

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 text.

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 |
| | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> |
| 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 |

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 |

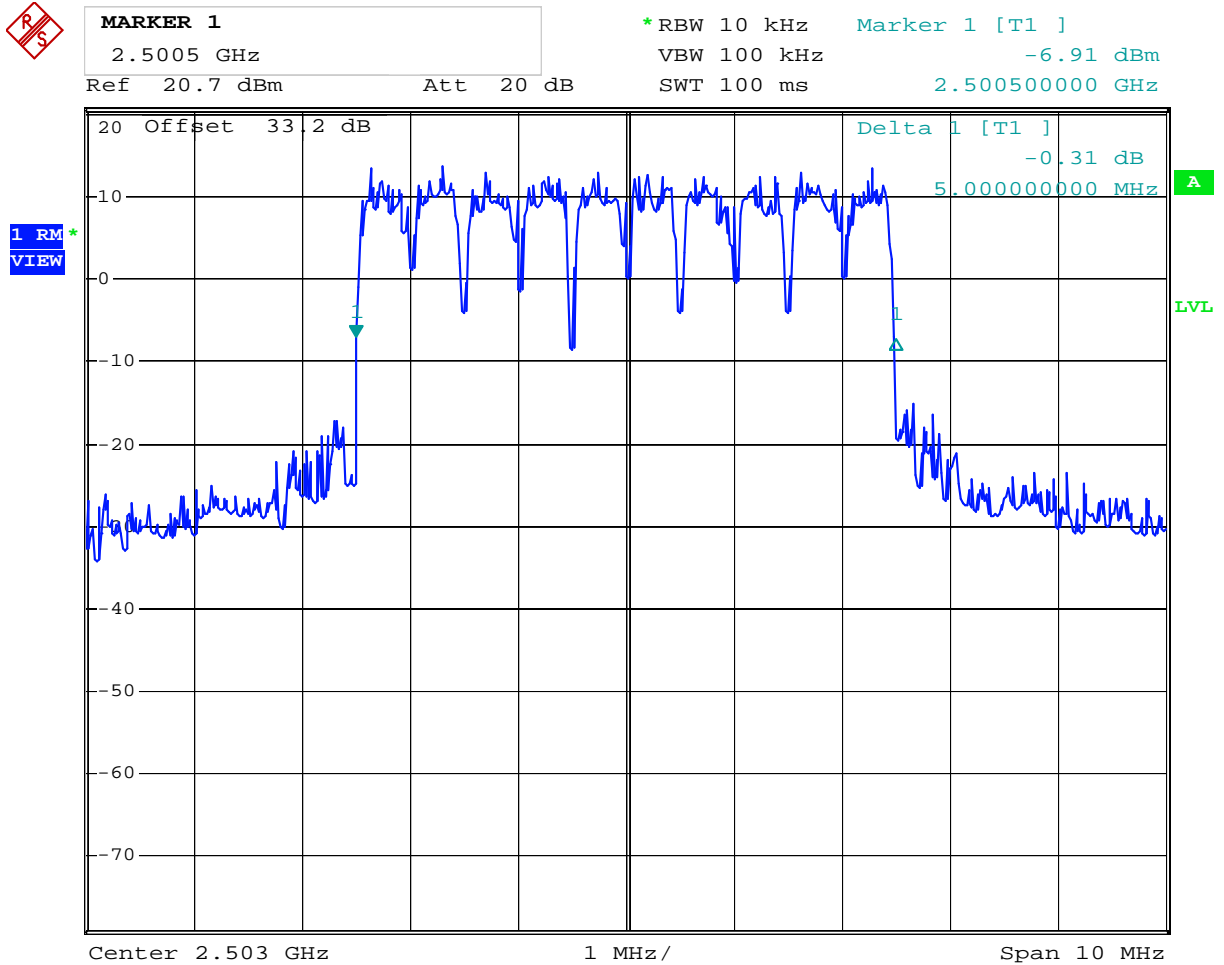
Test Results: Complies

Measurement Data: See attached plots.

