



Flom Test Labs  
EMI, EMC, RF Testing Experts Since 1963

toll-free: (866) 311-3268  
fax: (480) 926-3598  
<http://www.flomlabs.com>  
[info@flomlabs.com](mailto:info@flomlabs.com)

Date: March 28, 2007

Federal Communications Commission  
Via: Electronic Filing

Attention: Authorization & Evaluation Division

Applicant: Gigawave USA LLC  
Equipment: Video Booster Amplifier  
FCC ID: TO4-RFXPHT2027  
FCC Rules: Part 74 (F)

Gentlemen:

On behalf of the Applicant, enclosed please find Application Form 731, Engineering Test Report and all pertinent documentation, the whole for approval of the referenced equipment as shown.

We trust the same is in order. Should you need any further information, kindly contact the writer who is authorized to act as agent.

Sincerely yours,

Hoosamuddin S. Bandukwala, Lab Director

enclosure(s)  
cc: Applicant  
HSB/mdw

Flom Test Labs  
3356 North San Marcos Place, Suite 107  
Chandler, Arizona 85225-7176  
(866) 311-3268 phone, (480) 926-3598 fax

MFA p0730016, d0730068



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## **Transmitter Certification**

of

Model: RFX-PHT

to

### **Federal Communications Commission**

Rule Part(s)  
74(F)

Date of report: March 28, 2007

#### **On the Behalf of the Applicant:**

Gigawave USA LLC

#### **At the Request of:**

Gigawave USA LLC  
777 American Drive  
Bensalem, PA 19020

#### **Attention of:**

Tom Sharkoski  
215-633-1000; fax: 215-633-1085  
Email: [tsharkoski@totalrf.com](mailto:tsharkoski@totalrf.com)

#### **Supervised by:**

Hoosamuddin S. Bandukwala, Lab Director

## List of Exhibits

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

Applicant: Gigawave USA LLC

FCC ID: TO4-RFXPHT2027

### 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

### By M.F.A. Inc.:

- A. Testimonial & Statement of Certification

## Table of Contents

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|               | Standard Test Conditions and Engineering Practices | 3    |
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| 2.1046(a)     | Carrier Output Power (Conducted)                   | 7    |
| 2.1046(a)     | RF Power Output (Radiated)                         | 9    |
| 2.1051        | Spurious Emissions (Transmitter Conducted)         | 10   |
| 2.1053(a)     | Field Strength of Spurious Radiation               | 60   |
| 2.1049(c)(1)  | Occupied Bandwidth                                 | 67   |
| 2.202(g)      | Necessary Bandwidth and Emission Bandwidth         | 80   |

Required information per ISO 17025-1995, paragraph 5.0:

a) **Test Report**

b) Laboratory: Flom Test Lab  
 (FCC: 31040/SIT) 3356 N. San Marcos Place, Suite 107  
 (Canada: IC 2044) Chandler, AZ 85225

c) Report Number: d0730068

d) Client: Gigawave USA LLC  
 777 American Drive  
 Bensalem, PA 19020

e) Identification: Model # RFX-PHT

EUT Description: Video Booster Amplifier

f) EUT Condition: Not required unless specified in individual tests.

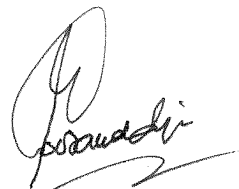
g) Report Date: March 28, 2007  
 EUT Received:

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:



Hoosamuddin S. Bandukwala, Lab Director

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.

Accessories used during testing:

| Type | Quantity | Manufacturer | Model | Serial No. | FCC ID |
|------|----------|--------------|-------|------------|--------|
|------|----------|--------------|-------|------------|--------|

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 - Radio Frequency Devices (unlicensed)
- ☐ 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 F Television Broadcast 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

### A2LA

---

"A2LA has accredited Flom Test Labs, 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 17025:2005 'General Requirements for the Competence of Testing and Calibration Laboratories' and any additional program requirements in the identified field of testing."

Please refer to [www.a2la.org](http://www.a2la.org) for current scope of accreditation.

Certificate Number: **2152.01**

## List of General Information Required for Certification

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

### Sub-part 2.1033

(c)(1): **Name and Address of Applicant:**

Gigawave USA LLC  
777 American Drive  
Bensalem, PA 19020

**Manufacturer:**

Gigawave USA LLC  
777 American Drive  
Bensalem, PA 19020

(c)(2): **FCC ID:**

TO4-RFXPHT2027

**Model Number:**

RFX-PHT

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

Please see attached exhibits

(c)(4): **Type of Emission:**

7M75F3W, 12M0F8W, 12M0W7D

(c)(5): **Frequency Range, MHz:**

2450 to 2500  
1990 to 2110

(c)(6): **Power Rating, Watts:**

\_\_\_\_\_ Switchable

\_\_\_\_\_ x \_\_\_\_\_ Variable

6 (Max)

\_\_\_\_\_ N/A

**FCC Grant Note:**

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

12.0

**DUT Results:**

Passes

\_\_\_\_\_ x \_\_\_\_\_

Fails

\_\_\_\_\_



Subpart 2.1033 (continued)

(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  
☒ N/A

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

Follows

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   | = | 6.0    |
| Collector Voltage, Vdc | = | 11.7   |
| Supply Voltage, Vdc    | = | 12 vdc |

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

Follows

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

**Specification:** 47 CFR 2.1046(a), 74.636

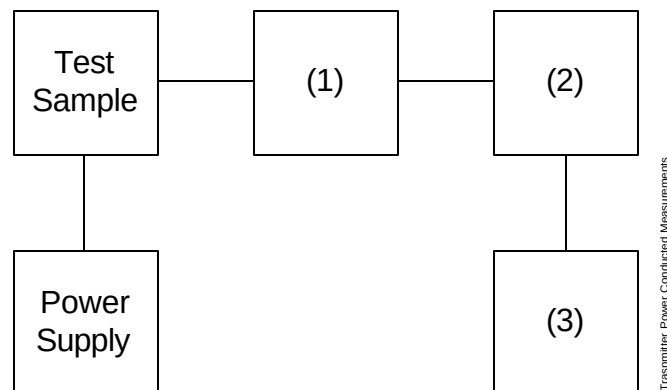
**Guide:** ANSI/TIA/EIA-603-1992, Paragraph 2.2.1

### 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  $\pm 3\%$ .

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



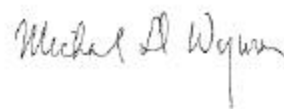
| Asset                                          | Description                                | s/n           | Cycle  | Last Cal |
|------------------------------------------------|--------------------------------------------|---------------|--------|----------|
| <b>(1) Coaxial Attenuator/Load Termination</b> |                                            |               |        |          |
| X                                              | i00231/2 PASTERNAK PE7021-30 (30 dB)       | 231 or 232    | N/A    | NCR      |
|                                                | i00122/3 NARDA 766 (10 dB)                 | 7802 or 7802A | N/A    | NCR      |
| X                                              | i00164 Termaline Coax Resistor 8201 50 ohm | 8321          | N/A    | NCR      |
| <b>(2) Power Meters</b>                        |                                            |               |        |          |
|                                                | i00321 HP 8901A Power Mode                 | 2239A02170    | 12 mo. | Sep-06   |
| X                                              | i00228 Agilent 4418B Power Meter           |               | 12 mo. | Aug-06   |
| X                                              | i00317 Agilent 8481A Power Head            |               | 12 mo. | Aug-06   |
| <b>(3) Frequency Counter</b>                   |                                            |               |        |          |
|                                                | i00321 HP 8901A Frequency Mode             | 2239A02170    | 12 mo. | Sep-06   |

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

**Measurement Results**  
(Worst case)

Frequency of Carrier, MHz = 2483.5, 2450, 2110, 1990  
 Ambient Temperature = 23°C ± 3°C

| Frequency, MHz | Power, dBm | RF Power, Watts |
|----------------|------------|-----------------|
| Low Power      |            |                 |
| 1990           | 20.79      | 0.318           |
| 2110           | 20.07      | 0.303           |
| 2450           | 20.42      | 0.309           |
| 2483.5         | 19.87      | 0.298           |
| High Power     |            |                 |
| 1990           | 38.70      | 5.87            |
| 2110           | 37.92      | 5.78            |
| 2450           | 37.54      | 5.74            |
| 2483.5         | 37.16      | 5.70            |



Performed by: Michael Wyman

**Name of Test:** RF Power Output (Radiated)

**Specification:** 47 CFR 2.1046(a), 74.636

**Test Equipment:** As per attached page

### Measurement Procedure (Radiated)

1. The EUT was placed on an open-field site and its radiated field strength at a known distance was measured by means of a spectrum analyzer. Equivalent loading was calculated from the equation  $P_t = (E \times R)^2 / 49.2$  watts, where  $R = 3m$ .
2. Measurement accuracy is  $\pm 1.5$  dB.

### Measurement Results

g0730119: 2007-Mar-27 Tue 15:21:00  
 State: 2:High Power

Ambient Temperature: 23°C  $\pm$  3°C

| Frequency Tuned,<br>MHz | Frequency Emission,<br>MHz | Meter,<br>dBuV/m | CF, dB | EIRP, dBm | EIRP, Watts |
|-------------------------|----------------------------|------------------|--------|-----------|-------------|
| 1990.000000             | 1987.700000                | 63.33            | 33.75  | 1.86      | 0.0014      |
| 2110.000000             | 2111.100000                | 58.33            | 34.28  | -1.64     | 0.000025    |
| 2450.000000             | 2447.666667                | 55.83            | 35.6   | -3.84     | 0.000045    |
| 2483.500000             | 2480.466667                | 54               | 35.71  | -5.54     | 0.000028    |

Note: The EUT was connected to a 500 watt 50 ohm load for termination.

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

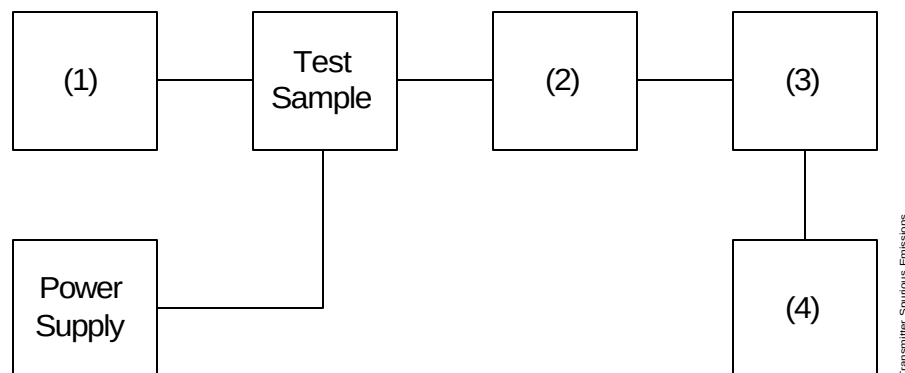
**Specification:** 47 CFR 2.1051, 74.637

**Guide:** ANSI/TIA/EIA-603-1992, Paragraph 2.2.13

### Measurement Procedure

- A) 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.
- B) 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           |        |        |
|---------------------------------------|-----------------------------------|---------------|--------|--------|
| <b>(1) Audio Oscillator/Generator</b> |                                   |               |        |        |
| X i00324                              | HP 8903B Audio Analyzer           | 3011A09079    | 12 mo. | Oct-06 |
| i00002                                | HP 3336B Synthesizer / Level Gen. | 1931A01465    | N/A    | NCR    |
| <b>(2) Coaxial Attenuator</b>         |                                   |               |        |        |
| X i00231/2                            | PASTERNAK PE7021-30 (30 dB)       | 231 or 232    | N/A    | NCR    |
| i0012/3                               | NARDA 766 (10 dB)                 | 7802 or 7802A | N/A    | NCR    |
| <b>(3) Filters; Notch, HP, LP, BP</b> |                                   |               |        |        |
|                                       |                                   |               | N/A    | NCR    |
| <b>(4) Spectrum Analyzer</b>          |                                   |               |        |        |
| X i00048                              | HP 8566B Spectrum Analyzer        | 2511A01467    | 12 mo. | Aug-06 |
| X i00029                              | HP 8563E Spectrum Analyzer        | 3213A00104    | 12 mo. | Jan-06 |

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

**Measurement Results**  
(Worst Case)

Summary:

|                           |   |                          |
|---------------------------|---|--------------------------|
| Frequency of carrier, MHz | = | 2483.5, 2450, 2110, 1990 |
| Spectrum Searched, GHz    | = | 0 to 10 x $F_c$          |
| Limit(s), dBc             |   | -80 (6 Watts)            |

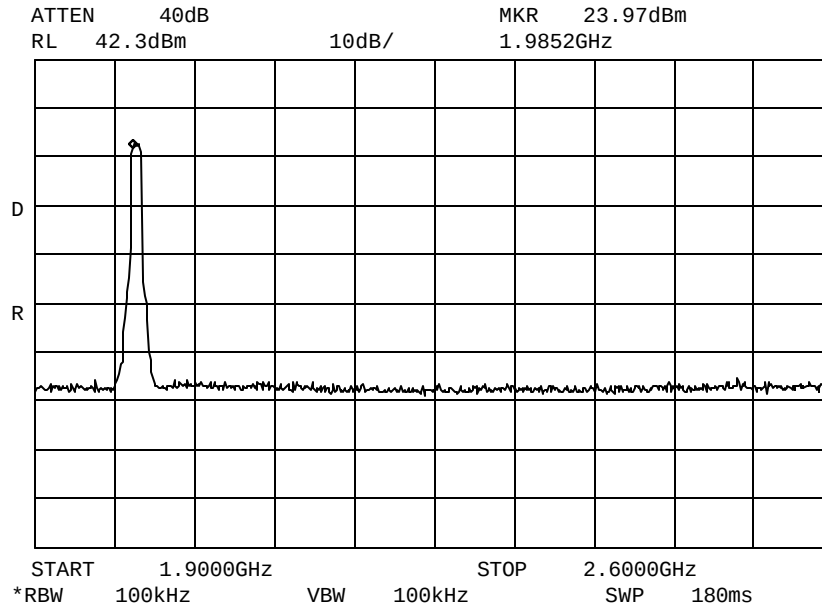
Graphical Results follow:

Name of Test: Emission Masks (Occupied Bandwidth)

### Measurement Results

g0740138: 2007-Apr-04 Wed 16:01:00  
State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power: HIGH 1990  
Modulation: QAM64  
TX Frequency 1900MHz

*Michael D Wyman*

Performed by:

Michael Wyman



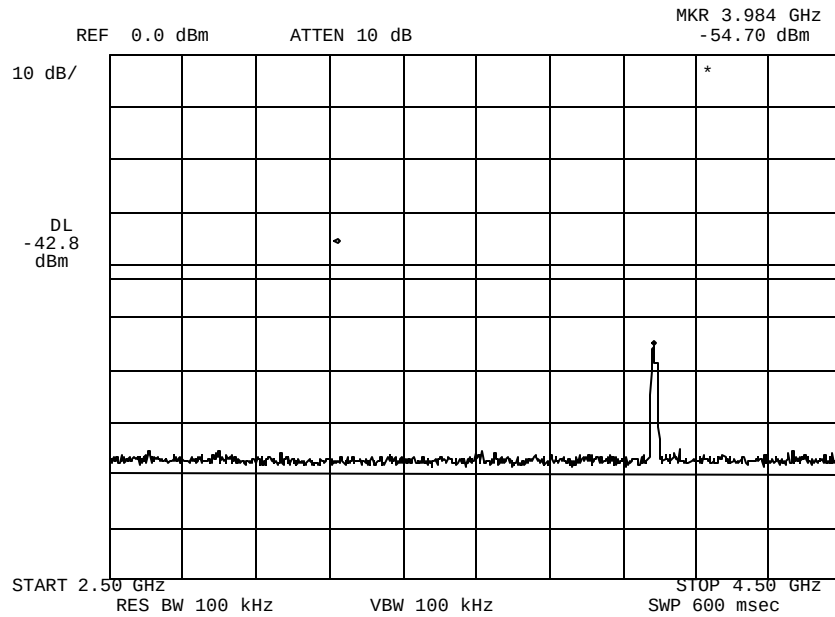
Name of Test: Conducted Emissions

### Measurement Results

g0730077: 2007-Mar-27 Tue 14:07:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power: HIGH  
Modulation: QAM 64  
TX Frequency: 1990MHz

Sample Calculation:  $80 \text{ dBc} = 37.2 \text{ dBm} - (\text{DL(dBm)})$ ;  $\text{DL} = 80 - 37.2 = 42.8$

*Michael D Wyman*

Performed by:

Michael Wyman

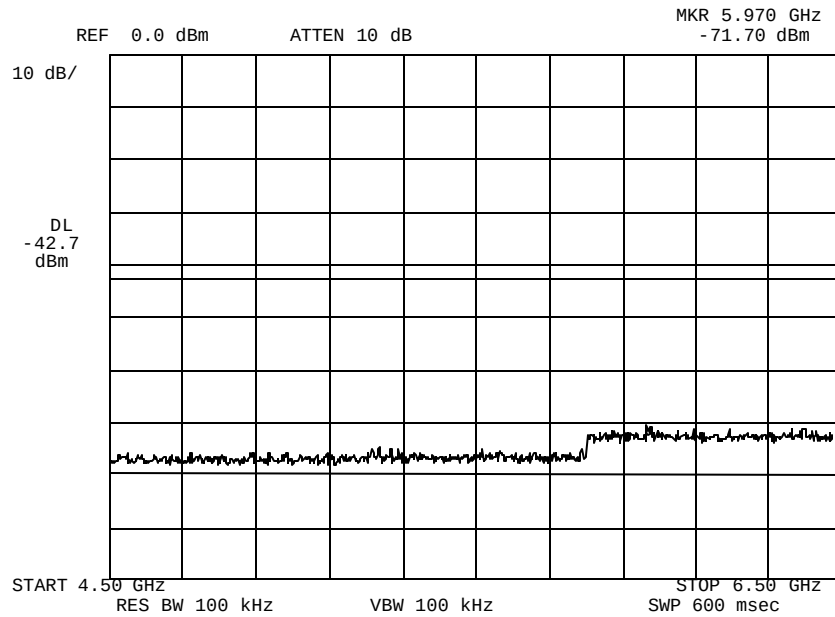
Name of Test: Conducted Emissions

### Measurement Results

g0730078: 2007-Mar-27 Tue 14:09:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:  
Modulation:  
TX Frequency

