

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

Type(s) of Modulation:	F3E (Voice)	F1D	F2D	D7W (QAM)	F9W
	☐	☐	☐	☐	☒

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



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Carrier EIRP

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Job No.: 4L0618 Date: 10/13/04 Complete X
Preliminary _____

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

Test Equipment Used

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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Data Plot

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Occupied Bandwidth

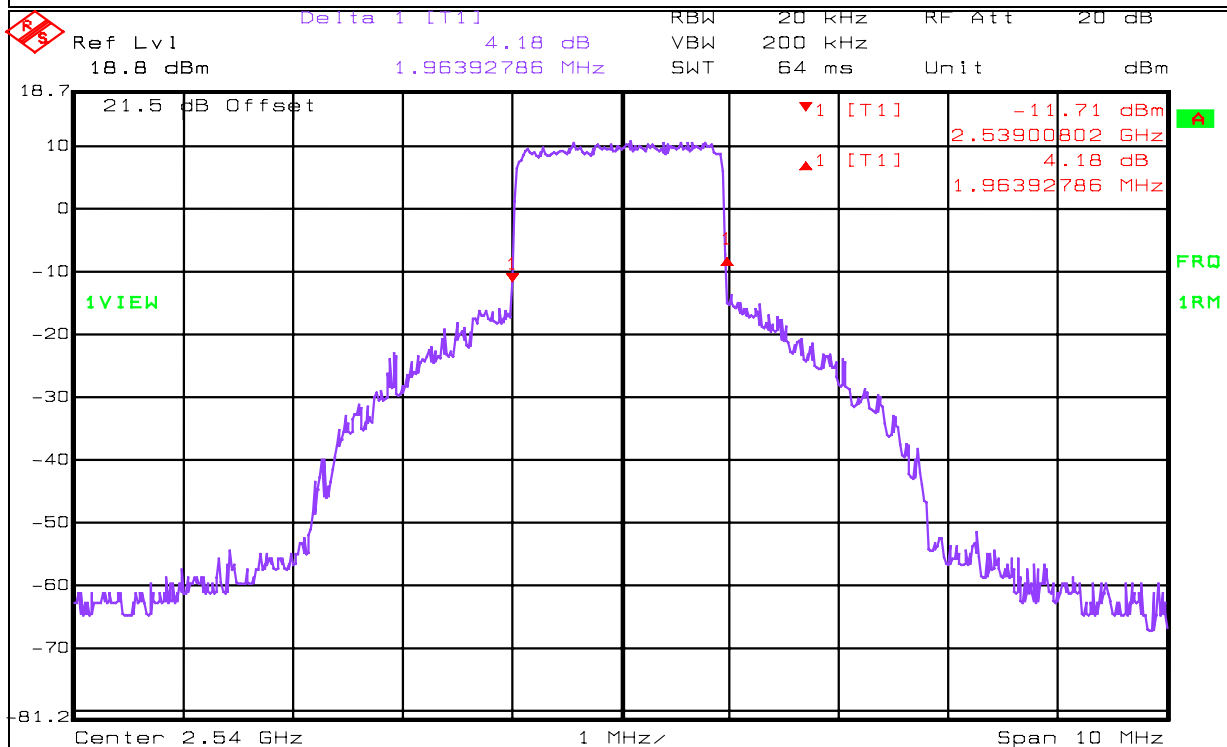
Job No.: 4L0618 Date: 2/21/2004
Specification: PT27 Temperature(°C): 22
Tested By: David Light Relative Humidity(%): 40
E.U.T.: LCD CPE
Configuration: TX
Sample Number: 1
Location: Lab 1 RBW: 20 kHz
Detector Type: Rms VBW: 200 kHz

Complete X
Preliminary: _____

Measurement
Distance: NA m

Test Equipment Used

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:

