MFA **M. Flom Associates, Inc. - Global Compliance Center**
3356 North San Marcos Place, Suite 107, Chandler, Arizona 85225-7176
www.mflom.com general@mflom.com (480) 926-3100, FAX: 926-3598

---

# Transmitter Certification

of

FCC ID: B95-NL6000
Model: NL6000

to

**Federal Communications Commission**

Rule Part(s) 90, Confidentiality

Date of Amended Report: September 24, 2003

**On the Behalf of the Applicant**:

RF Neulink

**At the Request of**: P.O. NPO-072503DL

RF Neulink
A Division of RF Industries
7610 Miramar Road
San Diego, CA 92126-4202

Attention of:
(800) 233-1728; (858) 549-6340; FAX: -6349
E-mail: rfneulink@rfindustries.com
David Lamb
Email: dlamb@rfneulink.com

M. Flom P. Eng

Supervised by: Morton Flom, P. Eng.

# The Applicant has been cautioned as to the following:

## 15.21 **Information to the User**.

The users manual or instruction manual for an intentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

## 15.27(a) **Special Accessories**.

Equipment marketed to a consumer must be capable of complying with the necessary regulations in the configuration in which the equipment is marketed. Where special accessories, such as shielded cables and/or special connectors are required to enable an unintentional or intentional radiator to comply with the emission limits in this part, the equipment must be marketed with, i.e. shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator, the responsible party may employ other methods of ensuring that the special accessories are provided to the consumer, without additional charge.

Information detailing any alternative method used to supply the special accessories for a grant of equipment authorization or retained in the verification records, as appropriate. The party responsible for the equipment, as detailed in § 2.909 of this chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.

# Table of Contents

| | |
|---|---|
| Page Number | 1 of 63. |

*Required information per ISO/IEC Guide 25-1990, paragraph 13.2:*

| | |
|---|---|
| a) | **Test Report** |
| b) Laboratory:<br>(FCC: 31040/SIT)<br>(Canada: IC 2044) | M. Flom Associates, Inc.<br>3356 N. San Marcos Place, Suite 107<br>Chandler, AZ 85225 |
| c) Report Number: | d0390078 |
| d) Client: | RF Neulink<br>A Division of RF Industries<br>7610 Miramar Road<br>San Diego, CA 92126-4202 |
| e) Identification: | NL6000<br>FCC ID: B95-NL6000 |
| EUT Description: | UHF/FM Modem |
| f) EUT Condition: | Not required unless specified in individual tests. |
| g) Amended Report Date: | September 24, 2003 |
| EUT Received: | August 1, 2003 |
| h, j, k): | As indicated in individual tests. |
| i) Sampling method: | No sampling procedure used. |
| l) Uncertainty: | In accordance with MFA internal quality manual. |
| m) Supervised by: | Morton Flom, P. Eng. |
| n) Results: | The results presented in this report relate only to the item tested. |
| o) Reproduction: | This report must not be reproduced, except in full, without written permission from this laboratory. |

## List of General Information Required for Certification

In Accordance with FCC Rules and Regulations,
Volume II, Part 2 and to

90

Sub-part 2.1033
(c)(1): **Name and Address of Applicant**:

RF Neulink
A Division of RF Industries
7610 Miramar Road
San Diego, CA 92126-4202

**Manufacturer**:

Applicant

(c)(2): **FCC ID**: B95-NL6000

**Model Number**: NL6000

(c)(3): **Instruction Manual(s):**

Please see attached exhibits

(c)(4): **Type of Emission**: 16K0F1D, 11K0F1D

(c)(5): **Frequency Range, MHz**: 450.000 to 470.000

(c)(6): **Power Rating, Watts**: 1 to 6
____ Switchable __x__ Variable ____ N/A

**FCC Grant Note:** BE - The output power is continuously variable from the value listed in this entry to 15%-20% of the value listed.

(c)(7): **Maximum Power Rating, Watts**: 300

**DUT Results**: Passes __x__ Fails ______

M. Flom Associates, Inc. is accredited by the American Association for Laboratory Association (A2LA) as shown in the scope below.

THE AMERICAN
ASSOCIATION
FOR LABORATORY
ACCREDITATION

**ACCREDITED LABORATORY**

A2LA has accredited

**M. FLOM ASSOCIATES, INC.**
**Chandler, AZ**

for technical competence in the field of

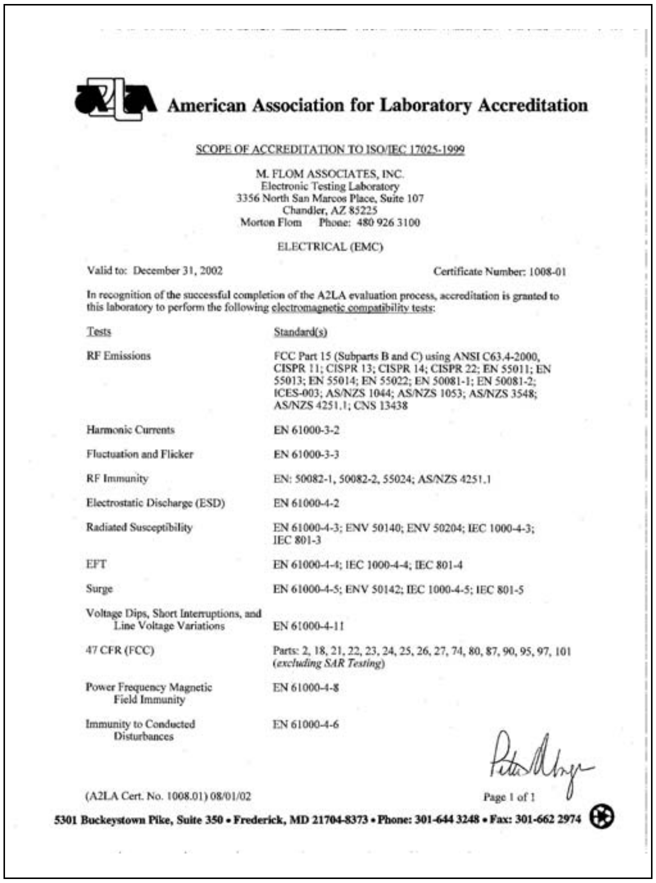
**Electrical (EMC) Testing**

The accreditation covers the specific tests and types of tests listed on the agreed scope of accreditation. This laboratory meets the requirements of ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration Laboratories" and any additional program requirements in the identified field of testing. Testing and calibration laboratories that comply with this International Standard also operate in accordance with ISO 9001 or ISO 9002.

Presented this 2nd day of March, 2001.

President
For the Accreditation Council
Certificate Number 1008.01
Valid to December 31, 2002

For tests or types of tests to which this accreditation applies, please refer to the laboratory's Electrical (EMC) Scope of Accreditation



**American Association for Laboratory Accreditation**

SCOPE OF ACCREDITATION TO ISO/IEC 17025-1999

M. FLOM ASSOCIATES, INC.
Electronic Testing Laboratory
3356 North San Marcos Place, Suite 107
Chandler, AZ 85225
Morton Flom Phone: 480 926 3100

ELECTRICAL (EMC)

Valid to: December 31, 2002 Certificate Number: 1008-01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following electromagnetic compatibility tests:

| Tests | Standard(s) |
|---|---|
| RF Emissions | FCC Part 15 (Subparts B and C) using ANSI C63.4-2000, CISPR 11; CISPR 13; CISPR 14; CISPR 22; EN 55011; EN 55013; EN 55014; EN 55022; EN 50081-1; EN 50081-2; ICES-003; AS/NZS 1044; AS/NZS 1053; AS/NZS 3548; AS/NZS 4251.1; CNS 13438 |
| Harmonic Currents | EN 61000-3-2 |
| Fluctuation and Flicker | EN 61000-3-3 |
| RF Immunity | EN: 50082-1, 50082-2, 55024; AS/NZS 4251.1 |
| Electrostatic Discharge (ESD) | EN 61000-4-2 |
| Radiated Susceptibility | EN 61000-4-3; ENV 50140; ENV 50204; IEC 1000-4-3; IEC 801-3 |
| EFT | EN 61000-4-4; IEC 1000-4-4; IEC 801-4 |
| Surge | EN 61000-4-5; ENV 50142; IEC 1000-4-5; IEC 801-5 |
| Voltage Dips, Short Interruptions, and Line Voltage Variations | EN 61000-4-11 |
| 47 CFR (FCC) | Parts: 2, 18, 21, 22, 23, 24, 25, 26, 27, 74, 80, 87, 90, 95, 97, 101 *(excluding SAR Testing)* |
| Power Frequency Magnetic Field Immunity | EN 61000-4-8 |
| Immunity to Conducted Disturbances | EN 61000-4-6 |

(A2LA Cert. No. 1008.01) 08/01/02 Page 1 of 1

**5301 Buckeystown Pike, Suite 350 • Frederick, MD 21704-8373 • Phone: 301-644 3248 • Fax: 301-662 2974**

"This laboratory is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this report have been determined in accordance with the laboratory's terms of accreditation unless stated otherwise in the report."

Should this report contain any data for tests for which we are not accredited, or which have been undertaken by a subcontractor that is not A2LA accredited, such data would not covered by this laboratory's A2LA accreditation.

Subpart 2.1033 (continued)

(c)(8): Voltages & currents in all elements in final RF stage, including final transistor or solid-state device:

Collector Current, A = per manual
Collector Voltage, Vdc = per manual
Supply Voltage, Vdc = 12

(c)(9): **Tune-Up Procedure**:

Please see attached exhibits

(c)(10): **Circuit Diagram/Circuit Description**:
Including description of circuitry & devices provided for determining and stabilizing frequency, for suppression of spurious radiation, for limiting modulation and limiting power.

Please see attached exhibits

(c)(11): **Label Information**:

Please see attached exhibits

(c)(12): **Photographs**:

Please see attached exhibits

(c)(13): **Digital Modulation Description**:

___ Attached Exhibits
_x_ N/A

(c)(14): **Test and Measurement Data**:

Follows

Sub-part
2.1033(c)(14): **Test and Measurement Data**

All tests and measurement data shown were performed in accordance with FCC Rules and Regulations, Volume II; Part 2, Sub-part J, Sections 2.947, 2.1033(c), 2.1041, 2.1046, 2.1047, 2.1079, 2.1051, 2.1053, 2.1055, 2.1057 and the following individual Parts:

_____ 21 – Domestic Public Fixed Radio Services
_____ 22 – Public Mobile Services
_____ 22 Subpart H - Cellular Radiotelephone Service
_____ 22.901(d) - Alternative technologies and auxiliary services
_____ 23 – International Fixed Public Radiocommunication services
_____ 24 – Personal Communications Services
_____ 74 Subpart H - Low Power Auxiliary Stations
_____ 80 – Stations in the Maritime Services
_____ 80 Subpart E - General Technical Standards
_____ 80 Subpart F - Equipment Authorization for Compulsory Ships
_____ 80 Subpart K - Private Coast Stations and Marine Utility Stations
_____ 80 Subpart S - Compulsory Radiotelephone Installations for Small Passenger Boats
_____ 80 Subpart T - Radiotelephone Installation Required for Vessels on the Great Lakes
_____ 80 Subpart U - Radiotelephone Installations Required by the Bridge-to-Bridge Act
_____ 80 Subpart V - Emergency Position Indicating Radio Beacons (EPIRB'S)
_____ 80 Subpart W - Global Maritime Distress and Safety System (GMDSS)
_____ 80 Subpart X - Voluntary Radio Installations
_____ 87 – Aviation Services
__x__ 90 – Private Land Mobile Radio Services
_____ 94 – Private Operational-Fixed Microwave Service
_____ 95 Subpart A - General Mobile Radio Service (GMRS)
_____ 95 Subpart C - Radio Control (R/C) Radio Service
_____ 95 Subpart D - Citizens Band (CB) Radio Service
_____ 95 Subpart E - Family Radio Service
_____ 95 Subpart F - Interactive Video and Data Service (IVDS)
_____ 97 - Amateur Radio Service
_____ 101 – Fixed Microwave Services

# Standard Test Conditions
# and
# Engineering Practices

Except as noted herein, the following conditions and procedures were observed during the testing:

In accordance with ANSI C63.4-1992/2000 Draft, section 6.1.9, and unless otherwise indicated in the specific measurement results, the ambient temperature of the actual EUT was maintained within the range of 10° to 40°C (50° to 104 °F) unless the particular equipment requirements specify testing over a different temperature range. Also, unless otherwise indicated, the humidity levels were in the range of 10% to 90% relative humidity.

Prior to testing, the EUT was tuned up in accordance with the manufacturer's alignment procedures. All external gain controls were maintained at the position of maximum and/or optimum gain throughout the testing.

Measurement results, unless otherwise noted, are worst-case measurements.

Page Number 7 of 63.

**Name of Test**: Carrier Output Power (Conducted)

**Specification**: 47 CFR 2.1046(a)

**Guide**: ANSI/TIA/EIA-603-1992, Paragraph 2.2.1

**Test Equipment**: As per attached page

## Measurement Procedure

1. The EUT was connected to a resistive coaxial attenuator of normal load impedance, and the unmodulated output power was measured by means of an RF Power Meter.

2. Measurement accuracy is ±3%.

## Measurement Results

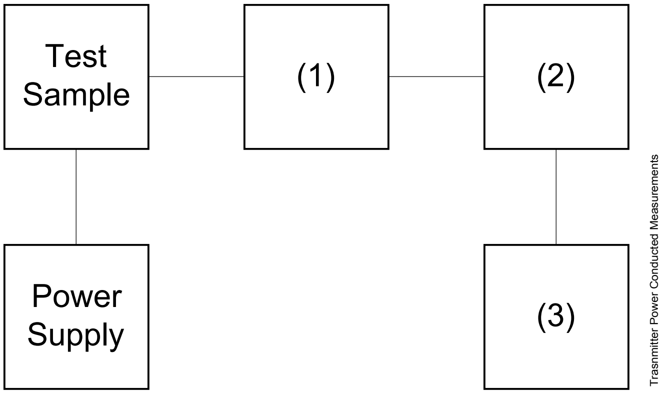
(Worst case)

Frequency of Carrier, MHz = 452.500, 460.100, 467.500
Ambient Temperature = 22°C ± 3°C

| Power Setting | RF Power, Watts |
|---|---|
| Low | 1 |
| High | 6 |

Performed by: David Lee

## Transmitter Power Conducted Measurements



| | Asset (as applicable) | Description | s/n |
|---|---|---|---|
| (1) | **Coaxial Attenuator** | | |
| | i00122 | Narda 766-10 | 7802 |
| | i00123 | Narda 766-10 | 7802A |
| | i00231 | Pasternack PE7021 | N/A |
| | i00232 | Pasternack PE7021 | N/A |
| (2) | **Power Meters** | | |
| | i00020 | HP 8901A Power Mode | 2105A01087 |
| (3) | **Frequency Counter** | | |
| | i00020 | HP 8901A Frequency Mode | 2105A01087 |

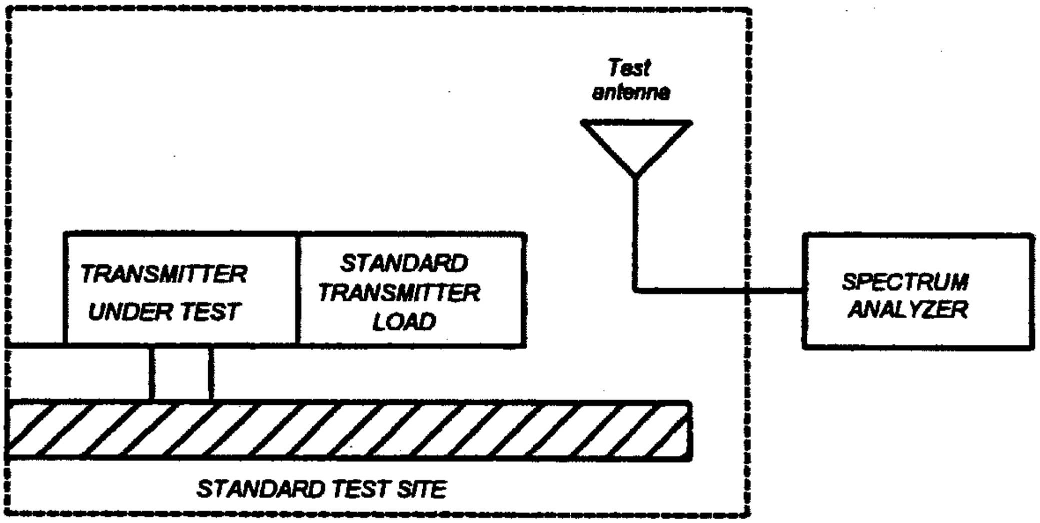
| | |
|---|---|
| Page Number | 9 of 63. |
| **Name of Test**: | Field Strength of Spurious Radiation |
| **Specification**: | 47 CFR 2.1053(a) |
| **Guide**: | ANSI/TIA/EIA-603-1992/2001, Paragraph 1.2.12 and Table 16, 47 CFR 22.917 |

## Measurement Procedure

1.2.12.1 Definition: Radiated spurious emissions are emissions from the equipment when transmitting into a non-radiating load on a frequency or frequencies which are outside an occupied band sufficient to ensure transmission of information of required quality for the class of communications desired.

