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Electromagnetic Emissions Test Report In Accordance With Industry Canada Radio Standards Specification 119 Issue 6, FCC Part 90 on the Microwave Data System Model: TRM450

FCC ID NUMBER:	E5MDS-TRM450
UPN:	3738A-TRM450
APPLICANT:	Microwave Data Systems 175 Science Parkway Rochester NY, 14620
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Ave Sunnyvale, CA 94086
TEST SITE:	Elliott Laboratories, Inc. 41039 Boyce Road Fremont, CA 94538
REPORT DATE:	October 20, 2003
FINAL TEST DATE:	October 21, 2003
AUTHORIZED SIGNATORY:	Sr. EMC Engineer

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FCC CERTIFICATION INFORMATION

The following information is in accordance with FCC Rules, 47CFR Part 2, Subpart J, Section 2.1033(C) & to Industry Canada RSP-100.

2.1033(c)(1) Applicant:

Microwave Data Systems
175 Science Parkway
Rochester NY, 14620

2.1033(c)(2) & RSP-100 (4) FCC ID: E5MDS-TRM450
UPN: 3738A-TRM450

2.1033(c)(3) & RSP-100 (7.2(a)) Instructions/Installation Manual

Please refer to Exhibit 7: User Manual, Theory of Operation, and Tune-up Procedure

2.1033(c)(4) & RSP-100 (7.2(b)(iii)) Type of emissions

FCC 90 & RSS-119**:** 25kHz Channel (20KG1D)
12.5kHz Channel (11K25G1D)

2.1033(c)(5) & RSP-100 (7.2(a)) Frequency Range

FCC 90 & RSS-119**:** 410 – 470 MHz

2.1033(c)(6) & RSP-100 (7.2(a)) Range of Operation Power

FCC 90 & RSS-119**:** 2 Watts (33 dBm), High Setting
FCC 90 & RSS-119**:** .5 Watts (27 dBm), Low Setting

2.1033(c)(7) & RSP-100 (7.2(a)) Maximum FCC & IC Allowed Power Level

FCC 90 & RSS-119**:** 90.205(f)(g): 421-430, 450-470 Limitation on power based on height of antenna.

2.1033(c)(8) & RSP-100 (7.2(a)) Applied voltage and currents into the final transistor elements

The power amplifier chain of the transmitter section consists of U202 and U302. U202 is a buffer amplifier powered by the + 5v supply. The output of U202 is input to a two-watt power amplifier U302.

2.1033(c)(9) & RSP-100 (7.2(a)) Tune-up Procedure

Please refer to Exhibit 7: User Manual, Theory of Operation, and Tune-up Procedure

2.1033(c)(10) & RSP 100 (7.2(a)) Schematic Diagram of the Transmitter

Refer to Exhibit 6: Schematic diagram

2.1033(c)(10) & RSP-100 (7.2(a)) Means for Frequency Stabilization

Y201 (16MHz) TXCO

2.1033(c)(10) & RSP-100 (7.2(a)) Means for Suppression of Spurious radiation

520 MHz LPF at the antenna port. Please refer to Exhibit 6: Schematic diagram (page 3 of 3).

2.1033(c)(10) & RSP-100 (7.2(a)) Means for Limiting Modulation

30kHz FL205 filter (Refer to Exhibit 6: Schematic diagram (page 2 of 3).

2.1033(c)(10) & RSP-100 (7.2(a)) Means for Limiting Power

U201 IF amplifier *I* limiter.

2.1033(c)(11) & RSP-100 (7.2(g)) Photographs or Drawing of the Equipment Identification Plate or Label

Refer to Exhibit 4

2.1033(c)(12) & RSP-100 (7.2(c)) Photographs of equipment

Refer to Exhibit 5

2.1033(c)(13) & RSP-100 (7.2(a)) Equipment Employing Digital Modulation & 90.203 (Certification Requirements)

90.203(J)(2)(ii)&(iii): 421–512 MHz bands, received on or after February 14, 1997, must include a certification that the equipment meets a spectrum efficiency standard
of one voice channel per 12.5 kHz of channel bandwidth. Additionally, if the equipment is capable of transmitting data, has transmitter output power greater than 500 mW, and has a channel bandwidth of more than 6.25 kHz, the equipment must be capable of sup-porting
a minimum data rate of 4800 bits per second per 6.25 kHz of channel bandwidth.

GSMK modulation is used with the following settings:

BAUD=19.2Kbps, BT=.3, BW=25.0KHz
BAUD=16.0kbps, BT=.3, BW=25.0KHz
BAUD=9.6kbps, BT=.5, BW=25.0KHz
BAUD=9.6kbps, BT=.3, BW=12.5KHz
BAUD=8.0kbps, BT=.5, BW=25.0KHz
BAUD=8.0kbps, BT=.3, BW=12.5KHz
BAUD=4.8kbps, BT=.5, BW=25.0KHz
BAUD=4.8kbps, BT=.5, BW=12.5KHz

2.1033(c)(14) & RSP-100 (7.2(b)(ii)) Data taken per Section 2.1046 to 2.1057 and RSS-133 issue 2, Rev. 1.

Refer to Exhibit 2

DECLARATIONS OF COMPLIANCE

Equipment Name and Model:

TRM450

Manufacturer:

Microwave Data Systems
175 Science Parkway
Rochester NY, 14620

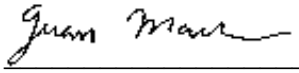
Tested to applicable standards:

RSS-119, Issue 6 (Land Mobile and Fixed Radio Transmitters and Receivers, 27.41 to 960 MHz).
FCC Part 90 (Private Land Mobile Radio Service)

Measurement Facility Description Filed With Department of Industry:

Departmental Acknowledgement Number: IC4549_**3** Dated March 5, 2003
Departmental Acknowledgement Number: IC4549_**5** Dated March 5, 2003
Departmental Acknowledgement Number: IC2845-**2** Dated August 8, 2001

I declare that the testing was performed or supervised by me; that the test measurements were made in accordance with the above mentioned departmental standards (through the use of TIA/EIA-603 and the specific RSS standards applicable to this device); and that the equipment performed in accordance with the data submitted in this report.

Signature	
Name	Juan Martinez
Title	Sr. EMC Engineer
Company	Elliott Laboratories Inc.
Address	684 W. Maude Ave Sunnyvale, CA 94086 USA
Date:	October 20, 2003

Maintenance of compliance with the above standards is the responsibility of the manufacturer. Any modification of the product which may result in increased emissions should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

SCOPE

FCC Part 90 & IC RSS-119 testing was performed for the equipment mentioned in this report. The equipment was tested in accordance with the procedures specified in Sections 2.1046 to 2.1057 of the FCC Rules & IC RSS-119. TIA-603 was also used as a test procedure guideline to perform some of the required tests.

The intentional radiator above was tested in a simulated typical installation to demonstrate compliance with the relevant FCC & RSS performance and procedural standards.

Final system data was gathered in a mode that tended to maximize emissions by varying orientation of EUT, orientation of power and I/O cabling, antenna search height, and antenna polarization.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

OBJECTIVE

The primary objective of the manufacturer is compliance with the FCC Part 90 & IC RSS-119. Certification of these devices is required as a prerequisite to marketing as defined in Section 2.1033 & RSP-100.

Certification is a procedure where the manufacturer or a contracted laboratory makes measurements and submits the test data and technical information to FCC & Industry Canada. FCC & Industry Canada issues a grant of equipment authorization and a certification number upon successful completion of their review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units subsequently manufactured.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product that may result in increased emissions should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

SUMMARY OF TEST RESULTS

Part 90 and RSS-119 Test Summary

Measurement Required	FCC Part 2 & 90 Sections	RSS-119 Section	Test Performed	Measured Value	Test Procedure Used	Result
Modulation Tested	GMSK	GMSK	-	-	-	-
Modulation characteristics	2.1047/	5.7	Modulated with appropriated signal	-	H	-
Radiated RF power output (ERP/EIRP)	2.1046 / 90.279 & 90.205(g)	6.2	Radiated Output Power Test	-	-	-
Conducted RF power output	2.1046 / 90.279 & 90.205(g)	6.2	Conducted Output Power Test	33.2dBm (2.1 Watts)	B	Complies
Spurious emissions at antenna Port	2.1051/ 90.210(d)	6.3 & 6.4(d)	Emission Limits and/or Unwanted Emission 30MHz – 5GHz (**Antenna Conducted**)	All spurious emissions < -20dBm	J	Complies
Occupied Bandwidth	2.1049/ 90.210(c) & (d)	6.4(c) & 6.4(d)	Emission Mask and 99% Bandwidth	Refer to Plots	C & D	Complies
Field strength of spurious radiation	2.1053 / 90.210(d)	6.3 & 6.4(d)	Radiated Spurious Emissions 30MHz – 5GHz	-25.4 dBm @ 4199.968 MHz (-5.4 dB)	N	Complies
Frequency stability	2.1055 / 90.213	7	Frequency Vs. Temperature	0 Hz	K	Complies
Frequency stability	2.1055 / 90.213	7	Frequency Vs. Voltage	0 Hz (Battery End Point is 1Vdc)	L & M	Complies
Transient Frequency Behavior	90.214	6.5	Transient Behavior	Refer to Plots	I	Complies
Exposure to Mobile devices	2.1091	9	Exposure of Humans to RF Fields	N/A	-	
Receiver	15.109	8	Receiver Spurious Emissions	40.3 dBuV/m @ 484.999 MHz (-5.7 dB)	N/A	Complies

MEASUREMENT UNCERTAINTIES

ISO Guide 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level and were calculated in accordance with NAMAS document NIS 81.

Measurement Type	Frequency Range (MHz)	Calculated Uncertainty (dB)
Conducted Emissions	0.15 to 30	± 2.4
Radiated Emissions	30 to 1000	± 3.6

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The MDS XPOGO Data Transceiver is intended primarily for use in Point-to- Multipoint networks. Normally, the EUT would be placed on a tabletop during operation. The EUT was, therefore, treated as tabletop equipment during testing to simulate the end-user environment. The electrical rating of the EUT is 3.3Vdc, 2 Amps.

The sample was received on October 6, 2003 and tested on October 7, October 9, October 13, October 15 and October 22, 2003. The EUT consisted of the following component(s):

Manufacturer/Model/Description	Serial Number	Proposed FCC ID #
Microwave Data Systems/ TRM450/Module	N/A	E5MDS-TRM450

OTHER EUT DETAILS

None

ENCLOSURE

The EUT enclosure is primarily constructed of aluminum shielding. It measures approximately 4.5 cm wide by 7 cm deep by 1.2 cm high.

MODIFICATIONS

The EUT did not require modifications during testing in order to comply with the emission specifications.

SUPPORT EQUIPMENT

No remote support equipment was used during testing.

EUT INTERFACE PORTS

The I/O cabling configuration during emissions testing was as follows:

Port	Connected to	Description	Shielded or Unshielded	Length (m)
RF	Spectrum Analyzer, 50-Ohm Termination, or Antenna	Coax	Shielded	.2
Serial	Laptop	Multiwire	Shielded	2
DC In	Power Supply	2 wire	Unshielded	2

EUT OPERATION DURING TESTING

The unit was transmitting at full power at 420, 440, and 460MHz.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on October 15, and October 20, 2003 at the Elliott Laboratories Chamber # 3 and 5 located Fremont, 41039 Boyce Road, Fremont CA 94538. Final test measurements were taken on October 21, 2003 at the Elliott Laboratories Open Area Test Site # 2 located at 684 West Maude Avenue, Sunnyvale, California. Pursuant to Section 2.948 of the FCC Rules, construction, calibration, and equipment data has been filed with the Commission.

CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions testing are performed in conformance with Section 2 of FCC Rules. Measurements are made with the EUT connected to a spectrum analyzer through an attenuator to prevent overloading the analyzer.

RADIATED EMISSIONS CONSIDERATIONS

Radiated measurements are performed in an open field environment or Anechoic Chamber. The test site is maintained free of conductive objects within the CISPR 16-1 defined elliptical area.

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

An EMI receiver as specified in CISPR 16-1 is used for emissions measurements. The receivers are capable of measuring over the frequency range of 9 kHz up to 2000 MHz. These receivers allow both ease of measurement and high accuracy to be achieved. The receivers have Peak, Average, and CISPR (Quasi-peak) detectors built into their design so no external adapters are necessary. The receiver automatically sets the required bandwidth for the particular detector used during measurements.

For measurements above the frequency range of the receivers, a spectrum analyzer is utilized because it provides visibility of the entire spectrum along with the precision and versatility required to support engineering analysis. If average measurements above 1000MHz are performed, the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz is used.

INSTRUMENT CONTROL COMPUTER

A personal computer is utilized to record the receiver measurements of the field strength at the antenna, which is then compared directly with the appropriate specification limit. The receiver is programmed with appropriate factors to convert the received voltage into filed strength at the antenna. Results are printed in a graphic and/or tabular format, as appropriate.

The test receiver also provides a visual display of the signal being measured.

PEAK POWER METER

A peak power meter and thermister mount may be used for output power measurements from transmitters as they provide a broadband indication of the power output.

FILTERS/ATTENUATORS

External filters and precision attenuators are often connected between the receiving antenna or EUT and the receiver. This eliminates saturation effects and non-linear operation due to high amplitude transmitters and transient events.

ANTENNAS

A biconical antenna is used to cover the range from 30 MHz to 300 MHz and a log periodic antenna is utilized from 300 MHz to 1000 MHz. Narrowband tuned dipole antennas are used over the 30 to 1000 MHz range for precision measurements of field strength. Above 1000 MHz, a horn antenna is used. The antenna calibration factors are included in site factors programmed into the test receivers

ANTENNA MAST AND EQUIPMENT TURNTABLE

The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor drive to vary the antenna height.

The requirements of ANSI C63.4 were used for configuration of the equipment turntable. It specifies that the test height above ground for table-mounted devices shall be 80 centimeters. Floor mounted equipment shall be placed on the ground plane if the device is normally used on a conductive floor or separated from the ground plane by insulating material from 3 to 12 mm if the device is normally used on a non-conductive floor. During radiated measurements, the EUT is positioned on a motorized turntable in conformance with this requirement.

INSTRUMENT CALIBRATION

All test equipment is regularly checked to ensure that performance is maintained in accordance with the manufacturer's specifications. All antennas are calibrated at regular intervals with respect to tuned half-wave dipoles. An appendix of this report contains the list of test equipment used and calibration information.

TEST PROCEDURES

General: For Transmitters with detachable antenna, direct measurements for output power, modulation characterization, occupied bandwidth, and frequency stability are performed with the antenna port of the EUT connected to either the power meter, modulation analyzer, or spectrum analyzer via a suitable attenuator and/or filter. The attenuators and/or filters are used to ensure that the transmitter fundamental will not overload the front end of the measurement instrument.

Procedure B – Power Measurement (Conducted Method): The following procedure was used for transmitters that do use external antennas.

1) Set the EUT to maximum power and to the lowest channel.
2) Either a power meter or a spectrum analyzer was used to measure the power output.
3) If a spectrum analyzer was used a resolution and video bandwidth 10kHz was used to measure the power output. Corrected for any external attenuation used for the protection of the input of analyzer. In addition, For CDMA or TDMA modulations set spectrum analyzer resolution to 1MHz and video to 30 kHz. Use video averaging with a 100-sample rate.
4) If a power meter was used, corrected for any external attenuation used for the protection of the input of the sensor head. Also set the power sensor correction by setting up the frequency range that will be measured.
5) Repeat this for the high channel and all modulations that will be used and all output ports used for transmission

Procedure C - Occupied Bandwidth (Conducted Method): Either for analog, digital, or data modulations, occupied bandwidth was performed. The EUT was set to transmit the appropriate modulation at maximum power. The bandwidth was measured using following methods:

1) The built-in 99% function of the spectrum analyzer was used.
2) If the built-in 99% is not available then the following method is used:

   26-dB or 20-dB was subtracted to the maximum peak of the emission. Then the display line function was used, in conjunction with the marker delta function, to measure the emissions bandwidth.

3) For the above two methods a resolution and video bandwidth of 100 or 300 Hz was used to measure the emission's bandwidth.

Procedure D - Occupied Bandwidth (Conducted Emission Mask): Either for analog, digital, or data modulations, emission mask was performed. The EUT was set to transmit the appropriate modulation at maximum power. The following method was used:

1) The EUT was connected directly to the spectrum analyzer and used an attenuator to protect the input of the analyzer. The EUT antenna was removable, so conducted measurements was performed. The EUT was set to transmit continuous packets of data and the Fundamental Frequency set to the middle of the EUT frequency range.

2) Since EUT is designed with a 12.5 kHz channel Section 90.210 (d)(1)(2)(3) was used to show compliance to the emission mask.

3) Any emission must be attenuated below the power (P) as follow:

90.210 (d)(1): 5.625 kHz: 0 dB

90.210(d)(2): 5.625 kHz: 20 dB
12.5 kHz: 70 dB

90.210(d)(3): more than 12.5 kHz: -20 dBm (50+10*log(P))

The following Resolution and Video bandwidth was used to show compliance for the above requirement: 100 Hz.

4) Since EUT is designed with a 25 kHz channel Section 90.210 (c)(1)(2)(3) was used to show compliance to the emission mask.

5) Any emission must be attenuated below the power (P) as follow:

90.210 (c)(1): 5 kHz but no more then 10kHz: 83*log(F_d / 5) dB

90.210(c)(2): 10kHz but no more then 250%: At least 29 log (fd 2/11) dB or 50 dB, whichever is the lesser attenuation

90.210(c)(3): more than 250%: -13 dBm (43+10*log(P))

The following Resolution and Video bandwidth was used to show compliance for the above requirement: 300 Hz.

Procedure H - Other Types of Equipment: Either digital or data modulated signals were simulated, by software or external sources, to performed the required tests. The EUT was set to transmit the appropriate digital modulation.

Procedure J – Antenna Conducted Emissions: For spurious emission measurements at the antenna terminal the following procedure was performed:

1) Set the transmitting signal at the middle of the operating range of the transmitter, as specified in the standard. Power is set to maximum and then to minimum.
2) Set the spectrum analyzer display line function to –20-dBm.
3) Set the spectrum analyzer bandwidth to 10kHz <1GHz and 1 MHz >1GHz.
4) For the spectrum analyzer, the start frequency was set to 30 MHz and the stop frequency set to the 10^{th} harmonic of the fundamental. All spurious or intermodulation emission must not exceed the –20dBm limit.
5) Steps 1 to 4 were repeated for all modulations and output ports that will be used for transmission.

Procedure K - Frequency Stability: The EUT is placed inside a temperature chamber with all support and test equipment located outside of the chamber. The spectrum analyzer is configured to give a 6-digit display for the marker-frequency function. The spectrum analyzer's built-in frequency counter is used to measure the maximum deviation of the fundamental frequency at each temperature. The Temperature chamber was varied from –30 to +50° C (or +60° C for some IC RSS standards, if applicable) in 10 degrees increment. The EUT was allowed enough time to stabilize for each temperature variation.

Procedure L - Frequency Stability: For AC or DC operated devices the nominal voltage is varied to 85% and to 115% at either room temperature or at a controlled +20°C temperature.

Procedure M - Frequency Stability: For battery-powered devices the voltage battery end-point is determined by reducing the dc voltage until the unit ceases to function. This is performed at either room temperature or at a controlled +20°C temperature.

Procedure N - Field Strength Measurement: The EUT was set on the turntable and the search antenna position 3 meters away. The output antenna terminal was terminated with a 50-ohm terminator. The EUT was set at the middle of the frequency band and set at maximum output power.

For the first scan, a pre-liminary measurement is performed. A preliminary scan of emissions is conducted in which all significant EUT frequencies are identified with the system in a nominal configuration. One or more of these is with the antenna polarized vertically while the one or more of these are with the antenna polarized horizontally. During the preliminary scans, the EUT is rotated through 360°, the antenna height is varied and cable positions are varied to determine the highest emission relative to the limit.

For the final measurement, Substitution method is performed on spurious emissions not being 20-dB below the calculated radiated limit. Substitution method is performed by replacing the EUT with a horn antenna and signal generator. The horn antenna factors can be reference to a half-wave dipole in dBi. The signal generator power level was adjusted until a similar level, which was measured on the first scan, is achieved on the spectrum analyzer. The level on the signal generator is than added to the antenna factor, in dBi, which will give the corrected value.

Procedure I – Transient Frequency Behavior: The TIA/EIA 603 procedure was used to determine compliance to radio being keyed on and off.

1) Connected the Test Receiver DOP or Video Output to Channel 1 of the oscilloscope. The output of the RF crystal detector was connected to Auxiliary channel 1, which served as a trigger input. The output of the combiner was connected to the Test Receiver.

2) Set the EUT to maximum power and connected as illustrated above. Set the signal generator to the assigned transmitter frequency and modulate it with a 1 kHz tone at 6.25kHz, 12.5 kHz, or 25 kHz deviation and set its output to –100 dBm, then turn on the EUT.

3) The Combiner output side was connected to the Test Receiver, which was used to measure the Power. Used enough external attenuation so that the output at the combiner was set to 40 dB below the maximum input of the Test Receiver, then turn off the EUT.

4) Set the signal generator output to the same level in step 3. This level was maintained for the remainder of the test.

5) Set the horizontal sweep rate on the storage oscilloscope to 10 milliseconds per division and adjusted the display to continuously view the 1 kHz tone from the DOP or Video Output. Adjusted the vertical amplitude control to display the 1 kHz at +/- 4 divisions vertically centered on the display.

6) Set the oscilloscope to trigger at the AUX channel 1 input port.

7) Removed enough external attenuation so that the input to the RF detector and combiner is increased by 30 dB.

8) Turn on the transmitter and plotted the result for **Ton**, **T1**, and **T2**.

9) Set the oscilloscope to trigger in decreasing magnitude from the RF crystal detector.

10) Turn off the transmitter and plotted the result for **T3**.

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS

RADIATED EMISSIONS SPECIFICATION LIMITS

The limits for radiated emissions are based on the power of the transmitter at the operating frequency. Data is measured in the logarithmic form of decibels relative to one milliwatt (dBm) or one microvolt/meter (dBuV/m,). The field strength of the emissions from the EUT is measured on a test site with a receiver.

Below is a formula example used to calculate the attenuation requirement, relative to the transmitters power output, in dBuV/m. For this example an operating power range of 3 watts is used. The radiated emissions limit for spurious signals outside of the assigned frequency block is $43+10\text{Log}_{10}$ (mean output power in watts) dB below the measured amplitude at the operating power.

CALCULATIONS – EFFECTIVE RADIATED POWER

$$E(V/m) = \frac{30 * P * G}{d}$$

E= Field Strength in V/m
P= Power in Watts (for this example we use 3 watts)
G= Gain of antenna in numeric gain (Assume 1.64 for ERP)
d= distance in meters

$$E(V/m) = \frac{30 * 3 \text{ watts} * 1.64 \text{ dB}}{3 \text{ meters}}$$

20 * log (4.049 V/m * 1,000,000) = 132.14 dBuV/m @ 3 meters

FCC Rules request an attenuation of 43 + 10 log (3) or 47.8 dB for all emissions outside the assigned block, the limit for spurious and harmonic emissions is:

132.1 dBuV/m – 47.8 dB = 84.3 dBuV/m @ 3 meter.

Note: Substitution Method is performed for spurious emission not being 20-dB below the calculated field strength.

EXHIBIT 1: Test Equipment Calibration Data

Radiated Emissions, 30 - 5,000 MHz, 13-Oct-03
Engineer: Chris Byleckie

Manufacturer	Description	Model #	Assett #	Cal Due
Elliott Laboratories	RF Immunity/Emissions Chamber #3	Chamber 3	1558	08-Mar-04
Rohde & Schwarz	EMI Test Receiver, 20Hz-7GHz	ESIB 7	1538	28-Mar-04
Sunol Sciences	Biconilog, 30-3000MHz	JB3	1548	06-Feb-04
Thinking Assets	Weather Forecaster	Baro/Press/Humidity	648	16-Apr-04

Radiated Emissions, 30 - 5,000 MHz, 20-Oct-03
Engineer: Juan Martinez

Manufacturer	Description	Model #	Assett #	Cal Due
EMCO	Horn Antenna, D. Ridge 1-18GHz	3115	868	14-Mar-04
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	263	06-Oct-04
Hewlett Packard	EMC Spectrum Analyzer 9kHz - 6.5GHz	8595EM	787	04-Dec-03
Hewlett Packard	RF Preamplifier 100 kHz -1.3 GHz	8447D	789	24-Jan-04
Sunol Sciences	Biconilog, 30-3000MHz	JB3	1549	06-Feb-04
Thinking Assets	Weather Forecaster	Baro/Press/Humidity	648	16-Apr-04

Substitution Method and Power Measurement, 20-Oct-03
Engineer: Juan Martinez

Manufacturer	Description	Model #	Assett #	Cal Due
EMCO	Horn Antenna, D. Ridge 1-18GHz	3115	868	15-Apr-04
Hewlett Packard	Signal Generator (sweep) 0.01 - 26.5 GHz	8340A	1244	
Rohde & Schwarz	Power Meter, Single Channel	NRVS	1290	22-Aug-04
Rohde & Schwarz	Power Sensor 100uW - 10 Watts	NRV-Z53	1555	11-Sep-04

Transient Behavior, 03-Dec-03
Engineer: Juan Martinez

Manufacturer	Description	Model #	Assett #	Cal Due
Rohde & Schwarz	Test Receiver, 0.009-2000 MHz	ESN	1332	24-Jul-04
RLC Electronics	Crystal Detector	CR-133-N	-	N/a

Transient Behavior, 03-Dec-03
Engineer: Juan Martinez

Manufacturer	Description	Model #	Assett #	Cal Due
Fluke Mfg Co	Signal Generator, 100KHz - 2100MHz	6062A	852	N/A
Tektronix	Oscilloscope 500MHz DSO	TDS520	1000	30-Sep-04

Radiated Emissions, 30 - 3000 MHz, 23-Oct-03
Engineer: jmartinez

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
Elliott Laboratories	RF Emissions Chamber #5	Chamber 5	1560	12	3/3/2003	3/3/2004
EMCO	Horn Antenna, D. Ridge 1-18GHz	3115	868	12	3/14/2003	3/14/2004
Hewlett Packard	EMC Spectrum Analyzer 9kHz - 6.5GHz	8595EM	787	12	12/4/2002	12/4/2003
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	263	12	10/6/2003	10/6/2004
Hewlett Packard	RF Preamplifier 100 kHz -1.3 GHz	8447D	789	12	1/24/2003	1/24/2004
Sunol Sciences	Biconilog, 30-3000MHz	JB3	1549	12	2/6/2003	2/6/2004
Thinking Assets	Weather Forecaster	Baro/Press/Humidity	648	12	4/16/2003	4/16/2004

EXHIBIT 2: Test Measurement Data

The following data includes conducted and radiated emission measurements of the Microwave Data Systems, Model No: TRM450.

T53020_Radio	51 Pages
T53020_Digital	14 Pages
Transient Behavior Plots	12 Pages

Elliott

EMC Test Data

Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Emissions Spec:	FCC Part 90 & RSS-119	Class:	Radio
Immunity Spec:		Environment:	

EMC Test Data

For The

Microwave Data Systems

Model

XPOGO 401,-402,-403

Date of Last Test: 10/22/2003

Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Emissions Spec:	FCC Part 90 & RSS-119	Class:	Radio
Immunity Spec:	Enter immunity spec on cover	Environment:	

EUT INFORMATION

General Description

The MDS XPOGO Data Transceiver and is intended primarily for use in Point-to- Multipoint networks. Normally, the EUT would be placed on a table top during operation. The EUT was, therefore, treated as table-top equipment during testing to simulate the end-user environment. The electrical rating of the EUT is 3.3VDC, 2 Amps.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
Microwave Data Systems	XPOGO-401	410 - 430MHz transciever	N/A	E5MDS-TRM450
Microwave Data Systems	XPOGO-402	430 - 450MHz transceiver	N/A	E5MDS-TRM450
Microwave Data Systems	XPOGO-403	450 - 470MHz transceiver	N/A	E5MDS-TRM450

EUT Enclosure

The EUT enclosure is primarily constructed of aluminum shielding. It measures approximately 4.5 cm wide by 7 cm deep by 1.2 cm high.

Modification History

Mod. #	Test	Date	Modification
1	-	-	None

Modifications applied are assumed to be used on subsequent tests unless otherwise stated as a further modification.

Elliott

EMC Test Data

Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Emissions Spec:	FCC Part 90 & RSS-119	Class:	Radio
Immunity Spec:	Enter immunity spec on cover	Environment:	

Test Configuration #1

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
None				

Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
Power Designs		Power Supply		

Interface Cabling and Ports

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
RF	Spectrum Analyzer	Coax	Shielded	6
Serial	Laptop	Multiwire	Shielded	2
DC in	Power Suplly	2 wire	Unshielded	2

EUT Operation During Emissions

The unit was transmitting at full power at 420, 440, and 460MHz.

Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Emissions Spec:	FCC Part 90 & RSS-119	Class:	Radio
Immunity Spec:	Enter immunity spec on cover	Environment:	

Test Configuration #2

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
EMCO	PSV-5	Power Supply		
Winbook	Winbook XL	Laptop	H1106677	DoC

Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
None				

Interface Cabling and Ports

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
RF	50 ohm termination	Termination Load	N/A	N/A
Serial	Laptop	Multiwire	Shielded	2
DC in	Power Suplly	2 wire	Unshielded	2

EUT Operation During Emissions

The 410 unit was transmitting at full power at 420MHz, The 430 unit was transmitting full power at 440MHz

Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

RF Power Output (Section 2.1047)

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 10/9/2003
Test Engineer: jmartinez
Test Location: SVOATS #2
Config. Used: 1
Config Change: None
EUT Voltage: 3.3Vdc

General Test Configuration

The EUT was connected directly to a Peak power meter, so as to perform the conducted measurements at the antenna terminal.

