Flom Test Labs
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# Transmitter Certification

of

FCC ID: ROJEXPLORER-700
Model: Explorer 700

to

**Federal Communications Commission**

Rule Part(s) Part 25 and Confidentiality

Date of report: April 20, 2006 (Amended June 6, 2006)
Date of revision: January 3, 2008

**On the Behalf of the Applicant**: Thrane & Thrane A/S

**At the Request of**: Thrane & Thrane A/S
Lundtoftegardsvej 93D
DK-2800 Lyngby, Denmark

**Attention of:** Morten Becker Saul
+45 39 55 8209
Email: mbs@thrane.com

Supervised by: David E. Lee, FCC/IC Compliance Manager

# List of Exhibits

(FCC **Certification** (Transmitters) - Revised 9/28/98)

Applicant: Thrane & Thrane A/S

FCC ID: ROJEXPLORER-700

**By Applicant**:

1. Letter of Authorization

2. Confidentiality Request: 0.457 And 0.459

3. Identification Drawings, 2.1033(c)(11)
   - Label
   - Location of Label
   - Compliance Statement
   - Location of Compliance Statement

4. Photographs, 2.1033(c)(12)

5. Documentation: 2.1033(c)
   - (3) User Manual
   - (9) Tune Up Info
   - (10) Schematic Diagram
   - (10) Circuit Description
   - Block Diagram
   - Parts List
   - Active Devices

6. MPE Report

**By M.F.A. Inc.:**

A. Testimonial & Statement of Certification

## 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

*Required information per ISO/IEC Guide 17025-2005, 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: | d0640017A |
| d) Client: | Thrane & Thrane A/S<br>Lundtoftegardsvej 93D<br>DK-2800 Lyngby, Denmark |
| e) Identification:<br>EUT Description: | Explorer 700<br>FCC ID: ROJEXPLORER-700<br>Imarsat Terminal |
| f) EUT Condition: | Not required unless specified in individual tests. |
| g) Report Date:<br>EUT Received: | April 20, 2006<br>April 17, 2006 |
| 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: |  <br>David E. Lee, FCC/IC Compliance Manager |
| 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. |

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:

_____ 15 Subpart C – Unlicensed Low Power Devices
_____ 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
__X__ 25 – Satellite Communications
_____ 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
_____ 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 C63.4-1992/2003, 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.

THE AMERICAN
ASSOCIATION
FOR LABORATORY
ACCREDITATION

**ACCREDITED LABORATORY**

A2LA has accredited

**FLOM TEST LABS**
**Chandler, AZ**

for technical competence in the field of

**Electrical 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.

Presented this 14th day of June 2004.

President
For the Accreditation Council
Certificate Number 2152.01
Valid to November 30th, 2006
Revised September 25, 2006

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

## A2LA

"A2LA has accredited M. Flom Associates, Inc. Chandler, AZ for technical competence in the field of Electrical 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."

Certificate Number: **2152-01**

# List of General Information Required for Certification

In Accordance with FCC Rules and Regulations,
Volume II, Part 2, Part 25, 15.247 (Bluetooth), 15.247 (802.11a/b/g) and Confidentiality
Sub-part 2.1033
(c)(1):

**Name and Address of Applicant::** Thrane & Thrane A/S
Lundtoftegardsvej 93D
DK-2800 Lyngby, Denmark

**Manufacturer**: Thrane & Thrane A/S
Lundtoftegardsvej 93D
DK-2800 Lyngby, Denmark

(c)(2): **FCC ID**: ROJEXPLORER-700

**Model Number**: Explorer 700

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

Please see attached exhibits

(c)(4): **Type of Emission**: 42K0D1W, 84K0D1W, 200KD1W, 21K0GID, 42K0G1D, 84K0G1D, 200KG1D

(c)(5): **Frequency Range, MHz**: 1626.5 – 1660.5

(c)(6): **Power Rating, Watts**: 100.0 (20dBW)
____ Switchable ____ Variable ____ N/A

(c)(7): **FCC Limit, Watts**: 200.0

**DUT Results**: Passes ___X___ Fails _____

Subpart 2.1033 (continued)
(c)(8): Voltages & currents in all elements in final RF stage, including final transistor or solid-state device:

Immarsat:

| | | |
|---|---|---|
| Collector Current, A | = | 3.2 |
| Collector Voltage, Vdc | = | 8.5 |
| Supply Voltage, Vdc | = | 10 – 32 (Battery 11.1 Nominal) |

(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

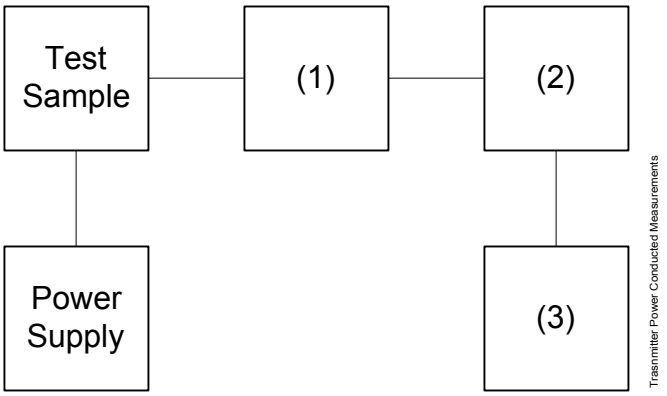
**Name of Test**: Carrier Output Power (Conducted)
**Specification**: 47 CFR 2.1046(a)
**Guide**: ANSI/TIA/EIA-603C: 2004

**Measurement Procedure**

A) 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.

B) Measurement accuracy is ±3%.

**Transmitter Test Set-Up: RF Power Output**




| | Asset | Description | s/n | Cycle | Last Cal |
|---|---|---|---|---|---|
| (1) **Coaxial Attenuator** | | | | | |
| | i00231/2 | PASTERNACK PE7021-30 (30 dB) | 231 or 232 | NCR | |
| X | i00122/3 | NARDA 766 (10 dB) | 7802 or 7802A | NCR | |
| (2) **Power Meter** | | | | | |
| X | i00048 | HP 8566B Spectrum Analyzer | 2511A01467 | 12 mo. | Oct-05 |
| | i00029 | HP 8563E Spectrum Analyzer | 3213A00104 | 12 mo. | Jan-06 |
| (3) **Frequency Counter** | | | | | |
| X | i00048 | HP 8566B Spectrum Analyzer* | 2511A01467 | 12 mo. | Oct-05 |
| | i00029 | HP 8563E Spectrum Analyzer | 3213A00104 | 12 mo. | Jan-06 |

* Peak Conducted Power measured with RBW=VBW=3MHz

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

**Measurement Results**
(Worst case)

Immarsat:

| | | |
|---|---|---|
| Frequency of Carrier, MHz | = | 1643.5, 1626.5, 1660.5 |
| Ambient Temperature | = | 23°C ± 3°C |

| Power Setting | RF Power, dBm | RF Power, Watts |
|---|---|---|
| High | 35.45 | 3.50 |

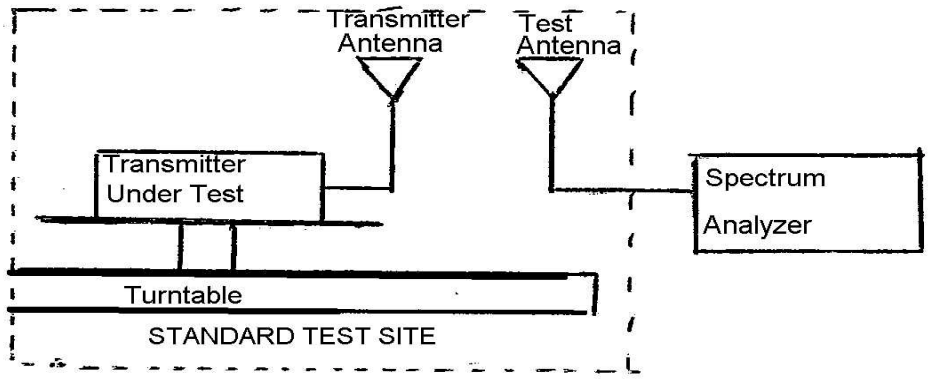
Performed by: David E. Lee, FCC/IC Compliance Manager

**Name of Test**: EIRP Carrier Power (Radiated)
**Specification**: 47 CFR 2.1046(a)
**Guide**: TIA/EIA-603C: 2004 Substitution Method

**Measurement Procedure**

**Definition**
The average radiated power of a licensed device is the equivalent power required to produce at a distant point the same average received power as produced by the licensed device.

**Method of Measurement**:
A) Connect the equipment as illustrated. Place the transmitter to be tested on the turntable in the standard test site.




B) Raise and lower the test antenna from 1m to 6 m with the transmitter facing the antenna and record the highest received signal in dB as LVL.

C) Repeat step B) for seven additional readings at 45˚ interval positions of the turntable.

D) Replace the transmitter under test with a half-wave or horn vertically polarized antenna. The center of the antenna should be at the same location as the transmitter under test. Connect the antenna to a signal generator with a known output power and record the path loss in dB or LOSS.

E) Calculate the average radiated output power from the readings in step C) and D) by the following:

**average radiated power = 10 $\log_{10}$ Ó 10(LVL – LOSS)/10 (dBm)**

**Name of Test**: EIRP Carrier Power (Radiated)

**Test Equipment**

| | Asset | Description | s/n | Cycle | Last Cal |
|---|---|---|---|---|---|
| **Transducer** | | | | | |
| | i00088 | EMCO 3109-B 25MHz-300MHz | 2336 | 24 mo. | Sep-05 |
| X | i00089 | Aprel 2001 200MHz-1GHz | 001500 | 24 mo. | Sep-05 |
| X | i00103 | EMCO 3115 1GHz-18GHz | 9208-3925 | 24 mo. | Jan-05 |
| **Amplifier** | | | | | |
| X | i00028 | HP 8449A | 2749A00121 | 12 mo. | May-05 |
| **Spectrum Analyzer** | | | | | |
| X | i00029 | HP 8563E | 3213A00104 | 12 mo. | Jan-06 |
| X | i00033 | HP 85462A | 3625A00357 | 12 mo. | Sep-05 |
| **Substitution Generator** | | | | | |
| X | i00286 | SMT 03, R&S, Signal Generator | 826211/005 | 12 mo. | Jul-05 |
| **Substitution Antenna** | | | | | |
| X | i00091 | APREL 3115 1GHz-18GHz | 001469 | 24 mo. | Sep-04 |

**Measurement Results**

**Imarsat**

| Frequency Tuned, MHz | Measured, dBm | Sub Gen, dBm | Sub Meter dBm | Path Loss, dB | Cable CF, dB | Ant, dBi | EIRP, dBm | EIRP, dBW |
|---|---|---|---|---|---|---|---|---|
| 1626.500000 | 8.50 | 10.00 | -2.20 | 12.20 | 33.50 | 4.80 | 49.40 | 19.39 |
| 1643.500000 | 9.30 | 10.00 | -1.30 | 11.30 | 33.60 | 4.90 | 49.30 | 19.30 |
| 1660.500000 | 10.10 | 10.00 | -1.40 | 11.40 | 33.70 | 5.00 | 50.20 | 20.19 |

Performed by: David E. Lee, FCC/IC Compliance Manager

**Name of Test**: Unwanted Emissions (Transmitter Conducted)
**Specification**: 47 CFR 2.1051
**Guide**: ANSI C63.4: 2003

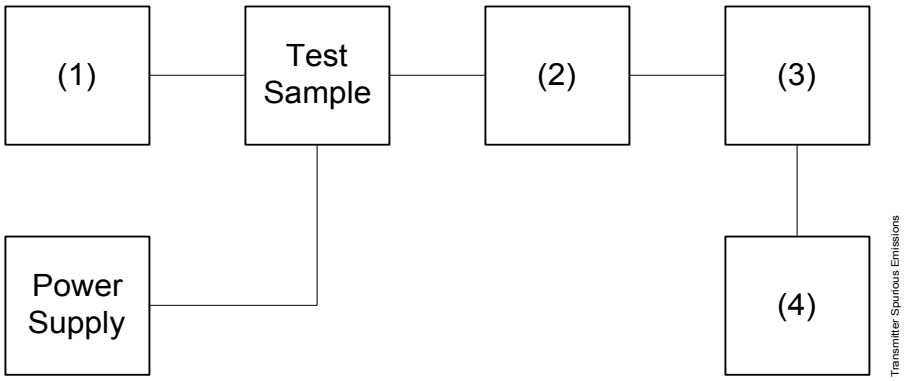
**Measurement Procedure**

The emissions were measured for the worst case as follows:

1). within a band of frequencies defined by the carrier frequency plus and minus one channel.
2). from the lowest frequency generated in the EUT and to at least the 10th harmonic of the carrier frequency, or 40 GHz, whichever is lower.

The magnitude of spurious emissions that are attenuated more than 20 dB below the permissible value need not be specified.

**Transmitter Test Set-Up: Spurious Emission**




| | Asset | Description | s/n | | |
|---|---|---|---|---|---|
| (1) **Audio Oscillator/Generator (Not Required)** | | | | | |
| (2) **Coaxial Attenuator** | | | | | |
| X | i00231/2 | PASTERNACK PE7021-30 (30 dB) | 231 or 232 | NCR | |
| | i0012/3 | NARDA 766 (10 dB) | 7802 or 7802A | NCR | |
| (3) **Filters; Notch, HP, LP, BP** | | | | | |
| X | - | Band Pass, 3GHz (Applicant Supplied) | - | NCR | |
| X | - | High Pass, 3.7GHz | - | NCR | |
| (4) **Spectrum Analyzer** | | | | | |
| X | i00033 | HP 85462A | 3625A00357 | 12 mo. | Sep-05 |
| X | i00029 | HP 8563E Spectrum Analyzer | 3213A00104 | 12 mo. | May-05 |

**Name of Test**: Unwanted Emissions (Transmitter Conducted)

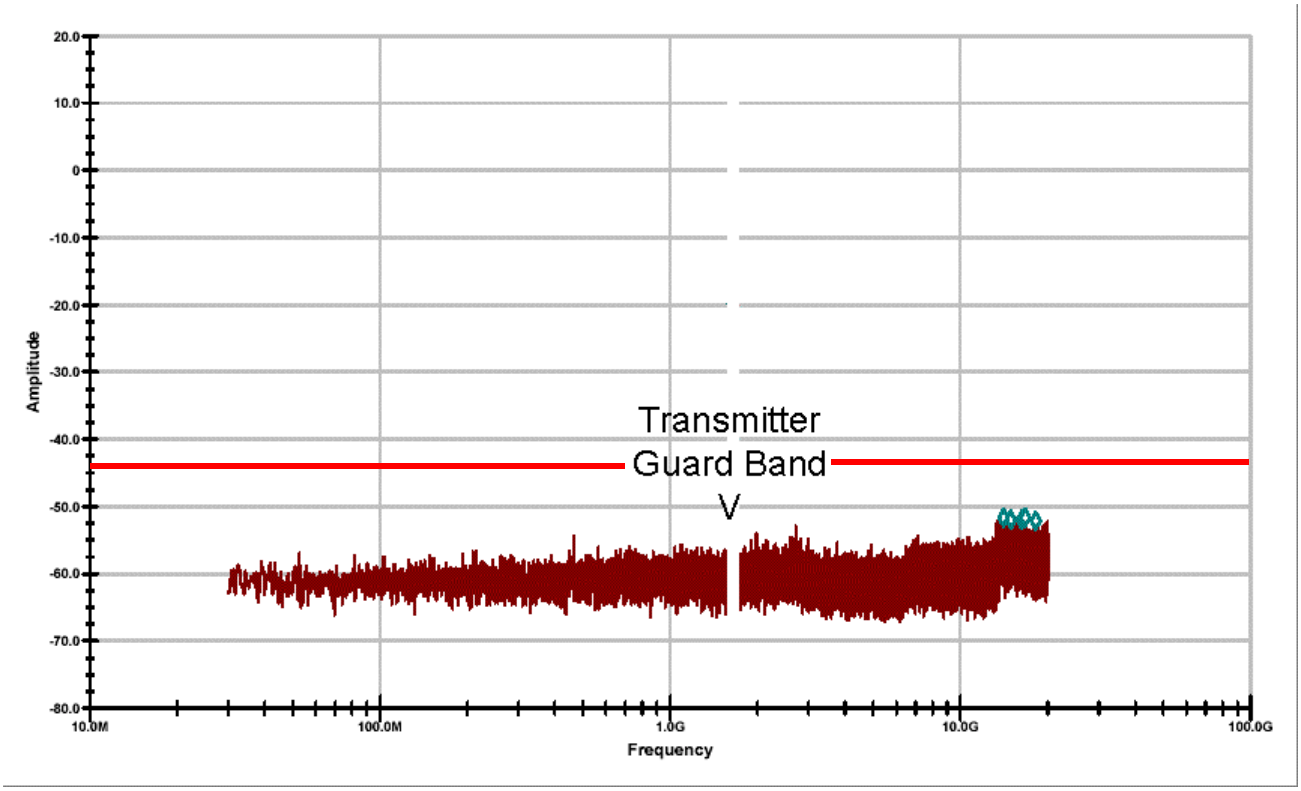
**Measurement Results**
(Worst Case)