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

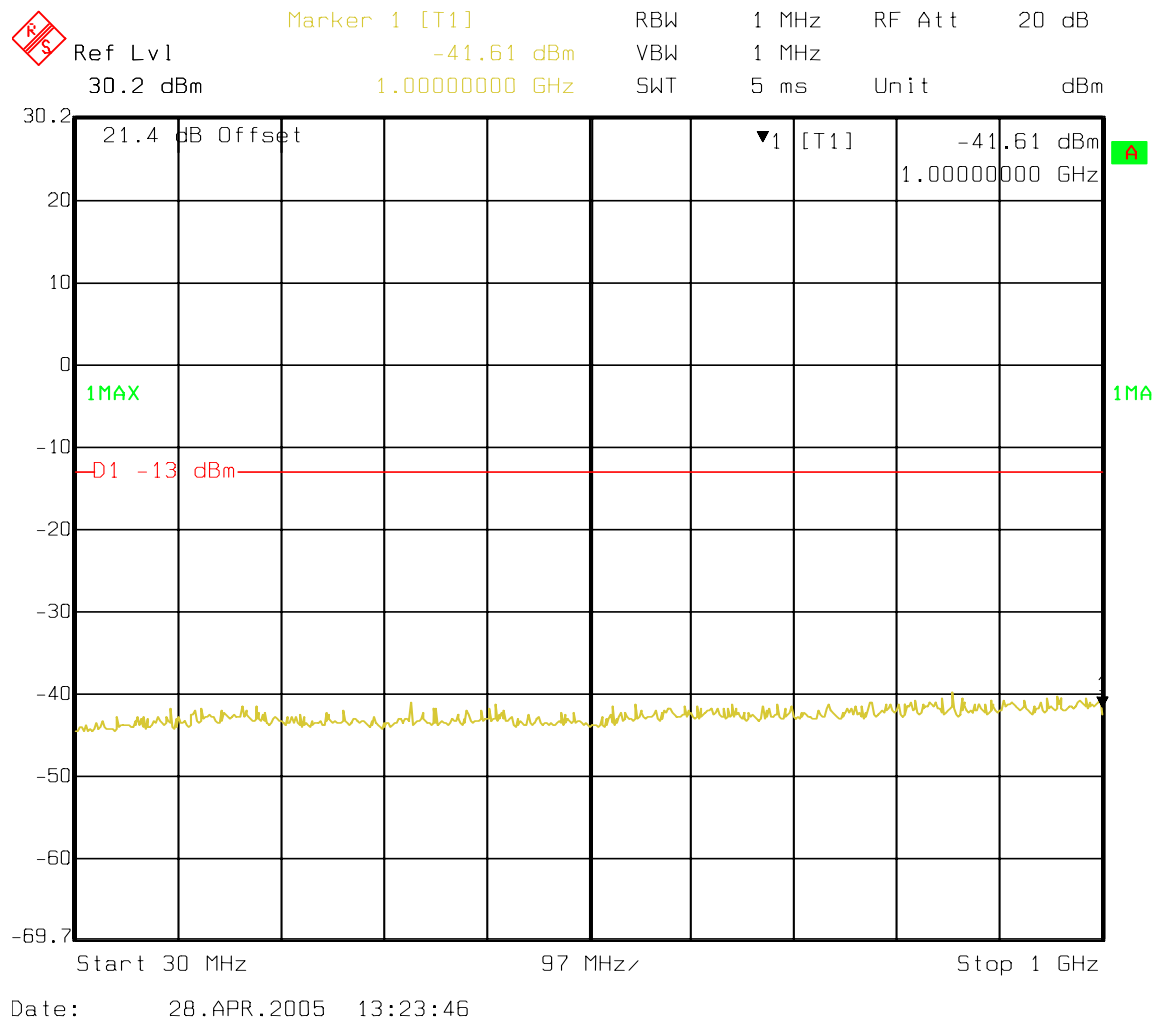
Test Results: Complies

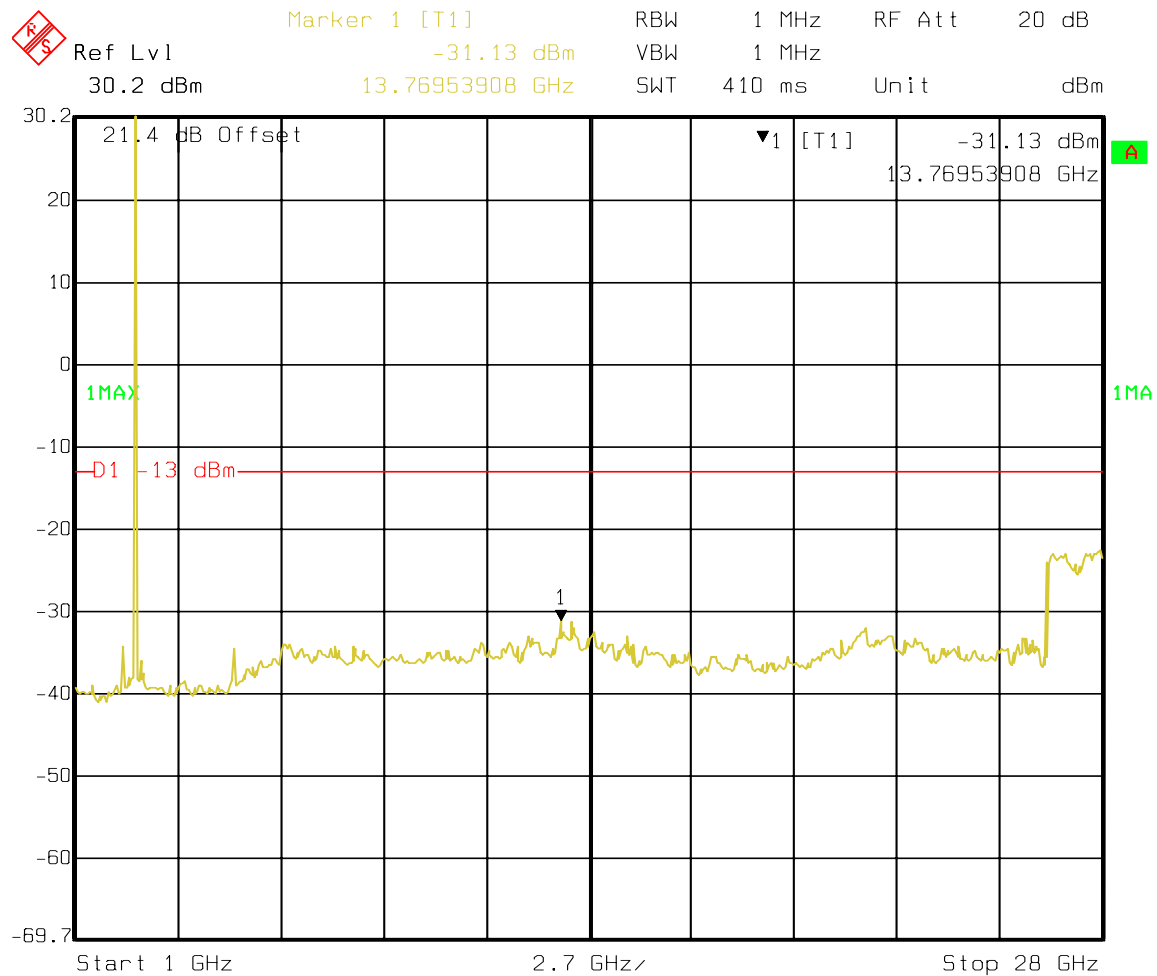
Measurement Data: See attached plots.

