Measurement of RF Interference from an Orion SE Gateway Transceiver

For : Badger Meter, Inc.
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: Milwaukee, WI

P.O. No. : 560842
Date Tested : October 15 - 18, 2012
Test Personnel : Ian F Carnegie
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
: FCC “Code of Federal Regulations” Title 47, Part15,
: Subpart 15B, Section 15.107 and 15.109 for Receivers
: Industry Canada RSS-210
: Industry Canada RSS-GEN

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REVISION HISTORY

Revision	Date	Description
—	Nov 20, 2012	Initial release

Measurement of RF Emissions from an Orion SE Gateway Transceiver

1 INTRODUCTION

1.1 Scope of Tests

This document represents the results of the series of radio interference measurements performed on a Badger Meter, Inc. Orion SE Gateway Transceiver, Serial No. 231, (hereinafter referred to as the EUT). The EUT is a frequency hopping spread spectrum transceiver. The transceiver was designed to transmit and receive in the 902-928 MHz band using an external antenna. The EUT contained a super-heterodyne type receiver which utilizes an intermediate frequency (IF) of 56.6 kHz. The EUT was manufactured and submitted for testing by Badger Meter, Inc. located in Milwaukee, WI.

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 B, Sections 15.107 and 15.109, for receivers and Subpart C, Sections 15.207 and 15.249 for Intentional Radiators Operating within the 902-928 MHz band.

The test series was also performed to determine if the EUT meets the conducted and radiated RF emission requirements of the Industry Canada Radio Standards Specification, RSS-Gen, Section 7.2.2 and Section 7.2.3 for receivers and 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 C63.4-2009.

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 33%.

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, Subparts B and C, dated October 2012
- ANSI C63.4-2009, "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, June 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, June 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 Gateway Transceiver. A block diagram of the EUT setup is shown as Figure 1.

3.1.1 Power Input

The EUT obtained 24VDC from a Phihong AC Power Adapter, Model No. PSAA60M-240, via 100 feet of 4 wire cable (4 wires to the EUT were tied together to the 2 wire output wires of the AC Power Adapter. These 4 wires were used to provide 24VDC to 2 different points on the EUT.) The Phihong AC Power Adapter was powered with 115V, 60Hz via a 1.8 meter long, 3-wire power cable. For conducted emissions tests, the high and low leads were connected through a line impedance stabilization network (LISN) which was located on the copper ground plane. The network complies with the requirements of Paragraph 4.1.2 of ANSI C63.4-2001.

The EUT was also alternately powered by a Power Over Ethernet (referred to as POE) adapter which was used in testing the EUT while supplied from either supply.

3.1.2 Peripheral Equipment

Equipment	Description
EUT Stand	A 80cm tall stand for mounting the EUT
Dell Laptop	Dell Latitude E5512 Laptop for setting each mode on the EUT
POE	**P**ower **O**ver **E**thernet brick for powering the EUT over Ethernet lines.
Phihong AC Power Adapter	Standard 120VAC 60Hz to DC power brick

No peripheral equipment was submitted with the EUT.

3.1.3 Interconnect Cables

No interconnect cables were submitted with the EUT.

3.1.4 Grounding

The EUT was grounded only through the third wire of its input power cord.

3.2 Operational Mode

For all tests, the EUT was placed on an 80cm high stand. The EUT was energized. The unit was programmed to operate in one of the following modes:

- Transmit at 904.9MHz (Channel 1)
- Transmit at 914.5MHHz (Channel 25)
- Transmit at 924.5MHHz (Channel 50)
- Receive at 904.9MHz (Channel 1)
- Receive at 914.5MHHz (Channel 25)
- Receive at 924.5MHHz (Channel 50)
- Frequency Hopping Enabled

In order to make the EUT go into each mode, a laptop with Badger Meter provided software (Gateway Configuration Tool, version 1.5.0.6) was used to manually configure the EUT.

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 C63.4-2009 for site attenuation.

4.2 Test Instrumentation

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

Conducted emission tests were performed with a spectrum analyzer in conjunction with a quasi-peak adapter. Radiated emissions were performed with a spectrum analyzer. This receiver allows measurements with the bandwidths specified by the FCC and with the quasi-peak and average detector functions.

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 Receiver

5.1.1 Powerline Conducted Emissions

5.1.1.1 Requirements

Per the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart B, 15.107(a) and Industry Canada RSS-Gen Section 7.2.2, all radio frequency voltages on the power lines of a receiver shall be below the values shown below when using a quasi-peak or average detector:

CONDUCTED LIMITS FOR A RECEIVER

Frequency MHz	RFI Voltage dBuV(QP)	RFI Voltage dBuV(Average)
0.15-0.5	66 decreasing with logarithm of frequency to 56	56 decreasing with logarithm of frequency to 46
0.5-5	56	46

5-30	60	50

Note 1: The lower limit shall apply at the transition frequencies.
Note 2: If the levels measured using the QP detector meet both the QP and the Average limits, the EUT is considered to have met both requirements and measurements do not need to be performed using the Average detector.

5.1.1.2 Procedures

The interference on each power lead of the EUT was measured by connecting the measuring equipment to the appropriate meter terminal of the Line Impedance Stabilization Network (LISN). The meter terminal of the LISN not under test was terminated with 50 ohms.

a) The EUT was operated in the Receive mode.

b) Measurements were first made on the 120V, 60Hz high line of the Phihong AC Power Adapter.

c) The frequency range from 150 kHz to 30 MHz was broken up into smaller frequency sub-bands.

d) Conducted emissions measurements were taken on the first frequency sub-band using a peak detector.

e) The data thus obtained was then searched by the computer for the highest levels. Any emissions levels that were within 10dB of the average limit were then measured again using both a quasi-peak detector and an average detector. (If no peak readings were within 10dB of the average limit, quasi-peak and average readings were taken on the highest emissions levels measured during the peak detector scan.)

f) Steps (d) and (e) were repeated for the remainder of the frequency sub-bands until the entire frequency range from 150kHz to 30MHz was investigated. The peak trace was automatically plotted. The plot also shows quasi-peak and average readings that were taken on discrete frequencies. A table showing the quasi-peak and average readings was also generated. This tabular data compares the quasi-peak and average conducted emissions to the applicable conducted emissions limits.

g) Steps (c) through (f) were repeated on the 120V, 60Hz return line of the Phihong AC Power Adapter.

h) Steps (b) through (g) were repeated on the lines of the POE Power Adapter.

5.1.1.3 Results

The tabular data and the plots of the peak, quasi-peak, and average conducted voltage levels acquired from each input power line with the EUT operated in the Receive mode are shown on pages 24 and 31. All power line conducted emissions measured from the EUT were within the specification limits. The emissions level closest to the limit (worst case) occurred at 0.401 MHz. The emissions level at this frequency was 3 dB within the limit and was noted on Line 2 with the AC/DC power converter only. Photographs of the test configuration which yielded the highest or worst case, conducted emission levels are shown on Figure 2.

5.1.2 Radiated Measurements

5.1.2.1 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.

5.1.2.2 Procedures

Testing was performed separately on a low, middle, and high channel. The emissions in the frequency range of 30MHz to 5GHz were measured and plotted using a 'screen-dump' utility. 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 C63.4-2009 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 1 GHz 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 1 GHz 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 1 GHz were made using a quasi-peak detector and a broadband bilog antenna. Measurements above 1 GHz 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.

5.1.2.3 Results

The preliminary plots are presented on pages 32 through 55. The plots are presented for a reference only, and are not used to determine compliance. The final radiated levels are presented on page 56 through 67. 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 Transmitter

5.2.1 Powerline Conducted Emissions

5.2.1.1 Requirements

Per the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Per 15.207(a) and Industry Canada RSS-Gen section 7.2.2, all radio frequency voltages on the power lines of a transmitter shall be below the values shown below when using a quasi-peak or average detector:

Frequency MHz	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 – 0.5	66 decreasing with logarithm of frequency to 56	56 decreasing with logarithm of frequency to 46
0.5 – 5	56	46
5 – 30	60	50

Note 1: The lower limit shall apply at the transition frequencies.
Note 2: If the levels measured using the QP detector meet both the QP and the Average limits, the test item is considered to have met both requirements and measurements do not need to be performed using the Average detector.

5.2.1.1 Procedures

The interference on each power lead of the EUT was measured by connecting the measuring equipment to the appropriate meter terminal of the Line Impedance Stabilization Network (LISN). The meter terminal of the LISN not under test was terminated with 50 ohms.

a) The EUT was operated in the Transmit at 914.5MHz mode.

b) Measurements were first made on the 120V, 60Hz high line of the Phihong AC Adapter.

c) The frequency range from 150 kHz to 30 MHz was broken up into smaller frequency sub-bands.

d) Conducted emissions measurements were taken on the first frequency sub-band using a peak detector.

e) The data thus obtained was then searched by the computer for the highest levels. Any emissions levels that were within 10dB of the average limit were then measured again using both a quasi-peak detector and an average detector. (If no peak readings were within 10dB of the average limit, quasi-peak and average readings were taken on the highest emissions levels measured during the peak detector scan.)

f) Steps (d) and (e) were repeated for the remainder of the frequency sub-bands until the entire frequency range from 150 kHz to 30MHz was investigated. The peak trace was automatically plotted. The plot also shows quasi-peak and average readings that were taken on discrete frequencies. A table showing the quasi-peak and average readings was also generated. This tabular data compares the quasi-peak and average conducted emissions to the applicable conducted emissions limits.

g) Steps (c) through (f) were repeated on the 120V, 60Hz return line of the Phihong AC Adapter.

5.2.1.1 Results

The plots and tabular data of the peak, quasi-peak, and average conducted voltage levels acquired from each input power line with the EUT operated in the Transmit at 914.5MHz mode are shown on pages 68 and 77. All power line conducted emissions measured from the EUT were within the specification limits. The emissions level closest to the limit (worst case) occurred at 477kHz. The emissions level at this frequency was 1.2dB within the limit. Photographs of the test configuration which yielded the highest or worst case, conducted emission levels are shown on Figure 2.

5.2.2 20dB Bandwidth

5.2.2.1 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 902-928 MHz band, the 20 dB bandwidth shall be measured for determination of the carrier frequency separation limits and must not exceed 500 kHz. If the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping channels. If the 20dB bandwidth of the hopping channel is 250 kHz or greater (but not greater than 500 kHz), the system shall use at least 25 hopping channels.

5.2.2.2 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 ≥ 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.

5.2.2.3 Results

The plots on pages 78 through 80 show that the maximum 20 dB bandwidth was 134.26 kHz. The 99% bandwidth was measured to be 110.2 kHz. Therefore, since the 20dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping channels.

5.2.3 Carrier Frequency Separation

5.2.3.1 Requirements

Per section 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.

5.2.3.2 Procedures

The EUT was setup inside the chamber. 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.

5.2.3.3 Results

Page 81 shows the carrier frequency separation. As can be seen from this plot, the carrier frequency separation is 400.8 kHz, which is greater than the 20dB bandwidth.

5.2.4 Number of Hopping Frequencies

5.2.4.1 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.

5.2.4.2 Procedures

The EUT was setup inside the chamber. 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 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.

5.2.4.3 Results

Page 82 shows the number of hopping frequencies. As can be seen from this plot, the number of hopping frequencies is 50 which is equal to minimum number of required hopping frequencies for systems with a 20dB bandwidth less than 250kHz.

5.2.5 Time of Occupancy

5.2.5.1 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 less than 250kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period.

5.2.5.2 Procedures

The EUT was setup inside the chamber. 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 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 20 seconds to capture the number of hops in the appropriate sweep time. A single sweep was made. 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.

5.2.5.3 Results

Pages 83 and 85 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) multiplied by (# of hops). This calculated value is equal to 0.398 seconds, which is less than the 0.4 seconds maximum allowed.

5.2.6 Antenna Conducted Peak Output Power

5.2.6.1 Requirements

Per section 15.247(b)(2), for frequency hopping systems operating in the 902-928MHz band and employing at least 50 hopping channels, 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.

5.2.6.2 Procedures

The output of the EUT was connected to the spectrum analyzer through 60dB 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.

5.2.6.3 Results

The results are presented on pages 86 through 88. The maximum peak conducted output power from the transmitter was 830mW (29.2dBm) which is below the 1 Watt limit.

5.2.7 Effective Isotropic Radiated Power (EIRP)

5.2.7.1 Requirements

Per section 15.247(b)(2), for frequency hopping systems operating in the 902-928MHz band and employing at least 50 hopping channels, 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 4 W (36 dBm). If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below 30dBm by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.2.7.2 Procedures

The EUT was placed on the 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.

5.2.7.3 Results

The results are presented on page 89. The maximum EIRP measured from the transmitter was 32 dBm or 1.6 W

which is below the 4 Watt limit.

5.2.8 Antenna Conducted Spurious Emissions

5.2.8.1 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.

5.2.8.2 Procedures

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

5.2.8.3 Results

The results of the antenna conducted emissions levels were plotted. These plots are presented on pages 90 through 92. These plots show that the spurious emissions were at least 20 dB below the level of the fundamental.

5.2.9 Radiated Spurious Emissions Measurements

5.2.9.1 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

5.2.9.2 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 1 GHz, 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).

5.2.9.3 Results

Preliminary radiated emissions plots with the EUT transmitting at low, middle, and high hopping frequencies are shown on pages 93 through 110. Final radiated emissions data are presented on data pages 111 through 117. 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 Figures 3 and Figure 4.

5.2.10 Band Edge Compliance

5.2.10.1 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.

5.2.10.2 Procedures

5.2.10.2.1 Low Band Edge

1) The EUT was setup inside the test chamber on a stand.

2) A broadband measuring antenna was placed at a test distance of 3 meters from the EUT.

3) The EUT was set to transmit continuously at the channel closest to the low band-edge (hopping function disabled).
4) The EUT was maximized for worst case emissions at the measuring antenna. The maximum meter reading was recorded.
5) 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) =100kHz.
    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.
6) Step 5) was repeated with the frequency hopping function enabled.

5.2.10.2.2 High Band Edge

1) The EUT was set up inside the test chamber on a stand.
2) A broadband measuring antenna was placed at a test distance of 3 meters from the EUT.
3) The EUT was set to transmit continuously at the channel closest to the high band-edge (hopping function disabled).
4) The EUT was maximized for worst case emissions at the measuring antenna.
5) 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 = 100kHz.
    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.
6) Step 5) was repeated with the frequency hopping function enabled.

5.2.10.3 Results

Pages 118 through 121 show the radiated 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 Gateway frequency hopping spread transceiver, Serial No. 231, did fully meet the conducted and radiated emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart B, Sections 15.107 and 15.109 for receivers and Subpart C, Sections 15.207 and 15.247 for Intentional Radiators Operating within the 902-928 MHz band, when tested per ANSI C63.4-2009.

It was also determined that the Badger Meter, Inc. Orion SE Gateway frequency hopping spread spectrum transceiver, Serial No. 231, did fully meet the conducted and radiated RF emission requirements of the Industry Canada Radio Standards Specification, RSS-Gen, Section 7.2.2 and Section 7.2.3 for receivers and 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 C63.4-2009.

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	8/22/2012	8/22/2013
CDW3	COMPUTER			004		N/A	
CDY0	WORKSTATION	ELITE	WORKSTATION			N/A	
GSE0	SIGNAL GENERATOR (40GHZ)	RHODE & SCHWARZ	SMB100A	175137	100KHZ-40GHZ	7/30/2012	7/30/2013
NTA2	BILOG ANTENNA	TESEQ	6112D	28040	25-1000MHz	7/30/2012	7/30/2013
NWH0	RIDGED WAVE GUIDE	TENSOR	4105	2081	1-12.4GHZ	11/3/2011	11/3/2012
PLF1	CISPR16 50UH LISN	ELITE	CISPR16/70A	001	.15-30MHz	6/20/2012	6/20/2013
PLF3	CISPR16 50UH LISN	ELITE	CISPER16/70A	003	.15-30MHz	6/20/2012	6/20/2013
RBB0	EMI TEST RECEIVER 20HZ TO 40 GHZ	ROHDE & SCHWARZ	ESIB40	100250	20 HZ TO 40GHZ	3/5/2012	3/5/2013
T1D2	10DB 20W ATTENUATOR	NARDA	768-10	6	DC-11GHZ	1/6/2012	1/6/2013
T1E1	10DB 25W ATTENUATOR	WEINSCHEL	46-10-43	AU1883	DC-18GHZ	8/6/2012	8/6/2013
T2D1	20DB, 25W ATTENUATOR	WEINSCHEL	46-20-43	AV5814	DC-18GHZ	1/3/2012	1/3/2013
T2S7	20DB 25W ATTENUATOR	WEINSCHEL	46-20-34	BU8139	DC-18GHZ	1/3/2012	1/3/2013
XLT8	5W, 50 OHM TERMINATION	JFW INDUSTRIES	50T-052	009	DC-2GHZ	1/6/2012	1/6/2013
XPQ3	HIGH PASS FILTER	K&L MICROWAVE	4IH30-1804/T10000-0	4	1.8GHZ-10GHZ	11/15/2011	11/15/2012

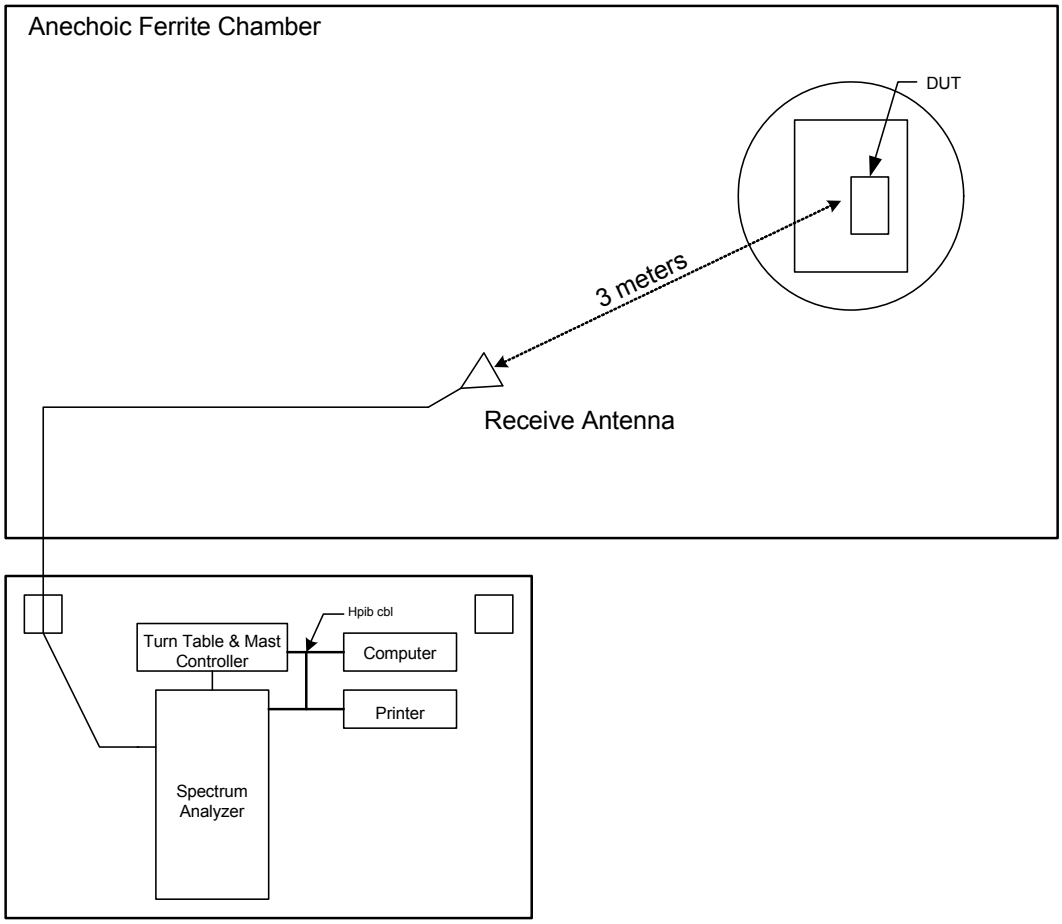
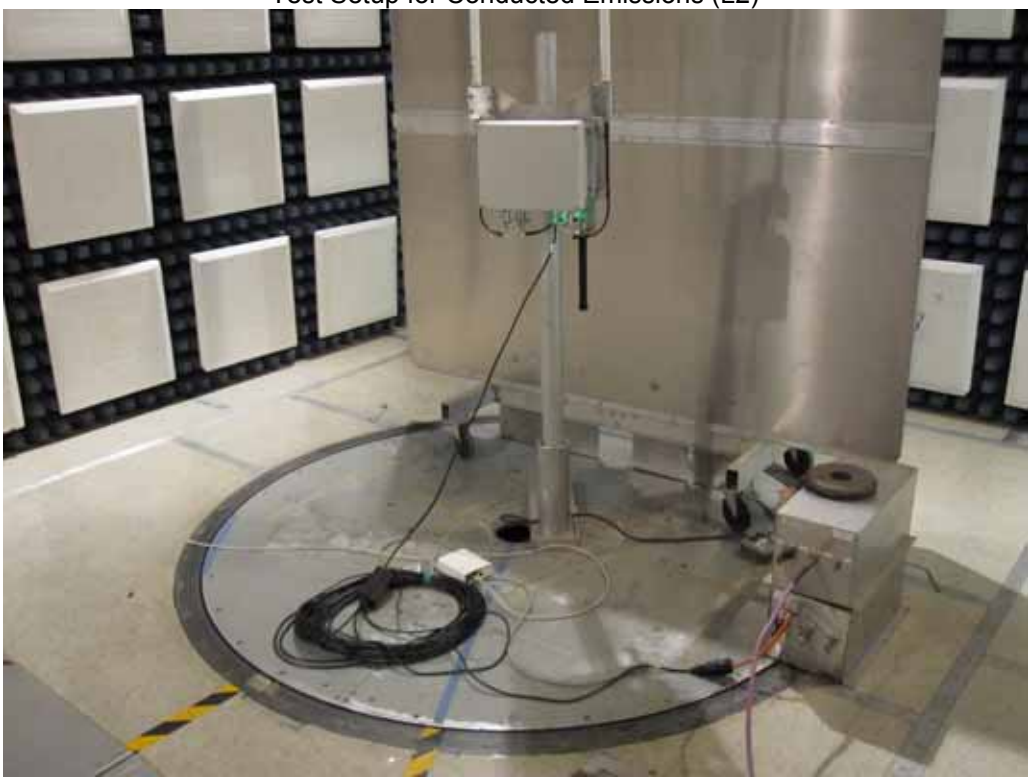


FIGURE 1 BLOCKDIAGRAM OF TEST SETUP

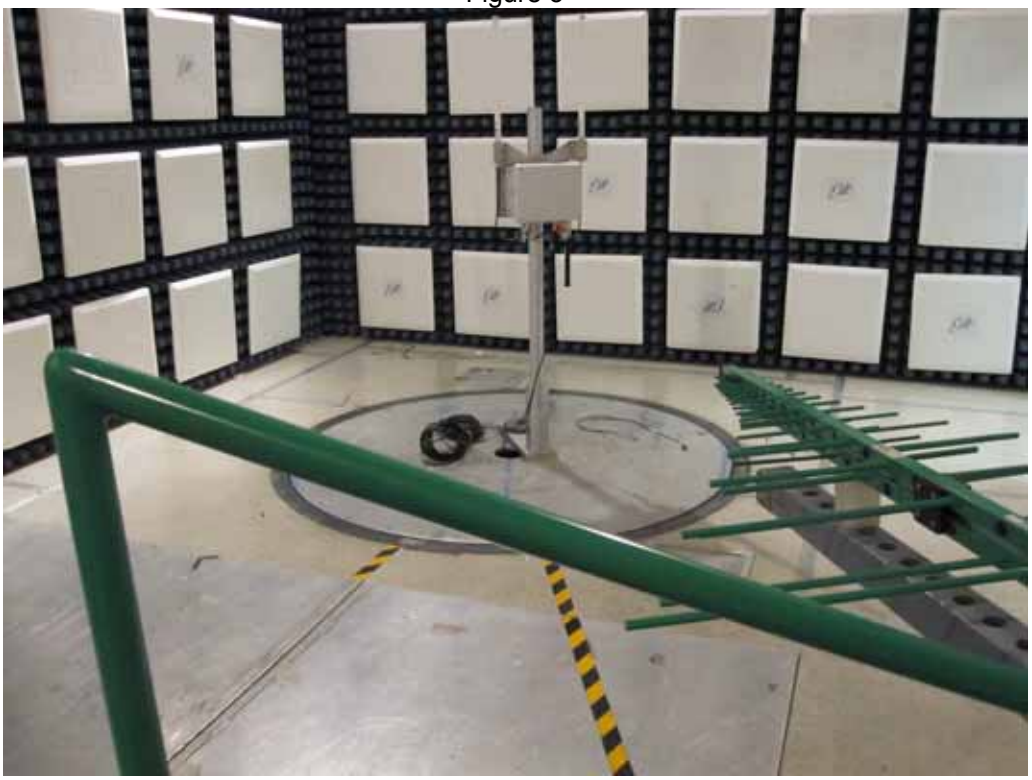
Figure 2

Test Setup for Conducted Emissions (L2)



Test Setup for Conducted Emissions (L1)

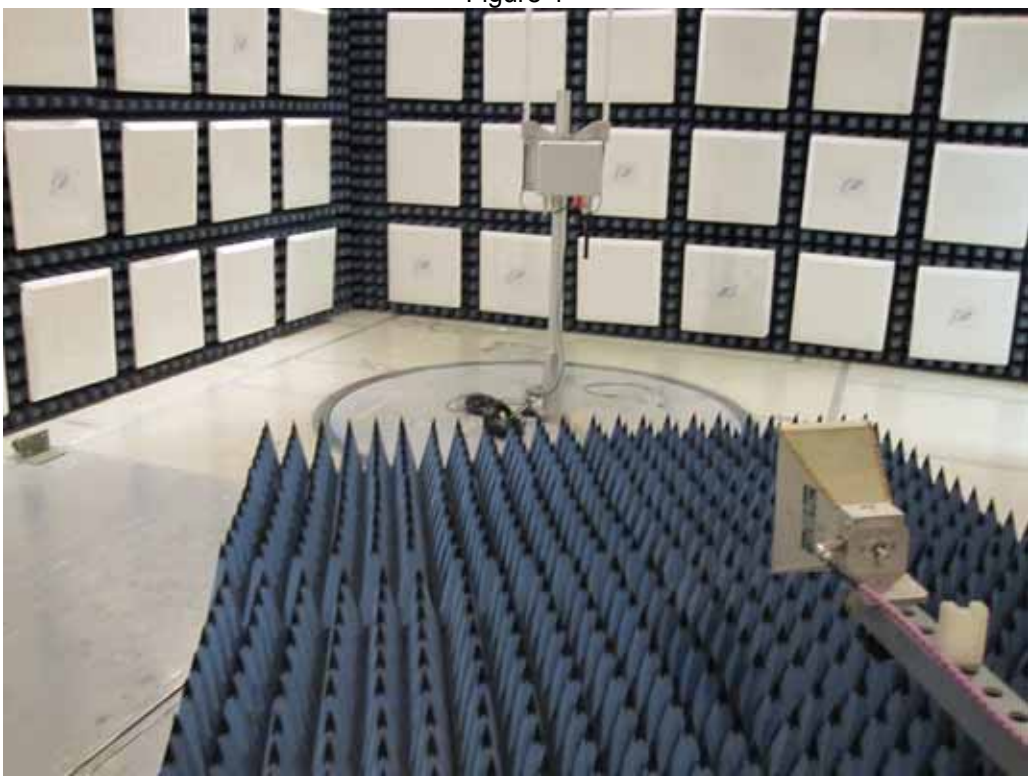
Figure 3



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

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

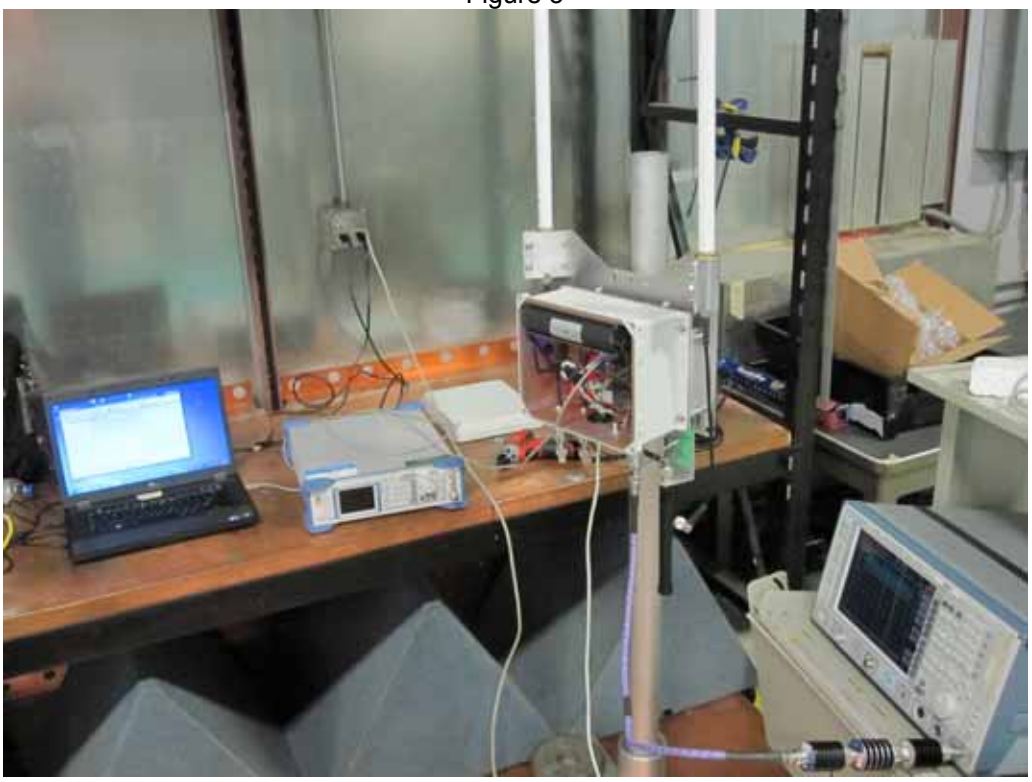
Figure 4



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

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

Figure 5



Direct Antenna Port Setup

Direct Antenna Port Setup

FCC Part 15 Subpart B Conducted Emissions Test

Significant Emissions Data

VB** 02/09/2011

Manufacturer	:	BADGER METER
Model	:	ORION SE GATEWAY
DUT Revision	:	BEAD ON ETHERNET LINE
Serial Number	:	
DUT Mode	:	Rx [ACDC]
Line Tested	:	120V 60Hz L1
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-10
Notes	:	AC/DC Converter w/ Clamp on AC
Test Engineer	:	I. Carnegie
Limit	:	Class B
Test Date	:	Oct 15, 2012 01:27:12 PM
Data Filter	:	Up to 80 maximum levels detected with 6 dB level excursion threshold over 10 dB margin below limit

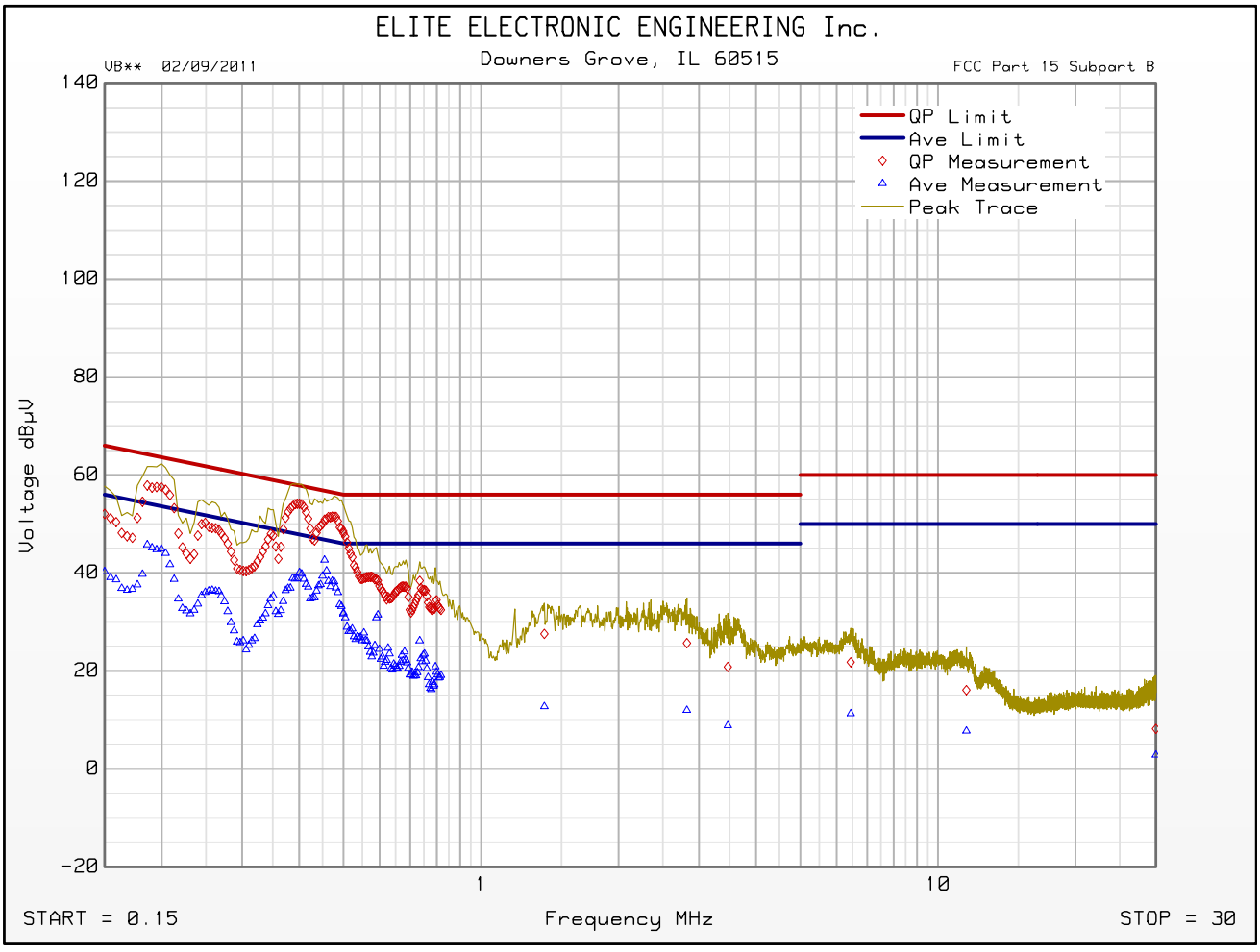
Freq MHz	Quasi-peak Level dBµV	Quasi-peak Limit dBµV	Excessive Quasi-peak Emissions	Average Level dBµV	Average Limit dBµV	Excessive Average Emissions
0.186	57.9	64.2		45.8	54.2	
0.200	57.5	63.6		44.9	53.6	
0.387	53.7	58.1		39.0	48.1	
0.401	54.1	57.8		40.1	47.8	
0.455	50.9	56.8		42.6	46.8	
0.473	51.5	56.5		38.3	46.5	
0.477	51.5	56.4		38.2	46.4	
0.500	48.1	56.0		31.9	46.0	
0.799	34.5	56.0		19.8	46.0	
1.376	27.6	56.0		12.7	46.0	
2.822	25.7	56.0		12.0	46.0	
3.469	20.8	56.0		8.8	46.0	
6.445	21.8	60.0		11.3	50.0	
11.543	16.1	60.0		7.8	50.0	
29.998	8.2	60.0		2.9	50.0	

FCC Part 15 Subpart B Conducted Emissions Test

Cumulative Data

VB** 02/09/2011

Manufacturer	:	BADGER METER
Model	:	ORION SE GATEWAY
DUT Revision	:	BEAD ON ETHERNET LINE
Serial Number	:	
DUT Mode	:	Rx [ACDC]
Line Tested	:	120V 60Hz L1
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-10
Notes	:	AC/DC Converter w/ Clamp on AC
Test Engineer	:	I. Carnegie
Limit	:	Class B
Test Date	:	Oct 15, 2012 01:27:12 PM



Emissions Meet QP Limit
Emissions Meet Ave Limit

FCC Part 15 Subpart B Conducted Emissions Test

Significant Emissions Data

VB** 02/09/2011

Manufacturer	:	BADGER METER
Model	:	ORION SE GATEWAY
DUT Revision	:	BEAD ON ETHERNET LINE
Serial Number	:	
DUT Mode	:	Rx [ACDC]
Line Tested	:	120V 60Hz L2
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-10
Notes	:	AC/DC Converter w/ Clamp on AC
Test Engineer	:	I. Carnegie
Limit	:	Class B
Test Date	:	Oct 15, 2012 01:19:05 PM
Data Filter	:	Up to 80 maximum levels detected with 6 dB level excursion threshold over 10 dB margin below limit

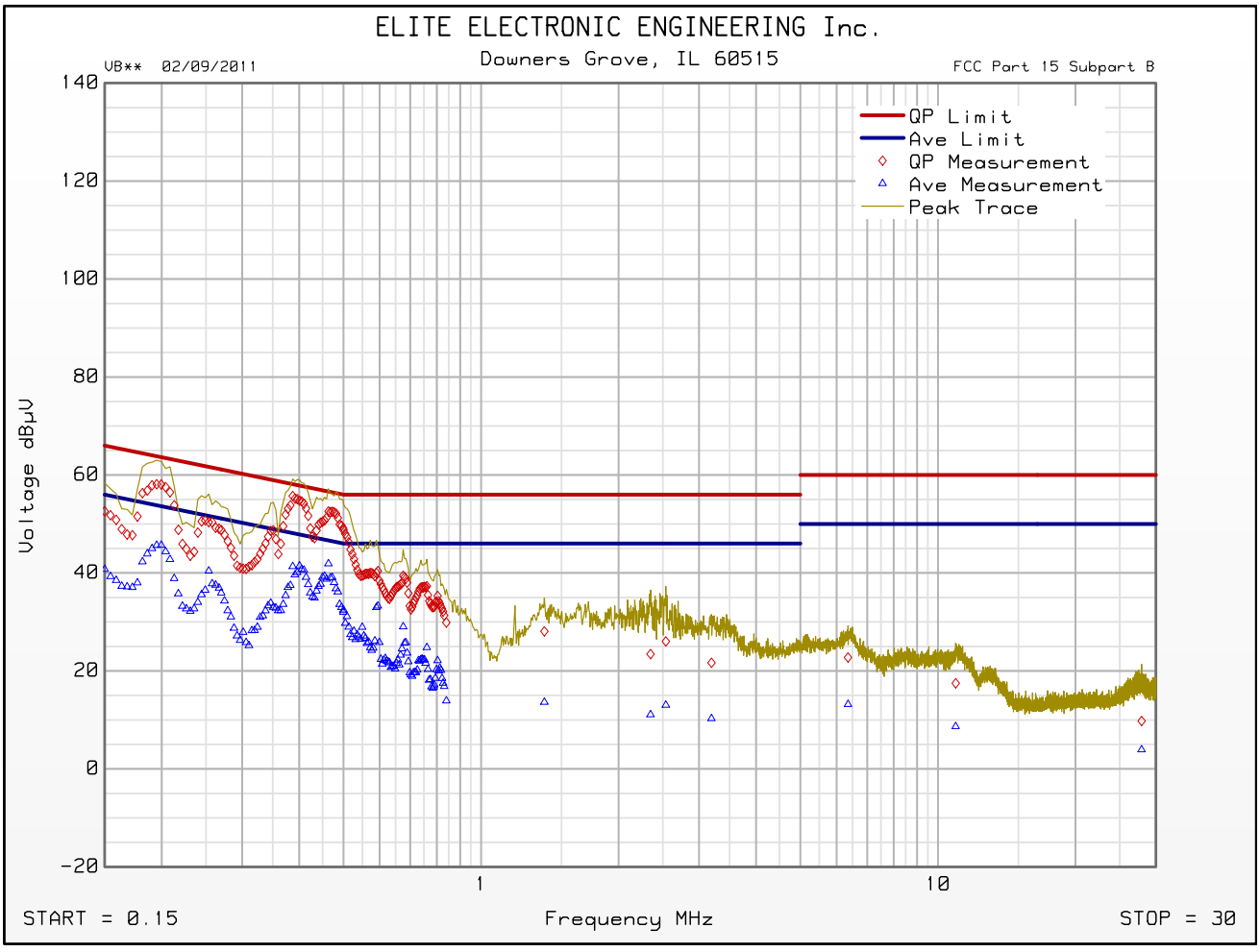
Freq MHz	Quasi-peak Level dBµV	Quasi-peak Limit dBµV	Excessive Quasi-peak Emissions	Average Level dBµV	Average Limit dBµV	Excessive Average Emissions
0.200	58.1	63.6		45.7	53.6	
0.387	55.7	58.1		41.3	48.1	
0.396	55.1	57.9		40.1	47.9	
0.401	54.8	57.8		41.5	47.8	
0.455	50.7	56.8		39.4	46.8	
0.464	52.6	56.6		41.9	46.6	
0.473	52.5	56.5		39.1	46.5	
0.500	48.7	56.0		32.5	46.0	
0.804	35.3	56.0		22.1	46.0	
1.376	28.1	56.0		13.6	46.0	
2.538	26.0	56.0		13.0	46.0	
3.194	21.7	56.0		10.3	46.0	
6.355	22.8	60.0		13.2	50.0	
10.935	17.5	60.0		8.7	50.0	
27.910	9.8	60.0		3.9	50.0	

FCC Part 15 Subpart B Conducted Emissions Test

Cumulative Data

VB** 02/09/2011

Manufacturer	:	BADGER METER
Model	:	ORION SE GATEWAY
DUT Revision	:	BEAD ON ETHERNET LINE
Serial Number	:	
DUT Mode	:	Rx [ACDC]
Line Tested	:	120V 60Hz L2
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-10
Notes	:	AC/DC Converter w/ Clamp on AC
Test Engineer	:	I. Carnegie
Limit	:	Class B
Test Date	:	Oct 15, 2012 01:19:05 PM



Emissions Meet QP Limit
Emissions Meet Ave Limit

FCC Part 15 Subpart B Conducted Emissions Test

Significant Emissions Data

VB** 02/09/2011

Manufacturer	:	BADGER METER
Model	:	ORION SE GATEWAY
DUT Revision	:	BEAD ON ETHERNET LINE
Serial Number	:	
DUT Mode	:	Rx [POE]
Line Tested	:	120V 60Hz L1
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-10
Notes	:	POE POWER
Test Engineer	:	I. Carnegie
Limit	:	Class B
Test Date	:	Oct 15, 2012 09:19:08 AM
Data Filter	:	Up to 80 maximum levels detected with 6 dB level excursion threshold over 10 dB margin below limit

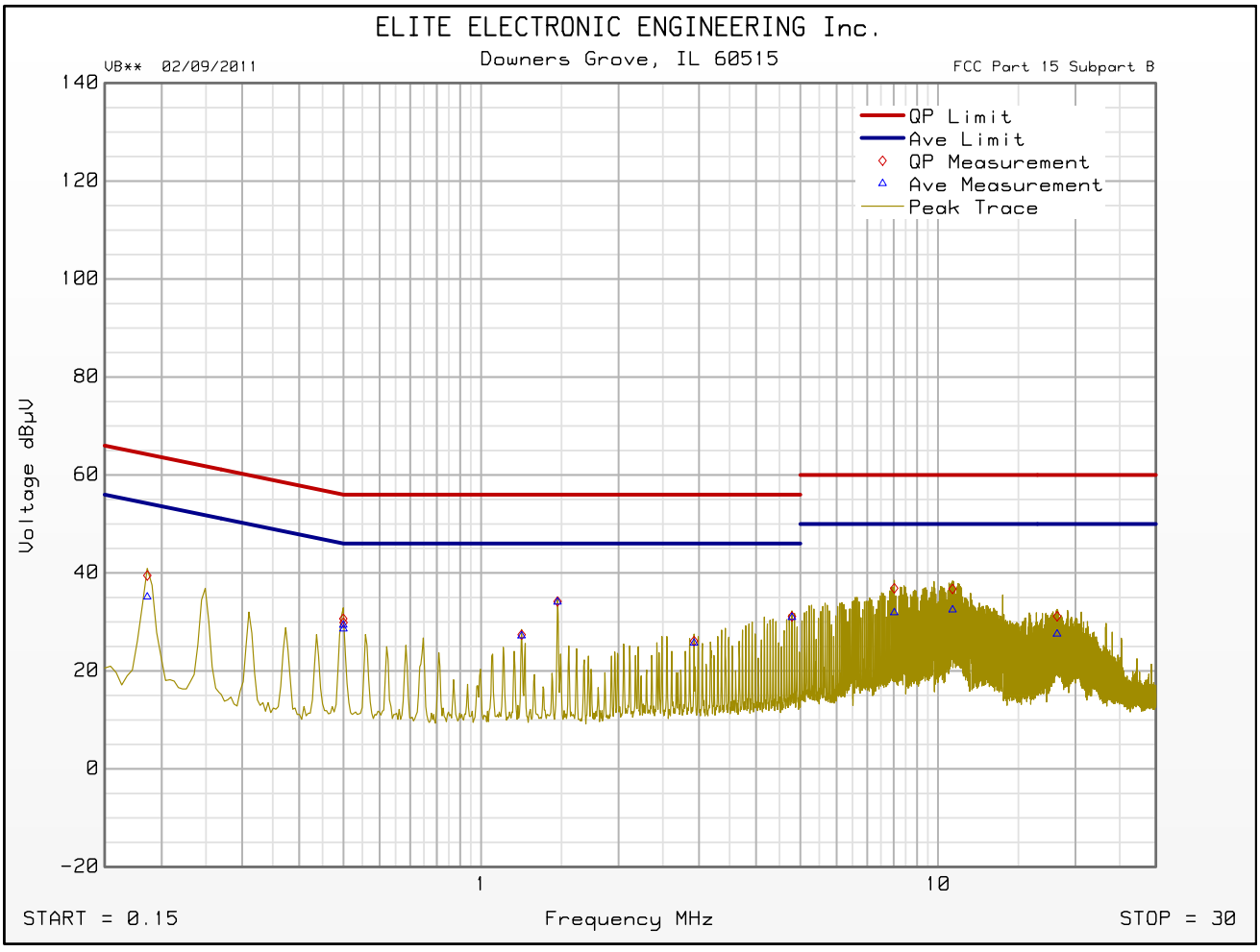
Freq MHz	Quasi-peak Level dBµV	Quasi-peak Limit dBµV	Excessive Quasi-peak Emissions	Average Level dBµV	Average Limit dBµV	Excessive Average Emissions
0.186	39.5	64.2		35.1	54.2	
0.500	30.7	56.0		29.4	46.0	
0.500	29.9	56.0		28.6	46.0	
1.227	27.4	56.0		27.2	46.0	
1.471	34.2	56.0		34.1	46.0	
2.925	26.1	56.0		25.7	46.0	
4.792	31.1	56.0		30.9	46.0	
8.024	36.9	60.0		31.9	50.0	
10.764	36.7	60.0		32.5	50.0	
18.230	31.2	60.0		27.6	50.0	

