L. S. Compliance, Inc.
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Cedarburg, Wisconsin 53012

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# L. S. Compliance, Inc.

*Compliance Testing of:*

## K & A WIRELESS

## MODEL VTRAN-2500

## SPREAD SPECTRUM TRANSMITTER MODULE

*Prepared for:*

*K & A WIRELESS*

*Test Report Number: 90057a (revised)*

*Date(s) of Testing:*

*May 7, 12,19; July 2; Aug 14; Sept 30; Oct 1, 1999*

# Table of Contents:

# DESCRIPTION OF MEASUREMENT FACILITIES

Site on File with the FCC

ID Number: 31040 / SIT

1300F2

*" The site referenced above has been found to comply with the test site criteria found in ANSI C63.4-1992 and 47CFR Section 2.948."*

THE AMERICAN
ASSOCIATION
FOR LABORATORY
ACCREDITATION

## ACCREDITED LABORATORY

A2LA has accredited

**L.S. COMPLIANCE, INC.**
**Cedarburg, WI**

for technical competence in the field of

**Electrical (EMC) Testing**

The accreditation covers the specific tests and types of tests listed on the agreed scope of accreditation. This laboratory meets the requirements of ISO/IEC Guide 25-1990 "General Requirements for the Competence of Calibration and Testing Laboratories" (equivalent to relevant requirements of the ISO 9000 series of standards) and any additional program requirements in the identified field of testing.

Presented this 30th day of December, 1998.

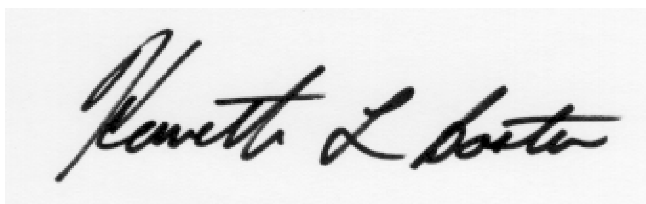
President
For the Accreditation Council
Certificate Number 1255.01
Valid to January 31, 2001

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

# ***SIGNATURE PAGE***

tested By:

Prepared By:



11 November 1999

Kenneth L. Boston, EMC Lab Manager — Date

PE #31926

Registered Professional Engineer

(State of Wisconsin)

## 2.3 Summary of Test Report

| | |
|---|---|
| MANUFACTURER: | K & A Wireless |
| MODEL: | VTRAN-2500 |
| SERIAL: | pre-production |
| DESCRIPTION: | SPREAD SPECTRUM RADIO MODULE |
| FREQUENCY RANGE: | 2400-2483.5 |

The K & A Wireless model VTRAN-2500 was found to **"meet"** the radiated emission specification of Title 47 CFR FCC, Part 15, subpart C. for an intentional radiator

This product is a small 2.4 GHz Spread Spectrum video transmitter module that is integrated with a camera, battery powered, and the resultant package is worn on the body. This package is designed for use by Emergency personnel ( primarily firefighters); to monitor the environment at the scene of the fire; and to ensure the safety of the personnel. Therefore, this report will contain data that is pertinent to the certification of the transmitter module.

## 2.4 INTRODUCTION

During various dates spanning from May through October of 1999, a series of Emissions tests were performed on two sample models of the K & A Wireless model VTRAN-2500, a spread spectrum transmitter module, designed for short distance video transmission. These tests were performed using the test procedures outlined in ANSI C63.4-1992 for intentional radiators, and in accordance with the requirements set forth in FCC Part 15.247 for a direct sequence spread spectrum transmitter. Tests were also performed as outlined in ANSI C63.4-1992 for non-intentional radiators, in order to verify compliance with the limits set forth in part 15.109 for and to allow verification of emissions for the digital section of the product. These tests were performed by Kenneth L. Boston, PE, of L. S. Compliance, Inc..

## 2.5 PURPOSE

The above mentioned tests were performed in order to determine the compliance of the K & A Wireless model VTRAN-2500 with limits contained in various provisions of Title 47 CFR, FCC Part 15, including:

| | | |
|---|---|---|
| 15.207 | 15.247b | 15.247e |
| 15.205 | 15.247c | 15.109 |
| 15.247a2 | 15.247d | |

All radiated emissions tests were performed to measure the emissions in the frequency bands described by the above sections, and to determine whether said emissions are below the limits established by the above sections. These tests were performed in accordance with the procedure described in the American National Standard for methods of measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ANSI C63.4-1992). Another document used as reference for the EMI receiver specification was the International Special Committee on Radio Interference (CISPR) number 16-1 (1993). Measurement technique guidelines found in Appendix C to FCC 97-114 were also consulted. During all tests, video modulation consisting of color bars was supplied to the transmitter via a short cable from an NTSC pattern generator.

## 2.6 Power Output Test Performed

For the 15.247b measurement, the output of the K & A Wireless model VTRAN-2500 module was connected via a short jumper cable created only for this measurement, into the input of the HP E4407B Spectrum Analyzer. The unit was configured to run in a continuous transmit mode, while being supplied with NTSC color bars as a modulation source. The HP receiver was set to a 5 MHz Bandwidth, and the transmit signal was then stored, with the peak signal level stored. This power level was collected for all four channels and can be seen in the chart presented below.

| CHANNEL | CENTER FREQ (MHz) | LIMIT (dBm) | MEASURED POWER (dBm) | MARGIN (dB) |
|---|---|---|---|---|
| 1 | 2412 | 30 dBm | 14.63 | 15.37 |
| 2 | 2427 | 30 dBm | 16.21 | 13.79 |
| 3 | 2442 | 30 dBm | 16.81 | 13.19 |
| 4 | 2457 | 30 dBm | 14.81 | 15.19 |

## 2.7 Conducted RF Test Setup and measurements

FCC part 15.247 (c) requires an antenna conducted measurement of conducted harmonic and spurious levels, as reference to the carrier frequency in a 100 kHz bandwidth. For this test, the video transmitter module was directly connected to the HP E4407B spectrum analyzer, through a very short coaxial cable and a 10 DB attenuator. Plots were then taken, with any noticeable spurious or harmonic signals identified. No significant levels at any spurious products could be found within -20 dBc of the fundamental of the transmitter. Signals that were observed were greater than 50 dB down. (In the 100 kHz bandwidth)

## 2.8 Occupied Bandwidth Measurements

The 6 dB bandwidth requirement found in 15.247.a.2 is a minimum of 500 kHz. Direct measurement of the transmitted signal, via a direct cabled connection to the HP E4407B analyzer, was then used to determine the signal bandwidth. For each of the representative channels, refer to the graphs found in Appendix C. From this data, the bandwidth of channel 3 and 4, which is the closest data to the specification limit, is 3.05 MHz, which is above the minimum of 500 kHz.

| CHANNEL | CENTER FREQ (MHz) | MEASURED 6 dB BW (kHz) | MINIMUM LIMIT (kHz) |
|---|---|---|---|
| 1 | 2412 | 10,150 | 500 |
| 2 | 2427 | 3800 | 500 |
| 3 | 2442 | 3050 | 500 |
| 4 | 2457 | 3050 | 500 |

## 2.9 Power Spectral Density

In accordance with FCC part 15.247(d), the peak power spectral density should not exceed +8 dBm in any 3 kHz band. This measurement was performed along with the conducted power output readings performed as described in section 2.6. The peak output frequency for each representative frequency was scanned, with a narrow bandwidth, and reduced sweep, and a power density measurement was performed using the utility built into the HP analyzer. The resultant density was then corrected to a 3 kHz bandwidth, and can be determined by inspection of the graphs found in Appendix C. The highest density was found to be no greater than –16.4 dBm, which is under the allowable limit by 24.4 dB.

| CHANNEL | CENTER FREQ | MEASURED P | 3khz corr. | CORRECTED | SPEC | MARGIN |
|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | 2413 | -55.9 | 34.8 | -21.1 | +8.0dBm | 29.1 |
| 2 | 2428 | -54.4 | 34.8 | -19.6 | +8.0dBm | 27.6 |
| 3 | 2442 | -51.2 | 34.8 | -16.4 | +8.0dBm | 24.4 |
| 4 | 2456 | -55.4 | 34.8 | -20.6 | +8.0dBm | 28.6 |

## 2.10 Processing Gain

A report detailing the results of a jamming margin test performed upon a typical system containing the Harris Prism chipset, which is attached to this report, wherein the processing gain of the system was determined by using the CW jamming margin method. Because this product contains the same base-band processing chipset, reference is made to this report as fulfilling the processing gain requirement. The justification for this means of showing compliance is contained in an E-mail from the FCC engineering staff, a copy of which is found in appendix D. This test was performed within a screened room located on the L.S. Compliance facility, by Brian Petted, of L.S. Research, which is co-located with L. S. Compliance in Cedarburg.

## 2.11 RADIATED EMISSIONS TEST SETUP

The test sample was operated within the 3 meter Semi-Anechoic, FCC listed chamber located at L.S. Compliance in Cedarburg, WI. The sample was set up on a small fixture and placed on a wooden pedestal, which was centered on the flush-mounted 2m diameter metal turntable. The test sample was operated on its own [new] internal power supply, a regulator and gel-cell battery. The test sample while powered from the battery package, was configured to run in a continuous transmit mode during the 15.247 and 15.205 measurements. Video modulation was supplied to the unit during the testing, and was supplied from an NTSC Pattern Generator. One test sample was set to operate on either channel 1 (2412mhz), channel 2 (2427MHz), channel 3 (2442MHz), or channel 4 (2457MHz) while being tested as an intentional radiator, in order to determine compliance within a frequency range of 2400-2483.5 MHz, as dictated by FCC part 15.31m

Please refer to Section 2.15 for pictures of the test setup.

## 2.12 RADIATED EMISSION TEST PROCEDURE

The fundamental and spurious (harmonic) emissions of the transmitter were tested for compliance to Title 47 CFR, FCC Part 15.247c limits for Direct Sequence Spread Spectrum systems, and the 15.205 general limits, within the restricted bands. For the calculations used to determine the 1 meter limits, see Appendix A. The test sample was tested from the lowest frequency generated by the transmitter to the 10th harmonic of the fundamental frequency generated by the device.(25 GHz) The appropriate limits were also observed where any spurious signals were located within any of the restricted bands as described in Part 15.205a. These frequencies, and their associated limits, are referenced in Section 2.14. The sample was positioned on an 80 CM high pedestal and placed in the 3 Meter chamber and the antenna mast was placed such that the antenna was either 1 meter or 3 meters from the test object. A biconical antenna was used to measure emissions from 30 to 200 MHz, a log periodic was used to measure emissions from 200 to 1000 MHz, and a double ridged waveguide horn was used to measure emissions above 1 GHz.

The test object was set to operate in continuous transmit, and the resultant signals were maximized by rotating the turntable 360 degrees, and by raising and lowering the antenna between 1 and 4 meters. The test object was also given several different orientations to determine the maximum signal levels, using both horizontal and vertical antenna polarities. Emissions above 5 GHz were also measured at a 1 meter separation, using the HP 8563E analyzer and 8348A preamplifier.

No significant emissions were found aside from the transmitter fundamental and some spurious signals. The unit was scanned for emissions, over the range 30 to 25000 MHz to establish compliance with Part 15.247c and 15.205 for the system. The results of the system measurements are found in Appendix B, with graphs of the signature scans found in Appendix

## 2.13 TEST EQUIPMENT UTILIZED FOR RADIATED EMISSIONS TEST

A list of the test equipment and antennas used for the tests can be found in Section 2.17, which includes the calibration information as well as the equipment description. All equipment is calibrated and used according to the user manuals supplied by the manufacturer. All antenna calibrations were performed at a N.I.S.T traceable site, and the resultant correction factors were entered into the Hewlett Packard 8546A EMI receiver software database. The connecting cables used were also measured for loss using a calibrated signal generator and the HP 8546A EMI receiver. The resulting loss factors were entered into the HP 8546A database. This allowed for automatic changes in the antenna correction factor, as well as cable loss or other corrections, to be added to the EMI receiver display while taking measurements. Thus, the resulting data taken from the HP 8546A is an actual reading and can be entered into the database as a corrected meter reading. The HP 8546A EMI receiver was operated with a bandwidth of 120 kHz when receiving signals below 1 GHz, and with a bandwidth of 1 MHz when receiving signals above 1 GHz, in accordance with CISPR 16. Both the peak and Quasi-peak detector functions were used.

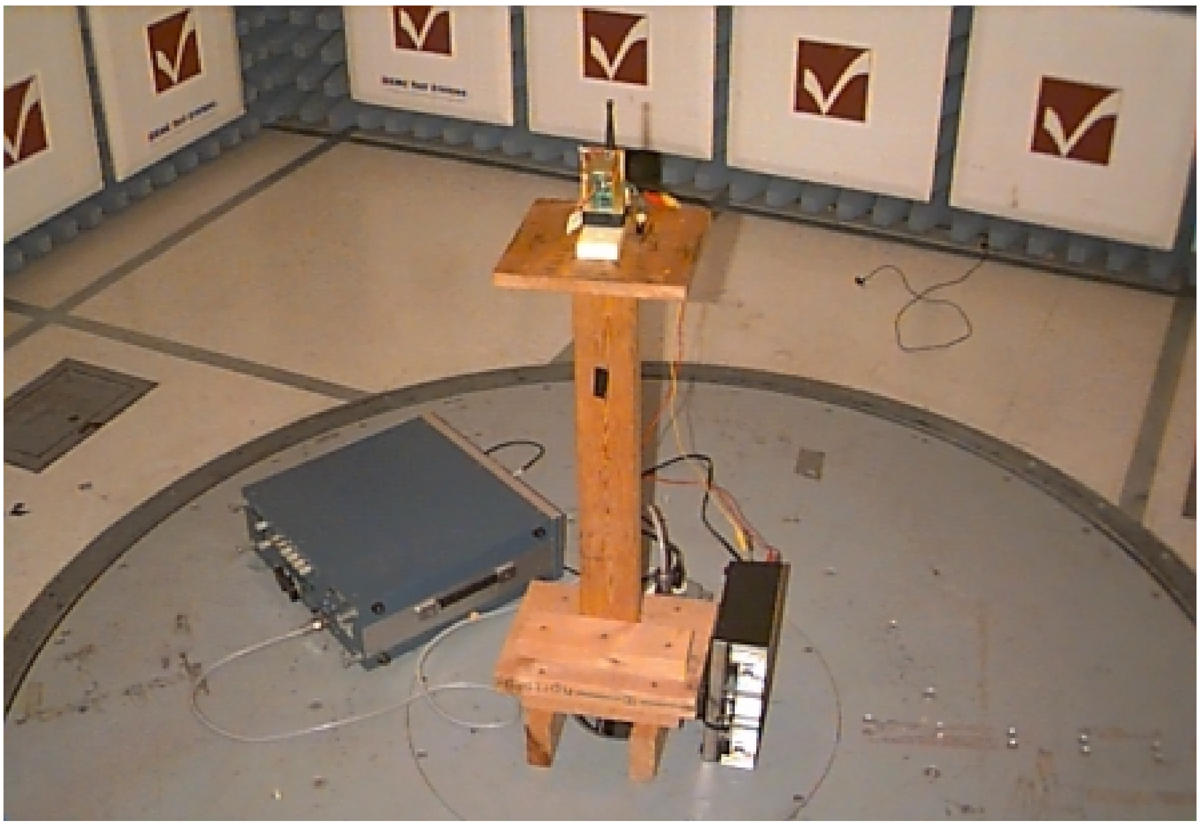
For measurements in the upper microwave region, a HP 8563E microwave spectrum analyzer and a HP 8348A preamplifier was leased from Hewlett Packard Corporation. Subsequently, a HP E4407B Spectrum analyzer was purchased from Hewlett Packard. Being that this instrument is an integrated system, all antenna factors, cable factors, and preamp gain factors are stored and recalled when initially calibrated and configured for use. Data appearing on the screen and measured during emissions testing is then presented as corrected readings. Data derived from the HP 8563E analyzer was raw data, and was corrected for preamplifier, cable and antenna factors in the tabular presentation. During emissions testing, signals where significant levels were noted were measured using the 1 MHz IF bandwidth, and a 10 or 100 Hz video bandwidth, resulting in an average measurement mode of the analyzer. Signal levels were also inspected using the 100 kHz bandwidth and compared to the maximum radiated signal in a 100 kHz bandwidth of the fundamental modulated carrier for the four channels tested.