1.2.12.2 Method of Measurement

A) Connect the equipment as illustrated
B) Adjust the spectrum analyzer for the following settings:
  1) Resolution Bandwidth 100 kHz (<1 GHZ), 1 MHZ (> 1GHz).
  2) Video Bandwidth ≥ 3 times Resolution Bandwidth, or 30 kHz (22.917)
  3) Sweep Speed ≤2000 Hz/second
  4) Detector Mode = Mean or Average Power
C) Place the transmitter to be tested on the turntable in the standard test site. The transmitter is transmitting into a non-radiating load which is placed on the turntable. The RF cable to this load should be of minimum length.

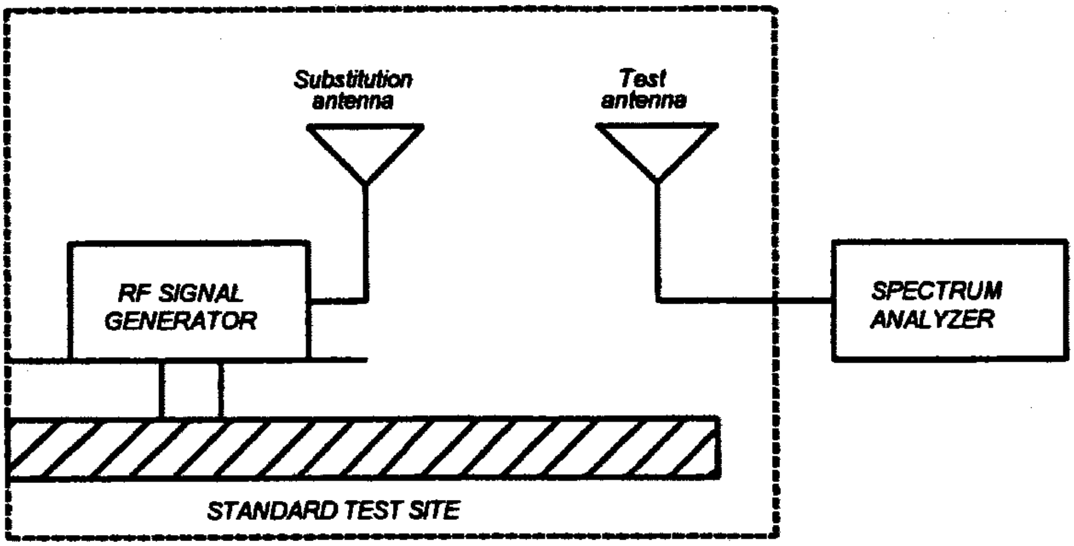


**Name of Test**: Field Strength of Spurious Radiation (Cont.)

D) For each spurious measurement the test antenna should be adjusted to the correct length for the frequency involved. This length may be determined from a calibration ruler supplied with the equipment. Measurements shall be made from the lowest radio frequency generated in the equipment to the tenth harmonic of the carrier, except for the region close to the carrier equal to ± the test bandwidth (see section 1.3.4.4).

E) For each spurious frequency, raise and lower the test antenna from 1 m to 4 m to obtain a maximum reading on the spectrum analyzer with the test antenna at horizontal polarity. Repeat this procedure to obtain the highest possible reading. Record this maximum reading.

F) Repeat step E) for each spurious frequency with the test antenna polarized vertically.



G) Reconnect the equipment as illustrated.

H) Keep the spectrum analyzer adjusted as in step B).

I) Remove the transmitter and replace it with a substitution antenna (the antenna should be half-wavelength for each frequency involved). The center of the substitution antenna should be approximately at the same location as the center of the transmitter. At lower frequencies, where the substitution antenna is very long, this will be impossible to achieve when the antenna is polarized vertically. In such case the lower end of the antenna should be 0.3 m above the ground.

**Name of Test**: Field Strength of Spurious Radiation (Cont.)

J) Feed the substitution antenna at the transmitter end with a signal generator connected to the antenna by means of a non-radiating cable. With the antennas at both ends horizontally polarized and with the signal generator tuned to a particular spurious frequency, raise and lower the test antenna to obtain a maximum reading at the spectrum analyzer. Adjust the level of the signal generator output until the previously recorded maximum reading for this set of conditions is obtained. This should be done carefully repeating the adjustment of the test antenna and generator output.

K) Repeat step J) with both antennas vertically polarized for each spurious frequency.

L) Calculate power in dBm into a reference ideal half-wave dipole antenna by reducing the readings obtained in steps J) and K) by the power loss in the cable between the generator and the antenna and further corrected for the gain of the substitution antenna used relative to an ideal half-wave dipole antenna.

M) The levels recorded in step L) are absolute levels of radiated spurious emissions in dBm. The radiated spurious emissions in dB can be calculated by the following:

Radiated spurious emissions dB =
$10\log_{10}$(TX power in watts/0.001) – the levels in step l)

NOTE: It is permissible that other antennas provided can be referenced to a dipole.

Test Equipment:

| Asset (as applicable) | Description | s/n | Cycle | Last Cal |
|---|---|---|---|---|
| | | | Per ANSI C63.4-1992/2000 Draft, 10.1.4 | |
| **Transducer** | | | | |
| i00103 | EMCO 3115 1GHz-18GHz | 9208-3925 | 12 mo. | Sep-01 |
| **Amplifier** | | | | |
| i00028 | HP 8449A | 2749A00121 | 12 mo. | Mar-03 |
| **Spectrum Analyzer** | | | | |
| i00029 | HP 8563E | 3213A00104 | 12 mo. | Mar-03 |

**Microphone, Antenna Port, and Cabling**

Antenna Port Terminated Yes Antenna Gain 0 dBd
All Ports Terminated by Load Yes

**Name of Test**: Field Strength of Spurious Radiation
g0380354: 2003-Aug-20 Wed 10:30:00
STATE: 2:High Power Ambient Temperature: 22°C ± 3°C

| Frequency Tuned, MHz | Frequency Emission, MHz | ERP, dBm | ERP, dbc |
|---|---|---|---|
| 450.100000 | 904.986667 | -19.9 | ≤ -58.8 |
| 450.100000 | 1357.591667 | -29.1 | ≤ -58.8 |
| 450.100000 | 1810.026667 | -46 | ≤ -58.8 |
| 450.100000 | 2262.526667 | -47.8 | ≤ -58.8 |
| 450.100000 | 2715.026667 | -47.6 | ≤ -58.8 |
| 450.100000 | 3167.526667 | -45.5 | ≤ -58.8 |
| 450.100000 | 3620.026667 | -43.5 | ≤ -58.8 |
| 450.100000 | 4072.526667 | -44.1 | ≤ -58.8 |
| 450.100000 | 4525.026667 | -44.6 | ≤ -58.8 |

Supervised by: David Lee

| | |
|---|---|
| Page Number | 13 of 63. |
| **Name of Test**: | Emission Masks (Occupied Bandwidth) |
| **Specification**: | 47 CFR 2.1049(c)(1) |
| **Guide**: | ANSI/TIA/EIA-603-1992, Paragraph 2.2.11 |
| **Test Equipment**: | As per previous page |

## Measurement Procedure

1. The EUT and test equipment were set up as shown on the following page, with the Spectrum Analyzer connected.

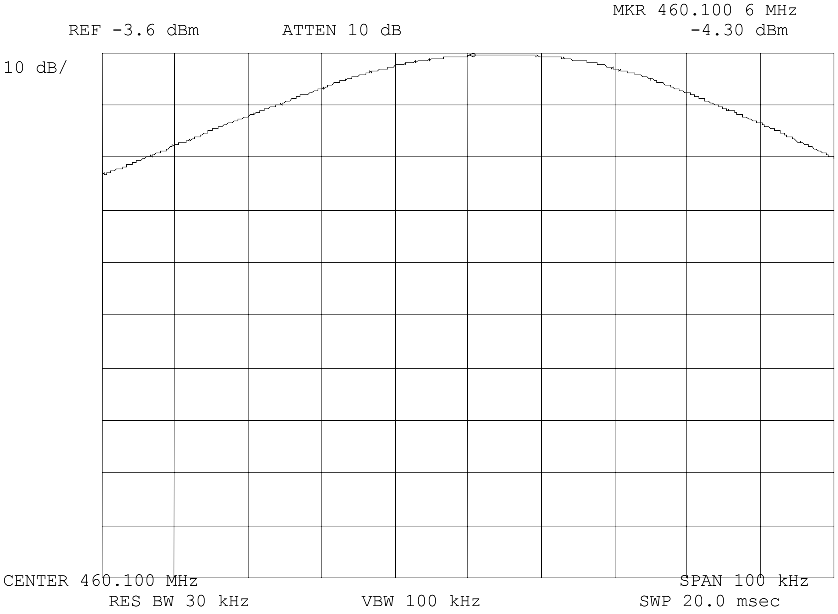
2. For EUTs supporting audio modulation, the audio signal generator was adjusted to the frequency of maximum response and with output level set for ±2.5/±1.25 kHz deviation (or 50% modulation). With level constant, the signal level was increased 16 dB.

3. For EUTs supporting digital modulation, the digital modulation mode was operated to its maximum extent.

4. The Occupied Bandwidth was measured with the Spectrum Analyzer controls set as shown on the test results.

5. Measurement Results: Attached

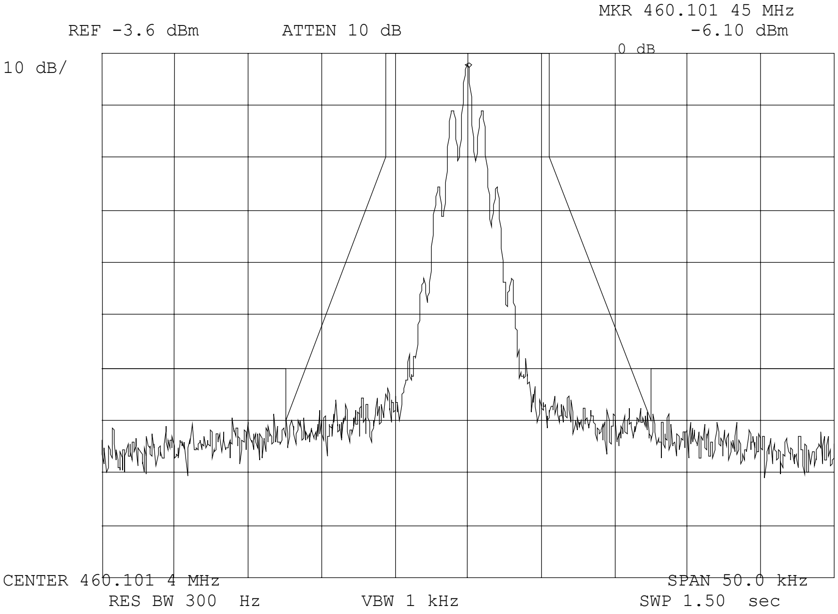
**Name of Test**: Emission Masks (Occupied Bandwidth)
g0380368: 2003-Aug-28 Thu 14:09:00
State: 1:Low Power Ambient Temperature: 22°C ± 3°C



| | |
|---|---|
| Power: | LOW |
| Modulation: | NONE |

Performed by: David Lee

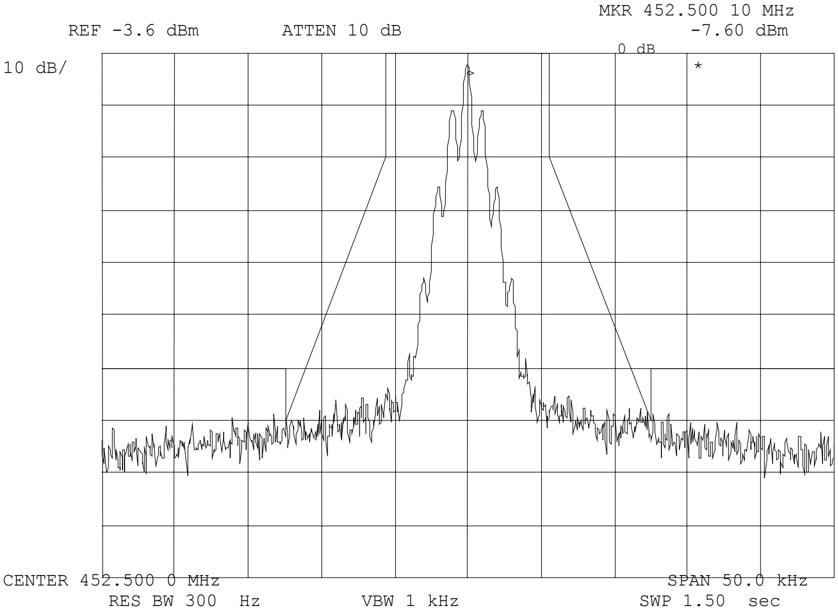
**Name of Test**: Emission Masks (Occupied Bandwidth)
g0390010: 2003-Sep-08 Mon 16:03:00
State: 1:Low Power Ambient Temperature: 22°C ± 3°C



| | |
|---|---|
| Power: | LOW |
| Modulation: | 1KHZ TONE<br>MASK: D, VHF/UHF 12.5kHz BW |

Performed by: David Lee

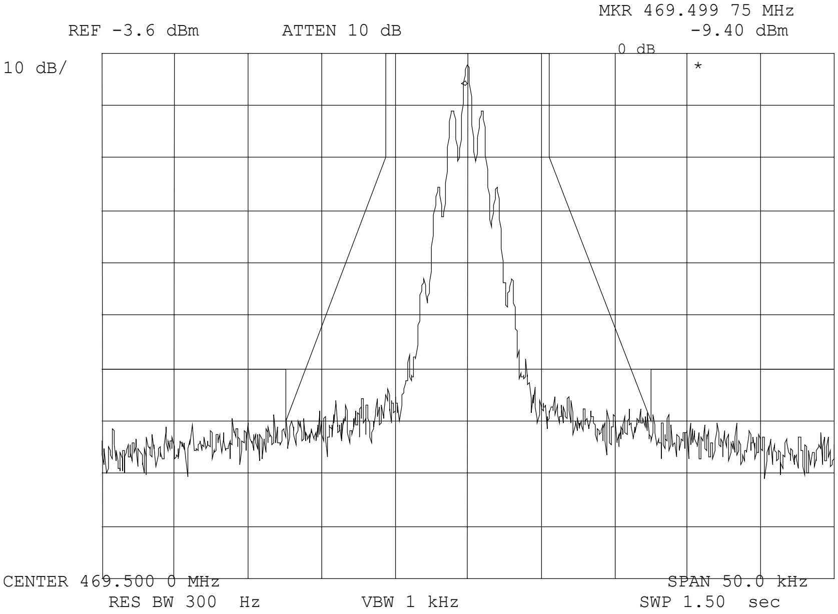
**Name of Test**: Emission Masks (Occupied Bandwidth)
g0390011: 2003-Sep-08 Mon 16:03:00
State: 1:Low Power Ambient Temperature: 22°C ± 3°C



| | |
|---|---|
| Power: | LOW |
| Modulation: | 1KHZ TONE |
| | MASK: D, VHF/UHF 12.5kHz BW |

Performed by: David Lee

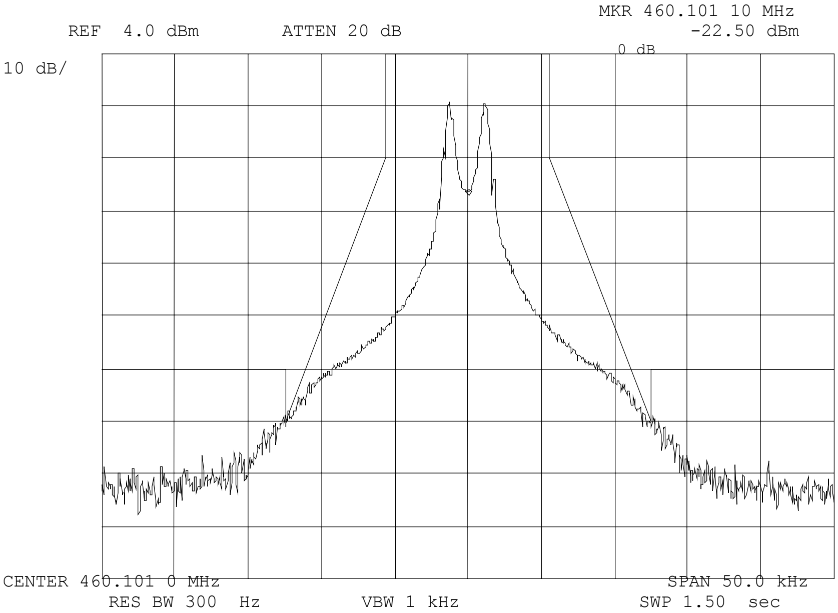
**Name of Test**: Emission Masks (Occupied Bandwidth)
g0390012: 2003-Sep-08 Mon 16:04:00
State: 1:Low Power Ambient Temperature: 22°C ± 3°C



| | |
|---|---|
| Power: | LOW |
| Modulation: | 1KHZ TONE<br>MASK: D, VHF/UHF 12.5kHz BW |

