Test of Strix Systems MWS100

To: FCC 47 CFR Part 90 & IC RSS 111

Test Report Serial No.: STRX17-A12 Rev A

TEST REPORT

FROM

MiCOM Labs

Test of Strix Systems MWS100

To FCC 47 CFR Part 90 & IC RSS 111

Test Report Serial No.: STRX17-A12 Rev A

This report supersedes: NONE

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

Product Function: Wireless Access Point Operating at 4.9 GHz

Copy No: pdf **Issue Date:** 28th August '08

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
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ACCREDITED
CERTIFICATE #2381.01

MiCOM Labs is an ISO 17025 Accredited Testing Laboratory

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ACCREDITATION, LISTINGS & RECOGNITION

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

ilac-MRA

THE AMERICAN ASSOCIATION FOR LABORATORY ACCREDITATION

ACCREDITED LABORATORY

A2LA has accredited

MICOM LABS
Pleasanton, CA

for technical competence in the field of

Electrical Testing

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

Presented this 26th day of February 2008.

President
For the Accreditation Council
Certificate Number 2381.01
Valid to November 30, 2009

For the 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

Canada

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

RECOGNITION

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

Conformity Assessment Body (CAB) – MiCOM Labs

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

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

DOCUMENT HISTORY

Document History		
Revision	Date	Comments
Draft		
		This document was initially released as STRX16-A4. Client modified the enclosure and to ensure continued compliance radiated emissions 0.03 – 1 GHz was completed and re-issued as STRX17-A4, see Section 5.1.6.2 Radiated Spurious Emissions (0.03 – 1 GHz), ac/dc adapter. With the case change the EUT can now be used indoors and outdoors
Rev A	27th August 2008	Initial Release

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:	MWS100, Wireless Access Point Operating at 4.9 GHz	Telephone:	+1 925 462 0304
Model(s):	MWS100	Fax:	+1 925 462 0306
S/N:	#1, #2		
Test Date(s):	18th - 19th Jan and 14th Aug '08	Website:	www.micomlabs.com

STANDARD(S)	TEST RESULTS
FCC 47 CFR Part 90 & IC RSS 111	EQUIPMENT COMPLIES

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

Notes:

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

Approved & Released for MiCOM Labs, Inc. by:

ACCREDITED
CERTIFICATE #2381.01

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 90	2004	Code of Federal Regulations
(ii)	FCC 47 CFR Part 90 Sect 90.210 Sect 90.1215	18th May 2005	90.210 Emission Masks (Revised requirements) 90.1215 Power Limits (Revised requirements)
(iii)	RSS-111	2007 Issue 2	Broadband Public Safety Equipment Operating in the Band 4940- 4990 MHz
(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

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 MWS100 to FCC 47 CFR Part 90 Subpart Y and Industry Canada RSS-111 regulations.
Applicant:	As 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:	STRX17-A12 Rev A
Date EUT received:	18TH January 2008
Standard(s) applied:	FCC 47 CFR Part 90 & IC RSS 111 (Public Safety Band)
Dates of test (from - to):	18th - 19th Jan and 14th Aug '08 and 14th August 2008
No of Units Tested:	2
Type of Equipment:	Wireless Access Point
Manufacturers Trade Name:	MWS100
Model(s):	MWS100
Location for use:	Indoor and Outdoor
Declared Frequency Range(s):	4940 - 4990 MHz
Declared Nominal Output Power:	+23 dBm (average)
Type of Modulation:	OFDM
EUT Modes of Operation:	Per 802.11 – DBPSK, DQPSK, CCK, OFDM
Transmit/Receive Operation:	TDD
Rated Input Voltage and Current:	12 – 48Vdc, Current 0.5 – 1.5A
Operating Temperature Range:	Declared range -40 to +80ºC
ITU Emission Designator:	4.9 GHz - 16M1W7D
Clock/Oscillator(s):	25 MHz, 40 MHz.
Frequency Stability:	±20 ppm (-40 to +80ºC)
Equipment Dimensions:	9.5" x 5.5625" x 1.95" (LxWxH)
Weight:	1.41 lbs
Primary function of equipment:	Transmission of data and voice

3.2. Scope of Test Program

The scope of the test program was to test Strix Systems MWS100 to;-

FCC 47 CFR Part 90, Subpart Y regulatory requirements;-

18th May 2005 revision of FCC 47 CFR Part 90;-

Sub Section 90.210	Emission Masks (revised requirements)
Sub Section 90.1215	Power Limits (revised requirements)

Industry Canada RSS-111.

The MWS100 is a Wireless Access Point operating in the 4.9 GHz Public Safety Band Radio employing OFDM modulation at 20 MHz bandwidths in the frequency range 4940 to 4990 MHz.

As a result of the modification to the case the EUT was retested for emissions below 1 GHz. This document was generated to satisfy FCC's Class II Permissive change.

Strix Systems Inc
MWS100 - Front

Strix Systems Inc
PSU

Strix Systems Inc
PSU Label

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

Type (EUT/ Support)	Equipment Description (Including Brand Name)	Manufacturer	Model No.	Serial No.
EUT	Strix Systems MWS100 4.9 GHz Wireless Access Unit	Strix Systems Inc	MWS100	#1
EUT	Strix Systems MWS100 4.9 GHz Wireless Access Unit	Strix Systems Inc	MWS100	#2
EUT	Strix Systems Class II Power Supply 100-240 Vac, 0.8A (50-60 Hz) 18 Vdc, 24W	N/A	SA07H1724	N/A
Support	Laptop	Sony	Vaio	

3.4. Antenna Details

Antenna Type	Gain (dBi)	Manufacturer	Model No.	Serial No.
Radome Dipole	11	Larsen	R380.500.227	N/A

An 11 dBi gain antenna was utilized for the calculation of MPE (Maximum Permissible Exposure) in Section 5.1.4 and testing receive spurious emissions.

3.5. Cabling and I/O Ports

Number and type of I/O ports

1. 10/100BT with POE (Power over Ethernet)
2. RF Main
3. RF Aux
4. Vdc Power

3.6. Test Configurations

Matrix of test configurations

Parameter	Operational Mode	Test Conditions	Bandwidths (MHz)
#A Occupied BW & Emission Mask	Modulated	Ambient	20
#A Peak Output power	Modulated	Ambient	20
#A Peak Power Spectral Density	Modulated	Ambient	20
#B Frequency Stability	CW	Temperature Variations and Voltage Variations	--
#B Conducted Spurious	Modulated	Ambient	20
#B Radiated Emissions	Modulated	Ambient	20
AC Wireline Emissions	N/A	--	--

See 3.7 Equipment Modifications

#A – EUT Serial No: #1

#B – EUT Serial No: #2

3.7. Equipment Modifications

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

1. NONE

   A second device MWS100 (S/N: #2) was used to complete the test program as a result of power amplifier problems in the initial unit (S/N: #1).

2. Emissions 0.03 – 1 GHz

   To comply with the digital emissions requirement (below 1 GHz) a ferrite was required on the Ethernet cable. Ferrite Fair-rite #: 0461167281 was used to reduce the emissions below the limit.

3.8. Deviations from the Test Standard

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

1. NONE

3.9. Subcontracted Testing or Third Party Data

1. NONE

4. TEST SUMMARY

List of Measurements

The following table represents the list of measurements required under the **FCC CFR47 Part 90**, **Subpart Y, Industry Canada RSS-111,** and **Industry Canada RSS-Gen.**

Section(s)	Test Items	Description	Condition	Result	Test Report Section
2.1049; 90.210(m) 4.4	26 dB / 99% Occupied BW & Emission Mask	Emission mask and bandwidth measurement(s)	Conducted	Complies	5.1.1
2.1046; 90.1215 (a) 4.3	Peak and Average Output Power	Modulated Output Power	Conducted	Complies	5.1.2
2.1046; 90.1215 (a) 4.3	Peak Power Spectral Density	Maximum Spectral Density	Conducted	Complies	5.1.3
Subpart C 90.1217	Maximum Permissible Exposure	Exposure to radio frequency energy levels	Radiated	Complies	5.1.4
2.1055(a)(1); 90.213 4.2	Frequency Stability	Includes temperature and voltage variations	Conducted	Complies	5.1.5
2.1051; 90.210(m) 4.4/4.5 6	Conducted Spurious Emissions at Antenna Port	Emissions from the antenna port 30 MHz – 40 GHz	Conducted	Complies	5.1.6
2.1053; 90.210(m) ANSI/TIA-603 4.4	Radiated Spurious Emissions	Spurious emissions 30 MHz – 40 GHz	Radiated	Complies	5.1.7
Industry Canada only **RSS-Gen §4.8, §6**	Receiver Radiated Spurious Emissions	Emissions above 1 GHz	Radiated	Complies	*5.1.8*
15.207 7.2.2	AC Wireline Conducted	Emissions 150 kHz–30 MHz	Conducted	N/A	*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*
Note 3: *Section 3.7 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. Occupied Bandwidth and Emission Mask

FCC 47 CFR Part 90, Subpart Y; 2.1049; §90.210(m)

IC Section 4.4

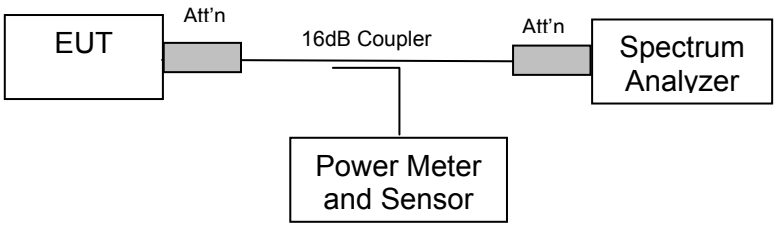
Test Procedure

The transmitter terminal of EUT was connected to the input of the spectrum analyzer set to measure the 26 dB occupied bandwidth and emission mask for the radio. The system highest power setting was selected with modulation ON and duty cycle set for 100% i.e. continuous operation at all times.

For emission masks the zero dB reference is measured relative to the highest average power of the fundamental emission measured across the designated channel bandwidth using a resolution bandwidth of at least one percent of the occupied bandwidth of the fundamental emission and a video bandwidth of 30 kHz.

The EUT is not equipped with an audio low-pass filter.

Test Measurement Set up



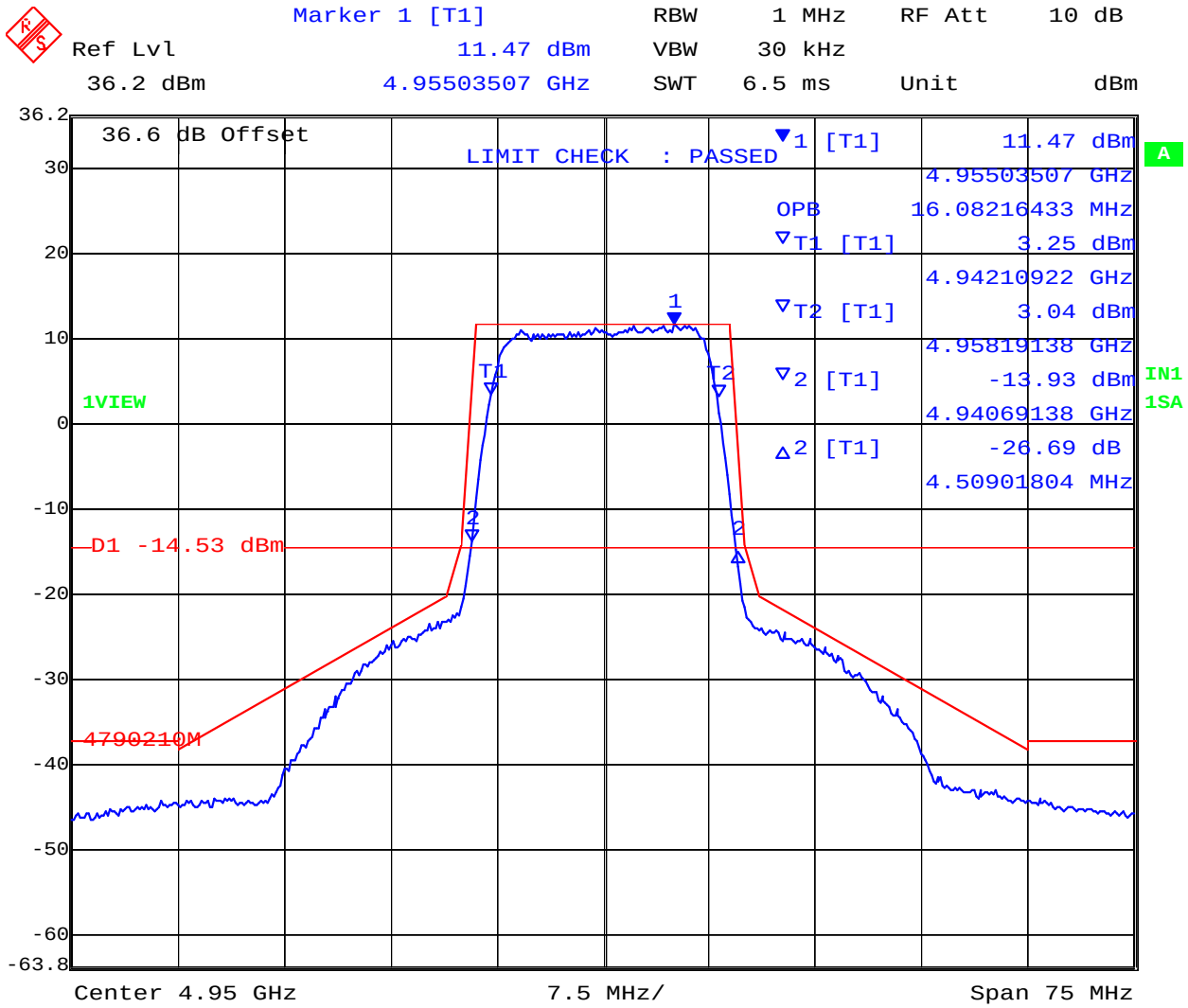
Test set up for Occupied Bandwidth and Emission Mask measurement

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

TABLE OF RESULTS – 20 MHz 26 dB Bandwidth(s)

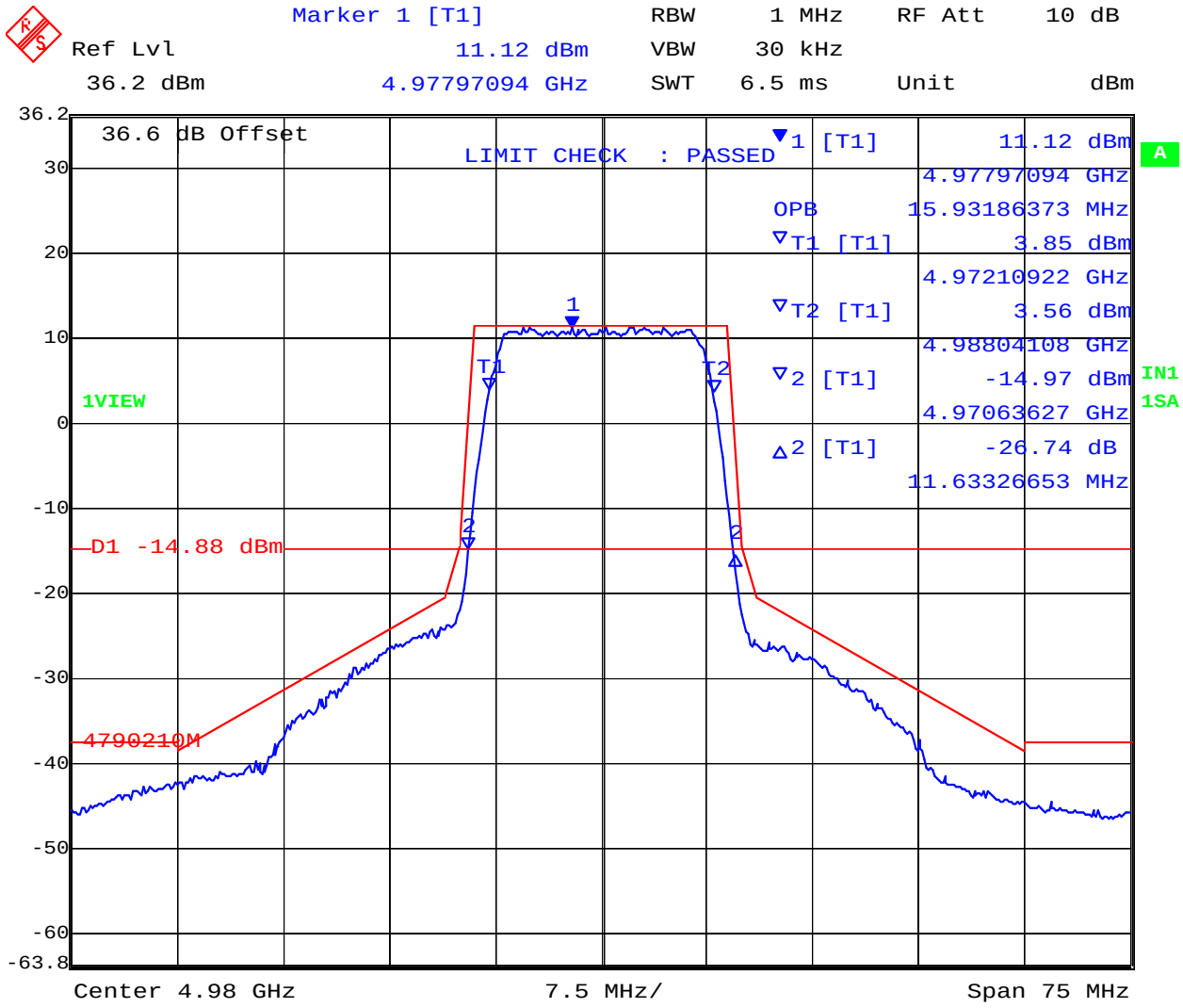
Center Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
4,950.0	18.859	16.082

Emission Mask, 26 dB & 99% Bandwidth for 20 MHz BW Channel Freq 4950 MHz



Center Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
4,980.0	18.963	15.932

Emission Mask, 26 dB & 99% Bandwidth for 20 MHz BW Channel Freq 4980 MHz



Specification Limits
FCC Part §90.210

Limits for Authorized Bandwidth

Frequency Band (MHz) and Related Documents	Spectrum Masks with Audio Filter	Without Audio Filter
4950 – 4990 MHz	L or M	L or M

Reference to the emission masks are provided below

Limits Emission Masks
90.210(L), Emission Mask L. For low power transmitters (20 dBm of less) operating in the 4940 – 4990 MHz frequency band, the power spectral density of the emissions must be attenuated below the output power of the transmitter as follows:

(1) On any frequency removed from the assigned frequency between 0 – 45% of the authorized bandwidth (BW) : 0dB.

