

Nemko Test Report: 6L0170RUS1 rev 1

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

Equipment Under Test: 2.5-2.6-BTS3A-R1
2.5-2.6-BTS3T-R1
2.5-2.6-BTS3F-R1

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

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

A handwritten signature in black ink, appearing to read "David Light", is positioned above the "Authorized By" field.

Authorized By: David Light, Senior Wireless Engineer

Date: 14 June 2006

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Section 1. Summary of Test Results

Manufacturer: Navini Networks

Model No.: 2.5-2.6-BTS3A-R1
2.5-2.6-BTS3T-R1
2.5-2.6-BTS3F-R1

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

Section 2. General Equipment Specification

Power Supply	120 Vac
Frequency Range	2503 to 2683.5 MHz
Type(s) of Modulation:	F3E (Voice) F1D F2D W7D F9W
	☐ ☐ ☐ ☒ ☒
Emission Designator	5M00F9W and 4M76W7D
Output Impedance:	50 ohms
RF Power Output:	33 dBm Conducted
Duty Cycle:	50% TDD
Selection Of Operating Frequency:	Not selectable by operator
Power Output Adjustment Capability:	Not selectable by operator

Nemko USA, Inc.

FCC PART 27, SUBPART C

Broadband Radio Service and Educational Broadband Service

EQUIPMENT: 2.5-2.6-BTS3T-R1

PROJECT NO.:6L0170RUS1 rev 1

Description of EUT

2.5-2.6-BTS3A-R1

2.5-2.6-BTS3T-R1

2.5-2.6-BTS3F-R1

Is a Point to Multi point base station.

System Diagram

Refer to separate exhibit.

Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 2.1046
TESTED BY: Kevin Rose	DATE: 05/28/2006

Test Results: Complies

Measurement Data: See Tables.

Test Equipment: 1659, 1055, 1081, 1474, 1471, 2071, 2072.

MAX RF POWER OUTPUT**Navini Mode**

Freq	Power (dBm)	Power (Watts)
2.503	33.2	2
2.590	33.0	2
2.6835	33.3	2

OFDM Mode

Freq	Power (dBm)	Power (Watts)
2.503	33.1	2
2.590	33.2	2
2.6835	33.2	2

Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.1049
TESTED BY: Kevin Rose	DATE: 05/27/2006

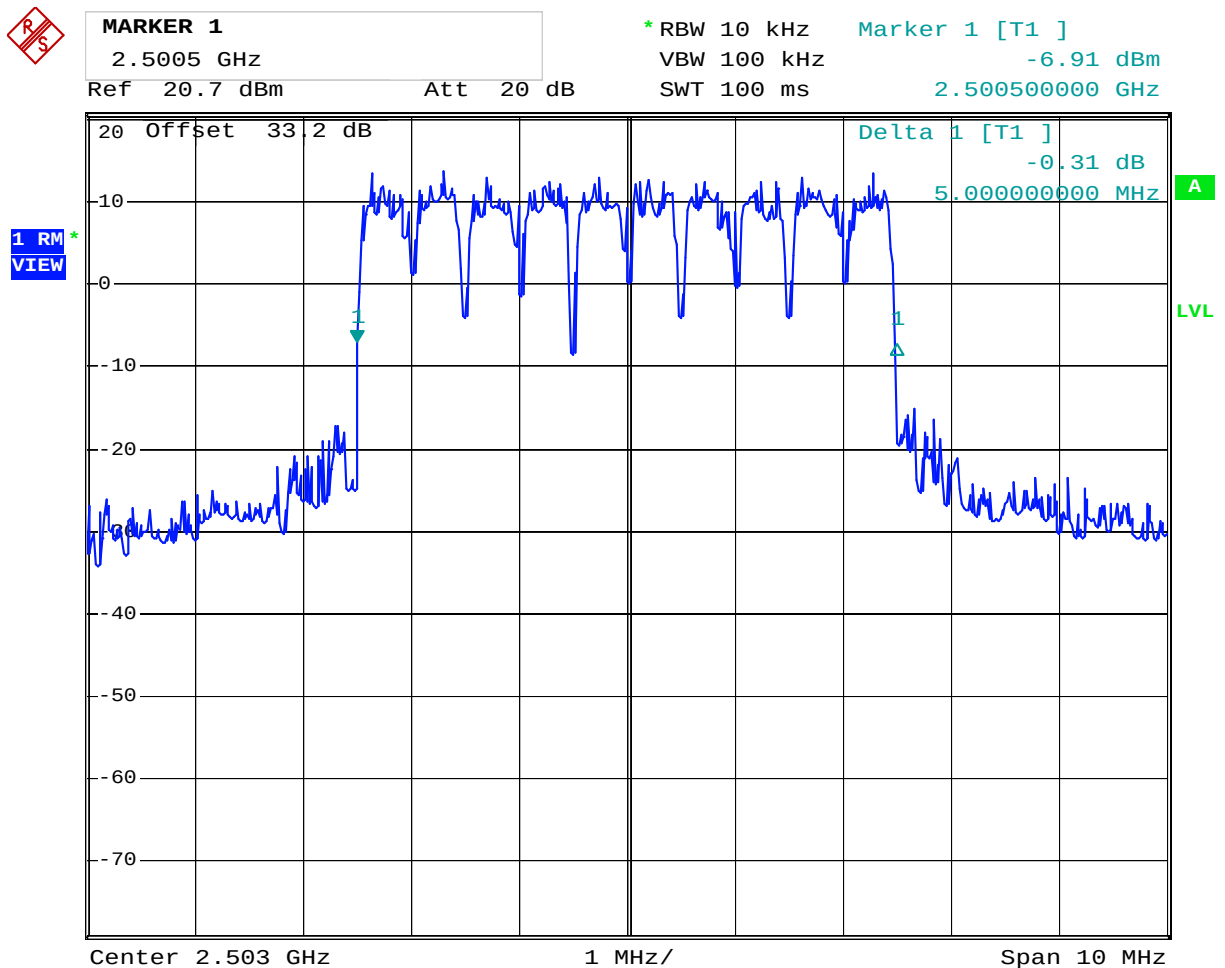
Test Results: Complies

Measurement Data: See attached plots.

Test Equipment: 1659, 1055, 1081, 1474, 1471, 2071,2072.