Performed by: David Lee

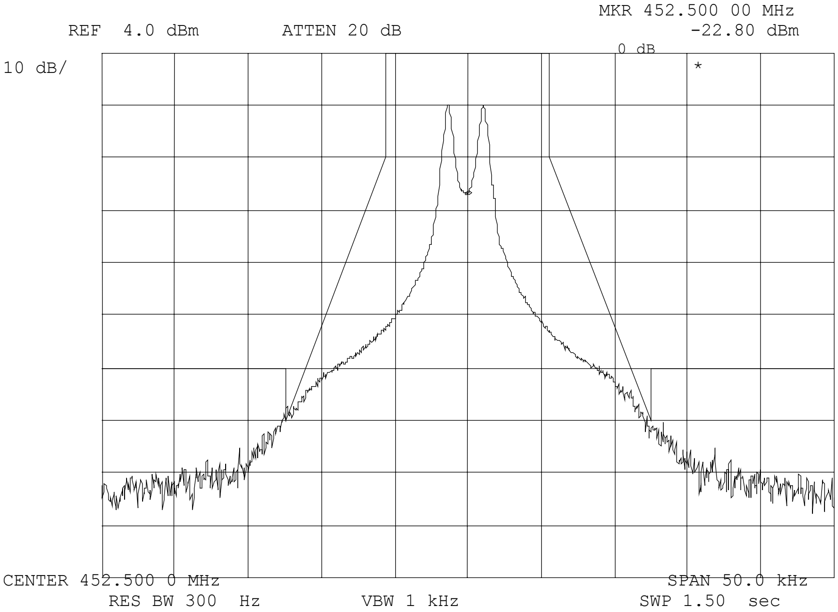
**Name of Test**: Emission Masks (Occupied Bandwidth)
g0390013: 2003-Sep-08 Mon 16:07:00
State: 1:Low Power Ambient Temperature: 22°C ± 3°C



Power: LOW
Modulation: 100HZ SQUAREWAVE
MASK: D, VHF/UHF 12.5kHz BW

Performed by: David Lee

**Name of Test**: Emission Masks (Occupied Bandwidth)
g0390014: 2003-Sep-08 Mon 16:08:00
State: 1:Low Power Ambient Temperature: 22°C ± 3°C

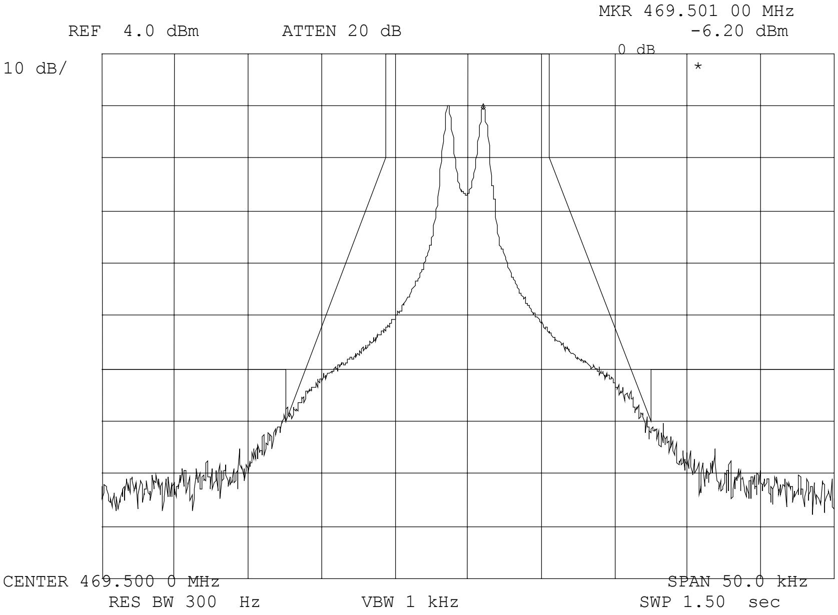


Power: LOW
Modulation: 100HZ SQUAREWAVE
MASK: D, VHF/UHF 12.5kHz BW

Performed by: David Lee

Page Number 20 of 63.

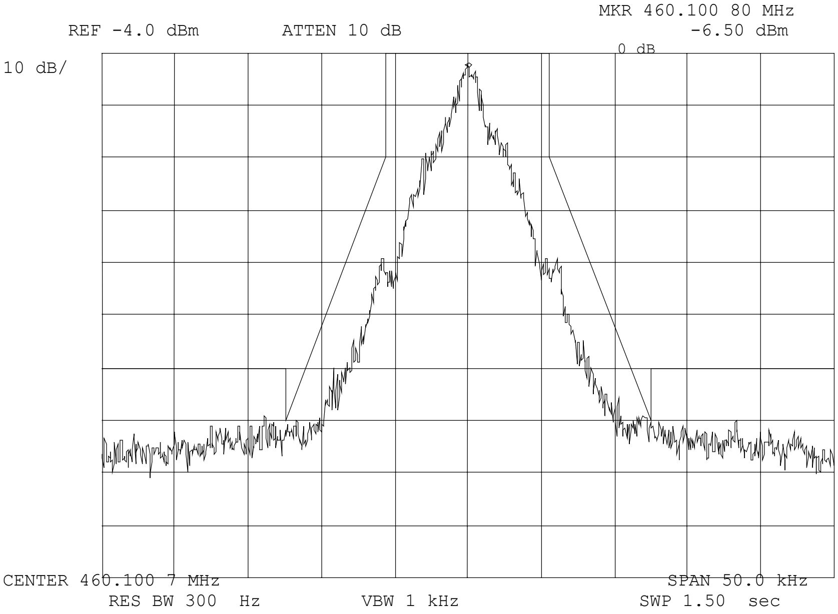
**Name of Test**: Emission Masks (Occupied Bandwidth)
g0390015: 2003-Sep-08 Mon 16:09:00
State: 1:Low Power Ambient Temperature: 22°C ± 3°C



| | |
|---|---|
| Power: | LOW |
| Modulation: | 100HZ SQUAREWAVE<br>MASK: D, VHF/UHF 12.5kHz BW |

Performed by: David Lee

**Name of Test**: Emission Masks (Occupied Bandwidth)
g0390016: 2003-Sep-08 Mon 16:11:00
State: 1:Low Power Ambient Temperature: 22°C ± 3°C

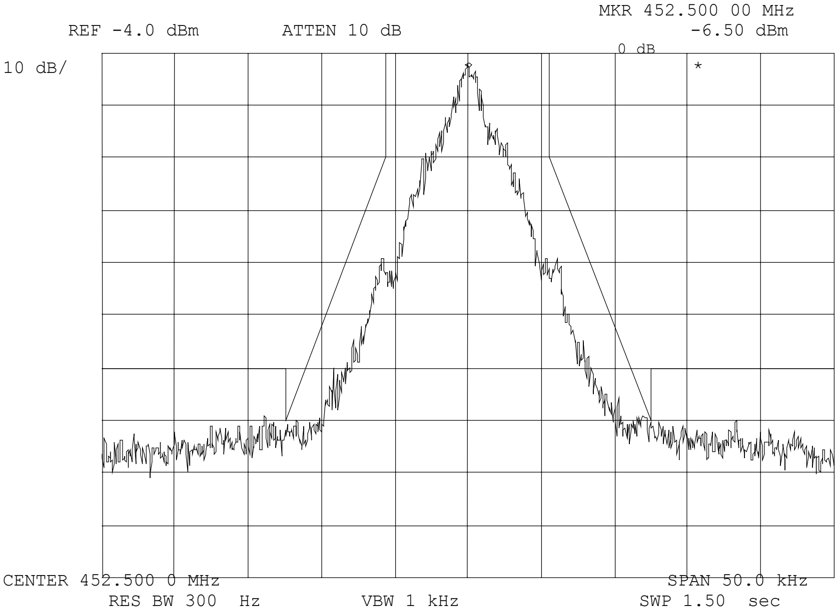


Power: LOW
Modulation: RANDOM DATA
MASK: D, VHF/UHF 12.5kHz BW

Performed by: David Lee

Page Number 22 of 63.

**Name of Test**: Emission Masks (Occupied Bandwidth)
g0390017: 2003-Sep-08 Mon 16:11:00
State: 1:Low Power Ambient Temperature: 22°C ± 3°C

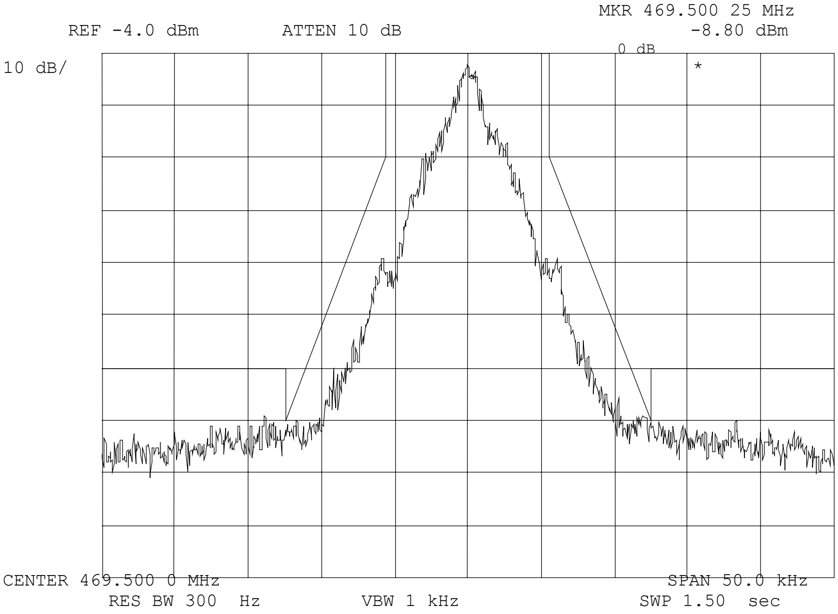


| | |
|---|---|
| Power: | LOW |
| Modulation: | RANDOM DATA<br>MASK: D, VHF/UHF 12.5kHz BW |

Performed by: David Lee

Page Number 23 of 63.

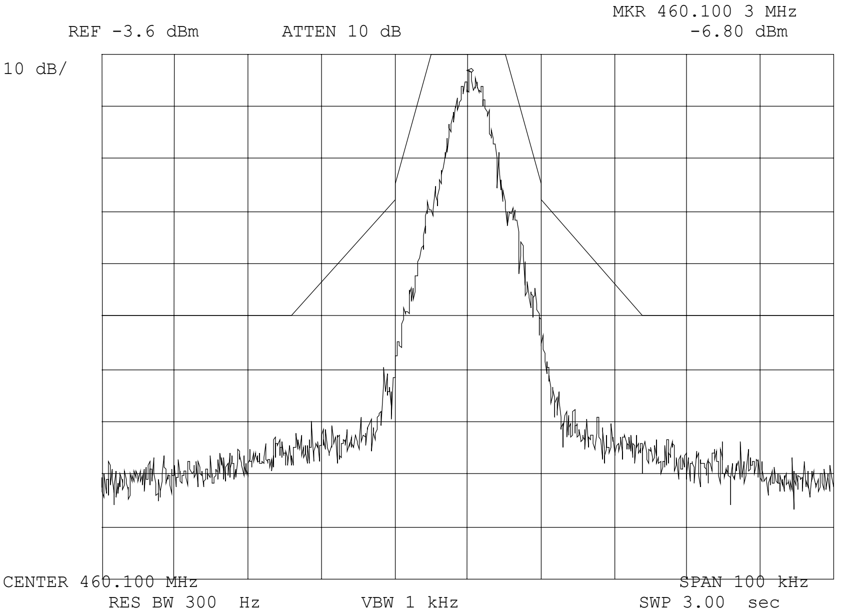
**Name of Test**: Emission Masks (Occupied Bandwidth)
g0390018: 2003-Sep-08 Mon 16:12:00
State: 1:Low Power Ambient Temperature: 22°C ± 3°C



Power: LOW
Modulation: RANDOM DATA
MASK: D, VHF/UHF 12.5kHz BW

Performed by: David Lee

**Name of Test**: Emission Masks (Occupied Bandwidth)
g0380369: 2003-Aug-28 Thu 14:10:00
State: 1:Low Power Ambient Temperature: 22°C ± 3°C

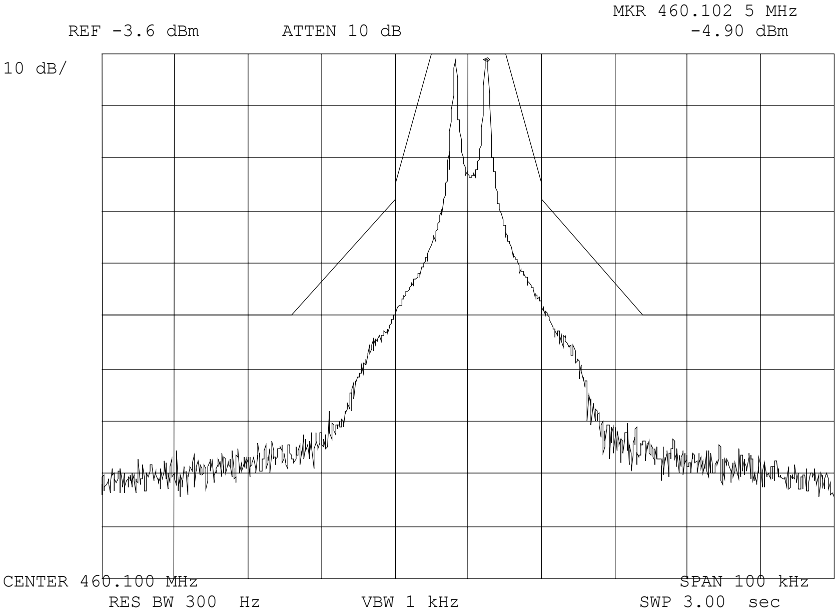


| | |
|---|---|
| Power: | LOW |
| Modulation: | RANDOM DATA<br>MASK: C, VHF/UHF 25kHz, no LPF |

Performed by: David Lee

Page Number 25 of 63.

