

**Nemko Test Report:** 4L0618RUS1rev6

**Applicant:** Navini Networks  
2240 Campbell Creek Blvd. Suite 110  
Richardson, TX 75082

**Equipment Under Test:  
(E.U.T.)** 2500-2686 MHz LCD Modem

**In Accordance With:** **FCC PART 27, Subpart M**  
Broadband Radio Service and Educational  
Broadband Service

**Tested By:** Nemko Dallas Inc.  
802 N. Kealy  
Lewisville, Texas 75057-3136

**Authorized By:**   
Dustin Oaks, Engineer

**Date:** 5/17/2005

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**Section 1. Summary of Test Results**

Manufacturer: Navini Networks

Model No.: 2500-2686 MHz LCD Modem

Serial No.: None

General: **All measurements are traceable to national standards.**

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 27, Subpart M.

New Submission

Production Unit

Class II Permissive Change

Pre-Production Unit

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE. NONE

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This report applies only to the items tested.

**Summary Of Test Data**

NAME OF TEST	PARA. NO.	SPEC. LIMIT	RESULT
RF Power Output	2.1046	33 dBW + 10log(X/Y) dBW	Complies
Occupied Bandwidth	2.1049	5.5 MHz	Complies
Spurious Emissions @ Antenna Terminals	2.1051	-13 dBm	Complies
Field Strength of Spurious Radiation	2.1053	-13 dBm	Complies
Frequency Stability	2.1055	Must remain within authorized bandwidth	Complies

**Footnotes:**

X is the actual channel width in MHz and Y is either 6 MHz if prior to transition or the station is in the MBS following transition or 5.5 MHz if the station is in the LBS and UBS following transition

## Section 2. General Equipment Specification

**Power Supply** 120 Vac

**Frequency Range (See note below):** 2501 to 2685 MHz

<b>Type(s) of Modulation:</b>	<b>F3E (Voice)</b>	<b>F1D</b>	<b>F2D</b>	<b>D7W (QAM)</b>	<b>F9W</b>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

**Emission Designator:** 2M00F9W

**Output Impedance:** 50 ohms

**RF Power Output:** 30 dBm Conducted

EIRP Patch: 37.2 dBm (5.22 Watts)

EIRP Upright: 35.4 dBm (3.45 Watts)

EIRP Window Mount: 40.3 dBm (10.67 Watts)

**Duty Cycle:** 50% TDD

**Selection Of Operating Frequency:** Not selectable by operator

**Power Output Adjustment Capability:** Not selectable by operator

**Description of EUT**

Navini's Wireless Modem is a sleek end-user wireless terminal device used to give the user access to Navini's wireless broadband network.

**System Diagram**

Refer to separate exhibit.

**Section 3. RF Power Output**

NAME OF TEST: RF Power Output	PARA. NO.: 2.1046
TESTED BY: David Light	DATE: 04/28/2005

**Test Results:** Complies

**Measurement Data:** See Tables.

**Test Equipment:** 1628, 1474

**MAX RF POWER OUTPUT**

Freq	Power (dBm)	Power (Watts)
Low	30.24	1.0
Mid	30.24	1.0
High	30.24	1.0

**RF POWER at mask edges**

Freq	Power (dBm)	Power (Watts)
Low	28.12	0.649
Mid	28.12	0.649
High	28.12	0.649

Note:

Power is reduced at mask edges to comply with mask requirements, see mask plots for details.

**Section 4. EIRP Power**

NAME OF TEST: RF Power Output	PARA. NO.: 2.1046
TESTED BY: David Light	DATE: 10/13/2004

**Test Results:** Complies

**Measurement Data:** See Tables.



Test Data – EIRP



Dallas Headquarters:  
 802 N. Kealy  
 Lewisville, TX 75057  
 Tel: (972) 436-9600  
 Fax: (972) 436-2667

<b>Carrier EIRP</b>										
Page 1 of 1								Complete <u>  X  </u>		
Job No.:	4L0618	Date:		10/13/04		Preliminary <u>          </u>				
Specification:	PT27	Temperature(°C):		22						
Tested By:	David Light	Relative Humidity(%):		40						
E.U.T.:	CPE									
Configuration:	TX									
Sample No.:	1									
Location:	AC 3	RBW:		3 MHz		Measurement				
Detector Type:	Average	VBW:		3 MHz		Distance:		3 m		
<b>Test Equipment Used</b>										
Antenna:	1304	Directional Coupler:								
Pre-Amp:		Cable #1:		1484						
Filter:		Cable #2:		1485						
Receiver:	1464	Cable #3:								
Attenuator #1		Cable #4:								
Attenuator #2:		Mixer:								
Additional equipment used:										
Measurement Uncertainty:	+/-1.7 dB									
Frequency (MHz)	Meter Reading (dBm)	Correction Factor (dB)		Pre-Amp Gain (dB)	Substitution Antenna Gain (dBi)		EIRP (dBm)	EIRP (mW)	Polarity	Comments
										Patch Antenna
2502	-8.7	35.6		0	10.1		37.0	4988.84	V	
2502	-21.8	34.6		0	10.1		22.9	196.34	H	
2600	-10.5	35.6		0	10.1		35.2	3296.10	V	
2600	-23.0	34.6		0	10.1		21.7	148.94	H	
2684	-8.5	35.6		0	10.1		37.2	5223.96	V	
2684	-19.8	34.6		0	10.1		24.9	311.17	H	
										Upright Antenna
2502	-10.5	35.6		0	10.1		35.2	3296.10	V	
2502	-20.5	34.6		0	10.1		24.2	264.85	H	
2600	-11.7	35.6		0	10.1		34.0	2500.35	V	
2600	-18.7	34.6		0	10.1		26.0	400.87	H	
2684	-10.3	35.6		0	10.1		35.4	3451.44	V	
2684	-15.8	34.6		0	10.1		28.9	781.63	H	
										Window Mount Ant.
2502	-6.0	35.6		0	10.1		39.7	9289.66	V	
2502	-19.3	34.6		0	10.1		25.4	349.14	H	
2600	-7.0	35.6		0	10.1		38.7	7379.04	V	
2600	-22.0	34.6		0	10.1		22.7	187.50	H	
2684	-5.4	35.6		0	10.1		40.3	10665.96	V	
2684	-18.6	34.6		0	10.1		26.1	410.20	H	
Notes: 3 dB was subtracted for average value.										

**Section 5. Occupied Bandwidth**

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.1049
TESTED BY: David Light	DATE: 02/21/2005

**Test Results:** Complies

**Measurement Data:** See attached plots.

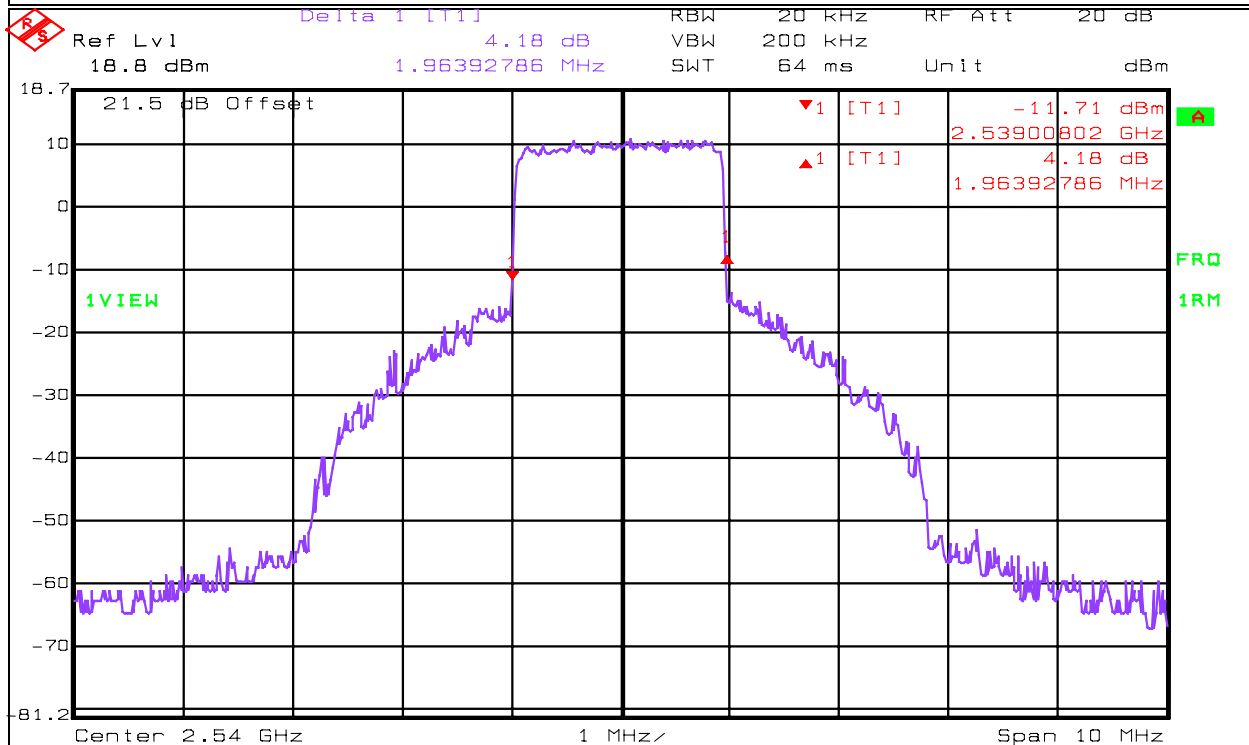
Test Data – Occupied Bandwidth



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Nemko Dallas, Inc.

