



Measurement of RF Interference from a Serial Interface Repeater Frequency Hoping Spread Spectrum Transceiver

For : Badger Meter
4545 W Brown Deer Road
Milwaukee, WI 53223

P.O. No. : 542987

Date Tested : June 18, 2007 through June 20, 2007

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Specification : FCC "Code of Federal Regulations" Title 47, Part 15,
: Subpart B and Subpart C, Section 15.247 for Frequency
: Hopping Spread Spectrum Intentional Radiators Operating
: within the band 902-928MHz
: Industry Canada RSS-210
: Industry Canada RSS-GEN

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REVISION HISTORY

Revision	Date	Description
—	June 22, 2007	Initial release

Measurement of RF Emissions from a Serial Interface Repeater Frequency Hopping Spread Spectrum 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 Serial Interface Repeater transceiver, (hereinafter referred to as the test item). Unit Number FCC 8 was assigned to the test item. The test item was designed to transmit and receive in the 911.65MHz to 921.25MHz band using frequency hopping spread spectrum techniques. The test item was equipped with an internal antenna. The test item 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 test item 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 and Subpart C, Section 15.247 and of Industry Canada RSS-210 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 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 23°C and the relative humidity was 37%.

2 APPLICABLE DOCUMENTS

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

- Federal Communications Commission "Code of Federal Regulations", Title 47, Part 15, Subpart C, dated 1 October 2005
- FCC Public Notice, DA 00-705, "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems", Released March 30, 2000
- ANSI C63.4-2003, "American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz"
- Industry Canada RSS-210, Issue 7, June 2007, "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 2, June 2007, "Spectrum Management and Telecommunications Radio Standards Specification, General Requirements and Information for the Certification of radio communication equipment"

3 TEST ITEM SETUP AND OPERATION

3.1 General Description

The test item is a Badger Meter Serial Interface Repeater transceiver. A block diagram of the test item setup is shown as Figure 1.

3.1.1 Power Input

The test item obtained 3.6VDC from a lithium "D cell" internal battery.

3.1.2 Grounding

The test item was ungrounded during the tests.

3.1.3 Support Equipment

The test item was submitted for testing with no support equipment.

3.1.4 Interconnect Cables

The test item was submitted for testing with no interconnect cables.

3.2 Operational Mode

The test item was placed on an 80cm high non-conductive stand. The test item was energized. The test item was programmed to operate in one of the following modes:

- Transmit at 911.65MHz, hopping disabled
- Transmit at 916.45MHz, hopping disabled
- Transmit at 921.25MHz, hopping disabled
- Receive at 911.65MHz, hopping disabled
- Receive at 916.45MHz, hopping disabled
- Receive at 921.25MHz, hopping disabled
- Transmit, frequency hopping enabled

3.3 Test Item Modifications

No modifications were required for compliance.

4 TEST EQUIPMENT

4.1 Test Equipment List

A list of the test equipment used can be found on **Table 8-1**. All equipment was calibrated per the instruction manuals supplied by the manufacturer.

4.2 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).

4.3 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 budgets were based on guidelines in "ISO Guide to the Expression of Uncertainty in Measurements" and NAMAS NIS81 "The Treatment of Uncertainty in EMC Measurements".

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 REQUIREMENTS, PROCEDURES AND RESULTS

5.1 Powerline Conducted Emissions

5.1.1 Receiver

5.1.1.1 Requirements

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

5.1.2 Transmitter

5.1.2.1 Requirements

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

5.2 20dB Bandwidth

5.2.1 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.

5.2.2 Procedures

The test item was setup inside the chamber on an 80cm high non-conductive stand. A bilog antenna was placed at a distance of 3 meters from the test time. The output of the bilog antenna was connected to a spectrum analyzer. 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) of the spectrum analyzer was set to $\geq$ 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.

5.2.3 Results

The plots on pages 21 through 23 show that the maximum 20dB bandwidth was 312.63kHz. Therefore, since the 20dB bandwidth of the hopping channel is greater than 250kHz, the system shall use at least 25 hopping channels. The 99% bandwidth was measured to be 280.56kHz.

5.3 Carrier Frequency Separation:

5.3.1 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.

5.3.2 Procedures

The test item was setup inside the chamber on an 80cm high non-conductive stand. A bilog antenna was placed at a distance of 3 meters from the test item. The output of the bilog antenna was connected to a spectrum analyzer. With the hopping function enabled, the test item was allowed to transmit continuously. The resolution bandwidth (RBW) of the spectrum analyzer was set to $\geq$ to 1% of the span. The peak detector and 'Max-Hold' function were engaged. The span was set wide enough to capture the 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.

5.3.3 Results

The plot on page 24 shows the carrier frequency separation. As can be seen from this plot, the separation is 380.76kHz which is greater than the 20dB bandwidth (312.63kHz).

5.4 Number of Hopping Frequencies

5.4.1 Requirements

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

5.4.2 Procedures

The test item was setup inside the chamber on an 80cm high non-conductive stand. A bilog antenna was placed at a distance of 3 meters from the test item. The output of the bilog antenna was connected to a spectrum analyzer. With the hopping function enabled, the test item was allowed to transmit continuously. The resolution bandwidth (RBW) of the spectrum analyzer was set to $\geq$ to 1% of the span. The peak detector and 'Max-Hold' function were engaged. The span was set wide enough to capture the entire frequency band of operation. The 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.

5.4.3 Results

The plot on page 25 shows the number of hopping frequencies. As can be seen from this plot, the number of hopping frequencies is 25 which meets the minimum requirement of 25 hopping channels.

5.5 Time of Occupancy

5.5.1 Requirement

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

5.5.2 Procedures

The test item was setup inside the chamber on an 80cm high non-conductive stand. A bilog antenna was placed at a distance of 3 meters from the test item. The output of the bilog antenna was connected to a spectrum analyzer. With the hopping function enabled, the test item was allowed to transmit continuously. The resolution bandwidth (RBW) was set to 1 MHz. The peak detector function was engaged. With the span set

to 0Hz, the sweep time was adjusted to capture a single event in order to measure the dwell time per hop. The analyzer's display was plotted using a 'screen dump' utility. Then, the sweep time was expanded to capture the average time between hops on the same channel. The analyzer's display was plotted using a 'screen dump' utility. Since the time between hops on the same channel was greater than 10 seconds, the sweep time was decreased to 10 seconds to show that only 1 hop on the same channel occurred in a 10 second period. 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 times the number of hops on the same channel in a 10 second period.

5.5.3 Results

The plots on pages 26 through 28 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 burst every 92.58 seconds or a worst case of 1 burst within a 10 second period. This calculated value is equal to 0.00172 seconds which is less than the 0.4 seconds allowed.

5.6 Peak Output Power

5.6.1 Requirement

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

5.6.2 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, a second dipole antenna was then set in place of the 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, and antenna gain, as required. The peak power output was calculated for low, middle, and high hopping frequencies.

5.6.3 Results

The results are presented on page 29. The maximum EIRP measured from the transmitter was 12.0 dBm which meets the De Facto 30 dBm limit.

5.7 Band-edge Compliance

5.7.1 Requirement

Per section 15.247(c), the emissions at the band-edges must be at least 20dB below the highest level measured within the band.

5.7.2 Procedures

The test item was placed on the non-conductive stand. A bilog antenna was placed at a test distance of 3 meters from the test item. The output of the bilog antenna was connected to a spectrum analyzer.

- a) With the hopping function disabled, the test item was set to transmit continuously at the channel closest to the low band edge.

- b) The test item was maximized for worst case emissions at the measuring antenna.
- c) The span on the spectrum analyzer was set wide enough to capture the peak level of the emissions as well as any modulation products which fall outside of the authorized band of operation. The resolution bandwidth was set to $\geq 1\%$ of the span.
- d) The 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transmitter peak power was defined.
- e) The analyzer's display was plotted using a 'screen dump' utility.
- f) Steps b) through d) were repeated with the frequency hopping function enabled.
- g) With the hopping function disabled, the test item was set to transmit continuously at the channel closest to the high band edge with the hopping function disabled.
- h) Steps b) through e) were repeated.

5.7.3 Results

The results are presented on pages 30 through 33. As can be seen from these plots, the emissions at the band-edge are within the 20dB down limits.

5.8 Duty Cycle Factor Measurements

5.8.1 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 500uSec/div. The amplitude settings are adjusted so that the on/off transitions clear the 4th division from the bottom of the display. The markers are set at the beginning and end of a word period. If the word period exceeds 100 msec the word period is set to 100 msec. The on-time and off-time are then measured. The on-time is total time signal level exceeds the 4th division. Off-time is time under for the word period. The duty cycle is then computed as the (On-time/ word period) where the word period = (On-time + Off-time).

5.8.2 Results

The plots of the duty cycle are shown on pages 34 and 35. The test item transmits a 1.72msec pulse every 92.58 seconds. Since a word is greater than 100 msec long, the duty cycle factor was computed over a 100msec interval. The duty cycle correction factor was calculated to be -35.3dB ($-35.3\text{dB} = 20 \cdot \log(1.72\text{msec}/100\text{msec})$).

5.9 Spurious Radiated Emissions

5.9.1 Receiver

5.9.1.1 Requirements

All emanations from a receiver shall be below the levels shown on the following table:

RADIATION LIMITS FOR RECIEVERS

Frequency MHz	Distance between Test Item And Antenna in Meters	Field Strength uV/m
30-88	3	100
88-216	3	150



216-960	3	200
Above 960	3	500

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

5.9.1.2 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 C63.4-2003 for site attenuation.

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

Since a quasi-peak detector requires long integration times, it is not practical to automatically sweep through the quasi-peak levels. Therefore, radiated emissions from the test item 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.

The broadband measuring antenna was positioned at a 3 meter distance from the test item. The frequency range from 30MHz to 5.0GHz was investigated using a peak detector function with a bi-log and waveguide antenna. The maximum levels were plotted.

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

For all frequencies 1GHz and below, measurements were made using a broadband bi-log antenna.

For all frequencies above 1GHz, measurements were made using a waveguide antenna.

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

- The test item was rotated so that all of its sides were exposed to the receiving antenna.
- Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.
- The measuring antenna was raised and lowered from 1 to 4 meters for each antenna polarization to maximize the readings.

5.9.1.3 Results

The preliminary plots with the test item set to receive at 911.65MHz are presented on pages 36 and 37. These plots are presented for a reference only, and are not used to determine compliance.

The final radiated levels with the test item set to receive at 911.65MHz are presented on page 38. As can be seen from the data, all emissions measured from the test item were within the specification limits. The emissions level closest to the limit (worst case) occurred at 911.65MHz. The emissions level at this frequency was 0.9dB within the limit. Photographs of the test configuration which yielded the highest or worst case, radiated emission levels are shown on Figure 3.

The preliminary plots with the test item set to receive at 916.45MHz are presented on pages 39 and 40. These plots are presented for a reference only, and are not used to determine compliance.

The final radiated levels with the test item set to receive at 916.45MHz are presented on page 41. As can be seen from the data, all emissions measured from the test item were within the specification limits. The emissions level closest to the limit (worst case) occurred at 916.45MHz. The emissions level at this frequency was 0.5dB within the limit. Photographs of the test configuration which yielded the highest or worst case, radiated emission levels are

shown on Figure 3.

The preliminary plots with the test item set to receive at 921.25MHz are presented on pages 42 and 43. These plots are presented for a reference only, and are not used to determine compliance.

The final radiated levels with the test item set to receive at 921.25MHz are presented on page 44. As can be seen from the data, all emissions measured from the test item were within the specification limits. The emissions level closest to the limit (worst case) occurred at 921.25MHz. The emissions level at this frequency was 0.6dB within the limit. Photographs of the test configuration which yielded the highest or worst case, radiated emission levels are shown on Figure 3.

5.9.2 Transmitter

5.9.2.1 Requirement

Per section 15.247(d), in any 100kHz bandwidth outside the frequency band in which the spread spectrum 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

5.9.2.2 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).

5.9.2.3 Results

The preliminary plots with the test item set to transmit at 911.65MHz are presented on pages 45 and 46. These plots are presented for a reference only, and are not used to determine compliance.

The final radiated levels with the test item set to transmit at 911.65MHz are presented on pages 47 and 48. As can be seen from the data, all emissions measured from the test item were within the specification limits. The emissions level closest to the limit (worst case) occurred at 3646.6MHz. The emissions level at this frequency was 13.2dB within the limit. Photographs of the test configuration which yielded the highest or worst case, radiated emission levels are shown on Figure 4 and Figure 5.

The preliminary plots with the test item set to transmit at 916.45MHz are presented on pages 49 and 50. These plots are presented for a reference only, and are not used to determine compliance.

The final radiated levels with the test item set to transmit at 916.45MHz are presented on pages 51 and 52. As can be seen from the data, all emissions measured from the test item were within the specification limits. The emissions level closest to the limit (worst case) occurred at 3665.8MHz. The emissions level at this frequency was 13.5dB within the limit. Photographs of the test configuration which yielded the highest or worst case, radiated emission levels are shown on Figure 4 and Figure 5.

The preliminary plots with the test item set to transmit at 921.25MHz are presented on pages 53 and 54. These plots are presented for a reference only, and are not used to determine compliance.

The final radiated levels with the test item set to transmit at 921.25MHz are presented on pages 55 and 56. As can be seen from the data, all emissions measured from the test item were within the specification limits. The emissions level closest to the limit (worst case) occurred at 3685.0MHz. The emissions level at this frequency was 14.1dB within the limit. Photographs of the test configuration which yielded the highest or worst case, radiated emission levels are shown on Figure 4 and Figure 5.

A block diagram of the test item orientation position is shown in Figure 1.

6 CONCLUSIONS

It was determined that the Badger Meter Serial Interface Repeater transceiver, Unit Number FCC 8 was assigned to the test item, 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 and Subpart C, Section 15.247 and of Industry Canada RSS-210 for Intentional Radiators, when tested per ANSI C63.4-2001.

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 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.

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



8 EQUIPMENT LIST

Table 8-1 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								
XPQ2	HIGH PASS FILTER	K&L MICROWAVE	4IH30-1804/T	3	1.8-10GHZ	11/27/06	12	11/27/07
Equipment Type: AMPLIFIERS								
APW3	PRE-AMPLIFIER	PLANAR ELECTRON	PE2-35-120-5	PL2924	1GHZ-20GHZ	11/27/06	12	11/27/07
Equipment Type: ANTENNAS								
NDQ0	TUNED DIPOLE ANTENNA	EMCO	3121C-DB4	311	400-1000MHZ	03/06/07	12	03/06/08
NDQ1	TUNED DIPOLE ANTENNA	EMCO	3121C-DB4	313	400-1000MHZ	03/28/07	12	03/28/08
NTA1	BILOG ANTENNA	CHASE EMC LTD.	BILOG CBL611	2054	0.03-2GHZ	06/05/07	12	06/05/08
NWH0	RIDGED WAVE GUIDE	TENSOR	4105	2081	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: POWER SUPPLIES								
SRA7	DC POWER SUPPLY	TEKPOWER	HY3005D	0023471			NOTE 1	
Equipment Type: PRINTERS AND PLOTTERS								
HRE1	LASER JET 5P	HEWLETT PACKARD	C3150A	USHB061052	---		N/A	
Equipment Type: RECEIVERS								
RBB0	EMI TEST RECEIVER 20HZ TO	ROHDE & SCHWARZ	ESIB40	100250	20 HZ TO 40GHZ	09/29/06	12	09/29/07
Equipment Type: SIGNAL GENERATORS								
GRD0	SIGNAL GENERATOR	HEWLETT PACKARD	E4432B	US38080222	250KHZ-3.0GHZ	08/28/06	12	08/28/07

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.

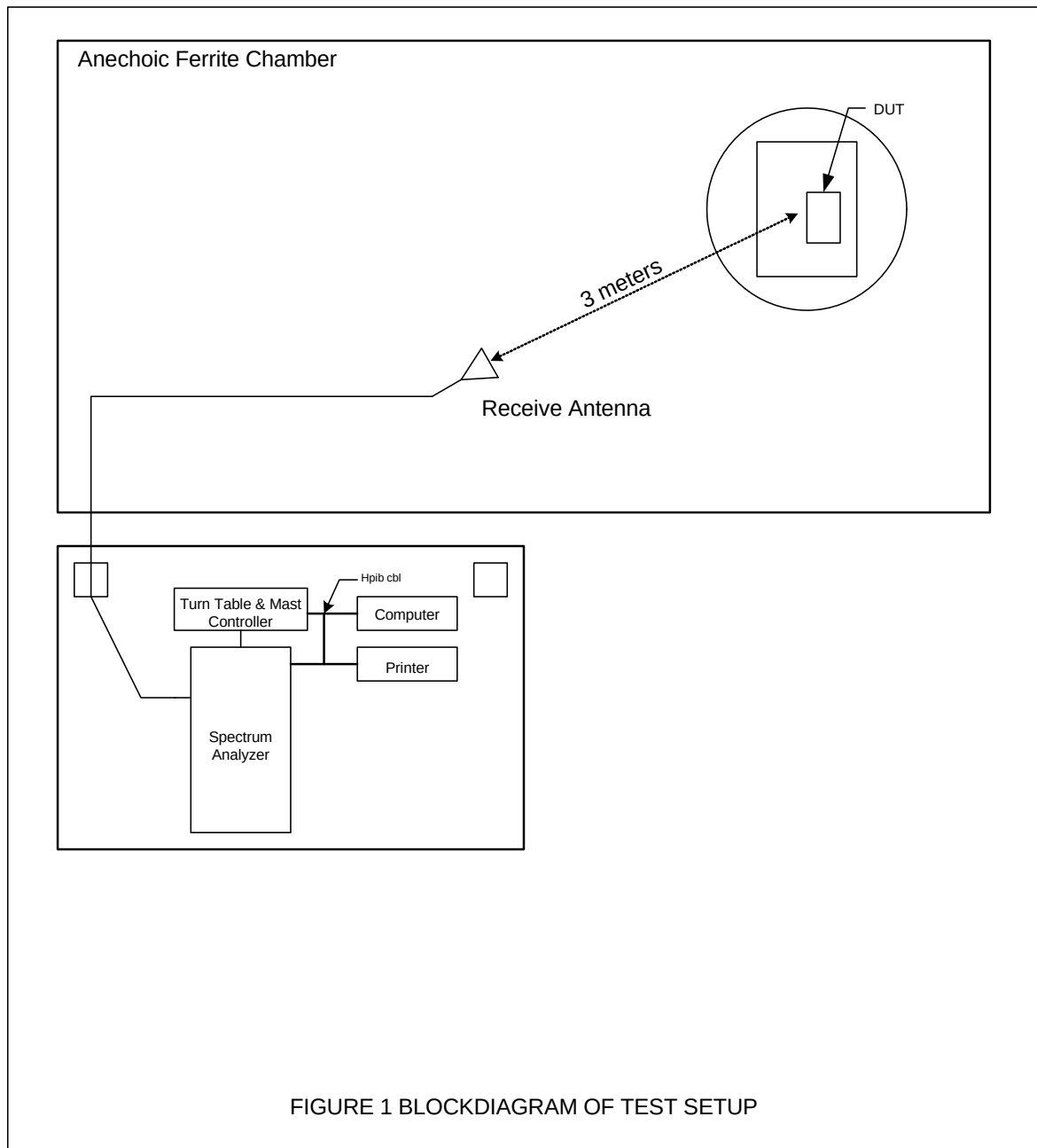
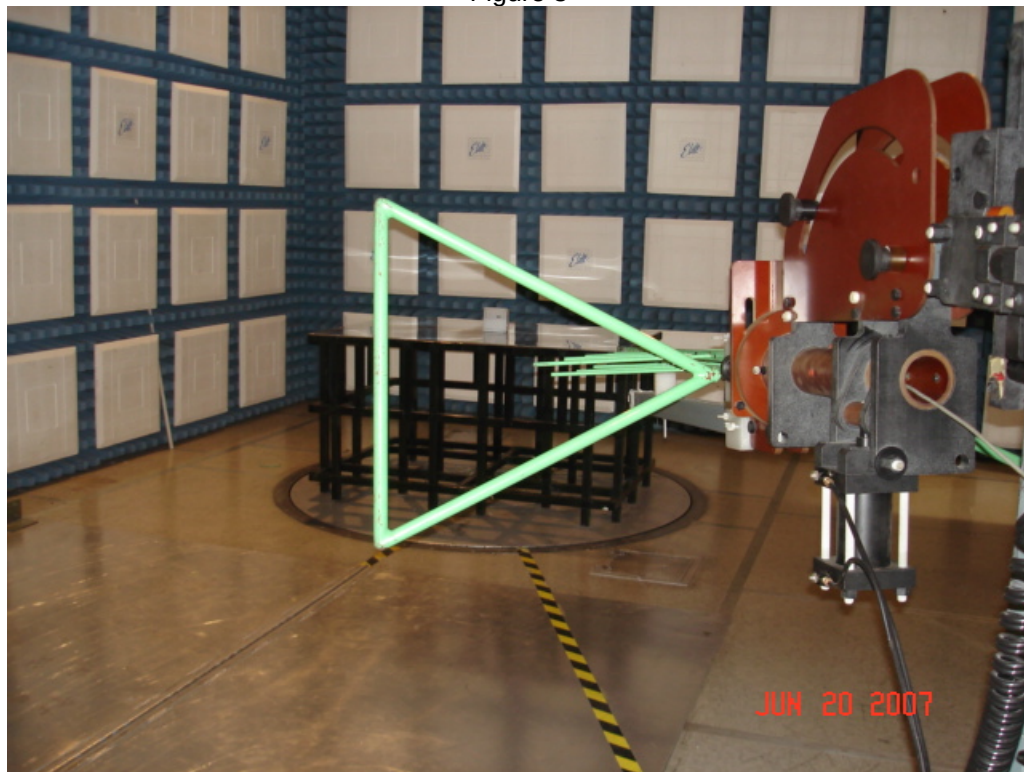


