Measurement of RF Interference from an ORION SE3 Endpoint Transceiver

For	Badger Meter 4545 W Brown Deer Road Milwaukee, WI 53223
P.O. Number	276831
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Test Personnel	Mark Longinotti
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 902-928MHz band 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
—	10/09/2014	Initial release

Measurement of RF Emissions from an ORION SE3 Endpoint 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 Transceiver, Part No. ORION SE3 Endpoint (hereinafter referred to as the EUT). Serial No. 30148151 was used for all tests except RF conducted output power tests. For RF conducted output power tests, Serial No. 30140822, with a special antenna port attachment, was used. The EUT is a frequency hopping spread spectrum transceiver designed to transmit and receive in the 902-928 MHz, band using an internal, non-removable antenna. The EUT contained a super-heterodyne type receiver which utilizes an intermediate frequency (IF) of 152.343 kHz. The EUT was manufactured and submitted for testing by Badger Meter 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 7.2.4 and Section 6 for receivers and the Industry Canada Radio Standards Specification RSS-Gen Section 7.2.4 and RSS-210 Annex 8, 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 21°C and the relative humidity was 35%.

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 1 October 2013

- 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, December 2010, “Spectrum Management and Telecommunications Radio Standards Specification, Low-power License-exempt radio communication devices (All Frequency Bands): Category I Equipment”

- Industry Canada RSS-GEN, Issue 3, December 2010, “Spectrum Management and Telecommunications Radio Standards Specification, General Requirements and Information for the

Certification of radio communication equipment”

3 EUT SET-UP AND OPERATION

3.1 General Description

The EUT is a Transceiver, Part No. ORION SE3 Endpoint. A block diagram of the EUT setup is shown as Figure 1.

3.1.1 Power Input

The EUT is normally powdered with 3.5VDC from an internal lithium thinly chloride battery. For testing purposes, the battery leads of the EUT were connected to an external power supply. The power supply provided a constant 3.5VDC power to the EUT during all tests.

3.1.2 Peripheral Equipment

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 ungrounded during the tests.

3.2 Operational Mode

For all tests the EUT was placed on an 80cm high non-conductive stand. The EUT was energize and was programmed to operate in one of the following modes:

- Receive at 904.9MHz
- Receive at 914.5MHz
- Receive at 924.5MHz
- Transmit at 904.9MHz, Fixed Mode, Output Power = 3C
- Transmit at 914.5MHz, Fixed Mode, Output Power = 3C
- Transmit at 924.5MHz, Fixed Mode, Output Power = 3C
- Hopping Enabled, Fixed Mode, Output Power = 3C
- Transmit at 904.9MHz, Mobile Mode, Output Power = C0
- Transmit at 914.5MHz, Mobile Mode, Output Power = C0
- Transmit at 923.675MHz, Mobile Mode, Output Power = C0
- Hopping Enabled, Mobile Mode, Output Power = C0

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

Since the EUT was powered by an internal battery with no connections for AC power, no conducted emissions tests are required.

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 6.1, 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

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 1GHz was investigated using a peak detector function with the bilog antenna at several heights, horizontal and vertical polarization, and with several different orientations of the EUT with respect to the antenna. The frequency range from 1GHz to 5GHz was investigated using a peak detector function with the double ridged waveguide antenna at several heights, horizontal and vertical polarization, and with several different orientations of the EUT with respect to the antenna. The maximum levels for each antenna polarization were plotted. The resultant field strength (FS) is a summation in decibels (dB) of the receiver meter reading (MTR), the antenna correction factor (AF), and the cable loss factor (CF). If an external pre-amplifier is used, the total is reduced by its gain (-PA). If a distance correction (DC) is required, it is added to the total.

Formula 1: FS (dBuV/m) = MTR (dBuV) + AF (dB/m) + CF (dB) + (- PA (dB)) + DC (dB)

To convert the Field Strength dBuV/m term to uV/m, the dBuV/m is first divided by 20. The Base 10 AntiLog is taken of this quotient. The result is the Field Strength value in uV/m terms.

Formula 2: FS (uV/m) = AntiLog [(FS (dBuV/m))/20]

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

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

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

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

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

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

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

5.1.2.3 Results

The preliminary plots with the EUT operated in the Receive at 904.9MHz mode are presented on pages 22 through 25. The plots are presented for a reference only, and are not used to determine compliance. The final radiated levels are presented on pages 26 and 27. As can be seen from the data, all emissions measured from

the EUT were within the specification limits.

The preliminary plots with the EUT operated in the Receive at 914.5MHz mode are presented on pages 28 through 31. The plots are presented for a reference only, and are not used to determine compliance. The final radiated levels are presented on pages 32 and 33. As can be seen from the data, all emissions measured from the EUT were within the specification limits.

The preliminary plots with the EUT operated in the Receive at 924.5MHz mode are presented on pages 34 through 37. The plots are presented for a reference only, and are not used to determine compliance. The final radiated levels are presented on pages 38 and 39. As can be seen from the data, all emissions measured from the EUT were within the specification limits.

Photographs of the test configuration which yielded the highest or worst case, radiated emission levels are shown on Figure 2 and Figure 3.

5.2 Transmitter

5.2.1 Powerline Conducted Emissions

5.2.1.1 Requirements

Since the EUT was powered by an internal battery, no conducted emissions tests were performed.

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 902-928MHz 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.

5.2.2.2 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 40 through 42 show that the maximum 20 dB bandwidth was 138.28kHz for Fixed mode. The 99% bandwidth was measured to be 116.23kHz for Fixed mode. Therefore, since the 20dB bandwidth of the hopping channel is less than 250kHz, the system shall use at least 50 hopping channels in the Fixed mode.

The plots on pages 43 through 45 show that the maximum 20 dB bandwidth was 296.59kHz for Mobile mode. The 99% bandwidth was measured to be 290.58kHz for Fixed mode. Therefore, since the 20dB bandwidth of the hopping channel is 250kHz or greater, but not greater than 500kHz, the system shall use at least 25 hopping channels in the Mobile mode.

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 25kHz or the 20dB 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 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 46 shows the carrier frequency separation for Fixed mode. As can be seen from this plot, the carrier frequency separation is 400.55kHz, which is greater than the 20dB bandwidth (138.28kHz) for Fixed mode.

Page 47 shows the carrier frequency separation for Mobile mode. As can be seen from this plot, the carrier frequency separation is 400kHz, which is greater than the 20dB bandwidth (296.59kHz) for Mobile mode.

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

Page 49 shows the number of hopping frequencies. As can be seen from this plot, the number of hopping frequencies is 48 which is greater than 25 which is the minimum number of required hopping frequencies for systems with a 20dB bandwidth greater 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.

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

5.2.5.2 Procedures

The EUT was setup inside the chamber. With the hopping function enabled in Fixed mode, the resolution bandwidth (RBW) was set to 1 MHz. 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 show the number of hops that occur in a 20 second period. The analyzer's display was plotted using a 'screen dump' utility.

The EUT was setup inside the chamber. With the hopping function enabled in Mobile mode, the resolution bandwidth (RBW) was set to 1 MHz. With the span set to 0Hz, the sweep time was adjusted to capture a single event in order to measure the dwell time per hop. The analyzer's display was plotted using a 'screen dump' utility. Then, the sweep time was expanded to 10 seconds to show the number of hops that occur in a 10 second period. The analyzer's display was plotted using a 'screen dump' utility.

5.2.5.3 Results

Pages 50 and 51 show the plots for the time of occupancy for Fixed mode. As can be seen from the plots, the time of occupancy can be determined by (dwell time/hop = 58.51msec) multiplied by (# of hops = 6). This calculated value is equal to 0.351sec seconds which is less than the 0.4 seconds maximum allowed.

Pages 52 and 53 show the plots for the time of occupancy for Mobile mode. As can be seen from the plots, the time of occupancy can be determined by (dwell time/hop = 10.6msec) multiplied by (# of hops = 2). This calculated value is equal to 0.0212sec seconds which is less than the 0.4 seconds maximum allowed.

5.2.6 Peak Conducted 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). For frequency hopping systems operating in the 902-928MHz band and employing less than 50 hopping channels, but at least 25 hopping channels, the maximum peak output conducted power shall not be greater than 0.25W (24dBm).

5.2.6.2 Procedures

The output of the EUT was connected to the spectrum analyzer through 40dB 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

Pages 54 through 56 show the peak conducted output power for Fixed mode. The maximum peak conducted output power from the transmitter in Fixed mode was 28.54dBm (714.5mW) which is below the 1 Watt limit.

Pages 57 through 59 show the peak conducted output power for Mobile mode. The maximum peak conducted output power from the transmitter in Mobile mode was 10.37dBm (10.89mW) which is below the 0.25 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 Watt (36dBm). 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.

Per section 15.247(b)(2), for frequency hopping systems operating in the 902-928MHz band and employing less than 50 hopping channels, but at least 25 hopping channels, the maximum peak output conducted power shall not be greater than 0.25W (24dBm). Per section 15.247(b)(4), this limit is based on the use of antennas with directional gains that do not exceed 6dBi. Since the limit allows for a 6dBi antenna gain, the maximum EIRP can be increased by 6dB to 1 Watt (30dBm). If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below 24dBm by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.2.7.2 Procedures

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

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

5.2.7.3 Results

Page 60 shows the EIRP for Fixed mode. The maximum EIRP in Fixed mode was 31.6dBm (1.45W) which is below the 4W limit.

Page 6160 shows the EIRP for Mobile mode. The maximum EIRP in Fixed mode was 11.7dBm (14.8mW) which is below the 1W limit.

5.2.8 Duty Cycle Factor Measurements

5.2.8.1 Requirements

Unless otherwise specified, when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value. The exact method of calculating the average field strength shall be submitted with any application for certification or shall be retained in the measurement data file for equipment subject to notification or verification.

5.2.8.2 Procedures

a. The EUT was placed on the non-conductive stand and set to transmit continuously with hopping enabled.
b. A bilog antenna was positioned at a 3 meter distance from the EUT. The output of the antenna was connected to the input of a spectrum analyzer.
c. The center frequency of the spectrum analyzer was set to a single hopping channel frequency of the EUT.
d. The frequency span of the spectrum analyzer was set to 0Hz so that the time domain trace of the transmitted pulse of the EUT was displayed on the spectrum analyzer.

e. The sweep time of the spectrum analyzer was adjusted so that the beginning and end of a single pulse could be seen on the display of the spectrum analyzer.
f. The single sweep function of the spectrum analyzer was used multiple times to determine the maximum pulse width of the EUT.
g. The maximum pulse width display of the spectrum analyzer was recorded and then plotted using a 'screen dump' utility.
h. The sweep time of the spectrum analyzer was then adjusted to 100msec.
i. The single sweep function of the spectrum analyzer was used multiple times to determine the maximum number of transmitted pulses that occurred in a 100msec time period.
j. The maximum number of pulses transmitted in a 100msec time period was recorded and then plotted using a 'screen dump' utility.
k. The duty cycle correction was calculated using the following equation:

Duty Cycle Correction Factor (dB) = D.C. (dB)
D.C. (dB) = 20 x log [((pulse width (msec)) x (#pulses in a 100msecperiod)) / 100msec]

5.2.8.3 Results

Pages 62 and 63 show the duty cycle plots for mobile mode. The EUT transmits a 10.62msec pulse 1 time in a 100msec period. This results in a duty cycle correction factor of -19.48dB. (No duty cycle factor was determined for fixed mode.)

5.2.9 Radiated Spurious Emissions Measurements

5.2.9.1 Requirements

Per section 15.247(d), in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated emissions measurement. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must comply with the radiated emission limits specified in §15.209(a).

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 Strenght (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.

1) For all harmonics not in the restricted bands, the following procedure was used:
   a) The field strength of the fundamental was measured using a bilog antenna. The bilog 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 of the harmonics not in the restricted band were then measured using either a bilog antenna (for emission below 1GHz) or a double-ridged waveguide antenna (for emissions above 1GHz). The antennas were 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.
   c) To ensure that maximum or worst case emission levels at the fundamental and harmonics were measured, the following steps were taken when measuring the fundamental emissions and the spurious emissions:
      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) All harmonics not in the restricted bands must be at least 20 dB below levels measured at the fundamental. However, attenuation below the general limits specified in §15.209(a) is not required.
2) 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 bilog antenna. The bilog 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.
   d) For all radiated emissions measurements below 1 GHz, if the peak reading is below the limits listed in 15.209(a), no further measurements are required. If however, the peak readings exceed the limits listed in 15.209(a), then the emissions are remeasured using a quasi-peak detector.
   e) For all radiated emissions measurements above 1 GHz, the peak readings must comply with the 15.35(b) limits. 15.35(b) states that when average radiated emissions measurements are specified, there also is a limit on the peak level of the radiated emissions. The limit on the peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test. Therefore, all peak readings above 1 GHz must be no greater than 20 dB above the limits specified in 15.209(a).

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

5.2.9.3 Results

Preliminary radiated emissions plots with the EUT transmitting at Low Frequency, Middle Frequency, and High Frequency, Fixed mode are shown on pages 64 through 75.

Final radiated emissions data plots with the EUT transmitting at Low Frequency, Middle Frequency, and High Frequency, Fixed mode are presented on data pages 76 through 84. As can be seen from the data, all emissions measured from the EUT were within the specification limits. The emissions level closet to the limit (worst case) occurred at 4622.50MHz. The emissions level at this frequency was 1.7dB within the limit. Photographs of the test configuration which yielded the highest, or worst case, radiated emission levels are shown on Figures 2 and Figure 3.

Preliminary radiated emissions plots with the EUT transmitting at Low Frequency, Middle Frequency, and High Frequency, Mobile mode are shown on pages 85 through 96.

Final radiated emissions data plots with the EUT transmitting at Low Frequency, Middle Frequency, and High Frequency, Fixed mode are presented on data pages 97 through 105. As can be seen from the data, all emissions measured from the EUT were within the specification limits. The emissions level closet to the limit (worst case) occurred at 7316MHz. The emissions level at this frequency was 9.2dB within the limit. Photographs of the test configuration which yielded the highest or worst case, radiated emission levels are shown on Figures 2 and Figure 3.

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 non-conductive 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) ≥ 1% of the span.
    d. The 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined.
    e. The marker was set on the peak of the in-band emissions. A display line was placed 20dB down from the peak of the in-band emissions. All emissions which fall outside of the authorized band of operation must be below the 20dB down display line. (All emissions to the left of the center frequency (band-edge) must be below the display line.)

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

6) Step 5) was repeated with the frequency hopping function enabled.

5.2.10.2.2 High Band Edge

1) The EUT was setup inside the test chamber on a non-conductive 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 (RBW) ≥ 1% of the span.
   d. The 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined.
   e. The marker was set on the peak of the in-band emissions. A display line was placed 20dB down from the peak of the in-band emissions. All emissions which fall outside of the authorized band of operation must be below the 20dB down display line. (All emissions to the right of the center frequency (band-edge) must be below the display line.)
   f. The analyzer's display was plotted using a 'screen dump' utility.

6) Step 5) was repeated with the frequency hopping function enabled.

5.2.10.3 Results

Pages 106 through 109 show the radiated band-edge compliance results for fixed mode. 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 for Fixed mode.

Pages 110 through 113 show the radiated band-edge compliance results for Mobile mode. 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 for Mobile mode.

6 CONCLUSIONS

It was determined that the Badger Meter, Part No. ORION SE3 Endpoint frequency hopping spread spectrum transceiver, 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 Transceiver, Part No. ORION SE3 Endpoint frequency hopping spread spectrum transceiver, did fully meet the conducted and radiated RF emission requirements of the Industry Canada Radio Standards Specification, RSS-Gen, Section 7.2.4 and Section 6 for receivers and the Industry Canada Radio Standards Specification RSS-Gen Section 7.2.4 and RSS-210 Annex 8, 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 certification, approval, or endorsement by NVLAP, NIST or any agency of the Federal Government.

9 EQUIPMENT LIST

Table 9-1 Equipment List

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Due Date
APW11	PREAMPLIFIER	PMI	PE2-35-120-5R0-10-12-SFF	PL11685/1241	1GHZ-20GHZ	3/11/2014	3/11/2015
CDX8	COMPUTER	ELITE	WORKSTATION			N/A	
GSD3	SIGNAL GENERATOR	ROHDE & SCHWARZ	SMB100A	104454	9KHZ-6GHZ	9/10/2014	9/10/2015
NDQ1	TUNED DIPOLE ANTENNA	EMCO	3121C-DB4	313	400-1000MHZ	4/17/2014	4/17/2015
NTA3	BILOG ANTENNA	TESEQ	6112D	28040	25-1000MHz	2/19/2014	2/19/2015
NWQ1	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS-LINDGREN	3117	66655	1GHZ-18GHZ	3/11/2014	3/11/2015
RAKI	RF SECTION	HEWLETT PACKARD	85462A	3411A00181	0.009-6500MHZ	3/19/2014	3/19/2015
RAKJ	RF FILTER SECTION	HEWLETT PACKARD	85460A	3330A00154	---	3/19/2014	3/19/2015
RBA0	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESIB26	100145	20HZ-26.5GHZ	3/7/2014	3/7/2015
T2D4	20DB, 25W ATTENUATOR	WEINSCHEL	46-20-43	AY9243	DC-18GHZ	8/11/2014	8/11/2015
T2DA	20DB, 25W ATTENUATOR	WEINSCHEL	46-20-34	BH5446	DC-18GHZ	7/22/2014	7/22/2015
XPQ3	HIGH PASS FILTER	K&L MICROWAVE	4IH30-1804/T10000-0	4	1.8GHZ-10GHZ	11/25/2013	11/25/2014

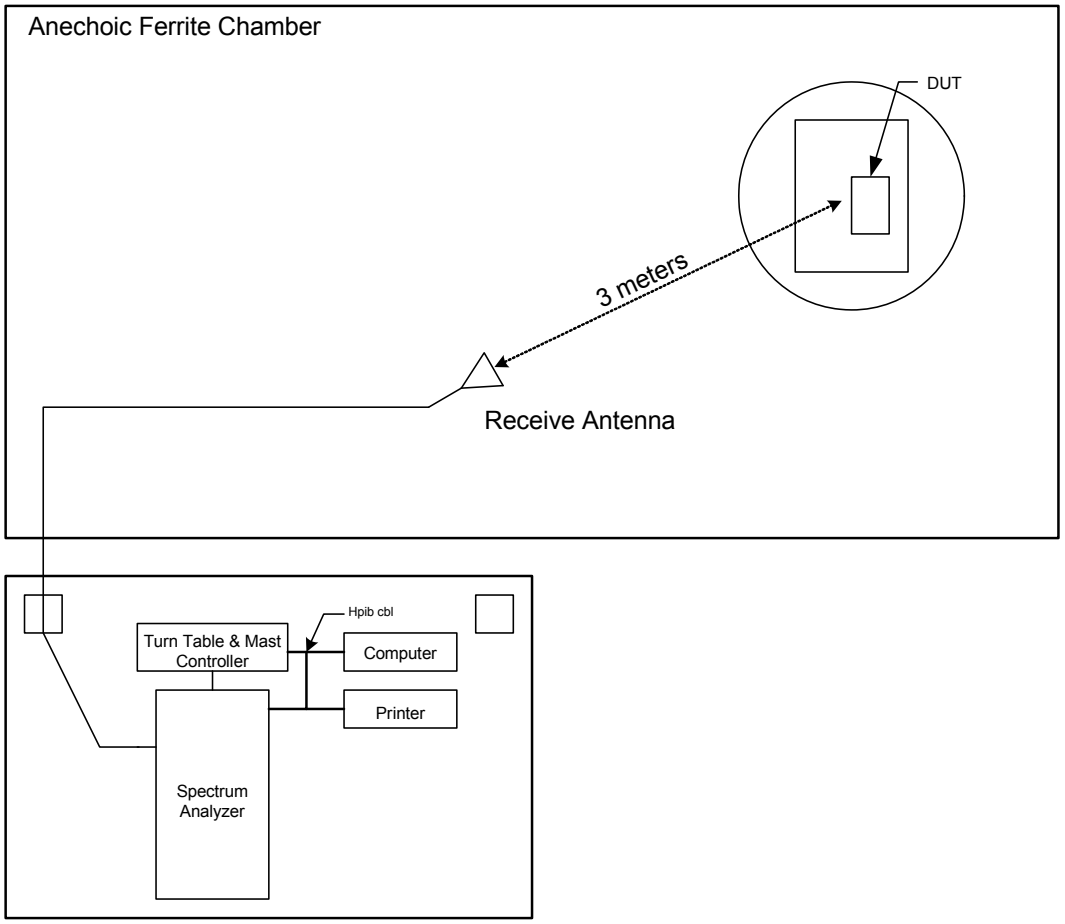
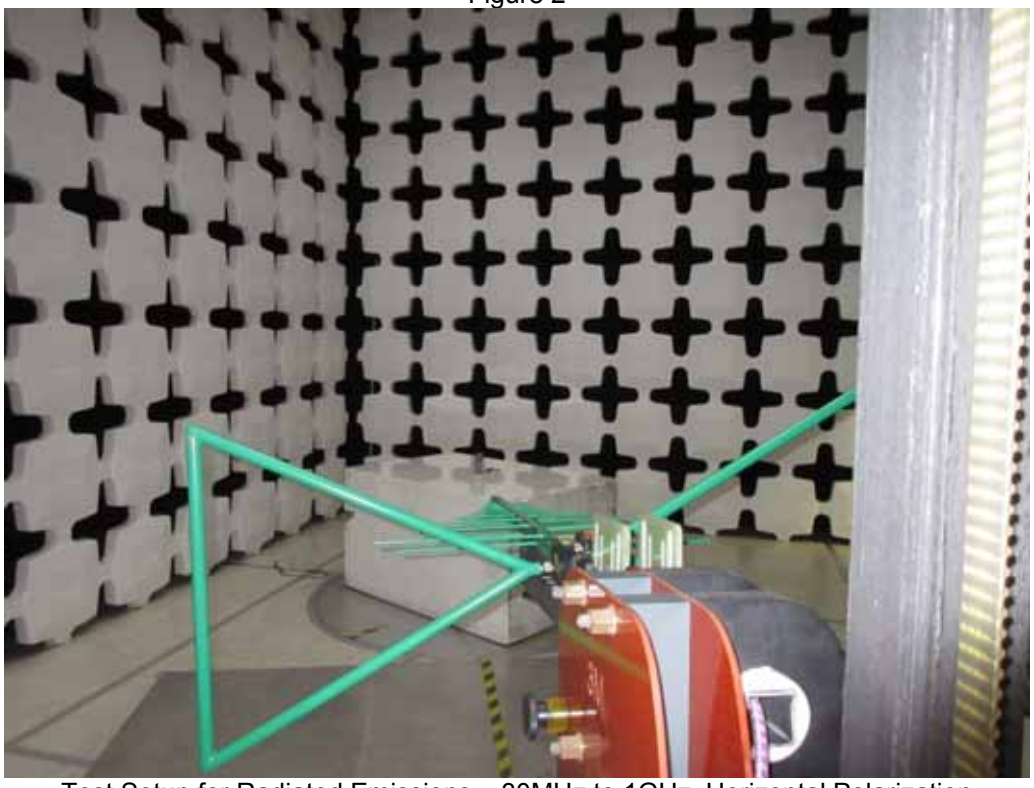
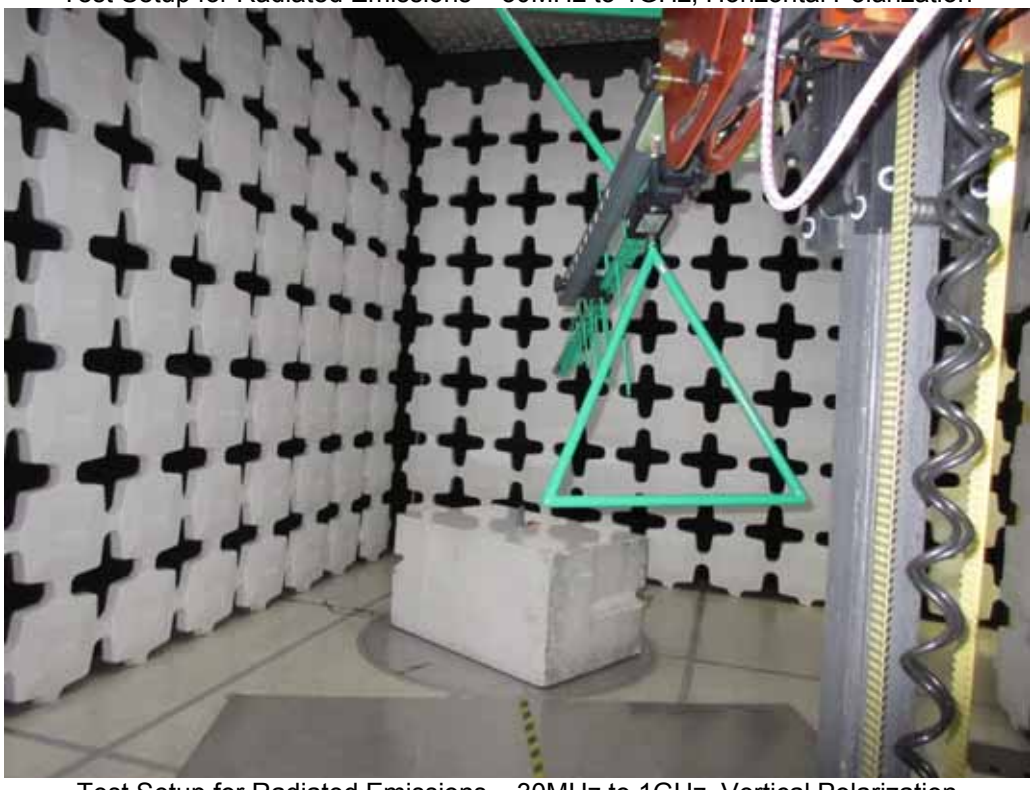


FIGURE 1 BLOCKDIAGRAM OF TEST SETUP

Figure 2

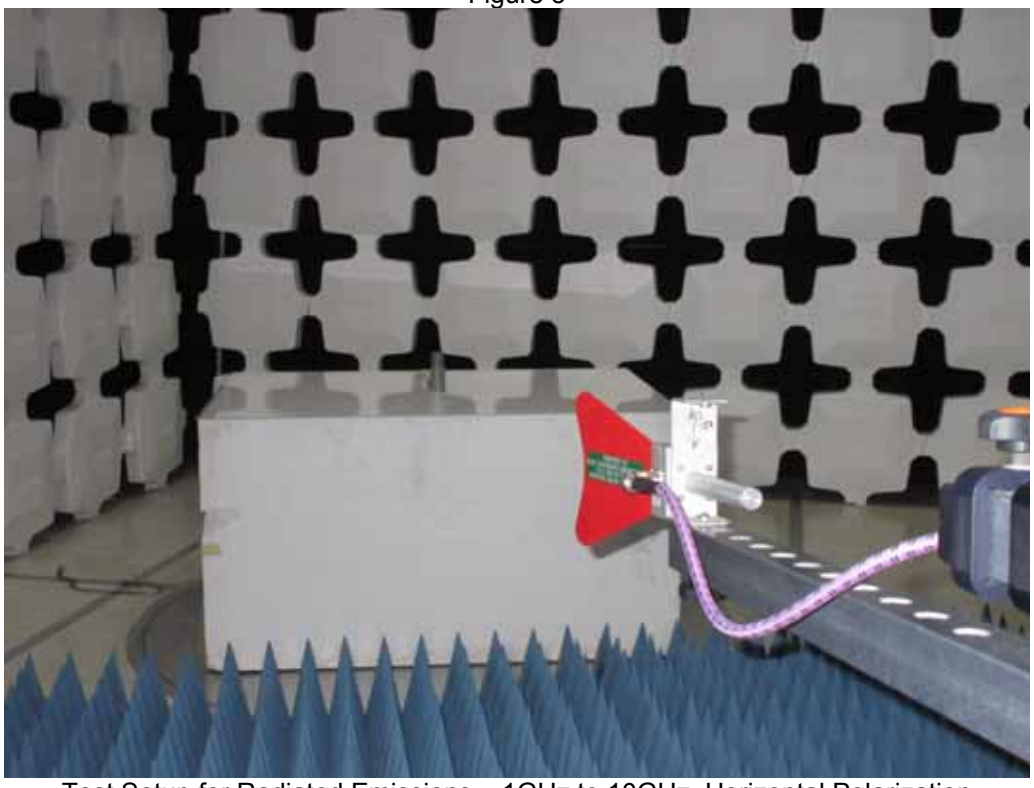


Test Setup for Radiated Emissions – 30MHz to 1GHz, Horizontal Polarization

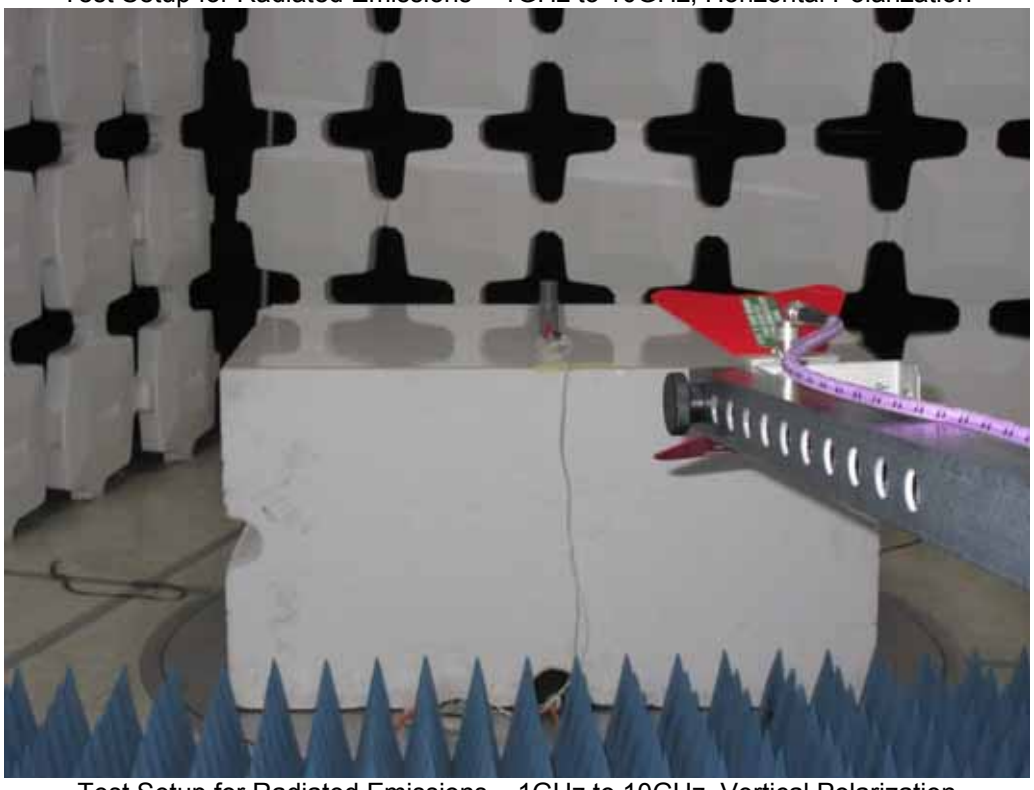


Test Setup for Radiated Emissions – 30MHz to 1GHz, Vertical Polarization

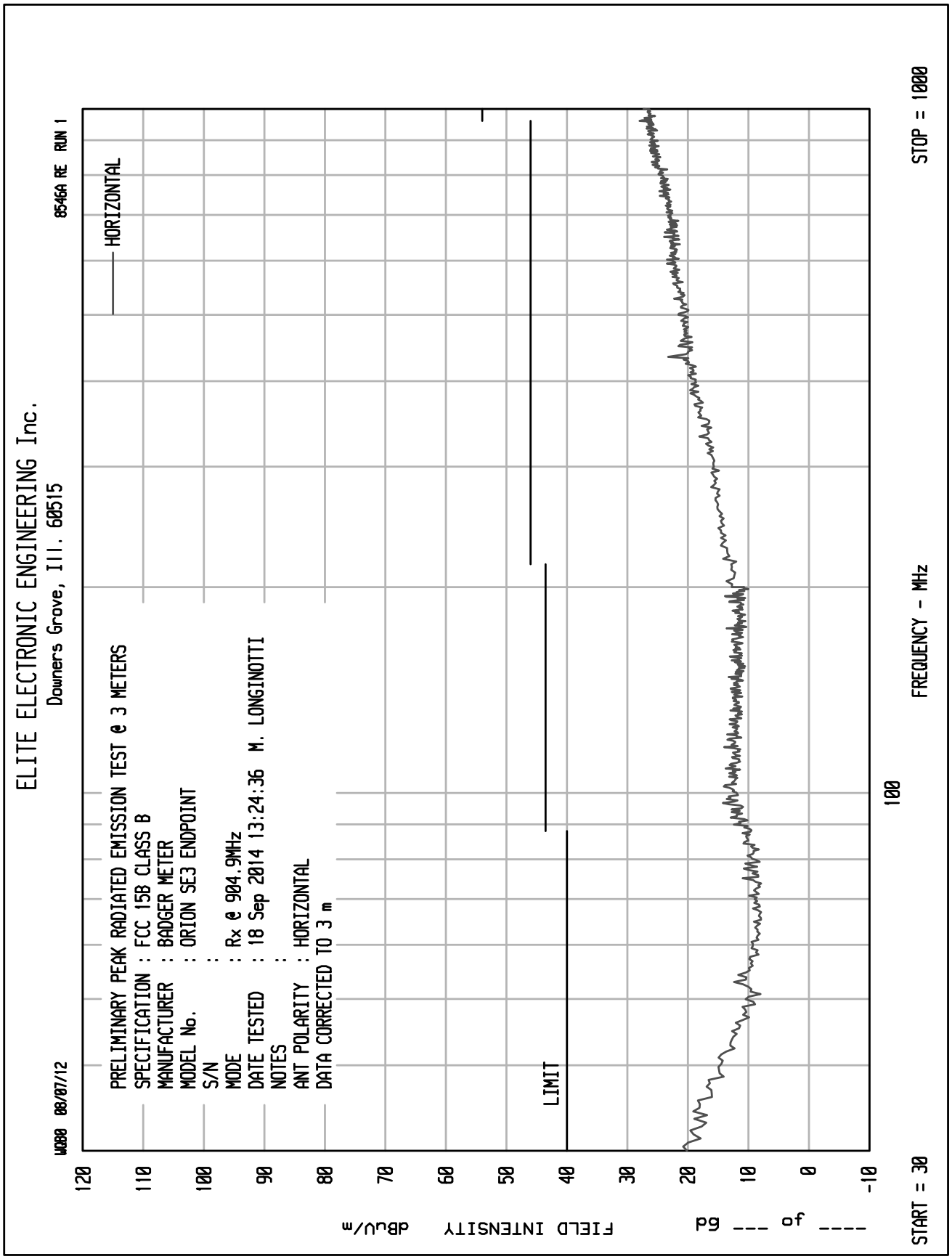
Figure 3

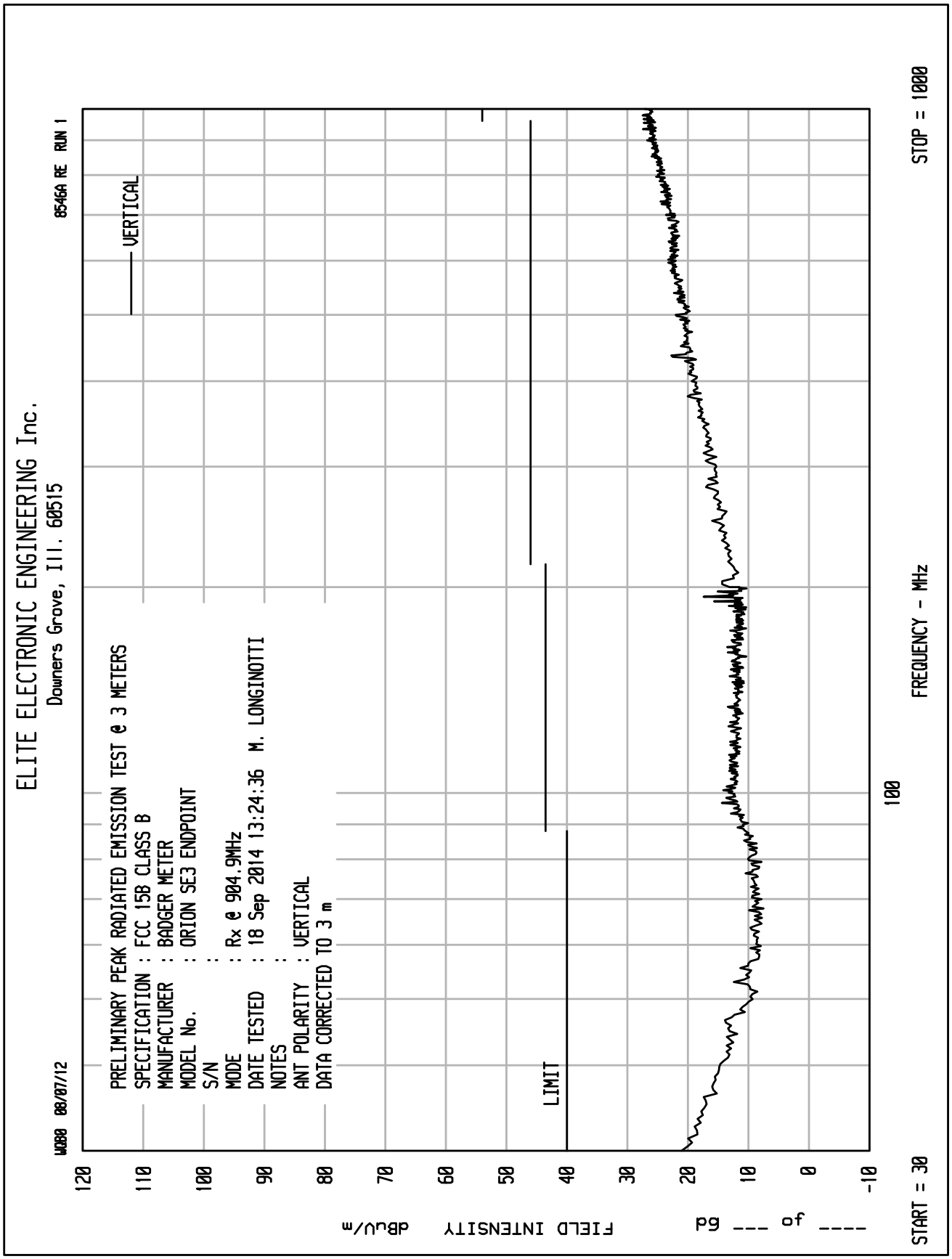


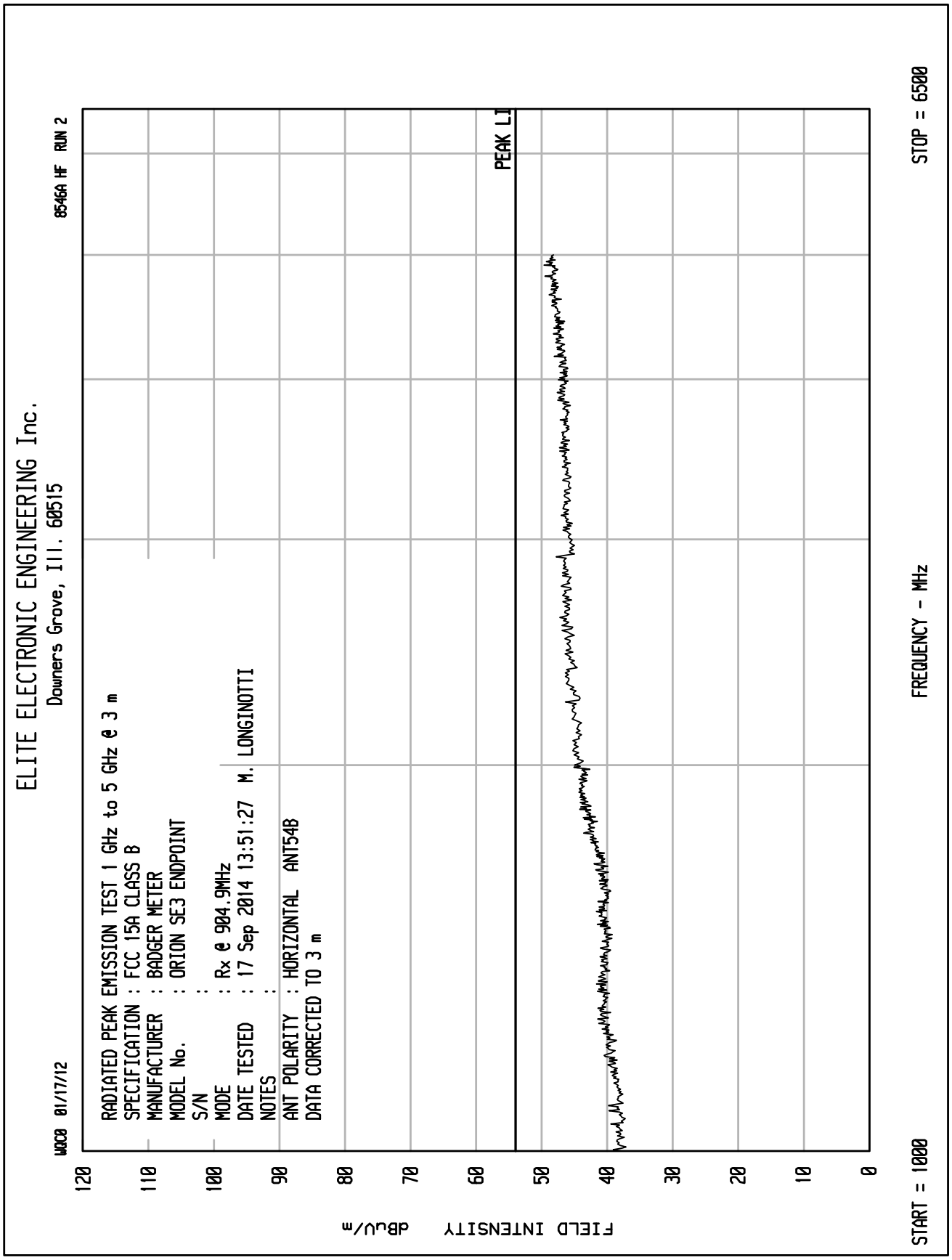
Test Setup for Radiated Emissions – 1GHz to 10GHz, Horizontal Polarization