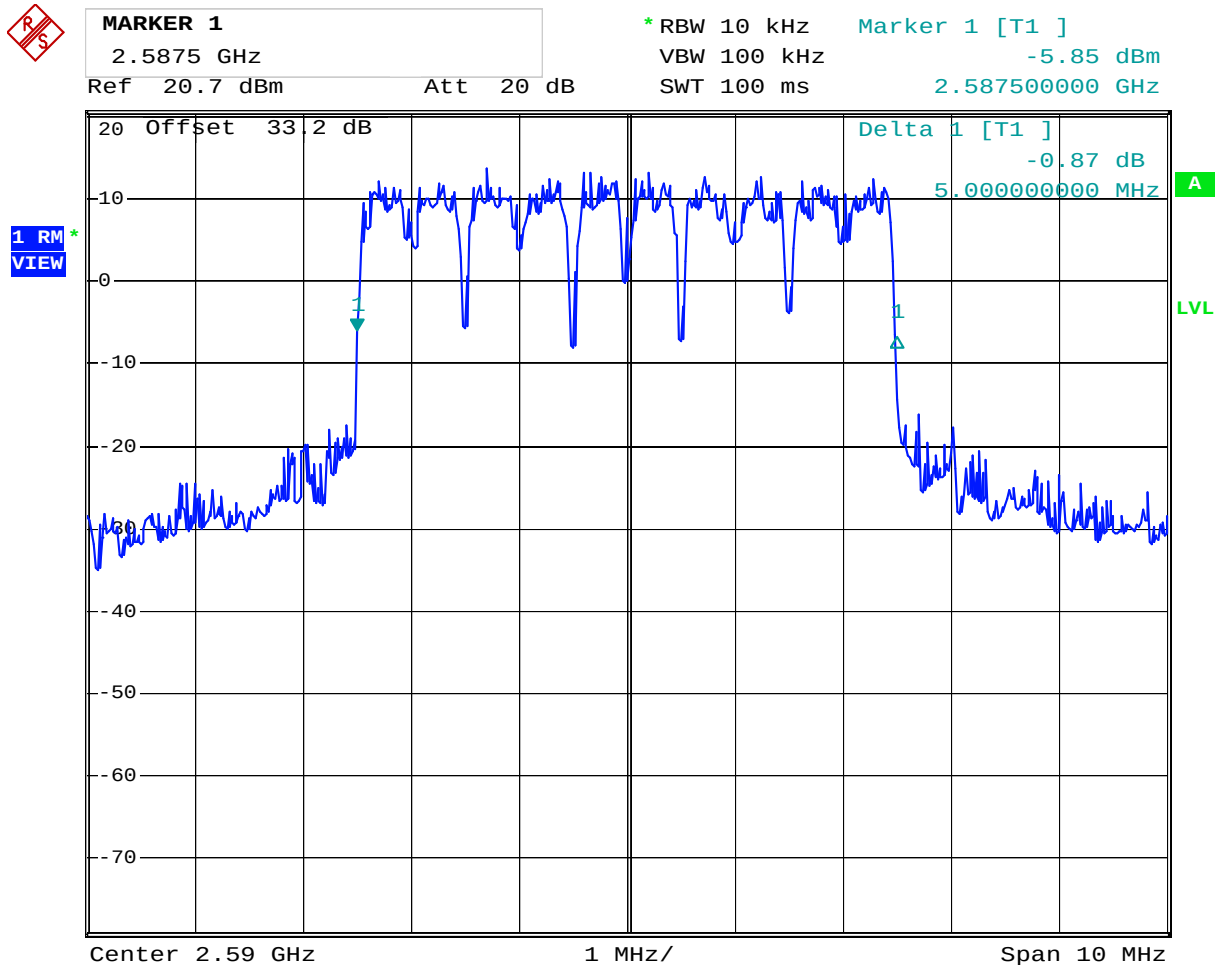
Test Data – Occupied Bandwidth

2.503 GHz Navini Mode



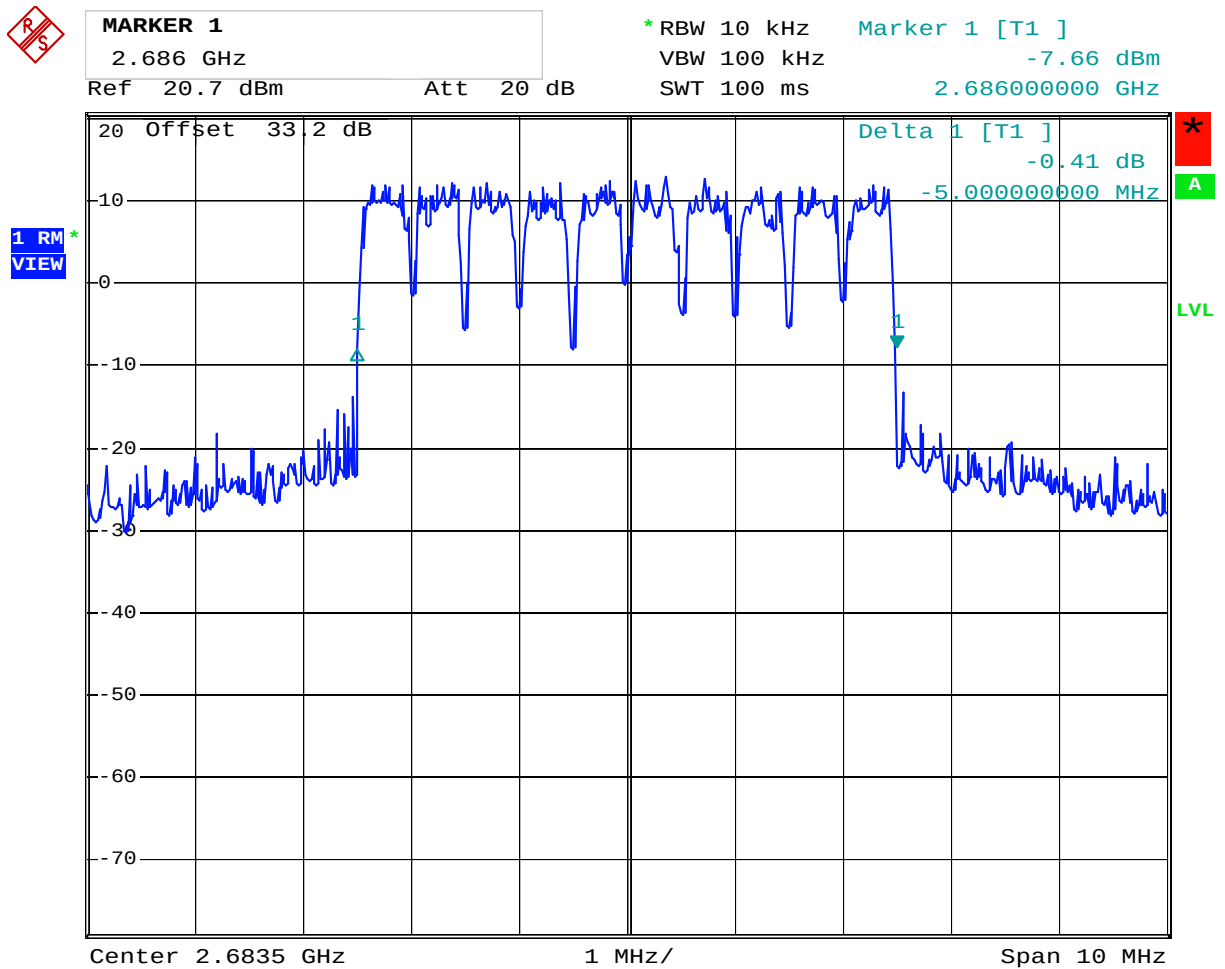
Date: 31.MAY.2006 11:38:21

2.590 GHz Navini Mode



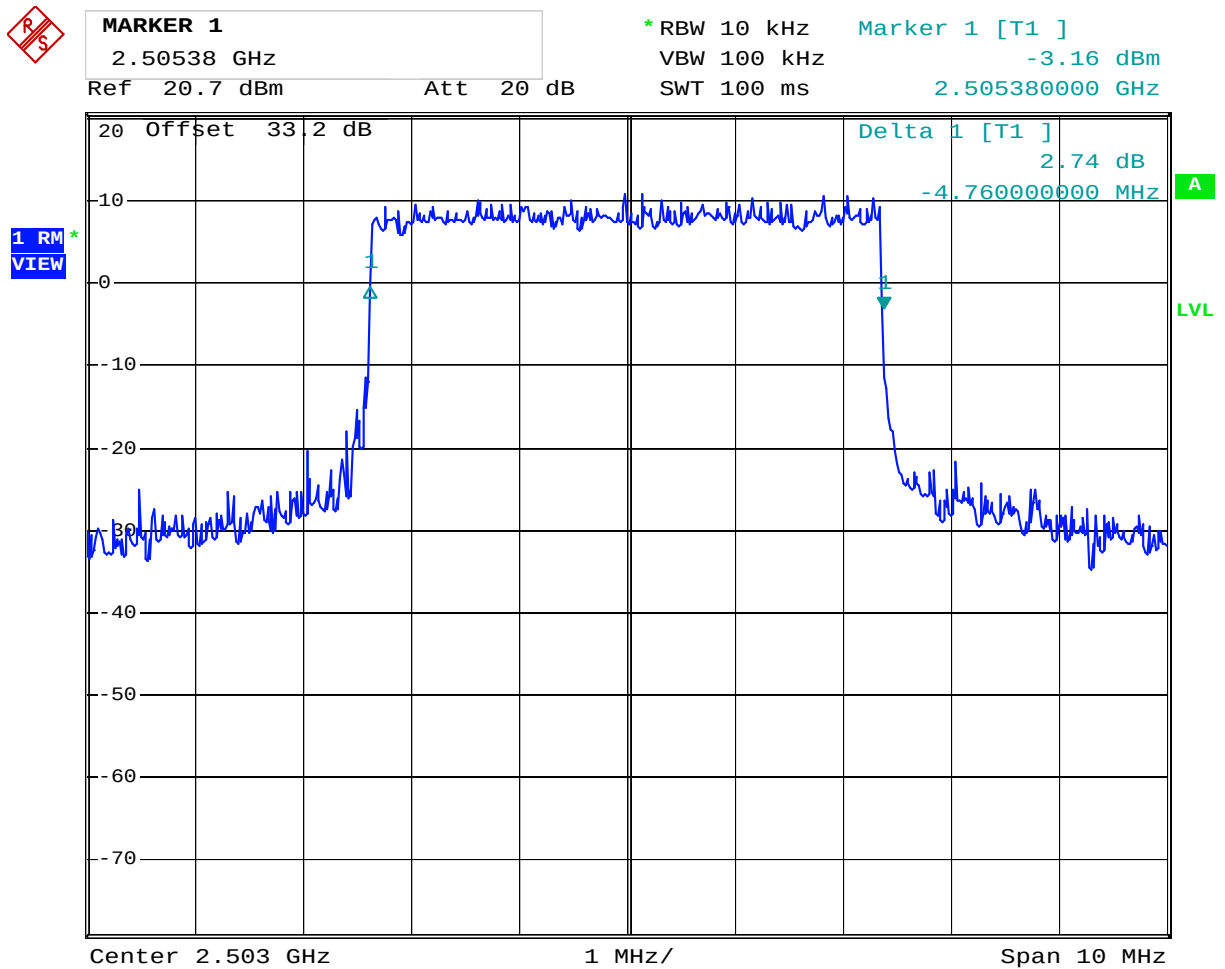
Date: 31.MAY.2006 11:36:39

2.683.5 GHz Navini Mode



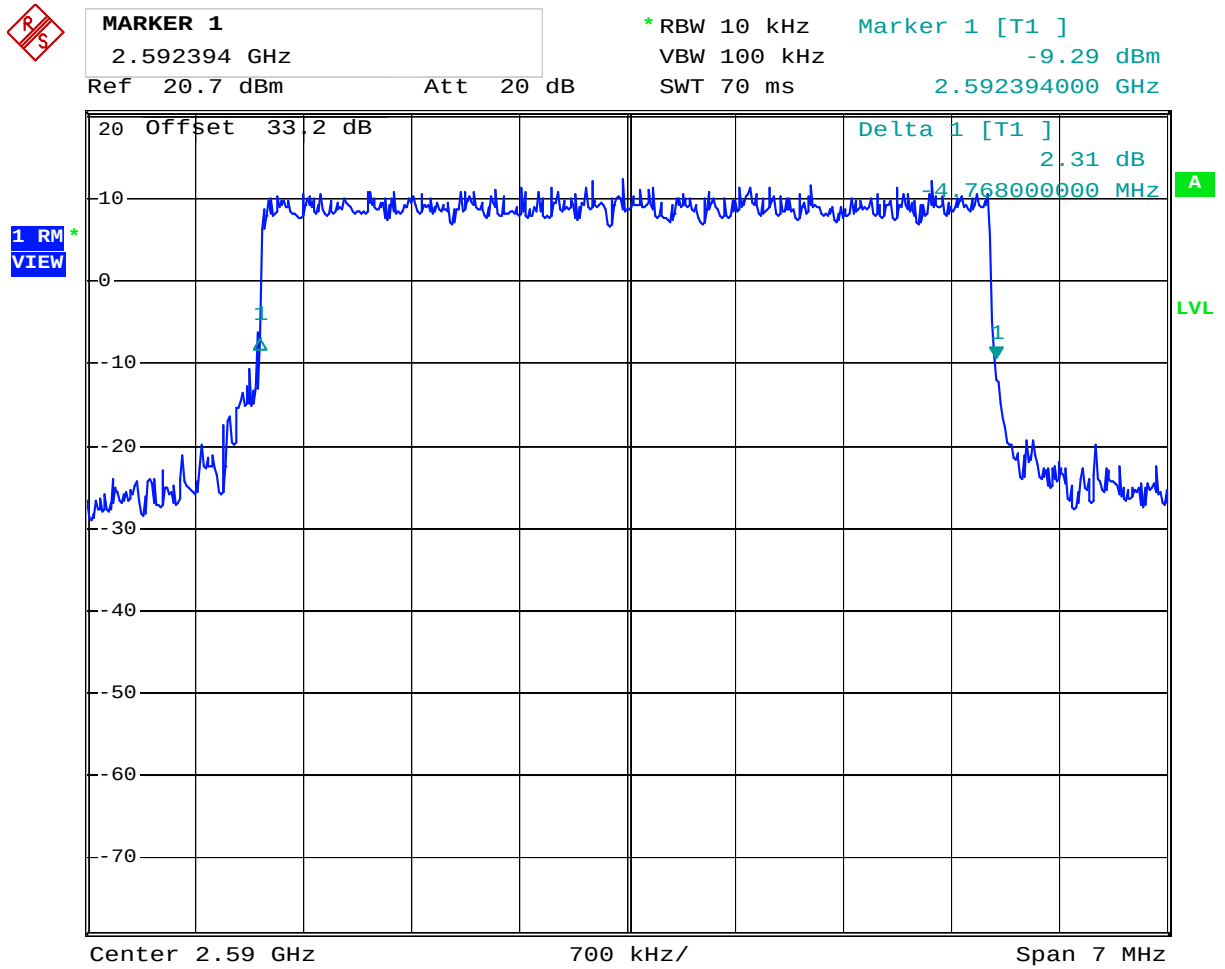
Date: 31.MAY.2006 11:33:19

2.503 GHz OFDM Mode



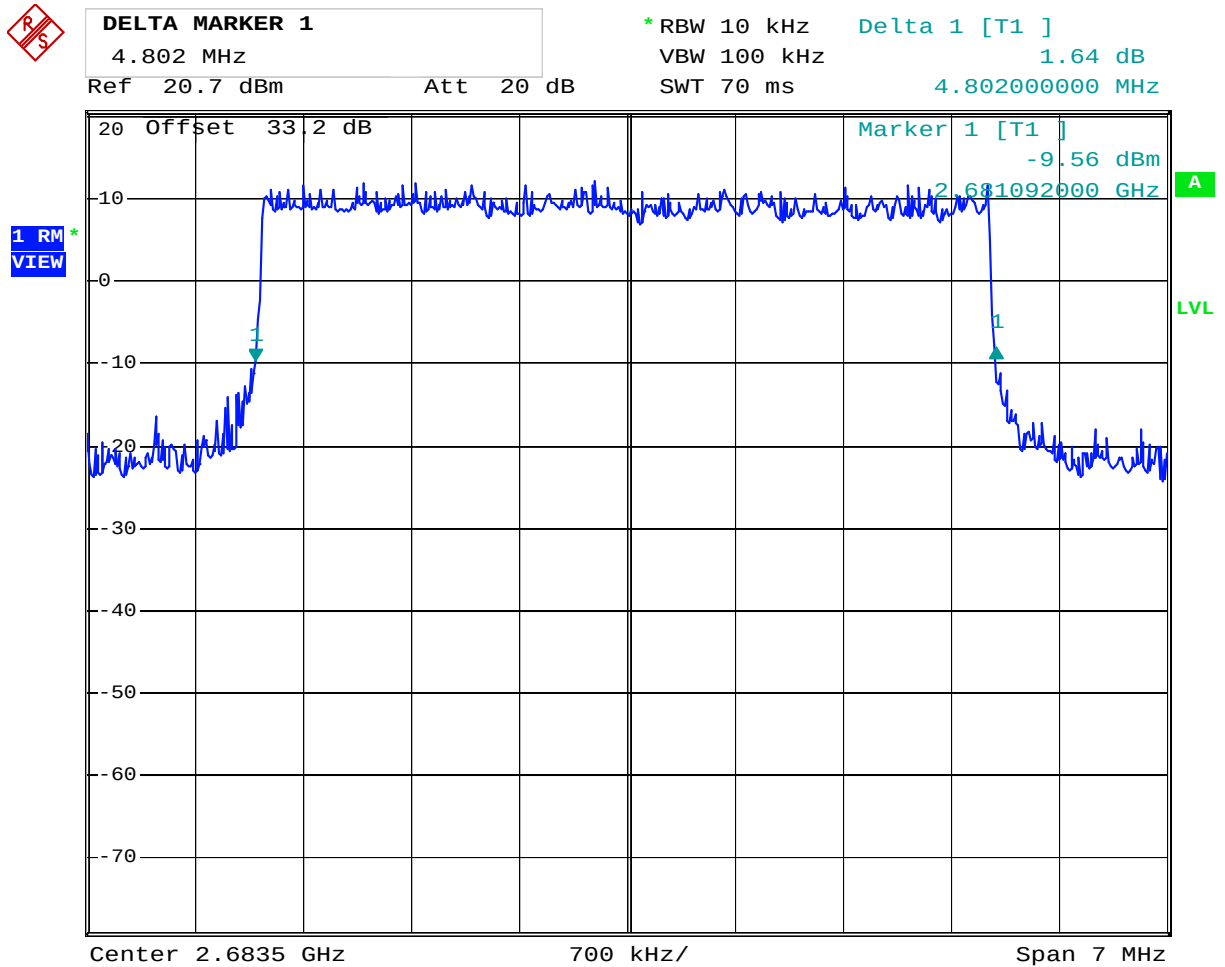
Date: 31.MAY.2006 09:55:20

2.590 GHz OFDM Mode



Date: 31.MAY.2006 09:58:51

2.6835 GHz OFDM Mode



Date: 31.MAY.2006 10:04:38

Section 5. Spurious Emissions at Antenna TerminalsNAME OF TEST: Spurious Emissions @ Antenna
Terminals

PARA. NO.: 2.1051

TESTED BY: Kevin Rose

DATE: 05/27/2006

Test Results: Complies**Measurement Data:** See attached plots.**Test Equipment:** 1659, 1055, 1081, 1474, 1471.

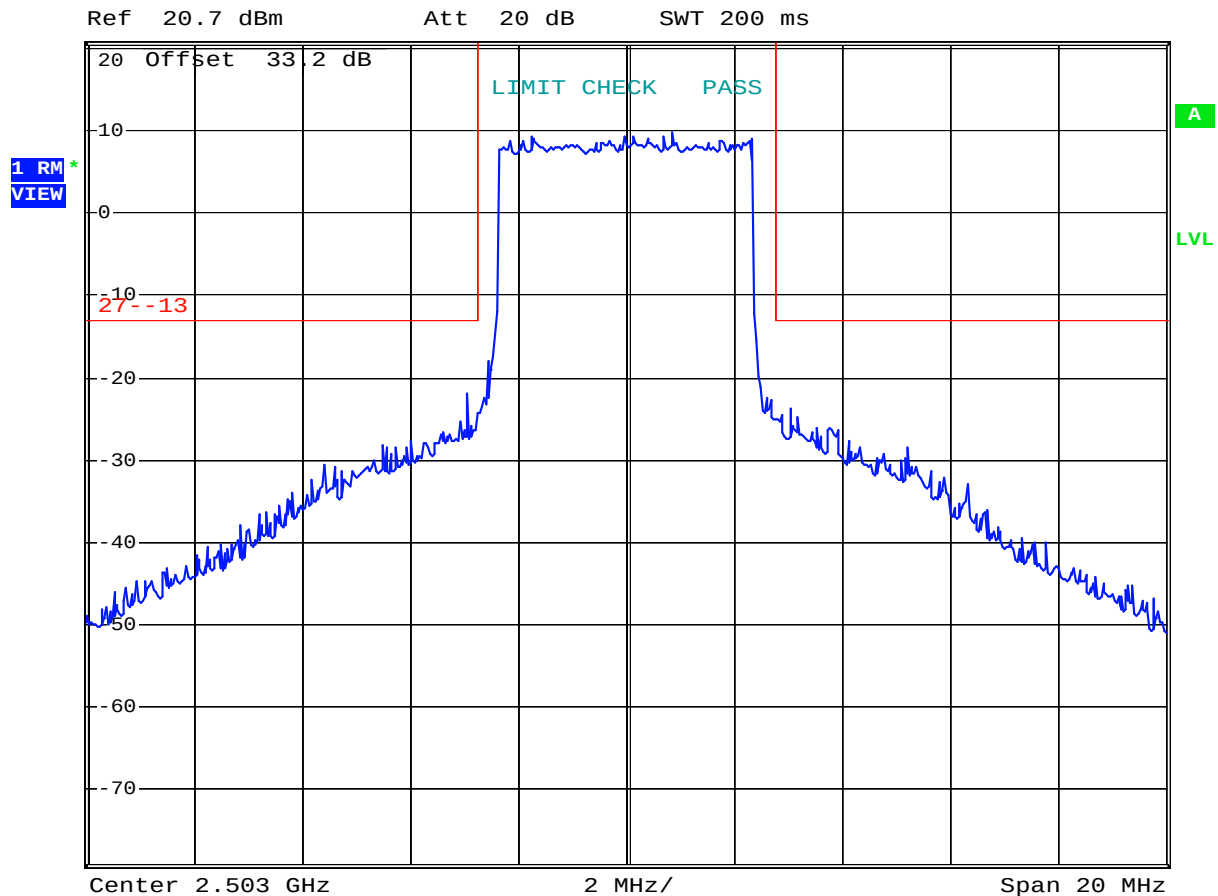
Notes: Device operating at 2.59GHz and 33 dBm conducted power. Frequency Range scanned from 9 kHz to 26.5GHz.

