Test of Access One Network OWS 2400-30

To: FCC 47 CFR Part 15.407 & IC RSS-210

Test Report Serial No.: STRX14-A4
OWS 2400-30 Rev A

TEST REPORT

FROM

Test of Access One Network OWS 2400-30

To: FCC 47 CFR Part 15.407 & IC RSS-210

Test Report Serial No.: STRX14-A4 OWS 2400-30 Rev A

Note: this report only contains RF data with regard to the 5,250 to 5,350 MHz, and 5,470 to 5,725 MHz operational mode of the radio module. DFS Test data is reported in MiCOM Labs test report STRX14-A3. 2.4 and 5.8 GHz test data is reported in MiCOM Labs test report STRX01-A14 OWS 2400-30

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:** 24th May 2007

This Test Report is Issued Under the Authority of;

MiCOM Labs, Inc.
440 Boulder Court, Suite 200
Pleasanton, CA 94566 USA
Phone: +1 (925) 462-0304
Fax: +1 (925) 462-0306
www.micomlabs.com

ACCREDITED
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	24th May 2007	First issue.

1. TEST RESULT CERTIFICATE

Manufacturer:	Strix Systems, Inc 26610 Agoura Road Calabasas California 91302, USA	Tested By:	MiCOM Labs, Inc. 440 Boulder Court Suite 200 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 19th Jan '06, 7th to 8th May '07	Website:	www.micomlabs.com

STANDARD(S)	TEST RESULTS
FCC 47 CFR Part 15.407 & IC RSS-210 (Not including DFS)	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.

A2LA 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 15.407	Sept 2005	Code of Federal Regulations
(ii)	Industry Canada RSS-210	Issue 6 Sept. 2005	Low Power License-Exempt Radiocommunication Devices (All Frequency Bands): Category 1 Equipment
(iii)	Industry Canada RSS-Gen	Issue 1 Sept. 2005	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	14th September 2005	Reference to A2LA Accreditation Status – A2LA Advertising Policy
(x)	FCC Public Notice – DA 02-2138	2002	Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices

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 2400-30 in the frequency ranges 5,250 to 5,350 MHz and 5,470 to 5,725 MHz to FCC Part 15.407 and Industry Canada RSS-210 regulations.
Applicant:	Manufacturer
Manufacturer:	Strix Systems, Inc 26610 Agoura Road Calabasas California 91302, USA
Laboratory performing the tests:	MiCOM Labs, Inc. 440 Boulder Court, Suite 200 Pleasanton, California 94566 USA
Test report reference number:	STRX14-A4 OWS 2400-30 Rev A
Standard(s) applied:	FCC 47 CFR Part 15.407 & IC RSS-210
Dates of test (from - to):	6th Dec to 19th Jan '06, 7th to 8th May '07
No of Units Tested:	1
Type of Equipment:	802.11a/b/g Wireless Access Point
Manufacturers Trade Name:	Access One Network
Model:	OWS 2400-30
Location for use:	Outdoor use only
Declared Frequency Range(s):	5,250 to 5,350 MHz, 5,470 to 5,725 MHz.
Software Build	3.0.3
Type of Modulation:	OFDM
Declared Nominal Output Power:	802.11a: +26 dBm
EUT Modes of Operation:	Per 802.11 DSSS with OFDM modulation
Transmit/Receive Operation:	Simplex
Rated Input Voltage and Current:	100 to 240 VAC. Single Phase, 50-60 Hz, 1 amp max. DC 12 to 24 Volts, 9 amps max.
Operating Temperature Range:	-30 to +55ºC
ITU Emission Designator:	5,250 to 5,350 MHz 802.11a 17M7W7D, 5,470 to 5,725 MHz 802.11a 18M0W7D
Microprocessor(s) Model:	Atheros AR5312
Clock/Oscillator(s):	25 MHz, 40 MHz.
Frequency Stability:	±20 ppm
Equipment Dimensions:	12”x10”x6”
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 range 5250 to 5350 MHz and 5,470 to 5,725 MHz for compliance against FCC 47 CFR Part 15.407 and Industry Canada RSS-210 specifications

The Strix Systems, Inc Access One Network OWS 2400 employs OFDM modulation for 802.11a operational.

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) and RF measurements in the 5,470 to 5,725 MHz band are reproduced from the data used in MiCOM Labs test report STRX01-A5 for the fully equipped model OWS 3600-30.

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.
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)	Frequencies (MHz)	Maximum Data Rates (MBit/s)	Data Rate(s) Selected for Test Purposes (Mbit/s)	
			Conducted	Radiated
a	5,260 5,300 5,320	54	6	6
a	5,500 5,600 5,700	54	6	6

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. 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

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 15.407** and **Industry Canada RSS-210**.and **Industry Canada RSS-Gen**.

Section(s)	Test Items	Description	Condition	Result	Test Report Section
15.407(a) **A9.2(2)** **4.4**	26dB and 99% Emission BW	Emission bandwidth measurement	Conducted	Complies	5.1.1
15.407(a) **A9.2(2)** **4.6**	Peak Transmit Power	Peak Power Measurement	Conducted	Complies	5.1.2
15.407(a) **A9.2(2)**	Peak Power Spectral Density	PPSD	Conducted	Complies	5.1.3
15.407(a)(6)	Peak Excursion Ratio	<13dB in any 1MHz bandwidth	Conducted	Complies	5.1.4
15.407(g) **15.31** **2.1** **4.5**	Frequency Stability	Limits: contained within band of operation at all times.	Manufacturer declaration	Complies	5.1.5
15.407(f) **5.5**	Radio Frequency Radiation Exposure	Exposure to radio frequency energy levels, Maximum Permissible Exposure (MPE)	Calculation	Complies	5.1.6
15.407(b)(2) **2.2** **2.6** **A9.3(2)** **4.7**	Conducted Spurious Emissions	Spurious emissions above 1GHz (1-40GHz) including band edge	Conducted	Complies	5.1.7

List of Measurements (continued)

The following table represents the list of measurements required under the **FCC CFR47 Part 15.407** and **Industry Canada RSS-210** and **Industry Canada RSS-Gen**.

Section(s)	Test Items	Description	Condition	Result	Test Report Section
15.407(b)(2) **15.205(a)** **15.209(a)** **2.2** **2.6** **A9.3(2)** **4.7**	Radiated Emissions		Radiated		5.1.8
	Transmitter Radiated Spurious Emissions	Emissions above 1 GHz		Complies	*5.1.8.1*
	Radiated Band Edge	Band edge results		Complies	*5.1.8.2*
15.407(b)(6) **15.205(a)** **15.209(a)** **2.2**	Radiated Emissions	Emissions <1 GHz (30M-1 GHz)		Complies	*5.1.8.3*
15.407(b)(6) **15.207** **7.2.2**	AC Wireline Conducted Emissions 150 kHz–30 MHz	Conducted Emissions	Conducted	Complies	5.1.9

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*

5. TEST RESULTS

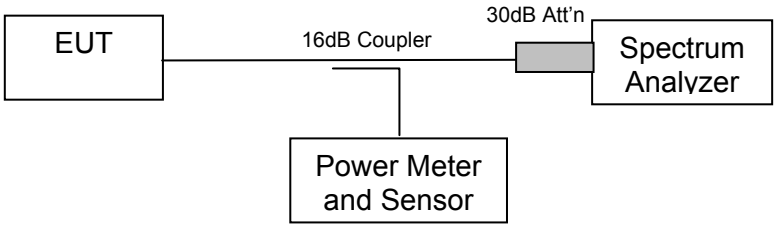
5.1. Device Characteristics

5.1.1. 26 dB and 99 % Bandwidth

FCC, Part 15 Subpart C §15.407(a)
Industry Canada RSS-210 § A9.2(2)
Industry Canada RSS-Gen 4.4

Test Procedure
The bandwidth at 6 dB and 99 % is measured with a spectrum analyser connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency. The spectrum analyzer utilized the 6 dB resolution bandwidth filter for all measurements.

Test Measurement Set up



Measurement set up for 6 dB and 99 % bandwidth test

Radio parameters.
Data Rate(s): 802.11a 6 MBit/s.
Power Level: maximum for 0 dBi antenna, +24 dBm (250mW)

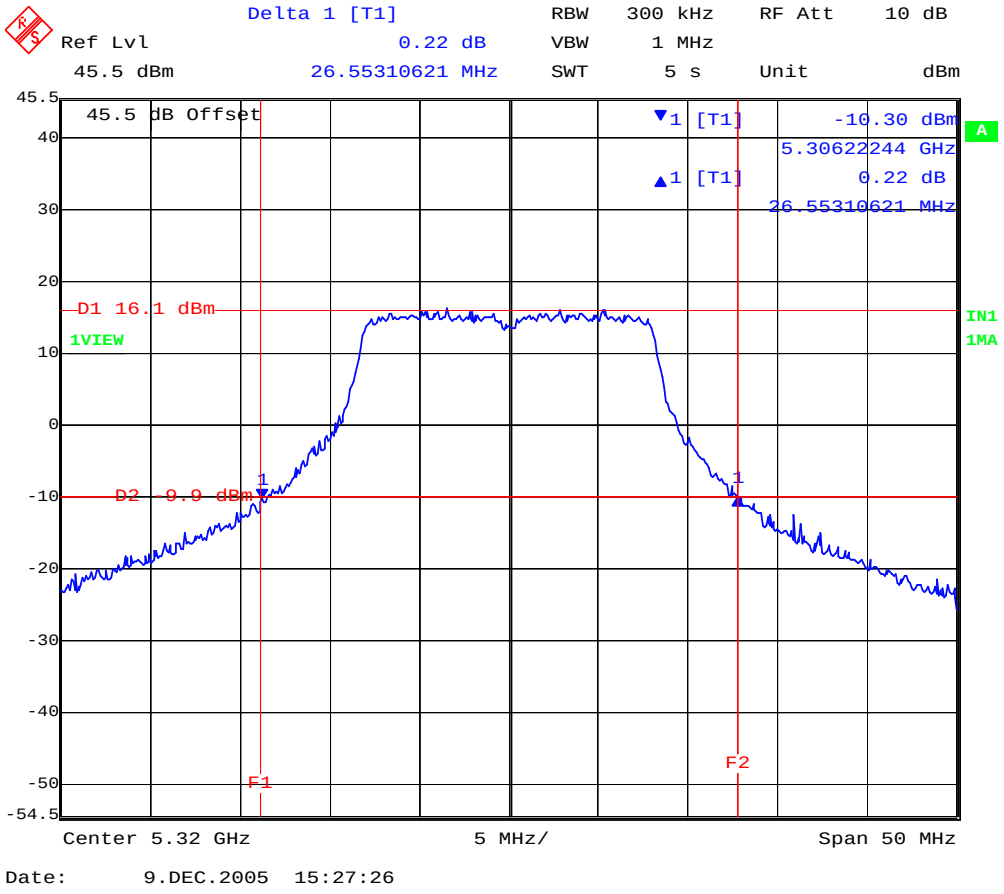
Measurement Results for 26 dB and 99 % Operational Bandwidth(s)

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

TABLE OF RESULTS – **802.11a**

Center Frequency (MHz)	26 dB Bandwidth (MHz)	26 dB Plot #	99 % BW (MHz)	99 % BW Plots
5,260	25.55110220	On File	17.55511022	On File
5,300	26.25250501	On File	17.61523046	On File
5,320	26.55310621	01	17.73547094	02

Plot 01
5,320 MHz 802.11a 26 dB Bandwidth



Plot 02
5,320 MHz 802.11a 99% Bandwidth

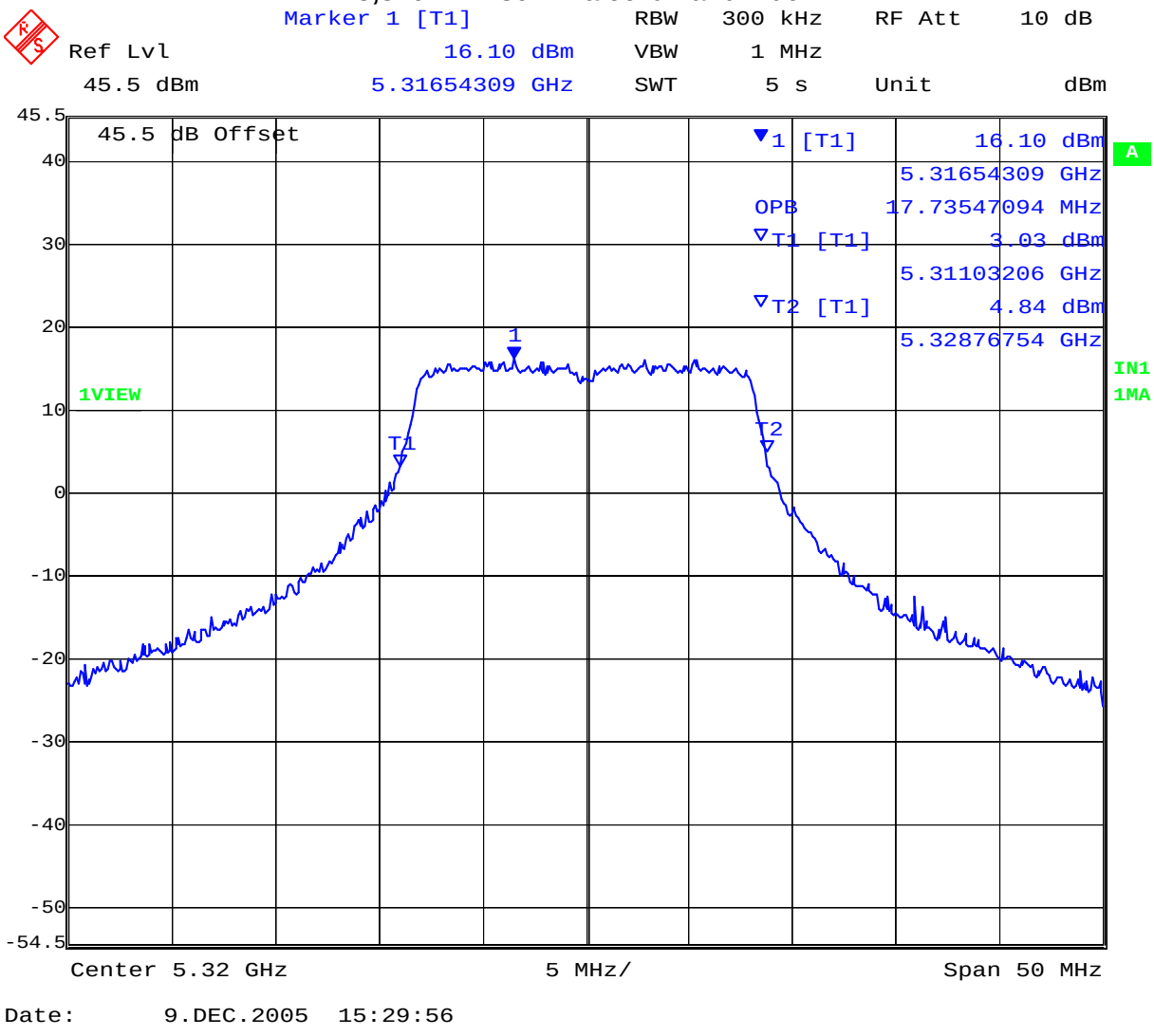
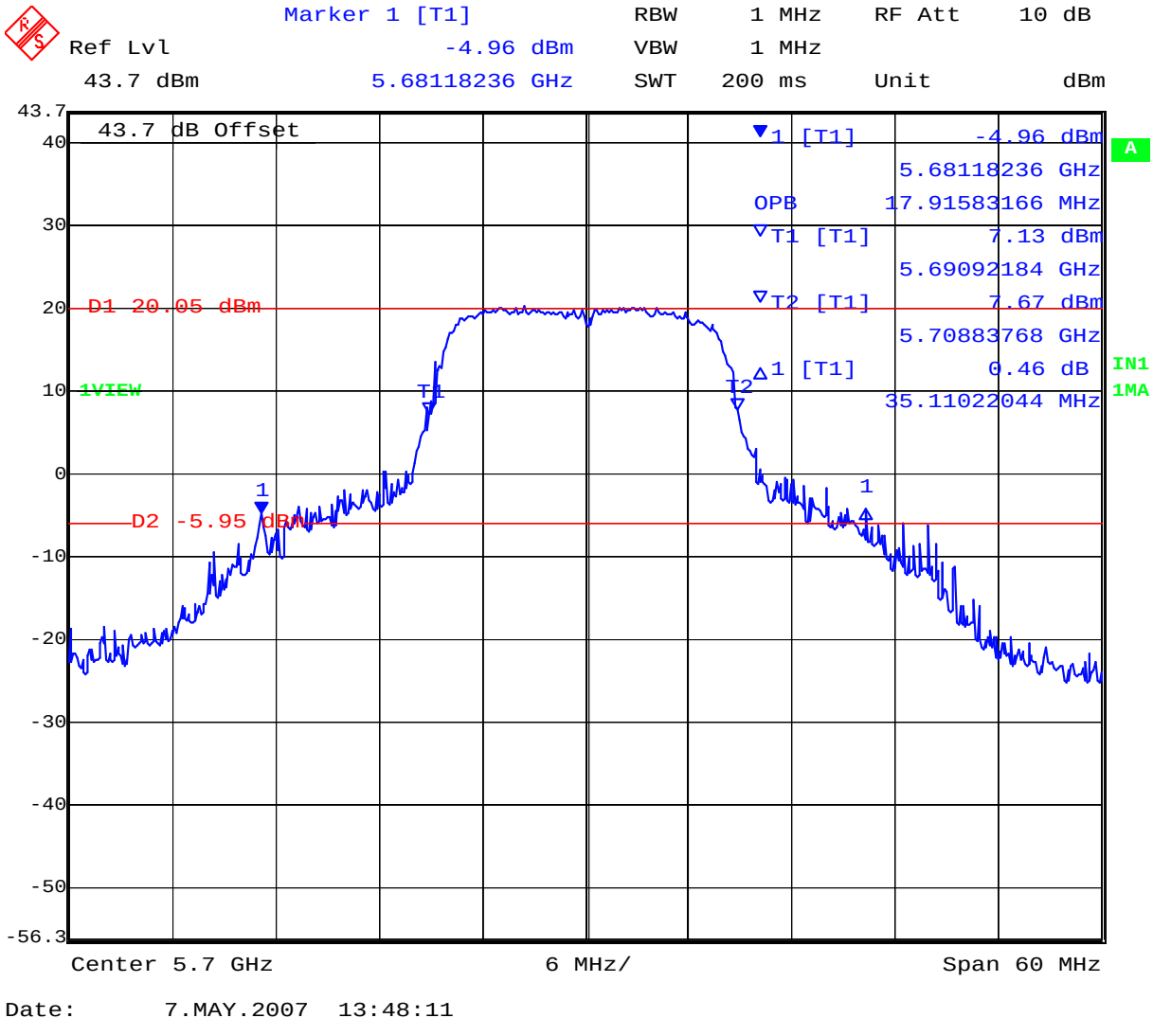