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 13:24:49

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.

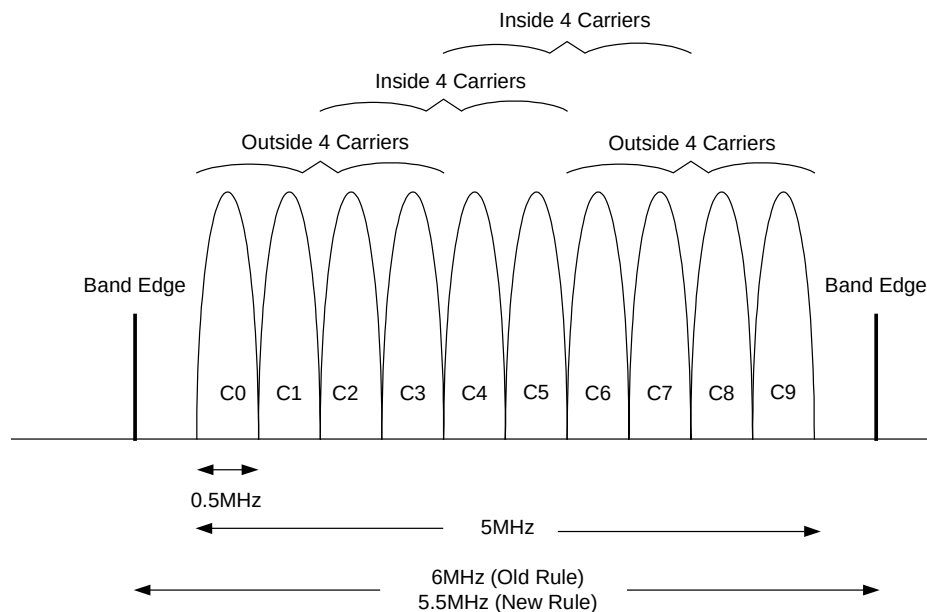
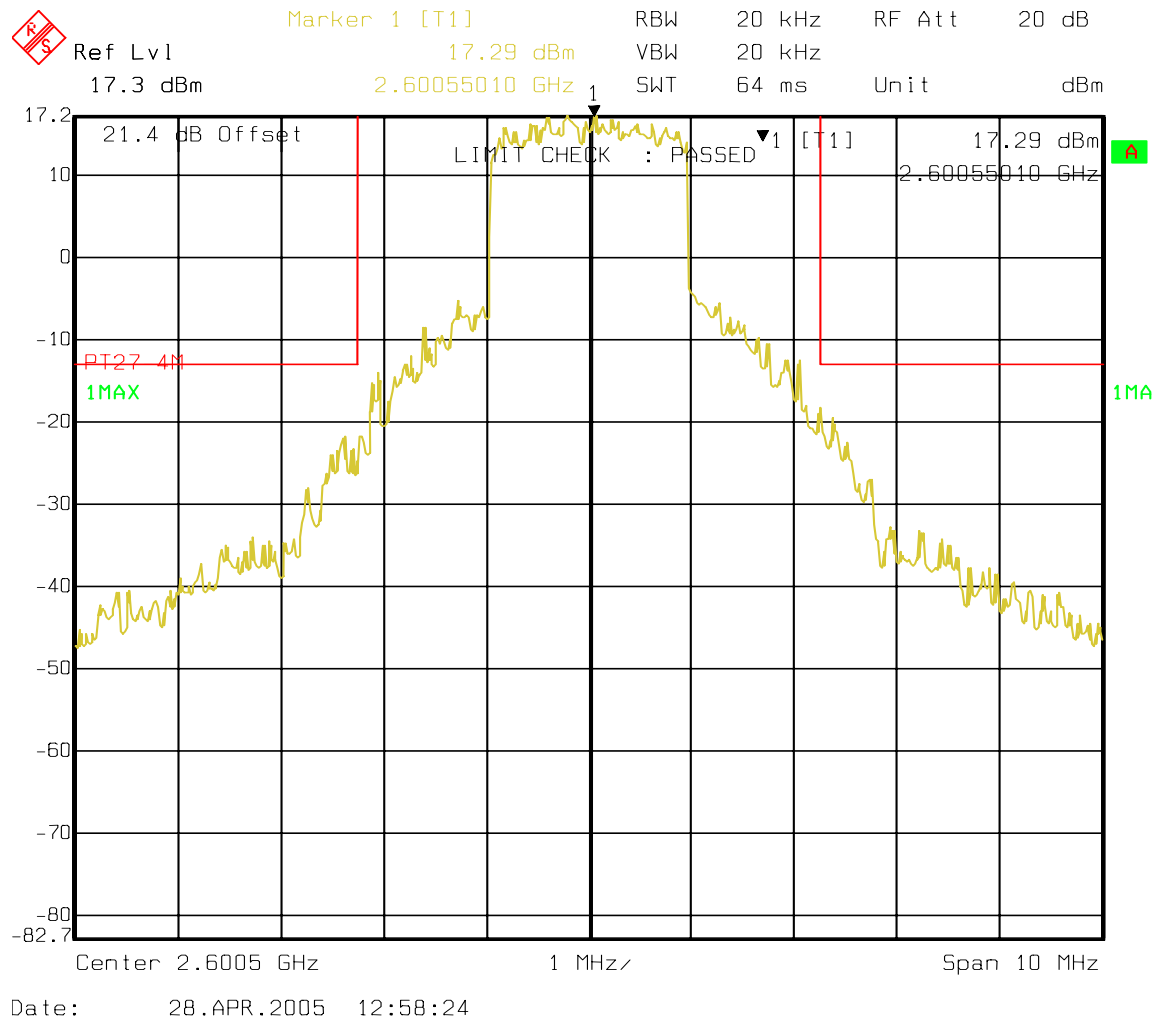
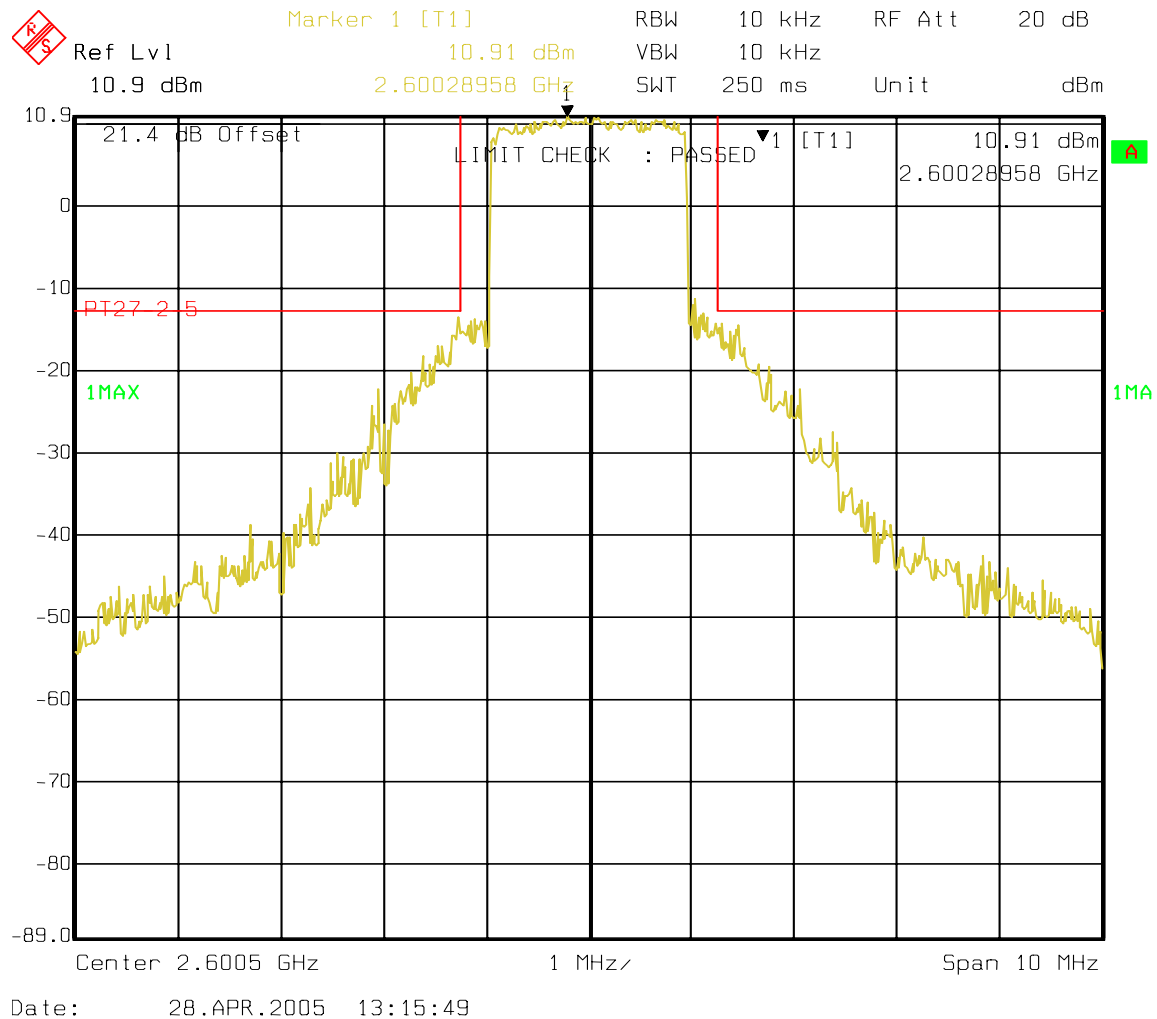