Test Data – Spurious Emissions at Antenna Terminals

Lower Bandedge OFDM mode

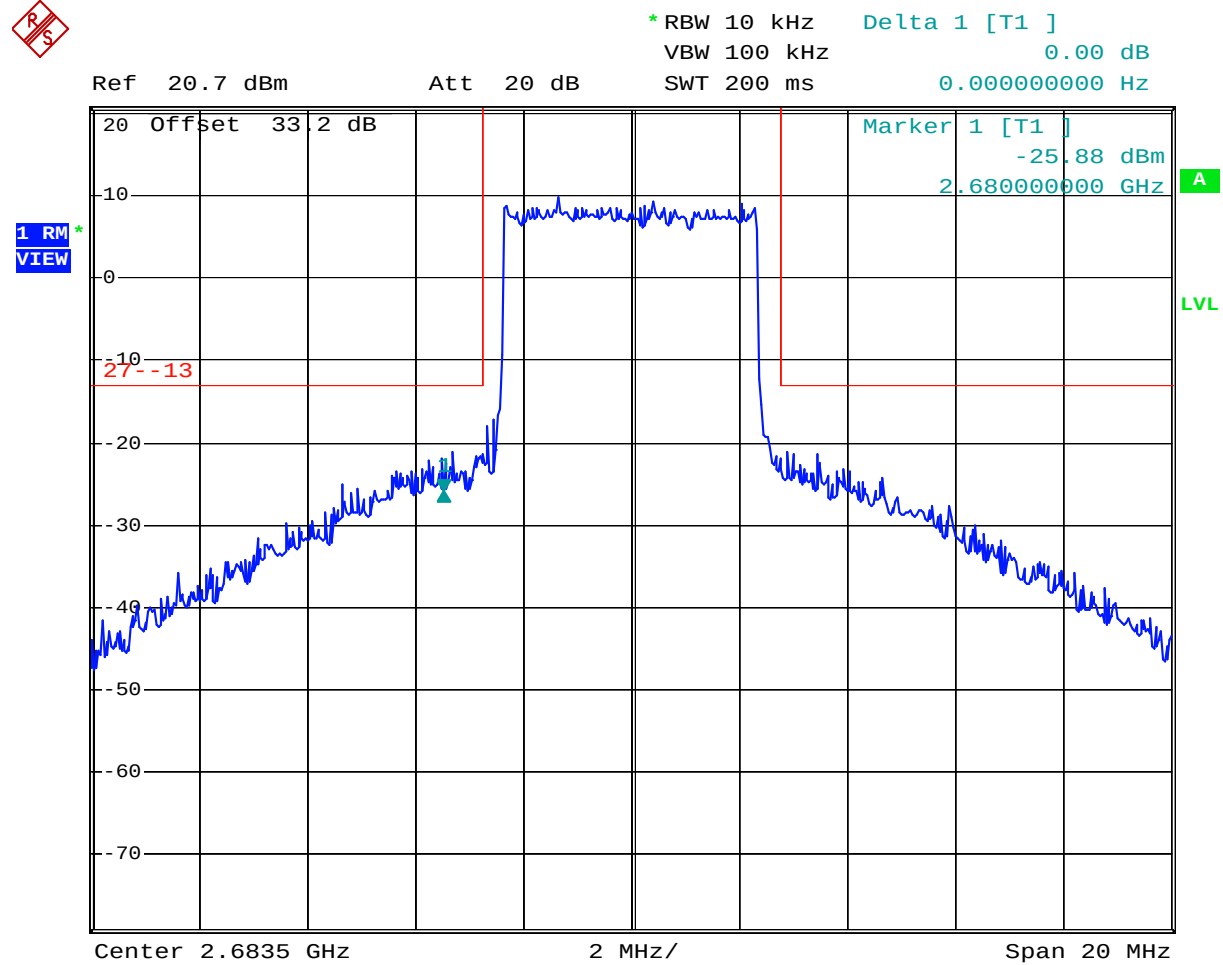


* RBW 10 kHz
VBW 100 kHz
SWT 200 ms



Date: 31.MAY.2006 09:52:02

Upper Bandedge OFDM mode

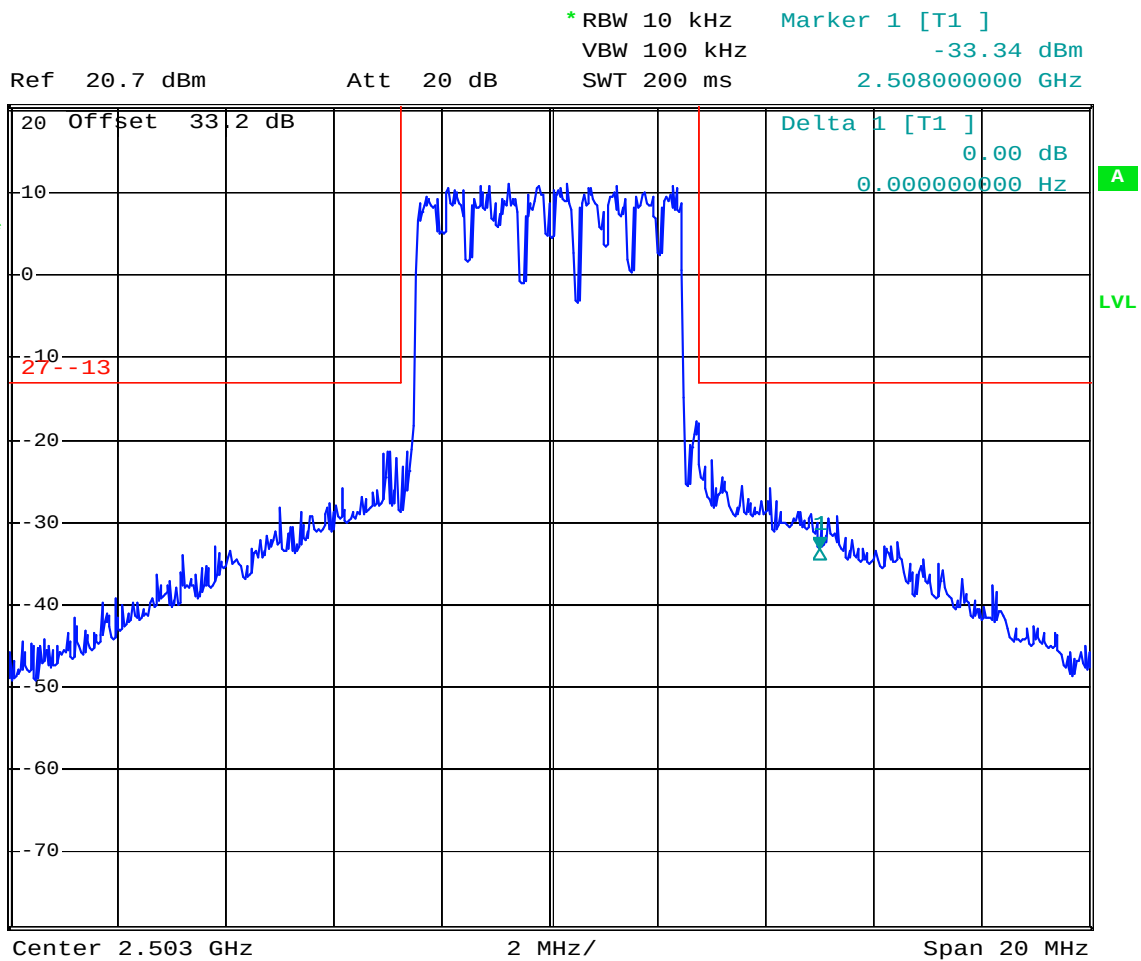


Date: 31.MAY.2006 10:03:18

Lower Bandedge Navini mode



1 RM
VIEW



Date: 31.MAY.2006 11:37:23

Upper Bandedge Navini mode



CENTER FREQUENCY

2.6835 GHz

Ref 20.7 dBm

Att 20 dB

*RBW 10 kHz

VBW 100 kHz

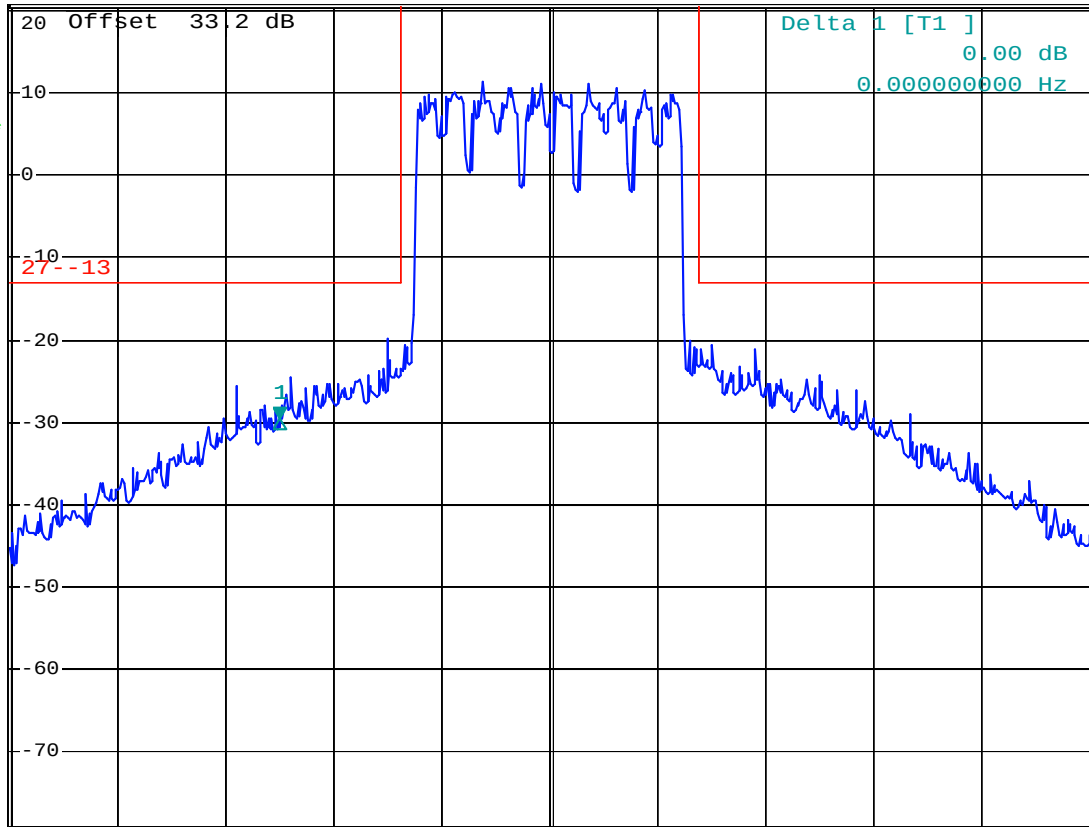
SWT 200 ms

Marker 1 [T1]