TABLE OF RESULTS – **802.11a**

Center Frequency (MHz)	26 dB Bandwidth (MHz)	26 dB Plot #	99 % BW (MHz)	99 % BW Plots
5,500	31.98396794.	On File	17.79559118	On File
5,600	32.58517034	On File	17.91583166	On File
5,700	35.11022044	03	17.91583166	03

Plot 03
5,700 MHz 802.11a 26 dB Bandwidth



Specification

Limits

FCC, Part 15 §15.407 (a)(2) and Industry Canada RSS-210 § A9.2(2)

For the 5.25-5.35 GHz band the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the peak power spectral density shall not exceed 11 dBm in any 1 megahertz band.

Industry Canada RSS-Gen 4.4

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.

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

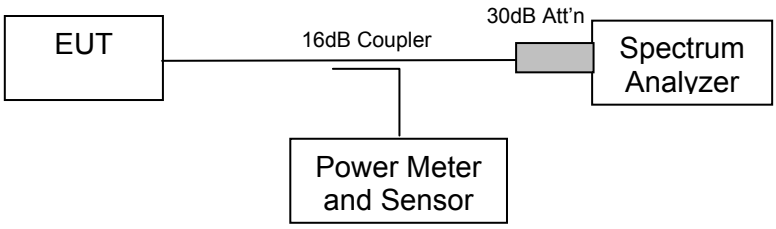
FCC, Part 15 Subpart C §15.407(a)
Industry Canada RSS-210 §9.9(2)
Industry Canada RSS-Gen 4.6

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 measured 99 % bandwidth.

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

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10log B, where B is the 26 dB emission bandwidth in megahertz.

802.11a 26 dB bandwidth (b) = 35.12 MHz

250 mW = +24 dBm
11 dBm + 10log B = +26.46 dBm
Maximum reference power level for test purposes = +24 dBm

Antenna Gain - Maximum Permissible Peak Transmit Power

If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum allowable peak power in the 5250 – 5350 MHz frequency band is + 24 dBm.

Antenna Type	Gain (dBi)	Antenna Gain >6dBi (dB)	Max. Allowable Peak Power (dBm)	Max. EIRP (dBm)
5.8G 2ft Omni Dipole Serial numbers 0521083 & 0536020	12	6	24 – 6 = 18	30.0
5G Patch Panel	23	17	24 – 17 = 7	30.0

Measurement Results for Peak Output Power

Ambient conditions.
Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar
Radio parameters.
Data Rate(s): 6 MBit/s

TABLE OF RESULTS – **802.11a**

Center Frequency (MHz)	Peak Power (dBm)
5,260	+22.76
5,300	+23.59
5,320	+22.97
5,500	+23.14
5,600	+23.16
5,700	+23.80

Specification

Limits

FCC, Part 15 §15.407 (a)(2) and Industry Canada RSS-210 § A9.2(2)

For the 5.25-5.35 GHz band the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the peak power spectral density shall not exceed 11 dBm in any 1 megahertz band.

Industry Canada RSS-Gen 4.4

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.

Laboratory Measurement Uncertainty for Power Measurements

Measurement uncertainty	±1.33 dB

Traceability

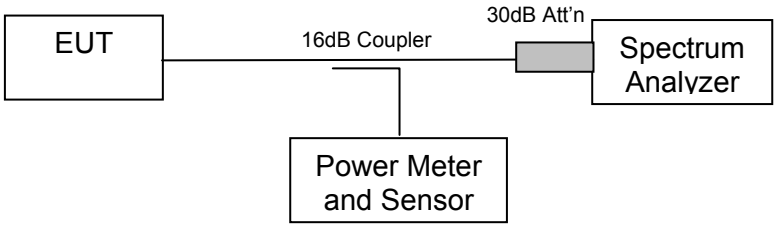
Method	Test Equipment Used
Measurements were made per work instruction WI-01 'Measuring RF Output Power'	0158, 0193, 0252, 0313, 0314, 0070, 0116, 0117

5.1.3. Peak Power Spectral Density

FCC, Part 15 Subpart C §15.407(a)
Industry Canada RSS-210 § A9.2(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. The Peak Power Spectral Density is the highest level found across the emission in a 1 MHz resolution bandwidth.

Test Measurement Set up



Measurement set up for Peak Power Spectral Density

Antenna Gain - Maximum Permissible Peak Power Spectral Density

If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum allowable peak power in the 5250 – 5350 MHz frequency band is + 11 dBm.

Antenna Type	Gain (dBi)	Antenna Gain >6dBi (dB)	Max. Allowable Peak Power Spectral Density (dBm)
5.8G 2ft Omni Dipole Serial numbers 0521083 & 0536020	12	6	11 – (12-6) = 5
5G Patch Panel	23	17	11 – (23-6) = -6

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): 802.11a 6 MBit/s.
Power Level: maximum for 0 dBi antenna, +24 dBm (250mW)

TABLE OF RESULTS – **802.11a**

Center Frequency (MHz)	Peak Frequency (MHz)	PPSD (dBm)	Plot #
5,260	5,256.46794	+9.77	On File
5,300	5,299.92485	+10.68	On File
5,320	5,319.62425	+10.91	04

Plot 04
5,320 MHz 802.11a Peak Power Spectral Density

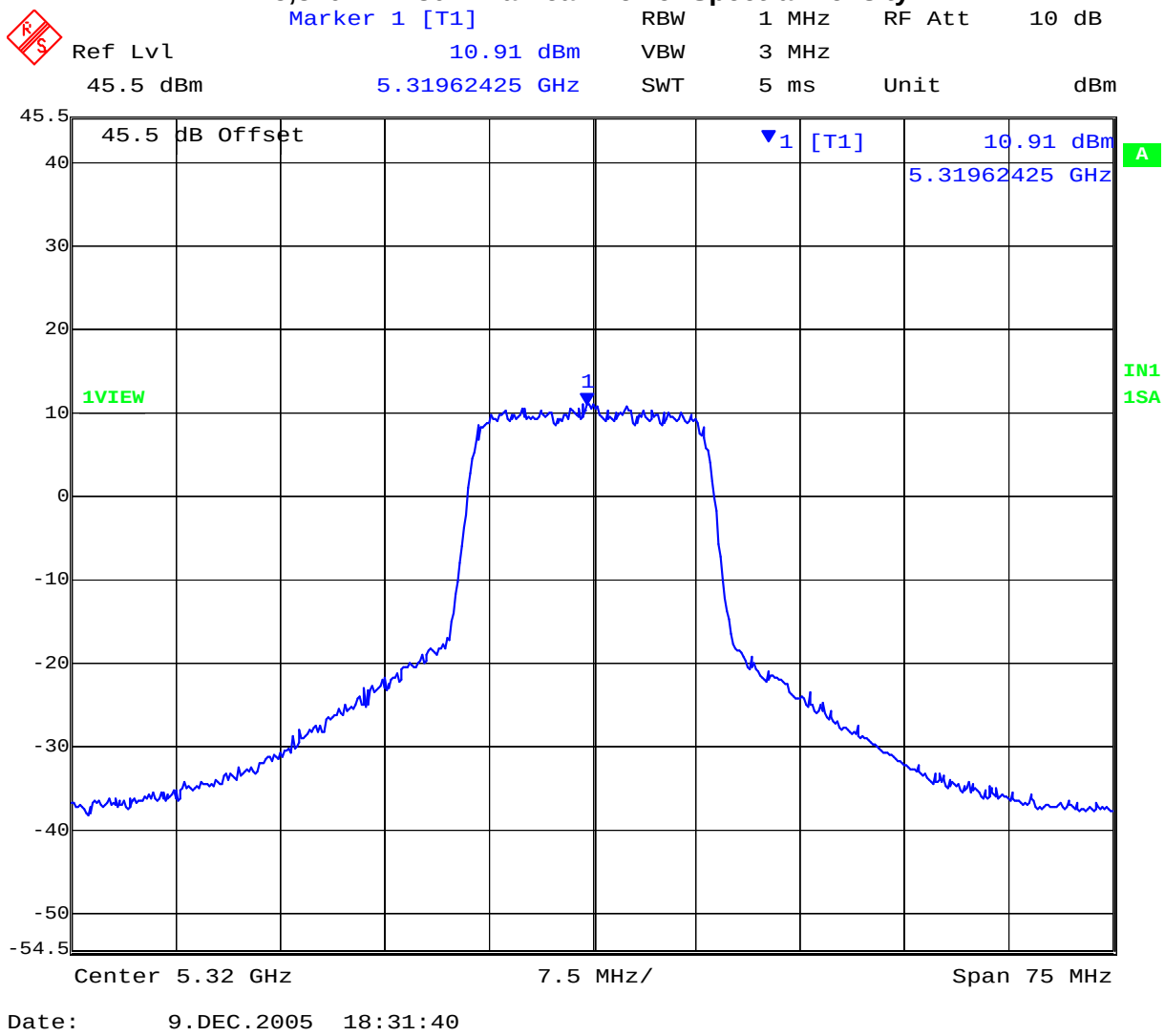
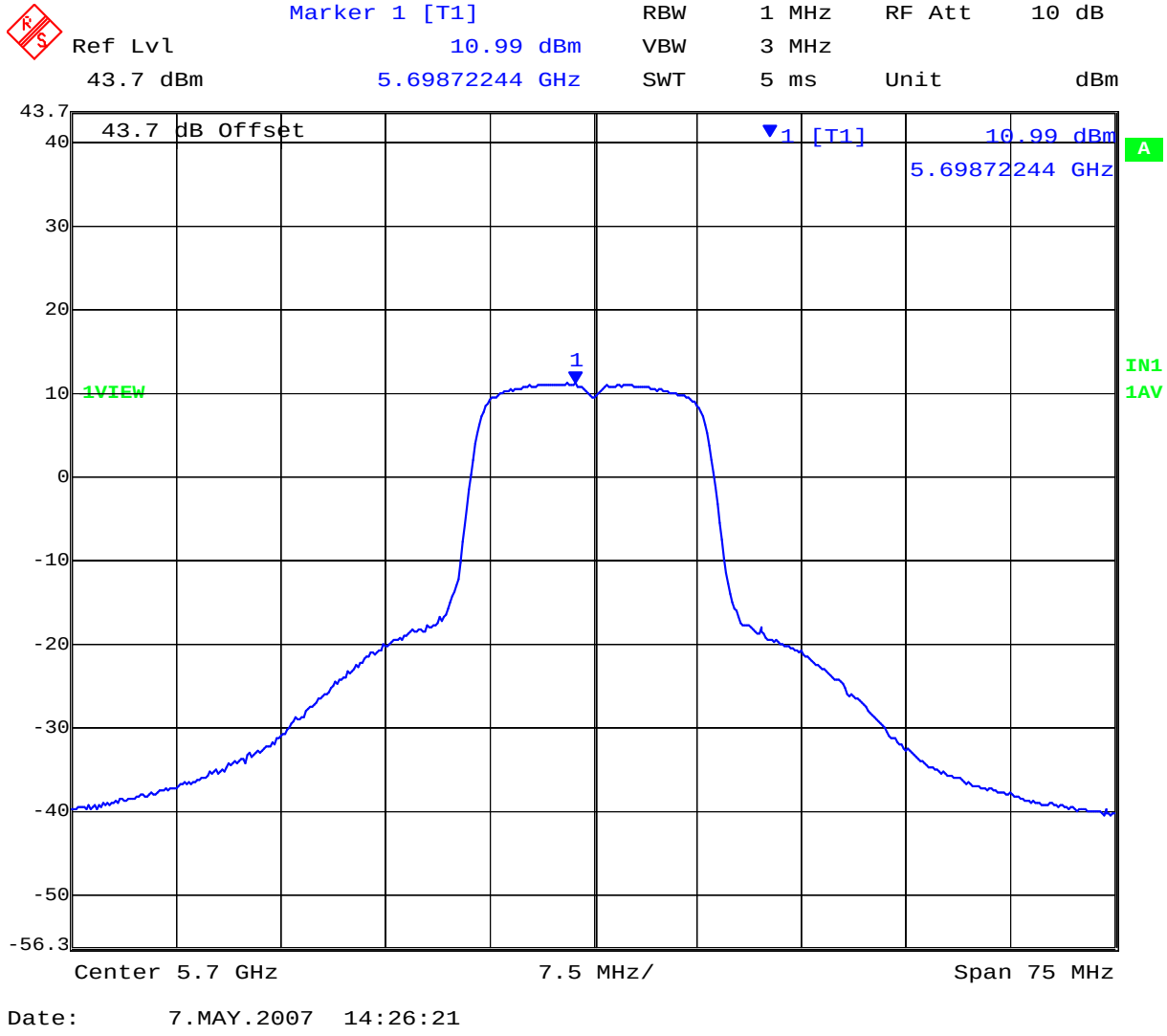


TABLE OF RESULTS – **802.11a**

Center Frequency (MHz)	Peak Frequency (MHz)	PPSD (dBm)	Plot #
5,500	5,498.42184	+10.46	On File
5,600	5,597.36974	+10.35	On File
5,700	5,698.72244	+10.99	05

Plot 05
5,700 MHz 802.11a Peak Power Spectral Density



Specification

FCC, Part 15 §15.407 (a)(2) and Industry Canada RSS-210 § A9.2(2)

For the 5.25-5.35 GHz band the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the peak power spectral density shall not exceed +11 dBm in any 1 megahertz band.

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

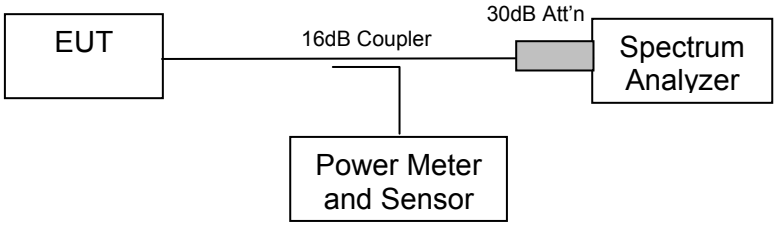
5.1.4. Peak Excursion Ratio

FCC, Part 15 Subpart C §15.407(a)(6)

Test Procedure

This is an antenna conducted measurement using a spectrum analyzer. Method 3 in Normative Reference (x) Section 2.1 was implemented to determine module Peak Excursion Ratio. The Peak Excursion Ratio is the difference in amplitude (dB) between the two traces.