## 2.14 - Restricted Bands affecting this product

3 Meter limits

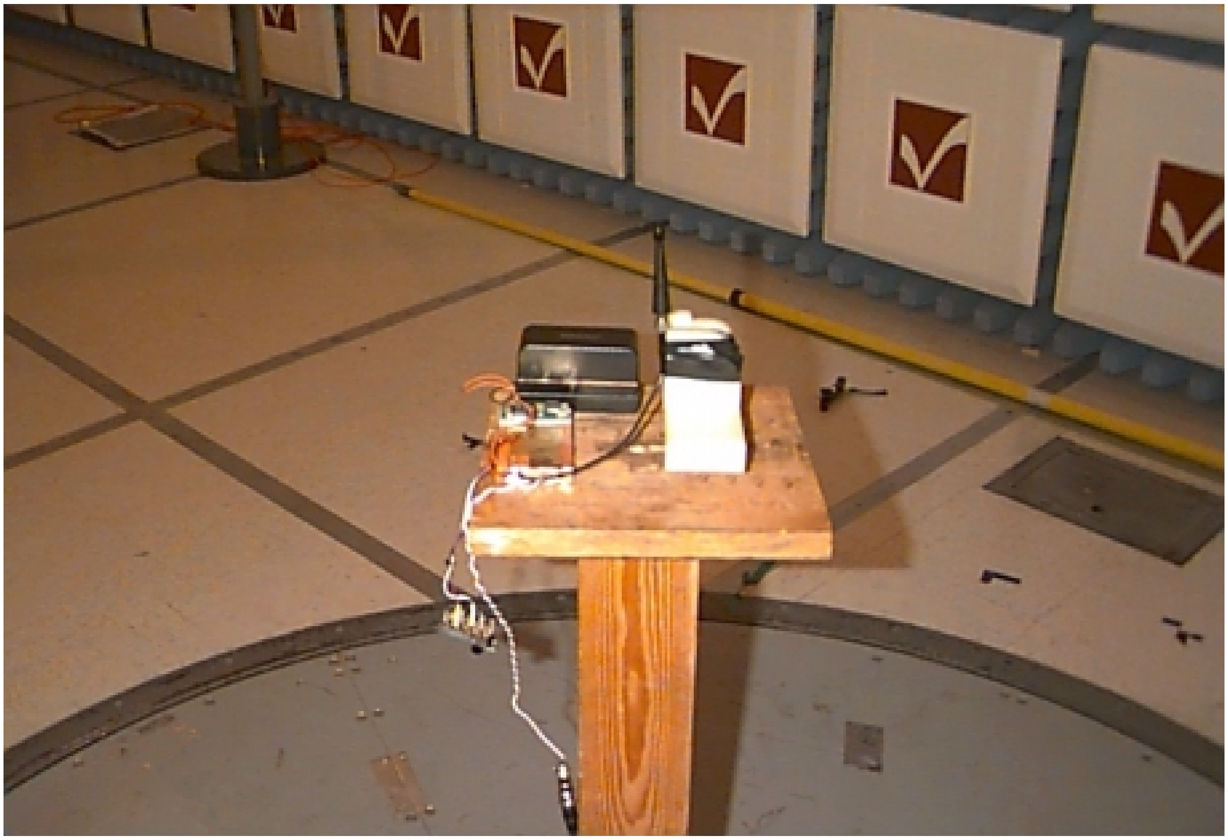
| Frequency (MHz) | Limit (μV) | Limit (dB / μV / m) |
|---|---|---|
| 162.013-167.17 | 150 | 43.5 |
| 167.72-173.2 | 150 | 43.5 |
| 240-285 | 200 | 46.0 |
| 960-1240 | 500 | 54.0 |
| 1300-1427 | 500 | 54.0 |
| 1435-1626.5 | 500 | 54.0 |
| 1645.5-1646.5 | 500 | 54.0 |
| 1660-1710 | 500 | 54.0 |
| 1718.8-1722.2 | 500 | 54.0 |
| 2200-2300 | 500 | 54.0 |
| 2310-2390 | 500 | 54.0 |
| 2483.5-2500 | 500 | 54.0 |
| 2655-2900 | 500 | 54.0 |
| 3260-3267 | 500 | 54.0 |
| 3332-3339 | 500 | 54.0 |
| 3345.8-3358 | 500 | 54.0 |
| 3600-4400 | 500 | 54.0 |
| 4500-5150 | 500 | 54.0 |
| 5350-5460 | 500 | 54.0 |
| 7250-7750 | 500 | 54.0 |
| 8025-8500 | 500 | 54.0 |
| 9000-9200 | 500 | 54.0 |
| 9300-9500 | 500 | 54.0 |
| 10600-12700 | 500 | 54.0 |
| 13250-13400 | 500 | 54.0 |
| 14470-14500 | 500 | 54.0 |
| 15350-16200 | 500 | 54.0 |
| 17700-21400 | 500 | 54.0 |
| 22010-23120 | 500 | 54.0 |
| 23600-24000 | 500 | 54.0 |

# 2.15 – Photos taken during testing

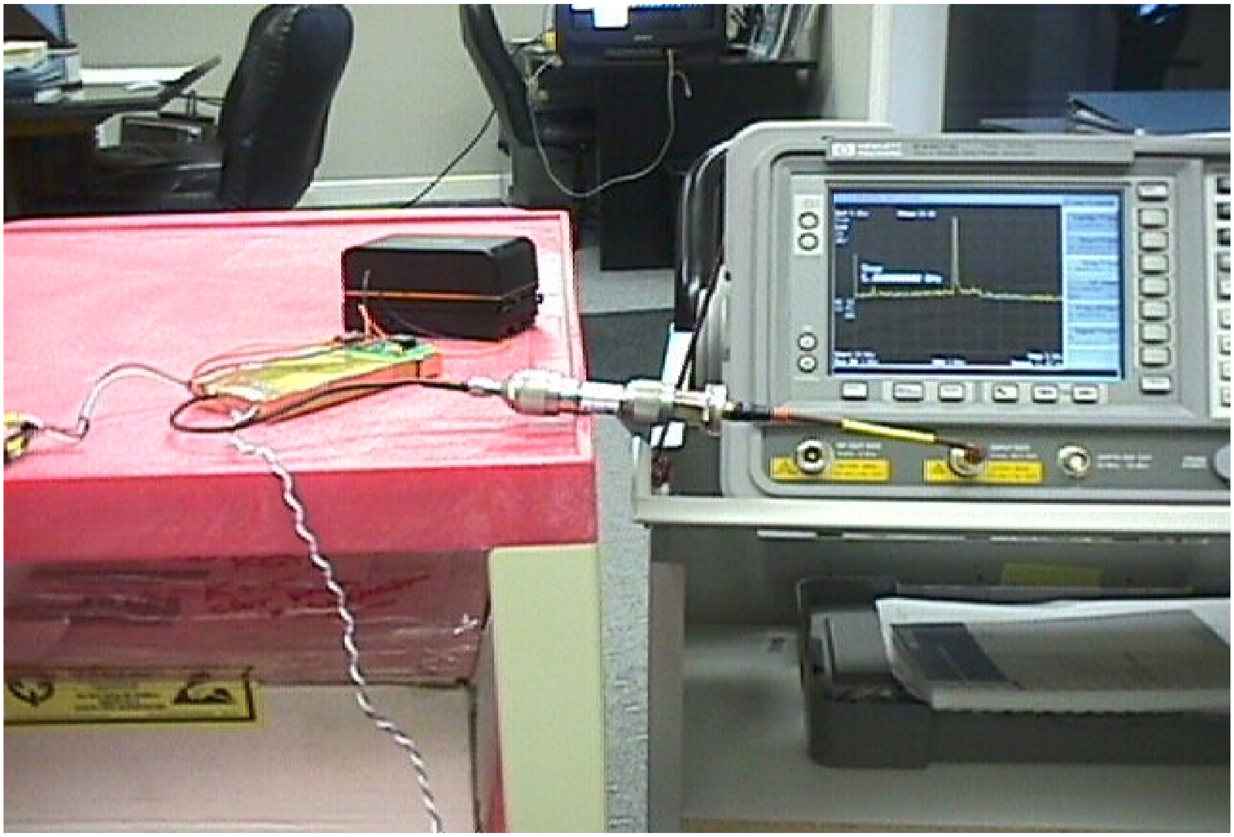


View of the K & A Wireless model VTRAN-2500 module during the Radiated Emissions tests.

This view shows the orientation of the product during tests of the emission from the system.



View of the K & A Wireless model VTRAN-2500 module during the Radiated Emissions tests.



View of the K & A Wireless model VTRAN-2500 module during conducted emission testing.

## 2.16 SUMMARY OF RESULTS AND CONCLUSIONS

Based on the procedures outlined in this report, and the test results included in appendices B and C, it can be determined that the K & A Wireless model VTRAN-2500 module does **"meet"** the emission requirements of Title 47 CFR, FCC Part 15 Subpart C for an intentional radiator. Some of the emissions, at 167 MHz and in the restricted bands immediately adjacent to the 2.4 GHz ISM are within 4 dB of the limits respectively, and could be found to be over the limits if these samples, or others were to be tested by another agency.

The enclosed test results pertain to the samples of the test item listed, and only for the tests performed on the data sheets. Any subsequent modification or changes to the test items could invalidate the data contained herein, and could therefore invalidate the findings of this report.

# 2.17 - Test Equipment

| Asset # | Manufacturer | Model # | Serial# | Description | Due Date |
|---|---|---|---|---|---|
| AA960004 | EMCO | 3146 | 9512-4276 | Log Periodic Antenna | 3aug2000 |
| AA960005 | EMCO | 3110B | 9601/2280 | Biconical Antenna | 3aug2000 |
| AA960007 | EMCO | 3115 | 99111-4198 | Double Ridge Horn Antenna | 1aug2000 |
| EE960004 | EMCO | 2090 | 9607-1164 | Mast/Ttable controller | I.O. |
| EE960014 | HP | 85460 | 3617A00320 | EMI receiver Display section | 23aug2000 |
| EE960013 | HP | 85462 | 3205A00103 | EMI receiver Preselector section | 23aug2000 |
| CC000221 | HP | E4407b | Us39160256 | 26.5 GHz Spectrum Analyzer | 16june2000 |
| Leased | HP | 8563E | 3305A00780 | Spectrum Analyzer | 19dec1999 |
| leased | HP | 8348A | 3111A00472 | Microwave Preamplifier | 20oct1999 |
| CC000156C | Leader | LCG400 | 1040108 | NTSC pattern generator | I.O. |
| N/a | LSC | Cable | 0011 | 3 meter 1/2 " heliax Cable | 23 feb 2000 |
| N/a | LSC | Cable | 0038 | 1 meter RG214 Cable | 30 dec 1999 |
| N/a | LSC | cable | 0050 | 10 meter RG214 Cable | 30 dec 1999 |
| N/a | Maury Microwav | attenuato r | N/a | 10 db attenuator | I.O. |

# APPENDIX A:

SAMPLE CALCULATIONS

Manufacturer: K & A Wireless
Model: VTRAN-2500
Serial Number(s): pre-production

# Calculation of Radiated Emissions limits for FCC Part 15.209 (above 1 GHz)

The following table depicts the Class B limits for an unintentional radiator: Limits established at a measurement distance of 3 meters and limits corrected for a 1 meter measurement distance which are extrapolated from the 3 meter limit.

| Frequency (MHz) | 3m limit (dB µV/m) | 1m limit (dB µV/m) |
|---|---|---|
| 960 MHz up | 54 | 63.54 |

- The 1 meter limits were calculated by adding a factor of 9.54 dB, derived from:

$20\log_{10}(3/1) = 9.54$ dB uV / m

3m limit = 10m limit + factor

$= 54$ dB µV / m + 9.54 dB µV / m

$=63.54$ dB µV / m

# APPENDIX B:

DATA CHARTS

# Measurement of Electromagnetic Radiated Emission within 3 Meter FCC Listed Chamber

Frequency Range inspected: 30 to 1000 MHz

| | | | |
|---|---|---|---|
| Date of Test: | October 1, August 14, 1999 | Manufacturer: | K & A Wireless |
| Location: | L. S. Compliance, Inc. | Model No.: | Vtran-2500 |
| | W66 N220 Commerce Court | | |
| | Cedarburg, WI 53012 | | |
| Specifications: | 47CFR FCC Part 15.247, 15.205 | Serial No.: | Pre-production |
| Distance: | 3 meters | Configuration: | Continuous Tx on channel 1,2 or 4; worst case |
| Equipment: | HP 8546A EMI Receiver | Detector(s) Used: | Quasi-peak, below 1 GHz |
| | | | Average above 1 GHz |
| | EMCO 3146A Log Periodic | | |
| | EMCO 3110B Biconical | | |

