Measurement of RF Interference from a Model Telependant Transmitter

For : Telemotive Industrial Controls
Glendale Heights IL

P.O. No. : 11521-000 OP
Date Received : September 15, 2003
Date Tested : September 15th. And 16th., 2003
Test Personnel : Richard E. King
Specification : FCC "Code of Federal Regulations" Title 47 Part 15, Subpart C, Class C

Test Report By :
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Witnessed by :
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Telemotive Industrial Controls

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Registered Professional Engineer of Illinois - 44894

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TABLE I - EQUIPMENT LIST 9

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

1.0 INTRODUCTION:

1.1 Description of Test Item - This document represents the results of the series of radio interference measurements performed on a model Telependant transmitter, (hereinafter referred to as the test item). The test item was designed to transmit in the range 430.0MHz to 440.0MHz using an internal PCB antenna. The test item was manufactured and submitted for testing by Telemotive Industrial Controls located in Glendale Heights 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, Sections 15.231 for Intentional Radiators. Testing was performed in accordance with ANSI C63.4-2001.

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 2002
- ANSI C63.4-2001, "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 Subcontractor 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 22ºC and the relative humidity was 39%.

2.0 TEST ITEM SETUP AND OPERATION:

A block diagram of the test item setup is shown as Figure 1.

2.1 Power Input - The test item obtained 3VDC through two “AA” batteries.

2.2 Grounding - Since the test item was powered with 3VDC through two “AA” batteries, it was ungrounded during the tests.

2.3 Peripheral Equipment - There was no peripheral equipment submitted with the test item.

2.4 Interconnect Cables - There were no interconnect cables submitted with the test item.

2.5 Operational Mode - For all tests the test item was placed on a 80cm high non-conductive stand. The test item was programmed to transmit continuously. Transmission was verified by observation of an LED which was lit whenever the transmitter was enabled. The transmitting mechanism automatically deactivated when released. The battery voltage was periodically checked to ensure proper operation at the maximum level. The tests were performed separately with the test item operating at 433.125MHz, 436.0MHz and 439.8MHz.

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.

The fundamental, harmonics and spurious emissions were measured with a spectrum analyzer. The spectrum analyzer peak detected readings were converted to average readings using a duty cycle factor. All measurements were taken with the resolution and video bandwidth of the measuring instrument adjusted to 100kHz below 1GHz and 1MHz above 1GHz.

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 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

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 were performed.

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 10msec/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).

4.2.2 Results: The duty cycle factor was computed to be .6 dB. Representative plots of the duty cycle at each transmit frequency are shown on data pages 12 through 14.

4.3 Radiated Measurements

4.3.1 Requirements - The test item must comply with the requirements of FCC "Code of Federal Regulations Title 47", Part 15, Subpart C, Section 15.205 et seq.

Paragraph 15.231(b) has the following radiated emission limits:

Fundamental Frequency MHz	Field Intensity uV/m @ 3 meters	Field Strength Harmonics and Spurious @ 3 meters
260 to 470	3,750 to 12,500*	375 to 1,250*

* - Linear Interpolation

For 433.125MHz, the limit at the fundamental is 10963.5uV/m @ 3m and the limit on the harmonics is 1096.4uV/m @ 3m.

For 436.0MHz, the limit at the fundamental is 11083.3uV/m @ 3m and the limit on the harmonics is 1108.3uV/m @ 3m.

For 439.8MHz, the limit at the fundamental is 11241.7uV/m @ 3m and the limit on the harmonics is 1124.2uV/m @ 3m.

In addition, emissions appearing in the Restricted Bands of Operation listed in paragraph 15.205(a) shall not exceed the general requirements shown in paragraph 15.209.

4.3.2 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 2001 for site attenuation.

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

Preliminary radiated emissions measurements were first performed using a peak detector and automatically plotted. The frequencies where significant emission levels were noted were then remeasured.