Data Plot		Occupied Bandwidth	
Page 1 of 1		Complete <u>X</u>	
Job No.: 4L0618	Date: 2/21/2004	Preliminary: _____	
Specification: PT27	Temperature(°C): 22		
Tested By: David Light	Relative Humidity(%): 40		
E.U.T.: LCD CPE			
Configuration: TX			
Sample Number: 1			
Location: Lab 1	RBW: 20 kHz	Measurement	
Detector Type: Rms	VBW: 200 kHz	Distance: <u>NA</u> m	
<b>Test Equipment Used</b>			
Antenna: _____	Directional Coupler: _____		
Pre-Amp: _____	Cable #1: 1081		
Filter: _____	Cable #2: _____		
Receiver: 1036	Cable #3: _____		
Attenuator #1: _____	Cable #4: _____		
Attenuator #2: 1471	Mixer: _____		
Additional equipment used: _____			
Measurement Uncertainty: +/-1.7 dB			



Date: 21.FEB.2005 16:32:36

Notes:

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**Section 6. Spurious Emissions at Antenna Terminals**

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.1051
TESTED BY: David Light	DATE: 4/28/2005

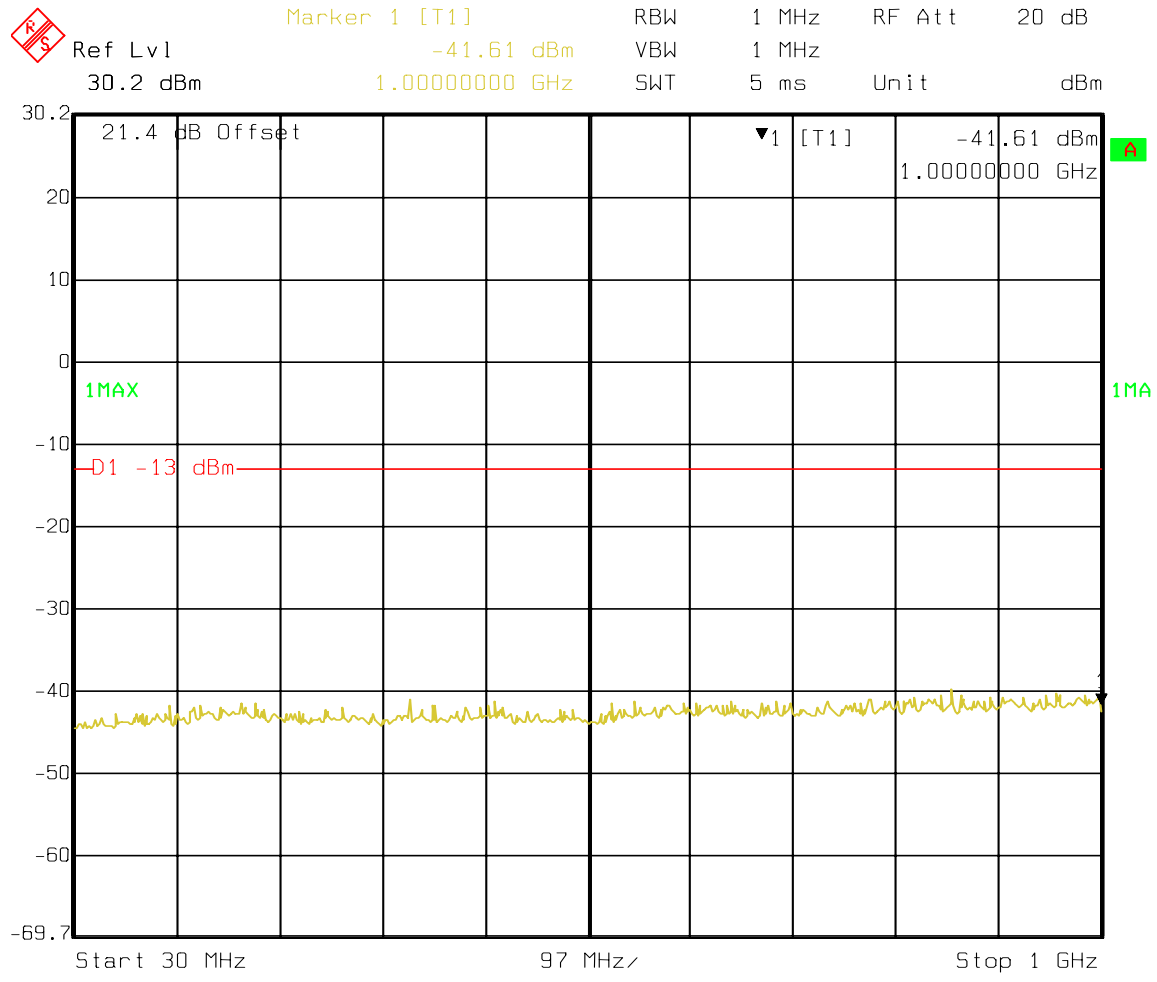
**Test Results:** Complies

**Measurement Data:** See attached plots.

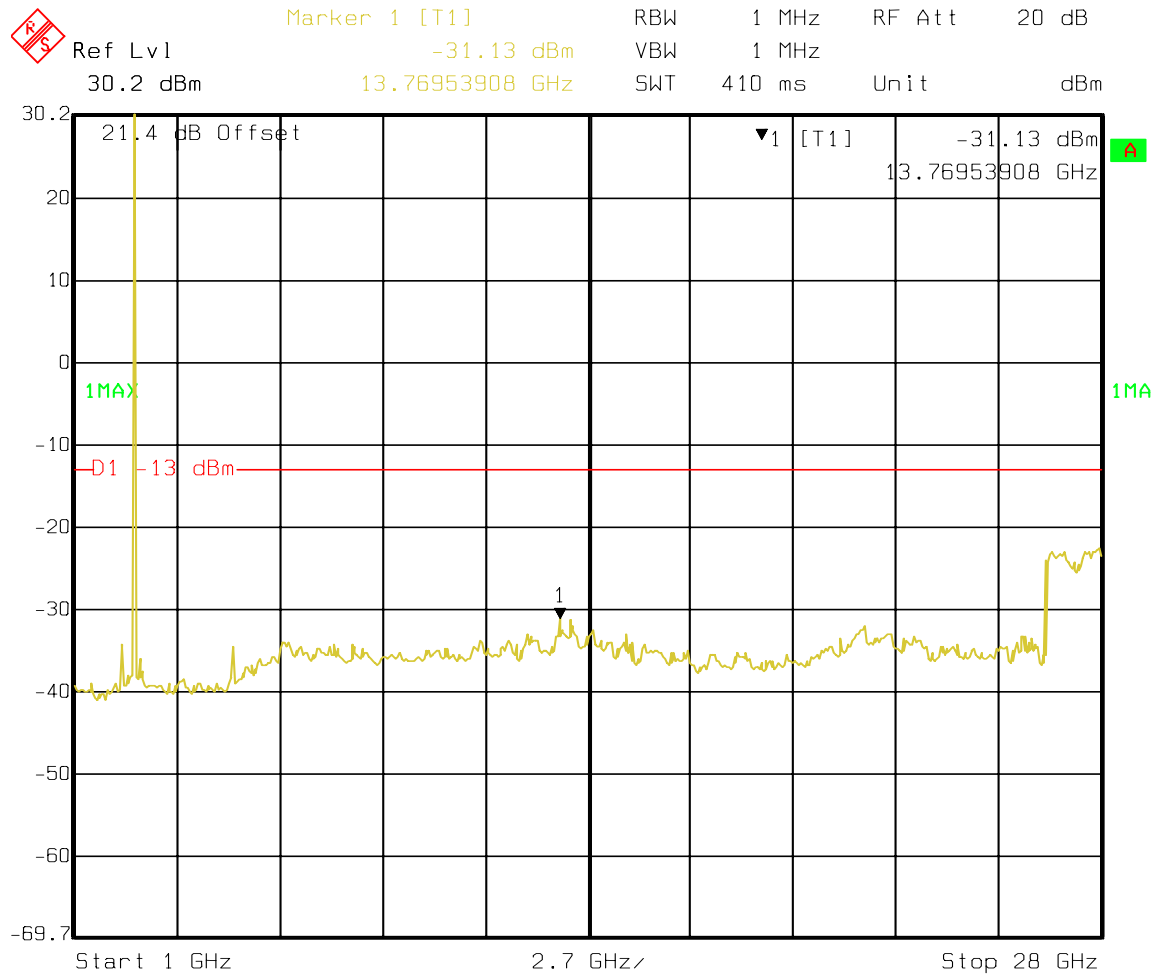
**Test Equipment:** 1036, 1628, 1474

Notes: Device operating at 2.6GHz and 30dBm conducted power. Frequency Range scanned from 9kHz to 28GHz.

Test Data – Spurious Emissions at Antenna Terminals



Date: 28.APR.2005 13:23:46



Date: 28.APR.2005 13:24:49

**Test Data – Spurious Emissions at Antenna Terminals - Emissions Mask**

**Explanation of Mask Testing Method**

The Navini networks system is comprised of a BTS which occupies 5 MHz of spectrum, a CPE which occupies 2MHz, and a PCMCIA card which occupies 1 MHz. Since the channels are spaced at 5.5MHz that leaves .25 MHz of guard band on both the upper and lower edges of the Channel for the BTS.

Within the 5 MHz of spectrum which the BTS occupies we have ten 500 KHz carriers (please see figure below). Of these ten carriers the CPE will use only 4 carriers.

When the CPE occupies carriers C0,C1 ,C2 , and C3 or carriers C6, C7, C8, and C9 the power at the antenna port is 28 dBm avg. To show compliance the mask is reduced from 5.5 MHz wide to 2.5 MHz wide. By placing the signal in the center of this mask we are able to show compliance to both the upper and lower edges of the channel. If however the CPE occupies carriers C2, C3, C4, and C5 or carriers C4, C5, C6, and C7 then the power at the antenna port is increased to 30dBm avg. In this case the mask is increased to 4.5 MHz. In doing so we shall show compliance to both the upper and lower edges of the Channel with a 1.25Mhz guard band at both edges.