The following table depicts the level of significant spurious emissions found:

| Frequency (MHz) | Antenna Polarity | Height (meters) | Azimuth (0° - 360°) | EMI Meter Reading (dB μV / m) | 15.109 Limit (dB μV / m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 163.0 | H | 1.8 | 270 | 41.7 | 43.5 | 1.8 |
| 163.0 | V | 1.75 | 30 | 41.3 | 43.5 | 2.2 |
| 167.0 | H | 1.8 | 270 | 36.7 | 43.5 | 6.8 |
| 167.0 | V | 1.75 | 30 | 34.1 | 43.5 | 9.4 |
| 169.0 | H | 1.8 | 270 | 36.1 | 43.5 | 7.4 |
| 169.0 | V | 1.75 | 30 | 33.2 | 43.5 | 10.3 |
| 273.0 | H | 1.0 | 125 | 40.1 | 46.0 | 5.9 |
| 279.0 | H | 1.0 | 125 | 39.8 | 46.0 | 6.2 |
| 284.0 | H | 1.0 | 125 | 38.4 | 46.0 | 7.6 |
| 2387.4 | V | 1.1 | 250 | 50.5 | 54.0 | 3.5 |
| 2483.6 | V | 1.08 | 125 | 45.1 | 54.0 | 8.9 |
| 2486.7 | V | 1.08 | 125 | 46.3 | 54.0 | 7.7 |
| 2494.6 | V | 1.08 | 240 | 48.3 | 54.0 | 5.7 |
| 4887.0 | V | 1.0 | 120 | 46.1 | 54.0 | 7.9 |

**FCC ID: OPH-KAW1100**

Measurement of Electromagnetic Radiated Emission within 3 Meter FCC Listed Chamber

Frequency Range inspected: 5 to 25 GHz

| | | | |
|---|---|---|---|
| Date of Test: | 7,12 May 1999 | Manufacturer: | K & A Wireless |
| Location: | L.S. Compliance, Inc.<br>W66 N220 Commerce Court<br>Cedarburg, WI 53012 | Model No.: | Vtran-2500 |
| Specifications: | 47CFR, FCC Part 15.247(c), 15.205 | Serial No.: | Pre-production |
| Distance: | 1 meter | Configuration: | Tx on Ch 1,4 |
| Equipment: | HP 8546A EMI Receiver<br>HP 84125C microwave EMI system<br>EMCO 3115 Double Ridged Waveguide | Detector(s) Used: | Average |

The following table depicts the level of significant spurious and harmonic emissions found:

| Frequency (GHz) | Antenna Polarity | Height (meters) | Azimuth (0° - 360°) | Measured Value (dBuV/m) | Correction (ant, cbl, preamp) | Final Value (dBuV/m) | Limit (dB µV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| 6.44 | H | 1.0 | 90 | 39.2 | 6.6 | 45.8 | 63.54 | 17.7 |
| 7.28 | H | 1.0 | 135 | 49.5 | 8.5 | 58.0 | 63.54 | 5.5 |
| 9.71 | H | 1.0 | 135 | 53.7 | 3.4 | 57.1 | 63.54 | 6.4 |
| 10.52 | H | 1.0 | 90 | 37.8 | 3.9 | 41.7 | 63.54 | 21.8 |
| 12.14 | H | 1.0 | 225 | 46.3 | 11.1 | 57.4 | 63.54 | 6.1 |
| 14.56 | H | 1.0 | 90 | 37.7 | 4.1 | 41.8 | 63.54 | 21.7 |

Measurement of Conducted Emissions with direct connection

| | | | |
|---|---|---|---|
| Date of Test: | October 1, 1999 | Manufacturer: | K & A Wireless |
| Location: | L. S. Compliance, Inc. | Model No.: | Vtran-500 |
| | W66 N220 Commerce Court | | |
| | Cedarburg, WI 53012 | | |
| Specifications: | Title 47CFR, FCC Part 15.247 | Serial No.: | Pre-production |
| Distance: | N / A | Configuration: | Channel 1-4 TX |
| Equipment: | HP 85460A, 85462A EMI Receiver | Detector(s) Used: | Peak |
| | HP-E4407B | | |
| Lab Conditions: | Temp.: 72° F | Humidity:50% | |

The following table depicts the level of significant spurious emissions found:

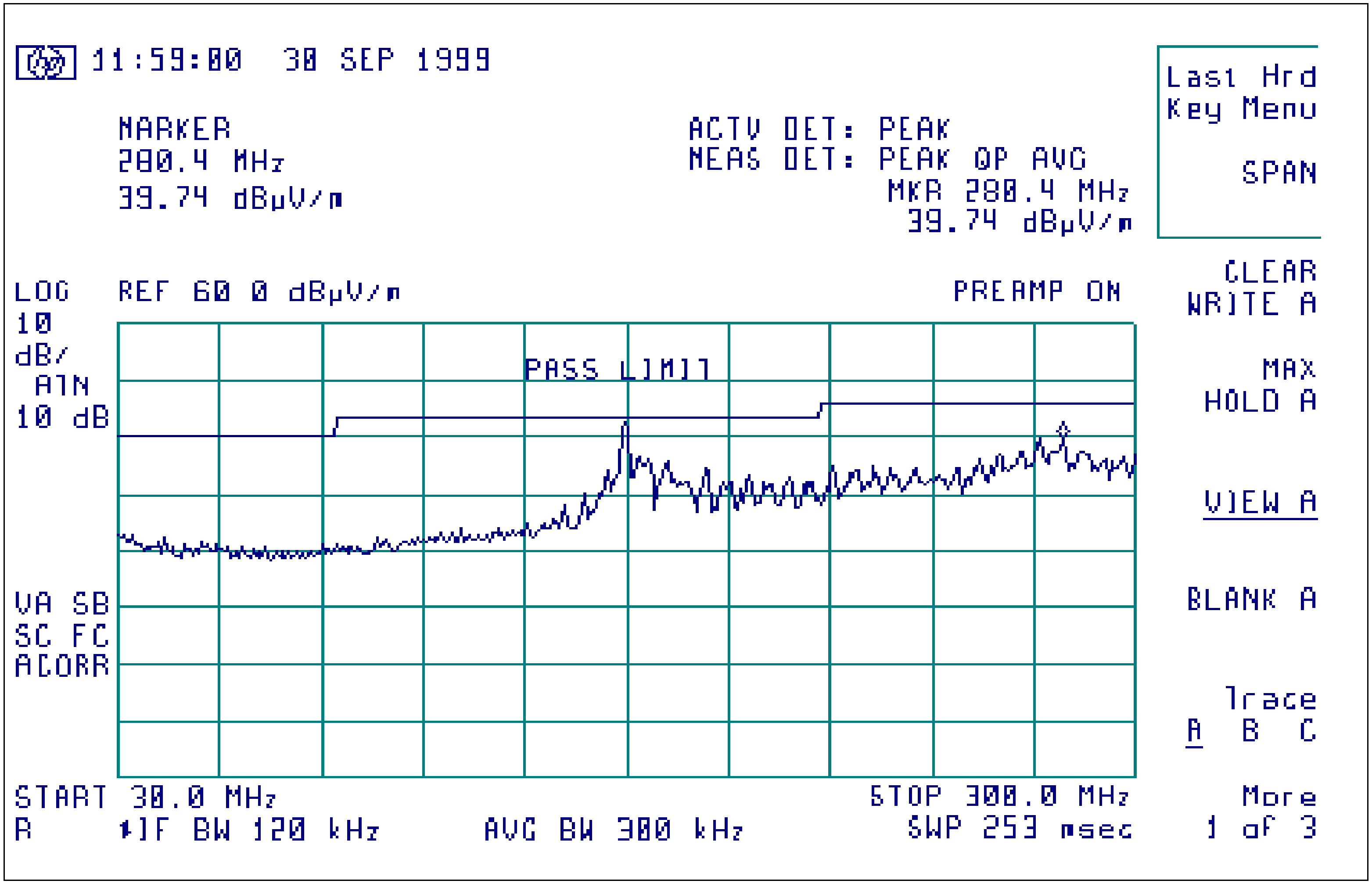
| Frequency (MHz) | Channel | EMI Meter Reading (dBm) | FCC Limit (output P) (dBm) | Delta (dBc) |
|---|---|---|---|---|
| 456 | 1 | -59.6 | 2.5 | -62.1 |
| 472 | 2 | -64.0 | 5.0 | -69.0 |
| 484 | 3 | -56.4 | 6.5 | -62.9 |
| 497 | 4 | -58.0 | 3.0 | -61.0 |
| 13300 | 1 | -55.7 | 2.5 | -58.2 |
| 7300 | 2 | -55.7 | 5.0 | -60.7 |
| 7300 | 3 | -59.8 | 6.5 | -66.3 |
| 7350 | 4 | -60.7 | 3.0 | -63.7 |