With the broadband measuring antennas positioned at a 3 meter distance from the test item, the frequency range from 30MHz to 5GHz was investigated using a peak detector function with the antennas set for vertical polarization.

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

1) Measurements were made using a peak detector and a tuned dipole (below 1GHz) or a double ridged waveguide (above 1GHz) antenna.

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

   (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 from 1 to 4 meters for each antenna polarization to maximize the readings.

   (d) The fundamental through the 10th harmonic of the transmit frequency were measured.

Since the test item can transmit over the range 430MHz to 440.0MHz, it was tested at three frequencies, one near the bottom of the frequency range (433.1MHz), one in the middle of the frequency range (436.0MHz) and one near the top of the frequency range (439.8MHz).

4.3.3 RESULTS : The preliminary plots, with the test item transmitting at 433.1MHz, are presented on data pages 15 through 18. The preliminary plots, with the test item transmitting at 436.0MHz, are presented on data pages 19 through 22. The preliminary plots, with the test item transmitting at 439.8MHz, are presented on data pages 23 through 26. The plots are presented for a reference only, and are not used to

determine compliance.

The final open area radiated levels, with the test item transmitting at 433.1MHz, is presented on data page 27. The final open area radiated levels, with the test item transmitting at 436.0MHz, is presented on data page 28. The final open area radiated levels, with the test item transmitting at 439.8MHz, is presented on data page 29. As can be seen from the data, all emissions measured from the test item were within the specification limits. Photographs of the test configuration which yielded the highest, or worst case, radiated emission levels are shown on Figure 2.

4.4 Occupied Bandwidth Measurements

4.4.1 Requirement - In accordance with paragraph 15.231(c), all emissions within 20dB of the peak amplitude level of the center frequency are required to be within a band less than 0.25% of the center frequency wide.

4.4.2 Procedures - The test item was placed on an 80cm high non-conductive stand. The unit was set to transmit continuously. With an antenna positioned nearby, occupied bandwidth emissions were displayed on the spectrum analyzer. The resolution bandwidth was set to 30 kHz and span was set to 2 MHz. The frequency spectrum near the fundamental was plotted

4.4.3 Results - The plot of the emissions near the fundamental frequency when transmitting at 433.125MHz are presented on data page 30. The plot of the emissions near the fundamental frequency when transmitting at 436.0MHz are presented on data page 31. The plot of the emissions near the fundamental frequency when transmitting at 439.8MHz are presented on data page 32. As can be seen from this data page, the transmitter met the occupied bandwidth requirements.

5.0 CONCLUSIONS:

It was determined that the Telemotive Industrial Controls Telependant did fully meet the radiated emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Section 15.205 et seq. for Intentional Radiators, when tested per ANSI C63.4-2001.

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								
XZG3	ATTENUATOR/SWITCH DRIVER	HEWLETT PACKARD	11713A	2421A03059	---		N/A	
Equipment Type: AMPLIFIERS								
APK3	PREAMPLIFIER	AGILENT TECHNOL	8449B	3008A01593	1-26.5GHZ	05/09/03	12	05/09/04
Equipment Type: ANTENNAS								
NDQ0	TUNED DIPOLE ANTENNA	EMCO	3121C-DB4	311	400-1000MHZ	12/20/02	12	12/20/03
NTA0	BILOG ANTENNA	CHASE EMC LTD.	BILOG CBL611	2057	0.03-2GHZ	07/03/03	12	07/03/04
NWH0	RIDGED WAVE GUIDE	TENSOR	4105	2081	1-12.4GHZ	09/05/03	12	09/05/04
Equipment Type: CONTROLLERS								
CDD2	COMPUTER	HEWLETT PACKARD	D4171A#ABA	US61654645	---		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	3638A08770	100HZ-22GHZ	02/10/03	12	02/10/04
RACD	RF PRESELECTOR	HEWLETT PACKARD	85685A	3010A01205	20HZ-2GHZ	02/10/03	12	02/10/04
RAF4	QUASIPEAK ADAPTER	HEWLETT PACKARD	85650A	2043A00320	0.01-1000MHZ	02/10/03	12	02/10/04
RAKG	RF SECTION	HEWLETT PACKARD	85462A	3549A00284	0.009-6500MHZ	03/05/03	12	03/05/04
RAKH	RF FILTER SECTION	HEWLETT PACKARD	85460A	3448A00324	---	03/05/03	12	03/05/04

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.

