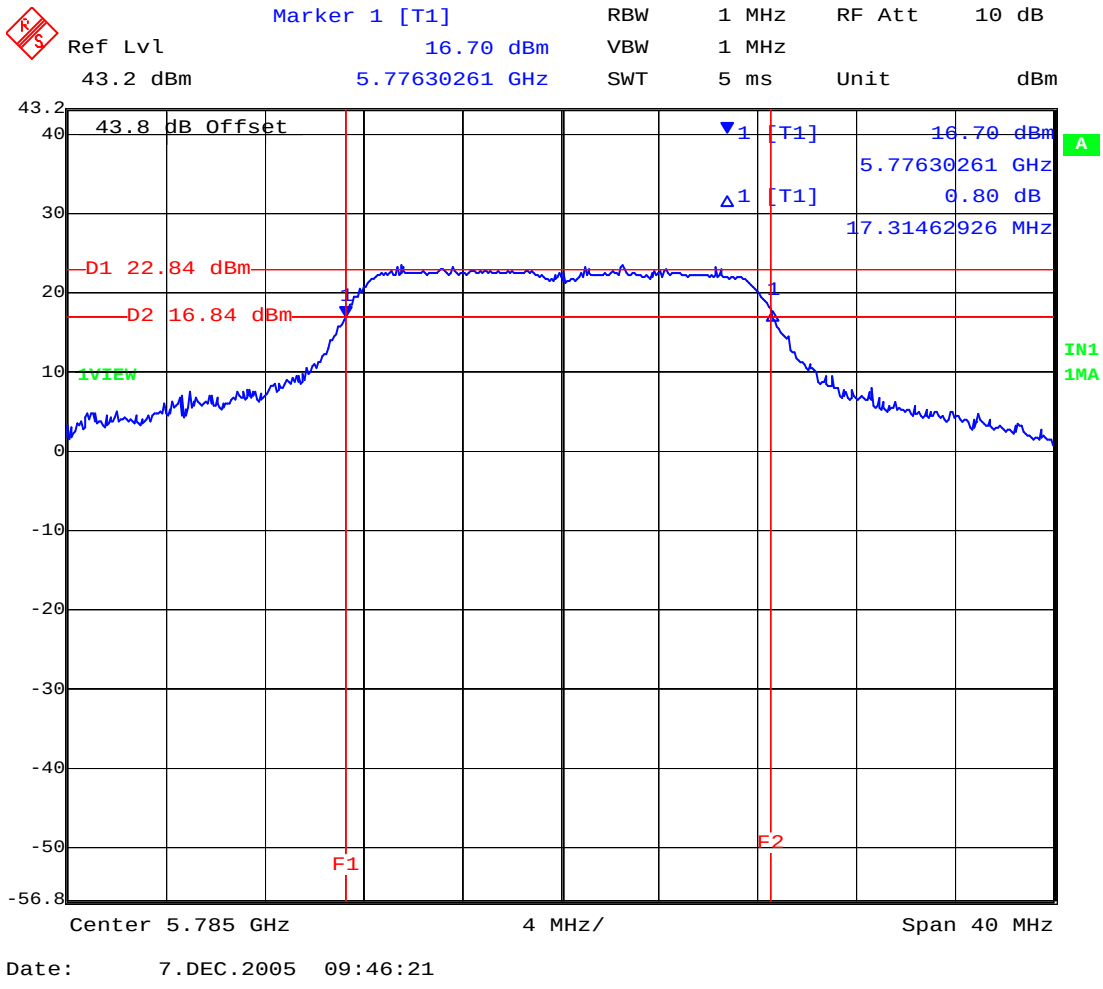


TABLE OF RESULTS – **802.11a**

Center Frequency (MHz)	6 dB Bandwidth (MHz)	6 dB Plot #	99 % BW (MHz)	99 % BW Plots
5,745	17.23446894	On File	19.28857715	On File
5,785	17.31462926	07	19.48897796	08
5,825	17.23446894	On File	19.48897796	On File
5,800 Turbo	33.83767535	09	34.46893788	10

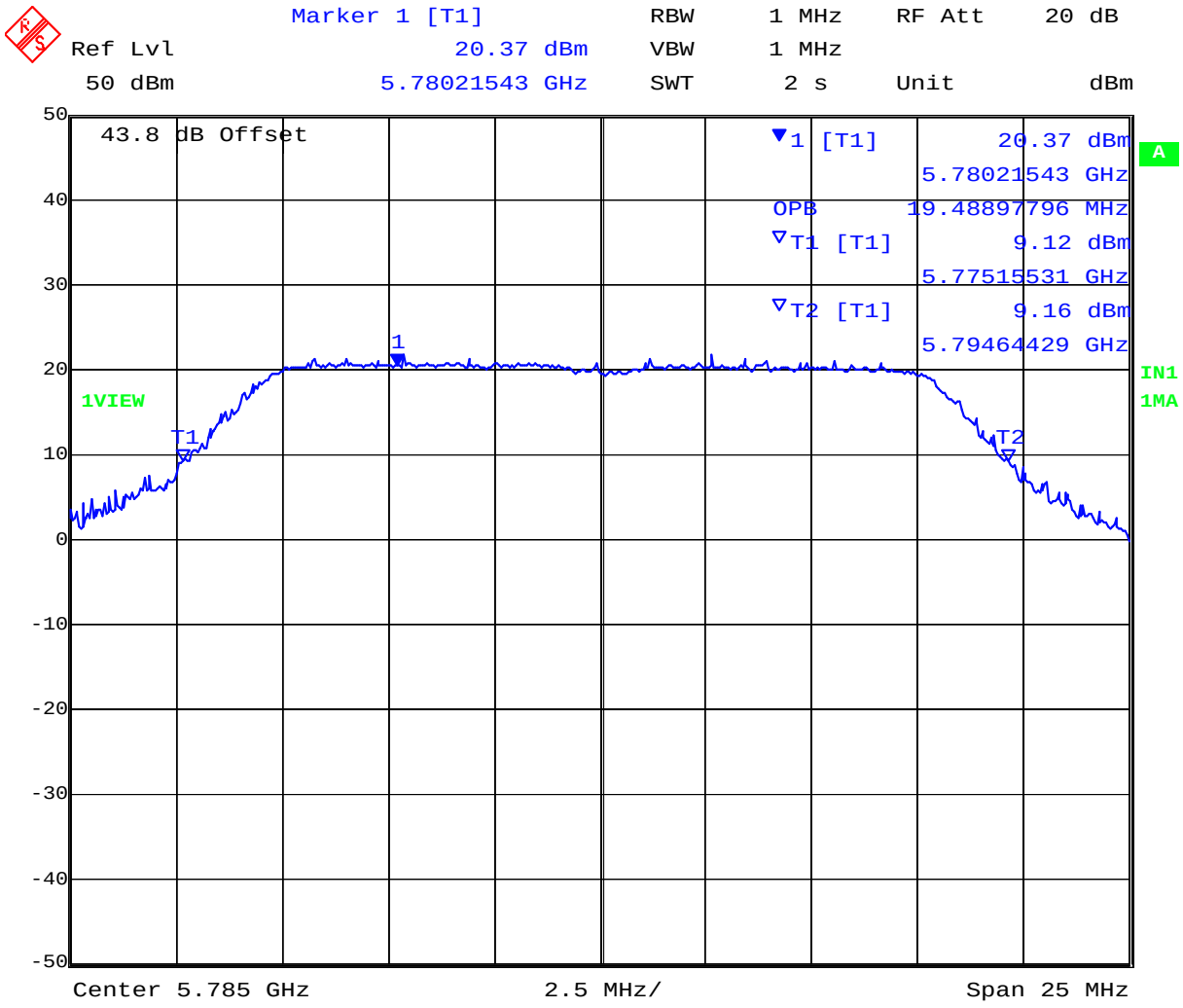
Plot 07

5,785 MHz 802.11a 6 dB Bandwidth



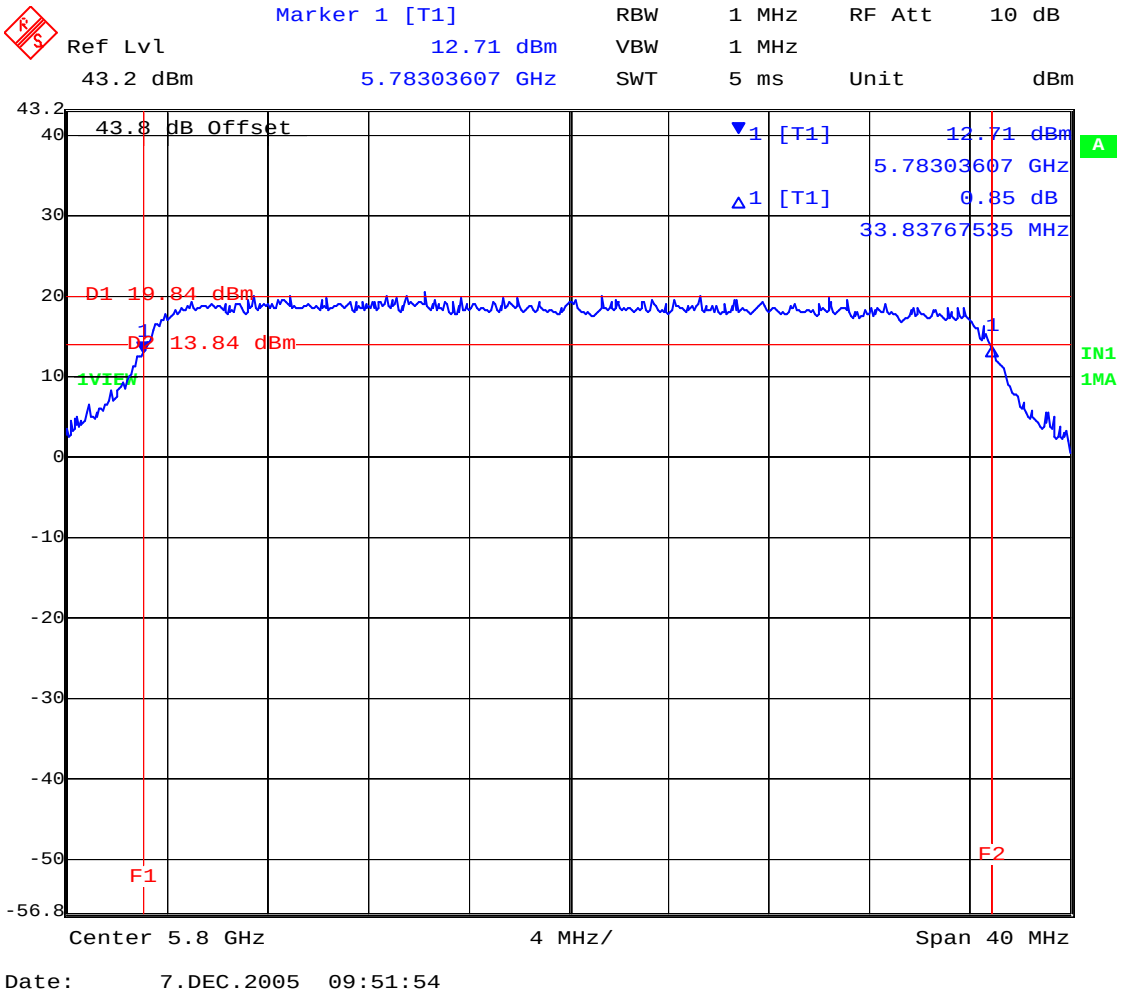
Plot 08

5,785 MHz 802.11a 99 % Bandwidth



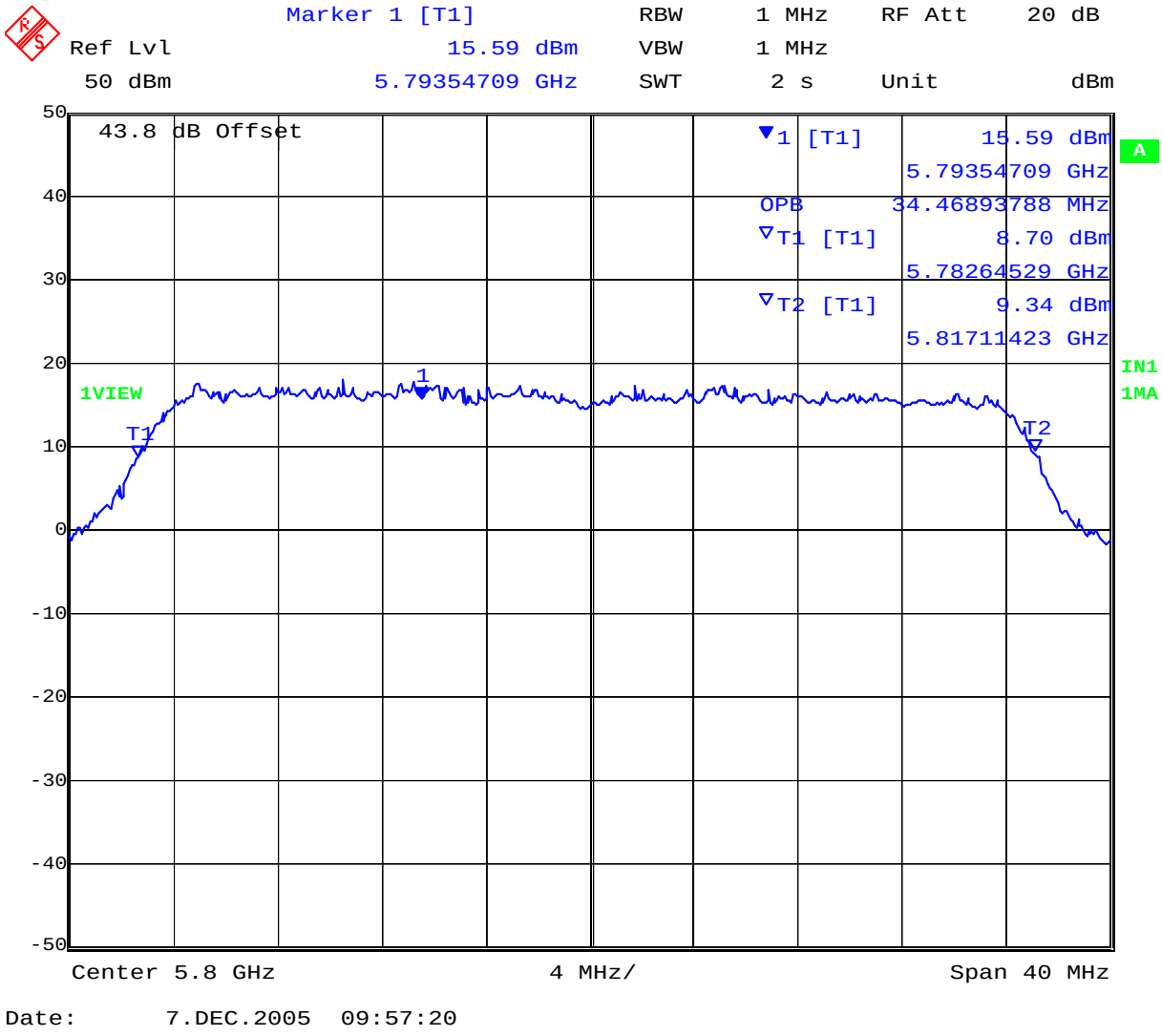
Plot 09

5,800 MHz Turbo 802.11a 6 dB Bandwidth



Plot 10

5,800 MHz 802.11a Turbo 99% Bandwidth



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

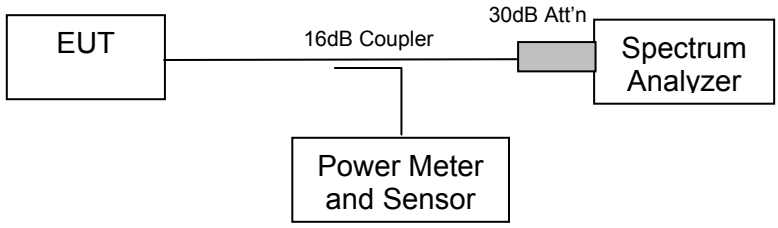
Method	Test Equipment Used
Measurements were made per work instruction WI-03 'Measurement of RF Spectrum Mask'	0158, 0193, 0252, 0313, 0314, 0070, 0116, 0117

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 resolution filter bandwidth was set to 6 dB, peak detector selected and the analyzer built-in power function was used to measure peak power over the 99 % bandwidth. Initial measurements were employed to define which data rate provided the highest output power. Measurements were made while EUT was operating in a continuous transmission mode i.e. 100 % duty cycle at the appropriate center frequency.

Test Measurement Set up



Measurement set up for Transmitter Peak Output Power

15.247 (c) Operation with directional antenna gains greater than 6 dBi

(1) Fixed point –to-point operation:

(i) Systems operating in the 2400 – 2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

(ii) Systems operating in the 5725-5850 MHz band that are used exclusively for point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

Antenna Type	Gain (dBi)	Antenna Gain >6dBi (dB)	Max. Allowable Peak Power (dBm)	Maximum EIRP (dBm)
2.4G 3ft Omni Dipole	12	6	30 – 6/3 = 28	40
2.4G 120° Sector	16.4	10.4	30 – 10.4/3 = 26.5	42.9
5.8G 2ft Omni Dipole	12	6	30	42
5.8G Patch Panel	23	17	30	53

Radio parameters.
Data Rate(s):
802.11b - 11MBit/s
802.11g – 6MBit/s, g Turbo 108MBit/s
802.11a - 6MBit/s, a Turbo 108MBit/s

Ambient conditions.

Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar
TABLE OF RESULTS – **802.11b**

Center Frequency (MHz)	99% Measurement Bandwidth (MHz)	Peak Power (dBm)	Plot #
2,412	15.7916	+28.82	On File
2,437	15.8717	+29.39	On File
2,462	15.8717	+29.90	11

Plot 11
2,462 MHz 802.11b Peak Power (dBm)

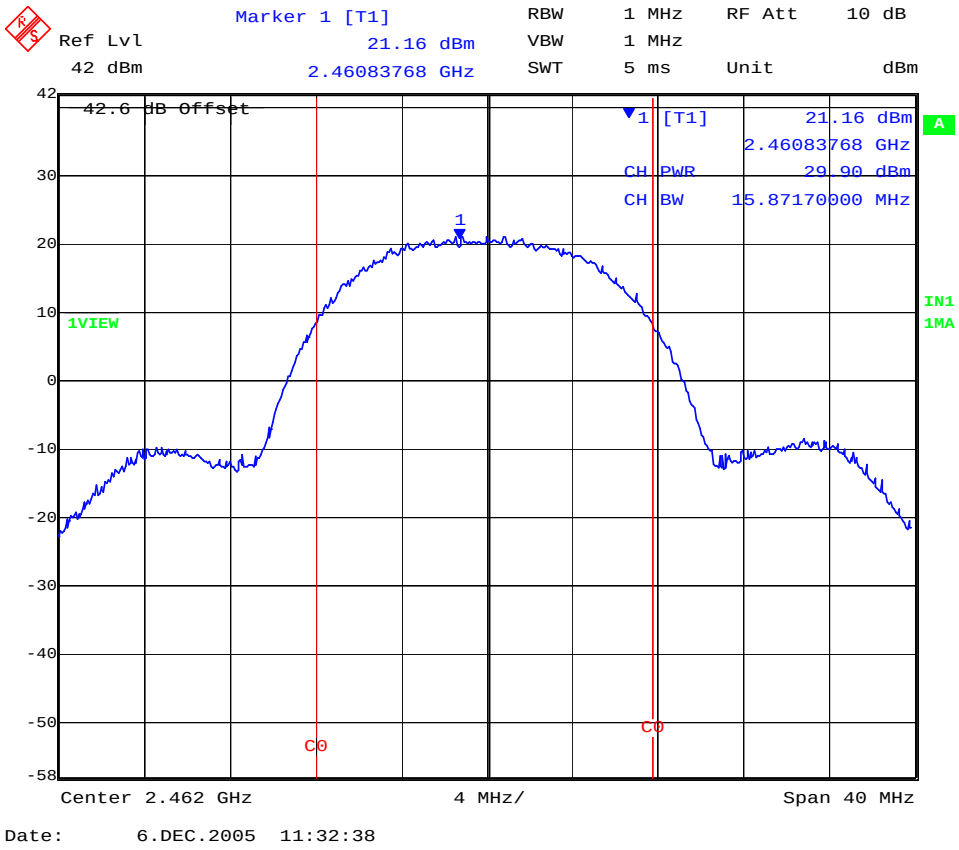


TABLE OF RESULTS – **802.11g**

Center Frequency (MHz)	99%Measurement Bandwidth (MHz)	Peak Power (dBm)	Plot #
2,412	18.4369	29.66	On File
2,437	19.4790	29.83	On File
2,462	19.3988	29.95	12

Plot 12

2,462 MHz 802.11g Peak Power (dBm)

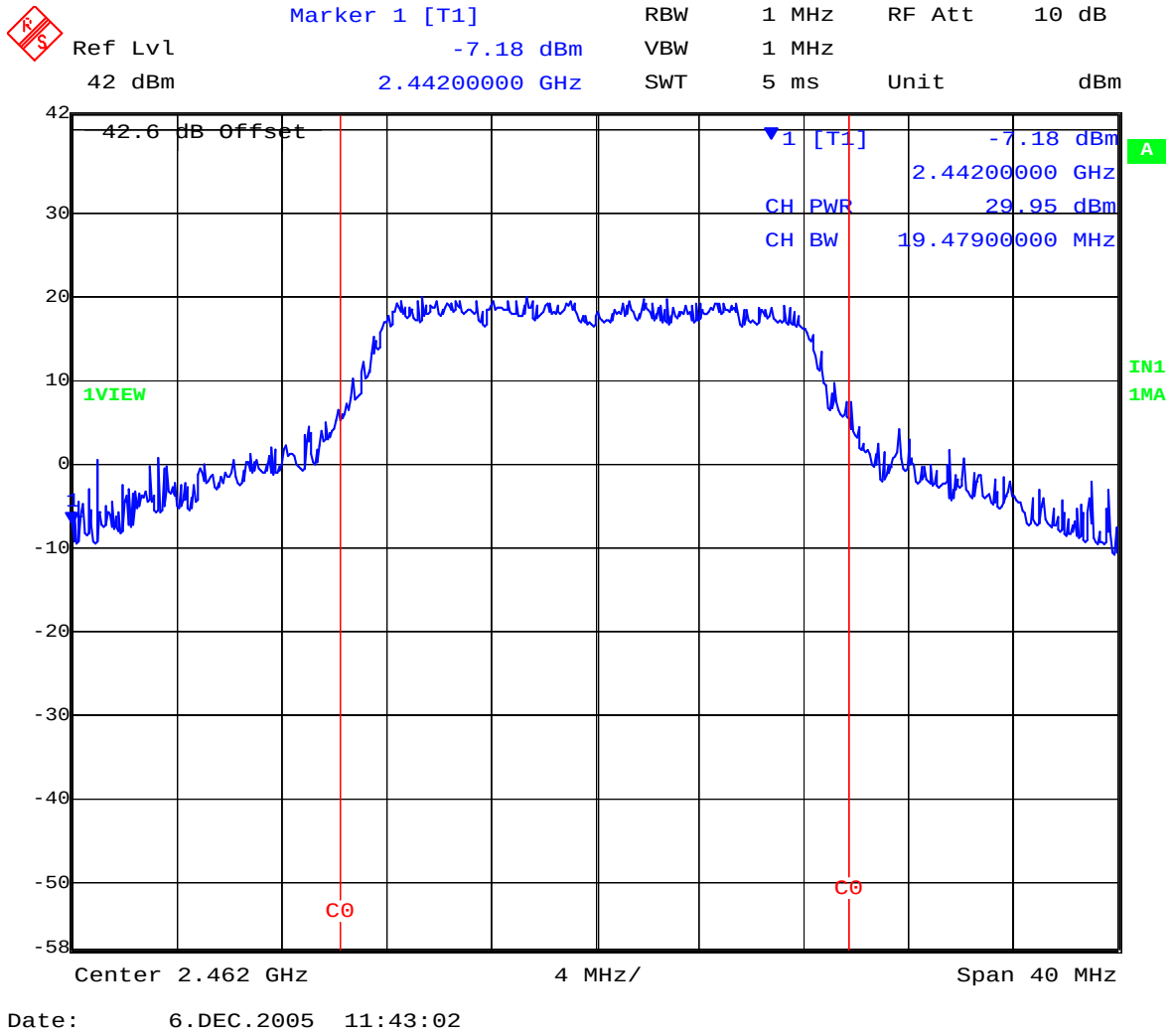


TABLE OF RESULTS – **802.11g Turbo**

Center Frequency (MHz)	99%Measurement Bandwidth (MHz)	Peak Power (dBm)	Plot #
2,437 Turbo	33.7475	27.55	13

Plot 13

2,437 MHz 802.11g Turbo Peak Power (dBm)

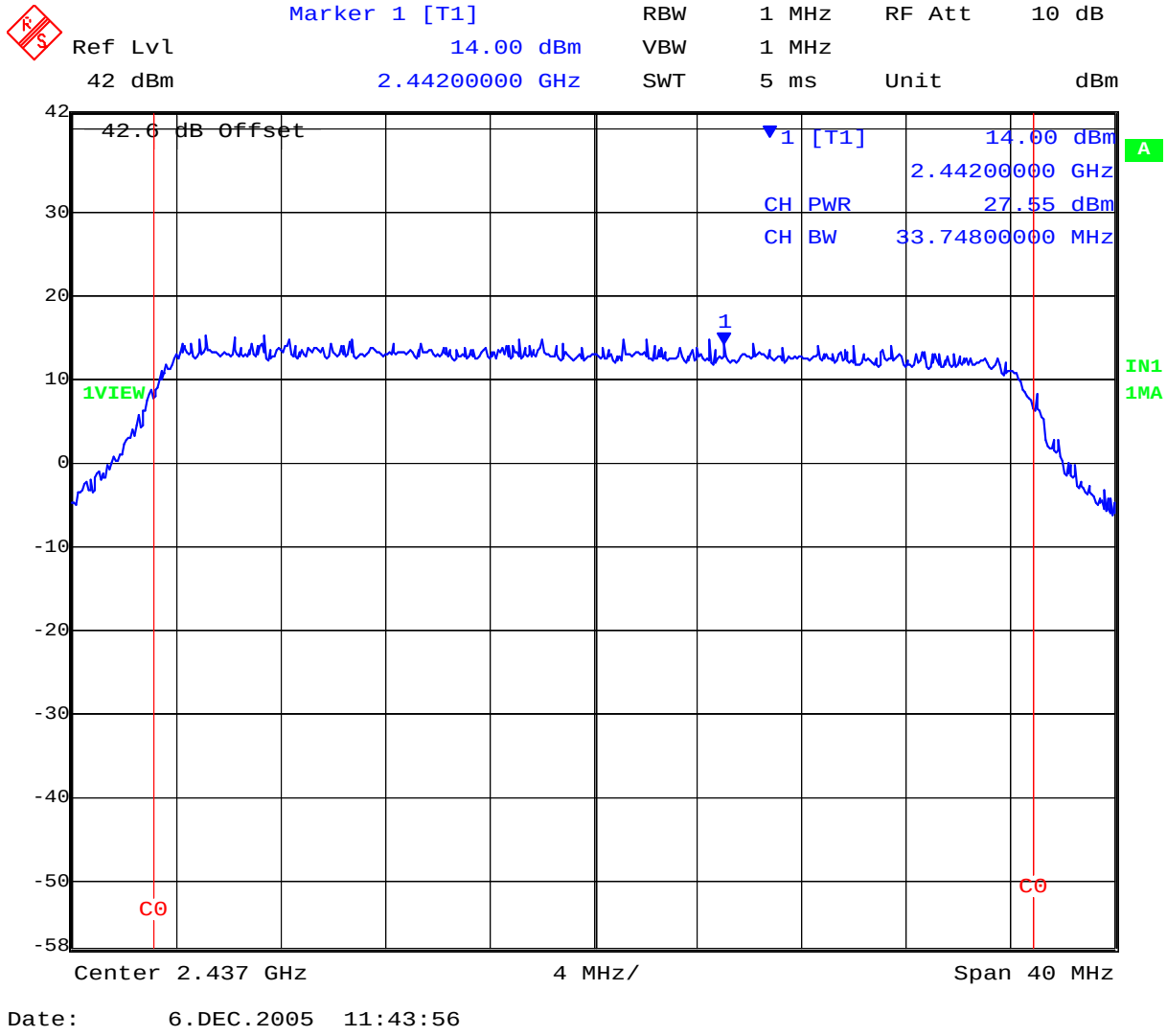


TABLE OF RESULTS – **802.11a**

Center Frequency (MHz)	99% Measurement Bandwidth (MHz)	Peak Power (dBm)	Plot #
5,745	19.489	29.95	14
5,785	19.489	29.71	On File
5,825	19.489	29.80	On File

Plot 14

5,745 MHz 802.11a Peak Power (dBm)

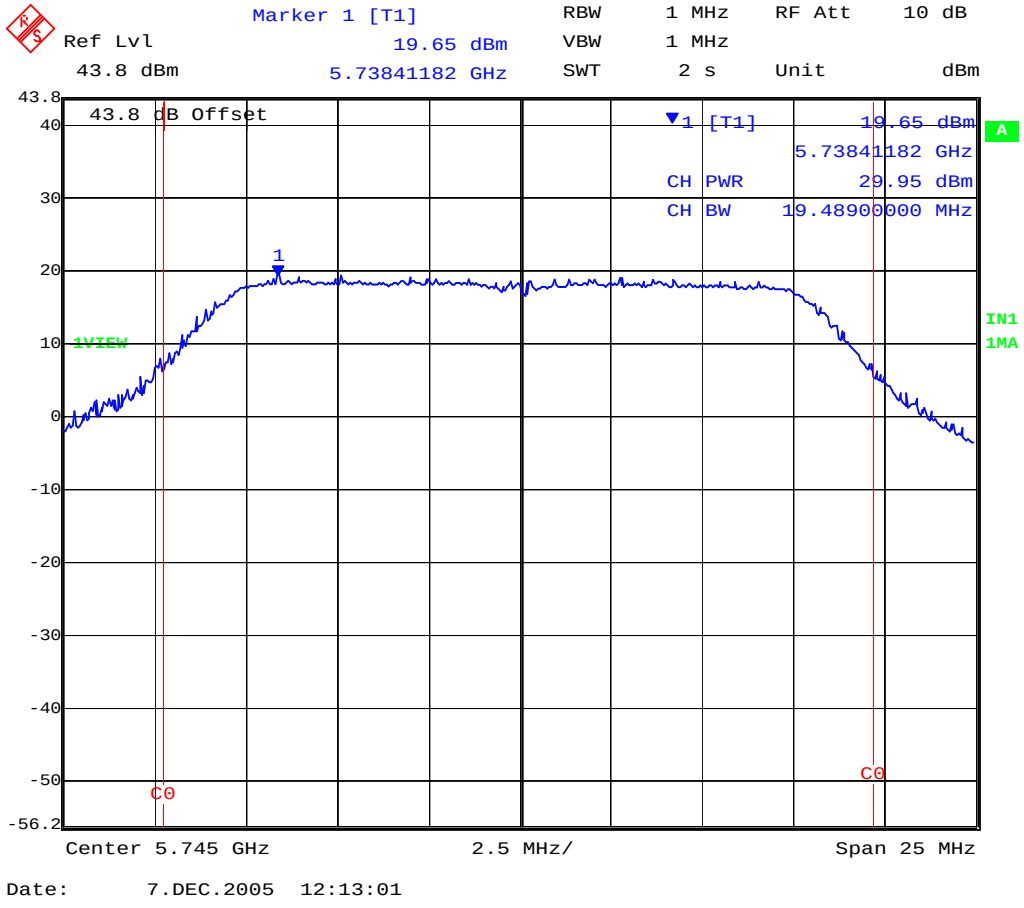
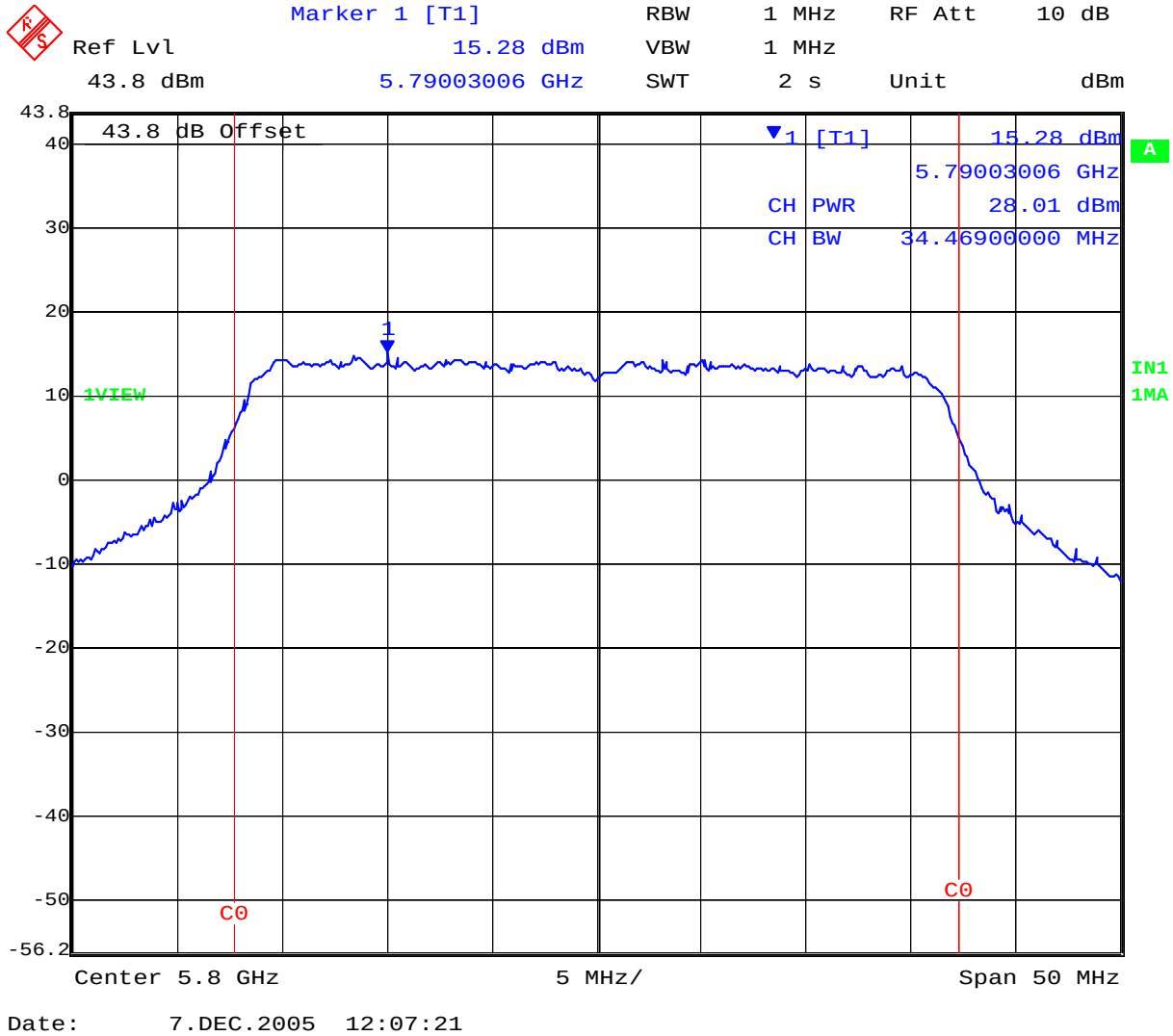


TABLE OF RESULTS – **802.11a Turbo**

Center Frequency (MHz)	99% Measurement Bandwidth (MHz)	Peak Power (dBm)	Plot #
5,800 Turbo	34.469	28.01	15

Plot 15

5,800 MHz 802.11a Turbo Peak Power (dBm)



Supply Voltage Variation

The supply voltage was varied between 97.75 VAC and 132.25 VAC. The system operated as intended at either extreme with no change in the above measurement bandwidths.