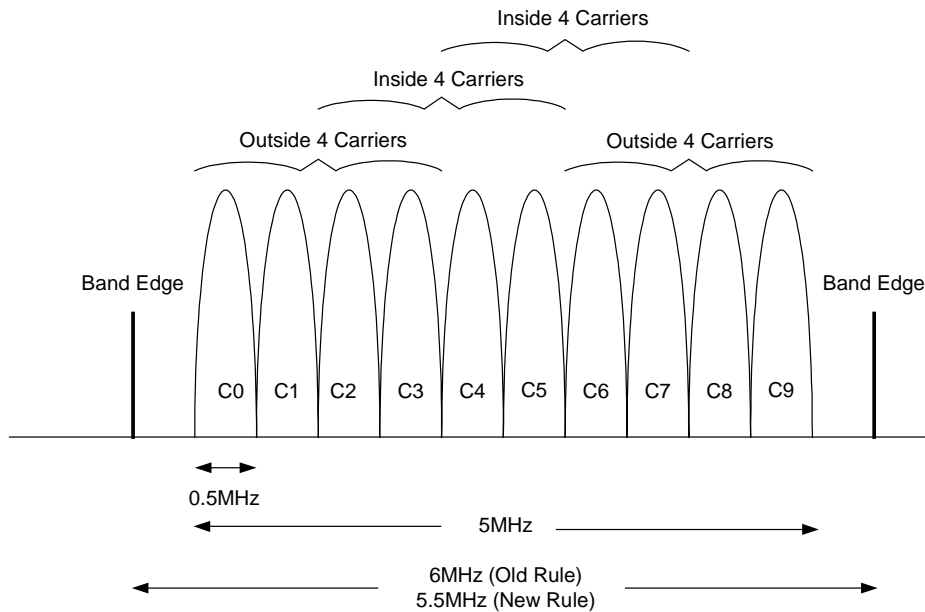
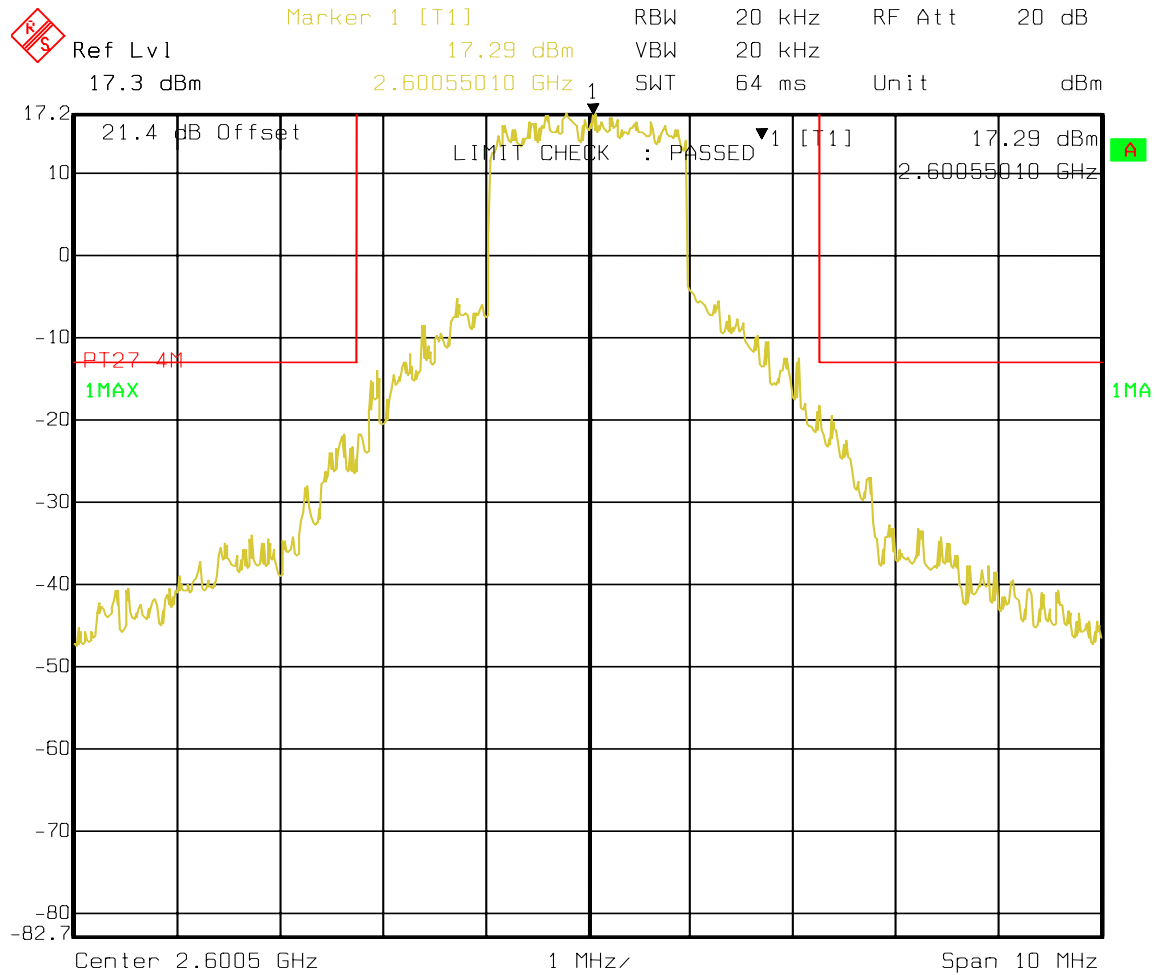


Figure 1. 4-Carrier Signal

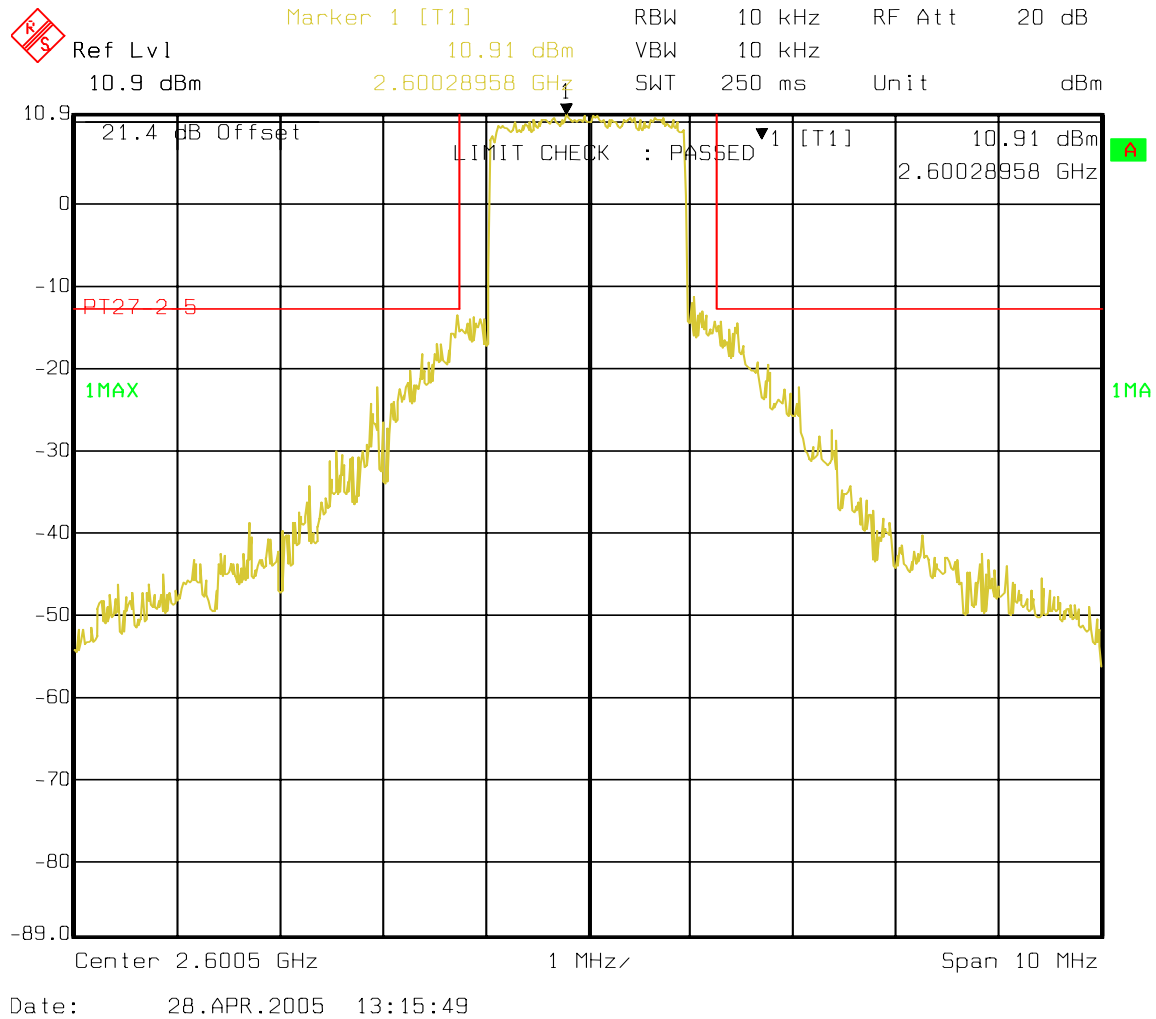
Mask Center (Conducted Power at 30.24dBm)



Date: 28.APR.2005 12:58:24



Mask Edges (Conducted Power at 28.12dBm)



**Section 7. Field Strength of Spurious**

NAME OF TEST: Field Strength of Spurious Emissions	PARA. NO.: 2.1053
TESTED BY: David Light	DATE: 02/21/2005

**Test Results:** Complies

**Measurement Data:** See attached table.

Test Data - Radiated Emissions



Nemko Dallas, Inc.

Dallas Headquarters:

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 Lewisville, TX 75057  
 Tel: (972) 436-9600  
 Fax: (972) 436-2667

**Field Strength of Spurious Emissions**

Page 1 of 1 Complete X  
 Preliminary \_\_\_\_\_

Job No.: 4L0618 Date: 10/14/04  
 Specification: PT27 Temperature(°C): 25  
 Tested By: David Light Relative Humidity(%) 45  
 E.U.T.: \_\_\_\_\_  
 Configuration: TX  
 Sample No: 1  
 Location: AC 3 RBW: 1 MHz Measurement  
 Detector Type: Peak VBW: 1 MHz Distance: 3 m

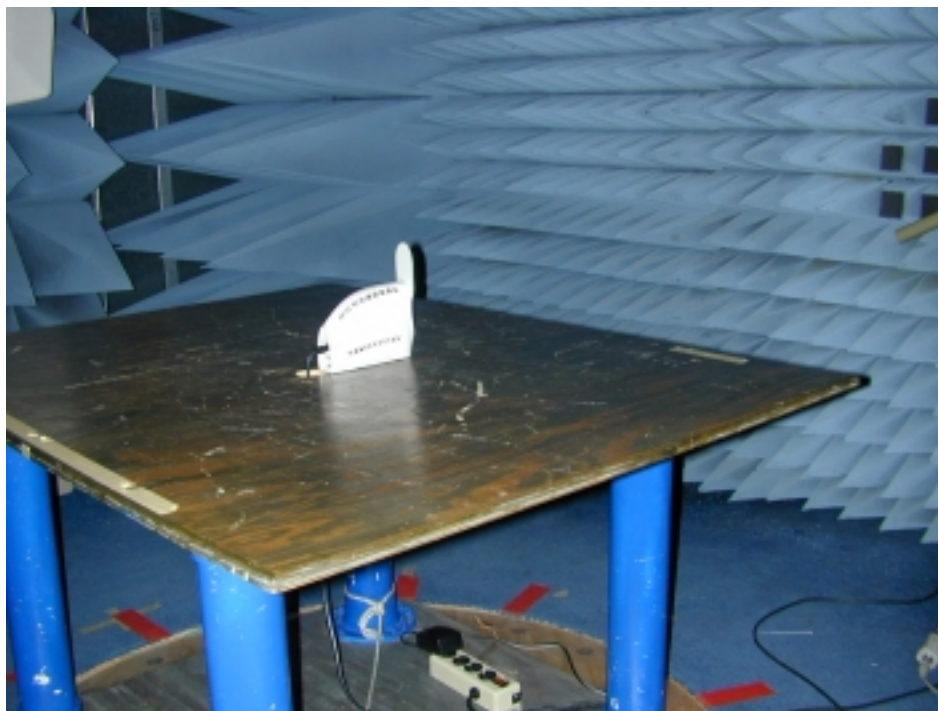
**Test Equipment Used**

Antenna: \_\_\_\_\_ Directional Coupler: \_\_\_\_\_  
 Pre-Amp: 1016 Cable #1: 1484  
 Filter: 1482 Cable #2: 1485  
 Receiver: 1464 Cable #3: \_\_\_\_\_  
 Attenuator #1: \_\_\_\_\_ Cable #4: \_\_\_\_\_  
 Attenuator #2: \_\_\_\_\_ Mixer: \_\_\_\_\_  
 Additional equipment used: \_\_\_\_\_  
 Measurement Uncertainty: +/- 1.7 dB

