



## Measurement of RF Interference from an Orion SE Water Meter Transceiver

For : Badger Meter, Inc.  
: 4545 W. Brown Deer Road  
: Milwaukee, WI

P.O. No. : 556074

Date Tested : March 21 through April 8, 2011

Test Personnel : Richard E. King

Specification : FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Sections 15.207 and 15.247 for Frequency Hopping Spread Spectrum Intentional Radiators Operating within the band 902-928MHz

Industry Canada RSS-210  
Industry Canada RSS-GEN

Test Report By

*Richard E. King*  
Richard E. King  
EMC Engineer

Approved By

*Raymond J. Klouda*  
Raymond J. Klouda  
Registered Professional Engineer of  
Illinois - 44894

## TABLE OF CONTENTS

PARAGRAPH	DESCRIPTION OF CONTENTS	PAGE NO.
1	INTRODUCTION .....	5
1.1	Scope of Tests .....	5
1.2	Purpose .....	5
1.3	Deviations, Additions and Exclusions .....	5
1.4	EMC Laboratory Identification .....	5
1.5	Laboratory Conditions .....	5
2	APPLICABLE DOCUMENTS .....	5
3	EUT SETUP AND OPERATION .....	6
3.1	General Description .....	6
3.1.1	Power Input .....	6
3.1.2	Peripheral Equipment .....	6
3.1.3	Interconnect Cables .....	6
3.1.4	Grounding .....	6
3.2	Operational Mode .....	6
3.3	EUT Modifications .....	6
4	TEST FACILITY AND TEST INSTRUMENTATION .....	6
4.1	Shielded Enclosure .....	6
4.2	Test Instrumentation .....	6
4.3	Calibration Traceability .....	6
4.4	Measurement Uncertainty .....	7
5	TEST PROCEDURES .....	7
5.1	Transmitter .....	7
5.1.1	20dB Bandwidth .....	7
5.1.1.1	Requirements .....	7
5.1.1.2	Procedures .....	7
5.1.1.3	Results .....	7
5.1.2	Carrier Frequency Separation .....	7
5.1.2.1	Requirements .....	7
5.1.2.2	Procedures .....	8
5.1.2.3	Results .....	8
5.1.3	Number of Hopping Frequencies .....	8
5.1.3.1	Requirements .....	8
5.1.3.2	Procedures .....	8
5.1.3.3	Results .....	8
5.1.4	Time of Occupancy .....	8
5.1.4.1	Requirements .....	8
5.1.4.2	Procedures .....	8
5.1.4.3	Results .....	9
5.1.5	Antenna Conducted Peak Output Power .....	9
5.1.5.1	Requirements .....	9
5.1.5.2	Procedures .....	9
5.1.5.3	Results .....	9
5.1.6	Effective Isotropic Radiated Power (EIRP) .....	9
5.1.6.1	Requirements .....	9
5.1.6.2	Procedures .....	10
5.1.6.3	Results .....	10

THIS REPORT SHALL NOT BE REPRODUCED, EXCEPT IN FULL, WITHOUT THE  
WRITTEN APPROVAL OF ELITE ELECTRONIC ENGINEERING INCORPORATED.

5.1.7	Duty Cycle Factor Measurements.....	10
5.1.7.1	Procedures .....	10
5.1.7.2	Results.....	10
5.1.8	Antenna Conducted Spurious Emissions.....	10
5.1.8.1	Requirements .....	10
5.1.8.2	Procedures .....	10
5.1.8.3	Results.....	11
5.1.9	Radiated Spurious Emissions Measurements.....	11
5.1.9.1	Requirements .....	11
5.1.9.2	Procedures .....	11
5.1.9.3	Results.....	12
5.1.10	Band Edge Compliance .....	12
5.1.10.1	Requirements .....	12
5.1.10.2	Procedures .....	12
5.1.10.2.1	Low Band Edge .....	12
5.1.10.2.2	High Band Edge .....	13
5.1.10.3	Results.....	13
6	CONCLUSIONS.....	13
7	CERTIFICATION .....	13
8	ENDORSEMENT DISCLAIMER .....	13
9	EQUIPMENT LIST.....	14

THIS REPORT SHALL NOT BE REPRODUCED, EXCEPT IN FULL, WITHOUT THE  
WRITTEN APPROVAL OF ELITE ELECTRONIC ENGINEERING INCORPORATED.



**REVISION HISTORY**

Revision	Date	Description
—	May 2, 2011	Initial release

## Measurement of RF Emissions from an Orion SE Water Meter Transceiver

### 1 INTRODUCTION

#### 1.1 Scope of Tests

This report presents the results of the radio interference measurements performed on a 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, Inc. 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.

Testing was limited to the transmitter section.

#### 1.2 Purpose

The test series was performed to determine if the EUT meets the requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, 15.247 for Intentional Radiators Operating within the 902-928 MHz band.

The test series was also performed to determine if the EUT meets the requirements of the Industry Canada Radio Standards Specification RSS-Gen Section 7.2.2 and RSS-210 Annex 2, section A2.9 for Transmitters.

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 National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP). NVLAP Lab Code: 100278-0.

#### 1.5 Laboratory Conditions

The temperature at the time of the test was 22°C and the relative humidity was 45%.

### 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, dated 1 October 2010
- 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"
- FCC Public Notice, DA 00-705, "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems", Released March 30, 2000
- Industry Canada RSS-210, Issue 8, December 2010, "Spectrum Management and Telecommunications Radio Standards Specification, Low-power License-exempt radio communication devices (All Frequency Bands): Category I Equipment"
- Industry Canada RSS-GEN, Issue 3, December 2010, "Spectrum Management and Telecommunications Radio Standards Specification, General Requirements and Information for the Certification of radio communication equipment"

### 3 EUT SETUP AND OPERATION

#### 3.1 General Description

The EUT is an Orion SE Water Meter Transceiver. A block diagram of the EUT setup is shown as Figure 1.

##### 3.1.1 Power Input

The EUT typically obtains 3.6VDC from an internal battery. For testing purposes the EUT obtained 3.6VDC from a DC power supply.

##### 3.1.2 Peripheral Equipment

No peripheral equipment was submitted with the EUT.

##### 3.1.3 Interconnect Cables

The test items does not utilize any interconnect cables.

##### 3.1.4 Grounding

The EUT was not grounded during the tests.

#### 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
- Frequency Hopping Enabled

#### 3.3 EUT Modifications

No modifications were required for compliance.

### 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.

The receiver allows measurements with the bandwidths and detectors specified by the FCC.

#### 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).

#### 4.4 Measurement Uncertainty

All measurements are an estimate of their true value. The measurement uncertainty characterizes, with a specified confidence level, the spread of values which may be possible for a given measurement system.

The measurement uncertainty for these tests is presented below:

Conducted Emission Measurements			
Combined Standard Uncertainty		1.07	-1.07
Expanded Uncertainty (95% confidence)		2.1	-2.1

Radiated Emission Measurements			
Combined Standard Uncertainty		2.26	-2.18
Expanded Uncertainty (95% confidence)		4.5	-4.4

### 5 TEST PROCEDURES

#### 5.1 Transmitter

##### 5.1.1 20dB Bandwidth

###### 5.1.1.1 Requirements

Per 15.247(a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Per section 15.247(a)(1)(i), for frequency hopping systems operating in the 902-928MHz band, the 20dB bandwidth shall be measured for determination of the carrier frequency separation limits and must not exceed 500 kHz. If the 20dB bandwidth of the hopping channel is less than 250kHz, the system shall use at least 50 hopping channels. If 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.

###### 5.1.1.2 Procedures

The antenna port of the EUT was connected to the input of the spectrum analyzer through 50dB of attenuation.

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  $\geq 1\%$  of the 20 dB BW. The span was set to approximately 2 to 3 times the 20 dB bandwidth.

The 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined. The analyzer's display was plotted using a 'screen dump' utility.

###### 5.1.1.3 Results

The plots on pages 18 through 23 show that the maximum 20 dB bandwidth was 282.4kHz. The 99% bandwidth was measured to be 253.6kHz. 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.

##### 5.1.2 Carrier Frequency Separation

###### 5.1.2.1 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.

### 5.1.2.2 Procedures

The antenna port of the EUT was connected to the input of the spectrum analyzer through 50dB of attenuation. With the hopping function enabled, the EUT was allowed to transmit continuously. The resolution bandwidth (RBW) was set to  $>$  to 1% of the span. The peak detector and 'Max-Hold' function were 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.

### 5.1.2.3 Results

Page 24 shows the carrier frequency separation. As can be seen from this plot, the carrier frequency separation is 400.8kHz, which is greater than the 20dB bandwidth (282.4kHz).

## 5.1.3 Number of Hopping Frequencies

### 5.1.3.1 Requirements

Per section 15.247(a)(1)(i), for frequency hopping systems operating in the 902-928MHz band, the 20dB bandwidth shall be measured for determination of the carrier frequency separation limits and must not exceed 500 kHz. If the 20dB bandwidth of the hopping channel is less than 250kHz, the system shall use at least 50 hopping channels. If 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.

### 5.1.3.2 Procedures

The antenna port of the EUT was connected to the input of the spectrum analyzer through 50dB of attenuation. 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 were 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.

### 5.1.3.3 Results

Pages 25 and 26 show 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.

## 5.1.4 Time of Occupancy

### 5.1.4.1 Requirements

Per section 15.247(a)(1)(i), for frequency hopping systems operating in the 902-928MHz band, if the 20dB bandwidth of the hopping channel is 250kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period.

### 5.1.4.2 Procedures

The antenna port of the EUT was connected to the input of the spectrum analyzer through 50dB of attenuation. With the hopping function enabled, the EUT was allowed to transmit continuously. The resolution bandwidth (RBW) was set to 1 MHz. The peak detector and 'Max-Hold' function were 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. The analyzer's display was plotted using a 'screen dump' utility. Then, the sweep time was expanded to 10 seconds.

#### 5.1.4.3 Results

Pages 27 through 30 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. This time of occupancy is the same for both the mobile and fixed power settings.

#### 5.1.5 Antenna Conducted Peak Output Power

##### 5.1.5.1 Requirements

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.

##### 5.1.5.2 Procedures

The output of the EUT was connected to the spectrum analyzer through 50dB of attenuation. 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 greater than the 20dB bandwidth. The span was set to approximately 5 times the 20 dB bandwidth. The 'Max-Hold' function was engaged. The maximum meter reading was recorded. The peak power output was calculated for the low, middle and high hopping frequencies.

##### 5.1.5.3 Results

The results are presented on pages 31 through 36. The maximum peak conducted output power from the transceiver in the mobile power setting was 7.0 mW (8.41dBm) which is below the 250 milliwatt limit. The maximum peak conducted output power from the transceiver in the fixed power setting was 839 mW (29.24dBm) which is below the 1 Watt limit.

#### 5.1.6 Effective Isotropic Radiated Power (EIRP)

##### 5.1.6.1 Requirements

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)(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). 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 by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

#### 5.1.6.2 Procedures

The EUT was placed on the non-conductive stand and set to transmit. A dipole 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 second 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.

#### 5.1.6.3 Results

The results are presented on pages 37 and 38. The maximum EIRP measured from the transceiver in the mobile power setting was 9.5 dBm which meets the De Facto 30 dBm limit. The maximum EIRP measured from the transceiver in the fixed power setting was 28.4 dBm which meets the De Facto 36 dBm limit.

### 5.1.7 Duty Cycle Factor Measurements

#### 5.1.7.1 Procedures

The duty cycle factor is used to convert peak detected readings to average readings. This factor is computed from the time domain trace of the pulse modulation signal.

With the transmitter set up to transmit for maximum pulse density, the time domain trace is displayed on the spectrum analyzer. This trace is obtained by tuning center frequency to the transmitter frequency and then setting a zero span width with 1msec/div (adjust this for what you need). The amplitude settings are adjusted so that the on/off transitions clear the 4th division from the bottom of the display. The markers are set at the beginning and end of the "on-time". The trace is recorded.

Next the spectrum analyzer center frequency is set to the transmitter frequency with a zero span width and 10msec/div. This shows if the word is longer than 100msec or shorter than 100msec. If the word period is less than 100msec, the display is set to show at least one word. The on-time and off-time are then measured. The on-time is total time signal level exceeds the 4th division. Off-time is time under for the word period. The duty cycle is then computed as the (On-time/ word period) where the word period = (On-time + Off-time).

#### 5.1.7.2 Results

The plots of the duty cycle are shown on data pages 39 and 40. Duty Cycle Correction Factor =  $20 \times \log((\text{pulse width}) \times (\text{number of times the channel is used in a 100msec period}) / 100) = 20 \times (\log(10.2\text{mS}) \times (1) / 100\text{msec}) = -19.9\text{dB}$

### 5.1.8 Antenna Conducted Spurious Emissions

#### 5.1.8.1 Requirements

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.

#### 5.1.8.2 Procedures

The output of the EUT was connected to the spectrum analyzer through 50dB of attenuation. The frequency hopping function was disabled. The resolution bandwidth (RBW) was set to 100kHz. The peak detector and 'Max-Hold' function were engaged. The emissions in the frequency range from 30MHz to 10GHz were observed and plotted separately with the EUT transmitting at low, middle and high hopping frequencies.

### 5.1.8.3 Results

The results of the antenna conducted emissions levels were plotted. These plots are presented on pages 41 through 51. These plots show that the spurious emissions were at least 20 dB below the level of the fundamental.

### 5.1.9 Radiated Spurious Emissions Measurements

#### 5.1.9.1 Requirements

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

#### 5.1.9.2 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  $20 * \log(\text{dwell time}/100\text{msec})$ . These readings must be no greater than the limits specified in 15.209(a).

#### 5.1.9.3 Results

Preliminary radiated emissions plots with the EUT transmitting at low, middle, and high hopping frequencies are shown on pages 52 through 75. Final radiated emissions data are presented on data pages 76 through 88. 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 2 and Figure 3.

#### 5.1.10 Band Edge Compliance

##### 5.1.10.1 Requirements

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.

##### 5.1.10.2 Procedures

###### 5.1.10.2.1 Low Band Edge

- 1) The output of the EUT was connected to the spectrum analyzer through 50dB of attenuation.
- 2) The EUT was set to transmit continuously at the channel closest to the low band-edge (hopping function disabled).
- 3) 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)  $\geq 1\%$  of the span.
  - d. The 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transmitter 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.
- 4) Step 3) was repeated with the frequency hopping function enabled.
  - 5.1.10.2.2 High Band Edge
    - 1) The output of the EUT was connected to the spectrum analyzer through 50dB of attenuation.
    - 2) The EUT was set to transmit continuously at the channel closest to the high band-edge (hopping function disabled).
    - 3) 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)  $\geq 1\%$  of the span.
      - d. The 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transmitter 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.
    - 4) Step 3) was repeated with the frequency hopping function enabled

#### 5.1.10.3 Results

Pages 89 through 96 show the conducted band-edge compliance results. As can be seen from these plots, the emissions at the low end band edge and the high end band edge are within the 20 dB down limits.

## 6 CONCLUSIONS

It was determined that the Badger Meter, Inc. Orion SE Water Meter frequency hopping spread spectrum transceiver, Serial No. None Assigned, did fully meet the requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Section 15.247 for Intentional Radiators Operating within the 902-928 MHz band, when tested per ANSI C63.4-2003.

It was also determined that the Badger Meter, Inc. Orion SE Water Meter frequency hopping spread spectrum transceiver, Serial No. None Assigned, did fully meet the emission requirements of the Industry Canada Radio Standards Specification, RSS-Gen, Section 7.2.2 and RSS-210 Annex 2, section A2.9 for transmitters, when tested per ANSI C63.4-2003.

## 7 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.

## 8 ENDORSEMENT DISCLAIMER

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
GBX0	SYNTHESIZED SWEEPER	HEWLETT PACKARD	83630A	3420A00976	10MHZ-26.5GHZ	4/7/2011	4/7/2012
NDQ1	TUNED DIPOLE ANTENNA	EMCO	3121C-DB4	313	400-1000MHZ	4/20/2011	4/20/2012
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
RBB0	EMI TEST RECEIVER 20HZ TO 40 GHZ	ROHDE & SCHWARZ	ESIB40	100250	20 HZ TO 40GHZ	3/24/2011	3/24/2012
SES1	24VDC POWER SUPPLY	P TRANS	FS-32024-1M	002	18-27VDC	NOTE 1	
T1N5	10DB 20W ATTENUATOR	NARDA	766-10	---	DC-4GHZ	8/9/2010	8/9/2011
T2DL	20DB, 25W ATTENUATOR	WEINSCHEL	46-20-34	BS0910	DC-18GHZ	8/9/2010	8/9/2011
T2S8	20DB 25W ATTENUATOR	WEINSCHEL	46-20-34	BV3541	DC-18GHZ	1/3/2011	1/3/2012
XPQ2	HIGH PASS FILTER	K&L MICROWAVE	4IH30-1804/T10000-0	3	1.8-10GHZ	10/28/2010	10/28/2011

I/O: Initial Only

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.

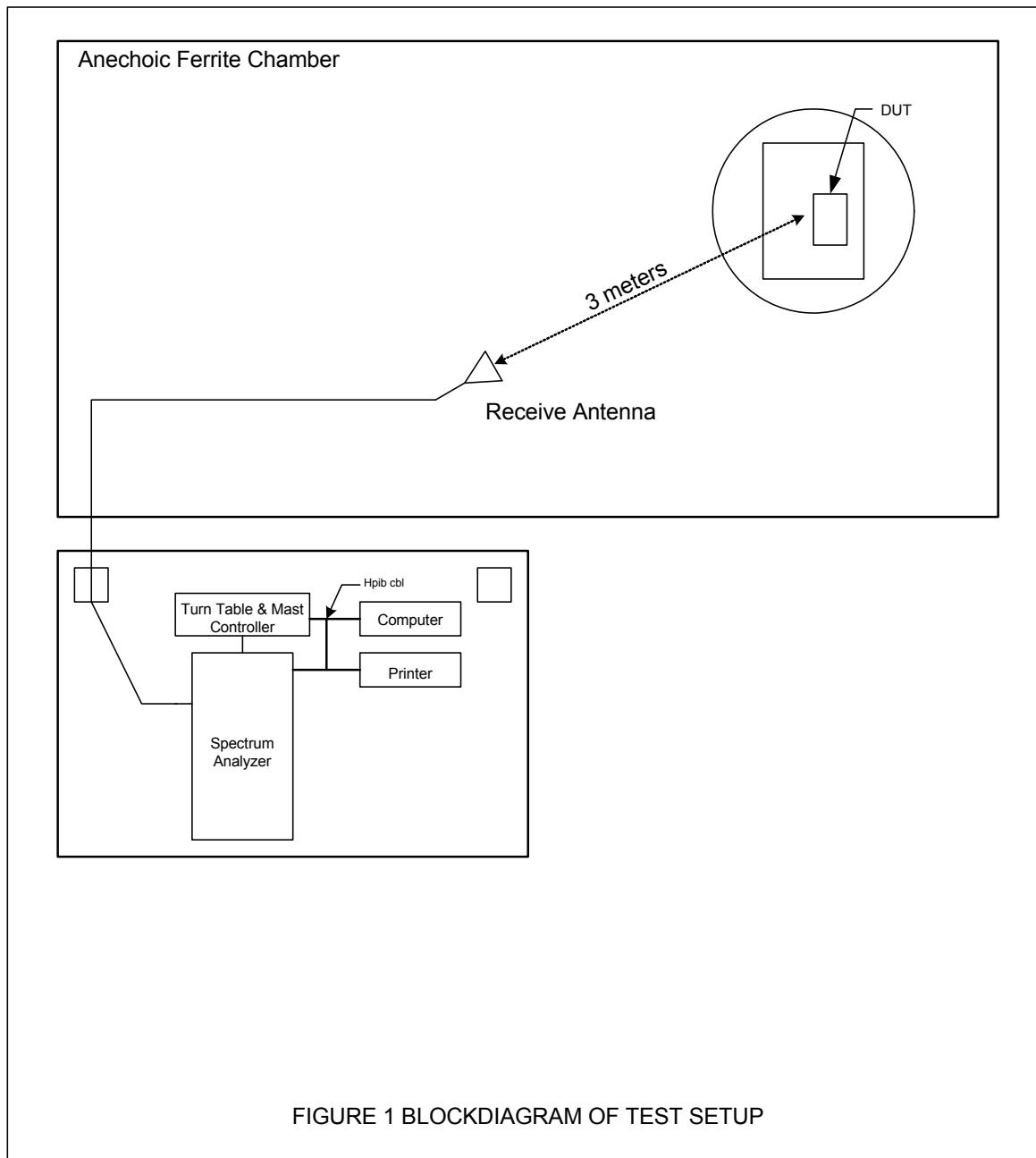


Figure 2



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



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

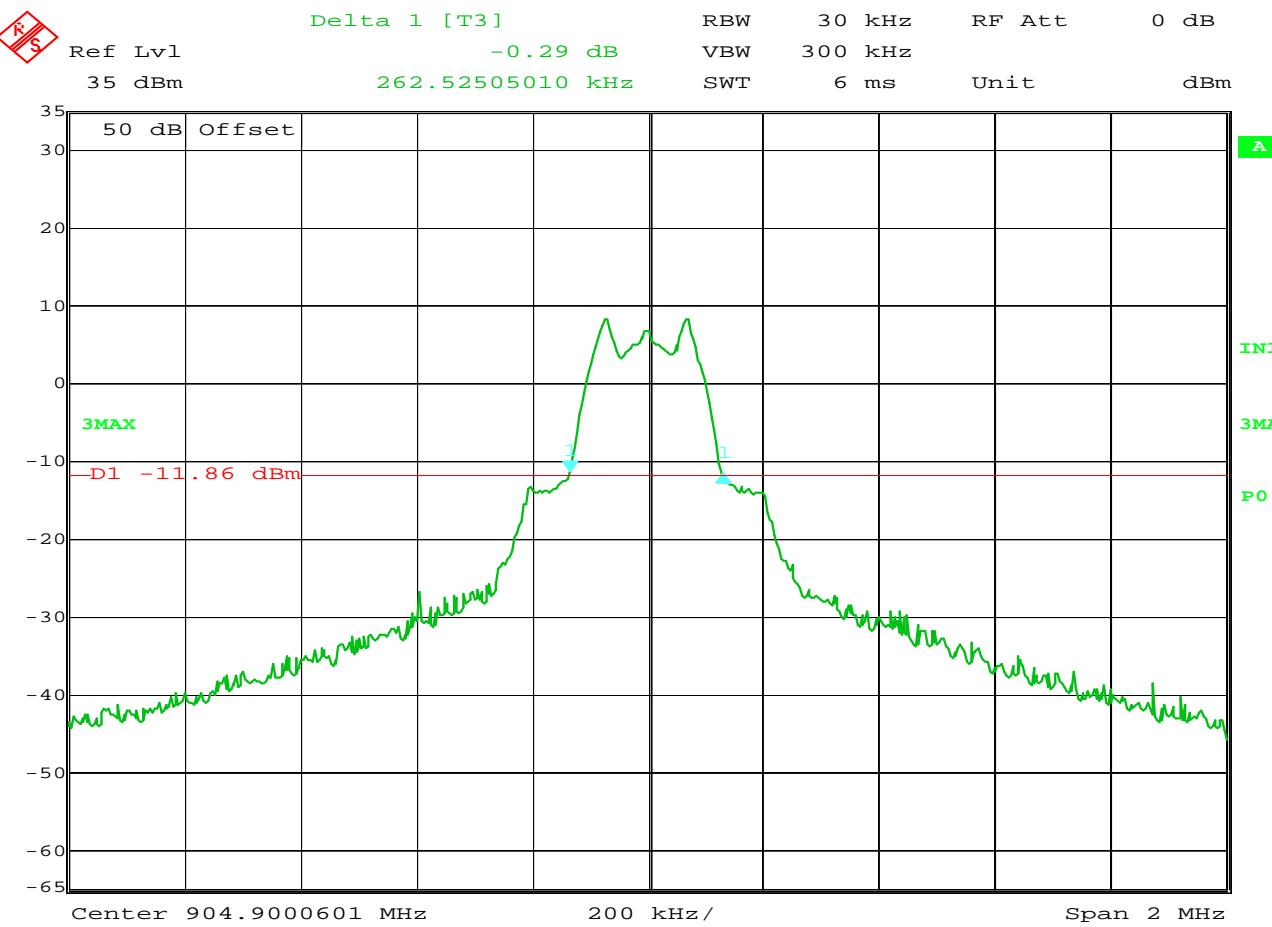
Figure 3



Test Setup for Radiated Emissions – 1GHz to 10GHz, Horizontal Polarization



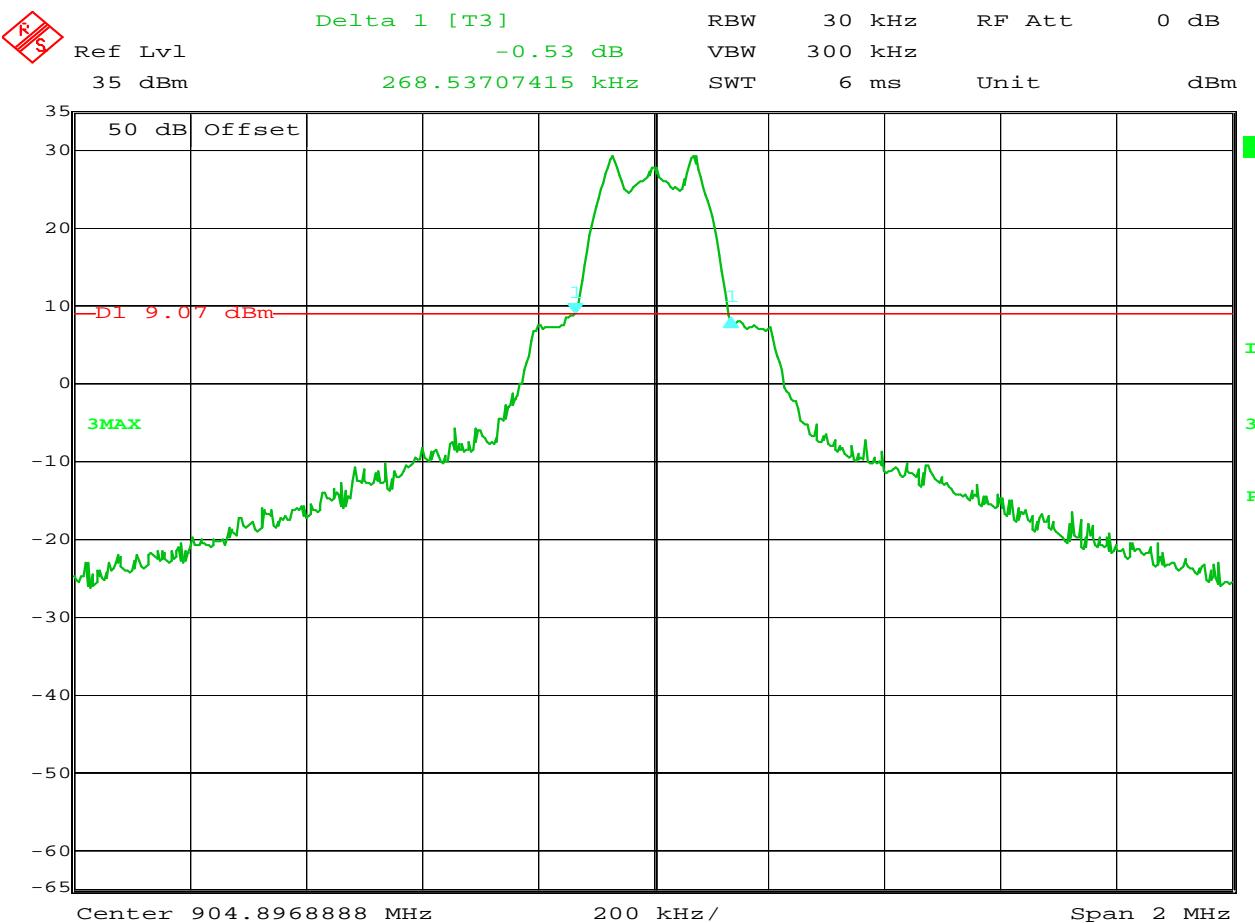
Test Setup for Radiated Emissions – 1GHz to 10GHz, Vertical Polarization



Date: 21.MAR.2011 10:31:20

### 15.247(a) 20dB Bandwidth

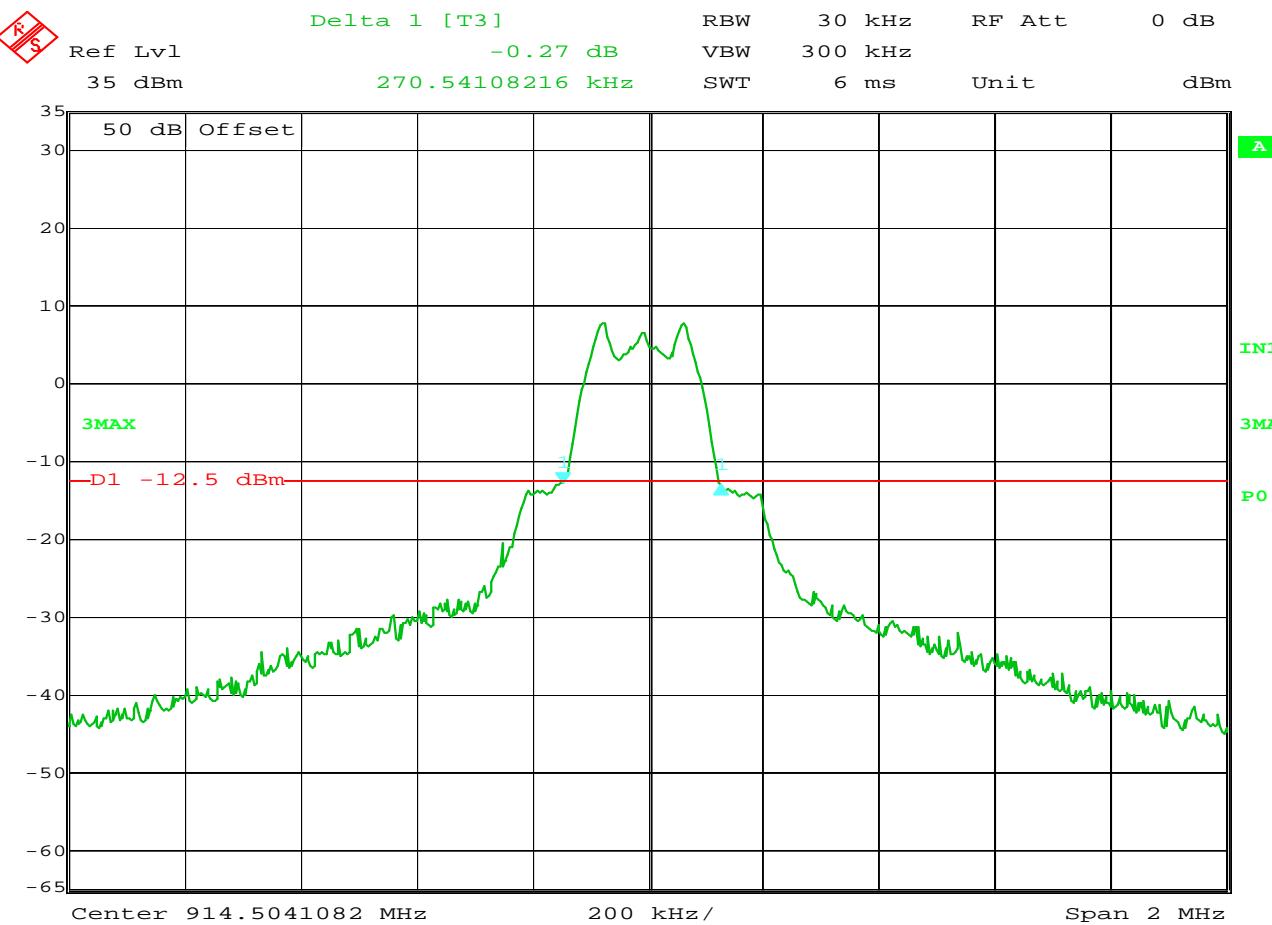
MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	Orion SE Water Meter
SERIAL NUMBER	:	None Assigned
TEST MODE	:	Tx @ 904.9MHz
TEST DATE	:	March 21, 2011
TEST PARAMETERS	:	20dB bandwidth = 262.5kHz
NOTES	:	Mobile Power Setting



Date: 21.MAR.2011 10:24:08

### 15.247(a) 20dB Bandwidth

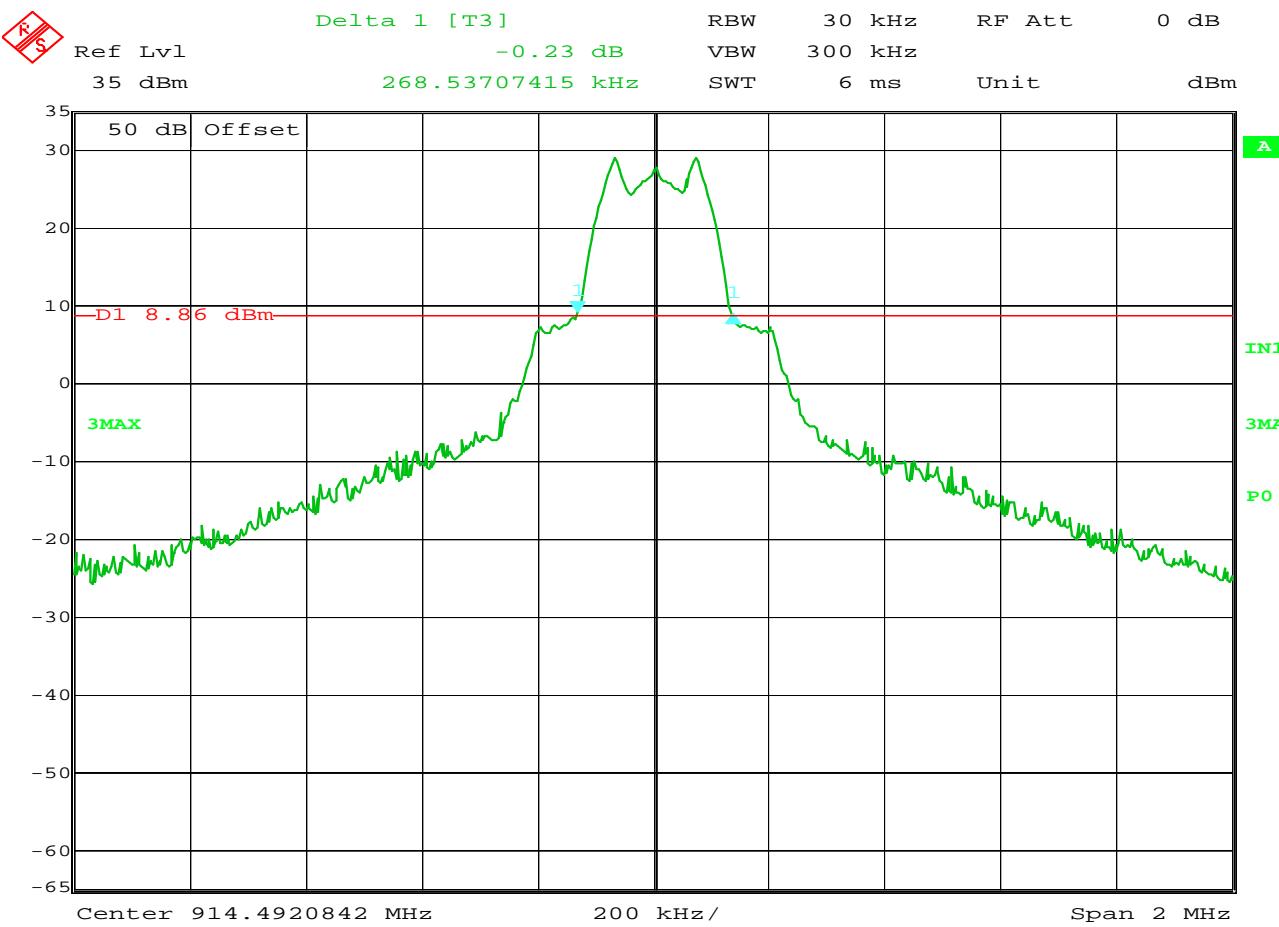
MANUFACTURER : Badger Meter  
 MODEL NUMBER : Orion SE Water Meter  
 SERIAL NUMBER : None Assigned  
 TEST MODE : Tx @ 904.9MHz  
 TEST DATE : March 21, 2011  
 TEST PARAMETERS : 20dB bandwidth = 268.5kHz  
 NOTES : Fixed Power Setting



Date: 21.MAR.2011 10:36:27

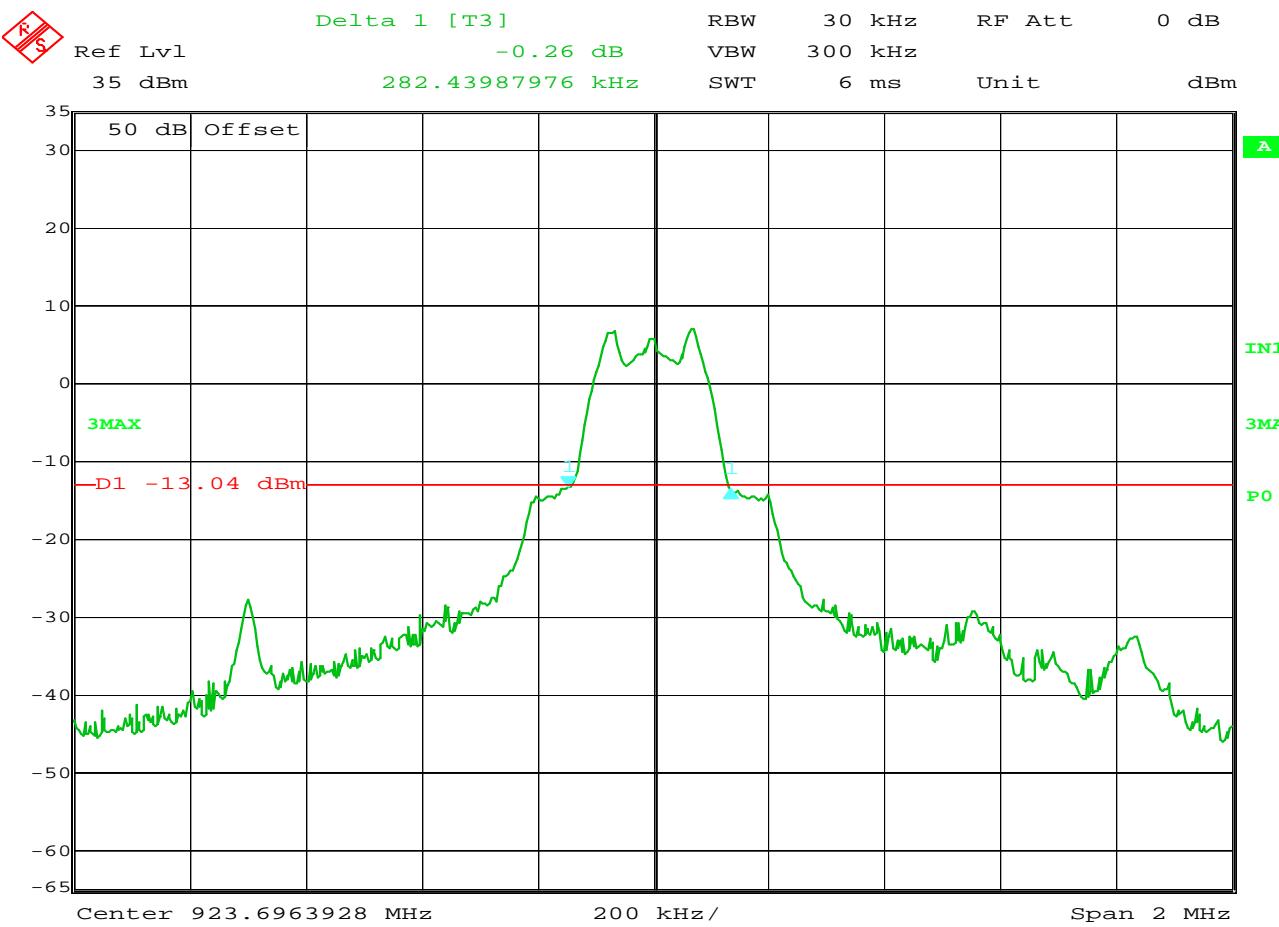
### 15.247(a) 20dB Bandwidth

MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	Orion SE Water Meter
SERIAL NUMBER	:	None Assigned
TEST MODE	:	Tx @ 914.5MHz
TEST DATE	:	March 21, 2011
TEST PARAMETERS	:	20dB bandwidth = 270.5kHz
NOTES	:	Mobile Power Setting