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

Test Data – Occupied Bandwidth

2.503 GHz Navini Mode



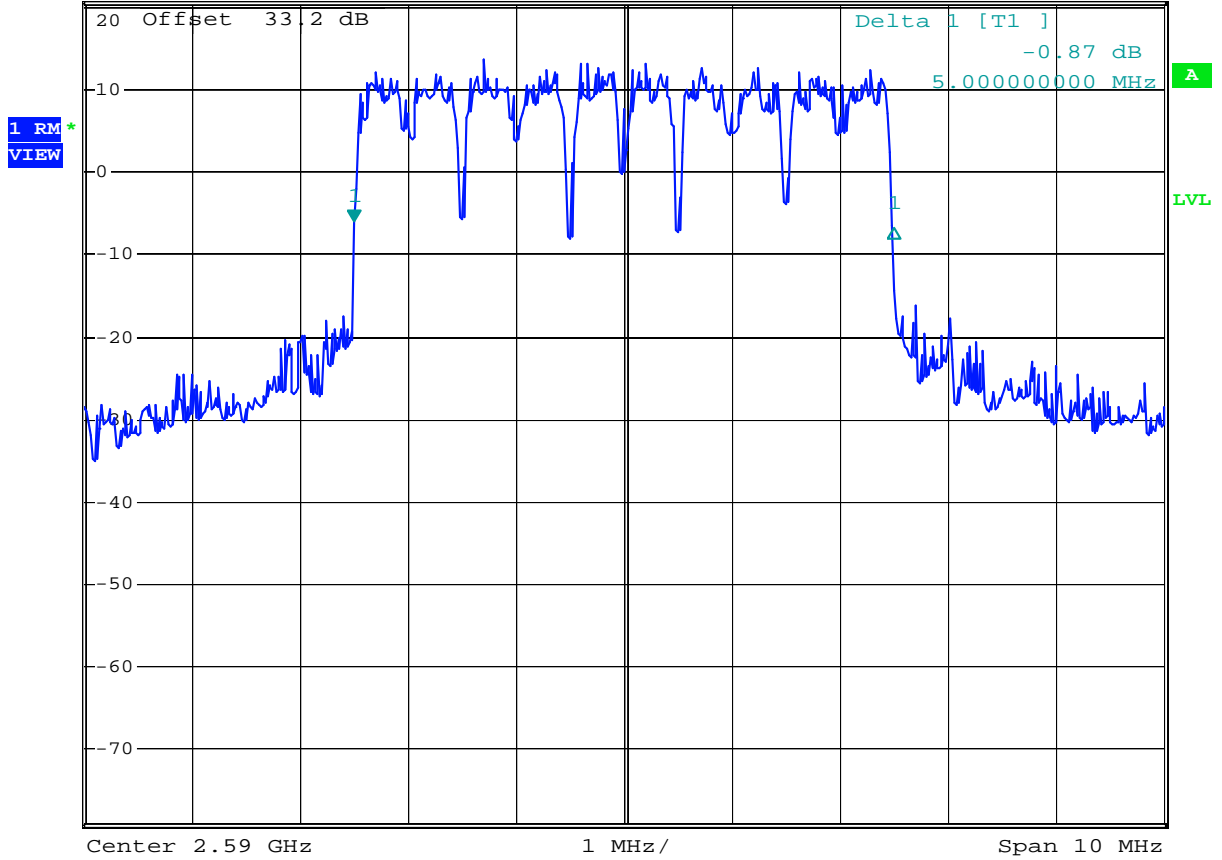
Date: 31.MAY.2006 11:38:21

2.590 GHz Navini Mode



MARKER 1
2.5875 GHz
Ref 20.7 dBm Att 20 dB

*RBW 10 kHz Marker 1 [T1]
VBW 100 kHz -5.85 dBm
SWT 100 ms 2.587500000 GHz



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

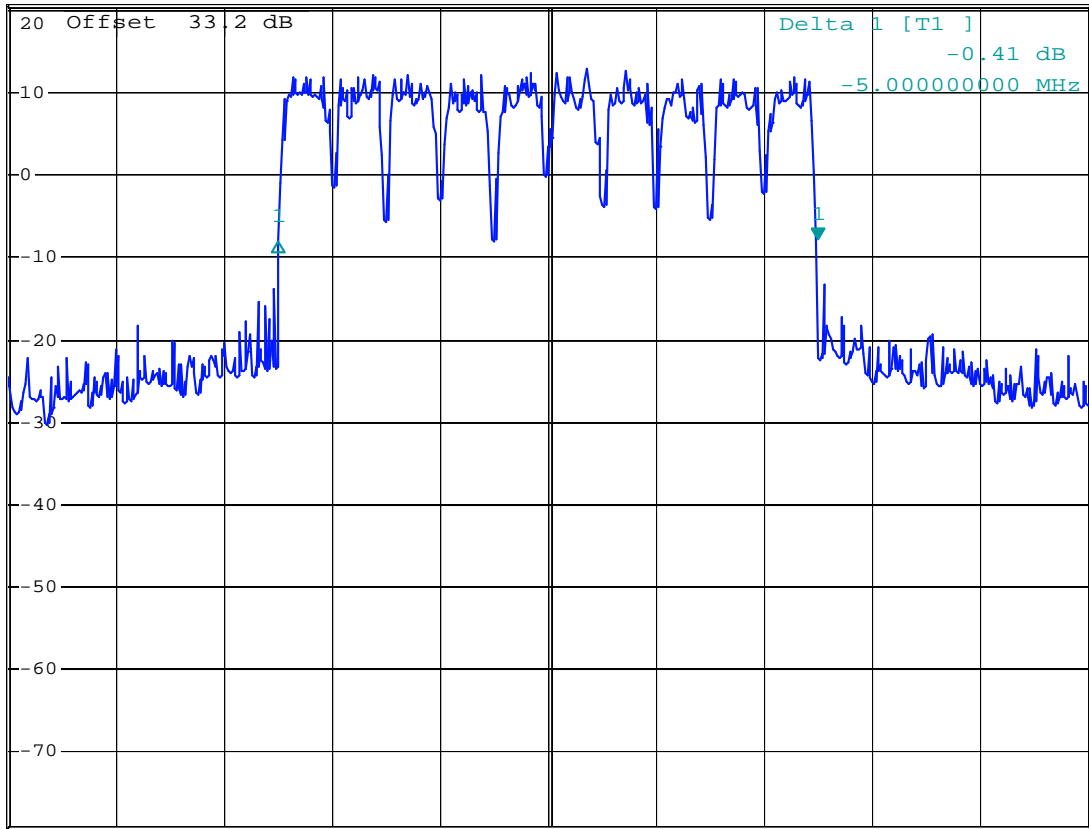
2.683.5 GHz Navini Mode



MARKER 1
2.686 GHz
Ref 20.7 dBm Att 20 dB

*RBW 10 kHz Marker 1 [T1]
VBW 100 kHz -7.66 dBm
SWT 100 ms 2.686000000 GHz

1 RM*
VIEW



Center 2.6835 GHz 1 MHz/ Span 10 MHz

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

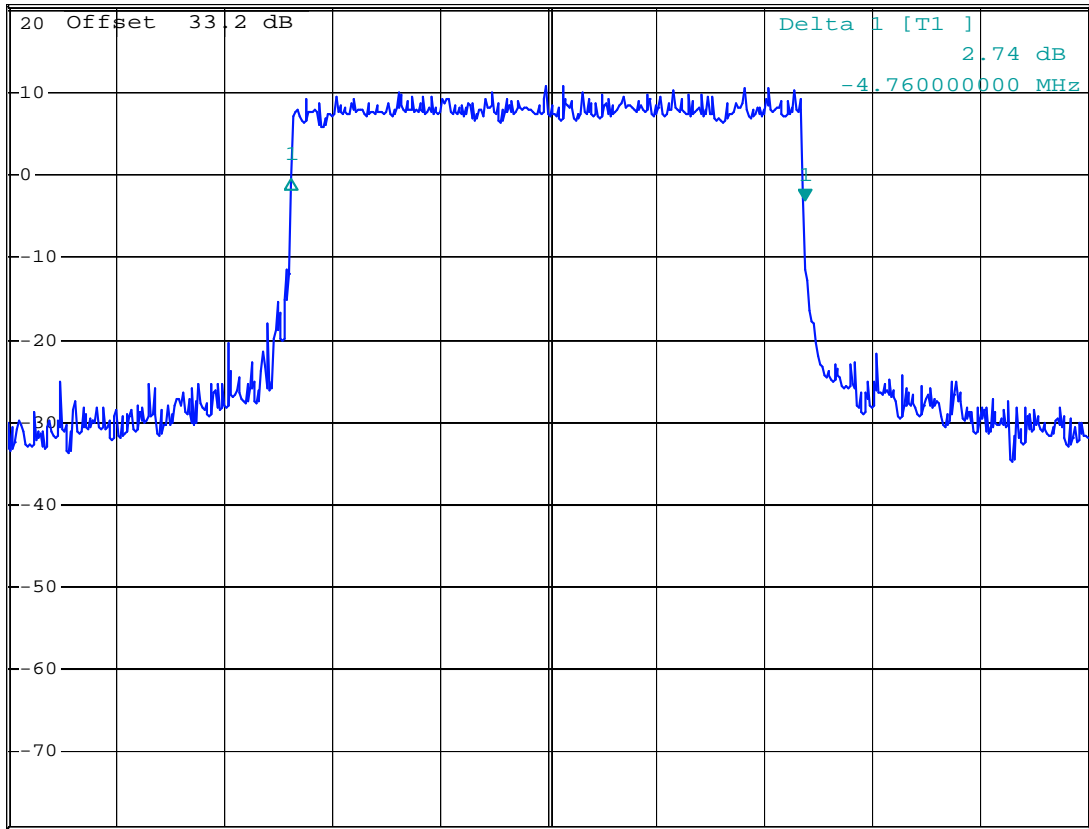
2.503 GHz OFDM Mode



MARKER 1
2.50538 GHz
Ref 20.7 dBm Att 20 dB

*RBW 10 kHz Marker 1 [T1]
VBW 100 kHz -3.16 dBm
SWT 100 ms 2.505380000 GHz

1 RM*
VIEW



A

LVL

Center 2.503 GHz 1 MHz/ Span 10 MHz

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

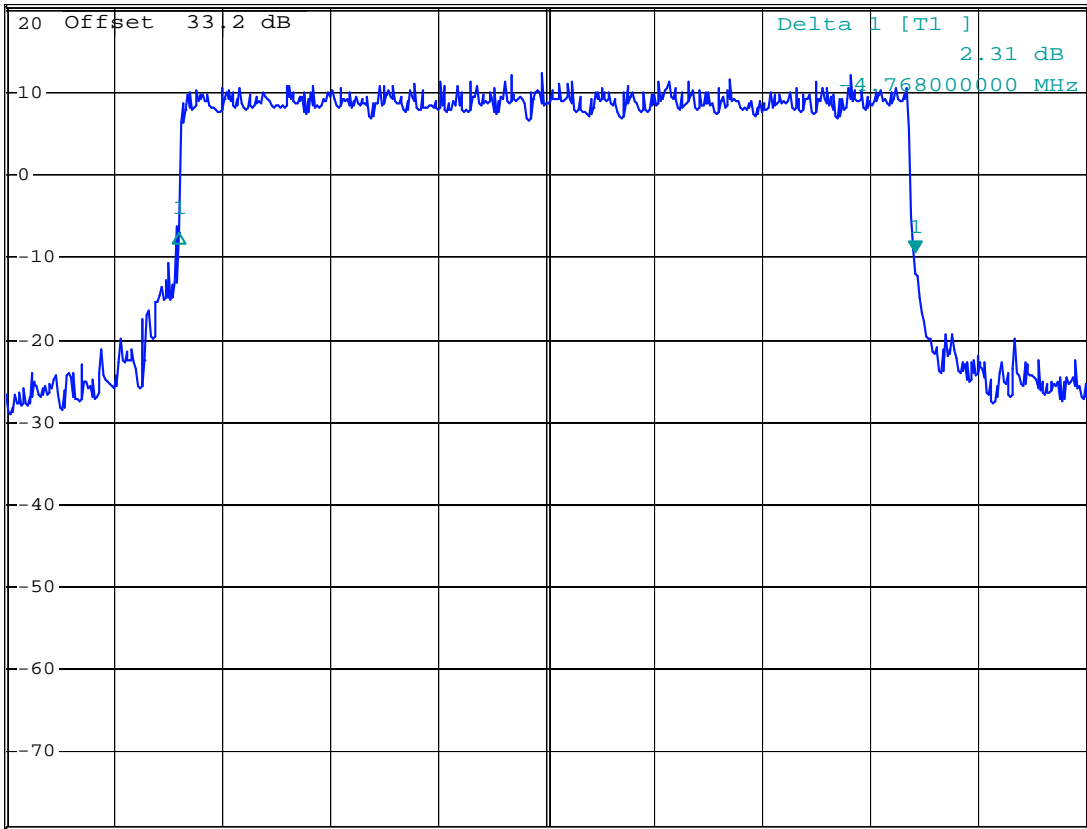
2.590 GHz OFDM Mode



MARKER 1
2.592394 GHz
Ref 20.7 dBm Att 20 dB

*RBW 10 kHz Marker 1 [T1]
VBW 100 kHz -9.29 dBm
SWT 70 ms 2.592394000 GHz

1 RM*
VIEW



Center 2.59 GHz 700 kHz/ Span 7 MHz

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

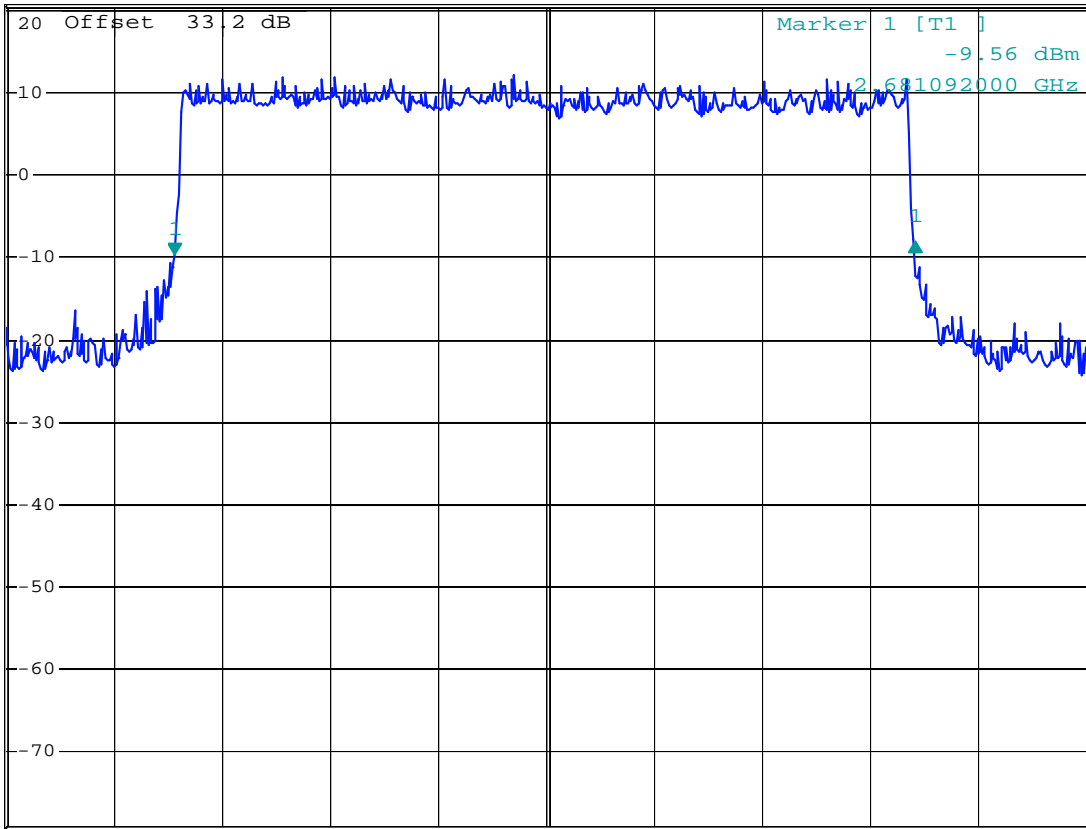
2.6835 GHz OFDM Mode



DELTA MARKER 1
4.802 MHz
Ref 20.7 dBm Att 20 dB

*RBW 10 kHz Delta 1 [T1]
VBW 100 kHz 1.64 dB
SWT 70 ms 4.802000000 MHz

1 RM*
VIEW



Center 2.6835 GHz 700 kHz/ Span 7 MHz

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

Section 5. Spurious Emissions at Antenna Terminals

| | |
|--|-------------------|
| NAME 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.

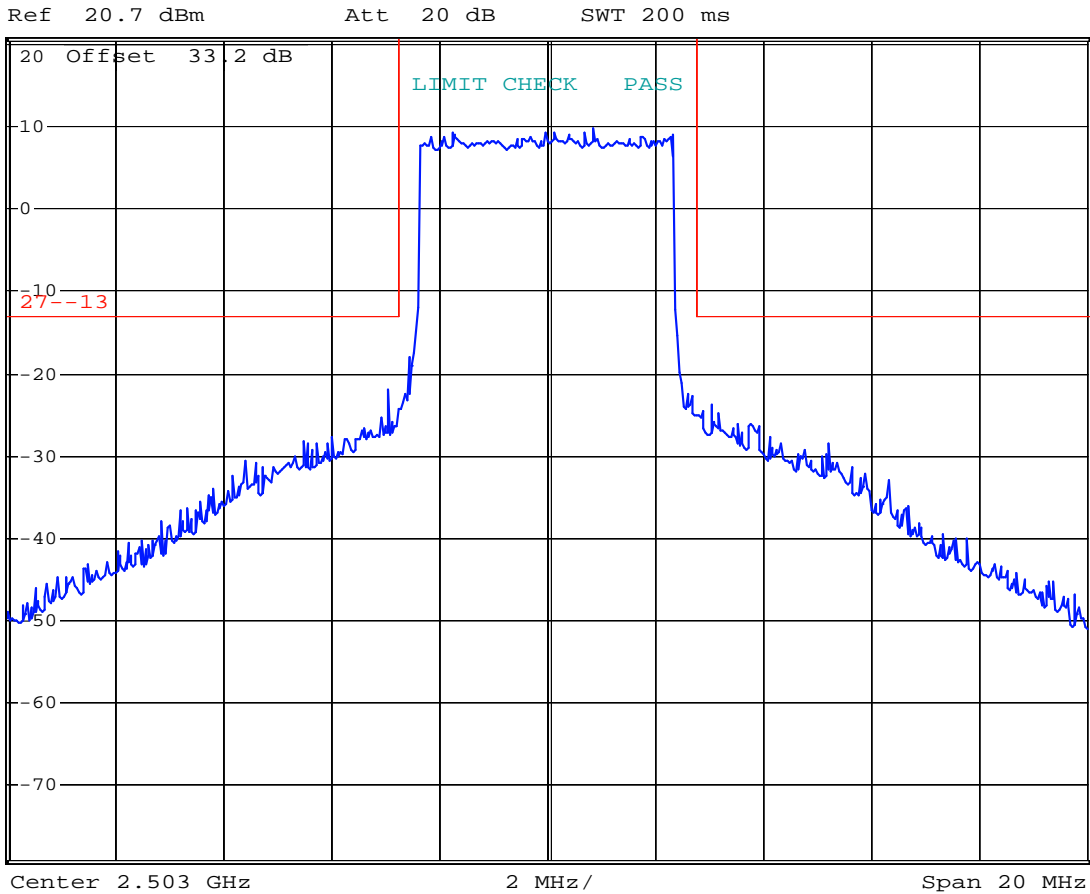
Notes: Device operating at 2.59GHz and 33 dBm conducted power. Frequency Range scanned from 9 kHz to 26.5GHz.