Frequency (MHz)	Meter Reading (dBm)	Correction Factor (dB)	Pre-Amp Gain (dB)	Substitution Antenna Gain (dBi)	EIRP (dBm)	EIRP (mW)	Polarity	Comments
								Tx @ 2600 MHz
								Upright Ant
5200	-45.8	40.6	32.3	11.2	-26.3	0.00	V	
10400	-54.5	41.0	34.7	12.7	-35.6	0.00	V	
5200	-48.8	36.3	32.3	9.1	-35.8	0.00	H	
10400	-52.5	42.5	34.7	10.5	-34.2	0.00	H	
13000	-63.2	47.5	33.7	11.2	-38.3	0.00	H	
								Patch Antenna
5200	-54.3	40.6	32.3	11.2	-34.8	0.00	V	
10400	-57.8	41.0	34.7	12.7	-38.9	0.00	V	
5200	-53.3	36.3	32.3	9.1	-40.3	0.00	H	
10400	-53.3	42.5	34.7	10.5	-35.0	0.00	H	
13000	-61.8	47.5	33.7	11.2	-36.9	0.00	H	
The spectrum was searched to the 10th harmonic. All emissions were reported								



**Photos – Radiated Emissions**



**Section 8. Frequency Stability**

NAME OF TEST: Frequency Stability	PARA. NO.: 2.1055
TESTED BY: David Light	DATE: 2/21/2005

**Test Results:** Complies

**Measurement Data:** See attached plots.

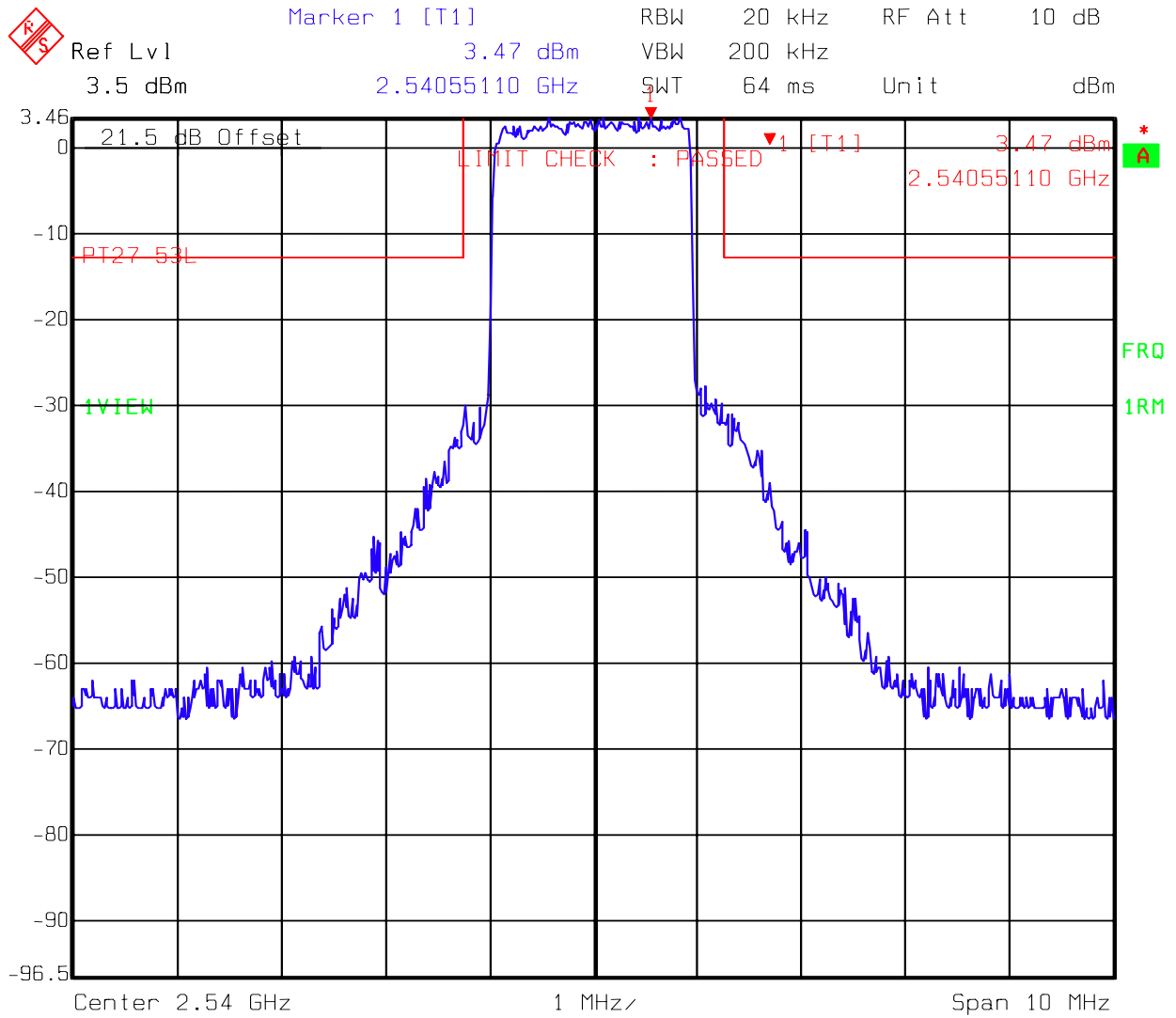
**Test Equipment Used:** 1036-1469-1474-1625-283-619