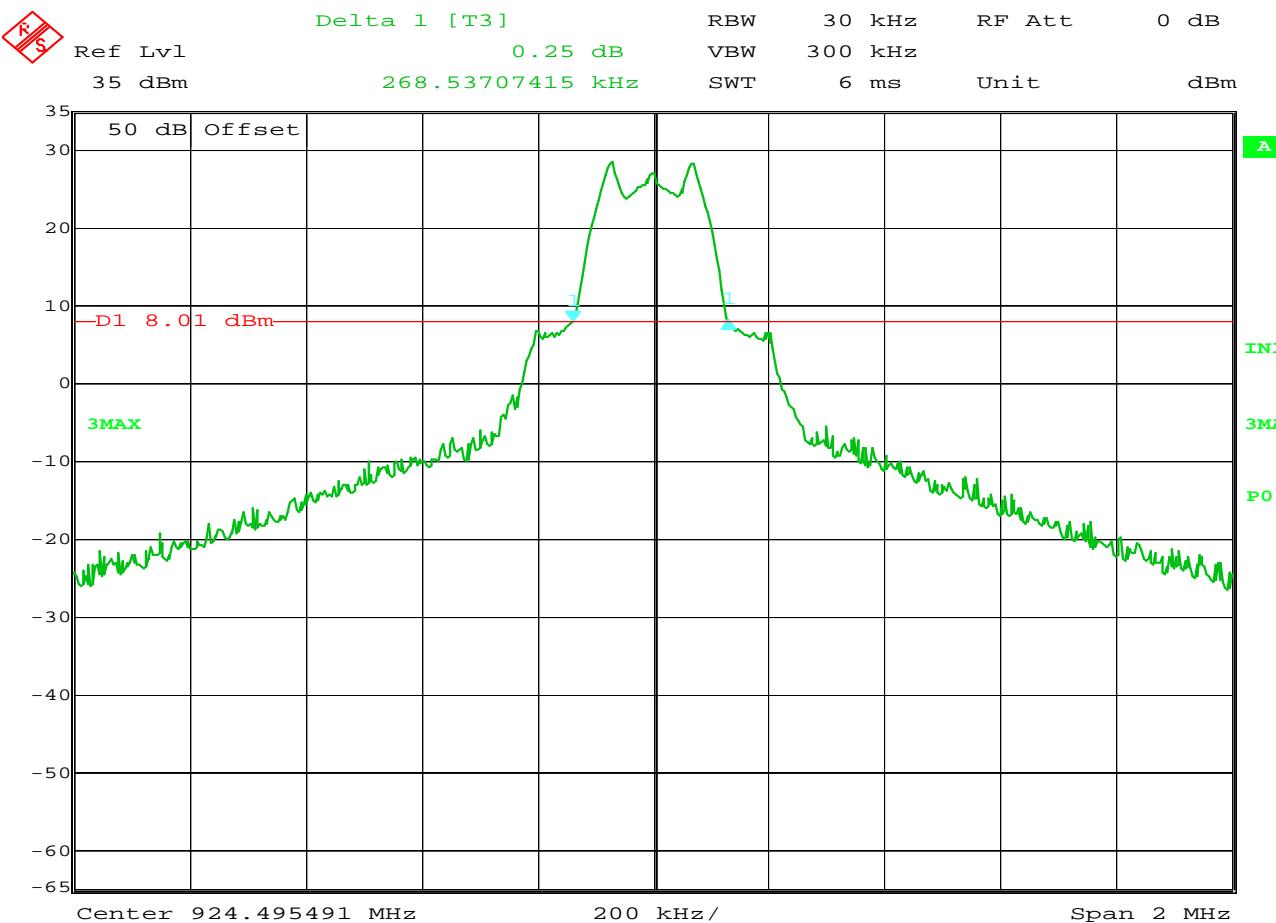
### 15.247(a) 20dB Bandwidth

MANUFACTURER : Badger Meter  
 MODEL NUMBER : Orion SE Water Meter  
 SERIAL NUMBER : None Assigned  
 TEST MODE : Tx @ 914.5MHz  
 TEST DATE : March 21, 2011  
 TEST PARAMETERS : 20dB bandwidth = 268.5kHz  
 NOTES : Fixed Power Setting



### 15.247(a) 20dB Bandwidth

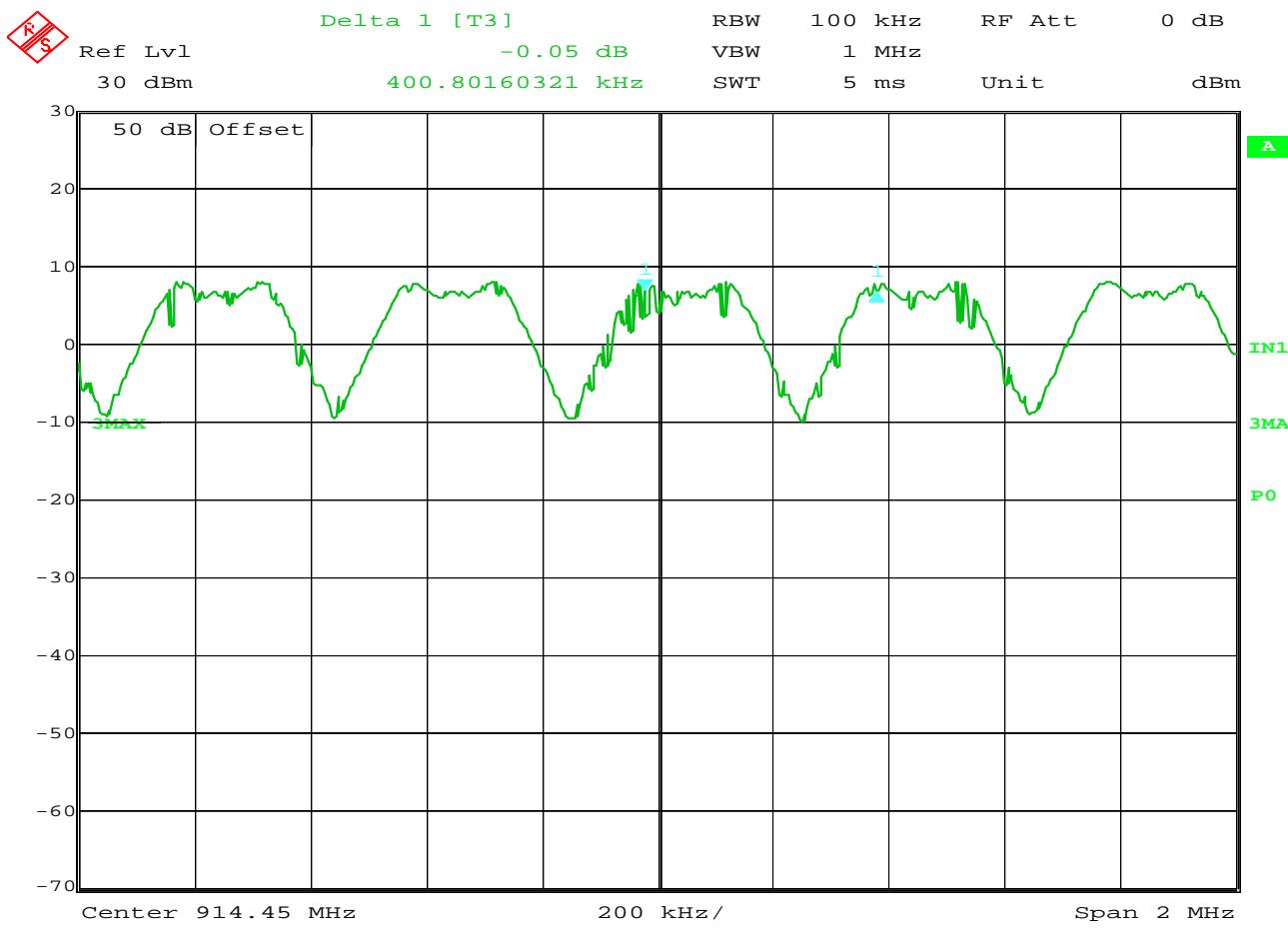
MANUFACTURER : Badger Meter  
 MODEL NUMBER : Orion SE Water Meter  
 SERIAL NUMBER : None Assigned  
 TEST MODE : Tx @ 923.7MHz  
 TEST DATE : March 21, 2011  
 TEST PARAMETERS : 20dB bandwidth = 282.4kHz  
 NOTES : Mobile Power Setting



Date: 21.MAR.2011 10:17:45

### 15.247(a) 20dB Bandwidth

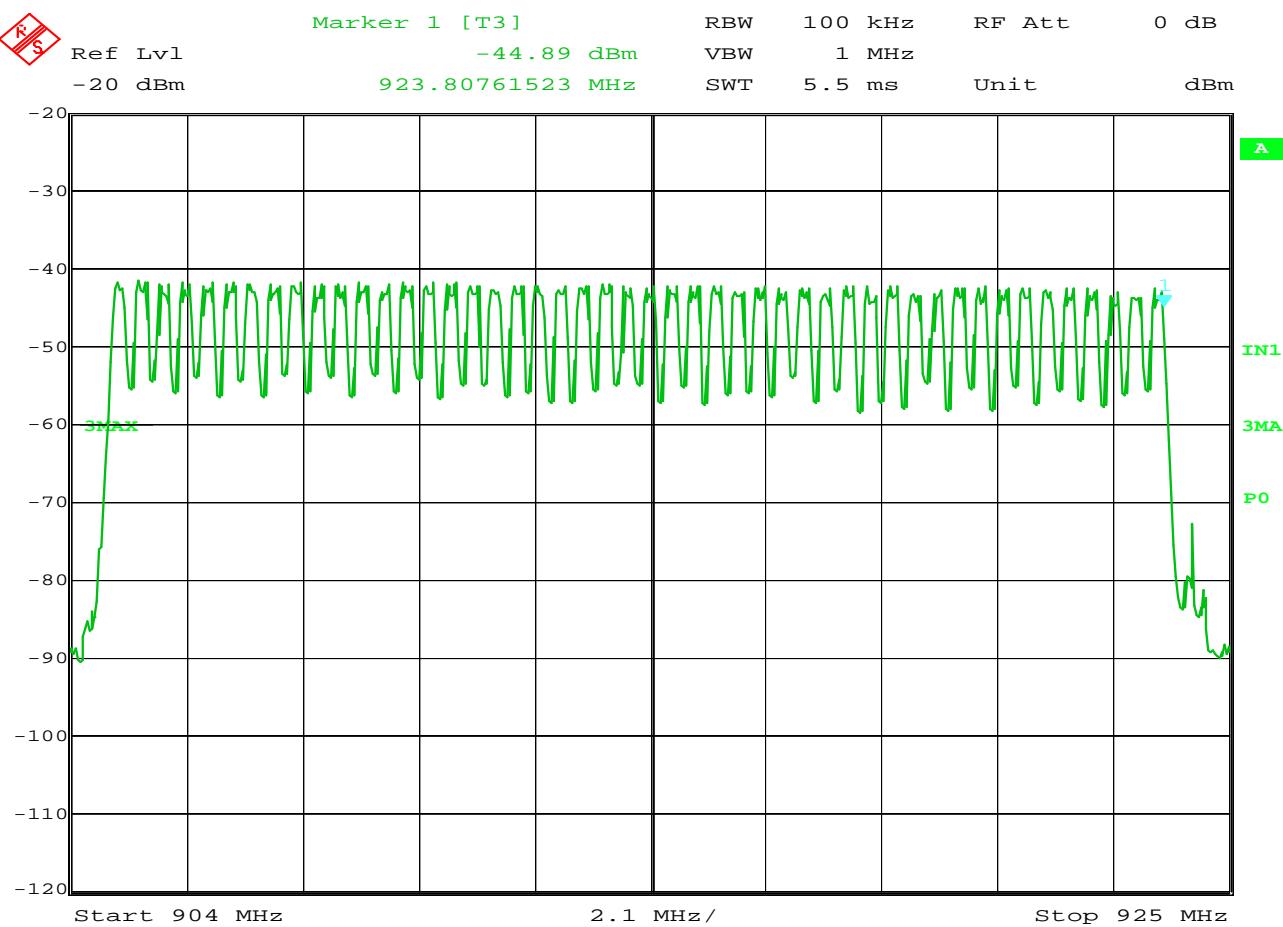
MANUFACTURER : Badger Meter  
 MODEL NUMBER : Orion SE Water Meter  
 SERIAL NUMBER : None Assigned  
 TEST MODE : Tx @ 924.45MHz  
 TEST DATE : March 21, 2011  
 TEST PARAMETERS : 20dB bandwidth = 268.5kHz  
 NOTES : Fixed Power Setting



Date: 21.MAR.2011 09:48:52

### 15.247(a) Carrier Frequency Separation

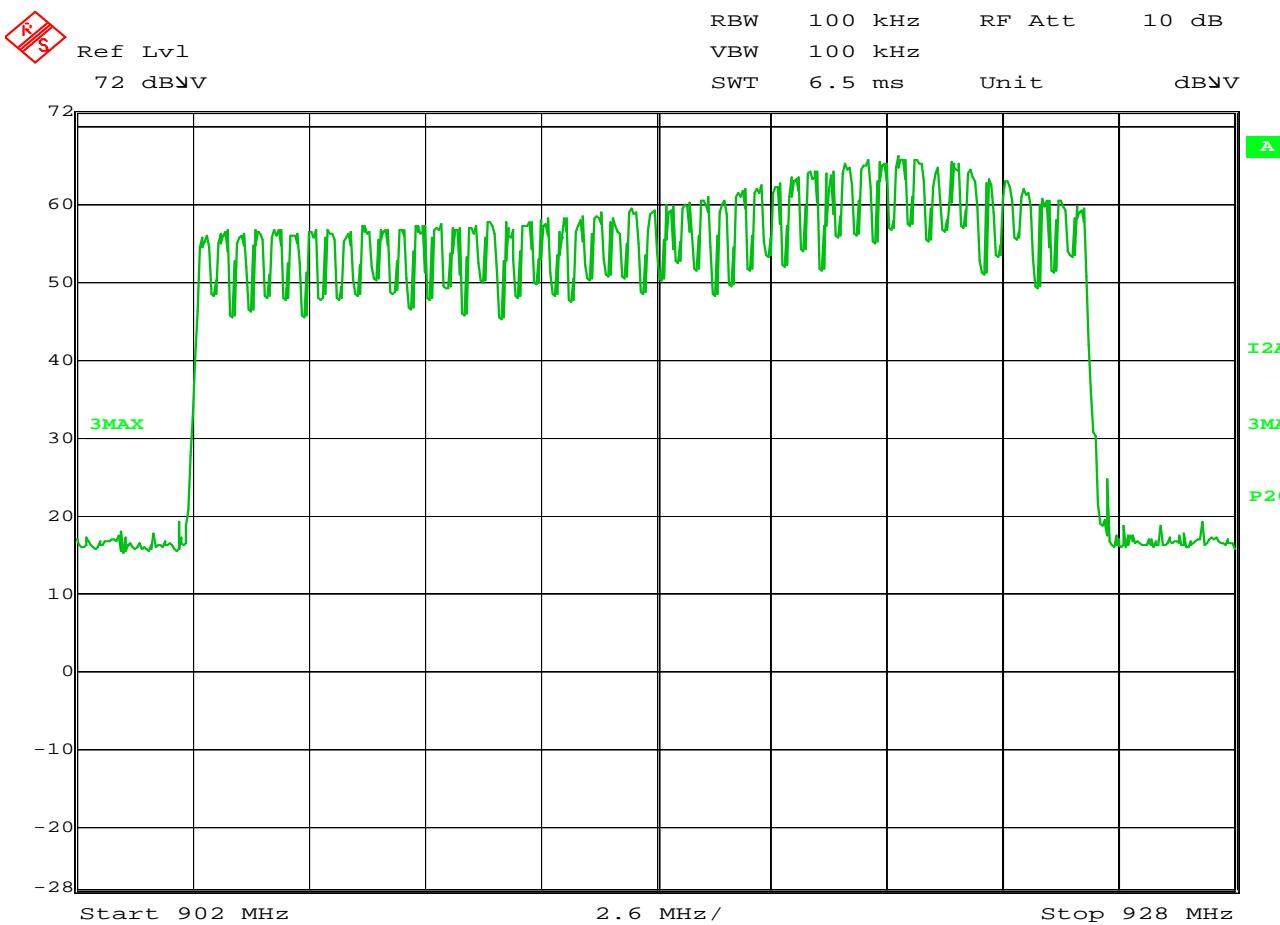
MANUFACTURER : Badger Meter  
MODEL NUMBER : Orion SE Water Meter  
SERIAL NUMBER : None Assigned  
TEST MODE : Hopping Enabled  
TEST DATE : March 21, 2011  
TEST PARAMETERS : Carrier Frequency Separation = 400.8kHz  
NOTES : Mobile Power Setting



Date: 21.MAR.2011 09:31:17

### 15.247(a) Number of Hopping Frequencies

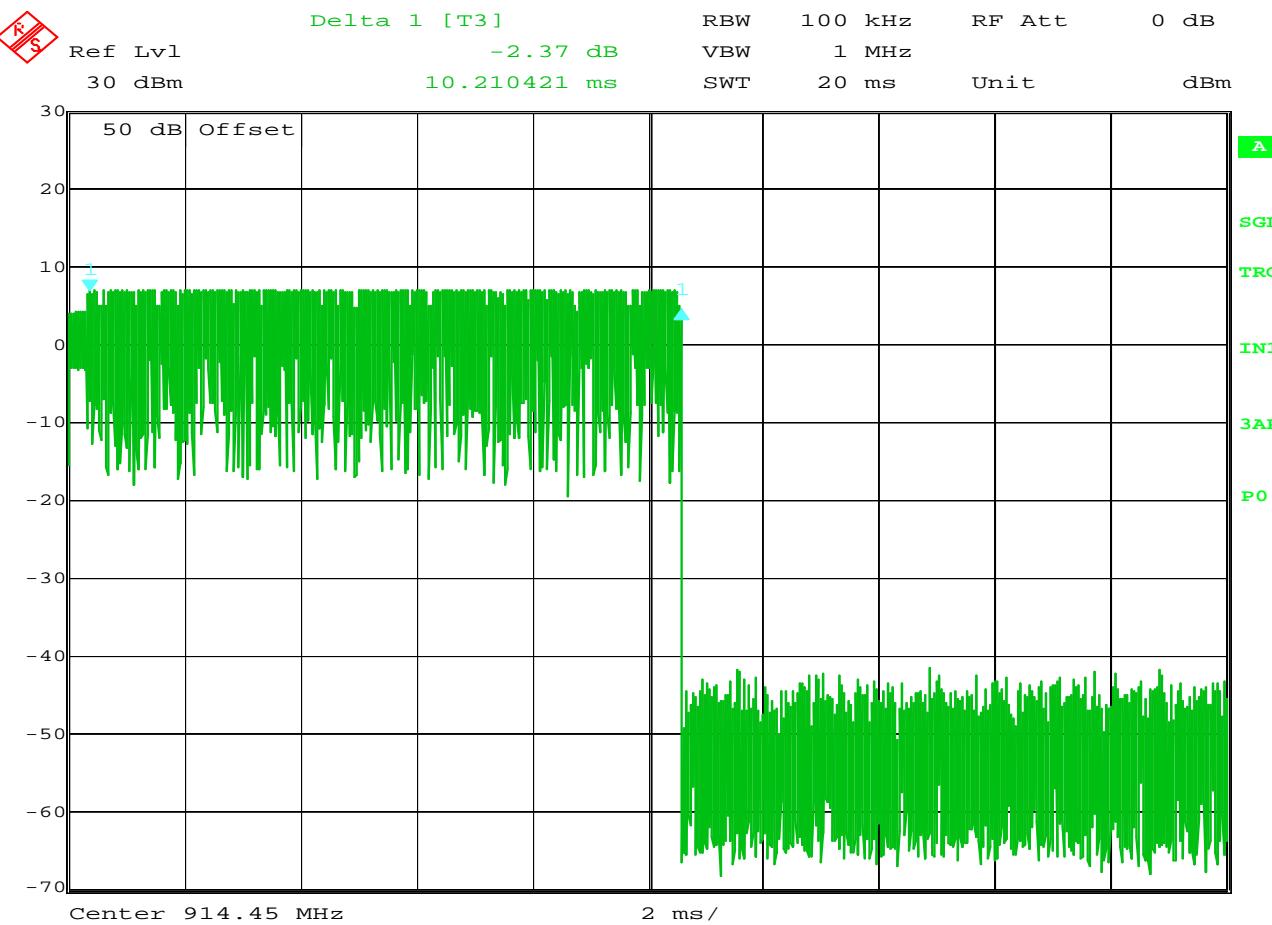
MANUFACTURER : Badger Meter  
MODEL NUMBER : Orion SE Water Meter  
SERIAL NUMBER : None Assigned  
TEST MODE : Hopping Enabled  
TEST DATE : March 21, 2011  
TEST PARAMETERS : Number of Hopping Frequencies = 48  
NOTES : Mobile Power Setting



Date: 29.NOV.2010 10:45:58

### 15.247(a) Number of Hopping Frequencies

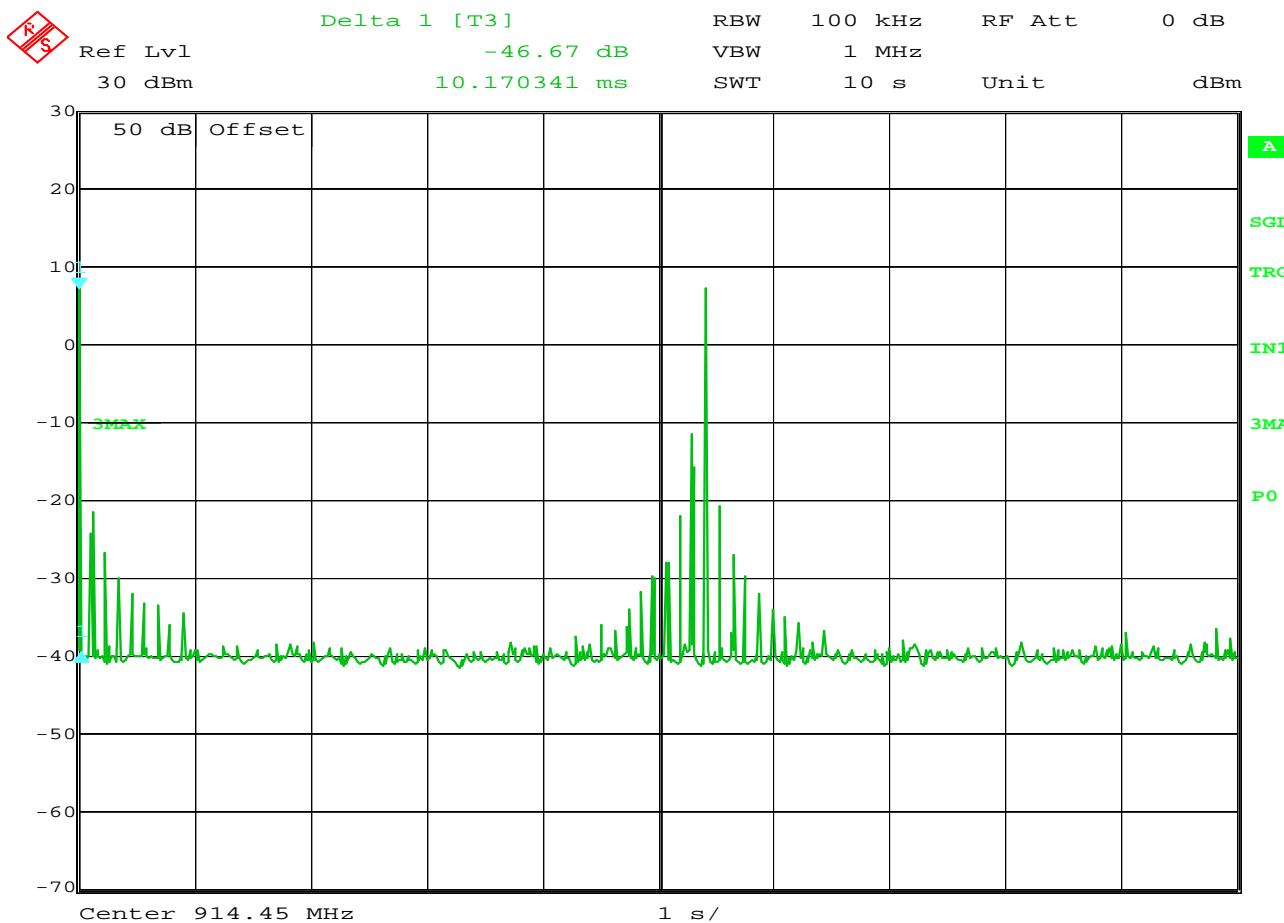
MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	Orion SE Water Meter
SERIAL NUMBER	:	None Assigned
TEST MODE	:	Hopping Enabled
TEST DATE	:	March 21, 2011
TEST PARAMETERS	:	Number of Hopping Frequencies = 50
NOTES	:	Fixed Power Setting



Date: 21.MAR.2011 09:53:48

### 15.247(a) Time of Occupancy

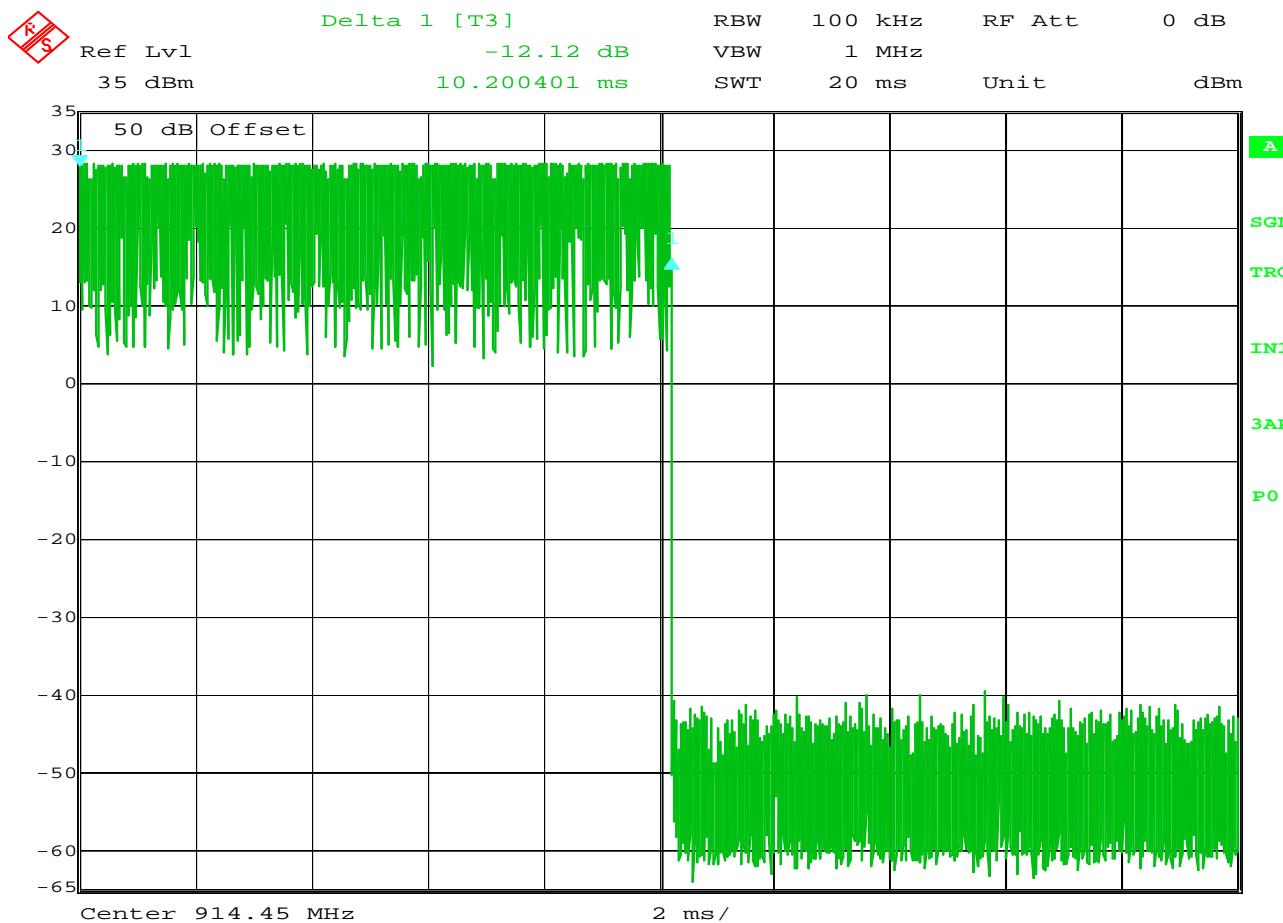
MANUFACTURER : Badger Meter  
 MODEL NUMBER : Orion SE Water Meter  
 SERIAL NUMBER : None Assigned  
 TEST MODE : Hopping Enabled  
 TEST DATE : March 21, 2011  
 TEST PARAMETERS : Time of Occupancy; Pulse width = 10.2mS  
 NOTES : Mobile Power Setting



Date: 21.MAR.2011 09:57:56

### 15.247(a) Time of Occupancy

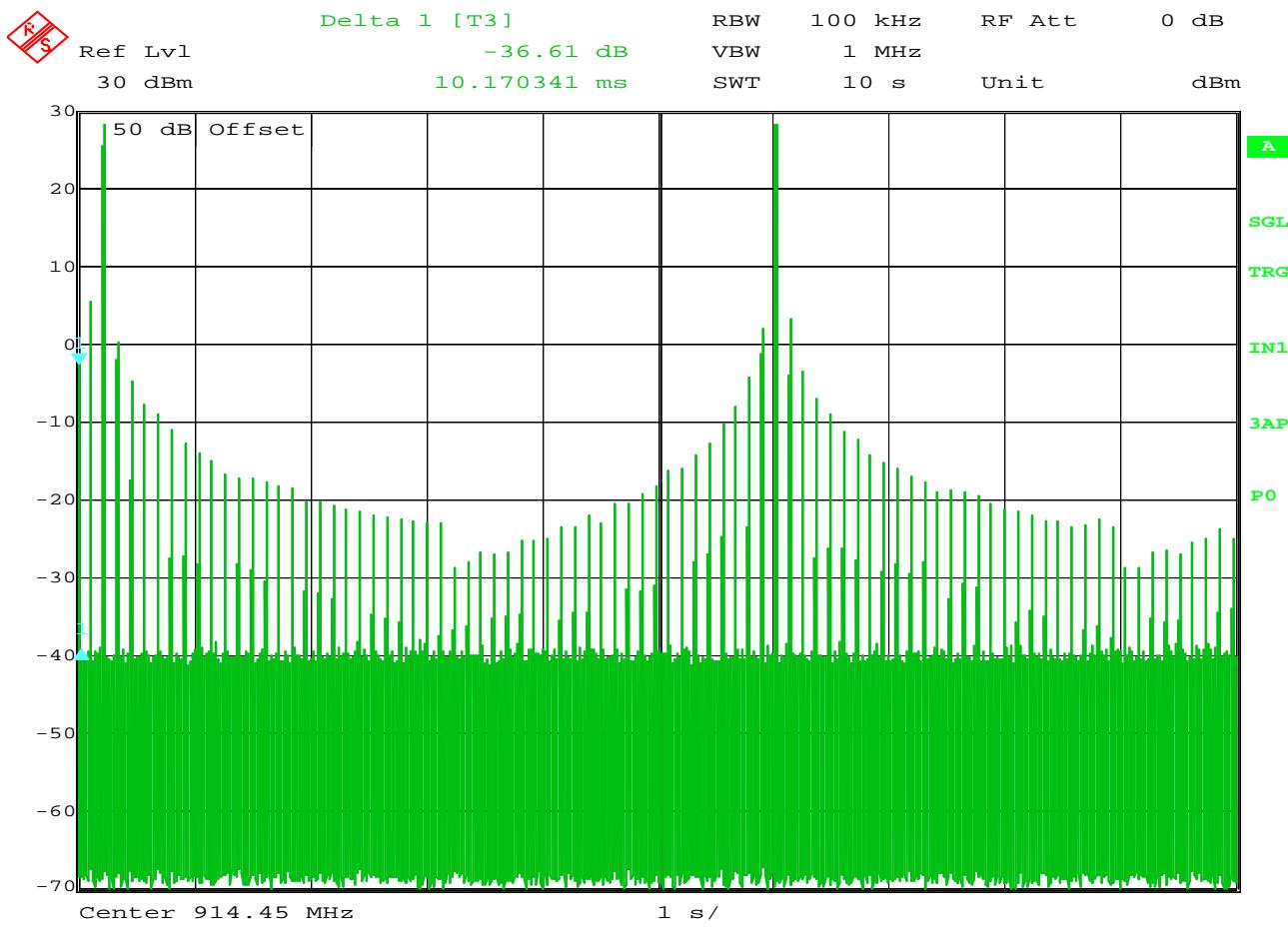
MANUFACTURER : Badger Meter  
 MODEL NUMBER : Orion SE Water Meter  
 SERIAL NUMBER : None Assigned  
 TEST MODE : Hopping Enabled  
 TEST DATE : March 21, 2011  
 TEST PARAMETERS : Time of Occupancy; Number of hops in 10 seconds = 2  
 NOTES : Mobile Power Setting



Date: 21.MAR.2011 10:03:06

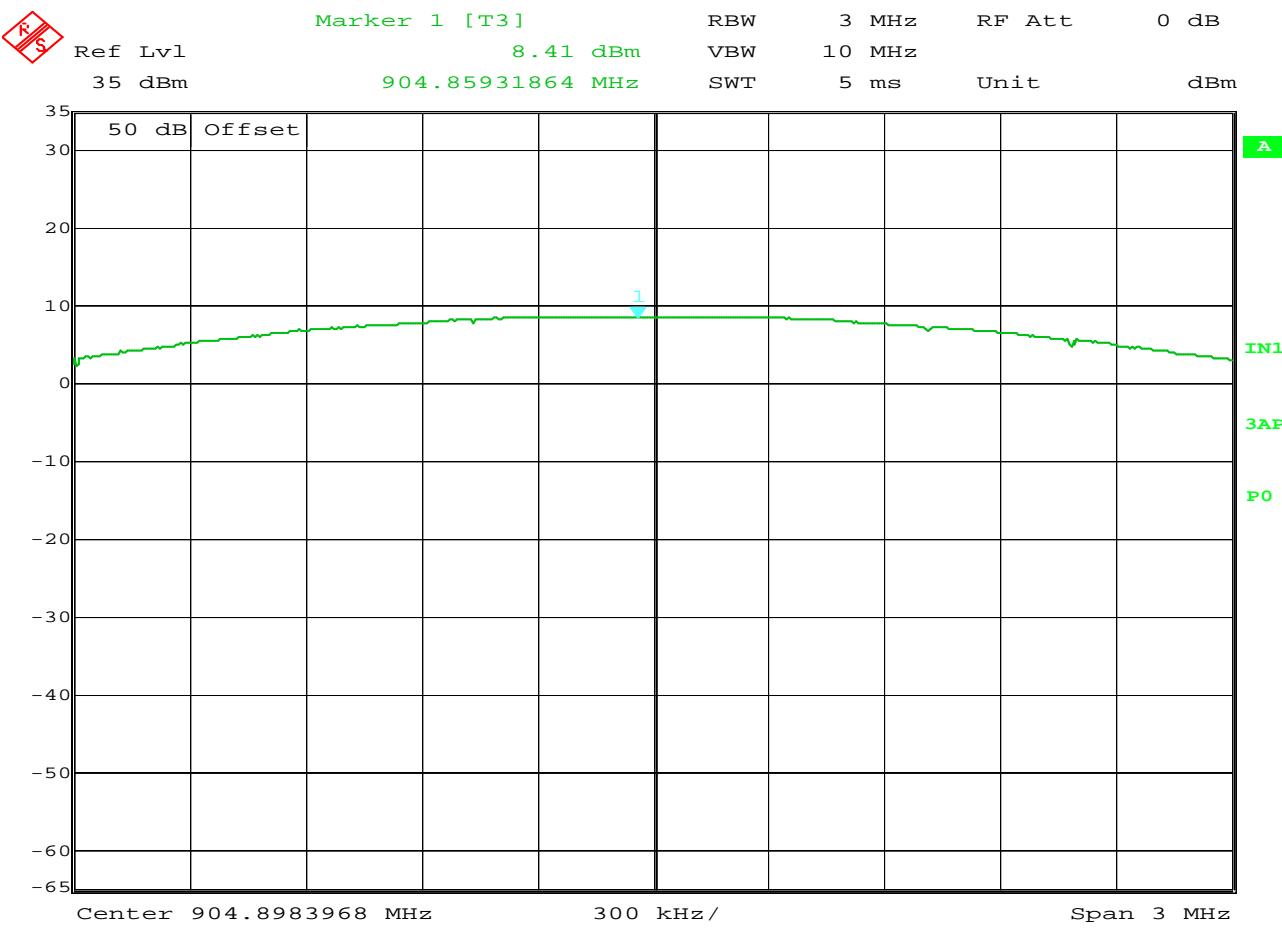
### 15.247(a) Time of Occupancy

MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	Orion SE Water Meter
SERIAL NUMBER	:	None Assigned
TEST MODE	:	Hopping Enabled
TEST DATE	:	March 21, 2011
TEST PARAMETERS	:	Time of Occupancy; Pulse width = 10.2mS
NOTES	:	Fixed Power Setting



