MEASUREMENT/TECHNICAL REPORT

Company - Model: PinPoint
TAG-1001-02
FCC ID: OGK30011662001
March 22, 2000

Description: This is a report to support a request for an original grant of equipment authorization.

Equipment Type: Low Power Communications Device Transmitter (DXX)

Report prepared for:

PinPoint Corporation
One Fortune Drive
Billerica, MA 01821
Phone: (978) 901-0028
Fax: (978) 901-0050

Report prepared by:

Chad A. Bell
Curtis-Straus LLC
527 Great Road
Littleton, MA 01460 USA
Phone: 978-486-8880
FAX: 978-486-8828

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Letter of Agency

LETTER OF AGENCY

Agent's Authorization Letter

April 19, 1999

I, an officer of PinPoint Corporation, do hereby authorize, until further notice, Curtis-Straus LLC, of 527 Great Road, Littleton, MA, 01460, to act on behalf of PinPoint Corporation in dealings before the Federal Communications Commission with respect to all matters relating to equipment authorizations under 47 CFR. This authorization includes but is not limited to the signing of Form 731.

I certify that no party (as defined in 47 CFR 1.2002) to this application, including myself, is subject to a denial of federal benefits, that include FCC benefits, pursuant to section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C., 853A.

Certified by:

Colin Lanzl
Vice President of Engineering

19 April '99
Date

Introduction

This report is an application for Certification of a Transmitter operating pursuant to Part 15.249 of the FCC Rules, Code of Federal Regulations 47. The model number covered by this report is TAG-1001-02. This report is designed to demonstrate the compliance of this device with the requirements outlined in Part 15 of CFR 47 using the methods outlined in Part 2 of CFR 47. The current revision date, October 1,1998, of each Part has been used for technical requirements.

The confidential information and descriptions included in this application are detailed descriptions of the products, block diagrams, component specifications, and schematic diagrams. We hereby respectfully request under the provision of section 0.457d of the code that the documents listed below be held confidential.

Exhibit 6.1: Technical Descriptions and Block Diagrams

Exhibit 6.2: Schematics

Exhibit 6.3: Bill of Materials

PinPoint is requesting that the Technical Descriptions, Block Diagrams, Schematics and Bill of Materials be kept confidential in the FCC application because of the proprietary design developed by PinPoint that is unique to the industry.

EXHIBIT 1:

1.0 Statement of Conformity

The PinPoint 3D-*i*D Tag Model T30 TAG-1001-02 has been found to conform with the following parts of the 47 CFR as detailed below:

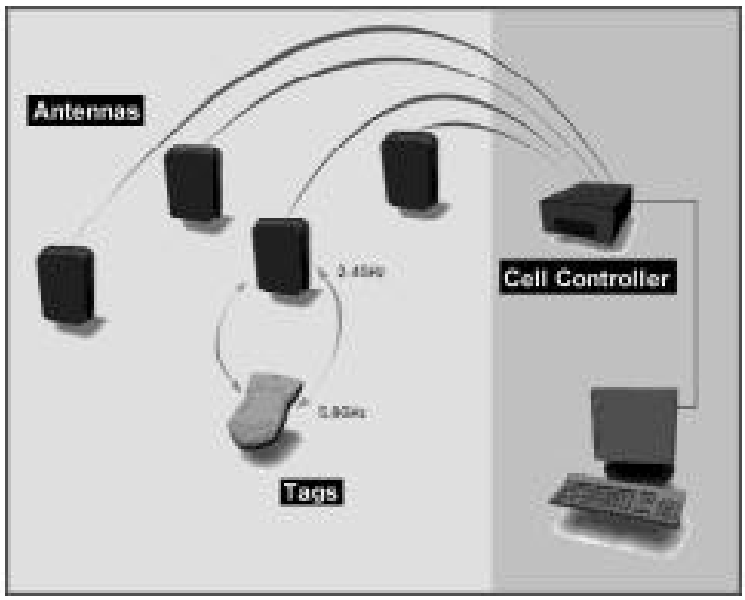
Part 2	Part 15	Comments
	15.15(b)	The product contains no user accessible controls that increase transmission power above allowable levels.
2.925	15.19	The label is shown in the label exhibit.
	15.21	Information to the user is shown in the instruction manual exhibit.
	15.27	No special accessories are required for compliance.
	15.203	The antenna is built into the board and there is no external antenna connection.
	15.205 15.209	The fundamental is not in a Restricted band and the spurious and harmonic emissions in the Restricted bands comply with the general emission limits of 15.209.
	15.207	The unit is battery powered without the capability of being recharged or operated from the AC mains.
	15.249(a)	The unit complies with the field strength limits of the 15.249(a) table including the 20dB peak restriction of 15.35(b) and 15.249(d).
	15.249(c)	The unit complies with the field strength limits of the 15.209(a) table.

EXHIBIT 2

2.0 General Description

2.1 Product Description

The 3D-*i*D Tag is a low cost RF device which transponds radio signals from the cell controller transmit antenna to the cell controller receive antenna. Additionally, it modulates tag information such as the tag ID onto the signal sent to the cell controller receive antenna. The Cell Controller broadcasts spread spectrum signals at 2.442GHz to the 3D-iD tags via its attached Antennas. It then measures the total time transpired until the return signals (at 5.80GHz) are received from the Tags. Using this information it calculates the distance the Tag is from the Antenna, called Tag Antenna Distance (TAD) data. The Cell Controller sends the TAD data it generates to the ViewPoint Software via a standard ethernet link. The software can, using TAD data from several antennas, accurately determine a Tag's location (Note: The 3D-iD cell controller is not included in this application).



Unit Tested
Model Number: TAG-1001-02
Serial Number: FCC 1

2.2 Related Submittal(s) Grants

There are no other approvals required for this device.

2.3 Test Methodology

Radiated emission 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 below 1 GHz, and at a distance of 3 or 1 meter(s) above 1 GHz. The actual test distance used is noted in the test data sheets. The device's performance was investigated to 40GHz. The EUT was powered by a DC power supply for all tests.

All other performance tests were made in accordance with the procedures outlined in Part 15 of CFR 47 with the expansion noted below. The applicable sections provided under Part 15 are provided in the measurement section of this report, Exhibit 3.

Discussion of CFR47 Part 15.249 Testing Procedure

The PinPoint 3D-*i*D tag is a low-power transponder. It accepts incoming signals in the 2400-2483.5 MHz band and shifts these signals to the 5725-5875 MHz band. The PinPoint 3D-*i*D cell controller emits a spread-spectrum signal in the 2400-2483.5 MHz band which is "reflected" by the tag, with some modifications (principally modulation of the tag ID) into the 5725-5875 MHz band. The cell controller then correlates the received signal to determine the tag location. For all legal Part 15.247 input signals, the tag conforms to the requirements of Part 15.249.