**Standard Supply Voltage:** 120 Vac

**Environmental Conditions:** 20 °Celsius  
50 % RH

Test Data – Frequency Stability

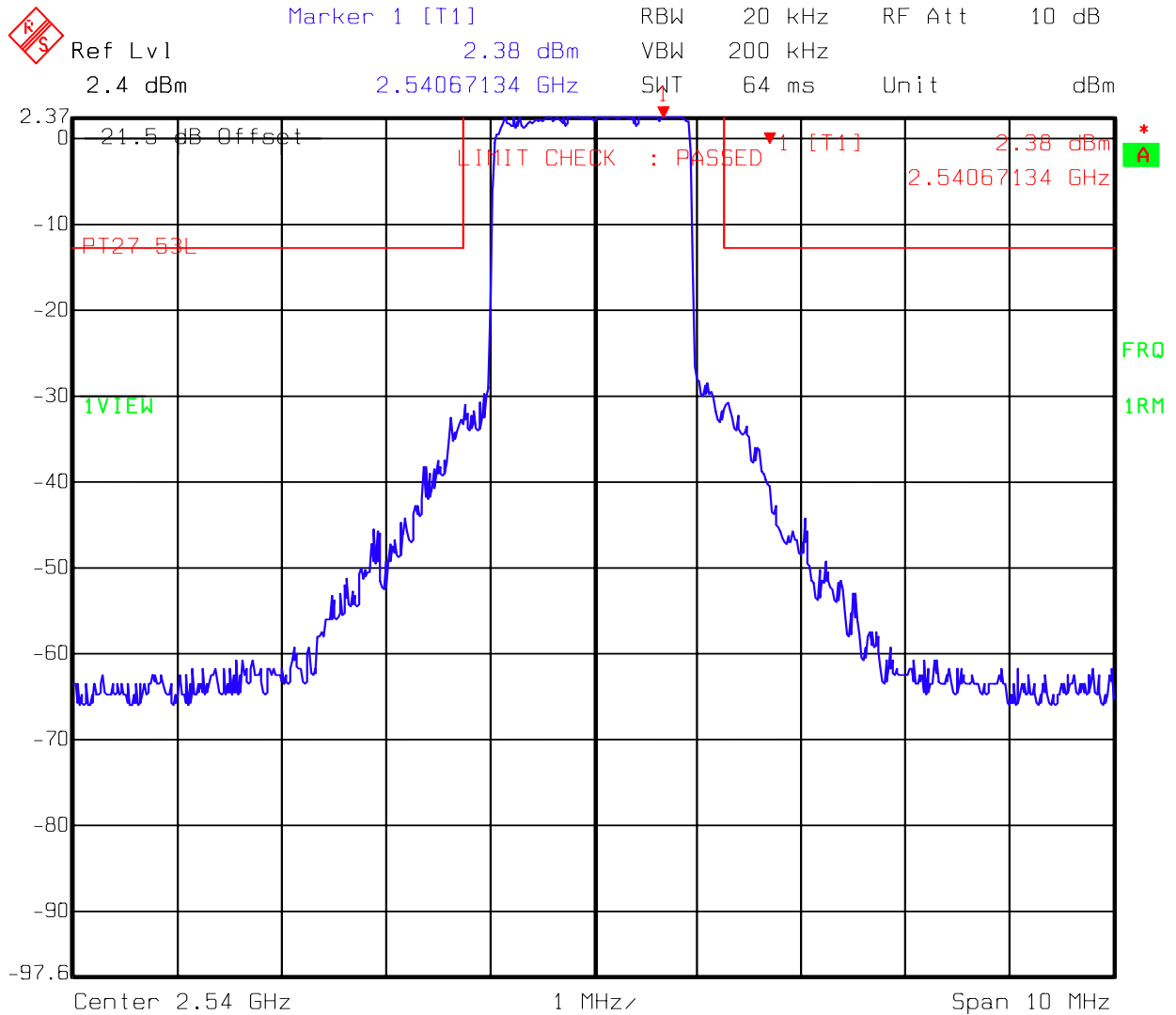
+20 C / 102 Vac



Date: 22.FEB.2005 10:39:53

### Test Data – Frequency Stability

+20 C/ 138 Vac



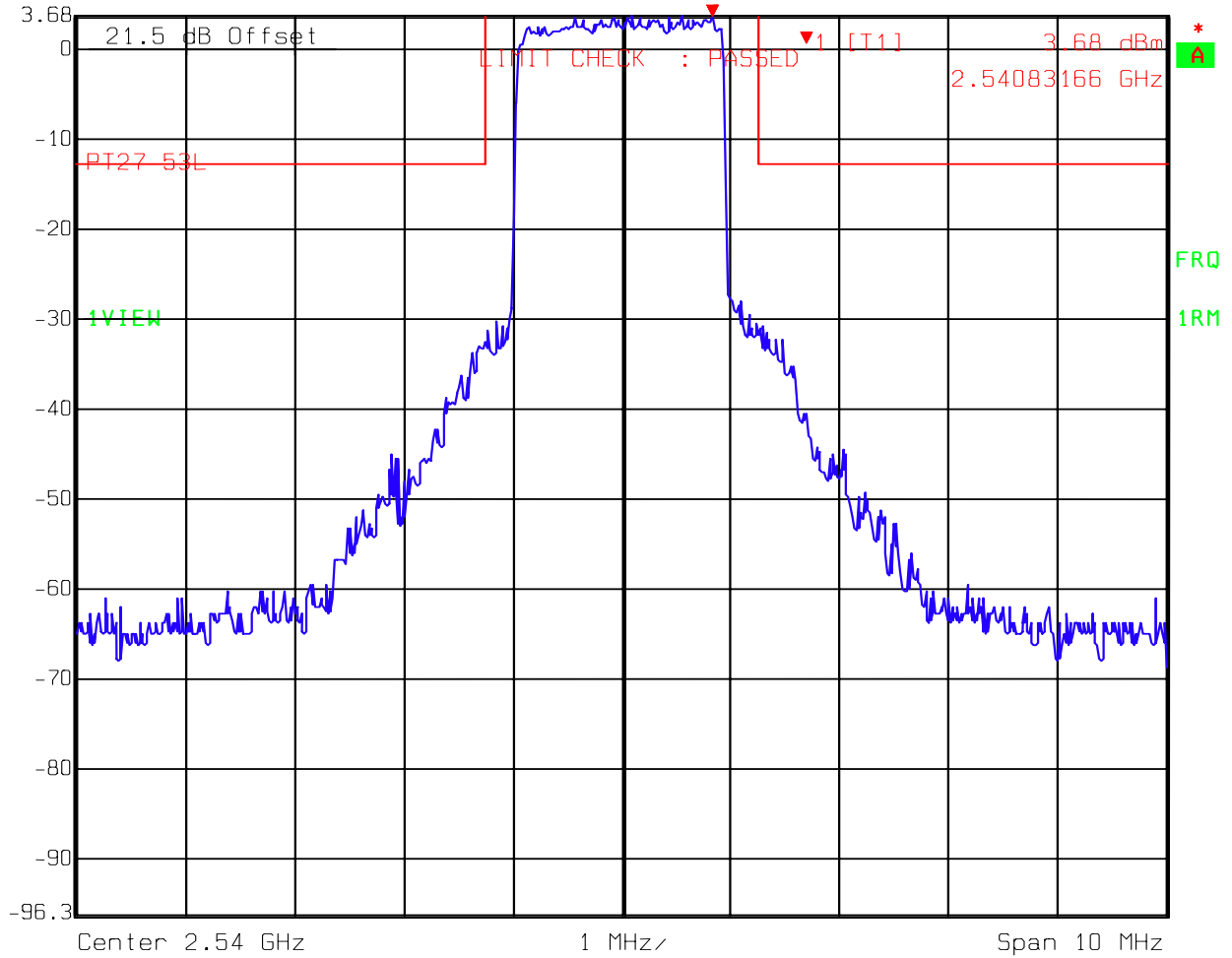
Date: 22.FEB.2005 10:43:14



Test Data – Frequency Stability

+20 C / 120 Vac

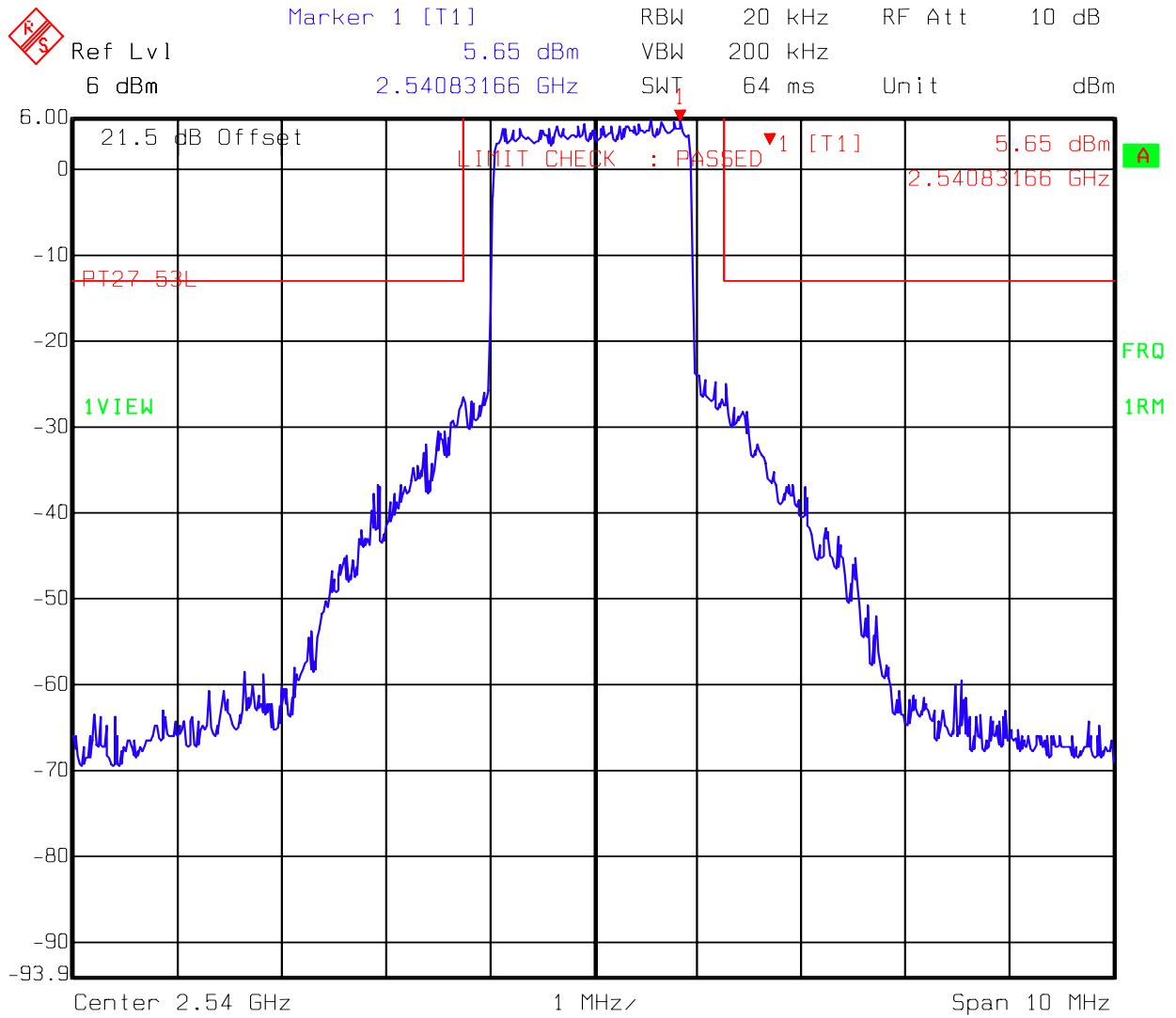
Marker 1 [T1] RBW 20 kHz RF Att 10 dB  
Ref Lvl 3.68 dBm VBW 200 kHz  
3.7 dBm 2.54083166 GHz SWT 64 ms Unit dBm



