Measurement of RF Interference
Orion SE Water Meter
Frequency Hopping Spread Spectrum Transceiver

For	Badger Meter Corporation Milwaukee, WI 53224
P.O. Number	555008
Date Tested	October 5, 2010 through December 8, 2010
Test Personnel	Brandon Lugo, Richard King
Test Specification	FCC "Code of Federal Regulations" Title 47 Part 15, Subpart C, Section 15.247 for Frequency Hopping Intentional Radiators Operating within the 902-928MHz Industry Canada RSS-210, Annex 8, for Frequency Hopping Systems Operating in the Bands 902–928MHz Industry Canada RSS-GEN
Test Report By:	Brandon Lugo EMC Engineer
Requested By:	John Olson Badger Meter Corporation
Approved By:	Raymond J. Klouda Registered Professional Engineer of Illinois - 44894

Elite Electronic Engineering, Inc.
1516 Centre Circle
Downers Grove, IL 60515
Tel : (630) 495-9770
Fax: (630) 495-9785
www.elitetest.com

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REVISION HISTORY

Revision	Date	Description
—	1-6-2011	Initial release

Measurement of RF Emissions from a Model Orion SE Water Meter F.H.S.S Transceiver

1. INTRODUCTION

1.1. Scope of Tests

This report presents the results of the radio interference measurements performed on a Water Meter transceiver, Model No. Orion SE Water Meter, no serial number was assigned, (hereinafter referred to as the Equipment Under Test (EUT)). The EUT was manufactured and submitted for testing by Badger Meter Corporation located in Milwaukee, WI.

The EUT has a fixed and a mobile power setting. The fixed power setting is a high power setting and utilizes 50 hopping channels. The mobile power setting is a low power setting and utilizes only 48 hopping channels.

The receive portion of the test item is a super-heterodyne type receiver designed to receive over the 902 to 928MHz band. The test item contains a tuner which utilizes one local oscillator (LO) at the tuned frequency.

1.2. Purpose

The test series was performed to determine if the EUT meets the conducted and radiated RF emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Sections 15.207 and 15.247 for Intentional Radiators. The test series was also performed to determine if the EUT meets the conducted RF emission requirements of the Industry Canada Radio Standards Specification, RSS-Gen, Section 7.2.2 and the radiated RF emission requirements of the Industry Canada Radio Standards Specification, RSS-210, Annex 8 for transceivers. Testing was performed in accordance with ANSI C63.4-2003.

1.3. Deviations, Additions and Exclusions

There were no deviations, additions to, or exclusions from the test specification during this test series.

1.4. EMC Laboratory Identification

This series of tests was performed by Elite Electronic Engineering Incorporated of Downers Grove, Illinois. The laboratory is accredited by The American Association for Laboratory Accreditation (A2LA). A2LA Certificate Number: 1786.01.

1.5. Laboratory Conditions

The temperature at the time of the test was 24^{o}C and the relative humidity was 31%.

2. APPLICABLE DOCUMENTS

The following documents of the exact issue designated form part of this document to the extent specified herein:

- Federal Communications Commission "Code of Federal Regulations", Title 47, Part 15, Subpart C, dated 1 October 2009
- FCC Public Notice, DA 00-705, "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems", Released March 30, 2000
- ANSI C63.4-2003, "American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz"
- Industry Canada Radio Standards Specification, RSS-Gen, “General Requirements and Information for the Certification of Radiocommunication Equipment”, Issue 2, June 2007

- Industry Canada Radio Standards Specification, RSS-210, “Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment”, Issue 7, June 2007

3. EUT Setup and Operation

3.1. General Description

The EUT is a Badger Meter Corporation, Water Meter, Model No. Orion SE Water Meter. A block diagram of the EUT setup is shown as Figure 1.

3.1.1. Power Input

The EUT typically obtains 3.3VDC from an internal battery. For testing purposes the EUT obtained 3.3VDC from a DC power supply.

3.1.2. Peripheral Equipment

No peripheral equipment was submitted with the EUT.

3.1.3. Signal Input/Output Leads

The test items does not utilize any interconnect cables.

3.1.4. Grounding

Since only two wires were used to provide the input power, the EUT was ungrounded during the tests. The third primary input terminal of the transformer was not used.

3.2. Operational Mode

For all tests, the test item and peripheral equipment was placed on an 80cm high non-conductive stand. The test item was energized. The unit was programmed to operate in one of the following modes:

- Transmit at 904.9MHz, Fixed Power Level
- Transmit at 914.5MHz, Fixed Power Level
- Transmit at 924.6MHz, Fixed Power Level
- Transmit at 904.9MHz, Mobile Power Level
- Transmit at 914.5MHz, Mobile Power Level
- Transmit at 923.7MHz, Mobile Power Level
- Receive at 904.9MHz
- Receive at 914.5MHz
- Receive at 924.6MHz
- Frequency Hopping Enabled

3.3. EUT Modifications

No test item modifications were needed to meet the specification requirements for FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C.

4. Test Facility and Test Instrumentation

4.1. Shielded Enclosure

All tests were performed in a 32ft. x 20ft. x 18ft. hybrid ferrite-tile/anechoic absorber lined test chamber. With the exception of the floor, the reflective surfaces of the shielded chamber are lined with ferrite tiles on the walls and ceiling. Anechoic absorber material is installed over the ferrite tile. The floor of the chamber is used as the ground plane. The chamber complies with ANSI C63.4-2003 for site attenuation.

4.2. Test Instrumentation

The test instrumentation and auxiliary equipment used during the tests are listed in Table 9-1.

4.3. Calibration Traceability

Test equipment is maintained and calibrated on a regular basis. All calibrations are traceable to the National Institute of Standards and Technology (NIST).

5. TEST PROCEDURES

5.1. Radiated Measurements Receiver:

5.1.1.Requirements

Per the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart B, Section 15.109(a) and Industry Canada RSS-Gen, Section 7.2.3, all radio frequency emissions from a receiver shall be below the limits shown on the following table:

RADIATION LIMITS FOR A RECEIVER

Frequency MHz	Distance between EUT And Antenna in Meters	Field Strength uV/m	Field Strength dBuV/m
30-88	3	100	40
88-216	3	150	43.5
216-960	3	200	46
Above 960	3	500	54

Note: The tighter limit shall apply at the edge between the two frequency bands.

5.1.2.Procedures

Testing was performed separately on a low, middle, and high channel. The emissions in the frequency range of 30MHz to 5GHz were measured. Testing was performed with the antenna of the EUT in place.

All tests were performed in a 32ft. x 20ft. x 18ft. hybrid ferrite-tile/anechoic absorber lined test chamber. The walls and ceiling of the shielded chamber are lined with ferrite tiles. Anechoic absorber material is installed over the ferrite tile. The floor of the chamber is used as the ground plane. The chamber complies with ANSI C63.4-2003 for site attenuation.

The shielded enclosure prevents emissions from other sources, such as radio and TV stations from interfering with the measurements. All powerlines and signal lines entering the enclosure pass through filters on the enclosure wall. The powerline filters prevent extraneous signals from entering the enclosure on these leads.

Since a quasi-peak detector and an average detector require long integration times, it is not practical to automatically sweep through the quasi-peak and average levels. Therefore, radiated emissions from the EUT were first scanned using a peak detector and automatically plotted. The frequencies where significant emission levels were noted were then remeasured using the quasi-peak detector or average detector.

The broadband measuring antenna was positioned at a 3 meter distance from the EUT. The frequency range from 30MHz to 1GHz was investigated using a peak detector function with the bilog antenna at several heights, horizontal and vertical polarization, and with several different orientations of the EUT with respect to the antenna. The frequency range from 1GHz to 5GHz was investigated using a peak detector function with the double ridged waveguide antenna at several heights, horizontal and vertical polarization, and with several different orientations of the EUT with respect to the antenna. The maximum levels for each antenna polarization were plotted.

Final radiated emissions were performed on all significant broadband and narrowband emissions found in the preliminary sweeps using the following methods:

1) Measurements from 30MHz to 1GHz were made using a quasi-peak detector and a broadband bilog antenna. Measurements above 1GHz were made using an average detector and a broadband double ridged waveguide antenna.

2) To ensure that maximum or worst case, emission levels were measured, the following steps were taken:

    a) The EUT was rotated so that all of its sides were exposed to the receiving antenna.

    b) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.

    c) The measuring antenna was raised and lowered from 1 to 4 meters for each antenna polarization to maximize the readings.

    d) For hand-held or body-worn devices, the EUT was rotated through three orthogonal axes to determine which orientation produces the highest emission relative to the limit.

5.1.3.Results

The preliminary plots are presented on pages 18 through 25. The plots are presented for a reference only, and are not used to determine compliance. The final radiated levels are presented on page 26 through 28. As can be seen from the data, all emissions measured from the EUT were within the specification limits. Photographs of the test configuration which yielded the highest or worst case, radiated emission levels are shown on Figure 3 and Figure 4.

5.2. Carrier Frequency Separation:

5.2.1.Requirements

Per section 15.247 (a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater.

5.2.2.Procedures

The EUT was set up inside the chamber. With the hopping function enabled, the EUT was allowed to transmit continuously.

The resolution bandwidth (RBW) was set to $\geq$ to 1% of the span. The peak detector and 'Max-Hold' function was engaged. The span was set wide enough to capture the peaks of at least two adjacent channels. When, the trace had stabilized after multiple scans. The marker-delta function was used to determine the separation between the peaks of the adjacent channels. The analyzer's display was plotted using a 'screen dump' utility.

5.2.3.Results

Pages 29 and 30 show the results of the carrier frequency separation measurements. As can be seen from this plot, the separation is 400.8kHz which is greater than the 20dB bandwidth (384.8kHz).

5.3. Number of Hopping Frequencies

5.3.1.Requirements

Per section 15.247(a)(1)(i), for frequency hopping systems operating in the 902-928MHz band. The frequency hopping system shall use at least 50 hopping frequencies if the 20dB bandwidth is less than 250kHz. If the 20dB bandwidth is greater than 250kHz the frequency hopping system shall use at least 25 hopping frequencies.

5.3.2.Procedures

The EUT was set up inside the chamber. With the hopping function enabled, the EUT was allowed to transmit continuously.

The resolution bandwidth (RBW) was set to 100kHz. The peak detector and 'Max-Hold' function was engaged. The span was set wide enough to capture the entire frequency band of operation.

The EUT's signal was allowed to stabilize after multiple scans. The number of hopping frequencies was counted. The analyzer's display was plotted using a 'screen dump' utility.

5.3.3.Results

Pages 31 and 32 shows the number of hopping frequencies. As can be seen from these plots, the number of frequencies is 50 for the fixed power setting and 48 for the mobile power setting both of which is greater than the minimum required.

5.4. Time of Occupancy

5.4.1.Requirement

Per section 15.247(a)(1)(i), For frequency hopping systems operating in the 902-928MHz band. The average time of occupancy shall not be greater than 0.4 seconds within a 20 second period if the 20dB bandwidth is less than 250kHz. If the 20dB bandwidth is greater than 250kHz, the average time of occupancy shall not be greater than 0.4 seconds within a 10 second period.

5.4.2.Procedures

The EUT was set up inside the chamber. The output of the EUT was connected to the spectrum analyzer. With the hopping function enabled, the EUT was allowed to transmit continuously.

The resolution bandwidth (RBW) was set to 100 kHz. The peak detector and 'Max-Hold' function was engaged. With the span set to 0Hz, the sweep time was adjusted to capture a single event in order to measure the dwell time per hop. Then, the sweep time was expanded to capture the average time between hops. When the trace had stabilized after multiple scans, the time between hops was measured. The analyzer's display was plotted using a 'screen dump' utility.

The dwell time in the specified time period was then calculated from dwell time per hop multiplied by the number of hops in the specified time period.

5.4.3.Results

Pages 33 and 34 show the plots for the time of occupancy (dwell time). As can be seen from the plots, the time of occupancy can be determined by dwell time/hop (10.11 mS) multiplied by number of hops (2). This calculated value is equal to 0.020 seconds, which is less than the 0.4 seconds maximum allowed.

5.5. 20dB Bandwidth

5.5.1.Requirement

Per section 15.247(a)(1)(i), for frequency hopping systems operating in the 902-928MHz band. The 20dB bandwidth shall not be greater than 500kHz.

5.5.2.Procedures

The EUT was setup inside the chamber. With the hopping function disabled, the EUT was allowed to transmit continuously. The frequency hopping channel was set separately to low, middle, and high hopping channels. The resolution bandwidth (RBW) was set to $\geq$ to 1% of the 20 dB BW.

The 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transceiver

bandwidth was defined. The analyzer's display was plotted using a 'screen dump' utility.

5.5.3.Results

The plots on pages 35 through 40 show that the maximum 20 dB bandwidth was 384.8kHz. The 99% bandwidth was measured to be 263.7kHz. Therefore, since the 20dB bandwidth of the hopping channel is 250kHz or greater, but not greater than 500kHz, the system shall use at least 25 hopping channels.

5.6. Peak Output Power

5.6.1.Requirement

Per section 15.247(b)(2), for frequency hopping systems operating in the 902-928MHz band and employing less than 50 hopping channels, but at least 25 hopping channels, the maximum peak output conducted power shall not be greater than 0.25W (24dBm).

Per section 15.247(b)(2), for frequency hopping systems operating in the 902-928MHz band and employing 50 hopping channels or more, the maximum peak output conducted power shall not be greater than 1W (30dBm).

Per section 15.247(b)(4), this limit is based on the use of antennas with directional gains that do not exceed 6dBi. Since the limit allows for a 6dBi antenna gain, the maximum EIRP can be increased by 6dB to 1 Watt (30dBm) for a transmitter with less than 50 hopping channels and 4 watts (36dBm) for a transmitter with at least 50 hopping channels.

If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below 24dBm for a transmitter employing less than 50 hopping channels and below 30dBm for a transmitter employing 50 hopping channels or more, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.6.2.Procedures

The EUT was placed on the non-conductive stand and set to transmit. A bilog antenna was placed at a test distance of 3 meters from the EUT. The resolution bandwidth (RBW) of the spectrum analyzer was set to greater than the 20dB bandwidth. The span was set to approximately 5 times the 20 dB bandwidth. The EUT was maximized for worst case emissions (or maximum output power) at the measuring antenna. The maximum meter reading was recorded. The peak power output was measured for the low, middle and high hopping frequencies.

The equivalent power was determined from the field intensity levels measured at 3 meters using the substitution method. To determine the emission power, a dipole antenna was then set in place of the EUT and connected to a calibrated signal generator. The output of the signal generator was adjusted to match the received level at the spectrum analyzer. The signal level was recorded. The reading was then corrected to compensate for cable loss as required. The peak power output was calculated for low, middle, and high hopping frequencies.

5.6.3.Results

The results are presented on pages 41 and 42. The maximum EIRP measured from the transceiver in the mobile power setting was 9.4 dBm which meets the De Facto 30 dBm limit. The maximum EIRP measured from the transceiver in the fixed power setting was 24.4 dBm which meets the De Facto 36 dBm limit.

5.7. Radiated Spurious Emissions

5.7.1.Requirement

Per section 15.247(c), the spurious emissions in any 100 kHz BW outside the frequency band must be at least 20dB below the highest 100 kHz BW level measured within the band. In addition, Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must comply with the radiated emission limits specified in §15.209(a).

Paragraph 15.209(a) has the following radiated emission limits:

Frequency MHz	Field Strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	3
30.0-88.0	100	3
88.0-216.0	150	3
216.0-960.0	200	3
Above 960	500	3

5.7.2.Procedures

Radiated measurements were performed in a 32ft. x 20ft. x 14ft. high shielded enclosure. The shielded enclosure prevents emissions from other sources, such as radio and TV stations from interfering with the measurements. All powerlines and signal lines entering the enclosure pass through filters on the enclosure wall. The powerline filters prevent extraneous signals from entering the enclosure on these leads.

Preliminary radiated emissions tests were performed to determine the emission characteristics of the EUT. For the preliminary test, a broadband measuring antenna was positioned at a 3 meter distance from the EUT. The entire frequency range from 30MHz to 10.0GHz was investigated using a peak detector function.

The final open field emission tests were then manually performed over the frequency range of 30MHz to 10.0GHz.

For all emissions in the restricted bands, the following procedure was used:

a) The field strengths of all emissions below 1 GHz were measured using a bi-log antenna. The bi-log antenna was positioned at a 3 meter distance from the EUT. A peak detector with a resolution bandwidth of 100 kHz was used on the spectrum analyzer.

b) The field strengths of all emissions above 1 GHz were measured using a double-ridged waveguide antenna. The waveguide antenna was positioned at a 3 meter distance from the EUT. A peak detector with a resolution bandwidth of 1 MHz was used on the spectrum analyzer.

c) To ensure that maximum or worst case emission levels were measured, the following steps were taken when taking all measurements:

   i) The EUT was rotated so that all of its sides were exposed to the receiving antenna.

   ii) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.

   iii) The measuring antenna was raised and lowered for each antenna polarization to maximize the readings.

   iv) In instances where it was necessary to use a shortened cable between the measuring antenna and the spectrum analyzer. The measuring antenna was not raised or lowered to ensure maximized readings, instead the EUT was rotated through all axis to ensure the maximum readings were recorded for the EUT.

d) For all radiated emissions measurements below 1 GHz, if the peak reading is below the limits listed in 15.209(a), no further measurements are required. If however, the peak readings exceed the limits listed in 15.209(a), then the emissions are remeasured using a quasi-peak detector.

e) For all radiated emissions measurements above 1 GHz, the peak readings must comply with the 15.35(b) limits. 15.35(b) states that when average radiated emissions measurements are specified, there also is a limit on the peak level of the radiated emissions. The limit on the peak radio frequency

emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test. Therefore, all peak readings above 1 GHz must be no greater than 20 dB above the limits specified in 15.209(a).

f) Next, for all radiated emissions measurements above 1GHz, the resolution bandwidth was set to 1MHz. The analyzer was set to linear mode with a 10Hz video bandwidth in order to simulate an average detector. An average reading was taken. If the dwell time per channel of the hopping signal is less than 100msec, then the reading obtained with the 10 Hz video bandwidth may be further adjusted by a “duty cycle correction factor”, derived from 20*log(dwell time/100msec). These readings must be no greater than the limits specified in 15.209(a).

5.7.3.Results

The preliminary emissions levels were plotted. These plots are presented on pages 43 through 66. These plots show that the radiated spurious emissions were at least 20 dB below the level of the fundamental.

The harmonics and any other emissions that fall in the restricted frequency bands were then re-measured manually. This data is shown in the tables on pages 67 through 78. The field intensities levels for the harmonics in the restricted band were within the limit.

5.8. Bandedge Compliance

5.8.1.Requirement

Per section 15.247(d), the emissions at the band-edges must be at least 20dB below the highest level measured within the band but attenuation below the general limits listed in 15.209(a) is not required.

5.8.2.Procedures

5.8.2.1 Low Band Edge

1) The test item was set to transmit continuously at the channel closest to the low band-edge (hopping function disabled).
2) To determine the band edge compliance, the following spectrum analyzer settings were used:

    a. Center frequency = low band-edge frequency.
    b. Span = Wide enough to capture the peak level of the emission operating on the channel closest to the band-edge, as well as any modulation products which fall outside of the authorized band of operation.
    c. Resolution bandwidth (RBW) was set to 100kHz.
    d. The 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transceiver bandwidth was defined.
    e. The marker was set on the peak of the in-band emissions. A display line was placed 20dB down from the peak of the in-band emissions. All emissions which fall outside of the authorized band of operation must be below the 20dB down display line. (All emissions to the left of the center frequency (band-edge) must be below the display line.)
    f. The analyzer's display was plotted using a 'screen dump' utility.

3) Step 3) was repeated with the frequency hopping function enabled.

5.8.2.2 High Band Edge

1) The test item was set to transmit continuously at the channel closest to the high band-edge (hopping function disabled).
2) To determine the band edge compliance, the following spectrum analyzer settings were used:

    a. Center frequency = high band-edge frequency.
    b. Span = Wide enough to capture the peak level of the emission operating on the

channel closest to the band-edge, as well as any modulation products which fall outside of the authorized band of operation.

c. Resolution bandwidth (RBW) was set to 100kHz.
d. The 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transceiver bandwidth was defined.
e. The marker was set on the peak of the in-band emissions. A display line was placed 20dB down from the peak of the in-band emissions. All emissions which fall outside of the authorized band of operation must be below the 20dB down display line. (All emissions to the right of the center frequency (band-edge) must be below the display line.)
f. The analyzer's display was plotted using a 'screen dump' utility.

g. Step 3) was repeated with the frequency hopping function enabled.

5.8.3. Results

Pages 79 through 86 show the band-edge compliance results using the marker-delta method. As can be seen from these plots, the emissions at the band-edge in the restricted band are within the general limits.

6. OTHER TEST CONDITIONS

6.1. Test Personnel and Witnesses

All tests were performed by qualified personnel from Elite Electronic Engineering Incorporated.

6.2. Disposition of the EUT

The EUT and all associated equipment were returned to Badger Meter Corporation upon completion of the tests.

7. CONCLUSIONS

It was determined that the Badger Meter Corporation Water Meter, Model No. Orion SE Water Meter, did fully meet the radiated emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Section 15.207 and 15.247 for Intentional Radiators, when tested per ANSI C63.4-2003.

It was determined that the Badger Meter Corporation Water Meter, Model No. Orion SE Water Meter, did fully meet the radiated emissions requirements of the Industry Canada Radio Standards Specification, RSS-Gen. Section 7.2.2 and the radiated emissions requirements of the Industry Canada Radio Standards Specification RSS-210, Annex 8 for transceivers, when tested per ANSI C63.4-2003.

8. CERTIFICATION

Elite Electronic Engineering Incorporated certifies that the information contained in this report was obtained under conditions which meet or exceed those specified in the test specifications.

The data presented in this test report pertains to the EUT at the test date. Any electrical or mechanical modification made to the EUT subsequent to the specified test date will serve to invalidate the data and void this certification.

This report must not be used to claim product endorsement by NVLAP or any agency of the US Government.

9. EQUIPMENT LIST

Table 9-1 Equipment List

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Due Date
APW3	PREAMPLIFIER	PLANAR ELECTRONICS	PE2-35-120-5R0-10-12	PL2924	1GHZ-20GHZ	8/27/2010	8/27/2011
CDS2	COMPUTER	GATEWAY	MFATXPNT NMZ 500L	0028483108	1.8GHZ	N/A	
CDW5	DESKTOP COMPUTER	ELITE	PENTIUM 4	006	3.8GHZ	N/A	
GBR5	SIGNAL GENERATOR	AGILENT TECHNOLOGIES	8648D	4037U00607	0.009-4000MHZ	2/23/2010	2/23/2011
NDQ1	TUNED DIPOLE ANTENNA	EMCO	3121C-DB4	313	400-1000MHZ	4/12/2010	4/12/2011
NTA2	BILOG ANTENNA	TESEQ	6112D	28040	25-1000MHz	6/7/2010	6/7/2011
NWH0	RIDGED WAVE GUIDE	TENSOR	4105	2081	1-12.4GHZ	8/31/2010	8/31/2011
RBA0	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESIB26	100145	20HZ-26.5GHZ	3/12/2010	3/12/2011
RBB0	EMI TEST RECEIVER 20HZ TO 40 GHZ	ROHDE & SCHWARZ	ESIB40	100250	20 HZ TO 40GHZ	3/16/2010	3/16/2011
SES1	24VDC POWER SUPPLY	P TRANS	FS-32024-1M	002	18-27VDC	NOTE 1	
T1D2	10DB 20W ATTENUATOR	NARDA	768-10	6	DC-11GHZ	1/5/2010	1/5/2011
XPQ2	HIGH PASS FILTER	K&L MICROWAVE	4IH30-1804/T10000-0	3	1.8-10GHZ	10/28/2010	10/28/2011

N/A: Not Applicable

Note 1: For the purpose of this test, the equipment was calibrated over the specified frequency range, pulse rate, or modulation prior to the test or monitored by a calibrated instrument.

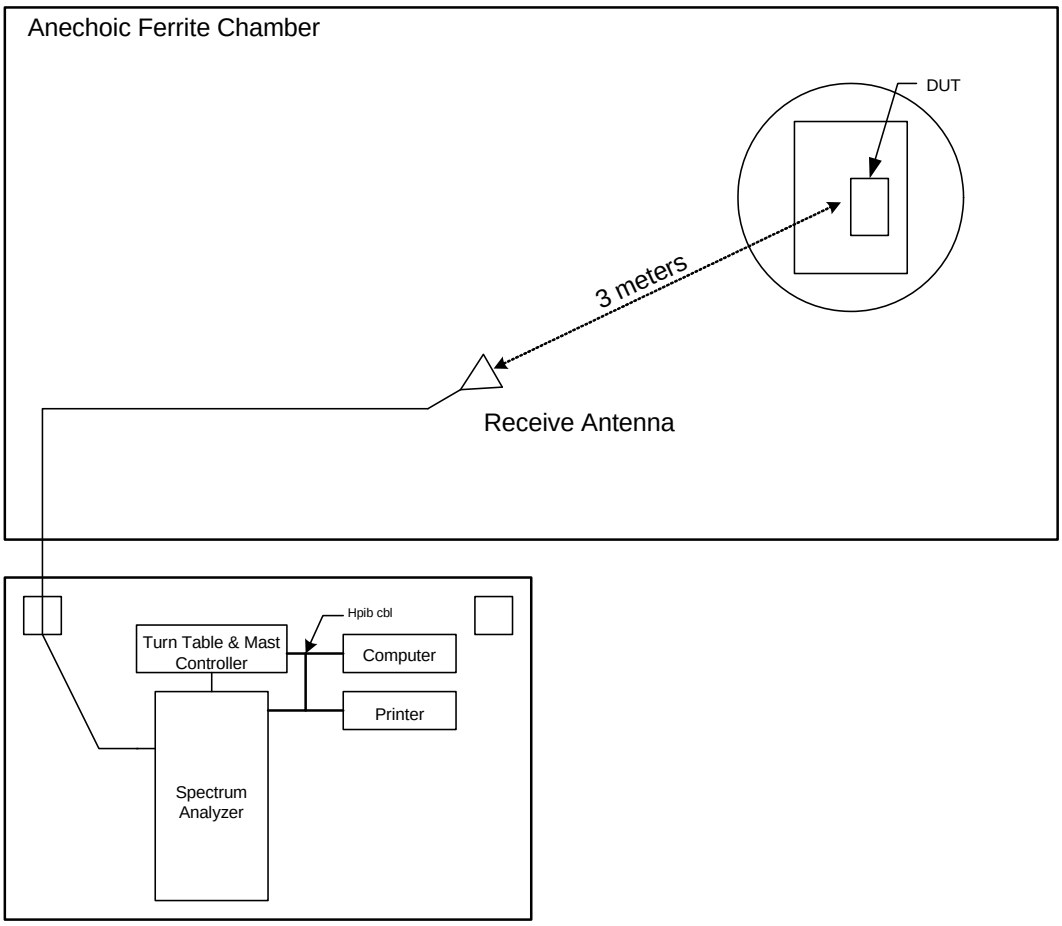


FIGURE 1 BLOCKDIAGRAM OF TEST SETUP

Figure 2

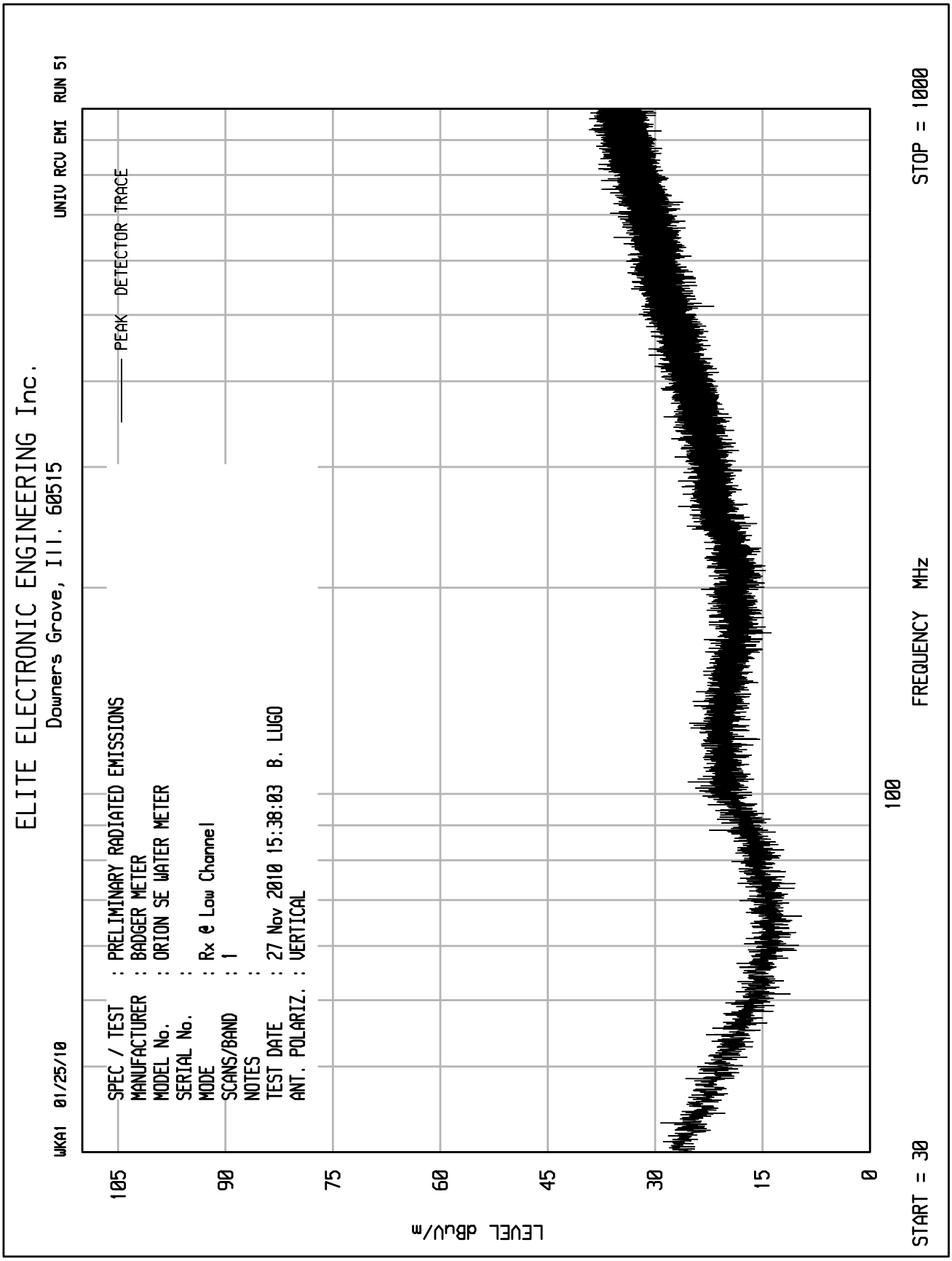
Test Setup for Radiated Emissions, 30MHz to 1GHz – Horizontal Polarization