Test Data – Spurious Emissions at Antenna Terminals

Lower Bandedge OFDM mode



*RBW 10 kHz
VBW 100 kHz
SWT 200 ms

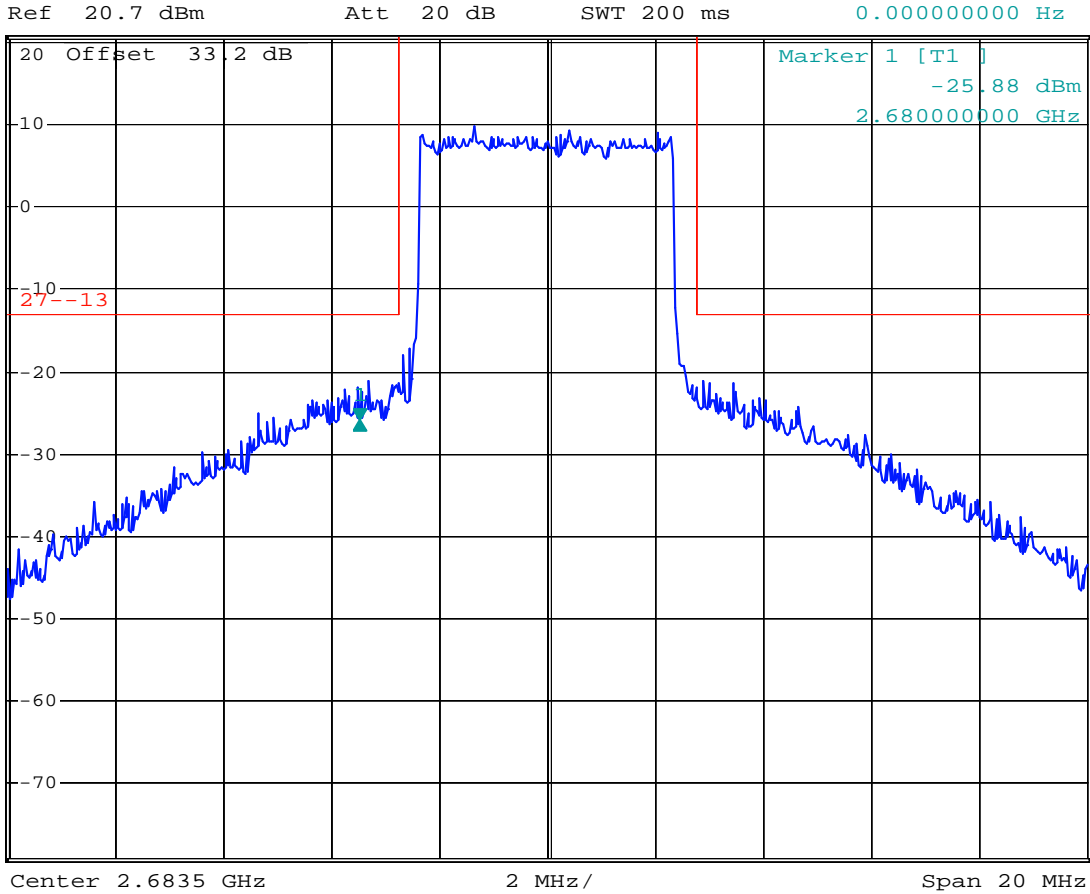


Date: 31.MAY.2006 09:52:02

Upper Bandedge OFDM mode

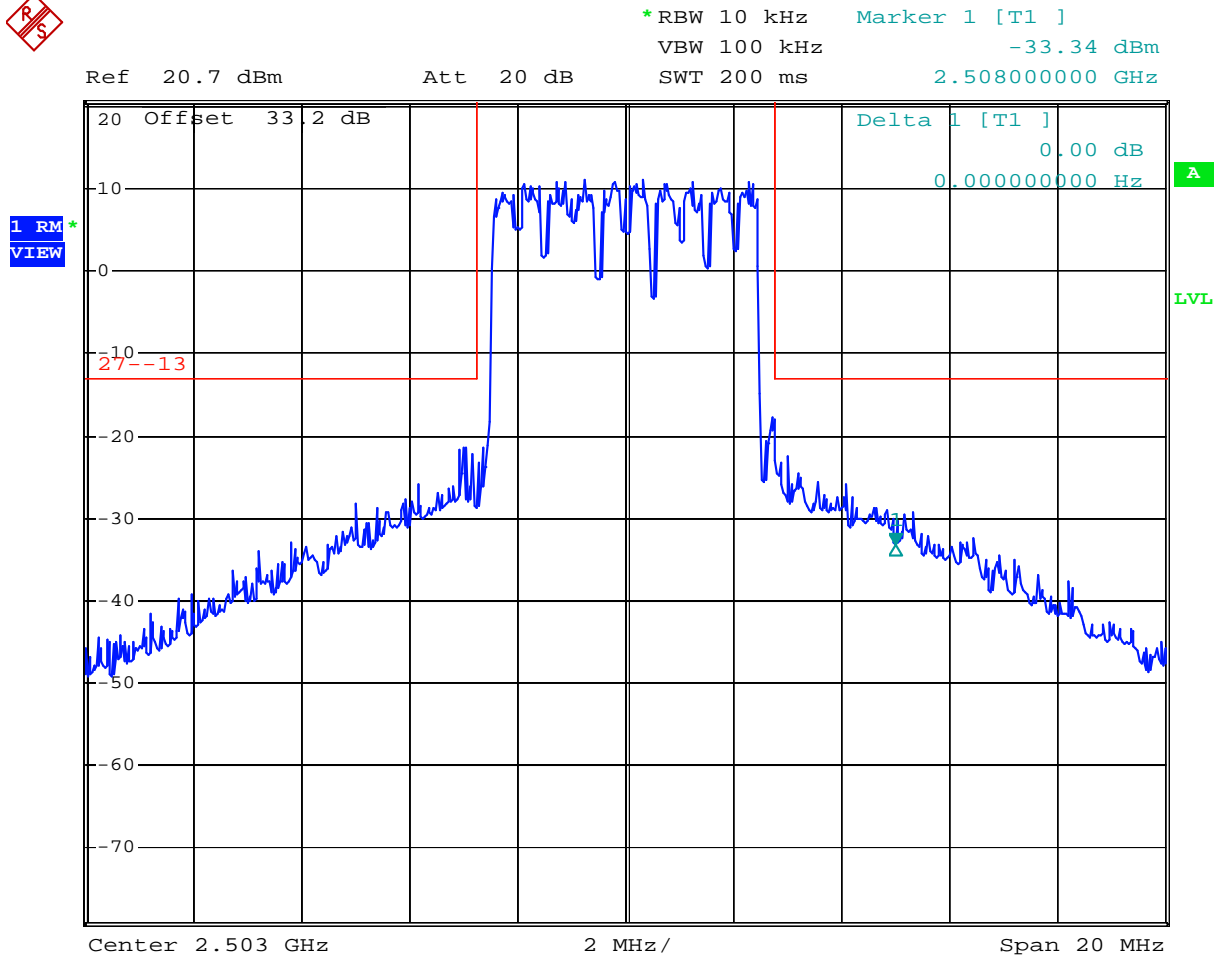


*RBW 10 kHz Delta 1 [T1]
VBW 100 kHz 0.00 dB
SWT 200 ms 0.000000000 Hz



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

Lower Bandedge Navini mode



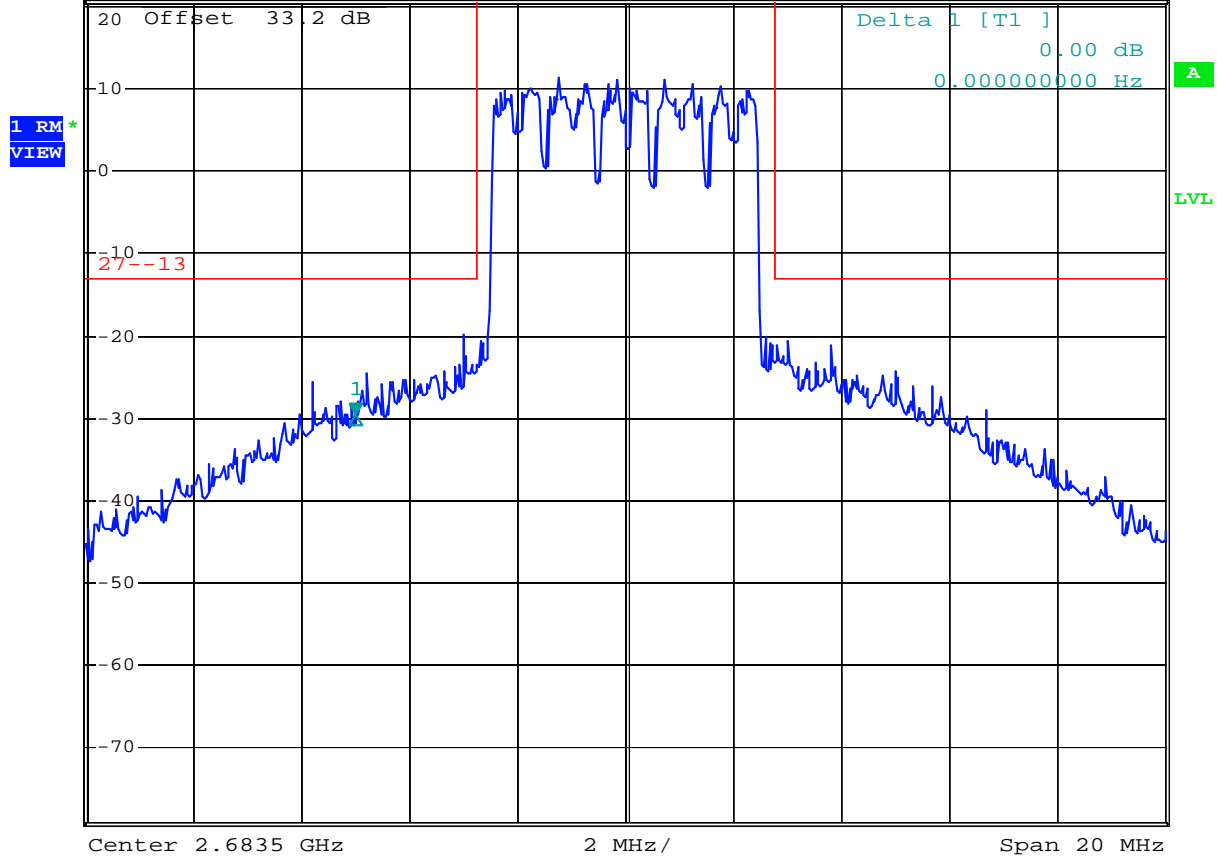
Date: 31.MAY.2006 11:37:23

Upper Bandedge Navini mode

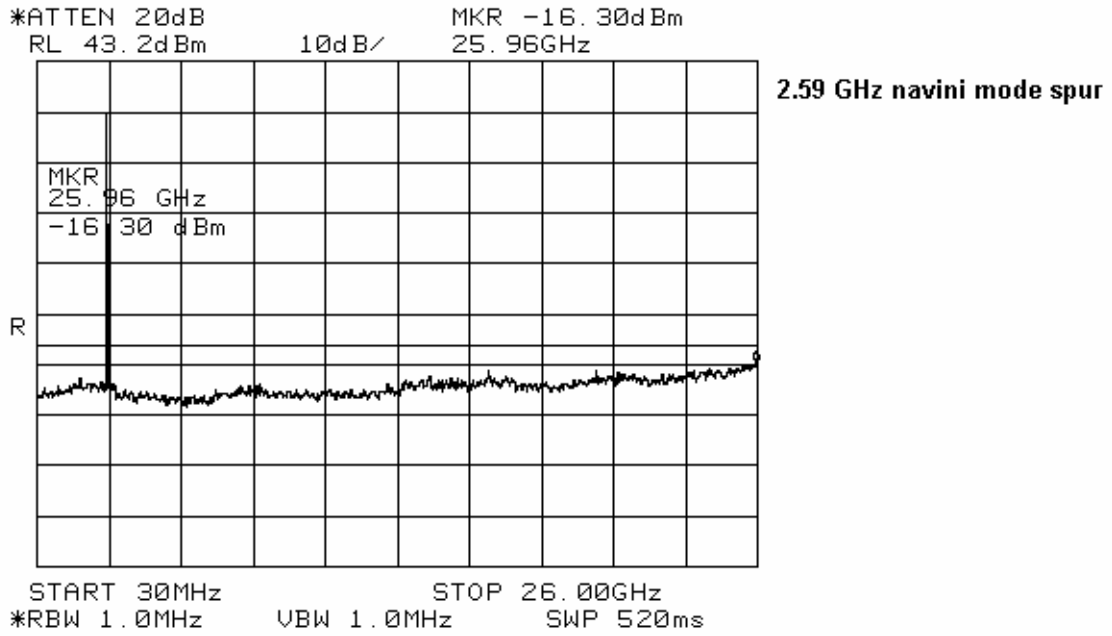


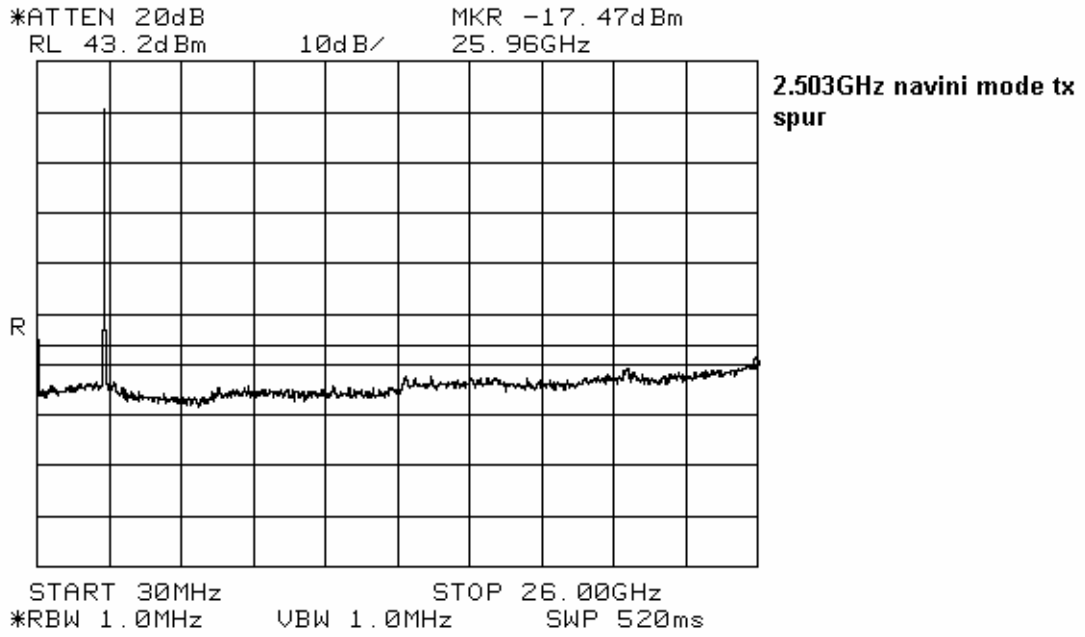
CENTER FREQUENCY
2.6835 GHz
Ref 20.7 dBm Att 20 dB

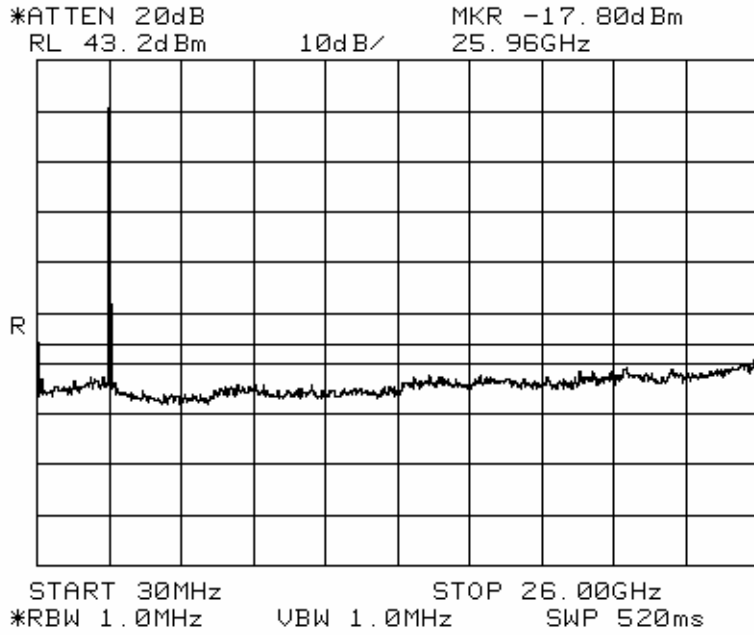
*RBW 10 kHz Marker 1 [T1]
VBW 100 kHz -29.50 dBm
SWT 200 ms 2.678500000 GHz