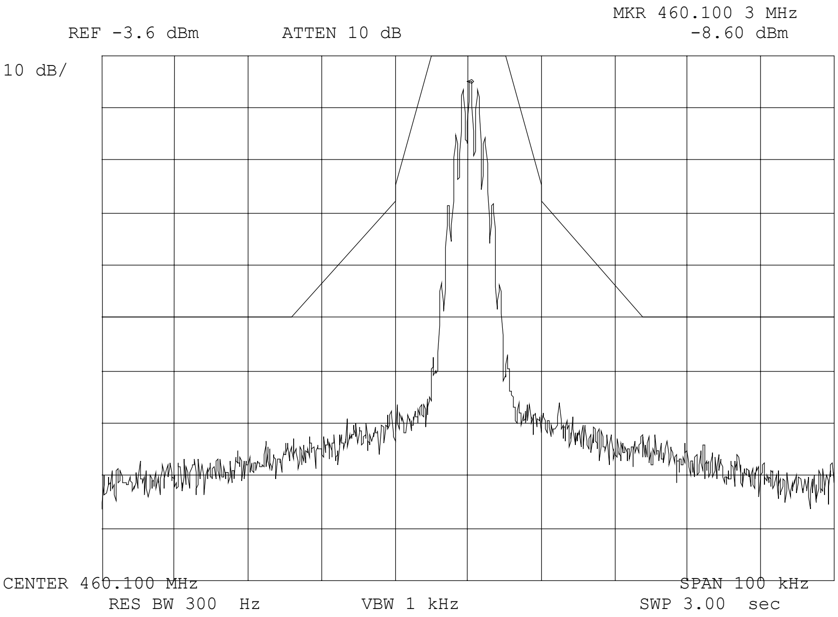
**Name of Test**: Emission Masks (Occupied Bandwidth)
g0380370: 2003-Aug-28 Thu 14:12:00
State: 1:Low Power Ambient Temperature: 22°C ± 3°C



| | |
|---|---|
| Power: | LOW |
| Modulation: | 100HZ SQUARE WAVE<br>MASK: C, VHF/UHF 25kHz, no LPF |

Performed by: David Lee

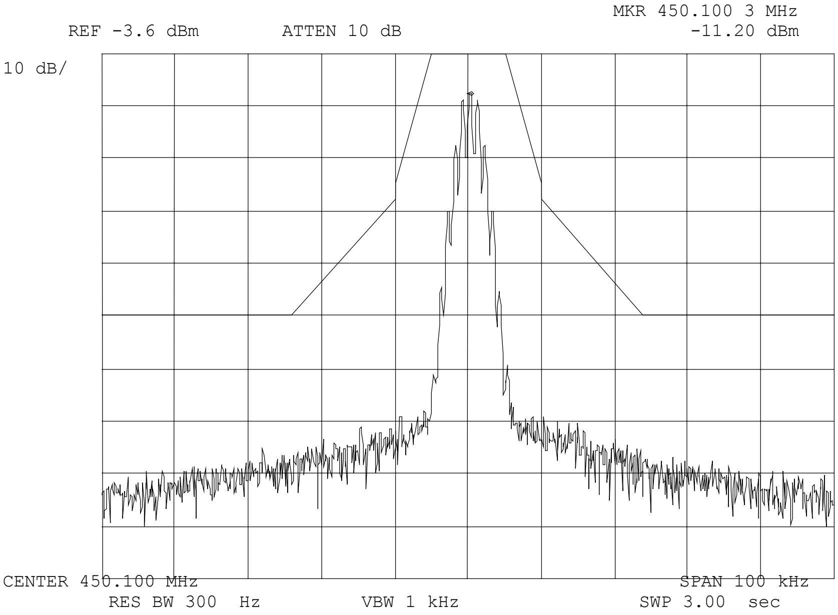
**Name of Test**: Emission Masks (Occupied Bandwidth)
g0380371: 2003-Aug-28 Thu 14:13:00
State: 1:Low Power Ambient Temperature: 22°C ± 3°C



| | |
|---|---|
| Power: | LOW |
| Modulation: | 1KHZ TONE 60% DEV<br>MASK: C, VHF/UHF 25kHz, no LPF |

Performed by: David Lee

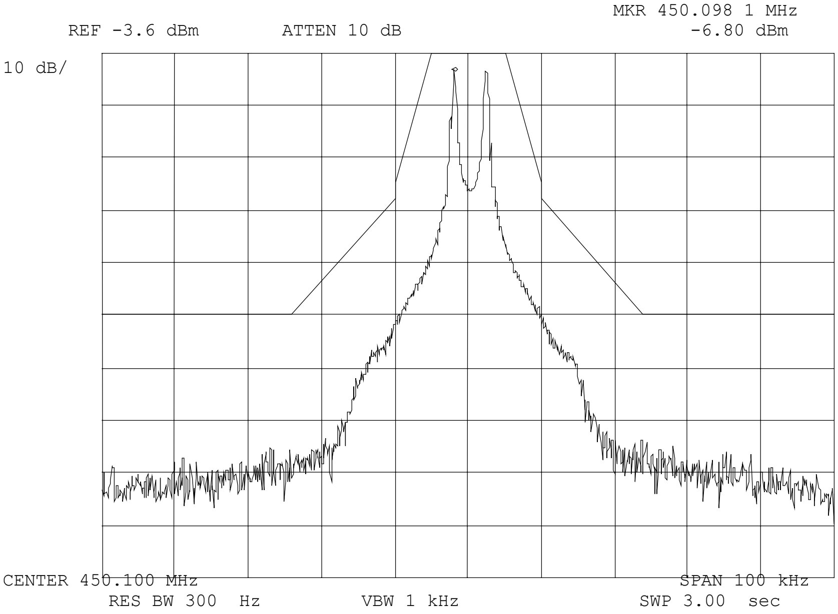
**Name of Test**: Emission Masks (Occupied Bandwidth)
g0380372: 2003-Aug-28 Thu 14:15:00
State: 1:Low Power Ambient Temperature: 22°C ± 3°C



| | |
|---|---|
| Power: | LOW |
| Modulation: | 1KHZ TONE 60% DEV<br>MASK: C, VHF/UHF 25kHz, no LPF |

Performed by: David Lee

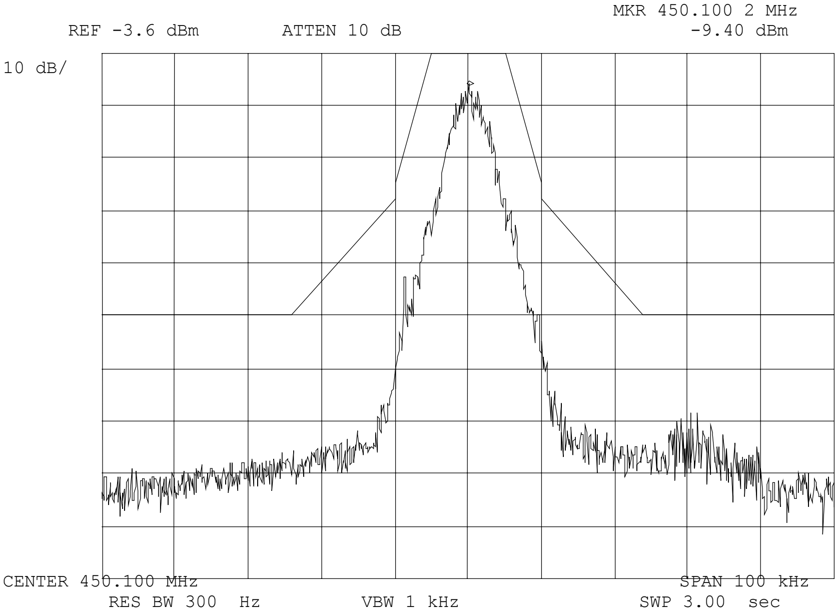
**Name of Test**: Emission Masks (Occupied Bandwidth)
g0380374: 2003-Aug-28 Thu 14:16:00
State: 1:Low Power Ambient Temperature: 22°C ± 3°C



Power: LOW
Modulation: 100HZ SQUARE WAVE
MASK: C, VHF/UHF 25kHz, no LPF

Performed by: David Lee

**Name of Test**: Emission Masks (Occupied Bandwidth)
g0380375: 2003-Aug-28 Thu 14:18:00
State: 1:Low Power Ambient Temperature: 22°C ± 3°C



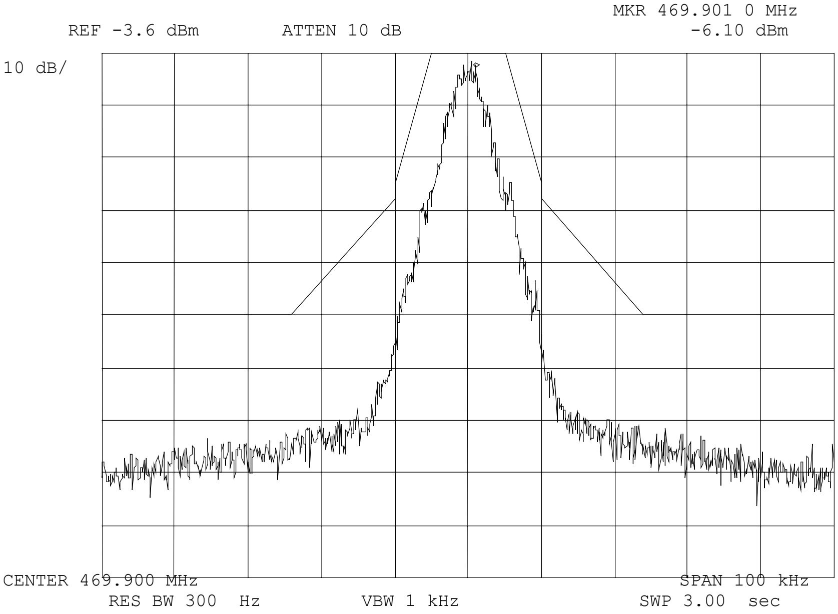
Power: LOW
Modulation: RANDOM DATA
MASK: C, VHF/UHF 25kHz, no LPF

Performed by: David Lee

**Name of Test**: Emission Masks (Occupied Bandwidth)

g0380376: 2003-Aug-28 Thu 14:21:00

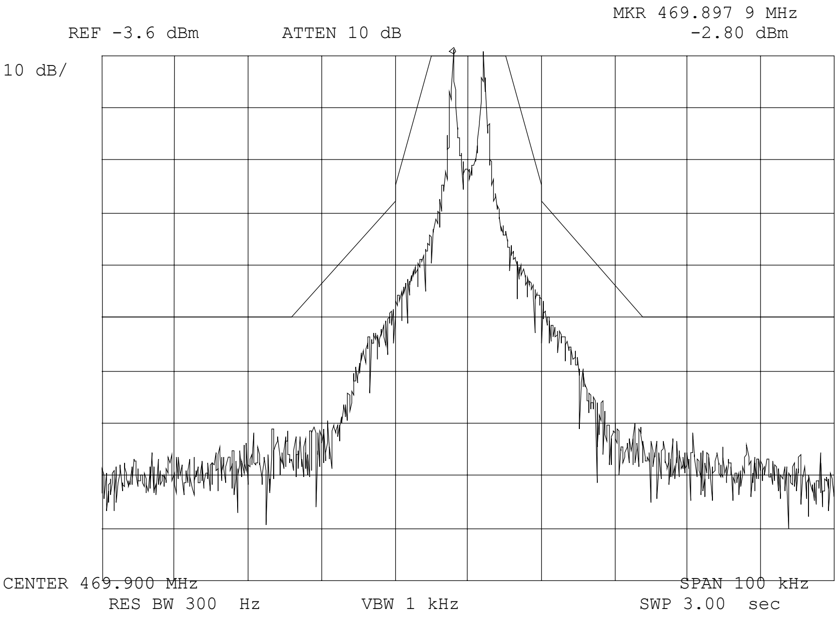
State: 1:Low Power Ambient Temperature: 22°C ± 3°C



| | |
|---|---|
| Power: | LOW |
| Modulation: | RANDOM DATA |
| | MASK: C, VHF/UHF 25kHz, no LPF |

Performed by: David Lee

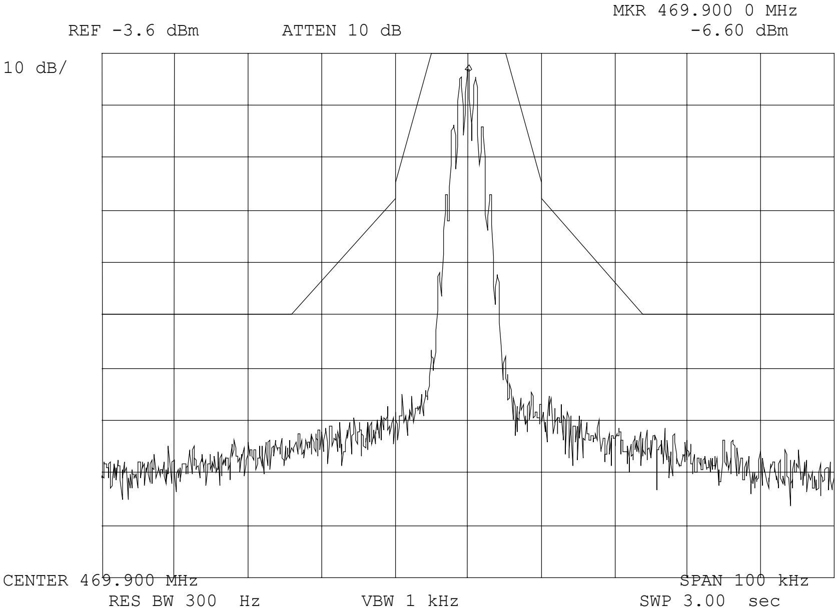
**Name of Test**: Emission Masks (Occupied Bandwidth)
g0380378: 2003-Aug-28 Thu 14:40:00
State: 1:Low Power Ambient Temperature: 22°C ± 3°C



Power: LOW
Modulation: 100HZ SQUARE WAVE
MASK: C, VHF/UHF 25kHz, no LPF

Performed by: David Lee

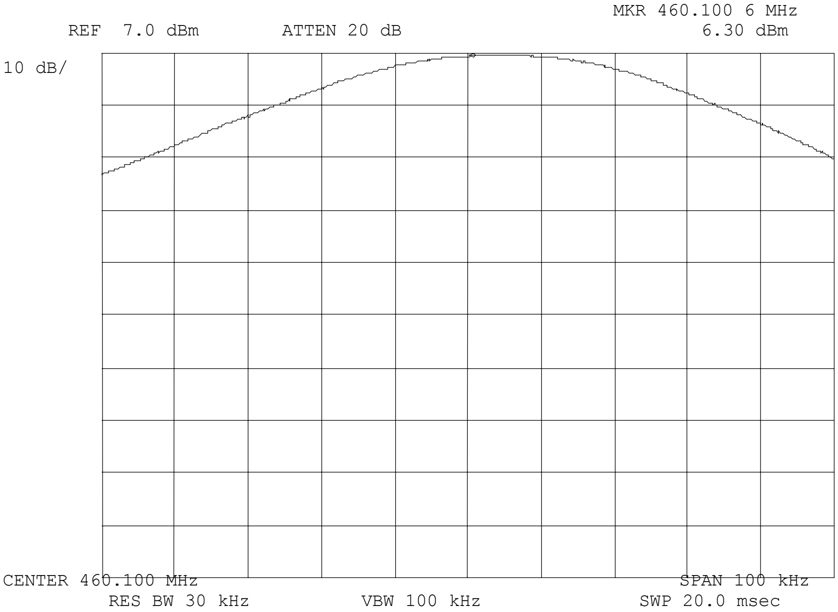
**Name of Test**: Emission Masks (Occupied Bandwidth)
g0380379: 2003-Aug-28 Thu 14:42:00
State: 1:Low Power Ambient Temperature: 22°C ± 3°C