Test Measurement Set up



Measurement set up for Peak Excursion Ratio

Measurement Results for Peak Excursion Ratio

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

Radio parameters.
Data Rate(s): 802.11a 6 MBit/s.
Power Level: maximum for 0 dBi antenna, +24 dBm (250mW)

TABLE OF RESULTS – **802.11a**

Centre Frequency (MHz)	Peak Excursion Ratio (dB)	Plot #
5,260	+8.86	On File
5,300	+9.02	On File
5,320	+9.06	06

Plot 06

5,320 MHz 802.11a - Peak Excursion Ratio

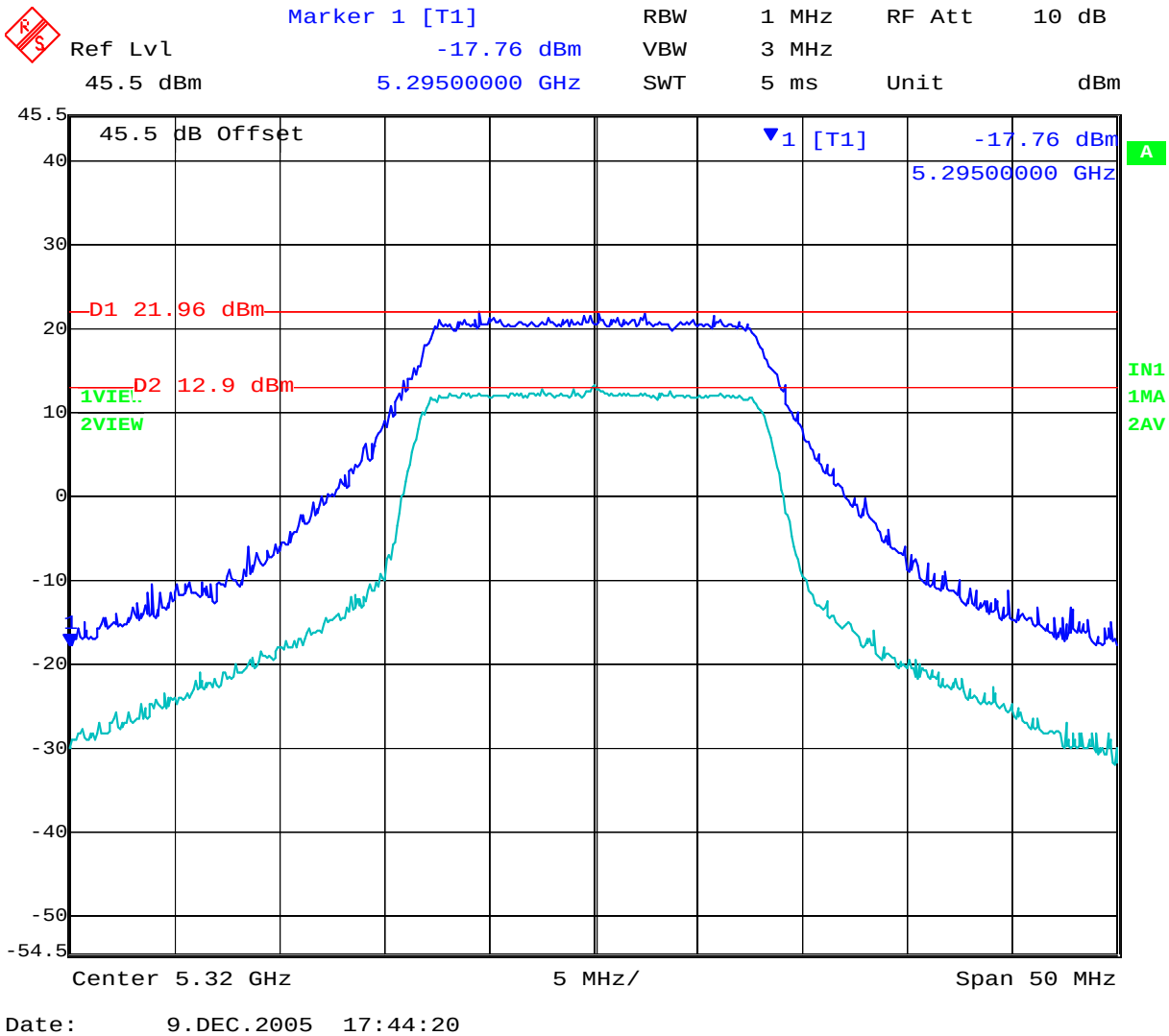
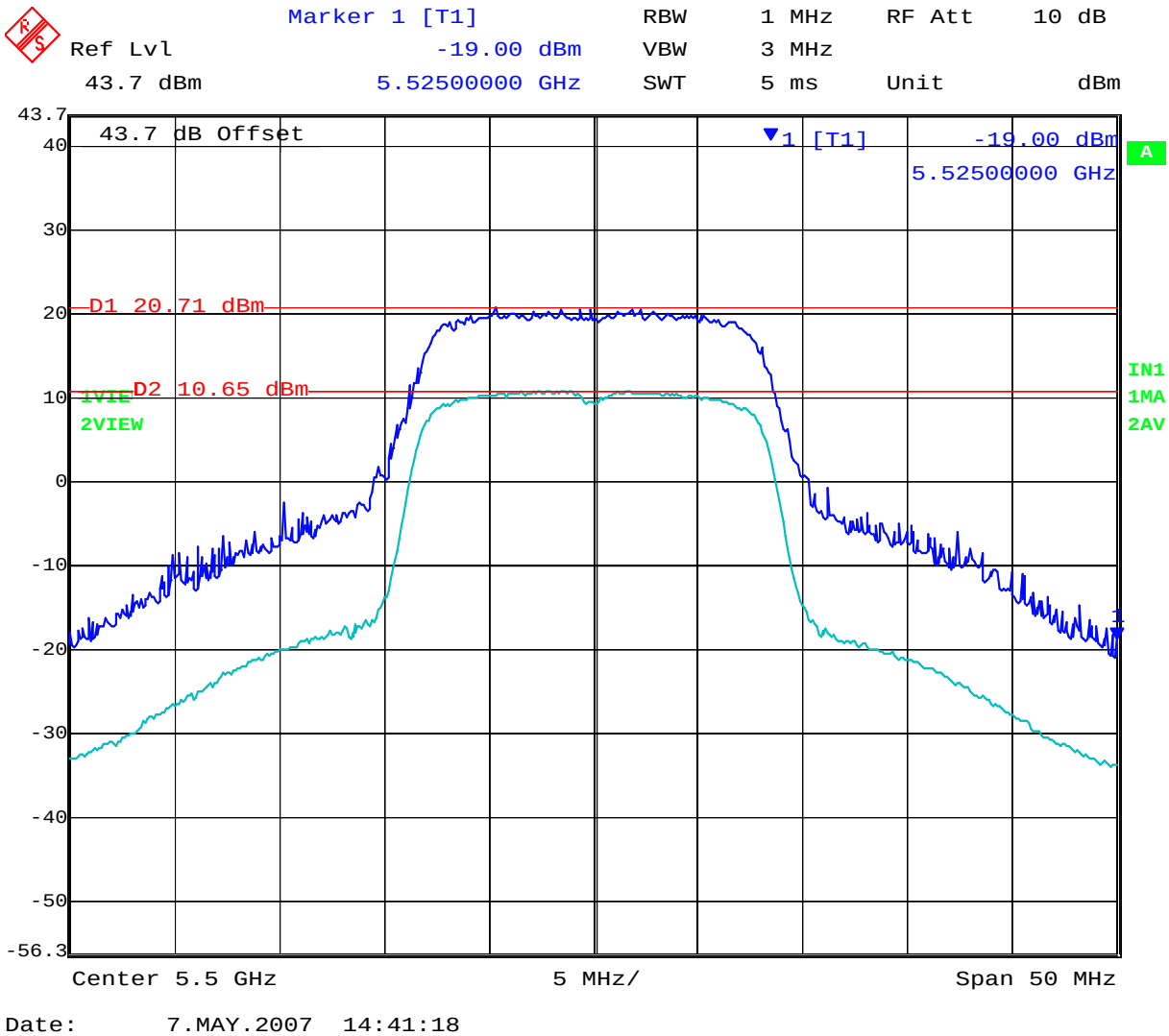


TABLE OF RESULTS – **802.11a**

Centre Frequency (MHz)	Peak Excursion Ratio (dB)	Plot #
5,500	+10.06	07
5,600	+9.89	On File
5,700	+9.36	On File

Plot 07

5,500 MHz 802.11a - Peak Excursion Ratio



Specification

Limits

§15.407 (a)(6) The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified in this paragraph) shall not exceed 13dB across any 1MHz bandwidth or the emission bandwidth whichever is less

Laboratory Measurement Uncertainty for Spectrum Measurement

Measurement uncertainty	± 2.81dB

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

5.1.5. Frequency Stability

FCC, Part 15 Subpart C §15.407(g)
Industry Canada RSS-210 §2.1

Test Procedure

The manufacturer of the equipment is responsible for ensuring that the frequency stability is such that emissions are always maintained within the band of operation under all conditions.

Manufacturer Declaration

The frequency stability of the reference oscillator sets the frequency stability of the RF transceiver signals. Therefore all of the RF signals should have ±20ppm stability.
This stability accounts for room temp tolerance of the crystal oscillator circuit, frequency variation across temperature, and crystal ageing.

±20ppm at 5.250 GHz translates to a maximum frequency shift of ±105 KHz. As the edge of the channels is at least one MHz from either of the band edges, ±105 KHz is more than sufficient to guarantee that the intentional emission will remain in the band over the entire operating range of the radio.

Specification

Limits

§15.407 (g) Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

5.1.6. Maximum Permissible Exposure

FCC, Part 15 Subpart C §15.407(f)
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)

P (worst case) = 12.0 dBi antenna +18.0 dBm, 23.0 dBi antenna +7.0 dBm

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

Antenna Gain (dBi)	Numeric Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Calculated safe distance @ max limit 1mW/ cm^2 (d=cm)
12.0	15.9	+18.0	63.0	8.9
23.0	199.5	+7.0	5.01	8.9

Specification
Maximum Permissible Exposure Limits

§15.247 (f) U-NII devices are subject to the radio frequency radiation exposure requirements specified in §1.1307 (b), 2.1091 and 2.1093 as appropriate. All equipment shall be considered to operate in a "general population/uncontrolled" environment.

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 application requirements of RSS-102 shall be met.

Laboratory Measurement Uncertainty for Power Measurements

Measurement uncertainty	±1.33 dB

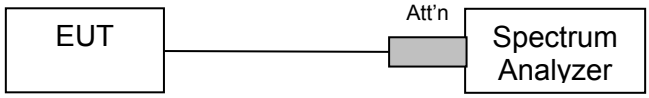
5.1.7. Conducted Spurious Emissions

FCC, Part 15 Subpart C §15.407(b)(2)
Industry Canada RSS-210 §A9.3(2); §2.2; §2.6; RSS-Gen §4.7

Note: The data in this section along with the data in sections 5.1.8.1 (Transmitter Radiated Spurious emissions) and section 5.1.8.2 (Radiated Band Edge- Restricted Bands) identifies that the EUT is in compliance with the -27dBm/MHz EIRP limit for out of band emissions.

Test Procedure
Conducted emissions were measured at a EIRP limit of -27 dBm/MHz 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

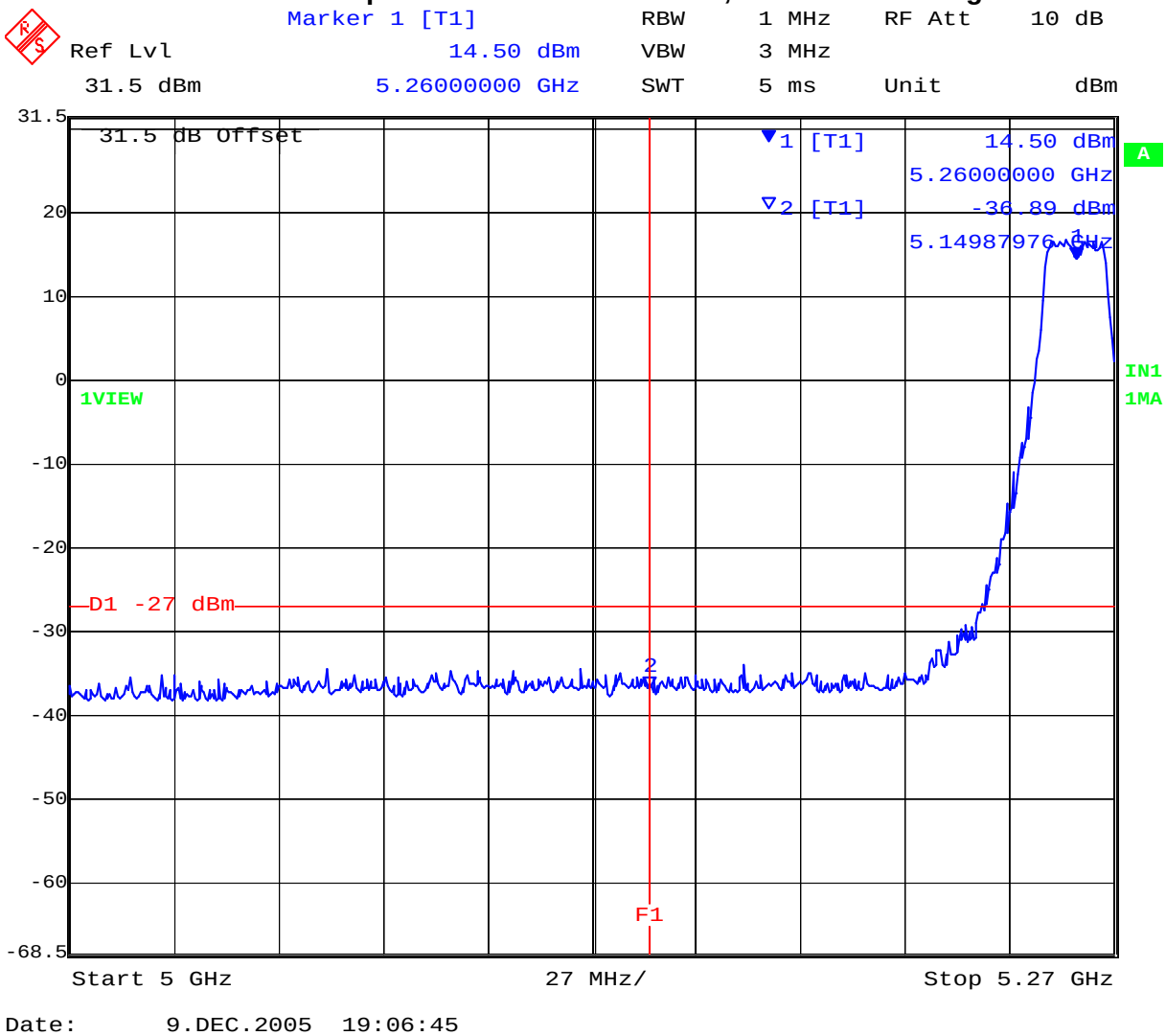
Radio parameters.
Data Rate(s): 802.11a 6 MBit/s
Output Power: 12 dBi antenna +18 dBm, 23 dBi antenna +7 dBm

Conducted Band-Edge Results

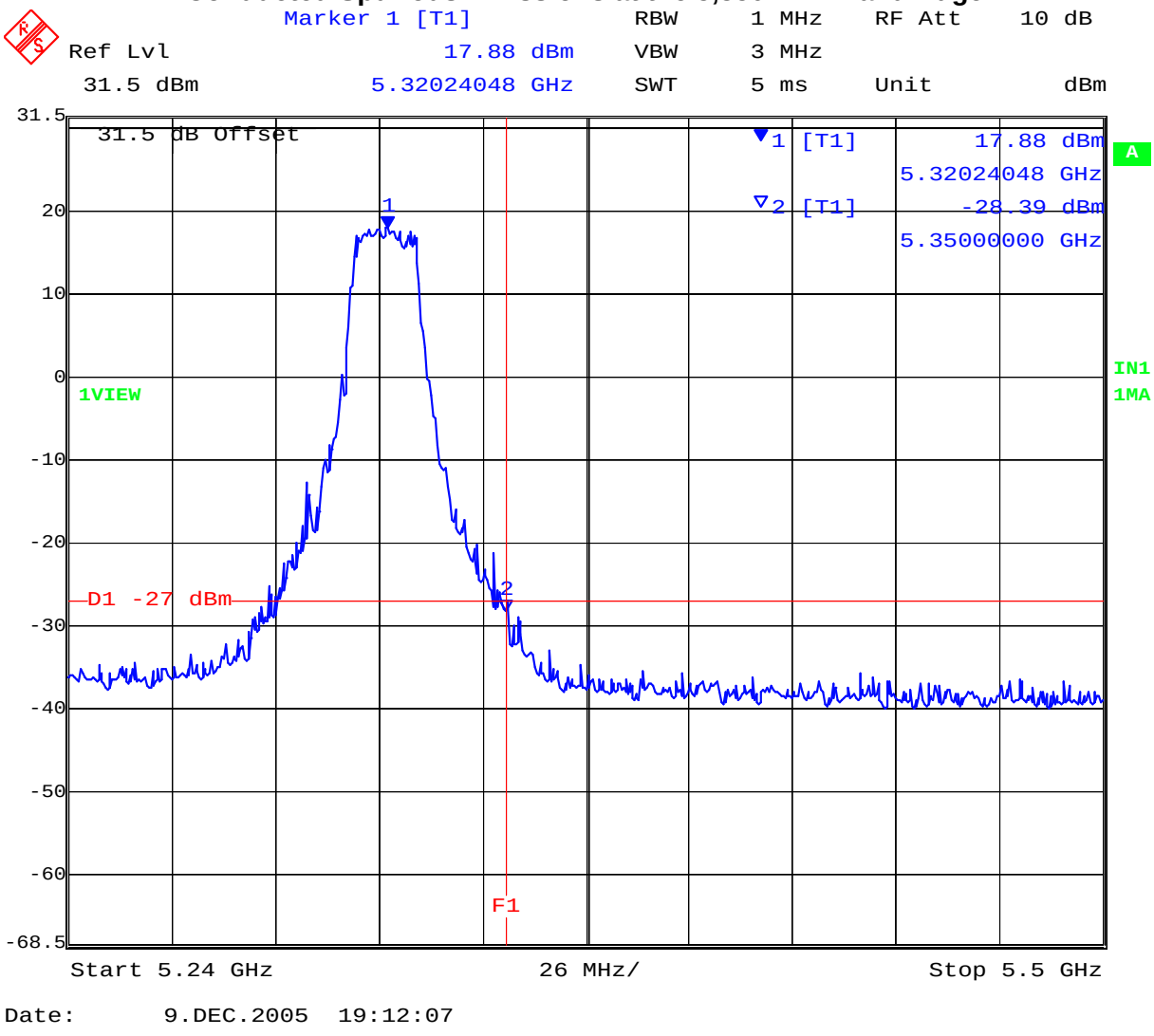
TABLE OF RESULTS – **802.11a**

Center Frequency (MHz)	Band edge Frequency (MHz)	Limit (dBm/MHz)	Amplitude @ Band edge (dBm/MHz)	Plot #	Margin (dB)
5,260	5,150	-27.00	-36.89	08	-9.89
5,320	5,350	-27.00	-28.39	09	-1.39