# APPENDIX C:

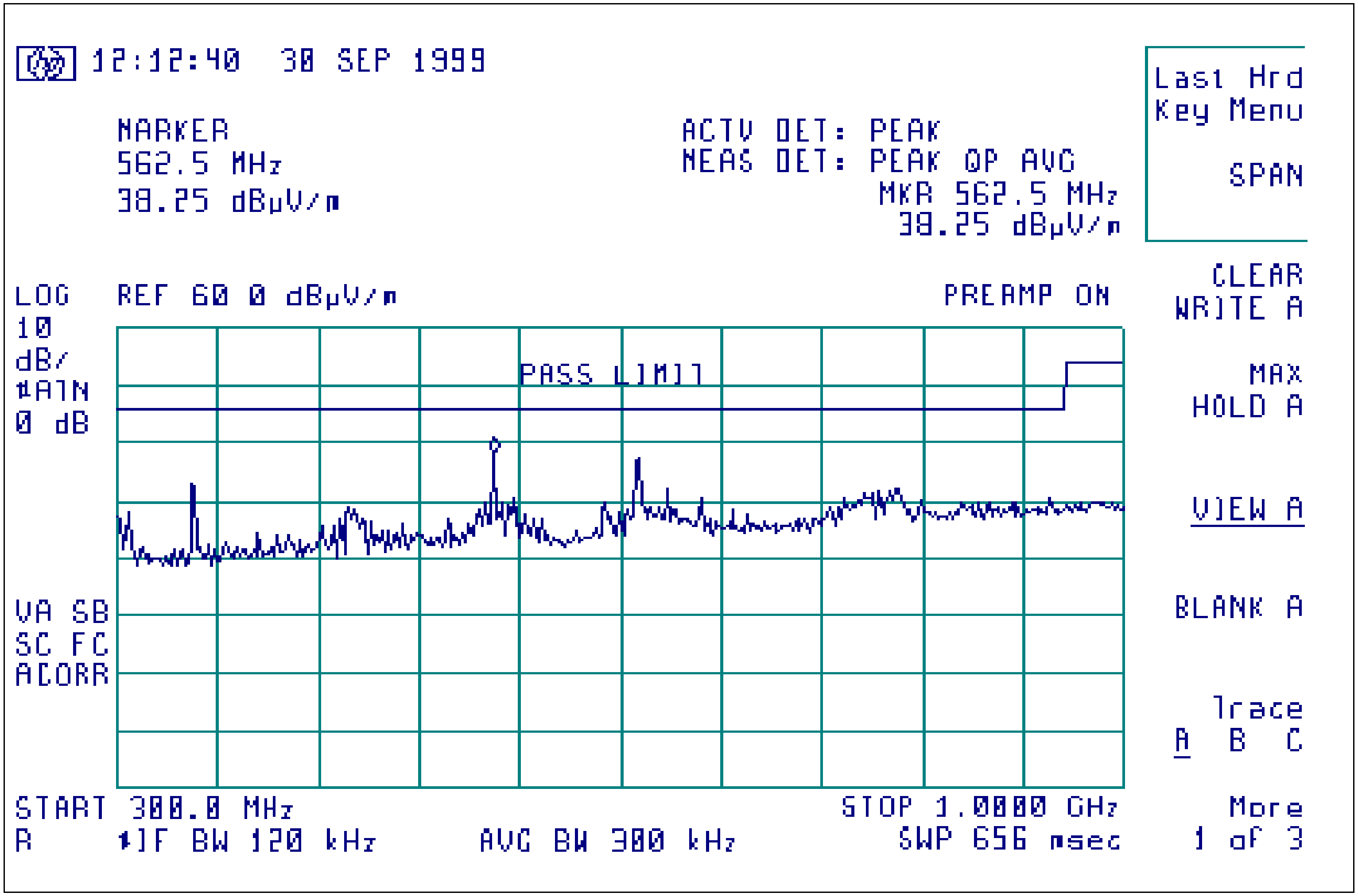
GRAPHS

**FCC ID : OPH-KAW1000**

**TX channel 2, 30-300 MHz, horizontal polarity**

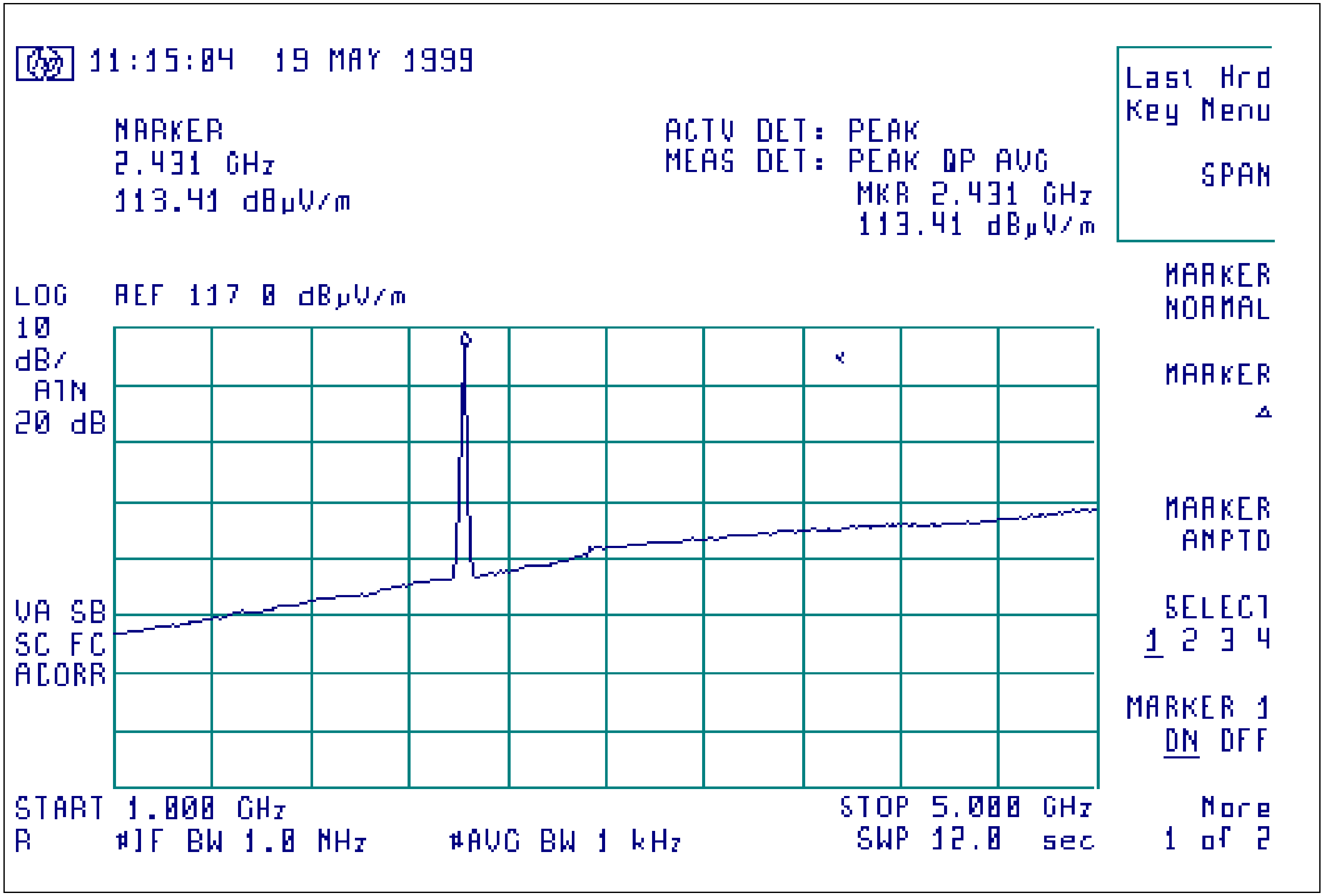


**TX channel 2, 300-1000 MHz, vertical polarity**



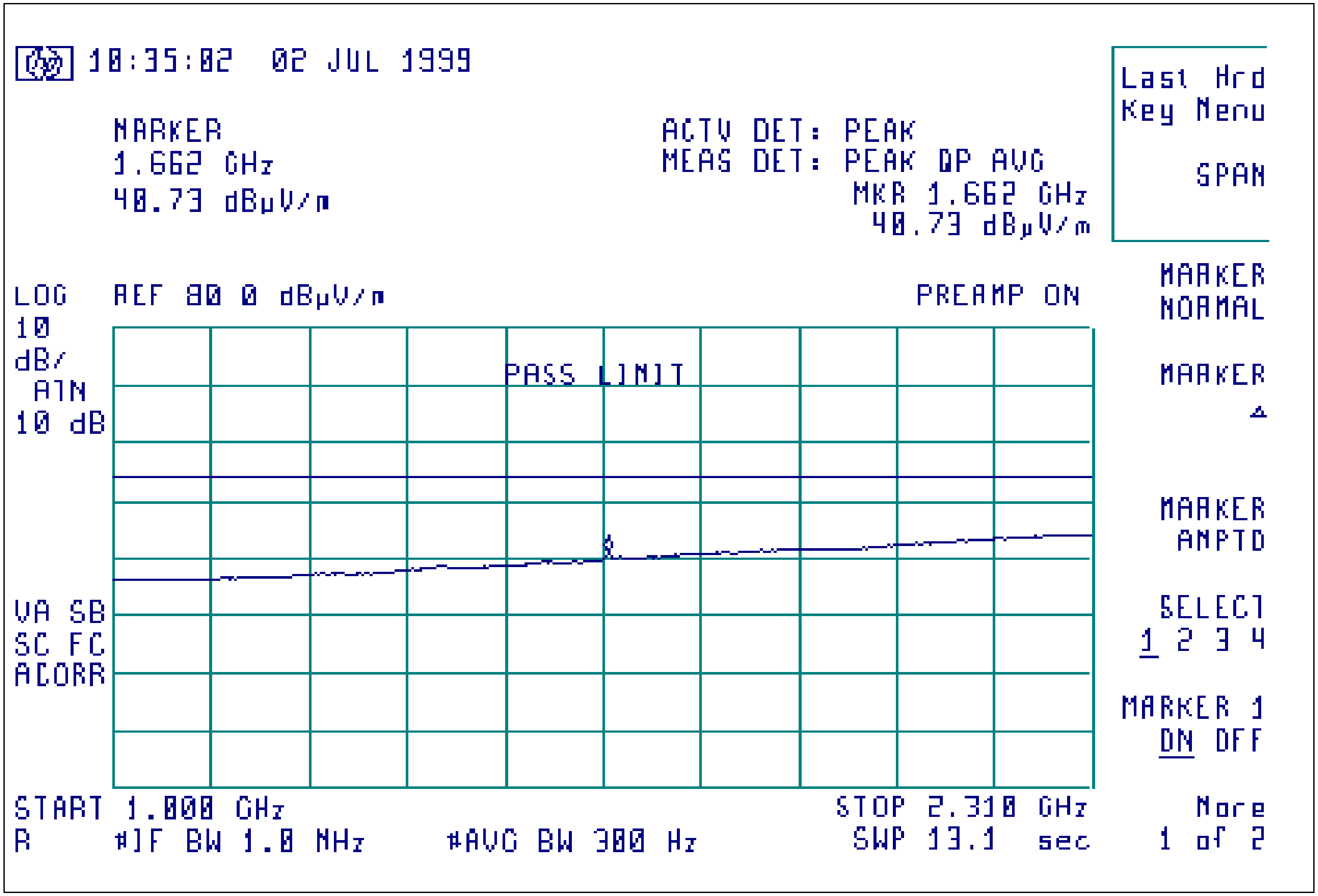
**FCC ID : OPH-KAW1000**

**TX channel 2, 1-5 GHz, vertical polarity**

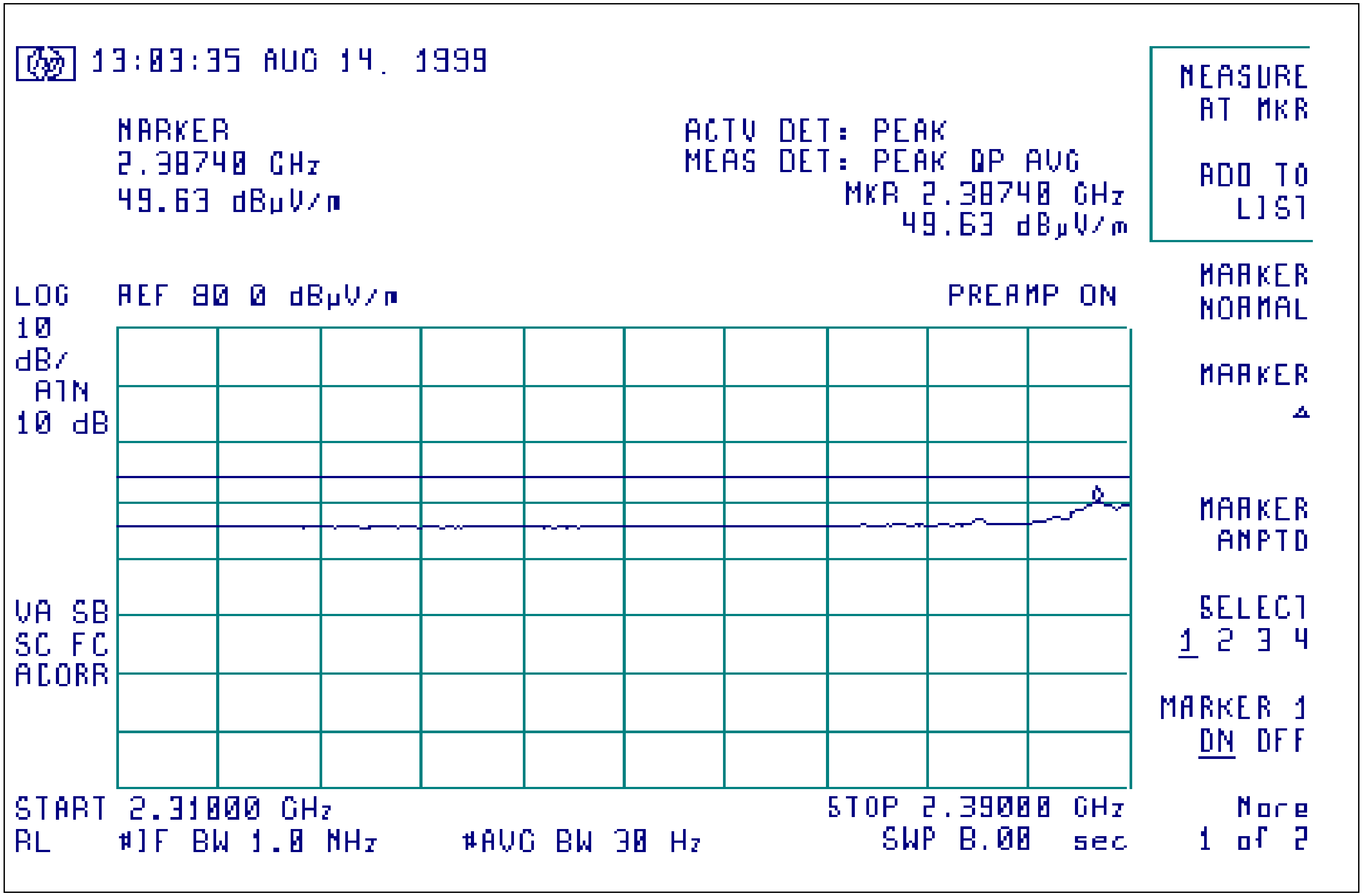


**FCC ID : OPH-KAW1000**

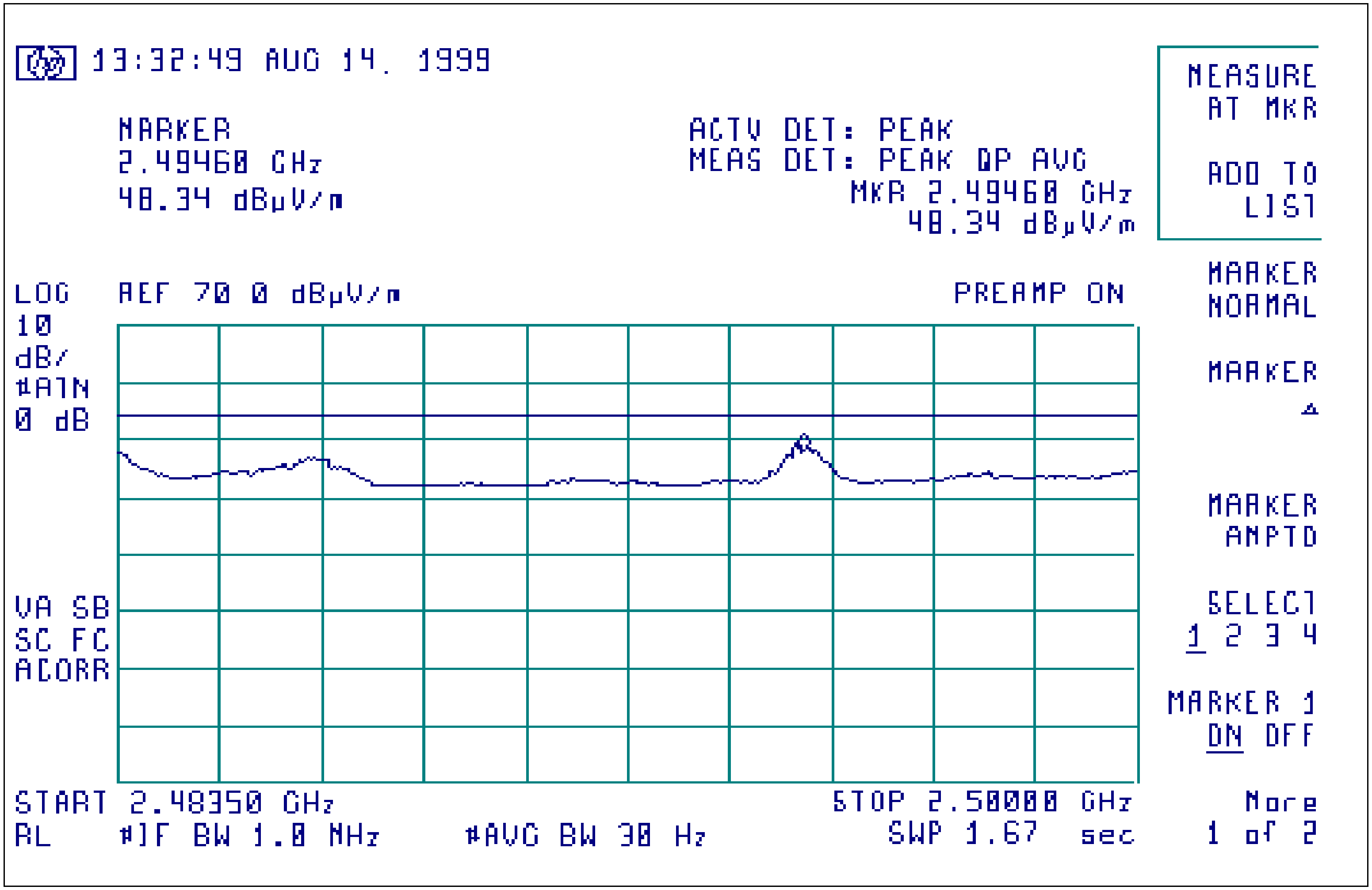
**TX channel 1, 1-2.31 GHz, vertical polarity**