There is a possibility that signals present at and below 2367 MHz and at and above 2517 MHz will be seen and shifted in frequency by the tag. These frequencies translate to the band edges at 5725 MHz and 5875 MHz at the tag output. For these frequencies, there is not such a clear-cut definition of emitter power as for 2400-2483.5 MHz. To show conformance to the requirements of Part 15.249, we looked at the Part 2 allocations around these frequencies and found that the primary likely emitters are amateur radio below 2400 MHz and passive, non-transmitting astronomical use above 2483.5 MHz.

Power components at 2.4 GHz are expensive, so for amateur operation, an effective isotropic radiated power of 10 W is a top-end estimate of likely emission. PinPoint 3D-*i*D system installations will be within areas owned by private companies, which have typical separations to residences (likely amateur radio operators) of at least 100 feet. Following this reasoning, the search for tag outputs corresponding to input signals outside the ISM band proceeds with looking at the tag output with inputs corresponding to the likely worst-case emission from amateur radio operation at a distance of 100 feet.

It is difficult to provide the radiated signals necessary to excite the 3D-*i*D tag while still measuring the tag output on an open-air test site. To facilitate the testing process, a 3D-*i*D tag had the input antenna removed and an SMA connector installed at the input to the receive bandpass filter. This allowed the introduction of wired signals, both spread signals from PinPoint 3D-*i*D cell controllers and CW signals representing potential in-band and out-of-band emitters to the tag so the tag output could be examined for compliance to 15.249.

The determination of the input signal for the in-band signals was done as follows. The input signals were brought up in power from very low levels up to +10 dBm. The radiated measurement was made on a spectrum analyzer to read emissions in max hold thereby capturing the peak emission over the entire input power range of the tag, including with no input present.

For signals present outside the frequencies of 2400-2483.5 MHz, the input bandpass filter reduces the amplitude of the input sufficiently that the AGC is not operating (the tag sets the RF gain to the maximum value). This also represents the worst case for the out-of-band signals because any additional AGC gain

reduction also reduces the tag output signal. The test for compliance to 15.249 at the 5725-5875 MHz band edges then merely needs to be examination of the tag output for an input at 2367 MHz and below as well as 2517 MHz and above at a level into the tag corresponding to the scenario outlined above.

So, the input signal level at 2367 MHz will be the effective power 30 m from a 10 W isotropic radiator. This power level is:

$P_{rx} = P_{tx} – P_{path}$

P_{rx} = +40 dBm – (32.44 dB + 20 * log(f) + 20 * log(D)),

where f is expressed in GHz and D is expressed in meters.

Thus,

P_{rx} = +40 - (32.44 + 7.48 + 29.54) = -29.6 dBm

represents the isotropic power level impinging on the tag receive antenna. This signal experiences a gain of 4.6 dB from the tag Rx antenna, so the signal into the tag itself should be -25 dBm.

The test is performed as follows. A tag is supplied with the antenna removed and a connector installed at the input bandpass filter. A cable is then attached to this connector and to a signal generator set to a frequency of 2367 MHz and a level of –25 dBm. The output signal radiated from the tag is examined to determine if the radiated field strength at 3 m complies with the requirements of 15.249. This signal is then swept down in frequency to ensure that the tag signal rolls off. This procedure is then repeated with the signal generator set to 2517 MHz and –25.5 dBm (the frequency term in the path loss equation increases by 0.5 dB from 2367 MHz to 2517 MHz) and swept up.

It was determined that the highest in-band input level that the PinPoint 3D-*i*D Tag Model T30 TAG-1001-02 would see would be the output of the Cell Controller. The PinPoint 3D-*i*D Tag Model T30 TAG-1001-02 in-band input level was found to be +10dbm when placed against the antenna of the cell controller. We tested the PinPoint 3D-*i*D Tag Model T30 TAG-1001-02 with the input level set to +17dbm, due to equipment limitations, and showed that the PinPoint 3D-*i*D Tag Model T30 TAG-1001-02 passes with the input level set to significantly higher than it will typically receive.

2.4 Test Facility

Curtis-Straus LLC
All testing for the range 30–26500MHz was performed at Curtis-Straus (NVLAP Lab Code: 200057-0). The open area test site used to collect the radiated data is located at 527 Great Road, Littleton, MA 01460. Site “F” was used. This test facility have been fully described in a report submitted to your office, and a letter from your office dated February 28, 1997 verified receipt of the report and confirmed compliance of the site. Please reference your file # 31040/SIT 1300F2 should you have any questions regarding the test site construction.

Chomerics Test Service
All testing for the range 26500-40000MHz was performed at Chomerics Test Service (NVLAP Lab Code: 100296-0). Chomerics’ Open Area Test Site "A" is located in the lower parking lot attached to the Seeger Building at Chomerics, 84 Dragon Court, Woburn, Massachusetts. The Open Area Test Site “A” enclosure is a wooden structure measuring 56 x 30 x 25 feet in size with galvanized steel sheet metal used as the ground plane. The structure used to support equipment under test is an EMCO 4 foot diameter motorized turntable. For tabletop equipment, a wooden table measuring 1.5 x 1 meter in size is positioned at the center of the turntable, at the proper height above the ground plane. The area at the end of the Open Area Test Site “A” is the location for the test personnel and equipment to ensure they are outside the imaginary ellipse. This Site is listed with the Federal Communications Commissions (FCC).

2.5 Test Equipment Used

Curtis- Straus

SPECTRUM ANALYZERS					
X	**Analyzer**	**Model No.**	**Company**	**Serial No.**	**Calibration Due**
X	**GREEN** 9kHz-26.5GHz	8593E	HP	3829A03618	04-OCT-2000

OPEN AREA TEST SITES (OATS)					
X	**Site**	**FCC Code**	**IC Code**	**VCCI Code**	**Calibration Due**
X	**"F"** Florida	90527	IC 2762-F	R-468/ C-480	04-JUN-2000

ANTENNAS					
X	**Antenna**	**Model No.**	**Company**	**Serial No.**	**Calibration Due**
X	**RED** Bilog: 30MHz-1GHz	3143	EMCO	1270	27-MAY-2000
X	**BLUE** Bilog: 30MHz-1GHz	3143	EMCO	1271	27-MAY-2000
X	**YELLOW** Horn: 1-18GHz	3115	EMCO	9608-4898	10-MAR-2000
X	**BLACK** Horn: 1-18GHz	3115	EMCO	9703-5148	26-APR-2000
X	**WHITE** Std Gain Horn: 18-26.5GHz	3160-09	EMCO	9610-1068	05-MAY-2000

PREAMPLIFIERS					
X	**Preamplifier**	**Model No.**	**Company**	**Serial No.**	**Calibration Due**
X	**BLUE-BLACK** 0.01-2000MHz	ZFL-1000-LN	MiniCircuits/ C-S	n/a	19-OCT-2000
X	**WHITE** 2-18GHz	SMC-12A	MITEQ	426643	19-OCT-2000
X	**YELLOW-BLACK** 1-20GHz	SMC-12A	MITEQ	535055	17-OCT-2000
X	**YELLOW** 18-26.5GHz	AFS4-18002650-60-8P-4	MITEQ	467559	16-JUN-2000

METEOROLOGICAL METERS					
X	**Meter**	**Model No.**	**Company**	**Serial No.**	**Calibration Due**
X	**TEMPERATURE /HUMIDITY GAUGE**	TH300	Dickson	9044101	13-MAR-2000
X	**ATMOSPHERIC PRESSURE GAUGE**	BA928	Oregon Scientific	C3166-1	14-JUL-2000

Unless otherwise noted the calibration interval is one year. All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.