Figure 2

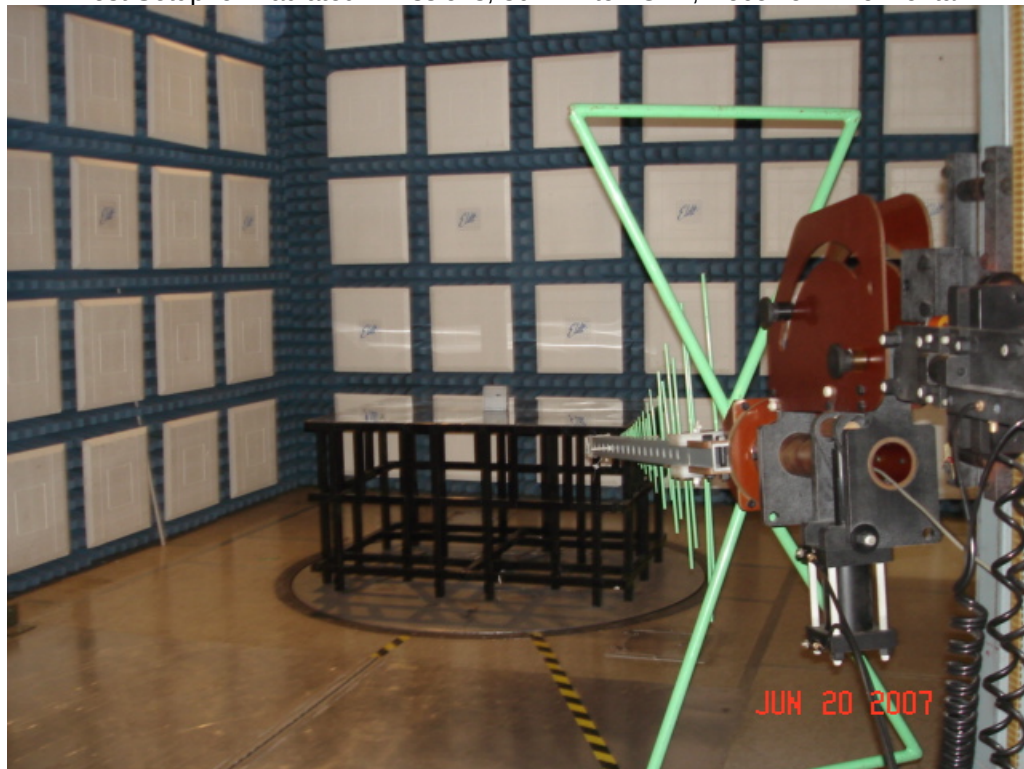


Test Item Setup

Figure 3



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



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

Figure 4



Test Setup for Radiated Emissions, Transmitter, below 1GHz – Horizontal Polarization



Test Setup for Radiated Emissions, Transmitter below 1GHz – Vertical Polarization

Figure 5



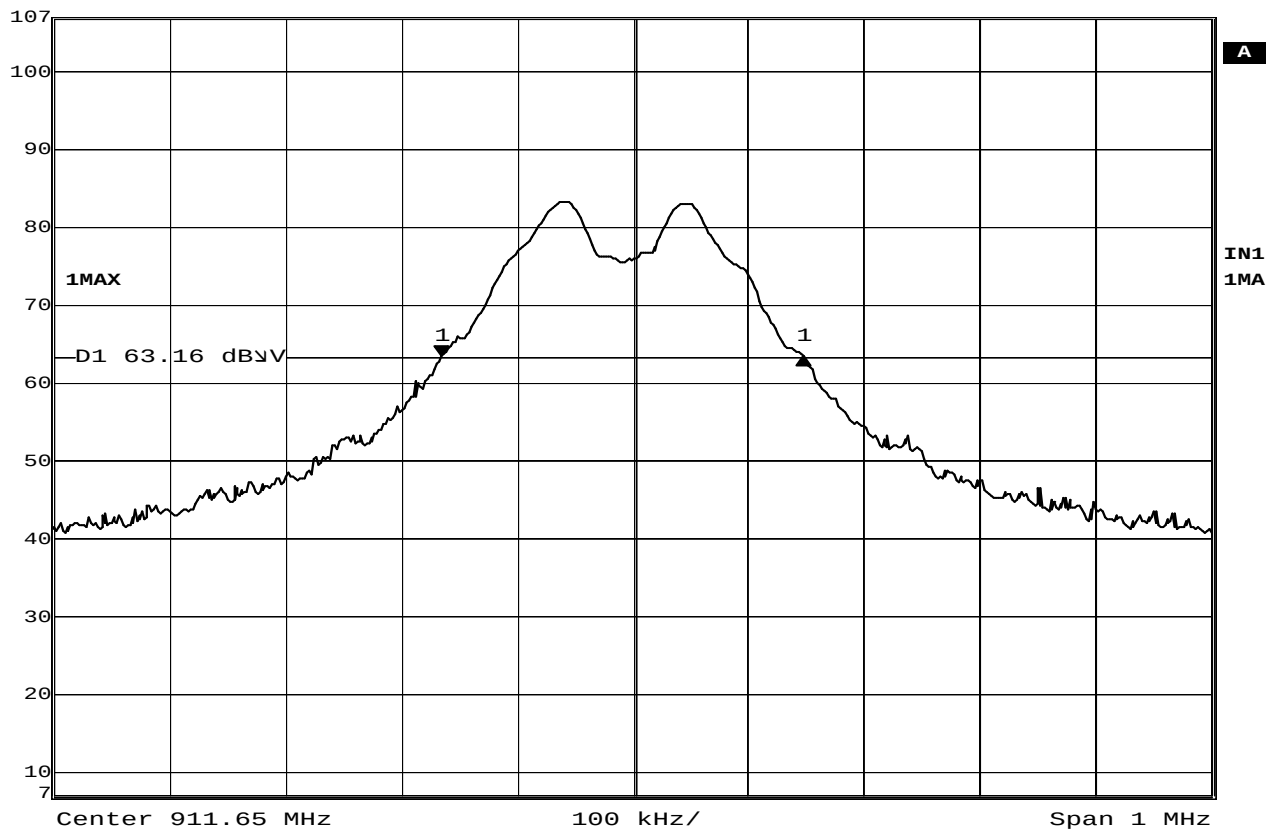
Test Setup for Radiated Emissions, above 1GHz – Horizontal Polarization



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



 Delta 1 [T1] RBW 30 kHz RF Att 20 dB
Ref Lvl -0.07 dB VBW 30 kHz
107 dBμV 312.62525050 kHz SWT 5 ms Unit dBμV

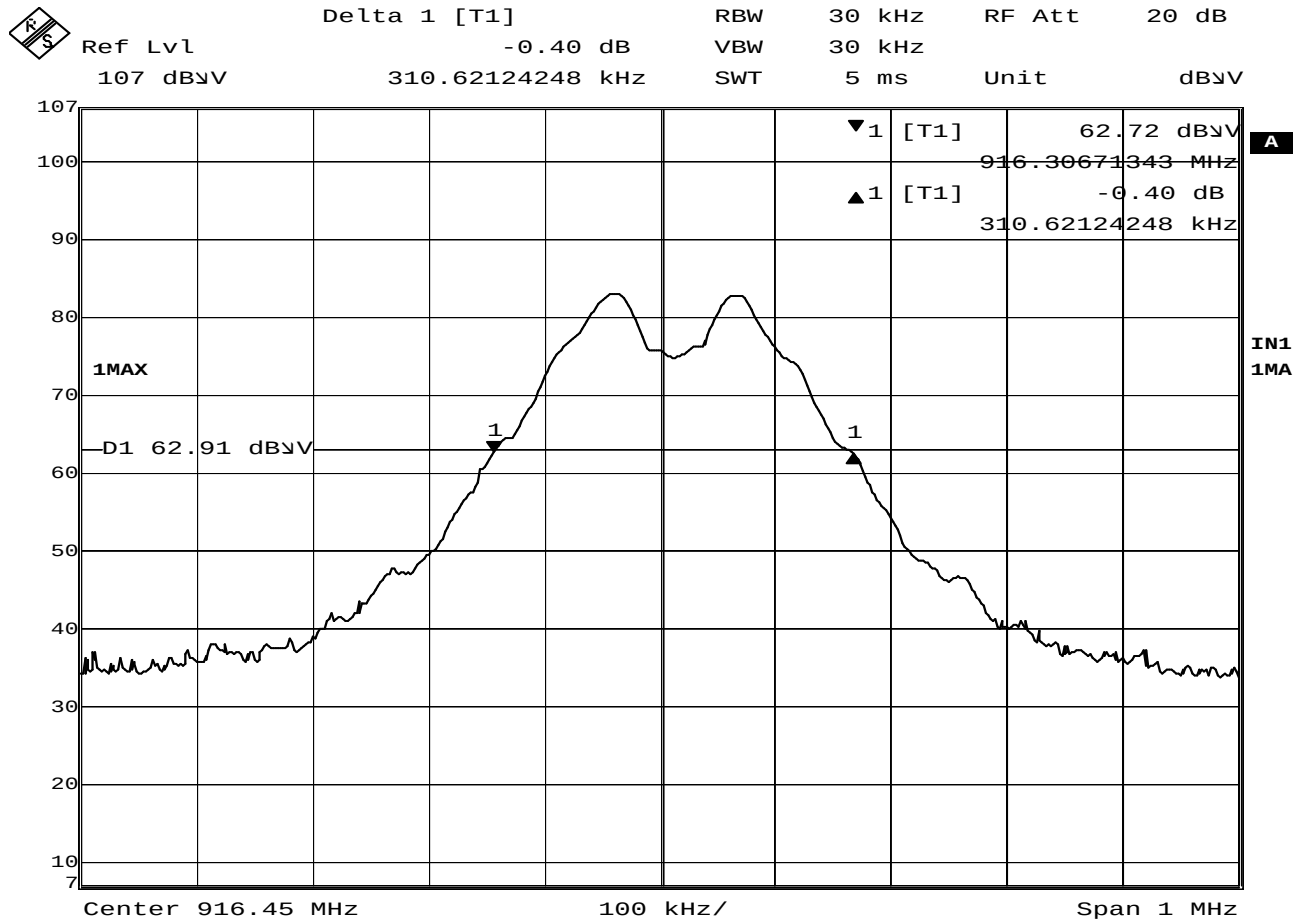


Date: 20.JUN.2007 20:04:50

FCC 15.247 20dB Bandwidth

MANUFACTURER : Badger Meter
PRODUCT NAME : Repeater
SERIAL NUMBER : None Assigned
TEST MODE : Tx @ 911.65MHz
TEST PARAMETER : 20dB bandwidth = 312.63kHz
EQUIPMENT USED : RBB0, NTA1

NOTES

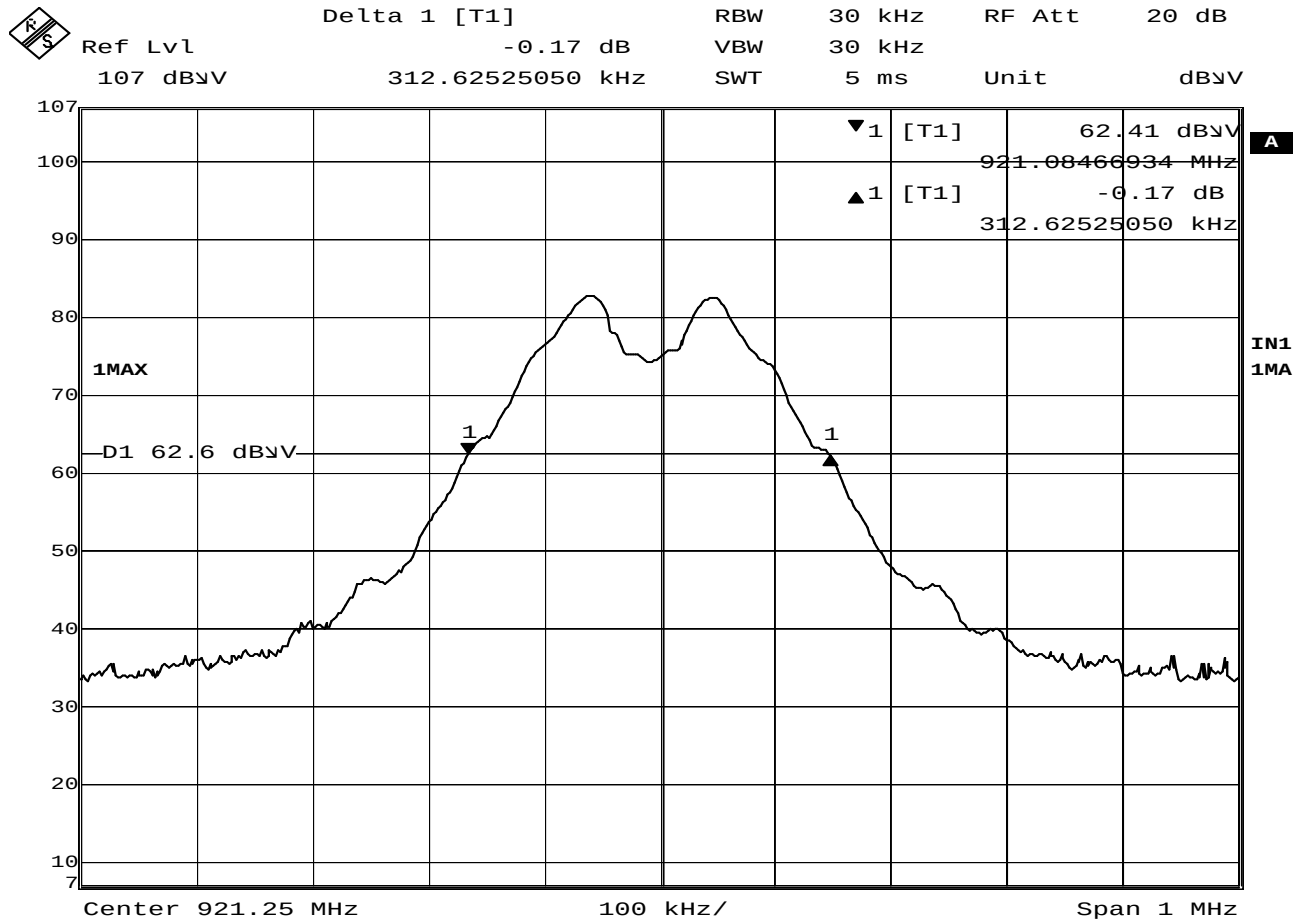


Date: 20.JUN.2007 20:24:32

FCC 15.247 20dB Bandwidth

MANUFACTURER : Badger Meter
PRODUCT NAME : Repeater
SERIAL NUMBER : None Assigned
TEST MODE : Tx @ 916.45MHz
TEST PARAMETER : 99% bandwidth = 310.62kHz
EQUIPMENT USED : RBB0, NTA1