Equipment Peak Power Settings

Testing was concluded with the following peak power settings;

Antenna Type	Gain (dBi)	Max. Allowable Peak Power (dBm)	Maximum Peak Power Levels (derived as a result of testing) (dBm)		
			802.11b	802.11g	802.11a
2.4G 3ft Omni Dipole	12	+28	+27.0	+27.0[1]	--
2.4G 120° Sector	16.4	+26.5	+24.0	+24.0[1]	--
5.8G 2ft Omni Dipole	12	+30	--	--	+29.95[2]
5.8G Patch Panel	23	+30	--	--	+29.95[3]

[1]includes RF Linx band pass filter Model # 2400BPF-8-FB, see Appendix A

[2] For mid-channels only. The maximum peak power level on the upper and lower channels (149 and 165) is +28.0 dBm.

[3] Band pass filter Manufacturer: K&L Part #: 6C50-5787.5/U120-N/N was used to attain the stated power levels, see Appendix A

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

Traceability

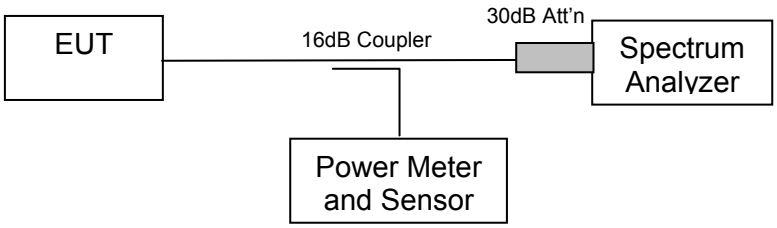
Method	Test Equipment Used
Measurements were made per work instruction WI-01 'Measuring RF Output Power'	0158, 0193, 0252, 0313, 0314, 0070, 0116, 0117

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 => 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. Spectrum analyzer settings:

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

Radio parameters.
Data Rate(s):
802.11b - 11MBit/s
802.11g – 6MBit/s, g Turbo 108MBit/s
802.11a - 6MBit/s, a Turbo 108MBit/s

TABLE OF RESULTS – **802.11b**

Center Frequency (MHz)	Peak Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dBm)	Plot #
2,412	2,411.99699	+3.82	+8	-4.18	On File
2,437	2,436.99499	+7.32	+8	-0.68	16
2,462	2,461.99699	+5.14	+8	-2.86	On File

Plot 16
2,437 MHz 802.11b Peak Power Spectral Density

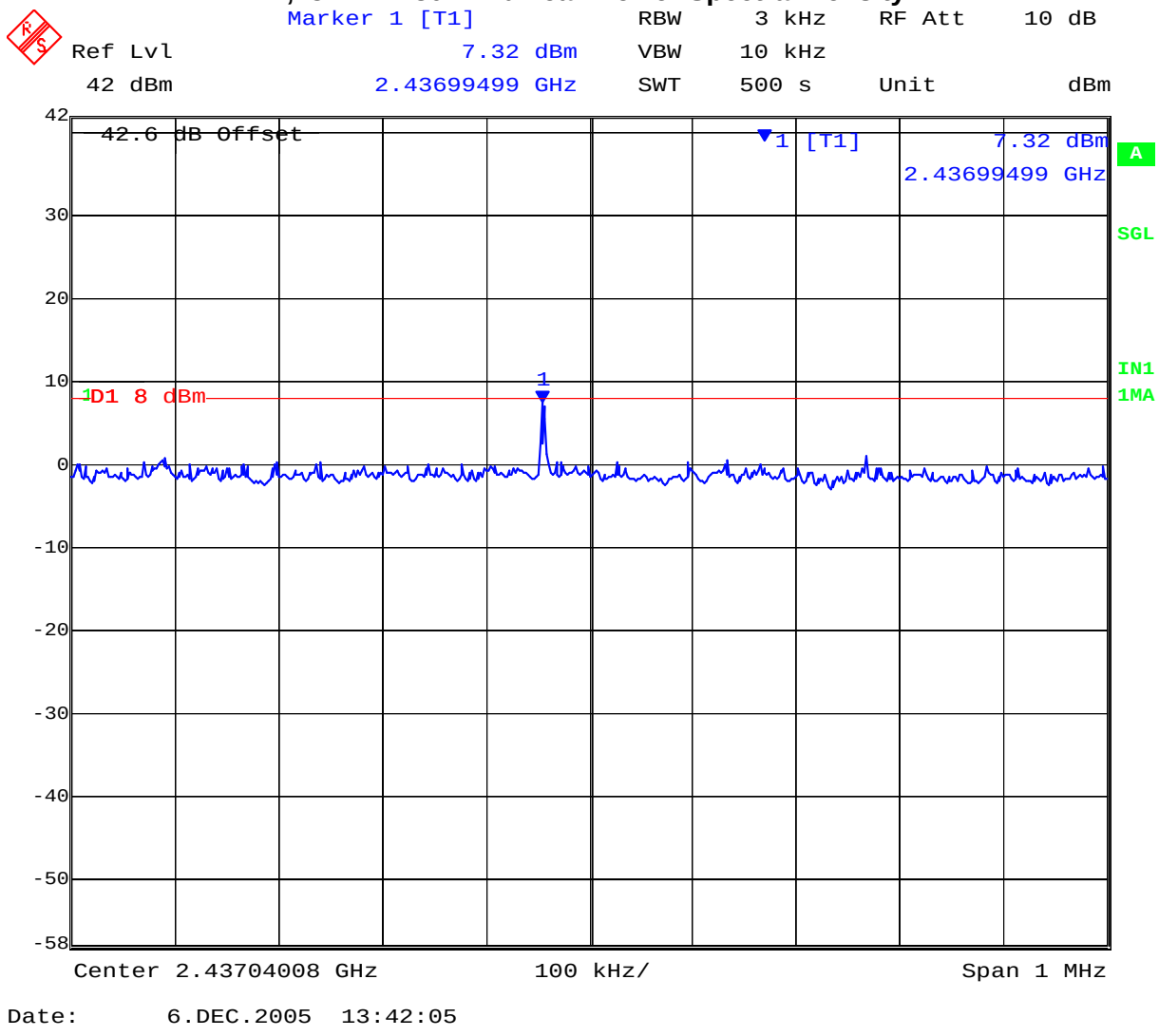
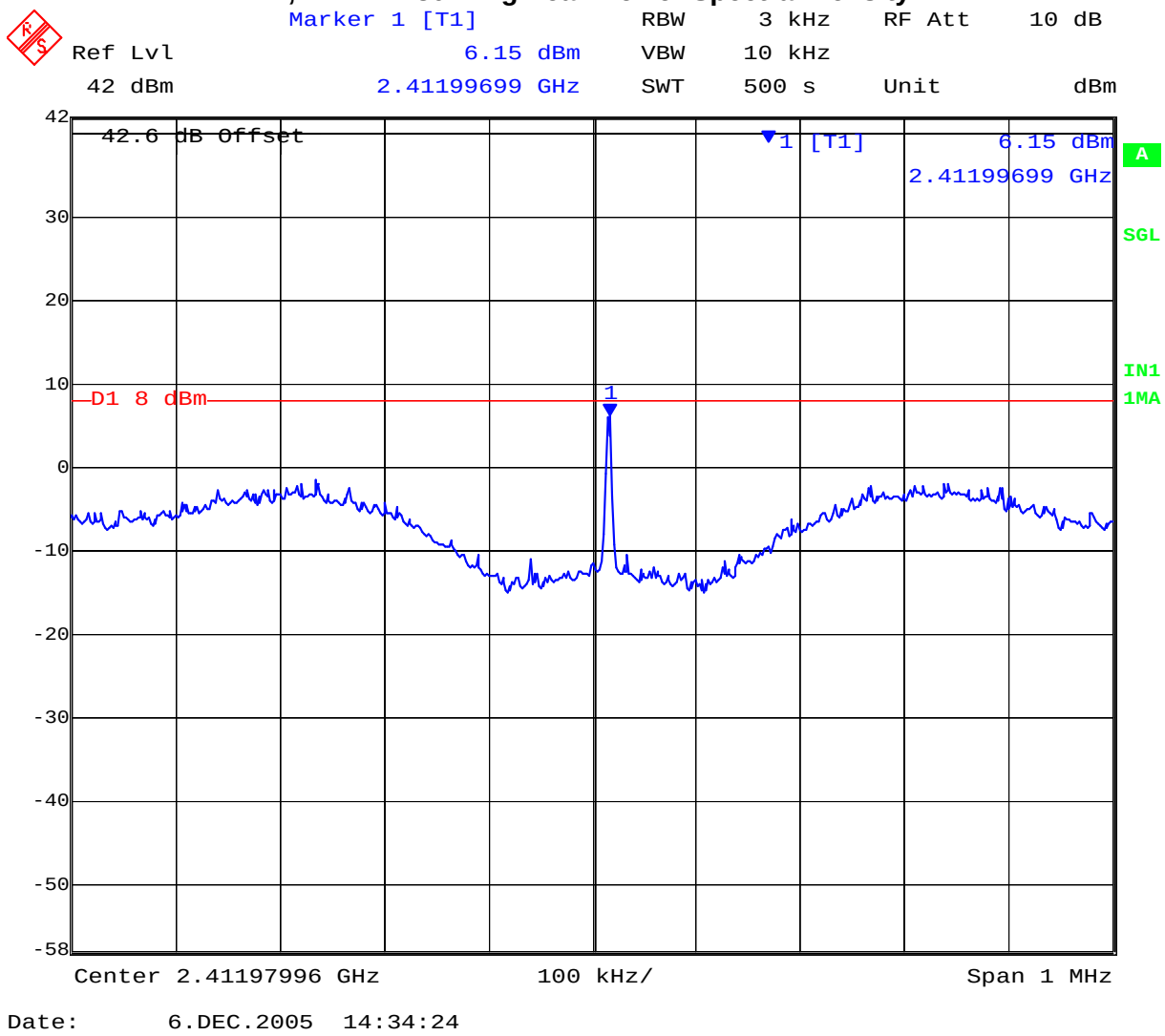


TABLE OF RESULTS – **802.11g**

Center Frequency (MHz)	Peak Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dBm)	Plot #
2,412	2,411.99699	+6.15	+8	-1.85	17
2,437	2,436.99699	+1.11	+8	-6.89	On File
2,462	2,461.99599	+1.58	+8	-6.42	On File
2,437 Turbo	2,436.99699	-0.76	+8	-8.76	18

Plot 17
2,412 MHz 802.11g Peak Power Spectral Density



Plot 18
2,437 MHz 802.11g Turbo Peak Power Spectral Density

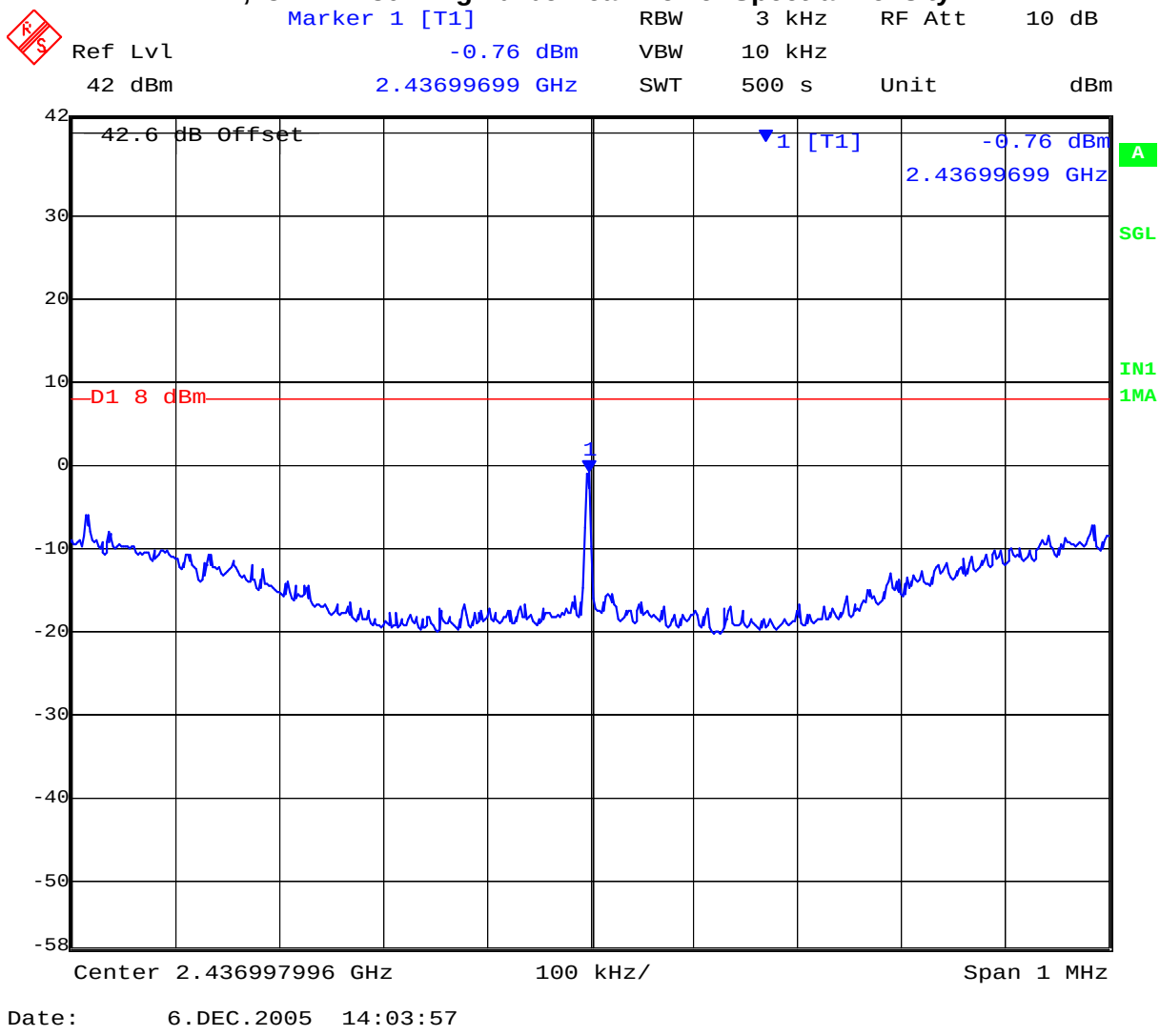
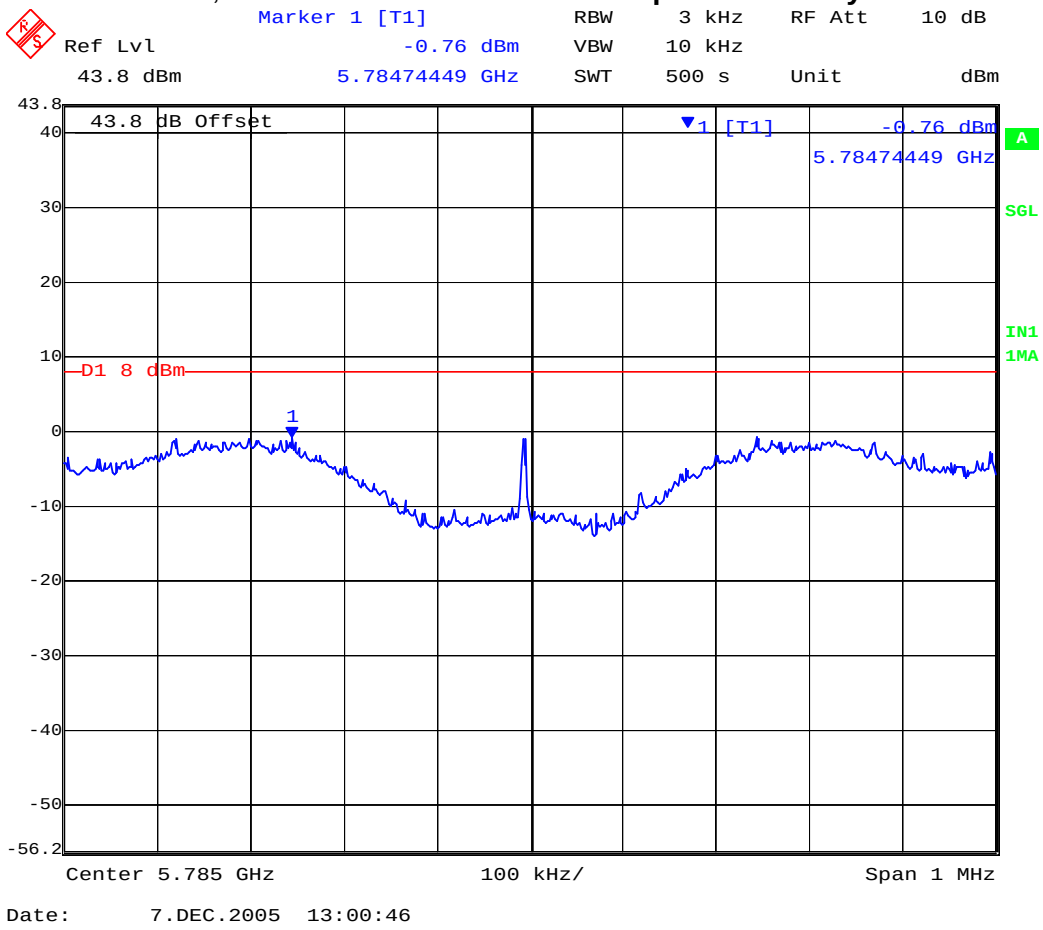


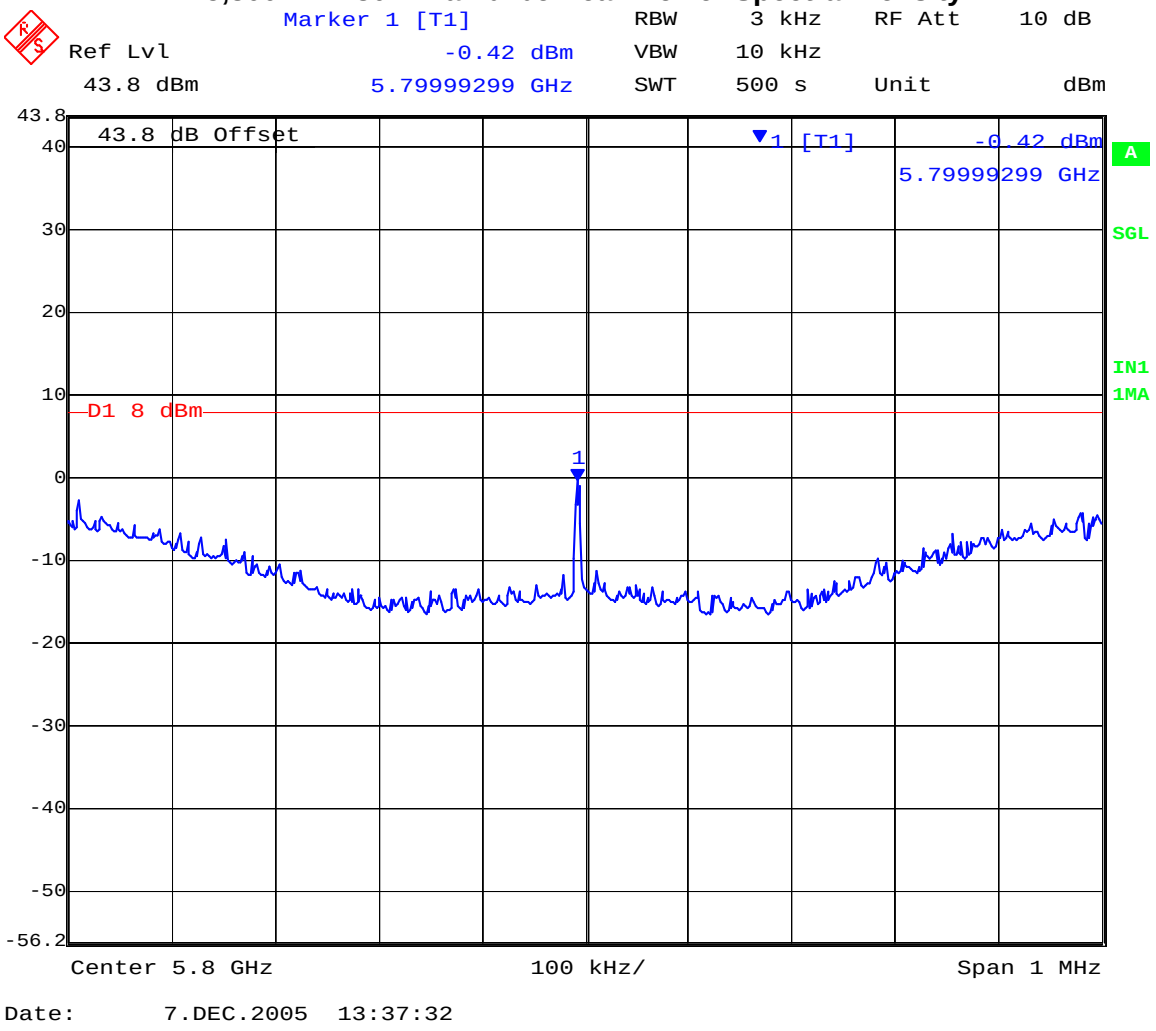
TABLE OF RESULTS – **802.11a 54Mbit/s**

Center Frequency (MHz)	Peak Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dBm)	Plot #
5,745 Note 1	5,744.74248	-1.02	+8	-9.02	On File
5,785	5,784.74449	-0.76	+8	-8.76	19
5,825	5,825.24349	-1.23	+8	-9.23	On File
5,800 Turbo	5,799.99299	-0.42	+8	-8.42	20

Plot 19
5,785 **MHz 802.11a Peak Power Spectral Density**



Plot 20
5,800 MHz 802.11a Turbo Peak Power Spectral Density



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

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/cm^2) = EIRP/(4πd^2)

EIRP = P * G

P = Peak output power (mW)

G = Antenna numeric gain (numeric)

d = Separation distance (cm)

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

Worst case = 2.4 GHz +26.9 dBm 12 dBi (15.9 num.), +23.9 dBm 16.4 dBi (43.7 num.)

5.8 GHz +29.8 dBm 23 dBi (199.53 num.), 29.8 dBm, 12 dBi (15.9 num.)

Because the EUT belongs to the General Population/Uncontrolled Exposure the limit of power density is 1.0 mW/cm^2

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)
2.4	12	15.85	+26.9	489.8	24.9
2.4	16.4	43.65	+23.9	245.5	29.2
5.8	12	15.85	+29.8	955.0	34.7
5.8	23	199.53	+29.8	955.0	123.1

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.

Limit S = 1mW / cm^2 from 1.310 Table 1

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

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

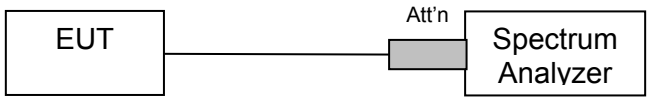
5.1.5. Conducted Spurious Emissions

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

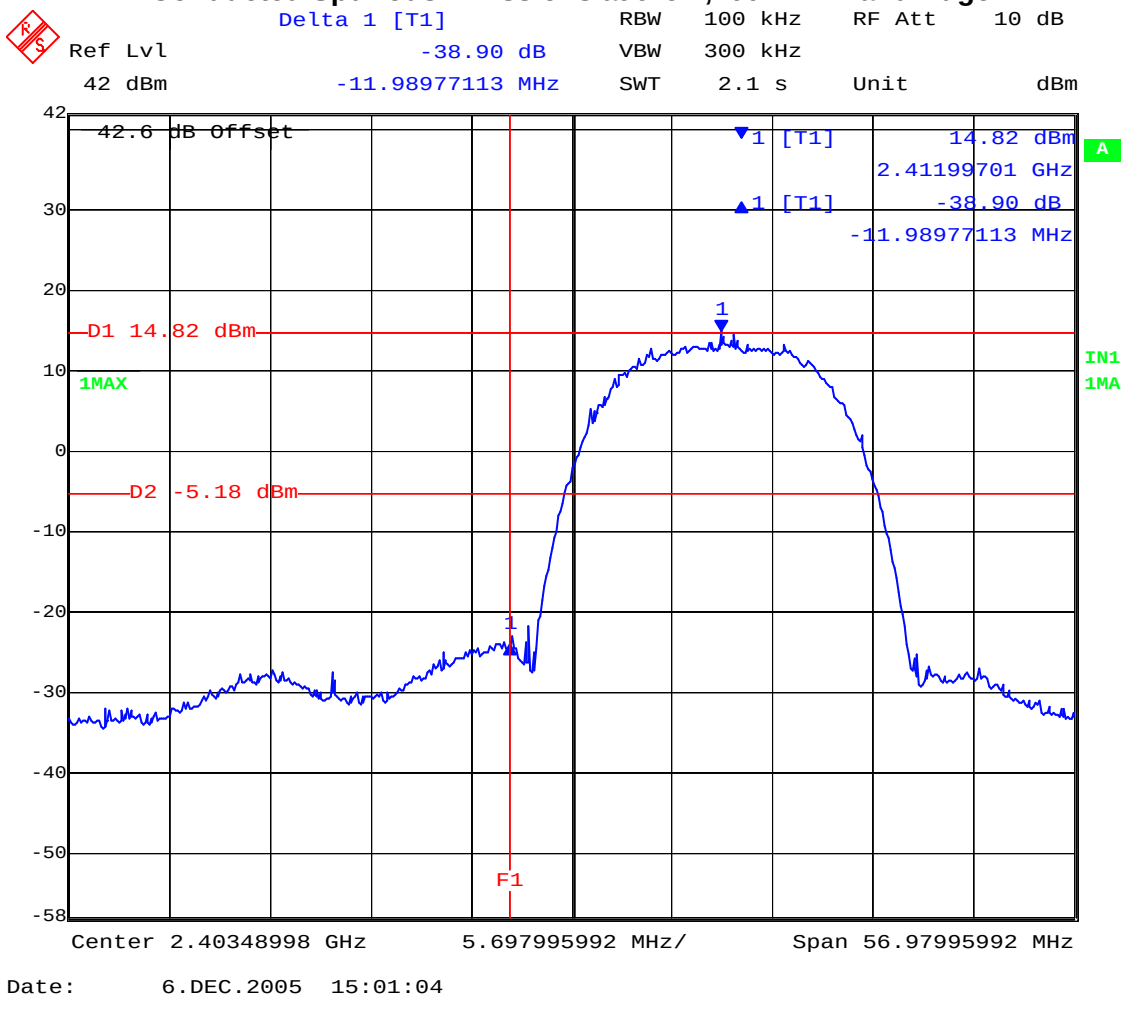
Conducted Band-Edge Results

Measurements were performed with the transmitter tuned to the channel closest to the band-edge being measured. All emissions were maximized during measurement. Limits which were derived from the band-edge measurements provided below are drawn on each plot.

TABLE OF RESULTS – **802.11b**

Center Frequency (MHz)	Band edge Frequency (MHz)	Limit (20 dB below peak of fundamental)	Amplitude @ Band edge (dBm)	Plot #	Margin (dB)
2,412	2,400	-5.18	-24.08	21	-18.90
2,462	2,483.5	-4.81	-33.33	22	-28.52

Plot 21
Conducted Spurious Emissions at the 2,400 MHz Band Edge



Plot 22
Conducted Spurious Emissions at the 2,483.5 MHz Band Edge

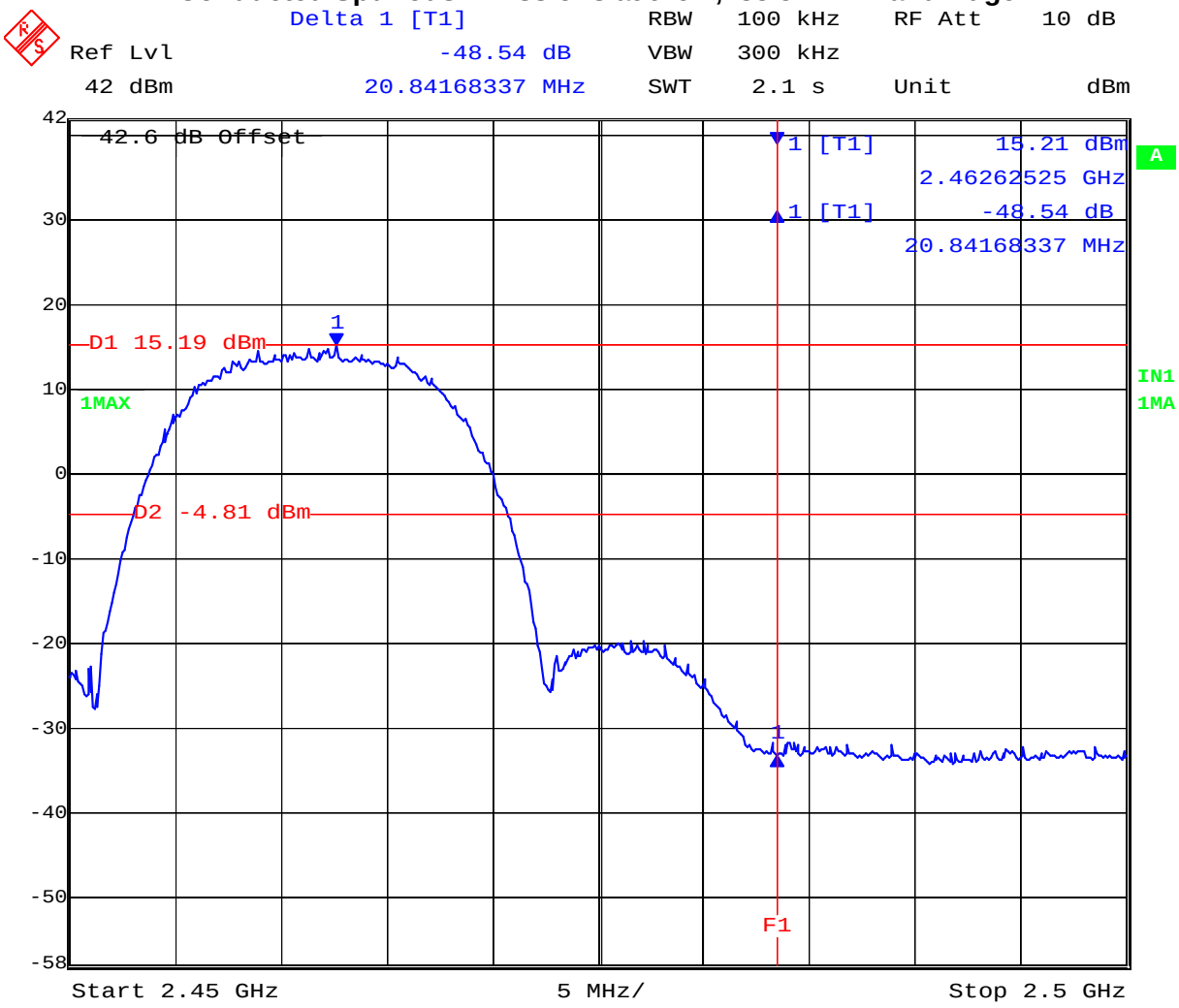
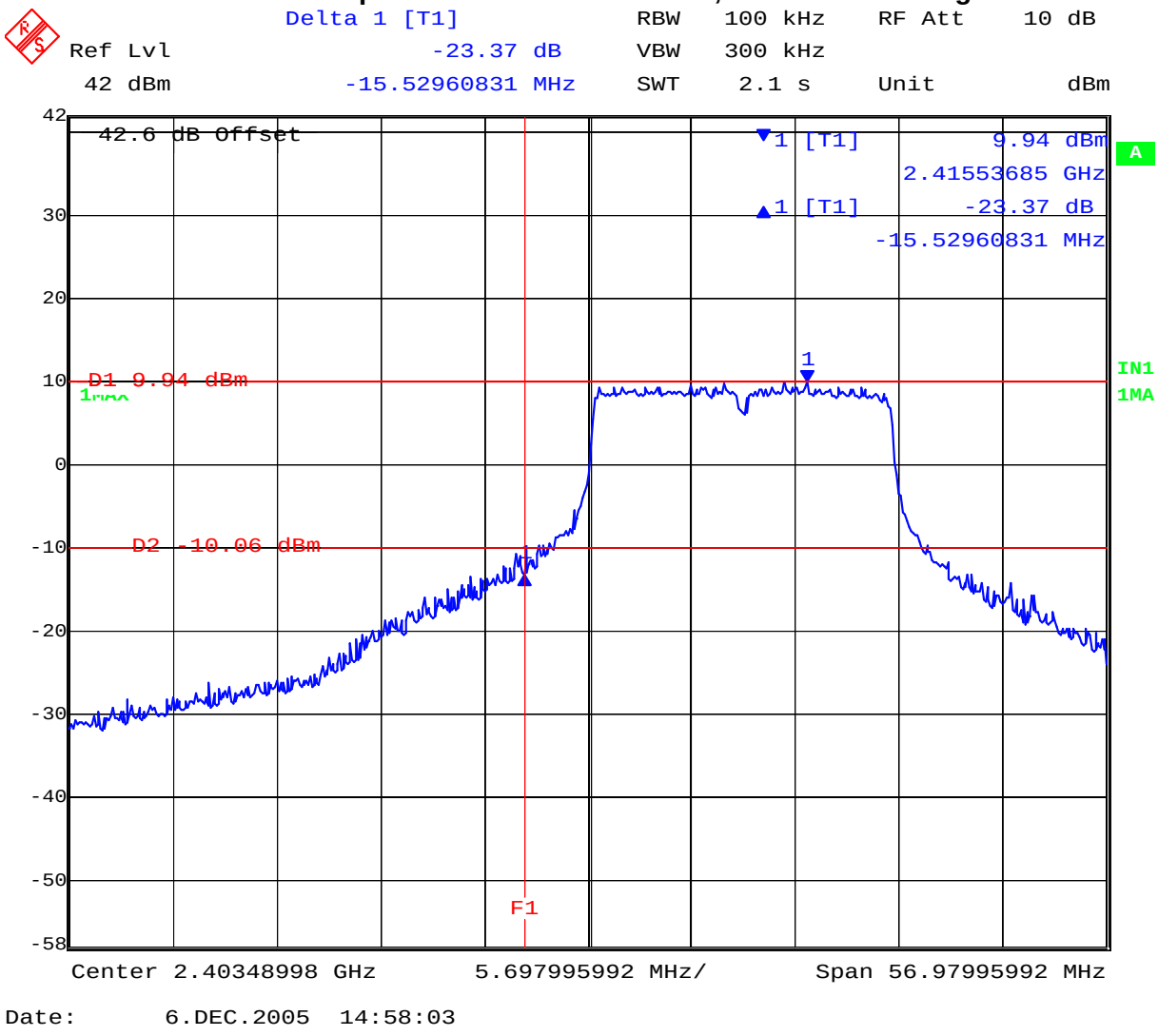


TABLE OF RESULTS – **802.11g**

Center Frequency (MHz)	Band edge Frequency (MHz)	Limit (20 dB below peak of fundamental)	Amplitude @ Band edge (dBm)	Plot #	Margin (dB)
2,412	2,400	-10.06	-13.43	23	-3.37
2,462	2,483.5	-9.34	-21.93	24	-12.59

NOTE; The transmitter power had to be reduced 1 dB for 802.11g mode from the nominal +26 dBm to +25 dBm to meet the lower band edge requirements.