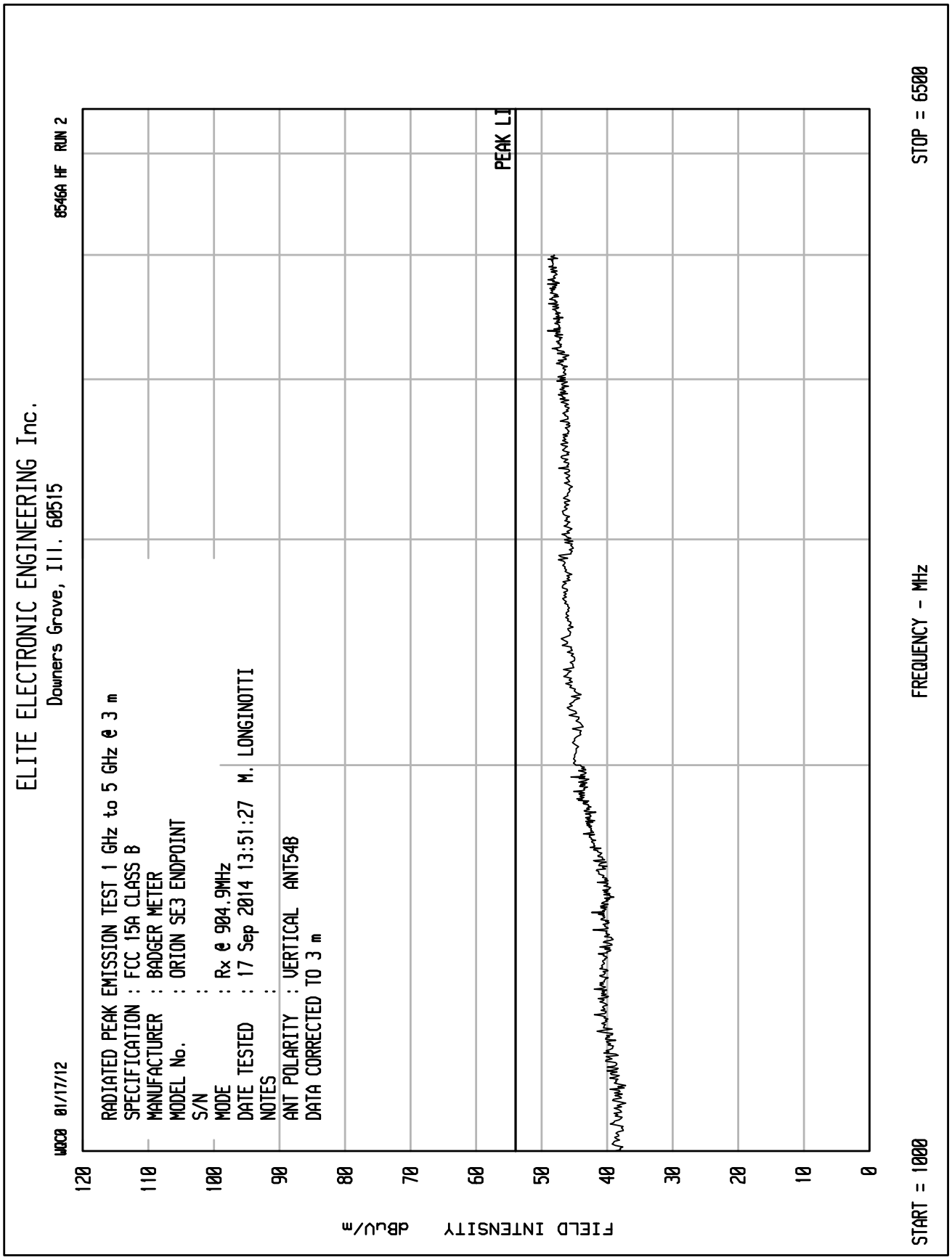


Test Setup for Radiated Emissions – 1GHz to 10GHz, Vertical Polarization


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
8546A RE RUN 1
W380 08/07/12
PRELIMINARY PEAK RADIATED EMISSION TEST @ 3 METERS
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : BADGER METER
MODEL No. : ORION SE3 ENDPOINT
S/N :
MODE : Rx @ 904.9MHz
DATE TESTED : 18 Sep 2014 13:24:36 M. LONGINOTTI
NOTES :
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
FREQUENCY - MHz
STOP = 1000
---- of ---- pg


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
8546A RE RUN 1
W080 08/07/12
PRELIMINARY PEAK RADIATED EMISSION TEST @ 3 METERS
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : BADGER METER
MODEL No. : ORION SE3 ENDPOINT
S/N :
MODE : Rx @ 904.9MHz
DATE TESTED : 18 Sep 2014 13:24:36 M. LONGINOTTI
NOTES :
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
---- of ---- pg
START = 30
100
FREQUENCY - MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WACO 01/17/12
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 SE3 ENDPOINT
S/N :
MODE : Rx @ 904.9MHz
DATE TESTED : 17 Sep 2014 13:51:27 M. LONGINOTTI
NOTES :
ANT POLARITY : HORIZONTAL ANT54B
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
WO#0 01/17/12
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 SE3 ENDPOINT
S/N :
MODE : Rx @ 904.9MHz
DATE TESTED : 17 Sep 2014 13:51:27 M. LONGINOTTI
NOTES :
ANT POLARITY : VERTICAL ANT54B
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. 8546A
DATA SHEET TEST NO. 1

RADIATED QP EMISSION MEASUREMENTS in a 3 m SEMI-ANECHOIC ROOM
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : BADGER METER
MODEL NO. : ORION SE3 ENDPOINT
SERIAL NO. :
TEST MODE : Rx @ 904.9MHz
NOTES :
TEST DATE : 18 Sep 2014 13:24:36
TEST DISTANCE : 3 m (DATA EXTRAPOLATED TO 3 m)

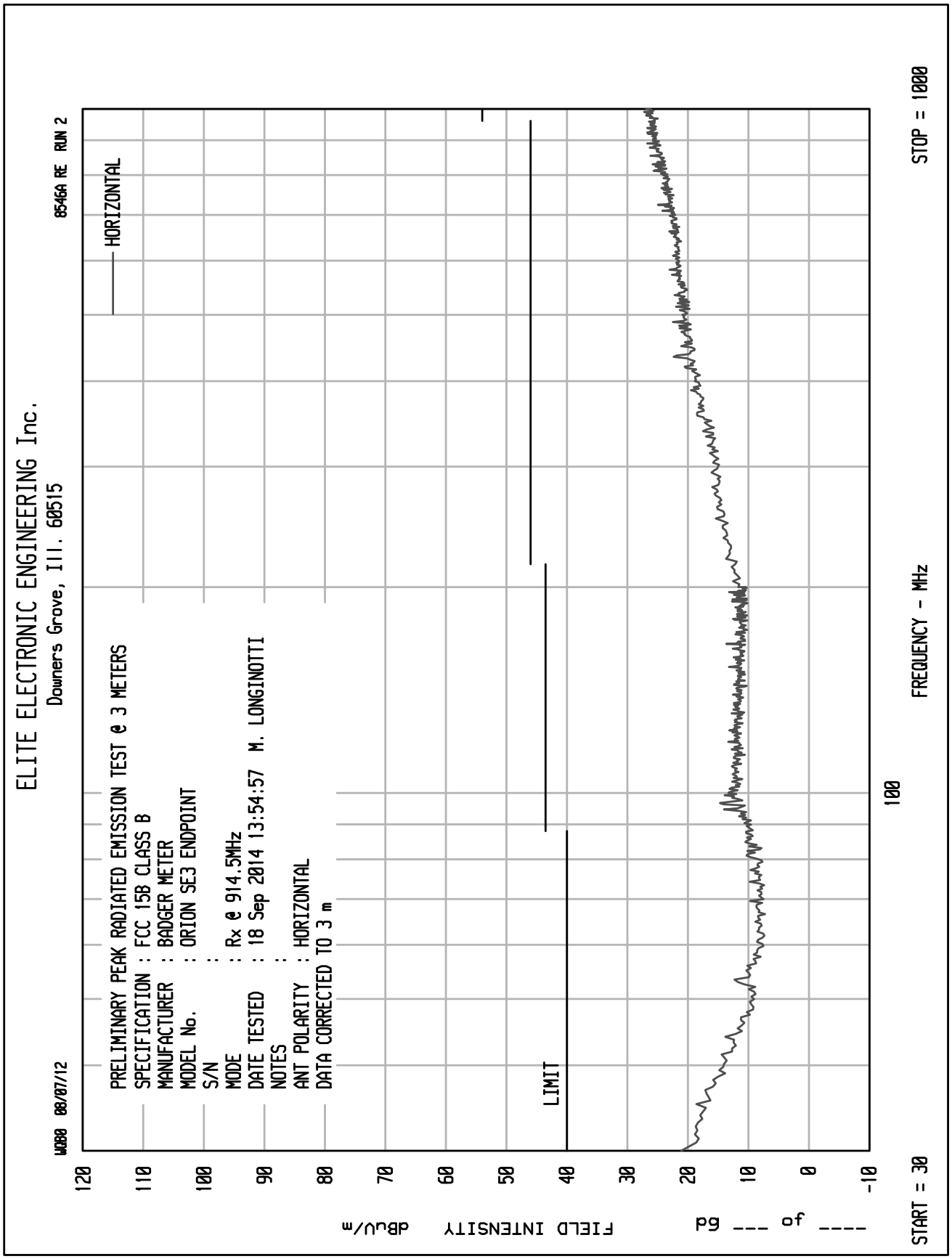
FREQUENCY	QP READING	ANT FAC	CBL FAC	EXT ATTN	DIST FAC	TOTAL	QP LIMIT	AZ	ANT HT	POLAR
MHz	dBuV	dB	dB	dB	dB	dBuV/m	dBuV/m	deg	cm	
31.39	-8.3	17.5	.4	0.0	0.0	9.5	40.0	45	200	V
52.63	-5.7	7.5	.4	0.0	0.0	2.2	40.0	90	340	V
85.66	-8.1	8.1	.4	0.0	0.0	.4	40.0	270	120	H
102.25	-8.5	11.0	.4	0.0	0.0	2.9	43.5	45	120	V
122.63	-8.5	10.6	.5	0.0	0.0	2.6	43.5	45	340	H
162.04	-.8	9.9	.6	0.0	0.0	9.8	43.5	0	120	V
174.77	-8.5	9.7	.7	0.0	0.0	2.0	43.5	225	120	H
192.05	4.9	9.5	.7	0.0	0.0	15.1	43.5	135	120	V
352.30	-7.1	14.3	1.0	0.0	0.0	8.2	46.0	135	200	V
431.99	1.0	15.9	1.1	0.0	0.0	18.1	46.0	270	200	H
575.22	-7.4	18.3	1.1	0.0	0.0	12.0	46.0	270	340	H
650.64	-7.7	18.5	1.2	0.0	0.0	12.1	46.0	0	120	H
795.10	-7.1	19.8	1.5	0.0	0.0	14.3	46.0	90	200	V
896.77	-6.0	20.8	1.5	0.0	0.0	16.3	46.0	135	340	V
960.42	-6.1	21.2	1.5	0.0	0.0	16.7	54.0	45	340	H

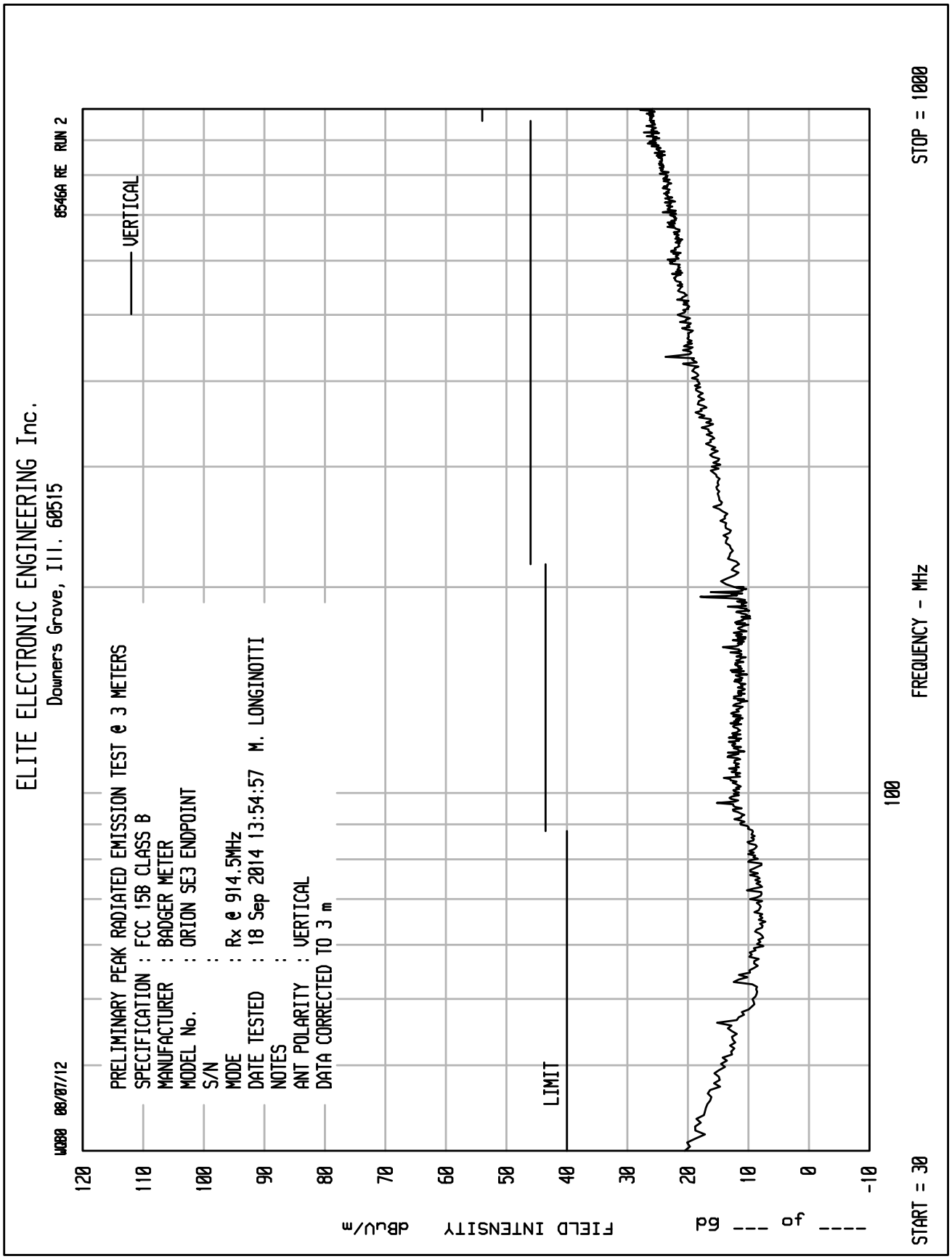
DATA SHEET HF TEST NO. 2

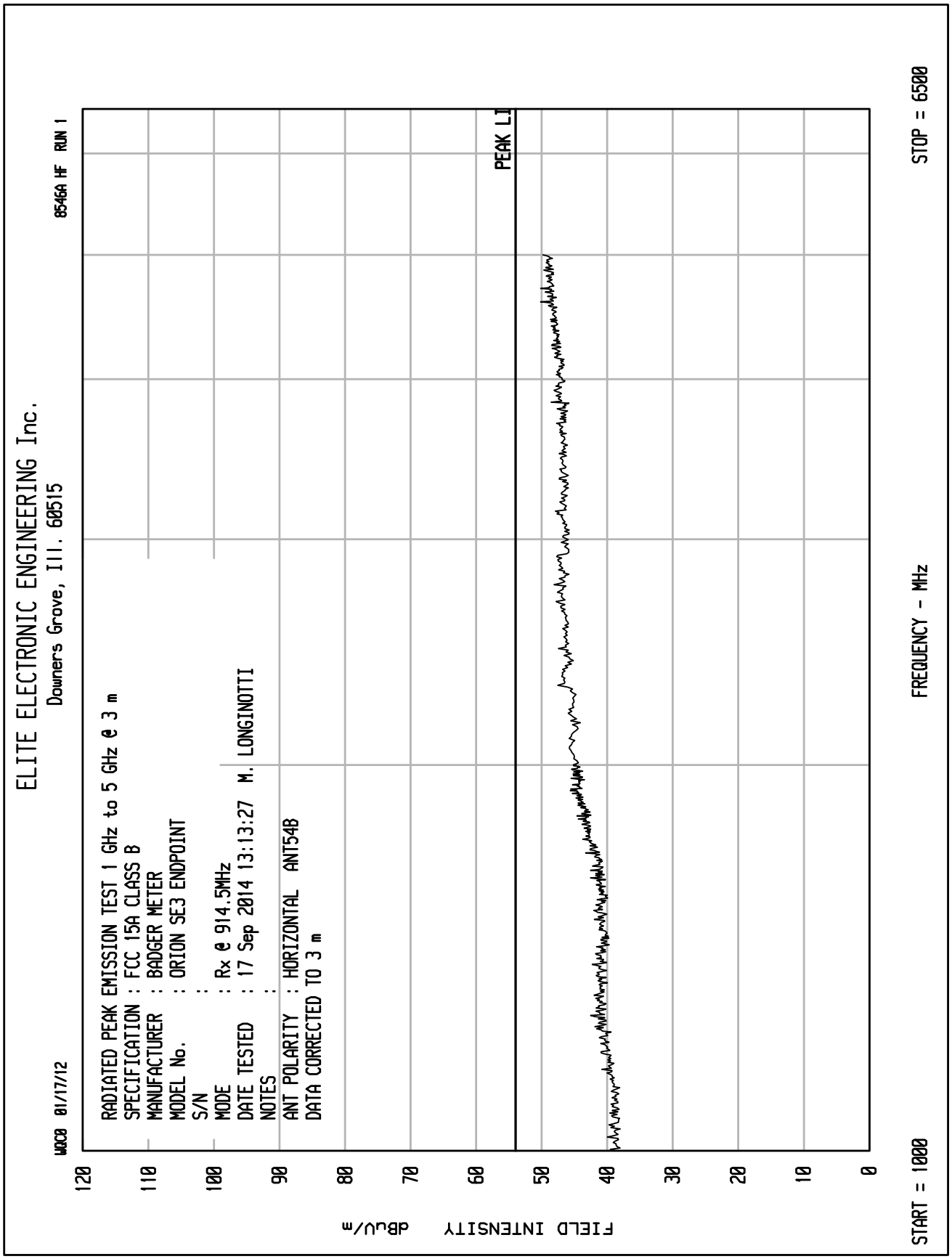
RADIATED AVG EMISSION MEASUREMENTS >=1000 MHz in a 3 m ANECHOIC ROOM

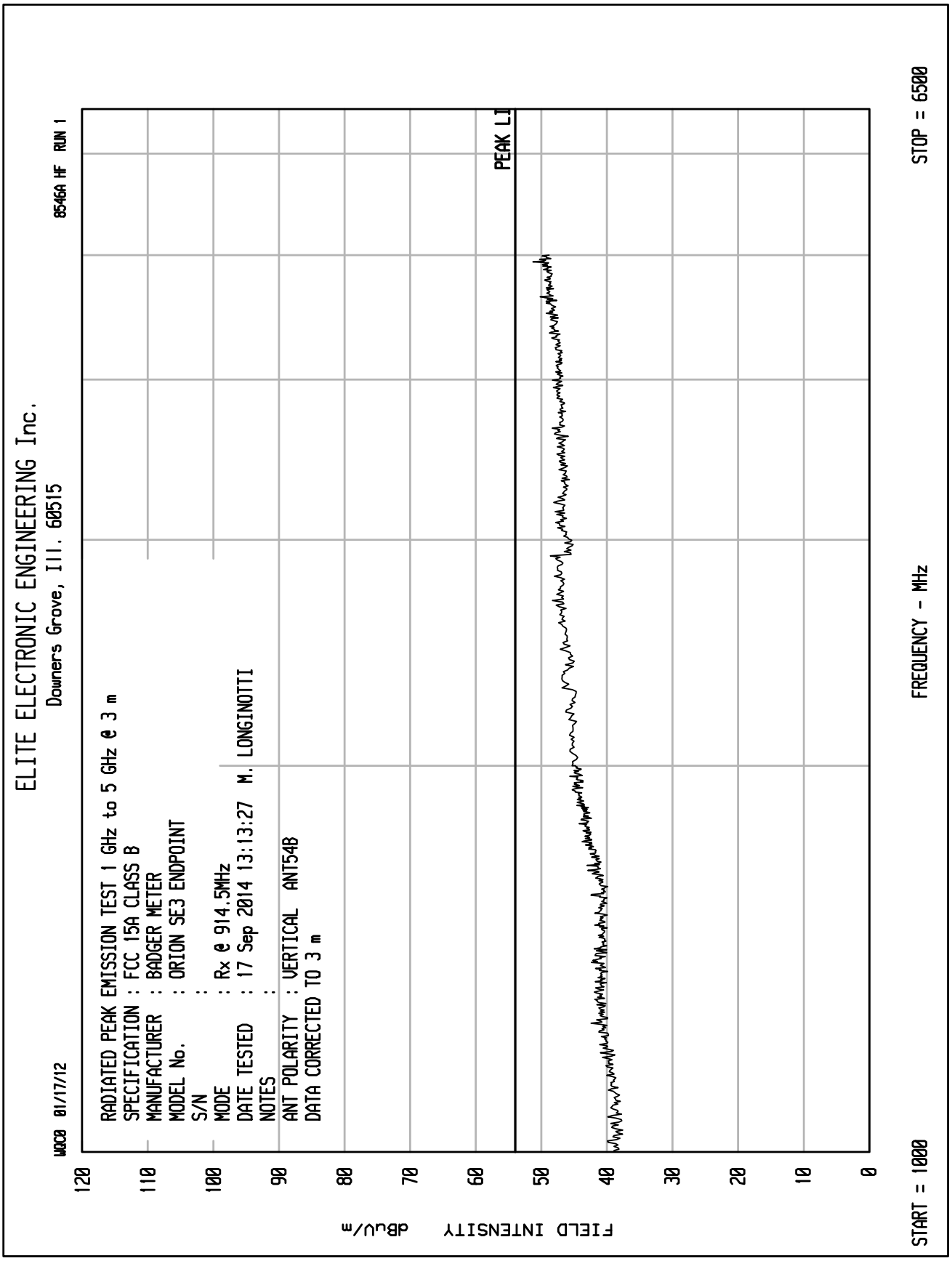
SPECIFICATION : FCC 15A CLASS B
MANUFACTURER : BADGER METER
MODEL NO. : ORION SE3 ENDPOINT
SERIAL NO. :
TEST MODE : Rx @ 904.9MHz
NOTES :
TEST DATE : 17 Sep 2014 13:51:27
TEST DISTANCE : 3 m
ANTENNA : ANT54B

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	
1050.09	-3.1	27.1	1.6	0.0	25.5	54.0		90	200	H
1225.95	-3.9	28.6	1.7	0.0	26.4	54.0		0	120	V
1322.92	-3.3	29.2	1.8	0.0	27.7	54.0		270	200	V
1547.01	-3.2	28.4	2.0	0.0	27.2	54.0		270	340	V
1672.66	-3.2	29.1	2.1	0.0	27.9	54.0		315	340	H
1770.22	-3.0	30.2	2.1	0.0	29.3	54.0		0	200	V
1880.76	-4.4	31.4	2.2	0.0	29.2	54.0		180	340	V
2228.89	-2.8	31.6	2.5	0.0	31.3	54.0		180	200	V
2577.55	-3.4	32.6	2.7	0.0	31.9	54.0		180	200	H
2902.38	-4.1	32.7	2.9	0.0	31.4	54.0		225	200	H
3408.74	-4.4	33.0	3.2	0.0	31.7	54.0		180	340	V
3538.70	-4.5	33.1	3.2	0.0	31.8	54.0		315	200	H
4236.11	-4.3	33.6	3.5	0.0	32.9	54.0		180	200	V
4344.11	-4.6	33.9	3.6	0.0	32.8	54.0		225	340	V
4929.14	-4.3	34.8	3.8	0.0	34.2	54.0		135	340	H


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
8546A RE RUN 2
W280 08/07/12
PRELIMINARY PEAK RADIATED EMISSION TEST @ 3 METERS
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : BADGER METER
MODEL No. : ORION SE3 ENDPOINT
S/N :
MODE : Rx @ 914.5MHz
DATE TESTED : 18 Sep 2014 13:54:57 M. LONGINOTTI
NOTES :
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 ---- pg
START = 30
100
FREQUENCY - MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
8546A RE RUN 2
W080 08/07/12
PRELIMINARY PEAK RADIATED EMISSION TEST @ 3 METERS
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : BADGER METER
MODEL No. : ORION SE3 ENDPOINT
S/N :
MODE : Rx @ 914.5MHz
DATE TESTED : 18 Sep 2014 13:54:57 M. LONGINOTTI
NOTES :
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
---- of ---- dB
START = 30
100
FREQUENCY - MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WACO 01/17/12
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 SE3 ENDPOINT
S/N :
MODE : Rx @ 914.5MHz
DATE TESTED : 17 Sep 2014 13:13:27 M. LONGINOTTI
NOTES :
ANT POLARITY : HORIZONTAL ANT54B
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 1
WOCO 01/17/12
RADIATED PEAK EMISSION TEST 1 GHz to 5 GHz @ 3 m
SPECIFICATION : FCC 15A CLASS B
MANUFACTURER : BADGER METER
MODEL No. : ORION SE3 ENDPOINT
S/N :
MODE : Rx @ 914.5MHz
DATE TESTED : 17 Sep 2014 13:13:27 M. LONGINOTTI
NOTES :
ANT POLARITY : VERTICAL ANT54B
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. 8546A

DATA SHEET TEST NO. 2

RADIATED QP EMISSION MEASUREMENTS in a 3 m SEMI-ANECHOIC ROOM

SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : BADGER METER
MODEL NO. : ORION SE3 ENDPOINT
SERIAL NO. :
TEST MODE : Rx @ 914.5MHz
NOTES :
TEST DATE : 18 Sep 2014 13:54:57
TEST DISTANCE : 3 m (DATA EXTRAPOLATED TO 3 m)

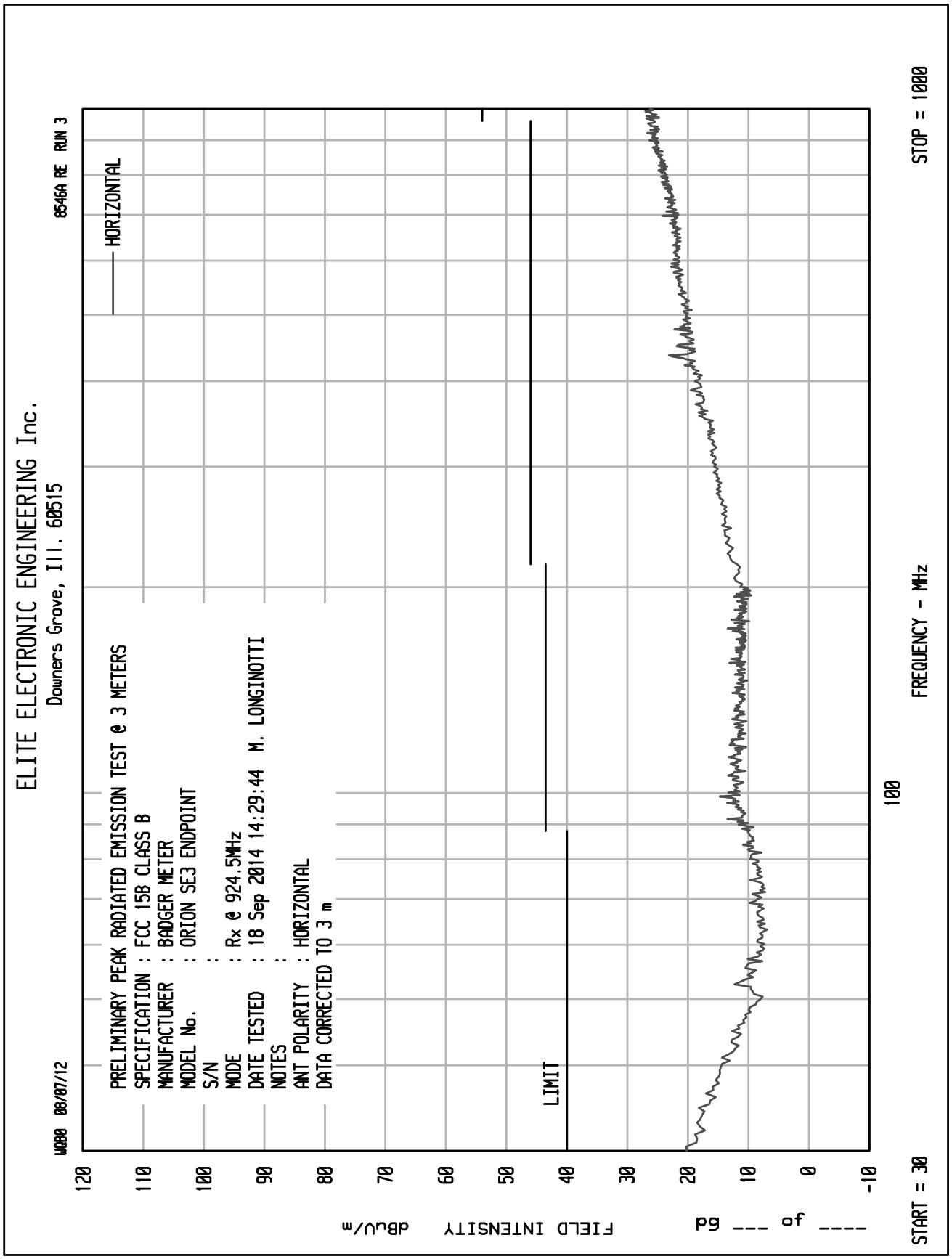
FREQUENCY	QP READING	ANT FAC	CBL FAC	EXT ATTN	DIST FAC	TOTAL	QP LIMIT	AZ	ANT HT	POLAR
MHz	dBuV	dB	dB	dB	dB	dBuV/m	dBuV/m	deg	cm	
30.10	-8.3	18.3	.4	0.0	0.0	10.4	40.0	225	200	H
51.95	-6.6	7.6	.4	0.0	0.0	1.5	40.0	90	337	V
95.98	-1.9	10.3	.4	0.0	0.0	8.8	43.5	45	337	V
104.48	-8.9	11.0	.4	0.0	0.0	2.5	43.5	45	200	V
124.86	-8.5	10.5	.5	0.0	0.0	2.5	43.5	90	337	H
164.53	-7.8	9.9	.7	0.0	0.0	2.7	43.5	0	337	V
185.92	-6.4	9.6	.7	0.0	0.0	3.9	43.5	270	120	V
192.01	1.8	9.5	.7	0.0	0.0	12.0	43.5	225	200	V
365.40	-7.4	14.6	1.0	0.0	0.0	8.2	46.0	180	200	V
431.98	2.0	15.9	1.1	0.0	0.0	19.1	46.0	135	200	V
577.06	-7.5	18.3	1.1	0.0	0.0	12.0	46.0	90	200	H
673.17	-7.8	18.5	1.3	0.0	0.0	12.0	46.0	135	340	V
719.98	-7.0	18.8	1.4	0.0	0.0	13.2	46.0	225	340	H
888.00	-6.3	20.7	1.5	0.0	0.0	15.9	46.0	45	120	H
922.75	-6.2	21.0	1.5	0.0	0.0	16.3	46.0	45	336	V

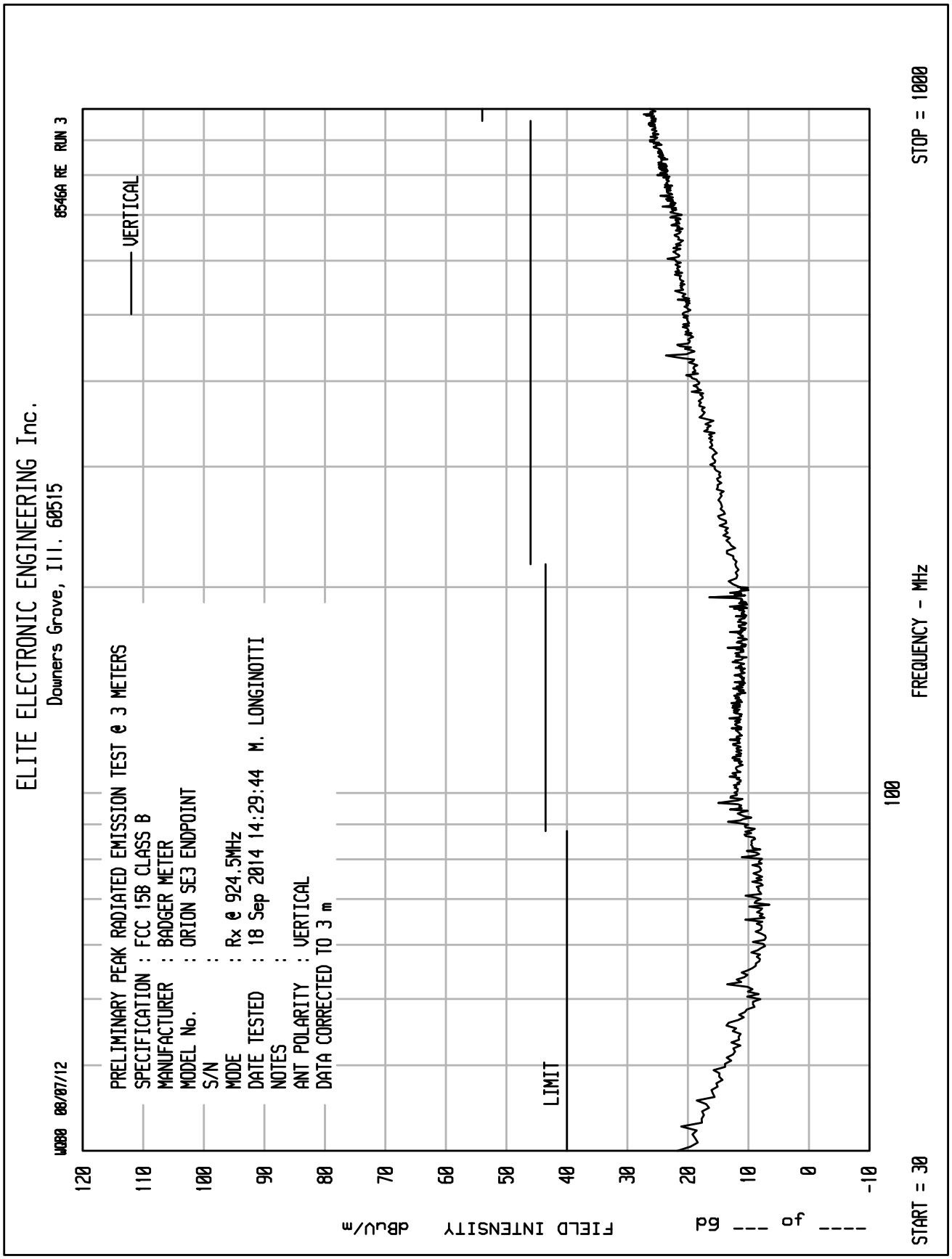
DATA SHEET HF TEST NO. 1

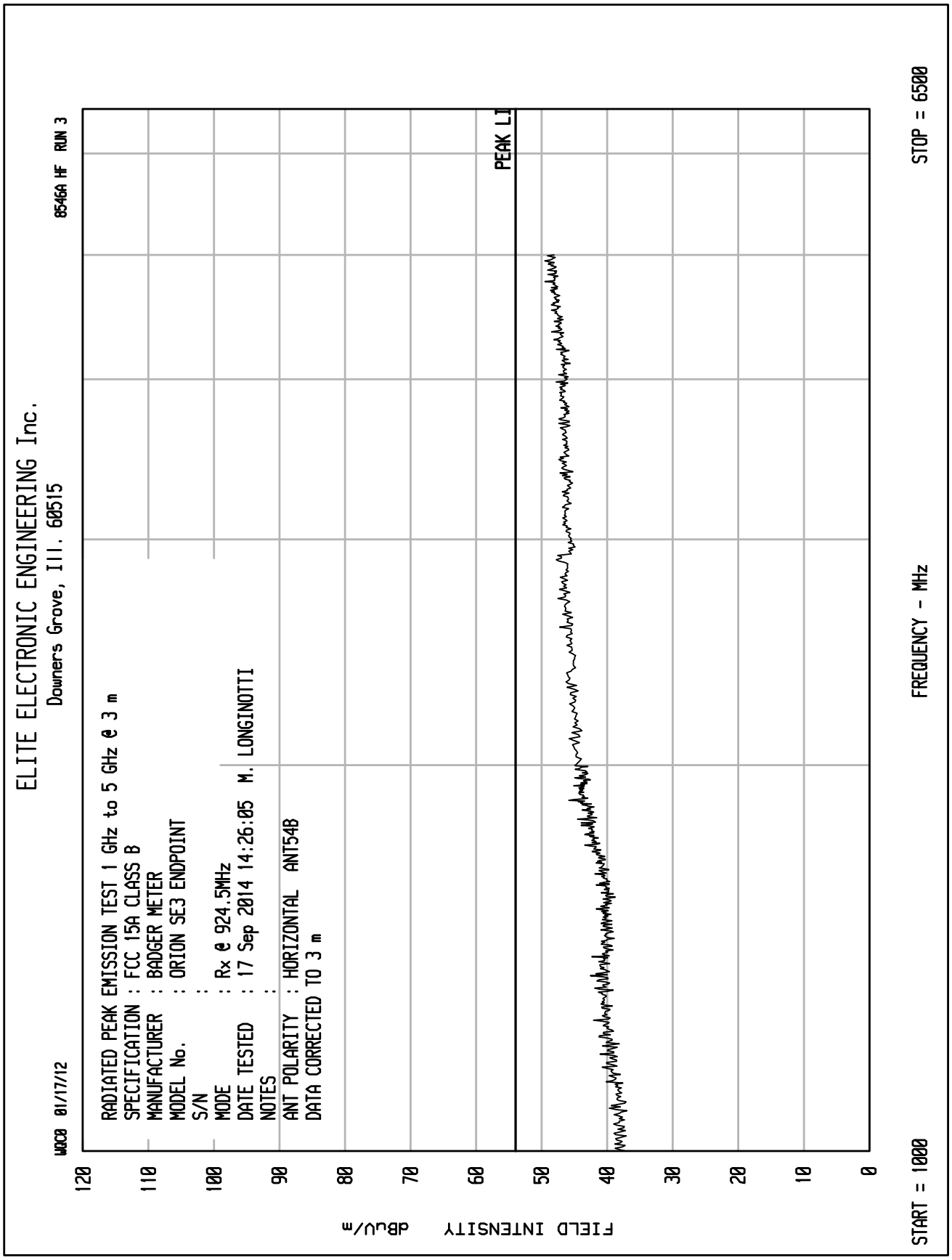
RADIATED AVG EMISSION MEASUREMENTS >=1000 MHz in a 3 m ANECHOIC ROOM

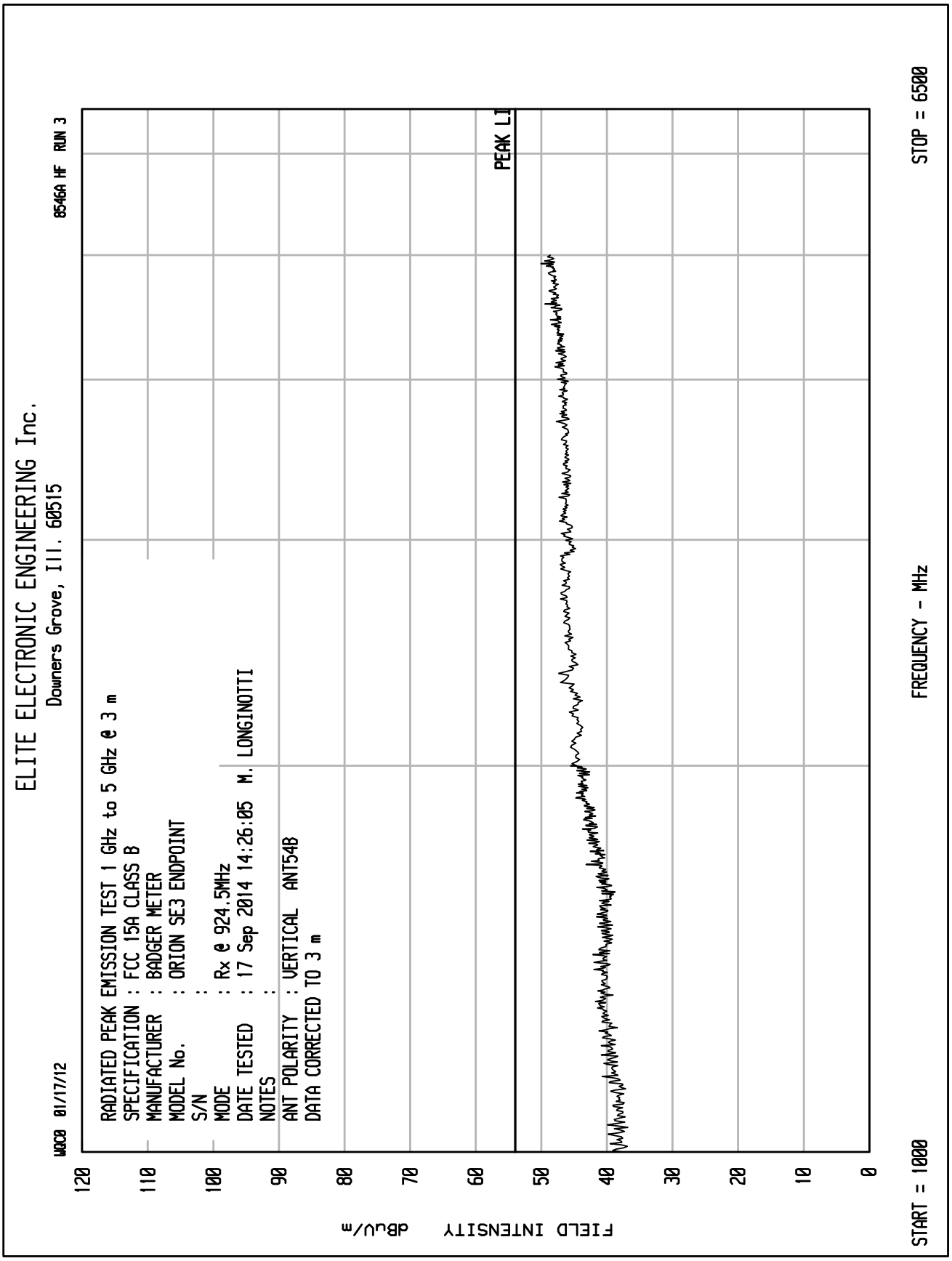
SPECIFICATION : FCC 15A CLASS B
MANUFACTURER : BADGER METER
MODEL NO. : ORION SE3 ENDPOINT
SERIAL NO. :
TEST MODE : Rx @ 914.5MHz
NOTES :
TEST DATE : 17 Sep 2014 13:13:27
TEST DISTANCE : 3 m
ANTENNA : ANT54B