NOTES

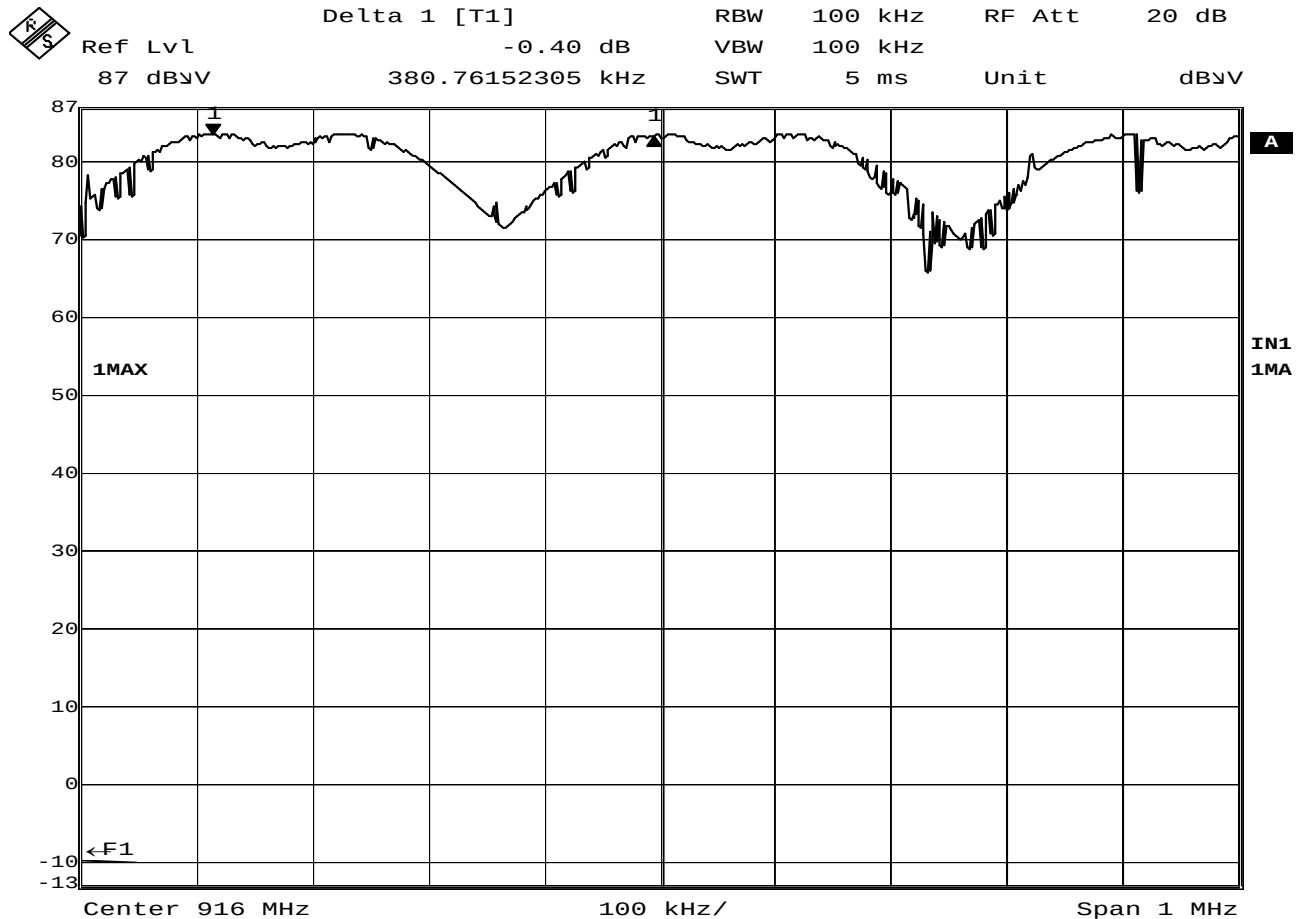


Date: 20.JUN.2007 20:29:45

FCC 15.247 20dB Bandwidth

MANUFACTURER : Badger Meter
PRODUCT NAME : Repeater
SERIAL NUMBER : None Assigned
TEST MODE : Tx @ 916.45MHz
TEST PARAMETER : 20dB bandwidth = 312.63kHz
EQUIPMENT USED : RBB0, NTA1

NOTES

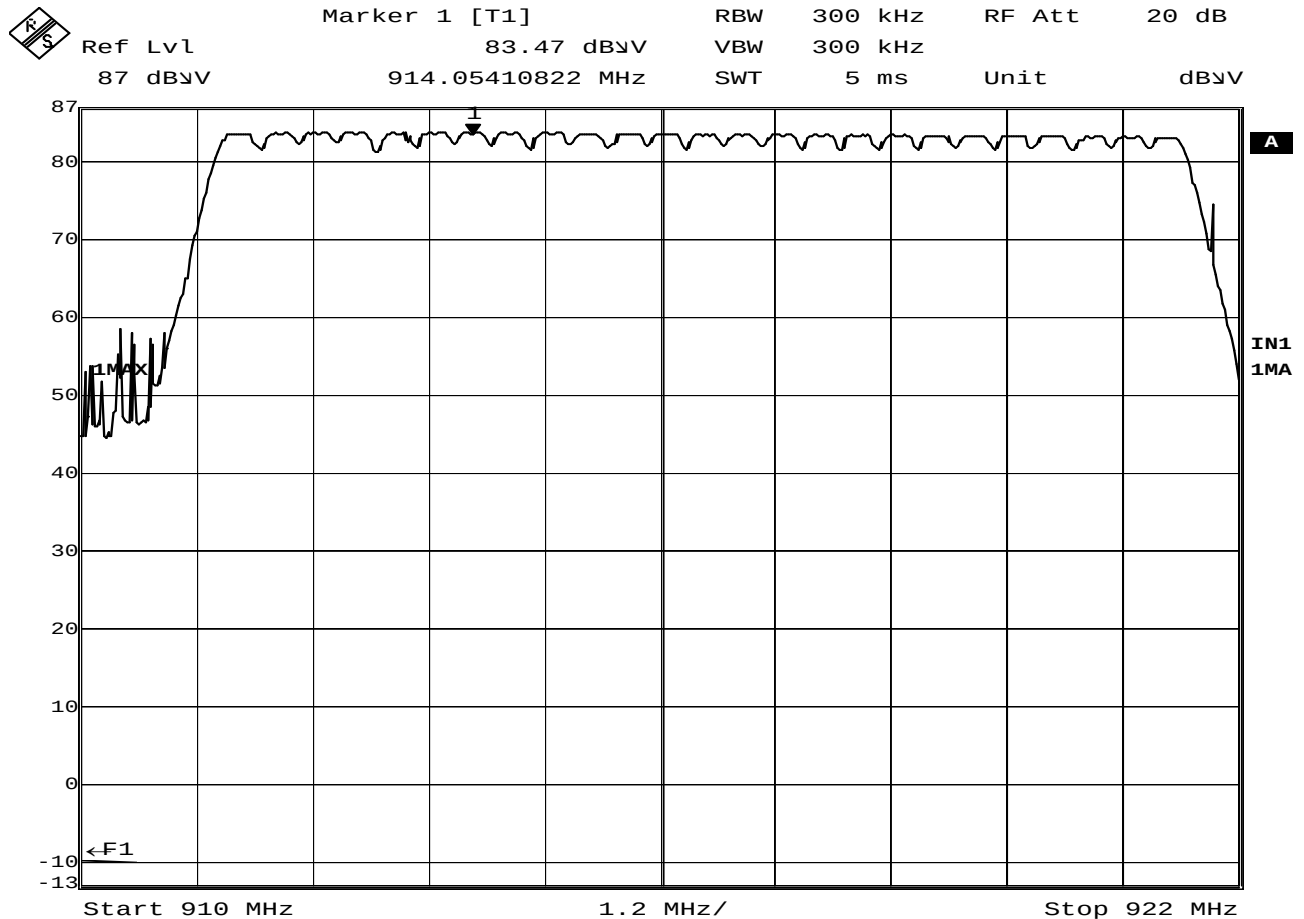


Date: 20.JUN.2007 19:37:19

FCC 15.247 Carrier Frequency Separation

MANUFACTURER : Badger Meter
PRODUCT NAME : Repeater
SERIAL NUMBER : None Assigned
TEST MODE : Hopping Enabled
TEST PARAMETER : Carrier Frequency Separation = 380.76kHz
EQUIPMENT USED : RBB0, NTA1

NOTES

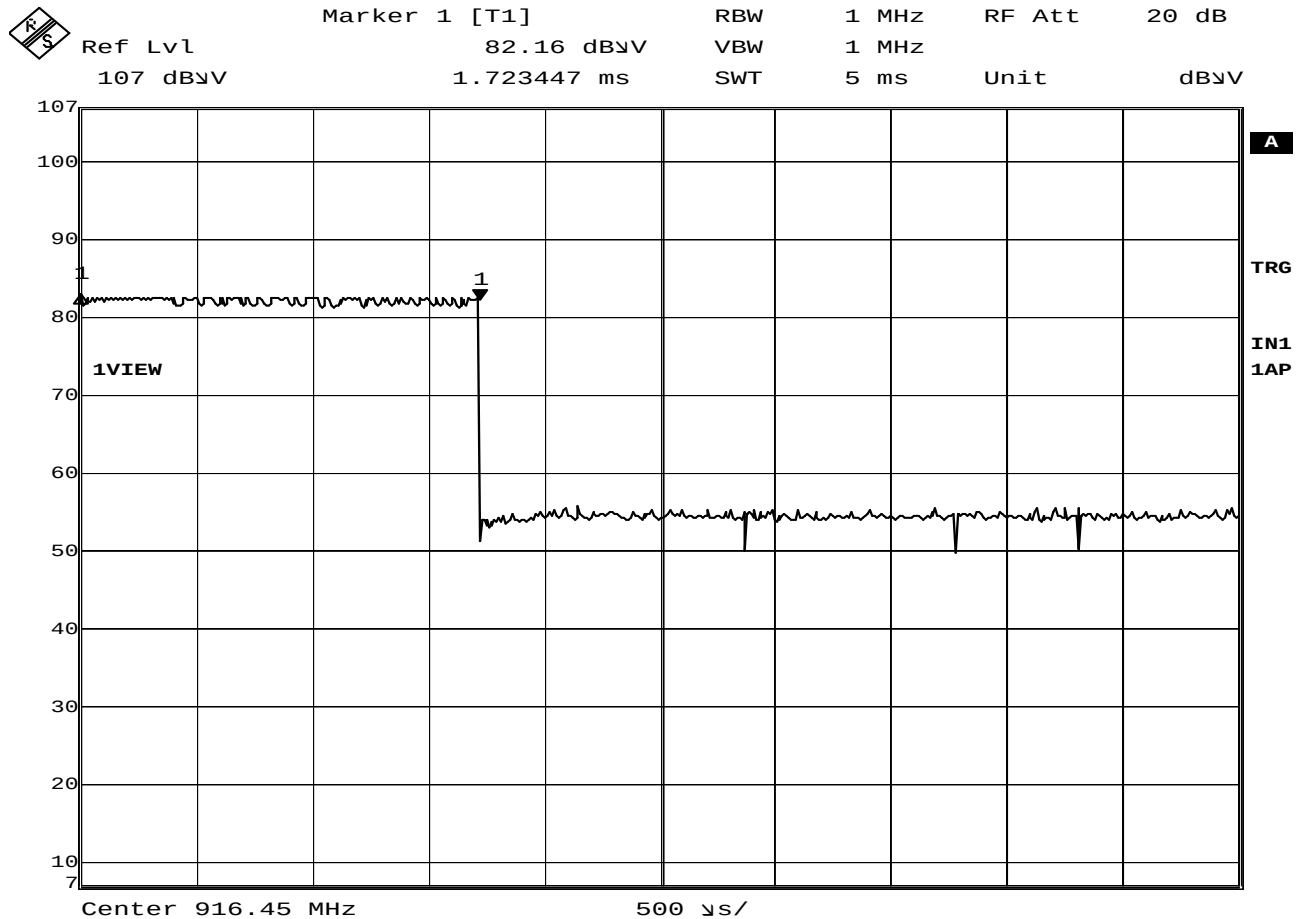


Date: 20.JUN.2007 19:31:16

FCC 15.247 Number of Hopping Frequencies

MANUFACTURER : Badger Meter
PRODUCT NAME : Repeater
SERIAL NUMBER : None Assigned
TEST MODE : Hopping Enabled
TEST PARAMETER : Number of Hopping Frequencies = 25
EQUIPMENT USED : RBB0, NTA1

NOTES

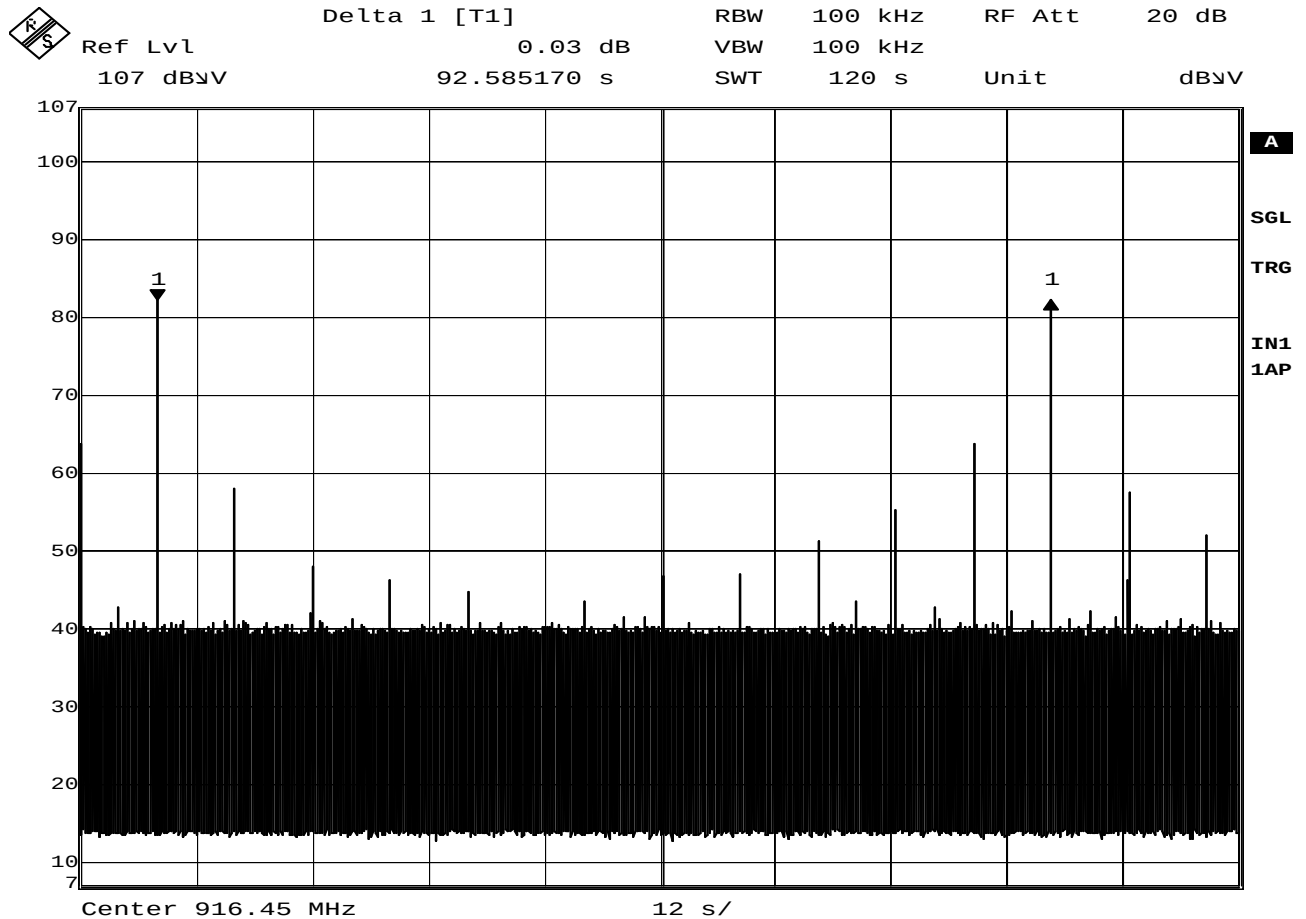


Date: 20.JUN.2007 19:43:37

FCC 15.247 Time of Occupancy

MANUFACTURER : Badger Meter
PRODUCT NAME : Repeater
SERIAL NUMBER : None Assigned
TEST MODE : Hopping Enabled
TEST PARAMETER : Pulse width = 1.72msec
EQUIPMENT USED : RBB0, NTA1

NOTES



Date: 20.JUN.2007 19:54:46

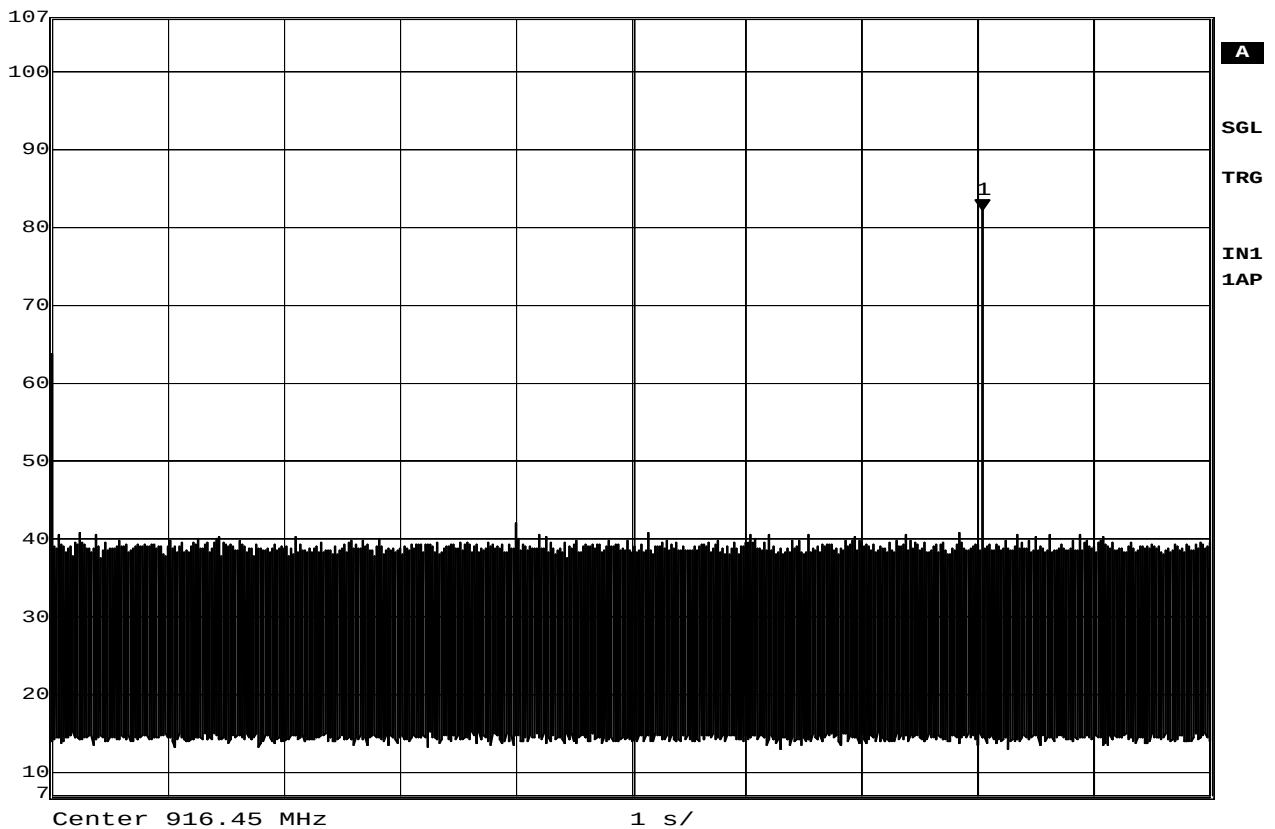
FCC 15.247 Time of Occupancy

MANUFACTURER : Badger Meter
PRODUCT NAME : Repeater
SERIAL NUMBER : None Assigned
TEST MODE : Hopping Enabled
TEST PARAMETER : Time of Occupancy = 1 pulse per channel every 92.58 seconds.
EQUIPMENT USED : RBB0, NTA1

