Engineering and Testing for EMC and Safety Compliance

# APPLICATION FOR FCC CERTIFICATION

# DIRECT SEQUENCE SPREAD SPECTRUM TRANSMITTER

**Carlson Wireless Technologies, Inc.**
**1180-B Evergreen Road**
**Redway, CA 95560**
**707-923-3000**

## Model: I-WLL-T

## FCC ID: OPA-I-WLL-T

***December 2, 2000***

| STANDARDS REFERENCED FOR THIS REPORT | |
|---|---|
| **PART 2: 1999** | FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS |
| **PART 15: 1999** | RADIO FREQUENCY DEVICES |
| **FCC 97-114** | GUIDANCE ON MEASUREMENTS FOR DIRECT SEQUENCE SPREAD SPECTRUM SYSTEMS |
| **ANSI C63.4-1992** | STANDARD FORMAT MEASUREMENT/TECHNICAL REPORT PERSONAL COMPUTER AND PERIPHERALS |
| **RSS-210, Issue 3: 2000** | LOW POWER LICENSE-EXEMPT RADIO COMMUNICATION DEVICES (ALL FREQUENCY BANDS) |
| **RSS-139, Issue 1: 1999** | EVALUATION PROCEDURE FOR MOBILE AND PORTABLE RADIO TRANSMITTERS |

| FCC Rules Parts | Frequency Range MHz | Output Power (W) | Freq. Tolerance | Emission Designator |
|---|---|---|---|---|
| 15.247 | 2407-2468 | 0.0557 | N/A | N/A |

**This report concerns (check one):** **Original Grant:** X **Class II Change:**
**Equipment Type: Remote Phone Link**

**Deferred grant requested per 47 CFR 0.457 (d) (1) (ii)? Yes:** **No**: X
**If yes, defer until:** _____

**Company name agrees to notify the Commission by: _____(date) of the intended date of announcement of the product so that the grant can be issued on that date.**

**Transition Rules Request per 15.37? Yes:** **No:** X
**If no, assumed Part 15, subpart B for unintentional radiators - the new 47 CFR. [10-1-90 Edition] provision.**

*Document Number: 2000422*



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# 1 GENERAL INFORMATION

The following Application for Certification for a Direct Sequence Spread Spectrum Wireless Local Loop transmitter is prepared on behalf of ***Carlson Wireless Technologies, Inc.*** in accordance with Federal Communications Commissions Rules and Regulations and with Industry Canada. The Equipment Under Test (EUT) was the ***I-WLL-T (FSO and FSX) Central office and Subscriber unit respectively, FCC ID: OPA-I-WLL-T***. The test results reported in this document relate only to the item that was tested.

All measurements contained in this Application were conducted in accordance with ANSI C63.4 Methods of Measurement of Radio Noise Emissions, 1992, with Federal Communications Commissions Rules and Regulations Part 15.247, 1999, and with Industry Canada RSS210 and RSS102. The instrumentation utilized for the measurements conforms to the ANSI C63.4 standard for EMI and Field Strength Instrumentation. Some accessories are used to increase sensitivity and prevent overloading of the measuring instrument. These are explained in the appendix of this report. Calibration checks are performed regularly on the instruments, and all accessories including the high pass filter, preamplifier and cables.

All radiated and conducted emissions measurement were performed manually at Rhein Tech, Incorporated. The radiated emissions measurements required by the rules were performed on the three meter, open field, test range maintained by Rhein Tech Laboratories, Inc., 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. Complete description and site attenuation measurement data have been placed on file with the Federal Communications Commission and with Industry Canada. The power line conducted emission measurements were performed in a shielded enclosure also located at the Herndon, Virginia facility. Rhein Tech, Labs, Inc. is on the FCC and Industry Canada accepted lab list as a Facility available to do measurement work for others on a contract basis.

## 1.1 RELATED SUBMITTAL(S)/GRANT(S

This is an original application for unlicensed certification. A part 68-certification is in place for the telephone interface section of the device.

## 1.2 TEST METHODOLOGY

Both conducted and radiated testing was performed according to the procedures in ANSI C63.4 1992. Radiated testing was performed at an antenna to EUT distance of 3 meters. Emissions above 1 GHz were video averaged.

## 1.3 TEST FACILITY

The open area test site and conducted measurement facility used to collect the radiated data is located on the parking lot of Rhein Tech Laboratories, Inc. 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report dated, submitted to and approved by the Federal Communication Commission to perform AC line conducted and radiated emissions testing (ANSI C63.4 1992).

## 1.4 EMISSIONS EQUIPMENT LIST

| RTL equipment for emission testing | | | | | |
|---|---|---|---|---|---|
| **RTL Asset Number** | **Manufacturer** | **Model** | **Part Type** | **Serial Number** | **Calibration due date** |
| 900969 | Hewlett Packard | 85650A | Quasi-Peak Adapter (30 Hz – 40 GHz) | 2412A00414 | 03/23/01 |
| 900929 | Hewlett Packard | 85650A | Quasi-Peak Adapter (30 Hz – 40 GHz) | 2811A01276 | 03/28/01 |
| 900901 | Hewlett Packard | 85650A | Quasi-Peak Adapter (30 Hz – 40 GHz) | 3145A01599 | 11/02/01 |
| 900339 | Hewlett Packard | 85650A | Quasi-Peak Adapter (30 Hz – 40 GHz) | 2521A00743 | 03/27/01 |
| 900042 | Hewlett Packard | 85650A | Quasi-Peak Adapter (30 Hz – 40 GHz) | 2521A01032 | 11/05/01 |
| 900924 | Amplifier Research | 75A220 | Amplifier (10 kHz – 220 MHz) | | N/A |
| 900933 | Hewlett Packard | 11975A | Power Amplifier (2 - 8 GHz) | 2304A00348 | 11/15/01 |
| 901067 | Hewlett Packard | 8903B | Audio Analyzer | 2303A00307 | 06/28/01 |
| 901055 | Hewlett Packard | 8901A Opt. 002-003 | Modulation Analyzer | 2545A04102 | 06/08/01 |
| 900718 | Voltech | PM3000A | Power Analyzer | 6836-002-10 | 11/08/01 |
| 900397 | Associated Research, Inc. | 6554SA | Electrical Safety Compliance Analyzer | 940281 | 11/08/01 |
| 900926 | Hewlett Packard | 8753D | RF Vector Network Analyzer | 3410A09659 | 03/28/01 |
| 901089 | Hewlett Packard | HP875ET | Transmission/Reflection Network Analyzer | US39170052 | N/A |
| 900968 | Hewlett Packard | 8567A | Spectrum Analyzer (10 kHz – 1.5 GHz) | 2602A00160 | 03/23/01 |
| 900903 | Hewlett Packard | 8567A | Spectrum Analyzer (10 kHz – 1.5 GHz) | 2841A00614 | 11/02/01 |
| 900897 | Hewlett Packard | 8567A | Spectrum Analyzer (10 kHz – 1.5 GHz) | 2727A00535 | 11/08/01 |
| 900931 | Hewlett Packard | 8566B | Spectrum Analyzer (100 Hz – 22 GHz) | 3138A07771 | 03/27/01 |
| 900912 | Hewlett Packard | 8568A | RF Spectrum Analyzer (100 Hz – 1.5 GHz) | 2634A02704 | 08/02/01 |
| 900824 | Hewlett Packard | 8591E | RF Spectrum Analyzer (9 KHz – 1.8 GHz) | 3710A06135 | 11/14/01 |
| 900724 | ARA | LPB-2520 | Log Periodic / Biconical Antenna (25-1000 MHz) | 1037 | 2/1/01 |
| 900725 | ARA | LPB-2520 | Log Periodic / Biconical Antenna (25-1000 MHz) | 1036 | 07/12/01 |
| 900967 | A.H. Systems | TDS-206/535-1 through TDS-206/535-4 | Tuned Dipole set (30 – 1000 MHz) | 126, 128, 129, 132 | 12/15/00 |
| 900154 | Compliance Design | Roberts Dipole | Adjustable Elements Dipole antenna (30-1000MHz) | N/A | 7/26/01 |
| 900814 | Electro-Metrics | RGA-60 | Double Ridges Guide Antenna (1-18 GHz) | 2310 | 2/26/01 |
| 900081 | EMCO | 3146 | Log-Periodic Antenna (200-1000 MHz) | 1850 | |

# RTL equipment for emission testing

| RTL Asset Number | Manufacturer | Model | Part Type | Serial Number | Calibration due date |
|---|---|---|---|---|---|
| 900800 | EMCO | 3301B | Active Monopole (Rod antenna) (30 Hz – 50 MHz) | 9809-4071 | 05/02/01 |
| 900151 | Rohde@ Schwarz | HFH@-Z2 | Loop Antenna (9kHz-30 MHz) | 82825/019 | 05/26/01 |
| 900791 | Schaffner – Chase | CSL6112 | Bilog antenna (30 MHz – 2GHz) | 2099 | 2/22/01 |
| 901053 | Schaffner – Chase | CBL6112B | Bilog Chase antenna (200 MHz – 2 GHz) | 2648 | 05/24/01 |
| 900060 | Hewlett Packard | 86634B | Auxiliary Section for External Pulse Modulator | 1314A02913 | 11/08/01 |
| 901041 | ACO Pacific | 511E | Sound Level Calibrator | 028751 | In calibration |
| 900970 | Hewlett Packard | 85662A | Spectrum Analyzer Display | 254211239 | 03/23/01 |
| 900930 | Hewlett Packard | 85662A | Spectrum Analyzer Display | 3144A20839 | 03/28/01 |
| 900911 | Hewlett Packard | 85662A | Spectrum Analyzer Display | 2542A12739 | 08/02/01 |
| 900902 | Hewlett Packard | 85662A | Spectrum Analyzer Display | 2848A17585 | 11/02/01 |
| 900896 | Hewlett Packard | 85662A | Spectrum Analyzer Display | 2816A16471 | 11/02/01 |
| 900914 | Hewlett Packard | 8546OA | RF Filter Section, (100 KHz to 6.5 GHz) | 3330A00107 | 11/07/01 |
| 901057 | Hewlett Packard | 3336B | Synthesizer/Level Generator | 2514A02585 | 06/21/01 |
| 900059 | Hewlett Packard | 8660C | Signal Generator (9 KHz – 3200 MHz) | 1947A02956 | 11/08/01 |
| 900960 | Hewlett Packard | 8444A | Tracking Generator (0.5 –1500MHz) | 2325A07827 | 03/08/01 |
| 900917 | Hewlett Packard | 8648C | Synthesized. Signal Generator (9 KHz – 3200 MHz) | 3537A01741 | 03/28/01 |
| 900821 | Hewlett Packard | 33120A | 15 MHz Function / Arbitrary Waveform Generator | US36029992 | 11/14/01 |
| 900059 | Hewlett Packard | 8660C | Synthesized. Signal Generator (9 kHz –3200 MHz) | 1947A02956 | 11/08/01 |
| 900560 | Haefely | PESD 1600 | ESD Generator | H 703146 | 10/05/01 |
| 900099 | Marconi | 52022-910E | Signal Generator (10 kHz – 1 GHz) | 119044-189 | 11/14/01 |
| 900195 | Tektronix | CFG280 | Function Generator (0.1 Hz – 11 MHz) | TW12167 | N/A |
| 900927 | Tektronix | ASG 100 | Audio Signal Generator | B03274 V2.3 | N/A |
| 900935 | Wavetek | 3510B | Signal Generator | 5372160 | 03/28/00 |
| 900660 | Philips | PM5418TDS | TV Generator | LO 604891 | 11/21/01 |
| 900369 | Philips | PM5418TDS | TV Generator | LR81436C | N/A |
| 900268 | Taylor | 5565 | Hygrometer / Thermometer | N/A | 09/05/01 |
| 901056 | Hewlett Packard | 8954A, Opt.H03 | Transceiver Interface | 2924A00830 | 06/02/01 |
| 901088 | Hewlett Packard | 8954A | Transceiver Interface | 2146A00139 | 07/28/01 |
| 901082 | AFJ International | AFJ LS16 | LISN (9 kHz – 30 MHz) | 16010020081 | 06/16/01 |

# RTL equipment for emission testing

| RTL Asset Number | Manufacturer | Model | Part Type | Serial Number | Calibration due date |
|---|---|---|---|---|---|
| 901083 | AFJ International | AFJ LS16 | LISN (9 kHz – 30 MHz) | 16010020082 | 06/16/01 |
| 901084 | AFJ International | AFJ LS16 | LISN (9 kHz – 30 MHz) | 16010020080 | 06/16/01 |
| 901090 | Bajog electronic | 4V-100/200 | LISN (150 kHz – 30 MHz) | 00-44-007 | 08/03/01 |
| 900726 | Solar | 7225-1 | LISN | N/A | 03/29/01 |
| 900727 | Solar | 7225-1 | LISN | N/A | 03/29/01 |
| 900078 | Solar | 7225-1 | LISN | N/A | 03/29/01 |
| 900077 | Solar | 7225-1 | LISN | N/A | 03/29/01 |
| 901054 | Hewlett Packard | HP 3586B | Selective Level Meter | 1928A01892 | 06/08/01 |
| 900770 | Hewlett Packard | 437B | Power Meter | 2949A02966 | In cal. |
| 900793 | Hewlett Packard | 432A | Thermistor Power Meter | 1848a22632 | N/A |
| 900126 | Hewlett Packard | 11970A | Harmonic Mixer (26-40 GHz) | 2332A01199 | 11/10/02 |
| 900396 | Hewlett Packard | 11970K | Harmonic Mixer (18-26 GHz) | 2332A00563 | 11/00/02 |
| 900921 | Haefely | IP 6.2 | Coupling Network | 083-334-13 | 11/10/01 |
| 900918 | Voltech | IEC Standard 555 | Reference Impedance Network (rented) | 7701 | 11/08/01 |
| 900061 | Hewlett Packard | 86603A | RF Plug-in (1 to 2600 MHz) | 2221A02967 | 11/08/01 |
| 900160 | Pacific | 112-AMX | AC Power Source (rented) | 0187 | 11/15/01 |
| 900932 | Hewlett Packard | 8449B OPT H02 | Preamplifier (1-26.5 GHz) | 3008A00505 | 09/15/01 |
| 900045 | Hewlett Packard | 8447F | Preamplifier | 2944A03783 | N/A |
| 901040 | Industrial | SMX100 | Wide Band Preamplifier (0.01-1000 MHz) | 1736-0696 | 11/17/01 |
| 900721 | Hewlett Packard | 8447D | Preamplifier (0.1-1300 MHz) | 2727A05397 | N/A |
| 900889 | Hewlett Packard | 85685A | RF Preselector for HP 8566B or 8568B (20Hz-2GHz) | 3146A01309 | 11/14/01 |
| 900566 | Amplifier Research | FP 2000 | Isotropic Field Probe | 20760 | 08/29/01 |
| 900174 | FCC | F-120-9A | RF Injection Probe (10 kHz – 300 MHz) | N/A | 05/31/01 |
| 901044 | FCC | F-120-5 | Bulk Current Injection Probe (10 kHz – 150 MHz) | 17 | 05/12/01 |
| 901042 | FCC | F-72-1 | RF Current Probe (10 Hz – 100 MHz) | 44 | 05/11/01 |
| 900704 | FCC | F-14-1 | Current Probe (10 Hz – 500 kHz) | 33 | 05/12/01 |
| 900894 | FCC | F-33-1 | RF Current Probe (10 kHz – 250 MHz) | 303 | 05/30/01 |
| 900854 | Solar Electronics Co | 9119-IN | RF Current Probe | 972501 | |
| 900849 | Solar Electronics Co | 9121-IN | Injection Probe (10 MHz – 1 GHz) | 953501 | |
| 900848 | Solar Electronics Co | 9320-IN | RF Current Probe | 990521 | |
| 900913 | Hewlett Packard | 85462A | EMI Receiver RF | 3325A00159 | 03/29/01 |

# RTL equipment for emission testing

| RTL Asset Number | Manufacturer | Model | Part Type | Serial Number | Calibration due date |
|---|---|---|---|---|---|
| | | | Section (9 KHz – 6.5 GHz) | | |
| 900769 | Hewlett Packard | 8481B | Power Sensor | 2702A05059 | In cal. |
| 900937 | Hewlett Packard | 8482H | 3-watt Power Sensor (100 KHz to 4.2 GHz) | 3318A08961 | 12/02/01 |
| 900928 | Hewlett Packard | 83752A | Synthesized Sweeper, 0.01 to 20 GHz | 3610A00866 | 03/28/01 |
| 900946 | Tenney Engineering, Inc. | TH65 | Temperature Chamber with Humidity | 11380 | 11/07/01 |
| 900111 | Omega Engineering | DP41-TC-DSS | Temperature Monitor | 2060123 | In cal. |
| 901043 | FCC | | Terminator for RF Current Probe F-72-1 | | 05/12/01 |
| 900731 | Haefely | PEFT.1 | Burst Tester with Coupling Network | 082 106-29 | 11/10/01 |
| 900402 | BAPCO Electro-Com | IEC 601 L | Safety Tester | 000028 | 11/10/01 |
| 900720 | Haefely | Psurge 4.1 | Surge Tester | 083-342-02 | 11/10/01 |
| 900839 | Bird | 43P | Peak Reading Wattmeter | 3110 | 11/10/01 |

# 2 SYSTEM TEST CONFIGURATION

## 2.1 JUSTIFICATION

The EUT was tested in all three orthogonal planes in order to determine worst case emission. Channel 1 at 2.407GHz, Channel 3 at 2.438GHz and Channel 6 at 2.468GHz were tested and investigated from 9kHz to 24GHz. All three channels were investigated and tested. Data for all three channels are presented in this report.

To complete the configuration required by the FCC, the EUT was tested by connecting the FXO unit to a telephone line and the FXS to a standard telephone. Both units were oriented so that the individual antennas were line of sight similar to its intended use.

The EUT was investigated with the internal patch antenna as well as the grid antenna. The worst case data taken in this report represents the highest data rate at 144KBPS.
**Note:** The EUT was tested as a digital device as well as a receiver. A DOC report is on file for the device as a digital interface device**.** Emission data for the receiver section is part of this report.

## 2.2 EUT EXERCISE SOFTWARE

The EUT (FXO) was enabled to continuously transmit, which was verified by the receiving unit (FXS) during testing. The carrier was also checked to verify that the information was being transmitted.

## 2.3 FCC 15.203 SUPPORT FOR STANDARD CONNECTORS INCLUDING SPECIAL ACCESSORIES

The I-WLL-T system uses unique connectors: Johnson Components, MMCX Connector from the transmitter to the internal patch antenna or to a standard N connector for connection to an external antenna. **The use of the standard connector is supported by the manufacturers professional installation manual that is a part of this report.**

# 3 FIELD STRENGTH CALCULATION

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FI(dBuV/m) = SAR(dBuV) + SCF(dB/m)
FI = Field Intensity
SAR = Spectrum Analyzer Reading
SCF = Site Correction Factor

The Site Correction Factor (SCF) used in the above equation is determined empirically, and is expressed in the following equation:

SCF(dB/m) = - PG(dB) + AF(dB/m) + CL(dB)

SCF = Site Correction Factor
PG = Pre-amplifier Gain
AF = Antenna Factor
CL = Cable Loss

The field intensity in microvolts per meter can then be determined according to the following equation:

$$FI(uV/m) = 10^{FI(dBuV/m)/20}$$

For example, assume a signal at a frequency of 125 MHz has a received level measured as 49.3 dBuV. The total Site Correction Factor (antenna factor plus cable loss minus preamplifier gain) for 125 MHz is -11.5 dB/m. The actual radiated field strength is calculated as follows:

49.3 dBuV - 11.5 dB/m = 37.8 dBuV/m

$$10^{37.8/20} = 10^{1.89} = 77.6 \text{ uV/m}$$

**EIRP calculation:** Power from power meter in (dBm) + antenna gain in (dBi)

# 4 Conformance Statement

| STANDARDS REFERENCED FOR THIS REPORT | |
|---|---|
| **PART 2: 1999** | FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS |
| **PART 15: 1999** | RADIO FREQUENCY DEVICES |
| **FCC 97-114** | GUIDANCE ON MEASUREMENTS FOR DIRECT SEQUENCE SPREAD SPECTRUM SYSTEMS |
| **ANSI C63.4-1992** | STANDARD FORMAT MEASUREMENT/TECHNICAL REPORT PERSONAL COMPUTER AND PERIPHERALS |
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| **RSS-139, Issue 1: 1999** | EVALUATION PROCEDURE FOR MOBILE AND PORTABLE RADIO TRANSMITTERS |

| FCC Rules Parts | Frequency Range MHz | Output Power (W) | Freq. Tolerance | Emission Designator |
|---|---|---|---|---|
| 15.247 | 2407-2468 | 0.0557 | N/A | N/A |

**I, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described above. No modifications were made during testing to the equipment in order to achieve compliance with these standards. Furthermore, there was no deviation from, additions to or exclusions from the ANSI C63.4 test methodology.**

**REPORT PREPARED BY:**

| | | |
|---|---|---|
| **Supervising Engineer:** | **Desmond A. Fraser** |  |
| **EMC Engineer:** | **Elizabeth Szrajer** |  |
| **EMC Engineer:** | **Dan Baltzell** |  |
| **Administrative Writer:** | **Melissa Fleming** |  |

# 5 TEST SYSTEM DETAILS

The FCC Identifiers for all equipment, plus descriptions of all cables used in the tested system (including inserted cards, which have grants) are:

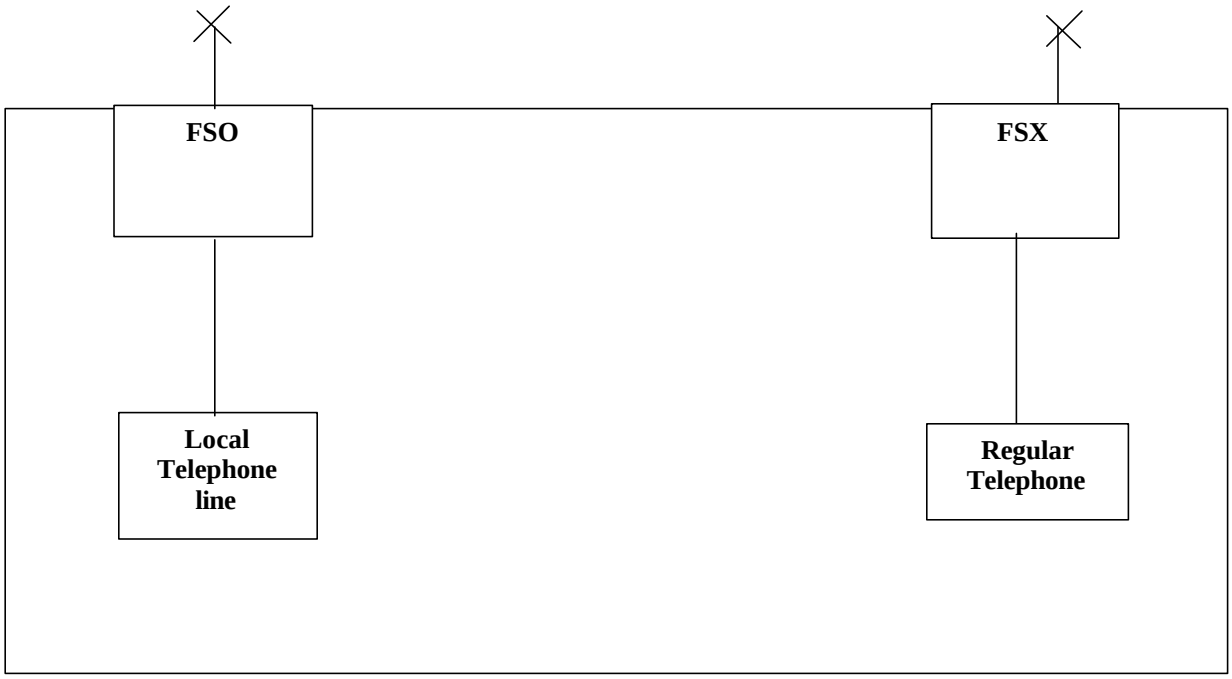
**External Components:**

| Part | Manufacturer | Model | Serial Number | FCC ID | Cable Description | RTL Bar Code |
|---|---|---|---|---|---|---|
| **EUT** | **CARLSON** | **FXO** | **N/A** | **OPA-I-WLL-T** | **SHIELDED I/O** | **12624** |
| **EUT** | **CARLSON** | **FXO** | **N/A** | **OPA-I-WLL-T** | **SHIELDED I/O** | **12623** |
| POWER SUPPLY | GLOBTEK, INC. | SYS1089-1515-T3 | N/A | N/A | UNSHIELDED | 12625 |
| POWER SUPPLY | GLOBTEK, INC. | SYS1089-1515-T3 | N/A | N/A | UNSHIELDED | 12626 |
| ANTENNA (GRID) | PACIFIC WIRELESS | PMPF-1 | N/A | N/A | SHIELDED I/O | 12630 |
| ANTENNA (PATCH) | **CARLSON** | PATCH | N/A | N/A | N/A | N/A |
| 36 INCH CABLE | N/A | N/A | N/A | N/A | N/A | N/A |

**Internal Components:**

| Part | Manufacturer | Model | Serial Number | FCC ID | Cable Description | RTL Bar Code |
|---|---|---|---|---|---|---|
| **PCMCIA CARD** | **ZOOM AIR WIRELESS NETWORK** | **FXO (4000)** | **1570-Z 4000-02-00-1119** | **BDNWLANPSARD1** | **COAX** | **N/A** |
| **PCMCIA CARD** | **ZOOM AIR WIRELESS NETWORK** | **FXS (4000)** | **1570-Z 4000-02-00-1119** | **BDNWLANPSARD1** | **COAX** | **N/A** |

## 5.1 CONFIGURATION OF TESTED SYSTEM



# 6 Conducted Emissions

## 6.1 CONDUCTED EMISSIONS MEASUREMENTS

The power line conducted emission measurements were performed in a Series 81 type shielded enclosure manufactured by Rayproof. The EUT was assembled on a wooden table 80 centimeters high. Power was fed to the EUT through a 50 ohm / 50 microhenry Line Impedance Stabilization Network (EUT LISN). The EUT LISN was fed power through an A.C. filter box on the outside of the shielded enclosure. The filter box and EUT LISN housing are bonded to the ground plane of the shielded enclosure. A second LISN, the peripheral LISN, provides isolation for the EUT test peripherals. This peripheral LISN was also fed A.C. power. A metal power outlet box, which is bonded to the ground plane and electrically connected to the peripheral LISN, powers the EUT host peripherals.

The spectrum analyzer was connected to the A.C. line through an isolation transformer. The 50-ohm output of the EUT LISN was connected to the spectrum analyzer input through a Solar 7 kHz high-pass filter. The filter is used to prevent overload of the spectrum analyzer from noise below 7 kHz. Conducted emission levels were measured on each current-carrying line with the spectrum analyzer operating in the CISPR quasi-peak mode (or average mode if applicable). The analyzer's 6 dB bandwidth was set to 9 kHz. No video filter less than 10 times the resolution bandwidth was used. Average measurements are performed in linear mode using a 10 kHz resolution bandwidth, a 1 Hz video bandwidth, and by increasing the sweep time in order to obtain a calibrated measurement. The range of the frequency spectrum to be investigated is specified in FCC Part 15. The highest emission amplitudes relative to the appropriate limit were measured and have been recorded in this report.

## 6.2 CONDUCTED EMISSIONS TEST RESULTS

The following table lists worst case conducted emission date. Specifically: Emission Frequency, Test Detector, Analyzer Reading, Site Correction Factor, corrected Emission Level, Quasi Peak Limit and Margin, and the Average Limit and Margin.

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. If the conducted emissions exceed the limit with the instrument set to the quasi-peak mode, then measurements are made in the average mode.

The conducted test was performed with the EUT exercise program loaded, and the emissions were scanned between 150 kHz to 30 MHz on the NEUTRAL SIDE and HOT SIDE, herein referred to as L1 and L2, respectively.