Chomerics Test Service

HP 8566B Spectrum Analyzer	S/N: 2637A04064	Calibration Due: 10-JAN-2000
HP 11974-60028 Preselector	S/N: 00126	Calibration Due: 13-MAY-2000
HP 11975A Amplifier	S/N: 2738A01696	Calibration Due: UWC
HP 11970K Harmonic Mixer	S/N: 3003A02298	Calibration Due: UWC
HP 11794A Preselector RF Section	S/N: 3001A6019	Calibration Due: UWC
HP 1197-60028 Power Supply	S/N: 00126	Calibration Due: n/a
Eaton 94276-1	S/N: 5767-002	Calibration Due: 13-MAY-2000

(UWC = use with calibrated equipment)

EXHIBIT 3

3.0 Measurement Results

3.1 Operating Frequency

This device operates at 5800.0 MHz.

3.2 Electric Field Strength Radiation Measurements

Radiated Emissions Table — *Curtis-Straus LLC*

Date: 28-Feb-00 **Company:** PinPoint **Table** 1
Engineer: Chad A. Bell **EUT Desc:** Tag **Work Order:** EA0440

Frequency Range: 1-18Ghz **Measurement Distance:** 3 m

Notes: Final configuration with input power level set to +17dbm
Tag harmonics and band edge scan **EUT Max Freq:** 5.8Ghz

Antenna Polarization (H / V)	Frequency (MHz)	Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Duty Cycle Factor	Adjusted Reading (dBµV/m)	--- Limit (dBµV/m)	--- Margin (dB)	--- Result (Pass/Fail)	FCC Part 15 Sec 15.249 Limit (dBµV/m)	FCC Part 15 Sec 15.249 Margin (dB)	FCC Part 15 Sec 15.249 Result (Pass/Fail)
Tag TX Clock Harmonics													
H	5800.0	79.0	19.8	36.9	1.7	20.0	77.8	---	---	---	93.97	-16.2	Pass
H	11600.0	46.0	16.1	40.6	2.5	20.0	53.0	---	---	---	54.0	-1.0	Pass
H	17400.0	37.4	16.6	44.4	3.1	20.0	48.3	---	---	---	54.0	-5.7	Pass
Tag TX Band Edge Readings at Fundamental - Continuous Wave													
H	5725.0	35.5	19.8	36.9	1.7	20.0	34.3	---	---	---	54.0	-19.7	Pass
H	5875.0	37.3	19.7	36.9	1.7	20.0	36.2	---	---	---	54.0	-17.8	Pass
Tag TX Peak and Band Edge Readings at Fundamental - Spread Source set at +17dbm													
H	5800.0	70.5	19.8	36.9	1.7	20.0	69.3	---	---	---	93.97	-24.7	Pass
H	5725.0	43.8	19.8	36.9	1.7	20.0	42.6	---	---	---	54.0	-11.4	Pass
H	5875.0	44.8	19.7	36.9	1.7	20.0	43.7	---	---	---	54.0	-10.3	Pass

Table Result: Pass by -1.0 dB ***Worst Freq:*** 11600.0 MHz

Test Site: "F" **Pre-Amp:** White **Cable:** 3m Sucoflex **Analyzer:** Green **Antenna:** Yellow Horn

Radiated Emissions Table — *Curtis-Straus LLC*

Date: 28-Feb-00 **Company:** PinPoint **Table** 2
Engineer: Chad A. Bell **EUT Desc:** Tag **Work Order:** EA0440

Frequency Range: 18-26.5Ghz **Measurement Distance:** 1 m

Notes: Final configuration with input power level set to +17dbm
Tag harmonics and band edge scan **EUT Max Freq:** 5.8Ghz

Antenna Polarization (H / V)	Frequency (MHz)	Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Duty Cycle Factor	Adjusted Reading (dBµV/m)	--- Limit (dBµV/m)	--- Margin (dB)	--- Result (Pass/Fail)	FCC Class B Limit (dBµV/m)	FCC Class B Margin (dB)	FCC Class B Result (Pass/Fail)
H	23200.0	37.5	0.0	40.4	0.0	20.0	57.9	---	---	---	63.5	-5.6	Pass

Table Result: Pass by -5.6 dB ***Worst Freq:*** 23200.0 MHz

Test Site: "F" **Pre-Amp:** none **Cable:** n/a **Analyzer:** Green **Antenna:** High F Horn

Radiated Emissions Table

Curtis-Straus LLC

Date: 16-Mar-00 **Company:** PinPoint **Table**
Engineer: Chad A. Bell **EUT Desc:** Tag T30 **Work Order:** EA0440

Frequency Range: 26.5-40.0Ghz **Measurement Distance:** 1 m

Notes: Scan from 26.5-40.0Ghz as performed by Chomerics **EUT Max Freq:** 5.8Ghz

Antenna Polarization (H / V)	Frequency (MHz)	Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Duty Cycle Factor	Adjusted Reading (dBµV/m)	--- Limit (dBµV/m)	--- Margin (dB)	--- Result (Pass/Fail)	FCC Class B Limit (dBµV/m)	FCC Class B Margin (dB)	FCC Class B Result (Pass/Fail)
nf	29000.0	42.1	0.0	37.1	0.0	20.0	59.2	---	---	---	63.5	-4.3	Pass
nf	34800.0	42.3	0.0	36.8	0.0	20.0	59.1	---	---	---	63.5	-4.4	Pass

Table Result: Pass by -4.3 dB ***Worst Freq:*** 29000.0 MHz

Test Site: "A" **Pre-Amp:** n/a **Cable:** Flexible Waveguide **Analyzer:** 8566B **Antenna:** Horns

Radiated Emissions Table

Curtis-Straus LLC

Date: 28-Feb-00 **Company:** PinPoint **Table** 4
Engineer: Chad A. Bell **EUT Desc:** Tag **Work Order:** EA0440

Frequency Range: 30-26.5GHz **Measurement Distance:** 3 m

Notes: Final configuration with input power level set to +17dbm **EUT Max Freq:** 5.8Ghz
Final spurious scan