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	
1016.54	-3.1	27.0	1.5	0.0	25.5	54.0		90	340	H
1252.02	-3.8	28.8	1.8	0.0	26.7	54.0		90	120	H
1252.61	-3.9	28.8	1.8	0.0	26.7	54.0		45	200	V
1410.01	-3.5	28.9	1.9	0.0	27.3	54.0		0	120	V
1684.44	-3.3	29.2	2.1	0.0	27.9	54.0		225	120	V
1784.31	-3.3	30.4	2.2	0.0	29.2	54.0		225	120	V
1924.43	-3.2	31.6	2.2	0.0	30.6	54.0		135	120	H
2197.63	-2.9	31.6	2.4	0.0	31.1	54.0		270	340	V
2298.46	-3.2	31.7	2.5	0.0	31.0	54.0		270	120	H
2921.87	-3.9	32.7	2.9	0.0	31.7	54.0		0	200	V
3221.37	-3.9	32.9	3.1	0.0	32.1	54.0		225	340	V
3833.22	-4.6	33.3	3.4	0.0	32.1	54.0		0	340	H
4228.52	-4.3	33.6	3.5	0.0	32.9	54.0		270	200	H
4657.88	-4.3	34.6	3.7	0.0	34.0	54.0		90	340	V
4947.69	-4.1	34.8	3.8	0.0	34.4	54.0		45	200	V


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
8546A RE RUN 3
W280 08/07/12
PRELIMINARY PEAK RADIATED EMISSION TEST @ 3 METERS
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : BADGER METER
MODEL No. : ORION SE3 ENDPOINT
S/N :
MODE : Rx @ 924.5MHz
DATE TESTED : 18 Sep 2014 14:29:44 M. LONGINOTTI
NOTES :
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


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
8546A RE RUN 3
W280 08/07/12
PRELIMINARY PEAK RADIATED EMISSION TEST @ 3 METERS
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : BADGER METER
MODEL No. : ORION SE3 ENDPOINT
S/N :
MODE : Rx @ 924.5MHz
DATE TESTED : 18 Sep 2014 14:29:44 M. LONGINOTTI
NOTES :
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
---- of ---- Bd
START = 30
100
FREQUENCY - MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WACO 01/17/12
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 SE3 ENDPOINT
S/N :
MODE : Rx @ 924.5MHz
DATE TESTED : 17 Sep 2014 14:26:05 M. LONGINOTTI
NOTES :
ANT POLARITY : HORIZONTAL ANT54B
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 3
WACO 01/17/12
RADIATED PEAK EMISSION TEST 1 GHz to 5 GHz @ 3 m
SPECIFICATION : FCC 15A CLASS B
MANUFACTURER : BADGER METER
MODEL No. : ORION SE3 ENDPOINT
S/N :
MODE : Rx @ 924.5MHz
DATE TESTED : 17 Sep 2014 14:26:05 M. LONGINOTTI
NOTES :
ANT POLARITY : VERTICAL ANT54B
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. 8546A

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 SE3 ENDPOINT
SERIAL NO. :
TEST MODE : Rx @ 924.5MHz
NOTES :
TEST DATE : 18 Sep 2014 14:29:44
TEST DISTANCE : 3 m (DATA EXTRAPOLATED TO 3 m)

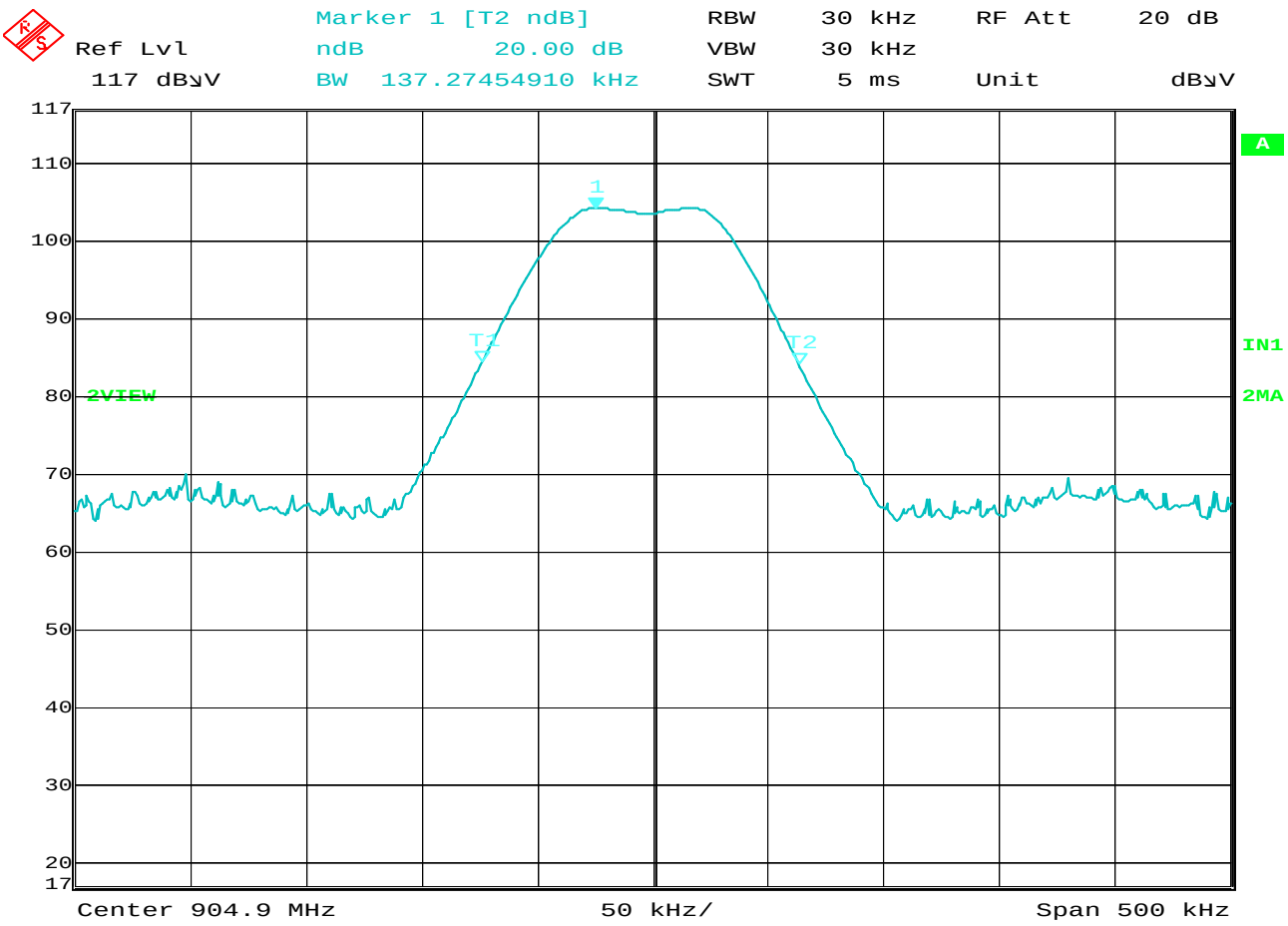
FREQUENCY	QP READING	ANT FAC	CBL FAC	EXT ATTN	DIST FAC	TOTAL	QP LIMIT	AZ	ANT HT	POLAR
MHz	dBuV	dB	dB	dB	dB	dBuV/m	dBuV/m	deg	cm	
52.35	-6.4	7.6	.4	0.0	0.0	1.5	40.0	180	120	V
95.30	-8.5	10.1	.4	0.0	0.0	2.0	43.5	270	120	V
98.89	-8.0	10.9	.4	0.0	0.0	3.3	43.5	45	200	H
162.00	-1.2	9.9	.6	0.0	0.0	9.3	43.5	0	337	V
174.41	-8.6	9.7	.7	0.0	0.0	1.8	43.5	225	340	H
192.04	3.2	9.5	.7	0.0	0.0	13.4	43.5	225	120	V
357.56	-7.4	14.4	1.0	0.0	0.0	8.1	46.0	135	200	H
582.69	-7.6	18.4	1.1	0.0	0.0	11.9	46.0	225	200	H
603.53	-7.8	18.6	1.1	0.0	0.0	11.9	46.0	270	120	V
743.54	-7.3	19.1	1.4	0.0	0.0	13.3	46.0	45	200	V

DATA SHEET HF TEST NO. 3

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

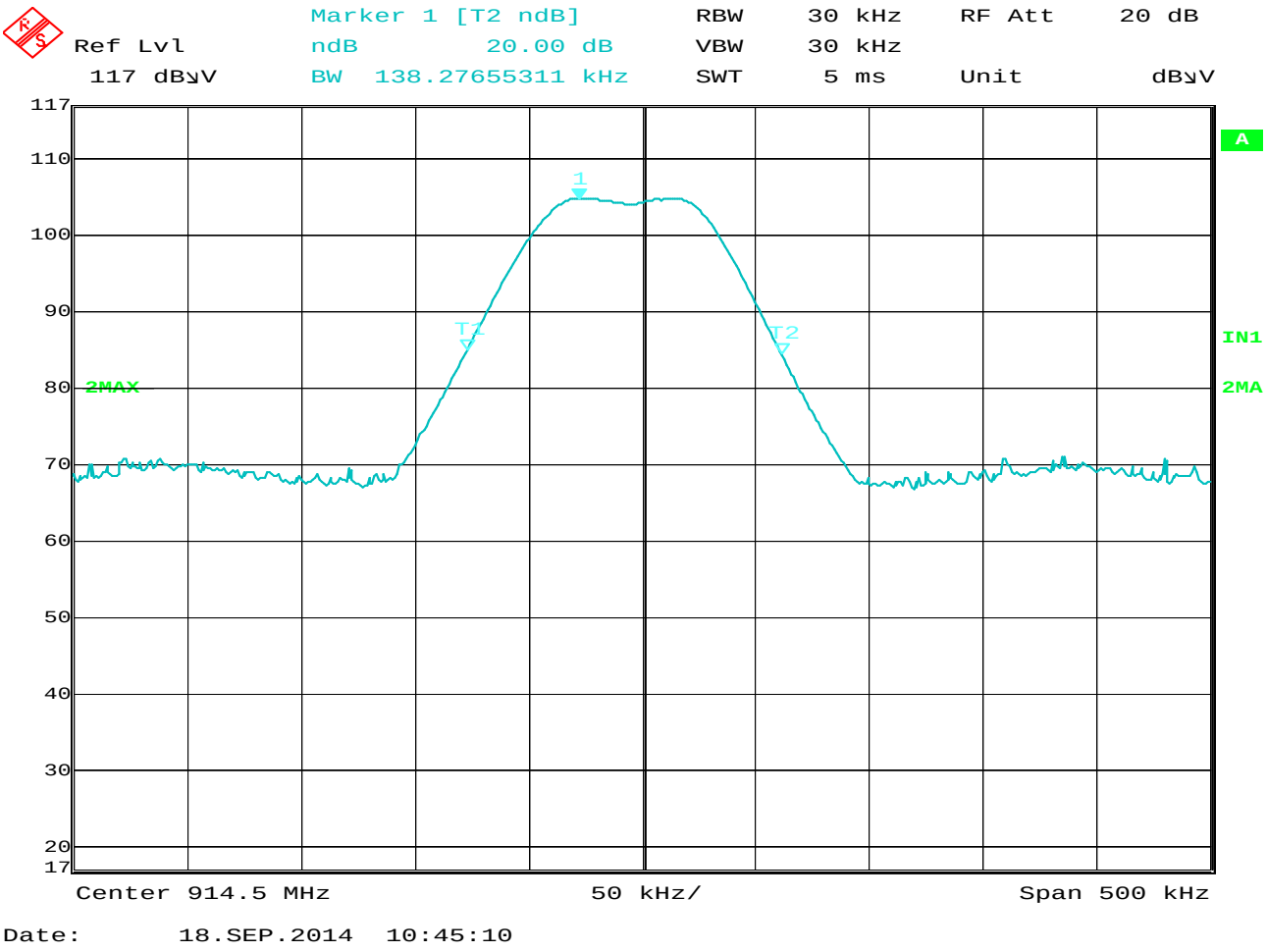
SPECIFICATION : FCC 15A CLASS B
MANUFACTURER : BADGER METER
MODEL NO. : ORION SE3 ENDPOINT
SERIAL NO. :
TEST MODE : Rx @ 924.5MHz
NOTES :
TEST DATE : 17 Sep 2014 14:26:05
TEST DISTANCE : 3 m
ANTENNA : ANT54B

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	
1081.06	-2.8	27.1	1.6	0.0	25.9	54.0		135	340	V
1271.83	-3.9	29.0	1.8	0.0	26.8	54.0		270	200	H
1382.16	-3.6	29.0	1.9	0.0	27.3	54.0		225	340	H
1421.87	-3.2	28.8	1.9	0.0	27.5	54.0		45	120	H
1644.87	-3.4	28.8	2.1	0.0	27.5	54.0		315	340	H
1780.18	-2.8	30.4	2.2	0.0	29.7	54.0		0	340	H
1879.40	-4.0	31.4	2.2	0.0	29.6	54.0		135	340	H
2079.42	-2.9	31.8	2.3	0.0	31.2	54.0		180	340	H
2361.84	-2.5	32.0	2.6	0.0	32.1	54.0		45	340	V
2881.91	-2.7	32.7	2.9	0.0	32.8	54.0		315	340	H
3231.43	-3.3	32.9	3.1	0.0	32.6	54.0		90	340	V
3713.55	-4.9	33.3	3.3	0.0	31.7	54.0		135	120	V
4105.18	-4.9	33.6	3.5	0.0	32.2	54.0		315	120	V
4595.28	-4.2	34.4	3.7	0.0	33.9	54.0		90	340	V
4900.34	-4.3	34.8	3.8	0.0	34.3	54.0		225	120	V



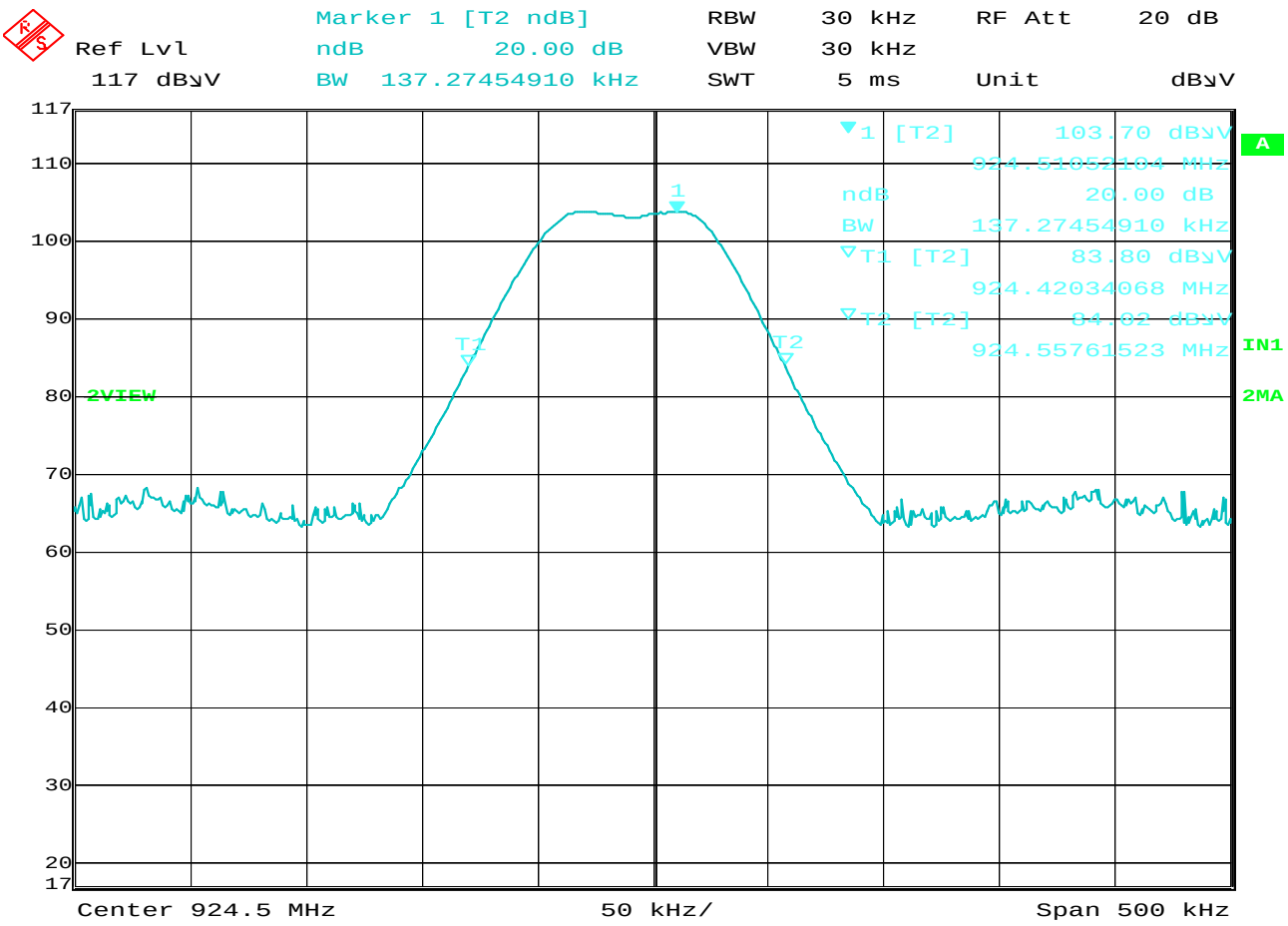
20dB Bandwidth

MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	ORION SE3 Endpoint
SERIAL NUMBER	:	30148151
TEST MODE	:	Tx @ 904.9MHz, Fixed Mode
TEST PARAMETERS	:	20dB bandwidth
NOTES	:	20dB bandwidth = 137.27kHz
EQUIPMENT USED	:	RBA0, NTA3



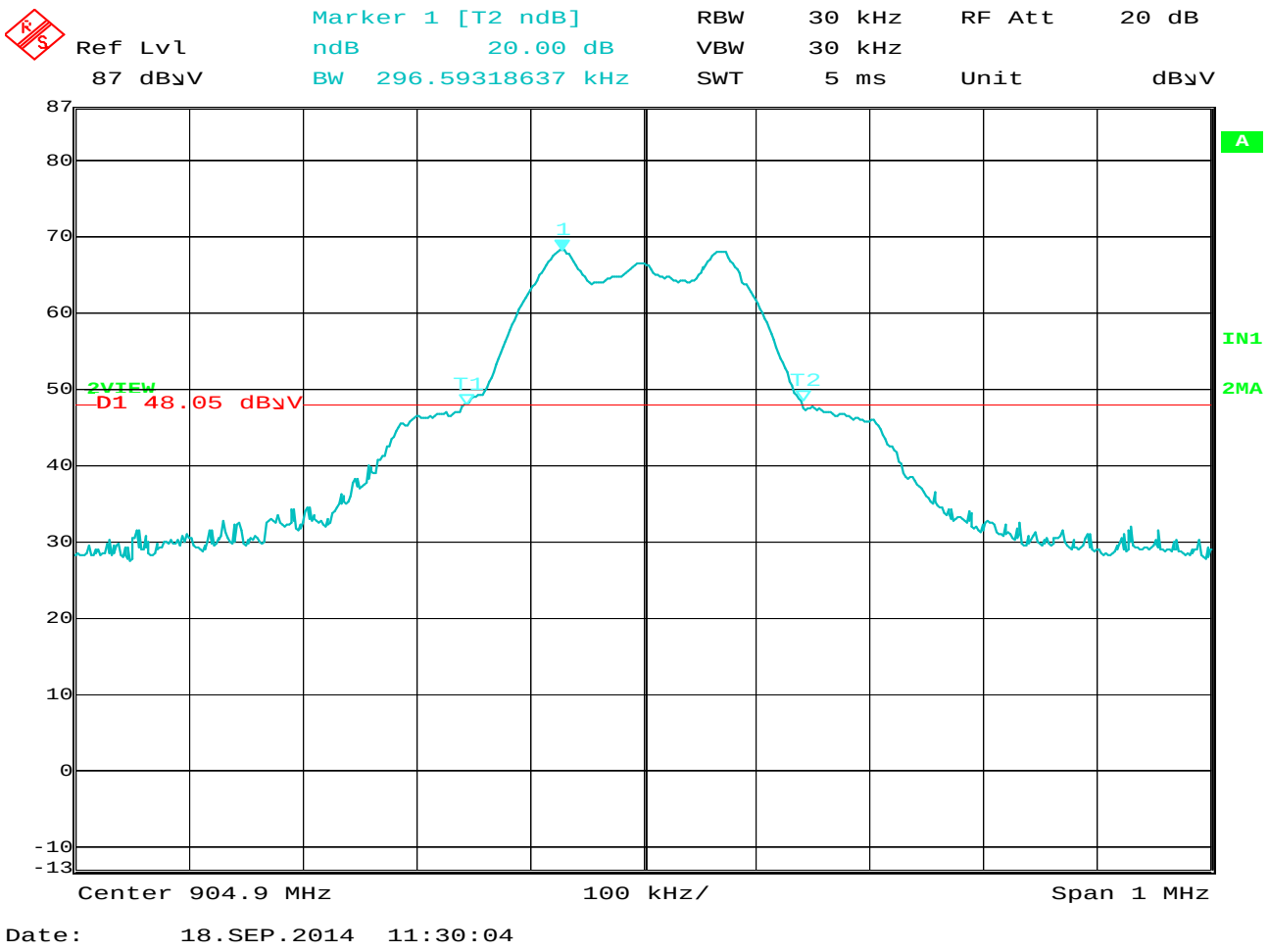
20dB Bandwidth

MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	ORION SE3 Endpoint
SERIAL NUMBER	:	30148151
TEST MODE	:	Tx @ 914.5MHz, Fixed Mode
TEST PARAMETERS	:	20dB bandwidth
NOTES	:	20dB bandwidth = 138.28kHz
EQUIPMENT USED	:	RBA0, NTA3



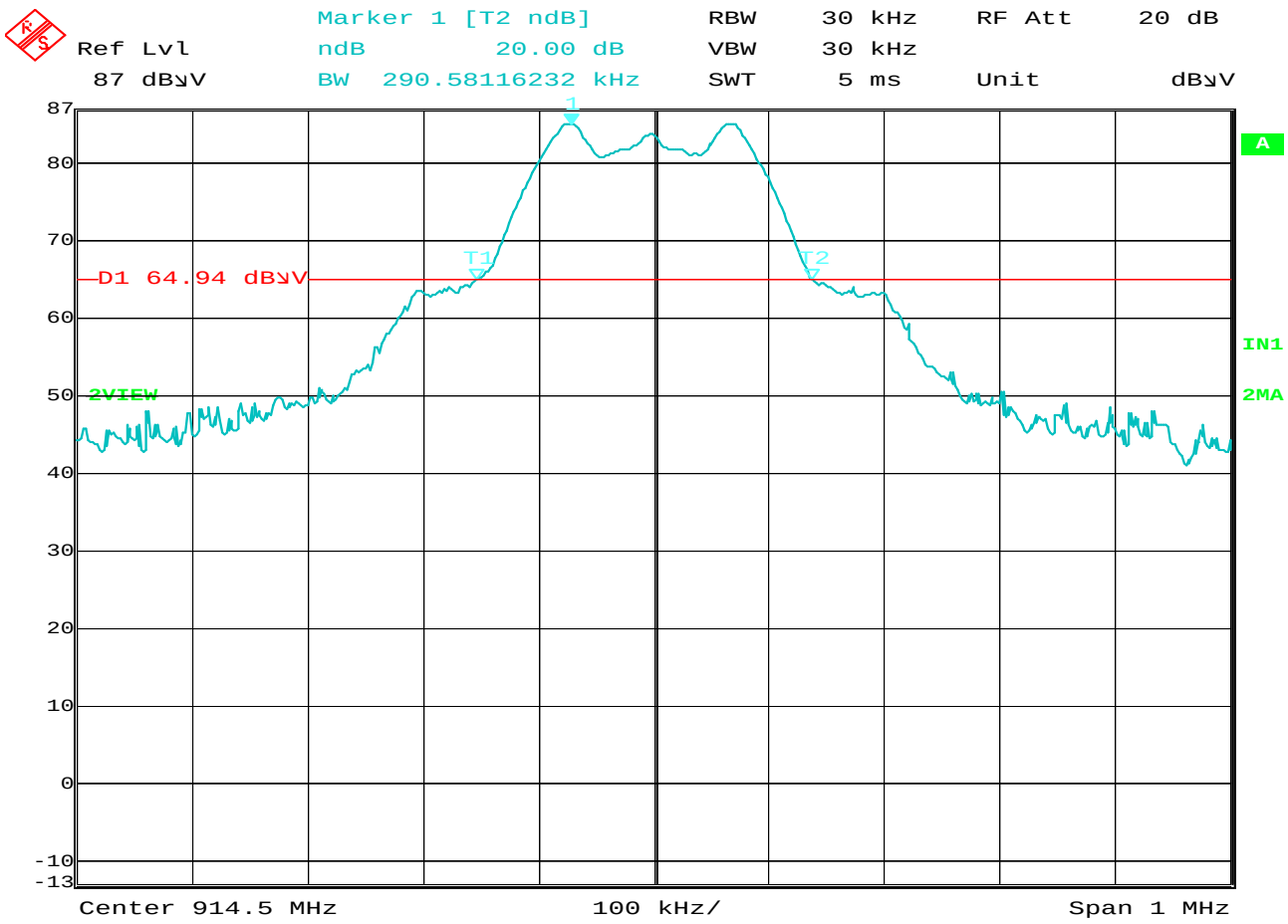
20dB Bandwidth

MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	ORION SE3 Endpoint
SERIAL NUMBER	:	30148151
TEST MODE	:	Tx @ 924.5MHz, Fixed Mode
TEST PARAMETERS	:	20dB Bandwidth
NOTES	:	20dB Bandwidth = 137.27kHz
EQUIPMENT USED	:	RBA0, NTA3



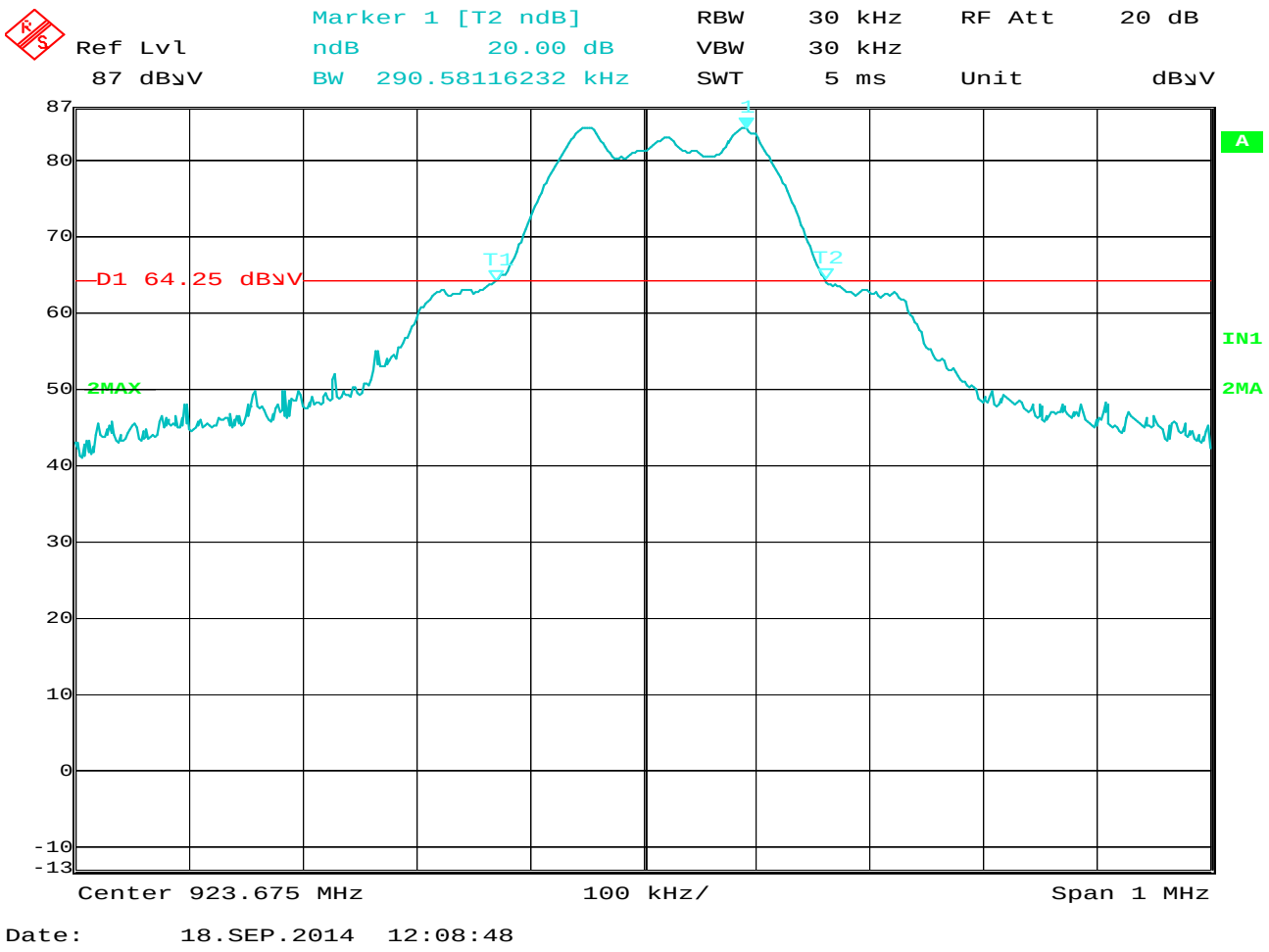
20dB Bandwidth

MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	ORION SE3 Endpoint
SERIAL NUMBER	:	30148151
TEST MODE	:	Tx @ 904.9MHz, Mobile Mode
TEST PARAMETERS	:	20dB Bandwidth
NOTES	:	20dB Bandwidth = 296.59kHz
EQUIPMENT USED	:	RBA0, NTA3



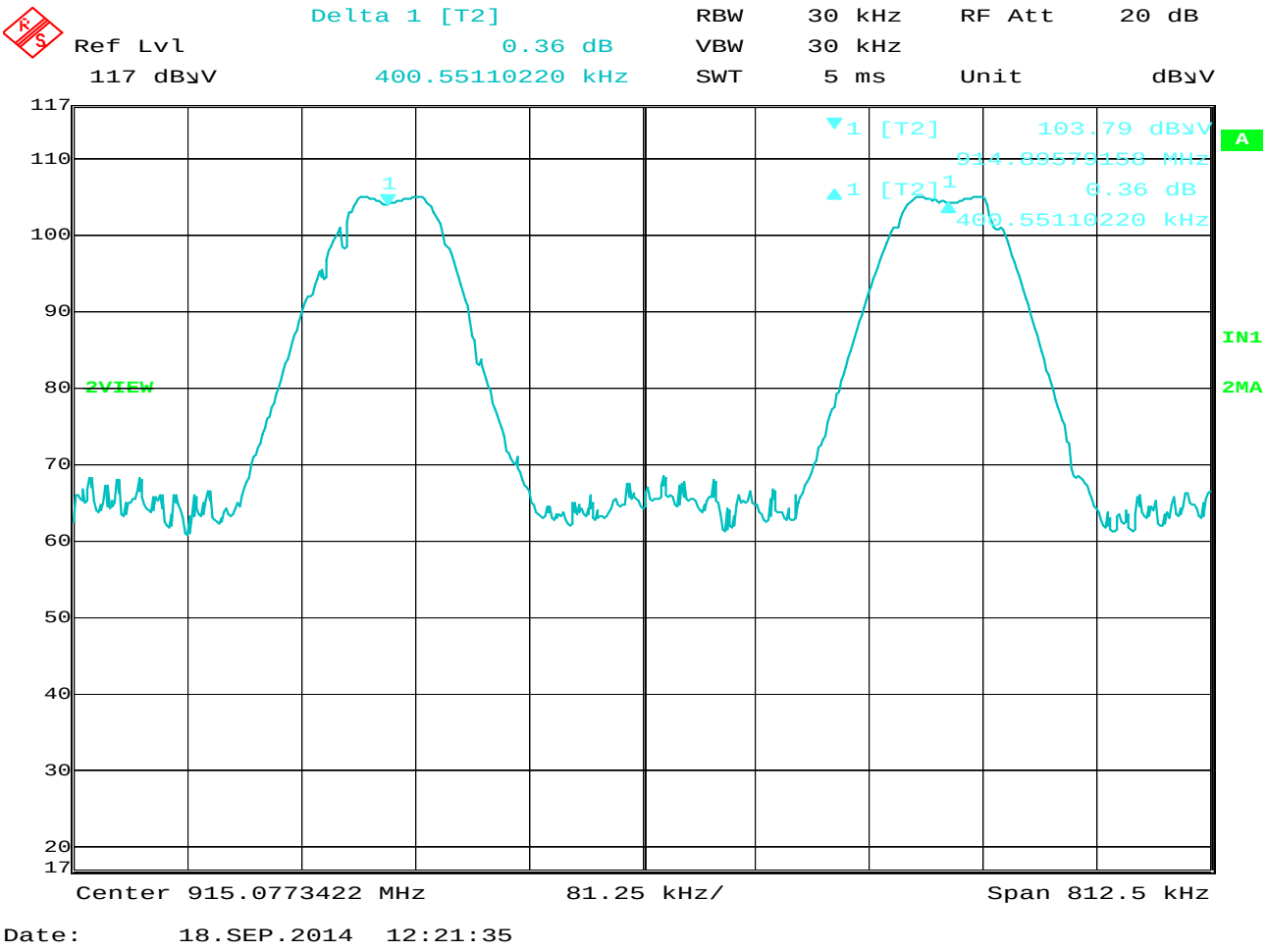
20dB Bandwidth

MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	ORION SE3 Endpoint
SERIAL NUMBER	:	30148151
TEST MODE	:	Tx @ 914.5MHz, Mobile Mode
TEST PARAMETERS	:	20dB Bandwidth
NOTES	:	20dB Bandwidth = 290.58kHz
EQUIPMENT USED	:	RBA0, NTA3



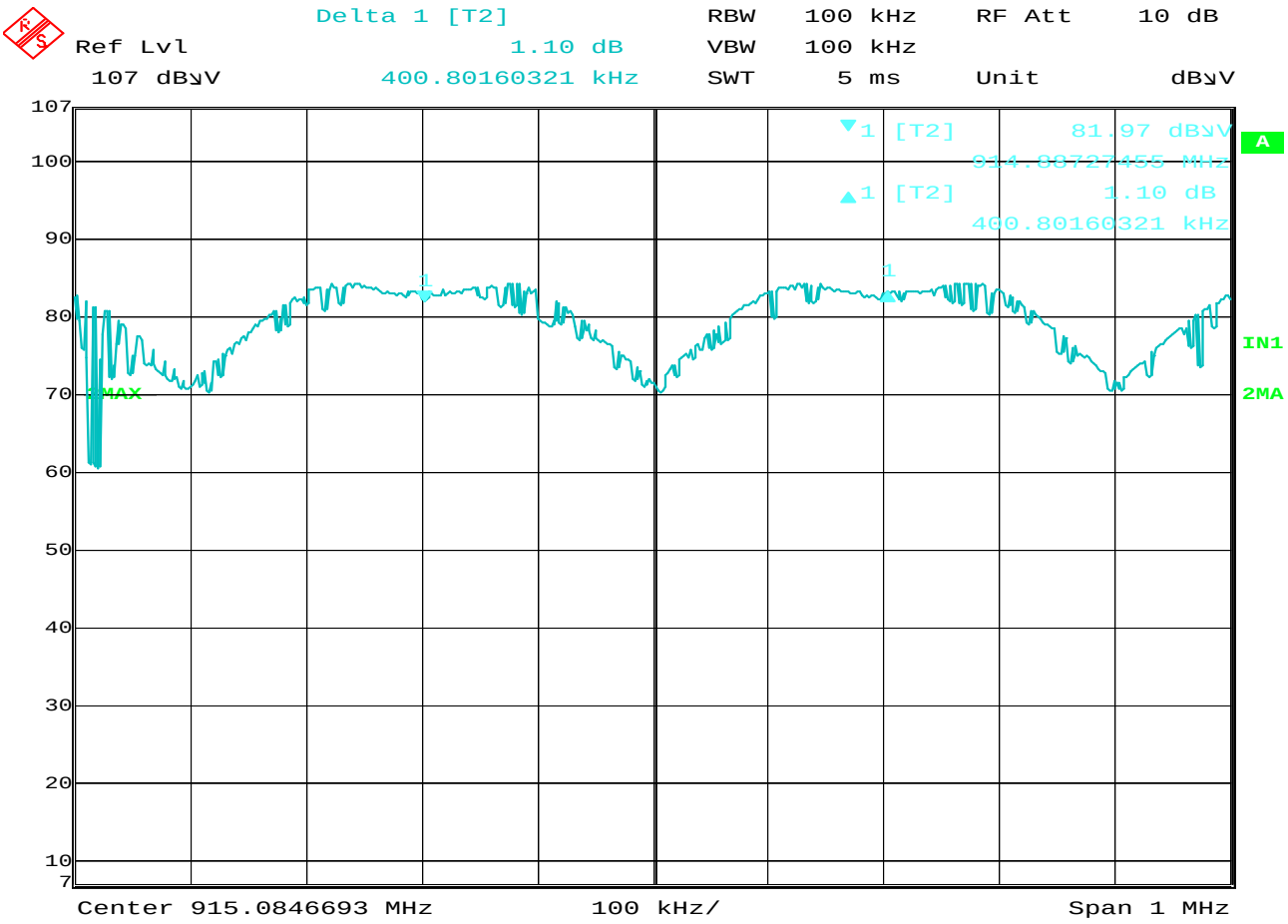
20dB Bandwidth

MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	ORION SE3 Endpoint
SERIAL NUMBER	:	30148151
TEST MODE	:	Tx @ 923.675MHz, Mobile Mode
TEST PARAMETERS	:	20dB Bandwidth
NOTES	:	20dB Bandwidth = 290.58kHz
EQUIPMENT USED	:	RBA0, NTA3



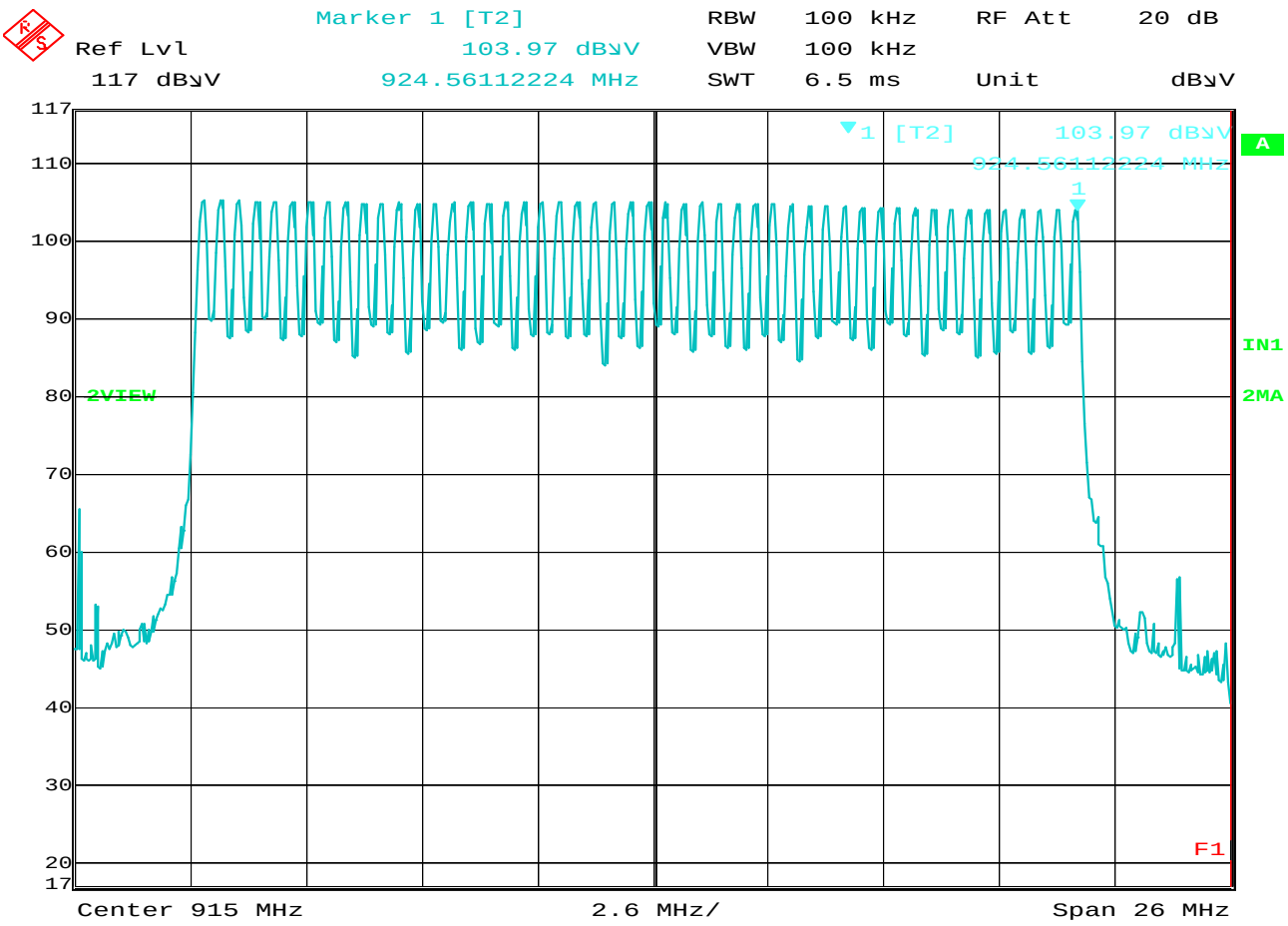
Carrier Frequency Separation

MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	ORION SE3 Endpoint
SERIAL NUMBER	:	30148151
TEST MODE	:	Hopping Enabled, Fixed Mode
TEST PARAMETERS	:	Carrier Frequency Separation
NOTES	:	Carrier Frequency Separation = 400.55kHz
EQUIPMENT USED	:	RBA0, NTA3