Date: 22.FEB.2005 10:41:50

Test Data – Frequency Stability

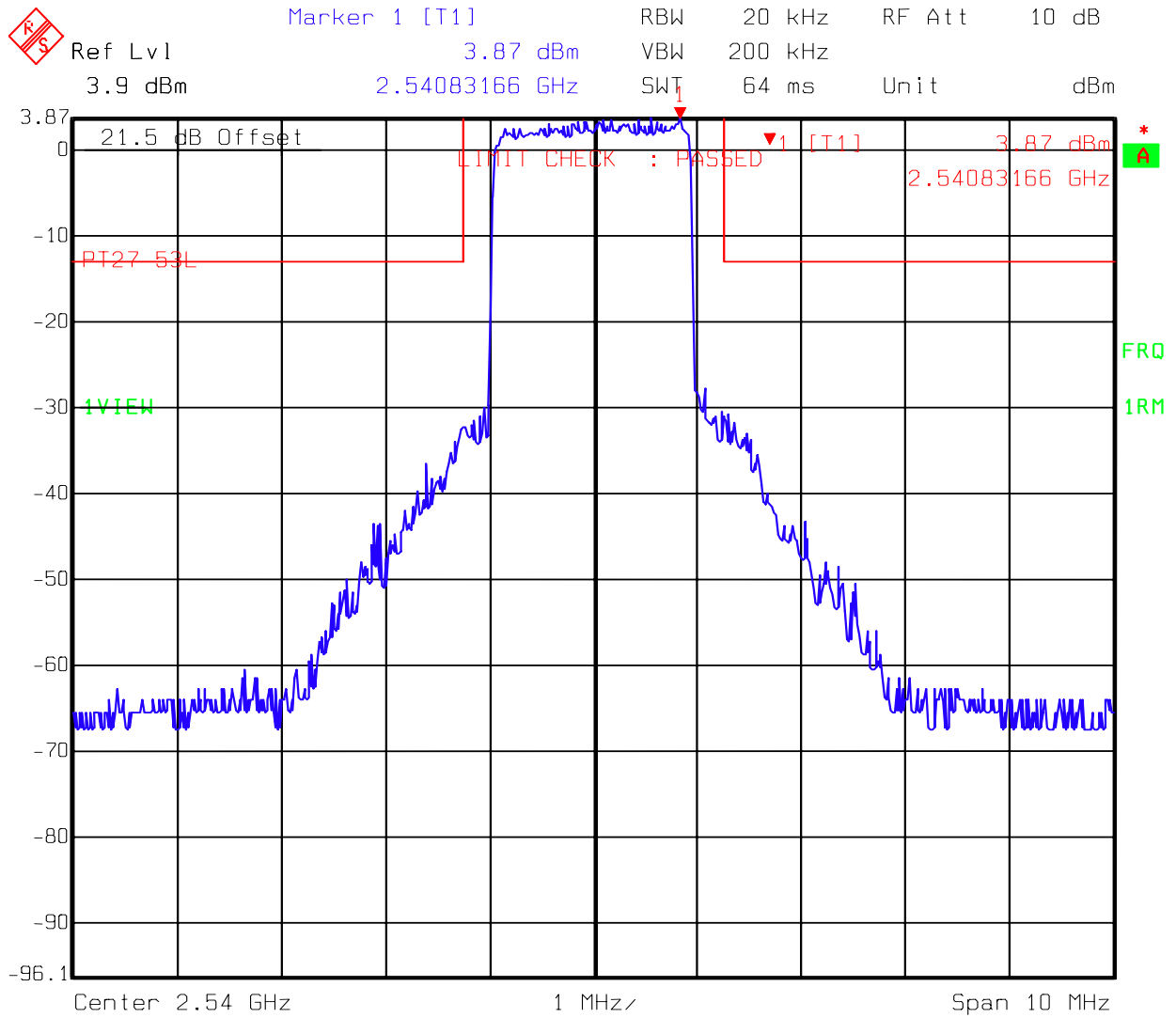
+50 C



Date: 22.FEB.2005 11:29:25

Test Data – Frequency Stability

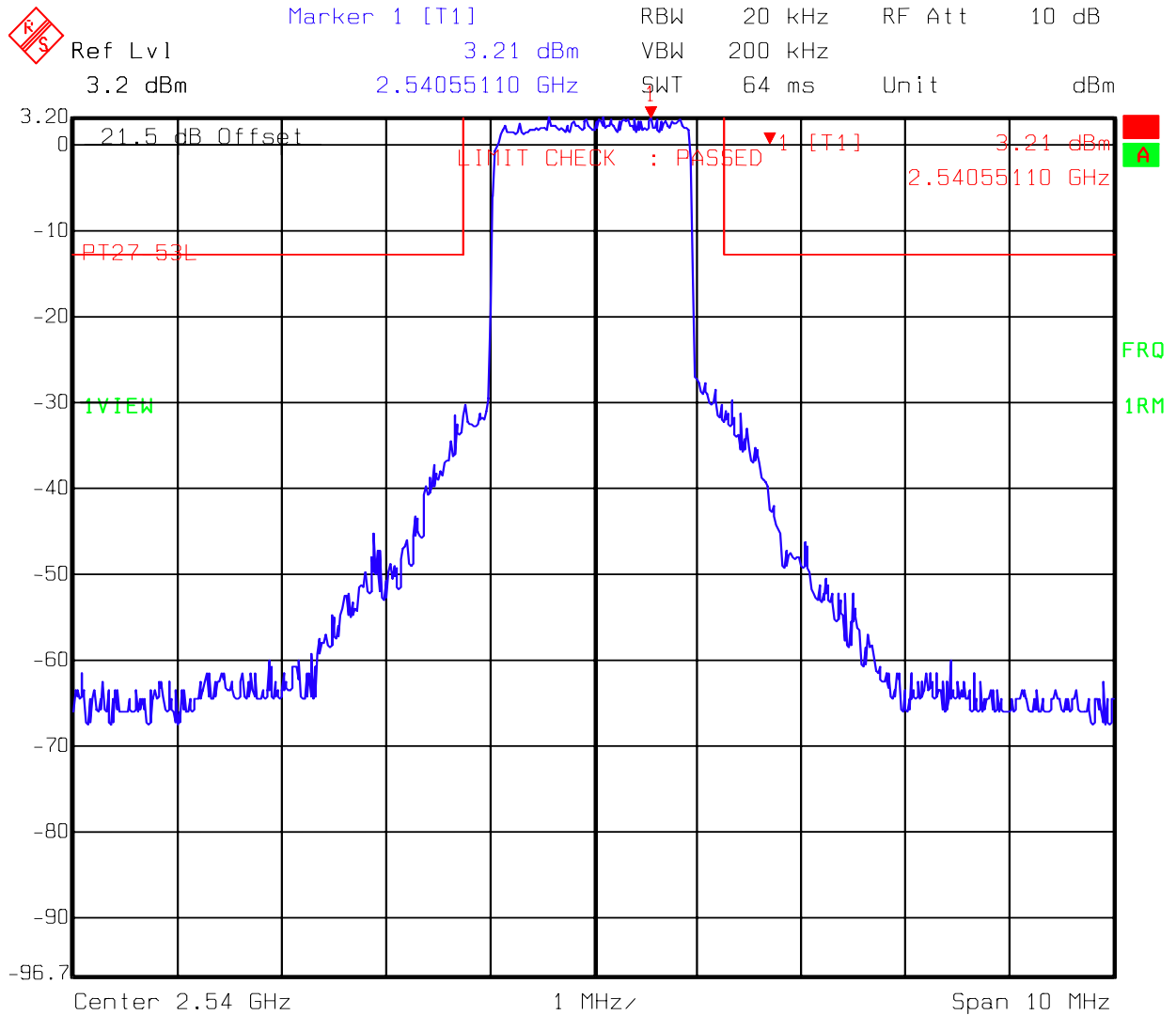
+40 C



Date: 22.FEB.2005 12:13:39

Test Data – Frequency Stability

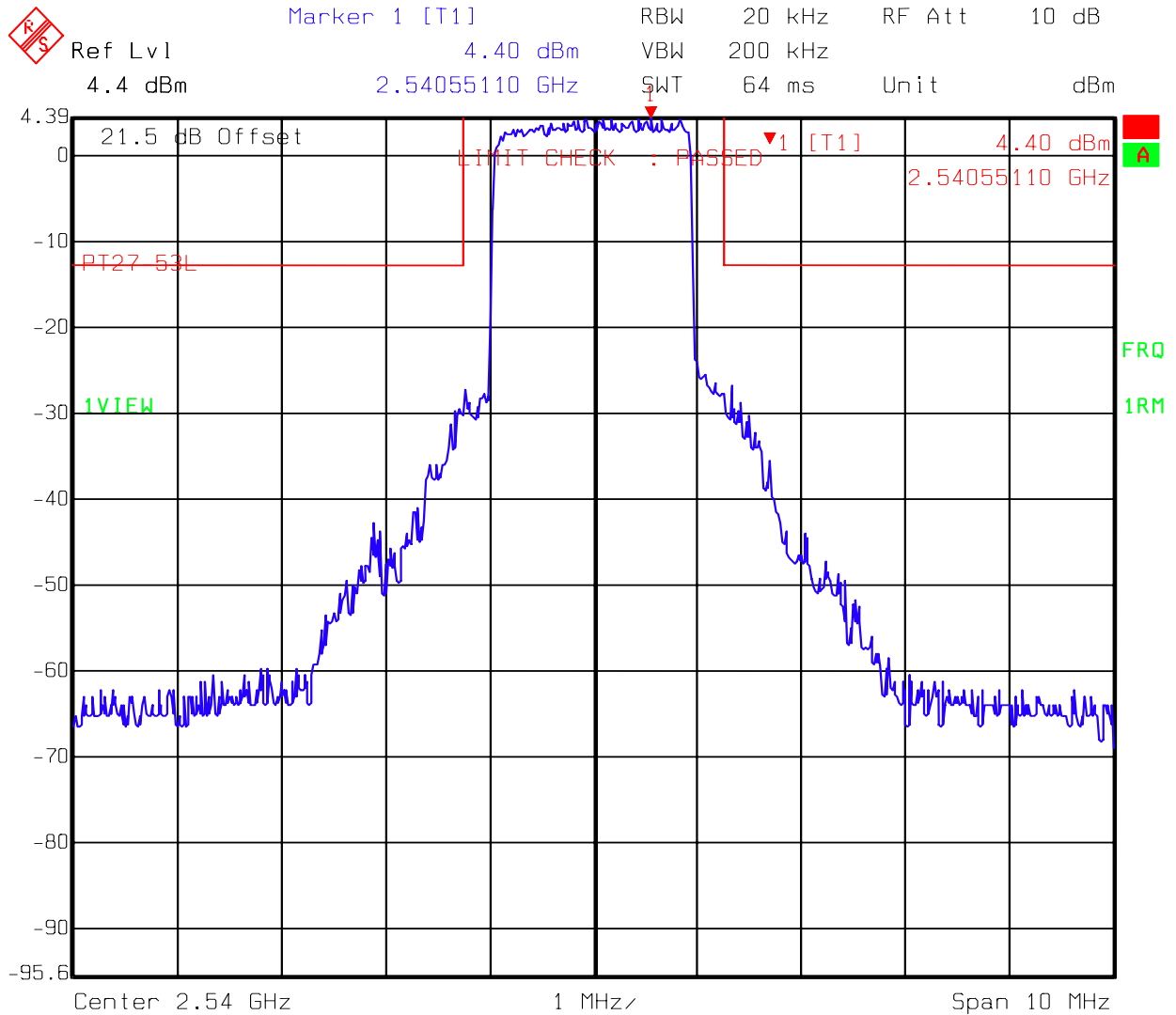
+30 C



Date: 22.FEB.2005 12:37:09

Test Data – Frequency Stability

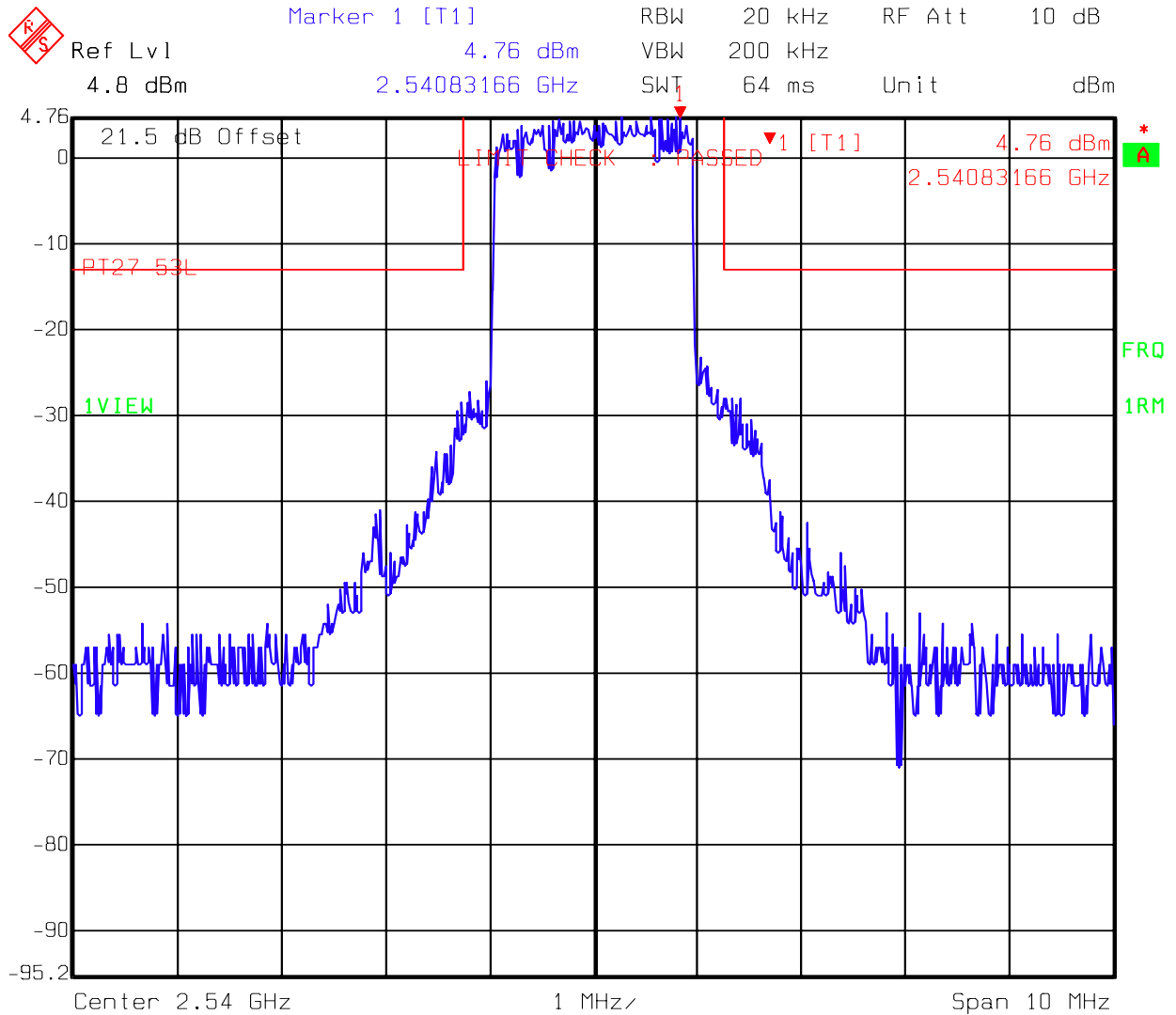
10 C



Date: 22.FEB.2005 14:08:48

Test Data – Frequency Stability

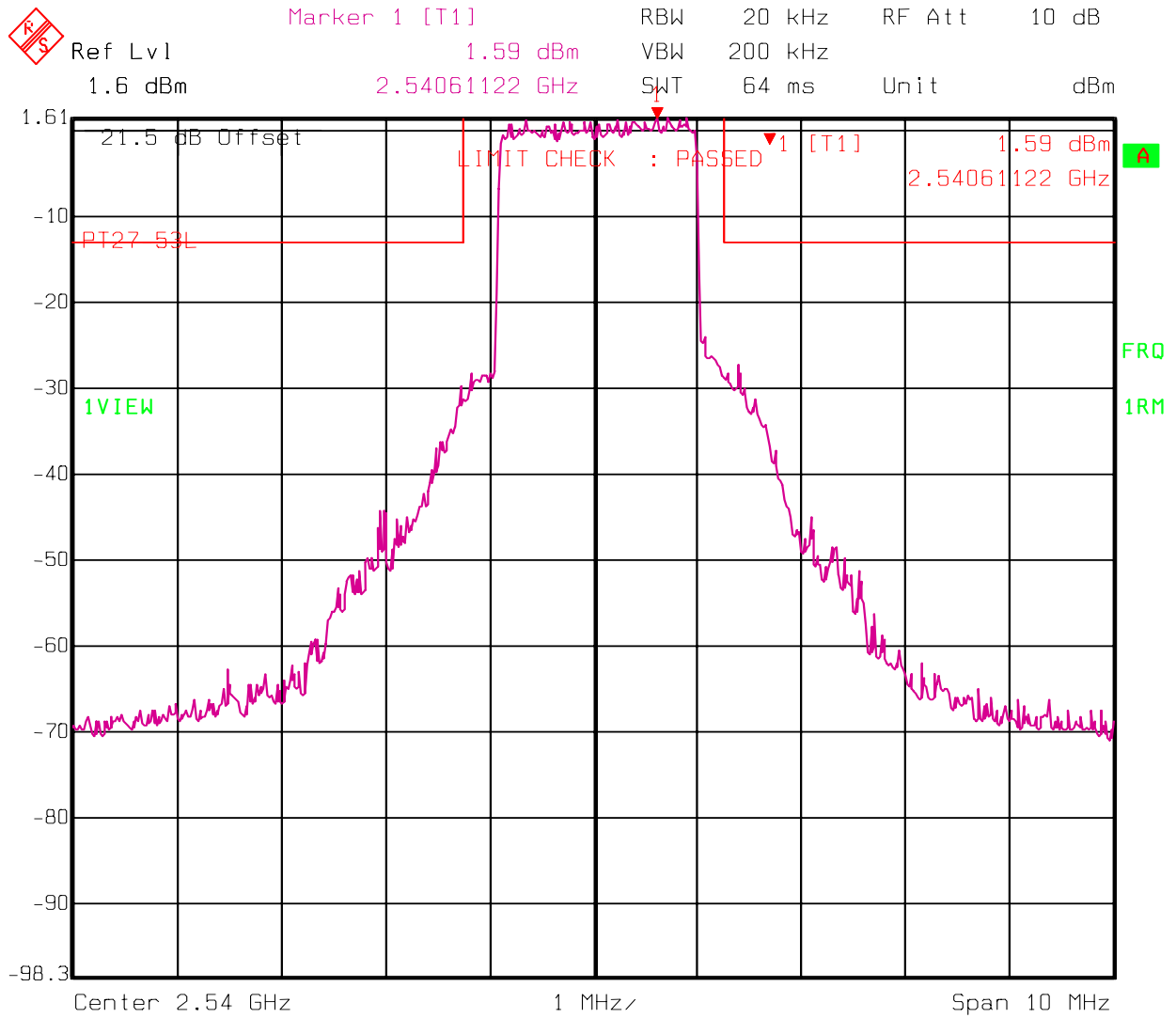
0 C



Date: 22.FEB.2005 14:29:15

Test Data – Frequency Stability

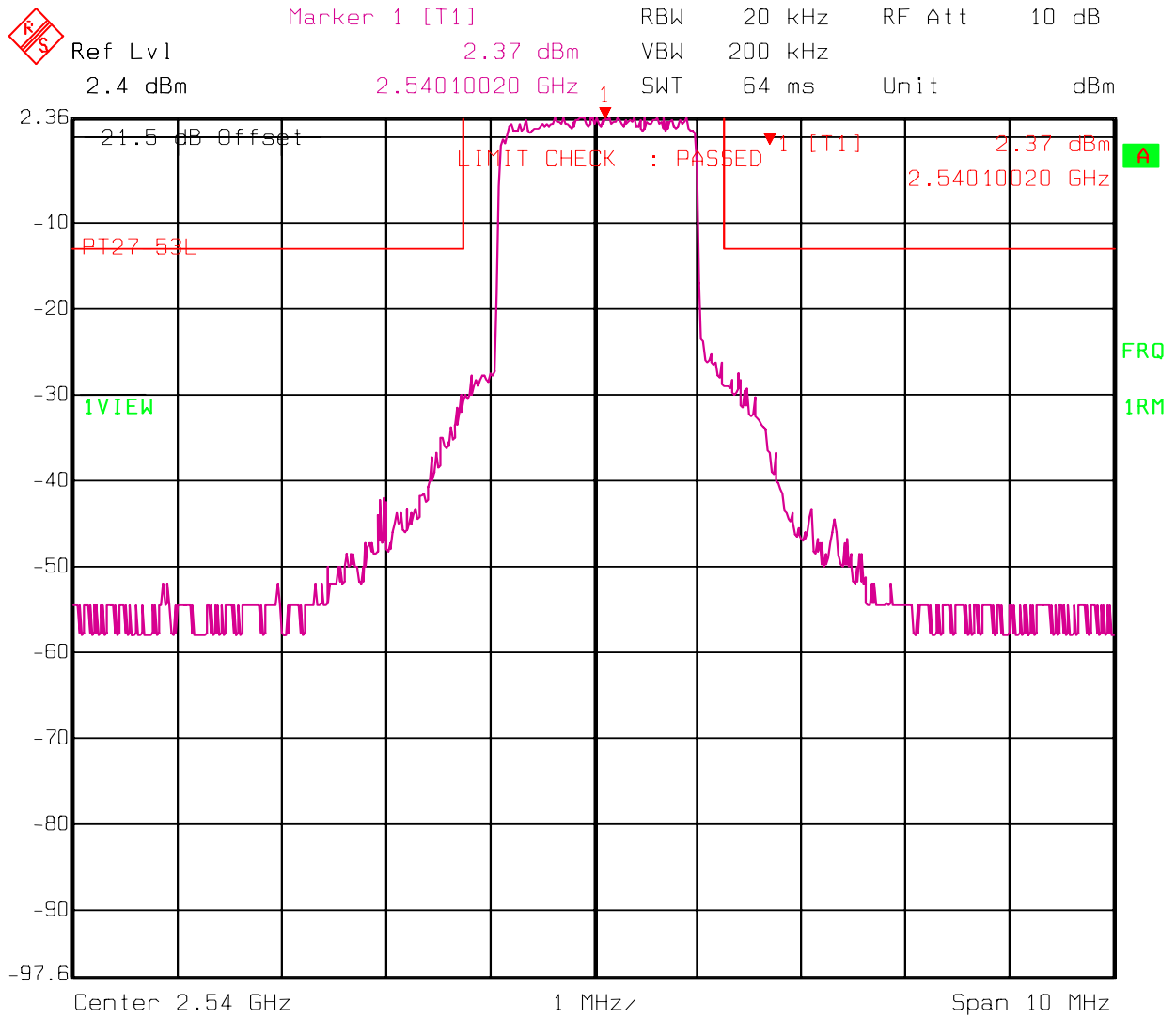
-10 C



Date: 25.FEB.2005 13:49:49

Test Data – Frequency Stability

-20 C



Date: 25.FEB.2005 17:46:43

The unit ceased operation below -20C



### Section 9. Test Equipment List

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date	Calibration Due
1304	HORN ANTENNA	ELECTRO METRICS RGA-60	6151	09/22/03	09/22/05
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	11/12/04	11/12/05
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	07/30/04	07/31/06
1484	Cable 2.0-18.0 Ghz	Storm PR90-010-072	N/A	08/26/04	08/26/05
1485	Cable 2.0-18.0 Ghz	Storm PR90-010-216	N/A	08/02/04	08/02/05
759	ANTENNA, LOG PERIODIC	A.H. SYSTEMS SAS-200/510	556	07/23/04	07/23/05
760	Antenna biconical	Electro Metrics MFC-25	477	06/22/04	06/22/05
791	PREAMP, 25dB	ICC LNA25	398	11/12/04	11/12/05
1983	CABLE	KTL Site A OATS	N/A	03/11/04	03/11/05
1036	SPECTRUM ANALYZER	ROHDE & SCHWARZ FSEK30	830844/006	03/22/04	03/23/06
1064	ATTENUATOR	NARDA 776B-20	NONE	CBU	N/A
1628	CABLE, 6 ft	MEGAPHASE TM26 S1S5 72	N/A	CBU	CBU
1482	Band Pass Filter	K & L 11SH10-4000/T12000-0/0	2	Cal B4 Use	N/A
1469	10 db Attenuator DC 18 Ghz	MCL Inc. BW-S10W2 10db-2WDC	NONE	CBU	N/A
1474	20db Attenuator DC 18 Ghz	MCL Inc. BW-S20W2	NONE	CBU	N/A
1625	CABLE, 18 ft	MEGAPHASE 10311 1GVT4	N/A	08/02/04	08/02/05
283	Environmental Chamber with controller # 1189006	ENVIROTRONICS SH27 & 2030-22844	129010083	04/22/03	04/21/04