Ambient Conditions:

Temperature: 19 °C
Rel. Humidity: 45 %

Summary of Results

Run #	Test Performed	Limit	Result	Measured (dBm)	
1	Power Output Measurement (410-430 MHz)	FCC 90.205 & RSS-119 (6.2)	Pass	33.01	26.1
2	Power Output Measurement (430-450 MHz)	FCC 90.205 & RSS-119 (6.2)	Pass	32.89	27
3	Power Output Measurement (450-470 MHz)	FCC 90.205 & RSS-119 (6.2)	Pass	33.2	26.5

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

Occupied Bandwidth

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 10/9/2003
Test Engineer: jmartinez
Test Location: SVOATS #2

Config. Used: 1
Config Change: None
EUT Voltage: 3.3Vdc

General Test Configuration

A spectrum analyzer, support equipment, and EUT were all place on top of a table. The EUT was connected directly to the spectrum analyzer by a low loss coaxial cable, so as to perform the conducted measurements at the antenna terminal.

Ambient Conditions:

Temperature: 19 °C
Rel. Humidity: 45 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	Emission Mask	90.210(d) & RSS-119, 6.4(d)	Pass	Refer to plots
2	Emission Mask	90.210(c)& RSS-119, 6.4(c)	Pass	Refer to plots
3	Out of Band @ 2 Watts	90.210(d) & RSS-119 6.4(d)	Pass	All Emissions < -20dBm
4	Out of Band @ .5 Watts	90.210(d) & RSS-119 6.4(d)	Pass	All Emissions < -20dBm

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

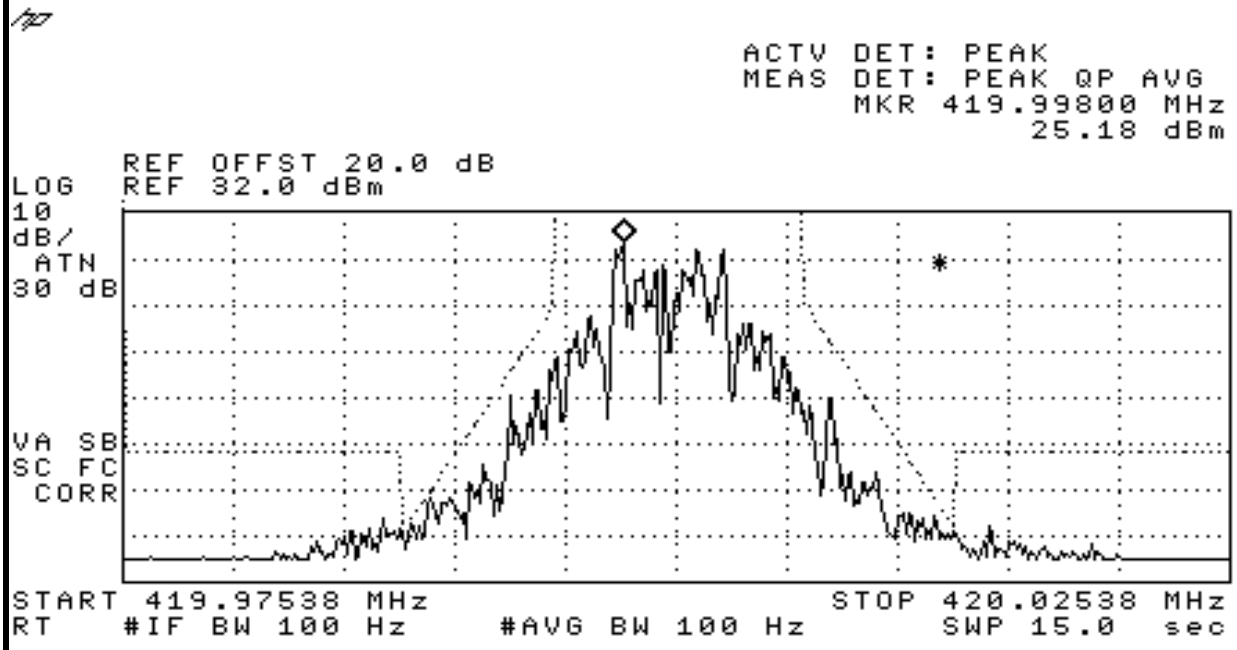
No deviations were made from the requirements of the standard.

Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

Run# 1: 410-430 module (12.5kHz Channel; Emission Mask D)

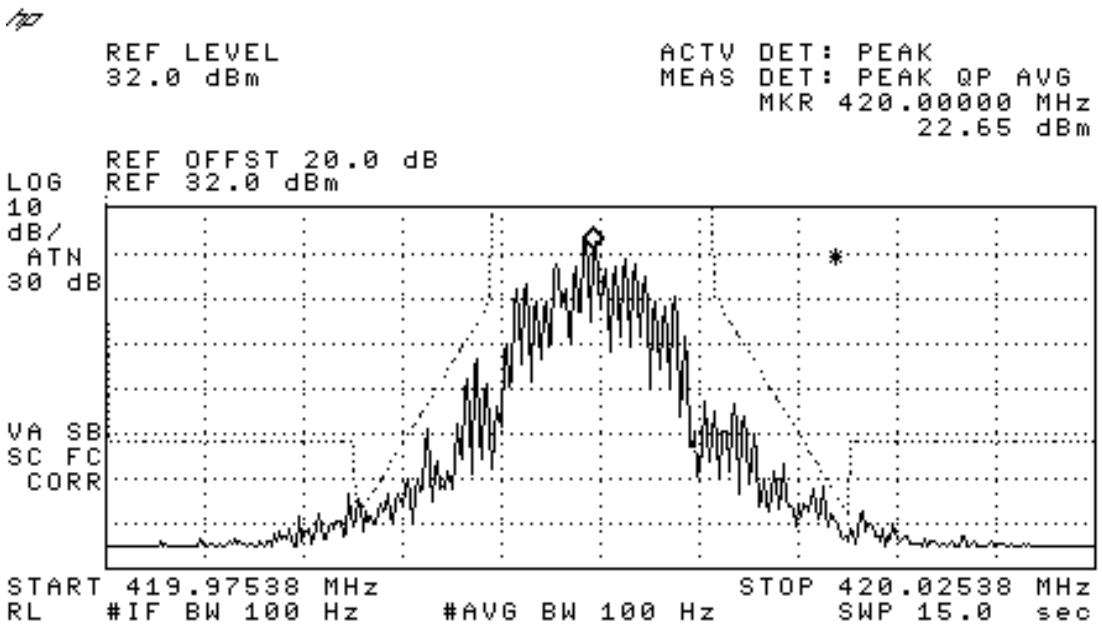
Emission Mask D:	Frequency offset (kHz)	Attenuation (dB)
	5.625	0
	5.625	19.95615
	12.5	69.9374

4.8 kbps, BT=.5, BW=12.5kHz, Cal Dev= 65

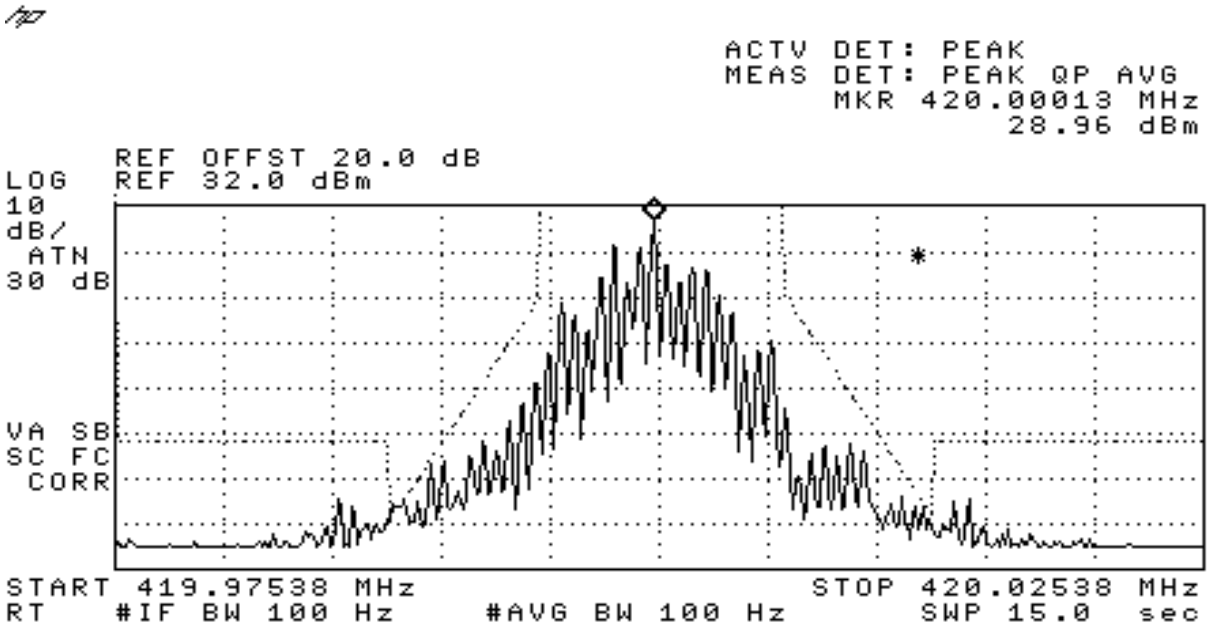


Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

8.0 kbps, BT=.3, BW=12.5kHz, Cal dev= 70



9.6 kbps, BT=.3, BW=12.5kHz, Cal Dev= 67



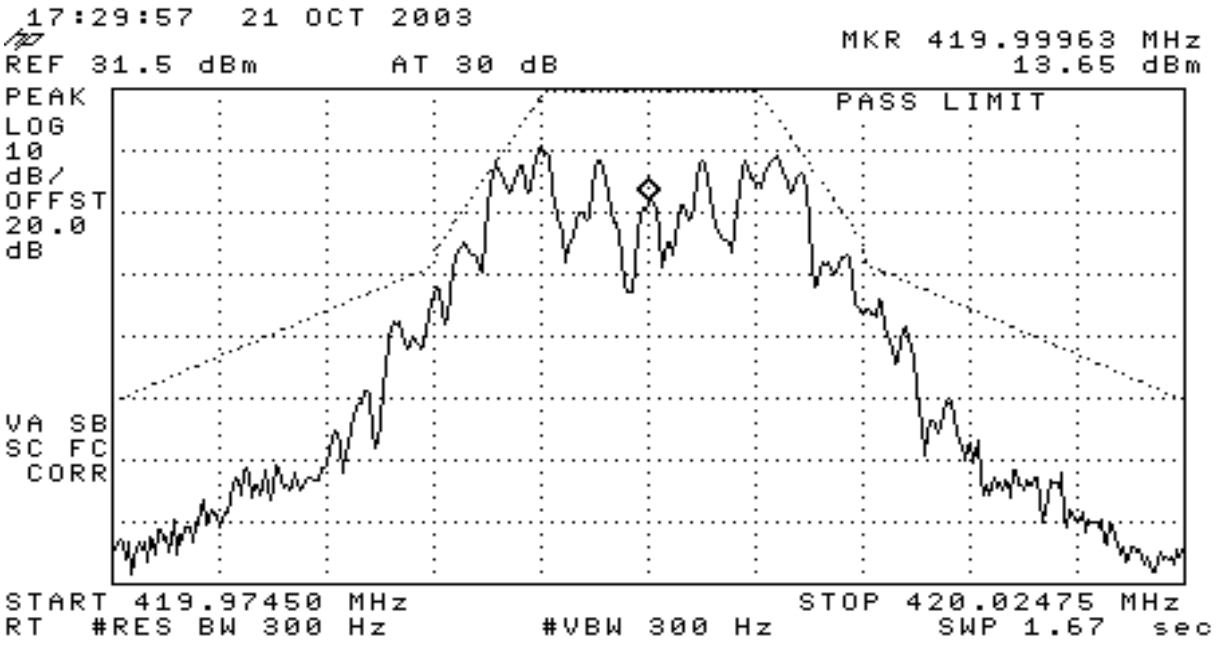
Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

Run# 2: 410-430 module (25kHz Channel; Emission Mask C)

NO-Audio low pass filter

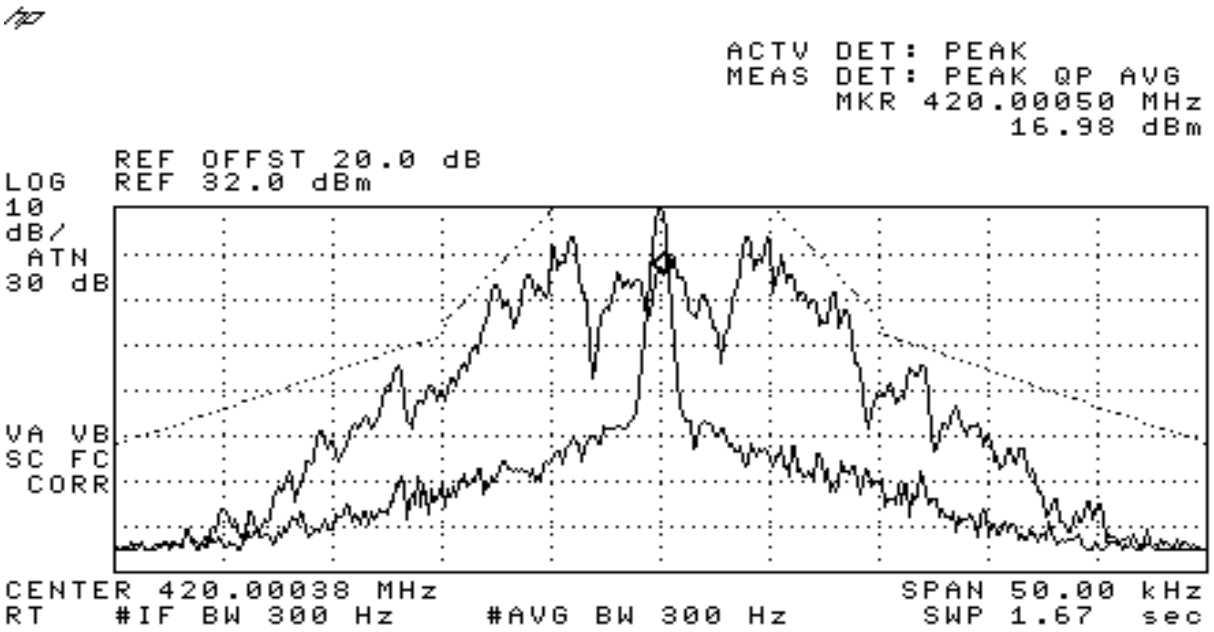
Emission Mask C:	Frequency offset (kHz)	Attenuation (dB)	
	5	0	
	10	24.98548964	
	10	27.79961213	
20	50	68.33987238	or 50dB, whichever is the lesser attenuation

4.8 kbps, BT=.5, BW=25kHz, Cal Dev= 210

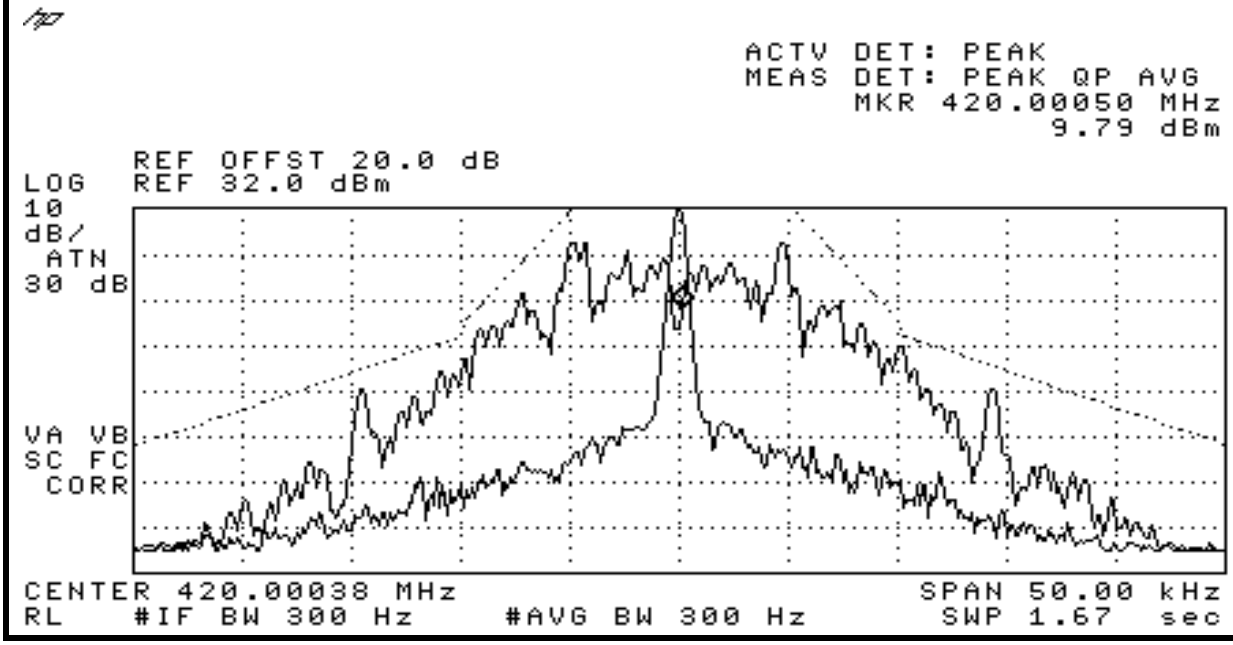


Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

8.0 kbps, BT=.5, BW=25kHz, Cal Dev= 170

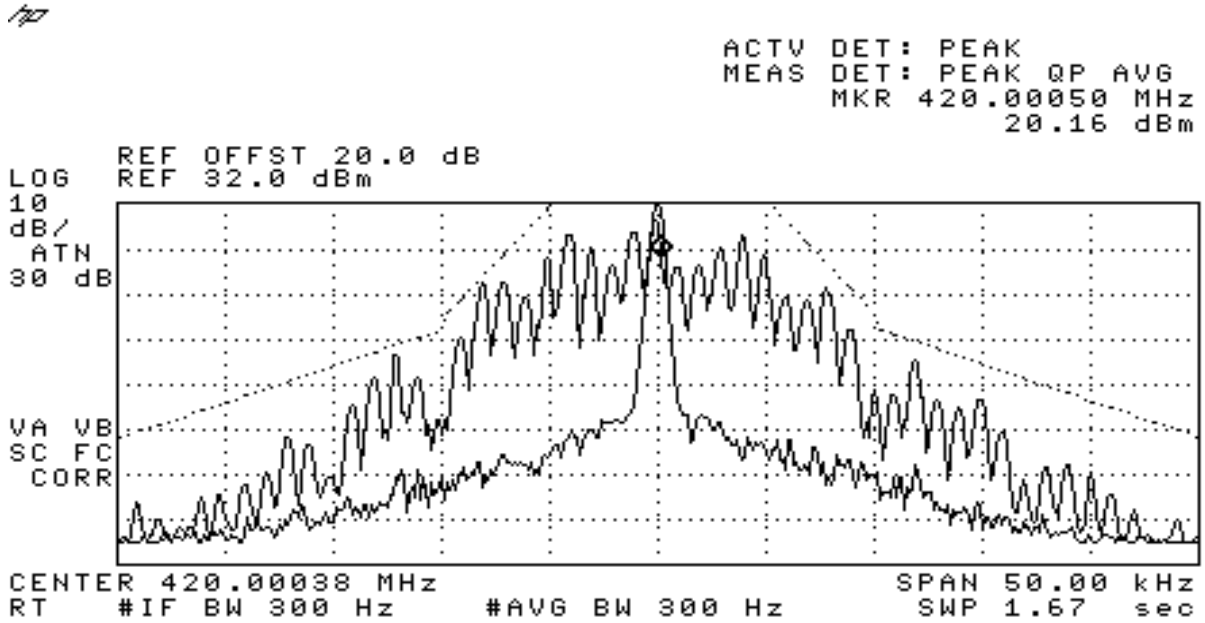


9.6 kbps, BT=.5, BW=25kHz, Cal Dev= 150

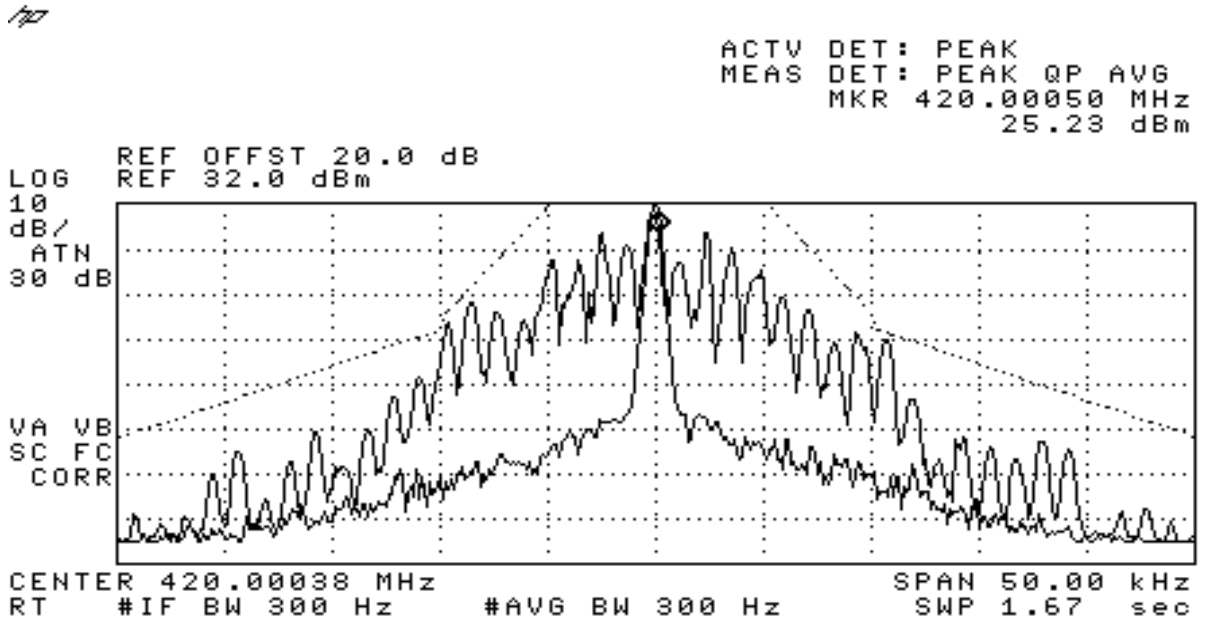


Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

16.0 kbps, BT=.3, BW=25kHz, Cal Dev= 130



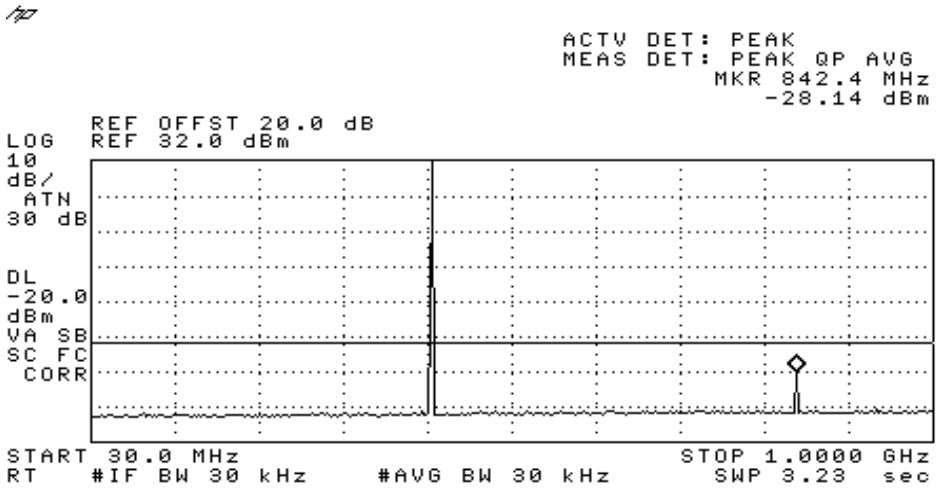
19.2 kbps, BT=.3, BW=25kHz, Cal Dev= 95



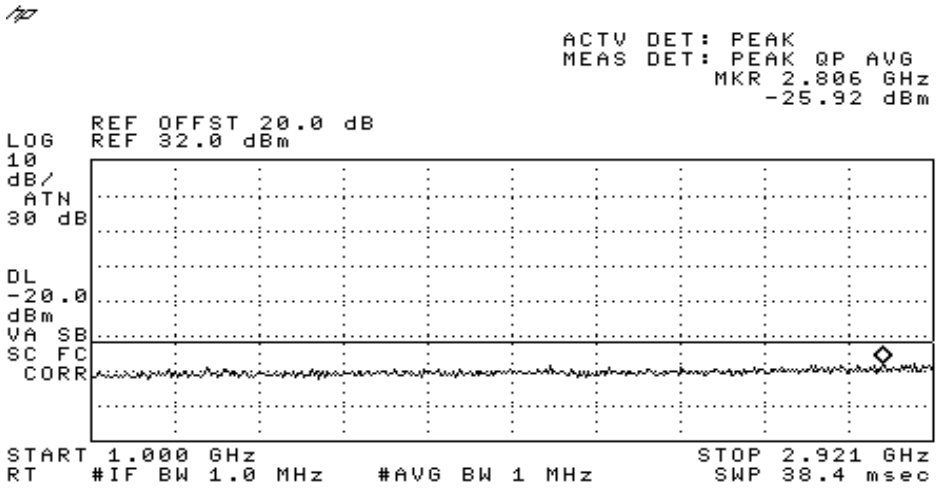
Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

Run# 3: 410-430 module (out of Band @ 2 watts)

Out of Band @ 2Watts

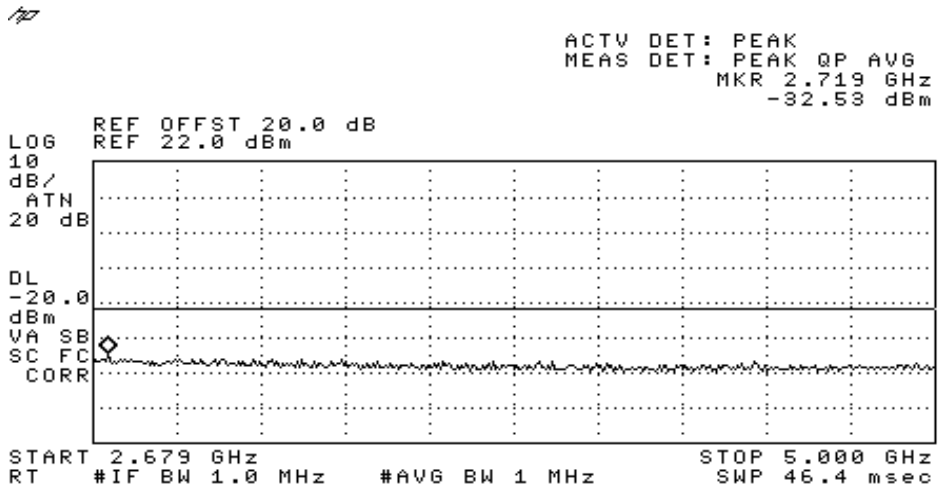


Out of Band @ 2Watts



Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

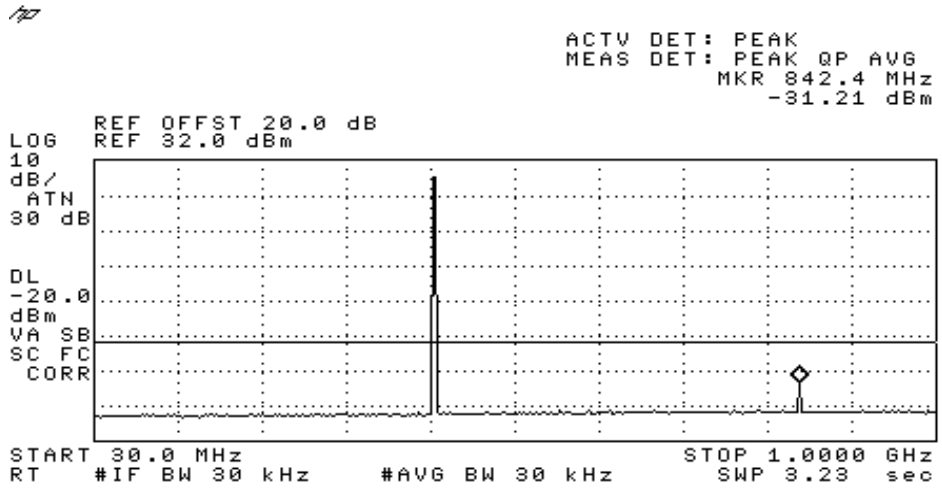
Out of Band @ 2Watts



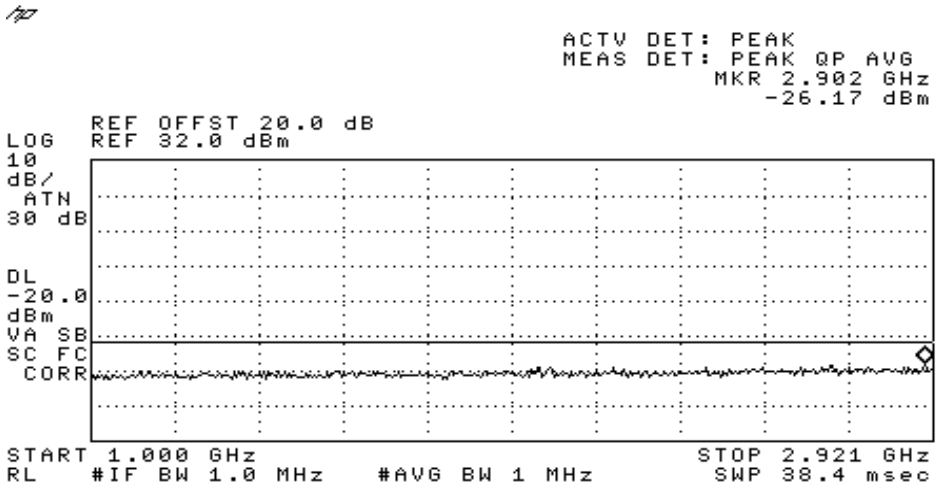
Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

Run# 4: 410-430 module (out of Band @ .5 watts)

Out of Band @ .5Watts

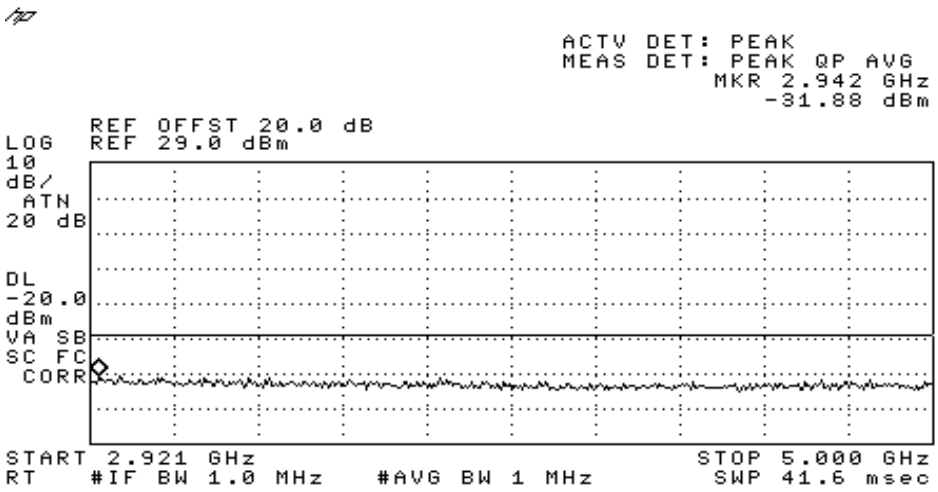


Out of Band @ .5Watts



Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

Out of Band @ .5Watts



Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

Occupied Bandwidth

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 10/9/2003
Test Engineer: jmartinez
Test Location: SVOATS #2

Config. Used: 1
Config Change: None
EUT Voltage: 3.3Vdc

General Test Configuration

A spectrum analyzer, support equipment, and EUT were all place on top of a table. The EUT was connected directly to the spectrum analyzer by a low loss coaxial cable, so as to perform the conducted measurements at the antenna terminal.

