Measurement of RF Interference from an Orion Gas American Transmitter

For : Badger Meter, Inc.
Milwaukee, IL

P.O. No. : 541002
Date Received : January 3, 2007
Date Tested : January 3, 2007 through January 12, 2007
Test Personnel : Richard E. King
Specification : FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Section 15.247 for Frequency Hopping Spread Spectrum Intentional Radiators Operating within The 902-928MHz band

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Richard E. King

Witnessed By : John Olsen
Badger Meter, Inc.

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Raymond J. Klouda
Registered Professional Engineer
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REVISION HISTORY

Revision	Date	Description
—	January 18, 2007	Initial release

Measurement of RF Emissions from an Orion Gas American transmitter

1.0 INTRODUCTION:

1.1 Description of Test Item - This document represents the results of the series of radio interference measurements performed on an Orion Gas American Transmitter, Serial No. None Assigned, (hereinafter referred to as the test item). The test item is a frequency hopping spread spectrum transmitter. The transmitter was designed to transmit in the 902-928 MHz band using an internal antenna. The test item was manufactured and submitted for testing by Badger Meter, Inc. located in Milwaukee, IL.

1.2 Purpose - The test series was performed to determine if the test item meets the conducted and radiated RF emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Section 15.247 for Intentional Radiators. Testing was performed in accordance with ANSI C63.4-2003.

1.3 Deviations, Additions and Exclusions - There were no deviations, additions to, or exclusions from the test specification during this test series.

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

- Federal Communications Commission "Code of Federal Regulations", Title 47, Part 15, Subpart C, dated 1 October 2006.
- ANSI C63.4-2003, "American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz"

1.5 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.

1.6 Laboratory Conditions The temperature at the time of the test was 22.3C and the relative humidity was 21%.

2.0 TEST ITEM SET-UP AND OPERATION:

The test item is an Orion Gas American Transmitter. A block diagram of the test item setup is shown as Figure 1.

2.1 Power Input - The test item obtained 3.6VDC from 2 lithium thionylchloride internal batteries.

2.2 Grounding - The test item was ungrounded during the tests.

2.3 Peripheral Equipment - The test item does require peripheral equipment.

2.4 Interconnect Cables - The test item does not require interconnect cables.

2.5 Operational Mode - For all tests the test item and all peripheral equipment were placed on an 80cm high non-conductive stand. The test item and all peripheral equipment were energized. The test item could be programmed to operate in one of the following modes: transmit at 911.65MHz, transmit at 916.45MHz, transmit at 921.25MHz, or frequency hopping enabled.

2.6 Test Item Modifications - No modifications were required for compliance to the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Sections 15.247 requirements.

3.0 TEST EQUIPMENT:

3.1 Test Equipment List - A list of the test equipment used can be found on Table I. All equipment was calibrated per the instruction manuals supplied by the manufacturer.

3.2 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).

3.3 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

4.0 REQUIREMENTS, PROCEDURES AND RESULTS:

4.1 Powerline Conducted Emissions

4.1.1 Requirements – Since the test item was powered by internal batteries, no conducted emissions tests are required.

4.2 Duty Cycle Factor Measurements:

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

With the transmitter set up to transmit for maximum pulse density, the time domain trace is displayed on the spectrum analyzer. This trace is obtained by tuning center frequency to the transmitter frequency and then setting a zero span width with 2msec/div. The markers are set at the beginning and end of a word period. If the word period exceeds 100 msec the word period is set to 100 msec.

4.2.2 Results: The plots of the duty cycle are shown on data pages 18 and 19. The test item transmits a 1.76 msec pulse every 4.14 seconds. Since a word is greater than 100 msec long, the duty cycle factor was computed over a 100 msec interval. The duty cycle correction factor was calculated to be -35dB (-35dB = 20*log(1.76msec/100msec).

4.3 Radiated Measurements

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

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

4.3.2 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 test item. For the preliminary test, a broadband measuring antenna was positioned at a 3 meter distance from the test item. 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.

A) For all harmonics **not** in the restricted bands, the following procedure was used:

1) The field strength of the fundamental was measured using a tuned dipole antenna. The dipole antenna was positioned at a 3 meter distance from the test item. A peak detector with a resolution bandwidth of 100kHz was used on the spectrum analyzer.

2) The field strength of all of the harmonics not in the restricted band were then measured using a double-ridged waveguide antenna. The waveguide antenna was positioned at a 3 meter distance from the test item. A peak detector with a resolution bandwidth of 100kHz was used on the spectrum analyzer.

3) To ensure that maximum or worst case emission levels were measured, the following steps were taken when measuring the fundamental emissions and the spurious emissions:

    a) The test item 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 for each antenna polarization to maximize the readings.

4) All harmonics not in the restricted bands must be at least 20dB below level measured at the fundamental. However, attenuation below the general limits specified in §15.209(a) is not required.

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

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

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

3) To ensure that maximum or worst case emission levels were measured, the following

steps were taken when taking all measurements:

a) The test item 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 for each antenna polarization to maximize the readings.

4) For all radiated emissions measurements below 1GHz, 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.

5) For all radiated emissions measurements above 1GHz, 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 1GHz must be no greater than 20 dB above the limits specified in 15.209(a).

6) For all radiated emissions measurements above 1GHz, the peak readings were converted to average levels using a duty cycle factor which was computed from the pulse train. All average levels must comply with the limits specified in 15.209(a).

4.3.3 Results - Preliminary radiated emissions plots are shown on pages 20 through 31. Final radiated emissions data are presented on data pages 32 through 37. As can be seen from the data, all emissions measured from the test item were within the specification limits. The emissions level closet to the limit (worst case) occurred at 7370.0 MHz. The emissions level at this frequency was 5.6 dB within the limit. See data pages 32 through 37 for details. Photographs of the test configuration which yielded the highest, or worst case, radiated emission levels are shown on Figure 3.

4.4 20dB Bandwidth

4.4.1 Requirement - 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.

4.4.2 Procedures - The test item was setup inside the chamber. With the hopping function disabled, the test item 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 ≥ to 1% of the 20 dB BW.

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.

4.4.3 Results - The plots on pages 38 through 40 show that the maximum 20 dB bandwidth was 253kHz. Therefore, the carrier frequency separation must be greater than 253kHz and the number of hopping channels must be at least 25.

4.5 Carrier Frequency Separation

4.5.1 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.

4.5.2 Procedures - The test item was setup inside the chamber. With the hopping function enabled, the test item was allowed to transmit continuously.

The resolution bandwidth (RBW) was set to ≥ to 1% of the span. The peak detector and 'Max-Hold' function were engaged. The span was set wide enough to capture the peaks of at least two adjacent channels.

When the trace had stabilized after multiple scans, the marker-delta function was used to determine the separation between the peaks of the adjacent channels. The analyzer's display was plotted using a 'screen dump' utility.

4.5.3 Results - Page 41 shows the carrier frequency separation. As can be seen from this plot, the separation is 402 kHz which is greater than the 20dB bandwidth (253kHz).

4.6 Number of Hopping Frequencies

4.6.1 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.

4.6.2 Procedures - The test item was setup inside the chamber. With the hopping function enabled, the test item was allowed to transmit continuously.

The resolution bandwidth (RBW) was set to ≥ to 1% of the span. The peak detector and 'Max-Hold' function were engaged. The span was set wide enough to capture the entire frequency band of operation.

The test item'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.

4.6.3 Results - Page 42 shows the number of hopping frequencies. As can be seen from this plot, the number of hopping frequencies is 25 which is equal to the minimum number of required hopping frequencies for systems with a 20dB bandwidth greater than 250kHz.

4.7 Time of Occupancy

4.7.1 Requirement - Per section 15.247(a)(1)(i), for frequency hopping systems operating in the 902-928MHz band, the average time of occupancy shall not be greater than 0.4 seconds within a 10 second period multiplied by the number of hopping channels employed.

4.7.2 Procedures - The test item was setup inside the chamber. With the hopping function enabled, the test item was allowed to transmit continuously.

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

The dwell time in a 10 second period was then calculated from dwell time per hop multiplied by the number of hops.

4.7.3 Results - Pages 43 and 44 show the plots for the time of occupancy (dwell time). As can be seen from the plots, the time of occupancy can be determined by a 1.72 msec pulse multiplied by 3 hops. This calculated value is equal to .00516 seconds which is less than the 0.4 seconds maximum allowed.

4.8 Peak Output Power

4.8.1 Requirement - Per section 15.247(b)(2), for frequency hopping systems operating in the 902-928MHz band and employing at least 25 hopping channels, the maximum peak output conducted power shall not be greater than 250mW (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).

4.8.2 Procedures - The test item was placed on the non-conductive stand and set to transmit. A dipole antenna was placed at a test distance of 3 meters from the test item. The test item 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, another dipole antenna was then set in place of test item 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.

4.8.3 Results - The results are presented on page 45. The maximum EIRP measured from the transmitter was 10.9 dBm or 12 mW which is below the 1 Watt limit.

4.9 Band edge Compliance

4.9.1 Requirement - Per section 15.247(d), the emissions at the band-edges must be at least 20dB below the highest level measured within the band. In addition, if the band-edge falls in a restricted band, the radiated emissions must meet the general limits of 15.209.

4.9.2 Procedures - The test item was setup inside the chamber on a non-conductive stand. A broadband measuring antenna was placed at a test distance of 3 meters from the test item. With the hopping function disabled, the test item was allowed to transmit continuously. The test item was maximized for worst case emissions at the measuring antenna. The maximum meter reading was recorded. The frequency hopping channel was set separately to low and high hopping channels. The resolution bandwidth (RBW) was set to 300 kHz. 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. The measurement was repeated with the frequency hopping function enabled.

4.9.3 Results - Pages 46 through 49 show the radiated band-edge compliance results. As can be seen from these plots, the emissions at the band-edge are within the 20 dB down limits.

5.0 CONCLUSIONS:

It was determined that the Badger Meter, Inc. Orion Gas American Transmitter, Serial No. None

Assigned, did fully meet the conducted and radiated emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Sections 15.207 and 15.247 for Intentional Radiators Operating within the 902MHz - 928MHz band, when tested per ANSI C63.4-2003.

6.0 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 test item at the test date. Any electrical or mechanical modification made to the test item subsequent to the specified test date will serve to invalidate the data and void this certification.

7.0 ENDORSEMENT DISCLAIMER:

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

TABLE I: TEST EQUIPMENT LIST

ELITE ELECTRONIC ENG. INC. Page: 1

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Cal Inv	Due Date
Equipment Type: ACCESSORIES, MISCELLANEOUS								
XPQ3	HIGH PASS FILTER	K&L MICROWAVE	4IH30-1804/T	4	1.8GHZ-10GHZ		12	
XZG5	ATTENUATOR/SWITCH DRIVER	HEWLETT PACKARD	11713A	2508A05689	PROGRAMMABLE		NOTE 1	
Equipment Type: AMPLIFIERS								
APK5	PREAMPLIFIER	HEWLETT PACKARD	8449B	29331A00183	2GHZ-22GHZ	04/27/06	12	04/27/07
Equipment Type: ANTENNAS								
NDQ0	TUNED DIPOLE ANTENNA	EMCO	3121C-DB4	311	400-1000MHZ	02/16/06	12	02/16/07
NDQ1	TUNED DIPOLE ANTENNA	EMCO	3121C-DB4	313	400-1000MHZ	03/10/06	12	03/10/07
NTA0	BILOG ANTENNA	CHASE EMC LTD.	BILOG CBL611	2057	0.03-2GHZ	08/21/06	12	08/21/07
NWF0	RIDGED WAVE GUIDE	EMCO	3105	2035	1-12.4GHZ	10/09/06	12	10/09/07
Equipment Type: CONTROLLERS								
CDS2	COMPUTER	GATEWAY	MFATXPNT NMZ	0028483108	1.8GHZ		N/A	
CMA0	MULTI-DEVICE CONTROLLER	EMCO	2090	9701-1213	---		N/A	
Equipment Type: PRINTERS AND PLOTTERS								
HRE1	LASER JET 5P	HEWLETT PACKARD	C3150A	USHB061052	---		N/A	
Equipment Type: RECEIVERS								
RAC2	SPECTRUM ANALYZER	HEWLETT PACKARD	85660B	2504A01234	100HZ-22GHZ	02/10/06	12	02/10/07
RACH	RF PRESELECTOR	HEWLETT PACKARD	85685A	8574A00284	20HZ-2GHZ	10/11/06	12	10/11/07
RAF6	QUASIPEAK ADAPTOR W/ RECEI	HEWLETT PACKARD	85650A	2412A00403	0.01-1000MHZ	08/17/06	12	08/17/07
Equipment Type: SIGNAL GENERATORS								
GBR6	SIGNAL GENERATOR	HEWLETT PACKARD	8648C	3642U02047	9KHZ-3000MHZ	02/16/06	12	02/16/07