FCC Part 15 Subpart B Conducted Emissions Test

Cumulative Data

VB** 02/09/2011

Manufacturer	:	BADGER METER
Model	:	ORION SE GATEWAY
DUT Revision	:	BEAD ON ETHERNET LINE
Serial Number	:	
DUT Mode	:	Rx [POE]
Line Tested	:	120V 60Hz L1
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-10
Notes	:	POE POWER
Test Engineer	:	I. Carnegie
Limit	:	Class B
Test Date	:	Oct 15, 2012 09:19:08 AM



Emissions Meet QP Limit
Emissions Meet Ave Limit

FCC Part 15 Subpart B Conducted Emissions Test

Significant Emissions Data

VB** 02/09/2011

Manufacturer	:	BADGER METER
Model	:	ORION SE GATEWAY
DUT Revision	:	BEAD ON ETHERNET LINE
Serial Number	:	
DUT Mode	:	Rx [POE]
Line Tested	:	120V 60Hz L2
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-10
Notes	:	POE POWER
Test Engineer	:	I. Carnegie
Limit	:	Class B
Test Date	:	Oct 15, 2012 09:12:52 AM
Data Filter	:	Up to 80 maximum levels detected with 6 dB level excursion threshold over 10 dB margin below limit

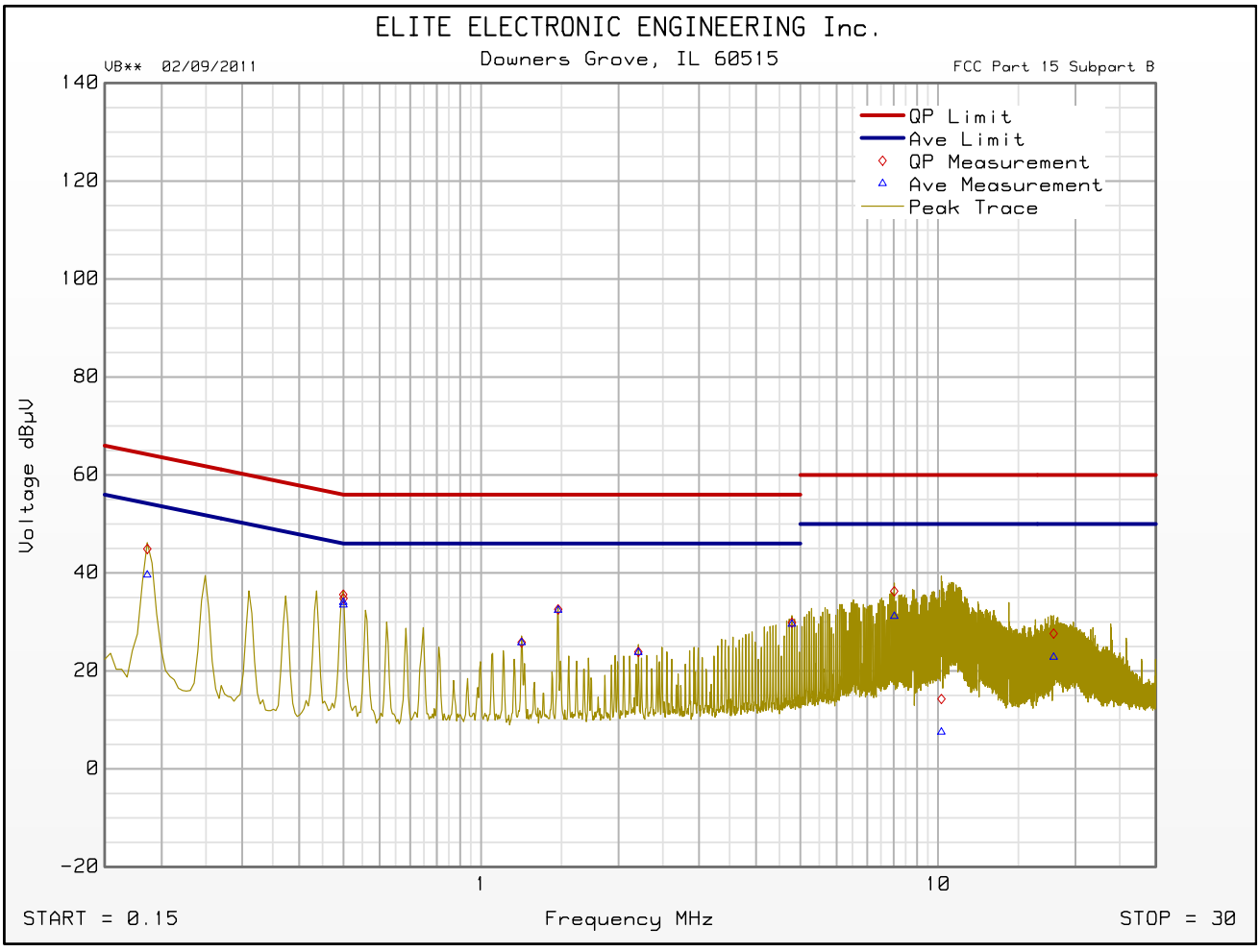
Freq MHz	Quasi-peak Level dBµV	Quasi-peak Limit dBµV	Excessive Quasi-peak Emissions	Average Level dBµV	Average Limit dBµV	Excessive Average Emissions
0.186	44.9	64.2		39.6	54.2	
0.500	35.6	56.0		34.0	46.0	
0.500	34.8	56.0		33.5	46.0	
1.227	25.8	56.0		25.8	46.0	
1.475	32.6	56.0		32.4	46.0	
2.210	23.9	56.0		23.8	46.0	
4.792	29.9	56.0		29.6	46.0	
8.024	36.3	60.0		31.2	50.0	
10.175	14.3	60.0		7.5	50.0	
17.920	27.6	60.0		22.8	50.0	

FCC Part 15 Subpart B Conducted Emissions Test

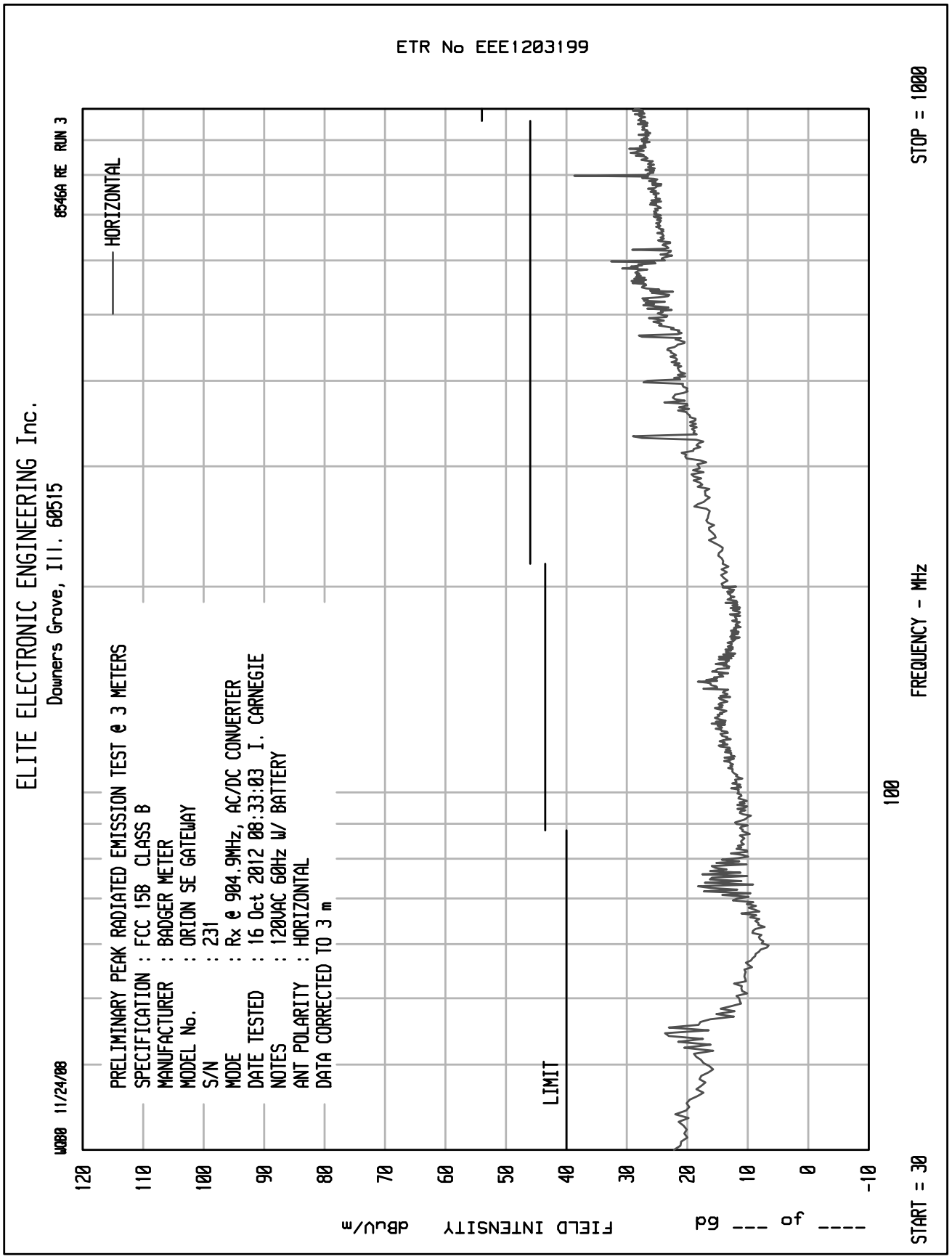
Cumulative Data

VB** 02/09/2011

Manufacturer	:	BADGER METER
Model	:	ORION SE GATEWAY
DUT Revision	:	BEAD ON ETHERNET LINE
Serial Number	:	
DUT Mode	:	Rx [POE]
Line Tested	:	120V 60Hz L2
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-10
Notes	:	POE POWER
Test Engineer	:	I. Carnegie
Limit	:	Class B
Test Date	:	Oct 15, 2012 09:12:52 AM



Emissions Meet QP Limit
Emissions Meet Ave Limit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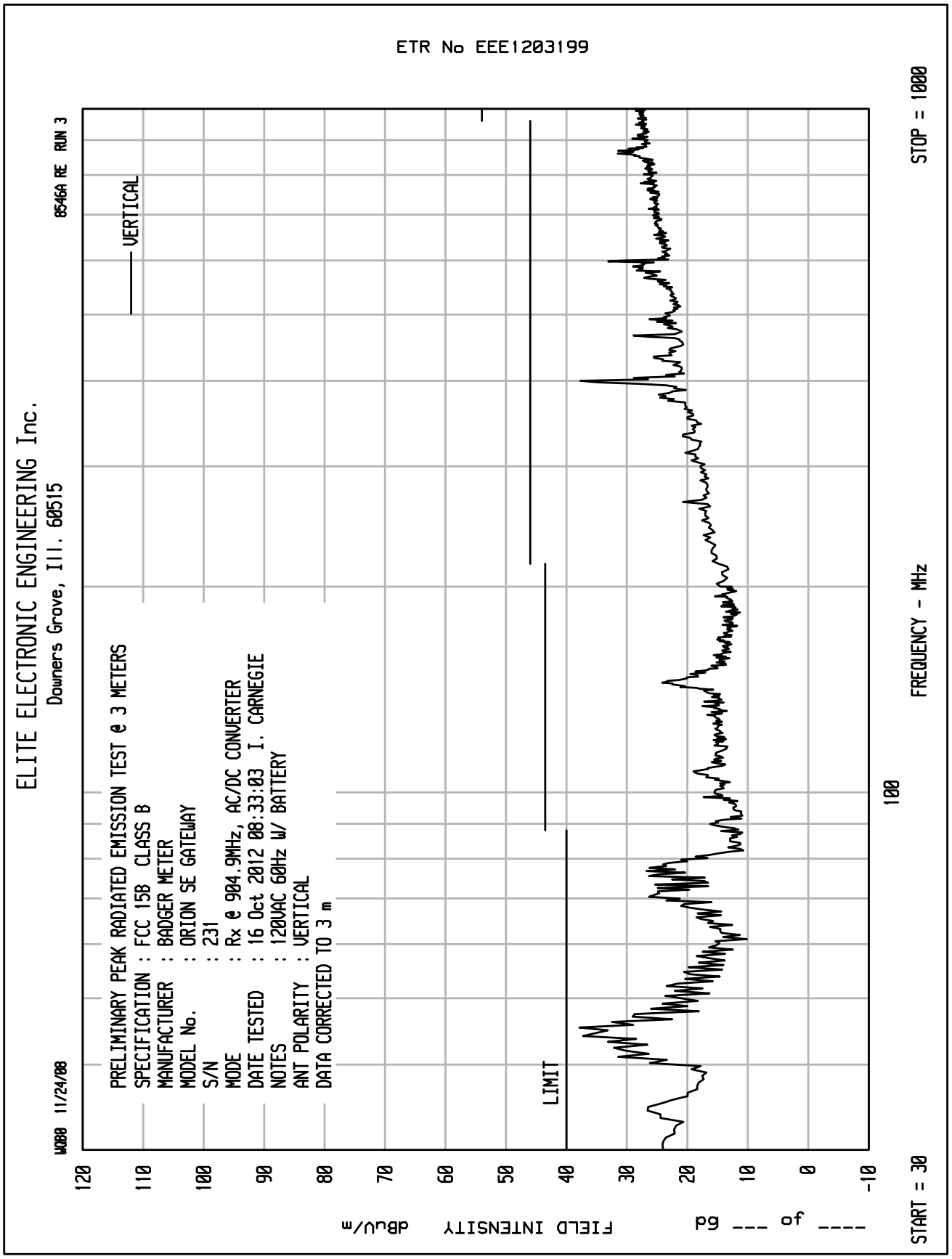
ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
8546A RE RUN 3
HORIZONTAL
PRELIMINARY PEAK RADIATED EMISSION TEST @ 3 METERS
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GATEWAY
S/N : 231
MODE : Rx @ 904.9MHz, AC/DC CONVERTER
DATE TESTED : 16 Oct 2012 08:33:03 I. CARNEGIE
NOTES : 120VAC 60Hz W/ BATTERY
ANT POLARITY : HORIZONTAL
DATA CORRECTED TO 3 m
LIMIT
FIELD INTENSITY dBuV/m
FREQUENCY - MHz
START = 30
STOP = 1000
100
120
110
100
90
80
70
60
50
40
30
20
10
0
-10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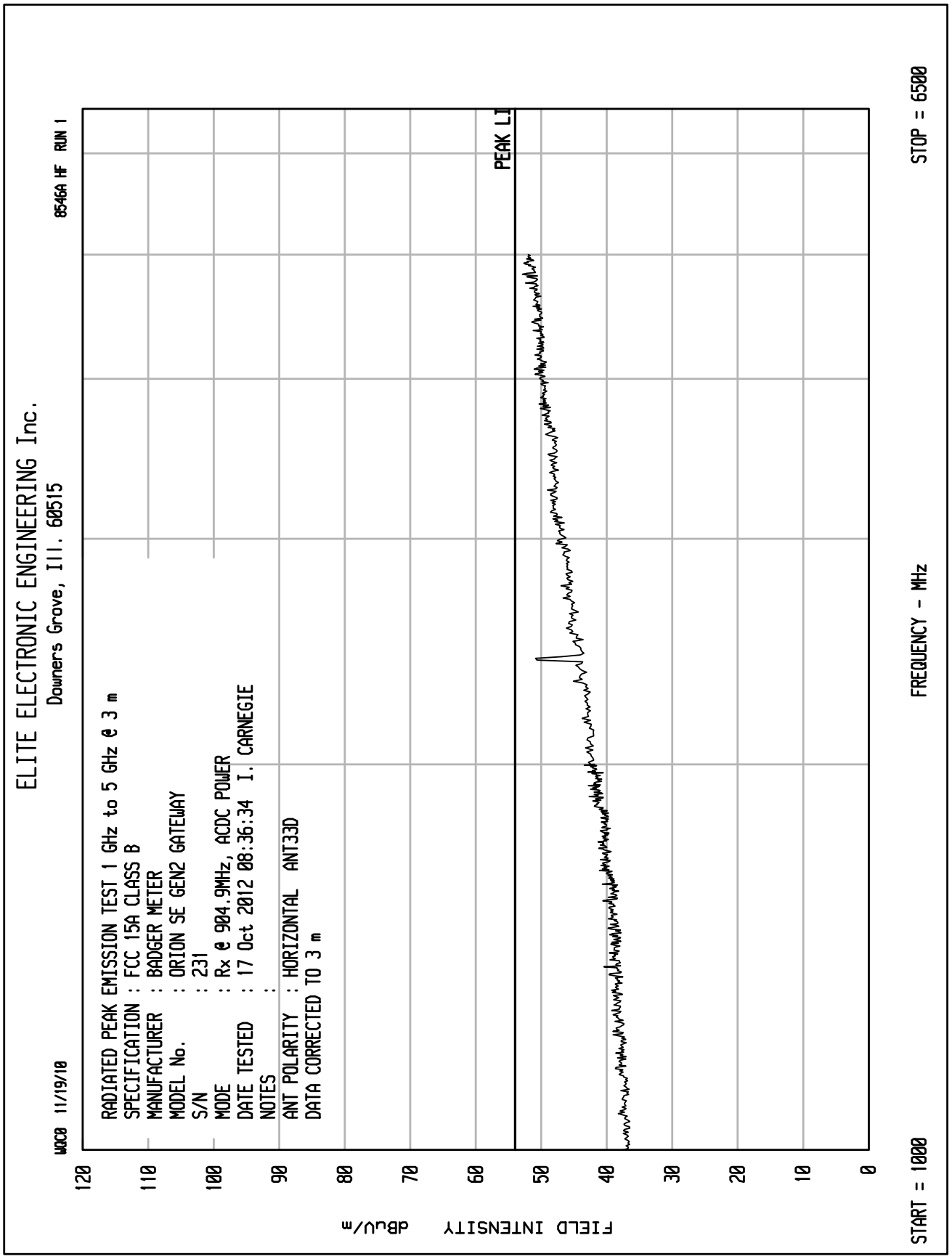
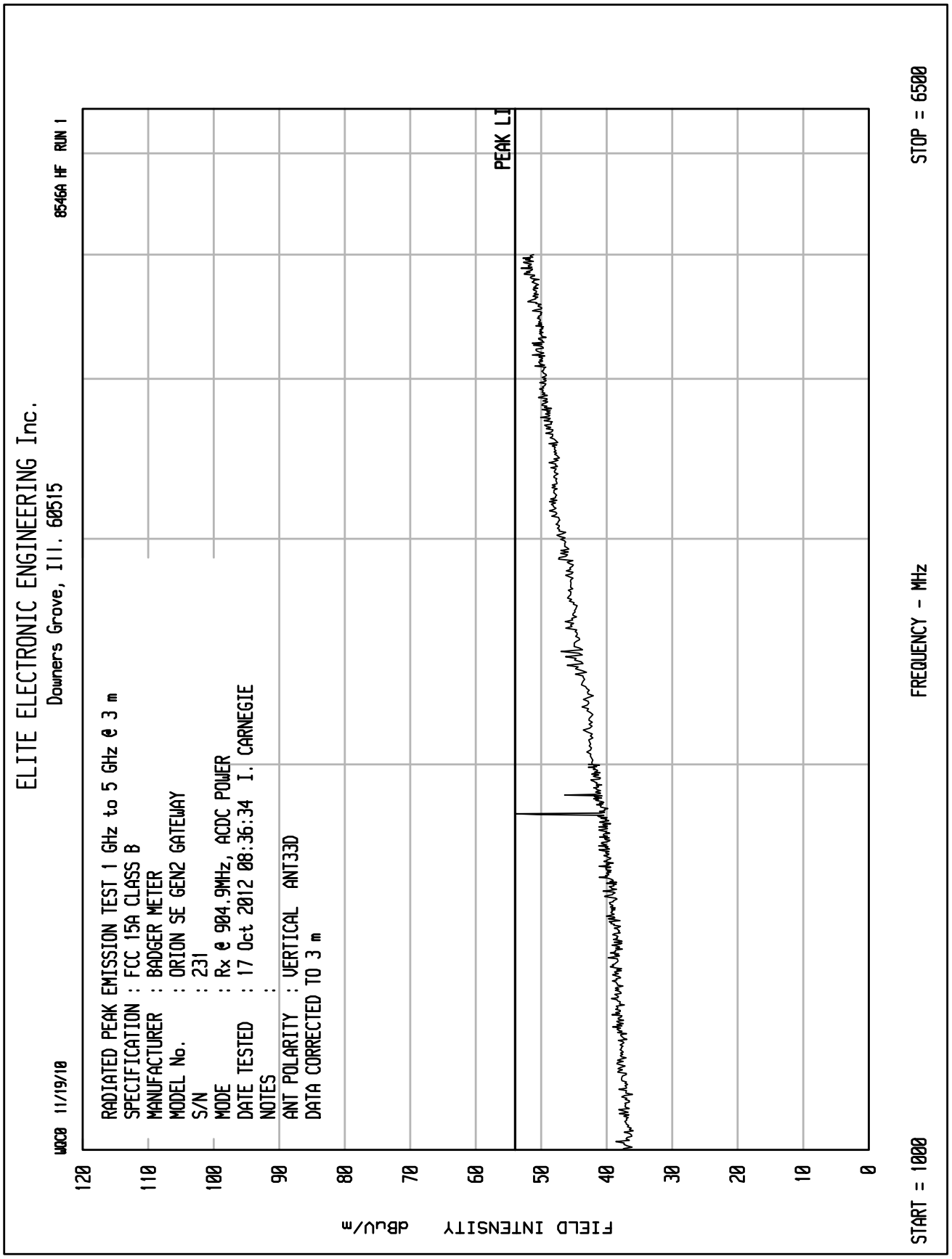
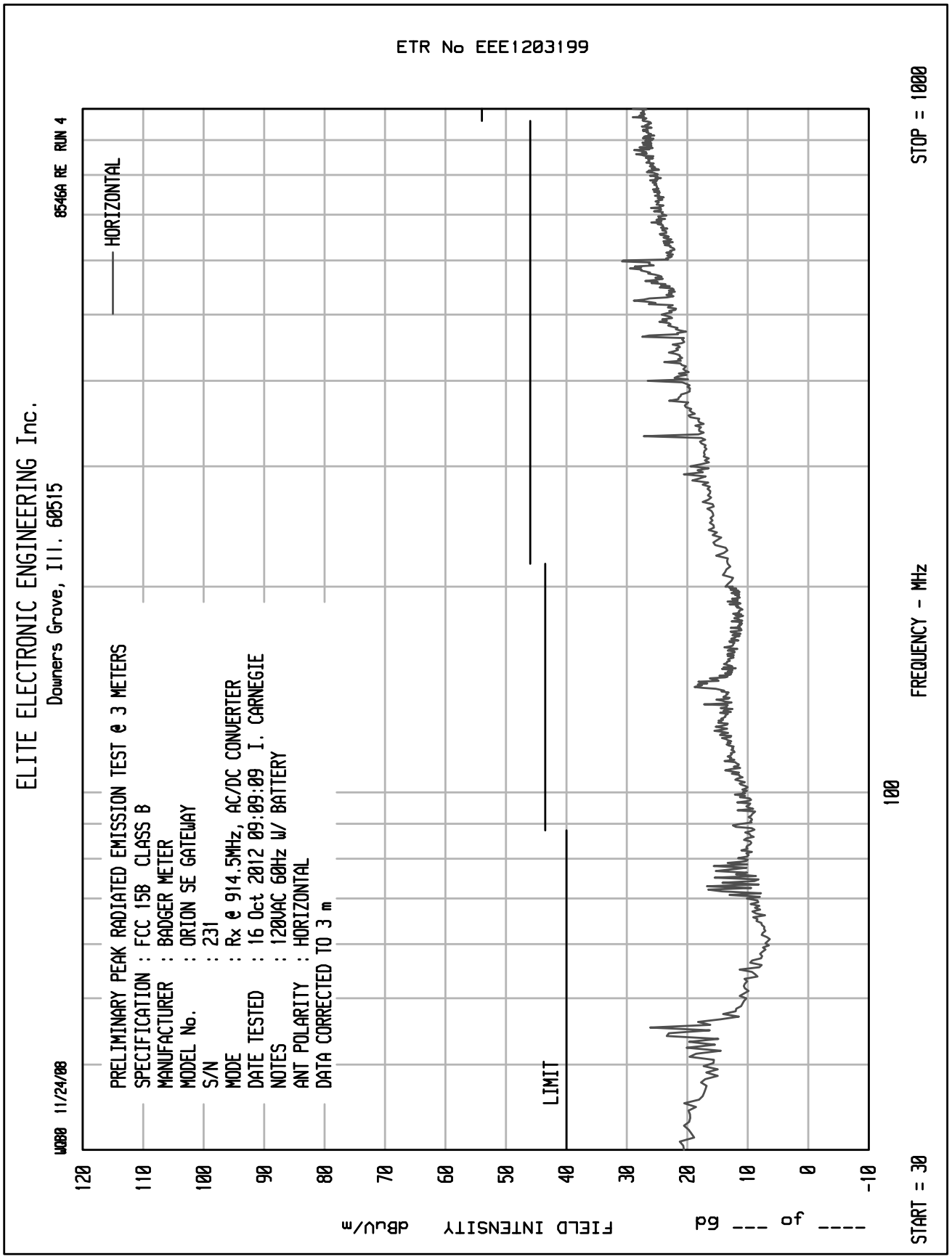
ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
8546A RE RUN 3
VERTICAL
PRELIMINARY PEAK RADIATED EMISSION TEST @ 3 METERS
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GATEWAY
S/N : 231
MODE : Rx @ 904.9MHz, AC/DC CONVERTER
DATE TESTED : 16 Oct 2012 08:33:03 I. CARNEGIE
NOTES : 120VAC 60Hz W/ BATTERY
ANT POLARITY : VERTICAL
DATA CORRECTED TO 3 m
LIMIT
FIELD INTENSITY dBuV/m
FREQUENCY - MHz
START = 30
STOP = 1000
100
120
110
90
80
70
60
50
40
30
20
10
0
-10


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WQC8 11/19/10
8546A HF RUN 1
RADIATED PEAK EMISSION TEST 1 GHz to 5 GHz @ 3 m
SPECIFICATION : FCC 15A CLASS B
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GEN2 GATEWAY
S/N : 231
MODE : Rx @ 904.9MHz, ACDC POWER
DATE TESTED : 17 Oct 2012 08:36:34 I. CARNEGIE
NOTES : :
ANT POLARITY : HORIZONTAL ANT33D
DATA CORRECTED TO 3 m
PEAK LI
FIELD INTENSITY dBuV/m
120
110
100
90
80
70
60
50
40
30
20
10
0
START = 1000
FREQUENCY - MHz
STOP = 6500


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WQC8 11/19/10
8546A HF RUN 1
RADIATED PEAK EMISSION TEST 1 GHz to 5 GHz @ 3 m
SPECIFICATION : FCC 15A CLASS B
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GEN2 GATEWAY
S/N : 231
MODE : Rx @ 904.9MHz, ACDC POWER
DATE TESTED : 17 Oct 2012 08:36:34 I. CARNEGIE
NOTES : :
ANT POLARITY : VERTICAL ANT33D
DATA CORRECTED TO 3 m
PEAK LI
FIELD INTENSITY dBuV/m
120
110
100
90
80
70
60
50
40
30
20
10
0
START = 1000
FREQUENCY - MHz
STOP = 6500


ETR No EEE1203199
ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
8546A RE RUN 4
11/24/08
PRELIMINARY PEAK RADIATED EMISSION TEST @ 3 METERS
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GATEWAY
S/N : 231
MODE : Rx @ 914.5MHz, AC/DC CONVERTER
DATE TESTED : 16 Oct 2012 09:09:09 I. CARNEGIE
NOTES : 120VAC 60Hz W/ BATTERY
ANT POLARITY : HORIZONTAL
DATA CORRECTED TO 3 m
HORIZONTAL
LIMIT
FIELD INTENSITY dBuV/m
FREQUENCY - MHz
START = 30
100
STOP = 1000
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
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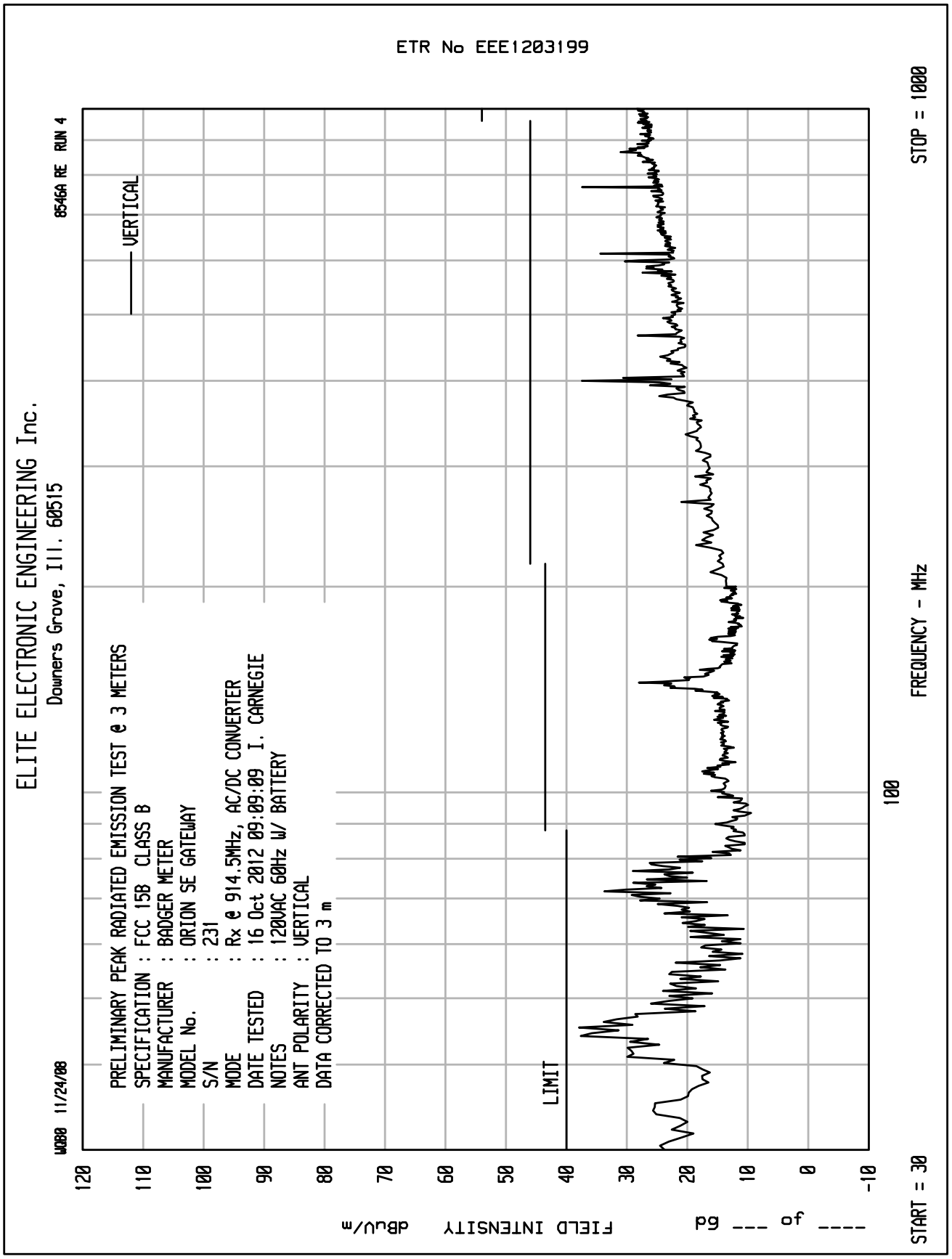
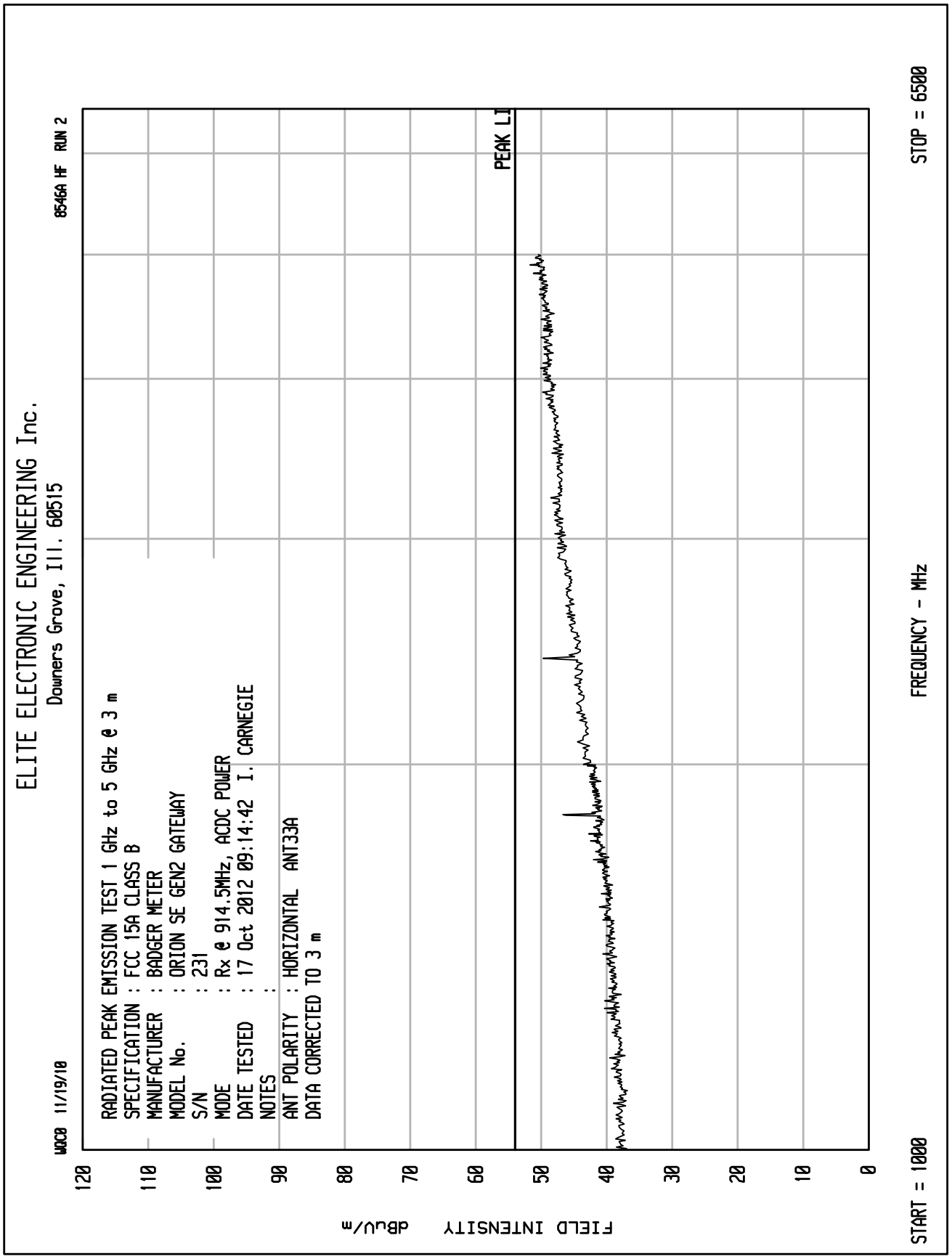
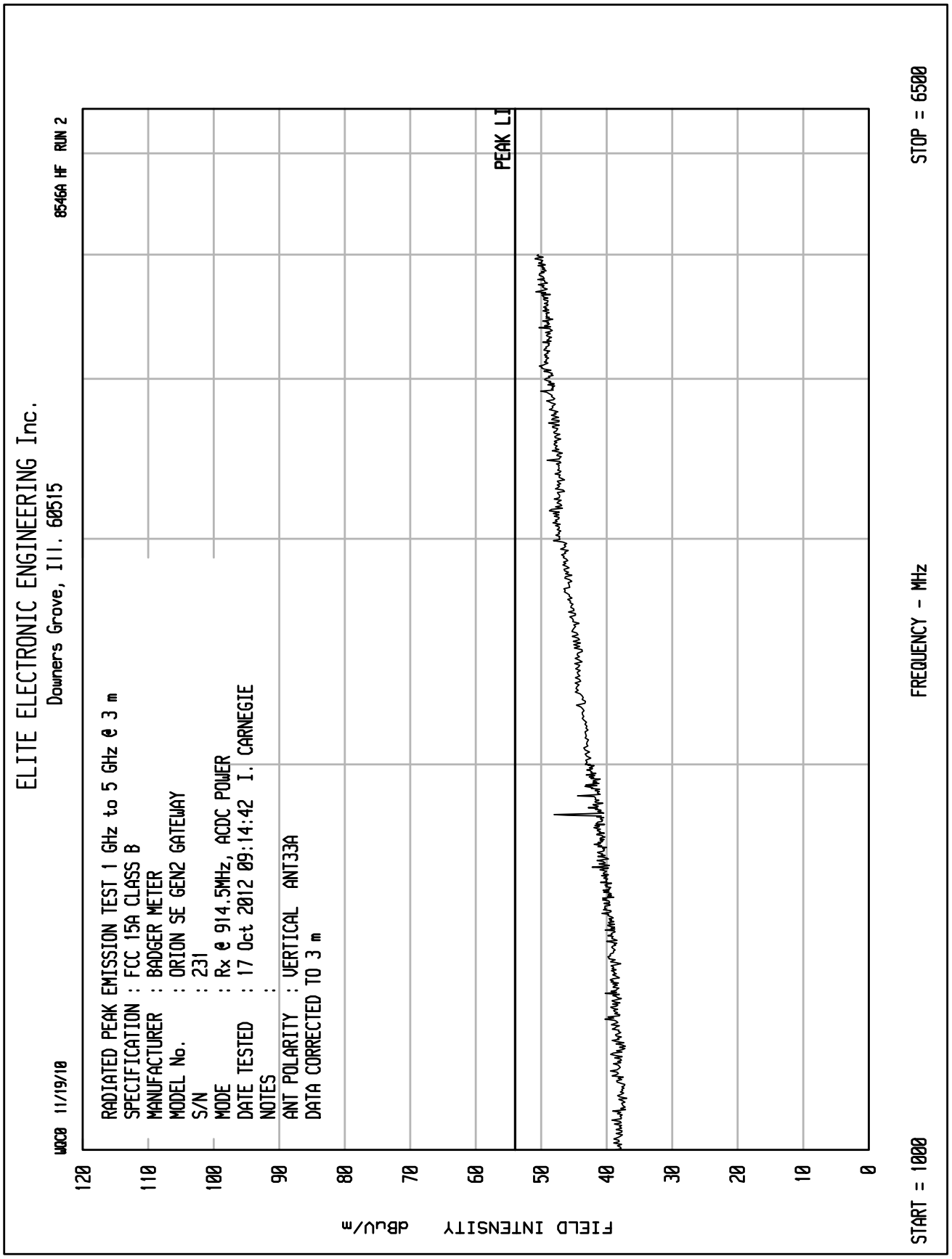
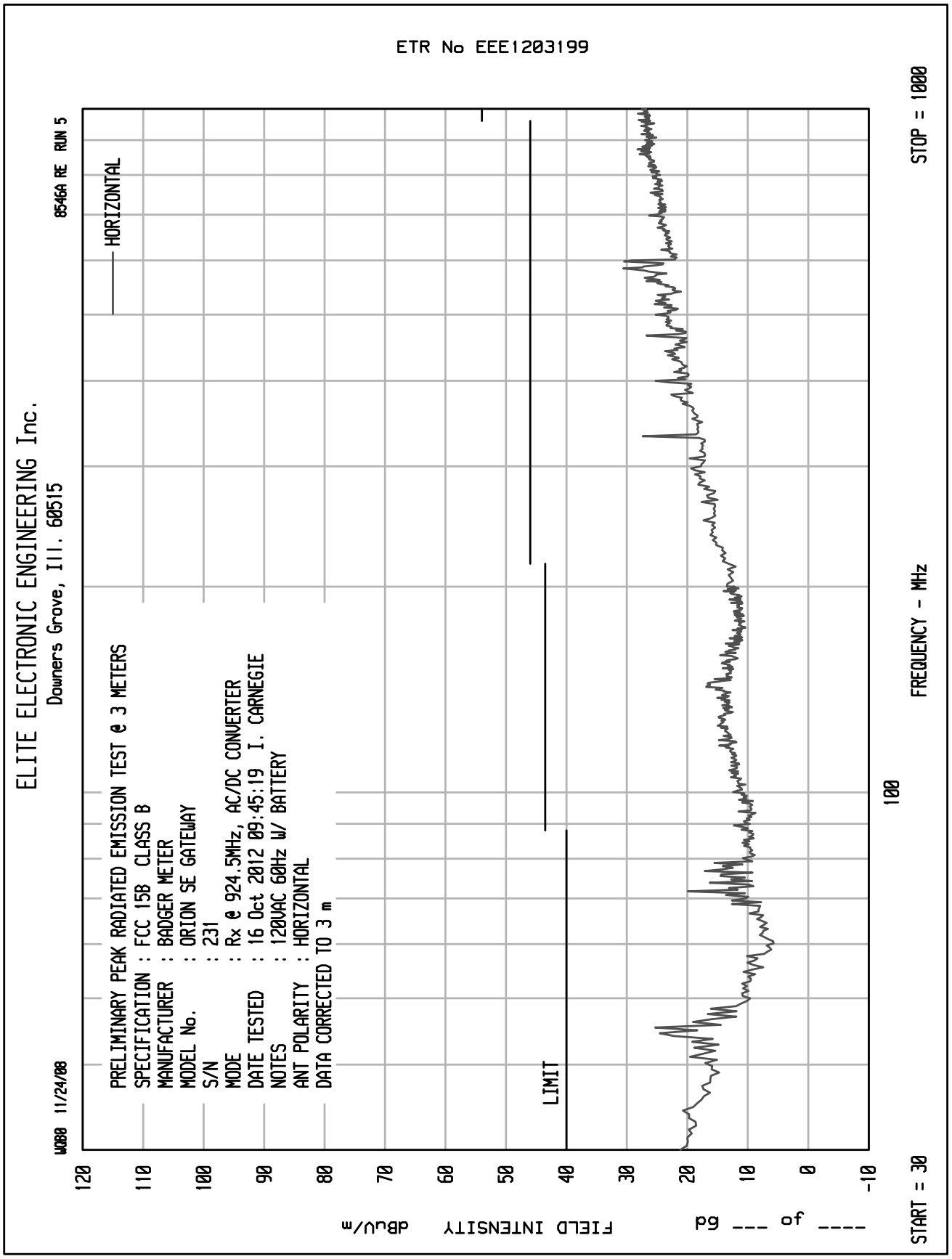
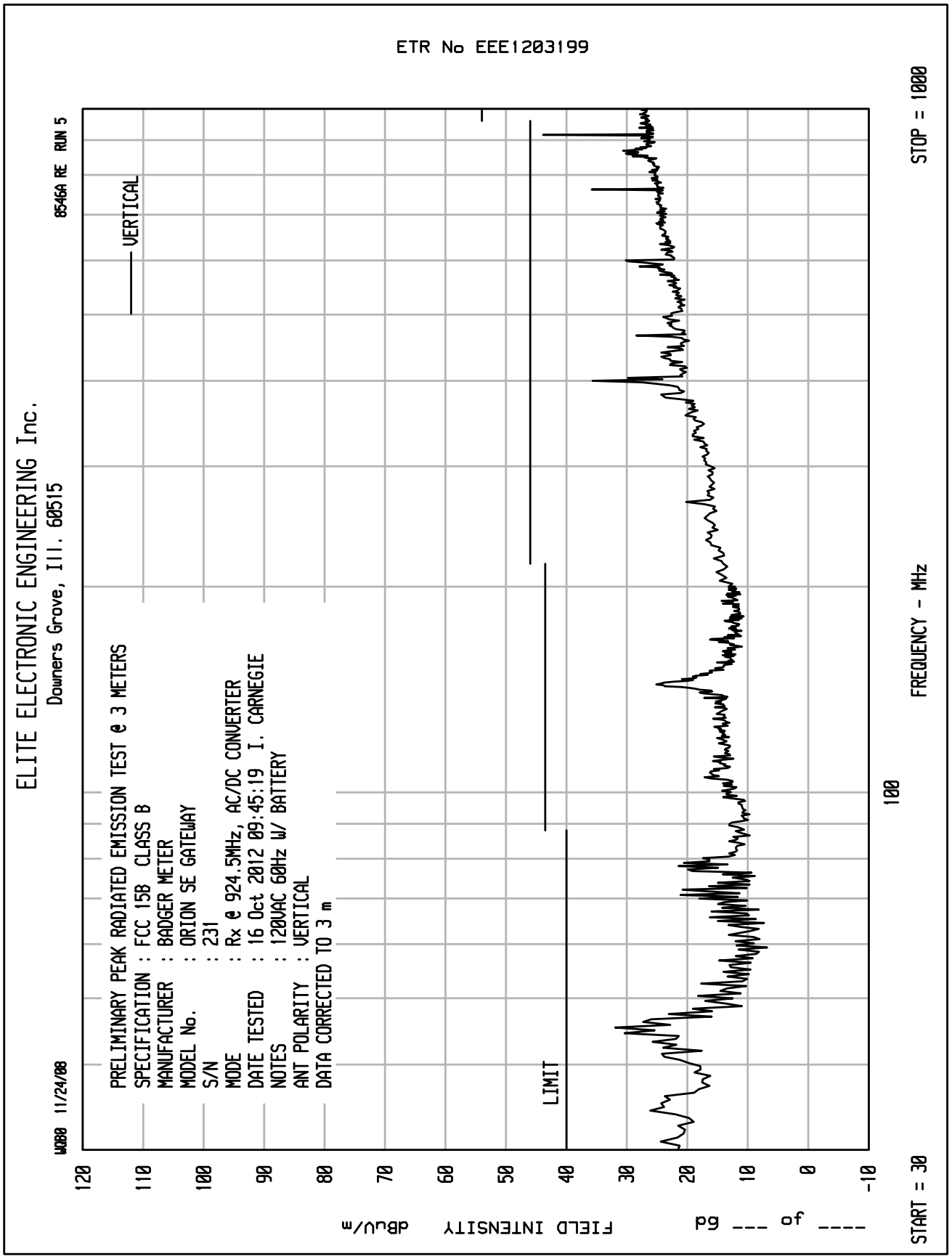
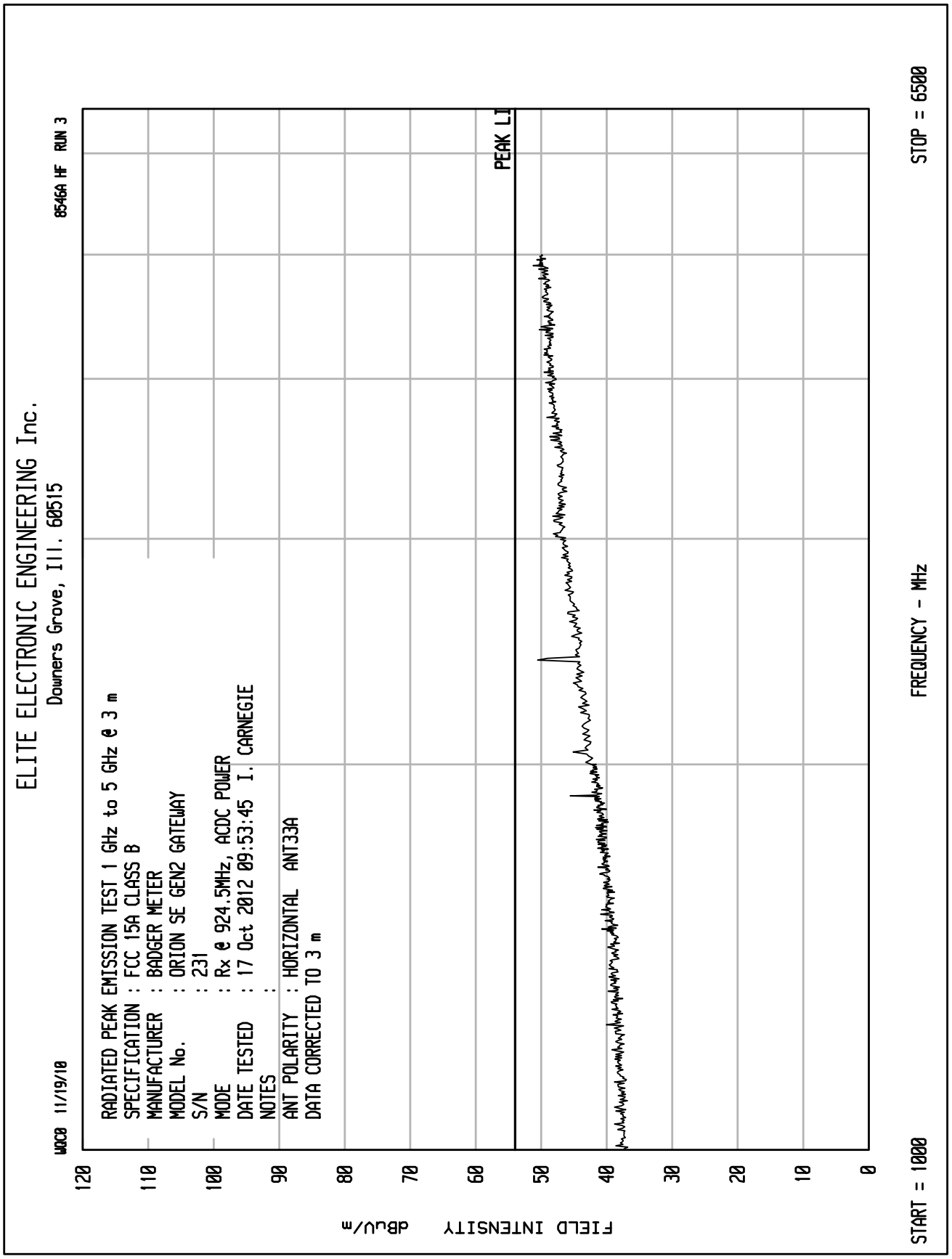