Ambient Conditions:

Temperature: 19 °C
Rel. Humidity: 45 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	Emission Mask	90.210(d) & RSS-119, 6.4(d)	Pass	Refer to plots
2	Emission Mask	90.210(c)& RSS-119, 6.4(c)	Pass	Refer to plots
3	Out of Band @ 2 Watts	90.210(d) & RSS-119 6.4(d)	Pass	All Emissions < -20dBm
4	Out of Band @ .5 Watts	90.210(d) & RSS-119 6.4(d)	Pass	All Emissions < -20dBm

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

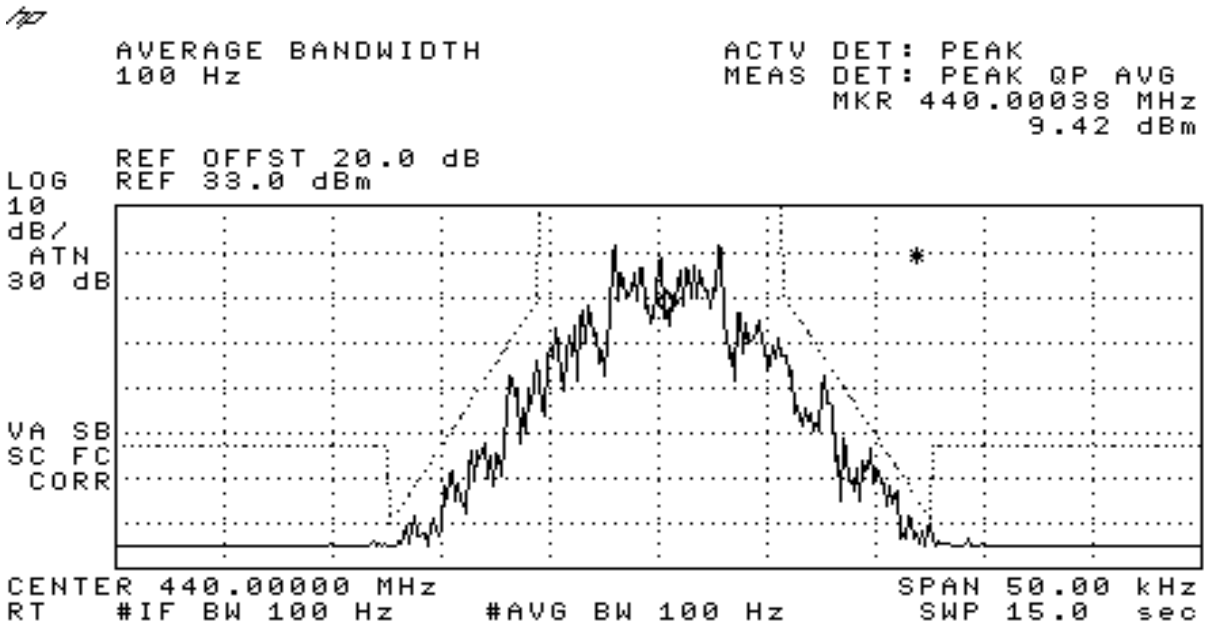
No deviations were made from the requirements of the standard.

Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

Run# 1: 430-450 module (12.5kHz Channel; Emission Mask D)

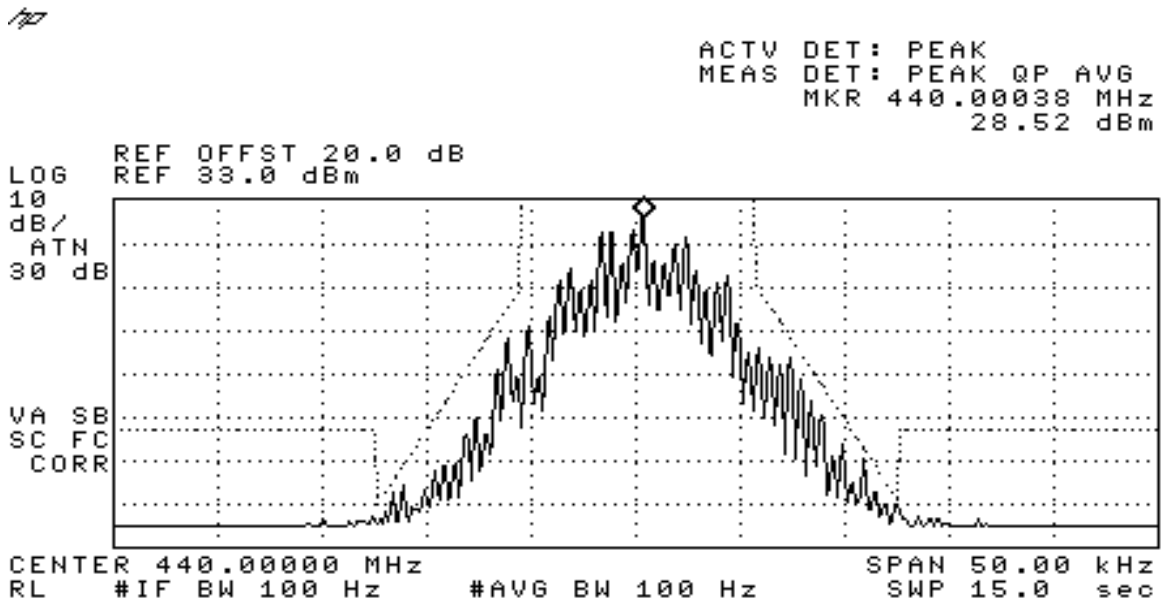
Emission Mask D:	Frequency offset (kHz)	Attenuation (dB)
	5.625	0
	5.625	19.95615
	12.5	69.9374

4.8 kbps, BT=.5, BW=12.5kHz, Cal Dev= 65

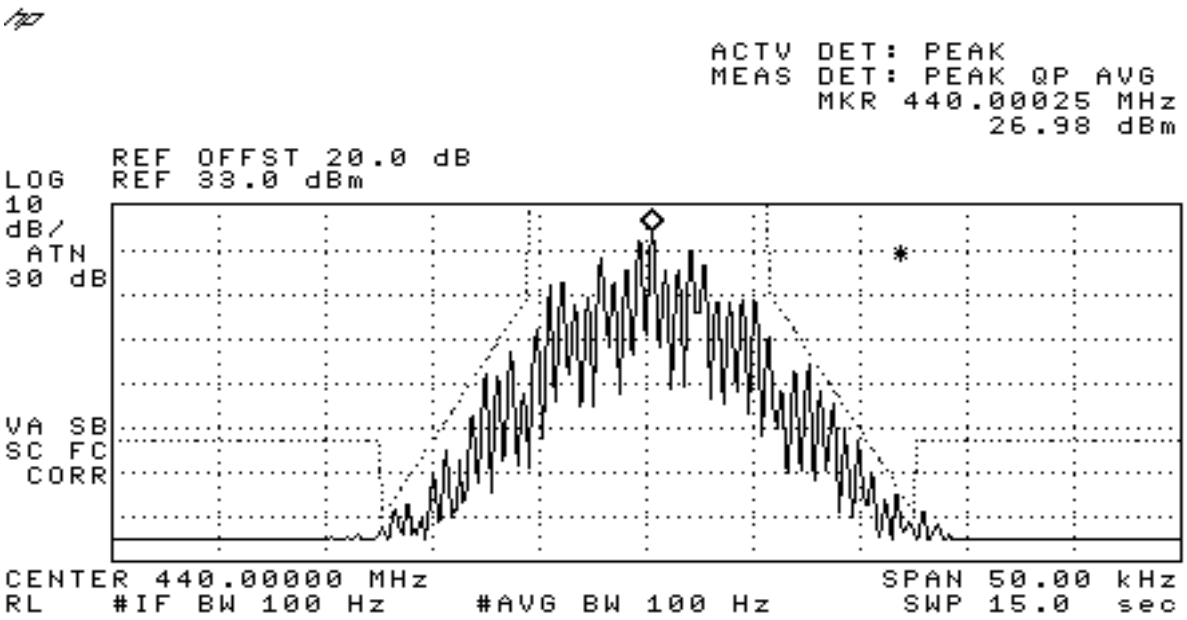


Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

8.0 kbps, BT=.3, BW=12.5kHz, Cal dev= 70



9.6 kbps, BT=.3, BW=12.5kHz, Cal Dev= 67



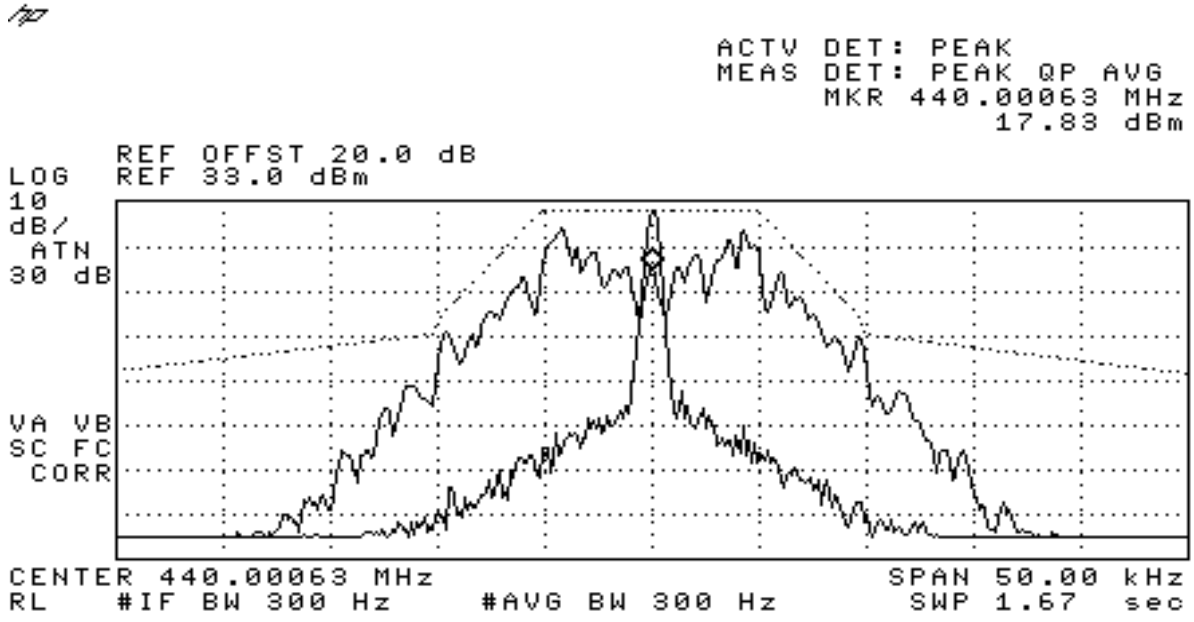
Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

Run# 2: 430-450 module (25kHz Channel; Emission Mask C)

NO-Audio low pass filter

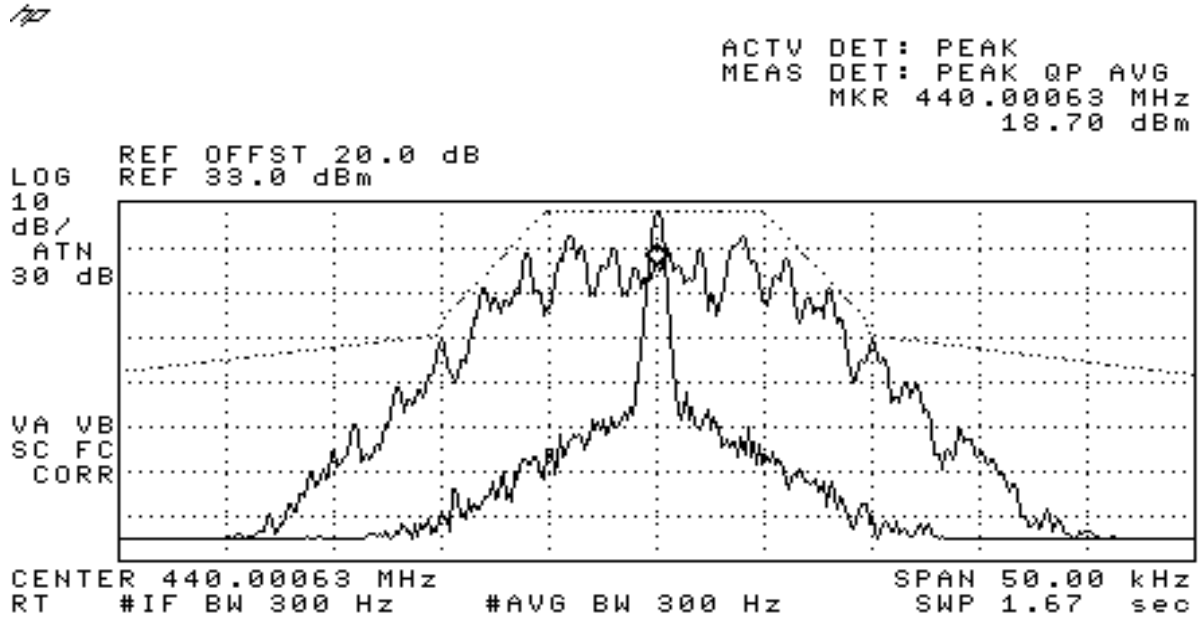
Emission Mask C:	Frequency offset (kHz)	Attenuation (dB)	
	5	0	
	10	24.98548964	
	10	27.79961213	
20	50	68.33987238	or 50dB, whichever is the lesser attenuation

4.8 kbps, BT=.5, BW=25kHz, Cal Dev= 140

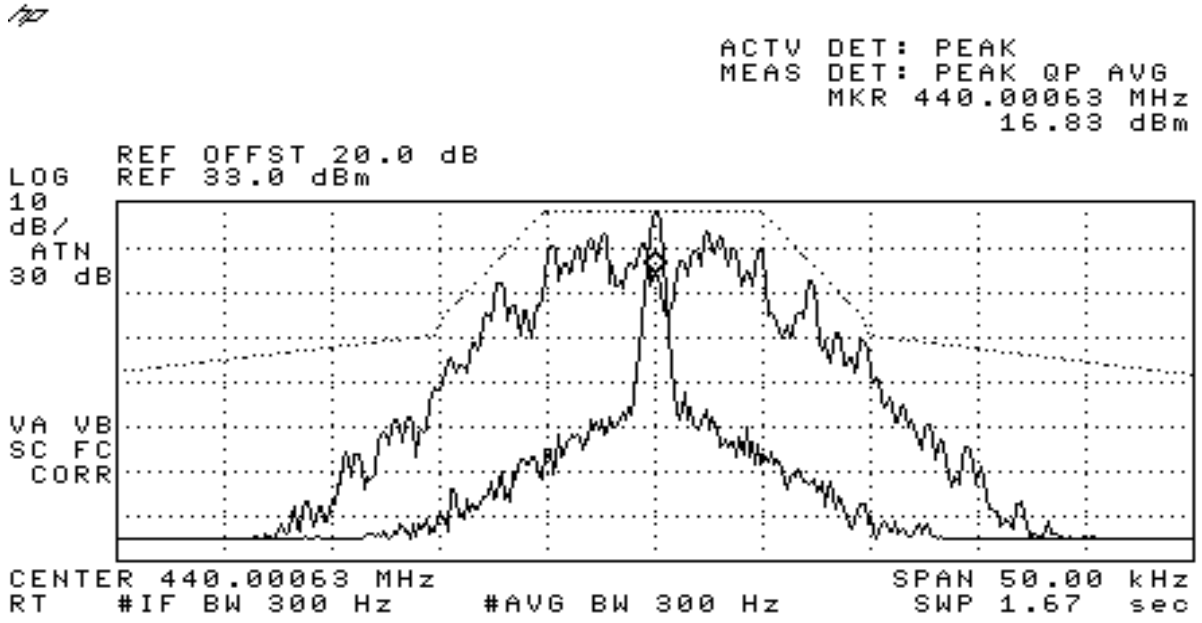


Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

8.0 kbps, BT=.5, BW=25kHz, Cal Dev= 130

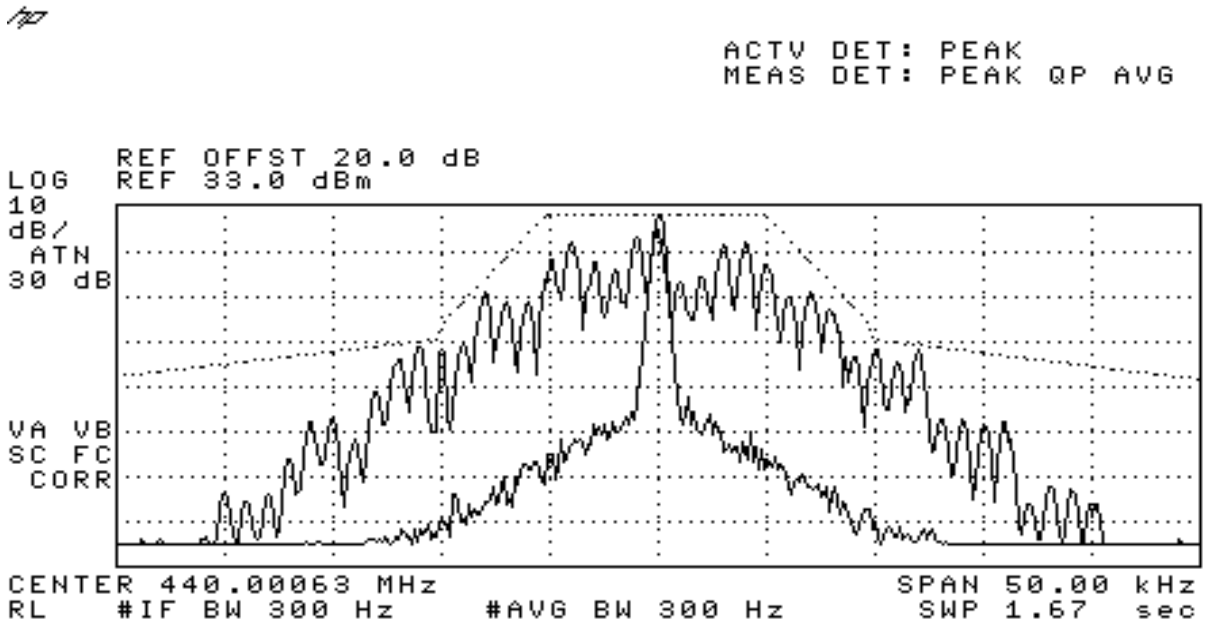


9.6 kbps, BT=.5, BW=25kHz, Cal Dev= 105

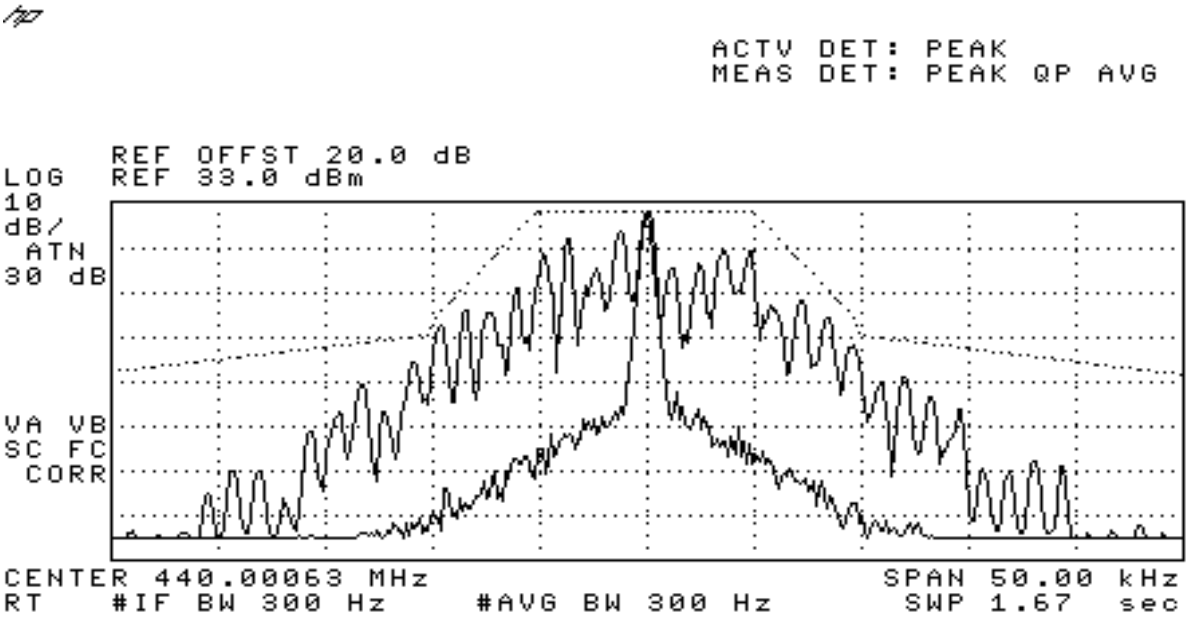


Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

16.0 kbps, BT=.3, BW=25kHz, Cal Dev= 130



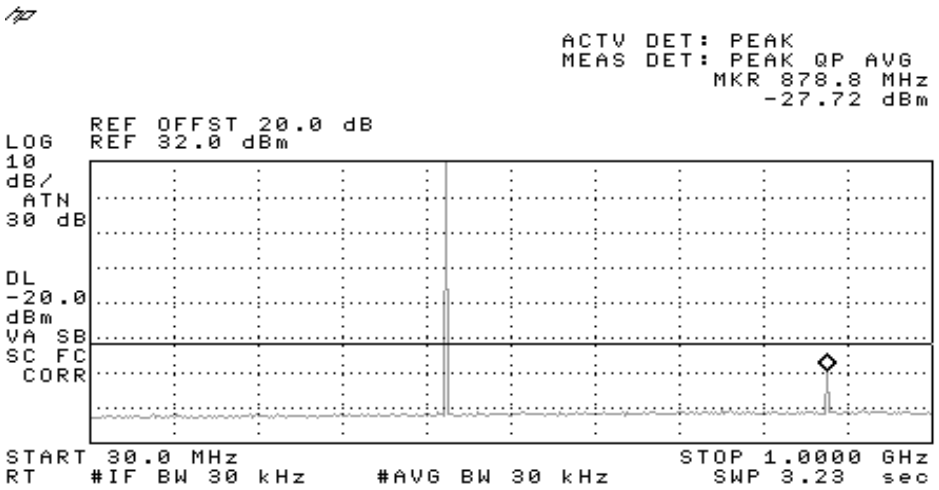
19.2 kbps, BT=.3, BW=25kHz, Cal Dev= 120



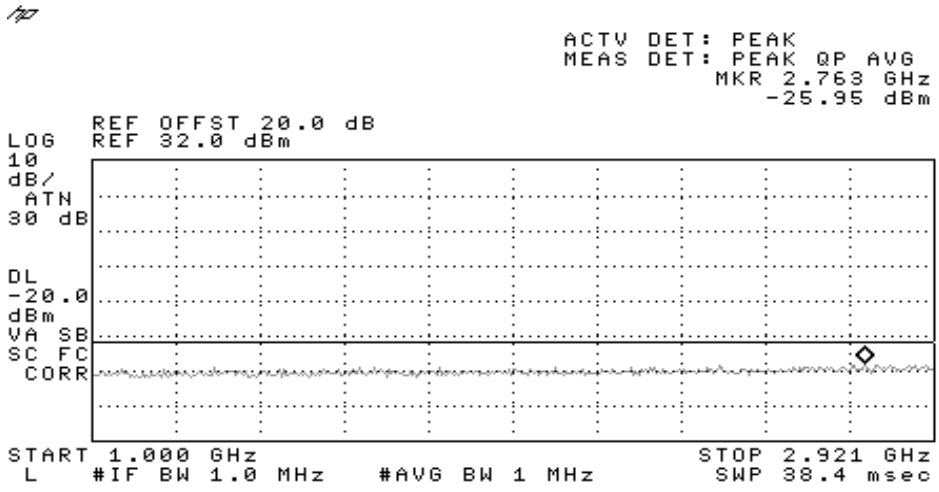
Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

Run #3: Out of band emissions (2 watts); 430-450 MHz

Out of band @ 2 Watts

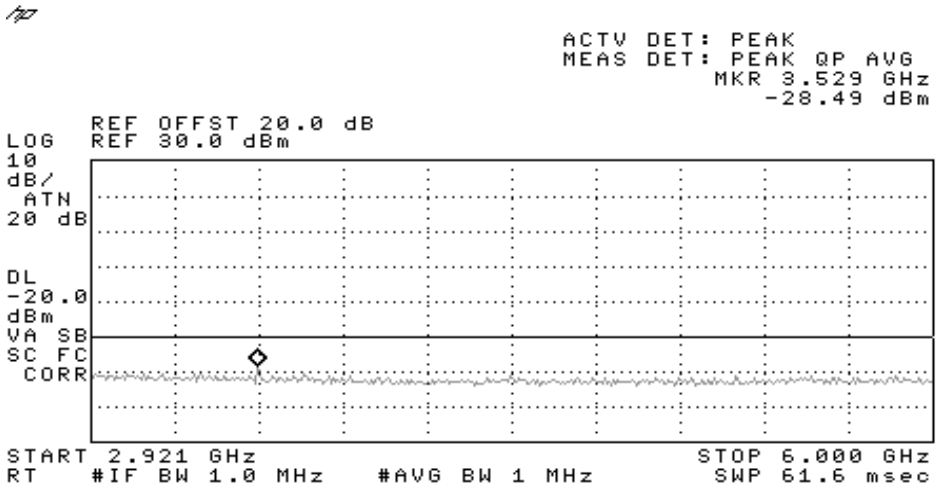


Out of band @ 2 Watts



Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

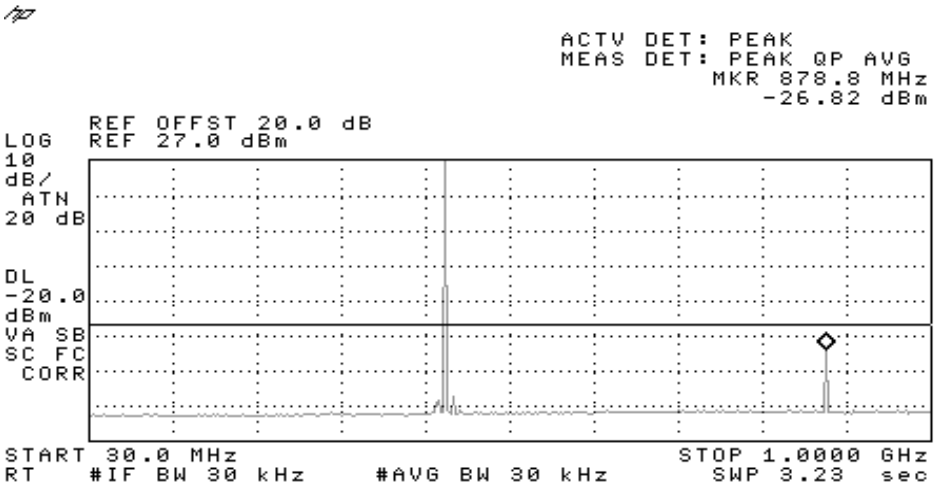
Out of band @ 2 Watts



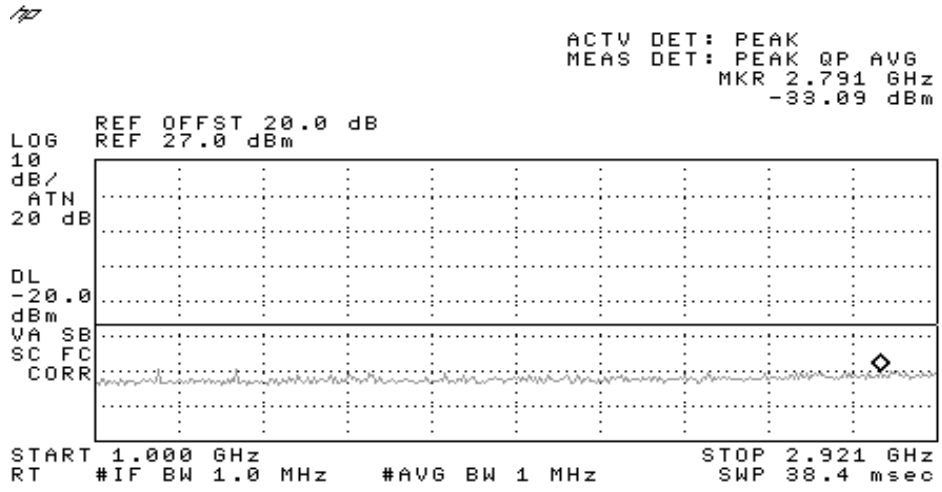
Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

Run #4: Out of band emissions (.5 watts); 430-450 MHz

Out of band @ .5 Watts

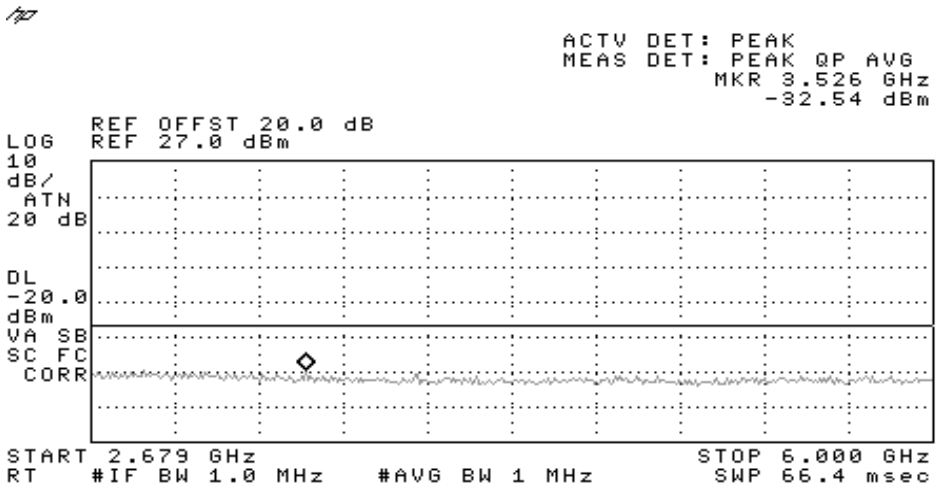


Out of band @ .5 Watts



Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

Out of band @ .5 Watts



Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

Occupied Bandwidth

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 10/22/2003
Test Engineer: Jmartinez
Test Location: SVOATS #2

Config. Used: 1
Config Change: None
EUT Voltage: 3.3Vdc

General Test Configuration

A spectrum analyzer, support equipment, and EUT were all place on top of a table. The EUT was connected directly to the spectrum analyzer by a low loss coaxial cable, so as to perform the conducted measurements at the antenna terminal.