Cal. Interval: Listed in Months I/O: Initial Only N/A: Not Applicable

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

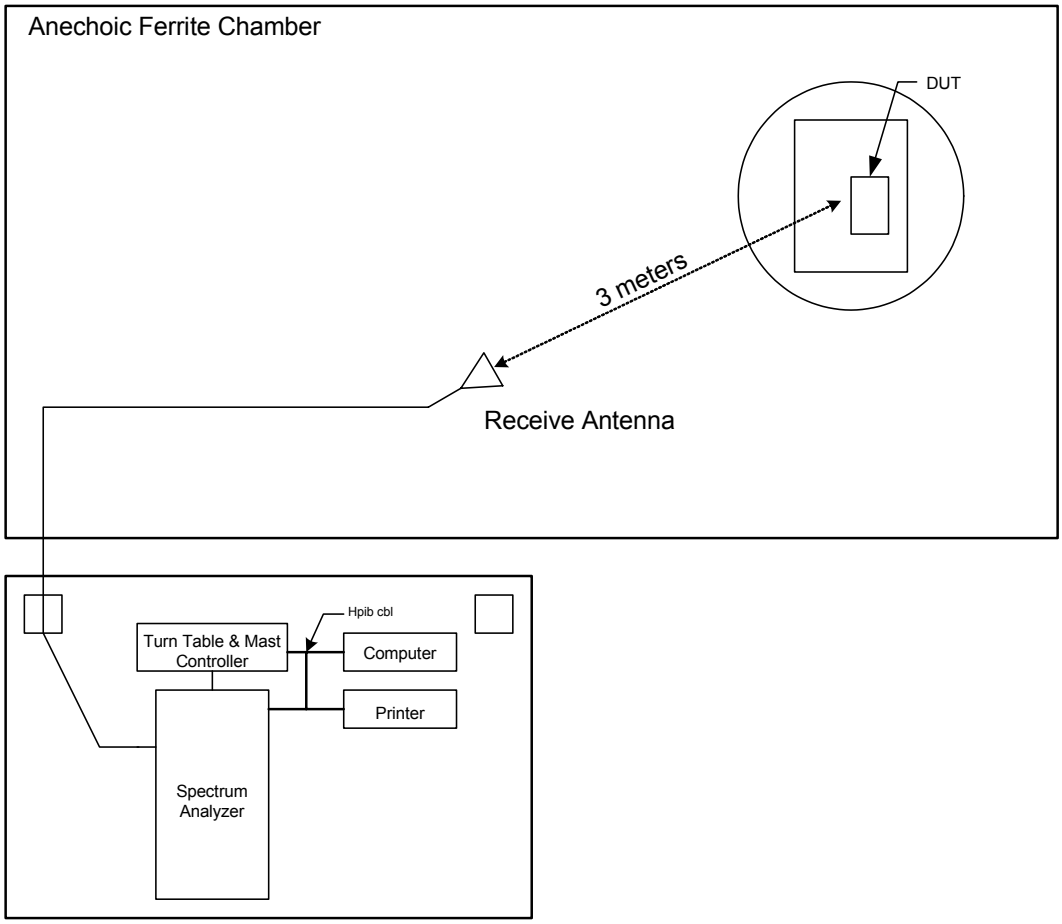


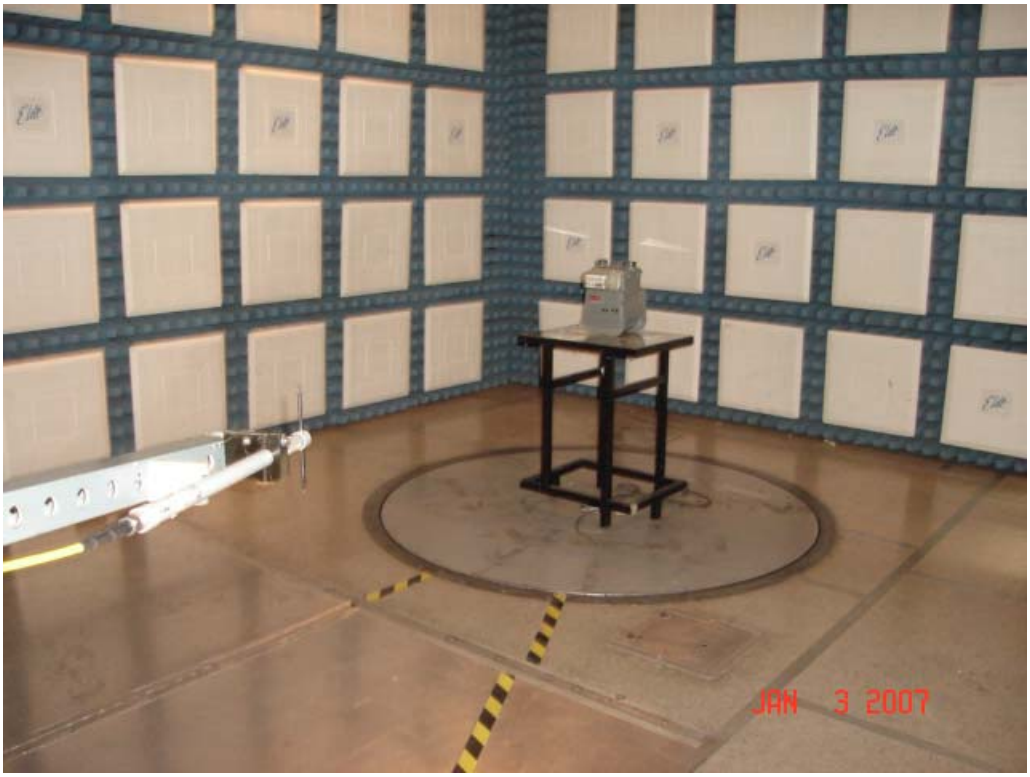
FIGURE 1 BLOCKDIAGRAM OF TEST SETUP

Figure 2

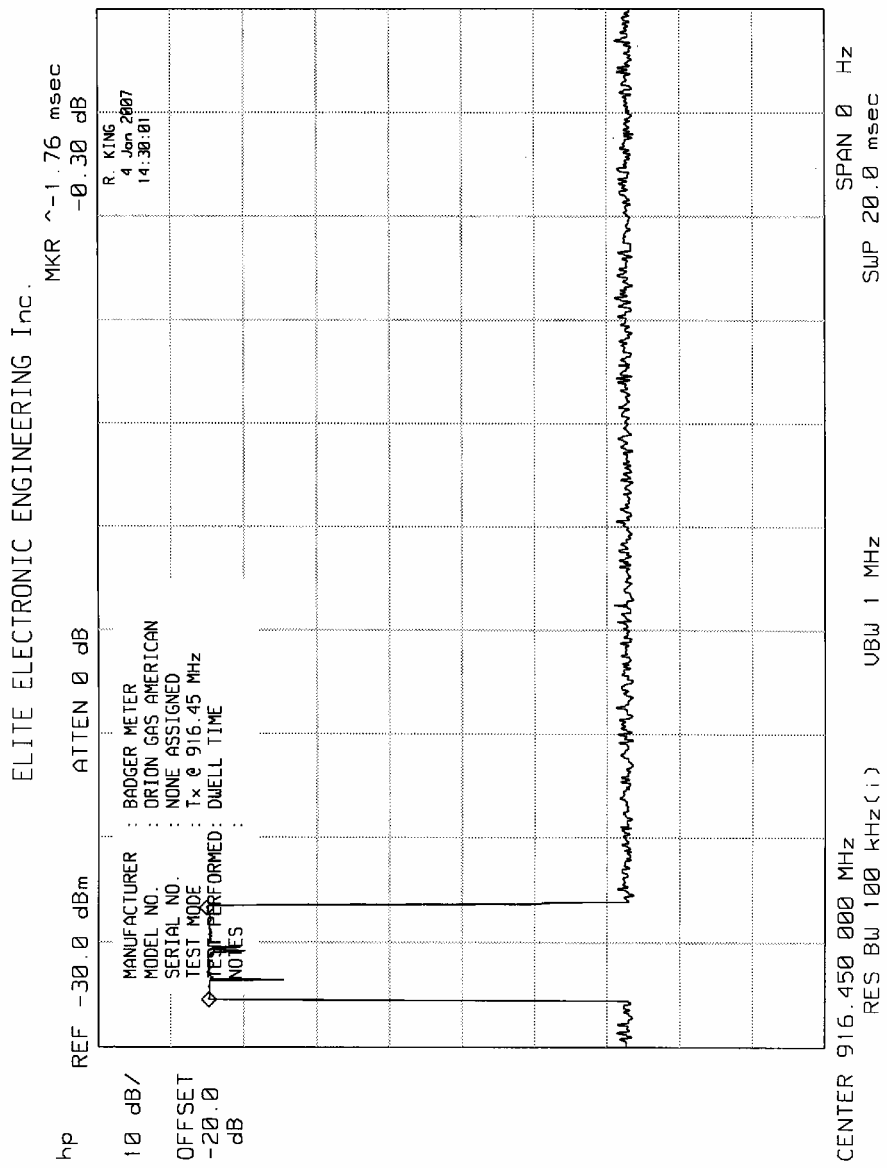
Test Item Set-up

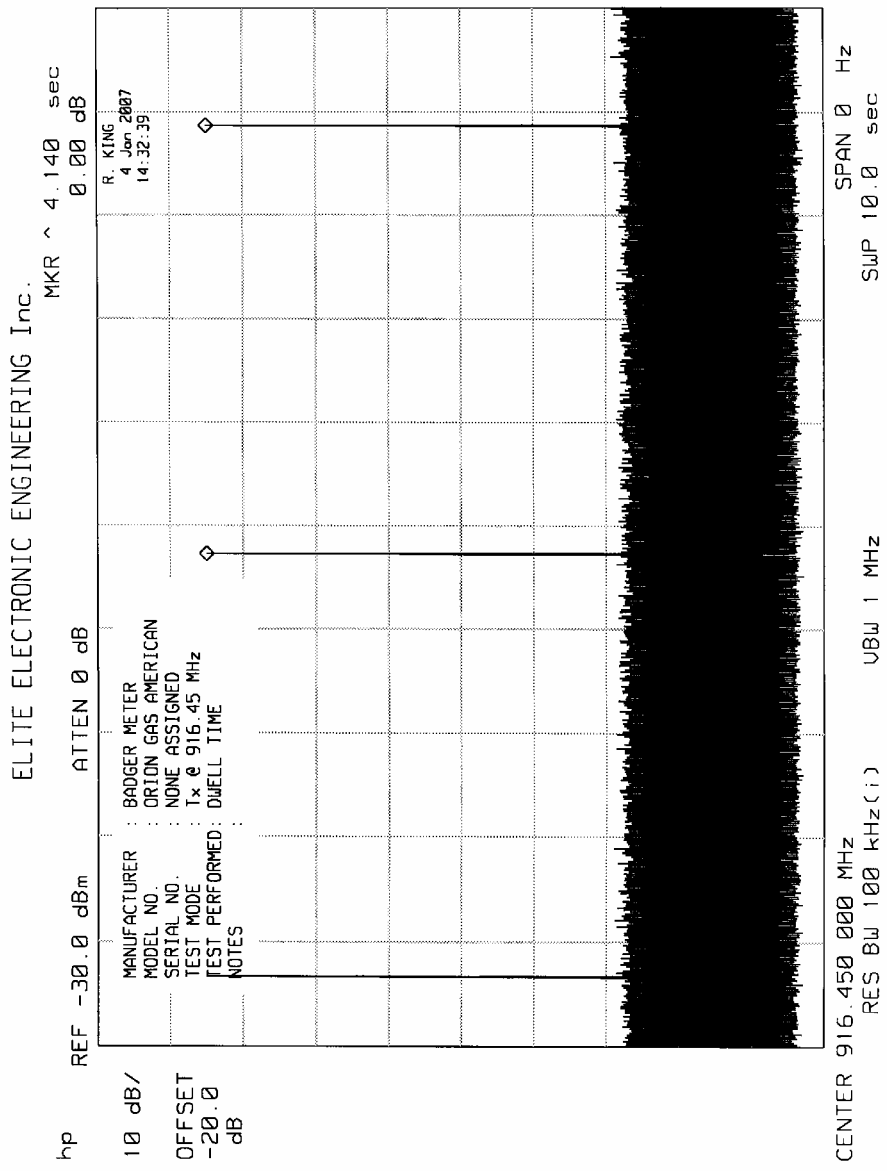
Figure 3

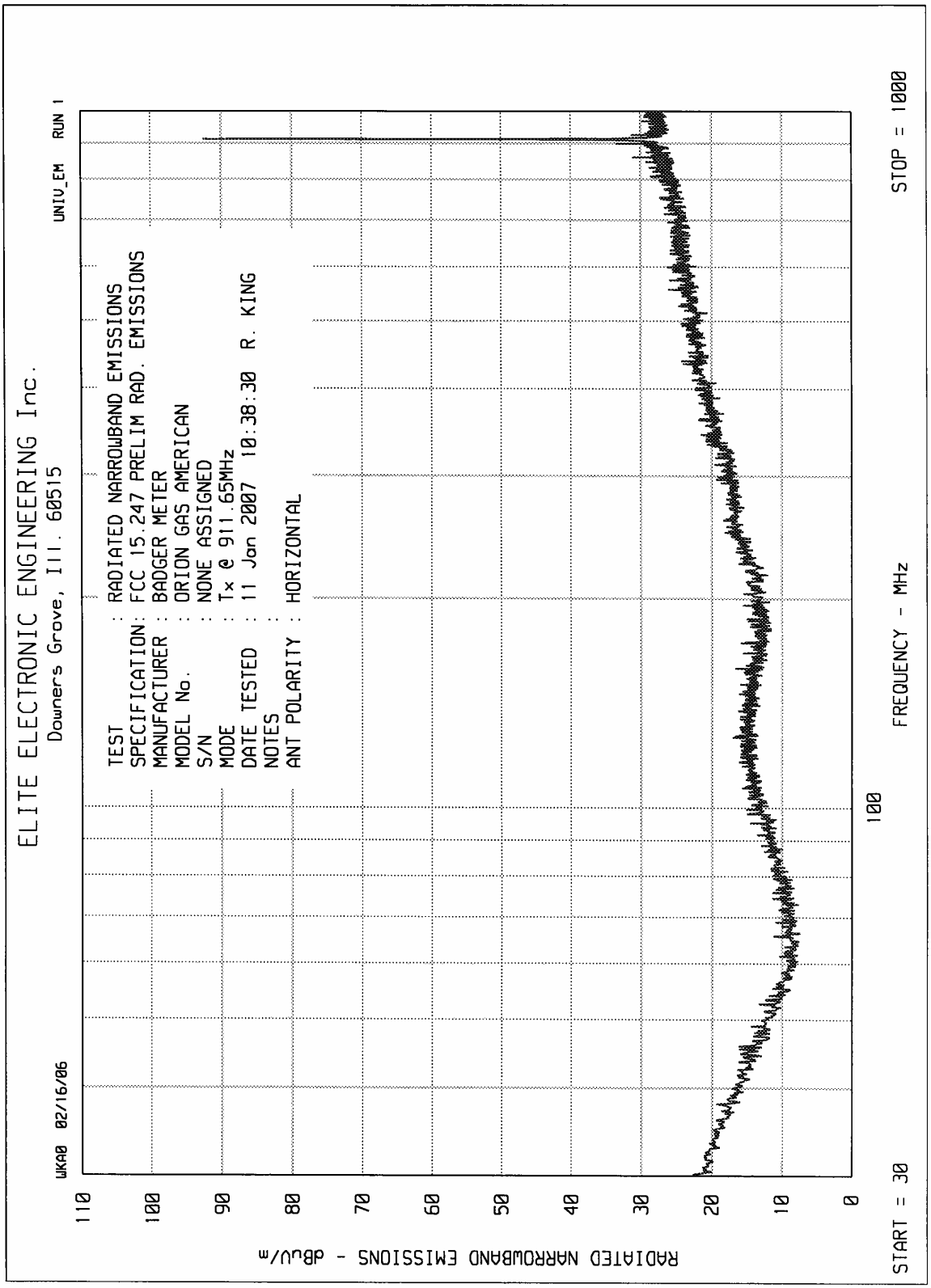
Test Set-up for Radiated Emissions, 911.65MHz to 921.25MHz Horizontal Polarization

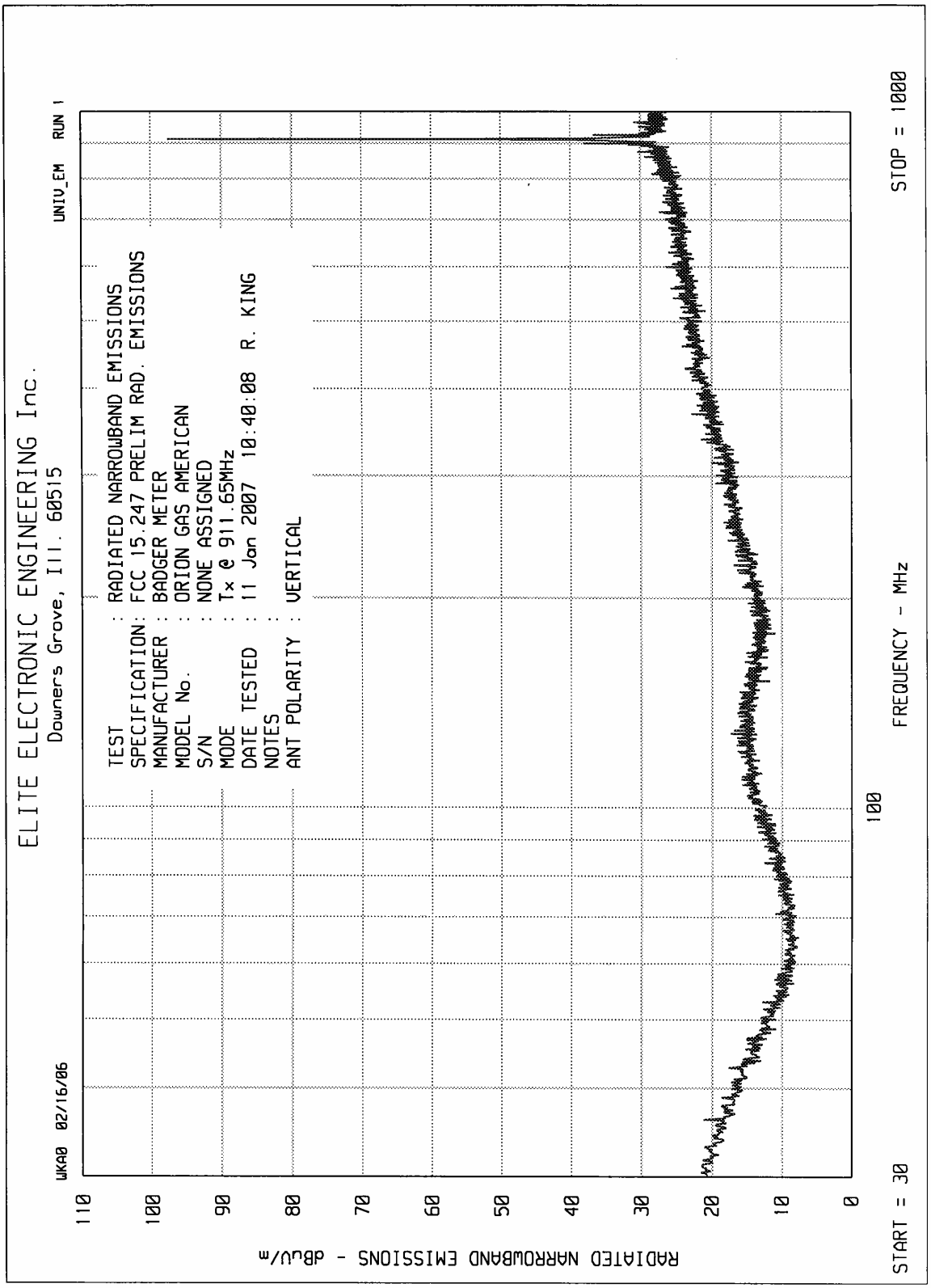


Test Set-up for Radiated Emissions, 911.65MHz to 921.25MHz Vertical Polarization


ELITE ELECTRONIC ENGINEERING Inc.
MKR ^-1.76 msec
-0.30 dB
R. KING
4 Jan 2007
14:30:01
hp
REF -30.0 dBm
ATTEN 0 dB
10 dB/
OFFSET
-20.0
dB
MANUFACTURER : BADGER METER
MODEL NO. : ORION GAS AMERICAN
SERIAL NO. : NONE ASSIGNED
TEST MODE : Tx @ 916.45 MHz
TEST PERFORMED: DWELL TIME
NOTES :
CENTER 916.450 000 MHz
RES BW 100 kHz(i)
VBW 1 MHz
SPAN 0 Hz
SWP 20.0 msec


ELITE ELECTRONIC ENGINEERING Inc.
hp
REF -30.0 dBm
ATTEN 0 dB
MKR ^ 4.140 sec
0.00 dB
10 dB/
OFFSET
-20.0
dB
MANUFACTURER : BADGER METER
MODEL NO. : ORION GAS AMERICAN
SERIAL NO. : NONE ASSIGNED
TEST MODE : 1x @ 916.45 MHz
TEST PERFORMED: DWELL TIME
NOTES :
R. KING
4 Jan 2007
14:32:39
CENTER 916.450 000 MHz
RES BW 100 kHz(i)
VBW 1 MHz
SPAN 0 Hz
SWP 10.0 sec