ETR No EEE1203199
ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
8546A RE RUN 4
VERTICAL
PRELIMINARY PEAK RADIATED EMISSION TEST @ 3 METERS
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GATEWAY
S/N : 231
MODE : Rx @ 914.5MHz, AC/DC CONVERTER
DATE TESTED : 16 Oct 2012 09:09:09 I. CARNEGIE
NOTES : 120VAC 60Hz W/ BATTERY
ANT POLARITY : VERTICAL
DATA CORRECTED TO 3 m
LIMIT
FIELD INTENSITY dBuV/m
FREQUENCY - MHz
START = 30
STOP = 1000
100
120
110
100
90
80
70
60
50
40
30
20
10
0
-10

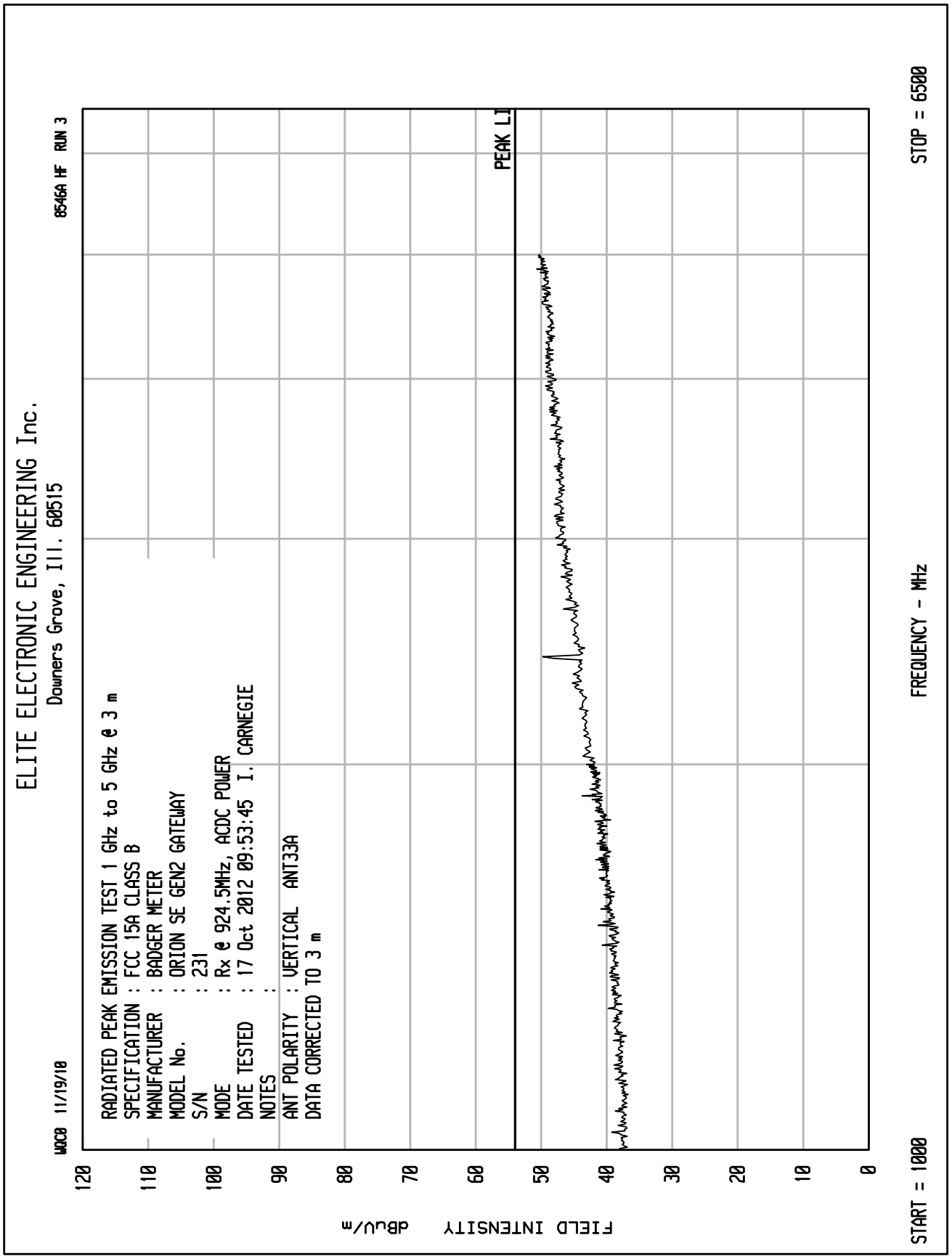

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WQC8 11/19/10
8546A HF RUN 2
RADIATED PEAK EMISSION TEST 1 GHz to 5 GHz @ 3 m
SPECIFICATION : FCC 15A CLASS B
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GEN2 GATEWAY
S/N : 231
MODE : Rx @ 914.5MHz, ACDC POWER
DATE TESTED : 17 Oct 2012 09:14:42 I. CARNEGIE
NOTES :
ANT POLARITY : HORIZONTAL ANT33A
DATA CORRECTED TO 3 m
PEAK LI
FIELD INTENSITY dBuV/m
120
110
100
90
80
70
60
50
40
30
20
10
0
START = 1000
FREQUENCY - MHz
STOP = 6500

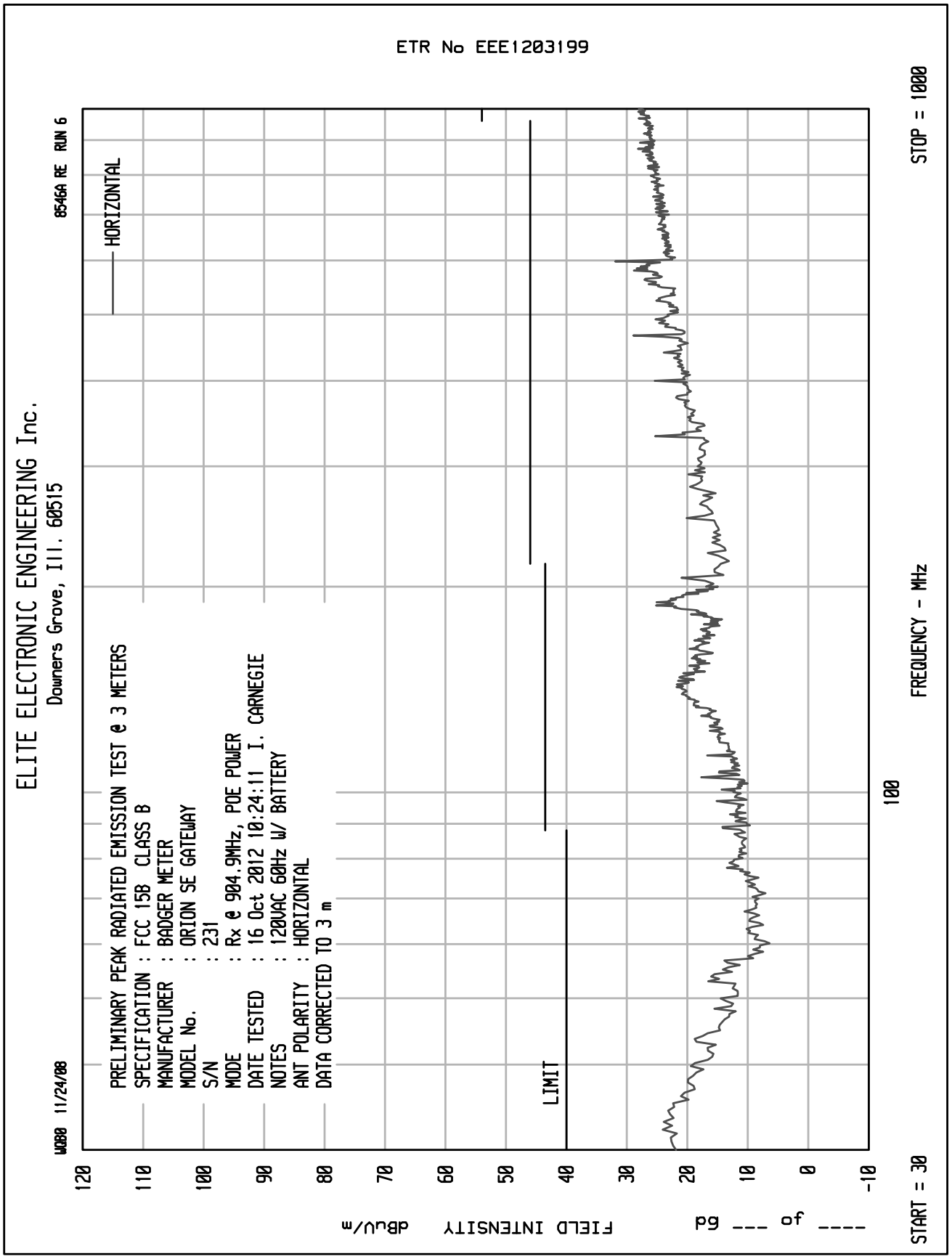

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WQC8 11/19/10
8546A HF RUN 2
RADIATED PEAK EMISSION TEST 1 GHz to 5 GHz @ 3 m
SPECIFICATION : FCC 15A CLASS B
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GEN2 GATEWAY
S/N : 231
MODE : Rx @ 914.5MHz, ACDC POWER
DATE TESTED : 17 Oct 2012 09:14:42 I. CARNEGIE
NOTES : :
ANT POLARITY : VERTICAL ANT33A
DATA CORRECTED TO 3 m
PEAK LI
FIELD INTENSITY dBuV/m
120
110
100
90
80
70
60
50
40
30
20
10
0
START = 1000
FREQUENCY - MHz
STOP = 6500

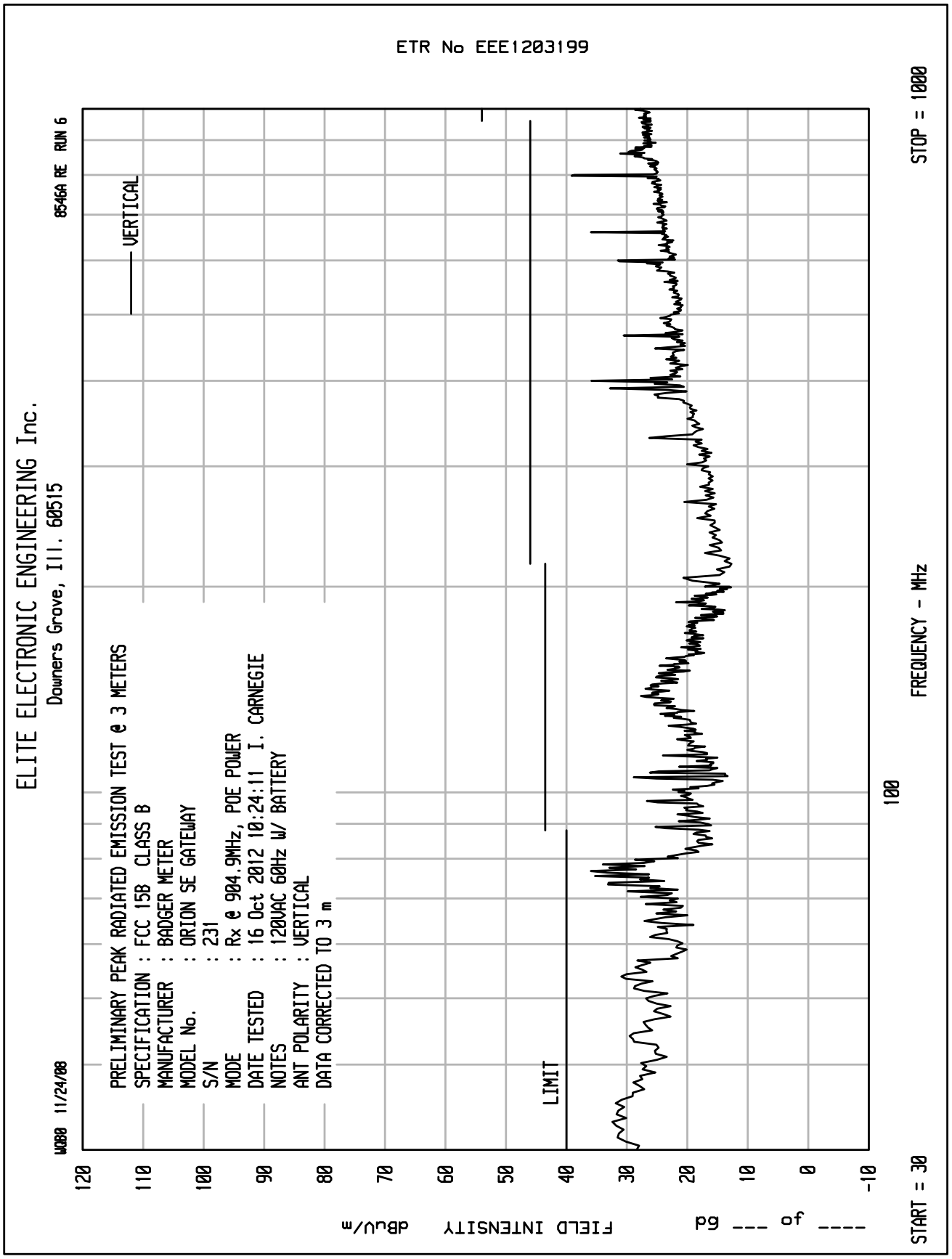

ETR No EEE1203199
ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
8546A RE RUN 5
11/24/08
PRELIMINARY PEAK RADIATED EMISSION TEST @ 3 METERS
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GATEWAY
S/N : 231
MODE : Rx @ 924.5MHz, AC/DC CONVERTER
DATE TESTED : 16 Oct 2012 09:45:19 I. CARNEGIE
NOTES : 120VAC 60Hz W/ BATTERY
ANT POLARITY : HORIZONTAL
DATA CORRECTED TO 3 m
HORIZONTAL
LIMIT
FIELD INTENSITY dBuV/m
FREQUENCY - MHz
START = 30
STOP = 1000
100
120
110
100
90
80
70
60
50
40
30
20
10
0
-10

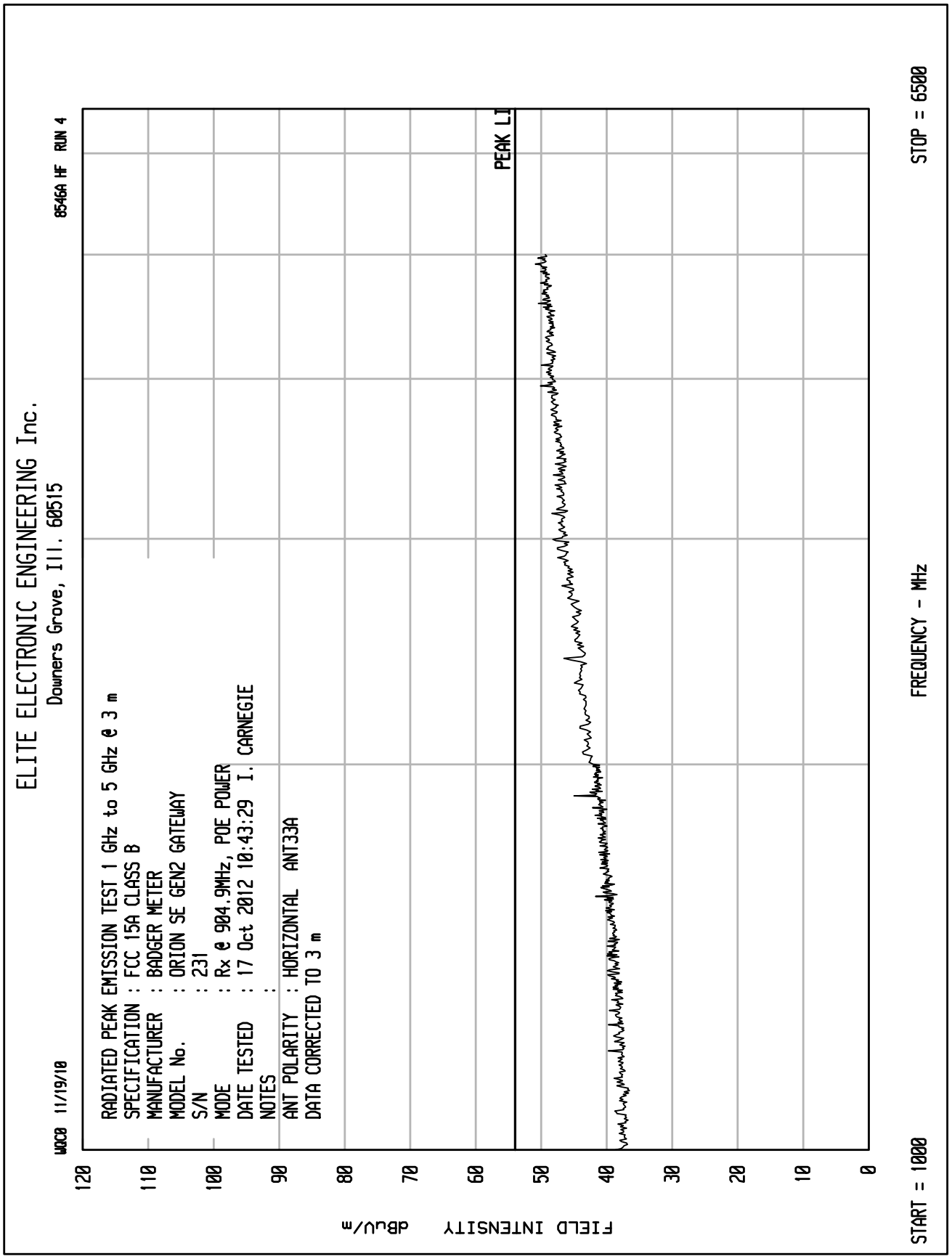

ETR No EEE1203199
ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
8546A RE RUN 5
VERTICAL
PRELIMINARY PEAK RADIATED EMISSION TEST @ 3 METERS
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GATEWAY
S/N : 231
MODE : Rx @ 924.5MHz, AC/DC CONVERTER
DATE TESTED : 16 Oct 2012 09:45:19 I. CARNEGIE
NOTES : 120VAC 60Hz W/ BATTERY
ANT POLARITY : VERTICAL
DATA CORRECTED TO 3 m
LIMIT
FIELD INTENSITY dBuV/m
FREQUENCY - MHz
START = 30
STOP = 1000
100
120
110
100
90
80
70
60
50
40
30
20
10
0
-10

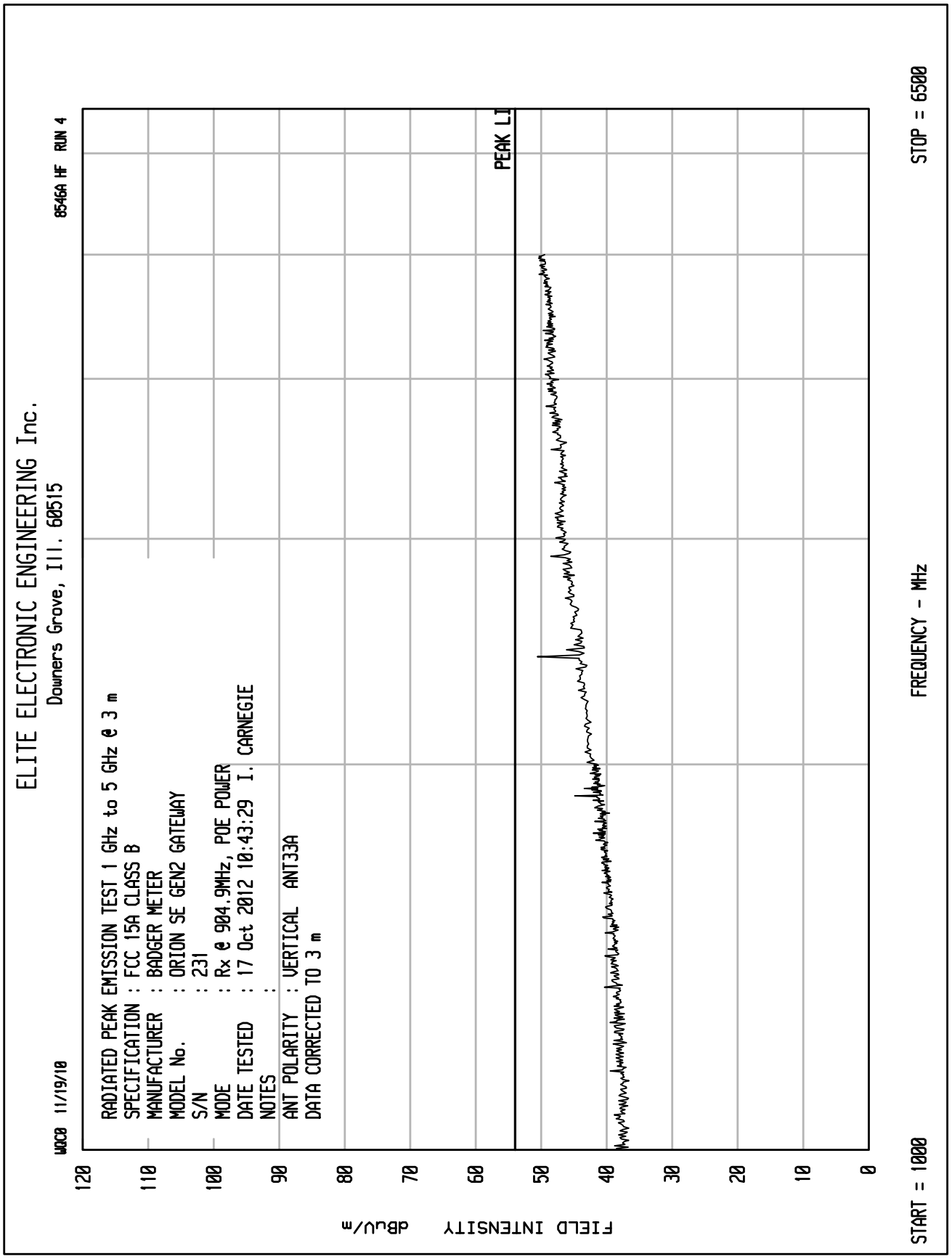

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WQC8 11/19/10
8546A HF RUN 3
RADIATED PEAK EMISSION TEST 1 GHz to 5 GHz @ 3 m
SPECIFICATION : FCC 15A CLASS B
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GEN2 GATEWAY
S/N : 231
MODE : Rx @ 924.5MHz, ACDC POWER
DATE TESTED : 17 Oct 2012 09:53:45 I. CARNEGIE
NOTES : :
ANT POLARITY : HORIZONTAL ANT33A
DATA CORRECTED TO 3 m
PEAK LI
FIELD INTENSITY dBuV/m
120
110
100
90
80
70
60
50
40
30
20
10
0
START = 1000
FREQUENCY - MHz
STOP = 6500

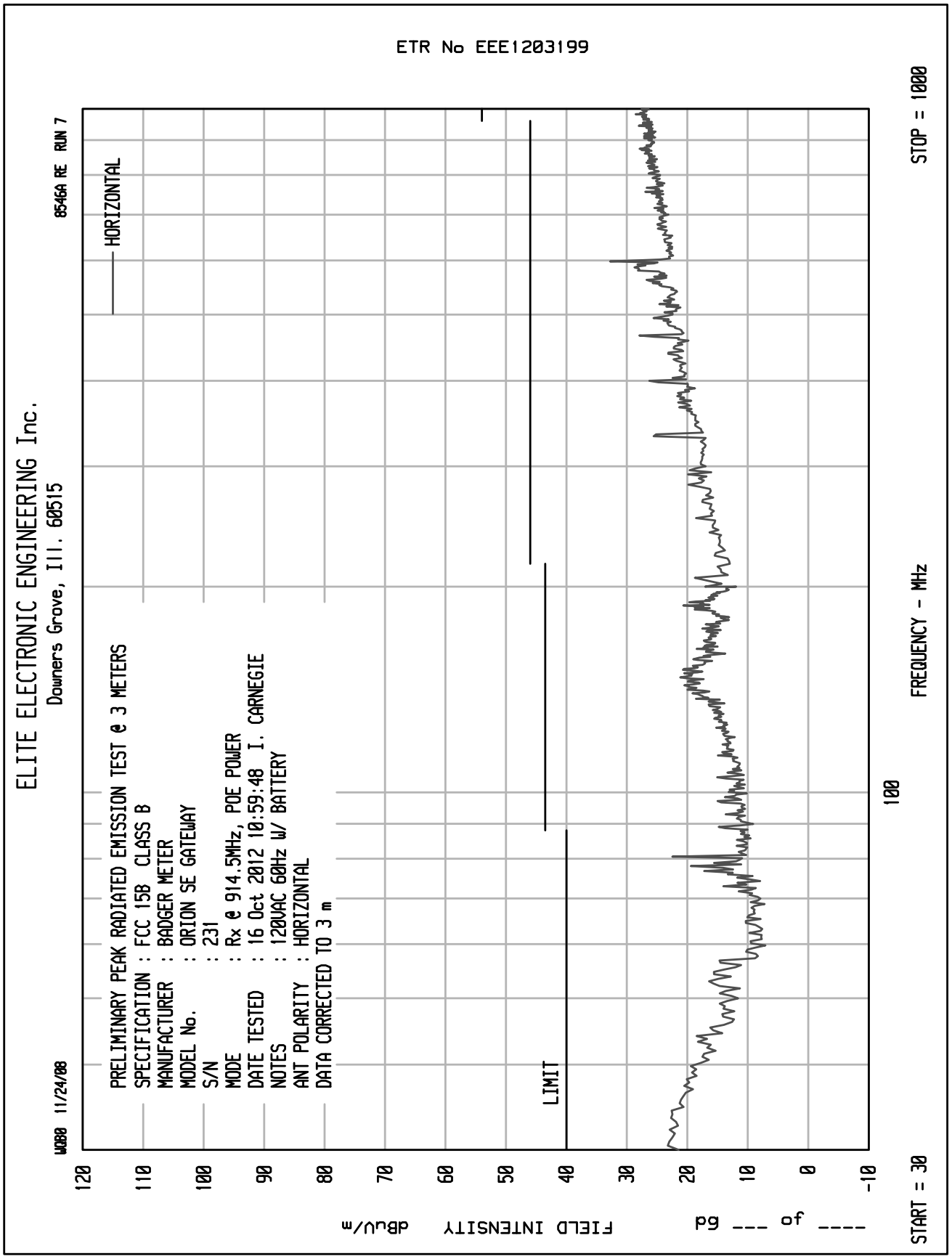

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WQC8 11/19/10
8546A HF RUN 3
RADIATED PEAK EMISSION TEST 1 GHz to 5 GHz @ 3 m
SPECIFICATION : FCC 15A CLASS B
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GEN2 GATEWAY
S/N : 231
MODE : Rx @ 924.5MHz, ACDC POWER
DATE TESTED : 17 Oct 2012 09:53:45 I. CARNEGIE
NOTES : :
ANT POLARITY : VERTICAL ANT33A
DATA CORRECTED TO 3 m
PEAK LI
FIELD INTENSITY dBuV/m
120
110
100
90
80
70
60
50
40
30
20
10
0
START = 1000
FREQUENCY - MHz
STOP = 6500

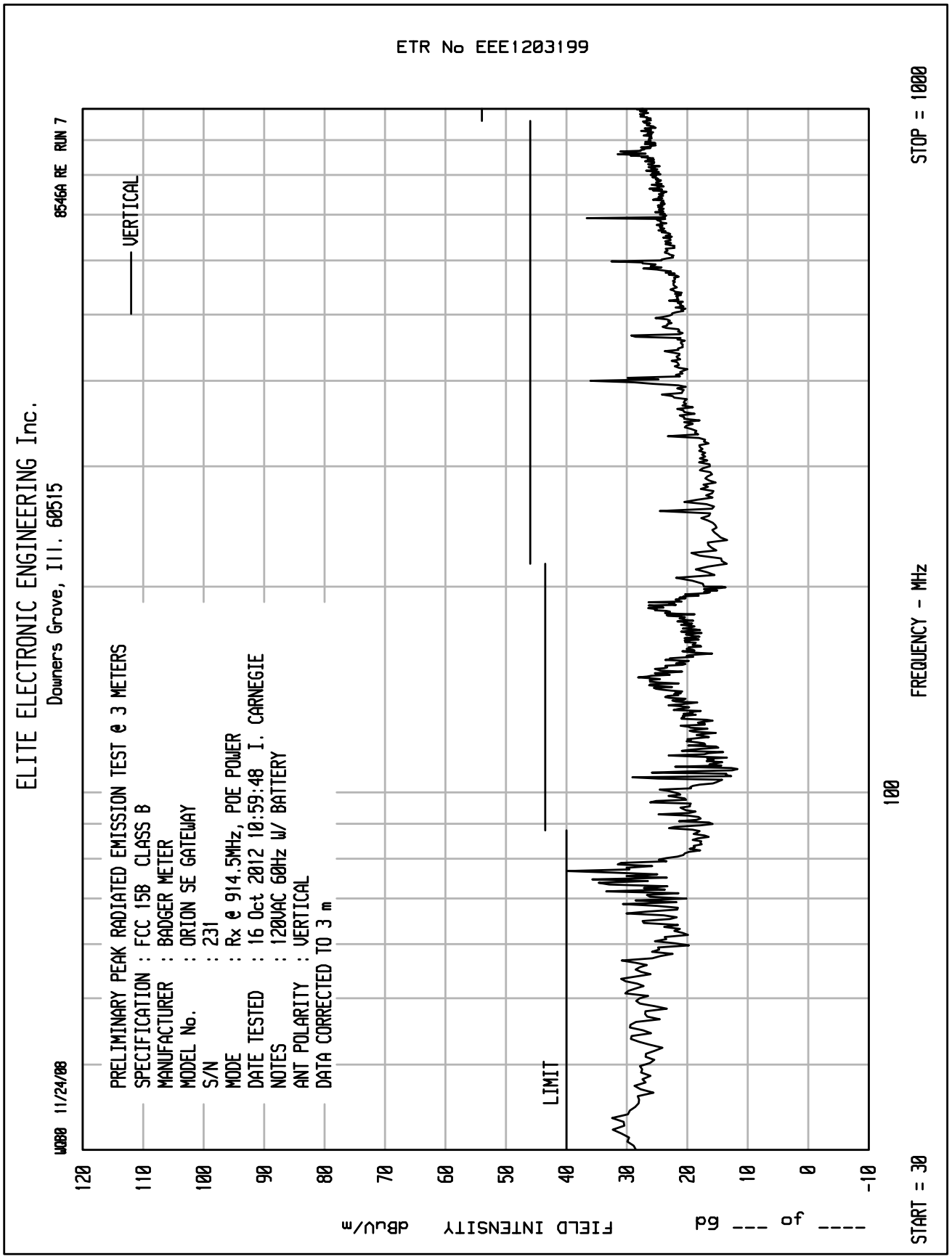

ETR No EEE1203199
ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
8546A RE RUN 6
WED 11/24/08
PRELIMINARY PEAK RADIATED EMISSION TEST @ 3 METERS
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GATEWAY
S/N : 231
MODE : Rx @ 904.9MHz, POE POWER
DATE TESTED : 16 Oct 2012 10:24:11 I. CARNEGIE
NOTES : 120VAC 60Hz W/ BATTERY
ANT POLARITY : HORIZONTAL
DATA CORRECTED TO 3 m
HORIZONTAL
LIMIT
FIELD INTENSITY dBuV/m
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
---- of ---- dB
START = 30
100
FREQUENCY - MHz
STOP = 1000

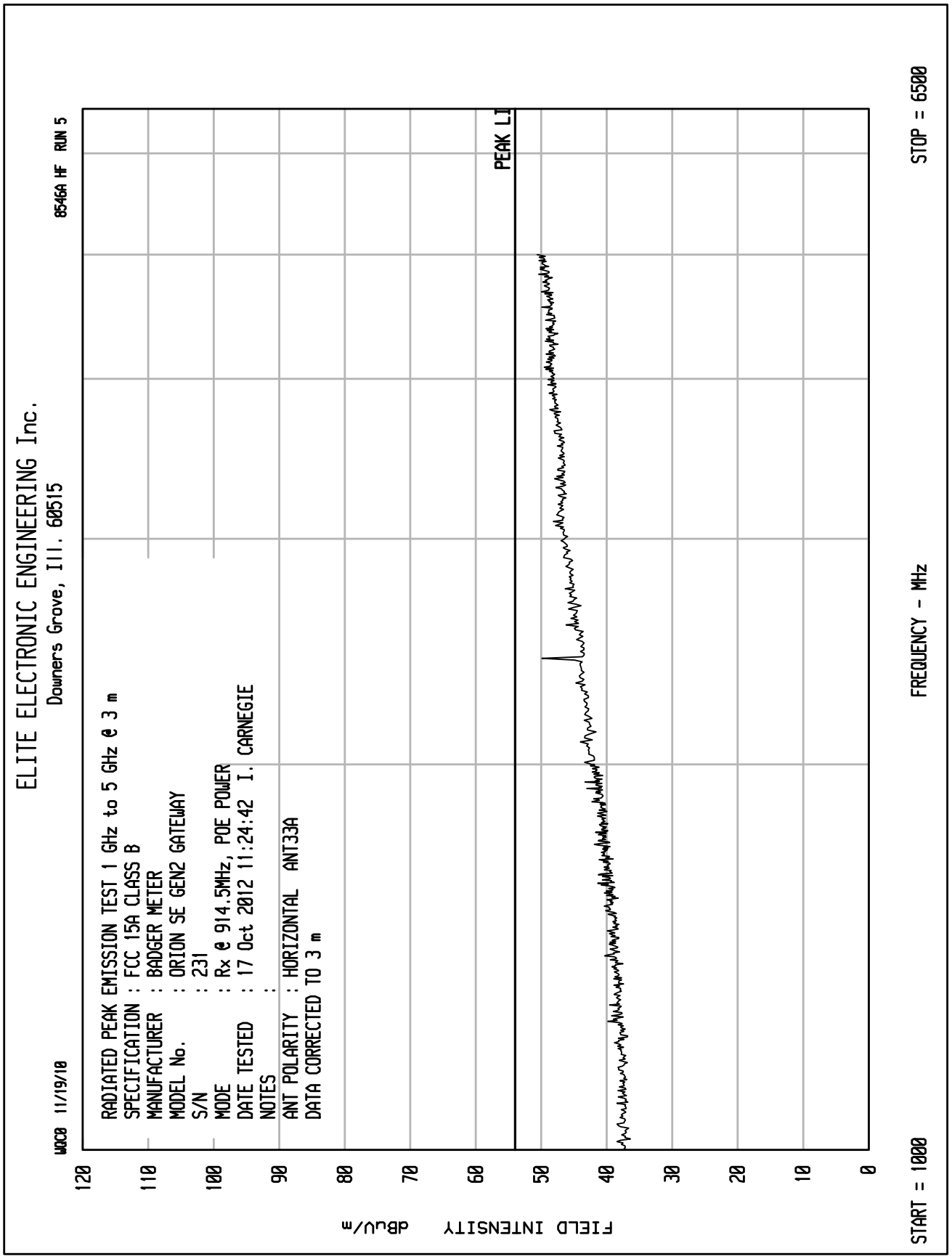

ETR No EEE1203199
ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
8546A RE RUN 6
VERTICAL
PRELIMINARY PEAK RADIATED EMISSION TEST @ 3 METERS
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GATEWAY
S/N : 231
MODE : Rx @ 904.9MHz, POE POWER
DATE TESTED : 16 Oct 2012 10:24:11 I. CARNEGIE
NOTES : 120VAC 60Hz W/ BATTERY
ANT POLARITY : VERTICAL
DATA CORRECTED TO 3 m
LIMIT
FIELD INTENSITY dBuV/m
FREQUENCY - MHz
START = 30
100
STOP = 1000
120
110
100
90
80
70
60
50
40
30
20
10
0
-10

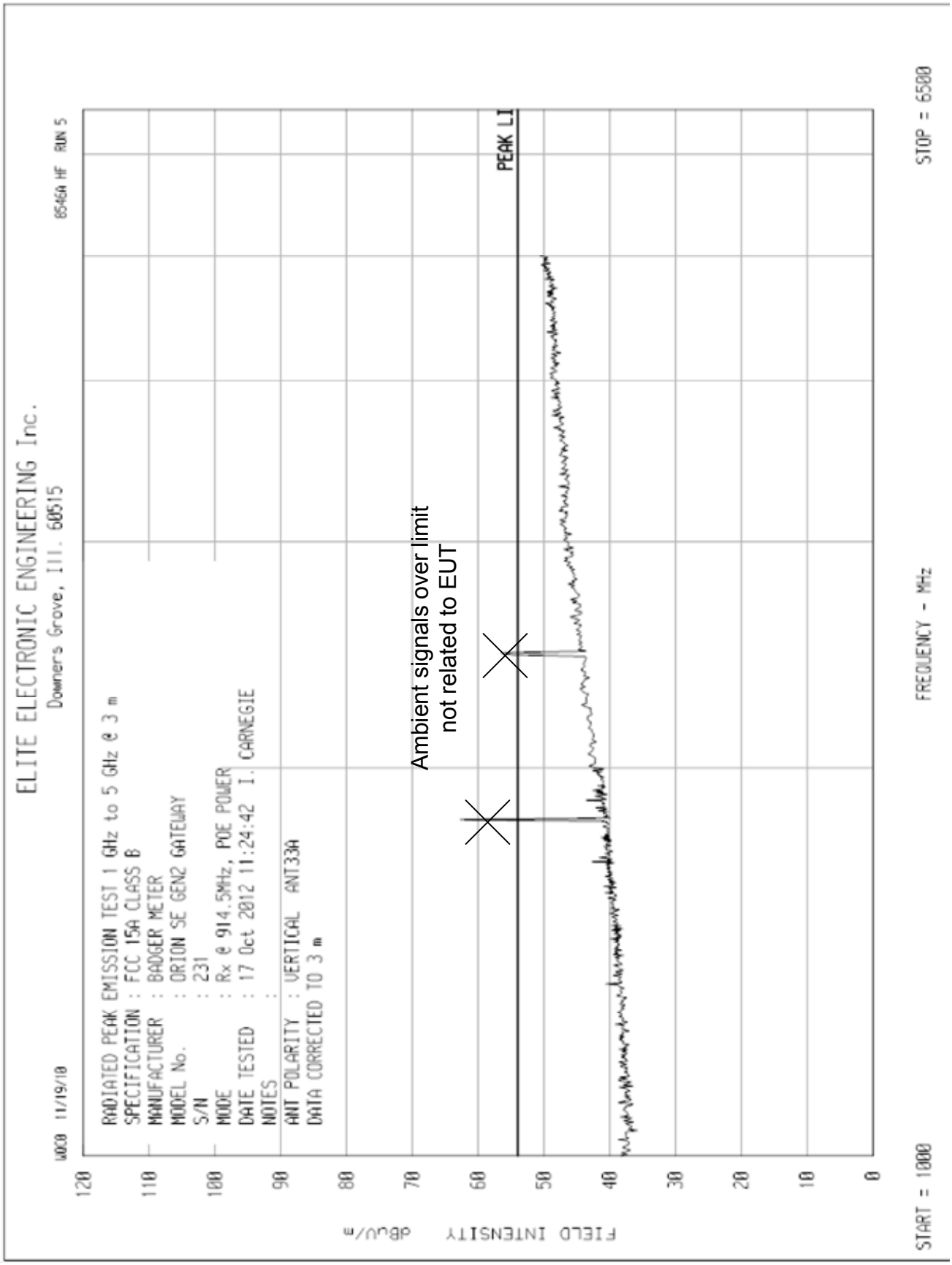

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WQC8 11/19/10
8546A HF RUN 4
RADIATED PEAK EMISSION TEST 1 GHz to 5 GHz @ 3 m
SPECIFICATION : FCC 15A CLASS B
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GEN2 GATEWAY
S/N : 231
MODE : Rx @ 904.9MHz, POE POWER
DATE TESTED : 17 Oct 2012 10:43:29 I. CARNEGIE
NOTES :
ANT POLARITY : HORIZONTAL ANT33A
DATA CORRECTED TO 3 m
PEAK LI
FIELD INTENSITY dBuV/m
120
110
100
90
80
70
60
50
40
30
20
10
0
START = 1000
FREQUENCY - MHz
STOP = 6500