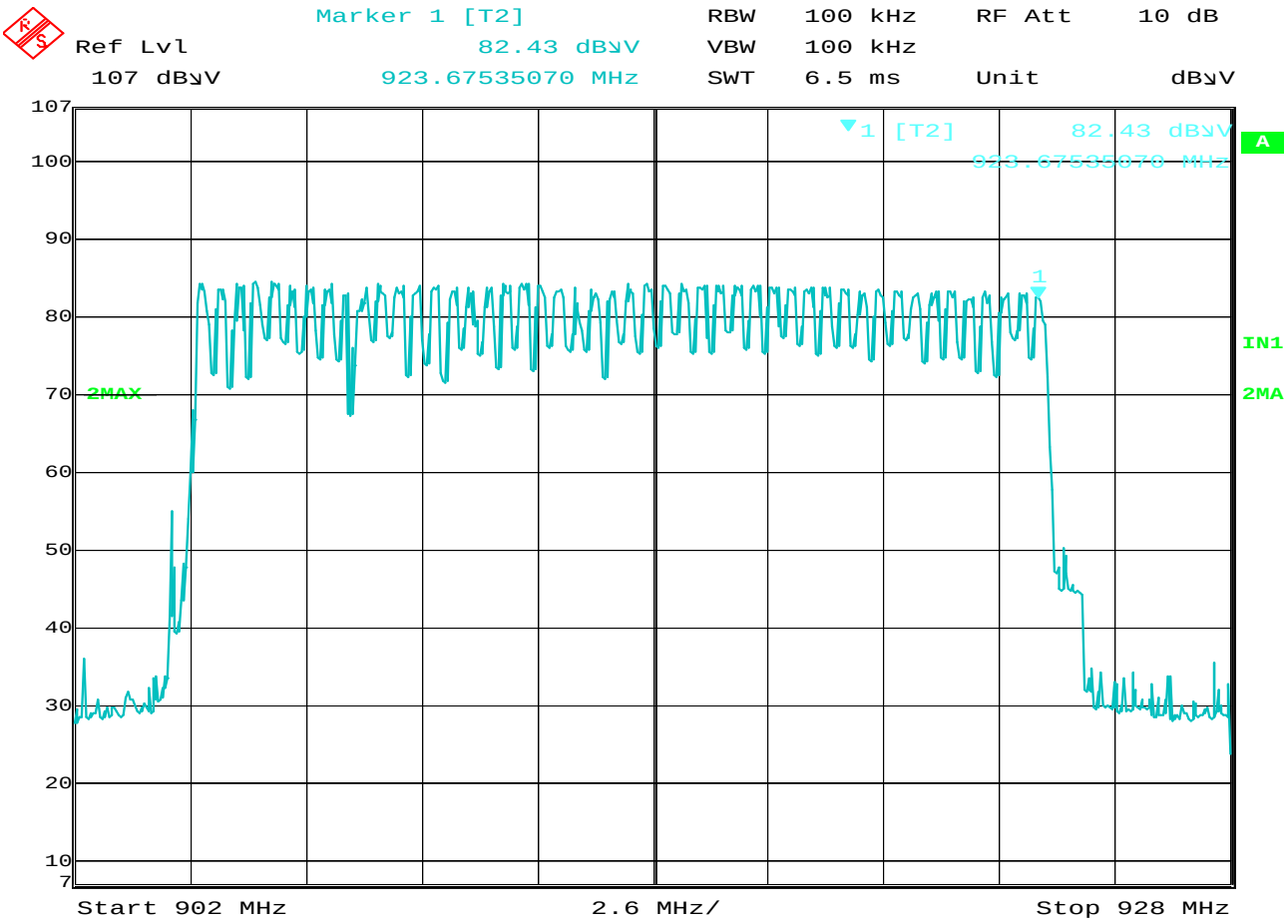
Carrier Frequency Separation

MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	ORION SE3 Endpoint
SERIAL NUMBER	:	30148151
TEST MODE	:	Hopping Enabled, Mobile Mode
TEST PARAMETERS	:	Carrier Frequency Separation
NOTES	:	Carrier Frequency Separation= 400kHz
EQUIPMENT USED	:	RBA0, NTA3



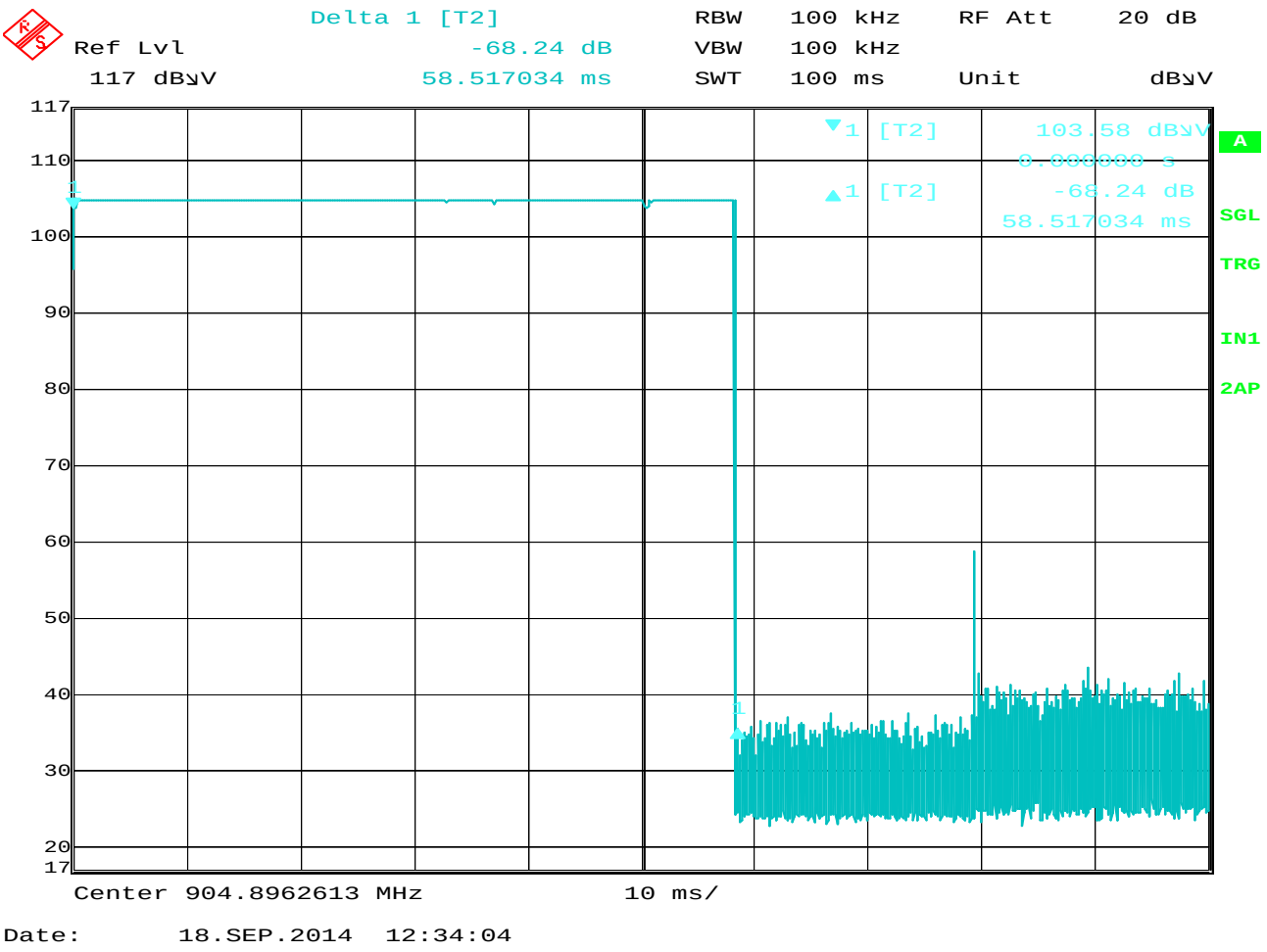
Number of Hopping Channels

MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	ORION SE3 Endpoint
SERIAL NUMBER	:	30148151
TEST MODE	:	Hopping Enabled, Fixed Mode
TEST PARAMETERS	:	Number of Hopping Channels
NOTES	:	Number of Hopping Channels = 50
EQUIPMENT USED	:	RBA0, NTA3



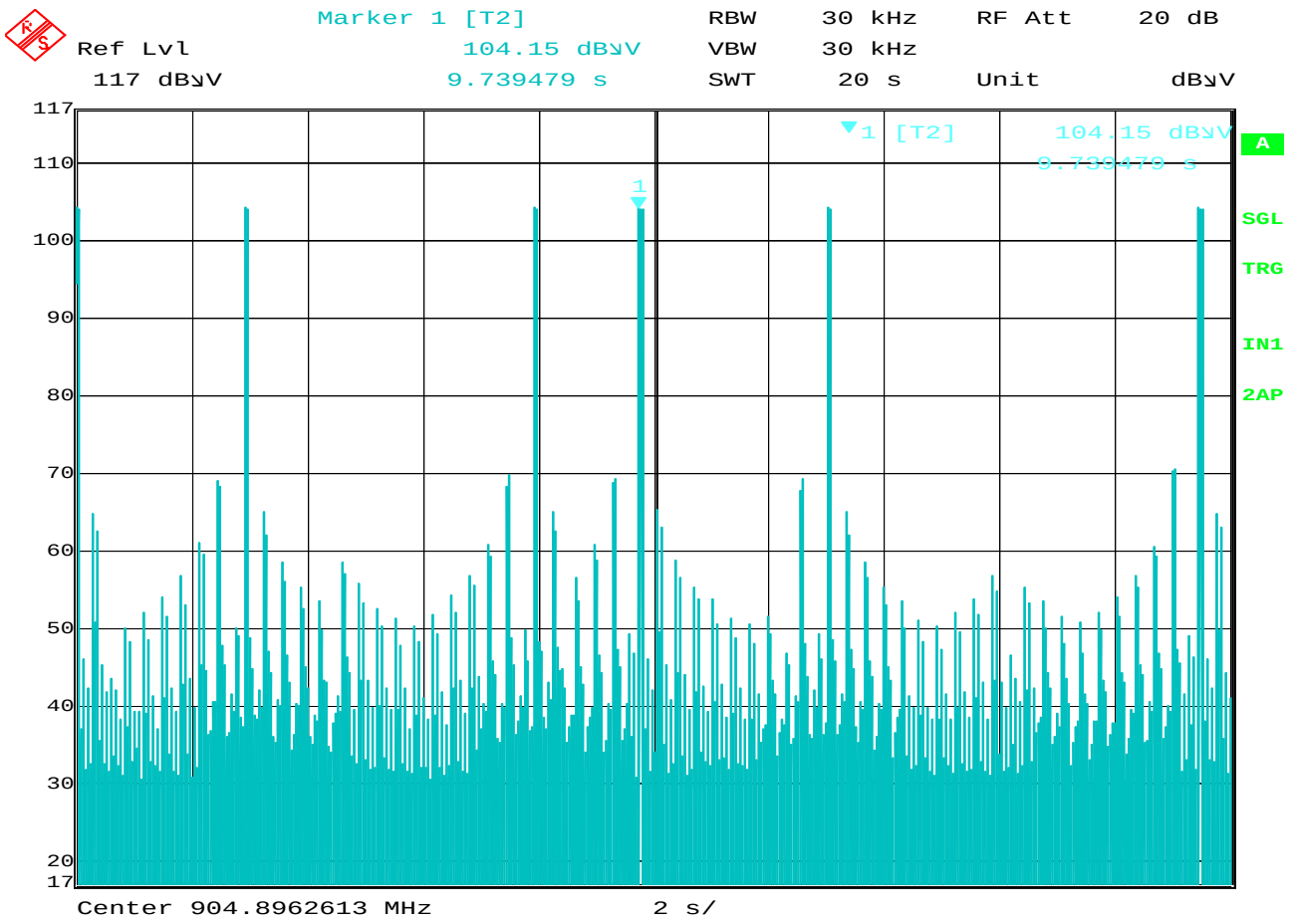
Number of Hopping Channels

MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	ORION SE3 Endpoint
SERIAL NUMBER	:	30148151
TEST MODE	:	Hopping Enabled, Mobile Mode
TEST PARAMETERS	:	Number of Hopping Channels
NOTES	:	Number of Hopping Channels = 48
EQUIPMENT USED	:	RBA0, NTA3



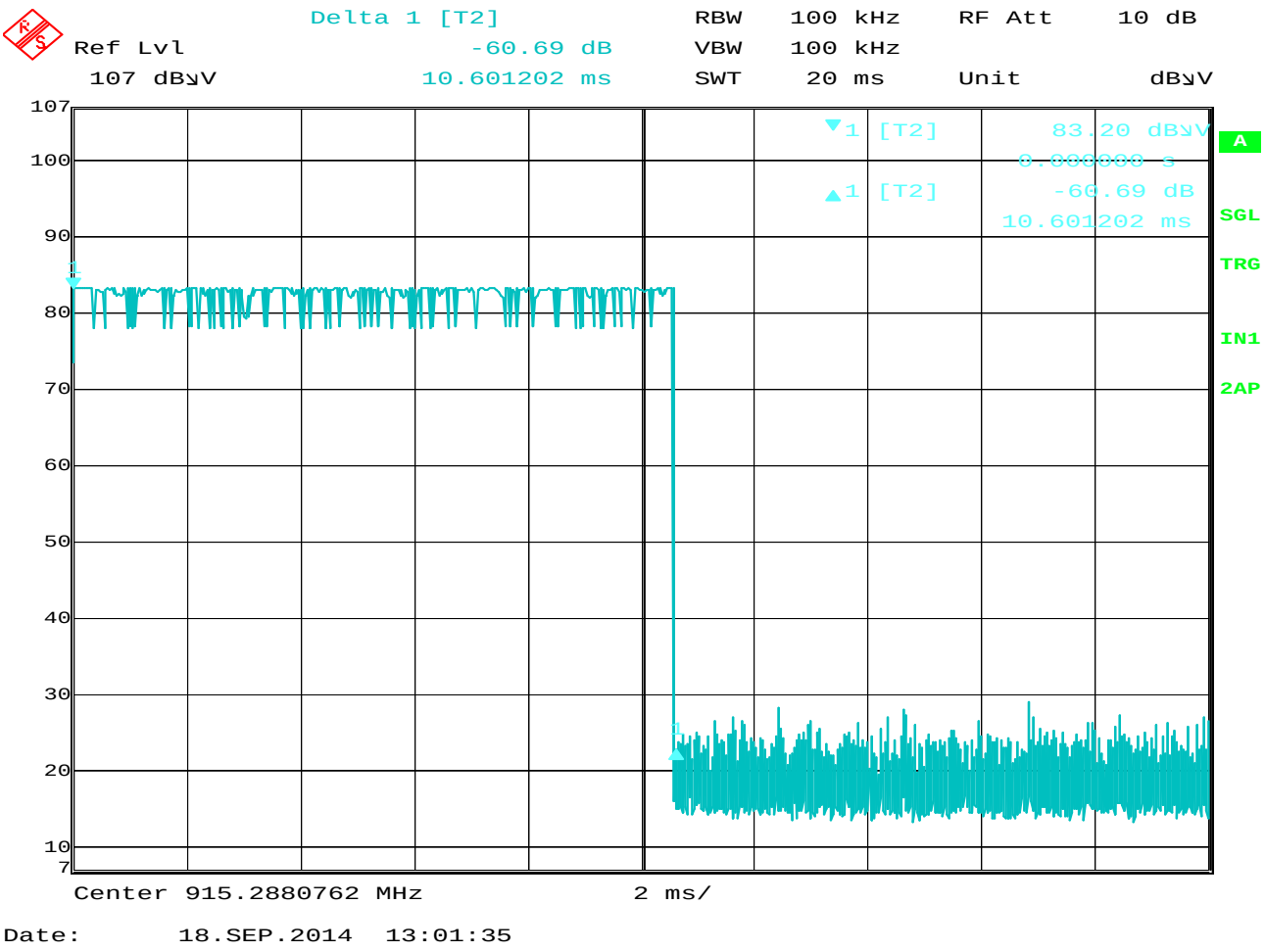
Time of Occupancy

MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	ORION SE3 Endpoint
SERIAL NUMBER	:	30148151
TEST MODE	:	Hopping Enabled, Fixed Mode
TEST PARAMETERS	:	Time of Occupancy
NOTES	:	Dwell Time per Hop = 58.51msec
EQUIPMENT USED	:	RBA0, NTA3



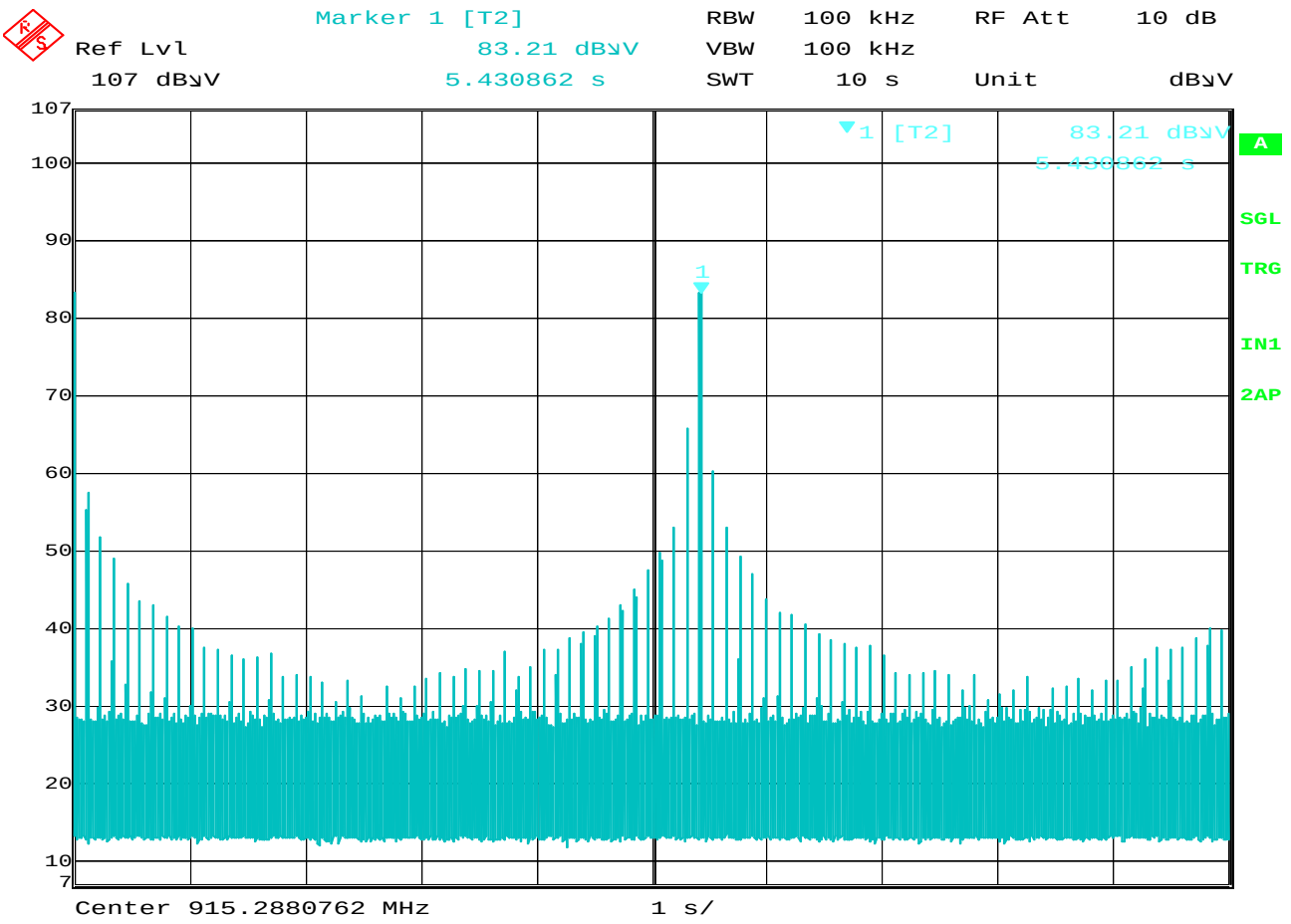
Time of Occupancy

MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	ORION SE3 Endpoint
SERIAL NUMBER	:	30148151
TEST MODE	:	Hopping Enabled, Fixed Mode
TEST PARAMETERS	:	Time of Occupancy
NOTES	:	Number of Hops in a 20second period = 6.
	:	Time of Occupancy = (dwell time per hop) x (number of hops in a 20 sec period)
	:	Time of Occupancy = 58.51msec x 6 = 351.06msec
EQUIPMENT USED	:	RBA0, NTA3



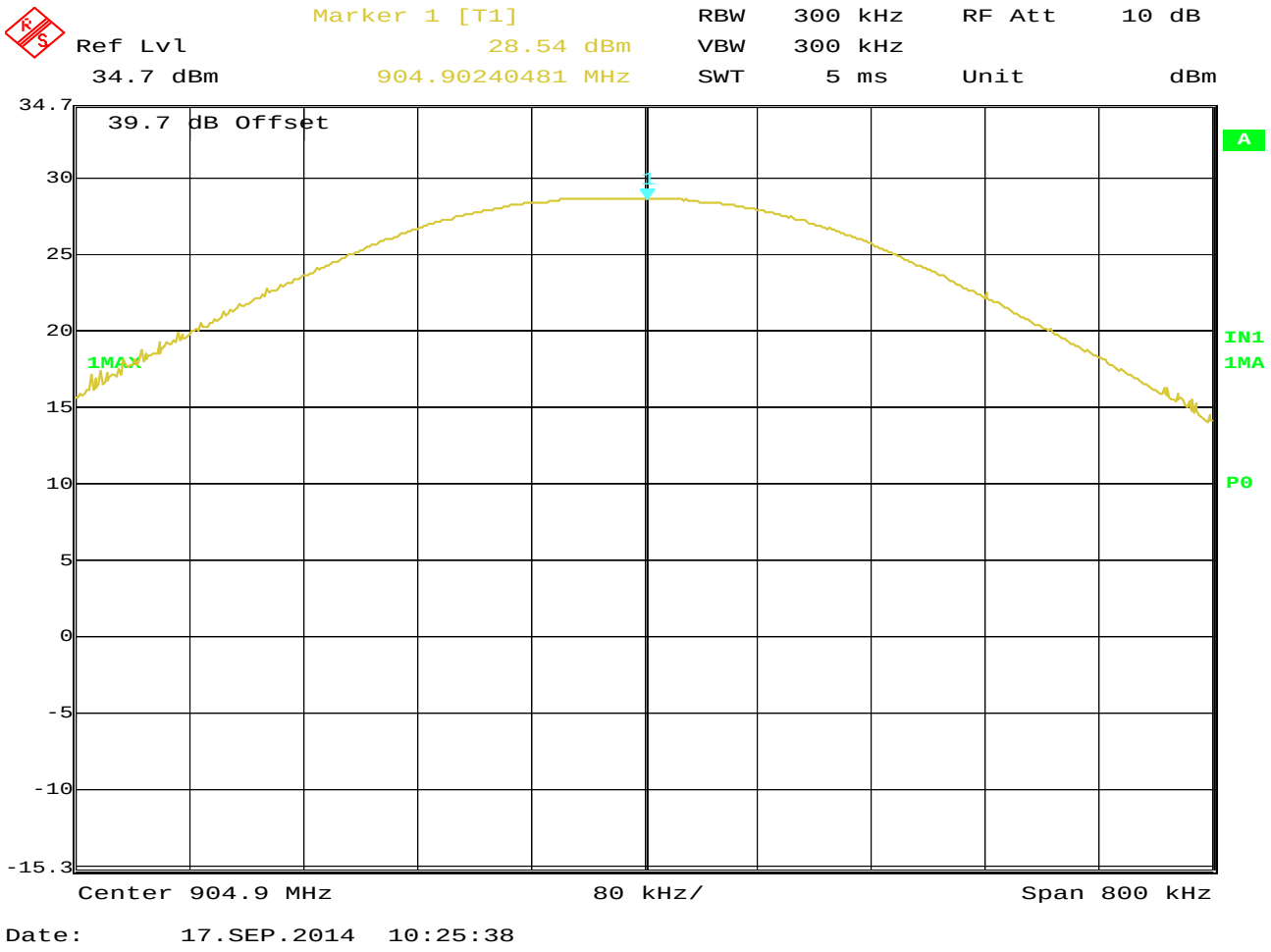
Time of Occupancy

MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	ORION SE3 Endpoint
SERIAL NUMBER	:	30148151
TEST MODE	:	Hopping Enabled, Mobile Mode
TEST PARAMETERS	:	Time of Occupancy
NOTES	:	Dwell Time per Hop = 10.6msec
EQUIPMENT USED	:	RBA0, NTA3



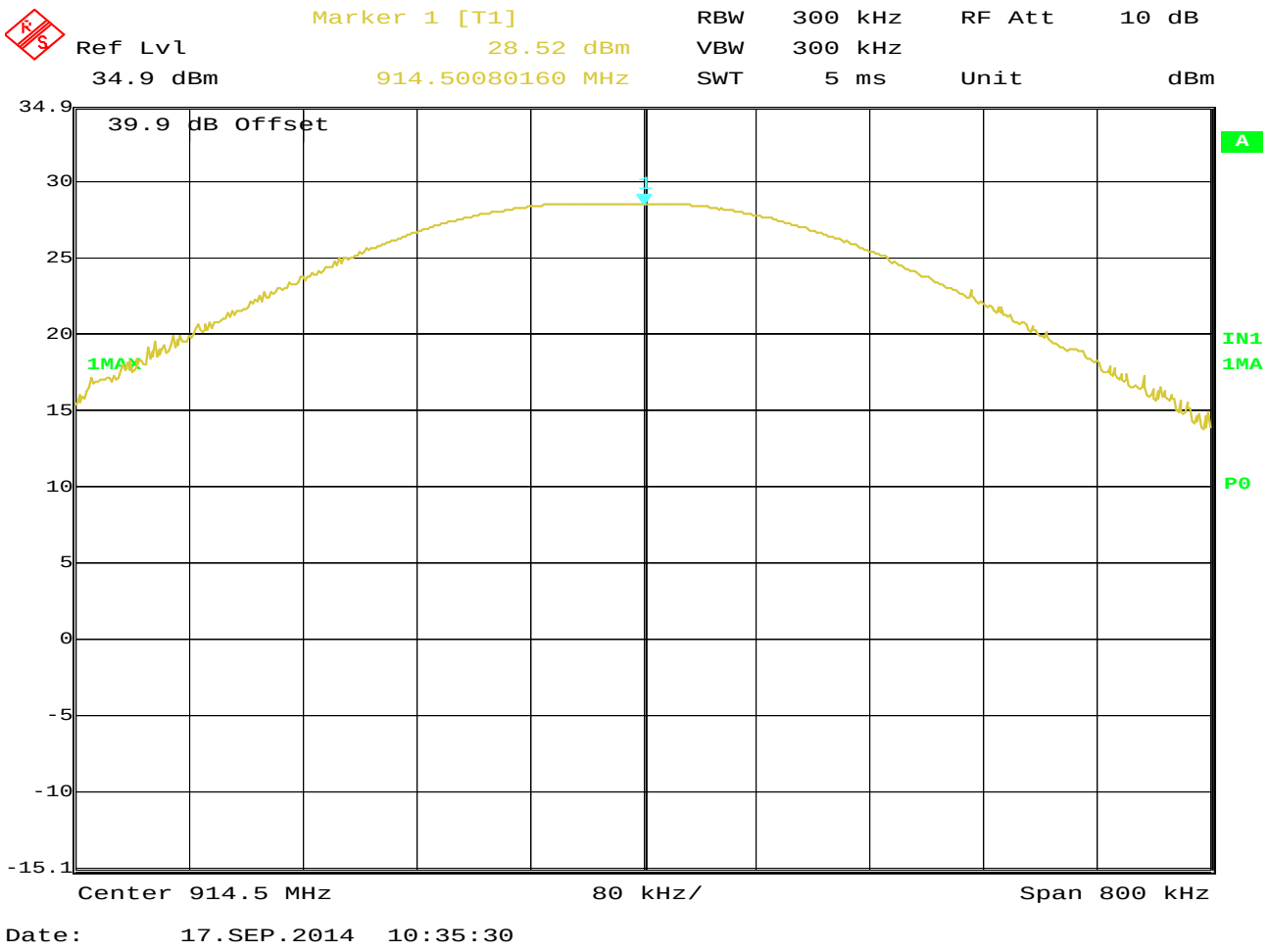
Time of Occupancy

MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	ORION SE3 Endpoint
SERIAL NUMBER	:	30148151
TEST MODE	:	Tx @ 904.9MHz, Fixed Mode
TEST PARAMETERS	:	Time of Occupancy
NOTES	:	Time of Occupancy=(Dwell Time per Hop)x(Number of Hops in a 10 sec period)
	:	Time of Occupancy = (10.6msec) x 2
	:	Time of Occupancy = 21.2msec
EQUIPMENT USED	:	RBA0, NTA3



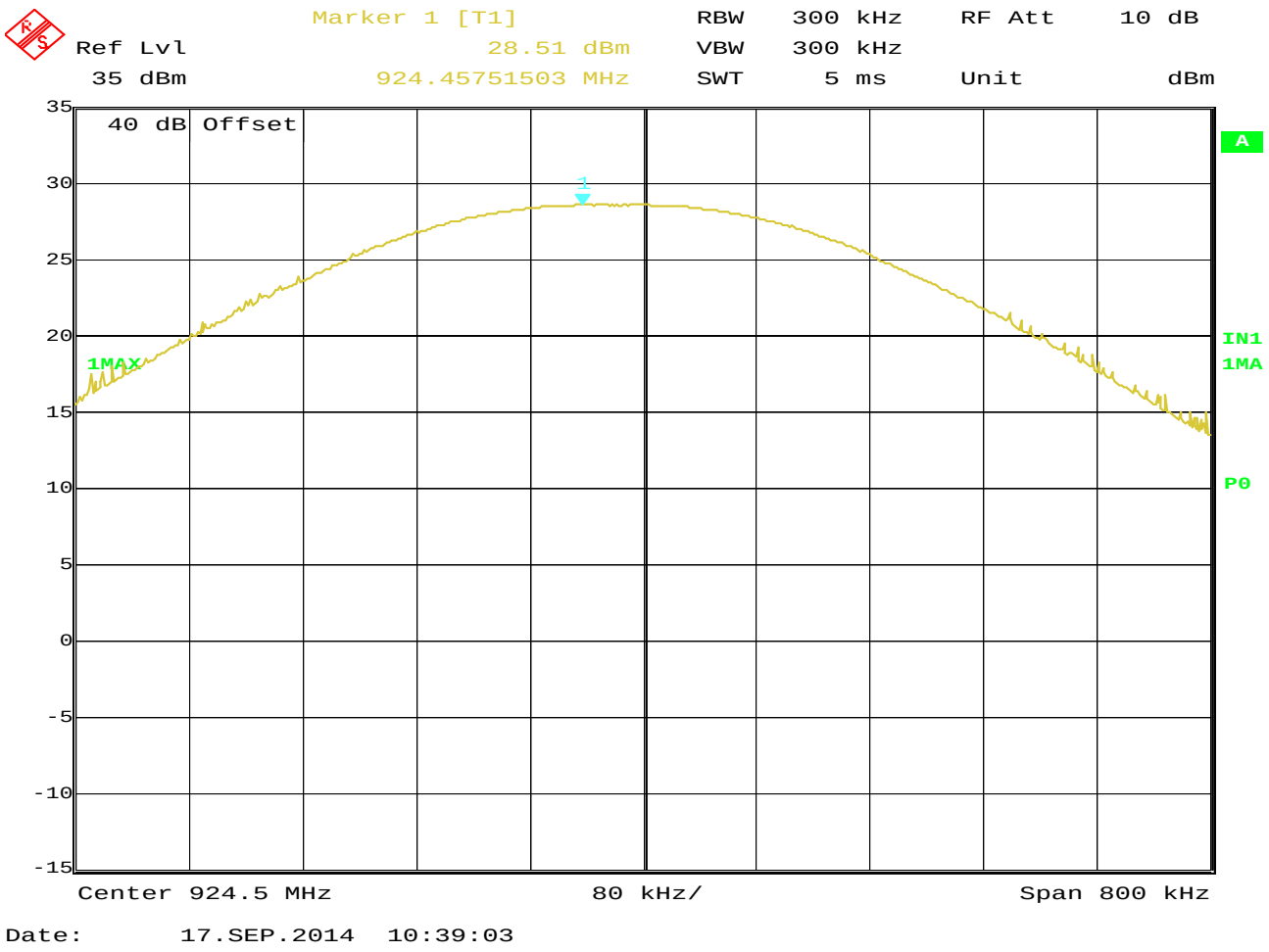
Conducted Output Power

MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	ORION SE3 Endpoint
SERIAL NUMBER	:	30140822
TEST MODE	:	Tx @ 904.9MHz, Fixed Mode
TEST PARAMETERS	:	Conducted Output Power
NOTES	:	Conducted Output Power = 28.54dBm = 714.5mW
EQUIPMENT USED	:	RBA0, T2D4, T2DA



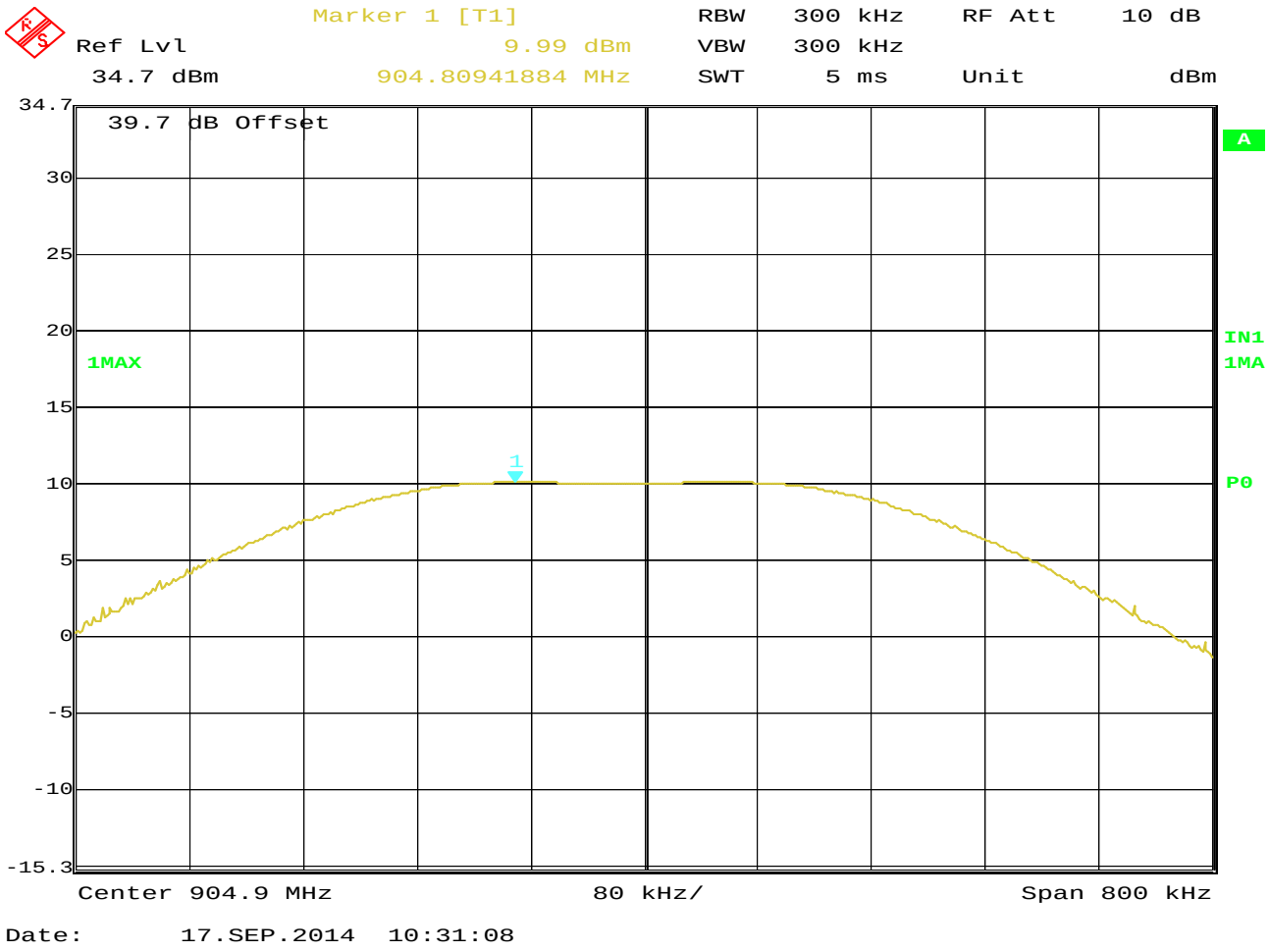
Conducted Output Power

MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	ORION SE3 Endpoint
SERIAL NUMBER	:	30140822
TEST MODE	:	Tx @ 914.5MHz, Fixed Mode
TEST PARAMETERS	:	Conducted Output Power
NOTES	:	Conducted Output Power = 28.52dBm = 711.2mW
EQUIPMENT USED	:	RBA0, T2D4, T2DA



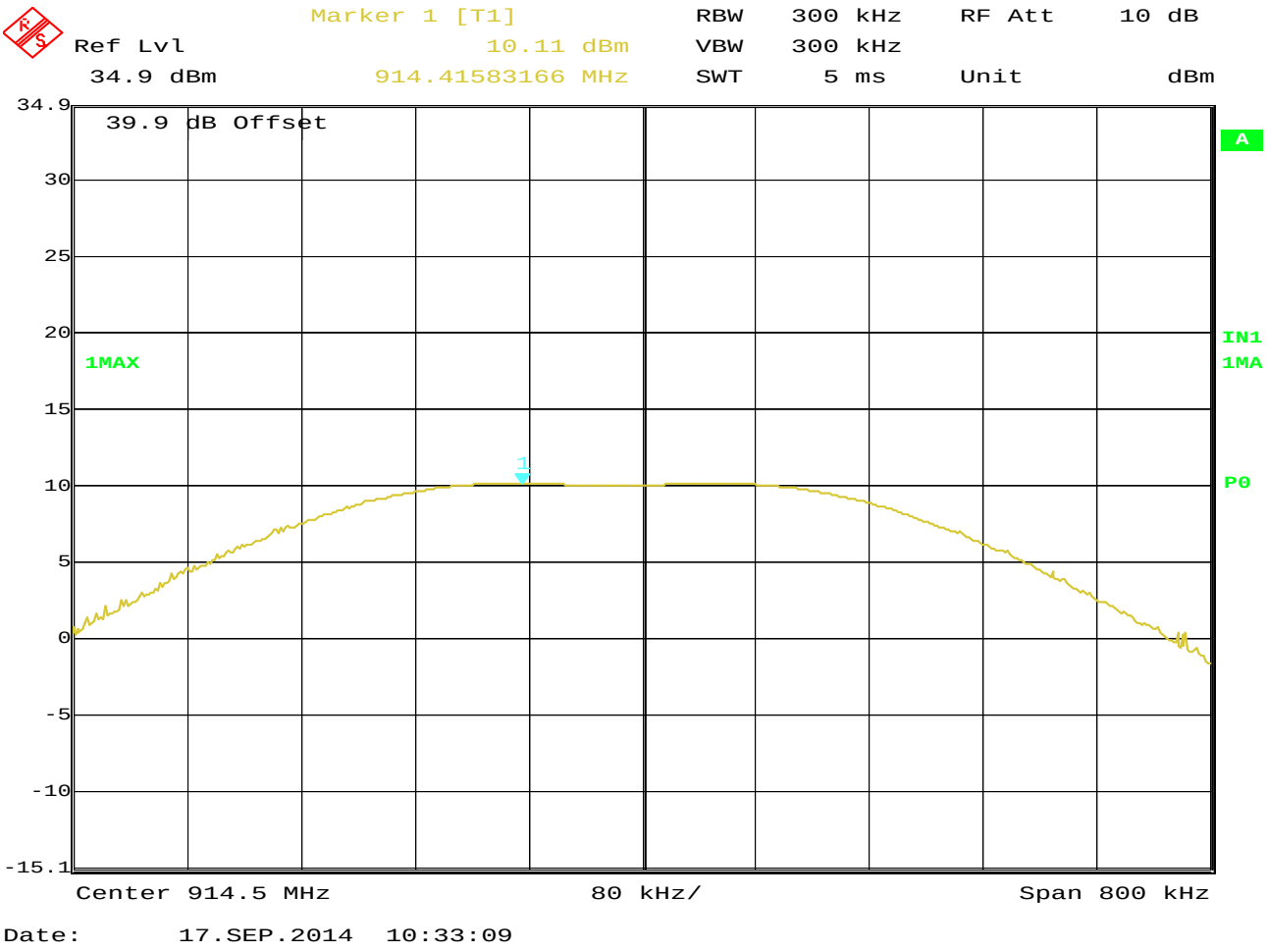
Conducted Output Power

MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	ORION SE3 Endpoint
SERIAL NUMBER	:	30140822
TEST MODE	:	Tx @ 924.5MHz, Fixed Mode
TEST PARAMETERS	:	Conducted Output Power
NOTES	:	Conducted Output Power = 28.51dBm = 709.6mW
EQUIPMENT USED	:	RBA0, T2D4, T2DA