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV_EM RUN 1
WKA0 02/16/06
TEST : RADIATED NARROWBAND EMISSIONS
SPECIFICATION: FCC 15.247 PRELIM RAD. EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION GAS AMERICAN
S/N : NONE ASSIGNED
MODE : Tx @ 911.65MHz
DATE TESTED : 11 Jan 2007 10:38:30 R. KING
NOTES : :
ANT POLARITY : HORIZONTAL
RADIATED NARROWBAND EMISSIONS - dBuV/m
110
100
90
80
70
60
50
40
30
20
10
0
START = 30
100
FREQUENCY - MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV_EM RUN 1
WKA0 02/16/06
TEST : RADIATED NARROWBAND EMISSIONS
SPECIFICATION: FCC 15.247 PRELIM RAD. EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION GAS AMERICAN
S/N : NONE ASSIGNED
MODE : Tx @ 911.65MHz
DATE TESTED : 11 Jan 2007 10:40:08 R. KING
NOTES :
ANT POLARITY : VERTICAL
RADIATED NARROWBAND EMISSIONS - dBuV/m
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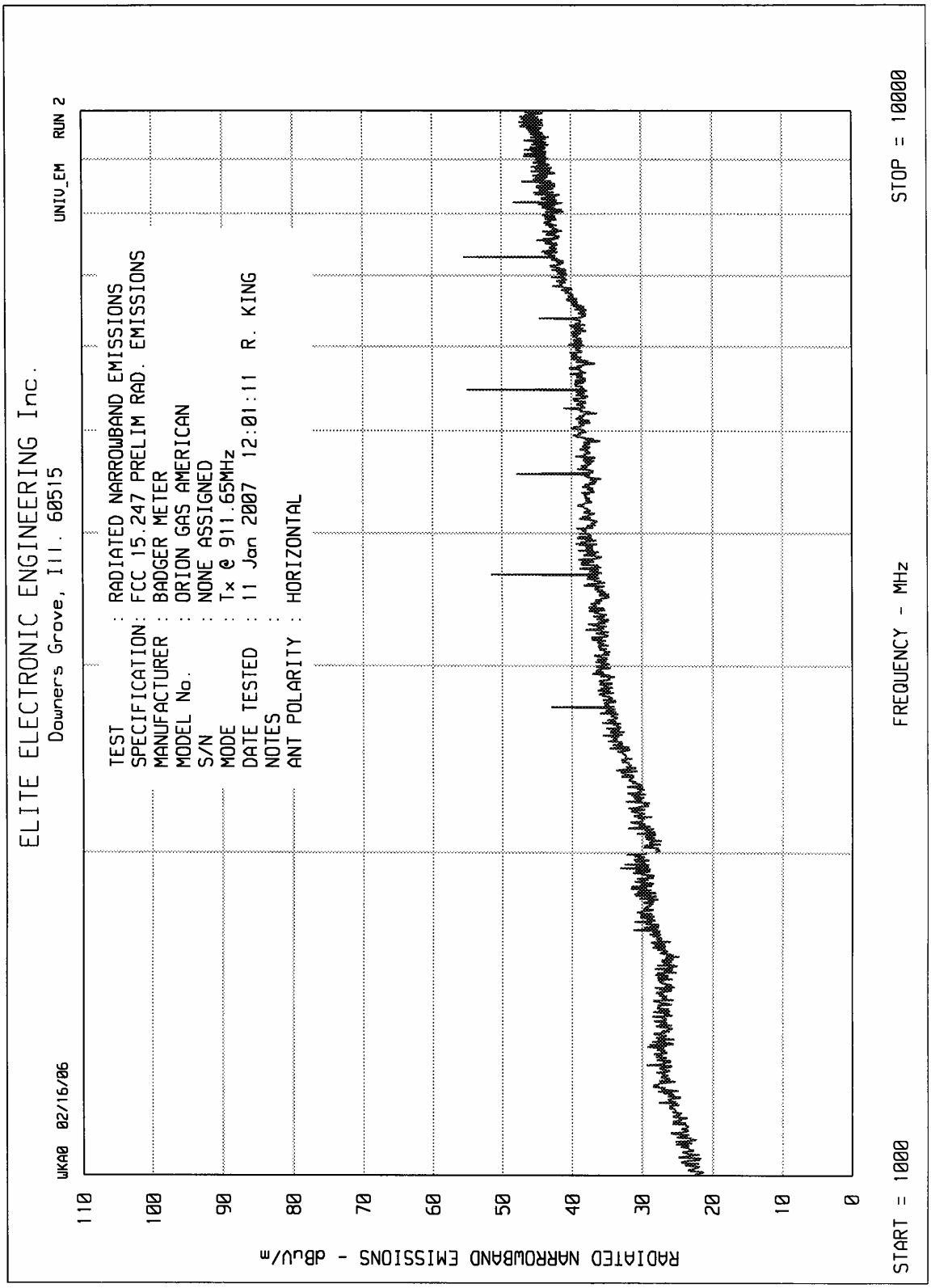
100
90
80
70
60
50
40
30
20
10
0
START = 30
100
FREQUENCY - MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV_EM RUN 2
WKA0 02/16/06
TEST : RADIATED NARROWBAND EMISSIONS
SPECIFICATION: FCC 15.247 PRELIM RAD. EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION GAS AMERICAN
S/N : NONE ASSIGNED
MODE : Tx @ 911.65MHz
DATE TESTED : 11 Jan 2007 12:01:11 R. KING
NOTES :
ANT POLARITY : HORIZONTAL
RADIATED NARROWBAND EMISSIONS - dBuV/m
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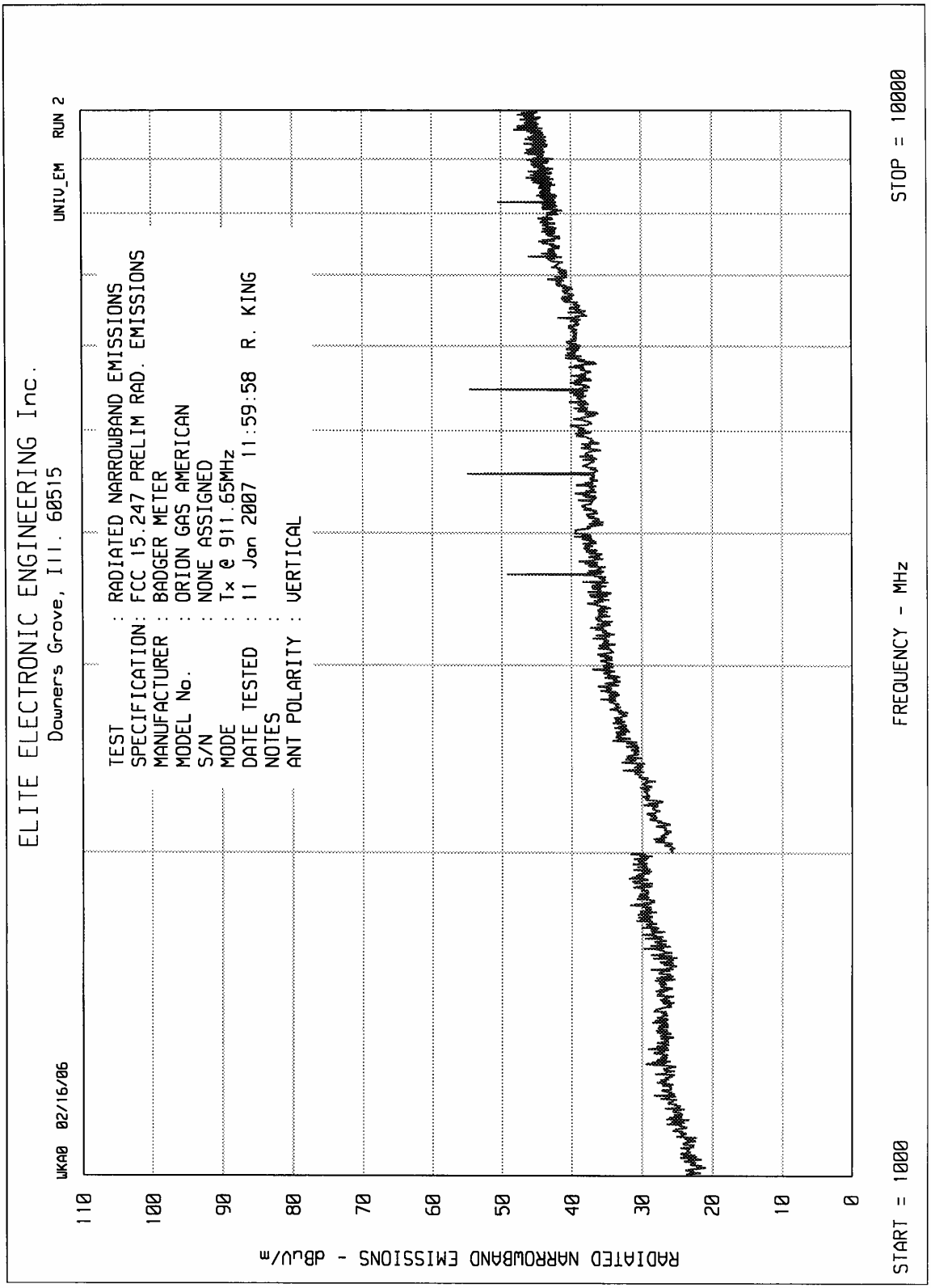
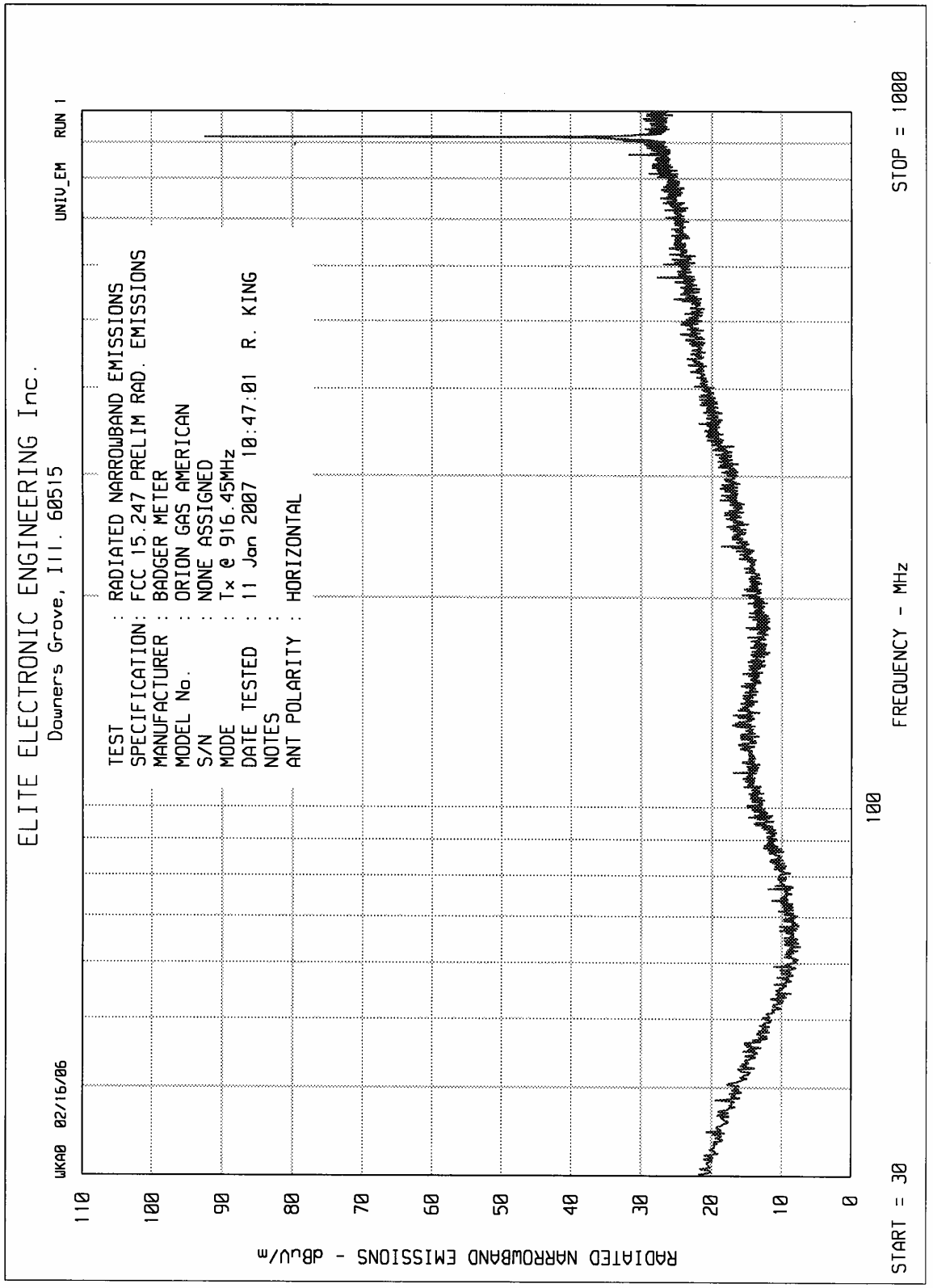
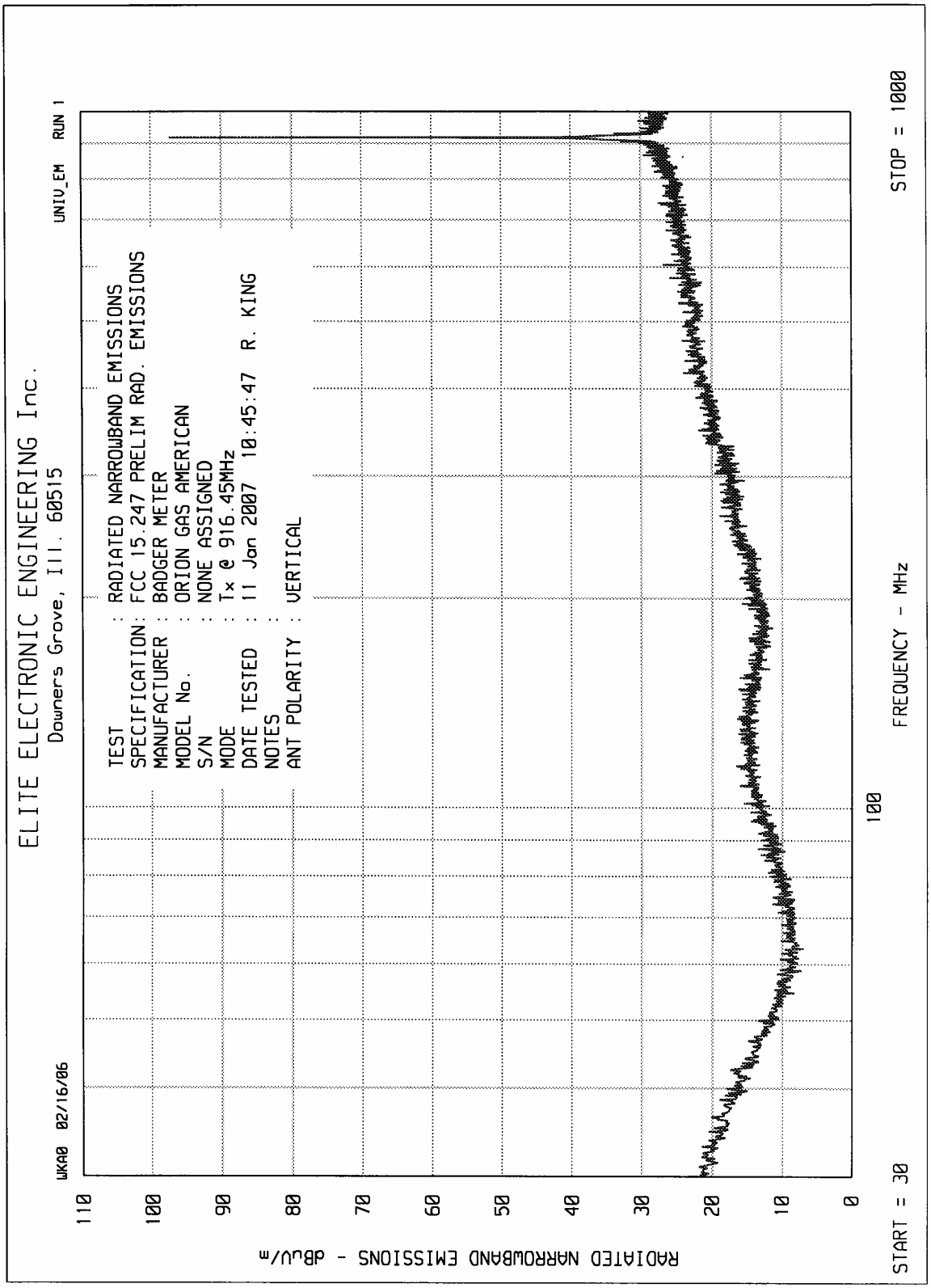
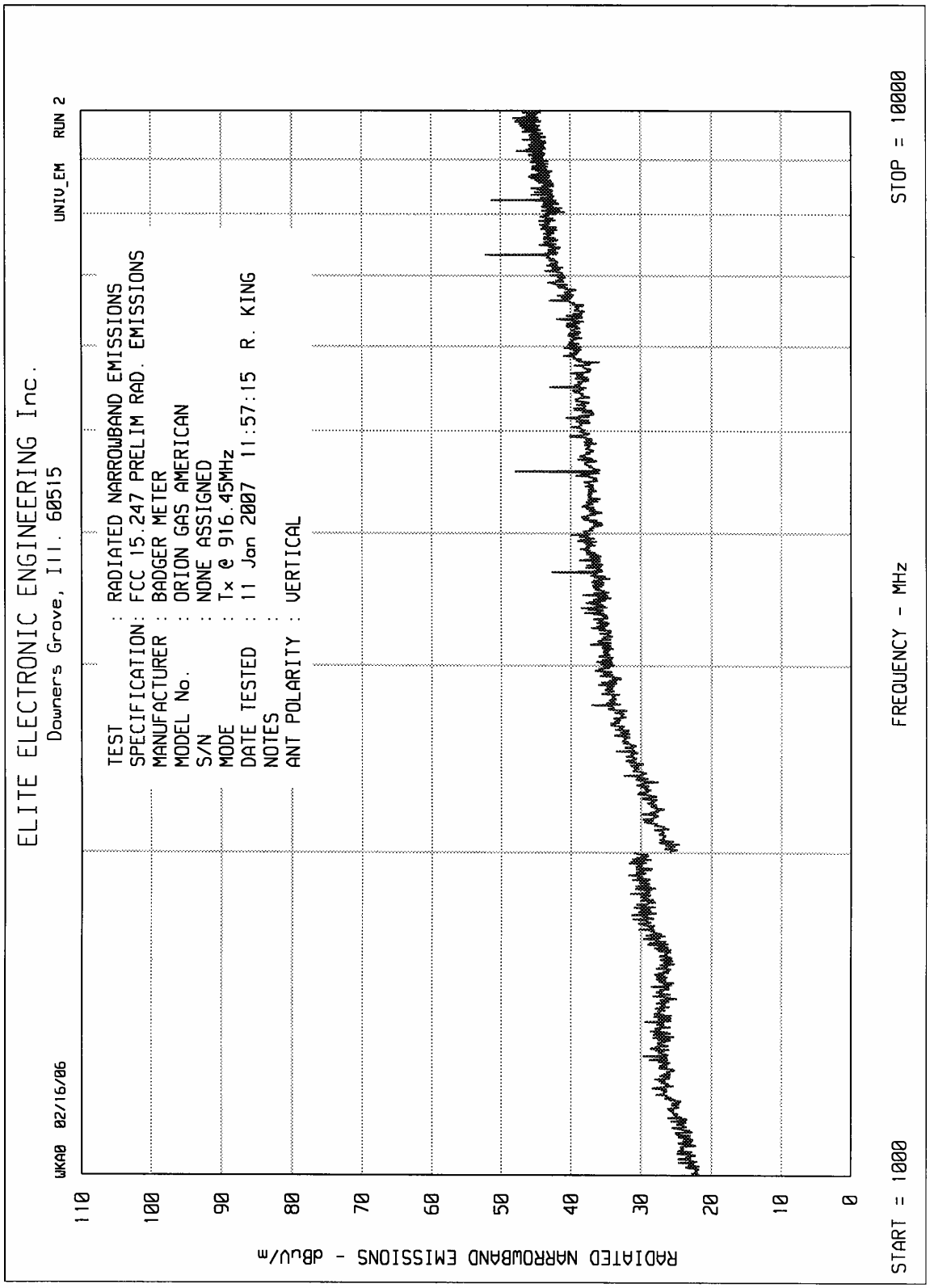
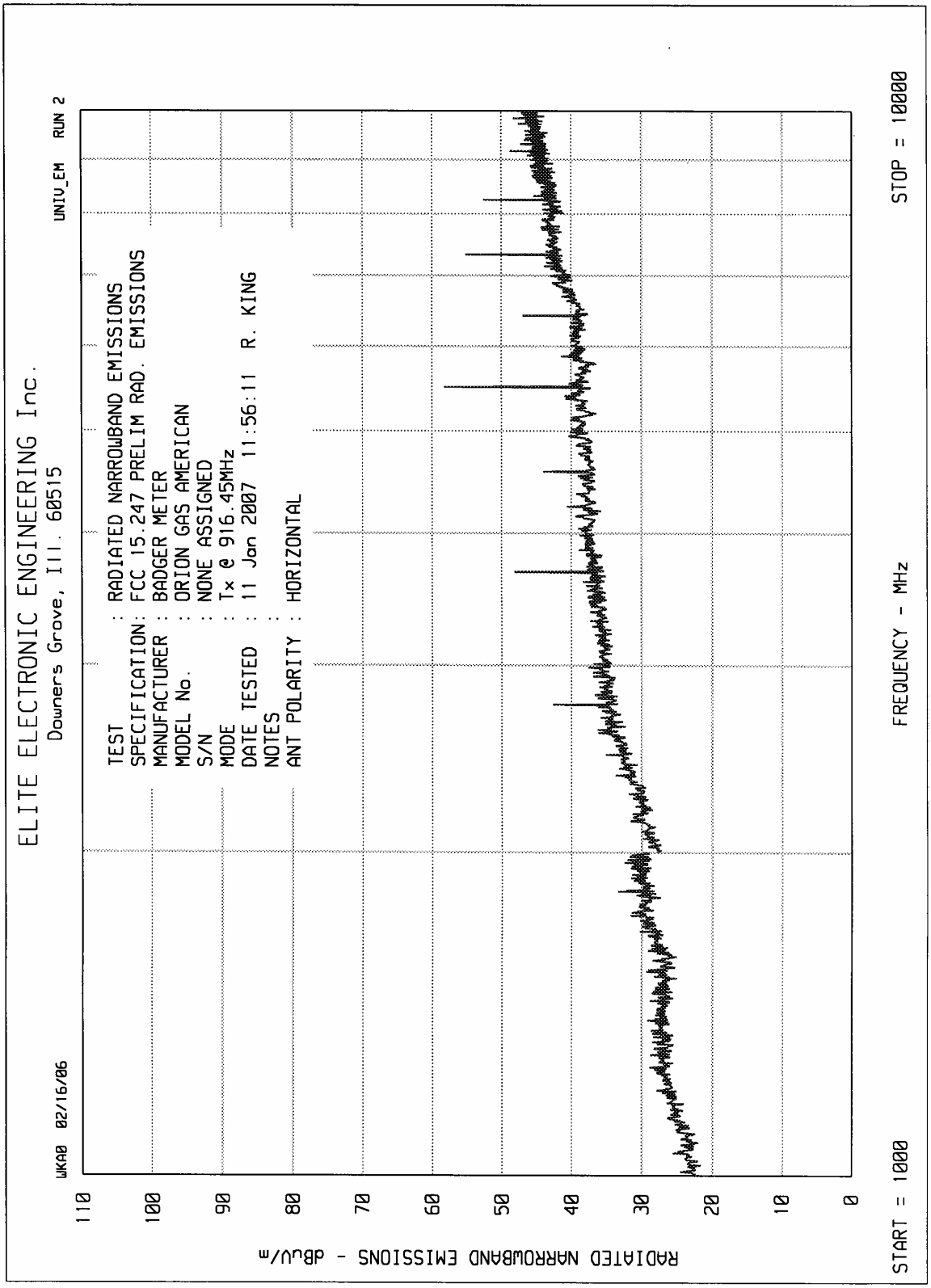
100
90
80
70
60
50
40
30
20
10
0
START = 1000
FREQUENCY - MHz
STOP = 10000