Figure 1. 4-Carrier Signal

Mask Center (Conducted Power at 30.24dBm)



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



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Field Strength of Spurious Emissions

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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.: CPE
Configuration: TX
Sample No: 1
Location: AC 3 RBW: 1 MHz
Detector Type: Peak VBW: 1 MHz

Measurement
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

Test Data - Radiated Emissions



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Field Strength of Spurious Emissions

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Job No.: 4L0618 Date: 2/22/05 Complete X
Preliminary _____

Specification: PT27 Temperature(°C): 22
Tested By: David Light Relative Humidity(%) 40

E.U.T.: LCD CPE

Configuration: TX

Sample No: 1

Location: AC 3 RBW: 1 MHz Measurement
Detector Type: Peak VBW: 1 MHz Distance: 3 m

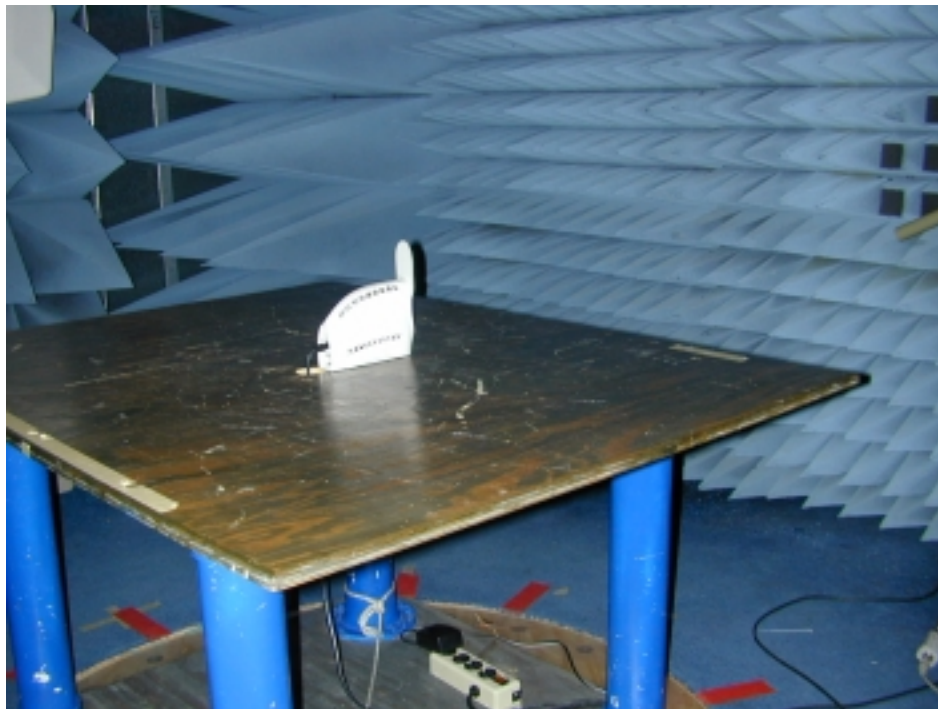
Test Equipment Used

Antenna: 1304 Directional Coupler: _____
Pre-Amp: 1016 Cable #1: 1484
Filter: 1482 Cable #2: 1485
Receiver: 1036 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
										Window Mount Ant.
5200	-39.4	36.3		32	11.2		-23.9	0.00	H	
10400	-55.2	42.5		35.3	12.7		-35.3	0.00	H	
5200	-41.0	40.6		32	11.2		-21.2	0.01	V	
10400	-57.0	41.0		35.3	12.7		-38.7	0.00	V	
Searched the spectrum 30 MHz to 26 GHz										
All emissions detected within 20 dB of the spec limit were reported										

The spectrum was searched from 30 MHz to the 10th harmonic of the carrier.

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.

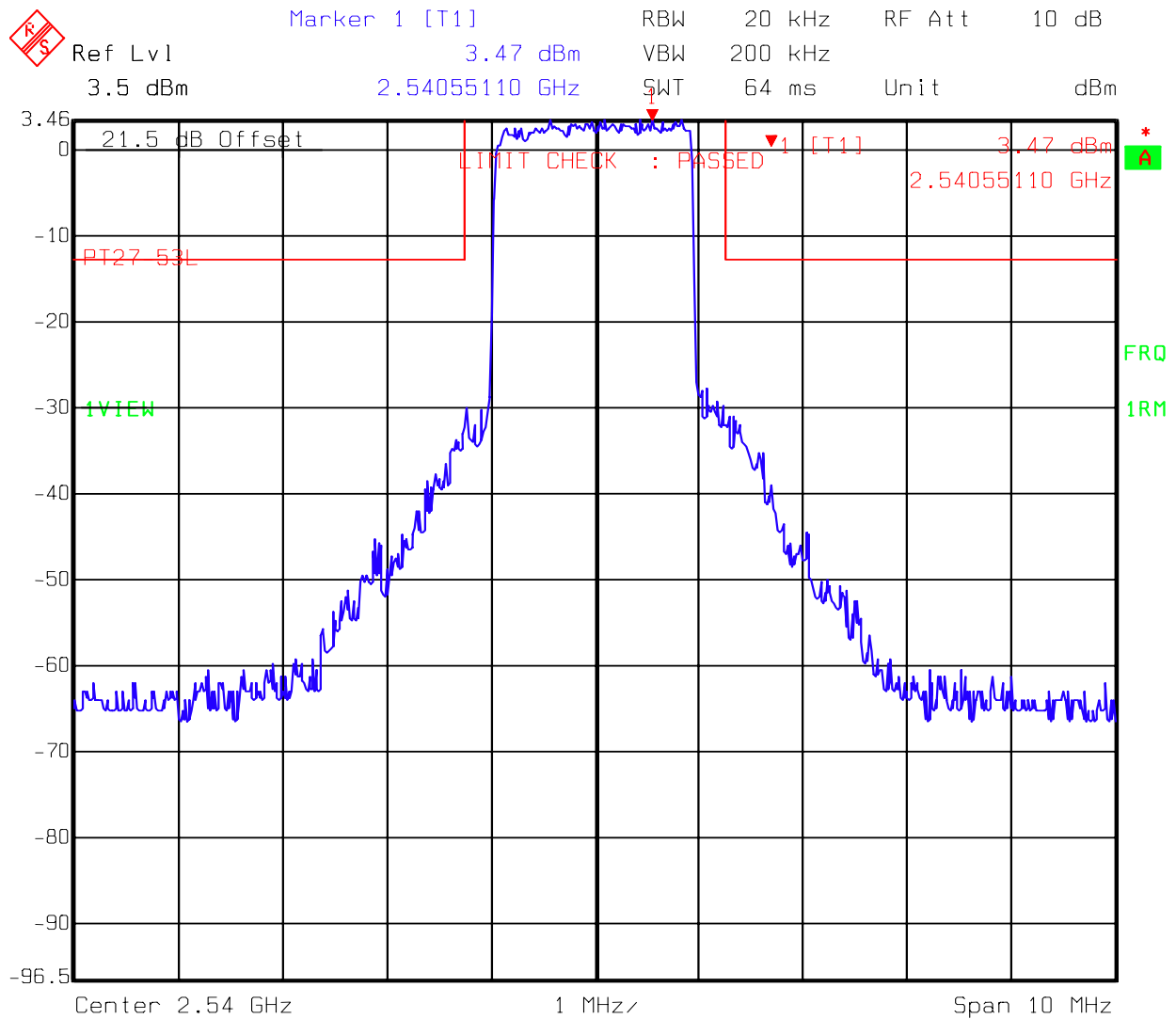
Test Equipment Used: 1036-1469-1474-1625-283-619