**Pk = Peak; QP = Quasi-Peak; Av = Average**

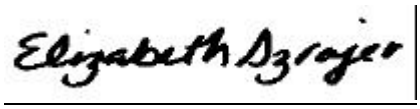
### 6.2.1.1 Neutral Side (Line 1)

| Temperature: 73°F | | | | Humidity: 36% | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Emission Frequency (MHz)** | **Test Detector** | **Analyzer Reading (dBuV)** | **Site Correction Factor (dB)** | **Emission Level (dBuV)** | **FCC A QP Limit (dBuV)** | **FCC A QP Margin (dBuV)** | **FCC A AV Limit (dBuV)** | **FCC A AV Margin (dBuV)** | **Pass/ Fail** | **Comments** |
| 0.852 | Pk | 33.8 | 0.4 | 34.2 | 60.0 | -25.8 | 60.0 | -25.8 | Pass | |
| 1.525 | Pk | 35.1 | 0.8 | 35.9 | 60.0 | -24.1 | 60.0 | -24.1 | Pass | |
| 2.728 | Pk | 35.0 | 1.1 | 36.1 | 69.5 | -33.4 | 69.5 | -33.4 | Pass | |
| 11.056 | Pk | 29.3 | 1.9 | 31.2 | 69.5 | -38.3 | 69.5 | -38.3 | Pass | |
| 16.383 | Pk | 37.6 | 2.9 | 40.5 | 69.5 | -29.0 | 69.5 | -29.0 | Pass | |
| 24.576 | Pk | 36.8 | 3.3 | 40.1 | 69.5 | -29.4 | 69.5 | -29.4 | Pass | |

### 6.2.1.2 Hot Side (Line 2)

| Temperature: 73°F | | | | Humidity: 36% | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Emission Frequency (MHz)** | **Test Detector** | **Analyzer Reading (dBuV)** | **Site Correction Factor (dB)** | **Emission Level (dBuV)** | **FCC A QP Limit (dBuV)** | **FCC A QP Margin (dBuV)** | **FCC A AV Limit (dBuV)** | **FCC A AV Margin (dBuV)** | **Pass/ Fail** | **Comments** |
| 0.842 | Pk | 37.1 | 0.4 | 37.5 | 60.0 | -22.5 | 60.0 | -22.5 | Pass | |
| 1.008 | Pk | 36.6 | 0.5 | 37.1 | 60.0 | -22.9 | 60.0 | -22.9 | Pass | |
| 2.714 | Pk | 34.6 | 1.0 | 35.6 | 69.5 | -33.9 | 69.5 | -33.9 | Pass | |
| 11.058 | Pk | 29.6 | 1.8 | 31.4 | 69.5 | -38.1 | 69.5 | -38.1 | Pass | |
| 16.383 | Pk | 37.5 | 2.8 | 40.3 | 69.5 | -29.2 | 69.5 | -29.2 | Pass | |
| 24.579 | Pk | 36.4 | 3.1 | 39.5 | 69.5 | -30.0 | 69.5 | -30.0 | Pass | |

**TEST PERSONNEL:**



**Typed/Printed Name**: Elizabeth Szrajer
**Date:** October 27, 2000

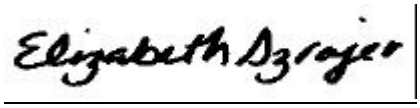
### 6.2.2.1 NEUTRAL SIDE (Line 1)

| Temperature: 73°F Humidity: 35% | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Emission Frequency (MHz) | Test Detector | Analyzer Reading (dBuV) | Site Correction Factor (dB) | Emission Level (dBuV) | FCC A QP Limit (dBuV) | FCC A QP Margin (dBuV) | FCC A AV Limit (dBuV) | FCC A AV Margin (dBuV) | Pass/ Fail | Comments |
| 1.532 | Pk | 35.4 | 0.8 | 36.2 | 60.0 | -23.8 | 60.0 | -23.8 | Pass | |
| 3.236 | Pk | 35.2 | 1.2 | 36.4 | 69.5 | -33.1 | 69.5 | -33.1 | Pass | |
| 9.995 | Pk | 33.8 | 1.8 | 35.6 | 69.5 | -33.9 | 69.5 | -33.9 | Pass | |
| 16.384 | Pk | 35.4 | 2.9 | 38.3 | 69.5 | -31.2 | 69.5 | -31.2 | Pass | |
| 22.118 | Pk | 35.5 | 2.8 | 38.3 | 69.5 | -31.2 | 69.5 | -31.2 | Pass | |
| 24.577 | Pk | 32.3 | 3.3 | 35.6 | 69.5 | -33.9 | 69.5 | -33.9 | Pass | |

### 6.2.2.2 HOT SIDE (Line 2)

| Temperature: 73°F Humidity: 35% | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Emission Frequency (MHz) | Test Detector | Analyzer Reading (dBuV) | Site Correction Factor (dB) | Emission Level (dBuV) | FCC A QP Limit (dBuV) | FCC A QP Margin (dBuV) | FCC A AV Limit (dBuV) | FCC A AV Margin (dBuV) | Pass/ Fail | Comments |
| 0.854 | Pk | 37.0 | 0.4 | 37.4 | 60.0 | -22.6 | 60.0 | -22.6 | Pass | |
| 1.017 | Pk | 36.6 | 0.5 | 37.1 | 60.0 | -22.9 | 60.0 | -22.9 | Pass | |
| 3.225 | Pk | 32.9 | 1.1 | 34.0 | 69.5 | -35.5 | 69.5 | -35.5 | Pass | |
| 10.001 | Pk | 30.4 | 1.8 | 32.2 | 69.5 | -37.3 | 69.5 | -37.3 | Pass | |
| 16.384 | Pk | 37.3 | 2.8 | 40.1 | 69.5 | -29.4 | 69.5 | -29.4 | Pass | |
| 24.576 | Pk | 35.6 | 3.1 | 38.7 | 69.5 | -30.8 | 69.5 | -30.8 | Pass | |

**TEST PERSONNEL:**



**Typed/Printed Name**: Elizabeth Szrajer
**Date:** October 27, 2000

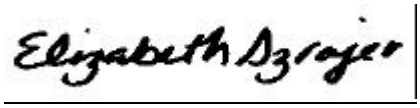
### 6.2.3.1 NEUTRAL SIDE (Line 1)

| Temperature: 74°F Humidity: 35% | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Emission Frequency (MHz) | Test Detector | Analyzer Reading (dBuV) | Site Correction Factor (dB) | Emission Level (dBuV) | FCC A QP Limit (dBuV) | FCC A QP Margin (dBuV) | FCC A AV Limit (dBuV) | FCC A AV Margin (dBuV) | Pass/ Fail | Comments |
| 0.808 | Pk | 33.5 | 0.4 | 33.9 | 60.0 | -26.1 | 60.0 | -26.1 | Pass | |
| 1.515 | Pk | 34.8 | 0.8 | 35.6 | 60.0 | -24.4 | 60.0 | -24.4 | Pass | |
| 2.889 | Pk | 35.0 | 1.2 | 36.2 | 69.5 | -33.3 | 69.5 | -33.3 | Pass | |
| 11.058 | Pk | 29.3 | 1.9 | 31.2 | 69.5 | -38.3 | 69.5 | -38.3 | Pass | |
| 16.383 | Pk | 37.7 | 2.9 | 40.6 | 69.5 | -28.9 | 69.5 | -28.9 | Pass | |
| 24.573 | Pk | 37.2 | 3.3 | 40.5 | 69.5 | -29.0 | 69.5 | -29.0 | Pass | |

### 6.2.3.2 HOT SIDE (Line 2)

| Temperature: 74°F Humidity: 35% | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Emission Frequency (MHz) | Test Detector | Analyzer Reading (dBuV) | Site Correction Factor (dB) | Emission Level (dBuV) | FCC A QP Limit (dBuV) | FCC A QP Margin (dBuV) | FCC A AV Limit (dBuV) | FCC A AV Margin (dBuV) | Pass/ Fail | Comments |
| 0.838 | Pk | 36.8 | 0.4 | 37.2 | 60.0 | -22.8 | 60.0 | -22.8 | Pass | |
| 1.521 | Pk | 34.6 | 0.7 | 35.3 | 60.0 | -24.7 | 60.0 | -24.7 | Pass | |
| 2.555 | Pk | 33.7 | 1.0 | 34.7 | 69.5 | -34.8 | 69.5 | -34.8 | Pass | |
| 11.060 | Pk | 29.4 | 1.8 | 31.2 | 69.5 | -38.3 | 69.5 | -38.3 | Pass | |
| 16.383 | Pk | 37.0 | 2.8 | 39.8 | 69.5 | -29.7 | 69.5 | -29.7 | Pass | |
| 24.576 | Pk | 37.1 | 3.1 | 40.2 | 69.5 | -29.3 | 69.5 | -29.3 | Pass | |

**TEST PERSONNEL:**



**Typed/Printed Name**: Elizabeth Szrajer
**Date:** October 27, 2000

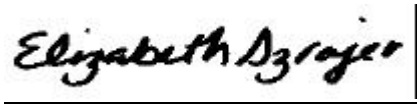
### 6.2.4.1 Neutral Side (Line 1)

| Temperature: 73°F Humidity: 35% | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Emission Frequency (MHz) | Test Detector | Analyzer Reading (dBuV) | Site Correction Factor (dB) | Emission Level (dBuV) | FCC A QP Limit (dBuV) | FCC A QP Margin (dBuV) | FCC A AV Limit (dBuV) | FCC A AV Margin (dBuV) | Pass/ Fail | Comments |
| 2.897 | Pk | 35.0 | 1.2 | 36.2 | 69.5 | -33.3 | 69.5 | -33.3 | Pass | |
| 8.894 | Pk | 40.6 | 1.9 | 42.5 | 69.5 | -27.0 | 69.5 | -27.0 | Pass | |
| 11.058 | Pk | 34.3 | 1.9 | 36.2 | 69.5 | -33.3 | 69.5 | -33.3 | Pass | |
| 16.382 | Pk | 35.1 | 2.9 | 38.0 | 69.5 | -31.5 | 69.5 | -31.5 | Pass | |
| 22.118 | Pk | 46.5 | 2.8 | 49.3 | 69.5 | -20.2 | 69.5 | -20.2 | Pass | |
| 24.574 | Pk | 37.6 | 3.3 | 40.9 | 69.5 | -28.6 | 69.5 | -28.6 | Pass | |

### 6.2.4.2 Hot Side (Line 2)

| Temperature: 73°F Humidity: 35% | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Emission Frequency (MHz) | Test Detector | Analyzer Reading (dBuV) | Site Correction Factor (dB) | Emission Level (dBuV) | FCC A QP Limit (dBuV) | FCC A QP Margin (dBuV) | FCC A AV Limit (dBuV) | FCC A AV Margin (dBuV) | Pass/ Fail | Comments |
| 0.924 | Pk | 36.9 | 0.4 | 37.3 | 60.0 | -22.7 | 60.0 | -22.7 | Pass | |
| 8.864 | Pk | 41.6 | 1.9 | 43.5 | 69.5 | -26.0 | 69.5 | -26.0 | Pass | |
| 11.059 | Pk | 34.6 | 1.8 | 36.4 | 69.5 | -33.1 | 69.5 | -33.1 | Pass | |
| 16.384 | Pk | 35.3 | 2.8 | 38.1 | 69.5 | -31.4 | 69.5 | -31.4 | Pass | |
| 22.118 | Pk | 47.0 | 2.5 | 49.5 | 69.5 | -20.0 | 69.5 | -20.0 | Pass | |
| 24.575 | Pk | 36.5 | 3.1 | 39.6 | 69.5 | -29.9 | 69.5 | -29.9 | Pass | |

**TEST PERSONNEL:**



**Typed/Printed Name**: Elizabeth Szrajer
**Date:** October 27, 2000

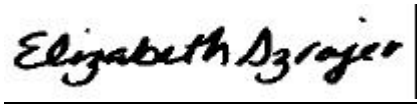
### 6.2.5.1 NEUTRAL SIDE (Line 1)

| Temperature: 73°F Humidity: 35% | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Emission Frequency (MHz)** | **Test Detector** | **Analyzer Reading (dBuV)** | **Site Correction Factor (dB)** | **Emission Level (dBuV)** | **FCC A QP Limit (dBuV)** | **FCC A QP Margin (dBuV)** | **FCC A AV Limit (dBuV)** | **FCC A AV Margin (dBuV)** | **Pass/ Fail** | **Comments** |
| 0.597 | Pk | 35.8 | 0.3 | 36.1 | 60.0 | -23.9 | 60.0 | -23.9 | Pass | |
| 8.721 | Pk | 48.0 | 1.9 | 49.9 | 69.5 | -19.6 | 69.5 | -19.6 | Pass | |
| 11.058 | Pk | 37.4 | 1.9 | 39.3 | 69.5 | -30.2 | 69.5 | -30.2 | Pass | |
| 16.382 | Pk | 36.5 | 2.9 | 39.4 | 69.5 | -30.1 | 69.5 | -30.1 | Pass | |
| 22.118 | Pk | 42.0 | 2.8 | 44.8 | 69.5 | -24.7 | 69.5 | -24.7 | Pass | |
| 28.669 | Pk | 39.5 | 4.2 | 43.7 | 69.5 | -25.8 | 69.5 | -25.8 | Pass | |

### 6.2.5.2 HOT SIDE (Line 2)

| Temperature: 73°F Humidity: 35% | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Emission Frequency (MHz)** | **Test Detector** | **Analyzer Reading (dBuV)** | **Site Correction Factor (dB)** | **Emission Level (dBuV)** | **FCC A QP Limit (dBuV)** | **FCC A QP Margin (dBuV)** | **FCC A AV Limit (dBuV)** | **FCC A AV Margin (dBuV)** | **Pass/ Fail** | **Comments** |
| 0.919 | Pk | 36.5 | 0.4 | 36.9 | 60.0 | -23.1 | 60.0 | -23.1 | Pass | |
| 8.622 | Pk | 45.5 | 1.9 | 47.4 | 69.5 | -22.1 | 69.5 | -22.1 | Pass | |
| 11.058 | Pk | 37.3 | 1.8 | 39.1 | 69.5 | -30.4 | 69.5 | -30.4 | Pass | |
| 16.383 | Pk | 36.1 | 2.8 | 38.9 | 69.5 | -30.6 | 69.5 | -30.6 | Pass | |
| 22.117 | Pk | 41.8 | 2.5 | 44.3 | 69.5 | -25.2 | 69.5 | -25.2 | Pass | |
| 28.673 | Pk | 40.1 | 3.8 | 43.9 | 69.5 | -25.6 | 69.5 | -25.6 | Pass | |

**TEST PERSONNEL:**



**Typed/Printed Name**: Elizabeth Szrajer
**Date:** October 27, 2000

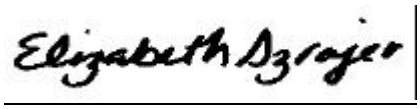
### 6.2.6.1 NEUTRAL SIDE (Line 1)

| Temperature: 74°F Humidity: 36% | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Emission Frequency (MHz) | Test Detector | Analyzer Reading (dBuV) | Site Correction Factor (dB) | Emission Level (dBuV) | FCC A QP Limit (dBuV) | FCC A QP Margin (dBuV) | FCC A AV Limit (dBuV) | FCC A AV Margin (dBuV) | Pass/ Fail | Comments |
| 0.578 | Pk | 36.3 | 0.3 | 36.6 | 60.0 | -23.4 | 60.0 | -23.4 | Pass | |
| 8.612 | Pk | 49.4 | 1.9 | 51.3 | 69.5 | -18.2 | 69.5 | -18.2 | Pass | |
| 11.058 | Pk | 37.2 | 1.9 | 39.1 | 69.5 | -30.4 | 69.5 | -30.4 | Pass | |
| 16.383 | Pk | 36.5 | 2.9 | 39.4 | 69.5 | -30.1 | 69.5 | -30.1 | Pass | |
| 22.117 | Pk | 41.9 | 2.8 | 44.7 | 69.5 | -24.8 | 69.5 | -24.8 | Pass | |
| 28.670 | Pk | 44.5 | 4.2 | 48.7 | 69.5 | -20.8 | 69.5 | -20.8 | Pass | |

### 6.2.6.2 HOT SIDE (Line 2)

| Temperature: 74°F Humidity: 36% | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Emission Frequency (MHz) | Test Detector | Analyzer Reading (dBuV) | Site Correction Factor (dB) | Emission Level (dBuV) | FCC A QP Limit (dBuV) | FCC A QP Margin (dBuV) | FCC A AV Limit (dBuV) | FCC A AV Margin (dBuV) | Pass/ Fail | Comments |
| 0.583 | Pk | 36.7 | 0.4 | 37.1 | 60.0 | -22.9 | 60.0 | -22.9 | Pass | |
| 8.594 | Pk | 47.8 | 1.9 | 49.7 | 69.5 | -19.8 | 69.5 | -19.8 | Pass | |
| 11.059 | Pk | 37.1 | 1.8 | 38.9 | 69.5 | -30.6 | 69.5 | -30.6 | Pass | |
| 16.384 | Pk | 36.3 | 2.8 | 39.1 | 69.5 | -30.4 | 69.5 | -30.4 | Pass | |
| 22.117 | Pk | 42.1 | 2.5 | 44.6 | 69.5 | -24.9 | 69.5 | -24.9 | Pass | |
| 28.670 | Pk | 44.8 | 3.8 | 48.6 | 69.5 | -20.9 | 69.5 | -20.9 | Pass | |

**TEST PERSONNEL:**



**Typed/Printed Name**: Elizabeth Szrajer
**Date:** October 27, 2000

# 7 Radiated Emissions

## 7.1 RADIATED EMISSIONS MEASUREMENTS

Before final measurements of radiated emissions were made on the open-field three/ten meter range; the EUT was scanned in-doors at one and three meter distances. This was done in order to determine its emissions spectrum signature. The physical arrangement of the test system and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. This process was repeated during final radiated emissions measurements on the open-field range, at each frequency, in order to insure that maximum emission amplitudes were attained.

Final radiated emissions measurements were made on the three/ten-meter, open-field test site. The EUT was placed on a nonconductive turntable 0.8 meters above the ground plane.

At each frequency, the EUT was rotated 360 degrees, and the antenna was raised and lowered from one to four meters in order to determine the maximum emission levels. Measurements were taken using both horizontal and vertical antenna polarizations. The spectrum analyzer's 6 dB bandwidth was set to 120 kHz, and the analyzer was operated in the CISPR quasi-peak detection mode. No video filter less than 10 times the resolution bandwidth was used. The range of the frequency spectrum to be investigated is specified in FCC Part 15. The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report. . **For radiated measurements above 1 GHz, a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz are used.**

*Note: Rhein Tech Laboratories, Inc. has implemented procedures to minimize errors that occur from test instruments, calibration, procedures, and test setups. Test instrument and calibration errors are documented from the manufacturer or calibration lab. Other errors have been defined and calculated within the Rhein Tech quality manual, section 6.1. Rhein Tech implements the following procedures to minimize errors that may occur: yearly as well as daily calibration methods, technician training, and emphasis to employees on avoiding error.*

## 7.2 RADIATED SPURIOUS EMISSIONS

Radiated Spurious Emissions applies to harmonics and spurious emissions that fall in the restricted and non-restricted bands. The restricted bands are listed in Section 15.205. The maximum permitted average field strength for the restricted band is listed in Section 15.209.

The following data lists the significant emission frequencies, measured levels, correction factor (includes cable and antenna corrections), the corrected reading, plus the limit.

| Temperature: 61°F Humidity: 100% | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Emission Frequency (MHz)** | **Test Detector** | **Antenna Polarity (H/V)** | **Turntable Azimuth (deg)** | **Antenna Height (m)** | **Analyzer Reading (dBuV)** | **Site Correction Factor (dB/m)** | **Emission Level (dBuV/m)** | **Limit (dBuV/m)** | **Margin (dB)** | **Pass/ Fail** | **Comments** |
| 2128.008 | Av | V | 15 | 1.0 | 58.4 | -1.2 | 57.2 | 101.5 | -44.3 | Pass | |
| **2407.310** | **Pk** | **V** | **0** | **1.0** | **121.4** | **0.1** | **121.5** | **20** | **101.5** | | **Fundamental** |
| **2407.310** | **Av** | **V** | **0** | **1.0** | **71.1** | **0.1** | **71.2** | | | | **Fundamental** |
| 2606.100 | Av | V | 0 | 1.2 | 43.3 | 1.3 | 44.6 | 101.5 | -9.4 | Pass | |
| 4816.000 | Av | V | 0 | 1.0 | 22.3 | 20.0 | 42.3 | 54 | -11.7 | | |

| Temperature: 61°F Humidity: 100% | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Emission Frequency (MHz)** | **Test Detector** | **Antenna Polarity (H/V)** | **Turntable Azimuth (deg)** | **Antenna Height (m)** | **Analyzer Reading (dBuV)** | **Site Correction Factor (dB/m)** | **Emission Level (dBuV/m)** | **Limit (dBuV/m)** | **Margin (dB)** | **Pass/ Fail** | **Comments** |
| 2157.916 | Av | V | 30 | 1.2 | 53.9 | -1.0 | 52.9 | 102.9 | -50.0 | Pass | |
| **2438.000** | **Pk** | **V** | **0** | **1.0** | **122.6** | **0.3** | **122.9** | **20** | **102.9** | | **Fundamental** |
| **2438.600** | **Av** | **V** | **10** | **1.0** | **67.5** | **0.3** | **67.8** | | | | **Fundamental** |
| 2799.412 | Av | V | 30 | 1.0 | 36.2 | 6.7 | 42.9 | 54 | -11.1 | Pass | |
| 4876.006 | Av | V | 0 | 1.0 | 19.5 | 19.8 | 39.3 | 54 | -14.7 | Pass | |

| Temperature: 61°F Humidity: 100% | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Emission Frequency (MHz)** | **Test Detector** | **Antenna Polarity (H/V)** | **Turntable Azimuth (deg)** | **Antenna Height (m)** | **Analyzer Reading (dBuV)** | **Site Correction Factor (dB/m)** | **Emission Level (dBuV/m)** | **Limit (dBuV/m)** | **Margin (dB)** | **Pass/ Fail** | **Comments** |
| 2188.060 | Av | V | 0 | 1.0 | 54.6 | -0.4 | 54.2 | 102.5 | -48.3 | Pass | |
| **2468.000** | **Pk** | **V** | **0** | **1.0** | **122.1** | **0.4** | **122.5** | **20** | **102.5** | | **Fundamental** |
| **2468.000** | **Av** | **V** | **0** | **1.0** | **70.0** | **0.4** | **70.4** | | | | **Fundamental** |
| 4936.000 | Av | V | 0 | 1.0 | 29.8 | 19.1 | 48.9 | 54 | -5.1 | Pass | |

**TEST PERSONNEL:**

**Typed/Printed Name**: Daniel Baltzell
**Date:** October 18, 2000

| Temperature: 72°F Humidity: 68% | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Emission Frequency (MHz)** | **Test Detector** | **Antenna Polarity (H/V)** | **Turntable Azimuth (deg)** | **Antenna Height (m)** | **Analyzer Reading (dBuV)** | **Site Correction Factor (dB/m)** | **Emission Level (dBuV/m)** | **Limit (dBuV/m)** | **Margin (dB)** | **Pass/ Fail** | **Comments** |
| **2407.310** | **Pk** | **V** | **0** | **1.4** | **126.6** | **0.1** | **126.7** | **20** | **106.7** | | |
| **2407.310** | **Av** | **V** | **0** | **1.5** | **70.8** | **0.1** | **70.9** | | | | |
| 2618.800 | Av | V | 0 | 1.5 | 30.7 | 1.4 | 32.1 | 106.7 | -74.6 | Pass | |
| 4816.000 | Av | V | 0 | 1.0 | 34.3 | 16.3 | 50.6 | 54.0 | -3.4 | Pass | |
| 6383.993 | Av | V | 0 | 1.0 | 31.2 | 17.7 | 48.9 | 106.7 | -57.8 | Pass | |
| 8512.029 | Av | V | 0 | 1.0 | 22.8 | 24.0 | 46.8 | 106.7 | -59.9 | Pass | |

| Temperature: 72°F Humidity: 68% | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Emission Frequency (MHz)** | **Test Detector** | **Antenna Polarity (H/V)** | **Turntable Azimuth (deg)** | **Antenna Height (m)** | **Analyzer Reading (dBuV)** | **Site Correction Factor (dB/m)** | **Emission Level (dBuV/m)** | **Limit (dBuV/m)** | **Margin (dB)** | **Pass/ Fail** | **Comments** |
| **2438.000** | **Pk** | **V** | **0** | **1.5** | **126.8** | **0.3** | **127.1** | **20** | **107.1** | | |
| **2438.000** | **Av** | **V** | **0** | **1.5** | **83.8** | **0.3** | **84.1** | | | | |
| 2618.800 | Av | V | 0 | 1.5 | 30.4 | 1.4 | 31.8 | 107.1 | -75.3 | Pass | |
| 3946.440 | Av | V | 0 | 1.5 | 33.3 | 6.9 | 40.2 | 54.0 | -13.8 | Pass | |
| 4876.017 | Av | V | 0 | 1.0 | 20.5 | 19.8 | 40.3 | 54.0 | -13.7 | Pass | |

| Temperature: 72°F Humidity: 68% | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Emission Frequency (MHz)** | **Test Detector** | **Antenna Polarity (H/V)** | **Turntable Azimuth (deg)** | **Antenna Height (m)** | **Analyzer Reading (dBuV)** | **Site Correction Factor (dB/m)** | **Emission Level (dBuV/m)** | **Limit (dBuV/m)** | **Margin (dB)** | **Pass/ Fail** | **Comments** |
| 2188.030 | Av | V | 110 | 1.5 | 57.1 | -0.4 | 56.7 | 104.5 | -47.8 | Pass | |
| **2468.000** | **Pk** | **V** | **0** | **1.4** | **124.1** | **0.4** | **124.5** | **20** | **104.5** | | |
| **2468.000** | **Av** | **V** | **0** | **1.4** | **78.2** | **0.4** | **78.6** | | | | |
| 2608.000 | Av | V | 0 | 1.4 | 30.4 | 1.3 | 31.7 | 104.5 | -72.8 | Pass | |
| 2918.810 | Av | V | 0 | 1.5 | 34.8 | 3.6 | 38.4 | 104.5 | -66.1 | Pass | |
| 4936.051 | Av | V | 0 | 1.0 | 27.3 | 19.1 | 46.4 | 54.0 | -7.6 | Pass | |

**TEST PERSONNEL:**

**Typed/Printed Name**: Daniel Baltzell
**Date:** October 18, 2000

| Temperature: 24.3°F Humidity: 63% | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Emission Frequency (MHz) | Test Detector | Antenna Polarity (H/V) | Turntable Azimuth (deg) | Antenna Height (m) | Analyzer Reading (dBuV) | Site Correction Factor (dB/m) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Pass/ Fail | Comments |
| 81.918 | Qp | H | 200 | 2.5 | 42.0 | -21.2 | 20.8 | 49.5 | -28.7 | Pass | |
| 163.837 | Qp | H | 70 | 1.4 | 62.7 | -17.5 | 45.2 | 54 | -8.8 | Pass | |
| 204.795 | Qp | V | 350 | 1.8 | 38.5 | -17.2 | 21.3 | 54 | -32.7 | Pass | |
| 229.374 | Qp | H | 350 | 1.0 | 70.3 | -16.7 | 53.6 | 56.9 | -3.3 | Pass | |
| 245.754 | Qp | H | 85 | 1.4 | 46.8 | -14.9 | 31.9 | 56.9 | -25 | Pass | |
| 294.908 | Qp | H | 20 | 1.0 | 67.5 | -13.4 | 54.1 | 56.9 | -2.8 | pass | |
| 327.674 | Qp | H | 30 | 2.4 | 55.5 | -12.1 | 43.4 | 56.9 | -13.5 | Pass | |
| 491.508 | Qp | V | 260 | 1.8 | 40.1 | -8.1 | 32.0 | 56.9 | -24.9 | Pass | |

**WORSTCASE EMISSION IS THE FSX**

**TEST PERSONNEL:**

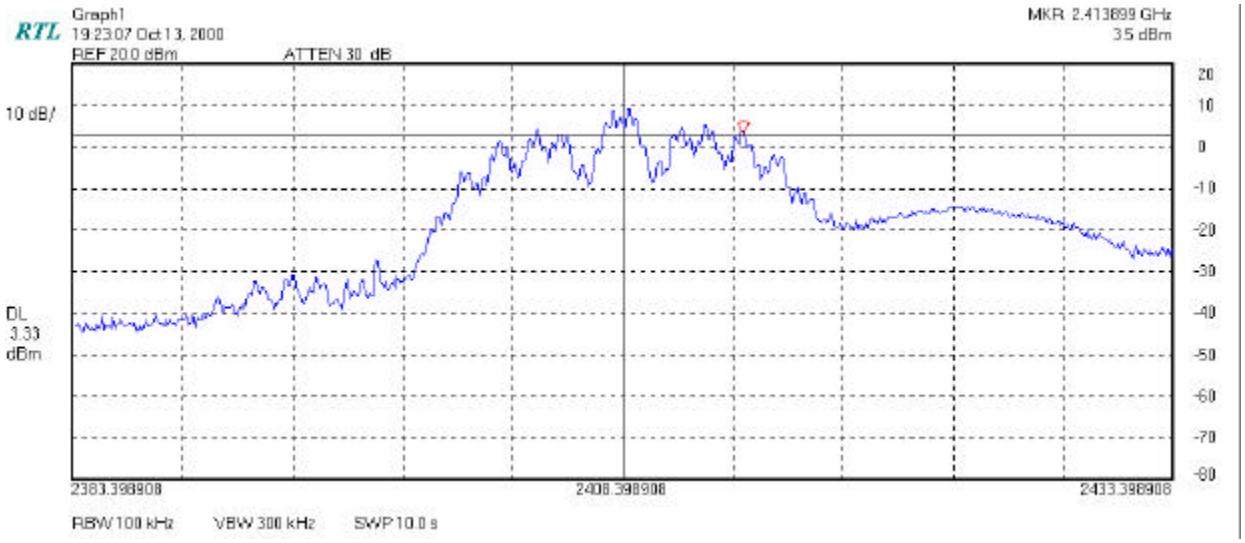
**Typed/Printed Name**: Daniel Baltzell
**Date:** October 18, 2000