Imarsat:

| | | |
|---|---|---|
| Frequency of carrier, MHz | = | 1643.5, 1626.5, 1660.5 |
| Spectrum Searched, GHz | = | 0 to 10 x $F_C$ |
| Maximum Response, Hz | = | N/A |
| All Other Emissions | = | ≥ 20 dB Below Limit |
| Limit(s), dBc | -(43+10xLOG P) = | -13dBm |

**Measurement Results**

Limit = -13dBm (via 30dB attenuator)

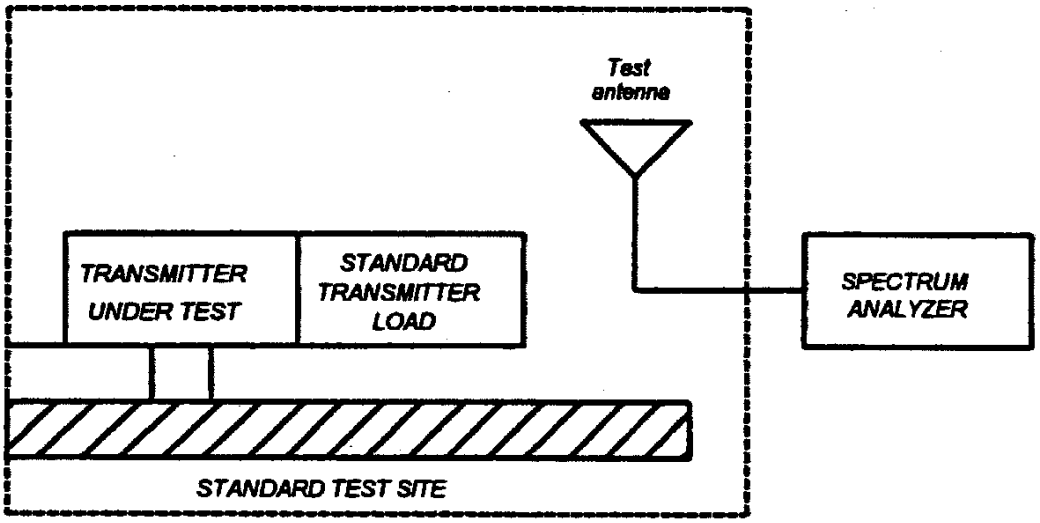


**Name of Test**: Field Strength of Spurious Radiation - Imarsat
**Specification**: 47 CFR 2.1053(a)
**Guide**: ANSI/TIA/EIA-603-C, 47 CFR 22.917

**Measurement Procedure**

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

**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 that is placed on the turntable. The RF cable to this load should be of minimum length.

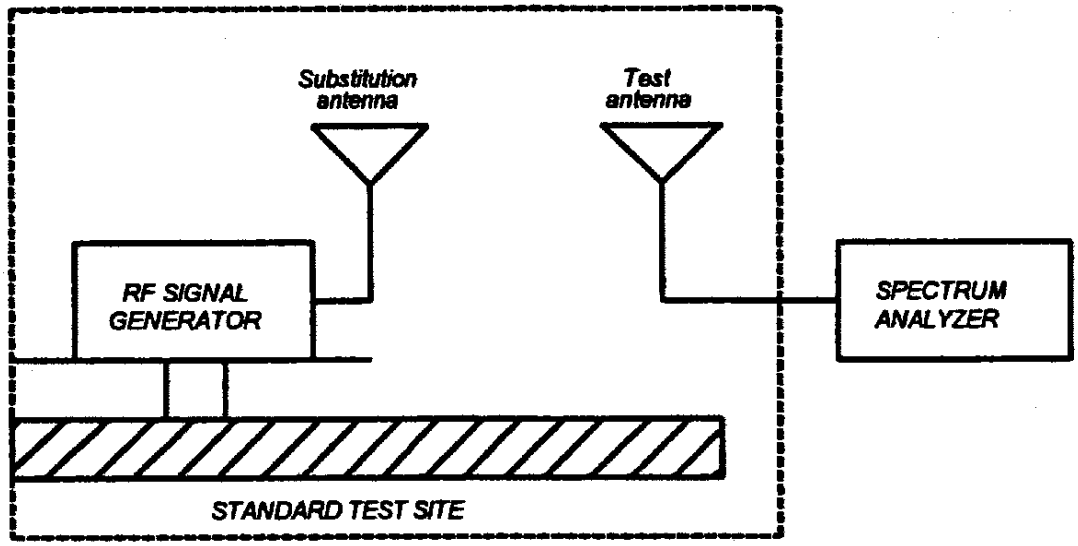


**Name of Test**: Field Strength of Spurious Radiation (Cont.)

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 | Description | s/n | Cycle | Last Cal |
|---|---|---|---|---|---|
| **Transducer** | | | | | |
| | i00088 | EMCO 3109-B 25MHz-300MHz | 2336 | 24 mo. | Sep-05 |
| X | i00089 | Aprel 2001 200MHz-1GHz | 001500 | 24 mo. | Sep-05 |
| X | i00103 | EMCO 3115 1GHz-18GHz | 9208-3925 | 24 mo. | Jan-05 |
| **Amplifier** | | | | | |
| X | i00028 | HP 8449A | 2749A00121 | 12 mo. | May-05 |
| **Spectrum Analyzer** | | | | | |
| X | i00029 | HP 8563E | 3213A00104 | 12 mo. | Jan-06 |
| X | i00033 | HP 85462A | 3625A00357 | 12 mo. | Sep-05 |
| **Substitution Generator** | | | | | |
| X | i00286 | SMT 03, R&S, Signal Generator | 826211/005 | 12 mo. | Jul-05 |
| **Substitution Antenna** | | | | | |
| X | i00091 | APREL 3115 1GHz-18GHz | 001469 | 24 mo. | Sep-04 |

**Name of Test**: Field Strength of Spurious Radiation

**Measurement Results**

Summary:

| | | |
|---|---|---|
| Frequency of carrier, MHz | = | 1643.5, 1626.5, 1660.5 |
| Spectrum Searched, GHz | = | 0 to 10 x $F_C$ |
| Maximum Response, Hz | = | N/A |
| All Other Emissions | = | ≥ 20 dB Below Limit |
| Limit(s), dBc | -(43+10xLOG P) = | -13dBm |

**Measurement Results**

2006-Apr-18 Tue 10:52:00
State: 2:High Power

Ambient Temperature: 23°C ± 3°C

| Tuned Frequency, MHz | Emission Frequency, MHz | Meter, dBuV | Calc, dBm | Limit, dBm | | Calc, dBc | Margin, dB |
|---|---|---|---|---|---|---|---|
| 1626.600000 | 3253.193333 | 31.33 | -38.30 | -13.00 | P | -88.30 | 25.30 |
| 1643.000000 | 3285.993333 | 31.33 | -38.20 | -13.00 | P | -88.20 | 25.20 |
| 1660.400000 | 3320.783333 | 32.33 | -37.10 | -13.00 | P | -87.10 | 24.10 |
| 1626.600000 | 4879.825000 | 20.70 | -53.40 | -13.00 | P | -103.40 | 0.40 |
| 1643.000000 | 4928.993333 | 19.33 | -54.60 | -13.00 | A | -104.60 | 41.60 |
| 1660.400000 | 4981.201083 | 20.77 | -52.90 | -13.00 | P | -102.90 | 39.90 |
| 1643.000000 | 6571.993333 | 28.50 | -41.30 | -13.00 | P | -91.30 | 28.30 |
| 1660.400000 | 6641.601083 | 8.10 | -61.60 | -13.00 | P | -111.60 | 48.60 |
| 1626.600000 | 8133.000000 | -3.73 | -69.90 | -13.00 | P | -119.90 | 56.90 |
| 1643.000000 | 8214.998333 | 8.10 | -57.90 | -13.00 | P | -107.90 | 4.90 |
| 1660.400000 | 8302.001083 | 11.43 | -54.40 | -13.00 | P | -104.40 | 41.40 |
| 1643.000000 | 9857.998333 | 7.60 | -56.20 | -13.00 | P | -106.20 | 43.20 |
| 1660.400000 | 9962.401083 | 16.43 | -47.30 | -13.00 | P | -97.30 | 34.30 |
| 1626.600000 | 11386.200000 | -2.73 | -64.60 | -13.00 | P | -114.60 | 51.60 |
| 1643.000000 | 11500.998333 | 7.60 | -54.10 | -13.00 | P | -104.10 | 1.10 |
| 1660.400000 | 11622.801083 | 3.77 | -57.70 | -13.00 | P | -107.70 | 44.70 |
| 1626.600000 | 13012.800000 | -1.40 | -61.50 | -13.00 | P | -111.50 | 48.50 |
| 1643.000000 | 13143.998333 | 5.93 | -54.10 | -13.00 | P | -104.10 | 41.10 |
| 1660.400000 | 13283.201083 | 7.60 | -52.40 | -13.00 | P | -102.40 | 39.40 |
| 1660.400000 | 13283.201083 | 4.93 | -55.10 | -13.00 | P | -105.10 | 42.10 |
| 1626.600000 | 14639.400000 | 1.10 | -56.90 | -13.00 | P | -106.90 | 43.90 |
| 1643.000000 | 14786.998333 | 15.77 | -42.00 | -13.00 | P | -92.00 | 29.00 |
| 1626.600000 | 16266.000000 | -0.90 | -58.90 | -13.00 | P | -108.90 | 45.90 |
| 1643.000000 | 16429.998333 | 10.10 | -47.50 | -13.00 | P | -97.50 | 34.50 |
| 1660.400000 | 16604.001083 | 0.93 | -56.00 | -13.00 | P | -106.00 | 43.00 |

P = Peak
A = Average

**Test Setup**: Radiated Emissions

**Name of Test**: Emission Masks (Occupied Bandwidth) - Imarsat
**Specification**: 47 CFR 2.1049(c)(1)
**Guide**: ANSI/TIA/EIA-603C, ANSI C63.3:2003

**Measurement Procedure**

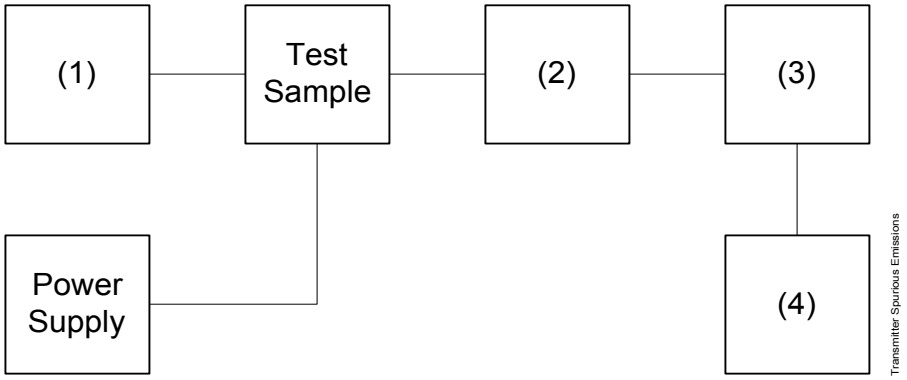
A) The EUT and test equipment were set up as shown below

B) Attenuator and Cable Offset = 35dB @ 1.6GHz

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

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

**Transmitter Test Set-Up: Occupied Bandwidth**



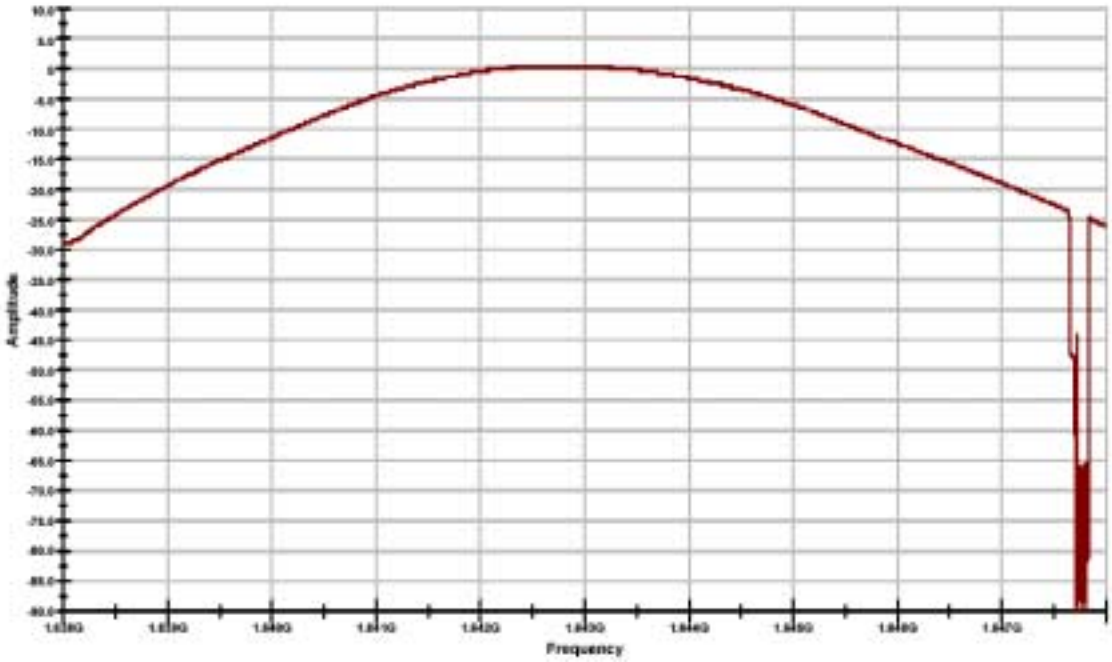

| | Asset | Description | s/n | Cycle | Last Cal |
|---|---|---|---|---|---|
| (1) **Audio Oscillator/Generator (Not Required)** | | | | | |
| (2) **Coaxial Attenuator** | | | | | |
| X | i00231/2 | PASTERNACK PE7021-30 (30 dB) | 231 or 232 | NCR | |
| | i00123 | NARDA 766 (10 dB) | 7802A | NCR | |
| (3) **Interface** | | | | | |
| X | i00021 | HP 8954A Transceiver Interface | 2146A00159 | NCR | |
| (4) **Spectrum Analyzer** | | | | | |
| X | i00048 | HP 8566B Spectrum Analyzer | 2511A01467 | 12 mo. | Oct-05 |
| | i00029 | HP 8563E Spectrum Analyzer | 3213A00104 | 12 mo. | Jan-06 |

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

Immarsat:

**Measurement Results**

2006-Apr-17 Mon 09:45:00
State: 2:High Power Ambient Temperature: 23°C ± 3°C




RBW=VBW=3MHz

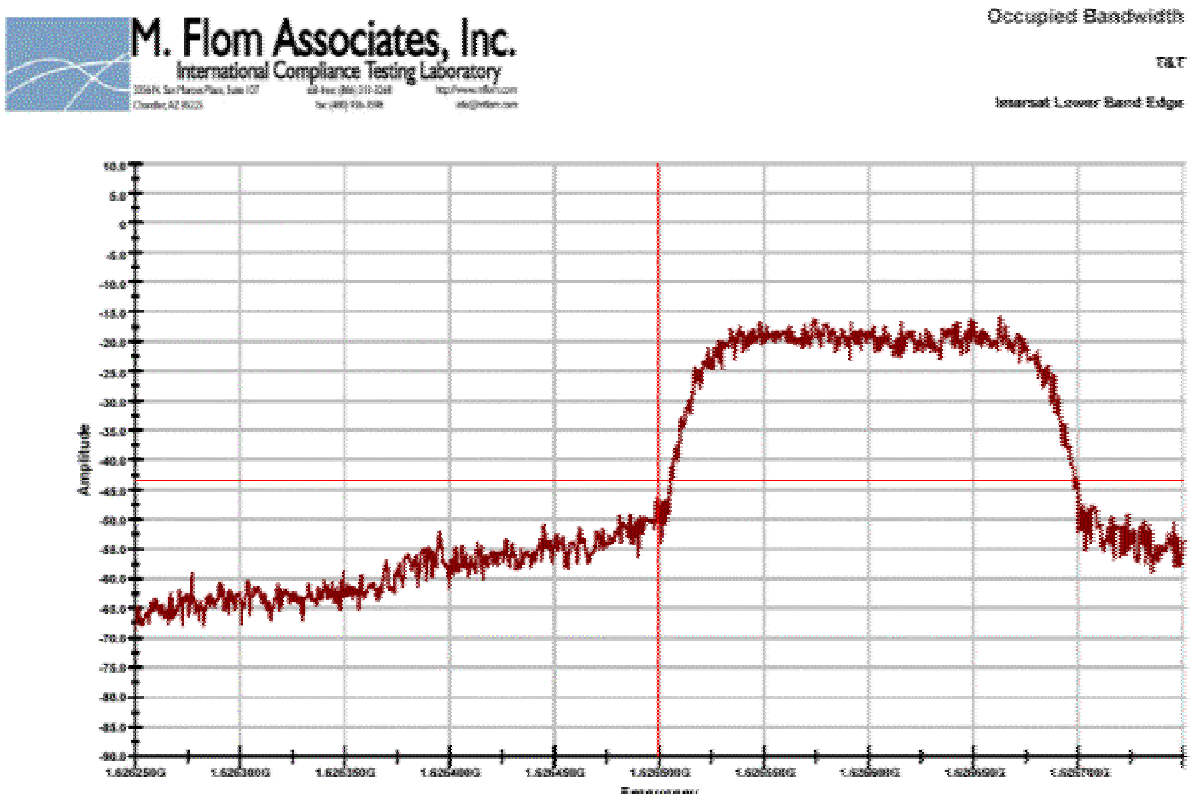
Power: HIGH
Modulation: QPSK 4.5
REFERENCE MAX POWER