Power: LOW
Modulation: 1KHZ TONE 60% DEV
MASK: C, VHF/UHF 25kHz, no LPF

Performed by: David Lee

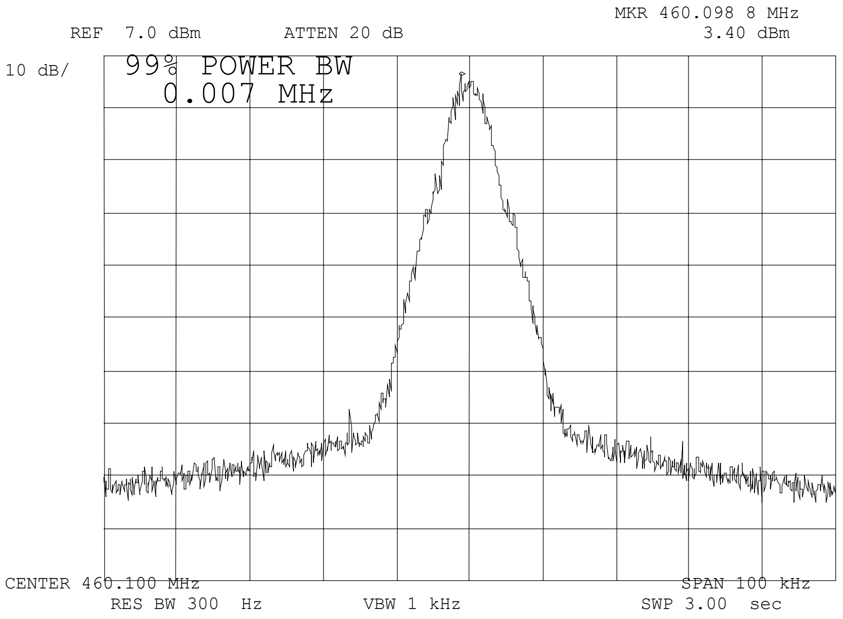
**Name of Test**: Emission Masks (Occupied Bandwidth)
g0380367: 2003-Aug-28 Thu 14:08:00
State: 2:High Power Ambient Temperature: 22°C ± 3°C



| | |
|---|---|
| Power: | HIGH |
| Modulation: | NONE |

Performed by: David Lee

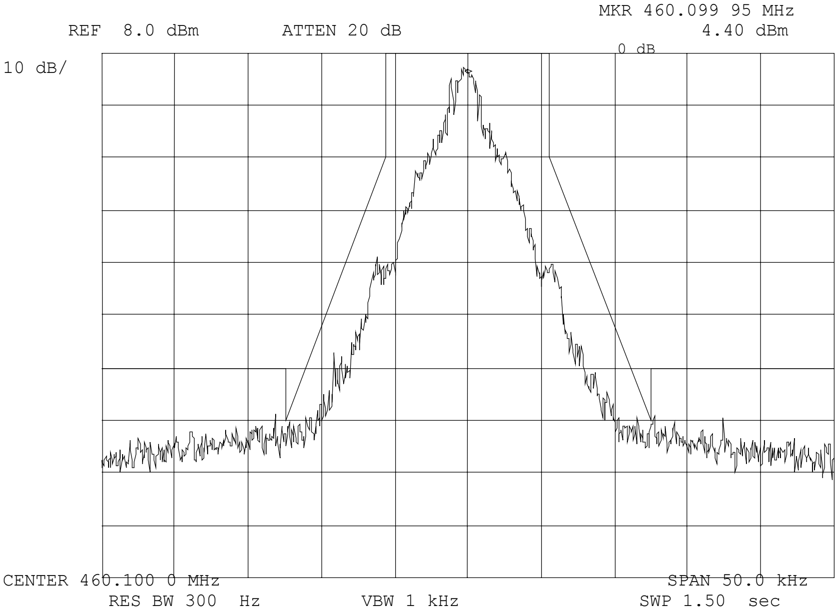
**Name of Test**: Emission Masks (Occupied Bandwidth)
g0380357: 2003-Aug-28 Thu 13:52:00
State: 2:High Power Ambient Temperature: 22°C ± 3°C



| | |
|---|---|
| Power: | HIGH |
| Modulation: | RANDOM DATA |

Performed by: David Lee

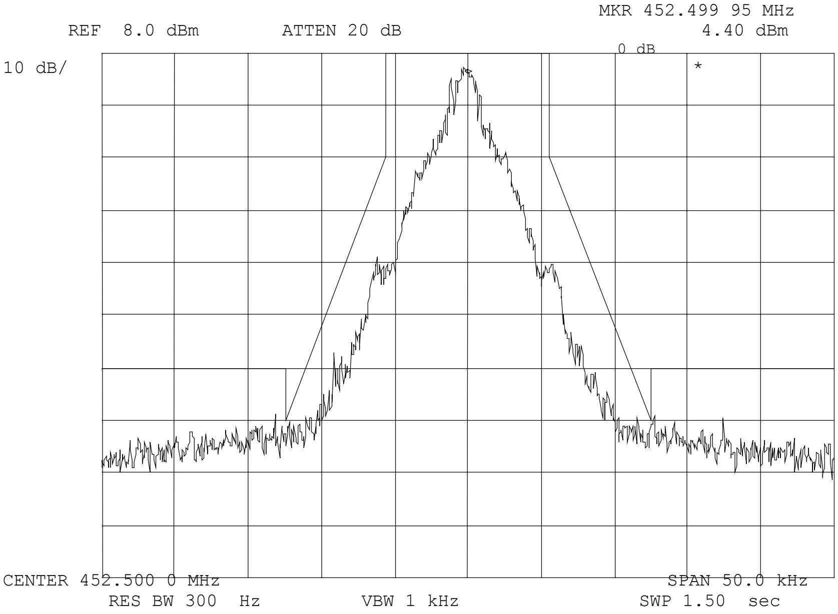
**Name of Test**: Emission Masks (Occupied Bandwidth)
g0390001: 2003-Sep-08 Mon 15:53:00
State: 2:High Power Ambient Temperature: 22°C ± 3°C



| | |
|---|---|
| Power: | HIGH |
| Modulation: | RANDOM DATA |
| | MASK: D, VHF/UHF 12.5kHz BW |

Performed by: David Lee

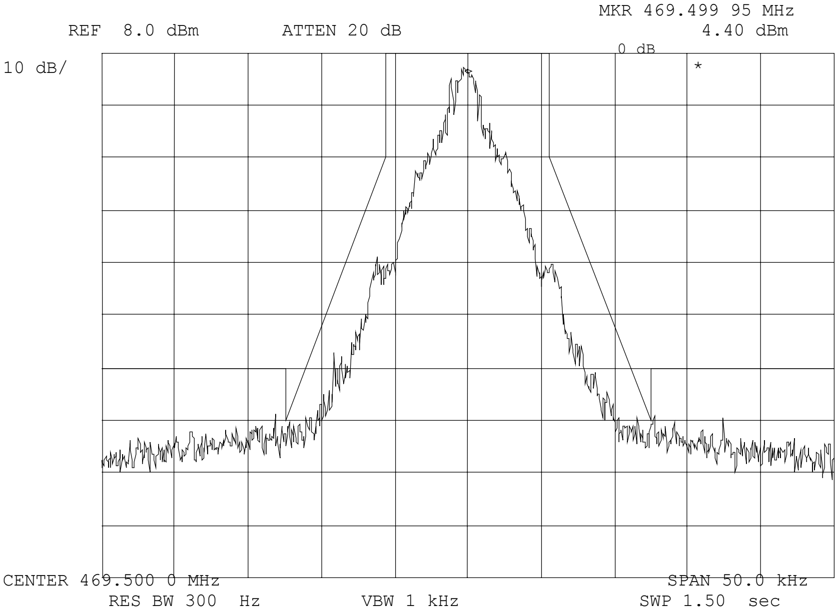
**Name of Test**: Emission Masks (Occupied Bandwidth)
g0390002: 2003-Sep-08 Mon 15:53:00
State: 2:High Power Ambient Temperature: 22°C ± 3°C



Power: HIGH
Modulation: RANDOM DATA
MASK: D, VHF/UHF 12.5kHz BW

Performed by: David Lee

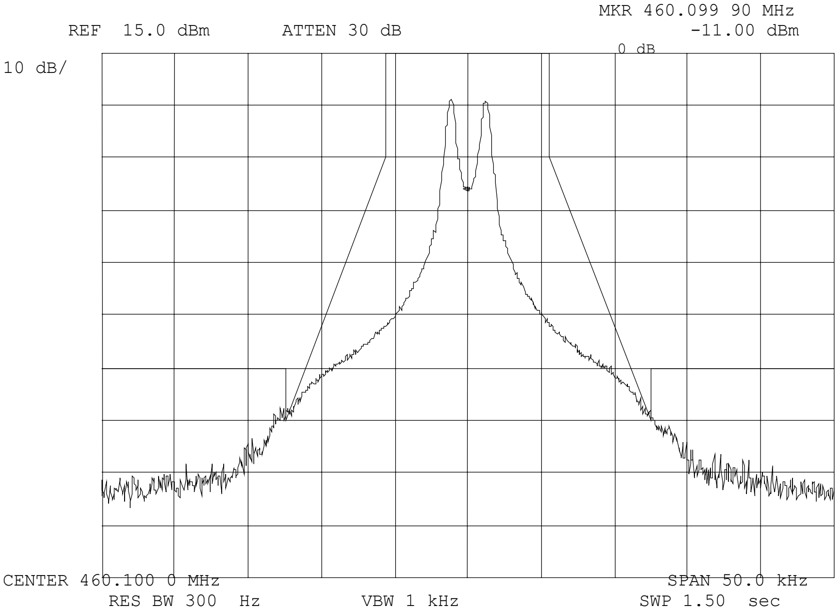
**Name of Test**: Emission Masks (Occupied Bandwidth)
g0390003: 2003-Sep-08 Mon 15:54:00
State: 2:High Power Ambient Temperature: 22°C ± 3°C



| | |
|---|---|
| Power: | HIGH |
| Modulation: | RANDOM DATA |
| | MASK: D, VHF/UHF 12.5kHz BW |

Performed by: David Lee

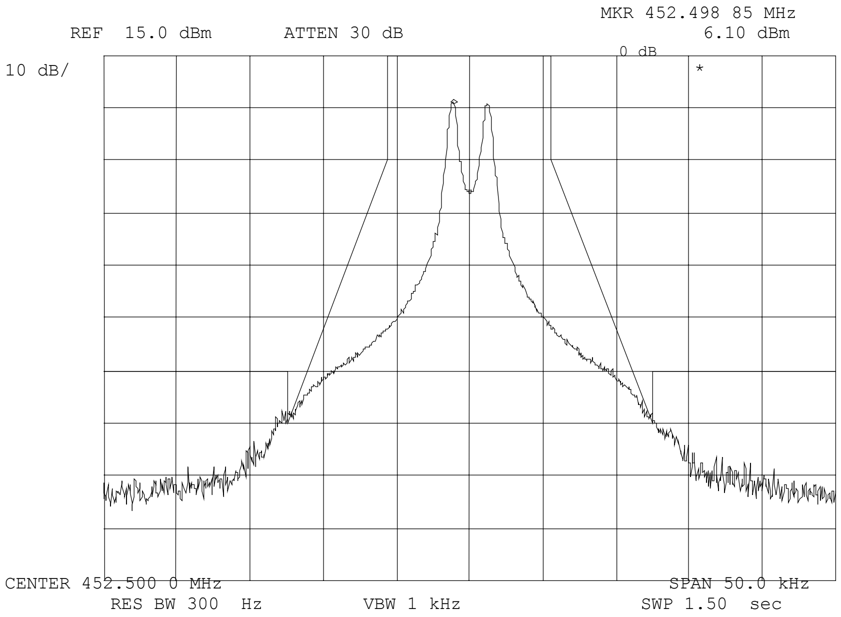
**Name of Test**: Emission Masks (Occupied Bandwidth)
g0390004: 2003-Sep-08 Mon 15:57:00
State: 2:High Power Ambient Temperature: 22°C ± 3°C



| | |
|---|---|
| Power: | HIGH |
| Modulation: | 100HZ SQUARE WAVE |
| | MASK: D, VHF/UHF 12.5kHz BW |

Performed by: David Lee

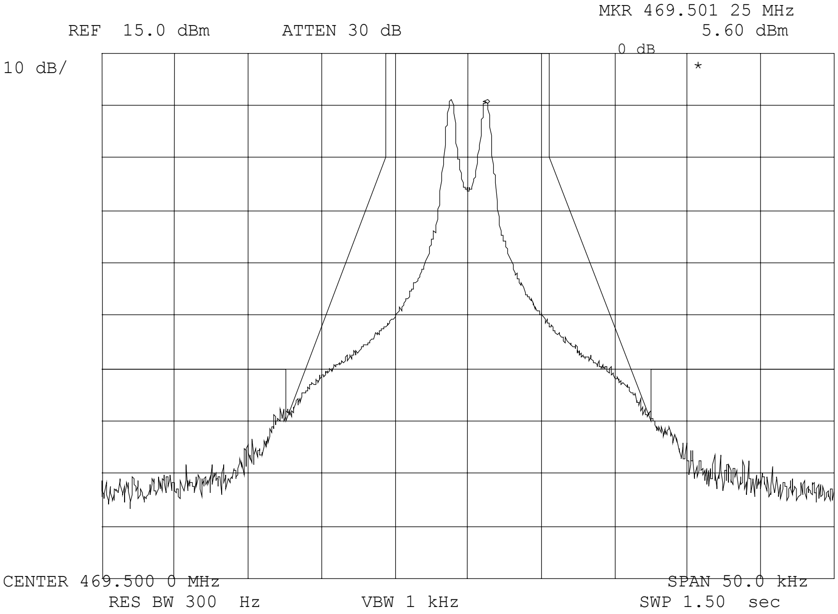
**Name of Test**: Emission Masks (Occupied Bandwidth)
g0390005: 2003-Sep-08 Mon 15:58:00
State: 2:High Power Ambient Temperature: 22°C ± 3°C



| | |
|---|---|
| Power: | HIGH |
| Modulation: | 100HZ SQUARE WAVE<br>MASK: D, VHF/UHF 12.5kHz BW |

Performed by: David Lee

**Name of Test**: Emission Masks (Occupied Bandwidth)
g0390006: 2003-Sep-08 Mon 15:58:00
State: 2:High Power Ambient Temperature: 22°C ± 3°C

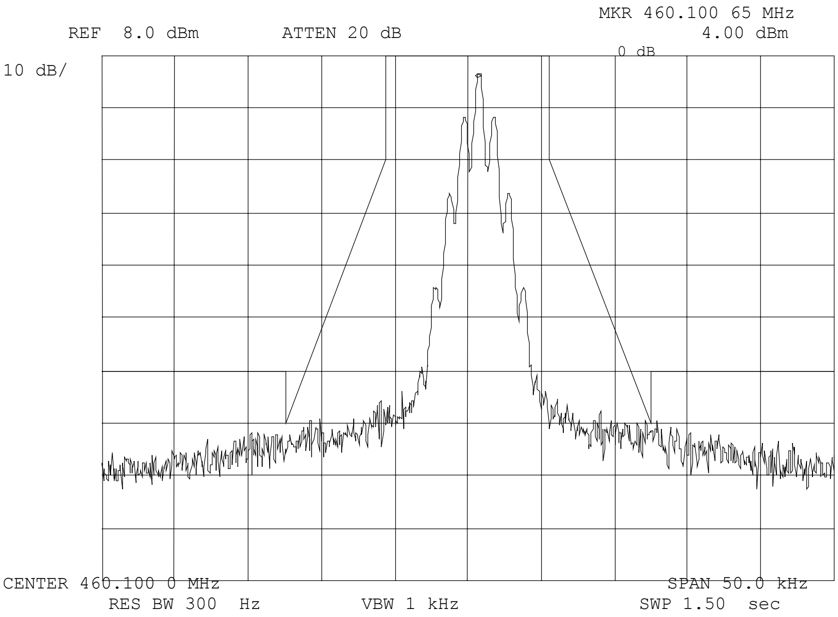


| | |
|---|---|
| Power: | HIGH |
| Modulation: | 100HZ SQUARE WAVE<br>MASK: D, VHF/UHF 12.5kHz BW |

Performed by: David Lee

Page Number 41 of 63.

**Name of Test**: Emission Masks (Occupied Bandwidth)
g0390007: 2003-Sep-08 Mon 16:00:00
State: 2:High Power Ambient Temperature: 22°C ± 3°C



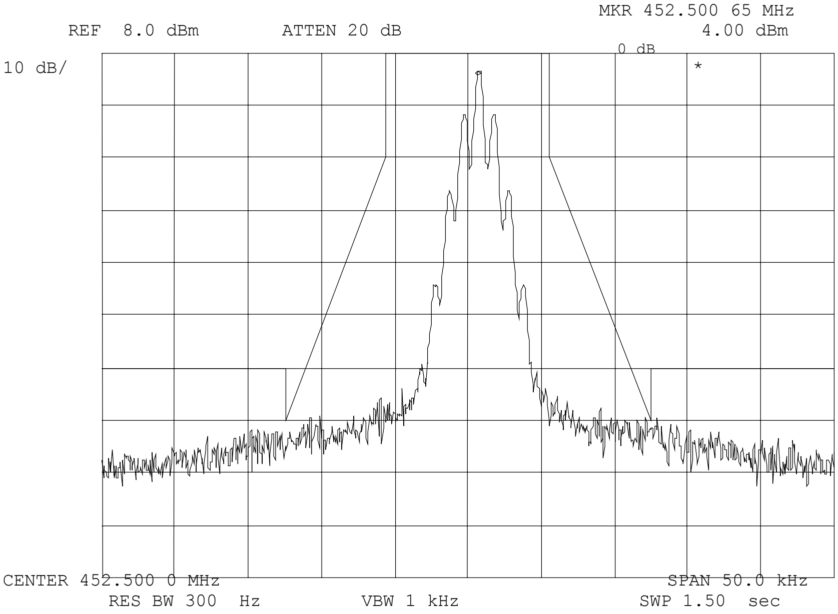
Power: HIGH
Modulation: 1KHZ TONE
MASK: D, VHF/UHF 12.5kHz BW