# 8 Modulated Bandwidth

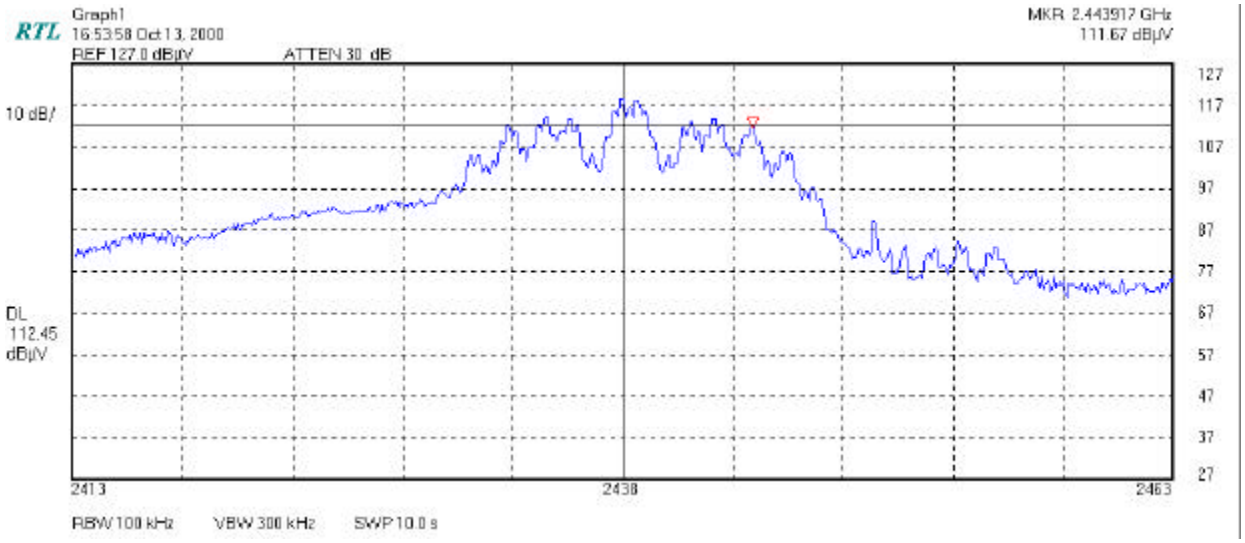
The minimum 6 dB bandwidth per FCC 15.247(a)(2) was measured using a 50 ohm spectrum analyzer with the resolution bandwidth set at 100 kHz, and the video bandwidth set at 100 kHz. The Minimum 6 dB modulated bandwidths are the following:

| FXO | | | FXS | |
|---|---|---|---|---|
| **Channel** | **6(dB) Bandwidth (MHz)** | | **Channel** | **6(dB) Bandwidth (MHz)** |
| 1 | 13.42 | | 1 | 13.40 |
| 3 | 15.17 | | 3 | 14.10 |
| 6 | 15.00 | | 6 | 13.59 |

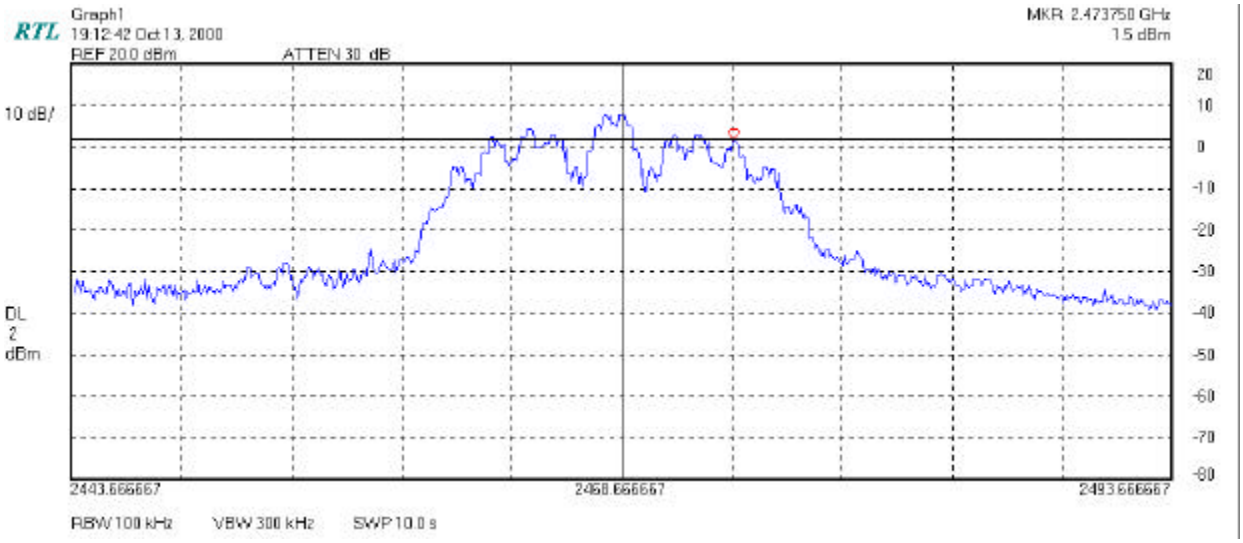
## 8.1 FXO-BW-CH1



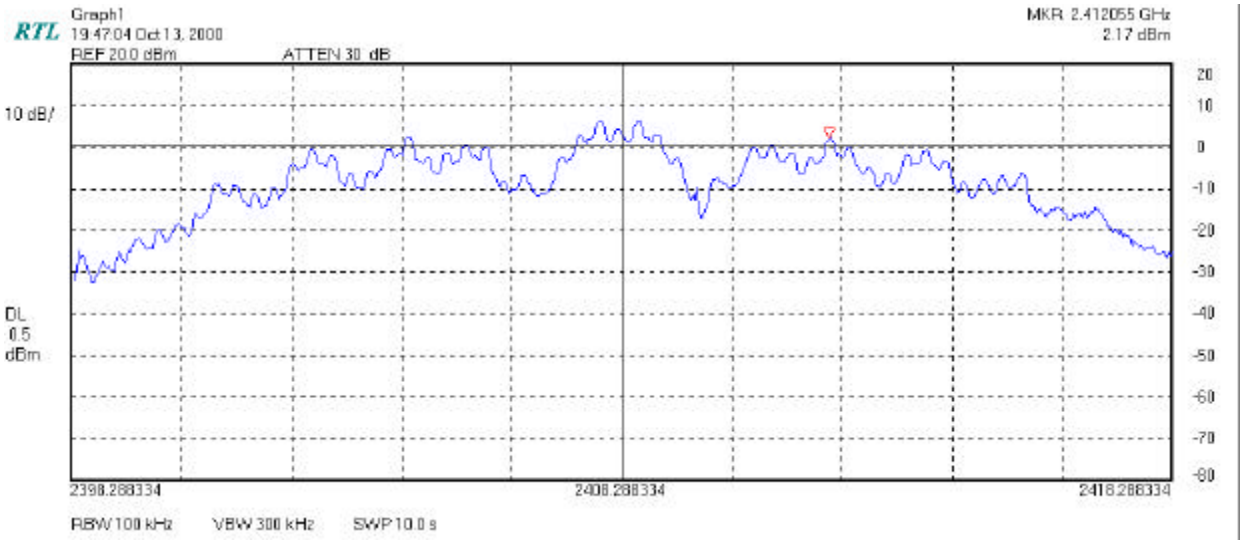

## 8.2 FXO-BW-CH3



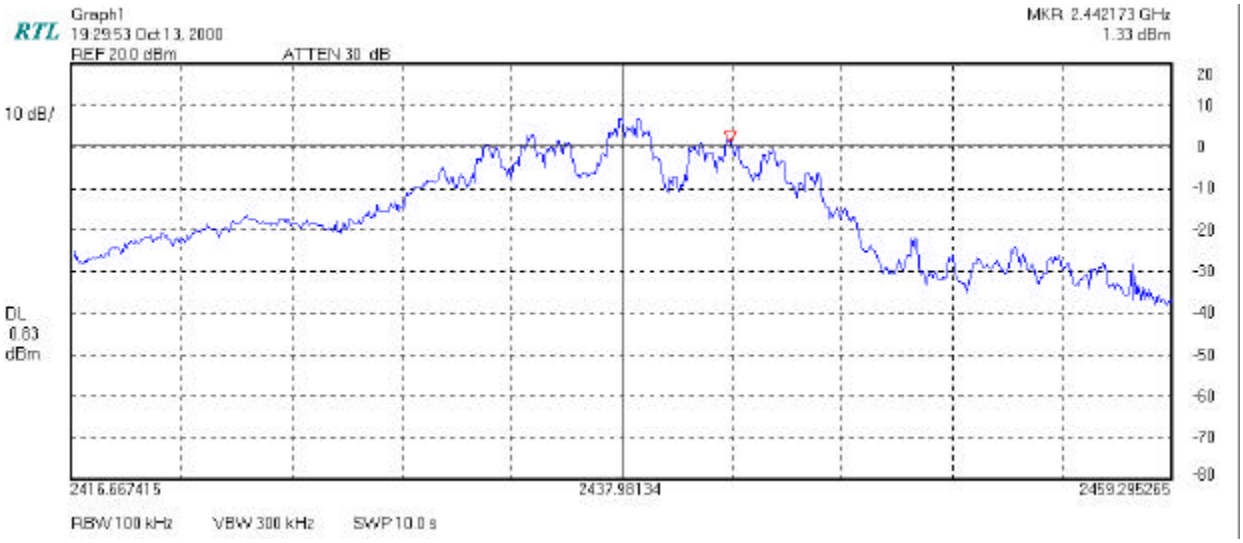
## 8.3 FXO-BW-CH6



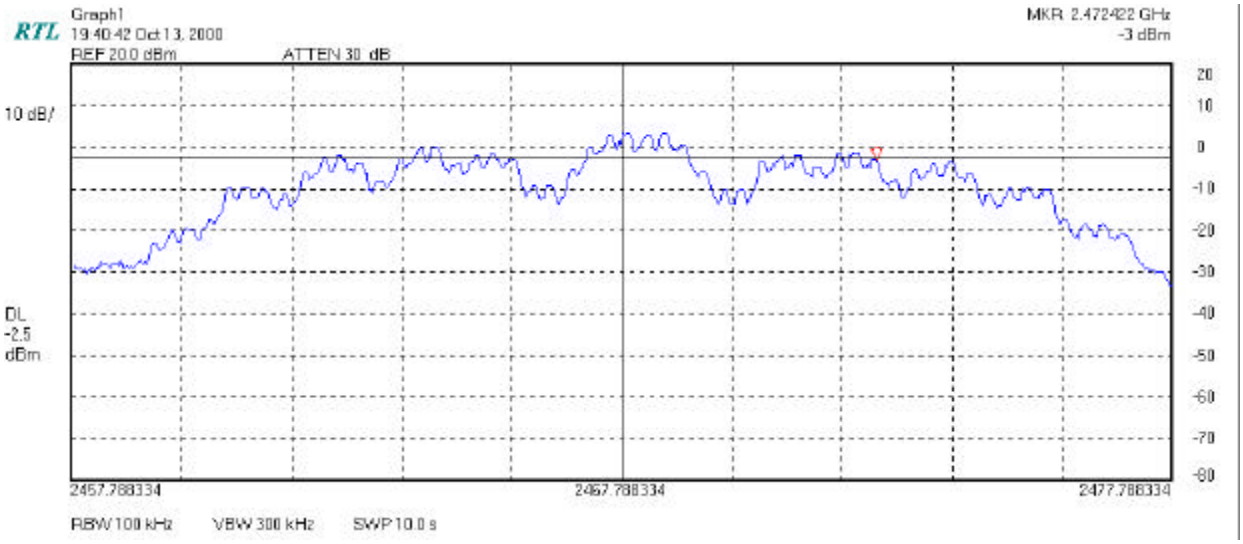

## 8.4 FXS-BW-CH1



## 8.5 FXS-BW-CH3




## 8.6 FXS-BW-CH6



## 8.7 POWER OUTPUT AND 15.247 (B)(3) AND (B)(3)(I) PERMISSIBLE OUTPUT POWER CALCULATIONS ( REGULATED EIRP LIMIT)

The power output per FCC 15.247(b) was measured on the EUT using an HP peak power meter. The output power was measured at the end of the 36 inch low loss coaxial cable connected to the antenna external connector.

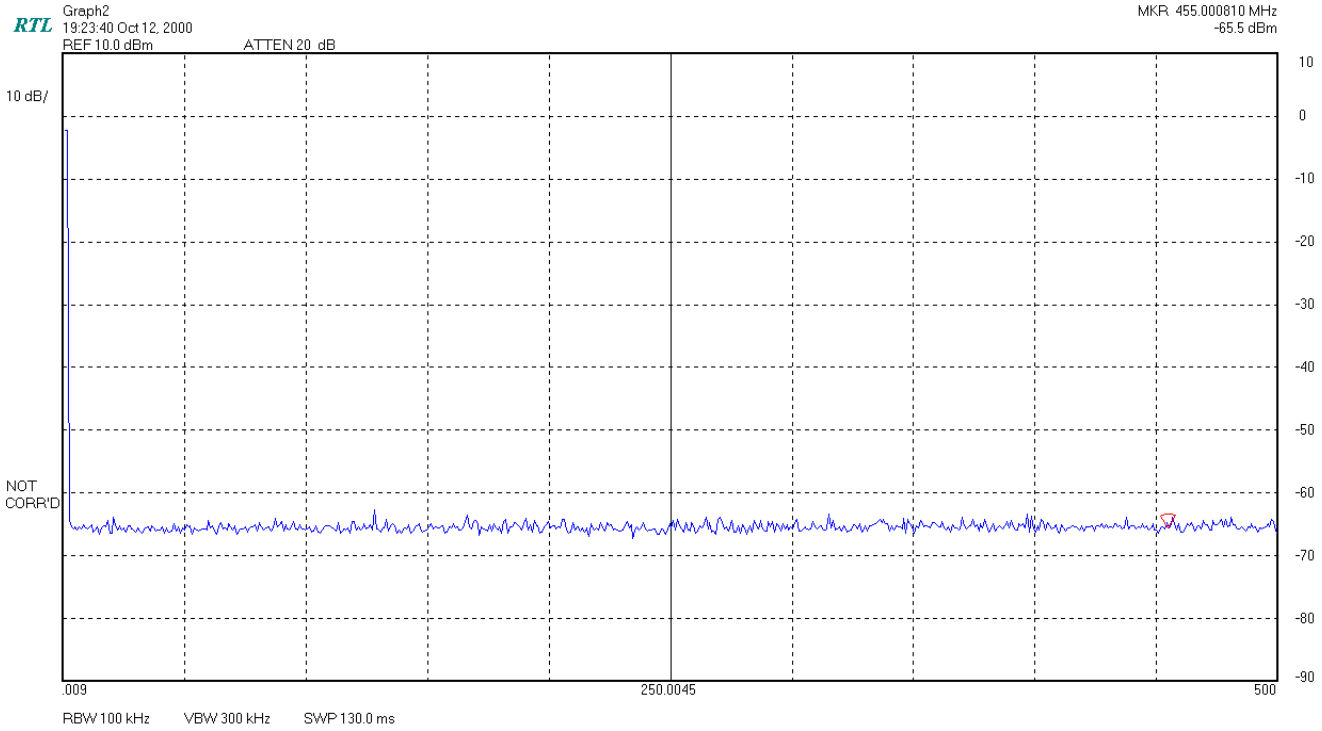
| FXO | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Patch Antenna | | | Grid Antenna | | |
| Channel | Conducted Power (mW) | Conducted Power (dBm) | EIRP (dBm) | Regulated EIRP (mW) | Regulated EIRP(dBm) | EIRP (dBm) | Regulated EIRP (mW) | Regulated EIRP(dBm) |
| 1 | 35.8 | 15.5 | 29.3 | **64.6** | **18.1** | 39.5 | **141.3** | **21.5** |
| 3 | 52.6 | 17.2 | 31.0 | **95.5** | **19.8** | 41.1 | **208.9** | **23.2** |
| 6 | 29.0 | 14.6 | 28.4 | **52.5** | **17.2** | 38.6 | **114.8** | **20.6** |

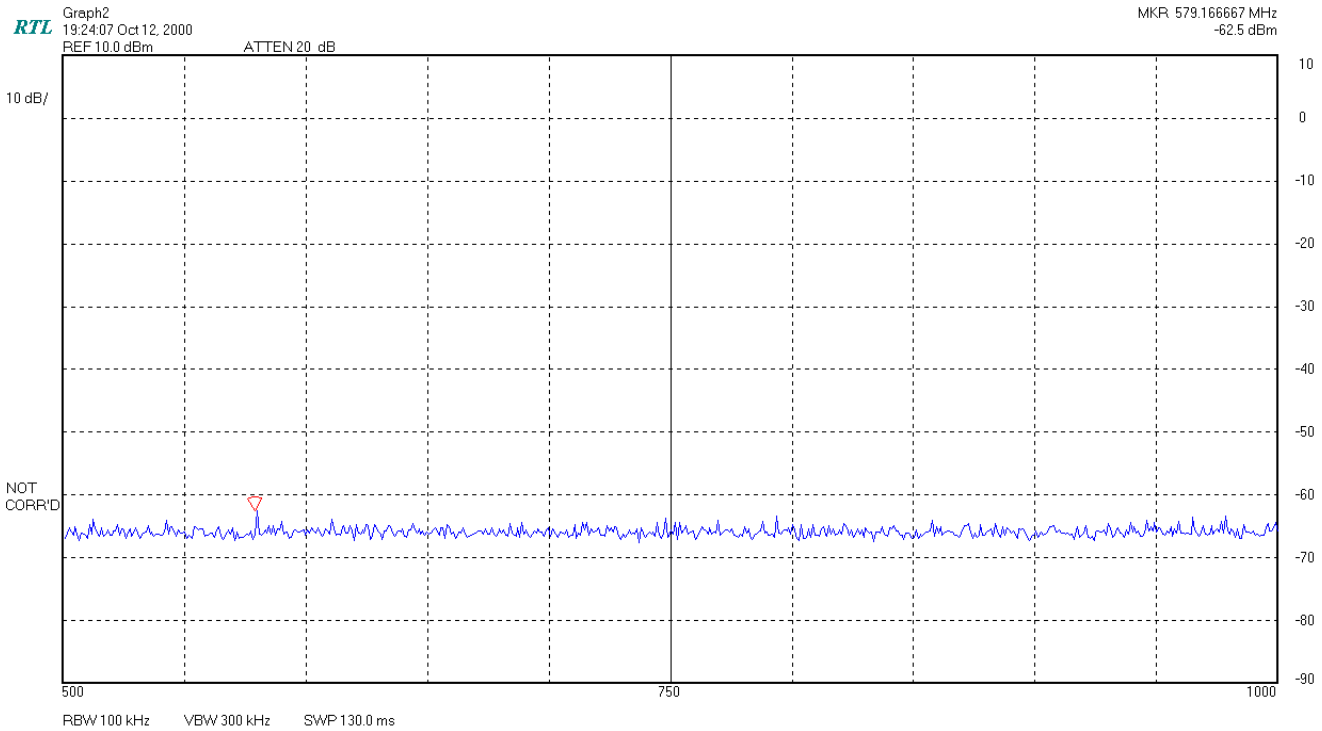
| FXS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Patch Antenna | | | Grid Antenna | | |
| Channel | Conducted Power (mW) | Conducted Power (dBm) | EIRP (dBm) | Regulated EIRP (mW) | Regulated EIRP(dBm) | EIRP (dBm) | Regulated EIRP (mW) | Regulated EIRP(dBm) |
| 1 | 36.6 | 15.9 | 29.7 | **70.8** | **18.5** | 39.9 | **154.9** | **21.9** |
| 3 | 55.7 | 17.5 | 31.3 | **102.3** | **20.1** | 41.5 | **223.9** | **23.5** |
| 6 | 25.6 | 14.1 | 27.9 | **46.8** | **16.7** | 38.1 | **102.3** | **20.1** |

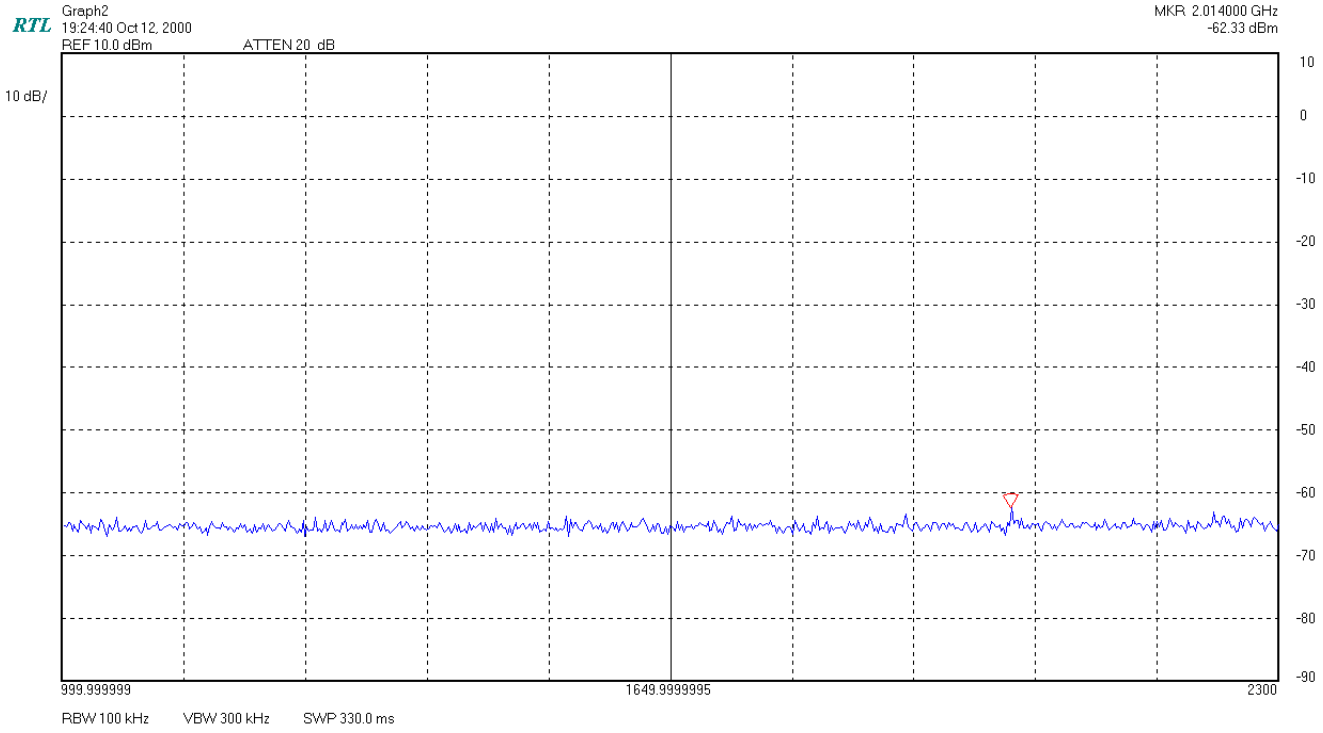
## 8.8 ANTENNA CONDUCTED SPURIOUS EMISSIONS

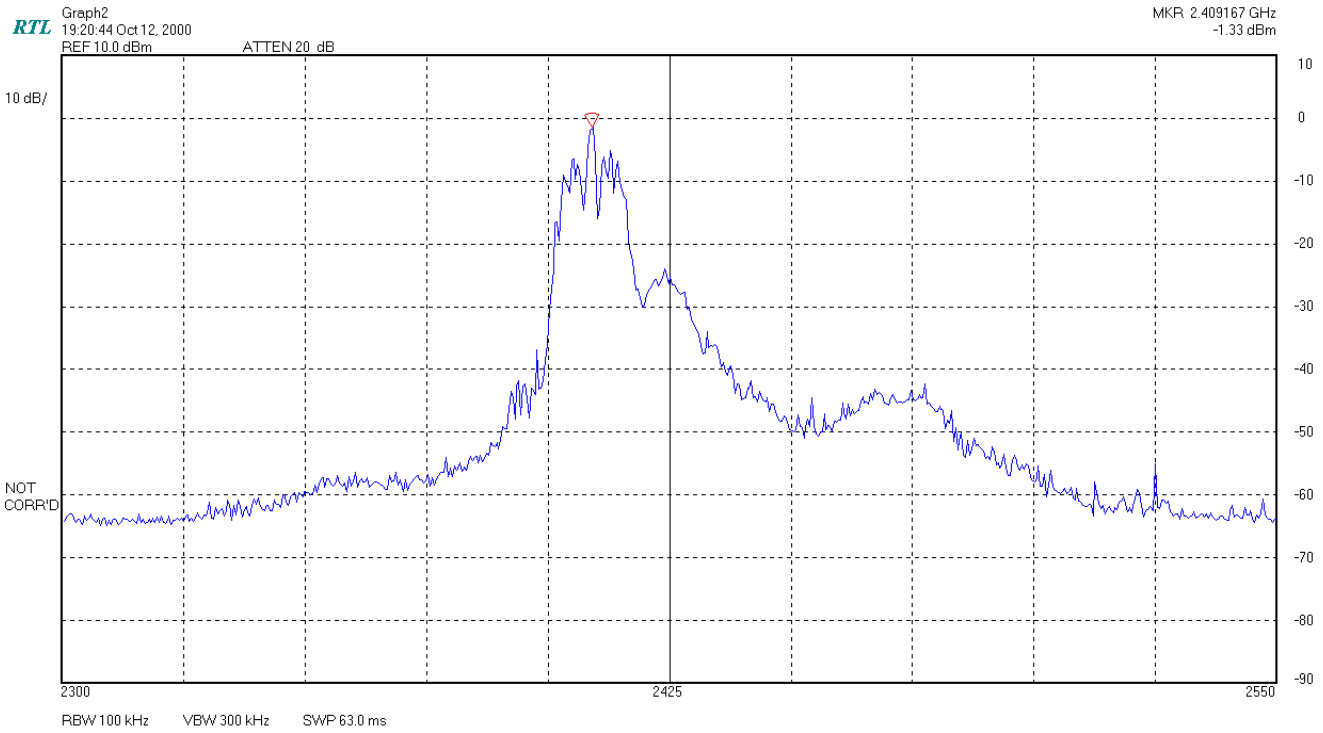
Antenna spurious emission per FCC 15.247(c) was measured from the EUT antenna port using a 50 ohm spectrum analyzer with the resolution bandwidth set at 100 kHz, and the video bandwidth set at 300 kHz. The modulated carrier was identified at Channel 1, Channel 3 and Channel 6. No other harmonics or spurs were found within 20 dB of the carrier level, and from 9kHz to the carriers 10$^{th}$ harmonic. See antenna conducted spurious noise table and plots.

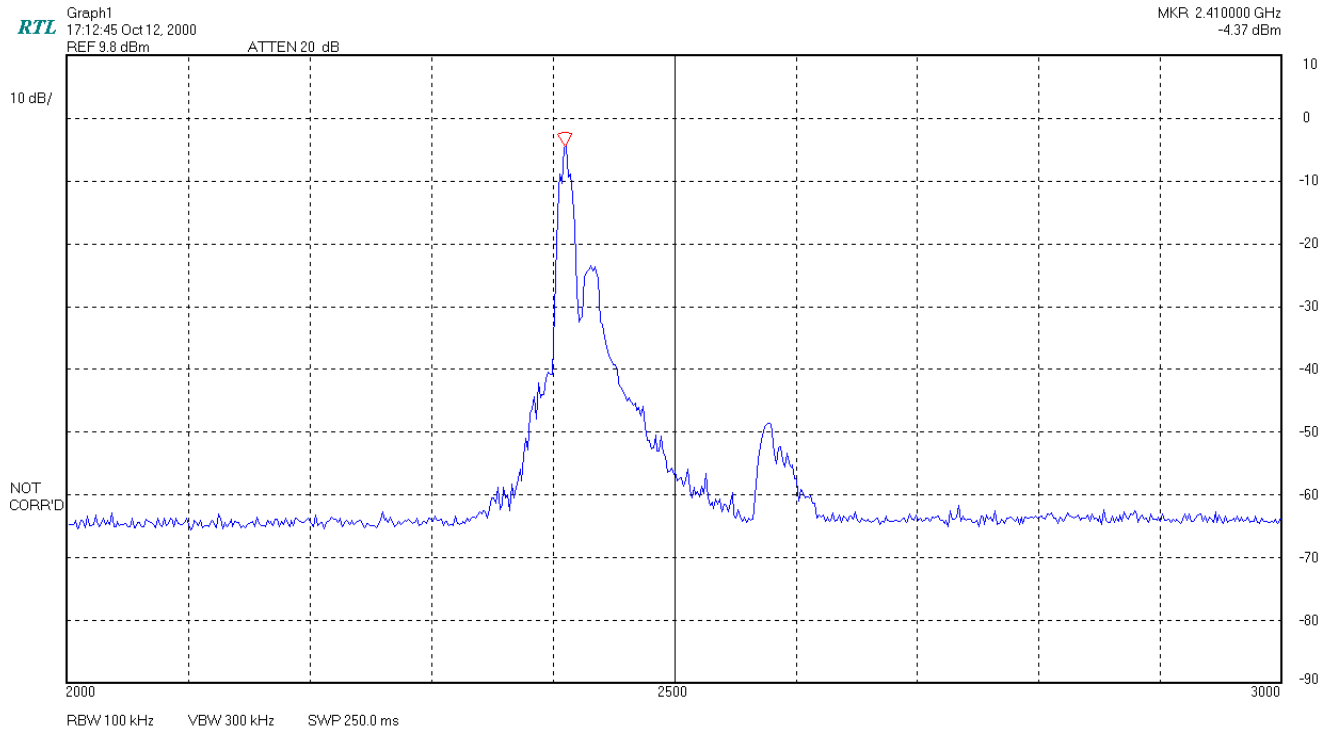
**Channels 1, 3, and 6 were investigated and tested, the worst case plots are presented in this report**.