Performed by: David E. Lee, FCC/IC Compliance Manager

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

**Measurement Results**

State: 2:High Power Ambient Temperature: 23°C ± 3°C




RBW=VBW=100kHz

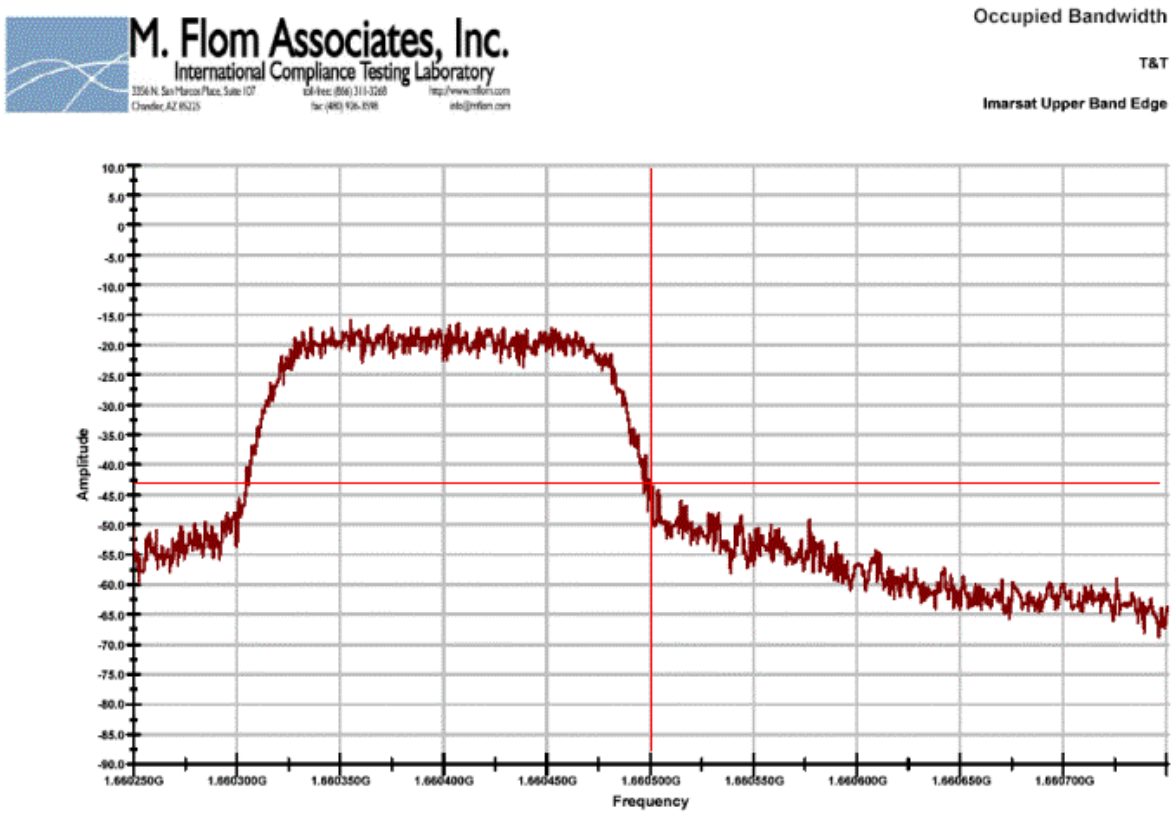
Power: HIGH
Modulation: Lower Band Edge
G1D

Performed by: David E. Lee, FCC/IC Compliance Manager

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

**Measurement Results**

State: 2:High Power Ambient Temperature: 23°C ± 3°C




RBW=VBW=100kHz

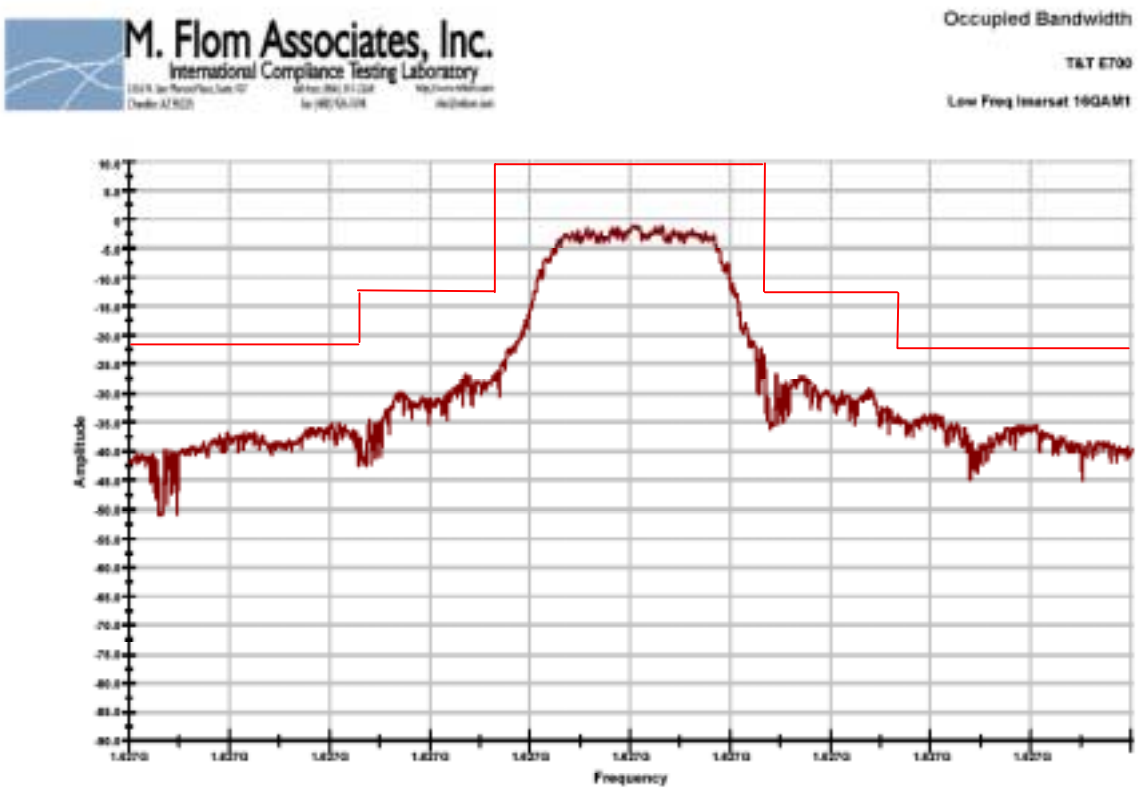
Power: HIGH
Modulation: Upper Band Edge
G1D

Performed by: David E. Lee, FCC/IC Compliance Manager

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

**Measurement Results**

State: 2:High Power Ambient Temperature: 23°C ± 3°C




RBW=VBW=100kHz

Power: HIGH

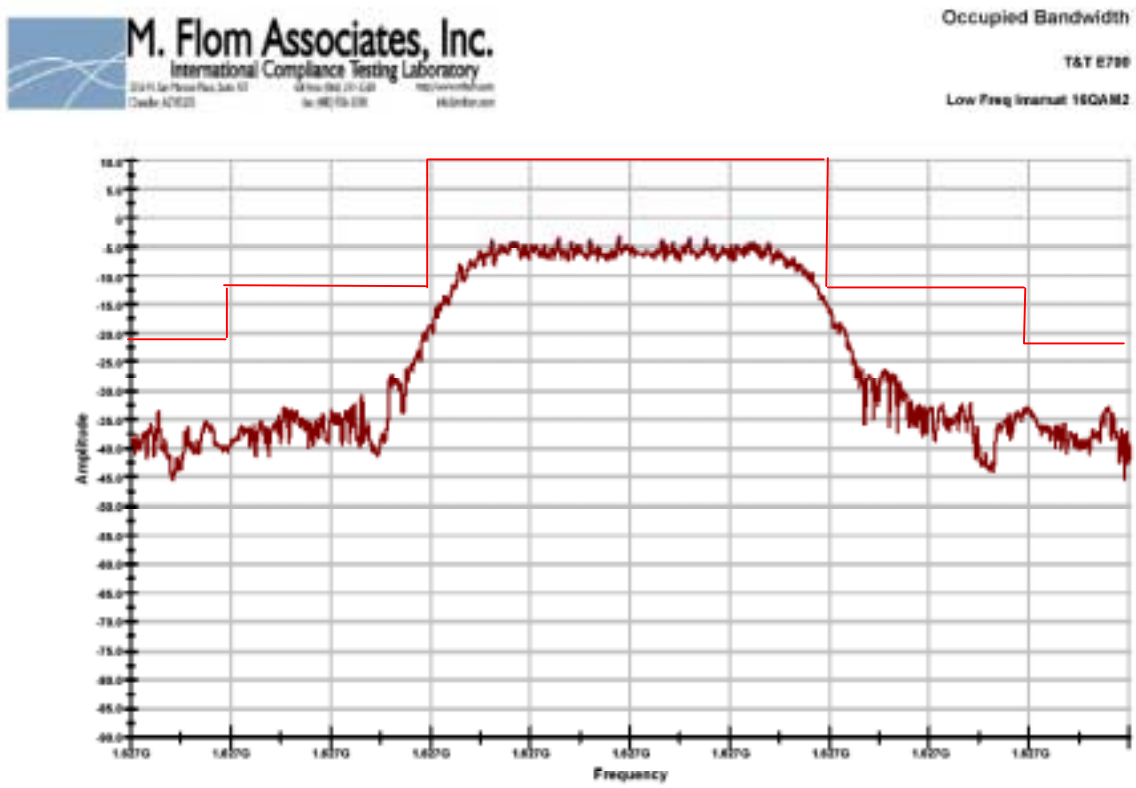
Modulation: Data Rate 33.6k
42K0G1D

Performed by: David E. Lee, FCC/IC Compliance Manager

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

**Measurement Results**

State: 2:High Power Ambient Temperature: 23°C ± 3°C




RBW=VBW=100kHz

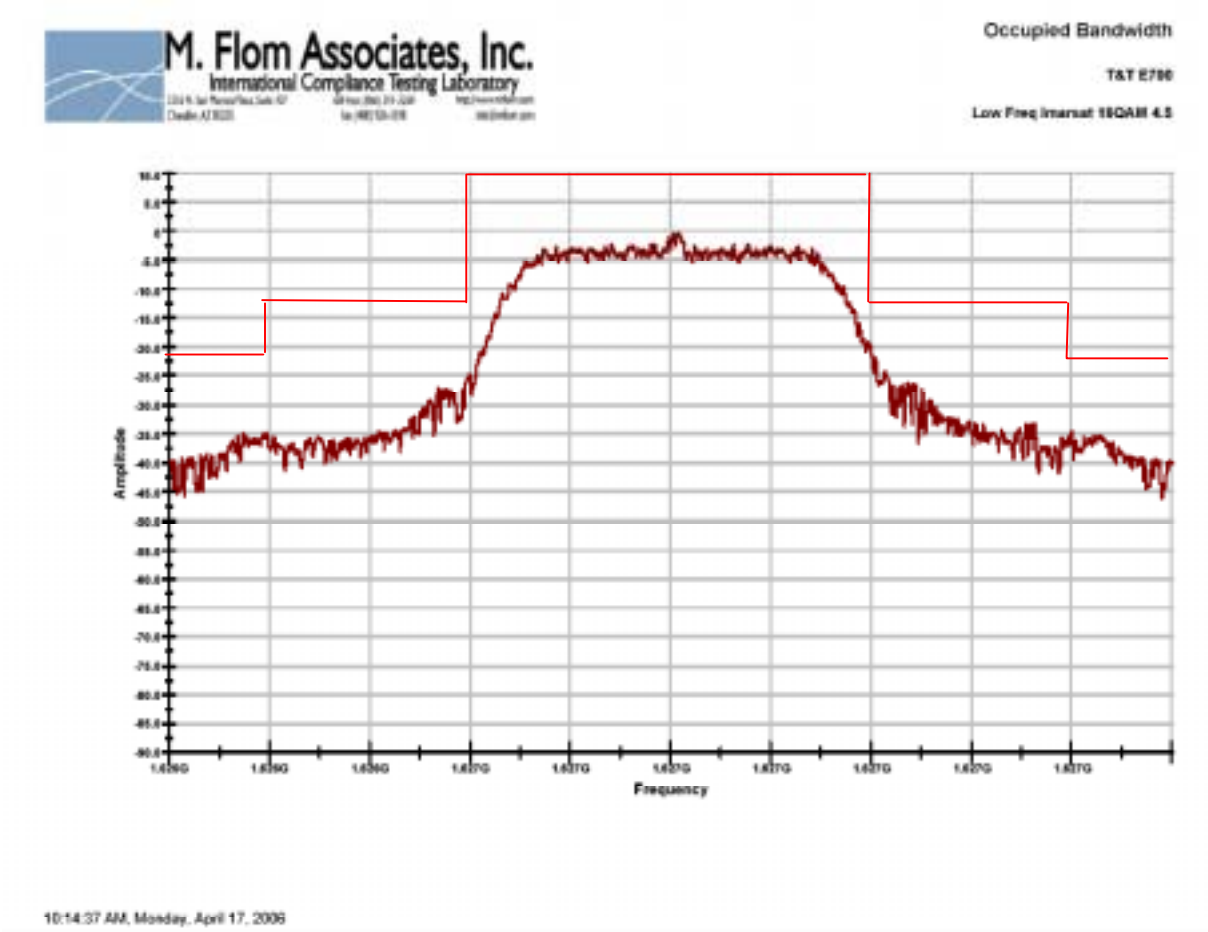
Power: HIGH
Modulation: Data Rate 67.2k
84K0G1D