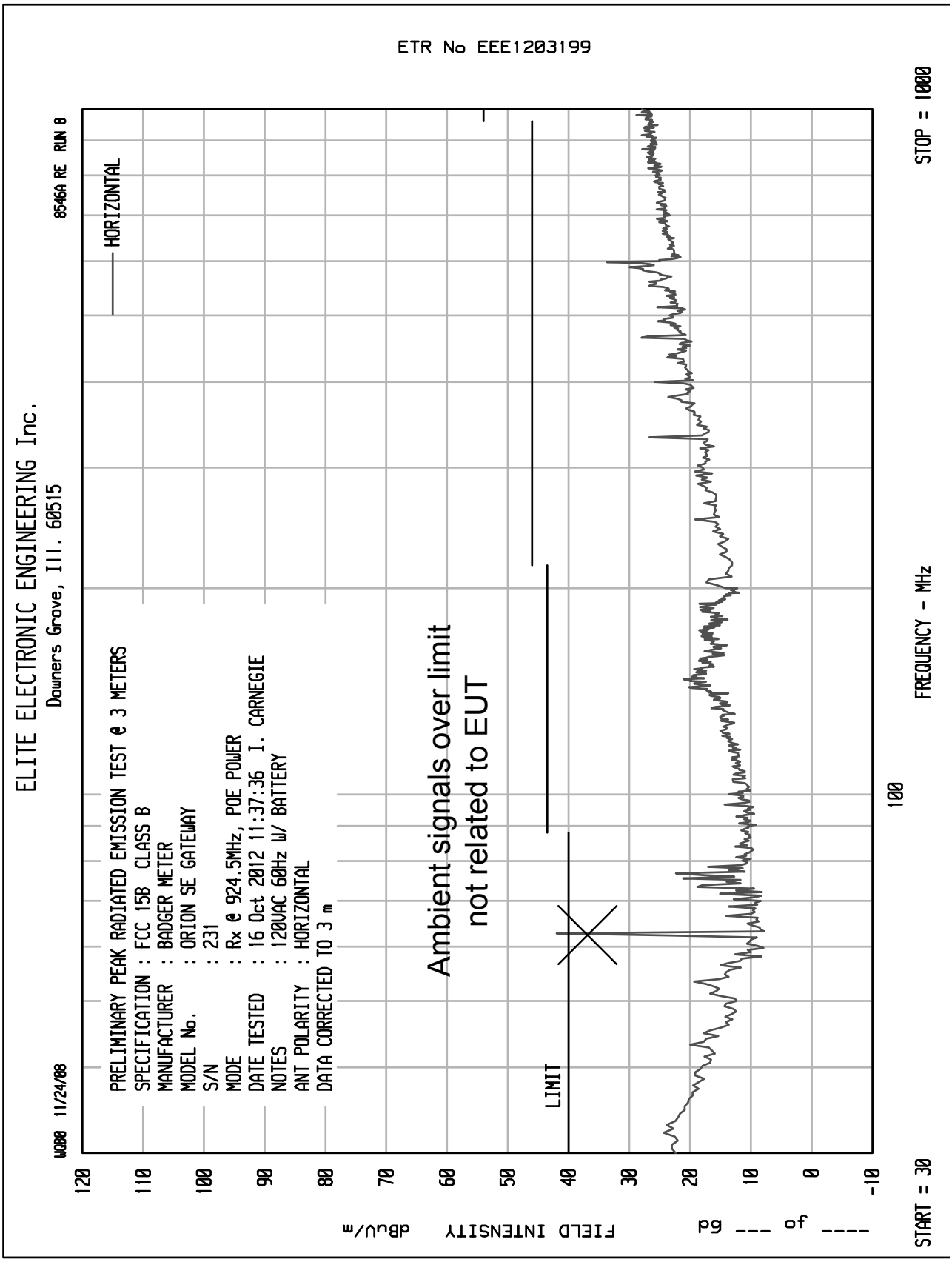

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
8546A HF RUN 4
WQC8 11/19/10
RADIATED PEAK EMISSION TEST 1 GHz to 5 GHz @ 3 m
SPECIFICATION : FCC 15A CLASS B
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GEN2 GATEWAY
S/N : 231
MODE : Rx @ 904.9MHz, POE POWER
DATE TESTED : 17 Oct 2012 10:43:29 I. CARNEGIE
NOTES : :
ANT POLARITY : VERTICAL ANT33A
DATA CORRECTED TO 3 m
PEAK LI
FIELD INTENSITY dBuV/m
120
110
100
90
80
70
60
50
40
30
20
10
0
START = 1000
FREQUENCY - MHz
STOP = 6500

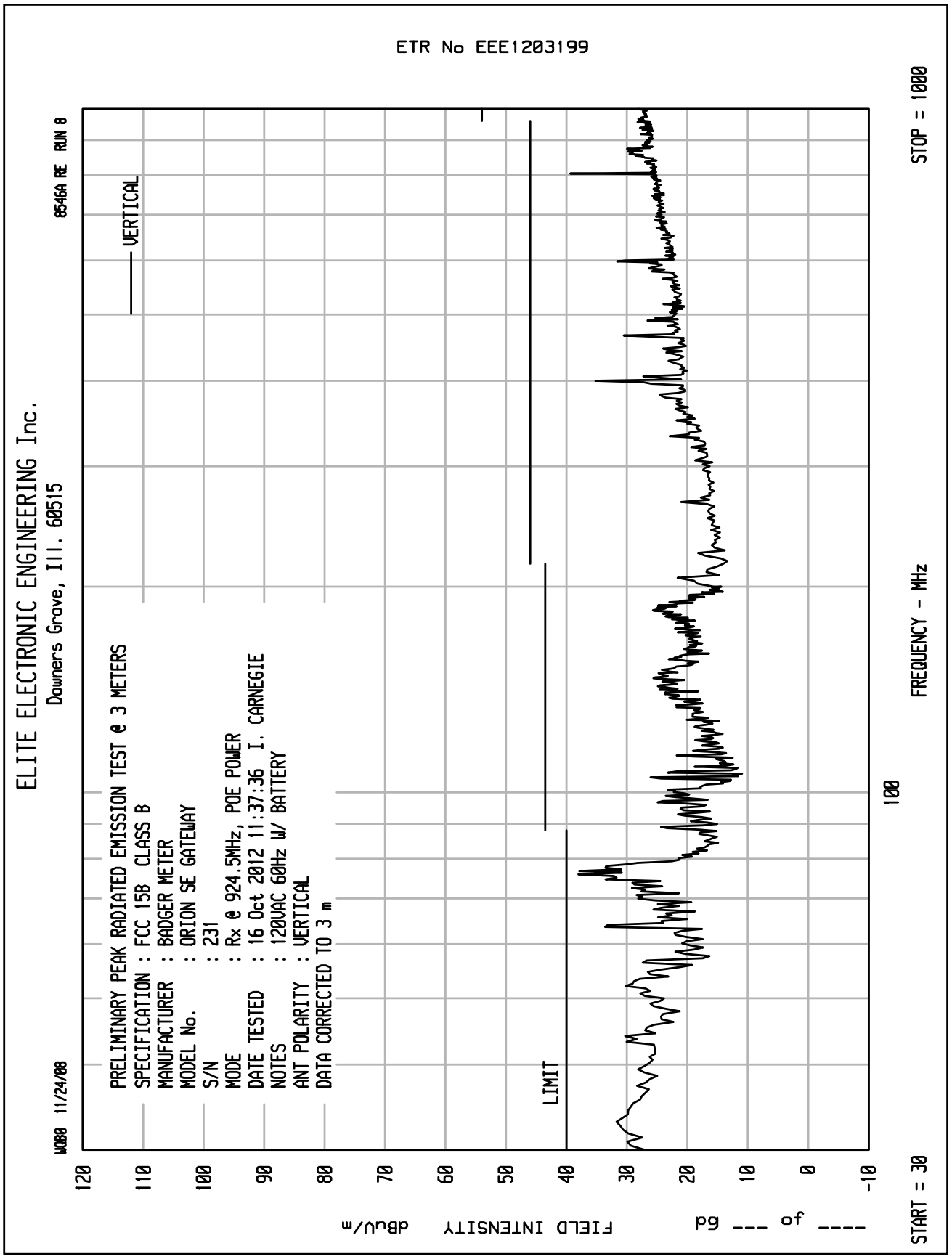

ETR No EEE1203199
ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
8546A RE RUN 7
11/24/08
PRELIMINARY PEAK RADIATED EMISSION TEST @ 3 METERS
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GATEWAY
S/N : 231
MODE : Rx @ 914.5MHz, POE POWER
DATE TESTED : 16 Oct 2012 10:59:48 I. CARNEGIE
NOTES : 120VAC 60Hz W/ BATTERY
ANT POLARITY : HORIZONTAL
DATA CORRECTED TO 3 m
HORIZONTAL
LIMIT
FIELD INTENSITY dBuV/m
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
START = 30
100
STOP = 1000
FREQUENCY - MHz
---- of ---- pg

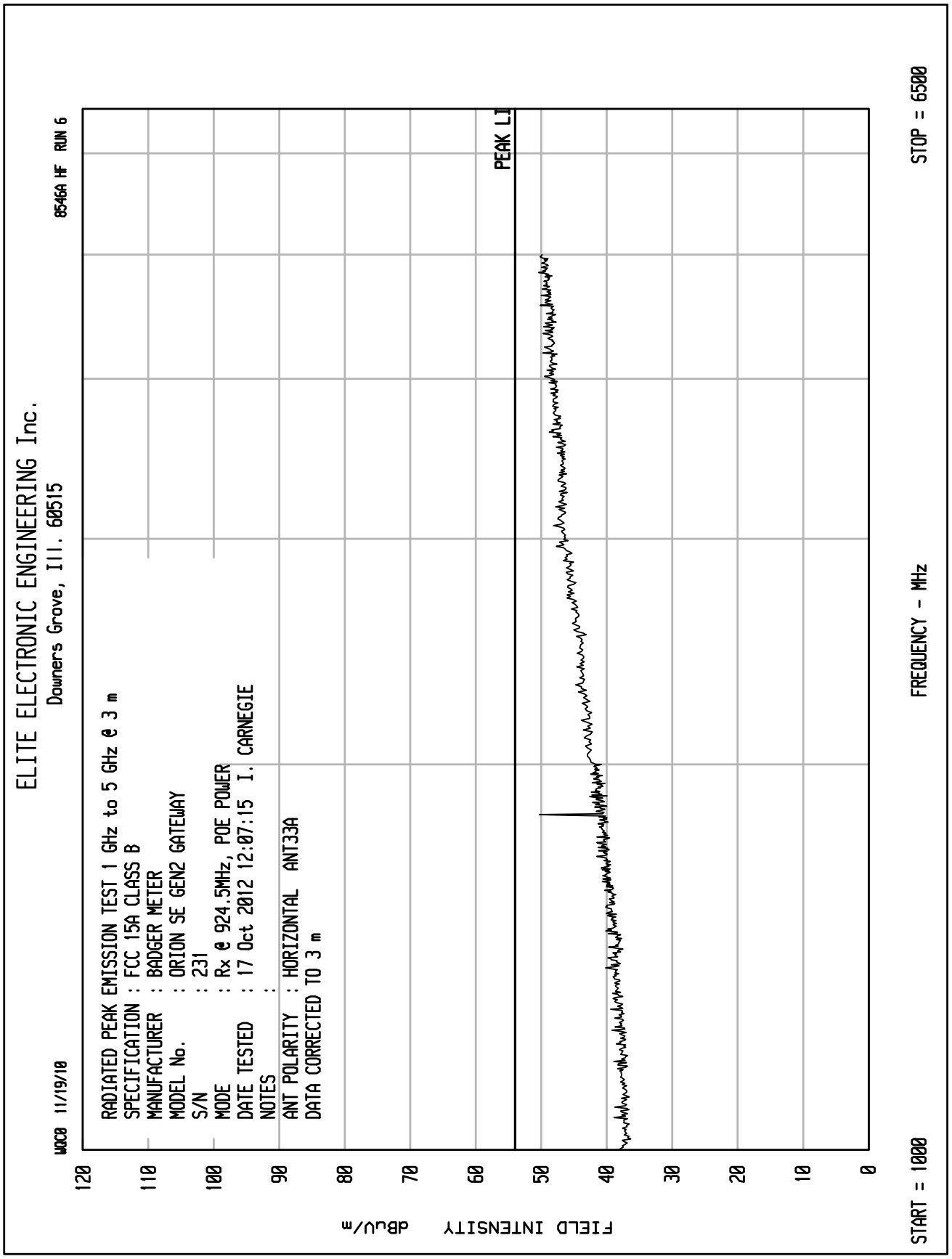

ETR No EEE1203199
ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
8546A RE RUN 7
VERTICAL
PRELIMINARY PEAK RADIATED EMISSION TEST @ 3 METERS
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GATEWAY
S/N : 231
MODE : Rx @ 914.5MHz, POE POWER
DATE TESTED : 16 Oct 2012 10:59:48 I. CARNEGIE
NOTES : 120VAC 60Hz W/ BATTERY
ANT POLARITY : VERTICAL
DATA CORRECTED TO 3 m
LIMIT
FIELD INTENSITY dBuV/m
FREQUENCY - MHz
START = 30
100
STOP = 1000
120
110
100
90
80
70
60
50
40
30
20
10
0
-10

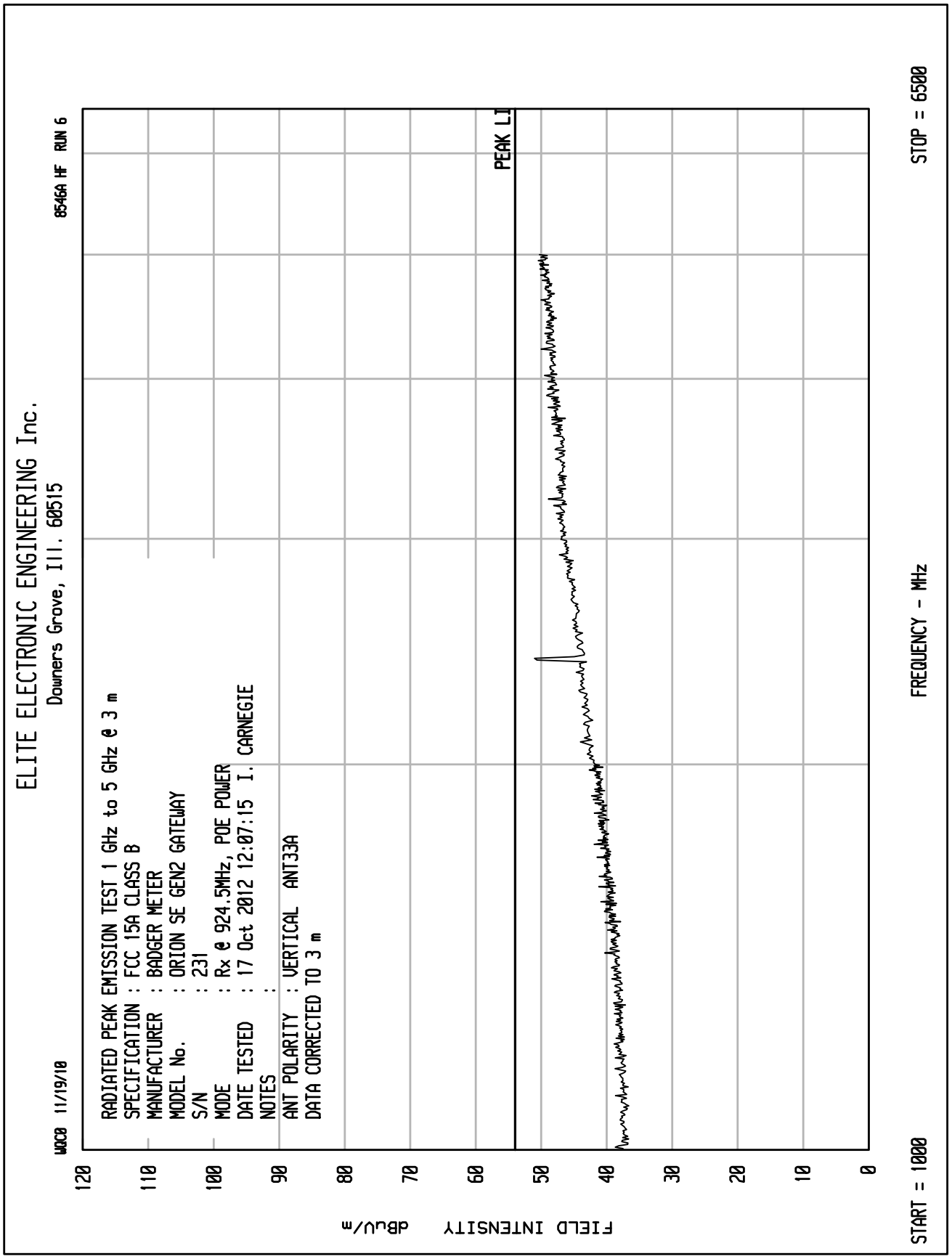

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WQC8 11/19/10
8546A HF RUN 5
RADIATED PEAK EMISSION TEST 1 GHz to 5 GHz @ 3 m
SPECIFICATION : FCC 15A CLASS B
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GEN2 GATEWAY
S/N : 231
MODE : Rx @ 914.5MHz, POE POWER
DATE TESTED : 17 Oct 2012 11:24:42 I. CARNEGIE
NOTES :
ANT POLARITY : HORIZONTAL ANT33A
DATA CORRECTED TO 3 m
PEAK LI
FIELD INTENSITY dBuV/m
120
110
100
90
80
70
60
50
40
30
20
10
0
START = 1000
FREQUENCY - MHz
STOP = 6500


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
6546A HF RUN 5
WO3 11/19/10
RADIATED PEAK EMISSION TEST 1 GHz to 5 GHz @ 3 m
SPECIFICATION : FCC 15A CLASS B
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GEN2 GATEWAY
S/N : 231
MODE : Rx @ 914.5MHz, POE POWER
DATE TESTED : 17 Oct 2012 11:24:42 I. CARNEGIE
NOTES :
ANT POLARITY : VERTICAL ANT33A
DATA CORRECTED TO 3 m
PEAK LI
Ambient signals over limit
not related to EUT
FIELD INTENSITY dBuV/m
120
110
100
90
80
70
60
50
40
30
20
10
0
START = 1000
FREQUENCY - MHz
STOP = 6500


ETR No EEE1203199
ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
8546A RE RUN 8
WQB0 11/24/08
PRELIMINARY PEAK RADIATED EMISSION TEST @ 3 METERS
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GATEWAY
S/N : 231
MODE : Rx @ 924.5MHz, POE POWER
DATE TESTED : 16 Oct 2012 11:37:36 I. CARNEGIE
NOTES : 120VAC 60Hz w/ BATTERY
ANT POLARITY : HORIZONTAL
DATA CORRECTED TO 3 m
HORIZONTAL
Ambient signals over limit
not related to EUT
LIMIT
FIELD INTENSITY dBuV/m
FREQUENCY - MHz
START = 30
100
STOP = 1000
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
pg --- of ----


ETR No EEE1203199
ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
8546A RE RUN 8
11/24/08
PRELIMINARY PEAK RADIATED EMISSION TEST @ 3 METERS
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GATEWAY
S/N : 231
MODE : Rx @ 924.5MHz, POE POWER
DATE TESTED : 16 Oct 2012 11:37:36 I. CARNEGIE
NOTES : 120VAC 60Hz W/ BATTERY
ANT POLARITY : VERTICAL
DATA CORRECTED TO 3 m
VERTICAL
LIMIT
FIELD INTENSITY dBuV/m
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
START = 30
100
STOP = 1000
FREQUENCY - MHz
---- of ---- pg


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
8546A HF RUN 6
WQC8 11/19/10
RADIATED PEAK EMISSION TEST 1 GHz to 5 GHz @ 3 m
SPECIFICATION : FCC 15A CLASS B
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GEN2 GATEWAY
S/N : 231
MODE : Rx @ 924.5MHz, POE POWER
DATE TESTED : 17 Oct 2012 12:07:15 I. CARNEGIE
NOTES : :
ANT POLARITY : HORIZONTAL ANT33A
DATA CORRECTED TO 3 m
PEAK LI
FIELD INTENSITY dBuV/m
120
110
100
90
80
70
60
50
40
30
20
10
0
START = 1000
FREQUENCY - MHz
STOP = 6500


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WQC0 11/19/10
8546A HF RUN 6
RADIATED PEAK EMISSION TEST 1 GHz to 5 GHz @ 3 m
SPECIFICATION : FCC 15A CLASS B
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GEN2 GATEWAY
S/N : 231
MODE : Rx @ 924.5MHz, POE POWER
DATE TESTED : 17 Oct 2012 12:07:15 I. CARNEGIE
NOTES :
ANT POLARITY : VERTICAL ANT33A
DATA CORRECTED TO 3 m
PEAK LI
FIELD INTENSITY dBuV/m
120
110
100
90
80
70
60
50
40
30
20
10
0
START = 1000
FREQUENCY - MHz
STOP = 6500

ETR No. EEE1203199 854

6A

DATA SHEET TEST NO. 3

RADIATED QP EMISSION MEASUREMENTS in a 3 m SEMI-ANECHOIC ROOM
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : BADGER METER
MODEL NO. : ORION SE GATEWAY
SERIAL NO. : 231
TEST MODE : Rx @ 904.9MHz, AC/DC CONVERTER
NOTES : 120VAC 60Hz W/ BATTERY
TEST DATE : 16 Oct 2012 08:33:03
TEST DISTANCE : 3 m (DATA EXTRAPOLATED TO 3 m)

FREQUENCY MHz	QP READING dBuV	ANT FAC dB	CBL FAC dB	EXT ATTN dB	DIST FAC dB	TOTAL dBuV/m	QP LIMIT dBuV/m	AZ deg	ANT HT cm	POLAR
44.49	16.4	11.7	.5	0.0	0.0	28.5	40.0	0	120	V
71.01	17.3	7.0	.5	0.0	0.0	24.8	40.0	45	340	V
77.78	13.1	8.2	.5	0.0	0.0	21.7	40.0	45	200	V
105.00	2.2	10.5	.5	0.0	0.0	13.2	43.5	315	120	V
143.38	4.0	12.2	.8	0.0	0.0	17.0	43.5	180	340	V
144.13	5.1	12.2	.8	0.0	0.0	18.0	43.5	225	340	V
166.51	-1.6	10.5	.9	0.0	0.0	9.8	43.5	225	120	V
192.23	-5.7	10.5	1.0	0.0	0.0	5.8	43.5	180	120	V
329.99	11.6	14.9	1.2	0.0	0.0	27.6	46.0	0	200	H
396.00	18.7	16.4	1.5	0.0	0.0	36.6	46.0	0	120	V
557.83	4.6	19.3	1.5	0.0	0.0	25.4	46.0	45	120	H
594.00	10.3	19.5	1.5	0.0	0.0	31.2	46.0	0	200	V
792.85	-6.7	21.5	2.0	0.0	0.0	16.8	46.0	270	200	H
862.26	4.1	22.5	2.0	0.0	0.0	28.5	46.0	0	200	V
954.24	-6.9	22.8	2.0	0.0	0.0	17.9	46.0	135	120	V

tested by: I. Carnegie

DATA SHEET HF TEST NO. 1

RADIATED AVG EMISSION MEASUREMENTS >=1000 MHz in a 3 m ANECHOIC ROOM

SPECIFICATION : FCC 15A CLASS B
MANUFACTURER : BADGER METER
MODEL NO. : ORION SE GEN2 GATEWAY
SERIAL NO. : 231
TEST MODE : Rx @ 904.9MHz, ACDC POWER
NOTES :
TEST DATE : 17 Oct 2012 08:36:34
TEST DISTANCE : 3 m
ANTENNA : ANT33D

FREQUENCY MHz	AVG READING dBuV	ANT FAC dB	CBL FAC dB	DIST FAC dB	TOTAL dBuV/m	AVG LIMIT dBuV/m	PASS/ FAIL	AZ deg	ANT HT cm	POLAR
1044.09	-2.1	23.9	2.1	0.0	23.9	54.0		0	200	V
1260.34	-2.7	24.8	2.3	0.0	24.5	54.0		135	200	V
1389.77	-2.5	25.0	2.5	0.0	25.0	54.0		45	200	H
1523.99	-2.5	25.2	2.6	0.0	25.3	54.0		180	340	V
1665.04	-2.4	26.1	2.7	0.0	26.5	54.0		45	340	V
1728.61	-2.3	26.4	2.8	0.0	26.9	54.0		90	200	H
1861.83	-2.9	27.1	2.9	0.0	27.1	54.0		90	120	V
2200.07	-2.4	27.6	3.2	0.0	28.5	54.0		45	340	V
2437.64	-.9	28.8	3.4	0.0	31.4	54.0		45	340	H
3006.14	-2.1	30.7	3.9	0.0	32.4	54.0		180	120	H
3266.85	-2.3	31.9	4.1	0.0	33.7	54.0		45	200	H
3839.15	-2.4	32.9	4.4	0.0	34.9	54.0		180	120	H
4159.59	-2.1	33.0	4.6	0.0	35.5	54.0		0	120	V
4626.19	-1.8	33.3	4.8	0.0	36.3	54.0		0	200	V
4877.49	-2.0	34.0	4.9	0.0	37.0	54.0		0	120	V

tested by: I. Carnegie

ETR No. EEE1203199 854

6A

DATA SHEET TEST NO. 4

RADIATED QP EMISSION MEASUREMENTS in a 3 m SEMI-ANECHOIC ROOM
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : BADGER METER
MODEL NO. : ORION SE GATEWAY
SERIAL NO. : 231
TEST MODE : Rx @ 914.5MHz, AC/DC CONVERTER
NOTES : 120VAC 60Hz W/ BATTERY
TEST DATE : 16 Oct 2012 09:09:09
TEST DISTANCE : 3 m (DATA EXTRAPOLATED TO 3 m)

FREQUENCY	QP READING	ANT FAC	CBL FAC	EXT ATTN	DIST FAC	TOTAL	QP LIMIT	AZ	ANT HT	POLAR
MHz	dBuV	dB	dB	dB	dB	dBuV/m	dBuV/m	deg	cm	
44.98	26.5	11.5	.5	0.0	0.0	38.5	40.0	225	120	V
71.61	14.1	7.0	.5	0.0	0.0	21.7	40.0	225	200	V
77.07	14.3	8.0	.5	0.0	0.0	22.8	40.0	225	200	V
106.42	1.6	10.7	.5	0.0	0.0	12.8	43.5	45	120	V
142.60	5.5	12.2	.8	0.0	0.0	18.4	43.5	270	200	V
143.39	5.9	12.2	.8	0.0	0.0	18.8	43.5	225	340	V
165.77	-2.3	10.6	.9	0.0	0.0	9.2	43.5	270	120	V
216.61	-6.2	11.2	1.0	0.0	0.0	6.0	46.0	180	120	V
329.99	10.0	14.9	1.2	0.0	0.0	26.1	46.0	0	200	H
395.99	18.2	16.4	1.5	0.0	0.0	36.1	46.0	0	120	V
523.76	3.9	18.6	1.5	0.0	0.0	24.0	46.0	45	120	H
618.84	-7.9	19.9	1.6	0.0	0.0	13.5	46.0	225	200	V
764.99	-7.2	21.2	1.9	0.0	0.0	15.9	46.0	270	200	V
862.25	4.9	22.5	2.0	0.0	0.0	29.4	46.0	0	200	V
952.66	-7.1	22.8	2.0	0.0	0.0	17.7	46.0	0	120	V

tested by: I. Carnegie

DATA SHEET HF TEST NO. 2

RADIATED AVG EMISSION MEASUREMENTS >=1000 MHz in a 3 m ANECHOIC ROOM

SPECIFICATION : FCC 15A CLASS B
MANUFACTURER : BADGER METER
MODEL NO. : ORION SE GEN2 GATEWAY
SERIAL NO. : 231
TEST MODE : Rx @ 914.5MHz, ACDC POWER
NOTES :
TEST DATE : 17 Oct 2012 09:14:42
TEST DISTANCE : 3 m
ANTENNA : ANT33A

FREQUENCY MHz	AVG READING dBuV	ANT FAC dB	CBL FAC dB	DIST FAC dB	TOTAL dBuV/m	AVG LIMIT dBuV/m	PASS/ FAIL	AZ deg	ANT HT cm	POLAR
1029.96	-2.8	25.6	2.0	0.0	24.8	54.0		91	200	V
1276.02	7.3	26.2	2.4	0.0	35.9	54.0		180	340	V
1276.29	-3.0	26.2	2.4	0.0	25.6	54.0		45	340	H
1543.69	-2.8	26.9	2.6	0.0	26.8	54.0		135	120	V
1673.05	-3.1	27.6	2.7	0.0	27.2	54.0		270	120	V
1787.15	-3.1	28.1	2.8	0.0	27.8	54.0		270	340	H
1818.25	-3.0	28.2	2.9	0.0	28.1	54.0		180	340	V
2177.32	-3.0	29.4	3.2	0.0	29.6	54.0		90	200	H
2404.64	-2.9	29.9	3.4	0.0	30.4	54.0		225	340	H
2987.19	-2.3	31.6	3.9	0.0	33.1	54.0		270	340	V
3141.01	-2.4	31.8	4.0	0.0	33.4	54.0		135	120	V
3426.24	-2.8	32.0	4.2	0.0	33.4	54.0		90	340	V
4073.01	-2.5	33.1	4.6	0.0	35.1	54.0		45	120	V
4368.19	-2.4	32.9	4.7	0.0	35.2	54.0		180	200	V
4888.79	-2.4	33.8	5.0	0.0	36.4	54.0		90	200	H

tested by: I. Carnegie

ETR No. EEE1203199 854

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DATA SHEET TEST NO. 5

RADIATED QP EMISSION MEASUREMENTS in a 3 m SEMI-ANECHOIC ROOM
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : BADGER METER
MODEL NO. : ORION SE GATEWAY
SERIAL NO. : 231
TEST MODE : Rx @ 924.5MHz, AC/DC CONVERTER
NOTES : 120VAC 60Hz W/ BATTERY
TEST DATE : 16 Oct 2012 09:45:19
TEST DISTANCE : 3 m (DATA EXTRAPOLATED TO 3 m)

FREQUENCY MHz	QP READING dBuV	ANT FAC dB	CBL FAC dB	EXT ATTN dB	DIST FAC dB	TOTAL dBuV/m	QP LIMIT dBuV/m	AZ deg	ANT HT cm	POLAR
45.01	20.7	11.5	.5	0.0	0.0	32.7	40.0	0	340	V
73.01	7.6	7.3	.5	0.0	0.0	15.4	40.0	0	340	V
78.79	1.2	8.4	.5	0.0	0.0	10.1	40.0	0	340	V
106.05	3.2	10.6	.5	0.0	0.0	14.4	43.5	45	120	V
142.56	5.5	12.2	.8	0.0	0.0	18.5	43.5	270	200	V
143.35	5.7	12.2	.8	0.0	0.0	18.6	43.5	90	120	V
165.95	-2.4	10.6	.9	0.0	0.0	9.1	43.5	225	120	V
209.44	-5.5	11.0	1.0	0.0	0.0	6.5	43.5	180	120	V
329.99	9.6	14.9	1.2	0.0	0.0	25.6	46.0	0	200	H
395.99	18.0	16.4	1.5	0.0	0.0	35.9	46.0	0	120	V
579.12	6.1	19.4	1.5	0.0	0.0	27.0	46.0	45	120	H
581.25	4.6	19.4	1.5	0.0	0.0	25.5	46.0	45	120	H
754.85	-7.3	21.1	1.9	0.0	0.0	15.7	46.0	90	200	V
872.90	-.5	22.6	2.0	0.0	0.0	24.1	46.0	0	200	V
912.31	-7.0	22.6	2.0	0.0	0.0	17.6	46.0	315	200	V

tested by: I. Carnegie

DATA SHEET HF TEST NO. 3

RADIATED AVG EMISSION MEASUREMENTS >=1000 MHz in a 3 m ANECHOIC ROOM

SPECIFICATION : FCC 15A CLASS B
MANUFACTURER : BADGER METER
MODEL NO. : ORION SE GEN2 GATEWAY
SERIAL NO. : 231
TEST MODE : Rx @ 924.5MHz, ACDC POWER
NOTES :
TEST DATE : 17 Oct 2012 09:53:45
TEST DISTANCE : 3 m
ANTENNA : ANT33A

FREQUENCY MHz	AVG READING dBuV	ANT FAC dB	CBL FAC dB	DIST FAC dB	TOTAL dBuV/m	AVG LIMIT dBuV/m	PASS/ FAIL	AZ deg	ANT HT cm	POLAR
1035.19	-3.0	25.6	2.1	0.0	24.6	54.0		90	340	V
1270.14	-3.3	26.2	2.3	0.0	25.3	54.0		45	340	H
1346.20	-3.3	26.4	2.4	0.0	25.5	54.0		180	200	H
1526.88	-3.1	26.8	2.6	0.0	26.3	54.0		180	340	V
1674.58	-3.2	27.6	2.7	0.0	27.2	54.0		45	200	H
1794.49	-3.2	28.1	2.8	0.0	27.7	54.0		180	340	V
1914.10	-3.5	28.7	2.9	0.0	28.1	54.0		135	120	H
2031.30	7.7	29.1	3.0	0.0	39.8	54.0		45	340	H
2421.95	8.0	30.0	3.4	0.0	41.4	54.0		45	200	H
3057.89	-2.7	31.7	3.9	0.0	32.9	54.0		270	120	H
3148.29	-2.5	31.8	4.0	0.0	33.2	54.0		225	200	H
3720.74	-3.1	32.6	4.4	0.0	33.9	54.0		90	200	H
4193.72	-2.8	33.0	4.6	0.0	34.8	54.0		314	120	H
4381.74	-2.6	32.9	4.7	0.0	35.0	54.0		45	200	H
4919.21	-2.6	33.9	5.0	0.0	36.3	54.0		270	120	H

tested by: I. Carnegie

ETR No. EEE1203199 854

6A

DATA SHEET TEST NO. 6

RADIATED QP EMISSION MEASUREMENTS in a 3 m SEMI-ANECHOIC ROOM
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : BADGER METER
MODEL NO. : ORION SE GATEWAY
SERIAL NO. : 231
TEST MODE : Rx @ 904.9MHz, POE POWER
NOTES : 120VAC 60Hz W/ BATTERY
TEST DATE : 16 Oct 2012 10:24:11
TEST DISTANCE : 3 m (DATA EXTRAPOLATED TO 3 m)

FREQUENCY MHz	QP READING dBuV	ANT FAC dB	CBL FAC dB	EXT ATTN dB	DIST FAC dB	TOTAL dBuV/m	QP LIMIT dBuV/m	AZ deg	ANT HT cm	POLAR
32.85	12.7	17.9	.5	0.0	0.0	31.1	40.0	315	120	V
72.30	18.8	7.2	.5	0.0	0.0	26.4	40.0	180	200	V
78.05	24.4	8.3	.5	0.0	0.0	33.1	40.0	180	200	V
104.30	18.0	10.4	.5	0.0	0.0	28.9	43.5	315	120	V
137.90	10.4	12.5	.7	0.0	0.0	23.6	43.5	45	120	V
147.13	12.1	12.0	.8	0.0	0.0	24.9	43.5	45	120	V
188.56	9.4	10.4	1.0	0.0	0.0	20.7	43.5	90	120	H
192.59	1.7	10.6	1.0	0.0	0.0	13.2	43.5	0	120	H
335.00	-3.3	15.1	1.2	0.0	0.0	13.0	46.0	270	340	V
395.99	17.8	16.4	1.5	0.0	0.0	35.7	46.0	0	120	V
579.12	4.3	19.4	1.5	0.0	0.0	25.2	46.0	0	120	H
667.66	-6.7	20.4	1.7	0.0	0.0	15.4	46.0	45	200	V
796.25	-6.2	21.5	2.0	0.0	0.0	17.2	46.0	90	200	V
797.33	-6.8	21.5	2.0	0.0	0.0	16.7	46.0	90	200	V
958.09	-6.3	22.9	2.0	0.0	0.0	18.5	46.0	270	340	V

tested by: I. Carnegie

DATA SHEET HF TEST NO. 4

RADIATED AVG EMISSION MEASUREMENTS >=1000 MHz in a 3 m ANECHOIC ROOM

SPECIFICATION : FCC 15A CLASS B
MANUFACTURER : BADGER METER
MODEL NO. : ORION SE GEN2 GATEWAY
SERIAL NO. : 231
TEST MODE : Rx @ 904.9MHz, POE POWER
NOTES :
TEST DATE : 17 Oct 2012 10:43:29
TEST DISTANCE : 3 m
ANTENNA : ANT33A

FREQUENCY MHz	AVG READING dBuV	ANT FAC dB	CBL FAC dB	DIST FAC dB	TOTAL dBuV/m	AVG LIMIT dBuV/m	PASS/ FAIL	AZ deg	ANT HT cm	POLAR
1060.48	7.6	25.7	2.1	0.0	35.4	54.0		0	340	V
1159.02	-3.6	25.9	2.2	0.0	24.6	54.0		315	340	H
1330.44	-3.4	26.3	2.4	0.0	25.3	54.0		270	120	V
1531.91	-3.1	26.9	2.6	0.0	26.3	54.0		45	200	V
1552.83	-3.0	27.0	2.6	0.0	26.6	54.0		225	340	H
1757.53	-3.0	28.0	2.8	0.0	27.8	54.0		315	120	V
1869.99	-3.4	28.5	2.9	0.0	27.9	54.0		0	120	H
2159.68	-3.3	29.4	3.2	0.0	29.2	54.0		45	200	H
2423.22	7.8	30.0	3.4	0.0	41.2	54.0		0	120	V
2941.66	-2.8	31.4	3.8	0.0	32.5	54.0		135	120	V
3158.35	-2.8	31.8	4.0	0.0	33.0	54.0		45	200	H
3811.25	-3.1	32.8	4.4	0.0	34.1	54.0		180	120	V
3949.24	-3.2	33.1	4.5	0.0	34.4	54.0		225	340	H
4601.44	-2.5	33.1	4.8	0.0	35.4	54.0		180	340	H
4937.53	-2.8	34.0	5.0	0.0	36.1	54.0		315	120	H

tested by: I. Carnegie

ETR No. EEE1203199 854

6A

DATA SHEET TEST NO. 7

RADIATED QP EMISSION MEASUREMENTS in a 3 m SEMI-ANECHOIC ROOM
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : BADGER METER
MODEL NO. : ORION SE GATEWAY
SERIAL NO. : 231
TEST MODE : Rx @ 914.5MHz, POE POWER
NOTES : 120VAC 60Hz W/ BATTERY
TEST DATE : 16 Oct 2012 10:59:48
TEST DISTANCE : 3 m (DATA EXTRAPOLATED TO 3 m)

FREQUENCY MHz	QP READING dBuV	ANT FAC dB	CBL FAC dB	EXT ATTN dB	DIST FAC dB	TOTAL dBuV/m	QP LIMIT dBuV/m	AZ deg	ANT HT cm	POLAR
33.59	11.7	17.5	.5	0.0	0.0	29.7	40.0	315	200	V
75.84	19.8	7.7	.5	0.0	0.0	28.0	40.0	315	200	V
75.95	25.0	7.8	.5	0.0	0.0	33.3	40.0	315	200	V
104.29	15.9	10.4	.5	0.0	0.0	26.8	43.5	0	121	V
142.39	10.3	12.2	.8	0.0	0.0	23.2	43.5	45	121	V
146.42	11.9	12.1	.8	0.0	0.0	24.7	43.5	45	121	V
186.51	11.7	10.3	1.0	0.0	0.0	23.0	43.5	315	200	V
263.99	5.0	13.5	1.0	0.0	0.0	19.5	46.0	45	200	V
329.99	10.2	14.9	1.2	0.0	0.0	26.3	46.0	45	200	H
395.99	18.0	16.4	1.5	0.0	0.0	35.9	46.0	0	120	V
579.13	5.1	19.4	1.5	0.0	0.0	26.0	46.0	90	120	H
594.00	12.2	19.5	1.5	0.0	0.0	33.2	46.0	0	120	H
694.00	-6.5	20.4	1.8	0.0	0.0	15.7	46.0	270	200	V
851.64	2.1	22.3	2.0	0.0	0.0	26.4	46.0	45	200	V
944.17	-7.2	22.7	2.0	0.0	0.0	17.5	46.0	270	120	H

tested by: I. Carnegie

DATA SHEET HF TEST NO. 5

RADIATED AVG EMISSION MEASUREMENTS >=1000 MHz in a 3 m ANECHOIC ROOM

SPECIFICATION : FCC 15A CLASS B
MANUFACTURER : BADGER METER
MODEL NO. : ORION SE GEN2 GATEWAY
SERIAL NO. : 231
TEST MODE : Rx @ 914.5MHz, POE POWER
NOTES :
TEST DATE : 17 Oct 2012 11:24:42
TEST DISTANCE : 3 m
ANTENNA : ANT33A

FREQUENCY MHz	AVG READING dBuV	ANT FAC dB	CBL FAC dB	DIST FAC dB	TOTAL dBuV/m	AVG LIMIT dBuV/m	PASS/ FAIL	AZ deg	ANT HT cm	POLAR
1023.86	-3.4	25.6	2.0	0.0	24.2	54.0		0	200	V
1246.16	6.8	26.2	2.3	0.0	35.3	54.0		315	340	H
1357.43	-3.4	26.4	2.4	0.0	25.4	54.0		180	120	V
1433.09	-3.3	26.6	2.5	0.0	25.8	54.0		45	200	H
1622.98	-3.6	27.3	2.7	0.0	26.4	54.0		0	200	H
1683.88	-3.2	27.6	2.8	0.0	27.2	54.0		0	120	V
1802.19	-3.4	28.2	2.8	0.0	27.6	54.0		180	200	V
2099.91	-3.1	29.3	3.1	0.0	29.3	54.0		225	200	H
2448.35	-1.6	30.0	3.4	0.0	31.8	54.0		315	200	V
3006.74	-2.9	31.6	3.9	0.0	32.6	54.0		180	120	V
3068.82	-2.6	31.7	3.9	0.0	33.0	54.0		270	340	H
3761.21	-3.2	32.7	4.4	0.0	33.9	54.0		135	120	V
4087.67	-2.9	33.1	4.6	0.0	34.8	54.0		135	200	H
4549.38	-2.5	32.9	4.8	0.0	35.3	54.0		0	120	H
4979.89	-2.8	34.1	5.0	0.0	36.3	54.0		315	120	H

tested by: I. Carnegie

ETR No. EEE1203199 854

6A

DATA SHEET TEST NO. 8

RADIATED QP EMISSION MEASUREMENTS in a 3 m SEMI-ANECHOIC ROOM
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : BADGER METER
MODEL NO. : ORION SE GATEWAY
SERIAL NO. : 231
TEST MODE : Rx @ 924.5MHz, POE POWER
NOTES : 120VAC 60Hz W/ BATTERY
TEST DATE : 16 Oct 2012 11:37:36
TEST DISTANCE : 3 m (DATA EXTRAPOLATED TO 3 m)

FREQUENCY MHz	QP READING dBuV	ANT FAC dB	CBL FAC dB	EXT ATTN dB	DIST FAC dB	TOTAL dBuV/m	QP LIMIT dBuV/m	AZ deg	ANT HT cm	POLAR
33.13	11.4	17.7	.5	0.0	0.0	29.6	40.0	180	121	V
64.16	-.6	6.5	.5	0.0	0.0	6.4	40.0	0	340	H
76.59	20.1	7.9	.5	0.0	0.0	28.5	40.0	314	200	V
104.28	14.2	10.4	.5	0.0	0.0	25.1	43.5	0	120	V
142.10	9.6	12.3	.8	0.0	0.0	22.6	43.5	45	120	V
147.84	8.9	12.0	.8	0.0	0.0	21.7	43.5	45	120	V
183.32	11.2	10.2	.9	0.0	0.0	22.4	43.5	270	120	V
204.57	7.5	10.9	1.0	0.0	0.0	19.4	43.5	315	120	V
329.99	10.6	14.9	1.2	0.0	0.0	26.7	46.0	45	200	H
395.99	17.6	16.4	1.5	0.0	0.0	35.5	46.0	0	120	V
583.38	6.0	19.4	1.5	0.0	0.0	26.9	46.0	0	120	H
594.00	12.1	19.5	1.5	0.0	0.0	33.1	46.0	0	120	H
789.87	-7.0	21.4	2.0	0.0	0.0	16.4	46.0	45	120	V
800.87	-6.9	21.5	2.0	0.0	0.0	16.6	46.0	45	200	V
951.64	-7.2	22.7	2.0	0.0	0.0	17.5	46.0	180	340	V

tested by: I. Carnegie

DATA SHEET HF TEST NO. 6

RADIATED AVG EMISSION MEASUREMENTS >=1000 MHz in a 3 m ANECHOIC ROOM
SPECIFICATION : FCC 15A CLASS B
MANUFACTURER : BADGER METER
MODEL NO. : ORION SE GEN2 GATEWAY
SERIAL NO. : 231
TEST MODE : Rx @ 924.5MHz, POE POWER
NOTES :
TEST DATE : 17 Oct 2012 12:07:15
TEST DISTANCE : 3 m
ANTENNA : ANT33A

FREQUENCY	AVG READING	ANT FAC	CBL FAC	DIST FAC	TOTAL	AVG LIMIT	PASS/ FAIL	AZ	ANT HT	POLAR
MHz	dBuV	dB	dB	dB	dBuV/m	dBuV/m		deg	cm	
1059.18	-3.3	25.7	2.1	0.0	24.5	54.0		225	200	H
1227.55	-4.0	26.1	2.3	0.0	24.4	54.0		225	200	H
1387.38	-3.6	26.5	2.5	0.0	25.3	54.0		-0	340	H
1522.96	-3.4	26.8	2.6	0.0	26.1	54.0		135	200	V
1624.00	-3.7	27.3	2.7	0.0	26.4	54.0		135	200	V
1741.03	7.4	27.9	2.8	0.0	38.1	54.0		315	340	V
1828.16	-3.4	28.3	2.9	0.0	27.7	54.0		225	120	H
2066.36	-3.0	29.2	3.1	0.0	29.2	54.0		135	120	V
2424.45	.4	30.0	3.4	0.0	33.8	54.0		90	120	V
2959.44	-2.9	31.5	3.9	0.0	32.5	54.0		180	120	H
3229.26	-2.9	31.8	4.0	0.0	33.0	54.0		0	200	V
3772.35	-3.1	32.7	4.4	0.0	34.0	54.0		135	200	V
4233.95	-2.7	33.0	4.6	0.0	34.9	54.0		90	340	V
4576.90	-2.6	33.0	4.8	0.0	35.3	54.0		270	340	H
4935.94	-2.7	34.0	5.0	0.0	36.2	54.0		-0	340	V

tested by: I. Carnegie

FCC Part 15 Conducted Emissions Test

Test Group Summary

VB** 02/09/2011

Manufacturer	:	BADGER METER
Model	:	ORION SE GATEWAY
DUT Revision	:	BEAD ON ETHERNET LINE
Serial Number	:	
DUT Mode	:	Tx @ 914.49MHz [ACDC]
Test Date	:	Oct 15, 2012 01:10:31 PM