Standard Supply Voltage: 120 Vac

Environmental Conditions: 20 °Celsius
50 % RH

Test Data – Frequency Stability

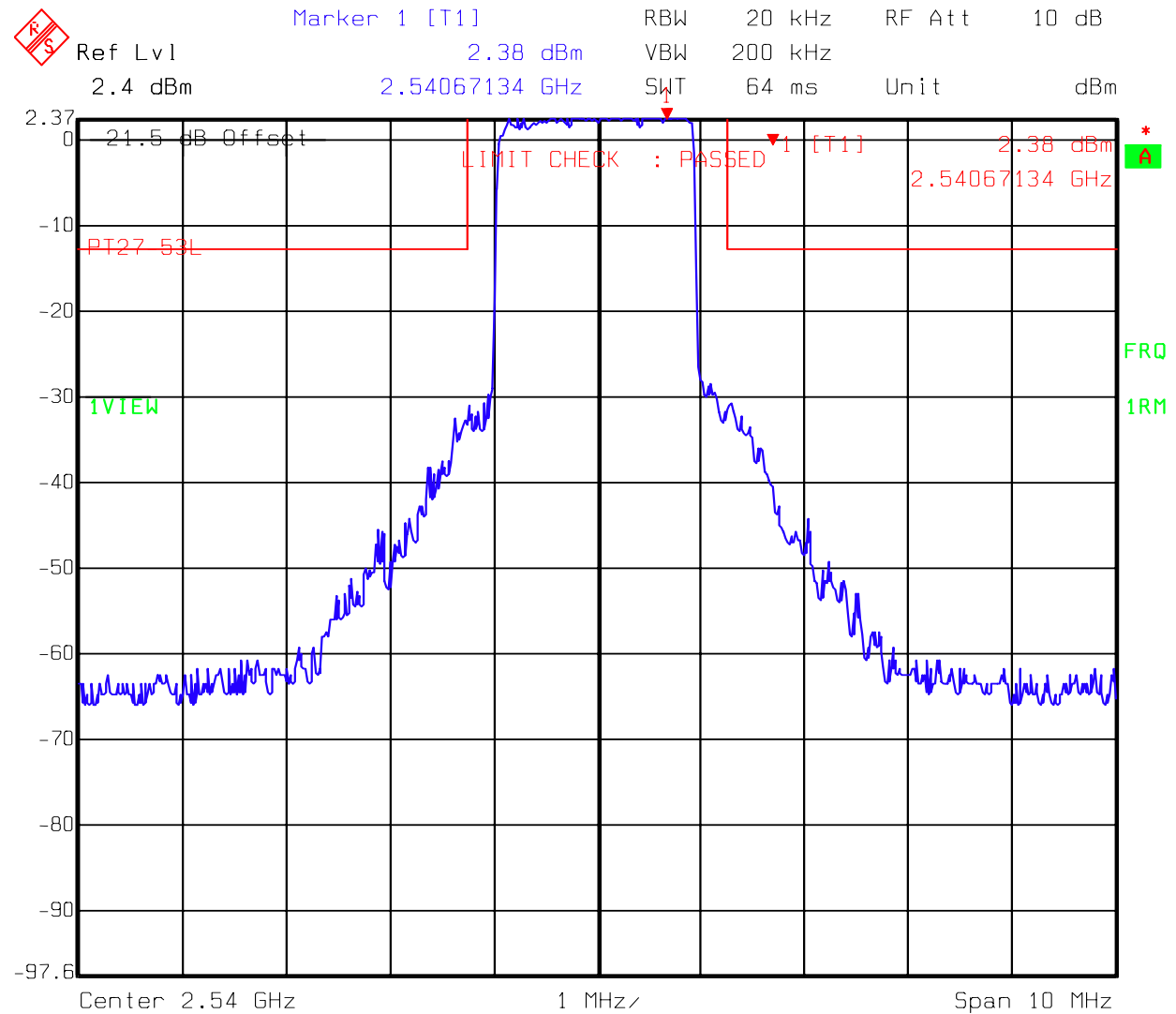
+20 C / 102 Vac



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

Test Data – Frequency Stability

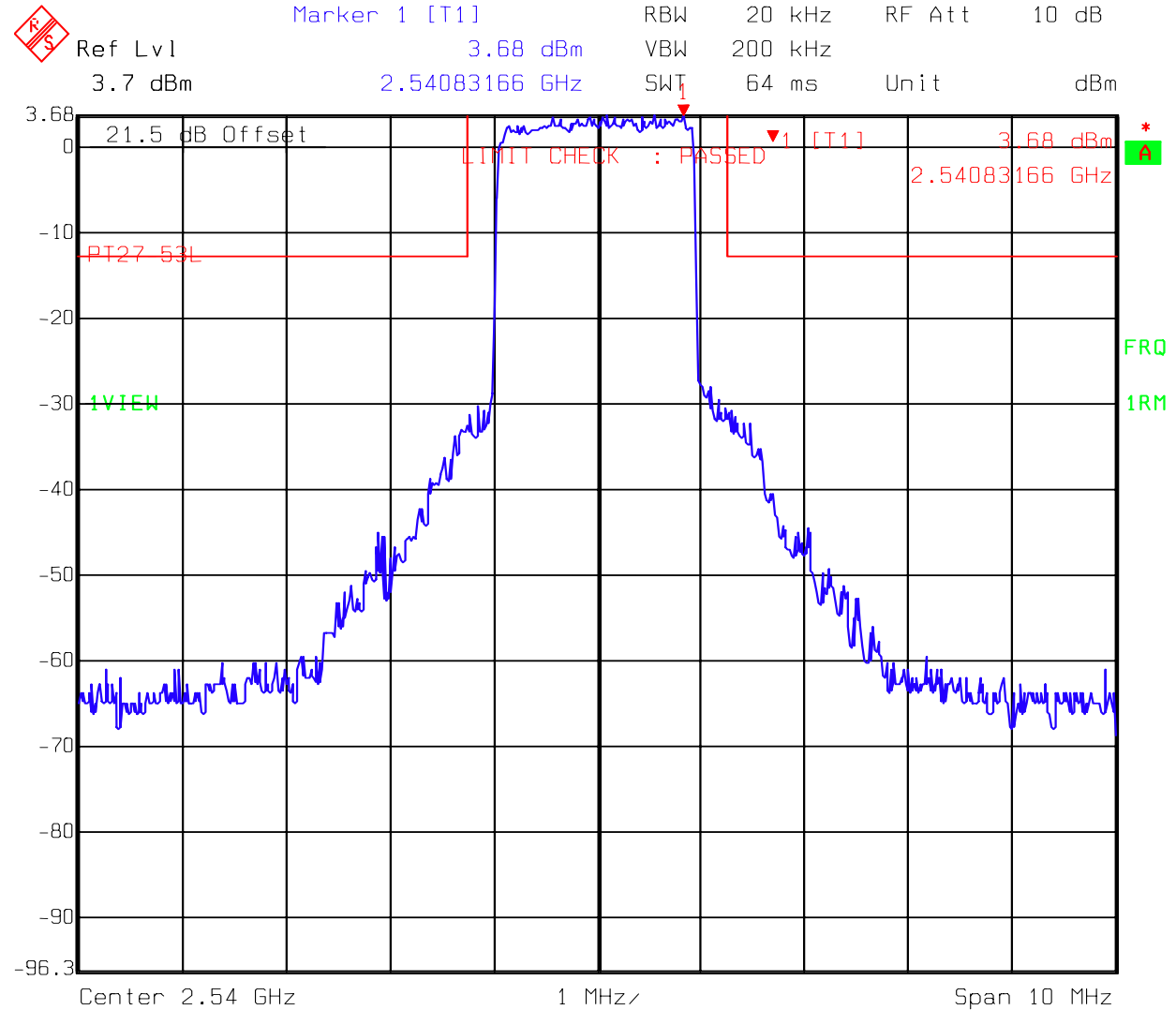
+20 C/ 138 Vac



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

Test Data – Frequency Stability

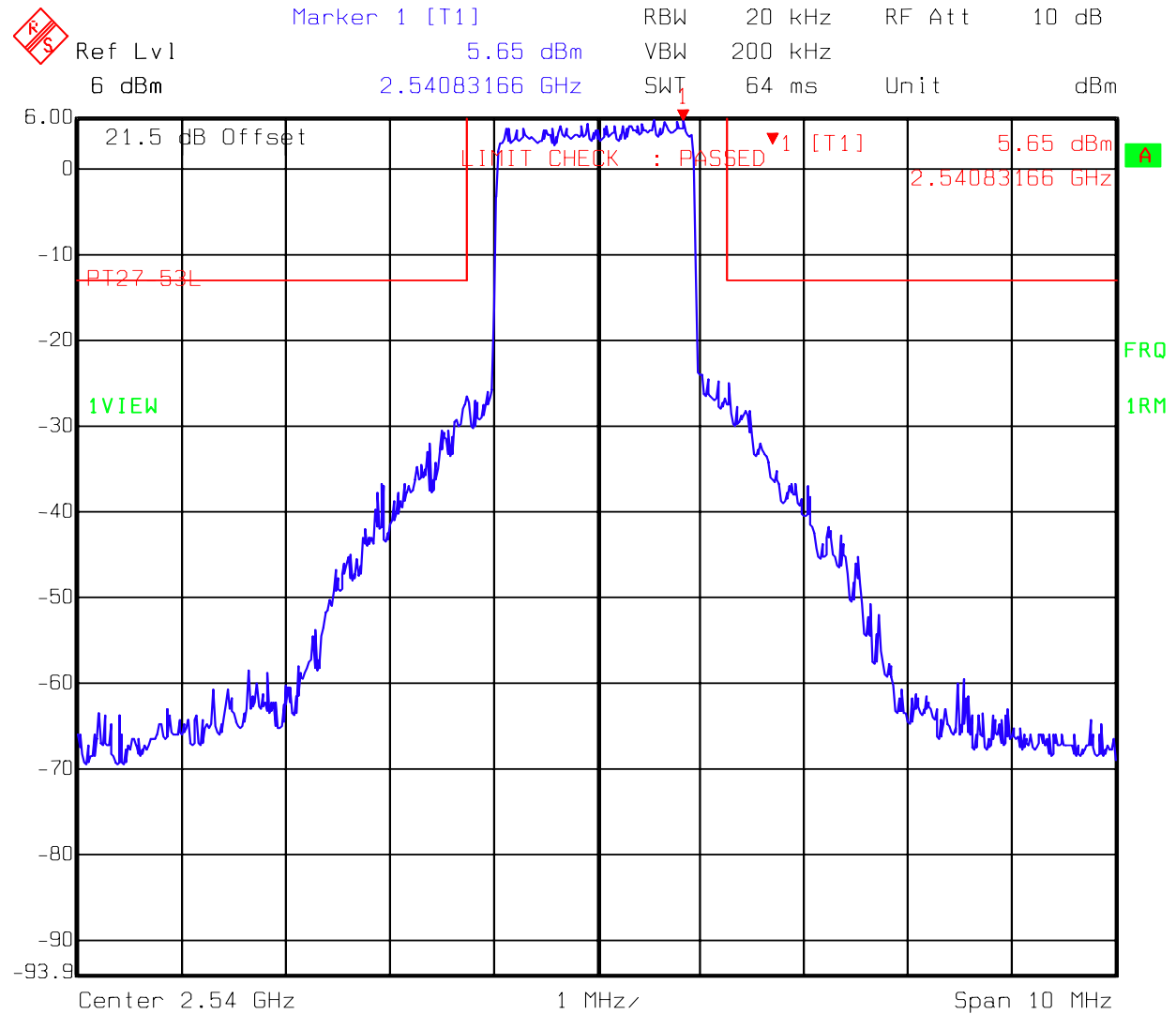
+20 C / 120 Vac



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

Test Data – Frequency Stability