Plot 23
Conducted Spurious Emissions at the 2,400 MHz Band Edge



Plot 24
Conducted Spurious Emissions at the 2,483.5 MHz Band Edge

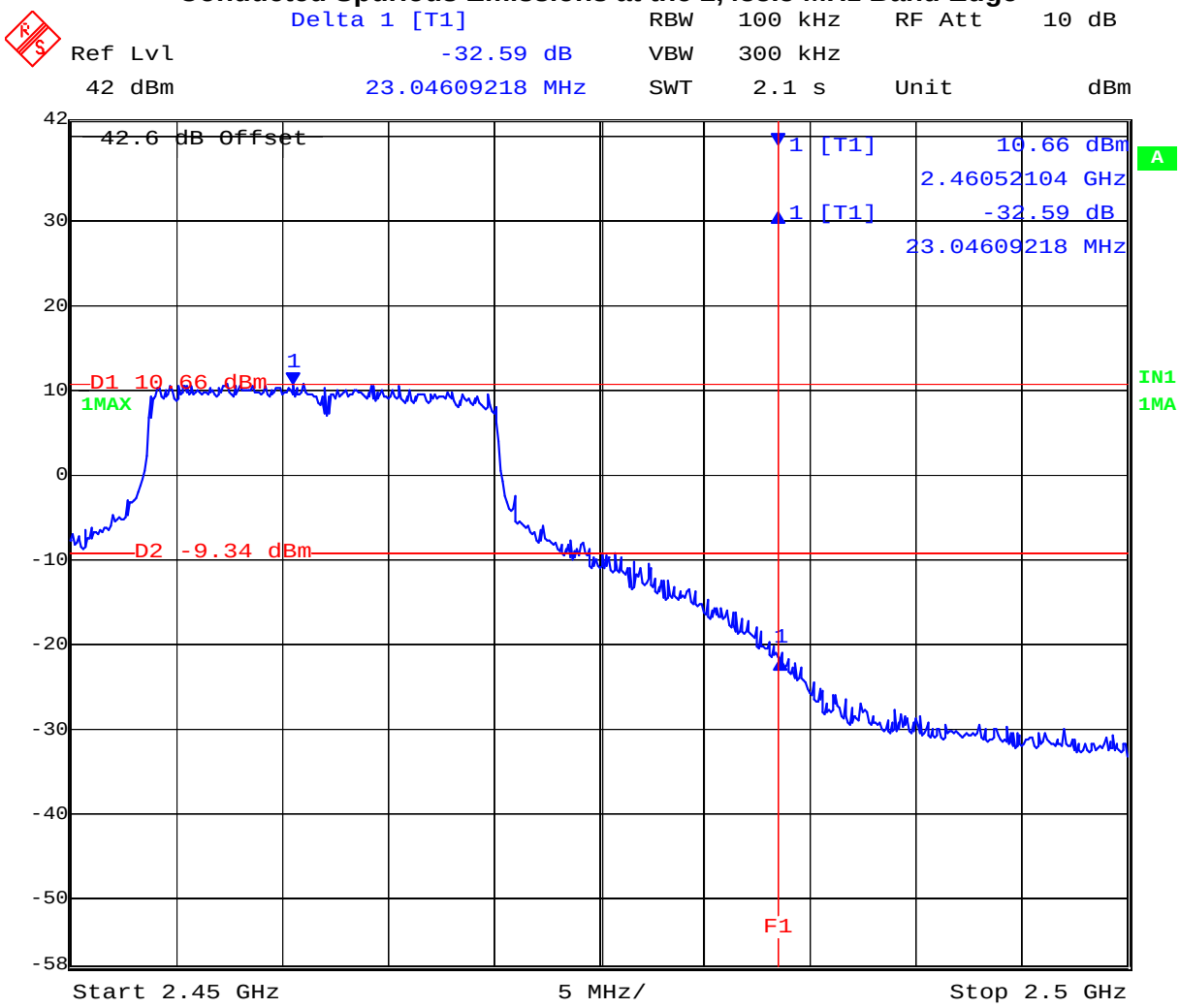
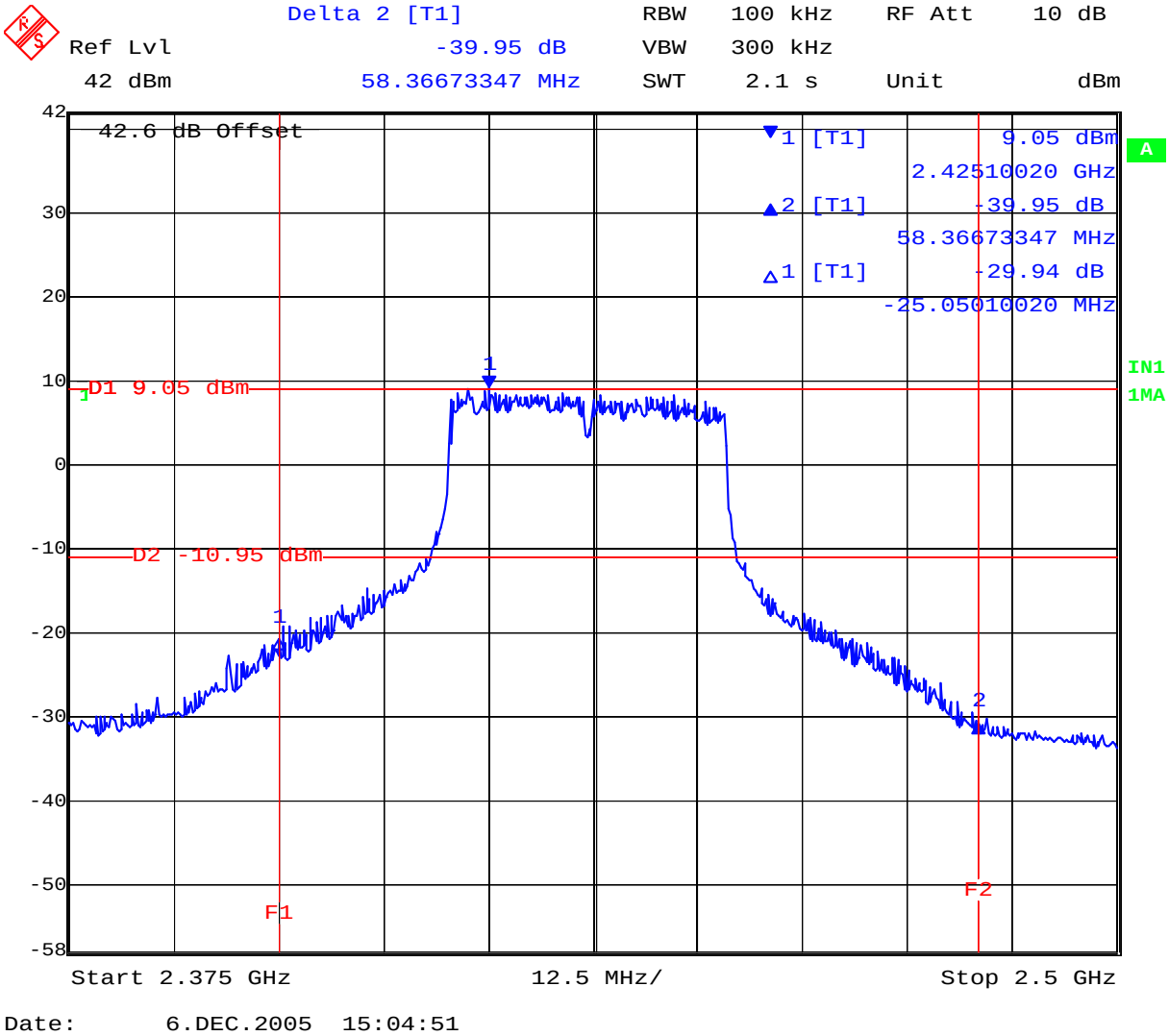


TABLE OF RESULTS – **802.11g Turbo**

Center Frequency (MHz)	Band edge Frequency (MHz)	Limit (20 dB below peak of fundamental)	Amplitude @ Band edge (dBm)	Plot #	Margin (dB)
2,437	2,400	-10.95	-20.89	25	-9.94
	2,483.5	-10.95	-30.90	25	-20.40

Plot 25
Conducted Spurious Emissions at the 2,400 MHz and 2,483.5 MHz Band Edges

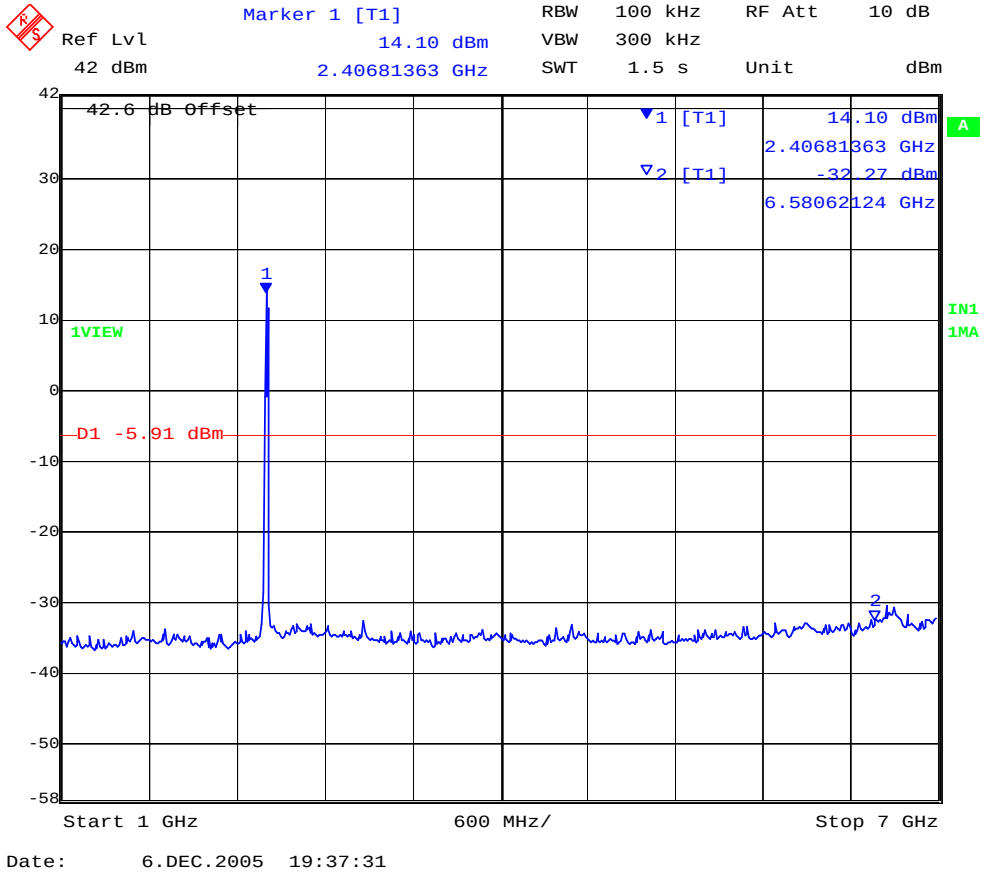


Spurious Emissions (1-26 GHz)

TABLE OF RESULTS – **802.11b**

Channel Centre Frequency (MHz)	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Plot #	Margin (dB)
2,412	1,000	7,000	-32.27	-5.91	26	-26.36
2,412	7,000	25,000	-44.17	-5.91	27	-38.26

Plot 26 802.11b
2,412 MHz Conducted Spurious Emissions 1,000 MHz to 7,000 MHz



Plot 27 802.11b
2,412 MHz Conducted Spurious Emissions 7,000 MHz to 25,000 MHz

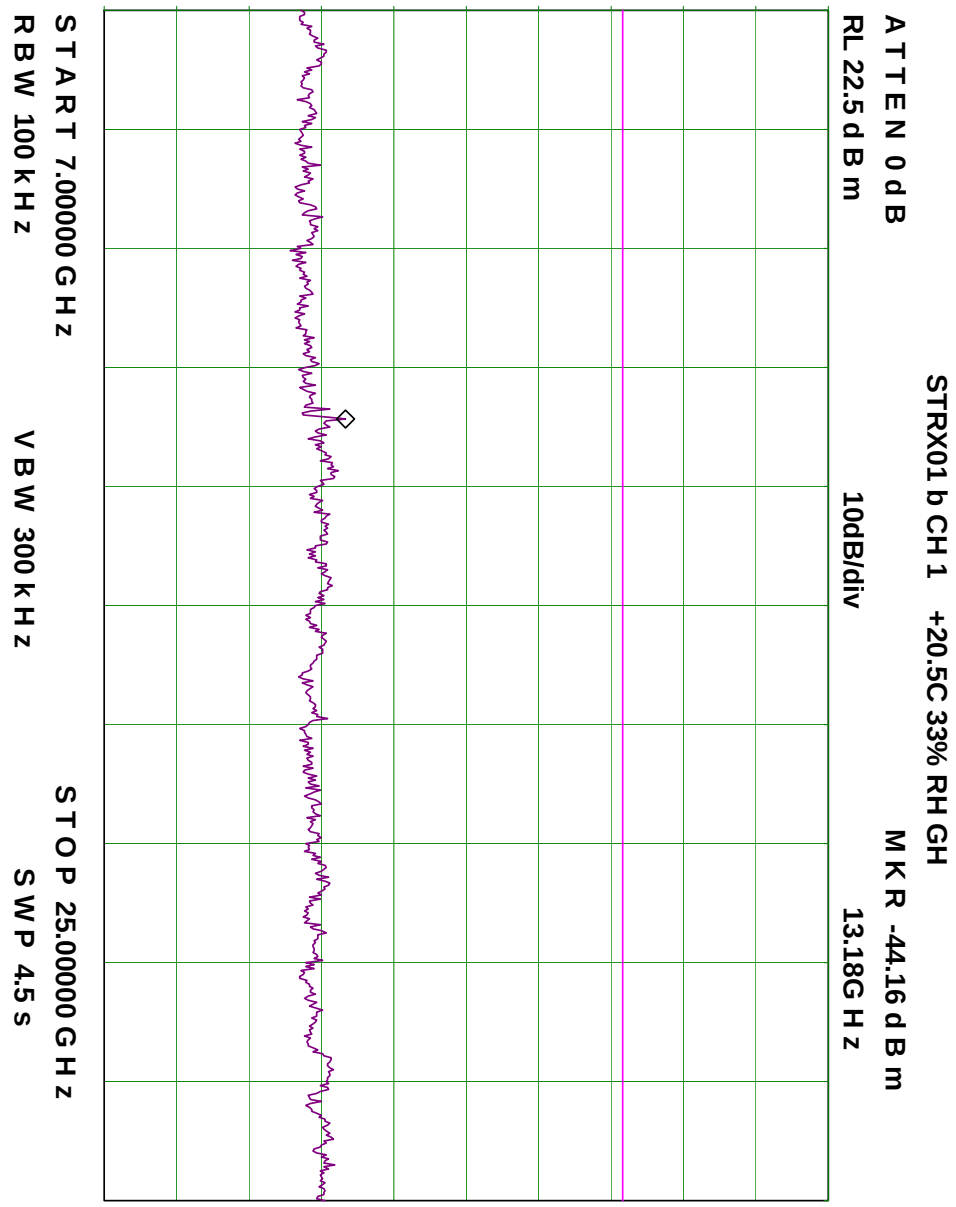
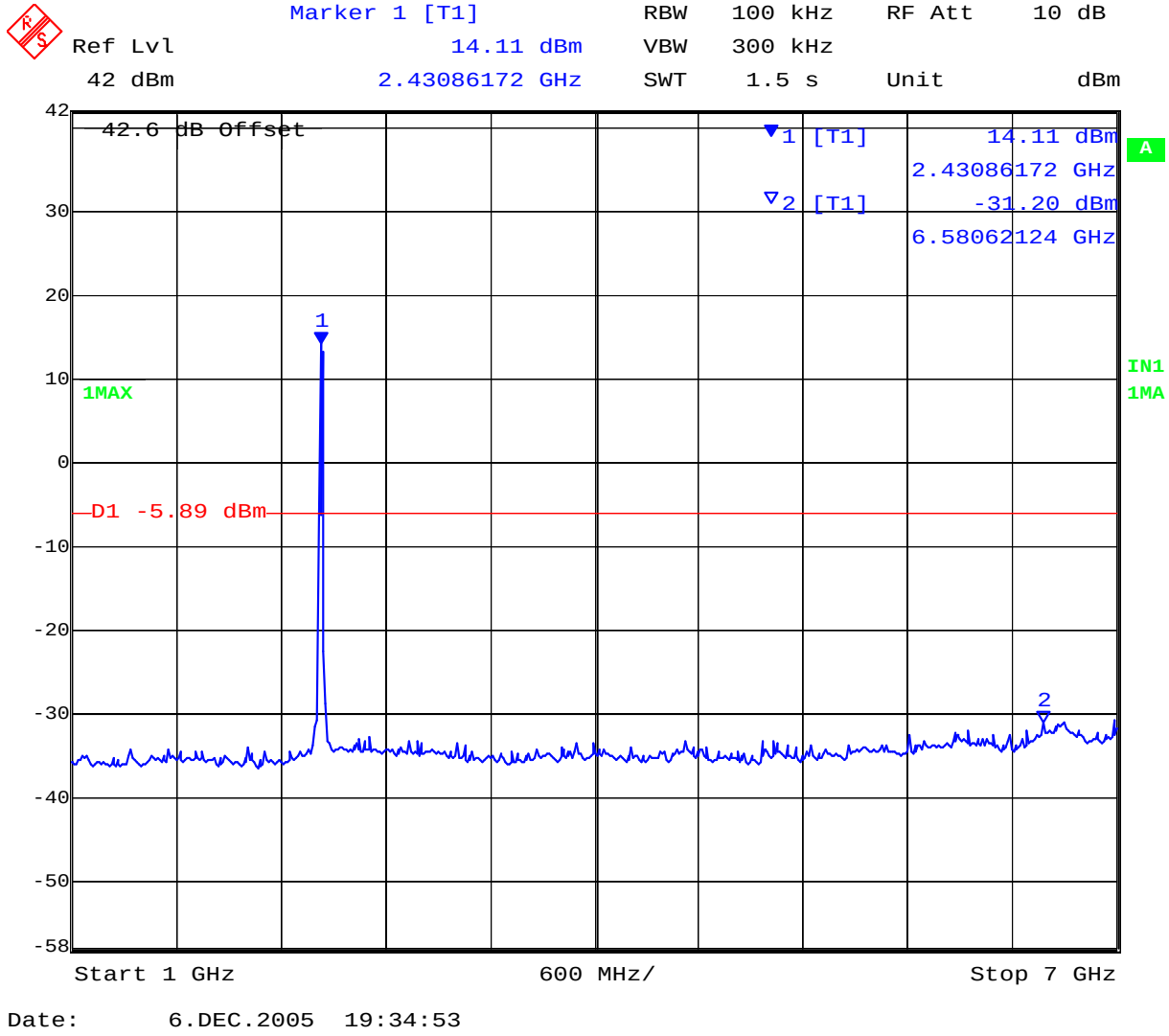


TABLE OF RESULTS – **802.11b**

Channel Centre Frequency	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Plot #	Margin (dB)
2,437	1,000	7,000	-31.20	-5.89	28	-25.31
2,437	7,000	25,000	-45.67	-5.89	29	-39.78

Plot 28 802.11b
2,437 MHz Conducted Spurious Emissions 1,000 MHz to 7,000 MHz



Plot 29 802.11b
2,437 MHz Conducted Spurious Emissions 7,000 MHz to 25,000 MHz

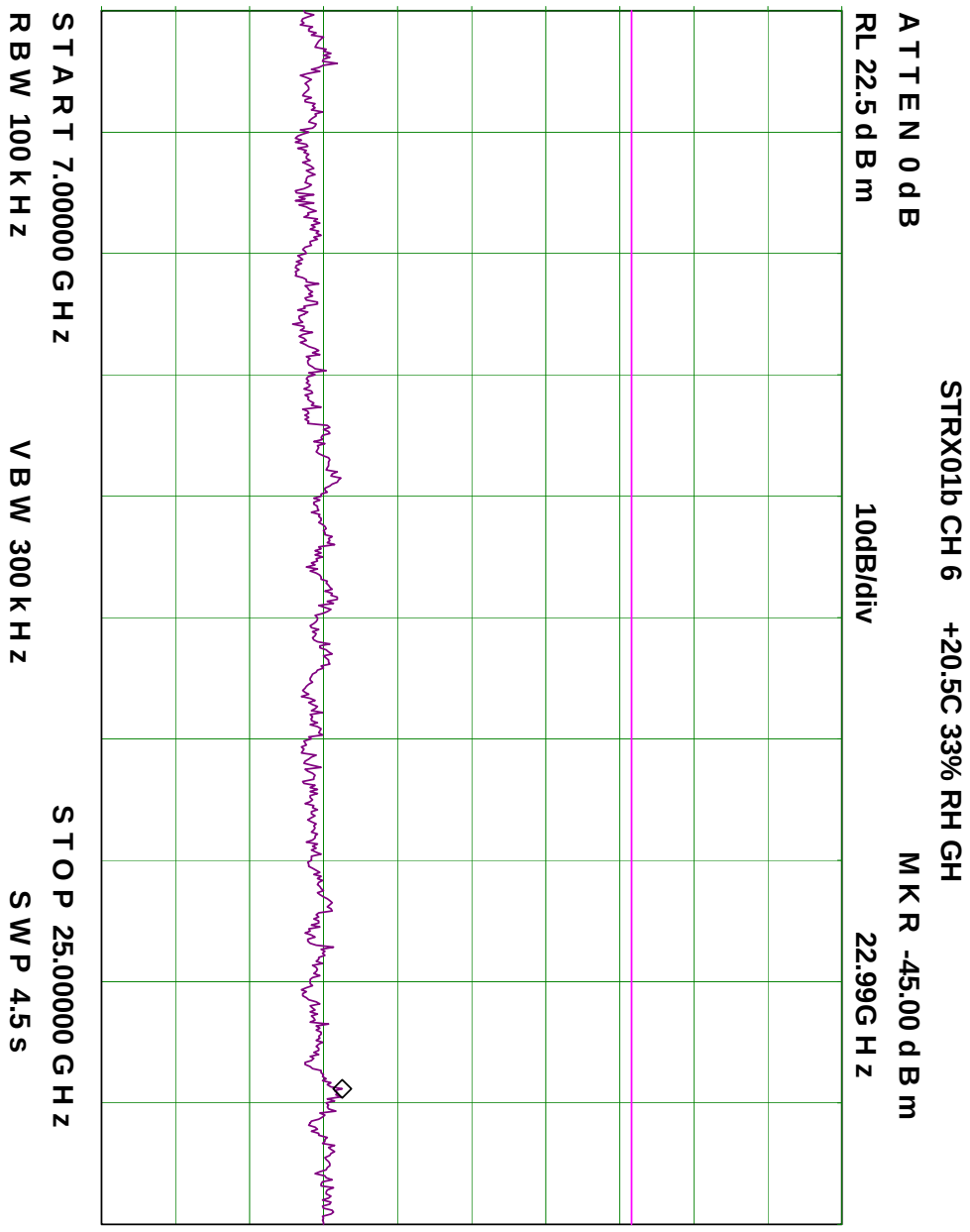
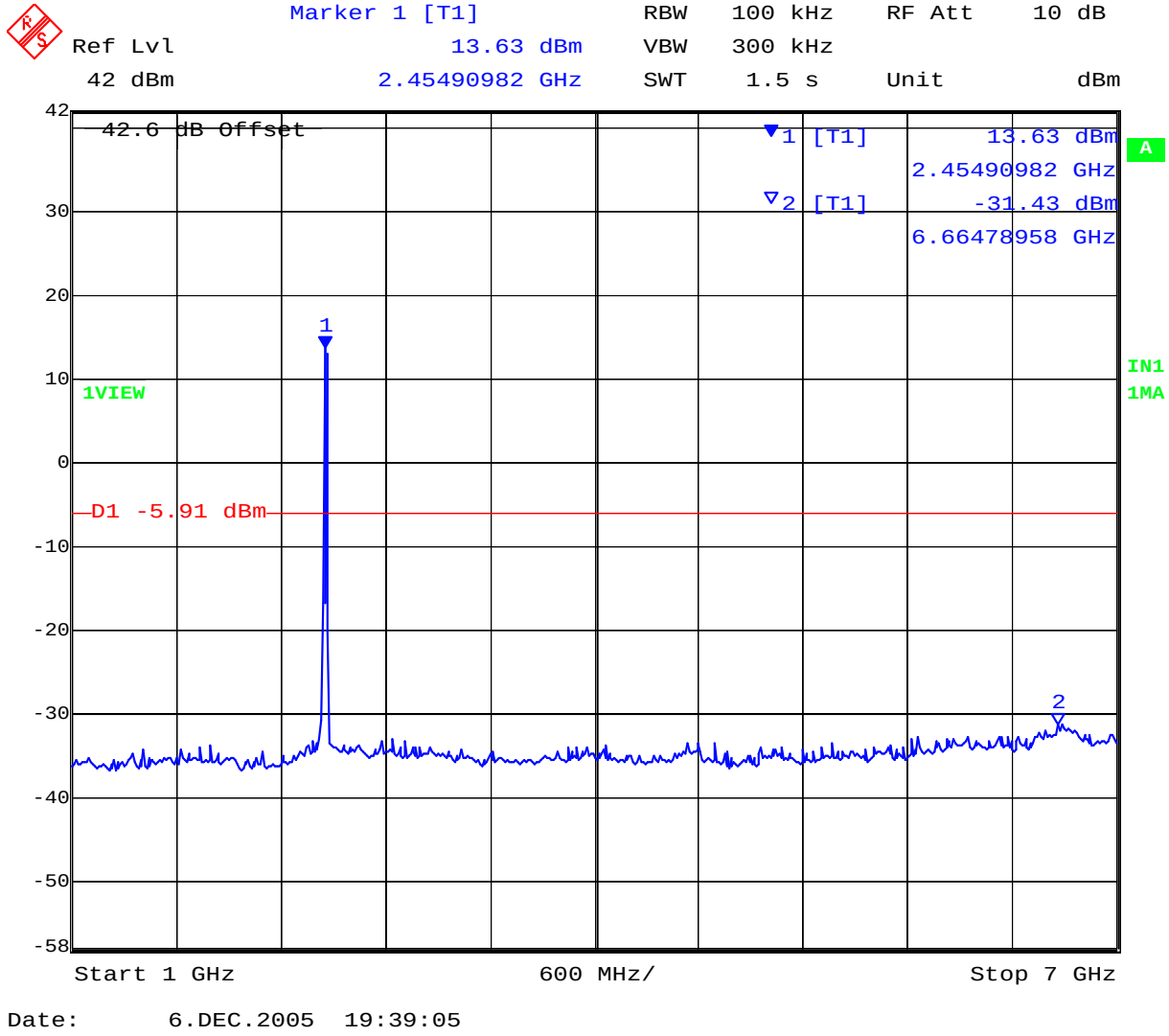


TABLE OF RESULTS – **802.11b**

Channel Centre Frequency	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Plot #	Margin (dB)
2,462	1,000	7,000	-31.43	-5.91	30	-25.52
2,462	7,000	25,000	-45.33	-5.91	31	-39.42