Plot 08
Conducted Spurious Emissions at the 5,150 MHz Band Edge



Plot 09
Conducted Spurious Emissions at the 5,350 MHz Band Edge



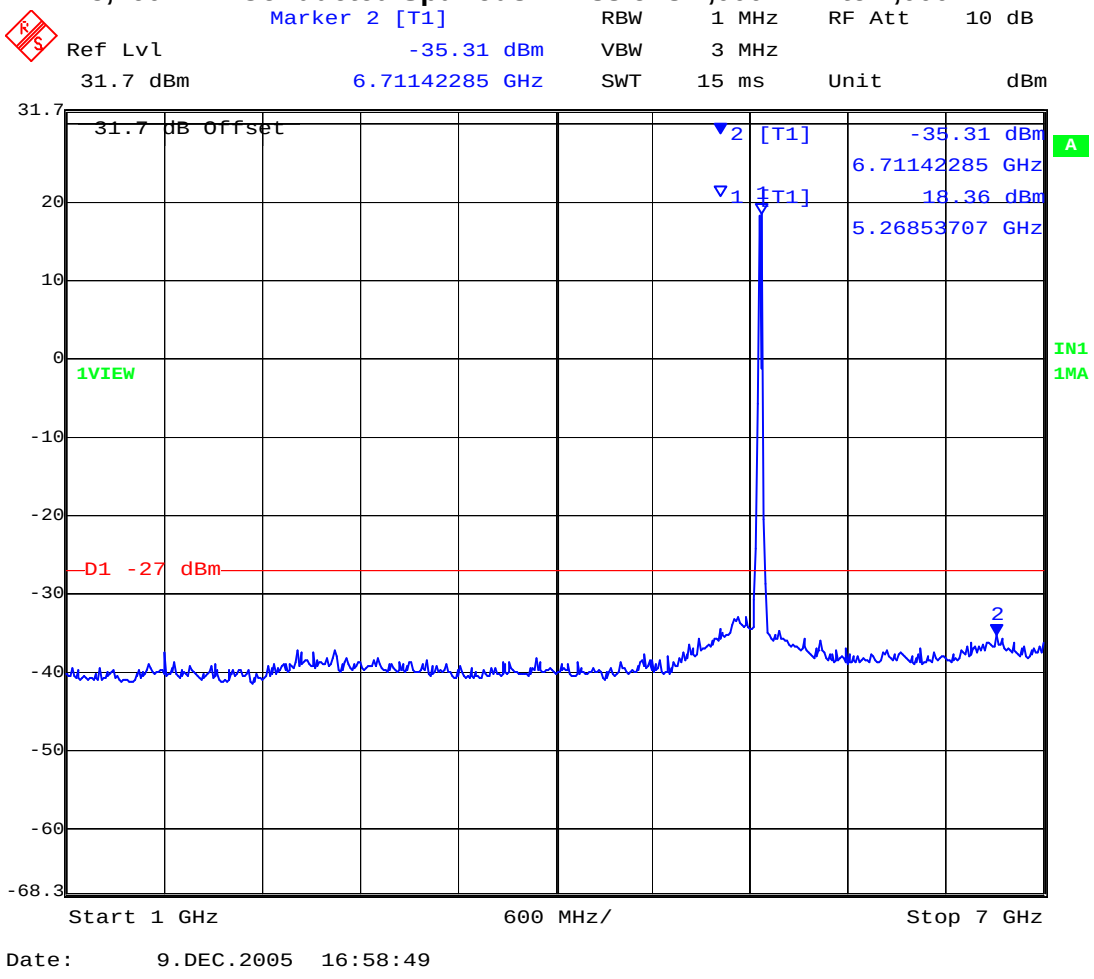
Conducted Spurious Emissions (1-40 GHz)

Conducted spurious emissions (1-40 GHz) are provided indicated by the following matrix. Measurements were performed with the transmitter tuned to the channel closest to the band-edge being measured. All emissions were maximized during measurement. Limit @ -27 dBm are drawn on each plot.

TABLE OF RESULTS – **802.11a**

Channel Centre Frequency (MHz)	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm/MHz)	Limit (dBm/MHz)	Plot #	Margin (dB)
5,260	1,000	7,000	-35.31	-27.00	10	-8.31
5,260	7,000	40,000	-33.30	-27.00	11	-6.30

Plot 10 802.11a
5,260 MHz Conducted Spurious Emissions 1,000 MHz to 7,000 MHz



Plot 11 802.11a
5,260 MHz Conducted Spurious Emissions 7,000 MHz to 25,000 MHz

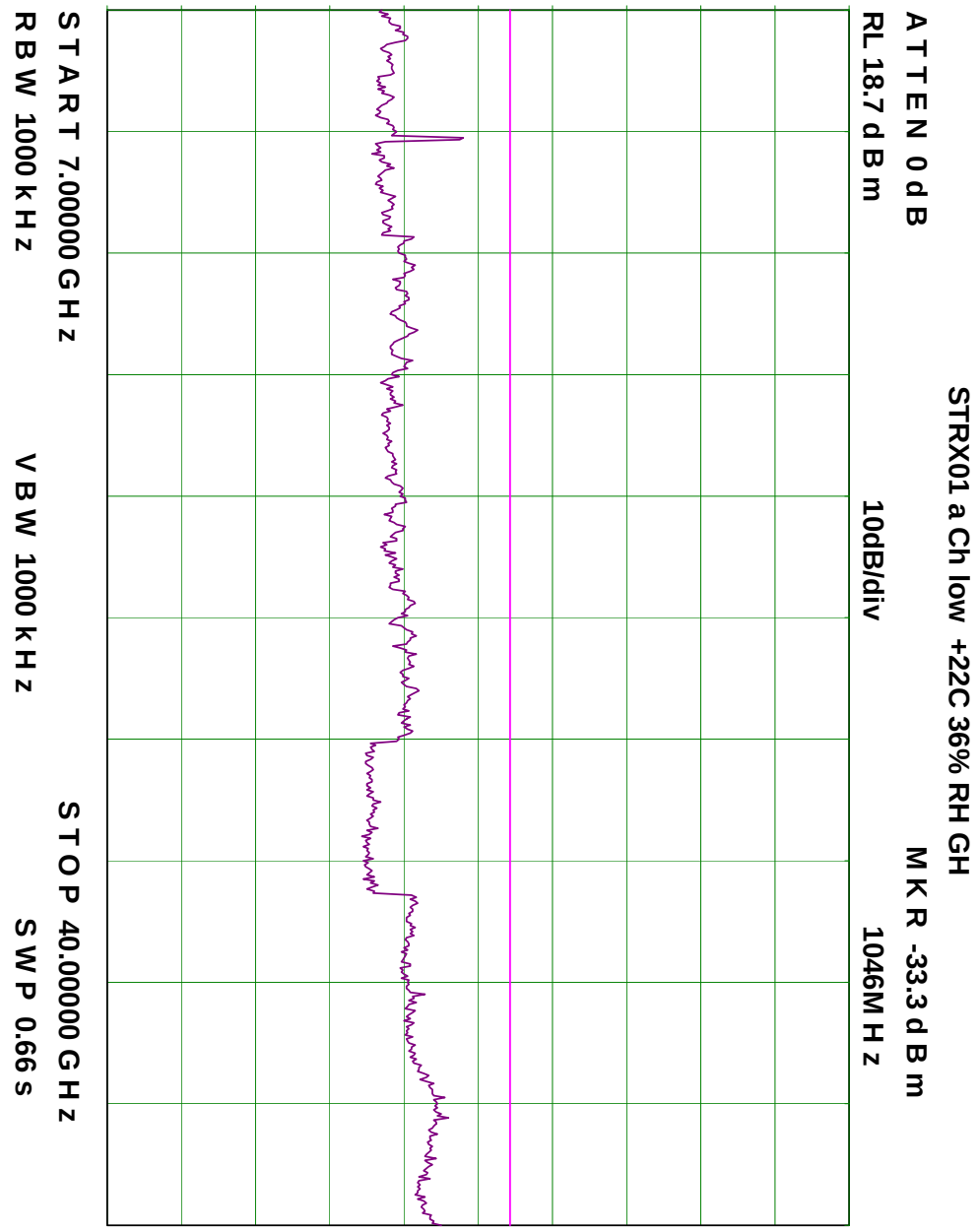
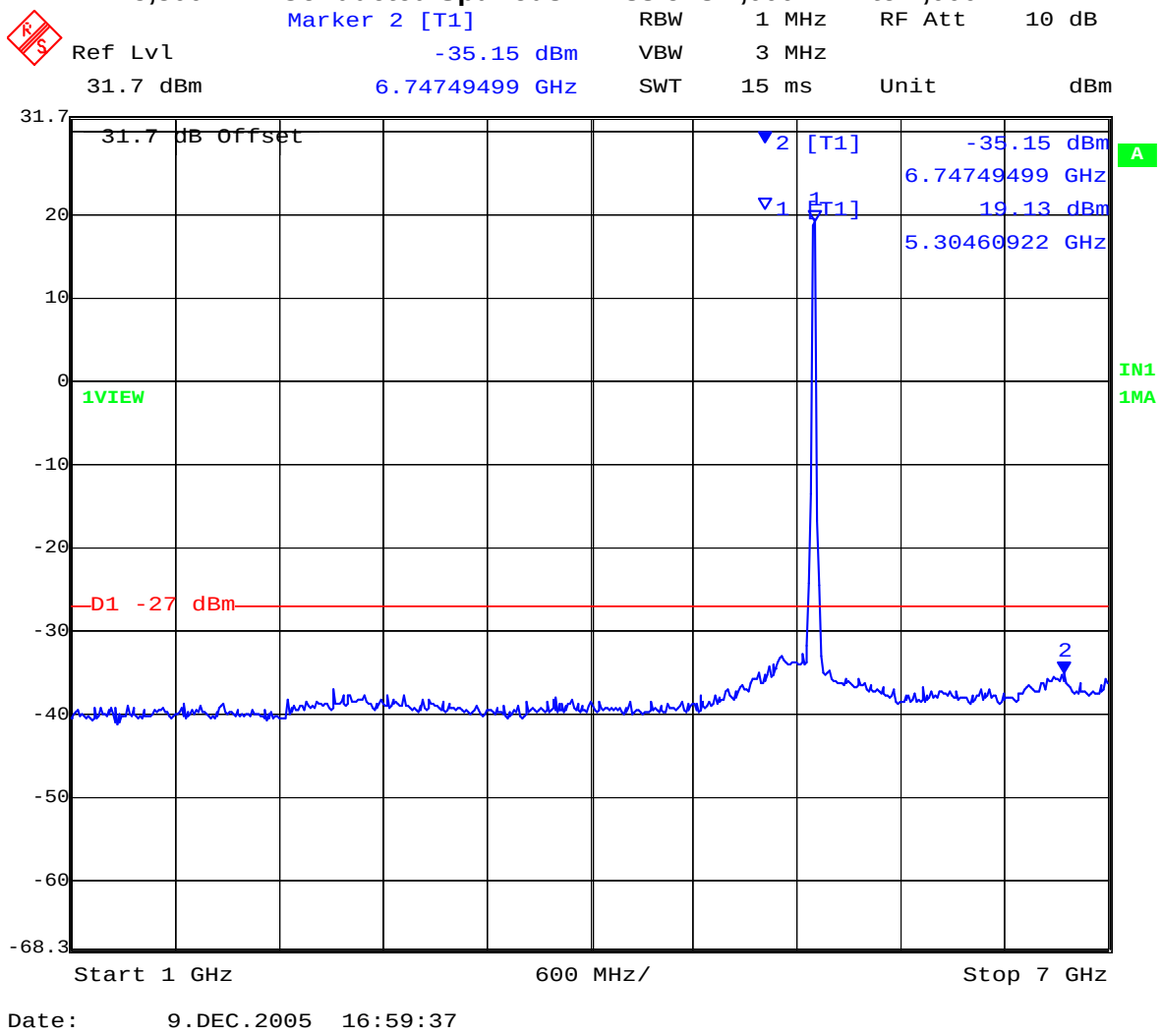


TABLE OF RESULTS – **802.11a**

Channel Centre Frequency	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm/MHz)	Limit (dBm/MHz)	Plot #	Margin (dB)
5,300	1,000	7,000	-35.15	-27.00	12	-8.15
5,300	7,000	25,000	-35.46	-27.00	13	-8.63