**TX channel 1, 2.31-2.39 GHz (15.205), vertical Polarity**

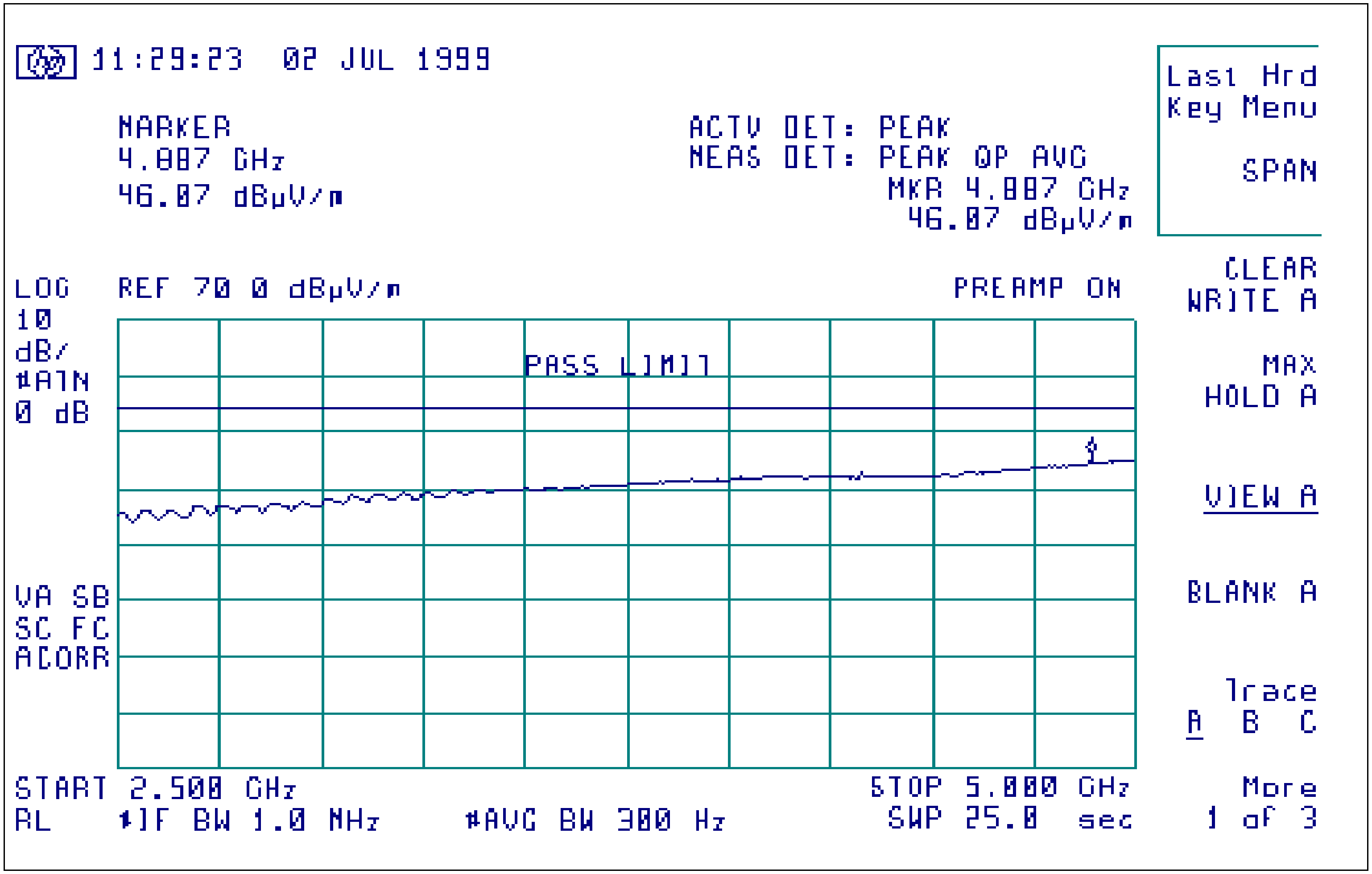


**TX channel 4, 2.48-2.5 GHz (15.205), vertical polarity**

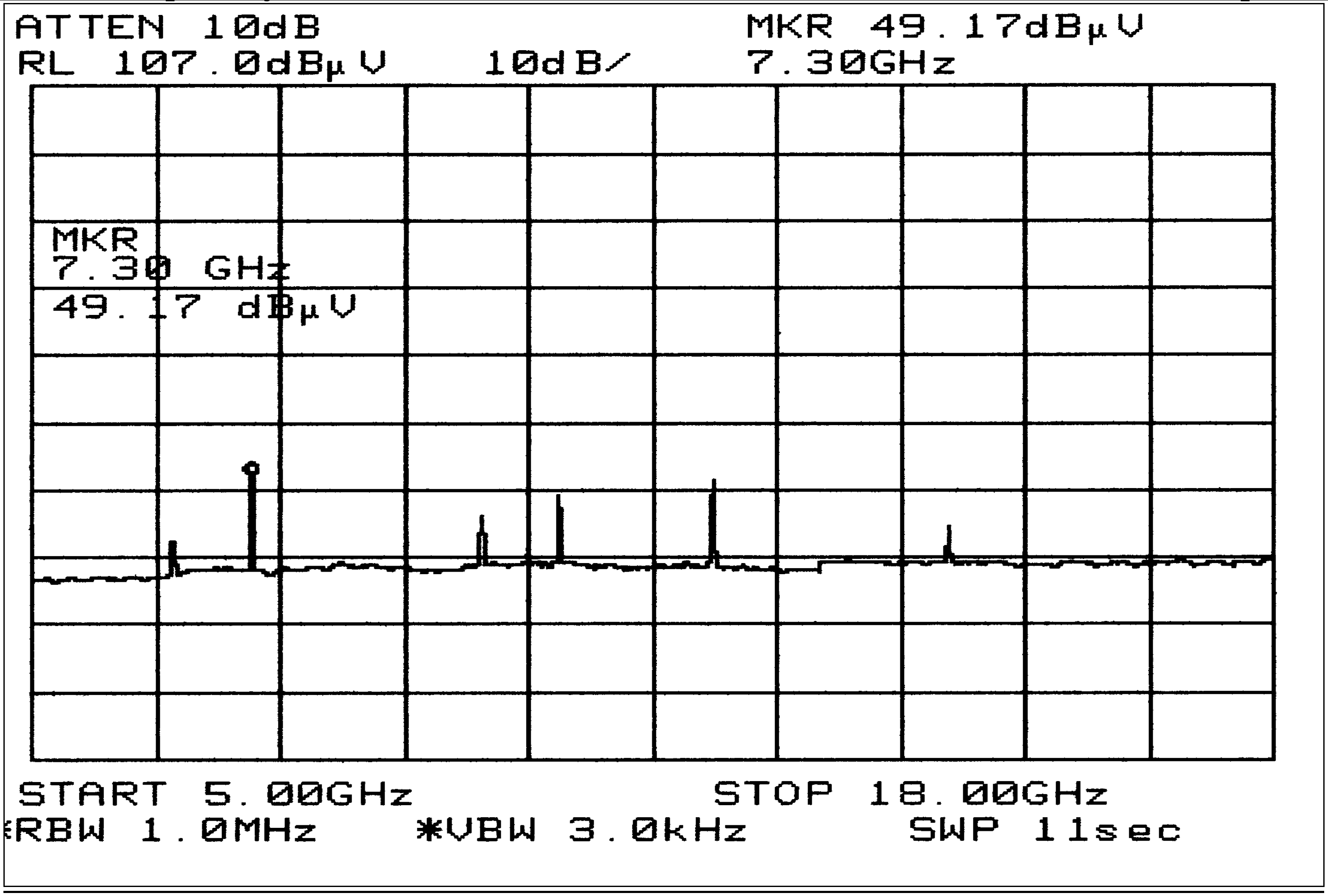


**FCC ID : OPH-KAW1000**

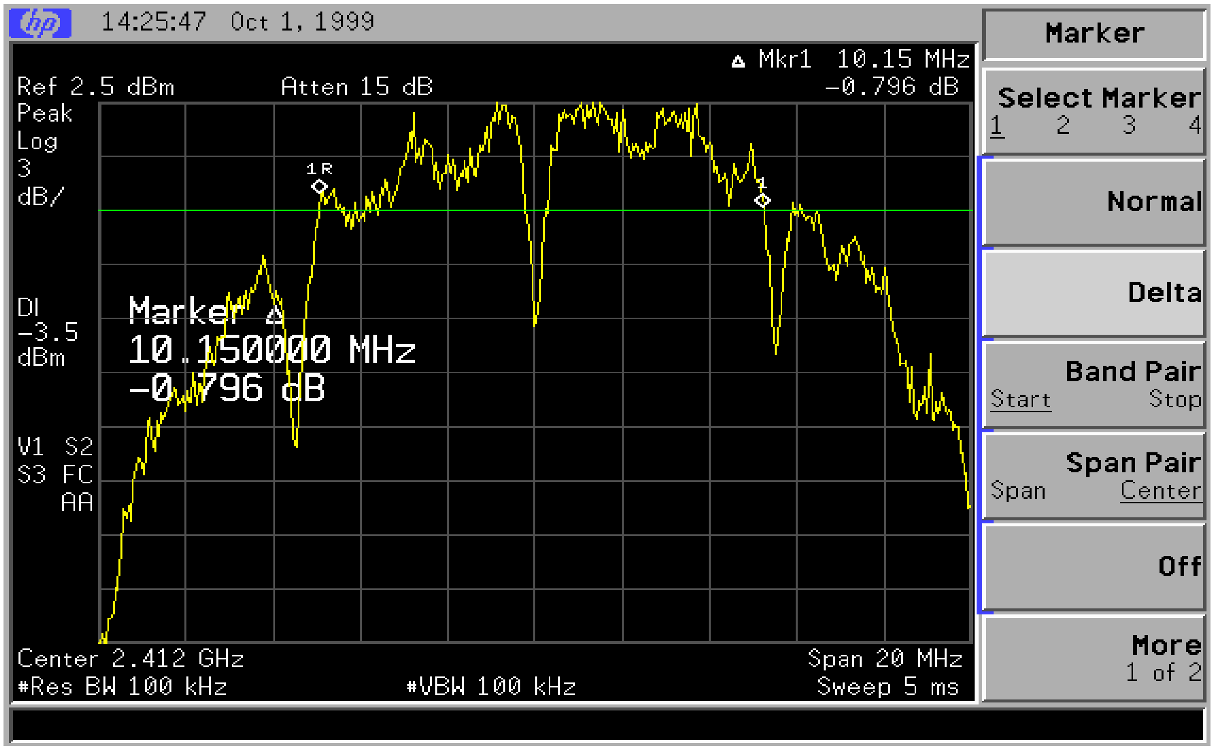
**TX channel 4, 2.5-5 GHz, vertical Polarity**



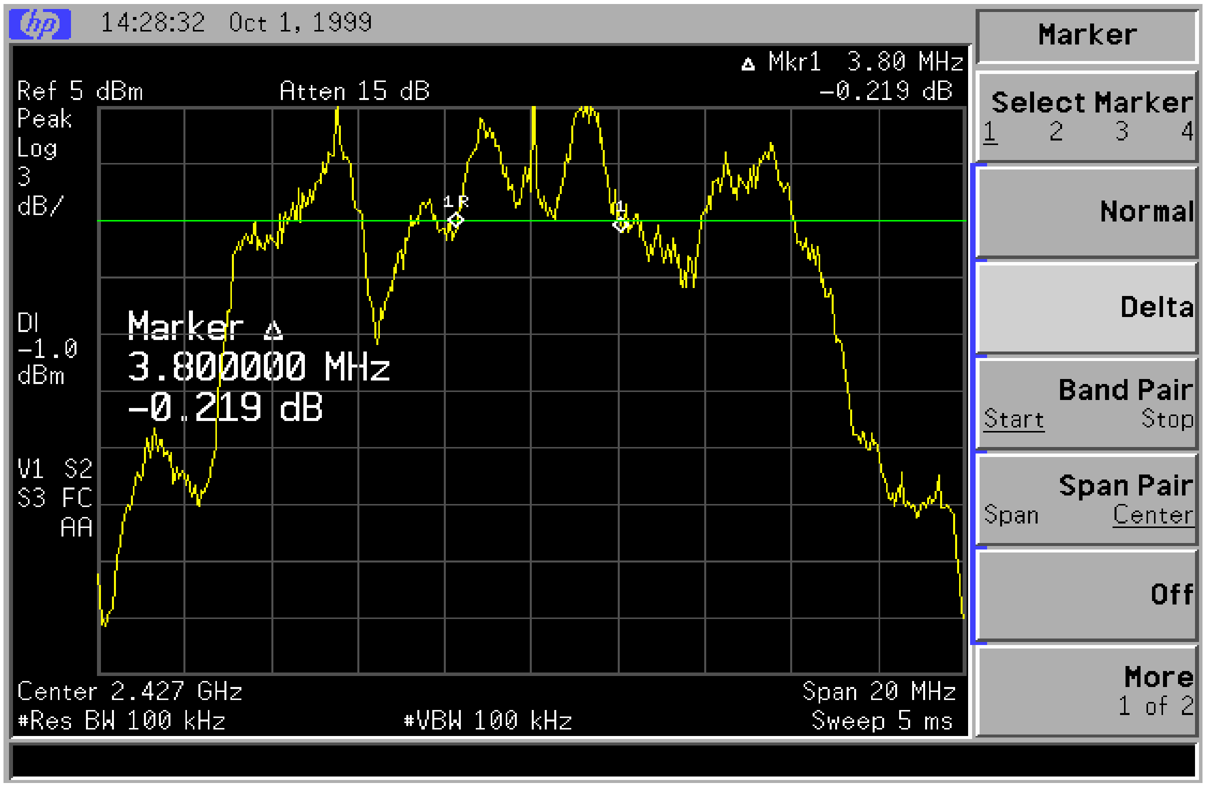
**5-18 GHz, vertical polarity, TX on channel 1 and 4., uncorrected for antenna, short cable and preamplifier.**