Plot 30 802.11b
2,462 MHz Conducted Spurious Emissions 1,000 MHz to 7,000 MHz



Plot 31 802.11b
2,462 MHz Conducted Spurious Emissions 7,000 MHz to 25,000 MHz

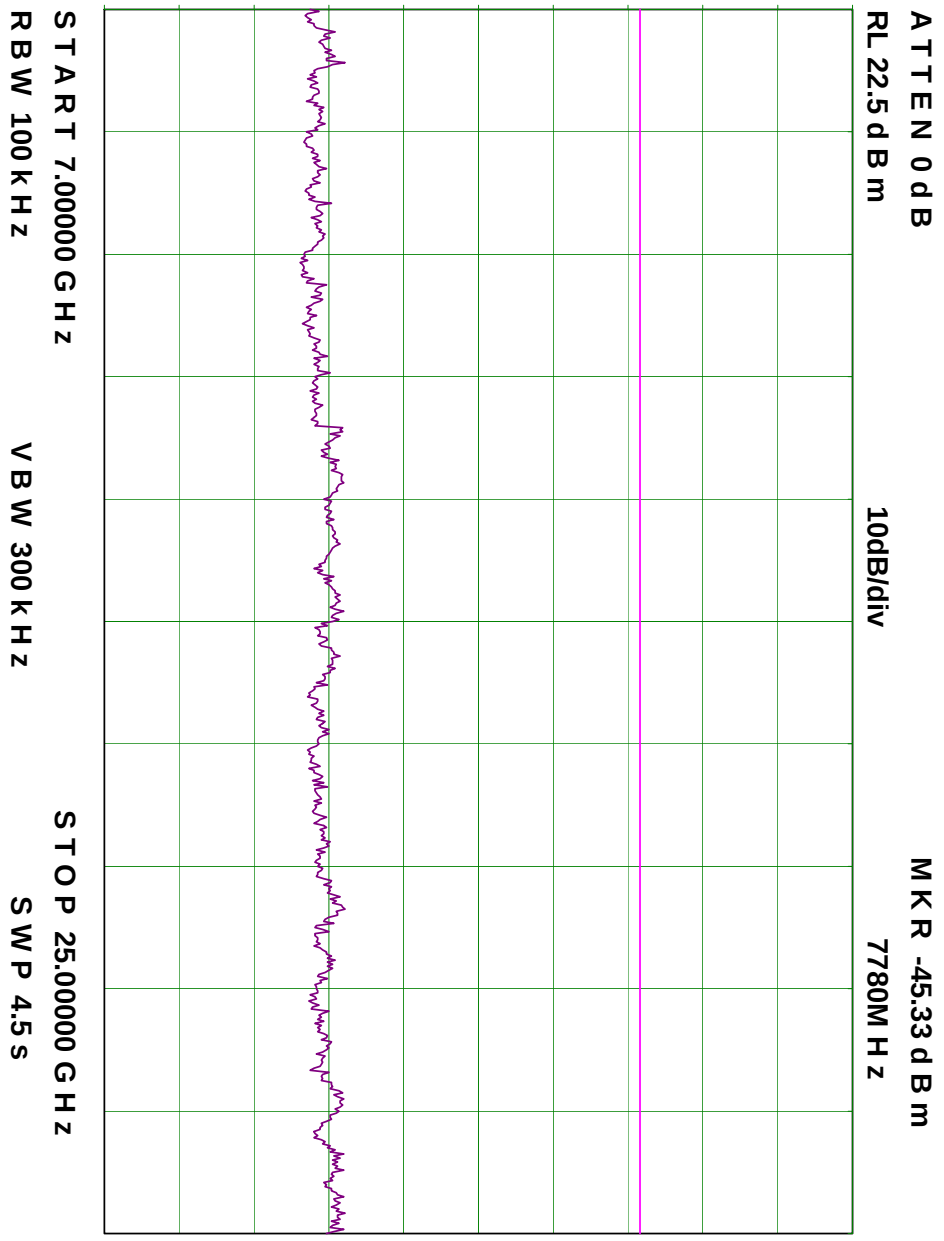
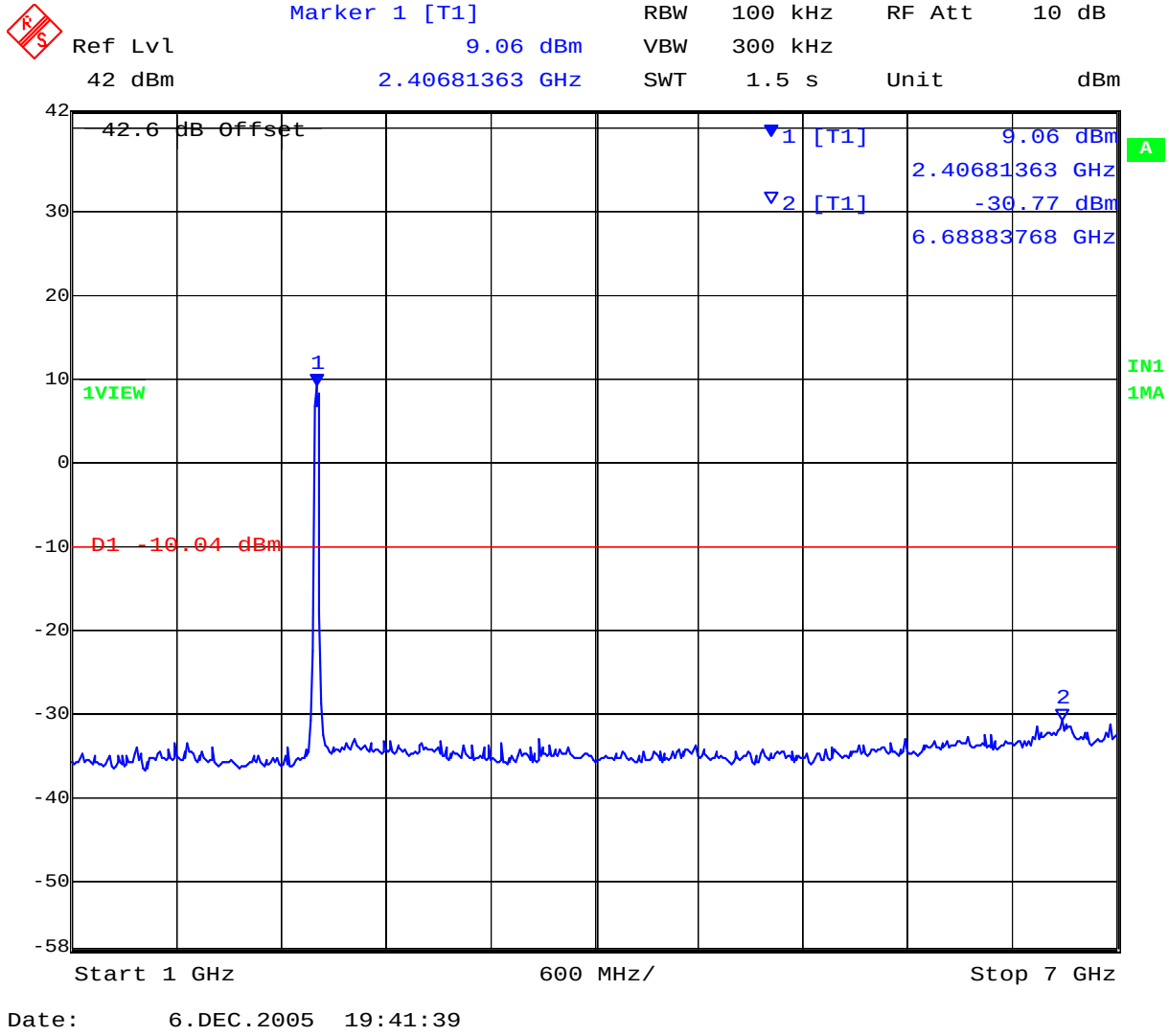


TABLE OF RESULTS – **802.11g**

Channel Centre Frequency	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Plot #	Margin (dB)
2,412	1,000	7,000	-30.77	-10.04	32	-20.73
2,412	7,000	25,000	-45.67	-10.04	33	-35.63

Plot 32 802.11g
2,412 MHz Conducted Spurious Emissions 1,000 MHz to 7,000 MHz



Plot 33 802.11g
2,412 MHz Conducted Spurious Emissions 7,000 MHz to 25,000 MHz

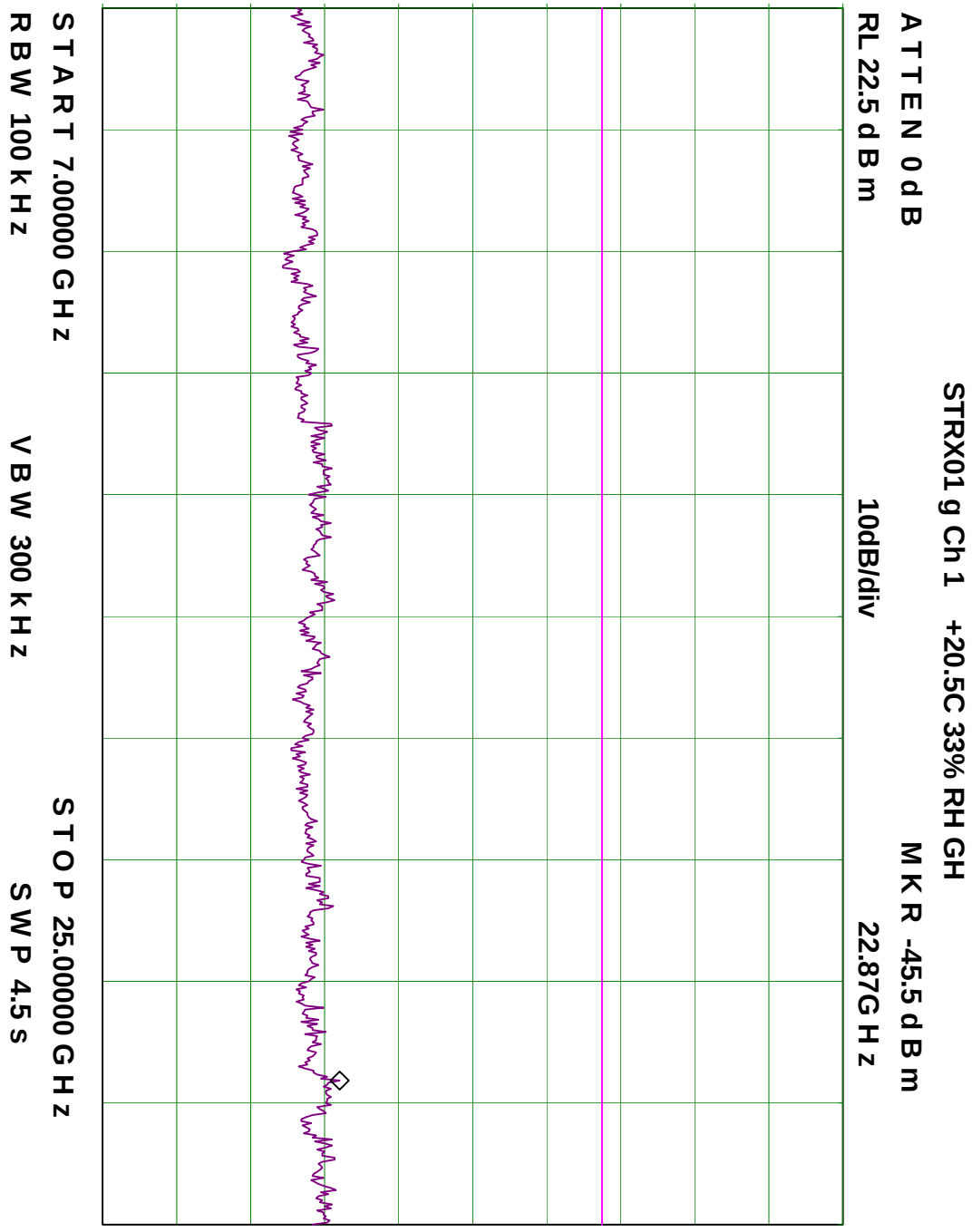
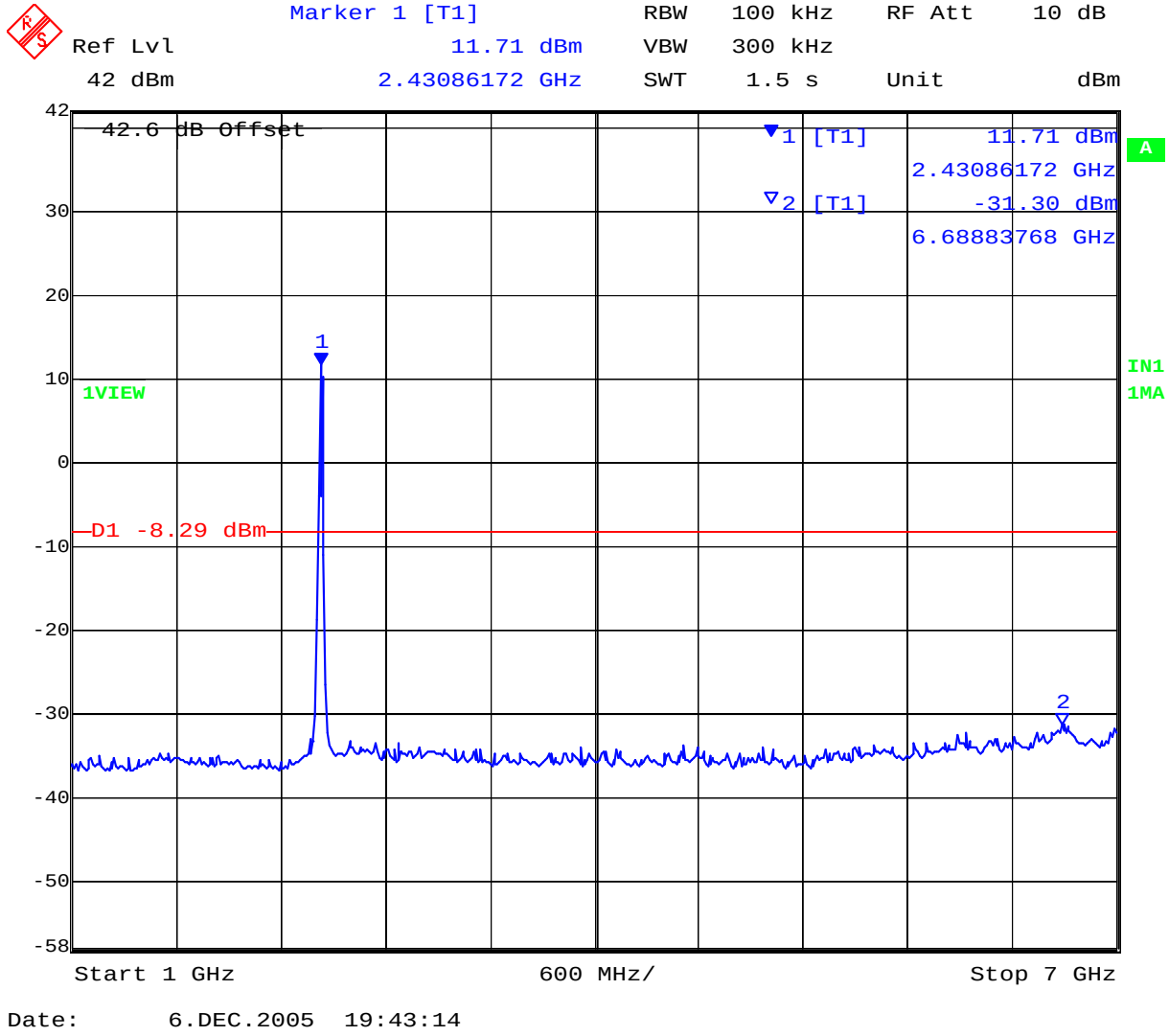


TABLE OF RESULTS – **802.11g**

Channel Centre Frequency	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Plot #	Margin (dB)
2,437	1,000	7,000	-31.30	-8.29	34	-23.01
2,437	7,000	25,000	-44.83	-8.29	35	-36.54

Plot 34 802.11g
2,437 MHz Conducted Spurious Emissions 1,000 MHz to 7,000 MHz



Plot 35 802.11g
2,437 MHz Conducted Spurious Emissions 7,000 MHz to 25,000 MHz

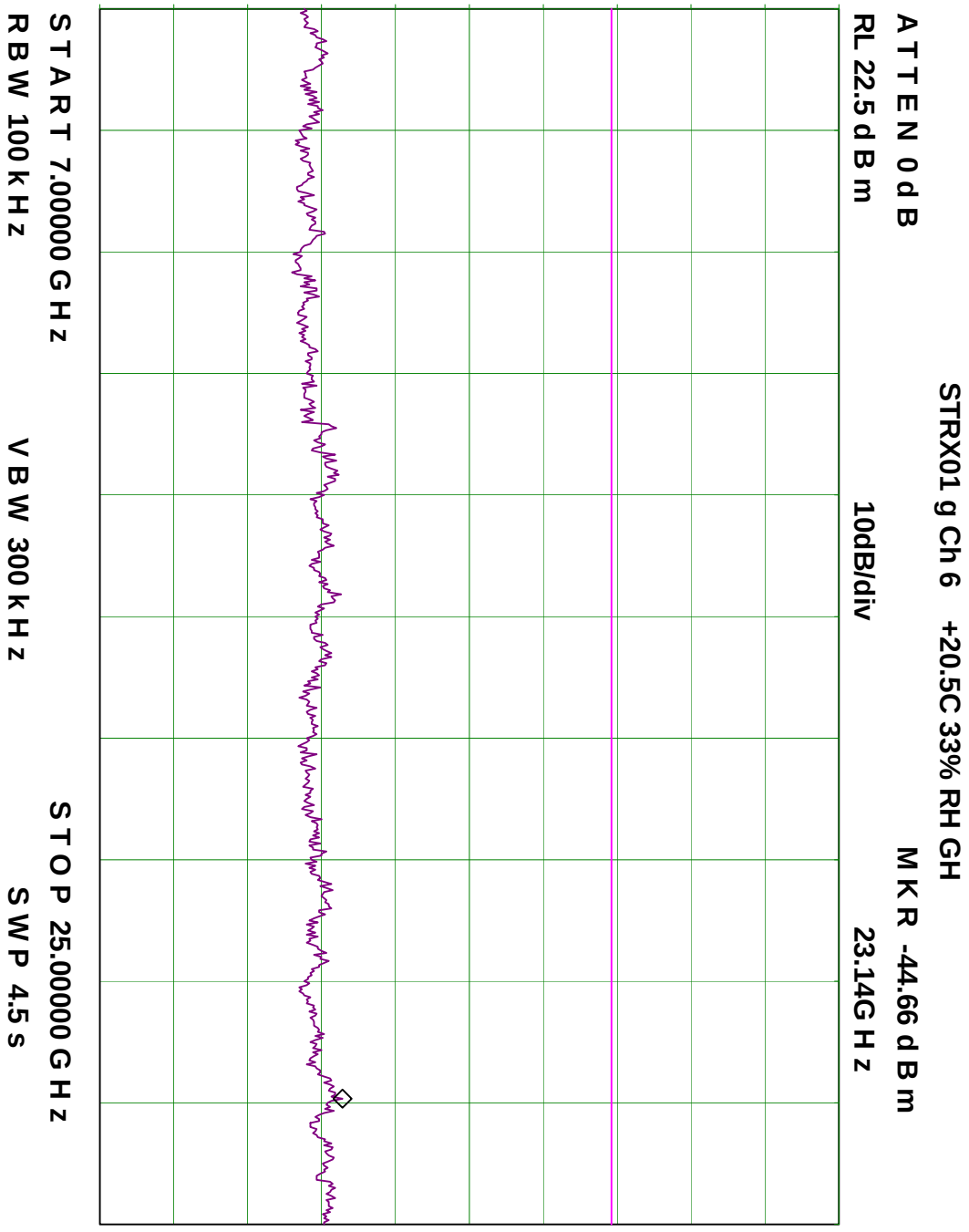
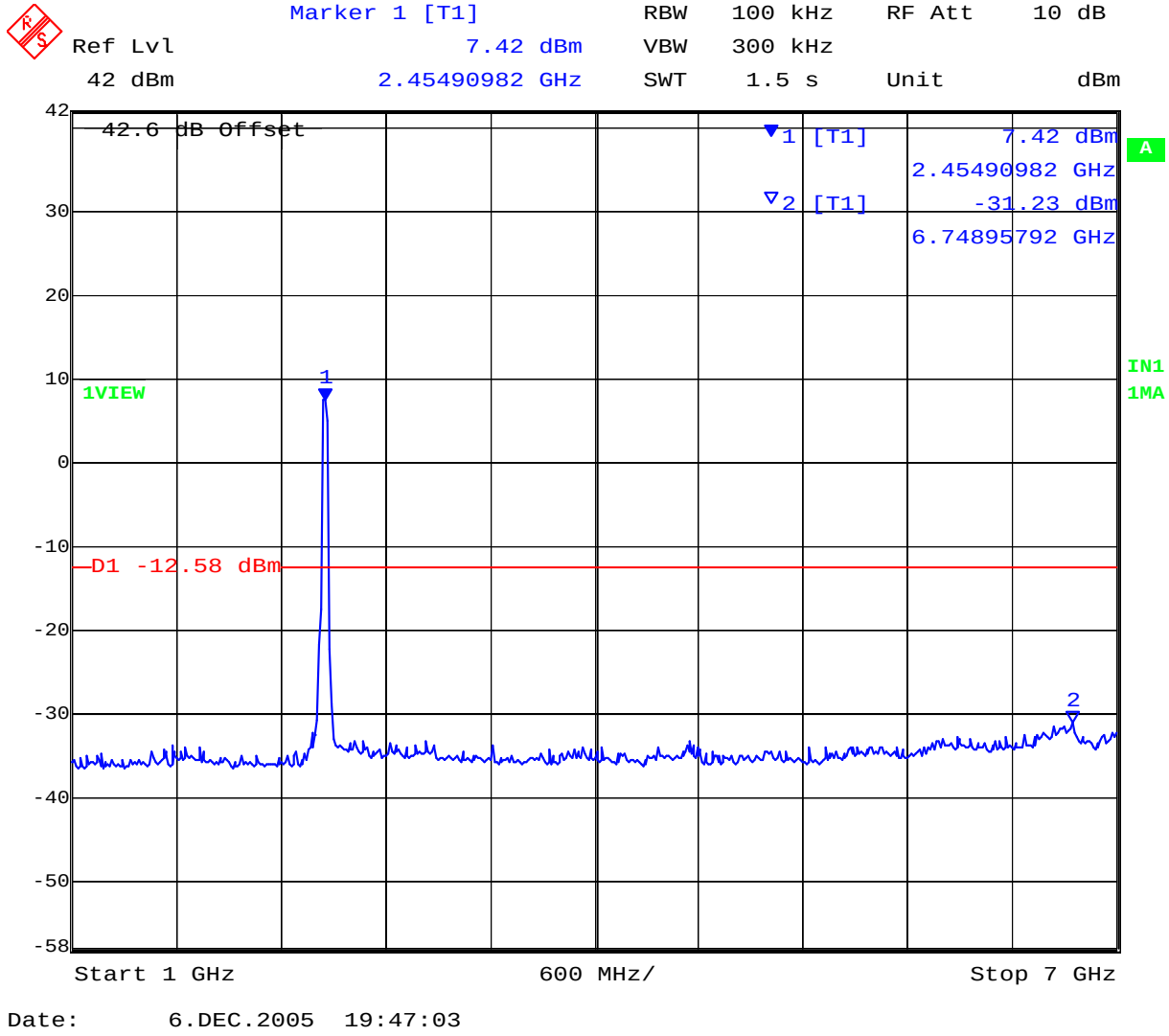


TABLE OF RESULTS – **802.11g**

Channel Centre Frequency	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Plot #	Margin (dB)
2,462	1,000	7,000	-31.23	-12.58	36	-18.65
2,462	7,000	25,000	-45.50	-12.58	37	-32.92

Plot 36 802.11g
2,462 MHz Conducted Spurious Emissions 1,000 MHz to 7,000 MHz



Plot 37 802.11g
2,462 MHz Conducted Spurious Emissions 7,000 MHz to 25,000 MHz

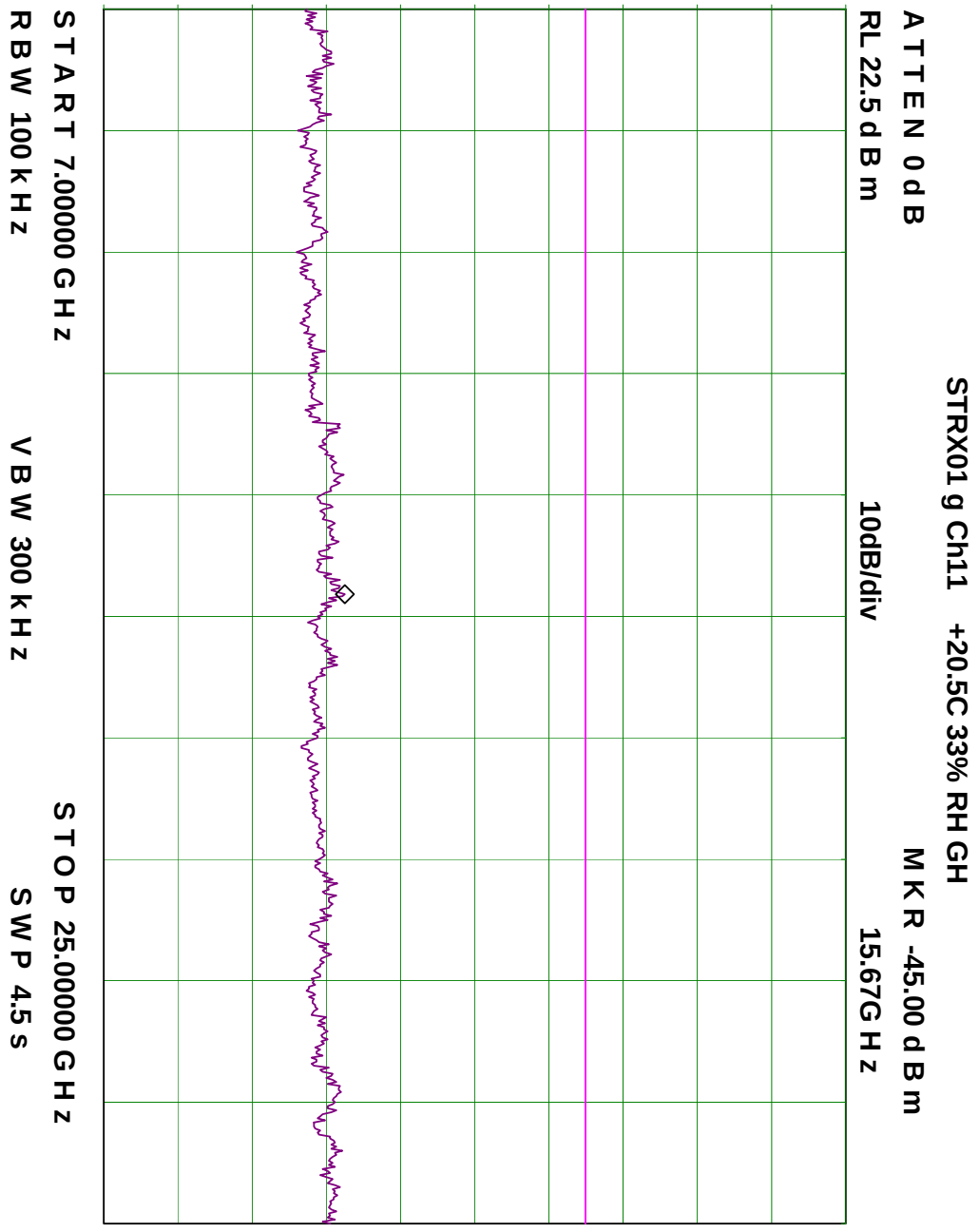
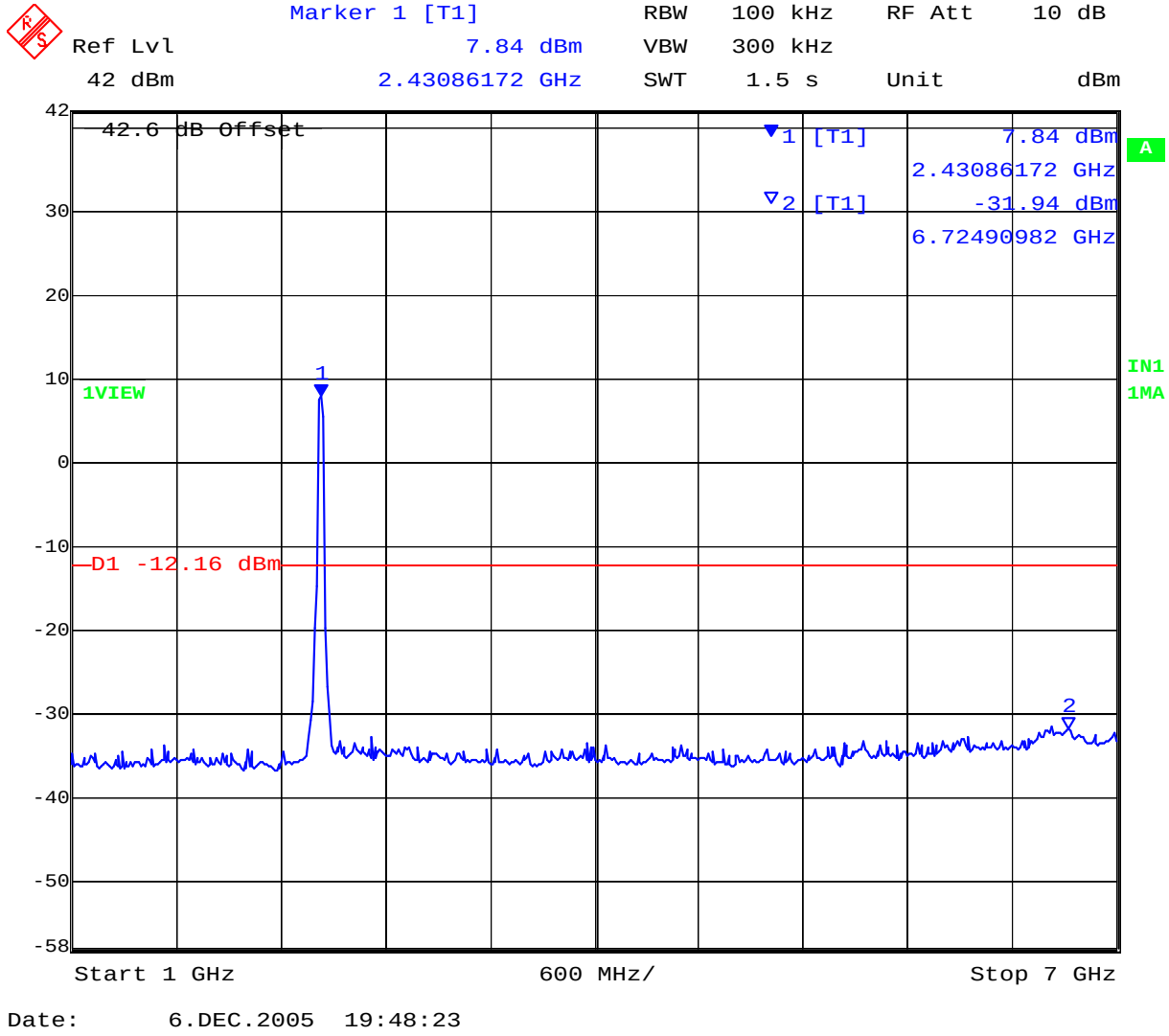


TABLE OF RESULTS – **802.11g Turbo**

Channel Centre Frequency	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Plot #	Margin (dB)
2,437	1,000	7,000	-31.94	-12.16	38	-19.78
2,437	7,000	25,000	-44.67	-12.16	39	-32.51

Plot 38 802.11g Turbo
2,437 MHz Conducted Spurious Emissions 1,000 MHz to 7,000 MHz



Plot 39 802.11g Turbo
2,437 MHz Conducted Spurious Emissions 7,000 MHz to 25,000 MHz

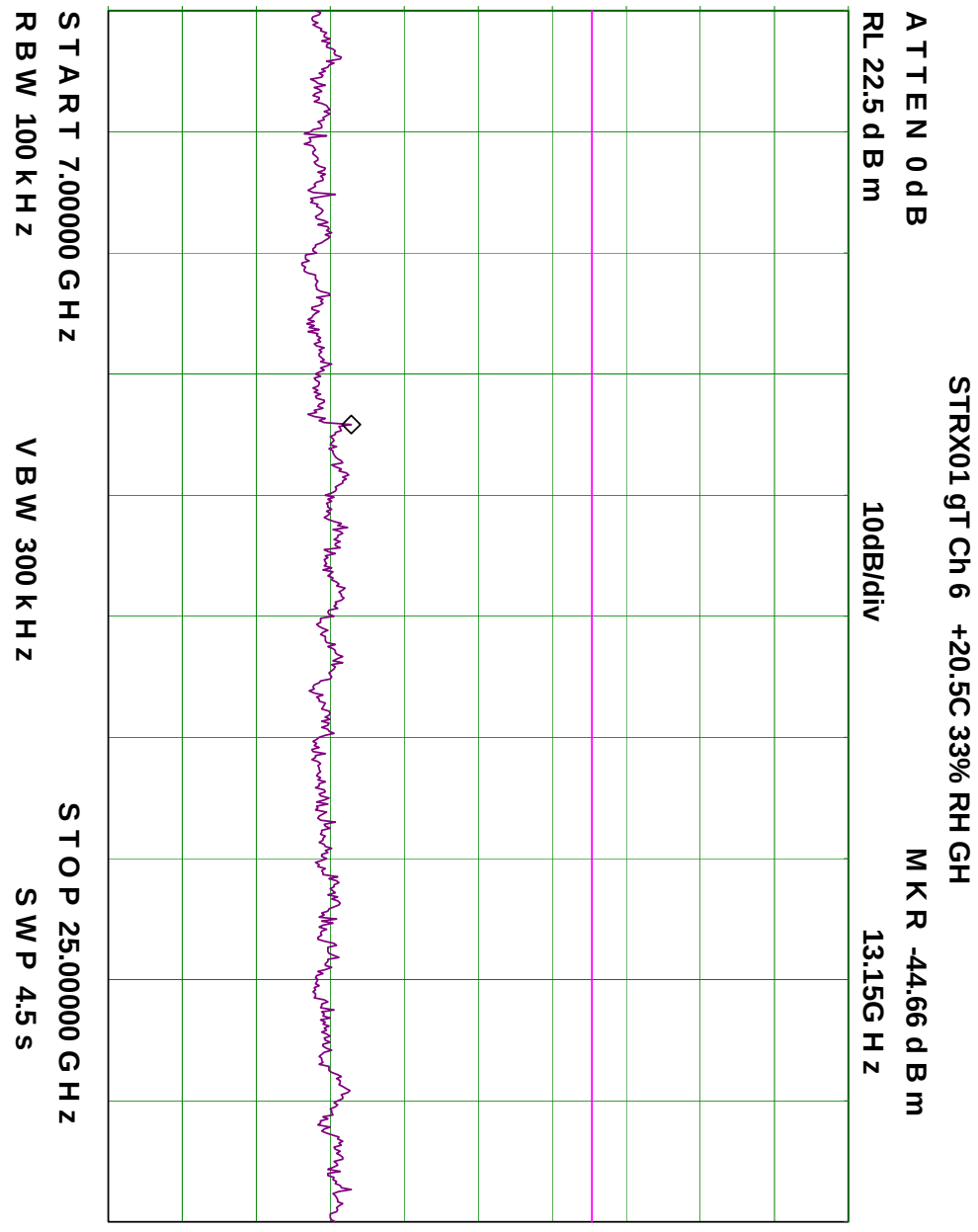
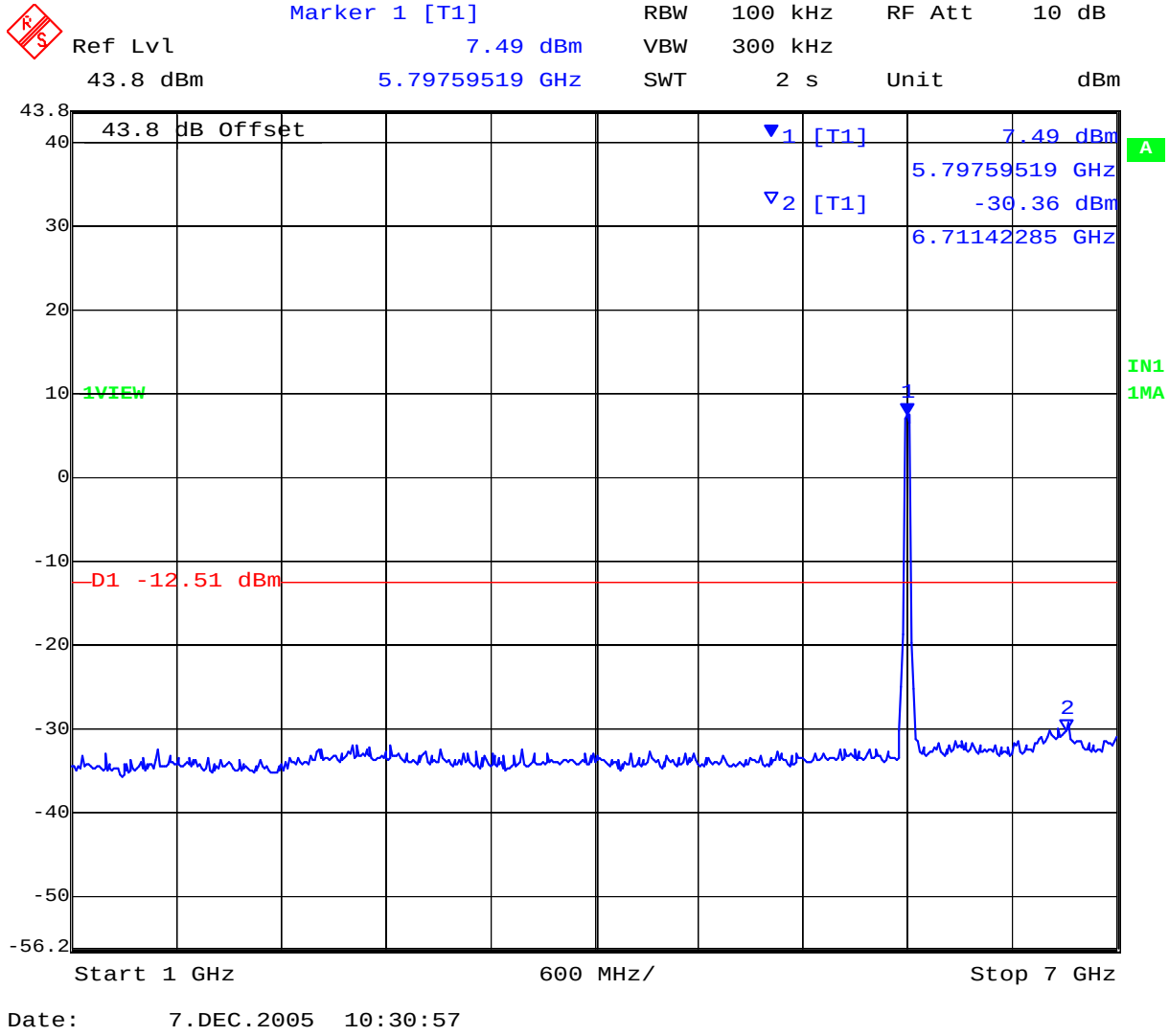