(2) On any frequency removed from the assigned frequency between 45 – 50 % of the authorized bandwidth: 219 log (% of (BW)/45) dB.

(3) On any frequency removed from the assigned frequency between 50 – 55 % of the authorized bandwidth: 10 + 242 log (% of (BW)/50) dB.

(4) On any frequency removed from the assigned frequency between 55 – 100 % of the authorized bandwidth: 20 + 31 log (% of (BW)/55) dB attenuation.

(5) On any frequency removed from the assigned frequency between 100 – 150 % of the authorized bandwidth: 28 + 68 log (% of (BW)/100) dB attenuation.

(6) On any frequency removed from the assigned frequency above 150 % of the authorized bandwidth: 50 dB.

(7) The zero dB reference is measured relative to the highest average power of the fundamental emission measured across the designated channel bandwidth using a resolution bandwidth of at least one percent of the occupied bandwidth of the fundamental emission and a video bandwidth of 30 kHz. The power spectral density is the power measured within the resolution bandwidth of the measurement device divided by the resolution bandwidth of the measurement device. Emission levels are also based on the use of measurement instrumentation employing a resolution bandwidth of at least one percent of the occupied bandwidth.

Limits Emission Masks (continued)

90.210(m), Emission Mask M. For high power transmitters (greater than 20 dBm) operating in the 4940 – 4900 MHz frequency band, the power spectral density of the emissions must be attenuated below the output power of the transmitter as follows:

(1) On any frequency removed from the assigned frequency between 0 – 45% of the authorized bandwidth (BW) : 0dB.

(2) On any frequency removed from the assigned frequency between 45 – 50 % of the authorized bandwidth: 568 log (% of (BW)/45) dB.

(3) On any frequency removed from the assigned frequency between 50 – 55 % of the authorized bandwidth: 26 + 145 log (% of (BW)/50) dB.

(4) On any frequency removed from the assigned frequency between 55 – 100 % of the authorized bandwidth: 32 + 31 log (% of (BW)/55) dB attenuation.

(5) On any frequency removed from the assigned frequency between 100 – 150 % of the authorized bandwidth: 40 + 57 log (% of (BW)/100) dB attenuation.

(6) On any frequency removed from the assigned frequency between above 150 % of the authorized bandwidth: 50 dB or 55 + 10 log (P) dB, whichever is the lesser attenuation.

(7) The zero dB reference is measured relative to the highest average power of the fundamental emission measured across the designated channel bandwidth using a resolution bandwidth of at least one percent of the occupied bandwidth of the fundamental emission and a video bandwidth of 30 kHz. The power spectral density is the power measured within the resolution bandwidth of the measurement device divided by the resolution bandwidth of the measurement device. Emission levels are also based on the use of measurement instrumentation employing a resolution bandwidth of at least one percent of the occupied bandwidth.

Note to paragraph m: Low power devices may as an option, comply with paragraph (m).

Laboratory Measurement Uncertainty for Power Measurements

Measurement uncertainty	±1.33 dB

Traceability

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

5.1.2. Peak Output Power

FCC 47 CFR Part 90, Subpart Y; 2.1046; §90.1215

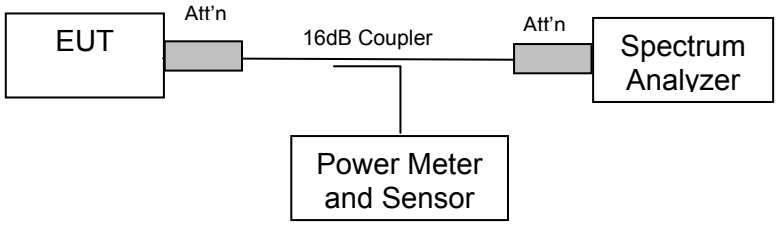
IC Section 4.3

Test Procedure

Average power measurements were measured with the use of an average power head. Peak power measurements were recorded via the spectrum analyzer. The system highest power setting was selected with modulation ON and duty cycle set for 100% i.e. continuous operation at all times.

The 26 dB emission bandwidth (see Section 5.1.1) was used by the spectrum analyzer to measure the peak output power.

Test Measurement Set up

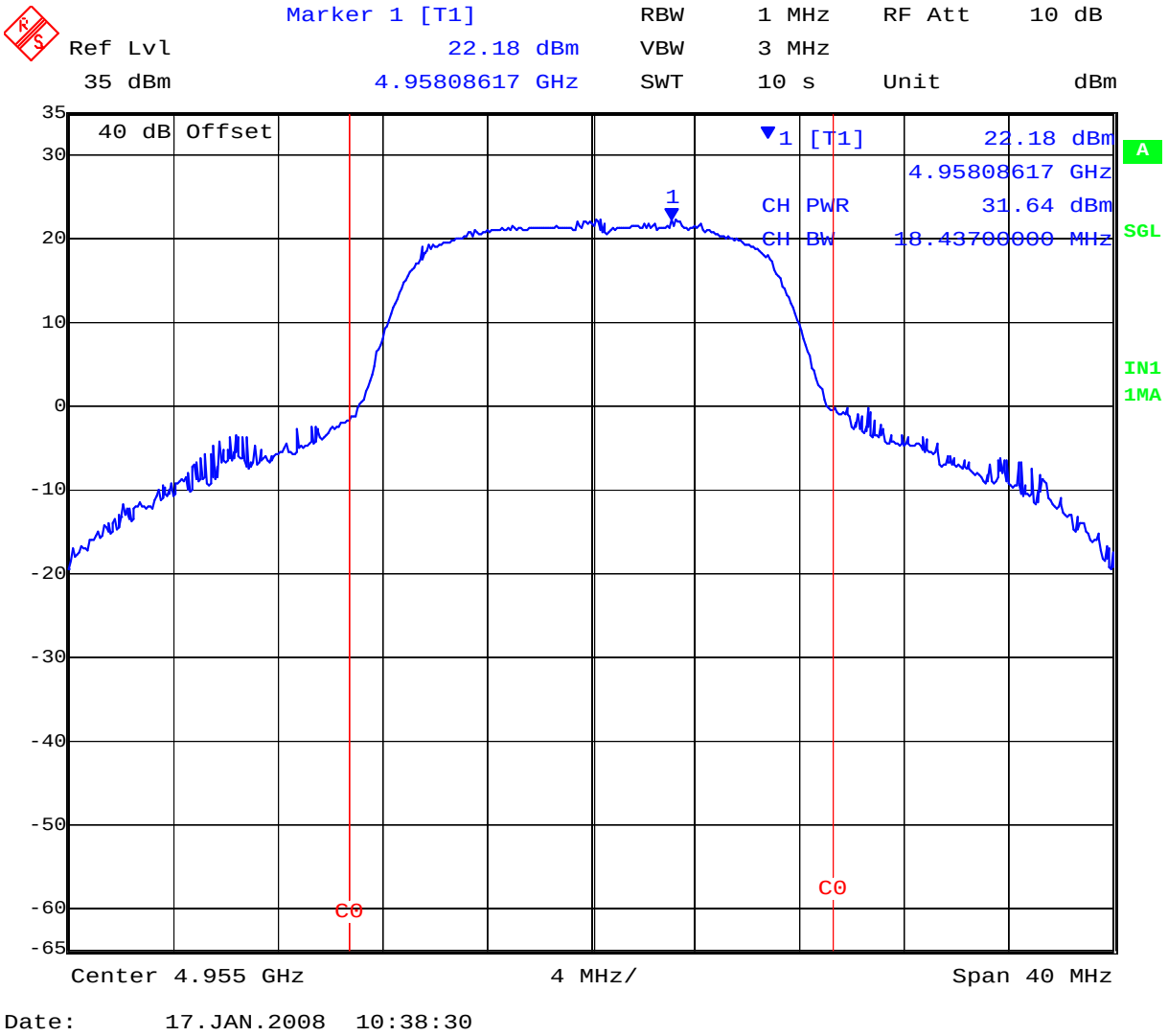


Test set up for modulated output power measurement

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

TABLE OF RESULTS – 20 MHz Bandwidth Modulated Carrier

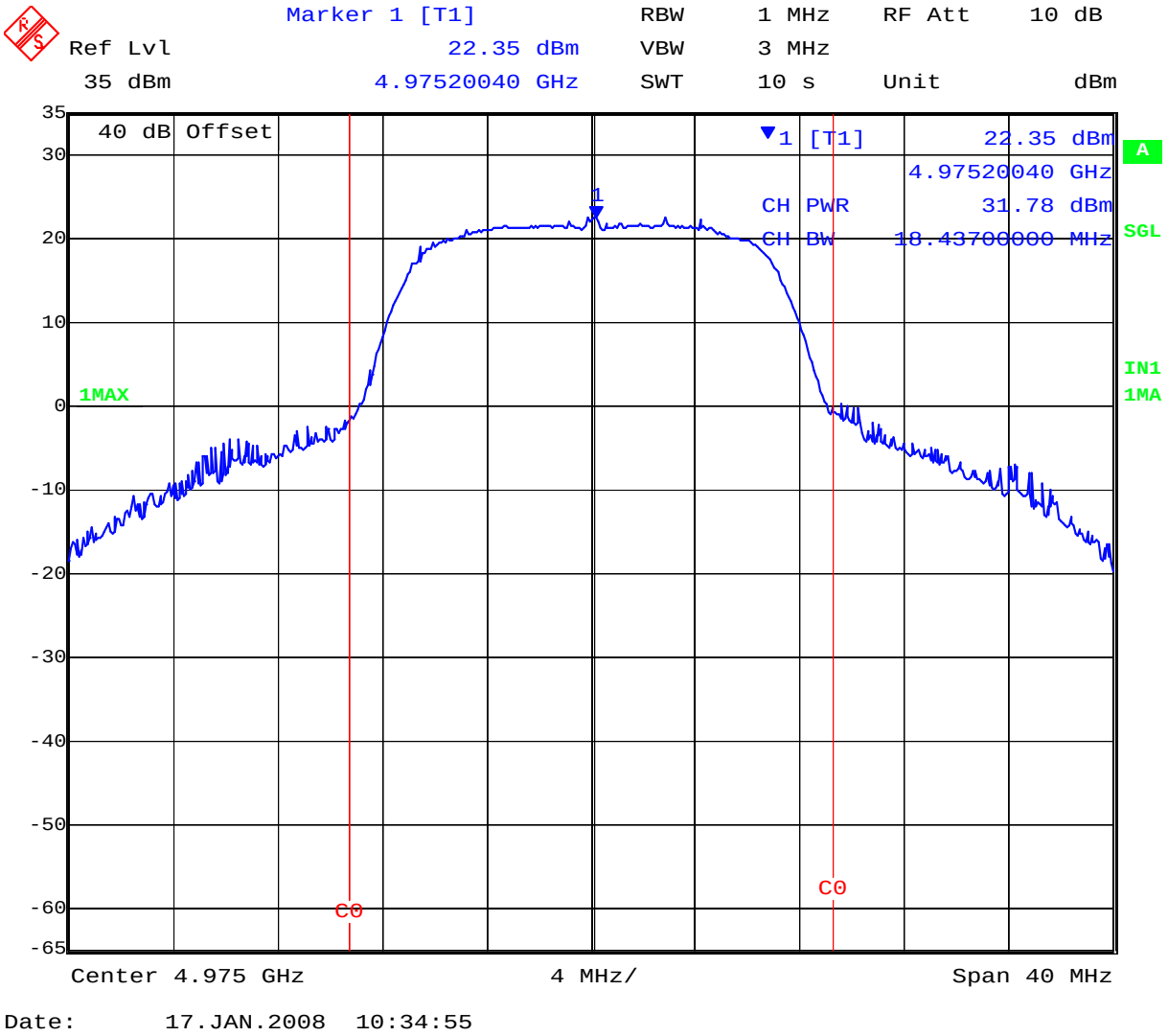
Center Frequency (MHz)	Peak Power (dBm)	Average Power (dBm)
4955.0	+31.64	+22.60



Peak Power 20 MHz BW Channel Freq 4955 MHz

TABLE OF RESULTS – 20 MHz Bandwidth Modulated Carrier

Center Frequency (MHz)	Peak Power (dBm)	Average Power (dBm)
4975.0	+31.78	+22.80



Peak Power 20 MHz BW Channel Freq 4975 MHz

Specification Limits

FCC Part §90.1215(a)

Power limits.

The transmitting power of stations operating in the 4940-4990 MHz band must not exceed the maximum limits in this section.

(a) The peak transmit power should not exceed:

Channel Bandwidth (MHz)	Low power peak transmitter power (dBm)	High power peak transmitter power (dBm)
1	7	20
5	14	27
10	17	30
15	18.8	31.8
20	20	33

High power devices are also limited to a peak power spectral density of 21 dBm per one MHz. High power devices using channel bandwidths other than those listed above are permitted; however, they are limited to a peak power spectral density of 21 dBm/MHz. If transmitting antennas of directional gain greater than 9 dBi are used, both the peak transmit power and the peak power spectral density should be reduced by the amount in decibels that the directional gain of the antenna exceeds 9 dBi. However, high power point-to-point or point-to-multipoint operation (both fixed and temporary-fixed rapid deployment) may employ transmitting antennas with directional gain up to 26 dBi without any corresponding reduction in the transmitter power or spectral density. Corresponding reduction in the peak transmit power and peak power spectral density should be the amount in decibels that the directional gain of the antenna exceeds 26 dBi.

(b) Low power devices are also limited to a peak power spectral density of 8 dBm per one MHz. Low power devices using channel bandwidths other than those listed above are permitted; however, they are limited to a peak power spectral density of 8 dBm/MHz. If transmitting antennas of directional gain greater than 9 dBi are used, both the peak transmit power and the peak power spectral density should be reduced by the amount in decibels that the directional gain of the antenna exceeds 9 dBi.

(c) The peak transmit power is measured as a conducted emission over any interval of continuous transmission calibrated in terms of an RMS-equivalent voltage. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, etc., so as to obtain a true peak measurement conforming to the definitions in this paragraph for the emission in question.

(d) The peak power spectral density is measured as conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements are made over

a bandwidth of one MHz or the 26 dB emission bandwidth of the device, whichever is less. A resolution bandwidth less than the measurement bandwidth can be used, provided that the measured power is integrated to show total power over the measurement bandwidth. If the resolution bandwidth is approximately equal to the measurement bandwidth, and much less than the emission bandwidth of the equipment under test, the measured results shall be corrected to account for any difference between the resolution bandwidth of the test instrument and its actual noise bandwidth.

Laboratory Measurement Uncertainty for Power Measurement

Measurement uncertainty	±1.33 dB

Traceability

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

5.1.3. Peak Power Spectral Density (PPSD)

FCC 47 CFR Part 90, Subpart Y; 2.1046; §90.1215

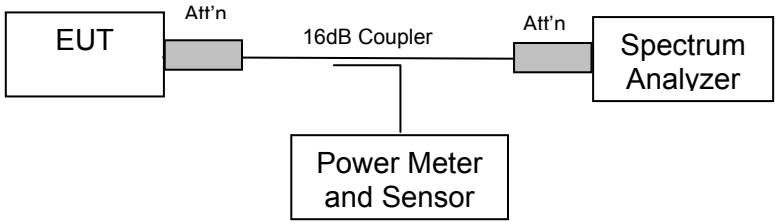
IC Section 4.3

Test Procedure

The test methodology used for this measurement was determined to provide the highest possible PPSD readings.

Peak power spectral density measurements were performed via the spectrum analyzer and plots were recorded. Modulation was ON and the system duty cycle was set for 100% i.e. continuous operation at all times. The system highest power setting was selected with modulation ON and duty cycle set for 100% i.e. continuous operation at all times.

Test Measurement Set up

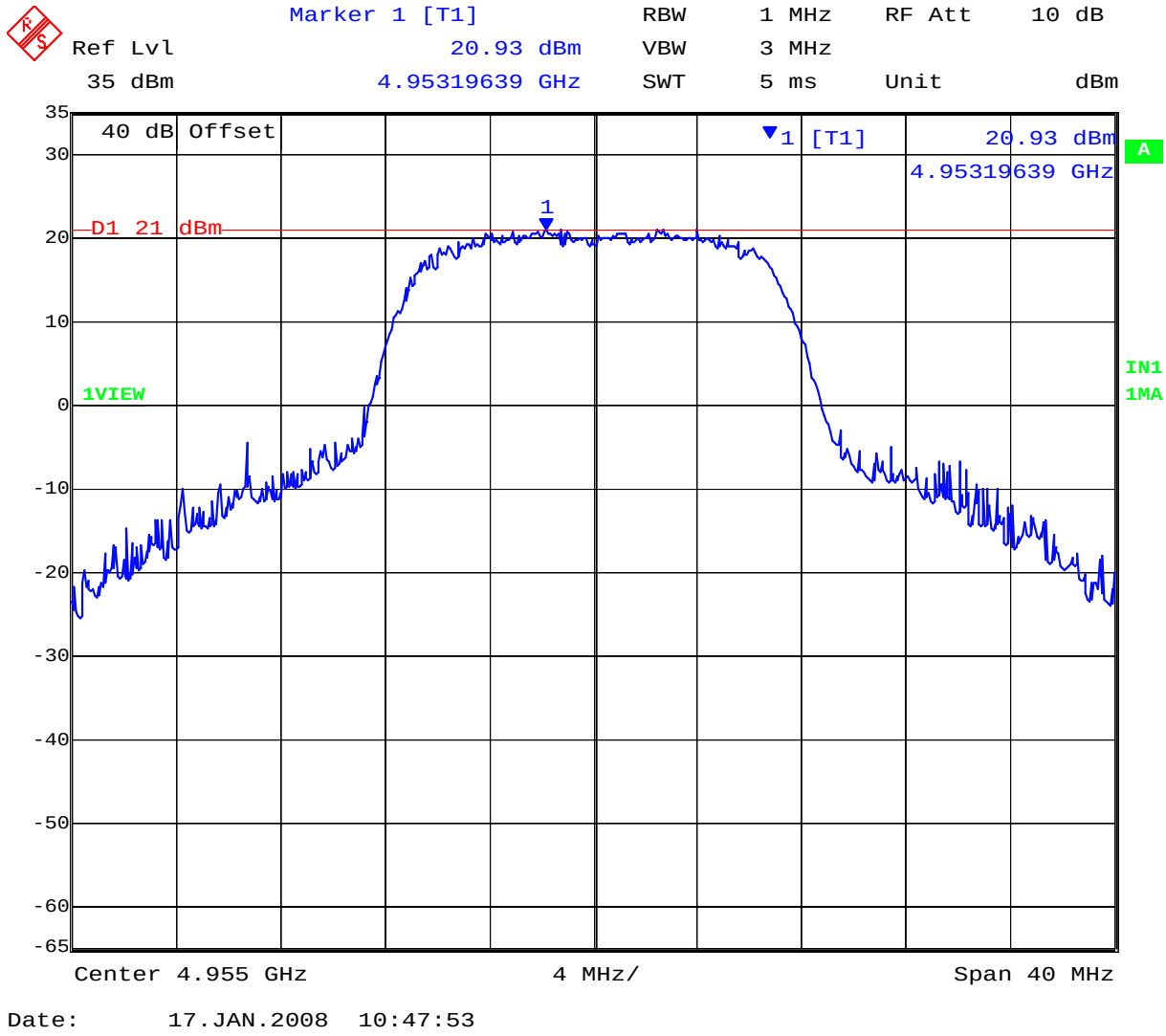


Test set up for Peak Power Spectral Density measurement(s)