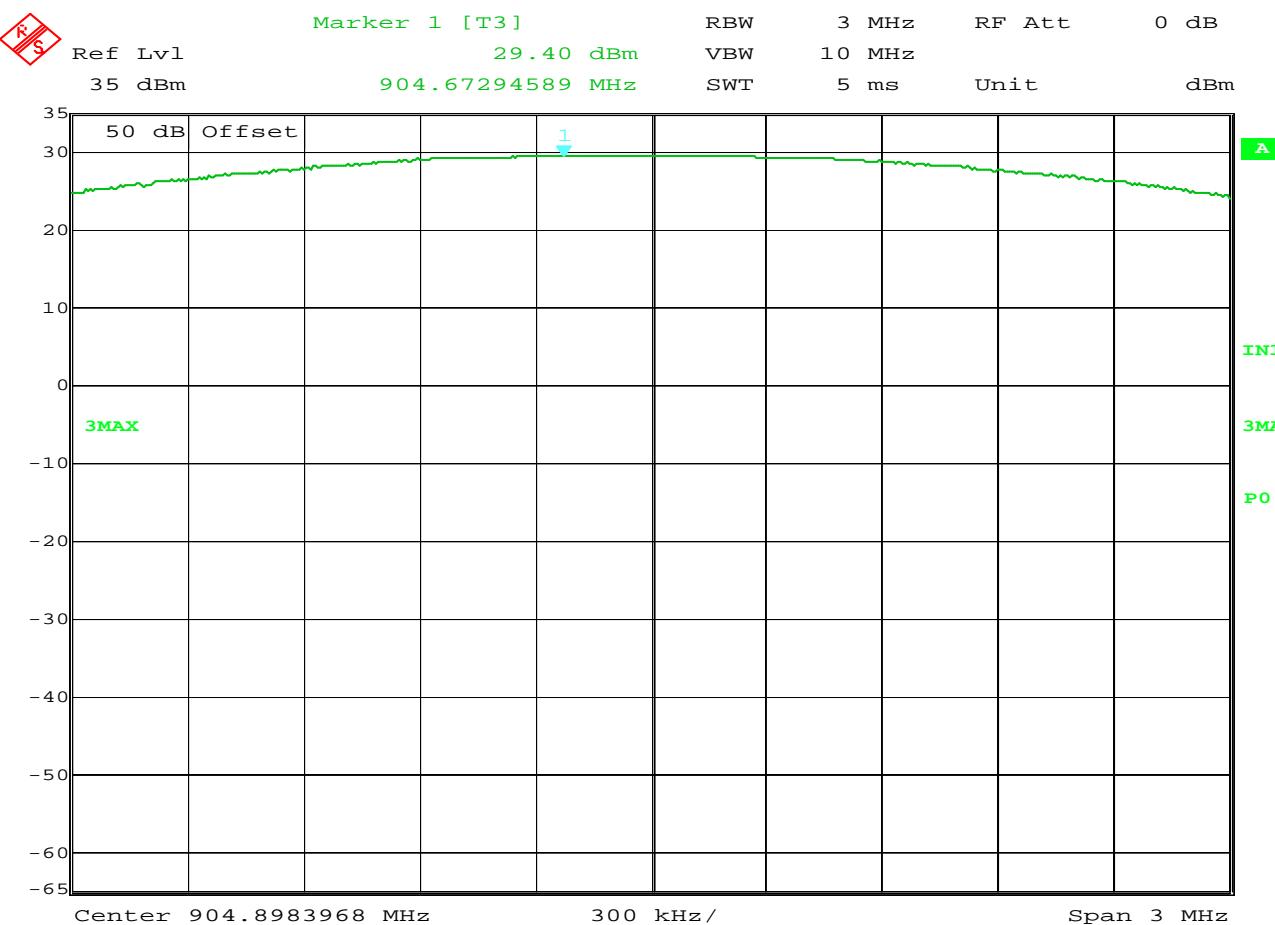
### 15.247(a) Time of Occupancy

MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	Orion SE Water Meter
SERIAL NUMBER	:	None Assigned
TEST MODE	:	Hopping Enabled
TEST DATE	:	March 21, 2011
TEST PARAMETERS	:	Time of Occupancy; Number of hops in 10 seconds = 2
NOTES	:	Fixed Power Setting

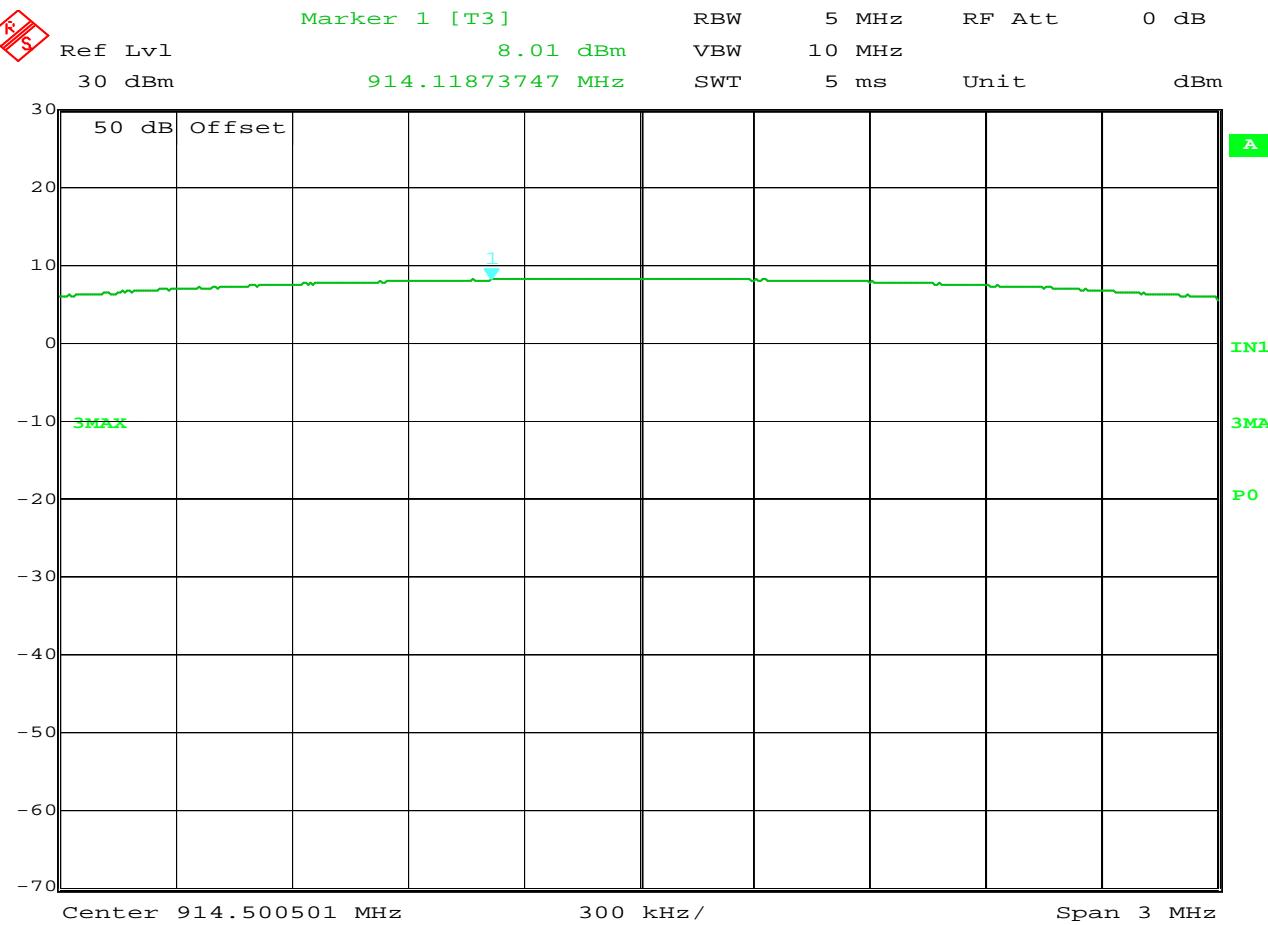


### 15.247(b) Peak Output Power At Antenna Terminal

MANUFACTURER : Badger Meter  
 MODEL NUMBER : Orion SE Water Meter  
 SERIAL NUMBER : None Assigned  
 TEST MODE : Tx @ 904.9MHz  
 TEST DATE : March 21, 2011  
 TEST PARAMETERS : Peak Output Power = 8.41dBm = 7mW  
 NOTES : Mobile Power Setting

**15.247(b) Peak Output Power At Antenna Terminal**

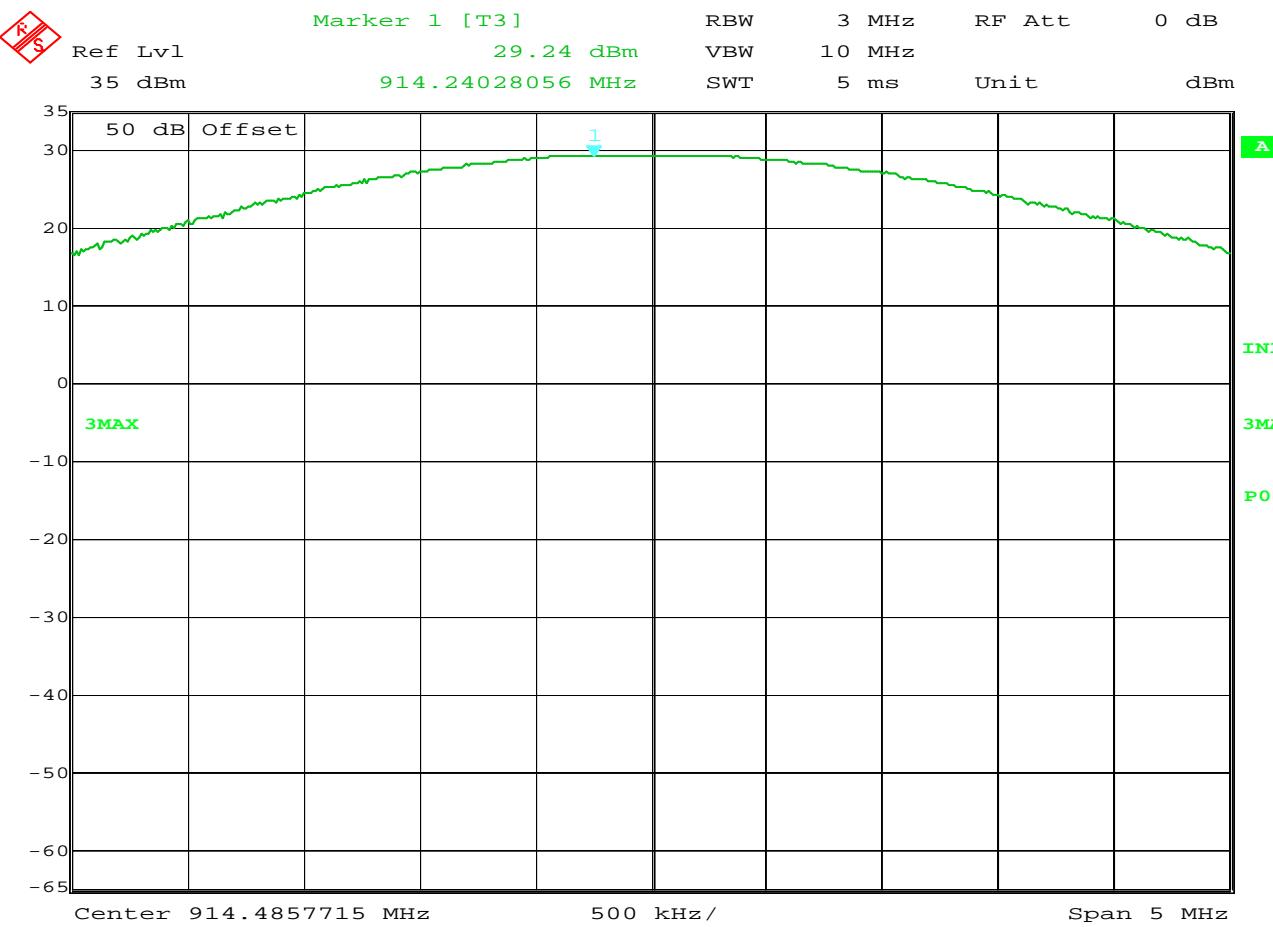
MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	Orion SE Water Meter
SERIAL NUMBER	:	None Assigned
TEST MODE	:	Tx @ 904.9MHz
TEST DATE	:	March 21, 2011
TEST PARAMETERS	:	Peak Output Power = 29.4dBm = 871mW
NOTES	:	Fixed Power Setting



Date: 21.MAR.2011 09:17:09

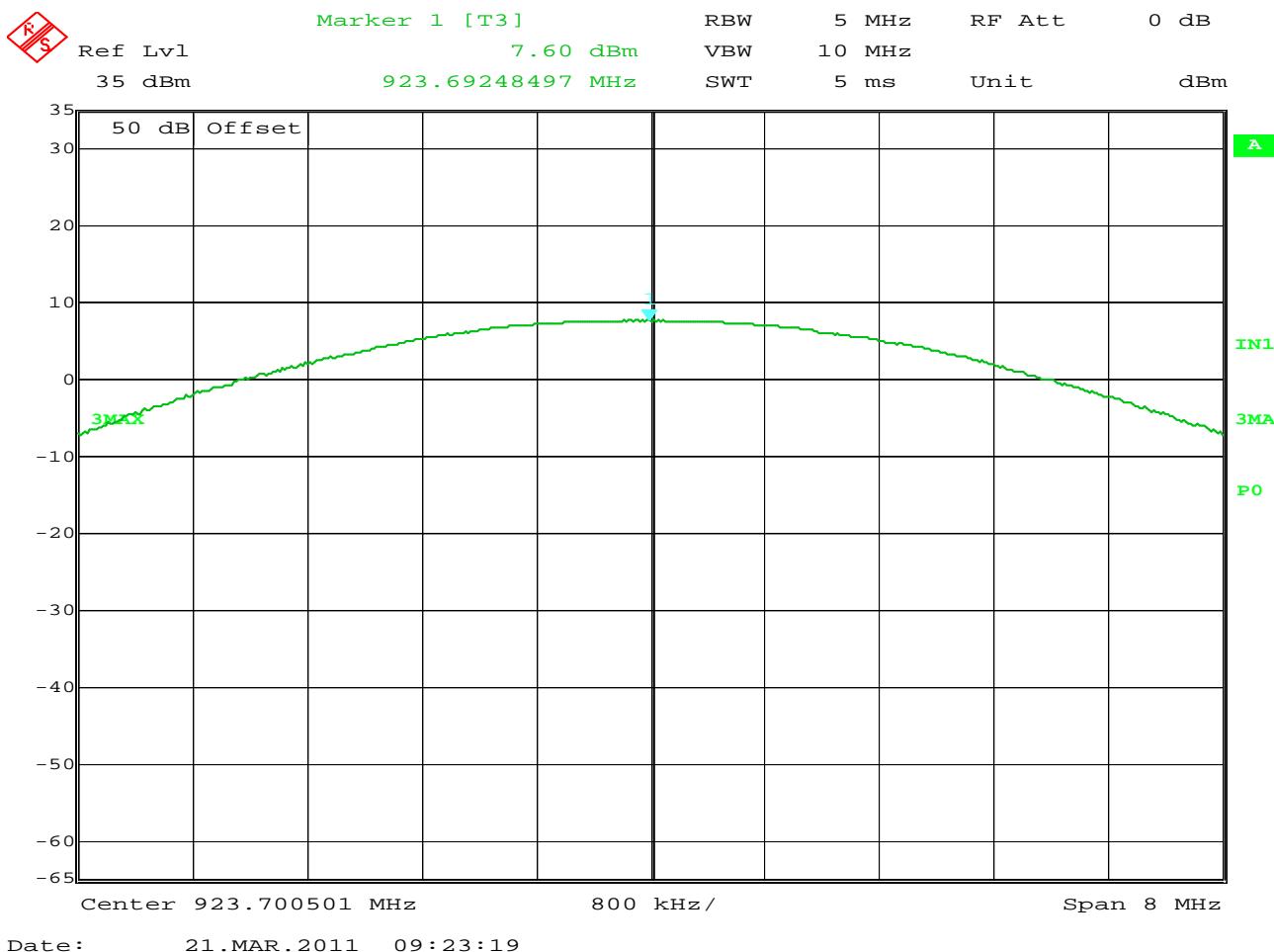
### 15.247(b) Peak Output Power At Antenna Terminal

MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	Orion SE Water Meter
SERIAL NUMBER	:	None Assigned
TEST MODE	:	Tx @ 914.45MHz
TEST DATE	:	March 21, 2011
TEST PARAMETERS	:	Peak Output Power = 8.01dBm = 6mW
NOTES	:	Mobile Power Setting



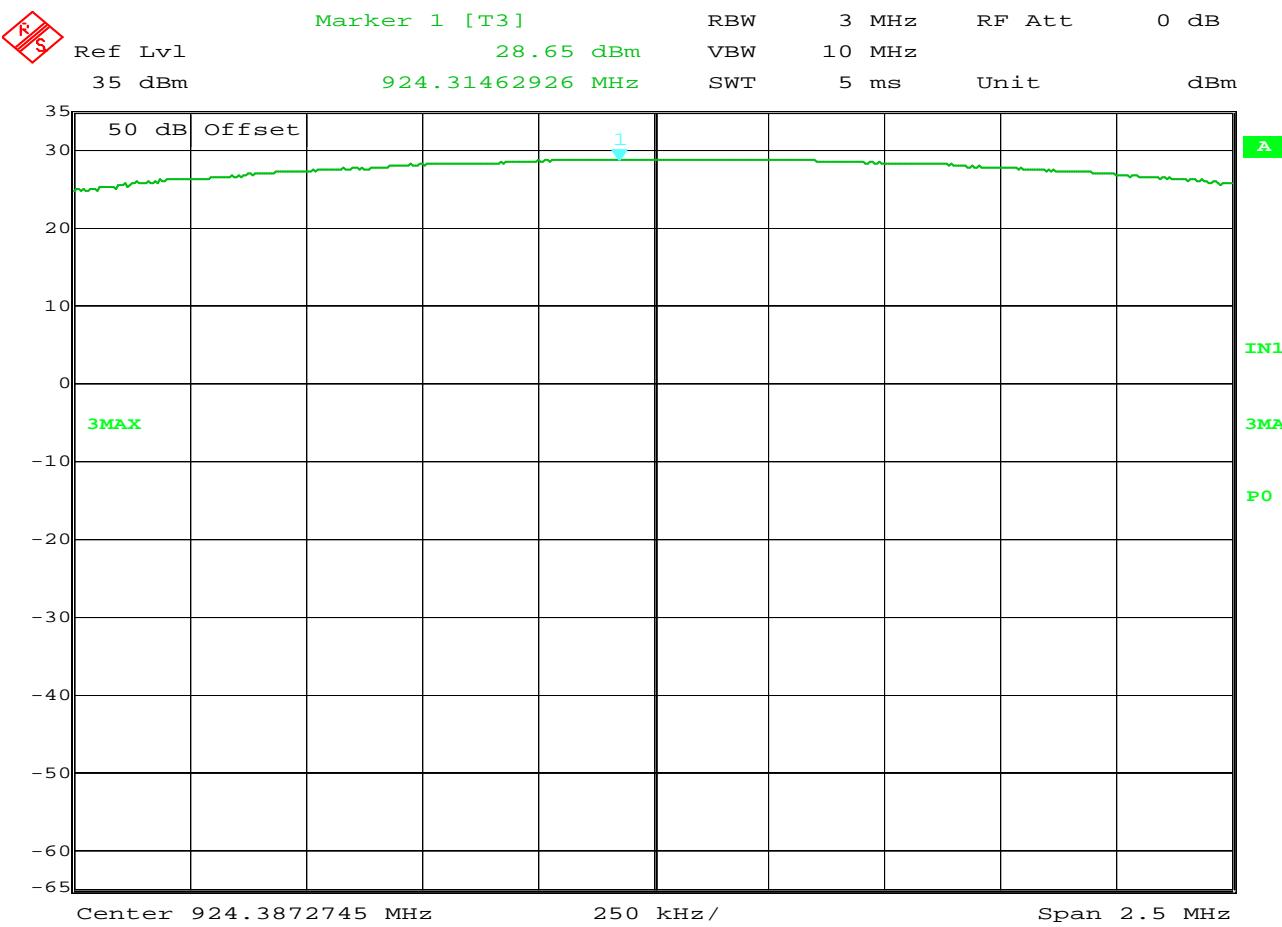
### 15.247(b) Peak Output Power At Antenna Terminal

MANUFACTURER : Badger Meter  
 MODEL NUMBER : Orion SE Water Meter  
 SERIAL NUMBER : None Assigned  
 TEST MODE : Tx @ 914.45MHz  
 TEST DATE : March 21, 2011  
 TEST PARAMETERS : Peak Output Power = 29.24dBm = 839mW  
 NOTES : Fixed Power Setting



### 15.247(b) Peak Output Power At Antenna Terminal

MANUFACTURER : Badger Meter  
 MODEL NUMBER : Orion SE Water Meter  
 SERIAL NUMBER : None Assigned  
 TEST MODE : Tx @ 923.7MHz  
 TEST DATE : March 21, 2011  
 TEST PARAMETERS : Peak Output Power = 7.6dBm = 6mW  
 NOTES : Mobile Power Setting



### 15.247(b) Peak Output Power At Antenna Terminal

MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	Orion SE Water Meter
SERIAL NUMBER	:	None Assigned
TEST MODE	:	Tx @ 924.45MHz
TEST DATE	:	March 21, 2011
TEST PARAMETERS	:	Peak Output Power = 28.65dBm = 733mW
NOTES	:	Fixed Setting Power Setting



MANUFACTURER : Badger Meter  
MODEL NUMBER : Orion SE Water Meter  
SERIAL NUMBER : None Assigned  
TEST DATE : March 22, 2011  
TEST PARAMETERS : FCC-15.247 Effective Isotropic Radiated Power (EIRP)  
NOTES : Mobile Power Setting

Matched								
Freq (MHz)	Ant Pol	Meter Reading (dBuV)	Ambient	SIG. GEN. (dBm)	Ant Gain (dB)	CBL (dB)	EIRP Total (dBm)	Limit dBm
Transmit at 904.9MHz								
904.87	H	81.4		5.6	2.2	1.9	5.9	36.0
904.87	V	83.4		9.2	2.2	1.9	9.5	36.0
Transmit at 913.9 (Ch. 24)								
914.45	H	77.9		1.8	2.2	1.9	2.0	36.0
914.45	V	82.1		7.8	2.2	1.9	8.0	36.0
Transmit at 923.7MHz (Ch. 48)								
923.70	H	74.7		-2.3	2.2	1.9	-2.1	36.0
923.70	V	80.1		5.9	2.2	1.9	6.1	36.0

EIRP (dBm) = Matched Signal Generator (dBm) + Antenna Gain (dB) – Cable Loss (dB)

Checked BY RICHARD E. KING :

Richard E. King



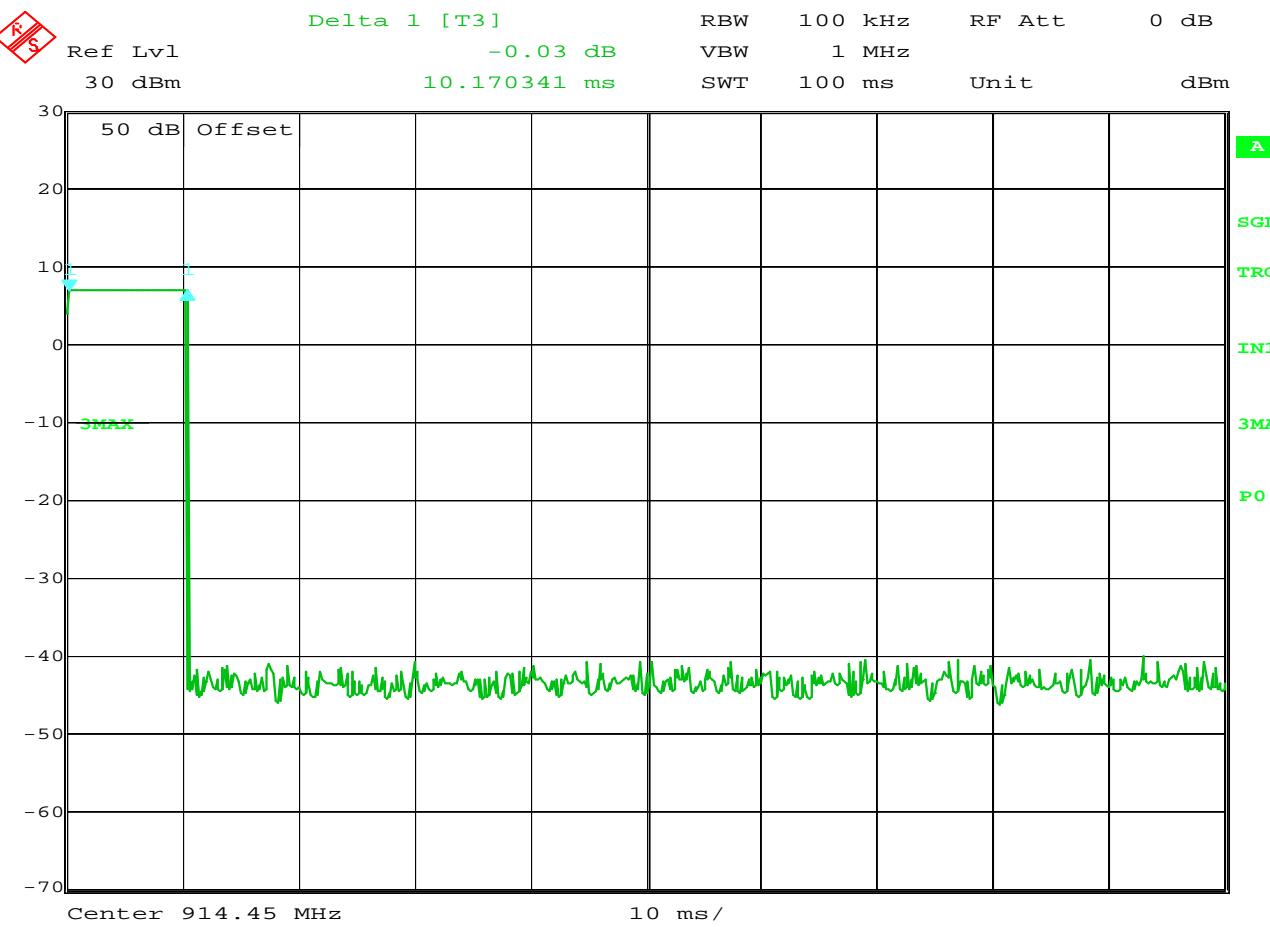
MANUFACTURER : Badger Meter  
MODEL NUMBER : Orion SE Water Meter  
SERIAL NUMBER : None Assigned  
TEST DATE : March 22, 2011  
TEST PARAMETERS : FCC-15.247 Effective Isotropic Radiated Power (EIRP)  
NOTES : Fixed Power Setting

Matched								
Freq (MHz)	Ant Pol	Meter Reading (dBuV)	Ambient	SIG. GEN. (dBm)	Ant Gain (dB)	CBL (dB)	EIRP Total (dBm)	Limit dBm
Transmit at 904.9MHz								
904.87	H	95.3		19.8	2.2	1.9	20.1	36.0
904.87	V	103.1		27.8	2.2	1.9	28.1	36.0
Transmit at 913.9 (Ch. 24)								
914.45	H	95.8		19.6	2.2	1.9	19.9	36.0
914.45	V	101.9		28.1	2.2	1.9	28.4	36.0
Transmit at 924.45MHz (Ch. 50)								
924.45	H	97.5		21.5	2.2	1.9	21.8	36.0
924.45	V	100.8		26.7	2.2	1.9	27.0	36.0

EIRP (dBm) = Matched Signal Generator (dBm) + Antenna Gain (dB) – Cable Loss (dB)

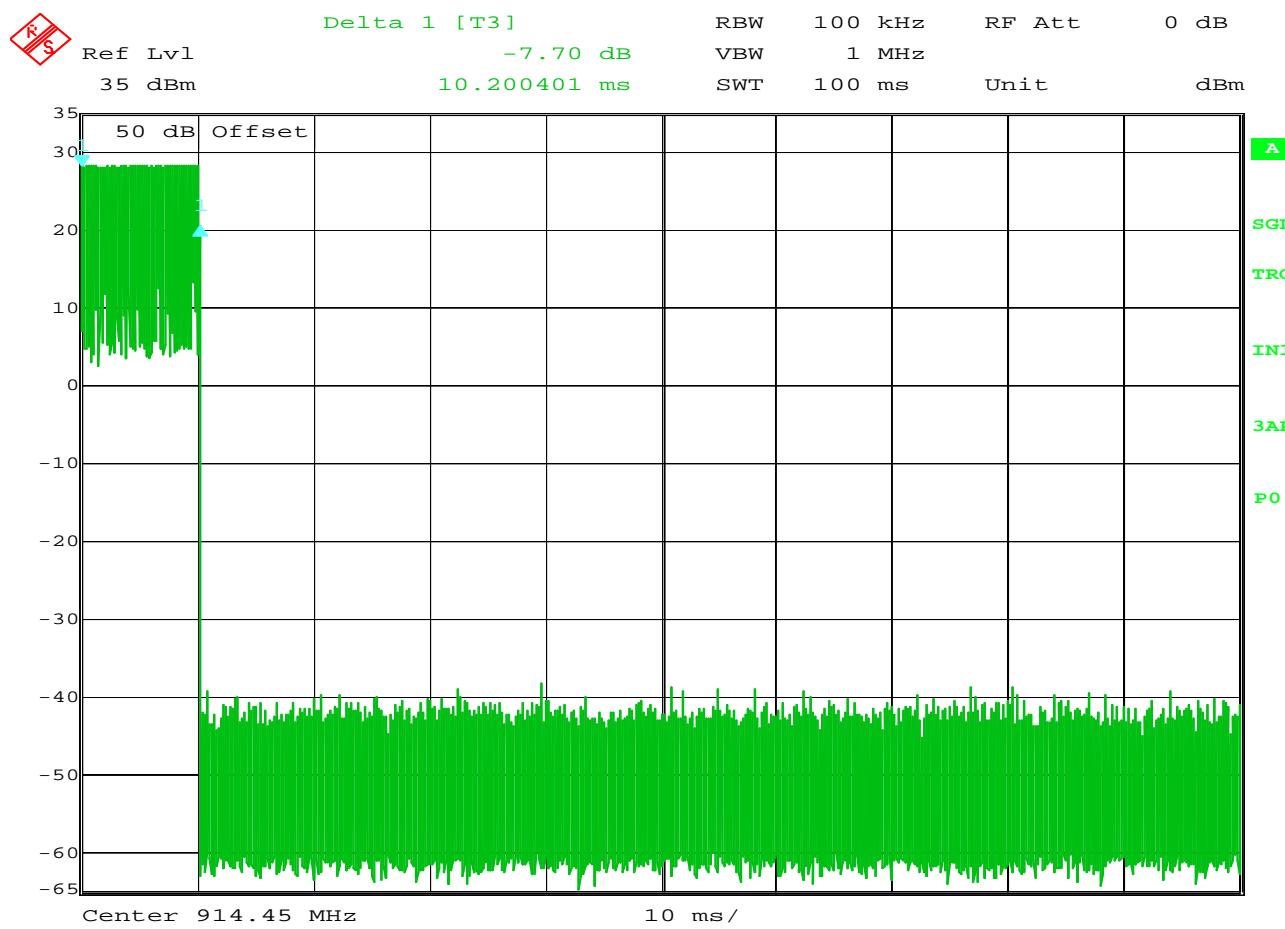
Checked BY RICHARD E. KING :

Richard E. King



Date: 21.MAR.2011 09:56:08

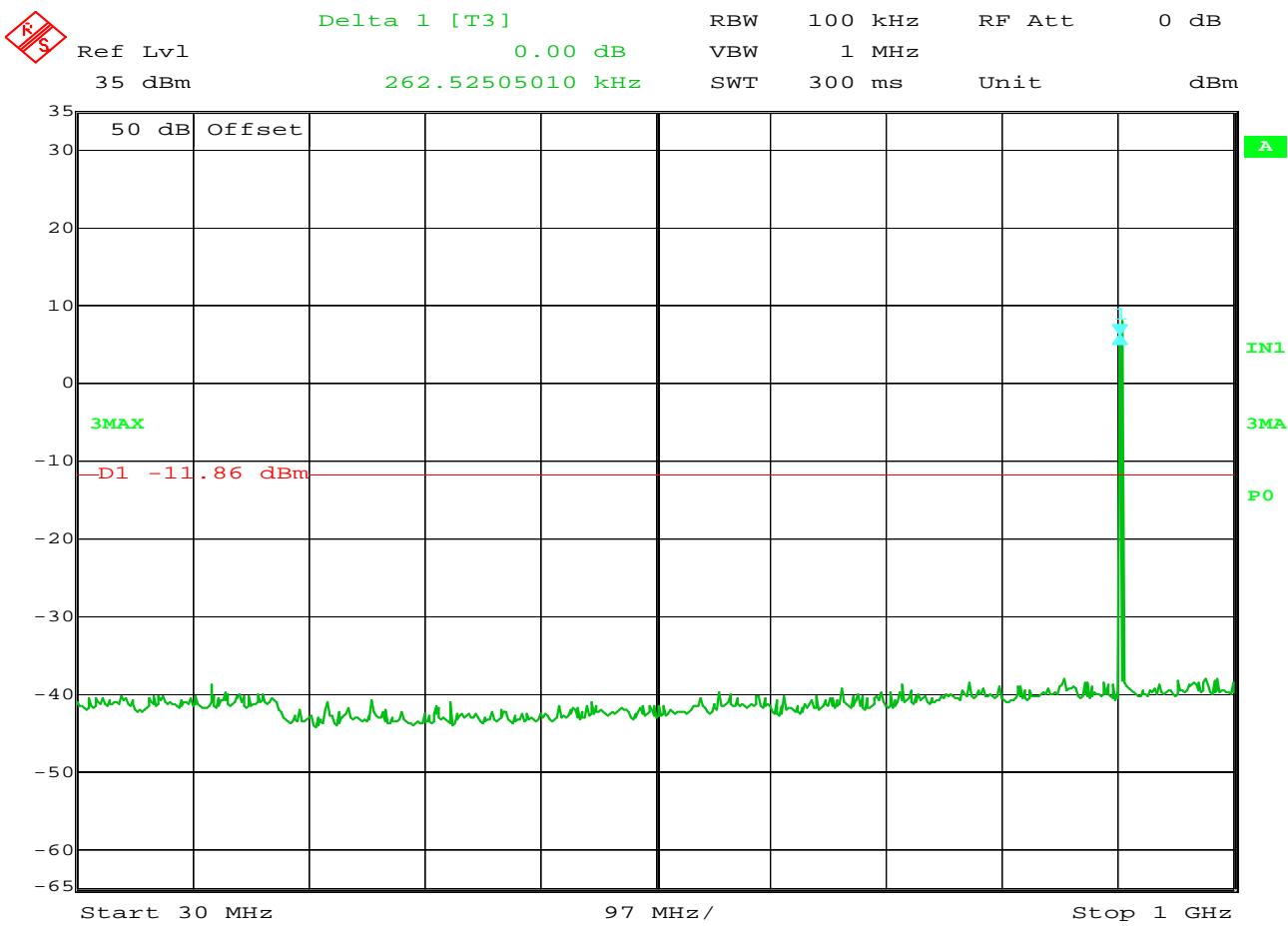
MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	Orion SE Water Meter
SERIAL NUMBER	:	None Assigned
TEST MODE	:	Hopping Enabled
NOTES	:	Mobile Power Setting
TEST DATE	:	March 21, 2011
NOTES	:	1 pulse = 10.2mS in 100mS



Date: 21.MAR.2011 10:04:24

### 15C Duty Cycle Factor Measurement

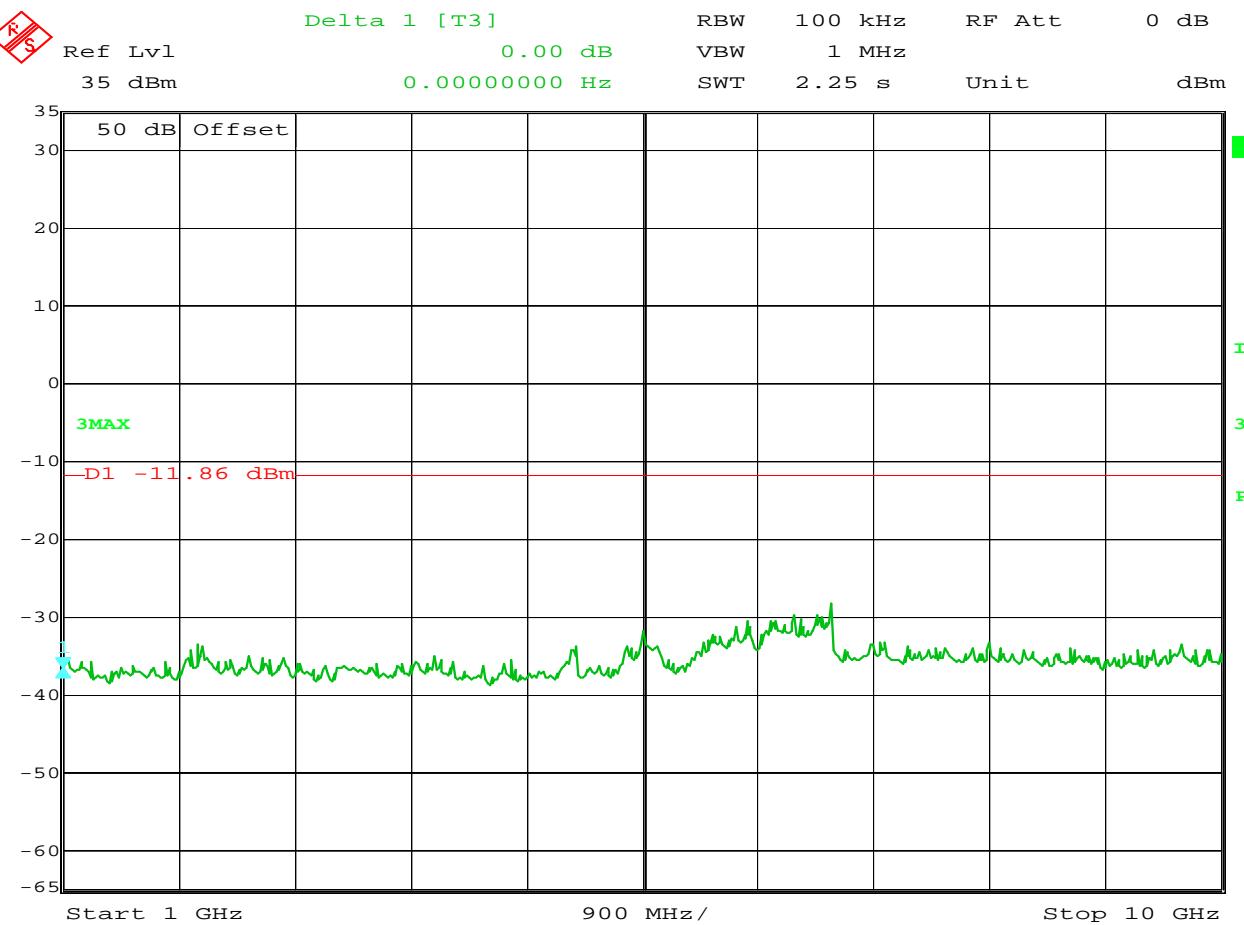
MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	Orion SE Water Meter
SERIAL NUMBER	:	None Assigned
TEST MODE	:	Hopping Enabled
NOTES	:	Fixed Power Setting
TEST DATE	:	March 21, 2011
NOTES	:	1 pulse = 10.2mS in 100mS