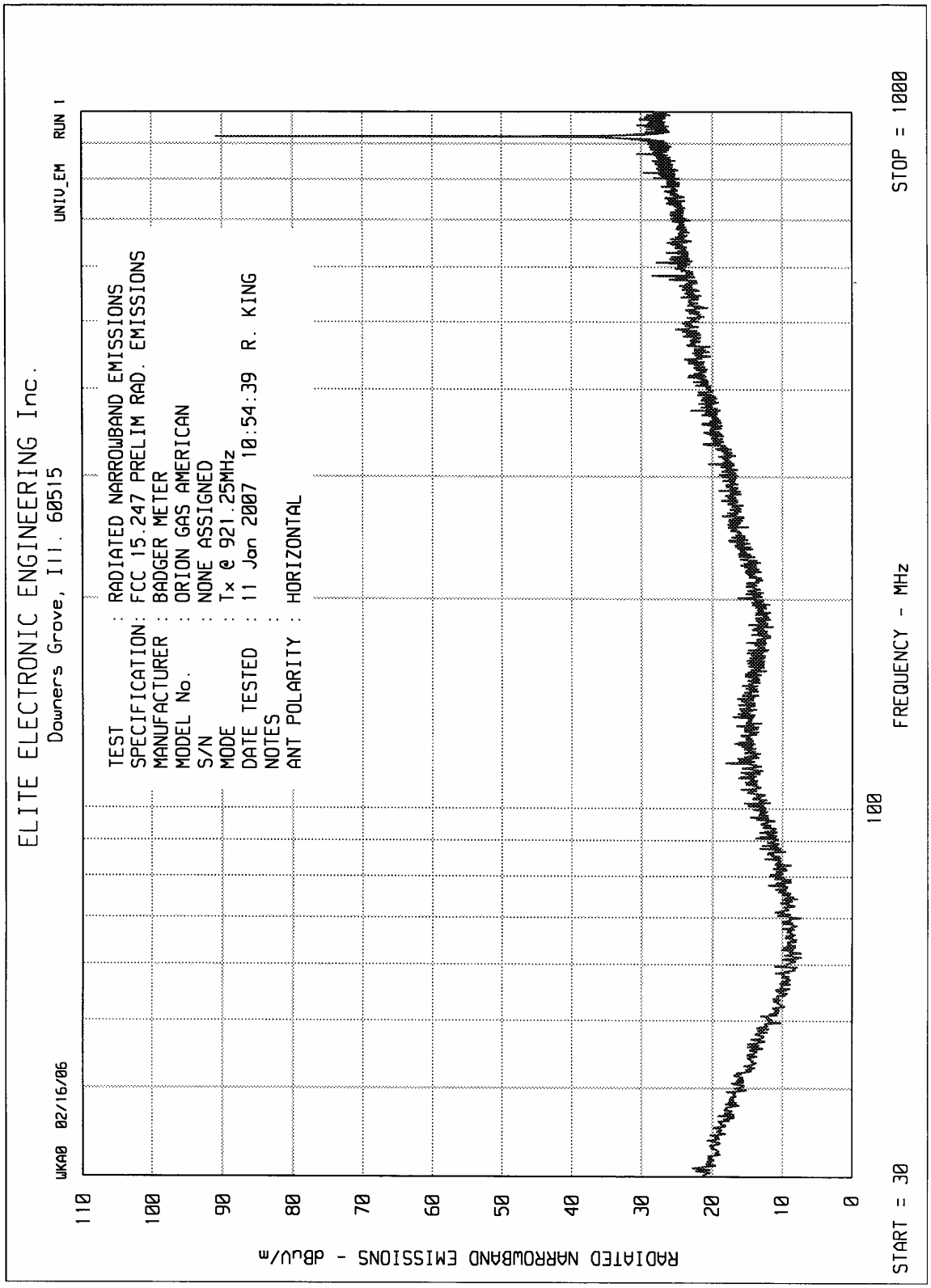

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV_EM RUN 2
WKA0 02/16/06
TEST : RADIATED NARROWBAND EMISSIONS
SPECIFICATION: FCC 15.247 PRELIM RAD. EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION GAS AMERICAN
S/N : NONE ASSIGNED
MODE : Tx @ 911.65MHz
DATE TESTED : 11 Jan 2007 11:59:58 R. KING
NOTES : :
ANT POLARITY : VERTICAL
RADIATED NARROWBAND EMISSIONS - dBuV/m
110
100
90
80
70
60
50
40
30
20
10
0
START = 1000
FREQUENCY - MHz
STOP = 10000

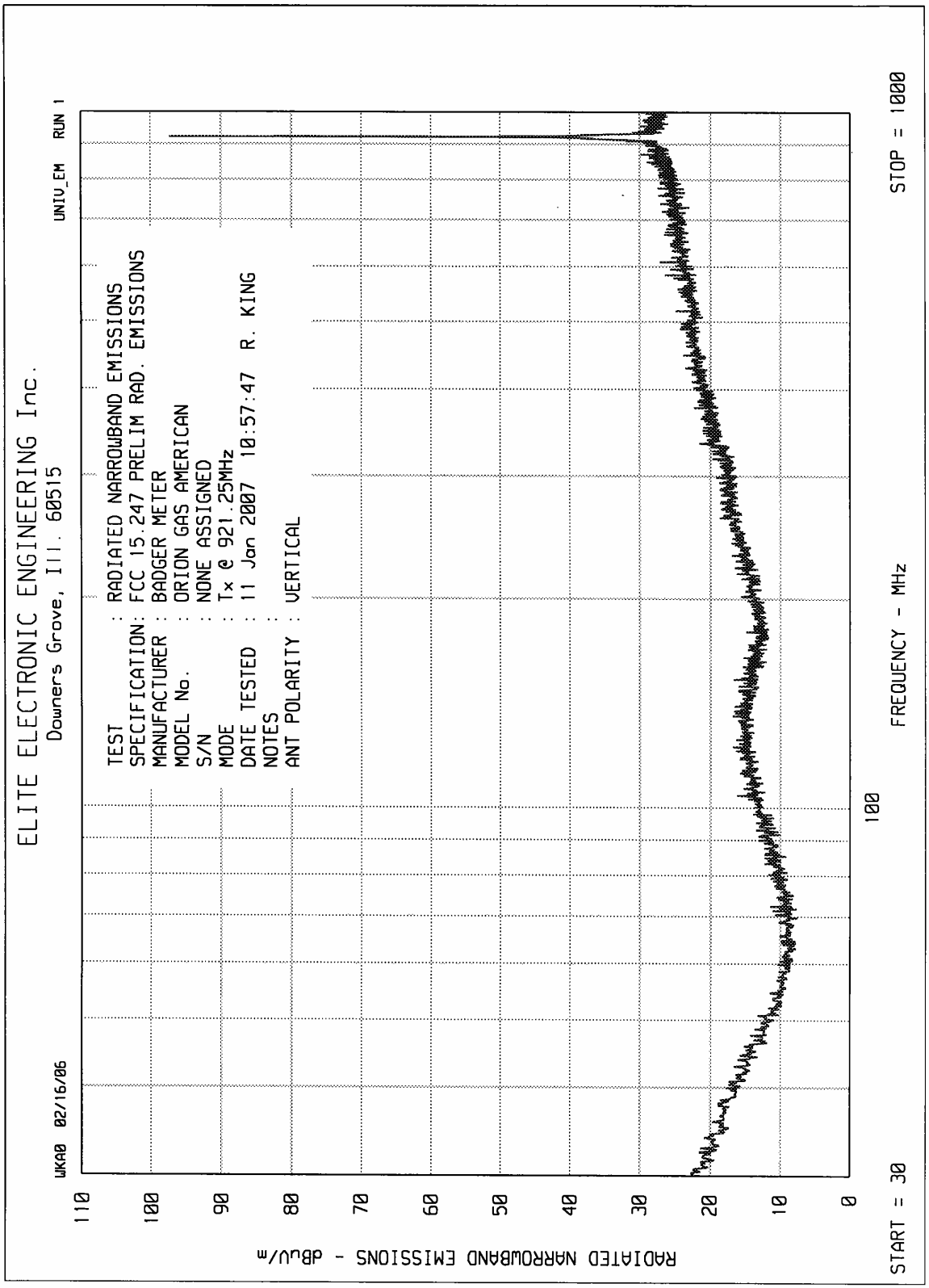

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV_EM RUN 1
WKA0 02/16/06
TEST : RADIATED NARROWBAND EMISSIONS
SPECIFICATION: FCC 15.247 PRELIM RAD. EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION GAS AMERICAN
S/N : NONE ASSIGNED
MODE : Tx @ 916.45MHz
DATE TESTED : 11 Jan 2007 10:47:01 R. KING
NOTES : :
ANT POLARITY : HORIZONTAL
RADIATED NARROWBAND EMISSIONS - dBuV/m
110
100
90
80
70
60
50
40
30
20
10
0
START = 30
100
FREQUENCY - MHz
STOP = 1000

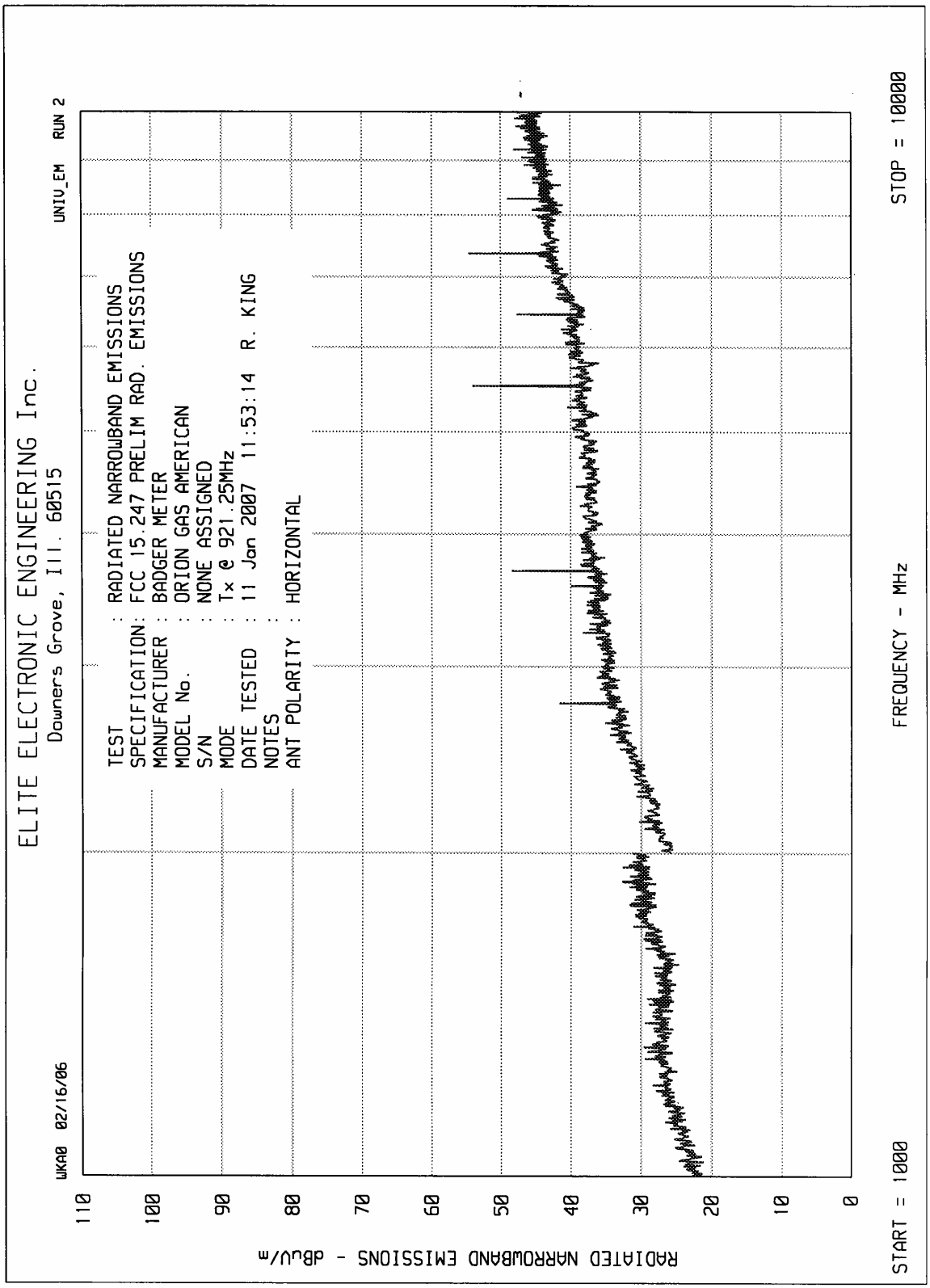

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV_EM RUN 1
WKA0 02/16/06
TEST : RADIATED NARROWBAND EMISSIONS
SPECIFICATION: FCC 15.247 PRELIM RAD. EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION GAS AMERICAN
S/N : NONE ASSIGNED
MODE : Tx @ 916.45MHz
DATE TESTED : 11 Jan 2007 10:45:47 R. KING
NOTES : :
ANT POLARITY : VERTICAL
RADIATED NARROWBAND EMISSIONS - dBuV/m
110
100
90
80
70
60
50
40
30
20
10
0
START = 30
100
FREQUENCY - MHz
STOP = 1000