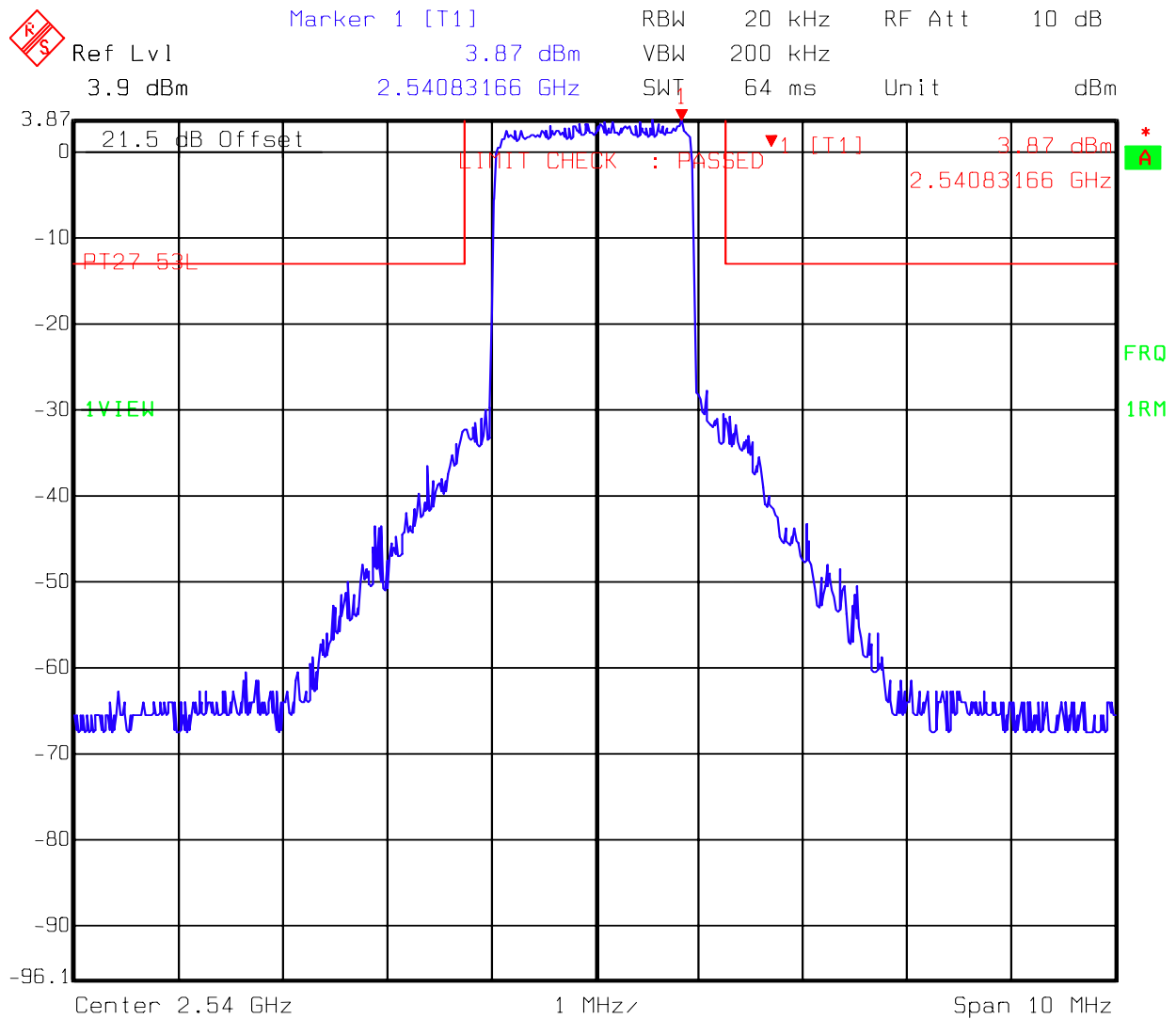
+50 C



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

Test Data – Frequency Stability

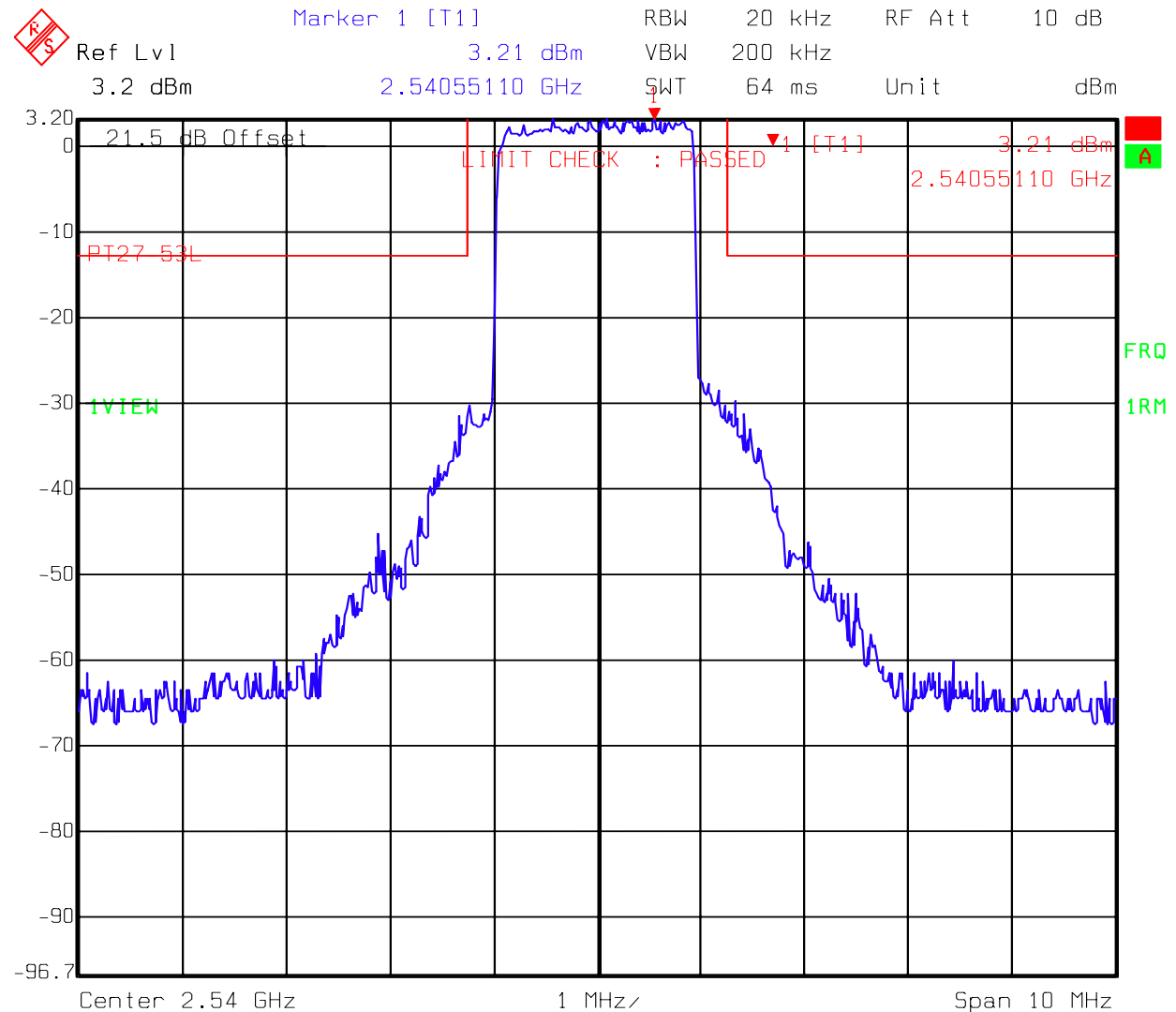
+40 C



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

Test Data – Frequency Stability

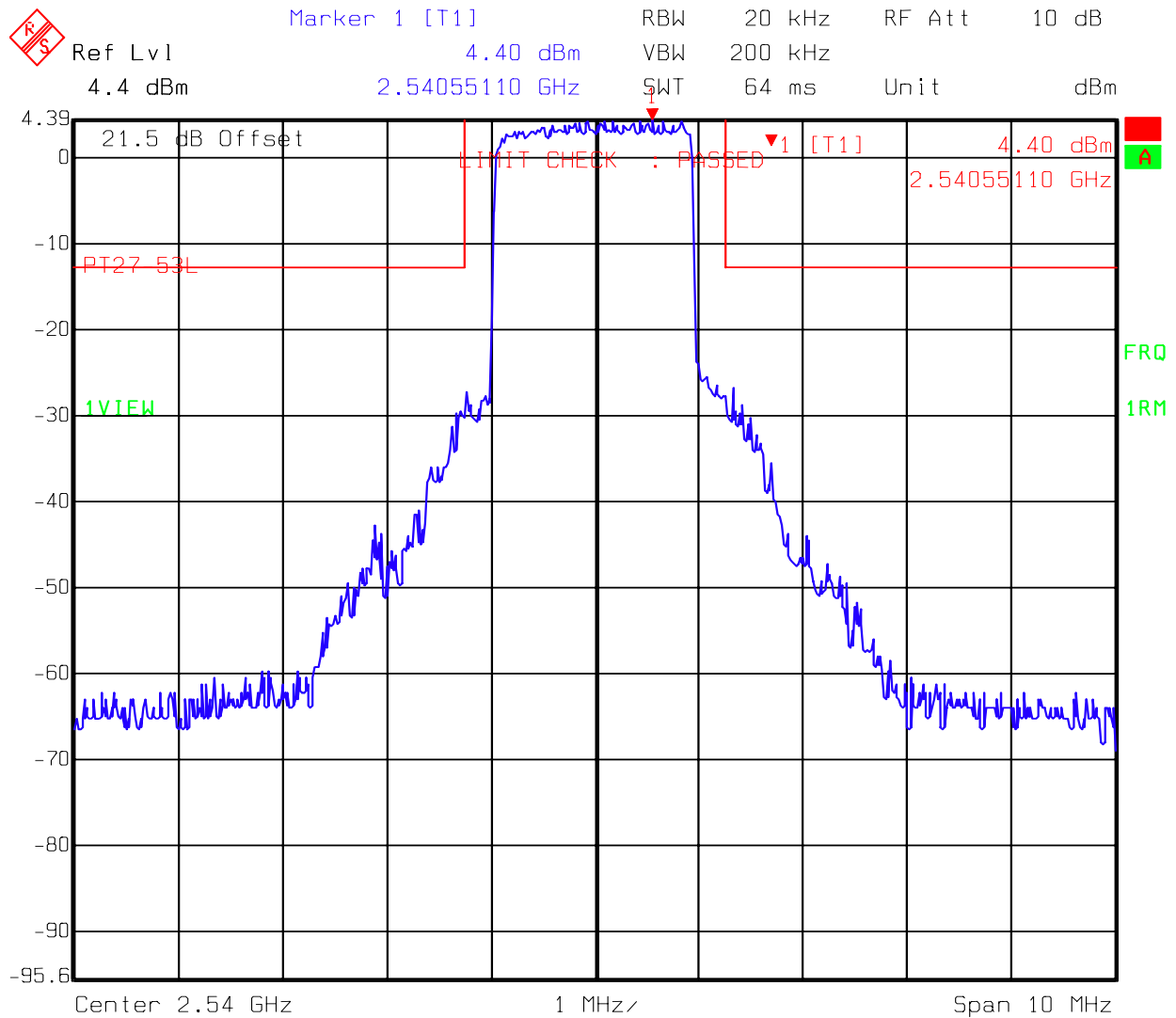
+30 C



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

Test Data – Frequency Stability

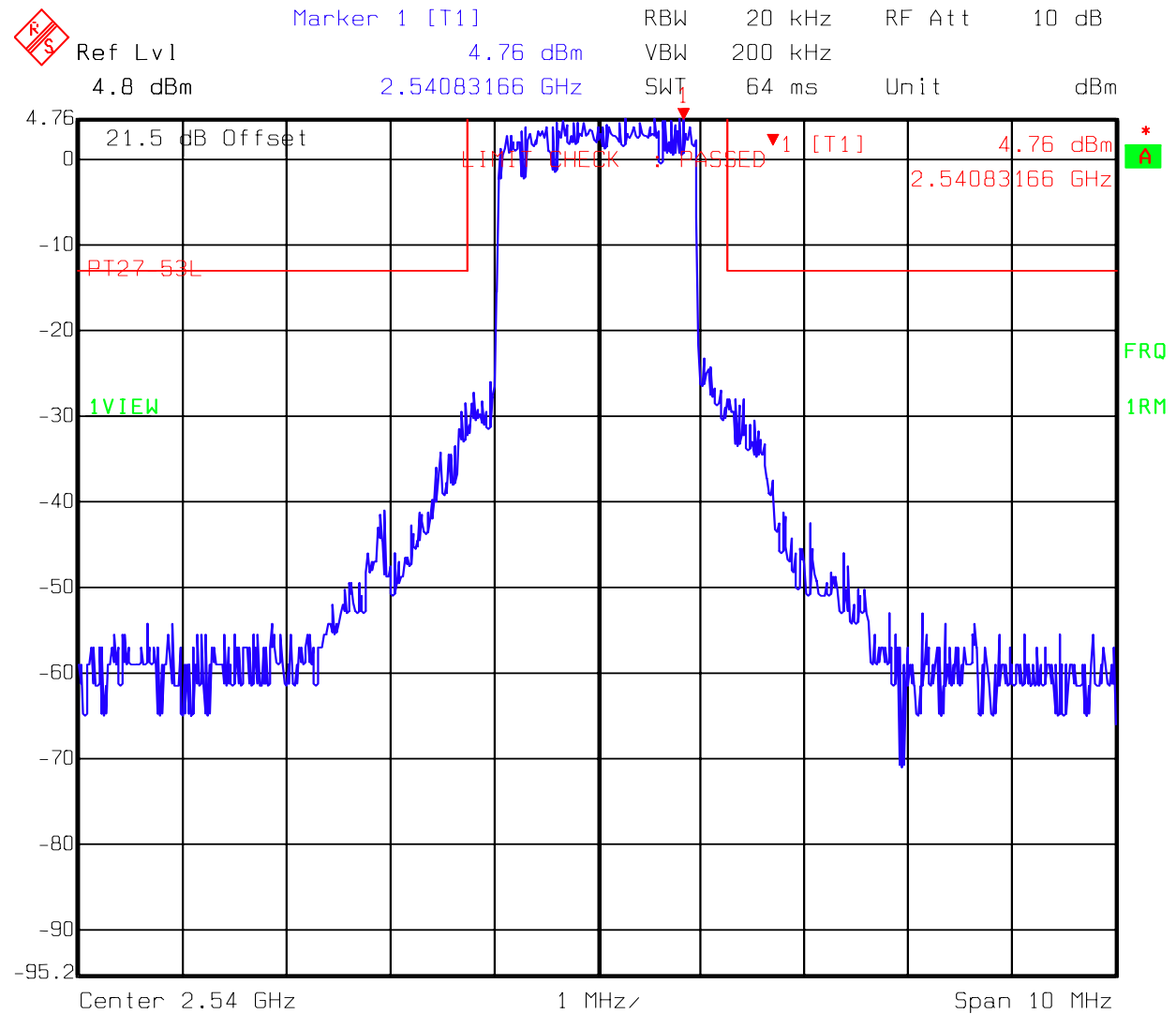
10 C



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

Test Data – Frequency Stability

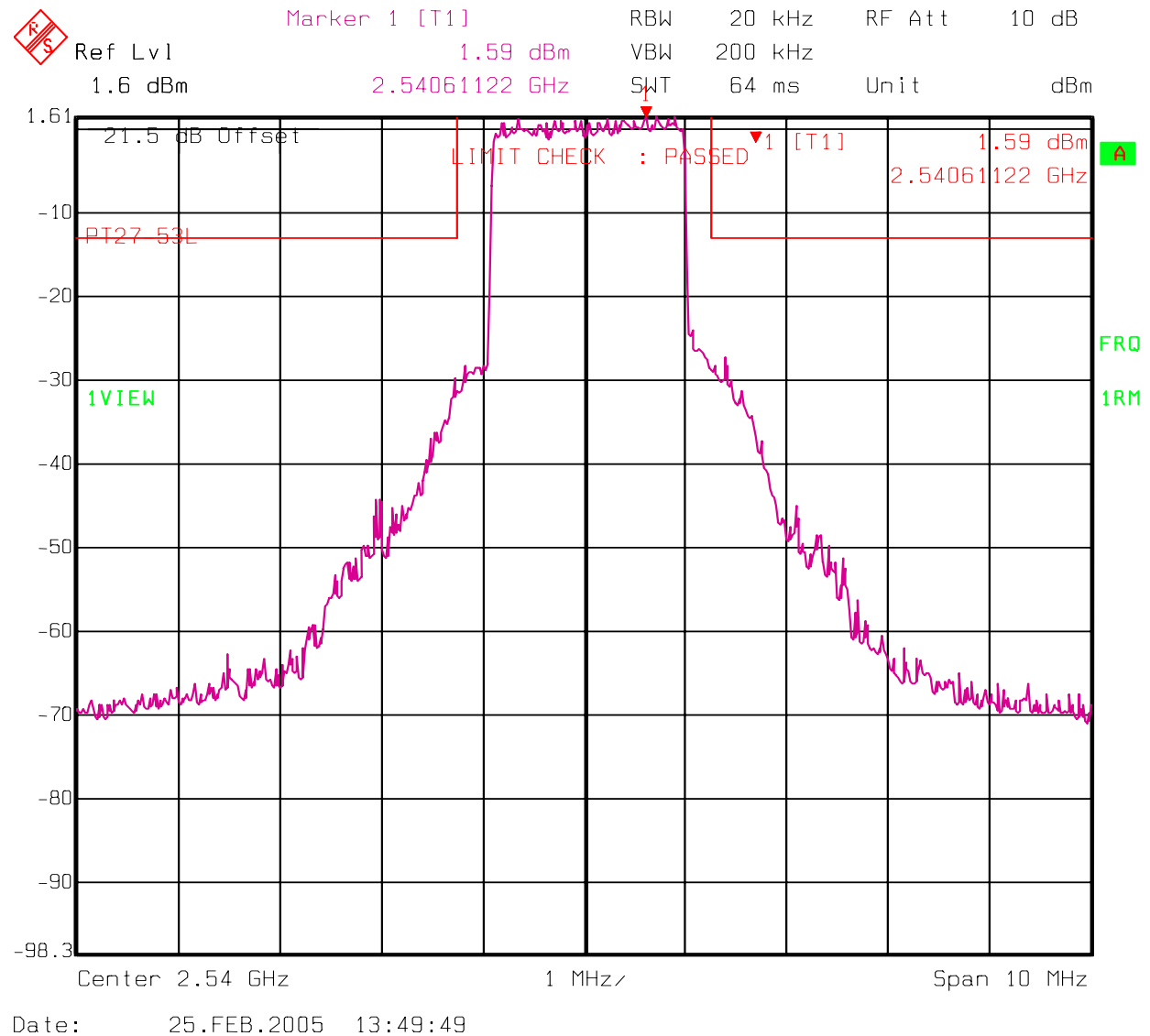