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

TABLE OF RESULTS – PPSD 20 MHz Bandwidth Modulated Carrier

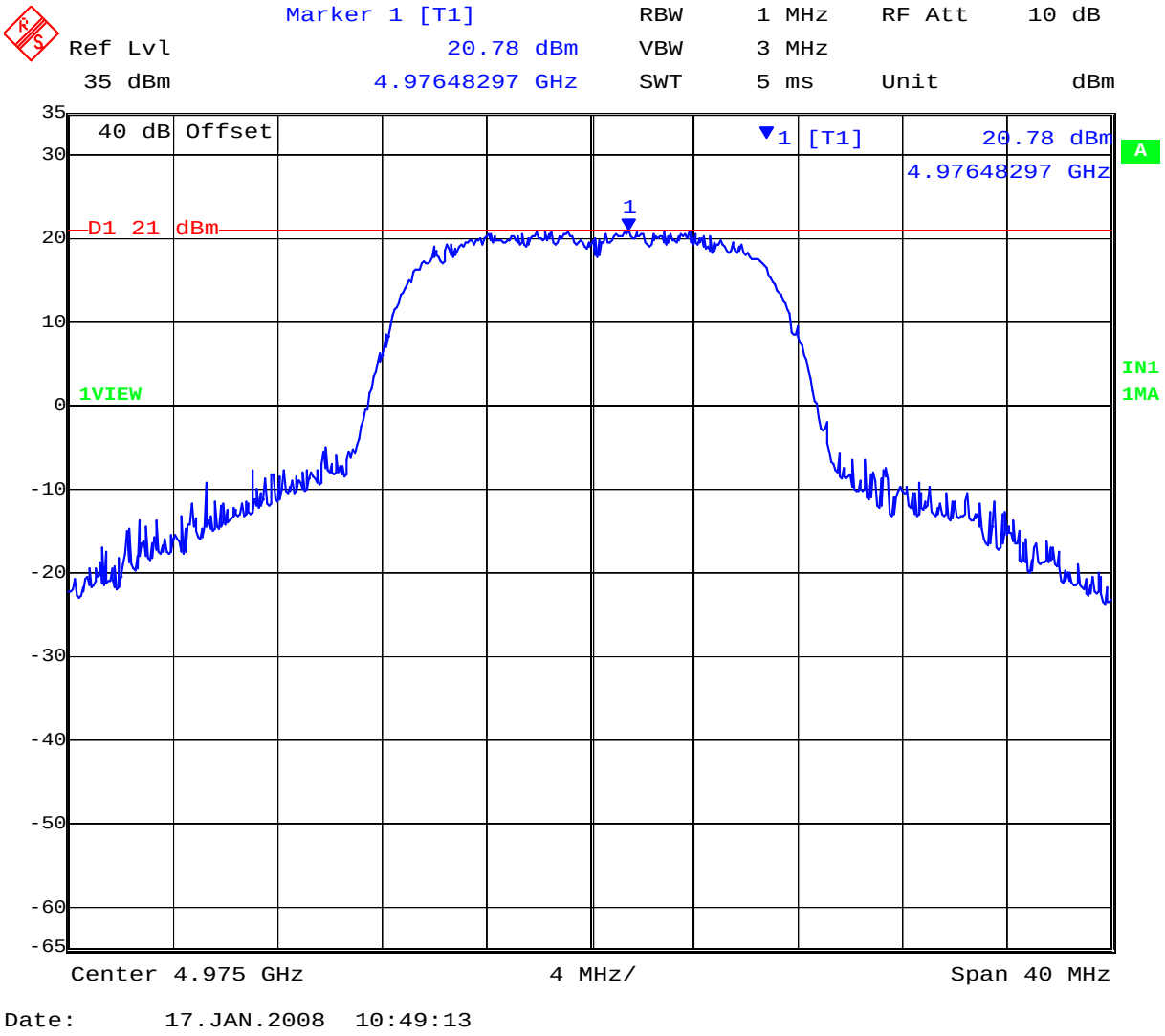
Center Frequency (MHz)	Peak Power Spectral Density (dBm/ MHz)
4955.0	20.93



Peak Power Spectral Density 20 MHz BW Channel Freq 4955 MHz

TABLE OF RESULTS – PPSD 10 MHz Bandwidth Modulated Carrier

Center Frequency (MHz)	Peak Power Spectral Density (dBm/MHz)
4975.0	20.78



Peak Power Spectral Density 20 MHz BW Channel Freq 4975 MHz

Specification Limits
FCC Part §90.1215

Refer to the Power Limits Specification in Section 5.1.2 of this report.

Laboratory Measurement Uncertainty for Power Measurement

Measurement uncertainty	±1.33 dB

Traceability

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

5.1.4. Maximum Permissible Exposure
FCC, Part 90 Subpart C §90.1217

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)

4 9 GHz 20 MHz Channel = Max. Peak Output Power +31.78 dBm, 1,506.61 mW

Max. Antenna Gain = 11.0 dBi, **12.59 numeric**

The EUT belongs to the Occupational/Controlled Exposure class of devices; power density limit is 5.0mW/cm^2

Maximum Gain Antennas – Calculated Safe Distance @ 1 mW/cm^2

Antenna Gain (dBi)	Numeric Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Calculated Safe Distance @ 1mW/cm^2 Limit(cm)	Minimum Separation Distance (cm)
11.0	12.59	+31.78	1,506.61	38.85	40.0

Note: for 4.9 GHz mobile or fixed location transmitters the minimum separation distance is 40cm, even if calculations indicate the MPE distance to be less.

Specification
Maximum Permissible Exposure Limits

§90.1217 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. See §1.1307 (b)(1) of this chapter.

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

Laboratory Measurement Uncertainty for Power Measurements

Measurement uncertainty	±1.33dB

5.1.5. Frequency Stability; Temperature Variations, and Voltage Variations

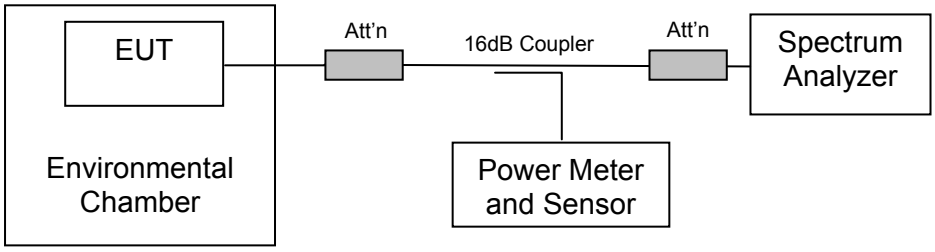
FCC 47 CFR Part 90, Subpart Y; 2.1055(a)(1); §90.213

IC Section 4.2

Test Procedure

The transmitter output was connected to a spectrum analyzer and the frequency stability was measured in an un-modulated state. Frequency stability was measured through the extremes of temperature on the mid channel only. Before measurements were taken at each temperature the equipment waited until thermal balance was obtained.

Test Measurement Set up



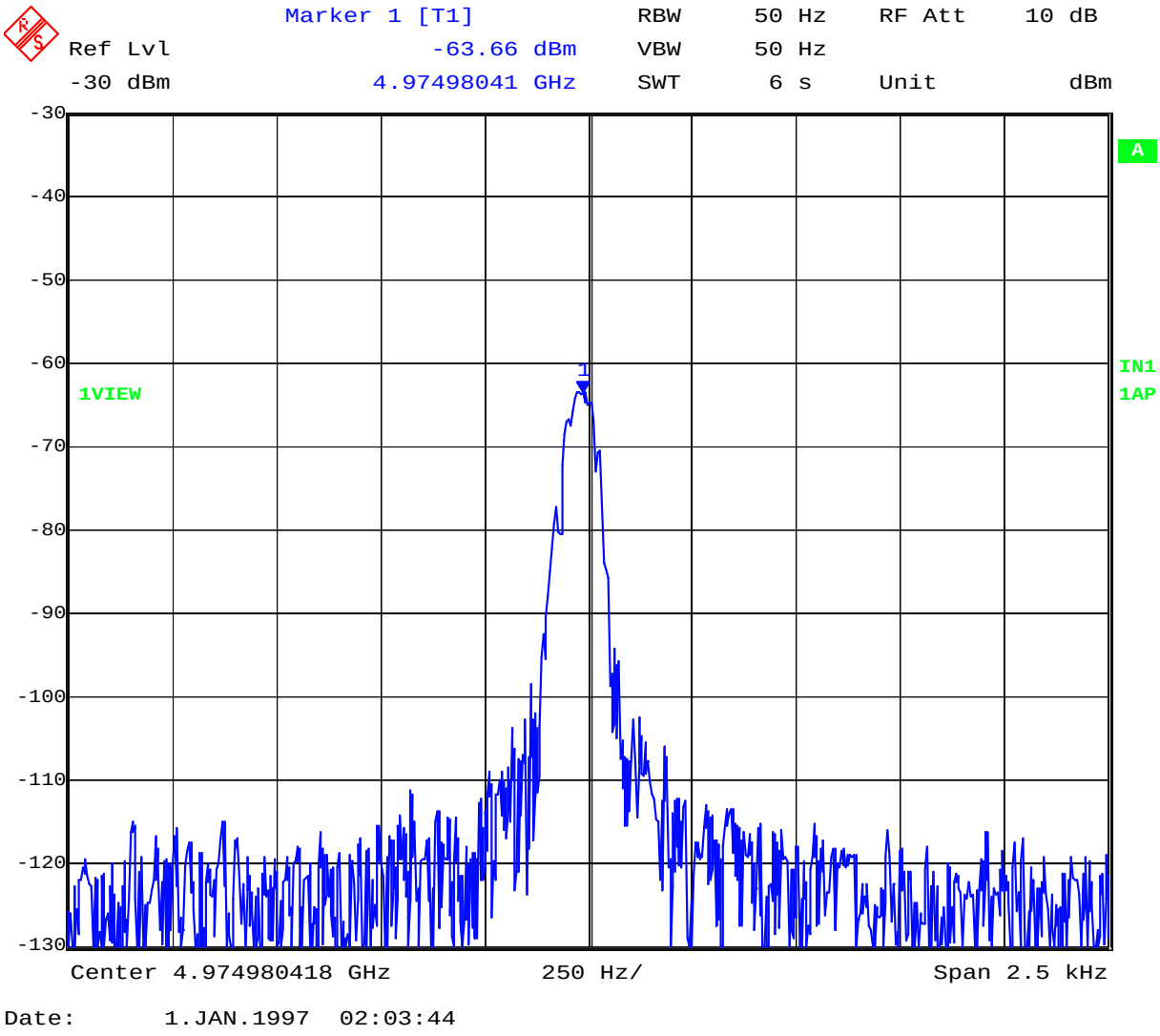
Measurement set up for Frequency Stability

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

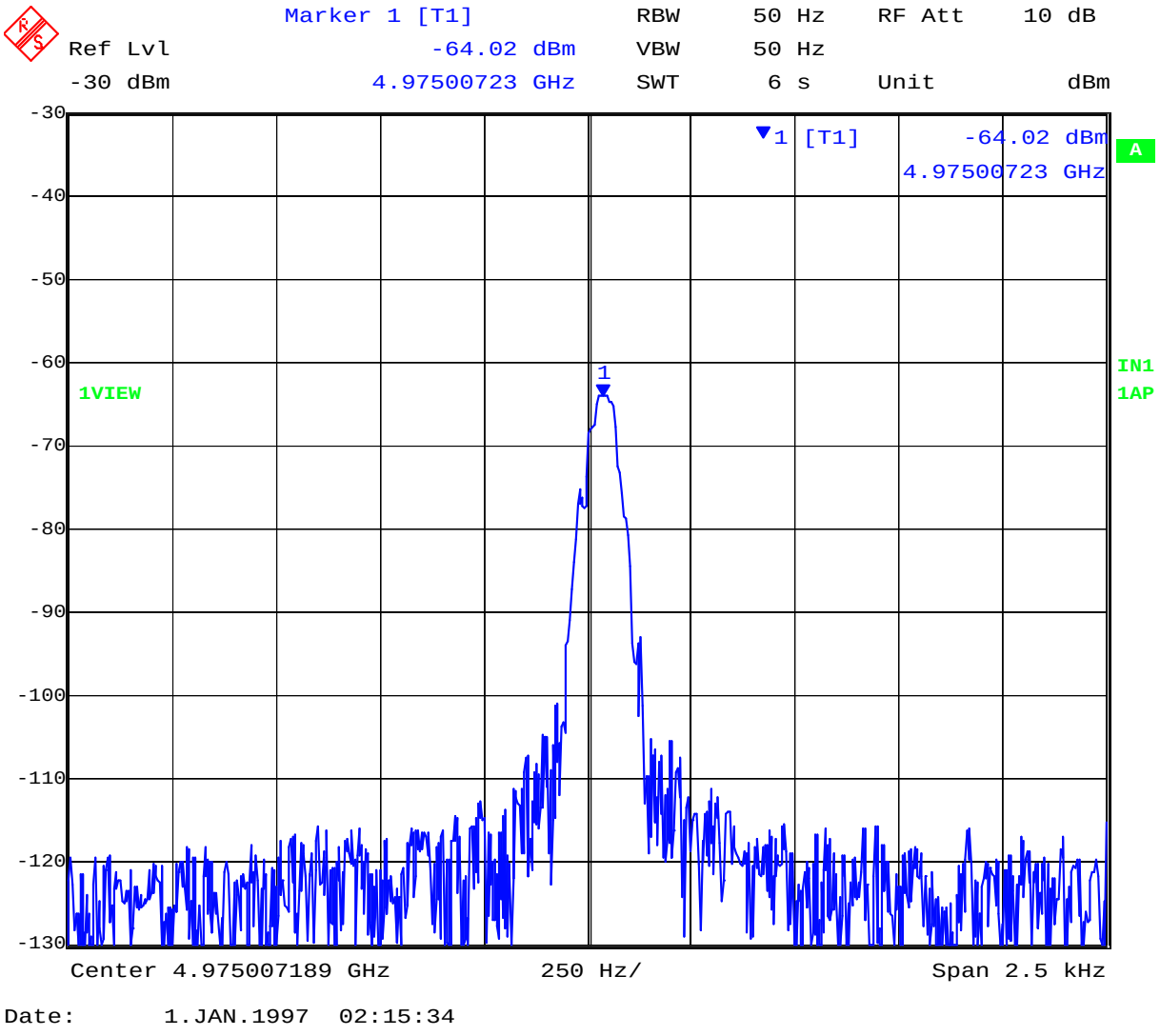
TABLE OF RESULTS Frequency Stability;-

Temperature Variations

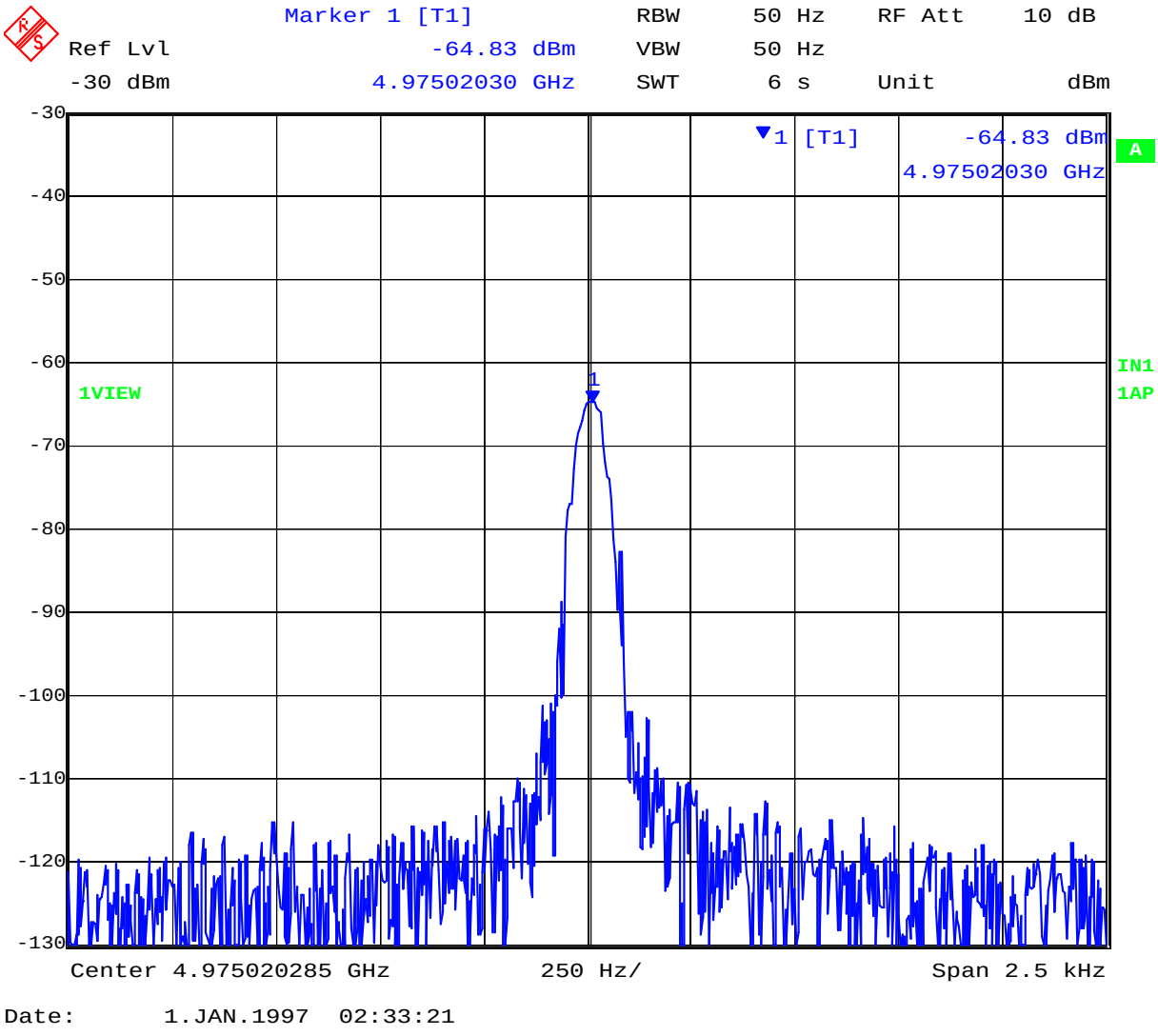
Voltage (Vdc)	Temperature(°C)	FREQUENCY	
		Channel 4975 MHz	
		Measured Value (MHz)	ppm
+12.0	-40	4974.98041	-3.93769
+12.0	-30	4975.00723	1.453266
+12.0	-20	4975.02030	4.080402
+12.0	-10	4975.02527	5.079397
+12.0	0	4975.02129	4.279397
+12.0	+10	4975.01572	3.159799
+10.2	+20	4975.01399	2.81206
+12.0	+20	4975.01395	2.80402
+52.8	+20	4975.01390	2.79397
+12.0	+30	4975.01019	2.048241
+12.0	+40	4975.00522	1.049246
+12.0	+50	4975.00739	1.485427
+12.0	+60	4975.01972	3.963819
+12.0	+70	4975.04142	8.325628
+12.0	+80	4975.08622	17.33065
Maximum Frequency Drift		+86.22 kHz / +17.33065 ppm	
Minimum Frequency Drift		-19.59 kHz / -3.93769 ppm	
Total Frequency Drift		105.81 kHz / 21.26834 ppm	