NOTES



Marker 1 [T1] RBW 100 kHz RF Att 20 dB
Ref Lvl 82.20 dBμV VBW 100 kHz
107 dBμV 8.036072 s SWT 10 s Unit dBμV



Date: 20.JUN.2007 19:59:30
FCC 15.247 Time of Occupancy

MANUFACTURER : Badger Meter
PRODUCT NAME : Repeater
SERIAL NUMBER : None Assigned
TEST MODE : Hopping Enabled
TEST PARAMETER : Time of Occupancy = 1 pulse per 10 seconds
EQUIPMENT USED : RBB0, NTA1

NOTES

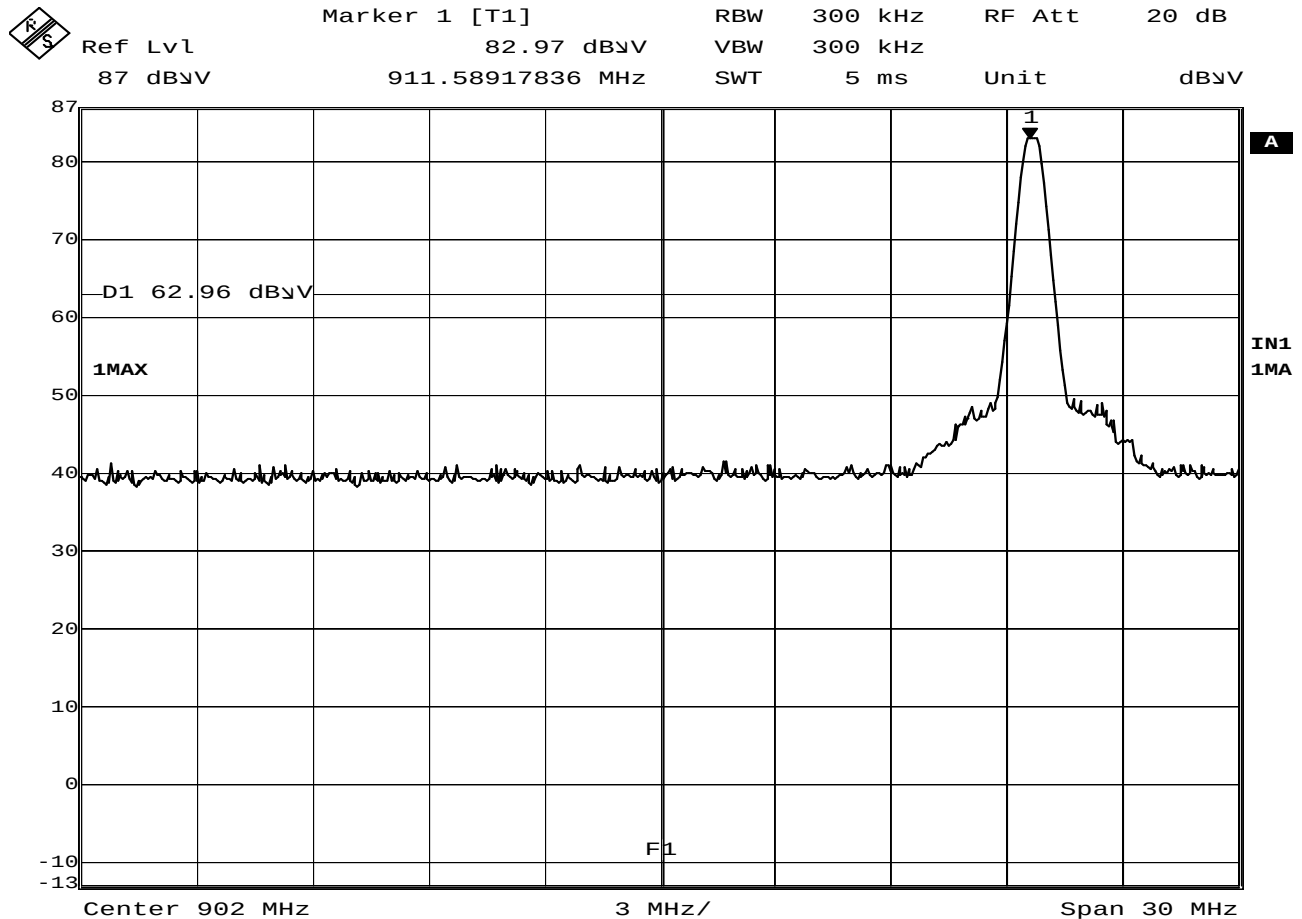


MANUFACTURER : Badger Meter
PRODUCT NAME : Repeater
SERIAL NUMBER : None Assigned
TEST MODE : See Below
DATE TESTED : June 18, 2007
TEST PARAMETERS : EIRP
EQUIPMENT USED : RBB0, NDQ1, NDQ0, GRD0

Frequency MHz	Antenna Polarity	Meter	Matched Sig Gen	Cable	Antenna		Limit dBm
		Reading dBuV	Reading dBm	Loss dB	Gain dB	EIRP dBm	
911.65	H	78.7	9.2	1.6	2.2	9.8	30
911.65	V	78.0	11.4	1.6	2.2	12	30
916.5	H	78.6	9	1.6	2.2	9.6	30
916.5	V	77.7	11.2	1.6	2.2	11.8	30
921.3	H	78.2	8.9	1.6	2.2	9.5	30
921.3	V	77.4	10.74	1.6	2.2	11.34	30

EIRP = Matched Signal Generator Reading - Cable Loss + Antenna Gain

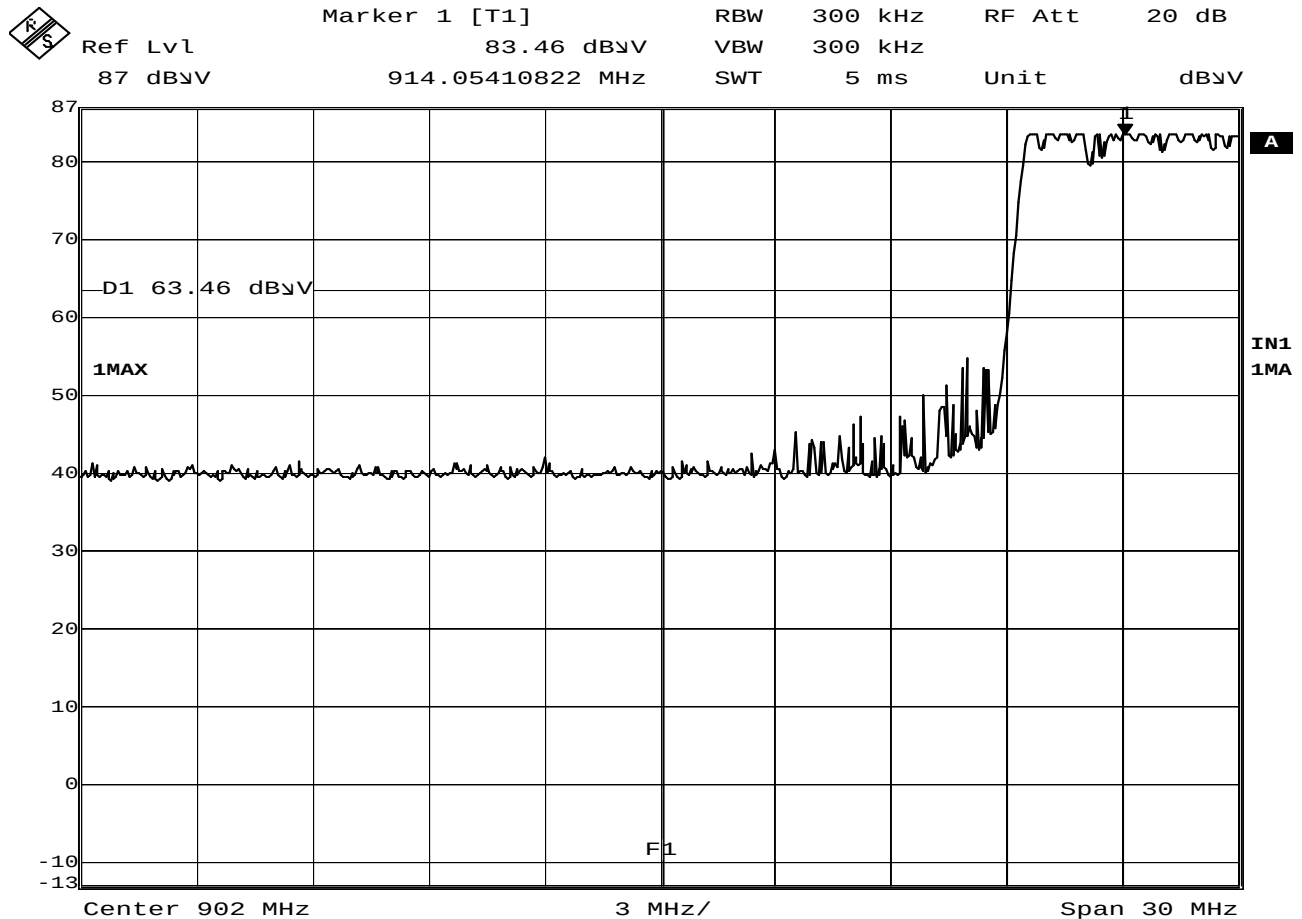
Checked By: MARK E. LONGINOTTI



Date: 20.JUN.2007 18:38:05
FCC 15.247 Band-edge Compliance

MANUFACTURER : Badger Meter
PRODUCT NAME : Repeater
SERIAL NUMBER : None Assigned
TEST MODE : Tx @ 911.65MHz
TEST PARAMETER : Display Line (D1) represents the 20dB down level of the peak emissions. Display Line (F1) represents the band-edge.
EQUIPMENT USED : RBB0, NTA1

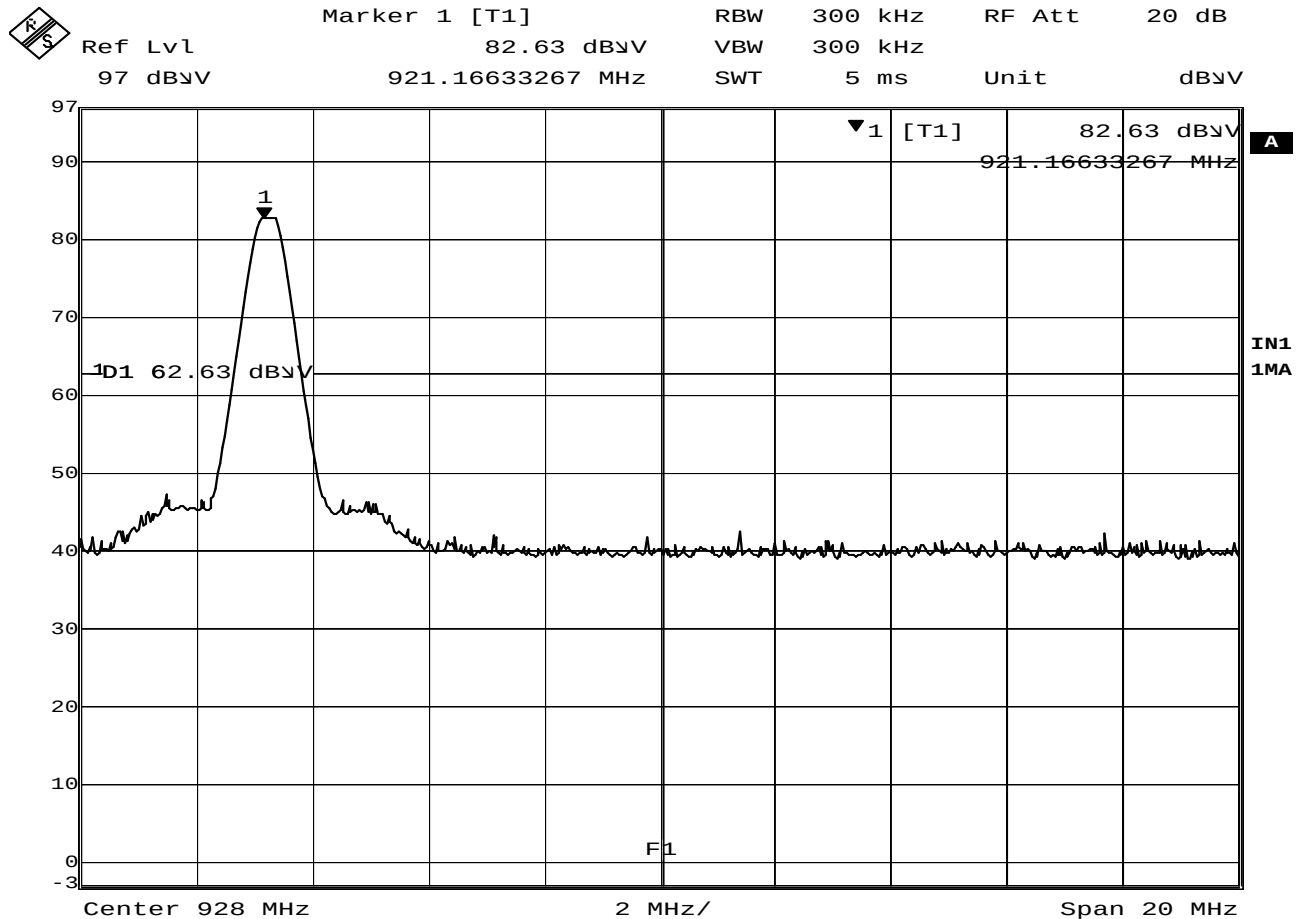
NOTES



Date: 20.JUN.2007 18:45:21
FCC 15.247 Band-edge Compliance

MANUFACTURER : Badger Meter
PRODUCT NAME : Repeater
SERIAL NUMBER : None Assigned
TEST MODE : Hopping Enabled
TEST PARAMETER : Display Line (D1) represents the 20dB down level of the peak emissions. Display Line (F1) represents the band-edge.
EQUIPMENT USED : RBB0, NTA1

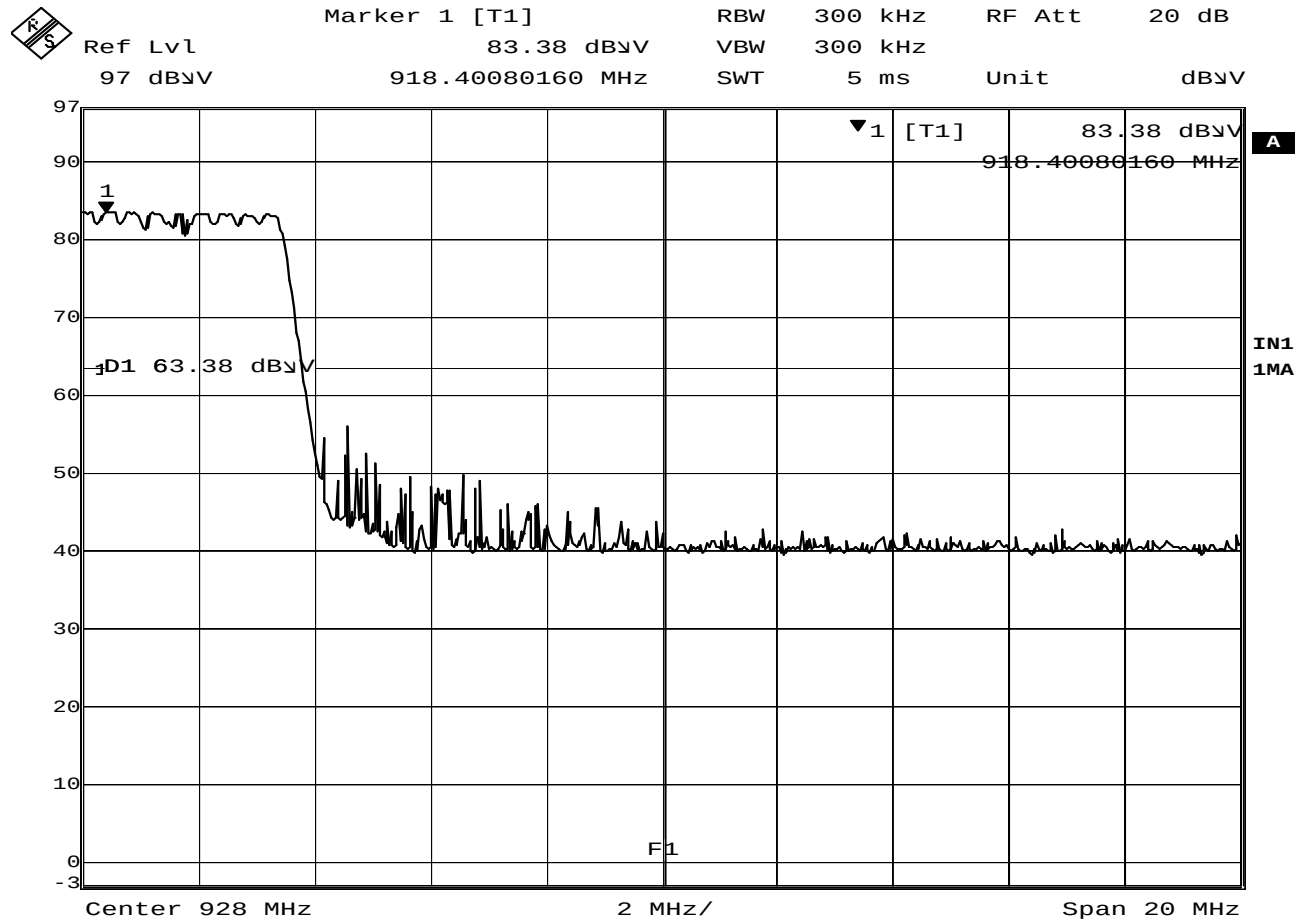
NOTES



Date: 20.JUN.2007 20:40:19
FCC 15.247 Band-edge Compliance

MANUFACTURER : Badger Meter
PRODUCT NAME : Repeater
SERIAL NUMBER : None Assigned
TEST MODE : Tx @ 921.25MHz
TEST PARAMETER : Display Line (D1) represents the 20dB down level of the peak emissions. Display Line (F1) represents the band-edge.
EQUIPMENT USED : RBB0, NTA1