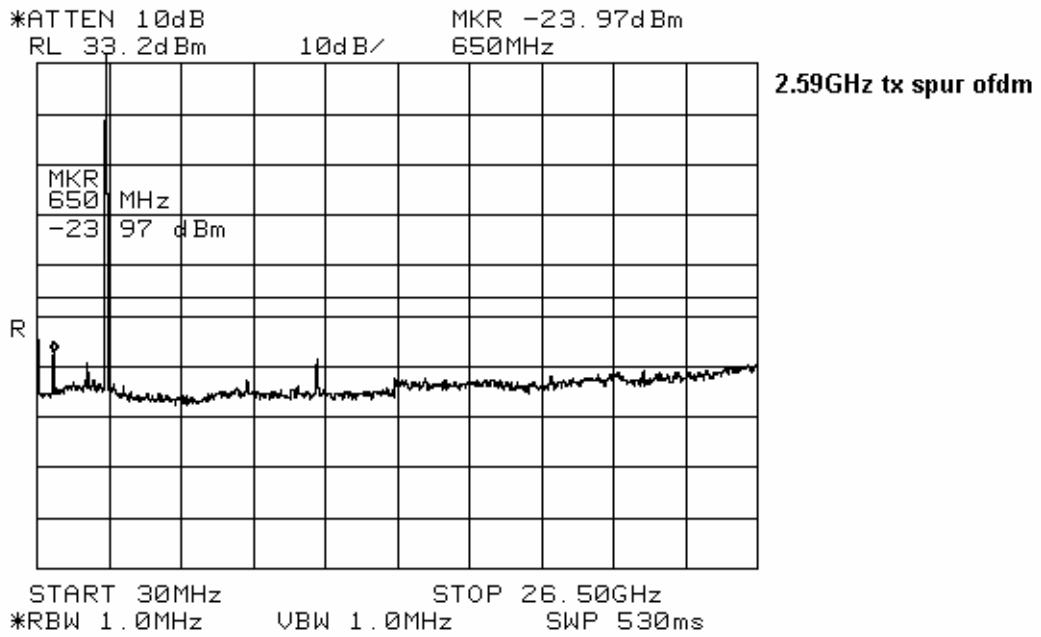
Date: 31.MAY.2006 11:32:07

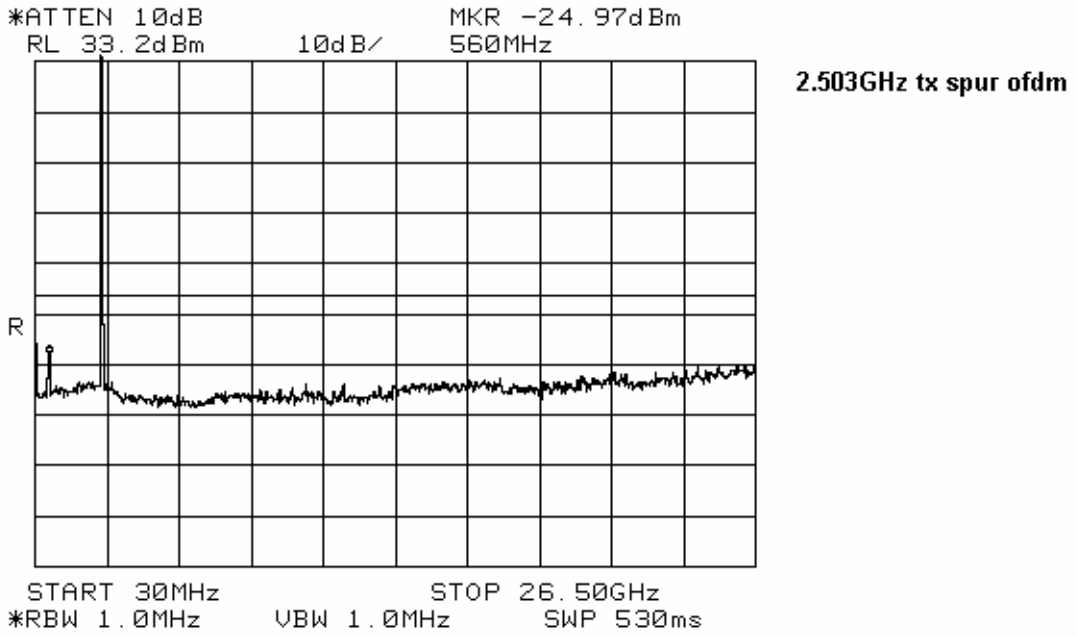


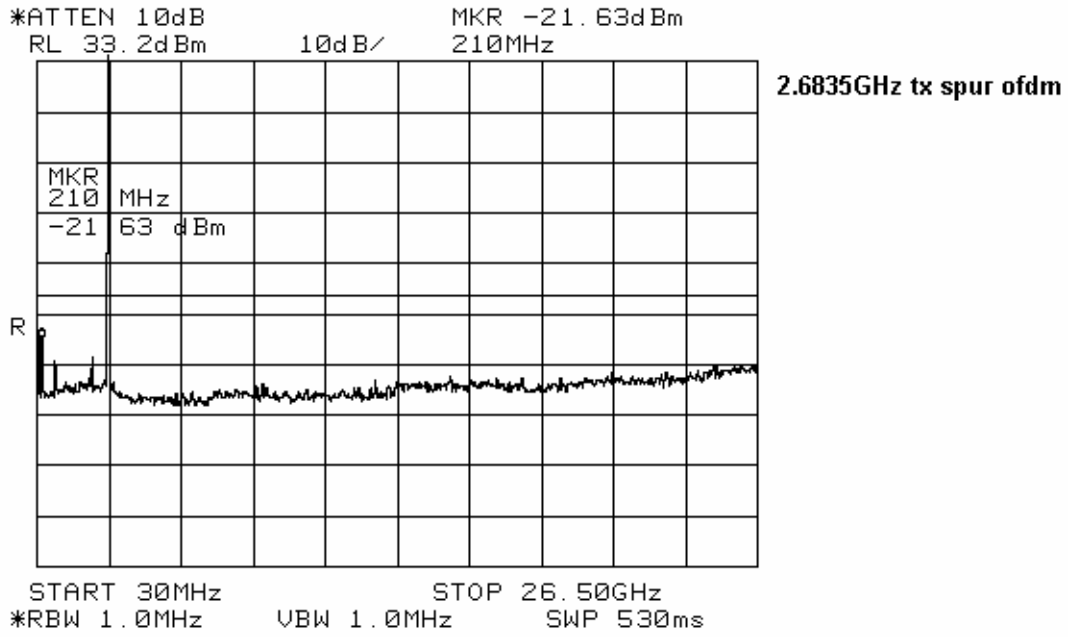




2.6835Ghz navini mode tx spur







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.