TABLE OF RESULTS – **802.11a**

Channel Centre Frequency	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Plot #	Margin (dB)
5,745	1,000	7,000	-30.36	-12.51	40	-17.85
5,745	7,000	40,000	-20.10	-12.51	41	-8.00

Plot 40 802.11a
5,745 MHz Conducted Spurious Emissions 1,000 MHz to 7,000 MHz



Plot 41 802.11a
5,745 MHz Conducted Spurious Emissions 7,000 MHz to 40,000 MHz

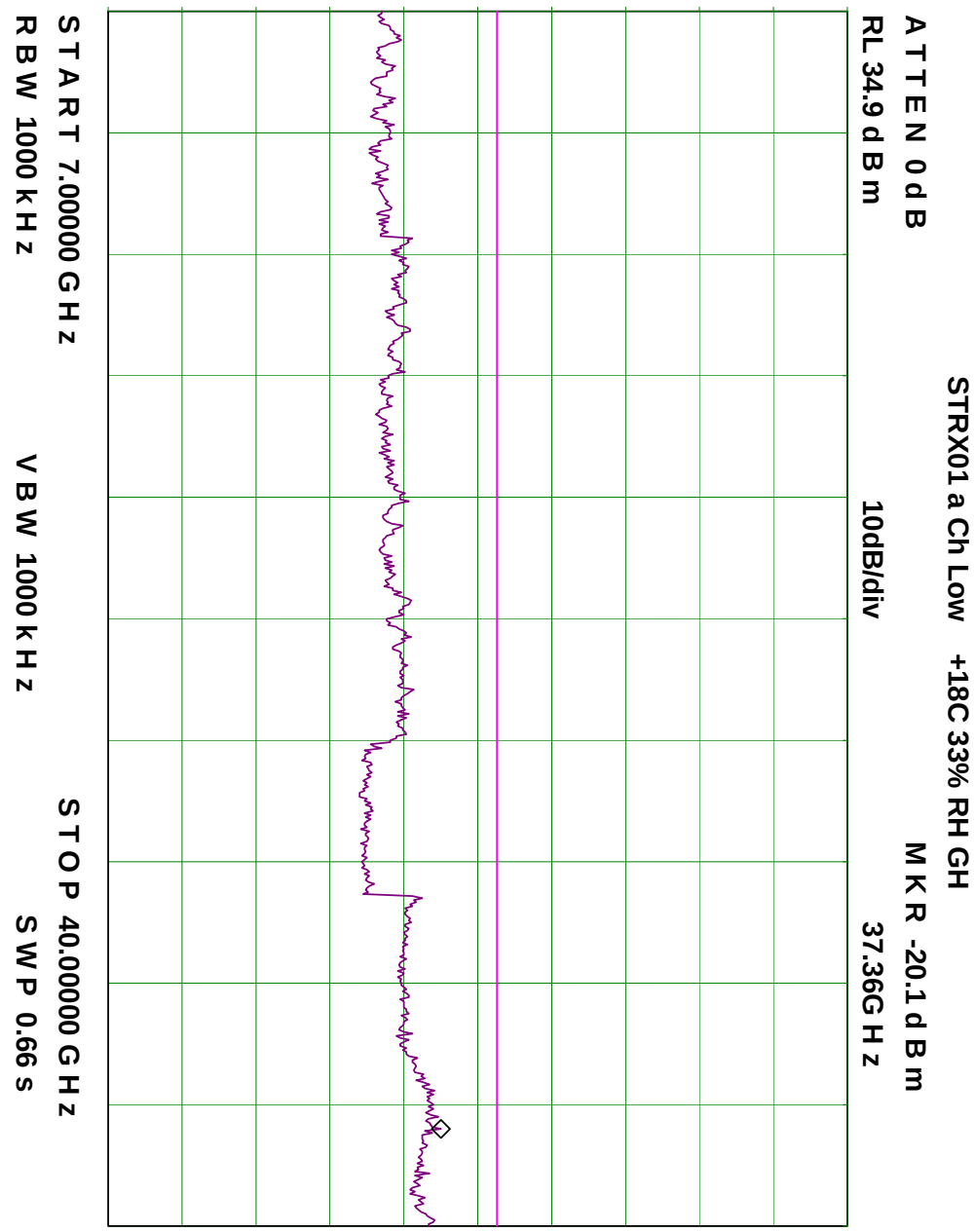
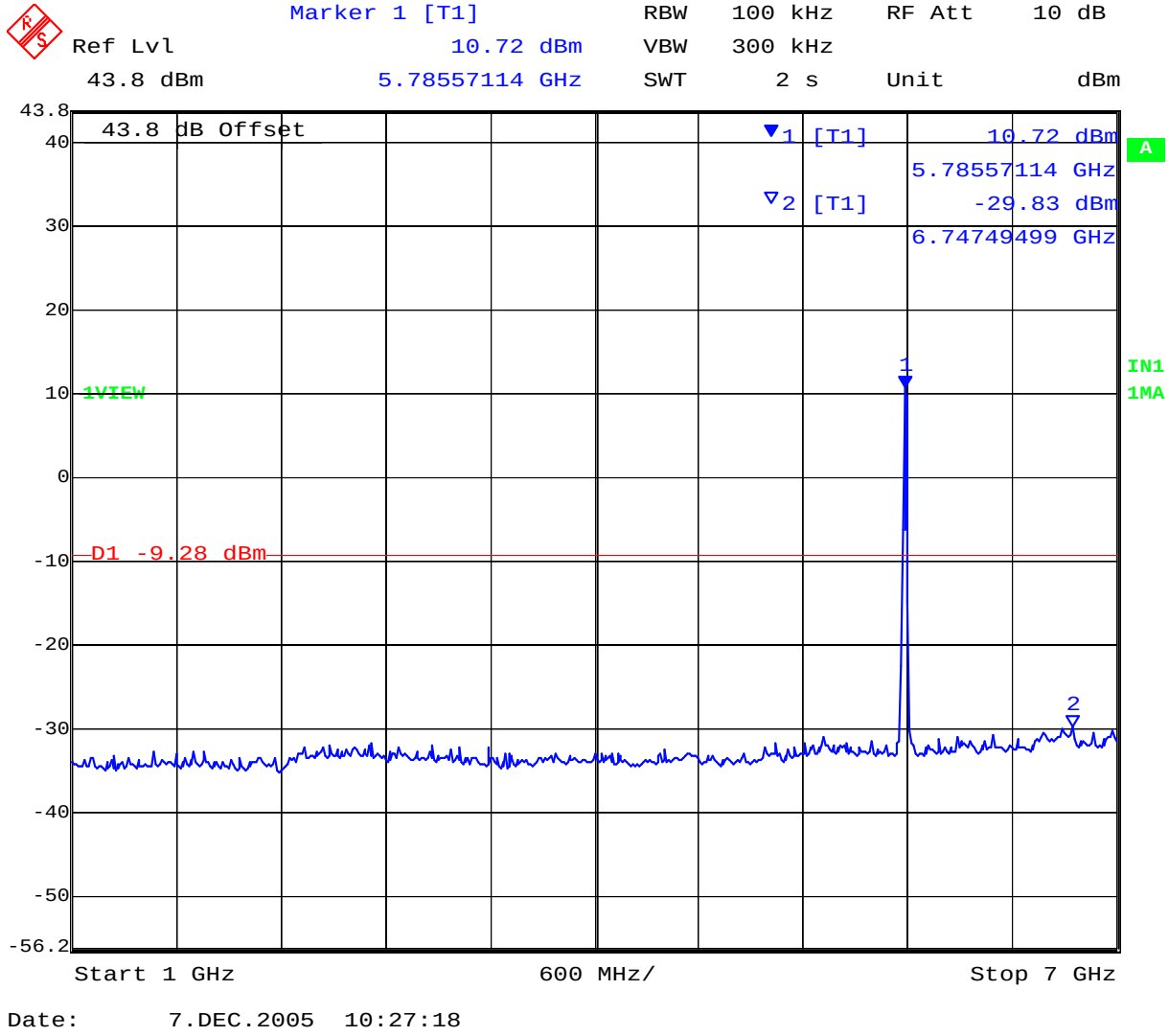


TABLE OF RESULTS – **802.11a**

Channel Centre Frequency	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Plot #	Margin (dB)
5,785	1,000	7,000	-29.83	-9.28	42	-20.55
5,785	7,000	40,000	-21.10	-9.28	43	-11.82

Plot 42 802.11a
5,785 MHz Conducted Spurious Emissions 1,000 MHz to 7,000 MHz



Plot 43 802.11a
5,785 MHz Conducted Spurious Emissions 7,000 MHz to 40,000 MHz

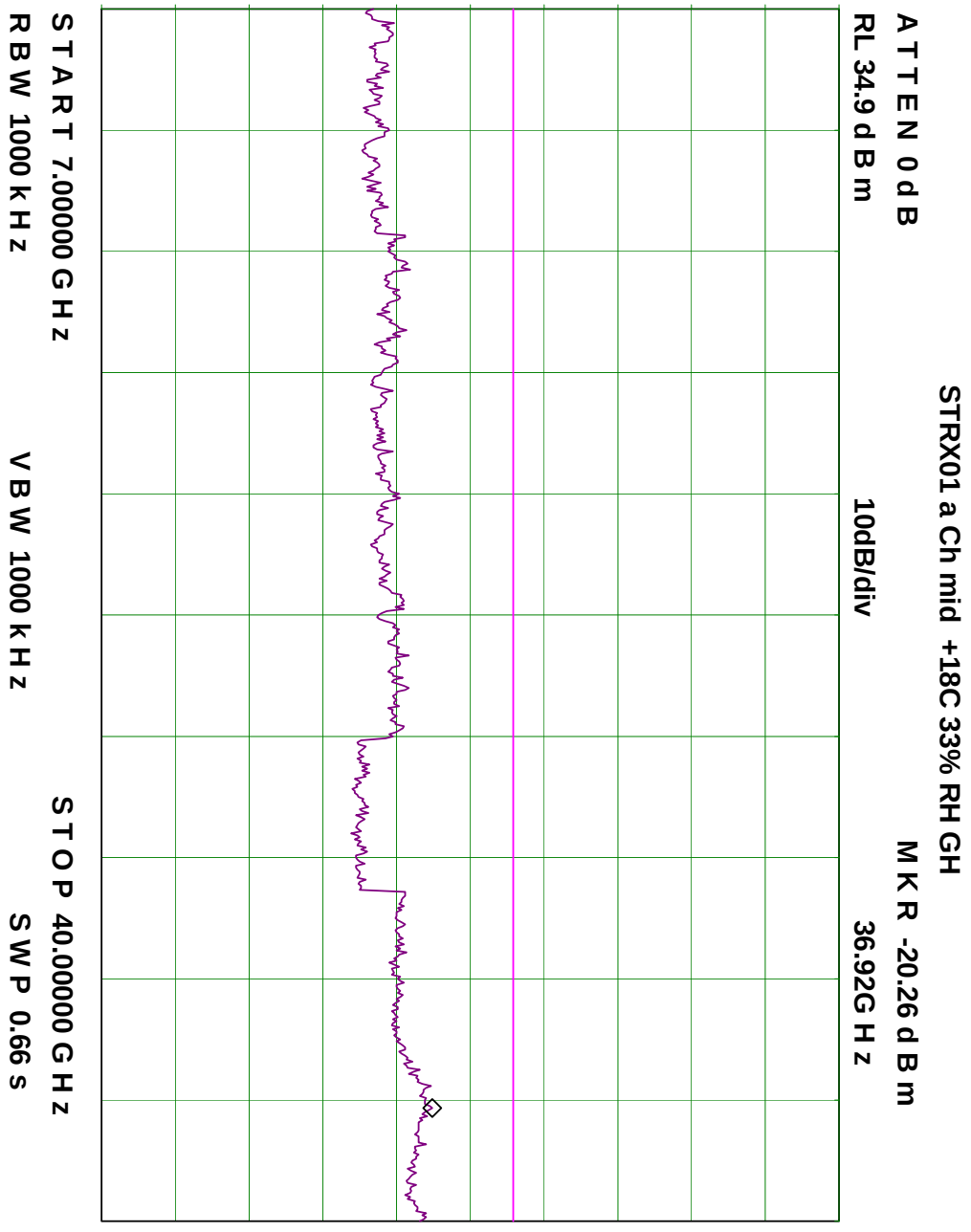
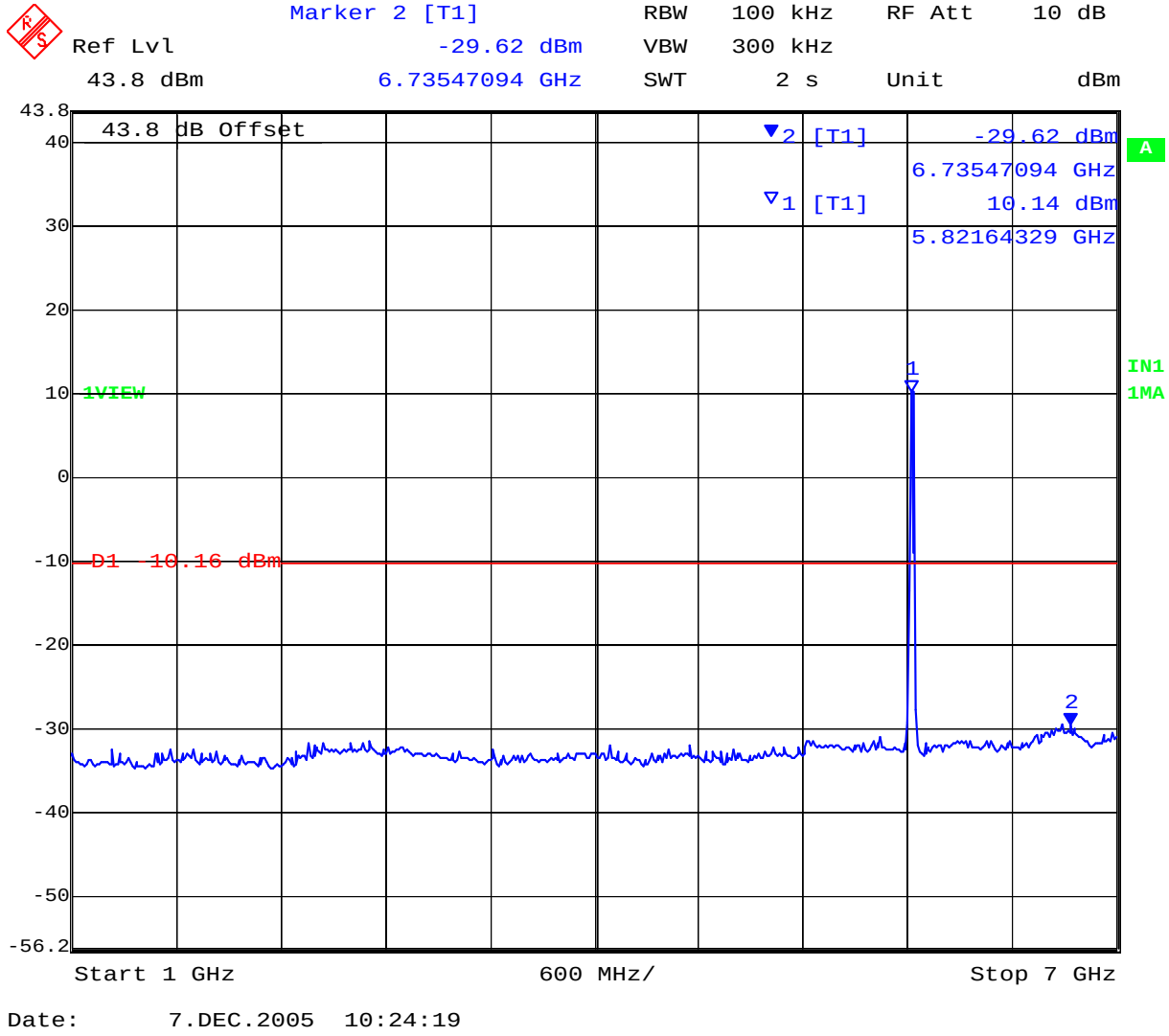


TABLE OF RESULTS – **802.11a**

Channel Centre Frequency	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Plot #	Margin (dB)
5,825	1,000	7,000	-29.62	-10.16	44	-19.46
5,825	7,000	40,000	-20.10	-10.16	45	-9.94

Plot 44 802.11a
5,825 MHz Conducted Spurious Emissions 1,000 MHz to 7,000 MHz



Plot 45 802.11a
5,825 MHz Conducted Spurious Emissions 7,000 MHz to 40,000 MHz

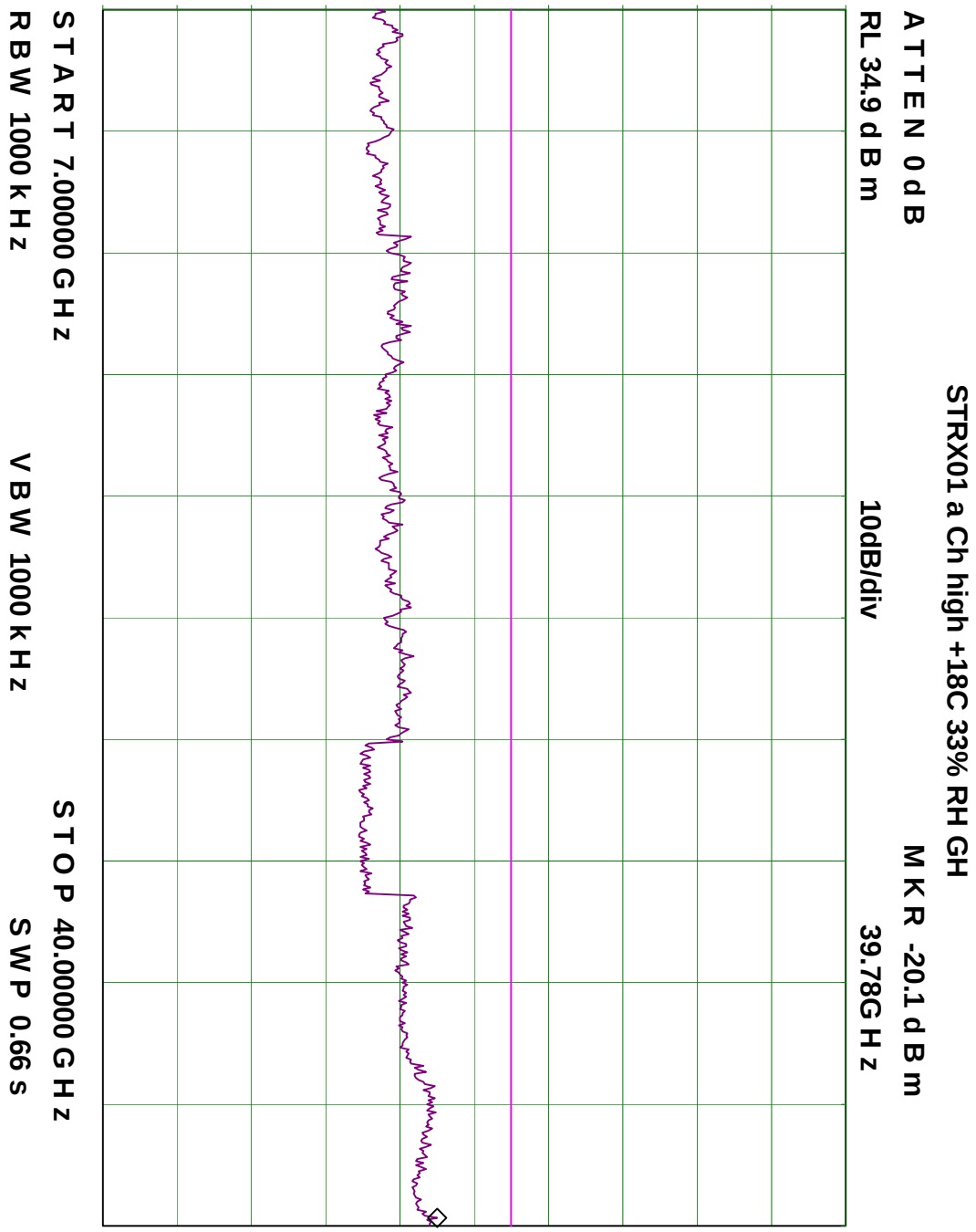
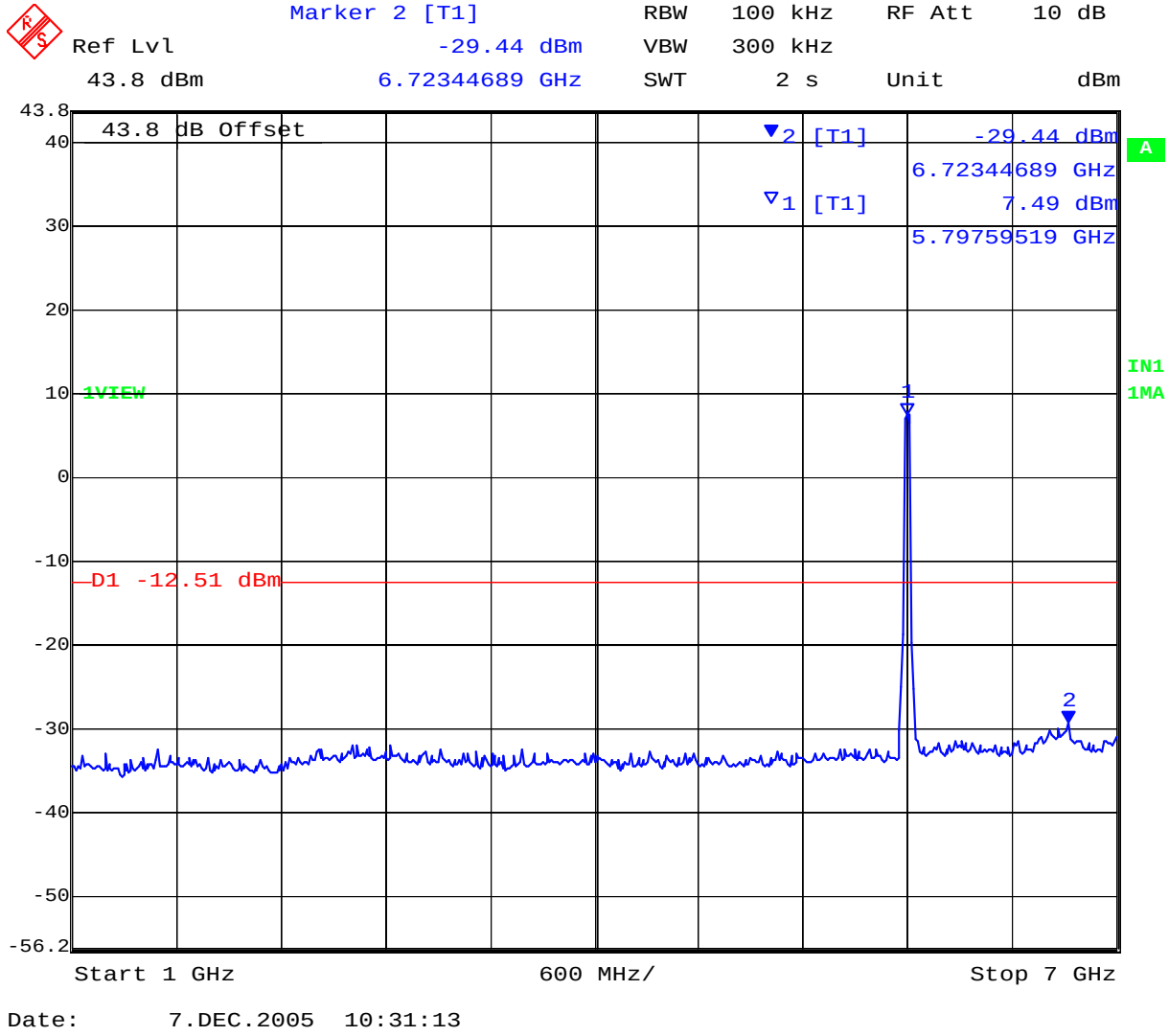


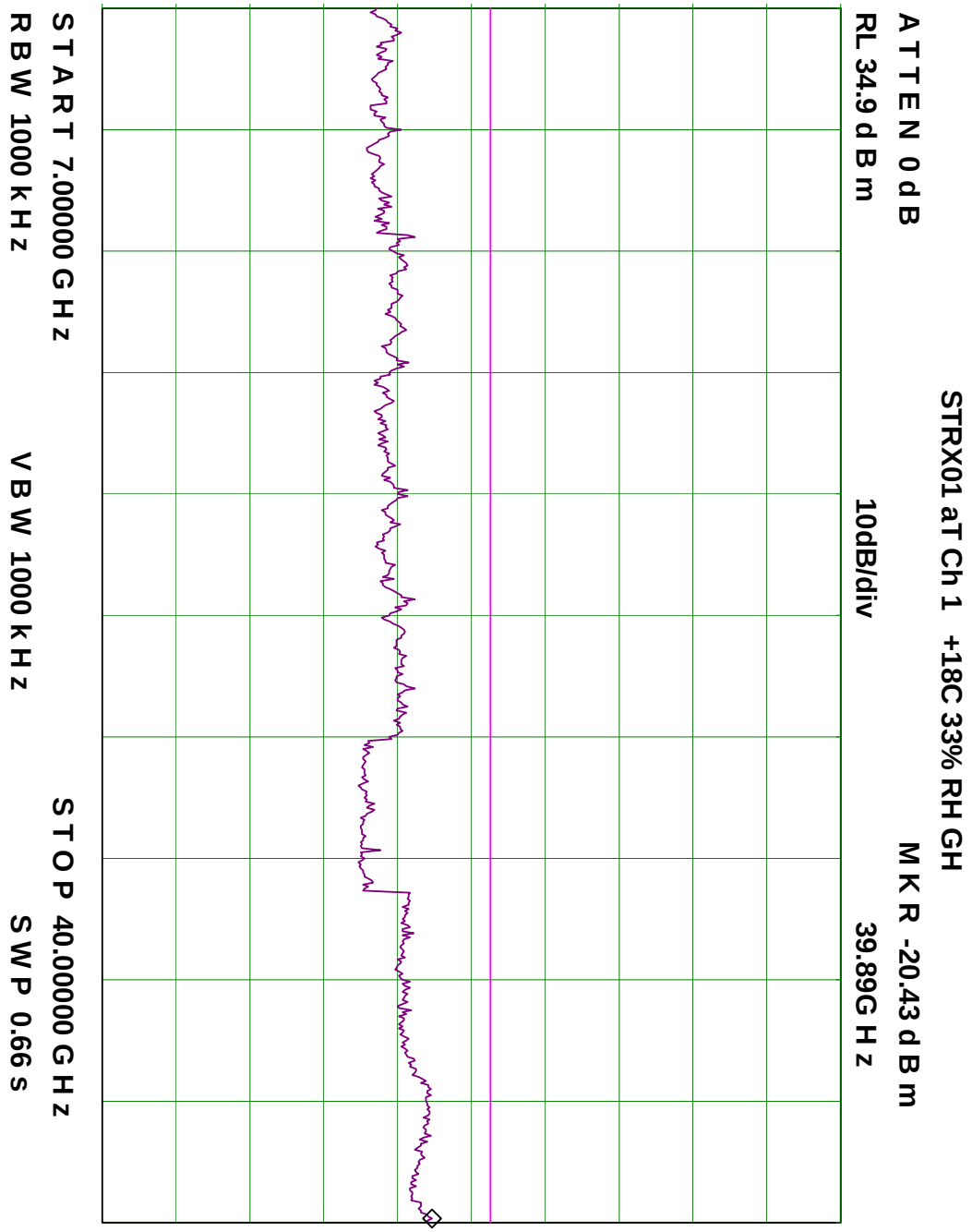
TABLE OF RESULTS – **802.11a Turbo**

Channel Centre Frequency	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Plot #	Margin (dB)
5,800	1,000	7,000	-29.44	-12.51	46	-16.93
5,800	7,000	40,000	-20.43	-12.51	47	-7.92

Plot 46 802.11a Turbo
5,800 MHz Conducted Spurious Emissions 1,000 MHz to 7,000 MHz



Plot 47 802.11a Turbo
5,800 MHz Conducted Spurious Emissions 7,000 MHz to 40,000 MHz



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

Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-05 'Measurement of Spurious Emissions'	0088, 0158, 0193, 0252, 0313, 0314, 0070, 0116, 0117.