-29.50 dBm

2.678500000 GHz

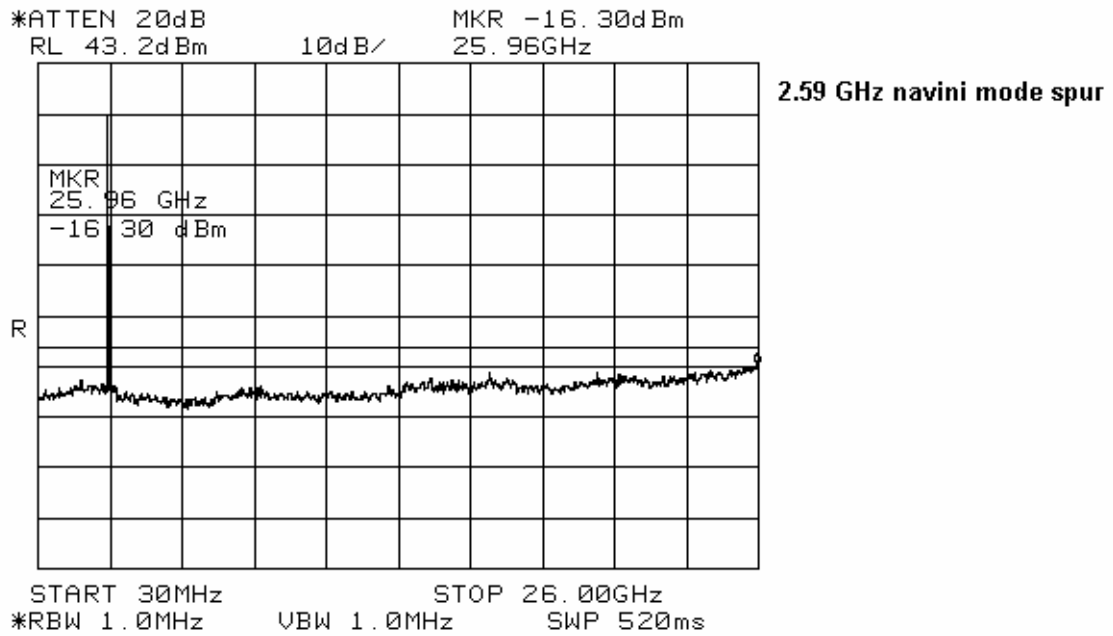
1 RM
VIEW

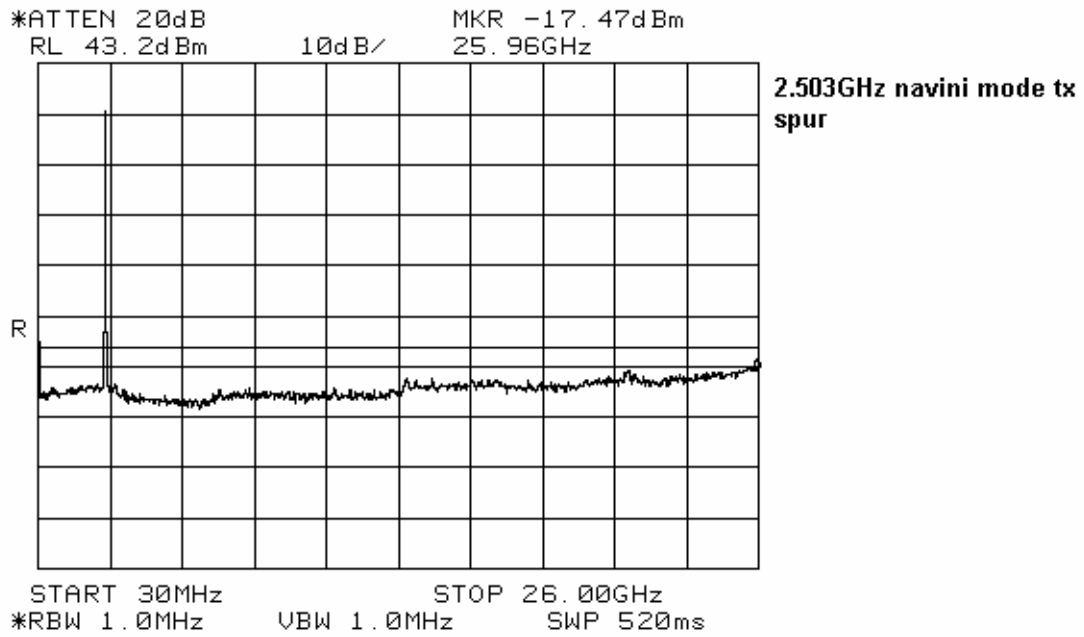


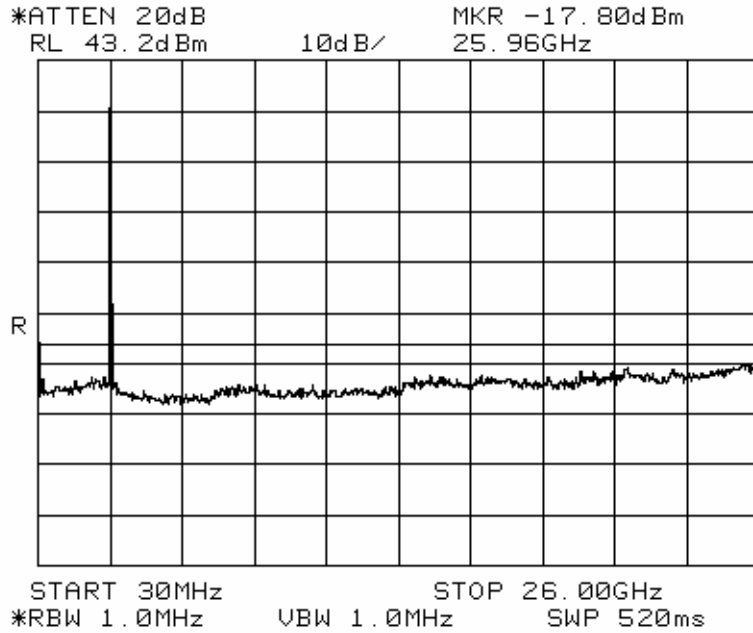
A

LVL

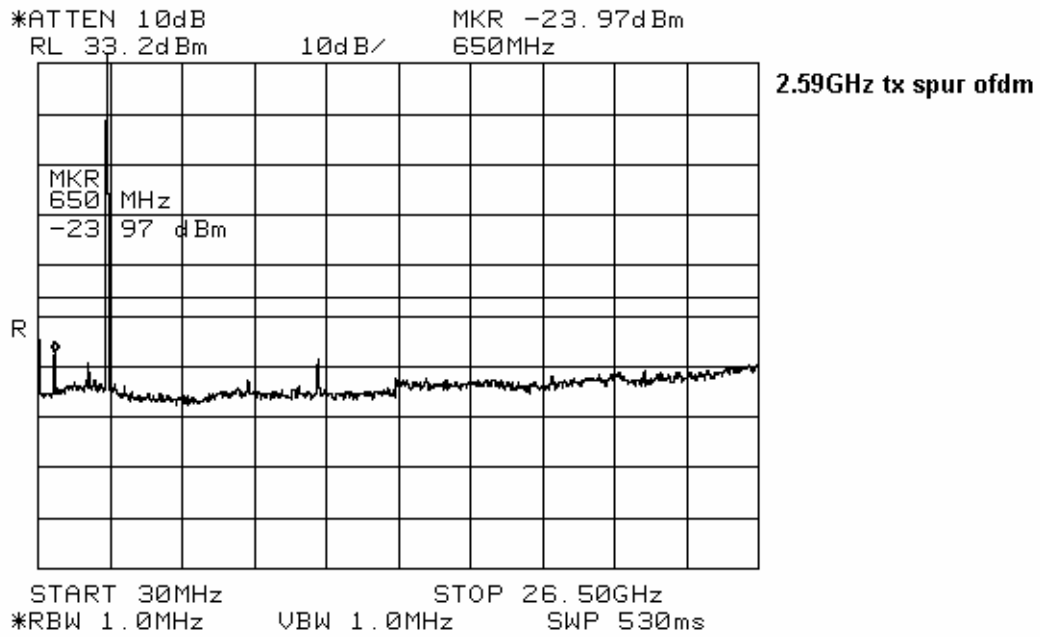
Date: 31.MAY.2006 11:32:07

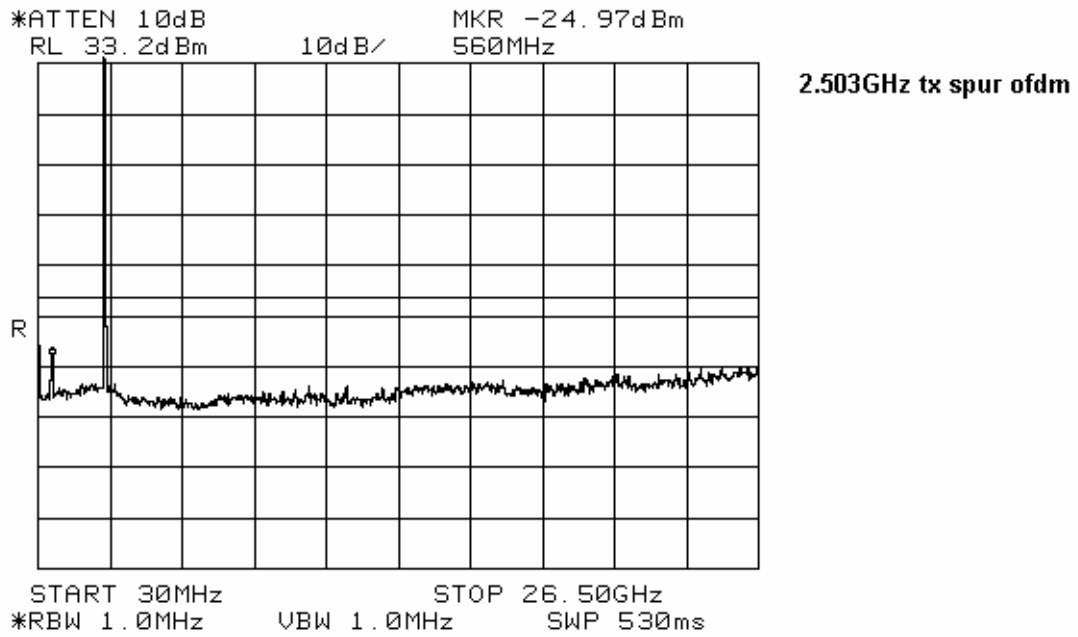


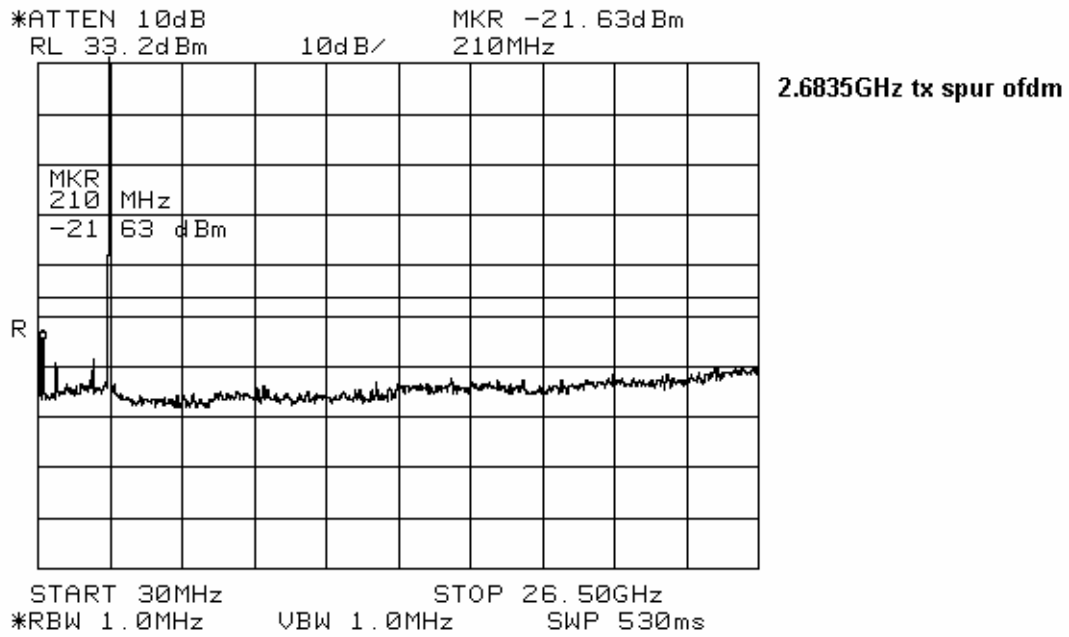




2.6835Ghz navini mode tx spur







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.

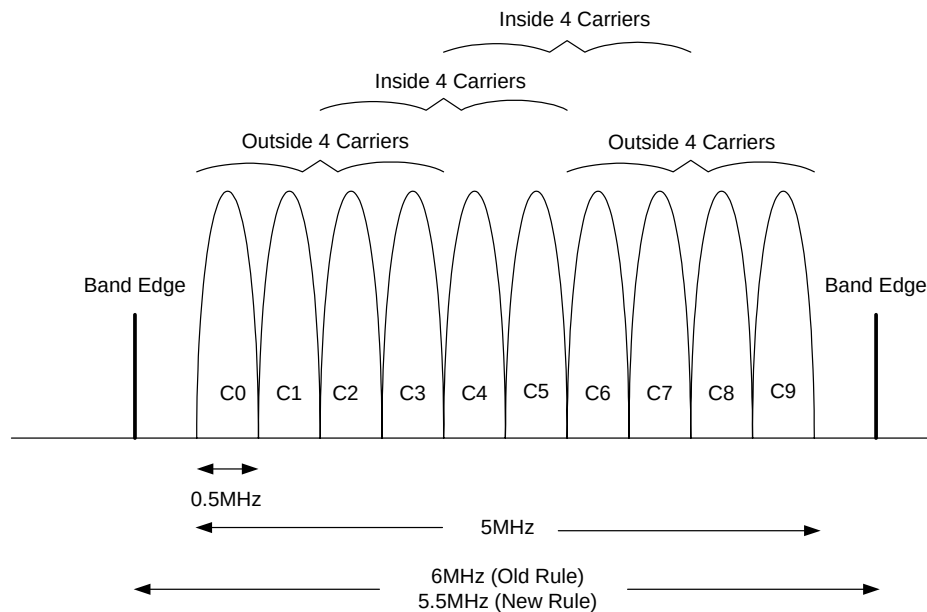


Figure 1. 4-Carrier Signal

Section 6. Field Strength of Spurious

NAME OF TEST: Field Strength of Spurious Emissions	PARA. NO.: 2.1053
TESTED BY: Kevin Rose	DATE: 06/27/2006

Test Results: Complies

Measurement Data: See attached table.

Test Equipment: 1464,1016,993,760,759,791,1484,1485..

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

Note: No Emissions were detected within 20db of the limit

30MHz to 1 GHz RBW/VBW =100 kHz

1 GHz to 10th harmonic RBW/VBW =1 MHz

Photos – Radiated Emissions



Section 7. Frequency Stability

NAME OF TEST: Frequency Stability	PARA. NO.: 2.1055
TESTED BY: Kevin Rose	DATE: 05/26/2006

Test Results: Complies

Measurement Data: See attached plots.

Standard Supply Voltage: 120 Vac

Environmental Conditions: 21 °Celsius
41 % RH

The EUT shut down during the transition from –10 degrees centigrade to –20degrees centigrade
No out of band were detected when the EUT shut down