Test Setup for Radiated Emissions, 30MHz to 1GHz – Vertical Polarization

Figure 3

Test Setup for Radiated Emissions, Above 1GHz – Horizontal Polarization

Test Setup for Radiated Emissions, Above 1GHz – Vertical Polarization


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 51
WKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE WATER METER
SERIAL No. :
MODE : Rx @ Low Channel
SCANS/BAND : 1
NOTES :
TEST DATE : 27 Nov 2010 15:38:03 B. LUGO
ANT. POLARIZ. : VERTICAL
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60
45
30
15
0
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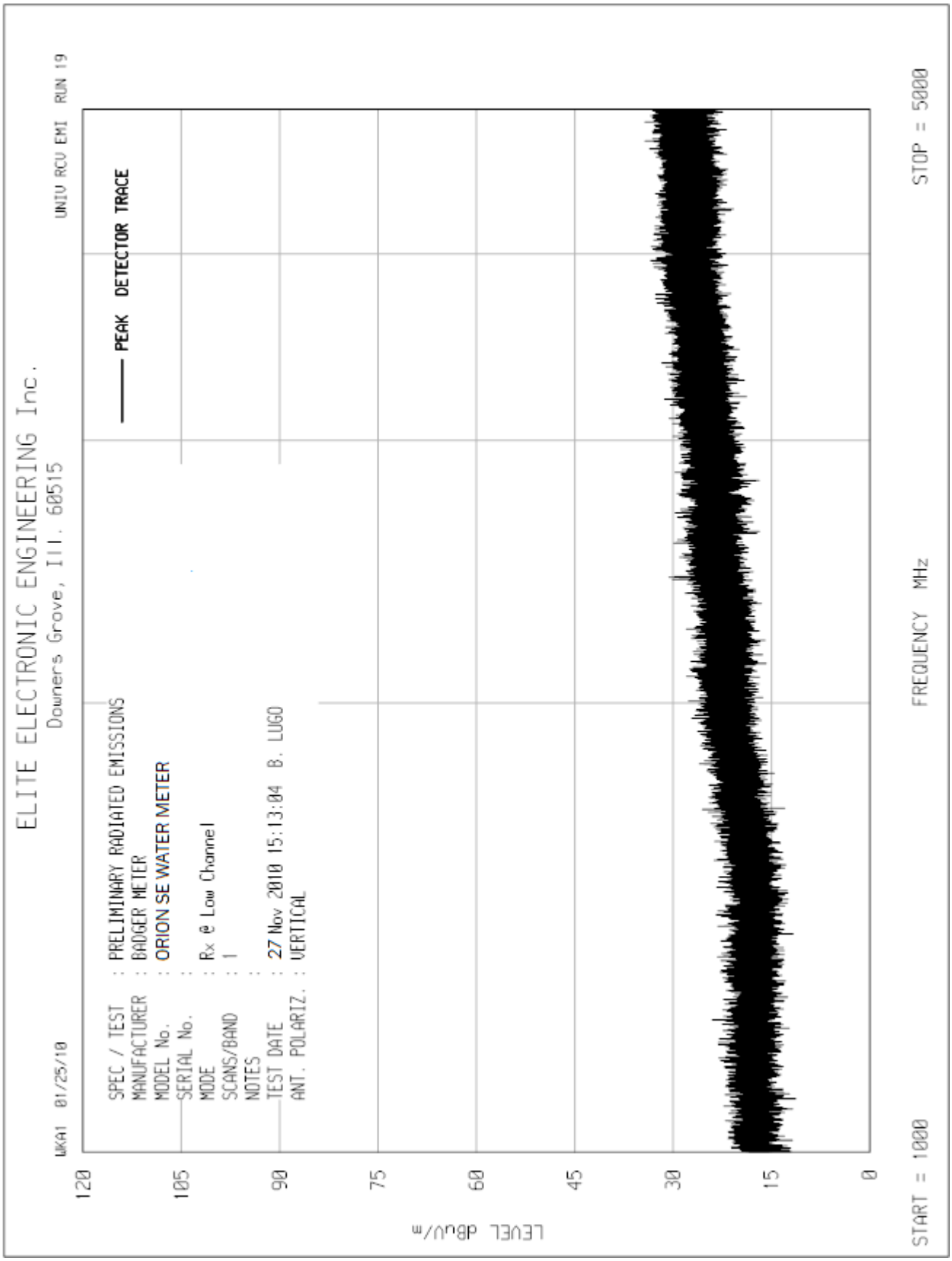
100
FREQUENCY MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
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MODEL No. : ORION SE WATER METER
SERIAL No. :
MODE : Rx @ Low Channel
SCANS/BAND : 1
NOTES :
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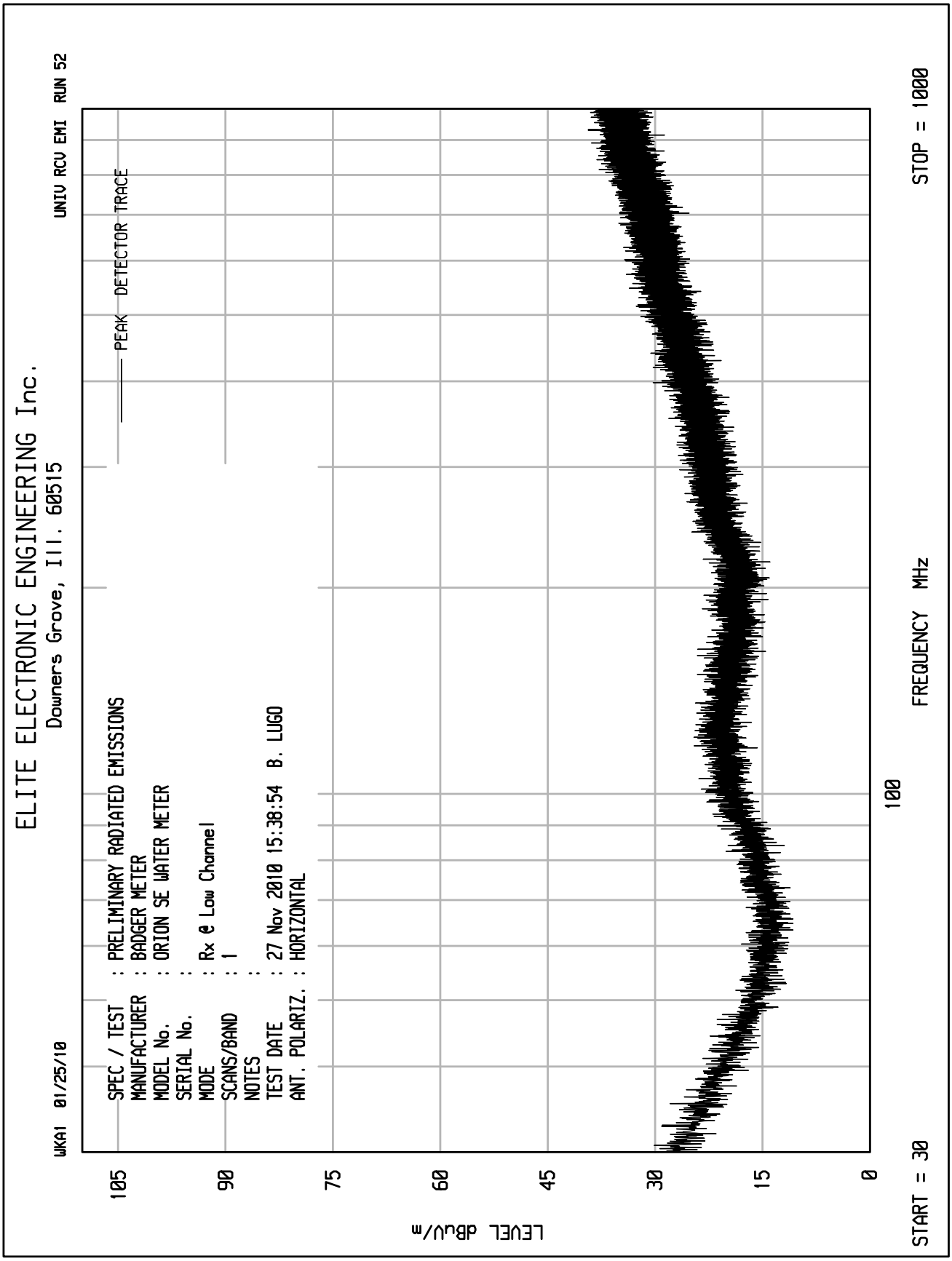
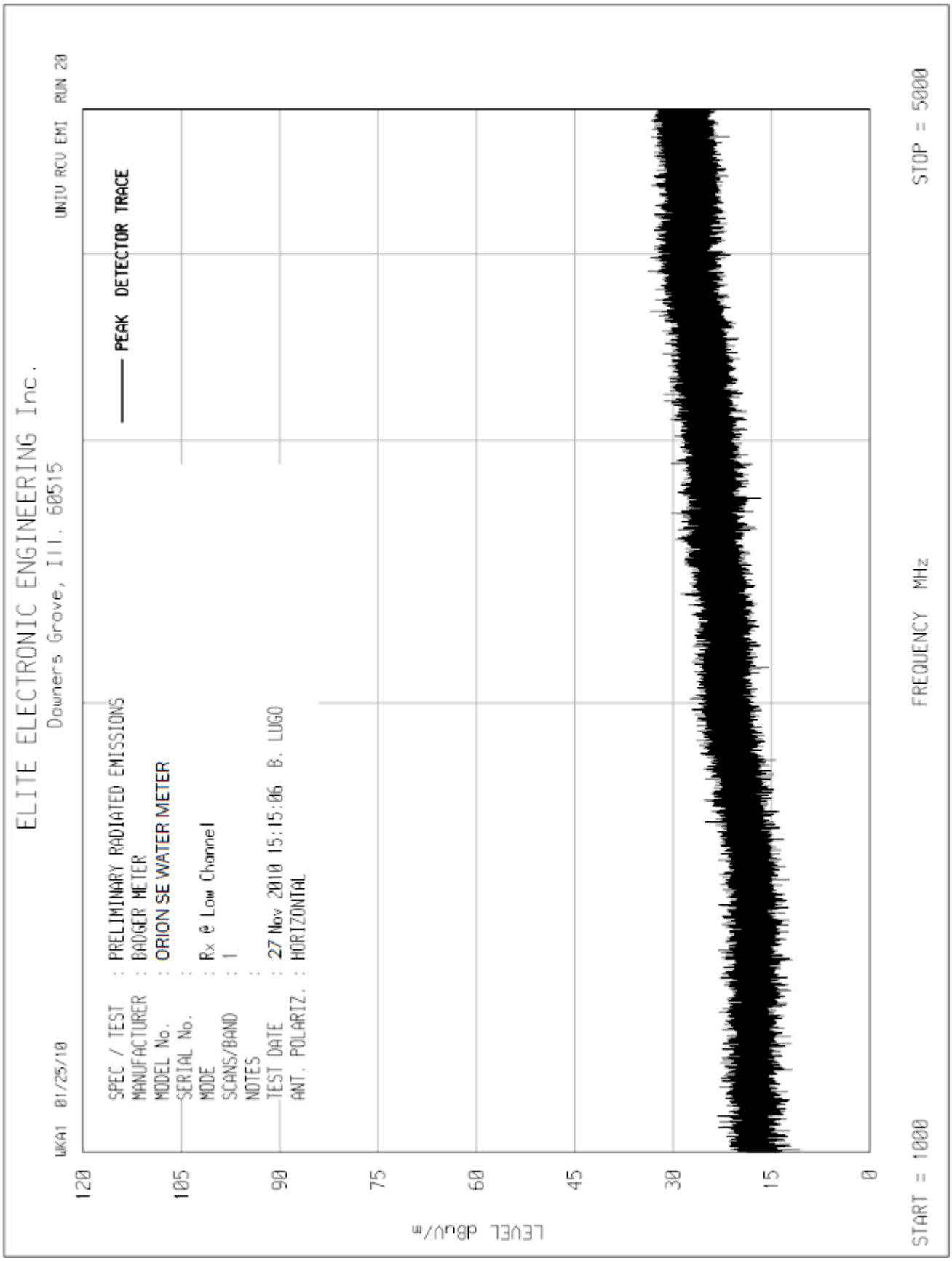
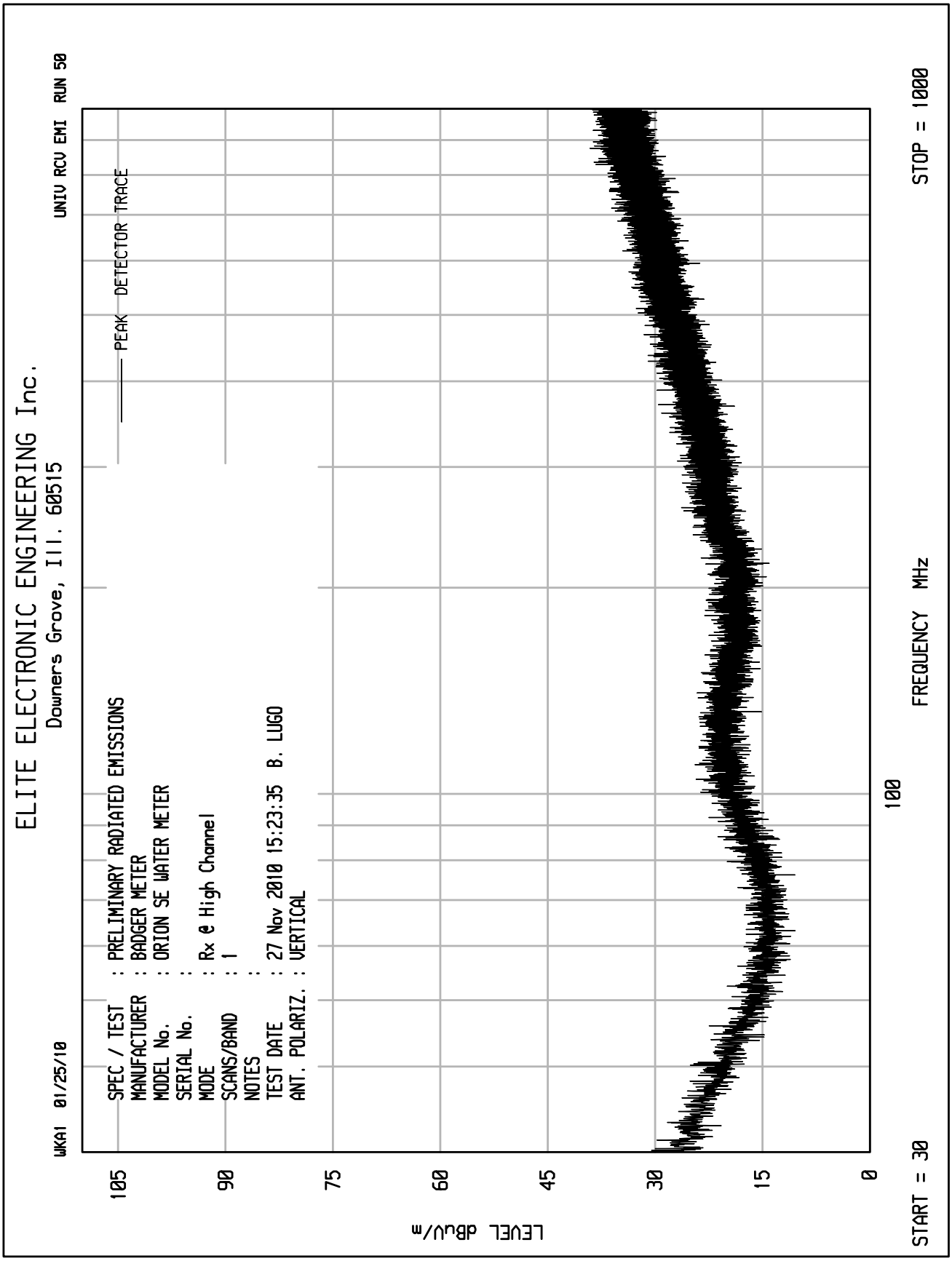
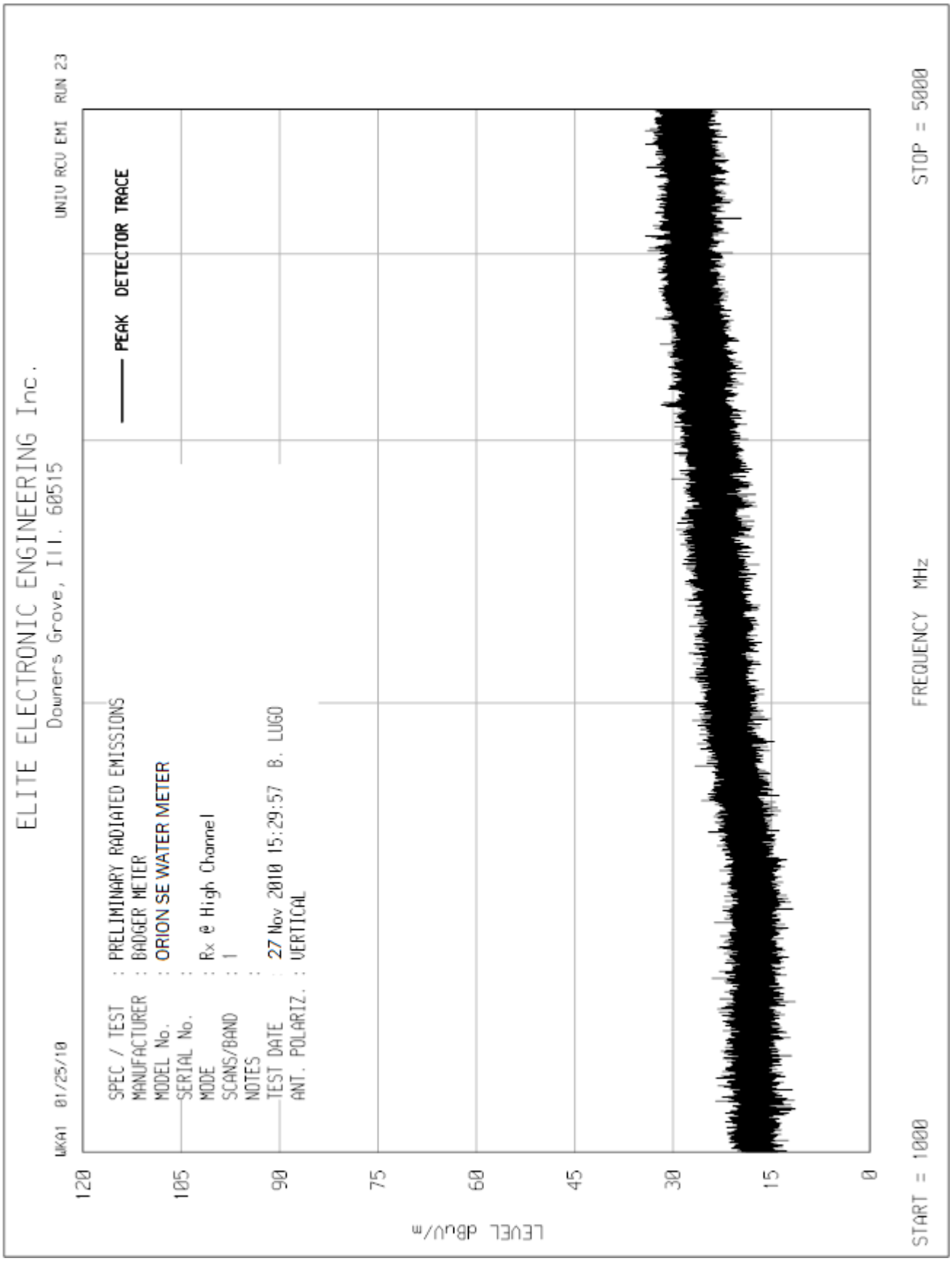
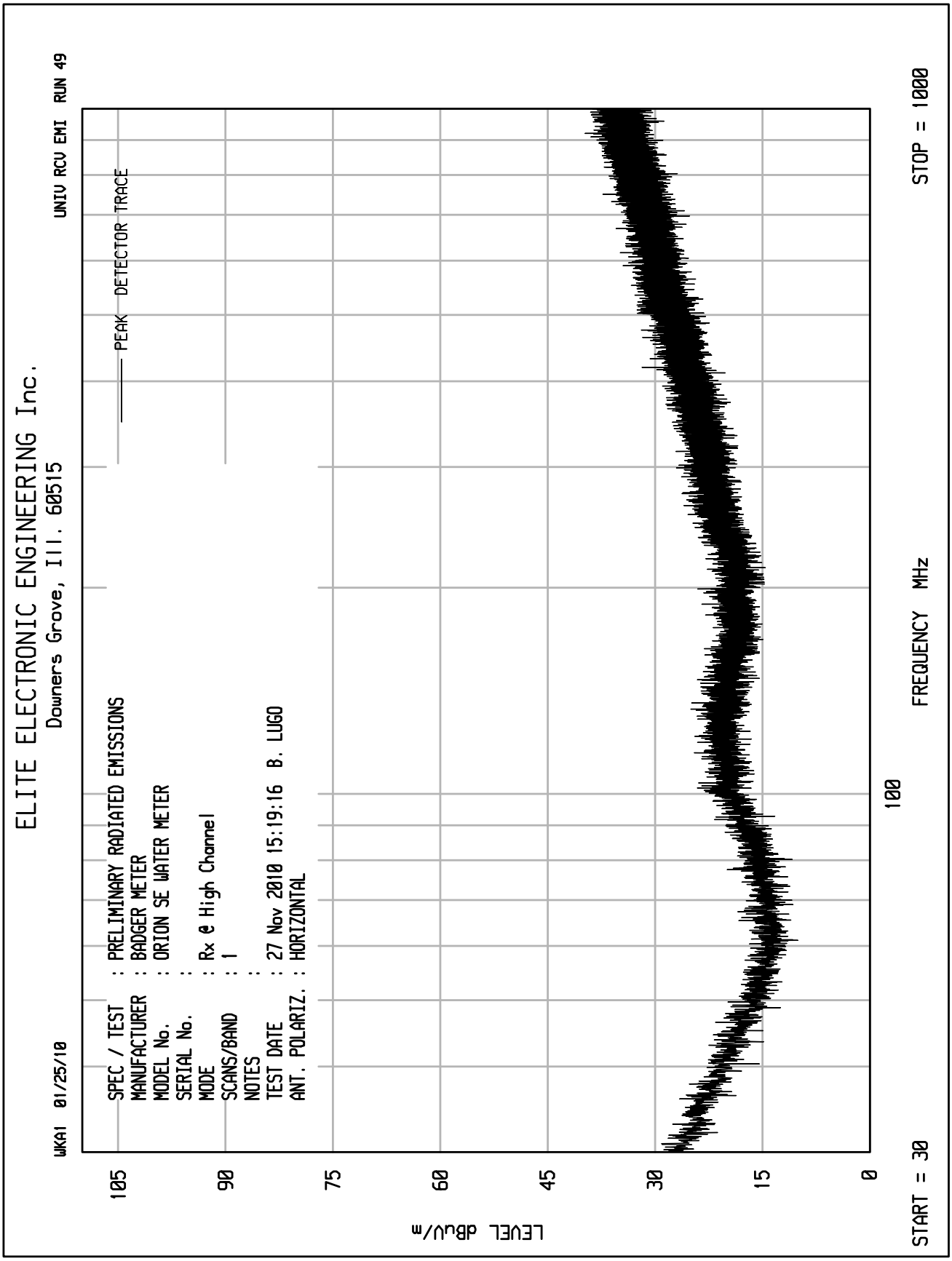
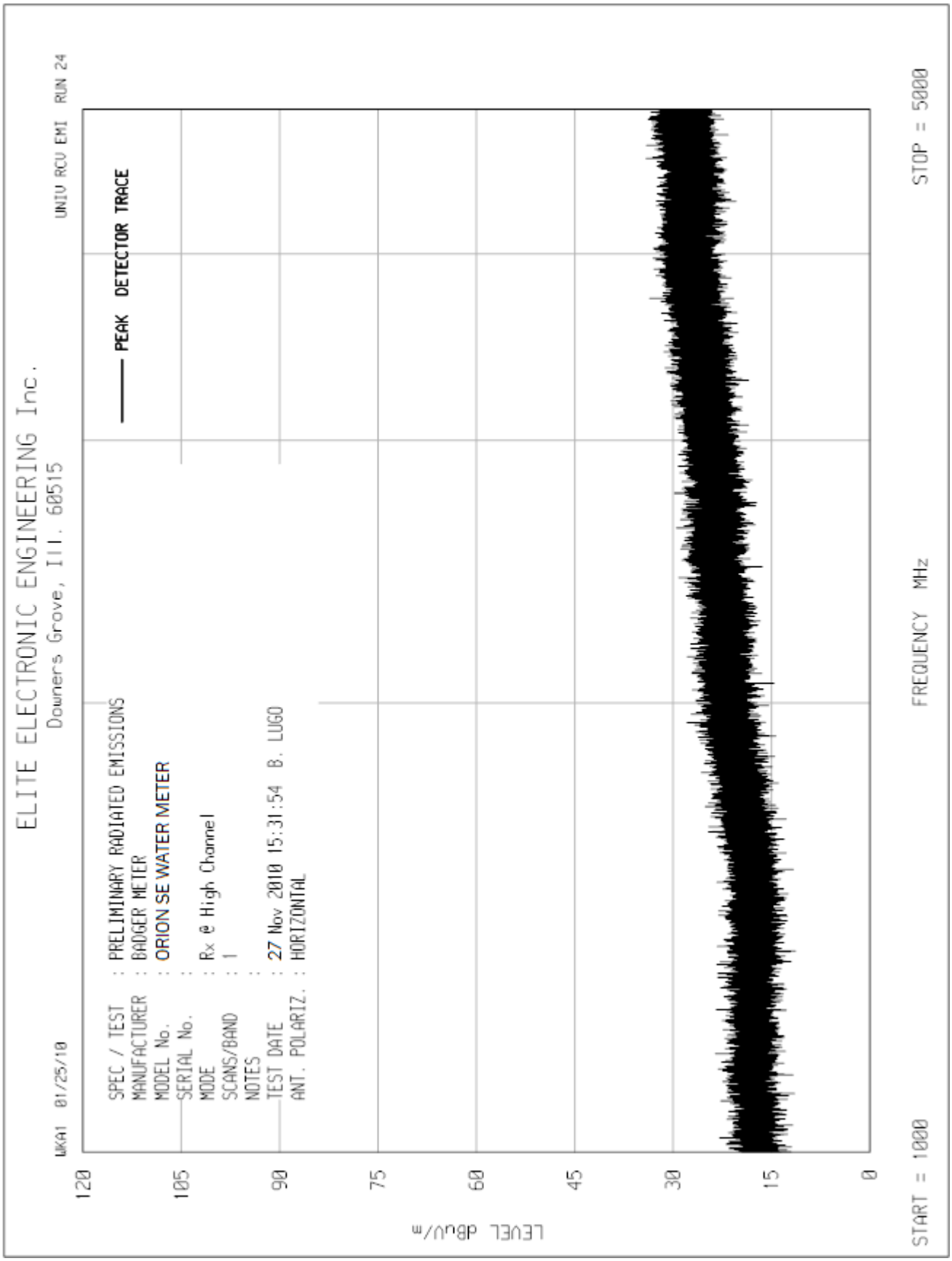

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 52
WKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE WATER METER
SERIAL No. :
MODE : Rx @ Low Channel
SCANS/BAND : 1
NOTES :
TEST DATE : 27 Nov 2010 15:38:54 B. LUGO
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 20
WKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE WATER METER
SERIAL No. :
MODE : Rx @ Low Channel
SCANS/BAND : 1
NOTES :
TEST DATE : 27 Nov 2010 15:15:06 B. LUGO
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 5000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 50
WKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE WATER METER
SERIAL No. :
MODE : Rx @ High Channel
SCANS/BAND : 1
NOTES :
TEST DATE : 27 Nov 2010 15:23:35 B. LUGO
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 23
UKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE WATER METER
SERIAL No. :
MODE : Rx @ High Channel
SCANS/BAND : 1
NOTES :
TEST DATE : 27 Nov 2010 15:29:57 B. LUGO
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 5000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 49
WKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE WATER METER
SERIAL No. :
MODE : Rx @ High Channel
SCANS/BAND : 1
NOTES :
TEST DATE : 27 Nov 2010 15:19:16 B. LUGO
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 24
UKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE WATER METER
SERIAL No. :
MODE : Rx @ High Channel
SCANS/BAND : 1
NOTES :
TEST DATE : 27 Nov 2010 15:31:54 B. LUGO
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 5000

Manufacturer : Badger Meter Corporation
Model No. : Orion SE Water Meter
Serial No. : None Assigned
Specification : FCC-15B Spurious Radiated Emissions
Date : December 8, 2010
Mode : Rx @ 904.9MHz
Notes : Test Distance is 3 meters

Freq (MHz)	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Total dBuV/m at 3 M	Total uV/m at 3M	Limit uV/m at 3M	Margin (dB)
904.9	H	5.6	*	2.4	21.8	0.0	29.8	30.8	200.0	-16.2
904.9	V	5.6	*	2.4	21.8	0.0	29.8	30.8	200.0	-16.2
1809.8	H	36.0	*	3.4	27.4	-40.0	26.9	22.1	500.0	-27.1
1809.8	V	36.0	*	3.4	27.4	-40.0	26.9	22.1	500.0	-27.1
2714.7	H	31.0	*	3.9	30.2	-39.3	25.8	19.5	500.0	-28.2
2714.7	V	31.0	*	3.9	30.2	-39.3	25.8	19.5	500.0	-28.2
3619.6	H	32.0	*	4.7	33.1	-38.5	31.3	36.6	500.0	-22.7
3619.6	V	32.0	*	4.7	33.1	-38.5	31.3	36.6	500.0	-22.7
4524.5	H	32.7	*	5.5	33.5	-38.2	33.5	47.4	500.0	-20.5
4524.5	V	32.7	*	5.5	33.5	-38.2	33.5	47.4	500.0	-20.5

H – Horizontal V – Vertical

Total (dBuV/m) = Meter Reading (dBuV) + Cable Factor (dB) + Antenna Factor (dB) + Pre Amp (dB)

Checked BY Richard E. King :

Richard E. King

Manufacturer : Badger Meter Corporation
Model No. : Orion SE Water Meter
Serial No. : None Assigned
Specification : FCC-15B Spurious Radiated Emissions
Date : October 5, 2010
Mode : Rx @ 914.5MHz
Notes : Test Distance is 3 meters

Freq (MHz)	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Total dBuV/m at 3 M	Total uV/m at 3M	Limit uV/m at 3M	Margin (dB)
914.5	H	9.7	*	2.4	21.8	0.0	33.9	49.6	200.0	-12.1
914.5	V	9.7	*	2.4	21.8	0.0	33.9	49.3	200.0	-12.2
1829.0	H	33.7	*	3.5	27.5	-40.0	24.7	17.1	500.0	-29.3
1829.0	V	33.7	*	3.5	27.5	-40.0	24.7	17.1	500.0	-29.3
2743.5	H	32.5	*	3.9	30.3	-39.3	27.4	23.5	500.0	-26.5
2743.5	V	32.5	*	3.9	30.3	-39.3	27.4	23.5	500.0	-26.5
3658.0	H	31.9	*	4.7	33.2	-38.5	31.3	36.7	500.0	-22.7
3658.0	V	31.9	*	4.7	33.2	-38.5	31.3	36.7	500.0	-22.7
4572.5	H	32.3	*	5.5	33.7	-38.2	33.3	46.2	500.0	-20.7
4572.5	V	32.3	*	5.5	33.7	-38.2	33.3	46.2	500.0	-20.7

H – Horizontal V – Vertical

Total (dBuV/m) = Meter Reading (dBuV) + Cable Factor (dB) + Antenna Factor (dB) + Pre Amp (dB)

Checked BY Richard E. King :

Richard E. King

Manufacturer : Badger Meter Corporation
Model No. : Orion SE Water Meter
Serial No. : None Assigned
Specification : FCC-15B Spurious Radiated Emissions
Date : October 5, 2010
Mode : Rx @ 924.5MHz
Notes : Test Distance is 3 meters

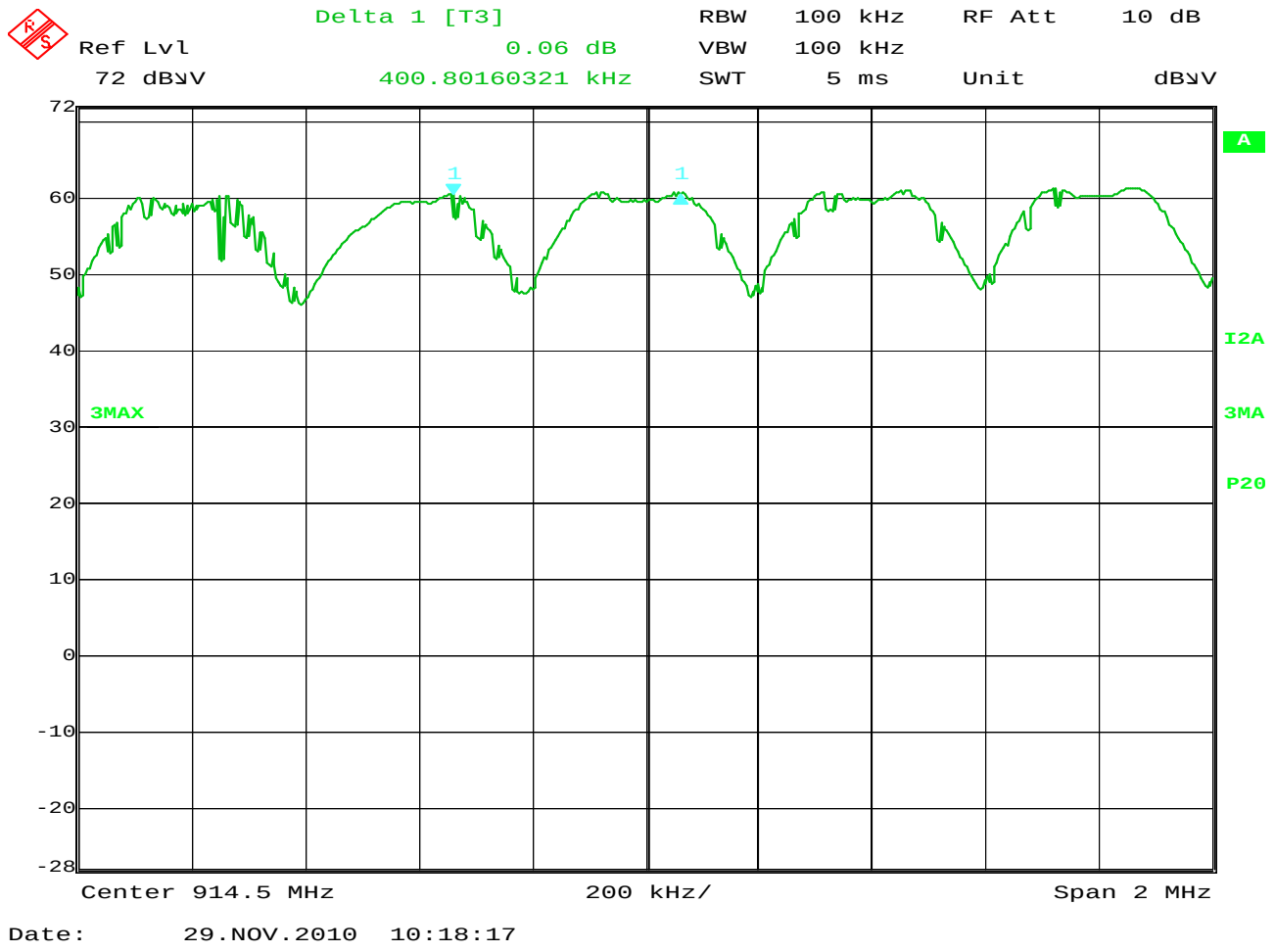
Freq (MHz)	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Total dBuV/m at 3 M	Total uV/m at 3M	Limit uV/m at 3M	Margin (dB)
924.5	H	5.3	*	2.4	21.8	0.0	29.5	30.0	200.0	-16.5
924.5	V	5.3	*	2.4	21.8	0.0	29.5	30.0	200.0	-16.5
1849.0	H	36.1	*	3.5	27.6	-40.0	27.2	22.8	500.0	-26.8
1849.0	V	36.1	*	3.5	27.6	-40.0	27.2	22.8	500.0	-26.8
2773.5	H	30.0	*	4.0	30.4	-39.2	25.1	18.0	500.0	-28.9
2773.5	V	30.1	*	4.0	30.4	-39.2	25.2	18.2	500.0	-28.8
3698.0	H	33.5	*	4.8	33.3	-38.5	33.0	44.8	500.0	-20.9
3698.0	V	33.5	*	4.8	33.3	-38.5	33.0	44.8	500.0	-20.9
4622.5	H	32.0	*	5.6	33.8	-38.2	33.1	45.4	500.0	-20.8
4622.5	V	32.0	*	5.6	33.8	-38.2	33.1	45.4	500.0	-20.8

H – Horizontal V – Vertical

Total (dBuV/m) = Meter Reading (dBuV) + Cable Factor (dB) + Antenna Factor (dB) + Pre Amp (dB)