5.1.6. Radiated Emissions

5.1.6.1. Transmitter Radiated Spurious Emissions (above 1 GHz)

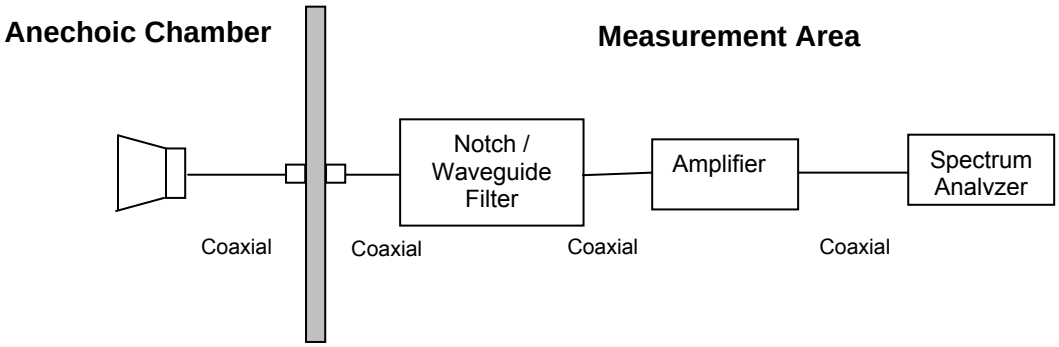
FCC, Part 15 Subpart C §15.247(d) 15.205; 15.209
Industry Canada RSS-210 §A8.5, §2.2, §2.6
Industry Canada RSS-Gen §4.7

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

For example:
Given receiver input reading of 51.5 dBμV; 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 dBμV/m

Conversion between dBμV/m (or dBμV) and μV/m (or μV) are done as:

Level (dBμV/m) = 20 * Log (level (μV/m))

40 dBμV/m = 100 μV/m
48 dBμV/m = 250 μV/m

Radiated Spurious Emissions above 1 GHz

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

2.4 GHz Operational Mode - Configuration # 1

2.4 GHz operational mode - 3 transmitters simultaneously operating
3 Antennas - 2 * 12 dBi OMNI, 1 * 16.4 dBi Sector

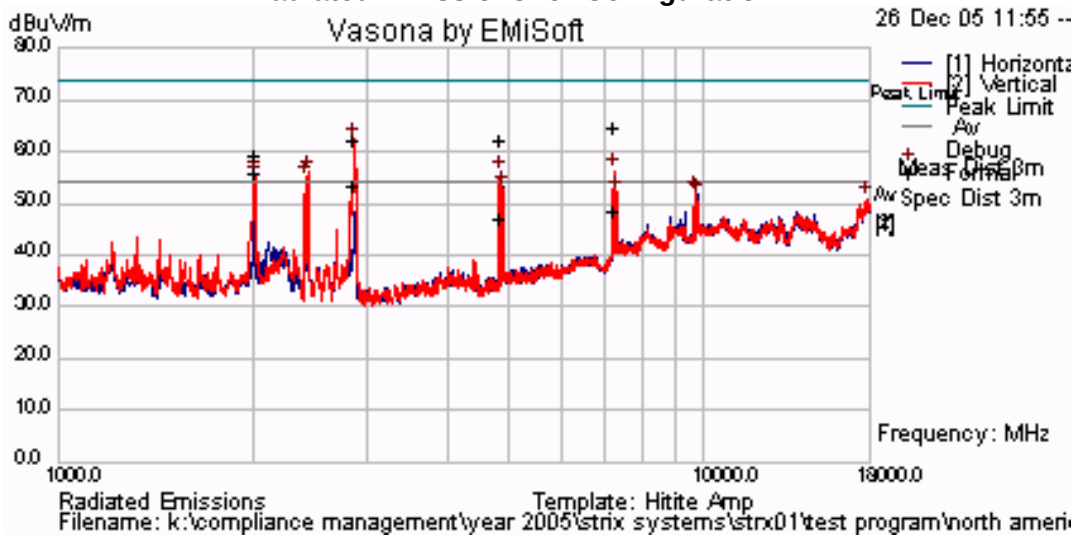
Sector IP 104 802.11b 11MB/s Ch 2412, ART power setting = +23.5 dBm
OMNI IP 103 802.11b 11MB/s Ch 2437, ART power setting = +25.0 dBm
OMNI IP 102 802.11g 6MB/s Ch 2462, ART power setting = +24.0 dBm

100% Duty Cycle all transmitters

TABLE OF RESULTS – **Configuration # 1**

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV/m)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2869.239	V	55.86	-4.77	51.09	54	-2.91
7231.406	V	43.66	+2.52	46.18	54	-7.82
2016.282	H	59.36	-5.66	53.70	54	-0.30
4820.917	V	45.33	-0.79	44.54	54	-9.46
2016.287	H	58.96	-5.66	53.30	54	-0.70

Plot 48
Radiated Emissions for Configuration # 1



Radiated Spurious Emissions above 1 GHz (continued)

2.4 GHz Operational Mode - Configuration # 2

2.4 GHz operational mode - 3 transmitters simultaneously operating
3 Antennas - 2 * 12 dBi OMNI, 1 * 16.4 dBi Sector

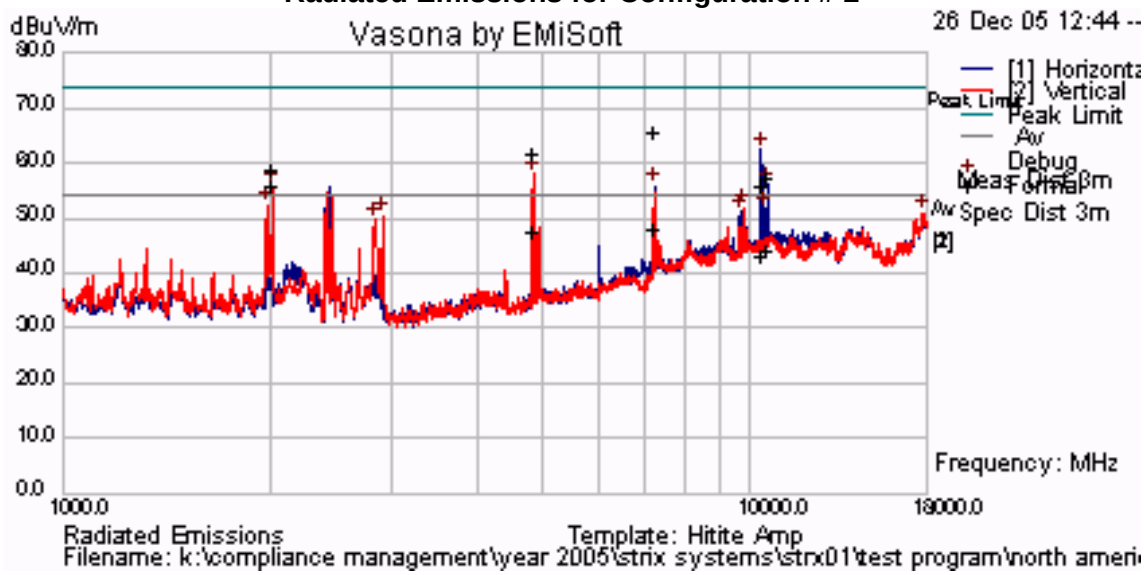
Sector IP 104 802.11b 11MB/s Ch 2437, ART power setting = +23.5 dBm
OMNI IP 103 802.11b 11MB/s Ch 2462, ART power setting = +25.0 dBm
OMNI IP 102 802.11g 6MB/s Ch 2412, ART power setting = +24.0 dBm

100% Duty Cycle all transmitters

TABLE OF RESULTS – **Configuration # 2**

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV/m)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10348.23	H	31.41	+9.24	40.65	54	-13.35
4825.344	V	46.01	-0.79	45.22	54	-8.78
10581.85	H	33.11	+8.52	41.63	54	-12.37
2016.282	V	59.15	-5.66	53.49	54	-0.51
7228.02	H	43.11	+2.52	45.63	54	-8.37

Plot 49
Radiated Emissions for Configuration # 2



Radiated Spurious Emissions above 1 GHz (continued)

2.4 GHz Operational Mode - Configuration # 3

2.4 GHz operational mode - 3 transmitters simultaneously operating
3 Antennas - 2 * 12 dBi OMNI, 1 * 16.4 dBi Sector

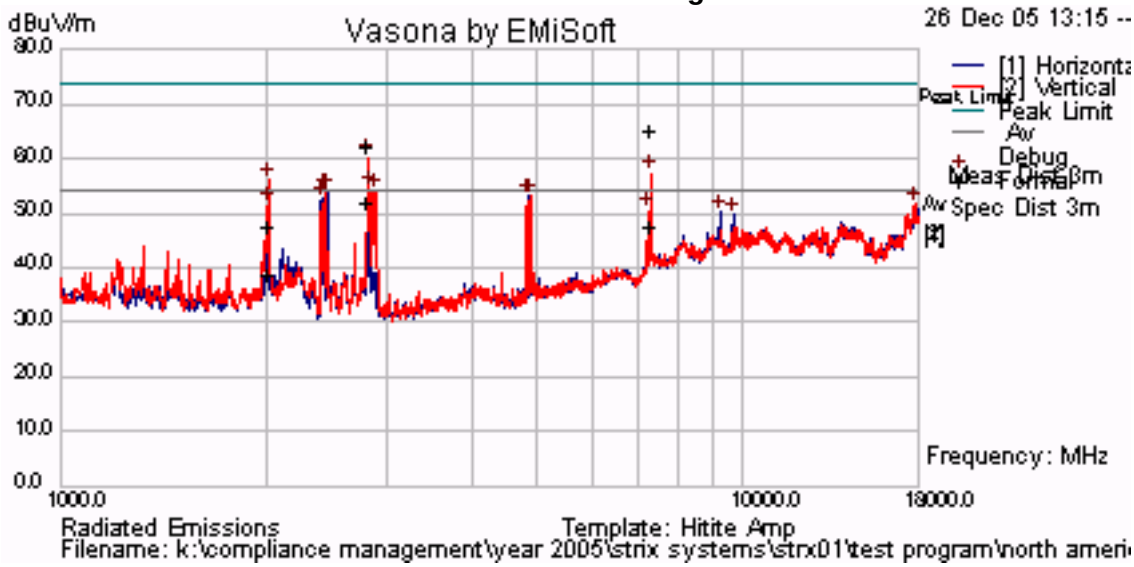
Sector IP 104 802.11b 11MB/s Ch 2462, ART power setting = +23.5 dBm
OMNI IP 103 802.11b 11MB/s Ch 2412, ART power setting = +25.0 dBm
OMNI IP 102 802.11g 6MB/s Ch 2437, ART power setting = +24.0 dBm

100% Duty Cycle all transmitters

TABLE OF RESULTS – **Configuration # 3**

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV/m)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2820.917	V	54.43	-4.64	49.79	54	-4.21
7305.833	H	42.45	+2.56	45.01	54	-8.99
2017.584	H	41.80	-5.66	36.14	54	-17.86

Plot 50
Radiated Emissions for Configuration # 3



Radiated Spurious Emissions above 1 GHz (continued)

2.4 GHz Operational Mode - Configuration # 4

2.4 GHz operational mode - 2 transmitters simultaneously operating
2 Antennas - 12 dBi OMNI, 16.4 dBi Sector

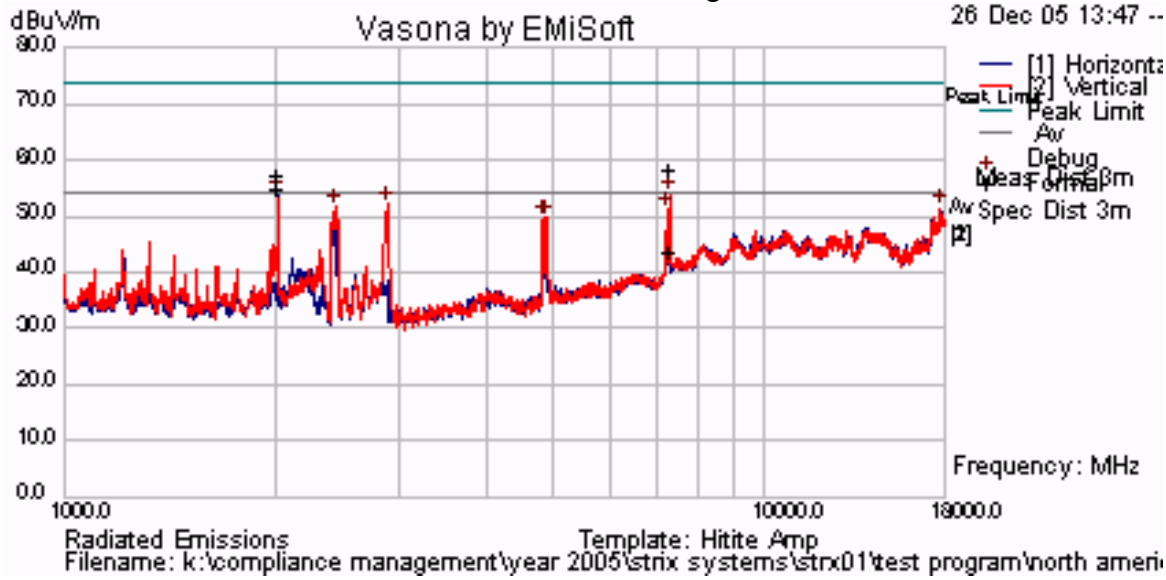
Sector IP 104 802.11g 6MB/s Ch 2412, ART power setting = +22.5 dBm
OMNI IP 103 802.11g Turbo 108MB/s Ch 2437, ART power setting = 23.0 dBm

100% Duty Cycle all transmitters

TABLE OF RESULTS – **Configuration # 4**

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV/m)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2016.355	H	58.25	-5.66	52.59	54	-1.41
7304.829	V	38.88	+2.56	41.44	54	-12.56

Plot 51
Radiated Emissions for Configuration # 4



Radiated Spurious Emissions above 1 GHz (continued)

2.4 GHz Operational Mode - Configuration # 5

2.4 GHz operational mode
Antenna - 16.4 dBi Sector

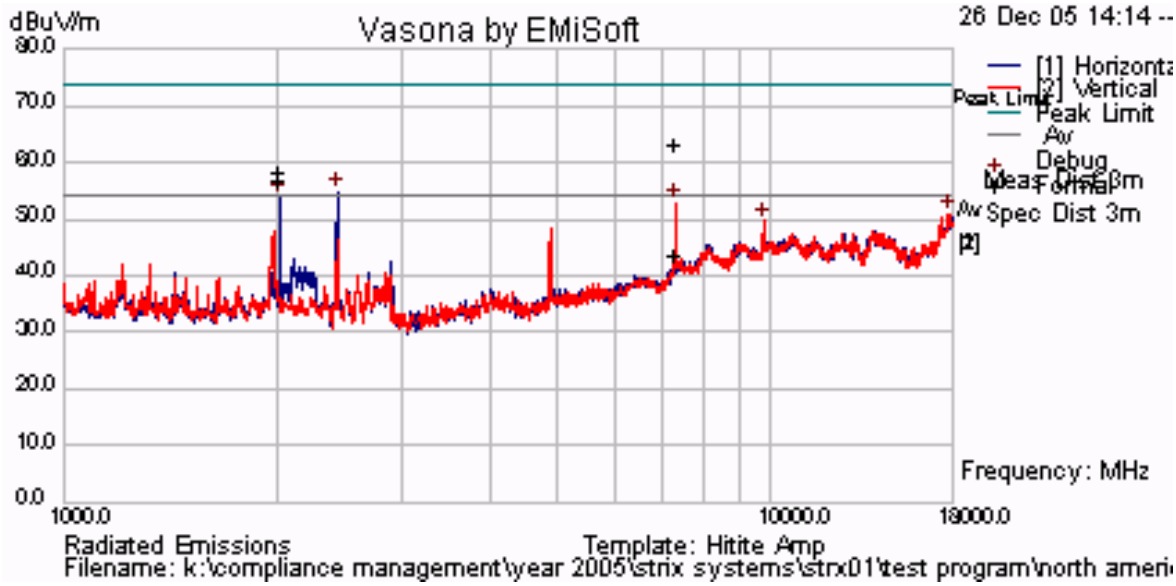
Sector IP 104 802.11g 6MB/s Ch 2437, ART power setting = +22.5 dBm

100% Duty Cycle all transmitters

TABLE OF RESULTS – **Configuration # 5**

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV/m)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2016.024	H	59.62	-5.65	53.97	54	-0.03
7303.214	V	38.76	+2.56	41.32	54	-12.68

Plot 52
Radiated Emissions for Configuration # 5



Radiated Spurious Emissions above 1 GHz (continued)

2.4 GHz Operational Mode - Configuration # 6

2.4 GHz operational mode
Antenna - 16.4 dBi Sector

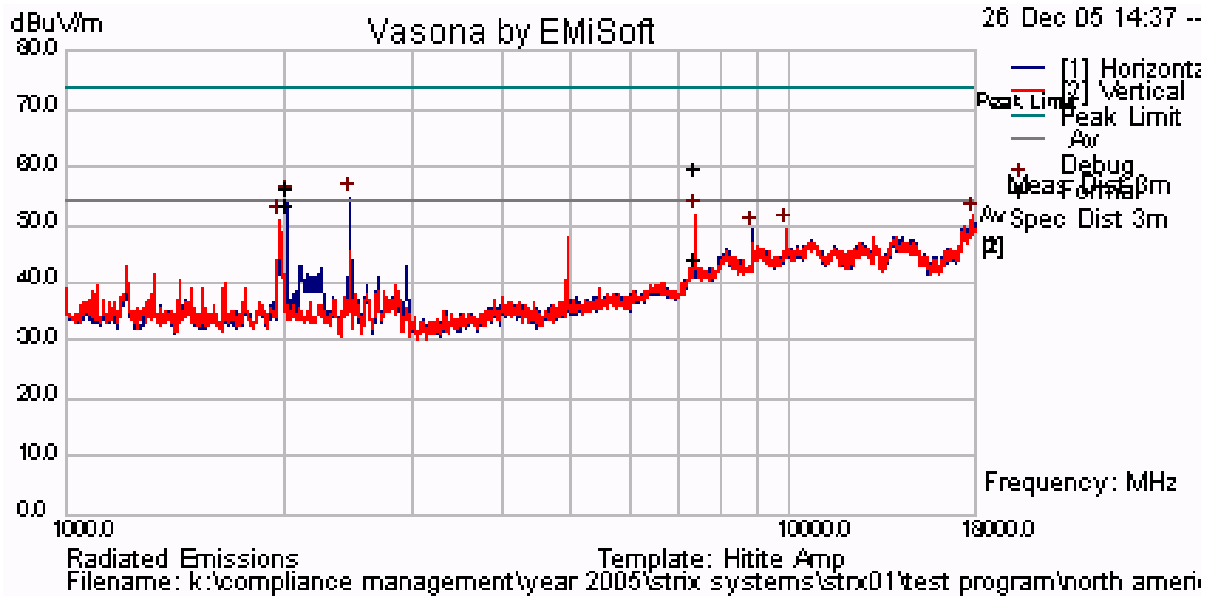
Sector IP 104 802.11g 6MB/s Ch 2462, ART power setting = +22.5 dBm

100% Duty Cycle all transmitters

TABLE OF RESULTS – **Configuration # 6**

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV/m)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2016.576	H	56.53	-5.66	50.87	54	-3.13
7381.619	V	38.91	+2.62	41.53	54	-12.47

Plot 53
Radiated Emissions for Configuration # 6



Radiated Spurious Emissions above 1 GHz (continued)

2.4 GHz Operational Mode - Configuration # 7

2.4 GHz operational mode
Antenna 16.4 dBi Sector

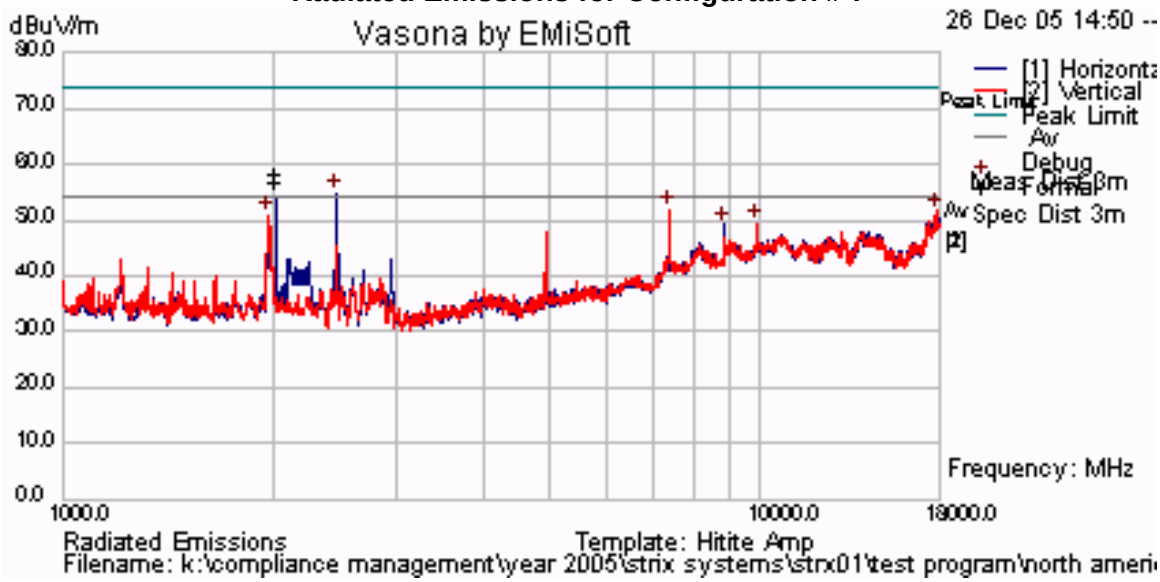
Sector IP 104 802.11gT 108MB/s Ch 2462, ART power setting = +21.5 dBm

100% Duty Cycle all transmitters

TABLE OF RESULTS – **Configuration # 7**

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV/m)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2016.087	H	59.44	-5.65	53.79	54	-0.21

Plot 54
Radiated Emissions for Configuration # 7



Radiated Spurious Emissions above 1 GHz (continued)

5.8 GHz Operational Mode - Configuration # 8

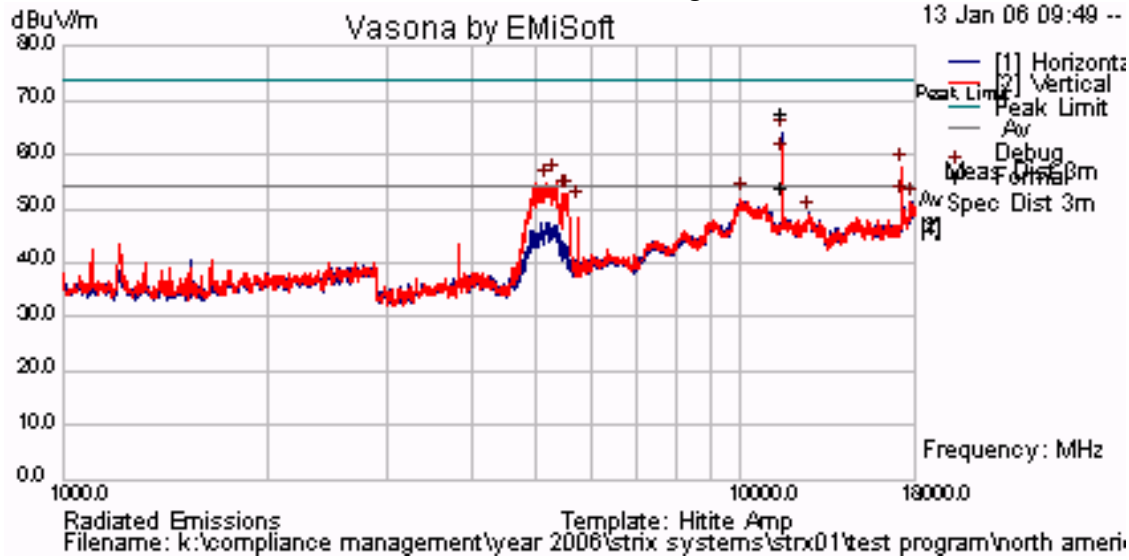
OMNI Directional Antenna

Single channel operation 5,745 MHz, ART power setting = +24 dBm

TABLE OF RESULTS – **Configuration # 8**

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV/m)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
11492.170	H	40.20	+11.40	51.60	54	-2.40
5180.286	V	48.88	+0.50	49.38	54	-4.62
17242.220	H	34.80	+13.38	48.18	54	-5.82

Plot 55
Radiated Emissions for Configuration # 8



Radiated Spurious Emissions above 1 GHz (continued)

5.8 GHz Operational Mode - Configuration # 9

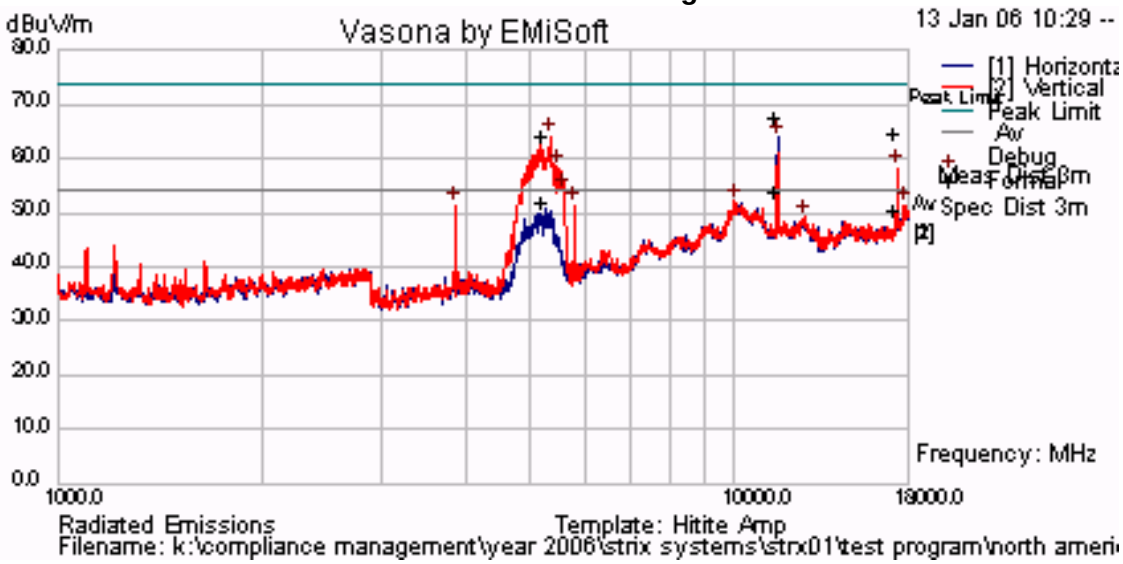
OMNI Directional Antenna

Single channel operation 5,785 MHz, ART power setting = +26 dBm

TABLE OF RESULTS – **Configuration # 9**

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV/m)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
5357.675	H	52.96	+1.04	54	54	0.0
11575.45	H	42.71	+11.23	53.94	54	-0.06
17354.36	H	35.33	+14.80	50.13	54	-3.87
5221.128	V	45.31	+0.66	45.97	54	-8.03

Plot 56
Radiated Emissions for Configuration # 9



Radiated Spurious Emissions above 1 GHz (continued)

5.8 GHz Operational Mode - Configuration # 10

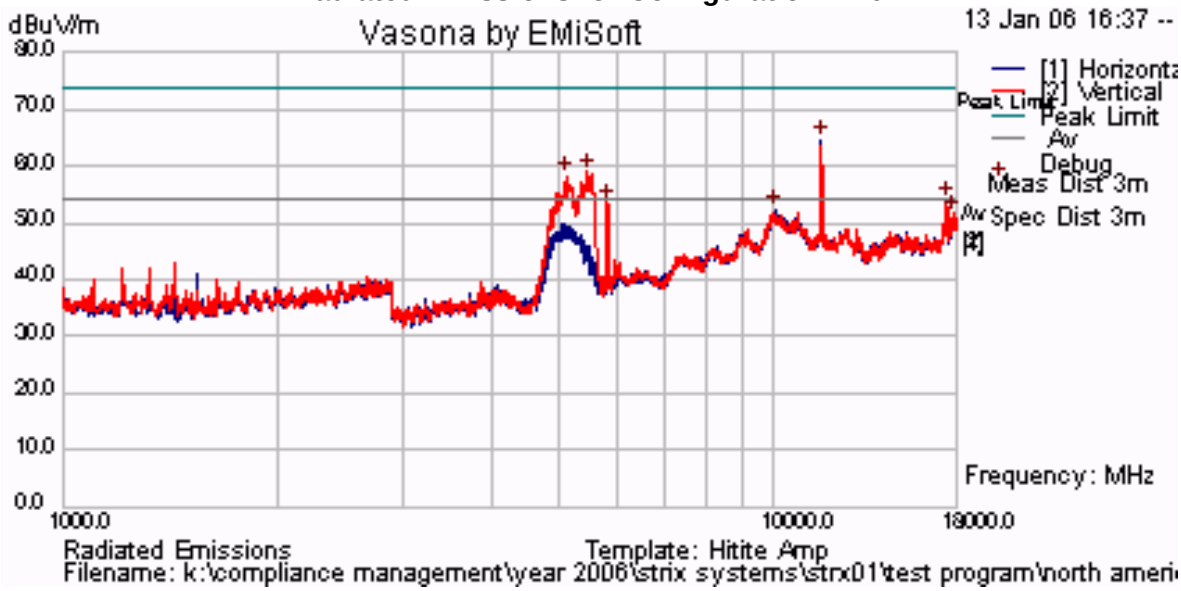
OMNI Directional Antenna

Single channel operation 5,825 MHz, ART power setting = +24dBm

TABLE OF RESULTS – **Configuration # 10**

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV/m)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
5176.286	V	50.78	+0.48	51.26	54	-2.74
5342.534	V	52.57	+1.11	53.68	54	-0.32
5443.44	V	46.01	+1.39	47.40	54	-6.60
11644.24	H	43.18	+10.37	53.55	54	-0.45

Plot 57
Radiated Emissions for Configuration # 10



Radiated Spurious Emissions above 1 GHz (continued)

5.8 GHz Operational Mode - Configuration # 11

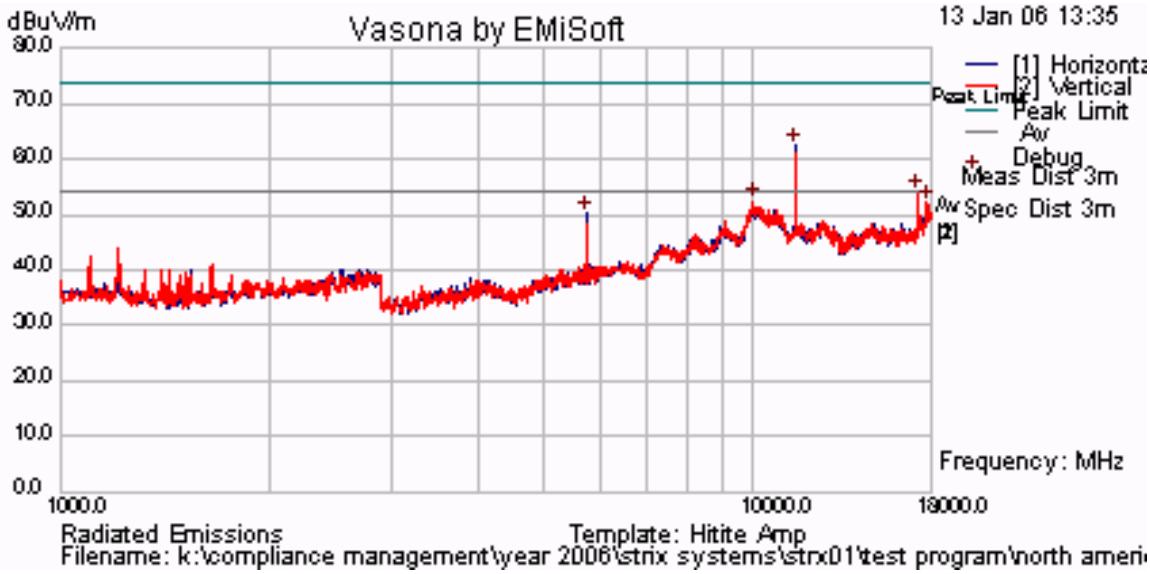
Patch Panel Antenna - **includes band-pass between EUT and antenna**

Single channel operation 5,745 MHz, ART power setting = +24dBm

TABLE OF RESULTS – **Configuration # 11**

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV/m)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
11484.41	H	39.68	+11.44	51.12	54	-2.88
17241.59	H	34.14	+13.37	47.51	54	-6.49

Plot 58
Radiated Emissions for Configuration # 11



Radiated Spurious Emissions above 1 GHz (continued)

5.8 GHz Operational Mode - Configuration # 12

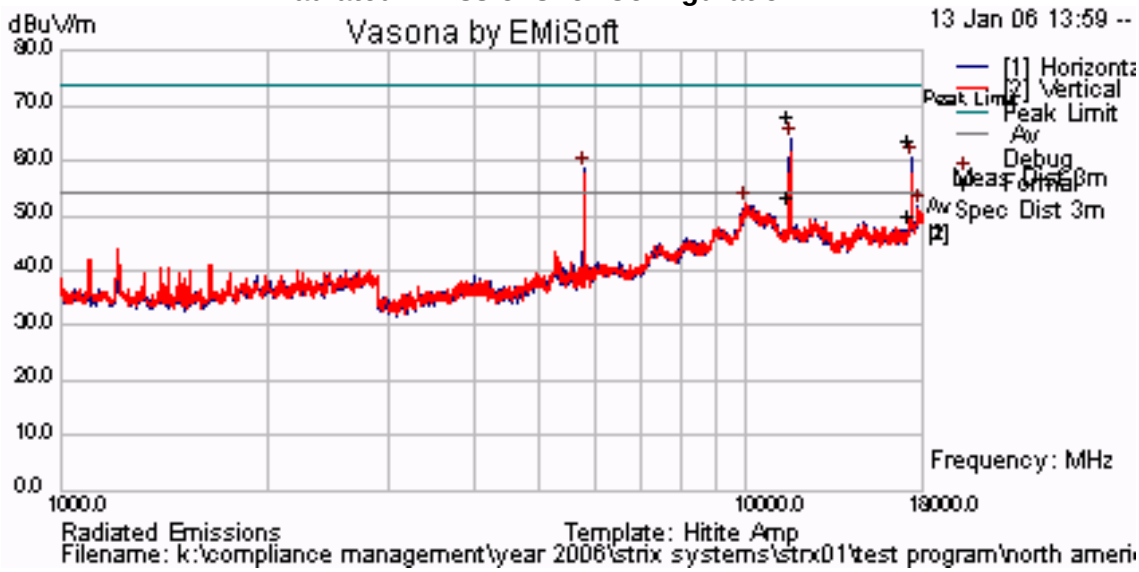
Patch Panel Antenna - **includes band-pass between EUT and antenna**

Single channel operation 5,785 MHz, ART power setting = +26dBm

TABLE OF RESULTS – **Configuration # 12**

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV/m)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
11576.29	V	40.33	+11.22	51.55	54	-2.45
17358.97	H	36.64	+14.83	51.47	54	-2.53

Plot 59
Radiated Emissions for Configuration # 12



Radiated Spurious Emissions above 1 GHz (continued)