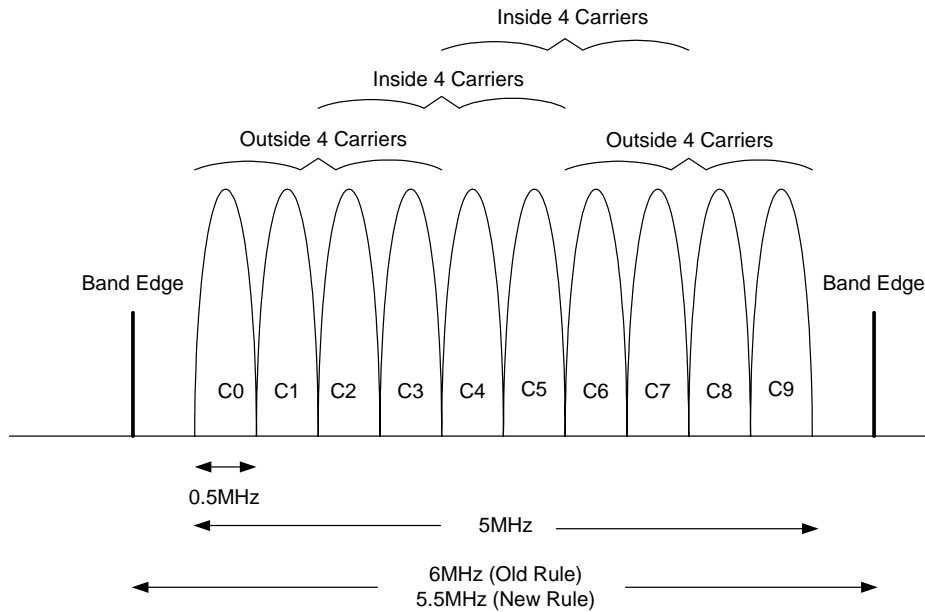


Figure 1. 4-Carrier Signal

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

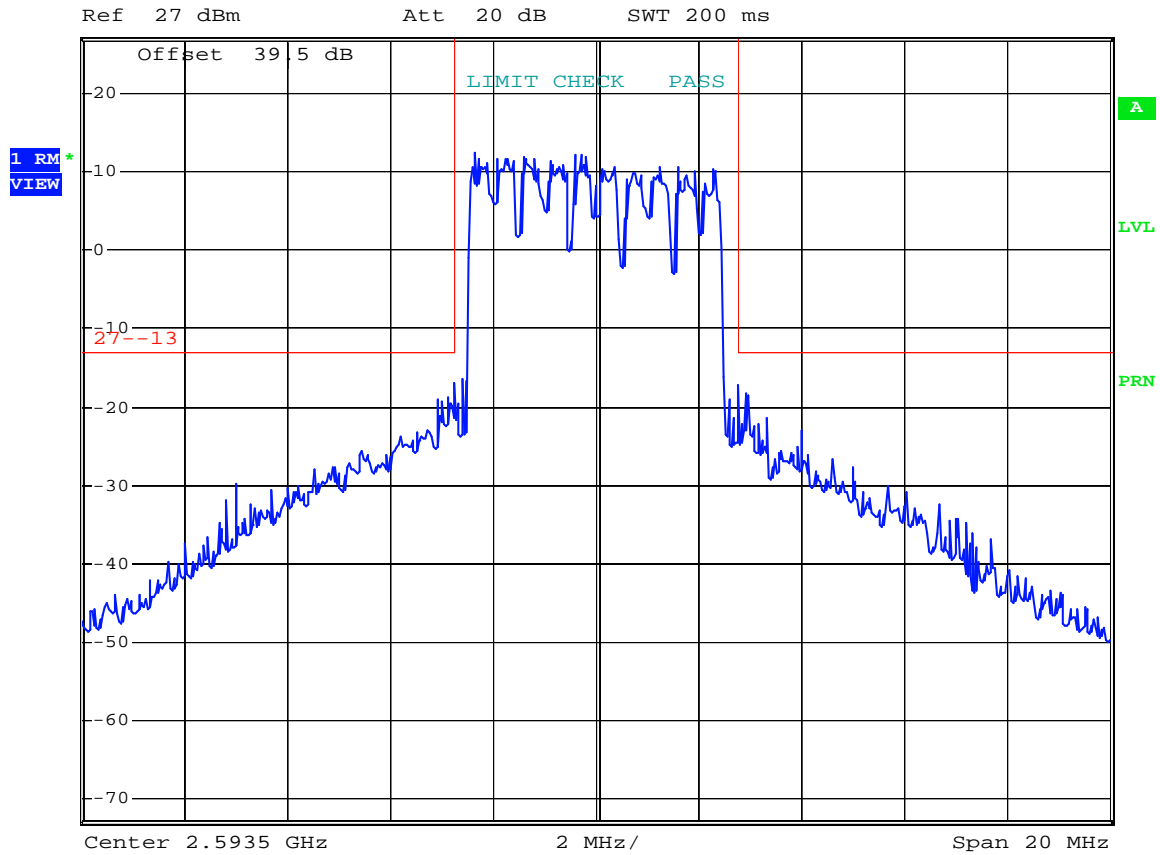
Equipment used

1659, 1483, 1064, 1065, 283, 619

20 Degrees C 120VAC



*RBW 10 kHz
VBW 100 kHz
SWT 200 ms

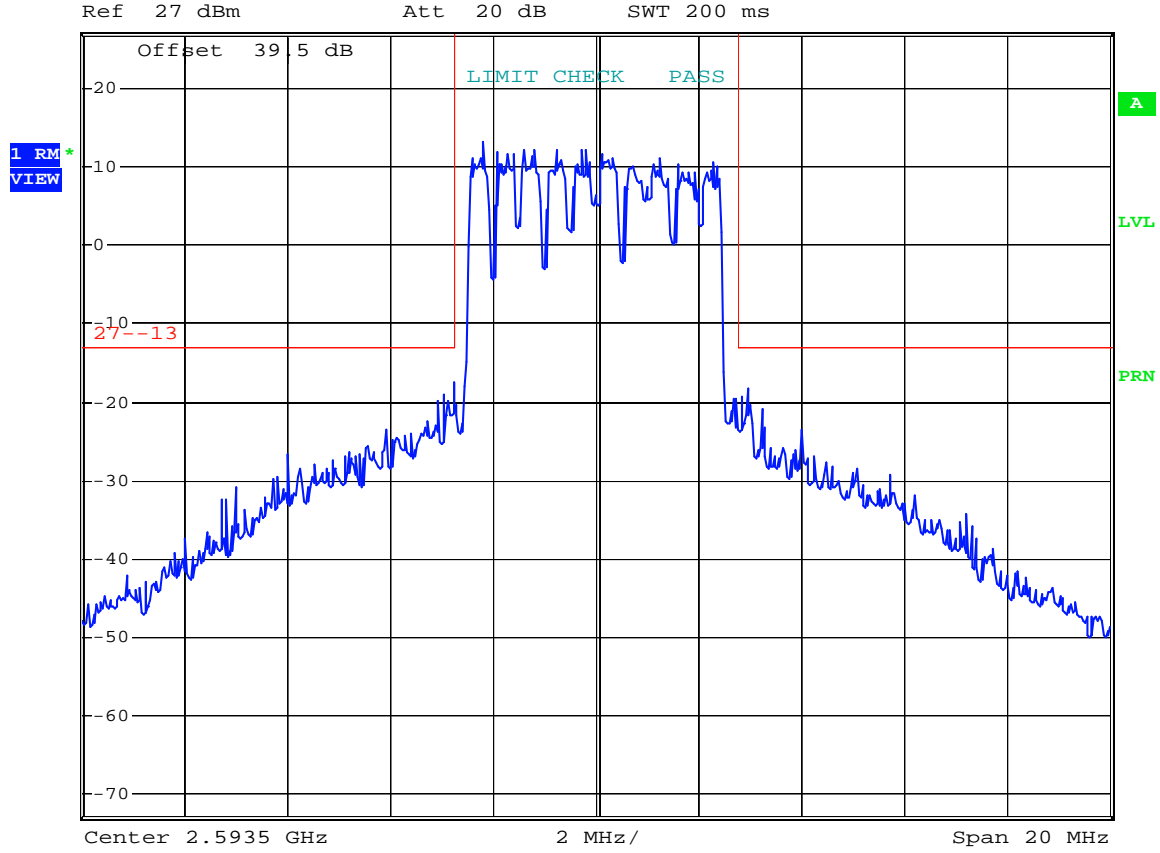


Date: 26.MAY.2006 09:58:40

20 Degrees C 102VAC



*RBW 10 kHz
VBW 100 kHz
SWT 200 ms

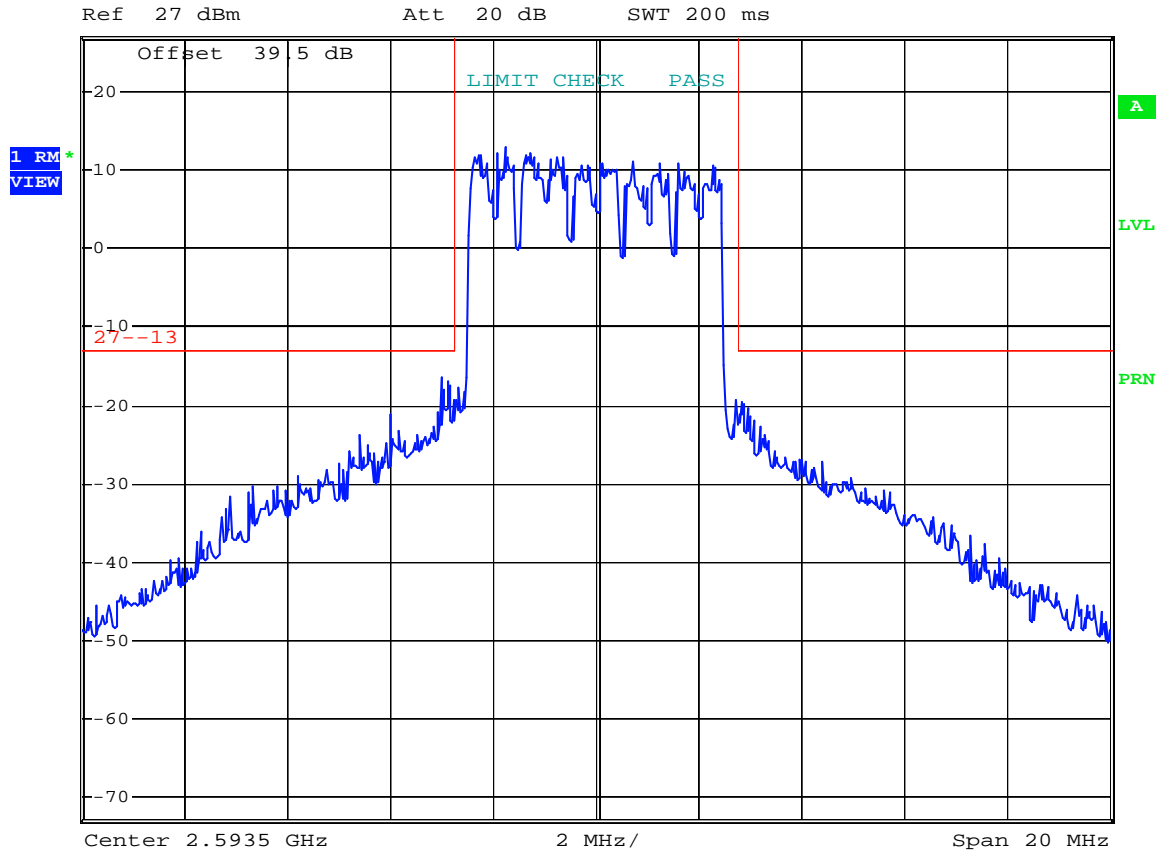


Date: 26.MAY.2006 09:56:22

20 Degrees C 138VAC



*RBW 10 kHz
VBW 100 kHz
SWT 200 ms



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

50 Degrees Navini mode



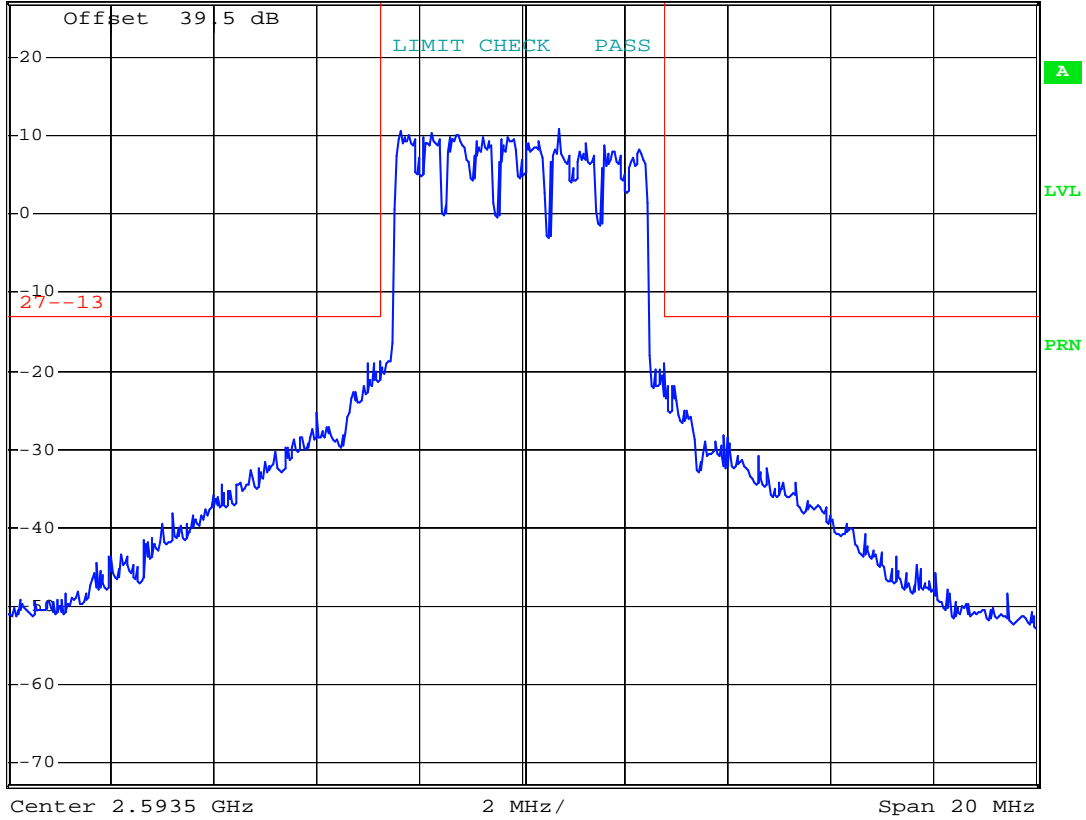
*RBW 10 kHz
VBW 100 kHz
SWT 200 ms

Ref 27 dBm

Att 20 dB

SWT 200 ms

1 RM*
VIEW



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

40 degrees Navini mode

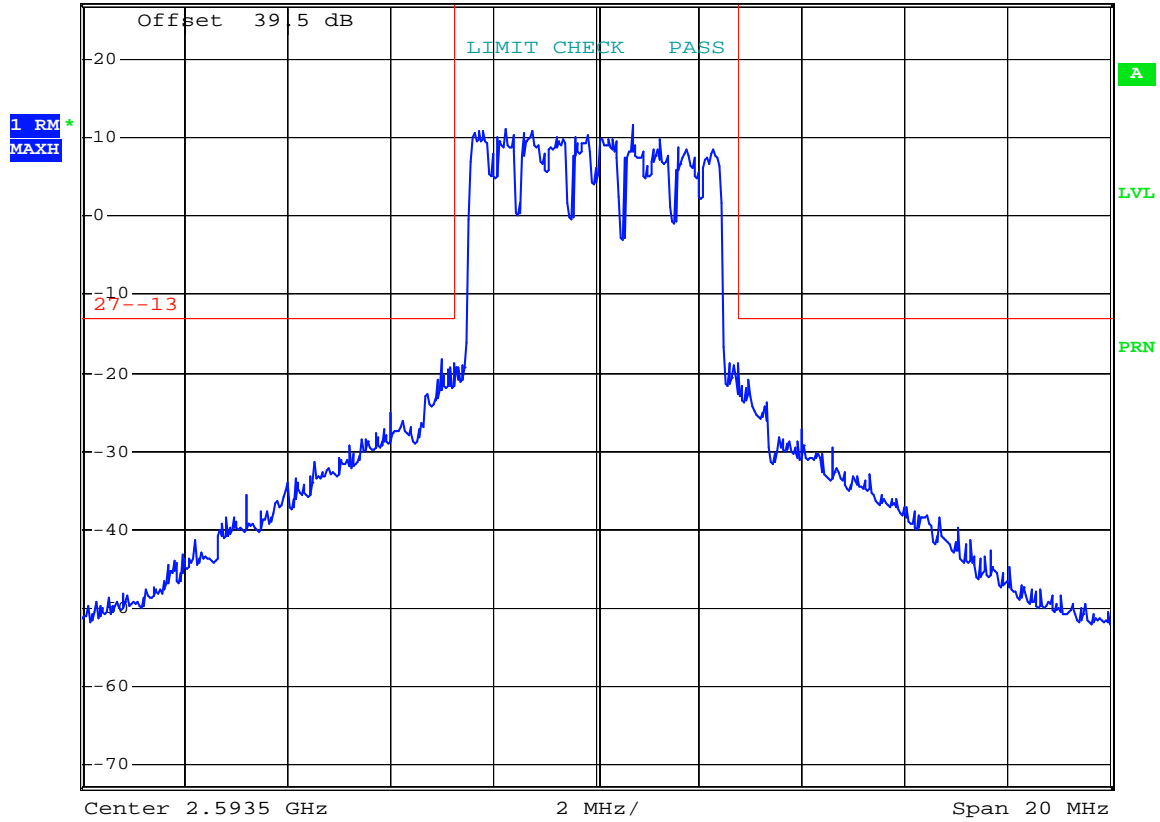