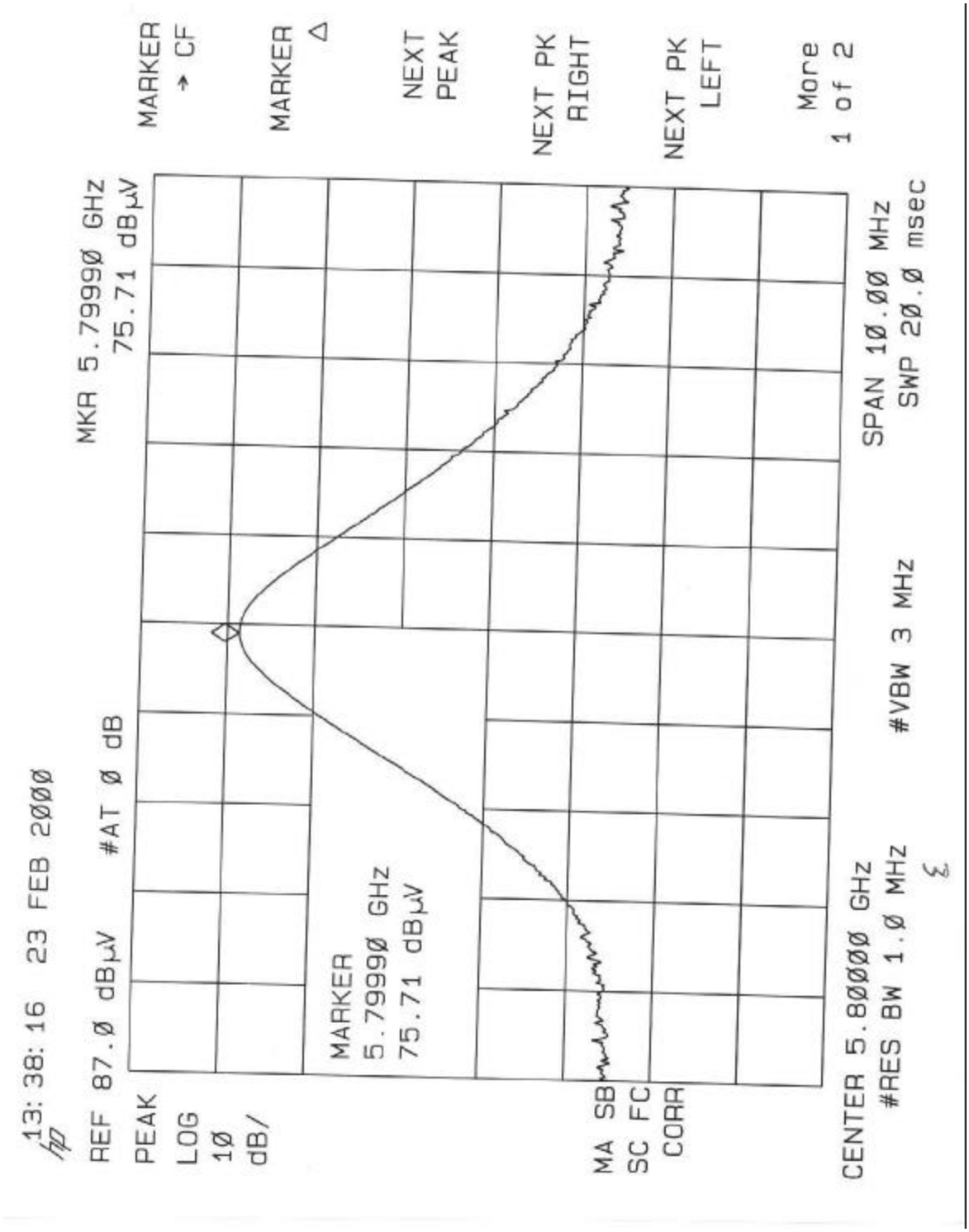
Antenna Polarization (H / V)	Frequency (MHz)	Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Duty Cycle Factor	Adjusted Reading (dBµV/m)	--- Limit (dBµV/m)	--- Margin (dB)	--- Result (Pass/Fail)	FCC Class B Limit (dBµV/m)	FCC Class B Margin (dB)	FCC Class B Result (Pass/Fail)
V	39.0	45.3	23.3	10.4	0.5	0.0	32.9	---	---	---	40.0	-7.1	Pass
V	122.8	44.1	23.3	7.3	1.0	0.0	29.1	---	---	---	43.5	-14.4	Pass
V	125.8	44.1	23.3	7.7	1.1	0.0	29.6	---	---	---	43.5	-13.9	Pass
V	134.8	43.8	23.3	8.9	1.1	0.0	30.5	---	---	---	43.5	-13.0	Pass
V	164.8	39.5	23.3	9.5	1.3	0.0	27.0	---	---	---	43.5	-16.5	Pass
V	212.6	38.2	23.3	11.0	1.6	0.0	27.5	---	---	---	43.5	-16.0	Pass
H	1679.0	47.9	18.8	27.8	1.1	20.0	38.0	---	---	---	54.0	-16.0	Pass
H	3358.0	58.6	20.1	33.0	1.3	20.0	52.8	---	---	---	54.0	-1.2	Pass
H	4884.0	44.1	20.0	36.0	1.5	20.0	41.6	---	---	---	54.0	-12.4	Pass
H	5037.0	48.3	20.0	36.3	1.6	20.0	46.2	---	---	---	54.0	-7.8	Pass
H	6716.0	50.8	18.6	37.4	1.8	20.0	51.4	---	---	---	54.0	-2.6	Pass
H	11600.0	46.0	16.1	40.6	2.5	20.0	53.0	---	---	---	54.0	-1.0	Pass
H	17400.0	37.4	16.6	44.4	3.1	20.0	48.3	---	---	---	54.0	-5.7	Pass