Date: 21.MAR.2011 10:32:41

### 15.247(c) Antenna Conducted Spurious Emissions

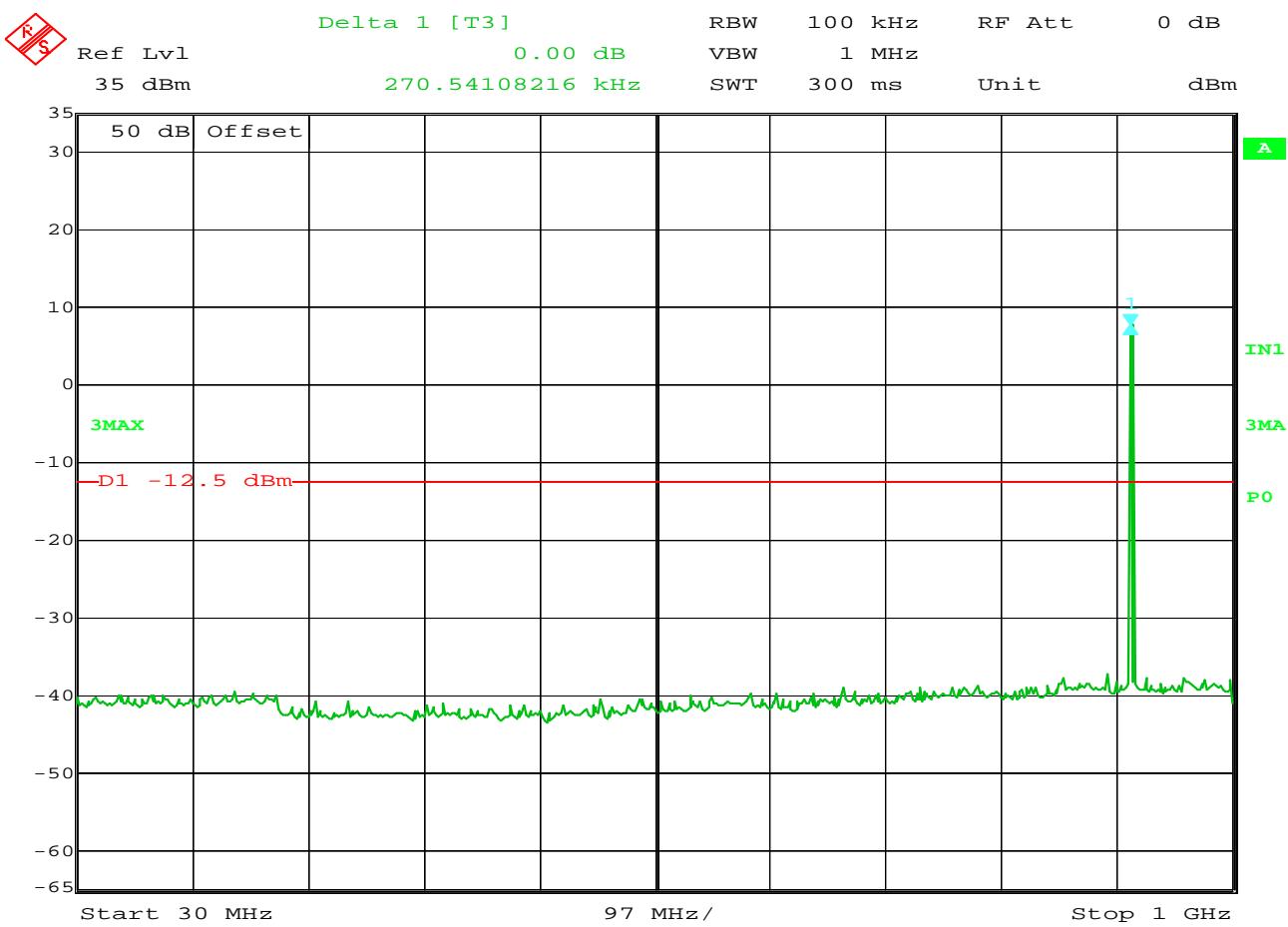
MANUFACTURER : Badger Meter  
 MODEL NUMBER : Orion SE Water Meter  
 SERIAL NUMBER : None Assigned  
 TEST MODE : Tx @ 904.9MHz  
 NOTES : Mobile Power Setting  
 TEST DATE : March 21, 2011  
 TEST PARAMETERS : Antenna Conducted Spurious Emissions  
 NOTES : Display Line D1 represents the 20dB down point from the maximum emissions in a 100kHz bandwidth



Date: 21.MAR.2011 10:33:45

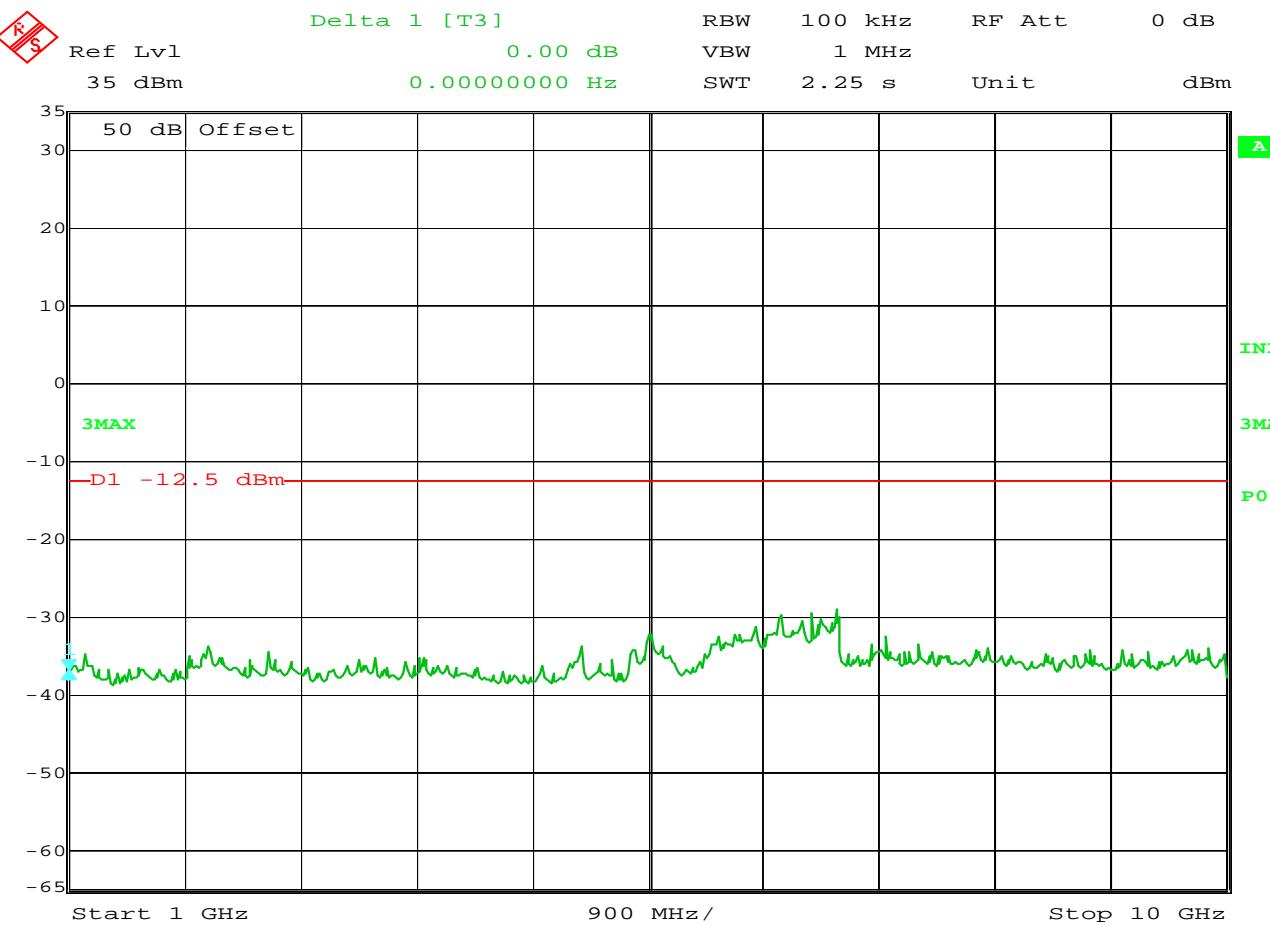
### 15.247(c) Antenna Conducted Spurious Emissions

MANUFACTURER : Badger Meter  
 MODEL NUMBER : Orion SE Water Meter  
 SERIAL NUMBER : None Assigned  
 TEST MODE : Tx @ 904.9MHz  
 NOTES : Mobile Power Setting  
 TEST DATE : March 21, 2011  
 TEST PARAMETERS : Antenna Conducted Spurious Emissions  
 NOTES : Display Line D1 represents the 20dB down point from the maximum emissions in a 100kHz bandwidth



### 15.247(c) Antenna Conducted Spurious Emissions

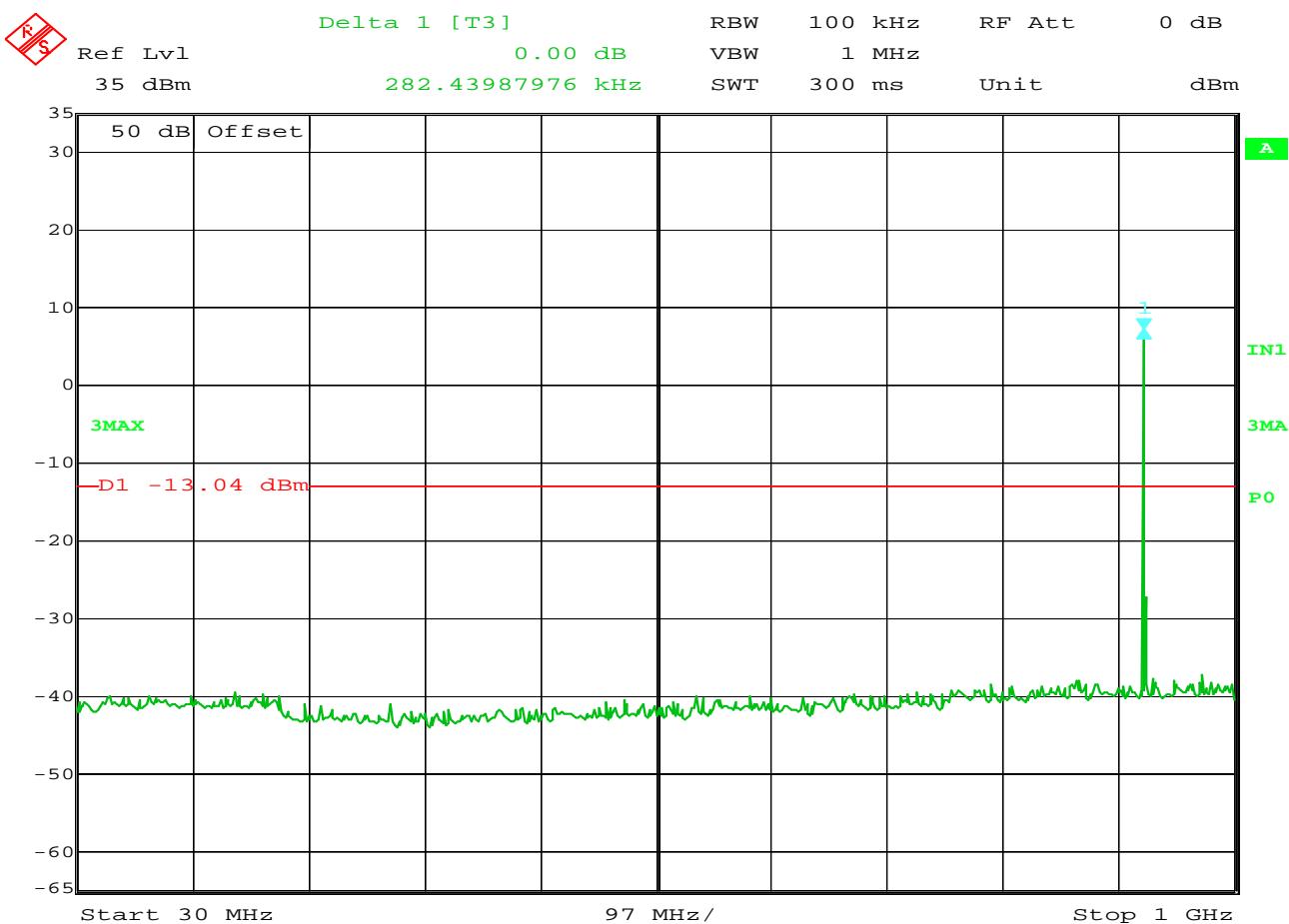
MANUFACTURER : Badger Meter  
MODEL NUMBER : Orion SE Water Meter  
SERIAL NUMBER : None Assigned  
TEST MODE : Tx @ 914.45MHz  
NOTES : Mobile Power Setting  
TEST DATE : March 21, 2011  
TEST PARAMETERS : Antenna Conducted Spurious Emissions  
NOTES : Display Line D1 represents the 20dB down point from the maximum emissions in a 100kHz bandwidth



Date: 21.MAR.2011 10:38:49

### 15.247(c) Antenna Conducted Spurious Emissions

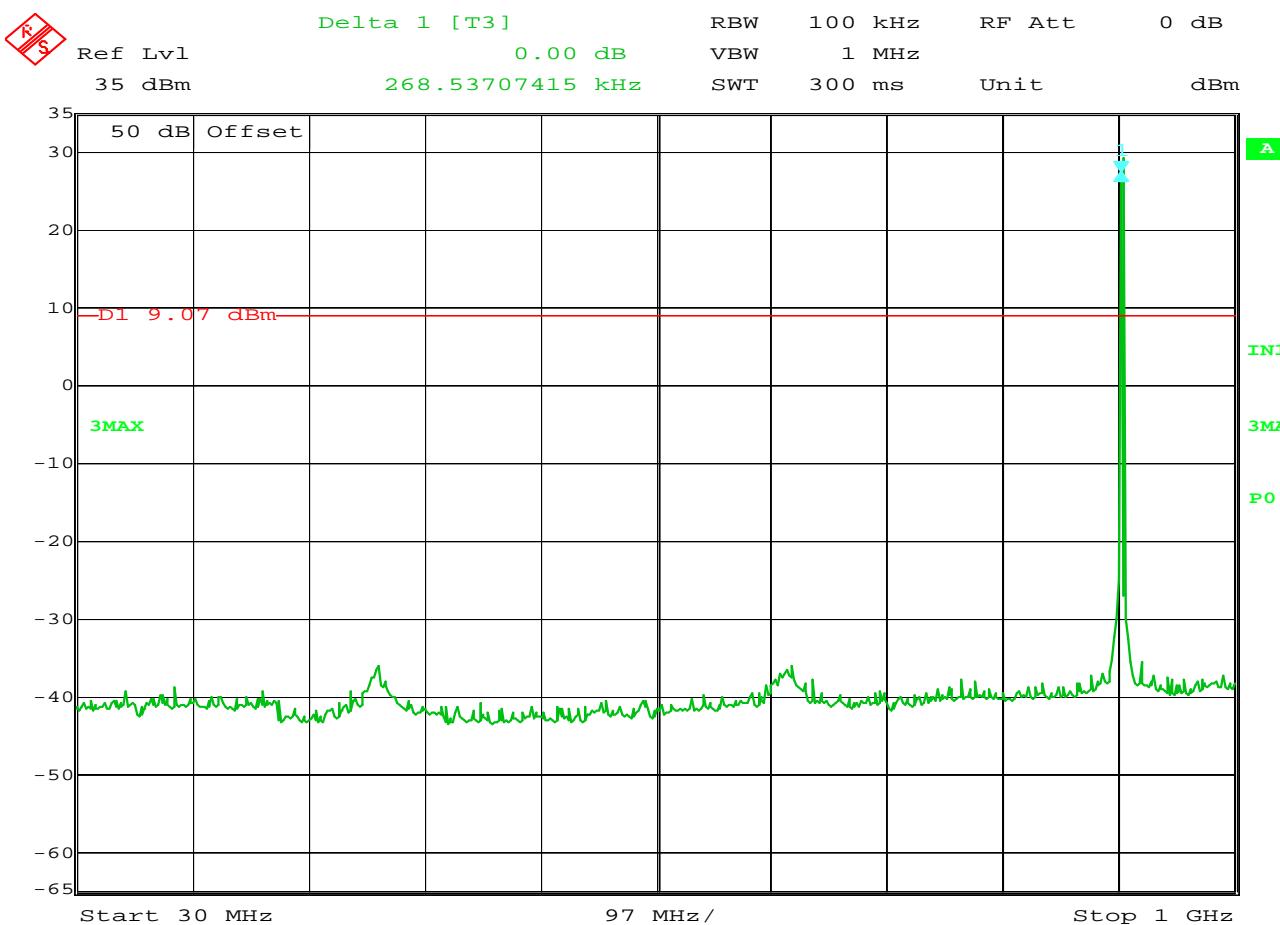
MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	Orion SE Water Meter
SERIAL NUMBER	:	None Assigned
TEST MODE	:	Tx @ 914.45MHz
NOTES	:	Mobile Power Setting
TEST DATE	:	March 21, 2011
TEST PARAMETERS	:	Antenna Conducted Spurious Emissions
NOTES	:	Display Line D1 represents the 20dB down point from the maximum emissions in a 100kHz bandwidth



Date: 21.MAR.2011 10:43:29

### 15.247(c) Antenna Conducted Spurious Emissions

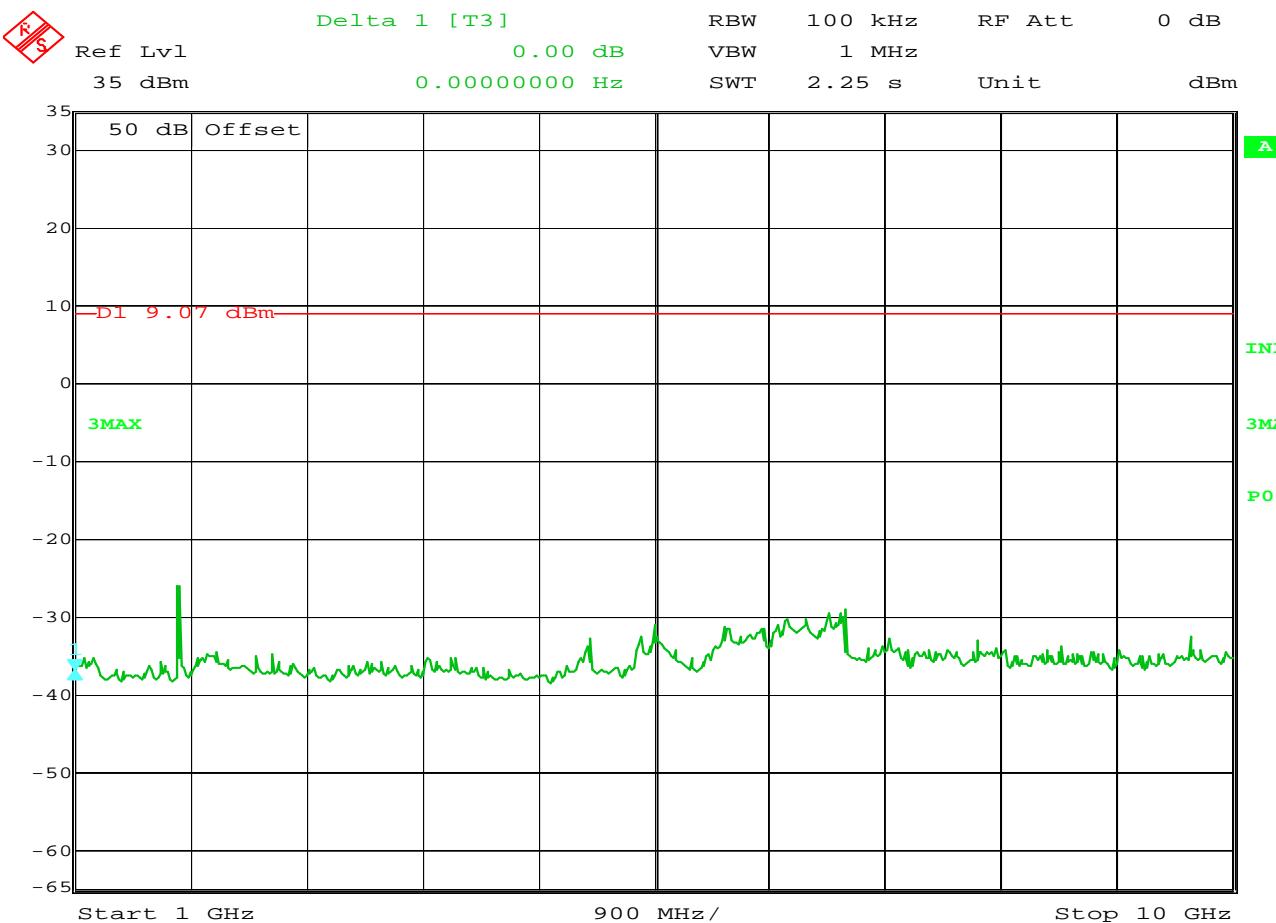
MANUFACTURER : Badger Meter  
MODEL NUMBER : Orion SE Water Meter  
SERIAL NUMBER : None Assigned  
TEST MODE : Tx @ 923.7MHz  
NOTES : Mobile Power Setting  
TEST DATE : March 21, 2011  
TEST PARAMETERS : Antenna Conducted Spurious Emissions  
NOTES : Display Line D1 represents the 20dB down point from the maximum emissions in a 100kHz bandwidth



Date: 21.MAR.2011 10:25:23

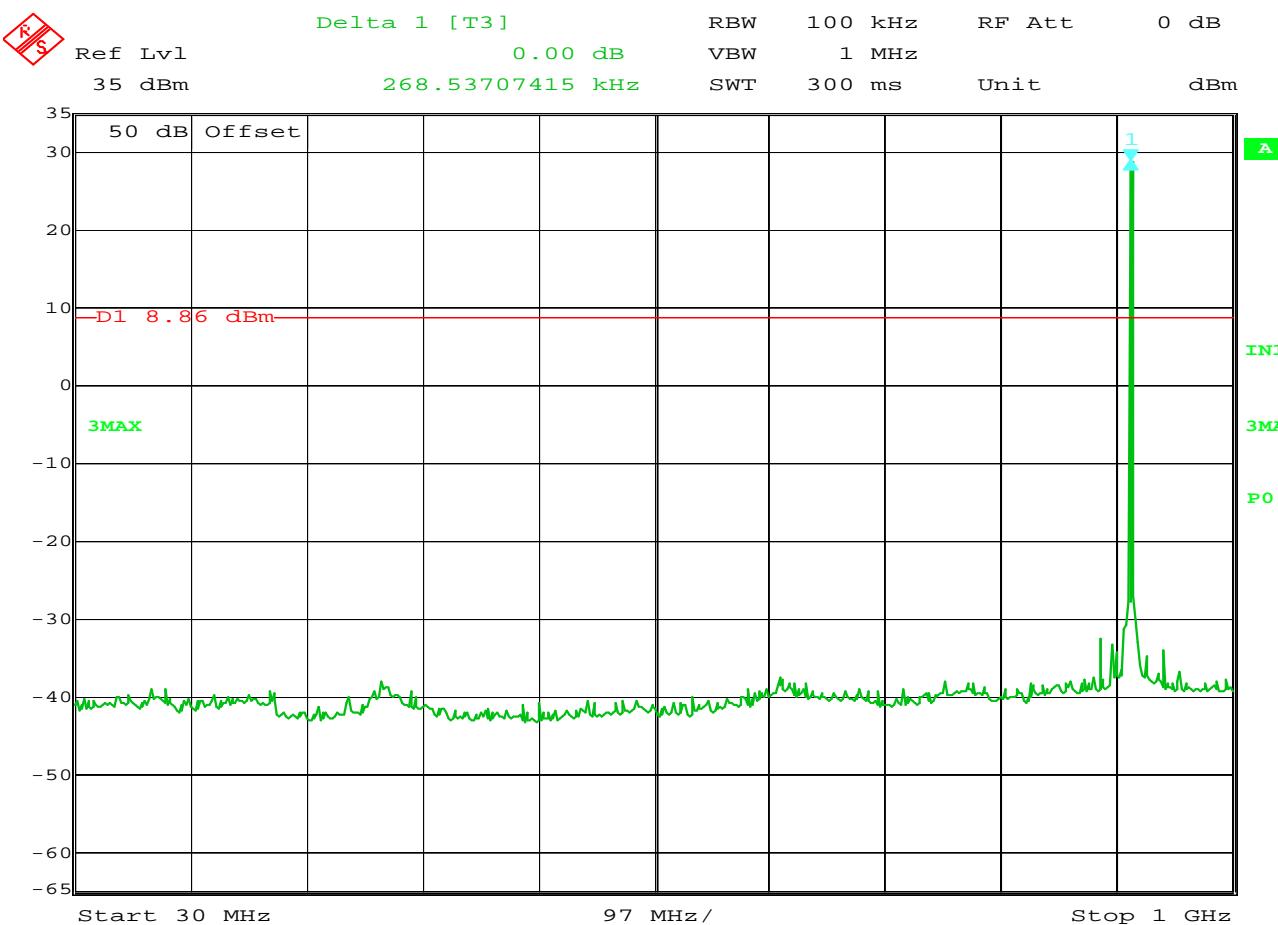
### 15.247(c) Antenna Conducted Spurious Emissions

MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	Orion SE Water Meter
SERIAL NUMBER	:	None Assigned
TEST MODE	:	Tx @ 904.9MHz
NOTES	:	Fixed Power Setting
TEST DATE	:	March 21, 2011
TEST PARAMETERS	:	Antenna Conducted Spurious Emissions
NOTES	:	Display Line D1 represents the 20dB down point from the maximum emissions in a 100kHz bandwidth



### 15.247(c) Antenna Conducted Spurious Emissions

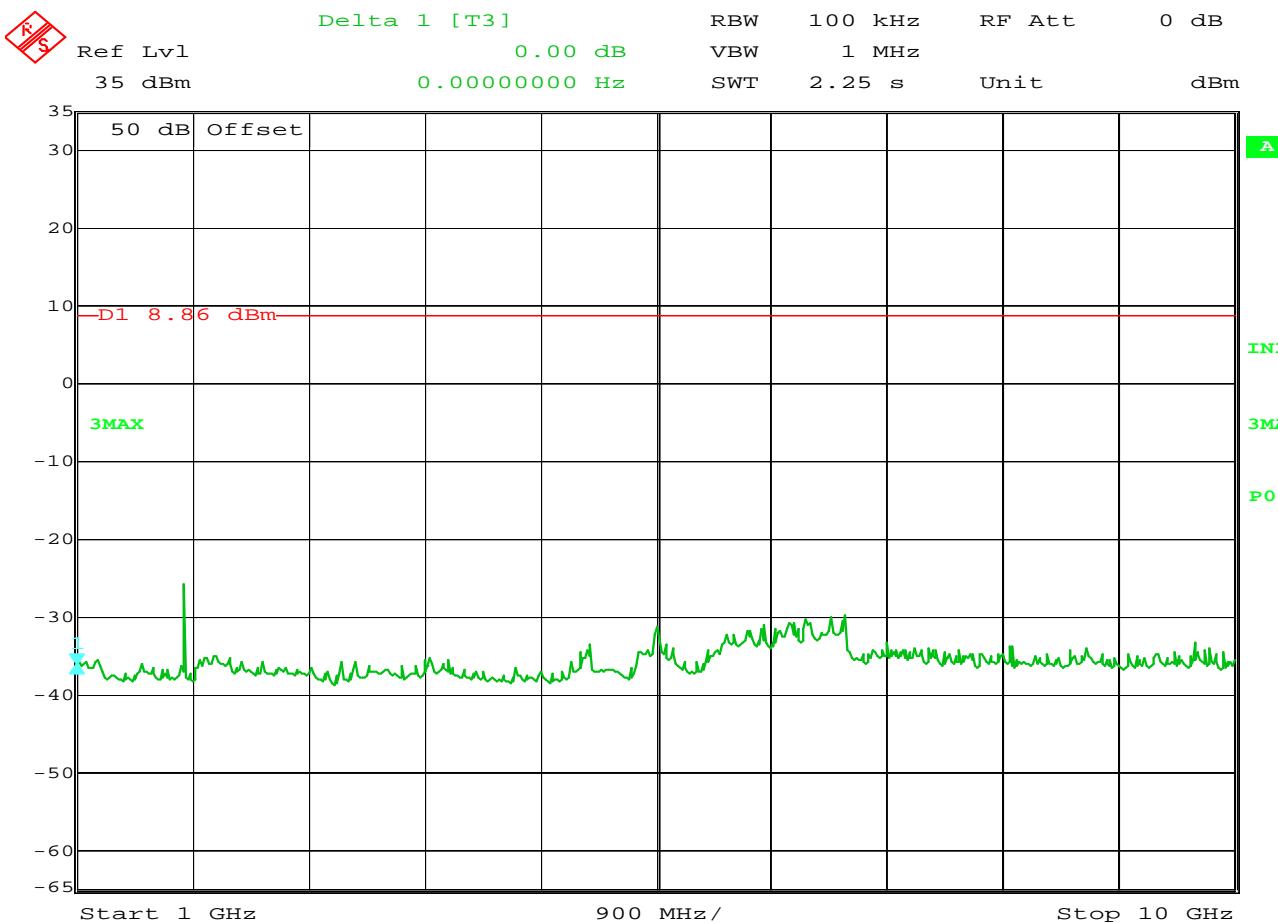
MANUFACTURER : Badger Meter  
 MODEL NUMBER : Orion SE Water Meter  
 SERIAL NUMBER : None Assigned  
 TEST MODE : Tx @ 904.9MHz  
 NOTES : Fixed Power Setting  
 TEST DATE : March 21, 2011  
 TEST PARAMETERS : Antenna Conducted Spurious Emissions  
 NOTES : Display Line D1 represents the 20dB down point from the maximum emissions in a 100kHz bandwidth



Date: 21.MAR.2011 10:13:32

### 15.247(c) Antenna Conducted Spurious Emissions

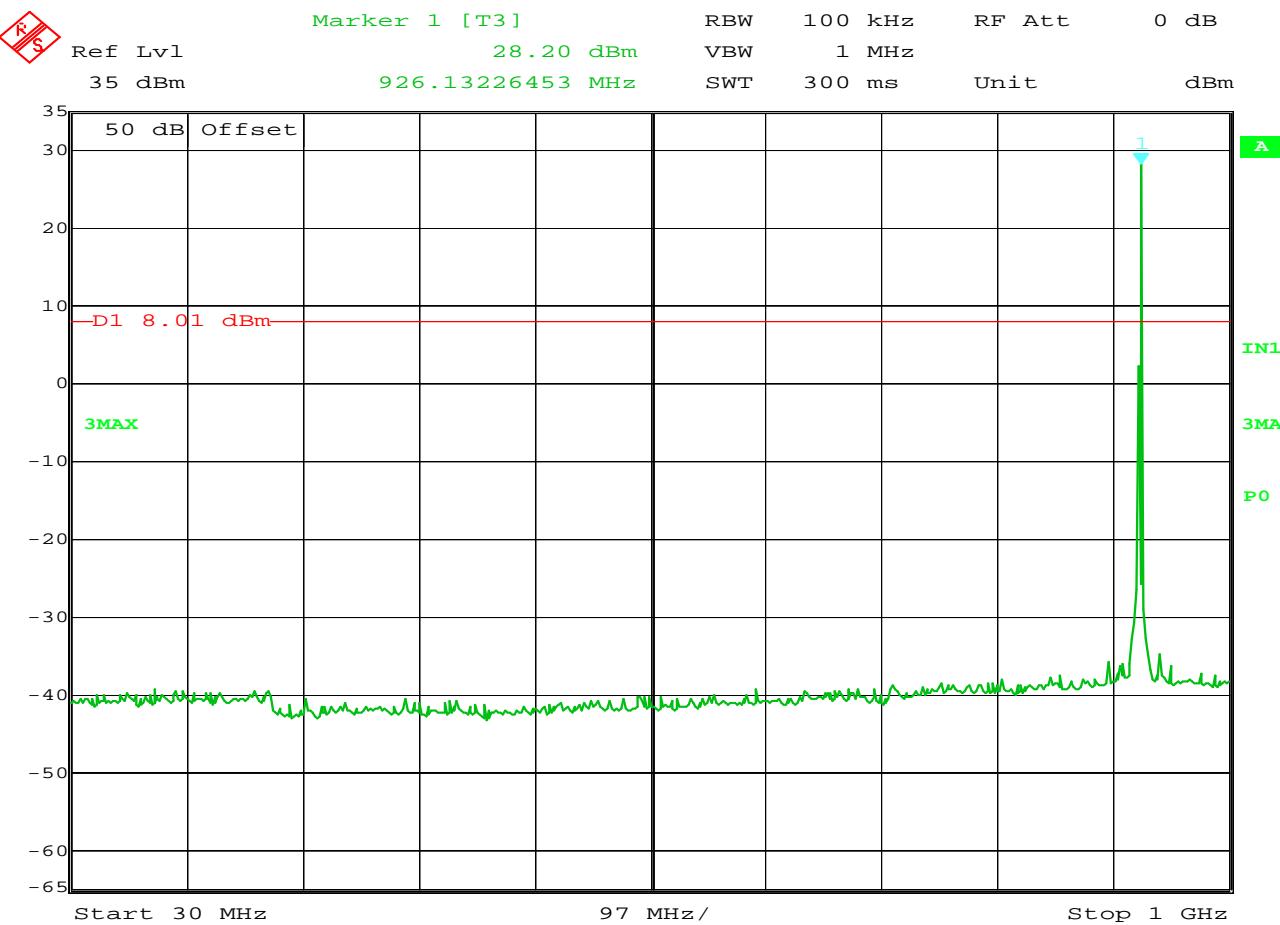
MANUFACTURER : Badger Meter  
 MODEL NUMBER : Orion SE Water Meter  
 SERIAL NUMBER : None Assigned  
 TEST MODE : Tx @ 914.45MHz  
 NOTES : Fixed Power Setting  
 TEST DATE : March 21, 2011  
 TEST PARAMETERS : Antenna Conducted Spurious Emissions  
 NOTES : Display Line D1 represents the 20dB down point from the maximum emissions in a 100kHz bandwidth



Date: 21.MAR.2011 10:14:50

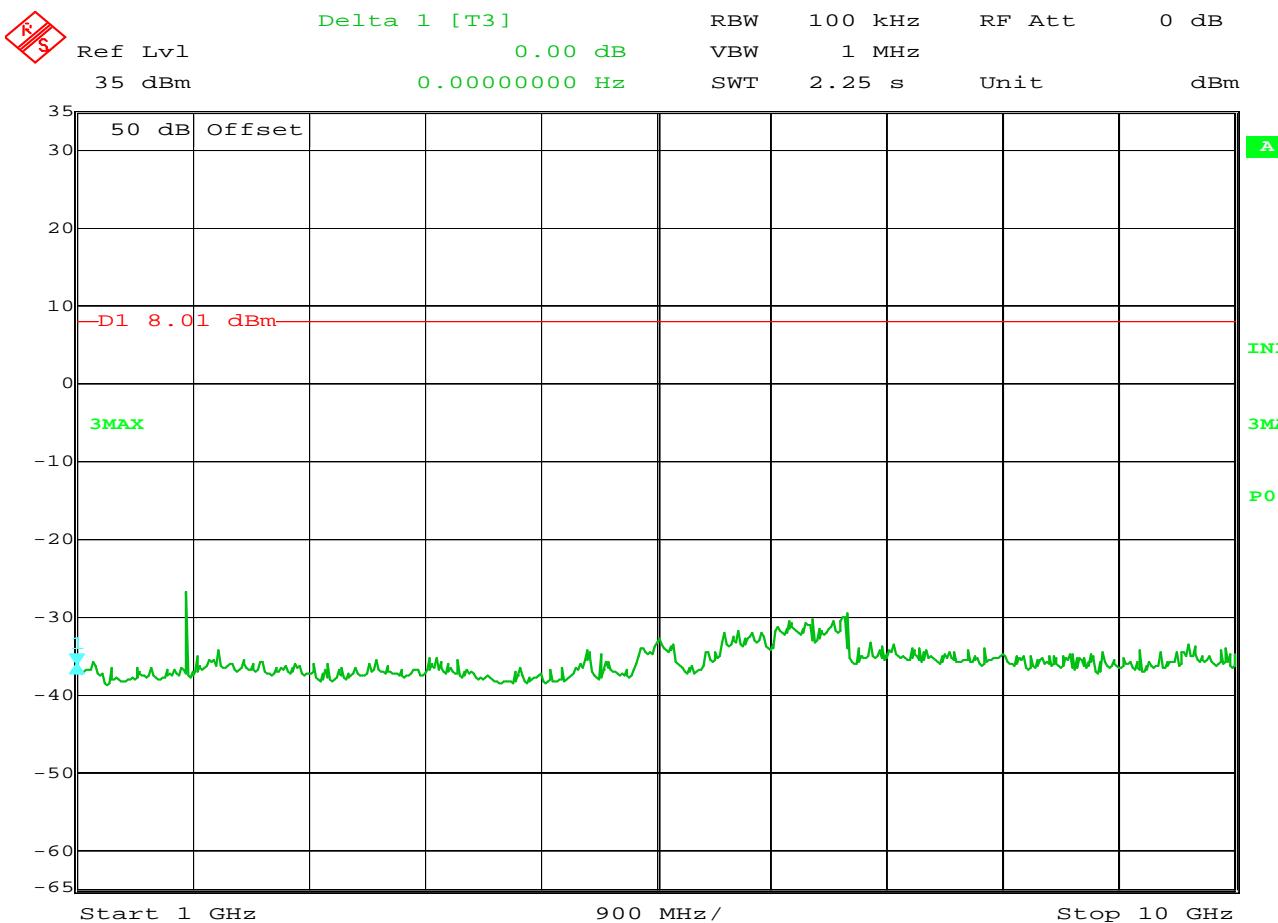
### 15.247(c) Antenna Conducted Spurious Emissions

MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	Orion SE Water Meter
SERIAL NUMBER	:	None Assigned
TEST MODE	:	Tx @ 914.45MHz
NOTES	:	Fixed Power Setting
TEST DATE	:	March 21, 2011
TEST PARAMETERS	:	Antenna Conducted Spurious Emissions
NOTES	:	Display Line D1 represents the 20dB down point from the maximum emissions in a 100kHz bandwidth



### 15.247(c) Antenna Conducted Spurious Emissions

MANUFACTURER : Badger Meter  
MODEL NUMBER : Orion SE Water Meter  
SERIAL NUMBER : None Assigned  
TEST MODE : Tx @ 924.45MHz  
NOTES : Fixed Power Setting  
TEST DATE : March 21, 2011  
TEST PARAMETERS : Antenna Conducted Spurious Emissions  
NOTES : Display Line D1 represents the 20dB down point from the maximum emissions in a 100kHz bandwidth



Date: 21.MAR.2011 10:21:09

### 15.247(c) Antenna Conducted Spurious Emissions

MANUFACTURER : Badger Meter  
 MODEL NUMBER : Orion SE Water Meter  
 SERIAL NUMBER : None Assigned  
 TEST MODE : Tx @ 924.45MHz  
 NOTES : Fixed Power Setting  
 TEST DATE : March 21, 2011  
 TEST PARAMETERS : Antenna Conducted Spurious Emissions  
 NOTES : Display Line D1 represents the 20dB down point from the maximum emissions in a 100kHz bandwidth

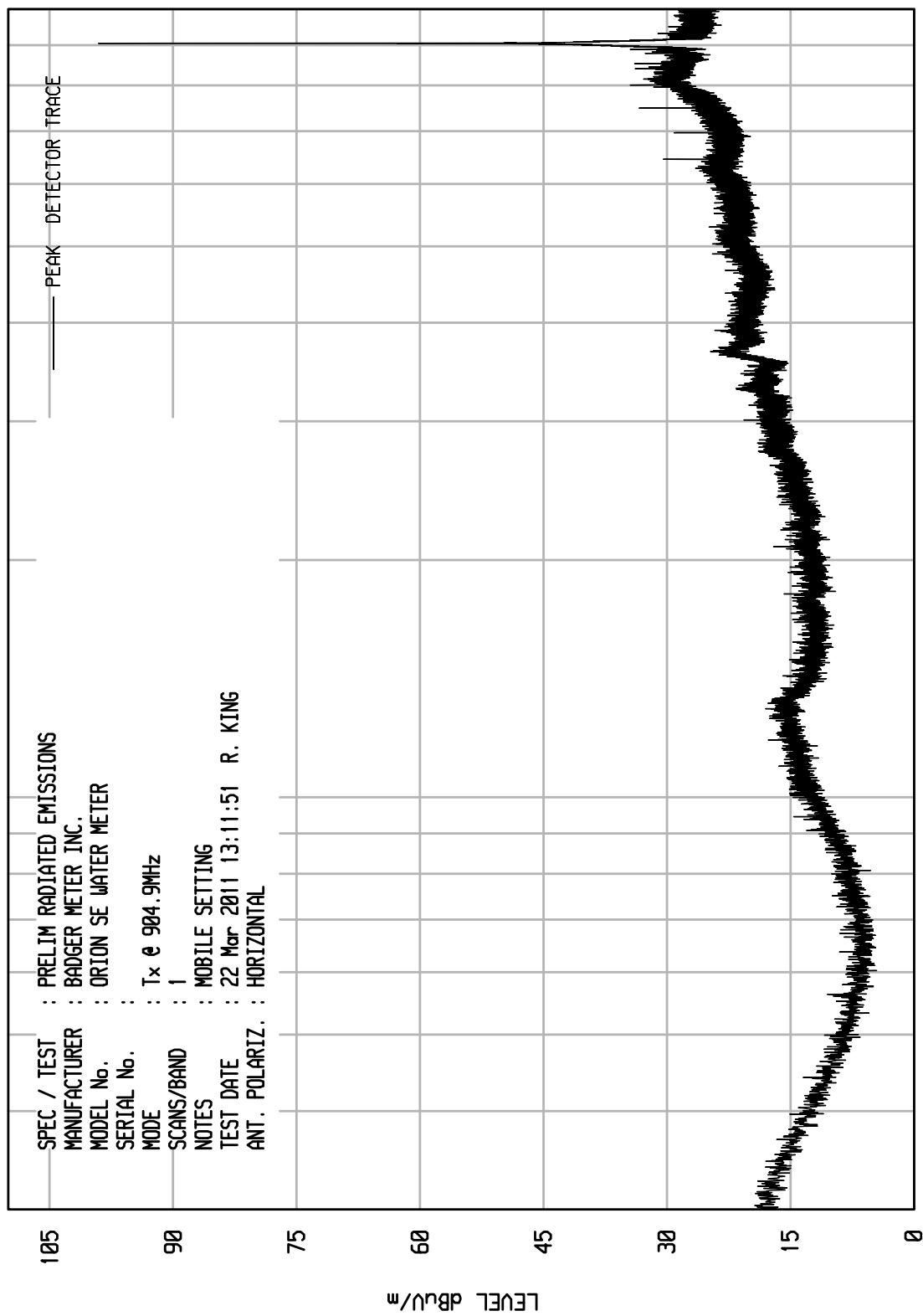
## ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

WKA1 10/28/10

UNIV RCU EMI RUN 9

SPEC / TEST	:	PRELIM RADIATED EMISSIONS
MANUFACTURER	:	BADGER METER INC.
MODEL No.	:	ORION SE WATER METER
SERIAL No.	:	
MODE	:	Tx @ 904.9MHz
SCANS/BAND	:	1
NOTES	:	MOBILE SETTING
TEST DATE	:	22 Mar 2011 13:11:51
ANT. POLARIZ.	:	HORIZONTAL



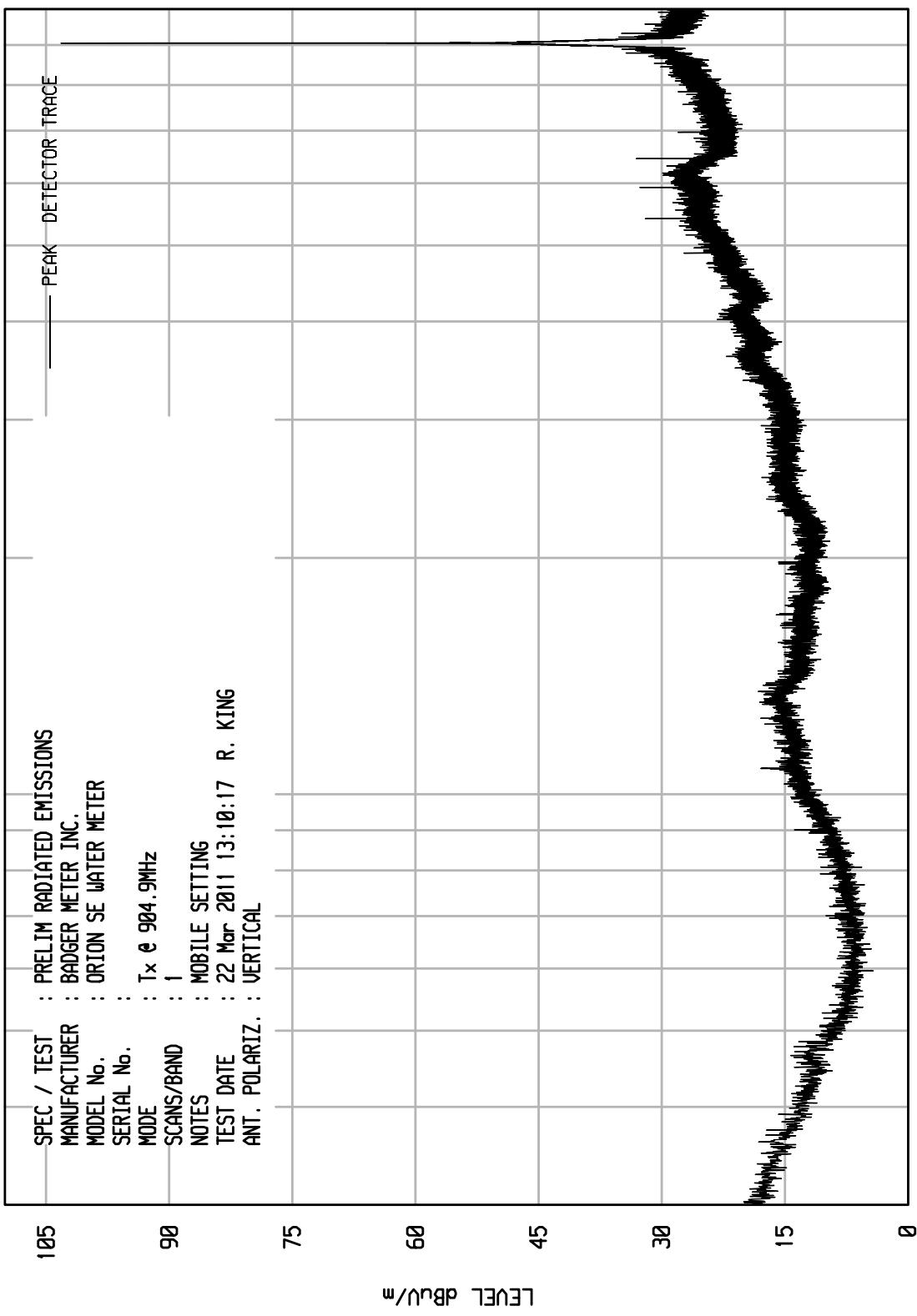
## ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

WKA1 10/28/10

UNIV RCU EMI RUN 8

SPEC / TEST	:	PRELIM RADIATED EMISSIONS
MANUFACTURER	:	BADGER METER INC.
MODEL No.	:	ORION SE WATER METER
SERIAL No.	:	
MODE	:	Tx @ 904.9MHz
SCANS/BAND	:	1
NOTES	:	MOBILE SETTING
TEST DATE	:	22 Mar 2011 13:10:17 R. KING
ANT. POLARIZ.	:	VERTICAL

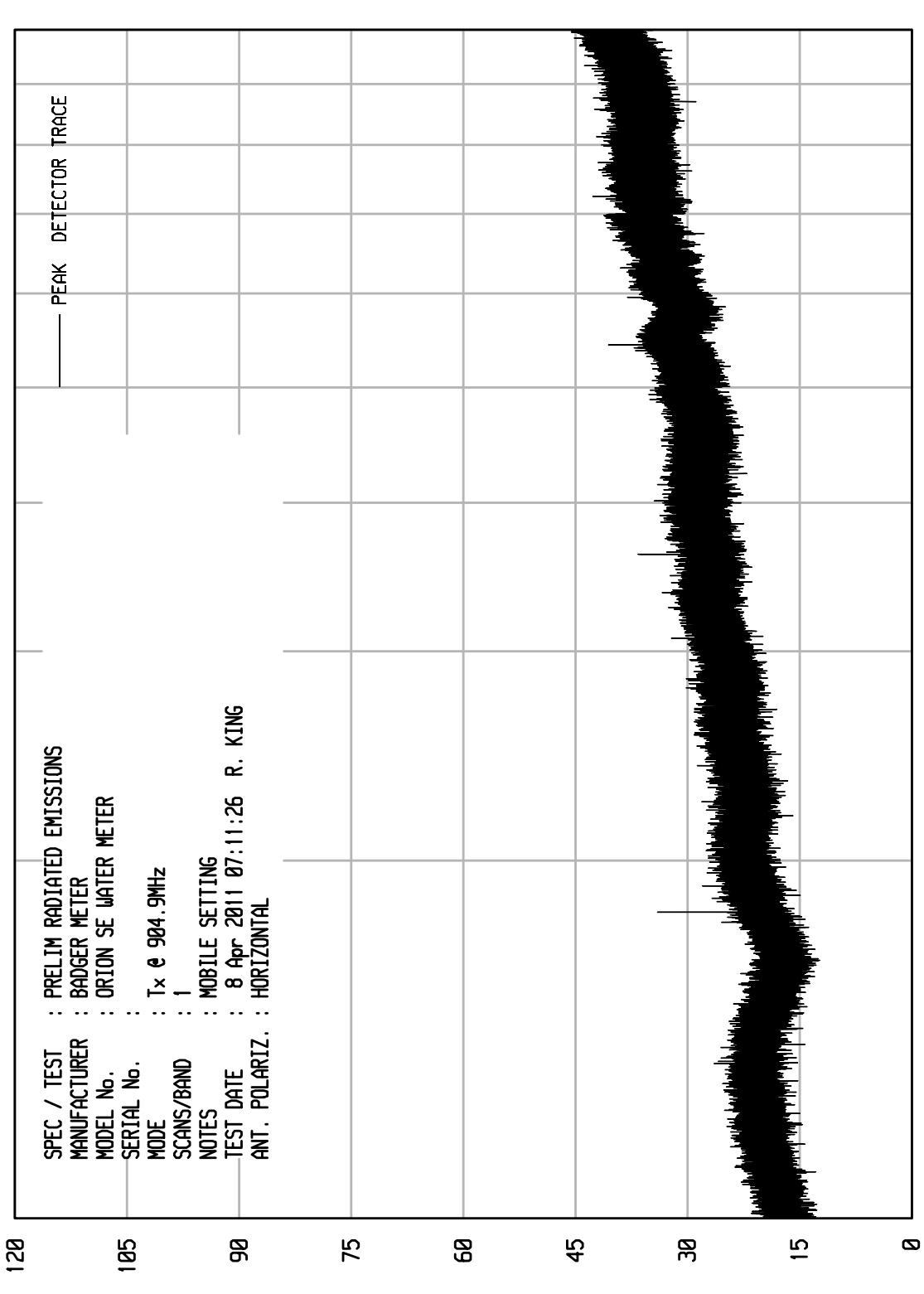


ELITE ELECTRONIC ENGINEERING Inc.  
Downers Grove, Ill. 60515

WKA1 10/28/10

UNIV RCU EMI RUN 12

SPEC / TEST	:	PRELIM RADIATED EMISSIONS
MANUFACTURER	:	BADGER METER
MODEL No.	:	ORION SE WATER METER
SERIAL No.	:	
MODE	:	Tx & 904.9MHz
SCANS/BAND	:	1
NOTES	:	MOBILE SETTING
TEST DATE	:	8 Apr 2011 07:11:26 R. KING
ANT. POLARIZ.	:	HORIZONTAL



START = 1000

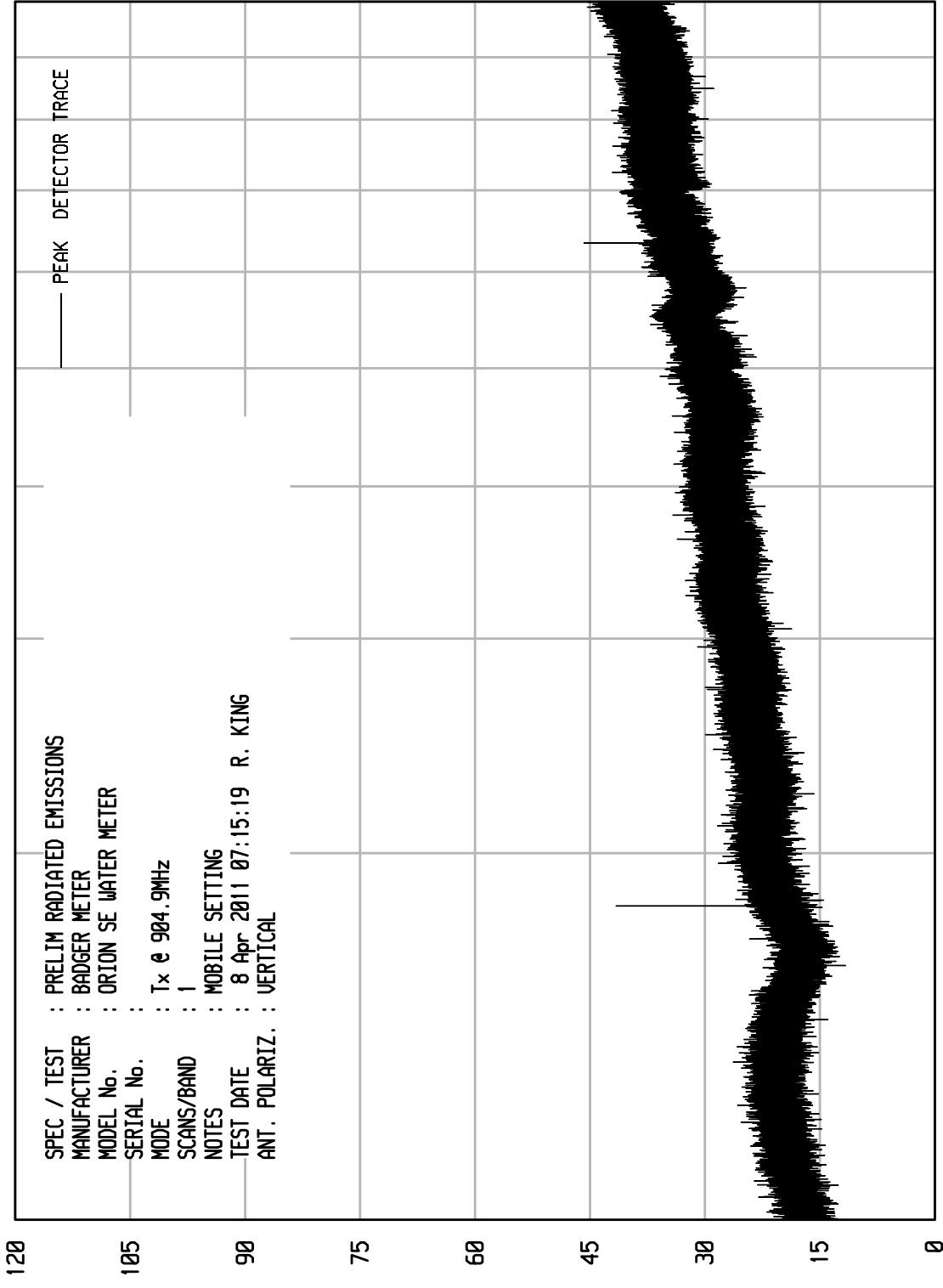
STOP = 100000

ELITE ELECTRONIC ENGINEERING Inc.  
Downers Grove, Ill. 60515

uKA1 10/28/10

UNIV RCU EMI RUN 13

SPEC / TEST	:	PRELIM RADIATED EMISSIONS
MANUFACTURER	:	BADGER METER
MODEL No.	:	ORION SE WATER METER
SERIAL No.	:	
MODE	:	Tx & 904.9MHz
SCANS/BAND	:	1
NOTES	:	MOBILE SETTING
TEST DATE	:	8 Apr 2011 07:15:19 R. KING
ANT. POLARIZ.	:	VERTICAL



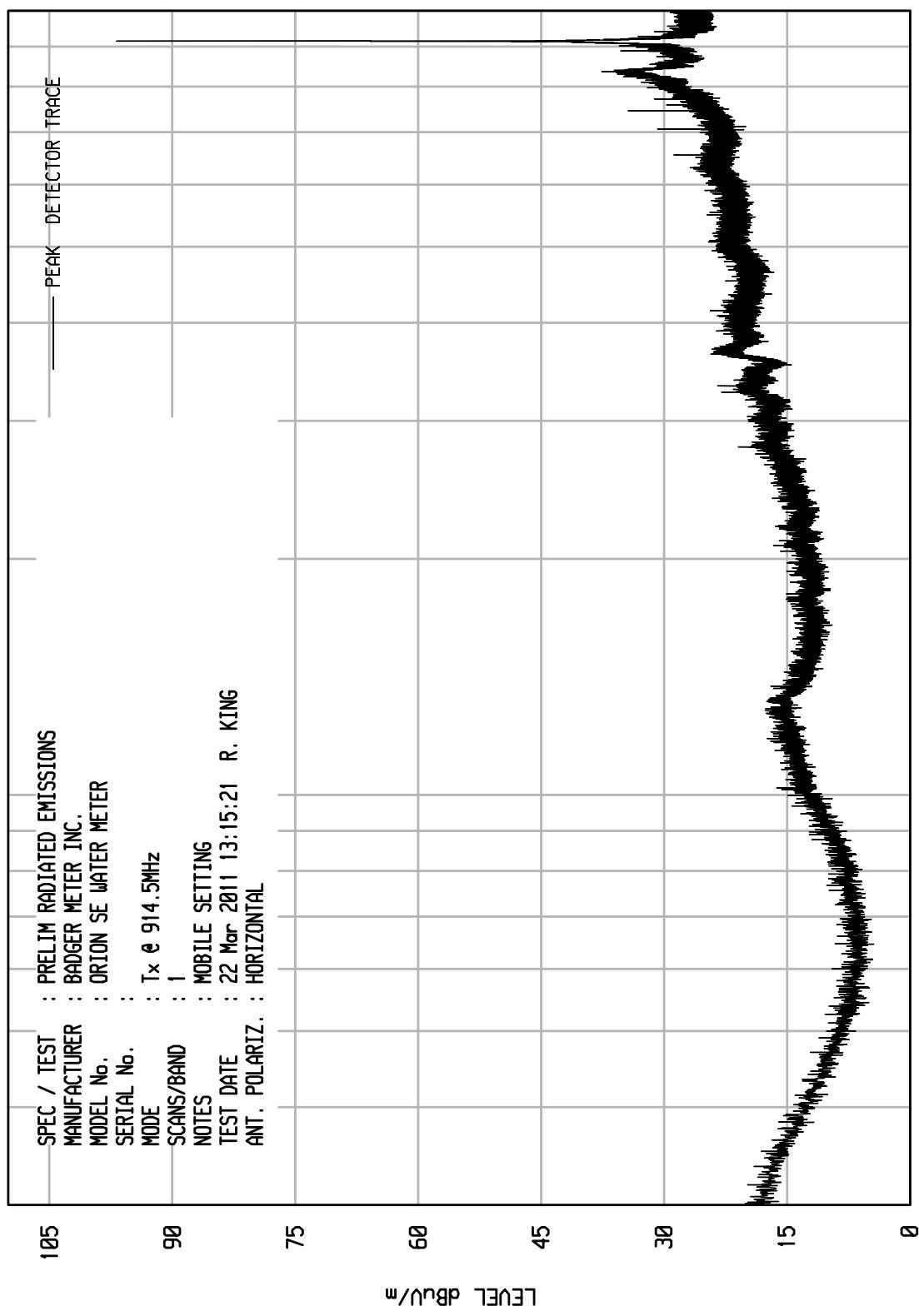
## ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

WKA1 10/28/10

UNIV RCU EMI RUN 10

SPEC / TEST	:	PRELIM RADIATED EMISSIONS
MANUFACTURER	:	BADGER METER INC.
MODEL No.	:	ORION SE WATER METER
SERIAL No.	:	
MODE	:	Tx @ 914.5MHz
SCANS/BAND	:	1
NOTES	:	MOBILE SETTING
TEST DATE	:	22 Mar 2011 13:15:21
ANT. POLARIZ.	:	HORIZONTAL

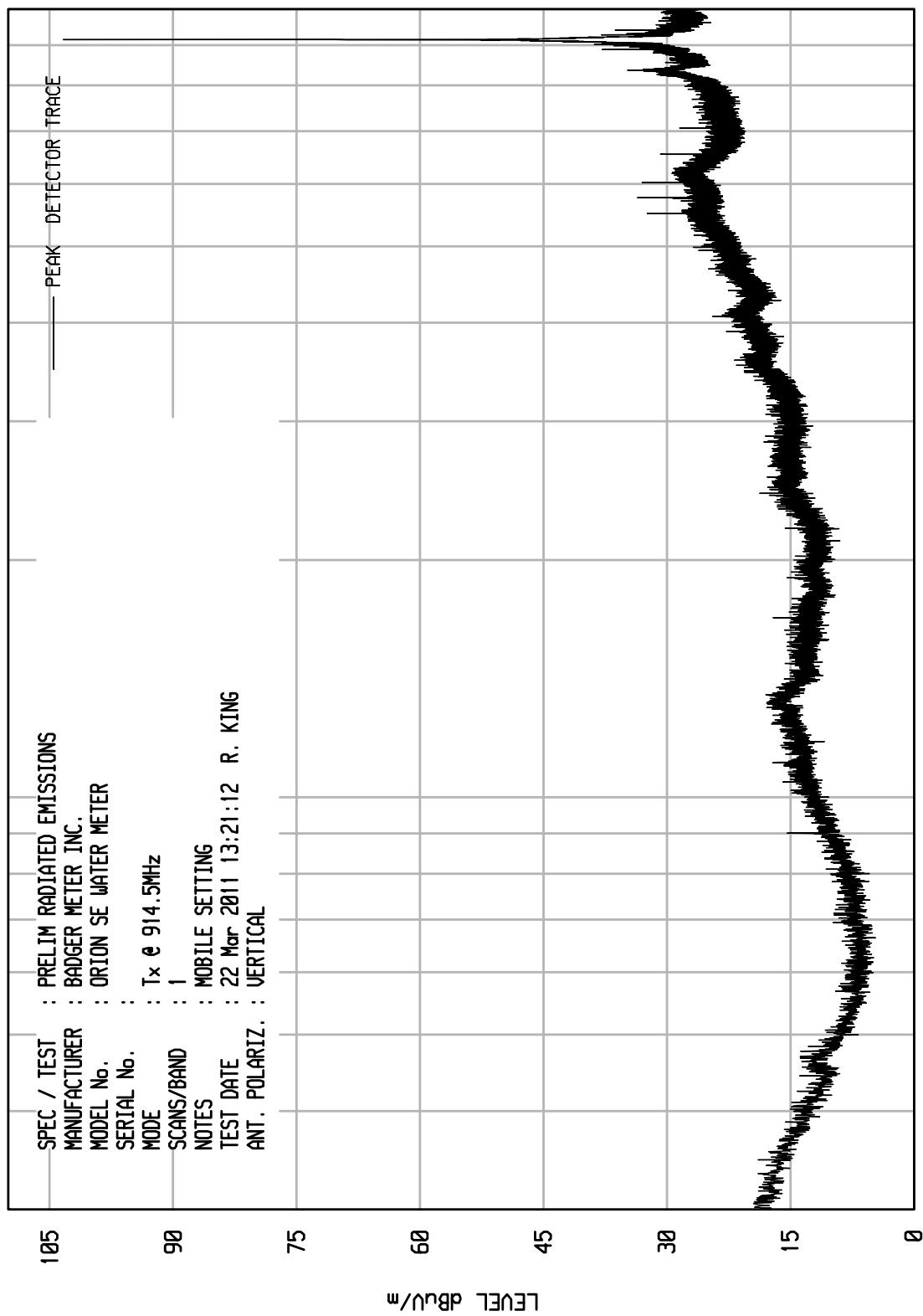


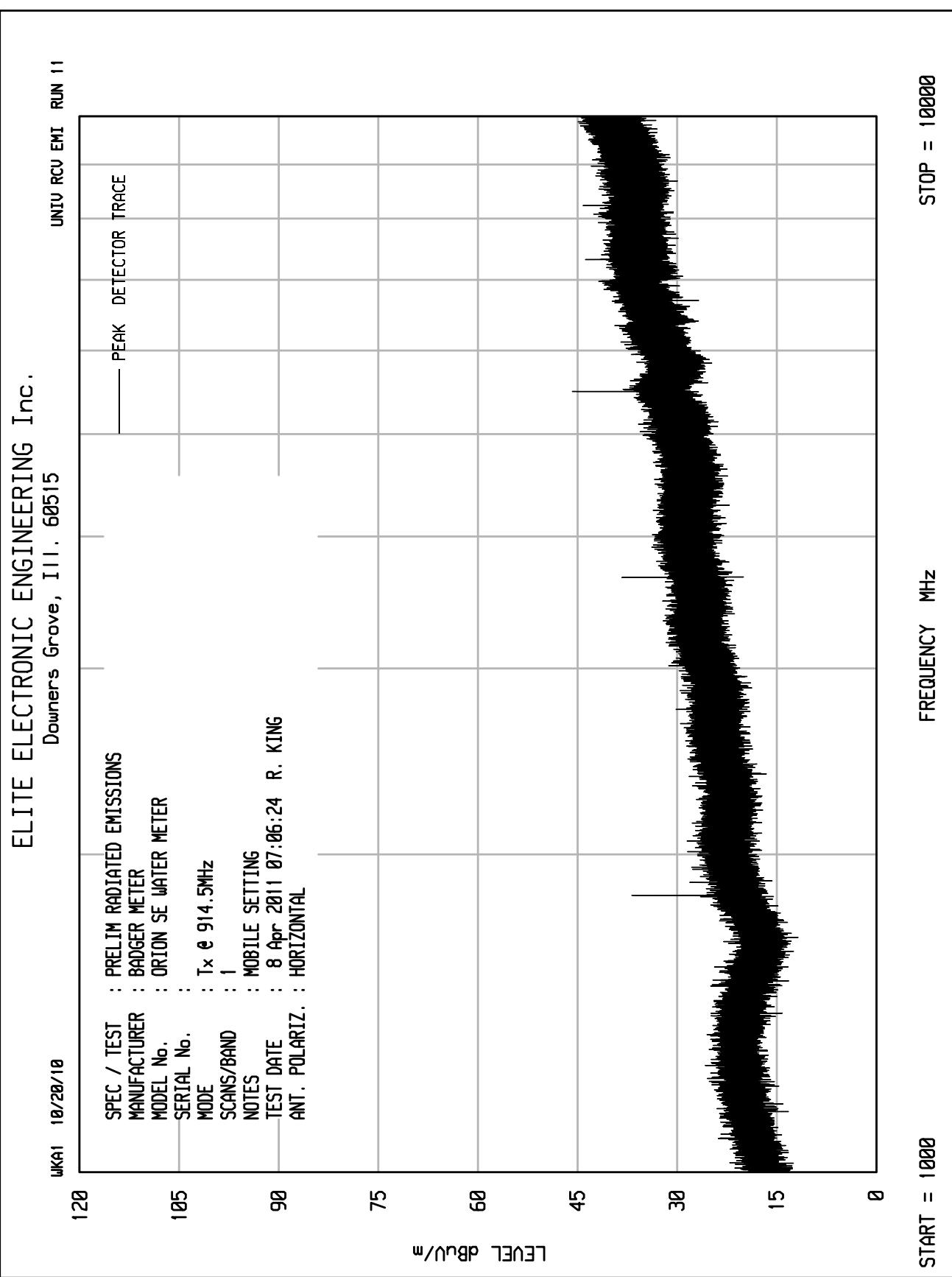
ELITE ELECTRONIC ENGINEERING Inc.  
Downers Grove, Ill. 60515

uKA1 10/28/10

UNI U RCU EMI RUN 11

105	SPEC / TEST	: PRELIM RADIATED EMISSIONS
	MANUFACTURER	: BADGER METER INC.
	MODEL No.	: ORION SE WATER METER
	SERIAL No.	
	MODE	: Tx @ 914.5MHz
90	SCANS/BAND	: 1
	NOTES	: MOBILE SETTING
	TEST DATE	: 22 Mar 2011 13:21:12 R. KING
	ANT. POLARIZ.	: VERTICAL



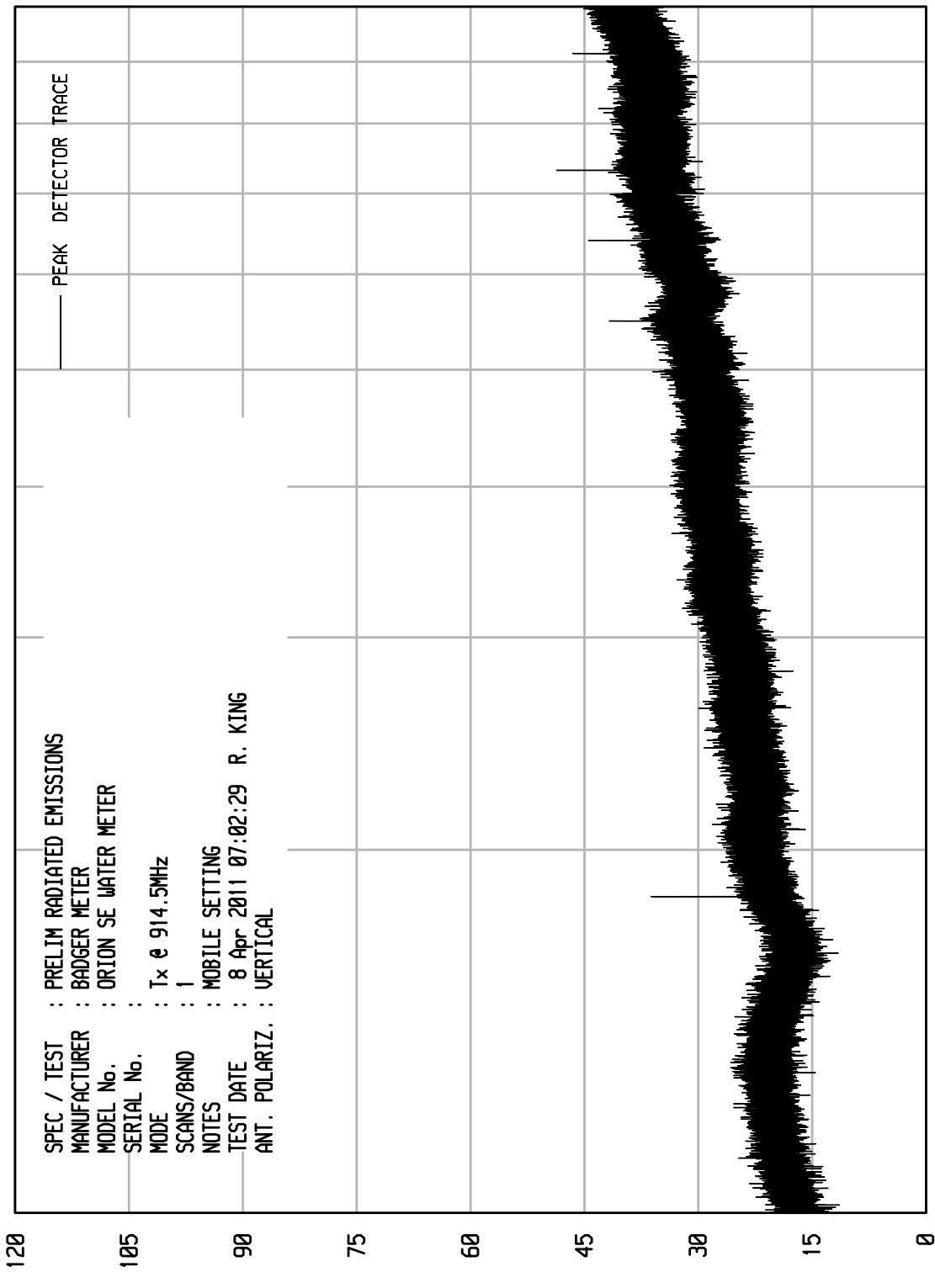


ELITE ELECTRONIC ENGINEERING Inc.  
Downers Grove, Ill. 60515

WKA1 10/28/10

UNIT RCU EMI RUN 10

SPEC / TEST	:	PRELIM RADIATED EMISSIONS
MANUFACTURER	:	BADGER METER
MODEL No.	:	ORION SE WATER METER
SERIAL No.	:	
MODE	:	Tx @ 914.5MHz
SCANS/BAND	:	1
NOTES	:	MOBILE SETTING
TEST DATE	:	8 Apr 2011 07:02:29 R. KING
ANT. POLARIZ.	:	VERTICAL

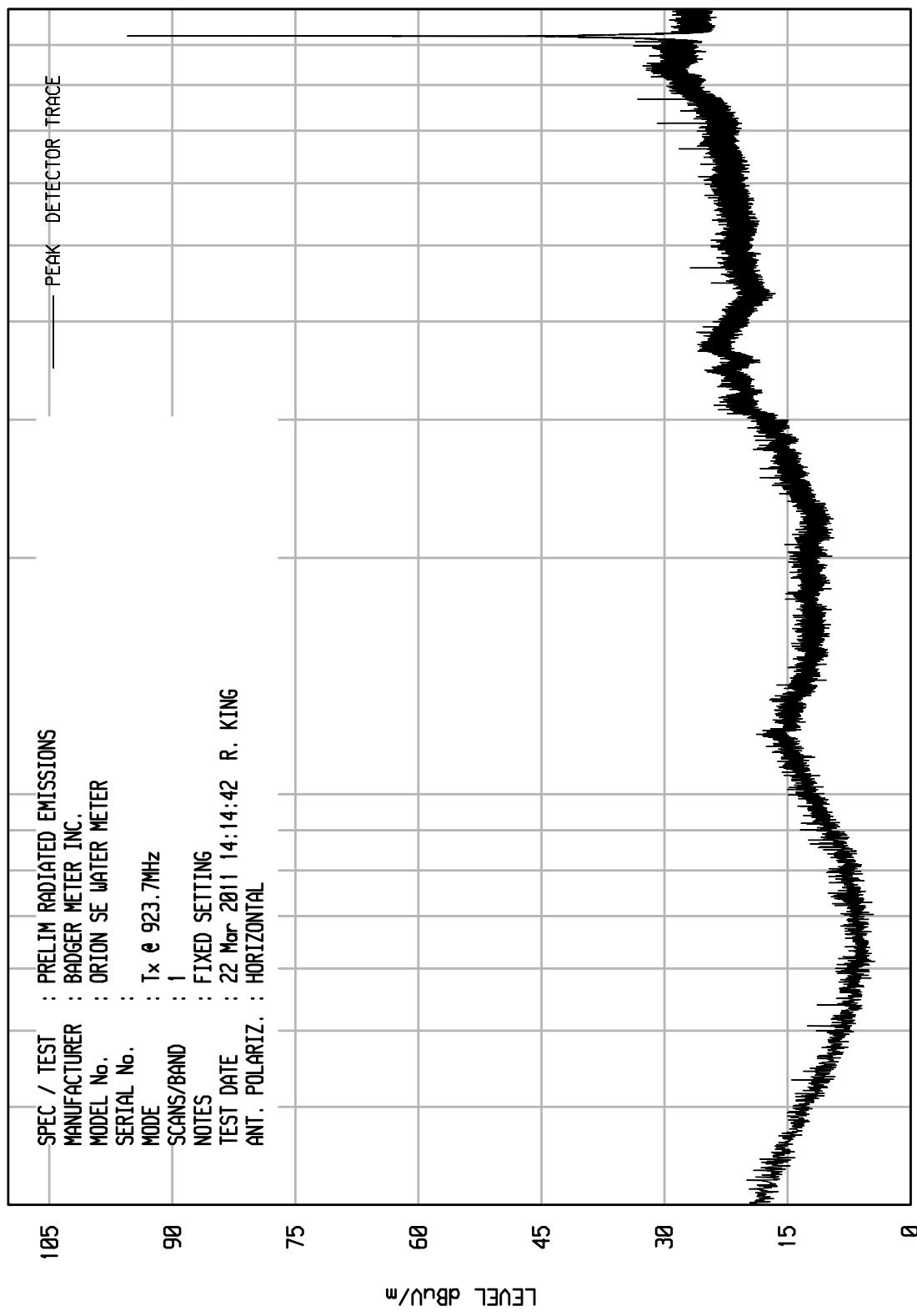


ELITE ELECTRONIC ENGINEERING Inc.  
Downers Grove, Ill. 60515

uKA1 10/28/10

UNIV RCU EMI RUN 21

SPEC / TEST	:	PRELIM RADIATED EMISSIONS
MANUFACTURER	:	BADGER METER INC.
MODEL No.	:	ORION SE WATER METER
SERIAL No.	:	
MODE	:	Tx @ 923.7MHz
SCANS/BAND	:	1
NOTES	:	FIXED SETTING
TEST DATE	:	22 Mar 2011 14:14:42 R. KING
ANT. POLARIZ.	:	HORIZONTAL



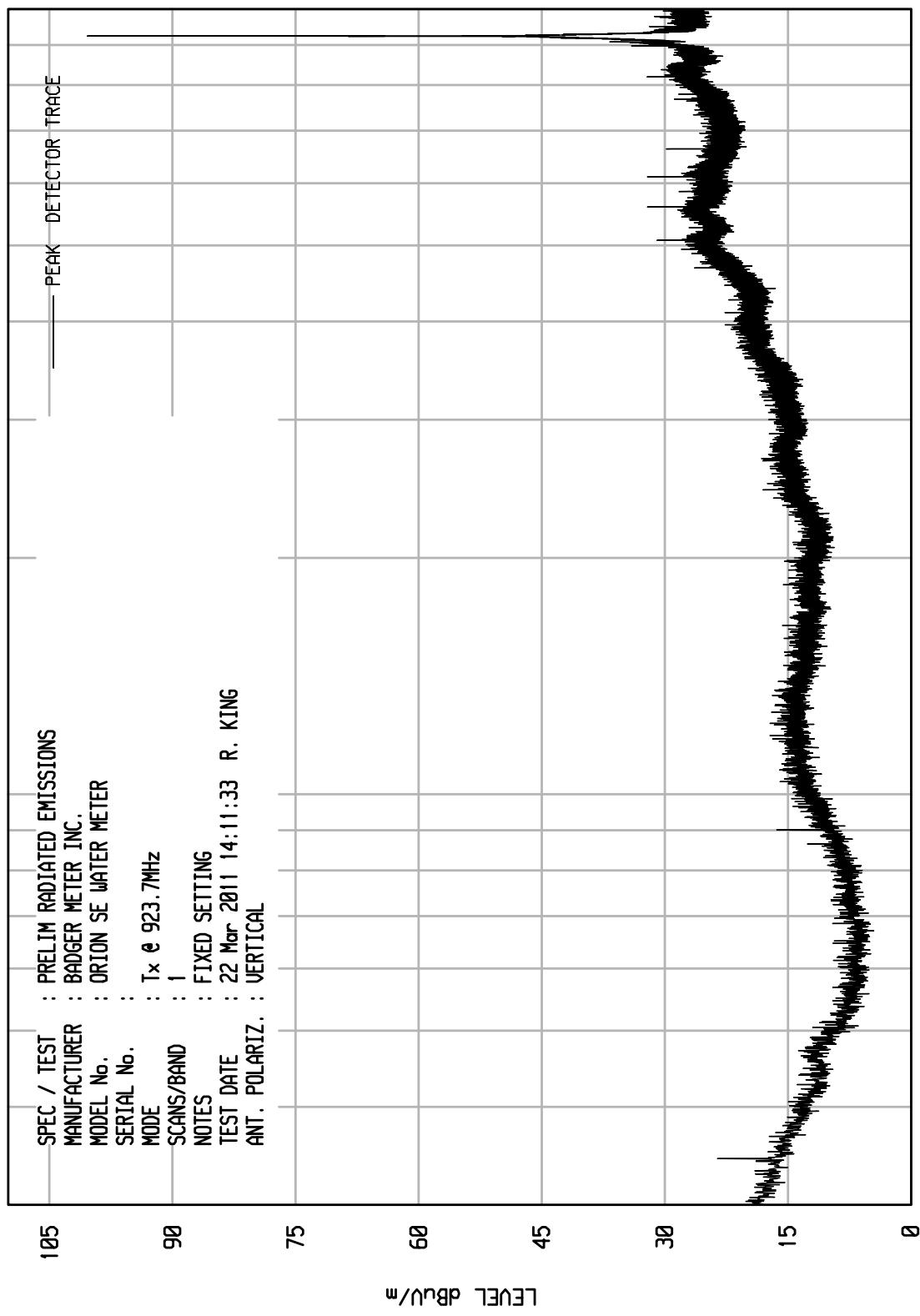
## ELITE ELECTRONIC ENGINEERING Inc.