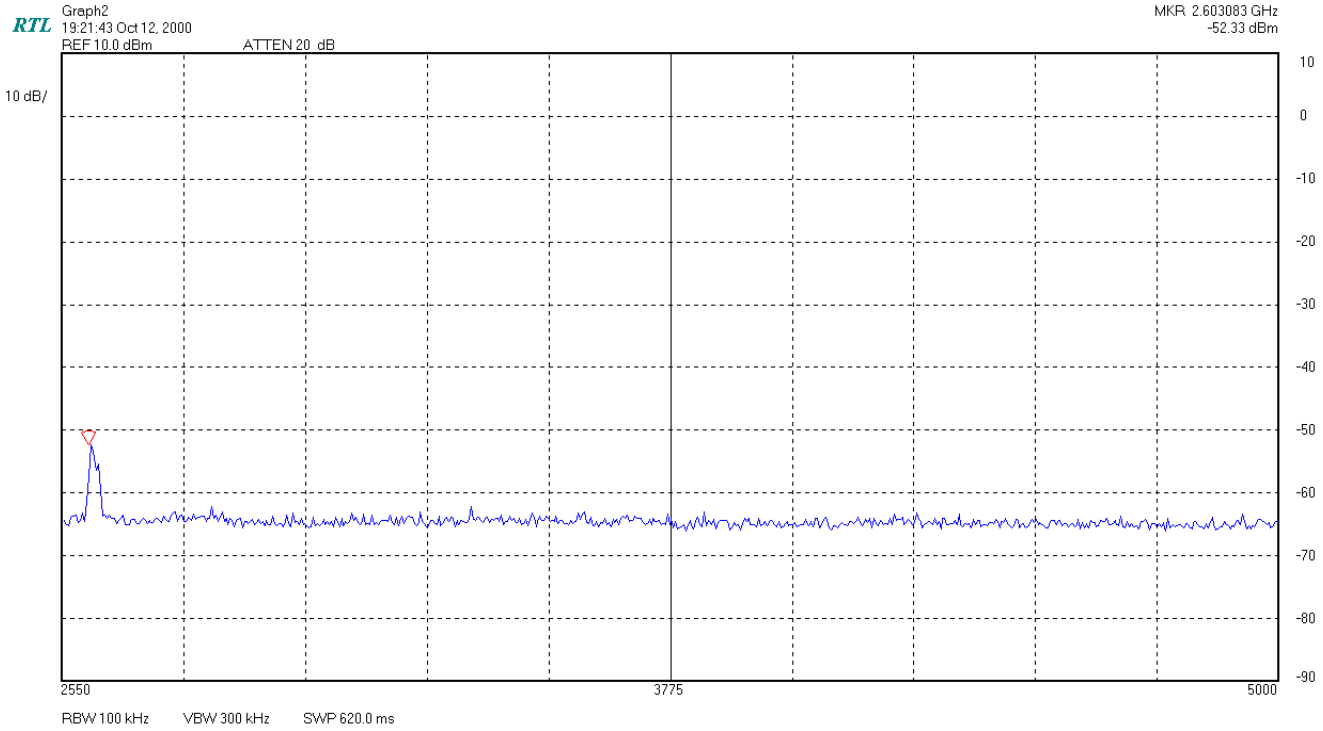

RTL
Graph2
19:23:40 Oct 12, 2000
REF 10.0 dBm
ATTEN 20 dB
MKR 455.000810 MHz
-65.5 dBm
10 dB/
NOT
CORR'D
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
.009
250.0045
500
RBW 100 kHz
VBW 300 kHz
SWP 130.0 ms

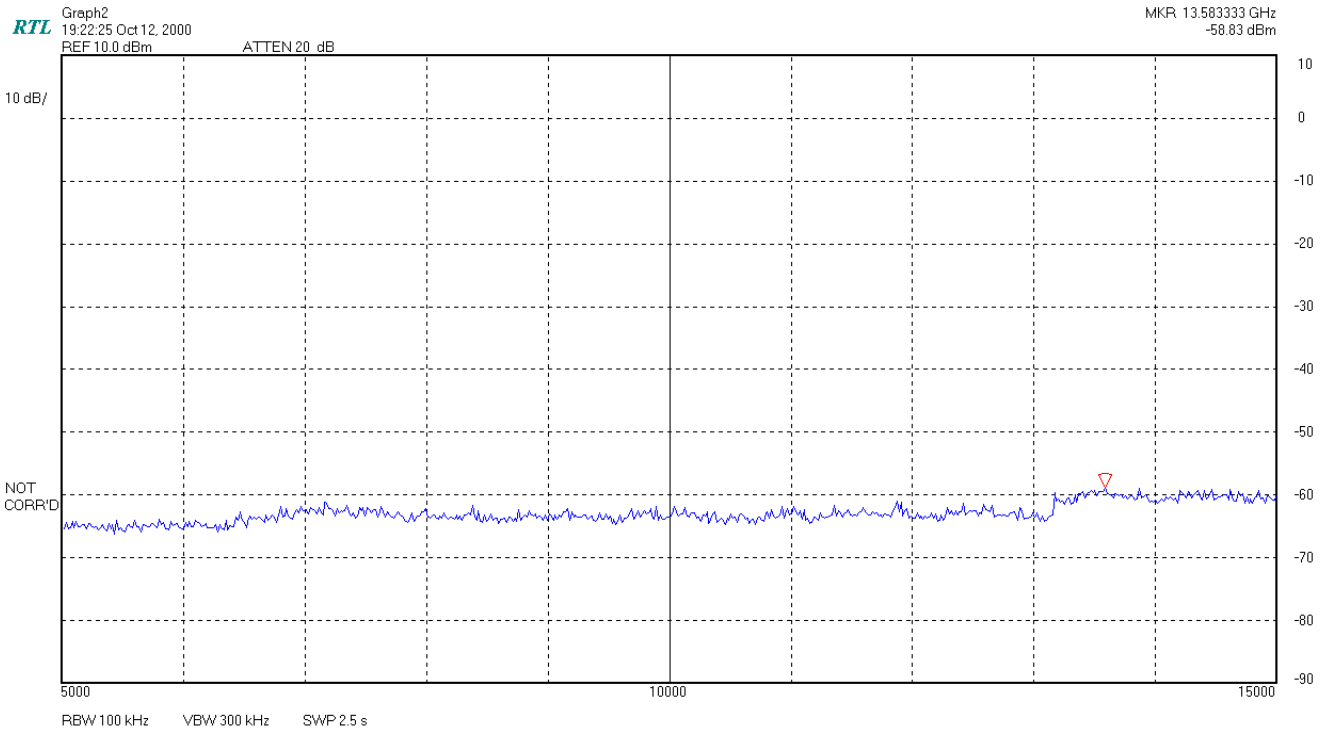

RTL
Graph2
19:24:07 Oct 12, 2000
REF 10.0 dBm
ATTEN 20 dB
MKR 579.166667 MHz
-62.5 dBm
10 dB/
NOT
CORR'D
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
500
750
1000
RBW 100 kHz
VBW 300 kHz
SWP 130.0 ms


RTL
Graph2
19:24:40 Oct 12, 2000
REF 10.0 dBm
ATTEN 20 dB
MKR 2.014000 GHz
-62.33 dBm
10 dB/
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
999.999999
1649.9999995
2300
RBW 100 kHz
VBW 300 kHz
SWP 330.0 ms

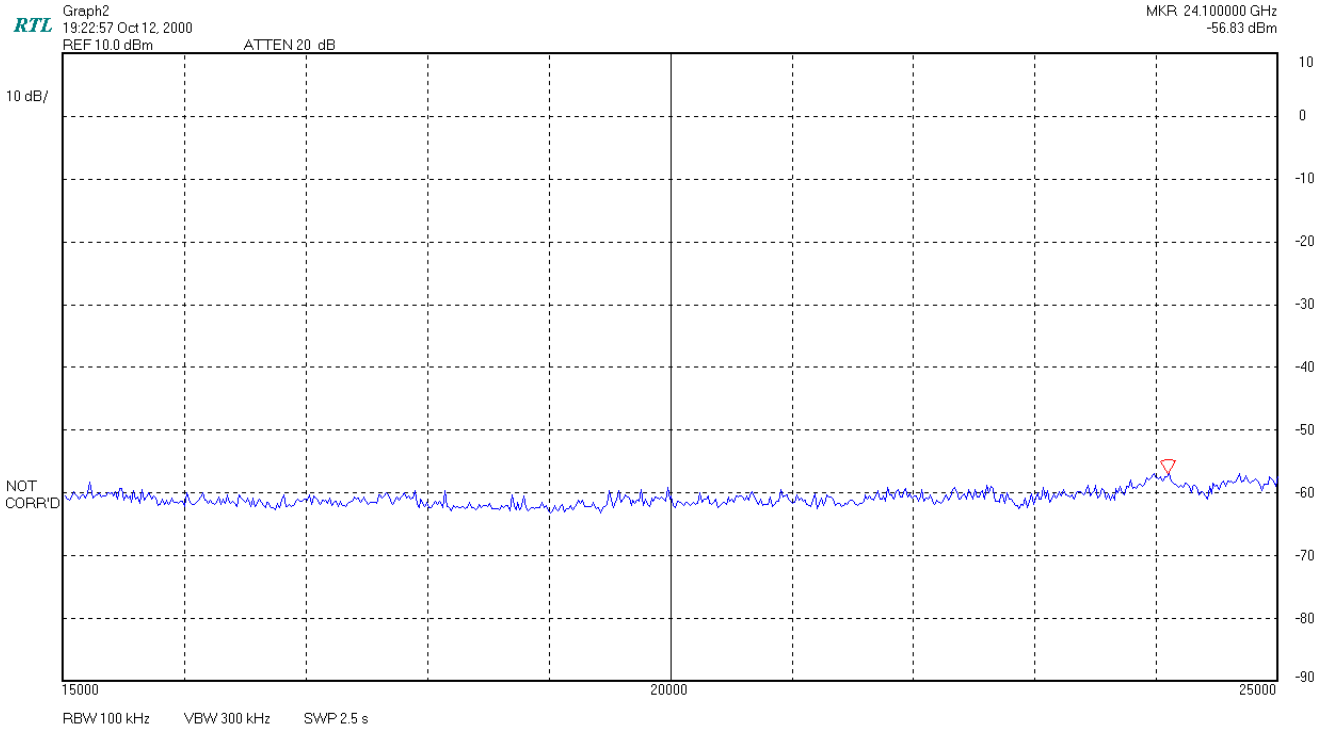

RTL
Graph2
19:20:44 Oct 12, 2000
REF 10.0 dBm
ATTEN 20 dB
MKR 2.409167 GHz
-1.33 dBm
10 dB/
NOT
CORR'D
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
2300
2425
2550
RBW 100 kHz
VBW 300 kHz
SWP 63.0 ms

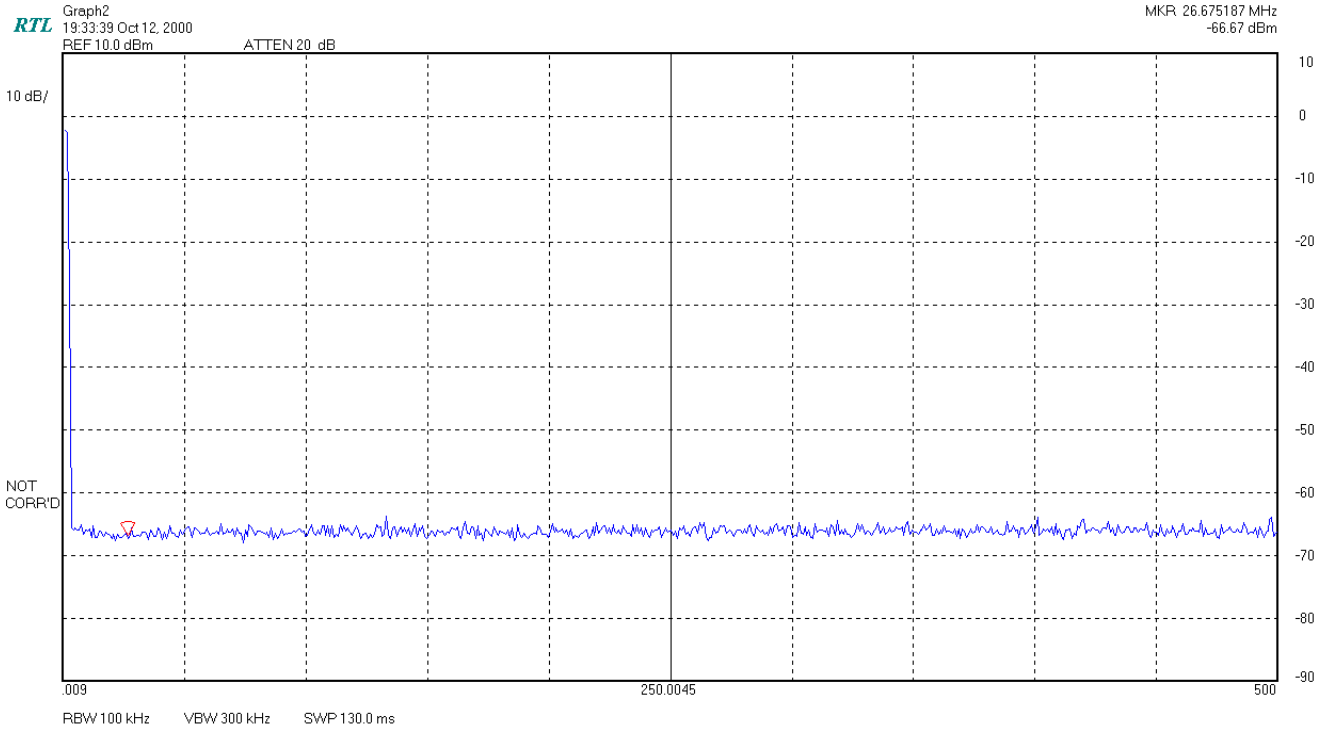

RTL
Graph1
17:12:45 Oct 12, 2000
REF 9.8 dBm
ATTEN 20 dB
MKR 2.410000 GHz
-4.37 dBm
10 dB/
NOT
CORR'D
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
2000
2500
3000
RBW 100 kHz
VBW 300 kHz
SWP 250.0 ms

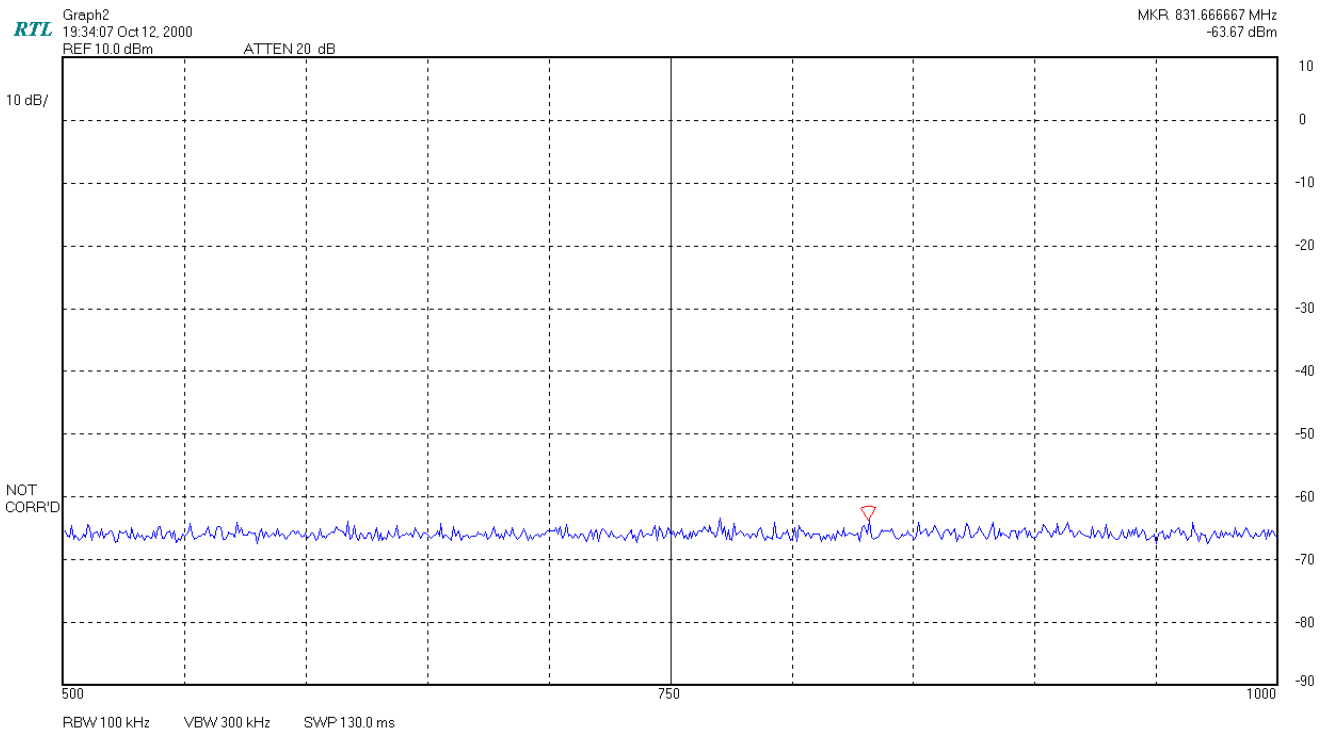

RTL
Graph2
19:21:43 Oct 12, 2000
REF 10.0 dBm
ATTEN 20 dB
MKR 2.603083 GHz
-52.33 dBm
10 dB/
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
2550
3775
5000
RBW 100 kHz
VBW 300 kHz
SWP 620.0 ms

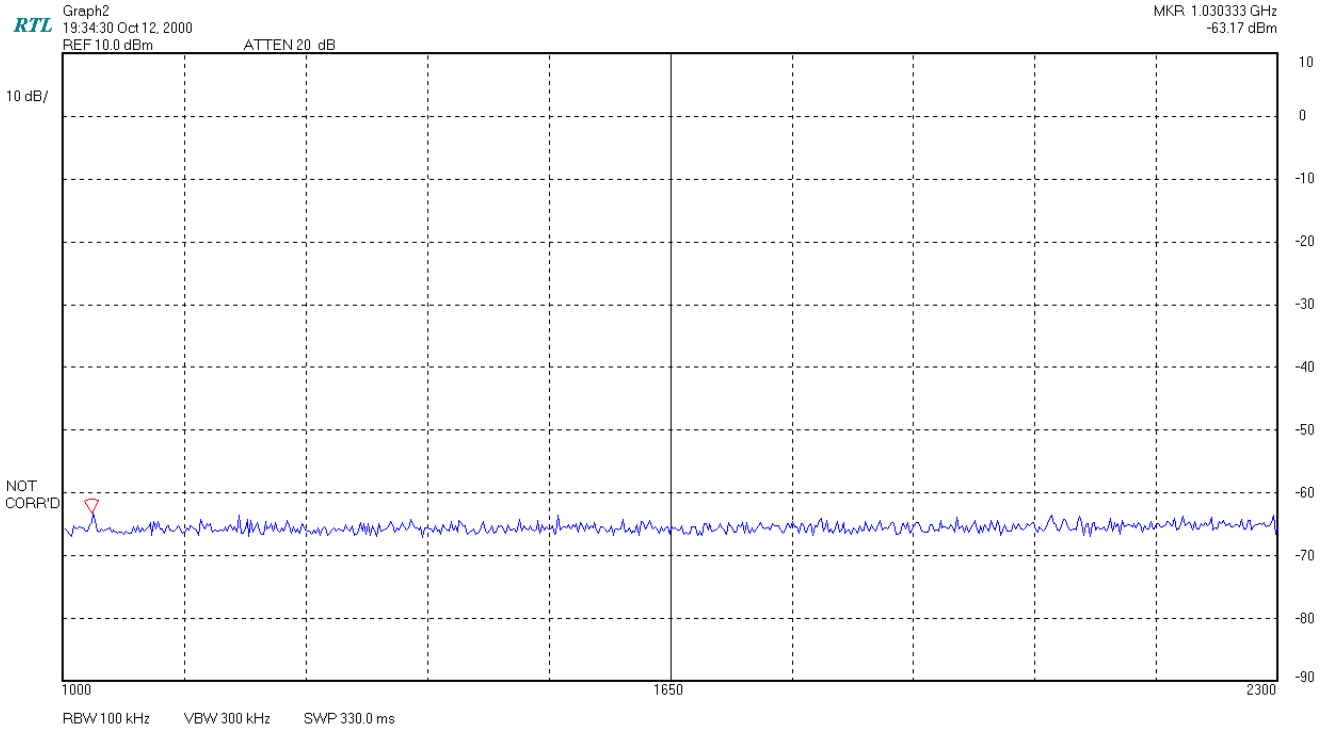

RTL
Graph2
19:22:25 Oct 12, 2000
REF 10.0 dBm
ATTEN 20 dB
MKR 13.583333 GHz
-58.83 dBm
10 dB/
NOT
CORR'D
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
5000
10000
15000
RBW 100 kHz
VBW 300 kHz
SWP 2.5 s

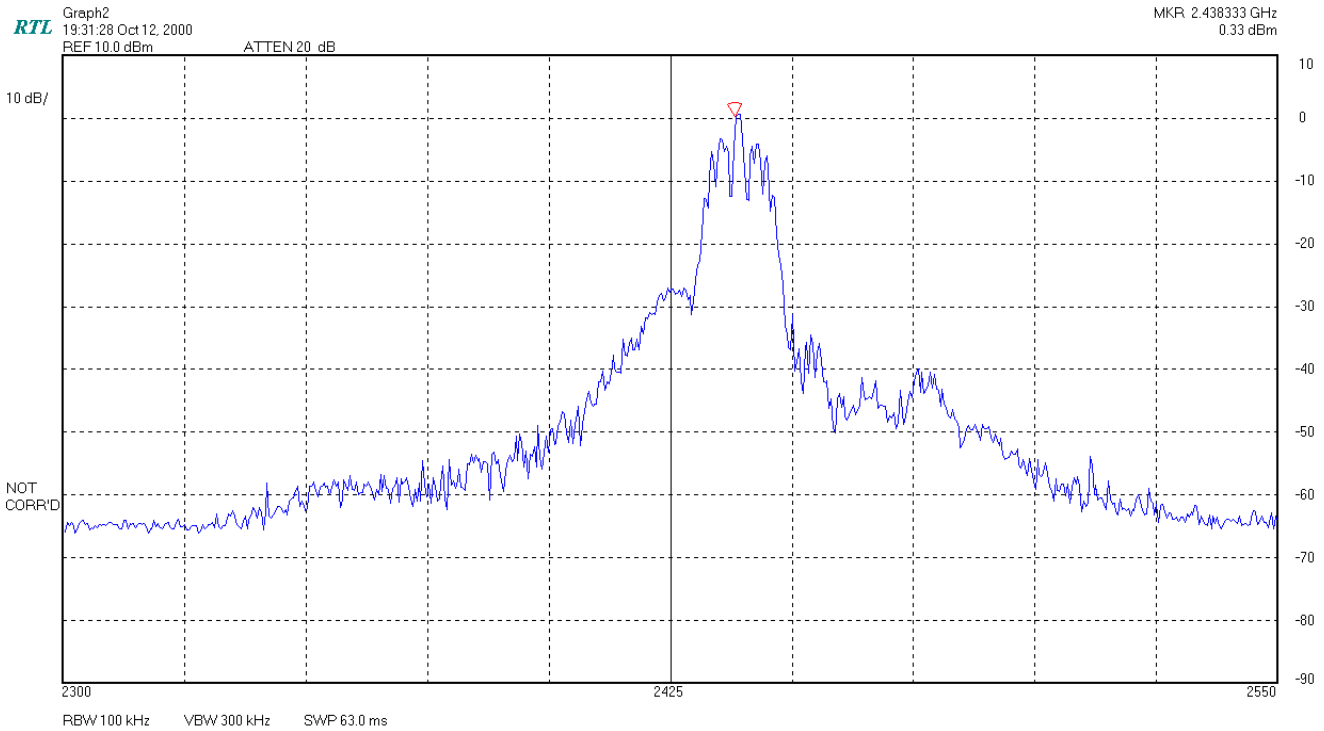
### 8.9.8 FXO channel 1 (15 GHz to 25 GHz)

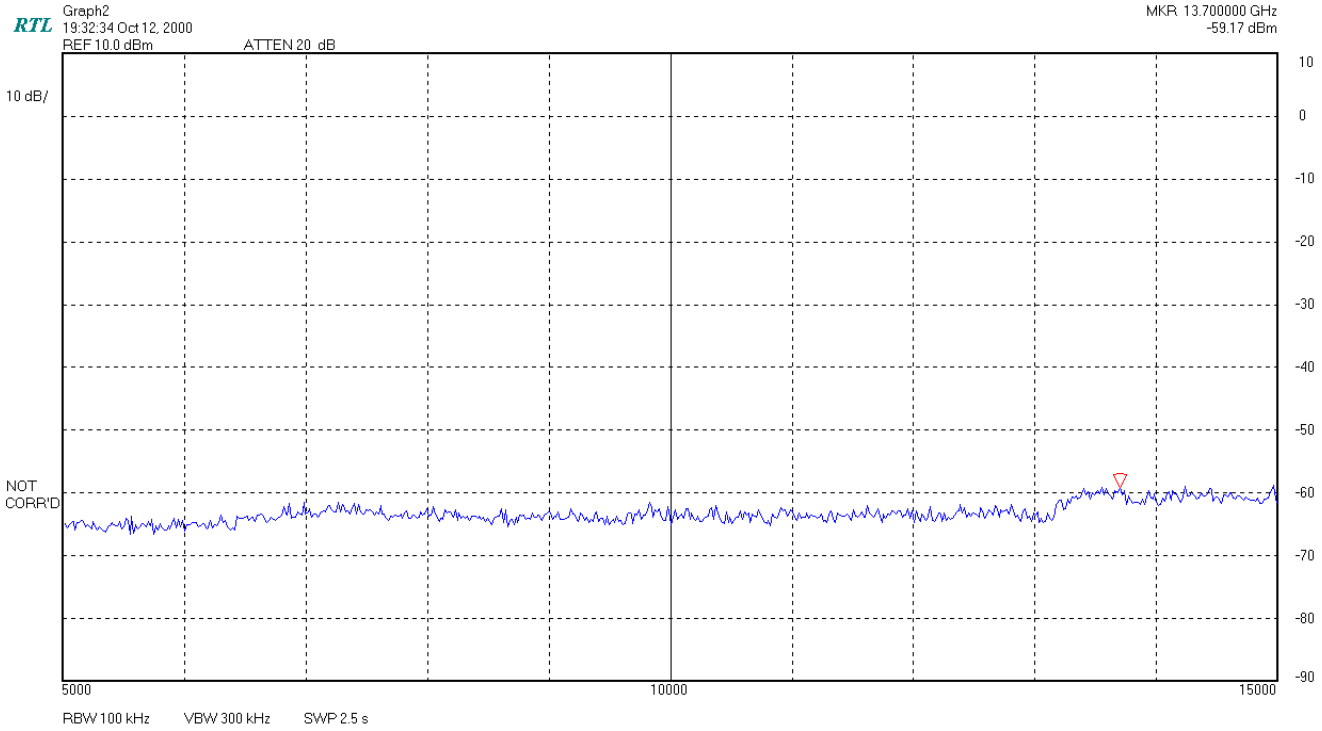


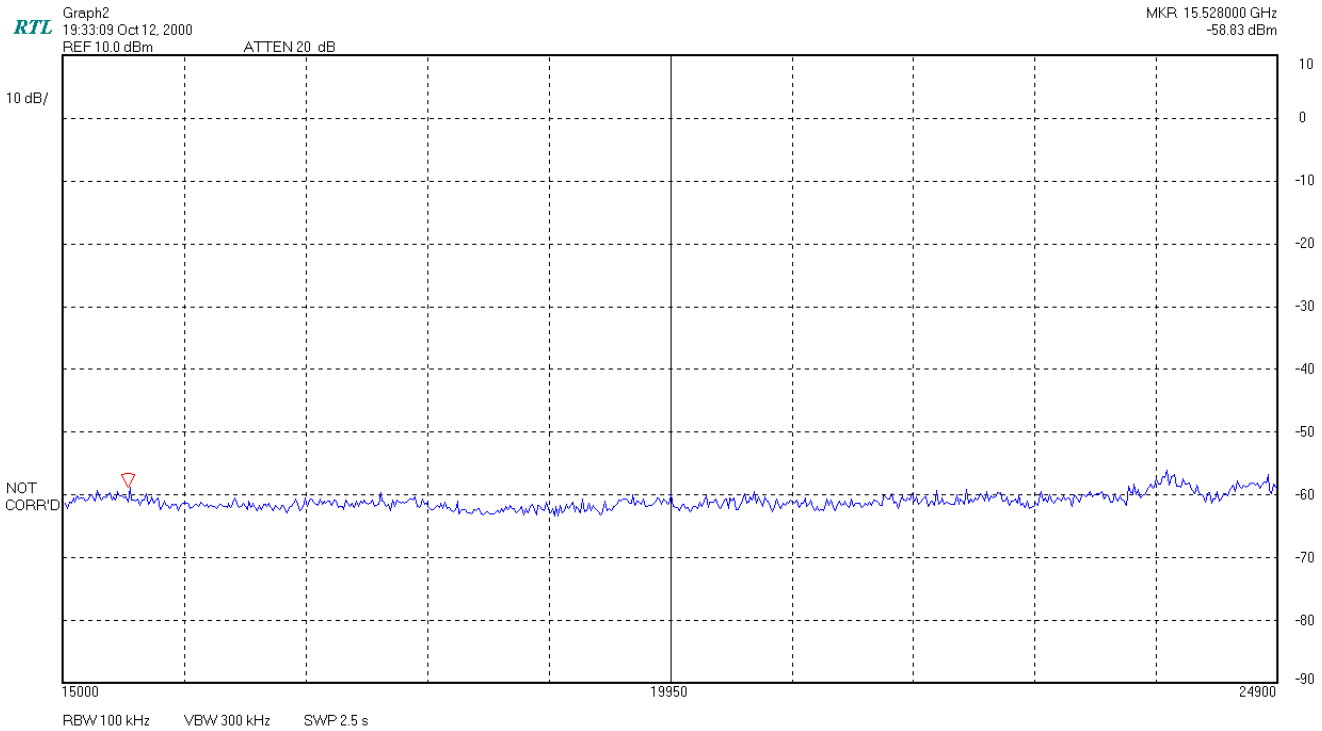

RTL
Graph2
19:33:39 Oct 12, 2000
REF 10.0 dBm
ATTEN 20 dB
MKR 26.675187 MHz
-66.67 dBm
10 dB/
NOT
CORR'D
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
.009
250.0045
500
RBW 100 kHz
VBW 300 kHz
SWP 130.0 ms