Performed by: David Lee

**Name of Test**: Emission Masks (Occupied Bandwidth)

g0390008: 2003-Sep-08 Mon 16:00:00

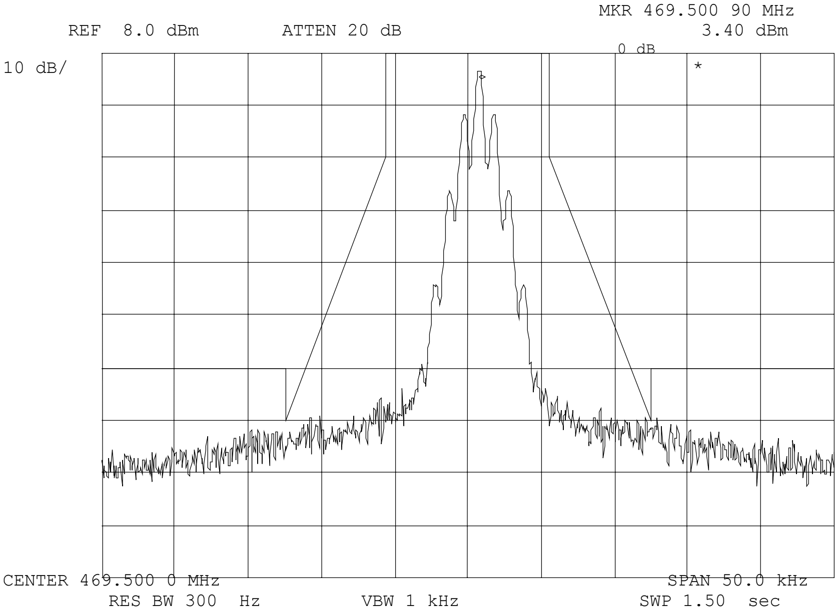
State: 2:High Power Ambient Temperature: 22°C ± 3°C



| | |
|---|---|
| Power: | HIGH |
| Modulation: | 1KHZ TONE |
| | MASK: D, VHF/UHF 12.5kHz BW |

Performed by: David Lee

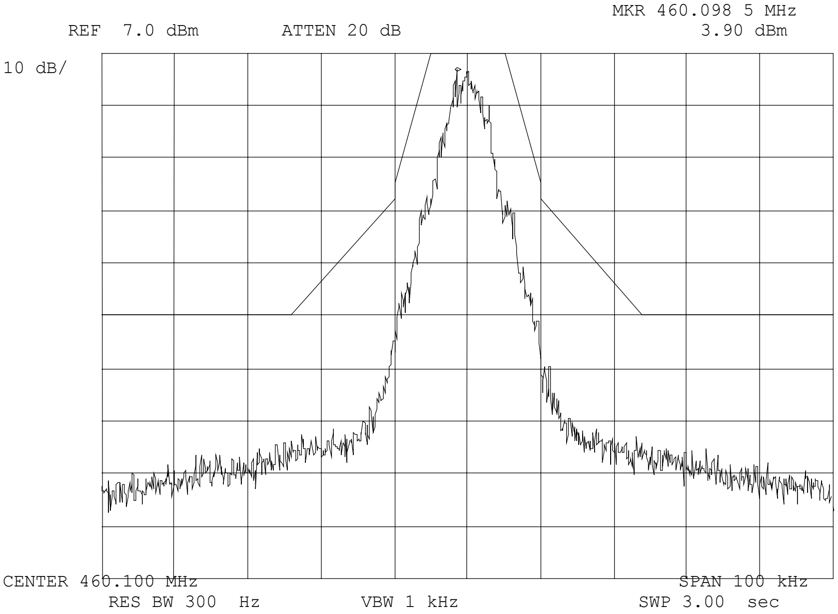
**Name of Test**: Emission Masks (Occupied Bandwidth)
g0390009: 2003-Sep-08 Mon 16:01:00
State: 2:High Power Ambient Temperature: 22°C ± 3°C



| | |
|---|---|
| Power: | HIGH |
| Modulation: | 1KHZ TONE<br>MASK: D, VHF/UHF 12.5kHz BW |

Performed by: David Lee

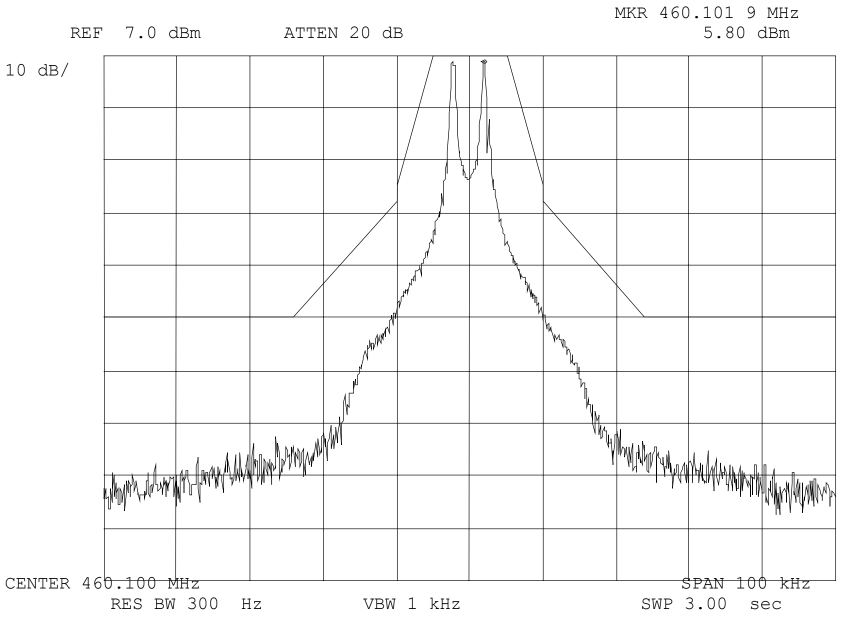
**Name of Test**: Emission Masks (Occupied Bandwidth)
g0380358: 2003-Aug-28 Thu 13:53:00
State: 2:High Power Ambient Temperature: 22°C ± 3°C



Power: HIGH
Modulation: RANDOM DATA
MASK: C, VHF/UHF 25kHz, no LPF

Performed by: David Lee

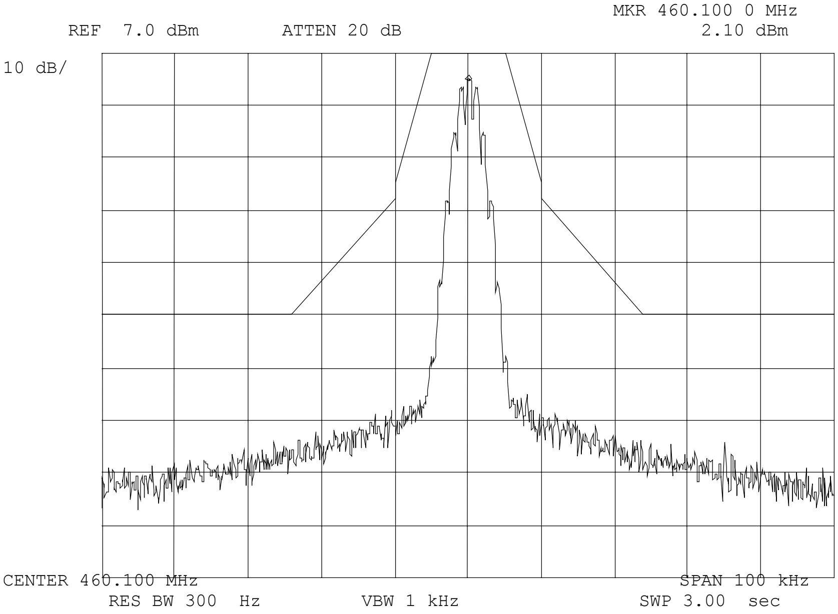
**Name of Test**: Emission Masks (Occupied Bandwidth)
g0380359: 2003-Aug-28 Thu 13:54:00
State: 2:High Power Ambient Temperature: 22°C ± 3°C



Power: HIGH
Modulation: 100HZ SQUARE WAVE
MASK: C, VHF/UHF 25kHz, no LPF

Performed by: David Lee

**Name of Test**: Emission Masks (Occupied Bandwidth)
g0380360: 2003-Aug-28 Thu 13:55:00
State: 2:High Power Ambient Temperature: 22°C ± 3°C

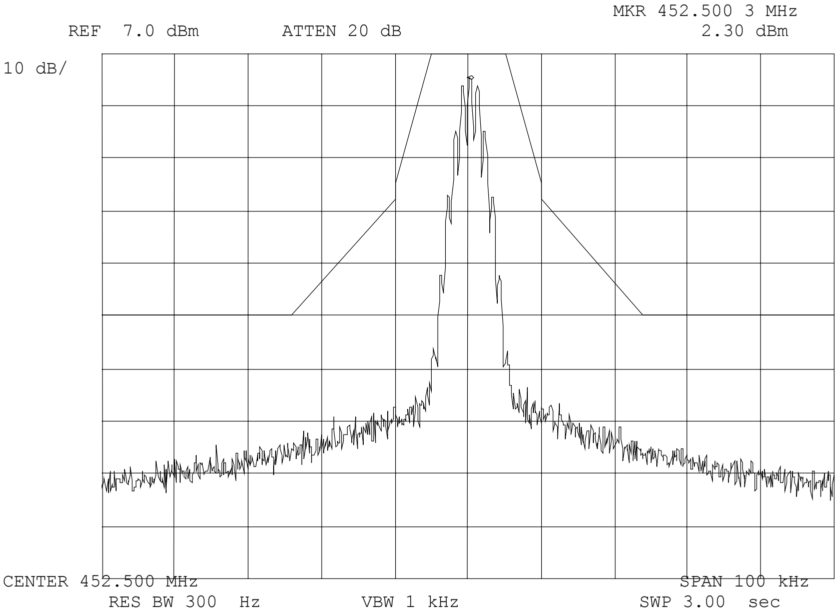


| | |
|---|---|
| Power: | HIGH |
| Modulation: | 1KHZ TONE 60% DEV<br>MASK: C, VHF/UHF 25kHz, no LPF |

Performed by: David Lee

Page Number 47 of 63.

**Name of Test**: Emission Masks (Occupied Bandwidth)
g0380361: 2003-Aug-28 Thu 13:57:00
State: 2:High Power Ambient Temperature: 22°C ± 3°C

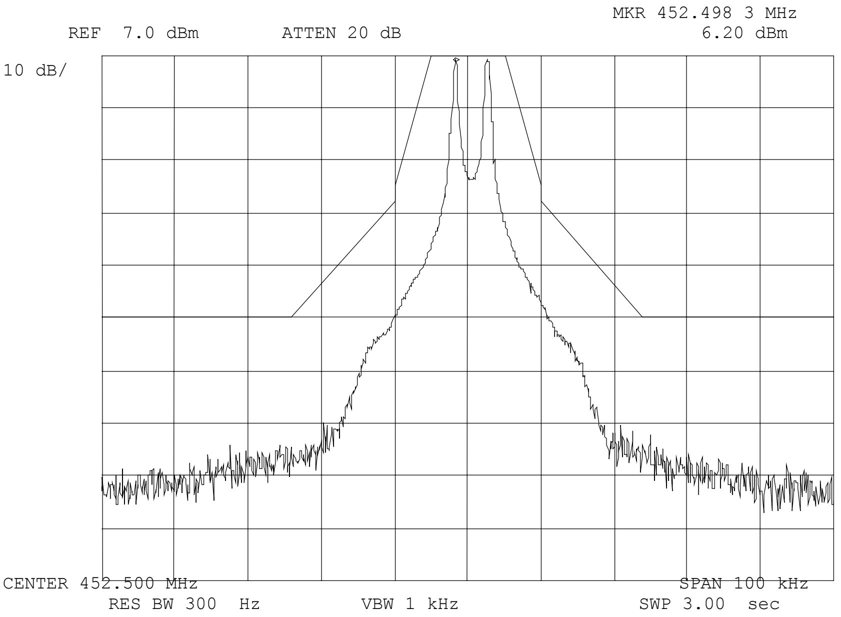


Power: HIGH
Modulation: 1KHZ TONE 60% DEV
MASK: C, VHF/UHF 25kHz, no LPF

Performed by: David Lee

Page Number 48 of 63.

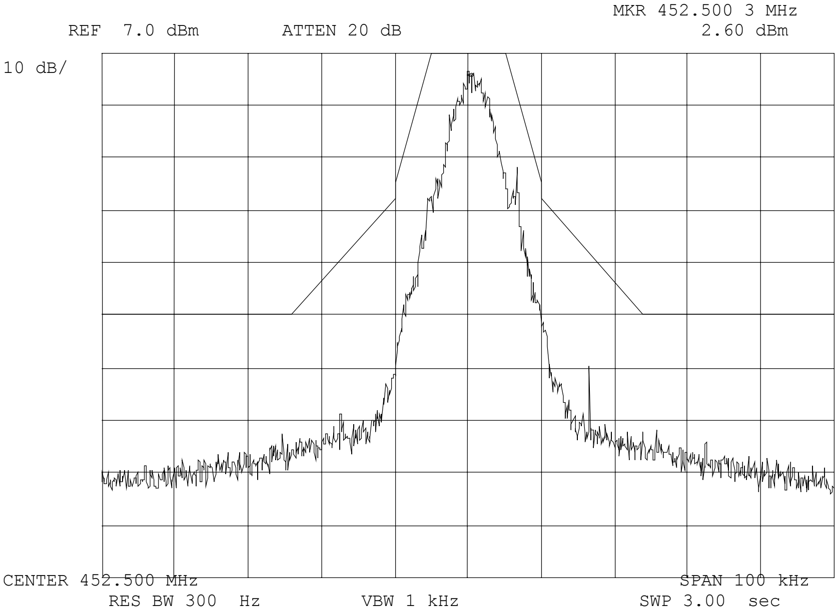
**Name of Test**: Emission Masks (Occupied Bandwidth)
g0380362: 2003-Aug-28 Thu 13:57:00
State: 2:High Power Ambient Temperature: 22°C ± 3°C



| | |
|---|---|
| Power: | HIGH |
| Modulation: | 100HZ SQUARE WAVE<br>MASK: C, VHF/UHF 25kHz, no LPF |

Performed by: David Lee

**Name of Test**: Emission Masks (Occupied Bandwidth)
g0380363: 2003-Aug-28 Thu 13:59:00
State: 2:High Power Ambient Temperature: 22°C ± 3°C

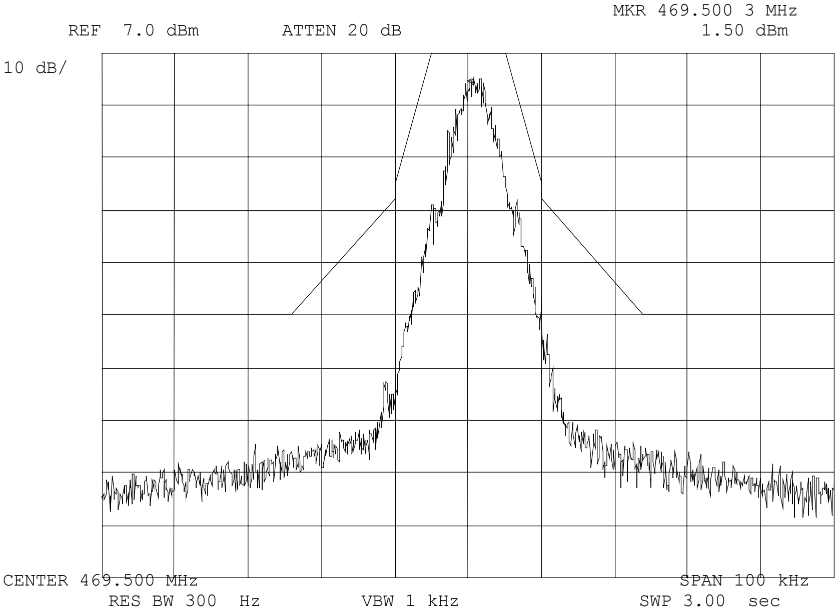


Power: HIGH
Modulation: RANDOM DATA
MASK: C, VHF/UHF 25kHz, no LPF

Performed by: David Lee

Page Number 50 of 63.