Temperature Stability

Navini mode

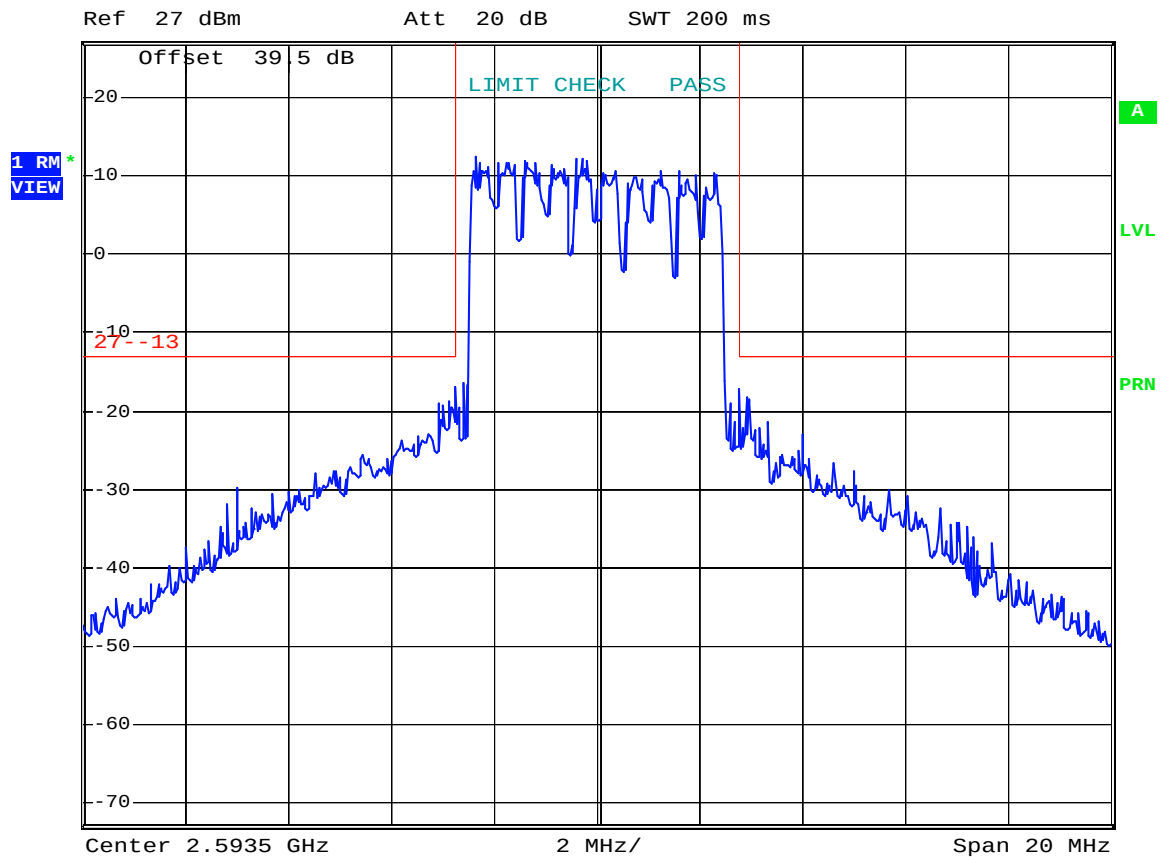
Equipment used

1659, 1483, 1064, 1065, 283, 619

20 Degrees C 120VAC



* RBW 10 kHz
VBW 100 kHz
SWT 200 ms

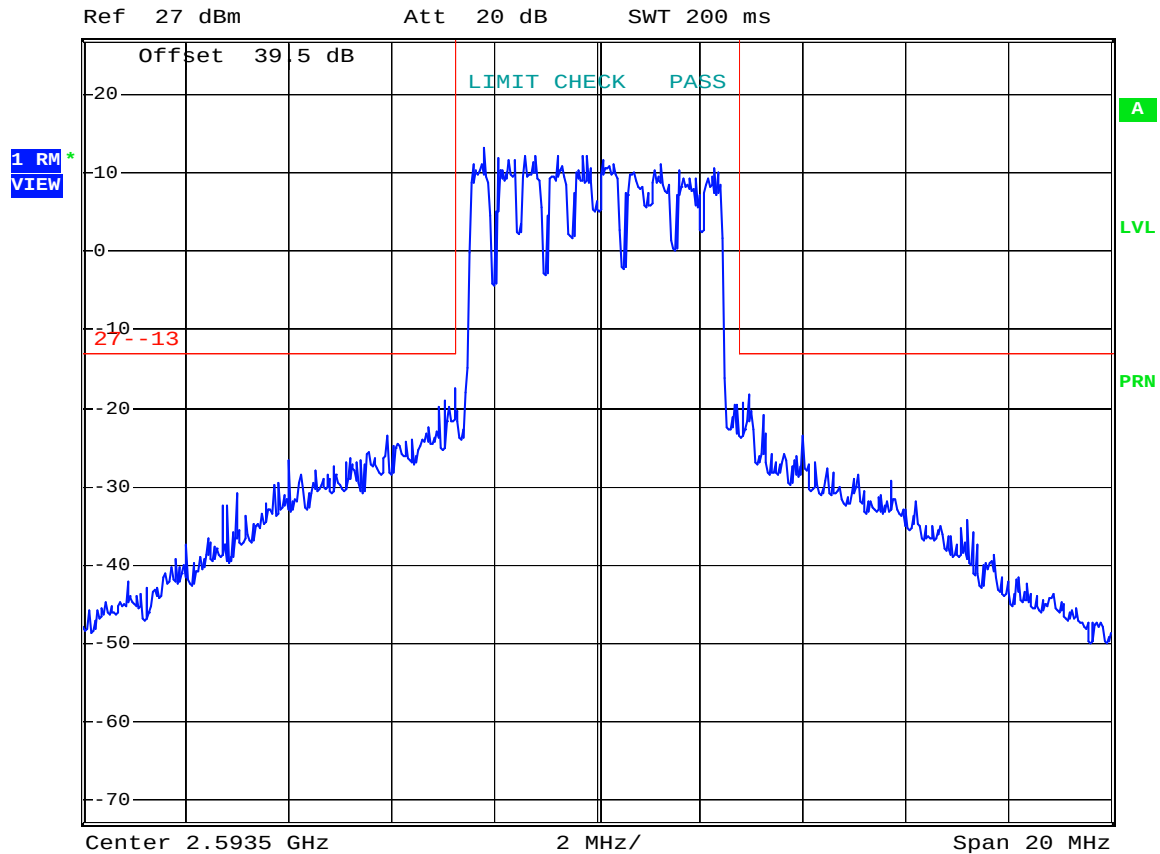


Date: 26.MAY.2006 09:58:40

20 Degrees C 102VAC

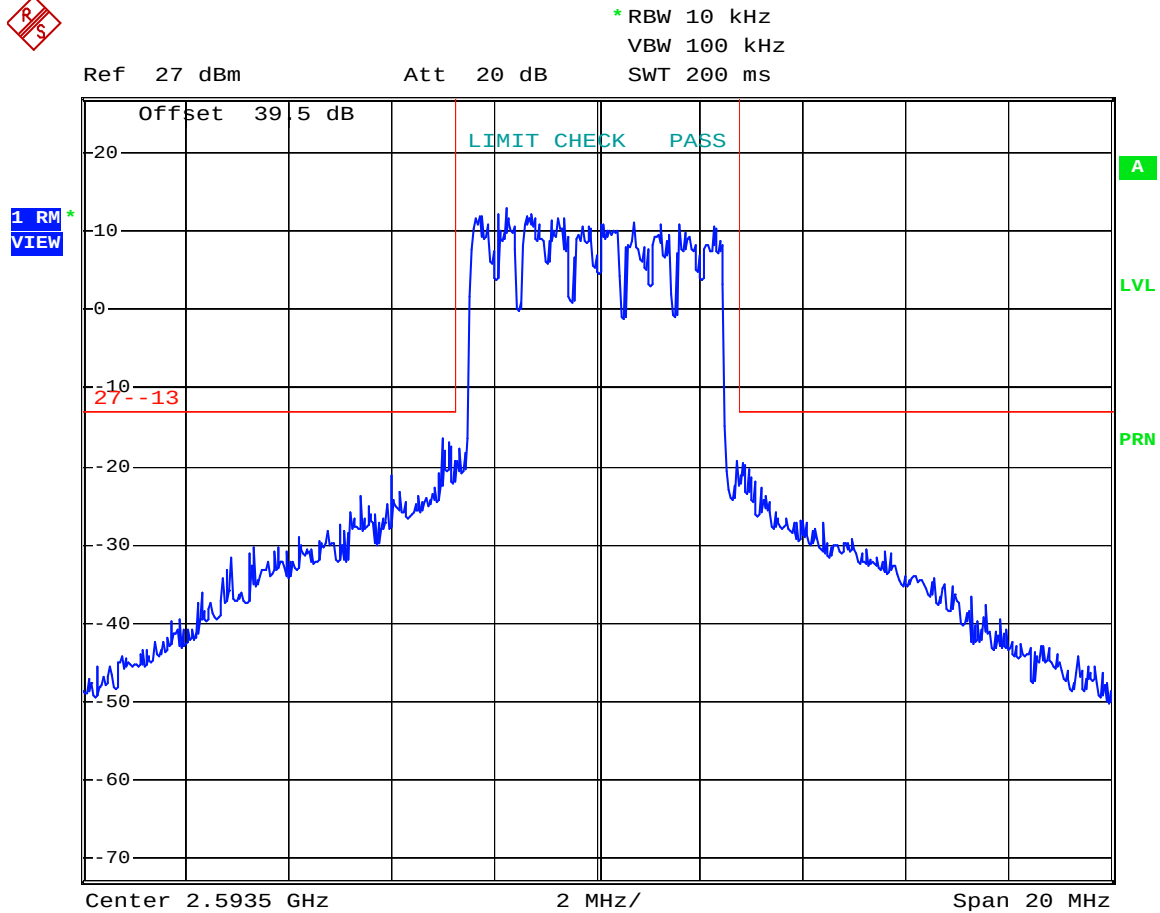


*RBW 10 kHz
VBW 100 kHz
SWT 200 ms



Date: 26.MAY.2006 09:56:22

20 Degrees C 138VAC

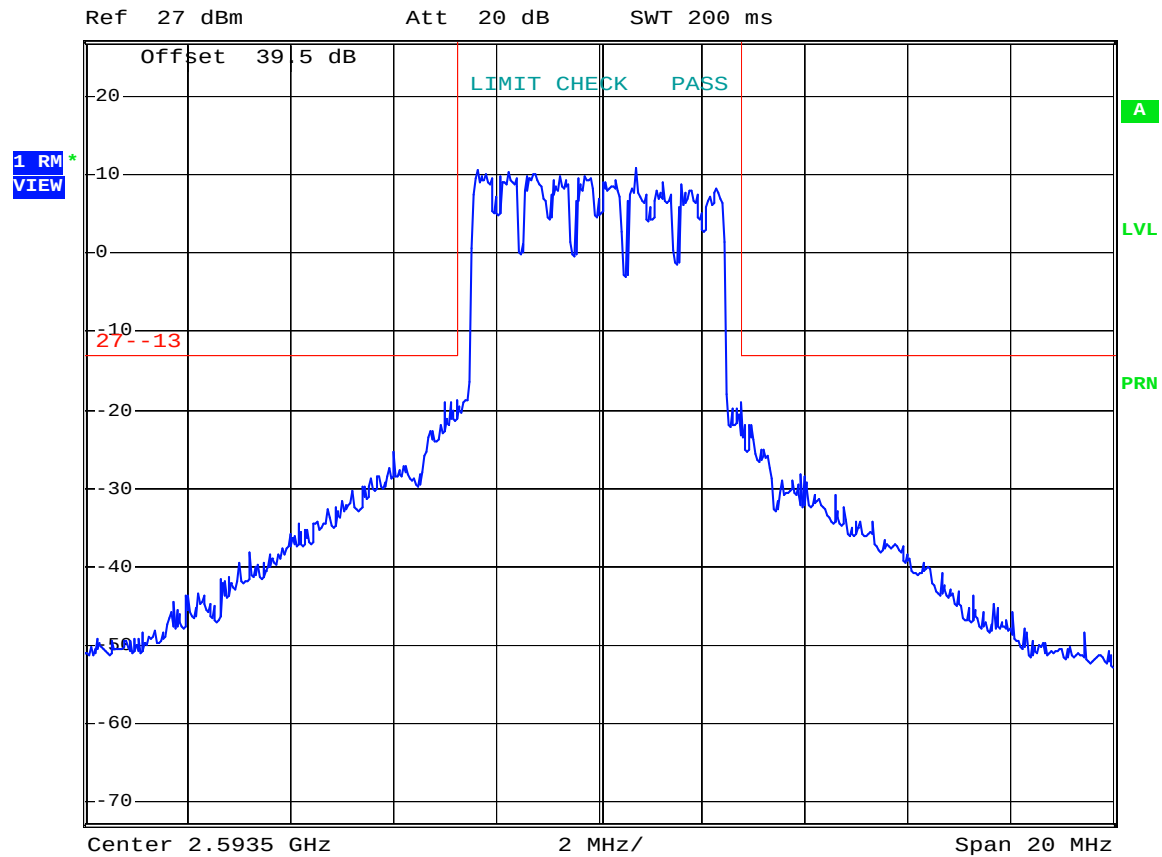


Date: 26.MAY.2006 09:59:24

50 Degrees Navini mode



* RBW 10 kHz
VBW 100 kHz
SWT 200 ms

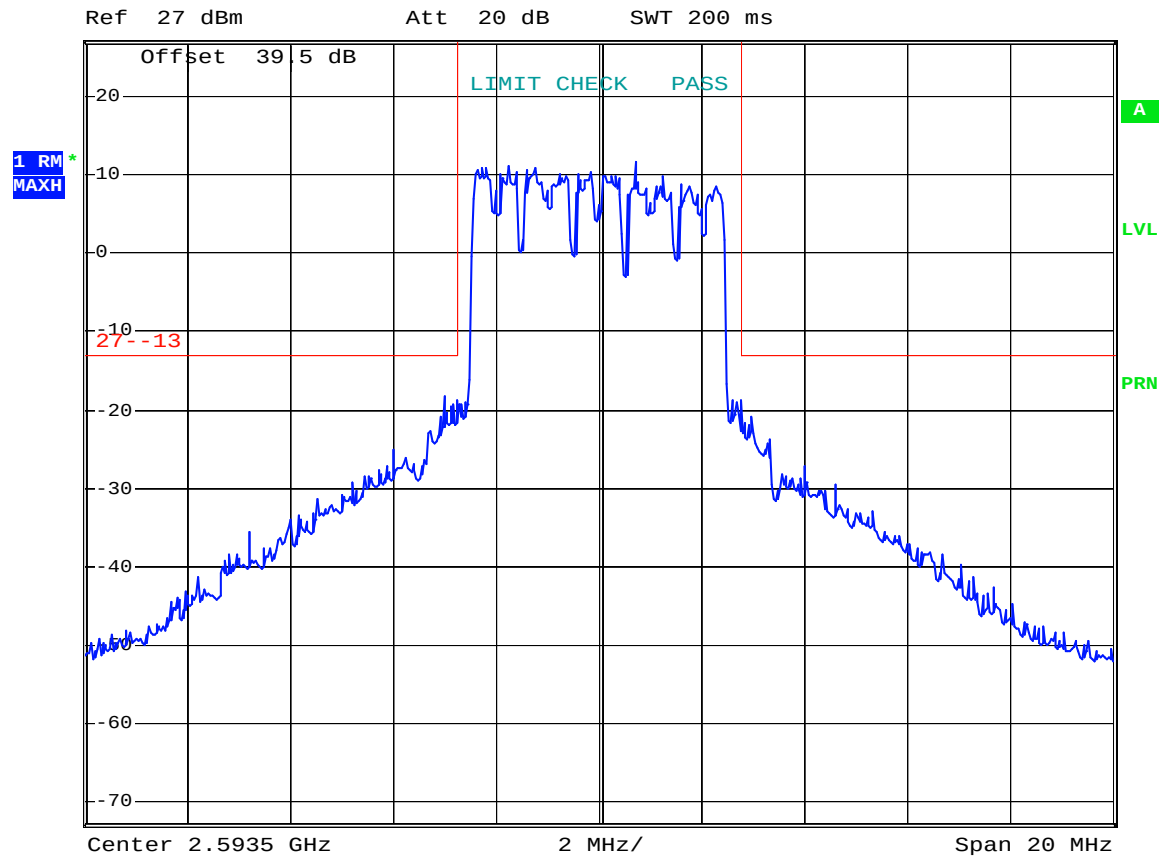


Date: 26.MAY.2006 10:32:59

40 degrees Navini mode

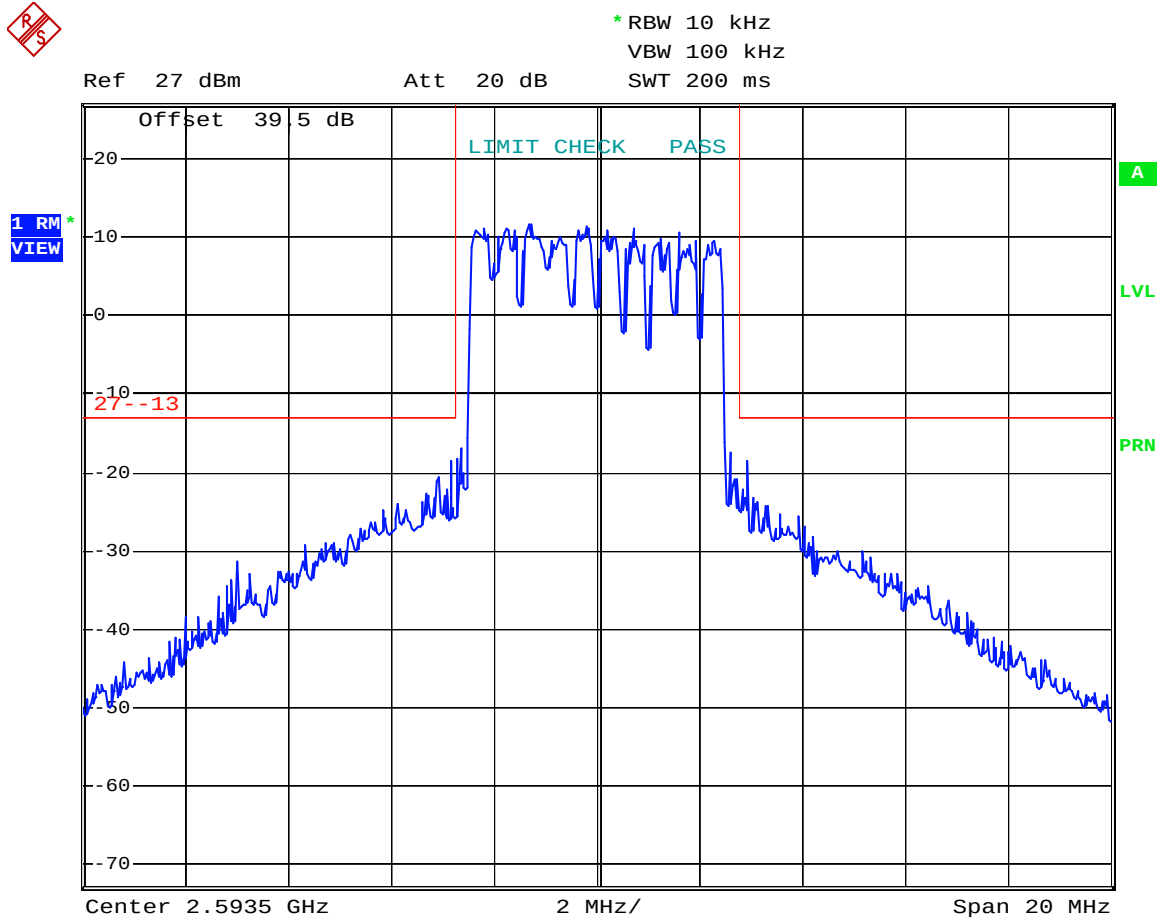


* RBW 10 kHz
VBW 100 kHz
SWT 200 ms



Date: 26.MAY.2006 10:56:23

30 degrees Navini mode

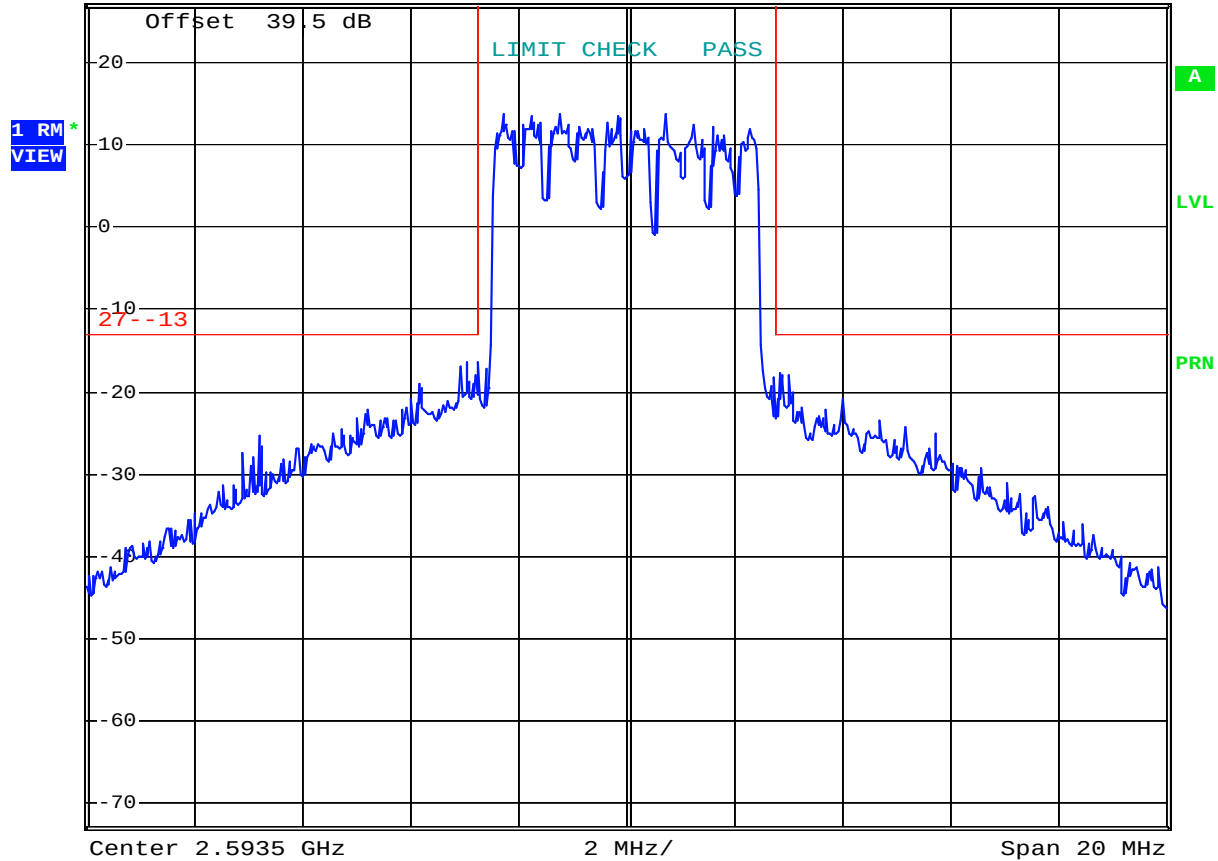


Date: 26.MAY.2006 11:24:15

10 degrees Navini mode

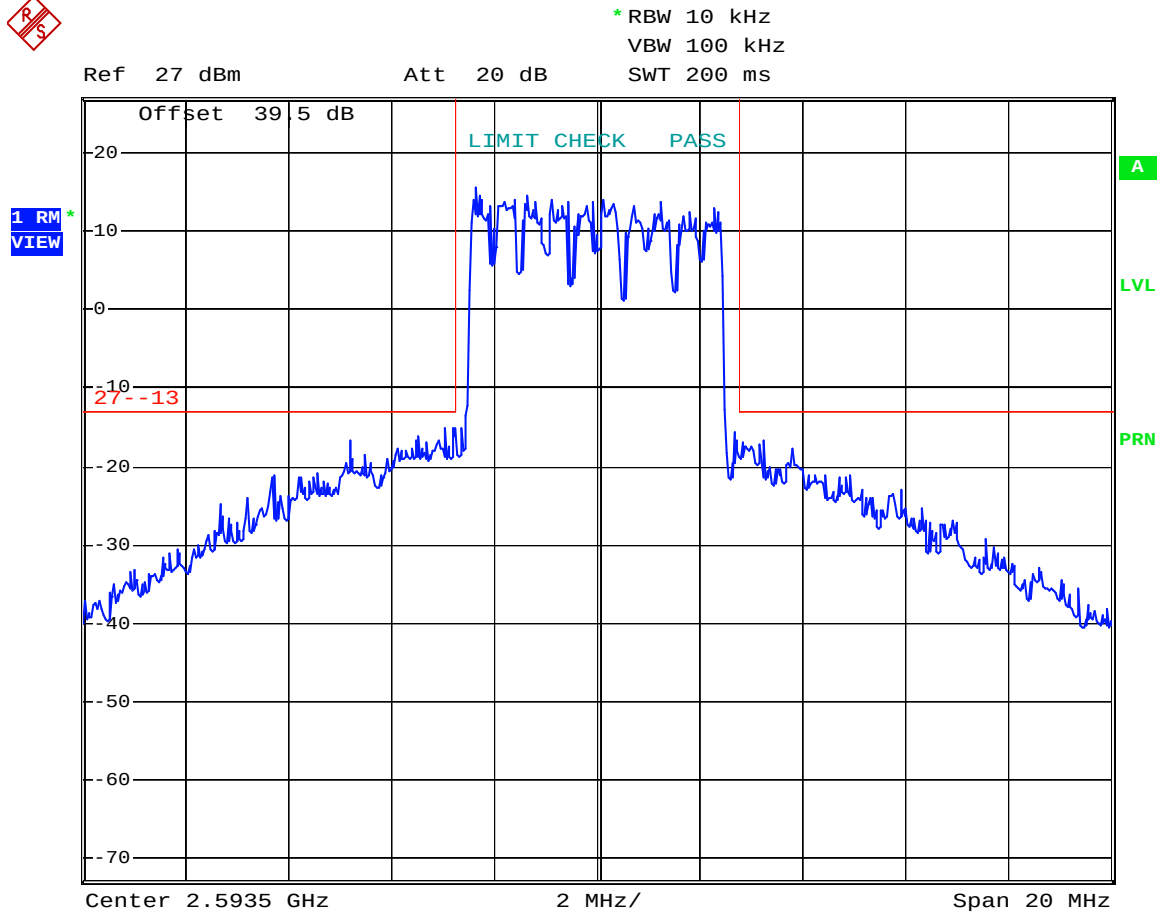


*RBW 10 kHz
VBW 100 kHz
SWT 200 ms



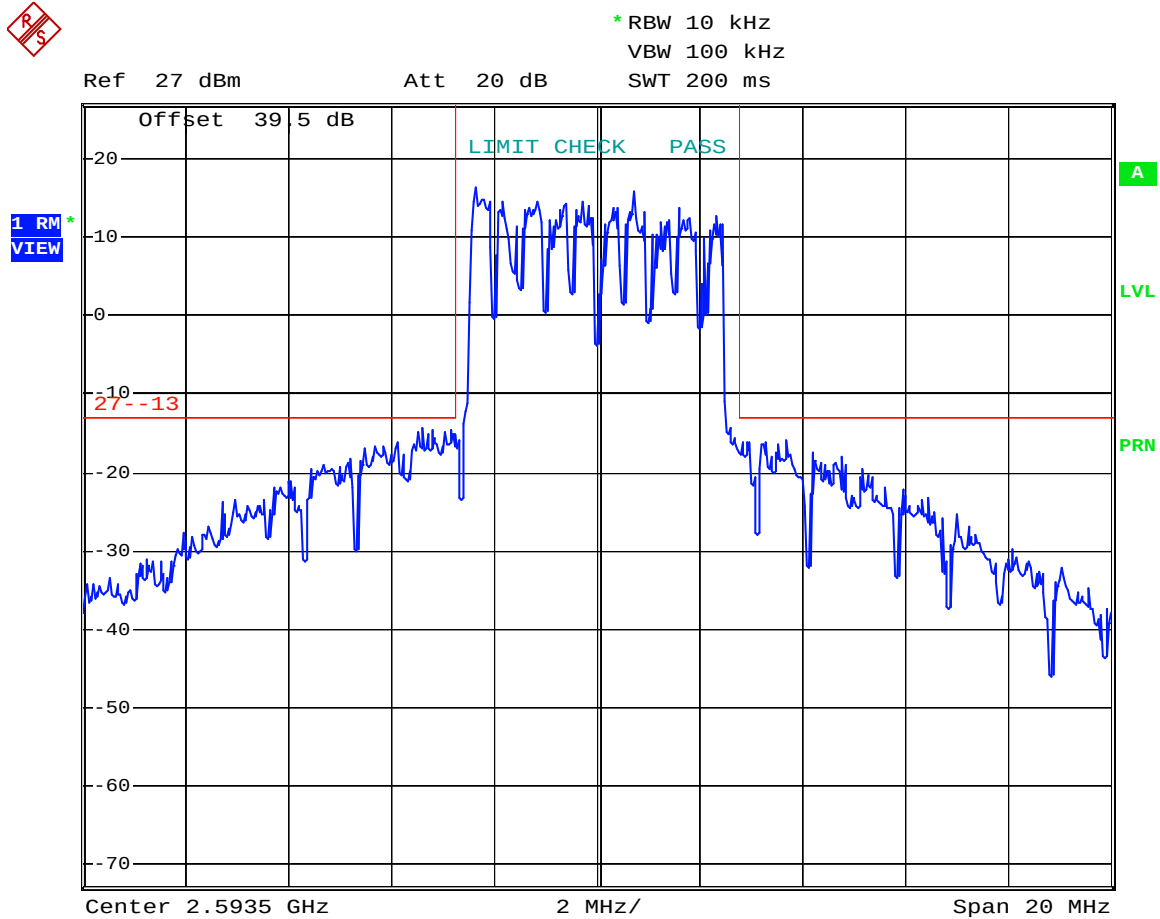
Date: 26.MAY.2006 12:55:06

0 degrees Navini mode



Date: 26.MAY.2006 14:25:01

-10 degrees Navini mode EUT ceased to operate at -15 degrees



Date: 26.MAY.2006 14:56:09

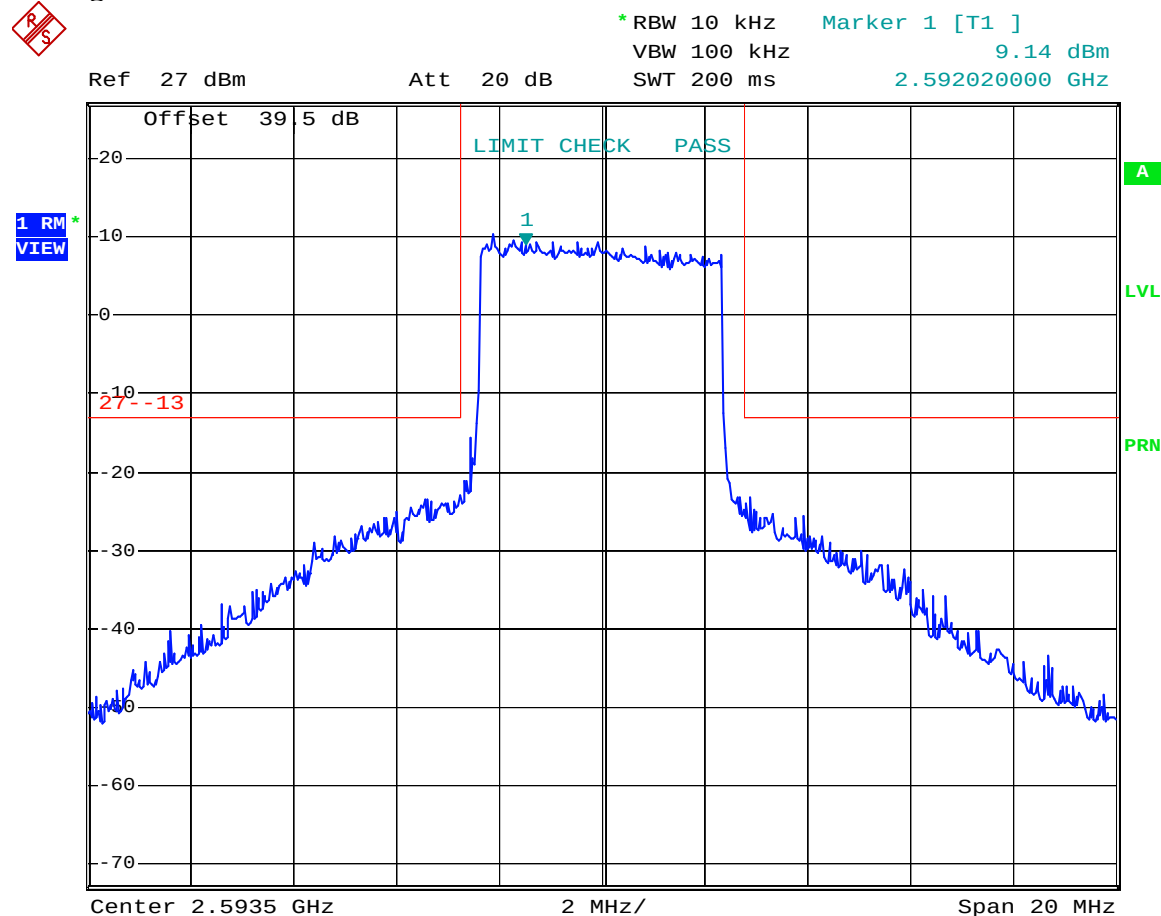
Temperature Stability

OFDM mode

Equipment used

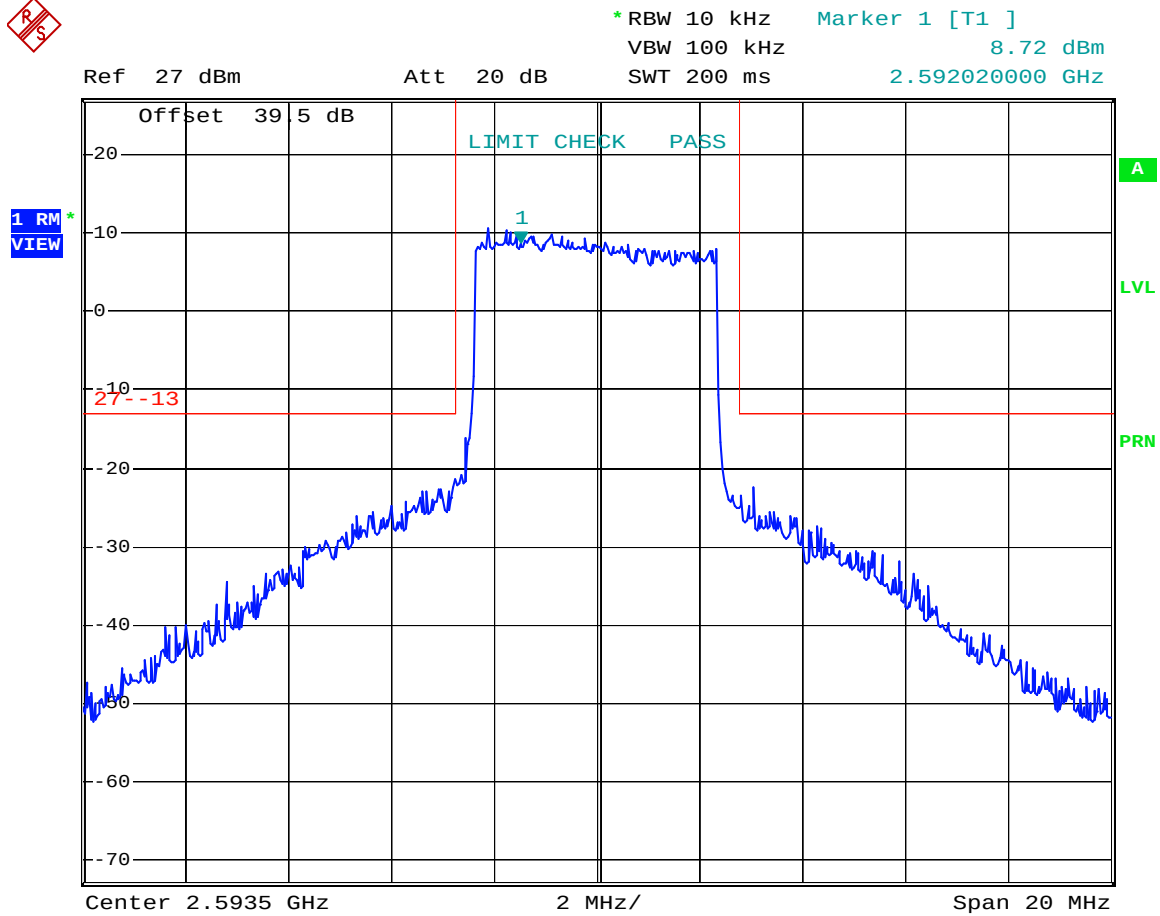