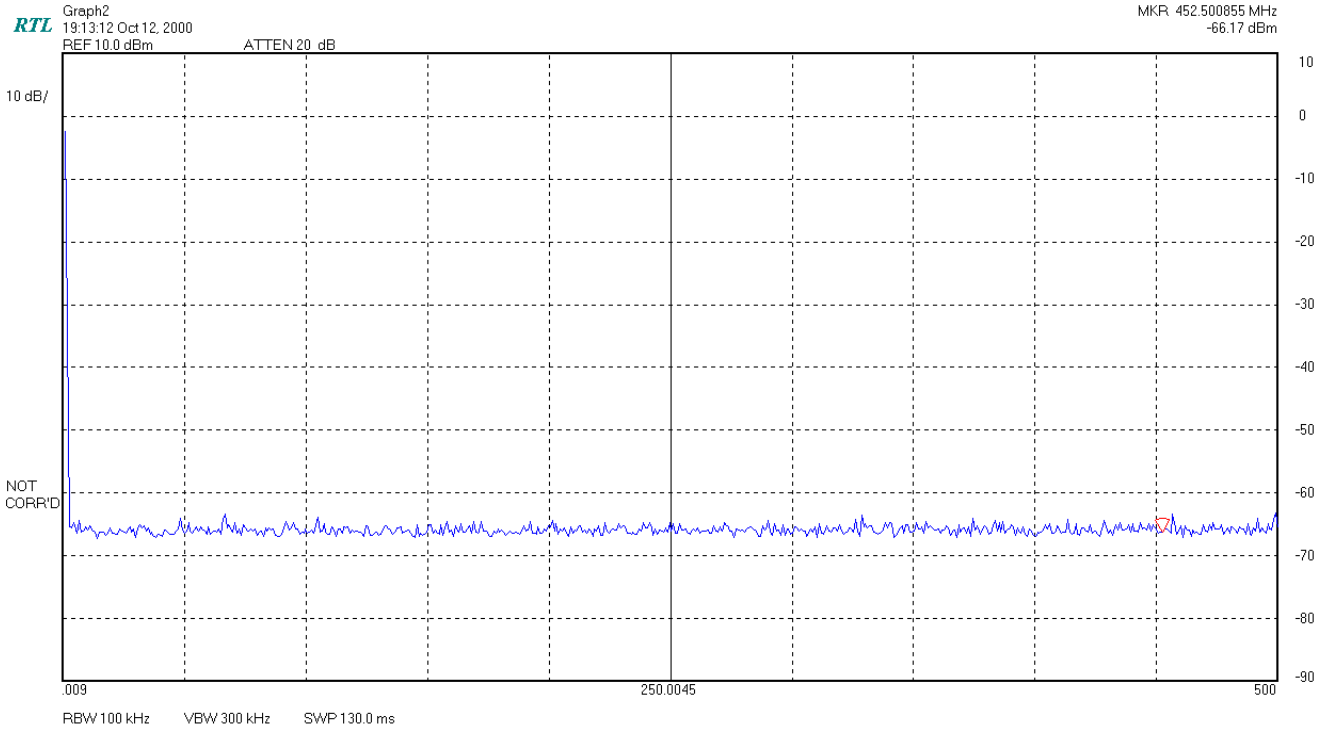

RTL
Graph2
19:34:07 Oct 12, 2000
REF 10.0 dBm
ATTEN 20 dB
MKR 831.666667 MHz
-63.67 dBm
10 dB/
NOT
CORR'D
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
500
750
1000
RBW 100 kHz
VBW 300 kHz
SWP 130.0 ms

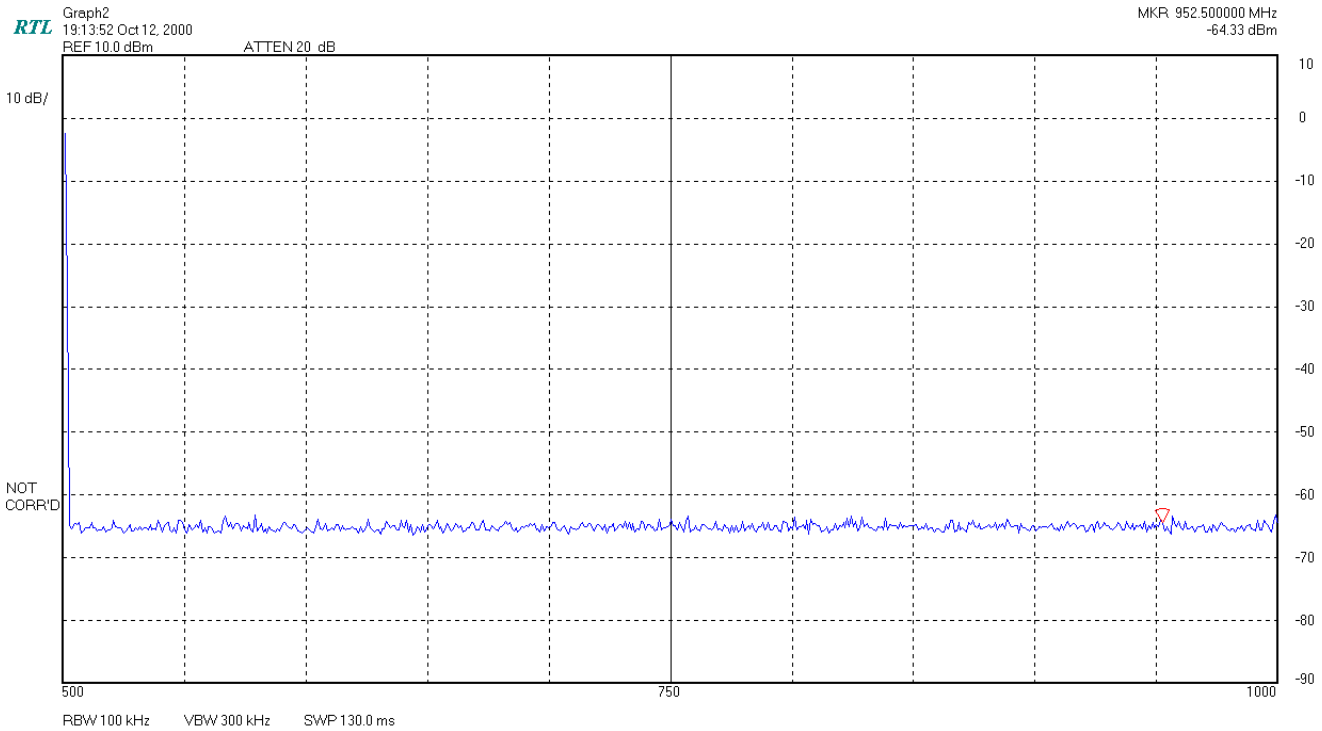

RTL
Graph2
19:34:30 Oct 12, 2000
REF 10.0 dBm
ATTEN 20 dB
MKR 1.030333 GHz
-63.17 dBm
10 dB/
NOT
CORR'D
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
1000
1650
2300
RBW 100 kHz
VBW 300 kHz
SWP 330.0 ms

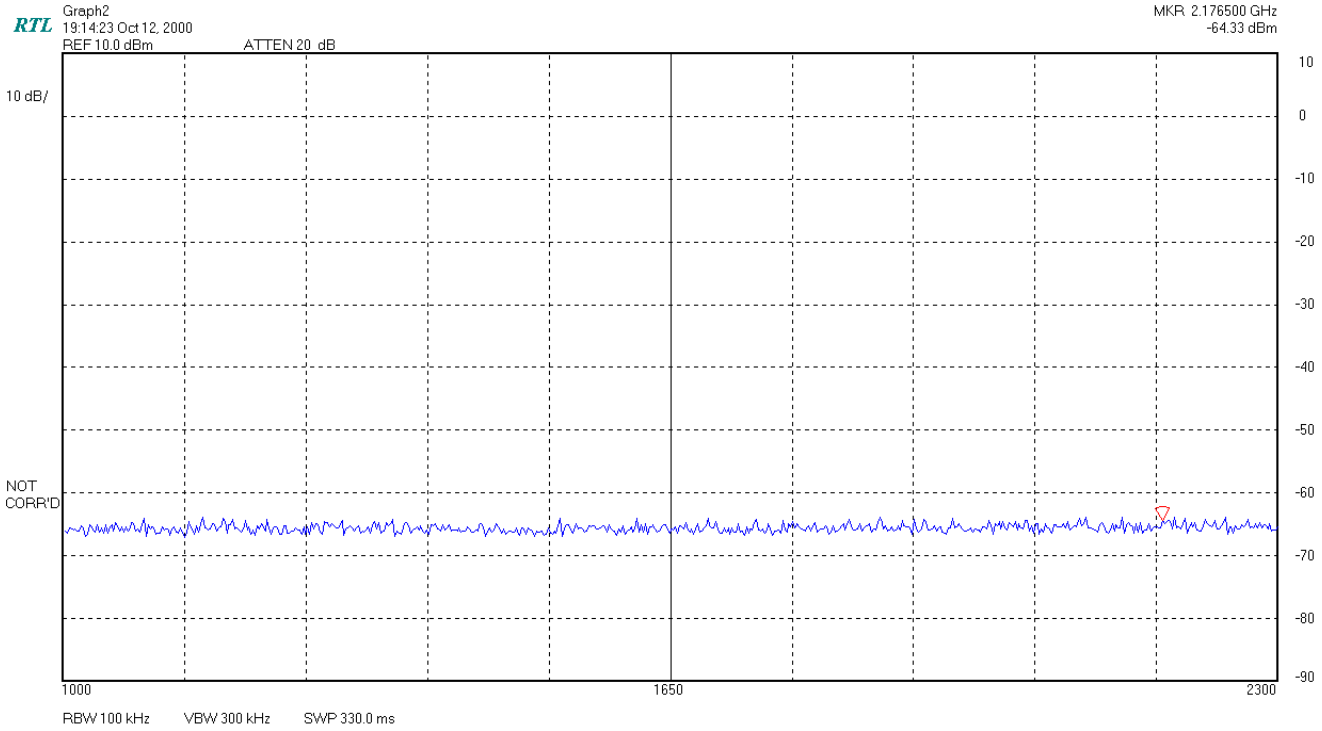

RTL
Graph2
19:31:28 Oct 12, 2000
REF 10.0 dBm
ATTEN 20 dB
MKR 2.438333 GHz
0.33 dBm
10 dB/
NOT
CORR'D
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
2300
2425
2550
RBW 100 kHz
VBW 300 kHz
SWP 63.0 ms

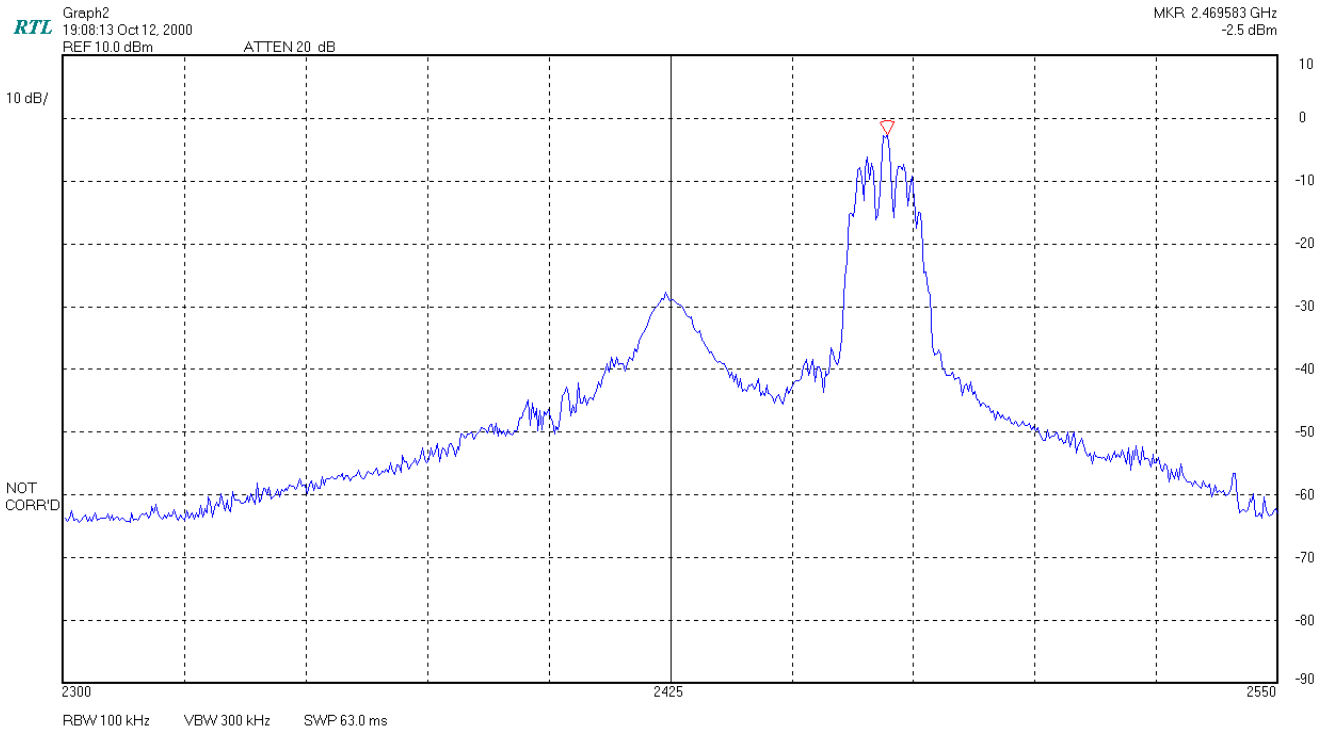

RTL
Graph2
19:32:34 Oct 12, 2000
REF 10.0 dBm
ATTEN 20 dB
MKR 13.700000 GHz
-59.17 dBm
10 dB/
NOT
CORR'D
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
5000
10000
15000
RBW 100 kHz
VBW 300 kHz
SWP 2.5 s

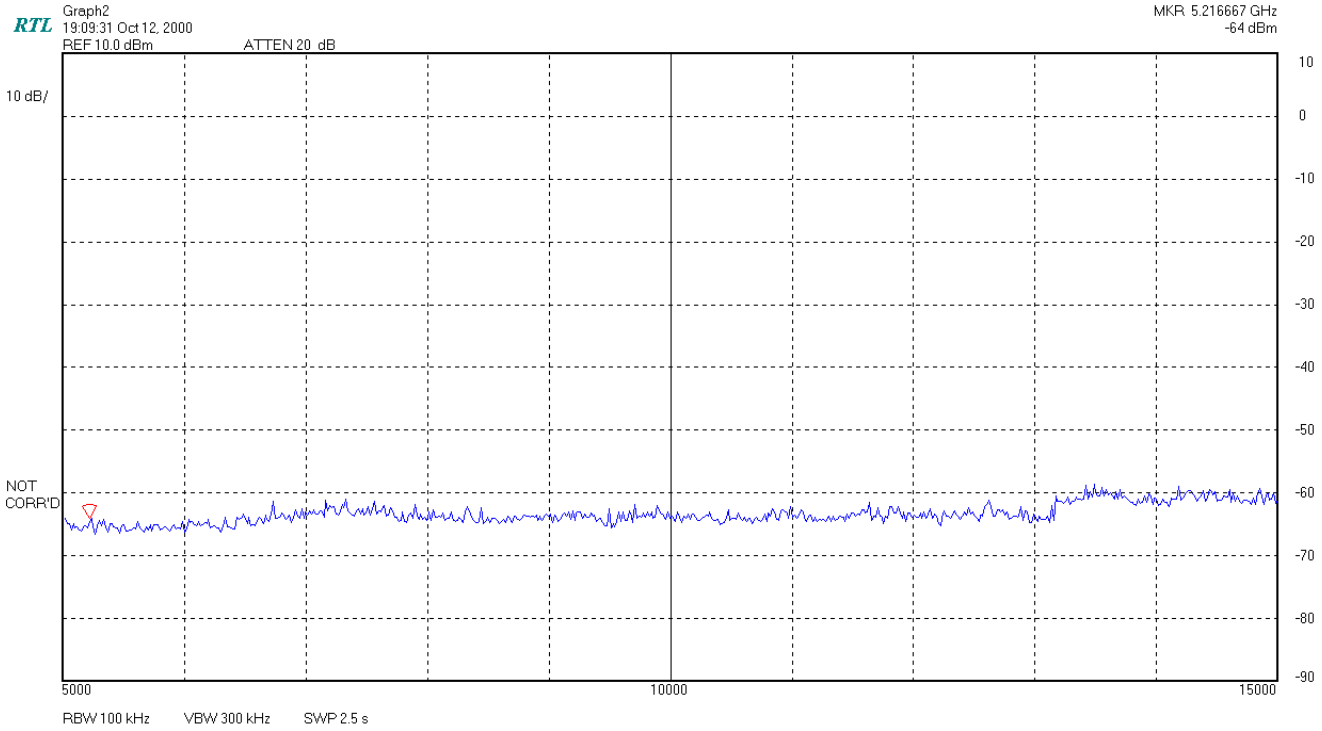

RTL
Graph2
19:33:09 Oct 12, 2000
REF 10.0 dBm
ATTEN 20 dB
MKR 15.528000 GHz
-58.83 dBm
10 dB/
NOT
CORR'D
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
15000
19950
24900
RBW 100 kHz
VBW 300 kHz
SWP 2.5 s

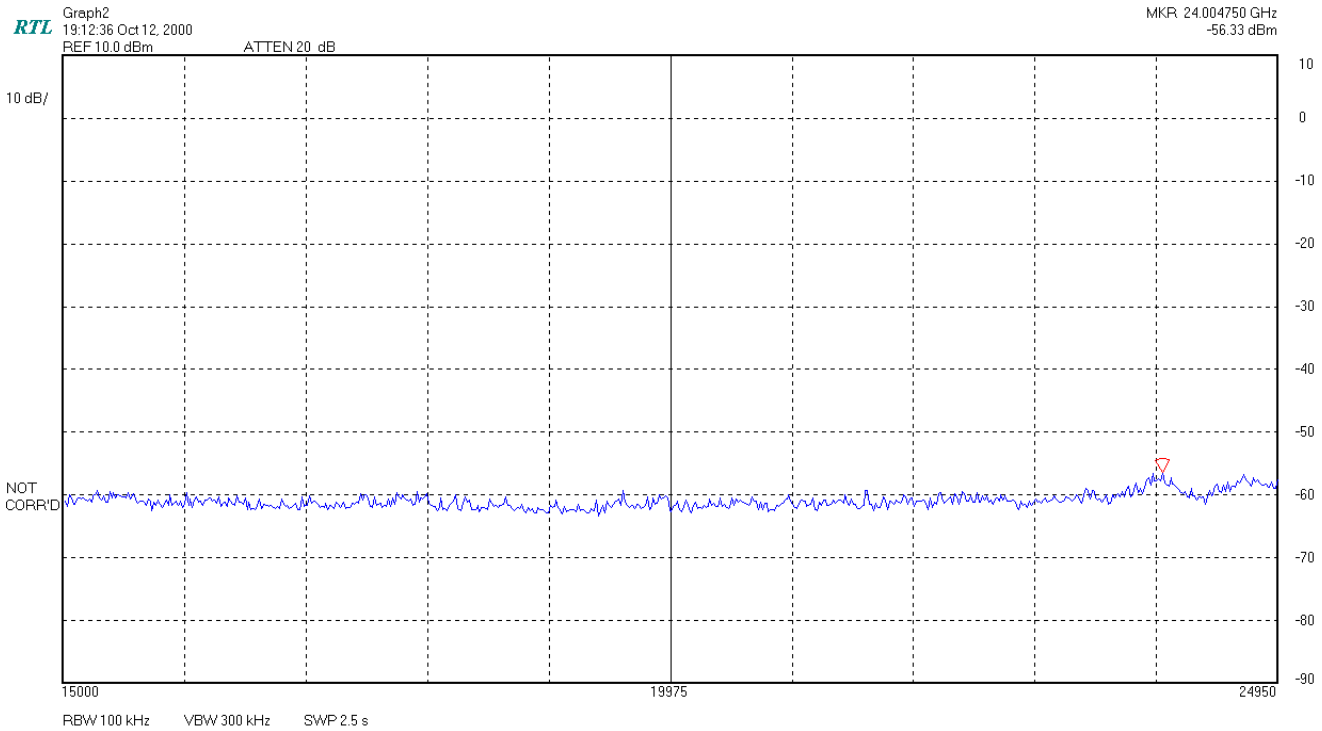

RTL
Graph2
19:13:12 Oct 12, 2000
REF 10.0 dBm
ATTEN 20 dB
MKR 452.500855 MHz
-66.17 dBm
10 dB/
NOT
CORR'D
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
.009
250.0045
500
RBW 100 kHz
VBW 300 kHz
SWP 130.0 ms

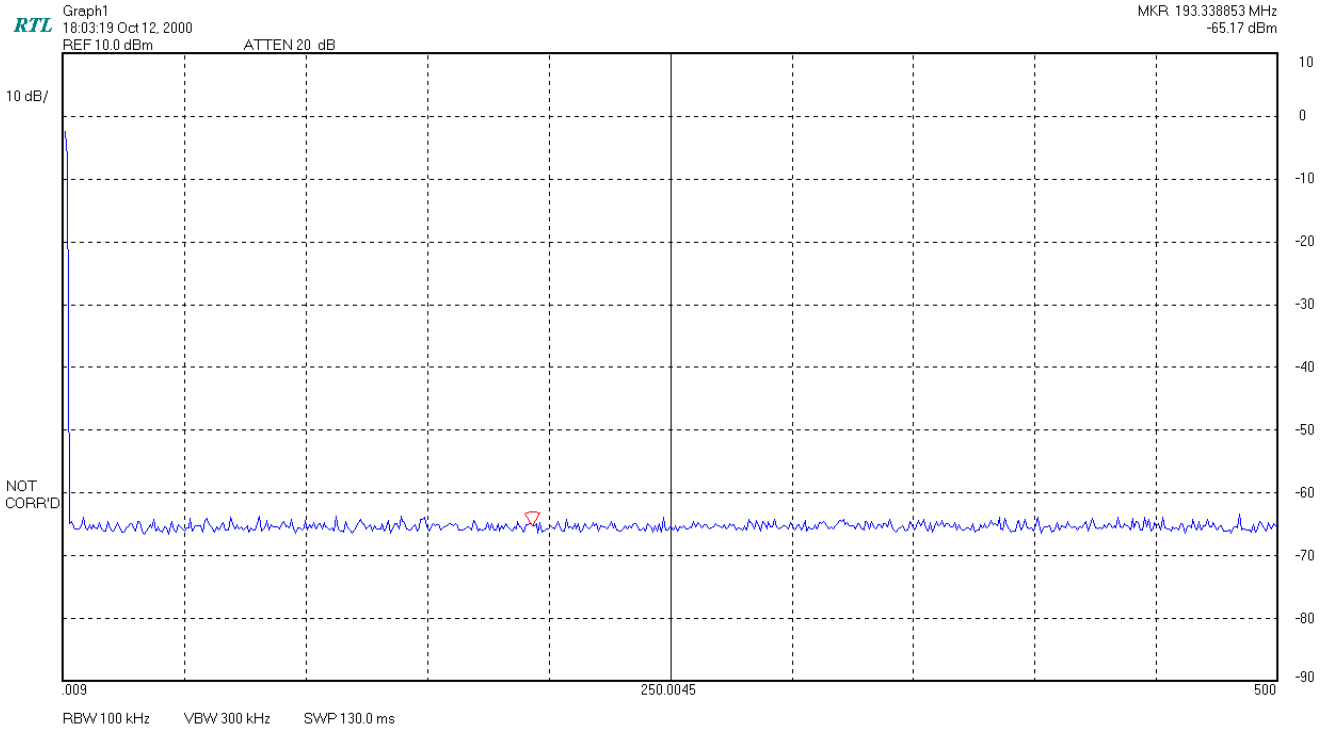

RTL
Graph2
19:13:52 Oct 12, 2000
REF 10.0 dBm
ATTEN 20 dB
MKR 952.500000 MHz
-64.33 dBm
10 dB/
NOT
CORR'D
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
500
750
1000
RBW 100 kHz
VBW 300 kHz
SWP 130.0 ms

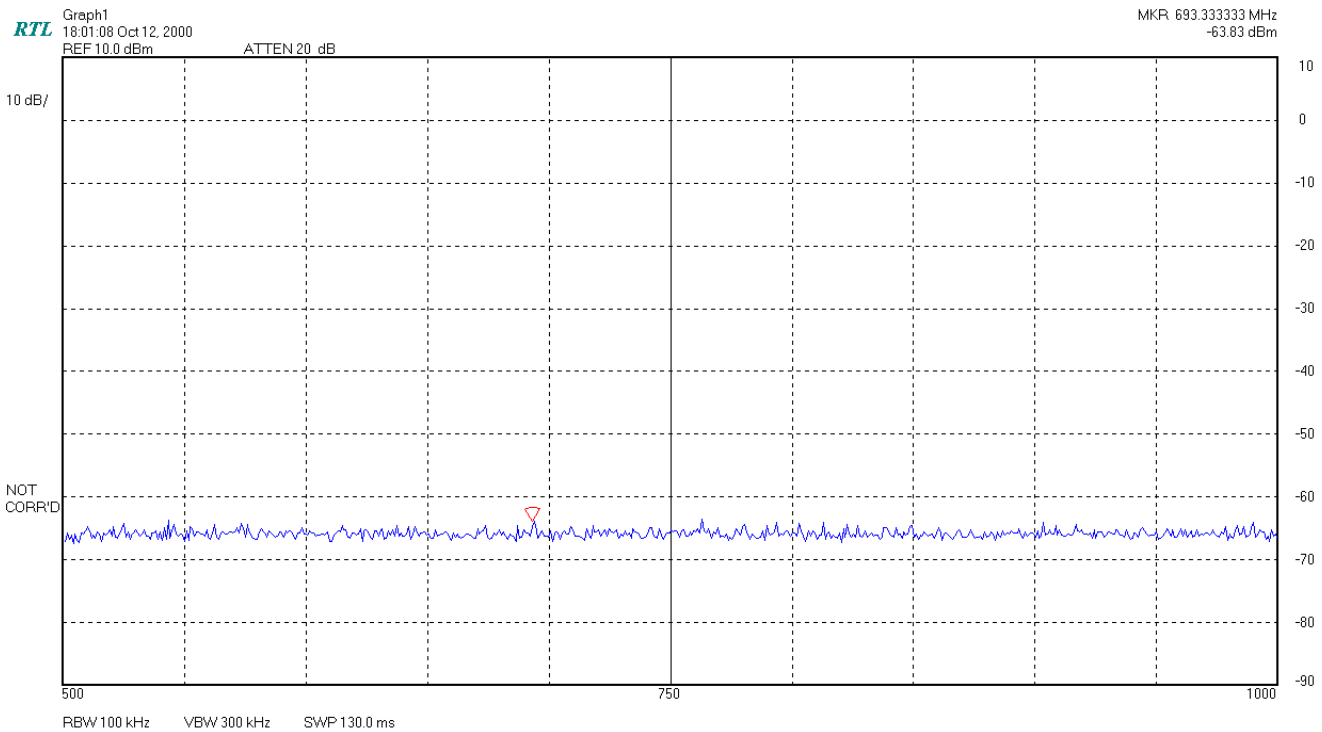

RTL
Graph2
19:14:23 Oct 12, 2000
REF 10.0 dBm
ATTEN 20 dB
MKR 2.176500 GHz
-64.33 dBm
10 dB/
NOT
CORR'D
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
1000
1650
2300
RBW 100 kHz
VBW 300 kHz
SWP 330.0 ms