Line Tested	Scan Step Time [ms]	Excessive NB Emissions	Excessive BB Emissions
120V 60Hz L2 (AC/DC Converter)	30		
120V 60Hz L1 (AC/DC Converter)	30		

FCC Part 15 Conducted Emissions Test

Test Group Summary

VB** 02/09/2011

Manufacturer : BADGER METER
Model : ORION SE GATEWAY
DUT Revision : BEAD ON ETHERNET LINE
Serial Number :
DUT Mode : Tx @ 914.49MHz [POE]
Test Date : Oct 15, 2012 10:36:31 AM

Line Tested	Scan Step Time [ms]	Excessive NB Emissions	Excessive BB Emissions
120V 60Hz L2 (POE)	30		
120V 60Hz L1 (POE)	30		

FCC Part 15 Conducted Emissions Test

Significant Emissions Data

VB** 02/09/2011

Manufacturer	:	BADGER METER
Model	:	ORION SE GATEWAY
DUT Revision	:	BEAD ON ETHERNET LINE
Serial Number	:	
DUT Mode	:	Tx @ 914.49MHz [ACDC]
Line Tested	:	120V 60Hz L1 (AC/DC Converter)
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-10
Notes	:	AC/DC Converter w/ Clamp on AC
Test Engineer	:	I. Carnegie
Limit	:	Tx
Test Date	:	Oct 15, 2012 01:00:06 PM
Data Filter	:	Up to 80 maximum levels detected with 6 dB level excursion threshold over 10 dB margin below limit

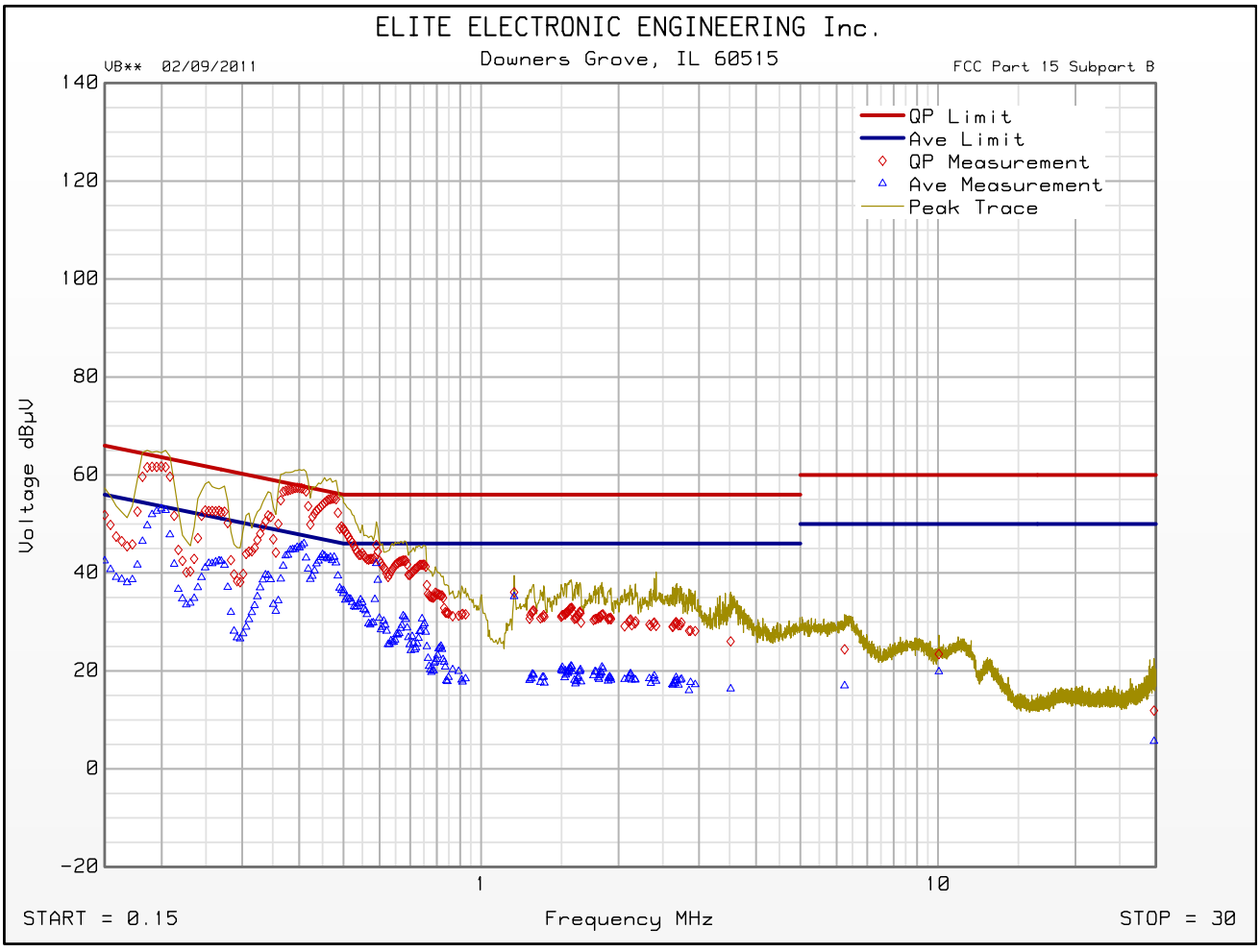
Freq MHz	Quasi-peak Level dBµV	Quasi-peak Limit dBµV	Excessive Quasi-peak Emissions	Average Level dBµV	Average Limit dBµV	Excessive Average Emissions
0.200	61.7	63.6		53.1	53.6	
0.204	61.6	63.4		52.8	53.4	
0.267	52.7	61.2		42.5	51.2	
0.270	52.4	61.1		42.4	51.1	
0.275	52.5	61.0		41.6	51.0	
0.338	50.5	59.3		39.6	49.3	
0.342	51.7	59.2		39.5	49.2	
0.405	57.3	57.8		45.6	47.8	
0.410	57.2	57.7		46.0	47.7	
0.450	53.9	56.9		43.8	46.9	
0.468	55.1	56.5		43.2	46.5	
0.477	55.2	56.4		43.2	46.4	
0.495	49.5	56.1		36.5	46.1	
0.500	48.8	56.0		36.4	46.0	
0.590	45.7	56.0		42.0	46.0	
1.182	36.1	56.0		35.2	46.0	
1.579	32.9	56.0		20.9	46.0	
2.124	30.5	56.0		19.4	46.0	
3.518	26.0	56.0		16.3	46.0	
6.247	24.4	60.0		17.0	50.0	
10.049	23.4	60.0		19.9	50.0	
29.714	11.9	60.0		5.6	50.0	

FCC Part 15 Conducted Emissions Test

Cumulative Data

VB** 02/09/2011

Manufacturer	:	BADGER METER
Model	:	ORION SE GATEWAY
DUT Revision	:	BEAD ON ETHERNET LINE
Serial Number	:	
DUT Mode	:	Tx @ 914.49MHz [ACDC]
Line Tested	:	120V 60Hz L1 (AC/DC Converter)
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-10
Notes	:	AC/DC Converter w/ Clamp on AC
Test Engineer	:	I. Carnegie
Limit	:	Tx
Test Date	:	Oct 15, 2012 01:00:06 PM



Emissions Meet QP Limit
Emissions Meet Ave Limit

FCC Part 15 Conducted Emissions Test

Significant Emissions Data

VB** 02/09/2011

Manufacturer	:	BADGER METER
Model	:	ORION SE GATEWAY
DUT Revision	:	BEAD ON ETHERNET LINE
Serial Number	:	
DUT Mode	:	Tx @ 914.49MHz [ACDC]
Line Tested	:	120V 60Hz L2 (AC/DC Converter)
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-10
Notes	:	AC/DC Converter w/ Clamp on AC
Test Engineer	:	I. Carnegie
Limit	:	Tx
Test Date	:	Oct 15, 2012 01:10:31 PM
Data Filter	:	Up to 80 maximum levels detected with 6 dB level excursion threshold over 10 dB margin below limit

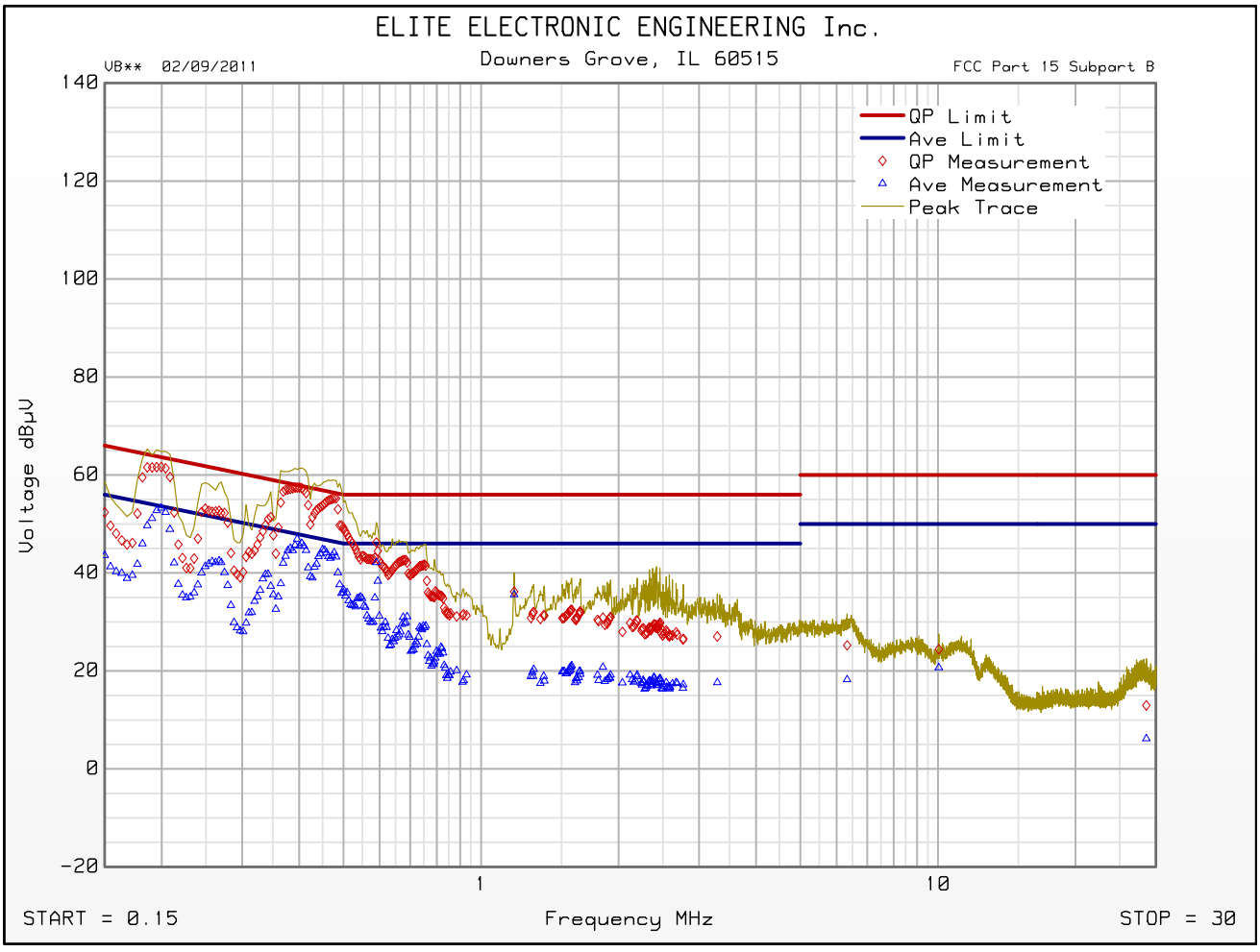
Freq MHz	Quasi-peak Level dBµV	Quasi-peak Limit dBµV	Excessive Quasi-peak Emissions	Average Level dBµV	Average Limit dBµV	Excessive Average Emissions
0.200	61.6	63.6		53.2	53.6	
0.249	53.1	61.8		41.3	51.8	
0.258	52.5	61.5		42.3	51.5	
0.267	52.7	61.2		42.5	51.2	
0.275	52.2	61.0		40.1	51.0	
0.342	51.0	59.2		39.8	49.2	
0.347	51.4	59.0		37.3	49.0	
0.383	57.2	58.2		45.1	48.2	
0.396	57.4	57.9		46.9	47.9	
0.401	57.5	57.8		45.5	47.8	
0.405	57.3	57.8		46.1	47.8	
0.455	54.2	56.8		44.7	46.8	
0.477	55.3	56.4		44.2	46.4	
0.482	55.2	56.3		43.3	46.3	
0.495	49.7	56.1		35.9	46.1	
0.500	48.9	56.0		36.6	46.0	
0.509	47.8	56.0		36.0	46.0	
0.590	46.2	56.0		42.1	46.0	
0.795	36.3	56.0		22.7	46.0	
1.579	32.5	56.0		21.1	46.0	
2.192	30.4	56.0		18.8	46.0	
3.289	27.0	56.0		17.6	46.0	
6.328	25.2	60.0		18.2	50.0	
10.044	24.4	60.0		20.7	50.0	
28.585	13.0	60.0		6.2	50.0	

FCC Part 15 Conducted Emissions Test

Cumulative Data

VB** 02/09/2011

Manufacturer	:	BADGER METER
Model	:	ORION SE GATEWAY
DUT Revision	:	BEAD ON ETHERNET LINE
Serial Number	:	
DUT Mode	:	Tx @ 914.49MHz [ACDC]
Line Tested	:	120V 60Hz L2 (AC/DC Converter)
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-10
Notes	:	AC/DC Converter w/ Clamp on AC
Test Engineer	:	I. Carnegie
Limit	:	Tx
Test Date	:	Oct 15, 2012 01:10:31 PM



Emissions Meet QP Limit
Emissions Meet Ave Limit

FCC Part 15 Conducted Emissions Test

Significant Emissions Data

VB** 02/09/2011

Manufacturer	:	BADGER METER
Model	:	ORION SE GATEWAY
DUT Revision	:	BEAD ON ETHERNET LINE
Serial Number	:	
DUT Mode	:	Tx @ 914.49MHz [POE]
Line Tested	:	120V 60Hz L1 (POE)
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-10
Notes	:	POE POWER
Test Engineer	:	I. Carnegie
Limit	:	Tx
Test Date	:	Oct 15, 2012 10:19:28 AM
Data Filter	:	Up to 80 maximum levels detected with 6 dB level excursion threshold over 10 dB margin below limit

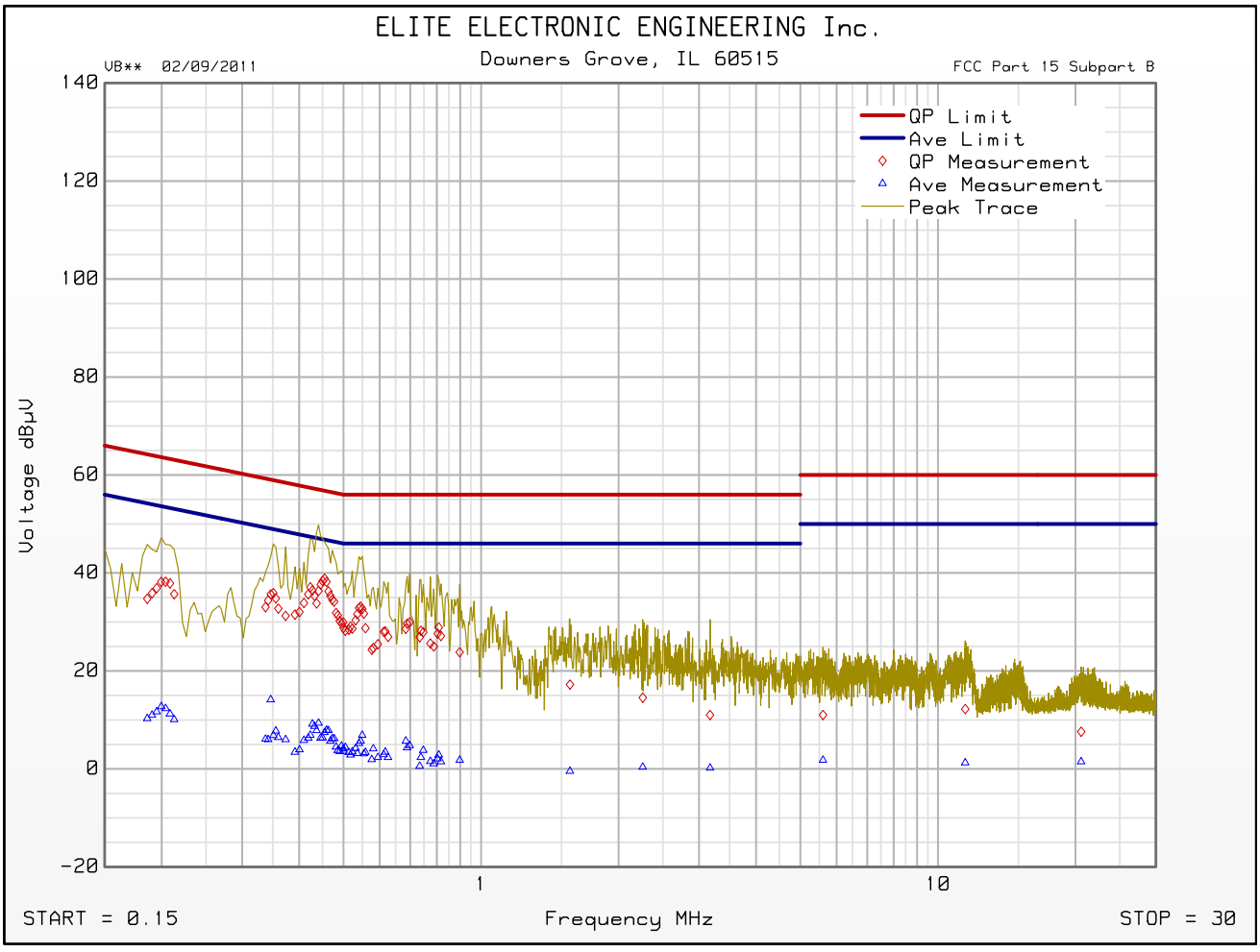
Freq MHz	Quasi-peak Level dBµV	Quasi-peak Limit dBµV	Excessive Quasi-peak Emissions	Average Level dBµV	Average Limit dBµV	Excessive Average Emissions
0.204	38.2	63.4		12.3	53.4	
0.455	38.8	56.8		7.5	46.8	
0.545	33.1	56.0		5.7	46.0	
0.808	28.9	56.0		2.9	46.0	
1.565	17.2	56.0		-0.5	46.0	
2.259	14.5	56.0		0.4	46.0	
3.172	11.0	56.0		0.2	46.0	
5.603	11.0	60.0		1.8	50.0	
11.475	12.2	60.0		1.2	50.0	
20.584	7.6	60.0		1.5	50.0	

FCC Part 15 Conducted Emissions Test

Cumulative Data

VB** 02/09/2011

Manufacturer	:	BADGER METER
Model	:	ORION SE GATEWAY
DUT Revision	:	BEAD ON ETHERNET LINE
Serial Number	:	
DUT Mode	:	Tx @ 914.49MHz [POE]
Line Tested	:	120V 60Hz L1 (POE)
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-10
Notes	:	POE POWER
Test Engineer	:	I. Carnegie
Limit	:	Tx
Test Date	:	Oct 15, 2012 10:19:28 AM



Emissions Meet QP Limit
Emissions Meet Ave Limit

FCC Part 15 Conducted Emissions Test

Significant Emissions Data

VB** 02/09/2011

Manufacturer	:	BADGER METER
Model	:	ORION SE GATEWAY
DUT Revision	:	BEAD ON ETHERNET LINE
Serial Number	:	
DUT Mode	:	Tx @ 914.49MHz [POE]
Line Tested	:	120V 60Hz L2 (POE)
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-10
Notes	:	POE POWER
Test Engineer	:	I. Carnegie
Limit	:	Tx
Test Date	:	Oct 15, 2012 10:36:31 AM
Data Filter	:	Up to 80 maximum levels detected with 6 dB level excursion threshold over 10 dB margin below limit

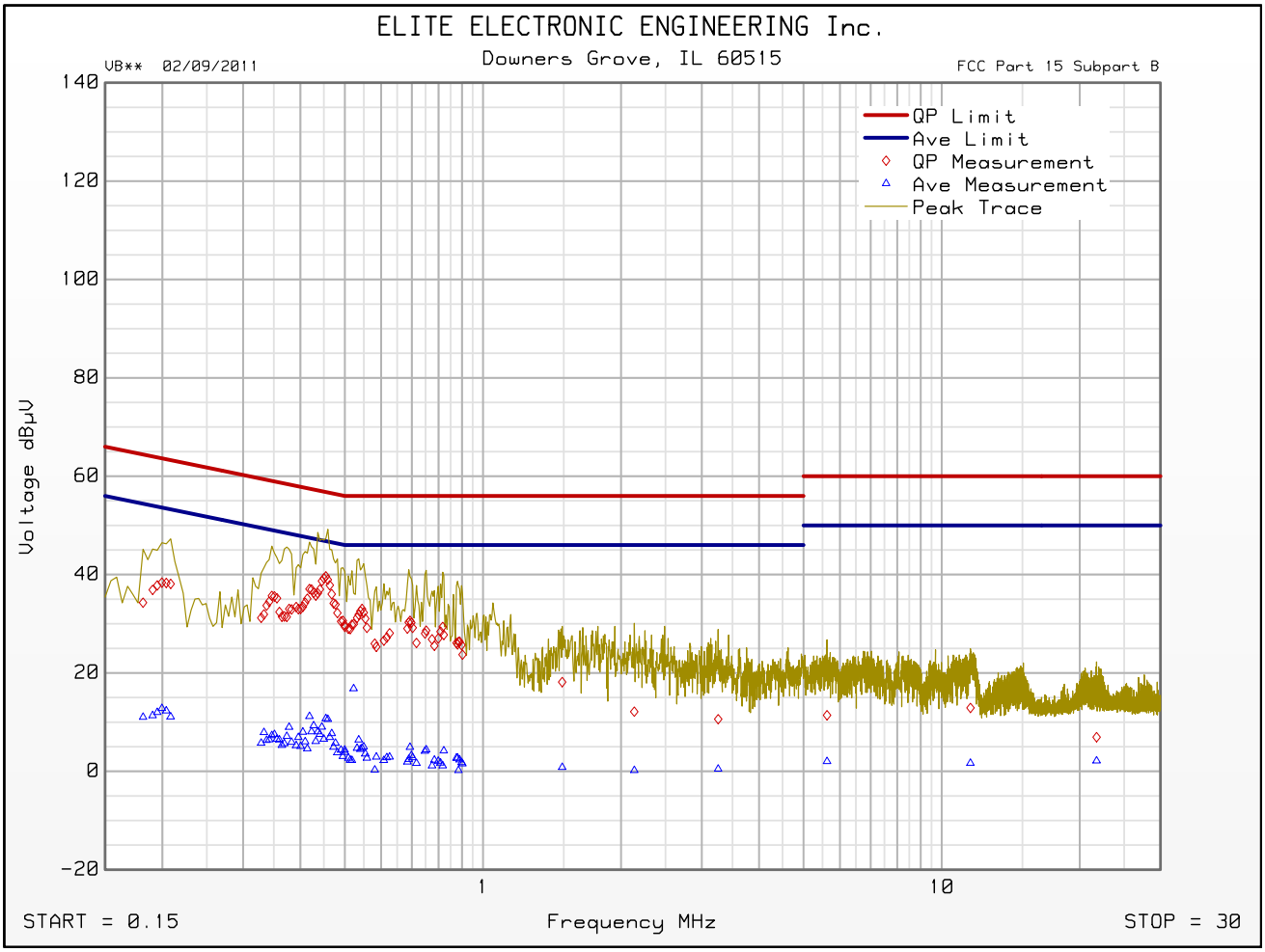
Freq MHz	Quasi-peak Level dBµV	Quasi-peak Limit dBµV	Excessive Quasi-peak Emissions	Average Level dBµV	Average Limit dBµV	Excessive Average Emissions
0.204	38.3	63.4		12.3	53.4	
0.455	39.6	56.8		10.7	46.8	
0.545	33.0	56.0		4.7	46.0	
0.817	29.4	56.0		1.1	46.0	
1.489	18.1	56.0		0.8	46.0	
2.138	12.1	56.0		0.2	46.0	
3.257	10.6	56.0		0.5	46.0	
5.626	11.4	60.0		2.0	50.0	
11.556	12.9	60.0		1.7	50.0	
21.767	6.9	60.0		2.1	50.0	

FCC Part 15 Conducted Emissions Test

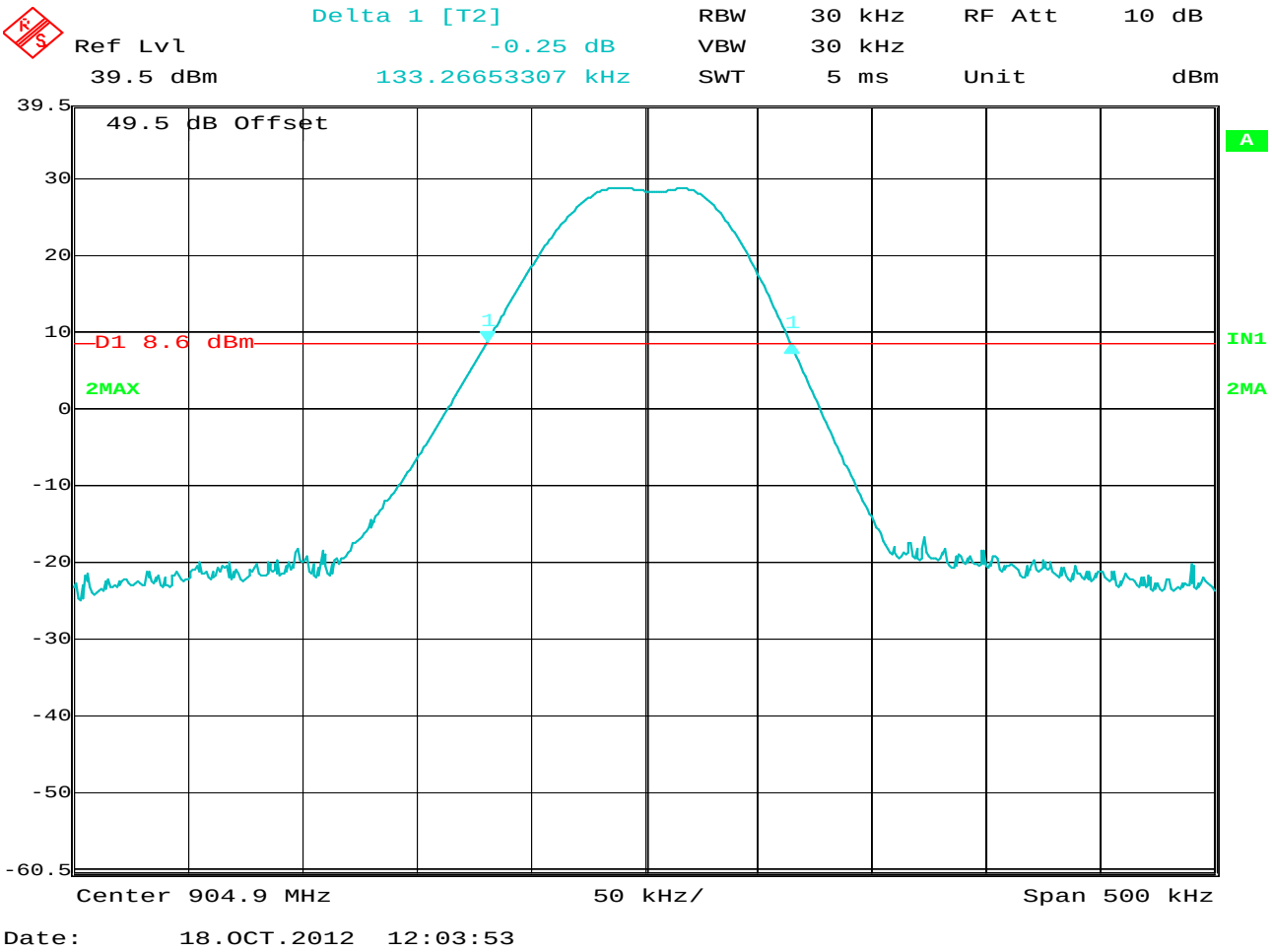
Cumulative Data

VB** 02/09/2011

Manufacturer	:	BADGER METER
Model	:	ORION SE GATEWAY
DUT Revision	:	BEAD ON ETHERNET LINE
Serial Number	:	
DUT Mode	:	Tx @ 914.49MHz [POE]
Line Tested	:	120V 60Hz L2 (POE)
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-10
Notes	:	POE POWER
Test Engineer	:	I. Carnegie
Limit	:	Tx
Test Date	:	Oct 15, 2012 10:36:31 AM



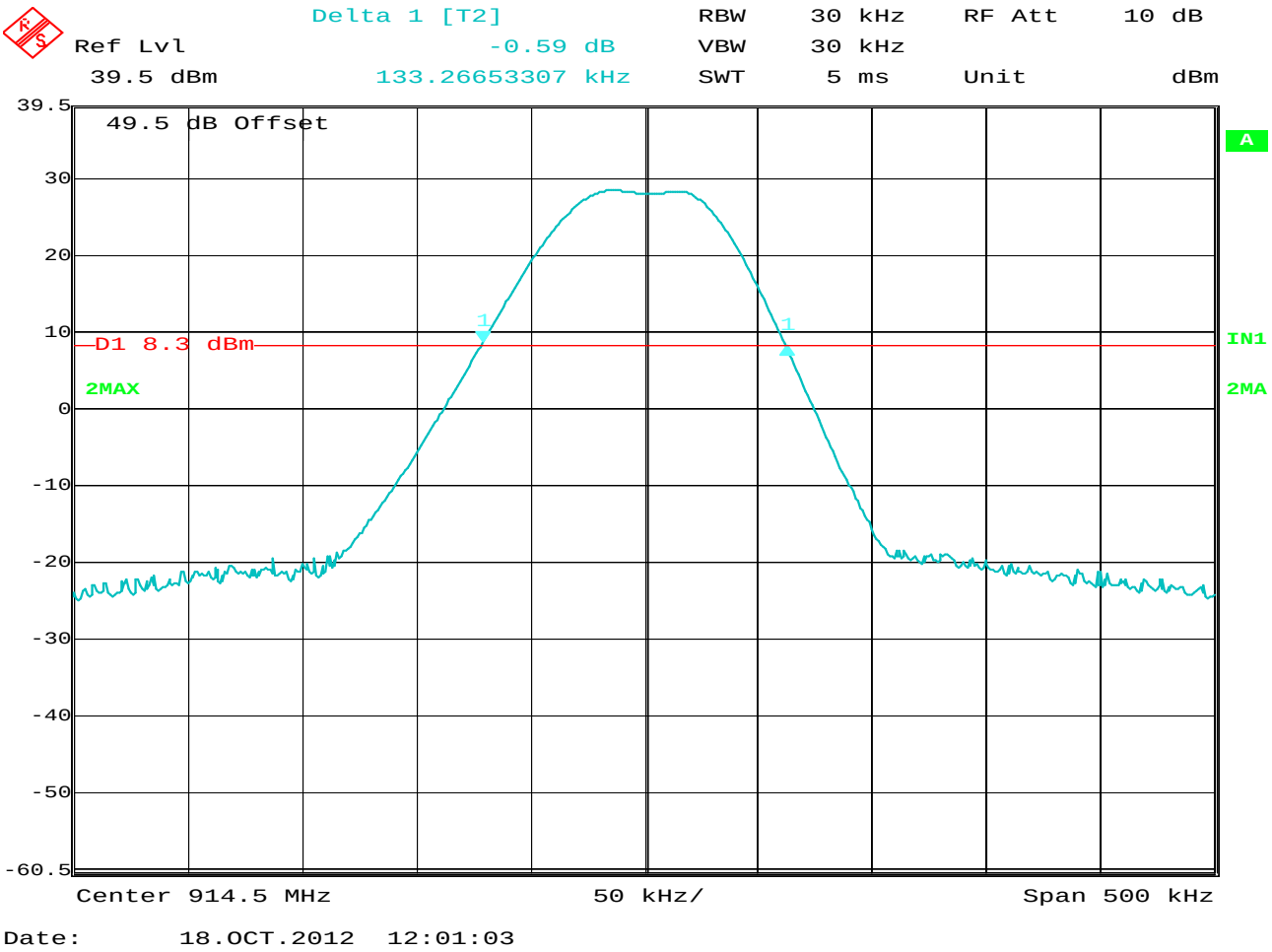
Emissions Meet QP Limit
Emissions Meet Ave Limit



FCC 15.247: 20db Bandwidth Measurements

MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	ORION SE Gen2 Gateway
SERIAL NUMBER	:	231
TEST MODE	:	Tx @ 904.9MHz
TEST PARAMETERS	:	Minimum 20 dB bandwidth from peak shall be no larger than 500 kHz
EQUIPMENT USED	:	RBA1, T2S3, T2D7, GBR6, CLT3, SHB0

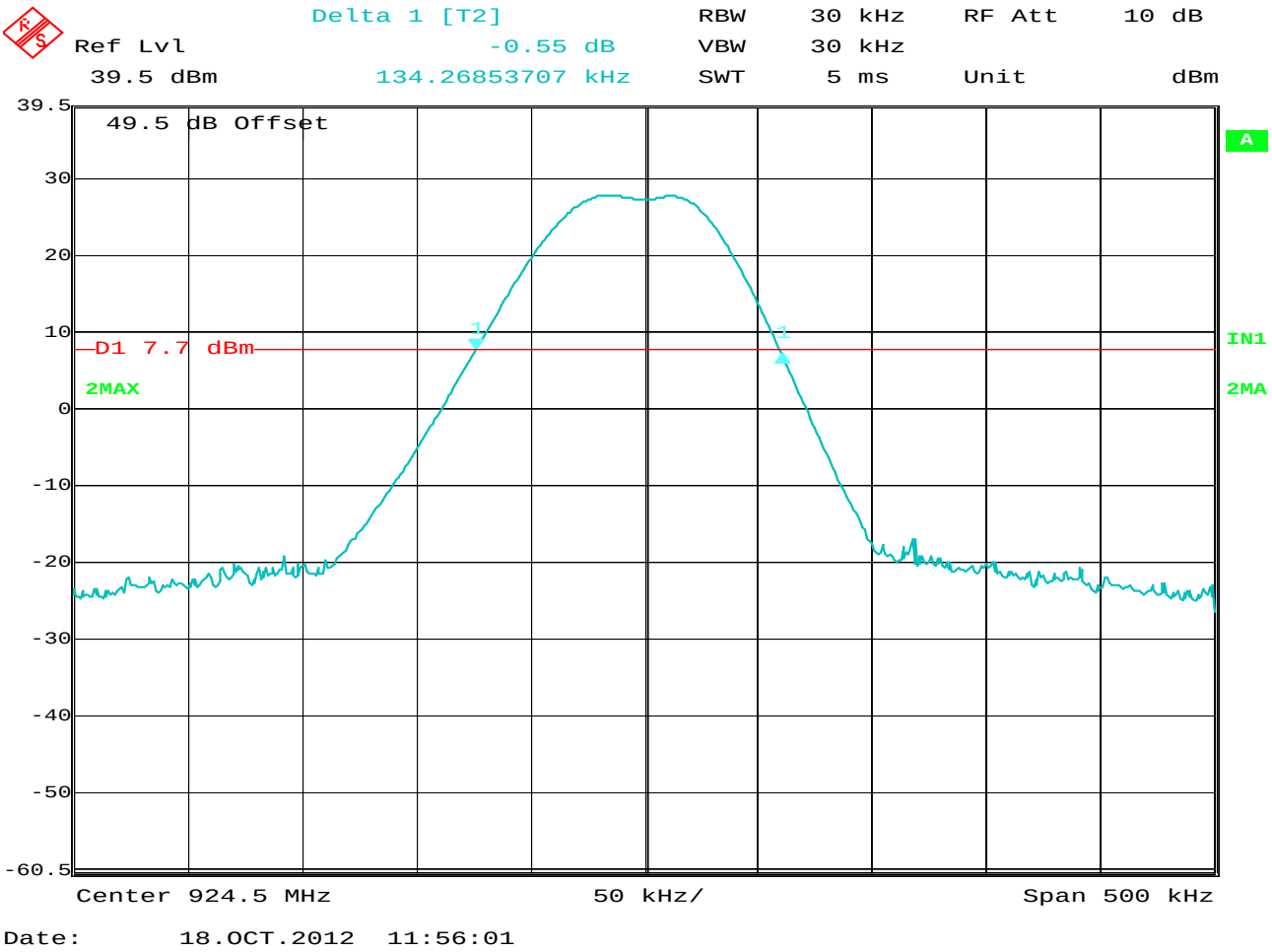
NOTES



FCC 15.247: 20db Bandwidth Measurements

MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	ORION SE Gen2 Gateway
SERIAL NUMBER	:	231
TEST MODE	:	Tx @ 914.5MHz
TEST PARAMETERS	:	Minimum 20 dB bandwidth from peak shall be no larger than 500 kHz
EQUIPMENT USED	:	RBA1, T2S3, T2D7, GBR6, CLT3, SHB0

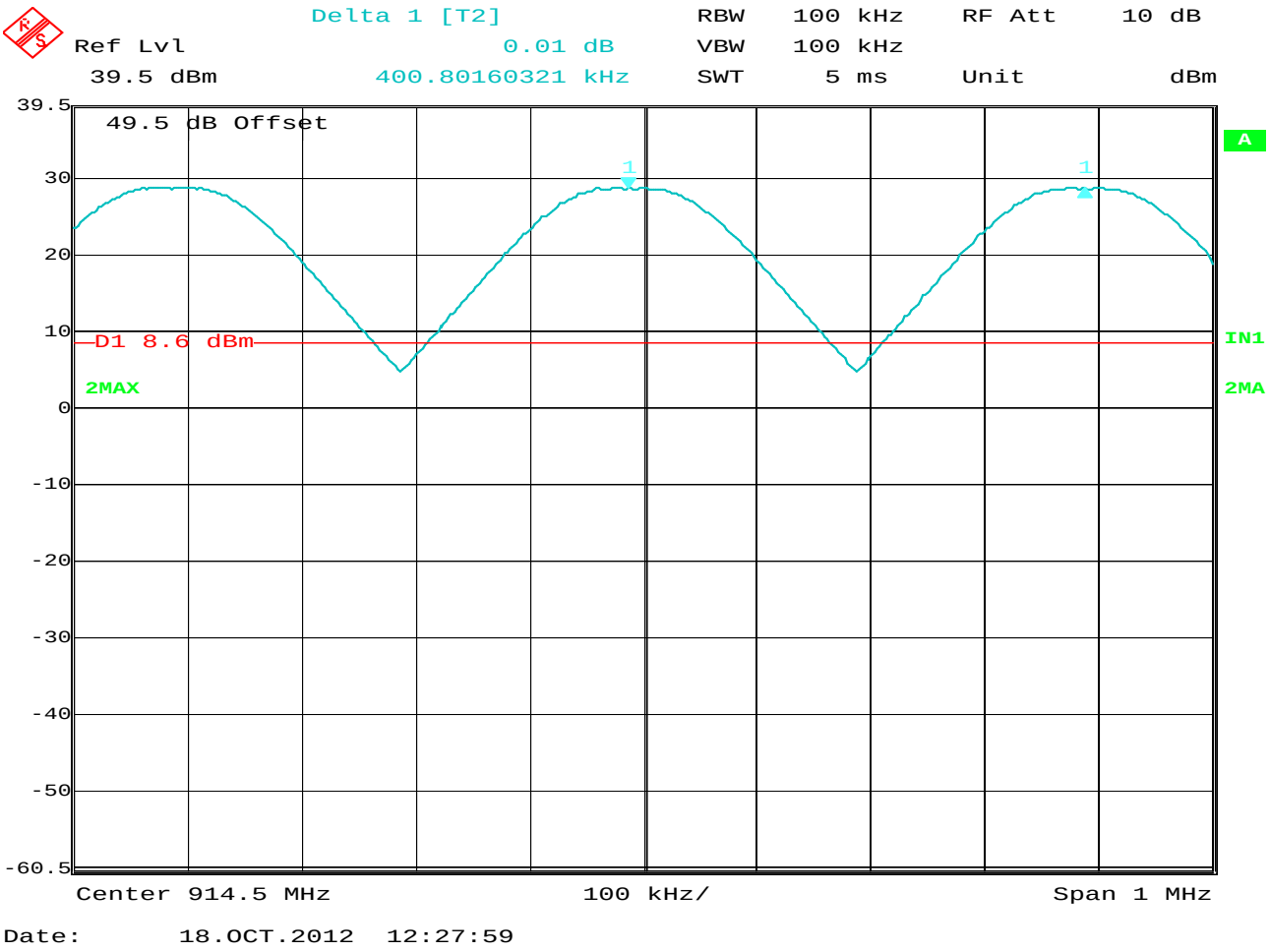
NOTES



FCC 15.247: 20db Bandwidth Measurements

MANUFACTURER : Badger Meter
MODEL NUMBER : ORION SE Gen2 Gateway
SERIAL NUMBER : 231
TEST MODE : Tx @ 924.5MHz
TEST PARAMETERS : Minimum 20 dB bandwidth from peak shall be no larger than 500 kHz
EQUIPMENT USED : RBA1, T2S3, T2D7, GBR6, CLT3, SHB0

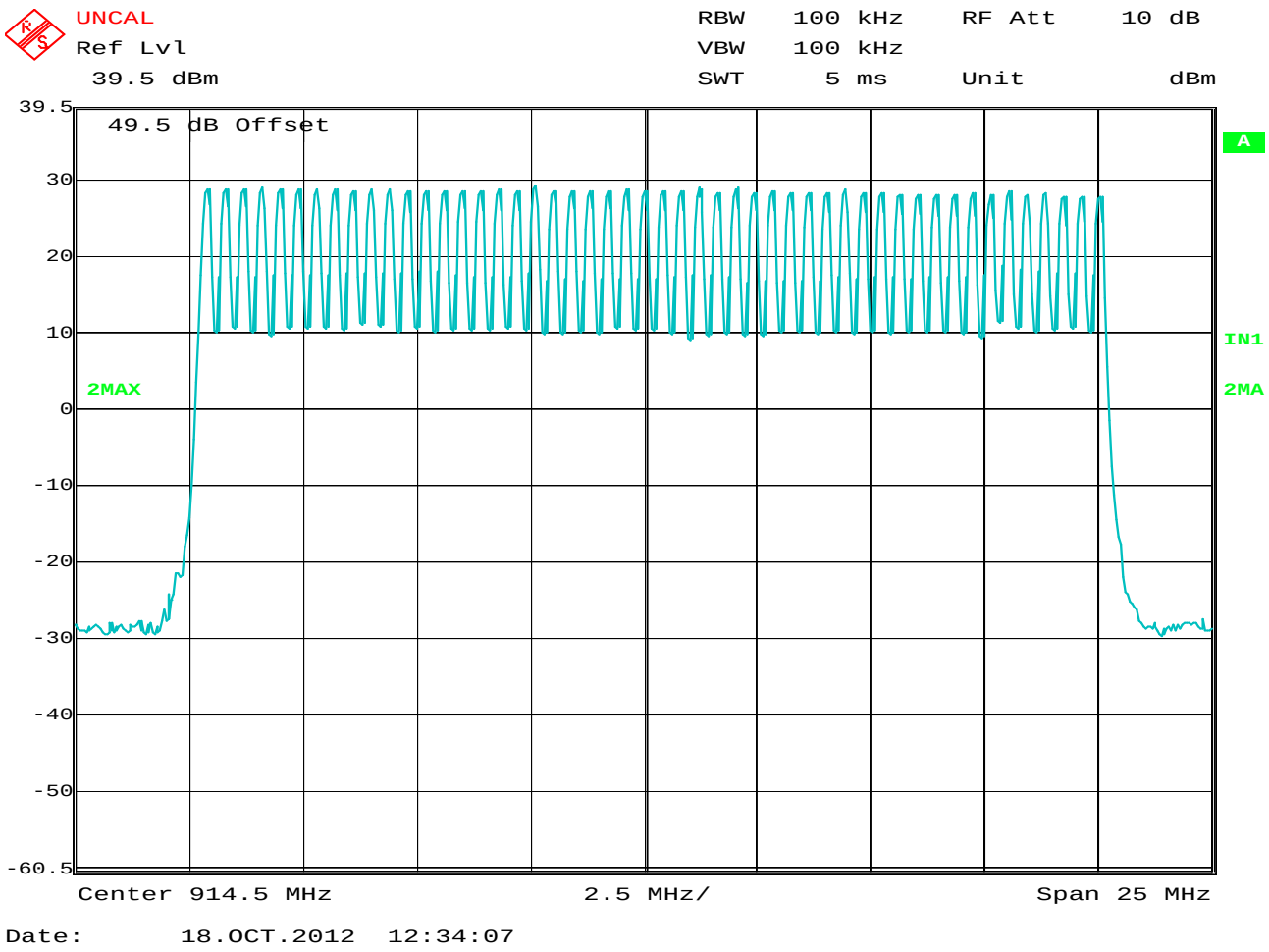
NOTES



FCC 15.247: Carrier Frequency Separation

MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	ORION SE Gen2 Gateway
SERIAL NUMBER	:	231
TEST MODE	:	Hopping Mode
TEST PARAMETERS	:	Separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater
EQUIPMENT USED	:	RBA1, T2S3, T2D7, GBR6, CLT3, SHB0