Table Result: Pass by -1.2 dB ***Worst Freq:*** 3358.0 MHz

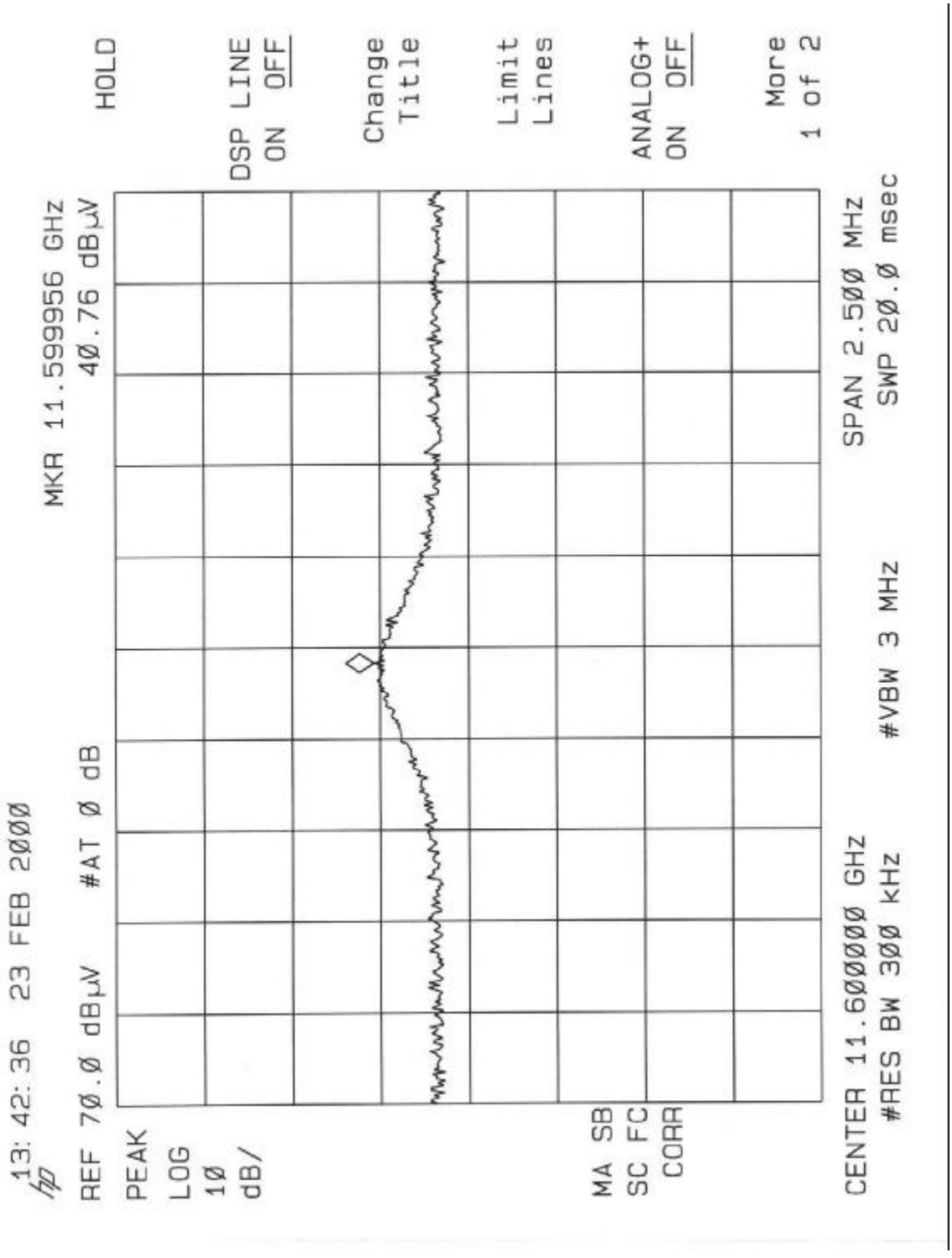
Test Site: "F" **Pre-Amp:** Blue-Blk **Cable:** 65 ft RG8A/U **Analyzer:** Green **Antenna:** Red

Emissions Plots:

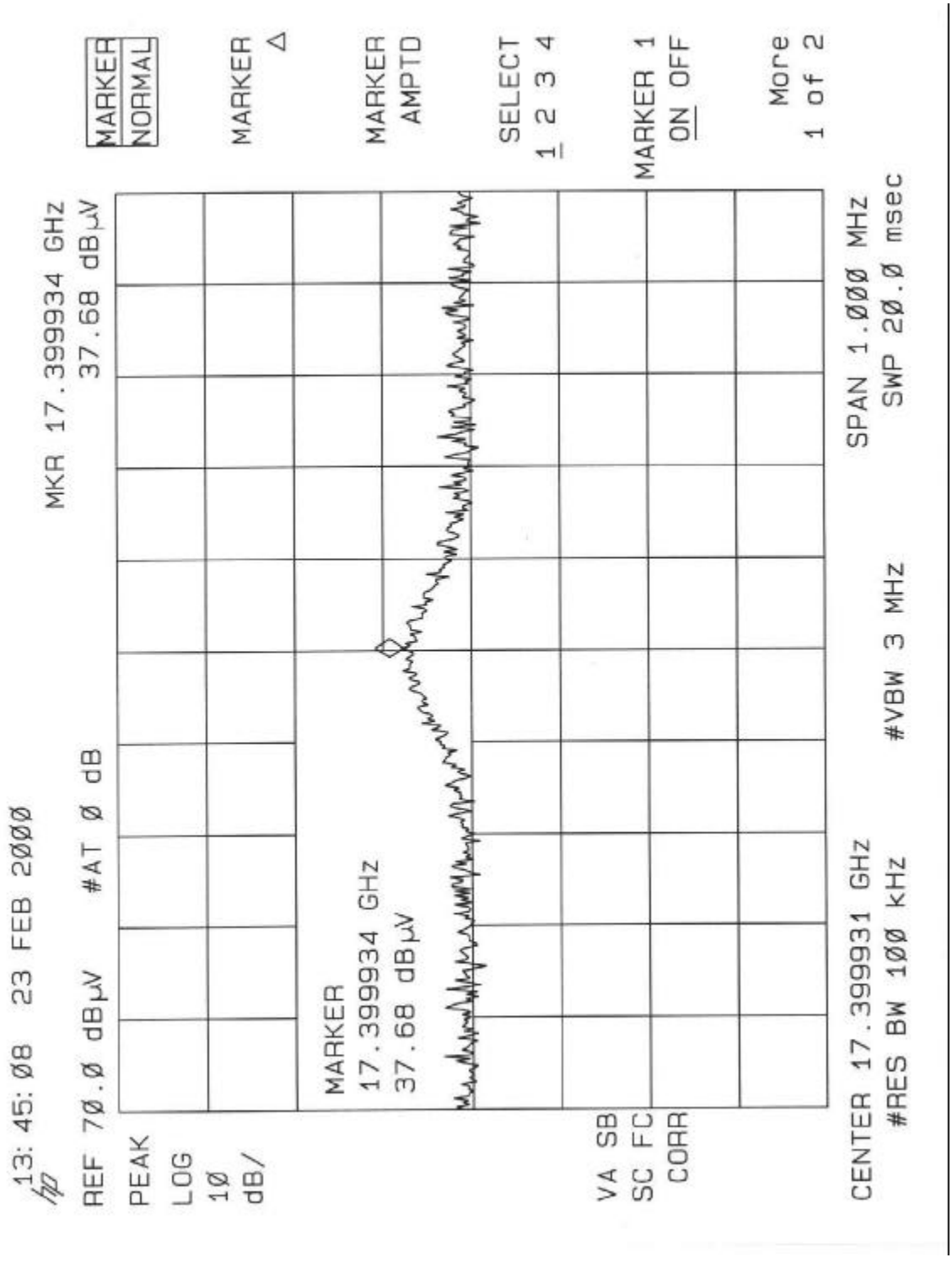
Fundamental



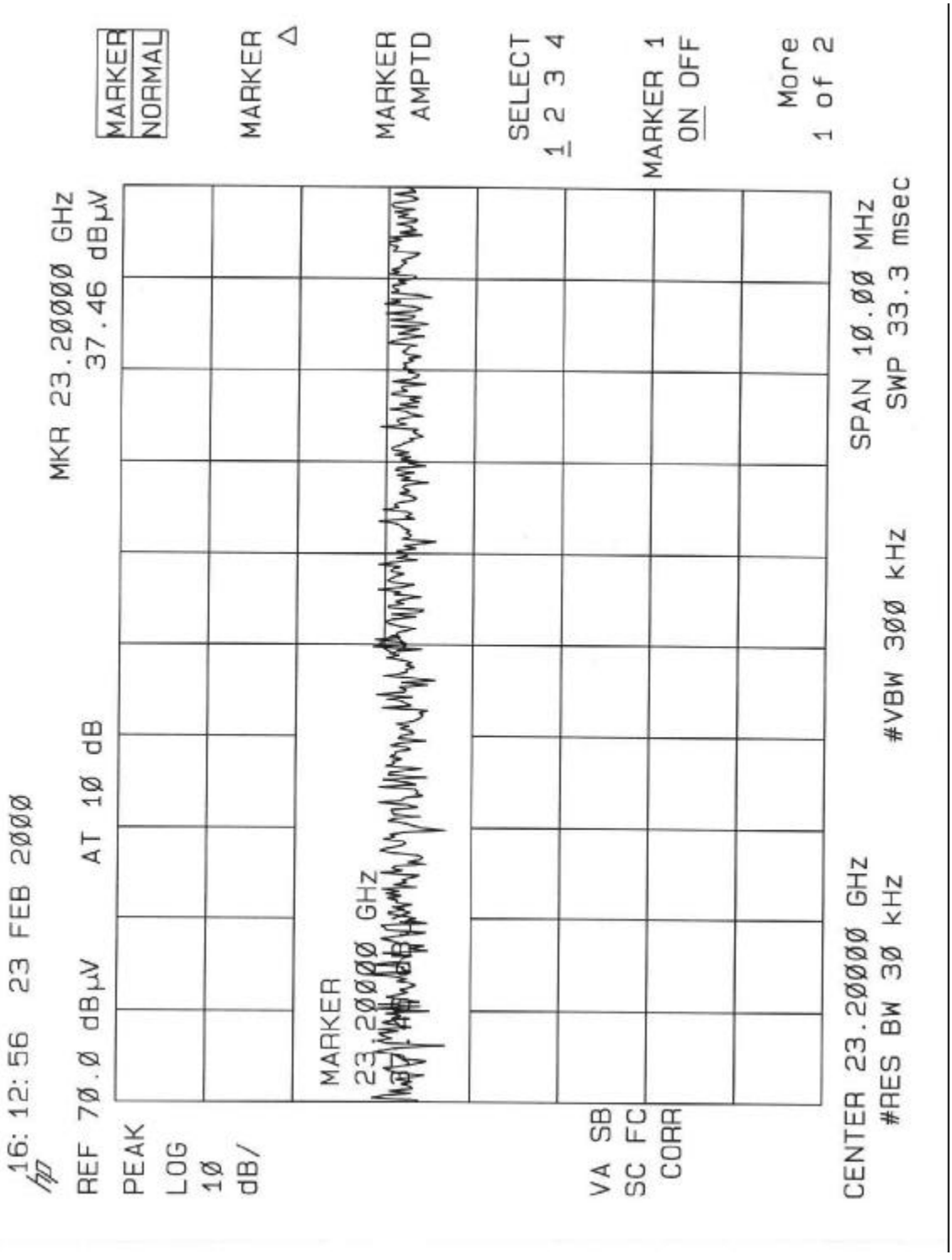
2nd Harmonic



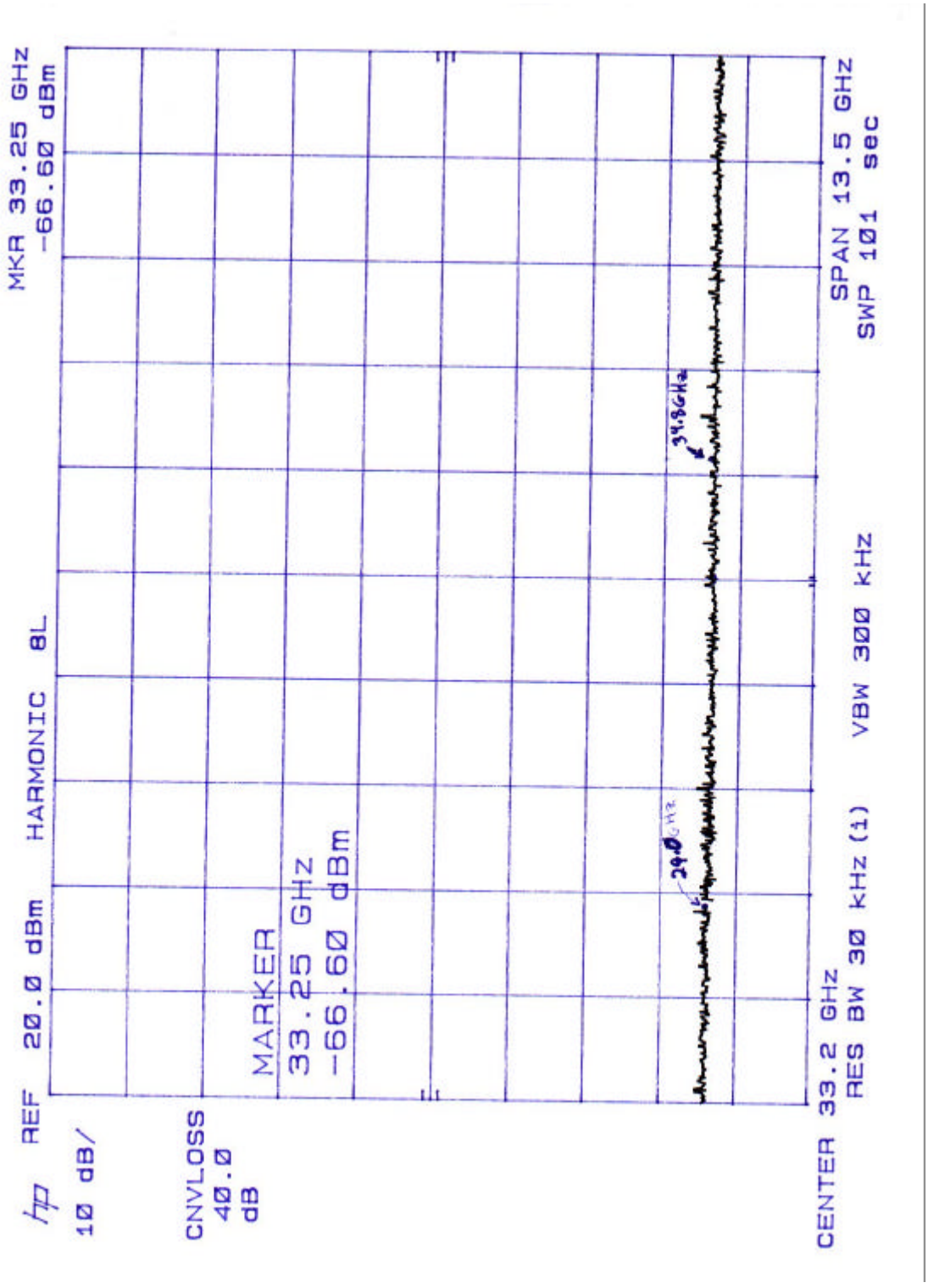
3rd Harmonic



4th Harmonic



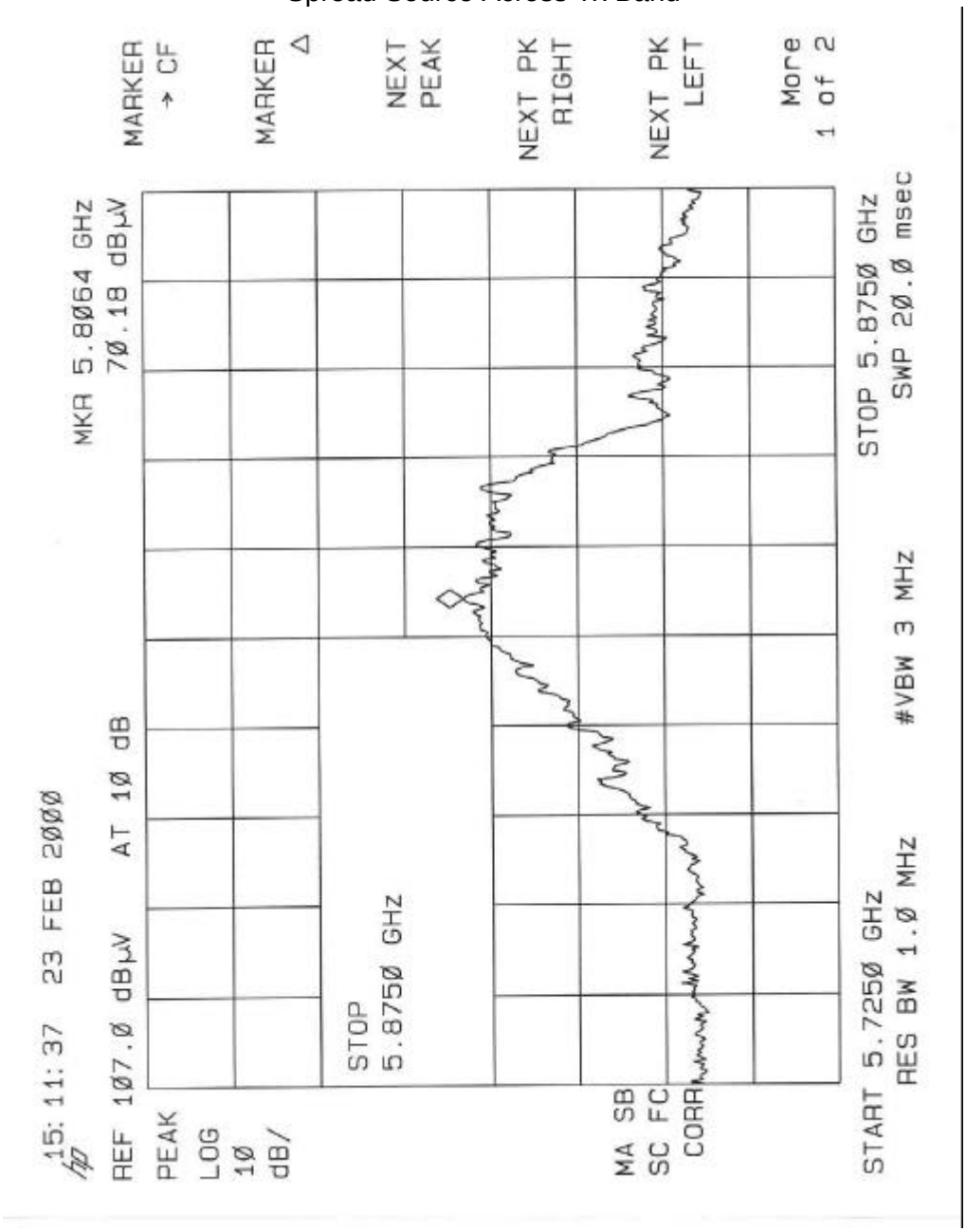
5th and 6th Harmonic



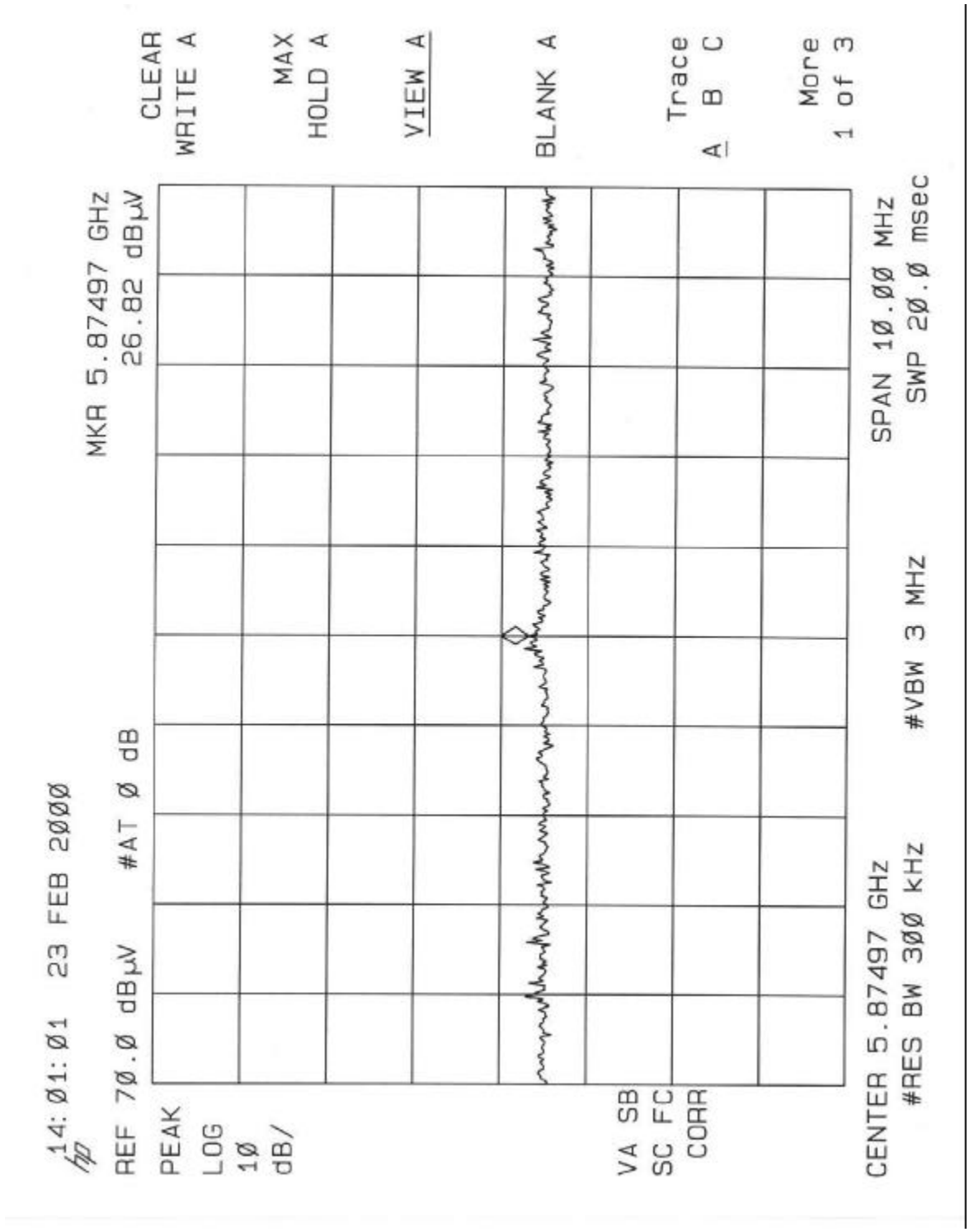
3.3 Occupied Bandwidth Measurements

In order to obtain accurate restricted band intrusion measurements, plots were obtained with the unit operating with a continuous wave source and a spread source. As shown in the plots below and the table in section 3.2, the Tag meets all bandwidth requirements (all components are within the 15.249 5.8GHz band).