Plot 12 802.11a
5,300 MHz Conducted Spurious Emissions 1,000 MHz to 7,000 MHz



Plot 13 802.11a
5,300 MHz Conducted Spurious Emissions 7,000 MHz to 25,000 MHz

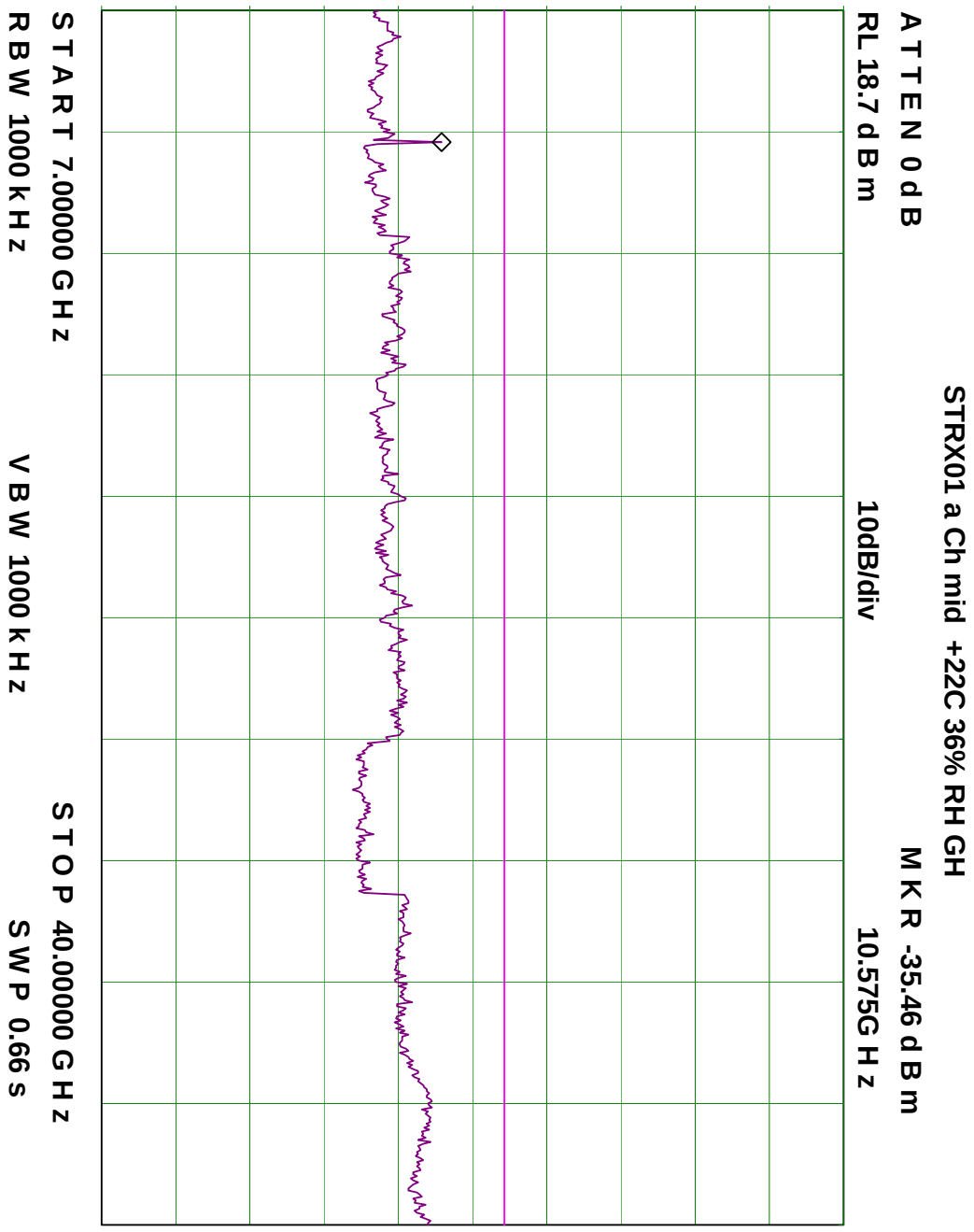
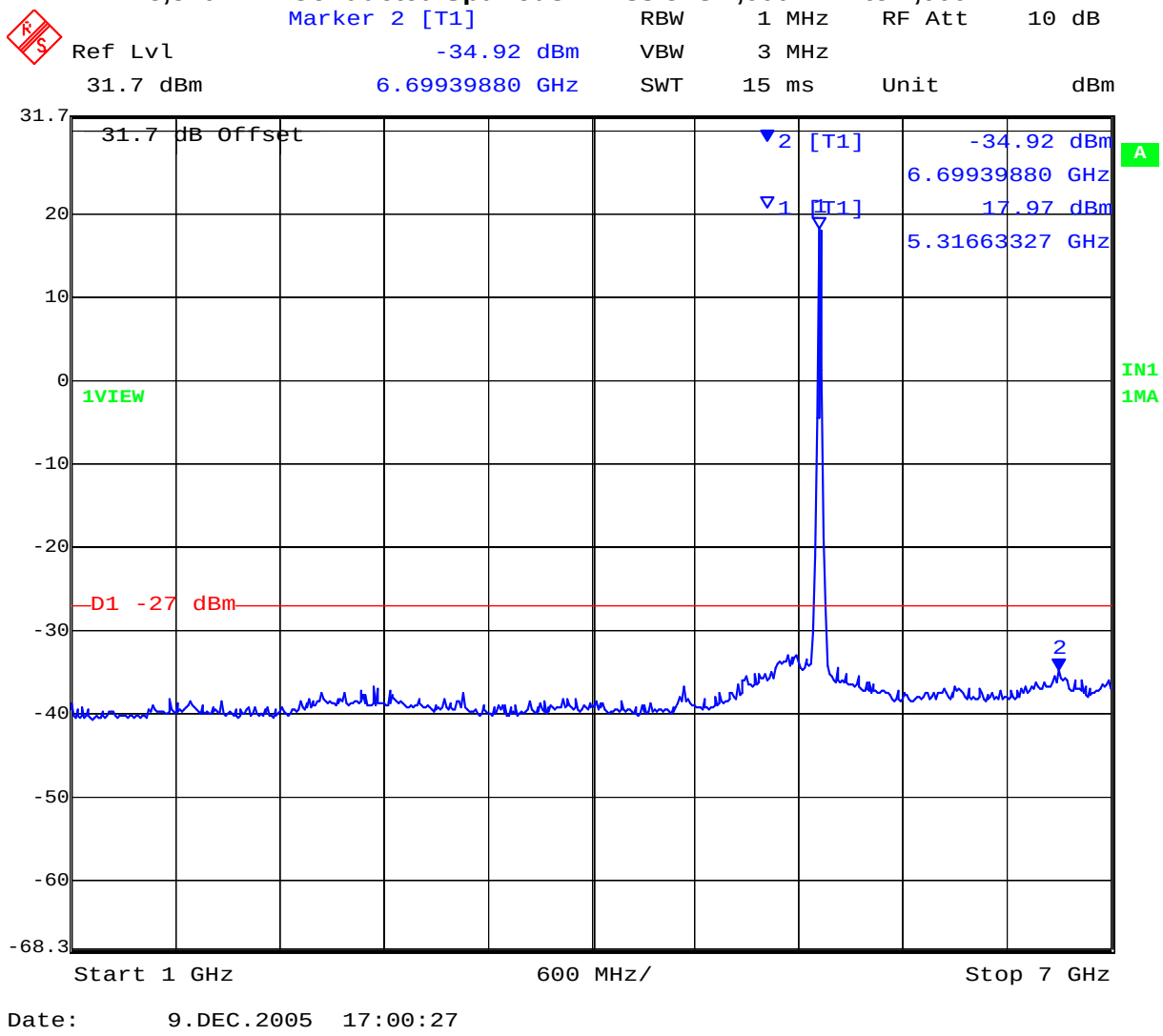


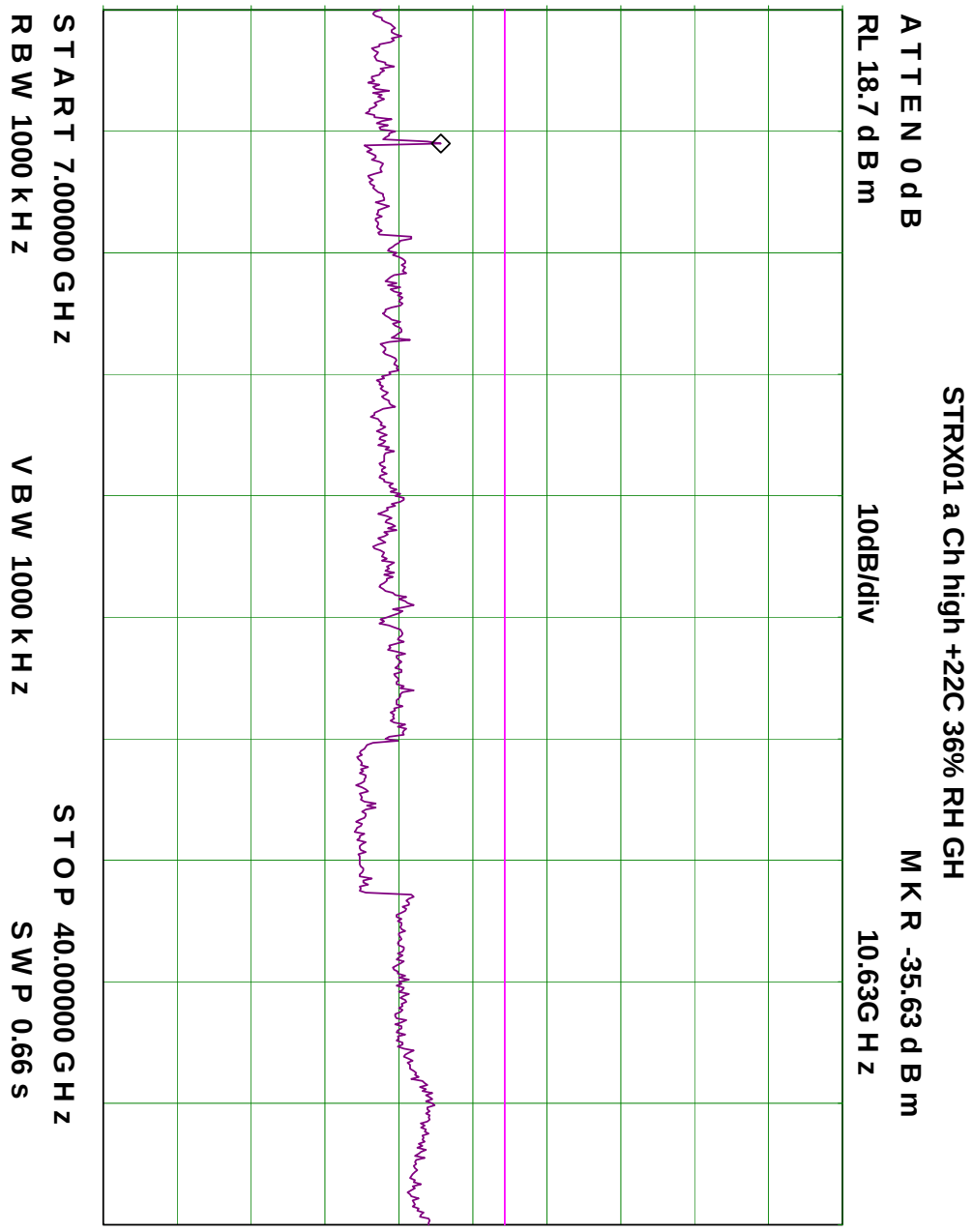
TABLE OF RESULTS – **802.11a**

Channel Centre Frequency	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm/MHz)	Limit (dBm/MHZ)	Plot #	Margin (dB)
5,320	1,000	7,000	-34.92	-27.00	14	-7.92
5,320	7,000	25,000	-35.63	-27.00	15	-8.63

Plot 14 802.11a
5,320 MHz Conducted Spurious Emissions 1,000 MHz to 7,000 MHz



Plot 15 802.11a
5,320 MHz Conducted Spurious Emissions 7,000 MHz to 25,000 MHz



Specification

Limits

15.407 (b)(2). All emissions outside of the 5,150-5,350MHz band shall not exceed an EIRP of -27dBm/MHz.

RSS-210 §A9.3(2) For transmitters operating in the 5250-5350 MHz band, all emissions outside the 5150-5350 MHz band shall not exceed -27 dBm/MHz e.i.r.p.

Devices operating in the 5250-5350 MHz band that generate emissions in the 5150-5250 MHz band shall not exceed out of band emission limit of -27 dBm/MHz e.i.r.p. in the 5150-5250 MHz band in order to operate indoor/outdoor, or alternatively shall comply with the spectral power density for operation within the 5150-5250 MHz band and shall be labeled “for indoor use only”.

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.

5.1.8. Radiated Emissions

5.1.8.1. Transmitter Radiated Spurious Emissions (above 1 GHz)

FCC, Part 15 Subpart C §15.407(b)(2), §15.205(a)/15.209(a)
Industry Canada RSS-210 §A9.3(2); §2.2; §2.6; RSS-Gen §4.7

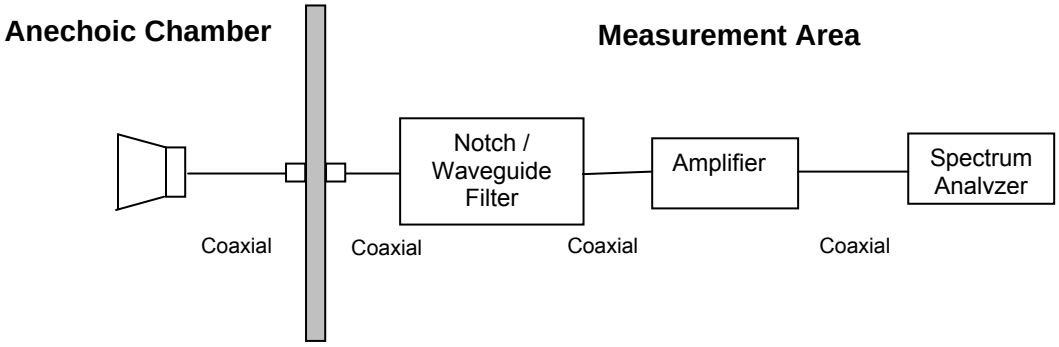
Note: The data in this section along with the data in sections 5.1.7 (Conducted Spurious emissions) and section 5.1.8.2 (Radiated Band Edge- Restricted Bands) shows that the EUT is in compliance with the -27dBm/MHz EIRP limit for out of band emissions.

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

The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength

$E = 1000000 \times \sqrt{30P} / 3$ μV/m, where P is the EIRP in Watts

Therefore: -27 dBm/MHz = 68.23 dBuV/m

Measurement Results Transmitter Radiated Spurious Emissions above 1 GHz

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

Configuration # 1

FCC 15.407 5 GHz (5250-5350 MHz) Measurement

5 GHz operational mode - 3 transmitters simultaneously operating

3 Antennas - 2 * 12 dBi Omni, 1 * 23.0 dBi Panel

Omni IP 104 802.11a 6MB/s Ch 5320, peak power setting = +18 dBm

Omni IP 103 802.11a 6MB/s Ch 5300, peak power setting = +18 dBm

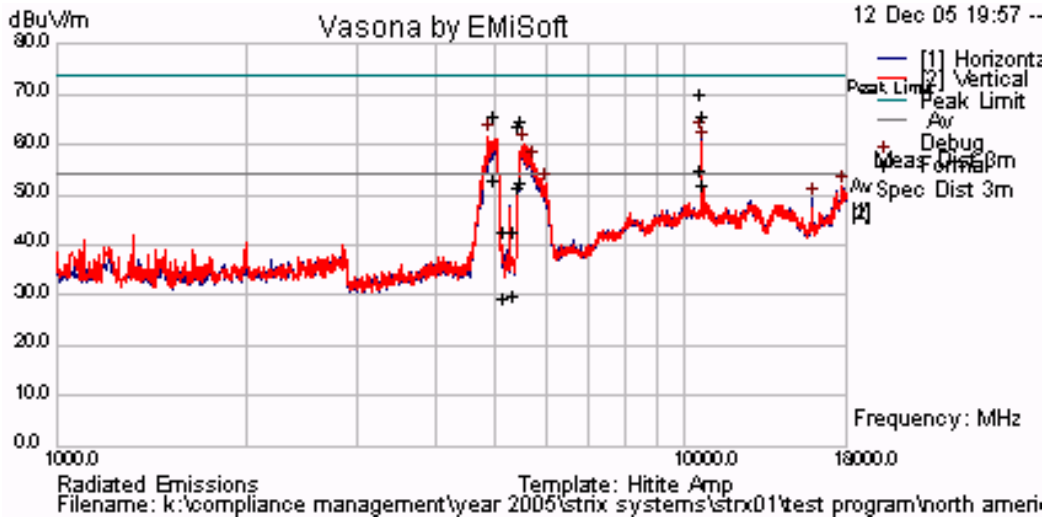
Patch IP 102 802.11a 6MB/s Ch 5260, peak power setting = +7 dBm

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)
4966.833	V	64.5	-1.35	63.15	74.00*	-10.85
4966.833	V	52.06	-1.35	50.71	54.00**	-3.29
5150.000	V	41.68	-1.34	40.34	74.00*	-33.66
5150.000	V	28.36	-1.34	27.02	54.00**	-26.98
5350.000	V	41.22	-0.84	40.38	74.00*	-33.62
5350.000	V	28.18	-0.84	27.34	54.00**	-26.66
5460.000	V	62.01	-0.46	61.55	74.00*	-12.45
5460.000	V	49.30	-0.46	48.84	54.00**	-5.16
5503.666	V	62.84	-0.38	62.46	68.23***	-4.03
10603.230	H	59.11	+8.41	67.52	74.00*	-6.48
10603.230	H	43.98	+8.41	52.39	54.00**	-1.61
10643.330	V	55.23	+8.21	63.44	74.00*	-10.56
10643.330	V	41.19	+8.21	49.40	54.00**	-4.60

*Restricted band limit (Peak), ** Restricted band limit (average), *** Outside restricted band limit (Peak)

Radiated Emissions for Configuration # 1



Configuration # 2

FCC 15.407 5 GHz (5250-5350 MHz) Measurement

5 GHz operational mode - 3 transmitters simultaneously operating

3 Antennas - 2 * 12 dBi Omni, 1 * 23.0 dBi Panel

Omni IP 104 802.11a 6MB/s Ch 5260, peak power setting = +18 dBm

Omni IP 103 802.11a 6MB/s Ch 5320, peak power setting = +18 dBm

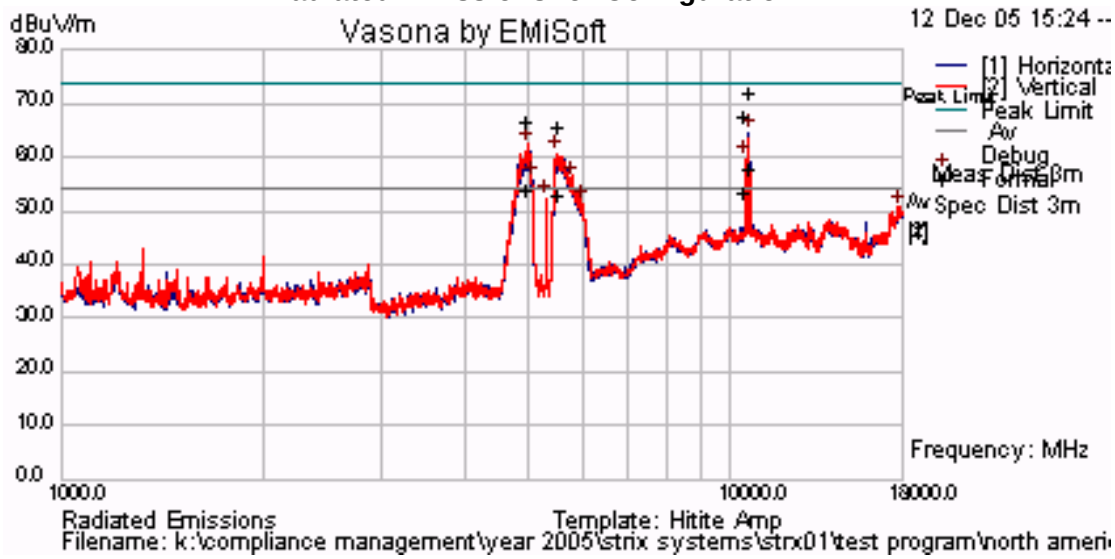
Patch IP 102 802.11a 6MB/s Ch 5300, peak power setting = +7 dBm