0 C



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

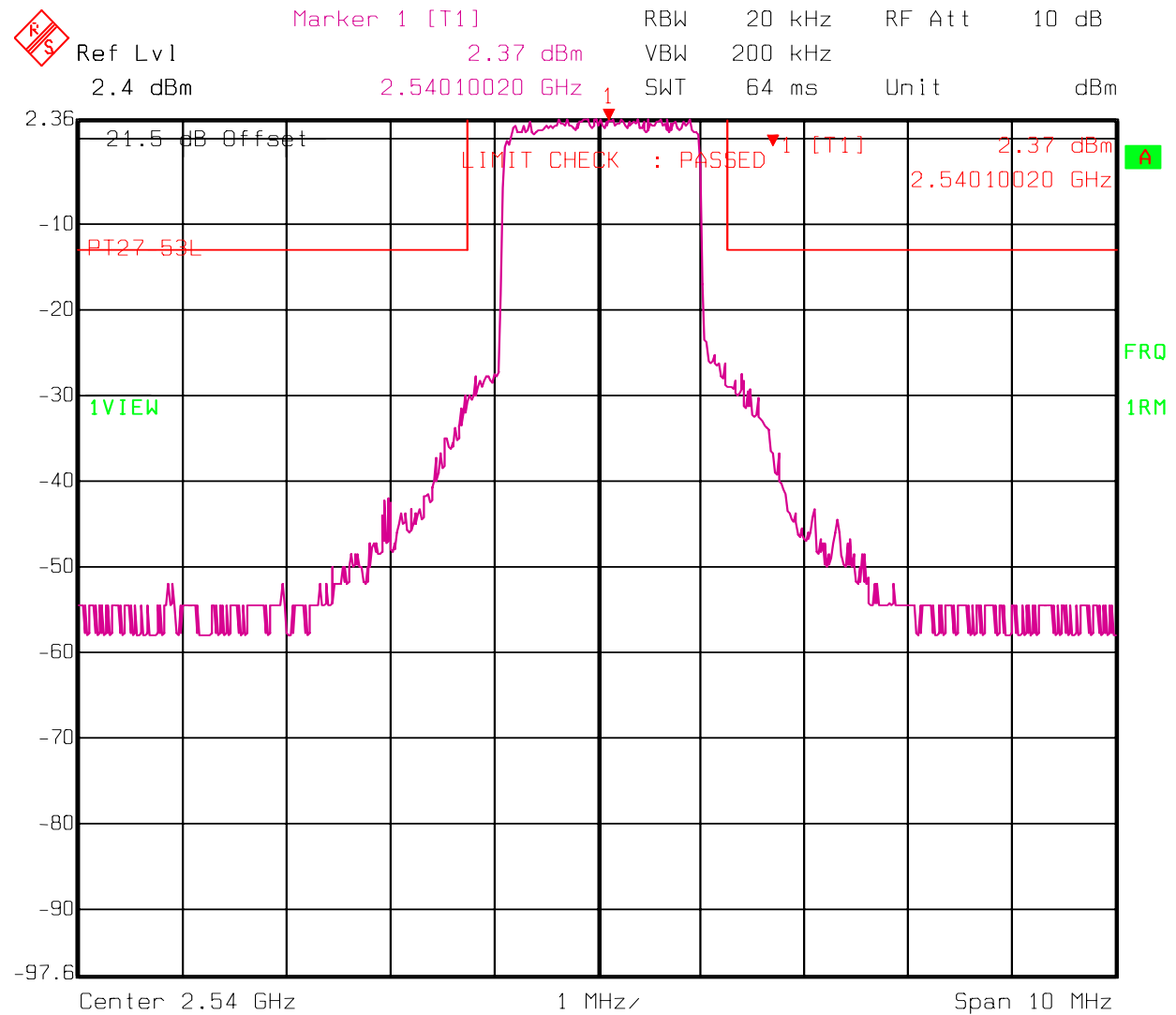
Test Data – Frequency Stability

-10 C



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

NAME OF TEST: RF Power Output**PARA. NO.: 2.1046****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

NAME OF TEST: Occupied Bandwidth**PARA. NO.: 2.1049****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.

NAME OF TEST: Field Strength of Spurious Radiation	PARA. NO.: 2.1053
---	--------------------------

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.