HIGH  
QAM 64  
1990MHz

*Michael D Wyman*

Performed by:

Michael Wyman

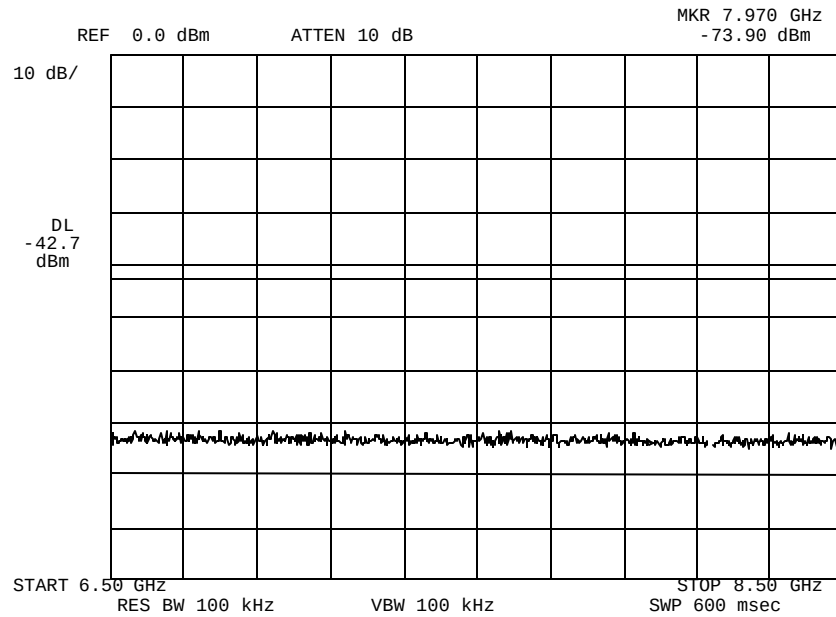
Name of Test: Conducted Emissions

### Measurement Results

g0730079: 2007-Mar-27 Tue 14:10:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:  
Modulation:  
TX Frequency

HIGH  
QAM 64  
1990MHz

*Michael D Wyman*

Performed by:

Michael Wyman

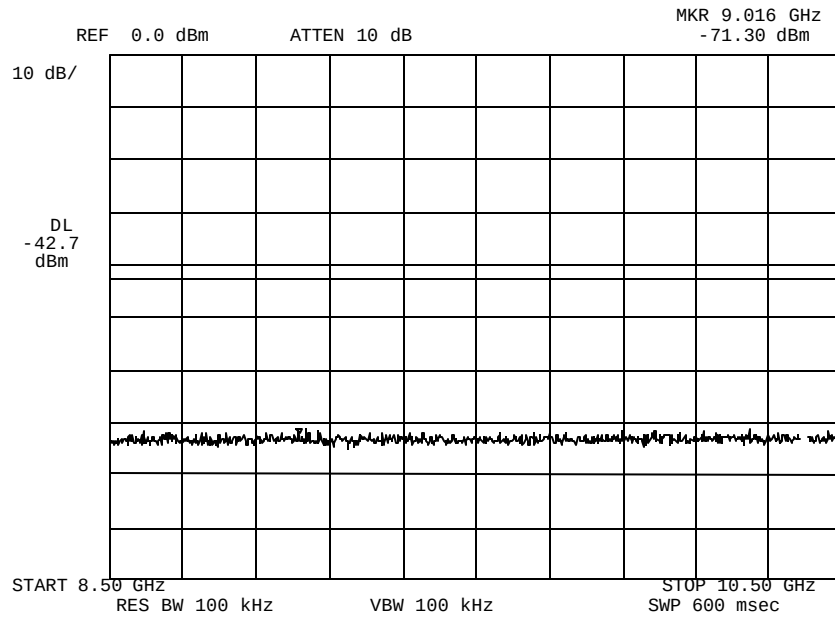
Name of Test: Conducted Emissions

### Measurement Results

g0730080: 2007-Mar-27 Tue 14:12:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:  
Modulation:  
TX Frequency

HIGH  
QAM 64  
1990MHz

*Michael D Wyman*

Performed by:

Michael Wyman

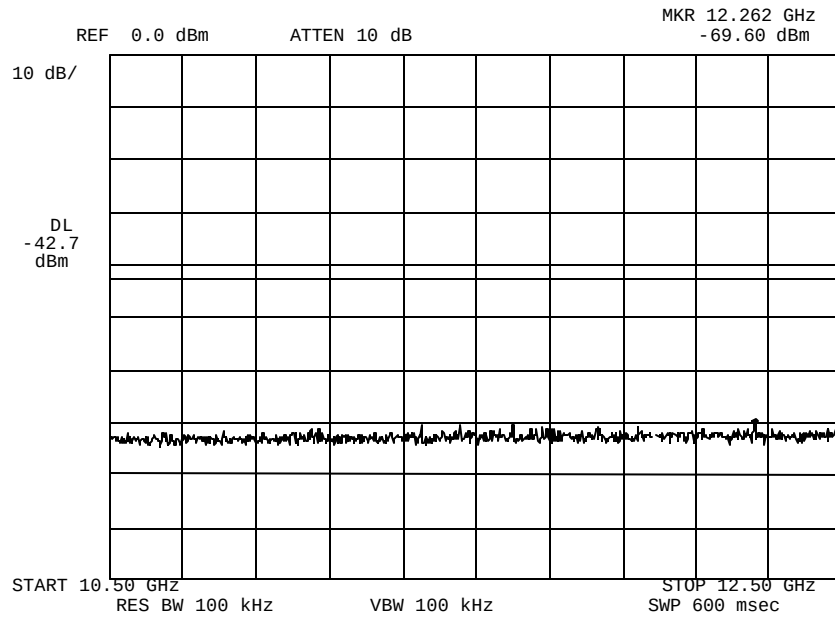
Name of Test: Conducted Emissions

### Measurement Results

g0730081: 2007-Mar-27 Tue 14:13:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:  
Modulation:  
TX Frequency

HIGH  
QAM 64  
1990MHz

*Michael D Wyman*

Performed by:

Michael Wyman

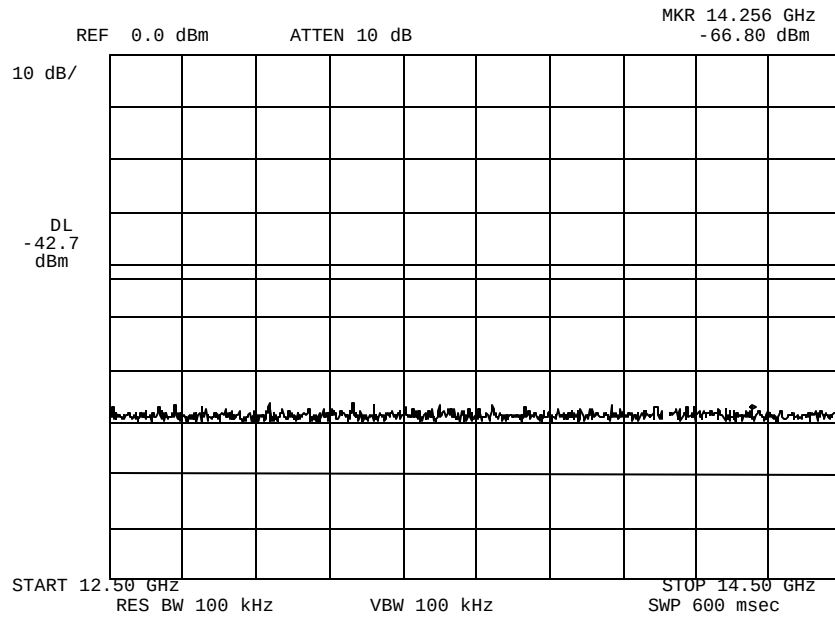
Name of Test: Conducted Emissions

### Measurement Results

g0730082: 2007-Mar-27 Tue 14:14:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:  
Modulation:  
TX Frequency

HIGH  
QAM 64  
1990MHz

*Michael D Wyman*

Performed by:

Michael Wyman

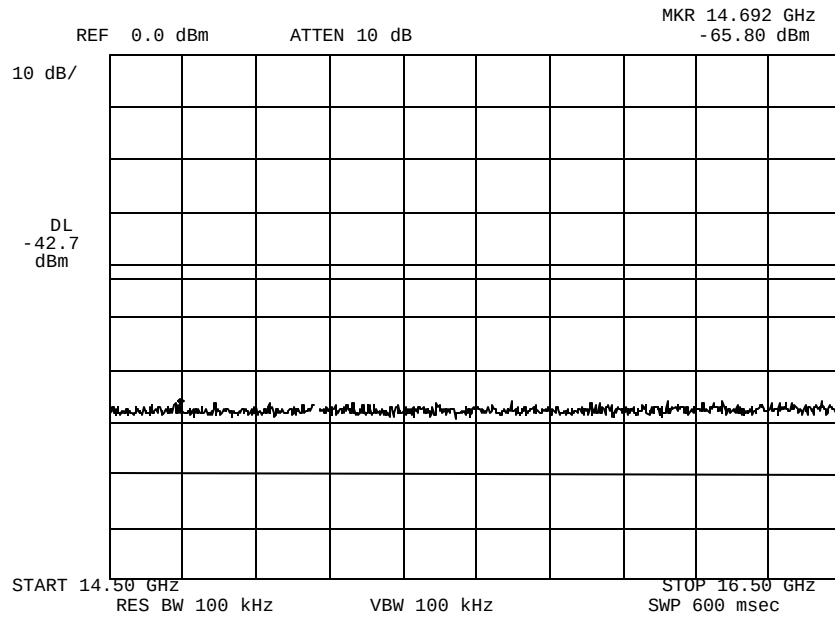
Name of Test: Conducted Emissions

### Measurement Results

g0730083: 2007-Mar-27 Tue 14:15:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:  
Modulation:  
TX Frequency

HIGH  
QAM 64  
1990MHz

*Michael D Wyman*

Performed by:

Michael Wyman

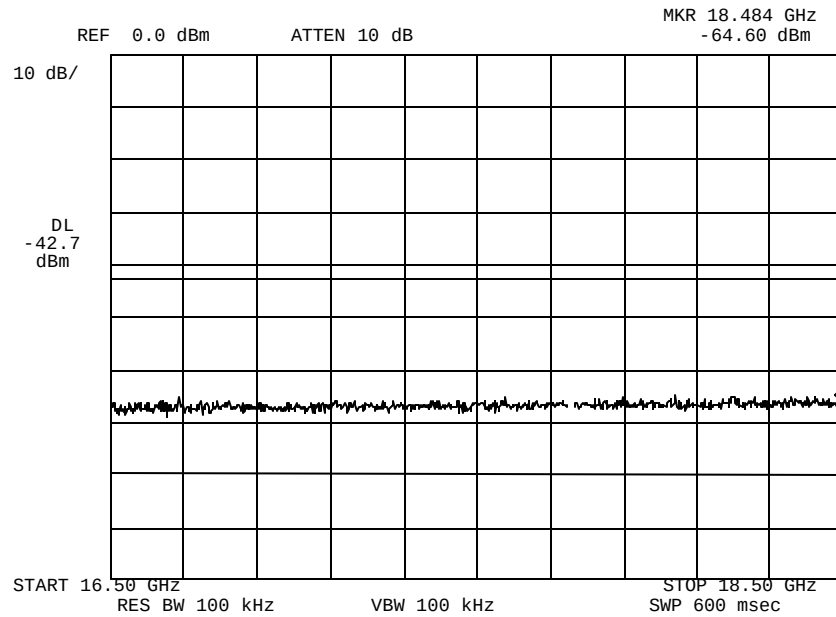
Name of Test: Conducted Emissions

### Measurement Results

g0730084: 2007-Mar-27 Tue 14:16:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:  
Modulation:  
TX Frequency

HIGH  
QAM 64  
1990MHz

*Michael D Wyman*

Performed by:

Michael Wyman



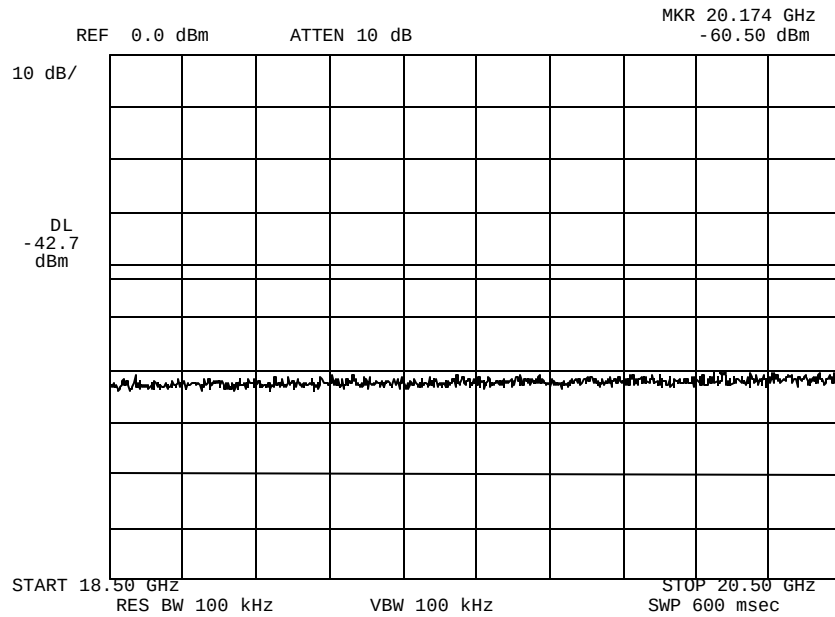
Name of Test: Conducted Emissions

### Measurement Results

g0730085: 2007-Mar-27 Tue 14:17:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:  
Modulation:  
TX Frequency

HIGH  
QAM 64  
1990MHz

*Michael D Wyman*

Performed by:

Michael Wyman

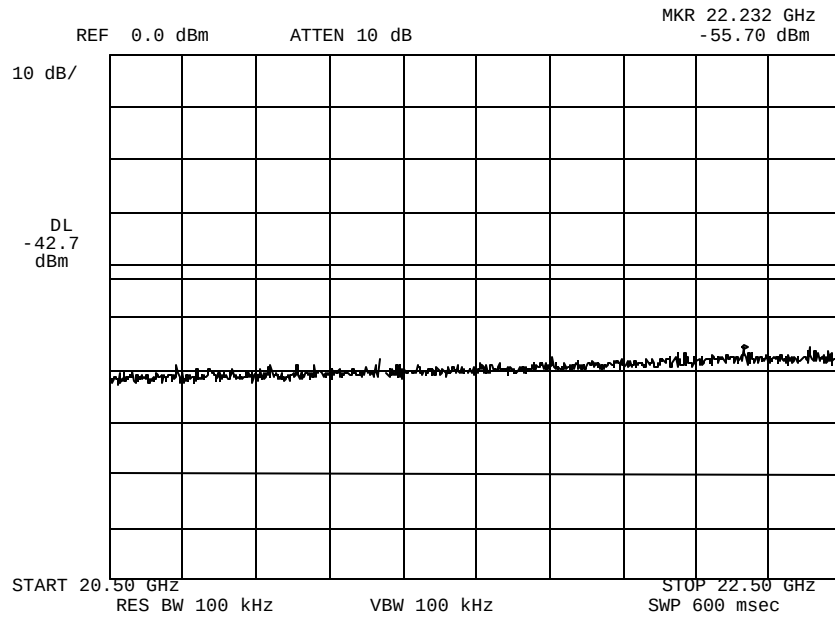
Name of Test: Conducted Emissions

### Measurement Results

g0730086: 2007-Mar-27 Tue 14:18:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:  
Modulation:  
TX Frequency

HIGH  
QAM 64  
1990MHz

*Michael D Wyman*

Performed by:

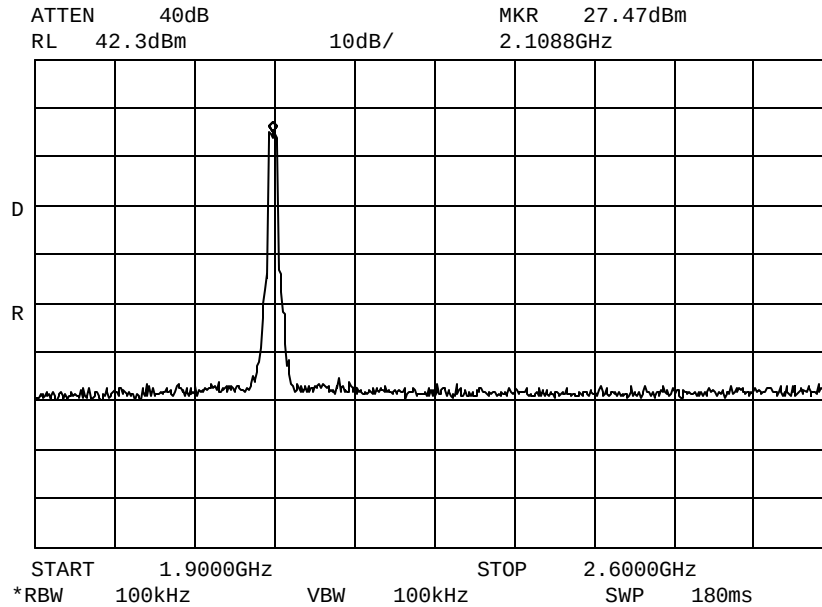
Michael Wyman

Name of Test: Emission Masks (Occupied Bandwidth)