5.8 GHz Operational Mode - Configuration # 13

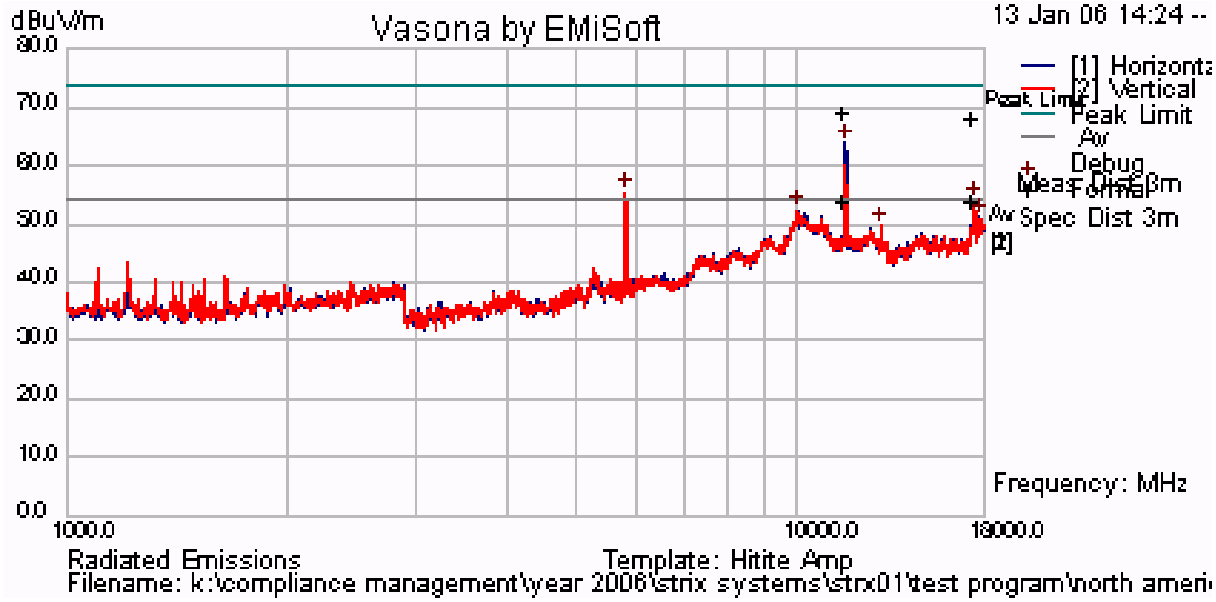
Patch Panel Antenna - **includes band-pass filter between EUT and antenna**

Single channel operation 5825 MHz, ART power setting = +24dBm

TABLE OF RESULTS – **Configuration # 13**

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV/m)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
17471.59	H	33.80	+14.03	47.83	54	-6.17
11651.18	H	42.06	+11.12	53.18	54	-0.82

Plot 60
Radiated Emissions for Configuration # 13



5.1.6.2. Receiver Radiated Spurious Emissions (above 1 GHz)

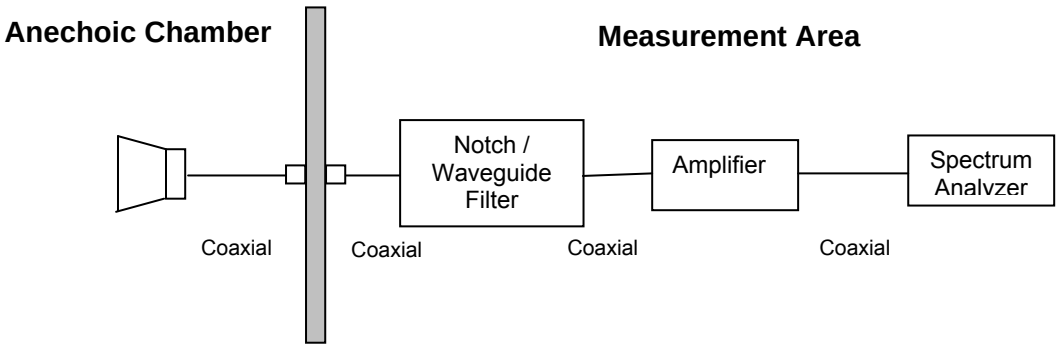
Industry Canada RSS-Gen §4.8, §6

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

For example:
Given receiver input reading of 51.5 dBμV; 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 dBμV/m

Conversion between dBμV/m (or dBμV) and μV/m (or μV) are done as:

Level (dBμV/m) = 20 * Log (level (μV/m))

40 dBμV/m = 100 μV/m
48 dBμV/m = 250 μV/m

Receiver Radiated Spurious Emissions above 1 GHz

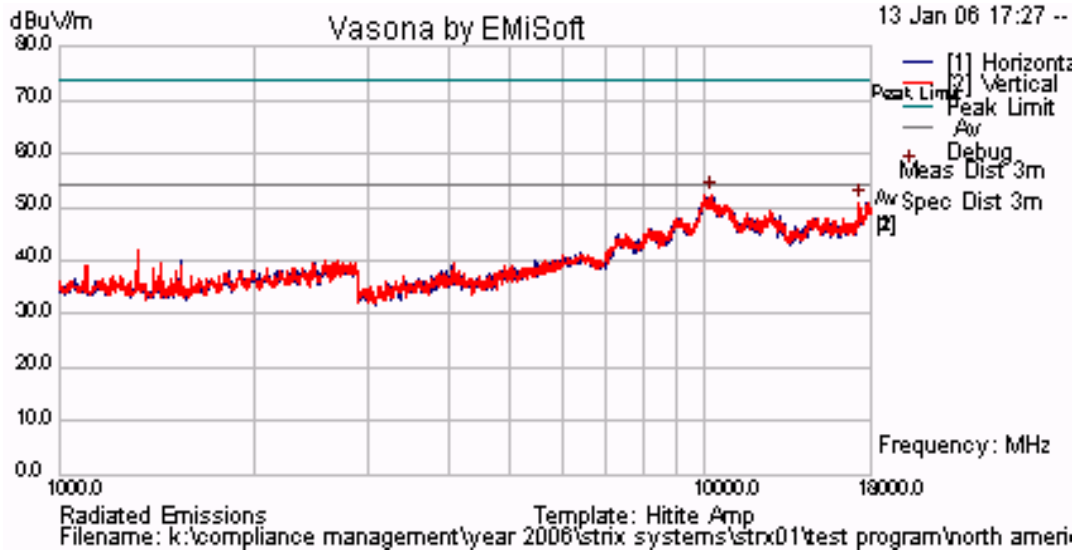
2.4 GHz Operational Mode - Configuration # 14a

802.11b 6MB/s Ch 2437 Sector Antenna Single channel operation

TABLE OF RESULTS – **Configuration # 14a**

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV/m)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10211.67	V	39.17	+13.21	52.39	54	-1.61
17325.0	V	36.17	+14.69	50.86	54	-3.14

Plot 61
Radiated Emissions for Configuration # 14a



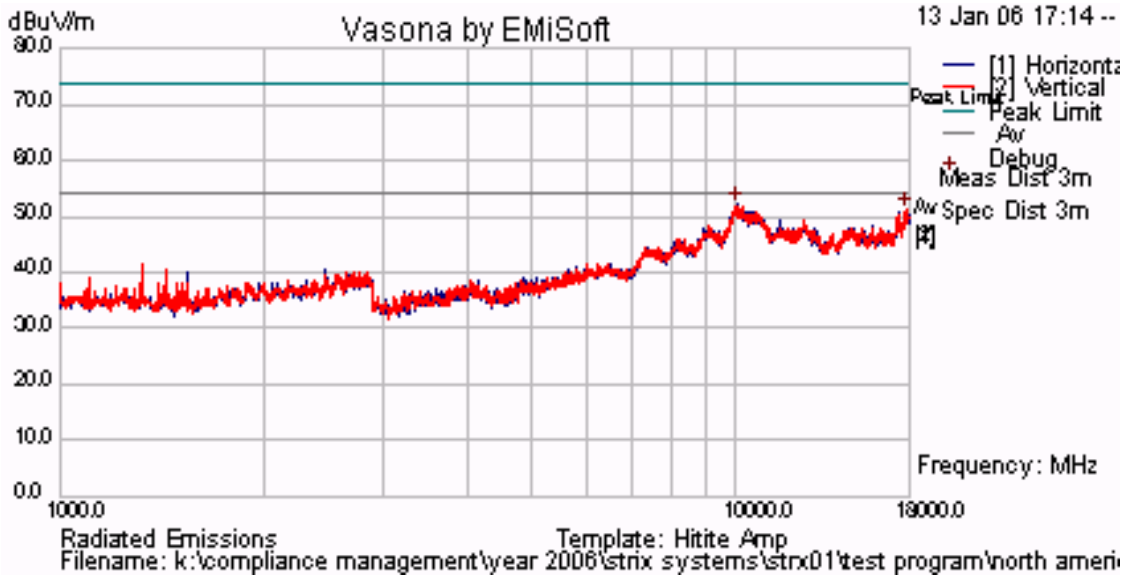
2.4 GHz Operational Mode - Configuration # 14b

802.11g 6MB/s Ch 2437 Omni Antenna Single channel operation

TABLE OF RESULTS – **Configuration # 14b**

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV/m)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10036.67	H	38.34	+13.65	51.99	54	-2.01
17816.67	V	34.17	+16.97	51.14	54	-2.86

Plot 61
Radiated Emissions for Configuration # 14b



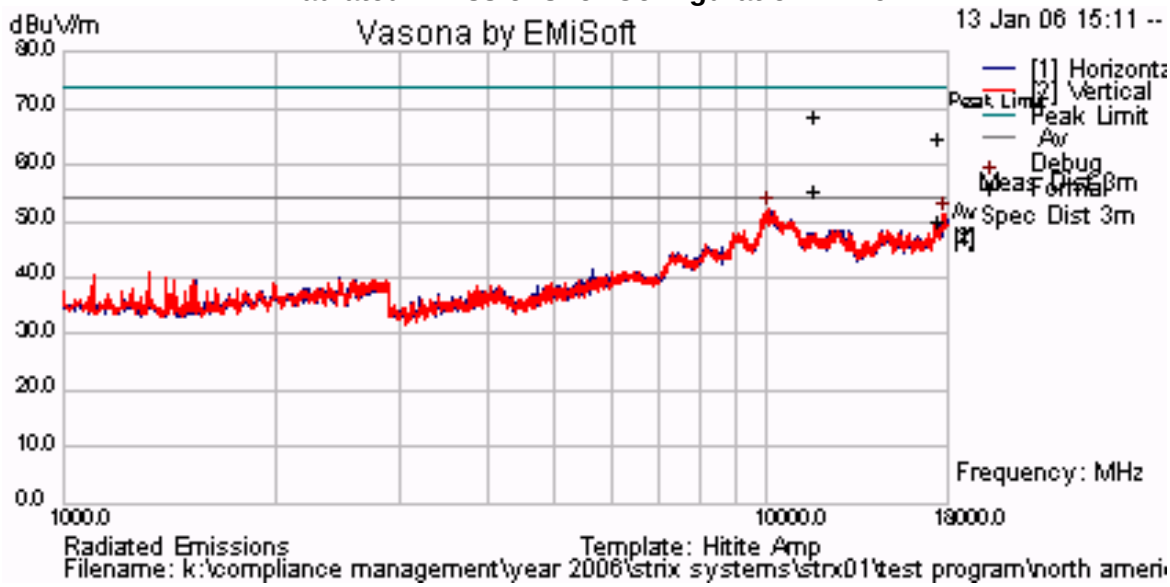
5.8 GHz Operational Mode - Configuration # 14c

Single channel operation 802.11a, 5785 MHz

TABLE OF RESULTS – **Configuration # 14c**

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV/m)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10048.33	H	38.50	+13.55	52.05	54	-1.95
17791.67	V	34.34	+16.88	51.22	54	-2.78

Plot 61
Radiated Emissions for Configuration # 14c



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 hall comply with the limits of Table 1.

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

Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-03 'Measurement of Radiated Emissions'	0088, 0158, 0134, 0304, 0311, 0315, 0310, 0312

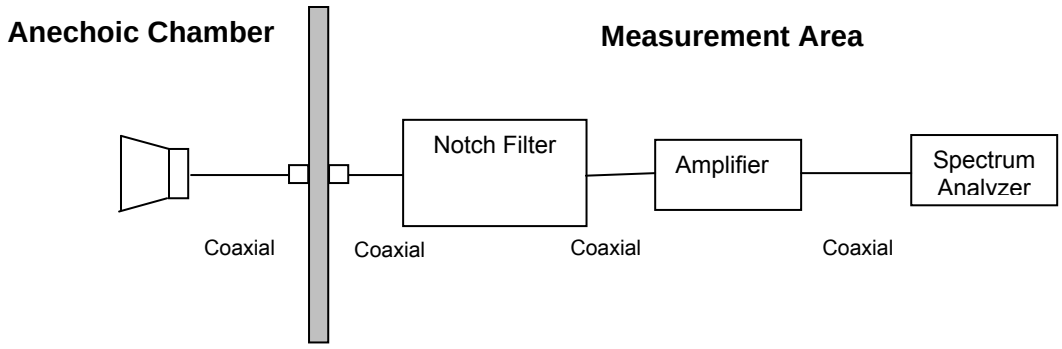
5.1.6.2.1. Radiated Band-Edge – Restricted Bands

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. A notch 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 = Band-stop Filter Loss or Waveguide Loss

For example:
Given receiver input reading of 51.5 dBμV; 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 dBμV/m

Conversion between dBμV/m (or dBμV) and μV/m (or μV) are done as:

Level (dBμV/m) = 20 * Log (level (μV/m))

40 dBμV/m = 100 μV/m
48 dBμV/m = 250 μV/m

Radiated Band Edge - Test Configurations

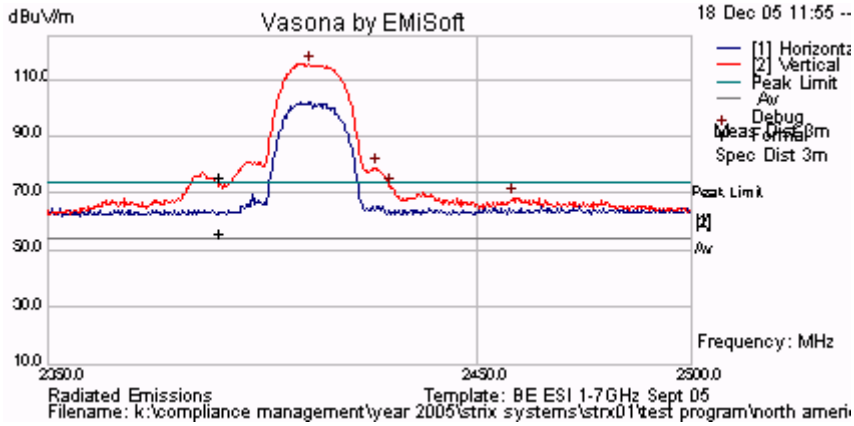
Antennas
12 dBi Dipole Antenna Part # OWS-ANTG-OMNI-12
16.4 dBi Sector Antenna Part # OWS-ANTG-SEC3-16

Radiated Band Edge Test Results for 2.4 GHz 12 dBi Dipole Antenna

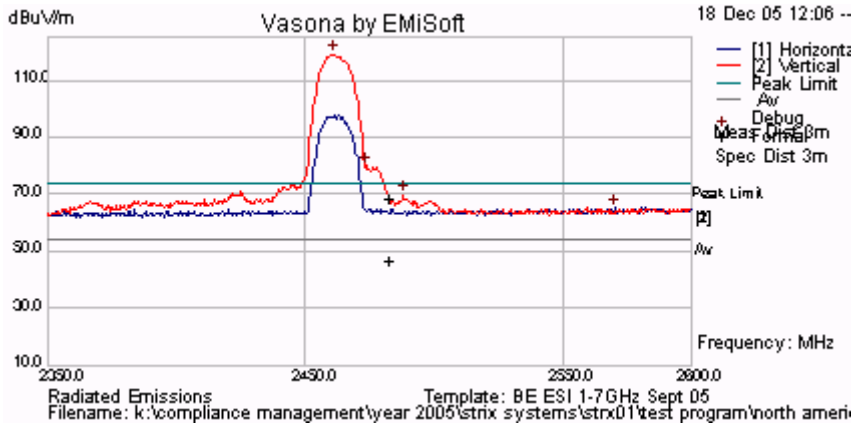
TABLE OF RESULTS – **802.11b**

Ch #	Tx Pwr (dBm)	Tx Freq. (MHz)	Restricted Band Edge Frequency (MHz)	Measured (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Plot #
1	+24	$2{,}412_{PEAK}$	2,390	72.38	74	-1.62	62
1	+24	$2{,}412_{AVE}$	2,390	52.09	54	-1.91	62
11	+24	$2{,}462_{PEAK}$	2,483.5	65.26	74	-8.74	63
11	+24	$2{,}462_{AVE}$	2,483.5	43.49	54	-10.51	63

Plot 62 Channel 1 - Lower Band Edge, Peak Emission = 115.41 dBµV/m



Plot 63 Channel 11 – Upper Band Edge, Peak Emission = 119.19 dBµV/m

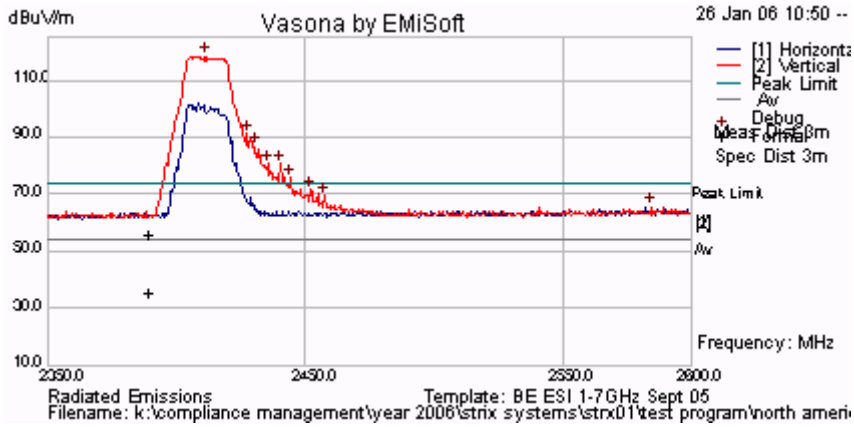


Radiated Band Edge Test Results for 2.4 GHz 12 dBi Dipole Antenna - Band pass filter INCLUDED in test setup

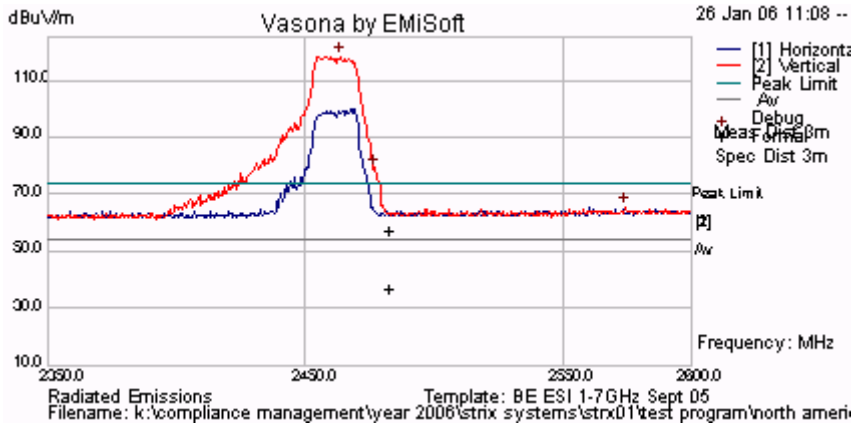
TABLE OF RESULTS – **802.11g**

Ch #	Tx Pwr (dBm)	Tx Freq. (MHz)	Restricted Band Edge Frequency (MHz)	Measured (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Plot #
1	+23	$2{,}412_{PEAK}$	2,390	52.50	74	-21.50	64
1	+23	$2{,}412_{AVE}$	2,390	32.02	54	-21.98	64
11	+23	$2{,}462_{PEAK}$	2,483.5	53.79	74	-20.21	65
11	+23	$2{,}462_{AVE}$	2,483.5	33.18	54	-20.82	65

Plot 64 Channel 1 - Lower Band Edge, Peak Emission =118.34 dBµV/m



Plot 65 Channel 11 – Upper Band Edge, Peak Emission =118.27 dBµV/m

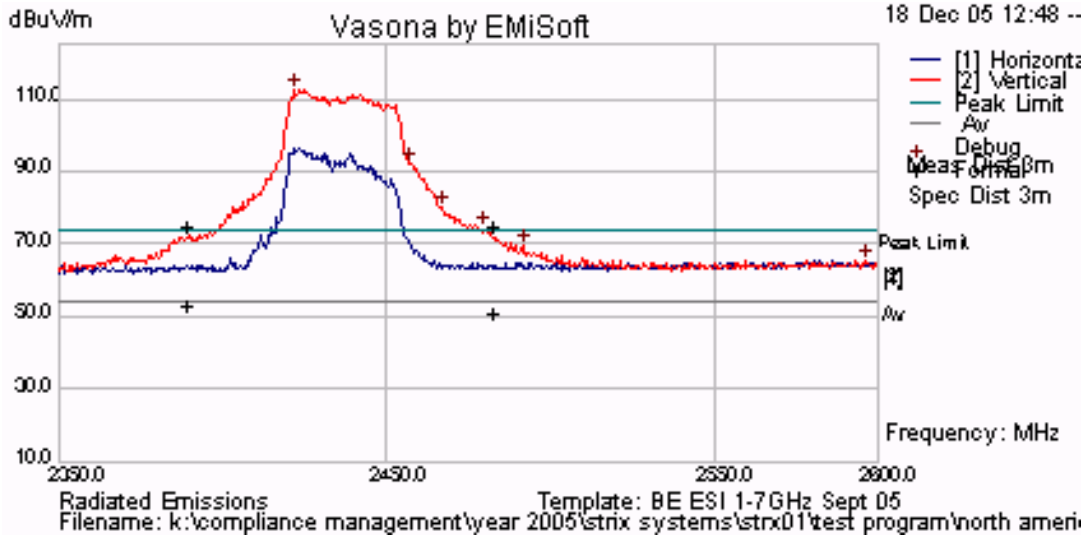


Radiated Band Edge Test Results for 2.4 GHz 12 dBi Dipole Antenna – Band pass filter NOT INCLUDED in test setup

TABLE OF RESULTS – **802.11g Turbo**

Ch #	Tx Pwr (dBm)	Tx Freq. (MHz)	Restricted Band Edge Frequency (MHz)	Measured (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Plot #
1	+19	$2{,}437_{PEAK}$	2,390	71.2	74	-2.80	66
1	+19	$2{,}437_{AVE}$	2,390	49.23	54	-4.77	66
11	+19	$2{,}437_{PEAK}$	2,483.5	71.43	74	-2.57	66
11	+19	$2{,}437_{AVE}$	2,483.5	47.65	54	-6.35	66

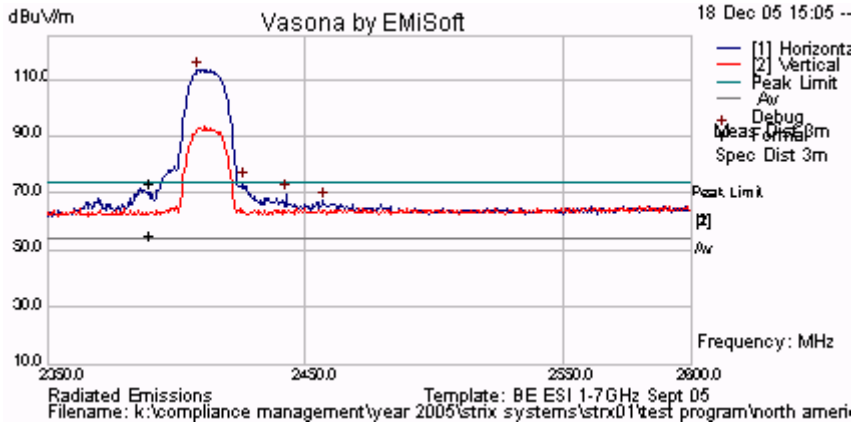
Plot 66 Band Edge, Peak Emission =112.46 dBµV/m



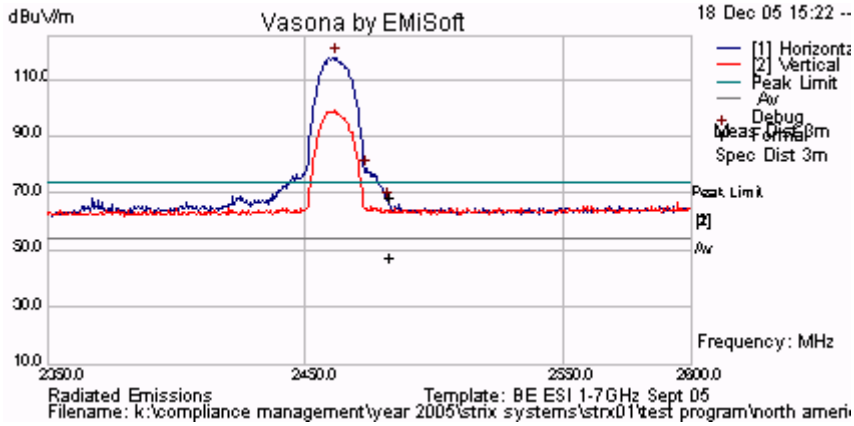
Radiated Band Edge Test Results for 2.4 GHz 16.4 dBi Sector Antenna
TABLE OF RESULTS – **802.11b**

Ch #	Tx Pwr (dBm)	Tx Freq. (MHz)	Restricted Band Edge Frequency (MHz)	Measured (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Plot #
1	+21	$2{,}412_{PEAK}$	2,390	69.94	74	-4.06	67
1	+21	$2{,}412_{AVE}$	2,390	51.63	54	-2.37	67
11	+21	$2{,}462_{PEAK}$	2,483.5	65.26	74	-8.74	68
11	+21	$2{,}462_{AVE}$	2,483.5	44.11	54	-9.89	68

Plot 67 Channel 1 - Lower Band Edge, Peak Emission = 113.28 dBµV/m



Plot 68 Channel 11 – Upper Band Edge, Peak Emission = 117.57 dBµV/m

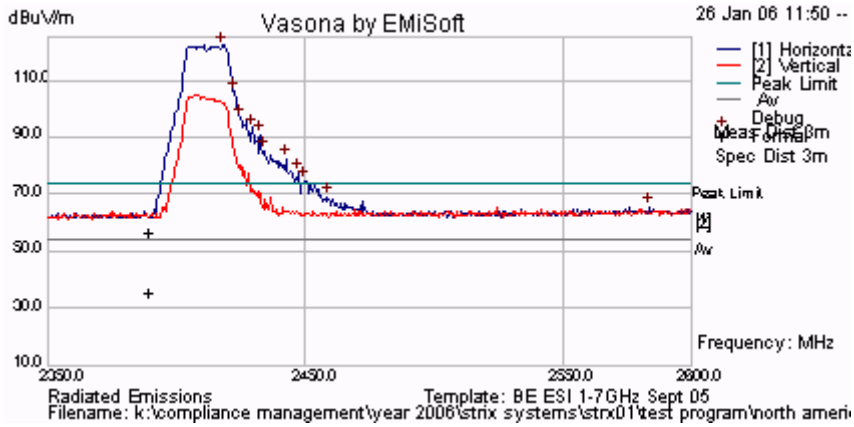


Radiated Band Edge Test Results for 2.4 GHz 16.4 dBi Sector Antenna – Band pass filter INCLUDED in test setup

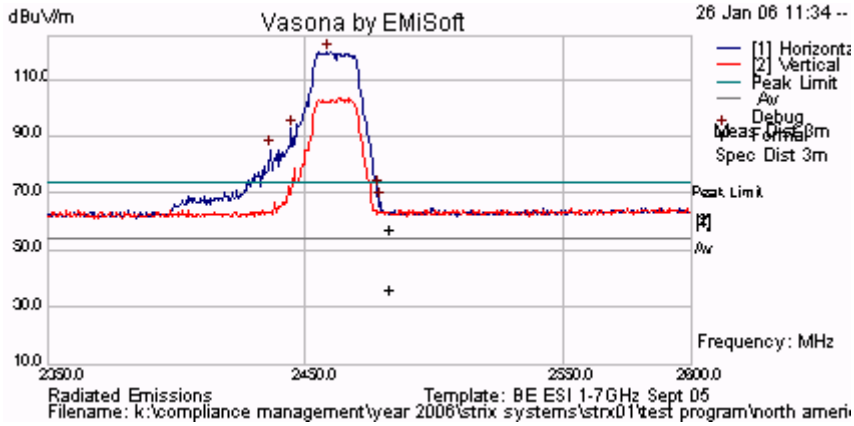
TABLE OF RESULTS – **802.11g**

Ch #	Tx Pwr (dBm)	Tx Freq. (MHz)	Restricted Band Edge Frequency (MHz)	Measured (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Plot #
1	+23	$2{,}412_{PEAK}$	2,390	52.89	74	-21.11	69
1	+23	$2{,}412_{AVE}$	2,390	32.02	54	-21.98	69
11	+23	$2{,}462_{PEAK}$	2,483.5	53.66	74	-20.34	70
11	+23	$2{,}462_{AVE}$	2,483.5	32.96	54	-21.04	70

Plot 69 Channel 1 - Lower Band Edge, Peak Emission =122.18 dBµV/m



Plot 70 Channel 11 – Upper Band Edge, Peak Emission =119.53 dBµV/m

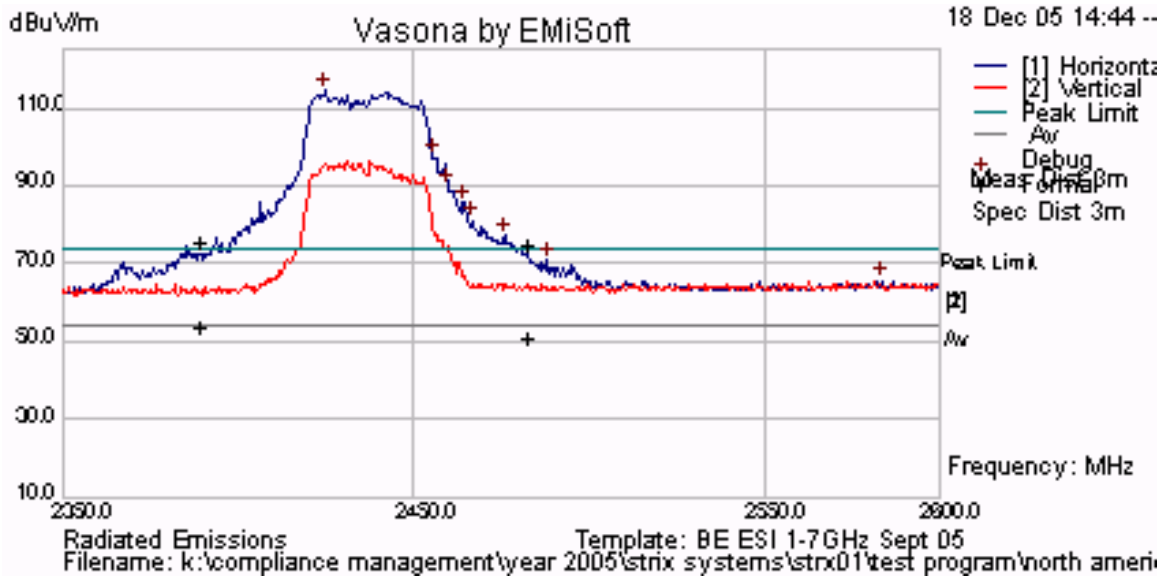


Radiated Band Edge Test Results for 2.4 GHz 16.4 dBi Sector Antenna - Band pass filter NOT INCLUDED in test setup

TABLE OF RESULTS – **802.11g Turbo**

Ch #	Tx Pwr (dBm)	Tx Freq. (MHz)	Restricted Band Edge Frequency (MHz)	Measured (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Plot #
1	+19	$2{,}437_{PEAK}$	2,390	72.12	74	-1.88	71
1	+19	$2{,}437_{AVE}$	2,390	50.22	54	-3.78	71
11	+19	$2{,}437_{PEAK}$	2,483.5	71.3	74	-2.70	71
11	+19	$2{,}437_{AVE}$	2,483.5	47.78	54	-6.22	71

Plot 71 Channel 1 - Lower Band Edge, Peak Emission =114.37 dBµV/m



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 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.

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.

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

Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-03 'Measurement of Radiated Emissions'	0088, 0158, 0134, 0304, 0311, 0315, 0310, 0312

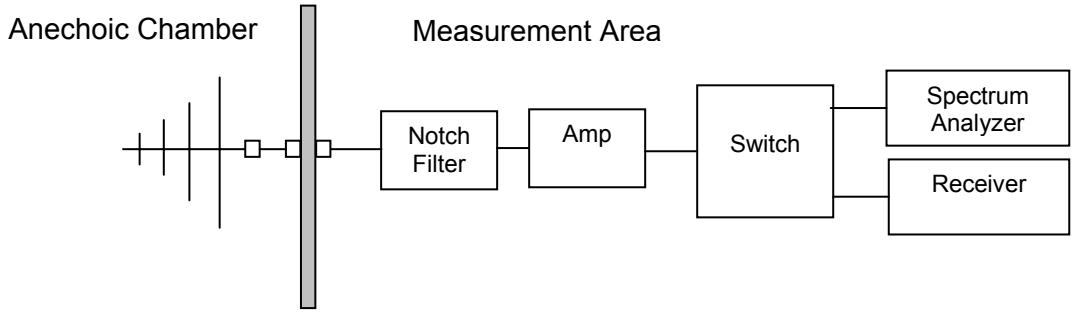
5.1.6.3. Radiated Spurious Emissions (30M-1 GHz)

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

Test Procedure

Testing 30M-1 GHz was subcontracted to the company identified in Section 3.9 Subcontracted Testing. Preliminary radiated emissions are measured in the anechoic chamber at a 10-meter distance on every azimuth in both horizontal and vertical polarity. The emissions are recorded with a spectrum analyzer 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.

System operation was completed with five operational transmitters terminated in a 50Ω load at maximum power and one 2.4 GHz transmitter terminated in the 16.4 dBi Sector antenna.