*RBW 10 kHz
VBW 100 kHz
SWT 200 ms

Ref 27 dBm

Att 20 dB

SWT 200 ms

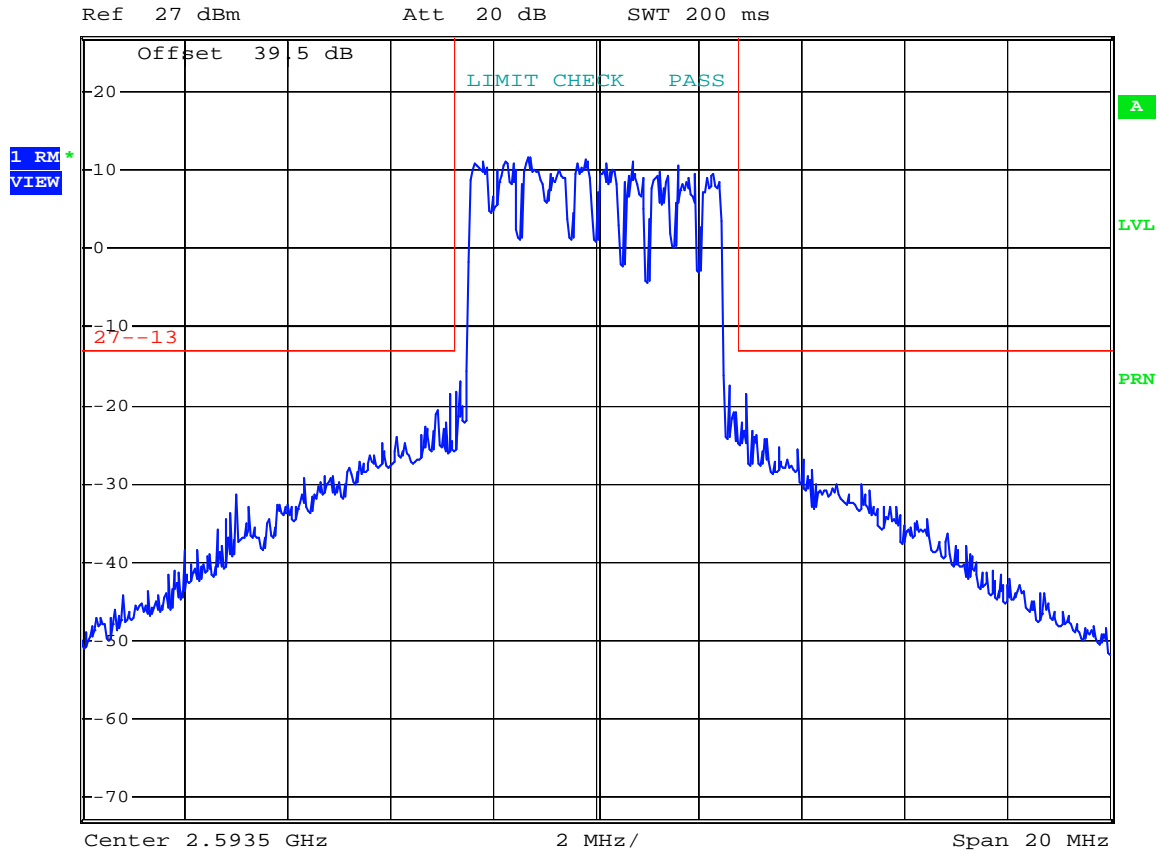


Date: 26.MAY.2006 10:56:23

30 degrees Navini mode



*RBW 10 kHz
VBW 100 kHz
SWT 200 ms



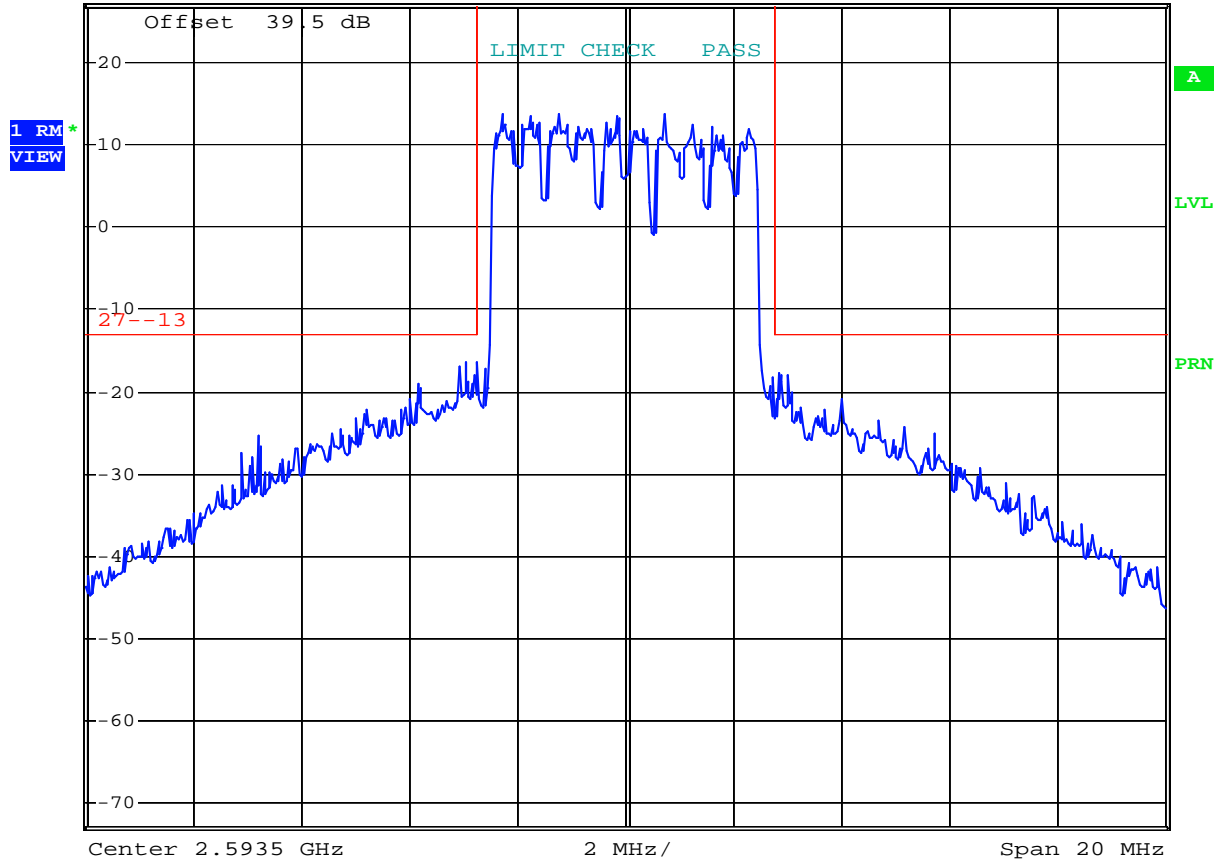
Date: 26.MAY.2006 11:24:15

10 degrees Navini mode



*RBW 10 kHz
VBW 100 kHz

Ref 27 dBm Att 20 dB SWT 200 ms

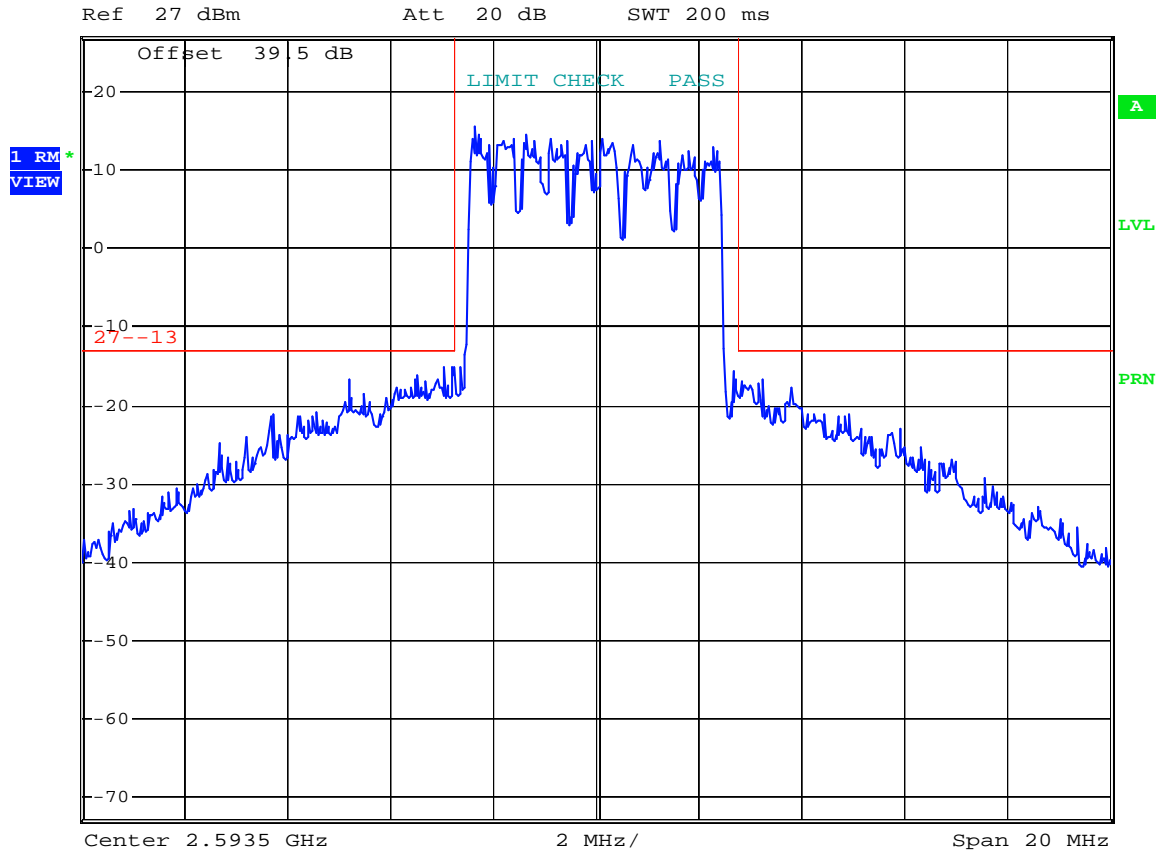


Date: 26.MAY.2006 12:55:06

0 degrees Navini mode



*RBW 10 kHz
VBW 100 kHz
SWT 200 ms

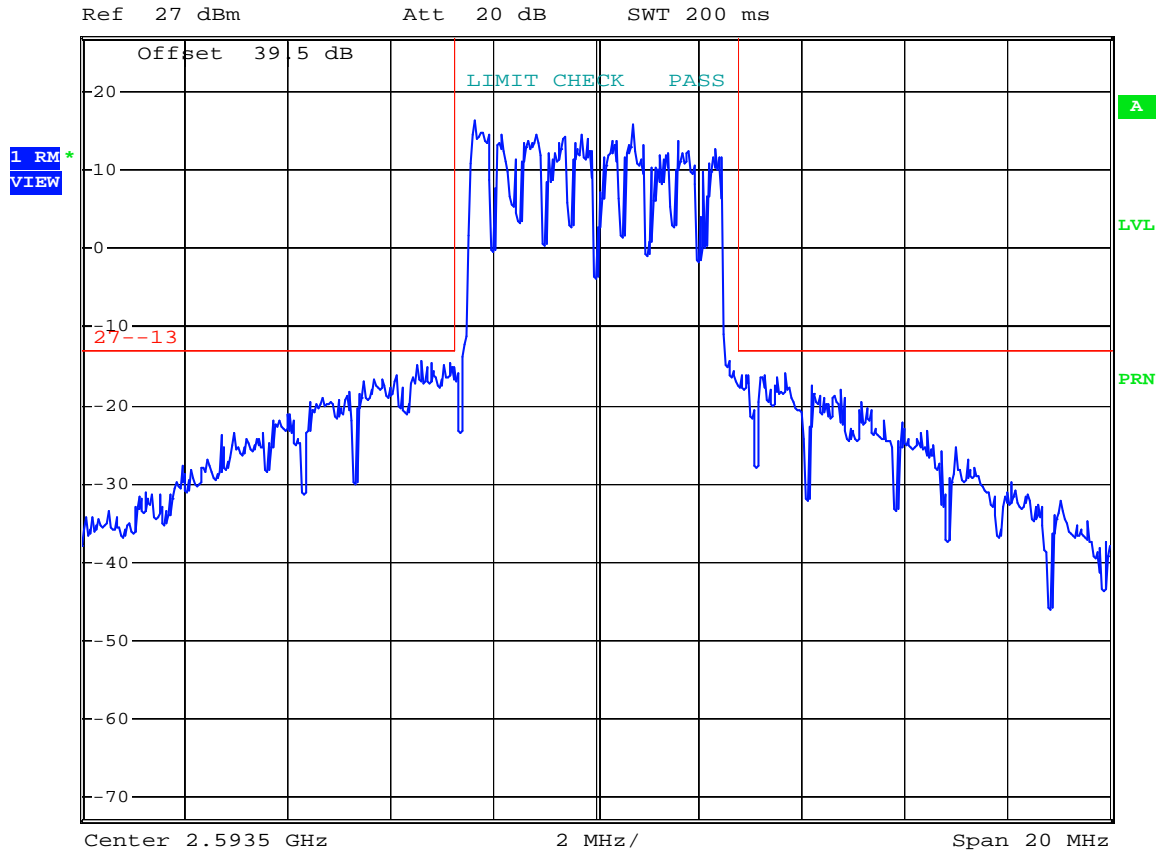


Date: 26.MAY.2006 14:25:01

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



*RBW 10 kHz
VBW 100 kHz
SWT 200 ms



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

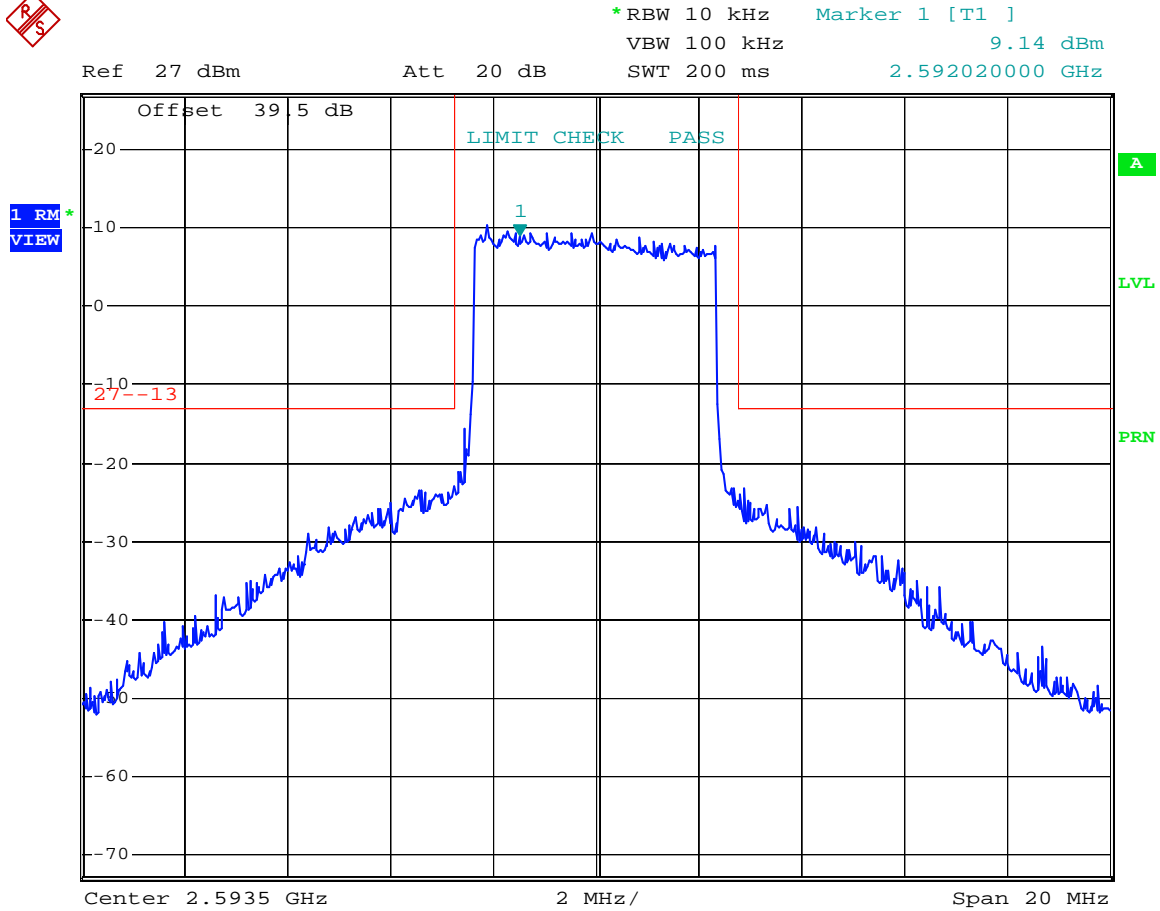
Temperature Stability

OFDM mode

Equipment used

1659, 1483, 1064, 1065, 283, 619