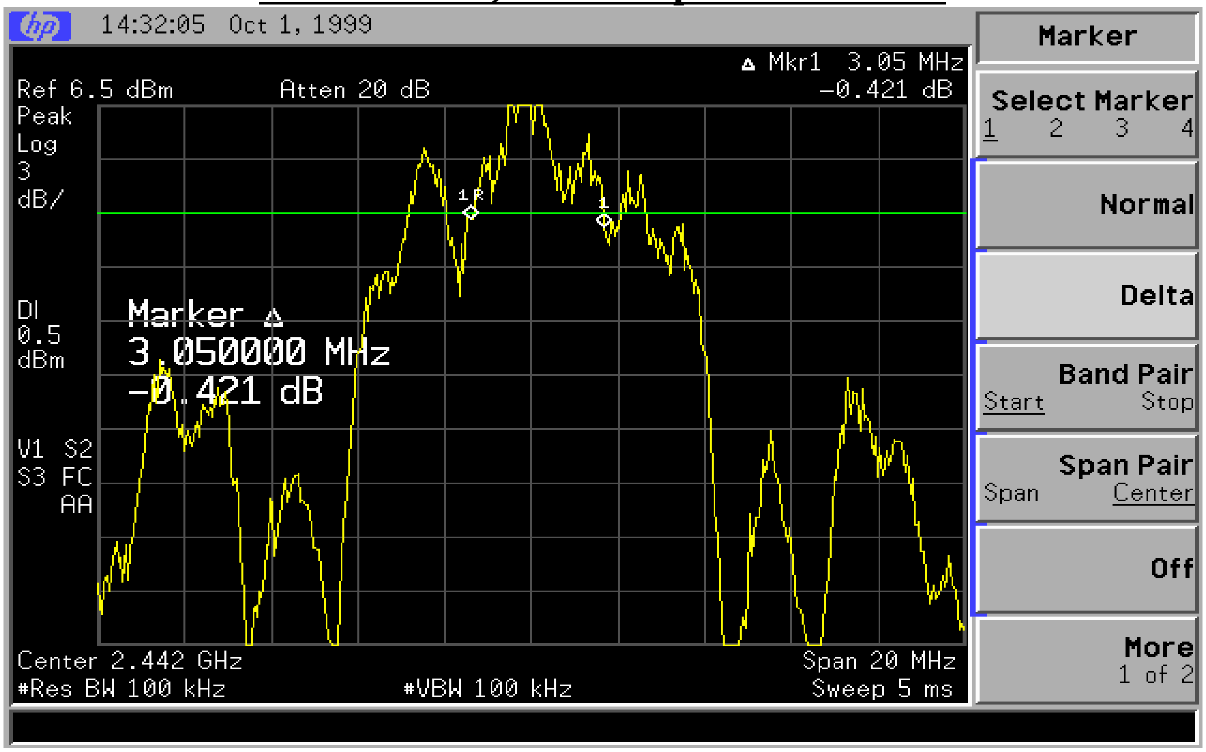
## Channel 1 TX, 6dB occupied bandwidth



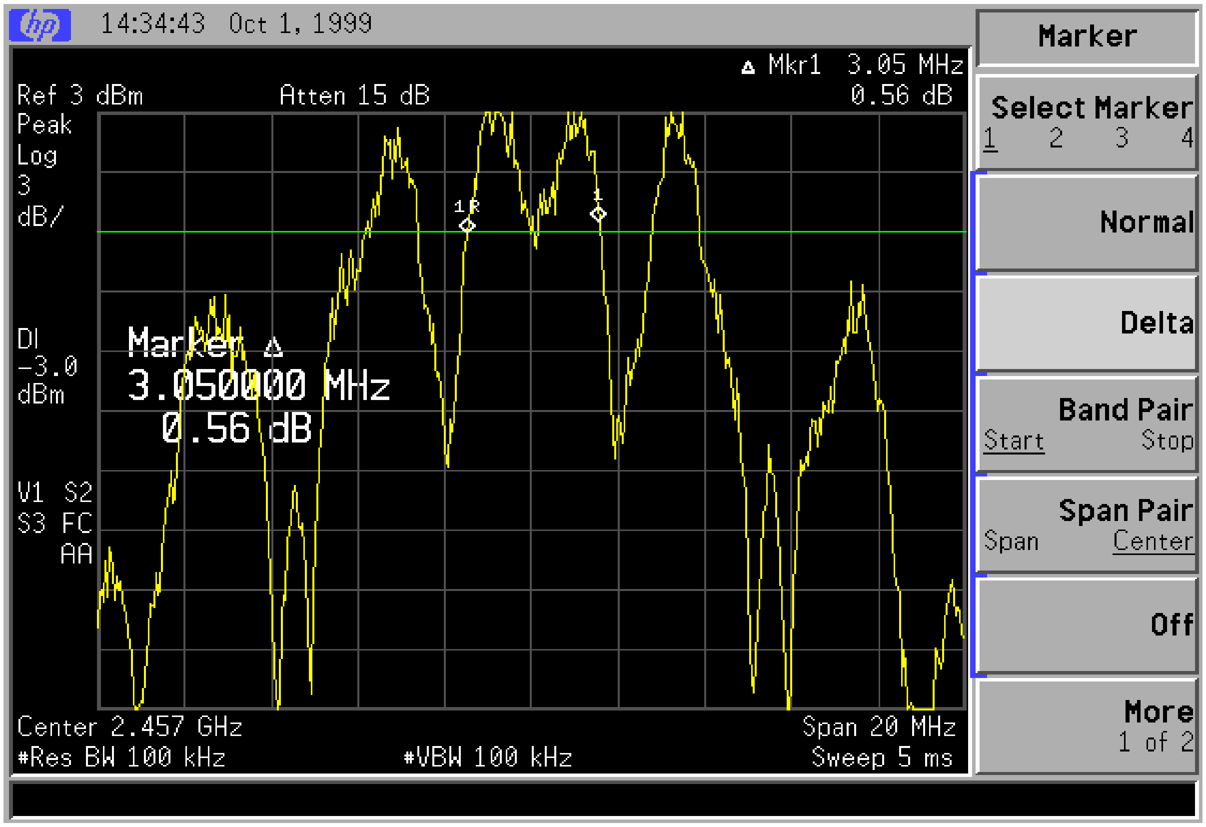

## Channel 2 TX, 6dB occupied bandwidth


14:28:32 Oct 1, 1999
Marker
Mkr1 3.80 MHz
-0.219 dB
Ref 5 dBm
Atten 15 dB
Peak
Log
3
dB/
Select Marker
1 2 3 4
Normal
Delta
DI
-1.0
dBm
Marker
3.800000 MHz
-0.219 dB
Band Pair
Start Stop
V1 S2
S3 FC
AA
Span Pair
Span Center
Off
More
1 of 2
Center 2.427 GHz
#Res BW 100 kHz
#VBW 100 kHz
Span 20 MHz
Sweep 5 ms

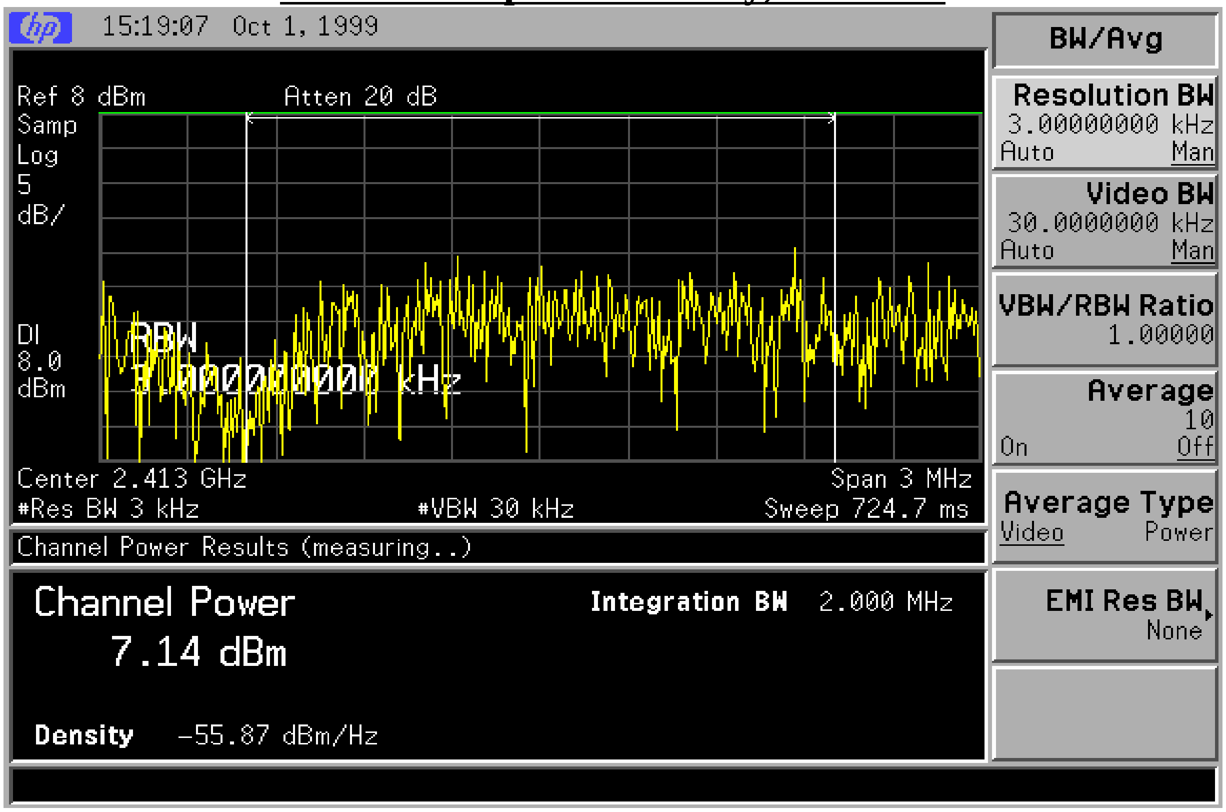
**Channel 3 TX, 6dB occupied bandwidth**



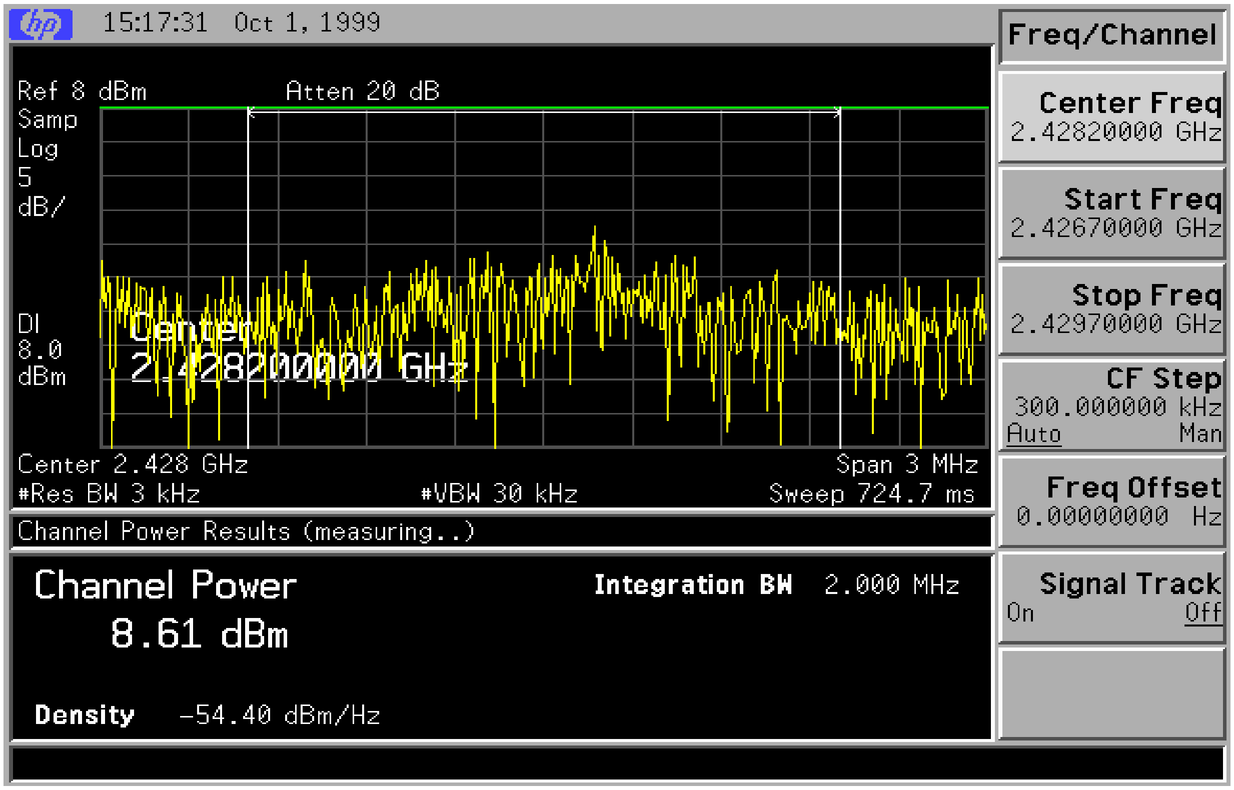

**Channel 4 TX, 6dB occupied bandwidth**


14:34:43 Oct 1, 1999
Marker
Mkr1 3.05 MHz
0.56 dB
Ref 3 dBm
Atten 15 dB
Peak
Log
3
dB/
Select Marker
1 2 3 4
Normal
Delta
DI
-3.0
dBm
Marker Δ
3.050000 MHz
0.56 dB
Band Pair
Start Stop
Span Pair
Span Center
V1 S2
S3 FC
AA
Off
More
1 of 2
Center 2.457 GHz
#Res BW 100 kHz
#VBW 100 kHz
Span 20 MHz
Sweep 5 ms

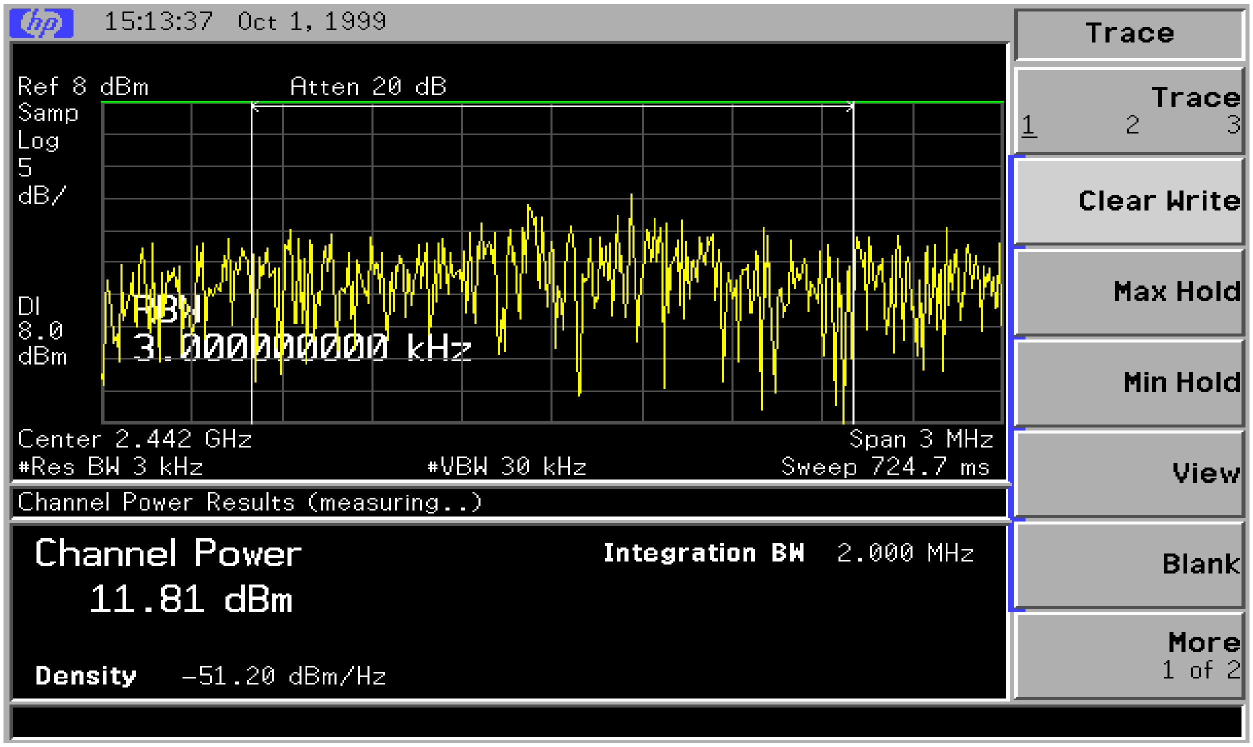
**3 Kilohertz Spectral Density; channel 1**