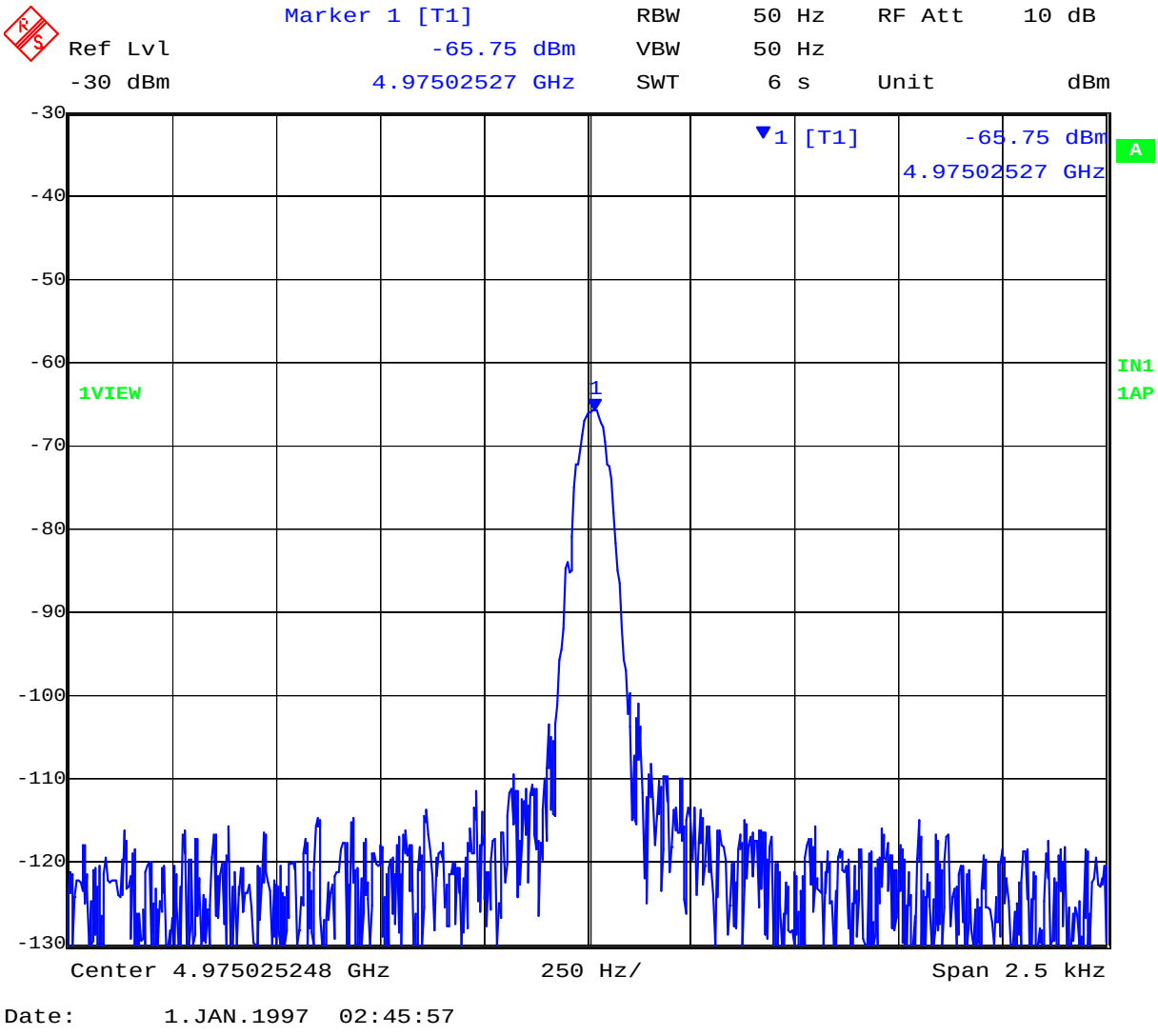
Frequency Stability @ -40°C



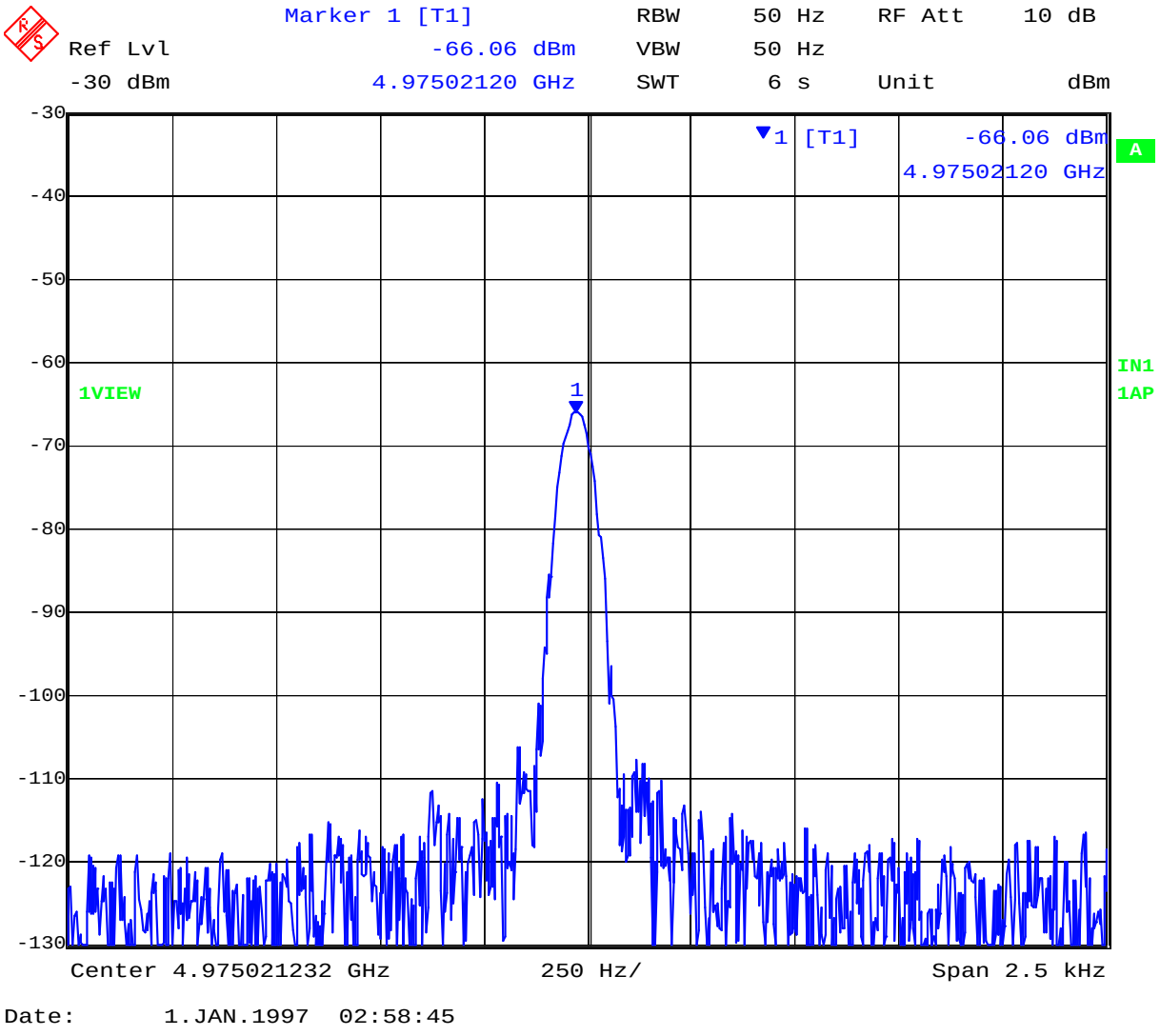
Frequency Stability @ -30°C



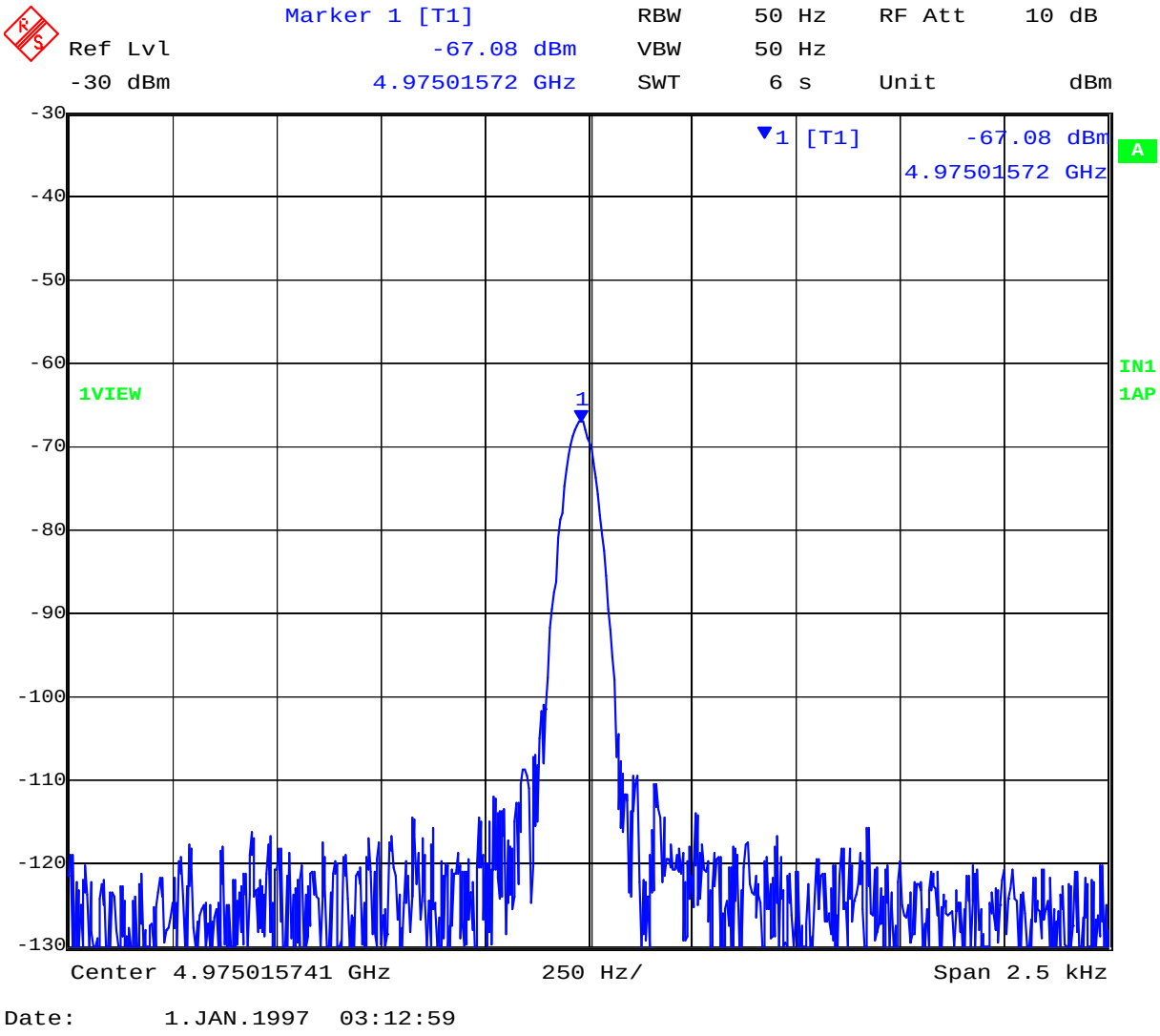
Frequency Stability @ -20°C



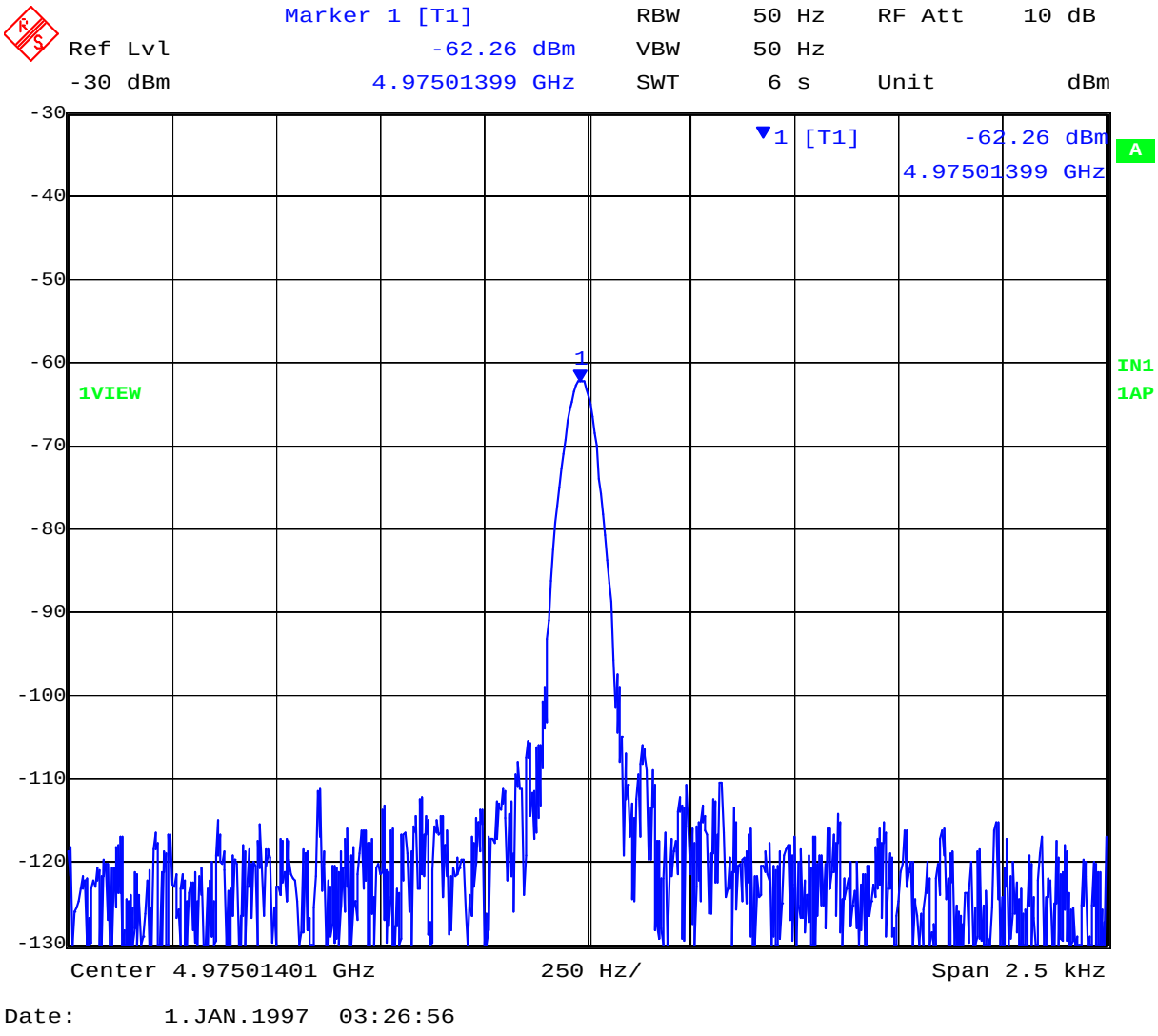
Frequency Stability @ -10°C



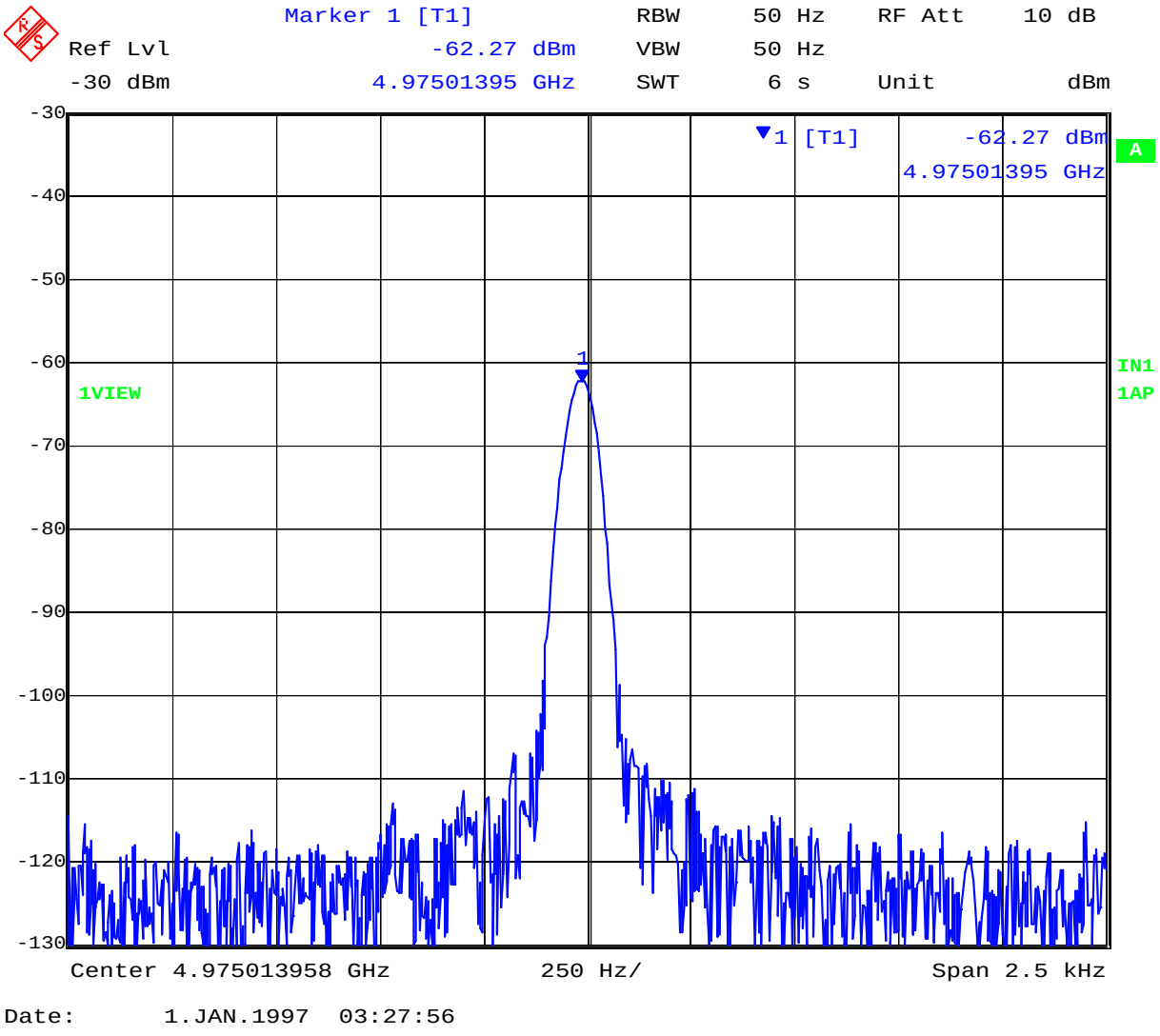
Frequency Stability @ 0°C



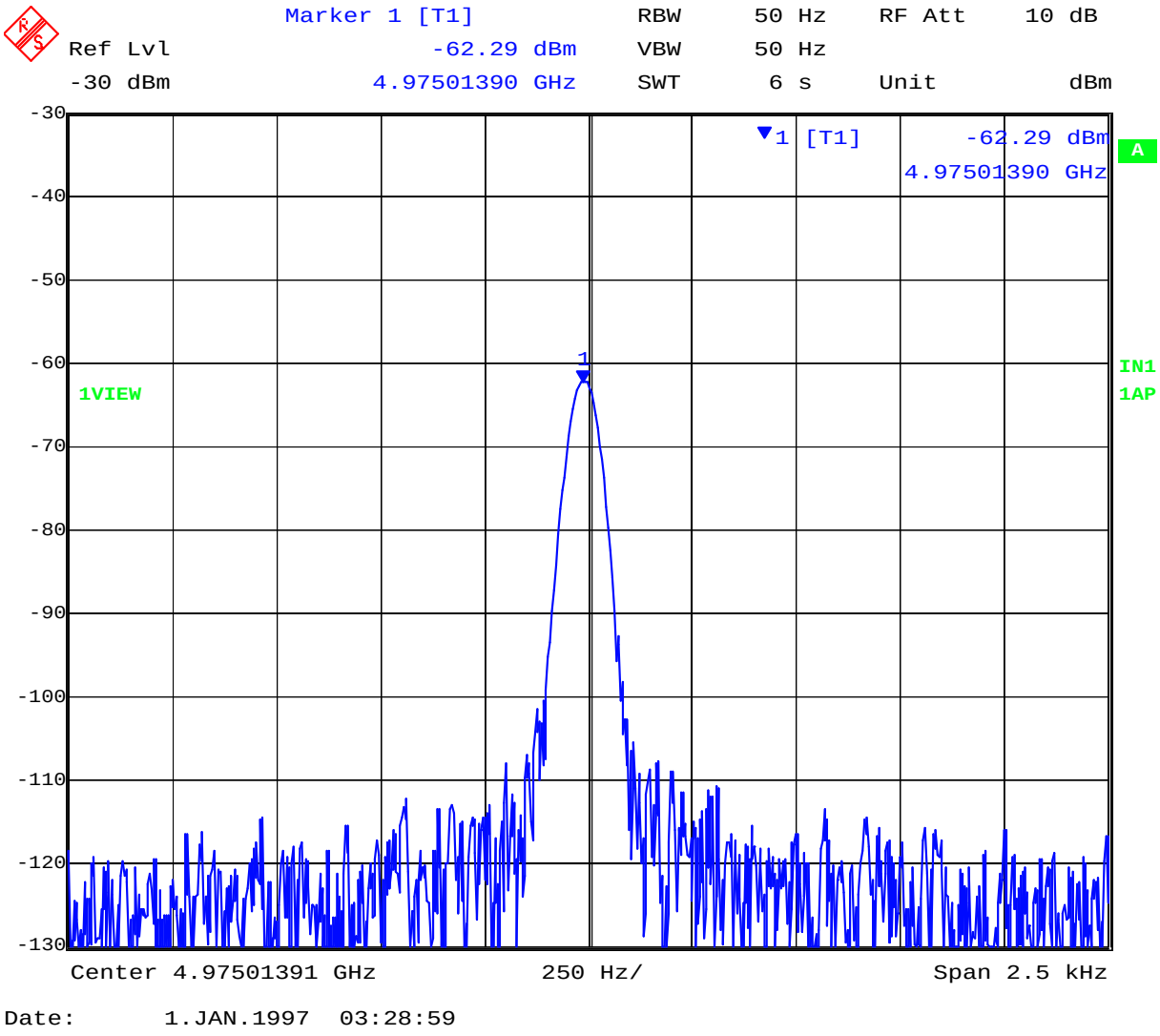
Frequency Stability @ +10°C



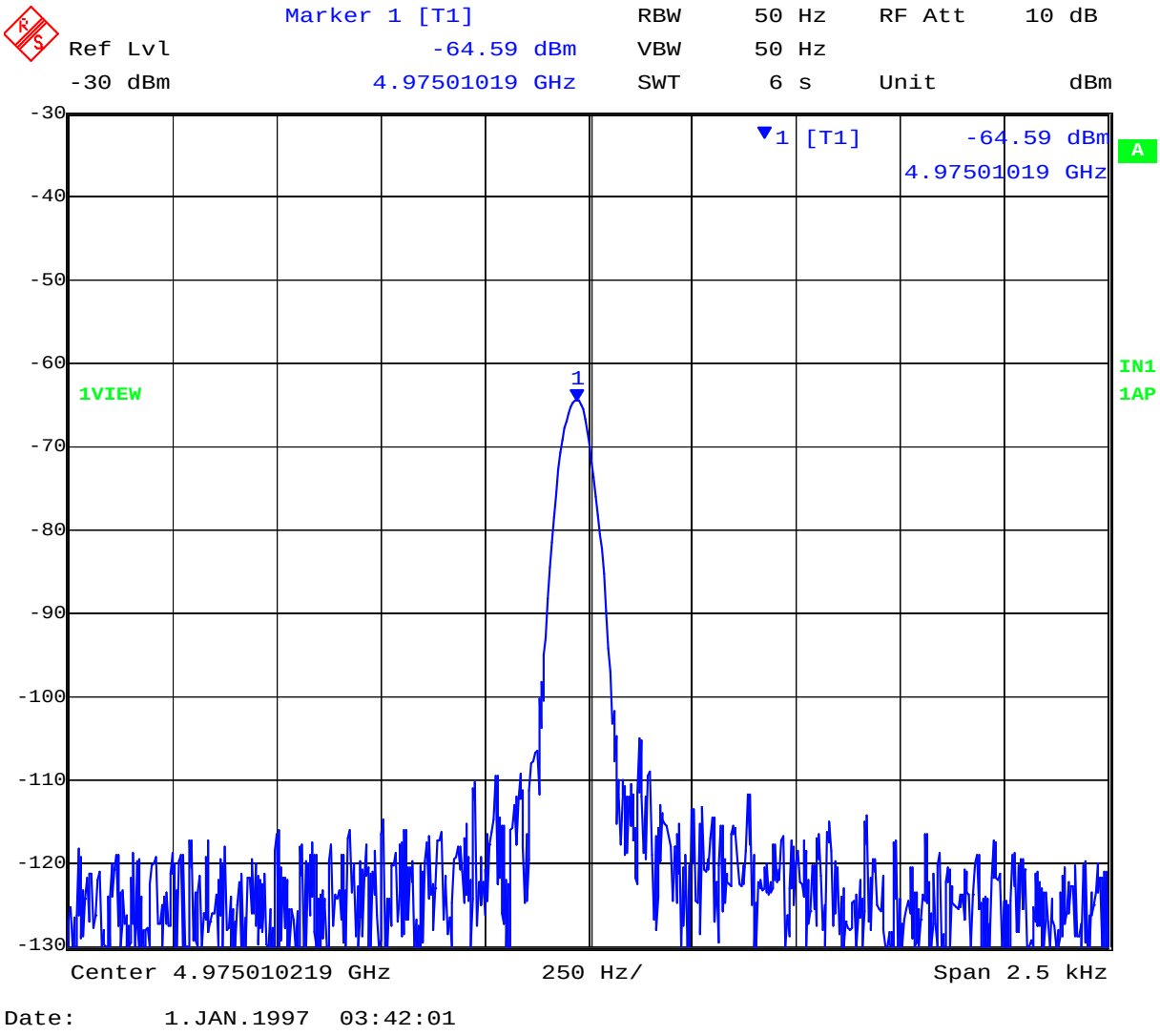
Frequency Stability @ +20°C, +10.2 Vdc



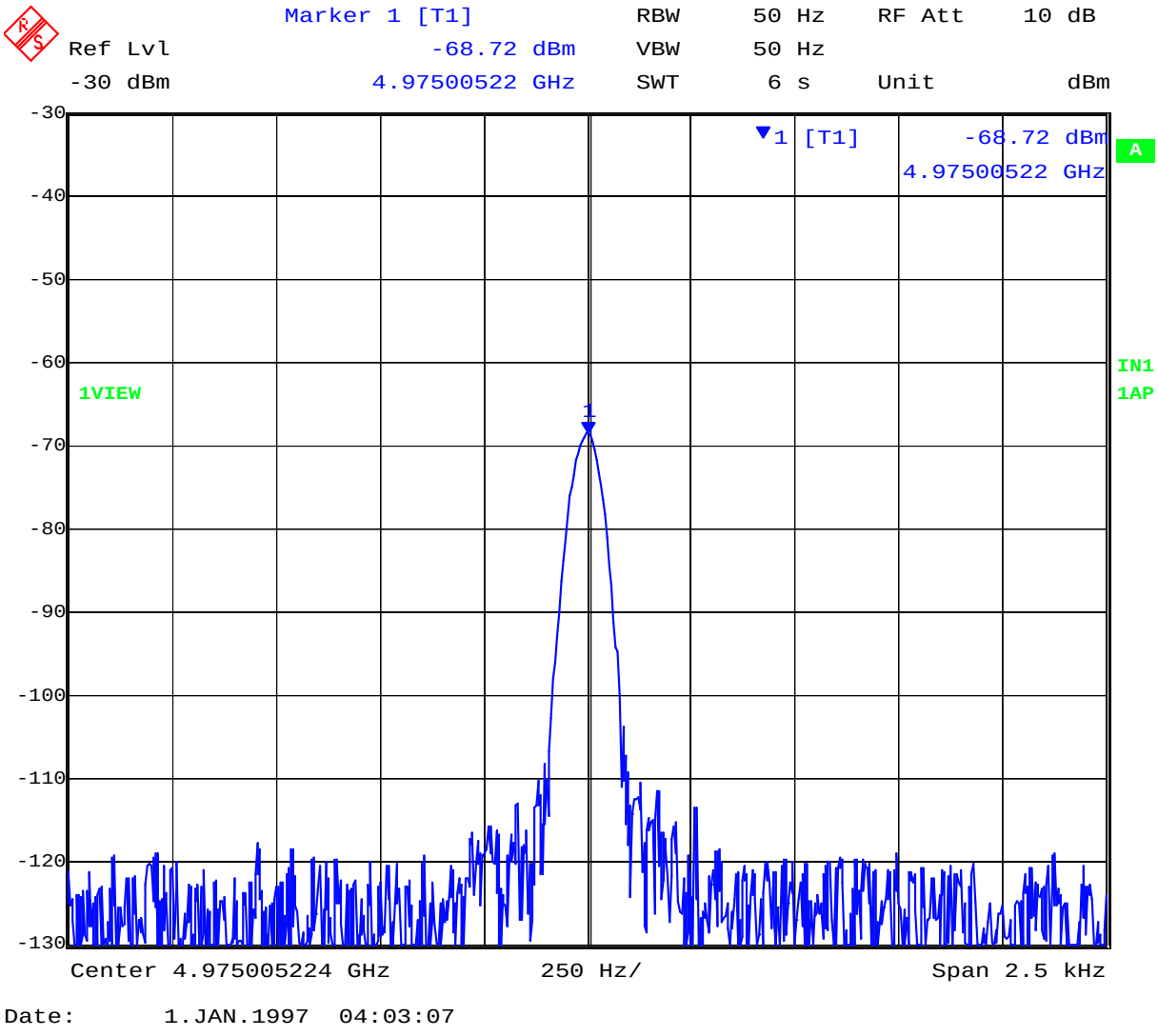
Frequency Stability @ +20°C, +12 Vdc



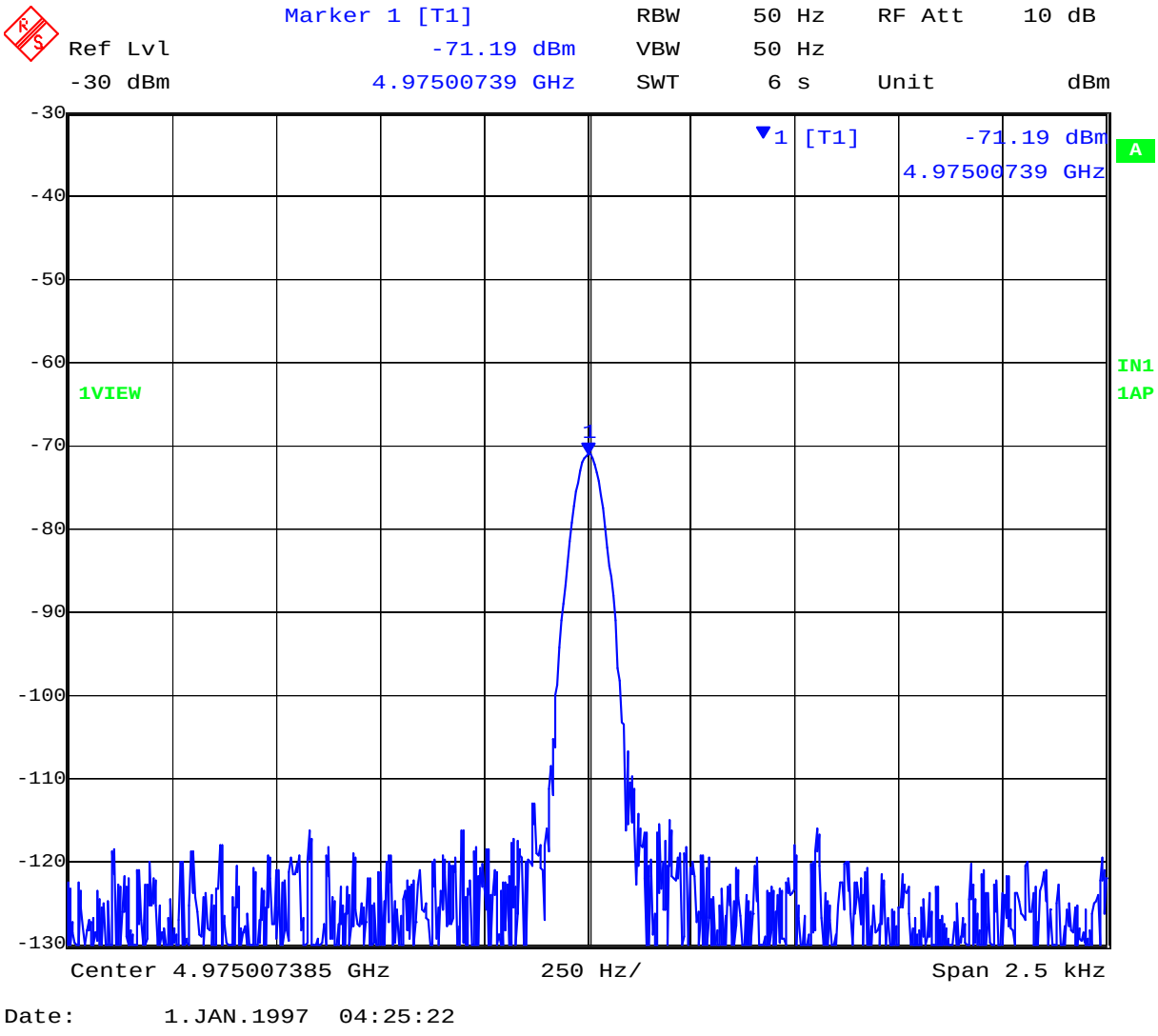
Frequency Stability @ +20°C, +52.8 Vdc



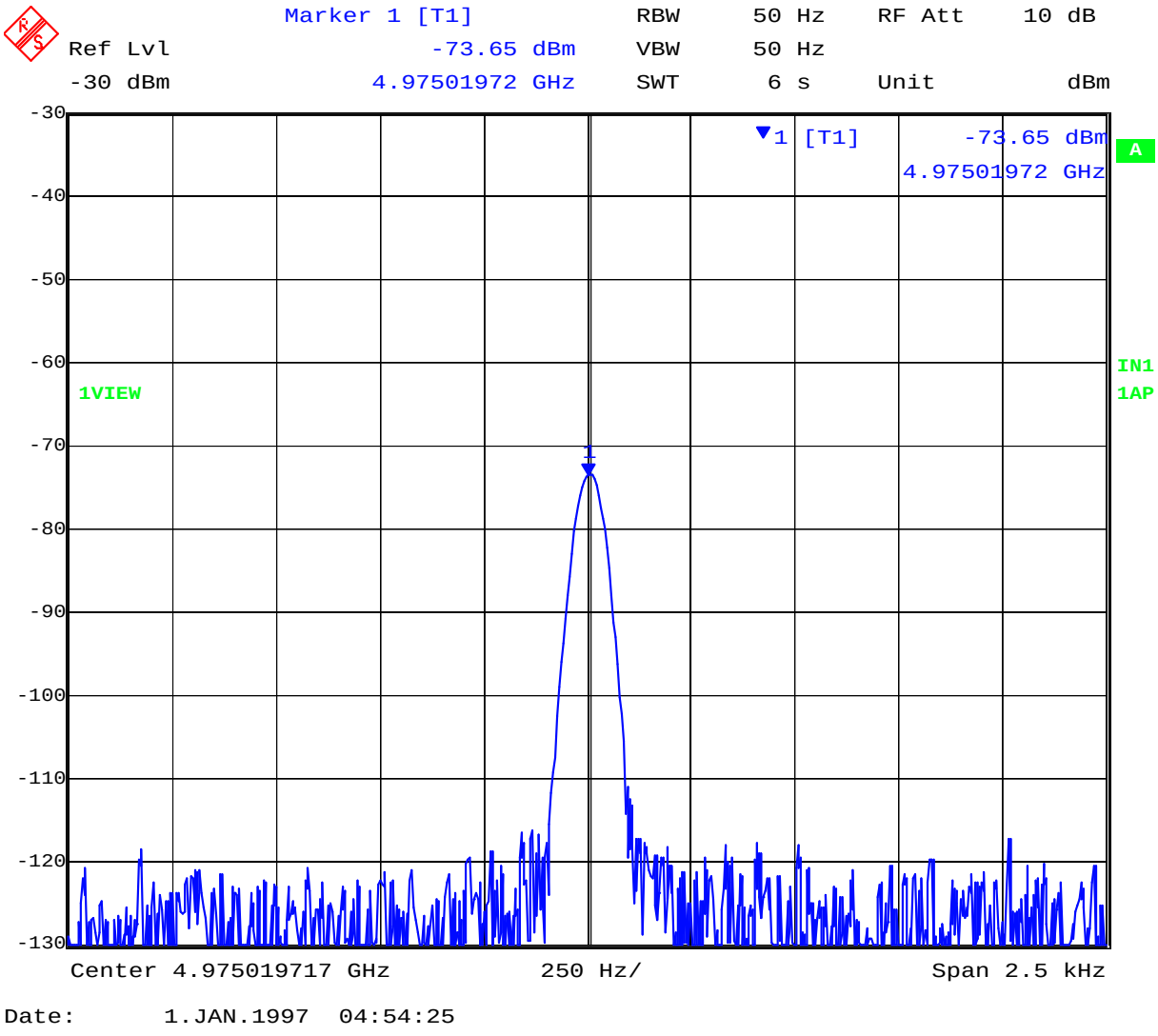
Frequency Stability @ +30°C



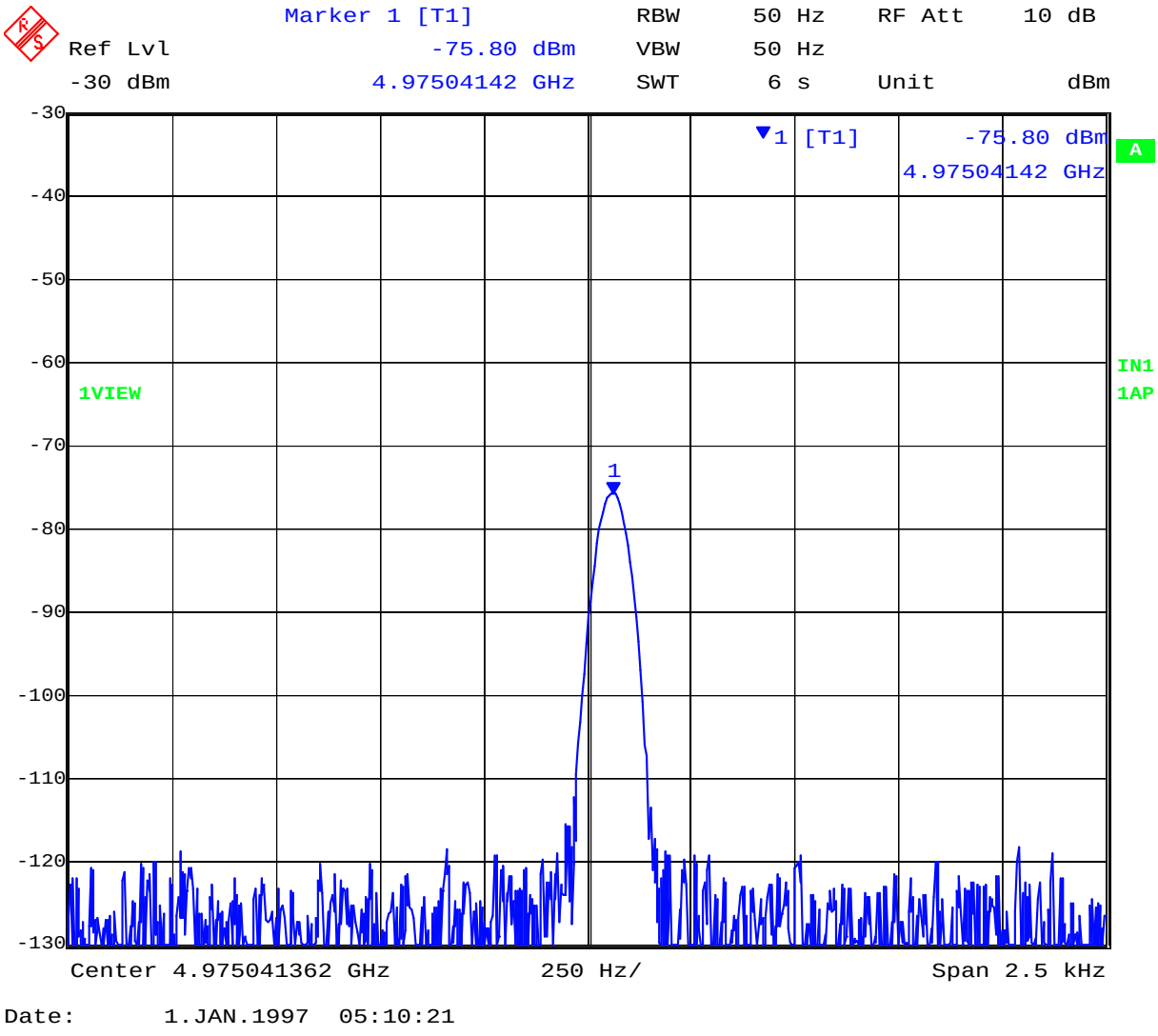
Frequency Stability @ +40°C



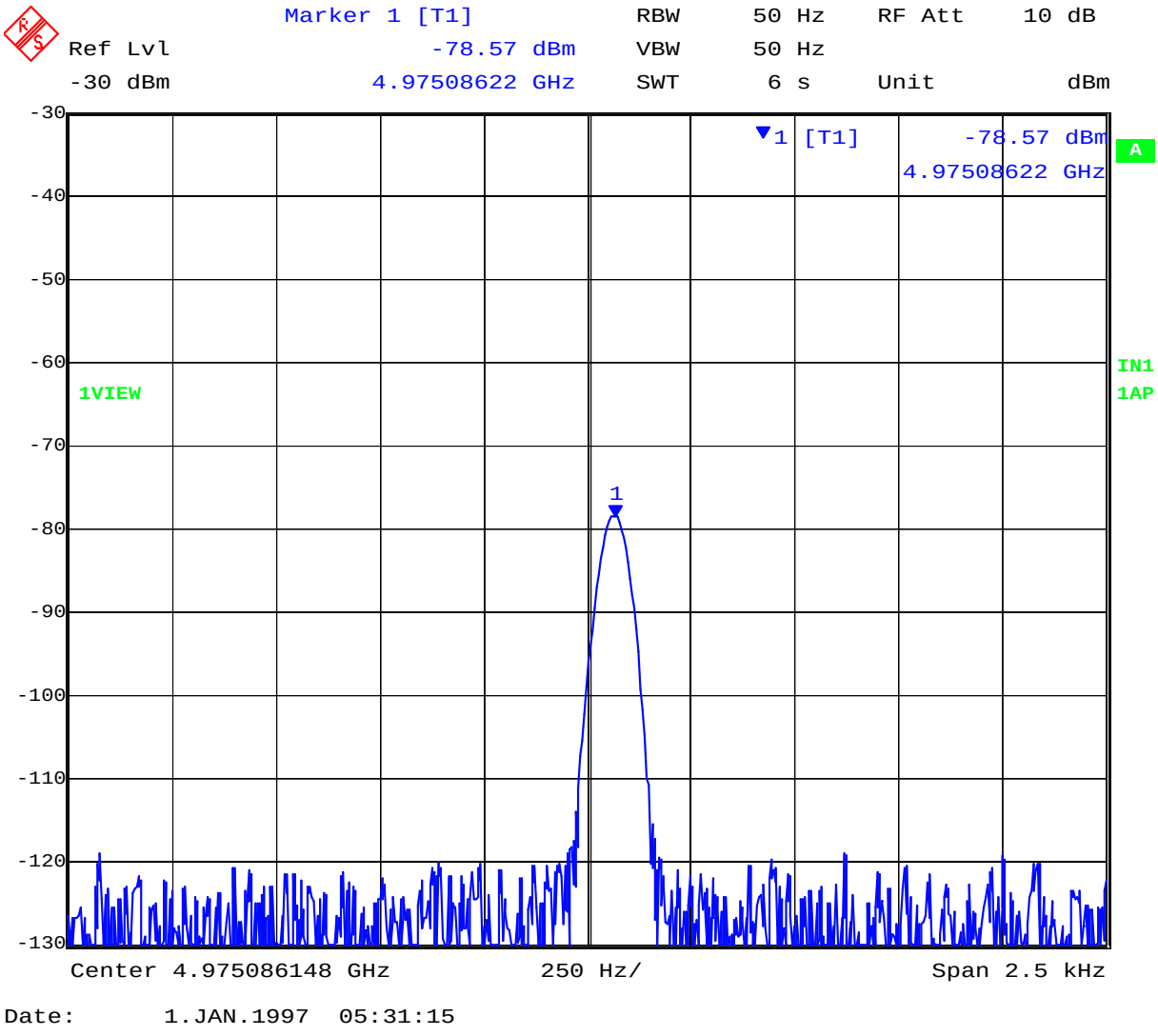
Frequency Stability @ +50°C



Frequency Stability @ +60°C



Frequency Stability @ +70°C



Frequency Stability @ +80°C

Laboratory Measurement Uncertainty for Frequency Stability

Measurement uncertainty	±0.866 ppm

Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-02 'Frequency Measurement'	0070, 0116, 0158, 0193, 0252, 0313, 0314.

5.1.6. Spurious Emissions at Antenna Terminals - Transmitter

FCC 47 CFR Part 90, Subpart Y; 2.1051; §90.210(m)

IC Section 4.4/4.5
Industry Canada RSS-Gen 6

Test Procedure
Transmitter conducted spurious emissions were measured for each bandwidth. Measurement were made while EUT was operating in a modulated transmit mode of operation, at the appropriate center frequency, 100% duty cycle and maximum power at all times. Conducted spurious emissions were measured to 40 GHz.

Limit calculation depended on average transmit power level(s). See test report Section 5.1.2 for maximum power level measurements.

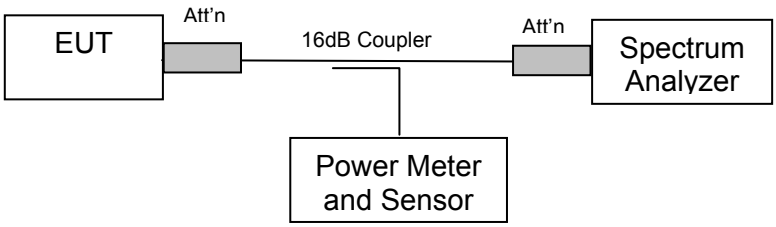
Worst case power measurement: +22.80 dBm

From FCC Part 90.210 (m)
On any frequency removed from the assigned frequency between above 150 % of the authorized bandwidth: 50 dB or 55 + 10 log (P) dB, whichever is the lesser attenuation.

Attenuation
55 + 10 log (P) dB for 20 MHz bandwidth = 47.80 dB attenuation where P is Watts