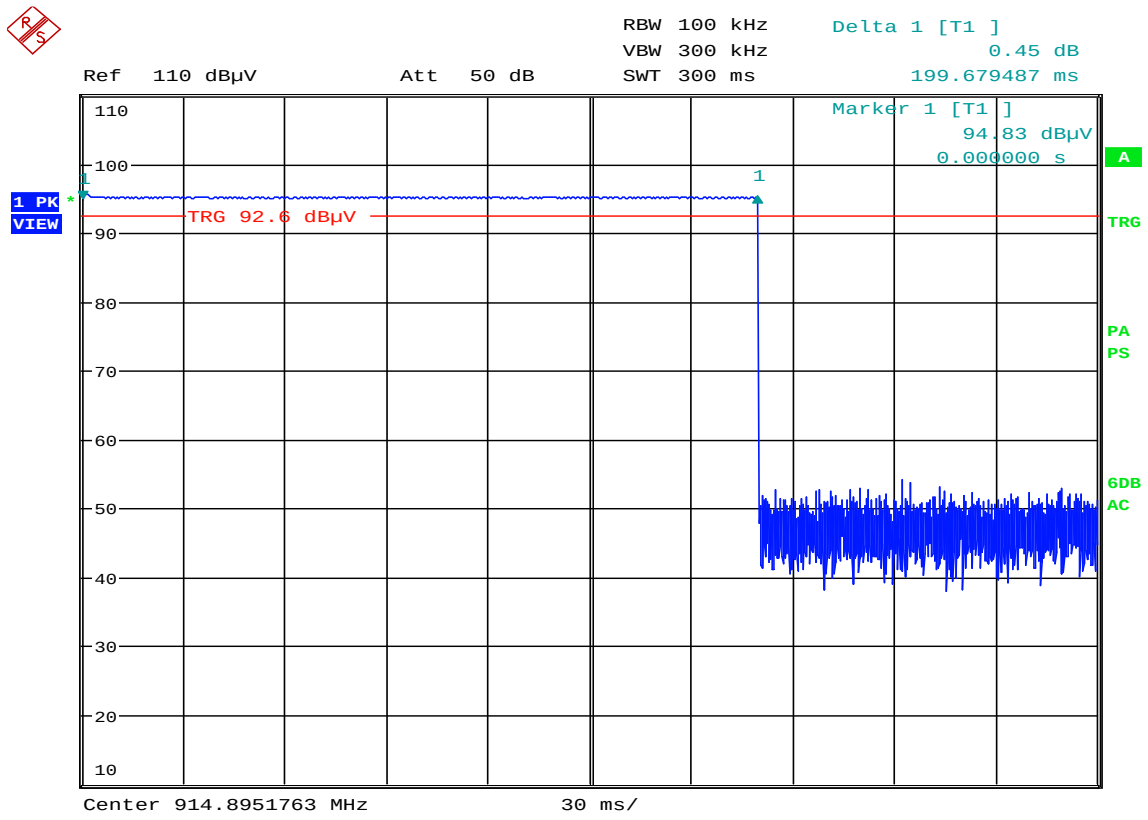
NOTES



FCC 15.247: Number of Hop Frequencies

MANUFACTURER : Badger Meter
MODEL NUMBER : ORION SE Gen2 Gateway
SERIAL NUMBER : 231
TEST MODE : Hopping Enabled
TEST PARAMETERS : If the 20 dB bandwidth of the hopping channel is <250 kHz, the system shall use at least 50 channels
EQUIPMENT USED : RBB0, T2S7, T2D1, T1D2

NOTES

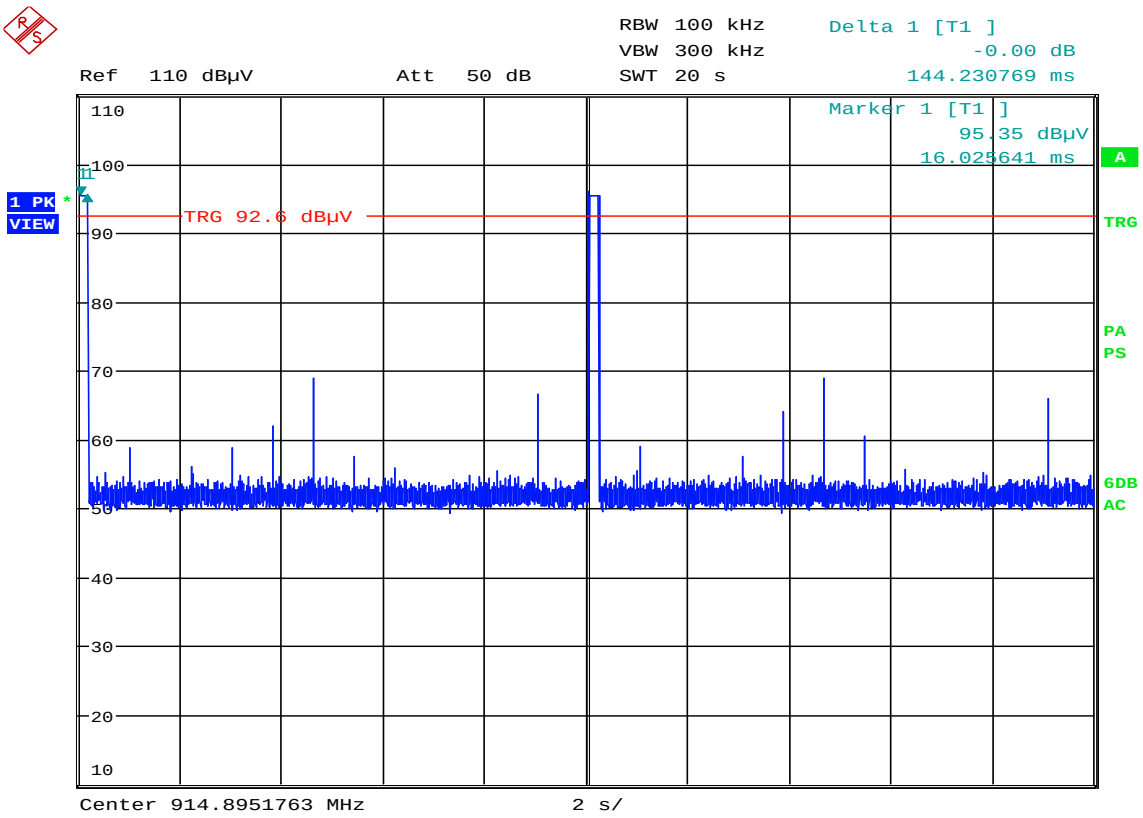


Date: 25.OCT.2012 11:09:53

15.247 Time of Occupancy (pulse width)

MANUFACTURER : Badger Meter
MODEL NUMBER : ORION SE Gen2 Gateway
SERIAL NUMBER : 231
TEST MODE : Hopping Enabled
TEST PARAMETERS :
EQUIPMENT USED : RBE1, T2DH, T2D8

NOTES

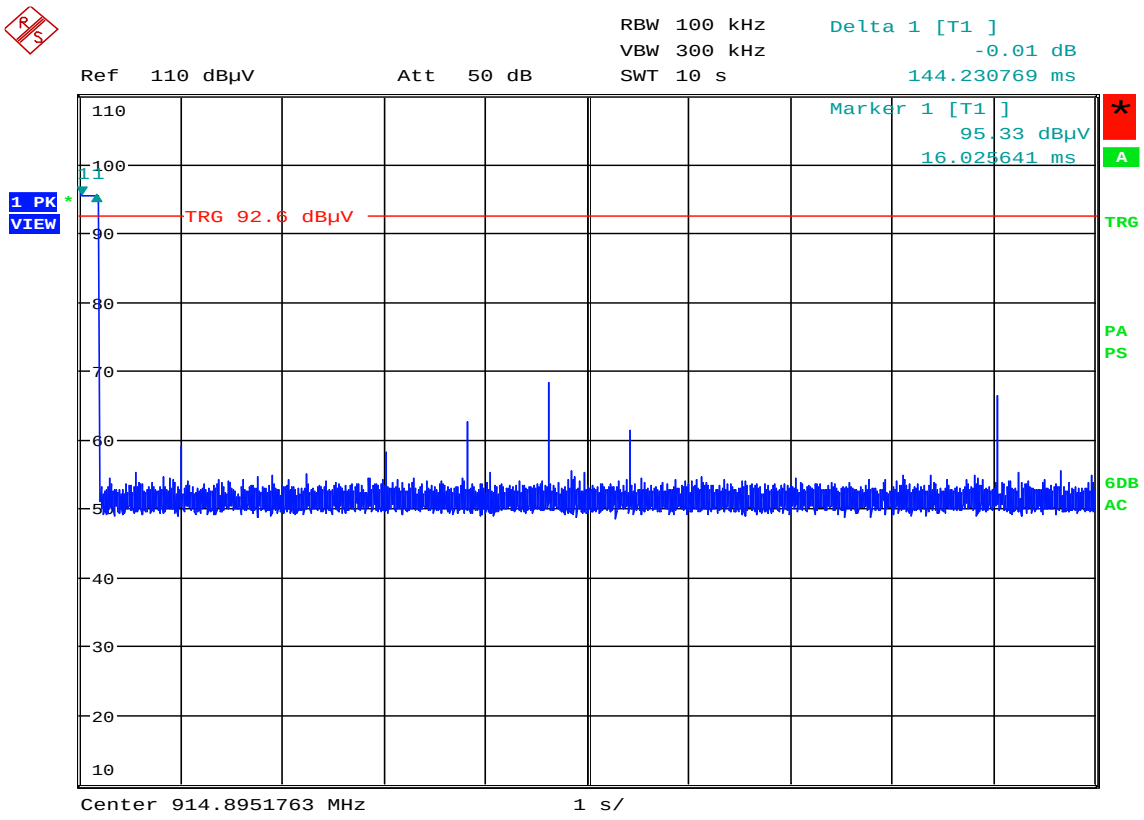


Date: 25.OCT.2012 11:06:41

15.247 Time of Occupancy (20 seconds)

MANUFACTURER : Badger Meter
MODEL NUMBER : ORION SE Gen2 Gateway
SERIAL NUMBER : 231
TEST MODE : Hopping Enabled
TEST PARAMETERS :
EQUIPMENT USED : RBE1, T2DH, T2D8

NOTES

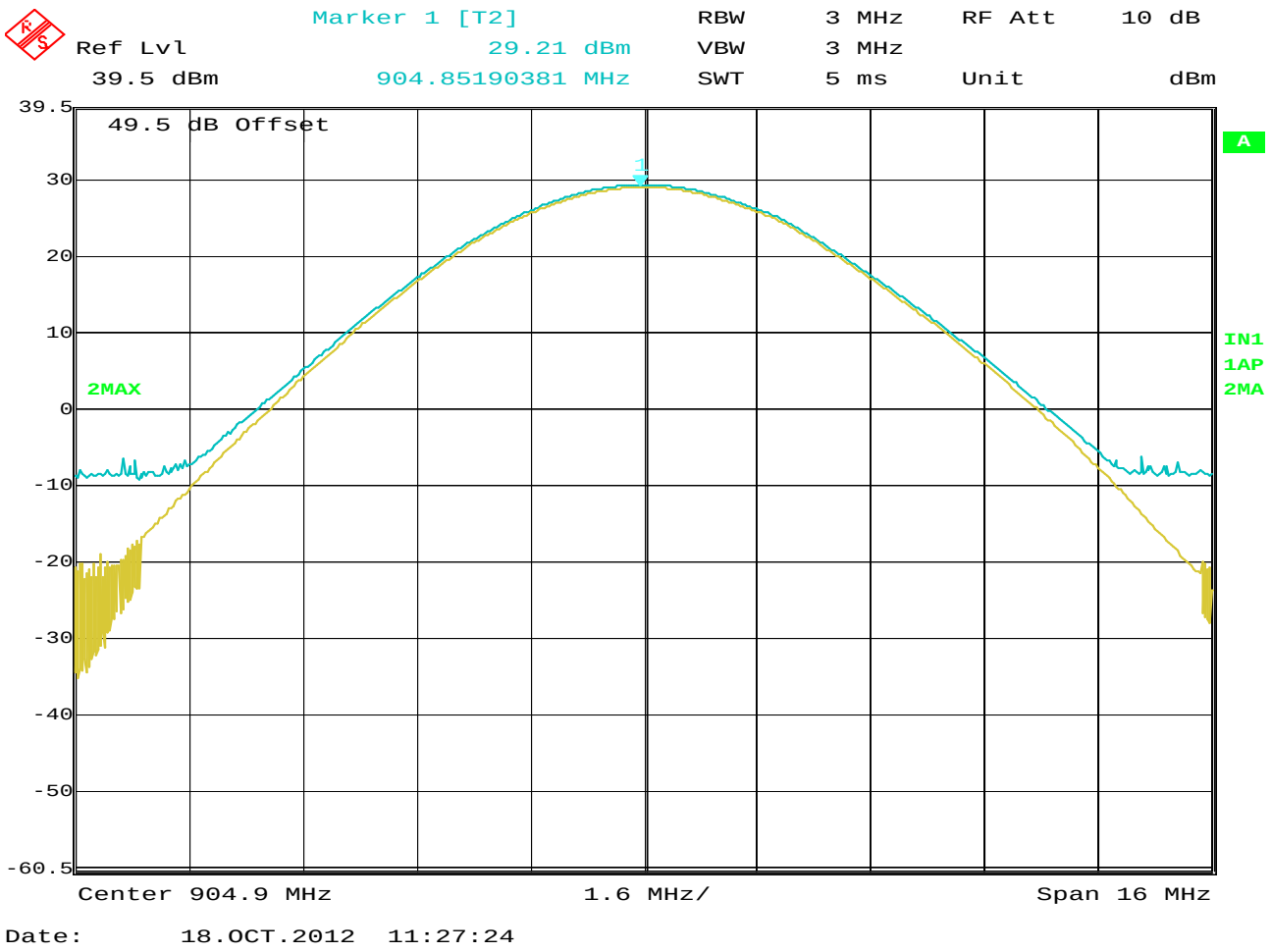


Date: 25.OCT.2012 11:07:54

15.247 Time of Occupancy

MANUFACTURER : Badger Meter
MODEL NUMBER : ORION SE Gen2 Gateway
SERIAL NUMBER : 231
TEST MODE : Hopping Enabled
TEST PARAMETERS :
EQUIPMENT USED : RBE1, T2DH, T2D8

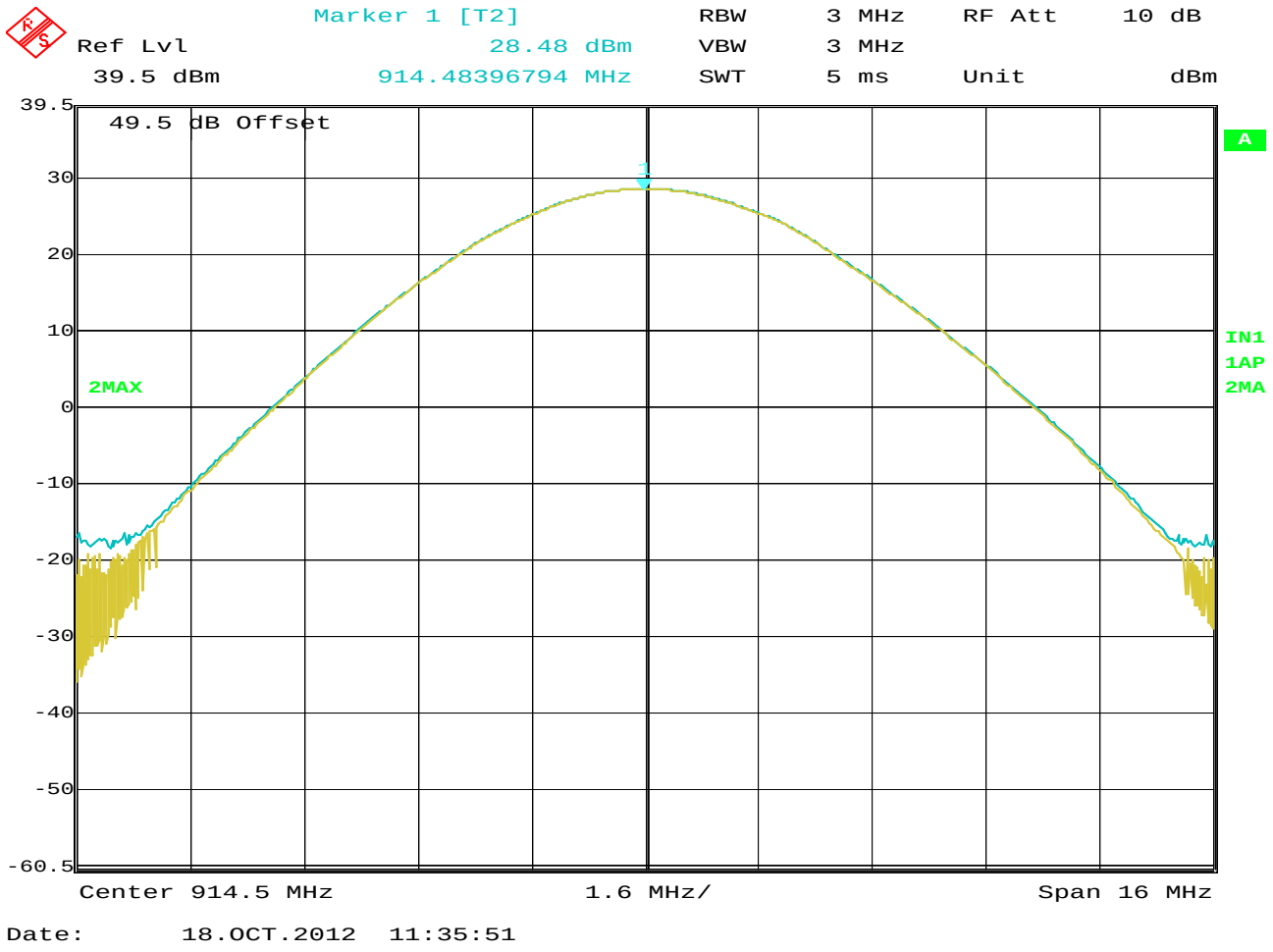
NOTES



FCC 15.247: Peak Power Output

MANUFACTURER : Badger Meter
MODEL NUMBER : ORION SE Gen2 Gateway
SERIAL NUMBER : 231
TEST MODE : Tx @ 904.9MHz
TEST PARAMETERS : ≤1W (30dBm)
EQUIPMENT USED : RBB0, T2S7, T2D1, T1D2

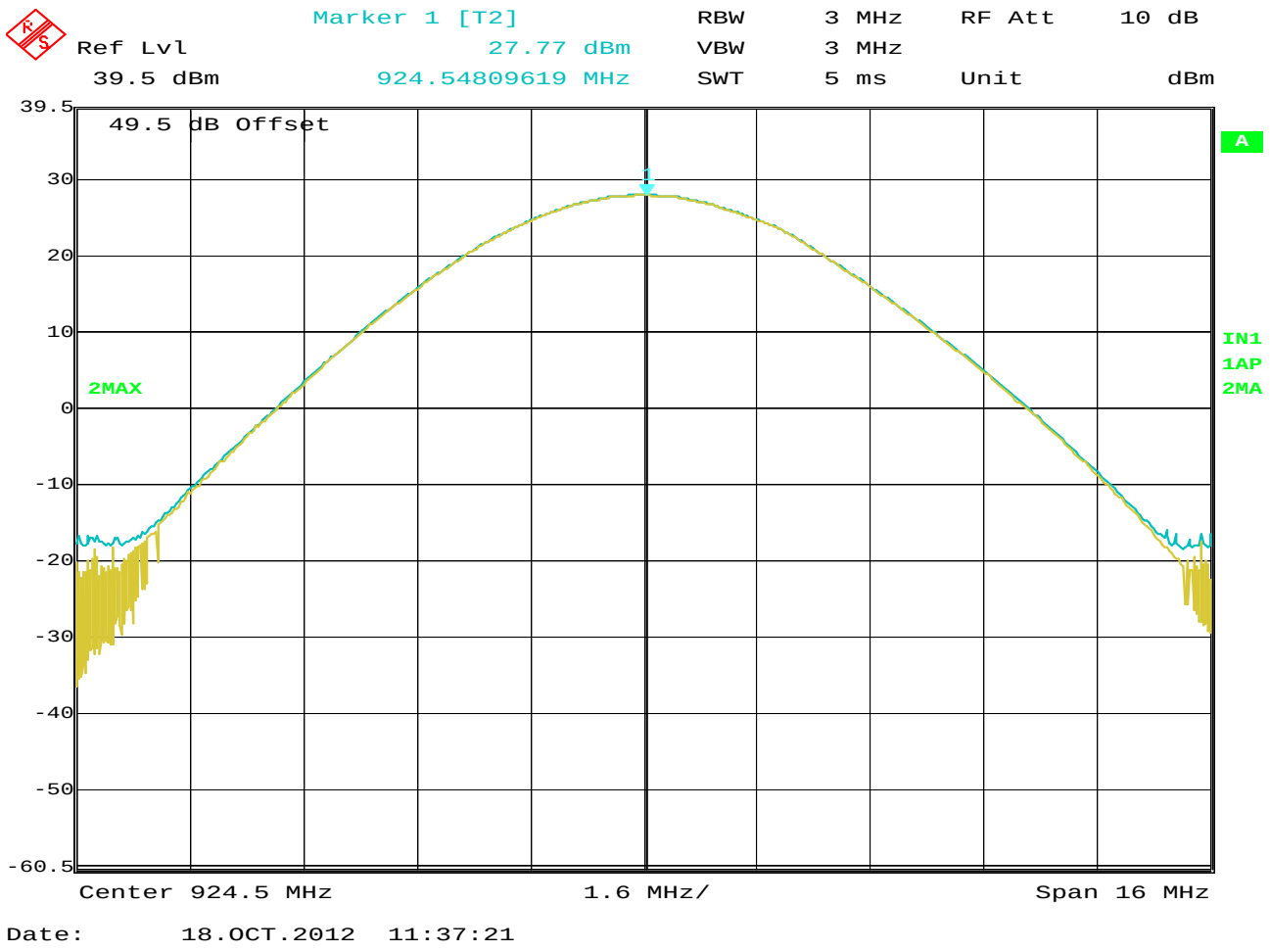
NOTES



FCC 15.247: Peak Power Output

MANUFACTURER : Badger Meter
MODEL NUMBER : ORION SE Gen2 Gateway
SERIAL NUMBER : 231
TEST MODE : Tx @ 914.5MHz
TEST PARAMETERS : ≤1W (30dBm)
EQUIPMENT USED : RBB0, T2S7, T2D1, T1D2

NOTES



FCC 15.247: Peak Power Output

MANUFACTURER : Badger Meter
MODEL NUMBER : ORION SE Gen2 Gateway
SERIAL NUMBER : 231
TEST MODE : Tx @ 924.5MHz
TEST PARAMETERS : ≤1W (30dBm)
EQUIPMENT USED : RBB0, T2S7, T2D1, T1D2

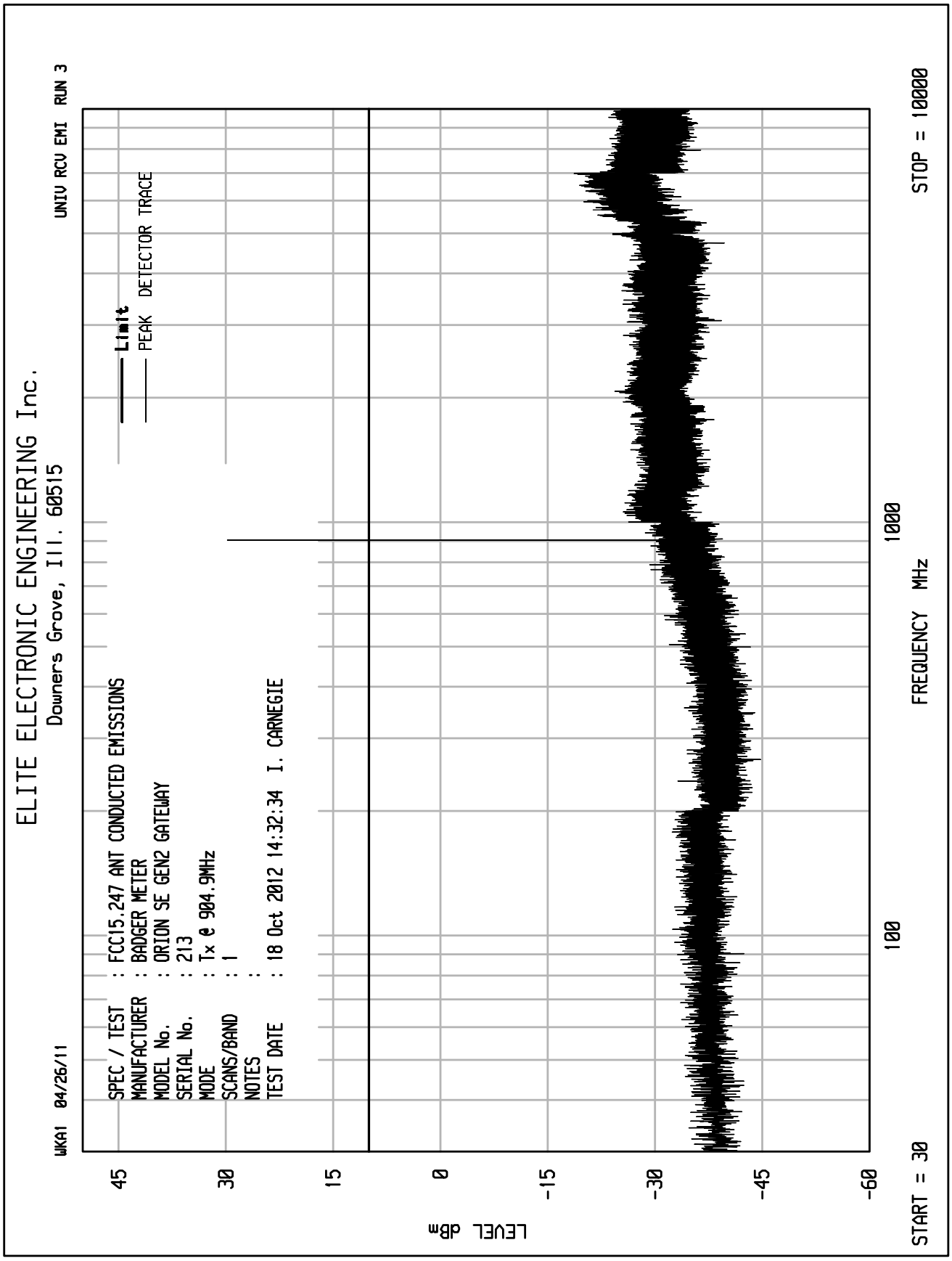
NOTES

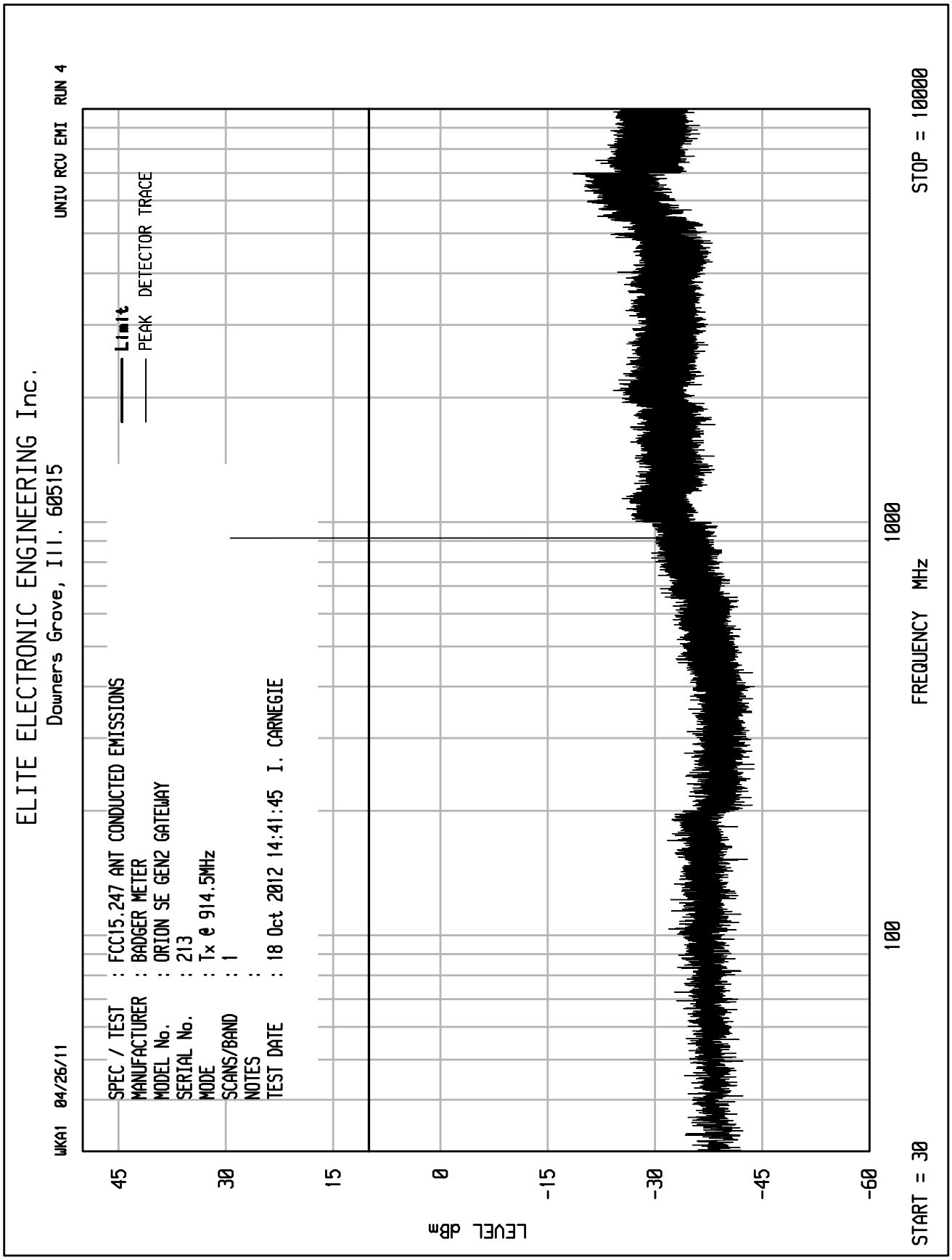
Manufacturer : Badger Meter
Model No. : Orion SE Gen2 Gateway
Serial No. : 231
Specification : FCC-15.247 Effective Isotropic Radiated Power (EIRP)
Date : October 16, 2012
Mode : See Below
Equipment Used : NTA2, CDY0, RBB0, NWH0
Notes : Test Distance is 3 meters

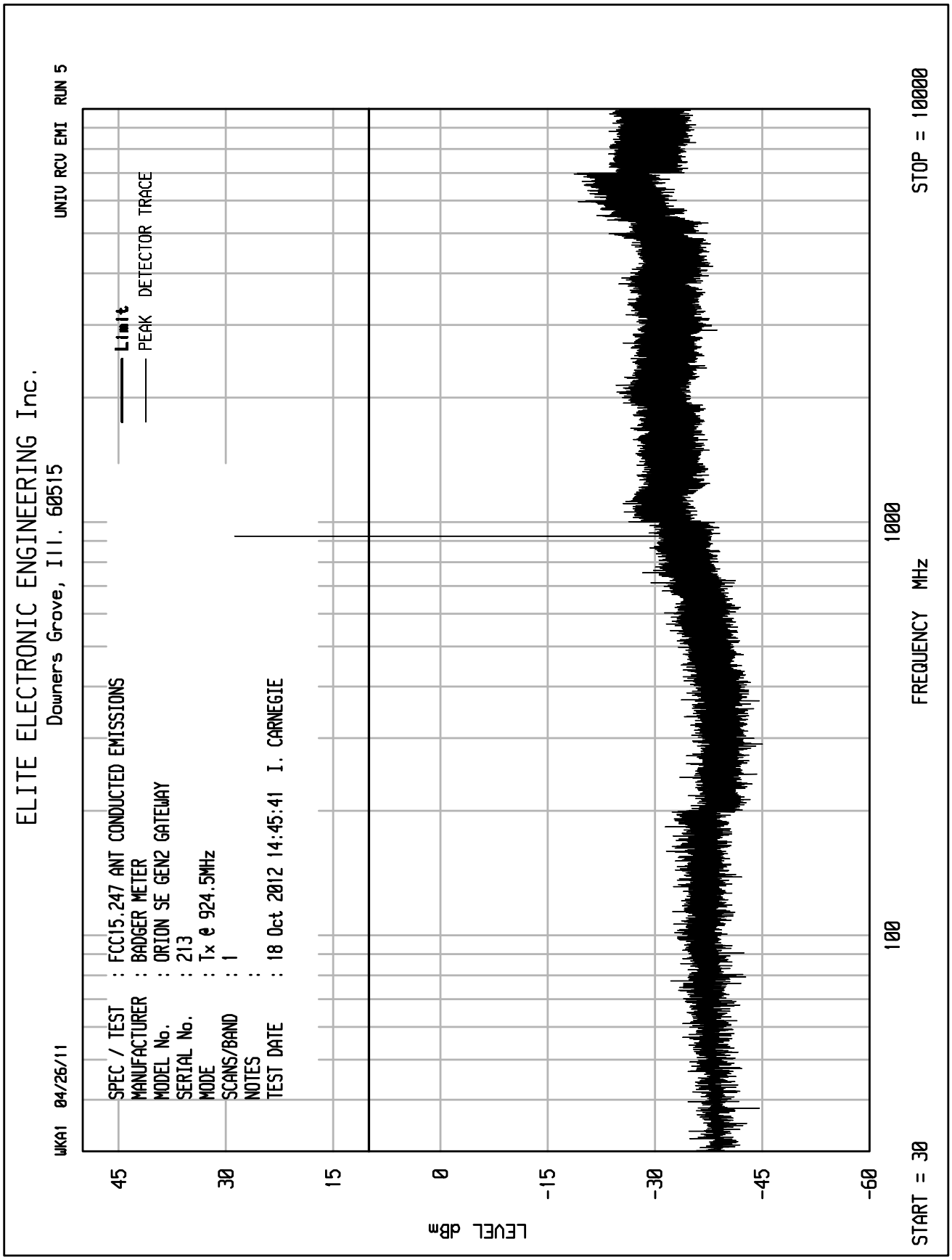
Freq. (MHz)	Ant Pol	Wide BW Meter Reading (dBuV)	Matched Sig. Gen. Reading (dB)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)
904.90	H	94.8	19.0	2.2	1.6	19.5	36.0
904.90	V	106.1	30.5	2.2	1.6	31.0	36.0
914.50	H	95.8	20.0	2.2	1.6	20.5	36.0
914.50	V	107.0	31.5	2.2	1.6	32.0	36.0
924.50	H	95.0	19.3	2.2	1.7	19.8	36.0
924.50	V	105.3	30.0	2.2	1.7	30.5	36.0

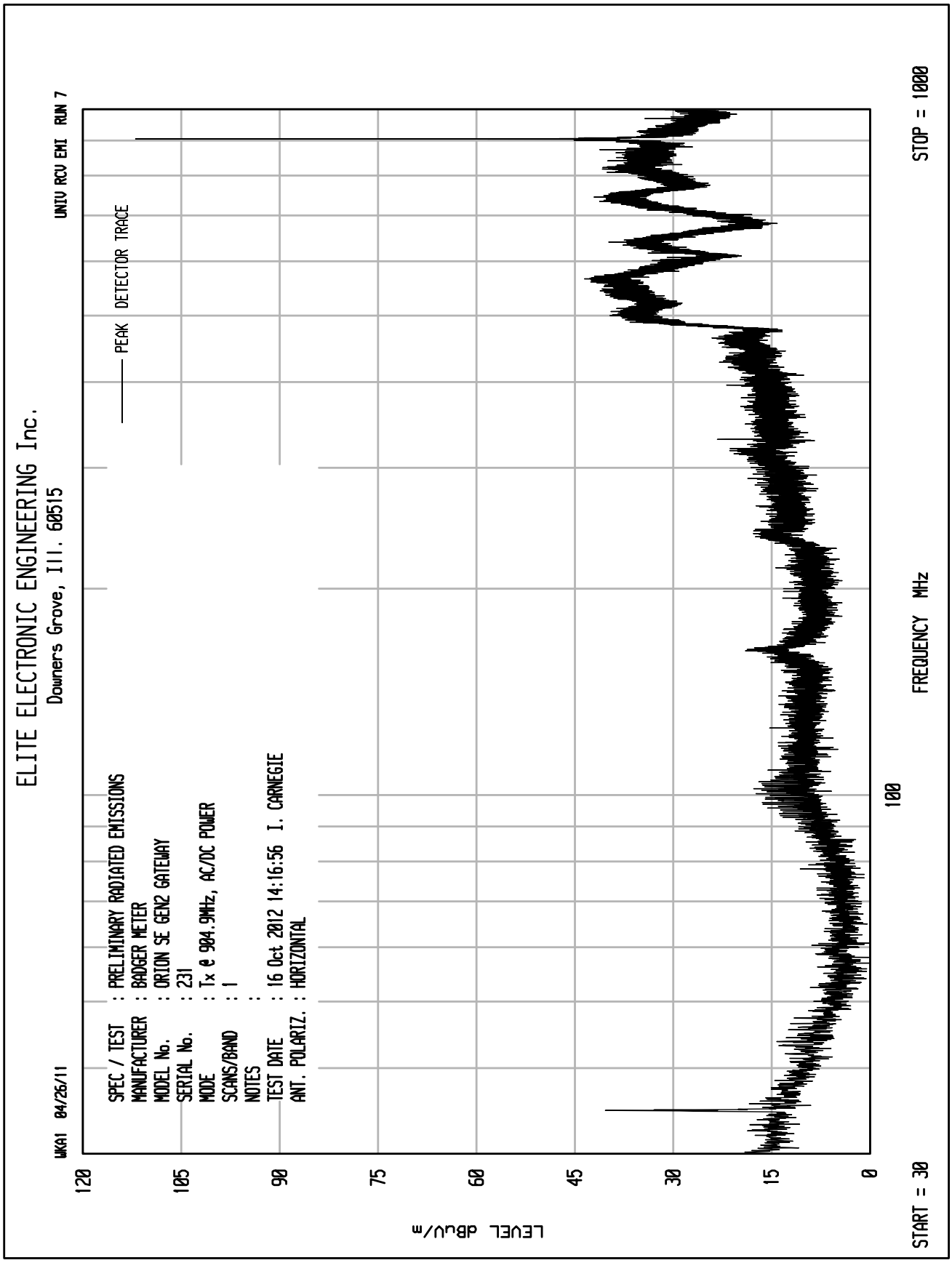
EIRP (dBm) = Matched Signal Generator (dBm) + Antenna Gain (dB) – Antenna Gain (dB)

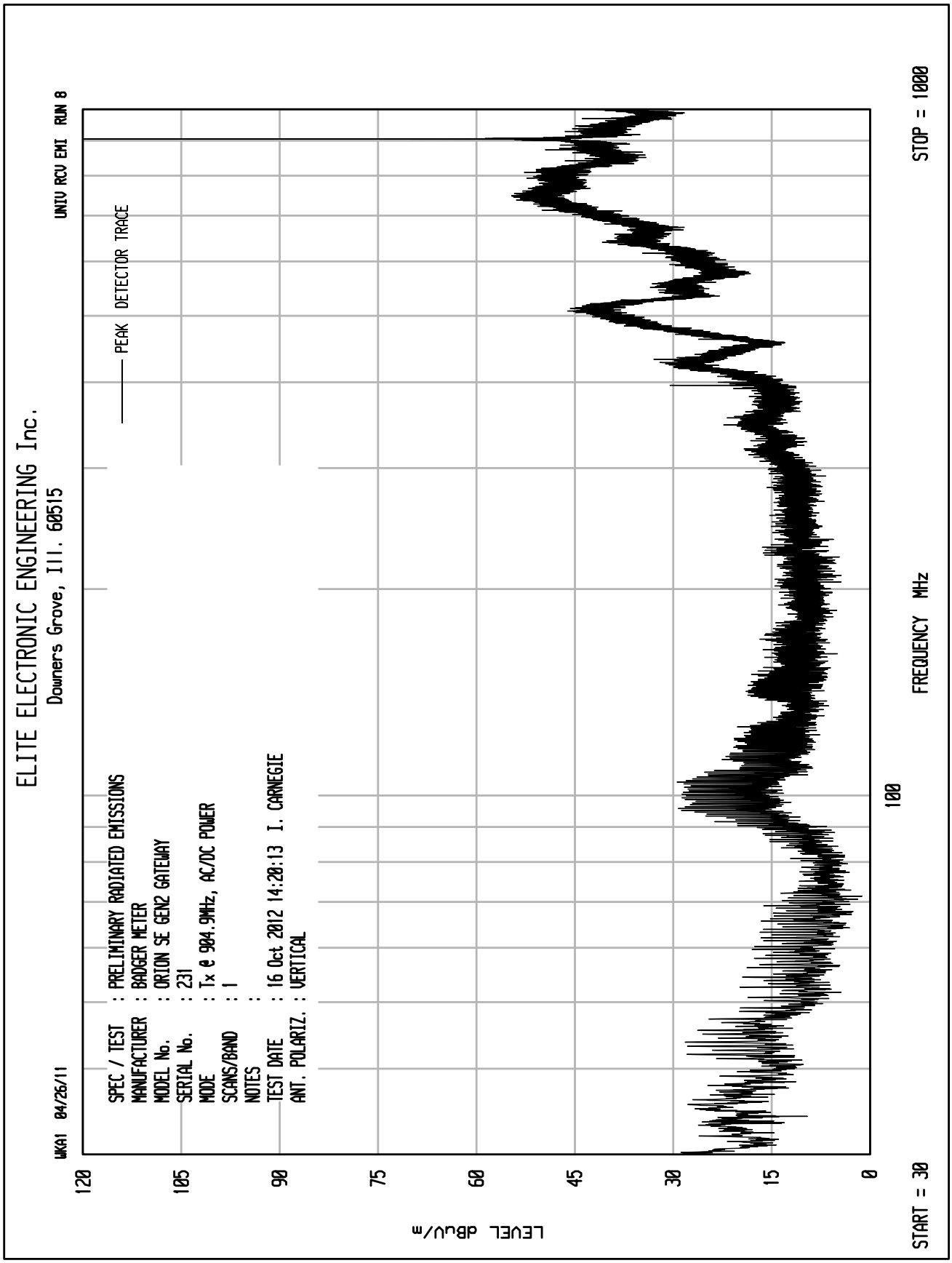
Checked By: Ian Carnegie

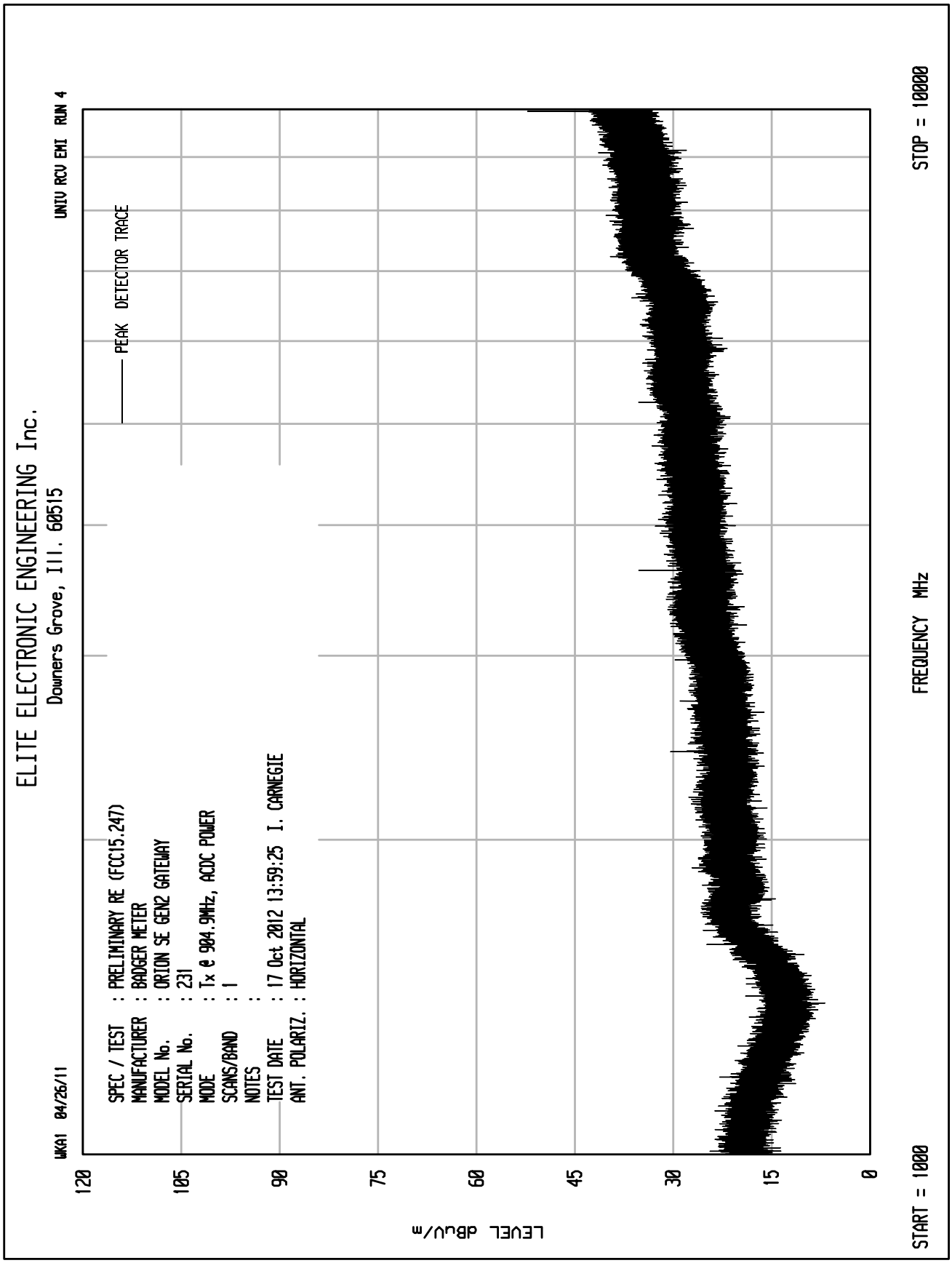

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 3
WKA1 04/26/11
SPEC / TEST : FCC15.247 ANT CONDUCTED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GEN2 GATEWAY
SERIAL No. : 213
MODE : Tx @ 904.9MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 18 Oct 2012 14:32:34 I. CARNEGIE
Limit
PEAK DETECTOR TRACE
LEVEL dBm
45
30
15
0
-15
-30
-45
-60
START = 30
100
1000
STOP = 10000
FREQUENCY MHz