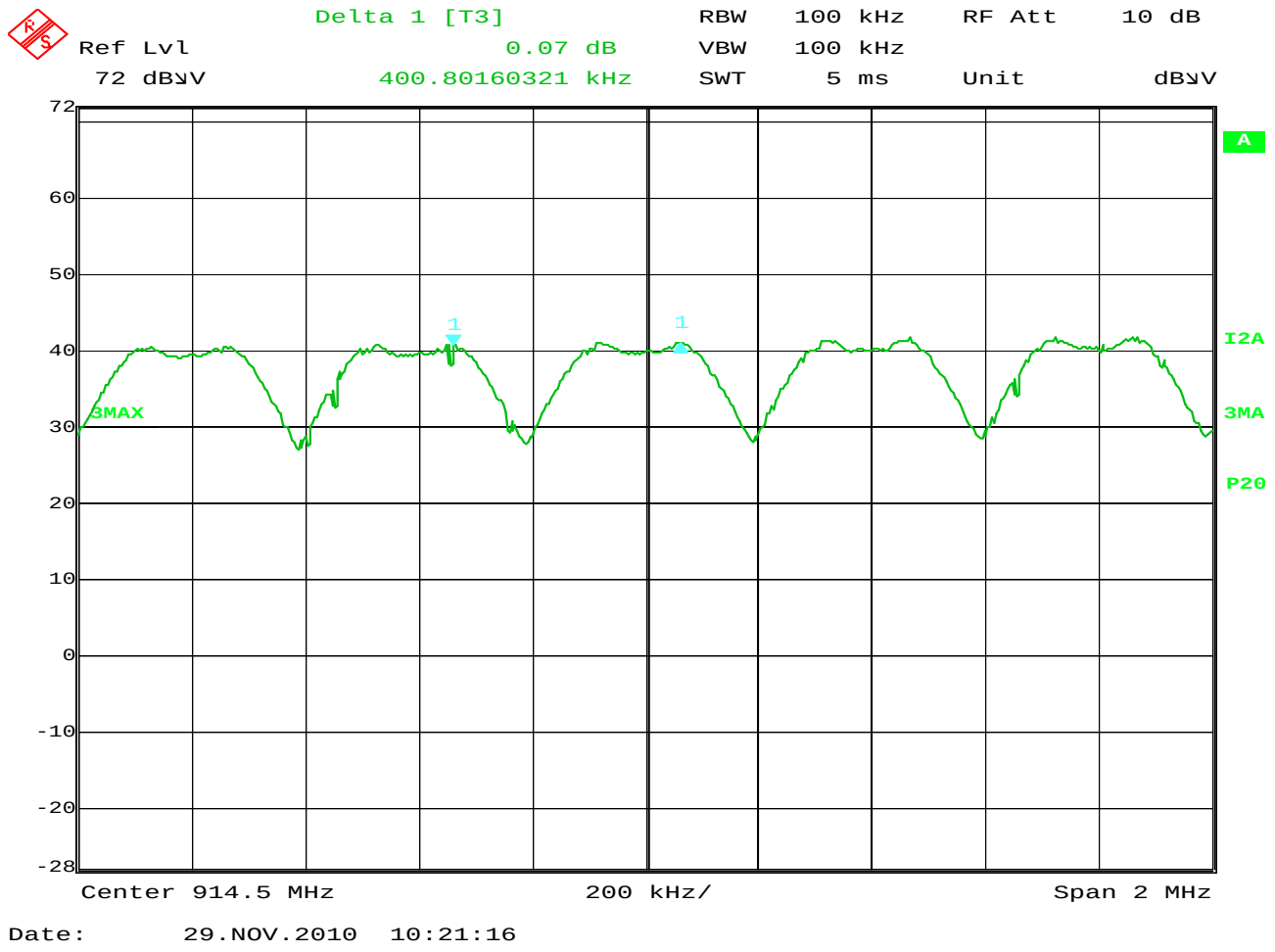
Checked BY Richard E. King :

Richard E. King



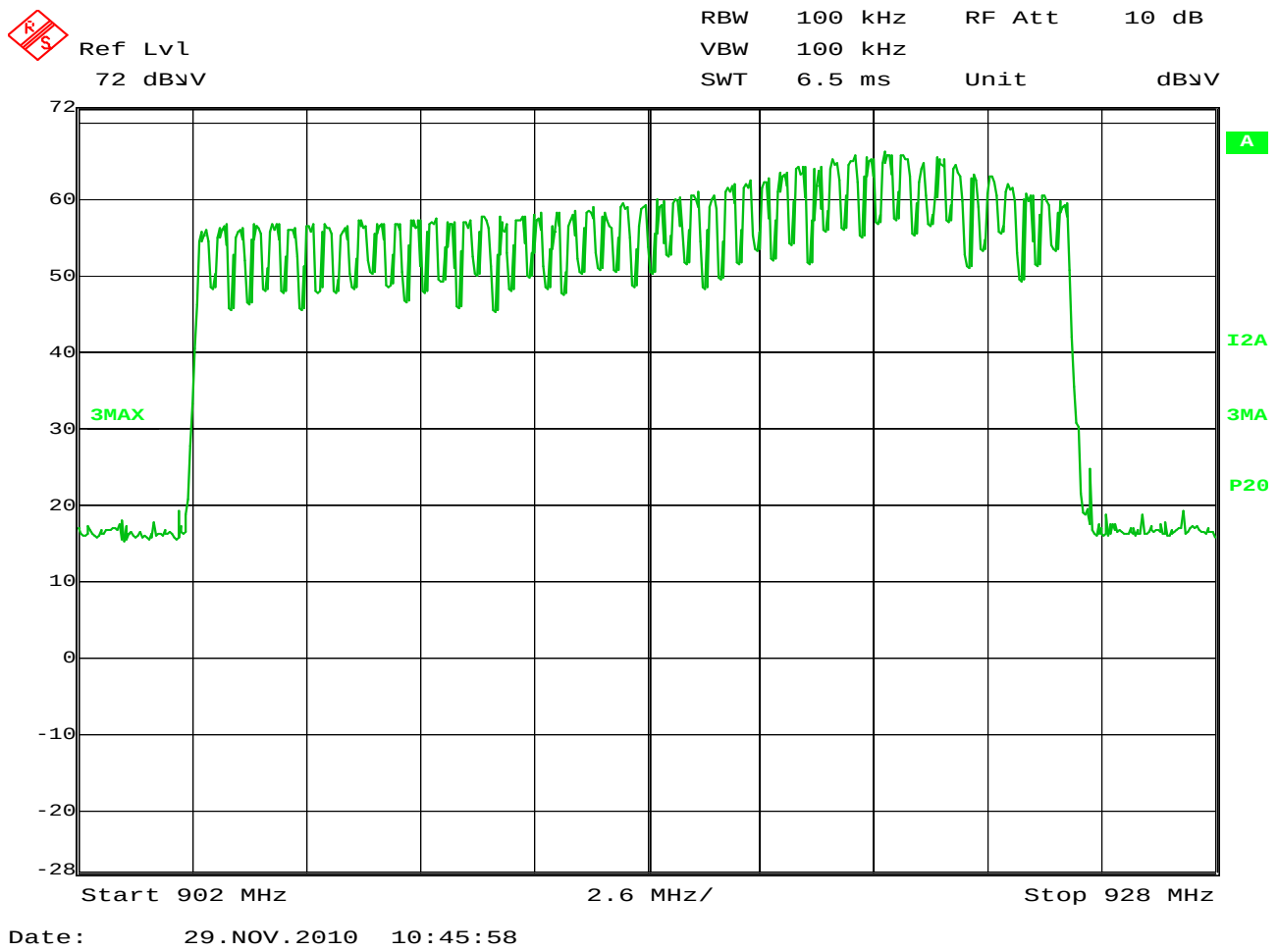
15.247(a) Carrier Frequency Separation

MANUFACTURER	:	Badger Meter Corporation
MODEL NUMBER	:	Orion SE Water Meter
TEST MODE	:	Hopping enabled
TEST PARAMETERS	:	Carrier Frequency Separation
NOTES	:	Fixed Power Setting
NOTES	:	Carrier Frequency Separation = 400.8kHz



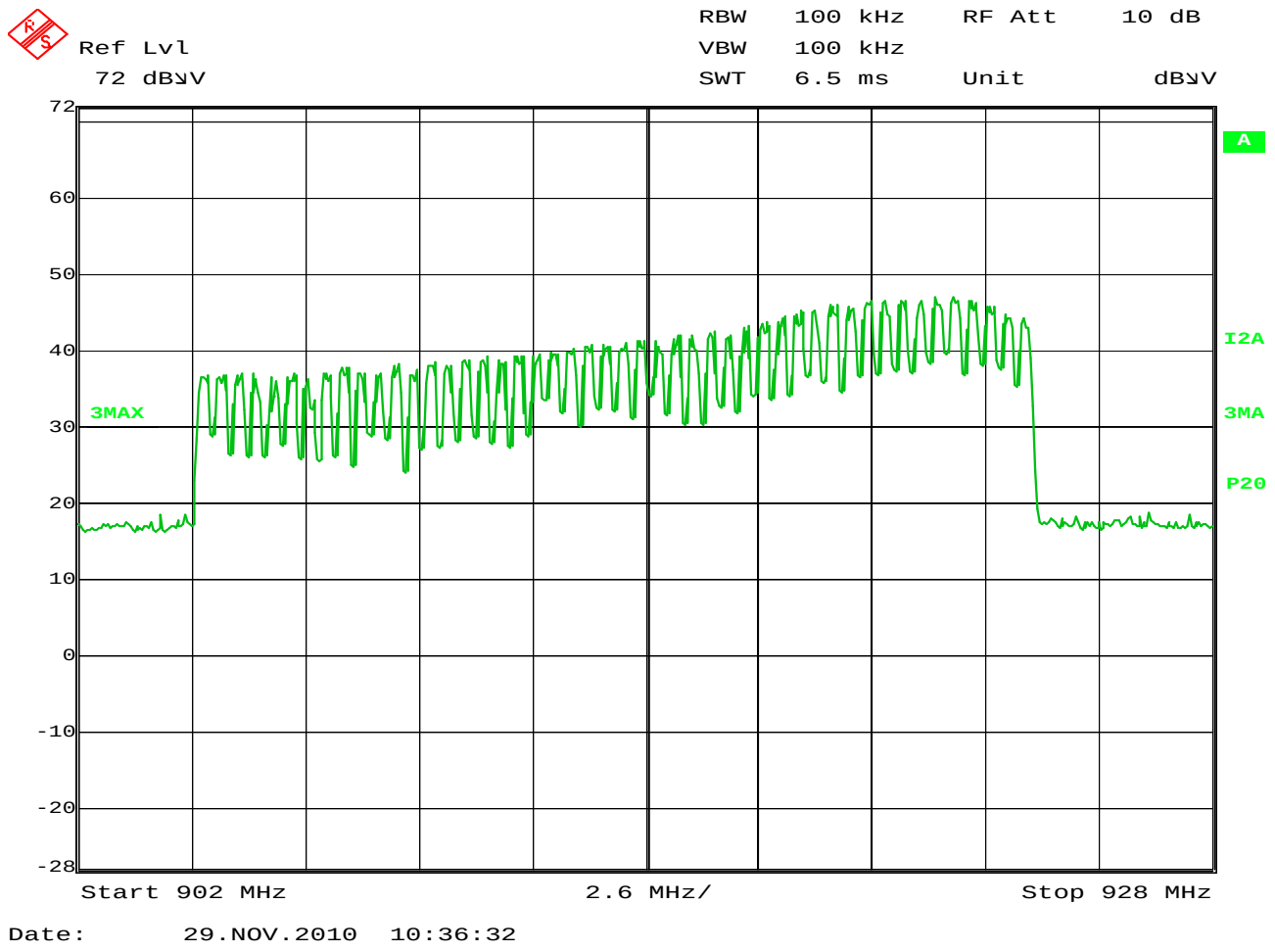
15.247(a) Carrier Frequency Separation

MANUFACTURER	:	Badger Meter Corporation
MODEL NUMBER	:	Orion SE Water Meter
TEST MODE	:	Hopping enabled
TEST PARAMETERS	:	Carrier Frequency Separation
NOTES	:	Mobile Power Setting
NOTES	:	Carrier Frequency Separation = 400.8kHz



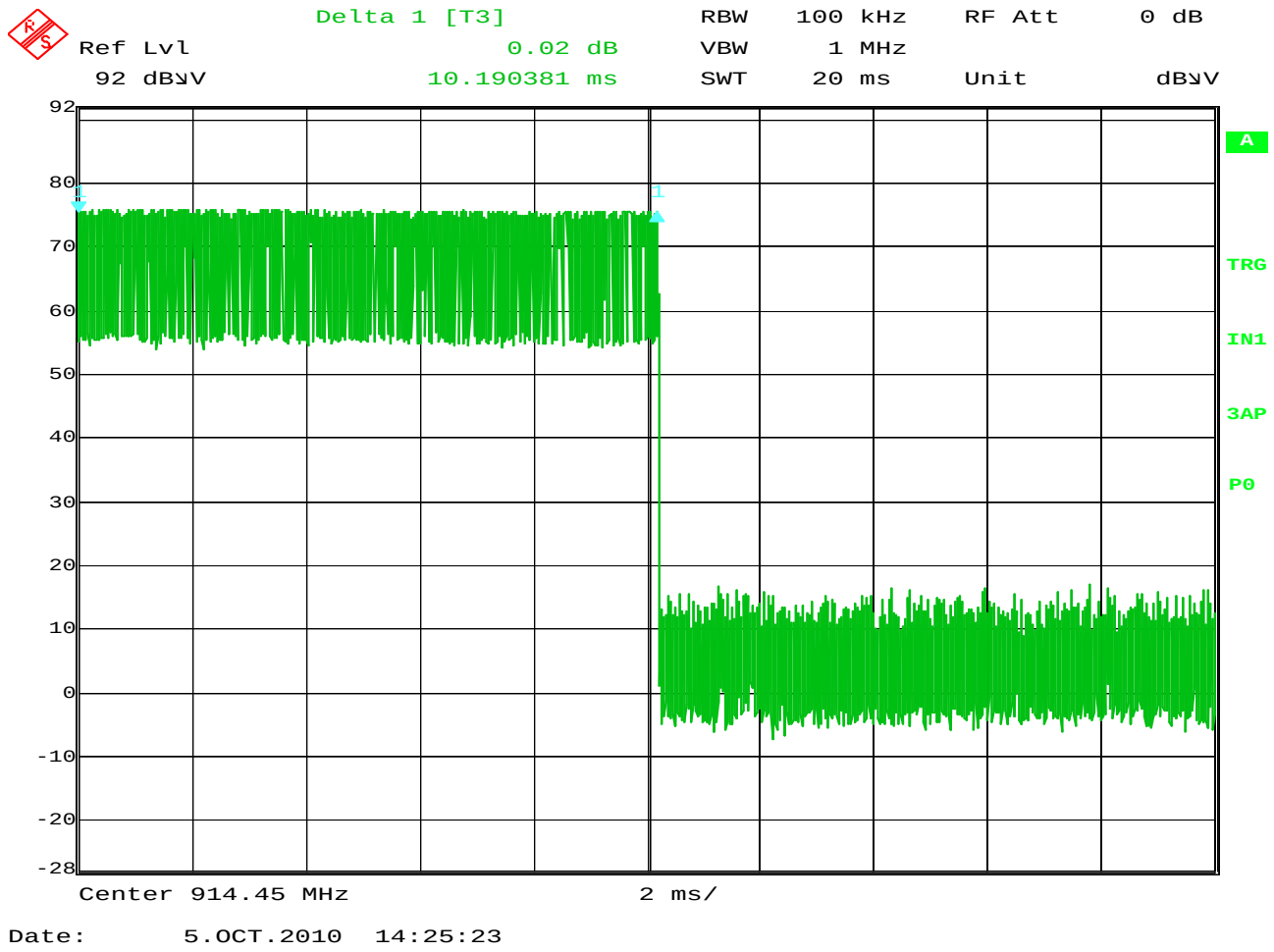
15.247(a) Number of Hopping Frequencies

MANUFACTURER	:	Badger Meter Corporation
MODEL NUMBER	:	Orion SE Water Meter
TEST MODE	:	Hopping enabled
TEST PARAMETERS	:	Number of Hopping Frequencies
NOTES	:	Fixed Power Setting
NOTES	:	Number of Hopping Frequencies = 50



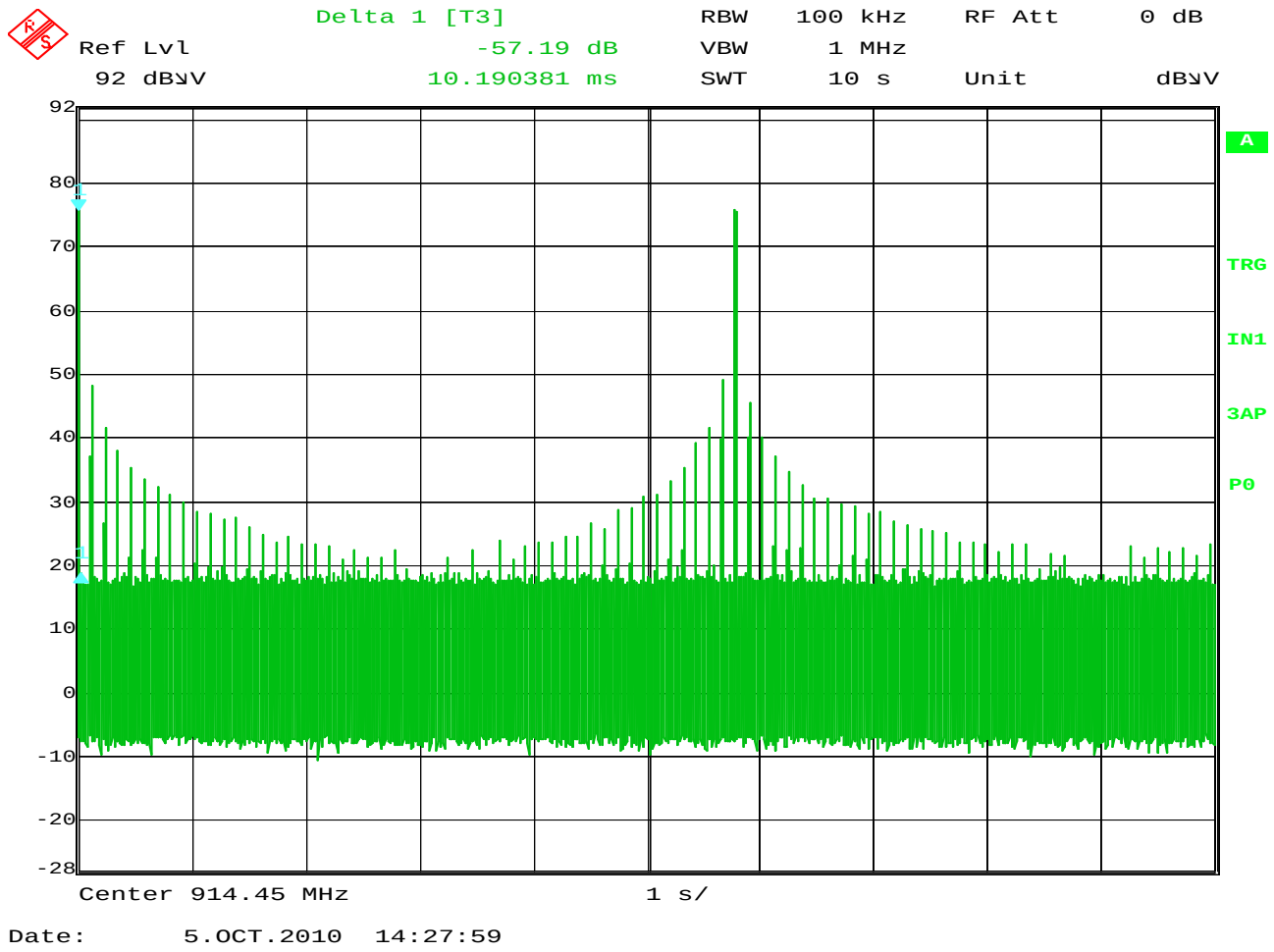
15.247(a) Number of Hopping Frequencies

MANUFACTURER	:	Badger Meter Corporation
MODEL NUMBER	:	Orion SE Water Meter
TEST MODE	:	Hopping enabled
TEST PARAMETERS	:	Number of Hopping Frequencies
NOTES	:	Mobile Power Setting
NOTES	:	Number of Hopping Frequencies = 48



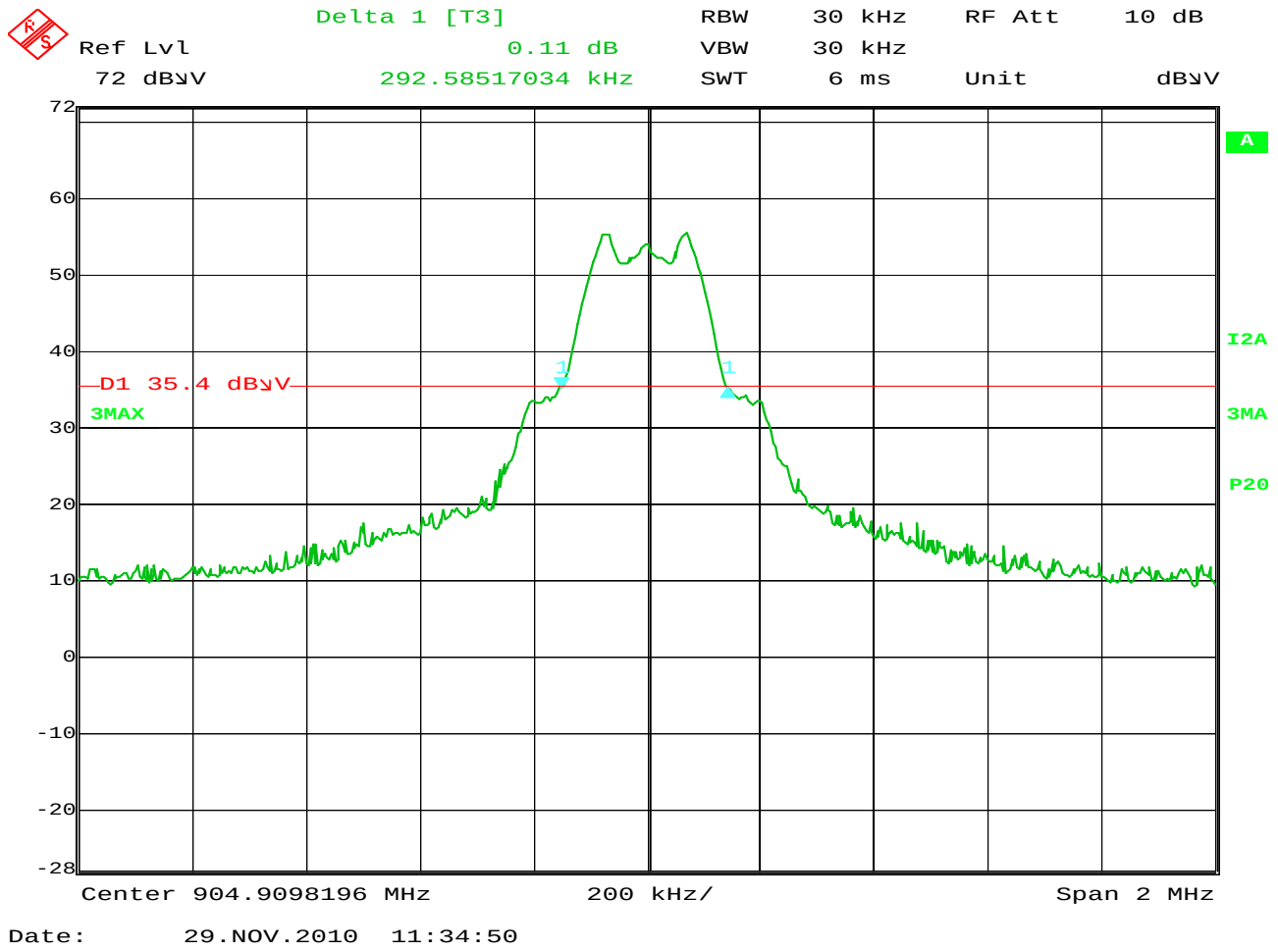
15.247(a) Time of Occupancy

MANUFACTURER	:	Badger Meter Corporation
MODEL NUMBER	:	Orion SE Water Meter
TEST MODE	:	Hopping enabled
TEST PARAMETERS	:	Time of Occupancy
NOTES	:	Fixed Power Setting



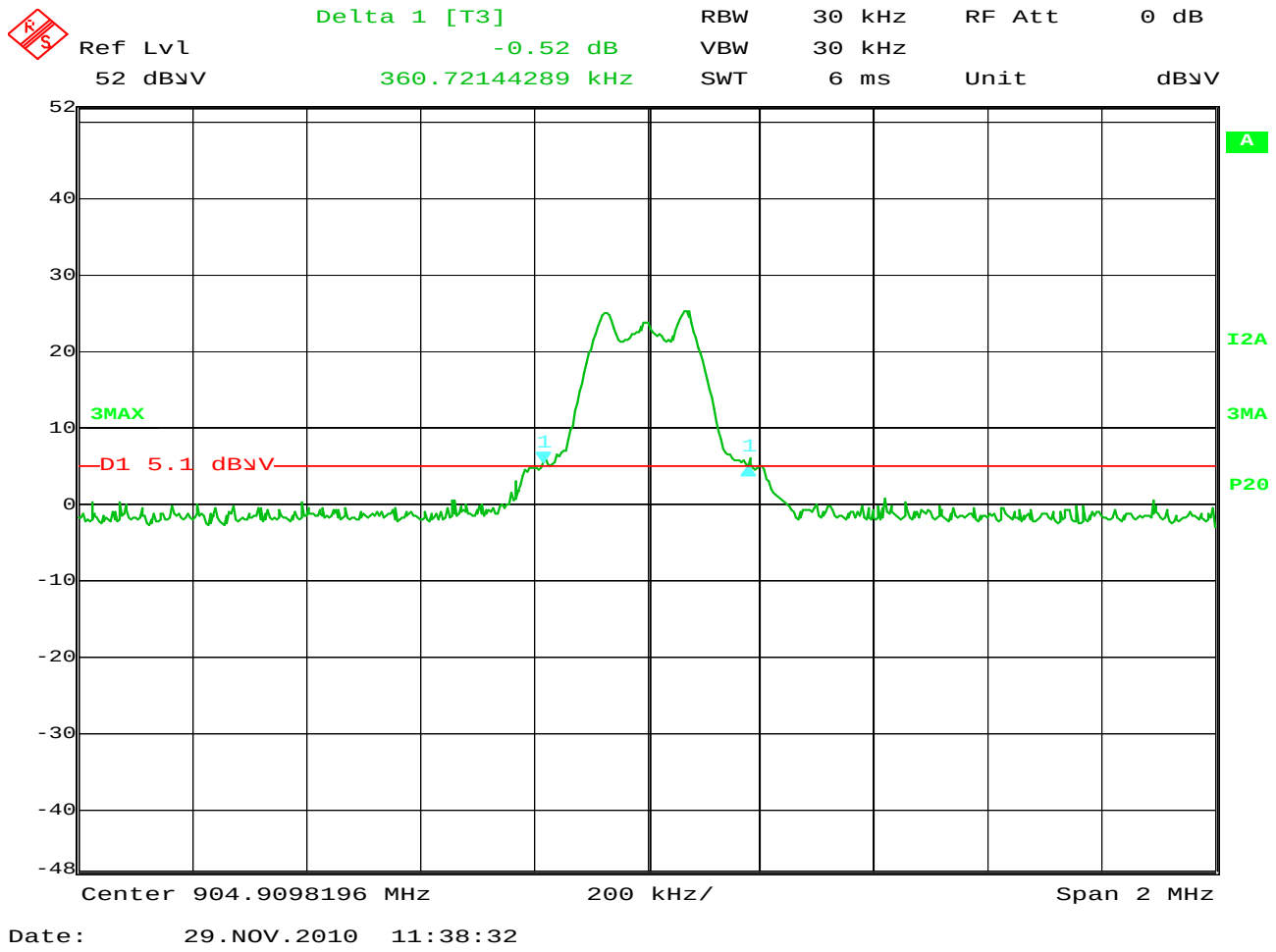
15.247(a) Time of Occupancy

MANUFACTURER	:	Badger Meter Corporation
MODEL NUMBER	:	Orion SE Water Meter
TEST MODE	:	Hopping enabled
TEST PARAMETERS	:	Time of Occupancy
NOTES	:	Fixed Power Setting



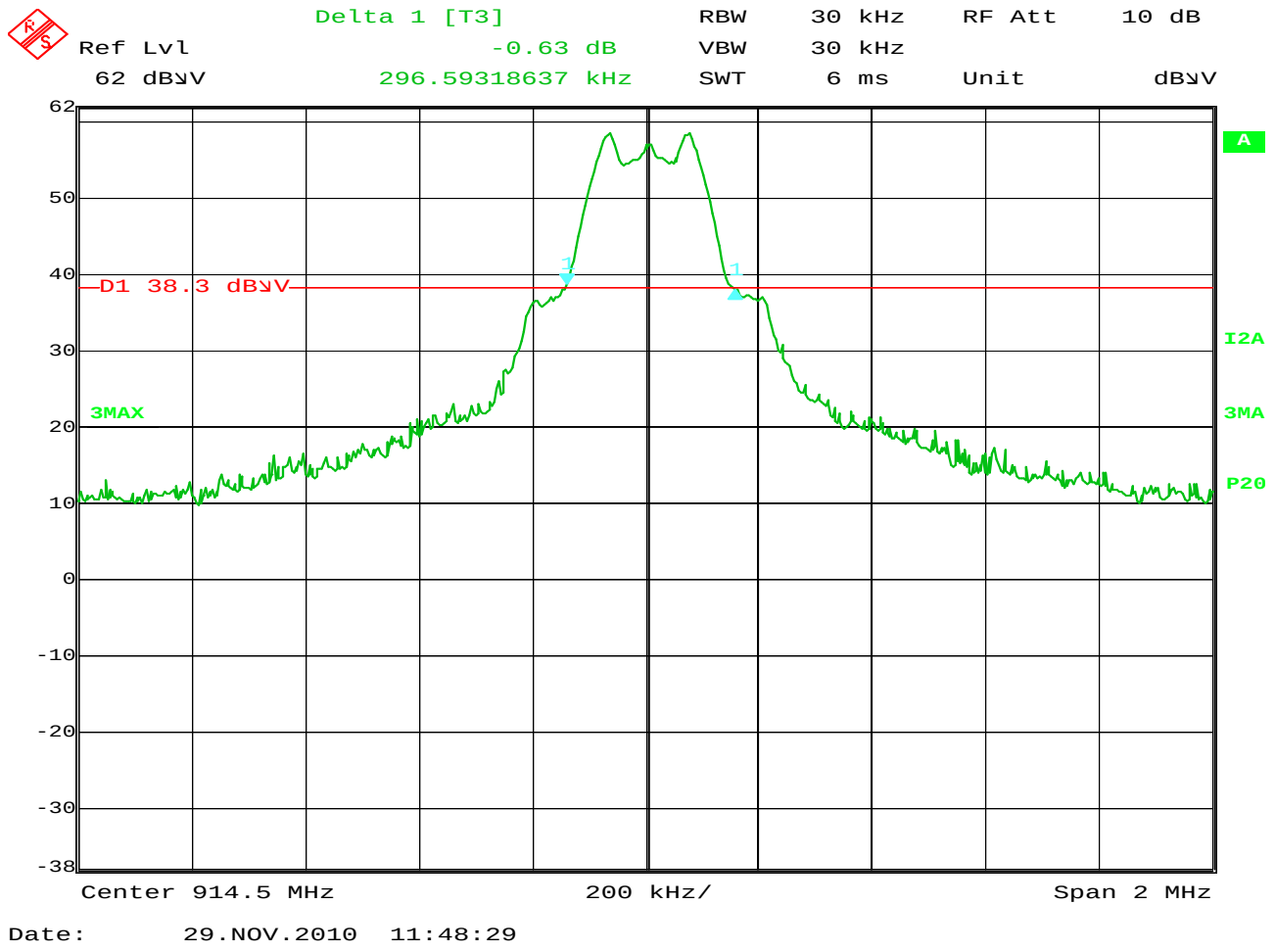
15.247(a) 20dB Bandwidth

MANUFACTURER	:	Badger Meter Corporation
MODEL NUMBER	:	Orion SE Water Meter
TEST MODE	:	Tx @ 904.9MHz
TEST PARAMETERS	:	20 dB Bandwidth
NOTES	:	20 dB Bandwidth = 292.6kHz
NOTES	:	Fixed Power Setting