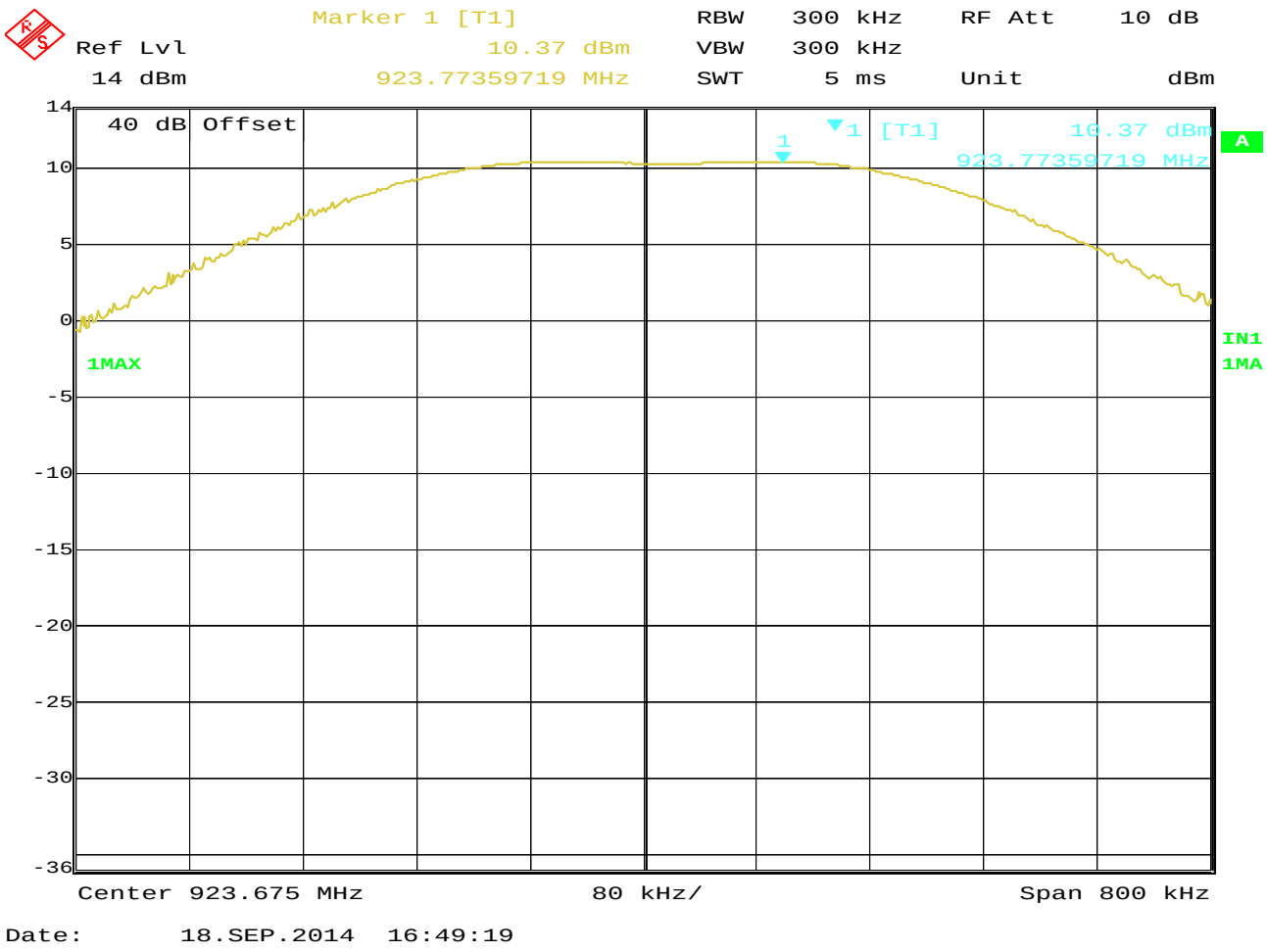
Conducted Output Power

MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	ORION SE3 Endpoint
SERIAL NUMBER	:	30140822
TEST MODE	:	Tx @ 904.9MHz, Mobile Mode
TEST PARAMETERS	:	Conducted Output Power
NOTES	:	Conducted Output Power = 9.99dBm = 9.98mW
EQUIPMENT USED	:	RBA0, T2D4, T2DA



Conducted Output Power

MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	ORION SE3 Endpoint
SERIAL NUMBER	:	30140822
TEST MODE	:	Tx @ 914.5MHz, Mobile Mode
TEST PARAMETERS	:	Conducted Output Power
NOTES	:	Conducted Output Power = 10.11dBm = 10.26mW
EQUIPMENT USED	:	RBA0, T2D4, T2DA



Conducted Output Power

MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	ORION SE3 Endpoint
SERIAL NUMBER	:	30140822
TEST MODE	:	Tx @ 923.675MHz, Mobile Mode
TEST PARAMETERS	:	Conducted Output Power
NOTES	:	Conducted Output Power = 10.37dBm = 10.89mW
EQUIPMENT USED	:	RBA0, T2D4, T2DA

Manufacturer : Badger Meter
Model No. : ORION SE3 Endpoint
Serial No. : 30148151
Mode : Fixed Mode
Test Performed : Effective Isotropic Radiated Power (EIRP)
Test Date : September 17 and 18, 2014
Test Distance : 3 meters
Notes :

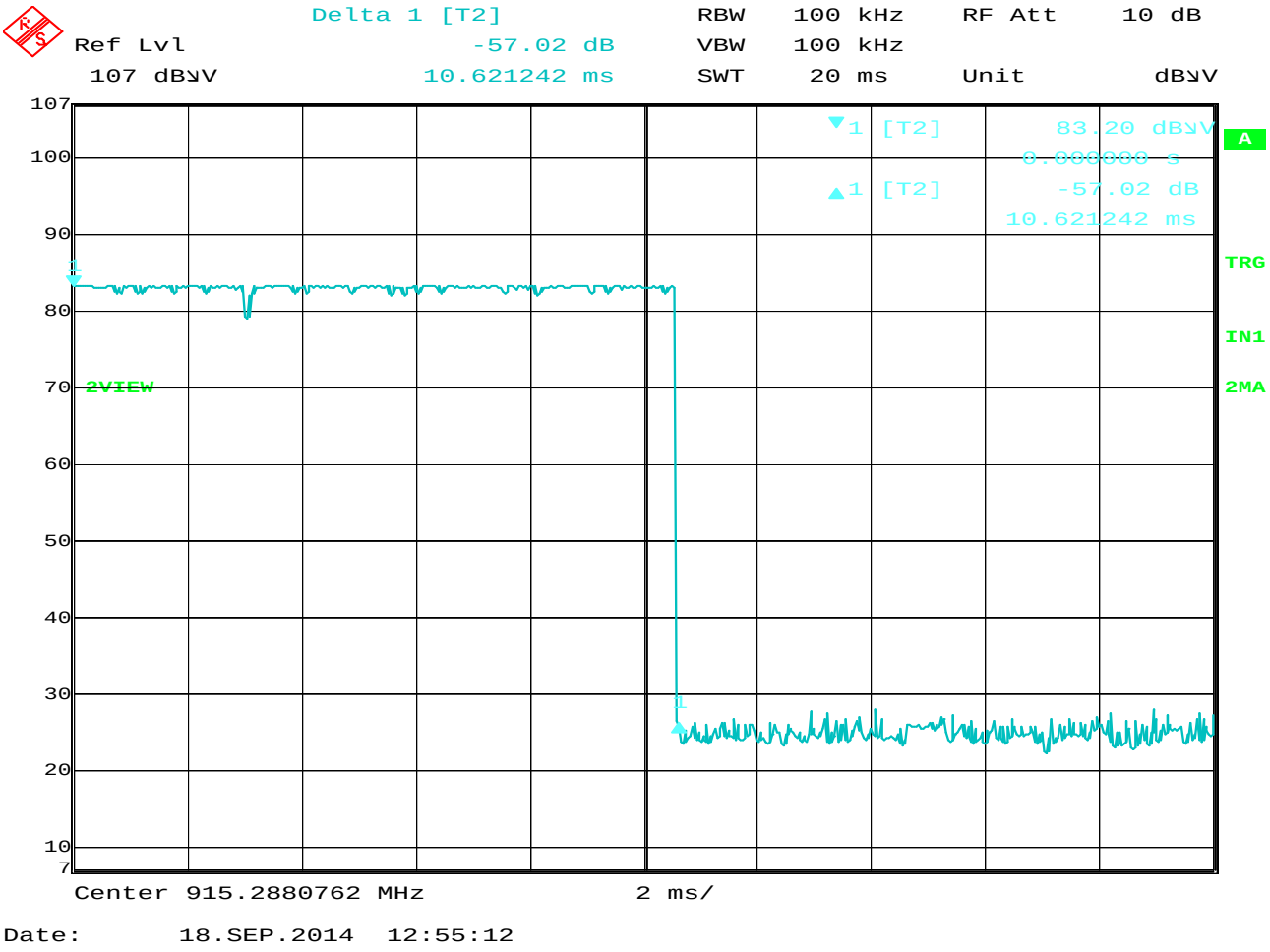
Freq. (MHz)	Ant Pol	Wide BW Meter Reading (dBuV)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
904.90	H	97.6	22.1	2.2	2.5	21.8	36.0	-14.2
904.90	V	105.9	31.9	2.2	2.5	31.6	36.0	-4.4
914.50	H	98.4	24.6	2.2	2.5	24.3	36.0	-11.7
914.50	V	104.9	31.3	2.2	2.5	31.0	36.0	-5.0
924.50	H	99.5	25.4	2.2	2.5	25.1	36.0	-10.9
924.50	V	103.9	31.2	2.2	2.5	30.9	36.0	-5.1

EIRP (dBm) = Meter Reading (dBuV) + Matched S.G. Reading (dBm) + Ant. Gain (dB) – Cable Loss (dB)

Manufacturer : Badger Meter
Model No. : ORION SE3 Endpoint
Serial No. : 30148151
Mode : Mobile Mode
Test Performed : Effective Isotropic Radiated Power (EIRP)
Test Date : September 17 and 18, 2014
Test Distance : 3 meters
Notes :

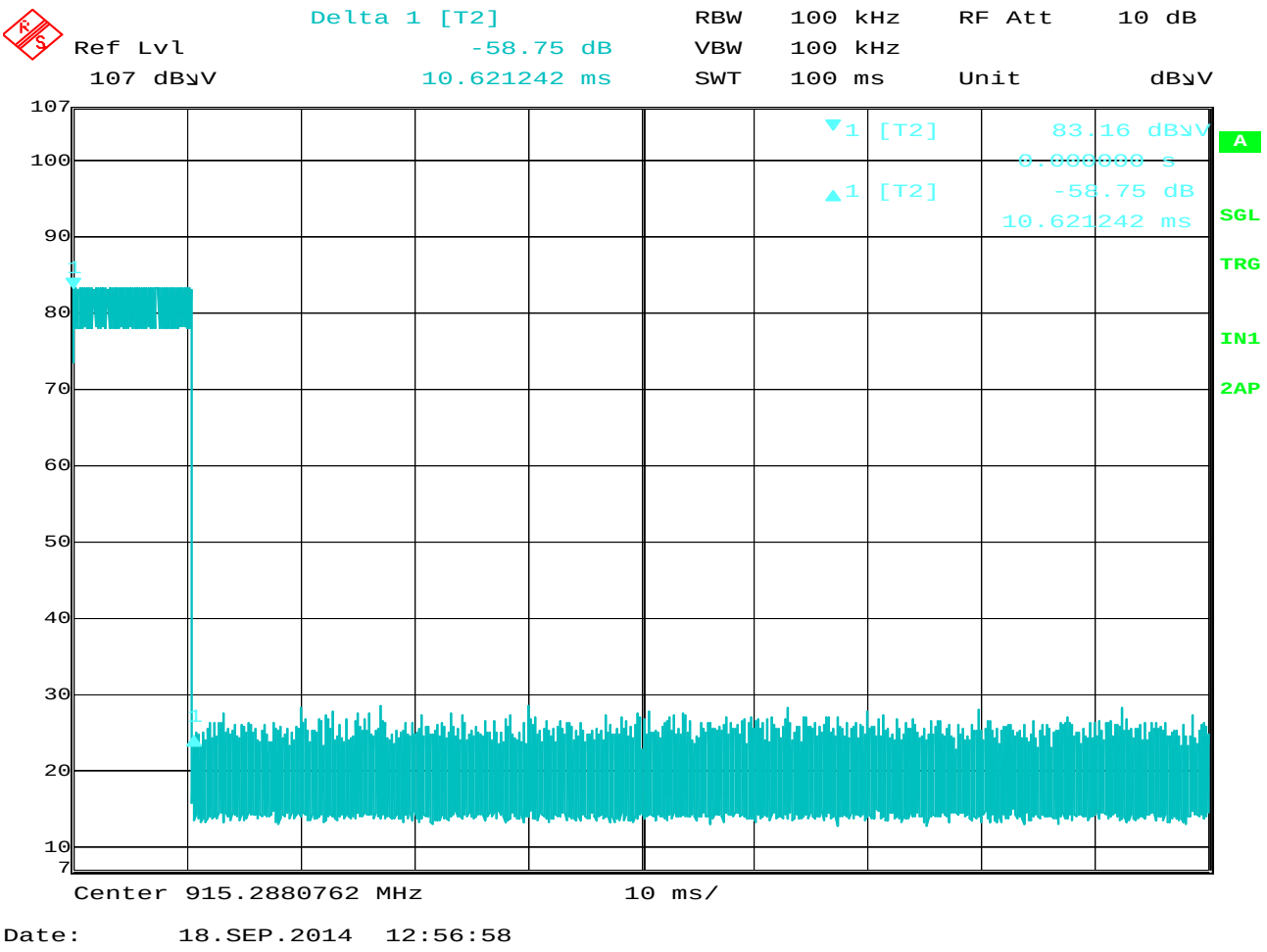
Freq. (MHz)	Ant Pol	Wide BW Meter Reading (dBuV)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
904.90	H	81.2	5.9	2.2	2.5	5.6	30.0	-24.4
904.90	V	85.7	12.0	2.2	2.5	11.7	30.0	-18.3
914.50	H	78.5	4.7	2.2	2.5	4.4	30.0	-25.6
914.50	V	85.0	11.6	2.2	2.5	11.3	30.0	-18.7
923.675	H	77.9	4.3	2.2	2.5	4.0	30.0	-26.0
923.675	V	84.5	12.0	2.2	2.5	11.7	30.0	-18.3

EIRP (dBm) = Meter Reading (dBuV) + Matched S.G. Reading (dBm) + Ant. Gain (dB) – Cable Loss (dB)



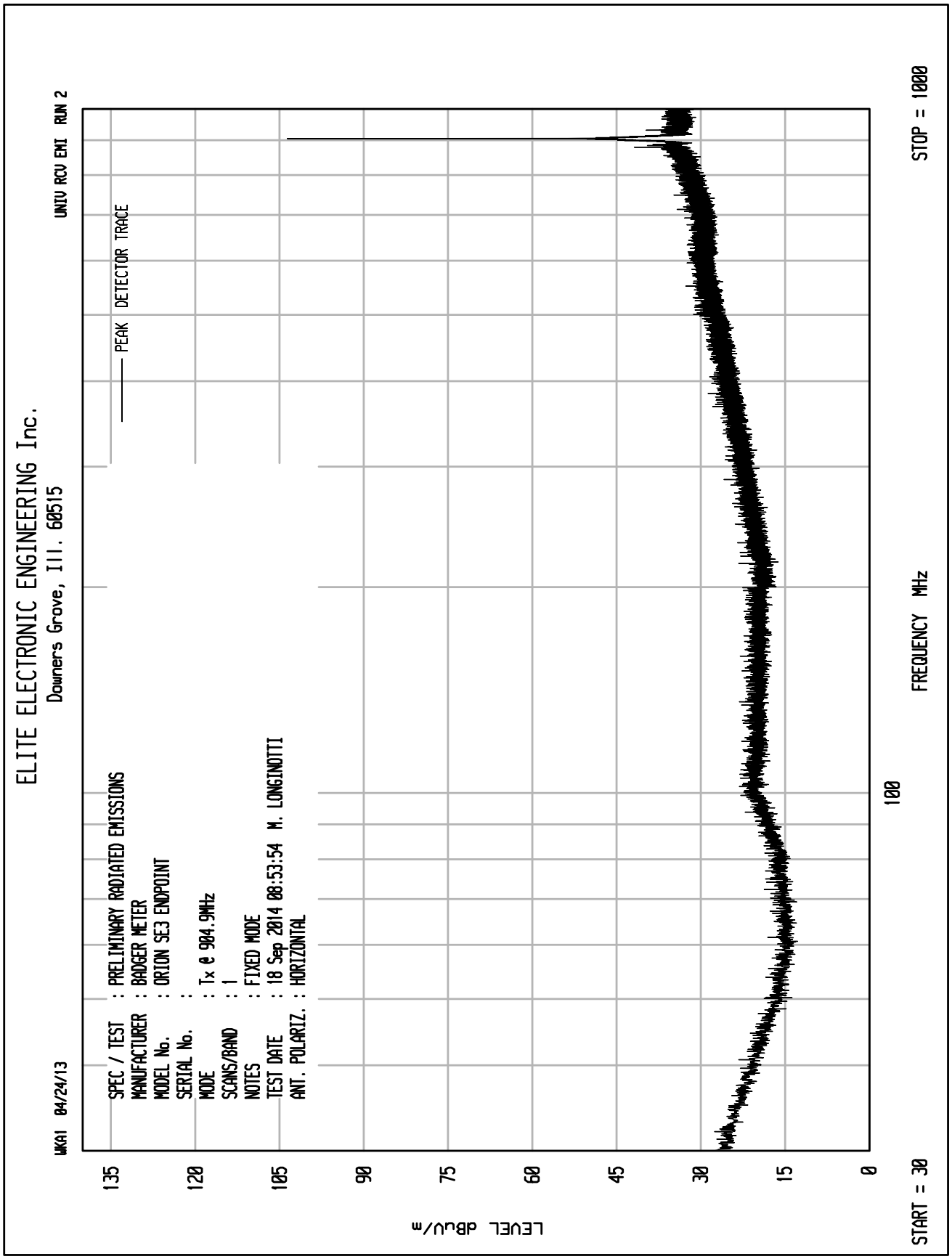
Duty Cycle Correction Factor

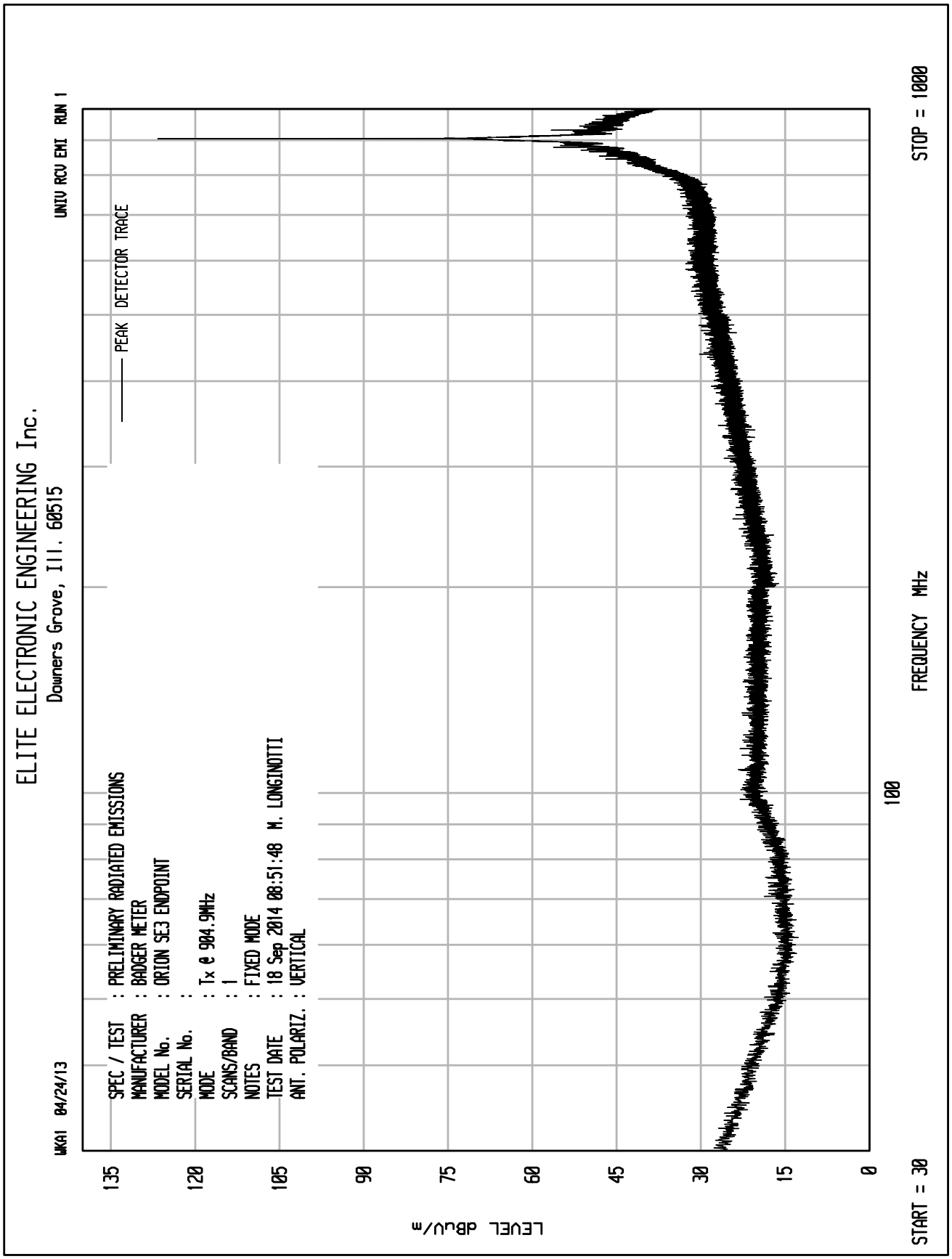
MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	ORION SE3 Endpoint
SERIAL NUMBER	:	30148151
TEST MODE	:	Hopping Enabled, Mobile Mode
TEST PARAMETERS	:	Dwell Time Per Hop
NOTES	:	Dwell Time per Hop = 10.62msec
EQUIPMENT USED	:	RBA0, NTA3

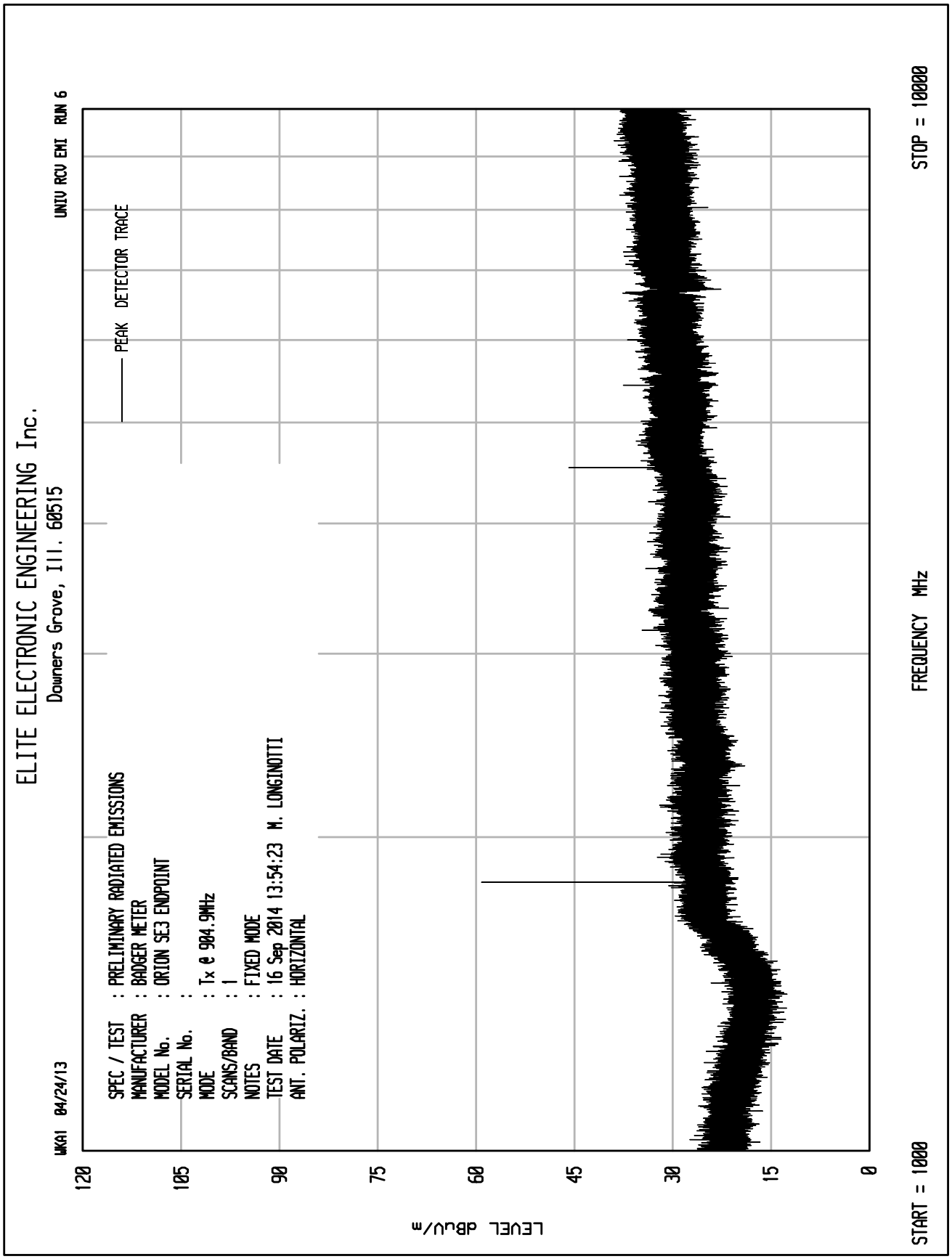


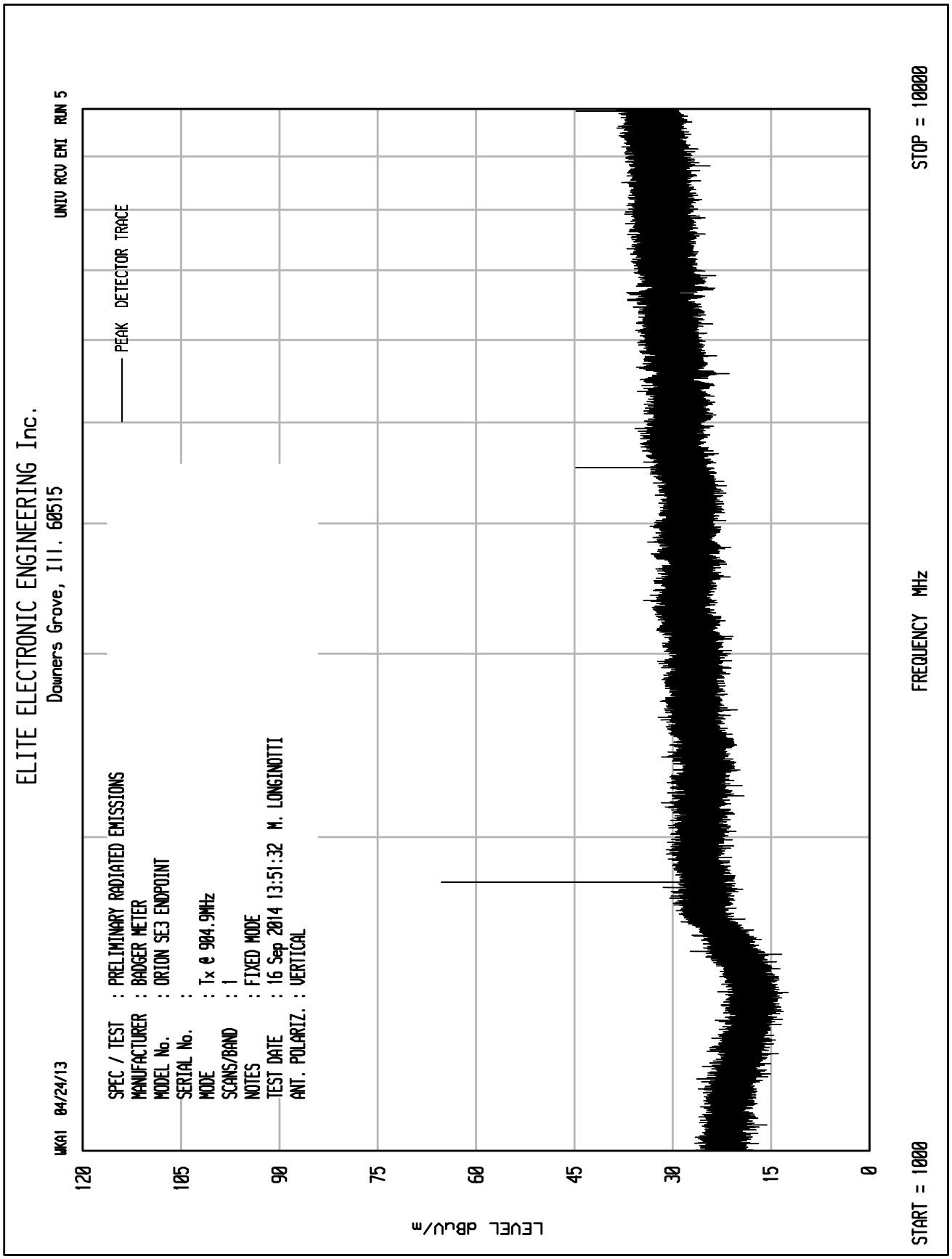
Duty Cycle Correction Factor

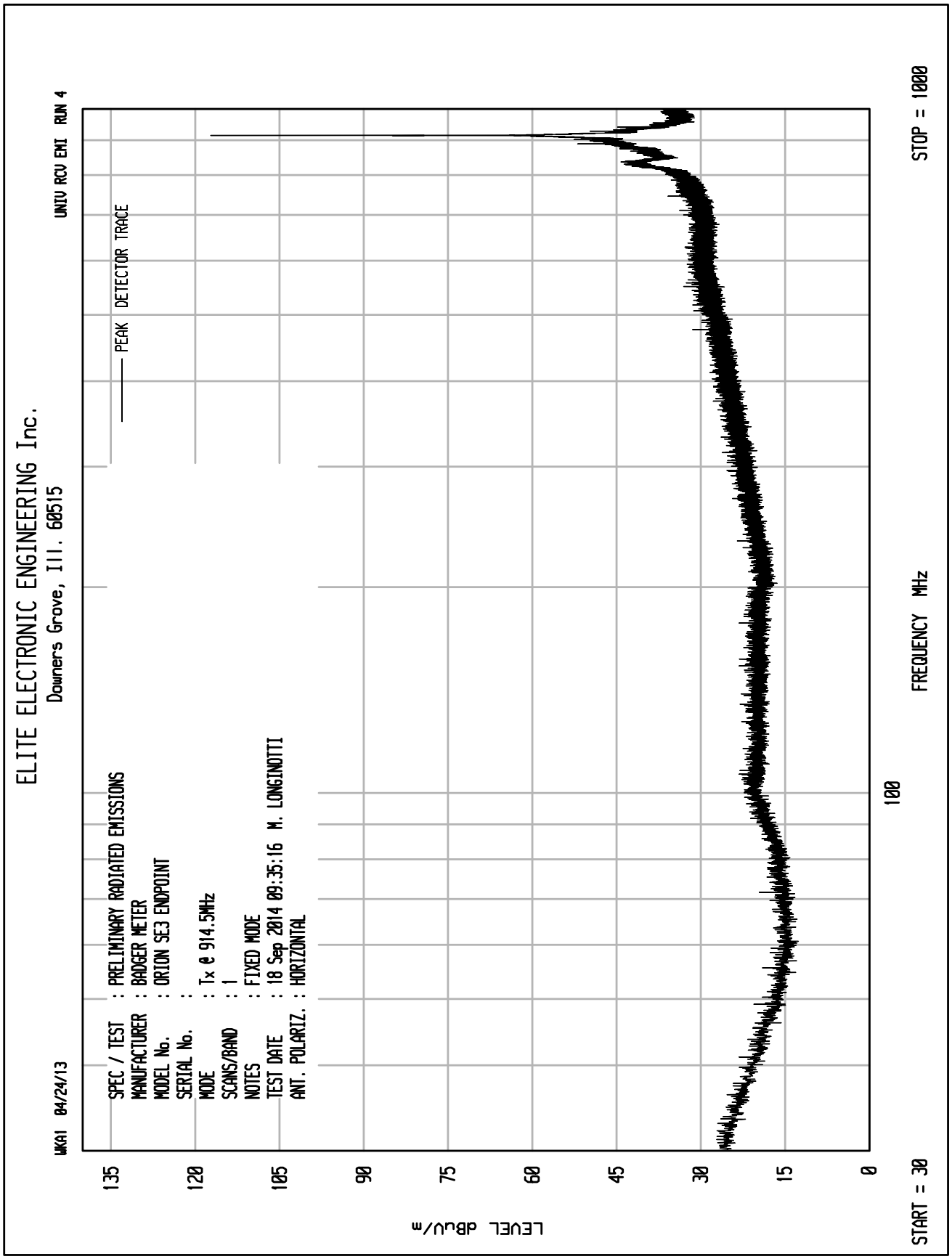
MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	ORION SE3 Endpoint
SERIAL NUMBER	:	30148151
TEST MODE	:	Hopping Enabled, Mobile Mode
TEST PARAMETERS	:	Duty Cycle Correction Factor
NOTES	:	Duty Cycle Correction Factor = 20 x log(((Dwell Time per Hop) x (number of hops in a 100msec period))/100msec)
	:	Duty Cycle Correction Factor = 20 x log (((10.62msec) x (1))/100msec)
	:	Duty Cycle Correction Factor = 20 x log (0.1062) = -19.48dB
EQUIPMENT USED	:	RBA0, NTA3

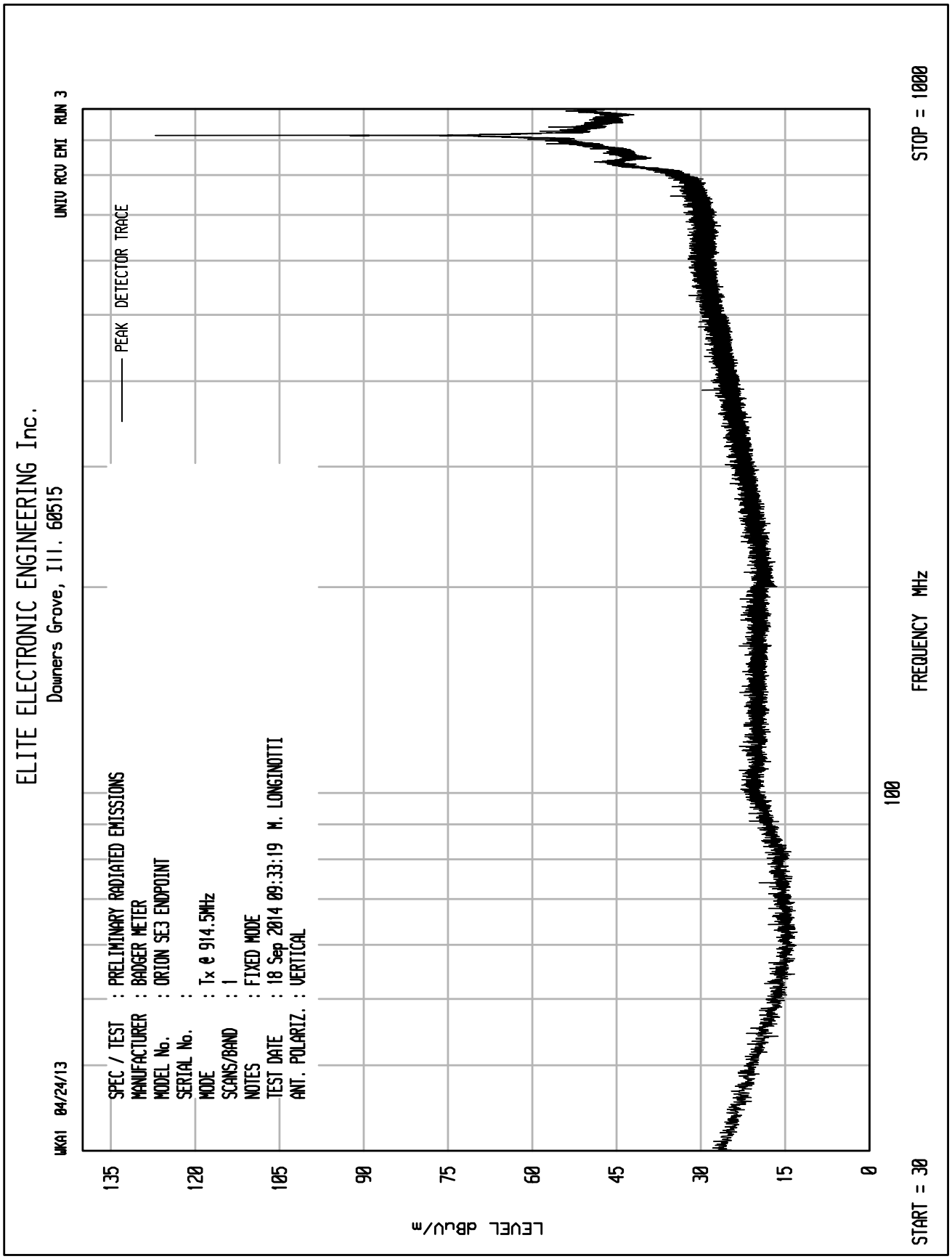

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 2
WKA1 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE3 ENDPOINT
SERIAL No. :
MODE : Tx @ 904.9MHz
SCANS/BAND : 1
NOTES : FIXED MODE
TEST DATE : 18 Sep 2014 08:53:54 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
135
120
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000

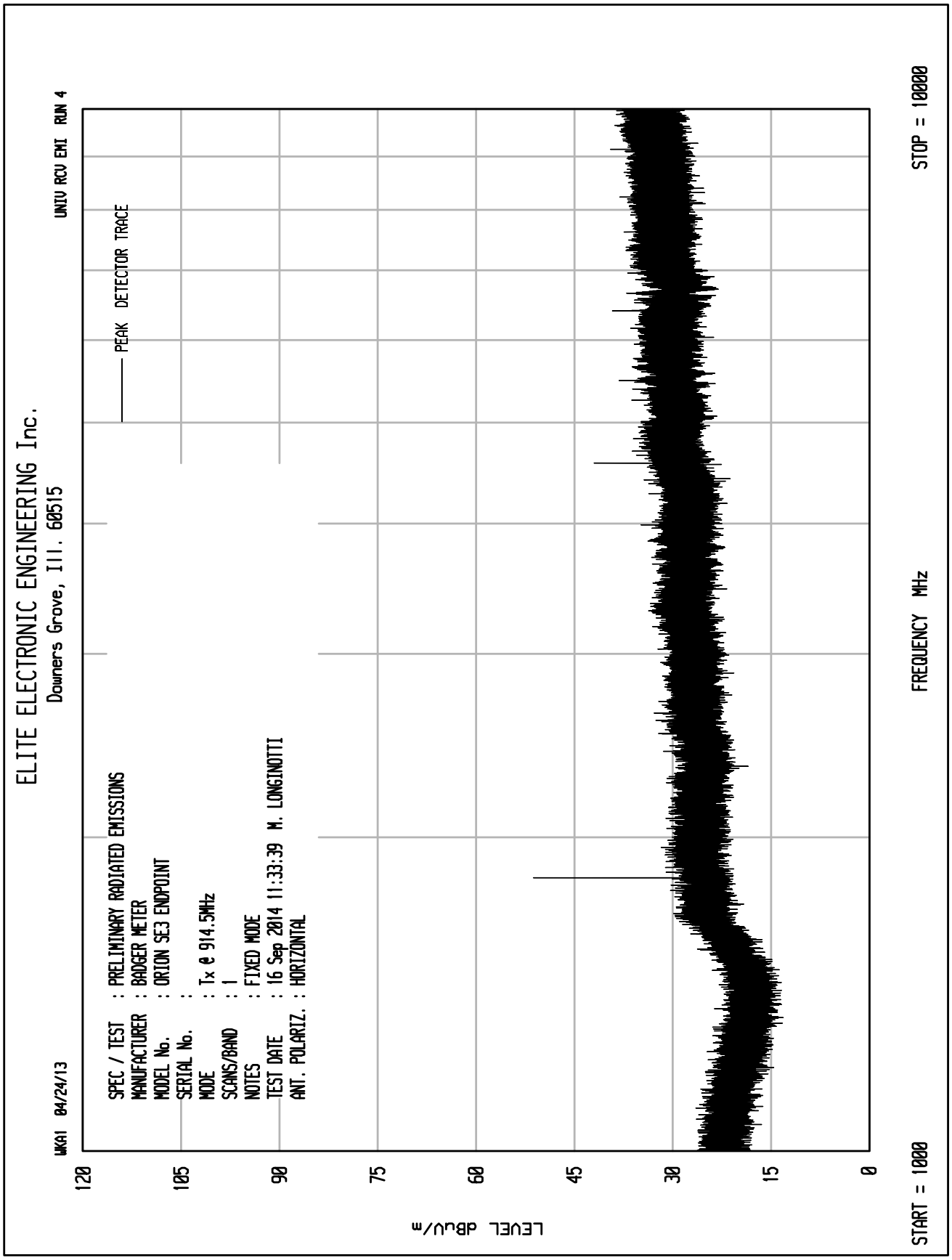

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 1
WKAI 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE3 ENDPOINT
SERIAL No. :
MODE : Tx @ 904.9MHz
SCANS/BAND : 1
NOTES : FIXED MODE
TEST DATE : 18 Sep 2014 08:51:48 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
135
120
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000