Performed by: David E. Lee, FCC/IC Compliance Manager

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

**Measurement Results**

State: 2:High Power Ambient Temperature: 23°C ± 3°C




RBW=VBW=100kHz

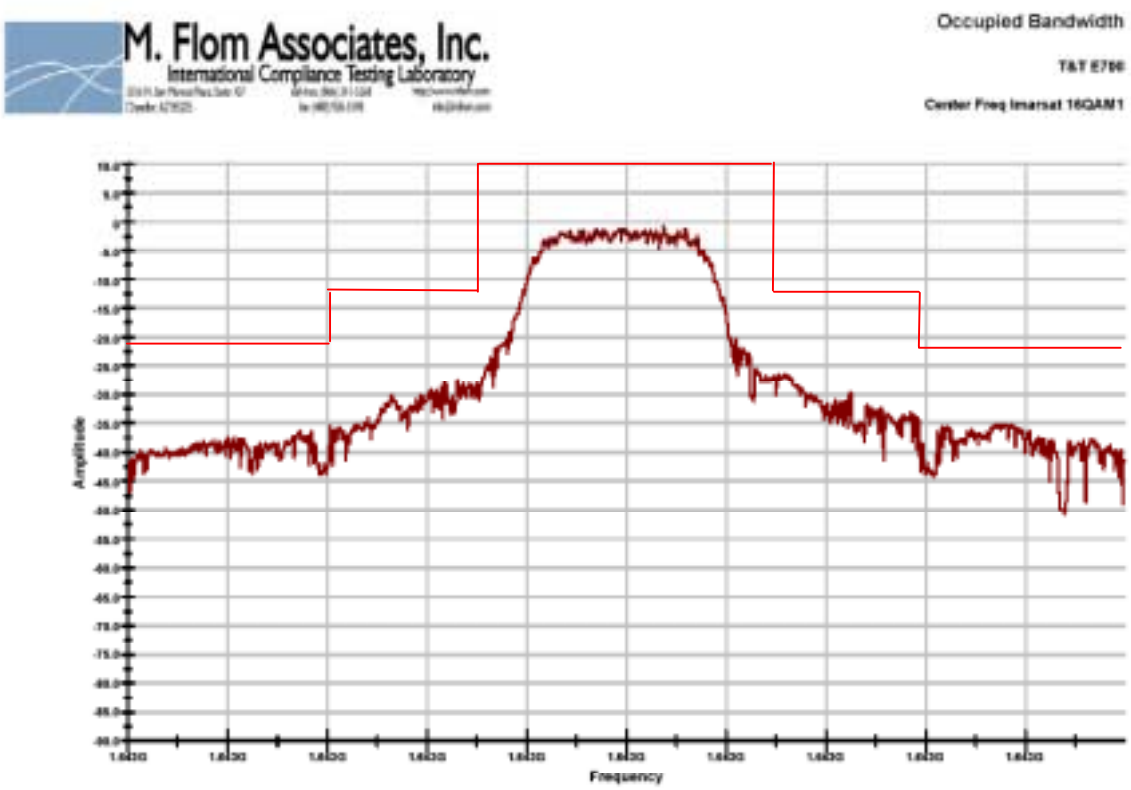
Power: HIGH
Modulation: Data Rate 151.2k
200KG1D

Performed by: David E. Lee, FCC/IC Compliance Manager

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

**Measurement Results**

State: 2:High Power Ambient Temperature: 23°C ± 3°C




RBW=VBW=100kHz

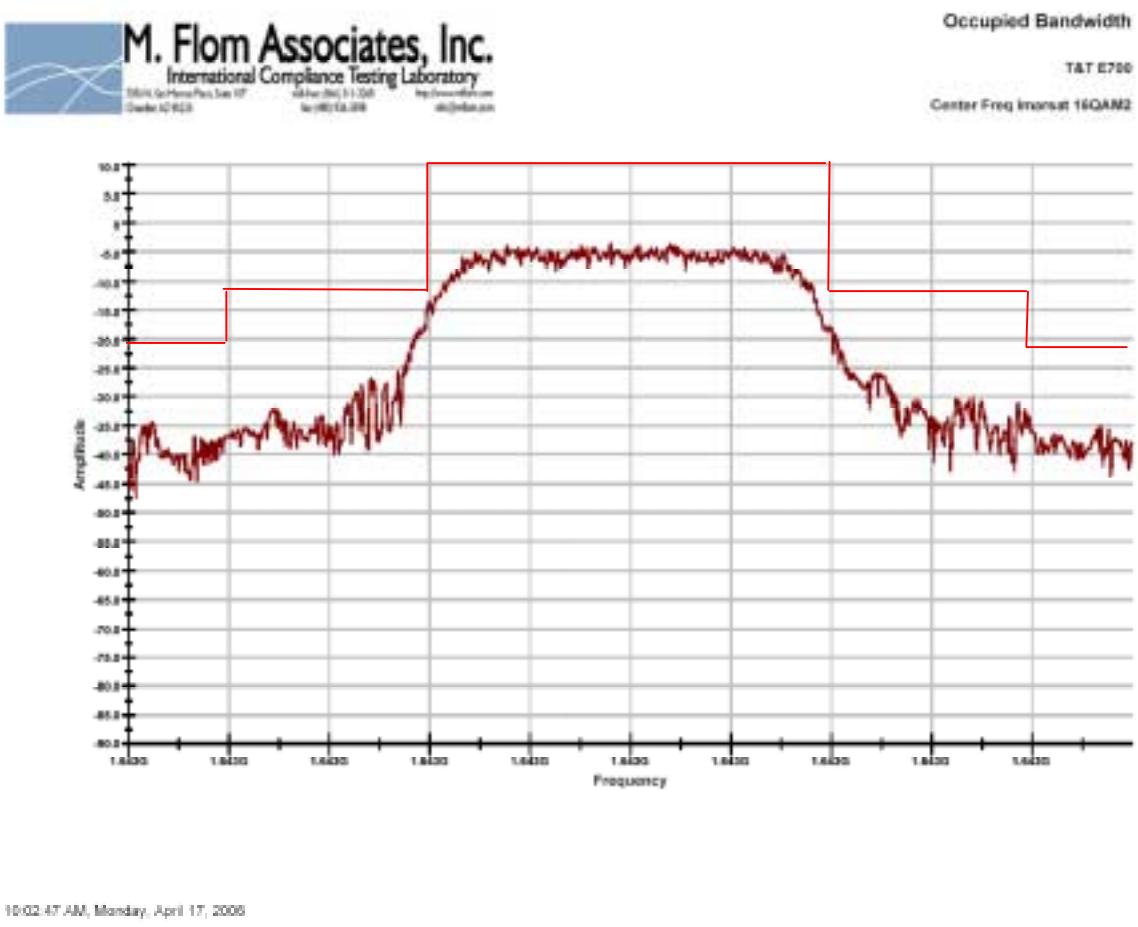
| | |
|---|---|
| Power: | HIGH |
| Modulation: | Data Rate 33.6k<br>42K0G1D |

Performed by: David E. Lee, FCC/IC Compliance Manager

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

**Measurement Results**

State: 2:High Power Ambient Temperature: 23°C ± 3°C




RBW=VBW=100kHz

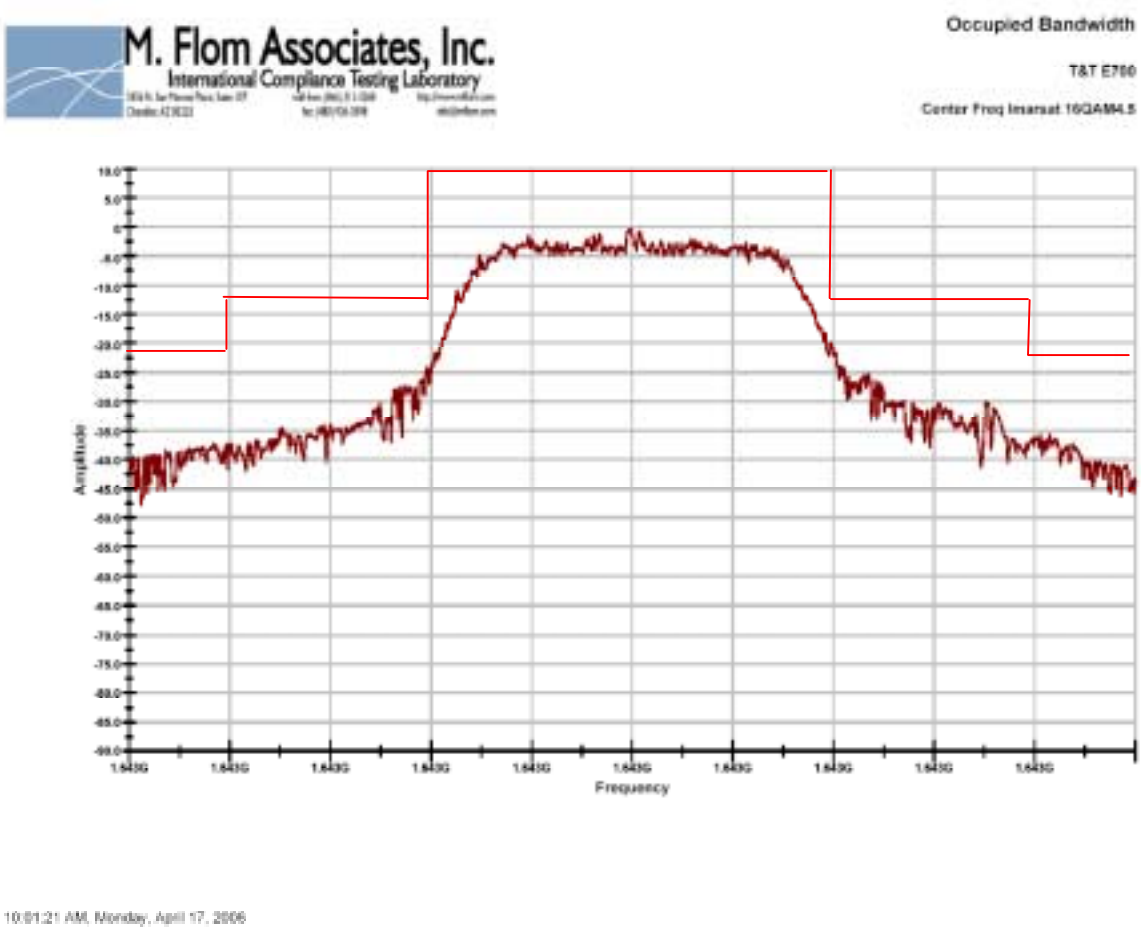
Power: HIGH
Modulation: Data Rate 67.2k
84K0G1D

Performed by: David E. Lee, FCC/IC Compliance Manager

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

**Measurement Results**

State: 2:High Power Ambient Temperature: 23°C ± 3°C




RBW=VBW=100kHz

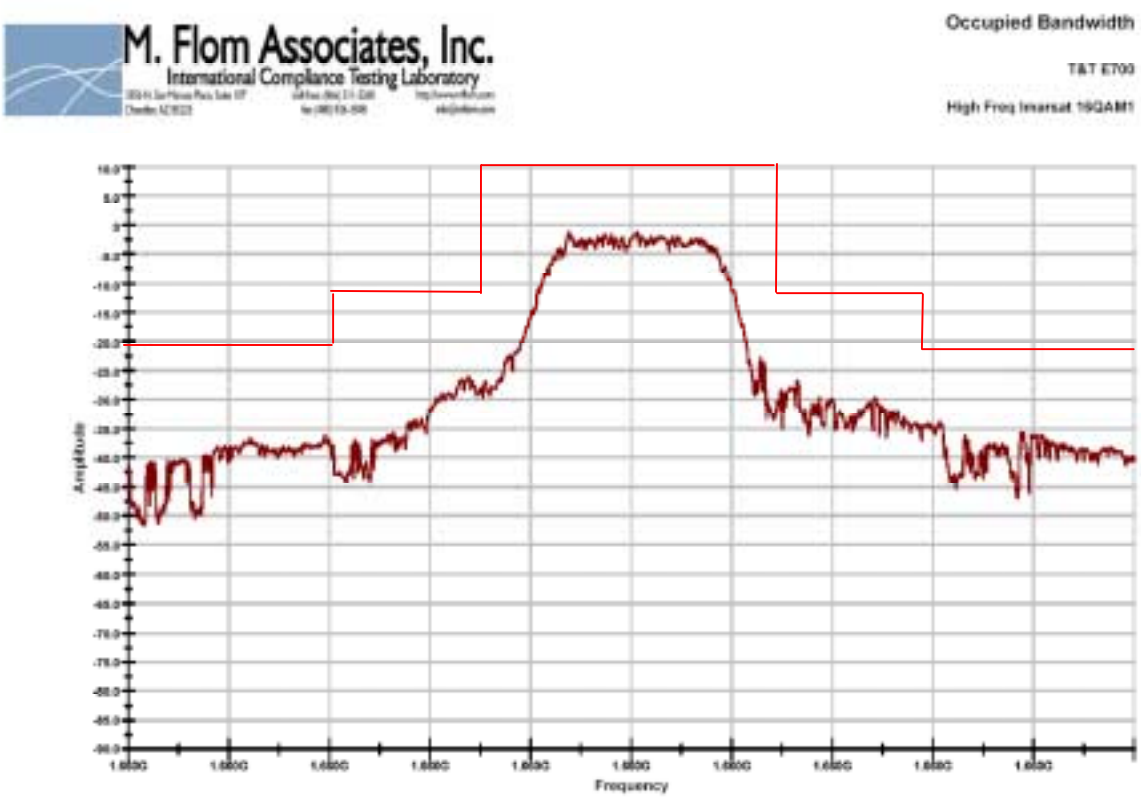
Power: HIGH
Modulation: Data Rate 151.2k
200KG1D