619	THERMOMETER	FLUKE 51	4520028	09/16/04	09/16/05

## **ANNEX A - TEST DETAILS**

<b>NAME OF TEST: RF Power Output</b>	<b>PARA. NO.: 2.1046</b>
--------------------------------------	--------------------------

**Method Of Measurement:****Antenna Conducted:**

The peak power at antenna terminals is measured using a Spectrum Analyzer or Power Meter. Power output is measured with the maximum rated input level.

**E.I.R.P.:**

If the antenna is not detachable from the circuit then the Peak Power Output is derived from the peak radiated field strength of the fundamental emission by using the plane wave relation  $GP/4\pi R^2 = E^2/120\pi$  and proceeding as follows:

$$P = \frac{E^2 R^2}{30G} = \frac{E^2 3^2}{30G}$$

where,

P = the equivalent isotropic radiated power in watts

E = the maximum measured field strength in V/m

R = the measurement range (3 meters)

G = the numeric gain of the transmit antenna in relation to an isotropic radiator

<b>NAME OF TEST: Occupied Bandwidth</b>
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<b>PARA. NO.: 2.1049</b>
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**Method Of Measurement:**

A portion of the transmitted signal is coupled to a Spectrum Analyzer with a resolution bandwidth of at least 1% of the bandwidth of the transmitted signal. The resolution bandwidth is chosen so as not to reduce the peak level of the measured waveform.

The appropriate bandwidth mask is applied to the output waveform to verify compliance.

**NAME OF TEST: Spurious Emission at Antenna  
Terminals**

**PARA. NO.: 2.1051**

**Antenna Conducted:**

A portion of the transmitted signal is coupled to a Spectrum Analyzer with a resolution bandwidth of 1 MHz for emissions above 1 GHz. Below 1 GHz the resolution bandwidth is chosen so as not to reduce the peak level of the measured waveform.

The appropriate limit line is applied to the output waveform to verify compliance.