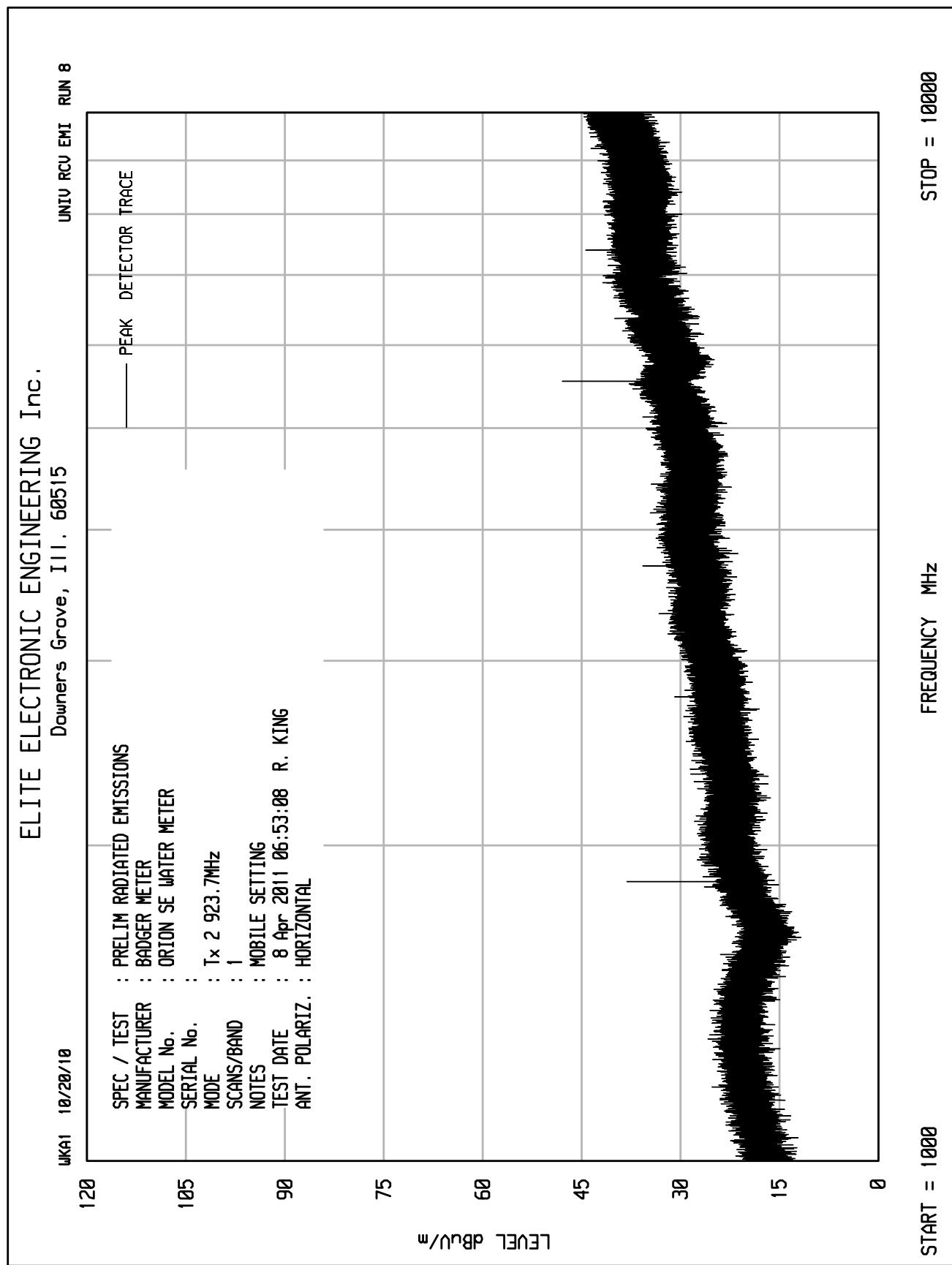
Downers Grove, Ill. 60515

WKA1 10/28/10

UNIV RCU EMI RUN 28

SPEC / TEST	:	PRELIM RADIATED EMISSIONS
MANUFACTURER	:	BADGER METER INC.
MODEL No.	:	ORION SE WATER METER
SERIAL No.	:	
MODE	:	Tx @ 923.7MHz
SCANS/BAND	:	1
NOTES	:	FIXED SETTING
TEST DATE	:	22 Mar 2011 14:11:33 R. KING
ANT. POLARIZ.	:	VERTICAL

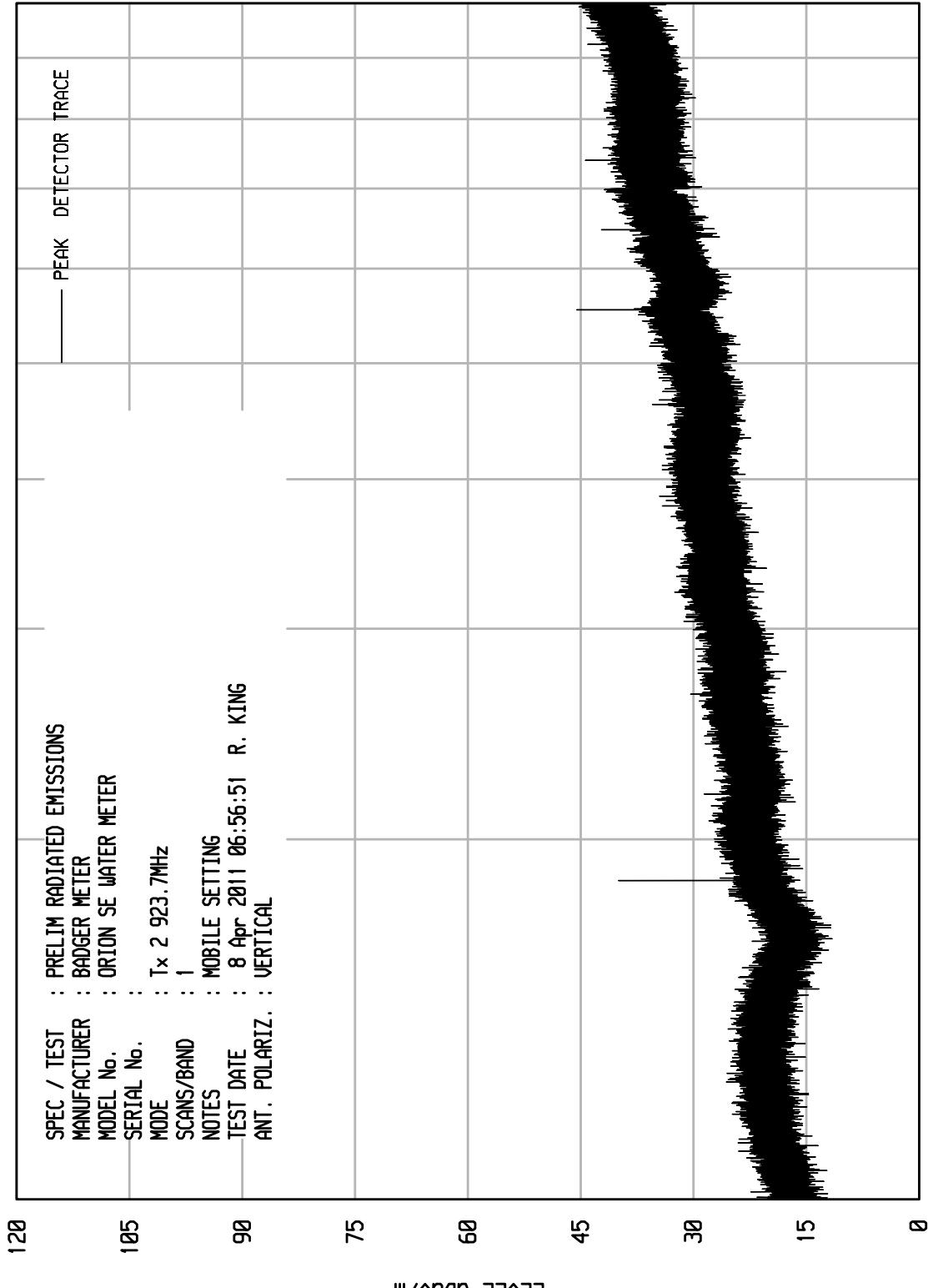




ELITE ELECTRONIC ENGINEERING Inc.  
Downers Grove, Ill. 60515

WKA1 10/28/10

UNIV RCU EMI RUN 9

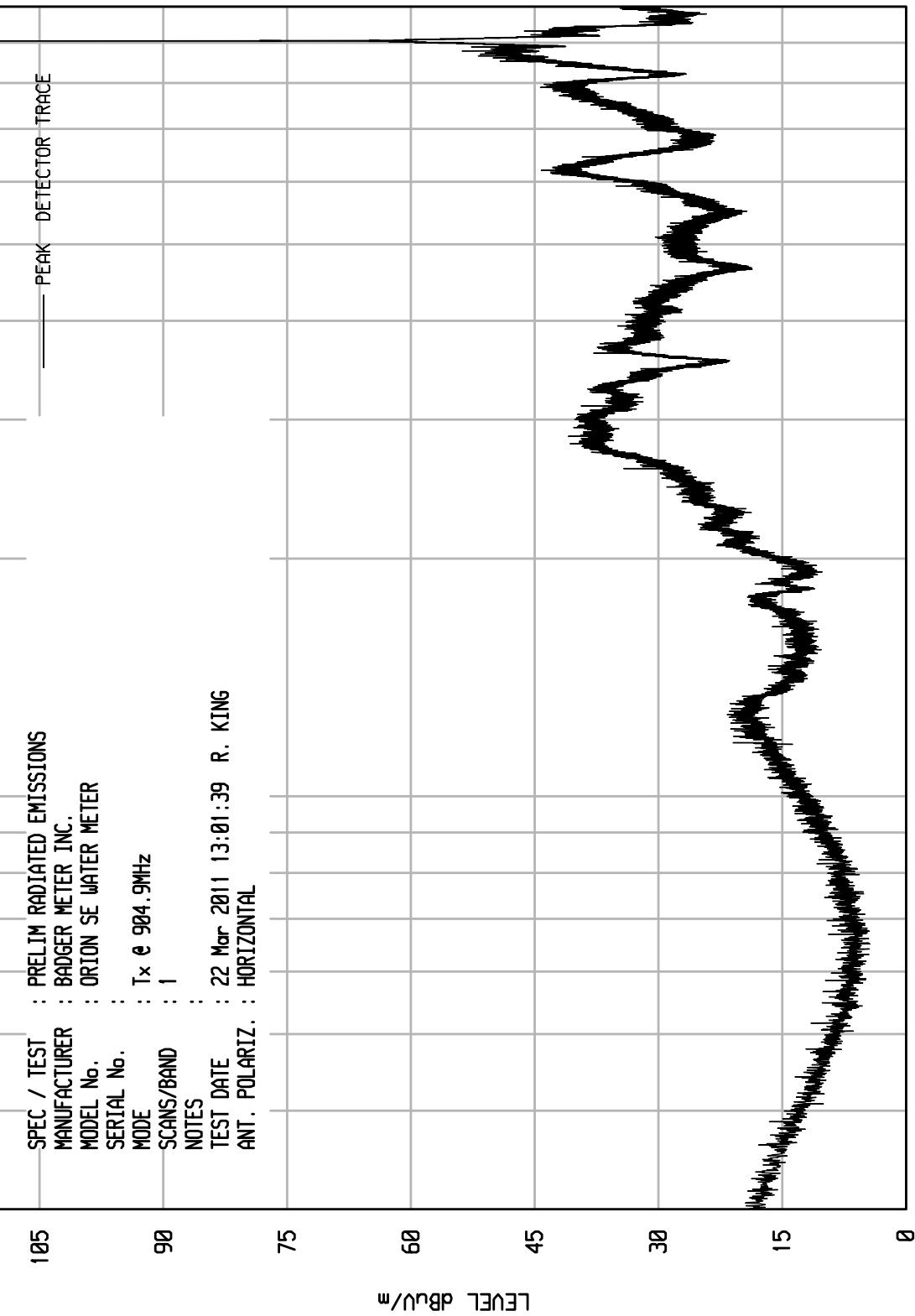


ELITE ELECTRONIC ENGINEERING Inc.  
Downers Grove, Ill. 60515

WKA1 10/28/10

UNIV RCU EMI RUN 6

105	SPEC / TEST	: PRELIM RADIATED EMISSIONS
	MANUFACTURER	: BADGER METER INC.
	MODEL No.	: ORION SE WATER METER
	SERIAL No.	
	MODE	: Tx @ 904.9MHz
90	SCANS/BAND	: 1
	NOTES	
	TEST DATE	: 22 Mar 2011 13:01:39 R. KING
	ANT. POLARIZ.	: HORIZONTAL



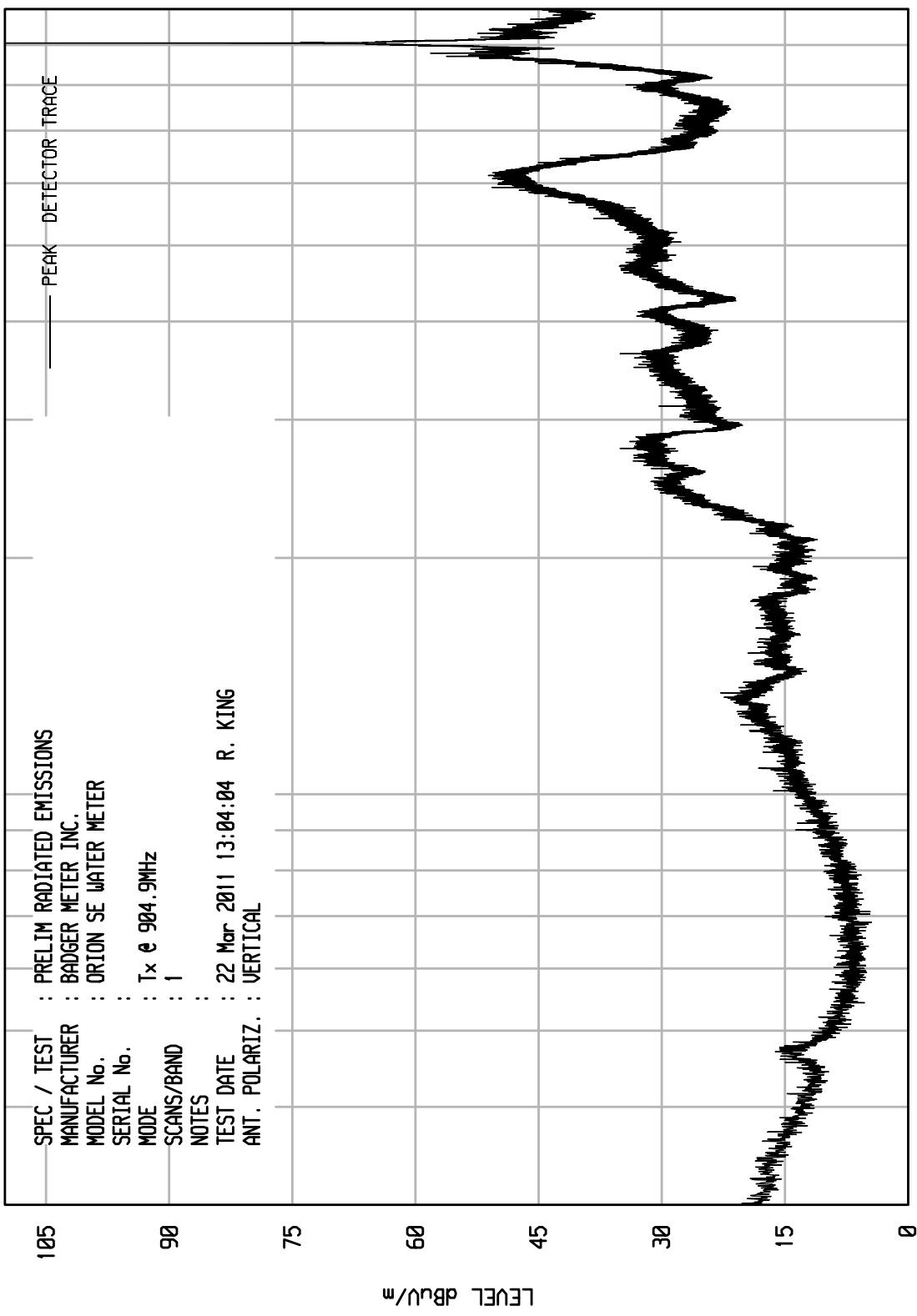
## ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

WKA1 10/28/10

UNIT RCU EMI RUN 7

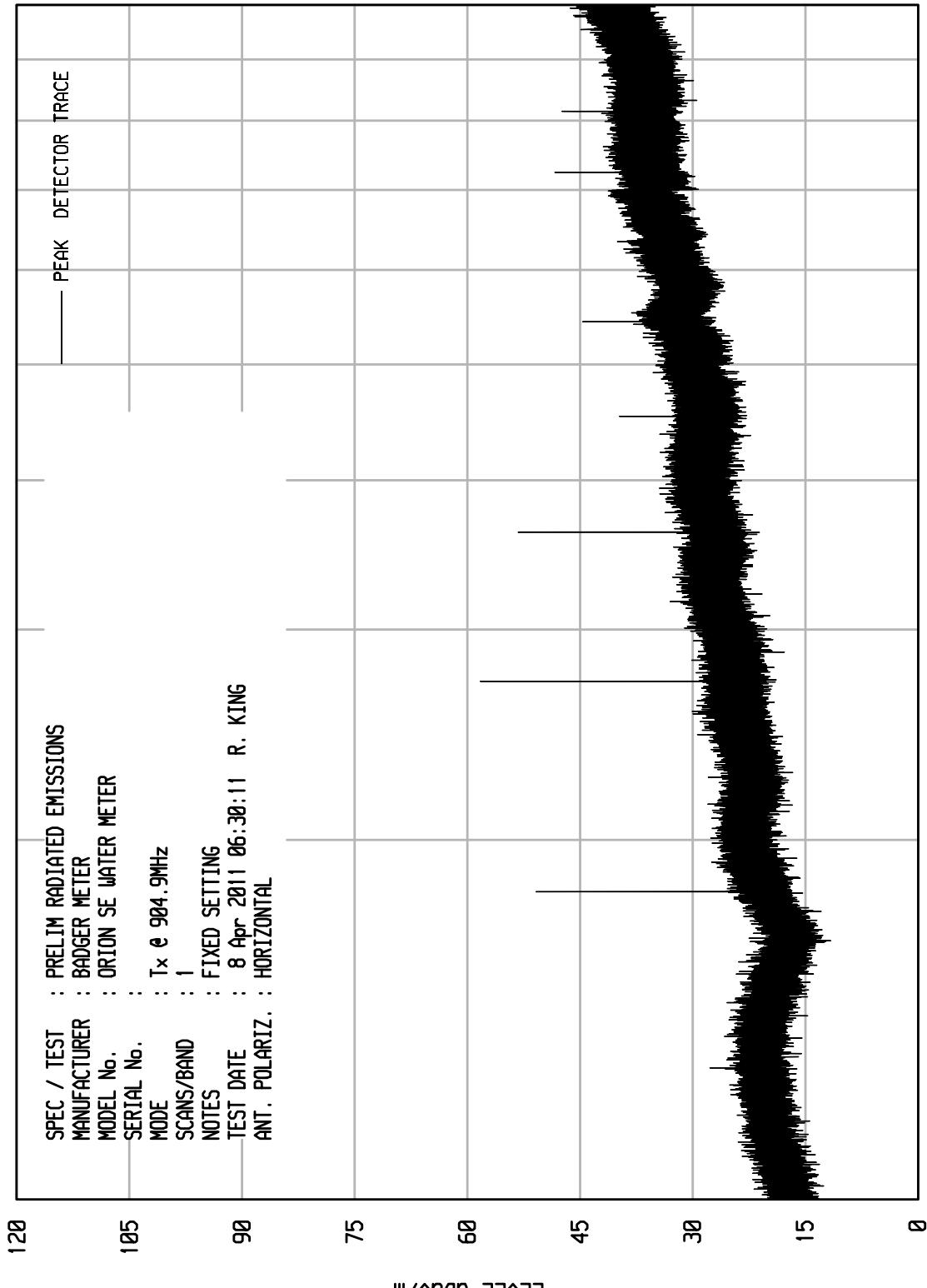
105	SPEC / TEST	: PRELIM RADIATED EMISSIONS
	MANUFACTURER	: BADGER METER INC.
	MODEL No.	: ORION SE WATER METER
	SERIAL No.	
	MODE	: Tx @ 904.9MHz
90	SCANS/BAND	: 1
	NOTES	
	TEST DATE	: 22 Mar 2011 13:04:04 R. KING
	ANT. POLARIZ.	: VERTICAL



ELITE ELECTRONIC ENGINEERING Inc.  
Downers Grove, Ill. 60515

uKA1 10/28/10

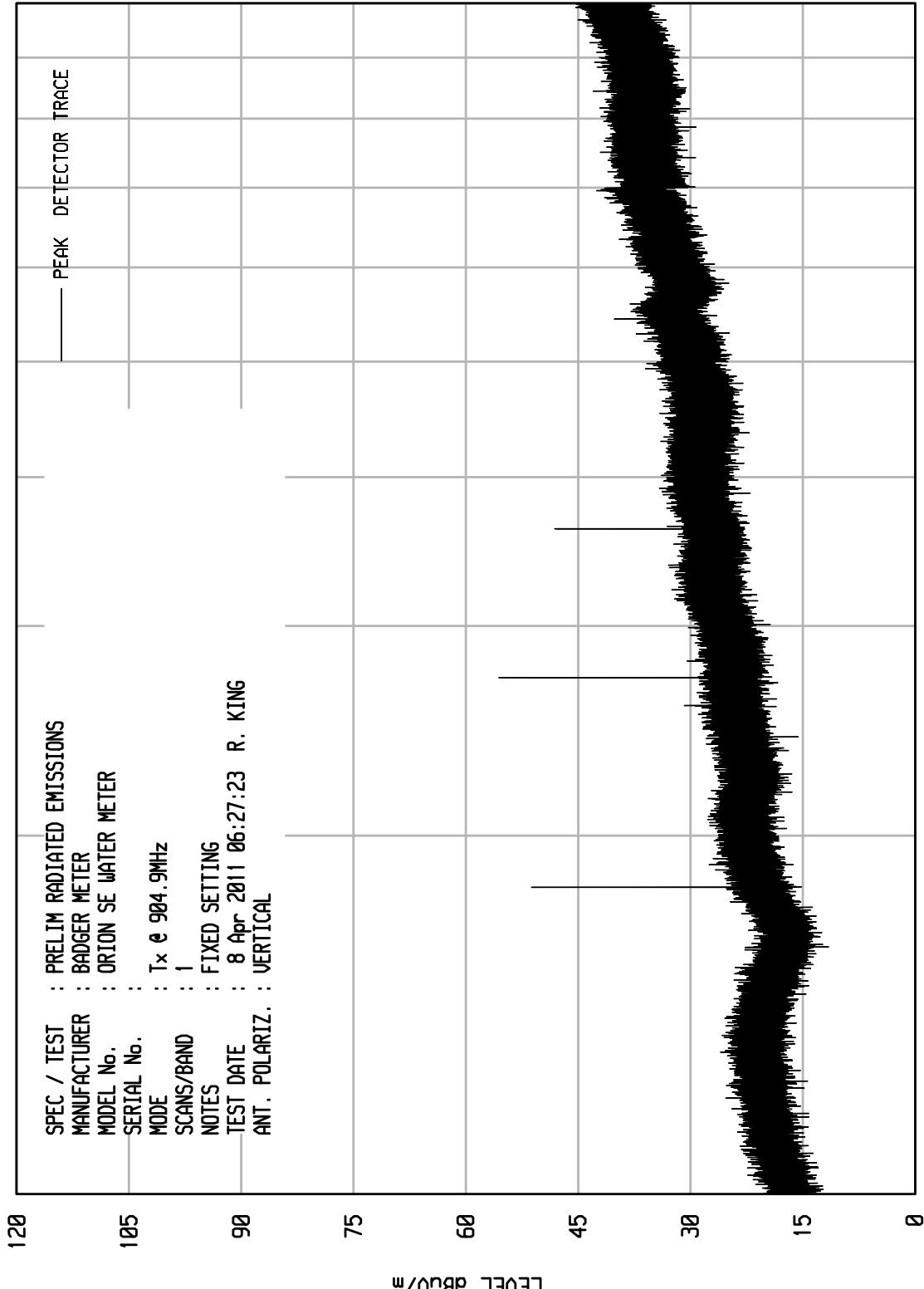
UNIV RCU EMI RUN 3



ELITE ELECTRONIC ENGINEERING Inc.  
Downers Grove, Ill. 60515

uKA1 10/28/10

UNIV RCU EMI RUN 2



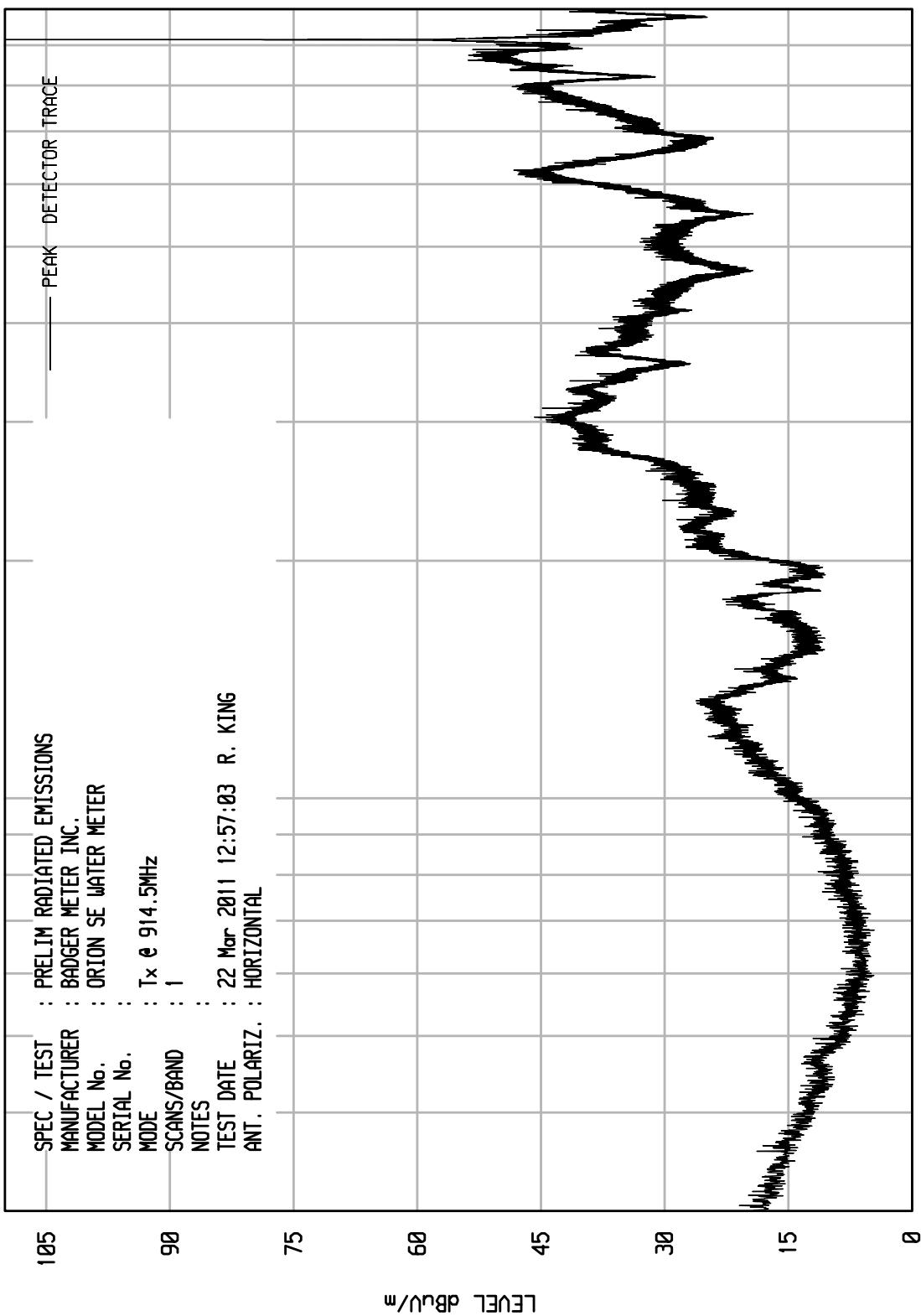
## ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

WKA1 10/28/10

UNIT RCU EMI RUN 5

SPEC / TEST	:	PRELIM RADIATED EMISSIONS
MANUFACTURER	:	BADGER METER INC.
MODEL No.	:	ORION SE WATER METER
SERIAL No.	:	
MODE	:	Tx @ 914.5MHz
SCANS/BAND	:	1
NOTES	:	
TEST DATE	:	22 Mar 2011 12:57:03 R. KING
ANT. POLARIZ.	:	HORIZONTAL

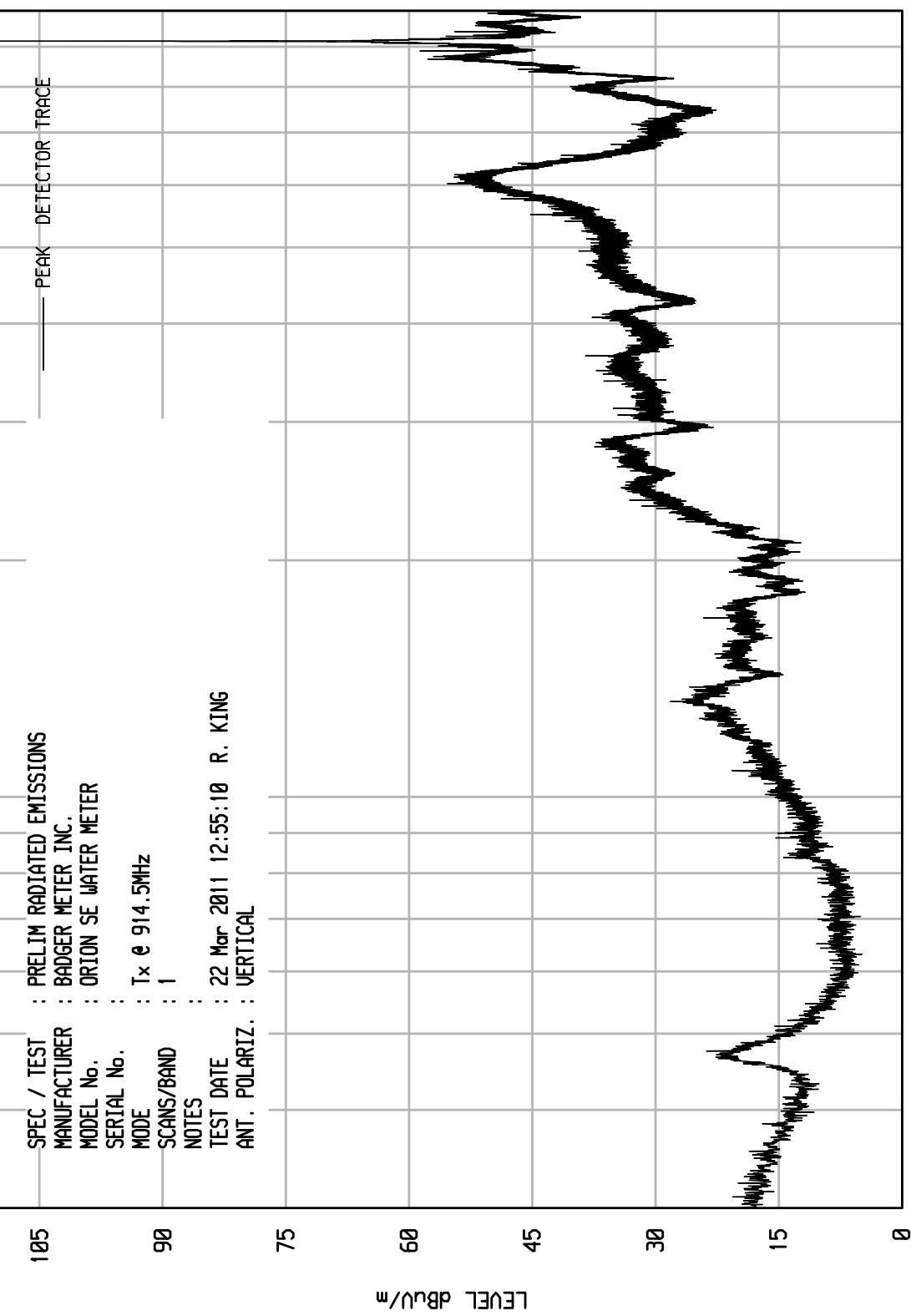


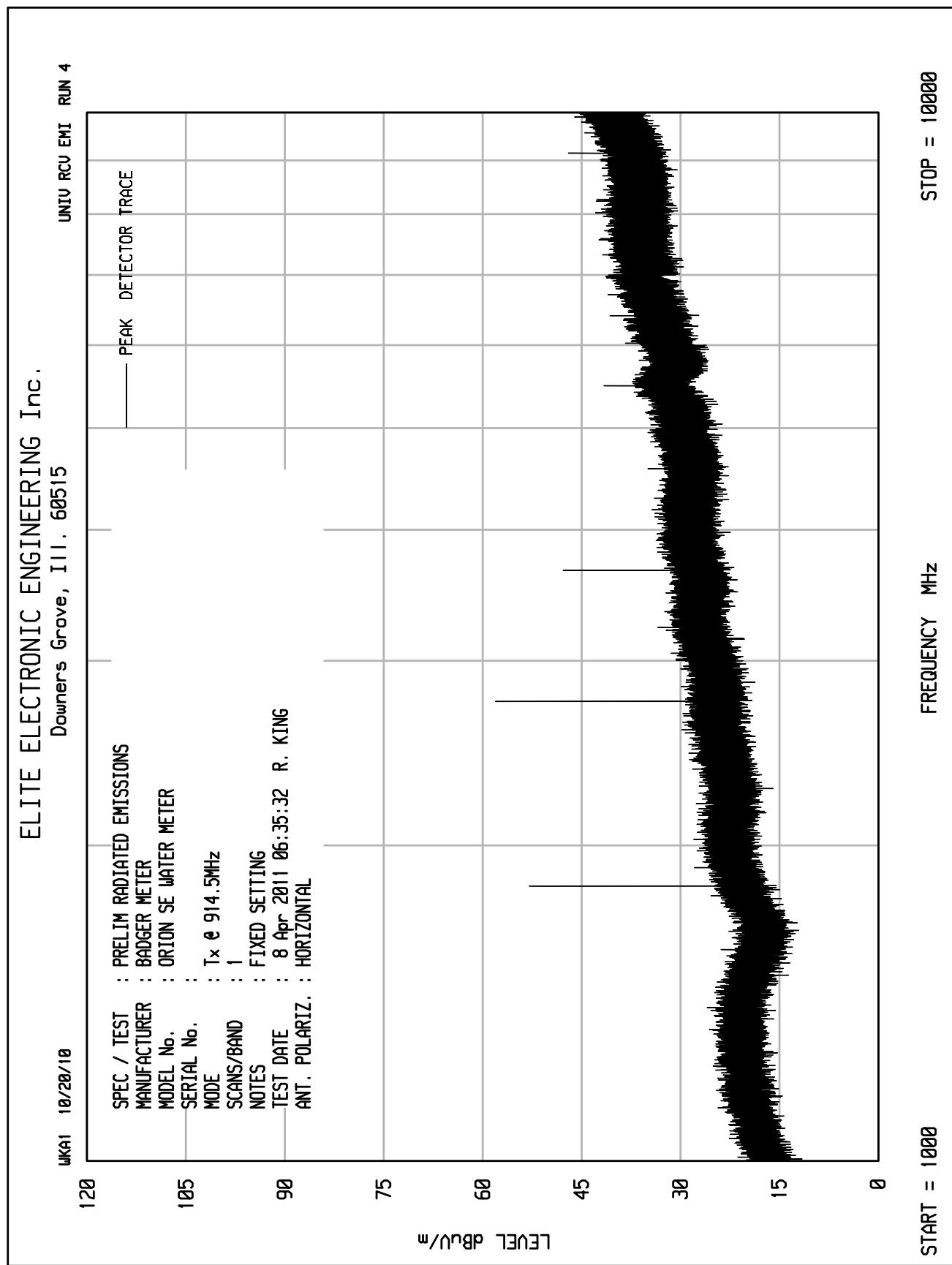
ELITE ELECTRONIC ENGINEERING Inc.  
Downers Grove, Ill. 60515

uKA1 10/28/10

UNIT RCU EMI RUN 4

105	SPEC / TEST	: PRELIM RADIATED EMISSIONS
	MANUFACTURER	: BADGER METER INC.
	MODEL No.	: ORION SE WATER METER
	SERIAL No.	
	MODE	: Tx @ 914.5MHz
90	SCANS/BAND	: 1
	NOTES	
	TEST DATE	: 22 Mar 2011 12:55:10 R. KING
	ANT. POLARIZ.	: VERTICAL