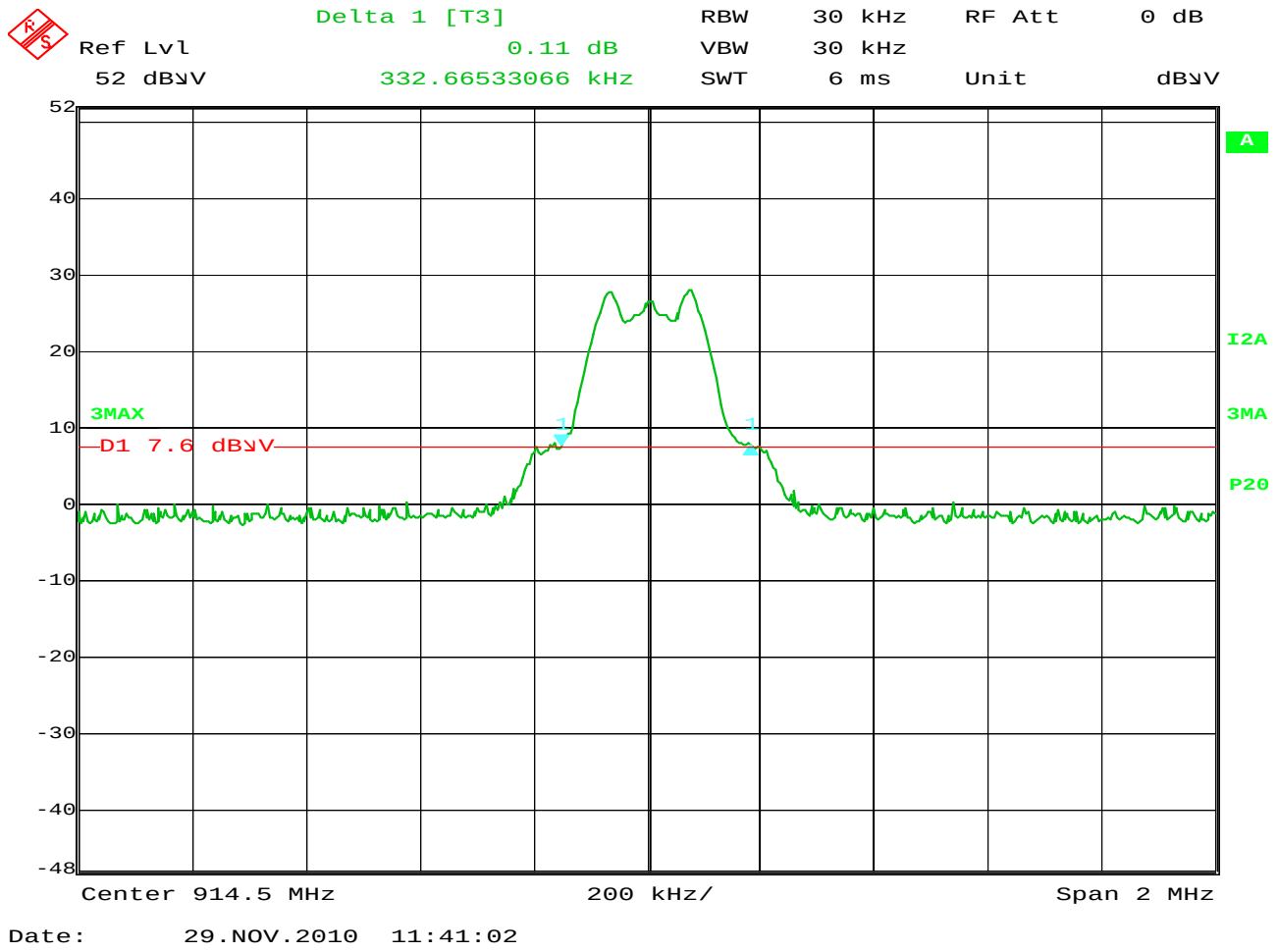
15.247(a) 20dB Bandwidth

MANUFACTURER	:	Badger Meter Corporation
MODEL NUMBER	:	Orion SE Water Meter
TEST MODE	:	Tx @ 904.9MHz
TEST PARAMETERS	:	20 dB Bandwidth
NOTES	:	20 dB Bandwidth = 360.7kHz
NOTES	:	Mobile Power Setting



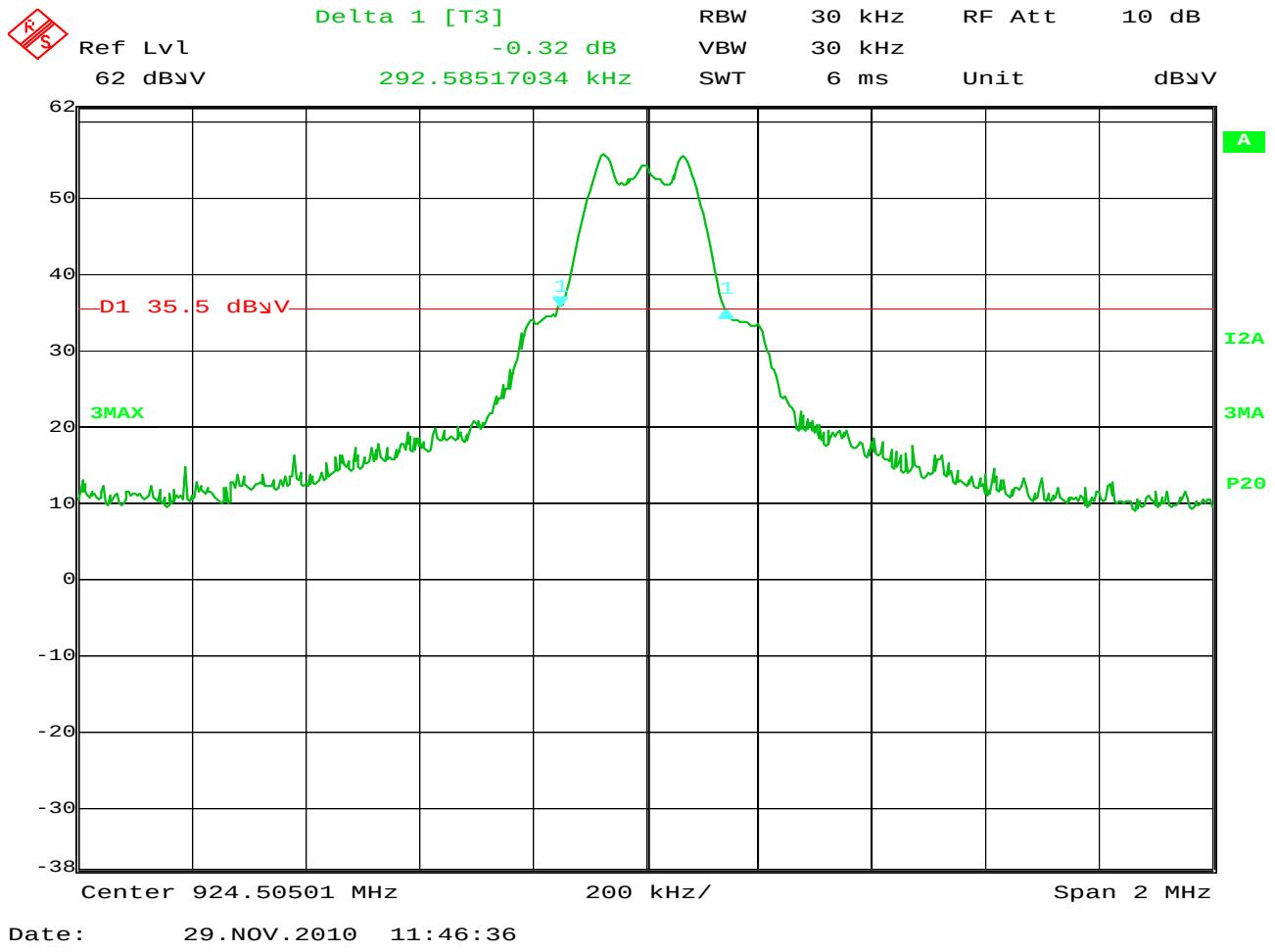
15.247(a) 20dB Bandwidth

MANUFACTURER	:	Badger Meter Corporation
MODEL NUMBER	:	Orion SE Water Meter
TEST MODE	:	Tx @ 914.5MHz
TEST PARAMETERS	:	20 dB Bandwidth
NOTES	:	20 dB Bandwidth = 296.6kHz
NOTES	:	Fixed Power Setting



15.247(a) 20dB Bandwidth

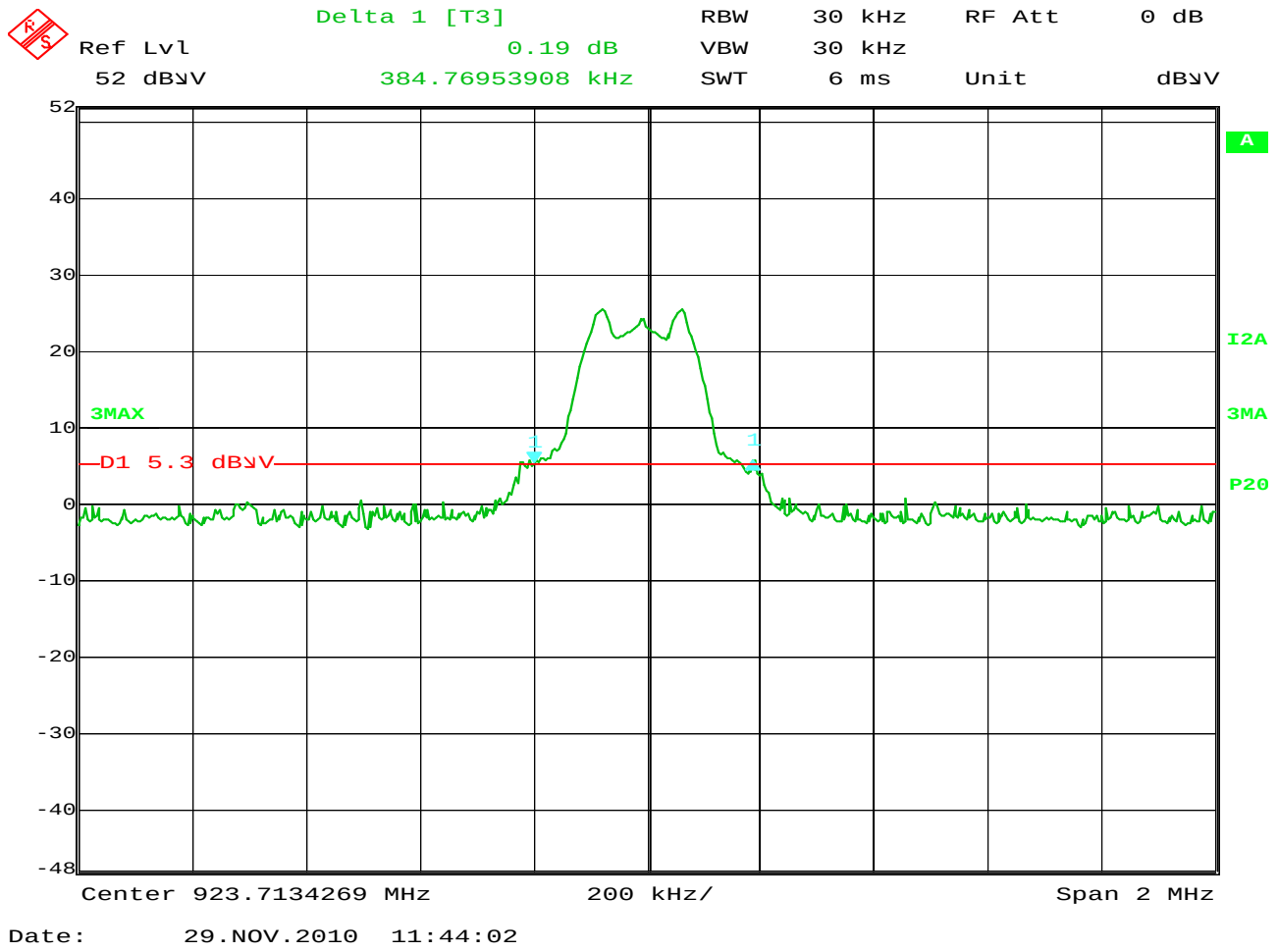
MANUFACTURER	:	Badger Meter Corporation
MODEL NUMBER	:	Orion SE Water Meter
TEST MODE	:	Tx @ 914.5MHz
TEST PARAMETERS	:	20 dB Bandwidth
NOTES	:	20 dB Bandwidth = 332.7kHz
NOTES	:	Mobile Power Setting



15.247(a) 20dB Bandwidth

MANUFACTURER	:	Badger Meter Corporation
MODEL NUMBER	:	Orion SE Water Meter
TEST MODE	:	Tx @ 924.5MHz
TEST PARAMETERS	:	20 dB Bandwidth
NOTES	:	20 dB Bandwidth = 292.6kHz
NOTES	:	Fixed Power Setting

NOTES



15.247(a) 20dB Bandwidth

MANUFACTURER	:	Badger Meter Corporation
MODEL NUMBER	:	Orion SE Water Meter
TEST MODE	:	Tx @ 923.7MHz
TEST PARAMETERS	:	20 dB Bandwidth
NOTES	:	20 dB Bandwidth = 384.8kHz
NOTES	:	Mobile Power Setting

Manufacturer : Badger Meter Corporation
Test Item : Water Meter
Model No. : Orion SE Water Meter
Test Specification : FCC Part 15, Subpart C, Section 15.247, Peak Output Power
Date : November 27, 2010
Notes : Mobile Power Setting

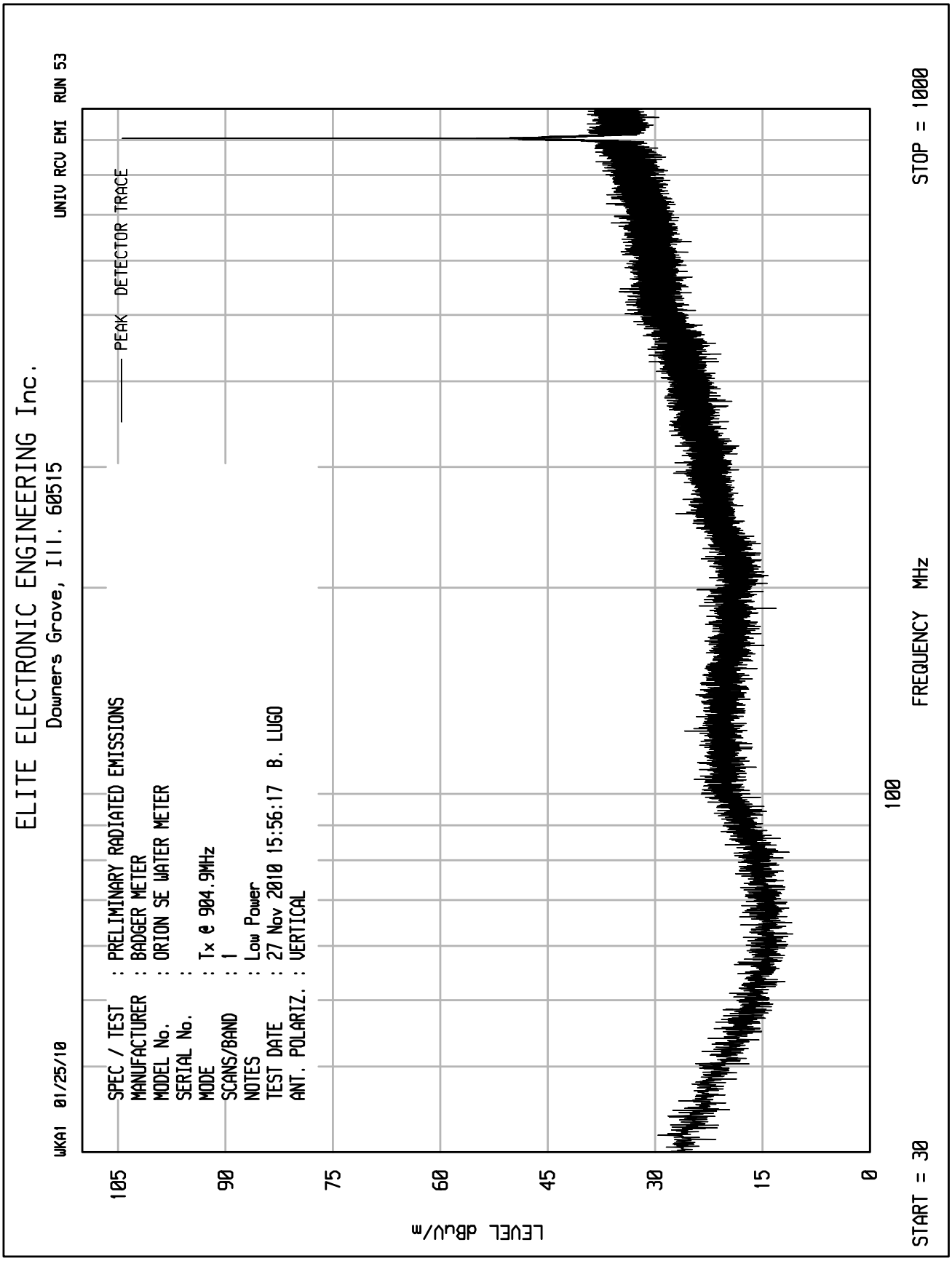
Frequency MHz	Antenna Polarity	Meter Reading dBuV	Matched Signal Generator Reading dBm	Antenna Gain dB	Cable Loss dB	EIRP dBm	Limit dBm
904.9	H	77.0	1.9	2.2	1.9	2.2	30
904.9	V	82.8	9.1	2.2	1.9	9.4	30
914.1	H	75.9	1.1	2.2	1.9	1.4	30
914.1	V	80.9	7.7	2.2	1.9	8.0	30
923.7	H	72.5	-1.9	2.2	1.9	-1.6	30
923.7	V	79.8	7.2	2.2	1.9	7.4	30

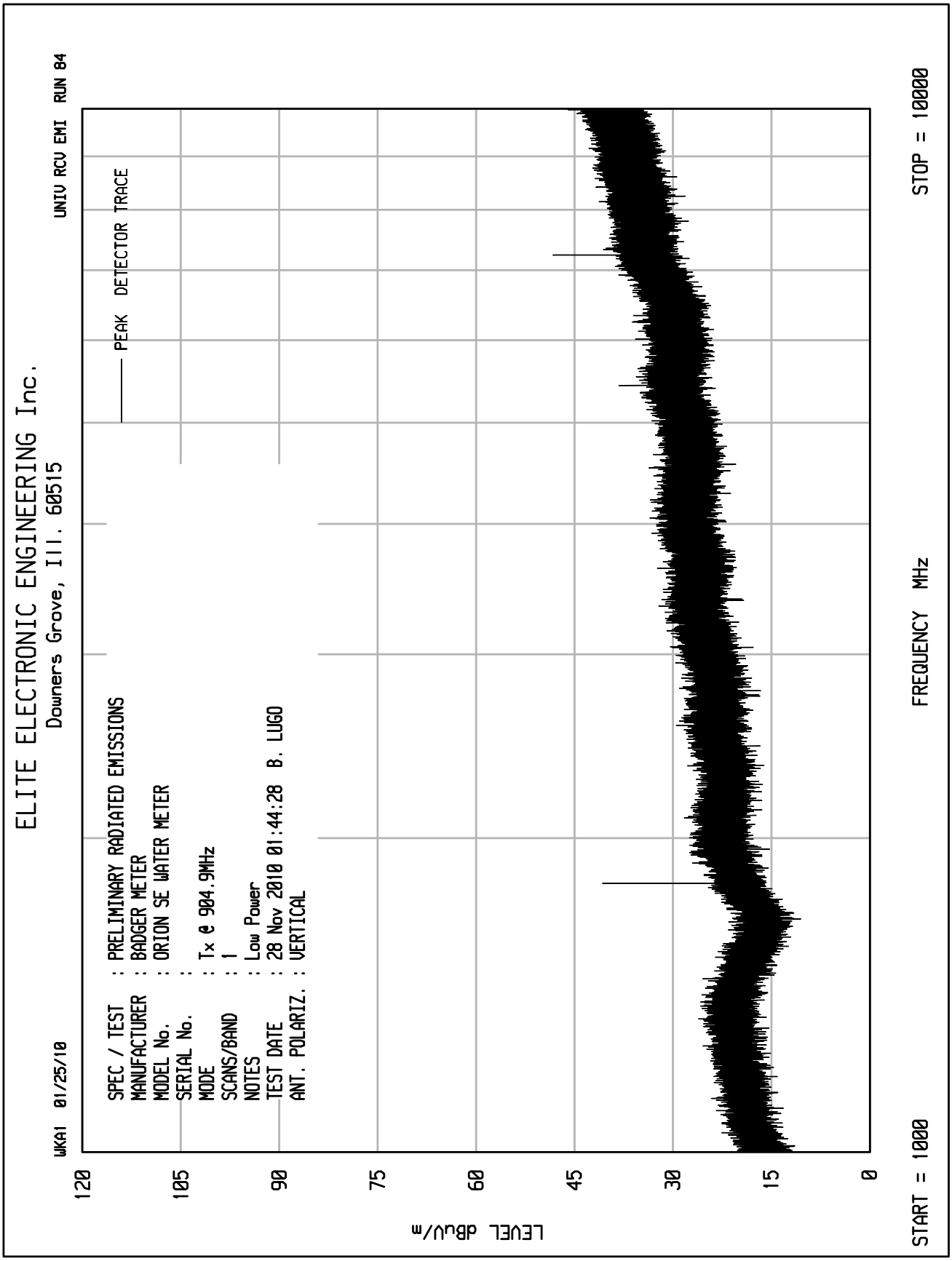
EIRP = Sig. Gen. Reading + Antenna Gain – Cable Loss

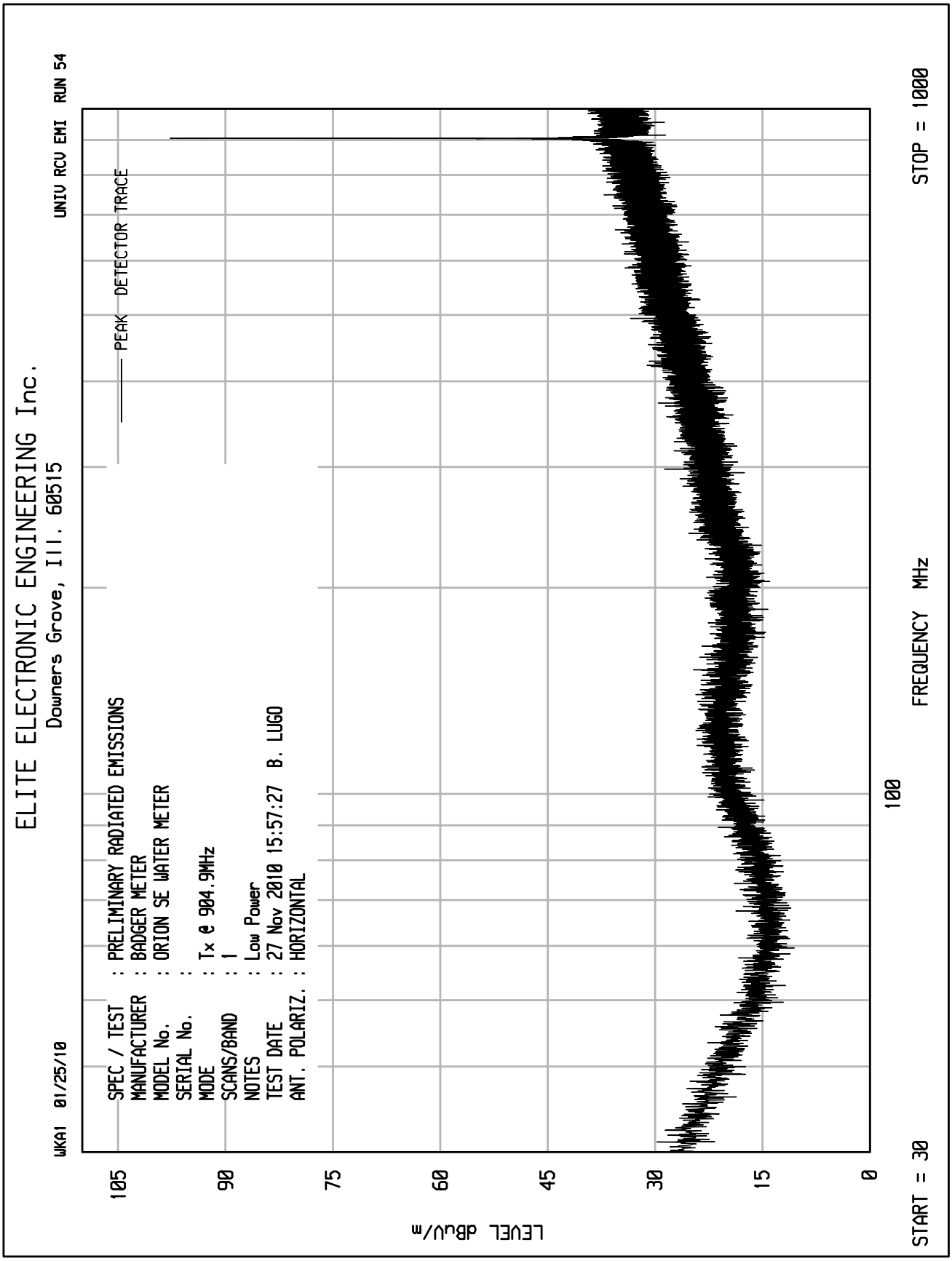
Manufacturer : Badger Meter Corporation
Test Item : Water Meter
Model No. : Orion SE Water Meter
Test Specification : FCC Part 15, Subpart C, Section 15.247, Peak Output Power
Date : November 27, 2010
Notes : Fixed Power Setting

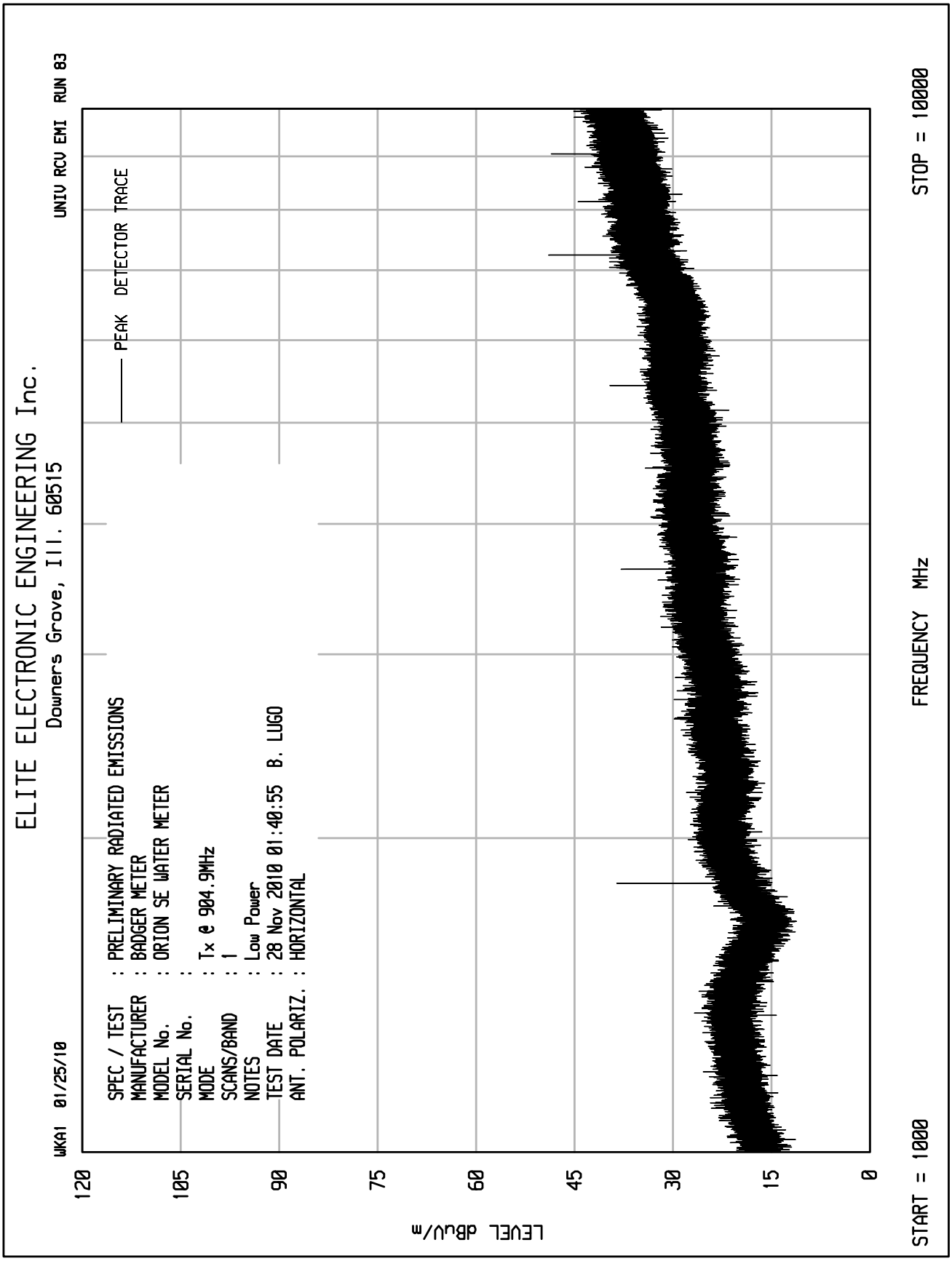
Frequency MHz	Antenna Polarity	Meter Reading dBuV	Matched Signal Generator Reading dBm	Antenna Gain dB	Cable Loss dB	EIRP dBm	Limit dBm
904.9	H	91.3	16.2	2.2	1.9	16.5	36
904.9	V	93.1	19.4	2.2	1.9	19.7	36
914.5	H	89.9	15.1	2.2	1.9	15.4	36
914.5	V	93.7	20.6	2.2	1.9	20.8	36
924.5	H	89.5	15.1	2.2	1.9	15.4	36
924.5	V	96.7	24.1	2.2	1.9	24.4	36

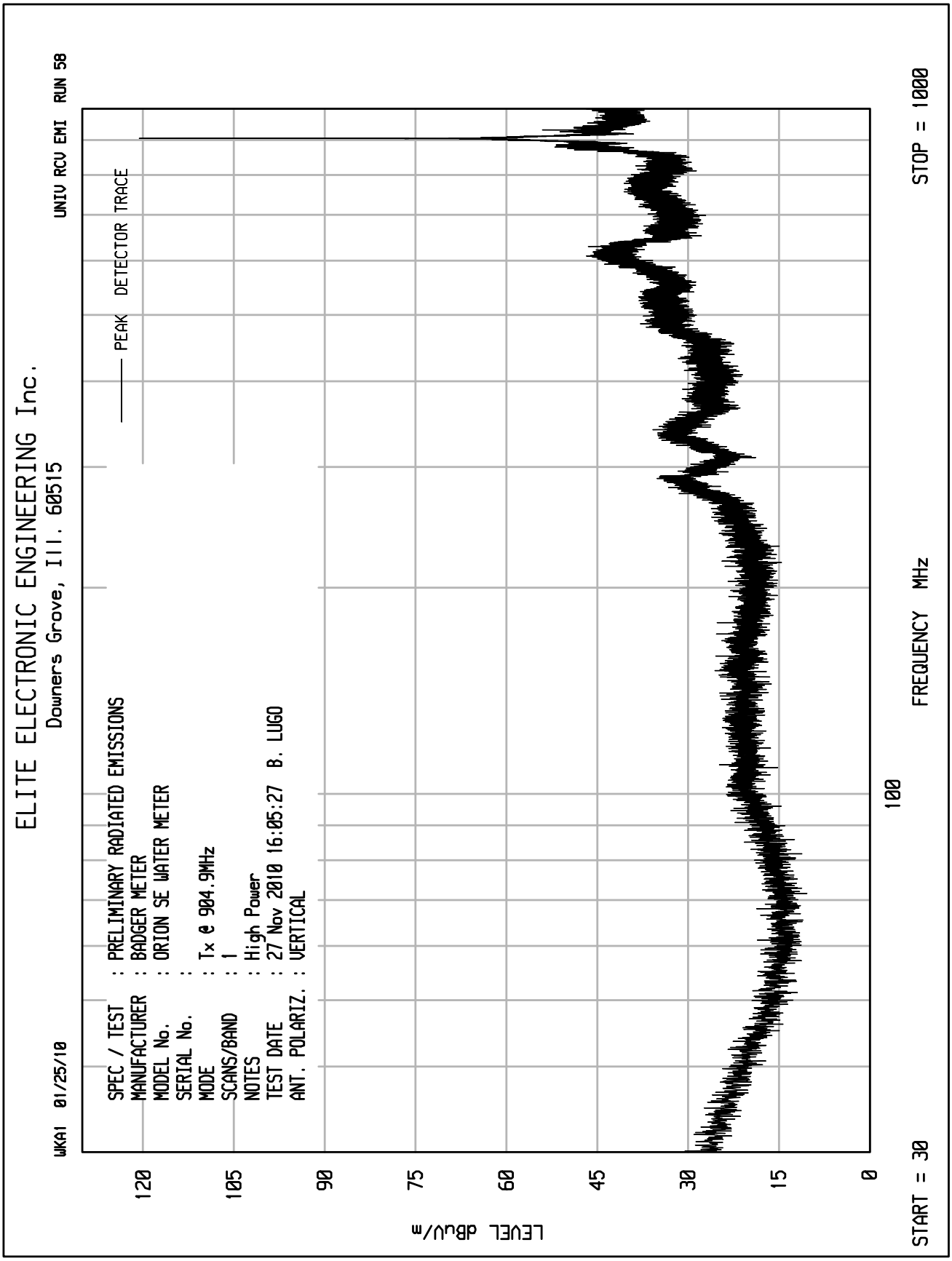
EIRP = Sig. Gen. Reading + Antenna Gain – Cable Loss