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

For example:
Given a Receiver input reading of 51.5dBμV; 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 = 36.3dBμV/m

Conversion between dBμV/m (or dBμV) and μV/m (or μV) are done as:

Level (dBμV/m) = 20 * Log (level (μV/m))

40 dBμV/m = 100μV/m
48 dBμV/m = 250μV/m

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

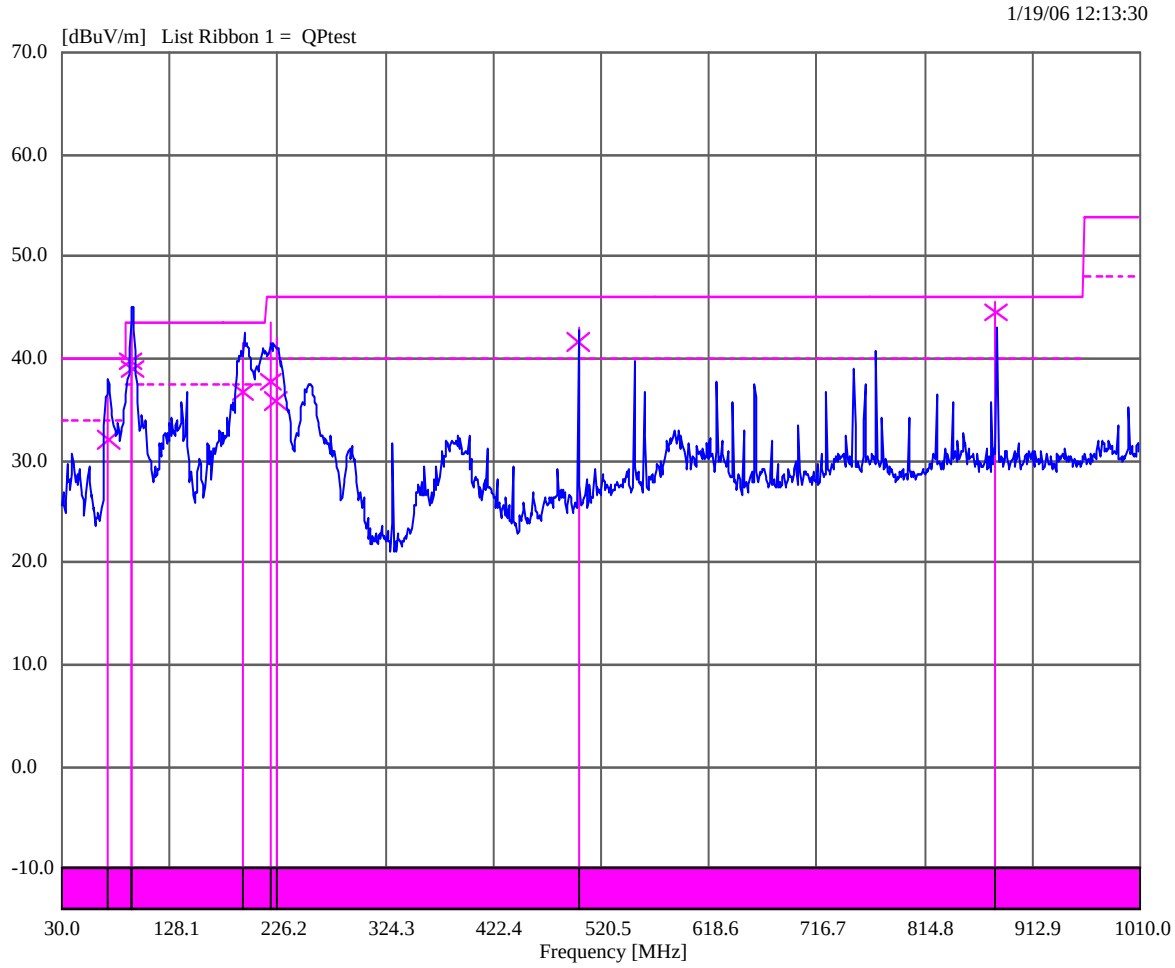
Ambient conditions.
Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

Radio parameters.
Data Rate(s): 11MBit/s
EUT Antenna: 2.4G 16dBi 120 degree sector antenna.

TABLE OF RESULTS

Freq. (MHz)	Peak (dBuV/m)	QP (dBuV/m)	QP Lmt (dBuV/m)	QP Margin (dB)	Angle (deg)	Height (cm)	Polarity
71.767008	36.11	32.11	39.96	-7.85	310	244	Vert
93.180200	43.48	39.76	43.46	-3.70	235	103	Vert
93.571265	42.63	38.93	43.46	-4.53	345	102	Vert
194.692985	41.61	36.69	43.46	-6.77	263	100	Vert
220.330924	43.44	37.68	45.96	-8.28	235	101	Vert
224.974037	41.99	35.85	45.96	-10.11	86	248	Horz
500.009422	43.01	41.63	45.96	-4.33	233	98	Horz
879.998671	45.51	44.57	45.96	-1.39	259	101	Horz

Plot 72
Radiated Spurious Emissions 30 MHz to 1 GHz



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

Traceability

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

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

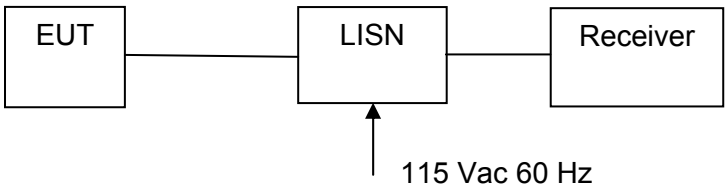
FCC, Part 15 Subpart C §15.207
Industry Canada RSS-Gen §7.2.2

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.

All six transmitters were operational and terminated in a 50Ω load.

Test Measurement Set up



Measurement set up for AC Wireline Conducted Emissions Test

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

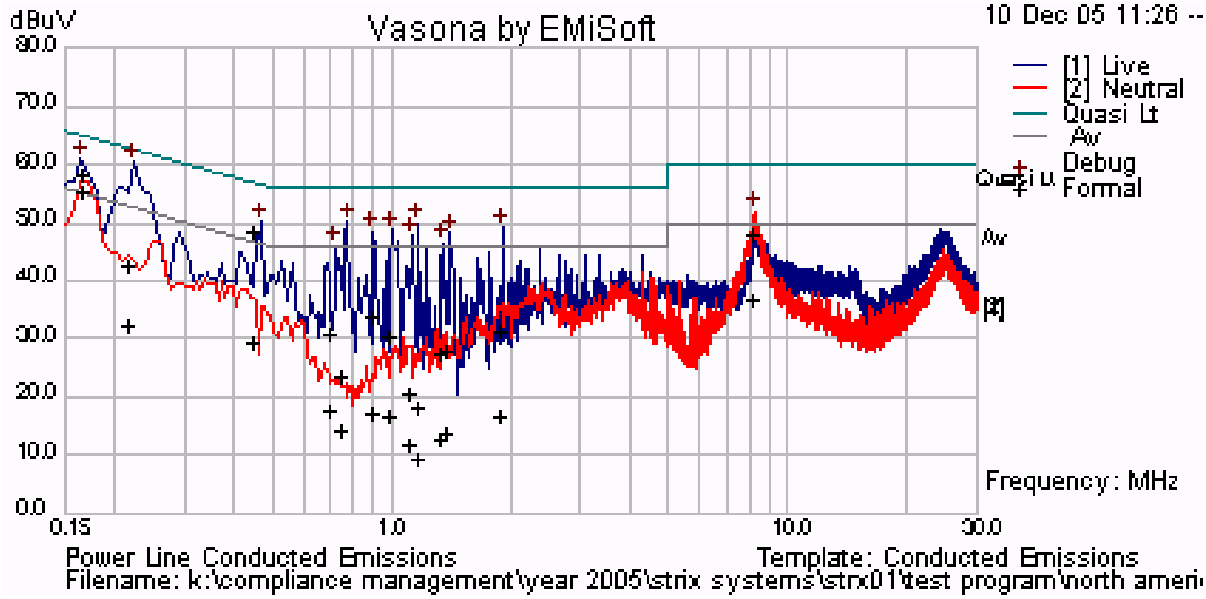
Ambient conditions.
Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

Radio parameters.
Transmitting 100% duty cycle, full power into a 50Ω load.

TABLE OF RESULTS

Freq (MHz)	Line	Peak (dBµV)	QP (dBµV)	QP Limit (dBµV)	QP Margin (dB)	Ave. (dBµV)	Ave. Limit (dBµV)	Ave. Margin (dB)
0.17	L	60.95	56.18	64.97	-8.79	52.83	54.97	-2.14
0.22	L	60.41	40.2	62.82	-22.61	29.74	52.82	-23.08
0.456	L	50.17	46.05	56.77	-10.72	27.2	46.77	-19.57
0.711	L	46.04	28.64	56	-27.36	15.13	46	-30.87
0.914	L	48.36	31.21	56	-24.79	14.9	46	-31.1
8.276	N	51.92	45.73	60	-14.27	34.17	50	-15.83

Plot 73
AC Wireline Conducted Emissions (150 kHz – 30 MHz)



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 μΩ 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 (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

Laboratory Measurement Uncertainty for Conducted Emissions

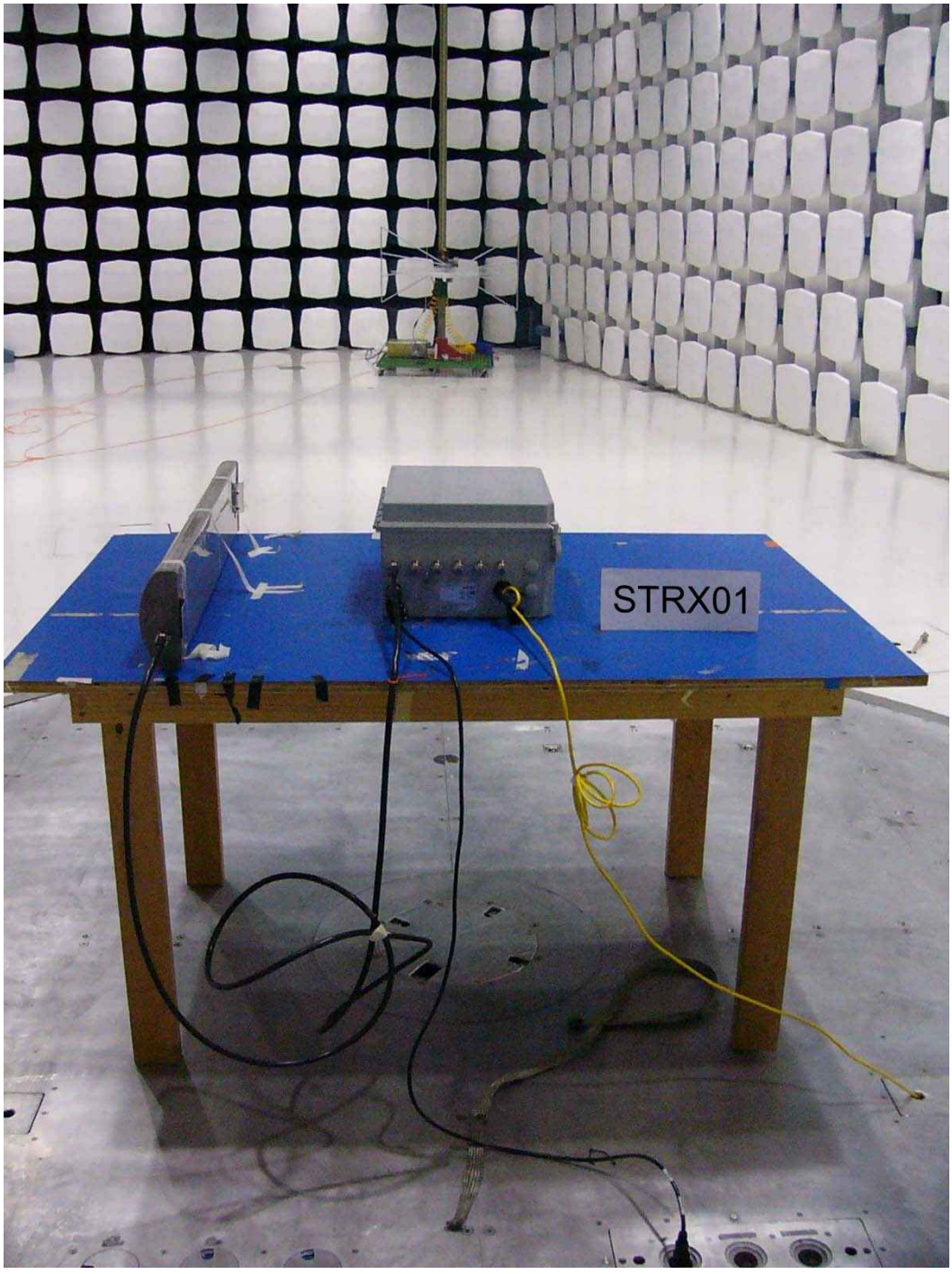
Measurement uncertainty	±2.64 dB

Traceability

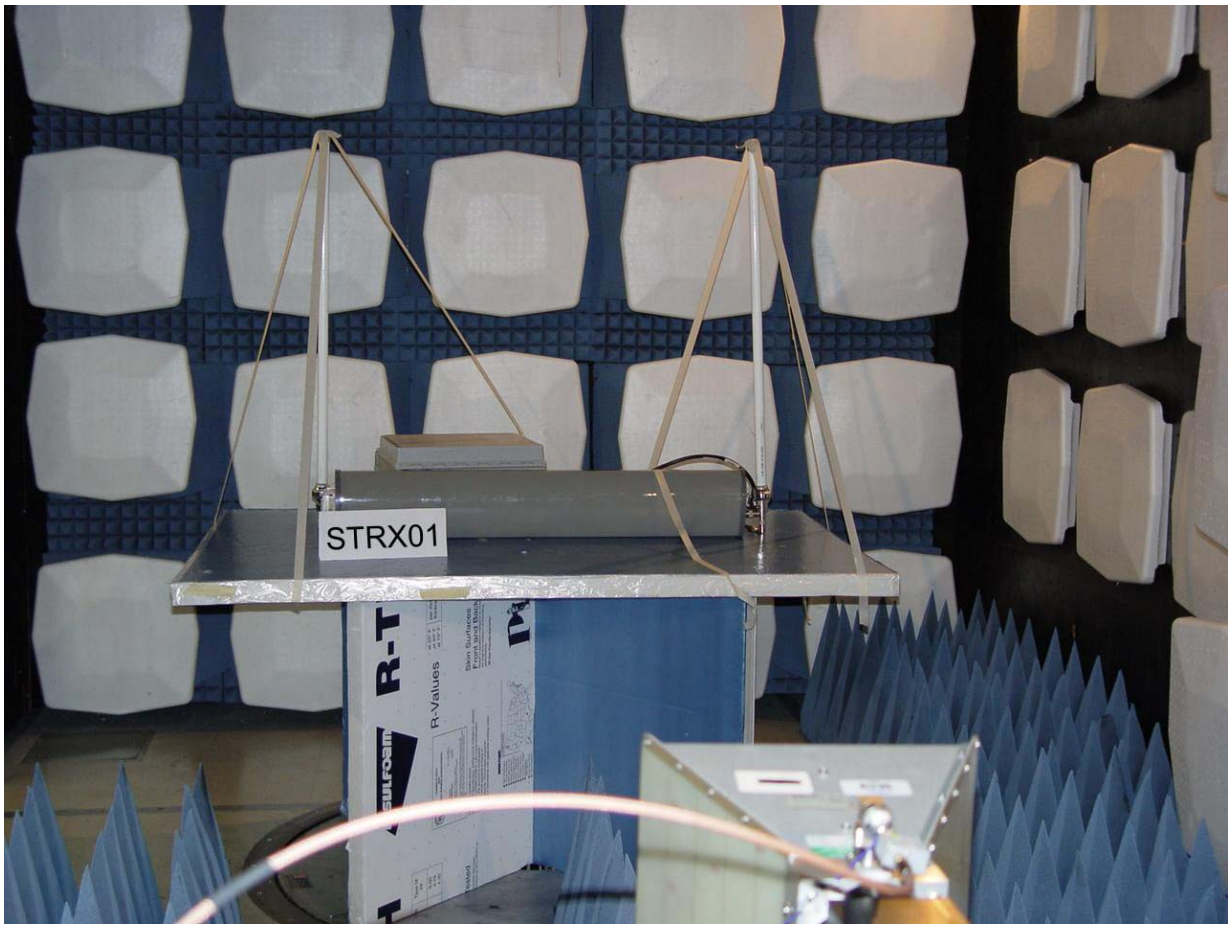
Method	Test Equipment Used
Measurements were made per work instruction WI-EMC-01 'Measurement of Conducted Emissions'	0158, 0184, 0193, 0190, 0293, 0307

6. PHOTOGRAPHS

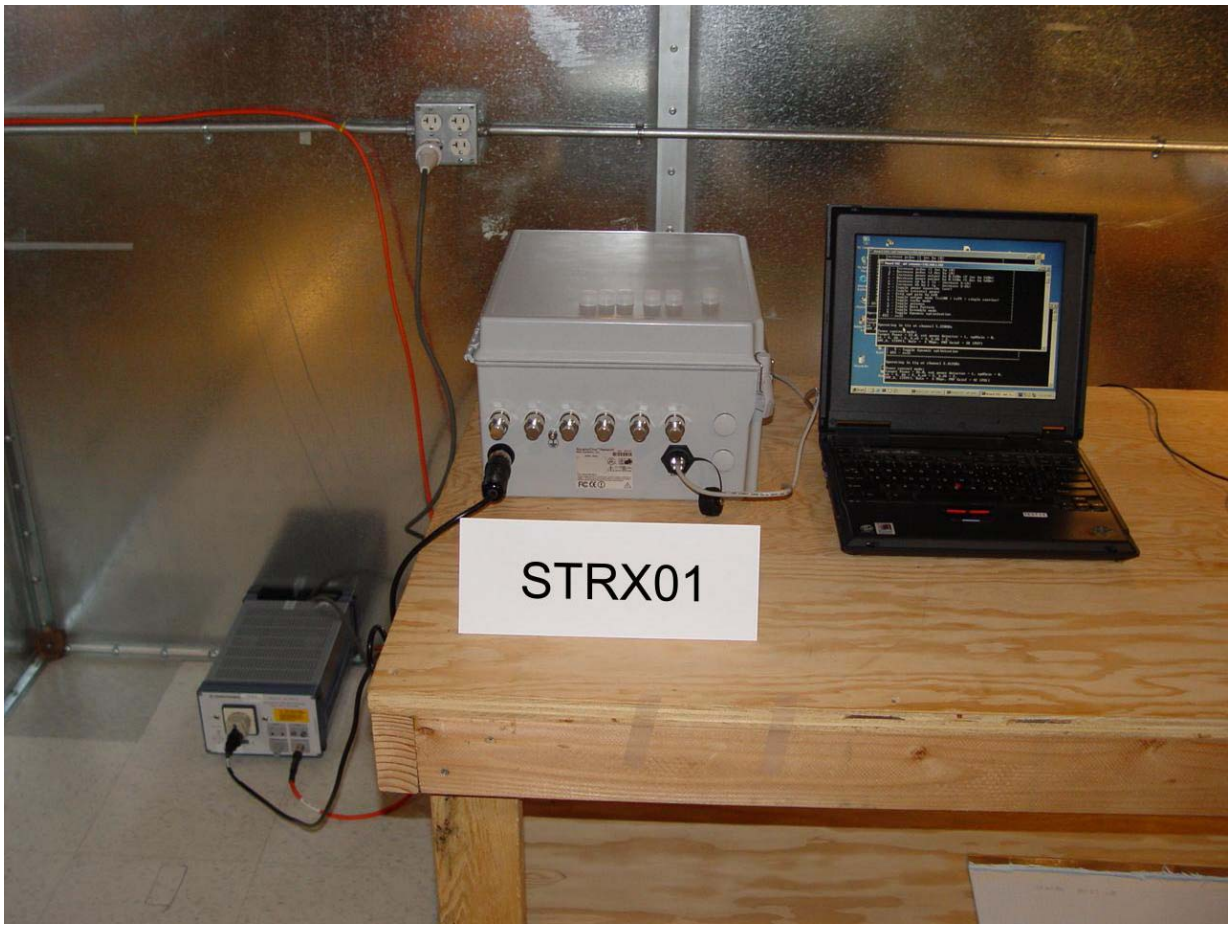
6.1. Radiated Emissions (30 MHz-1 GHz)



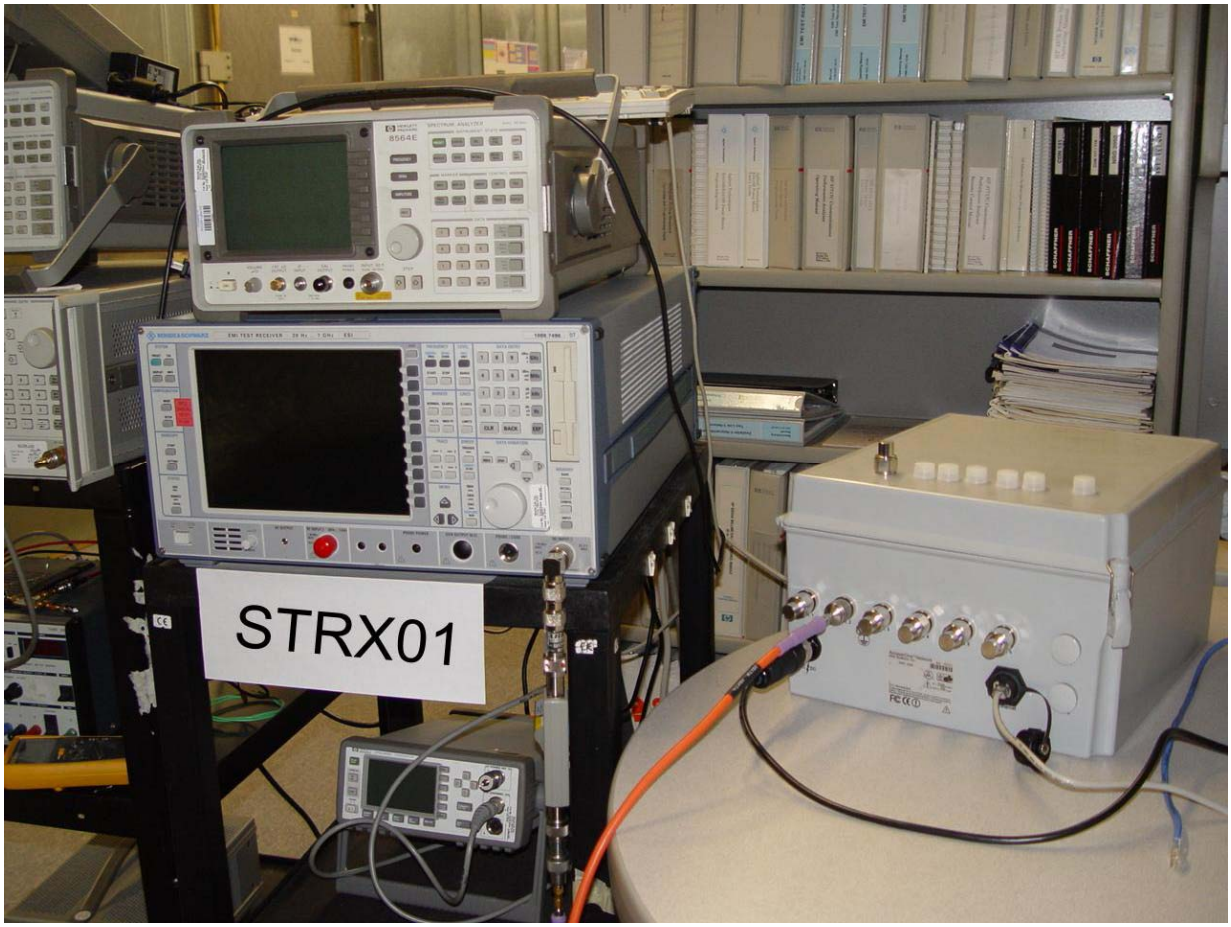
6.2. Spurious Emissions >1 GHz



6.3. Conducted Emissions (150 kHz - 30 MHz)



6.4. General Measurement Test Set-Up



7. TEST EQUIPMENT DETAILS

Asset #	Instrument	Manufacturer	Part #	Calibration Due Date	Serial #
0088	Spectrum Analyzer	Hewlett Packard	8564E	20th June '06	3410A00141
0104	1-18GHz Horn Antenna	The Electro-Mechanics Company	3115	21st Oct '06	9205-3882
0134	Amplifier	Com Power	PA 122	1st Dec '06	181910
0158	Barometer /Thermometer	Control Co.	4196	25th Aug '06	E2846
0193	EMI Receiver	Rhode & Schwartz	ESI 7	8th Apr '06	838496/007
0252	SMA Cable	Megaphase	Sucoflex 104	11th Jun '06	None
0304	2.4GHzHz Notch Filter	Micro-Tronics	--	1st Dec 06	001
0310	2m SMA Cable	Micro-Coax	UFA210A-0-0787-3G03G0	7th Dec '06	209089-001
0312	3m SMA Cable	Micro-Coax	UFA210A-1-1181-3G0300	9h Dec '06	209092-001
0313	Coupler	Hewlett Packard	86205A	N/A	3140A01285
0314	30dB N-Type Attenuator	ARRA	N9444-30	N/A	1623
0070	Power Meter	Hewlett Packard	437B	13th May 06	3125U11552
0116	Power Sensor	Hewlett Packard	8485A	7th April 06	3318A19694
0117	Power Sensor	Hewlett Packard	8487D	20th June 06	3318A00371
0184	Pulse Limiter	Rhode & Schwartz	ESH3Z2	3RD Oct 06	357.8810.52
0190	LISN	Rhode & Schwartz	ESH3Z5	22nd Jun 07	836679/006
0293	BNC Cable	Megaphase	1689 1GVT4	13TH Jul 06	15F50B001
0307	BNC Cable	Megaphase	1689 1GVT4	13th Jul 06	15F50B002

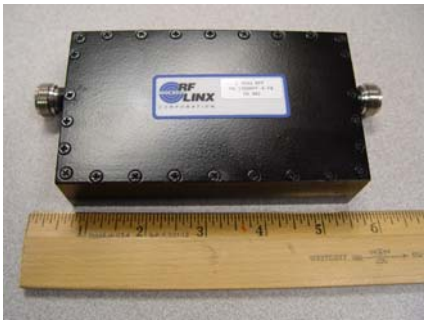
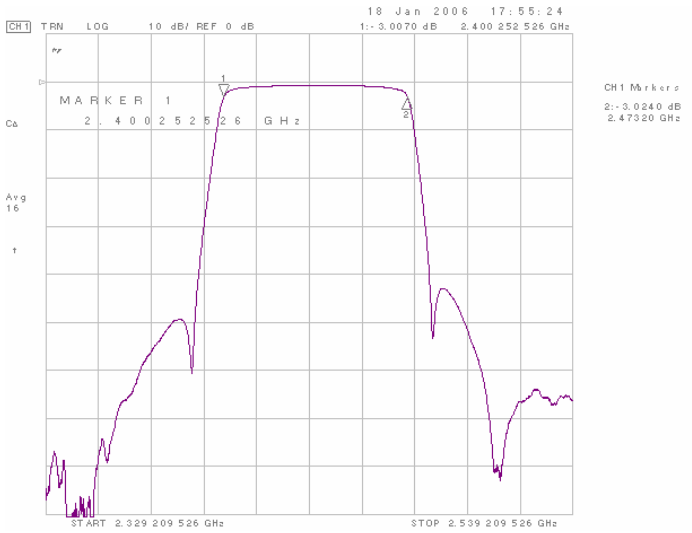
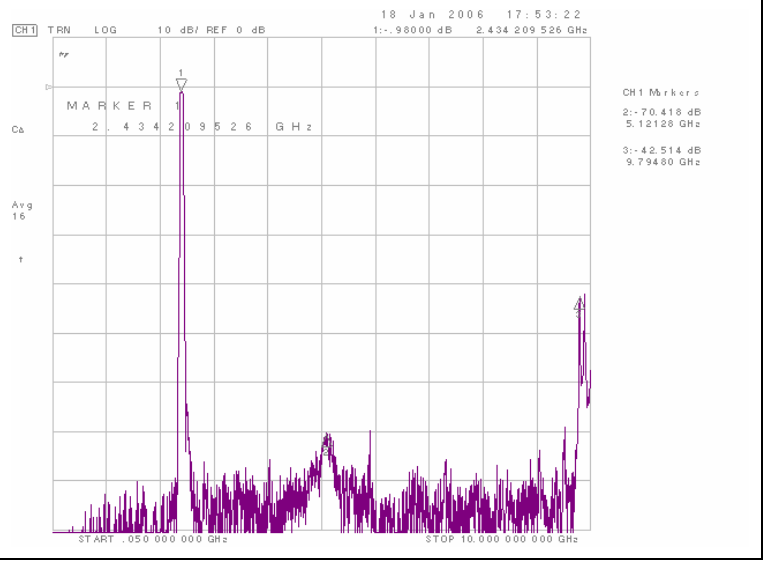
8. Appendix A

Equipment Modifications

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

1. A band pass filter was required to bring the product into compliance for 802.11g radiated band edge measurements, refer to the test results in Section 5.1.6.3.

   The filter band pass response was recorded on an HP 8722ET Network Analyzer and is illustrated in the tables below.

Band Pass Filter used for 802.11g Band Edge Measurements	
Manufactured by RF Linx Model # 2400BPF-8-FB 	
	

2. To bring the product into compliance with radiated spurious emissions 30 MHz – 1 GHz ferrites were required on both the ac power supply cable and ethernet ports.

   i. AC Power Cable Ferrite
   The AC power cable ferrite which had a double turn is manufactured by Fair-Rite model number 0444164181.

   ii. Ethernet Port
   The Ethernet Port ferrite which was implemented with a double turn was a

   Manufacturer: Fair-Rite VO
   Part #: 0444167281

3. Problems with spurious emissions above 1 GHz in the 802.11a and g operational modes. To bring the product into compliance the following changes were required;

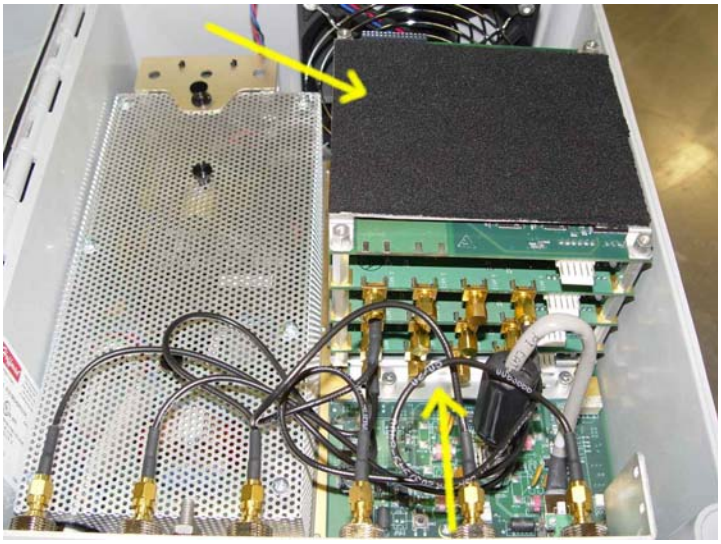
   i. 2.4 GHz Conducted Band-edge Power Reduction

   To bring 802.11g channel 1 into compliance with the conducted band-edge requirements the output power was reduced by 1 dB, see Section 5.1.5 Spurious Emissions

   ii. RF Housing

   The harmonics of the transmitter were emanating through the plastic housing of the EUT. Absorption material was applied to the top most shield in the stack and the bottom most bracket to attenuate the harmonics. The material is manufactured by ARC Technologies, part number ARC-DD-10214

Absorption Material



iii. 5.8 GHz Output Power Reduction

5.8 GHz Dipole Antenna Radiated Spurious Emissions

To bring the 5.8 GHz radio into compliance the output power on channels 5,745 and 5,825 MHz was reduced to +24 dBm. Mid channel complied +26 dBm.

Peak Power Spectral Density

The output power on 802.11a Channel 5,745 MHz was reduced to +24 dBm as a result of a Peak Power Spectral Density problem.

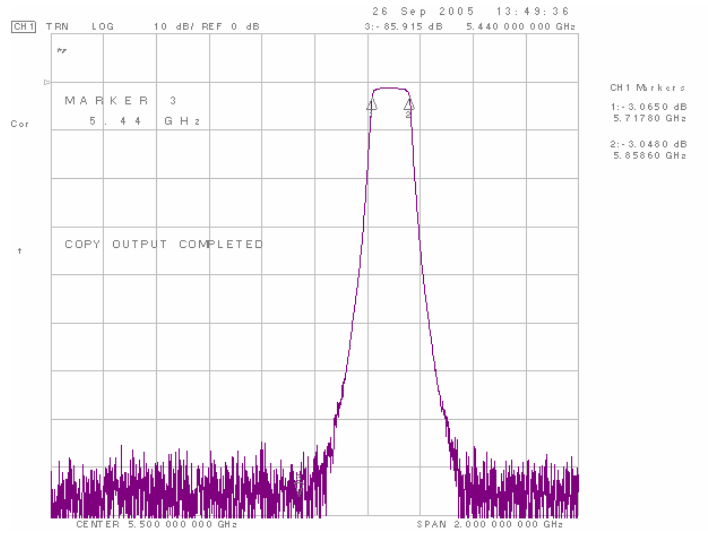
iv. 5.8 GHz Patch Panel Band Pass Filter

As a result of broadband emissions in the frequency range 5,725 – 5,850 MHz band a 5.8 GHz band pass filter was required to be installed when the Patch Panel antenna was tested.

5.8 GHz Band Pass Filter used for 802.11a Spurious Emission Measurements

Manufacturer: K&L

Part #: 6C50-5787.5/U120-N/N



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