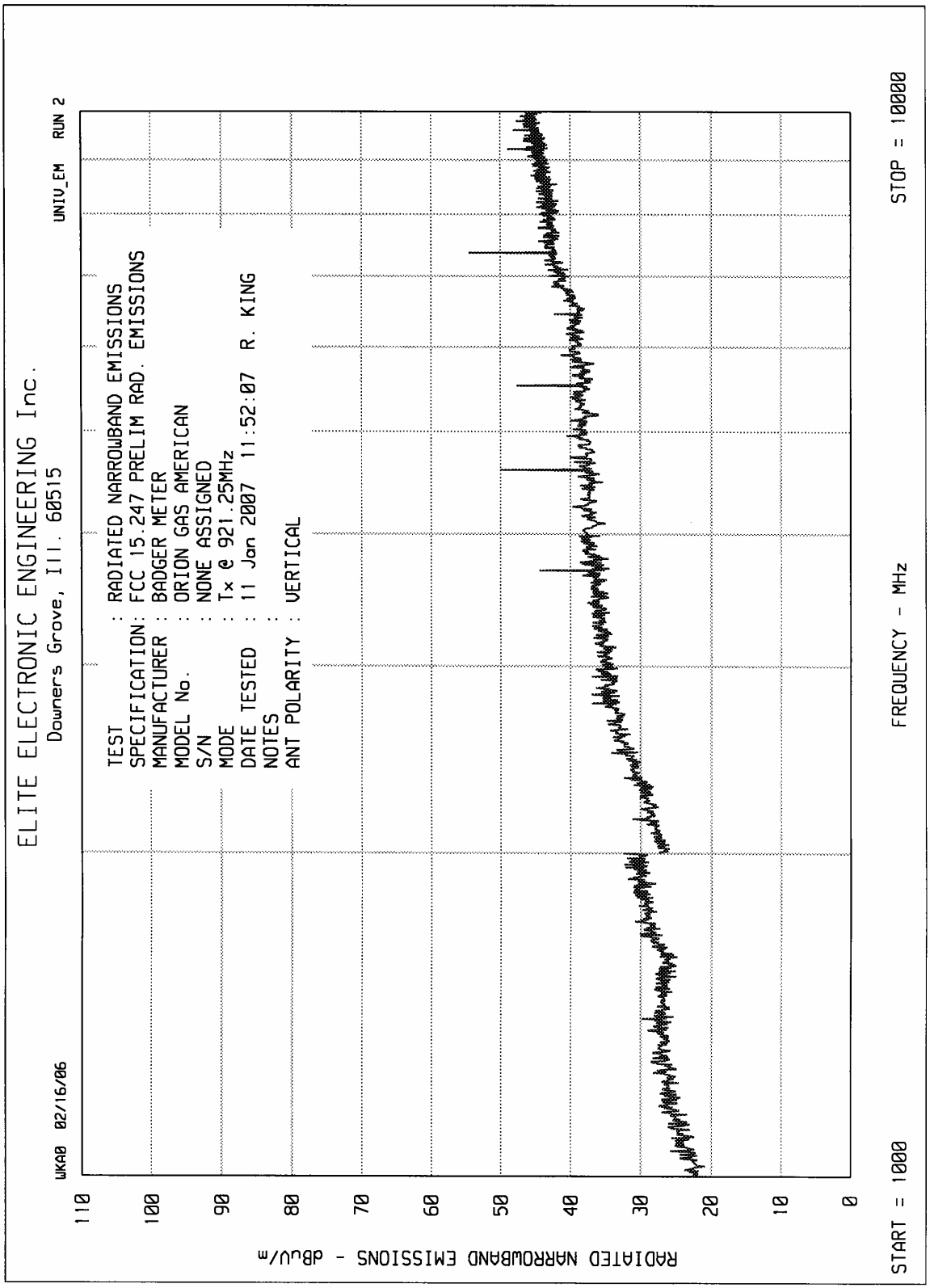

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV_EM RUN 2
WKA0 02/16/06
TEST : RADIATED NARROWBAND EMISSIONS
SPECIFICATION: FCC 15.247 PRELIM RAD. EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION GAS AMERICAN
S/N : NONE ASSIGNED
MODE : Tx @ 916.45MHz
DATE TESTED : 11 Jan 2007 11:57:15 R. KING
NOTES :
ANT POLARITY : VERTICAL
RADIATED NARROWBAND EMISSIONS - dBuV/m
110
100
90
80
70
60
50
40
30
20
10
0
START = 1000
FREQUENCY - MHz
STOP = 10000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV_EM RUN 2
WKA0 02/16/06
TEST : RADIATED NARROWBAND EMISSIONS
SPECIFICATION: FCC 15.247 PRELIM RAD. EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION GAS AMERICAN
S/N : NONE ASSIGNED
MODE : Tx @ 916.45MHz
DATE TESTED : 11 Jan 2007 11:56:11 R. KING
NOTES : :
ANT POLARITY : HORIZONTAL
RADIATED NARROWBAND EMISSIONS - dBuV/m
110
100
90
80
70
60
50
40
30
20
10
0
START = 1000
FREQUENCY - MHz
STOP = 10000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV_EM RUN 1
WKA0 02/16/06
TEST : RADIATED NARROWBAND EMISSIONS
SPECIFICATION: FCC 15.247 PRELIM RAD. EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION GAS AMERICAN
S/N : NONE ASSIGNED
MODE : Tx @ 921.25MHz
DATE TESTED : 11 Jan 2007 10:54:39 R. KING
NOTES : :
ANT POLARITY : HORIZONTAL
RADIATED NARROWBAND EMISSIONS - dBuV/m
110
100
90
80
70
60
50
40
30
20
10
0
START = 30
100
FREQUENCY - MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV_EM RUN 1
WKA0 02/16/06
TEST : RADIATED NARROWBAND EMISSIONS
SPECIFICATION: FCC 15.247 PRELIM RAD. EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION GAS AMERICAN
S/N : NONE ASSIGNED
MODE : Tx @ 921.25MHz
DATE TESTED : 11 Jan 2007 10:57:47 R. KING
NOTES :
ANT POLARITY : VERTICAL
RADIATED NARROWBAND EMISSIONS - dBuV/m
110
100
90
80
70
60
50
40
30
20
10
0
START = 30
100
FREQUENCY - MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV_EM RUN 2
WKA0 02/16/06
TEST : RADIATED NARROWBAND EMISSIONS
SPECIFICATION: FCC 15.247 PRELIM RAD. EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION GAS AMERICAN
S/N : NONE ASSIGNED
MODE : Tx @ 921.25MHz
DATE TESTED : 11 Jan 2007 11:53:14 R. KING
NOTES :
ANT POLARITY : HORIZONTAL
RADIATED NARROWBAND EMISSIONS - dBuV/m
110
100
90
80
70
60
50
40
30
20
10
0
START = 1000
FREQUENCY - MHz
STOP = 10000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV_EM RUN 2
WKA0 02/16/06
TEST : RADIATED NARROWBAND EMISSIONS
SPECIFICATION: FCC 15.247 PRELIM RAD. EMISSIONS
MANUFACTURER : BADGER METER
MODEL No. : ORION GAS AMERICAN
S/N : NONE ASSIGNED
MODE : Tx @ 921.25MHz
DATE TESTED : 11 Jan 2007 11:52:07 R. KING
NOTES : :
ANT POLARITY : VERTICAL
RADIATED NARROWBAND EMISSIONS - dBuV/m
110
100
90
80
70
60
50
40
30
20
10
0
START = 1000
FREQUENCY - MHz
STOP = 10000

Manufacturer : Badger Meter
Model No. : Orion Gas American Transmitter
Serial No. : None Assigned
Test Specification : FCC Part 15, Subpart C, Section 15.247, Radiated Emissions
Date : January 4 through 12, 2007
Mode : Transmit @ 911.65MHz,
Test Distance : 3 meters
Notes : Peak limits are shown for the restricted bands
: Peak Detector

Frequency MHz	Antenna Polarity	Meter Reading dBuV	Ambient	Cable Loss dB	Antenna Factor dB	Pre Amp Gain dB	Total dBuV/m	Total uV/m	Limit uV/m
911.65	H	77.0		1.9	27.7	0.0	106.6	214564.9	
911.65	V	66.9		1.9	27.7	0.0	96.5	67074.7	
1823.30	H	40.5		2.9	27.6	-28.8	42.1	127.7	21456.5
1823.30	V	45.3		2.9	27.6	-28.8	46.9	221.9	21456.5
2734.95	H	43.7		3.8	30.3	-29.7	48.1	253.9	5000.0
2734.95	V	42.4		3.8	30.3	-29.7	46.8	218.6	5000.0
3646.60	H	50.1		4.4	33.9	-30.1	58.3	826.6	5000.0
3646.60	V	47.4		4.4	33.9	-30.1	55.6	605.7	5000.0
4558.25	H	47.2		4.8	34.1	-28.9	57.2	722.3	5000.0
4558.25	V	47.0		4.8	34.1	-28.9	57.0	705.9	5000.0
5469.90	H	51.9		5.2	36.4	-28.6	65.0	1771.1	21456.5
5469.90	V	57.1		5.2	36.4	-28.6	70.2	3222.9	21456.5
6381.55	H	45.3		5.9	36.2	-27.8	59.6	954.3	21456.5
6381.55	V	45.4		5.9	36.2	-27.8	59.7	965.3	21456.5
7293.20	H	46.9		6.7	38.2	-27.1	64.7	1709.3	5000.0
7293.20	V	45.9		6.7	38.2	-27.1	63.7	1523.4	5000.0
8204.85	H	47.5		7.1	37.9	-27.8	64.7	1714.3	5000.0
8204.85	V	44.4		7.1	37.9	-27.8	61.6	1199.7	5000.0
9116.50	H	44.0		7.5	38.5	-28.4	61.6	1199.3	5000.0
9116.50	V	42.8		7.5	38.5	-28.4	60.4	1044.5	5000.0

Gray rows indicate restricted bands which must meet the general limits

Total = Meter Reading + Cable Loss + Antenna Factor + Preamp Gain

Checked By: Richard E. King

Manufacturer : Badger Meter
Model No. : Orion Gas American Transmitter
Serial No. : None Assigned
Test Specification : FCC Part 15, Subpart C, Section 15.247, Radiated Emissions
Date : January 4 through 12, 2007
Mode : Transmit @ 911.65MHz
Test Distance : 3 meters
Notes : For restricted bands, average limits are shown.
: For restricted bands, a Peak detector used; the peak readings converted to average readings using the duty cycle correction factor

Frequency MHz	Antenna Polarity	Meter Reading dBuV	Amb	Cable Loss dB	Antenna Factor dB	Pre Amp Gain dB	Duty Cycle Factor dB	Total dBuV/m	Total uV/m	Limit uV/m
2734.95	H	43.7		3.8	30.3	-29.7	-35.0	13.1	4.5	500.0
2734.95	V	42.4		3.8	30.3	-29.7	-35.0	11.8	3.9	500.0
3646.60	H	50.1		4.4	33.9	-30.1	-35.0	23.3	14.7	500.0
3646.60	V	47.4		4.4	33.9	-30.1	-35.0	20.6	10.8	500.0
4558.25	H	47.2		4.8	34.1	-28.9	-35.0	22.2	12.8	500.0
4558.25	V	47.0		4.8	34.1	-28.9	-35.0	22.0	12.6	500.0
7293.20	H	46.9		6.7	38.2	-27.1	-35.0	29.7	30.4	500.0
7293.20	V	45.9		6.7	38.2	-27.1	-35.0	28.7	27.1	500.0
8204.85	H	47.5		7.1	37.9	-27.8	-35.0	29.7	30.5	500.0
8204.85	V	44.4		7.1	37.9	-27.8	-35.0	26.6	21.3	500.0
9116.50	H	44.0		7.5	38.5	-28.4	-35.0	26.6	21.3	500.0
9116.50	V	42.8		7.5	38.5	-28.4	-35.0	25.4	18.6	500.0

Gray rows indicate restricted bands which must meet the general limits

Total = Meter Reading + Cable Loss + Antenna Factor + Preamp Gain + Duty Cycle Factor

Checked By: Richard E. King

Manufacturer : Badger Meter
Model No. : Orion Gas American Transmitter
Serial No. : None Assigned
Test Specification : FCC Part 15, Subpart C, Section 15.247, Radiated Emissions
Date : January 4 through 12, 2007
Mode : Transmit @ 916.45MHz
Test Distance : 3 meters
Notes : Peak limits are shown for the restricted bands
: Peak Detector

Frequency MHz	Antenna Polarity	Meter Reading dBuV	Ambient	Cable Loss dB	Antenna Factor dB	Pre Amp Gain dB	Total dBuV/m	Total uV/m	Limit uV/m
916.45	H	76.9		2.0	27.8	0.0	106.6	215006.6	
916.45	V	66.6		2.0	27.8	0.0	96.3	65682.8	
1832.90	H	43.8		2.9	27.6	-28.8	45.5	187.6	21500.7
1832.90	V	42.7		2.9	27.6	-28.8	44.4	165.2	21500.7
2749.35	H	43.0		3.8	30.3	-29.7	47.4	235.6	5000.0
2749.35	V	43.0		3.8	30.3	-29.7	47.4	235.6	5000.0
3665.80	H	48.6		4.4	34.0	-30.1	56.9	699.6	5000.0
3665.80	V	48.3		4.4	34.0	-30.1	56.6	675.9	5000.0
4582.25	H	45.3		4.8	34.1	-28.9	55.4	588.9	5000.0
4582.25	V	45.5		4.8	34.1	-28.9	55.6	602.6	5000.0
5498.70	H	54.6		5.3	36.5	-28.6	67.7	2431.1	21500.7
5498.70	V	56.4		5.3	36.5	-28.6	69.5	2990.9	21500.7
6415.15	H	44.2		5.9	36.1	-27.7	58.5	843.7	21500.7
6415.15	V	44.1		5.9	36.1	-27.7	58.4	834.1	21500.7
7331.60	H	49.8		6.7	38.3	-27.1	67.7	2416.6	5000.0
7331.60	V	46.3		6.7	38.3	-27.1	64.2	1615.1	5000.0
8248.05	H	46.3		7.1	37.9	-27.9	63.4	1485.4	5000.0
8248.05	V	41.7		7.1	37.9	-27.9	58.8	874.7	5000.0
9164.50	H	44.5		7.5	38.5	-28.5	62.1	1267.4	5000.0
9164.50	V	41.1		7.5	38.5	-28.5	58.7	856.9	5000.0

Gray rows indicate restricted bands which must meet the general limits

Total = Meter Reading + Cable Loss + Antenna Factor + Preamp Gain

Checked By: Richard E. King

Manufacturer : Badger Meter
Model No. : Orion Gas American Transmitter
Serial No. : None Assigned
Test Specification : FCC Part 15, Subpart C, Section 15.247, Radiated Emissions
Date : January 4 through 12, 2007
Mode : Transmit @ 916.45MHz
Test Distance : 3 meters
Notes : For restricted bands, average limits are shown.
: For restricted bands, a Peak detector used; the peak readings converted to average readings using the duty cycle correction factor

Frequency MHz	Antenna Polarity	Meter Reading dBuV	Ambient	Cable Loss dB	Antenna Factor dB	Pre Amp Gain dB	Duty Cycle Factor dB	Total dBuV/m	Total uV/m	Limit uV/m
2749.35	H	43.0		3.8	30.3	-29.7	-35.0	12.4	4.2	500.0
2749.35	V	43.0		3.8	30.3	-29.7	-35.0	12.4	4.2	500.0
3665.80	H	48.6		4.4	34.0	-30.1	-35.0	21.9	12.4	500.0
3665.80	V	48.3		4.4	34.0	-30.1	-35.0	21.6	12.0	500.0
4582.25	H	45.3		4.8	34.1	-28.9	-35.0	20.4	10.5	500.0
4582.25	V	45.5		4.8	34.1	-28.9	-35.0	20.6	10.7	500.0
7331.60	H	49.8		6.7	38.3	-27.1	-35.0	32.7	43.0	500.0
7331.60	V	46.3		6.7	38.3	-27.1	-35.0	29.2	28.7	500.0
8248.05	H	46.3		7.1	37.9	-27.9	-35.0	28.4	26.4	500.0
8248.05	V	41.7		7.1	37.9	-27.9	-35.0	23.8	15.6	500.0
9164.50	H	44.5		7.5	38.5	-28.5	-35.0	27.1	22.5	500.0
9164.50	V	41.1		7.5	38.5	-28.5	-35.0	23.7	15.2	500.0

Gray rows indicate restricted bands which must meet the general limits

Total = Meter Reading + Cable Loss + Antenna Factor + Preamp Gain + Duty Cycle Factor

Checked By: Richard E. King

Manufacturer : Badger Meter
Model No. : Orion Gas American Transmitter
Serial No. : None Assigned
Test Specification : FCC Part 15, Subpart C, Section 15.247, Radiated Emissions
Date : January 4 through 12, 2007
Mode : Transmit @ 921.25MHz
Test Distance : 3 meters
Notes : Peak limits are shown for the restricted bands
: Peak Detector