### Measurement Results

g0740139: 2007-Apr-04 Wed 16:01:00  
State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power: HIGH 2110  
Modulation: QAM64  
TX Frequency 2110 MHz

*Michael D Wyman*

Performed by:

Michael Wyman

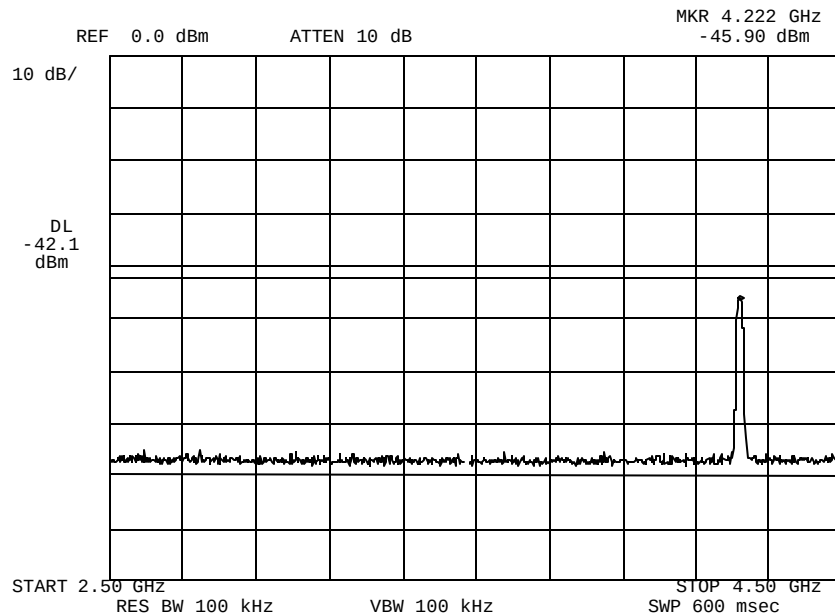
Name of Test: Conducted Emissions

### Measurement Results

g0730087: 2007-Mar-27 Tue 14:22:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power: HIGH  
Modulation: QAM 64  
TX Frequency: 2110MHz

Sample Calculation:  $80 \text{ dBc} = 37.9 \text{ dBm} - (\text{DL(dBm)})$ ;  $\text{DL} = 80 - 37.9 = 42.1$

*Michael D Wyman*

Performed by:

Michael Wyman

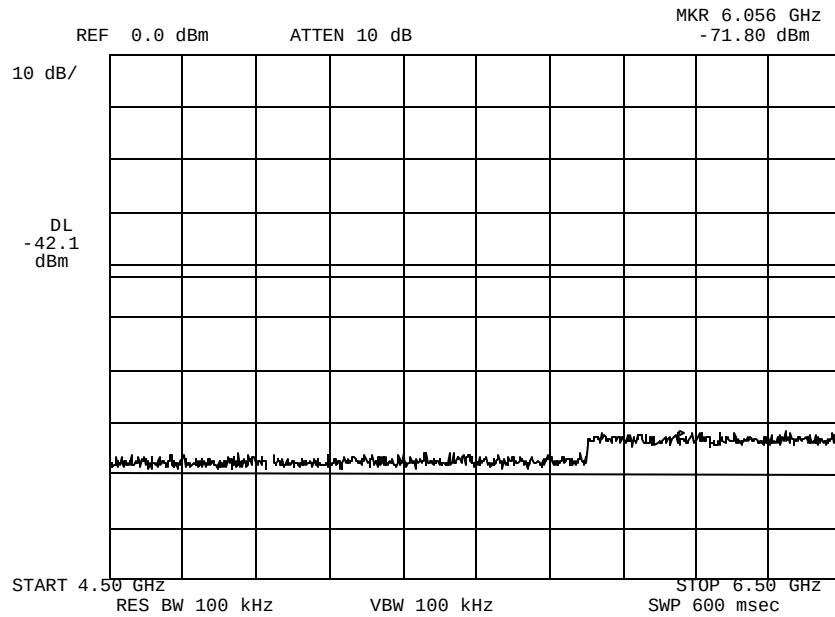
Name of Test: Conducted Emissions

### Measurement Results

g0730088: 2007-Mar-27 Tue 14:22:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:  
Modulation:  
TX Frequency

HIGH  
QAM 64  
2110MHz

*Michael D Wyman*

Performed by:

Michael Wyman

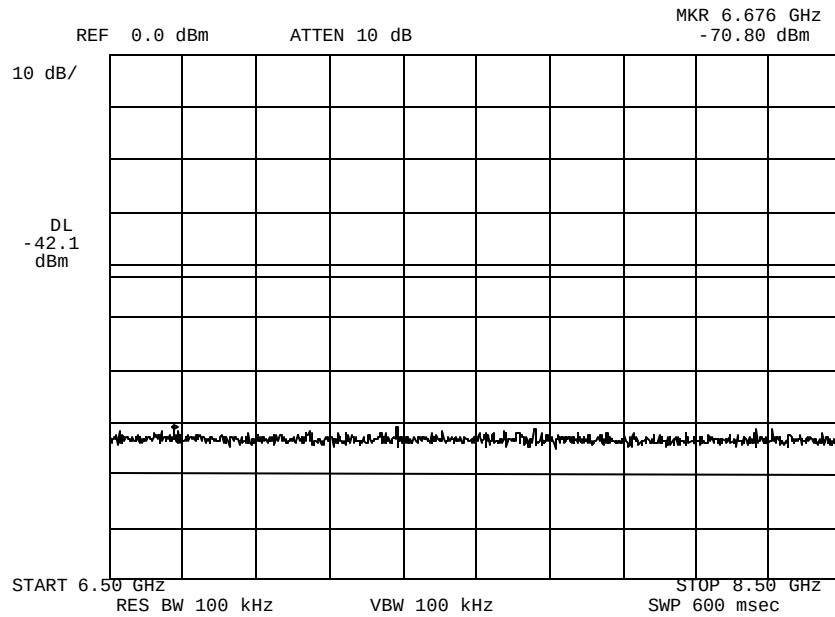
Name of Test: Conducted Emissions

### Measurement Results

g0730089: 2007-Mar-27 Tue 14:23:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:  
Modulation:  
TX Frequency

HIGH  
QAM 64  
2110MHz

*Michael D Wyman*

Performed by:

Michael Wyman

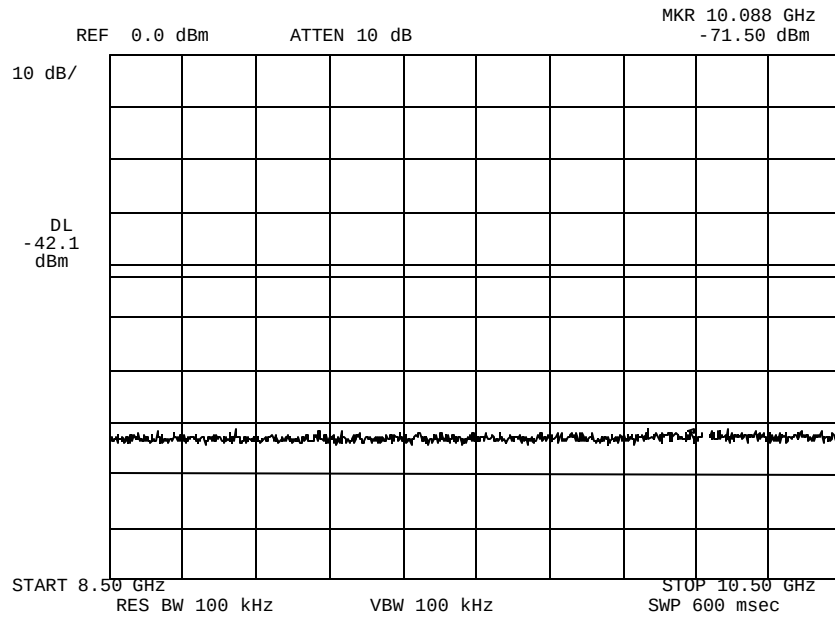
Name of Test: Conducted Emissions

### Measurement Results

g0730090: 2007-Mar-27 Tue 14:24:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:  
Modulation:  
TX Frequency

HIGH  
QAM 64  
2110MHz

*Michael D Wyman*

Performed by:

Michael Wyman

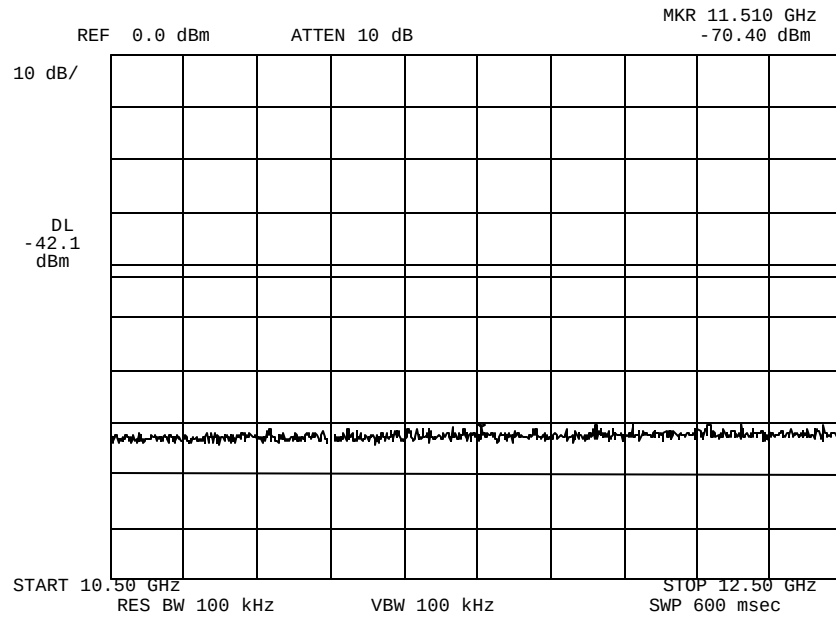
Name of Test: Conducted Emissions

### Measurement Results

g0730091: 2007-Mar-27 Tue 14:25:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:  
Modulation:  
TX Frequency

HIGH  
QAM 64  
2110MHz

*Michael D Wyman*

Performed by:

Michael Wyman



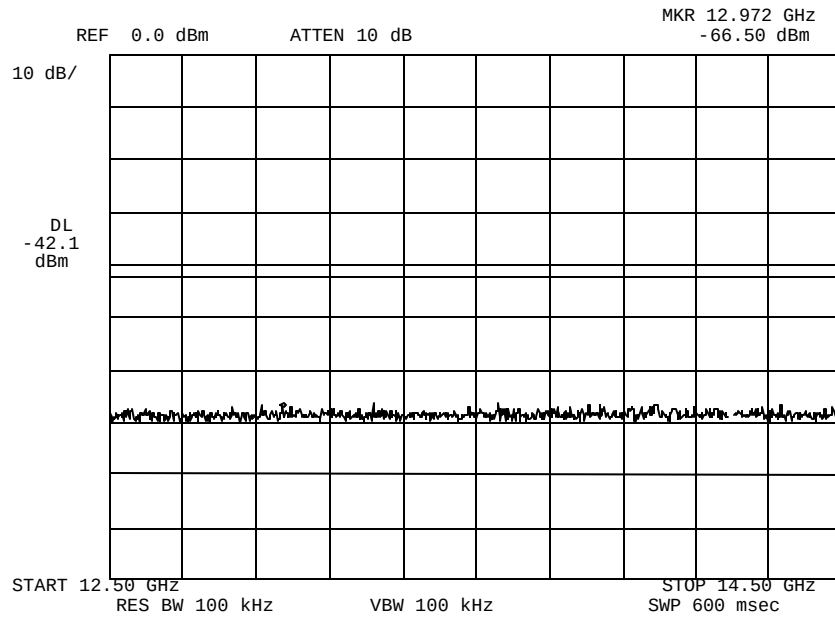
Name of Test: Conducted Emissions

### Measurement Results

g0730092: 2007-Mar-27 Tue 14:26:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:  
Modulation:  
TX Frequency

HIGH  
QAM 64  
2110MHz

*Michael D Wyman*

Performed by:

Michael Wyman

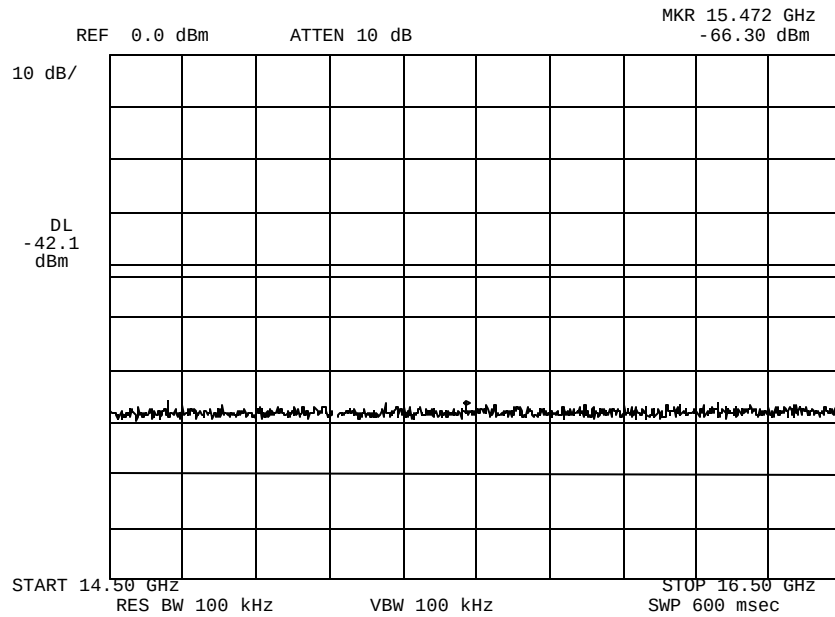
Name of Test: Conducted Emissions

### Measurement Results

g0730093: 2007-Mar-27 Tue 14:26:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:  
Modulation:  
TX Frequency

HIGH  
QAM 64  
2110MHz

*Michael D Wyman*

Performed by:

Michael Wyman

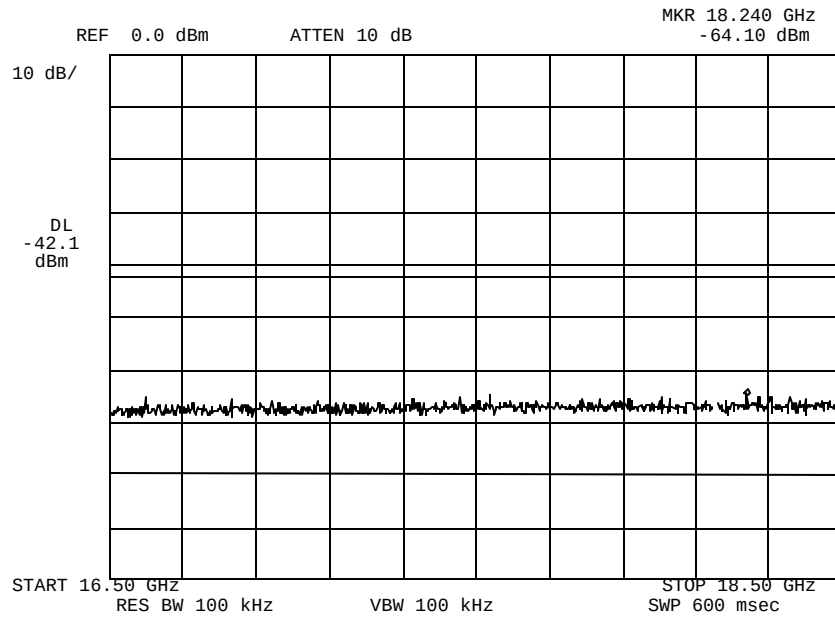
Name of Test: Conducted Emissions

### Measurement Results

g0730094: 2007-Mar-27 Tue 14:27:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:  
Modulation:  
TX Frequency

HIGH  
QAM 64  
2110MHz

*Michael D Wyman*

Performed by:

Michael Wyman

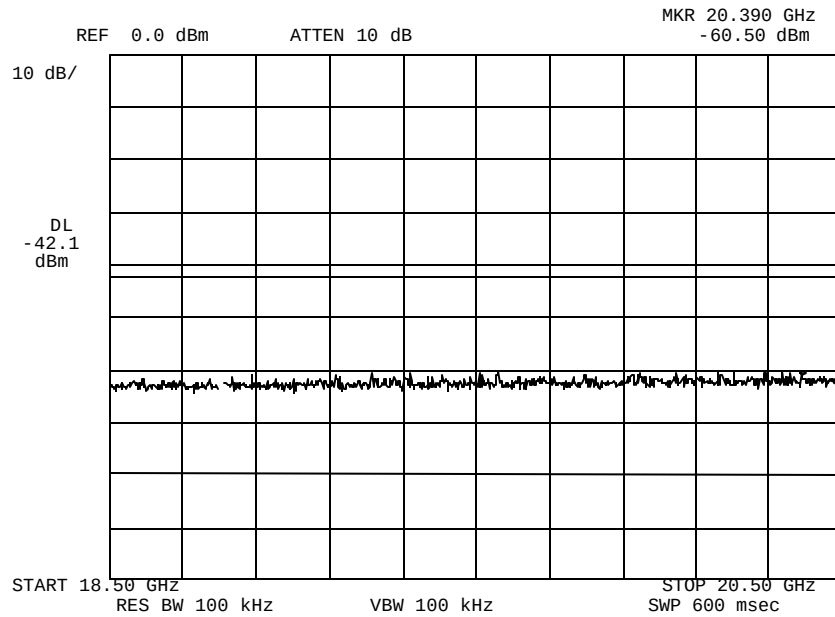
Name of Test: Conducted Emissions

### Measurement Results

g0730095: 2007-Mar-27 Tue 14:28:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:  
Modulation:  
TX Frequency