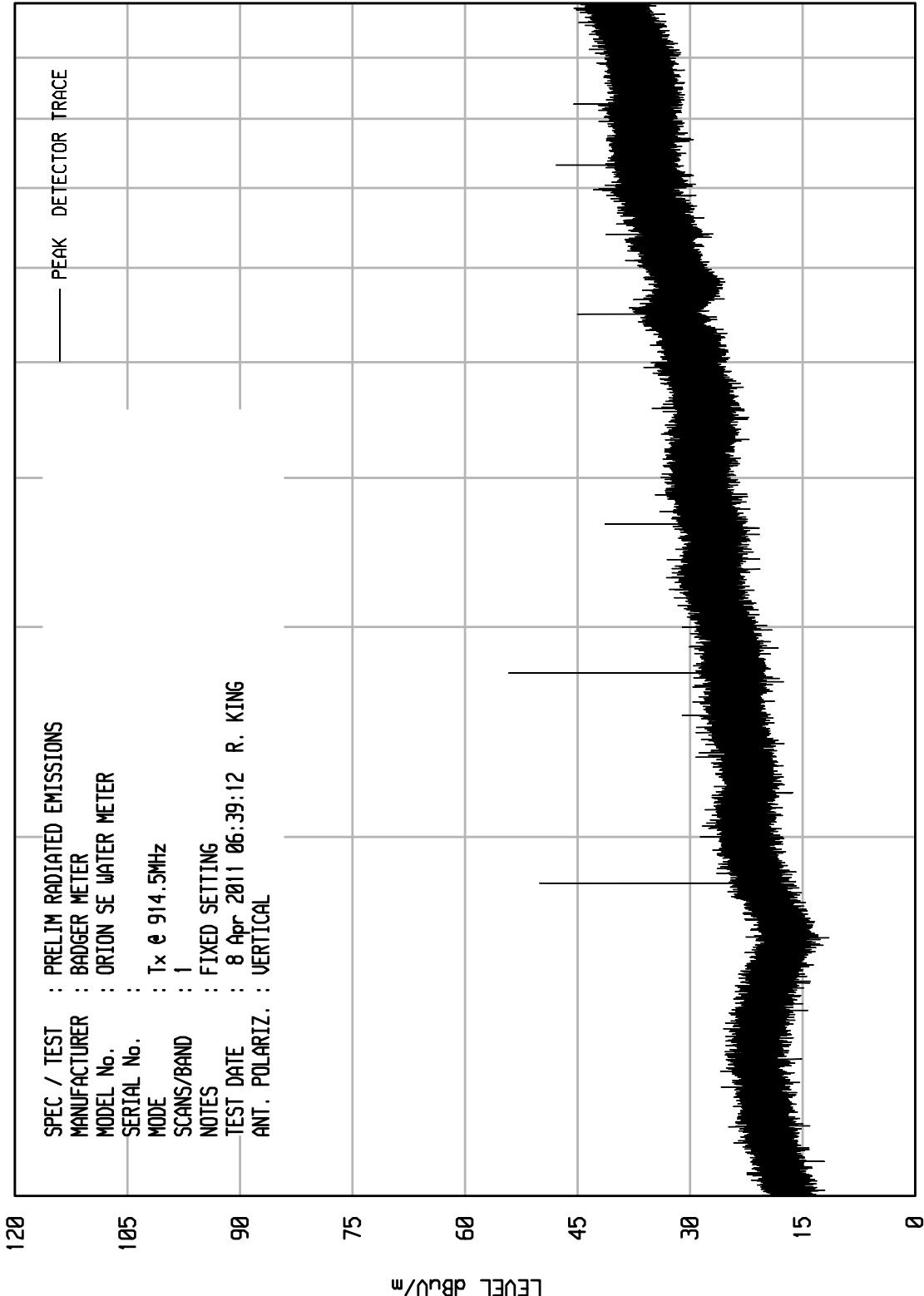




ELITE ELECTRONIC ENGINEERING Inc.  
Downers Grove, Ill. 60515

uKA1 10/28/10

UNIV RCU EMI RUN 5



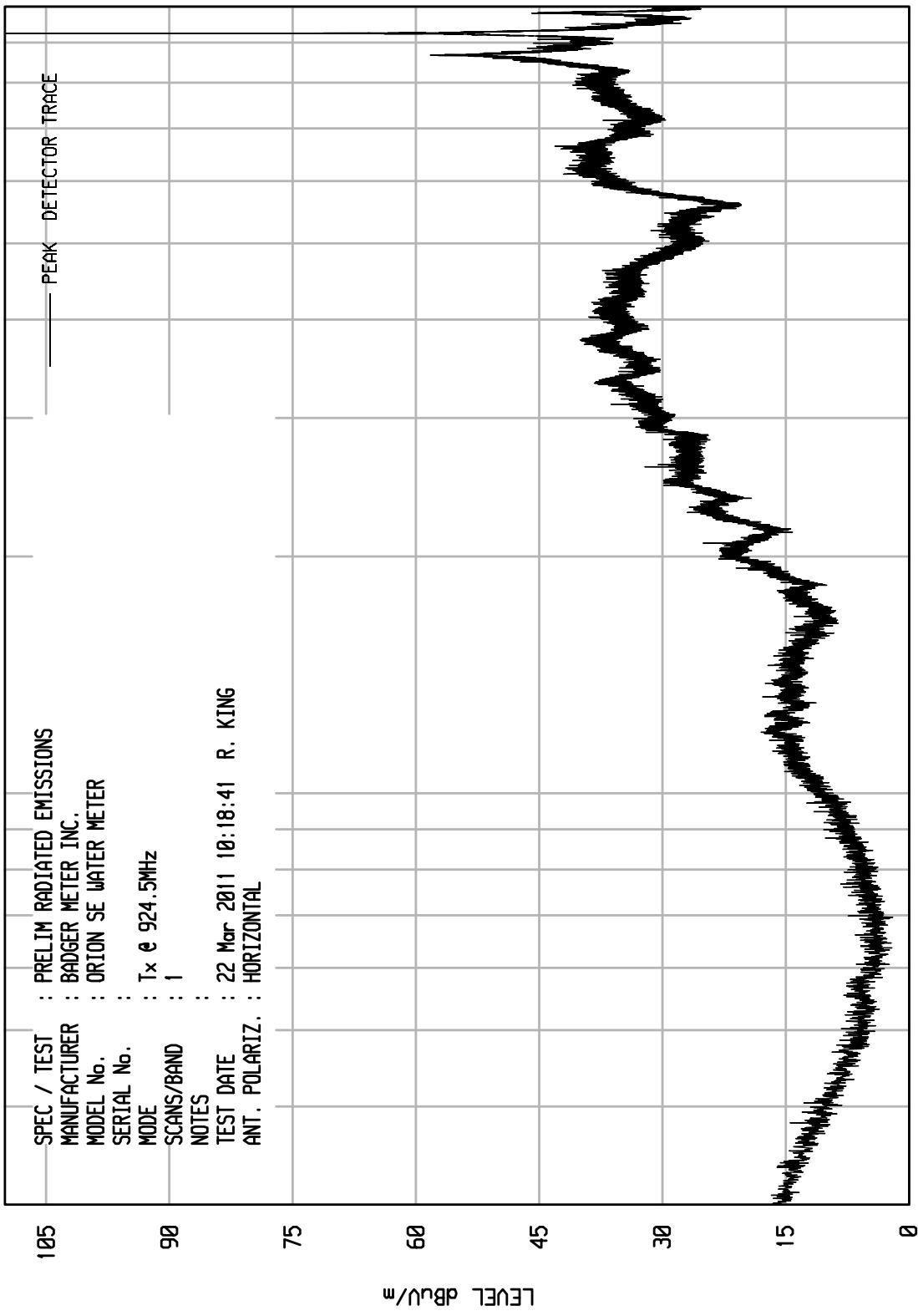
## ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

WKA1 10/28/10

UNIV RCU EMI RUN 1

SPEC / TEST	:	PRELIM RADIATED EMISSIONS
MANUFACTURER	:	BADGER METER INC.
MODEL No.	:	ORION SE WATER METER
SERIAL No.	:	
MODE	:	Tx @ 924.5MHz
SCANS/BAND	:	1
NOTES	:	
TEST DATE	:	22 Mar 2011 10:18:41
ANT. POLARIZ.	:	HORIZONTAL



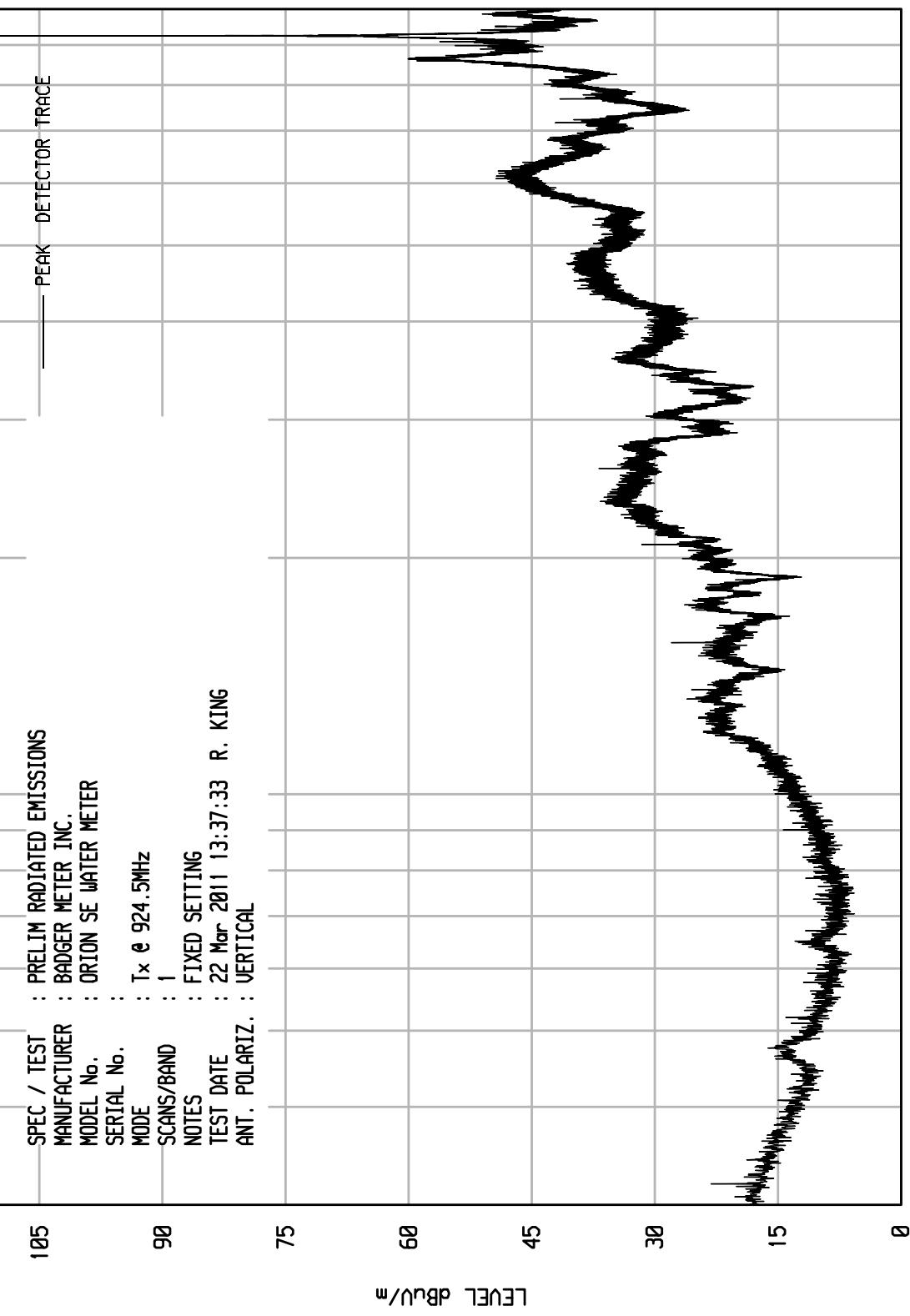
## ELITE ELECTRONIC ENGINEERING Inc.

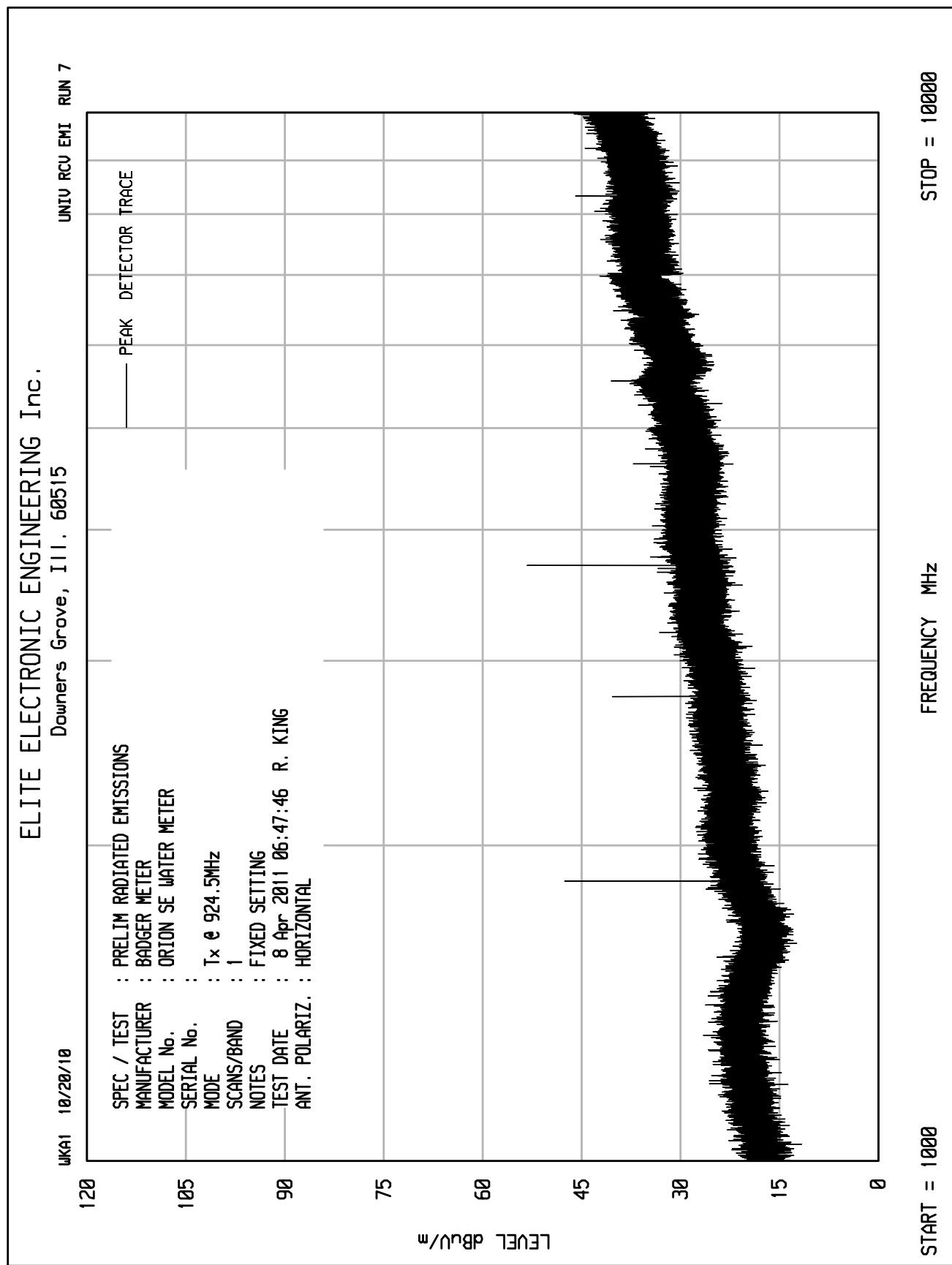
Downers Grove, Ill. 60515

uKA1 10/28/10

UNI U RCU EMI RUN 14

SPEC / TEST	:	PRELIM RADIATED EMISSIONS
MANUFACTURER	:	BADGER METER INC.
MODEL No.	:	ORION SE WATER METER
SERIAL No.	:	
MODE	:	Tx @ 924.5MHz
SCANS/BAND	:	1
NOTES	:	FIXED SETTING
TEST DATE	:	22 Mar 2011 13:37:33 R. KING
ANT. POLARIZ.	:	VERTICAL

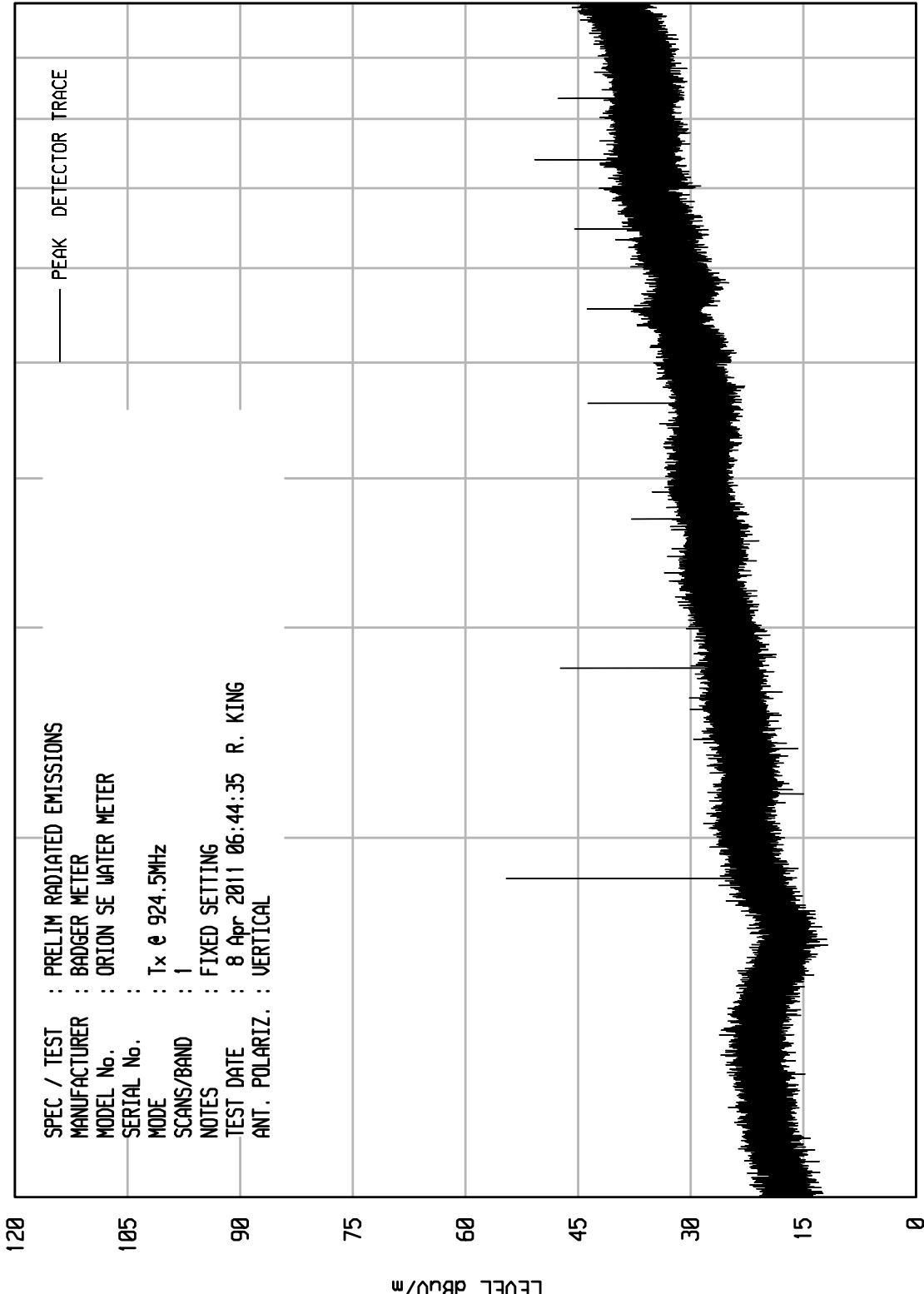




ELITE ELECTRONIC ENGINEERING Inc.  
Downers Grove, Ill. 60515

WKA1 10/28/10

UNIT RCU EMI RUN 6





## DATA PAGE

Manufacturer : Badger Meter, Inc.  
Model No. : Orion SE Water Meter  
Test Specification : FCC Part 15, Subpart C, Section 15.247, Radiated Emissions  
Date : April 8, 2011  
Mode : Transmit @ 904.9MHz  
Power Setting : Mobile Power Setting  
Test Distance : 3 meters  
Notes : Peak Readings in the restricted bands  
: Total = Meter Reading + Cable Loss + Antenna Factor + Preamp Gain

Freq (MHz)	An t Pol	Meter Readin	CBL	Ant	Pre	Total	Total	Limit	Margin (dB)
		g (dBuV)	Fac (dB)	Fac (dB)	Amp (dB)	dBuV/m at 3 M	uV/m at 3M	uV/m at 3M	
2714.7	H	48.0	3.9	30.2	-39.3	42.8	138.0	5000.0	-31.2
2714.7	V	47.2	3.9	30.2	-39.3	42.0	126.0	5000.0	-32.0
3619.6	H	48.2	4.7	33.1	-38.5	47.5	236.4	5000.0	-26.5
3619.6	V	47.5	4.7	33.1	-38.5	46.7	217.1	5000.0	-27.2
4524.5	H	46.6	5.5	33.5	-38.2	47.4	235.1	5000.0	-26.6
4524.5	V	45.8	5.5	33.5	-38.2	46.7	215.4	5000.0	-27.3
7239.2	H	51.7	7.7	37.6	-38.4	58.6	851.7	5000.0	-15.4
7239.2	V	54.5	7.7	37.6	-38.4	61.4	1175.7	5000.0	-12.6
8144.1	H	47.2	8.0	37.9	-38.7	54.3	519.2	5000.0	-19.7
8144.1	V	46.4	8.0	37.9	-38.7	53.5	475.2	5000.0	-20.4
9049.0	H	48.5	8.8	38.3	-38.8	56.8	692.3	5000.0	-17.2
9049.0	V	47.0	8.8	38.3	-38.8	55.3	583.8	5000.0	-18.7

Checked BY *RICHARD E. KING* :

Richard E. King



## DATA PAGE

Manufacturer : Badger Meter, Inc.  
Model No. : Orion SE Water Meter  
Test Specification : FCC Part 15, Subpart C, Section 15.247, Radiated Emissions  
Date : April 8, 2011  
Mode : Transmit @ 904.9MHz  
Power Setting : Mobile Power Setting  
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

Checked BY *RICHARD E. KING* :

Richard E. King



## DATA PAGE

Manufacturer : Badger Meter, Inc.  
Model No. : Orion SE Water Meter  
Test Specification : FCC Part 15, Subpart C, Section 15.247, Radiated Emissions  
Date : April 8, 2011  
Mode : Transmit @ 904.9MHz  
Power Setting : Fixed Power Setting  
Test Distance : 3 meters  
Notes : Peak Readings in the restricted bands  
: Total = Meter Reading + Cable Loss + Antenna Factor + Preamp Gain

Freq (MHz)	An t Pol	Meter Readin	CBL	Ant	Pre	Total	Total	Limit	Margin (dB)
		g (dBuV)	Fac (dB)	Fac (dB)	Amp (dB)	dBuV/m at 3 M	uV/m at 3M	uV/m at 3M	
2714.7	H	73.2	3.9	30.2	-39.3	67.9	2494.4	5000.0	-6.0
2714.7	V	68.3	3.9	30.2	-39.3	63.1	1432.1	5000.0	-10.9
3619.6	H	68.3	4.7	33.1	-38.5	67.6	2391.5	5000.0	-6.4
3619.6	V	59.4	4.7	33.1	-38.5	58.7	856.4	5000.0	-15.3
4524.5	H	63.4	5.5	33.5	-38.2	64.2	1622.5	5000.0	-9.8
4524.5	V	57.4	5.5	33.5	-38.2	58.2	815.0	5000.0	-15.8
7239.2	H	57.4	7.7	37.6	-38.4	64.2	1624.7	5000.0	-9.8
7239.2	V	54.4	7.7	37.6	-38.4	61.3	1156.9	5000.0	-12.7
8144.1	H	54.1	8.0	37.9	-38.7	61.3	1157.0	5000.0	-12.7
8144.1	V	52.5	8.0	37.9	-38.7	59.6	956.8	5000.0	-14.4
9049.0	H	47.7	8.8	38.3	-38.8	56.0	630.7	5000.0	-18.0
9049.0	V	46.3	8.8	38.3	-38.8	54.6	539.3	5000.0	-19.3

Checked BY *RICHARD E. KING* :

Richard E. King



## DATA PAGE

Manufacturer : Badger Meter, Inc.  
Model No. : Orion SE Water Meter  
Test Specification : FCC Part 15, Subpart C, Section 15.247, Radiated Emissions  
Date : April 8, 2011  
Mode : Transmit @ 904.9MHz  
Power Setting : Fixed Power Setting  
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	71.9	3.9	30.2	-39.3	-19.9	46.8	217.8	500.0	-7.2
2714.7	V	66.8	3.9	30.2	-39.3	-19.9	41.6	120.9	500.0	-12.3
3619.6	H	66.5	4.7	33.1	-38.5	-19.9	45.8	195.3	500.0	-8.2
3619.6	V	60.7	4.7	33.1	-38.5	-19.9	40.1	101.1	500.0	-13.9
4524.5	H	60.2	5.5	33.5	-38.2	-19.9	41.1	113.3	500.0	-12.9
4524.5	V	53.4	5.5	33.5	-38.2	-19.9	34.4	52.2	500.0	-19.6
7239.2	H	52.1	7.7	37.6	-38.4	-19.9	39.0	89.5	500.0	-14.9
7239.2	V	47.9	7.7	37.6	-38.4	-19.9	34.8	55.1	500.0	-19.2
8144.1	H	47.5	8.0	37.9	-38.7	-19.9	34.7	54.5	500.0	-19.3
8144.1	V	42.6	8.0	37.9	-38.7	-19.9	29.8	31.1	500.0	-24.1

Checked BY *RICHARD E. KING* :

Richard E. King



## DATA PAGE

Manufacturer : Badger Meter, Inc.  
Model No. : Orion SE Water Meter  
Test Specification : FCC Part 15, Subpart C, Section 15.247, Radiated Emissions  
Date : April 8, 2011  
Mode : Transmit @ 914.45MHz  
Power Setting : Mobile Power Setting  
Test Distance : 3 meters  
Notes : Peak Readings in the restricted bands  
: Total = Meter Reading + Cable Loss + Antenna Factor + Preamp Gain

Freq (MHz)	An t Pol	Meter Readin	CBL	Ant	Pre	Total	Total	Limit	Margin (dB)
		g (dBuV)	Fac (dB)	Fac (dB)	Amp (dB)	dBuV/m at 3 M	uV/m at 3M	uV/m at 3M	
2743.4	H	45.7	3.9	30.3	-39.3	40.6	107.5	5000.0	-33.4
2743.4	V	47.0	3.9	30.3	-39.3	41.9	124.6	5000.0	-32.1
3657.8	H	50.2	4.7	33.2	-38.5	49.6	301.9	5000.0	-24.4
3657.8	V	47.9	4.7	33.2	-38.5	47.3	232.7	5000.0	-26.6
4572.3	H	48.8	5.5	33.7	-38.2	49.8	309.9	5000.0	-24.2
4572.3	V	46.7	5.5	33.7	-38.2	47.7	242.8	5000.0	-26.3
7315.6	H	50.6	7.7	37.8	-38.4	57.6	758.6	5000.0	-16.4
7315.6	V	53.6	7.7	37.8	-38.4	60.7	1079.0	5000.0	-13.3
8230.1	H	48.8	8.1	37.9	-38.7	56.0	630.8	5000.0	-18.0
8230.1	V	45.8	8.1	37.9	-38.7	53.0	447.6	5000.0	-21.0
9144.5	H	45.4	8.7	38.4	-38.7	53.8	487.5	5000.0	-20.2
9144.5	V	47.1	8.7	38.4	-38.7	55.5	596.3	5000.0	-18.5

Checked BY *RICHARD E. KING* :

Richard E. King



## DATA PAGE

Manufacturer : Badger Meter, Inc.  
Model No. : Orion SE Water Meter  
Test Specification : FCC Part 15, Subpart C, Section 15.247, Radiated Emissions  
Date : April 8, 2011  
Mode : Transmit @ 914.45MHz  
Power Setting : Mobile Power Setting  
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)
2743.4	H	34.6	3.9	30.3	-39.3	-19.9	9.6	3.0	500.0	-44.3
2743.4	V	35.0	3.9	30.3	-39.3	-19.9	10.0	3.2	500.0	-44.0
3657.8	H	44.1	4.7	33.2	-38.5	-19.9	23.6	15.1	500.0	-30.4
3657.8	V	40.0	4.7	33.2	-38.5	-19.9	19.5	9.5	500.0	-34.5
4572.3	H	40.5	5.5	33.7	-38.2	-19.9	21.5	11.9	500.0	-32.4
4572.3	V	38.8	5.5	33.7	-38.2	-19.9	19.8	9.8	500.0	-34.1
7315.6	H	43.1	7.7	37.8	-38.4	-19.9	30.2	32.4	500.0	-23.8
7315.6	V	49.2	7.7	37.8	-38.4	-19.9	36.3	65.5	500.0	-17.7
8230.1	H	38.2	8.1	37.9	-38.7	-19.9	25.4	18.7	500.0	-28.5
8230.1	V	36.8	8.1	37.9	-38.7	-19.9	24.1	16.1	500.0	-29.8
9144.5	H	35.9	8.7	38.4	-38.7	-19.9	24.4	16.5	500.0	-29.6
9144.5	V	36.2	8.7	38.4	-38.7	-19.9	24.6	17.1	500.0	-29.3

Checked BY *RICHARD E. KING* :

---

Richard E. King





## DATA PAGE

Manufacturer : Badger Meter, Inc.  
Model No. : Orion SE Water Meter  
Test Specification : FCC Part 15, Subpart C, Section 15.247, Radiated Emissions  
Date : April 8, 2011  
Mode : Transmit @ 914.45MHz  
Power Setting : Fixed Power Setting  
Test Distance : 3 meters  
Notes : Peak Readings in the restricted bands  
: Total = Meter Reading + Cable Loss + Antenna Factor + Preamp Gain

Freq (MHz)	An t Pol	Meter Readin		CBL	Ant	Pre	Total	Total	Limit
		g (dBuV)	Fac (dB)	Fac (dB)	Amp (dB)	dBuV/m at 3 M	uV/m at 3M	uV/m at 3M	Margin (dB)
2743.5	H	70.6	3.9	30.3	-39.3	65.6	1896.7	5000.0	-8.4
2743.5	V	64.8	3.9	30.3	-39.3	59.7	971.6	5000.0	-14.2
3658.0	H	72.5	4.7	33.2	-38.5	71.9	3943.1	5000.0	-2.1
3658.0	V	65.1	4.7	33.2	-38.5	64.5	1684.0	5000.0	-9.5
4572.5	H	60.9	5.5	33.7	-38.2	61.9	1242.4	5000.0	-12.1
4572.5	V	58.3	5.5	33.7	-38.2	59.2	916.8	5000.0	-14.7
7316.0	H	50.6	7.7	37.8	-38.4	57.6	759.6	5000.0	-16.4
7316.0	V	53.3	7.7	37.8	-38.4	60.3	1036.5	5000.0	-13.7
8230.5	H	54.3	8.1	37.9	-38.7	61.5	1193.7	5000.0	-12.4
8230.5	V	54.6	8.1	37.9	-38.7	61.8	1224.4	5000.0	-12.2
9145.0	H	49.0	8.7	38.4	-38.7	57.4	742.1	5000.0	-16.6
9145.0	V	45.3	8.7	38.4	-38.7	53.7	485.8	5000.0	-20.2

Checked BY *RICHARD E. KING* :

Richard E. King



## DATA PAGE

Manufacturer : Badger Meter, Inc.  
Model No. : Orion SE Water Meter  
Test Specification : FCC Part 15, Subpart C, Section 15.247, Radiated Emissions  
Date : April 8, 2011  
Mode : Transmit @ 914.45MHz  
Power Setting : Fixed Power Setting  
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	69.3	3.9	30.3	-39.3	-19.9	44.4	165.6	500.0	-9.6
2743.5	V	63.1	3.9	30.3	-39.3	-19.9	38.1	80.4	500.0	-15.9
3658.0	H	70.1	4.7	33.2	-38.5	-19.9	49.6	300.5	500.0	-4.4
3658.0	V	63.2	4.7	33.2	-38.5	-19.9	42.7	136.9	500.0	-11.3
4572.5	H	58.2	5.5	33.7	-38.2	-19.9	39.2	91.6	500.0	-14.7
4572.5	V	55.1	5.5	33.7	-38.2	-19.9	36.2	64.3	500.0	-17.8
7316.0	H	42.8	7.7	37.8	-38.4	-19.9	29.9	31.4	500.0	-24.0
7316.0	V	46.8	7.7	37.8	-38.4	-19.9	33.9	49.6	500.0	-20.1
8230.5	H	48.2	8.1	37.9	-38.7	-19.9	35.5	59.7	500.0	-18.5
8230.5	V	47.2	8.1	37.9	-38.7	-19.9	34.5	53.3	500.0	-19.5
9145.0	H	37.8	8.7	38.4	-38.7	-19.9	26.3	20.6	500.0	-27.7
9145.0	V	36.1	8.7	38.4	-38.7	-19.9	24.6	17.0	500.0	-29.3

Checked BY *RICHARD E. KING* :

---

Richard E. King



## DATA PAGE

Manufacturer : Badger Meter, Inc.  
Model No. : Orion SE Water Meter  
Test Specification : FCC Part 15, Subpart C, Section 15.247, Radiated Emissions  
Date : April 8, 2011  
Mode : Transmit @ 923.7MHz  
Power Setting : Mobile Power Setting  
Test Distance : 3 meters  
Notes : Peak Readings in the restricted bands  
: Total = Meter Reading + Cable Loss + Antenna Factor + Preamp Gain

Freq (MHz)	An t Pol	Meter Readin	CBL	Ant	Pre	Total	Total	Limit	Margin (dB)
		g (dBuV)	Fac (dB)	Fac (dB)	Amp (dB)	dBuV/m at 3 M	uV/m at 3M	uV/m at 3M	
2771.0	H	46.6	4.0	30.4	-39.2	41.7	120.9	5000.0	-32.3
2771.0	V	45.9	4.0	30.4	-39.2	41.0	112.0	5000.0	-33.0
3694.6	H	49.4	4.8	33.3	-38.5	48.9	279.7	5000.0	-25.0
3694.6	V	48.1	4.8	33.3	-38.5	47.6	240.2	5000.0	-26.4
4618.3	H	47.9	5.6	33.8	-38.2	49.0	283.1	5000.0	-24.9
4618.3	V	47.9	5.6	33.8	-38.2	49.1	284.4	5000.0	-24.9
7389.2	H	50.3	7.7	37.9	-38.5	57.4	745.5	5000.0	-16.5
7389.2	V	52.5	7.7	37.9	-38.5	59.7	963.7	5000.0	-14.3
8312.9	H	49.2	8.2	37.9	-38.8	56.5	668.8	5000.0	-17.5
8312.9	V	48.6	8.2	37.9	-38.8	55.9	621.3	5000.0	-18.1