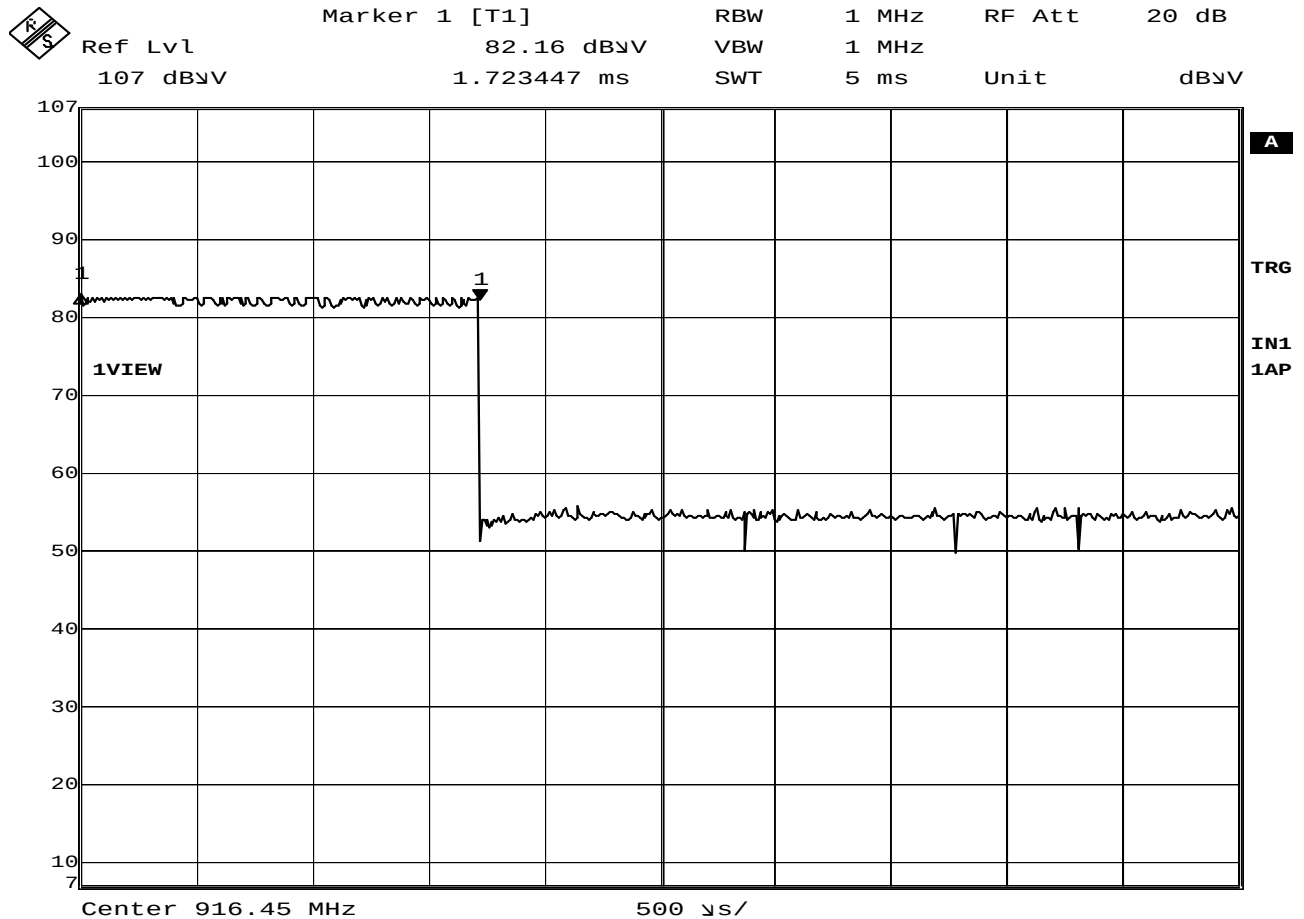
NOTES



Date: 20.JUN.2007 20:46:44
FCC 15.247 Band-edge Compliance

MANUFACTURER : Badger Meter
PRODUCT NAME : Repeater
SERIAL NUMBER : None Assigned
TEST MODE : Hopping Enabled
TEST PARAMETER : Display Line (D1) represents the 20dB down level of the peak emissions. Display Line (F1) represents the band-edge.
EQUIPMENT USED : RBB0, NTA1

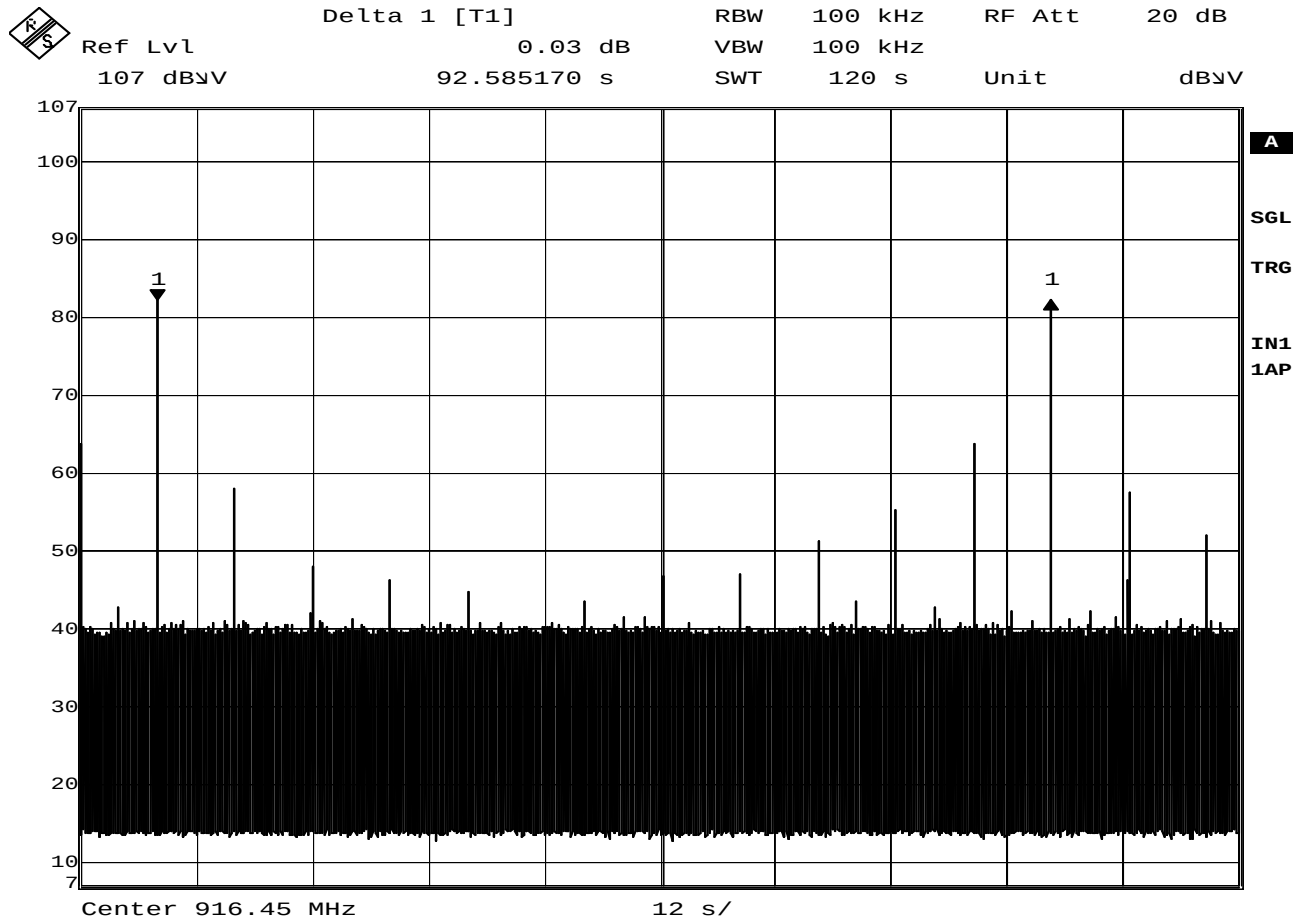
NOTES



Date: 20.JUN.2007 19:43:37
FCC 15.35(c) Duty Cycle Measurements

MANUFACTURER : Badger Meter
PRODUCT NAME : Repeater
SERIAL NUMBER : None Assigned
TEST MODE : Hopping Enabled
TEST PARAMETER : Pulse width = 1.72msec
EQUIPMENT USED : RBB0, NTA1

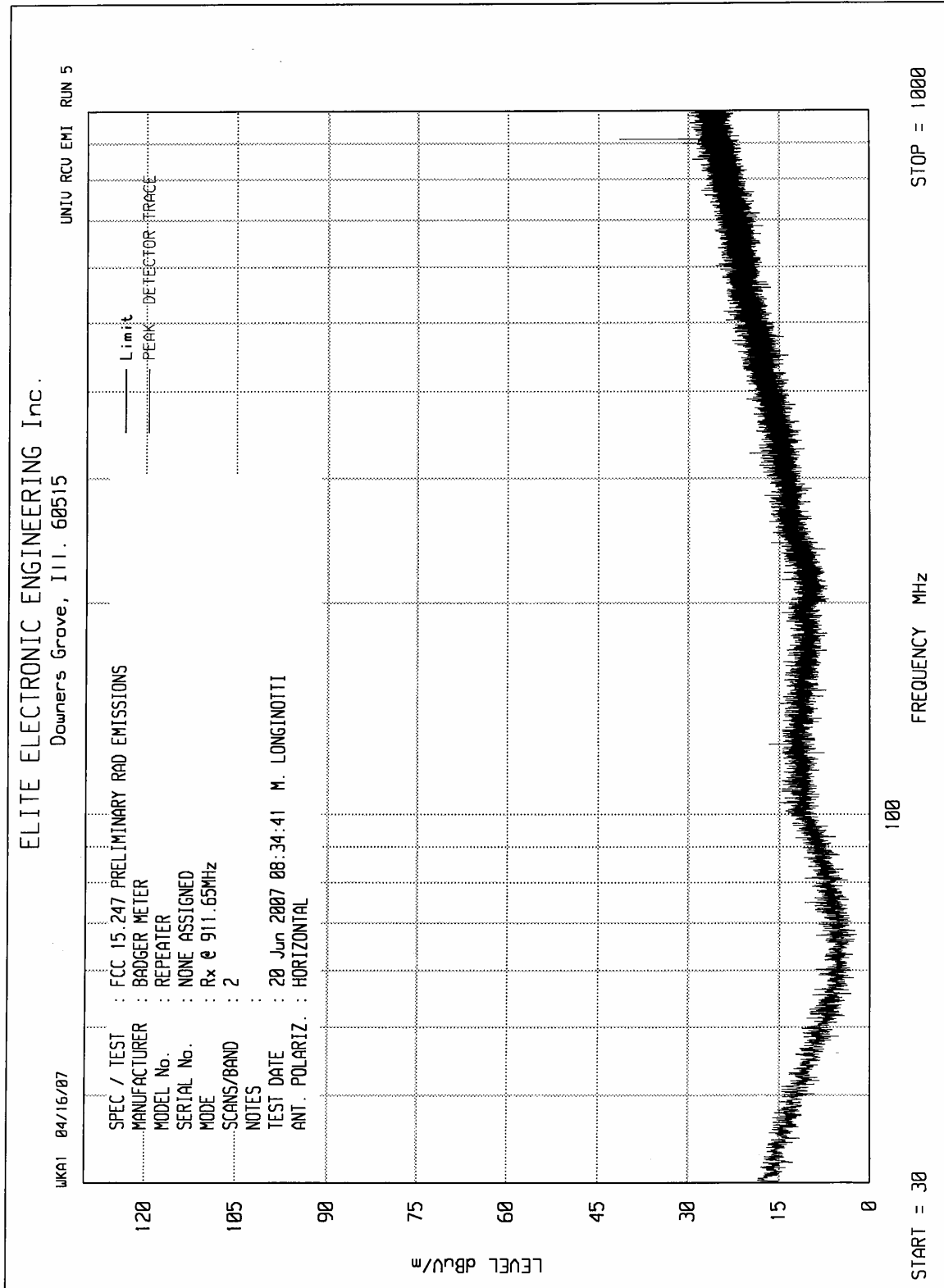
NOTES

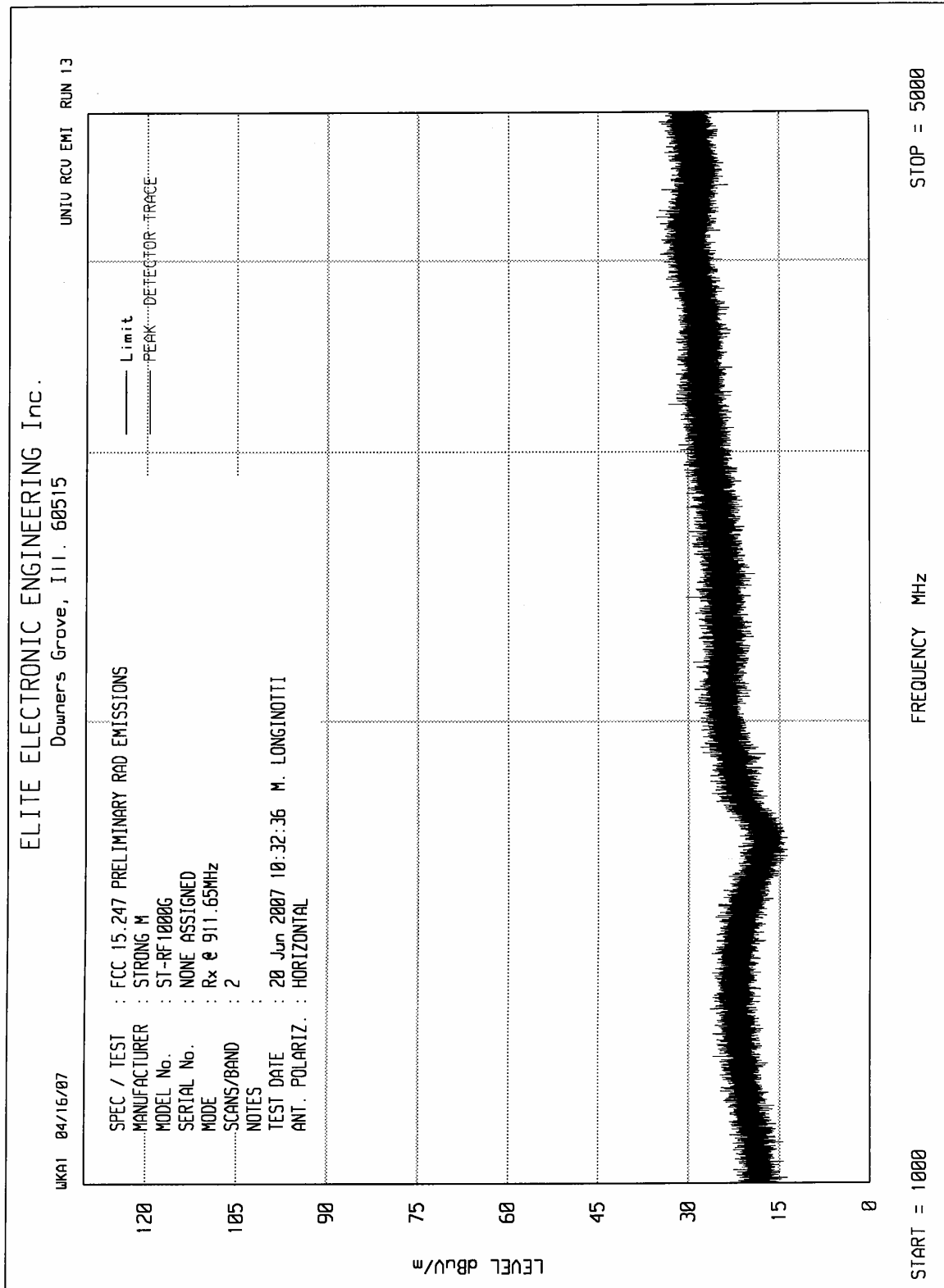


Date: 20.JUN.2007 19:54:46
FCC 15.35(c) Duty Cycle Measurements

MANUFACTURER : Badger Meter
PRODUCT NAME : Repeater
SERIAL NUMBER : None Assigned
TEST MODE : Hopping Enabled
TEST PARAMETER : Time of Occupancy = 1 pulse per channel every 92.58 seconds.
EQUIPMENT USED : RBB0, NTA1

NOTES







MANUFACTURER : Badger Meter
PRODUCT NAME : Repeater
SERIAL NUMBER : None Assigned
TEST MODE : Rx @ 911.65MHz
EQUIPMENT USED : RBB0, APW3, SRA7, NTA1, NWH0
DATE TESTED : June 20, 2007
NOTES : Peak Readings, Test Distance is 3 meters