Performed by: David E. Lee, FCC/IC Compliance Manager

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

**Measurement Results**

State: 2:High Power Ambient Temperature: 23°C ± 3°C




RBW=VBW=100kHz

Power: HIGH

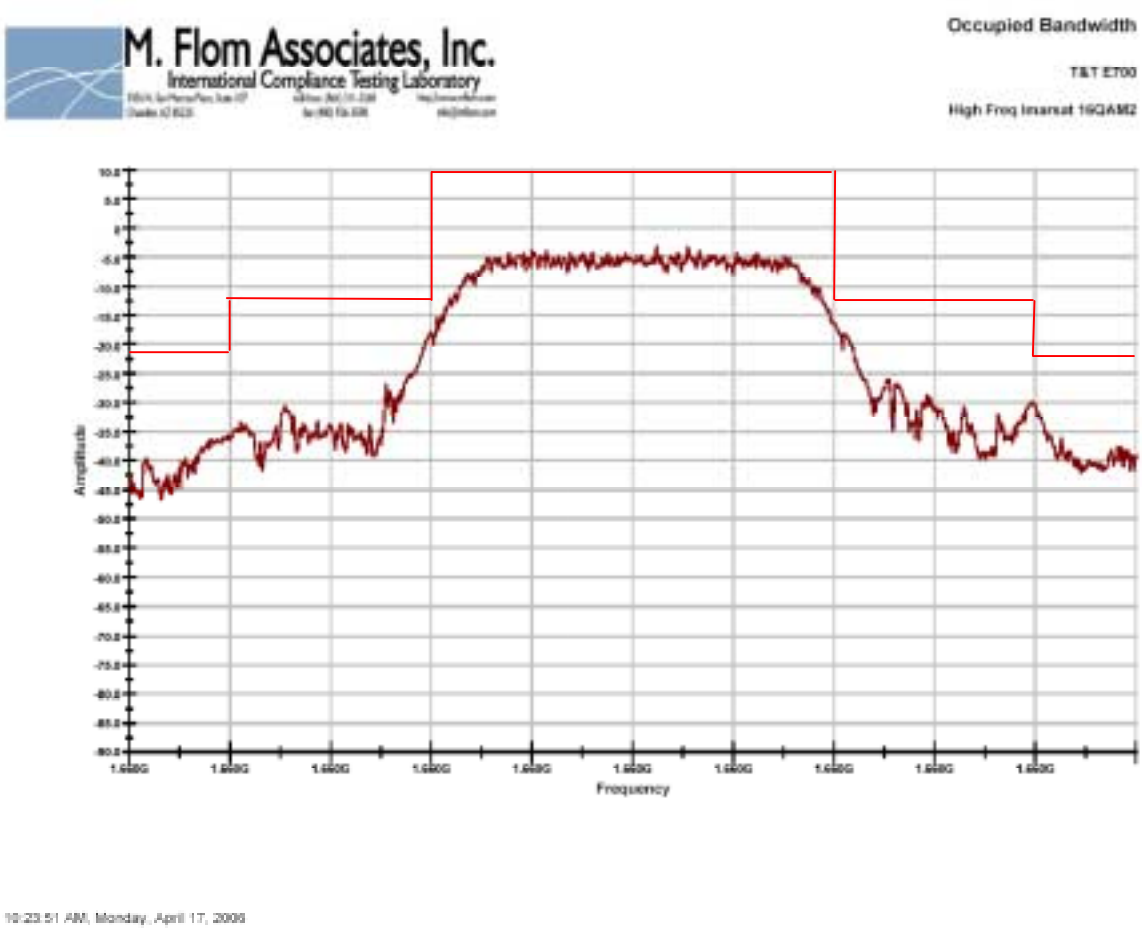
Modulation: Data Rate 33.6k
42K0G1D

Performed by: David E. Lee, FCC/IC Compliance Manager

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

**Measurement Results**

State: 2:High Power Ambient Temperature: 23°C ± 3°C




RBW=VBW=100kHz

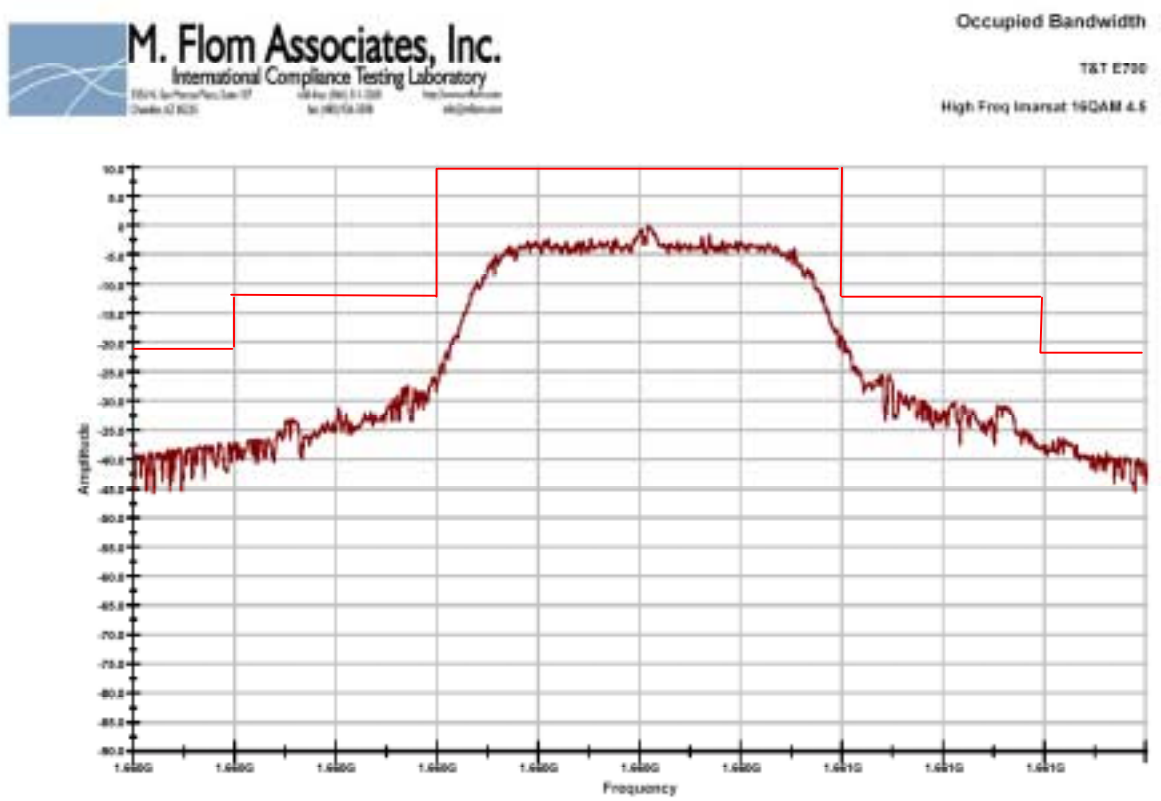
Power: HIGH
Modulation: Data Rate 67.2k
84K0G1D

Performed by: David E. Lee, FCC/IC Compliance Manager

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

**Measurement Results**

State: 2:High Power Ambient Temperature: 23°C ± 3°C




RBW=VBW=100kHz

Power: HIGH

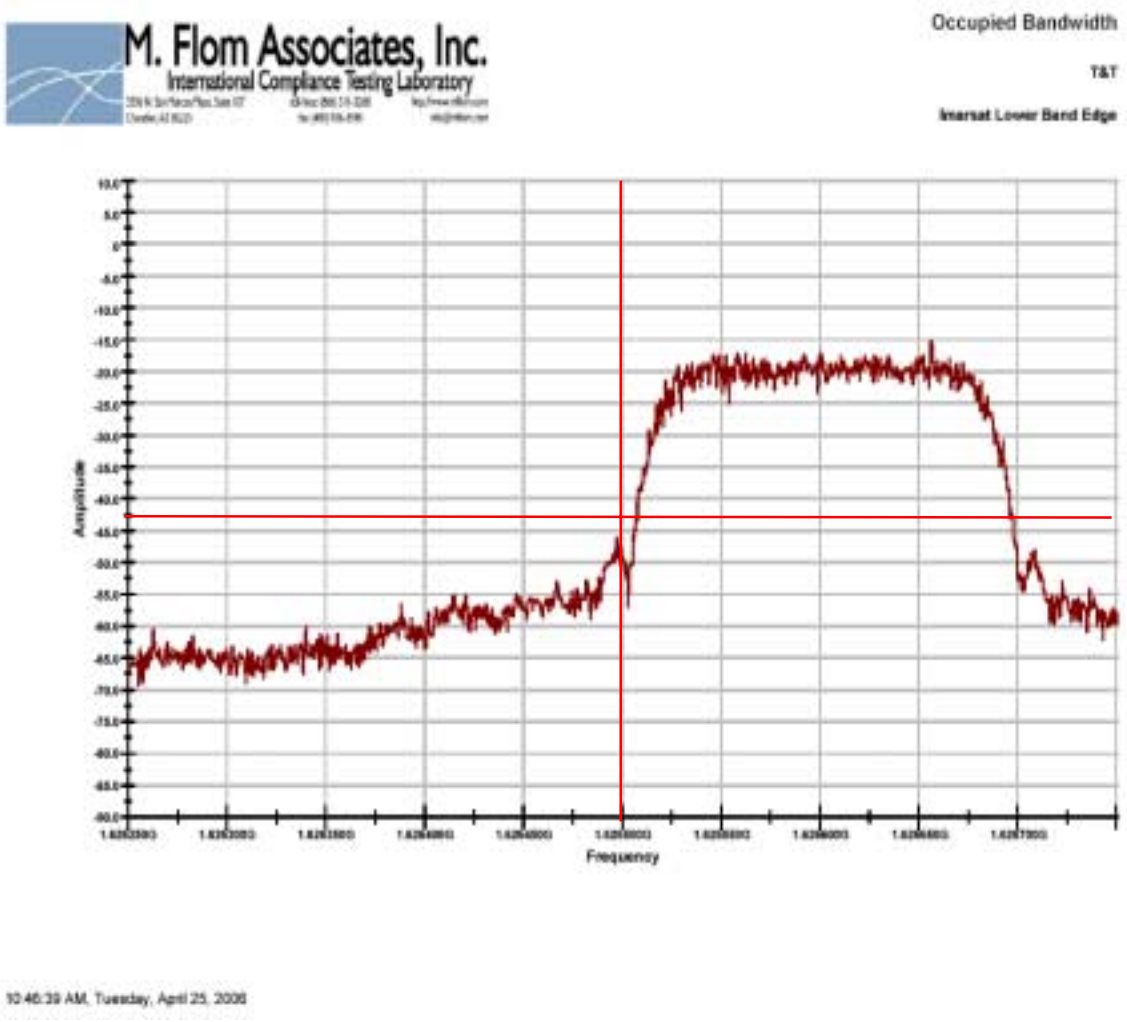
Modulation: Data Rate 151.2k
200KG1D

Performed by: David E. Lee, FCC/IC Compliance Manager

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

**Measurement Results**

State: 2:High Power Ambient Temperature: 23°C ± 3°C




RBW=VBW=100kHz

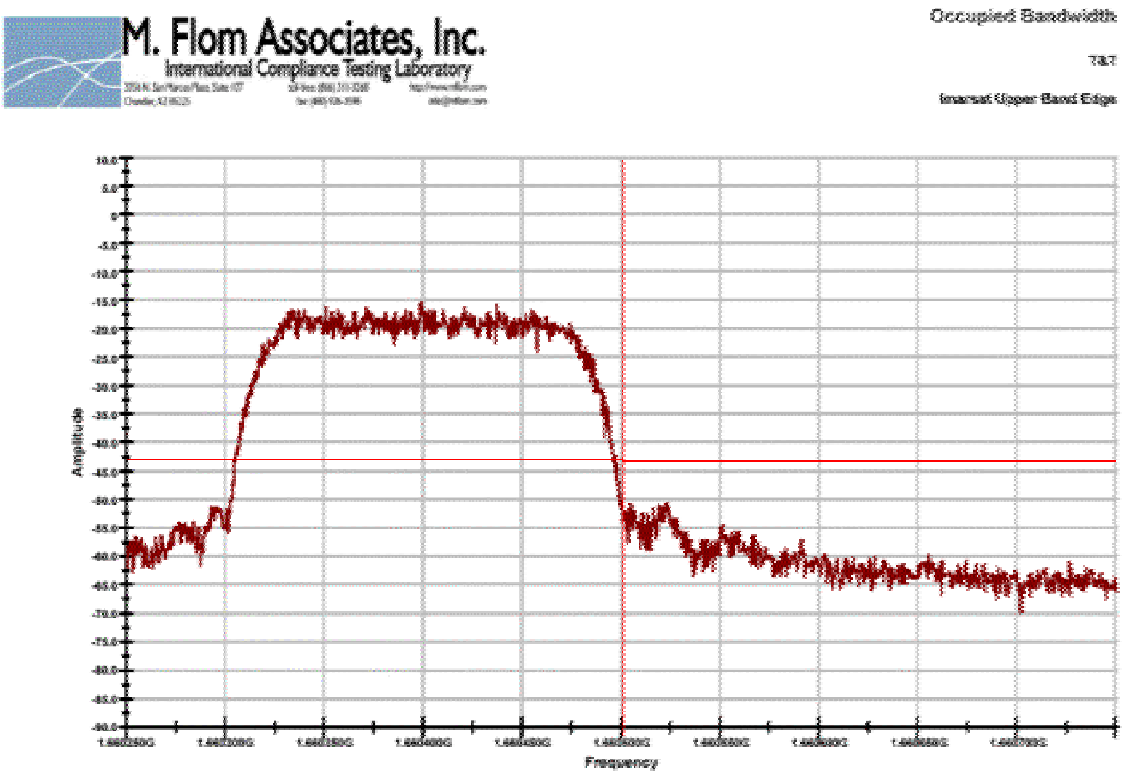
Power: HIGH
Modulation: Lower Band Edge
D1W

Performed by: David E. Lee, FCC/IC Compliance Manager

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

**Measurement Results**

State: 2:High Power Ambient Temperature: 23°C ± 3°C




RBW=VBW=100kHz

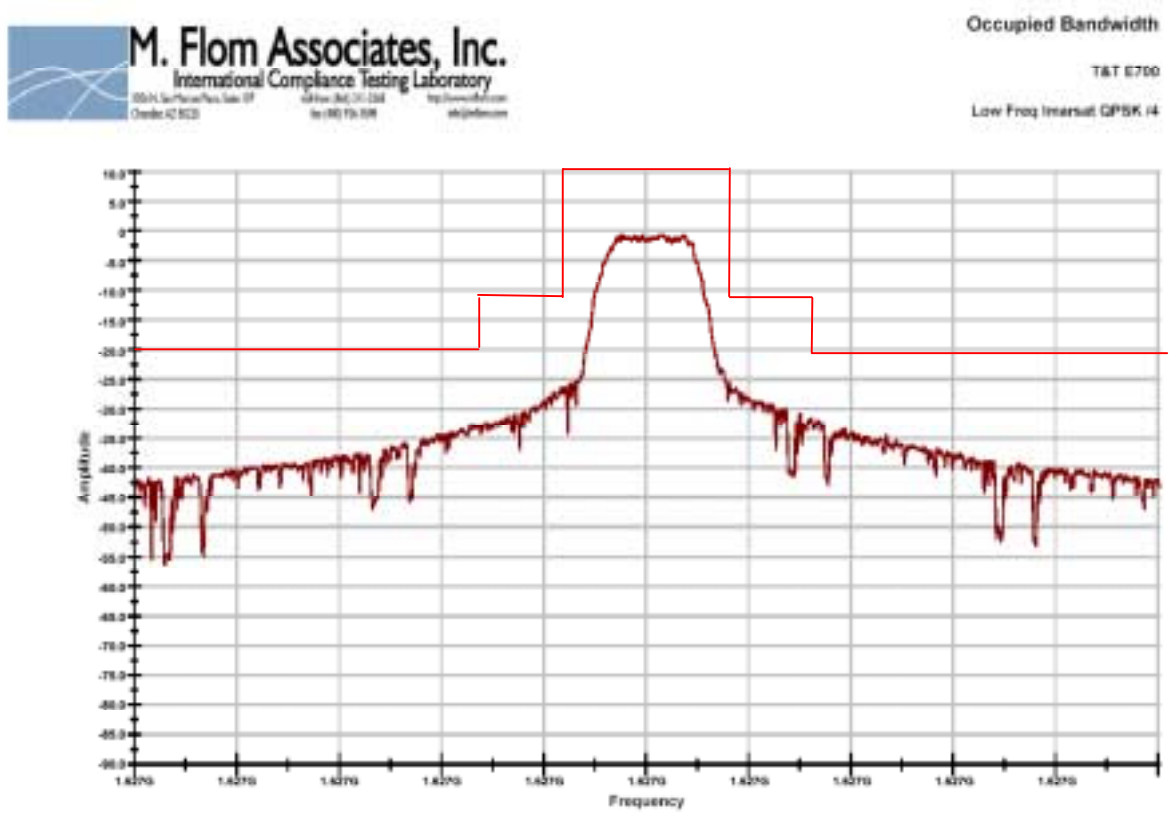
Power: HIGH
Modulation: Upper Band Edge
D1W

Performed by: David E. Lee, FCC/IC Compliance Manager

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

**Measurement Results**

State: 2:High Power Ambient Temperature: 23°C ± 3°C




RBW=VBW=100kHz

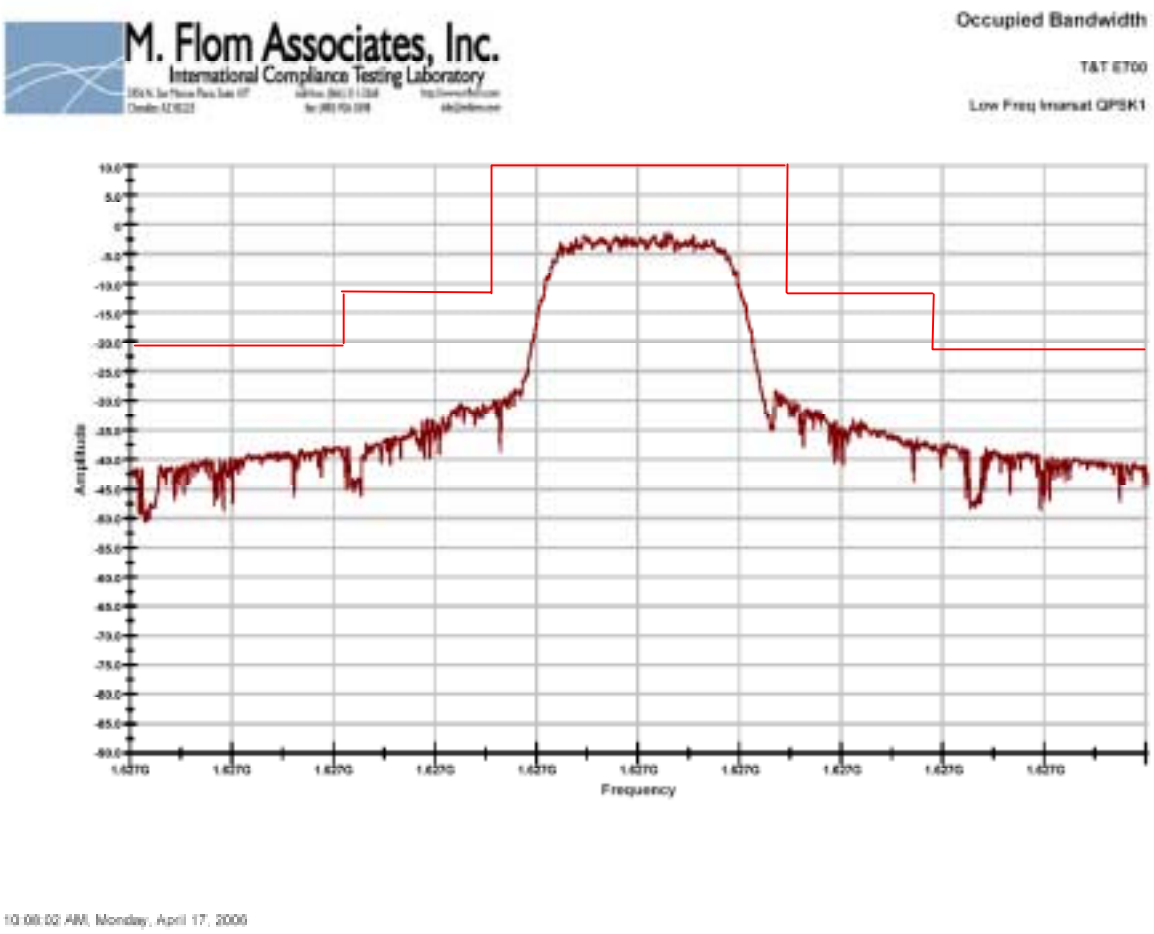
Power: HIGH
Modulation: Data Rate 16.0k
21K0D1W