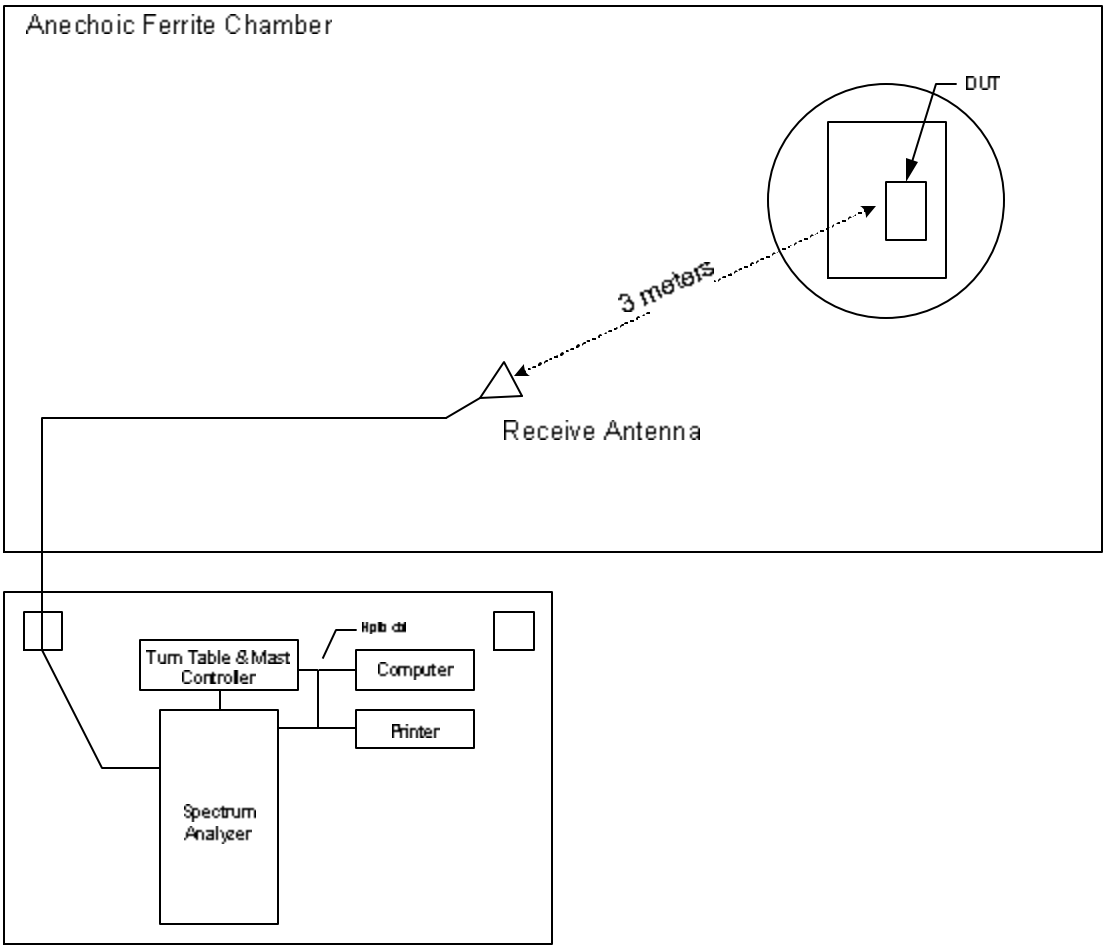