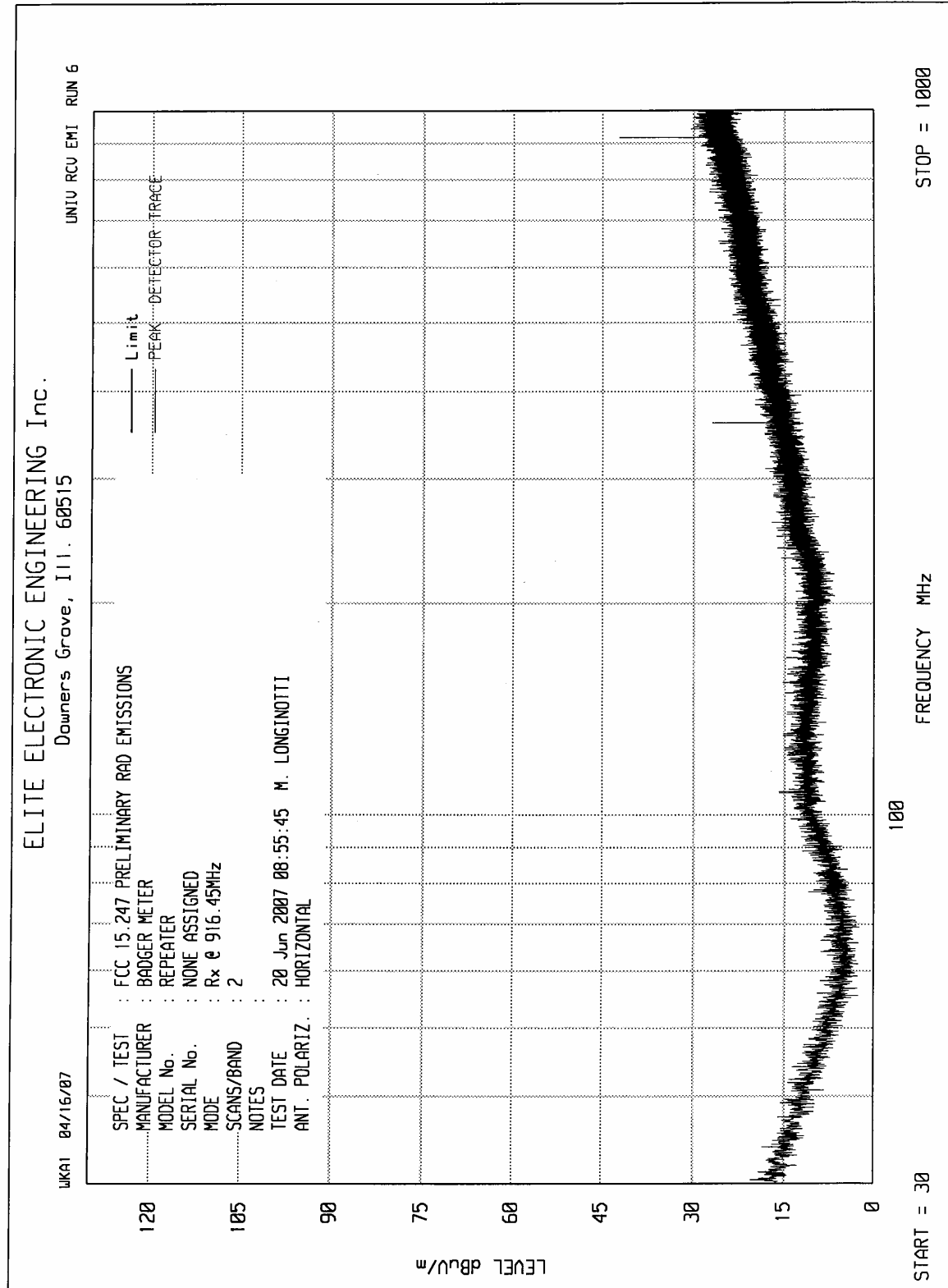
Frequency MHz	Antenna Polarity	Meter Reading dBuV	Ambient	Cable Factor dB	Antenna Factor dB	Pre-Amp Gain dB	Total dBuV/m	Total uV/m	Limit uV/m
911.7	H	19.1		1.9	23.0	0.0	44.1	160.0	200.0
911.7	V	20.1		1.9	23.0	0.0	45.1	179.5	200.0
1823.3	H	50.1	Ambient	2.9	27.6	-40.6	39.9	99.1	500.0
1823.3	V	49.3	Ambient	2.9	27.6	-40.6	39.1	90.4	500.0
2735.0	H	48.0	Ambient	3.8	30.3	-40.3	41.7	121.7	500.0
2735.0	V	48.8	Ambient	3.8	30.3	-40.3	42.5	133.4	500.0
3646.6	H	47.4	Ambient	4.4	33.9	-40.1	45.6	190.6	500.0
3646.6	V	47.2	Ambient	4.4	33.9	-40.1	45.4	186.2	500.0
4558.3	H	46.7	Ambient	4.8	34.1	-40.0	45.6	190.9	500.0
4558.3	V	46.6	Ambient	4.8	34.1	-40.0	45.5	188.7	500.0

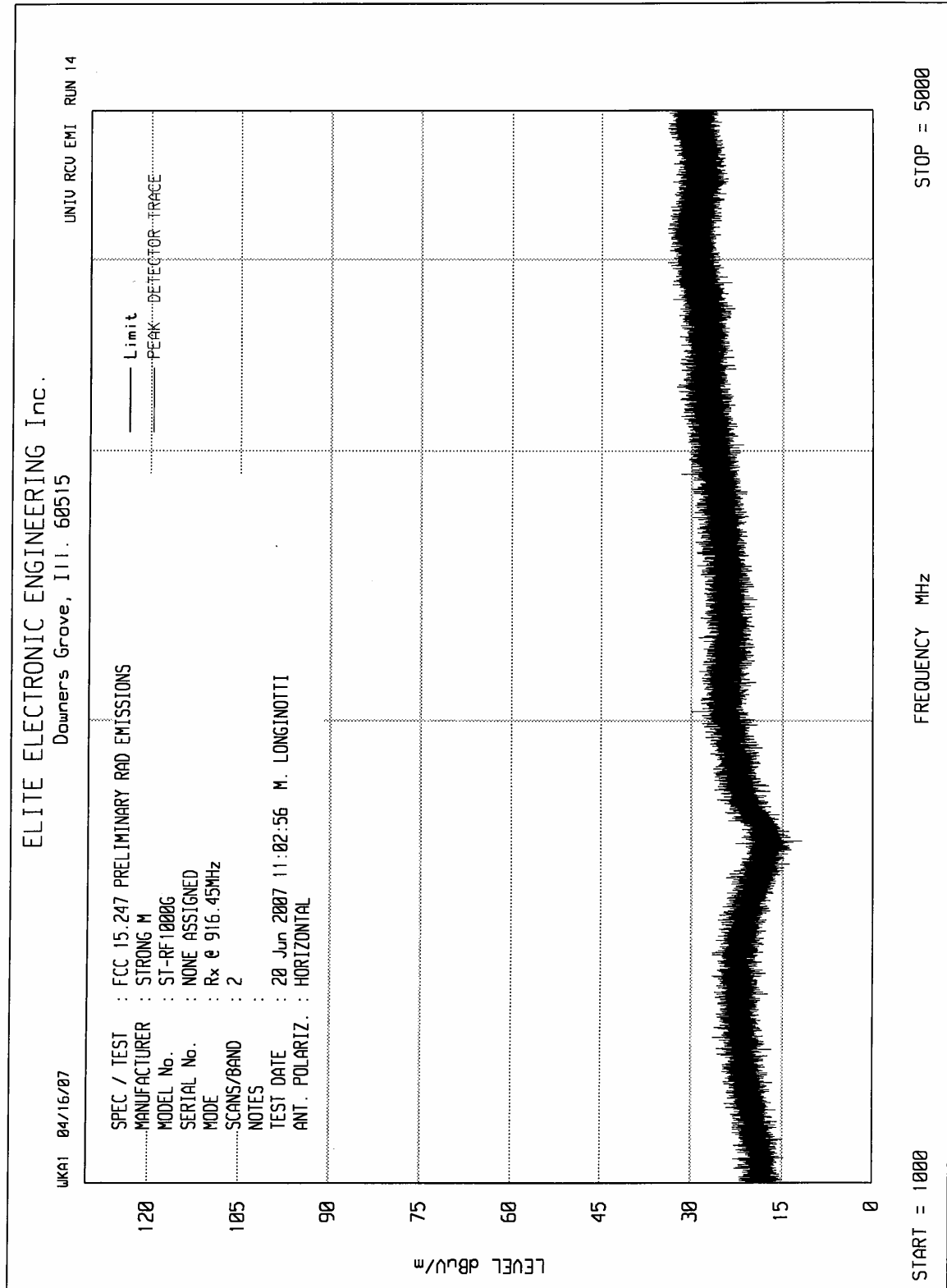
V - Vertical

H - Horizontal

Total = Meter Reading + Cable Factor + Antenna Factor + Pre-Amp Gain

Checked By: MARK E. LONGINOTTI







MANUFACTURER : Badger Meter
PRODUCT NAME : Repeater
SERIAL NUMBER : None Assigned
TEST MODE : Rx @ 916.45MHz
EQUIPMENT USED : RBB0, APW3, SRA7, NTA1, NWH0
DATE TESTED : June 20, 2007
NOTES : Peak Readings, Test Distance is 3 meters

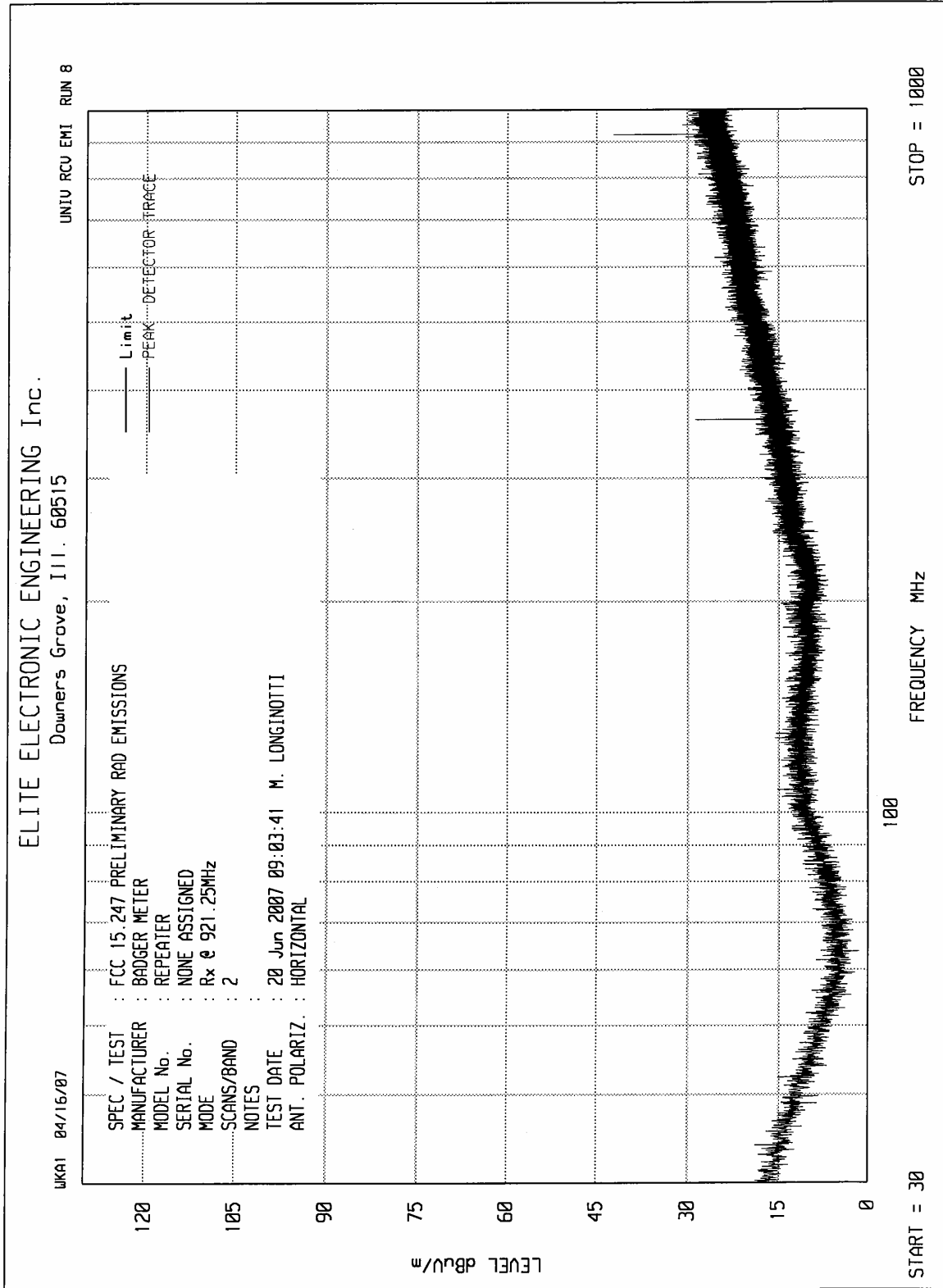
Frequency MHz	Antenna Polarity	Meter Reading dBuV	Ambient	Cable Factor dB	Antenna Factor dB	Pre-Amp Gain dB	Total dBuV/m	Total uV/m	Limit uV/m
916.5	H	18.4		2.0	23.1	0.0	43.5	149.3	200.0
916.5	V	20.4		2.0	23.1	0.0	45.5	188.0	200.0
1832.9	H	49.3		2.9	27.6	-40.6	39.2	91.2	500.0
1832.9	V	49.2		2.9	27.6	-40.6	39.1	90.1	500.0
2749.4	H	48.5		3.8	30.3	-40.3	42.3	129.7	500.0
2749.4	V	48.7		3.8	30.3	-40.3	42.5	132.7	500.0
3665.8	H	47.8		4.4	34.0	-40.1	46.1	200.9	500.0
3665.8	V	47.6		4.4	34.0	-40.1	45.9	196.3	500.0
4582.3	H	46.8		4.8	34.1	-40.0	45.8	194.7	500.0
4582.3	V	46.7		4.8	34.1	-40.0	45.7	192.5	500.0

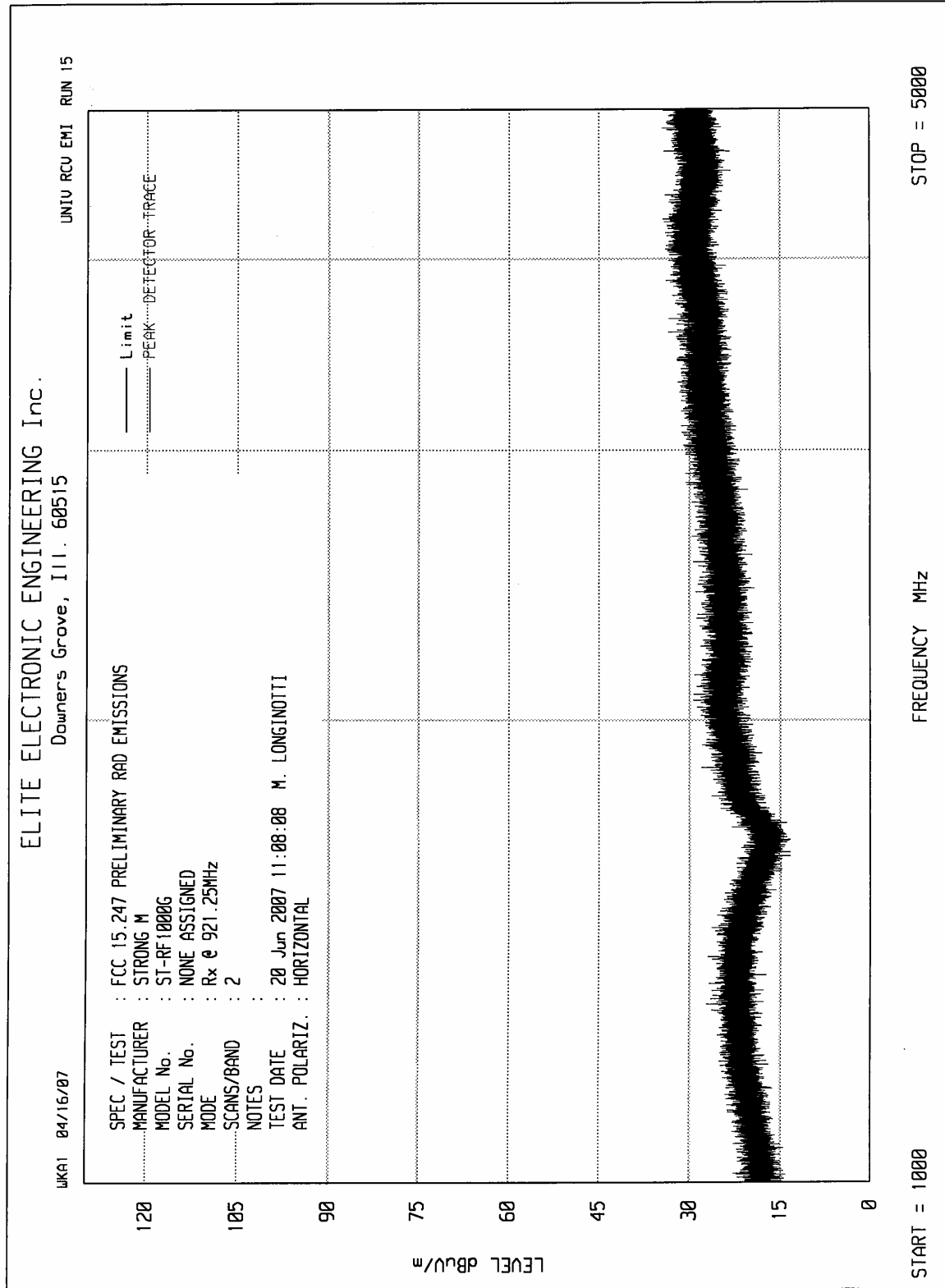
V - Vertical

H - Horizontal

Total = Meter Reading + Cable Factor + Antenna Factor + Pre-Amp Gain

Checked By: MARK E. LONGINOTTI







MANUFACTURER : Badger Meter
PRODUCT NAME : Repeater
SERIAL NUMBER : None Assigned
TEST MODE : Rx @ 921.25MHz
EQUIPMENT USED : RBB0, APW3, SRA7, NTA1, NWH0
DATE TESTED : June 20, 2007
NOTES : Peak Readings, Test Distance is 3 meters