Performed by: David E. Lee, FCC/IC Compliance Manager

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

**Measurement Results**

State: 2:High Power Ambient Temperature: 23°C ± 3°C




RBW=VBW=100kHz

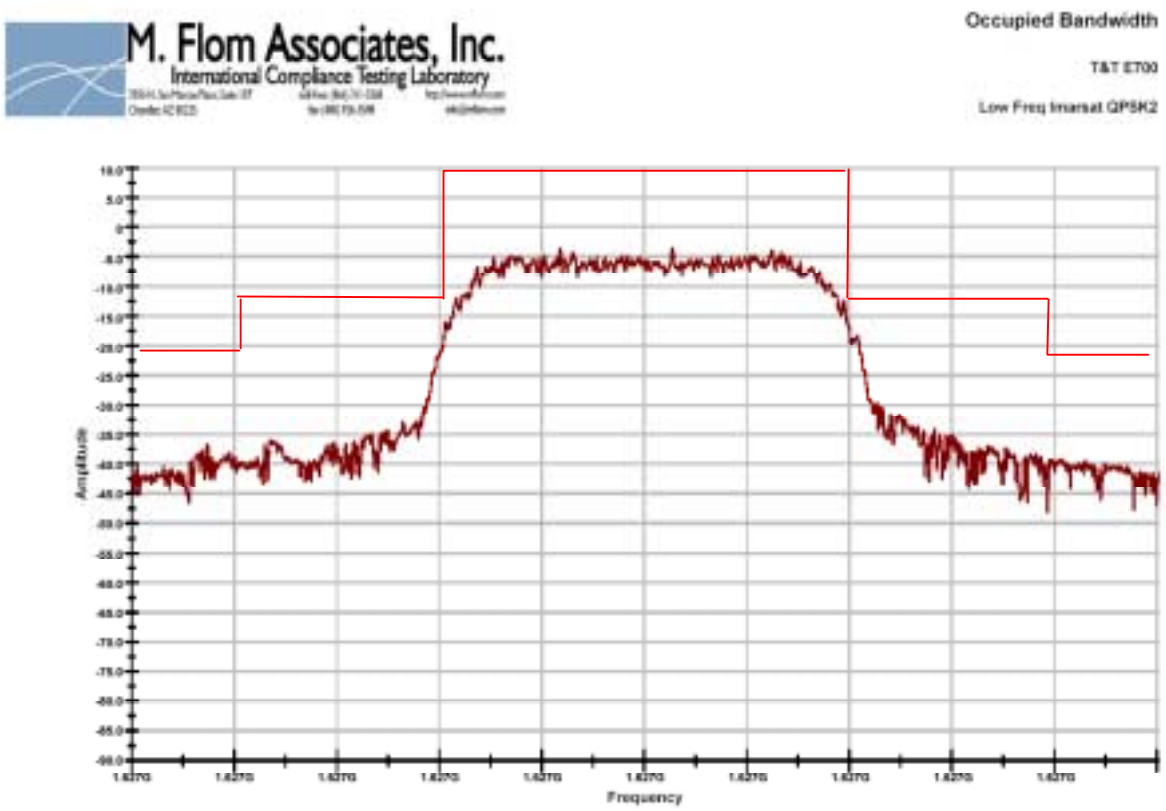
Power: HIGH
Modulation: Data Rate 33.6k
42K0D1W

Performed by: David E. Lee, FCC/IC Compliance Manager

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

**Measurement Results**

State: 2:High Power Ambient Temperature: 23°C ± 3°C




RBW=VBW=100kHz

Power: HIGH

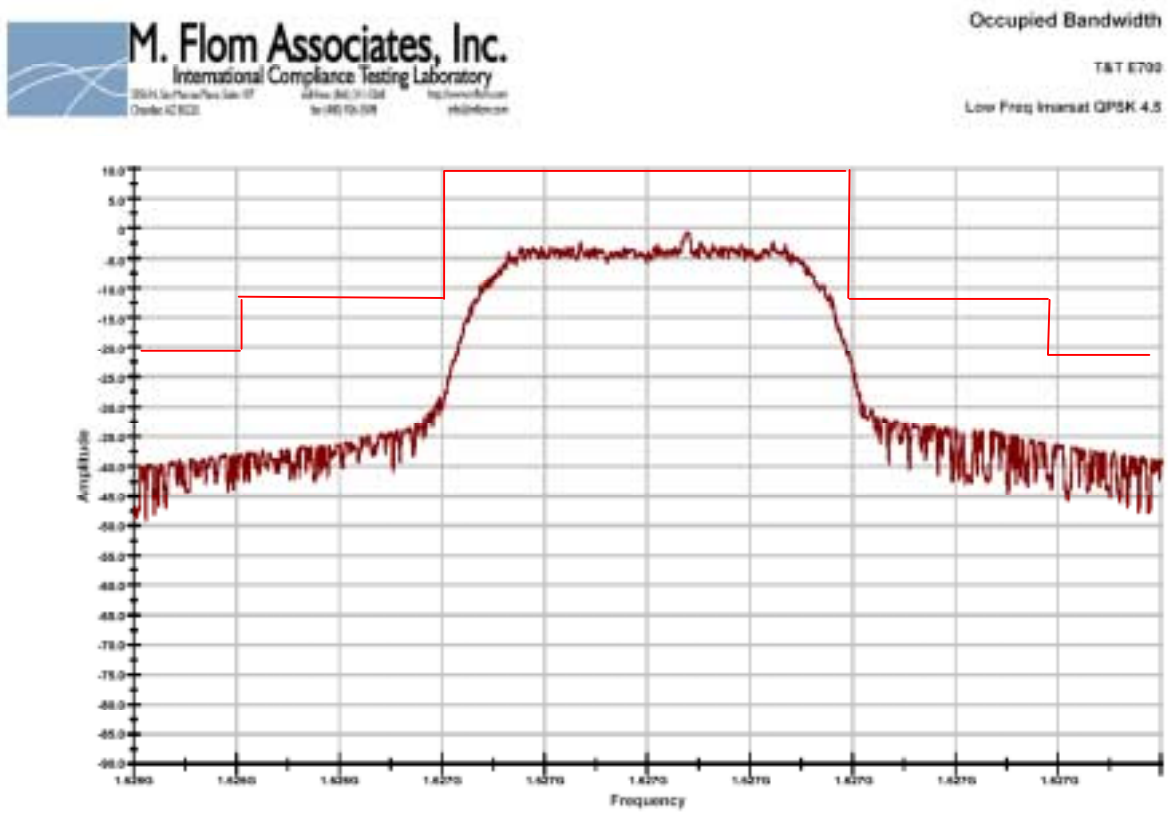
Modulation: Data Rate 67.2k
84K0D1W

Performed by: David E. Lee, FCC/IC Compliance Manager

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

**Measurement Results**

State: 2:High Power Ambient Temperature: 23°C ± 3°C




RBW=VBW=100kHz

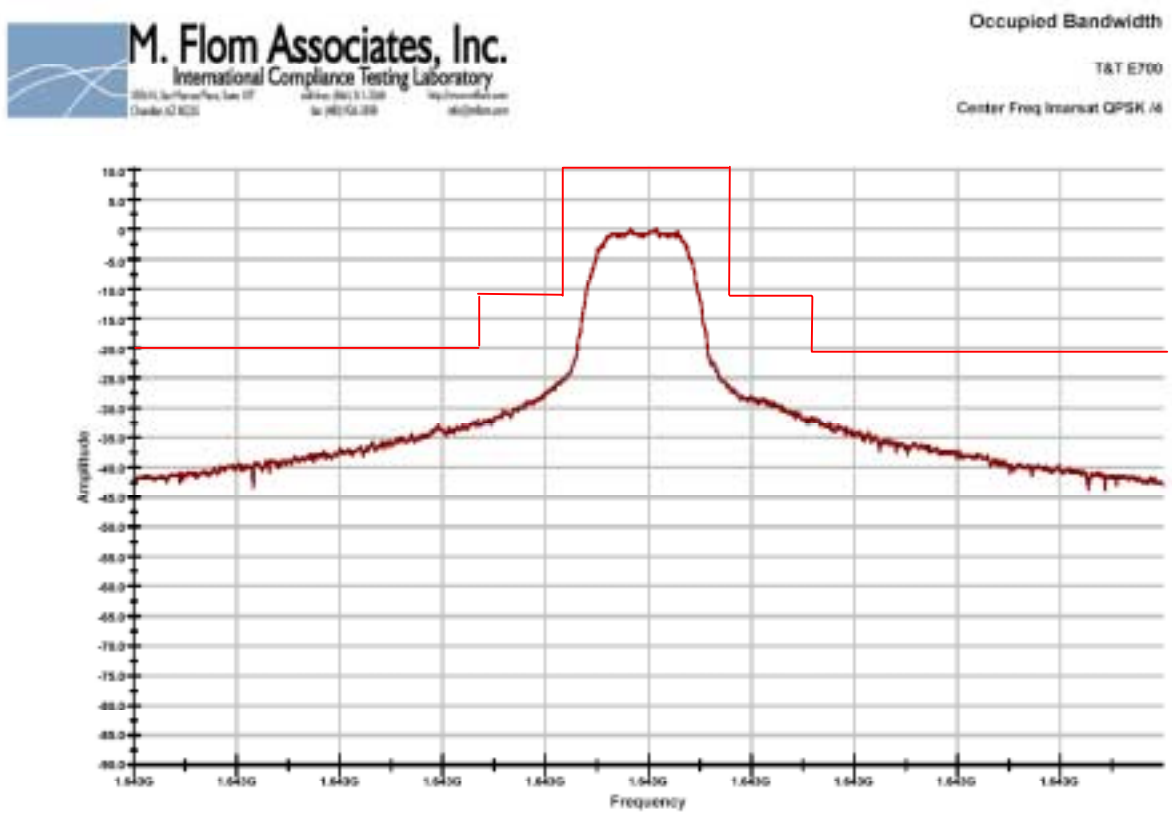
Power: HIGH
Modulation: Data Rate 151.2k
200KD1W

Performed by: David E. Lee, FCC/IC Compliance Manager

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

**Measurement Results**

State: 2:High Power Ambient Temperature: 23°C ± 3°C




RBW=VBW=100kHz

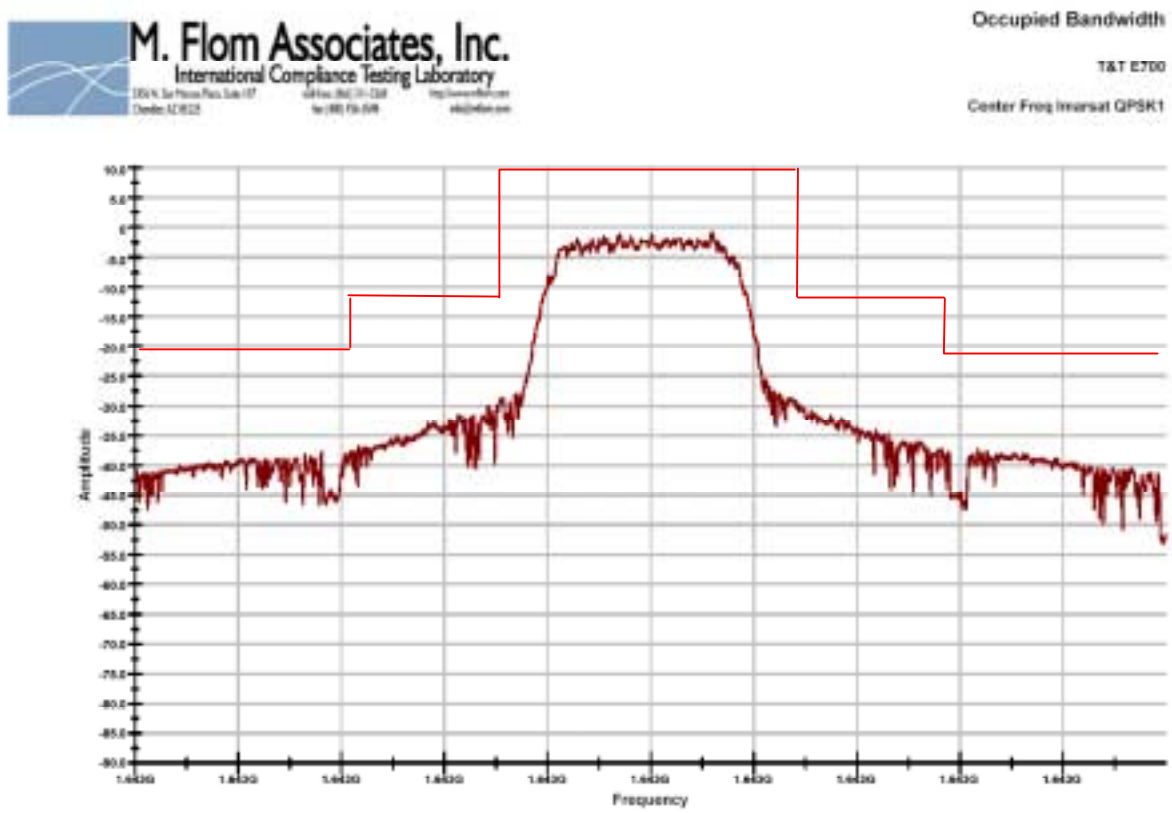
| | |
|---|---|
| Power: | HIGH |
| Modulation: | Data Rate 16.0k<br>21K0D1W |