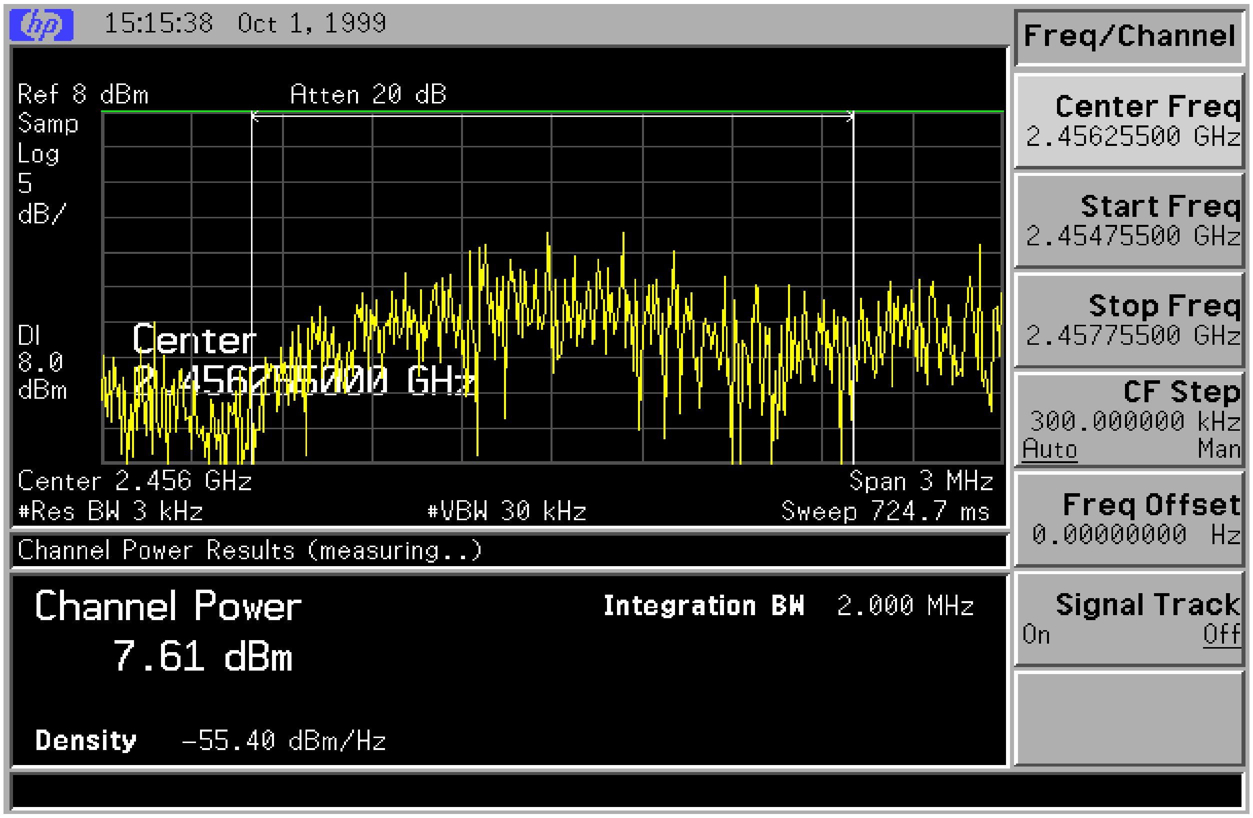
## 3 Kilohertz Spectral Density; channel 2



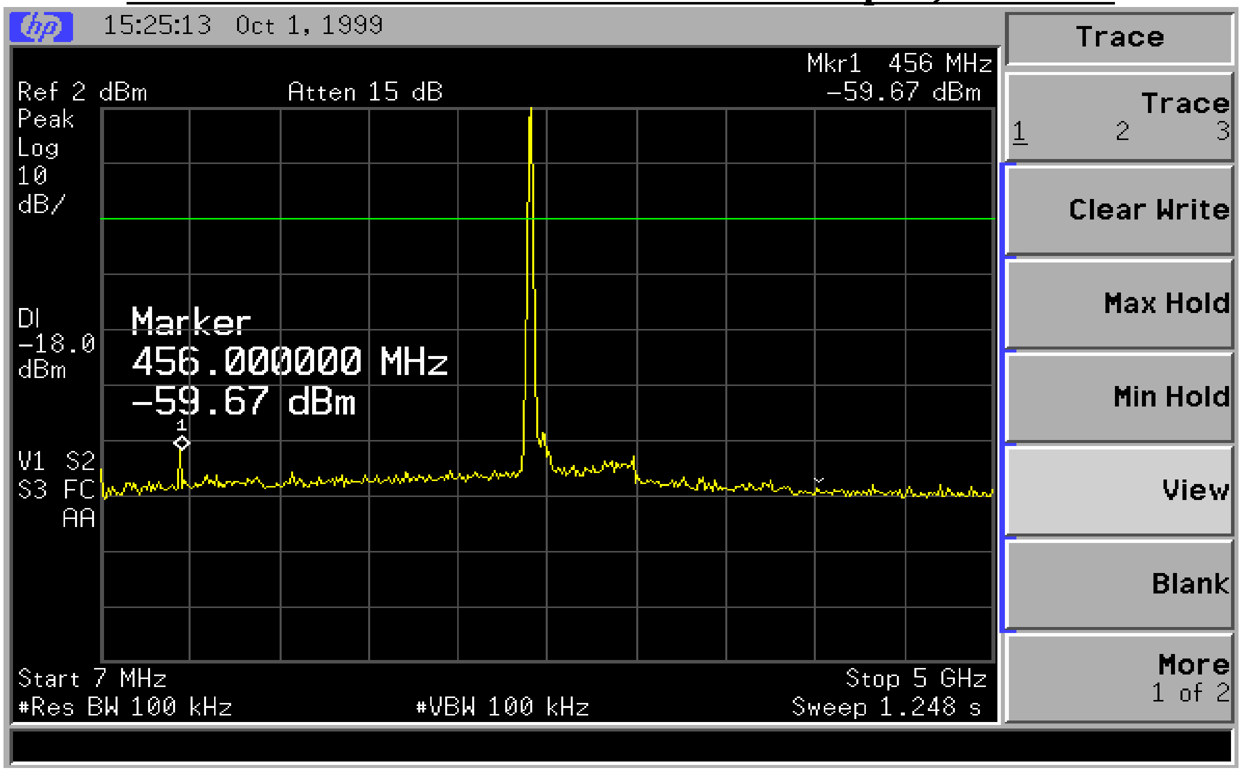
**3 Kilohertz Spectral Density; channel 3**

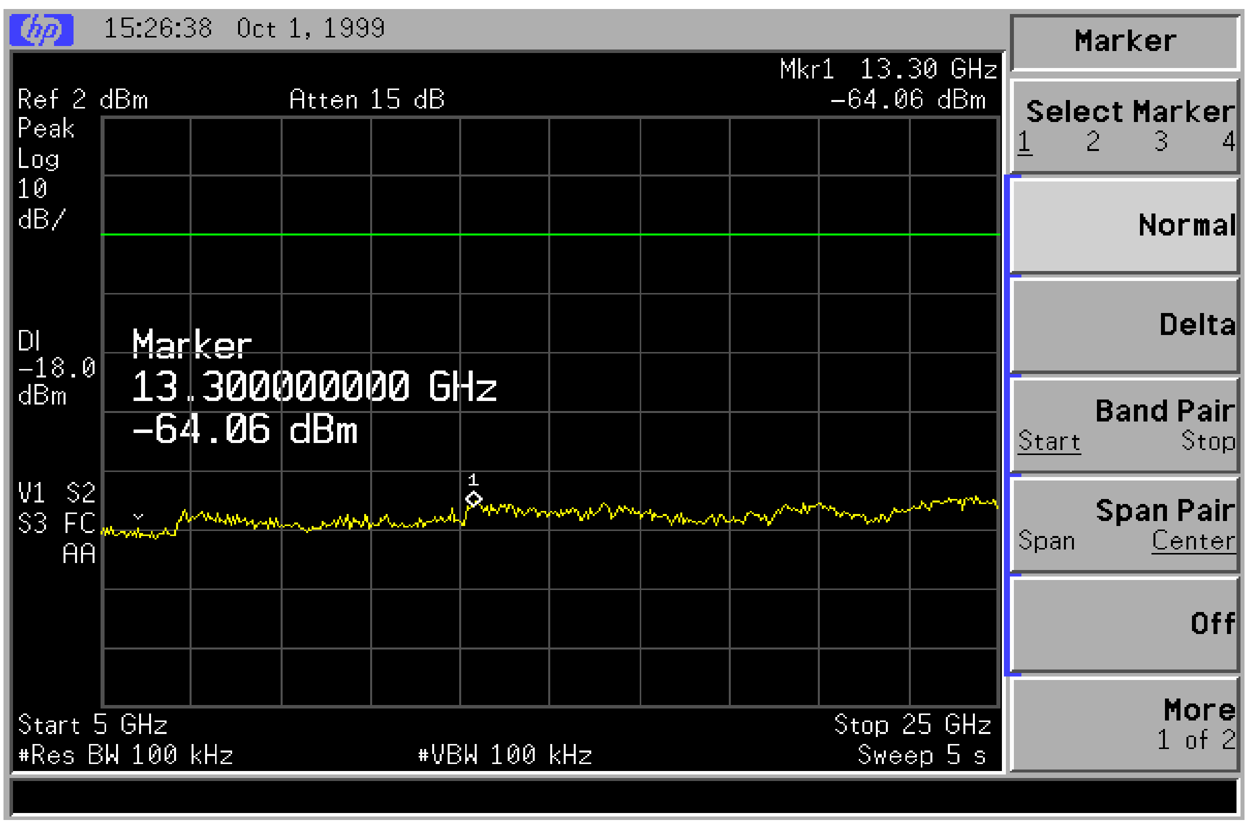



**3 Kilohertz Spectral Density; channel 3**

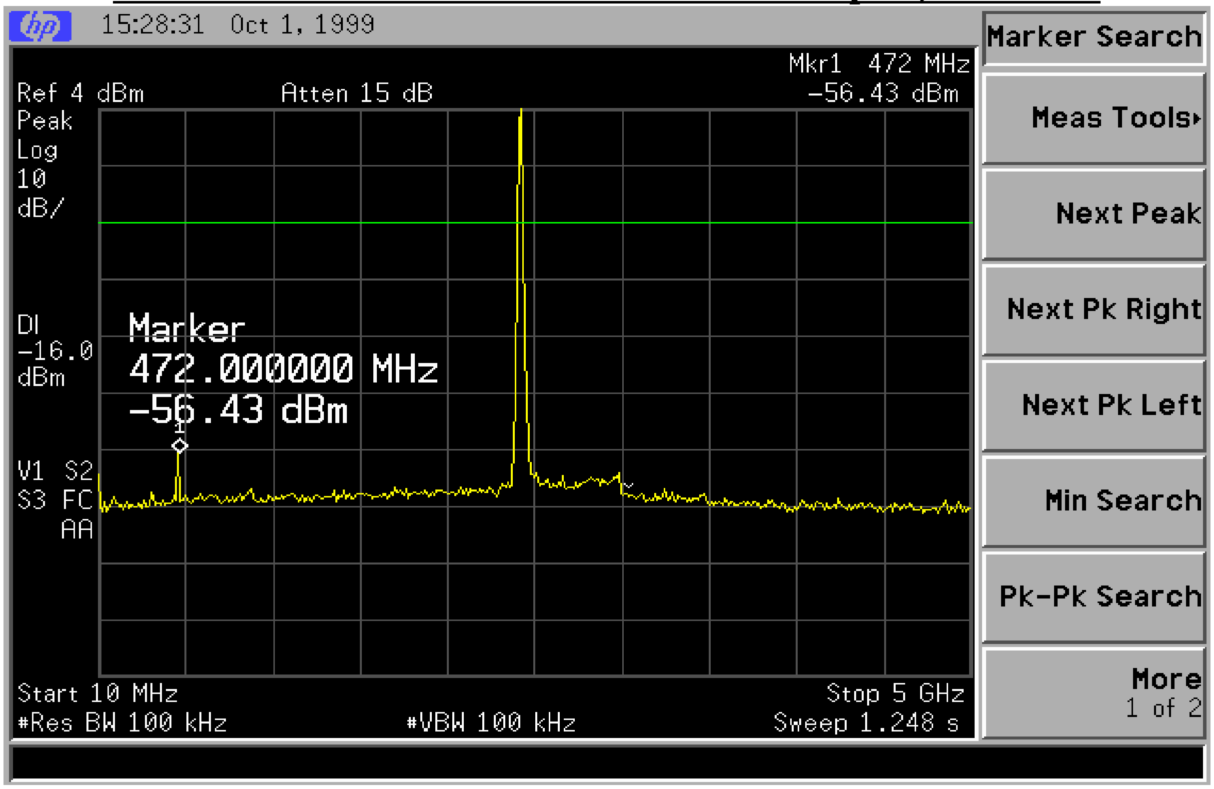

15:15:38 Oct 1, 1999
Freq/Channel
Ref 8 dBm
Atten 20 dB
Samp
Log
5
dB/
DI
8.0
dBm
Center
2.45625000 GHz
Center 2.456 GHz
Span 3 MHz
#Res BW 3 kHz
#VBW 30 kHz
Sweep 724.7 ms
Channel Power Results (measuring..)
Channel Power
7.61 dBm
Integration BW 2.000 MHz
Density -55.40 dBm/Hz
Center Freq
2.45625500 GHz
Start Freq
2.45475500 GHz
Stop Freq
2.45775500 GHz
CF Step
300.000000 kHz
Auto
Man
Freq Offset
0.00000000 Hz
Signal Track
On
Off

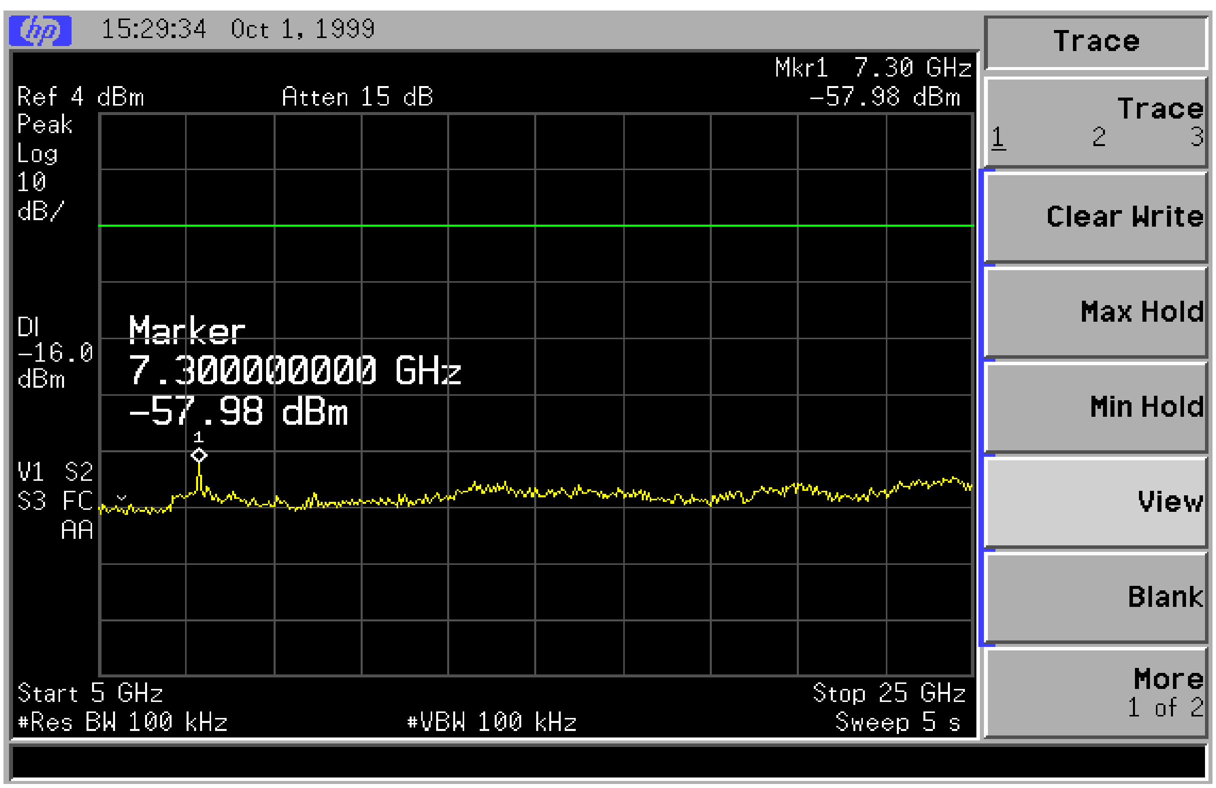
**Conducted RF emissions from the antenna port, channel 1**