Ambient Conditions:

Temperature: 21 °C
Rel. Humidity: 35 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	Emission Mask	90.210(d) & RSS-119, 6.4(d)	Pass	Refer to plots
2	Emission Mask	90.210(c)& RSS-119, 6.4(c)	Pass	Refer to plots
3	Out of Band @ 2 Watts	90.210(d) & RSS-119 6.4(d)	Pass	All Emissions < -20dBm
4	Out of Band @ .5 Watts	90.210(d) & RSS-119 6.4(d)	Pass	All Emissions < -20dBm

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

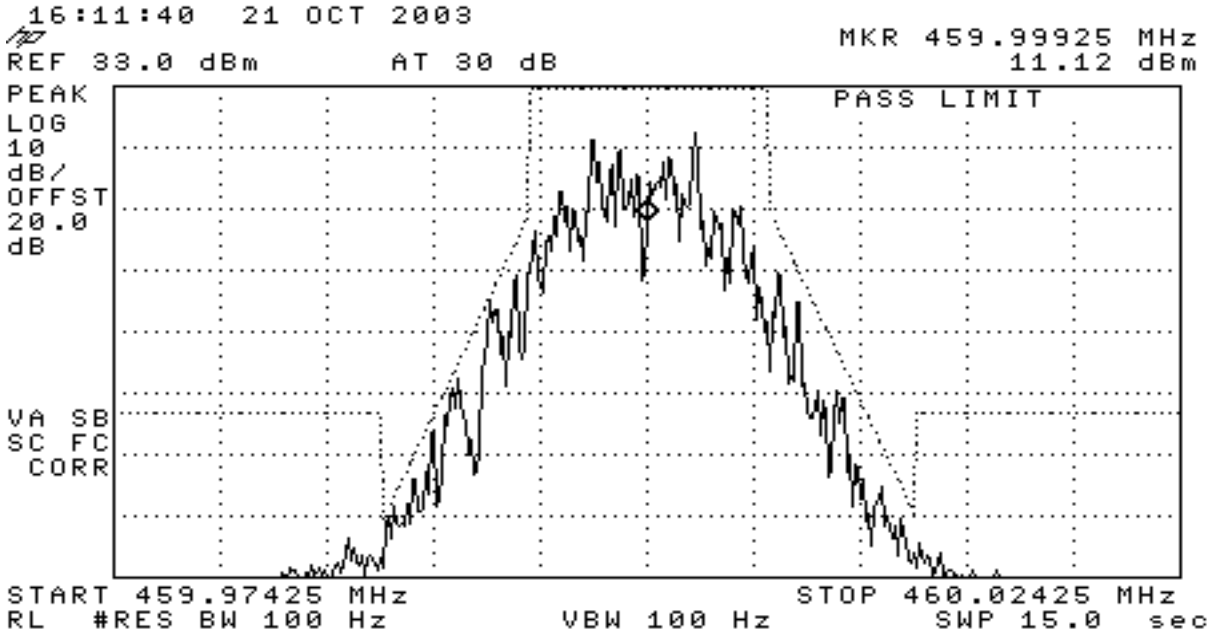
No deviations were made from the requirements of the standard.

Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

Run# 1: 450-470 module (12.5kHz Channel; Emission Mask D)

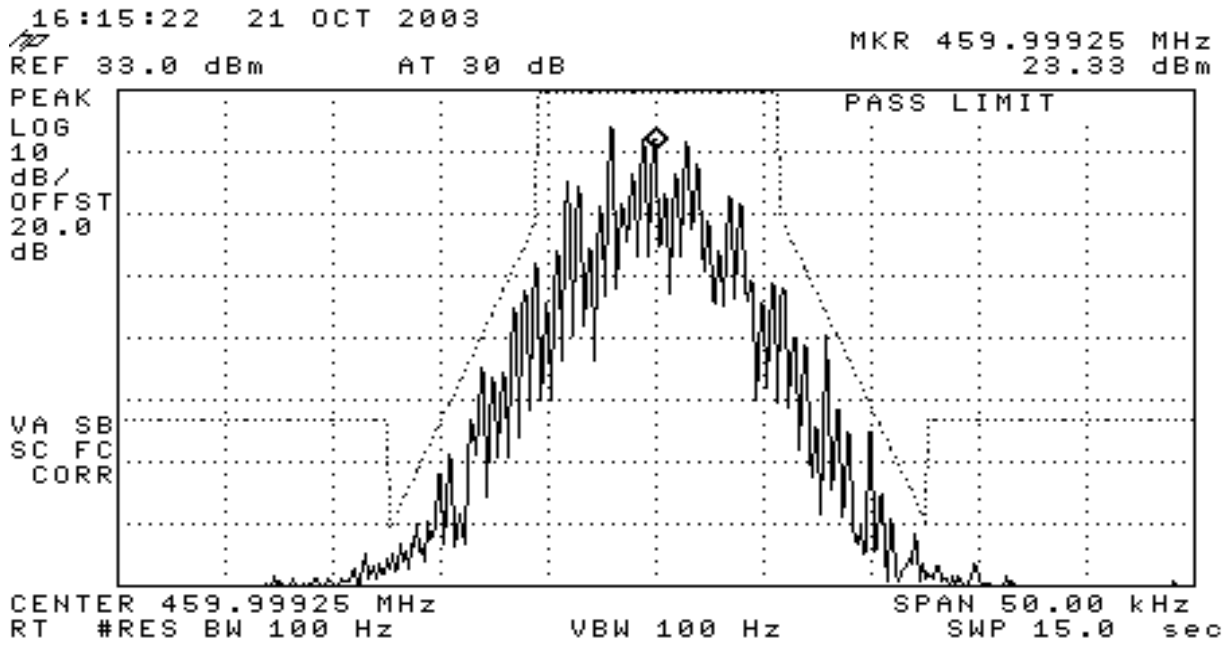
Emission Mask D:	Frequency offset (kHz)	Attenuation (dB)
	5.625	0
	5.625	19.95615
	12.5	69.9374

4.8 kbps, BT=.5, BW=12.5kHz, Cal Dev= 65

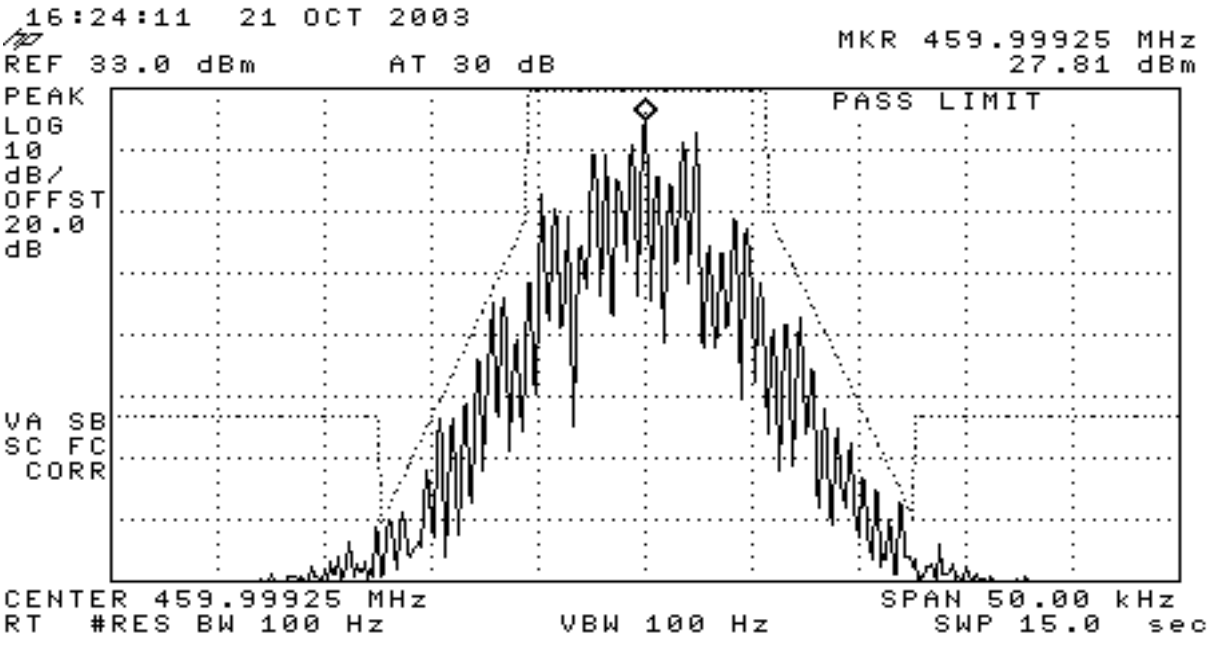


Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

8.0 kbps, BT=.3, BW=12.5kHz, Cal dev= 60



9.6 kbps, BT=.3, BW=12.5kHz, Cal Dev= 67



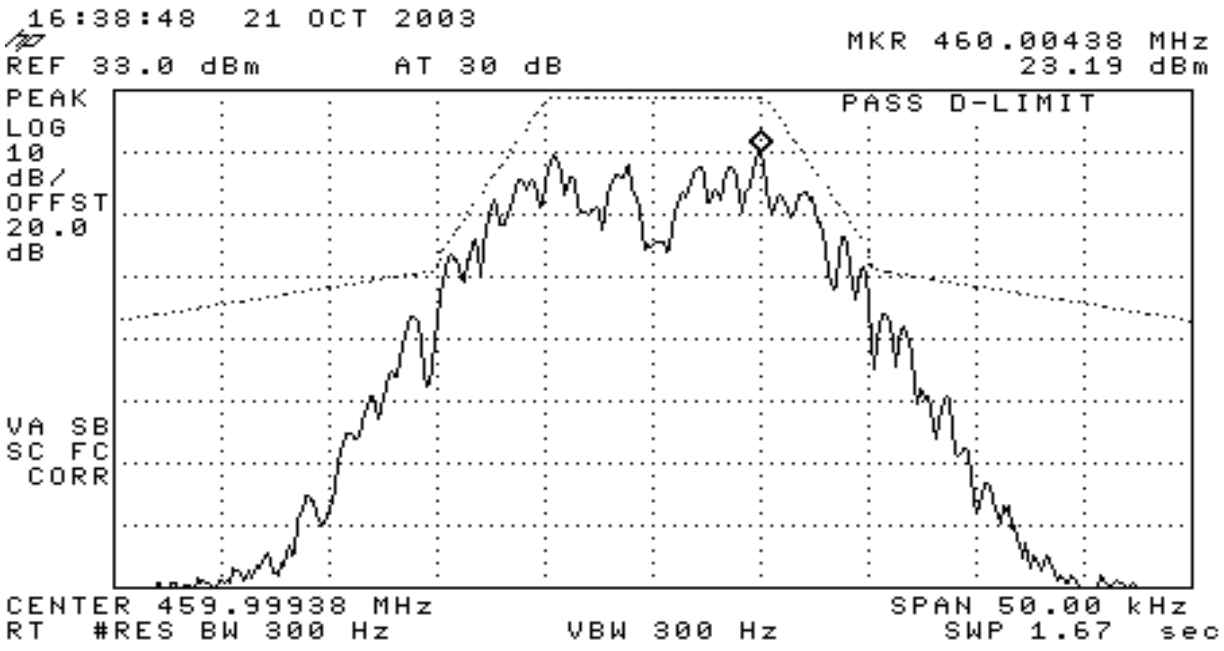
Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

Run# 2: 450-470 module (25kHz Channel; Emission Mask C)

NO-Audio low pass filter

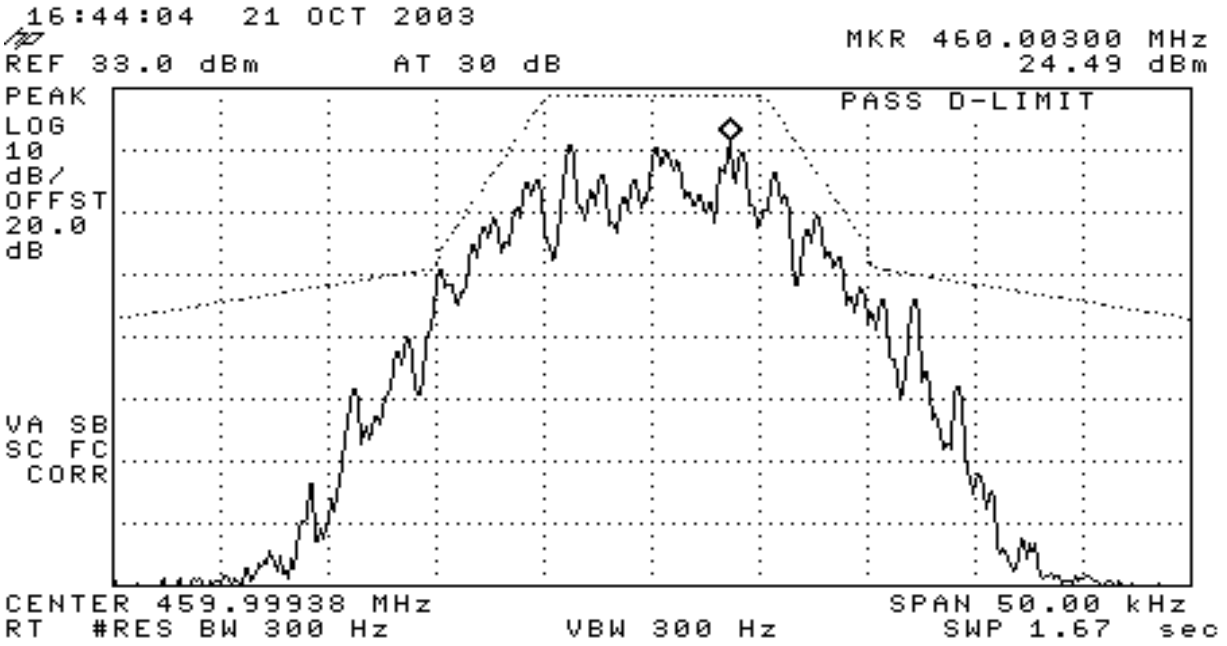
Emission Mask C:	Frequency offset (kHz)	Attenuation (dB)	
	5	0	
	10	24.98548964	
	10	27.79961213	
20	50	68.33987238	or 50dB, whichever is the lesser attenuation

4.8 kbps, BT=.5, BW=25kHz, Cal Dev= 140

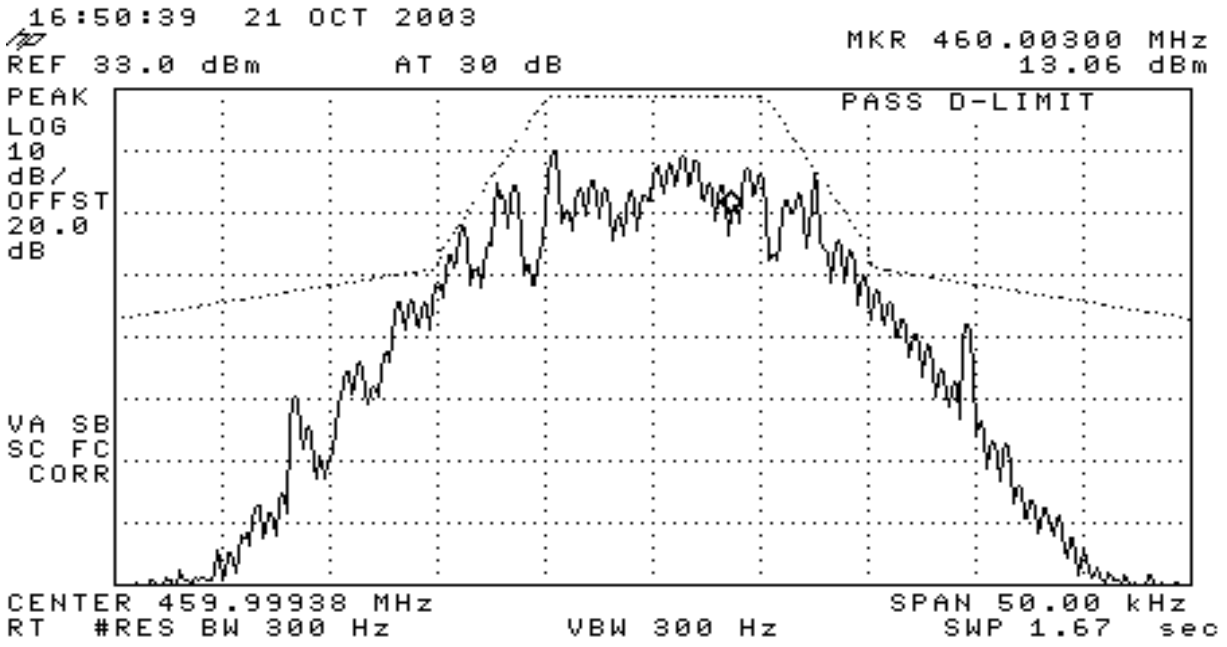


Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

8.0 kbps, BT=.5, BW=25kHz, Cal Dev= 120

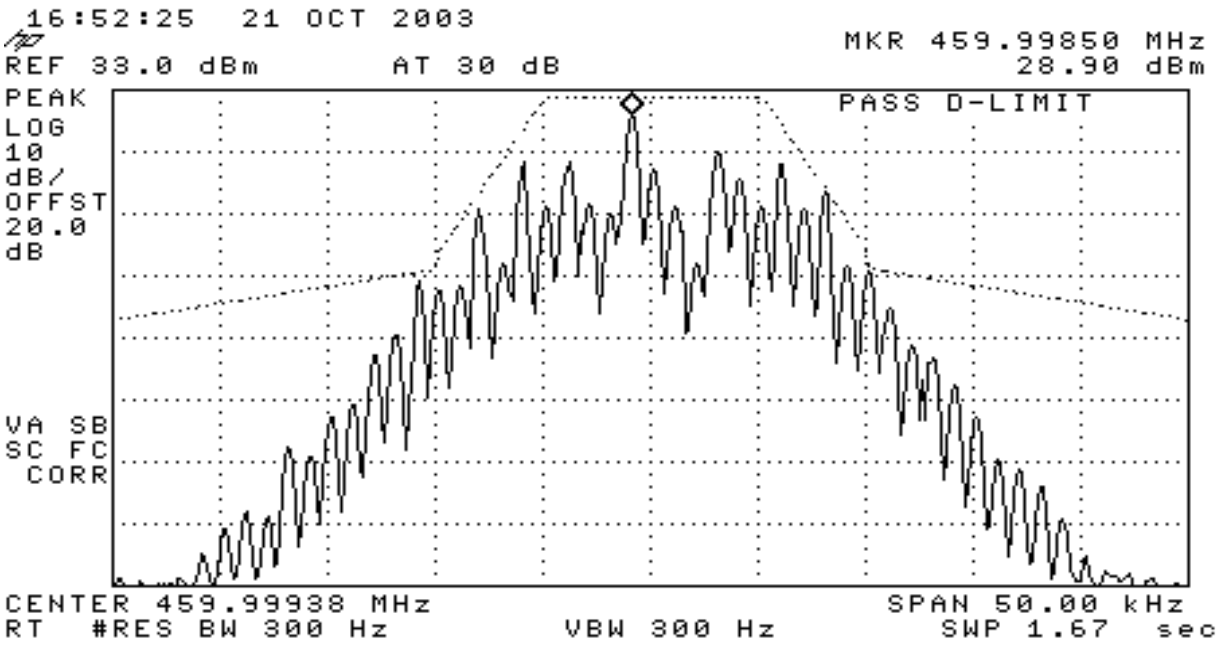


9.6 kbps, BT=.5, BW=25kHz, Cal Dev= 130

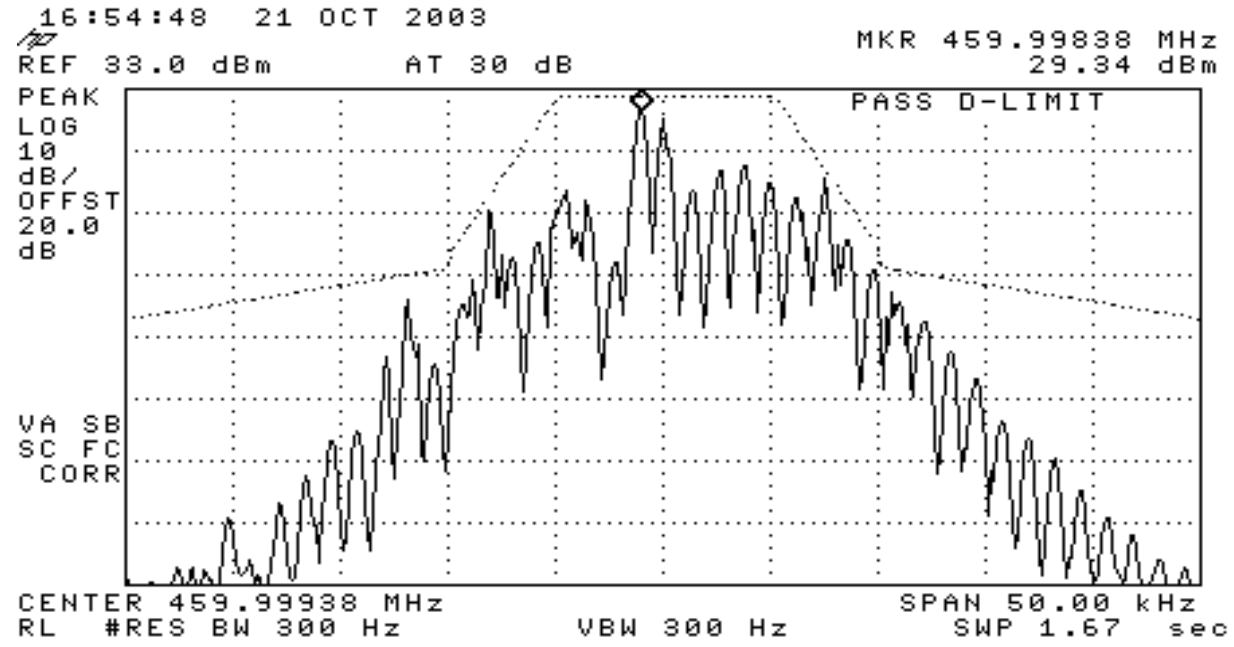


Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

16.0 kbps, BT=.3, BW=25kHz, Cal Dev= 155



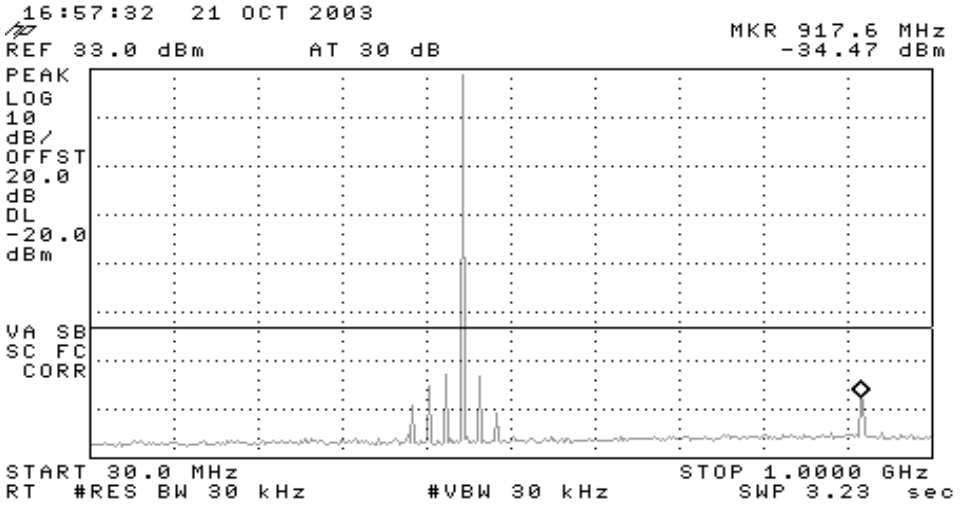
19.2 kbps, BT=.3, BW=25kHz, Cal Dev= 95



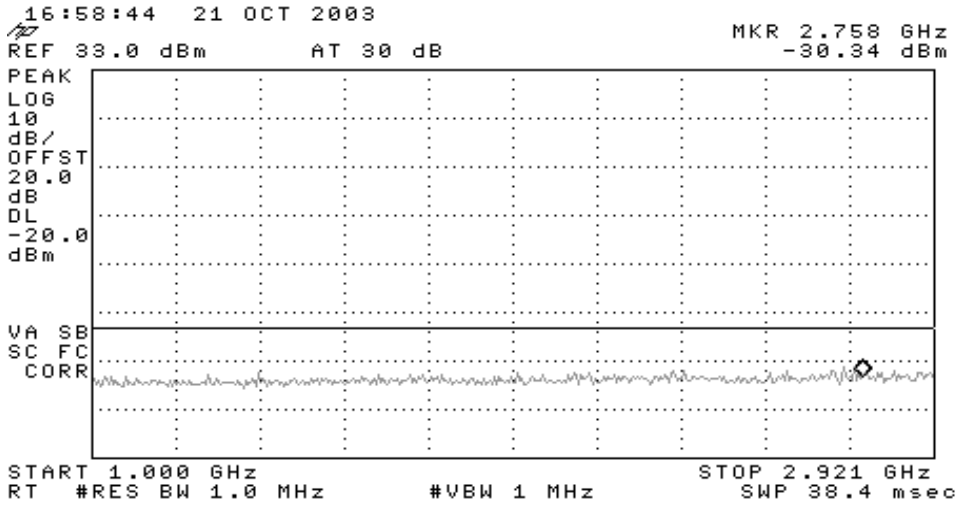
Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