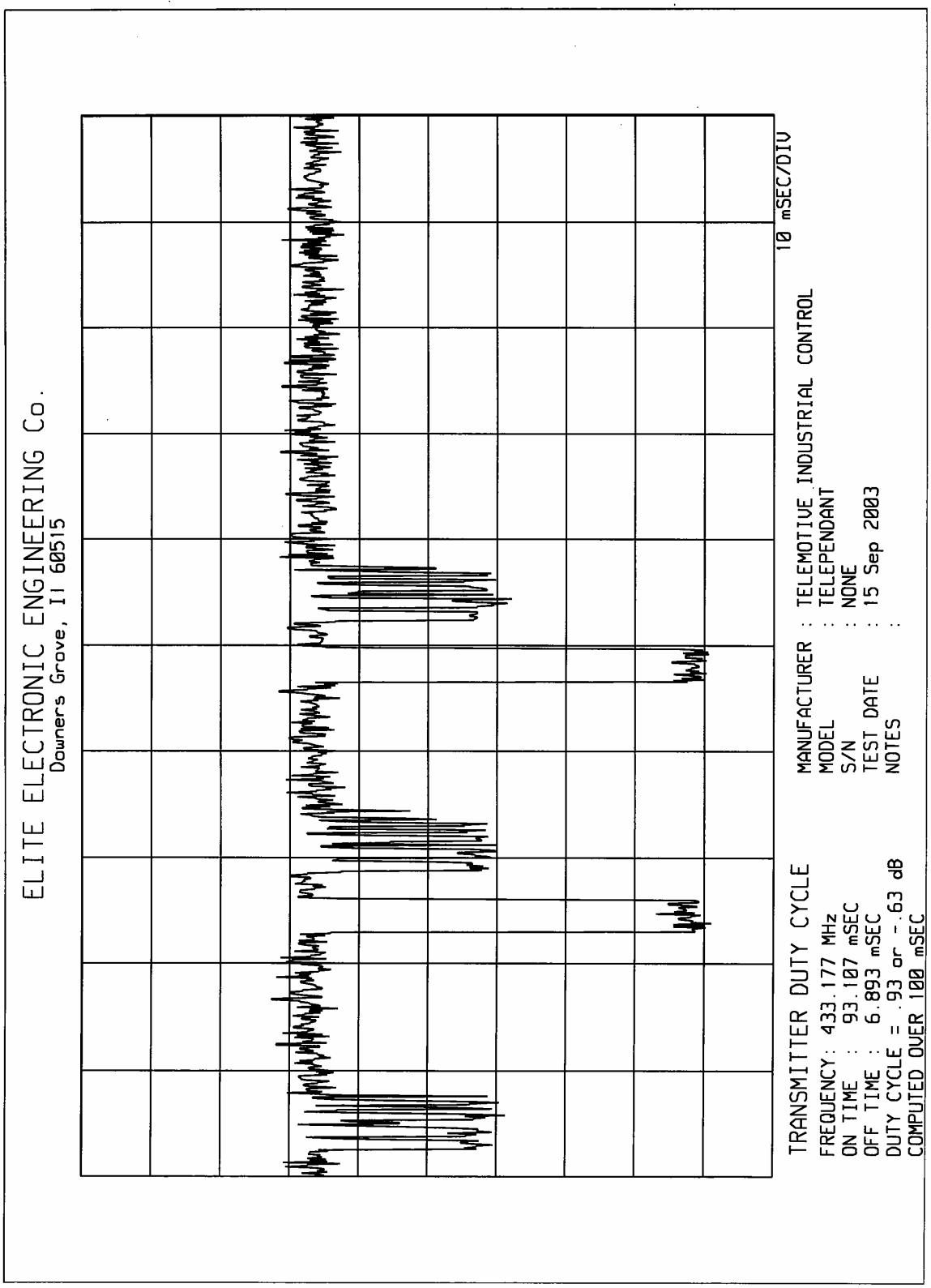