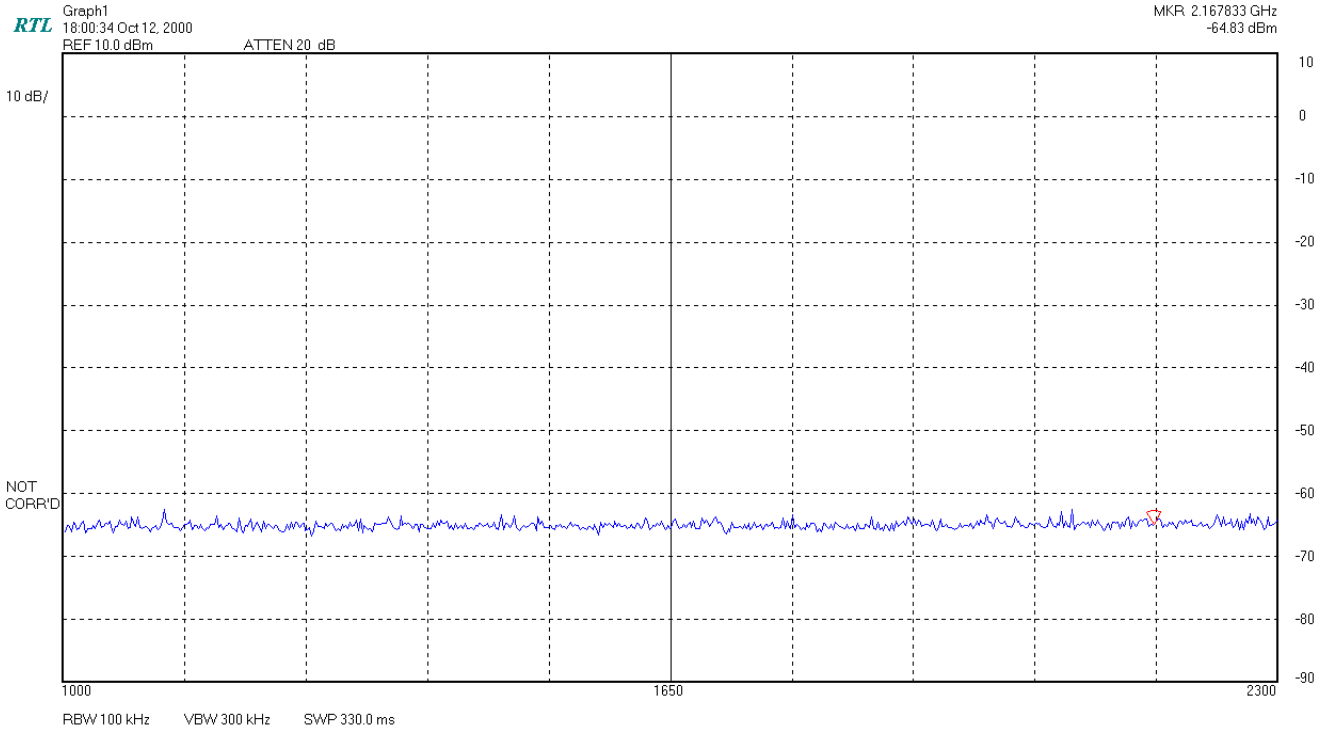

RTL
Graph2
19:08:13 Oct 12, 2000
REF 10.0 dBm
ATTEN 20 dB
MKR 2.469583 GHz
-2.5 dBm
10 dB/
NOT
CORR'D
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
2300
2425
2550
RBW 100 kHz
VBW 300 kHz
SWP 63.0 ms

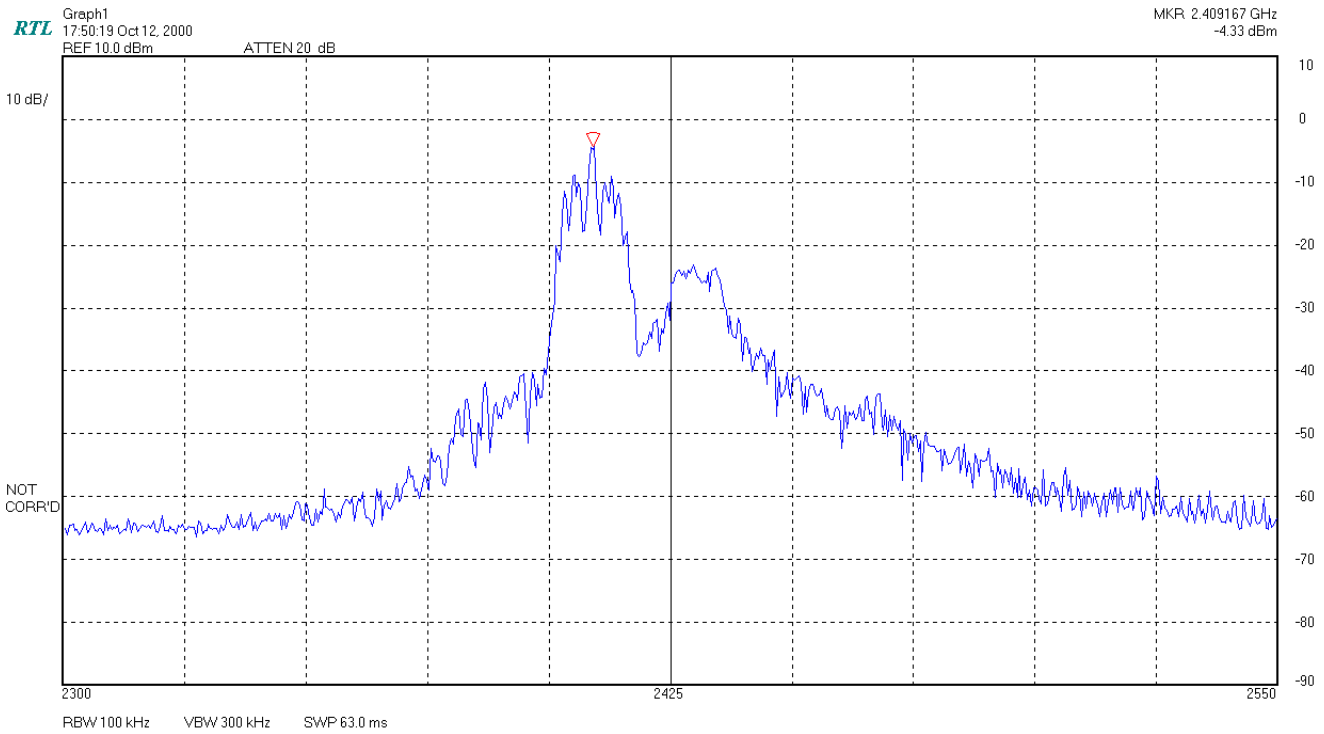

RTL
Graph2
19:09:31 Oct 12, 2000
REF 10.0 dBm
ATTEN 20 dB
MKR 5.216667 GHz
-64 dBm
10 dB/
NOT
CORR'D
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
5000
10000
15000
RBW 100 kHz
VBW 300 kHz
SWP 2.5 s

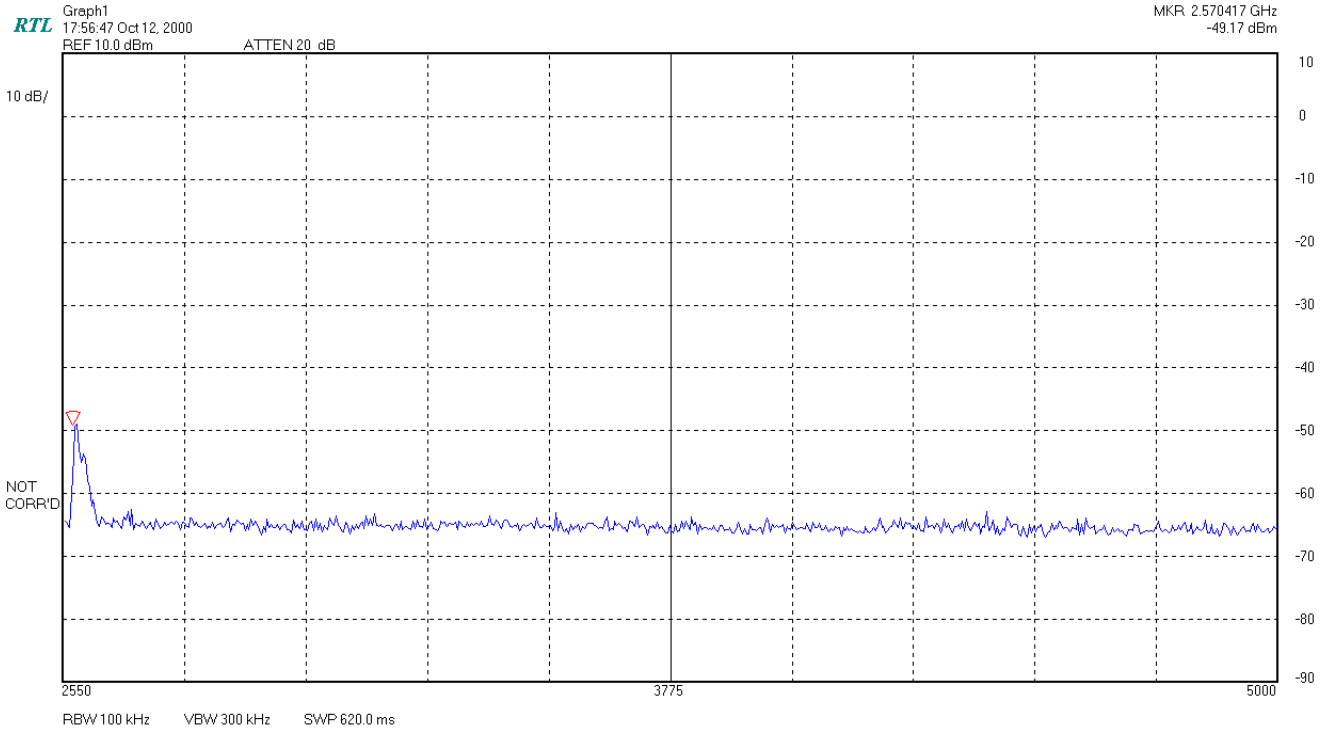

RTL
Graph2
19:12:36 Oct 12, 2000
REF 10.0 dBm
ATTEN 20 dB
MKR 24.004750 GHz
-56.33 dBm
10 dB/
NOT
CORR'D
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
15000
19975
24950
RBW 100 kHz
VBW 300 kHz
SWP 2.5 s

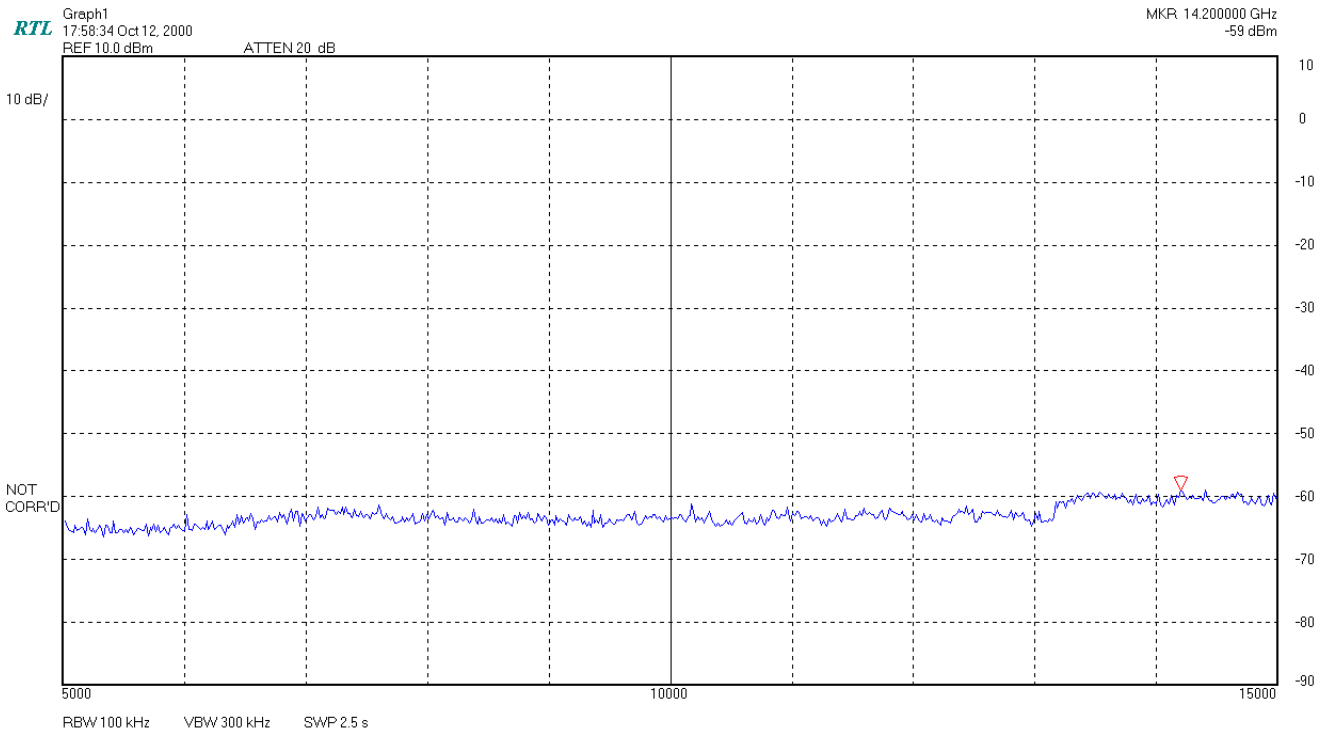

RTL
Graph1
18:03:19 Oct 12, 2000
REF 10.0 dBm
ATTEN 20 dB
MKR 193.338853 MHz
-65.17 dBm
10 dB/
NOT
CORR'D
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
.009
250.0045
500
RBW 100 kHz
VBW 300 kHz
SWP 130.0 ms

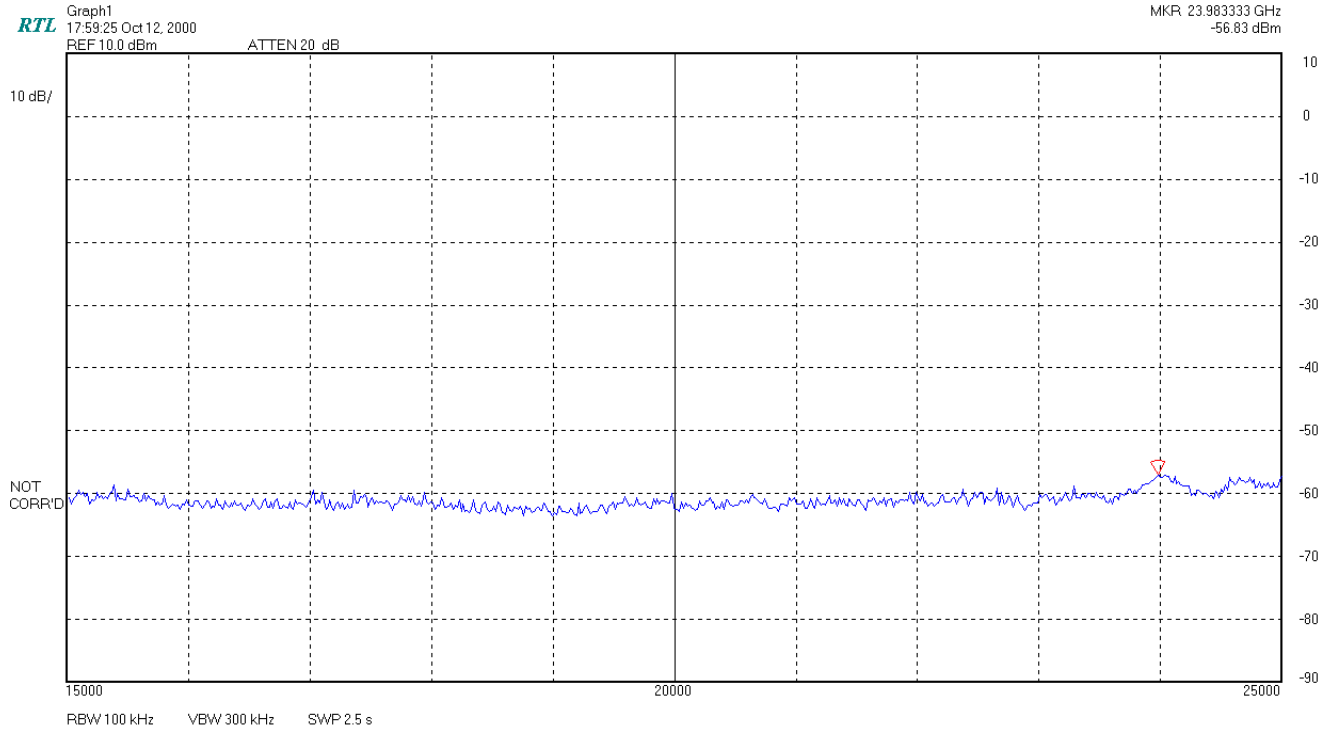

RTL
Graph1
18:01:08 Oct 12, 2000
REF 10.0 dBm
ATTEN 20 dB
MKR 693.333333 MHz
-63.83 dBm
10 dB/
NOT
CORR'D
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
500
750
1000
RBW 100 kHz
VBW 300 kHz
SWP 130.0 ms

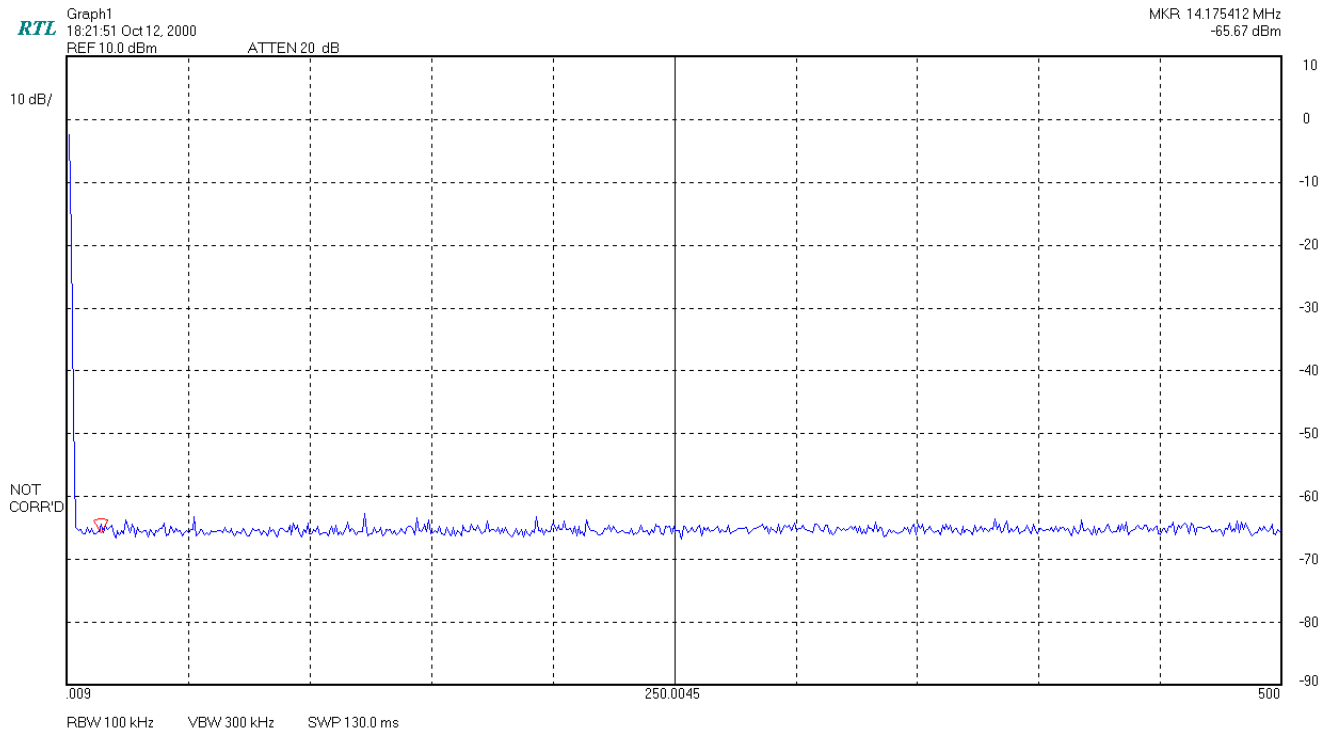

RTL
Graph1
18:00:34 Oct 12, 2000
REF 10.0 dBm
ATTEN 20 dB
MKR 2.167833 GHz
-64.83 dBm
10 dB/
NOT
CORR'D
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
1000
1650
2300
RBW 100 kHz
VBW 300 kHz
SWP 330.0 ms

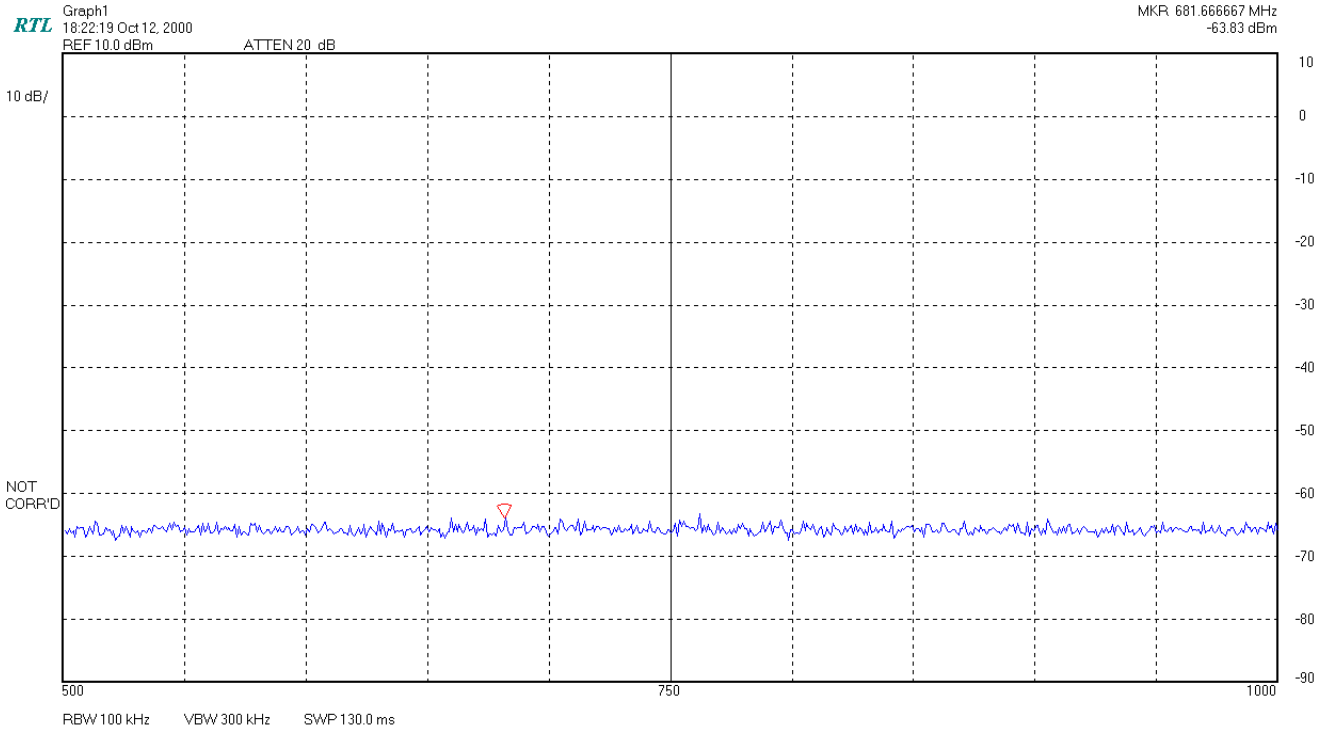

RTL
Graph1
17:50:19 Oct 12, 2000
REF 10.0 dBm
ATTEN 20 dB
MKR 2.409167 GHz
-4.33 dBm
10 dB/
NOT
CORR'D
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
2300
2425
2550
RBW 100 kHz
VBW 300 kHz
SWP 63.0 ms

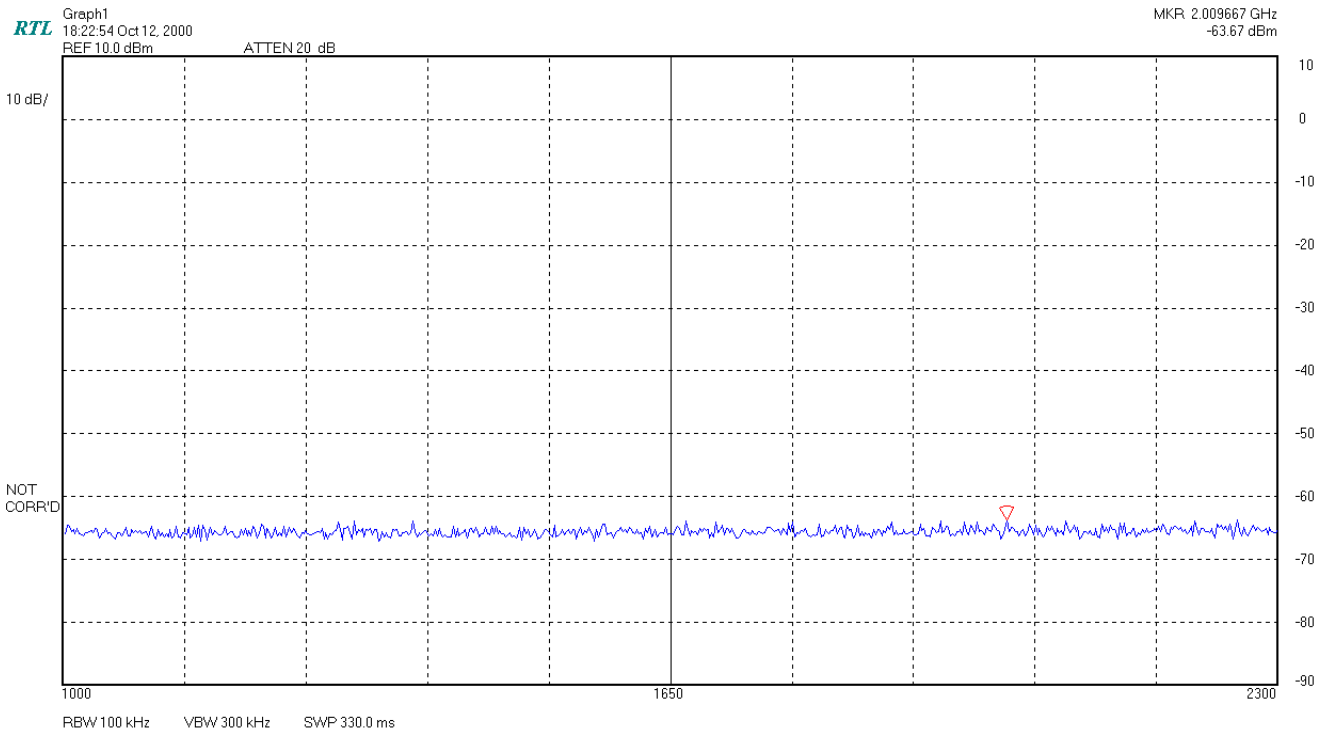

RTL
Graph1
17:56:47 Oct 12, 2000
REF 10.0 dBm
ATTEN 20 dB
MKR 2.570417 GHz
-49.17 dBm
10 dB/
NOT
CORR'D
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
2550
3775
5000
RBW 100 kHz
VBW 300 kHz
SWP 620.0 ms