Performed by: David E. Lee, FCC/IC Compliance Manager

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

**Measurement Results**

State: 2:High Power Ambient Temperature: 23°C ± 3°C




RBW=VBW=100kHz

Power: HIGH

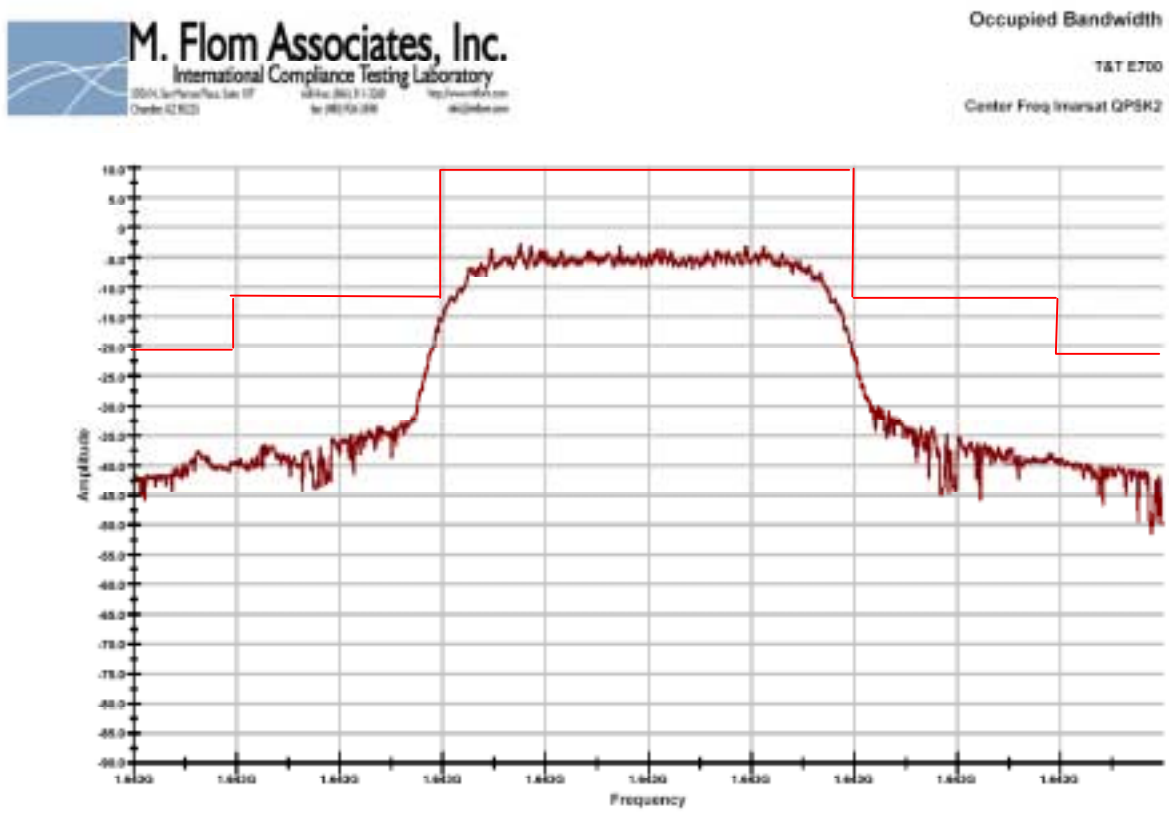
Modulation: Data Rate 33.6k
42K0D1W

Performed by: David E. Lee, FCC/IC Compliance Manager

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

**Measurement Results**

State: 2:High Power Ambient Temperature: 23°C ± 3°C




RBW=VBW=100kHz

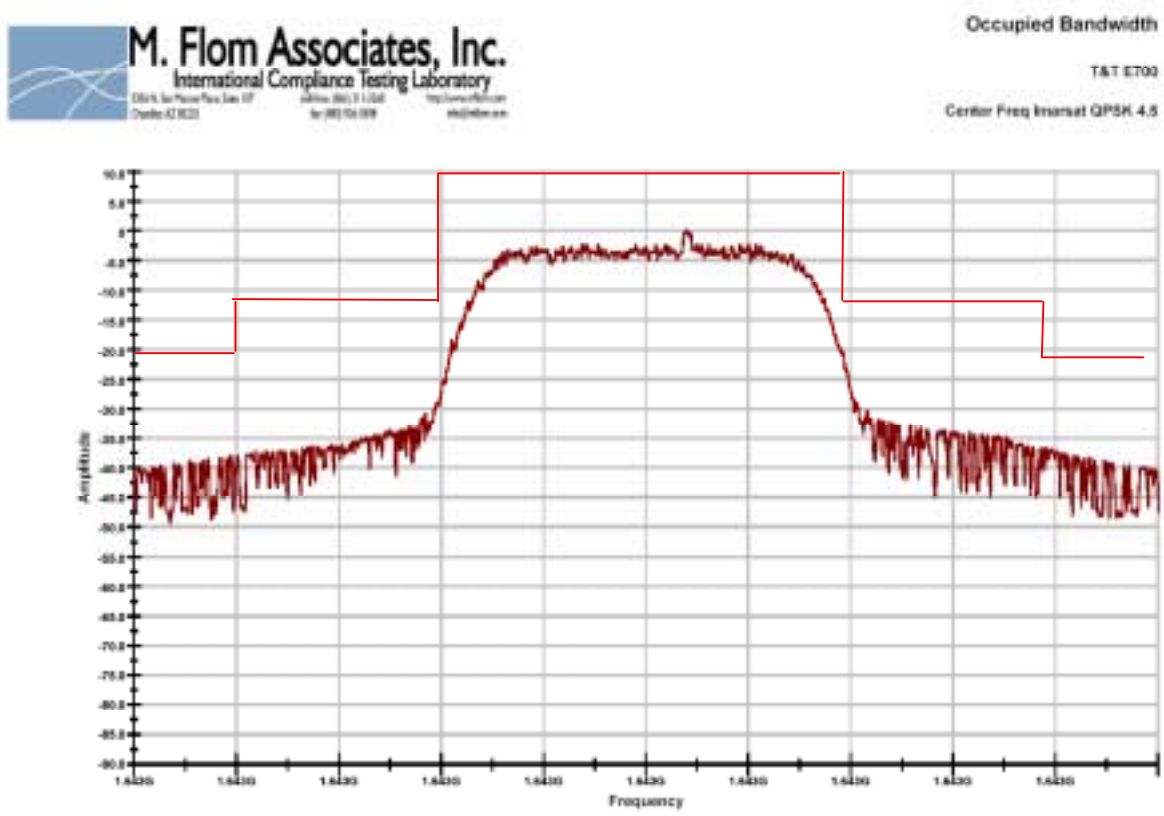
| | |
|---|---|
| Power: | HIGH |
| Modulation: | Data Rate 67.2k<br>84K0D1W |

Performed by: David E. Lee, FCC/IC Compliance Manager

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

**Measurement Results**

State: 2:High Power Ambient Temperature: 23°C ± 3°C




RBW=VBW=100kHz

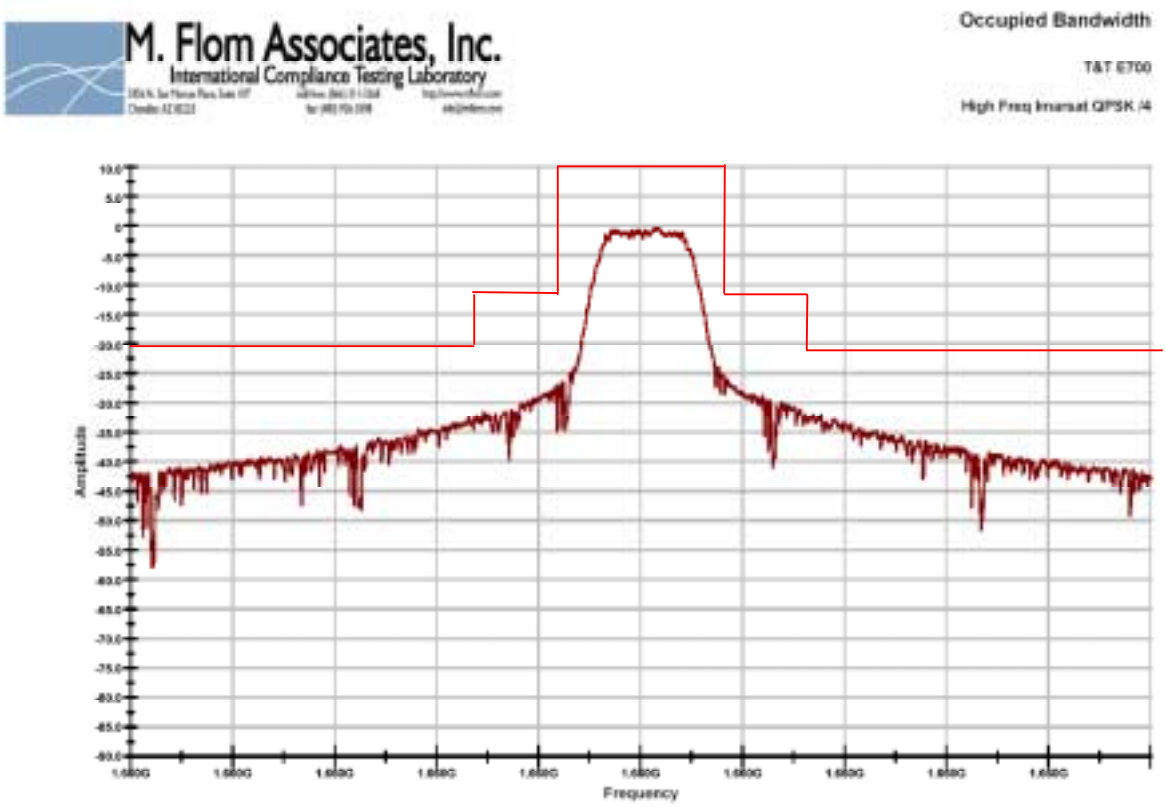
Power: HIGH
Modulation: Data Rate 151.2k
200KD1W

Performed by: David E. Lee, FCC/IC Compliance Manager

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

**Measurement Results**

State: 2:High Power Ambient Temperature: 23°C ± 3°C




RBW=VBW=100kHz

Power: HIGH

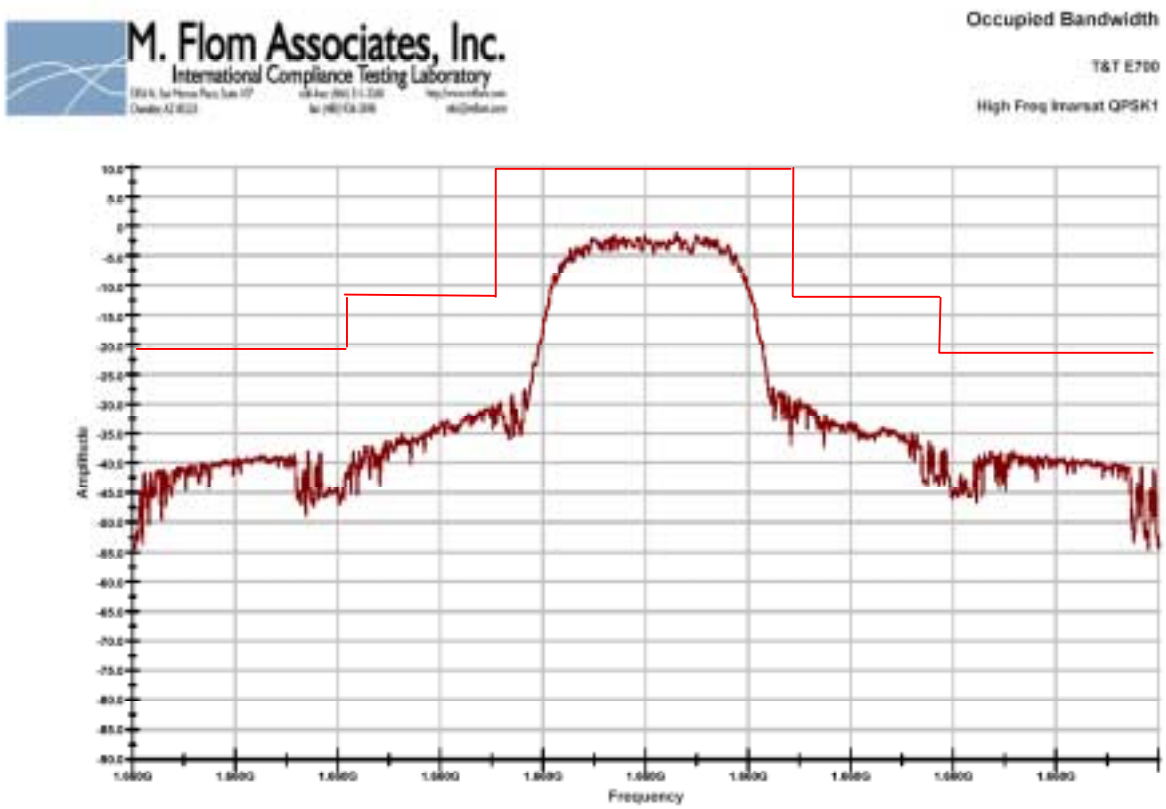
Modulation: Data Rate 16.0k
21K0D1W

Performed by: David E. Lee, FCC/IC Compliance Manager

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

**Measurement Results**

State: 2:High Power Ambient Temperature: 23°C ± 3°C




RBW=VBW=100kHz

Power: HIGH

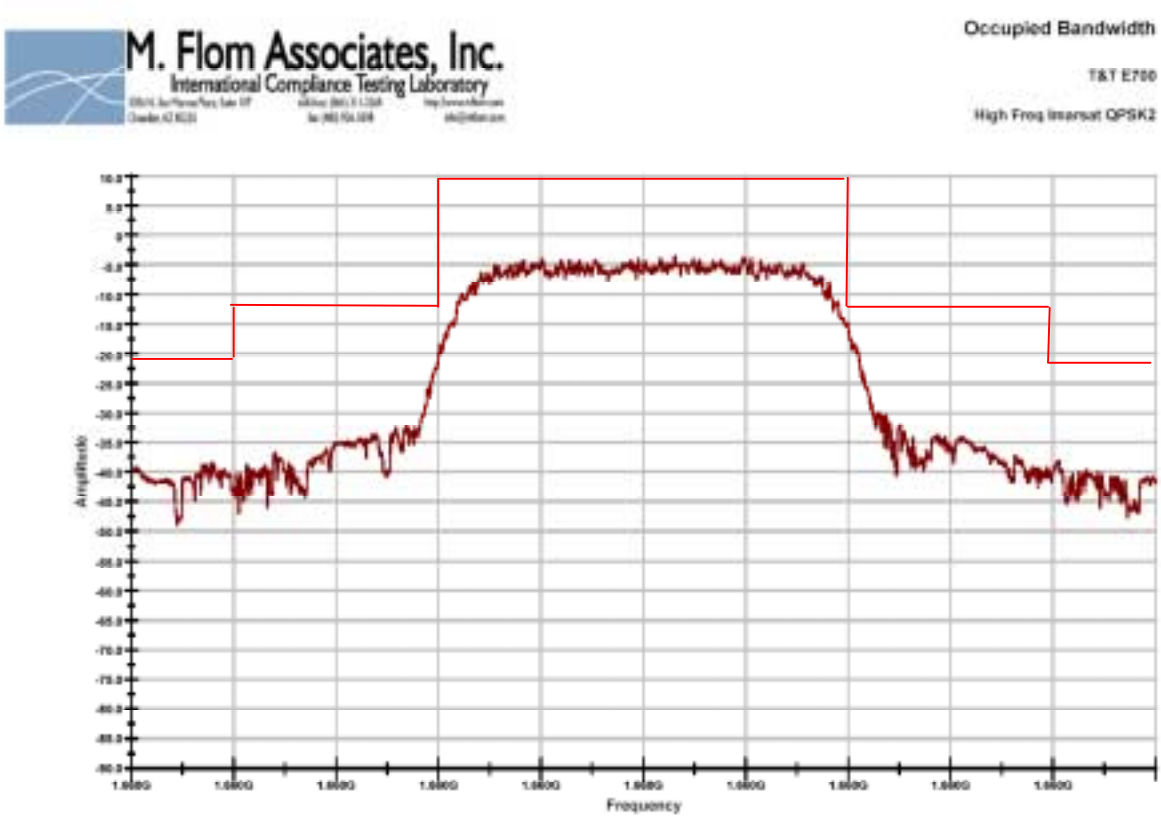
Modulation: Data Rate 33.6k
42K0D1W

Performed by: David E. Lee, FCC/IC Compliance Manager

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

**Measurement Results**

State: 2:High Power Ambient Temperature: 23°C ± 3°C




RBW=VBW=100kHz

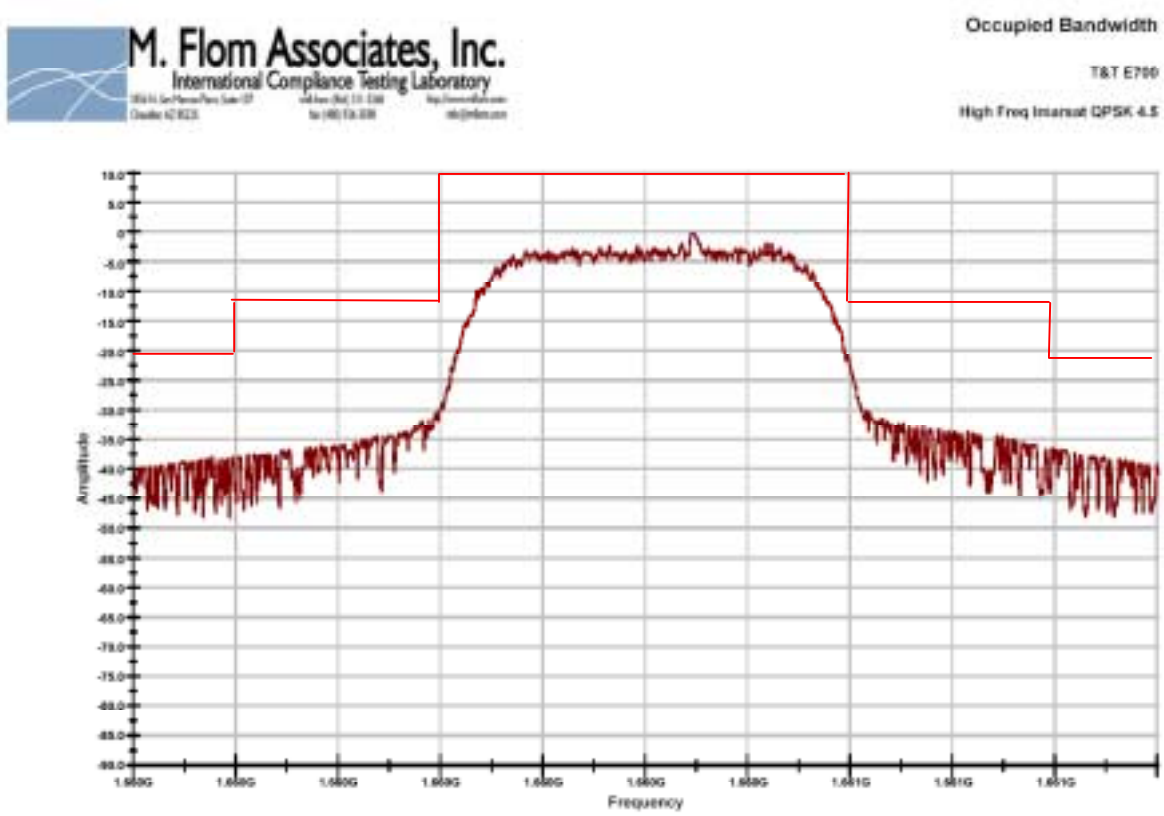
Power: HIGH
Modulation: Data Rate 67.2k
84K0D1W

Performed by: David E. Lee, FCC/IC Compliance Manager

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

**Measurement Results**

State: 2:High Power Ambient Temperature: 23°C ± 3°C




RBW=VBW=100kHz

Power: HIGH

Modulation: Data Rate 151.2k
200K0D1W

Performed by: David E. Lee, FCC/IC Compliance Manager

**Name of Test**: Frequency Stability (Temperature Variation)
**Specification**: 47 CFR 2.1055(a)(1)
**Guide**: ANSI/TIA/EIA-603-1992, Paragraph 2.2.2

**Measurement Procedure**

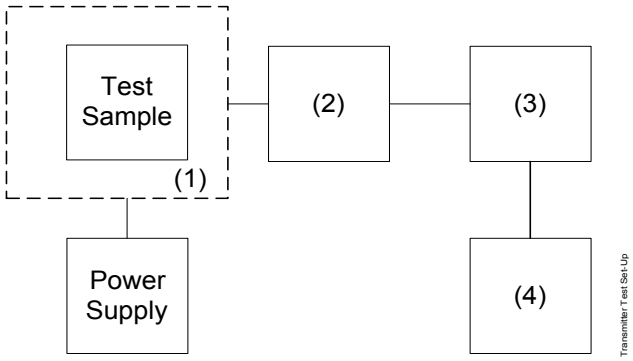
A) The EUT and test equipment were set up as shown on the following page.