20 Degrees C 120VAC

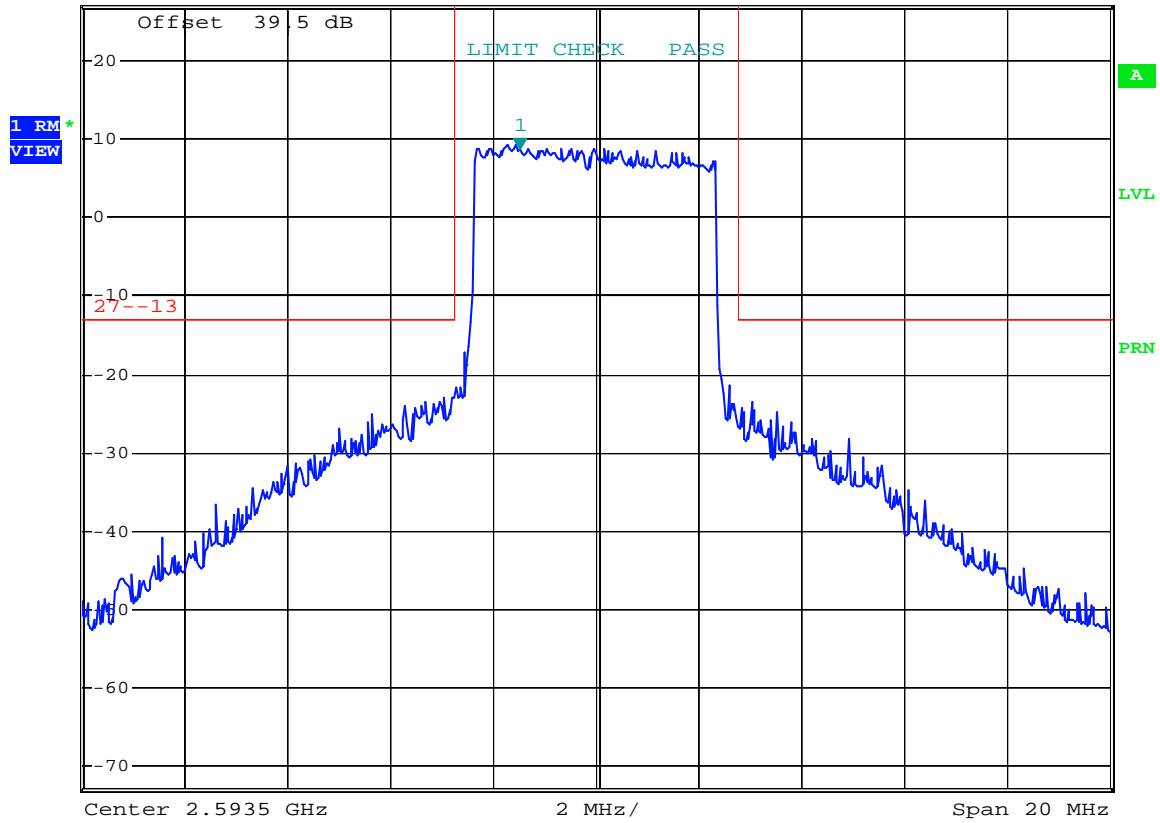


Date: 30.MAY.2006 09:21:24

20 Degrees C 138VAC



*RBW 10 kHz Marker 1 [T1]
VBW 100 kHz 8.74 dBm
SWT 200 ms 2.592020000 GHz



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

50 Degrees OFDM mode

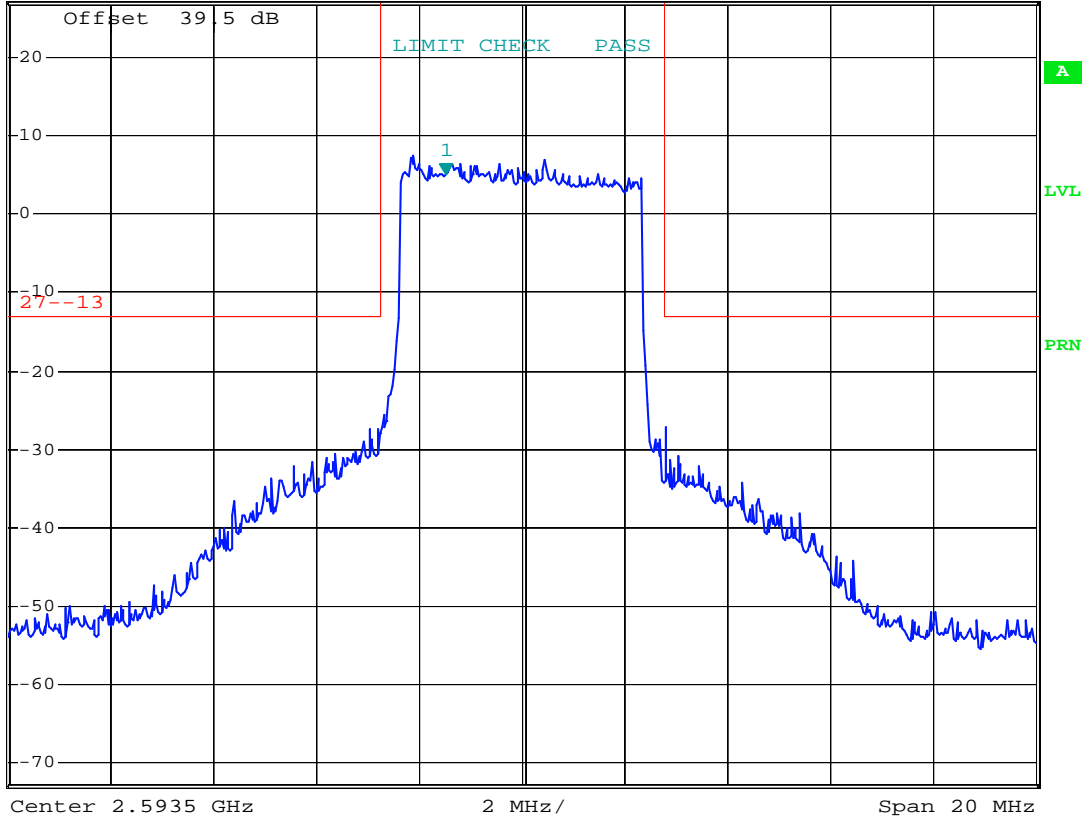


*RBW 10 kHz Marker 1 [T1]
VBW 100 kHz 5.13 dBm
SWT 200 ms 2.59202000 GHz

Ref 27 dBm

Att 20 dB

1 RM*
VIEW



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

40 degrees OFDM mode

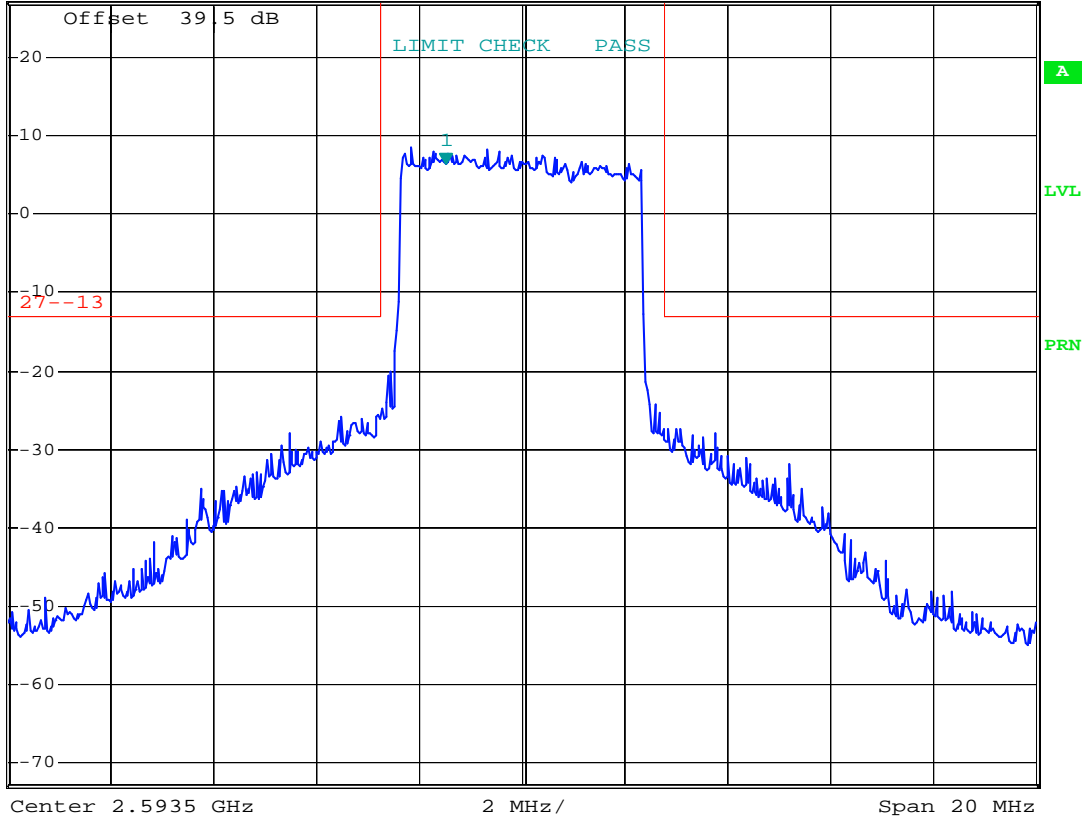


*RBW 10 kHz Marker 1 [T1]
VBW 100 kHz 6.35 dBm
SWT 200 ms 2.59202000 GHz

Ref 27 dBm

Att 20 dB

1 RM*
VIEW

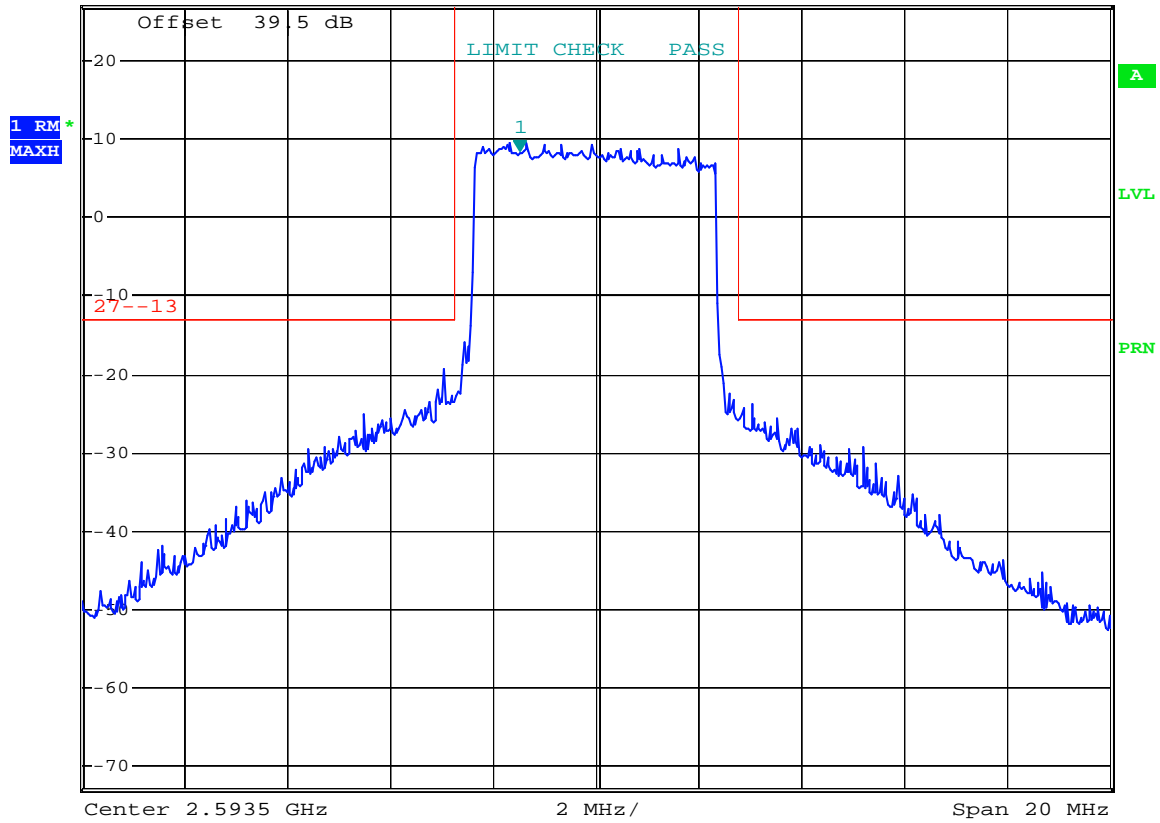


Date: 30.MAY.2006 11:34:34

30 degrees OFDM mode



*RBW 10 kHz Marker 1 [T1]
VBW 100 kHz 8.50 dBm
Ref 27 dBm Att 20 dB SWT 200 ms 2.592020000 GHz