<b>NAME OF TEST: Field Strength of Spurious Radiation</b>	<b>PARA. NO.: 2.1053</b>
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**Test Method:** TIA/EIA-603-1992, Section 2.2.12

The antenna substitution method was used to determine the equivalent radiated power at spurious frequencies. The spurious emissions were measured at a distance of 3 meters. The EUT was then replaced with a reference substitution antenna with a known gain referenced to an isotropic.. This antenna was fed with a signal at the spurious frequency. The level of the signal was adjusted to repeat the previously measured level. The resulting eirp is the signal level fed to the reference antenna corrected for gain referenced to an isotropic.

<b>NAME OF TEST: Frequency Stability</b>	<b>2.1055</b>
--	---------------

**Method Of Measurement:**

**Frequency Stability With Voltage Variation:**

The E.U.T. is placed in an environmental chamber and allowed to stabilize at +20 degrees Celsius for at least 15 minutes. The frequency counter and signal generator are phase locked with the same 10 MHz reference frequency by connecting the 10 MHz ref. out of the counter to the 10 MHz ref, in of the signal generator. With the voltage input to the E.U.T. set to 85% S.T.V., the frequency is measured in 30 second intervals for a period of 5 minutes. This procedure is repeated at 100% S.T.V. and 115% S.T.V.

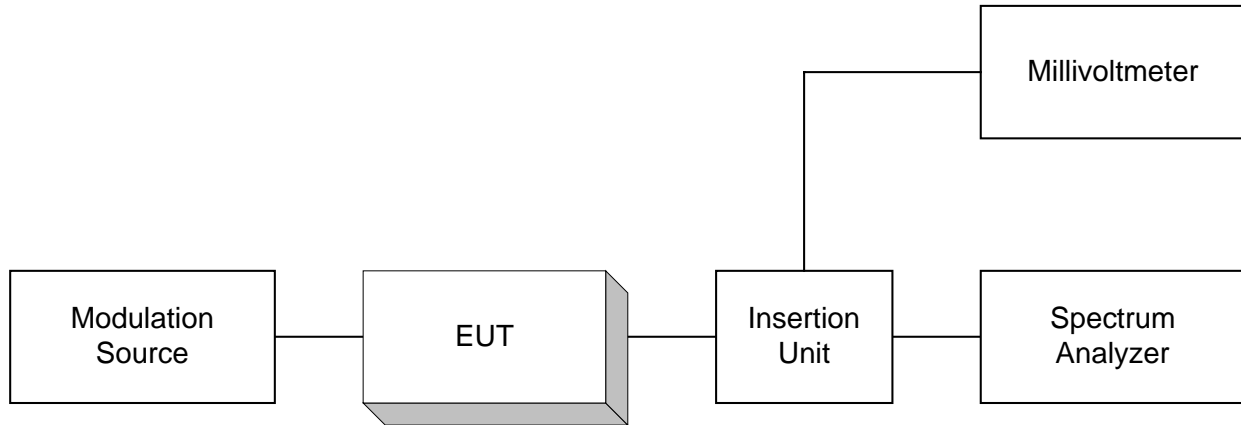
**Frequency Stability With Temperature Variation:**

The input voltage to the E.U.T. is set to S.T.V. and the temperature of the environmental chamber is varied in 10 degree steps from -30 degrees C to +50 degrees C. The E.U.T. is allowed to stabilize at each temperature and the frequency is measured in 30 second intervals for a period of 5 minutes.

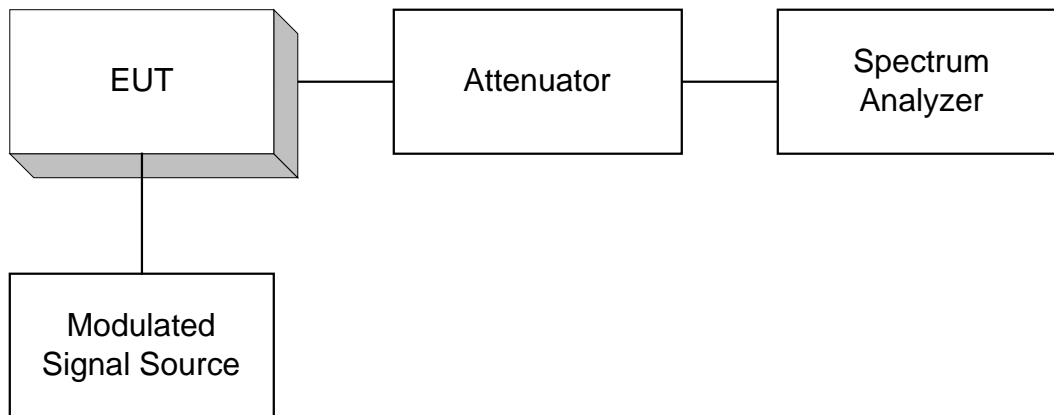
## **ANNEX B - TEST DIAGRAMS**



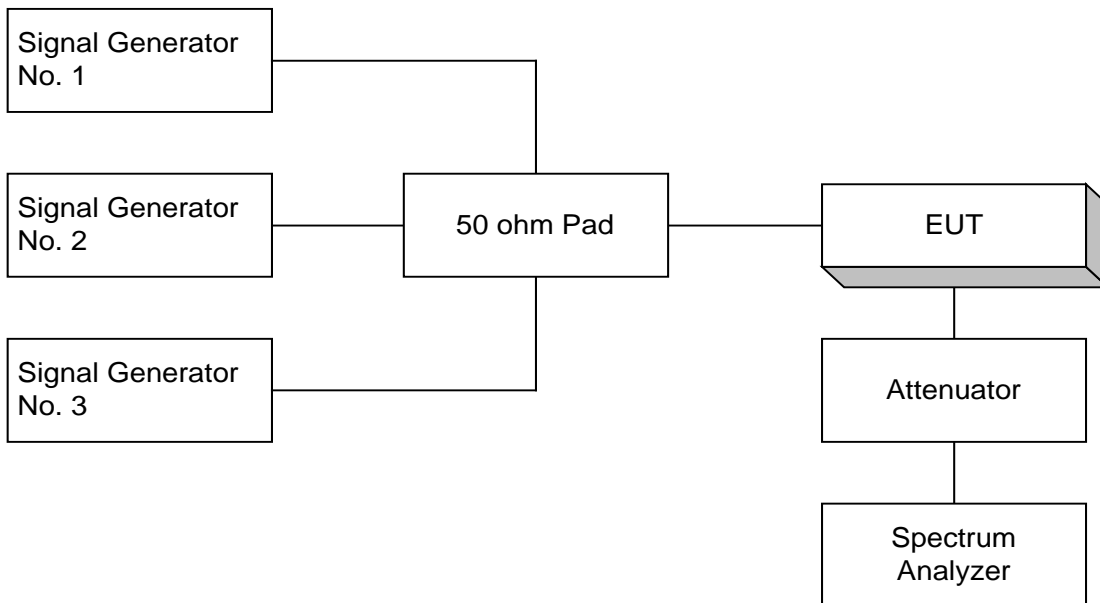
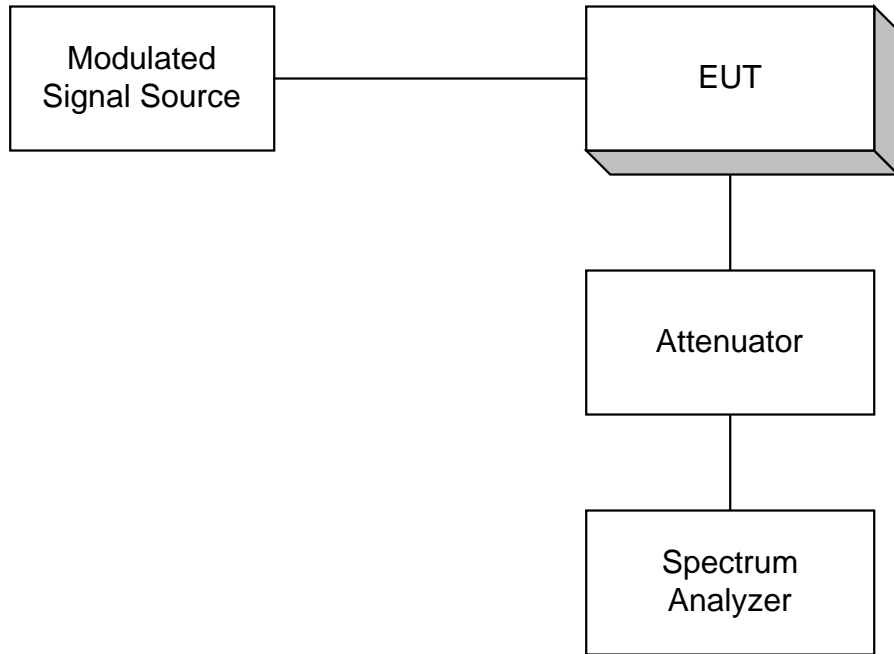
**Para. No. 2.1046 - R.F. Power Output**



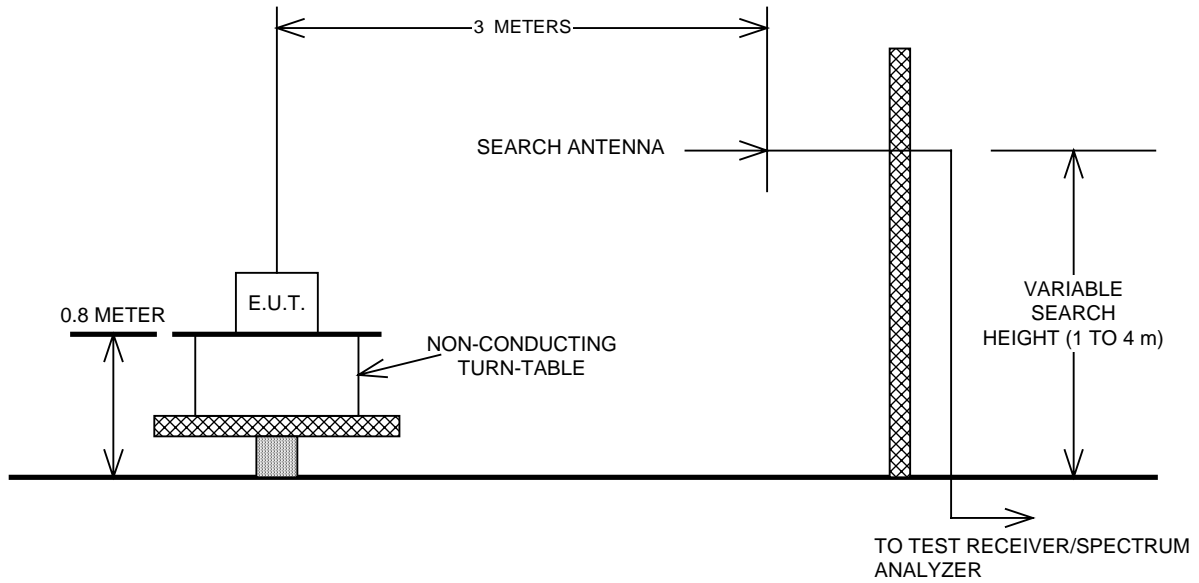
**Para. No. 2.1049 - Occupied Bandwidth**



**Para. No. 2.1051 - Spurious Emissions at Antenna Terminals**



**Para. No. 2.1053 - Field Strength of Radiation**



**Para. No. 2.1055 - Frequency Stability**