Run#3: 450-470 module (Out of Band @ 2 Watts)

Out of Band @ 2Watts

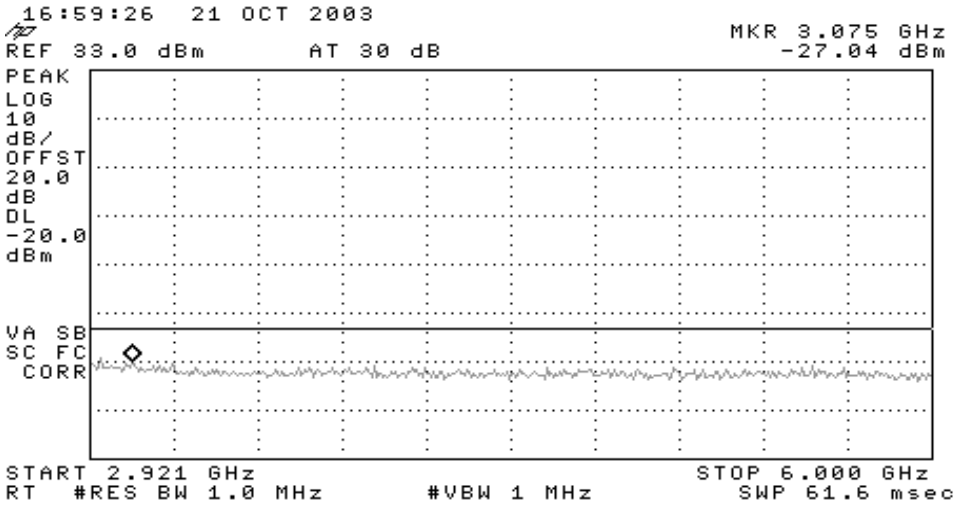


Out of Band @ 2Watts



Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

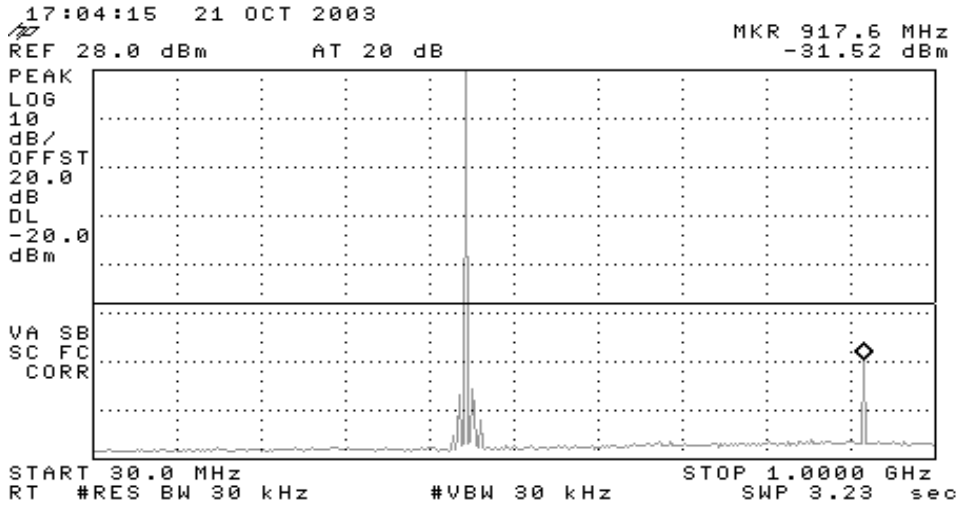
Out of Band @ 2Watts



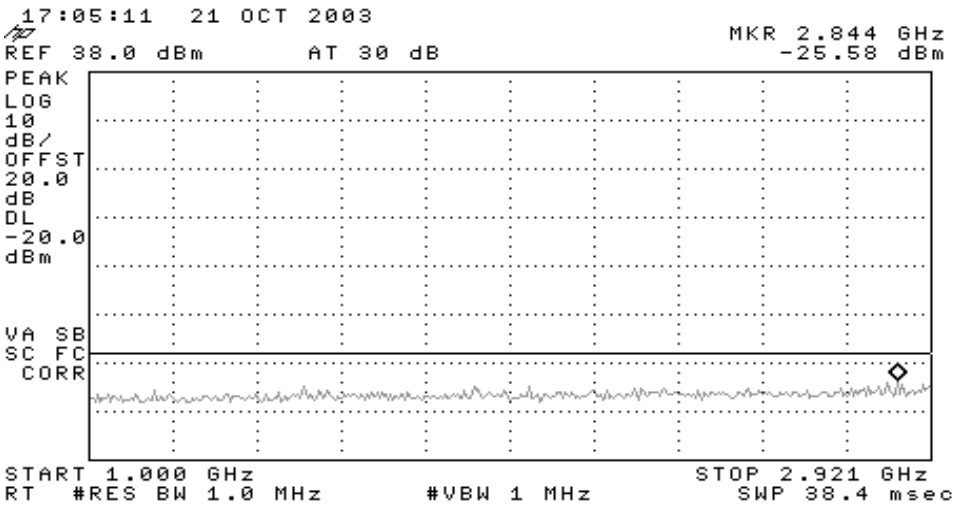
Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

Run#4: 450-470 module (Out of Band @ .5 Watts)

Out of Band @ .5Watts

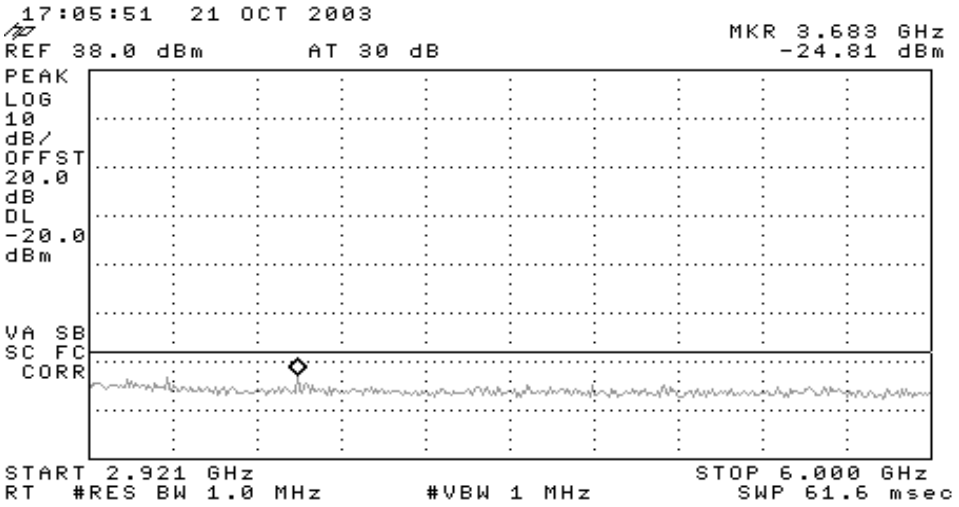


Out of Band @ .5Watts



Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

Out of Band @ .5Watts



Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

Radiated Emissions

(Elliott Laboratories Fremont Facility, Semi-Anechoic Chamber)

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 10/13/2003
Test Engineer: Chris Byleckie
Test Location: Fremont Chamber #3

Config. Used: 2
Config Change: None
EUT Voltage: 3.3VDC

General Test Configuration

The EUT and any local support equipment were located on the turntable for radiated emissions testing. Any remote support equipment was located outside the anechoic chamber. Any cables running to remote support equipment where routed through conduit and when possible passed through a ferrite clamp upon exiting the chamber.

Unless otherwise specified, the measurement antenna was located 3 meters from the EUT for the measurement range 30 - 1000 MHz and 3m from the EUT for the frequency range 1 - 10 GHz.

Ambient Conditions:

Temperature: 21 °C
Rel. Humidity: 32 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	RE, 30 - 4000 MHz, Field strength	90.210(d)& RSS-119 6.3 & 6.4(d)	Eval	Refer to individual runs
2	RE, 30 - 4000 MHz, ERP	90.210(d)& RSS-119 6.3 & 6.4(d)	Pass	-3.3dB @ 4200.0 MHz

Modifications Made During Testing:

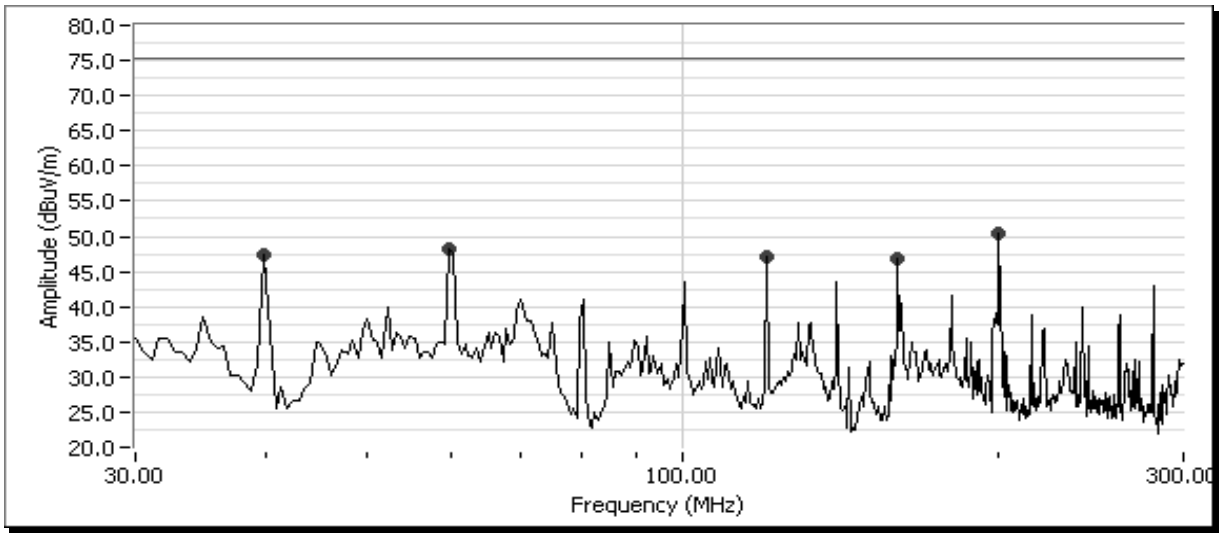
No modifications were made to the EUT during testing

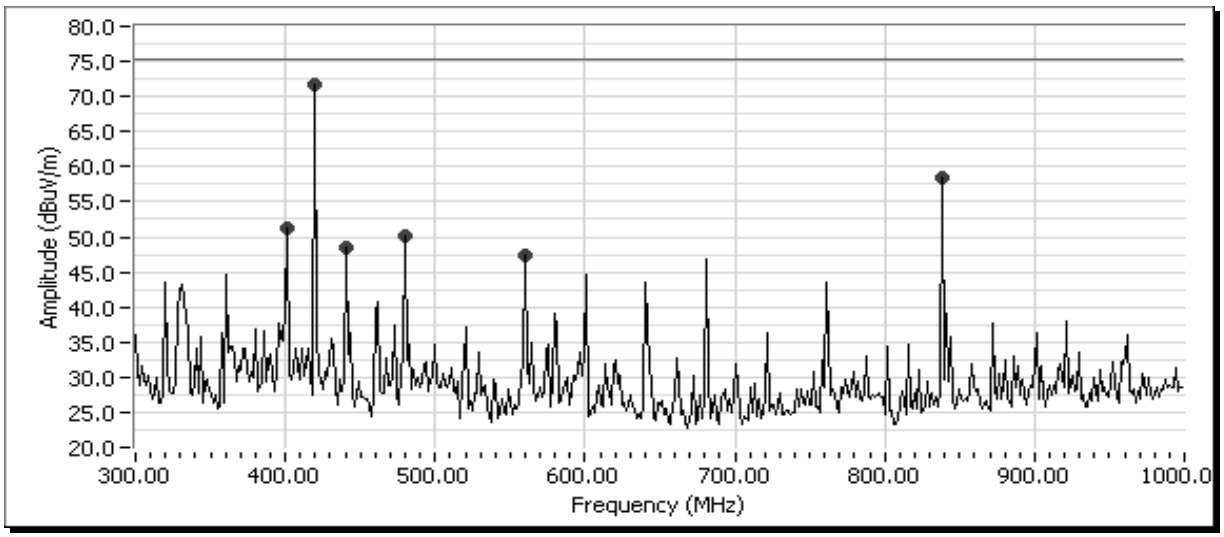
Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

Run #1: Preliminary Radiated Emissions, 30 - 5000 MHz

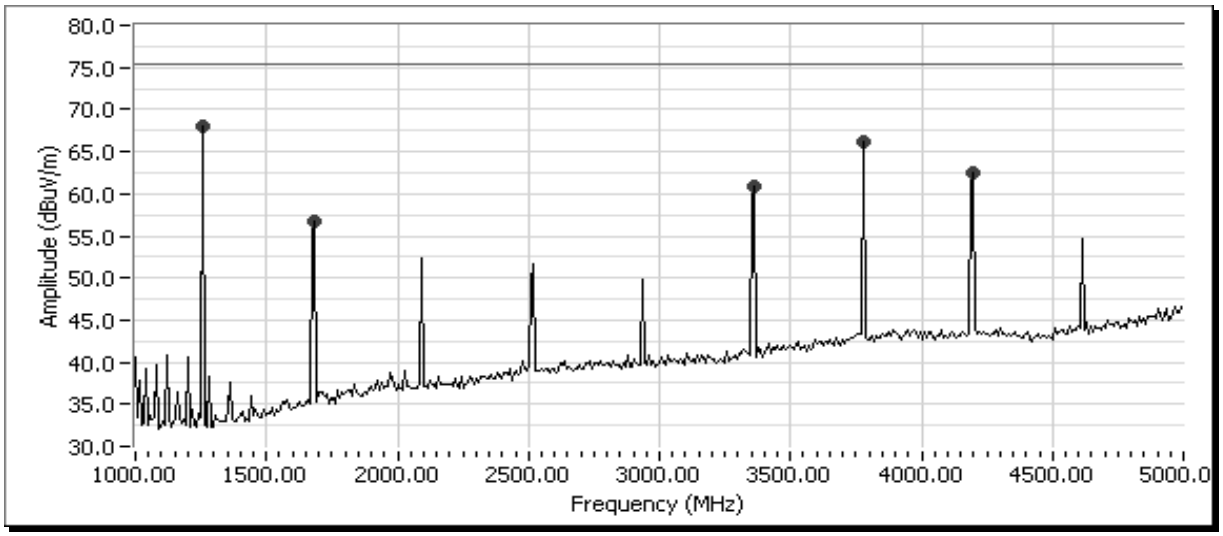




Run #1 continued on next page

Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

Run #1 continued



Frequency	Level	Pol	Part 90.210		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
419.989	71.8	H	-	-	Peak	22	1.0	Fundamental
1259.928	67.9	V	75.3	-7.4	Peak	16	1.0	
3779.928	66.2	H	75.3	-9.1	Peak	34	1.0	
4199.968	62.5	V	75.3	-12.8	Peak	219	2.0	
3359.968	60.9	H	75.3	-14.4	Peak	40	2.5	
839.989	58.4	V	75.3	-16.9	Peak	185	1.5	
1679.968	56.8	V	75.3	-18.6	Peak	269	1.0	
400.917	51.1	V	75.3	-24.2	Peak	180	1.0	
200.464	50.5	V	75.3	-24.8	Peak	222	1.0	
481.097	50.1	V	75.3	-25.2	Peak	189	1.0	
441.012	48.4	V	75.3	-26.9	Peak	194	1.0	
60.267	48.1	V	75.3	-27.2	Peak	175	1.0	
561.289	47.5	V	75.3	-27.8	Peak	219	1.0	
40.093	47.4	V	75.3	-28.0	Peak	237	1.0	
120.281	47.1	V	75.3	-28.2	Peak	202	1.0	
160.371	46.9	V	75.3	-28.4	Peak	187	1.0	

Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

Run #2: ERP measurements

ERP measurements

Frequency	Level	Pol	Substitution					
MHz	dBµV/m	v/h	Pin	Gain	ERP	Limit Note 1	Margin	
			(dBm)	(dBi)	(dBm)	(dBm)	(dB)	Comments
4199.968	62.5	V	-33.3	10.0	-25.4	-20.0	-5.4	
3359.968	60.9	H	-39.3	9.7	-31.7	-20.0	-11.7	
3779.928	66.2	H	-39.3	9.6	-31.8	-20.0	-11.8	
1259.928	67.9	V	-36.4	6.0	-32.5	-20.0	-12.5	
839.989	58.4	V	-37.0	2.2	-36.9	-20.0	-16.9	
1679.968	56.8	V	-49.3	7.3	-44.1	-20.0	-24.1	

Note 1:	Pin is the power input (dBm) to the substitution antenna to obtain the field strength recorded from the EUT. G is the gain (dBi) for the substitution antenna.ERP is the effective radiated power (Pin + GdBi - 2.2) from the substitution antenna. EIRP is calculated as follows (Pin+GdBi)

Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

Radiated Emissions

(Elliott Laboratories Fremont Facility, Semi-Anechoic Chamber)

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 10/13/2003
Test Engineer: Chris Byleckie
Test Location: Fremont Chamber #3

Config. Used: 2
Config Change: None
EUT Voltage: 3.3VDC

General Test Configuration

The EUT and any local support equipment were located on the turntable for radiated emissions testing. Any remote support equipment was located outside the anechoic chamber. Any cables running to remote support equipment where routed through conduit and when possible passed through a ferrite clamp upon exiting the chamber.

Unless otherwise specified, the measurement antenna was located 3 meters from the EUT for the measurement range 30 - 1000 MHz and 3m from the EUT for the frequency range 1 - 10 GHz.

Ambient Conditions:

Temperature: 21 °C
Rel. Humidity: 32 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	RE, 30 - 4000 MHz, Field strength	90.210(d)& RSS-119 6.3 & 6.4(d)	Eval	Refer to individual runs
2	RE, 30 - 4000 MHz, ERP	90.210(d)& RSS-119 6.3 & 6.4(d)	Pass	-4.1dB @ 3520.0 MHz

Modifications Made During Testing:

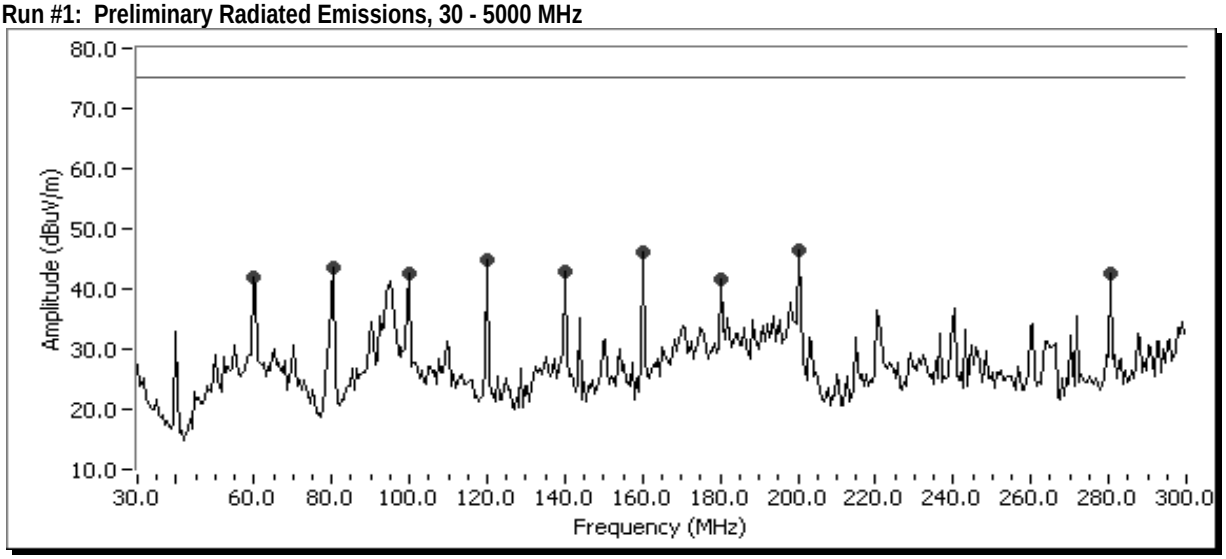
No modifications were made to the EUT during testing

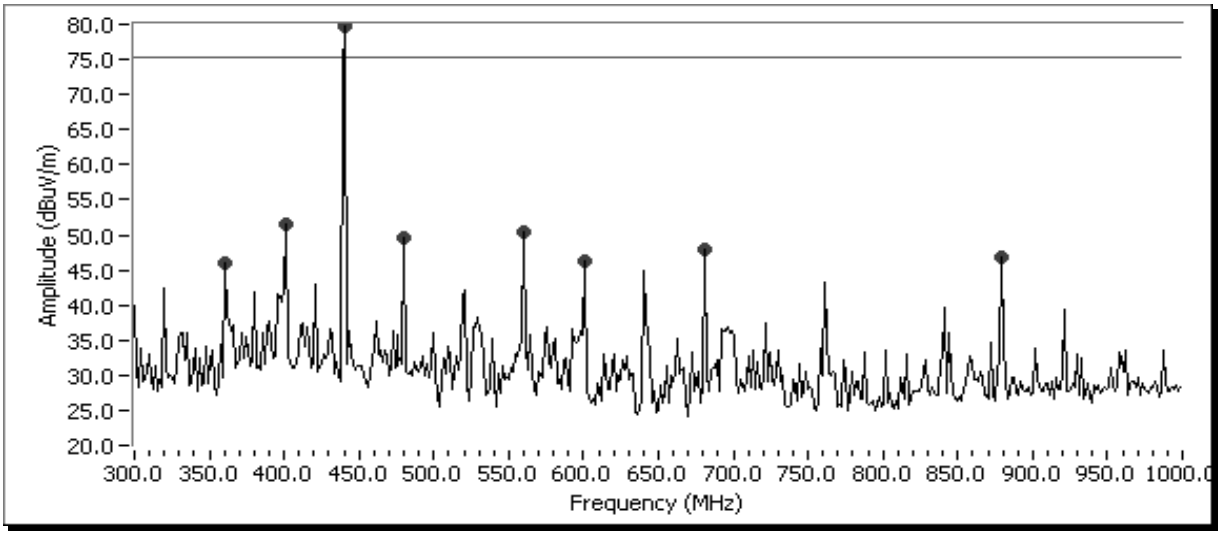
Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

Run #1: Preliminary Radiated Emissions, 30 - 5000 MHz

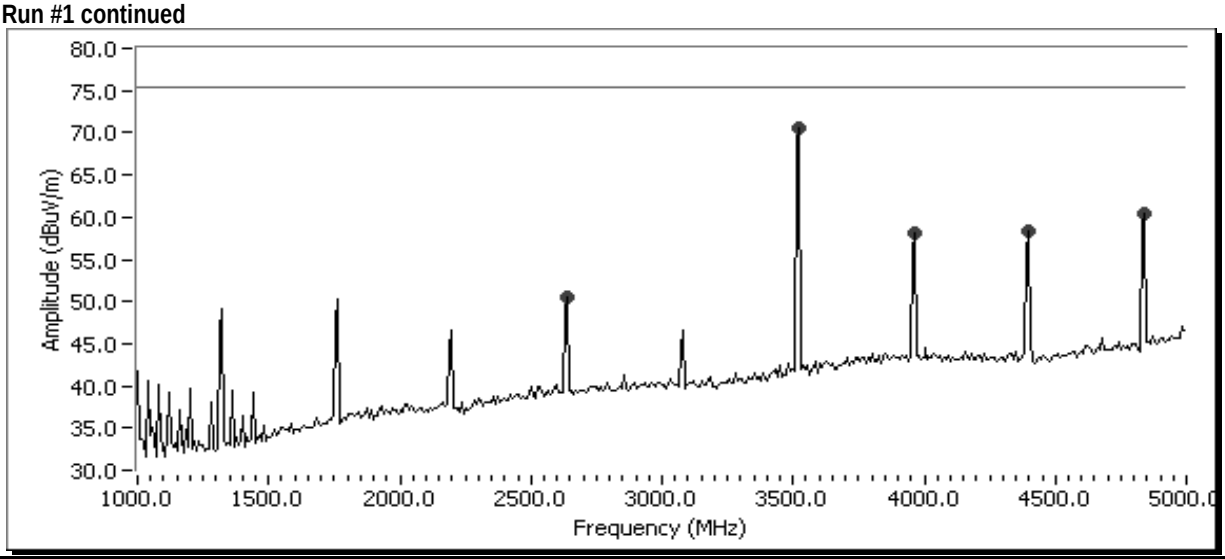




Run #1 continued on next page

Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

Run #1 continued



Frequency	Level	Pol	Part 90.210		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
439.994	79.8	H	-	-	Peak	141	2.0	Fundamental
3519.968	70.6	V	75.3	-4.7	Peak	87	1.0	
4839.968	60.5	V	75.3	-14.8	Peak	257	1.0	
4399.968	58.4	H	75.3	-16.9	Peak	19	1.0	
3959.968	58.2	H	75.3	-17.1	Peak	44	1.0	
400.906	51.6	V	75.3	-23.7	Peak	180	1.0	
2639.968	50.6	V	75.3	-24.8	Peak	150	1.5	
561.289	50.3	V	75.3	-25.0	Peak	200	1.0	
481.109	49.7	V	75.3	-25.6	Peak	194	1.0	
681.566	48.0	V	75.3	-27.3	Peak	221	1.0	
879.997	46.9	H	75.3	-28.4	Peak	329	1.0	
601.386	46.3	V	75.3	-29.0	Peak	221	1.0	
200.464	46.3	V	75.3	-29.0	Peak	182	1.0	
160.371	46.3	V	75.3	-29.0	Peak	310	1.0	
360.843	45.9	V	75.3	-29.4	Peak	212	1.0	
120.277	44.7	V	75.3	-30.6	Peak	209	1.0	
80.183	43.7	V	75.3	-31.6	Peak	109	1.5	
140.356	42.8	V	75.3	-32.5	Peak	241	1.0	
280.648	42.7	V	75.3	-32.6	Peak	185	1.0	
100.142	42.6	V	75.3	-32.7	Peak	209	1.0	
60.082	42.0	V	75.3	-33.3	Peak	233	1.0	
180.510	41.5	V	75.3	-33.8	Peak	274	1.0	

Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

Run #2: ERP measurements

ERP measurements

Frequency	Level	Pol	Substitution					
MHz	dBµV/m	v/h	Pin	Gain	ERP	Limit [Note 1]	Margin	
			(dBm)	(dBi)	(dBm)	(dBm)	(dB)	Comments
3519.968	70.6	V	-33.8	9.7	-26.2	-20.0	-6.2	
4839.968	60.5	V	-42.3	10.0	-34.4	-20.0	-14.4	
4399.968	58.4	H	-45.3	10.3	-37.1	-20.0	-17.1	
3959.968	58.2	H	-47.3	9.6	-39.8	-20.0	-19.8	

Note 1:	Pin is the power input (dBm) to the substitution antenna to obtain the field strength recorded from the EUT. G is the gain (dBi) for the substitution antenna.ERP is the effective radiated power (Pin + GdBi - 2.2) from the substitution antenna. EIRP is calculated as follows (Pin+GdBi)

Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

Radiated Emissions

(Elliott Laboratories Fremont Facility, Semi-Anechoic Chamber)

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 10/20/2003
Test Engineer: Jmartinez
Test Location: Fremont Chamber #5
Config. Used: 2
Config Change: None
EUT Voltage: 3.3VDC

General Test Configuration

The EUT and any local support equipment were located on the turntable for radiated emissions testing. Any remote support equipment was located outside the anechoic chamber. Any cables running to remote support equipment where routed through conduit and when possible passed through a ferrite clamp upon exiting the chamber.

Unless otherwise specified, the measurement antenna was located 3 meters from the EUT for the measurement range 30 - 1000 MHz and 3m from the EUT for the frequency range 1 - 10 GHz.