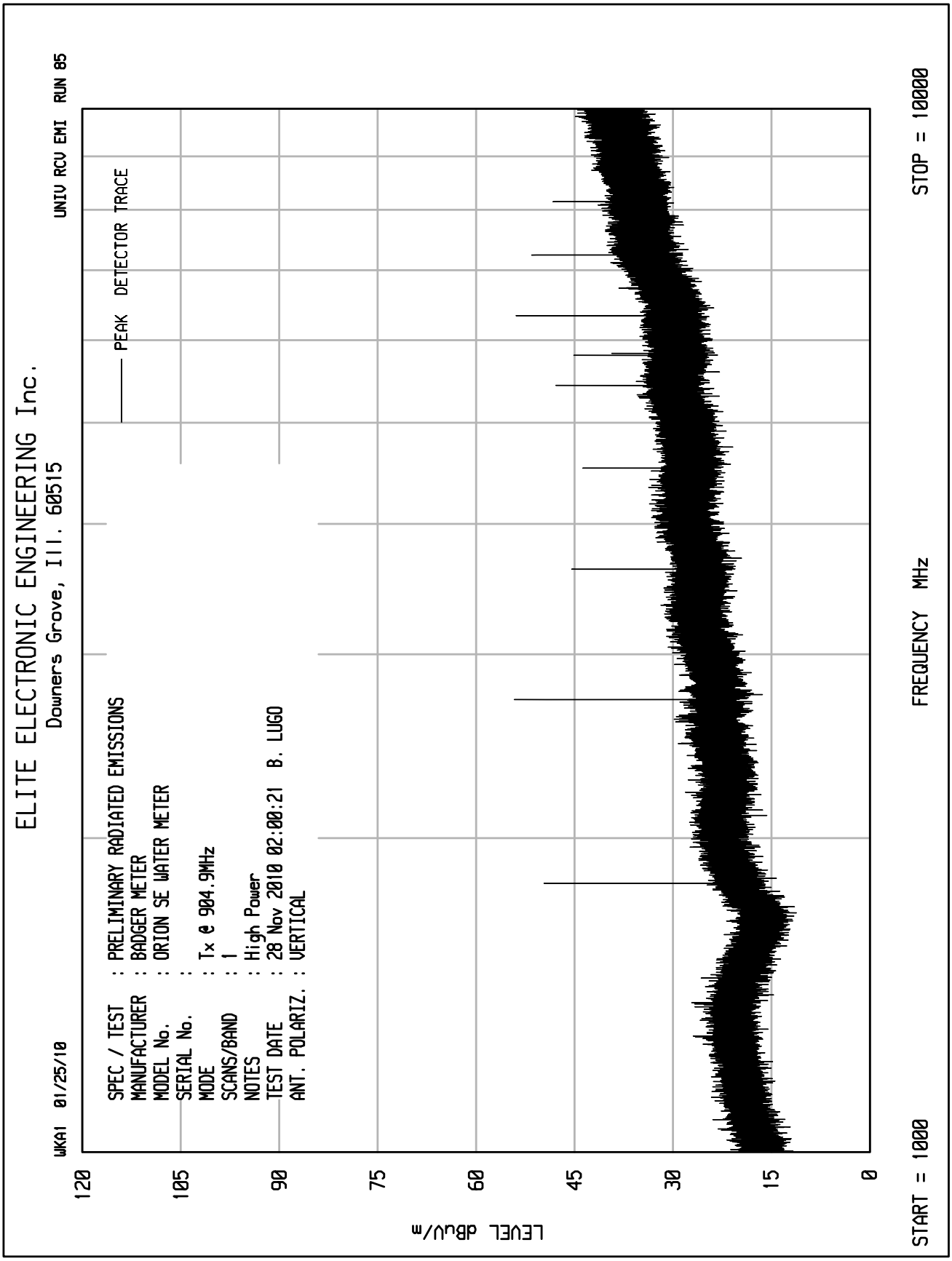

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 53
WKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE WATER METER
SERIAL No. :
MODE : Tx @ 904.9MHz
SCANS/BAND : 1
NOTES : Low Power
TEST DATE : 27 Nov 2010 15:56:17 B. LUGO
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000

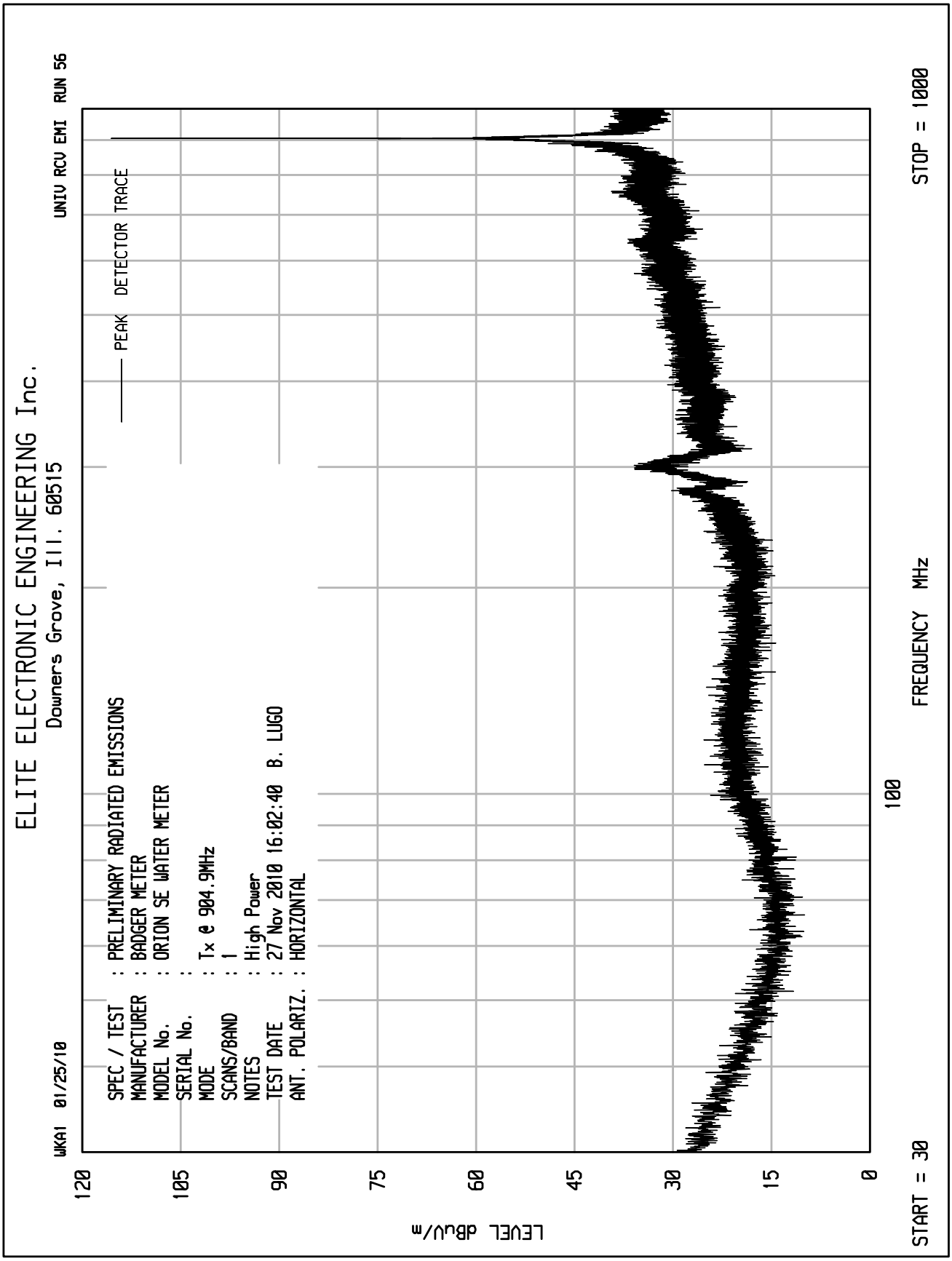

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 84
WKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE WATER METER
SERIAL No. :
MODE : Tx @ 904.9MHz
SCANS/BAND : 1
NOTES : Low Power
TEST DATE : 28 Nov 2010 01:44:28 B. LUGO
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000

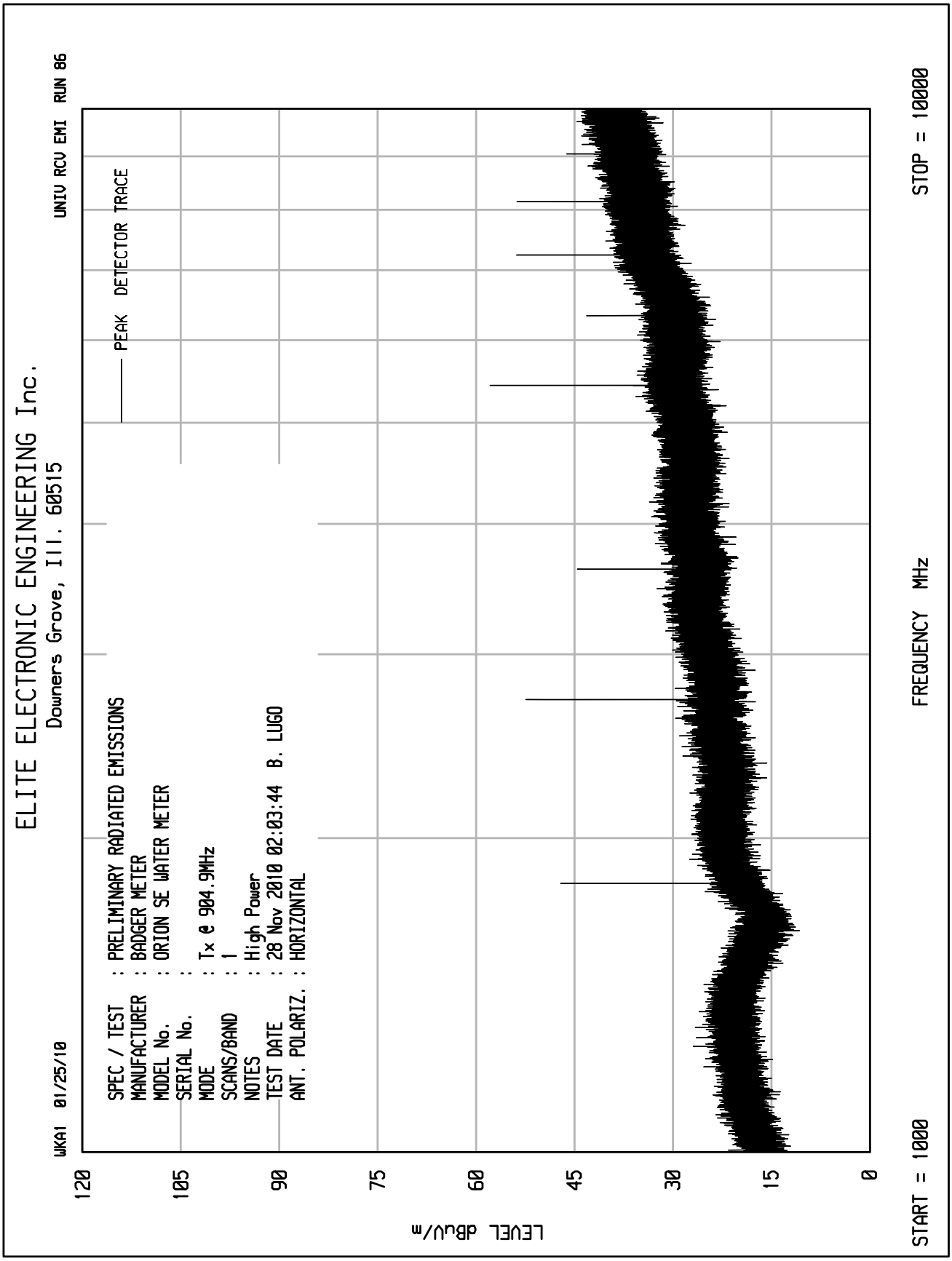

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 54
WKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE WATER METER
SERIAL No. :
MODE : Tx @ 904.9MHz
SCANS/BAND : 1
NOTES : Low Power
TEST DATE : 27 Nov 2010 15:57:27 B. LUGO
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000

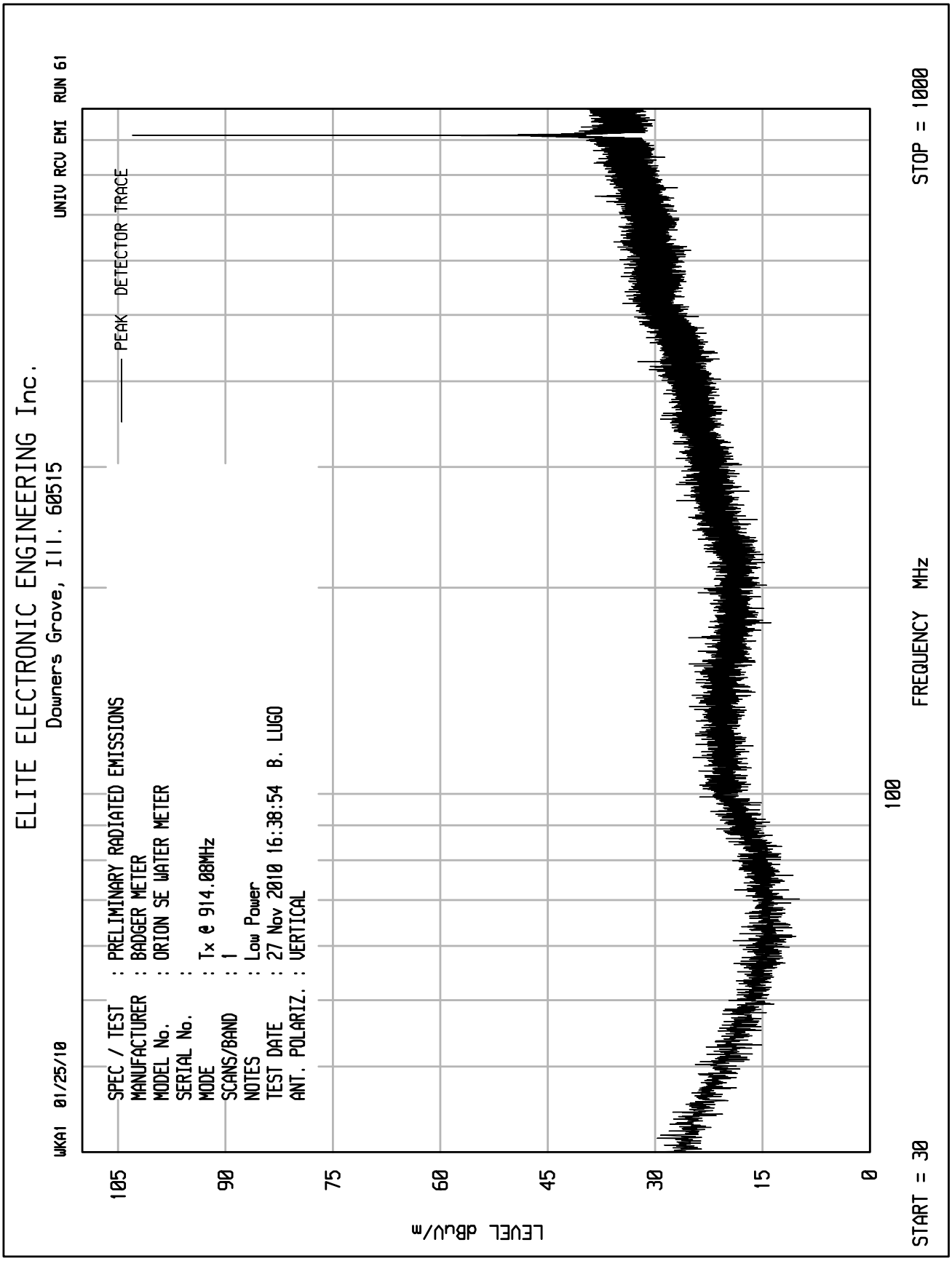

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 83
WKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE WATER METER
SERIAL No. :
MODE : Tx @ 904.9MHz
SCANS/BAND : 1
NOTES : Low Power
TEST DATE : 28 Nov 2010 01:40:55 B. LUGO
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000

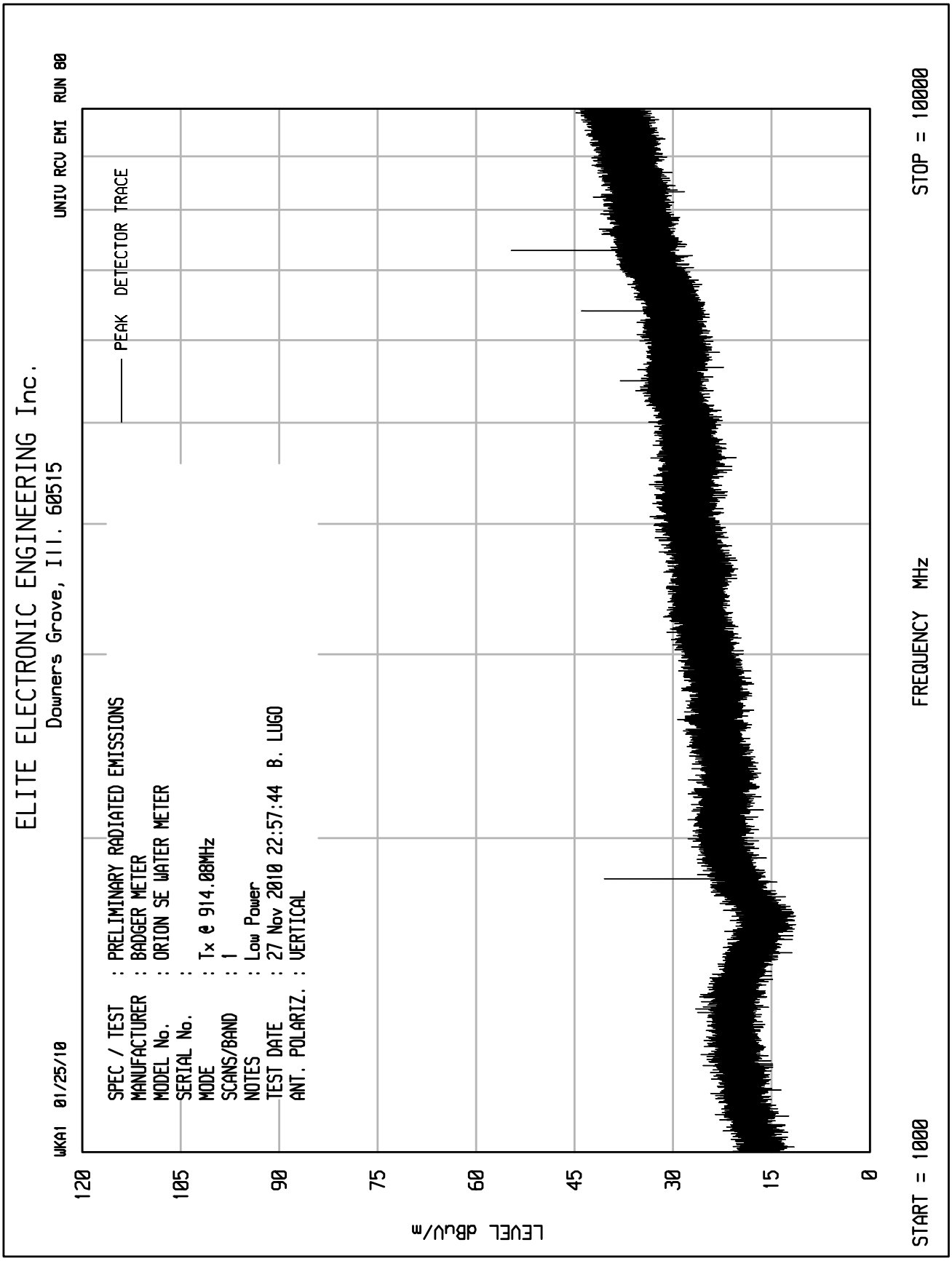

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 58
WKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE WATER METER
SERIAL No. :
MODE : Tx @ 904.9MHz
SCANS/BAND : 1
NOTES : High Power
TEST DATE : 27 Nov 2010 16:05:27 B. LUGO
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000

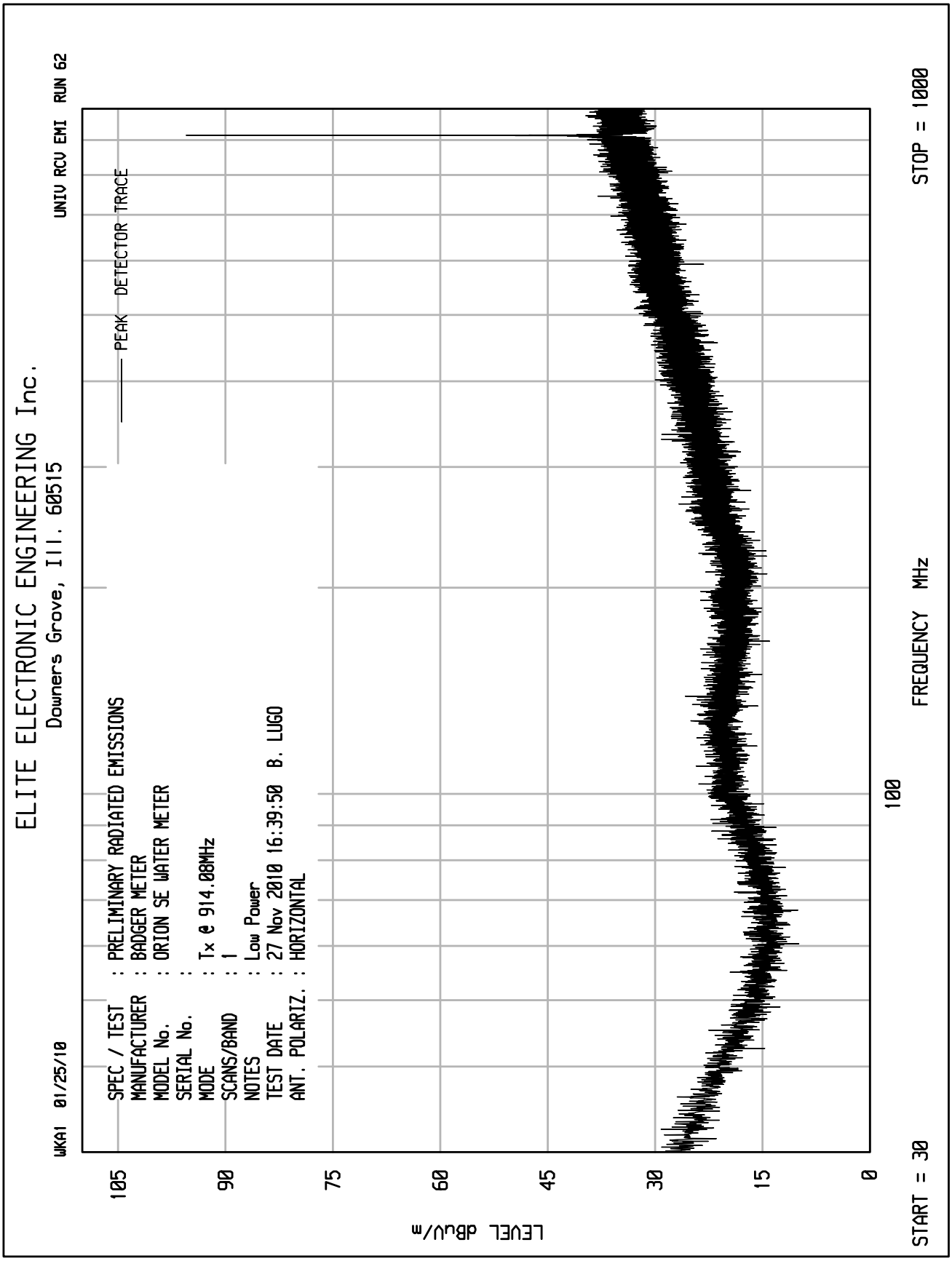

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 85
WKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE WATER METER
SERIAL No. :
MODE : Tx @ 904.9MHz
SCANS/BAND : 1
NOTES : High Power
TEST DATE : 28 Nov 2010 02:00:21 B. LUGO
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000

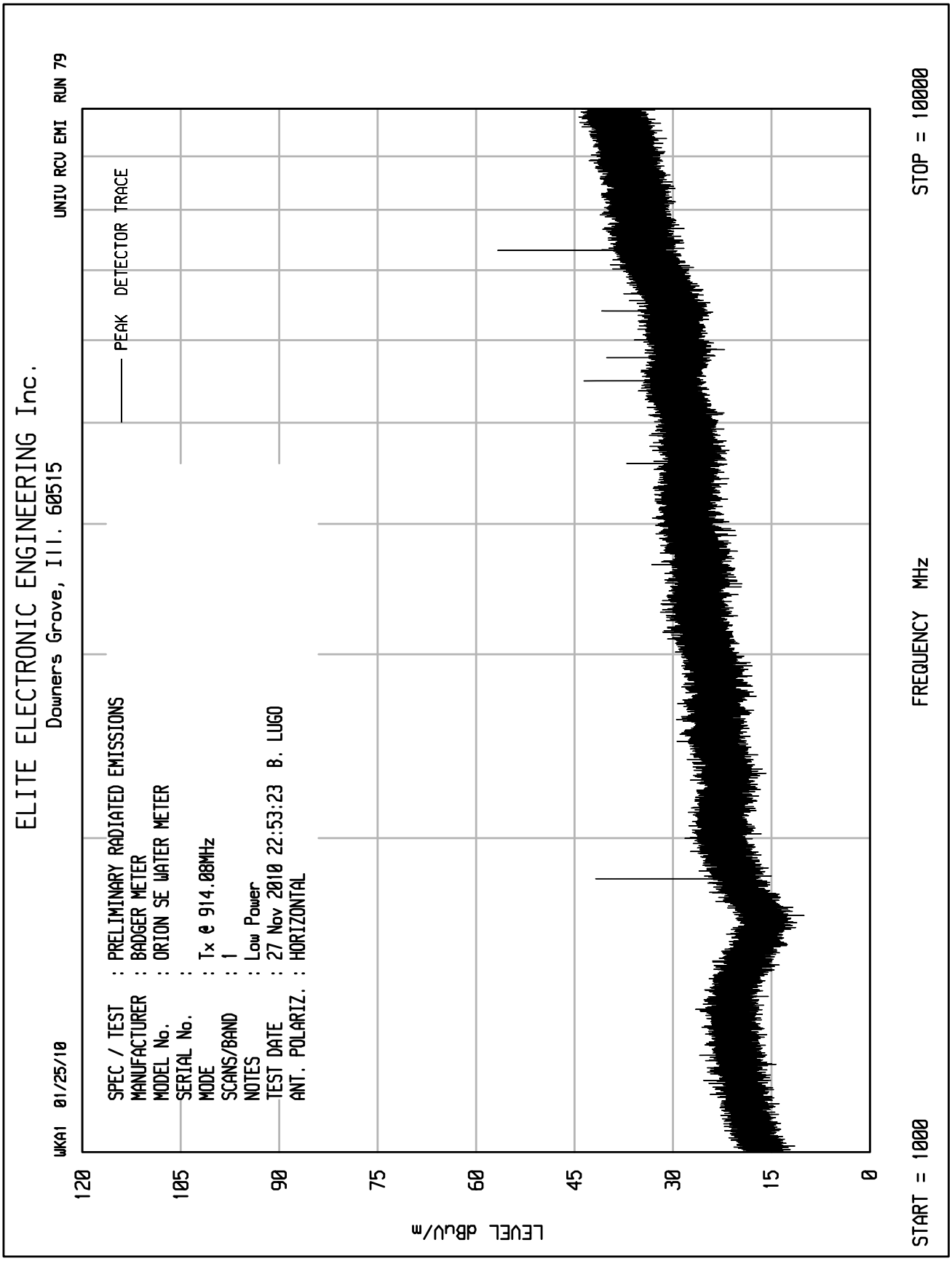

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 56
WKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE WATER METER
SERIAL No. :
MODE : Tx @ 904.9MHz
SCANS/BAND : 1
NOTES : High Power
TEST DATE : 27 Nov 2010 16:02:40 B. LUGO
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000

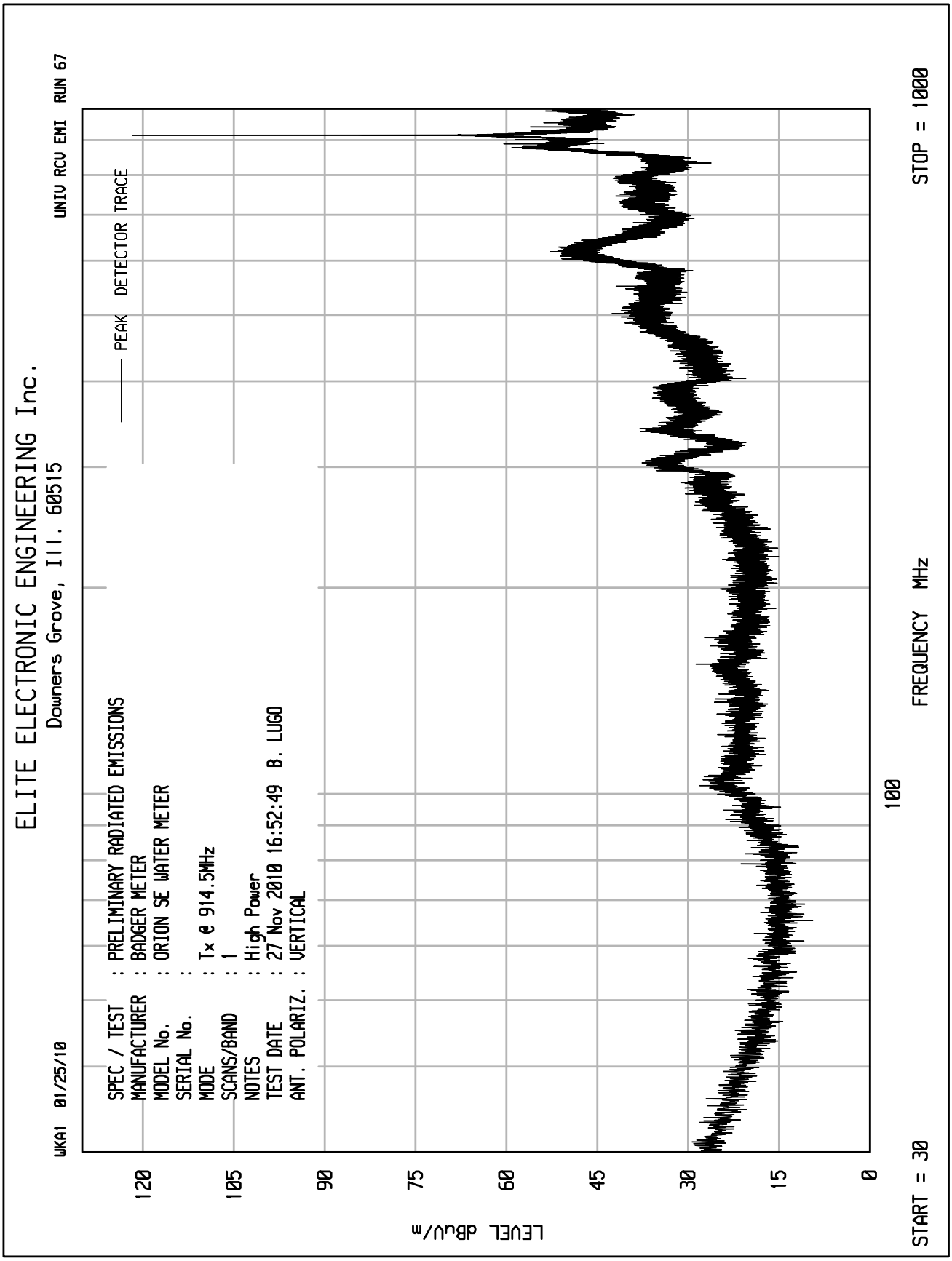

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 86
WKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE WATER METER
SERIAL No. :
MODE : Tx @ 904.9MHz
SCANS/BAND : 1
NOTES : High Power
TEST DATE : 28 Nov 2010 02:03:44 B. LUGO
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000

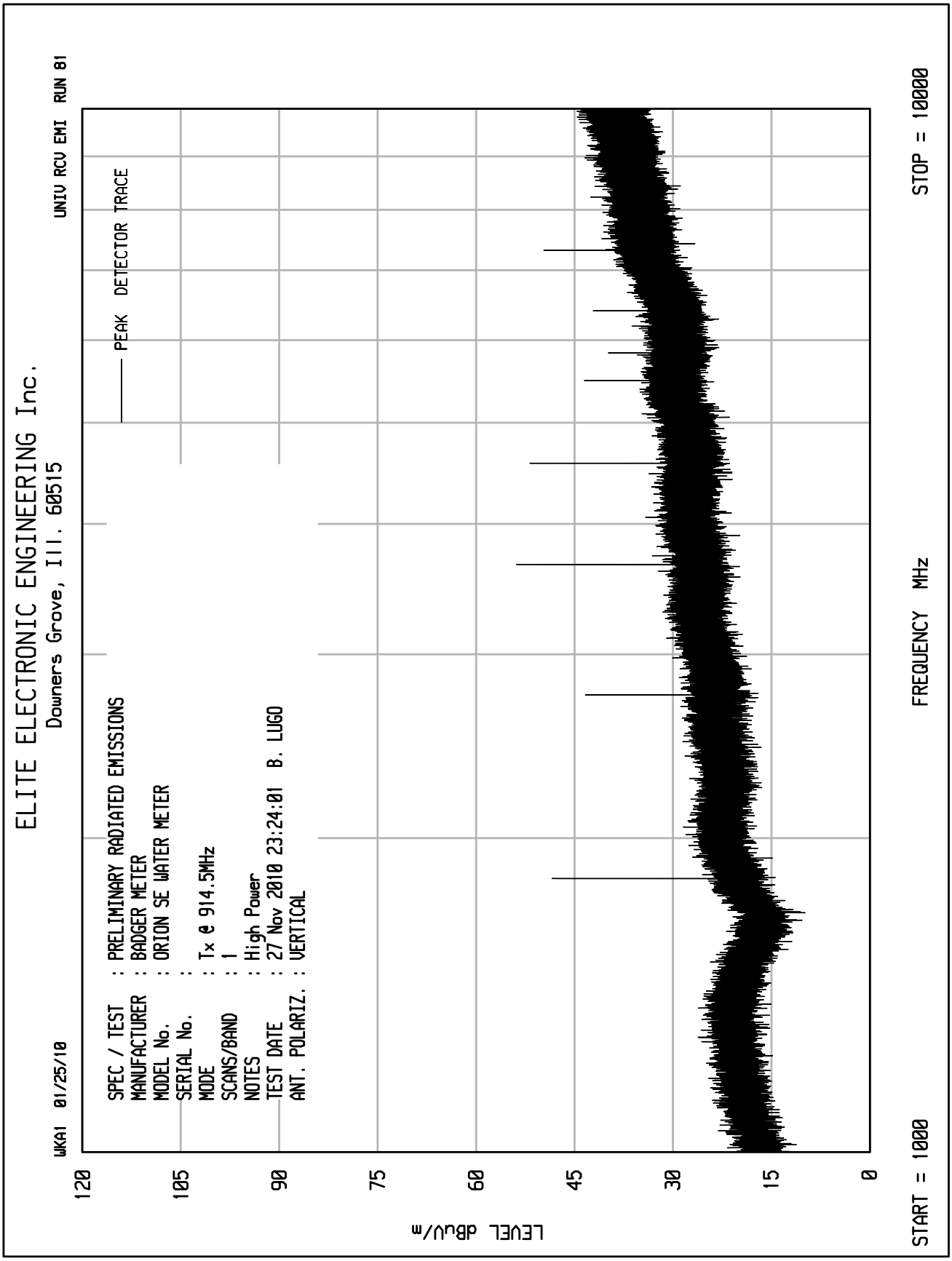

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 61
WKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE WATER METER
SERIAL No. :
MODE : Tx @ 914.00MHz
SCANS/BAND : 1
NOTES : Low Power
TEST DATE : 27 Nov 2010 16:38:54 B. LUGO
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000