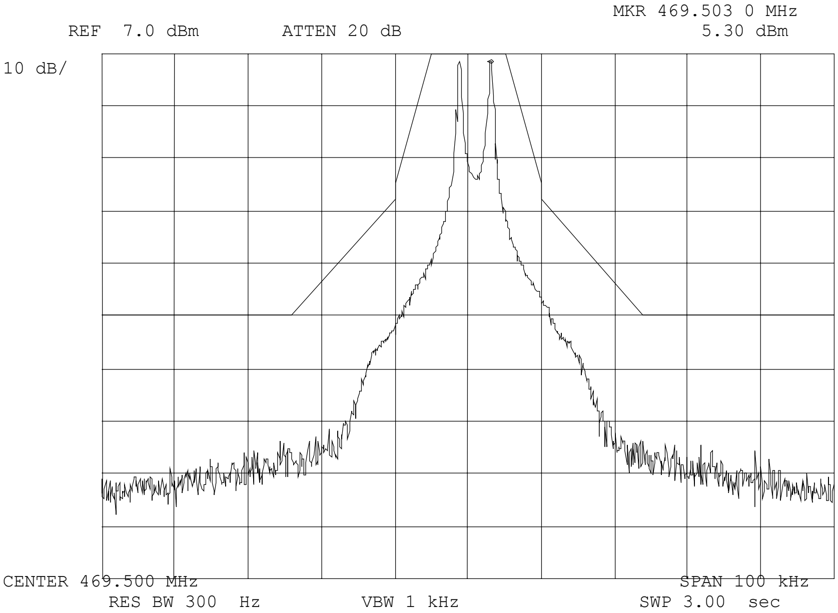
**Name of Test**: Emission Masks (Occupied Bandwidth)
g0380364: 2003-Aug-28 Thu 14:01:00
State: 2:High Power Ambient Temperature: 22°C ± 3°C



| | |
|---|---|
| Power: | HIGH |
| Modulation: | RANDOM DATA |
| | MASK: C, VHF/UHF 25kHz, no LPF |

Performed by: David Lee

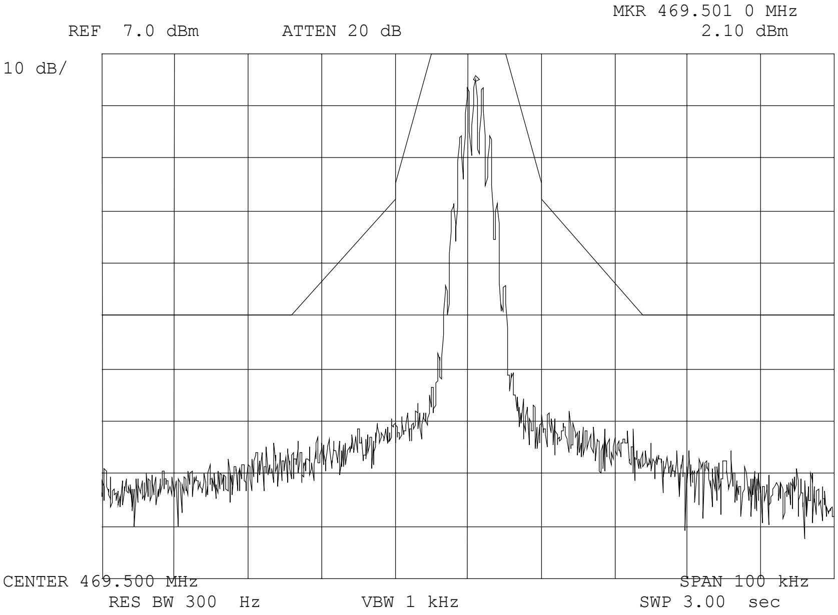
**Name of Test**: Emission Masks (Occupied Bandwidth)
g0380365: 2003-Aug-28 Thu 14:01:00
State: 2:High Power Ambient Temperature: 22°C ± 3°C



Power: HIGH
Modulation: 100HZ SQUARE WAVE
MASK: C, VHF/UHF 25kHz, no LPF

Performed by: David Lee

**Name of Test**: Emission Masks (Occupied Bandwidth)
g0380366: 2003-Aug-28 Thu 14:02:00
State: 2:High Power Ambient Temperature: 22°C ± 3°C



Power: HIGH
Modulation: 1KZ TONE 60% DEV
MASK: C, VHF/UHF 25kHz, no LPF

Performed by: David Lee

**Name of Test**: Transient Frequency Behavior
**Specification**: 47 CFR 90.214
**Guide**: ANSI/TIA/EIA-603-1992, Paragraph 2.2.19

**Test Equipment**: As per attached page

## Measurement Procedure

1. The EUT was setup as shown on the attached page, following TIA/EIA-603 steps a, b, and c as a *guide*.

2. The transmitter was turned on.

3. Sufficient attenuation was provided so that the transmitter carrier level measured at the output of the combiner was 40 dB below the maximum input level of the test receiver. This level was noted.

4. The transmitter was turned off.

5. An RF signal generator (1) modulated with a 1 kHz tone at either 25, 12.5, or 6.25 kHz deviation, and set to the same frequency as the assigned transmitter frequency, (2) was adjusted to a level -20 dB below the level recorded in step 3, as measured at the output of the combiner. This level was then fixed for the remainder of the test.

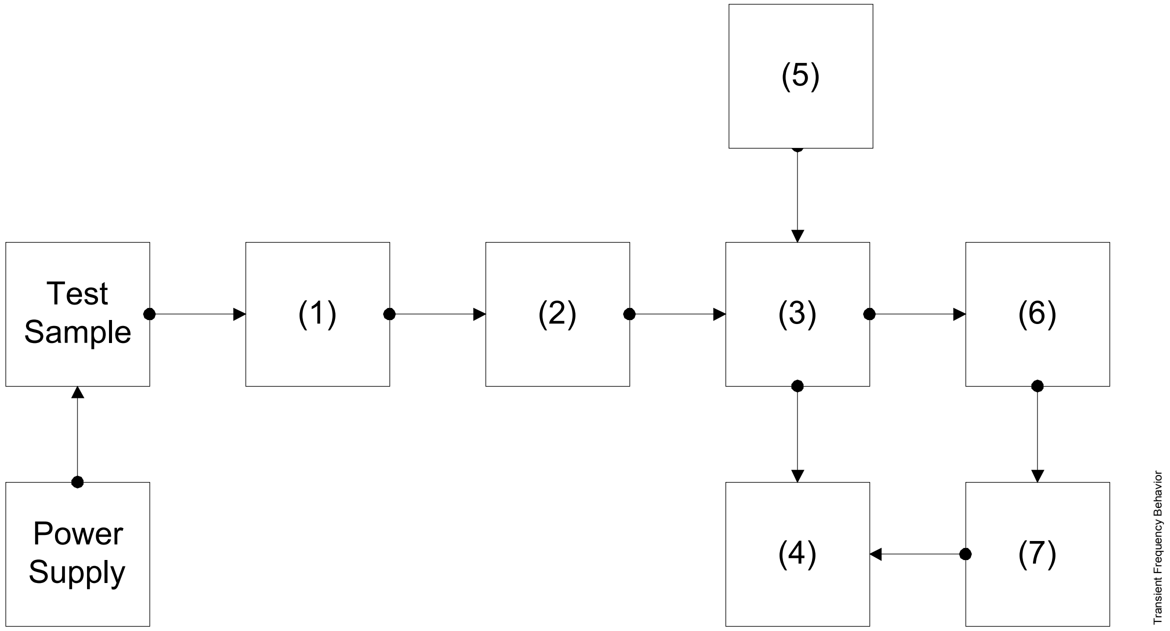
6. The oscilloscope was setup using TIA/EIA-603 steps j and k as a guide, and to either 10 ms/div (UHF) or 5 ms/div (VHF).

7. The 30 dB attenuator was removed, the transmitter was turned on.

8. The carrier on-time as referenced in TIA/EIA-603 steps m, n, and o was captured and plotted. The carrier off-time as referenced in TIA/EIA-603 steps p, q, r, and s was captured and plotted.

Performed by: David Lee

## Transient Frequency Behavior

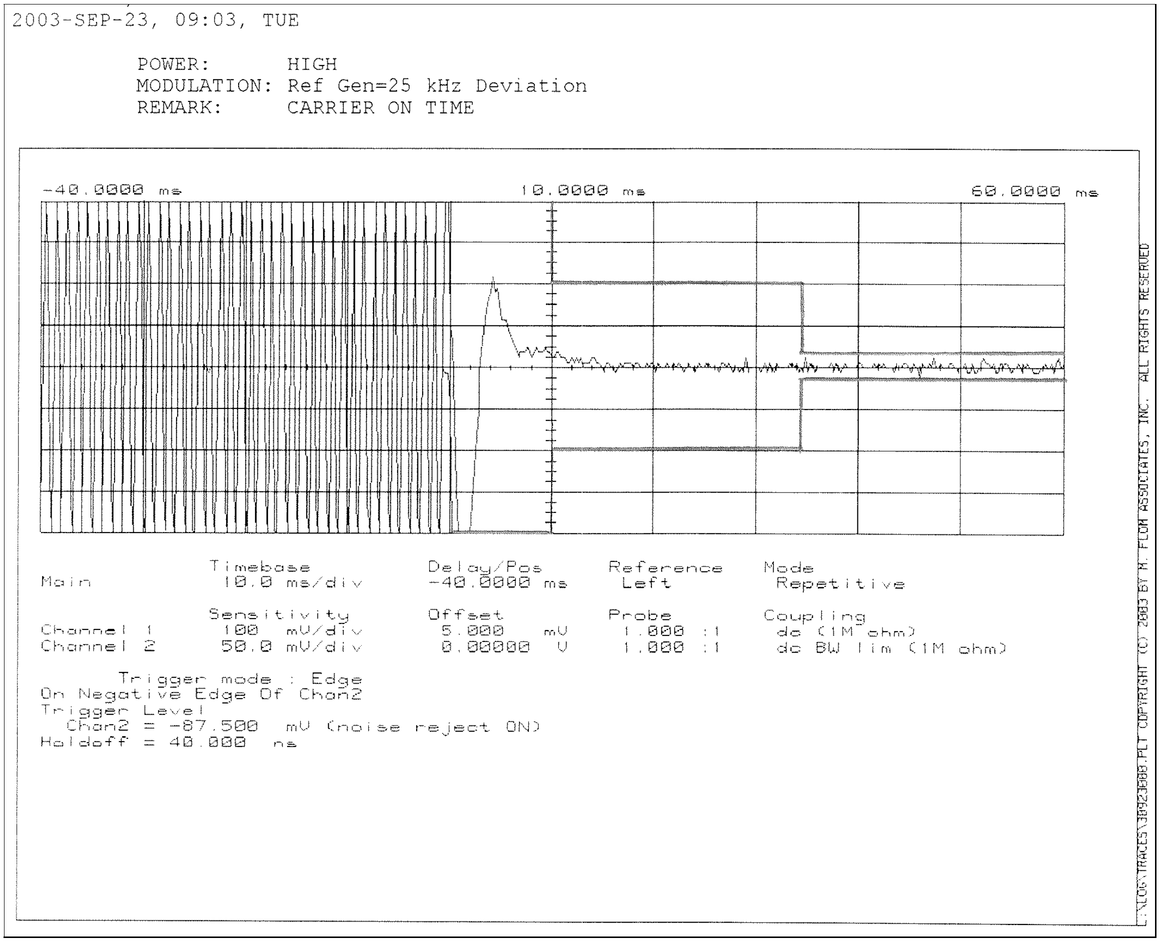


| Asset (as applicable) | Description | s/n |
|---|---|---|
| (1) **Attenuator** (Removed after 1st step) | | |
| i00112 | Philco 30 dB | 989 |
| (2) **Attenuator** | | |
| i00112 | Philco 30 dB | 989 |
| i00172 | Bird 30 dB | 989 |
| i00122 | Narda 10 dB | 7802 |
| i00123 | Narda 10 dB | 7802A |
| i00110 | Kay Variable | 145-387 |
| (3) **Combiner** | | |
| i00154 | 4 x 25 Ω Combiner | 154 |
| (4) **Crystal Decoder** | | |
| i00159 | HP 8470B | 1822A10054 |
| (5) **RF Signal Generator** | | |
| i00018 | HP 8656A | 2228A03472 |
| i00031 | HP 8656A | 2402A06180 |
| i00067 | HP 8920A | 3345U01242 |
| (6) **Modulation Analyzer** | | |
| i00020 | HP 8901A | 2105A01087 |
| (7) **Scope** | | |
| i00030 | HP 54502A | 2927A00209 |

Page Number 55 of 63.

**Name of Test**: Transient Frequency Behavior

Ambient Temperature: 22°C ± 3°C



2003-SEP-23, 09:03, TUE

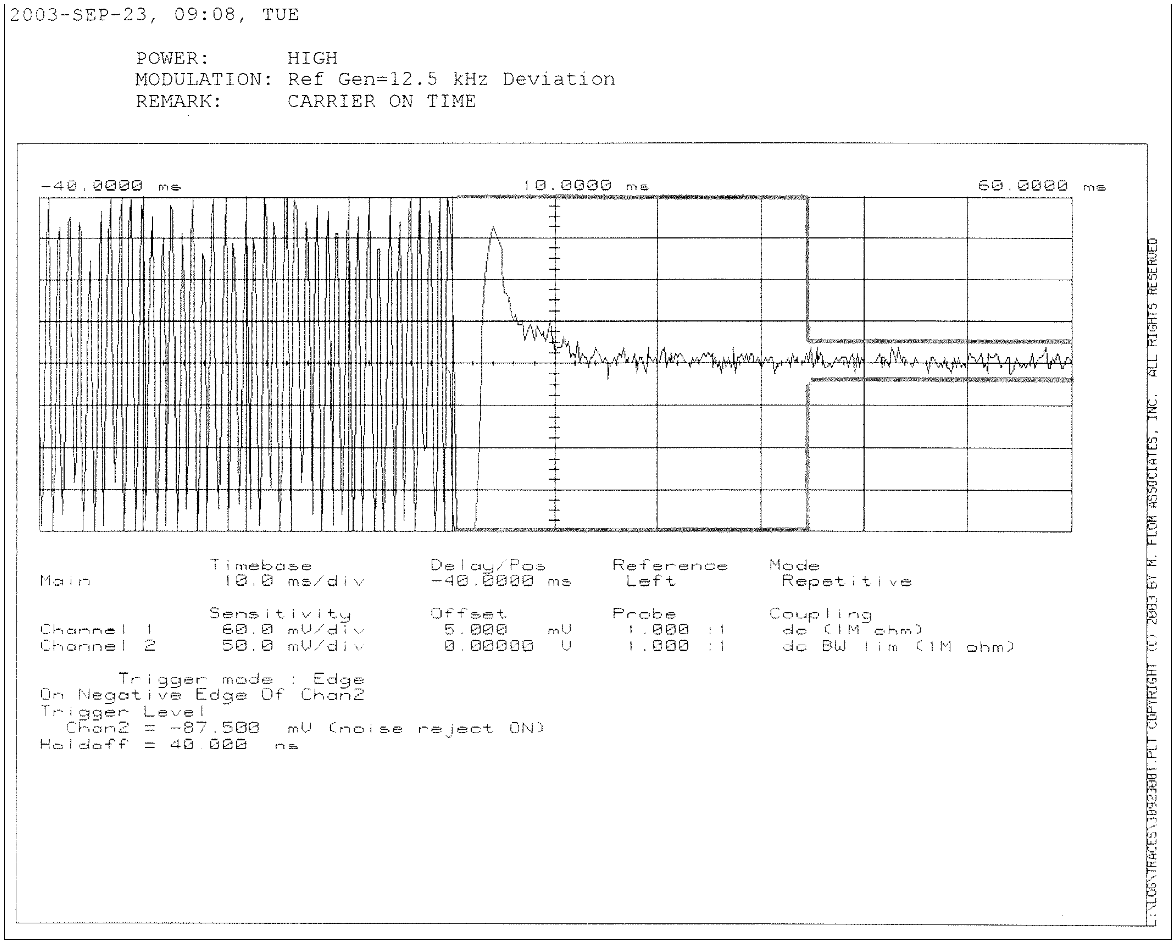
POWER: HIGH
MODULATION: Ref Gen=25 kHz Deviation
REMARK: CARRIER ON TIME

```
                Timebase          Delay/Pos      Reference    Mode
Main             10.0 ms/div      -40.0000 ms     Left         Repetitive

                Sensitivity       Offset         Probe        Coupling
Channel 1        100  mV/div       5.000   mV     1.000 :1     dc (1M ohm)
Channel 2        50.0 mV/div       0.00000  V     1.000 :1     dc BW lim (1M ohm)

       Trigger mode : Edge
On Negative Edge Of Chan2
Trigger Level
  Chan2 = -87.500  mV (noise reject ON)
Holdoff = 40.000  ns
```