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)
4989.666	V	65.77	-1.39	64.38	74.00*	-9.62
4989.666	V	52.88	-1.39	51.49	54.00**	-2.51
5520.667	V	50.88	-0.17	63.29	68.23***	-3.39
10520.340	H	42.56	+8.72	65.19	68.23***	-2.72
10641.230	H	60.22	+8.21	69.46	74.00*	-4.54
10641.230	H	45.41	+8.21	53.62	54.00*	-0.38

*Restricted band limit (Peak), ** Restricted band limit (average), *** Outside restricted band limit (Peak)

Radiated Emissions for Configuration # 2



Configuration # 3

FCC 15.407 5 GHz (5250-5350 MHz)
Measurement

5 GHz operational mode - 3 transmitters simultaneously operating

3 Antennas - 2 * 12 dBi Omni, 1 * 23.0 dBi Panel

Omni IP 104 802.11a 6MB/s Ch 5300, peak power setting = +18 dBm

Omni IP 103 802.11a 6MB/s Ch 5260, peak power setting = +18 dBm

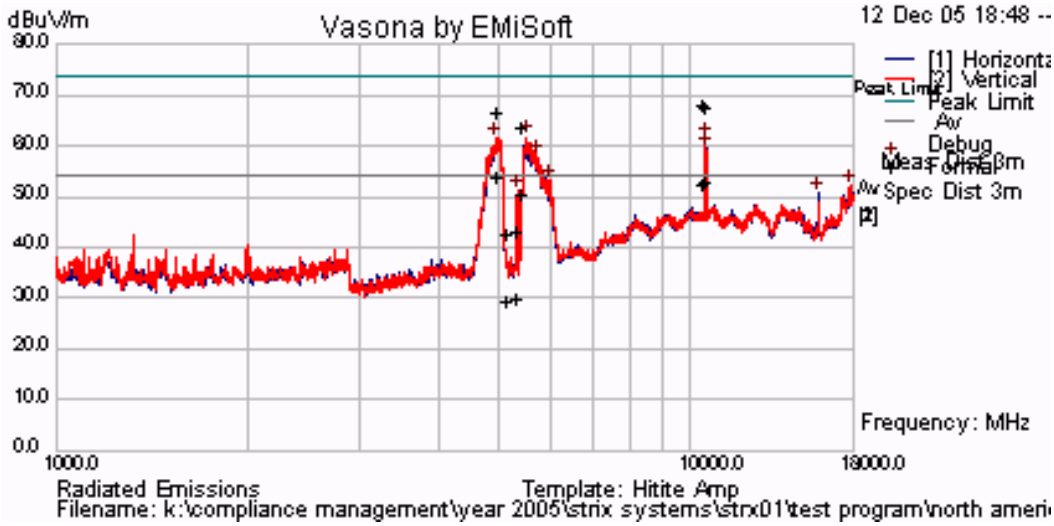
Patch IP 102 802.11a 6MB/s Ch 5320, peak power setting = +7 dBm

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)
4986.611	V	65.46	-1.39	64.07	74.00*	-9.93
4986.611	V	52.69	-1.39	51.30	54.00**	-2.70
10511.690	H	41.48	+8.78	65.62	68.23***	-3.74
10599.020	V	42.17	+8.43	65.34	68.23***	-3.40
5460.000	H	61.82	-.46	61.36	74.00*	12.64
5460.000	H	48.47	-0.46	48.01	54.00**	-5.99
5350.000	H	41.36	-.84	40.52	74.00*	-33.48
5350.000	H	28.18	-0.84	27.34	54.00**	-26.66
5150.000	V	41.67	-1.34	40.33	74*	-33.67
5150.000	V	28.33	-1.34	26.99	54.00**	-27.01

*Restricted band limit (Peak), ** Restricted band limit (average), *** Outside restricted band limit (Peak)

Radiated Emissions for Configuration # 3



Configuration # 4

FCC 15.407 5 GHz (5470-5725 MHz) Measurement

5 GHz operational mode - 3 transmitters simultaneously operating

3 Antennas - 2 * 12 dBi Omni, 1 * 23.0 dBi Panel

Omni IP 104 802.11a 6MB/s Ch 5,500, peak power setting = +16.4 dBm

Patch IP 102 802.11a 6MB/s Ch 5,600, peak power setting = +4.5 dBm

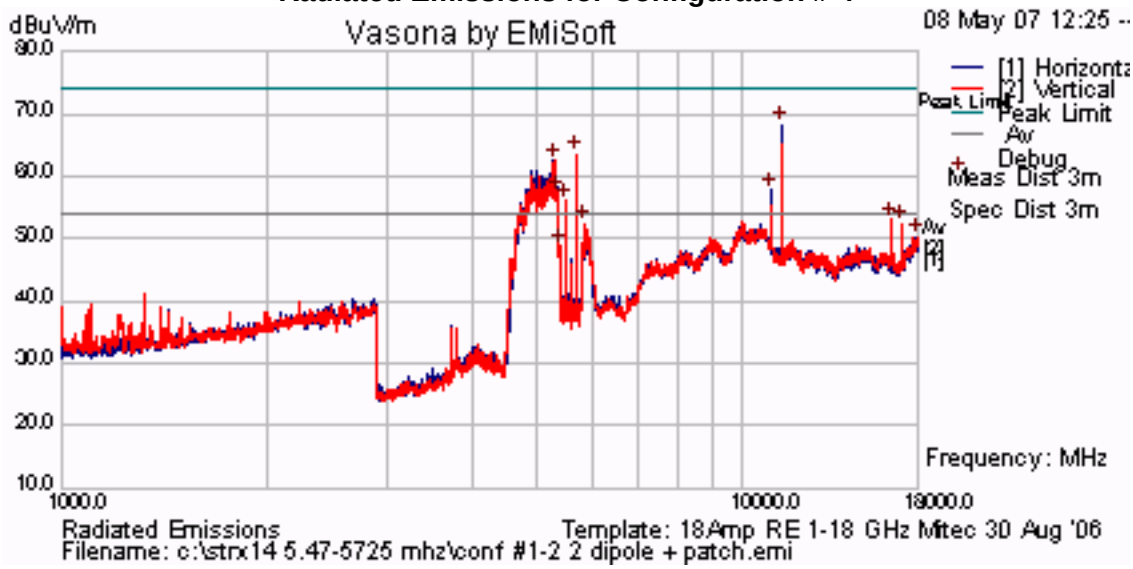
Omni IP 103 802.11a 6MB/s Ch 5,700, peak power setting = +16.2 dBm

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)
5291.573	V	68.10	-3.30	64.80	74	-9.20
5291.573	V	55.37	-3.30	52.07	54	-1.93
11001.34	H	54.85	+8.23	63.08	74	-10.92
11001.34	H	40.07	+8.23	48.30	54	-5.70
11397.67	V	60.41	+7.49	67.90	74	-6.10
11397.67	V	45.58	+7.49	53.07	54	-0.93

*Restricted band limit (Peak), ** Restricted band limit (average), *** Outside restricted band limit (Peak)

Radiated Emissions for Configuration # 4



Configuration # 5

FCC 15.407 5 GHz (5470-5725 MHz) Measurement

5 GHz operational mode - 3 transmitters simultaneously operating

3 Antennas - 2 * 12 dBi Omni, 1 * 23.0 dBi Panel

Omni IP 104 802.11a 6MB/s Ch 5,600, peak power setting = +17.0 dBm

Patch IP 102 802.11a 6MB/s Ch 5,700, peak power setting = +5.4 dBm

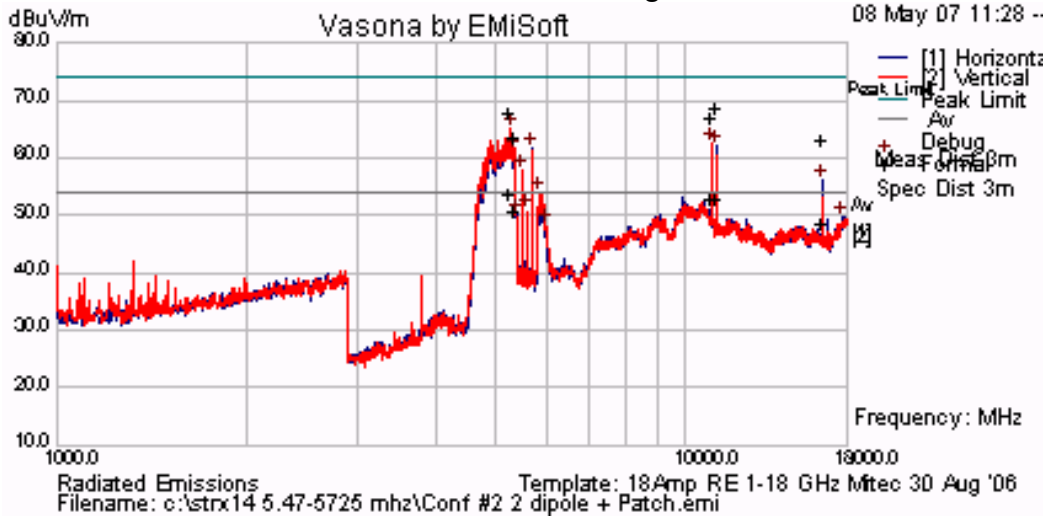
Omni IP 103 802.11a 6MB/s Ch 5,500, peak power setting = +16.7 dBm

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)
5244.736	V	69.21	-3.46	65.75	74	-8.25
5244.736	V	55.26	-3.46	51.80	54	-2.20
5350.011	V	64.36	-2.97	61.39	74	-12.61
5350.011	V	51.43	-2.97	48.46	54	-5.54
10996.6	V	56.57	+8.24	64.81	74	-9.19
10996.6	V	42.54	+8.24	50.78	54	-3.22
11203.8	H	58.86	+7.66	66.52	74	-7.48
11203.8	H	43.18	+7.66	50.84	54	-3.16
16494.93	H	51.76	+9.16	60.92	74	-13.08
16494.93	H	37.15	+9.16	46.31	54	-7.69

*Restricted band limit (Peak), ** Restricted band limit (average), *** Outside restricted band limit (Peak)

Radiated Emissions for Configuration # 5



Configuration # 6

FCC 15.407 5 GHz (5470-5725 MHz) Measurement

5 GHz operational mode - 3 transmitters simultaneously operating

3 Antennas - 2 * 12 dBi Omni, 1 * 23.0 dBi Panel

Omni IP 104 802.11a 6MB/s Ch 5,700, peak power setting = +17.2 dBm

Patch IP 102 802.11a 6MB/s Ch 5,500, peak power setting = +4.3 dBm

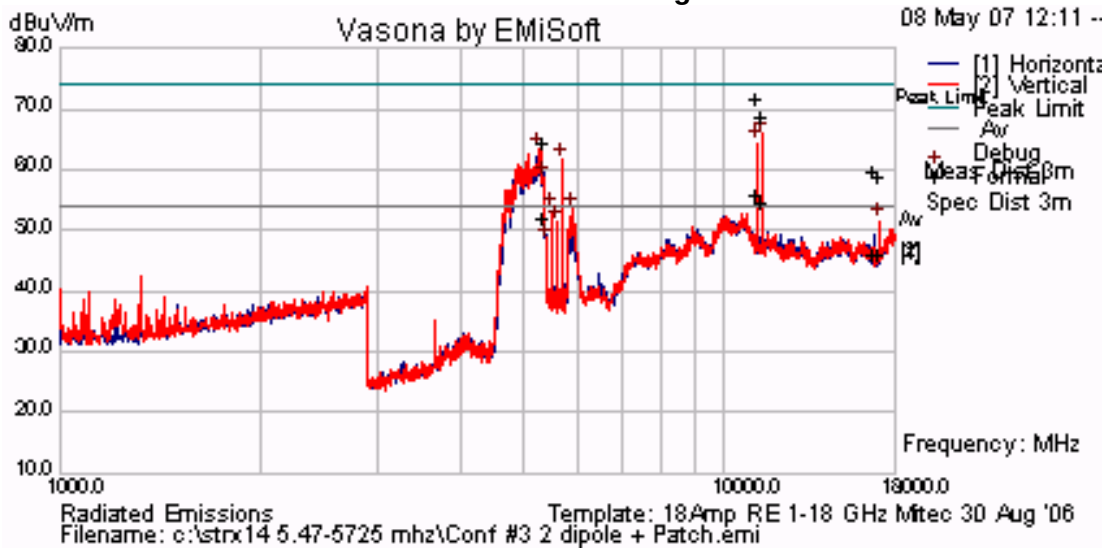
Omni IP 103 802.11a 6MB/s Ch 5,600, peak power setting = +16.8 dBm

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)
5327.781	V	65.58	-3.09	62.49	74	-11.51
5327.781	V	52.93	-3.09	49.84	54	-4.16
11205.24	V	61.82	+7.66	69.48	74	-4.52
11205.24	H	45.95	+7.66	53.61	54	-0.39
11398.24	V	59.23	+7.49	66.72	74	-7.28
11398.24	V	44.92	+7.49	52.41	54	-1.59
16798.72	H	48.46	+9.29	57.75	74	-16.25
16798.72	H	34.59	+9.29	43.88	54	-10.12
17097.4	V	46.72	+10.00	56.72	74	-17.28
17097.4	V	33.91	+10.00	43.91	54	-10.09

*Restricted band limit (Peak), ** Restricted band limit (average), *** Outside restricted band limit (Peak)

Radiated Emissions for Configuration # 6



5.1.8.2. Radiated Band-Edge – Restricted Bands

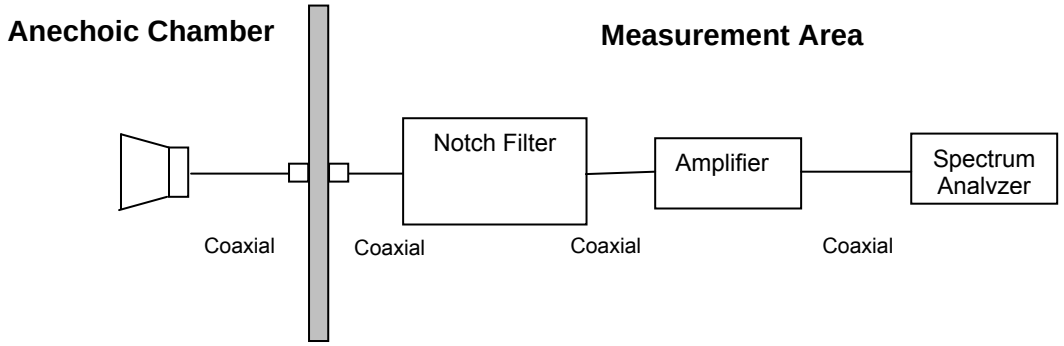
Note: The data in this section along with the data in sections 5.1.7 (Conducted Spurious emissions) and section 5.1.8.1 (Transmitter Radiated Spurious Emissions) shows that the EUT is in compliance with the -27dBm/MHz EIRP limit for out of band emissions.