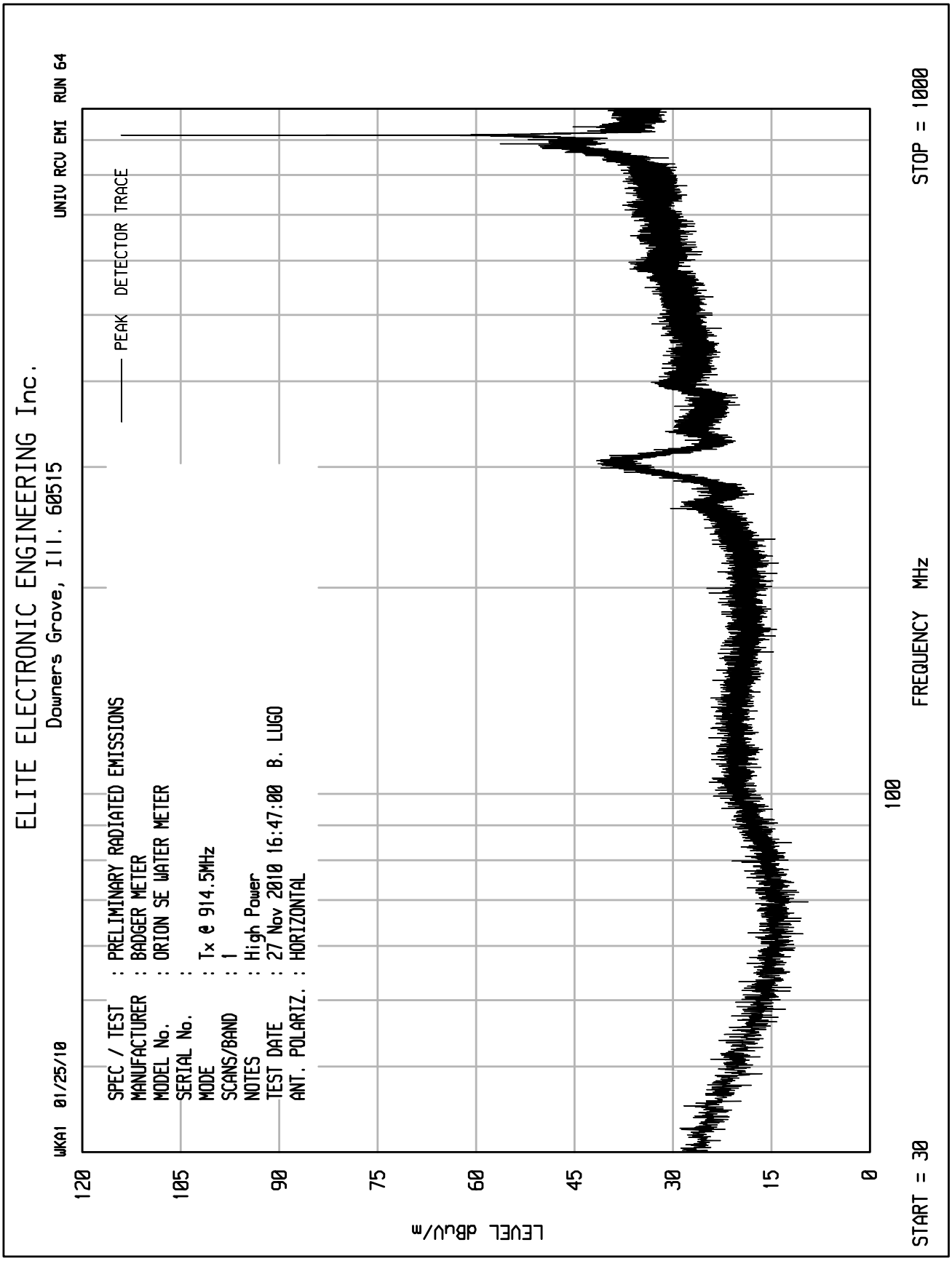

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 80
WKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE WATER METER
SERIAL No. :
MODE : Tx @ 914.00MHz
SCANS/BAND : 1
NOTES : Low Power
TEST DATE : 27 Nov 2010 22:57:44 B. LUGO
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000

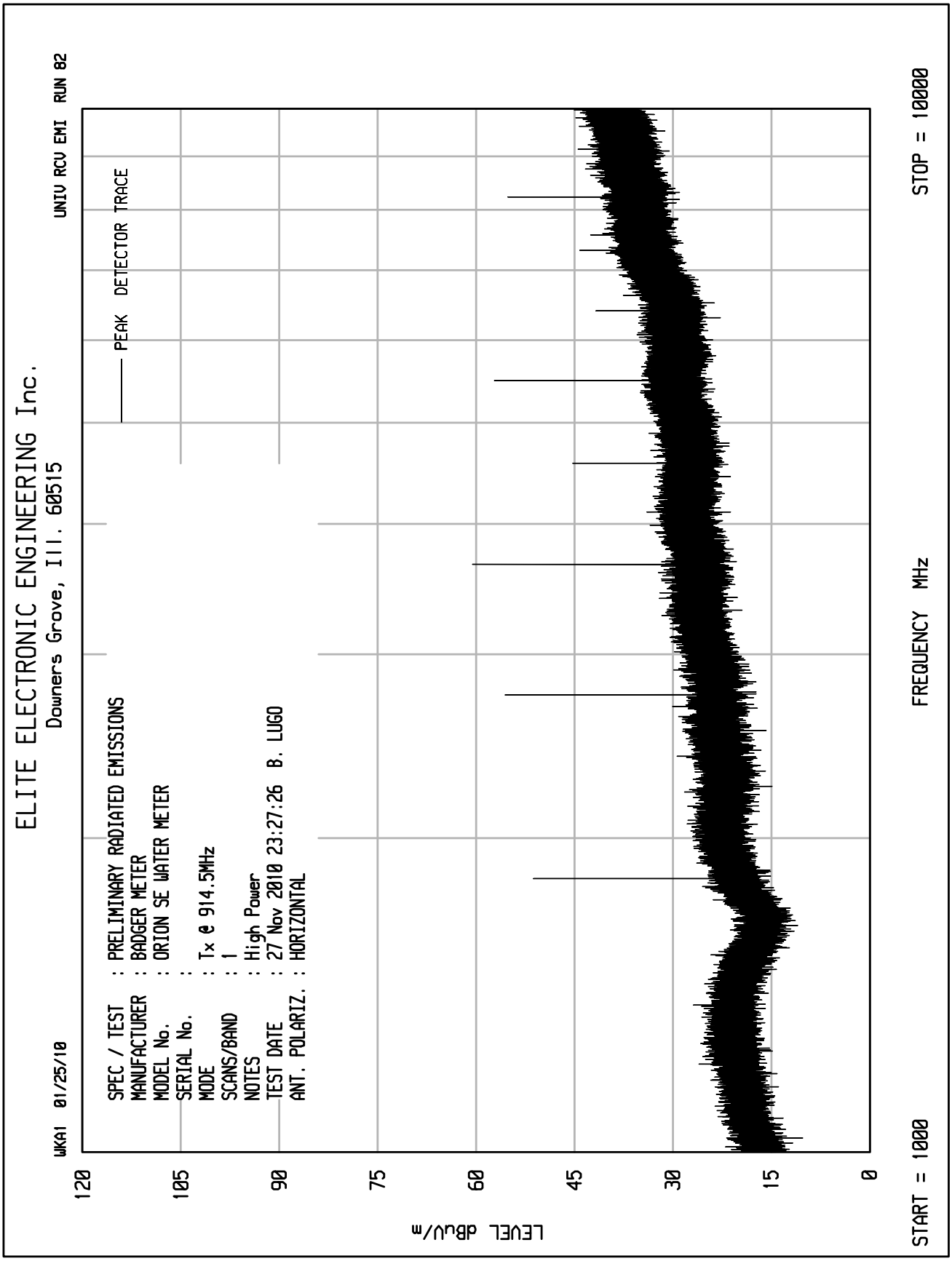

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 62
WKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE WATER METER
SERIAL No. :
MODE : Tx @ 914.00MHz
SCANS/BAND : 1
NOTES : Low Power
TEST DATE : 27 Nov 2010 16:39:50 B. LUGO
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000

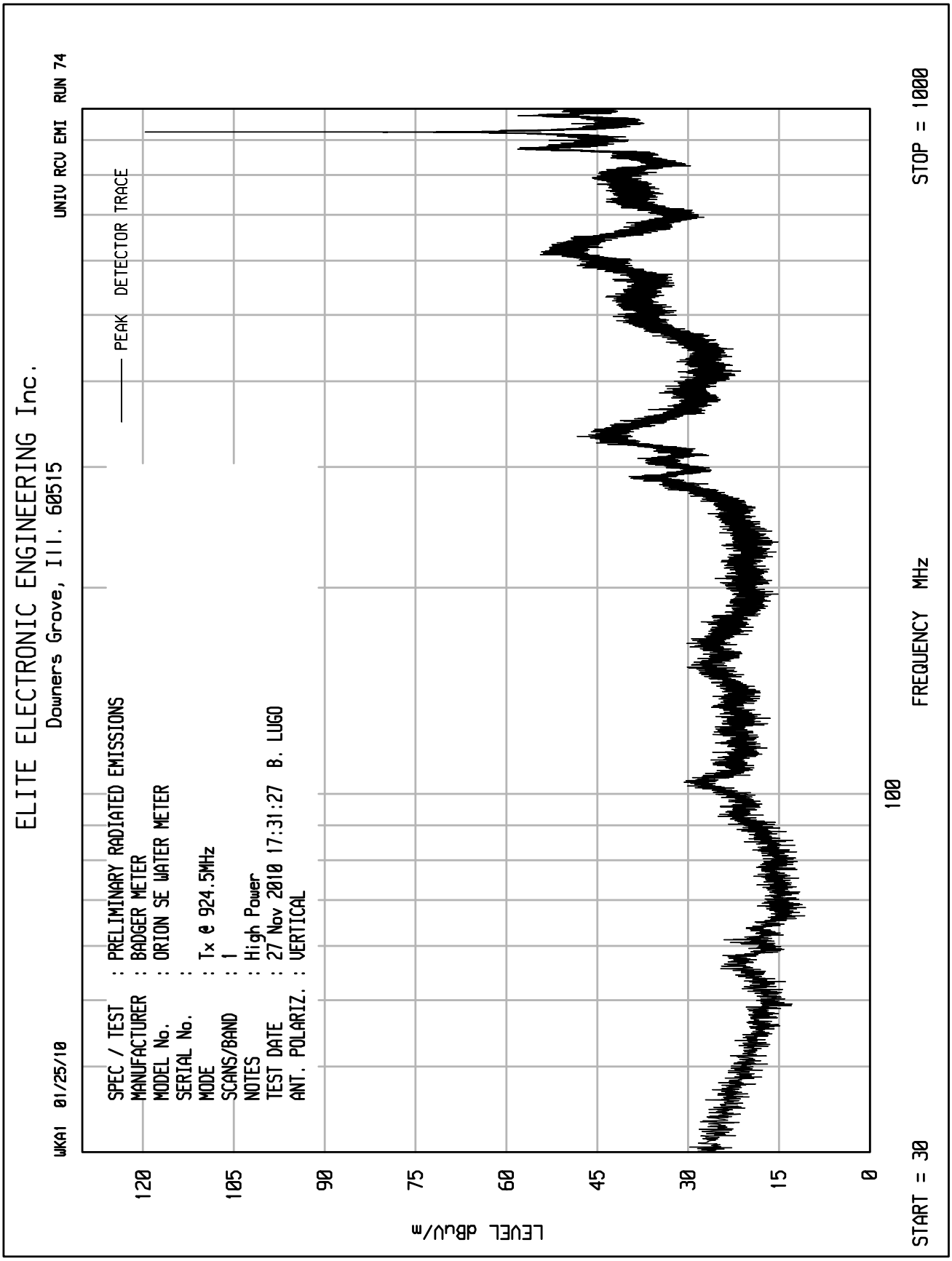

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 79
WKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE WATER METER
SERIAL No. :
MODE : Tx @ 914.00MHz
SCANS/BAND : 1
NOTES : Low Power
TEST DATE : 27 Nov 2010 22:53:23 B. LUGO
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000

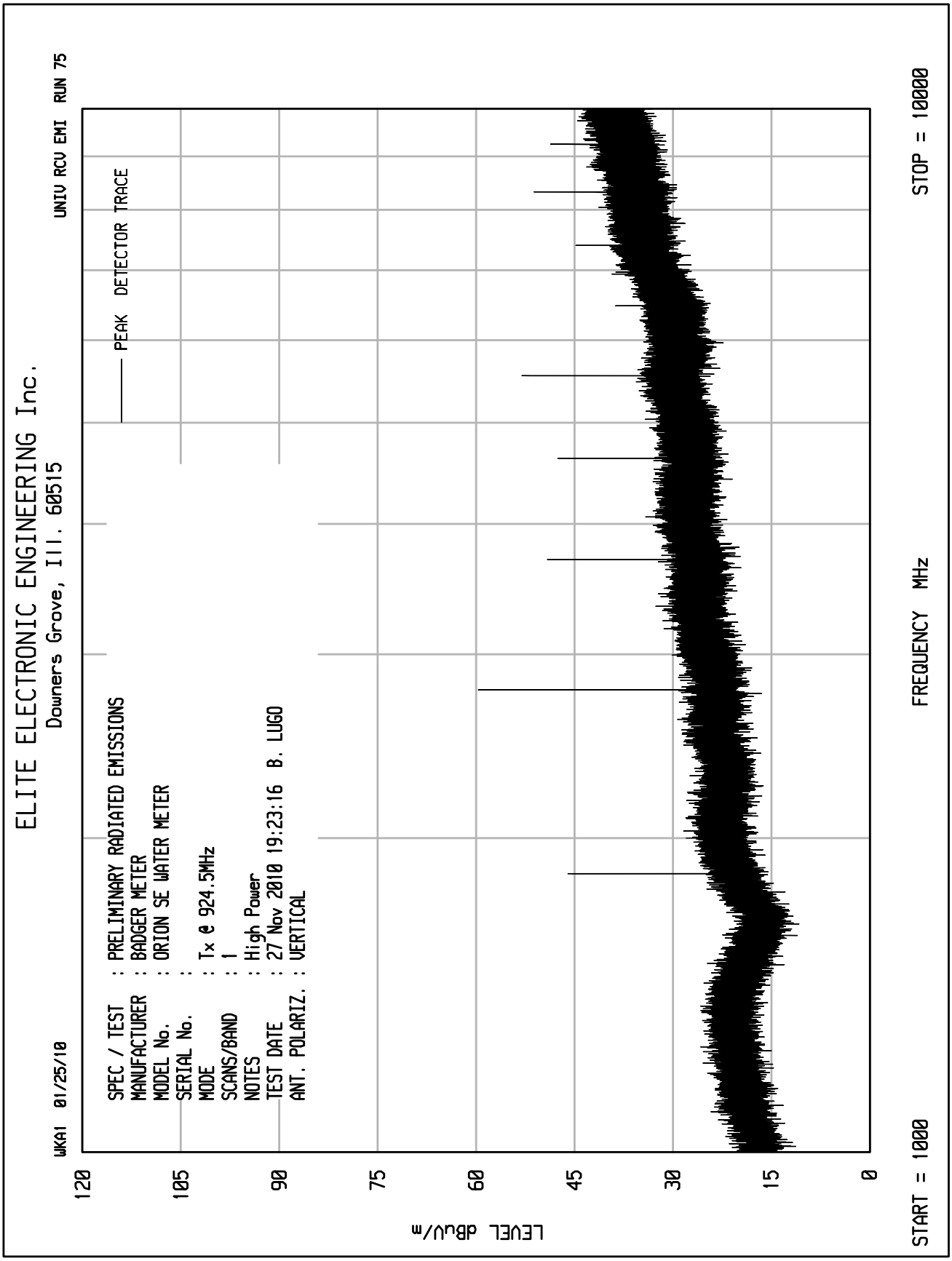

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 67
WKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE WATER METER
SERIAL No. :
MODE : Tx @ 914.5MHz
SCANS/BAND : 1
NOTES : High Power
TEST DATE : 27 Nov 2010 16:52:49 B. LUGO
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000

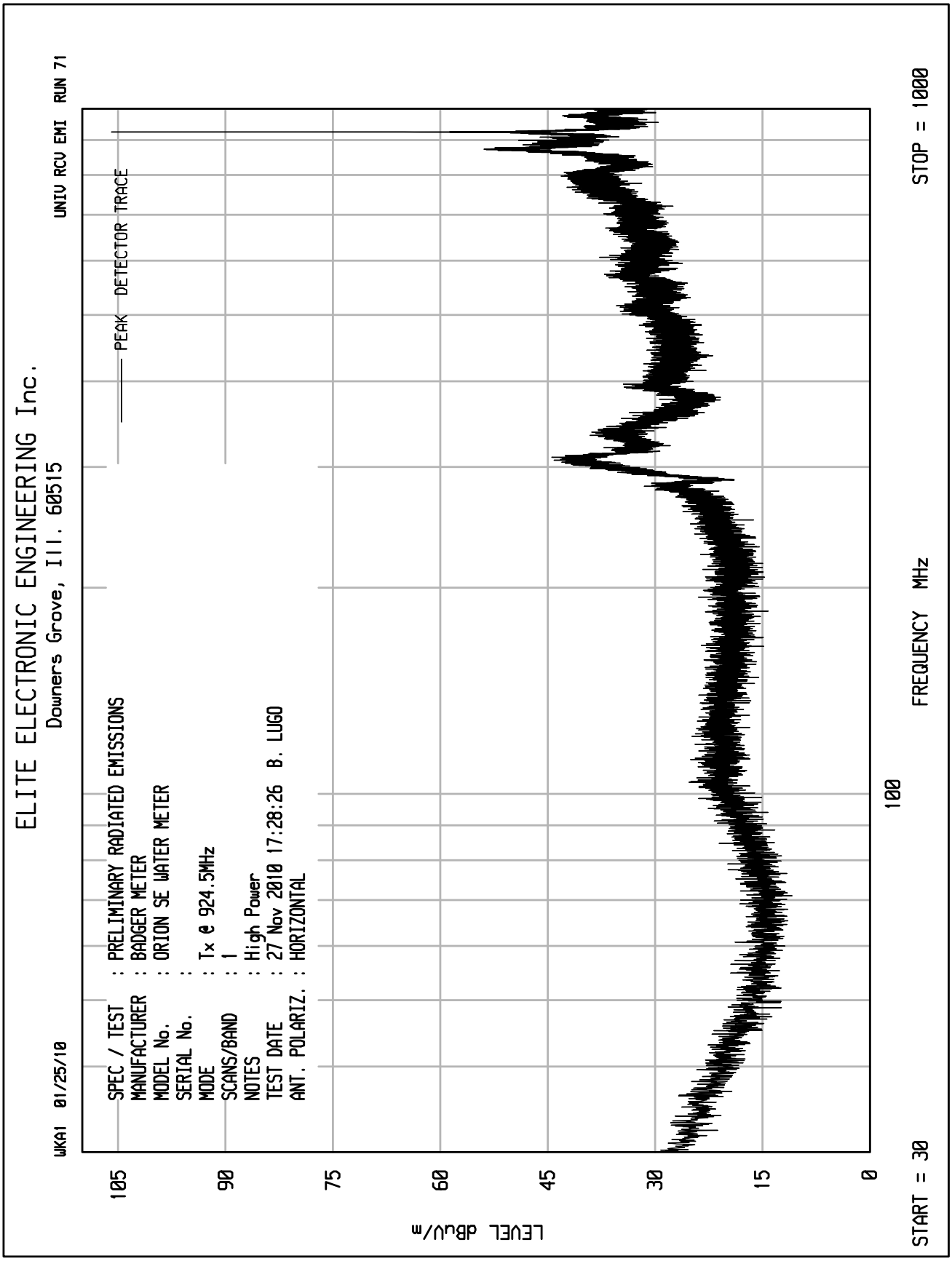

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 81
WKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE WATER METER
SERIAL No. :
MODE : Tx @ 914.5MHz
SCANS/BAND : 1
NOTES : High Power
TEST DATE : 27 Nov 2010 23:24:01 B. LUGO
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000

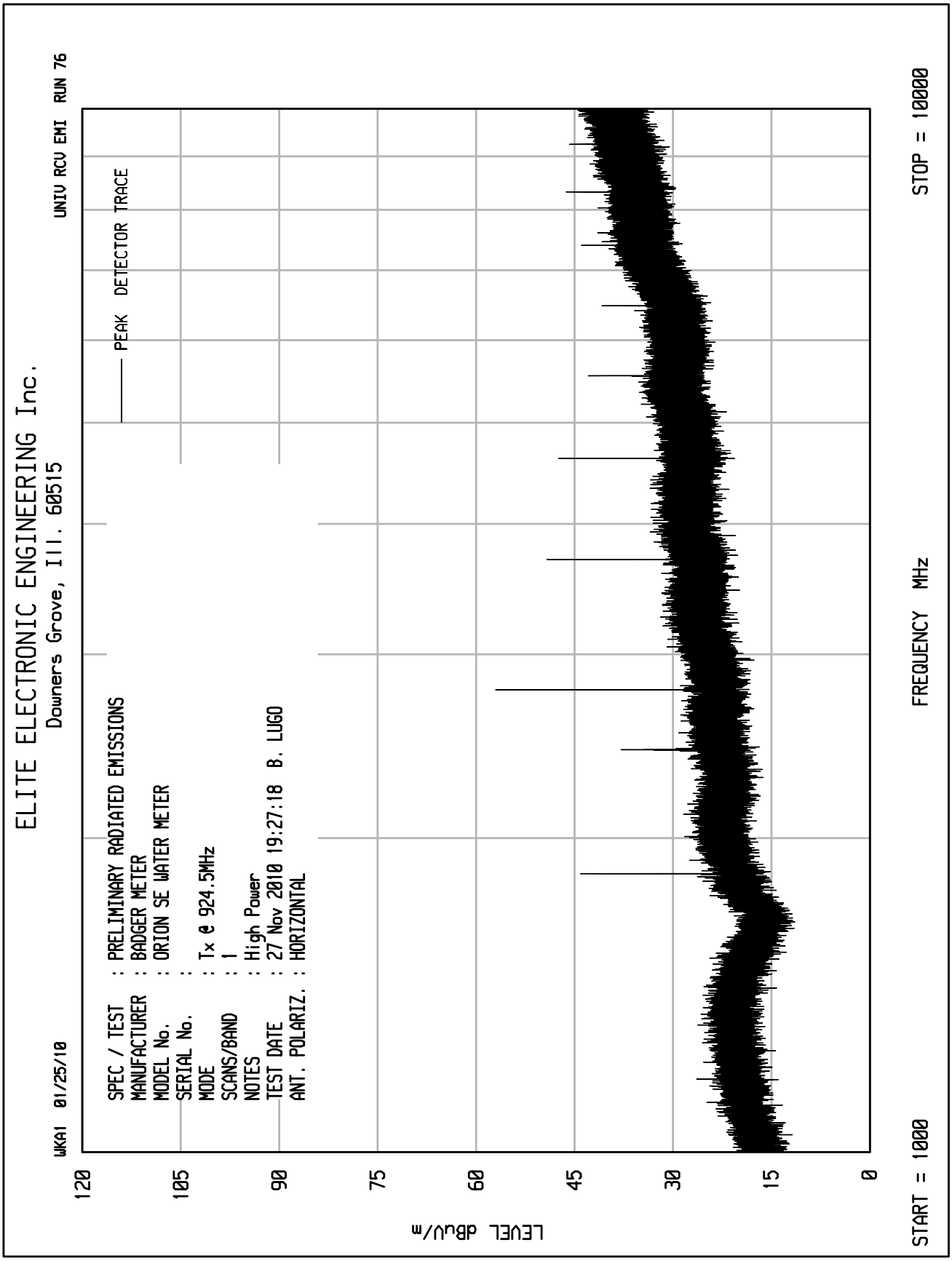

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 64
WKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE WATER METER
SERIAL No. :
MODE : Tx @ 914.5MHz
SCANS/BAND : 1
NOTES : High Power
TEST DATE : 27 Nov 2010 16:47:00 B. LUGO
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000

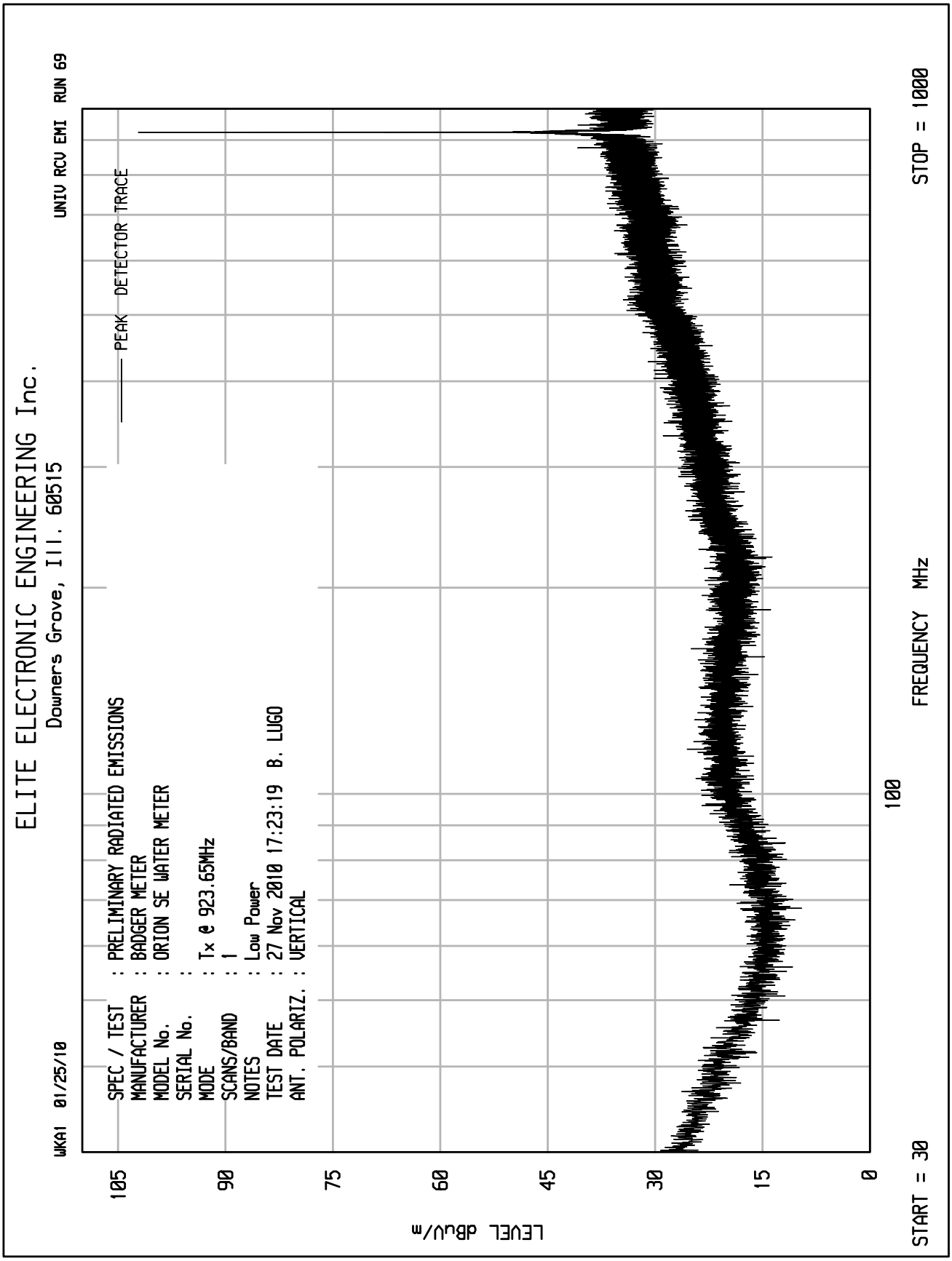

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 82
WKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE WATER METER
SERIAL No. :
MODE : Tx @ 914.5MHz
SCANS/BAND : 1
NOTES : High Power
TEST DATE : 27 Nov 2010 23:27:26 B. LUGO
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000

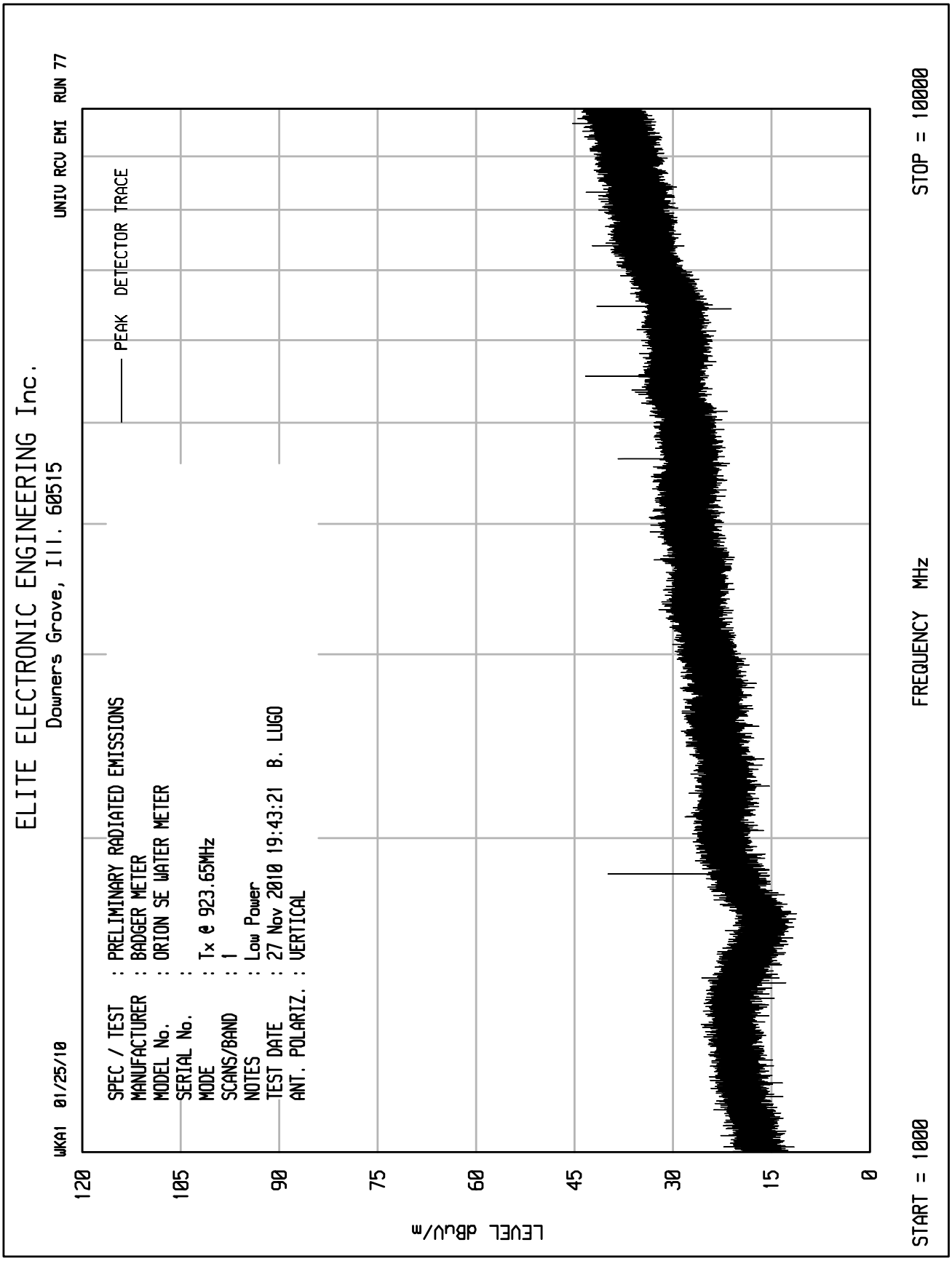

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 74
WKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE WATER METER
SERIAL No. :
MODE : Tx @ 924.5MHz
SCANS/BAND : 1
NOTES : High Power
TEST DATE : 27 Nov 2010 17:31:27 B. LUGO
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000