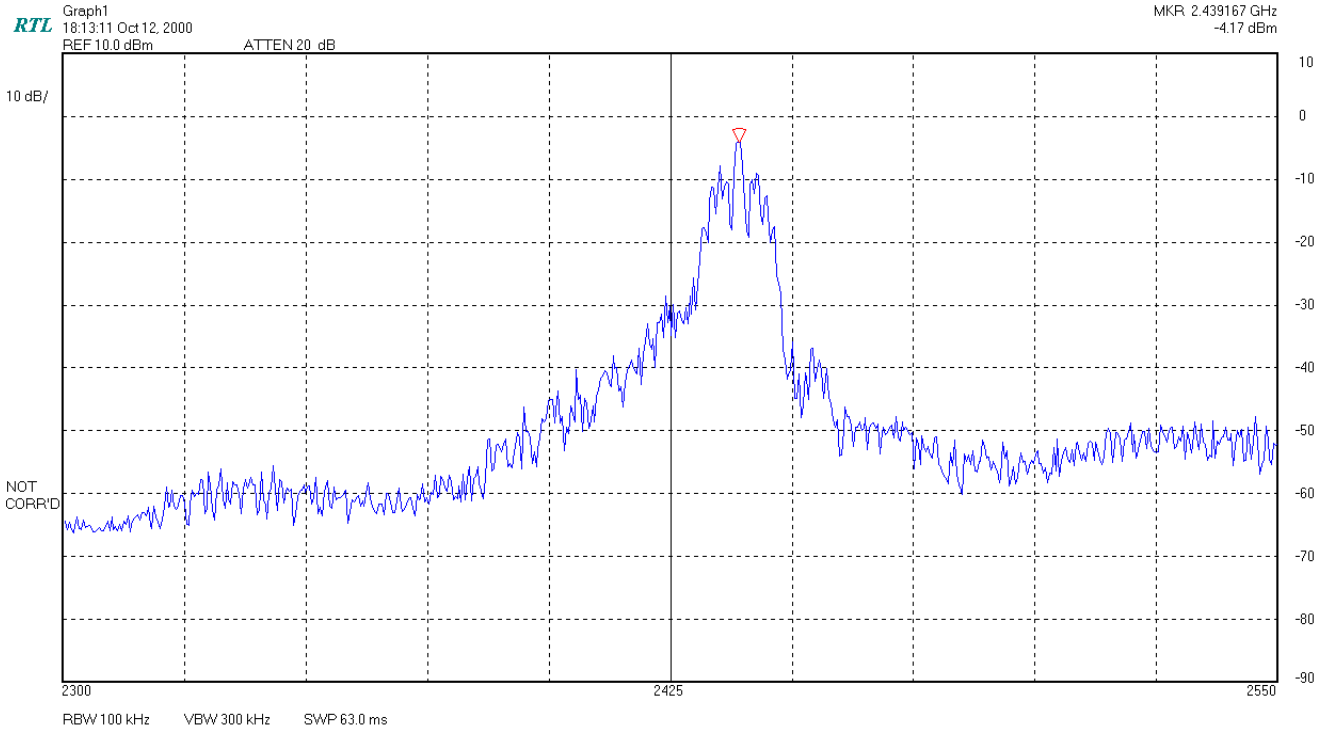

RTL
Graph1
17:58:34 Oct 12, 2000
REF 10.0 dBm
ATTEN 20 dB
MKR 14.200000 GHz
-59 dBm
10 dB/
NOT
CORR'D
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
5000
10000
15000
RBW 100 kHz
VBW 300 kHz
SWP 2.5 s

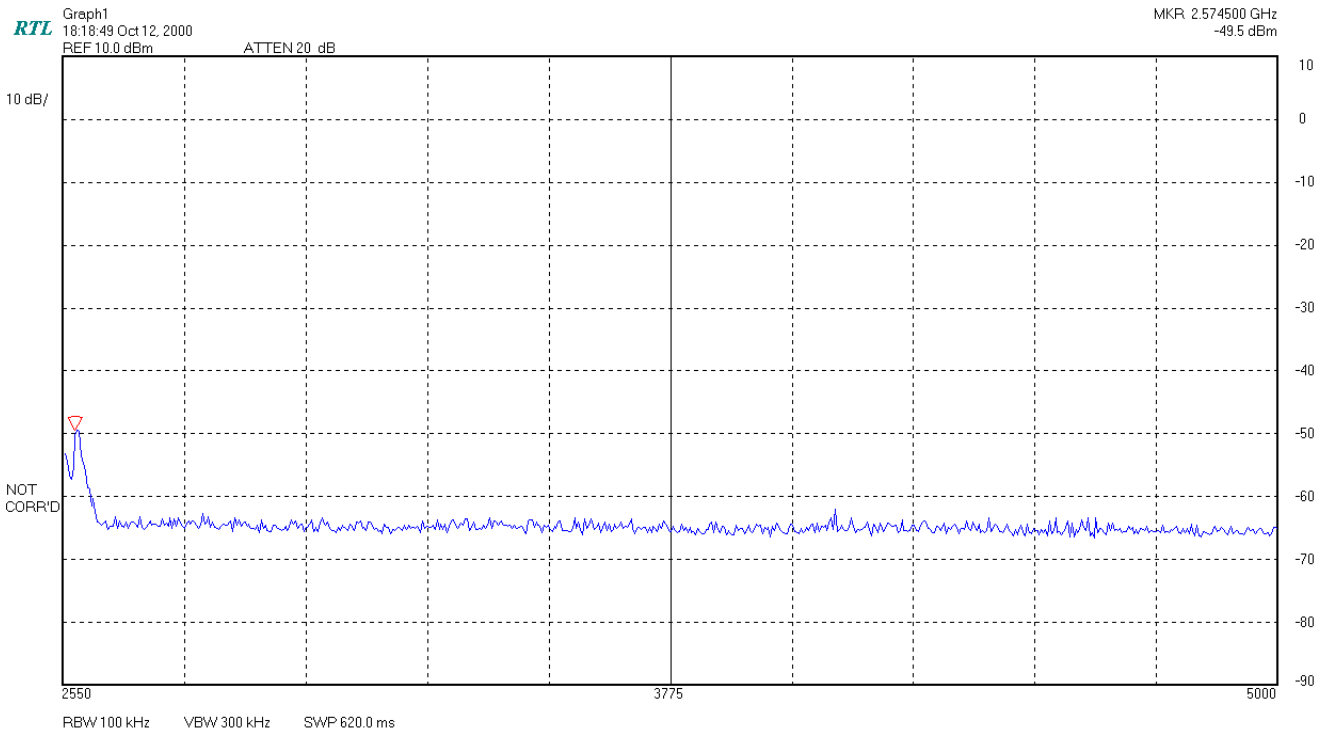

RTL
Graph1
17:59:25 Oct 12, 2000
REF 10.0 dBm
ATTEN 20 dB
MKR 23.983333 GHz
-56.83 dBm
10 dB/
NOT
CORR'D
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
15000
20000
25000
RBW 100 kHz
VBW 300 kHz
SWP 2.5 s

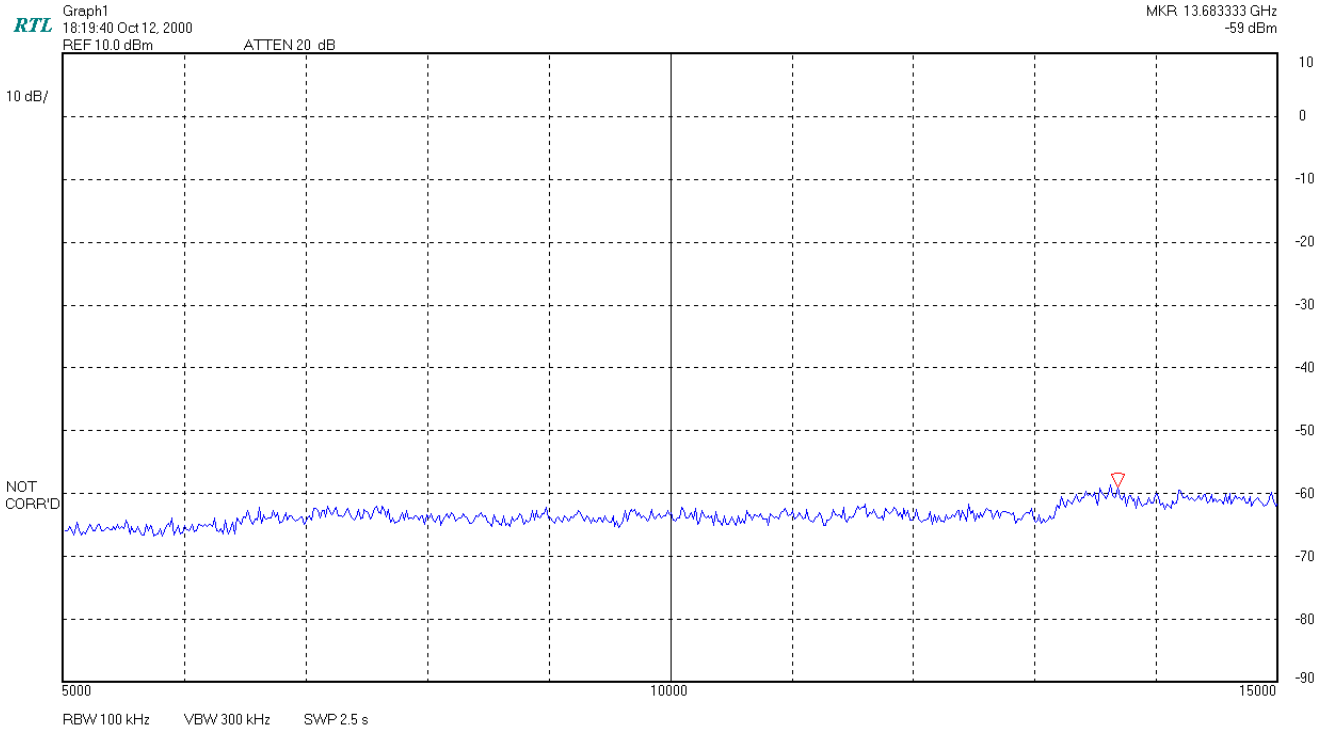

RTL
Graph1
18:21:51 Oct 12, 2000
REF 10.0 dBm
ATTEN 20 dB
MKR 14.175412 MHz
-65.67 dBm
10 dB/
NOT
CORR'D
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
.009
250.0045
500
RBW 100 kHz
VBW 300 kHz
SWP 130.0 ms

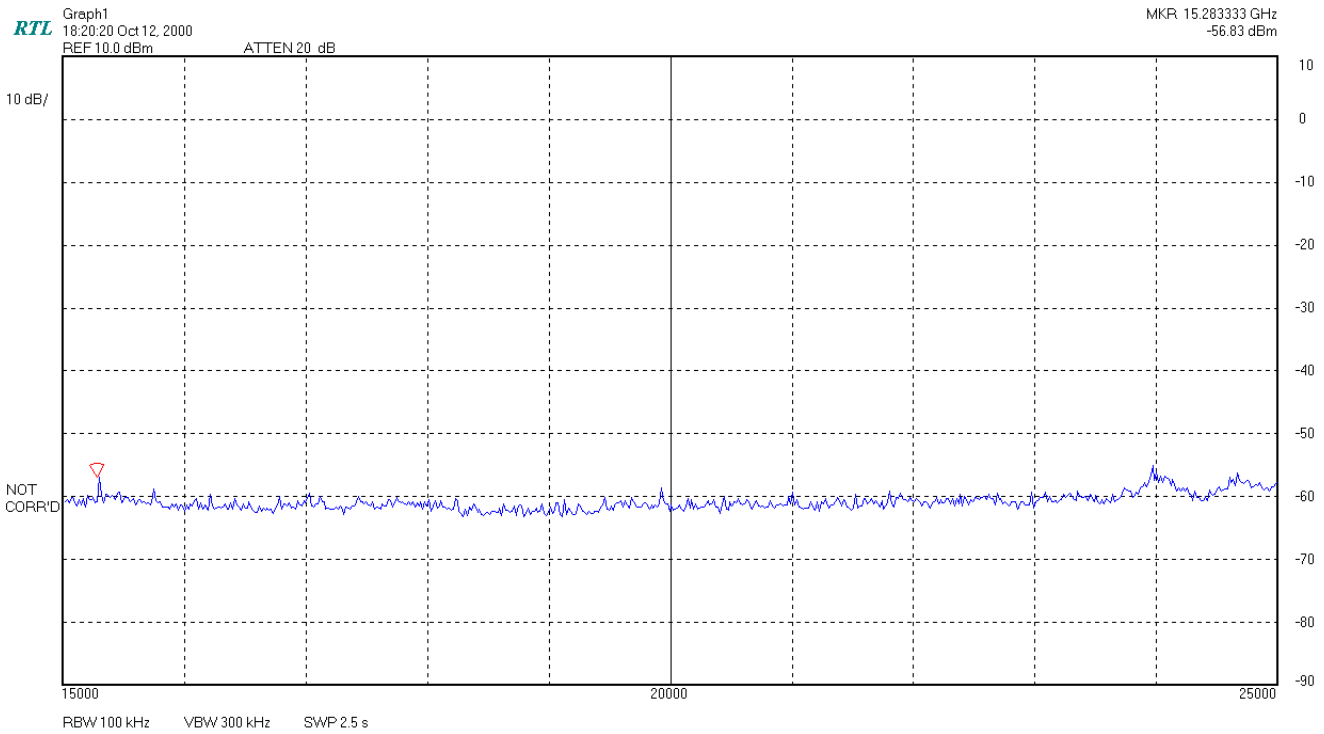

RTL
Graph1
18:22:19 Oct 12, 2000
REF 10.0 dBm
ATTEN 20 dB
MKR 681.666667 MHz
-63.83 dBm
10 dB/
NOT
CORR'D
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
500
750
1000
RBW 100 kHz
VBW 300 kHz
SWP 130.0 ms

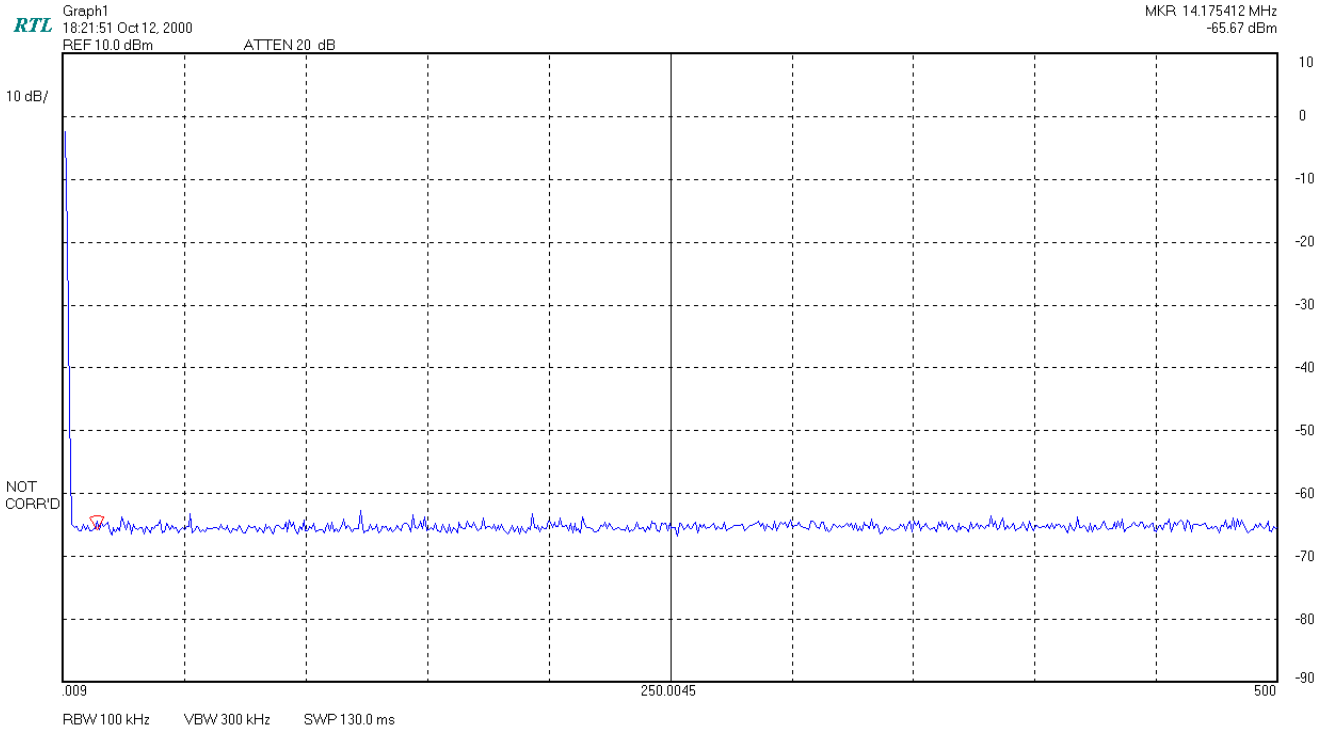

RTL
Graph1
18:22:54 Oct 12, 2000
REF 10.0 dBm
ATTEN 20 dB
MKR 2.009667 GHz
-63.67 dBm
10 dB/
NOT
CORR'D
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
1000
1650
2300
RBW 100 kHz
VBW 300 kHz
SWP 330.0 ms

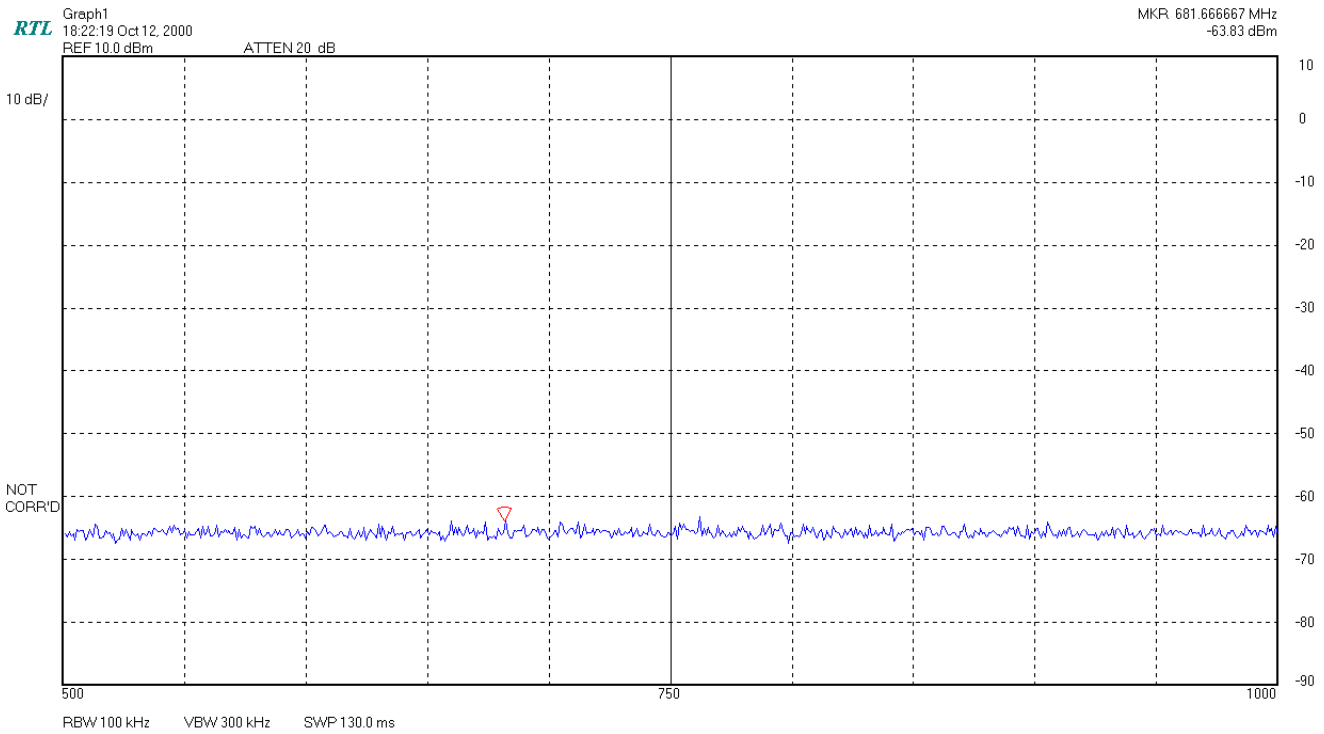

RTL
Graph1
18:13:11 Oct 12, 2000
REF 10.0 dBm
ATTEN 20 dB
MKR 2.439167 GHz
-4.17 dBm
10 dB/
NOT
CORR'D
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
2300
2425
2550
RBW 100 kHz
VBW 300 kHz
SWP 63.0 ms

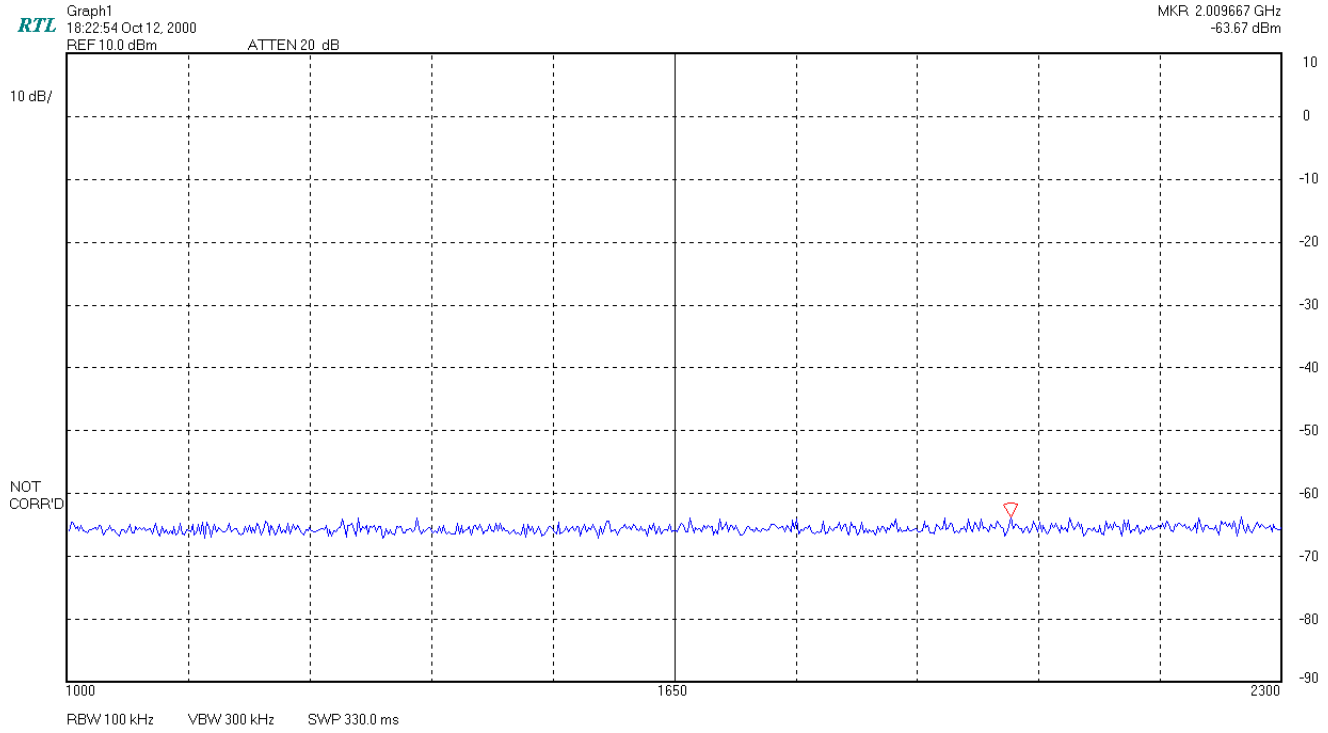

RTL
Graph1
18:18:49 Oct 12, 2000
REF 10.0 dBm
ATTEN 20 dB
MKR 2.574500 GHz
-49.5 dBm
10 dB/
NOT
CORR'D
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
2550
3775
5000
RBW 100 kHz
VBW 300 kHz
SWP 620.0 ms

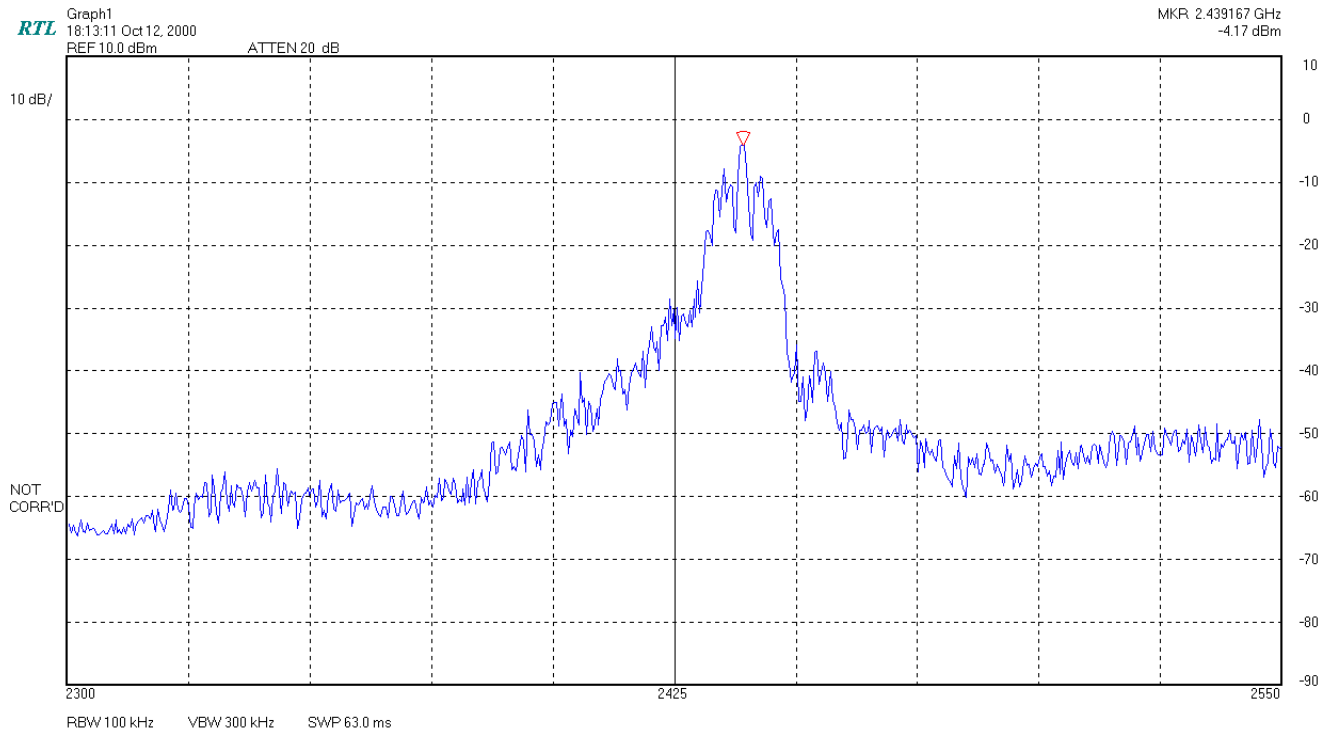

RTL
Graph1
18:19:40 Oct 12, 2000
REF 10.0 dBm
ATTEN 20 dB
MKR 13.683333 GHz
-59 dBm
10 dB/
NOT
CORR'D
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
5000
10000
15000
RBW 100 kHz
VBW 300 kHz
SWP 2.5 s

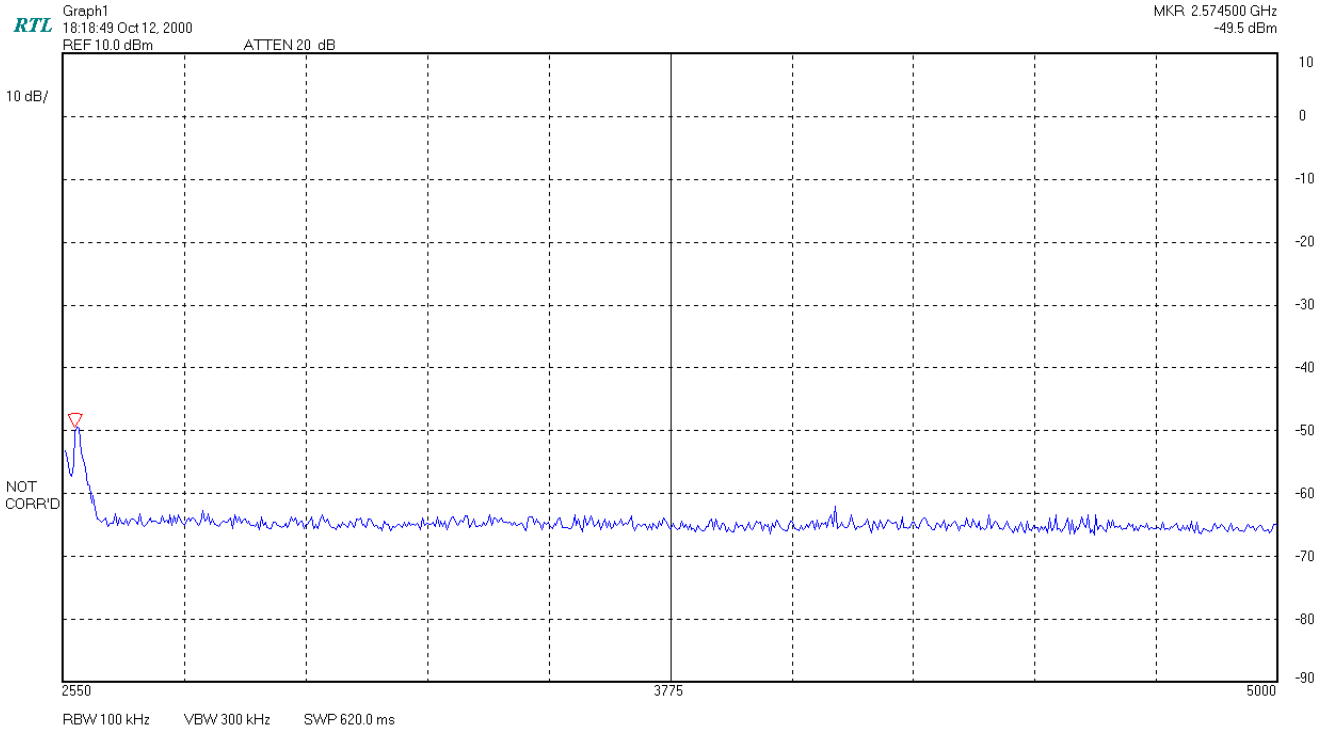

RTL
Graph1
18:20:20 Oct 12, 2000
REF 10.0 dBm
ATTEN 20 dB
MKR 15.283333 GHz
-56.83 dBm
10 dB/
NOT
CORR'D
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
15000
20000
25000
RBW 100 kHz
VBW 300 kHz
SWP 2.5 s