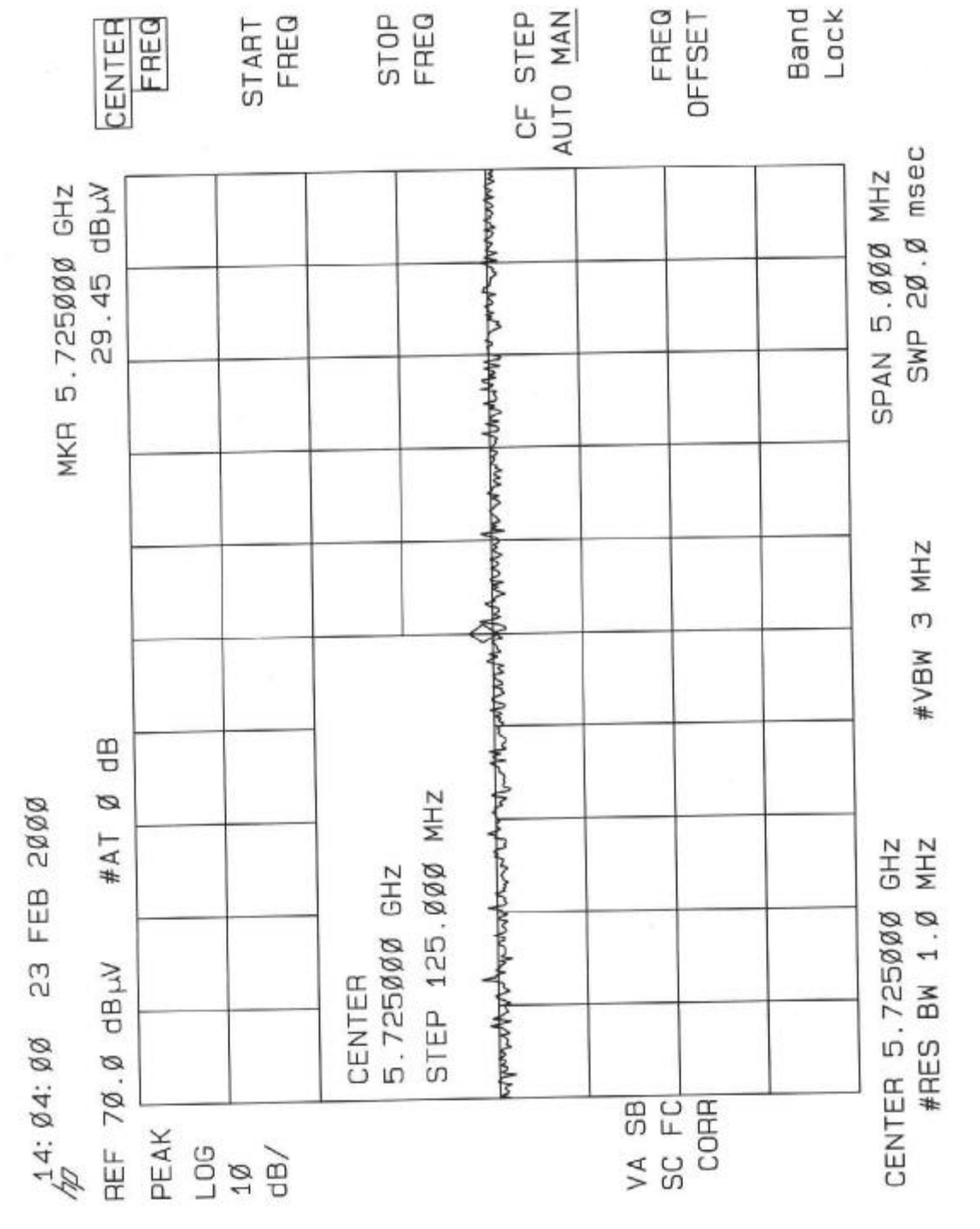
Spread Source Across Tx Band



Upper Band Edge – Max CW Input



Lower Band Edge – Max CW Input



3.4 Test Setup Photographs

See file "EA0440 Exhibit 3.4 - Test Setup Photos.doc"

3.5 Timing Diagram and Duty-Cycle Calculation

See file "EA0440 Exhibit 3.5 – Timing Diagram.doc"

EXHIBIT 4

4.0 Equipment Photographs

External

See file "EA0440 Exhibit 4 - External Photos.doc"

Internal

See file "EA0440 Exhibit 4 - Internal Photos.doc"

EXHIBIT 5

5.0 Product Labeling

See file "EA0440 Exhibit 5 - Label Info.doc"

EXHIBIT 6

6.0 Technical Specifications

6.1 Technical Description and Block Diagram

See file "EA0440 Exhibit 6.1 -Technical Description & Block Diagram.doc"

6.2 Schematics

See file "EA0440 Exhibit 6.2 – Tag Schematic.pdf"

6.3 Bill of Materials

See file "EA0440 Exhibit 6.3 – Tag Bill of Materials.doc"

EXHIBIT 7

7.0 Instruction Manuals

Please note the required user warnings that appear on page 2 of the manual. Also, the required FCC warnings appear on page 11 of the manual since there is not enough room on the tag itself.

See file "EA0440 Exhibit 7 – Tag Manual.pdf"

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