Frequency MHz	Antenna Polarity	Meter Reading dBuV	Ambient	Cable Loss dB	Antenna Factor dB	Pre Amp Gain dB	Total dBuV/m	Total uV/m	Limit uV/m
921.25	H	77.4		2.0	27.9	0.0	107.3	230841.6	
921.25	V	66.1		2.0	27.9	0.0	96.0	62851.3	
1842.50	H	43.2		2.9	27.6	-28.8	44.9	175.8	23084.2
1842.50	V	43.1		2.9	27.6	-28.8	44.8	173.8	23084.2
2763.75	H	43.4		3.8	30.4	-29.7	47.9	248.1	5000.0
2763.75	V	42.5		3.8	30.4	-29.7	47.0	223.7	5000.0
3685.00	H	48.4		4.4	34.0	-30.0	56.7	687.8	5000.0
3685.00	V	49.3		4.4	34.0	-30.0	57.6	762.9	5000.0
4606.25	H	44.4		4.8	34.2	-28.8	54.6	538.6	5000.0
4606.25	V	45.2		4.8	34.2	-28.8	55.4	590.6	5000.0
5527.50	H	54.4		5.3	36.5	-28.6	67.6	2389.3	23084.2
5527.50	V	56.4		5.3	36.5	-28.6	69.6	3007.9	23084.2
6448.75	H	44.5		6.0	36.1	-27.7	58.9	876.4	23084.2
6448.75	V	43.3		6.0	36.1	-27.7	57.7	763.4	23084.2
7370.00	H	50.4		6.7	38.3	-27.1	68.4	2621.6	5000.0
7370.00	V	47.4		6.7	38.3	-27.1	65.4	1855.9	5000.0
8291.25	H	45.2		7.2	37.8	-27.9	62.3	1302.0	5000.0
8291.25	V	42.2		7.2	37.8	-27.9	59.3	921.7	5000.0
9212.50	H	43.6		7.5	38.5	-28.5	61.1	1140.0	23084.2
9212.50	V	41.3		7.5	38.5	-28.5	58.8	874.8	23084.2

Gray rows indicate restricted bands which must meet the general limits

Total = Meter Reading + Cable Loss + Antenna Factor + Preamp Gain

Checked By: Richard E. King

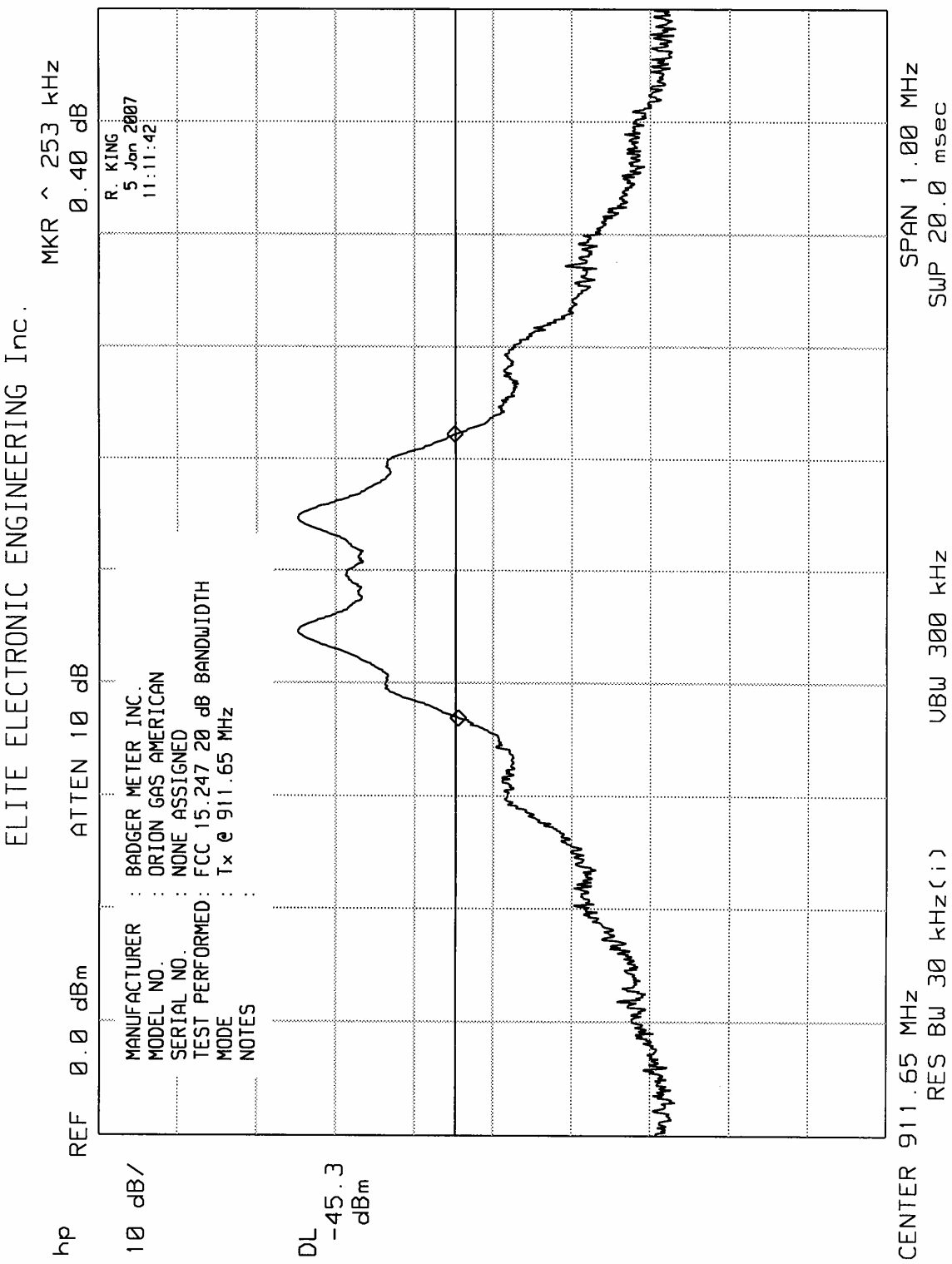
Manufacturer : Badger Meter
Model No. : Orion Gas American Transmitter
Serial No. : None Assigned
Test Specification : FCC Part 15, Subpart C, Section 15.247, Radiated Emissions
Date : January 4 through 12, 2007
Mode : Transmit @ 921.25MHz
Test Distance : 3 meters
Notes : For restricted bands, average limits are shown.
: For restricted bands, a Peak detector used; the peak readings converted to average readings using the duty cycle correction factor

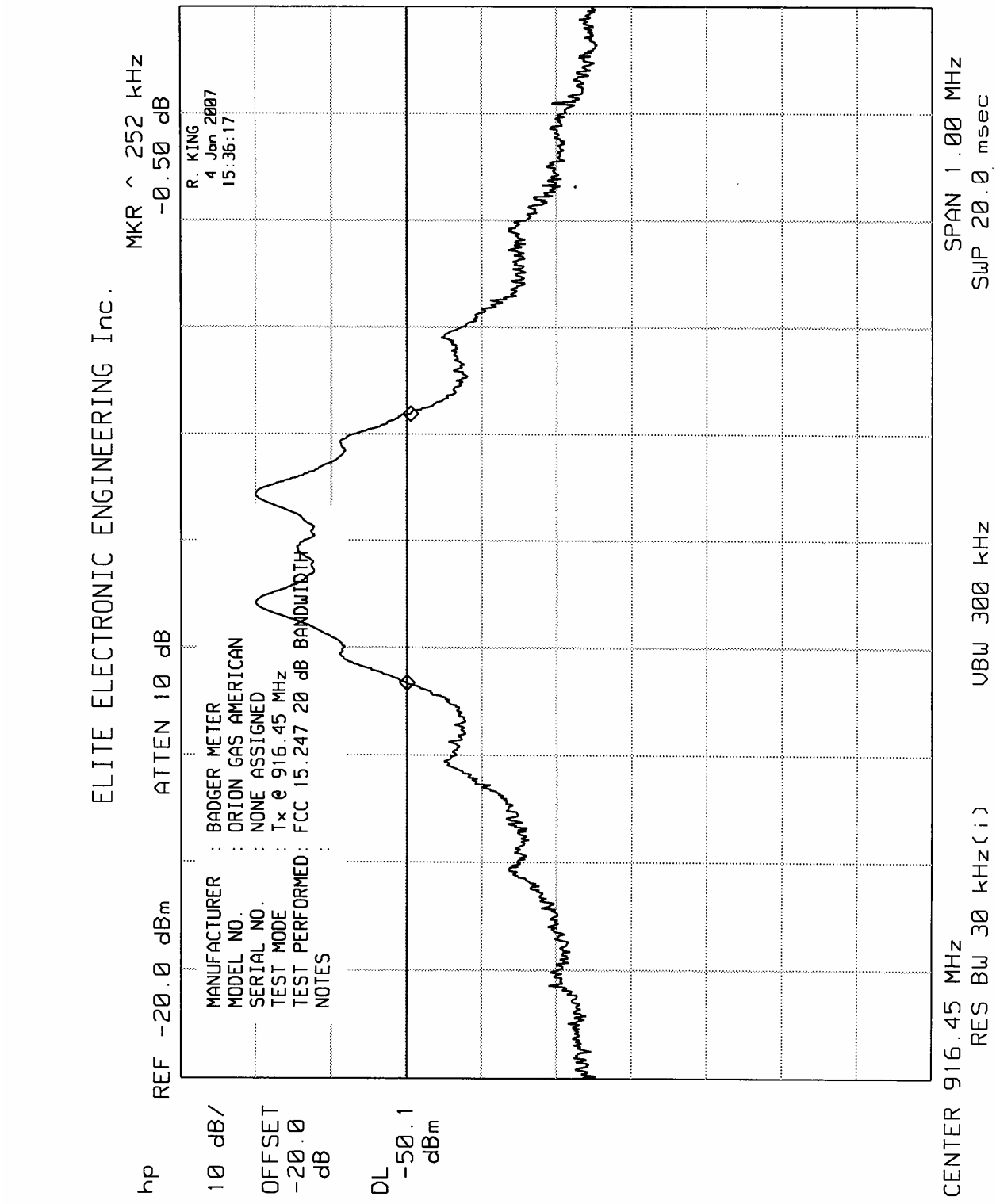
Frequency MHz	Antenna Polarity	Meter Reading dBuV	Ambient	Cable Loss dB	Antenna Factor dB	Pre Amp Gain dB	Duty Cycle Factor dB	Total dBuV/m	Total uV/m	Limit uV/m
2764.95	H	43.4		3.8	30.4	-29.7	-35.0	12.9	4.4	500.0
2764.95	V	42.5		3.8	30.4	-29.7	-35.0	12.0	4.0	500.0
3686.60	H	48.4		4.4	34.0	-30.0	-35.0	21.7	12.2	500.0
3686.60	V	49.3		4.4	34.0	-30.0	-35.0	22.6	13.6	500.0
4608.25	H	44.4		4.8	34.2	-28.8	-35.0	19.6	9.6	500.0
4608.25	V	45.2		4.8	34.2	-28.8	-35.0	20.4	10.5	500.0
7373.20	H	50.4		6.7	38.3	-27.1	-35.0	33.4	46.6	500.0
7373.20	V	47.4		6.7	38.3	-27.1	-35.0	30.4	33.0	500.0
8294.85	H	45.2		7.2	37.8	-27.9	-35.0	27.3	23.2	500.0
8294.85	V	42.2		7.2	37.8	-27.9	-35.0	24.3	16.4	500.0

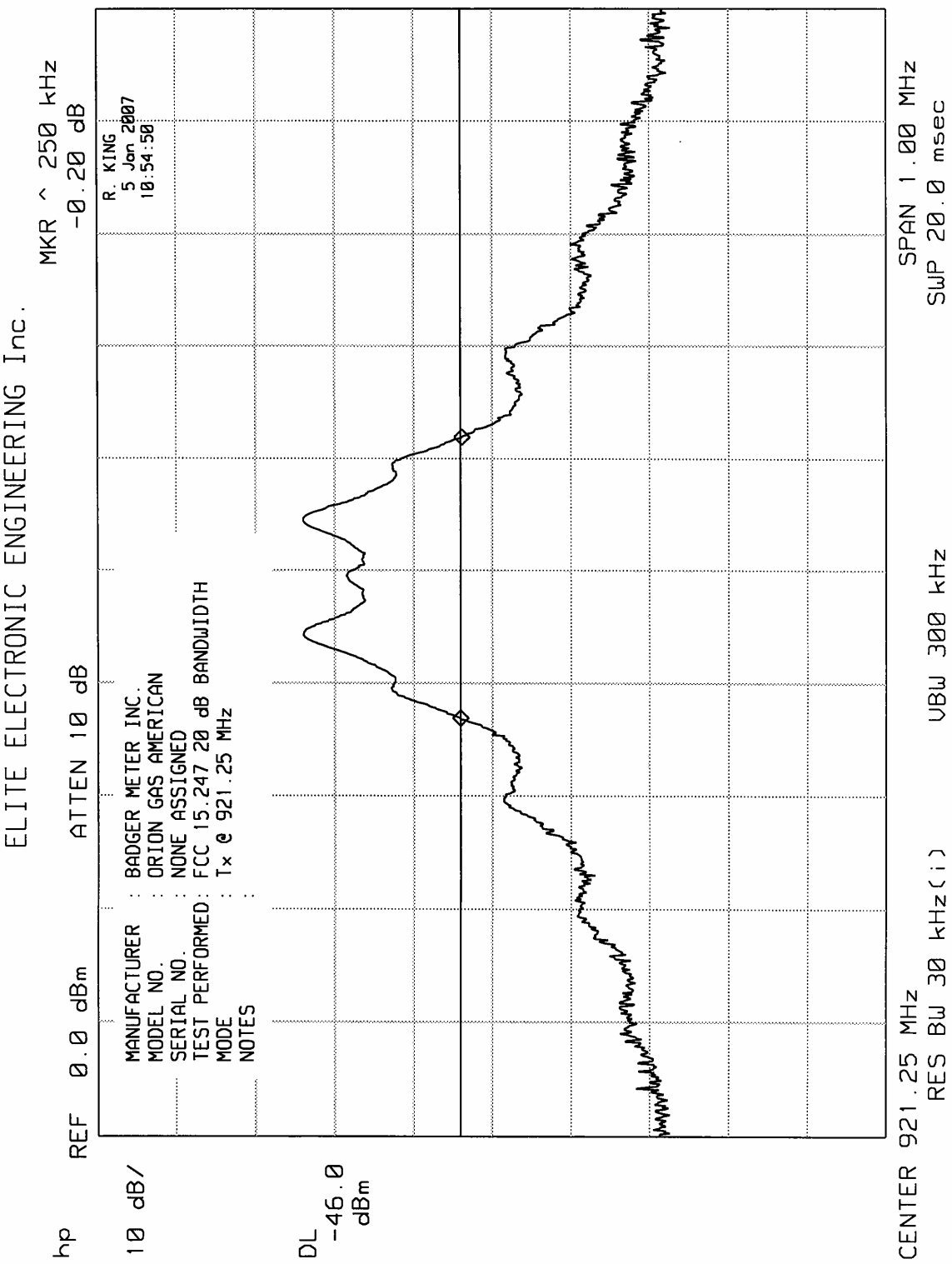
Gray rows indicate restricted bands which must meet the general limits

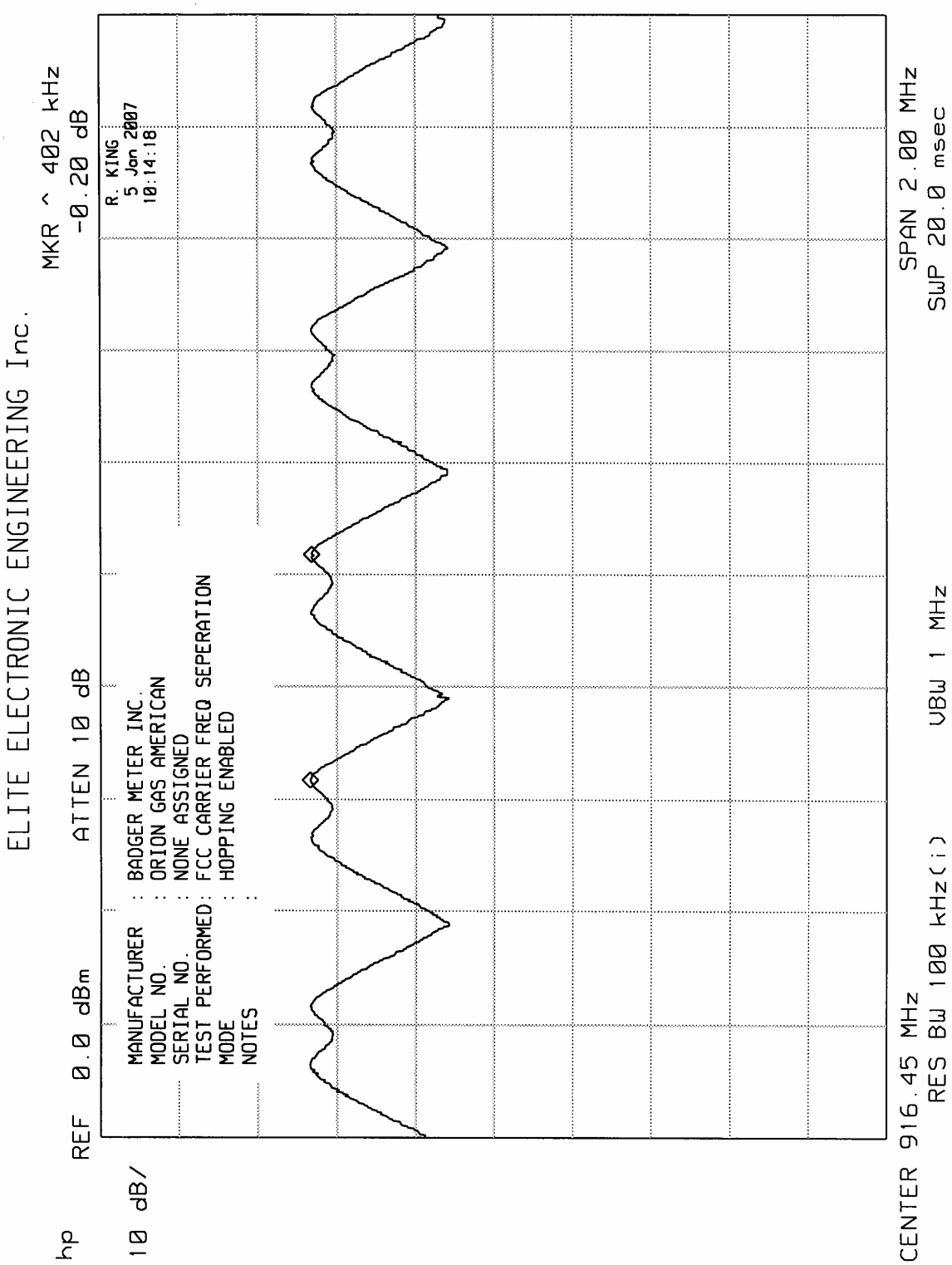
Total = Meter Reading + Cable Loss + Antenna Factor + Preamp Gain + Duty Cycle Factor