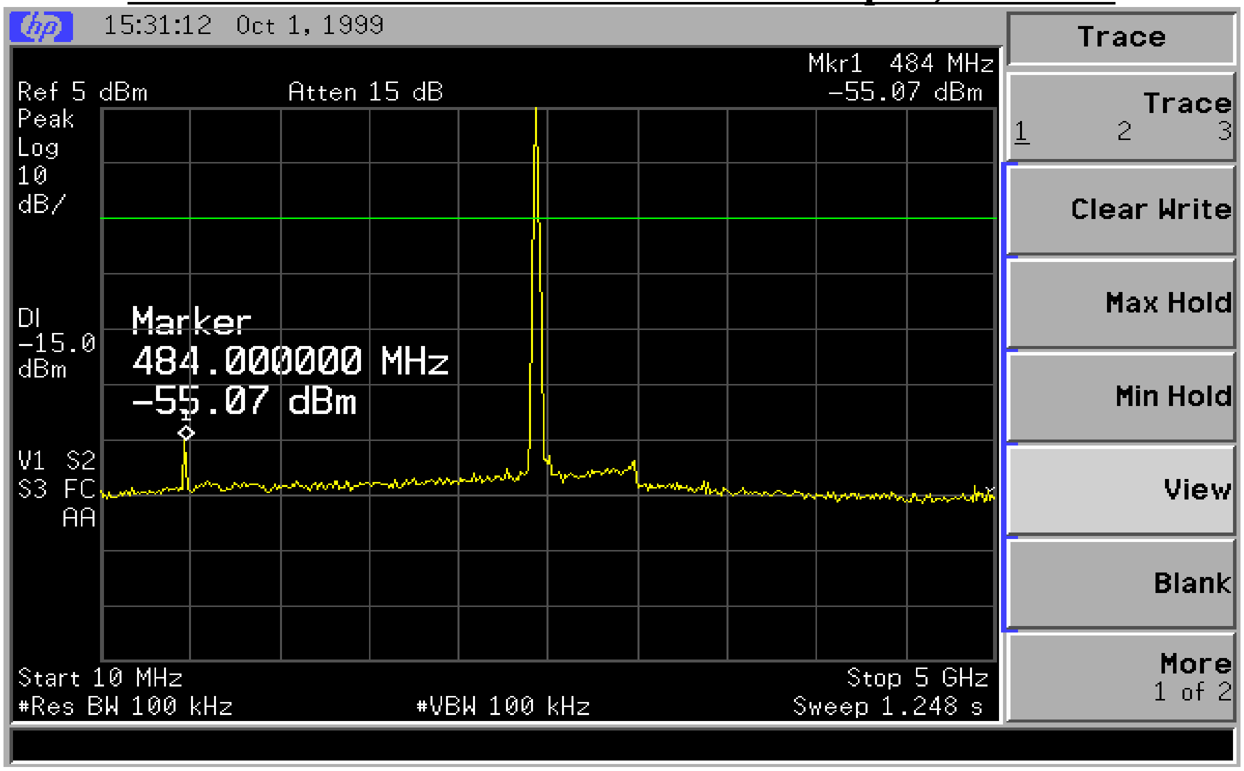



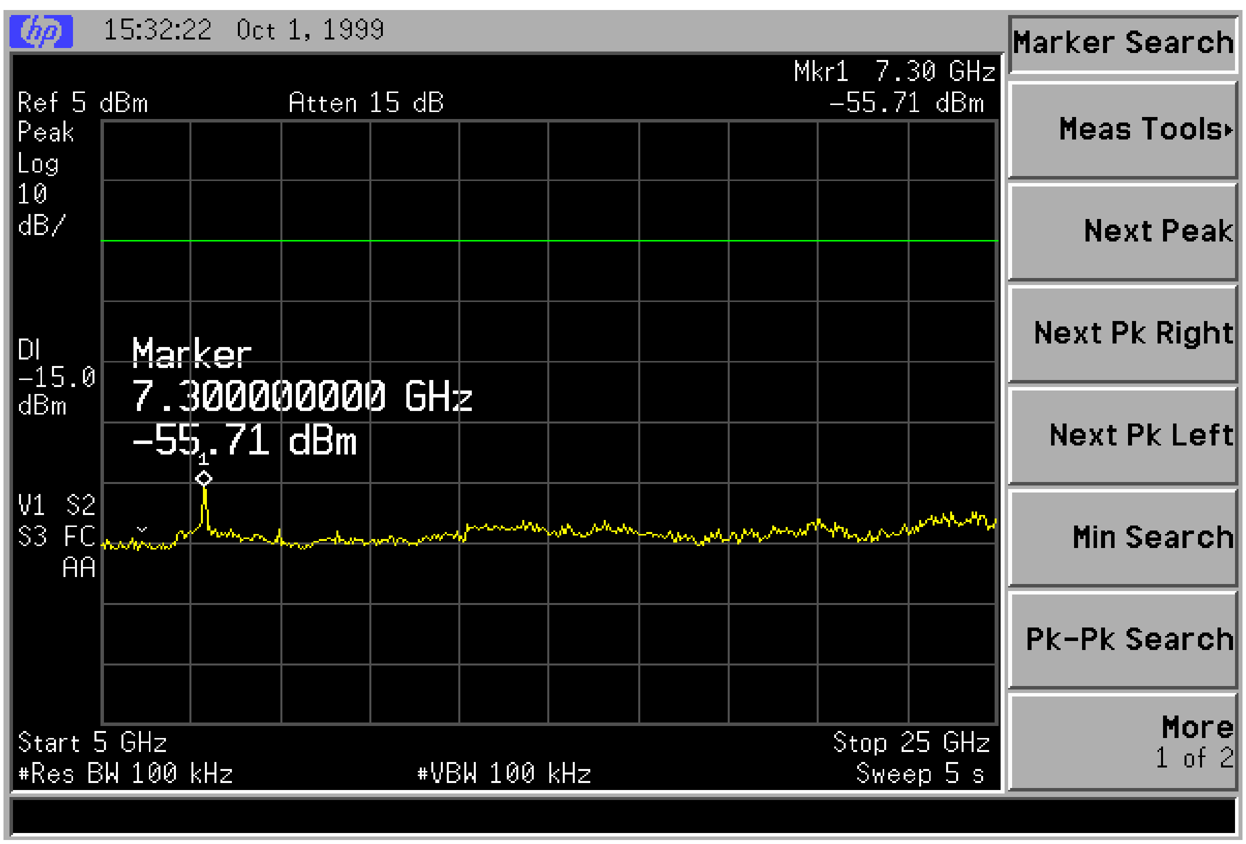
## Conducted RF emissions from the antenna port; channel 2



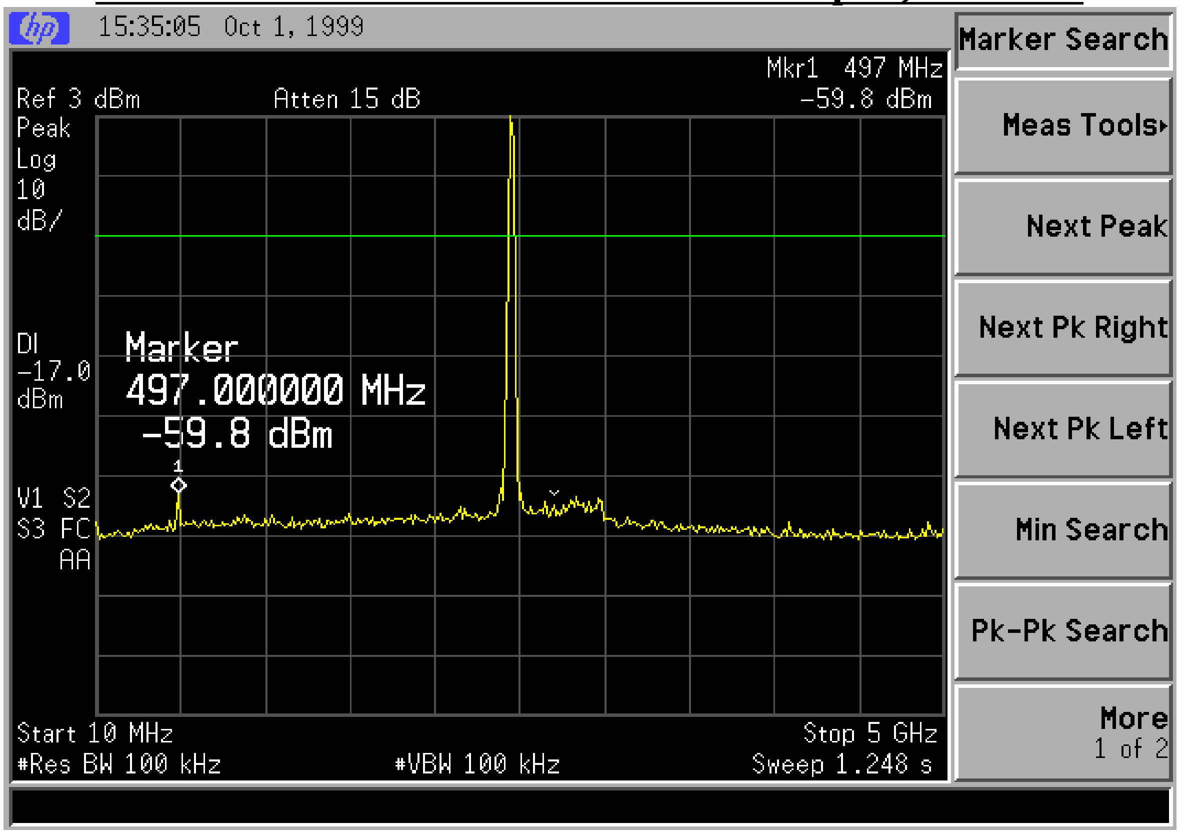



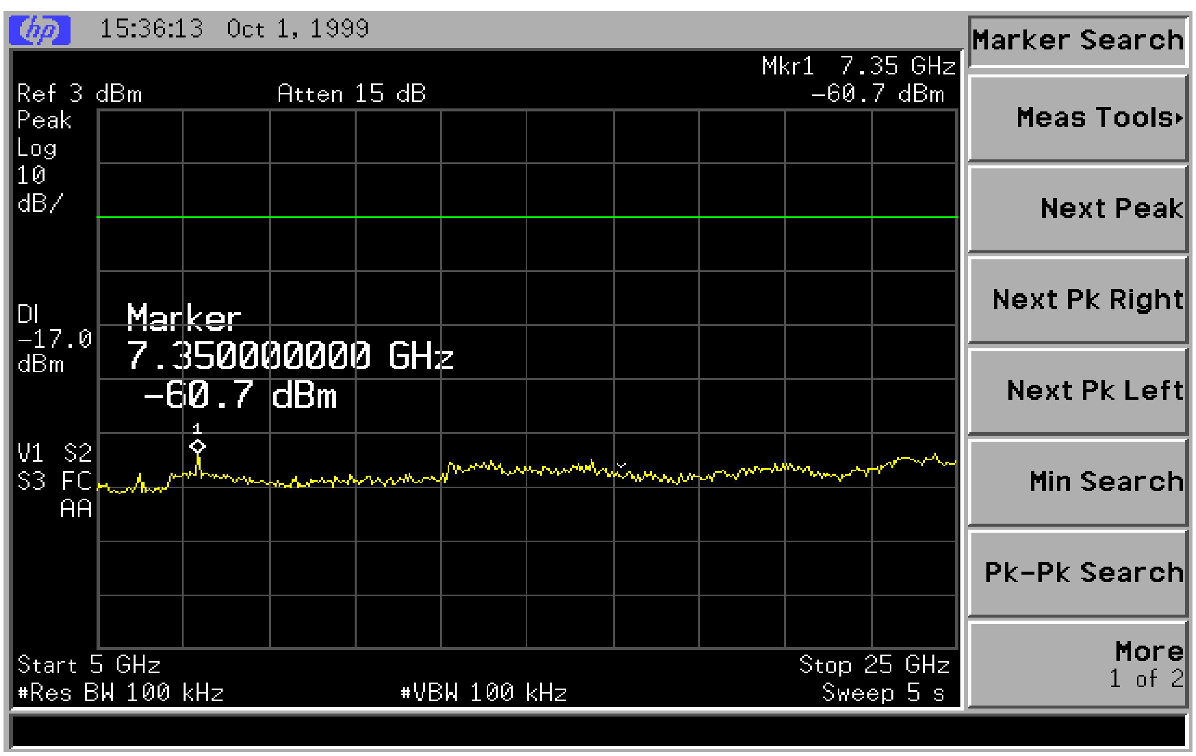
**Conducted RF emissions from the antenna port; channel 3**



## Conducted RF emissions from the antenna port, channel 4



# APPENDIX D:

**Abrahams, Richard**

**From:** Greg Czumak [GCZUMAK@fcc.gov]
**Sent:** Tuesday, December 29, 1998 8:51 AM
**To:** Abrahams, Richard
**Cc:** Willingham, J B Bartow; Andren, Carl; Fakatselis, John; Ciaccia, Larry; Rood, Robert
**Subject:** Processing Gain Measurements -Reply

This is in response to your e-mail dated December 4, 1998. With respect to your proposed "Reference Design," after discussing the issue here, we have decided that Harris should obtain an authorization (FCC ID) for the reference design (even if you never actually market this product). In this way, your customers may submit a copy of the processing gain (jamming margin) data from the granted application with their own applications, assuming they are using the exact same design. They would simply have to submit a statement verifying that the design is identical, along with the copied data. The advantage of this approach is that they will be referencing an authorized product, and not some unapproved design, thus avoiding any appearance of impropriety.

I hope this has been responsive to your inquiry. Please contact me with any additional questions.

# FCC 15.247(e) Jamming Margin Test