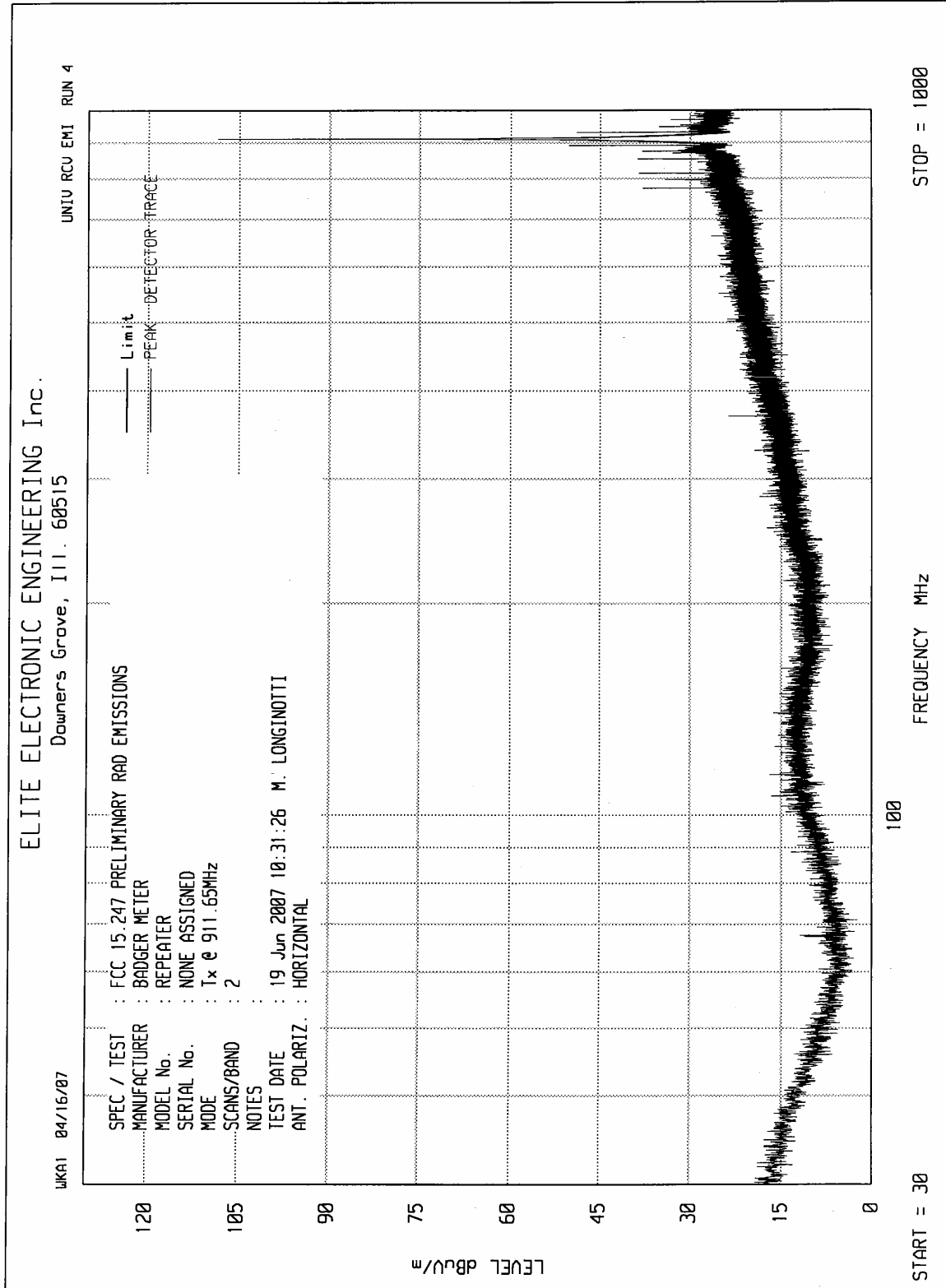
Frequency MHz	Antenna Polarity	Meter Reading dBuV	Ambient	Cable Factor dB	Antenna Factor dB	Pre-Amp Gain dB	Total dBuV/m	Total uV/m	Limit uV/m
921.3	H	17.8		2.0	23.3	0.0	43.0	141.3	200.0
921.3	V	20.2		2.0	23.3	0.0	45.4	186.3	200.0
1842.5	H	49.3		2.9	27.6	-40.5	39.3	91.9	500.0
1842.5	V	49.5		2.9	27.6	-40.5	39.5	94.1	500.0
2763.8	H	48.4		3.8	30.4	-40.3	42.2	129.0	500.0
2763.8	V	48.3		3.8	30.4	-40.3	42.1	127.5	500.0
3685.0	H	48.2		4.4	34.0	-40.1	46.5	211.7	500.0
3685.0	V	47.1		4.4	34.0	-40.1	45.4	186.5	500.0
4606.3	H	46.3		4.8	34.2	-40.0	45.4	185.3	500.0
4606.3	V	46.7		4.8	34.2	-40.0	45.8	194.0	500.0

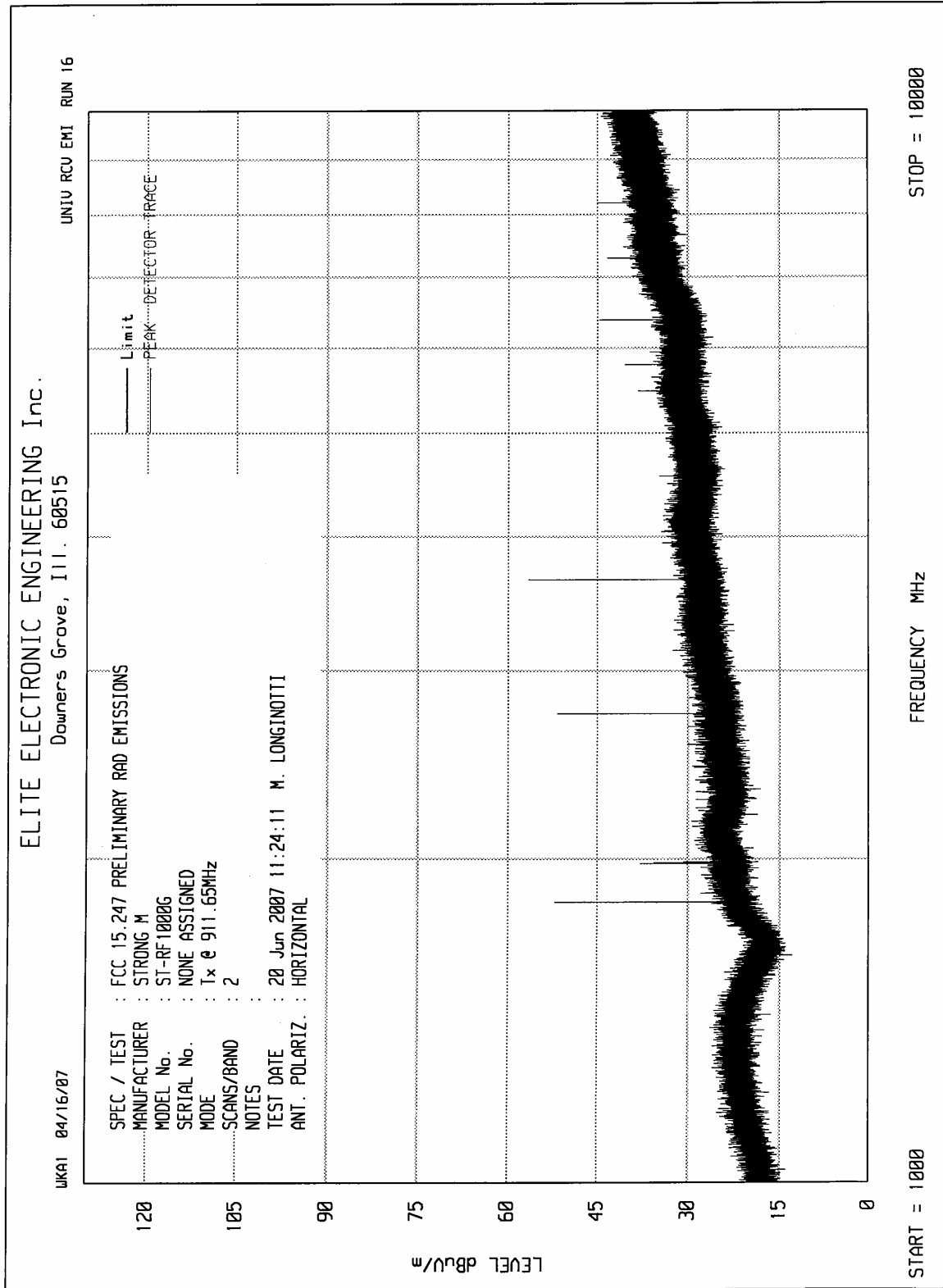
V - Vertical

H - Horizontal

Total = Meter Reading + Cable Factor + Antenna Factor + Pre-Amp Gain

Checked By: MARK E. LONGINOTTI







MANUFACTURER : Badger Meter
PRODUCT NAME : Repeater
SERIAL NUMBER : None Assigned
TEST MODE : Tx @ 911.65MHz
TEST SPECIFICATION : FCC Part 15, Subpart C, Section 15.247, Radiated Emissions
EQUIPMENT USED : RBB0, APW3, SRA7, NTA1, NDQ1, XPQ2, NWH0
DATE TESTED : June 19, 2007
NOTES : Peak Readings, Test Distance is 3 meters

Gray rows indicate restricted bands which must meet the general limits

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	78.7		1.9	27.7	0.0	108.3	260950.8	
911.65	V	78.0		1.9	27.7	0.0	107.6	240745.7	
1823.30	H	71.7		2.9	27.6	-40.6	61.5	1187.2	26095.1
1823.30	V	77.6		2.9	27.6	-40.6	67.4	2349.9	26095.1
2734.95	H	65.4		3.8	30.3	-40.3	59.1	902.0	5000.0
2734.95	V	65.5		3.8	30.3	-40.3	59.2	912.4	5000.0
3646.60	H	62.6		4.4	33.9	-40.1	60.8	1096.5	5000.0
3646.60	V	59.5		4.4	33.9	-40.1	57.7	767.4	5000.0
4558.25	H	42.8		4.8	34.1	-40.0	41.7	121.9	5000.0
4558.25	V	38.8		4.8	34.1	-40.0	37.7	76.9	5000.0
5469.90	H	45.4		5.2	36.4	-40.1	47.0	223.1	26095.1
5469.90	V	42.2		5.2	36.4	-40.1	43.8	154.4	26095.1
6381.55	H	51.2		5.9	36.2	-39.9	53.4	465.1	26095.1
6381.55	V	47.9		5.9	36.2	-39.9	50.1	318.1	26095.1
7293.20	H	52.1		6.7	38.2	-39.8	57.2	722.4	5000.0
7293.20	V	51.0		6.7	38.2	-39.8	56.1	636.5	5000.0
8204.85	H	44.4		7.1	37.9	-39.5	49.9	311.8	5000.0
8204.85	V	44.5		7.1	37.9	-39.5	50.0	315.4	5000.0
9116.50	H	41.3		7.5	38.5	-39.0	48.3	259.3	5000.0
9116.50	V	38.0		7.5	38.5	-39.0	45.0	177.4	5000.0

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

Checked By: MARK E. LONGINOTTI



MANUFACTURER : Badger Meter
PRODUCT NAME : Repeater
SERIAL NUMBER : None Assigned
TEST MODE : Tx @ 911.65MHz
TEST SPECIFICATION : FCC Part 15, Subpart C, Section 15.247, Radiated Emissions
EQUIPMENT USED : RBB0, APW3, SRA7, NTA1, NDQ1, XPQ2, NWH0
DATE TESTED : June 19, 2007
NOTES : Peak Readings, Test Distance is 3 meters
NOTES : Peak readings converted to average readings using the duty cycle correction factor

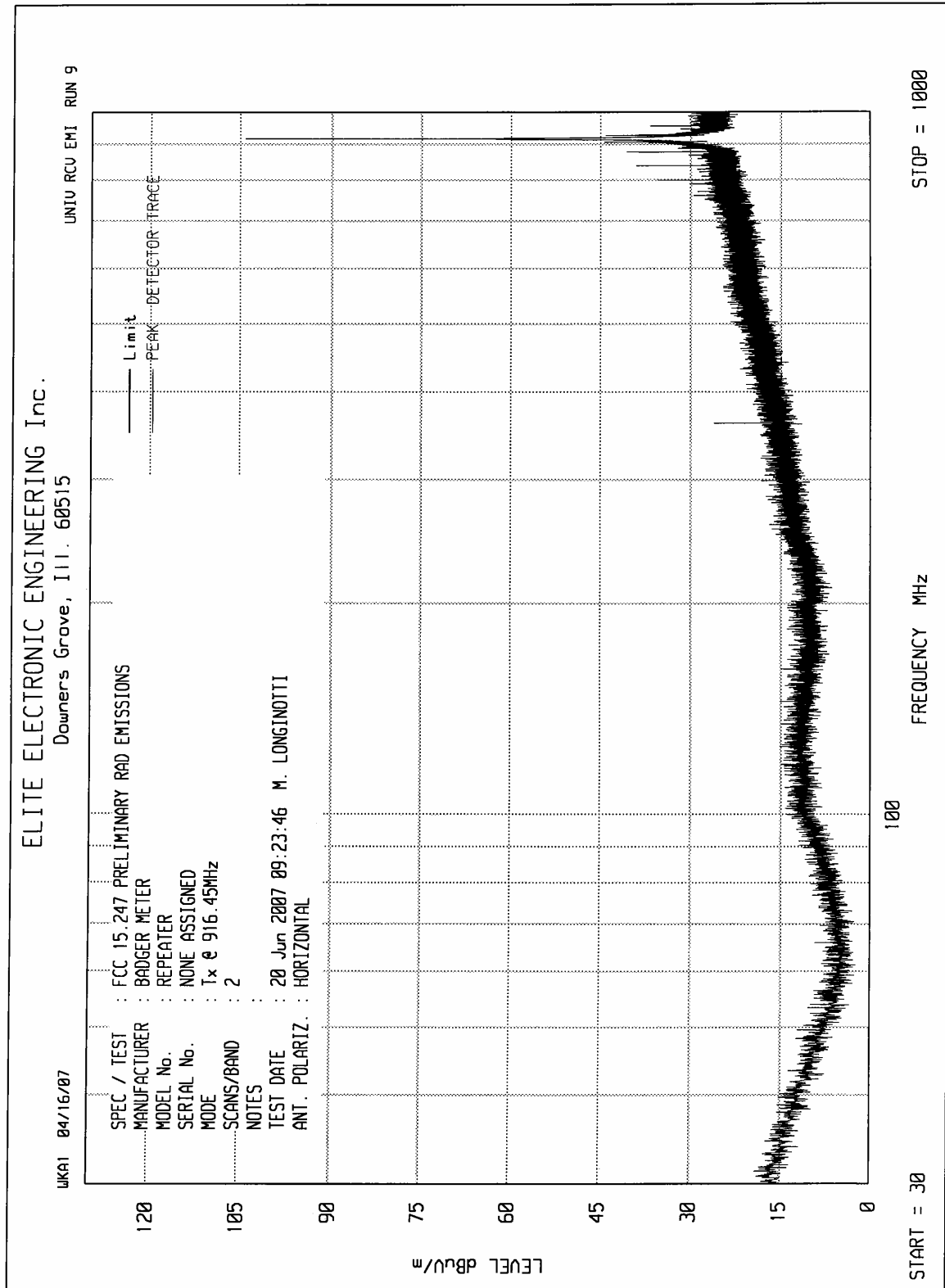
Gray rows indicate restricted bands which must meet the general limits

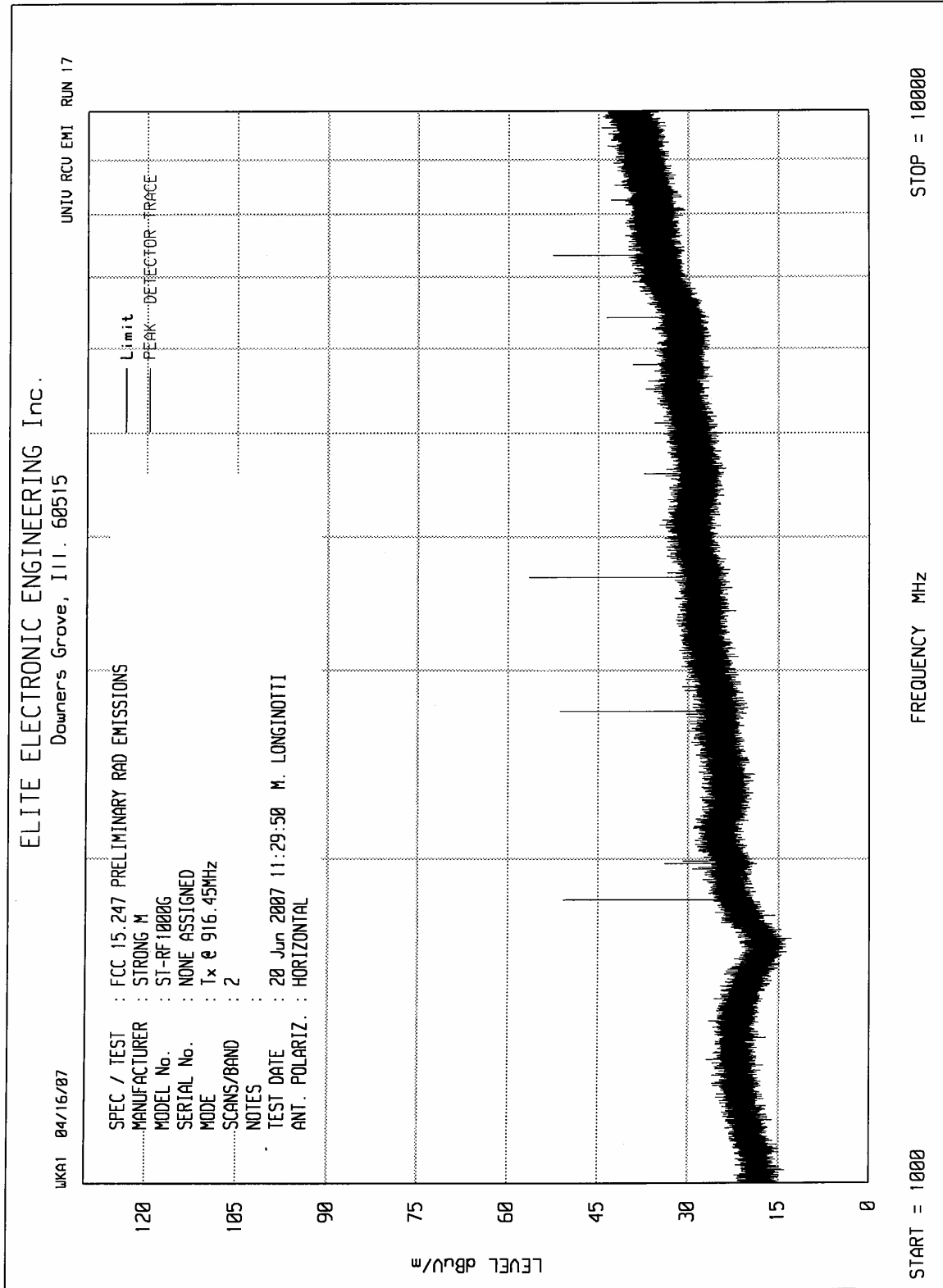
Frequency MHz	Antenna Polarity	Meter Reading dBuV	Ambient	Cable Loss dB	Antenna Factor dB	Pre Amp Gain dB	Duty Cycle Factor dB	Total dBuV/m	Total uV/m	Limit uV/m
911.65	H	78.7		1.9	27.7	0.0	0.0	108.3	26095.0	
911.65	V	78.0		1.9	27.7	0.0	0.0	107.6	24084.5	
1823.30	H	71.7		2.9	27.6	-40.6	0.0	61.5	1191.4	26095.1
1823.30	V	77.6		2.9	27.6	-40.6	0.0	67.4	2349.9	26095.1
2734.95	H	65.4		3.8	30.3	-40.3	-35.3	23.8	15.5	500.0
2734.95	V	65.5		3.8	30.3	-40.3	-35.3	23.9	15.7	500.0
3646.60	H	62.6		4.4	33.9	-40.1	-35.3	25.5	18.8	500.0
3646.60	V	59.5		4.4	33.9	-40.1	-35.3	22.4	13.2	500.0
4558.25	H	42.8		4.8	34.1	-40.0	-35.3	6.4	2.1	500.0
4558.25	V	38.8		4.8	34.1	-40.0	-35.3	2.4	1.3	500.0
5469.90	H	45.4		5.2	36.4	-40.1	0.0	47.0	223.1	26095.1
5469.90	V	42.2		5.2	36.4	-40.1	0.0	43.8	154.4	26095.1
6381.55	H	51.2		5.9	36.2	-39.9	0.0	53.4	465.1	26095.1
6381.55	V	47.9		5.9	36.2	-39.9	0.0	50.1	318.1	26095.1
7293.20	H	52.1		6.7	38.2	-39.8	-35.3	21.9	12.4	500.0
7293.20	V	51.0		6.7	38.2	-39.8	-35.3	20.8	10.9	500.0
8204.85	H	44.4		7.1	37.9	-39.5	-35.3	14.6	5.4	500.0
8204.85	V	44.5		7.1	37.9	-39.5	-35.3	14.7	5.4	500.0
9116.50	H	41.3		7.5	38.5	-39.0	-35.3	13.0	4.5	500.0
9116.50	V	38.0		7.5	38.5	-39.0	-35.3	9.7	3.0	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: MARK E. LONGINOTTI