1659, 1483, 1064, 1065, 283, 619

20 Degrees C 120VAC



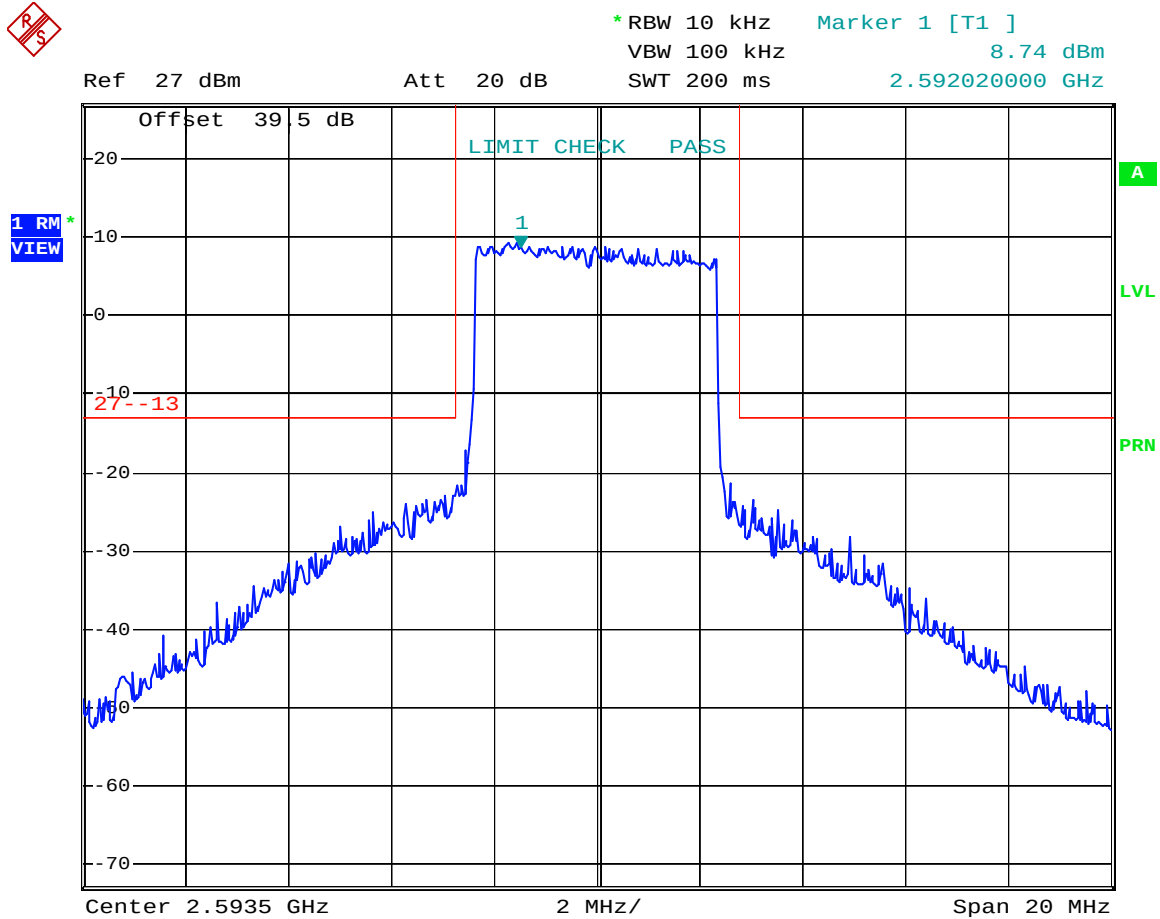
Date: 30.MAY.2006 09:21:24

20 Degrees C 102VAC



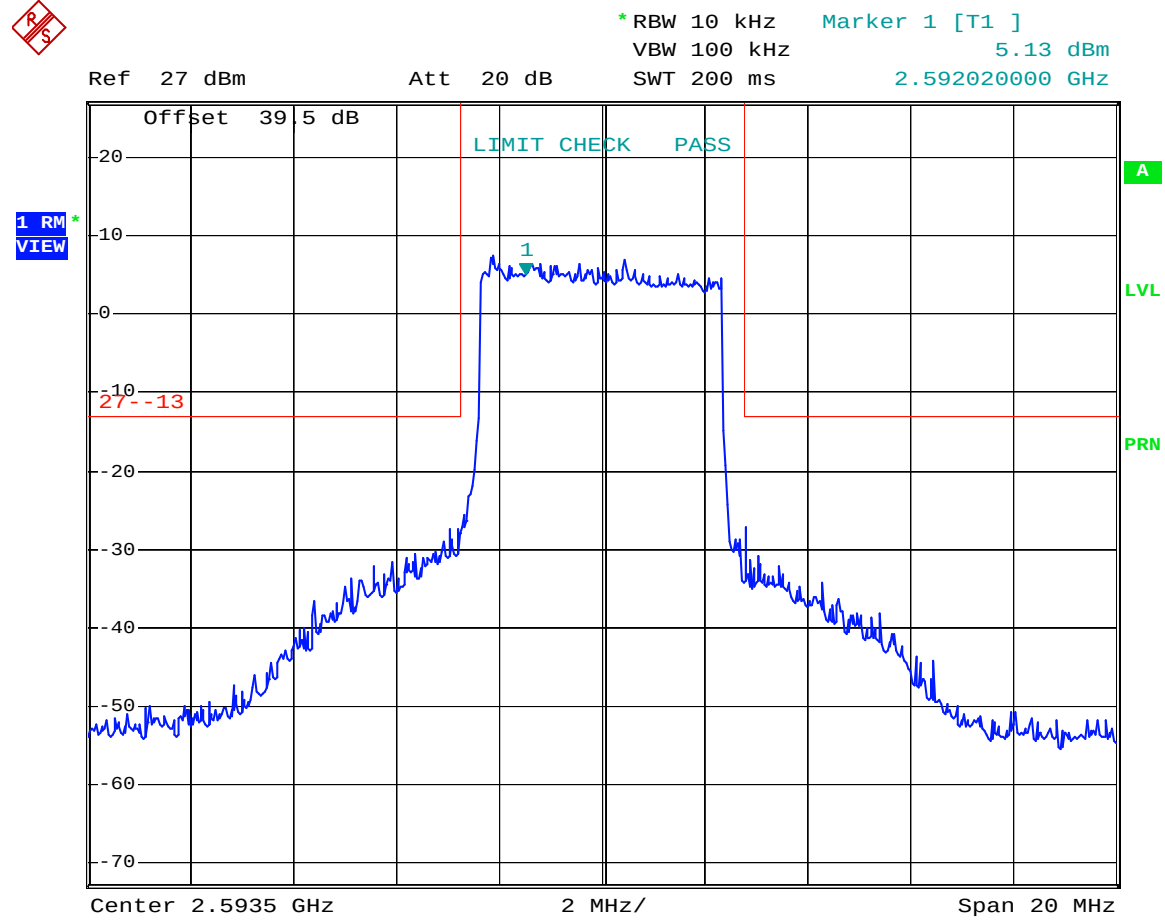
Date: 30.MAY.2006 09:17:50

20 Degrees C 138VAC



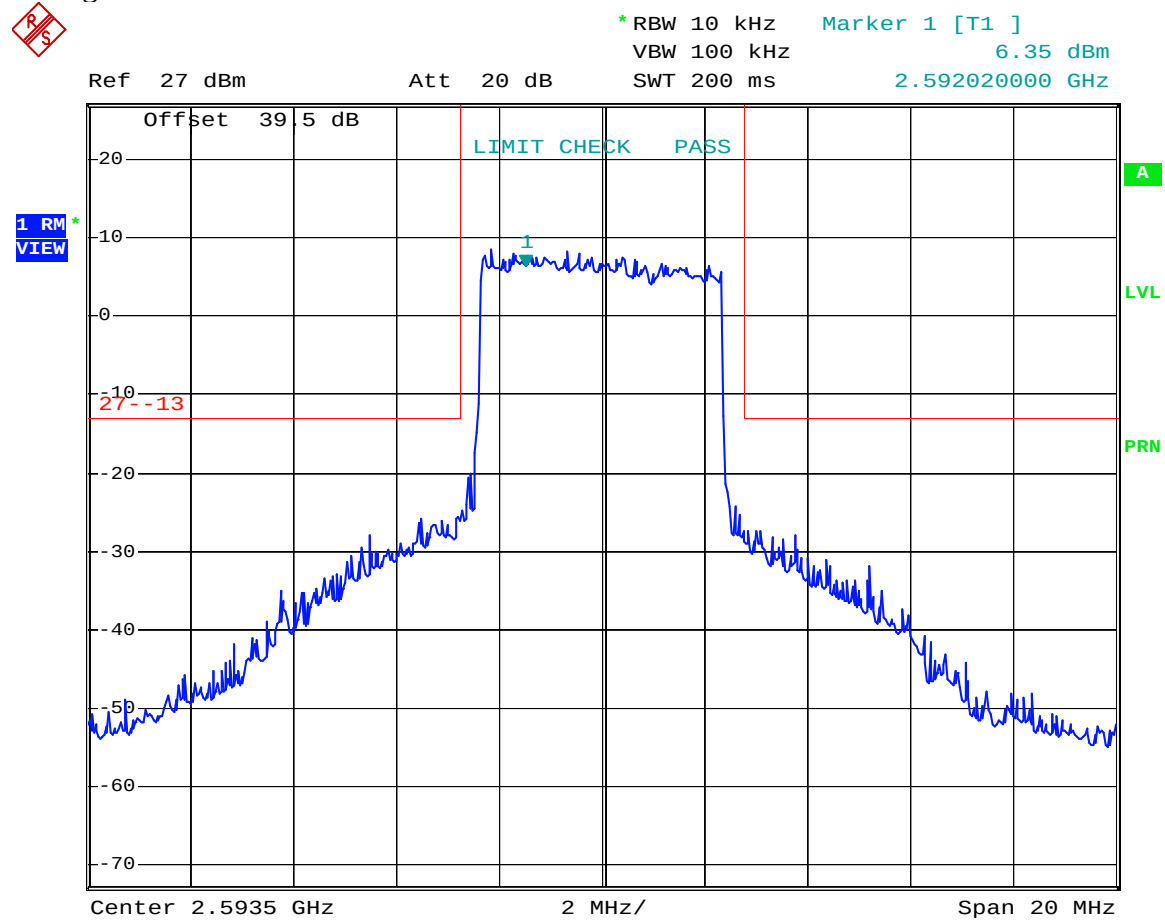
Date: 30.MAY.2006 09:19:09

50 Degrees OFDM mode



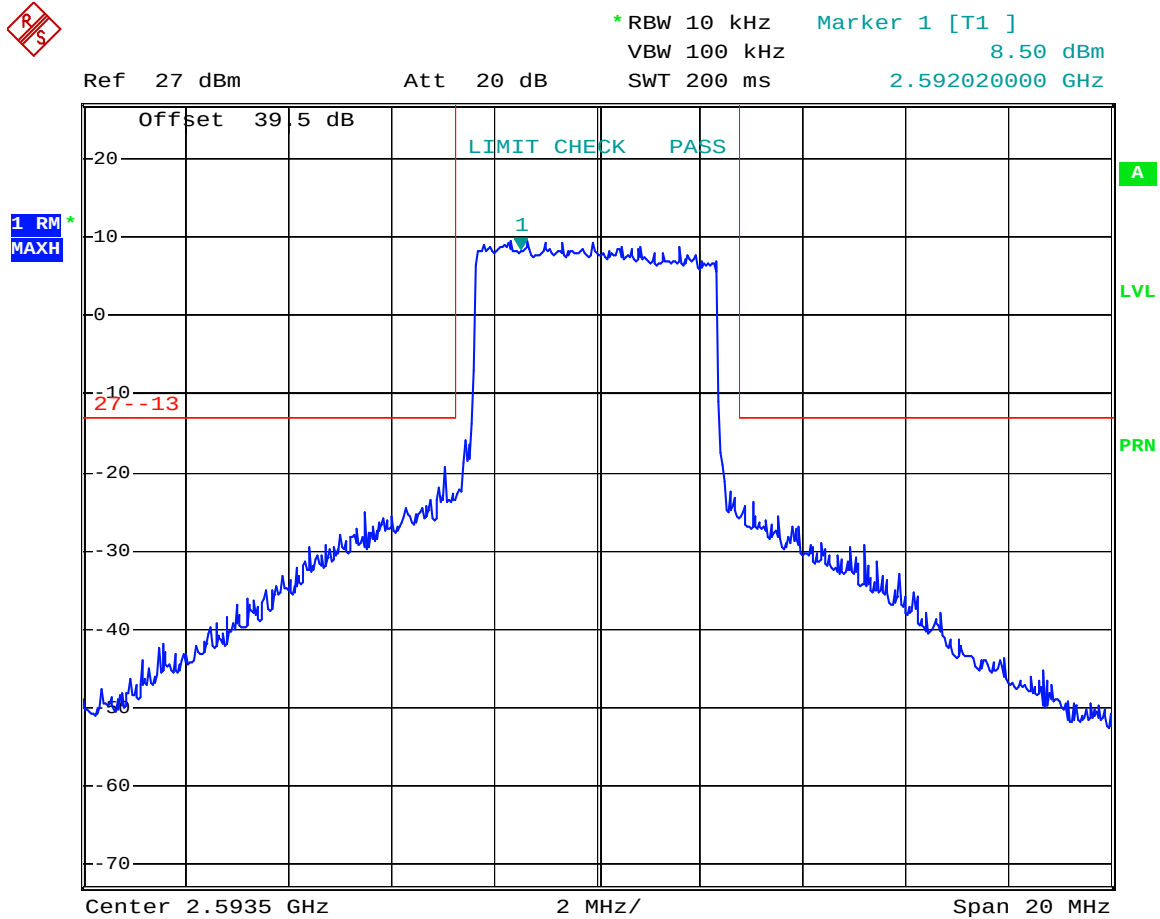
Date: 30.MAY.2006 10:28:18

40 degrees OFDM mode



Date: 30.MAY.2006 11:34:34

30 degrees OFDM mode

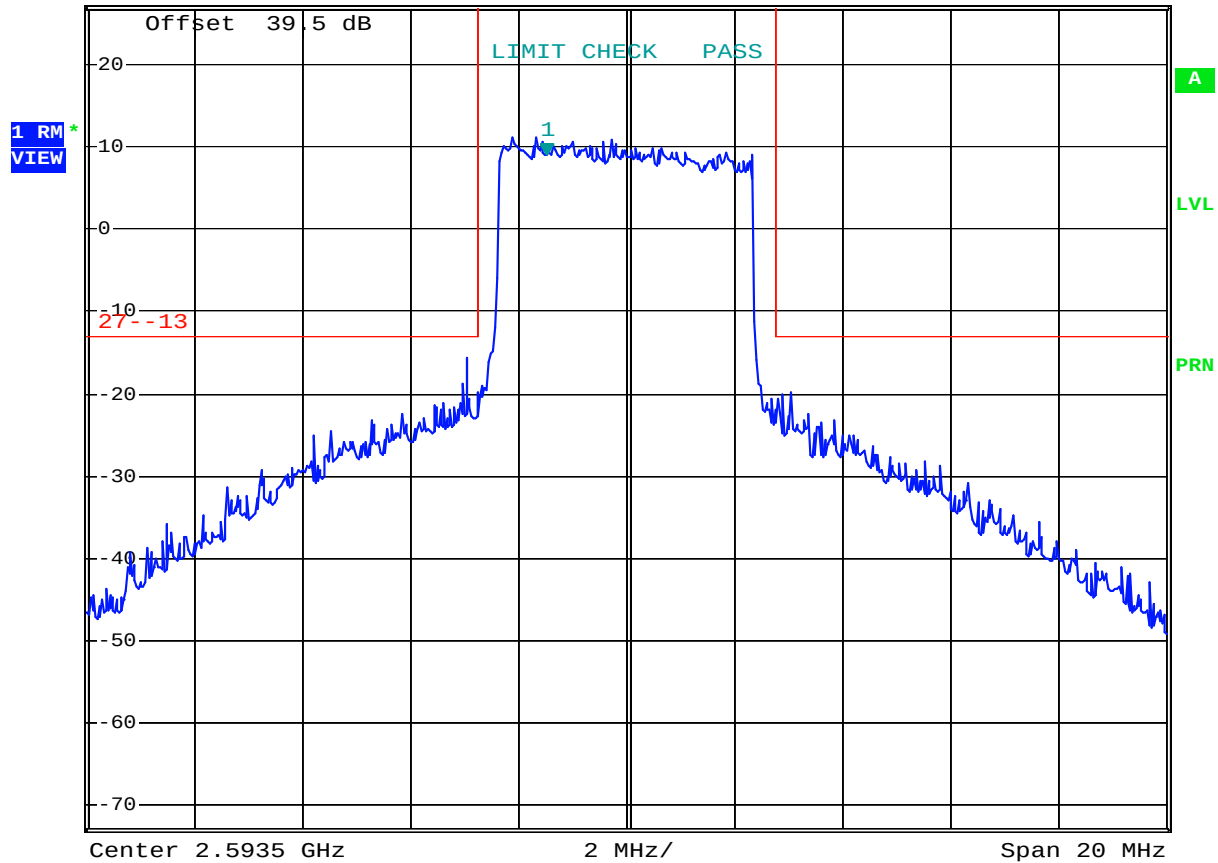


Date: 30.MAY.2006 12:33:19

10 degrees OFDM mode

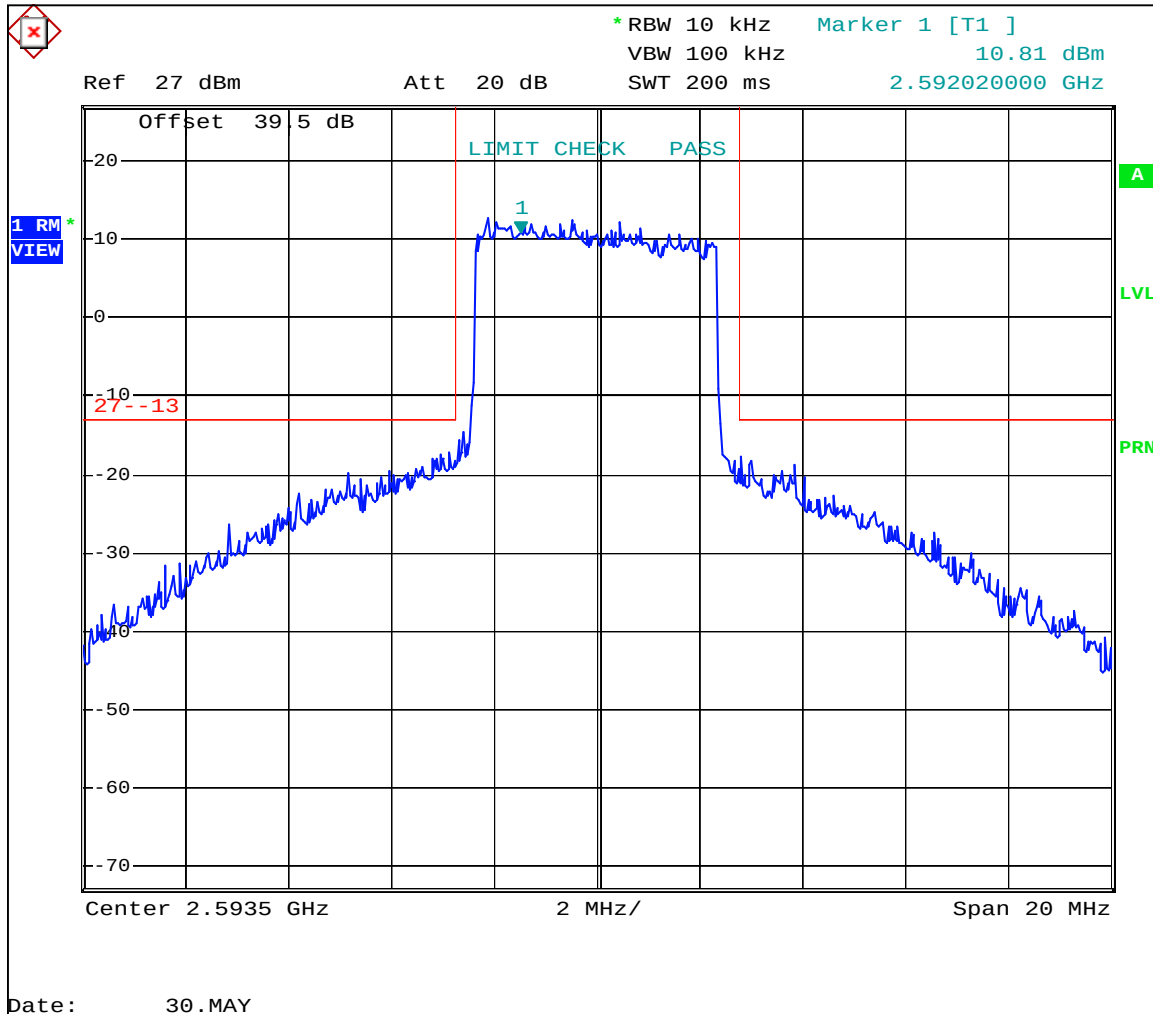


*RBW 10 kHz Marker 1 [T1]
 VBW 100 kHz 9.00 dBm
 SWT 200 ms 2.592020000 GHz

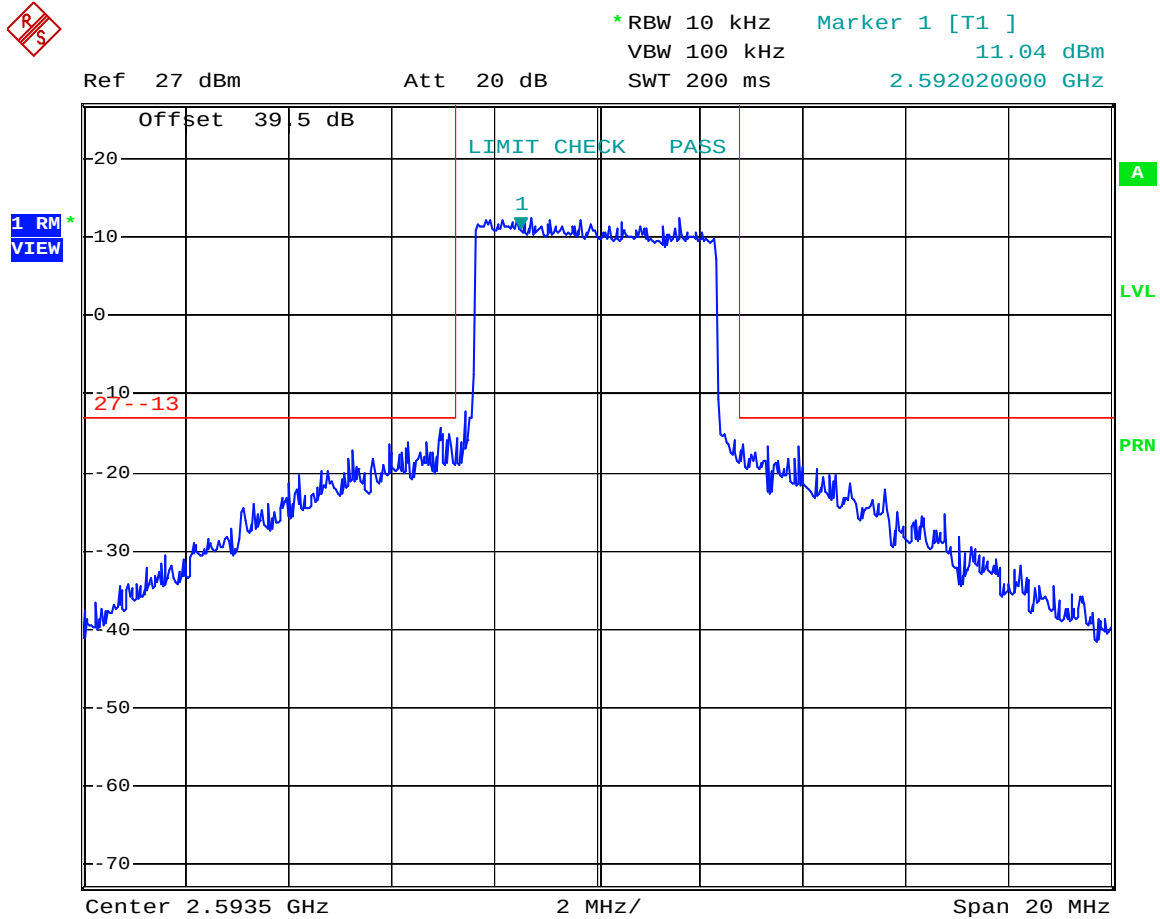


Date: 30.MAY.2006 13:39:01

0 degrees OFDM mode



-10 degrees OFDM mode EUT ceased to operate at -15 degrees



Date: 30.MAY.2006 14:40:05

Section 8. Test Equipment List

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date	Calibration Due
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	01/14/05	01/15/07
1659	Spectrum Analyzer	Rhode & Schwarz FSP	973353	01/10/06	01/10/07
1081	CABLE 2m	Astrolab 32027-2-29094-72TC	N/A	CBU	N/A
1474	20db Attenuator DC 18 Ghz	MCL Inc. BW-S20W2	NONE	CBU	N/A
1471	10 db Attenuator DC 18 Ghz	MCL Inc. BW-S10W2 10db-2WDC	NONE	CBU	N/A