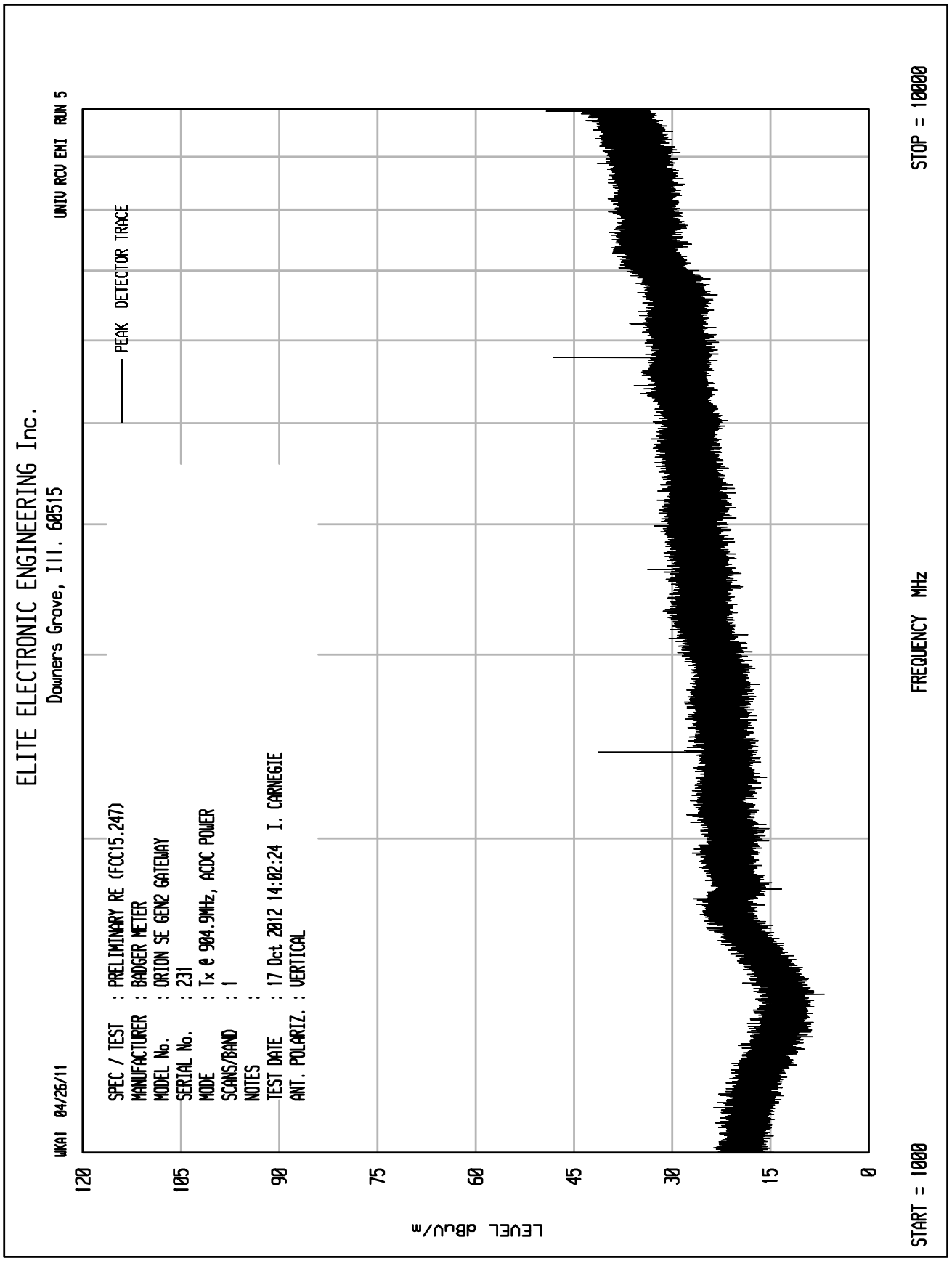

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 4
WKA1 04/26/11
SPEC / TEST : FCC15.247 ANT CONDUCTED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GEN2 GATEWAY
SERIAL No. : 213
MODE : Tx @ 914.5MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 18 Oct 2012 14:41:45 I. CARNEGIE
Limit
PEAK DETECTOR TRACE
LEVEL dBm
45
30
15
0
-15
-30
-45
-60
START = 30
100
1000
STOP = 10000
FREQUENCY MHz

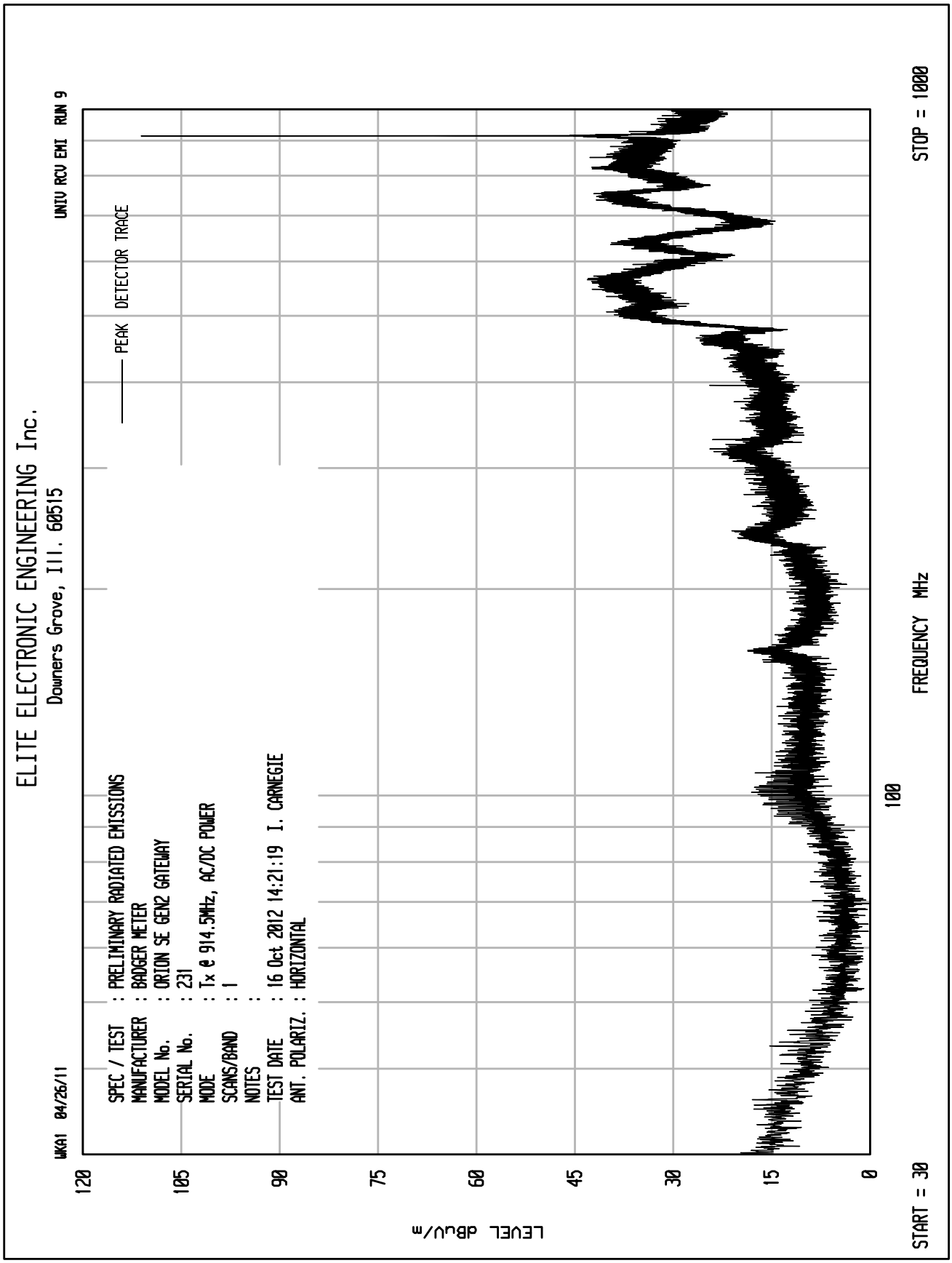

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 5
WKA1 04/26/11
SPEC / TEST : FCC15.247 ANT CONDUCTED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GEN2 GATEWAY
SERIAL No. : 213
MODE : Tx @ 924.5MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 18 Oct 2012 14:45:41 I. CARNEGIE
Limit
PEAK DETECTOR TRACE
LEVEL dBm
45
30
15
0
-15
-30
-45
-60
START = 30
100
1000
STOP = 10000
FREQUENCY MHz

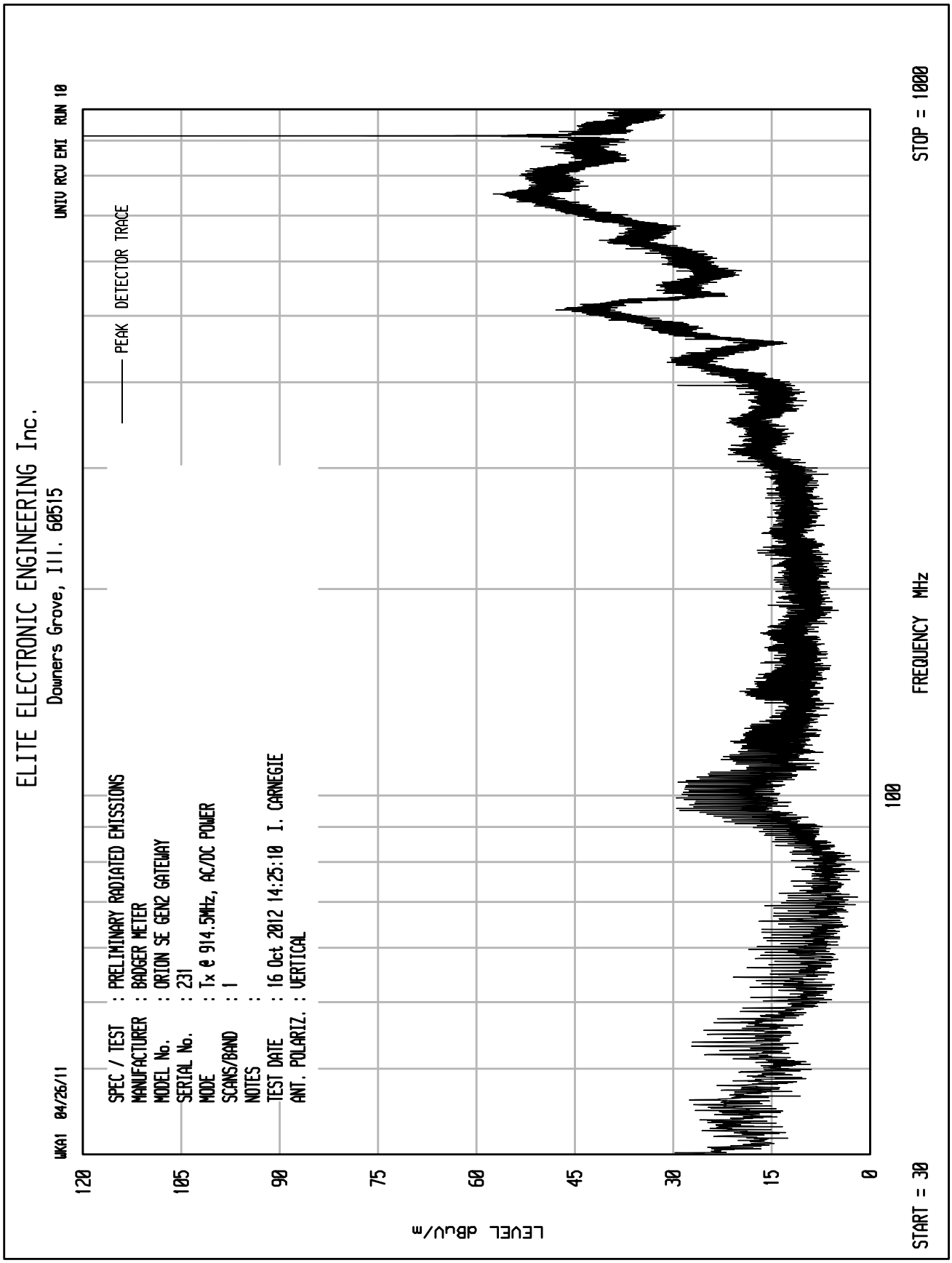

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 7
WKA1 04/26/11
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GEN2 GATEWAY
SERIAL No. : 231
MODE : Tx @ 904.9MHz, AC/DC POWER
SCANS/BAND : 1
NOTES :
TEST DATE : 16 Oct 2012 14:16:56 I. CARNEGIE
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

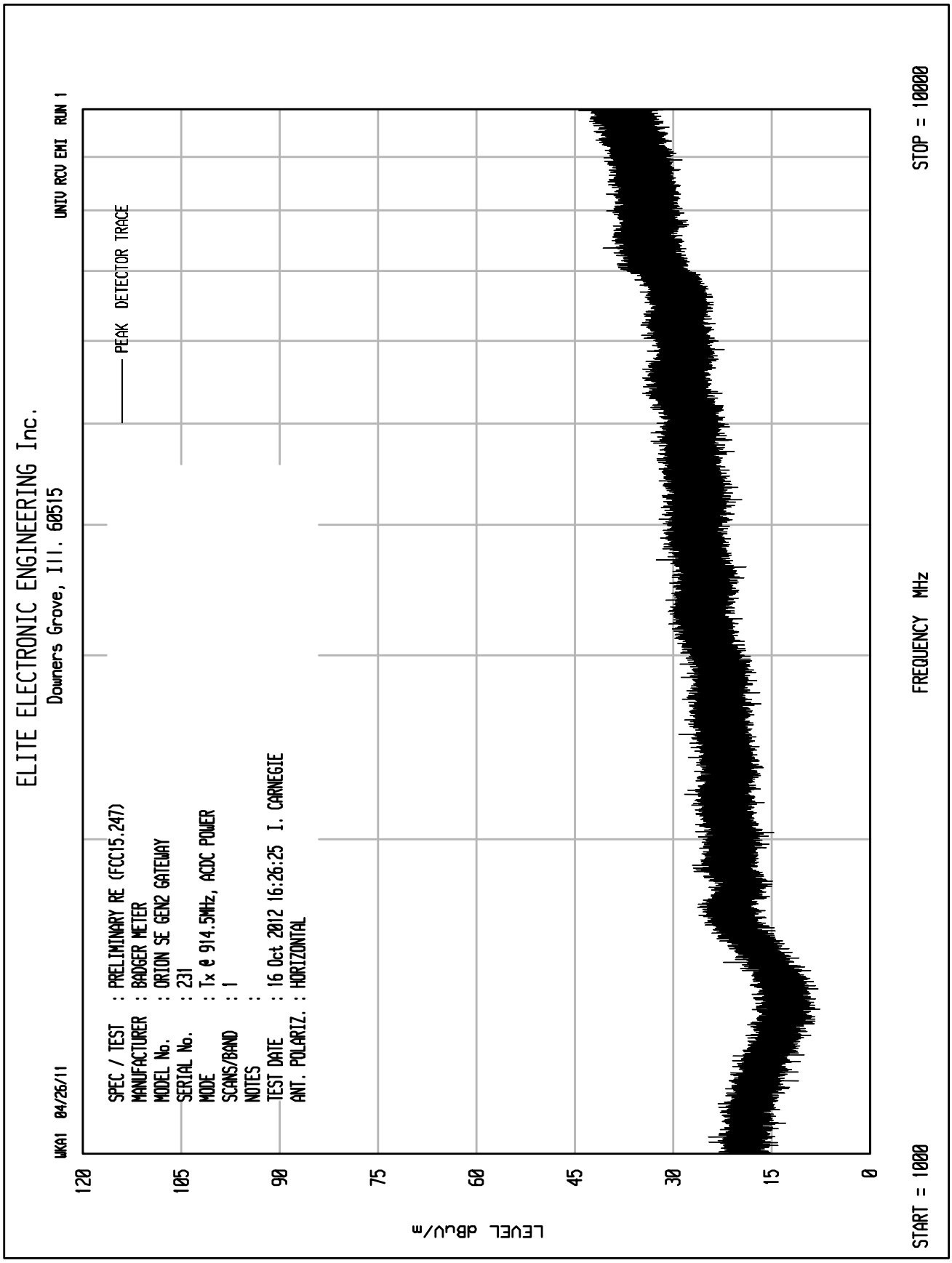

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 8
WKA1 04/26/11
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GEN2 GATEWAY
SERIAL No. : 231
MODE : Tx @ 904.9MHz, AC/DC POWER
SCANS/BAND : 1
NOTES :
TEST DATE : 16 Oct 2012 14:20:13 I. CARNEGIE
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

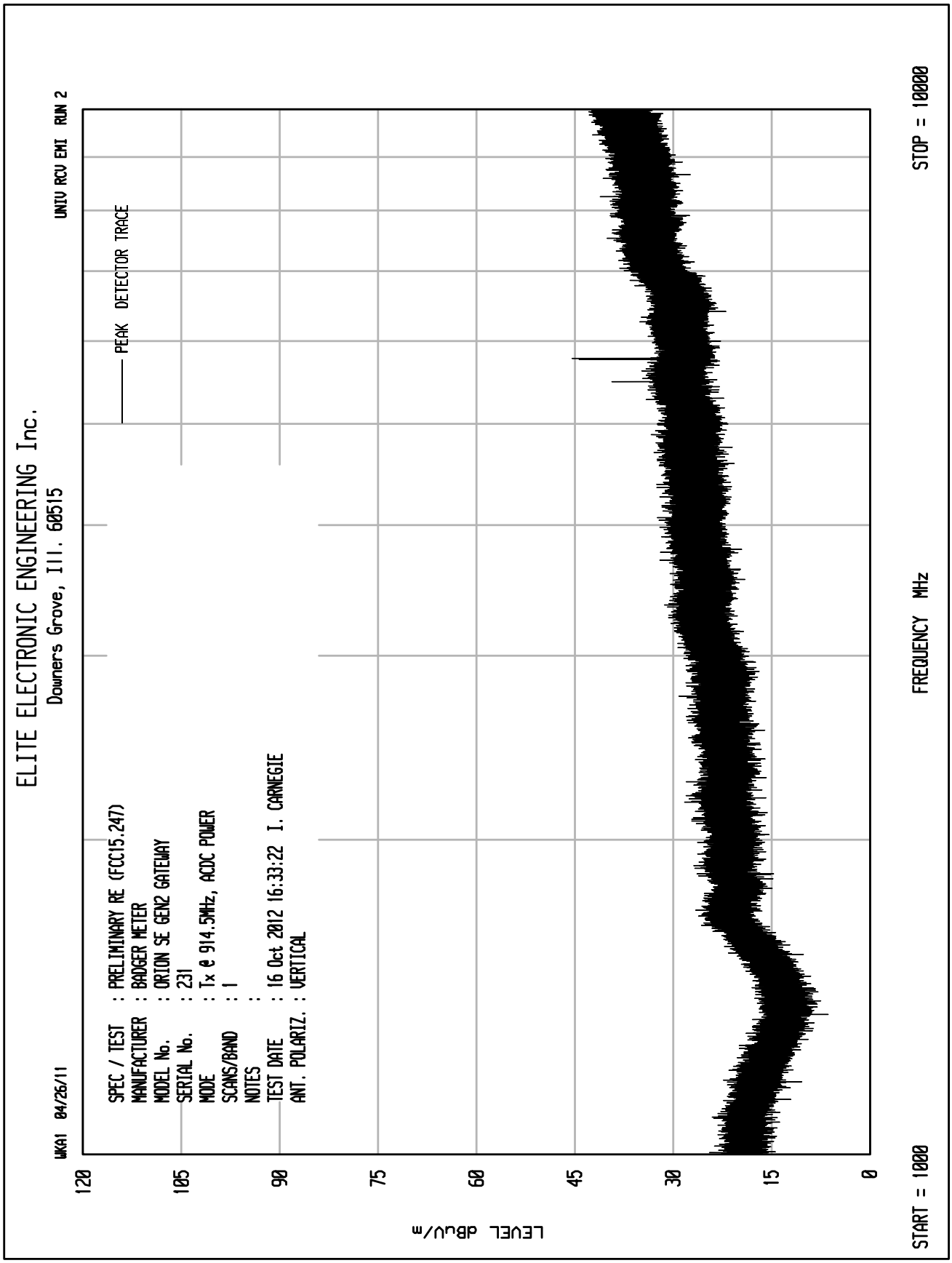

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 4
WKA1 04/26/11
SPEC / TEST : PRELIMINARY RE (FCC15.247)
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GEN2 GATEWAY
SERIAL No. : 231
MODE : Tx @ 904.9MHz, ACDC POWER
SCANS/BAND : 1
NOTES :
TEST DATE : 17 Oct 2012 13:59:25 I. CARNEGIE
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000

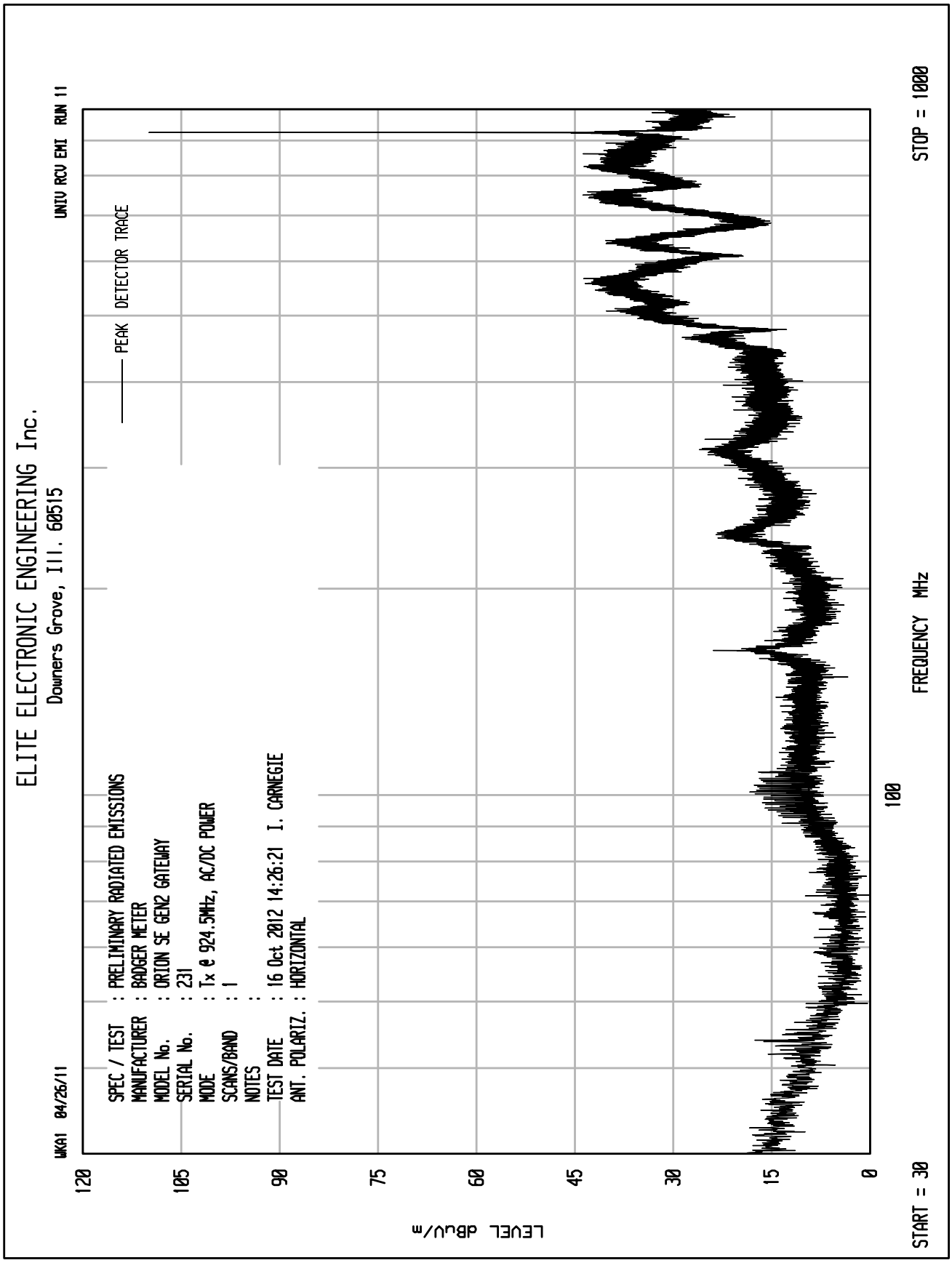

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 5
WKA1 04/26/11
SPEC / TEST : PRELIMINARY RE (FCC15.247)
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GEN2 GATEWAY
SERIAL No. : 231
MODE : Tx @ 904.9MHz, ACDC POWER
SCANS/BAND : 1
NOTES :
TEST DATE : 17 Oct 2012 14:02:24 I. CARNEGIE
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000

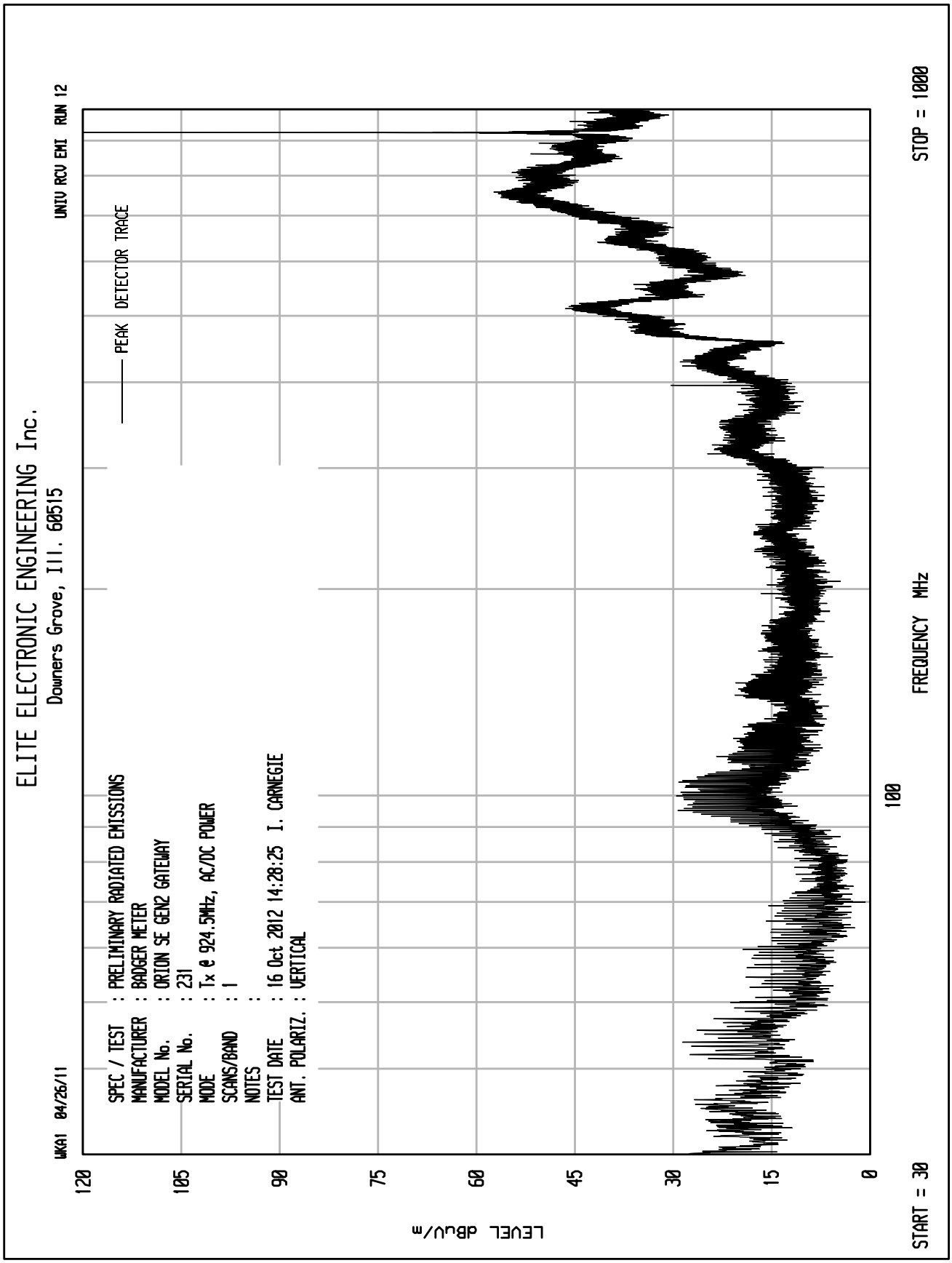

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 9
WKA1 04/26/11
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GEN2 GATEWAY
SERIAL No. : 231
MODE : Tx @ 914.5MHz, AC/DC POWER
SCANS/BAND : 1
NOTES :
TEST DATE : 16 Oct 2012 14:21:19 I. CARNEGIE
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

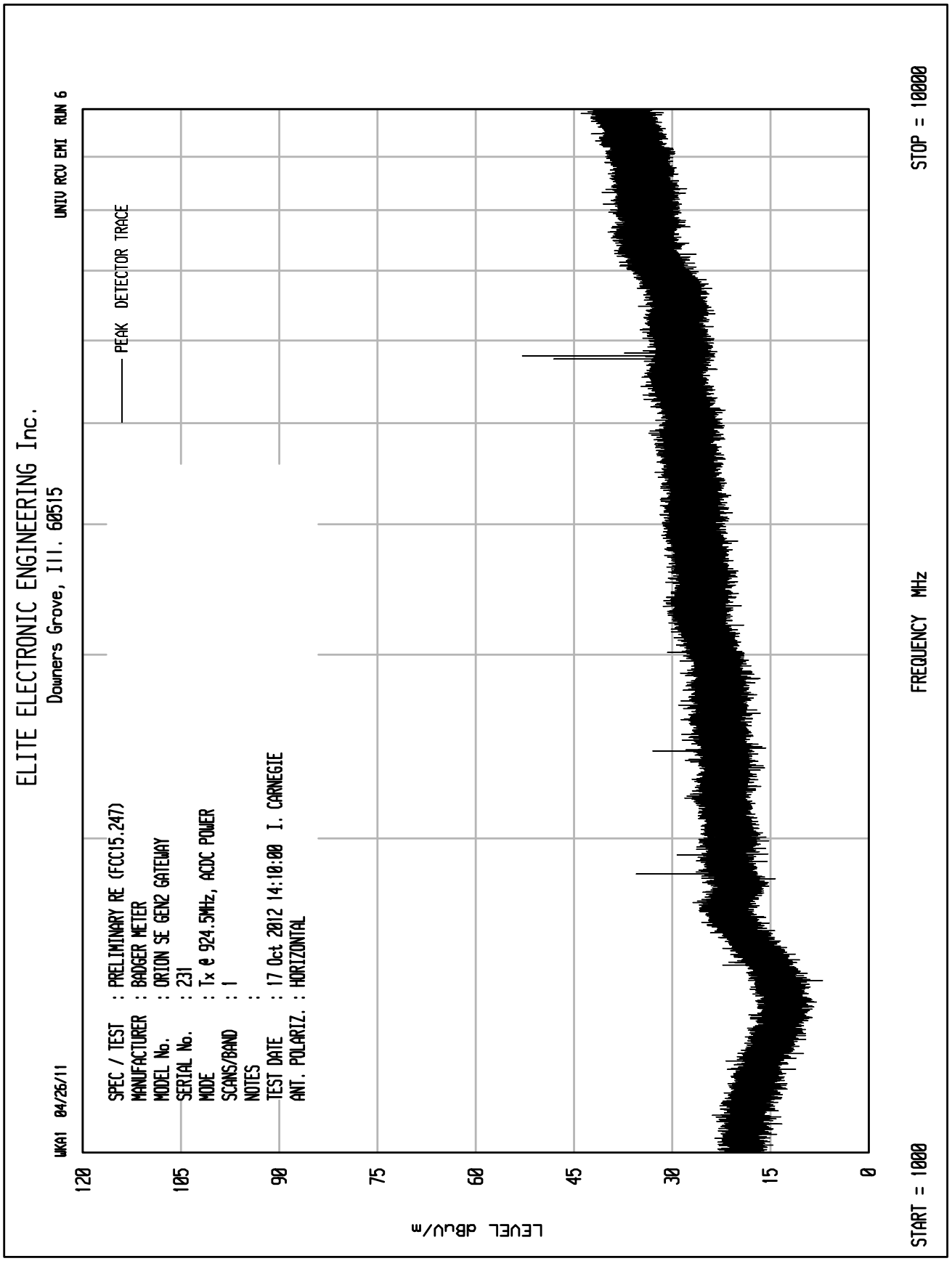

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 10
WKA1 04/26/11
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GEN2 GATEWAY
SERIAL No. : 231
MODE : Tx @ 914.5MHz, AC/DC POWER
SCANS/BAND : 1
NOTES :
TEST DATE : 16 Oct 2012 14:25:10 I. CARNEGIE
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

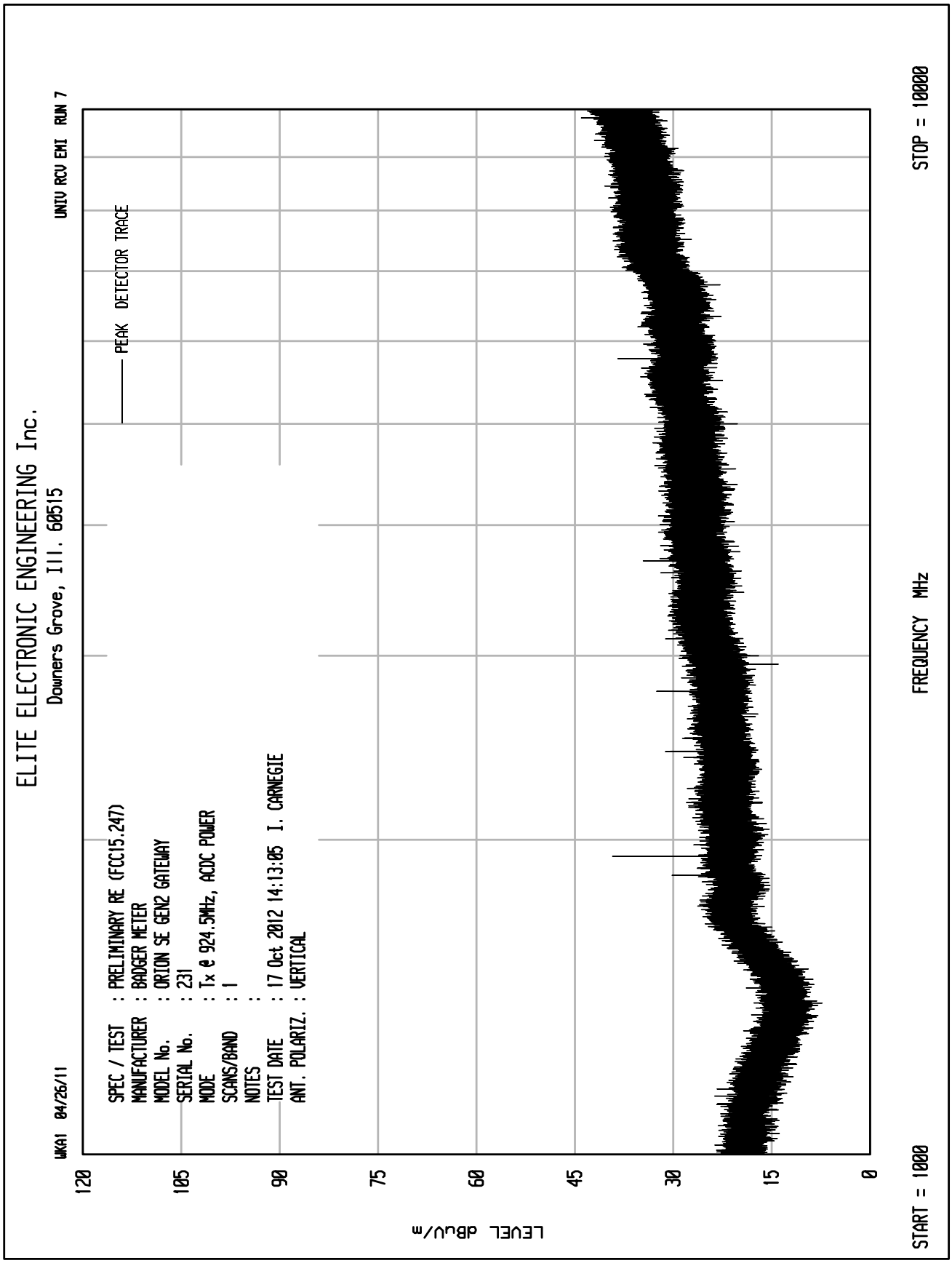

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 1
WKA1 04/26/11
SPEC / TEST : PRELIMINARY RE (FCC15.247)
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GEN2 GATEWAY
SERIAL No. : 231
MODE : Tx @ 914.5MHz, ACDC POWER
SCANS/BAND : 1
NOTES :
TEST DATE : 16 Oct 2012 16:26:25 I. CARNEGIE
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000

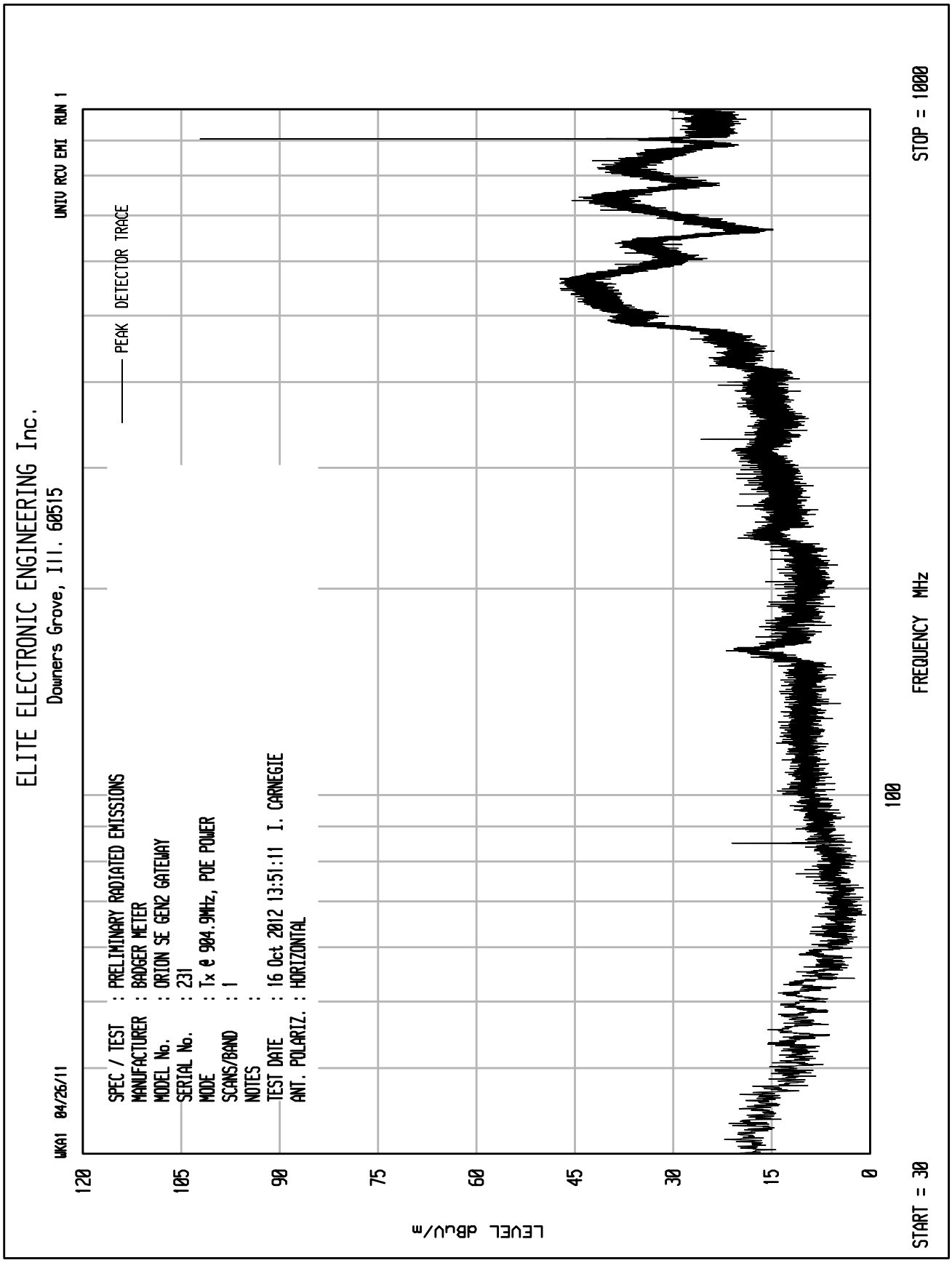

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 2
WKA1 04/26/11
SPEC / TEST : PRELIMINARY RE (FCC15.247)
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GEN2 GATEWAY
SERIAL No. : 231
MODE : Tx @ 914.5MHz, ACDC POWER
SCANS/BAND : 1
NOTES :
TEST DATE : 16 Oct 2012 16:33:22 I. CARNEGIE
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000

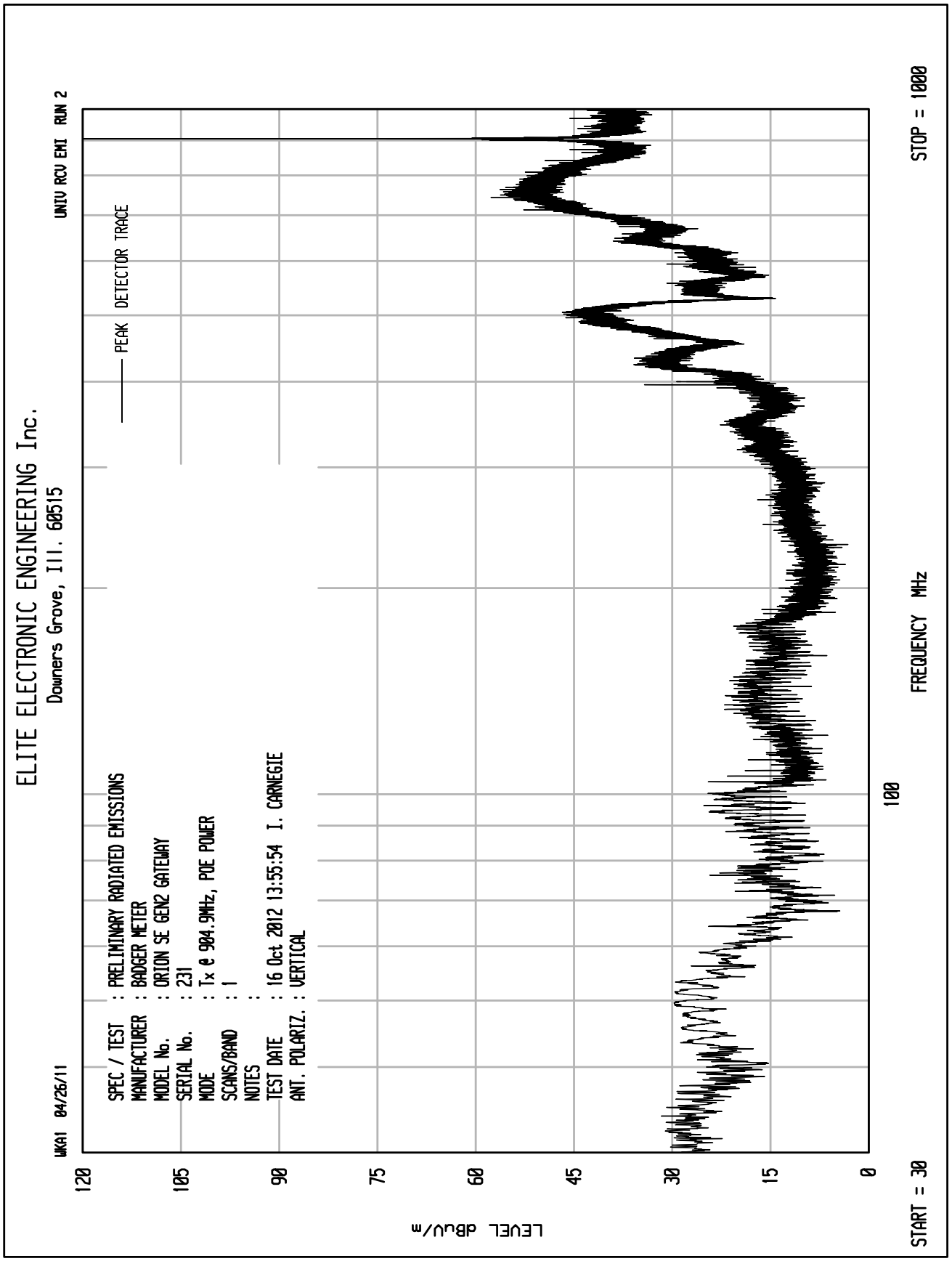

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 11
WKA1 04/26/11
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GEN2 GATEWAY
SERIAL No. : 231
MODE : Tx @ 924.5MHz, AC/DC POWER
SCANS/BAND : 1
NOTES :
TEST DATE : 16 Oct 2012 14:26:21 I. CARNEGIE
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