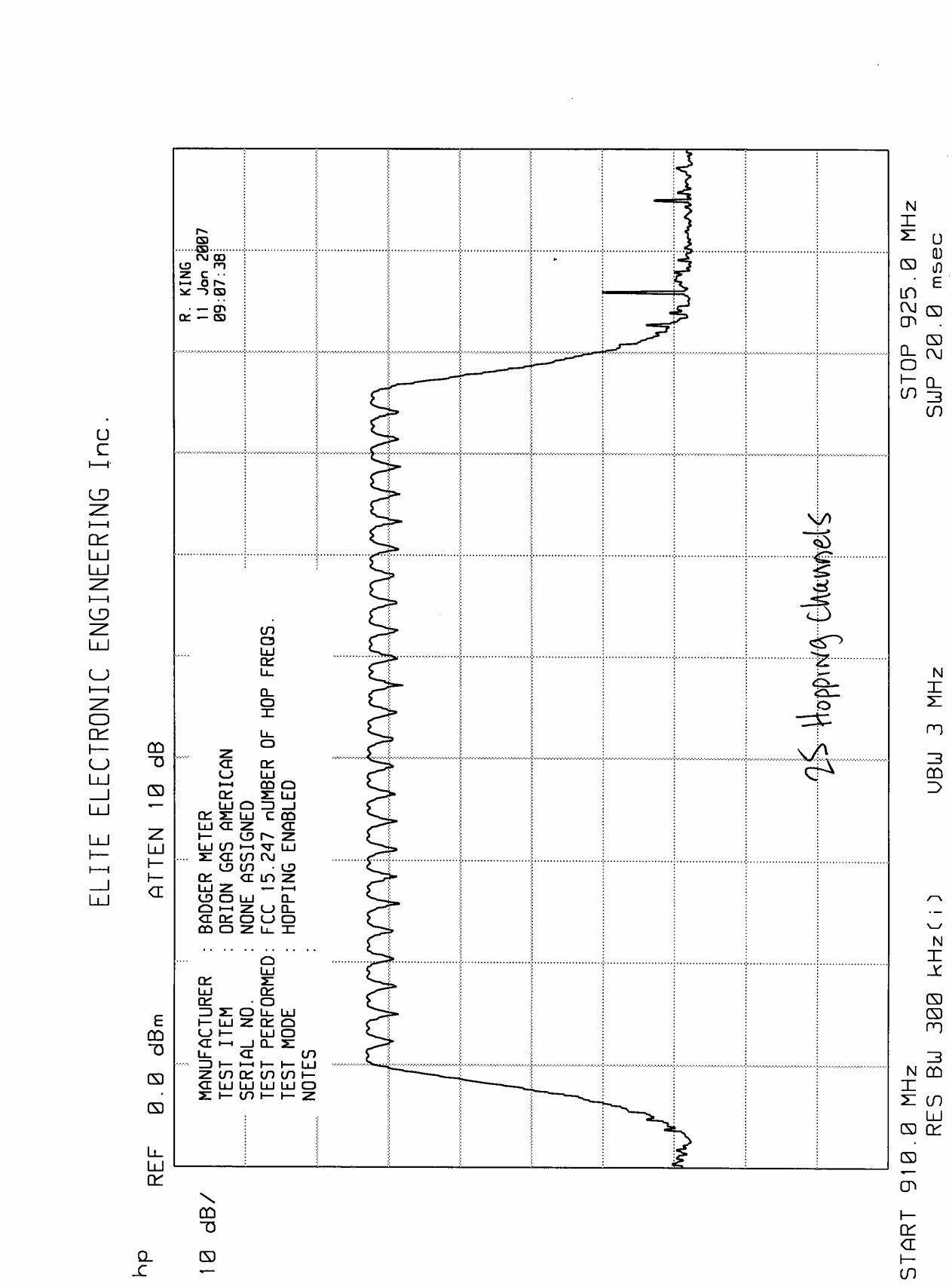
Checked By: Richard E. King

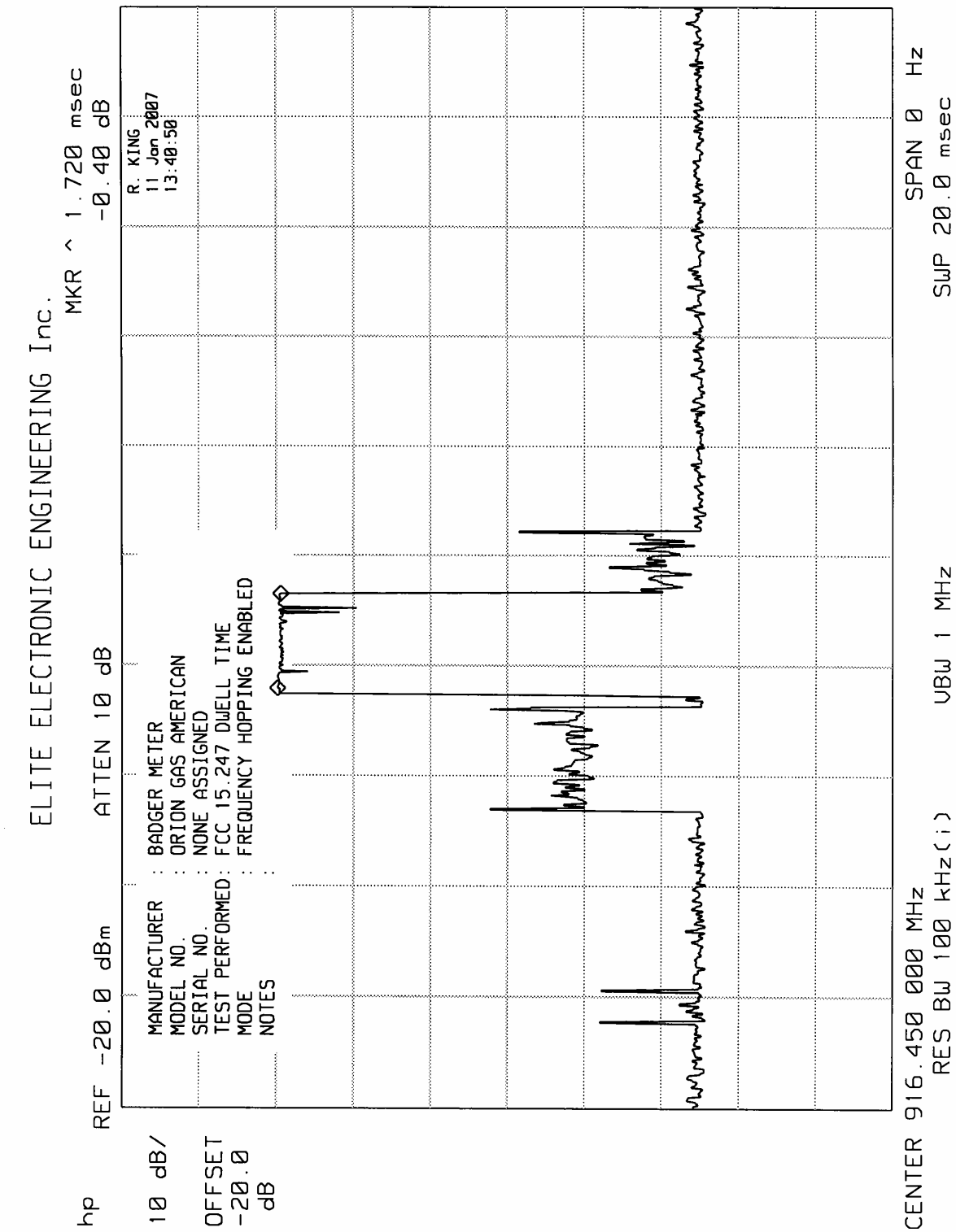

ELITE ELECTRONIC ENGINEERING Inc.
MKR ^ 253 kHz
0.40 dB
R. KING
5 Jan 2007
11:11:42
hp
REF 0.0 dBm
ATTEN 10 dB
10 dB/
MANUFACTURER : BADGER METER INC.
MODEL NO. : ORION GAS AMERICAN
SERIAL NO. : NONE ASSIGNED
TEST PERFORMED: FCC 15.247 20 dB BANDWIDTH
MODE : Tx @ 911.65 MHz
NOTES : :
DL
-45.3
dBm
CENTER 911.65 MHz
RES BW 30 kHz(i)
VBW 300 kHz
SPAN 1.00 MHz
SWP 20.0 msec

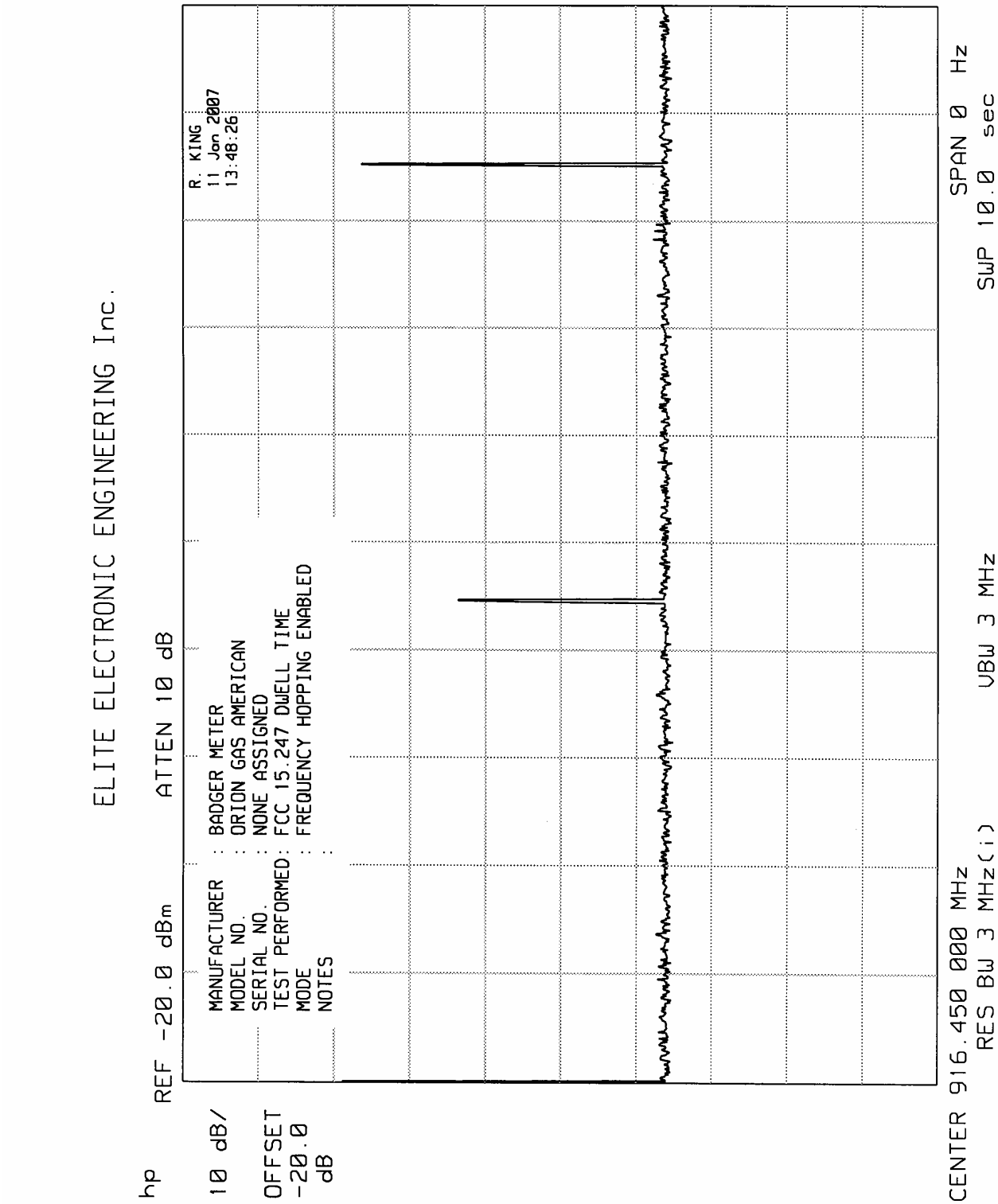

ELITE ELECTRONIC ENGINEERING Inc.
MKR ^ 252 kHz
-0.50 dB
R. KING
4 Jan 2007
15:36:17
hp
REF -20.0 dBm
ATTEN 10 dB
10 dB/
OFFSET
-20.0
dB
DL
-50.1
dBm
MANUFACTURER : BADGER METER
MODEL NO. : ORION GAS AMERICAN
SERIAL NO. : NONE ASSIGNED
TEST MODE : Tx @ 916.45 MHz
TEST PERFORMED: FCC 15.247 20 dB BANDWIDTH
NOTES :
CENTER 916.45 MHz
RES BW 30 kHz(i)
VBW 300 kHz
SPAN 1.00 MHz
SWP 20.0 msec


ELITE ELECTRONIC ENGINEERING Inc.
MKR ^ 250 kHz
-0.20 dB
R. KING
5 Jan 2007
10:54:50
hp
REF 0.0 dBm
ATTEN 10 dB
10 dB/
MANUFACTURER : BADGER METER INC.
MODEL NO. : ORION GAS AMERICAN
SERIAL NO. : NONE ASSIGNED
TEST PERFORMED: FCC 15.247 20 dB BANDWIDTH
MODE : Tx @ 921.25 MHz
NOTES
DL
-46.0
dBm
CENTER 921.25 MHz
RES BW 30 kHz(i)
VBW 300 kHz
SPAN 1.00 MHz
SWP 20.0 msec


ELITE ELECTRONIC ENGINEERING Inc.
MKR ^ 402 kHz
-0.20 dB
R. KING
5 Jan 2007
10:14:18
hp
REF 0.0 dBm
ATTEN 10 dB
10 dB/
MANUFACTURER : BADGER METER INC.
MODEL NO. : ORION GAS AMERICAN
SERIAL NO. : NONE ASSIGNED
TEST PERFORMED: FCC CARRIER FREQ SEPERATION
MODE : HOPPING ENABLED
NOTES : :
CENTER 916.45 MHz
SPAN 2.00 MHz
RES BW 100 kHz(i)
VBW 1 MHz
SWP 20.0 msec


ELITE ELECTRONIC ENGINEERING Inc.
hp
REF 0.0 dBm
ATTEN 10 dB
10 dB/
MANUFACTURER : BADGER METER
TEST ITEM : ORION GAS AMERICAN
SERIAL NO. : NONE ASSIGNED
TEST PERFORMED: FCC 15.247 nUMBER OF HOP FREQS.
TEST MODE : HOPPING ENABLED
NOTES :
R. KING
11 Jan 2007
09:07:38
25 Hopping channels
START 910.0 MHz
RES BW 300 kHz(i)
VBW 3 MHz
STOP 925.0 MHz
SWP 20.0 msec


ELITE ELECTRONIC ENGINEERING Inc.
MKR ^ 1.720 msec
-0.40 dB
hp
REF -20.0 dBm
ATTEN 10 dB
10 dB/
OFFSET
-20.0
dB
MANUFACTURER : BADGER METER
MODEL NO. : ORION GAS AMERICAN
SERIAL NO. : NONE ASSIGNED
TEST PERFORMED: FCC 15.247 DWELL TIME
MODE : FREQUENCY HOPPING ENABLED
NOTES :
R. KING
11 Jan 2007
13:40:50
CENTER 916.450 000 MHz
RES BW 100 kHz(i)
VBW 1 MHz
SPAN 0 Hz
SWP 20.0 msec