Ambient Conditions:

Temperature: 21 °C
Rel. Humidity: 46 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	RE, 30 - 4000 MHz, Field strength	90.210(d)& RSS-119 6.3 & 6.4(d)	Eval	Refer to individual runs
2	RE, 30 - 4000 MHz, ERP	90.210(d)& RSS-119 6.3 & 6.4(d)	Pass	-12.6dB @ 3683.292MHz

Modifications Made During Testing:

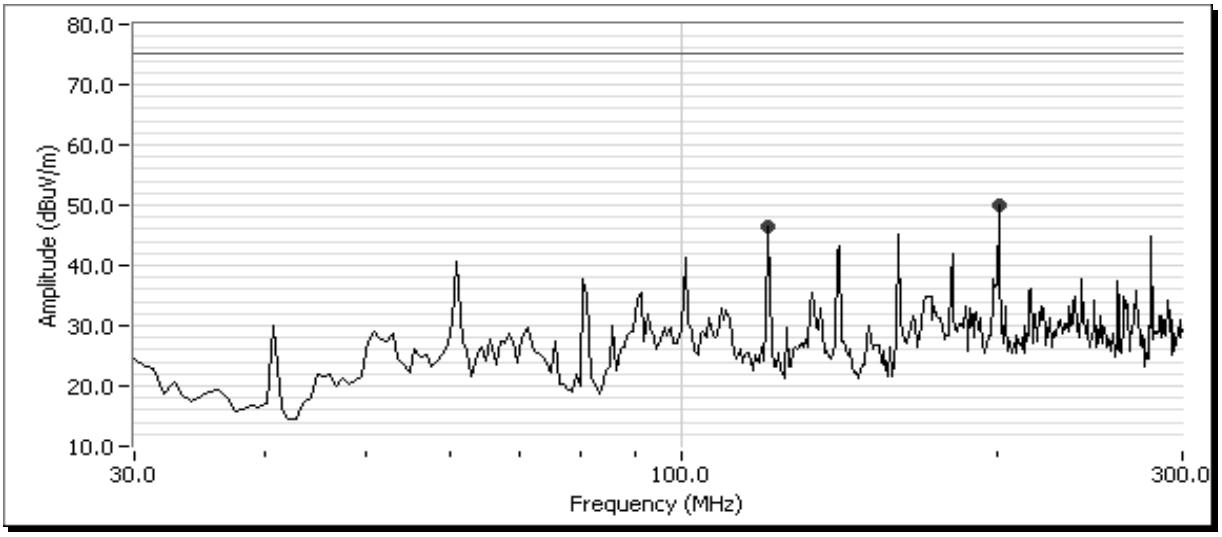
No modifications were made to the EUT during testing

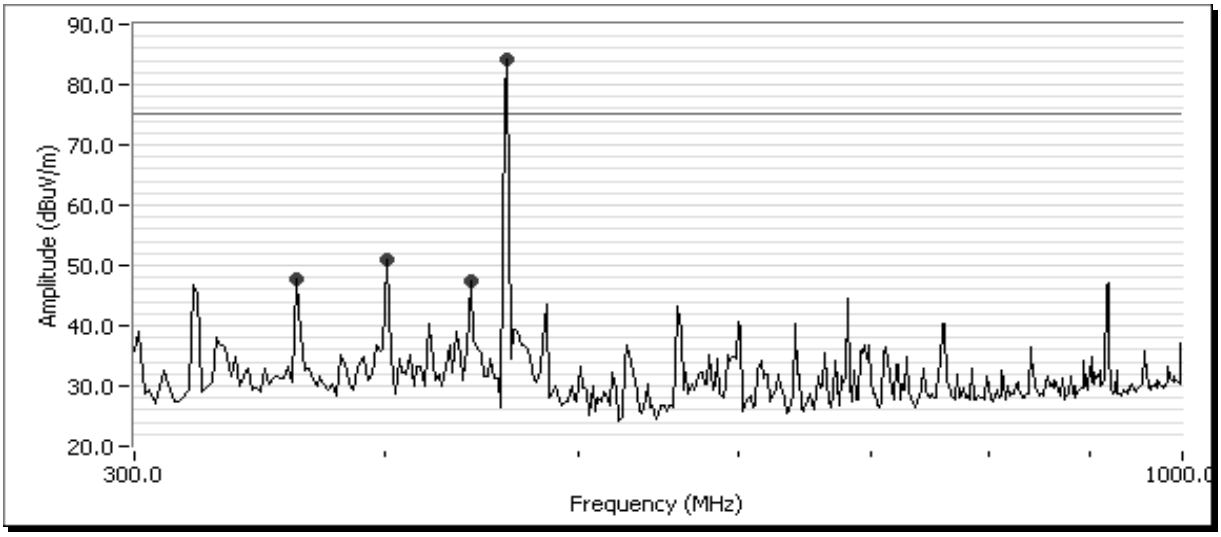
Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

Run #1: Preliminary Radiated Emissions, 30 - 5000 MHz

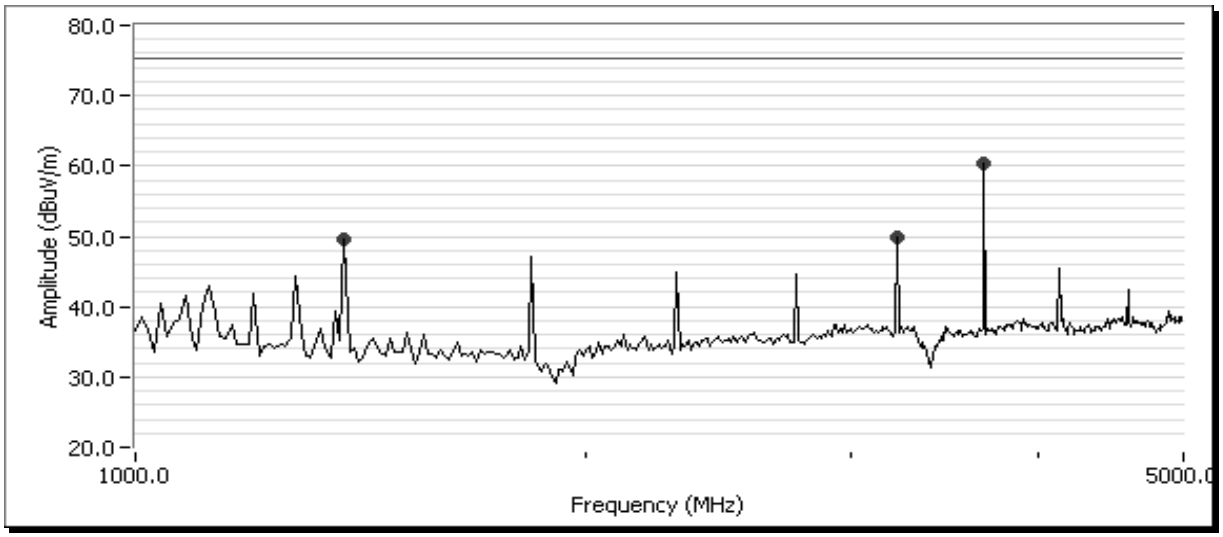




Run #1 continued on next page

Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

Run #1 continued



Frequency	Level	Pol	Part 90.210		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
460.599	-	H	-	-	Peak	31	2.0	Fundamental
3683.292	60.2	V	75.3	-15.1	Peak	100	1.5	
401.247	50.9	V	75.3	-24.4	Peak	56	1.0	
200.349	50.2	V	75.3	-25.2	Peak	58	1.0	
3224.439	49.7	V	75.3	-25.6	Peak	100	1.0	
1379.052	49.5	H	75.3	-25.9	Peak	332	1.5	
361.097	47.6	V	75.3	-27.7	Peak	158	1.0	
441.397	47.5	V	75.3	-27.8	Peak	158	1.0	
120.898	46.5	V	75.3	-28.8	Peak	126	1.0	

Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

Run #2: ERP measurements

ERP measurements

Frequency	Level	Pol	Substitution					
MHz	dBµV/m	v/h	Pin	Gain	ERP	Limit [Note 1]	Margin	
			(dBm)	(dBi)	(dBm)	(dBm)	(dB)	Comments
3683.292	60.2	V	-40.2	9.7	-32.6	-20.0	-12.6	

Note 1:	Pin is the power input (dBm) to the substitution antenna to obtain the field strength recorded from the EUT. G is the gain (dBi) for the substitution antenna.ERP is the effective radiated power (Pin + GdBi - 2.2) from the substitution antenna. EIRP is calculated as follows (Pin+GdBi)

Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

Frequency Stability

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 10/7/2003
Test Engineer: Chris Byleckie
Test Location: Environmental Chamber
Config. Used: 1
Config Change: None
EUT Voltage: 3.3V DC

General Test Configuration

EUT was place inside the Temperature Chamber and all local support equipment were located outside on a table for testing. The Eut was connected directly to Spectrum Analyzer. An attenuator was used between the EUT and Spectrum Analzyer. Chamber was set to -30 to 50 degrees Celsius. Incremented 10 degress per temperature and let unit stabilized for every temperature.

For battery operated units decrease DC voltage until battery end-point was found.

Summary of Results

Run #	Test Performed	Limit	Result	Result
1-3	Temperature Vs. Frequency	Part 90.213 & RSS-119 (7)	Pass	0 Hz
1-3	Temperature Vs. Voltage	Part 90.213 & RSS-119 (7)	Pass	0 Hz (Battery End point is 1Vdc)

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

Run# 1: Temperature Vs. Frequency
410-430 Mhz

Drift	Freq.	Limit
(ppm)	(MHz)	(Hz)
2.5	420.00	1050.0

Temperature	Reference Frequency	Frequency Drift	Drift	Limit
(Celsius)	(MHz)	(MHz)	(Hz)	(Hz)
-30	420.000110	420.000110	0	1050.0
-20	420.000110	420.000110	0	1050.0
-10	420.000110	420.000110	0	1050.0
0	420.000110	420.000110	0	1050.0
10	420.000110	420.000110	0	1050.0
20	420.000110	420.000110	0	1050.0
30	420.000110	420.000110	0	1050.0
40	420.000110	420.000110	0	1050.0
50	420.000110	420.000110	0	1050.0

Temperature Vs. Voltage
410-430 Mhz

Drift	Freq.	Limit
(ppm)	(MHz)	(Hz)
2.5	420.00	1050.0

Temperature	Reference Frequency	Frequency Drift	Drift	Voltage	Comment
(Celsius)	(MHz)	(MHz)	(Hz)	(DC)	
20	420.000110	420.000110	0	2.8	85%
20	420.000110	420.000110	0	3.8	115%

Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

Run# 2: Temperature Vs. Frequency

430-450 MHz

Drift	Freq.	Limit
(ppm)	(MHz)	(Hz)
2.5	440.00	1100.0

Temperature	Reference Frequency	Frequency Drift	Drift	Limit
(Celsius)	(MHz)	(MHz)	(Hz)	(Hz)
-30	440.000350	440.000350	0	1100.0
-20	440.000350	440.000350	0	1100.0
-10	440.000350	440.000350	0	1100.0
0	440.000350	440.000350	0	1100.0
10	440.000350	440.000350	0	1100.0
20	440.000350	440.000350	0	1100.0
30	440.000350	440.000350	0	1100.0
40	440.000350	440.000350	0	1100.0
50	440.000350	440.000350	0	1100.0

Temperature Vs. Voltage

430-450 Mhz

Drift	Freq.	Limit
(ppm)	(MHz)	(Hz)
2.5	440.00	1100.0

Temperature	Reference Frequency	Frequency Drift	Drift	Voltage	Comment
(Celsius)	(MHz)	(MHz)	(Hz)	(DC)	
20	440.000350	440.000350	0	2.8	85%
20	440.000350	440.000350	0	3.8	115%

Client:	Microwave Data Systems	Job Number:	J52668
Model:	XPOGO 401,-402,-403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis Mc Carthy		
Spec:	FCC Part 90 & RSS-119	Class:	Radio

Run# 3: Temperature Vs. Frequency
450-470 MHz

Drift	Freq.	Limit
(ppm)	(MHz)	(Hz)
2.5	460.00	1150.0

Temperature	Reference Frequency	Frequency Drift	Drift	Limit
(Celsius)	(MHz)	(MHz)	(Hz)	(Hz)
-30	459.999560	459.999560	0	1150.0
-20	459.999560	459.999560	0	1150.0
-10	459.999560	459.999560	0	1150.0
0	459.999560	459.999560	0	1150.0
10	459.999560	459.999560	0	1150.0
20	459.999560	459.999560	0	1150.0
30	459.999560	459.999560	0	1150.0
40	459.999560	459.999560	0	1150.0
50	459.999560	459.999560	0	1150.0

Temperature Vs. Voltage
450-470 Mhz

Drift	Freq.	Limit
(ppm)	(MHz)	(Hz)
2.5	460.00	1150.0

Temperature	Reference Frequency	Frequency Drift	Drift	Voltage	Comment
(Celsius)	(MHz)	(MHz)	(Hz)	(DC)	
20	459.999560	459.999560	0	2.8	85%
20	459.999560	459.999560	0	3.8	115%

Elliott

EMC Test Data

Client:	Microwave Data Systems	Job Number:	J52668
Model:	XP0G0 401, -402, -403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis McCarthy		
Emissions Spec:	FCC Part 15	Class:	B
Immunity Spec:	N/A	Environment:	N/A

EMC Test Data

For The

Microwave Data Systems

Model

XP0G0 401, -402, -403

Date of Last Test: 10/15/2003

Client:	Microwave Data Systems	Job Number:	J52668
Model:	XP0G0 401, -402, -403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis McCarthy		
Emissions Spec:	FCC Part 15	Class:	B
Immunity Spec:	N/A	Environment:	N/A

EUT INFORMATION

General Description

The MDS XPOGO Data Transceiver and is intended primarily for use in Point-to- Multipoint networks. Normally, the EUT would be placed on a table top during operation. The EUT was, therefore, treated as table-top equipment during testing to simulate the end-user environment. The electrical rating of the EUT is 3.3VDC, 2 Amps.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
Microwave Data Systems	XPOGO-401	410 - 430MHz transciever	N/A	E5MDS-TRM450
Microwave Data Systems	XPOGO-402	430 - 450MHz transceiver	N/A	E5MDS-TRM450
Microwave Data Systems	XPOGO-403	450 - 470MHz transceiver	N/A	E5MDS-TRM450

EUT Enclosure

The EUT enclosure is primarily constructed of aluminum shielding. It measures approximately 4.5 cm wide by 7 cm deep by 1.2 cm high.

Modification History

Mod. #	Test	Date	Modification
1	-	-	None

Modifications applied are assumed to be used on subsequent tests unless otherwise stated as a further modification.

Client:	Microwave Data Systems	Job Number:	J52668
Model:	XP0G0 401, -402, -403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis McCarthy		
Emissions Spec:	FCC Part 15	Class:	B
Immunity Spec:	N/A	Environment:	N/A

Test Configuration #1

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
None				

Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
Power Designs		Power Supply		

Interface Cabling and Ports

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
RF	Spectrum Analyzer	Coax	Shielded	6
Serial	Laptop	Multiwire	Shielded	2
DC in	Power Suplly	2 wire	Unshielded	2

EUT Operation During Emissions

The unit was transmitting at full power at 420, 440, and 460MHz.

Client:	Microwave Data Systems	Job Number:	J52668
Model:	XP0G0 401, -402, -403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis McCarthy		
Spec:	FCC Part 15	Class:	B

Radiated Emissions

(Elliott Laboratories Fremont Facility, Semi-Anechoic Chamber)

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 10/15/2003
Test Engineer: Ed Pavlu/Rafael
Test Location: Fremont Chamber #5
Config. Used: 1
Config Change: None
EUT Voltage: 3.3VDC supplied to host text fixture

General Test Configuration

The EUT was located on the turntable for radiated emissions testing. The remote 3.3 VDC power supply was located outside the anechoic chamber. The DC power leads running to the remote 3.3 VDC power supply where routed through conduit and passed through a ferrite clamp upon exiting the chamber.

Unless otherwise specified, the measurement antenna was located 3 meters from the EUT for the measurement range 30 - 1000 MHz and 3m from the EUT for the frequency range 1 - 3 GHz. Data was compared to FCC Class B limits (specifed at 3 meters).

Note, **preliminary** testing indicates that the emissions were maximized by orientation of the EUT and elevation of the measurement antenna. **Maximized** testing indicated that the emissions were maximized by orientation of the EUT, elevation of the measurement antenna, and manipulation of the EUT's interface cables.

Note, for testing above 1 GHz, the FCC specifies the limit as an average measurement. In addition, the FCC states that the peak reading of any emission above 1 GHz, can not exceed the average limit by more than 20 dB.

Ambient Conditions:

Temperature: 20 °C
Rel. Humidity: 47 %

Client:	Microwave Data Systems	Job Number:	J52668
Model:	XP0G0 401, -402, -403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis McCarthy		
Spec:	FCC Part 15	Class:	B

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1b	RE, 30 - 1000 MHz, Maximized Emissions	FCC B	Pass	-6.8dB @ 505.000MHz
2	RE, 1000 - 3000 MHz, Maximized Emissions	FCC B	Pass	-16.6dB @ 1010.0 MHz
3	RE, 1000 - 3000 MHz, Maximized Emissions	FCC B	Pass	-20.5dB @ 1295.7 MHz
4a	RE, 30 - 1000 MHz, Maximized Emissions	FCC B	Pass	-13.6dB @ 455.362MHz
5b	RE, 30 - 1000 MHz, Maximized Emissions	FCC B	Pass	-5.7dB @ 484.999 MHz
6	RE, 1000 - 3000 MHz, Maximized Emissions	FCC B	Pass	All Emission < 20 dB of limit

Modifications Made During Testing:

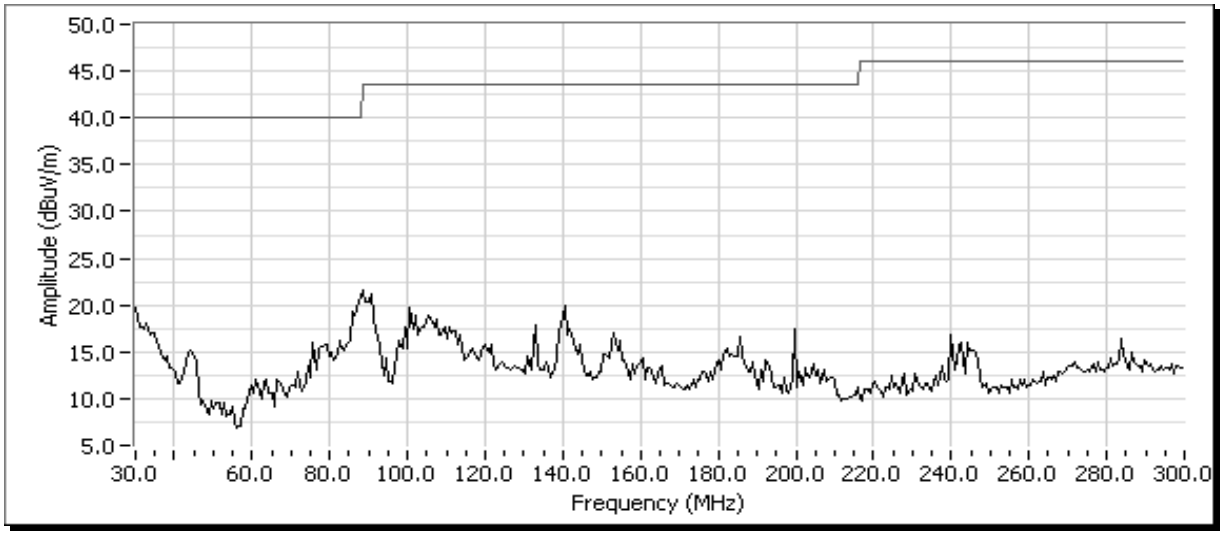
No modifications were made to the EUT during testing

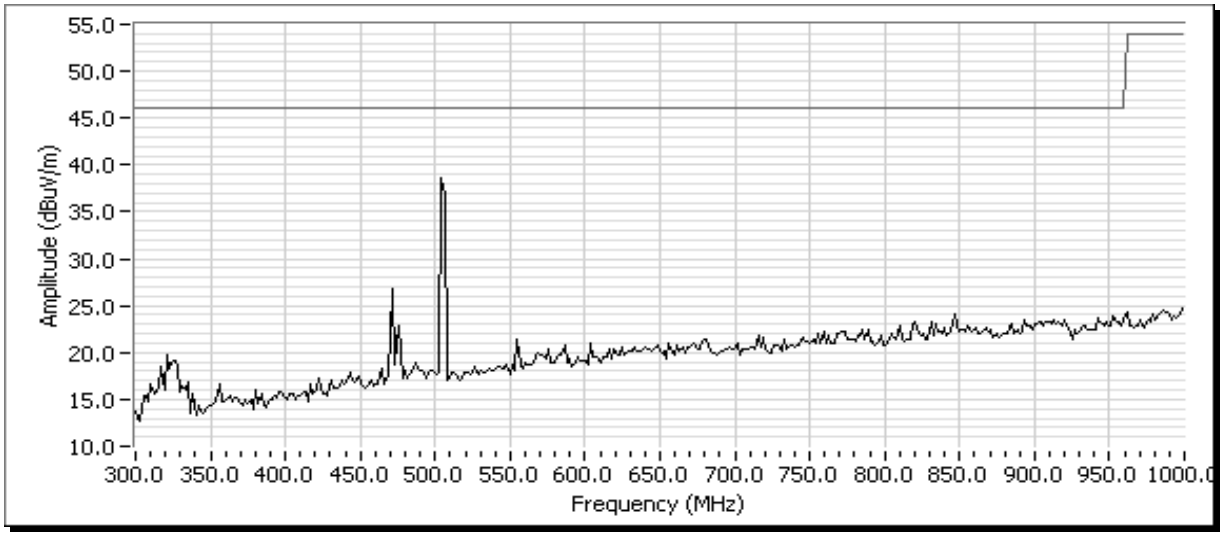
Deviations From The Standard:

No deviations were made from the requirements of the standard.

Client:	Microwave Data Systems	Job Number:	J52668
Model:	XP0G0 401, -402, -403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis McCarthy		
Spec:	FCC Part 15	Class:	B

Run #1: Preliminary Radiated Emissions, 30 - 1000 MHz
EUT is 450 - 470 MHz unit (s/n 1201606 A01), set to receive at 460 MHz using command "RX 460.00000"
EUT centered on tabletop with RF port connected to antenna (antenna mounted vertically)





Client:	Microwave Data Systems	Job Number:	J52668
Model:	XP0G0 401, -402, -403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis McCarthy		
Spec:	FCC Part 15	Class:	B

Run #1: (Continued) Preliminary Radiated Emissions, 30 - 1000 MHz

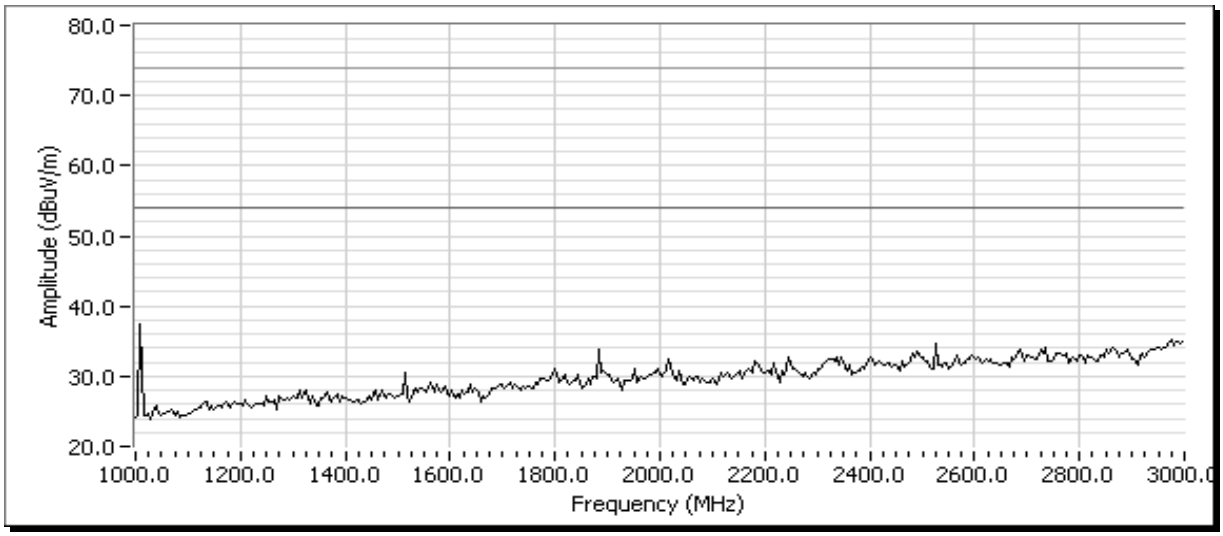
Frequency	Level	Pol	FCC Class B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
Preliminary peak readings captured during pre-scan								
88.579	21.6	H	43.5	-21.9	Peak	101	1.5	
320.948	19.7	H	46.0	-26.3	Peak	360	1.0	
471.072	26.8	V	46.0	-19.2	Peak	102	1.0	
504.239	38.6	V	46.0	-7.4	Peak	109	1.0	
846.384	24.1	V	46.0	-21.9	Peak	11	2.0	
984.289	24.4	H	54.0	-29.6	Peak	238	1.0	

Run #1b: Maximized readings from Run #1

Frequency	Level	Pol	FCC Class B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
505.000	39.3	V	46.0	-6.8	QP	107	1.0	
847.808	15.2	V	46.0	-30.8	QP	8	2.0	
471.260	19.1	V	46.0	-26.9	QP	100	1.0	
985.123	16.4	H	54.0	-37.6	QP	240	1.0	
320.791	5.3	H	46.0	-40.7	QP	358	1.0	
88.579	2.8	H	46.0	-43.2	QP	98	1.5	

Client:	Microwave Data Systems	Job Number:	J52668
Model:	XP0G0 401, -402, -403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis McCarthy		
Spec:	FCC Part 15	Class:	B

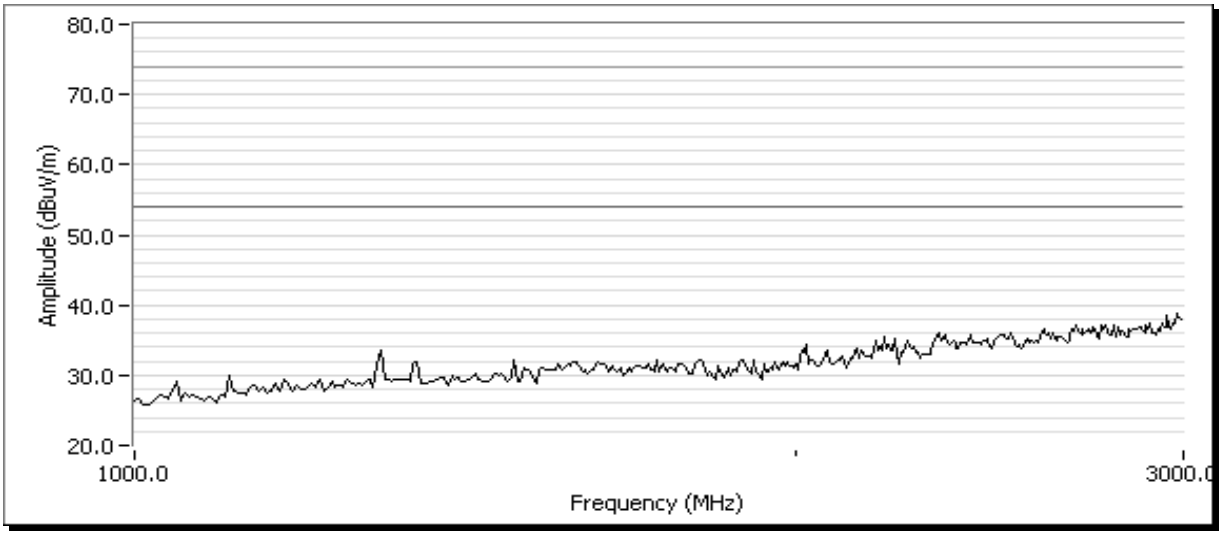
Run #2: Maximized Readings, 1000 - 3000 MHz
Measurements made at 3m per FCC requirements.
EUT is 450 - 470 MHz unit (s/n 1201606 A01), set to receive at 460 MHz using command "RX 460.00000"
EUT centered on tabletop with RF port connected to antenna (antenna mounted vertically)



Frequency	Level	Pol	FCC Class B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
1010.010	37.4	V	54.0	-16.7	Avg	44	1.6	
1010.010	38.9	V	74.0	-35.1	Pk	44	1.6	

Client:	Microwave Data Systems	Job Number:	J52668
Model:	XP0G0 401, -402, -403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis McCarthy		
Spec:	FCC Part 15	Class:	B

Run #3: Maximized Reading, 1000 - 3000 MHz
EUT is 410 - 430 MHz unit (s/n 1201634 A03), set to receive at 420 MHz using command "RX 420.00000"
EUT centered on tabletop with RF port connected to antenna (antenna mounted vertically)



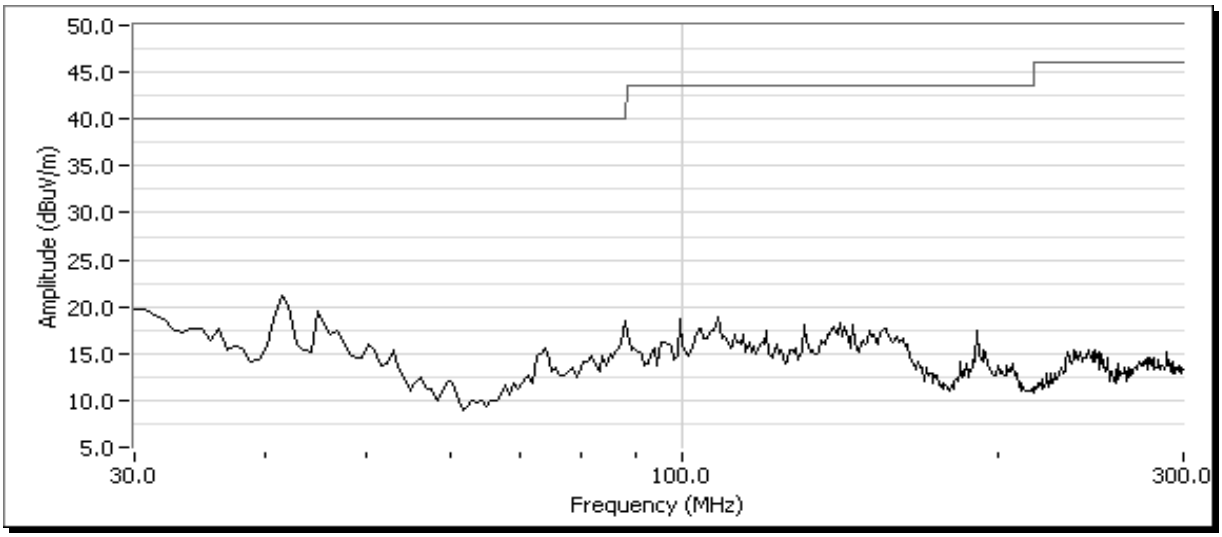
Frequency	Level	Pol	FCC Class B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
Final peak and average readings								
1295.703	33.5	V	54.0	-20.5	Peak	360	1.5	Peak reading, avg Limit