2071	Power Sensor	Agilent E9304A	MY41495174	09/30/05	09/30/06
2072	Power Meter	HP E4418B	GB39401848	09/30/05	09/30/06
283	Environmental Chamber with controller # 1189006	ENVIROTRONICS SH27 & 2030-22844	129010083	CNR	CNR
1083	Cable 2m	Astrolab 32027-2-29094-72TC	N/A	CBU	N/A
619	THERMOMETER	FLUKE 51	4520028	09/26/05	09/26/06
1064	ATTENUATOR	NARDA 776B-20	NONE	CBU	N/A
1055	DUAL DIRECTIONAL COUPLER	NARDA 3022	73393	Cal Not Req	N/A
1083	Cable 2m	Astrolab 32027-2-29094-72TC	N/A	CBU	N/A
1483	Cable 4m	Storm PR90-010-144	N/A	CBU	N/A
1064	ATTENUATOR	NARDA 776B-20	NONE	CBU	N/A
1065	ATTENUATOR	NARDA 776B-10	NONE	CBU	N/A
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	04/20/06	04/20/07
791	PREAMP, 25dB	Nemko USA, Inc. LNA25	398	04/20/06	04/20/07
760	Antenna biconical	Electro Metrics MFC-25	477	08/04/05	08/04/06
759	ANTENNA, LOG PERIODIC	A.H. SYSTEMS SAS-200/510	556	02/13/06	02/13/07
1484	Cable 2.0-18.0 Ghz	Storm PR90-010-072	N/A	08/26/05	08/26/06
1485	Cable 2.0-18.0 Ghz	Storm PR90-010-216	N/A	08/26/05	08/26/06
993	Horn antenna	A.H. Systems SAS-200/571	XXX	08/01/05	08/02/07

ANNEX A - TEST DETAILS

NAME OF TEST: RF Power Output**PARA. NO.: 2.1046****Method Of Measurement:****Antenna Conducted:**

The AVG 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