Checked BY

RICHARD E. KING

Richard E. King



## DATA PAGE

Manufacturer : Badger Meter, Inc.  
Model No. : Orion SE Water Meter  
Test Specification : FCC Part 15, Subpart C, Section 15.247, Radiated Emissions  
Date : April 8, 2011  
Mode : Transmit @ 923.7MHz  
Power Setting : Mobile Power Setting  
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	36.6	4.0	30.4	-39.2	-19.9	11.8	3.9	500.0	-42.2
2771.0	V	35.2	4.0	30.4	-39.2	-19.9	10.4	3.3	500.0	-43.6
3694.6	H	43.5	4.8	33.3	-38.5	-19.9	23.2	14.4	500.0	-30.8
3694.6	V	40.1	4.8	33.3	-38.5	-19.9	19.7	9.7	500.0	-34.3
4618.3	H	41.0	5.6	33.8	-38.2	-19.9	22.3	13.0	500.0	-31.7
4618.3	V	40.3	5.6	33.8	-38.2	-19.9	21.6	12.0	500.0	-32.4
7389.2	H	43.7	7.7	37.9	-38.5	-19.9	30.9	35.3	500.0	-23.0
7389.2	V	43.7	7.7	37.9	-38.5	-19.9	30.9	35.3	500.0	-23.0
8312.9	H	39.0	8.2	37.9	-38.8	-19.9	26.3	20.7	500.0	-27.7
8312.9	V	39.2	8.2	37.9	-38.8	-19.9	26.6	21.3	500.0	-27.4

Checked BY *RICHARD E. KING* :

Richard E. King



## DATA PAGE

Manufacturer : Badger Meter, Inc.  
Model No. : Orion SE Water Meter  
Test Specification : FCC Part 15, Subpart C, Section 15.247, Radiated Emissions  
Date : April 8, 2011  
Mode : Transmit @ 924.45MHz  
Power Setting : Fixed Power Setting  
Test Distance : 3 meters  
Notes : Peak Readings in the restricted bands  
: Total = Meter Reading + Cable Loss + Antenna Factor + Preamp Gain

Freq (MHz)	An t Pol	Meter Readin	CBL	Ant	Pre	Total	Total	Limit	
		g (dBuV)	Fac (dB)	Fac (dB)	Amp (dB)	dBuV/m at 3 M	uV/m at 3M	uV/m at 3M	Margin (dB)
2773.5	H	71.6	4.0	30.4	-39.2	66.7	2151.7	5000.0	-7.3
2773.5	V	68.0	4.0	30.4	-39.2	63.1	1436.4	5000.0	-10.8
3698.0	H	68.1	4.8	33.3	-38.5	67.6	2405.6	5000.0	-6.4
3698.0	V	60.7	4.8	33.3	-38.5	60.2	1028.5	5000.0	-13.7
4622.5	H	58.0	5.6	33.8	-38.2	59.2	911.2	5000.0	-14.8
4622.5	V	54.3	5.6	33.8	-38.2	55.5	593.8	5000.0	-18.5
7396.0	H	50.5	7.7	37.9	-38.5	57.7	765.8	5000.0	-16.3
7396.0	V	52.6	7.7	37.9	-38.5	59.8	976.3	5000.0	-14.2
8320.5	H	53.0	8.2	37.9	-38.8	60.2	1028.2	5000.0	-13.7
8320.5	V	52.2	8.2	37.9	-38.8	59.4	936.7	5000.0	-14.5

Checked BY

RICHARD E. KING

Richard E. King



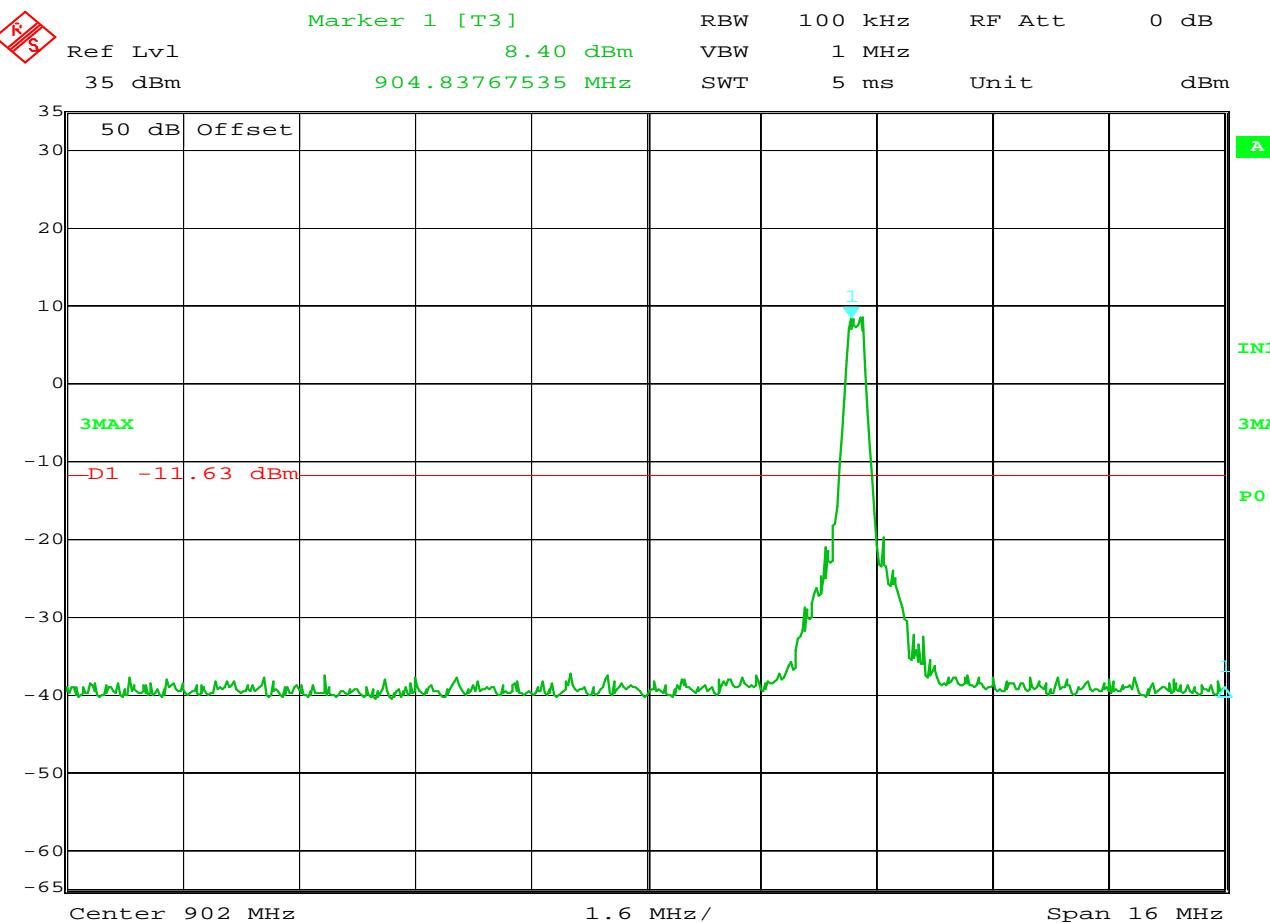
## DATA PAGE

Manufacturer : Badger Meter, Inc.  
Model No. : Orion SE Water Meter  
Test Specification : FCC Part 15, Subpart C, Section 15.247, Radiated Emissions  
Date : April 8, 2011  
Mode : Transmit @ 924.45MHz  
Power Setting : Fixed Power Setting  
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	70.1	4.0	30.4	-39.2	-19.9	45.3	185.0	500.0	-8.6
2773.5	V	66.2	4.0	30.4	-39.2	-19.9	41.4	116.9	500.0	-12.6
3698.0	H	65.9	4.8	33.3	-38.5	-19.9	45.5	188.0	500.0	-8.5
3698.0	V	57.8	4.8	33.3	-38.5	-19.9	37.4	74.5	500.0	-16.5
4622.5	H	54.8	5.6	33.8	-38.2	-19.9	36.0	63.2	500.0	-18.0
4622.5	V	50.4	5.6	33.8	-38.2	-19.9	31.7	38.4	500.0	-22.3
7396.0	H	43.3	7.7	37.9	-38.5	-19.9	30.5	33.7	500.0	-23.4
7396.0	V	45.2	7.7	37.9	-38.5	-19.9	32.5	42.2	500.0	-21.5
8320.5	H	46.1	8.2	37.9	-38.8	-19.9	33.5	47.4	500.0	-20.5
8320.5	V	43.9	8.2	37.9	-38.8	-19.9	31.3	36.7	500.0	-22.7

Checked BY RICHARD E. KING :

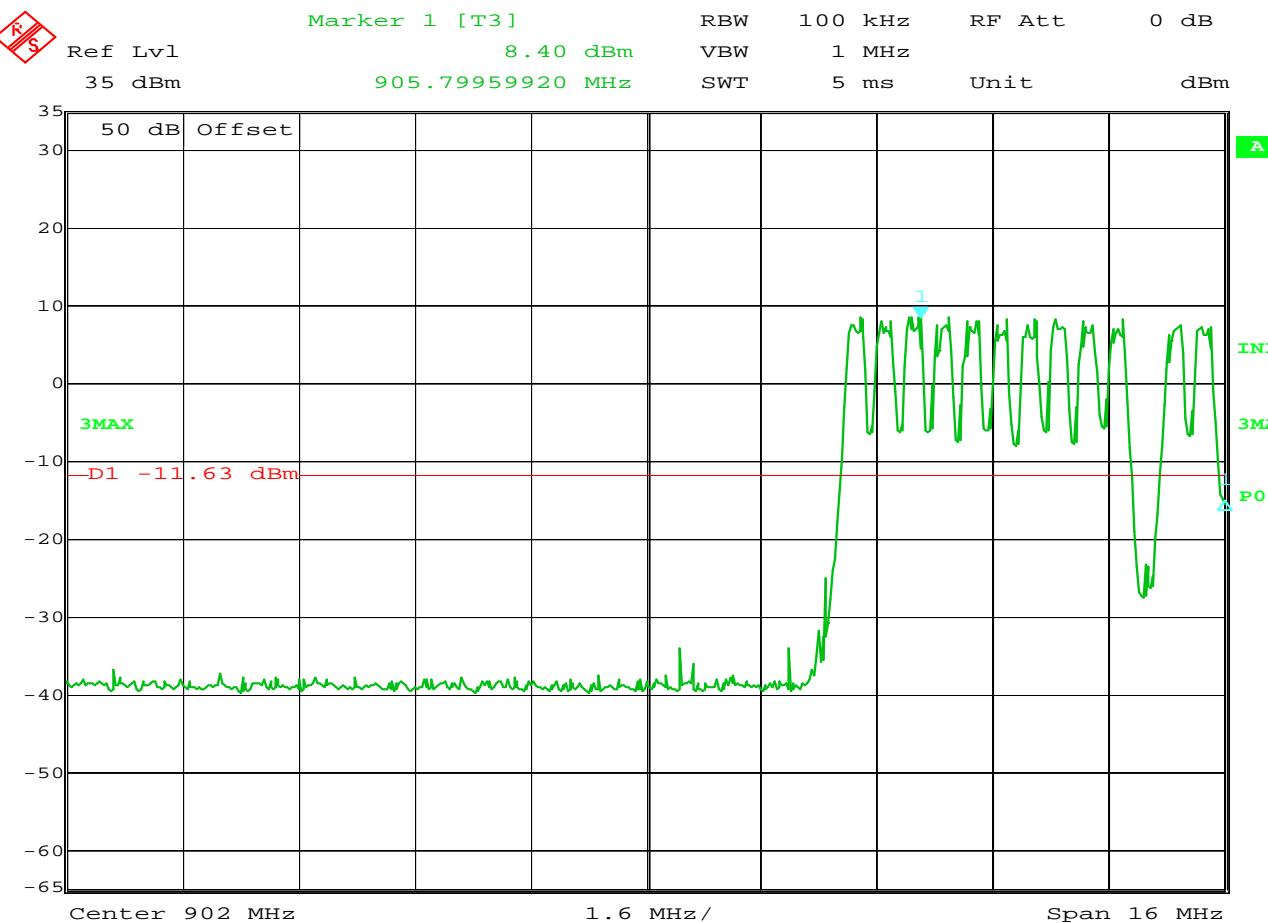
Richard E. King



Date: 21.MAR.2011 10:56:25

#### 15.247(d) Band Edge Compliance

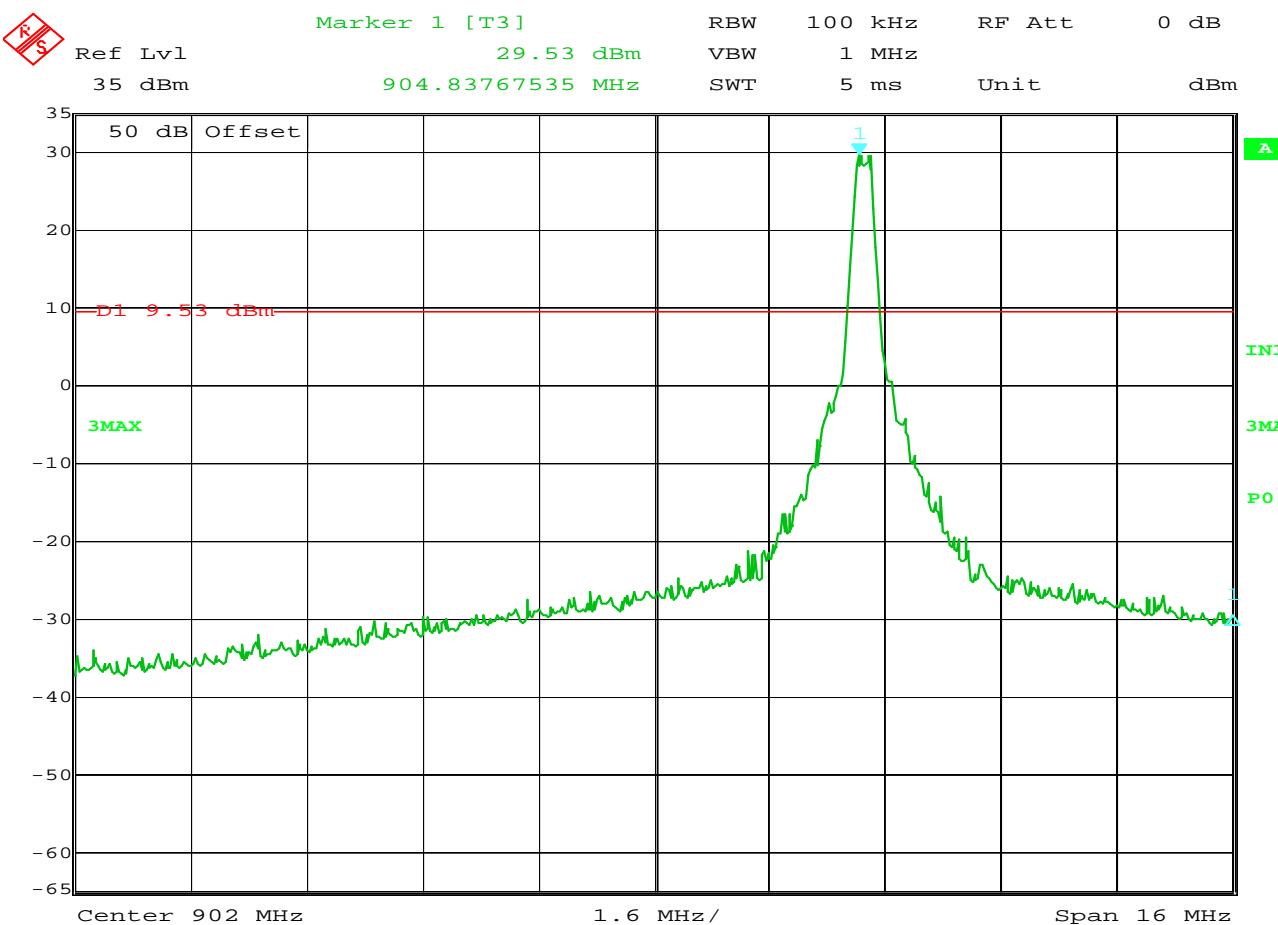
MANUFACTURER : Badger Meter  
 MODEL NUMBER : Orion SE Water Meter  
 SERIAL NUMBER : None Assigned  
 TEST MODE : Tx @ 904.9MHz  
 TEST DATE : March 21, 2011  
 TEST PARAMETERS : Band Edge Test  
 NOTES : Display Line D1 represents the 20dB down point from the peak emissions in a 100kHz bandwidth. The center line represents the band edge (902MHz).  
 NOTES : Mobile Power Setting



Date: 21.MAR.2011 10:54:35

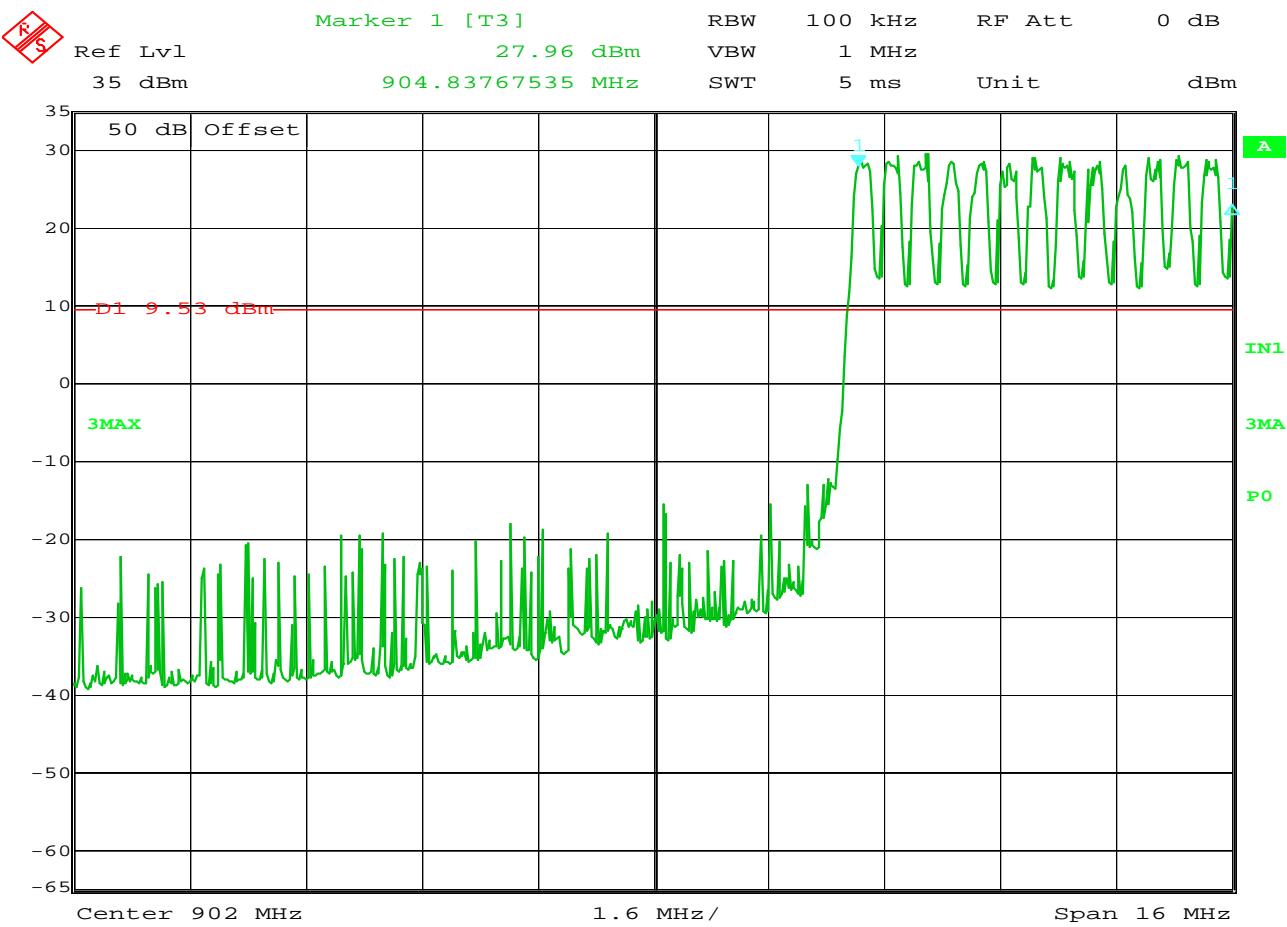
#### 15.247(d) Band Edge Compliance

MANUFACTURER : Badger Meter  
 MODEL NUMBER : Orion SE Water Meter  
 SERIAL NUMBER : None Assigned  
 TEST MODE : Hopping Enabled  
 TEST DATE : March 21, 2011  
 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

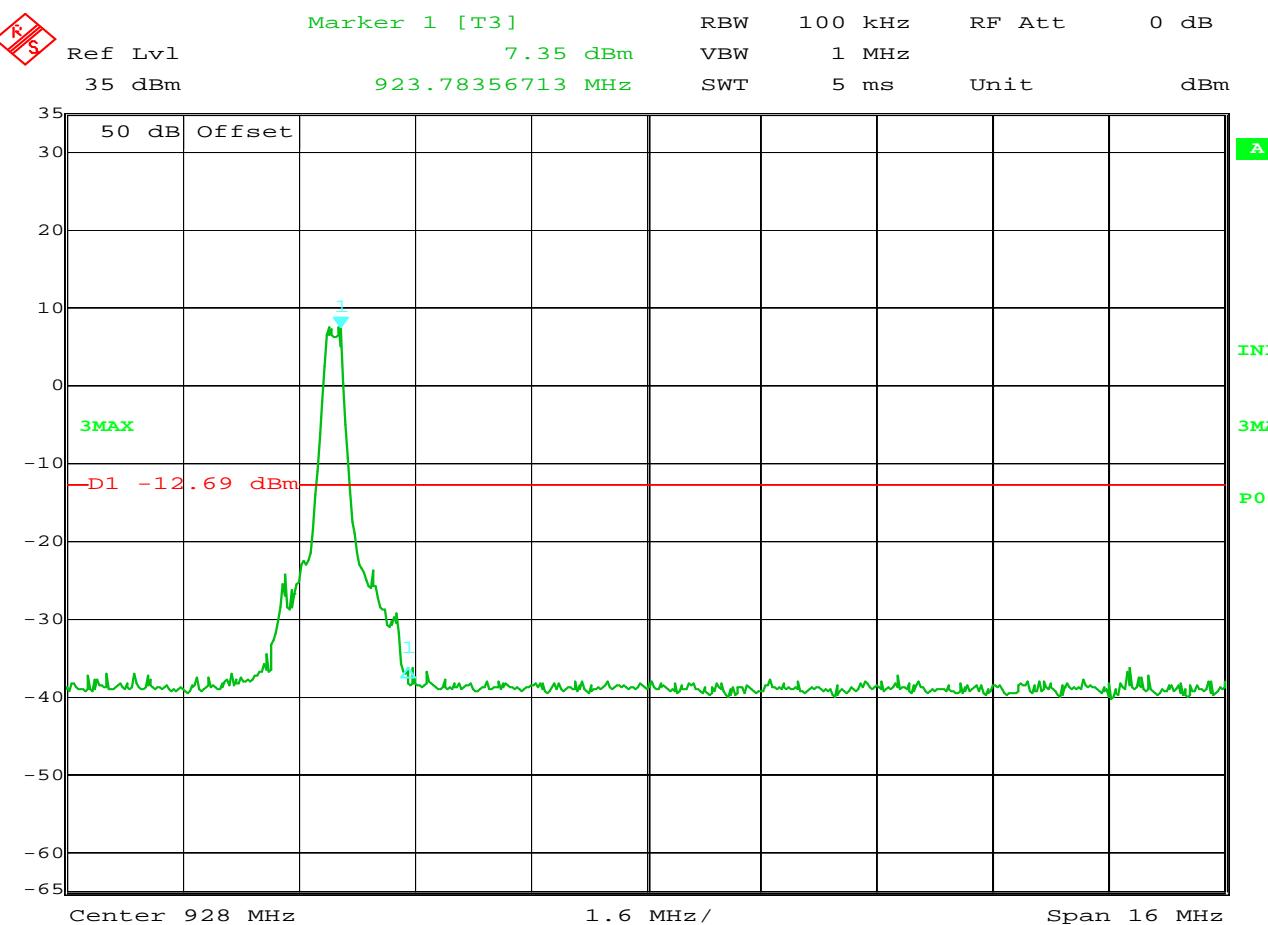
MANUFACTURER : Badger Meter  
 MODEL NUMBER : Orion SE Water Meter  
 SERIAL NUMBER : None Assigned  
 TEST MODE : Tx @ 904.9MHz  
 TEST DATE : March 21, 2011  
 TEST PARAMETERS : Band Edge Test  
 NOTES : Display Line D1 represents the 20dB down point from the peak emissions in a 100kHz bandwidth. The center line represents the band edge (902MHz).  
 NOTES : Fixed Power Setting



Date: 21.MAR.2011 11:01:01

#### 15.247(d) Band Edge Compliance

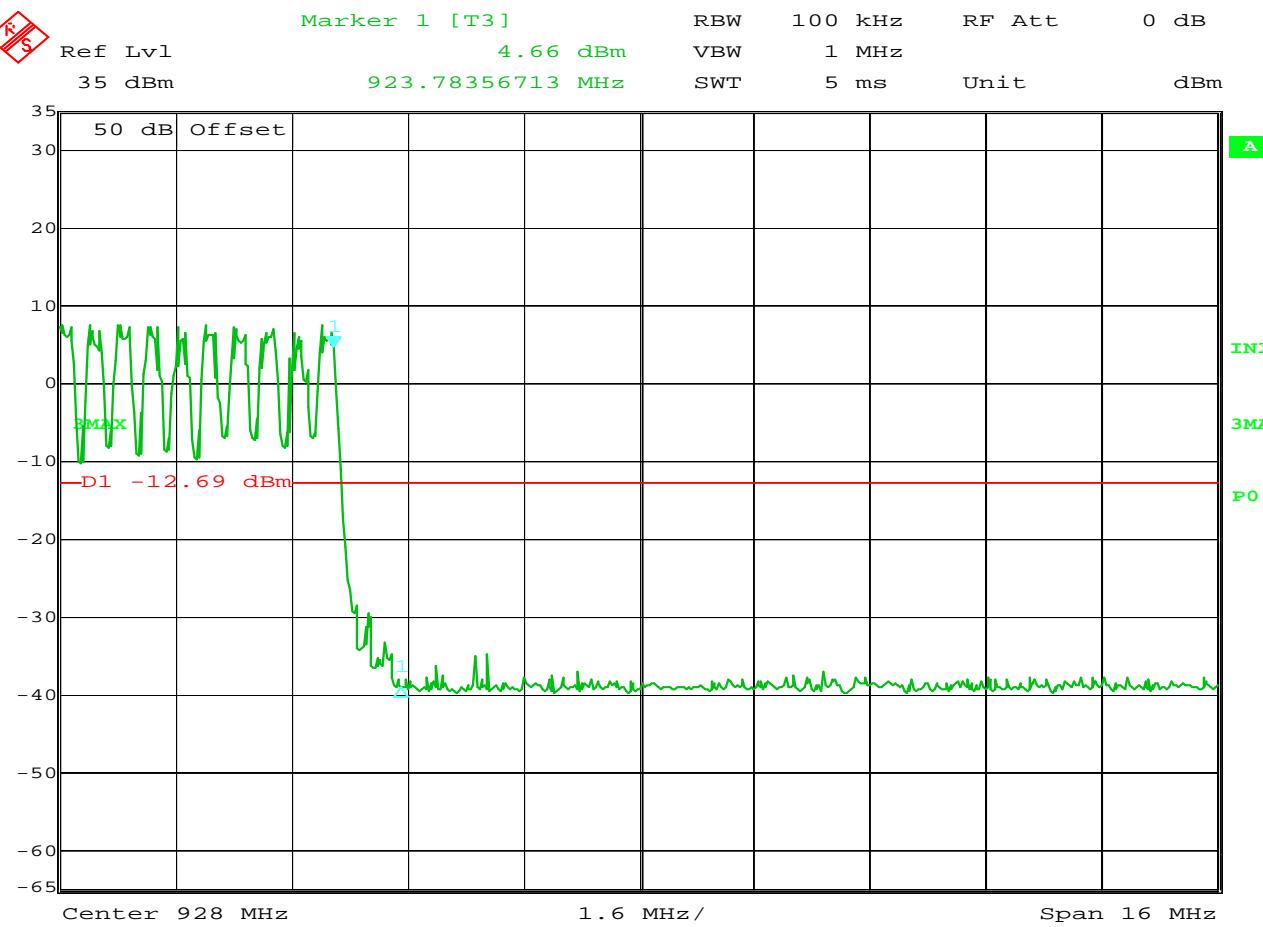
MANUFACTURER : Badger Meter  
 MODEL NUMBER : Orion SE Water Meter  
 SERIAL NUMBER : None Assigned  
 TEST MODE : Hopping Enabled  
 TEST DATE : March 21, 2011  
 TEST PARAMETERS : Band Edge Test  
 NOTES : Display Line D1 represents the 20dB down point from the peak emissions in a 100kHz bandwidth. The center line represents the band edge (902MHz).  
 NOTES : Fixed Power Setting



Date: 21.MAR.2011 10:48:34

#### 15.247(d) Band Edge Compliance

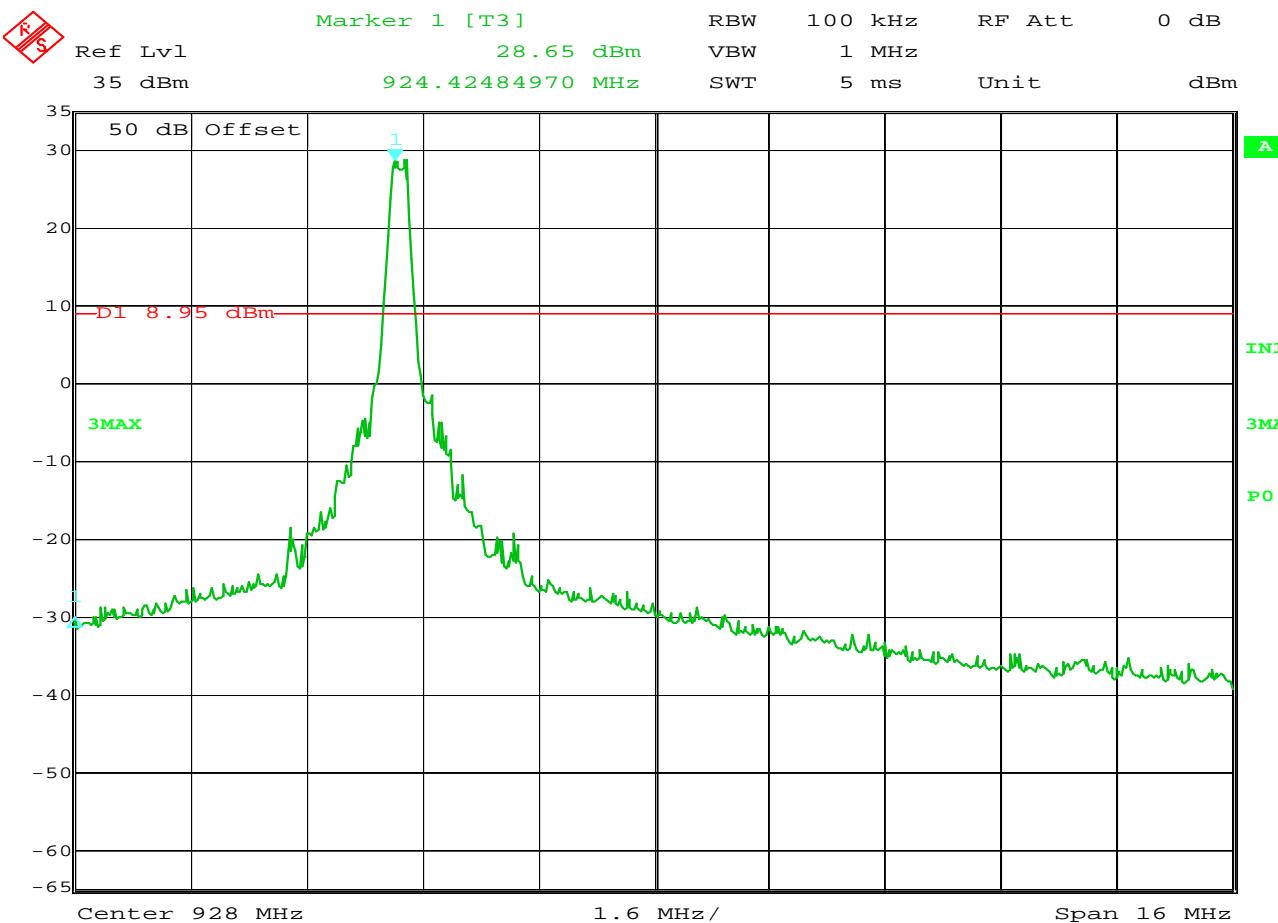
MANUFACTURER : Badger Meter  
 MODEL NUMBER : Orion SE Water Meter  
 SERIAL NUMBER : None Assigned  
 TEST MODE : Tx @ 923.7MHz  
 TEST DATE : March 21, 2011  
 TEST PARAMETERS : Band Edge Test  
 NOTES : Display Line D1 represents the 20dB down point from the peak emissions in a 100kHz bandwidth. The center line represents the band edge (902MHz).  
 NOTES : Mobile Power Setting



Date: 21.MAR.2011 10:51:58

#### 15.247(d) Band Edge Compliance

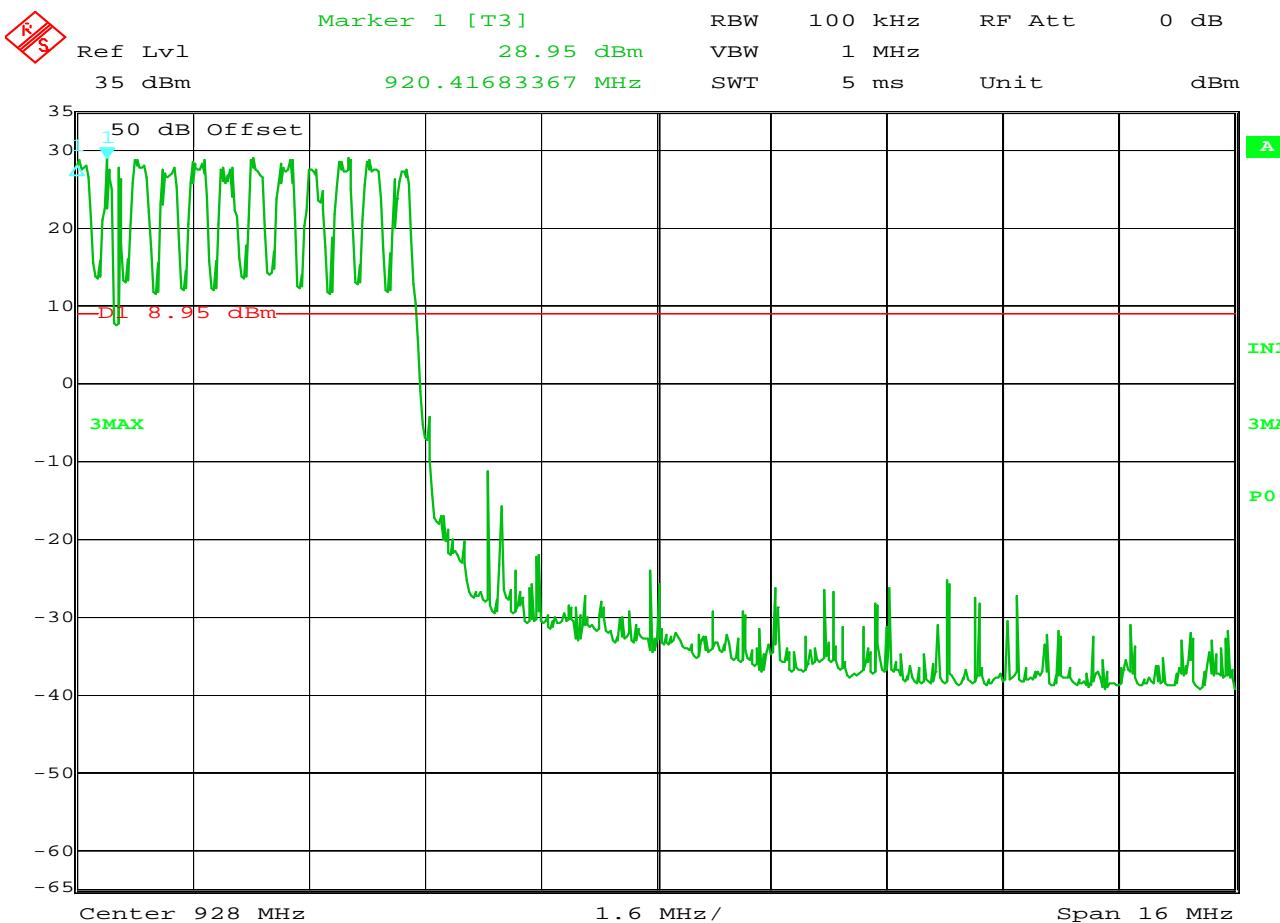
MANUFACTURER : Badger Meter  
 MODEL NUMBER : Orion SE Water Meter  
 SERIAL NUMBER : None Assigned  
 TEST MODE : Hopping Enabled  
 TEST DATE : March 21, 2011  
 TEST PARAMETERS : Band Edge Test  
 NOTES : Display Line D1 represents the 20dB down point from the peak emissions in a 100kHz bandwidth. The center line represents the band edge (902MHz).  
 NOTES : Mobile Power Setting



Date: 21.MAR.2011 11:04:47

#### 15.247(d) Band Edge Compliance

MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	Orion SE Water Meter
SERIAL NUMBER	:	None Assigned
TEST MODE	:	Tx @ 924.45MHz
TEST DATE	:	March 21, 2011
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



Date: 21.MAR.2011 11:02:57

#### 15.247(d) Band Edge Compliance

MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	Orion SE Water Meter
SERIAL NUMBER	:	None Assigned
TEST MODE	:	Hopping Enabled
TEST DATE	:	March 21, 2011
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