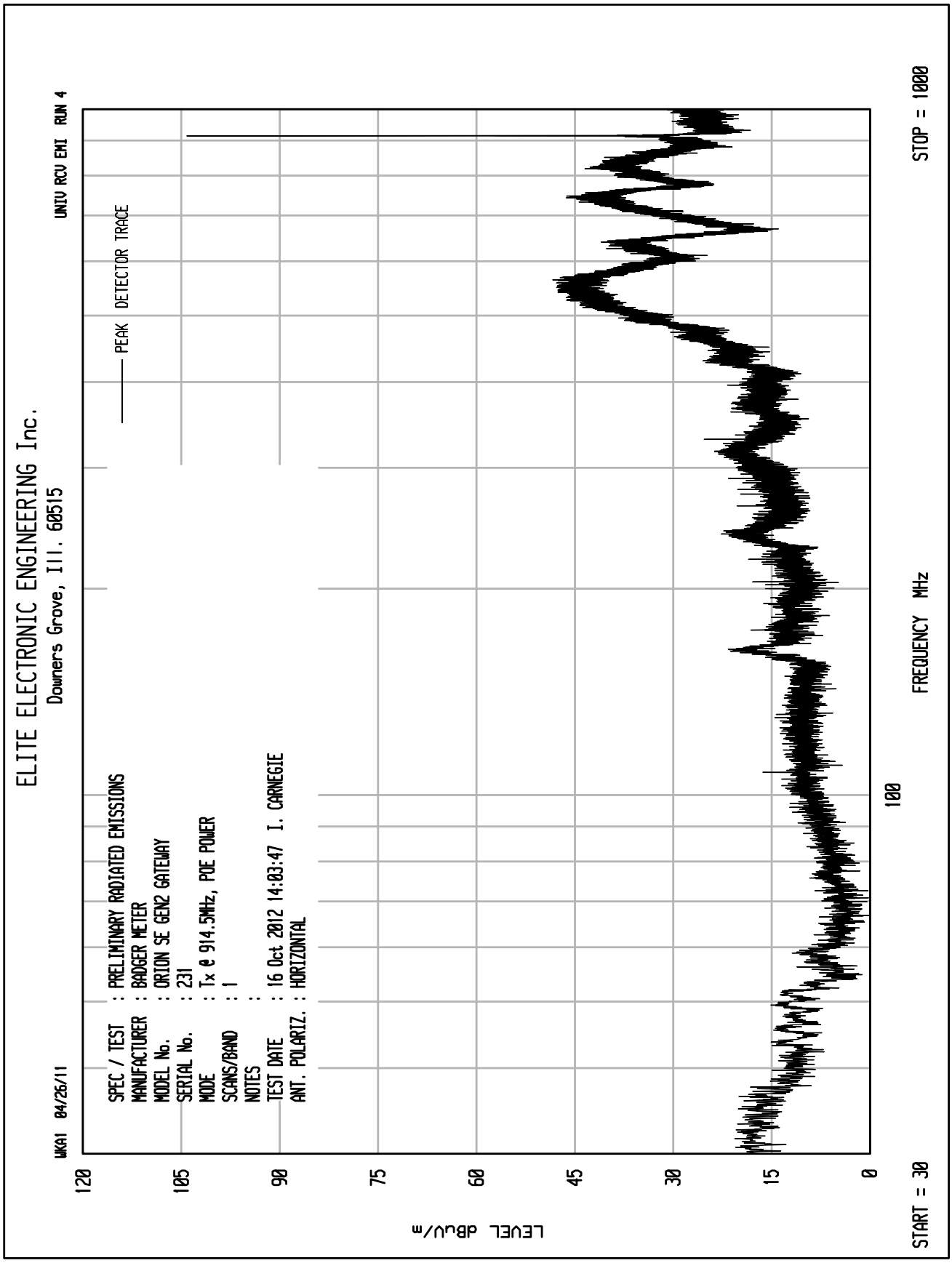

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 12
WKA1 04/26/11
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GEN2 GATEWAY
SERIAL No. : 231
MODE : Tx @ 924.5MHz, AC/DC POWER
SCANS/BAND : 1
NOTES :
TEST DATE : 16 Oct 2012 14:28:25 I. CARNEGIE
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

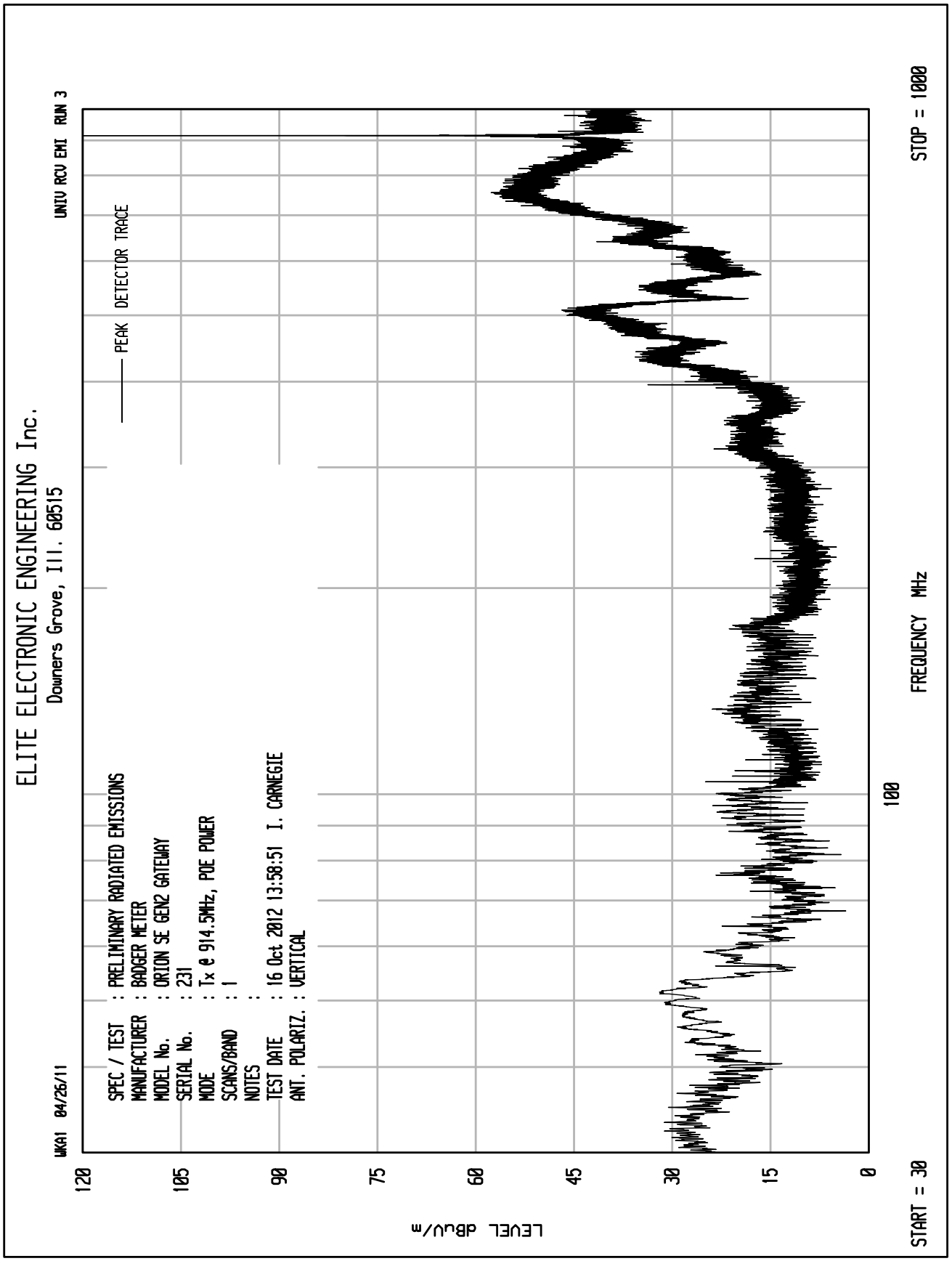

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 6
WKA1 04/26/11
SPEC / TEST : PRELIMINARY RE (FCC15.247)
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GEN2 GATEWAY
SERIAL No. : 231
MODE : Tx @ 924.5MHz, ACDC POWER
SCANS/BAND : 1
NOTES :
TEST DATE : 17 Oct 2012 14:10:00 I. CARNEGIE
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000

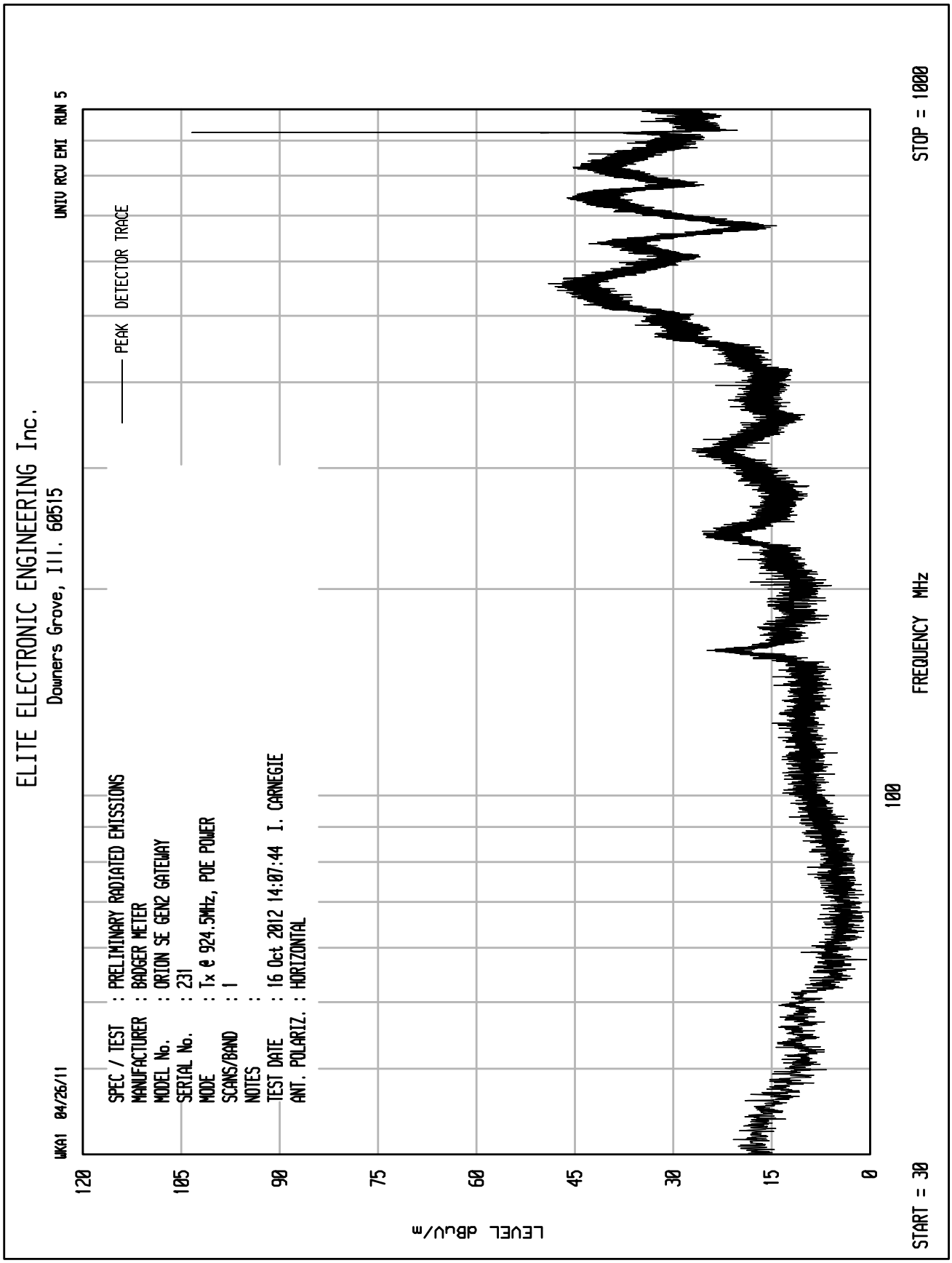

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 7
WKA1 04/26/11
SPEC / TEST : PRELIMINARY RE (FCC15.247)
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GEN2 GATEWAY
SERIAL No. : 231
MODE : Tx @ 924.5MHz, ACDC POWER
SCANS/BAND : 1
NOTES :
TEST DATE : 17 Oct 2012 14:13:05 I. CARNEGIE
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000

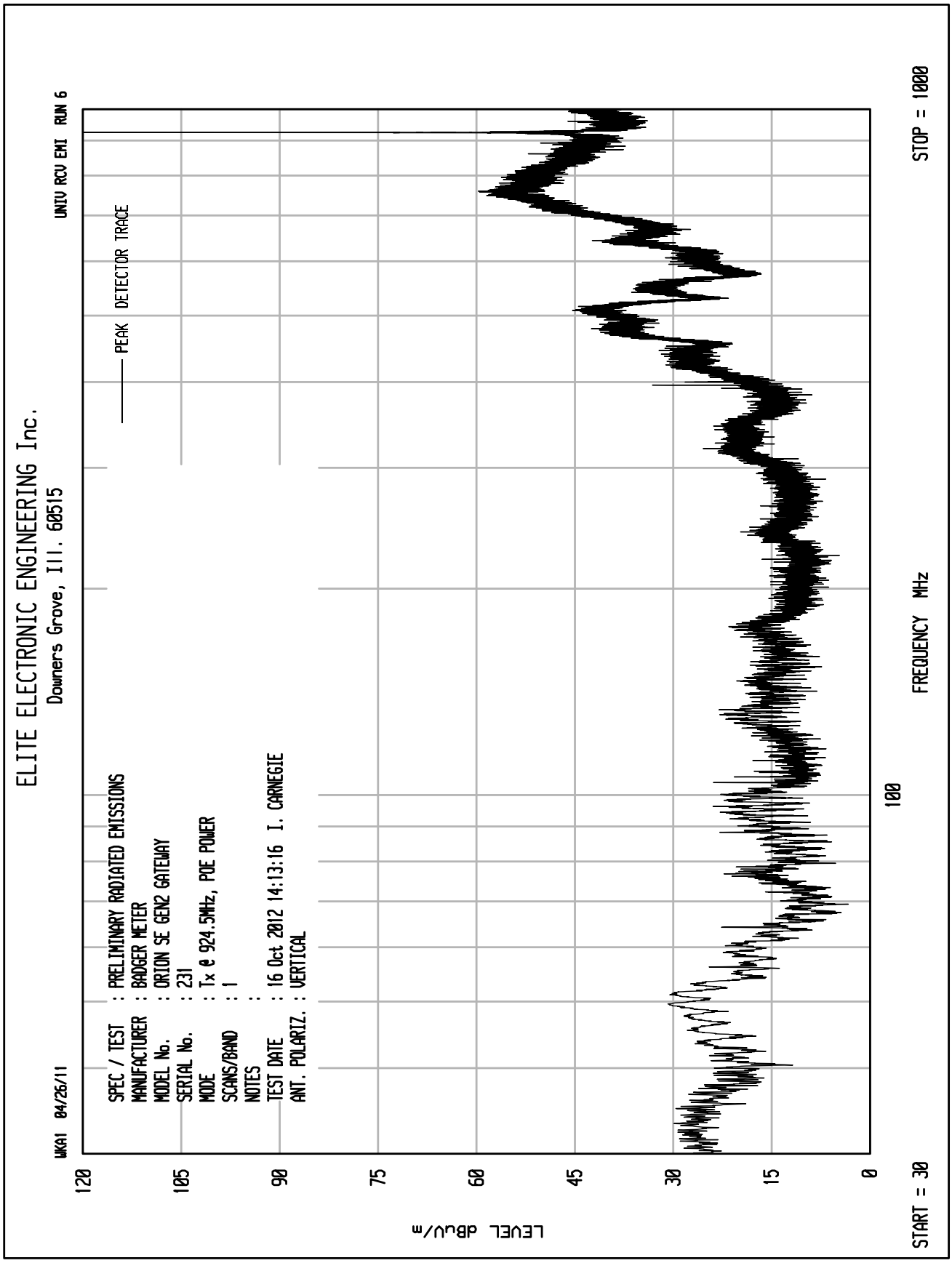

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 1
WKA1 04/26/11
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GEN2 GATEWAY
SERIAL No. : 231
MODE : Tx @ 904.9MHz, POE POWER
SCANS/BAND : 1
NOTES :
TEST DATE : 16 Oct 2012 13:51:11 I. CARNEGIE
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 2
WKA1 04/26/11
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GEN2 GATEWAY
SERIAL No. : 231
MODE : Tx @ 904.9MHz, POE POWER
SCANS/BAND : 1
NOTES :
TEST DATE : 16 Oct 2012 13:55:54 I. CARNEGIE
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 4
WKA1 04/26/11
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GEN2 GATEWAY
SERIAL No. : 231
MODE : Tx @ 914.5MHz, POE POWER
SCANS/BAND : 1
NOTES :
TEST DATE : 16 Oct 2012 14:03:47 I. CARNEGIE
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 3
WKA1 04/26/11
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GEN2 GATEWAY
SERIAL No. : 231
MODE : Tx @ 914.5MHz, POE POWER
SCANS/BAND : 1
NOTES :
TEST DATE : 16 Oct 2012 13:58:51 I. CARNEGIE
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 5
WKA1 04/26/11
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GEN2 GATEWAY
SERIAL No. : 231
MODE : Tx @ 924.5MHz, POE POWER
SCANS/BAND : 1
NOTES :
TEST DATE : 16 Oct 2012 14:07:44 I. CARNEGIE
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 6
WKA1 04/26/11
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE GEN2 GATEWAY
SERIAL No. : 231
MODE : Tx @ 924.5MHz, POE POWER
SCANS/BAND : 1
NOTES :
TEST DATE : 16 Oct 2012 14:13:16 I. CARNEGIE
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

Manufacturer : Badger Meter
Model No. : Orion SE Gateway
Serial No. : 231
Specification : FCC-15.247 Spurious Radiated Emissions in Restricted Bands
Date : October 16, 2012
Mode : Tx @ 904.9MHz (Ch. 1)
Equipment Used : NTA2, CDY0, RBB0, NWH0
Notes : Test Distance is 3 meters
Notes : Maximized Peak Readings in Restricted Bands

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)
2714.70	H	48.55		3.7	30.0	-40.3	41.9	123.9	5000.0	-32.1
2714.70	V	48.9		3.7	30.0	-40.3	42.2	129.0	5000.0	-31.8
3619.60	H	47.4		4.3	32.4	-40.1	43.9	156.7	5000.0	-30.1
3619.60	V	48.5		4.3	32.4	-40.1	45.0	177.8	5000.0	-29.0
4524.50	H	46.8	Ambient	4.7	33.2	-40.0	44.8	172.9	5000.0	-29.2
4524.50	V	47.0	Ambient	4.7	33.2	-40.0	45.0	177.3	5000.0	-29.0
5429.40	H	46.2	Ambient	5.2	35.3	-40.1	46.6	213.3	5000.0	-27.4
5429.40	V	47.0	Ambient	5.2	35.3	-40.1	47.4	234.2	5000.0	-26.6
8144.10	H	46.8	Ambient	6.5	37.8	-39.6	51.5	378.0	5000.0	-22.4
8144.10	V	47.0	Ambient	6.5	37.8	-39.6	51.7	385.5	5000.0	-22.3
9049.00	H	47.1	Ambient	6.5	37.6	-39.1	52.2	407.0	5000.0	-21.8
9049.00	V	47.3	Ambient	6.5	37.6	-39.1	52.4	415.5	5000.0	-21.6

H – Horizontal V – Vertical

* - Ambient

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

Checked By: Ian Carnegie

Manufacturer : Badger Meter
Model No. : Orion SE Gateway
Serial No. : 231
Specification : FCC-15.247 Spurious Radiated Emissions in Restricted Bands
Date : October 16, 2012
Mode : Tx @ 904.9MHz (Ch. 1)
Equipment Used : NTA2, CDY0, RBB0, NWH0
Notes : Test Distance is 3 meters
Notes : Average Readings in Restricted Bands

Freq (MHz)	Ant Pol	Meter Reading (dBuV)	Ambient	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)
2714.70	H	48.55		3.7	30.0	-40.3	0.0	41.9	123.9	500.0	-12.1
2714.70	V	48.9		3.7	30.0	-40.3	0.0	42.2	129.0	500.0	-11.8
3619.60	H	47.4		4.3	32.4	-40.1	0.0	43.9	156.7	500.0	-10.1
3619.60	V	48.5		4.3	32.4	-40.1	0.0	45.0	177.8	500.0	-9.0
4524.50	H	46.8	Ambient	4.7	33.2	-40.0	0.0	44.8	172.9	500.0	-9.2
4524.50	V	47.0	Ambient	4.7	33.2	-40.0	0.0	45.0	177.3	500.0	-9.0
5429.40	H	46.2	Ambient	5.2	35.3	-40.1	0.0	46.6	213.3	500.0	-7.4
5429.40	V	47.0	Ambient	5.2	35.3	-40.1	0.0	47.4	234.2	500.0	-6.6
8144.10	H	46.8	Ambient	6.5	37.8	-39.6	0.0	51.5	378.0	500.0	-2.4
8144.10	V	47.0	Ambient	6.5	37.8	-39.6	0.0	51.7	385.5	500.0	-2.3
9049.00	H	47.1	Ambient	6.5	37.6	-39.1	0.0	52.2	407.0	500.0	-1.8
9049.00	V	47.3	Ambient	6.5	37.6	-39.1	0.0	52.4	415.5	500.0	-1.6

H – Horizontal V – Vertical

* - Ambient

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

Checked By: Ian Carnegie

Manufacturer : Badger Meter
Model No. : Orion SE Gateway
Serial No. : 231
Specification : FCC-15.247 Spurious Radiated Emissions in Restricted Bands
Date : October 16, 2012
Mode : Tx @ 914.5MHz (Ch. 25)
Equipment Used : NTA2, CDY0, RBB0, NWH0
Notes : Test Distance is 3 meters
Notes : Maximized Peak Readings in Restricted Bands

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)
2743.50	H	48.66	Ambient	3.7	29.9	-40.3	42.0	125.3	5000.0	-32.0
2743.50	V	47.7	Ambient	3.7	29.9	-40.3	41.0	112.1	5000.0	-33.0
3658.00	H	46.7	Ambient	4.3	32.5	-40.1	43.4	148.7	5000.0	-30.5
3658.00	V	46.7	Ambient	4.3	32.5	-40.1	43.4	148.5	5000.0	-30.5
4572.50	H	46.5	Ambient	4.7	33.3	-40.0	44.6	169.3	5000.0	-29.4
4572.50	V	46.3	Ambient	4.7	33.3	-40.0	44.4	165.3	5000.0	-29.6
7316.00	H	46.6	Ambient	6.2	37.9	-39.8	50.8	348.7	5000.0	-23.1
7316.00	V	47.1	Ambient	6.2	37.9	-39.8	51.4	369.8	5000.0	-22.6
8230.50	H	47.0	Ambient	6.5	37.7	-39.5	51.7	383.9	5000.0	-22.3
8230.50	V	46.7	Ambient	6.5	37.7	-39.5	51.4	369.6	5000.0	-22.6
9145.00	H	47.5	Ambient	6.6	37.7	-39.0	52.7	432.4	5000.0	-21.3
9145.00	V	47.7	Ambient	6.6	37.7	-39.0	52.9	443.5	5000.0	-21.0

H – Horizontal V – Vertical

* - Ambient

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

Checked By: Ian Carnegie

Manufacturer : Badger Meter

Manufacturer : Badger Meter
Model No. : Orion SE Gateway
Serial No. : 231
Specification : FCC-15.247 Spurious Radiated Emissions in Restricted Bands
Date : October 16, 2012
Mode : Tx @ 94.5MHz (Ch. 25)
Equipment Used : NTA2, CDY0, RBB0, NWH0
Notes : Test Distance is 3 meters
Notes : Average Readings in Restricted Bands

Freq (MHz)	Ant Pol	Meter Reading (dBuV)	Ambient	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)
2743.50	H	48.66	Ambient	3.7	29.9	-40.3	0.0	42.0	125.3	500.0	-12.0
2743.50	V	47.7	Ambient	3.7	29.9	-40.3	0.0	41.0	112.1	500.0	-13.0
3658.00	H	46.7	Ambient	4.3	32.5	-40.1	0.0	43.4	148.7	500.0	-10.5
3658.00	V	46.7	Ambient	4.3	32.5	-40.1	0.0	43.4	148.5	500.0	-10.5
4572.50	H	46.5	Ambient	4.7	33.3	-40.0	0.0	44.6	169.3	500.0	-9.4
4572.50	V	46.3	Ambient	4.7	33.3	-40.0	0.0	44.4	165.3	500.0	-9.6
7316.00	H	46.6	Ambient	6.2	37.9	-39.8	0.0	50.8	348.7	500.0	-3.1
7316.00	V	47.1	Ambient	6.2	37.9	-39.8	0.0	51.4	369.8	500.0	-2.6
8230.50	H	47.0	Ambient	6.5	37.7	-39.5	0.0	51.7	383.9	500.0	-2.3
8230.50	V	46.7	Ambient	6.5	37.7	-39.5	0.0	51.4	369.6	500.0	-2.6
9145.00	H	47.5	Ambient	6.6	37.7	-39.0	0.0	52.7	432.4	500.0	-1.3
9145.00	V	47.7	Ambient	6.6	37.7	-39.0	0.0	52.9	443.5	500.0	-1.0

H – Horizontal V – Vertical

* - Ambient

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

Checked By: Ian Carnegie

Manufacturer : Badger Meter
Model No. : Orion SE Gateway
Serial No. : 231
Specification : FCC-15.247 Spurious Radiated Emissions in Restricted Bands
Date : October 16, 2012
Mode : Tx @ 924.5MHz (Ch. 50)
Equipment Used : NTA2, CDY0, RBB0, NWH0
Notes : Test Distance is 3 meters
Notes : Maximized Peak Readings in Restricted Bands

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)
2773.50	H	48.9		3.7	29.9	-40.3	42.2	129.2	5000.0	-31.8
2773.50	V	48.8		3.7	29.9	-40.3	42.1	127.7	5000.0	-31.9
3698.00	H	47.2		4.3	32.7	-40.1	44.1	161.1	5000.0	-29.8
3698.00	V	47.9		4.3	32.7	-40.1	44.8	174.7	5000.0	-29.1
4622.50	H	47.3	Ambient	4.8	33.5	-40.0	45.5	187.6	5000.0	-28.5
4622.50	V	47.1	Ambient	4.8	33.5	-40.0	45.3	183.5	5000.0	-28.7
7396.00	H	47.1		6.2	37.9	-39.7	51.5	376.2	5000.0	-22.5
7396.00	V	46.6		6.2	37.9	-39.7	51.0	355.1	5000.0	-23.0
8320.50	H	46.6	Ambient	6.5	37.5	-39.5	51.1	359.8	5000.0	-22.9
8320.50	V	46.2	Ambient	6.5	37.5	-39.5	50.7	344.4	5000.0	-23.2

H – Horizontal V – Vertical

* - Ambient

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

Checked By: Ian Carnegie

Manufacturer : Badger Meter
Model No. : Orion SE Gateway
Serial No. : 231
Specification : FCC-15.247 Spurious Radiated Emissions in Restricted Bands
Date : October 16, 2012
Mode : Tx @ 924.5MHz (Ch. 50)
Equipment Used : NTA2, CDY0, RBB0, NWH0
Notes : Test Distance is 3 meters
Notes : Average Readings in Restricted Bands

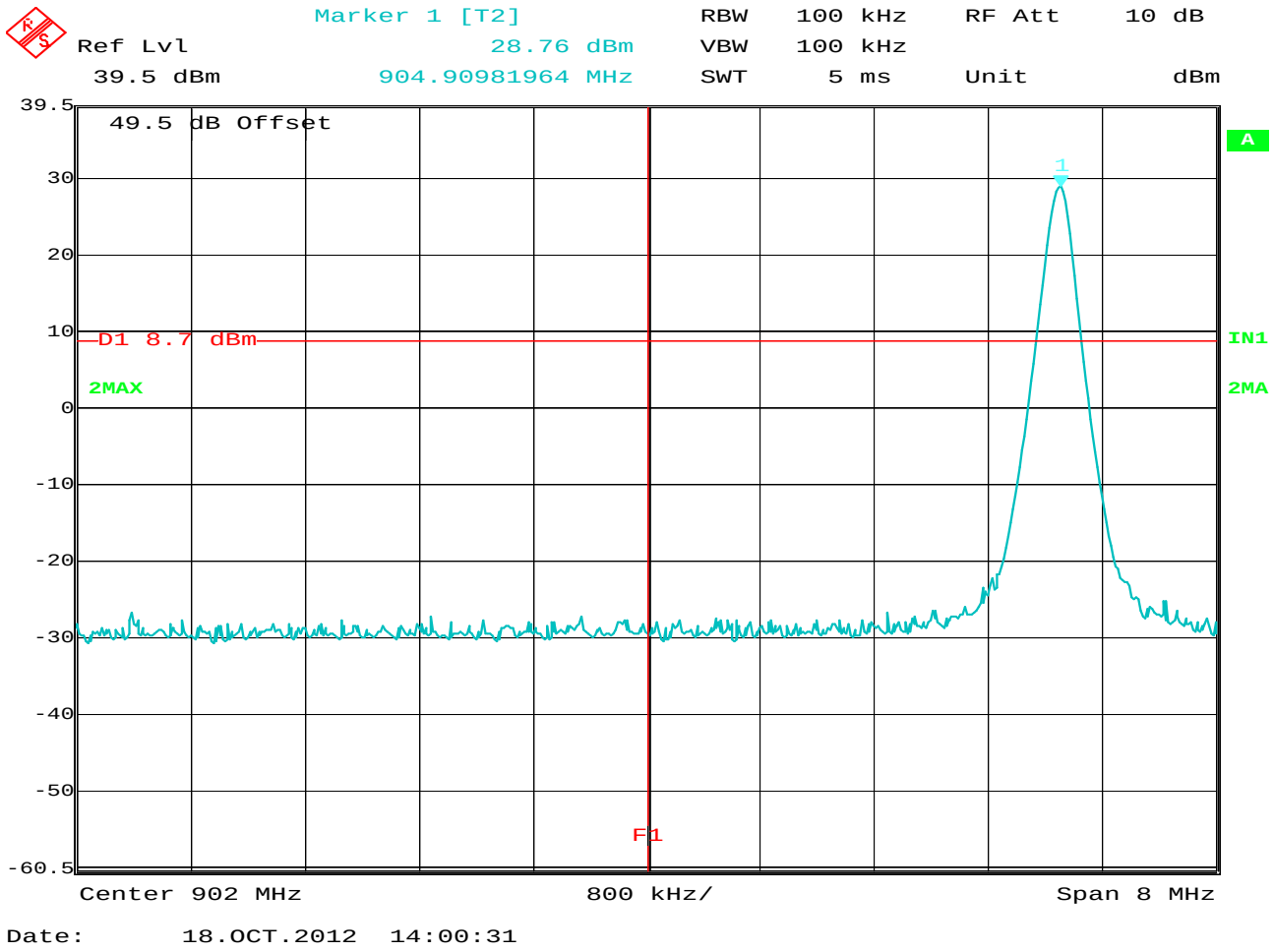
Freq (MHz)	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Total dBuV/m at 3 M	Total uV/m at 3M	Limit uV/m at 3M	Margin (dB)
2773.50	H	48.9		3.7	29.9	-40.3	0.0	42.2	129.2	500.0	-11.8
2773.50	V	48.8		3.7	29.9	-40.3	0.0	42.1	127.7	500.0	-11.9
3698.00	H	47.2		4.3	32.7	-40.1	0.0	44.1	161.1	500.0	-9.8
3698.00	V	47.9		4.3	32.7	-40.1	0.0	44.8	174.7	500.0	-9.1
4622.50	H	47.3	Ambient	4.8	33.5	-40.0	0.0	45.5	187.6	500.0	-8.5
4622.50	V	47.1	Ambient	4.8	33.5	-40.0	0.0	45.3	183.5	500.0	-8.7
7396.00	H	47.1		6.2	37.9	-39.7	0.0	51.5	376.2	500.0	-2.5
7396.00	V	46.6		6.2	37.9	-39.7	0.0	51.0	355.1	500.0	-3.0
8320.50	H	46.6	Ambient	6.5	37.5	-39.5	0.0	51.1	359.8	500.0	-2.9
8320.50	V	46.2	Ambient	6.5	37.5	-39.5	0.0	50.7	344.4	500.0	-3.2

H – Horizontal V – Vertical

* - Ambient

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

Checked By: Ian Carnegie

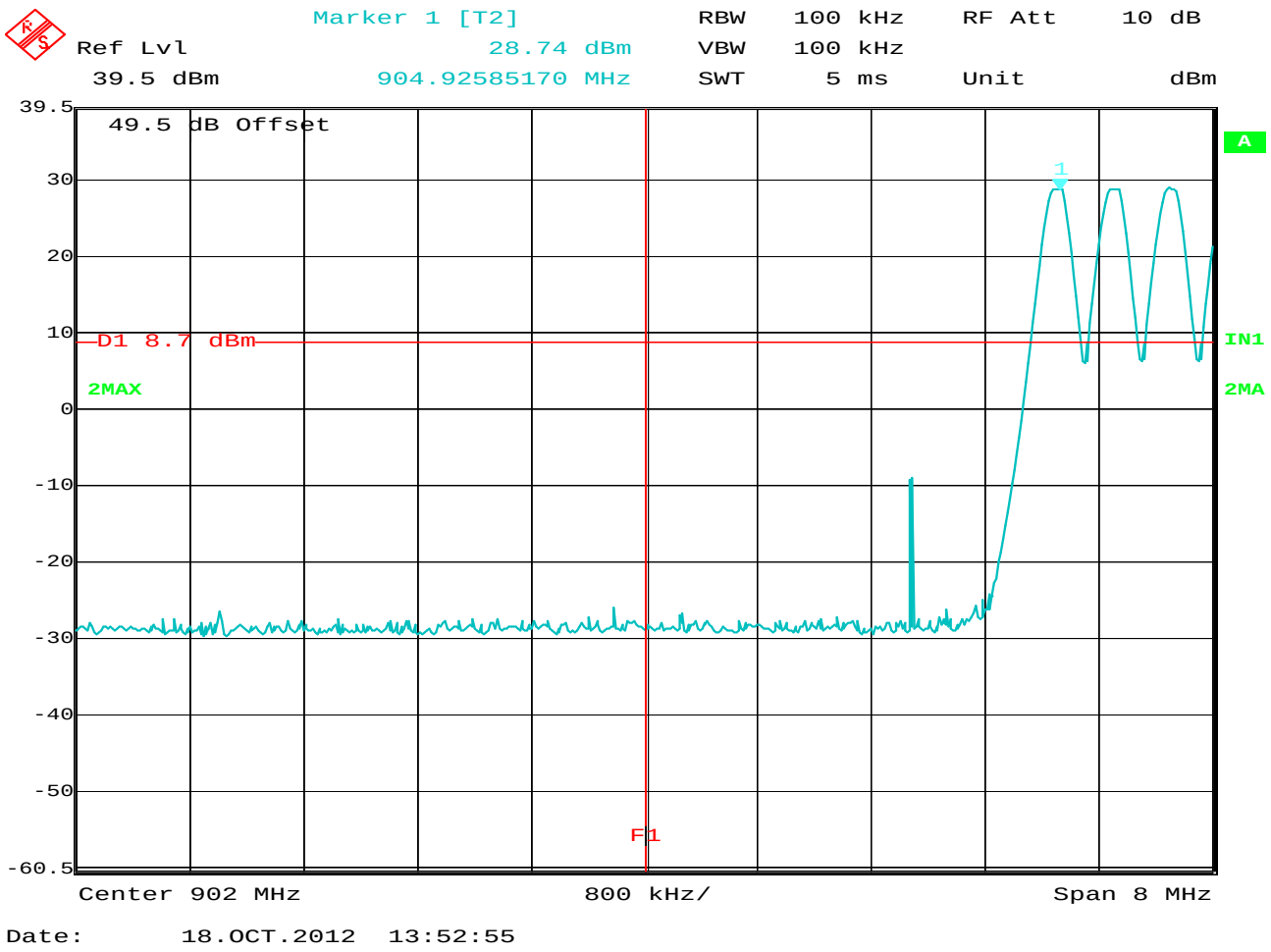


15.247(d) Band Edge Compliance

FCC 15.247: Band Edge (Bottom Band)

MANUFACTURER : Badger Meter
MODEL NUMBER : ORION SE Gen2 Gateway
SERIAL NUMBER : 231
TEST MODE : Tx @ 904.9 MHz
TEST PARAMETERS : 20 dBm down from band edge (902 MHz)
EQUIPMENT USED : RBB0, T2S7, T2D1, T1D2

NOTES



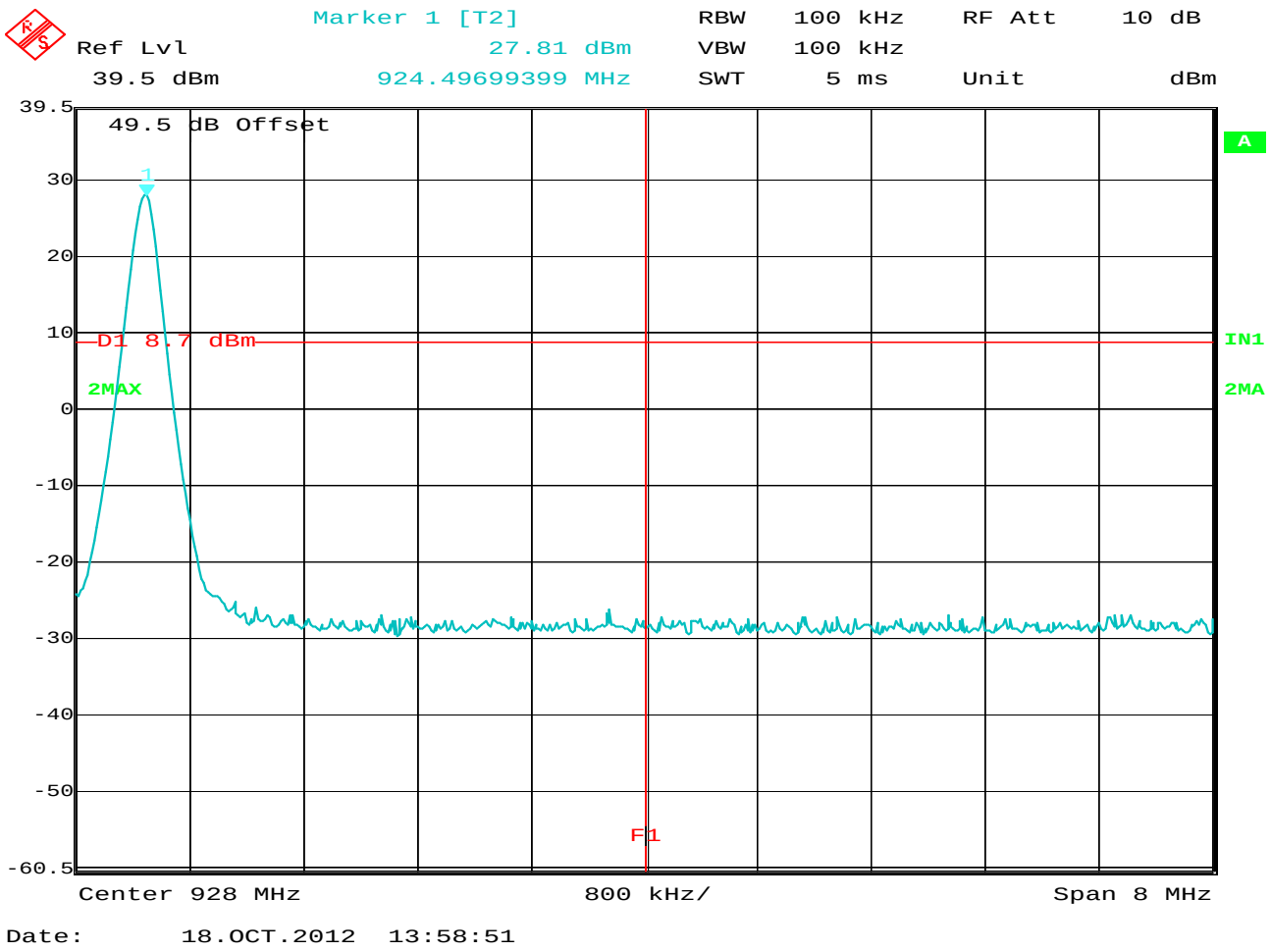
15.

247(d) Band Edge Compliance

FCC 15.247: Band Edge (Bottom Band)

MANUFACTURER : Badger Meter
MODEL NUMBER : ORION SE Gen2 Gateway
SERIAL NUMBER : 231
TEST MODE : Hopping Mode
TEST PARAMETERS : 20 dBm down from band edge (902 MHz)
EQUIPMENT USED : RBB0, T2S7, T2D1, T1D2

NOTES



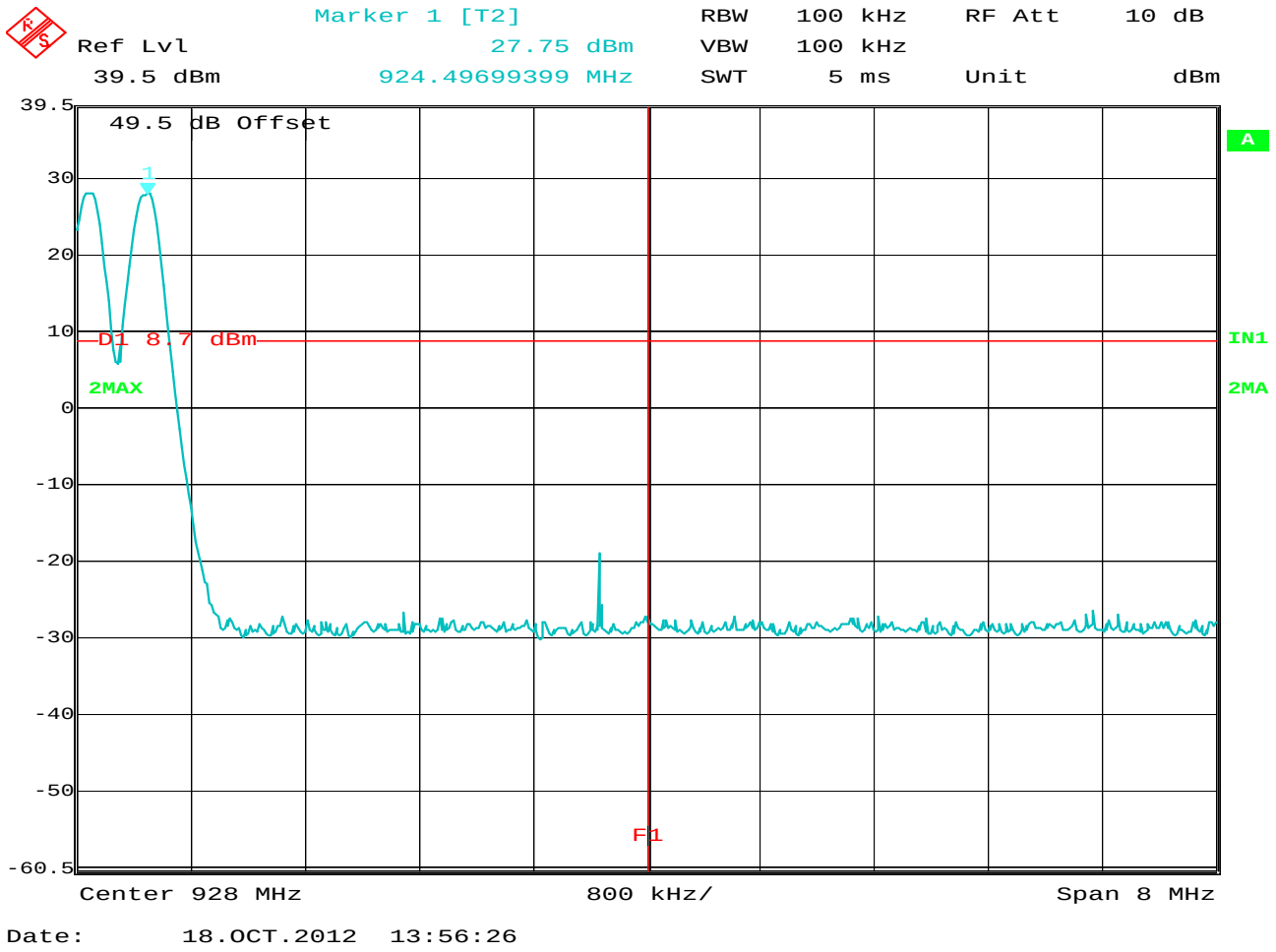
15.

247(d) Band Edge Compliance

FCC 15.247: Band Edge (Top Band)

MANUFACTURER : Badger Meter
MODEL NUMBER : ORION SE Gen2 Gateway
SERIAL NUMBER : 231
TEST MODE : Tx @ 924.5 MHz
TEST PARAMETERS : 20 dBm down from band edge (928 MHz)
EQUIPMENT USED : RBB0, T2S7, T2D1, T1D2

NOTES



FCC 15.247: Band Edge (Top Band)

MANUFACTURER : Badger Meter
MODEL NUMBER : ORION SE Gen2 Gateway
SERIAL NUMBER : 231
TEST MODE : Hopping Mode
TEST PARAMETERS : 20 dBm down from band edge (928 MHz)
EQUIPMENT USED : RBB0, T2S7, T2D1, T1D2

NOTES