Performed by: David Lee

**Name of Test**: Transient Frequency Behavior

Ambient Temperature: 22°C ± 3°C



2003-SEP-23, 09:08, TUE

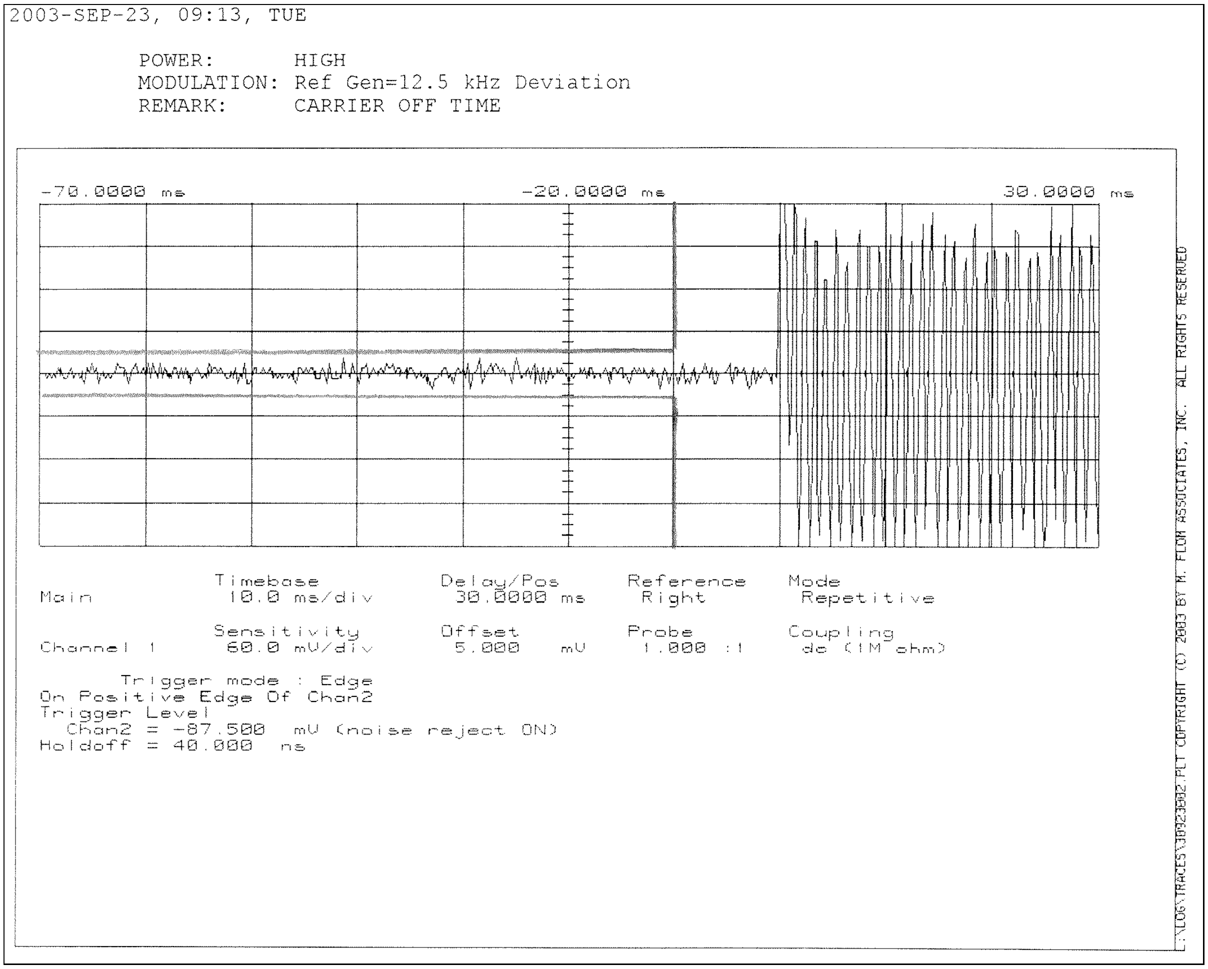
```
POWER:      HIGH
MODULATION: Ref Gen=12.5 kHz Deviation
REMARK:     CARRIER ON TIME
```

```
              Timebase        Delay/Pos      Reference    Mode
Main           10.0 ms/div    -40.0000 ms     Left         Repetitive

              Sensitivity     Offset         Probe        Coupling
Channel 1      60.0 mV/div     5.000    mV    1.000 :1     dc (1M ohm)
Channel 2      50.0 mV/div     0.00000  V     1.000 :1     dc BW lim (1M ohm)

      Trigger mode : Edge
On Negative Edge Of Chan2
Trigger Level
  Chan2 = -87.500  mV (noise reject ON)
Holdoff = 40.000  ns
```

Performed by: David Lee

**Name of Test**: Transient Frequency Behavior

Ambient Temperature: 22°C ± 3°C



```
2003-SEP-23, 09:13, TUE

          POWER:       HIGH
          MODULATION:  Ref Gen=12.5 kHz Deviation
          REMARK:      CARRIER OFF TIME
```

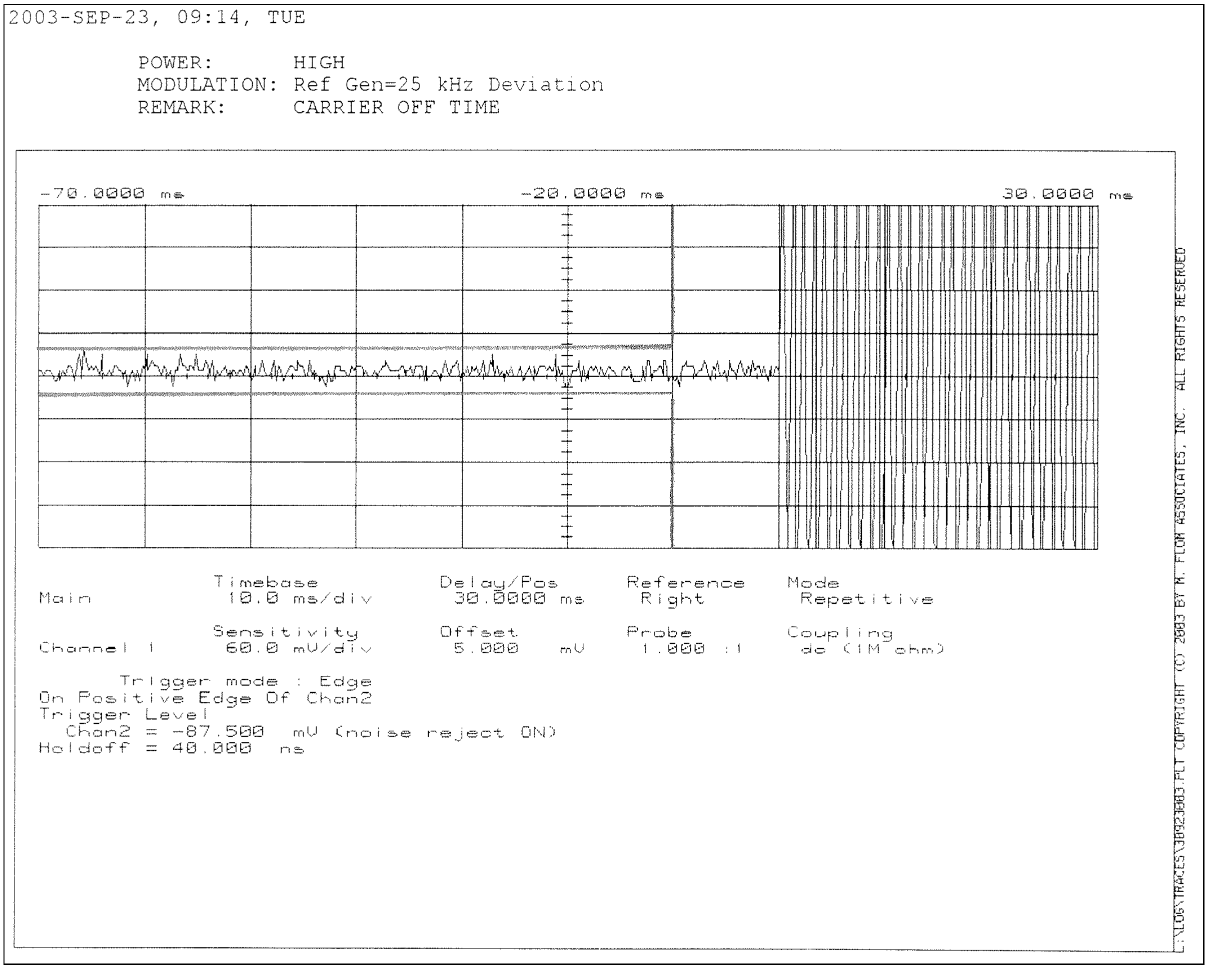
```
              Timebase         Delay/Pos      Reference    Mode
Main           10.0 ms/div      30.0000 ms     Right        Repetitive

              Sensitivity      Offset         Probe        Coupling
Channel 1      60.0 mV/div      5.000    mV    1.000 :1     dc (1M ohm)

      Trigger mode : Edge
On Positive Edge Of Chan2
Trigger Level
  Chan2 = -87.500  mV (noise reject ON)
Holdoff = 40.000  ns
```

Performed by: David Lee

Page Number 58 of 63.

**Name of Test**: Transient Frequency Behavior

Ambient Temperature: 22°C ± 3°C



```
2003-SEP-23, 09:14, TUE

         POWER:      HIGH
         MODULATION: Ref Gen=25 kHz Deviation
         REMARK:     CARRIER OFF TIME
```

```
                 Timebase          Delay/Pos      Reference    Mode
Main              10.0 ms/div       30.0000 ms     Right        Repetitive

                 Sensitivity       Offset         Probe        Coupling
Channel 1         60.0 mV/div       5.000   mV     1.000 :1     dc (1M ohm)

       Trigger mode : Edge
On Positive Edge Of Chan2
Trigger Level
  Chan2 = -87.500  mV (noise reject ON)
Holdoff = 40.000  ns
```

Performed by: David Lee

| | |
|---|---|
| Page Number | 59 of 63. |
| **Name of Test**: | Frequency Stability (Temperature Variation) |
| **Specification**: | 47 CFR 2.1055(a)(1) |
| **Guide**: | ANSI/TIA/EIA-603-1992, Paragraph 2.2.2 |
| **Test Conditions**: | As Indicated |
| **Test Equipment**: | As per previous page |

## Measurement Procedure

1. The EUT and test equipment were set up as shown on the following page.

2. With all power removed, the temperature was decreased to -30°C and permitted to stabilize for three hours. Power was applied and the maximum change in frequency was noted within one minute.

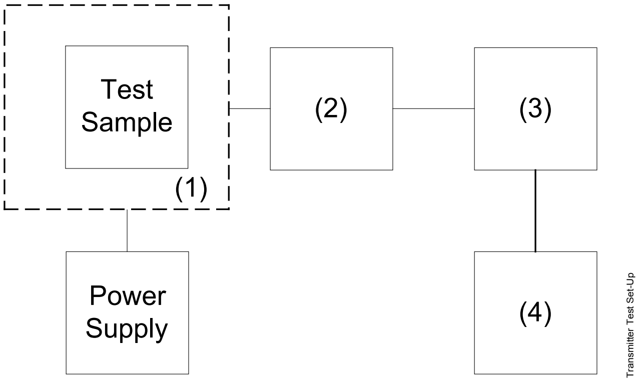
3. With power OFF, the temperature was raised in 10°C steps. The sample was permitted to stabilize at each step for at least one-half hour. Power was applied and the maximum frequency change was noted within one minute.

4. The temperature tests were performed for the worst case.

5. Measurement Results: Attached

## Transmitter Test Set-Up

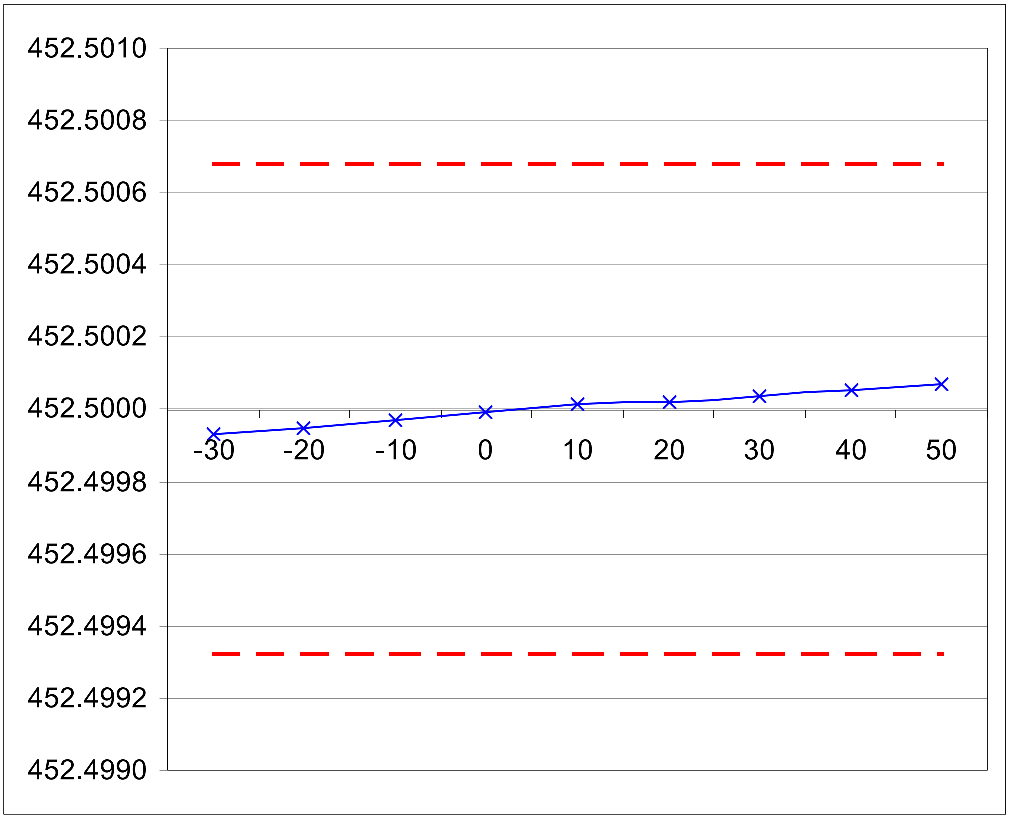
Frequency Stability: Temperature Variation
Frequency Stability: Voltage Variation



| Asset (as applicable) | Description | s/n |
|---|---|---|
| (1) **Temperature, Humidity, Vibration** | | |
| i00027 | Tenney Temp. Chamber | 9083-765-234 |
| i00 | Weber Humidity Chamber | |
| i00 | L.A.B. RVH 18-100 | |
| (2) **Coaxial Attenuator** | | |
| i00122 | NARDA 766-10 | 7802 |
| i00123 | NARDA 766-10 | 7802A |
| (3) **RF Power** | | |
| i00020 | HP 8901A Power Mode | 2105A01087 |
| (4) **Frequency Counter** | | |
| i00042 | HP 5383A | 1628A00959 |
| i00019 | HP 5334B | 2704A00347 |
| i00020 | HP 8901A | 2105A01087 |

**Name of Test**: Frequency Stability (Temperature Variation)

Ambient Temperature: 22°C ± 3°C



Performed by: David Lee

Page Number 62 of 63.

**Name of Test**: Frequency Stability (Voltage Variation)

**Specification**: 47 CFR 2.1055(d)(1)

**Guide**: ANSI/TIA/EIA-603-1992, Paragraph 2.2.2

**Test Equipment**: As per previous page

## Measurement Procedure

1. The EUT was placed in a temperature chamber at 25±5°C and connected as for "Frequency Stability - Temperature Variation" test.

2. The power supply voltage to the EUT was varied from 85% to 115% of the nominal value measured at the input to the EUT.

3. The variation in frequency was measured for the worst case.

**Results**: Frequency Stability (Voltage Variation)
g0380382: 2003-Aug-29 Fri 09:57:47
State: 0:General Ambient Temperature: 22°C ± 3°C

Limit, ppm = 5
Limit, Hz = 2263
Battery End Point (Voltage) = 8.5

| % of STV | Voltage | Frequency, MHz | Change, Hz | Change, ppm |
|---|---|---|---|---|
| 85 | 10.2 | 452.500000 | 0 | 0.00 |
| 100 | 12 | 452.500000 | 0 | 0.00 |
| 115 | 13.8 | 452.499970 | -30 | -0.07 |
| 71 | 8.5 | 452.499980 | -20 | -0.04 |

Performed by: David Lee

Page Number 63 of 63.

**Name of Test**: Necessary Bandwidth and Emission Bandwidth

**Specification**: 47 CFR 2.202(g)

Modulation = 16K0F1D

**Necessary Bandwidth Calculation**:

Maximum Modulation (M), kHz = 3
Maximum Deviation (D), kHz = 5
Constant Factor (K) = 1
Necessary Bandwidth ($B_N$), kHz = (2xM)+(2xDxK)
= 16.0

Modulation = 11K0F1D

**Necessary Bandwidth Calculation**:

Maximum Modulation (M), kHz = 3
Maximum Deviation (D), kHz = 2.5
Constant Factor (K) = 1
Necessary Bandwidth ($B_N$), kHz = (2xM)+(2xDxK)
= 11.0

Performed by: David Lee

END OF TEST REPORT

# Testimonial
# and
# Statement of Certification

**This is to Certify**:

1. **That** the application was prepared either by, or under the direct supervision of, the undersigned.
2. **That** the technical data supplied with the application was taken under my direction and supervision.
3. **That** the data was obtained on representative units, randomly selected.
4. **That**, to the best of my knowledge and belief, the facts set forth in the application and accompanying technical data are true and correct.

Certifying Engineer: Morton Flom, P. Eng.