B) 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.

C) 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.

D) The temperature tests were performed for the worst case.

**Transmitter Test Set-Up: Temperature Variation**

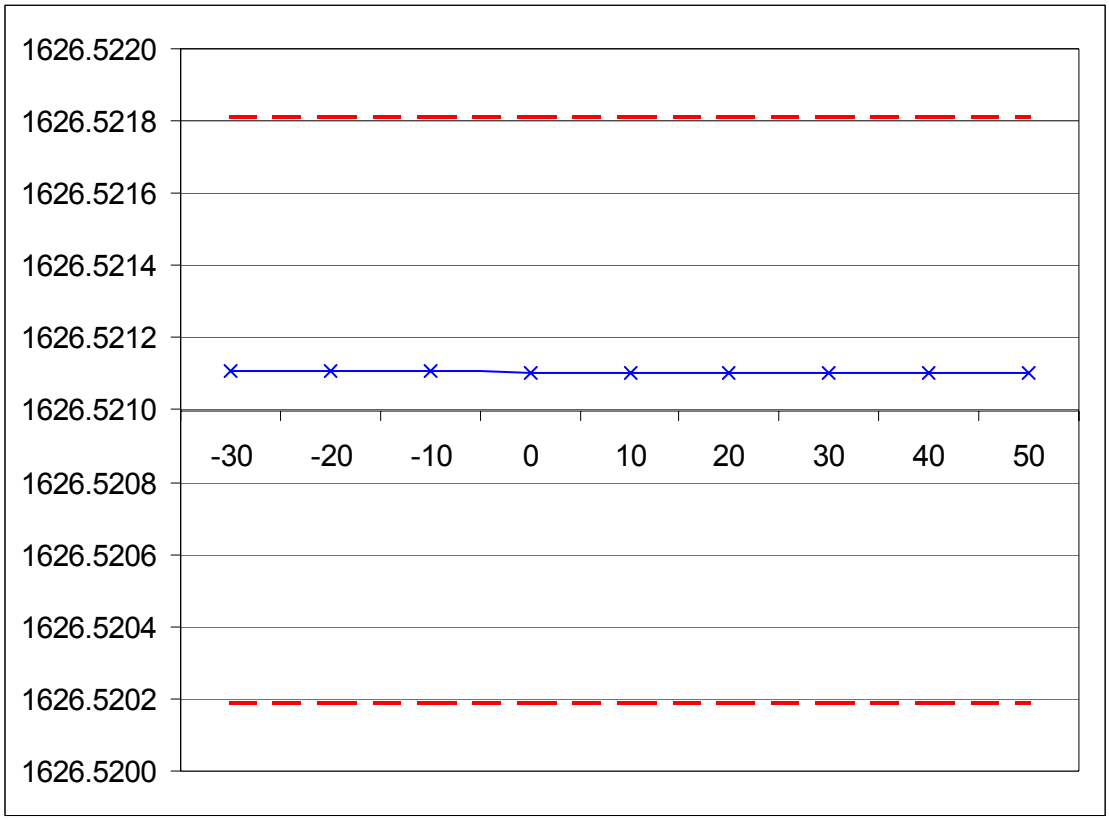



| | Asset | Description | s/n | Cycle | Last Cal |
|---|---|---|---|---|---|
| (1) **Temperature, Humidity, Vibration** | | | | | |
| X | i00027 | Tenney Temp. Chamber | 9083-765-234 | NCR | |
| (2) **Coaxial Attenuator** | | | | | |
| X | i00231/2 | PASTERNACK PE7021-30 (30 dB) | 231 or 232 | NCR | |
| | i00122/3 | NARDA 766 (10 dB) | 7802 or 7802A | NCR | |
| (3) **RF Power** | | | | | |
| X | i00067 | HP 8920A Communications TS | 3345U01242 | 12 mo. | Jun-05 |
| (4) **Frequency Counter** | | | | | |
| X | i00067 | HP 8920A Communications TS | 3345U01242 | 12 mo. | Jun-05 |

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

**Measurement Results**

State: Ambient Temperature: 23°C ± 3°C




Plot based on data obtained during Imarsat Compliance Testing with device locked to Satellite.

Limits shown are 0.5ppm

Performed by: David E. Lee, FCC/IC Compliance Manager

**Name of Test**: Frequency Stability (Voltage Variation)
**Specification**: 47 CFR 2.1055(d)(1)
**Guide**: ANSI/TIA/EIA-603-1992, Paragraph 2.2.2

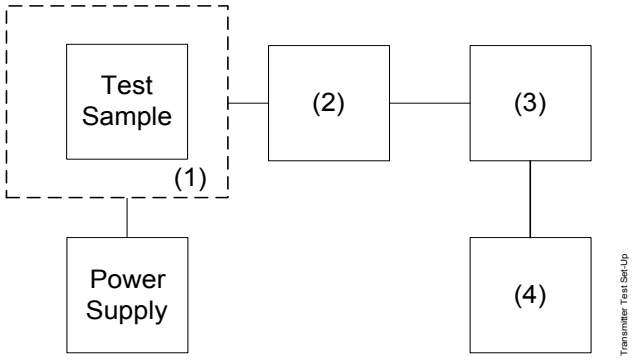
**Measurement Procedure**

A) The EUT was placed in a temperature chamber (if required) at 25±5°C and connected as shown below.

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

C) The variation in frequency was measured for the worst case.

**Transmitter Test Set-Up: Voltage Variation**



Transmitter Test Set-Up

| | Asset | Description | s/n | Cycle | Last Cal |
|---|---|---|---|---|---|
| (1) **Temperature, Humidity, Vibration** | | | | | |
| | i00027 | Tenney Temp. Chamber | 9083-765-234 | NCR | |
| (2) **Coaxial Attenuator** | | | | | |
| X | i00231/2 | PASTERNACK PE7021-30 (30 dB) | 231 or 232 | NCR | |
| | i00122/3 | NARDA 766 (10 dB) | 7802 or 7802A | NCR | |
| (3) **RF Power** | | | | | |
| X | i00020 | HP 8901A Power Mode | 2105A01087 | 12 mo. | Apr-05 |
| (4) **Frequency Counter** | | | | | |
| X | i00020 | HP 8901A Frequency Mode | 2105A01087 | 12 mo. | Apr-05 |

**Results**: Frequency Stability (Voltage Variation)

State: Ambient Temperature: 23°C ± 3°C

| | |
|---|---|
| Limit, ppm | = ± 0.5 |
| Limit, Hz | = ± 814 |
| Battery End Point (Voltage) | = 9.44 |

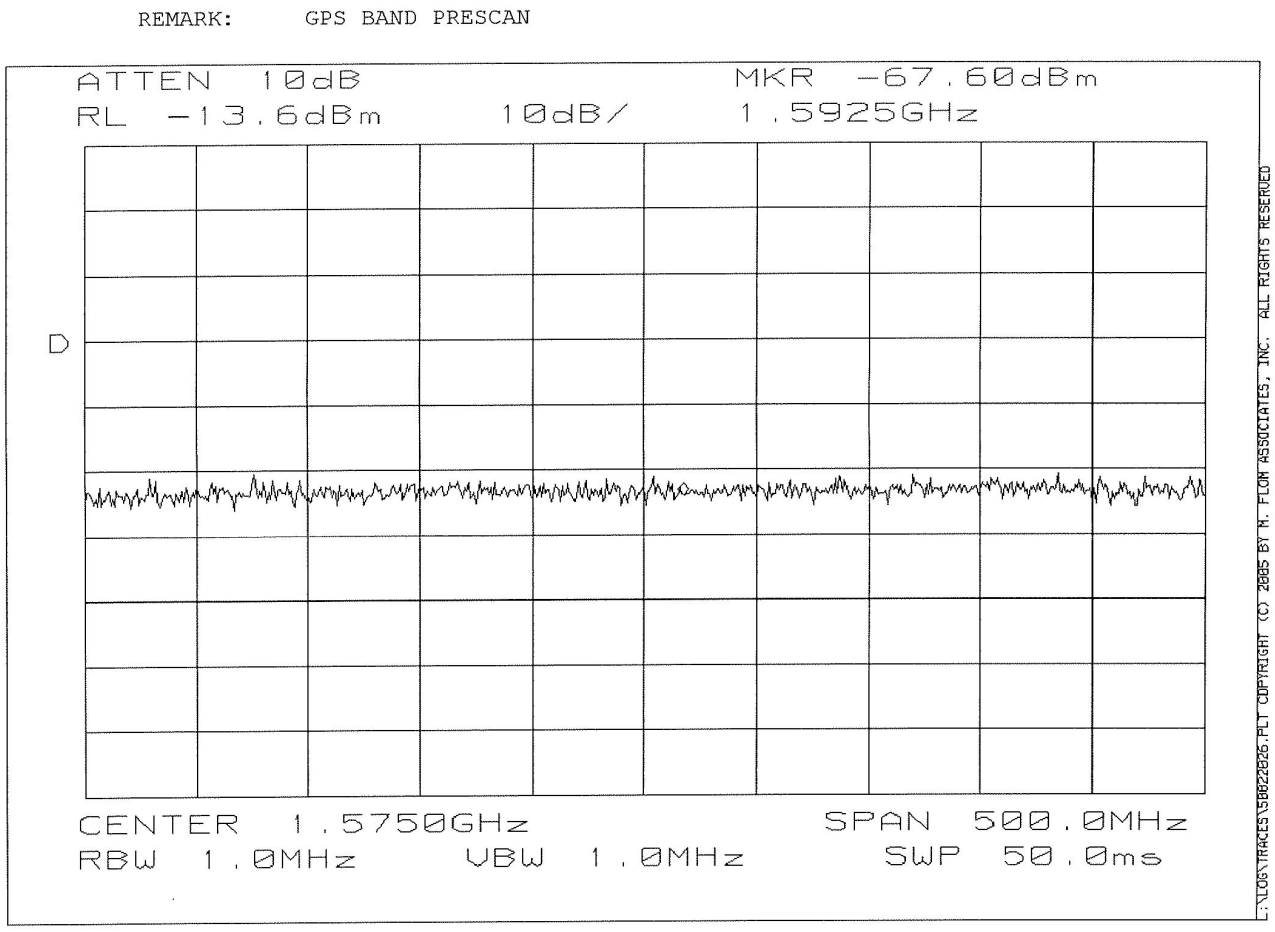
| % of STV | Voltage | Frequency, MHz | Change, Hz | Change, ppm |
|---|---|---|---|---|
| 115 | 12.77 | 1643.607640 | +40 | |
| 100 | 11.10 | 1643.607640 | +40 | >0.05 |
| 85 | 9.44 | 1643.607635 | +35 | |
| BEP | 9.44 | 1643.607635 | +35 | |

For this test the oscillator was not locked to the Satellite.

Performed by: David E. Lee, FCC/IC Compliance Manager

**Name of Test**: Limits on emissions from mobile earth stations for protection of aeronautical radio navigation satellite service

**Specification**: 47 CFR 25.216




No measurable emissions were present in the band of interest.

Performed by: David E. Lee, FCC/IC Compliance Manager

**Name of Test**: Special requirements for ancillary terrestrial components operating in the 1626.5-1660.5 MHz / 1525-1559 MHz bands

**Specification**: 47 CFR 25.253(d)(6), (d)(7), (g)(3)

**Measurement Procedure**

*(d)(6) Exceed a peak antenna gain of 16 dBi;*

The EUT has a peak antenna gain of 14.9dBi

*(d)(7) Exceed an EIRP in the 1559-1605 MHz band of -70 dBW/MHz for wideband emissions and -80 dBW for narrowband emissions (discrete emissions of less than 700 Hz bandwidth). The ATC station shall not exceed an EIRP in the 1605-1610 MHz frequency range that is determined by the linear interpolation from -70 dBW/MHz at 1605 MHz to -10 dBW/MHz at 1610 MHz for wideband emissions. The wideband EIRP level is to be measured using a root mean square (RMS) detector function with a resolution bandwidth of 1 MHz or equivalent and the video bandwidth is not less than the resolution bandwidth. The narrowband EIRP level is to be measured using an RMS detector function with a resolution bandwidth of 1 kHz or equivalent. The measurements are to be made over a 20 millisecond averaging period when the base station is transmitting.*

*And*

*(g)(3) . . . exceed an EIRP in the 1559-1605 MHz band of -70 dBW/MHz for wideband emissions and -80 dBW for narrowband emissions (discrete emissions of less than 700 Hz bandwidth). The ATC station shall not exceed an EIRP in the 1605-1610 MHz frequency range that is determined by the linear interpolation from -70 dBW/MHz at 1605 MHz to -10 dBW/MHz at 1610 MHz for wideband emissions. The wideband EIRP level is to be measured using a root mean square (RMS) detector function with a resolution bandwidth of 1 MHz or equivalent and the video bandwidth is not less than the resolution bandwidth. The narrowband EIRP level is to be measured using an RMS detector function with a resolution bandwidth of 1 kHz or equivalent. The measurements are to be made over a 20 millisecond averaging period when the mobile terminal is transmitting.*

The plots contained in **Annex A: E700 Glonass 25** are extracted from the Imarsat compliance data filed by the applicant, which show compliance with the corresponding paragraphs of 47CFR25.253

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

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

Modulation = 21K0D1W

**Necessary Bandwidth Calculation:**

| | | |
|---|---|---|
| Maximum Modulation (M), kHz | | 3.1 |
| Maximum Deviation (D), kHz | = | 7.4 |
| Constant Factor (K) | = | 1 |
| Necessary Bandwidth ($B_N$), kHz | = | (2xM)+(2xDxK) |
| | | (2x3.1)+(2x7.4x1) |
| | | 6.2+14.8 |
| | = | 21.0 |

Modulation = 42K0G1D / D1W

**Necessary Bandwidth Calculation**:

| | | |
|---|---|---|
| Maximum Modulation (M), kHz | | 14.1 |
| Maximum Deviation (D), kHz | = | 7.4 |
| Constant Factor (K) | = | 1 |
| Necessary Bandwidth ($B_N$), kHz | = | (2xM)+(2xDxK) |
| | | (2x13.1)+(2x7.4x1) |
| | | 28.2+14.8 |
| | = | 42.0 |

Modulation = 84K0G1D / D1W

**Necessary Bandwidth Calculation**:

| | | |
|---|---|---|
| Maximum Modulation (M), kHz | | 29.6 |
| Maximum Deviation (D), kHz | = | 7.4 |
| Constant Factor (K) | = | 1 |
| Necessary Bandwidth ($B_N$), kHz | = | (2xM)+(2xDxK) |
| | | (2x13.1)+(2x7.4x1) |
| | | 59.2+14.8 |
| | = | 84.0 |

Modulation = 200KG1D / D1W

**Necessary Bandwidth Calculation**:

| | | |
|---|---|---|
| Maximum Modulation (M), kHz | | 92.6 |
| Maximum Deviation (D), kHz | = | 7.4 |
| Constant Factor (K) | = | 1 |
| Necessary Bandwidth ($B_N$), kHz | = | (2xM)+(2xDxK) |
| | | (2x13.1)+(2x7.4x1) |
| | | 185.2+14.8 |
| | = | 200.0 |

Calculated by: David E. Lee, FCC/IC Compliance Manager

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: David E. Lee, FCC/IC Compliance Manager