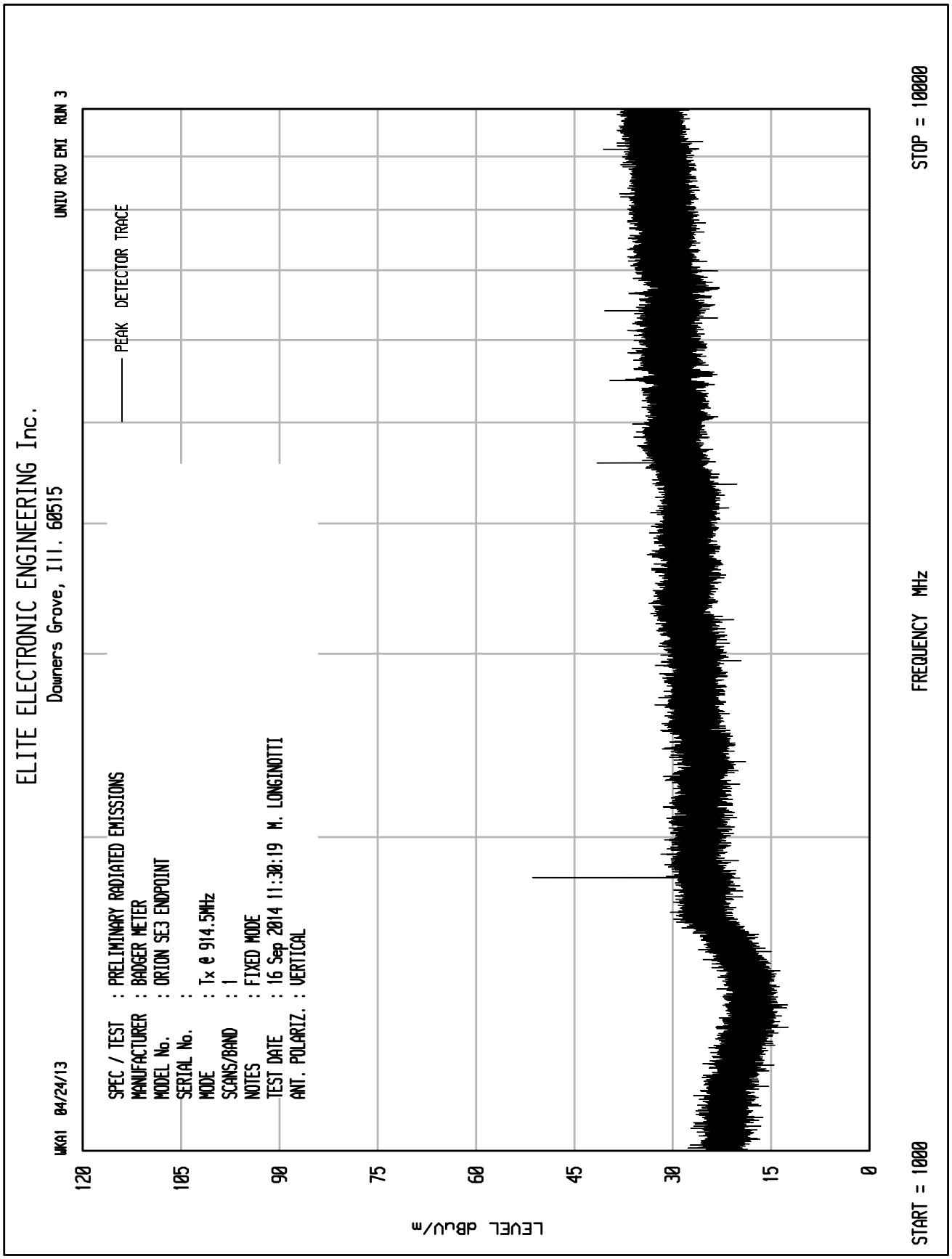

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 6
WKAI 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE3 ENDPOINT
SERIAL No. : :
MODE : Tx @ 904.9MHz
SCANS/BAND : 1
NOTES : FIXED MODE
TEST DATE : 16 Sep 2014 13:54:23 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000

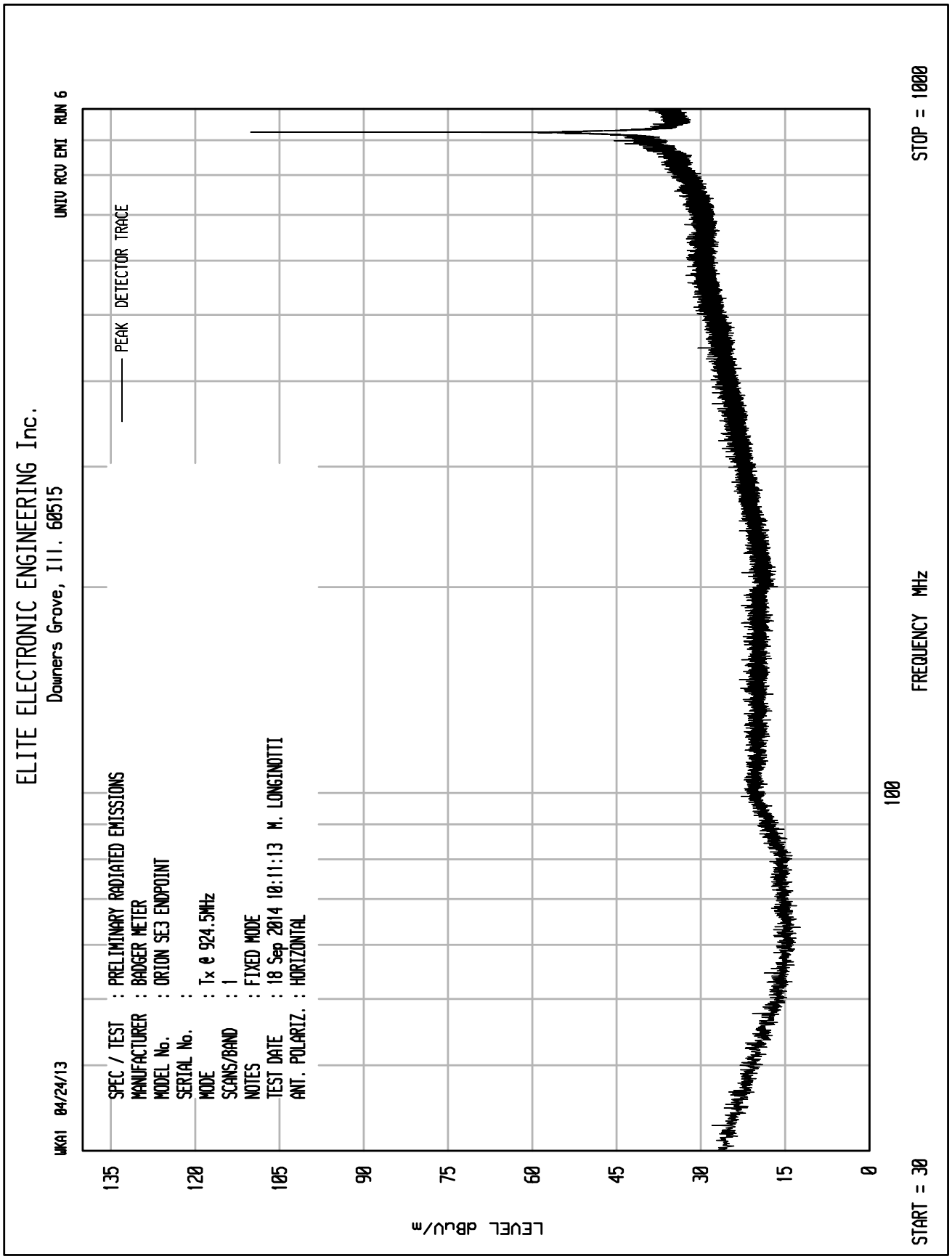

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 5
WKAI 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE3 ENDPOINT
SERIAL No. :
MODE : Tx @ 904.9MHz
SCANS/BAND : 1
NOTES : FIXED MODE
TEST DATE : 16 Sep 2014 13:51:32 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000

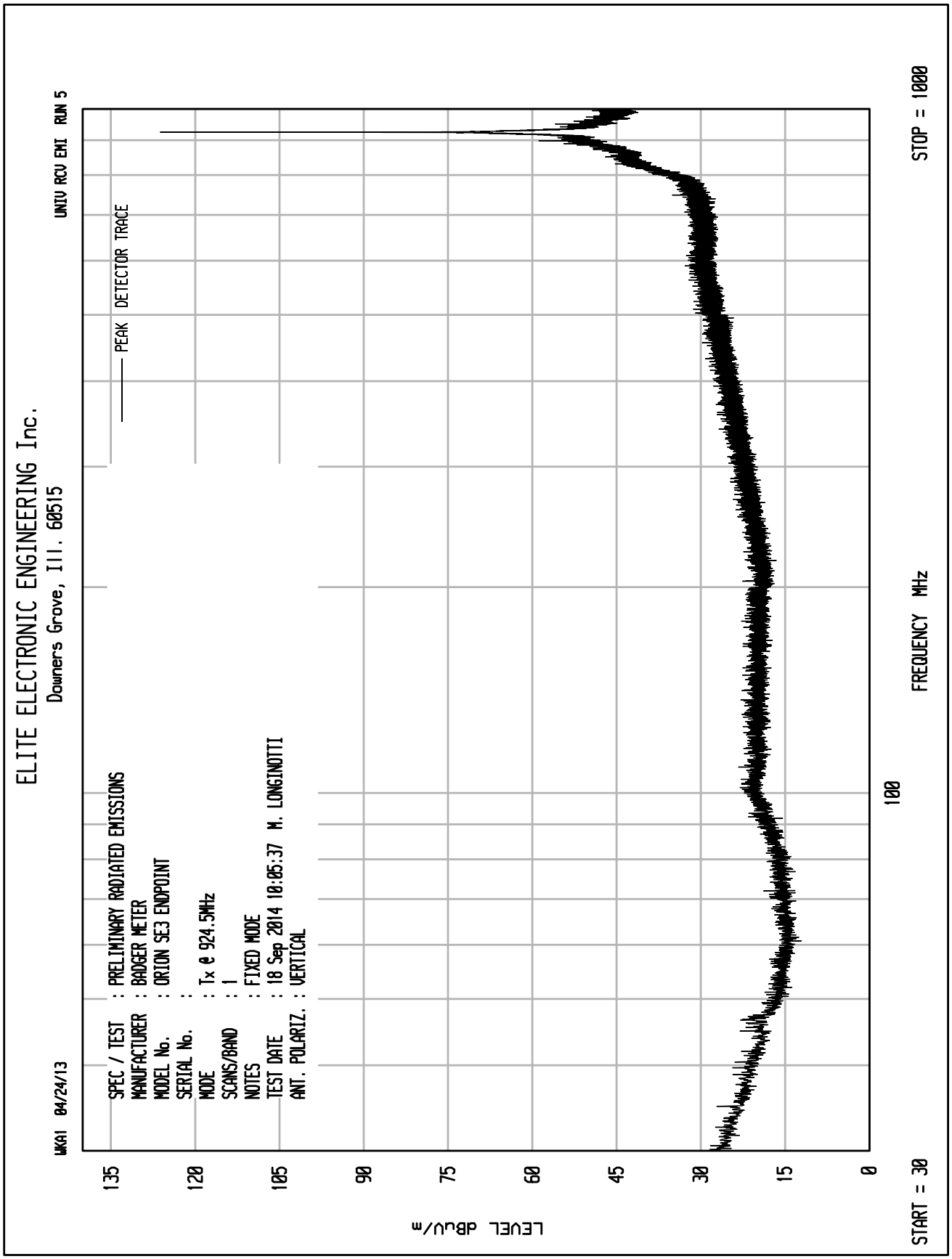

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 4
WKAI 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE3 ENDPOINT
SERIAL No. :
MODE : Tx @ 914.5MHz
SCANS/BAND : 1
NOTES : FIXED MODE
TEST DATE : 18 Sep 2014 09:35:16 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
135
120
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000

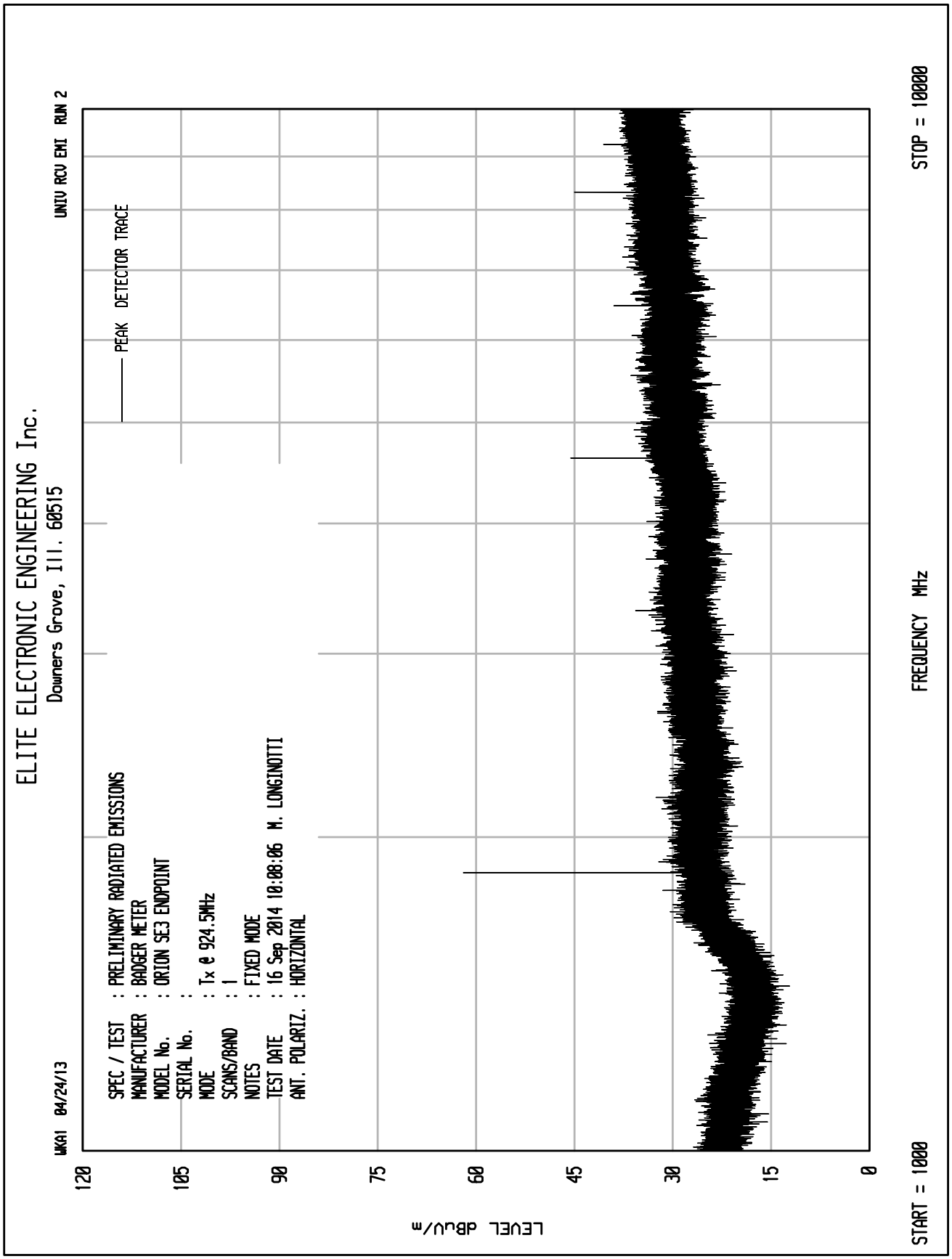

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 3
WKAI 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE3 ENDPOINT
SERIAL No. :
MODE : Tx @ 914.5MHz
SCANS/BAND : 1
NOTES : FIXED MODE
TEST DATE : 18 Sep 2014 09:33:19 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
135
120
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000

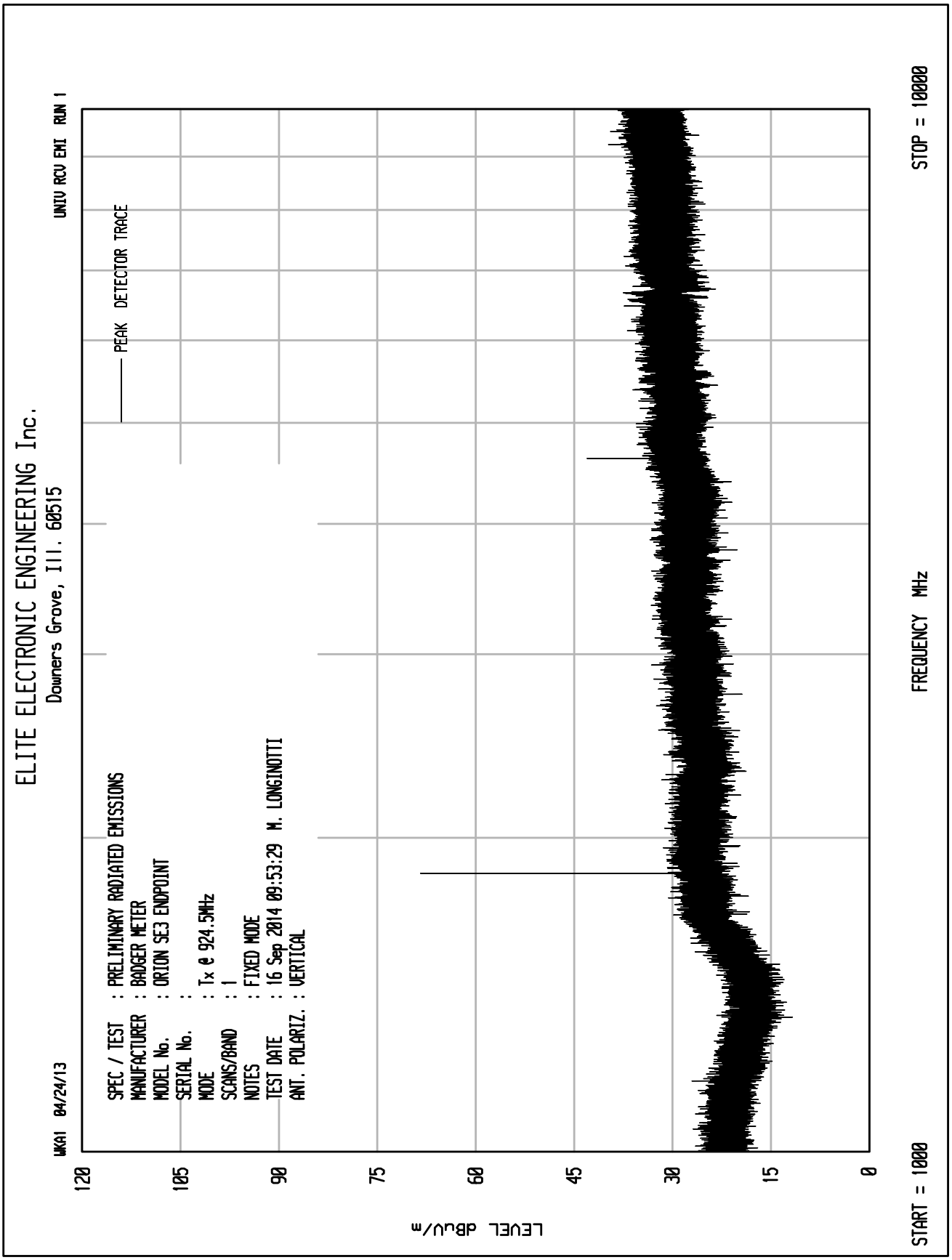

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 4
WKAI 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE3 ENDPOINT
SERIAL No. : :
MODE : Tx @ 914.5MHz
SCANS/BAND : 1
NOTES : FIXED MODE
TEST DATE : 16 Sep 2014 11:33:39 M. LONGINOTTI
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 3
WKAI 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE3 ENDPOINT
SERIAL No. :
MODE : Tx @ 914.5MHz
SCANS/BAND : 1
NOTES : FIXED MODE
TEST DATE : 16 Sep 2014 11:30:19 M. LONGINOTTI
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 6
WKAI 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE3 ENDPOINT
SERIAL No. :
MODE : Tx @ 924.5MHz
SCANS/BAND : 1
NOTES : FIXED MODE
TEST DATE : 18 Sep 2014 10:11:13 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
135
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
WKAI 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE3 ENDPOINT
SERIAL No. :
MODE : Tx @ 924.5MHz
SCANS/BAND : 1
NOTES : FIXED MODE
TEST DATE : 18 Sep 2014 10:05:37 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
135
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
WKAI 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE3 ENDPOINT
SERIAL No. : :
MODE : Tx @ 924.5MHz
SCANS/BAND : 1
NOTES : FIXED MODE
TEST DATE : 16 Sep 2014 10:08:06 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000



Manufacturer : Badger Meter

Model No. : ORION SE3 Endpoint
Serial No. : 30148151
Test Performed : Spurious Radiated Emissions NOT in restricted bands
Test Mode : Tx @ 904.9MHz, Fixed Mode, Power = 3C
Test Date : September 17 and 18, 2014
Test Distance : 3 meters
Notes : Peak Readings with a 100kHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
904.90	H	97.5		1.6	20.6	0.0	119.6	960497.5		
904.90	V	105.9		1.6	20.6	0.0	128.0	2526365.7		
1809.80	H	70.7		2.2	30.7	-39.8	63.9	1563.0	252636.6	-44.2
1809.80	V	76.1		2.2	30.7	-39.8	69.3	2910.4	252636.6	-38.8
6334.30	H	42.0		4.3	35.8	-39.0	43.1	142.2	252636.6	-65.0
6334.30	V	42.6		4.3	35.8	-39.0	43.7	152.4	252636.6	-64.4
7239.20	H	44.8		4.7	35.6	-39.0	46.1	200.9	252636.6	-62.0
7239.20	V	40.9		4.7	35.6	-39.0	42.2	128.2	252636.6	-65.9

Manufacturer : Badger Meter
Model No. : ORION SE3 Endpoint
Serial No. : 30148151
Test Performed : Spurious Radiated Emissions in restricted bands
Test Mode : Tx @ 904.9MHz, Fixed Mode, Power = 3C
Test Date : September 17 and 18, 2014
Test Distance : 3 meters
Notes : Peak Readings with a 1MHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
2714.70	H	48.8	Ambient	2.8	32.7	-39.5	44.8	173.7	5000.0	-29.2
2714.70	V	49.0	Ambient	2.8	32.7	-39.5	45.0	177.7	5000.0	-29.0
3619.60	H	49.2	Ambient	3.2	33.5	-38.9	47.0	225.0	5000.0	-26.9
3619.60	V	50.3	Ambient	3.2	33.5	-38.9	48.1	255.4	5000.0	-25.8
4524.50	H	55.6		3.6	34.5	-38.9	54.8	550.7	5000.0	-19.2
4524.50	V	52.9		3.6	34.5	-38.9	52.1	403.5	5000.0	-21.9
5429.40	H	50.9		3.9	34.9	-39.0	50.7	342.5	5000.0	-23.3
5429.40	V	46.8		3.9	34.9	-39.0	46.6	213.7	5000.0	-27.4
8144.10	H	48.8		4.9	35.9	-39.0	50.7	341.7	5000.0	-23.3
8144.10	V	48.1		4.9	35.9	-39.0	50.0	315.2	5000.0	-24.0
9049.00	H	49.6		5.0	36.2	-38.9	51.9	391.7	5000.0	-22.1
9049.00	V	48.9		5.0	36.2	-38.9	51.2	361.4	5000.0	-22.8

Manufacturer : Badger Meter
Model No. : ORION SE3 Endpoint
Serial No. : 30148151
Test Performed : Spurious Radiated Emissions in restricted bands
Test Mode : Tx @ 904.9MHz, Fixed Mode, Power = 3C
Test Date : September 17 and 18, 2014
Test Distance : 3 meters
Notes : Average Readings with a 1MHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Average Total dBuV/m at 3m	Average Total uV/m at 3 m	Average Limit uV/m at 3 m	Margin (dB)
2714.70	H	37.00	Ambient	2.8	32.7	-39.5	33.0	44.6	500.0	-21.0
2714.70	V	37.0	Ambient	2.8	32.7	-39.5	33.0	44.6	500.0	-21.0
3619.60	H	39.5		3.2	33.5	-38.9	37.3	73.6	500.0	-16.6
3619.60	V	39.1		3.2	33.5	-38.9	36.9	70.3	500.0	-17.0
4524.50	H	52.1		3.6	34.5	-38.9	51.3	368.0	500.0	-2.7
4524.50	V	46.9		3.6	34.5	-38.9	46.1	202.2	500.0	-7.9
5429.40	H	45.7		3.9	34.9	-39.0	45.5	188.2	500.0	-8.5
5429.40	V	37.4		3.9	34.9	-39.0	37.2	72.4	500.0	-16.8
8144.10	H	40.6		4.9	35.9	-39.0	42.5	132.9	500.0	-11.5
8144.10	V	37.1		4.9	35.9	-39.0	39.0	88.8	500.0	-15.0
9049.00	H	40.6		5.0	36.2	-38.9	42.9	139.0	500.0	-11.1
9049.00	V	37.4		5.0	36.2	-38.9	39.7	96.1	500.0	-14.3

Manufacturer : Badger Meter
Model No. : ORION SE3 Endpoint
Serial No. : 30148151
Test Performed : Spurious Radiated Emissions NOT in restricted bands
Test Mode : Tx @ 914.5MHz, Fixed Mode, Power = 3C
Test Date : September 17 and 18, 2014
Test Distance : 3 meters
Notes : Peak Readings with a 100kHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
914.50	H	98.4		1.6	20.6	0.0	120.6	1067844.6		
914.50	V	104.9		1.6	20.6	0.0	127.1	2256877.8		
1829.00	H	71.0		2.2	30.8	-39.7	64.3	1635.1	225687.8	-42.8
1829.00	V	76.6		2.2	30.8	-39.7	69.9	3115.6	225687.8	-37.2
5487.00	H	49.9		3.9	34.9	-39.0	49.7	304.2	225687.8	-57.4
5487.00	V	45.4		3.9	34.9	-39.0	45.2	181.2	225687.8	-61.9
6401.50	H	47.8		4.3	35.9	-39.0	49.0	282.8	225687.8	-58.0
6401.50	V	41.9		4.3	35.9	-39.0	43.1	143.4	225687.8	-63.9

Manufacturer : Badger Meter
Model No. : ORION SE3 Endpoint
Serial No. : 30148151
Test Performed : Spurious Radiated Emissions in restricted bands
Test Mode : Tx @ 914.5MHz, Fixed Mode, Power = 3C
Test Date : September 17 and 18, 2014
Test Distance : 3 meters
Notes : Peak Readings with a 1MHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
2743.50	H	49.5	Ambient	2.8	32.8	-39.5	45.6	190.2	5000.0	-28.4
2743.50	V	48.0	Ambient	2.8	32.8	-39.5	44.1	160.1	5000.0	-29.9
3658.00	H	47.8	Ambient	3.3	33.5	-38.9	45.7	192.7	5000.0	-28.3
3658.00	V	47.4	Ambient	3.3	33.5	-38.9	45.3	184.1	5000.0	-28.7
4572.50	H	55.0		3.6	34.5	-38.9	54.2	514.3	5000.0	-19.8
4572.50	V	52.7		3.6	34.5	-38.9	51.9	394.7	5000.0	-22.1
7316.00	H	49.5		4.7	35.6	-39.0	50.8	347.5	5000.0	-23.2
7316.00	V	47.9		4.7	35.6	-39.0	49.2	289.0	5000.0	-24.8
8230.50	H	49.3		4.9	35.9	-39.0	51.2	363.7	5000.0	-22.8
8230.50	V	47.9		4.9	35.9	-39.0	49.8	309.6	5000.0	-24.2
9145.00	H	50.0		5.0	36.2	-38.9	52.3	412.2	5000.0	-21.7
9145.00	V	48.3		5.0	36.2	-38.9	50.6	338.9	5000.0	-23.4

Manufacturer : Badger Meter
Model No. : ORION SE3 Endpoint
Serial No. : 30148151
Test Performed : Spurious Radiated Emissions in restricted bands
Test Mode : Tx @ 914.5MHz, Fixed Mode, Power = 3C
Test Date : September 17 and 18, 2014
Test Distance : 3 meters
Notes : Average Readings with a 1MHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Average Total dBuV/m at 3m	Average Total uV/m at 3 m	Average Limit uV/m at 3 m	Margin (dB)
2743.50	H	37.60	Ambient	2.8	32.8	-39.5	33.7	48.3	500.0	-20.3
2743.50	V	36.9	Ambient	2.8	32.8	-39.5	33.0	44.6	500.0	-21.0
3658.00	H	37.7		3.3	33.5	-38.9	35.6	60.2	500.0	-18.4
3658.00	V	37.1		3.3	33.5	-38.9	35.0	56.2	500.0	-19.0
4572.50	H	50.2		3.6	34.5	-38.9	49.4	296.0	500.0	-4.6
4572.50	V	47.0		3.6	34.5	-38.9	46.2	204.8	500.0	-7.8
7316.00	H	40.9		4.7	35.6	-39.0	42.2	129.1	500.0	-11.8
7316.00	V	37.6		4.7	35.6	-39.0	38.9	88.3	500.0	-15.1
8230.50	H	40.4		4.9	35.9	-39.0	42.3	130.5	500.0	-11.7
8230.50	V	38.0		4.9	35.9	-39.0	39.9	99.0	500.0	-14.1
9145.00	H	41.1		5.0	36.2	-38.9	43.4	148.0	500.0	-10.6
9145.00	V	38.4		5.0	36.2	-38.9	40.7	108.4	500.0	-13.3

Manufacturer : Badger Meter
Model No. : ORION SE3 Endpoint
Serial No. : 30148151
Test Performed : Spurious Radiated Emissions NOT in restricted bands
Test Mode : Tx @ 924.5MHz, Fixed Mode, Power = 3C
Test Date : September 17 and 18, 2014
Test Distance : 3 meters
Notes : Peak Readings with a 100kHz RBW

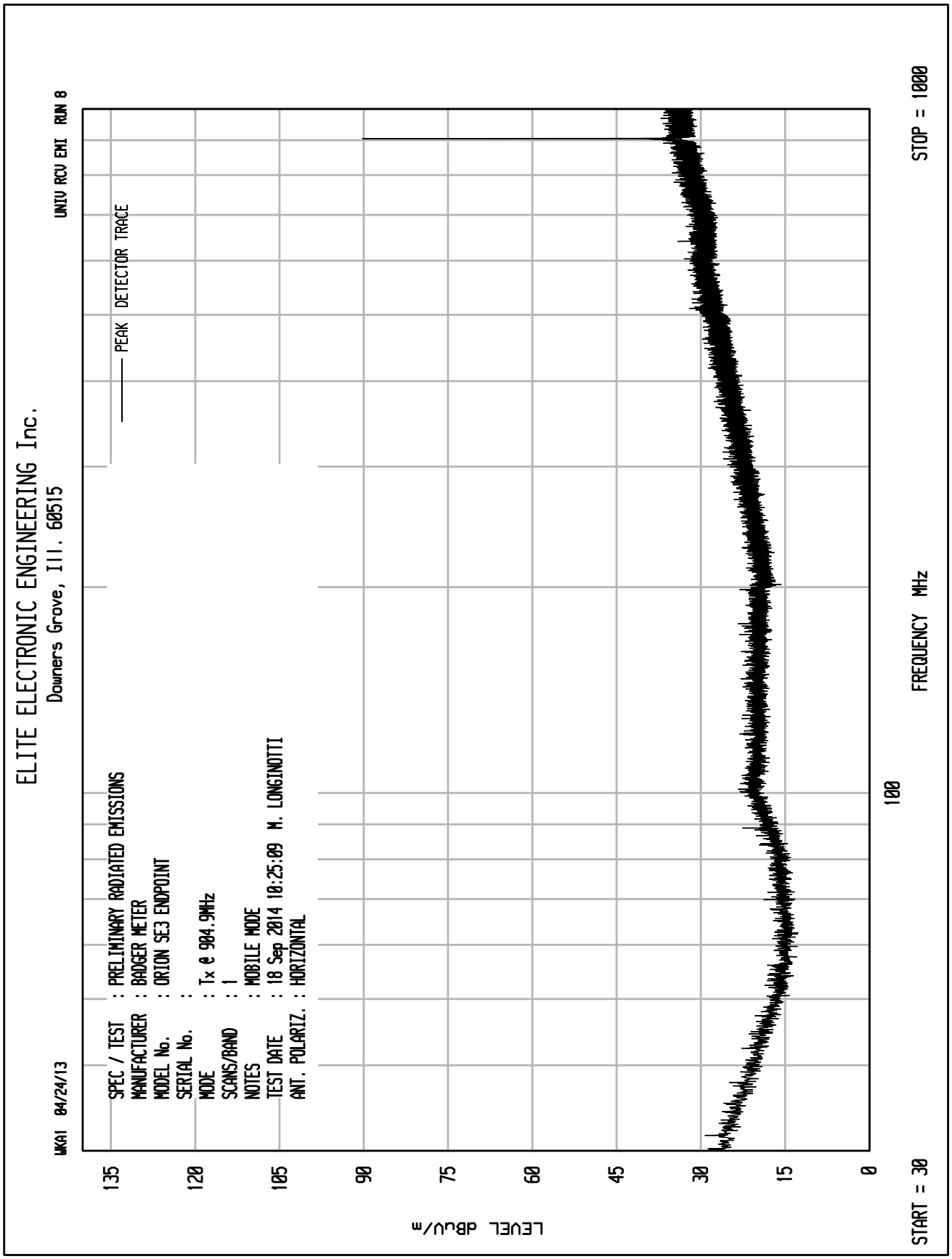
Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
924.50	H	99.4		1.6	19.9	0.0	120.9	1110274.5		
924.50	V	103.9		1.6	19.9	0.0	125.4	1863933.4		
1849.00	H	71.2		2.3	30.8	-39.7	64.6	1691.5	186393.3	-40.8
1849.00	V	75.9		2.3	30.8	-39.7	69.3	2905.8	186393.3	-36.1
5547.00	H	46.4		4.0	34.8	-39.0	46.2	203.2	186393.3	-59.2
5547.00	V	44.2		4.0	34.8	-39.0	44.0	157.8	186393.3	-61.4
6471.50	H	44.7		4.3	36.0	-39.0	46.0	199.8	186393.3	-59.4
6471.50	V	44.8		4.3	36.0	-39.0	46.1	202.1	186393.3	-59.3
9245.00	H	42.4		5.0	36.1	-38.9	44.7	172.3	186393.3	-60.7
9245.00	V	42.2		5.0	36.1	-38.9	44.5	168.4	186393.3	-60.9

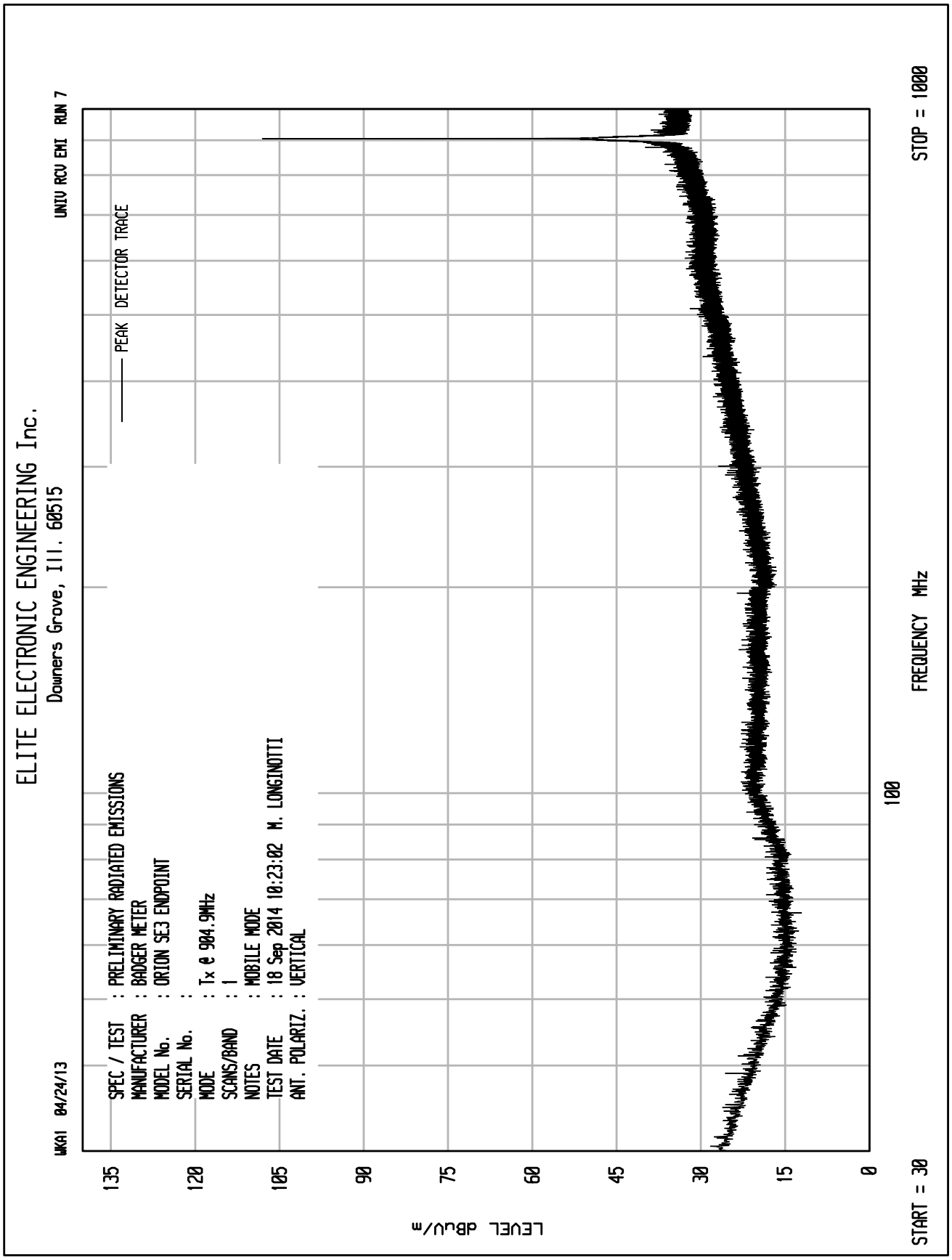
Manufacturer : Badger Meter
Model No. : ORION SE3 Endpoint
Serial No. : 30148151
Test Performed : Spurious Radiated Emissions in restricted bands
Test Mode : Tx @ 924.5MHz, Fixed Mode, Power = 3C
Test Date : September 17 and 18, 2014
Test Distance : 3 meters
Notes : Peak Readings with a 1MHz RBW

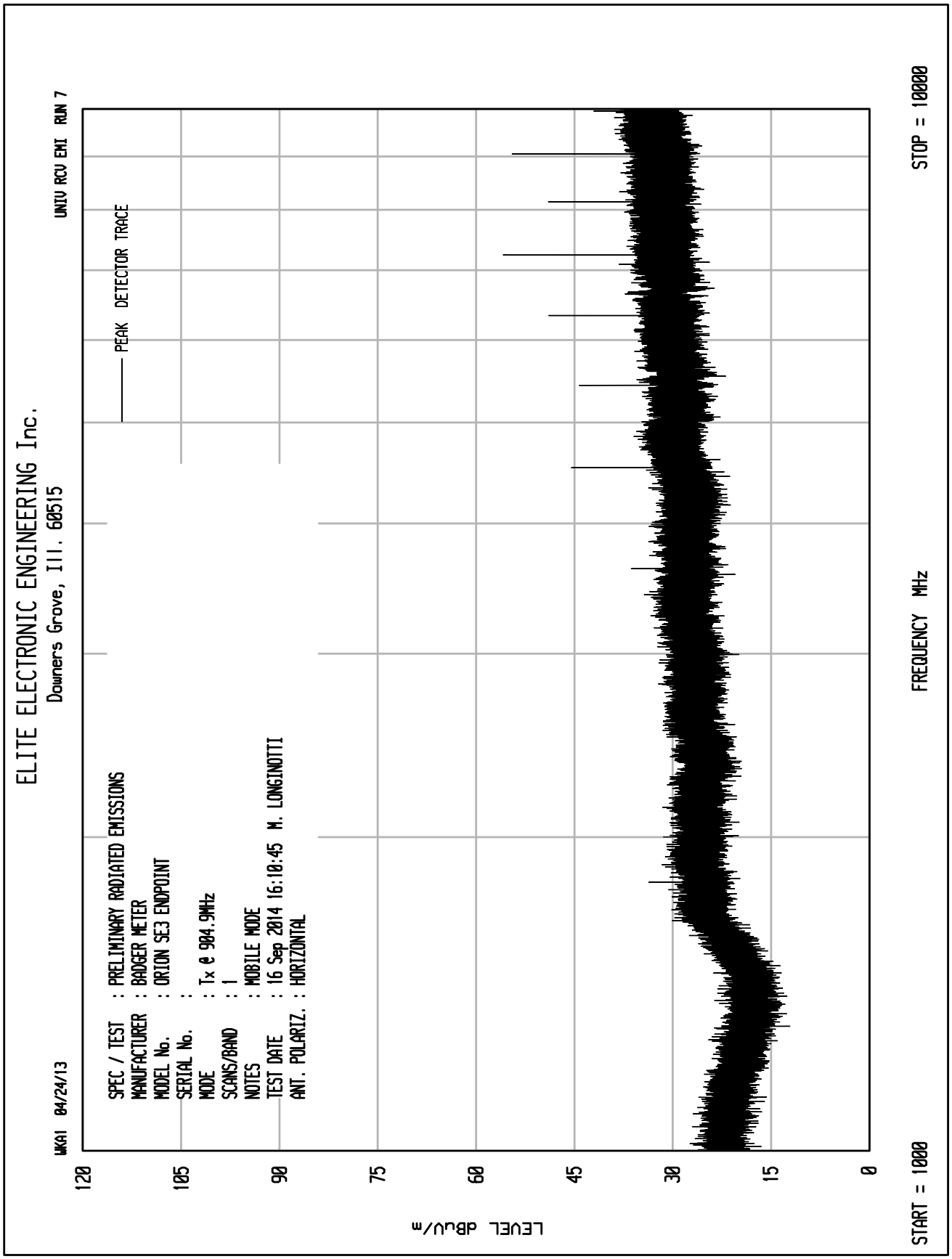
Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
2773.50	H	49.3	Ambient	2.8	32.8	-39.5	45.5	187.9	5000.0	-28.5
2773.50	V	49.2	Ambient	2.8	32.8	-39.5	45.4	185.7	5000.0	-28.6
3698.00	H	50.7	Ambient	3.3	33.5	-38.9	48.7	270.9	5000.0	-25.3
3698.00	V	49.1	Ambient	3.3	33.5	-38.9	47.1	225.3	5000.0	-26.9
4622.50	H	56.4		3.6	34.6	-38.9	55.7	607.9	5000.0	-18.3
4622.50	V	52.9		3.6	34.6	-38.9	52.2	406.3	5000.0	-21.8
7396.00	H	49.6		4.7	35.7	-39.0	51.0	353.4	5000.0	-23.0
7396.00	V	49.0		4.7	35.7	-39.0	50.4	329.8	5000.0	-23.6
8320.50	H	50.2		4.9	35.9	-39.0	52.1	402.2	5000.0	-21.9
8320.50	V	49.5		4.9	35.9	-39.0	51.4	371.0	5000.0	-22.6