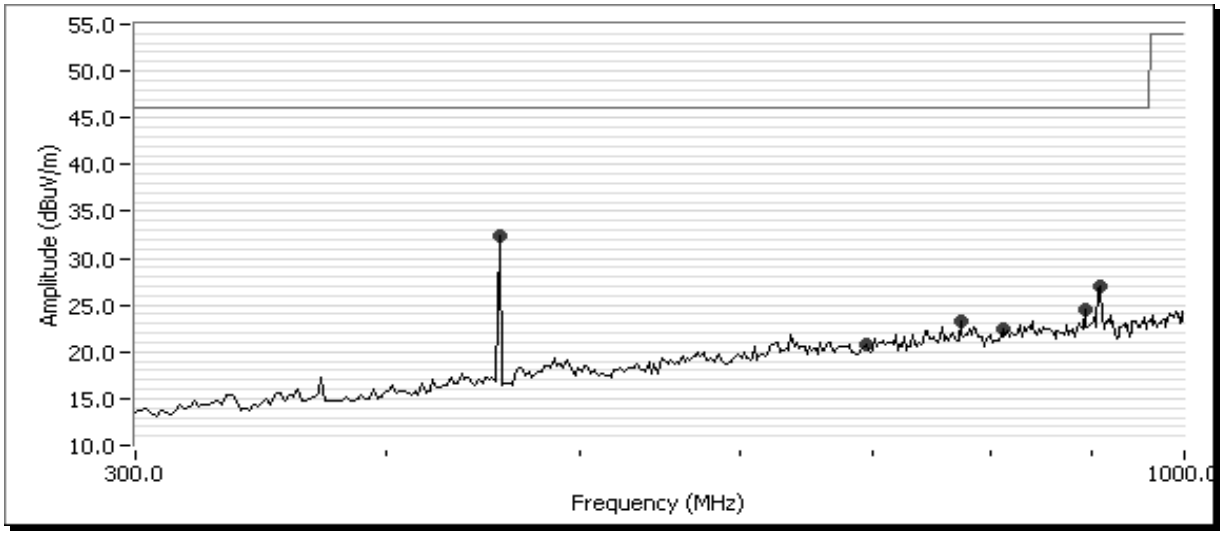
Client:	Microwave Data Systems	Job Number:	J52668
Model:	XP0G0 401, -402, -403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis McCarthy		
Spec:	FCC Part 15	Class:	B

Run #4: Preliminary Radiated Emissions, 30 - 1000 MHz

EUT is 410 - 430 MHz unit (s/n 1201634 A03), set to receive at 420 MHz using command "RX 420.00000"

EUT centered on tabletop with RF port connected to antenna (antenna mounted vertically)





Client:	Microwave Data Systems	Job Number:	J52668
Model:	XP0G0 401, -402, -403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis McCarthy		
Spec:	FCC Part 15	Class:	B

Run #4: Continued

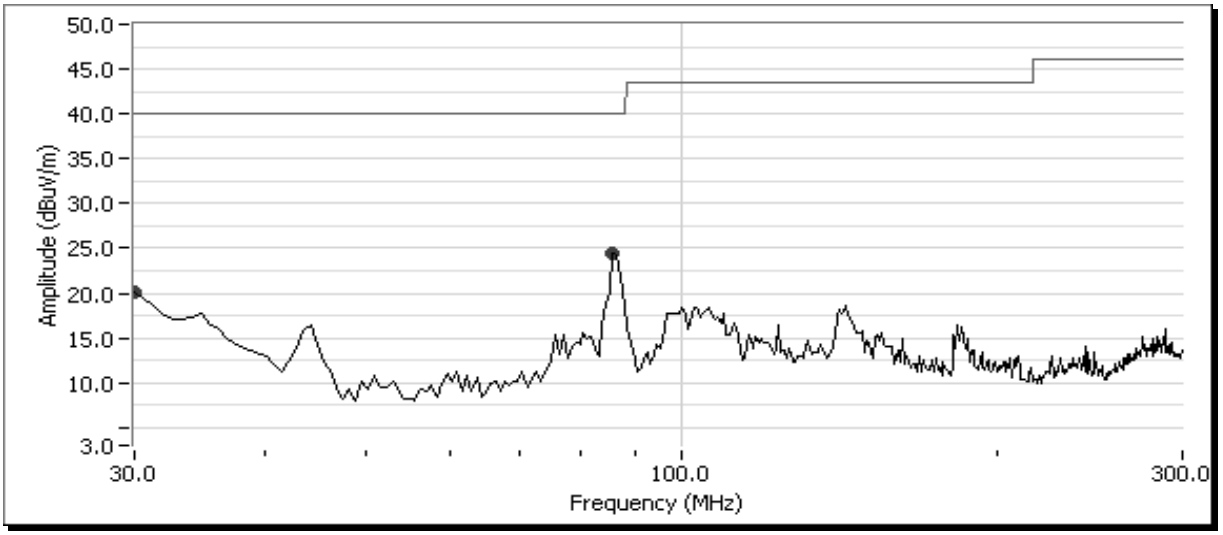
Frequency	Level	Pol	FCC Class B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
Preliminary Tuned peak readings captured during pre-scan								
455.362	32.4	V	46.0	-13.6	Peak	72	1.5	
694.514	20.7	H	46.0	-25.3	Peak	33	3.5	
773.067	23.4	V	46.0	-22.7	Peak	242	3.0	
811.471	22.5	V	46.0	-23.5	Peak	353	1.0	
891.771	24.5	V	46.0	-21.5	Peak	278	1.5	
907.481	27.0	H	46.0	-19.0	Peak	213	1.5	

Run #4a: Maximized readings from Run #4

Frequency	Level	Pol	FCC Class B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
455.362	32.4	V	46.0	-13.6	Peak	72	1.5	
907.481	27.0	H	46.0	-19.0	Peak	213	1.5	
891.771	24.5	V	46.0	-21.5	Peak	278	1.5	
773.067	23.4	V	46.0	-22.7	Peak	242	3.0	
811.471	22.5	V	46.0	-23.5	Peak	353	1.0	
694.514	20.7	H	46.0	-25.3	Peak	33	3.5	

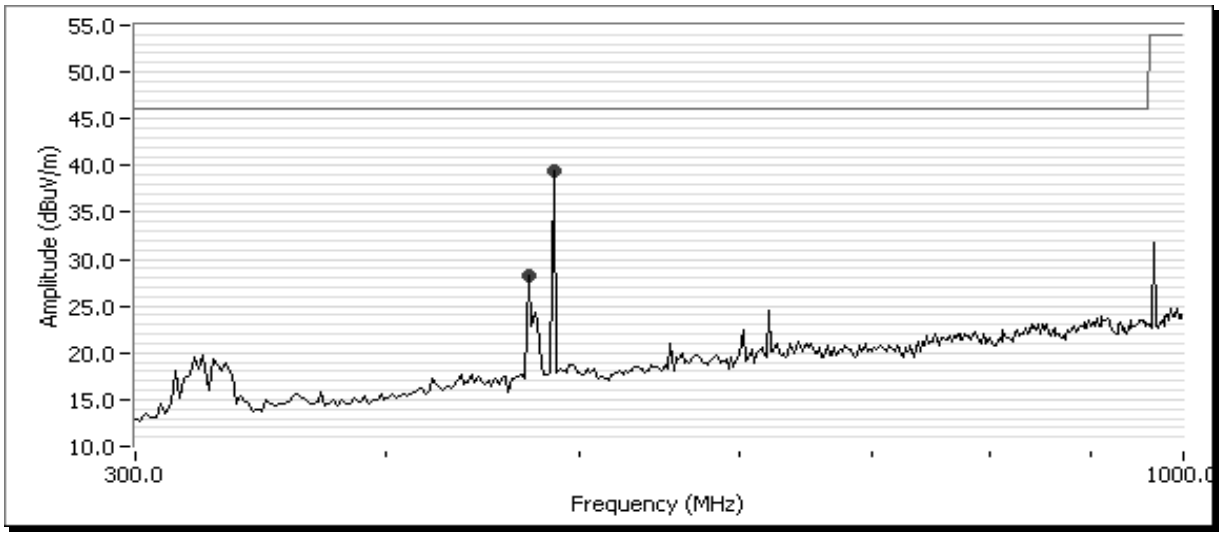
Client:	Microwave Data Systems	Job Number:	J52668
Model:	XP0G0 401, -402, -403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis McCarthy		
Spec:	FCC Part 15	Class:	B

Run #5: Preliminary Radiated Emissions, 30 - 1000 MHz
EUT is 430 - 450 MHz unit (s/n 1201622 A02), set to receive at 440 MHz using command "RX 440.00000"
EUT centered on tabletop with RF port connected to antenna (antenna mounted vertically)



Client:	Microwave Data Systems	Job Number:	J52668
Model:	XP0G0 401, -402, -403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis McCarthy		
Spec:	FCC Part 15	Class:	B

Run #5: Continued



Frequency	Level	Pol	FCC Class B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
Preliminary Tuned peak readings captured during pre-scan								
30.295	20.1	H	40.0	-19.9	Peak	116	3.5	
86.126	24.4	H	40.0	-15.6	Peak	86	2.0	
44.535	16.5	V	40.0	-23.5	Peak	56	1.0	
143.435	18.0	V	43.5	-25.5	Peak	286	1.0	
471.246	28.2	V	46.0	-17.8	Peak	165	1.5	
484.985	39.4	V	46.0	-6.6	Peak	114	1.0	
969.977	31.8	V	54.0	-22.2	Peak	129	1.5	
622.413	24.6	H	46.0	-21.4	Peak	218	2.0	

Client:	Microwave Data Systems	Job Number:	J52668
Model:	XP0G0 401, -402, -403	T-Log Number:	T53020
		Account Manager:	Danni Olivas
Contact:	Dennis McCarthy		
Spec:	FCC Part 15	Class:	B

Run #5b: Maximized readings from Run #5

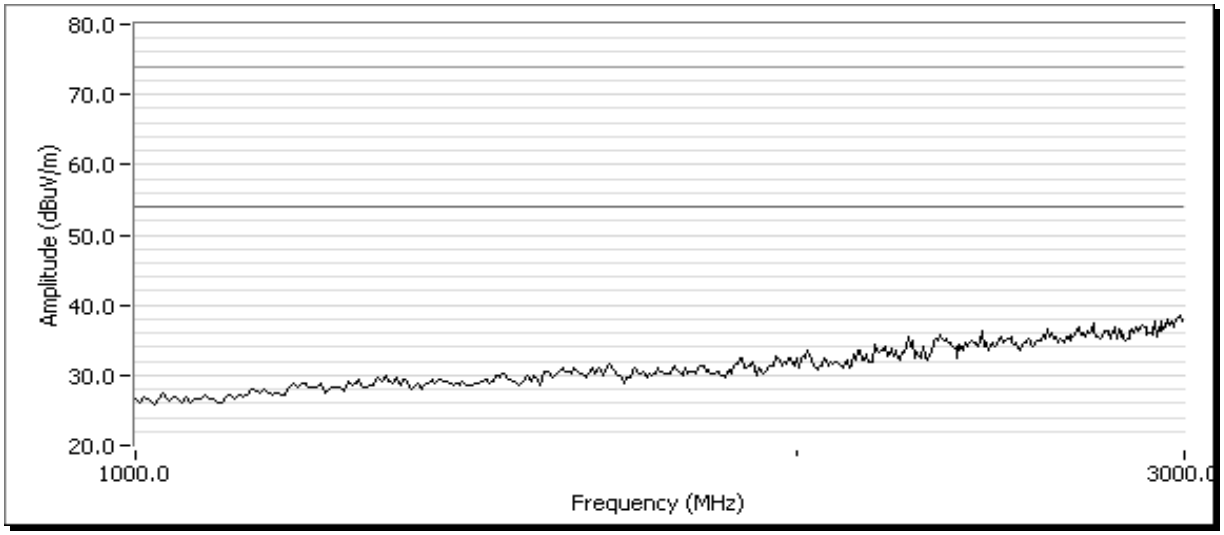
Frequency	Level	Pol	FCC Class B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
484.999	40.3	V	46.0	-5.7	QP	111	1.0	
86.126	14.8	H	40.0	-25.2	QP	88	2.0	
471.260	18.8	V	46.0	-27.2	QP	162	1.5	
30.295	12.4	H	40.0	-27.6	QP	113	3.5	
622.413	12.7	H	46.0	-33.3	QP	215	2.0	
44.535	2.5	V	40.0	-37.5	QP	57	1.0	

Run #6: Maximized Readings, 1000 - 3000 MHz

EUT is 430 - 450 MHz unit (s/n 1201622 A02), set to receive at 440 MHz using command "RX 440.00000"

EUT centered on tabletop with RF port connected to antenna (antenna mounted vertically)

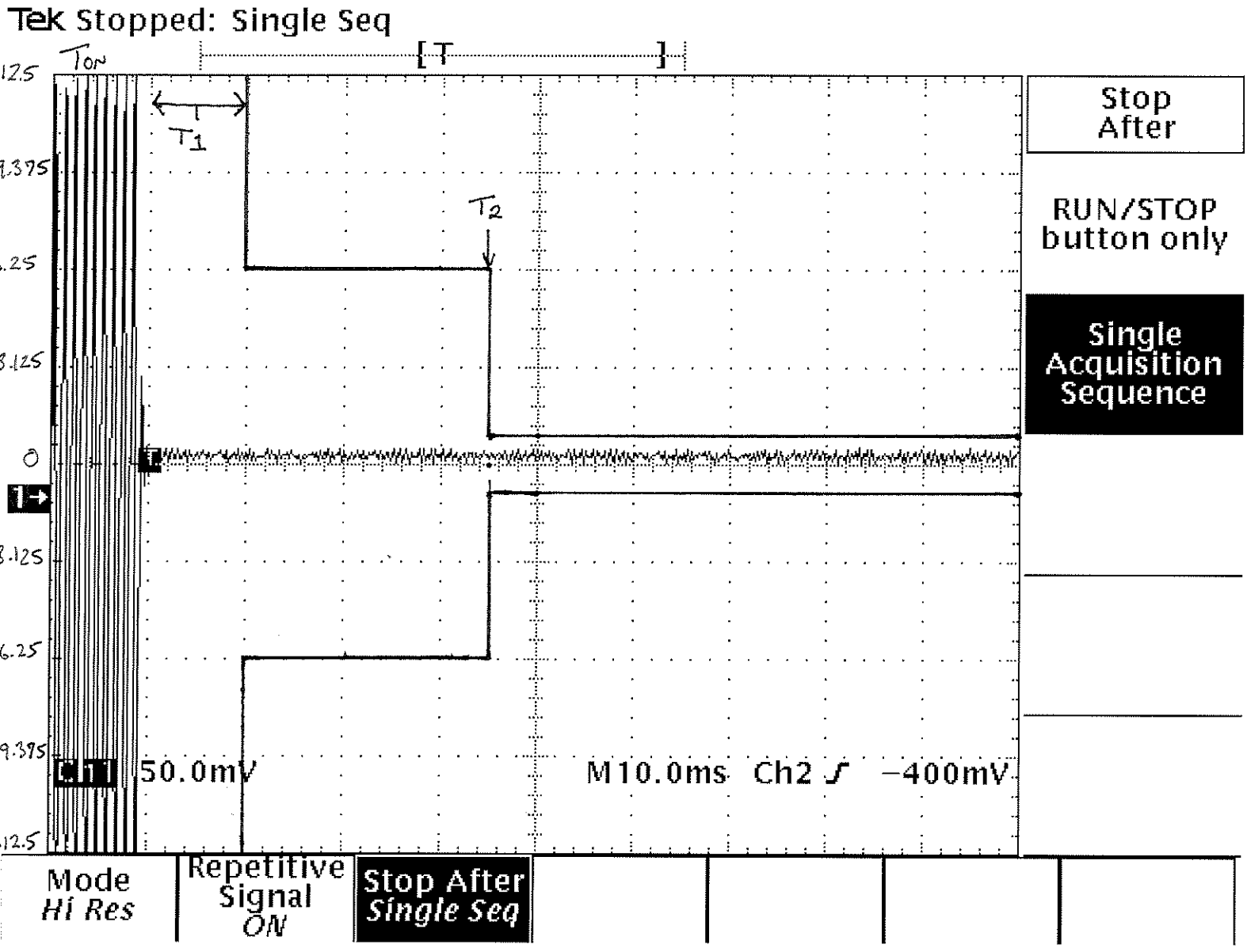
Only plot was taken since there were no data points