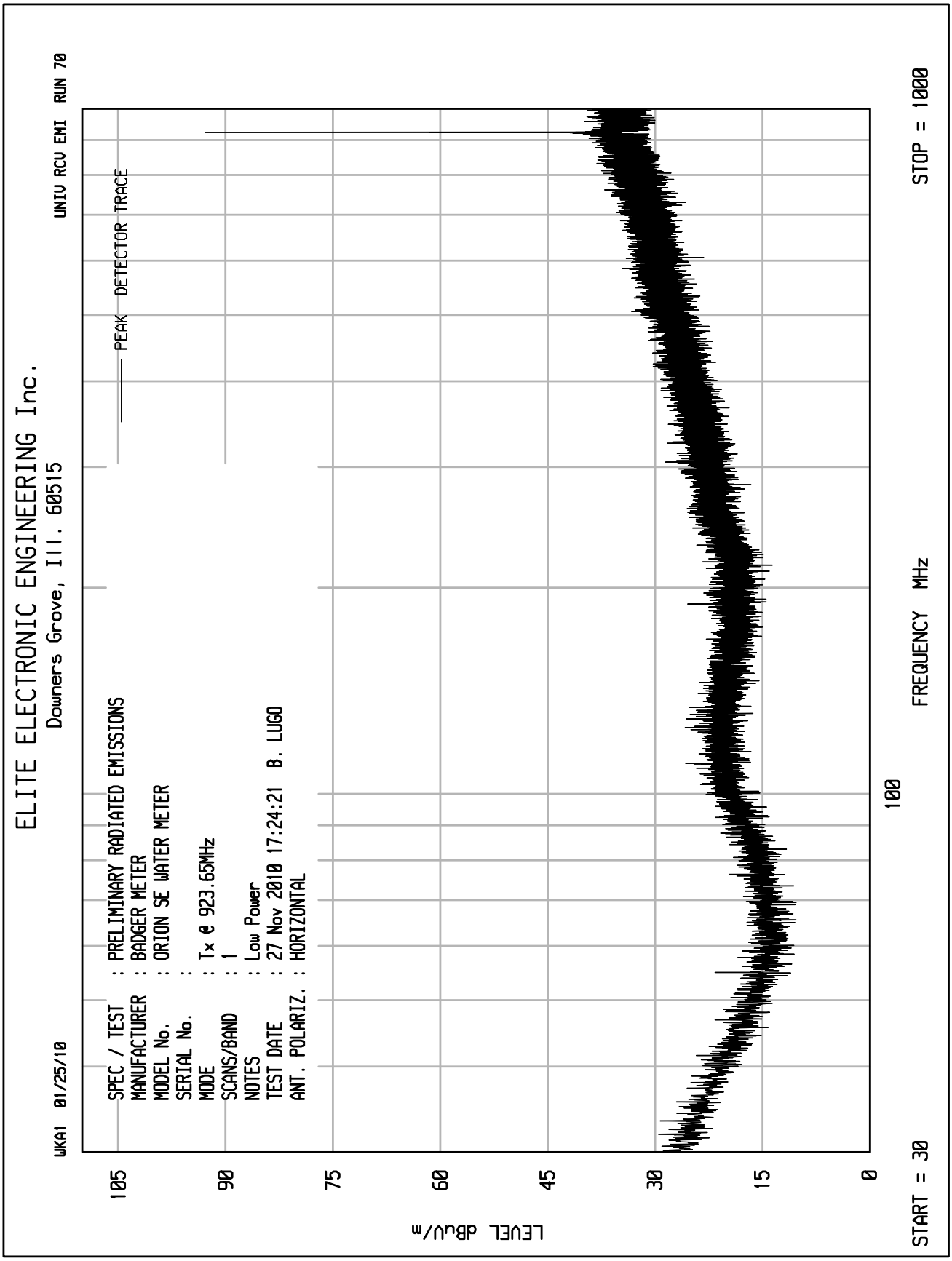

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 75
WKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE WATER METER
SERIAL No. :
MODE : Tx @ 924.5MHz
SCANS/BAND : 1
NOTES : High Power
TEST DATE : 27 Nov 2010 19:23:16 B. LUGO
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000

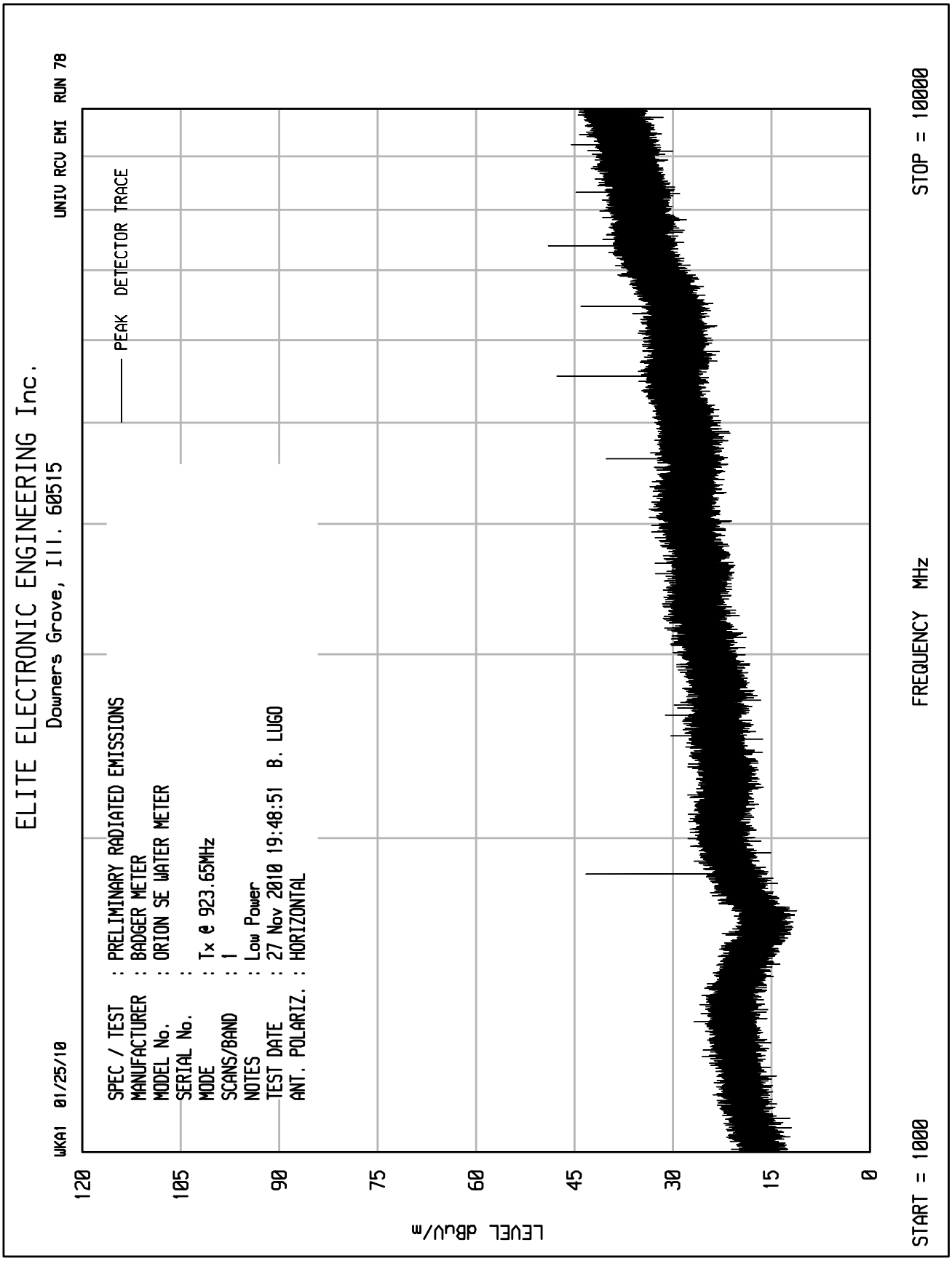

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 71
WKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE WATER METER
SERIAL No. :
MODE : Tx @ 924.5MHz
SCANS/BAND : 1
NOTES : High Power
TEST DATE : 27 Nov 2010 17:28:26 B. LUGO
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 76
WKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE WATER METER
SERIAL No. :
MODE : Tx @ 924.5MHz
SCANS/BAND : 1
NOTES : High Power
TEST DATE : 27 Nov 2010 19:27:18 B. LUGO
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 69
WKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE WATER METER
SERIAL No. :
MODE : Tx @ 923.65MHz
SCANS/BAND : 1
NOTES : Low Power
TEST DATE : 27 Nov 2010 17:23:19 B. LUGO
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 77
WKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE WATER METER
SERIAL No. :
MODE : Tx @ 923.65MHz
SCANS/BAND : 1
NOTES : Low Power
TEST DATE : 27 Nov 2010 19:43:21 B. LUGO
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 70
WKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE WATER METER
SERIAL No. :
MODE : Tx @ 923.65MHz
SCANS/BAND : 1
NOTES : Low Power
TEST DATE : 27 Nov 2010 17:24:21 B. LUGO
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 78
WKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE WATER METER
SERIAL No. :
MODE : Tx @ 923.65MHz
SCANS/BAND : 1
NOTES : Low Power
TEST DATE : 27 Nov 2010 19:48:51 B. LUGO
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000

DATA PAGE

Manufacturer : Badger Meter Corporation
Model No. : Orion SE Water Meter
Test Specification : FCC Part 15, Subpart C, Section 15.247, Radiated Emissions
Date : November 27, 2010
Mode : Transmit @ 904.9MHz
Power Setting : Fixed
Test Distance : 3 meters
Notes : Peak Detector
: Total = Meter Reading + Cable Loss + Antenna Factor + Preamp Gain

Freq (MHz)	Ant Pol	Meter Reading (dBuV)	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Total dBuV/m at 3 M	Total uV/m at 3M	Limit uV/m at 3M	Margin (dB)
904.9	H	91.3	2.4	21.8	0.0	115.5	592517.7		
904.9	V	93.1	2.4	21.8	0.0	117.3	730636.5		
1809.8	H	61.0	3.4	27.4	-40.0	51.9	392.3	73063.6	-45.4
1809.8	V	61.2	3.4	27.4	-40.0	52.0	399.6	73063.6	-45.2
2714.7	H	72.2	3.9	30.2	-39.3	66.9	2223.1	5000.0	-7.0
2714.7	V	67.3	3.9	30.2	-39.3	62.1	1276.3	5000.0	-11.9
3619.6	H	67.3	4.7	33.1	-38.5	66.6	2131.4	5000.0	-7.4
3619.6	V	58.4	4.7	33.1	-38.5	57.7	763.2	5000.0	-16.3
4524.5	H	62.4	5.5	33.5	-38.2	63.2	1446.1	5000.0	-10.8
4524.5	V	56.4	5.5	33.5	-38.2	57.2	726.4	5000.0	-16.8
5429.4	H	50.5	6.2	35.5	-38.2	54.0	501.8	73063.6	-43.3
5429.4	V	51.2	6.2	35.5	-38.2	54.7	540.2	73063.6	-42.6
6334.3	H	47.5	7.0	35.3	-38.4	51.3	366.4	73063.6	-46.0
6334.3	V	45.9	7.0	35.3	-38.4	49.7	304.8	73063.6	-47.6
7239.2	H	56.4	7.7	37.6	-38.4	63.2	1448.1	5000.0	-10.8
7239.2	V	53.4	7.7	37.6	-38.4	60.3	1031.1	5000.0	-13.7
8144.1	H	53.1	8.0	37.9	-38.7	60.3	1031.2	5000.0	-13.7
8144.1	V	51.5	8.0	37.9	-38.7	58.6	852.8	5000.0	-15.4
9049.0	H	46.7	8.8	38.3	-38.8	55.0	562.1	5000.0	-19.0
9049.0	V	45.3	8.8	38.3	-38.8	53.6	480.6	5000.0	-20.3

DATA PAGE

Manufacturer : Badger Meter Corporation
Model No. : Orion SE Water Meter
Test Specification : FCC Part 15, Subpart C, Section 15.247, Radiated Emissions
Date : November 27, 2010
Mode : Transmit @ 904.9MHz
Power Setting : Fixed
Test Distance : 3 meters
Notes : Average Readings in Restricted Bands
: Total = Meter Reading + Cable Loss + Antenna Factor + Preamp Gain + Duty Cycle Factor

Freq (MHz)	Ant Pol	Meter Reading (dBuV)	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Total dBuV/m at 3 M	Total uV/m at 3M	Limit uV/m at 3M	Margin (dB)
2714.7	H	71.4	3.9	30.2	-39.3	-19.9	46.3	205.6	500.0	-7.7
2714.7	V	66.3	3.9	30.2	-39.3	-19.9	41.1	114.1	500.0	-12.8
3619.6	H	66.0	4.7	33.1	-38.5	-19.9	45.3	184.4	500.0	-8.7
3619.6	V	60.2	4.7	33.1	-38.5	-19.9	39.6	95.4	500.0	-14.4
4524.5	H	59.7	5.5	33.5	-38.2	-19.9	40.6	107.0	500.0	-13.4
4524.5	V	52.9	5.5	33.5	-38.2	-19.9	33.9	49.3	500.0	-20.1
7239.2	H	51.6	7.7	37.6	-38.4	-19.9	38.5	84.5	500.0	-15.4
7239.2	V	47.4	7.7	37.6	-38.4	-19.9	34.3	52.0	500.0	-19.7
8144.1	H	47.0	8.0	37.9	-38.7	-19.9	34.2	51.4	500.0	-19.8
8144.1	V	42.1	8.0	37.9	-38.7	-19.9	29.3	29.3	500.0	-24.6

DATA PAGE

Manufacturer : Badger Meter Corporation
Model No. : Orion SE Water Meter
Test Specification : FCC Part 15, Subpart C, Section 15.247, Radiated Emissions
Date : November 27, 2010
Mode : Transmit @ 914.5MHz
Power Setting : Fixed
Test Distance : 3 meters
Notes : Peak Detector
: Total = Meter Reading + Cable Loss + Antenna Factor + Preamp Gain

Freq (MHz)	Ant Pol	Meter Reading (dBuV)	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Total dBuV/m at 3 M	Total uV/m at 3M	Limit uV/m at 3M	Margin (dB)
914.5	H	89.9	2.4	21.8	0.0	114.0	503162.3		
914.5	V	93.7	2.4	21.8	0.0	117.9	783805.1		
1829.0	H	61.8	3.5	27.5	-40.0	52.8	437.0	50316.2	-41.2
1829.0	V	62.3	3.5	27.5	-40.0	53.3	461.8	50316.2	-40.7
2743.5	H	69.4	3.9	30.3	-39.3	64.4	1652.0	5000.0	-9.6
2743.5	V	63.6	3.9	30.3	-39.3	58.5	846.3	5000.0	-15.4
3658.0	H	71.3	4.7	33.2	-38.5	70.7	3434.3	5000.0	-3.3
3658.0	V	63.9	4.7	33.2	-38.5	63.3	1466.7	5000.0	-10.7
4572.5	H	59.7	5.5	33.7	-38.2	60.7	1082.1	5000.0	-13.3
4572.5	V	57.1	5.5	33.7	-38.2	58.0	798.5	5000.0	-15.9
5487.0	H	46.8	6.2	35.6	-38.2	50.4	332.5	50316.2	-43.6
5487.0	V	41.8	6.2	35.6	-38.2	45.5	187.9	50316.2	-48.6
6401.5	H	40.0	7.0	35.2	-38.5	43.7	153.7	50316.2	-50.3
6401.5	V	36.6	7.0	35.2	-38.5	40.4	104.9	50316.2	-53.6
7316.0	H	49.4	7.7	37.8	-38.4	56.4	661.6	5000.0	-17.6
7316.0	V	52.1	7.7	37.8	-38.4	59.1	902.8	5000.0	-14.9
8230.5	H	53.1	8.1	37.9	-38.7	60.3	1039.7	5000.0	-13.6
8230.5	V	53.4	8.1	37.9	-38.7	60.6	1066.4	5000.0	-13.4
9145.0	H	47.8	8.7	38.4	-38.7	56.2	646.4	50316.2	-37.8
9145.0	V	44.1	8.7	38.4	-38.7	52.5	423.1	50316.2	-41.5

DATA PAGE

Manufacturer : Badger Meter Corporation
Model No. : Orion SE Water Meter
Test Specification : FCC Part 15, Subpart C, Section 15.247, Radiated Emissions
Date : November 27, 2010
Mode : Transmit @ 914.5MHz
Power Setting : Fixed
Test Distance : 3 meters
Notes : Average Readings in Restricted Bands
: Total = Meter Reading + Cable Loss + Antenna Factor + Preamp Gain + Duty Cycle Factor

Freq (MHz)	Ant Pol	Meter Reading (dBuV)	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Total dBuV/m at 3 M	Total uV/m at 3M	Limit uV/m at 3M	Margin (dB)
2743.5	H	68.5	3.9	30.3	-39.3	-19.9	43.6	151.0	500.0	-10.4
2743.5	V	62.3	3.9	30.3	-39.3	-19.9	37.3	73.3	500.0	-16.7
3658.0	H	69.3	4.7	33.2	-38.5	-19.9	48.8	274.1	500.0	-5.2
3658.0	V	62.4	4.7	33.2	-38.5	-19.9	41.9	124.8	500.0	-12.1
4572.5	H	57.4	5.5	33.7	-38.2	-19.9	38.4	83.5	500.0	-15.5
4572.5	V	54.3	5.5	33.7	-38.2	-19.9	35.4	58.7	500.0	-18.6
7316.0	H	42.0	7.7	37.8	-38.4	-19.9	29.1	28.6	500.0	-24.8
7316.0	V	46.0	7.7	37.8	-38.4	-19.9	33.1	45.2	500.0	-20.9
8230.5	H	47.4	8.1	37.9	-38.7	-19.9	34.7	54.4	500.0	-19.3
8230.5	V	46.4	8.1	37.9	-38.7	-19.9	33.7	48.6	500.0	-20.3
9145.0	H	37.0	8.7	38.4	-38.7	-19.9	25.5	18.8	500.0	-28.5
9145.0	V	35.3	8.7	38.4	-38.7	-19.9	23.8	15.5	500.0	-30.1

DATA PAGE

Manufacturer : Badger Meter Corporation
Model No. : Orion SE Water Meter
Test Specification : FCC Part 15, Subpart C, Section 15.247, Radiated Emissions
Date : November 27, 2010
Mode : Transmit @ 924.5MHz
Power Setting : Fixed
Test Distance : 3 meters
Notes : Peak Detector
: Total = Meter Reading + Cable Loss + Antenna Factor + Preamp Gain

Freq (MHz)	Ant Pol	Meter Reading (dBuV)	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Total dBuV/m at 3 M	Total uV/m at 3M	Limit uV/m at 3M	Margin (dB)
924.5	H	89.5	2.4	21.8	0.0	113.8	487527.6		
924.5	V	96.7	2.4	21.8	0.0	120.9	1109172.7		
1849.0	H	57.7	3.5	27.6	-40.0	48.7	272.9	48752.8	-45.0
1849.0	V	56.5	3.5	27.6	-40.0	47.6	240.1	48752.8	-46.2
2773.5	H	70.1	4.0	30.4	-39.2	65.2	1810.4	5000.0	-8.8
2773.5	V	66.5	4.0	30.4	-39.2	61.6	1208.6	5000.0	-12.3
3698.0	H	66.6	4.8	33.3	-38.5	66.1	2024.0	5000.0	-7.9
3698.0	V	59.2	4.8	33.3	-38.5	58.7	865.4	5000.0	-15.2
4622.5	H	56.5	5.6	33.8	-38.2	57.7	766.7	5000.0	-16.3
4622.5	V	52.8	5.6	33.8	-38.2	54.0	499.6	5000.0	-20.0
5547.0	H	43.8	6.3	35.6	-38.2	47.5	236.2	48752.8	-46.3
5547.0	V	40.3	6.3	35.6	-38.2	44.0	157.9	48752.8	-49.8
6471.5	H	40.4	7.1	35.1	-38.5	44.2	161.7	48752.8	-49.6
6471.5	V	38.8	7.1	35.1	-38.5	42.5	133.6	48752.8	-51.2
7396.0	H	49.0	7.7	37.9	-38.5	56.2	644.3	5000.0	-17.8
7396.0	V	51.1	7.7	37.9	-38.5	58.3	821.5	5000.0	-15.7
8320.5	H	51.5	8.2	37.9	-38.8	58.7	865.1	5000.0	-15.2
8320.5	V	50.7	8.2	37.9	-38.8	57.9	788.1	5000.0	-16.0
9245.0	H	36.9	8.7	38.4	-38.7	45.3	185.1	48752.8	-48.4
9245.0	V	36.5	8.7	38.4	-38.7	44.9	176.5	48752.8	-48.8

DATA PAGE

Manufacturer : Badger Meter Corporation
Model No. : Orion SE Water Meter
Test Specification : FCC Part 15, Subpart C, Section 15.247, Radiated Emissions
Date : November 27, 2010
Mode : Transmit @ 924.5MHz
Power Setting : Fixed
Test Distance : 3 meters
Notes : Average Readings in Restricted Bands
: Total = Meter Reading + Cable Loss + Antenna Factor + Preamp Gain + Duty Cycle Factor

Freq (MHz)	Ant Pol	Meter Reading (dBuV)	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Total dBuV/m at 3 M	Total uV/m at 3M	Limit uV/m at 3M	Margin (dB)
2773.5	H	69.1	4.0	30.4	-39.2	-19.9	44.3	164.9	500.0	-9.6
2773.5	V	65.2	4.0	30.4	-39.2	-19.9	40.4	104.2	500.0	-13.6
3698.0	H	64.9	4.8	33.3	-38.5	-19.9	44.5	167.6	500.0	-9.5
3698.0	V	56.8	4.8	33.3	-38.5	-19.9	36.4	66.4	500.0	-17.5
4622.5	H	53.8	5.6	33.8	-38.2	-19.9	35.0	56.3	500.0	-19.0
4622.5	V	49.4	5.6	33.8	-38.2	-19.9	30.7	34.2	500.0	-23.3
7396.0	H	42.3	7.7	37.9	-38.5	-19.9	29.5	30.0	500.0	-24.4
7396.0	V	44.2	7.7	37.9	-38.5	-19.9	31.5	37.6	500.0	-22.5
8320.5	H	45.1	8.2	37.9	-38.8	-19.9	32.5	42.2	500.0	-21.5
8320.5	V	42.9	8.2	37.9	-38.8	-19.9	30.3	32.7	500.0	-23.7

DATA PAGE

Manufacturer : Badger Meter Corporation
Model No. : Orion SE Water Meter
Test Specification : FCC Part 15, Subpart C, Section 15.247, Radiated Emissions
Date : November 27, 2010
Mode : Transmit @ 904.9MHz
Power Setting : Mobile
Test Distance : 3 meters
Notes : Peak Detector
: Total = Meter Reading + Cable Loss + Antenna Factor + Preamp Gain

Freq (MHz)	Ant Pol	Meter Reading (dBuV)	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Total dBuV/m at 3 M	Total uV/m at 3M	Limit uV/m at 3M	Margin (dB)
904.9	H	77.0	2.4	21.8	0.0	101.2	114472.5		
904.9	V	82.8	2.4	21.8	0.0	107.0	223203.7		
1809.8	H	54.8	3.4	27.4	-40.0	45.7	192.8	11447.3	-35.5
1809.8	V	51.4	3.4	27.4	-40.0	42.3	129.6	11447.3	-38.9
2714.7	H	47.9	3.9	30.2	-39.3	42.7	136.4	5000.0	-31.3
2714.7	V	47.1	3.9	30.2	-39.3	41.9	124.6	5000.0	-32.1
3619.6	H	48.1	4.7	33.1	-38.5	47.4	233.7	5000.0	-26.6
3619.6	V	47.4	4.7	33.1	-38.5	46.6	214.6	5000.0	-27.3
4524.5	H	46.5	5.5	33.5	-38.2	47.3	232.4	5000.0	-26.7
4524.5	V	45.7	5.5	33.5	-38.2	46.6	212.9	5000.0	-27.4
5429.4	H	44.1	6.2	35.5	-38.2	47.6	239.1	11447.3	-33.6
5429.4	V	42.4	6.2	35.5	-38.2	45.9	196.6	11447.3	-35.3
6334.3	H	38.5	7.0	35.3	-38.4	42.3	130.3	11447.3	-38.9
6334.3	V	37.0	7.0	35.3	-38.4	40.8	109.6	11447.3	-40.4
7239.2	H	51.6	7.7	37.6	-38.4	58.5	841.9	5000.0	-15.5
7239.2	V	54.4	7.7	37.6	-38.4	61.3	1162.2	5000.0	-12.7
8144.1	H	47.1	8.0	37.9	-38.7	54.2	513.3	5000.0	-19.8
8144.1	V	46.3	8.0	37.9	-38.7	53.4	469.7	5000.0	-20.5
9049.0	H	48.4	8.8	38.3	-38.8	56.7	684.4	5000.0	-17.3
9049.0	V	46.9	8.8	38.3	-38.8	55.2	577.2	5000.0	-18.8

DATA PAGE

Manufacturer : Badger Meter Corporation
Model No. : Orion SE Water Meter
Test Specification : FCC Part 15, Subpart C, Section 15.247, Radiated Emissions
Date : November 27, 2010
Mode : Transmit @ 904.9MHz
Power Setting : Mobile
Test Distance : 3 meters
Notes : Average Readings in Restricted Bands
: Total = Meter Reading + Cable Loss + Antenna Factor + Preamp Gain + Duty Cycle Factor

Freq (MHz)	Ant Pol	Meter Reading (dBuV)	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Total dBuV/m at 3 M	Total uV/m at 3M	Limit uV/m at 3M	Margin (dB)
2714.7	H	36.7	3.9	30.2	-39.3	-19.9	11.5	3.8	500.0	-42.4
2714.7	V	35.8	3.9	30.2	-39.3	-19.9	10.7	3.4	500.0	-43.3
3619.6	H	39.9	4.7	33.1	-38.5	-19.9	19.2	9.1	500.0	-34.8
3619.6	V	35.0	4.7	33.1	-38.5	-19.9	14.3	5.2	500.0	-39.6
4524.5	H	37.3	5.5	33.5	-38.2	-19.9	18.2	8.1	500.0	-35.8
4524.5	V	34.4	5.5	33.5	-38.2	-19.9	15.4	5.9	500.0	-38.6
7239.2	H	44.8	7.7	37.6	-38.4	-19.9	31.8	38.8	500.0	-22.2
7239.2	V	49.5	7.7	37.6	-38.4	-19.9	36.4	66.3	500.0	-17.6
8144.1	H	37.3	8.0	37.9	-38.7	-19.9	24.5	16.8	500.0	-29.5
8144.1	V	35.4	8.0	37.9	-38.7	-19.9	22.6	13.5	500.0	-31.3

DATA PAGE

Manufacturer : Badger Meter Corporation
Model No. : Orion SE Water Meter
Test Specification : FCC Part 15, Subpart C, Section 15.247, Radiated Emissions
Date : November 27, 2010
Mode : Transmit @ 914.1MHz
Power Setting : Mobile
Test Distance : 3 meters
Notes : Peak Detector
: Total = Meter Reading + Cable Loss + Antenna Factor + Preamp Gain

Freq (MHz)	Ant Pol	Meter Reading (dBuV)	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Total dBuV/m at 3 M	Total uV/m at 3M	Limit uV/m at 3M	Margin (dB)
914.1	H	75.9	2.4	21.8	0.0	100.1	100852.4		
914.1	V	80.9	2.4	21.8	0.0	105.1	178931.2		
1828.2	H	59.7	3.5	27.5	-40.0	50.7	341.8	10085.2	-29.4
1828.2	V	60.1	3.5	27.5	-40.0	51.1	357.5	10085.2	-29.0
2742.2	H	45.5	3.9	30.3	-39.3	40.4	105.0	5000.0	-33.6
2742.2	V	46.8	3.9	30.3	-39.3	41.7	121.7	5000.0	-32.3
3656.3	H	50.0	4.7	33.2	-38.5	49.4	294.8	5000.0	-24.6
3656.3	V	47.7	4.7	33.2	-38.5	47.1	227.3	5000.0	-26.8
4570.4	H	48.6	5.5	33.7	-38.2	49.6	302.6	5000.0	-24.4
4570.4	V	46.5	5.5	33.7	-38.2	47.5	237.1	5000.0	-26.5
5484.5	H	41.0	6.2	35.6	-38.2	44.7	170.8	10085.2	-35.4
5484.5	V	42.3	6.2	35.6	-38.2	46.0	198.6	10085.2	-34.1
6398.6	H	41.7	7.0	35.2	-38.5	45.5	187.8	10085.2	-34.6
6398.6	V	37.5	7.0	35.2	-38.5	41.2	115.4	10085.2	-38.8
7312.6	H	50.4	7.7	37.8	-38.4	57.4	740.9	5000.0	-16.6
7312.6	V	53.4	7.7	37.8	-38.4	60.5	1053.7	5000.0	-13.5
8226.7	H	48.6	8.1	37.9	-38.7	55.8	616.2	5000.0	-18.2
8226.7	V	45.6	8.1	37.9	-38.7	52.8	437.3	5000.0	-21.2
9140.8	H	45.2	8.7	38.4	-38.7	53.6	476.2	5000.0	-20.4
9140.8	V	46.9	8.7	38.4	-38.7	55.3	582.5	5000.0	-18.7

DATA PAGE

Manufacturer : Badger Meter Corporation
Model No. : Orion SE Water Meter
Test Specification : FCC Part 15, Subpart C, Section 15.247, Radiated Emissions
Date : November 27, 2010
Mode : Transmit @ 914.1MHz
Power Setting : Mobile
Test Distance : 3 meters
Notes : Average Readings in Restricted Bands
: Total = Meter Reading + Cable Loss + Antenna Factor + Preamp Gain + Duty Cycle Factor

Freq (MHz)	Ant Pol	Meter Reading (dBuV)	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Total dBuV/m at 3 M	Total uV/m at 3M	Limit uV/m at 3M	Margin (dB)
2742.2	H	34.4	3.9	30.3	-39.3	-19.9	9.4	3.0	500.0	-44.5
2742.2	V	34.8	3.9	30.3	-39.3	-19.9	9.8	3.1	500.0	-44.2
3656.3	H	43.9	4.7	33.2	-38.5	-19.9	23.4	14.8	500.0	-30.6
3656.3	V	39.8	4.7	33.2	-38.5	-19.9	19.3	9.2	500.0	-34.7
4570.4	H	40.3	5.5	33.7	-38.2	-19.9	21.3	11.7	500.0	-32.7
4570.4	V	38.6	5.5	33.7	-38.2	-19.9	19.6	9.6	500.0	-34.4
7312.6	H	42.9	7.7	37.8	-38.4	-19.9	30.0	31.7	500.0	-24.0
7312.6	V	49.0	7.7	37.8	-38.4	-19.9	36.1	63.9	500.0	-17.9
8226.7	H	38.0	8.1	37.9	-38.7	-19.9	25.2	18.3	500.0	-28.7
8226.7	V	36.6	8.1	37.9	-38.7	-19.9	23.9	15.7	500.0	-30.0
9140.8	H	35.7	8.7	38.4	-38.7	-19.9	24.2	16.1	500.0	-29.8
9140.8	V	36.0	8.7	38.4	-38.7	-19.9	24.4	16.7	500.0	-29.5

DATA PAGE

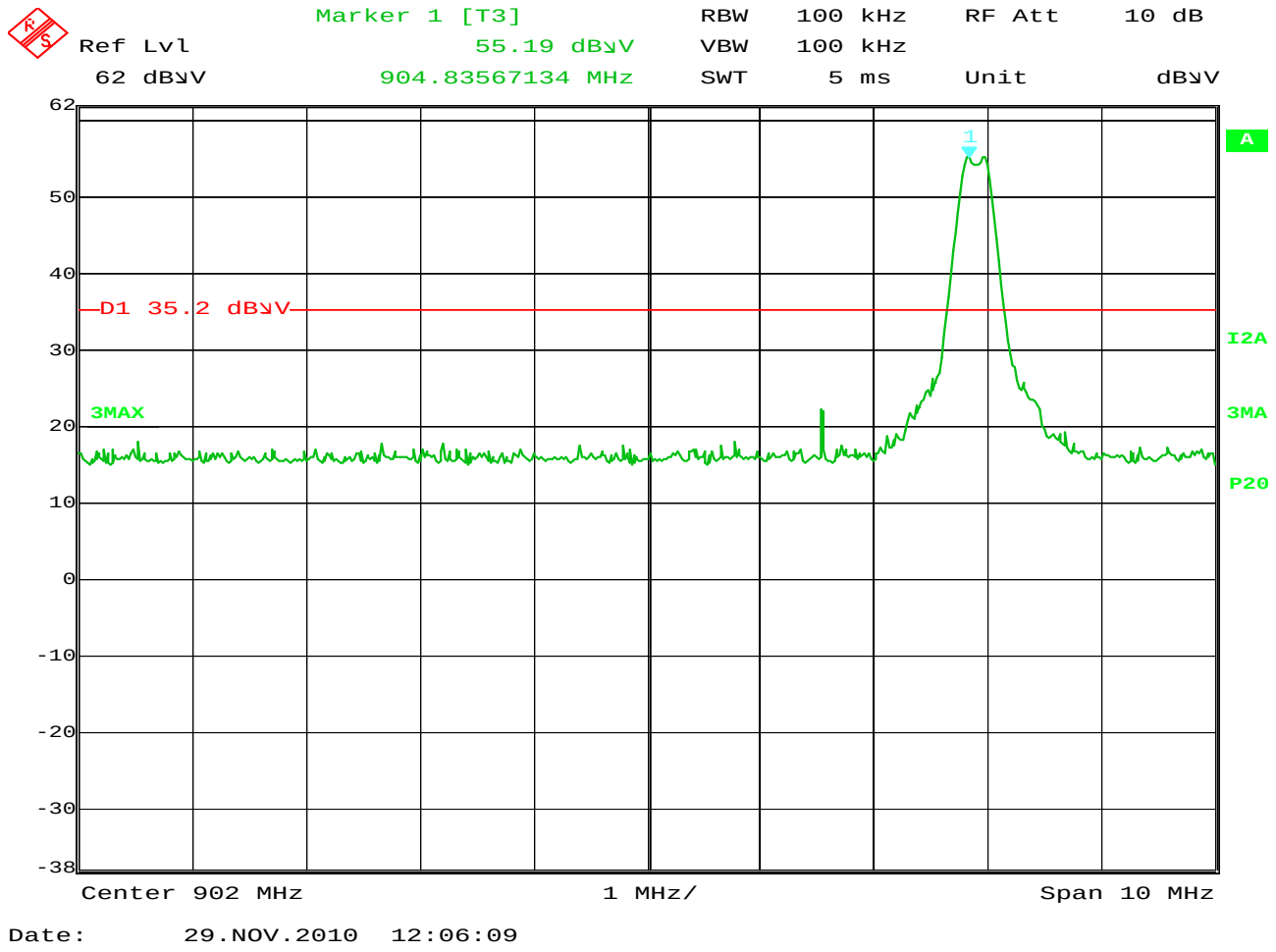
Manufacturer : Badger Meter Corporation
Model No. : Orion SE Water Meter
Test Specification : FCC Part 15, Subpart C, Section 15.247, Radiated Emissions
Date : November 27, 2010
Mode : Transmit @ 923.7MHz
Power Setting : Mobile
Test Distance : 3 meters
Notes : Peak Detector
: Total = Meter Reading + Cable Loss + Antenna Factor + Preamp Gain