NAME OF TEST: Frequency Stability**2.1055****Method Of Measurement:****Frequency Stability With Voltage Variation:**

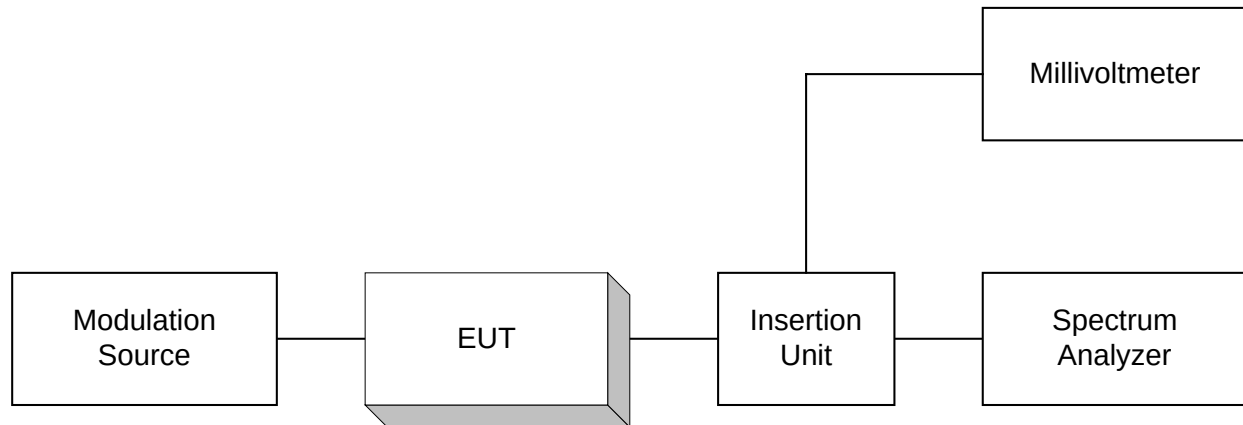
The E.U.T. is placed in an environmental chamber and allowed to stabilize at +20 degrees Celsius for at least 15 minutes. The frequency counter and signal generator are phase locked with the same 10 MHz reference frequency by connecting the 10 MHz ref. out of the counter to the 10 MHz ref, in of the 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:

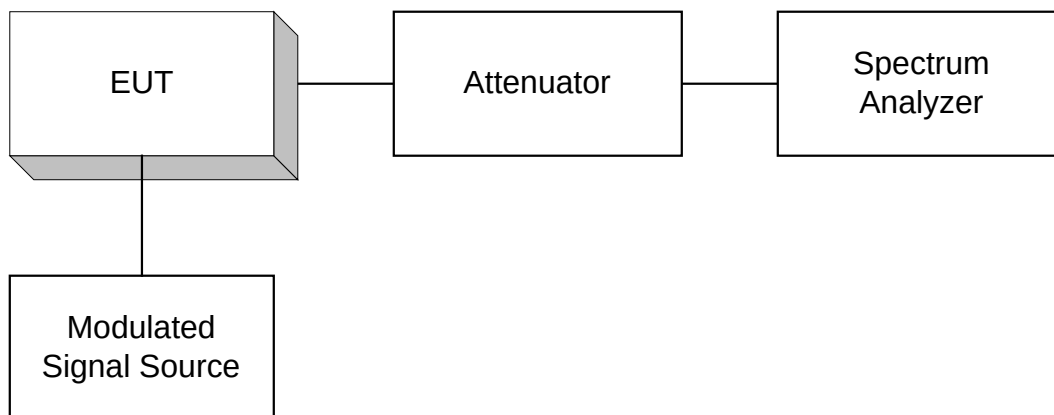
The input voltage to the E.U.T. is set to S.T.V. and the temperature of the environmental chamber is varied in 10 degree steps from -30 degrees C to +50 degrees C. The E.U.T. is allowed to stabilize at each temperature and the frequency is measured in 30 second intervals for a period of 5 minutes.

ANNEX B - TEST DIAGRAMS

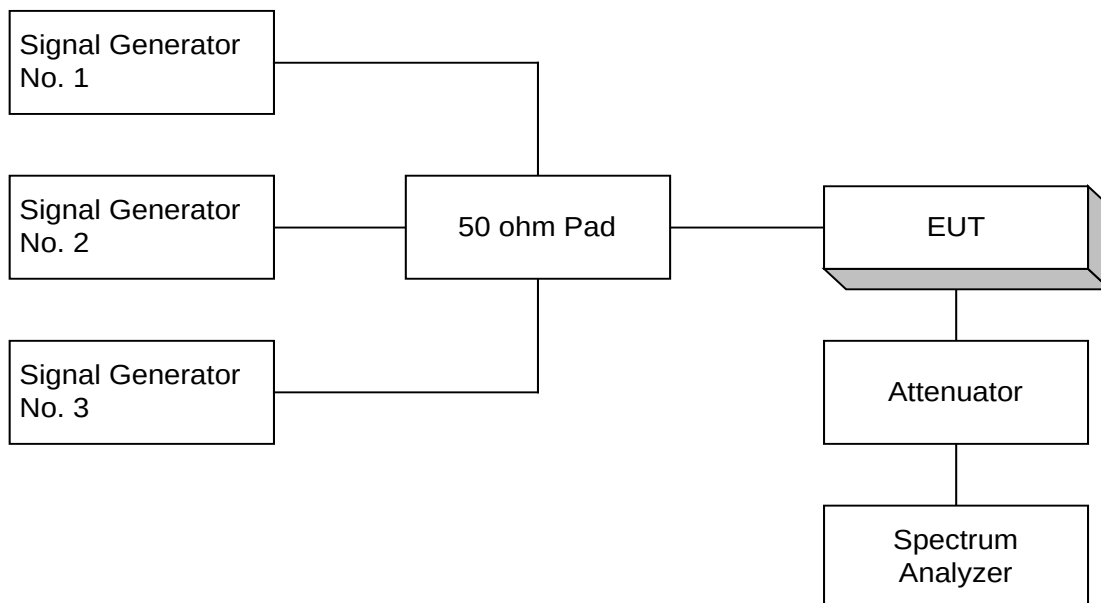
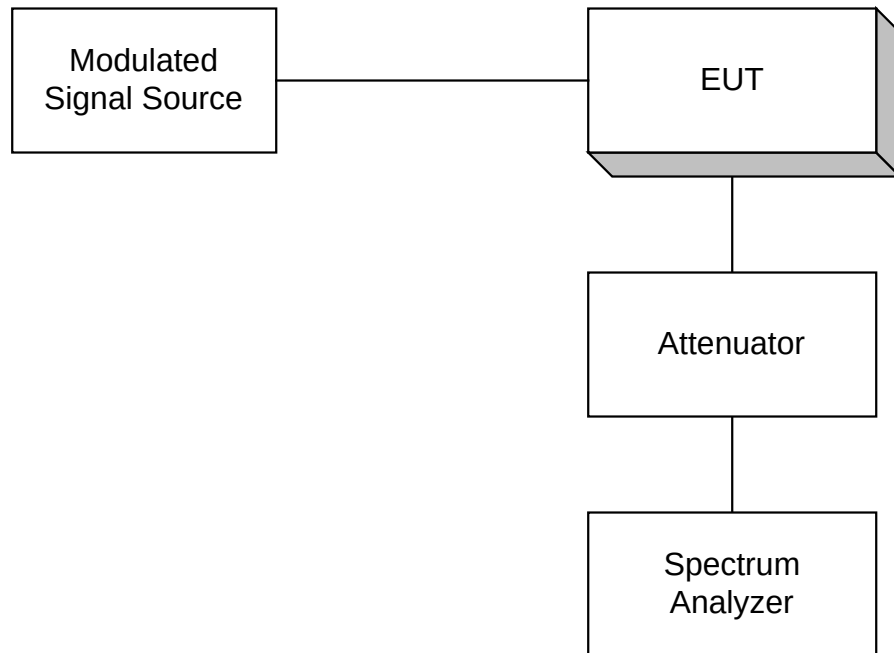
Para. No. 2.1046 - R.F. Power Output



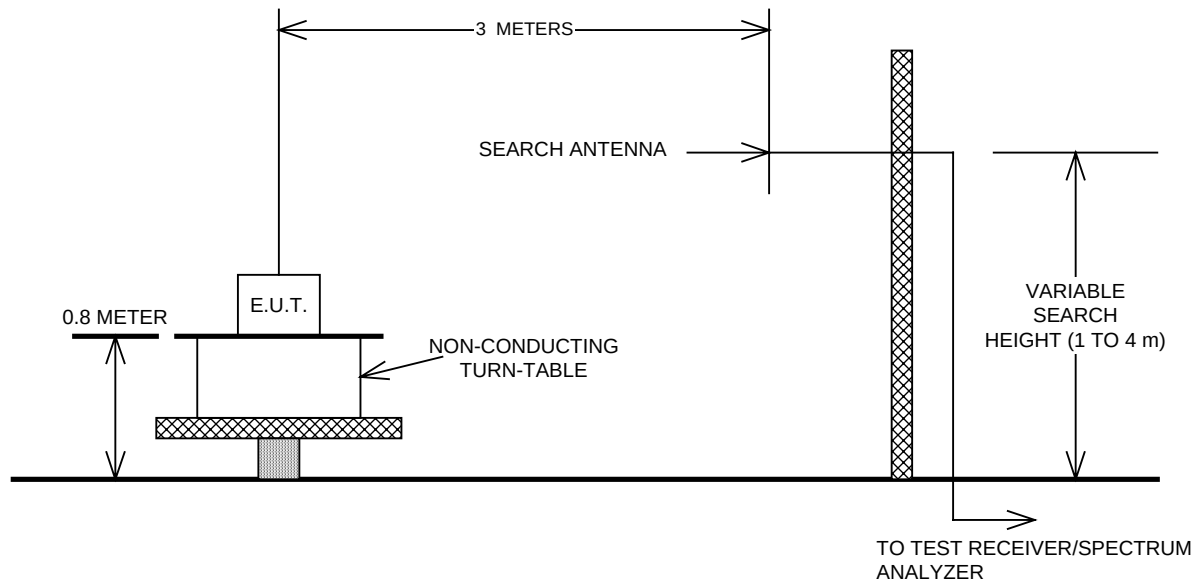
Para. No. 2.1049 - Occupied Bandwidth



Para. No. 2.1051 - Spurious Emissions at Antenna Terminals



Para. No. 2.1053 - Field Strength of Radiation



Para. No. 2.1055 - Frequency Stability