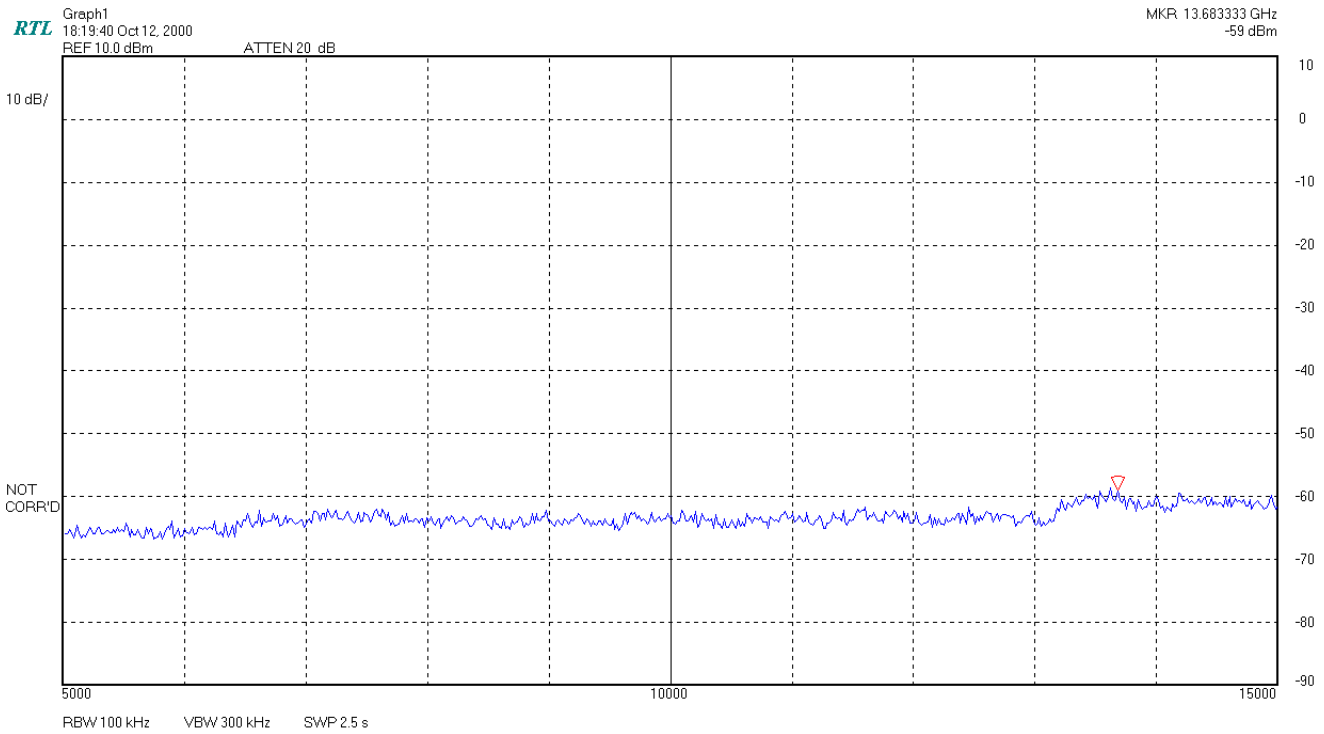

RTL
Graph1
18:21:51 Oct 12, 2000
REF 10.0 dBm
ATTEN 20 dB
MKR 14.175412 MHz
-65.67 dBm
10 dB/
NOT
CORR'D
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
.009
250.0045
500
RBW 100 kHz
VBW 300 kHz
SWP 130.0 ms

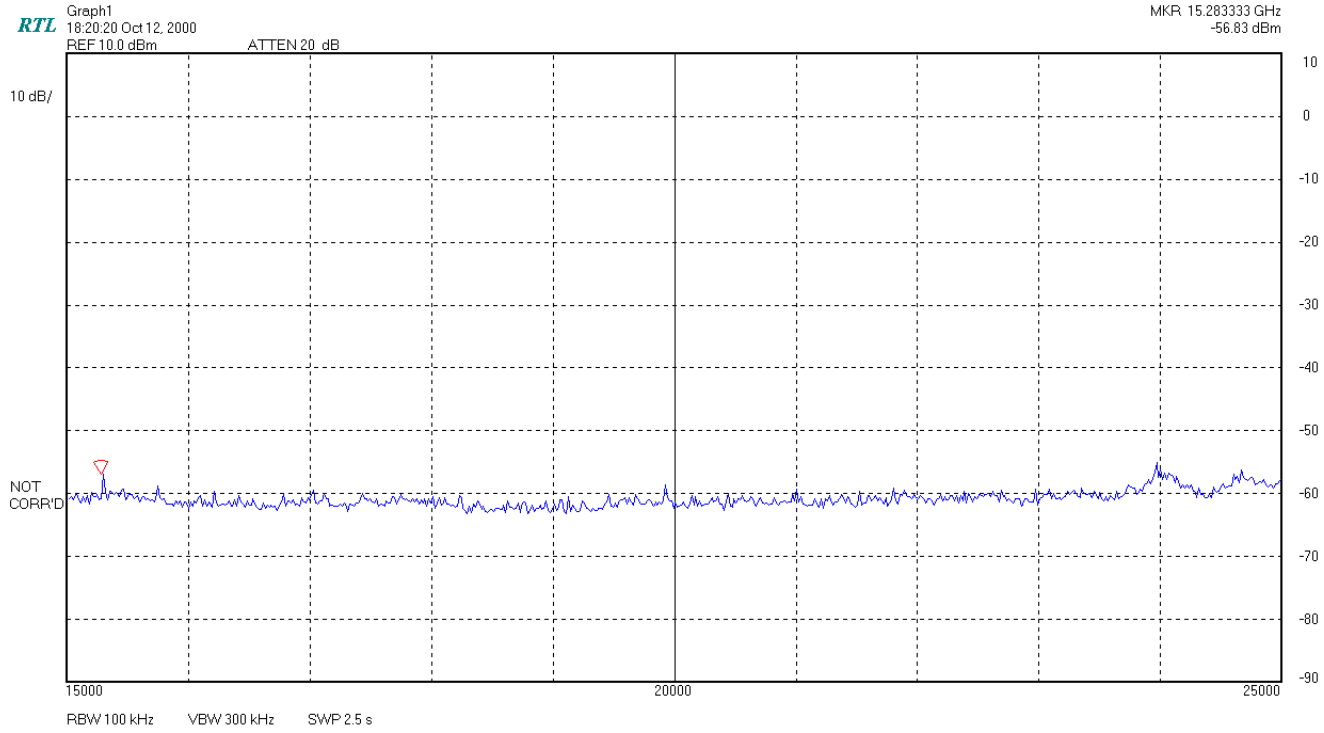

RTL
Graph1
18:22:19 Oct 12, 2000
REF 10.0 dBm
ATTEN 20 dB
MKR 681.666667 MHz
-63.83 dBm
10 dB/
NOT
CORR'D
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
500
750
1000
RBW 100 kHz
VBW 300 kHz
SWP 130.0 ms


RTL
Graph1
18:22:54 Oct 12, 2000
REF 10.0 dBm
ATTEN 20 dB
MKR 2.009667 GHz
-63.67 dBm
10 dB/
NOT
CORR'D
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
1000
1650
2300
RBW 100 kHz
VBW 300 kHz
SWP 330.0 ms


RTL
Graph1
18:13:11 Oct 12, 2000
REF 10.0 dBm
ATTEN 20 dB
MKR 2.439167 GHz
-4.17 dBm
10 dB/
NOT
CORR'D
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
2300
2425
2550
RBW 100 kHz
VBW 300 kHz
SWP 63.0 ms


RTL
Graph1
18:18:49 Oct 12, 2000
REF 10.0 dBm
ATTEN 20 dB
MKR 2.574500 GHz
-49.5 dBm
10 dB/
NOT
CORR'D
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
2550
3775
5000
RBW 100 kHz
VBW 300 kHz
SWP 620.0 ms


RTL
Graph1
18:19:40 Oct 12, 2000
REF 10.0 dBm
ATTEN 20 dB
MKR 13.683333 GHz
-59 dBm
10 dB/
NOT
CORR'D
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
5000
10000
15000
RBW 100 kHz
VBW 300 kHz
SWP 2.5 s

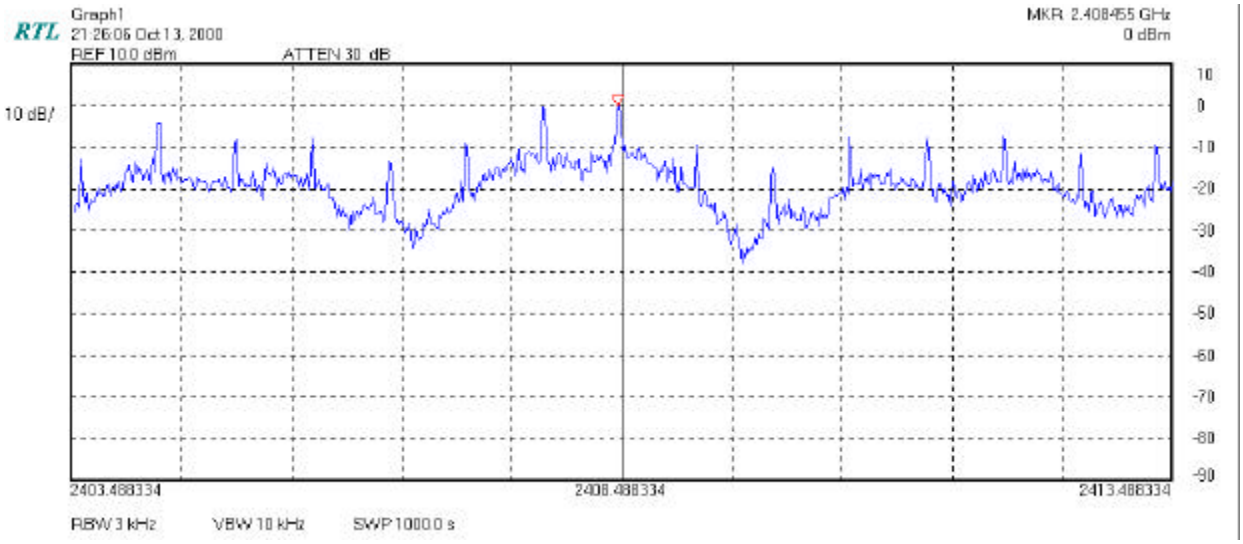

RTL
Graph1
18:20:20 Oct 12, 2000
REF 10.0 dBm
ATTEN 20 dB
MKR 15.283333 GHz
-56.83 dBm
10 dB/
NOT
CORR'D
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
15000
20000
25000
RBW 100 kHz
VBW 300 kHz
SWP 2.5 s

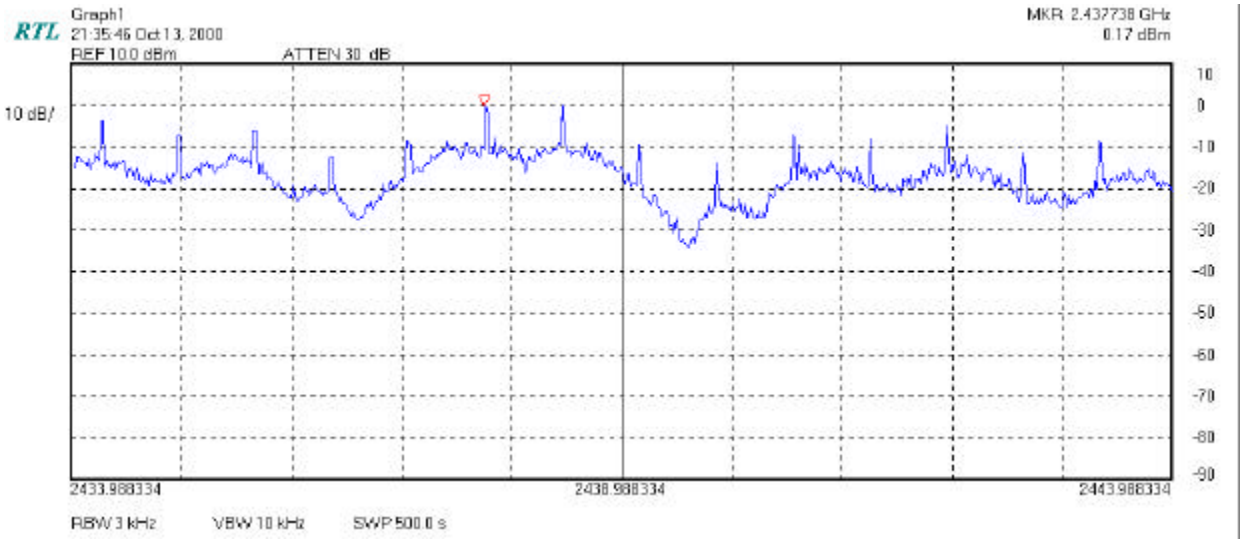
## 8.9 POWER SPECTRAL DENSITY

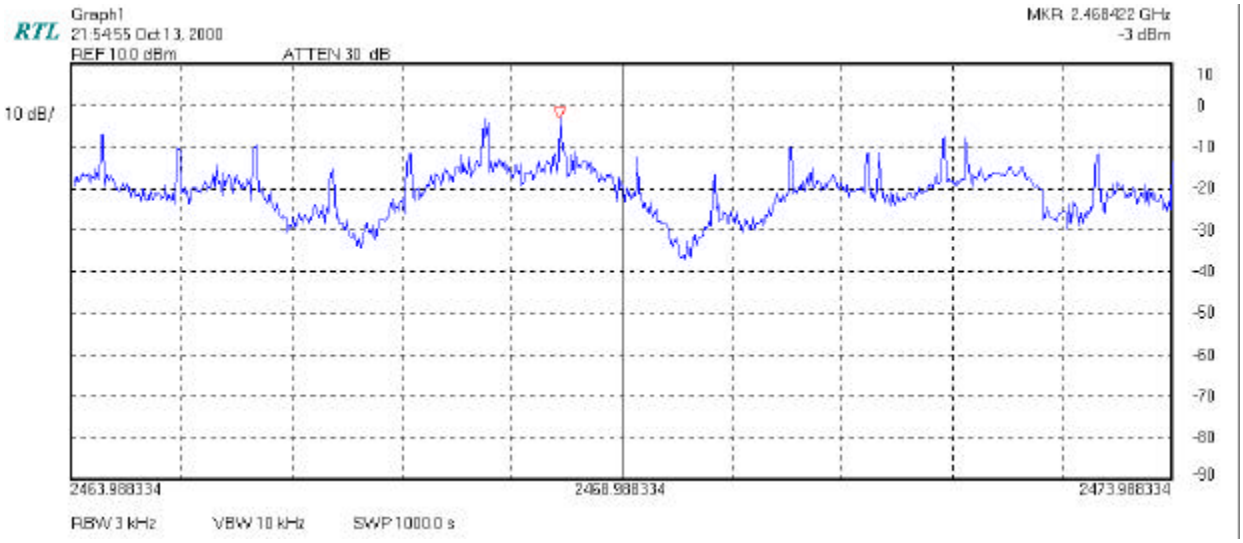
The Power spectral density per FCC 15.247(d) was measured from the antenna port of the EUT using a 50 ohm spectrum analyzer with the resolution bandwidth set at 3kHz, the video bandwidth set at 3kHz, and the sweep time set at 17 second. The spectral lines were resolved for the modulated carriers at channel 1, channel 3 and channel 6 respectively. These levels are well below the +8 dBm limit. See power spectral density table and plots. Both the FXO and FXS units were tested and investigated. **The worst case result for the FXS is reported below.**

| Spectral Density limit = +8dBm | |
|---|---|
| **Channel** | **FSX** |
| 1 | 0.00 |
| 3 | 0.17 |
| 6 | -3.00 |

**Worst case result FSX unit.**



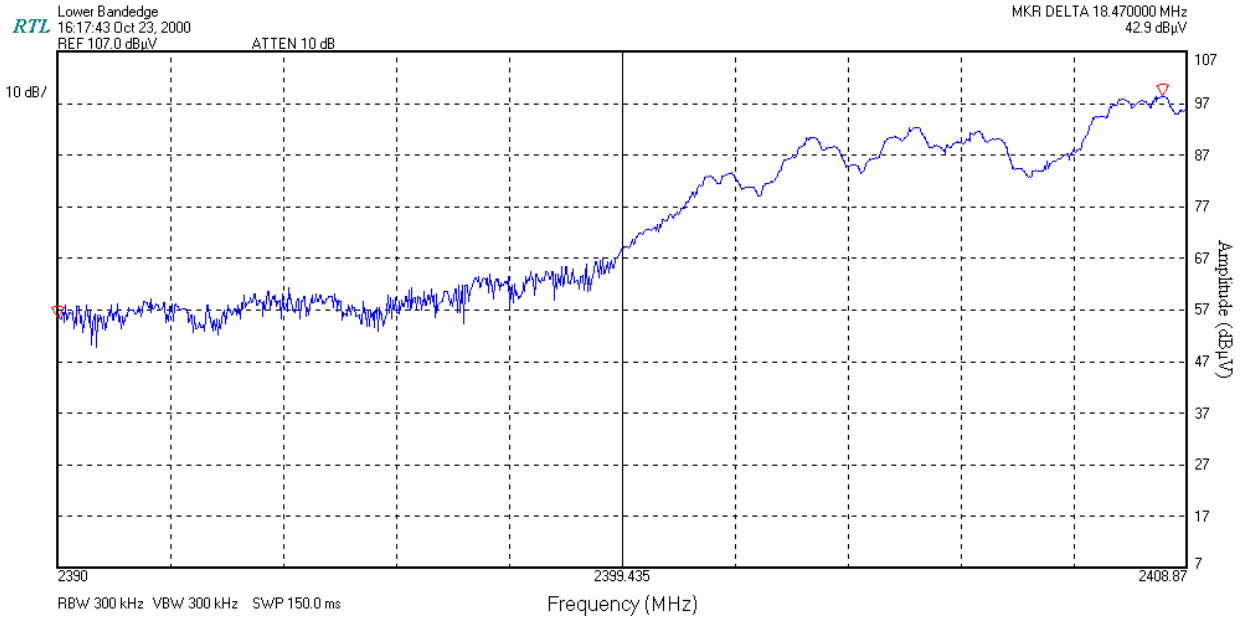

RTL
Graph1
21:35:46 Oct 13, 2000
REF 10.0 dBm
ATTEN 30 dB
MKR 2.437738 GHz
0.17 dBm
10 dB/
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
2433.988334
2438.988334
2443.988334
RBW 3 kHz
VBW 10 kHz
SWP 500.0 s

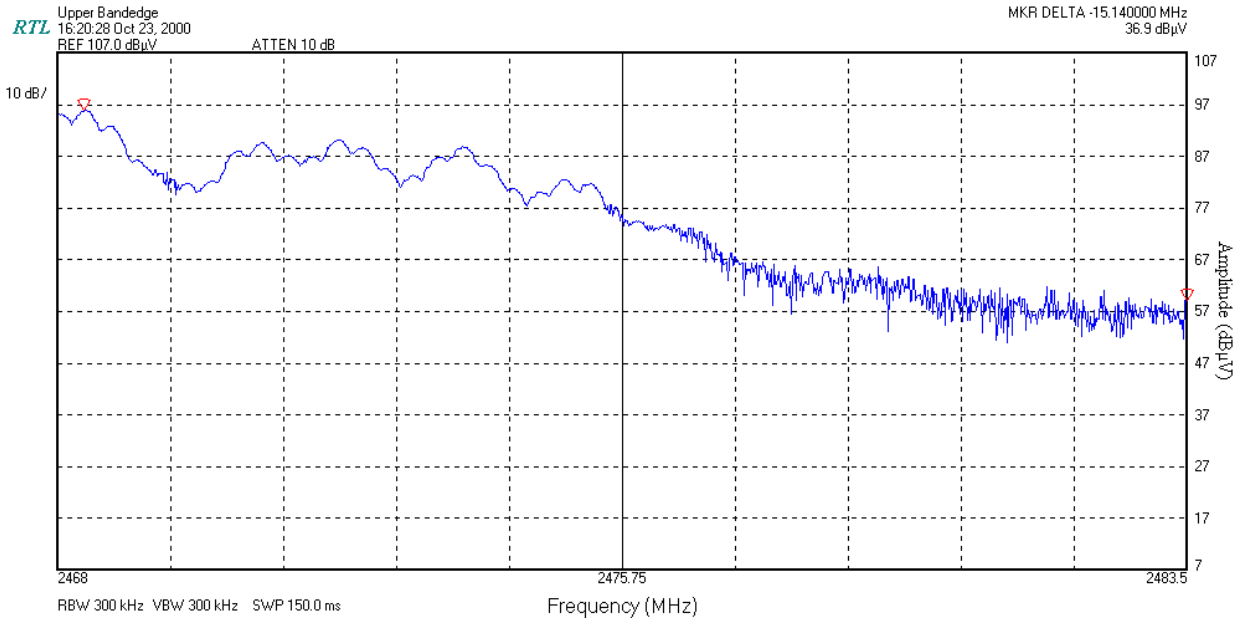

RTL
Graph1
21:54:55 Oct 13, 2000
REF 10.0 dBm
ATTEN 30 dB
MKR 2.468422 GHz
-3 dBm
10 dB/
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
2463.988334
2468.988334
2473.988334
RBW 3 kHz
VBW 10 kHz
SWP 1000.0 s

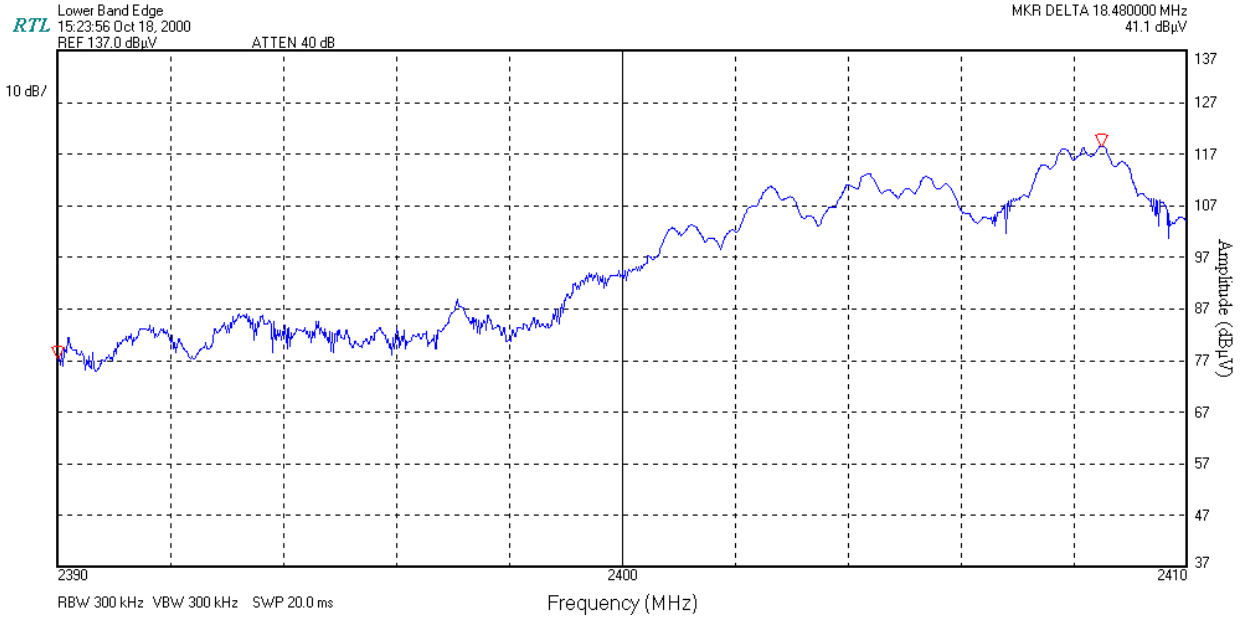
# 9 Compliance With The Restricted Band Edge

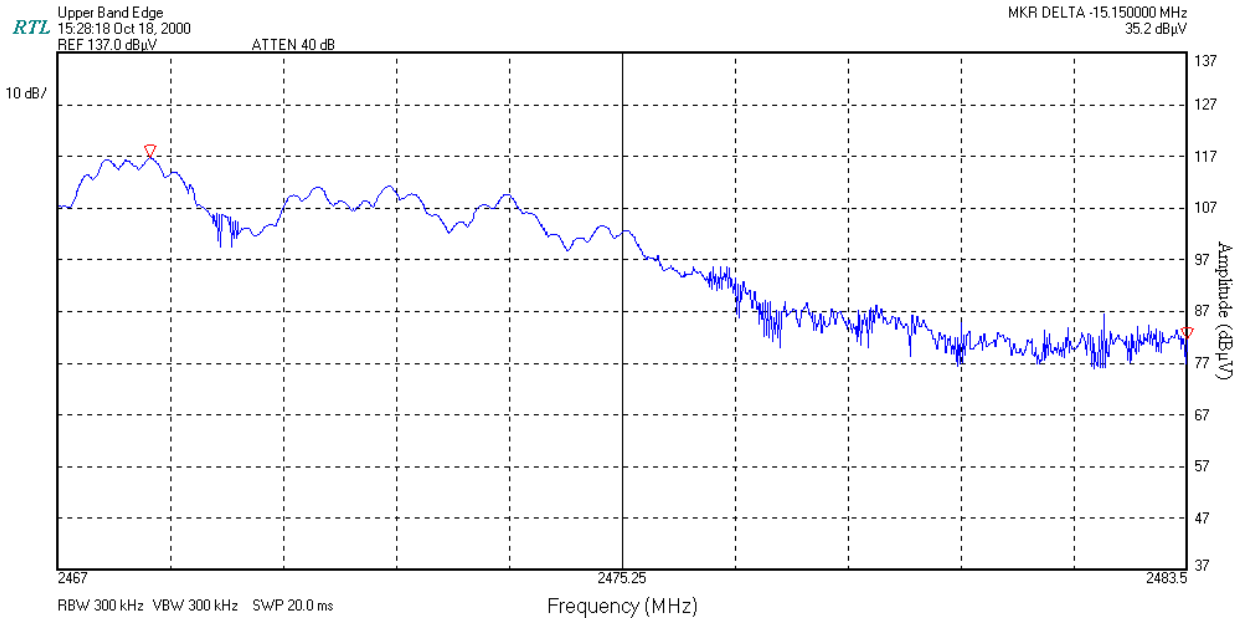
Compliance with the band edges was performed using the FCC's "Radiated Measurement at a Band Edge" guidance document. The final data derived below were from radiated measurements only. The data taken in this report represents the worst case at the maximum data rate. Band edge compliance was investigated and tested for the **FSX** and **FXO** units. **The worst case data below represents the FSX unit for both antennas.**

| Band edge Measurement | | | | | | |
|---|---|---|---|---|---|---|
| **Antenna** | **Channel** | **Delta dB** | **Field Strength Level (dBuV)** | **Corrected level (dBuV)** | **FCC Limit (dBuV)** | **FCC Margin (dB)** |
| Patch | 1 | 42.9 | 71.2 | 28.3 | 54 | -25.7 |
| Patch | 3 | 36.9 | 70.4 | 33.5 | 54 | -20.5 |
| Grid | 1 | 41.1 | 70.9 | 29.8 | 54 | -24.2 |
| Grid | 3 | 35.2 | 78.6 | 43.4 | 54 | -10.6 |




RTL
Upper Bandedge
16:20:28 Oct 23, 2000
REF 107.0 dBµV
ATTEN 10 dB
MKR DELTA -15.140000 MHz
36.9 dBµV
10 dB/
107
97
87
77
67
57
47
37
27
17
7
Amplitude (dBµV)
2468
2475.75
2483.5
RBW 300 kHz VBW 300 kHz SWP 150.0 ms
Frequency (MHz)


RTL
Lower Band Edge
15:23:56 Oct 18, 2000
REF 137.0 dBµV
ATTEN 40 dB
MKR DELTA 18.480000 MHz
41.1 dBµV
10 dB/
137
127
117
107
97
87
77
67
57
47
37
Amplitude (dBµV)
2390
2400
2410
RBW 300 kHz VBW 300 kHz SWP 20.0 ms
Frequency (MHz)


RTL
Upper Band Edge
15:28:18 Oct 18, 2000
REF 137.0 dBµV
ATTEN 40 dB
MKR DELTA -15.150000 MHz
35.2 dBµV
10 dB/
137
127
117
107
97
87
77
67
57
47
37
Amplitude (dBµV)
2467
2475.25
2483.5
RBW 300 kHz VBW 300 kHz SWP 20.0 ms
Frequency (MHz)

# 10 ANTENNA SPECIFICATIONS

## Patch antenna

Electrical Specifications:

| Model No. | Yagi Patch |
|---|---|
| Frequency Range | 2.400 –2.4835 GHz |
| Gain | 13.8 dBi |