HIGH  
QAM 64  
2110MHz

*Michael D Wyman*

Performed by:

Michael Wyman

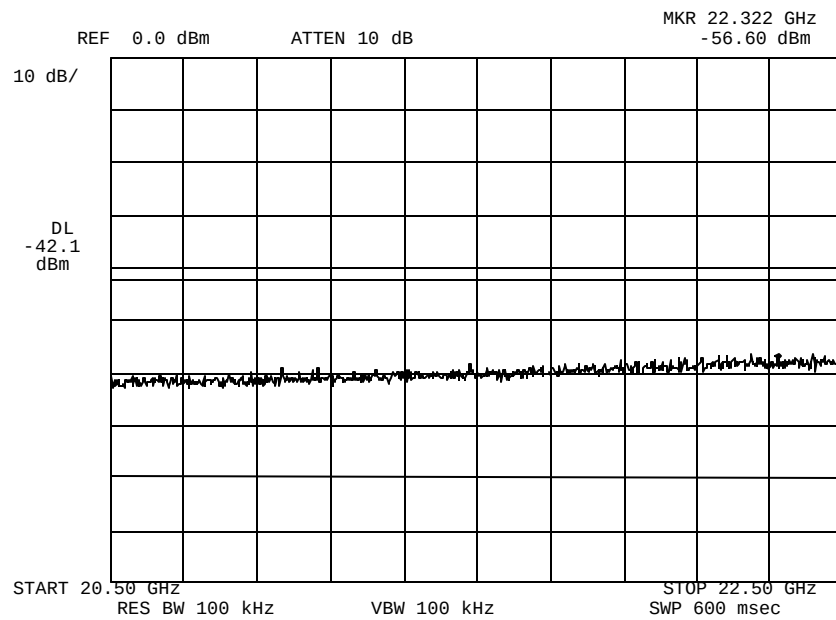
Name of Test: Conducted Emissions

### Measurement Results

g0730096: 2007-Mar-27 Tue 14:29:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:  
Modulation:  
TX Frequency

HIGH  
QAM 64  
2110MHz

*Michael D Wyman*

Performed by:

Michael Wyman

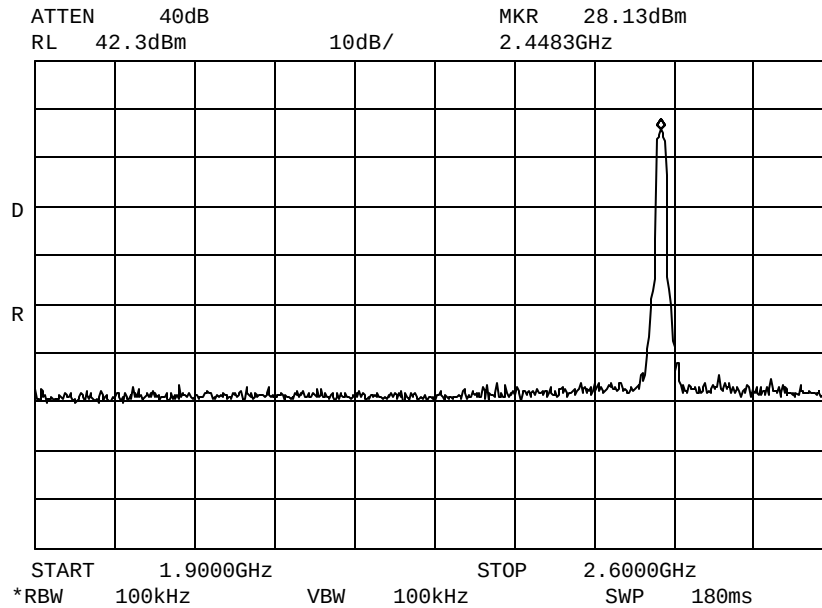
Name of Test: Emission Masks (Occupied Bandwidth)

### Measurement Results

g0740140: 2007-Apr-04 Wed 16:03:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:  
Modulation:  
TX Frequency

HIGH 2450  
QAM64  
2450

*Michael D Wyman*

Performed by:

Michael Wyman

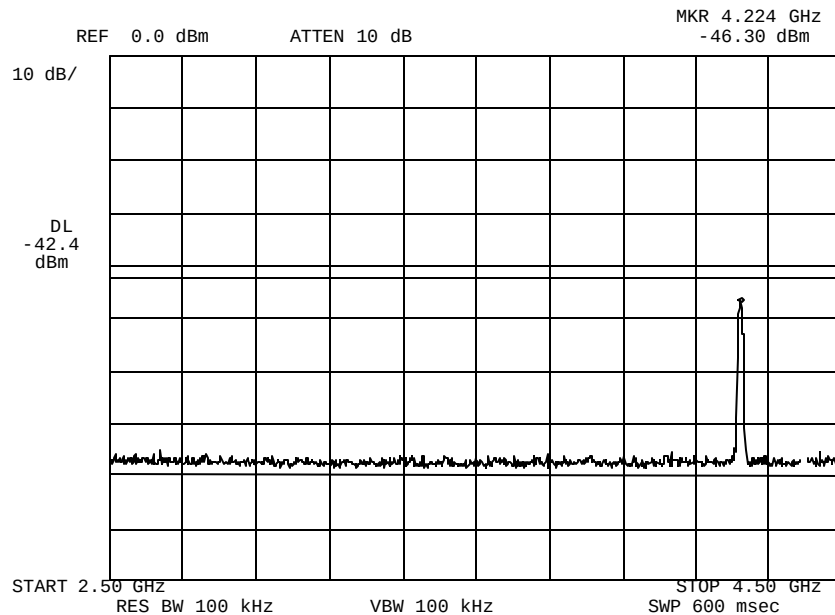
Name of Test: Conducted Emissions

### Measurement Results

g0730097: 2007-Mar-27 Tue 14:30:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power: HIGH  
Modulation: QAM 64  
TX Frequency: 2450MHz

Sample Calculation:  $80 \text{ dBc} = 37.6 \text{ dBm} - (\text{DL(dBm)})$ ;  $\text{DL} = 80 - 37.6 = 42.4$

*Michael D Wyman*

Performed by:

Michael Wyman

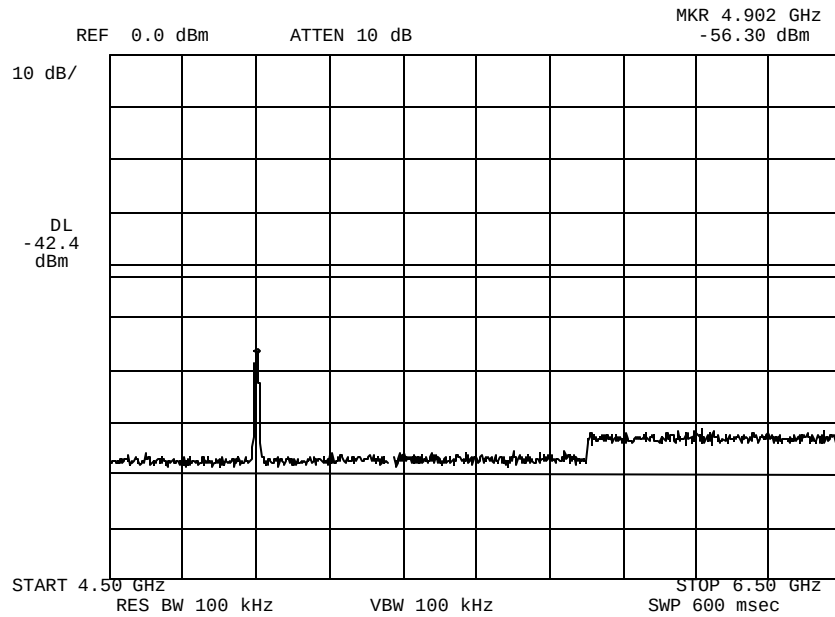
Name of Test: Conducted Emissions

### Measurement Results

g0730098: 2007-Mar-27 Tue 14:32:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:  
Modulation:  
TX Frequency

HIGH  
QAM 64  
2450MHz

*Michael D Wyman*

Performed by:

Michael Wyman



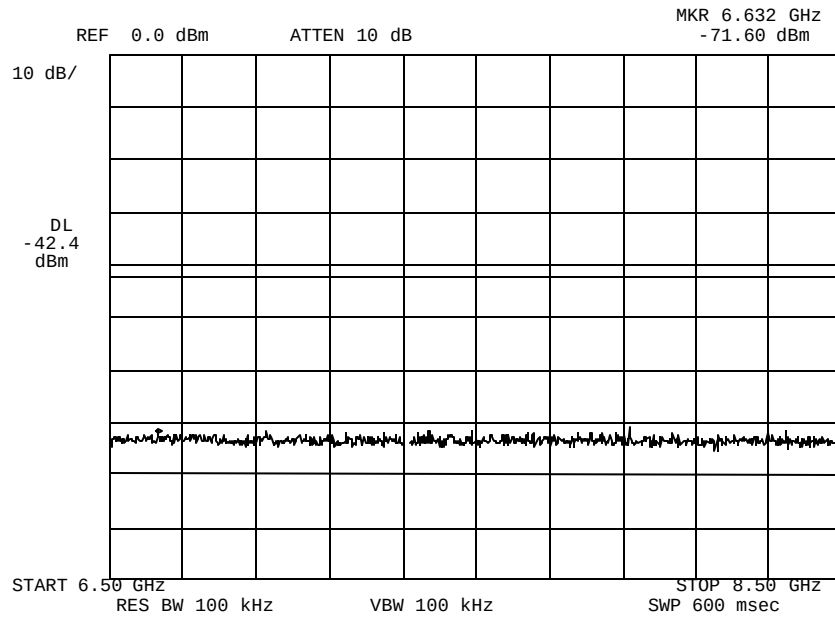
Name of Test: Conducted Emissions

### Measurement Results

g0730099: 2007-Mar-27 Tue 14:32:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:

HIGH

Modulation:

QAM 64

TX Frequency

2450MHz

*Michael D Wyman*

Performed by:

Michael Wyman

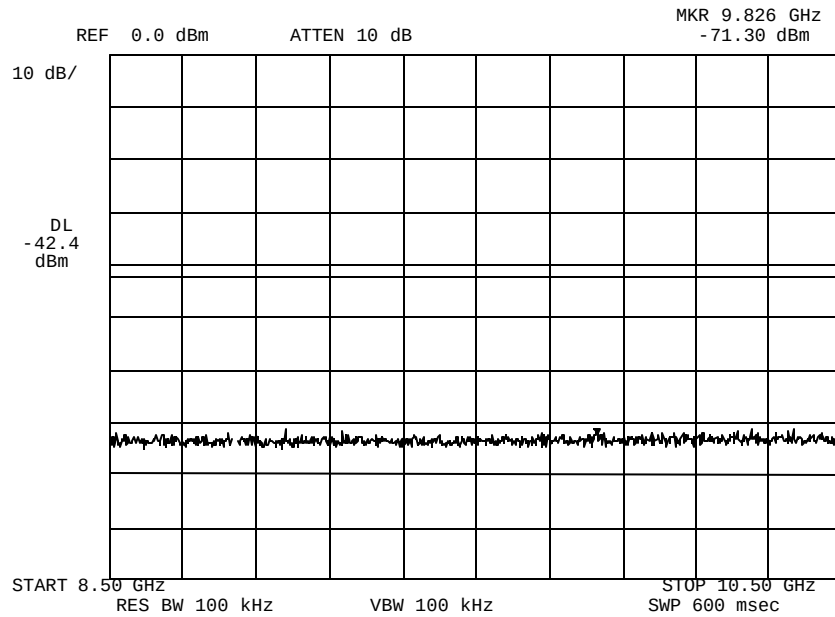
Name of Test: Conducted Emissions

### Measurement Results

g0730100: 2007-Mar-27 Tue 14:33:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:

HIGH

Modulation:

QAM 64

TX Frequency

2450MHz

*Michael D Wyman*

Performed by:

Michael Wyman

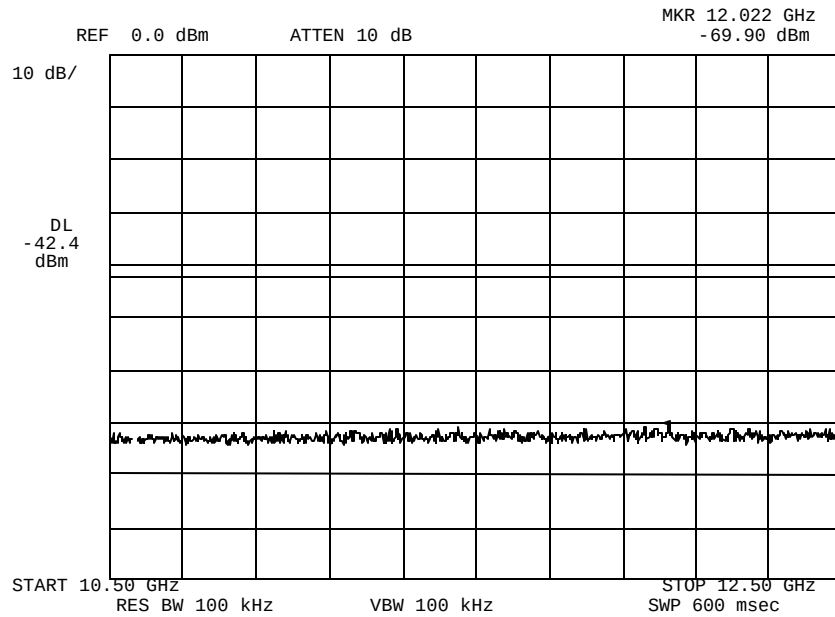
Name of Test: Conducted Emissions

### Measurement Results

g0730101: 2007-Mar-27 Tue 14:33:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:

HIGH

Modulation:

QAM 64

TX Frequency

2450MHz

*Michael D Wyman*

Performed by:

Michael Wyman

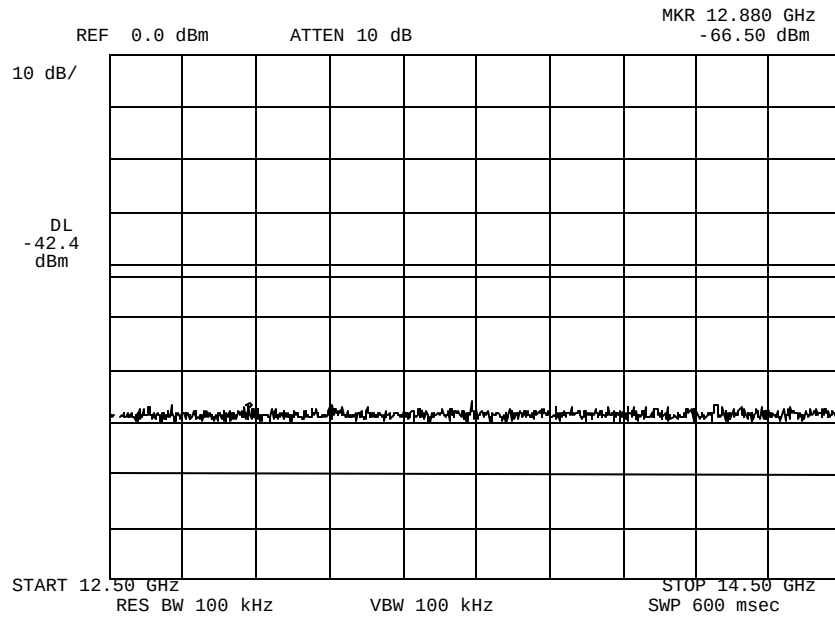
Name of Test: Conducted Emissions

### Measurement Results

g0730102: 2007-Mar-27 Tue 14:34:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:

HIGH

Modulation:

QAM 64

TX Frequency

2450MHz

*Michael D Wyman*

Performed by:

Michael Wyman

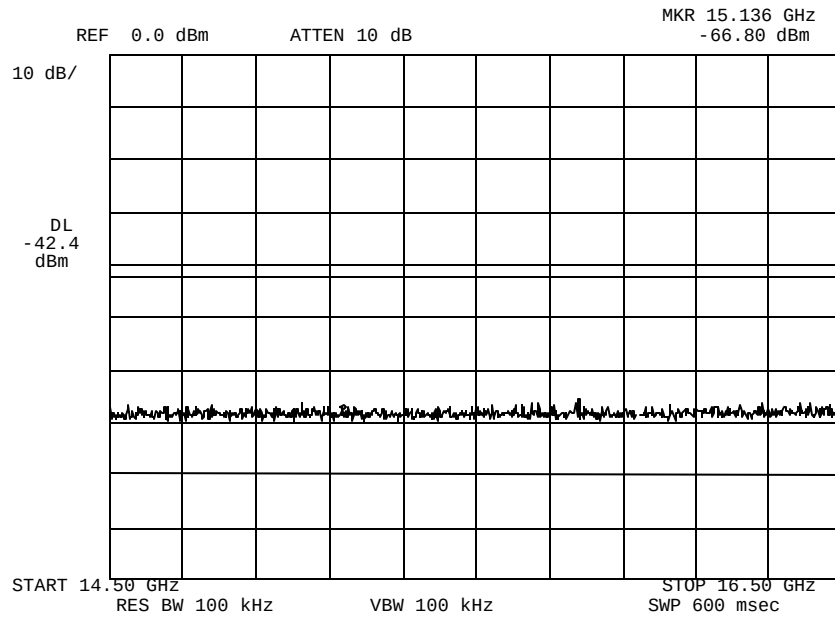
Name of Test: Conducted Emissions

### Measurement Results

g0730103: 2007-Mar-27 Tue 14:35:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:

HIGH

Modulation:

QAM 64

TX Frequency

2450MHz

*Michael D Wyman*

Performed by:

Michael Wyman

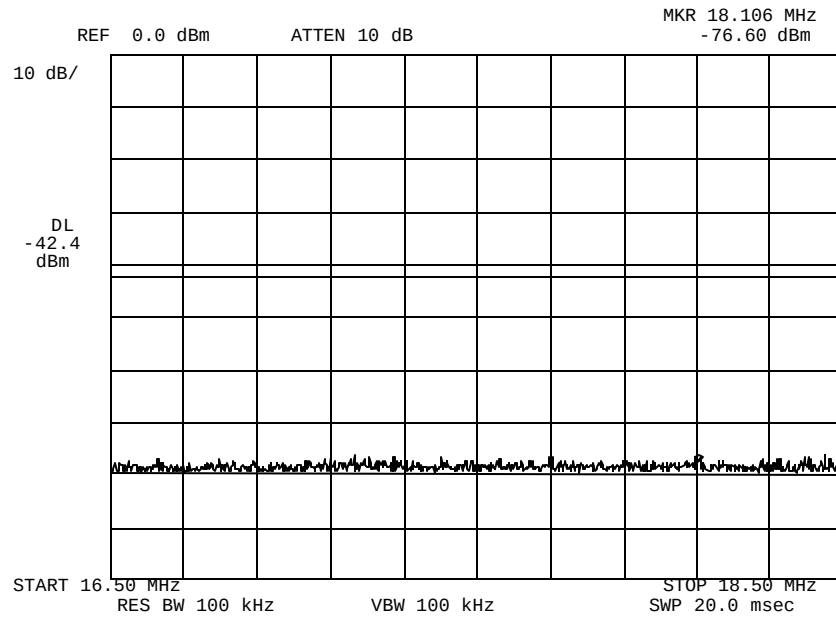
Name of Test: Conducted Emissions

### Measurement Results

g0730104: 2007-Mar-27 Tue 14:35:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:

HIGH

Modulation:

QAM 64

TX Frequency

2450MHz

*Michael D Wyman*

Performed by:

Michael Wyman

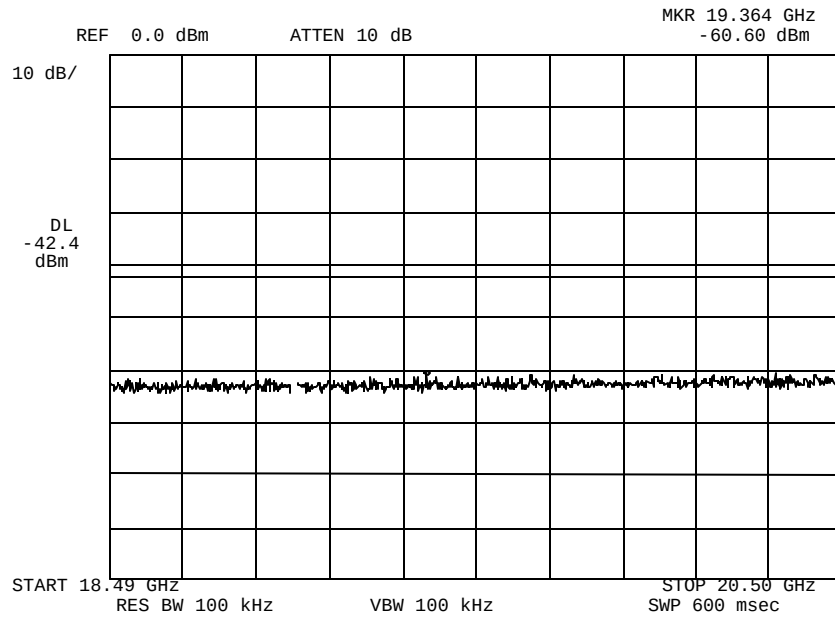
Name of Test: Conducted Emissions

### Measurement Results

g0730105: 2007-Mar-27 Tue 14:36:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:

HIGH

Modulation:

QAM 64

TX Frequency

2450MHz

*Michael D Wyman*

Performed by:

Michael Wyman

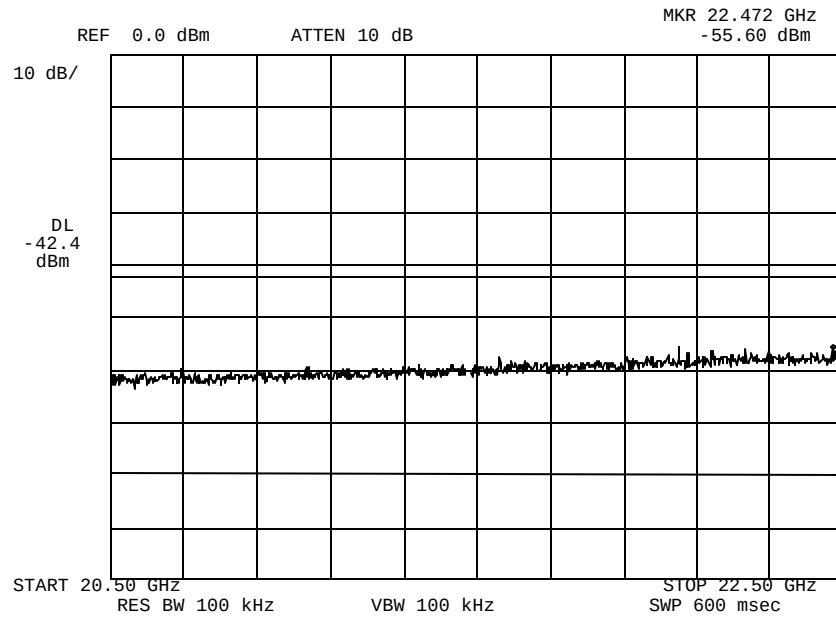
Name of Test: Conducted Emissions

### Measurement Results

g0730106: 2007-Mar-27 Tue 14:37:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:

HIGH

Modulation:

QAM 64

TX Frequency

2450MHz

*Michael D Wyman*

Performed by:

Michael Wyman



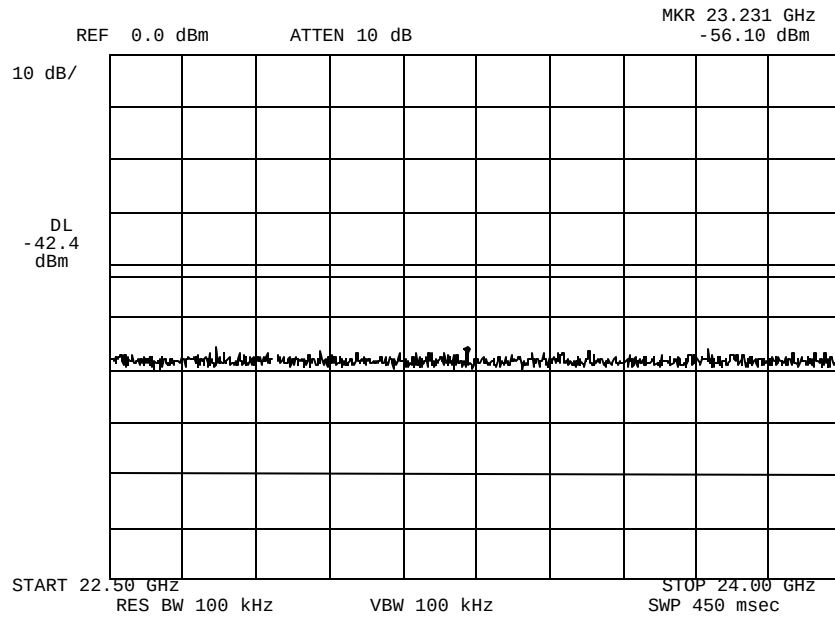
Name of Test: Conducted Emissions

### Measurement Results

g0730107: 2007-Mar-27 Tue 14:37:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:

HIGH

Modulation:

QAM 64

TX Frequency

2450MHz

*Michael D Wyman*

Performed by:

Michael Wyman

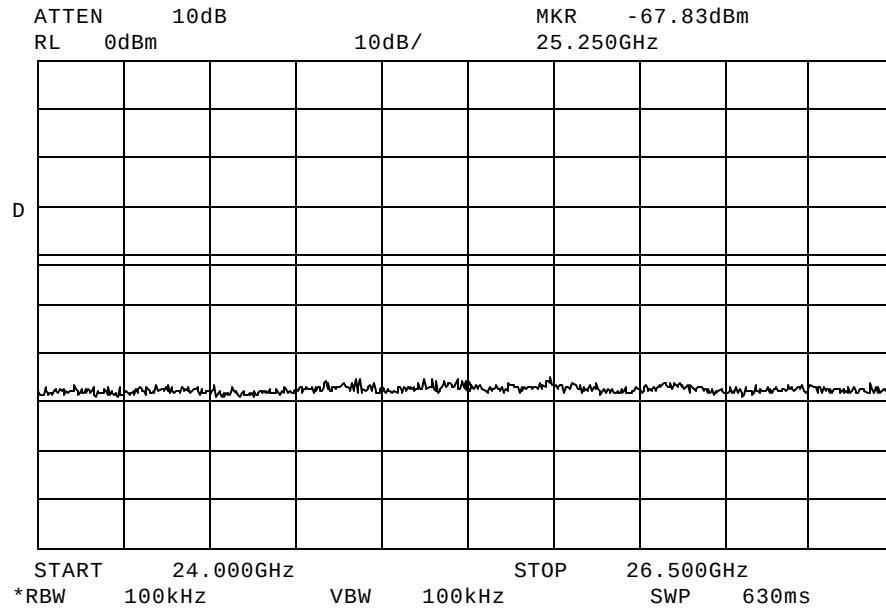
Name of Test: Conducted Emissions

### Measurement Results

g0730124: 2007-Mar-28 Wed 07:24:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:  
Modulation:  
TX Frequency

HIGH  
QAM 64  
2450MHz

*Michael D Wyman*

Performed by:

Michael Wyman

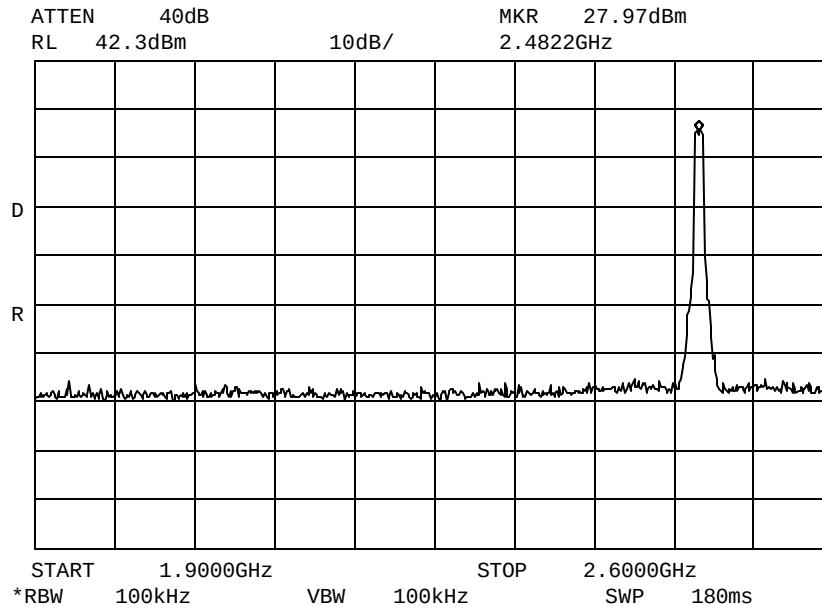
Name of Test: Emission Masks (Occupied Bandwidth)

### Measurement Results

g0740141: 2007-Apr-04 Wed 16:04:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power: HIGH 2483.5  
Modulation: QAM64  
TX Frequency 2483.5MHz

*Michael D Wyman*

Performed by:

Michael Wyman

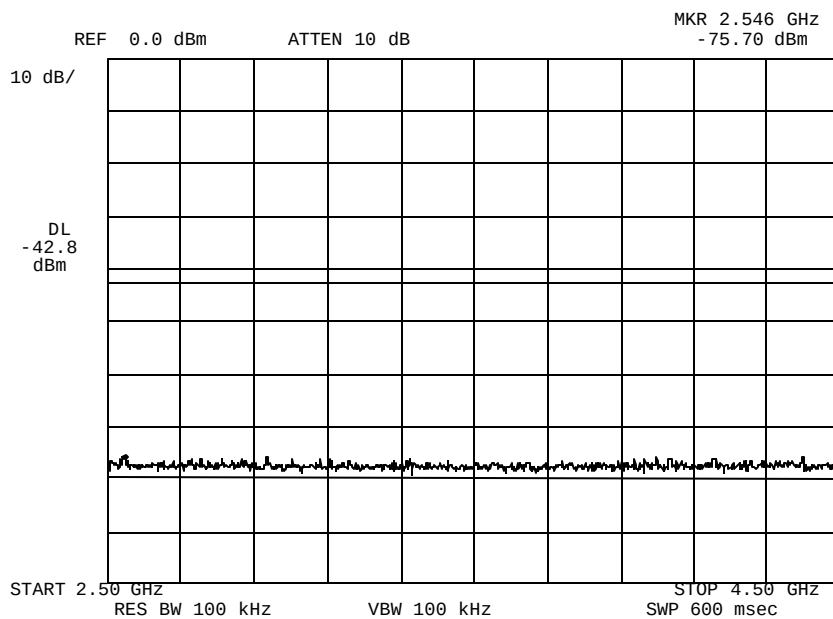
**Name of Test:** 2483.5MHz Conducted Emissions

### Measurement Results

g0730108: 2007-Mar-27 Tue 14:40:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:

HIGH

Modulation:

QAM 64

TX Frequency

2483.5MHz

*Michael D Wyman*

Performed by:

Michael Wyman

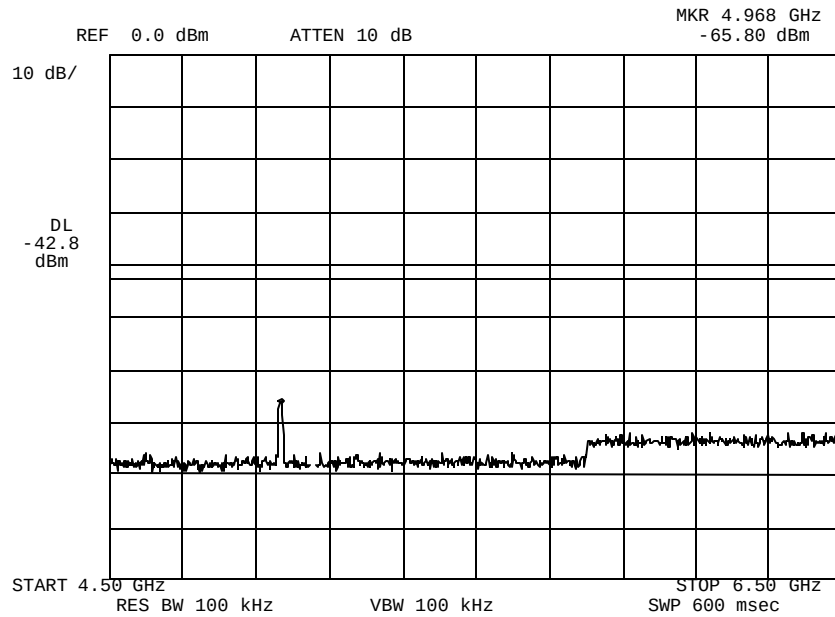
Name of Test: 2483.5MHz Conducted Emissions

### Measurement Results

g0730109: 2007-Mar-27 Tue 14:40:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:

HIGH

Modulation:

QAM 64

TX Frequency

2483.5MHz

*Michael D Wyman*

Performed by:

Michael Wyman

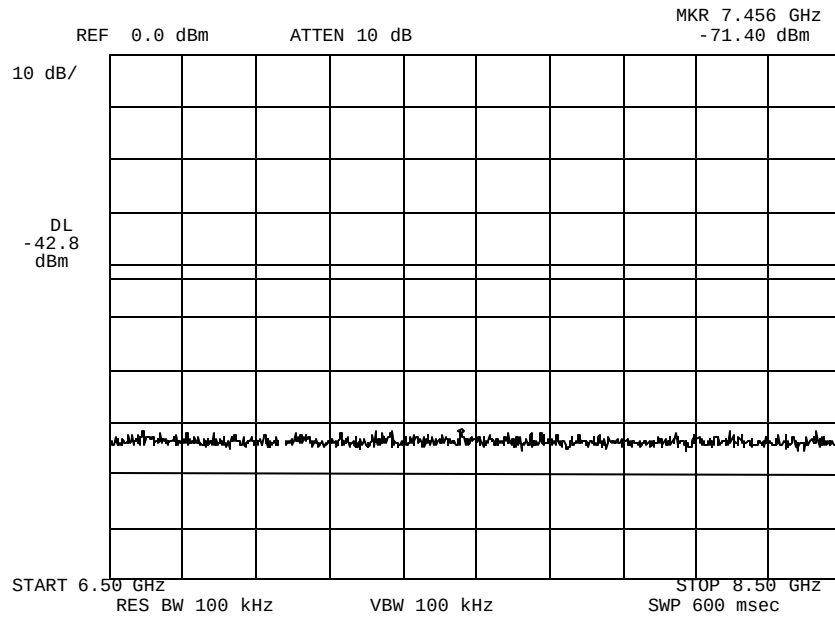
Name of Test: 2483.5MHz Conducted Emissions

### Measurement Results

g0730110: 2007-Mar-27 Tue 14:41:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:

HIGH

Modulation:

QAM 64

TX Frequency

2483.5MHz

*Michael D Wyman*

Performed by:

Michael Wyman

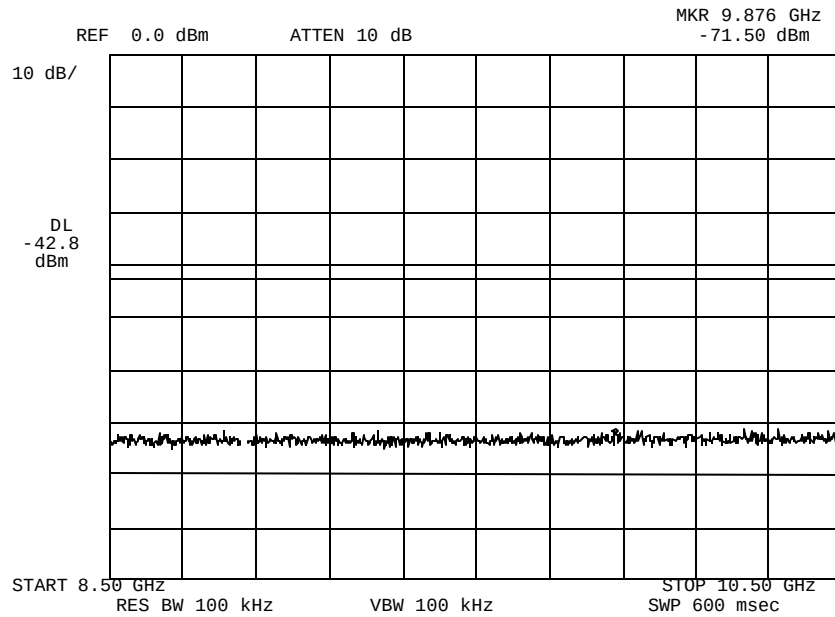
Name of Test: 2483.5MHz Conducted Emissions

### Measurement Results

g0730111: 2007-Mar-27 Tue 14:42:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:

HIGH

Modulation:

QAM 64

TX Frequency

2483.5MHz

*Michael D Wyman*

Performed by:

Michael Wyman

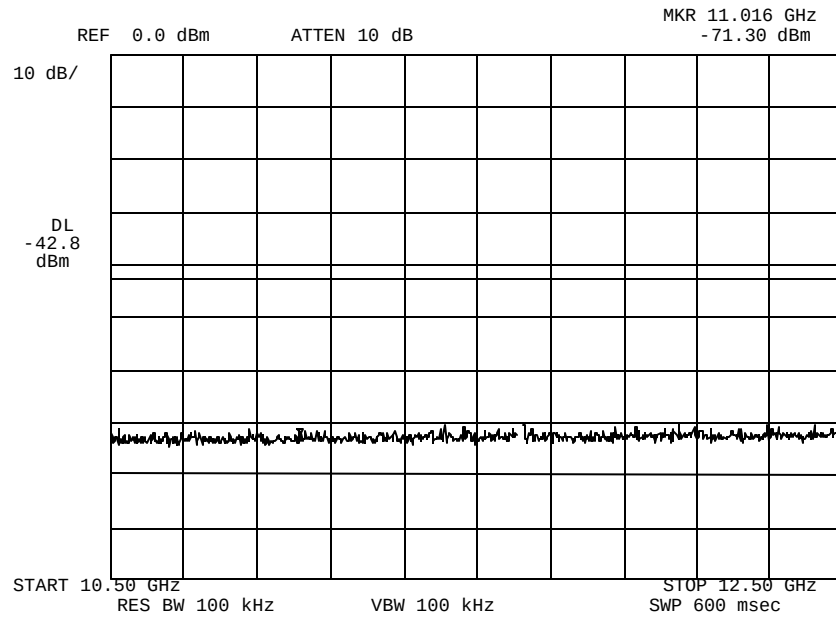
Name of Test: 2483.5MHz Conducted Emissions

### Measurement Results

g0730112: 2007-Mar-27 Tue 14:42:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:

HIGH

Modulation:

QAM 64

TX Frequency

2483.5MHz

*Michael D Wyman*

Performed by:

Michael Wyman



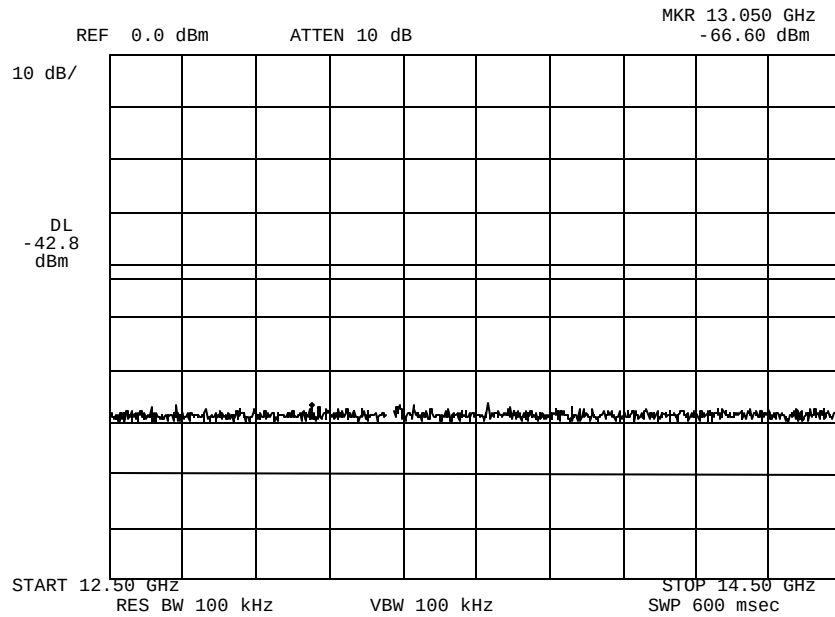
Name of Test: 2483.5MHz Conducted Emissions

### Measurement Results

g0730113: 2007-Mar-27 Tue 14:43:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:

Modulation:

TX Frequency

HIGH

QAM 64

2483.5MHz

*Michael D Wyman*

Performed by:

Michael Wyman

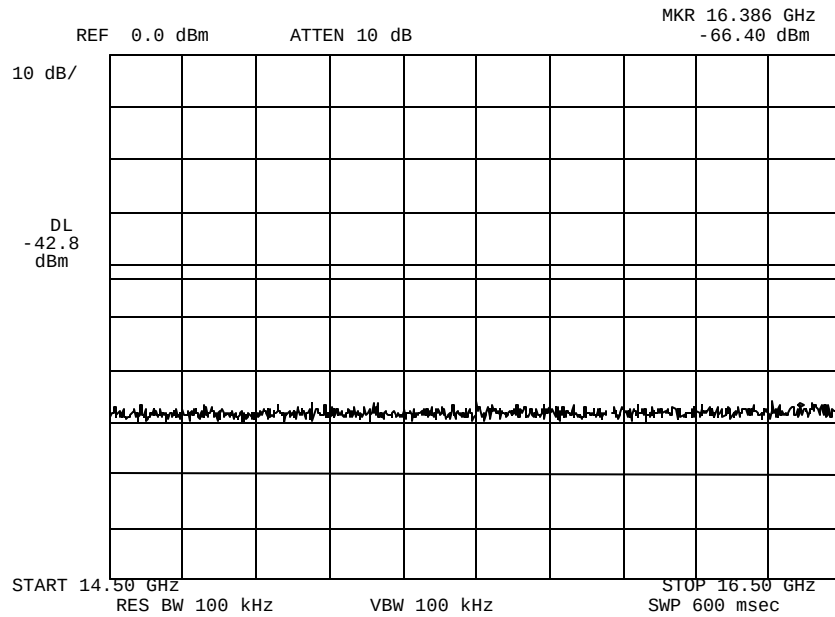
Name of Test: 2483.5MHz Conducted Emissions

### Measurement Results

g0730114: 2007-Mar-27 Tue 14:43:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:

HIGH

Modulation:

QAM 64

TX Frequency

2483.5MHz

*Michael D Wyman*

Performed by:

Michael Wyman

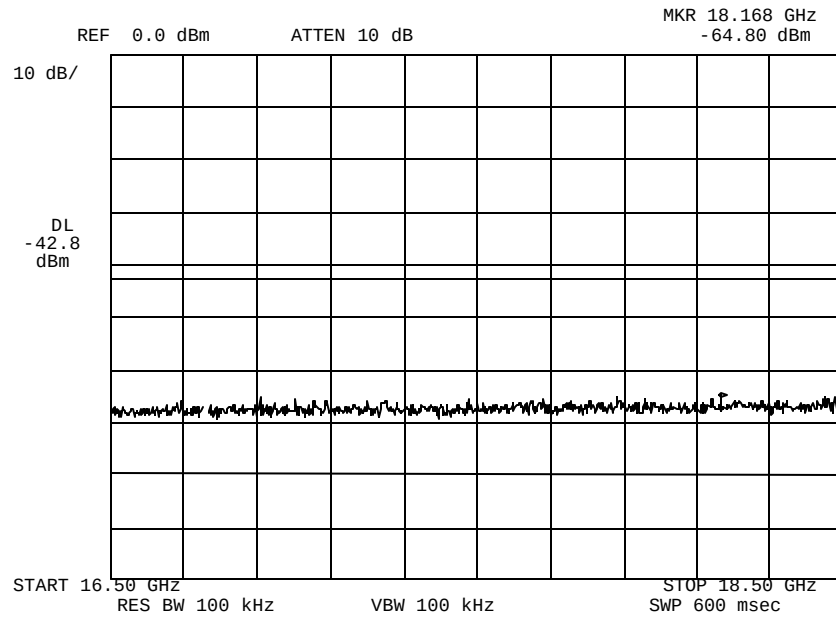
Name of Test: 2483.5MHz Conducted Emissions

### Measurement Results

g0730115: 2007-Mar-27 Tue 14:44:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:

HIGH

Modulation:

QAM 64

TX Frequency

2483.5MHz

*Michael D Wyman*

Performed by:

Michael Wyman

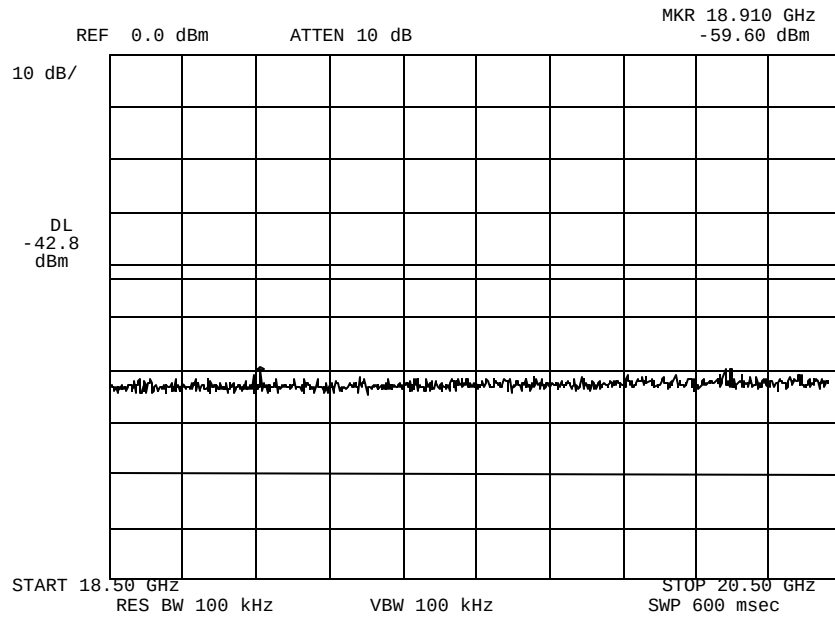
Name of Test: 2483.5MHz Conducted Emissions

### Measurement Results

g0730116: 2007-Mar-27 Tue 14:45:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:

HIGH

Modulation:

QAM 64

TX Frequency

2483.5MHz

*Michael D Wyman*

Performed by:

Michael Wyman

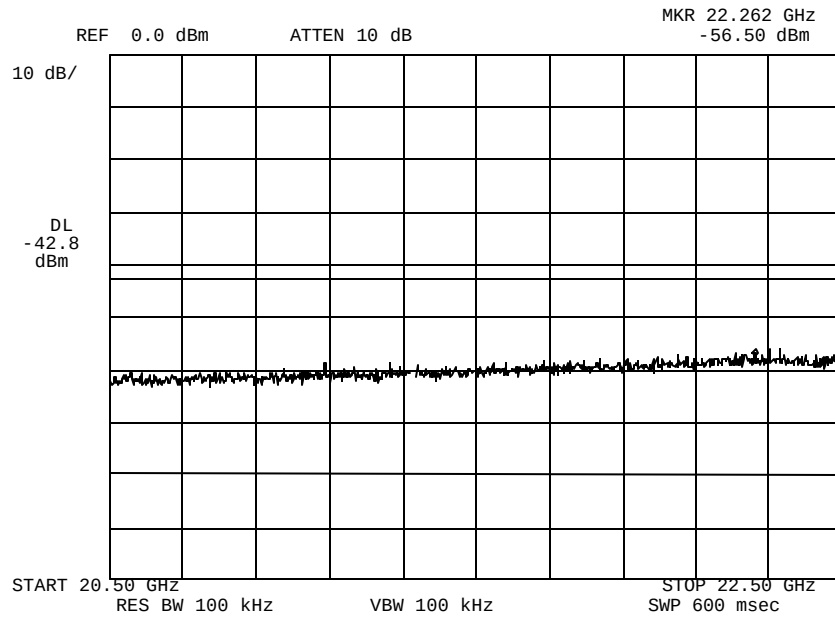
Name of Test: 2483.5MHz Conducted Emissions

### Measurement Results

g0730117: 2007-Mar-27 Tue 14:46:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:

HIGH

Modulation:

QAM 64

TX Frequency

2483.5MHz

*Michael D Wyman*

Performed by:

Michael Wyman

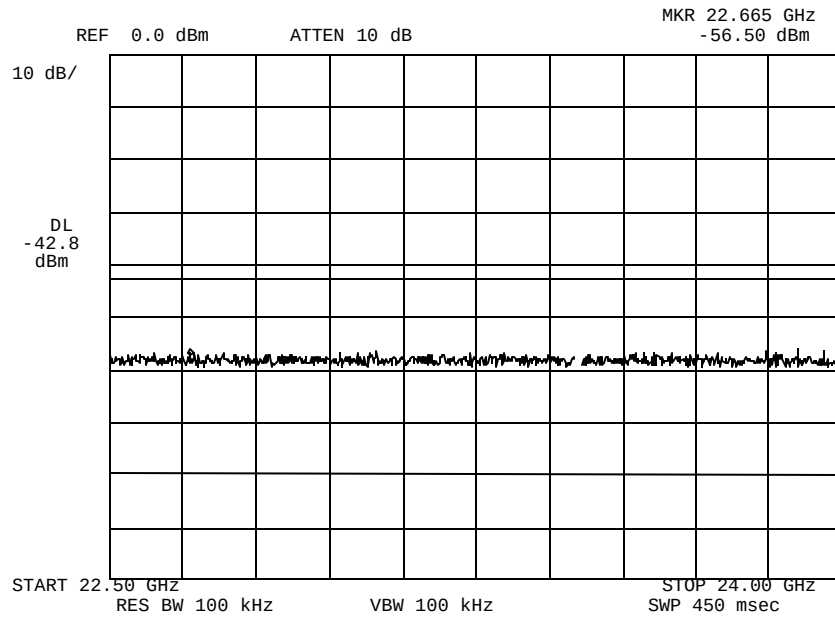
Name of Test: 2483.5MHz Conducted Emissions

### Measurement Results

g0730118: 2007-Mar-27 Tue 14:47:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:

HIGH

Modulation:

QAM 64

TX Frequency

2483.5MHz

*Michael D Wyman*

Performed by:

Michael Wyman

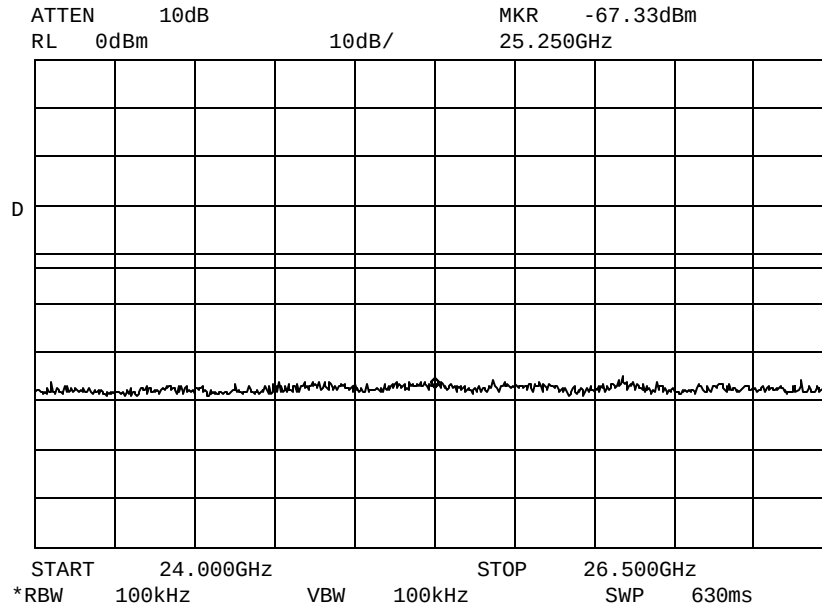
Name of Test: 2483.5MHz Conducted Emissions

### Measurement Results

g0730125: 2007-Mar-28 Wed 07:26:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:

Modulation:

TX Frequency

HIGH

QAM 64

2483.5MHz

*Michael D Wyman*

Performed by:

Michael Wyman

**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

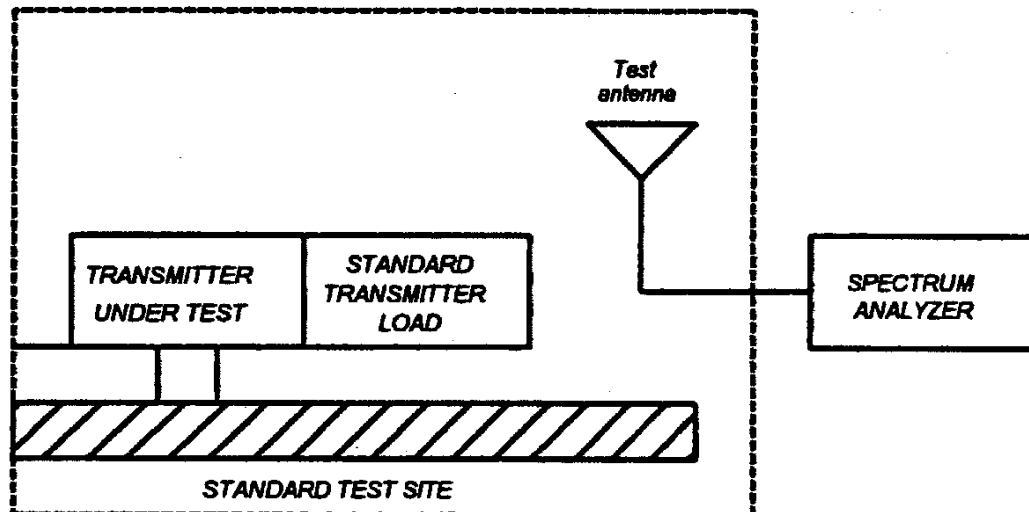
### Measurement Procedure

#### 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.

#### Method of Measurement:

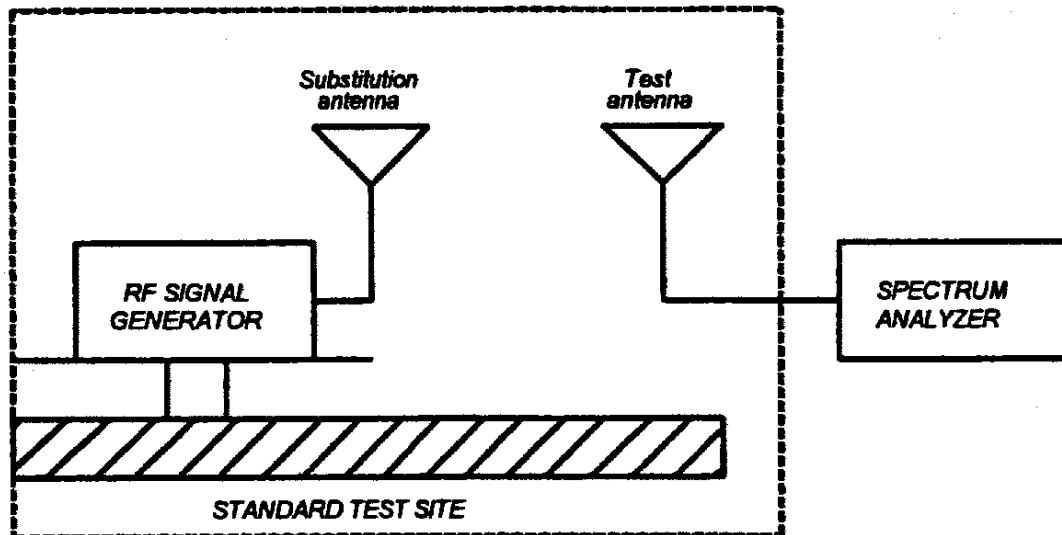
- A) Connect the equipment as illustrated
- B) Adjust the spectrum analyzer for the following settings:
  - 1) Resolution Bandwidth 100 kHz (<1 GHz), 1 MHz (> 1GHz).
  - 2) Video Bandwidth = 3 times Resolution Bandwidth, or 30 kHz (22.917)
  - 3) Sweep Speed  $\leq 2000$  Hz/second
  - 4) Detector Mode = 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  $\pm$  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 =

$$10\log_{10}(\text{TX power in watts}/0.001) - \text{the levels in step I)}$$

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

**Test Equipment**

| Asset                         | Description               | s/n        | Cycle  | Last Cal |
|-------------------------------|---------------------------|------------|--------|----------|
| <b>Transducer</b>             |                           |            |        |          |
| X i00088                      | EMCO 3109-B 25MHz-300MHz  | 2336       | 24 mo. | Oct-05   |
| X i00089                      | Apriel 2001 200MHz-1GHz   | 001500     | 24 mo. | Oct-05   |
| X i00103                      | EMCO 3115 1GHz-18GHz      | 9208-3925  | 36 mo. | Sep-06   |
| <b>Amplifier</b>              |                           |            |        |          |
| X i00028                      | HP 8449A                  | 2749A00121 | 12 mo. | Jun-06   |
| <b>Spectrum Analyzer</b>      |                           |            |        |          |
| X i00029                      | HP 8563E                  | 3213A00104 | 12 mo. | Jan-06   |
| X i00033                      | HP 85462A                 | 3625A00357 | 12 mo. | Oct-05   |
| <b>Substitution Generator</b> |                           |            |        |          |
| X i00067                      | HP 8920A Communication TS | 3345U01242 | 12 mo. | Jun-06   |
| i00207                        | HP 8753D Network Analyzer | 3410A08514 | 12 mo. | May-06   |

**Microphone, Antenna Port, and Cabling**

|                              |       |              |       |              |
|------------------------------|-------|--------------|-------|--------------|
| Microphone                   | _____ | Cable Length | _____ | Meters       |
| Antenna Port Terminated      | _____ | Load         | _____ | Antenna Gain |
| All Ports Terminated by Load | _____ | Peripheral   | _____ |              |

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

### Measurement Results

g0730120: 2007-Mar-27 Tue 15:28:00

STATE: 2:High Power

Ambient Temperature: 23°C ± 3°C

| Frequency Tuned, MHz | Frequency Emission, MHz | EIRP, dBm |
|----------------------|-------------------------|-----------|
| 1990.000000          | 3980.233333             | -41.54    |
| 1990.000000          | 5970.233333             | -38.14    |
| 1990.000000          | 7960.233333             | -34.24    |

Note: There were no observable signals past the 4<sup>th</sup> harmonic. The EUT was scanned to the 10<sup>th</sup> harmonic.

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

### Measurement Results

g0730121: 2007-Mar-27 Tue 15:35:00

STATE: 2:High Power

Ambient Temperature: 23°C ± 3°C

| Frequency Tuned, MHz | Frequency Emission, MHz | EIRP, dBm |
|----------------------|-------------------------|-----------|
| 2110.000000          | 4220.233333             | -42.64    |
| 2110.000000          | 6330.233333             | -39.64    |
| 2110.000000          | 8440.233333             | -32.94    |

Note: There were no observable signals past the 4<sup>th</sup> harmonic. The EUT was scanned to the 10<sup>th</sup> harmonic

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

### Measurement Results

g0730122: 2007-Mar-27 Tue 15:38:00

STATE: 2:High Power

Ambient Temperature: 23°C ± 3°C

| Frequency Tuned, MHz | Frequency Emission, MHz | EIRP, dBm |
|----------------------|-------------------------|-----------|
| 2450.000000          | 4900.233333             | -40.54    |
| 2450.000000          | 7350.233333             | -35.04    |
| 2450.000000          | 9800.233333             | -30.84    |

Note: There were no observable signals past the 4<sup>th</sup> harmonic. The EUT was scanned to the 10<sup>th</sup> harmonic

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

**Measurement Results**

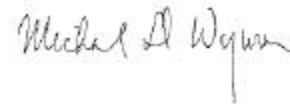
g0730123: 2007-Mar-27 Tue 15:42:00

STATE: 2:High Power

Ambient Temperature: 23°C ± 3°C

| Frequency Tuned, MHz | Frequency Emission, MHz | EIRP, dBm |
|----------------------|-------------------------|-----------|
| 2483.500000          | 4967.233333             | -41.44    |
| 2483.500000          | 7450.733333             | -35.14    |
| 2483.500000          | 9934.233333             | -32.04    |

Note: There were no observable signals past the 4<sup>th</sup> harmonic. The EUT was scanned to the 10<sup>th</sup> harmonic



Performed by:

Michael Wyman

**Name of Test:** Occupied Bandwidth

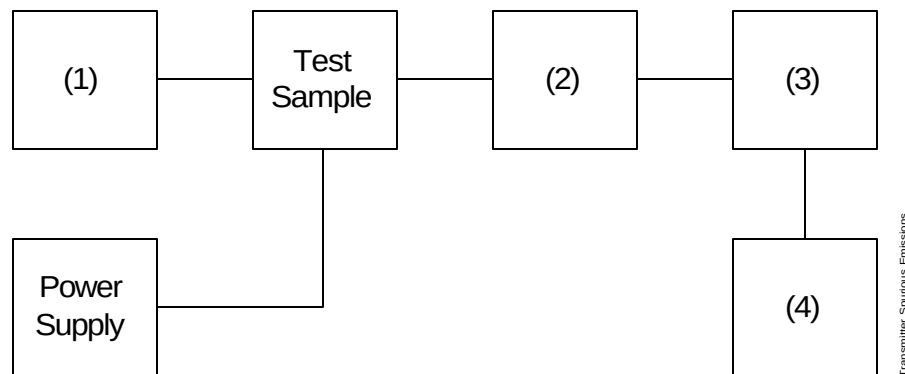
**Specification:** 47 CFR 2.1049(c)(1)

**Guide:** ANSI/TIA/EIA-603-1992, Paragraph 2.2.11

### Measurement Procedure

- A) The EUT and test equipment were set up as shown below
- B) For EUTs supporting audio modulation, the audio signal generator was adjusted to the frequency of maximum response and with output level set for  $\pm 2.5/\pm 1.25$  kHz deviation (or 50% modulation). With level constant, the signal level was increased 16 dB.
- 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 |
|---------------------------------------|--------------------------------|------------|--------|----------|
| <b>(1) Audio Oscillator/Generator</b> |                                |            |        |          |
| X i00324                              | HP 8903B Modulation Meter      | 3011A09079 | 12 mo. | Oct-06   |
| <b>(2) Coaxial Attenuator</b>         |                                |            |        |          |
| X i00231/2                            | PASTERNAK PE7021-30 (30 dB)    | 231 or 232 | N/A    | NCR      |
| i00123                                | NARDA 766 (10 dB)              | 7802A      | N/A    | NCR      |
| <b>(3) Interface</b>                  |                                |            |        |          |
| X i00021                              | HP 8954A Transceiver Interface | 2146A00159 | N/A    | NCR      |
| <b>(4) Spectrum Analyzer</b>          |                                |            |        |          |
| X i00048                              | HP 8566B Spectrum Analyzer     | 2511A01467 | 12 mo. | Aug-06   |
| i00029                                | HP 8563E Spectrum Analyzer     | 3213A00104 | 12 mo. | Jan-06   |

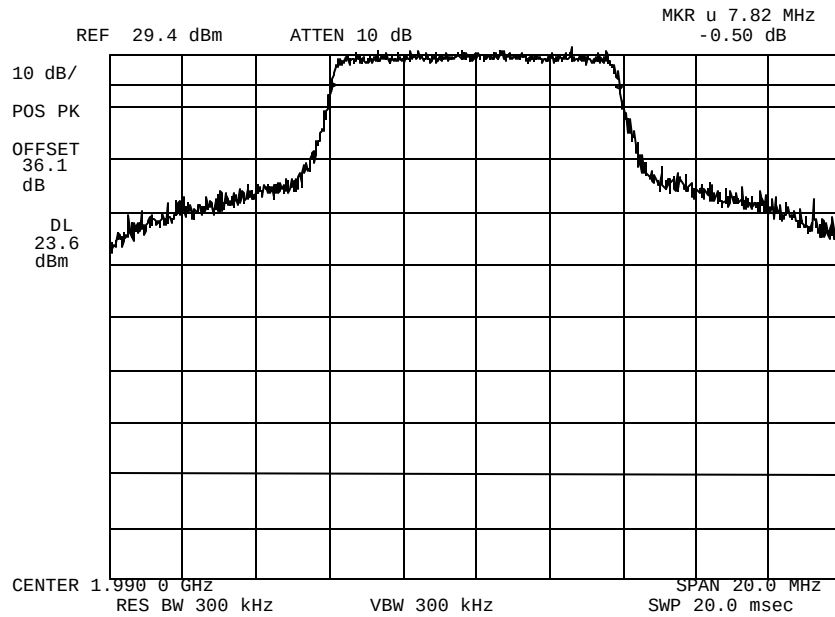
Name of Test: Occupied Bandwidth

### Measurement Results

g0730051: 2007-Mar-26 Mon 13:46:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:

HIGH 1990

Modulation:

QPSK

6DB BW = 7.82MHz

*Michael D Wyman*

Performed by:

Michael Wyman



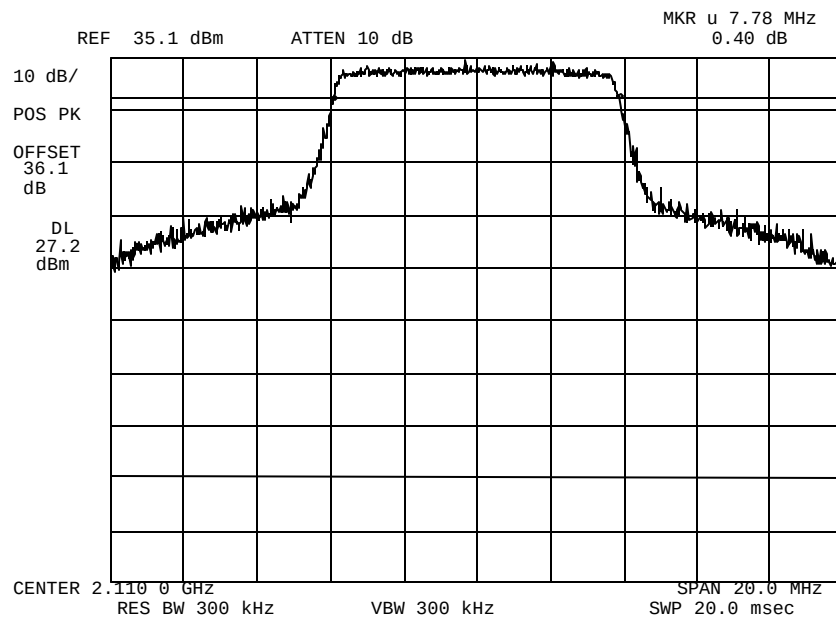
Name of Test: Occupied Bandwidth

### Measurement Results

g0730053: 2007-Mar-26 Mon 13:52:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:

HIGH 2110

Modulation:

QPSK

6DB BW = 7.78MHz

*Michael D Wyman*

Performed by:

Michael Wyman

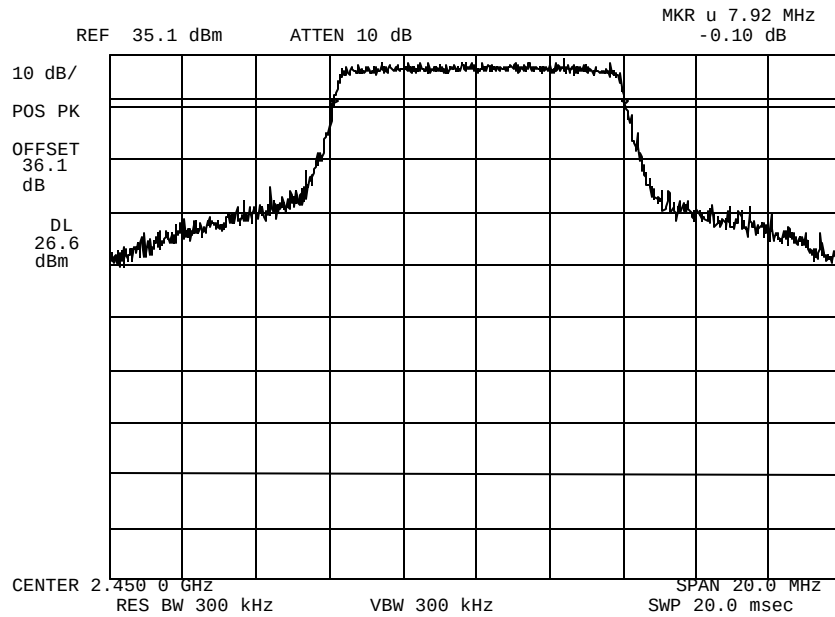
Name of Test: Occupied Bandwidth

### Measurement Results

g0730055: 2007-Mar-26 Mon 13:55:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:

HIGH 2450

Modulation:

QPSK

6DB BW = 7.92MHz

*Michael D Wyman*

Performed by:

Michael Wyman

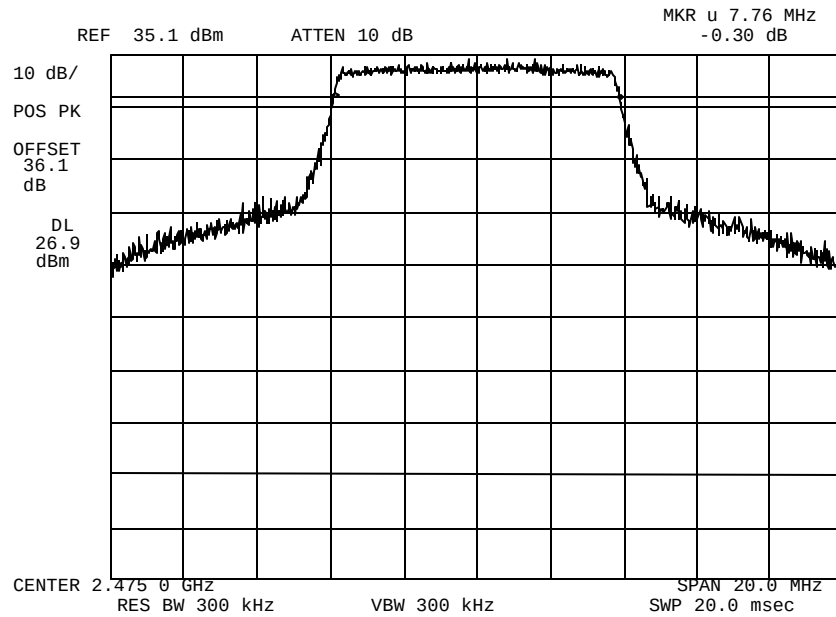
Name of Test: Occupied Bandwidth

### Measurement Results

g0730057: 2007-Mar-26 Mon 13:59:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:

HIGH 2470

Modulation:

QPSK

6DB BW = 7.76MHz

*Michael D Wyman*

Performed by:

Michael Wyman

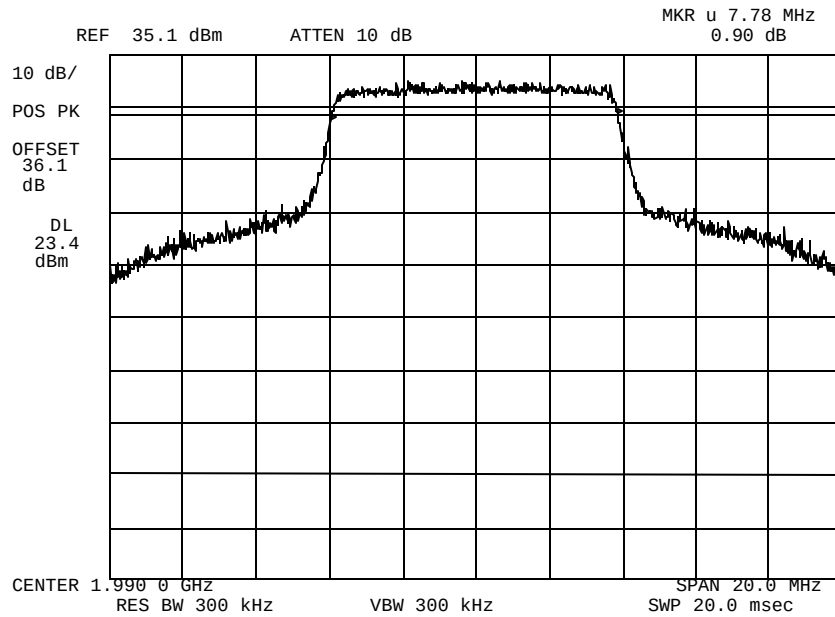
Name of Test: Occupied Bandwidth

### Measurement Results

g0730059: 2007-Mar-26 Mon 14:17:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:

HIGH 1990

Modulation:

QAM 16

6DB BW = 7.78MHz

*Michael D Wyman*

Performed by:

Michael Wyman

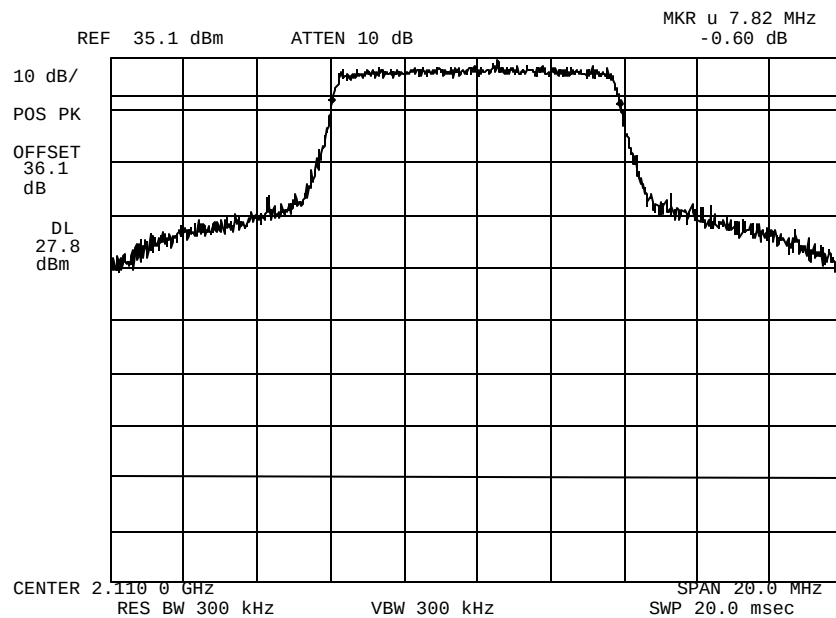
Name of Test: Occupied Bandwidth

### Measurement Results

g0730061: 2007-Mar-26 Mon 14:19:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:

HIGH 2110

Modulation:

QAM 16

6DB BW = 7.82MHz

*Michael D Wyman*

Performed by:

Michael Wyman

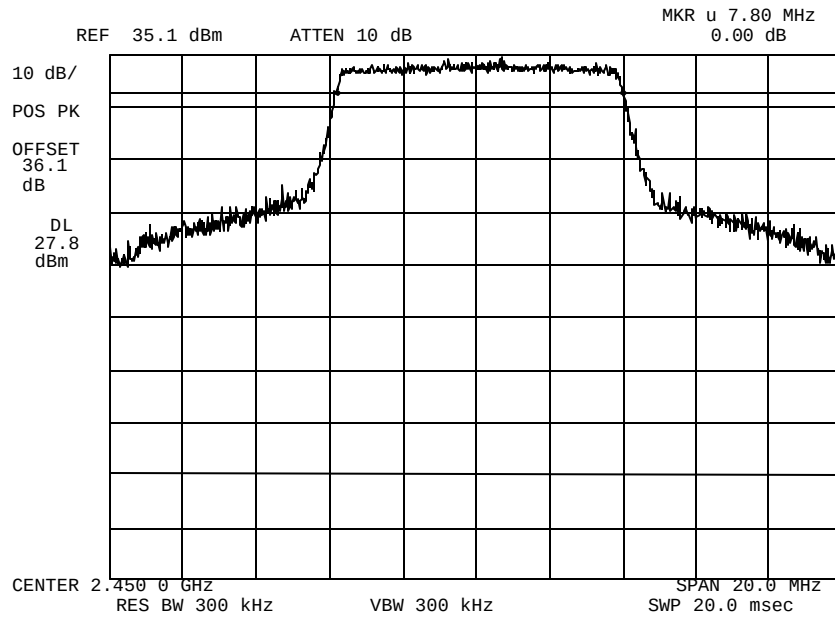
Name of Test: Occupied Bandwidth

### Measurement Results

g0730063: 2007-Mar-26 Mon 14:22:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:

HIGH 2450

Modulation:

QAM 16

6DB BW = 7.80MHz

*Michael D Wyman*

Performed by:

Michael Wyman

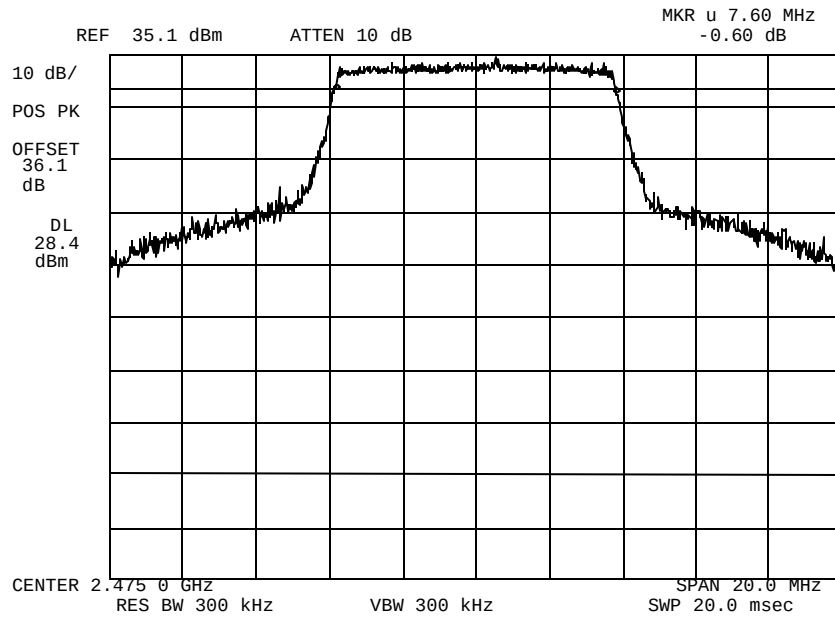
Name of Test: Occupied Bandwidth

### Measurement Results

g0730065: 2007-Mar-26 Mon 14:24:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:

HIGH 2475

Modulation:

QAM 16

6DB BW =7.60MHz

*Michael D Wyman*

Performed by:

Michael Wyman

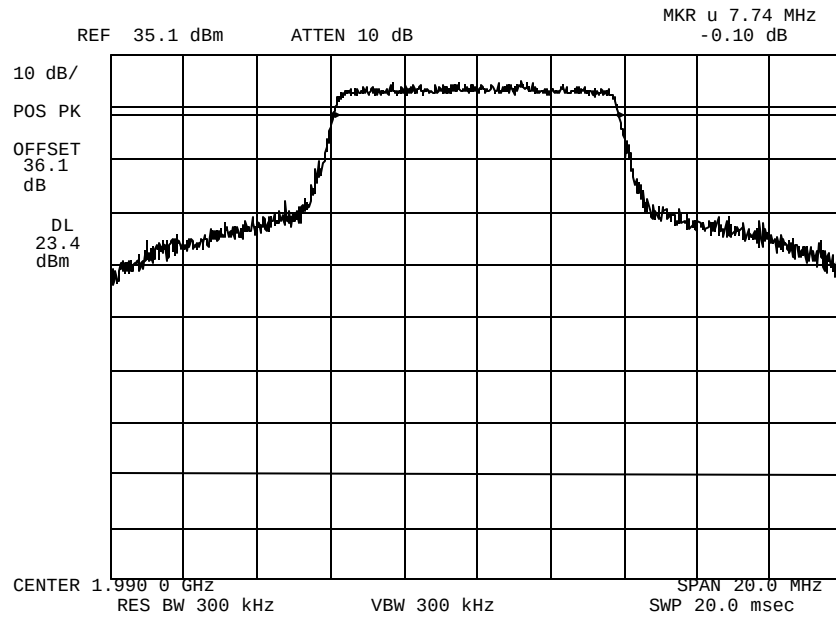
Name of Test: Occupied Bandwidth

### Measurement Results

g0730067: 2007-Mar-26 Mon 14:28:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:

HIGH 1990

Modulation:

QAM 64

6DB BW = 7.74MHz

*Michael D Wyman*

Performed by:

Michael Wyman



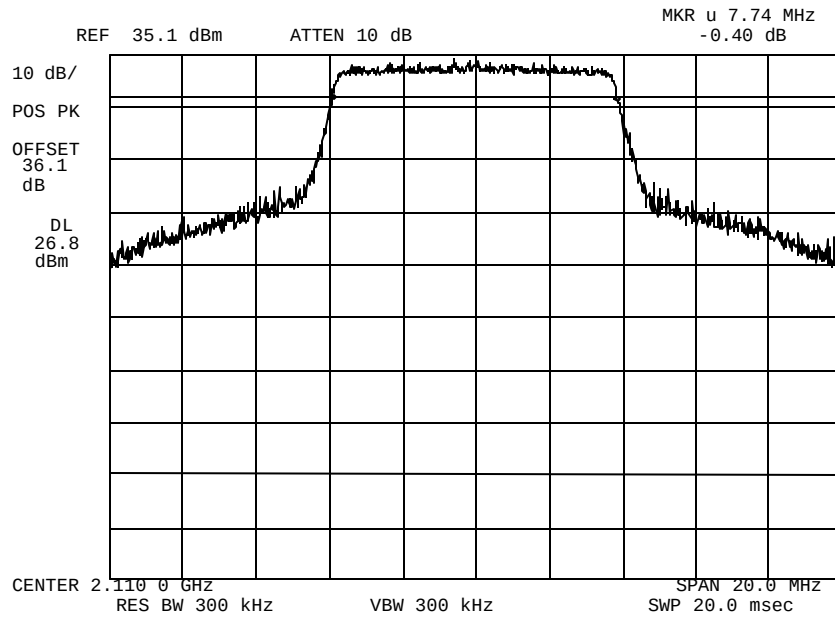
Name of Test: Occupied Bandwidth

### Measurement Results

g0730069: 2007-Mar-26 Mon 14:31:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:

HIGH 2110

Modulation:

QAM 64

6DB BW = 7.74MHz

*Michael D Wyman*

Performed by:

Michael Wyman

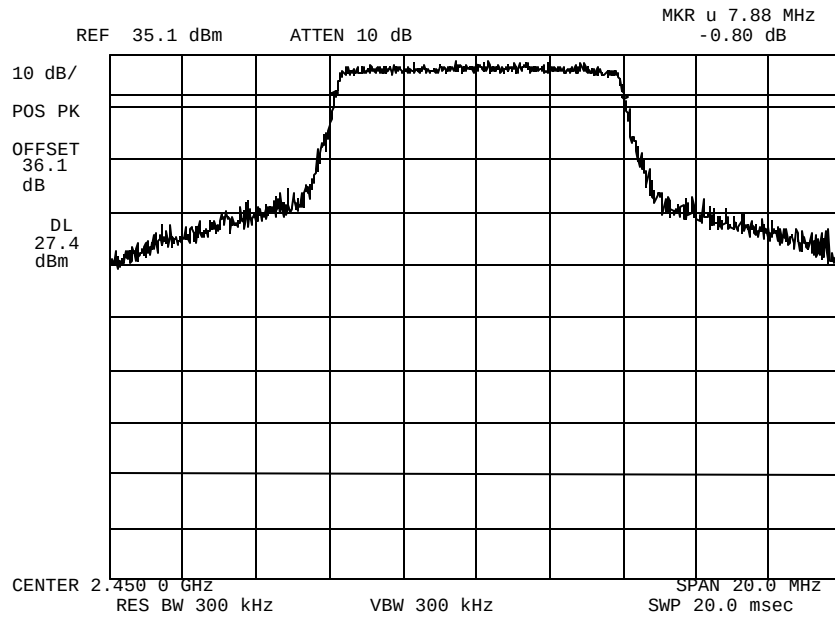
Name of Test: Occupied Bandwidth

### Measurement Results

g0730071: 2007-Mar-26 Mon 14:34:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:

HIGH 2450

Modulation:

QAM 64

6DB BW =7.88MHz

*Michael D Wyman*

Performed by:

Michael Wyman

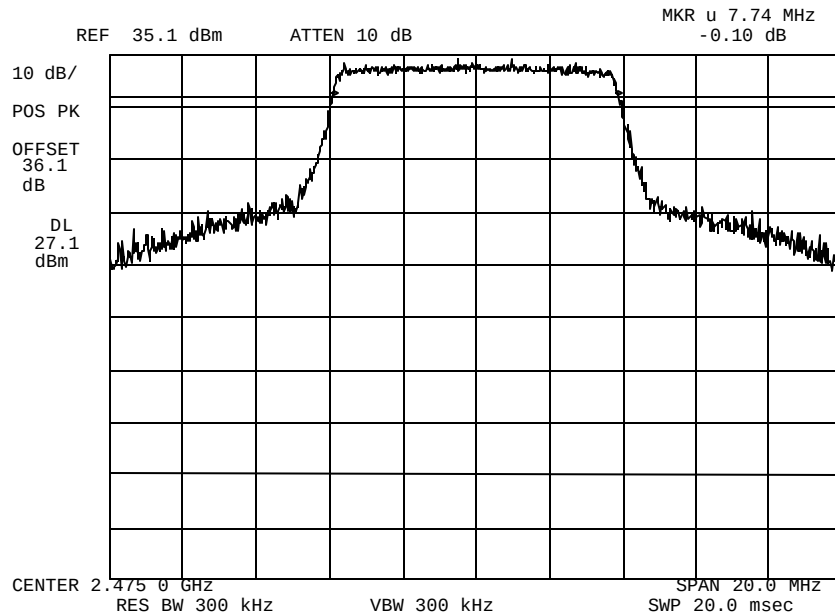
Name of Test: Occupied Bandwidth

### Measurement Results

g0730073: 2007-Mar-26 Mon 14:37:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:

HIGH 2475

Modulation:

QAM 64

6DB BW = 7.74MHz

*Michael D Wyman*

Performed by:

Michael Wyman

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

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

Modulation = 7M75F3W

**Necessary Bandwidth Calculation:**

|                                    |                                          |
|------------------------------------|------------------------------------------|
| Maximum Modulation (M), kHz        | = 3                                      |
| Maximum Deviation (D), kHz         | = 5                                      |
| Constant Factor (K)                | = 1                                      |
| Necessary Bandwidth ( $B_N$ ), kHz | = $(2 \times M) + (2 \times D \times K)$ |
|                                    | = 16.0                                   |

Modulation = 12M0F8W

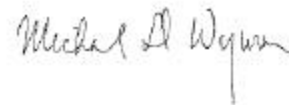
**Necessary Bandwidth Calculation:**

|                                    |                                          |
|------------------------------------|------------------------------------------|
| Maximum Modulation (M), kHz        | = 3                                      |
| Maximum Deviation (D), kHz         | = 5                                      |
| Constant Factor (K)                | = 1                                      |
| Necessary Bandwidth ( $B_N$ ), kHz | = $(2 \times M) + (2 \times D \times K)$ |
|                                    | = 16.0                                   |

Modulation = 12M0W7D

**Necessary Bandwidth Calculation:**

|                                    |                                          |
|------------------------------------|------------------------------------------|
| Maximum Modulation (M), kHz        | = 3                                      |
| Maximum Deviation (D), kHz         | = 5                                      |
| Constant Factor (K)                | = 1                                      |
| Necessary Bandwidth ( $B_N$ ), kHz | = $(2 \times M) + (2 \times D \times K)$ |
|                                    | = 16.0                                   |



Performed by:

Michael Wyman

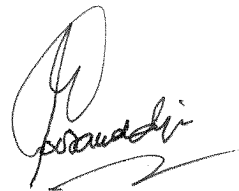
END OF TEST REPORT

**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:



Hoosamuddin S. Bandukwala, Lab Director