Limit: +22.80 – 47.80 = -25.0 dBm

Test Measurement Set up



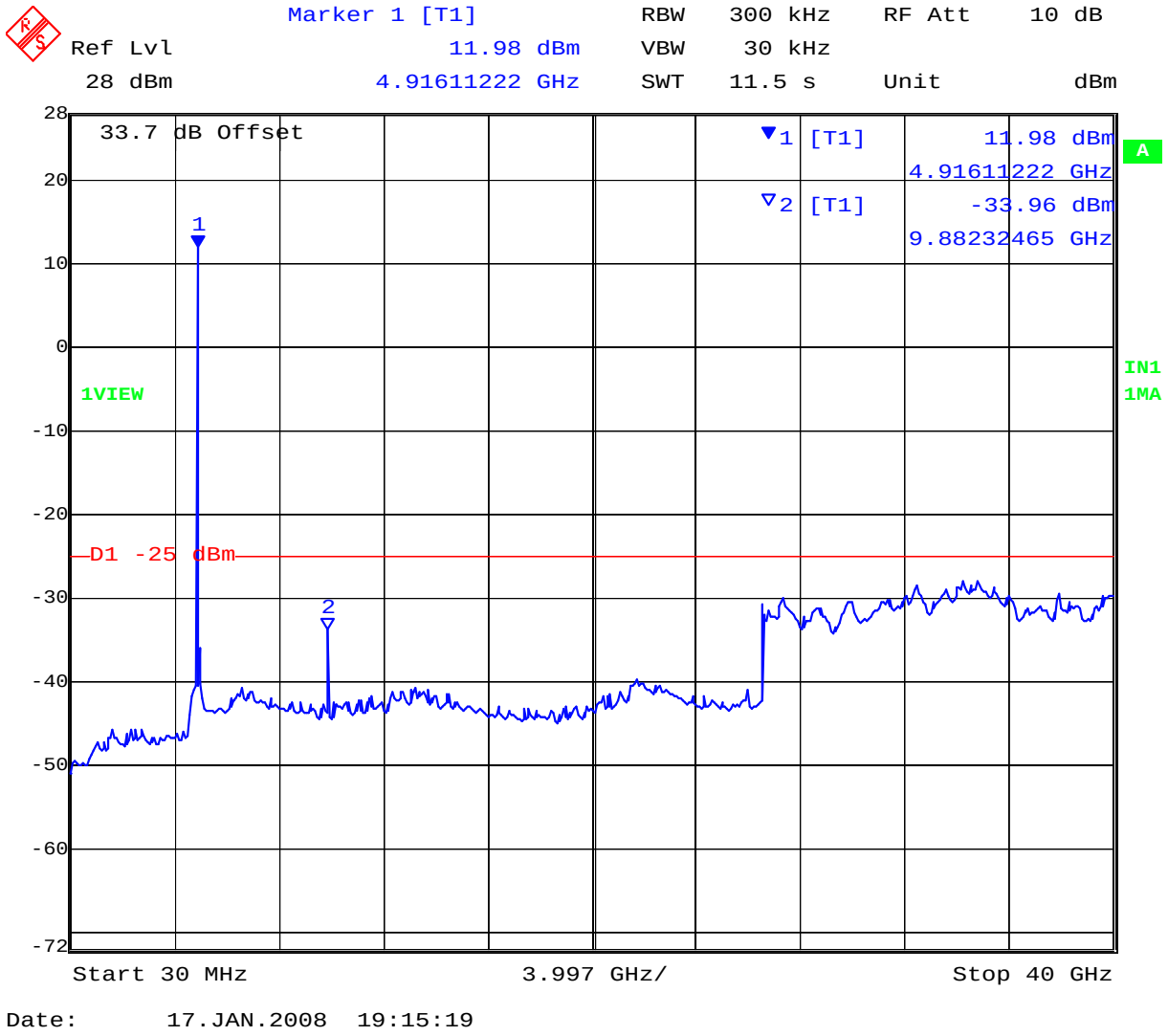
Conducted spurious emission test configuration

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

TABLE OF RESULTS

Channel 4,955 MHz, Limit: -25.0 dBm

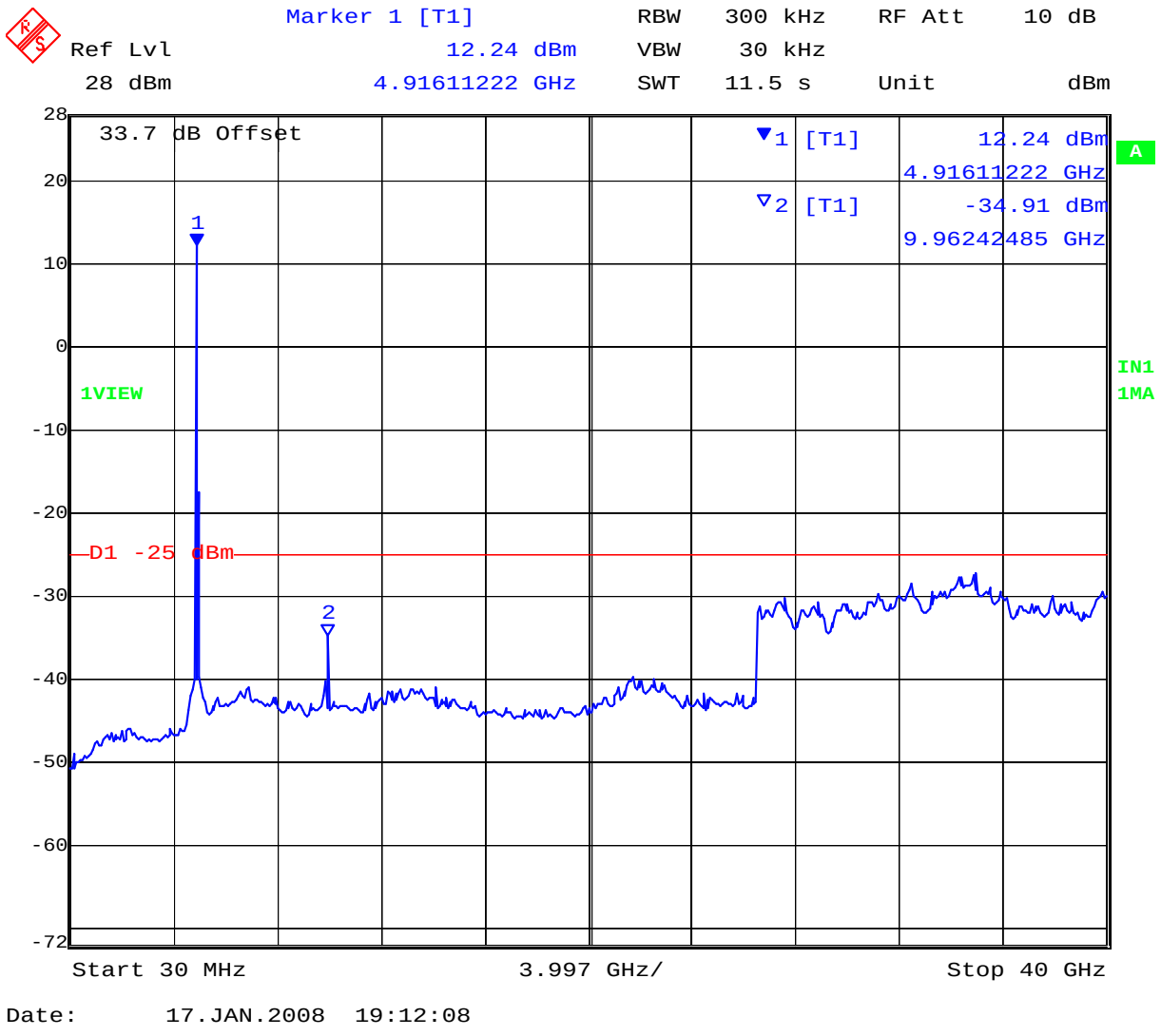
Frequency (MHz)				
Start (MHz)	**Stop (MHz)**	**Freq of Maximum Emission (MHz)**	**Emission Amplitude (dBm)**	**Margin (dB)**
30	40,000	9,882.32465	-33.96	-8.96



Transmitter Channel 4955 MHz 20 MHz Channel Spacing, 30 – 40,000 MHz

Channel 4,975 MHz, Limit: -25.0 dBm

Frequency (MHz)				
Start (MHz)	**Stop (MHz)**	**Freq of Maximum Emission (MHz)**	**Emission Amplitude (dBm)**	**Margin (dB)**
30	40,000	9,962.42485	-34.91	-9.91



Transmitter Channel 4975 MHz 20 MHz Spacing, 30 – 40,000 MHz

Specification Limits

Conducted Spurious Emission at Antenna Terminals – Transmitter Limits FCC Part §90.210

Emission Mask (m)
(6) On any frequency removed from the assigned frequency above 150% of the authorized bandwidth: 50 dB or 55 + 10log(P) dB, whichever is the lesser attenuation.