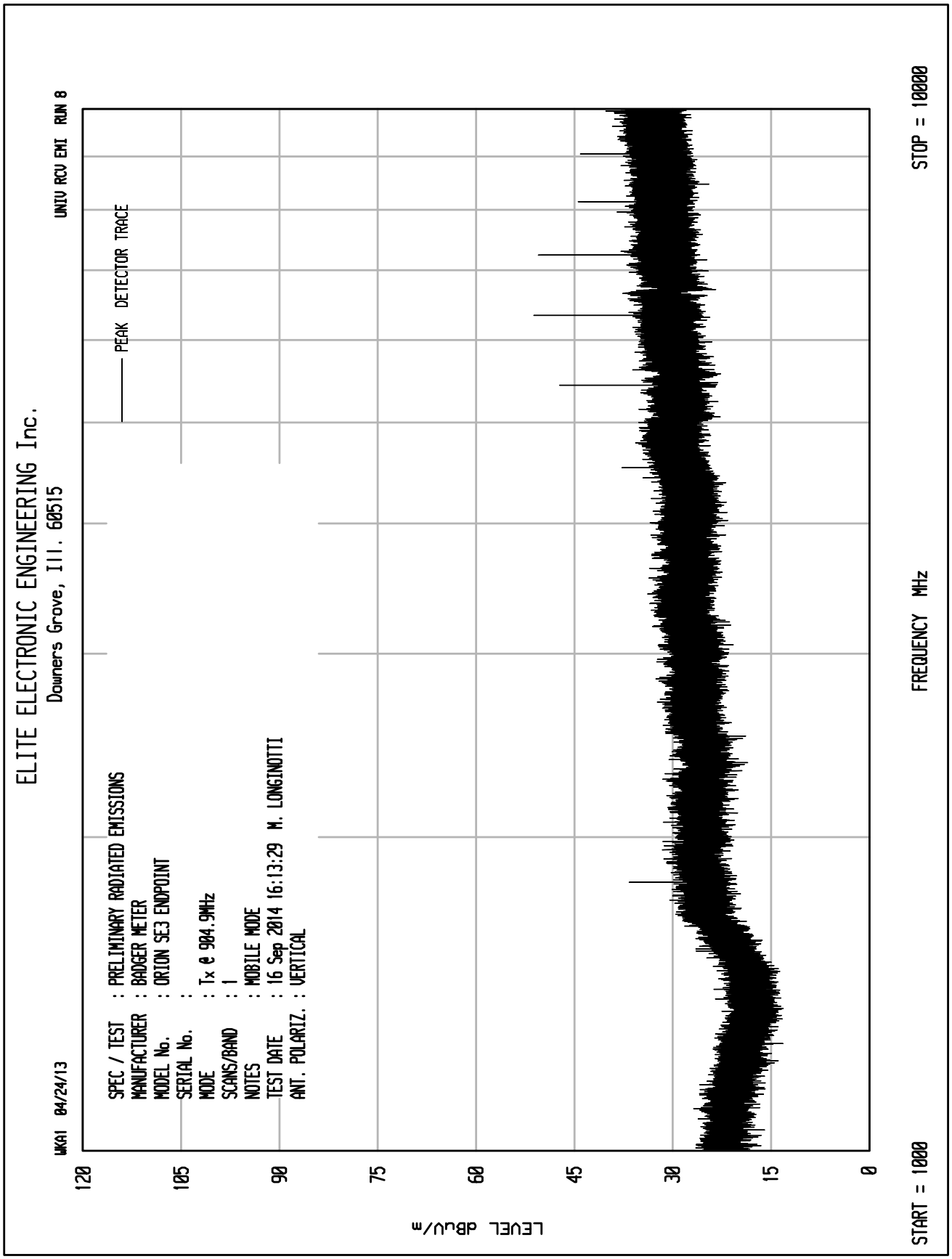
Manufacturer : Badger Meter
Model No. : ORION SE3 Endpoint
Serial No. : 30148151
Test Performed : Spurious Radiated Emissions in restricted bands
Test Mode : Tx @ 924.5MHz, Fixed Mode, Power = 3C
Test Date : September 17 and 18, 2014
Test Distance : 3 meters
Notes : Average Readings with a 1MHz RBW

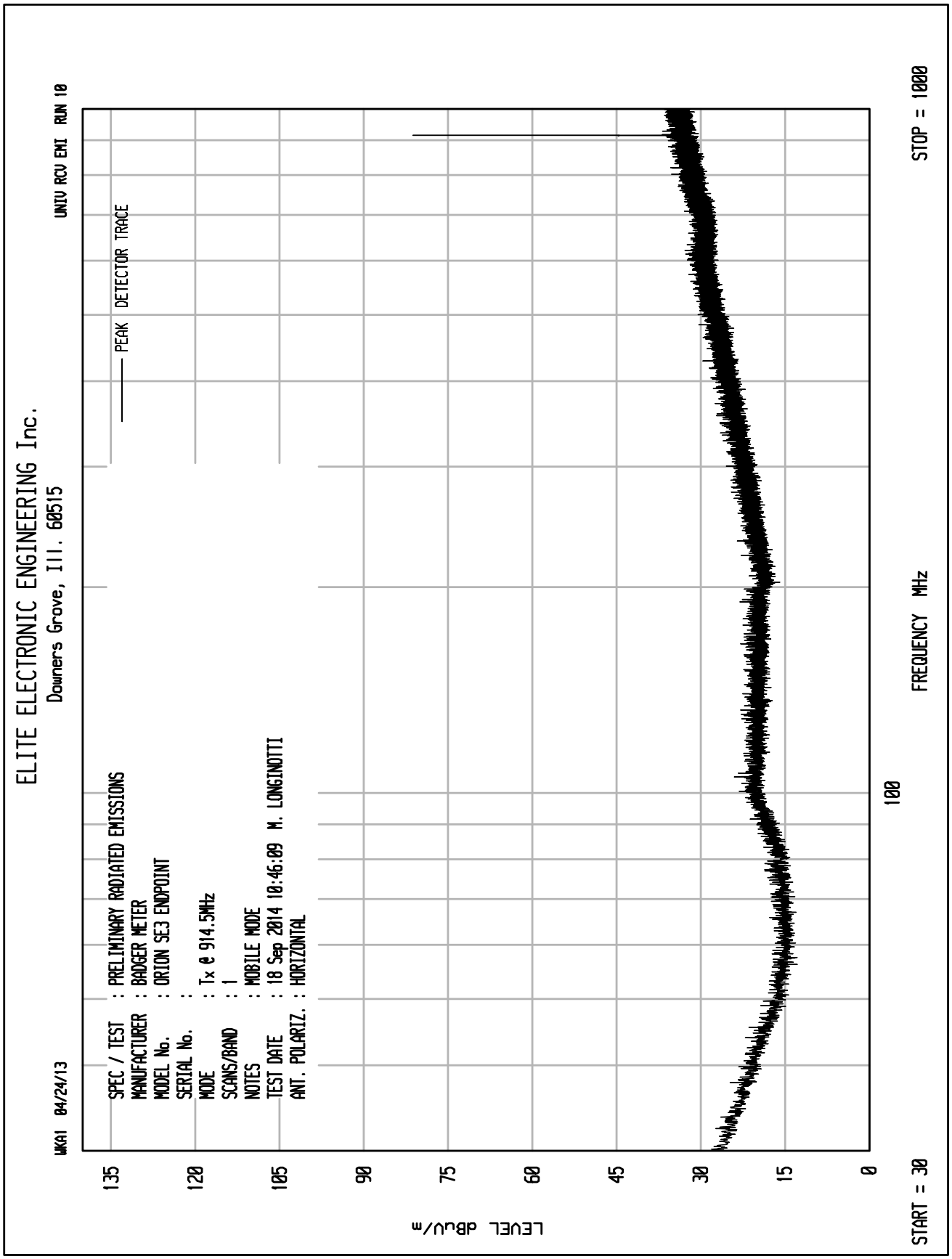
Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Average Total dBuV/m at 3m	Average Total uV/m at 3 m	Average Limit uV/m at 3 m	Margin (dB)
2773.50	H	37.10	Ambient	2.8	32.8	-39.5	33.3	46.1	500.0	-20.7
2773.50	V	36.9	Ambient	2.8	32.8	-39.5	33.1	45.1	500.0	-20.9
3698.00	H	39.4		3.3	33.5	-38.9	37.4	73.8	500.0	-16.6
3698.00	V	38.3		3.3	33.5	-38.9	36.3	65.0	500.0	-17.7
4622.50	H	53.0		3.6	34.6	-38.9	52.3	411.0	500.0	-1.7
4622.50	V	46.8		3.6	34.6	-38.9	46.1	201.3	500.0	-7.9
7396.00	H	38.9		4.7	35.7	-39.0	40.3	103.1	500.0	-13.7
7396.00	V	37.1		4.7	35.7	-39.0	38.5	83.8	500.0	-15.5
8320.50	H	42.1	Ambient	4.9	35.9	-39.0	44.0	158.3	500.0	-10.0
8320.50	V	38.3	Ambient	4.9	35.9	-39.0	40.2	102.2	500.0	-13.8

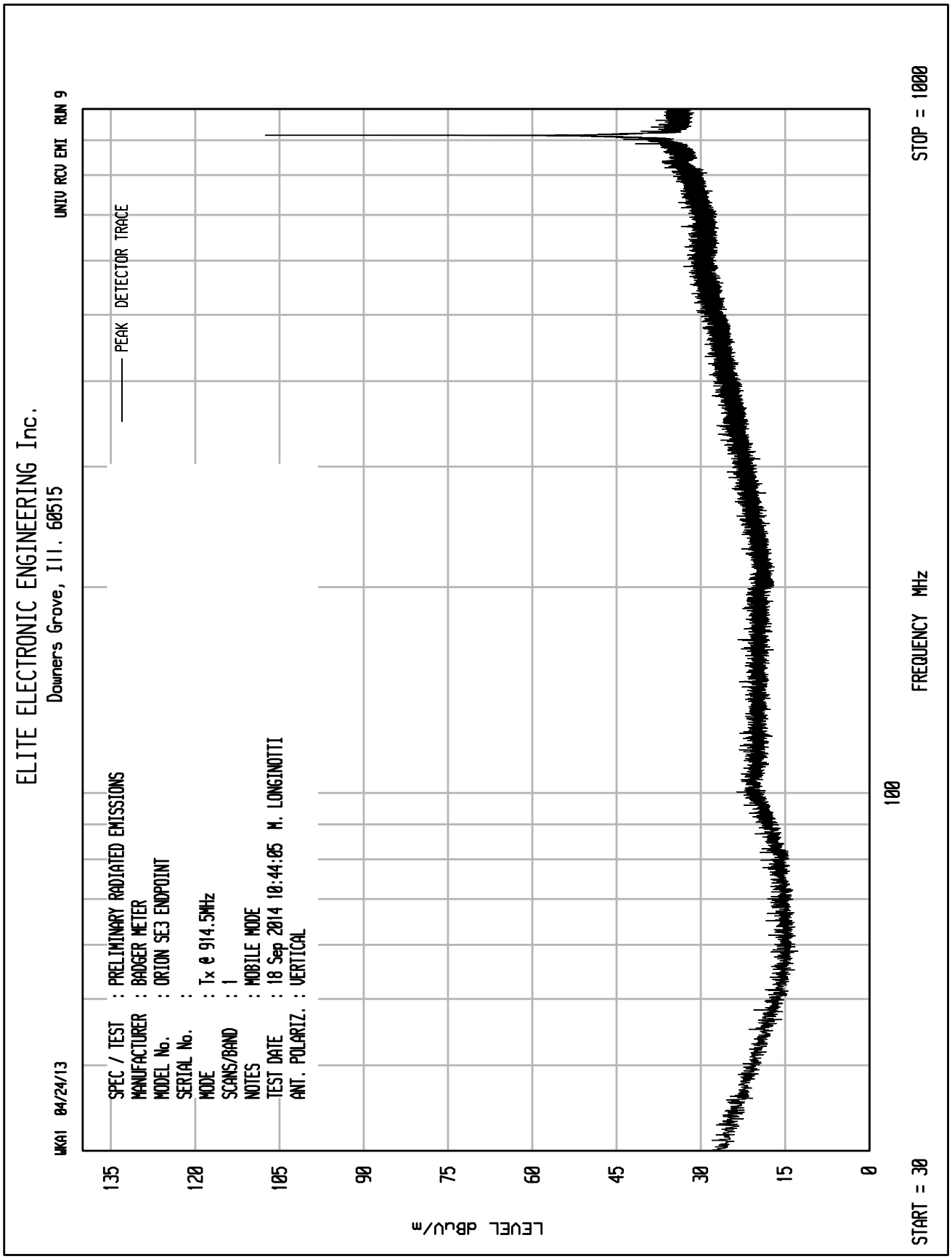

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 8
WKA1 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE3 ENDPOINT
SERIAL No. :
MODE : Tx @ 904.9MHz
SCANS/BAND : 1
NOTES : MOBILE MODE
TEST DATE : 18 Sep 2014 10:25:09 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
135
120
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000

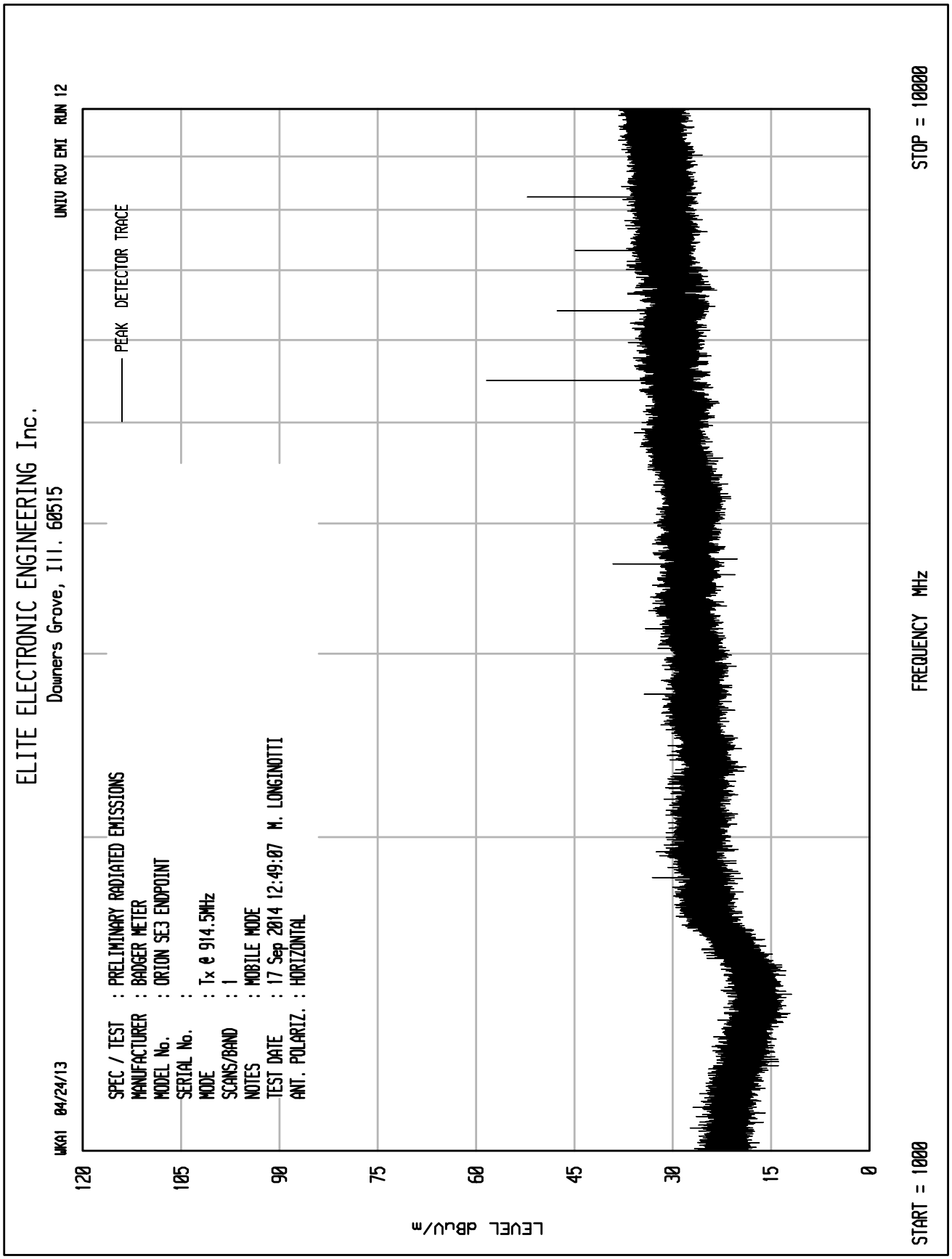

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 7
WKAI 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE3 ENDPOINT
SERIAL No. :
MODE : Tx @ 904.9MHz
SCANS/BAND : 1
NOTES : MOBILE MODE
TEST DATE : 18 Sep 2014 10:23:02 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
135
120
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000

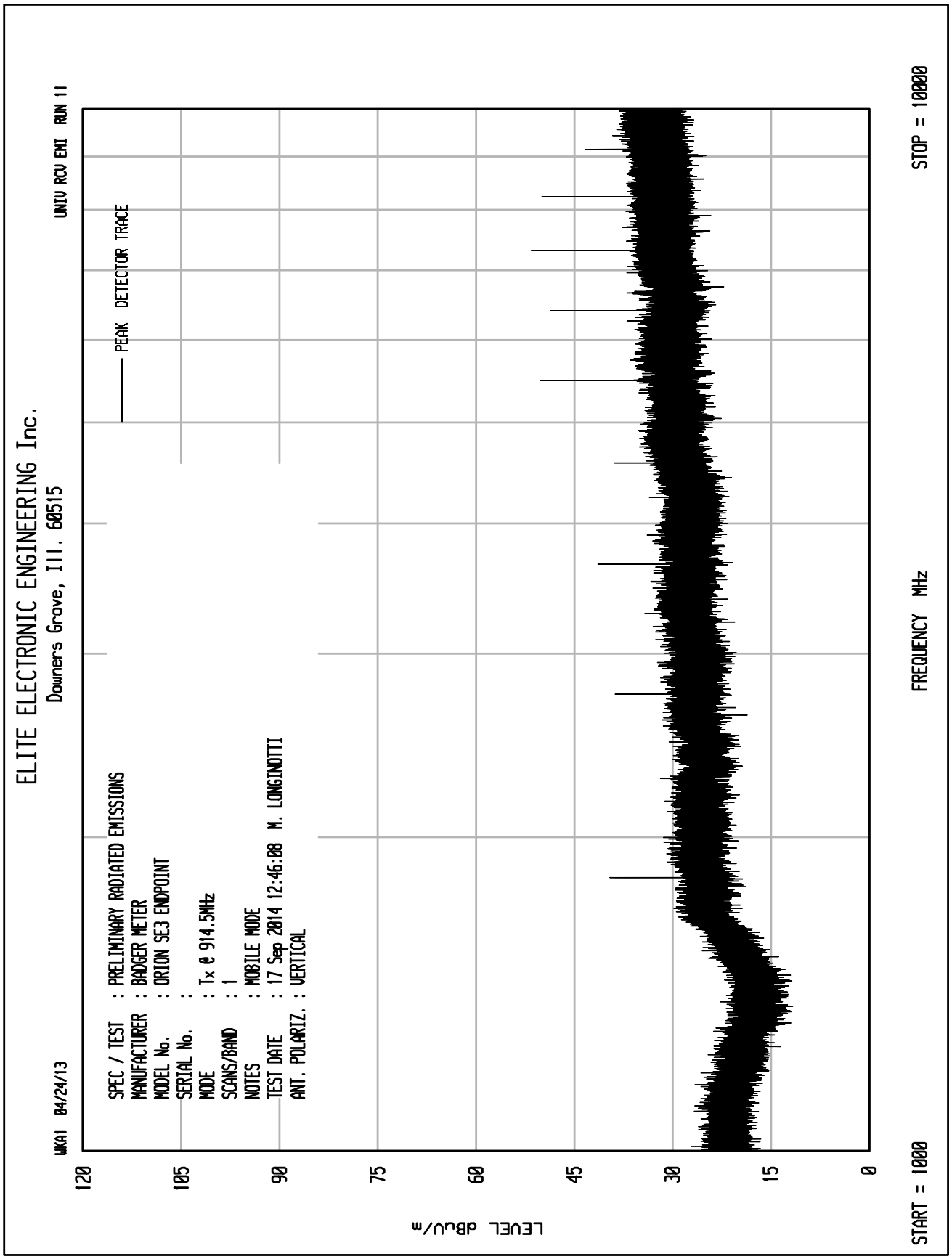

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 7
WKAI 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE3 ENDPOINT
SERIAL No. :
MODE : Tx @ 904.9MHz
SCANS/BAND : 1
NOTES : MOBILE MODE
TEST DATE : 16 Sep 2014 16:10:45 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000

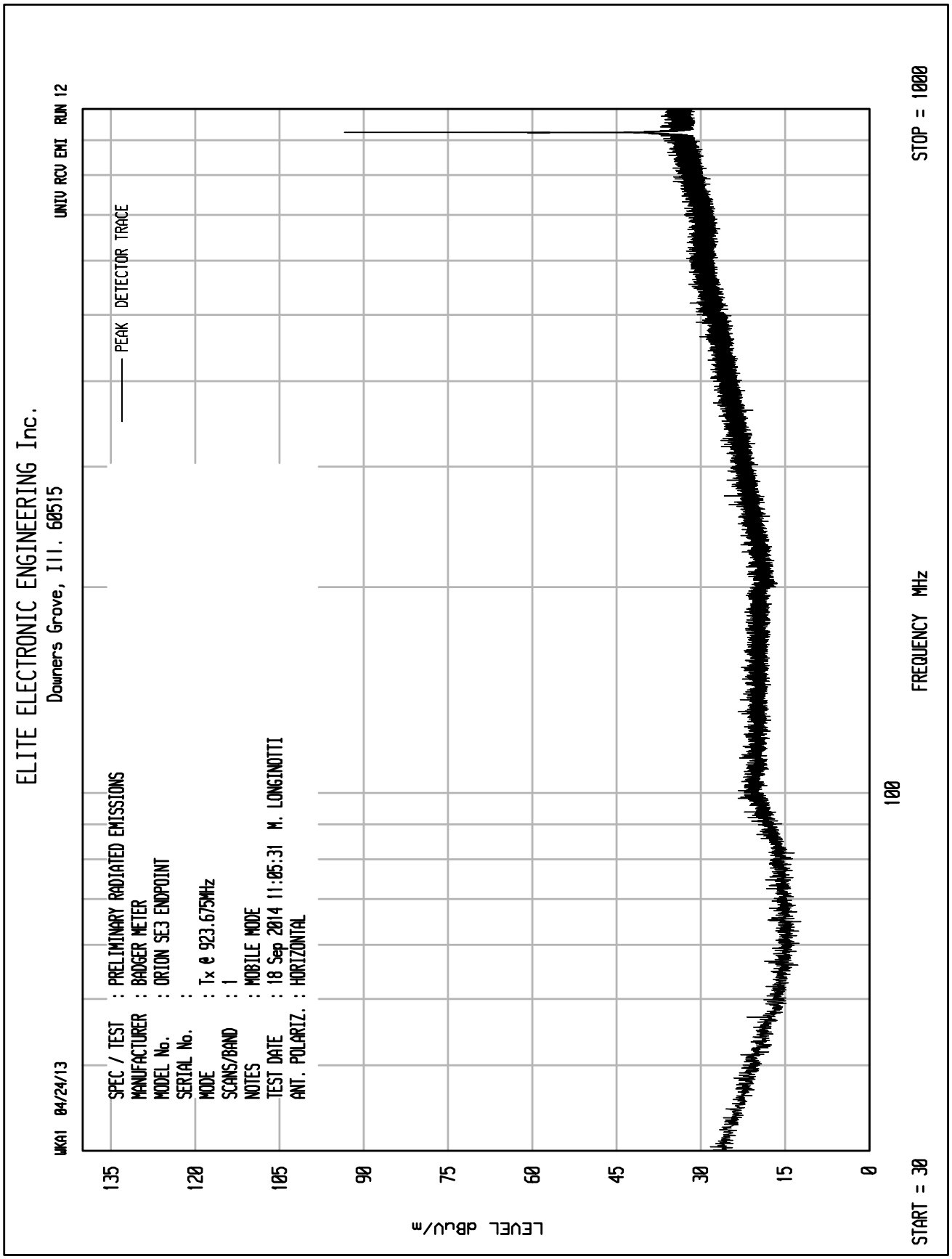

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 8
WKAI 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE3 ENDPOINT
SERIAL No. :
MODE : Tx @ 904.9MHz
SCANS/BAND : 1
NOTES : MOBILE MODE
TEST DATE : 16 Sep 2014 16:13:29 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000

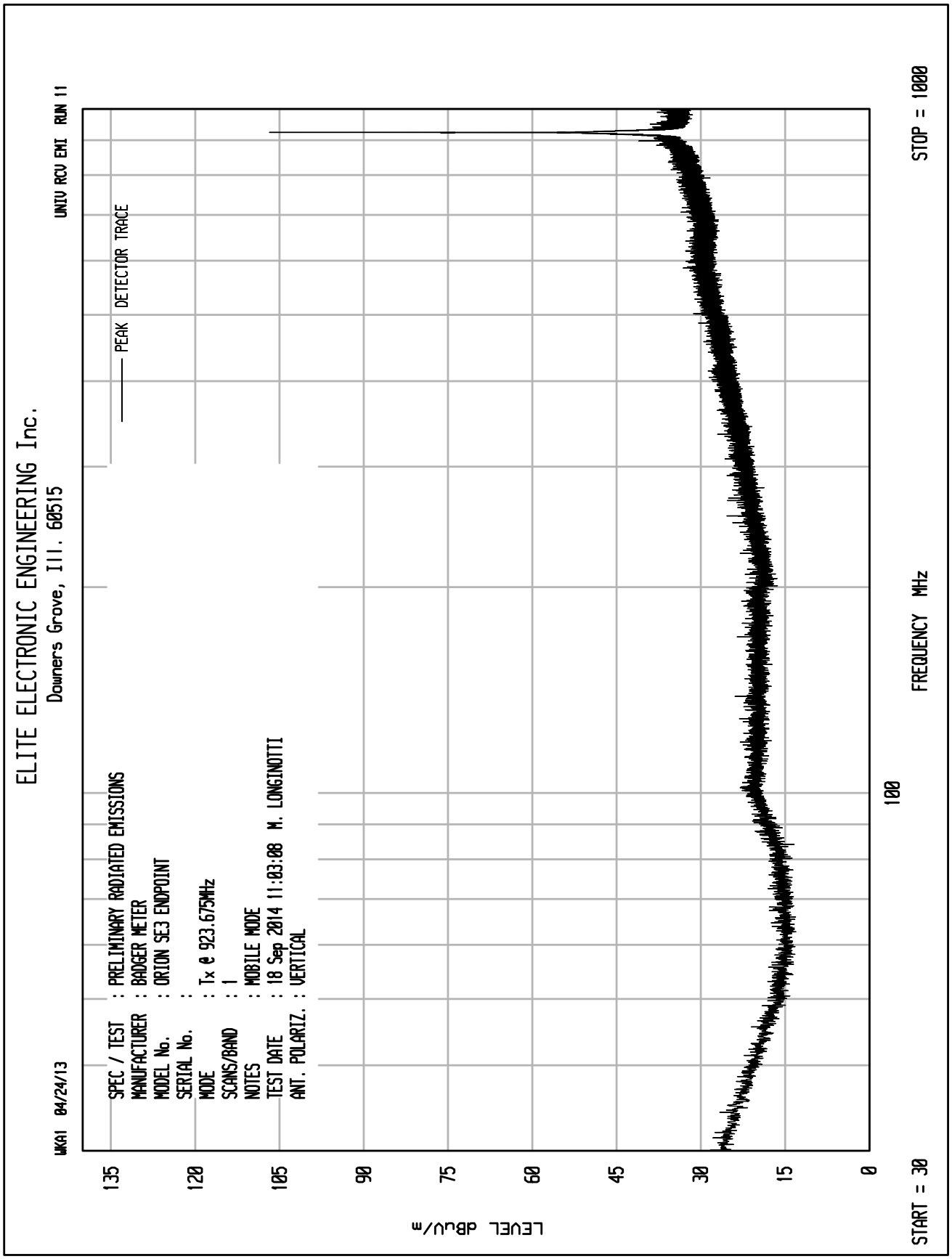

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 10
WKAI 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE3 ENDPOINT
SERIAL No. :
MODE : Tx @ 914.5MHz
SCANS/BAND : 1
NOTES : MOBILE MODE
TEST DATE : 18 Sep 2014 10:46:09 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
135
120
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000

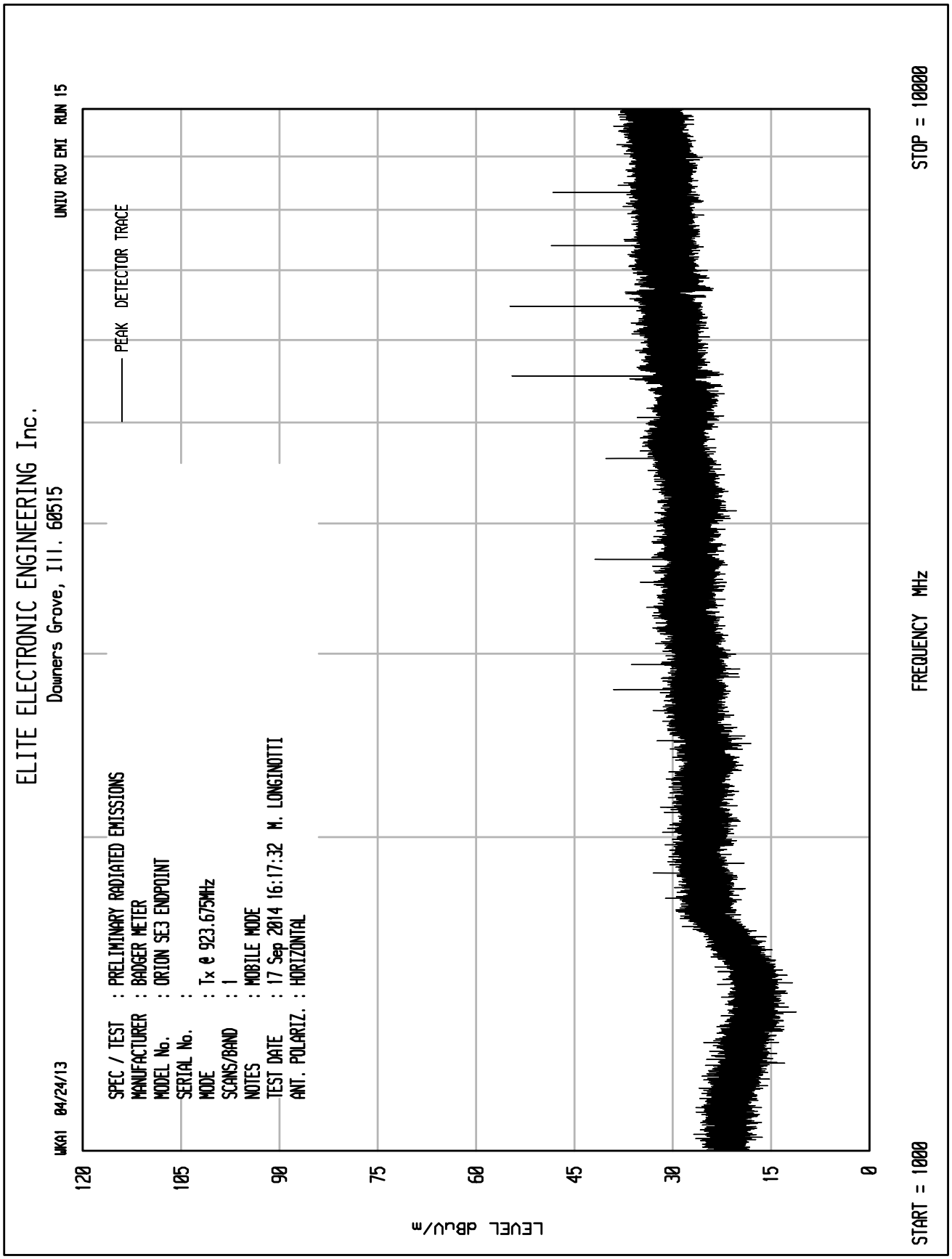

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 9
WKAI 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE3 ENDPOINT
SERIAL No. :
MODE : Tx @ 914.5MHz
SCANS/BAND : 1
NOTES : MOBILE MODE
TEST DATE : 18 Sep 2014 10:44:05 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
135
120
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000

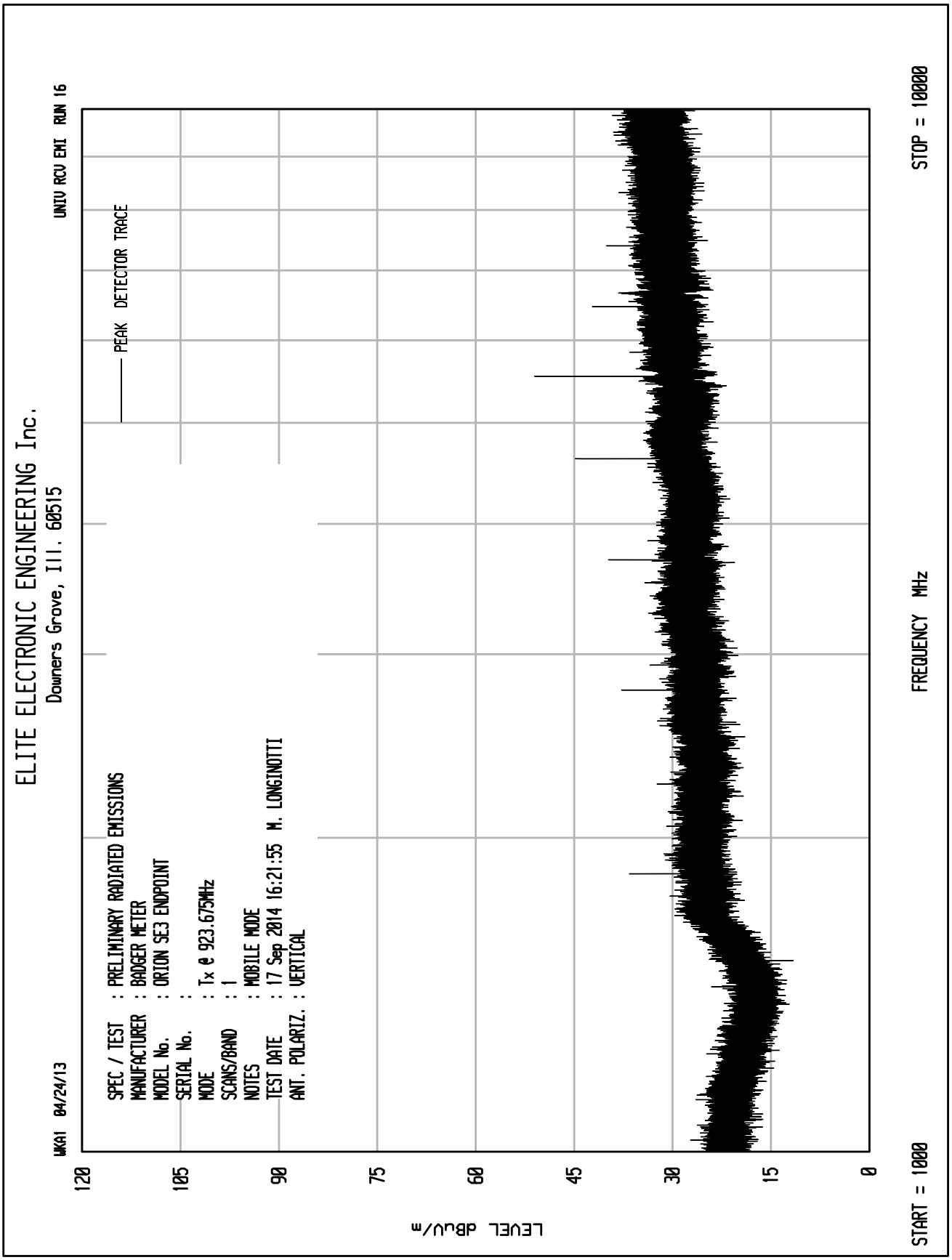

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 12
WKAI 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE3 ENDPOINT
SERIAL No. :
MODE : Tx @ 914.5MHz
SCANS/BAND : 1
NOTES : MOBILE MODE
TEST DATE : 17 Sep 2014 12:49:07 M. LONGINOTTI
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 11
WKAI 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE3 ENDPOINT
SERIAL No. :
MODE : Tx @ 914.5MHz
SCANS/BAND : 1
NOTES : MOBILE MODE
TEST DATE : 17 Sep 2014 12:46:08 M. LONGINOTTI
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 12
WKAI 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE3 ENDPOINT
SERIAL No. :
MODE : Tx @ 923.675MHz
SCANS/BAND : 1
NOTES : MOBILE MODE
TEST DATE : 18 Sep 2014 11:05:31 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
135
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 11
WKA1 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE3 ENDPOINT
SERIAL No. :
MODE : Tx @ 923.675MHz
SCANS/BAND : 1
NOTES : MOBILE MODE
TEST DATE : 18 Sep 2014 11:03:08 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
135
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 15
WKAI 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION SE3 ENDPOINT
SERIAL No. :
MODE : Tx @ 923.675MHz
SCANS/BAND : 1
NOTES : MOBILE MODE
TEST DATE : 17 Sep 2014 16:17:32 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000



Manufacturer : Badger Meter

Model No. : ORION SE3 Endpoint
Serial No. : 30148151
Mode : Mobile Mode
Test Performed : Spurious Radiated Emissions NOT in restricted bands
Test Mode : Tx @ 904.9MHz, Mobile Mode, Power = C0
Test Date : September 17 and 18, 2014
Test Distance : 3 meters
Notes : Peak Readings with a 100kHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
904.90	H	81.2		1.6	20.6	0.0	103.3	147060.6		
904.90	V	85.7		1.6	20.6	0.0	107.8	246885.9		
1809.80	H	46.4		2.2	30.7	-39.8	39.6	95.3	24688.6	-48.3
1809.80	V	49.7		2.2	30.7	-39.8	42.9	139.3	24688.6	-45.0
6334.30	H	60.7		4.3	35.8	-39.0	61.8	1224.7	24688.6	-26.1
6334.30	V	54.0		4.3	35.8	-39.0	55.1	566.3	24688.6	-32.8
7239.20	H	64.4		4.7	35.6	-39.0	65.7	1918.9	24688.6	-22.2
7239.20	V	56.2		4.7	35.6	-39.0	57.5	746.5	24688.6	-30.4

Manufacturer : Badger Meter
Model No. : ORION SE3 Endpoint
Serial No. : 30148151
Mode : Mobile Mode
Test Performed : Spurious Radiated Emissions in restricted bands
Test Mode : Tx @ 904.9MHz, Mobile Mode, Power = C0
Test Date : September 17 and 18, 2014
Test Distance : 3 meters
Notes : Peak Readings with a 1MHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
2714.70	H	51.0		2.8	32.7	-39.5	47.0	223.8	5000.0	-27.0
2714.70	V	51.6		2.8	32.7	-39.5	47.6	239.8	5000.0	-26.4
3619.60	H	53.5		3.2	33.5	-38.9	51.3	369.1	5000.0	-22.6
3619.60	V	51.7		3.2	33.5	-38.9	49.5	300.0	5000.0	-24.4
4524.50	H	53.7		3.6	34.5	-38.9	52.9	442.5	5000.0	-21.1
4524.50	V	51.5		3.6	34.5	-38.9	50.7	343.5	5000.0	-23.3
5429.40	H	57.9		3.9	34.9	-39.0	57.7	766.9	5000.0	-16.3
5429.40	V	56.0		3.9	34.9	-39.0	55.8	616.2	5000.0	-18.2
8144.10	H	55.7		4.9	35.9	-39.0	57.6	756.1	5000.0	-16.4
8144.10	V	53.3		4.9	35.9	-39.0	55.2	573.6	5000.0	-18.8
9049.00	H	56.9		5.0	36.2	-38.9	59.2	907.7	5000.0	-14.8
9049.00	V	56.5		5.0	36.2	-38.9	58.8	866.8	5000.0	-15.2

Manufacturer : Badger Meter
Model No. : ORION SE3 Endpoint
Serial No. : 30148151
Test Performed : Spurious Radiated Emissions in restricted bands
Test Mode : Tx @ 904.9MHz, Mobile Mode, Power = C0
Test Date : September 17 and 18, 2014
Test Distance : 3 meters
Notes : Average Readings with a 1MHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dBuV/m at 3m	Average Total uV/m at 3 m	Average Limit uV/m at 3 m	Margin (dB)
2714.70	H	42.70		2.8	32.7	-39.5	-19.5	19.2	9.1	500.0	-34.8
2714.70	V	44.7		2.8	32.7	-39.5	-19.5	21.2	11.5	500.0	-32.8
3619.60	H	47.5		3.2	33.5	-38.9	-19.5	25.9	19.6	500.0	-28.1
3619.60	V	44.3		3.2	33.5	-38.9	-19.5	22.7	13.6	500.0	-31.3
4524.50	H	47.8		3.6	34.5	-38.9	-19.5	27.5	23.8	500.0	-26.4
4524.50	V	44.0		3.6	34.5	-38.9	-19.5	23.7	15.4	500.0	-30.2
5429.40	H	54.0		3.9	34.9	-39.0	-19.5	34.3	52.0	500.0	-19.7
5429.40	V	51.9		3.9	34.9	-39.0	-19.5	32.2	40.8	500.0	-21.8
8144.10	H	49.0		4.9	35.9	-39.0	-19.5	31.4	37.1	500.0	-22.6
8144.10	V	45.7		4.9	35.9	-39.0	-19.5	28.1	25.4	500.0	-25.9
9049.00	H	49.8		5.0	36.2	-38.9	-19.5	32.6	42.6	500.0	-21.4
9049.00	V	49.2		5.0	36.2	-38.9	-19.5	32.0	39.7	500.0	-22.0

Manufacturer : Badger Meter
Model No. : ORION SE3 Endpoint
Serial No. : 30148151
Test Performed : Spurious Radiated Emissions NOT in restricted bands
Test Mode : Tx @ 914.5MHz, Mobile Mode, Power = C0
Test Date : September 17 and 18, 2014
Test Distance : 3 meters
Notes : Peak Readings with a 100kHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
914.50	H	78.3		1.6	20.6	0.0	100.5	105562.1		
914.50	V	85.0		1.6	20.6	0.0	107.2	228301.1		
1829.00	H	46.9		2.2	30.8	-39.7	40.2	102.0	22830.1	-47.0
1829.00	V	49.3		2.2	30.8	-39.7	42.6	134.4	22830.1	-44.6
5487.00	H	60.2		3.9	34.9	-39.0	60.0	995.7	22830.1	-27.2
5487.00	V	56.1		3.9	34.9	-39.0	55.9	621.0	22830.1	-31.3
6401.50	H	58.5		4.3	35.9	-39.0	59.7	969.2	22830.1	-27.4
6401.50	V	55.3		4.3	35.9	-39.0	56.5	670.5	22830.1	-30.6