MANUFACTURER : Badger Meter
PRODUCT NAME : Repeater
SERIAL NUMBER : None Assigned
TEST MODE : Tx @ 916.45MHz
TEST SPECIFICATION : FCC Part 15, Subpart C, Section 15.247, Radiated Emissions
EQUIPMENT USED : RBB0, APW3, SRA7, NTA1, NDQ1, XPQ2, NWH0
DATE TESTED : June 19, 2007
NOTES : Peak Readings, Test Distance is 3 meters

Gray rows indicate restricted bands which must meet the general limits

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	78.6		2.0	27.8	0.0	108.3	261488.0	
916.45	V	77.7		2.0	27.8	0.0	107.4	235750.0	
1832.90	H	70.8		2.9	27.6	-40.6	60.7	1083.3	26148.8
1832.90	V	77.5		2.9	27.6	-40.6	67.4	2342.9	26148.8
2749.35	H	63.5		3.8	30.3	-40.3	57.3	729.3	5000.0
2749.35	V	65.7		3.8	30.3	-40.3	59.5	939.5	5000.0
3665.80	H	62.2		4.4	34.0	-40.1	60.5	1054.1	5000.0
3665.80	V	59.3		4.4	34.0	-40.1	57.6	754.9	5000.0
4582.25	H	45.9		4.8	34.1	-40.0	44.9	175.5	5000.0
4582.25	V	41.1		4.8	34.1	-40.0	40.1	101.0	5000.0
5498.70	H	46.7		5.3	36.5	-40.1	48.4	261.6	26148.8
5498.70	V	40.0		5.3	36.5	-40.1	41.7	121.0	26148.8
6415.15	H	52.5		5.9	36.1	-39.9	54.7	540.9	26148.8
6415.15	V	46.4		5.9	36.1	-39.9	48.6	268.0	26148.8
7331.60	H	52.7		6.7	38.3	-39.7	57.9	783.7	5000.0
7331.60	V	45.4		6.7	38.3	-39.7	50.6	338.2	5000.0
8248.05	H	44.6		7.1	37.9	-39.5	50.1	319.4	5000.0
8248.05	V	42.6		7.1	37.9	-39.5	48.1	253.7	5000.0
9164.50	H	41.1		7.5	38.5	-39.0	48.1	254.6	5000.0
9164.50	V	38.1		7.5	38.5	-39.0	45.1	180.3	5000.0

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

Checked By: MARK E. LONGINOTTI



MANUFACTURER : Badger Meter
PRODUCT NAME : Repeater
SERIAL NUMBER : None Assigned
TEST MODE : Tx @ 916.45MHz
TEST SPECIFICATION : FCC Part 15, Subpart C, Section 15.247, Radiated Emissions
EQUIPMENT USED : RBB0, APW3, SRA7, NTA1, NDQ1, XPQ2, NWH0
DATE TESTED : June 19, 2007
NOTES : Peak Readings, Test Distance is 3 meters
NOTES : Peak readings converted to average readings using the duty cycle correction factor

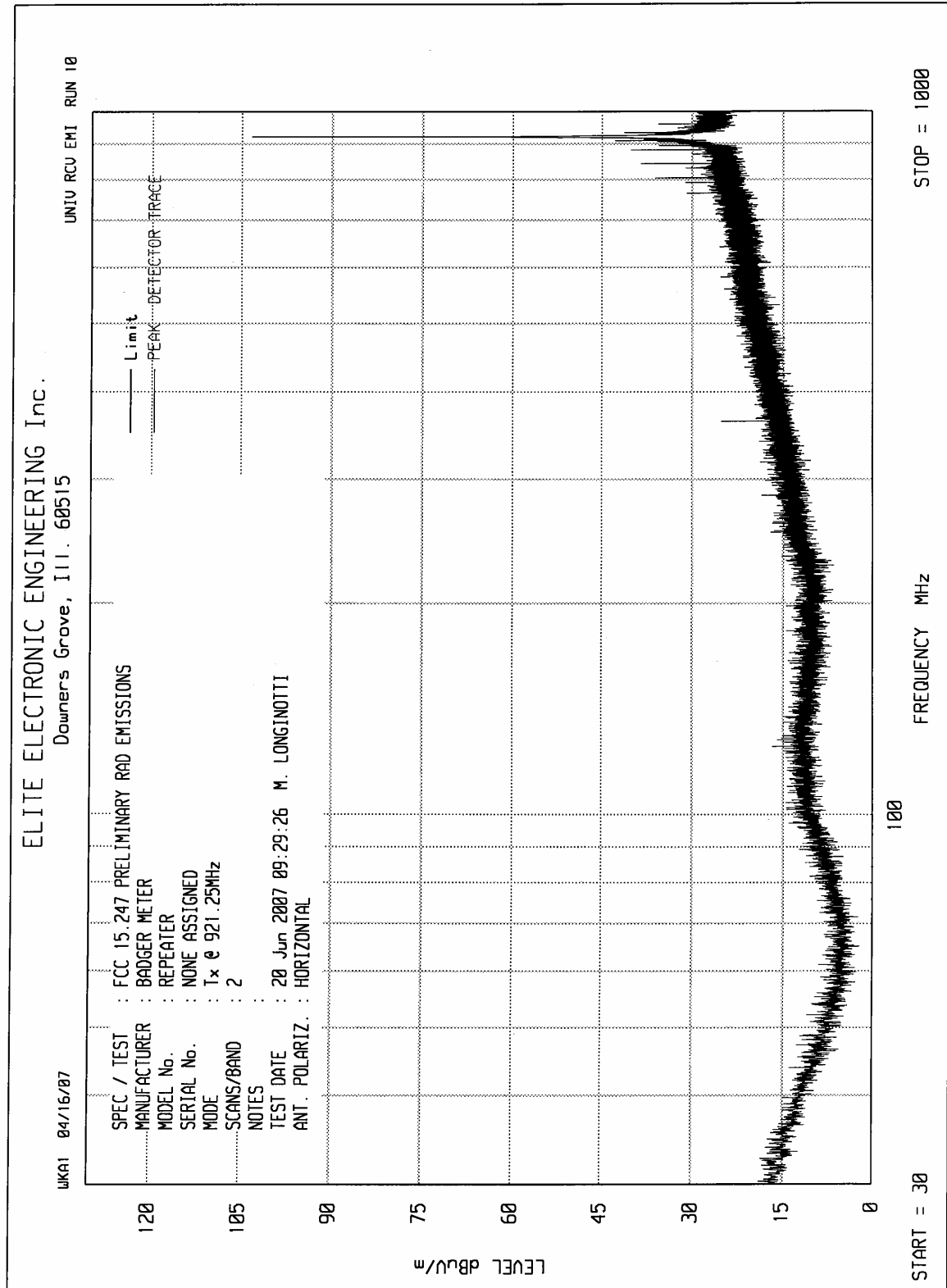
Gray rows indicate restricted bands which must meet the general limits

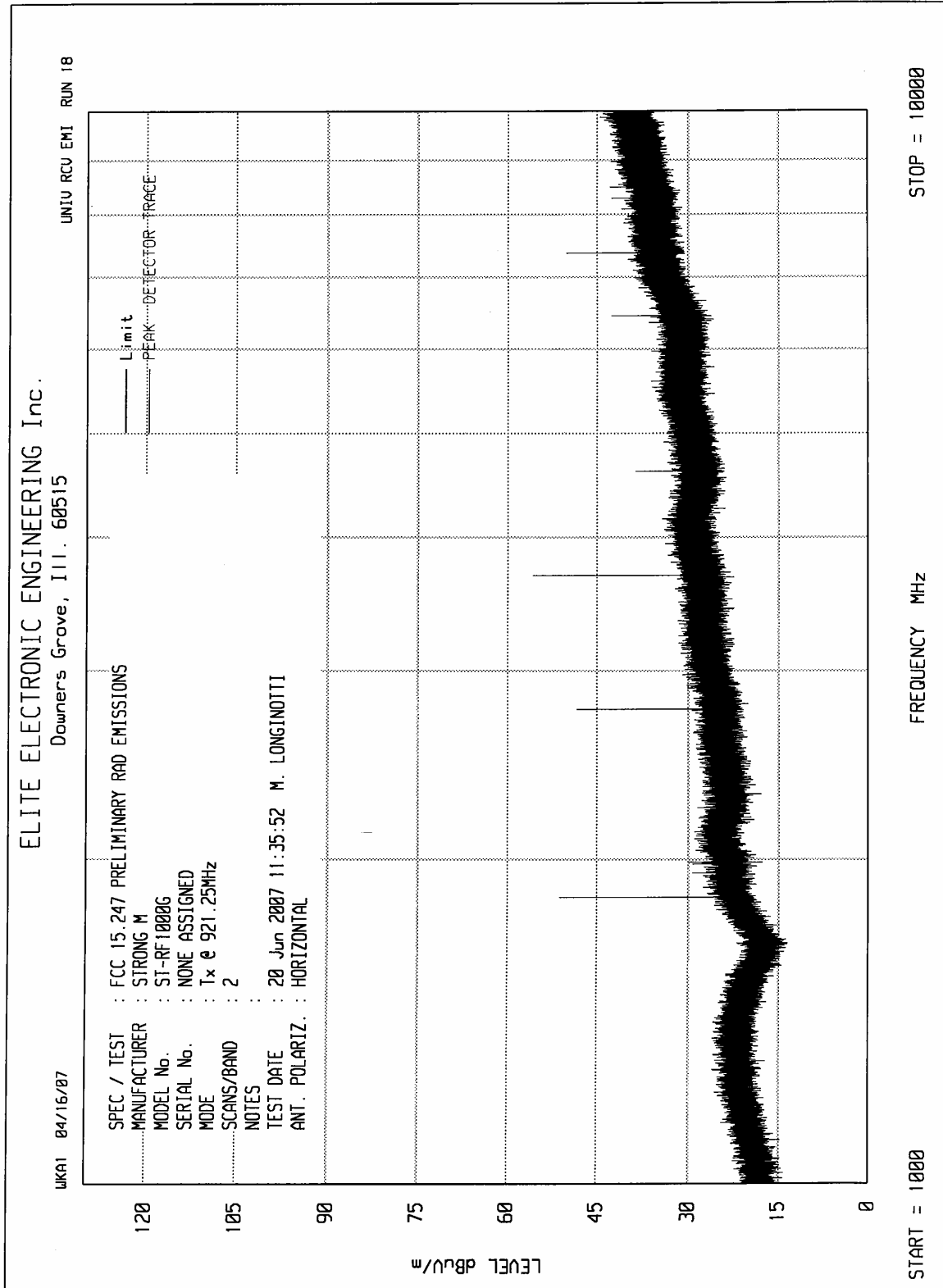
Frequency MHz	Antenna Polarity	Meter Reading dBuV	Ambient	Cable Loss dB	Antenna Factor dB	Pre Amp Gain dB	Duty Cycle Factor dB	Total dBuV/m	Total uV/m	Limit uV/m
916.45	H	78.6		2.0	27.8	0.0	0.0	108.3	261488.	
916.45	V	77.7		2.0	27.8	0.0	0.0	107.4	235750.	
1832.90	H	70.8		2.9	27.6	-40.6	0.0	60.7	1088.3	26148.8
1832.90	V	77.5		2.9	27.6	-40.6	0.0	67.4	2342.9	26148.8
2749.35	H	63.5		3.8	30.3	-40.3	-35.3	22.0	12.5	500.0
2749.35	V	65.7		3.8	30.3	-40.3	-35.3	24.2	16.1	500.0
3665.80	H	62.2		4.4	34.0	-40.1	-35.3	25.2	18.1	500.0
3665.80	V	59.3		4.4	34.0	-40.1	-35.3	22.3	13.0	500.0
4582.25	H	45.9		4.8	34.1	-40.0	-35.3	9.6	3.0	500.0
4582.25	V	41.1		4.8	34.1	-40.0	-35.3	4.8	1.7	500.0
5498.70	H	46.7		5.3	36.5	-40.1	0.0	48.4	261.6	26148.8
5498.70	V	40.0		5.3	36.5	-40.1	0.0	41.7	121.0	26148.8
6415.15	H	52.5		5.9	36.1	-39.9	0.0	54.7	540.9	26148.8
6415.15	V	46.4		5.9	36.1	-39.9	0.0	48.6	268.0	26148.8
7331.60	H	52.7		6.7	38.3	-39.7	-35.3	22.6	13.5	500.0
7331.60	V	45.4		6.7	38.3	-39.7	-35.3	15.3	5.8	500.0
8248.05	H	44.6		7.1	37.9	-39.5	-35.3	14.8	5.5	500.0
8248.05	V	42.6		7.1	37.9	-39.5	-35.3	12.8	4.4	500.0
9164.50	H	41.1		7.5	38.5	-39.0	-35.3	12.8	4.4	500.0
9164.50	V	38.1		7.5	38.5	-39.0	-35.3	9.8	3.1	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: MARK E. LONGINOTTI







MANUFACTURER : Badger Meter
PRODUCT NAME : Repeater
SERIAL NUMBER : None Assigned
TEST MODE : Tx @ 921.25MHz
TEST SPECIFICATION : FCC Part 15, Subpart C, Section 15.247, Radiated Emissions
EQUIPMENT USED : RBB0, APW3, SRA7, NTA1, NDQ1, XPQ2, NWH0
DATE TESTED : June 19, 2007
NOTES : Peak Readings, Test Distance is 3 meters

Gray rows indicate restricted bands which must meet the general limits

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	78.2		2.0	27.9	0.0	108.1	253112.8	
921.25	V	77.4		2.0	27.9	0.0	107.3	230841.6	
1842.50	H	73.6		2.9	27.6	-40.5	63.6	1508.2	25311.3
1842.50	V	76.5		2.9	27.6	-40.5	66.5	2106.0	25311.3
2763.75	H	58.7		3.8	30.4	-40.3	52.5	422.2	5000.0
2763.75	V	60.8		3.8	30.4	-40.3	54.6	537.7	5000.0
3685.00	H	61.6		4.4	34.0	-40.1	59.9	990.2	5000.0
3685.00	V	60.4		4.4	34.0	-40.1	58.7	862.4	5000.0
4606.25	H	47.6		4.8	34.2	-40.0	46.7	215.2	5000.0
4606.25	V	42.3		4.8	34.2	-40.0	41.4	116.9	5000.0
5527.50	H	43.3		5.3	36.5	-40.1	45.0	177.4	25311.3
5527.50	V	38.7	Ambient	5.3	36.5	-40.1	40.4	104.4	25311.3
6448.75	H	50.9		6.0	36.1	-39.9	53.1	450.6	25311.3
6448.75	V	45.4		6.0	36.1	-39.9	47.6	239.2	25311.3
7370.00	H	46.1		6.7	38.3	-39.7	51.4	371.1	5000.0
7370.00	V	45.9		6.7	38.3	-39.7	51.2	362.7	5000.0
8291.25	H	41.9		7.2	37.8	-39.5	47.4	234.3	5000.0
8291.25	V	42.9		7.2	37.8	-39.5	48.4	262.9	5000.0
9212.50	H	39.8	Ambient	7.5	38.5	-39.0	46.9	220.3	25311.3
9212.50	V	40.7	Ambient	7.5	38.5	-39.0	47.8	244.3	25311.3

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

Checked By: MARK E. LONGINOTTI



MANUFACTURER : Badger Meter
PRODUCT NAME : Repeater
SERIAL NUMBER : None Assigned
TEST MODE : Tx @ 921.25MHz
TEST SPECIFICATION : FCC Part 15, Subpart C, Section 15.247, Radiated Emissions
EQUIPMENT USED : RBB0, APW3, SRA7, NTA1, NDQ1, XPQ2, NWH0
DATE TESTED : June 19, 2007
NOTES : Peak Readings, Test Distance is 3 meters
NOTES : Peak readings converted to average readings using the duty cycle correction
NOTES : factor

Gray rows indicate restricted bands which must meet the general limits

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
921.25	H	78.2		2.0	27.9	0.0	0.0	108.1	253112.8	
921.25	V	77.4		2.0	27.9	0.0	0.0	107.3	230841.6	
1842.50	H	73.6		2.9	27.6	-40.5	0.0	63.6	1508.2	25311.3
1842.50	V	76.5		2.9	27.6	-40.5	0.0	66.5	2106.0	25311.3
2763.75	H	58.7		3.8	30.4	-40.3	-35.3	17.2	7.3	500.0
2763.75	V	60.8		3.8	30.4	-40.3	-35.3	19.3	9.2	500.0
3685.00	H	61.6		4.4	34.0	-40.1	-35.3	24.6	17.0	500.0
3685.00	V	60.4		4.4	34.0	-40.1	-35.3	23.4	14.8	500.0
4606.25	H	47.6		4.8	34.2	-40.0	-35.3	11.4	3.7	500.0
4606.25	V	42.3		4.8	34.2	-40.0	-35.3	6.1	2.0	500.0
5527.50	H	43.3		5.3	36.5	-40.1	0.0	45.0	177.4	25311.3
5527.50	V	38.7	Ambient	5.3	36.5	-40.1	0.0	40.4	104.4	25311.3
6448.75	H	50.9		6.0	36.1	-39.9	0.0	53.1	450.6	25311.3
6448.75	V	45.4		6.0	36.1	-39.9	0.0	47.6	239.2	25311.3
7370.00	H	46.1		6.7	38.3	-39.7	-35.3	16.1	6.4	500.0
7370.00	V	45.9		6.7	38.3	-39.7	-35.3	15.9	6.2	500.0
8291.25	H	41.9		7.2	37.8	-39.5	-35.3	12.1	4.0	500.0
8291.25	V	42.9		7.2	37.8	-39.5	-35.3	13.1	4.5	500.0
9212.50	H	39.8	Ambient	7.5	38.5	-39.0	0.0	46.9	220.3	25311.3
9212.50	V	40.7	Ambient	7.5	38.5	-39.0	0.0	47.8	244.3	25311.3

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: MARK E. LONGINOTTI