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'	0070, 0116, 0158, 0088, 0252, 0313, 0314

5.1.7. Radiated Spurious Emissions

FCC 47 CFR Part 90, Subpart Y; 2.1053; §90.210(m)

IC Section 4.4

Test Procedure

Measurements were made while EUT was operating in a modulated transmit mode of operation, at the appropriate center frequency, 100% duty cycle and maximum power at all times. Substitution was performed on any emissions observed within 6 dB of the limit line. The antenna port was attenuated with a 50 Ω termination.

The measurement equipment was set to measure in peak hold mode. The emissions were measured in the anechoic chamber at a 3-meter distance on every azimuth in both horizontal and vertical polarities. The emissions are recorded and maximized as a function of azimuth by rotation through 360° with a spectrum analyzer in peak hold mode.

The highest emissions relative to the limit are listed for each frequency spanned.

Measurements below 1 GHz utilized 100 KHz RBW, measurements above 1 GHz were performed using a minimum RBW of 1 MHz.

Limit calculation depended on average transmit power level(s). See test report Section 5.1.2 for maximum power level measurements.

Worst case power measurement: +22.80 dBm

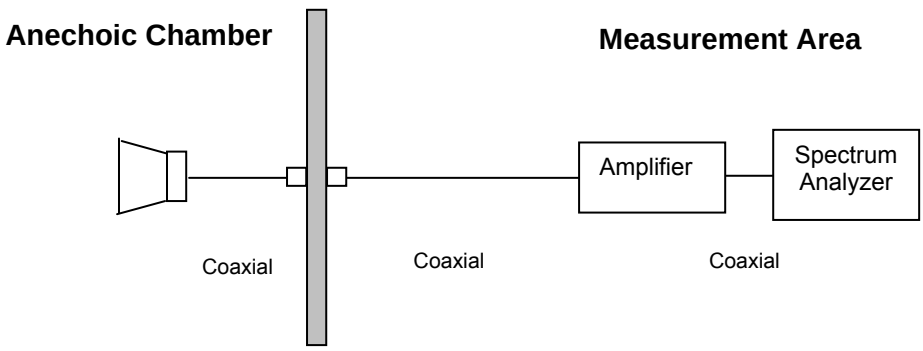
From FCC Part 90.210 (m)
On any frequency removed from the assigned frequency between above 150 % of the authorized bandwidth: 50 dB or 55 + 10 log (P) dB, whichever is the lesser attenuation.

Attenuation
55 + 10 log (P) dB for 20 MHz bandwidth = 47.80 dB attenuation where P is Watts

Limit: +22.80 – 47.80 = -25.0 dBm

The -25 dBm limit was verified using a substitution method.

Test Measurement Set up



Measurement set up for Radiated Emission Test

Radio parameters.

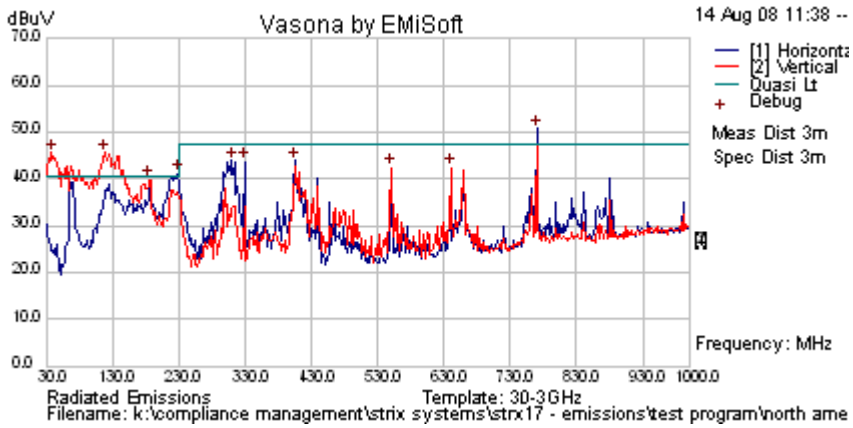
Radiated Emissions below 1GHz – ac/dc adapter to 12Vdc Power Supply

EMiSoft - Vasona Results	
Test	Radiated Emissions [Electric Field]
Class/Spec	B / CISPR22 RE B at 3m
Range	30 - 1000MHz
For	Gordon Hurst
Lab Used	MiCOM Labs
Template	30-3GHz
Date/Time	14 Aug 08/19:07, Status: Filed on
Manufacturer	Strix Systems
EUT	MWS100
Config	802.11abg ac/dc variant. Device operating full power 1m N-Type cable connected. New case style.

Formal Data

No	Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
1	39.42	59.34	3.56	-22.72	40.18	Quasi Max	V	100	0	40.5	-0.32	Pass	
2	219.955	64.40	4.86	-31.42	37.85	Quasi Max	H	100	128	40.5	-2.65	Pass	
3	769.983	52.34	6.99	-21.70	37.64	Quasi Max	H	100	197	47.5	-9.86	Pass	
4	118.918	60.10	4.20	-27.89	36.50	Quasi Max	V	100	118	40.5	-3.90	Pass	
5	229.456	62.05	4.75	-30.52	36.28	Quasi Max	H	100	127	40.5	-4.22	Pass	
6	310.021	62.80	5.25	-28.78	39.27	Quasi Max	H	100	125	47.5	-8.23	Pass	

Graphical Data



Note: Ferrite required on Ethernet cable, see Section 3.7 Equipment Modifications

MWS100

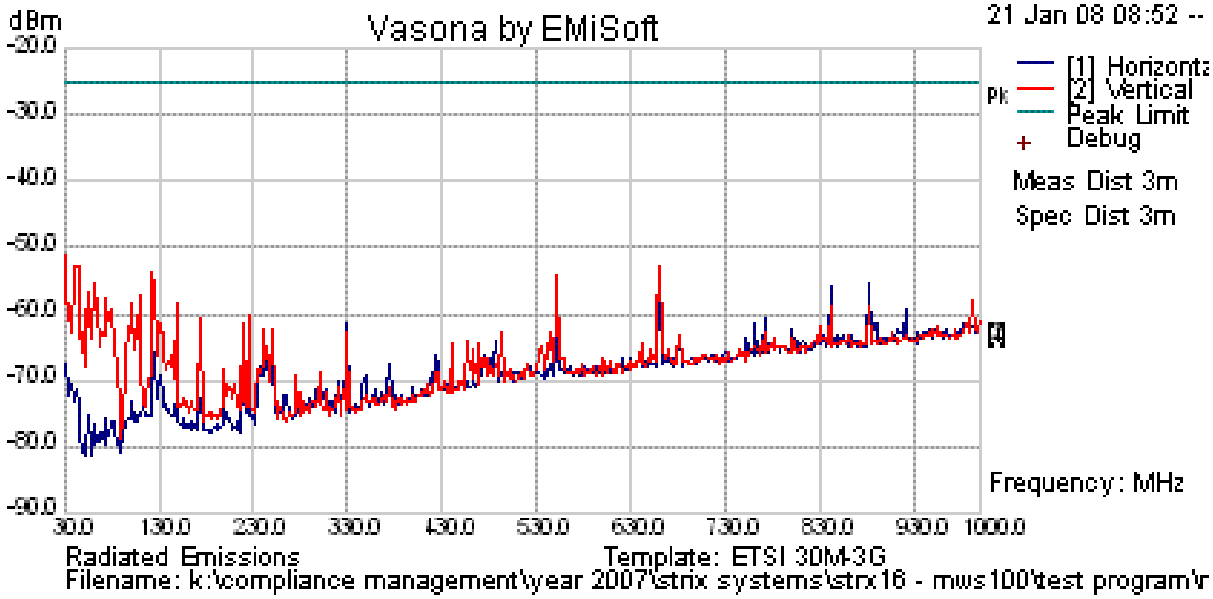
Channel Freq 4,955 MHz Results

Maximum Power
Duty Cycle 100%

INITIAL INVESTIGATION				SUBSTITUTION RESULTS				
Freq. (MHz)	Pol.	Raw (dBuV)	Res BW (KHz)	Pwr @ Antenna (dBm)	Ant. Gain (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
							-25.0	
							-25.0	
							-25.0	
							-25.0	
							-25.0	
							-25.0	

No emissions were found within 6 dB of the limit

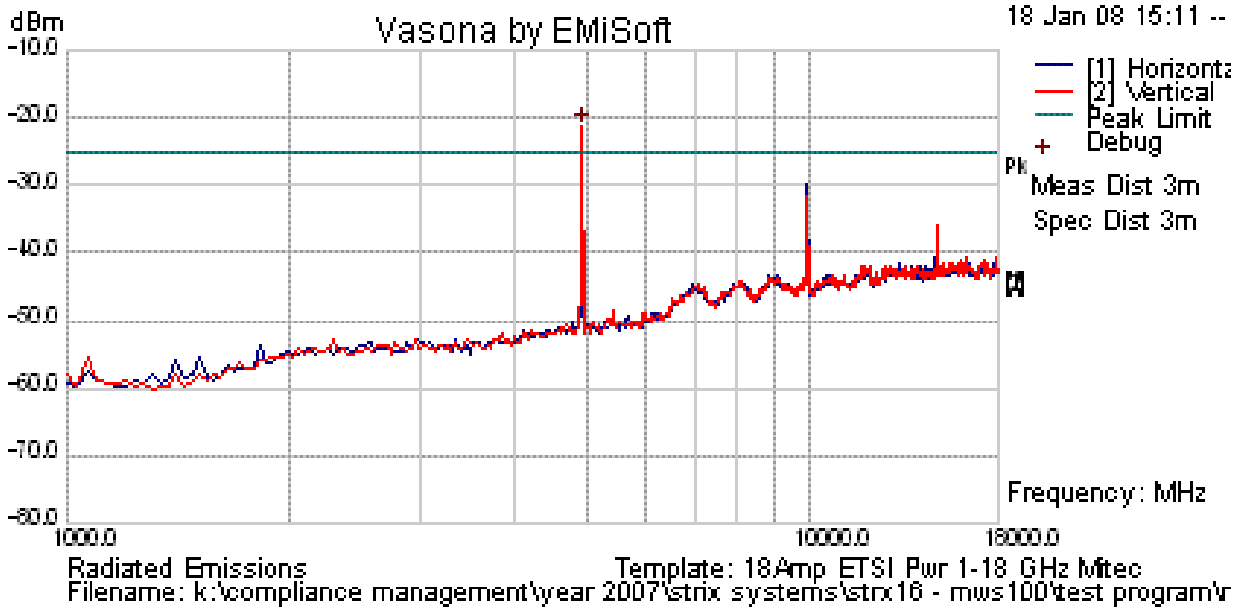
Channel Freq 4,955 MHz Results 30MHz to 1GHz



MWS100

Channel Freq 4,955 MHz Results 1GHz to 18GHz

Power setting = +23 dBm, 50 Ohm load on each output
Duty Cycle 100%



The emission breaking the limit line is the fundamental emission i.e carrier

MWS100

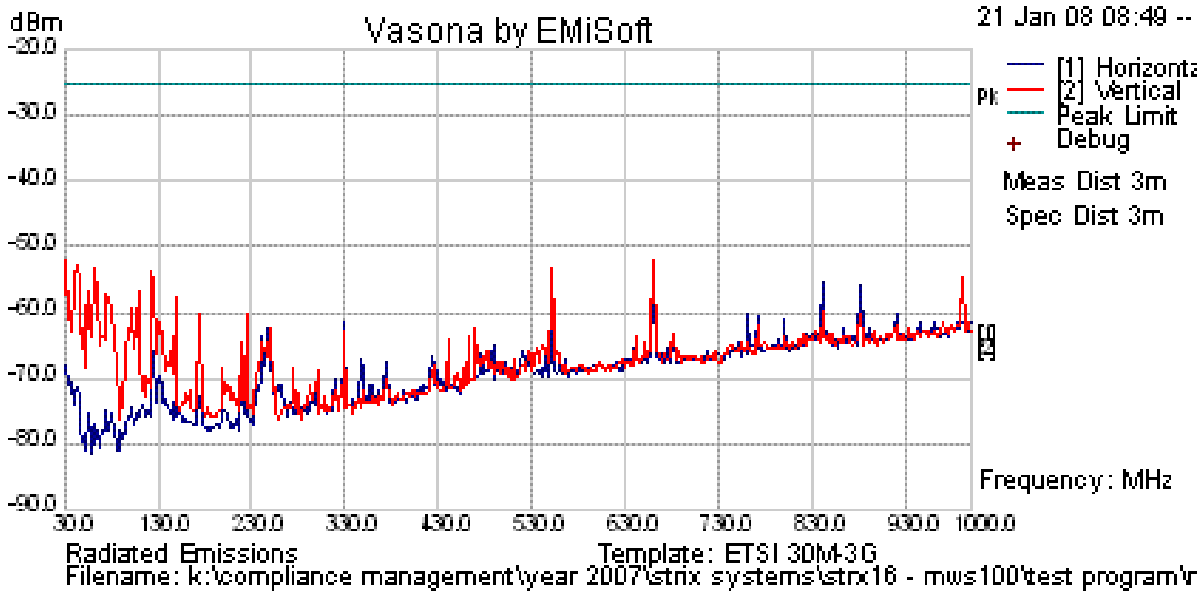
Channel Freq 4,975 MHz Results

Power setting = +23 dBm, 50 Ohm load on each output
Duty Cycle 100%

INITIAL INVESTIGATION				SUBSTITUTION RESULTS				
Freq. (MHz)	Pol.	Raw (dBuV)	Res BW (KHz)	Pwr @ Antenna (dBm)	Ant. Gain (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
							-25.0	
							-25.0	
							-25.0	
							-25.0	
							-25.0	
							-25.0	

No emissions were found within 6 dB of the limit

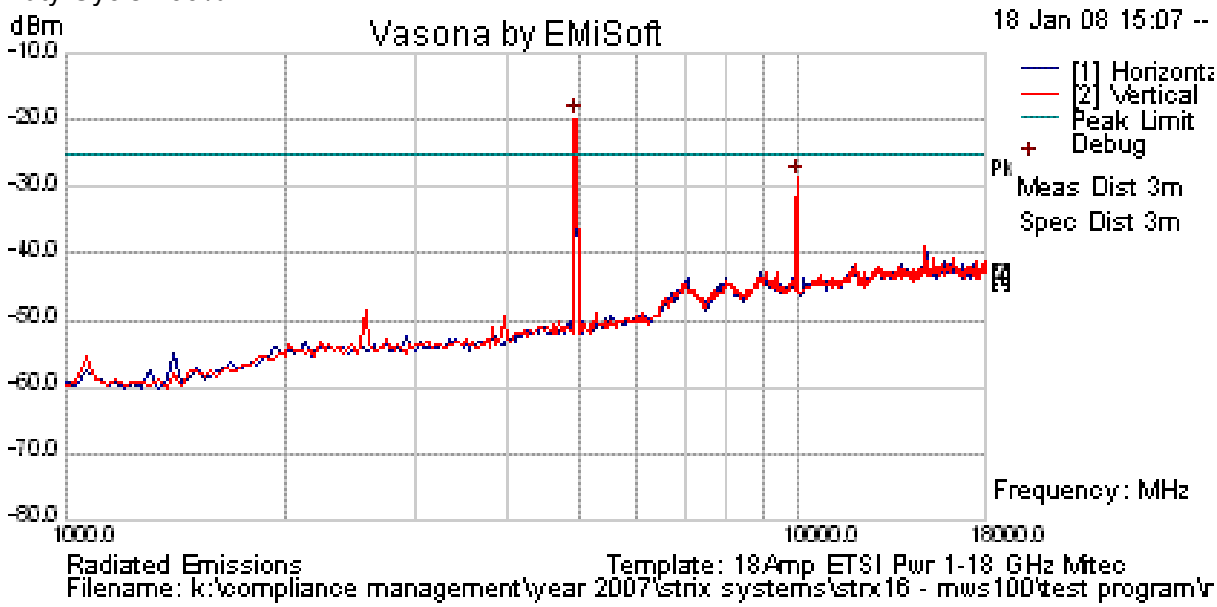
Channel Freq 4,975 MHz Results 30MHz to 1GHz



MWS100

Channel Freq 4,975 MHz Results

Power setting = +23 dBm, 50 Ohm load on each output
Duty Cycle 100%



The emission breaking the limit line is the fundamental emission i.e carrier

Transmitter Limits

Limits FCC Part §90.210 (m)

Emission Mask M
(6) On any frequency removed from the assigned frequency above 150% of the authorized bandwidth: 50 dB or 55 + 10 log (P) dB, whichever is the lesser attenuation.