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
23 dBi Patch Panel Part # OWS-ANTA-PNL-23
12 dBi Dipole Part # OWS-ANTA-OMNI-12

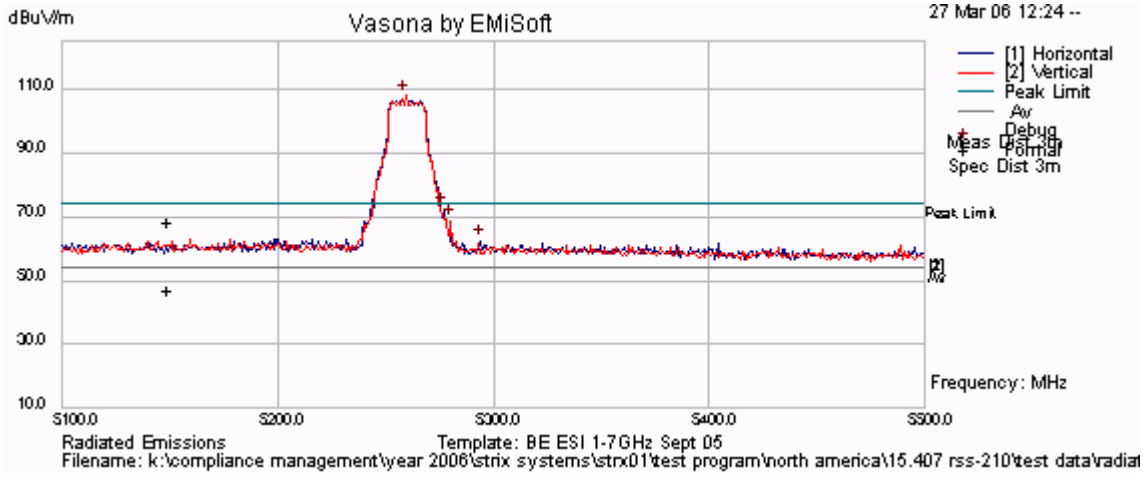
Radiated Band Edge Test Results for 23 dBi Patch Panel Part # OWS-ANTA-PNL-23

Transmitter peak power: +7 dBm

TABLE OF RESULTS - 802.11a

Tx Freq. (MHz)	Restricted Band Frequency (MHz)	Measured (dBuV/m)	Limit (dBuV/m)	Margin (dB)
$5{,}260_{PEAK}$	5,150	64.3	74.00	-9.7
$5{,}260_{AVE}$	5,150	42.63	54.00	-11.37

802.11a – 5,260 MHz
Lower Band Edge Peak Emission = 108 dBµV/m



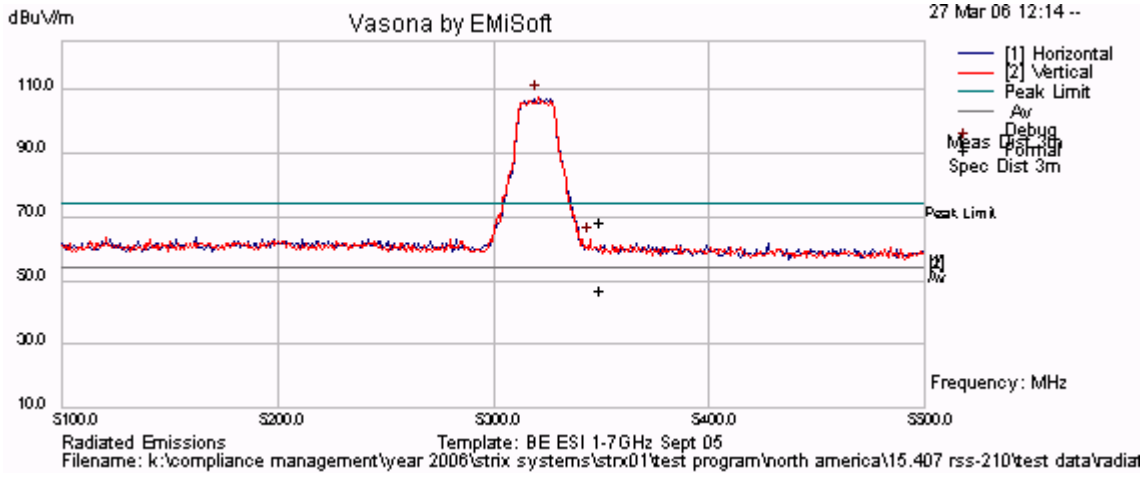
Radiated Band Edge Test Results for 23 dBi Patch Panel Part # OWS-ANTA-PNL-23

Transmitter peak power: +7dBm

TABLE OF RESULTS - 802.11a

Tx Freq. (MHz)	Restricted Band Frequency (MHz)	Measured (dBuV/m)	Limit (dBuV/m)	Margin (dB)
$5{,}320_{PEAK}$	5,350	64.4	74.00	-9.6
$5{,}320_{AVE}$	5,350	42.62	54.00	-11.38

802.11a – 5,320 MHz
Upper Band Edge Peak Emission = 107.85 dBµV/m



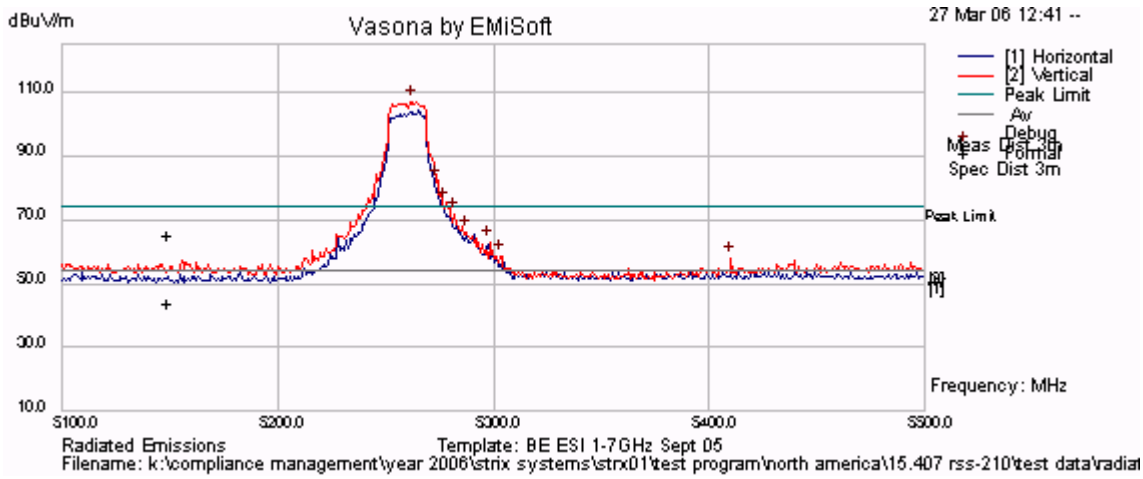
Radiated Band Edge Test Results for 12 dBi Dipole Part # OWS-ANTA-OMNI-12

Transmitter peak power: +18dBm

TABLE OF RESULTS - 802.11a

Tx Freq. (MHz)	Restricted Band Frequency (MHz)	Measured (dBuV/m)	Limit (dBuV/m)	Margin (dB)
$5{,}260_{PEAK}$	5,150	61.34	74.00	-12.66
$5{,}260_{AVE}$	5,150	39.57	54.00	-14.43

802.11a – 5,150 MHz
Lower Band Edge Peak Emission =107 dBµV/m



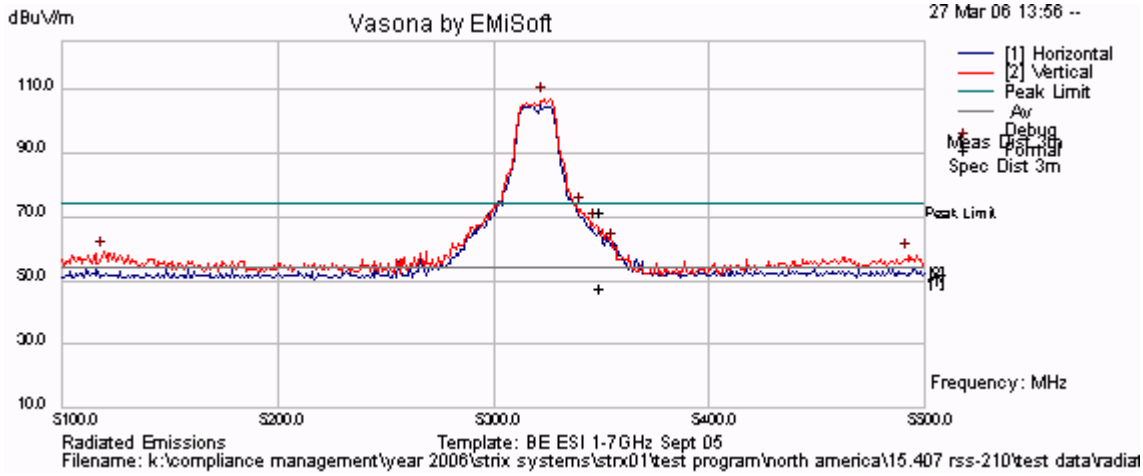
Radiated Band Edge Test Results for 12 dBi Dipole Part # OWS-ANTA-OMNI-12

Transmitter peak power: +18dBm

TABLE OF RESULTS - 802.11a

Tx Freq. (MHz)	Restricted Band Frequency (MHz)	Measured (dBuV/m)	Limit (dBuV/m)	Margin (dB)
$5{,}320_{PEAK}$	5,350	67.46	74.00	-6.54
$5{,}320_{AVE}$	5,350	43.57	54.00	-10.43

802.11a – 5,350 MHz
Upper Band Edge Peak Emission = 106.95 dBµV/m



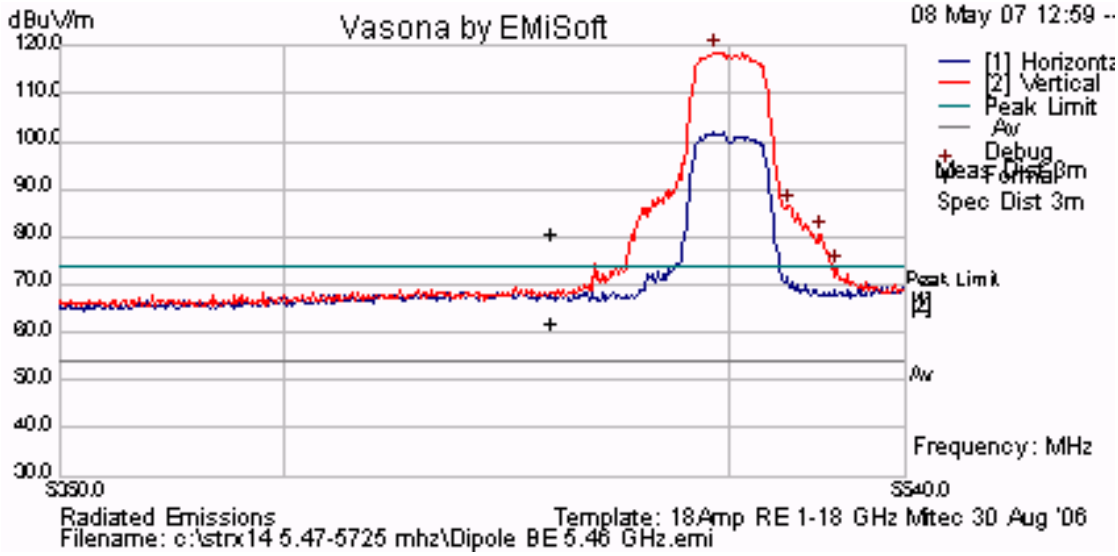
Radiated Band Edge Test Results for 12 dBi Dipole Part # OWS-ANTA-OMNI-12

Transmitter peak power: +16dBm

TABLE OF RESULTS - 802.11a

Tx Freq. (MHz)	Restricted Band Frequency (MHz)	Measured (dBuV/m)	Limit (dBuV/m)	Margin (dB)
$5{,}500_{PEAK}$	5,460	72.99	74.00	-1.01
$5{,}500_{AVE}$	5,460	50.5	54.00	-3.50

802.11a – 5,500 MHz



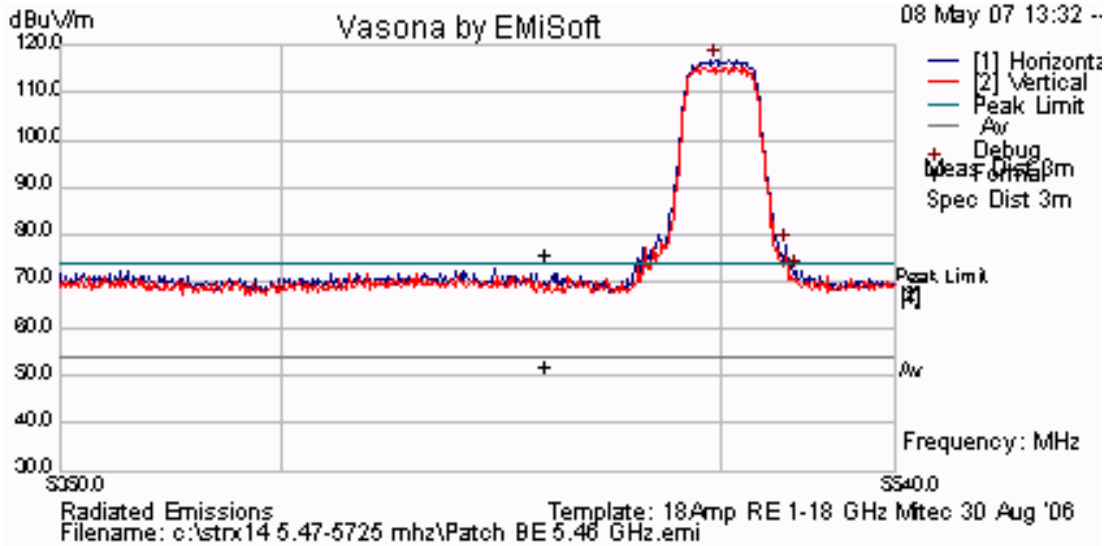
Radiated Band Edge Test Results for 23 dBi Patch Panel Part # OWS-ANTA-PNL-23

Transmitter peak power: +6dBm

TABLE OF RESULTS - 802.11a

Tx Freq. (MHz)	Restricted Band Frequency (MHz)	Measured (dBuV/m)	Limit (dBuV/m)	Margin (dB)
$5{,}500_{PEAK}$	5,460	73.08	74.00	-0.92
$5{,}500_{AVE}$	5,460	49.64	54.00	-4.36

802.11a – 5,500 MHz
Lower Band Edge Peak Emission =116.9 dBµV/m



Specification

Limits

15.407 (b)(2). All emissions outside of the 5,150-5,350MHz band shall not exceed an EIRP of -27dBm/MHz.

§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.

RSS-210 §A9.3(2) For transmitters operating in the 5250-5350 MHz band, all emissions outside the 5150-5350 MHz band shall not exceed -27 dBm/MHz e.i.r.p. Devices operating in the 5250-5350 MHz band that generate emissions in the 5150-5250 MHz band shall not exceed out of band emission limit of 27 dBm/MHz e.i.r.p. in the 5150-5250 MHz band in order to operate indoor/outdoor, or alternatively shall comply with the spectral power density for operation within the 5150-5250 MHz band and shall be labeled “for indoor use only”.

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.

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

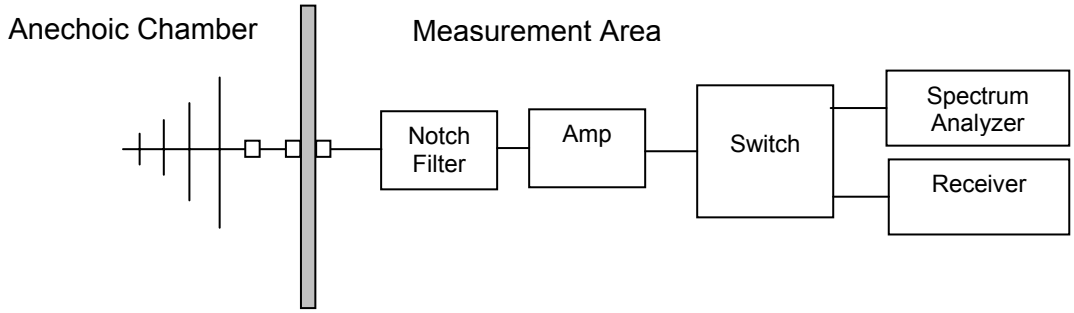
Method	Test Equipment Used
Measurements were made per work instruction WI-03 'Measurement of Radiated Emissions'	0088, 0158, 0134, 0304, 0311, 0315, 0310, 0312

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

FCC, Part 15 Subpart C §15.407(b)(6); §15.205(a); §15.209(a)
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)

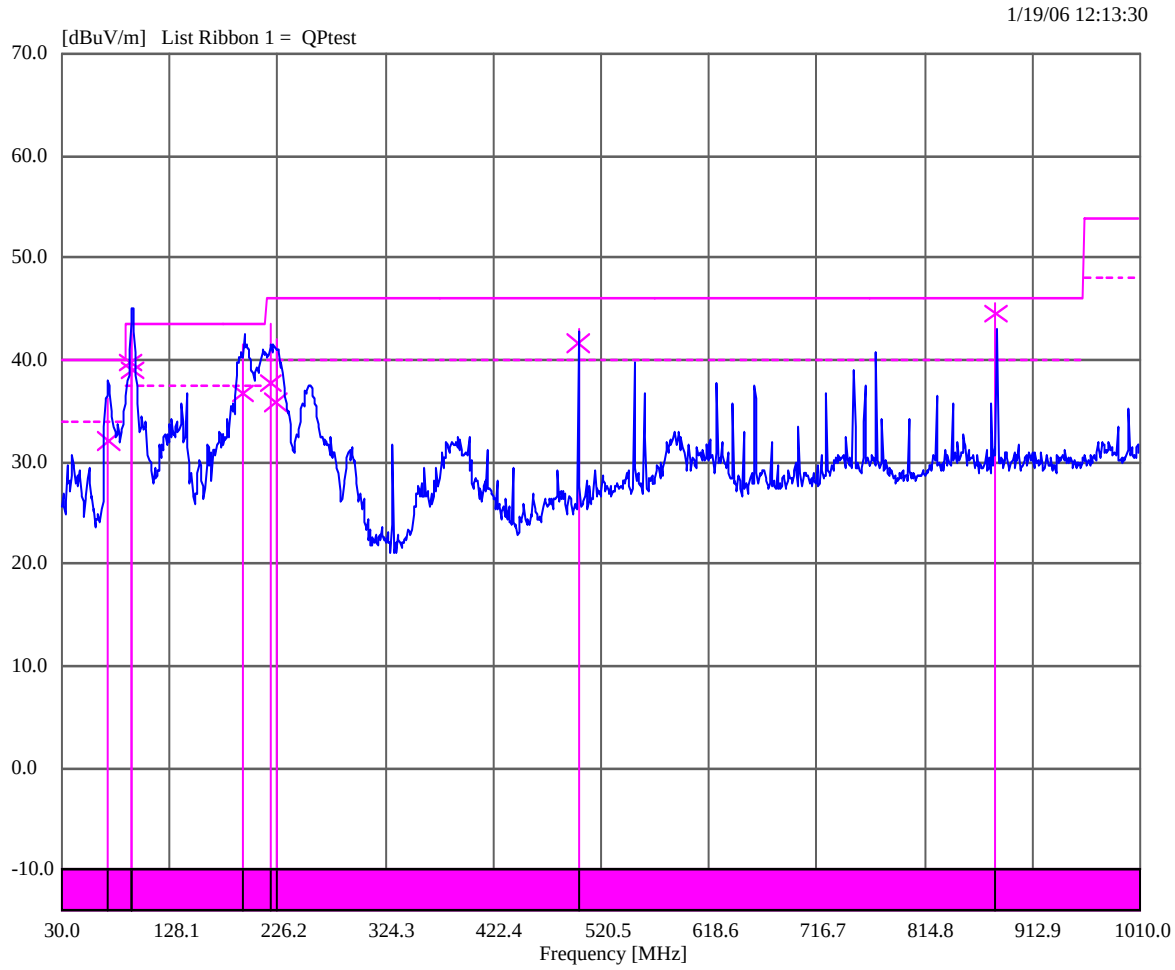
Ambient conditions.
Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

Radio parameters.
Data Rate(s): 6 MBit/s
Antenna Type: 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

Radiated Spurious Emissions 30 MHz to 1 GHz



Specification

Limits

§15.407(b)(6) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in Section 15.209.