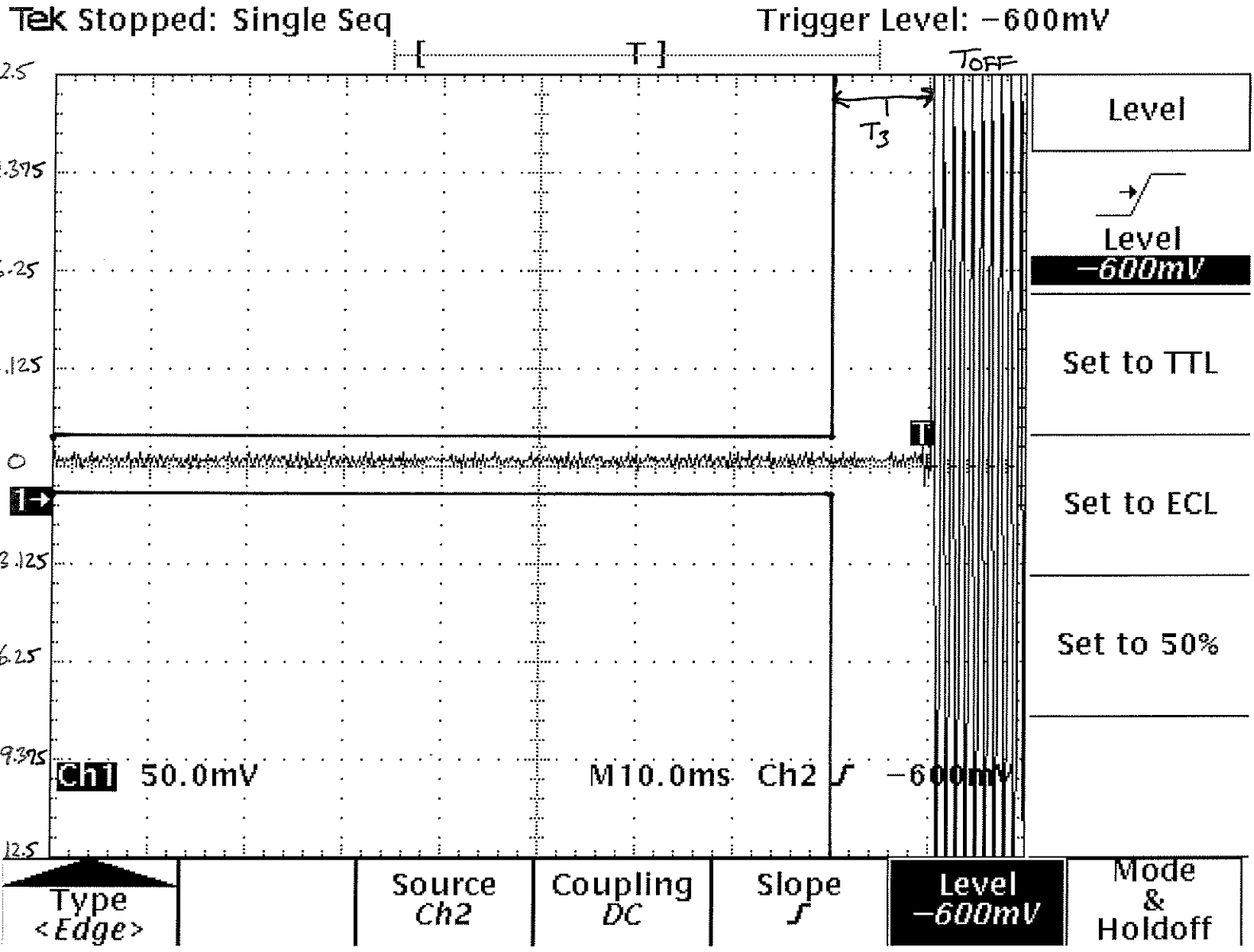
F_0 = 462MHz

Key ON

12.5 KHz Channel



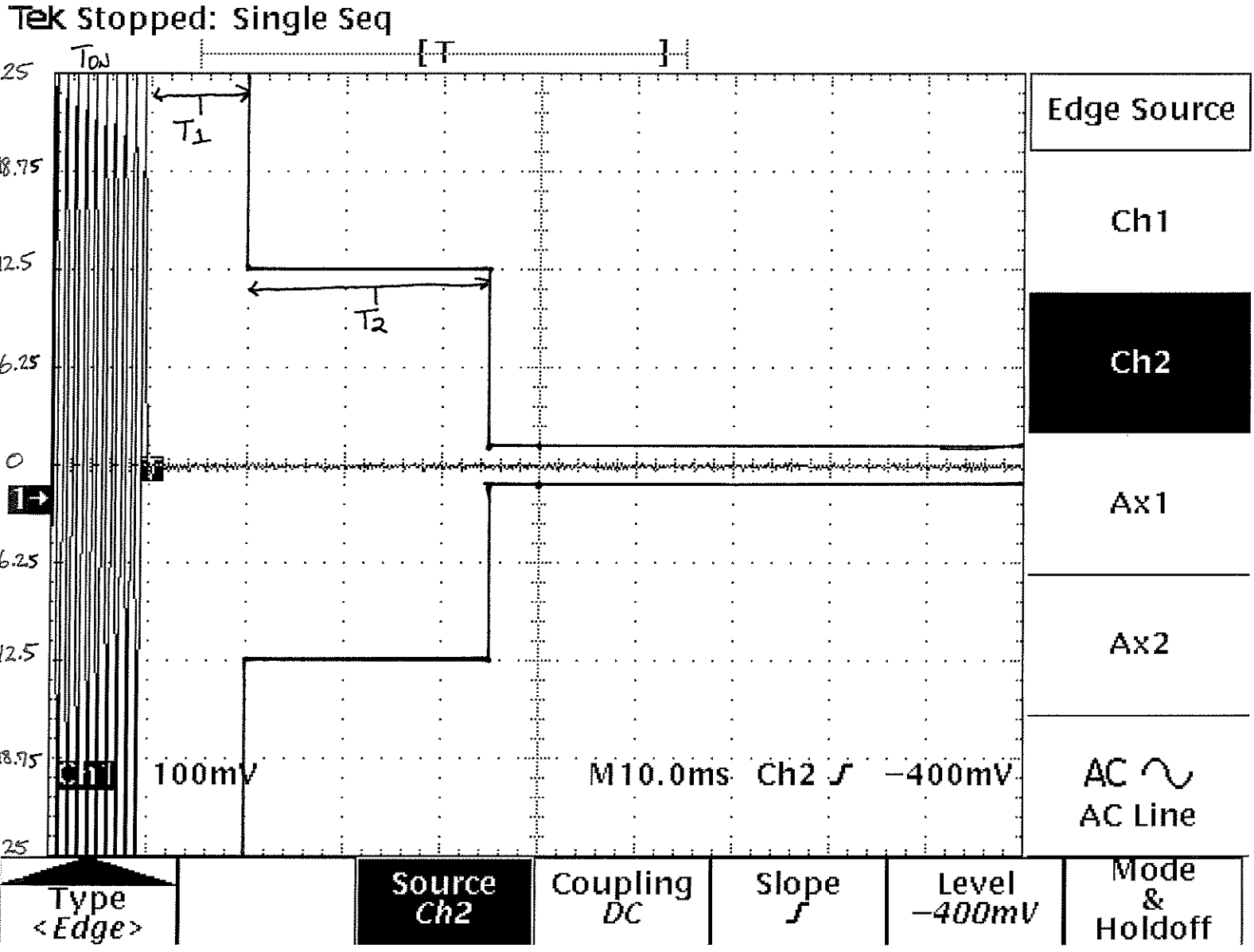
Fo= 420MHz
Key OFF
12.5KHz Channel



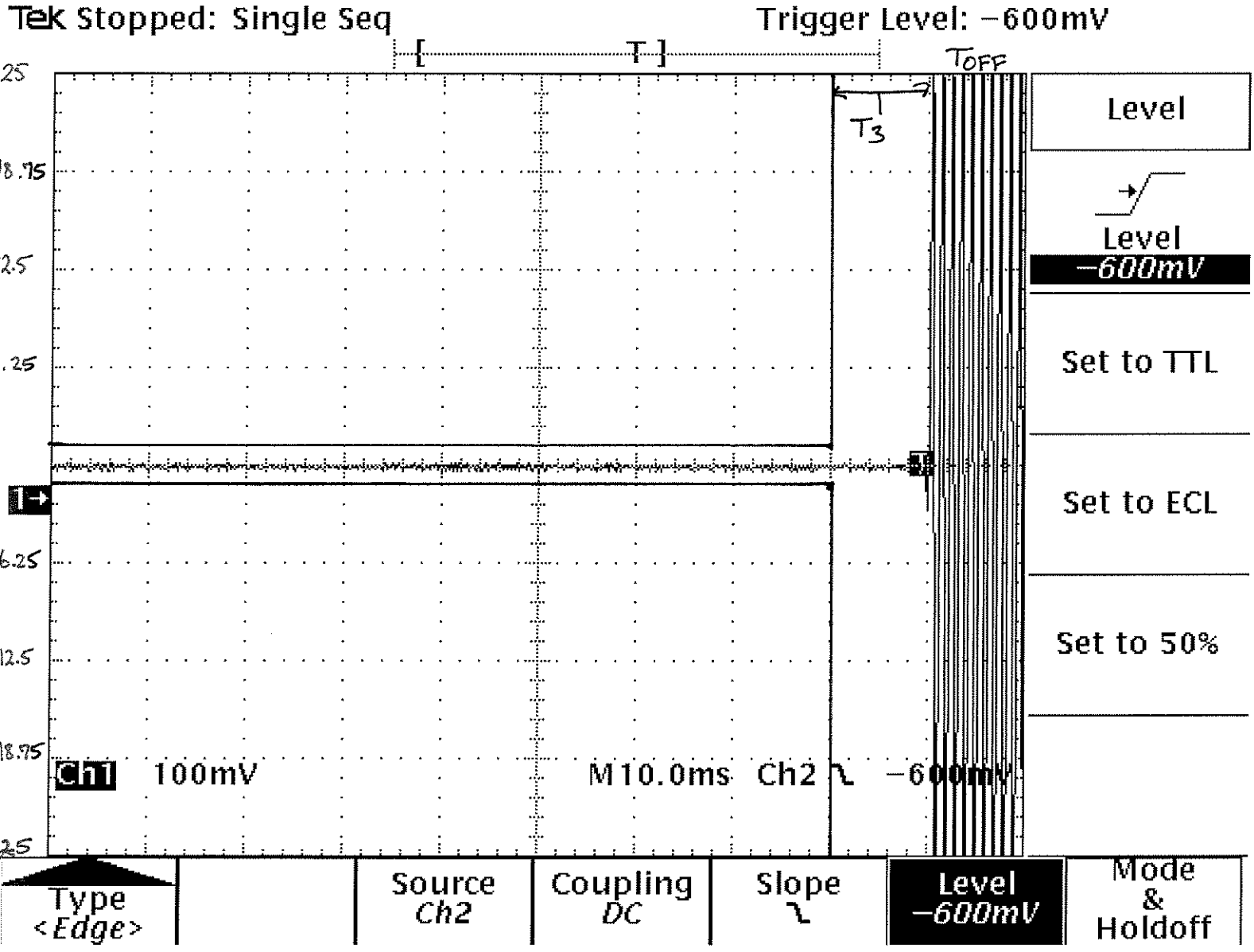
Fo = 420 MHz

Key on

25 kHz channel



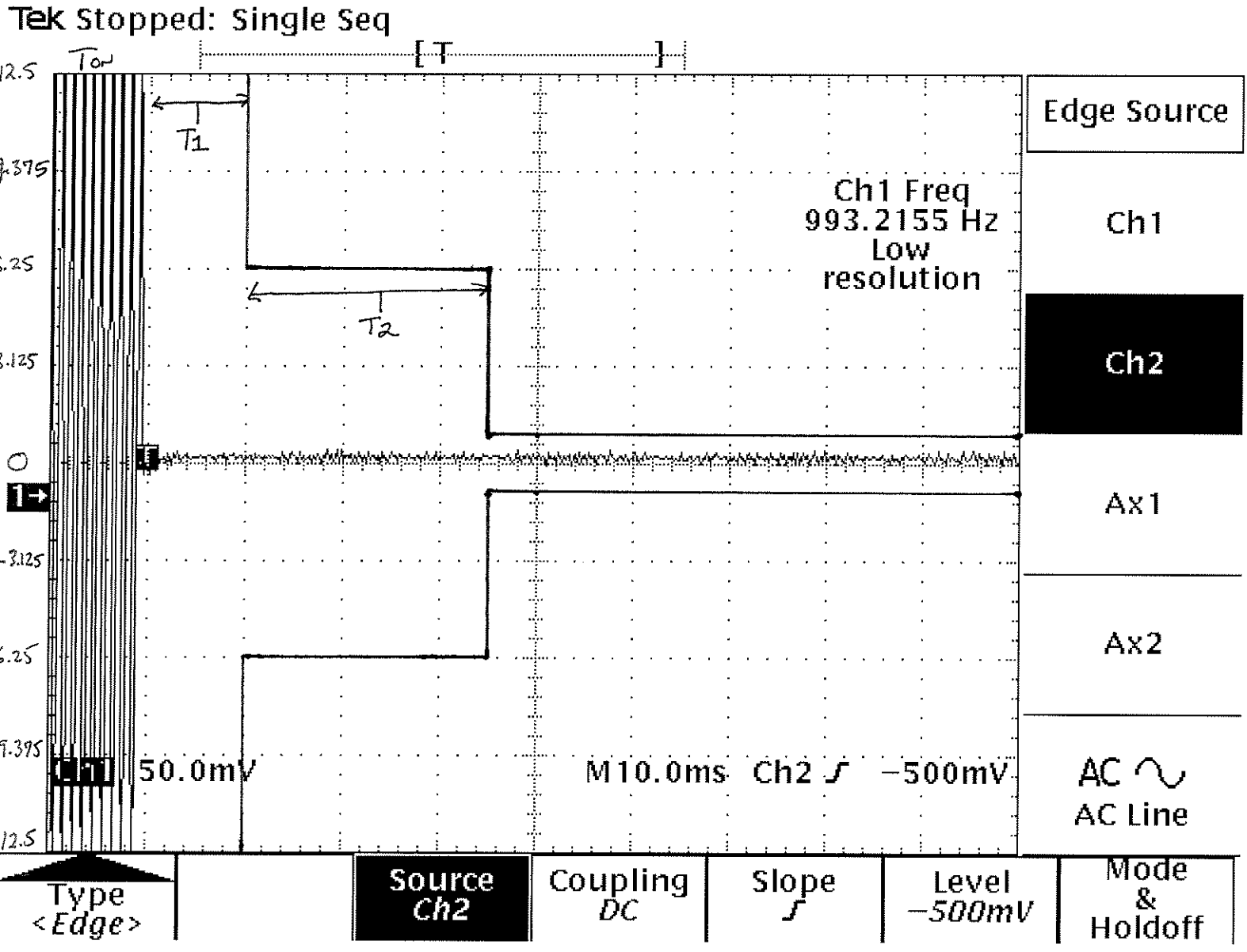
Fo = 420MHz
Key off
25KHz channel



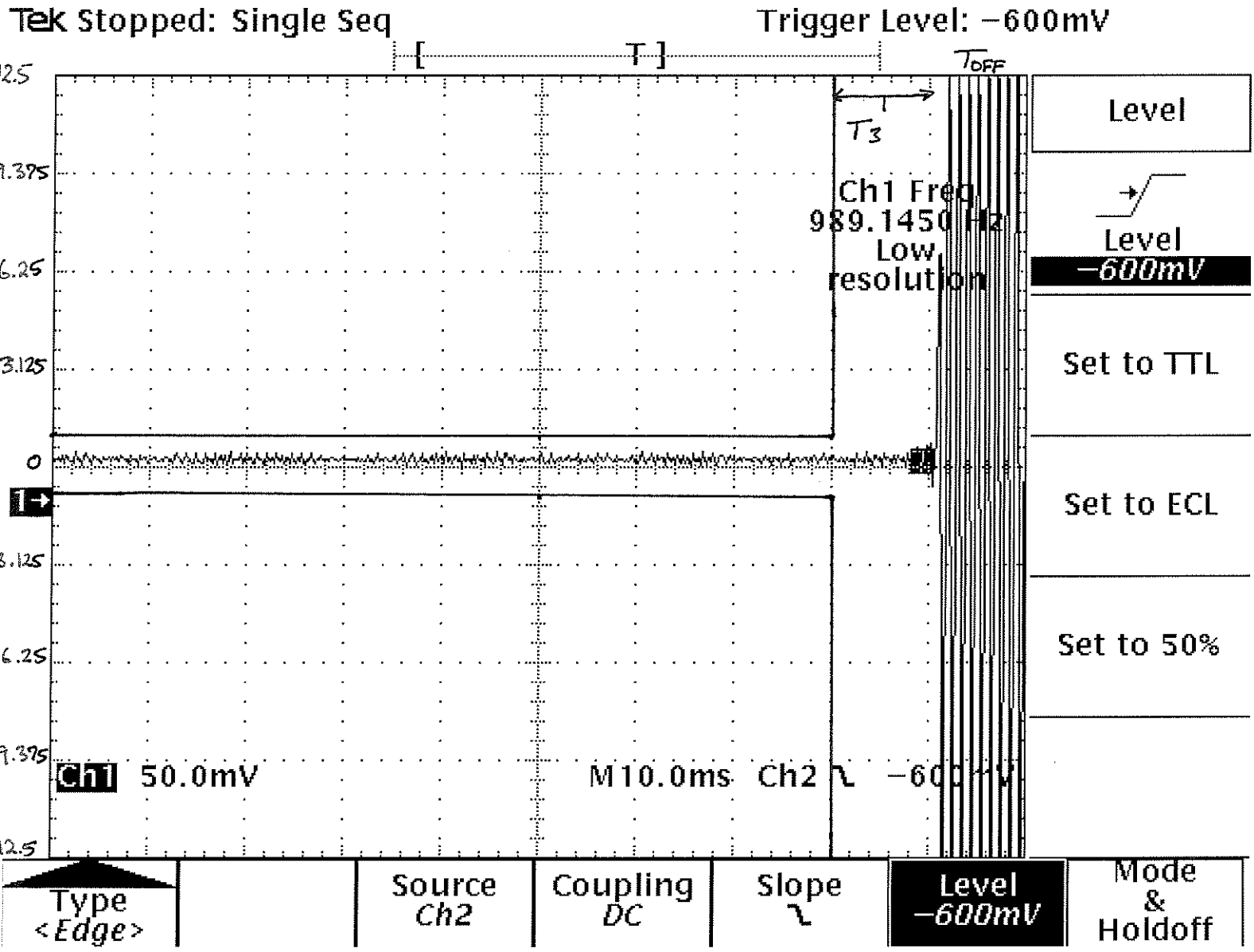
F_0 = 440 MHz

Key on

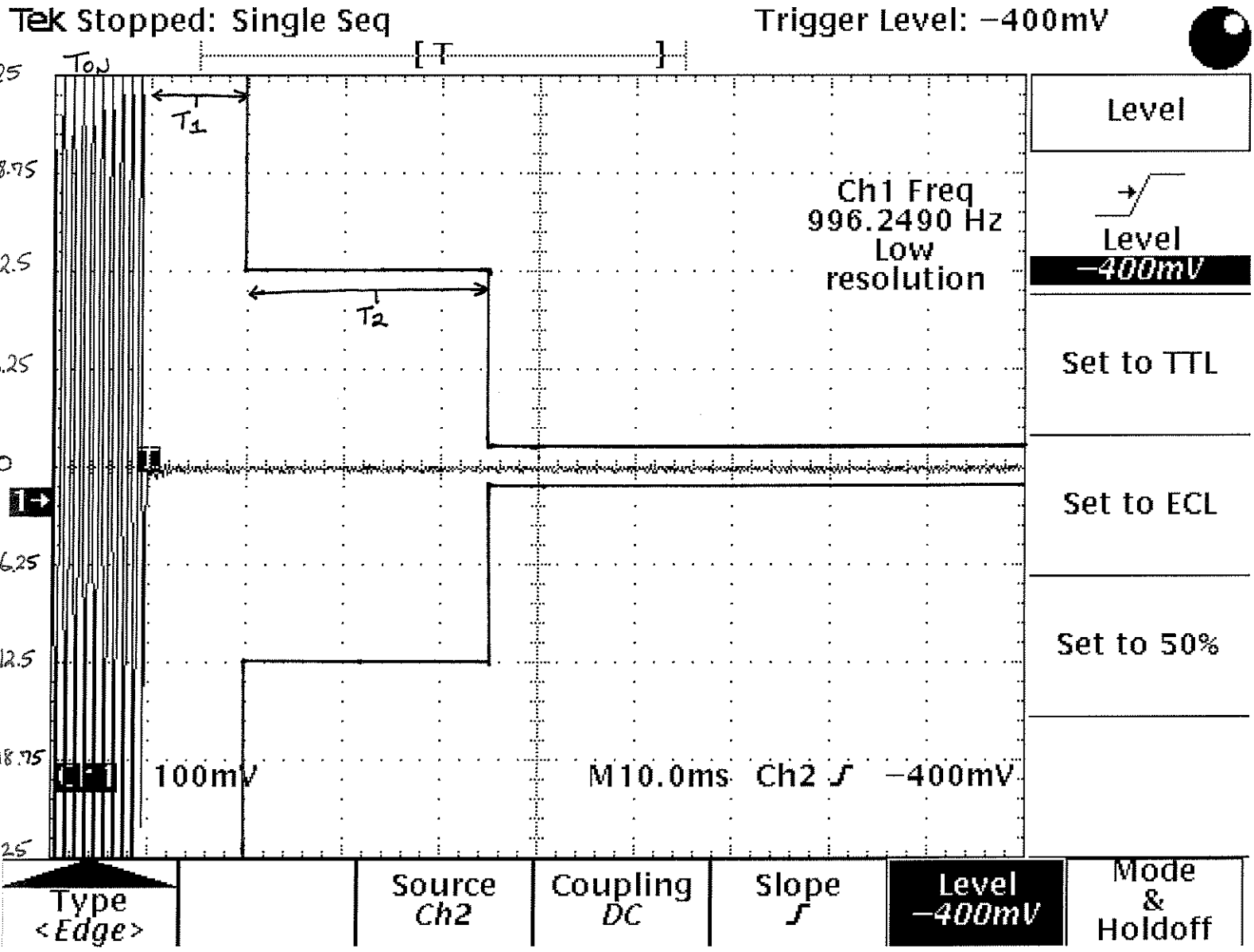
12.5 KHz channel



Fo= 440 MHz
Key OFF
12.5 channel



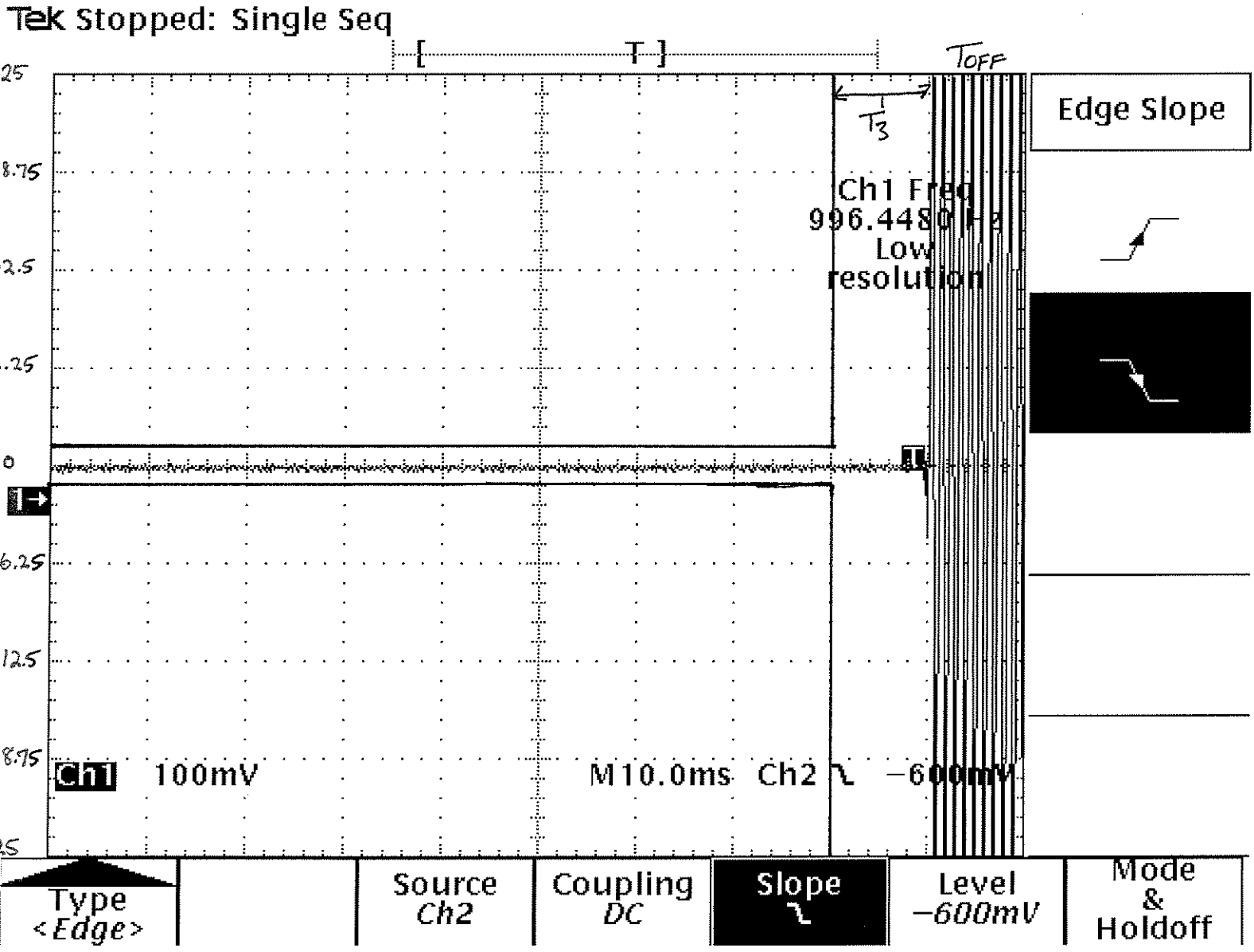
Fo: 440 MHz
Key on
25 kHz channel



F_o: 440MHz

Key Off

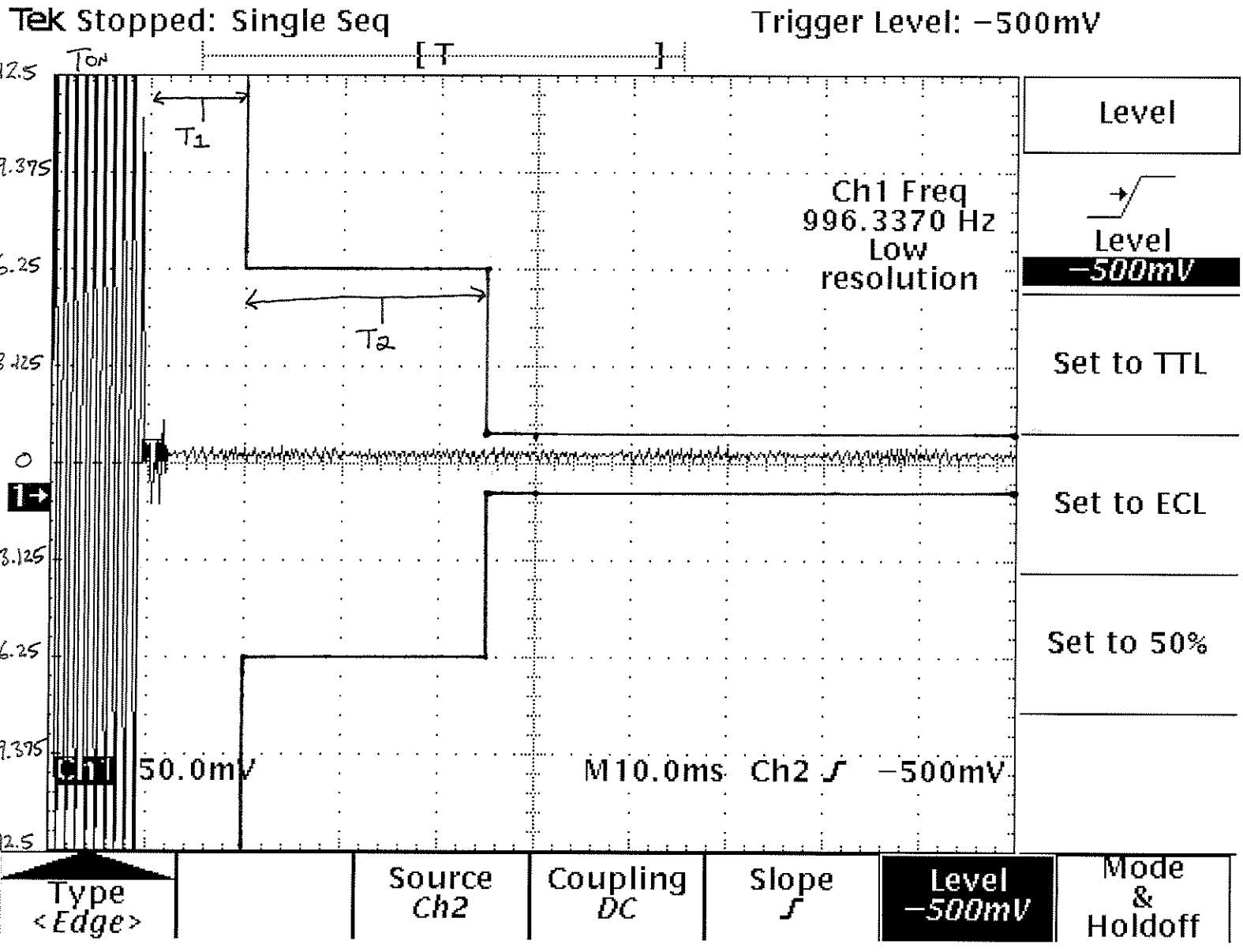
25KHz Channel



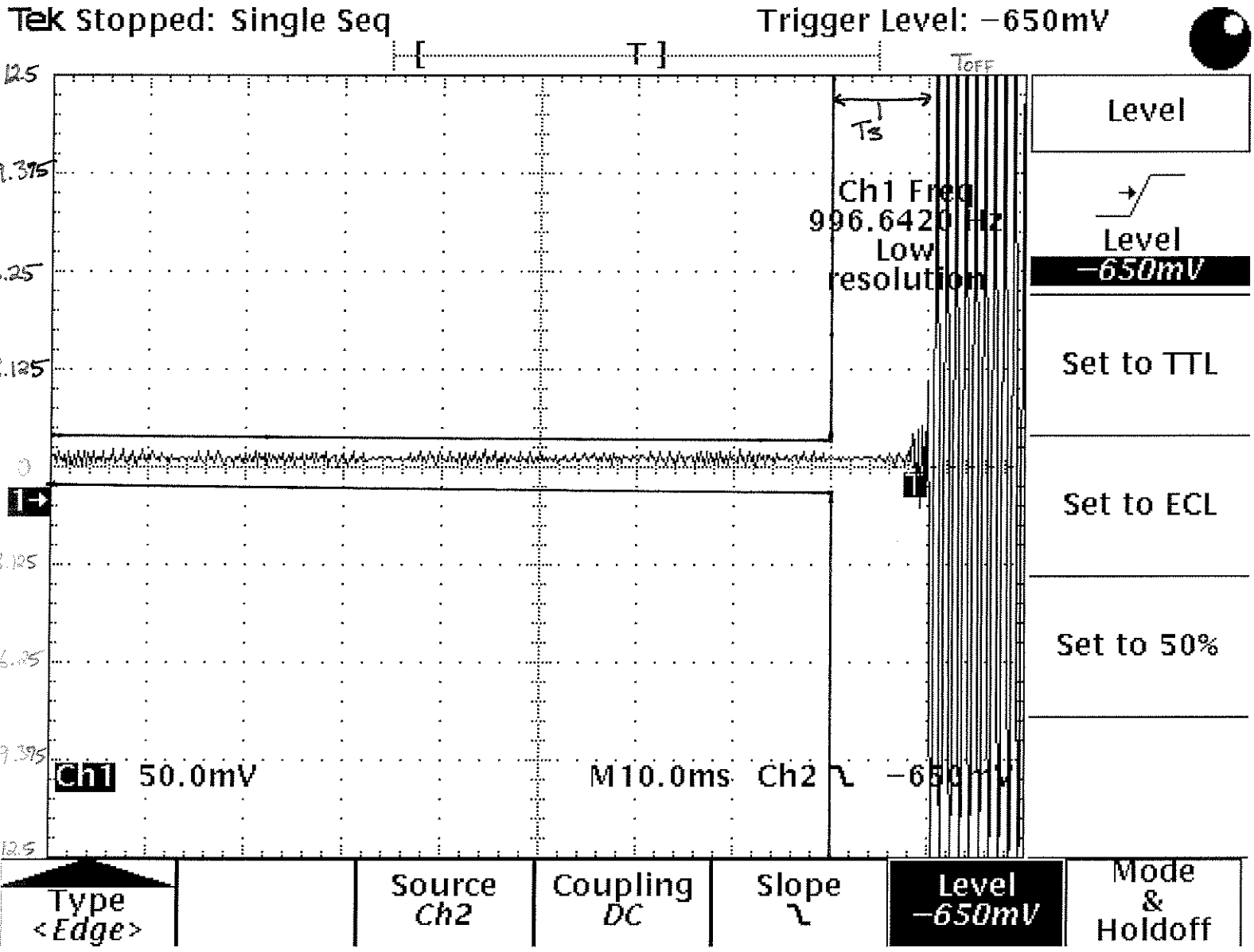
F_0 = 460 MHz

Key on

12.5 kHz channel



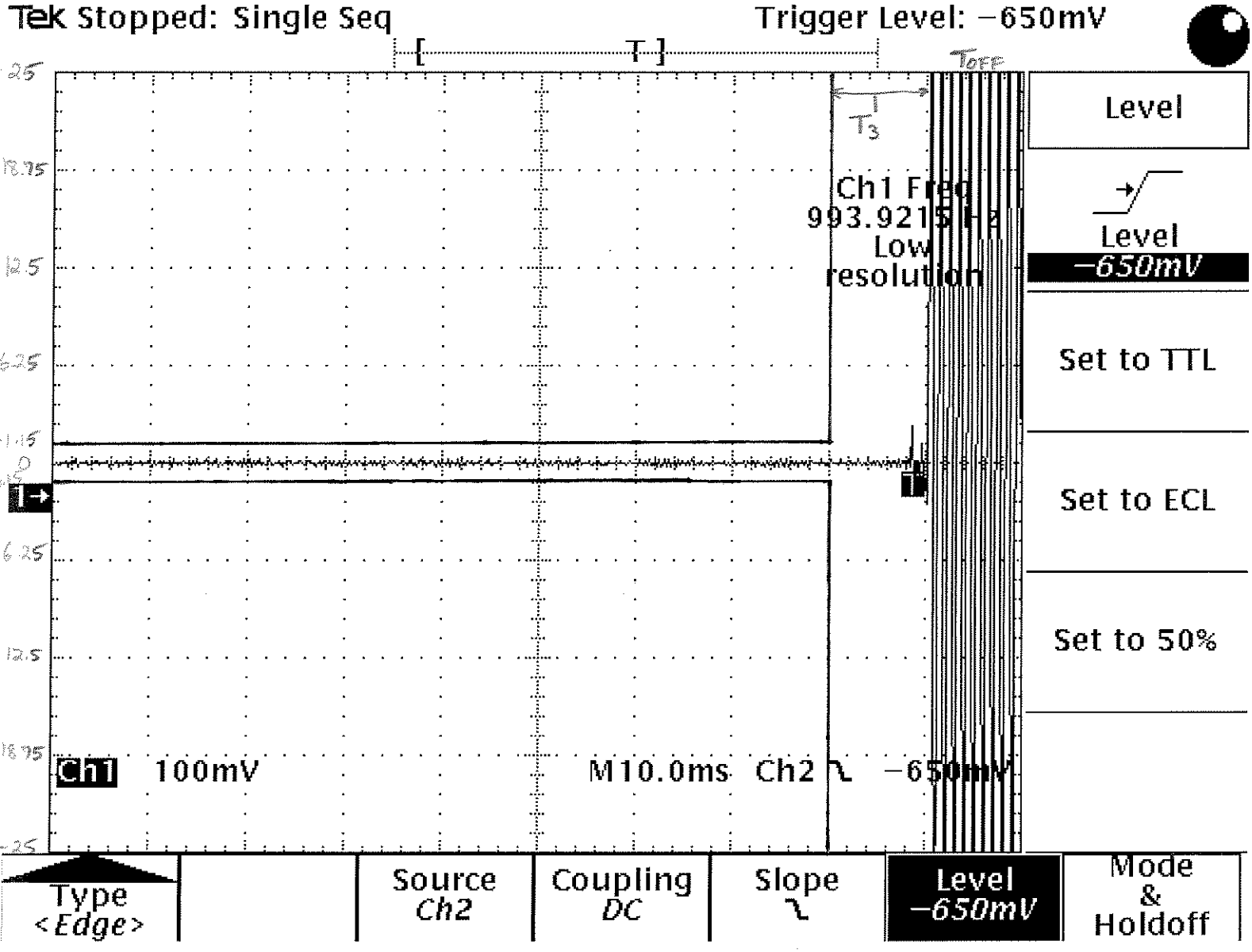
Fo= 460MHz
Key off
12.5KHz channel



F_0 = 460MHz

Trigger OFF
(Key)

25kHz channel



F_o = 460MHz

Trigger ON
(Key)

25KHz Channel

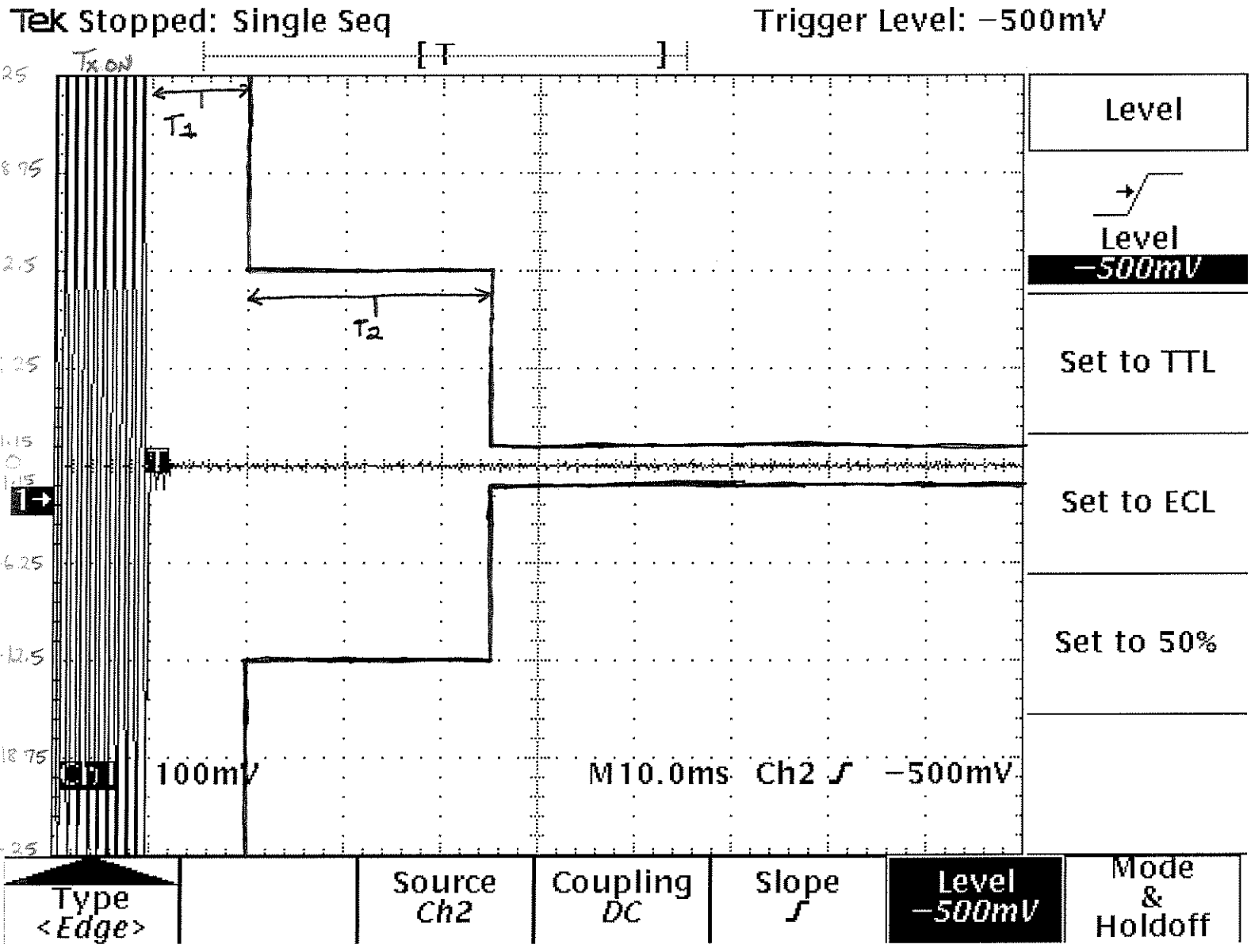


EXHIBIT 3: Test Configuration Photos

EXHIBIT 4: FCC ID Label and Label Location

EXHIBIT 5: Detailed Photographs

EXHIBIT 6: Schematics

EXHIBIT 7: Theory of Operation

EXHIBIT 8: User Manual

EXHIBIT 9: Block Diagram