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, 0104, 0158, 0134, 0310, 0312, Dipole.

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

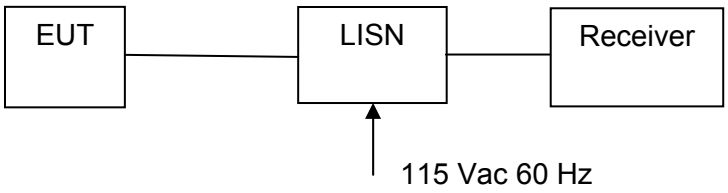
FCC, Part 15 Subpart C §15.207
Industry Canada RSS-Gen §4.8, §6

Test Procedure

The EUT is configured in accordance with ANSI C63.4. The conducted emissions are measured in the anechoic chamber a spectrum analyzer in peak hold in the first instance. To help detect potential offending emissions generated by the EUT an initial scan time of 4 minutes was implemented on each polarity, plot is provided. Emissions closest to the limit are formally assessed using a quasi-peak (QP) detector 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.

Transmitter was operational and terminated into a 50Ω load.

Test Measurement Set up



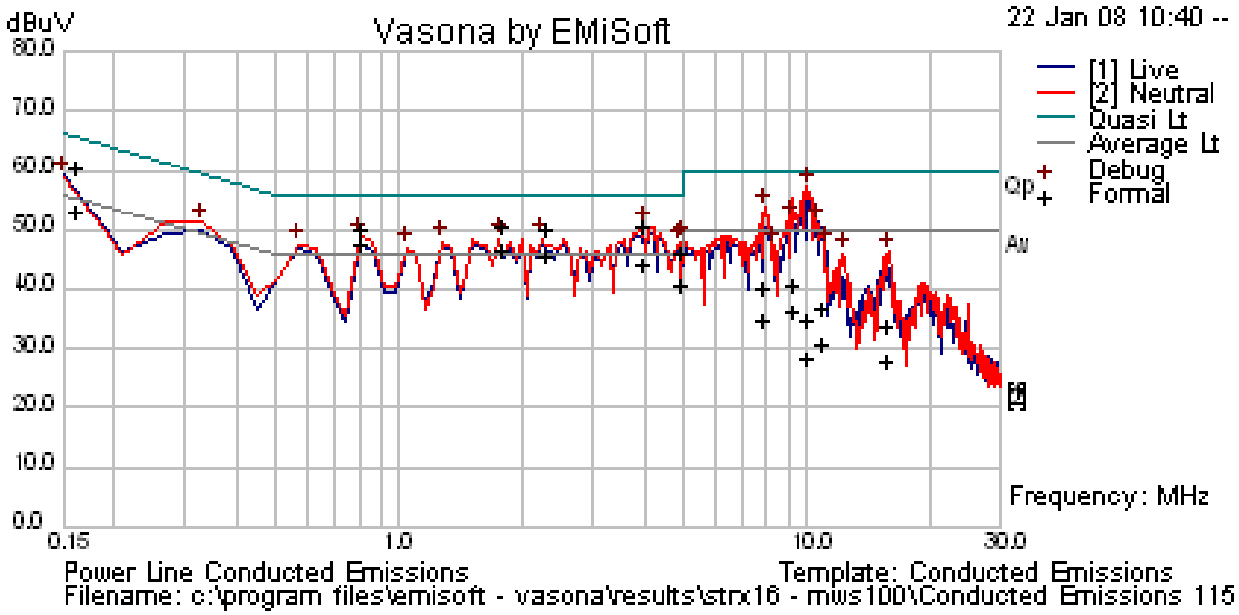
Measurement set up for AC Wireline Conducted Emissions Test

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): 802.11a, 6 MBit/s, +17 dBm output power

TABLE OF RESULTS
LINE – LIVE and NEUTRAL



Formally Assessed Frequencies

Frequency MHz	Raw dBuV	Cable Loss	Factors dB	Level dBuV	Measurement Type	Line	Limit dBuV	Margin dB	Pass /Fail
0.164	48.21	9.89	0.1	58.2	Quasi Peak	Live	65.26	-7.06	Pass
0.164	40.72	9.89	0.1	50.72	Average	Live	55.26	-4.54	Pass
4.024	37.78	10.11	0.2	48.09	Quasi Peak	Neutral	56	-7.91	Pass
4.024	31.75	10.11	0.2	42.05	Average	Neutral	46	-3.95	Pass
0.820	37.61	9.94	0.1	47.65	Quasi Peak	Neutral	56	-8.35	Pass
0.820	35.2	9.94	0.1	45.24	Average	Neutral	46	-0.76	Pass
2.300	37.49	10.07	0.1	47.65	Quasi Peak	Neutral	56	-8.35	Pass
2.300	33.03	10.07	0.1	43.2	Average	Neutral	46	-2.8	Pass
1.807	37.93	10.03	0.1	48.06	Quasi Peak	Neutral	56	-7.94	Pass
1.807	34.08	10.03	0.1	44.21	Average	Neutral	46	-1.79	Pass
5.011	33.48	10.15	0.2	43.83	Quasi Peak	Neutral	60	-16.17	Pass
5.011	27.97	10.15	0.2	38.32	Average	Neutral	50	-11.68	Pass

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.

§15.207 (a) 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

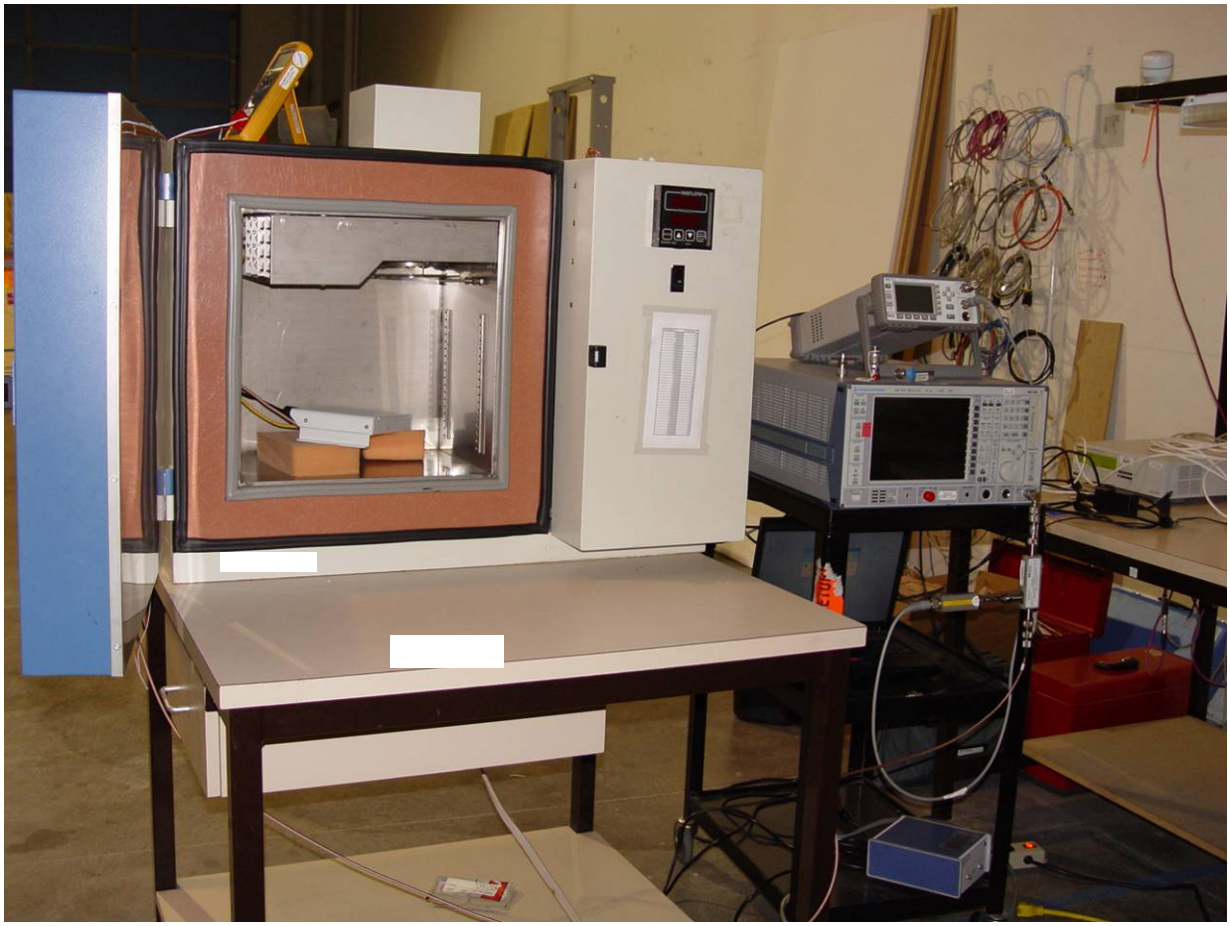
Measurement uncertainty	±2.64 dB

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. TEST SET-UP PHOTOGRAPHS

6.1. General Measurement Test Set-Up

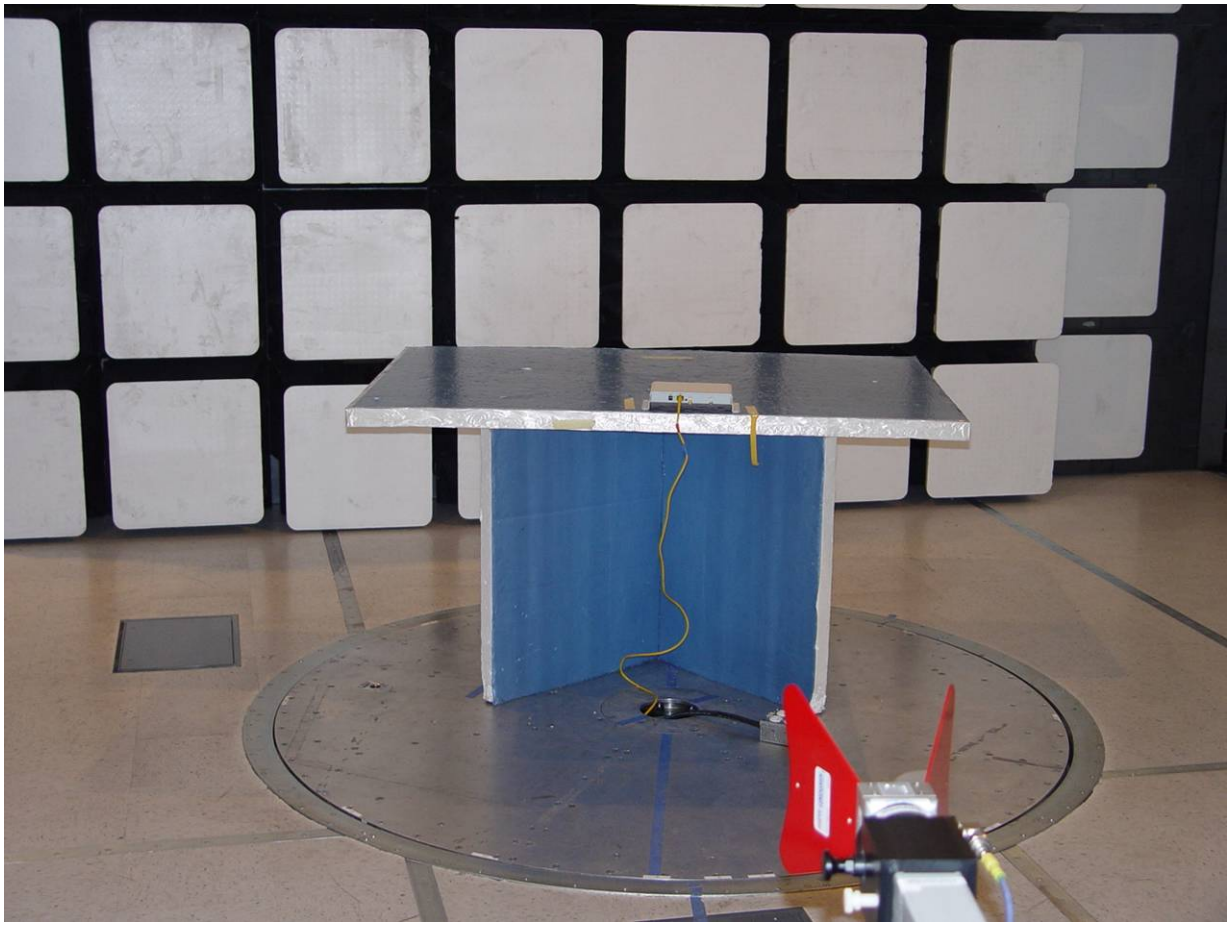


6.2. Radiated Emissions < 1 GHz (POE)

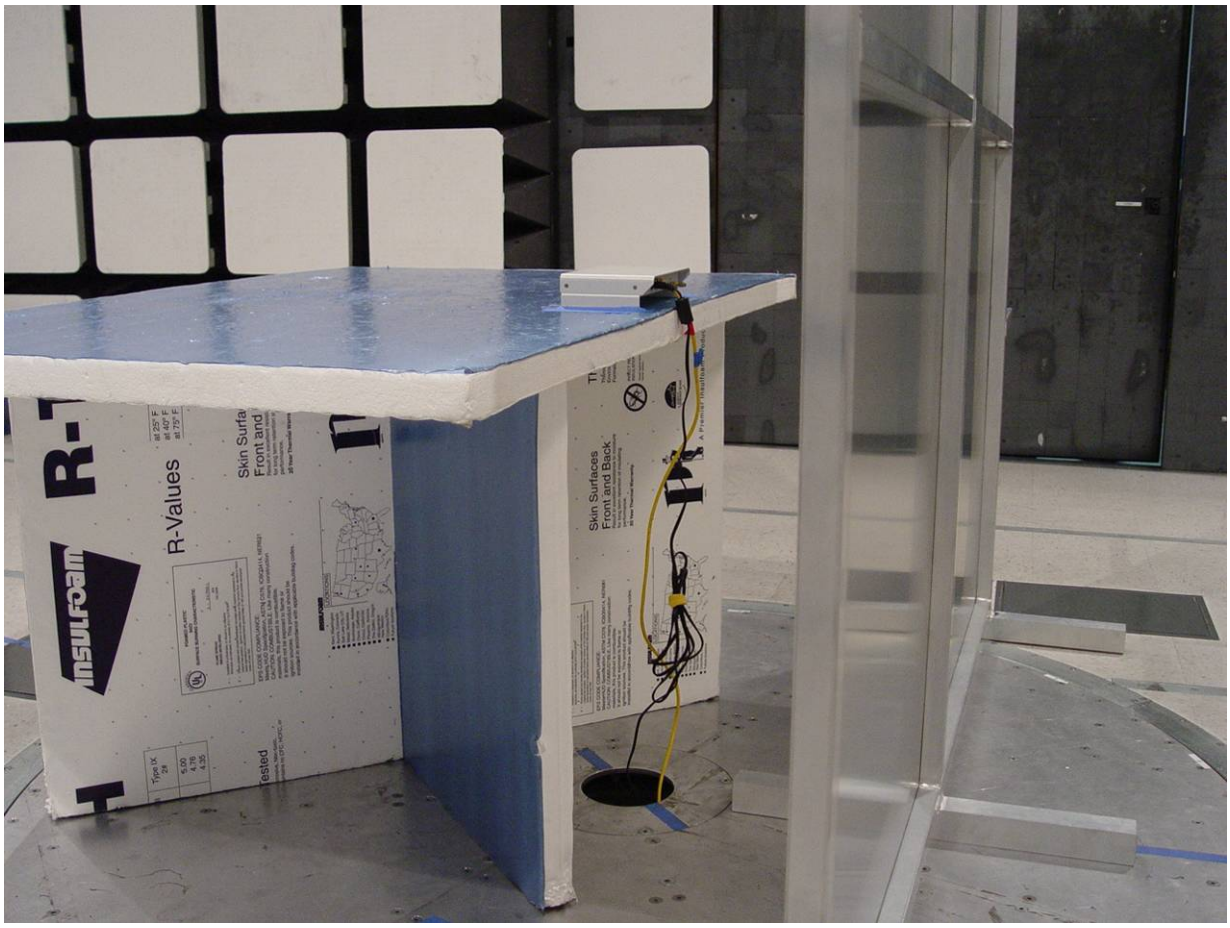
6.3. Radiated Emissions < 1 GHz (ac/dc Powered)

New case style

6.4. Spurious Emissions > 1 GHz



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



7. TEST EQUIPMENT DETAILS

Asset #	Instrument	Manufacturer	Part #	Calibration Due Date	Serial #
0088	Spectrum Analyzer	Hewlett Packard	8564E	20th June '07	3410A00141
0104	1-18GHz Horn Antenna	The Electro-Mechanics Company	3115	21st Oct '07	9205-3882
0134	Amplifier	Com Power	PA 122	1st Dec '07	181910
0158	Barometer /Thermometer	Control Co.	4196	26th Aug '07	E2846
0193	EMI Receiver	Rhode & Schwartz	ESI 7	17th Aug 07	838496/007
0252	SMA Cable	Megaphase	Sucoflex 104	11th Jun '07	None
0304	2.4GHzHz Notch Filter	Micro-Tronics	--	1st Dec 07	001
0310	2m SMA Cable	Micro-Coax	UFA210A-0-0787-3G03G0	7th Dec '07	209089-001
0312	3m SMA Cable	Micro-Coax	UFA210A-1-1181-3G0300	9h Dec '07	209092-001
0313	Coupler	Hewlett Packard	86205A	N/A	3140A01285
0314	30dB N-Type Attenuator	ARRA	N9444-30	N/A	1623
0223	Power Meter	Hewlett Packard	EPM-442A	16th Aug 07	3125U11552
0116	Power Sensor	Hewlett Packard	8485A	16th Aug 07	3318A19694
0117	Power Sensor	Hewlett Packard	8487D	20th June 07	3318A00371
0184	Pulse Limiter	Rhode & Schwartz	ESH3Z2	3RD Oct 07	357.8810.52
0190	LISN	Rhode & Schwartz	ESH3Z5	22nd Jun 07	836679/006
0293	BNC Cable	Megaphase	1689 1GVT4	13TH Jul 07	15F50B001
0307	BNC Cable	Megaphase	1689 1GVT4	13th Jul 07	15F50B002
	Dipole Antenna	EMCO	3121C	30th Dec '06	9009 - 605

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