§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.

RSS-210 §2.2 refers to Section 2.7 Table 2 below;-
.

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

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

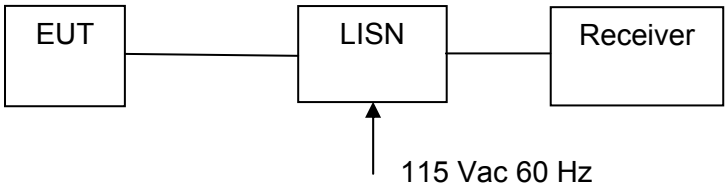
FCC, Part 15 Subpart C §15.407(b)(6)/15.207
Industry Canada RSS-Gen §7.2.2

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)

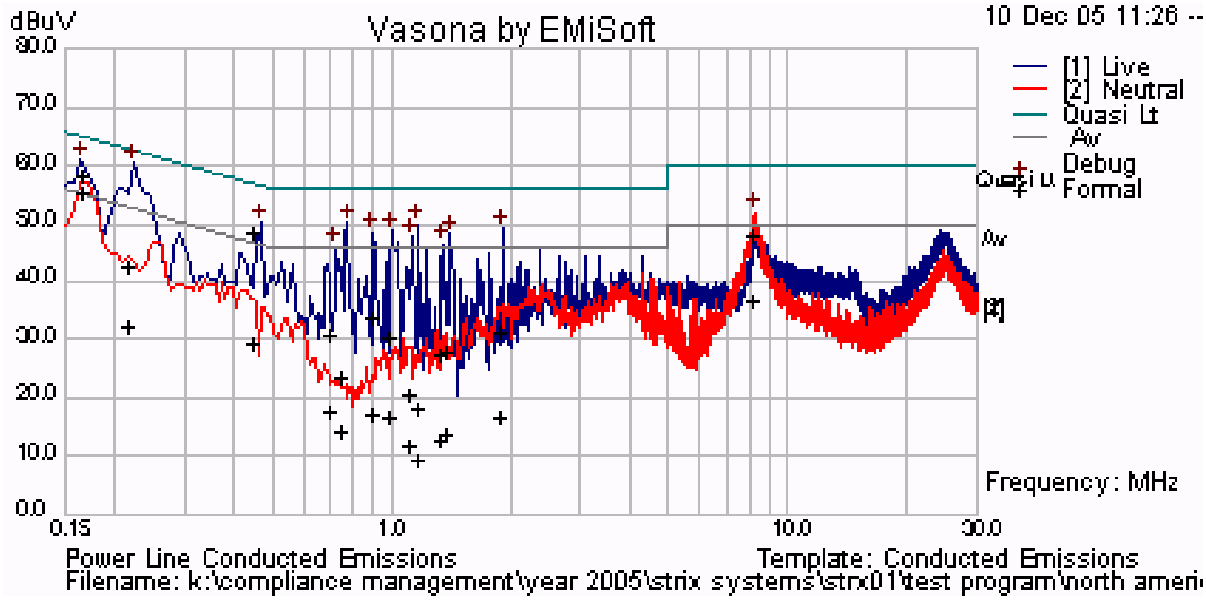
Ambient conditions.
Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

Radio parameters.
Data Rate(s): 6 Mbits/s

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

AC Wireline Conducted Emissions (150 kHz – 30 MHz)



Specification

Limit

§15.407 (b)(6); Any U-NII devices using an AC power line are required to comply also with the limits set forth in Section 15.207.

§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

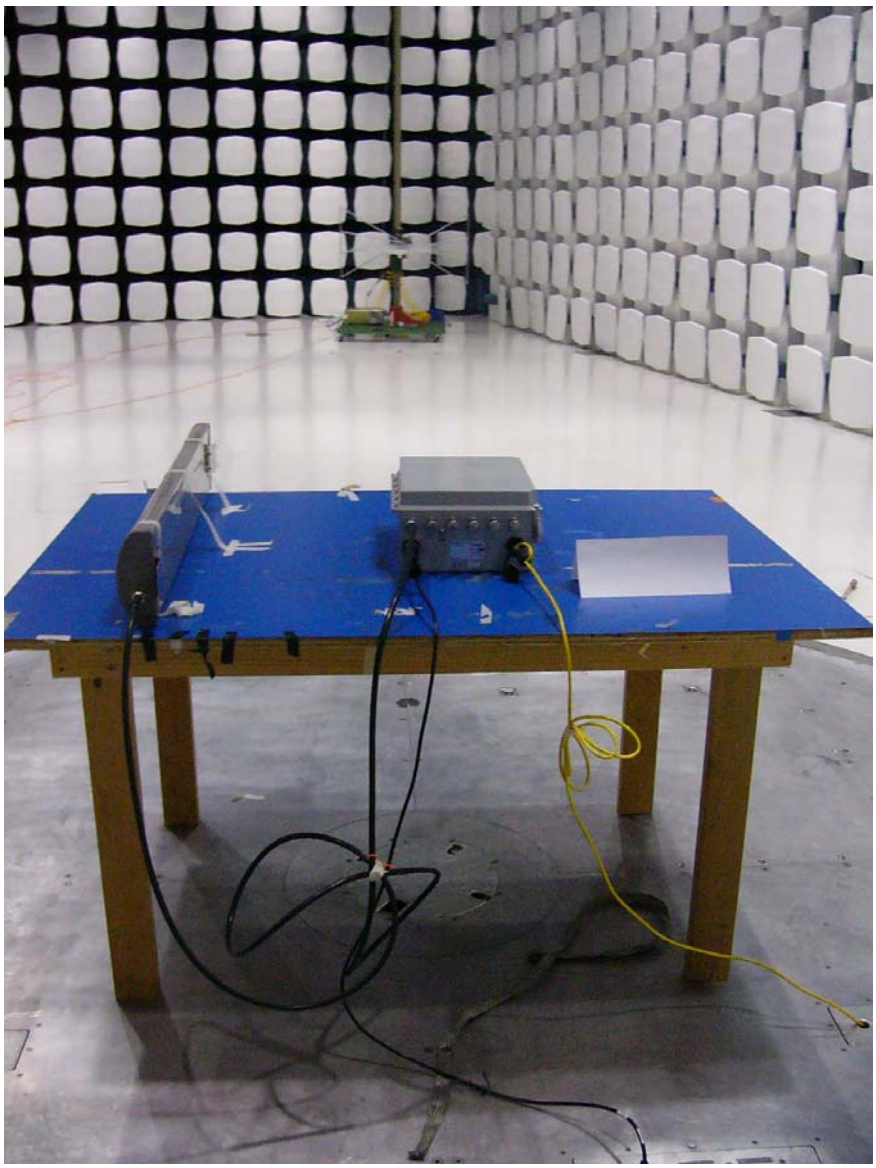
Measurement uncertainty	±2.64 dB

Traceability

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

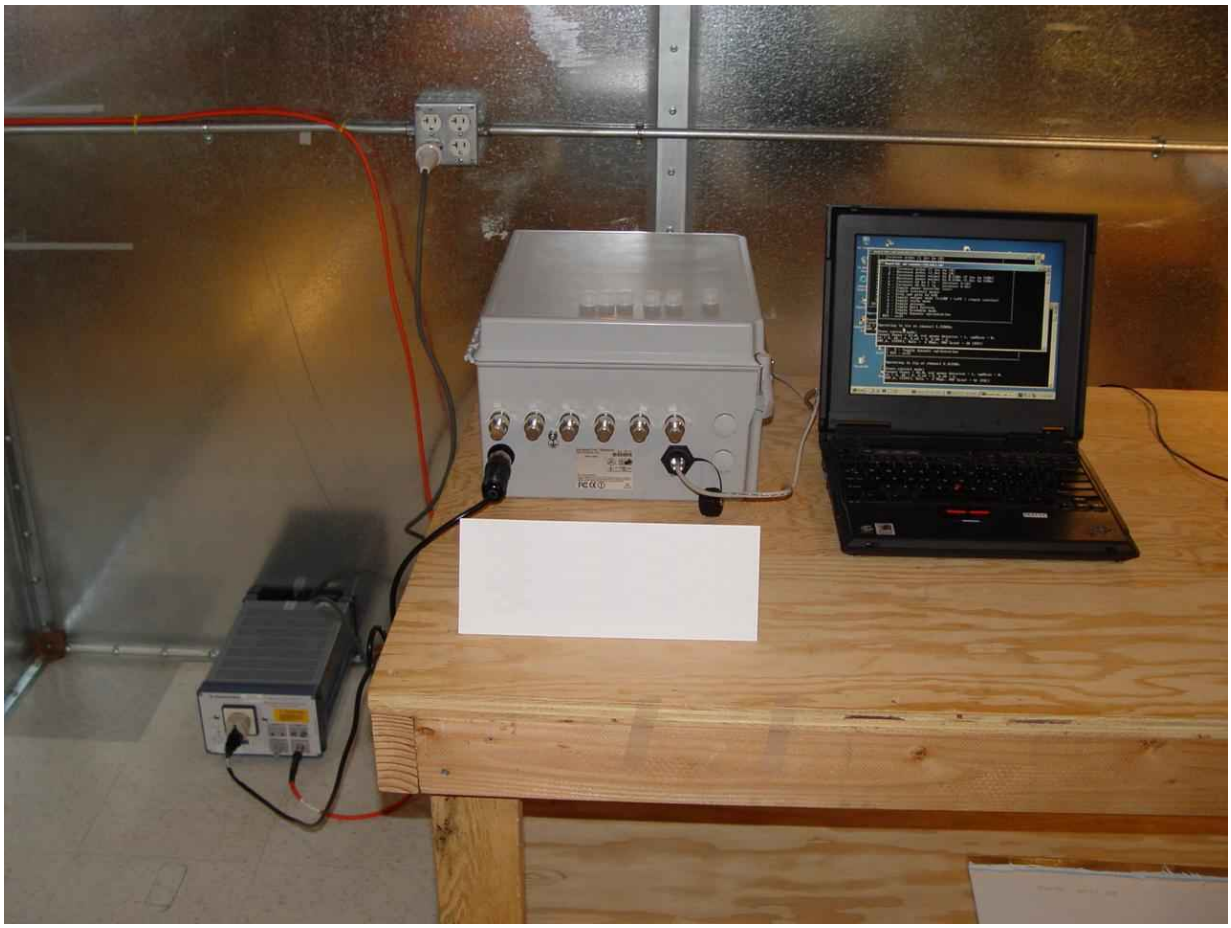
6. PHOTOGRAPHS

6.1. Radiated Emissions (30 MHz-1 GHz)

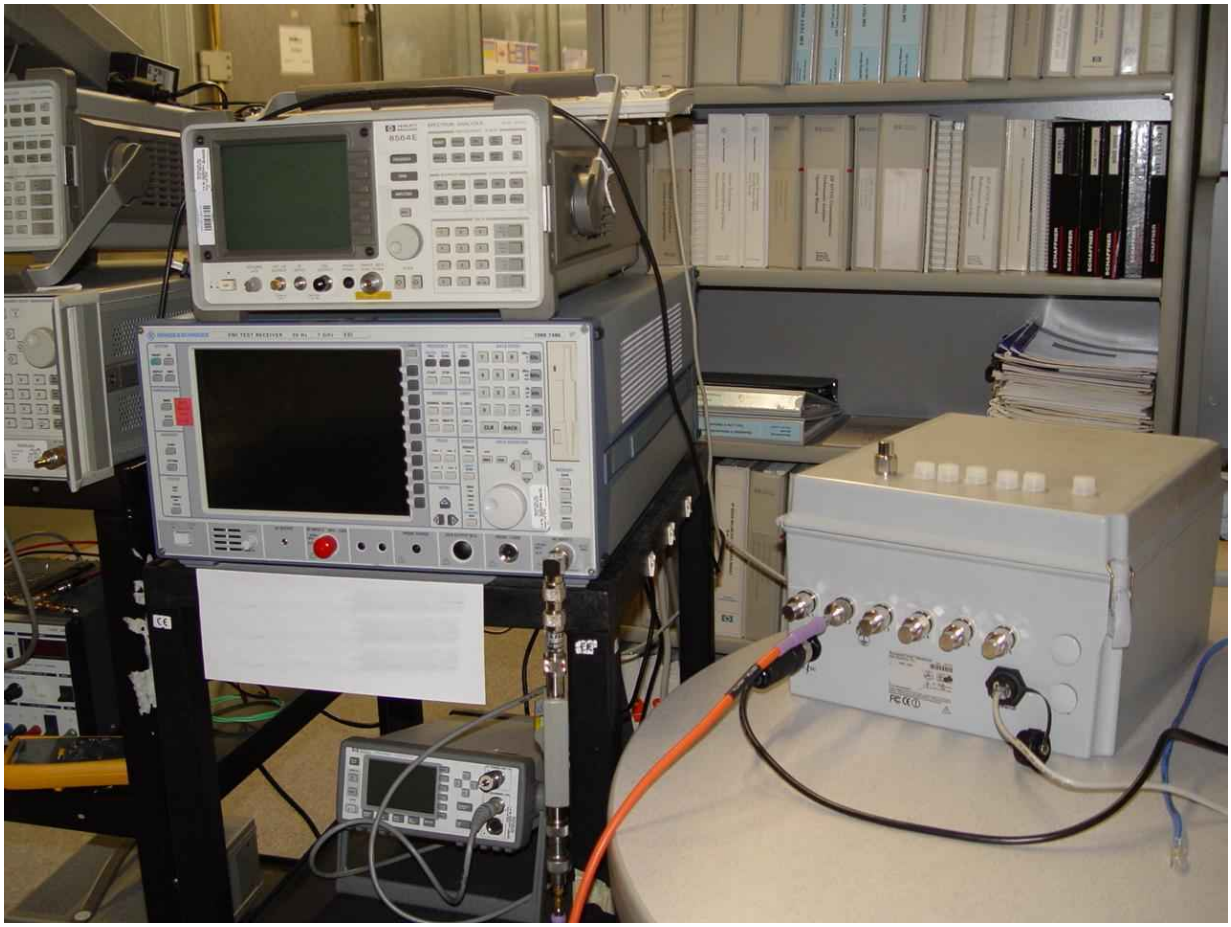


6.2. Spurious Emissions >1 GHz

6.3. Conducted Emissions (150 kHz - 30 MHz)



6.4. General Measurement Test Set-Up



7. TEST EQUIPMENT DETAILS

Asset #	Instrument	Manufacturer	Part #	Serial #
0088	Spectrum Analyzer	Hewlett Packard	8564E	3410A00141
0104	1-18GHz Horn Antenna	The Electro-Mechanics Company	3115	9205-3882
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
0307	BNC Cable	Megaphase	1689 1GVT4	15F50B002

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