Manufacturer : Badger Meter
Model No. : ORION SE3 Endpoint
Serial No. : 30148151
Test Performed : Spurious Radiated Emissions in restricted bands
Test Mode : Tx @ 914.5MHz, Mobile Mode, Power = C0
Test Date : September 17 and 18, 2014
Test Distance : 3 meters
Notes : Peak Readings with a 1MHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
2743.50	H	51.2		2.8	32.8	-39.5	47.3	231.3	5000.0	-26.7
2743.50	V	52.6		2.8	32.8	-39.5	48.7	271.8	5000.0	-25.3
3658.00	H	52.3		3.3	33.5	-38.9	50.2	323.5	5000.0	-23.8
3658.00	V	48.1		3.3	33.5	-38.9	46.0	199.5	5000.0	-28.0
4572.50	H	52.9		3.6	34.5	-38.9	52.1	403.9	5000.0	-21.9
4572.50	V	52.5		3.6	34.5	-38.9	51.7	385.7	5000.0	-22.3
7316.00	H	63.5		4.7	35.6	-39.0	64.8	1741.4	5000.0	-9.2
7316.00	V	56.6		4.7	35.6	-39.0	57.9	786.9	5000.0	-16.1
8230.50	H	55.0		4.9	35.9	-39.0	56.9	701.0	5000.0	-17.1
8230.50	V	53.3		4.9	35.9	-39.0	55.2	576.4	5000.0	-18.8
9145.00	H	53.1		5.0	36.2	-38.9	55.4	589.0	5000.0	-18.6
9145.00	V	50.1		5.0	36.2	-38.9	52.4	417.0	5000.0	-21.6

Manufacturer : Badger Meter
Model No. : ORION SE3 Endpoint
Serial No. : 30148151
Test Performed : Spurious Radiated Emissions in restricted bands
Test Mode : Tx @ 914.5MHz, Mobile Mode, Power = C0
Test Date : September 17 and 18, 2014
Test Distance : 3 meters
Notes : Average Readings with a 1MHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dBuV/m at 3m	Average Total uV/m at 3 m	Average Limit uV/m at 3 m	Margin (dB)
2743.50	H	43.00		2.8	32.8	-39.5	-19.5	19.6	9.6	500.0	-34.4
2743.50	V	46.8		2.8	32.8	-39.5	-19.5	23.4	14.8	500.0	-30.6
3658.00	H	46.7		3.3	33.5	-38.9	-19.5	25.1	18.0	500.0	-28.9
3658.00	V	38.6		3.3	33.5	-38.9	-19.5	17.0	7.1	500.0	-37.0
4572.50	H	46.7		3.6	34.5	-38.9	-19.5	26.5	21.0	500.0	-27.5
4572.50	V	45.4		3.6	34.5	-38.9	-19.5	25.2	18.1	500.0	-28.8
7316.00	H	59.2		4.7	35.6	-39.0	-19.5	41.0	112.8	500.0	-12.9
7316.00	V	50.8		4.7	35.6	-39.0	-19.5	32.6	42.9	500.0	-21.3
8230.50	H	48.1		4.9	35.9	-39.0	-19.5	30.5	33.7	500.0	-23.4
8230.50	V	45.1		4.9	35.9	-39.0	-19.5	27.5	23.8	500.0	-26.4
9145.00	H	44.0		5.0	36.2	-38.9	-19.5	26.8	22.0	500.0	-27.1
9145.00	V	39.1		5.0	36.2	-38.9	-19.5	21.9	12.5	500.0	-32.0

Manufacturer : Badger Meter
Model No. : ORION SE3 Endpoint
Serial No. : 30148151
Test Performed : Spurious Radiated Emissions NOT in restricted bands
Test Mode : Tx @ 923.675MHz, Mobile Mode, Power = C0
Test Date : September 17 and 18, 2014
Test Distance : 3 meters
Notes : Peak Readings with a 100kHz RBW

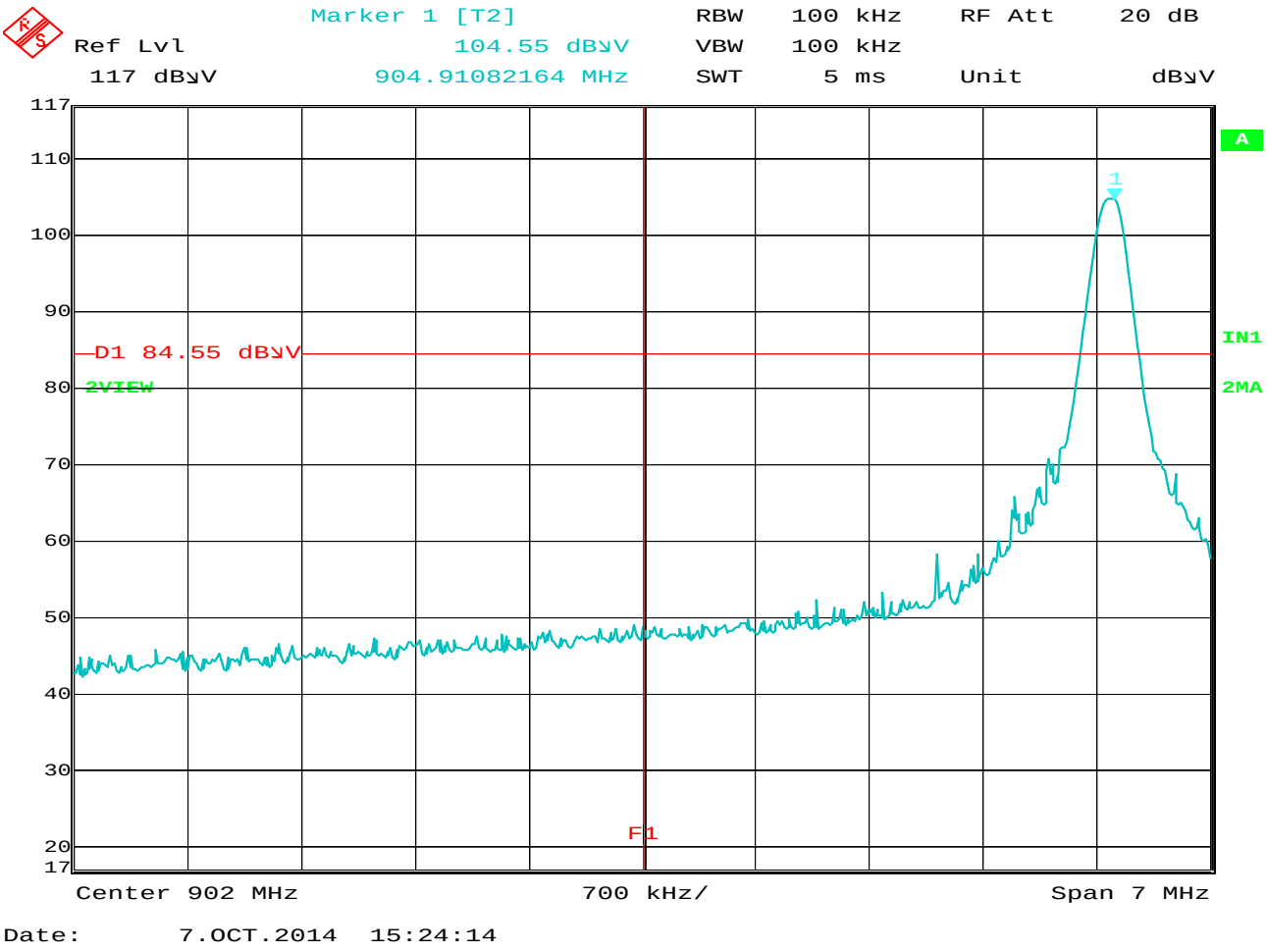
Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
923.68	H	77.8		1.6	20.0	0.0	99.4	93044.3		
923.68	V	84.2		1.6	20.0	0.0	105.8	194397.1		
1847.35	H	47.8		2.2	30.8	-39.7	41.2	114.3	19439.7	-44.6
1847.35	V	49.4		2.2	30.8	-39.7	42.8	137.4	19439.7	-43.0
5542.05	H	61.2		4.0	34.8	-39.0	61.0	1116.8	19439.7	-24.8
5542.05	V	54.9		4.0	34.8	-39.0	54.7	540.7	19439.7	-31.1
6465.73	H	63.5		4.3	36.0	-39.0	64.8	1738.7	19439.7	-21.0
6465.73	V	56.7		4.3	36.0	-39.0	58.0	794.7	19439.7	-27.8
9236.75	H	50.3		5.0	36.1	-38.9	52.6	427.7	19439.7	-33.2
9236.75	V	45.8		5.0	36.1	-38.9	48.1	254.7	19439.7	-37.7

Manufacturer : Badger Meter
Model No. : ORION SE3 Endpoint
Serial No. : 30148151
Test Performed : Spurious Radiated Emissions in restricted bands
Test Mode : Tx @ 923.675MHz, Mobile Mode, Power = C0
Test Date : September 17 and 18, 2014
Test Distance : 3 meters
Notes : Peak Readings with a 1MHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
2771.03	H	51.0		2.8	32.8	-39.5	47.2	228.3	5000.0	-26.8
2771.03	V	49.3		2.8	32.8	-39.5	45.5	187.7	5000.0	-28.5
3694.70	H	53.2		3.3	33.5	-38.9	51.2	361.1	5000.0	-22.8
3694.70	V	49.6		3.3	33.5	-38.9	47.6	238.5	5000.0	-26.4
4618.38	H	54.9		3.6	34.6	-38.9	54.2	511.0	5000.0	-19.8
4618.38	V	52.7		3.6	34.6	-38.9	52.0	396.7	5000.0	-22.0
7389.40	H	54.4		4.7	35.7	-39.0	55.8	613.9	5000.0	-18.2
7389.40	V	61.7		4.7	35.7	-39.0	63.1	1422.5	5000.0	-10.9
8313.08	H	56.2		4.9	35.9	-39.0	58.1	803.0	5000.0	-15.9
8313.08	V	54.8		4.9	35.9	-39.0	56.7	683.4	5000.0	-17.3
9236.75	H	50.3		5.0	36.1	-38.9	52.6	427.7	19439.7	-33.2
9236.75	V	45.8		5.0	36.1	-38.9	48.1	254.7	19439.7	-37.7

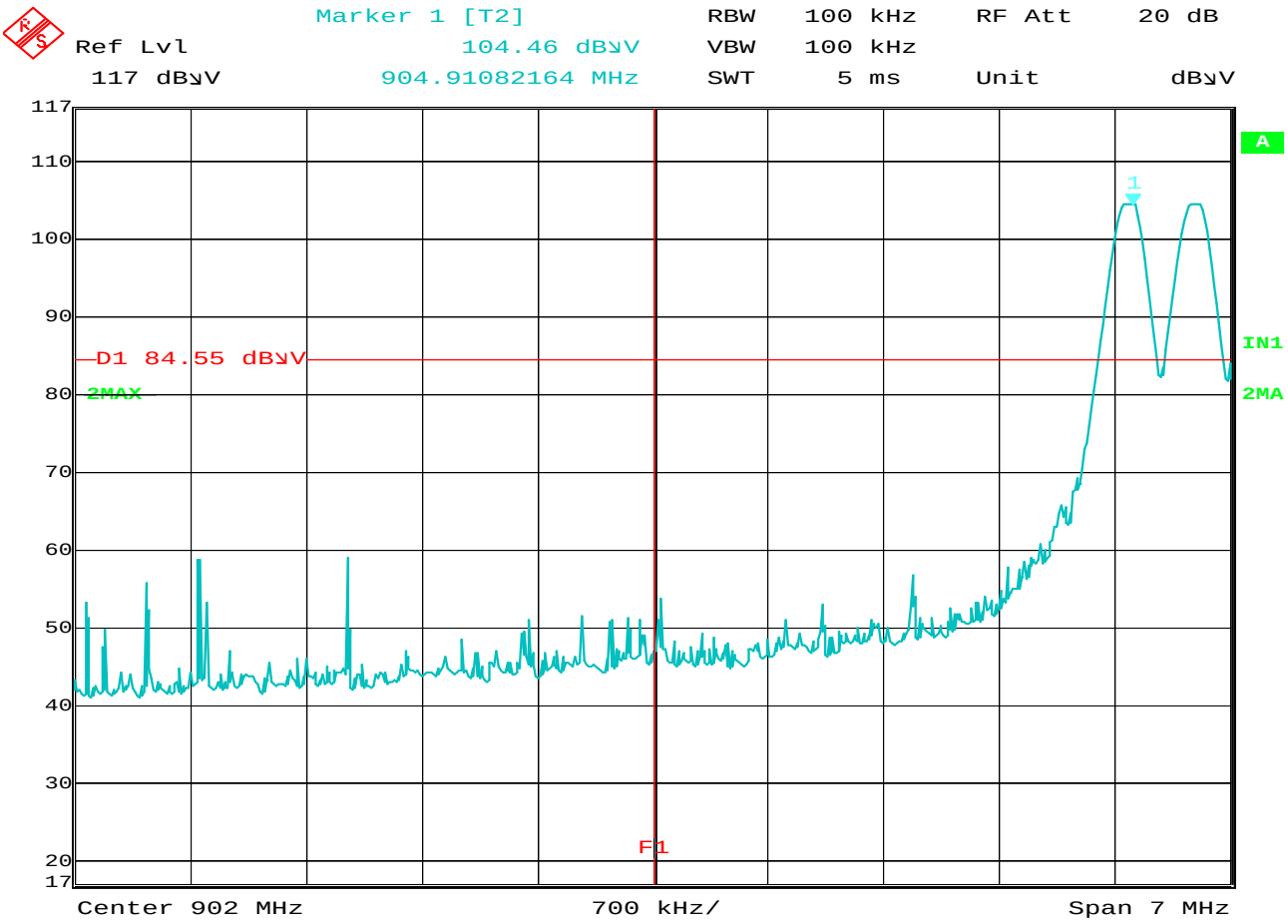
Manufacturer : Badger Meter
Model No. : ORION SE3 Endpoint
Serial No. : 30148151
Test Performed : Spurious Radiated Emissions in restricted bands
Test Mode : Tx @ 924.5MHz, Mobile Mode, Power = C0
Test Date : September 17 and 18, 2014
Test Distance : 3 meters
Notes : Average Readings with a 1MHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dBuV/m at 3m	Average Total uV/m at 3 m	Average Limit uV/m at 3 m	Margin (dB)
2771.03	H	43.60		2.8	32.8	-39.5	-19.5	20.3	10.3	500.0	-33.7
2771.03	V	45.4		2.8	32.8	-39.5	-19.5	22.1	12.7	500.0	-31.9
3694.70	H	47.8		3.3	33.5	-38.9	-19.5	26.3	20.6	500.0	-27.7
3694.70	V	40.8		3.3	33.5	-38.9	-19.5	19.3	9.2	500.0	-34.7
4618.38	H	49.3		3.6	34.6	-38.9	-19.5	29.1	28.5	500.0	-24.9
4618.38	V	45.8		3.6	34.6	-38.9	-19.5	25.6	19.0	500.0	-28.4
7389.40	H	47.2		4.7	35.7	-39.0	-19.5	29.1	28.4	500.0	-24.9
7389.40	V	57.2		4.7	35.7	-39.0	-19.5	39.1	90.0	500.0	-14.9
8313.08	H	48.9		4.9	35.9	-39.0	-19.5	31.3	36.8	500.0	-22.7
8313.08	V	46.7		4.9	35.9	-39.0	-19.5	29.1	28.6	500.0	-24.9



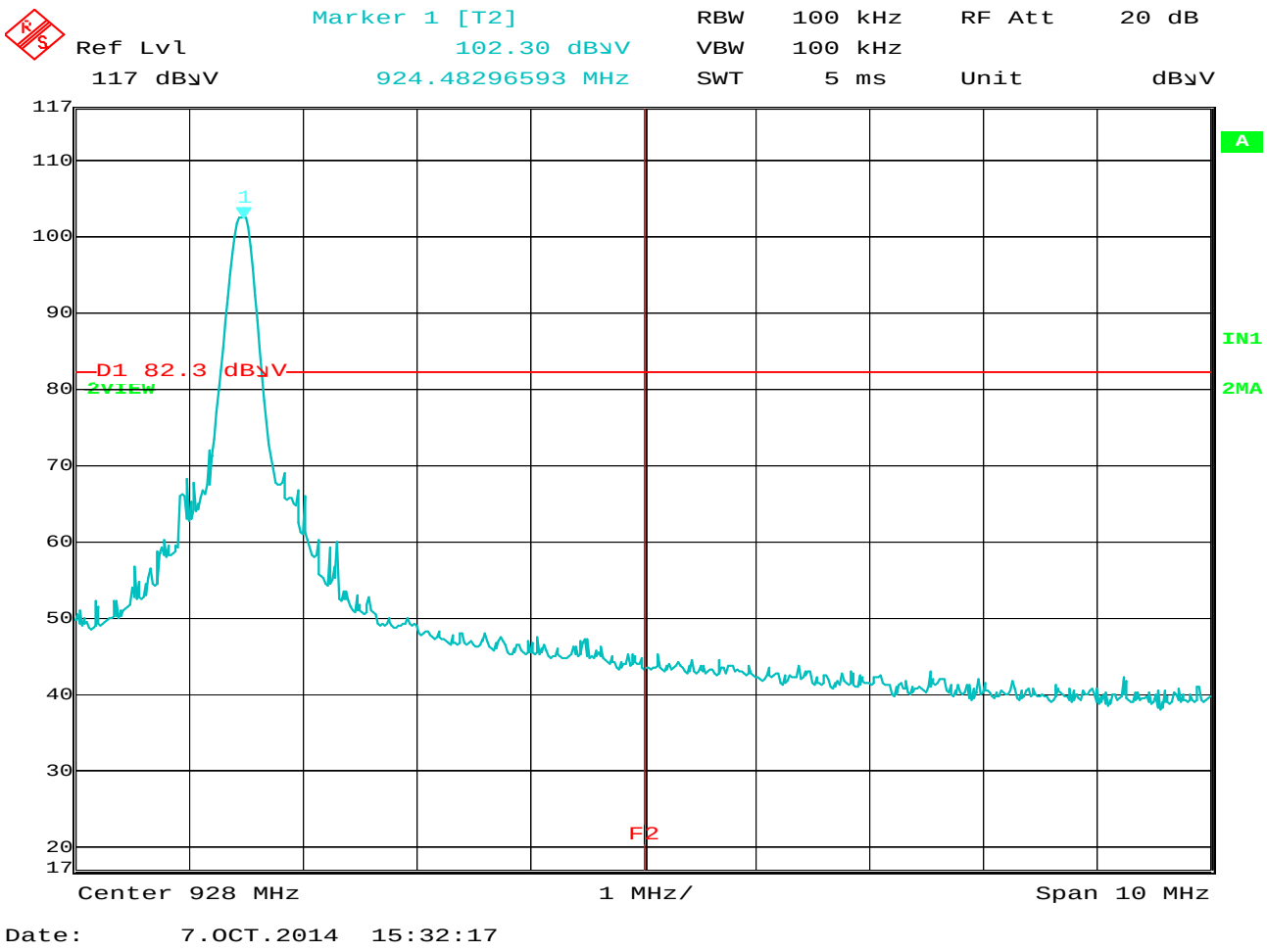
Band-Edge Requirements

MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	ORION SE3 Endpoint
SERIAL NUMBER	:	30148151
TEST MODE	:	Tx @ 904.9MHz, Fixed Mode
TEST PARAMETERS	:	Band-edge Requirements
NOTES	:	Marker 1 = peak power in a 100kHz bandwidth. Display Line D1 represents the level 20dB down from the peak power in a 100kHz bandwidth. Display Line F1 represents the band-edge (902MHz).
EQUIPMENT USED	:	RBA0, NTA3



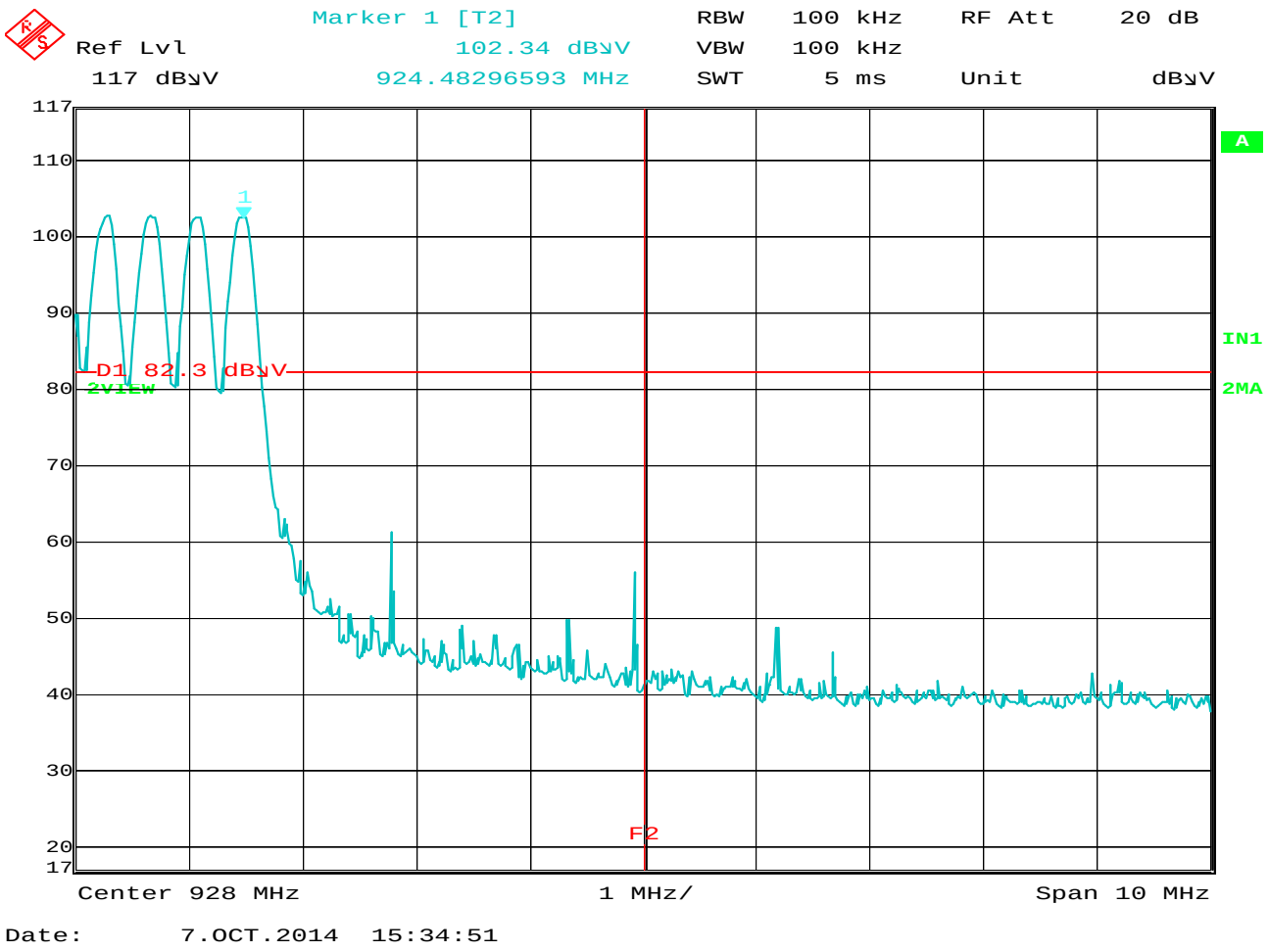
Band-Edge Requirements

MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	ORION SE3 Endpoint
SERIAL NUMBER	:	30148151
TEST MODE	:	Hopping Enabled, Fixed Mode
TEST PARAMETERS	:	Band-edge Requirements
NOTES	:	Marker 1 = peak power in a 100kHz bandwidth. Display Line D1 represents the level 20dB down from the peak power in a 100kHz bandwidth. Display Line F1 represents the band-edge (902MHz).
EQUIPMENT USED	:	RBA0, NTA3



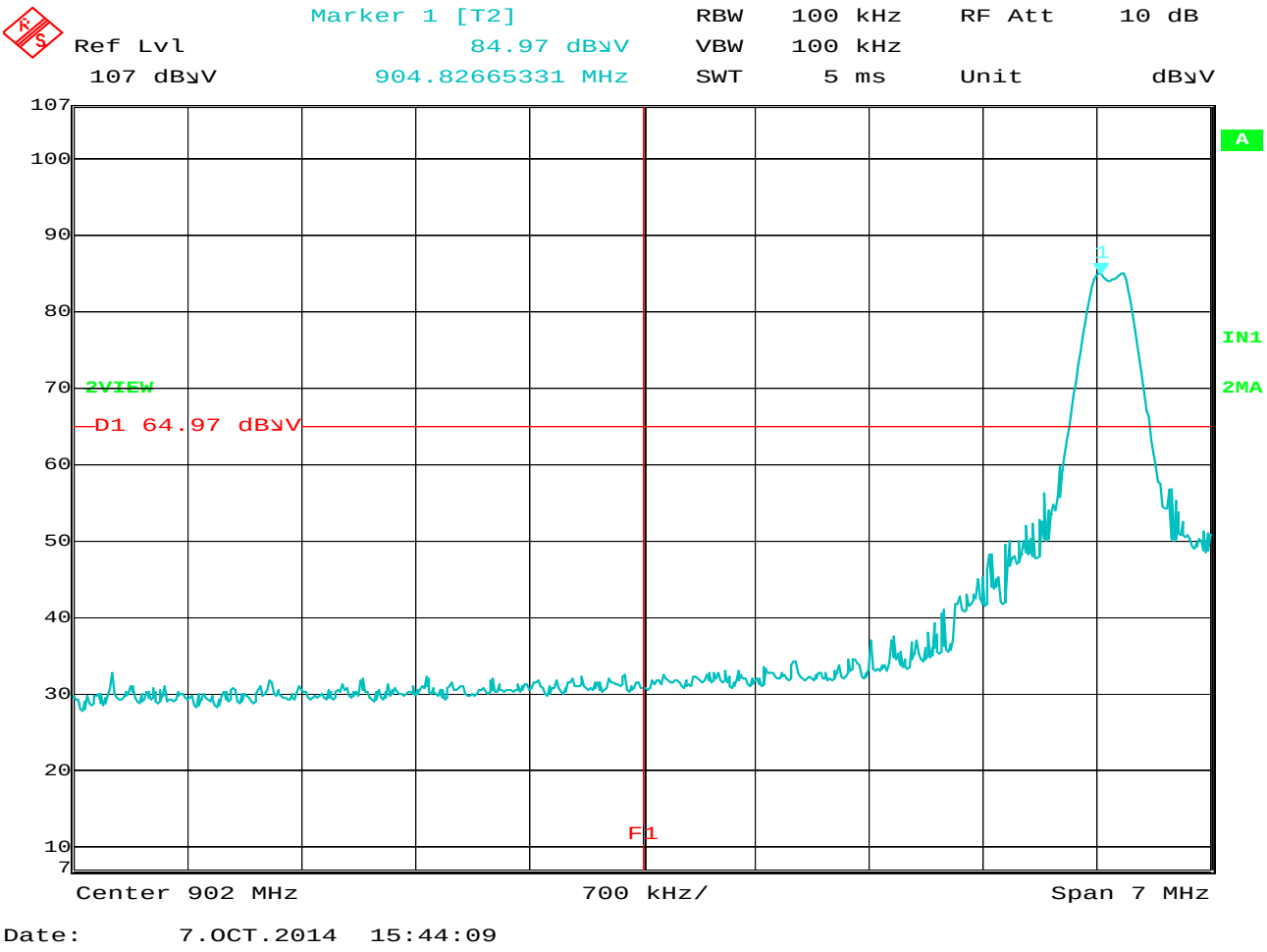
Band-Edge Requirements

MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	ORION SE3 Endpoint
SERIAL NUMBER	:	30148151
TEST MODE	:	Tx @ 924.5MHz, Fixed Mode
TEST PARAMETERS	:	Band-edge Requirements
NOTES	:	Marker 1 = peak power in a 100kHz bandwidth. Display Line D1 represents the level 20dB down from the peak power in a 100kHz bandwidth. Display Line F1 represents the band-edge (928MHz).
EQUIPMENT USED	:	RBA0, NTA3



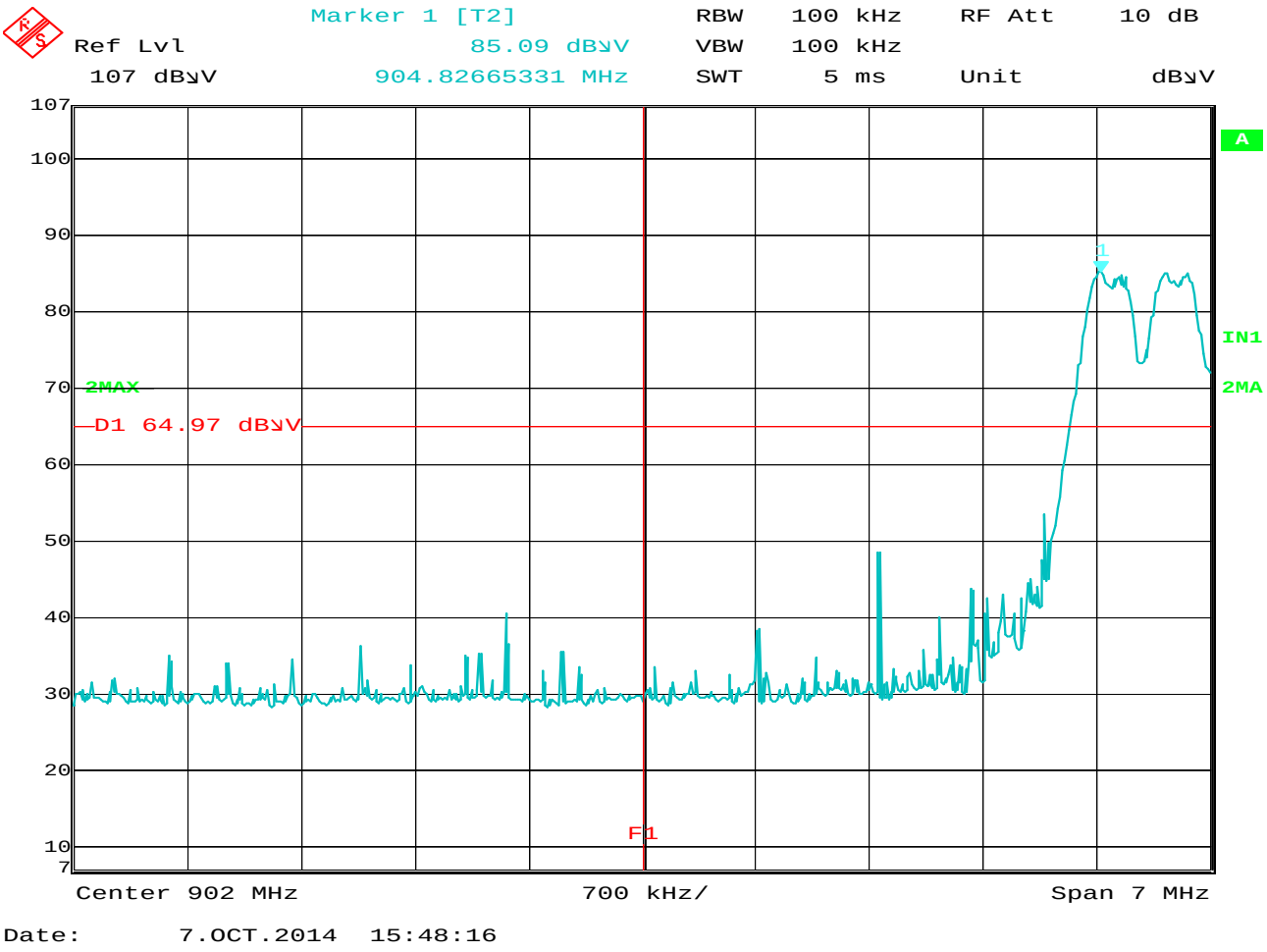
Band-Edge Requirements

MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	ORION SE3 Endpoint
SERIAL NUMBER	:	30148151
TEST MODE	:	Hopping Enabled, Fixed Mode
TEST PARAMETERS	:	Band-edge Requirements
NOTES	:	Marker 1 = peak power in a 100kHz bandwidth. Display Line D1 represents the level 20dB down from the peak power in a 100kHz bandwidth. Display Line F1 represents the band-edge (928MHz).
EQUIPMENT USED	:	RBA0, NTA3



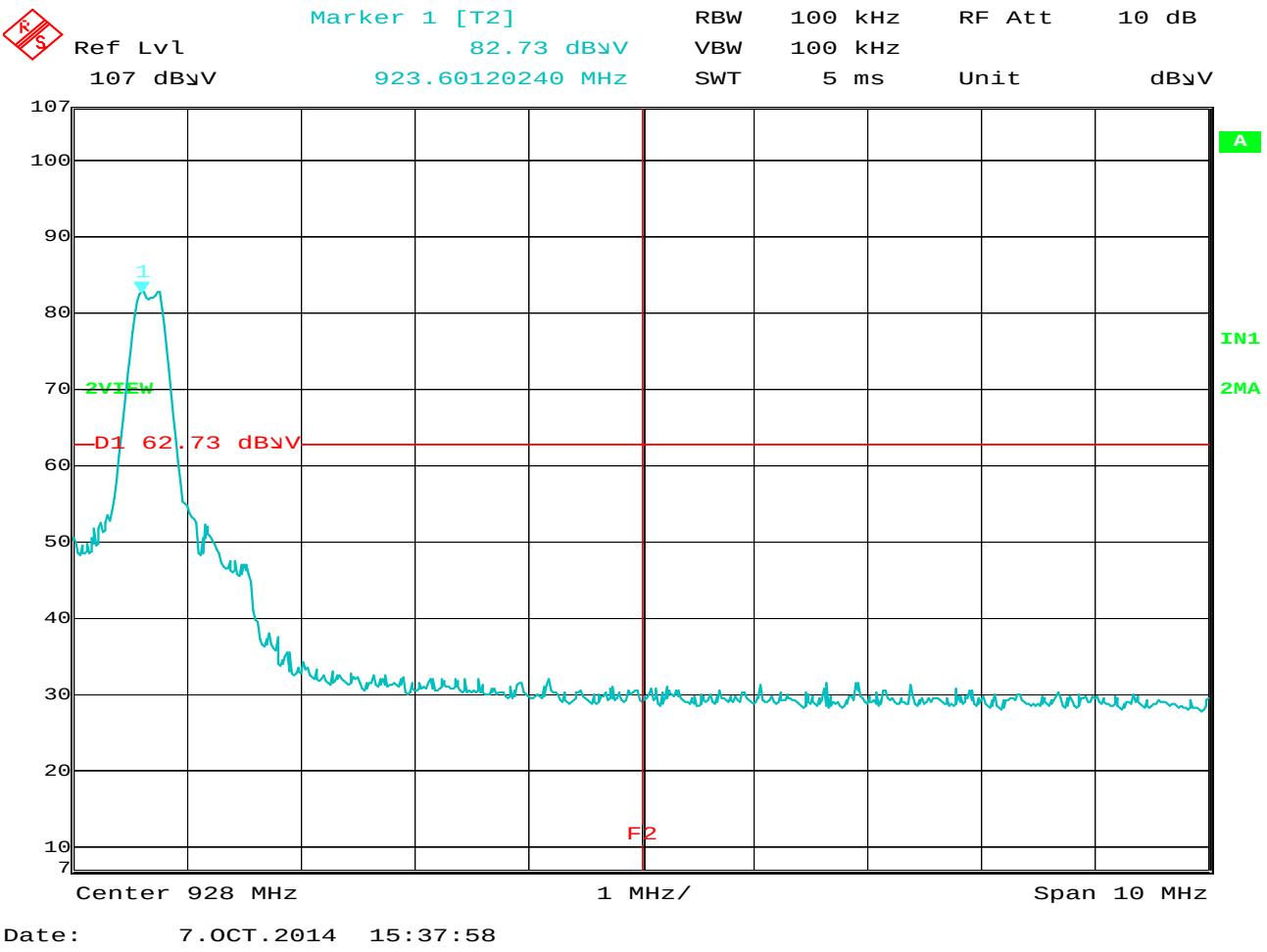
Band-Edge Requirements

MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	ORION SE3 Endpoint
SERIAL NUMBER	:	30148151
TEST MODE	:	Tx @ 904.9MHz, Mobile Mode
TEST PARAMETERS	:	Band-edge Requirements
NOTES	:	Marker 1 = peak power in a 100kHz bandwidth. Display Line D1 represents the level 20dB down from the peak power in a 100kHz bandwidth. Display Line F1 represents the band-edge (902MHz).
EQUIPMENT USED	:	RBA0, NTA3



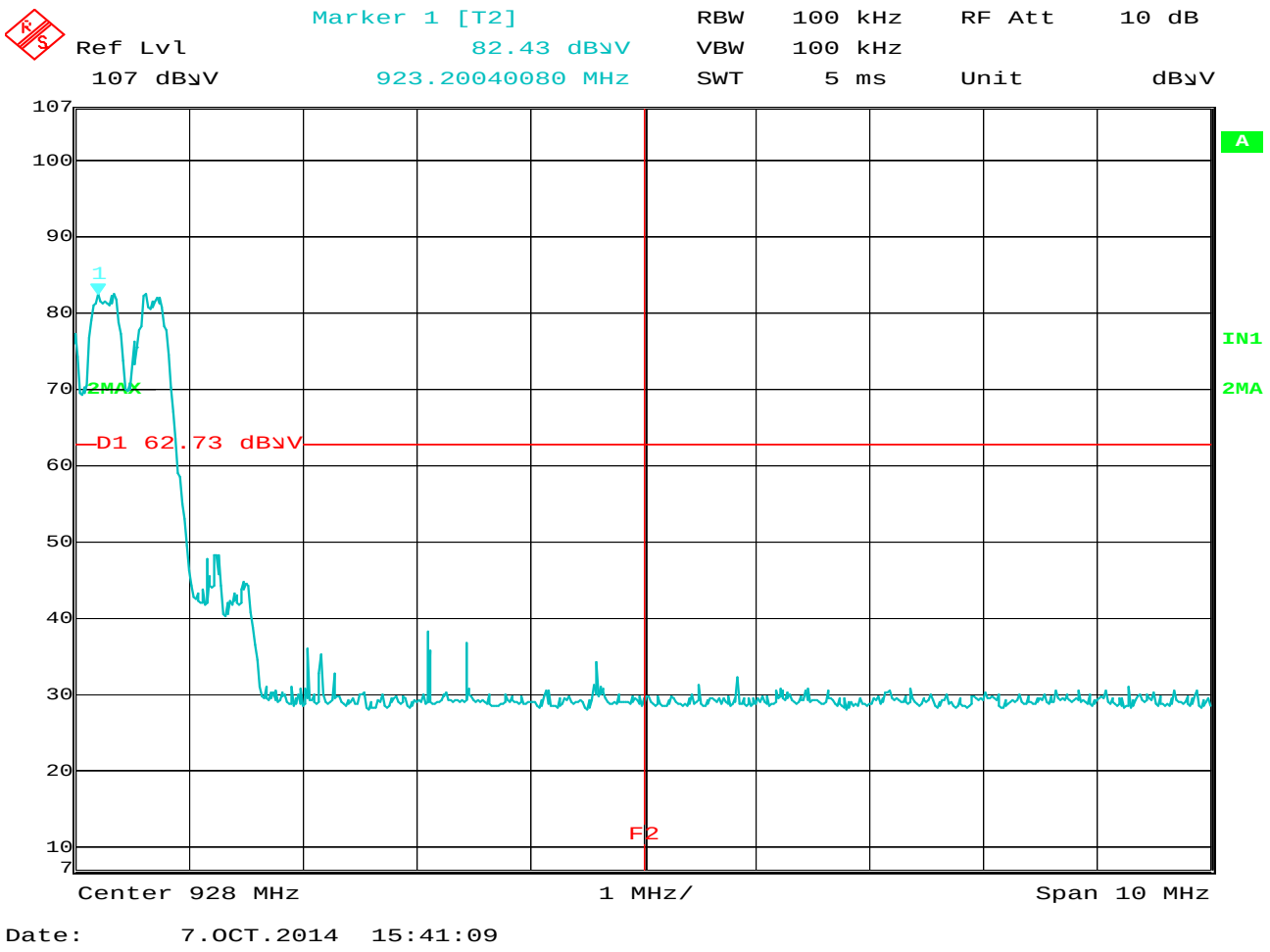
Band-Edge Requirements

MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	ORION SE3 Endpoint
SERIAL NUMBER	:	30148151
TEST MODE	:	Tx @ Hoping Enabled, Mobile Mode
TEST PARAMETERS	:	Band-edge Requirements
NOTES	:	Marker 1 = peak power in a 100kHz bandwidth. Display Line D1 represents the level 20dB down from the peak power in a 100kHz bandwidth. Display Line F1 represents the band-edge (902MHz).
EQUIPMENT USED	:	RBA0, NTA3



Band-Edge Requirements

MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	ORION SE3 Endpoint
SERIAL NUMBER	:	30148151
TEST MODE	:	Tx @ 923.675MHz, Mobile Mode
TEST PARAMETERS	:	Band-edge Requirements
NOTES	:	Marker 1 = peak power in a 100kHz bandwidth. Display Line D1 represents the level 20dB down from the peak power in a 100kHz bandwidth. Display Line F1 represents the band-edge (928MHz).
EQUIPMENT USED	:	RBA0, NTA3



Band-Edge Requirements

MANUFACTURER	:	Badger Meter
MODEL NUMBER	:	ORION SE3 Endpoint
SERIAL NUMBER	:	30148151
TEST MODE	:	Hopping Enabled, Mobile Mode
TEST PARAMETERS	:	Band-edge Requirements
NOTES	:	Marker 1 = peak power in a 100kHz bandwidth. Display Line D1 represents the level 20dB down from the peak power in a 100kHz bandwidth. Display Line F1 represents the band-edge (928MHz).
EQUIPMENT USED	:	RBA0, NTA3