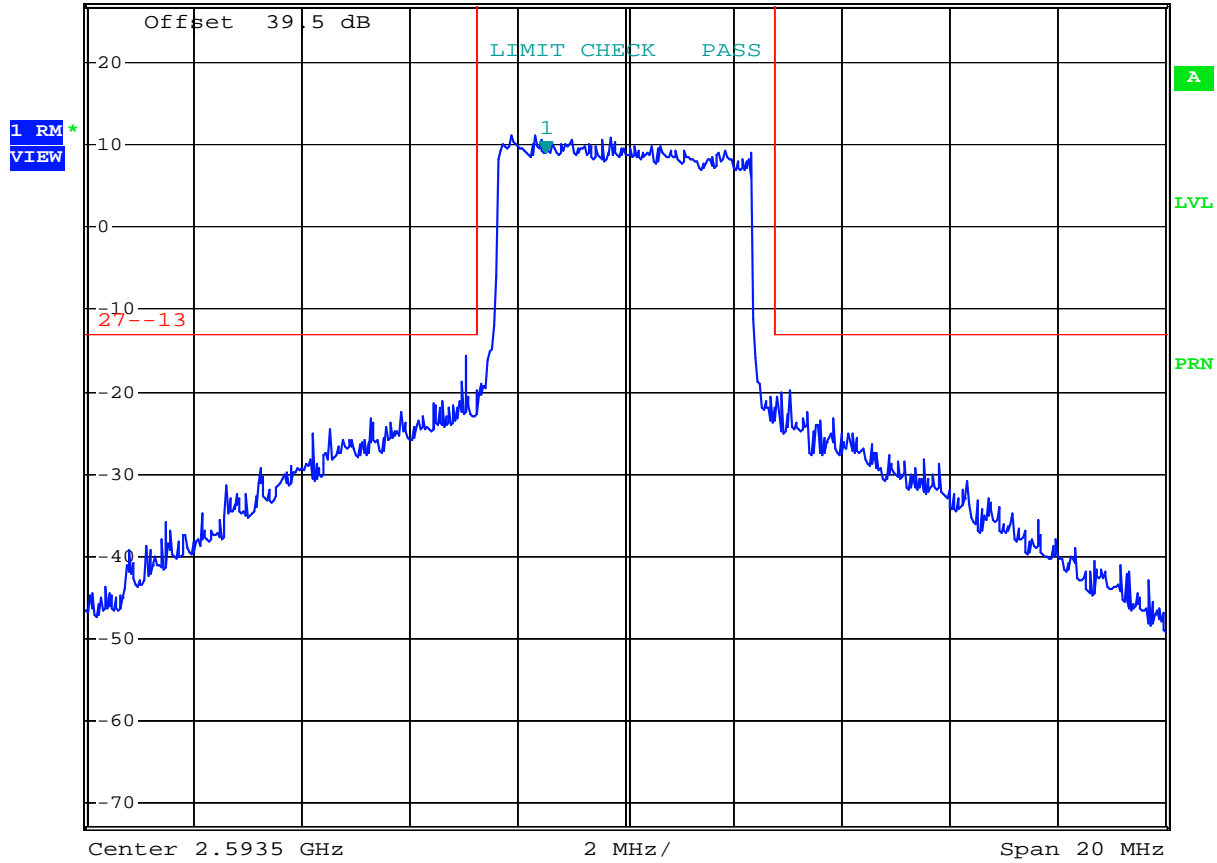


Date: 30.MAY.2006 12:33:19

10 degrees OFDM mode

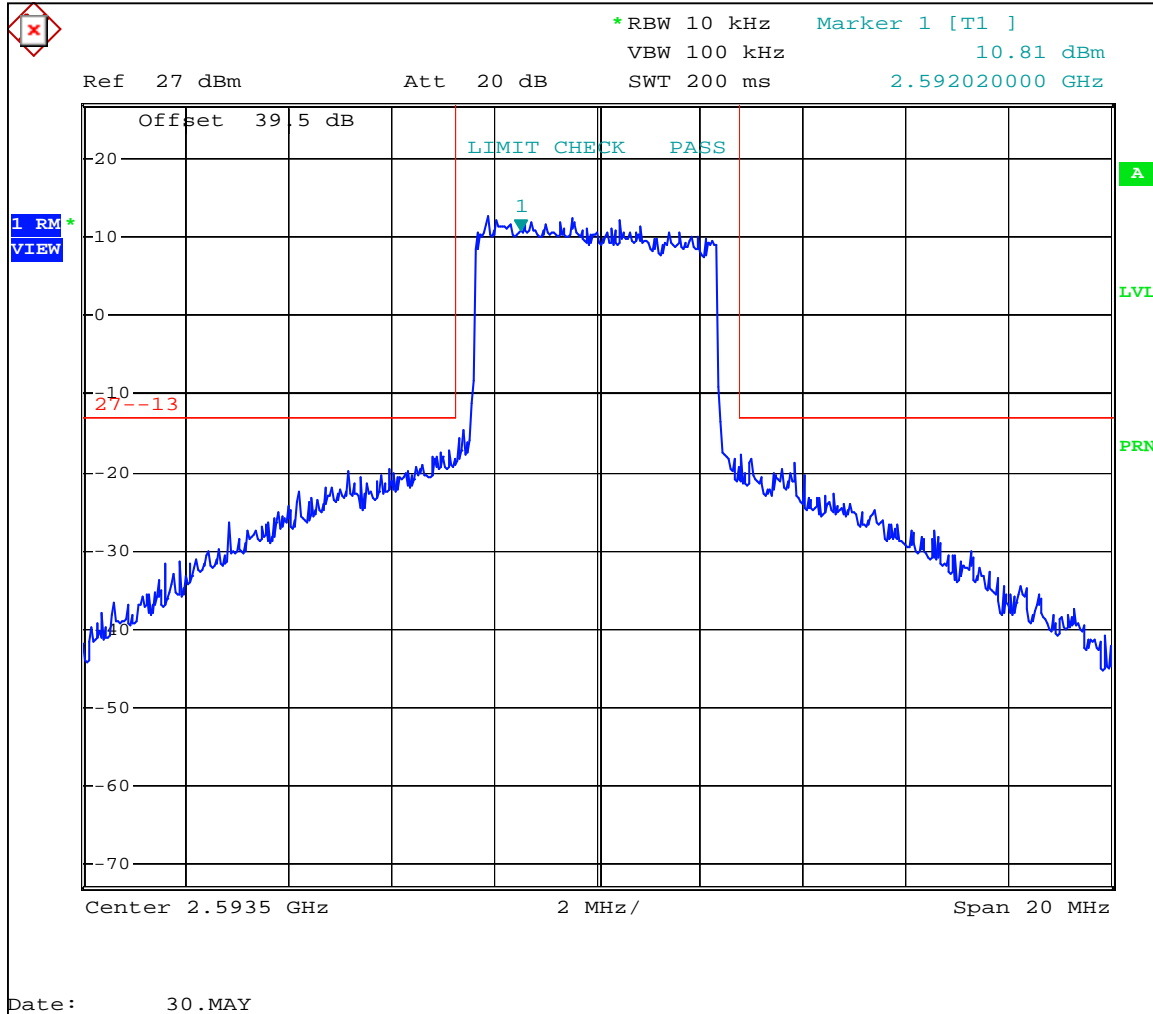


*RBW 10 kHz Marker 1 [T1]
VBW 100 kHz 9.00 dBm
Ref 27 dBm Att 20 dB SWT 200 ms 2.592020000 GHz

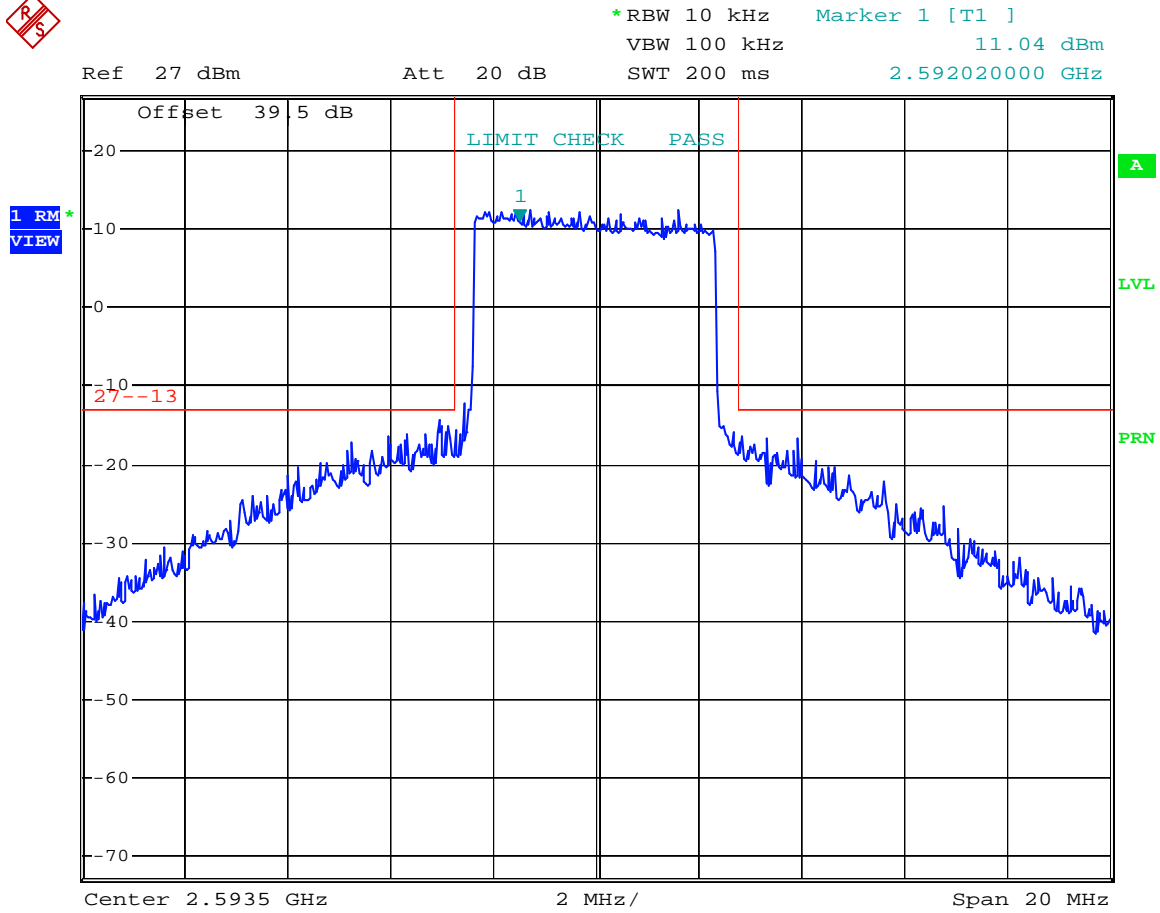


Date: 30.MAY.2006 13:39:01

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 |
|--------------------------|

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.

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| NAME OF TEST: Frequency Stability |
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|---------------|
| 2.1055 |
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Method Of Measurement:

Frequency Stability With Voltage Variation:

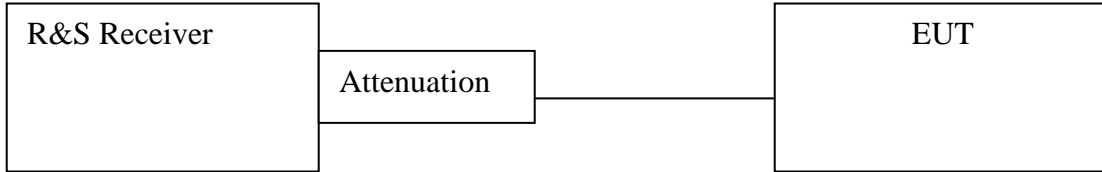
The E.U.T. is placed in an environmental chamber and allowed to stabilize at +20 degrees Celsius. This procedure is repeated at 100% S.T.V, 115% S.T.V. and 85% S.T.V

Frequency Stability With Temperature Variation:

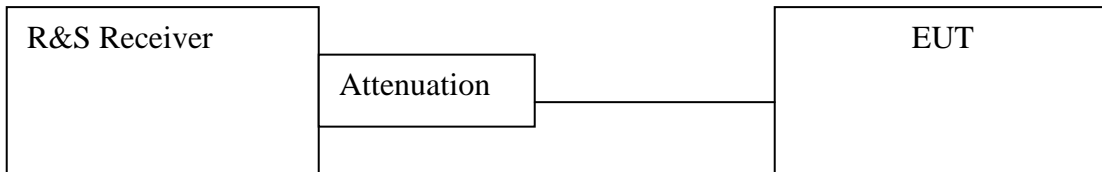
The input voltage to the E.U.T. is set to 100%S.T.V. and the temperature of the environmental chamber is varied in 10 degree steps from -30 degrees C to +50 degrees C. The E.U.T. is allowed to stabilize at each temperature.

ANNEX B - TEST DIAGRAMS

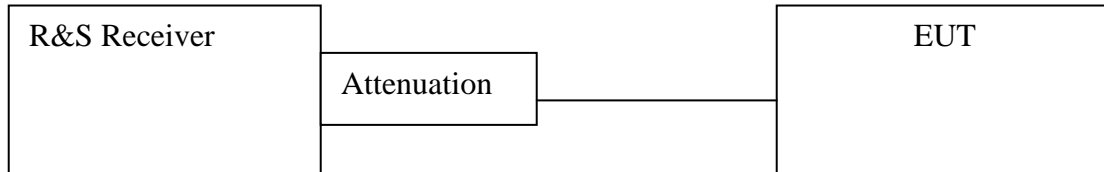
Para. No. 2.1046 - R.F. Power Output



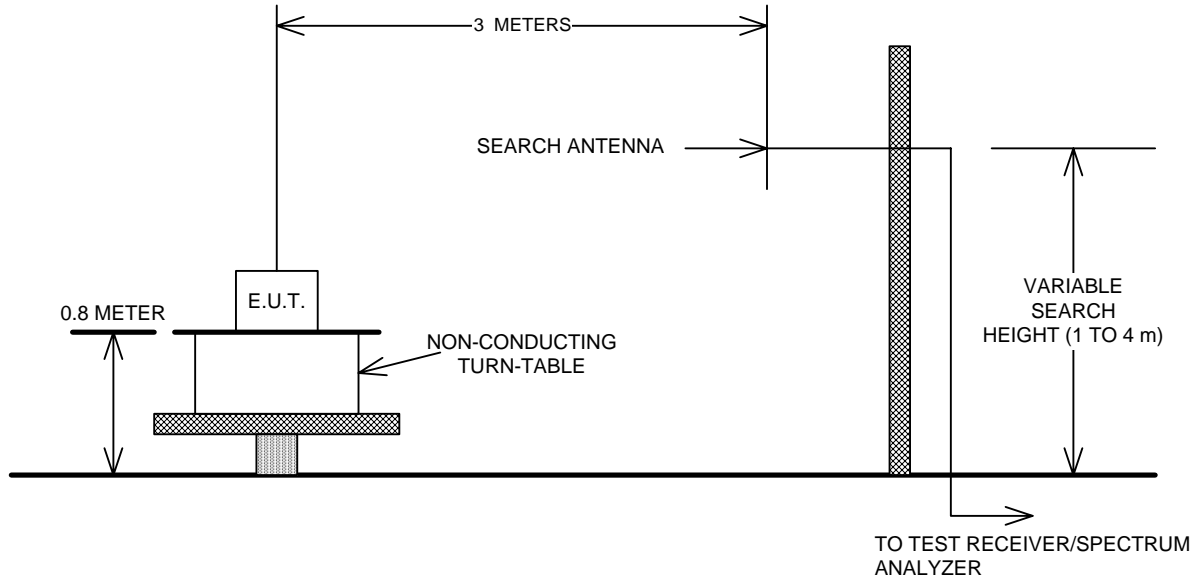
Para. No. 2.1049 - Occupied Bandwidth



Para. No. 2.1051 - Spurious Emissions at Antenna Terminals



Para. No. 2.1053 - Field Strength of Radiation



Para. No. 2.1055 - Frequency Stability