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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.

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

Test Method: TIA/EIA-603-1992

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 a dipole. 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 erp is the signal level fed to the reference antenna corrected for gain referenced to a dipole.

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

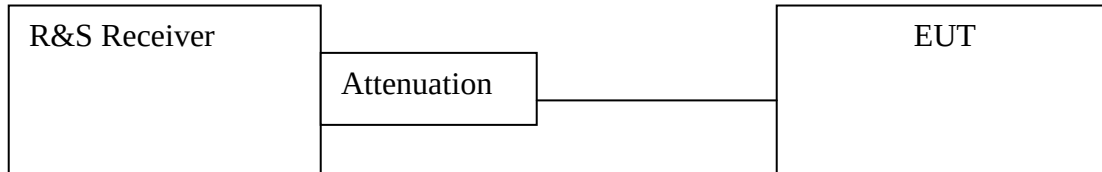
The E.U.T. is placed in an environmental chamber and allowed to stabilize at +20 degrees Celsius. This procedure is repeated at 100% S.T.V, 115% S.T.V. and 85% S.T.V

Frequency Stability With Temperature Variation:

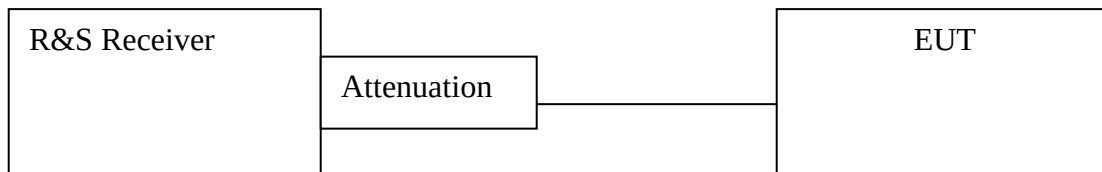
The input voltage to the E.U.T. is set to 100%S.T.V. and the temperature of the environmental chamber is varied in 10 degree steps from -30 degrees C to +50 degrees C. The E.U.T. is allowed to stabilize at each temperature.

ANNEX B - TEST DIAGRAMS

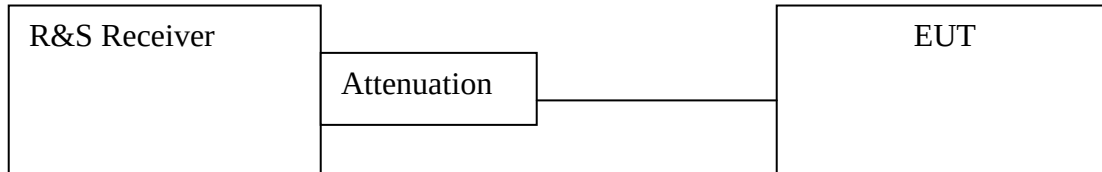
Para. No. 2.1046 - R.F. Power Output



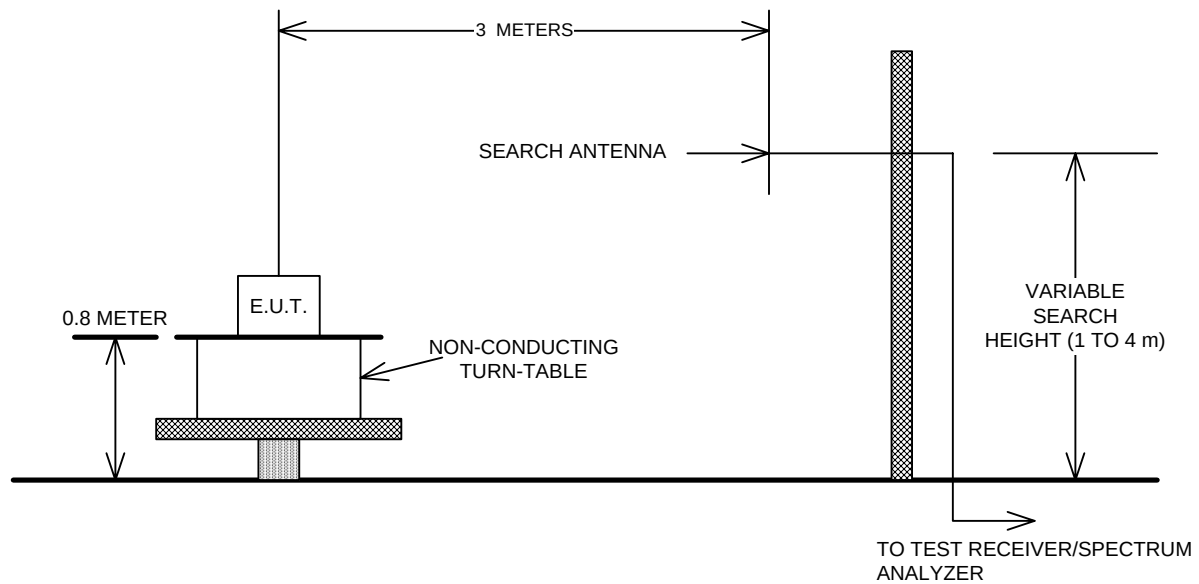
Para. No. 2.1049 - Occupied Bandwidth



Para. No. 2.1051 - Spurious Emissions at Antenna Terminals



Para. No. 2.1053 - Field Strength of Radiation



Para. No. 2.1055 - Frequency Stability