Freq (MHz)	Ant Pol	Meter Reading (dBuV)	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Total dBuV/m at 3 M	Total uV/m at 3M	Limit uV/m at 3M	Margin (dB)
923.7	H	72.5	2.4	21.8	0.0	96.7	68711.2		
923.7	V	79.8	2.4	21.8	0.0	104.0	158499.3		
1847.3	H	55.7	3.5	27.6	-40.0	46.7	217.0	6871.1	-30.0
1847.3	V	52.5	3.5	27.6	-40.0	43.5	150.0	6871.1	-33.2
2771.0	H	46.5	4.0	30.4	-39.2	41.6	119.6	5000.0	-32.4
2771.0	V	45.8	4.0	30.4	-39.2	40.9	110.7	5000.0	-33.1
3694.6	H	49.3	4.8	33.3	-38.5	48.8	276.5	5000.0	-25.1
3694.6	V	48.0	4.8	33.3	-38.5	47.5	237.5	5000.0	-26.5
4618.3	H	47.8	5.6	33.8	-38.2	48.9	279.8	5000.0	-25.0
4618.3	V	47.8	5.6	33.8	-38.2	49.0	281.1	5000.0	-25.0
5541.9	H	43.8	6.3	35.6	-38.2	47.5	236.4	6871.1	-29.3
5541.9	V	40.6	6.3	35.6	-38.2	44.2	163.0	6871.1	-32.5
6465.6	H	39.8	7.1	35.1	-38.5	43.5	149.9	6871.1	-33.2
6465.6	V	40.6	7.1	35.1	-38.5	44.3	164.2	6871.1	-32.4
7389.2	H	50.2	7.7	37.9	-38.5	57.3	736.9	5000.0	-16.6
7389.2	V	52.4	7.7	37.9	-38.5	59.6	952.6	5000.0	-14.4
8312.9	H	49.1	8.2	37.9	-38.8	56.4	661.1	5000.0	-17.6
8312.9	V	48.5	8.2	37.9	-38.8	55.8	614.2	5000.0	-18.2
9236.5	H	48.2	8.7	38.4	-38.7	56.6	679.9	5000.0	-17.3
9236.5	V	46.9	8.7	38.4	-38.7	55.3	584.8	5000.0	-18.6

DATA PAGE

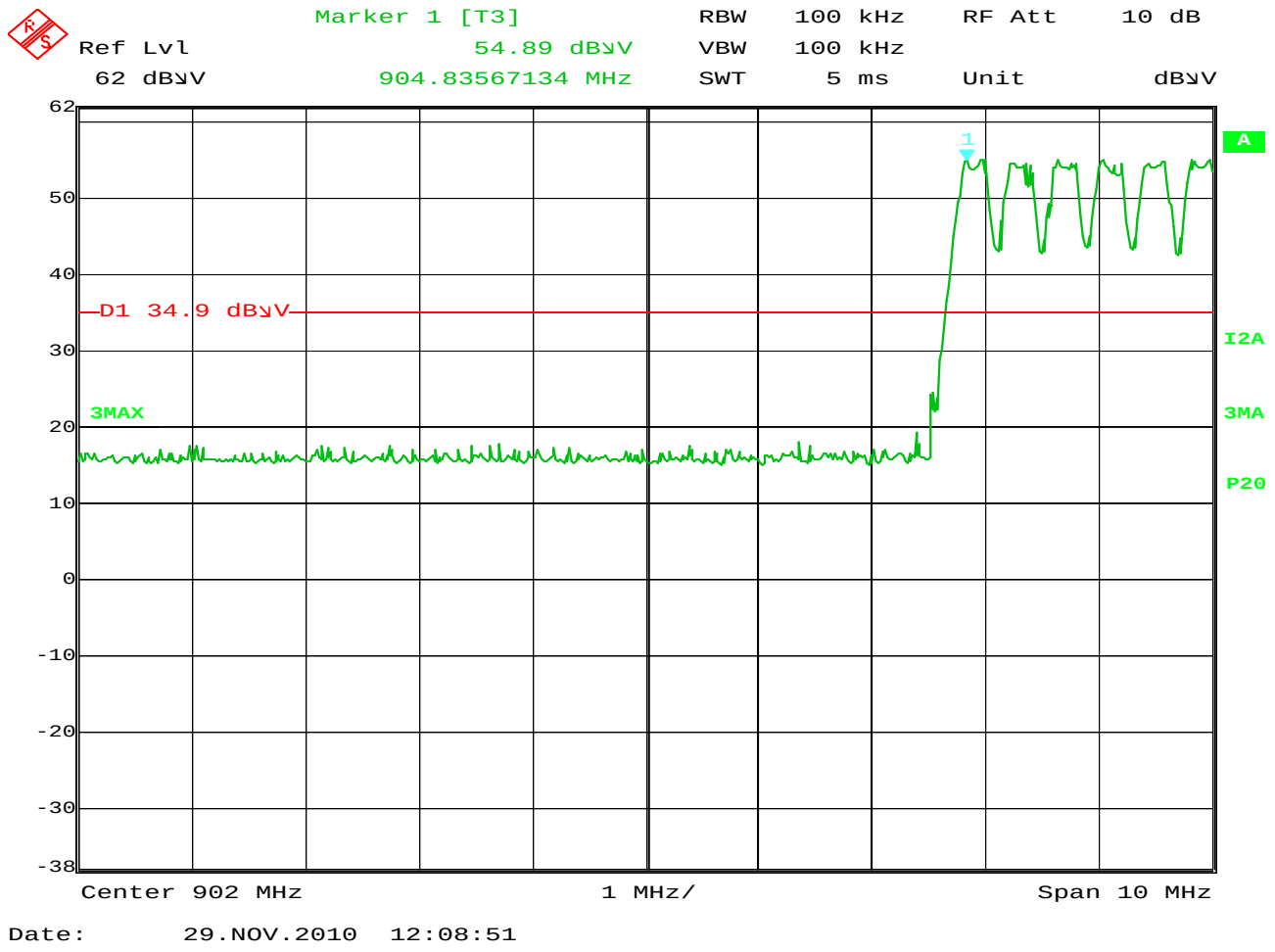
Manufacturer : Badger Meter Corporation
Model No. : Orion SE Water Meter
Test Specification : FCC Part 15, Subpart C, Section 15.247, Radiated Emissions
Date : November 27, 2010
Mode : Transmit @ 923.7MHz
Power Setting : Mobile
Test Distance : 3 meters
Notes : Average Readings in Restricted Bands
: Total = Meter Reading + Cable Loss + Antenna Factor + Preamp Gain + Duty Cycle Factor

Freq (MHz)	Ant Pol	Meter Reading (dBuV)	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Total dBuV/m at 3 M	Total uV/m at 3M	Limit uV/m at 3M	Margin (dB)
2771.0	H	36.5	4.0	30.4	-39.2	-19.9	11.7	3.8	500.0	-42.3
2771.0	V	35.1	4.0	30.4	-39.2	-19.9	10.3	3.3	500.0	-43.7
3694.6	H	43.4	4.8	33.3	-38.5	-19.9	23.1	14.2	500.0	-30.9
3694.6	V	40.0	4.8	33.3	-38.5	-19.9	19.6	9.6	500.0	-34.4
4618.3	H	40.9	5.6	33.8	-38.2	-19.9	22.2	12.8	500.0	-31.8
4618.3	V	40.2	5.6	33.8	-38.2	-19.9	21.5	11.8	500.0	-32.5
7389.2	H	43.6	7.7	37.9	-38.5	-19.9	30.8	34.9	500.0	-23.1
7389.2	V	43.6	7.7	37.9	-38.5	-19.9	30.8	34.9	500.0	-23.1
8312.9	H	38.9	8.2	37.9	-38.8	-19.9	26.2	20.5	500.0	-27.8
8312.9	V	39.1	8.2	37.9	-38.8	-19.9	26.5	21.1	500.0	-27.5



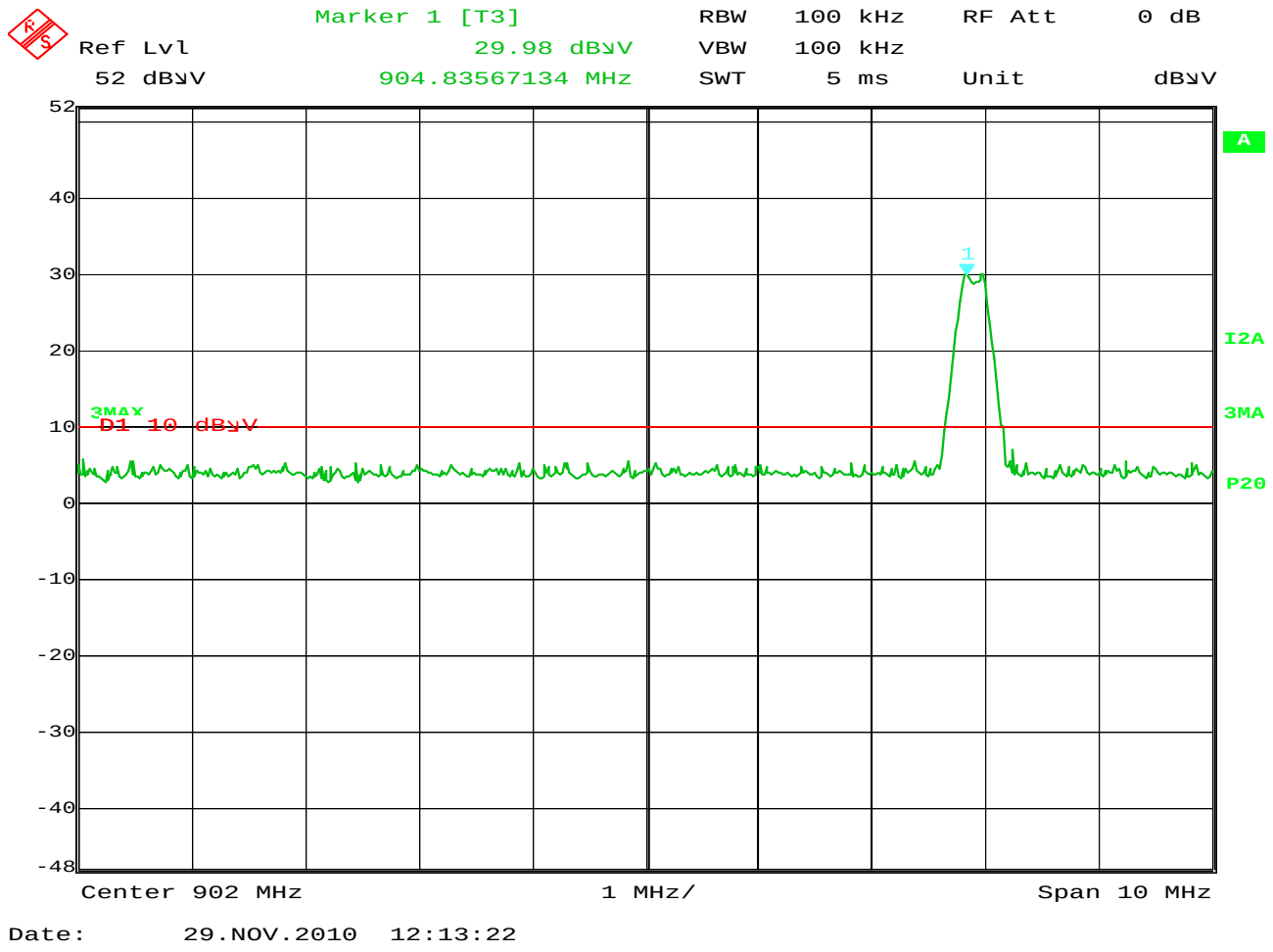
15.247(d) Band Edge Compliance

MANUFACTURER	:	Badger Meter Corporation
MODEL NUMBER	:	Orion SE Water Meter
TEST MODE	:	Tx @ 902.5MHz
TEST PARAMETERS	:	Band Edge Test
NOTES	:	Display Line D1 represents the 20dB down point from the peak emissions in a 100kHz bandwidth. The center line represents the band edge (902MHz).
NOTES	:	Fixed Power Setting



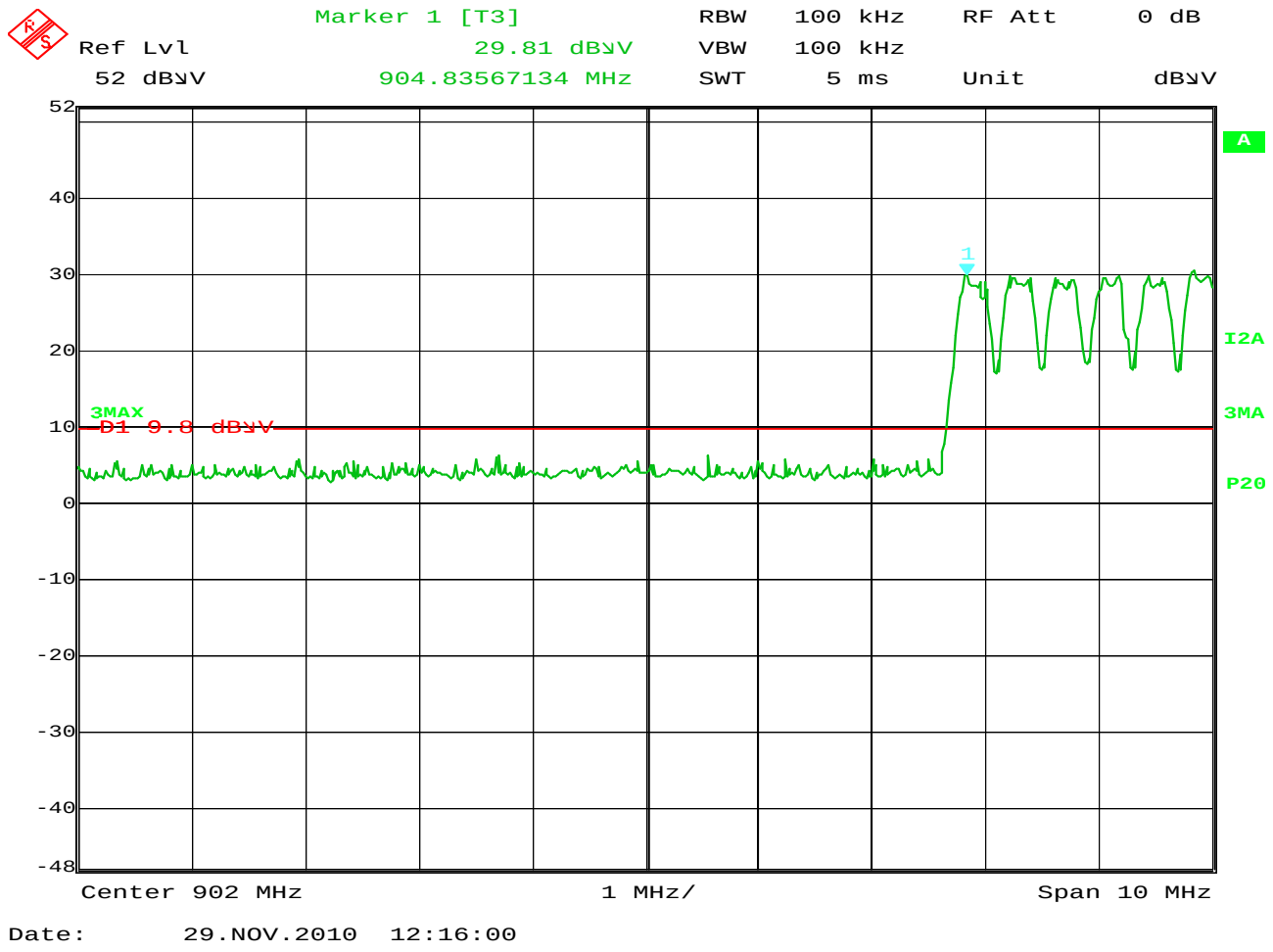
15.247(d) Band Edge Compliance

MANUFACTURER	:	Badger Meter Corporation
MODEL NUMBER	:	Orion SE Water Meter
TEST MODE	:	Hopping Enabled
TEST PARAMETERS	:	Band Edge Test
NOTES	:	Display Line D1 represents the 20dB down point from the peak emissions in a 100kHz bandwidth. The center line represents the band edge (902MHz).
NOTES	:	Fixed Power Setting



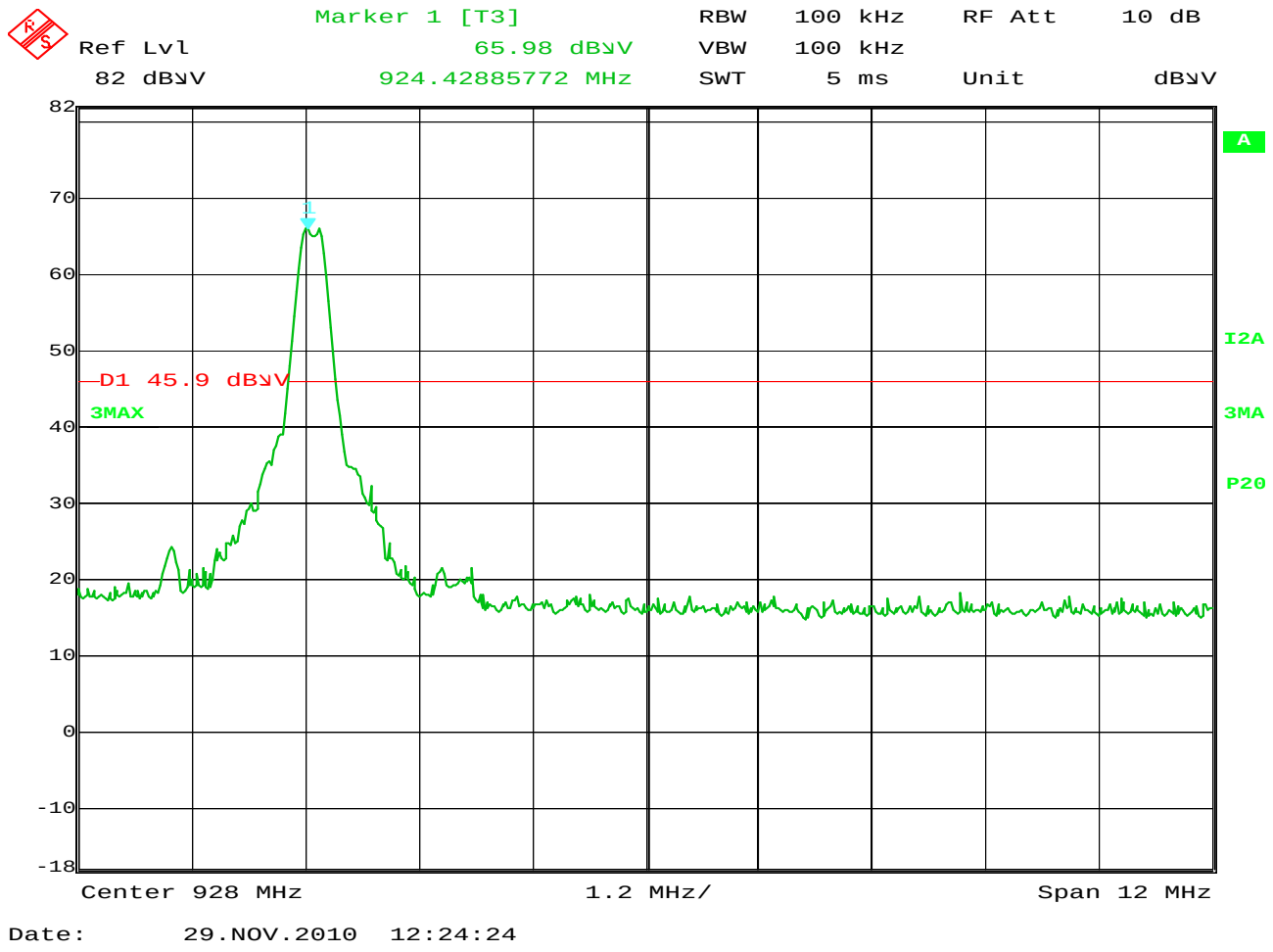
15.247(d) Band Edge Compliance

MANUFACTURER	:	Badger Meter Corporation
MODEL NUMBER	:	Orion SE Water Meter
TEST MODE	:	Tx @ 902.5MHz
TEST PARAMETERS	:	Band Edge Test
NOTES	:	Display Line D1 represents the 20dB down point from the peak emissions in a 100kHz bandwidth. The center line represents the band edge (902MHz).
NOTES	:	Mobile Power Setting



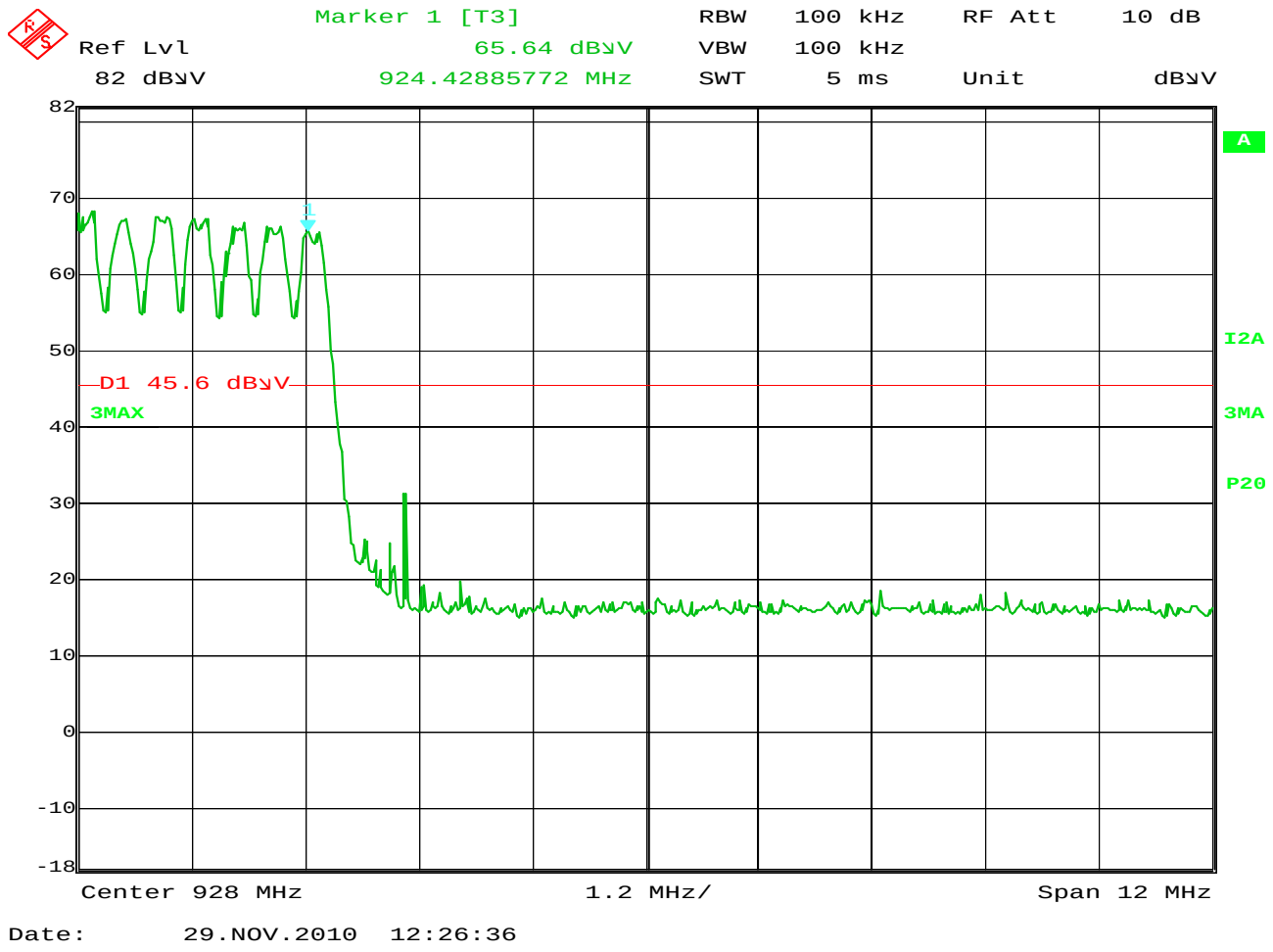
15.247(d) Band Edge Compliance

MANUFACTURER	:	Badger Meter Corporation
MODEL NUMBER	:	Orion SE Water Meter
TEST MODE	:	Hopping Enabled
TEST PARAMETERS	:	Band Edge Test
NOTES	:	Display Line D1 represents the 20dB down point from the peak emissions in a 100kHz bandwidth. The center line represents the band edge (902MHz).
NOTES	:	Mobile Power Setting



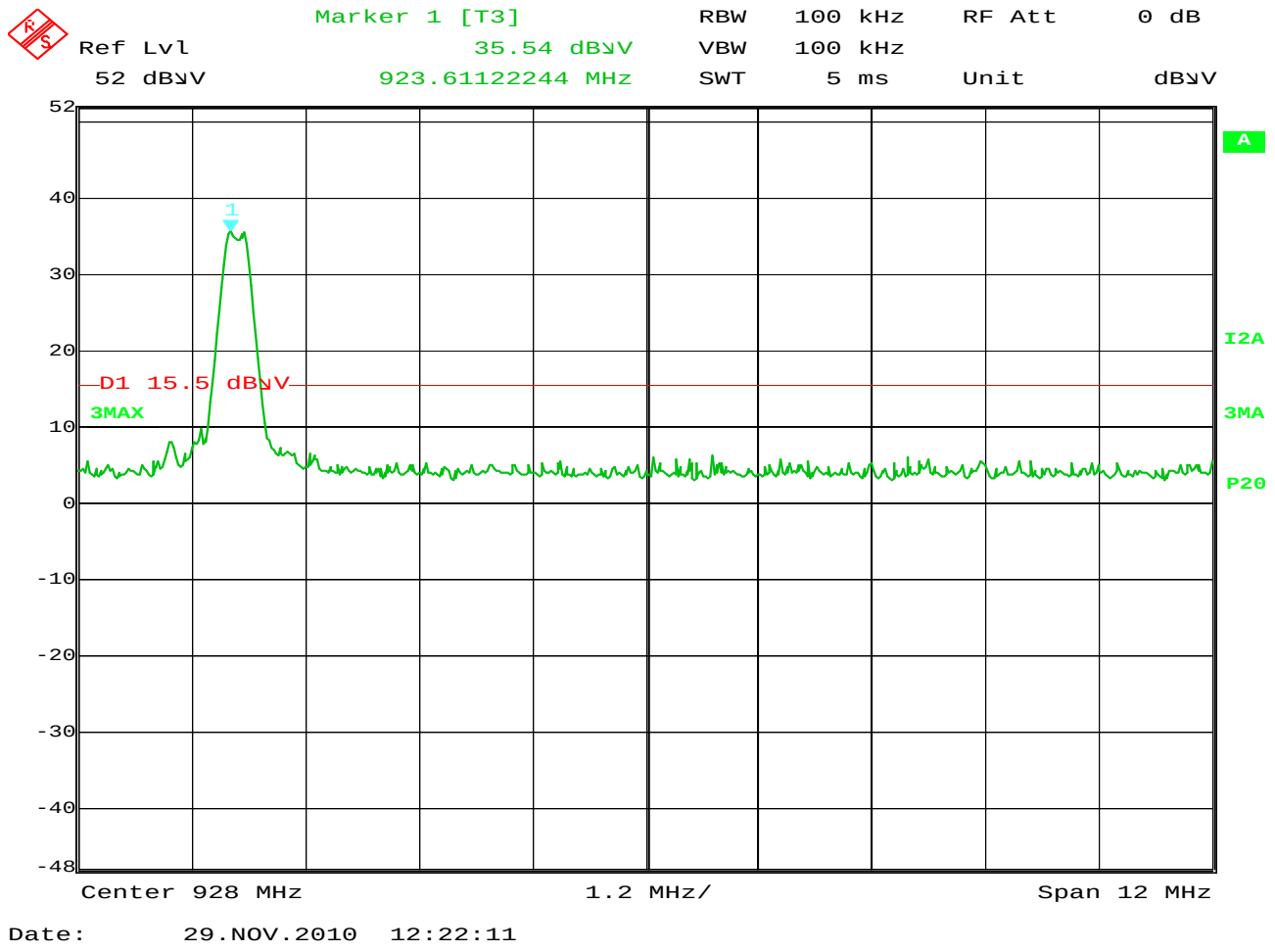
15.247(d) Band Edge Compliance

MANUFACTURER	:	Badger Meter Corporation
MODEL NUMBER	:	Orion SE Water Meter
TEST MODE	:	Tx @ 924.4MHz
TEST PARAMETERS	:	Band Edge Test
NOTES	:	Display Line D1 represents the 20dB down point from the peak emissions in a 100kHz bandwidth. The center line represents the band edge (928MHz).
NOTES	:	FIxed Power Setting



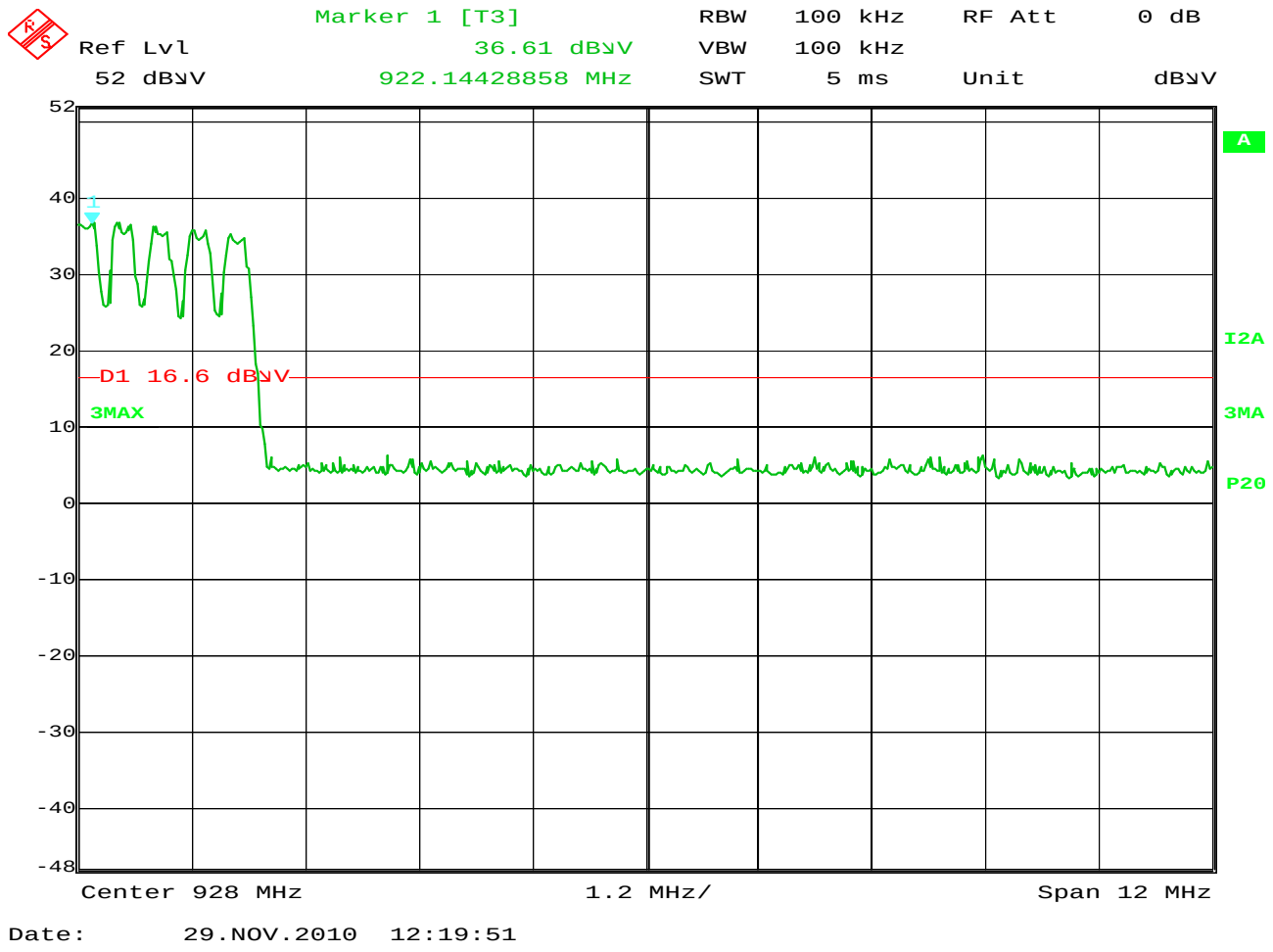
15.247(d) Band Edge Compliance

MANUFACTURER	:	Badger Meter Corporation
MODEL NUMBER	:	Orion SE Water Meter
TEST MODE	:	Hopping Enabled
TEST PARAMETERS	:	Band Edge Test
NOTES	:	Display Line D1 represents the 20dB down point from the peak emissions in a 100kHz bandwidth. The center line represents the band edge (928MHz).
NOTES	:	Fixed Power Setting



15.247(d) Band Edge Compliance

MANUFACTURER	:	Badger Meter Corporation
MODEL NUMBER	:	Orion SE Water Meter
TEST MODE	:	Tx @ 923.6MHz
TEST PARAMETERS	:	Band Edge Test
NOTES	:	Display Line D1 represents the 20dB down point from the peak emissions in a 100kHz bandwidth. The center line represents the band edge (928MHz).
NOTES	:	Mobile Power Setting



15.247(d) Band Edge Compliance

MANUFACTURER	:	Badger Meter Corporation
MODEL NUMBER	:	Orion SE Water Meter
TEST MODE	:	Hopping Enabled
TEST PARAMETERS	:	Band Edge Test
NOTES	:	Display Line D1 represents the 20dB down point from the peak emissions in a 100kHz bandwidth. The center line represents the band edge (928MHz).
NOTES	:	Mobile Power Setting