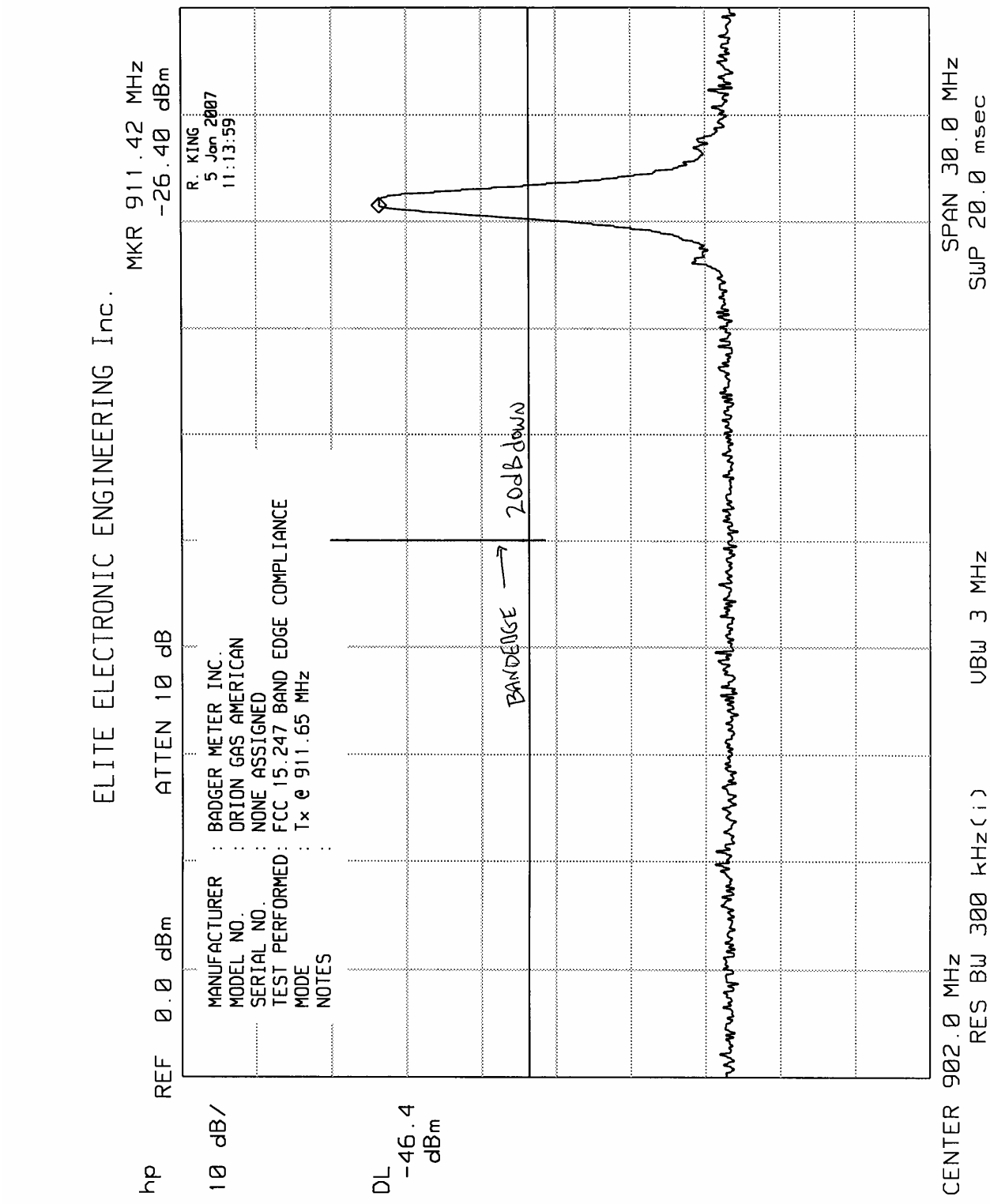

ELITE ELECTRONIC ENGINEERING Inc.
hp
REF -20.0 dBm
ATTEN 10 dB
10 dB/
OFFSET
-20.0
dB
MANUFACTURER : BADGER METER
MODEL NO. : ORION GAS AMERICAN
SERIAL NO. : NONE ASSIGNED
TEST PERFORMED: FCC 15.247 DWELL TIME
MODE : FREQUENCY HOPPING ENABLED
NOTES :
R. KING
11 Jan 2007
13:48:26
CENTER 916.450 000 MHz
RES BW 3 MHz(i)
VBW 3 MHz
SWP 10.0 sec
SPAN 0 Hz

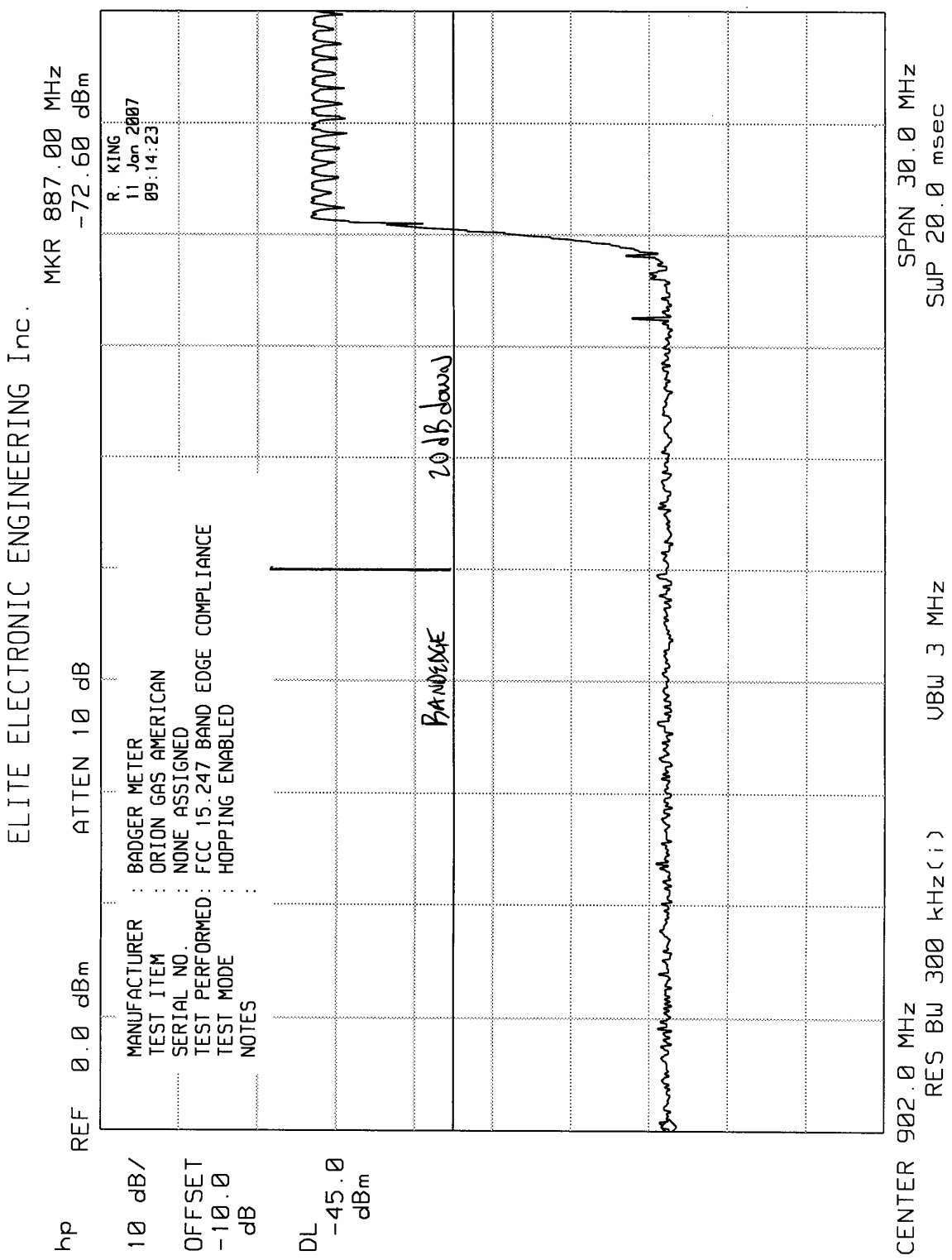
Manufacturer : Badger Meter
Model No. : Orion Gas American Transmitter
Serial No. : None Assigned
Test Specification : FCC Part 15, Subpart C, 15.247, Peak Output Power –
: Radiated Measurement
Date : January 4 through 12, 2007
Notes :
: Test Distance is 3 meters

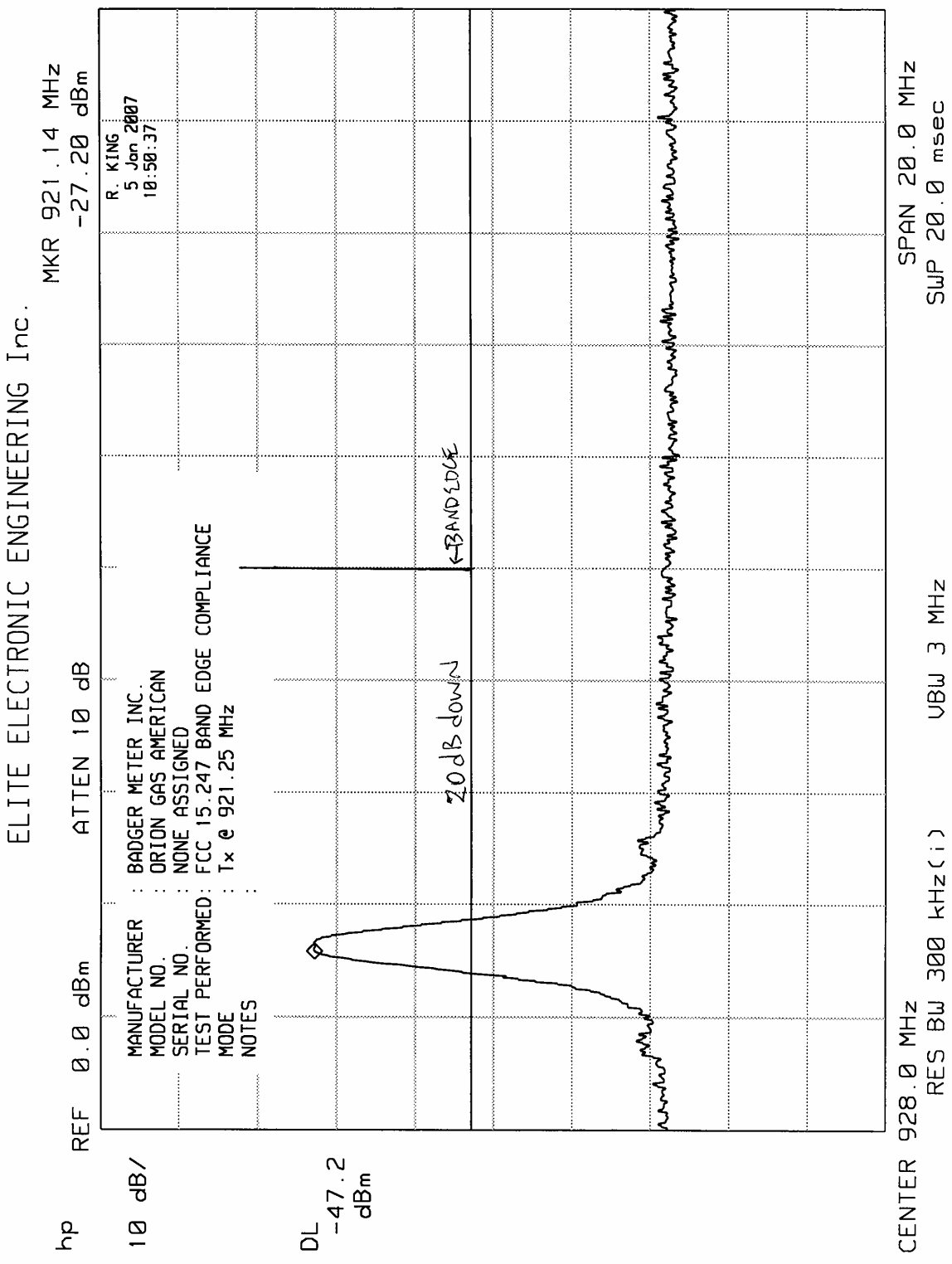
Frequency MHz	Antenna Polarity	Meter Reading dBuV	Matched Signal Generator Reading dBm	Antenna Gain dB	Cable Loss dB	EIRP dBm	Limit dBm
911.65	H	77.0	11.4	2.15	3.5	10.1	30
911.65	V	66.9	0.2	2.15	3.5	-1.2	30
916.45	H	76.9	11.6	2.15	3.5	10.3	30
916.45	V	66.6	-0.6	2.15	3.5	-2.0	30
921.25	H	77.4	12.2	2.15	3.5	10.9	30
921.25	V	66.1	-1.2	2.15	3.5	-2.6	30

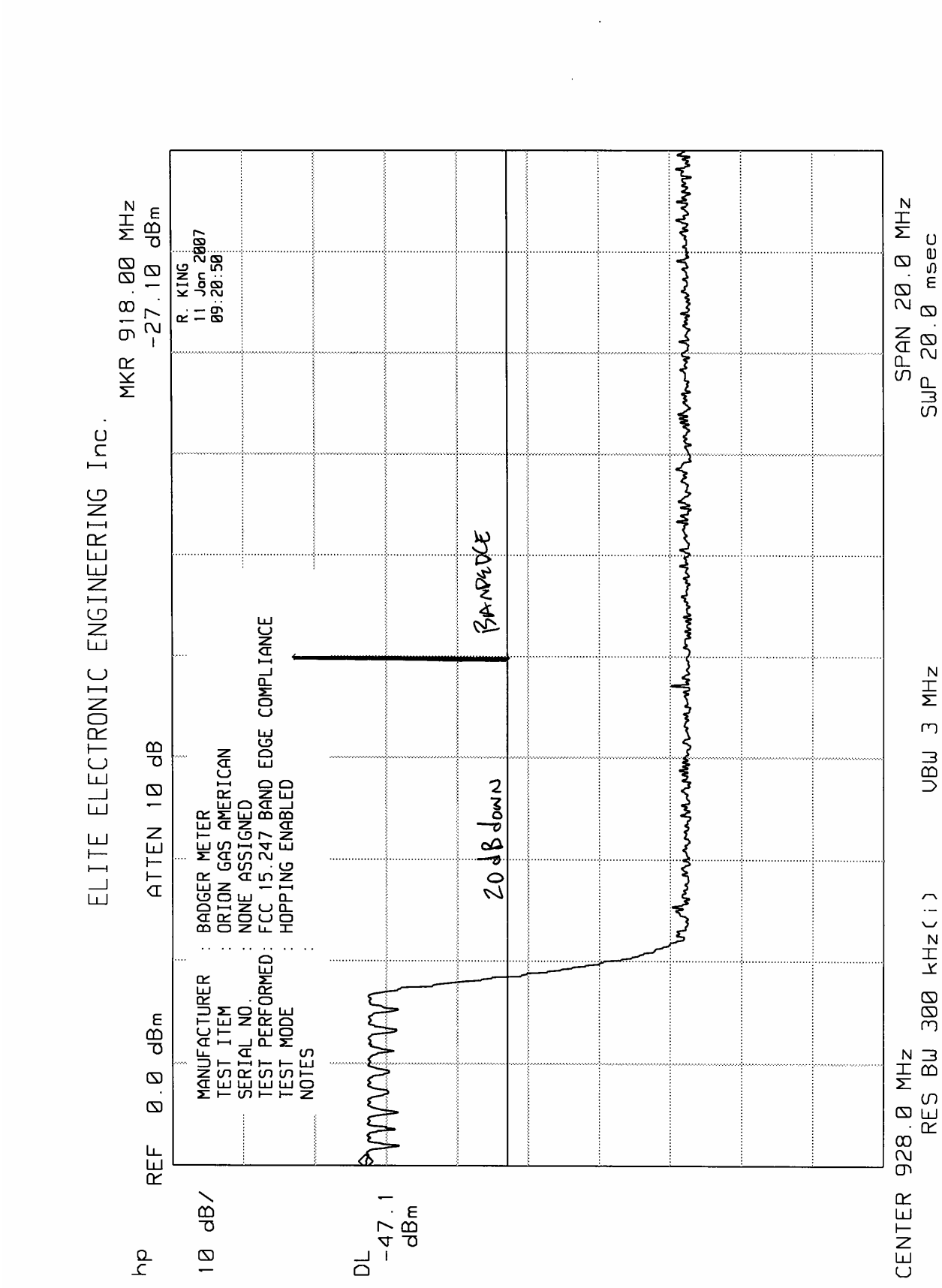
EIRP = Sig. Gen. Reading + Antenna Gain – Cable Loss

Checked By: Richard E. King


ELITE ELECTRONIC ENGINEERING Inc.
MKR 911.42 MHz
-26.40 dBm
R. KING
5 Jan 2007
11:13:59
hp
REF 0.0 dBm
ATTEN 10 dB
10 dB/
MANUFACTURER : BADGER METER INC.
MODEL NO. : ORION GAS AMERICAN
SERIAL NO. : NONE ASSIGNED
TEST PERFORMED: FCC 15.247 BAND EDGE COMPLIANCE
MODE : Tx @ 911.65 MHz
NOTES :
BANDEDGE
20dB down
DL
-46.4
dBm
CENTER 902.0 MHz
RES BW 300 kHz(i)
VBW 3 MHz
SPAN 30.0 MHz
SWP 20.0 msec


ELITE ELECTRONIC ENGINEERING Inc.
MKR 887.00 MHz
-72.60 dBm
R. KING
11 Jan 2007
09:14:23
hp
REF 0.0 dBm
ATTEN 10 dB
10 dB/
OFFSET
-10.0
dB
DL
-45.0
dBm
MANUFACTURER : BADGER METER
TEST ITEM : ORION GAS AMERICAN
SERIAL NO. : NONE ASSIGNED
TEST PERFORMED: FCC 15.247 BAND EDGE COMPLIANCE
TEST MODE : HOPPING ENABLED
NOTES :
20 dB down
Bandedge
CENTER 902.0 MHz
RES BW 300 kHz(i)
VBW 3 MHz
SPAN 30.0 MHz
SWP 20.0 msec


ELITE ELECTRONIC ENGINEERING Inc.
MKR 921.14 MHz
-27.20 dBm
R. KING
5 Jan 2007
10:50:37
hp
REF 0.0 dBm
ATTEN 10 dB
10 dB/
DL
-47.2
dBm
MANUFACTURER : BADGER METER INC.
MODEL NO. : ORION GAS AMERICAN
SERIAL NO. : NONE ASSIGNED
TEST PERFORMED: FCC 15.247 BAND EDGE COMPLIANCE
MODE : Tx @ 921.25 MHz
NOTES : :
20 dB down
BANDEDGE
CENTER 928.0 MHz
RES BW 300 kHz(i)
VBW 3 MHz
SPAN 20.0 MHz
SWP 20.0 msec


ELITE ELECTRONIC ENGINEERING Inc.
MKR 918.00 MHz
-27.10 dBm
R. KING
11 Jan 2007
09:20:50
hp
REF 0.0 dBm
ATTEN 10 dB
10 dB/
MANUFACTURER : BADGER METER
TEST ITEM : ORION GAS AMERICAN
SERIAL NO. : NONE ASSIGNED
TEST PERFORMED: FCC 15.247 BAND EDGE COMPLIANCE
TEST MODE : HOPPING ENABLED
NOTES : :
BANDEDGE
20 dB down
DL
-47.1
dBm
CENTER 928.0 MHz
RES BW 300 kHz(i)
VBW 3 MHz
SPAN 20.0 MHz
SWP 20.0 msec