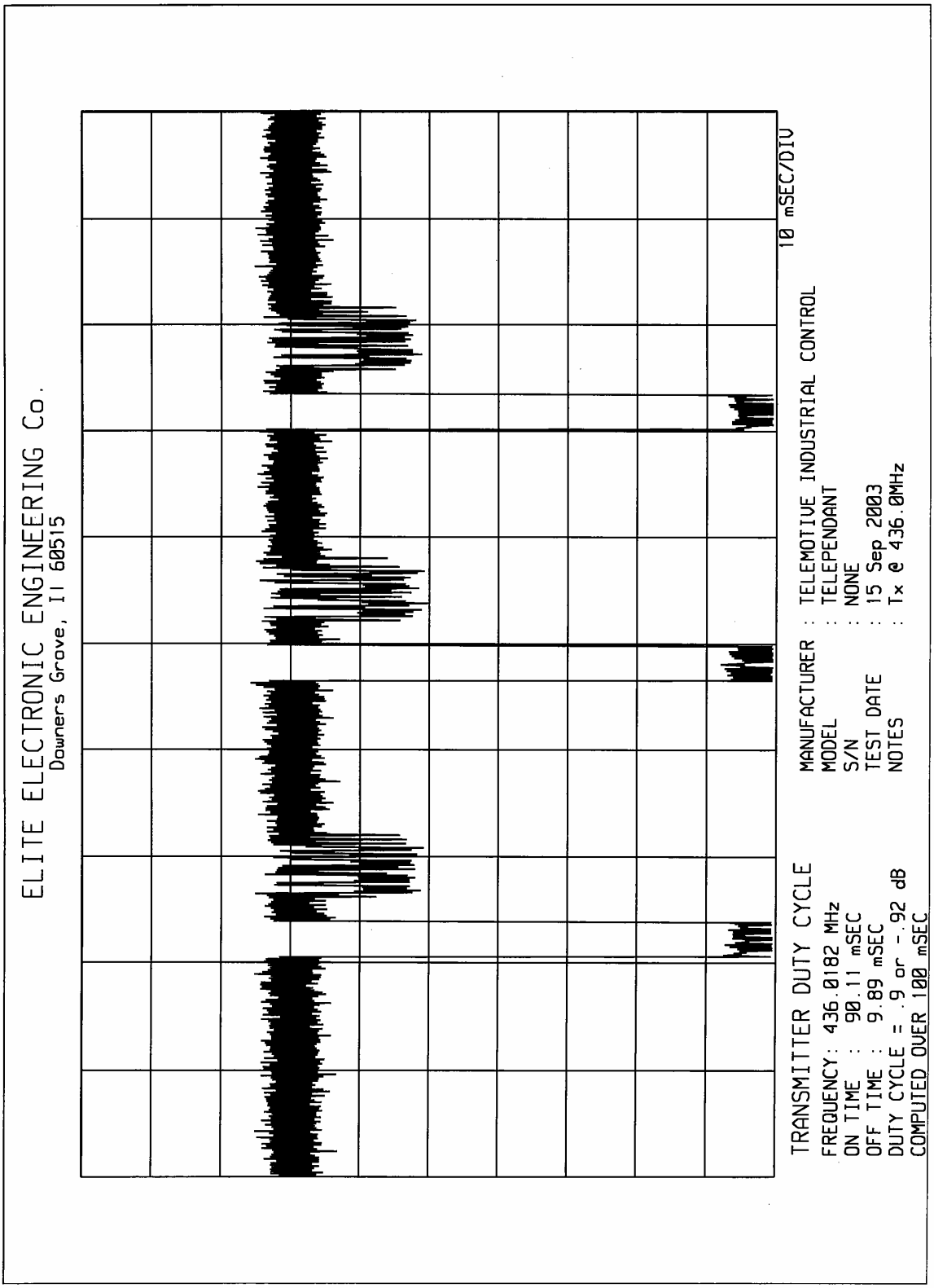


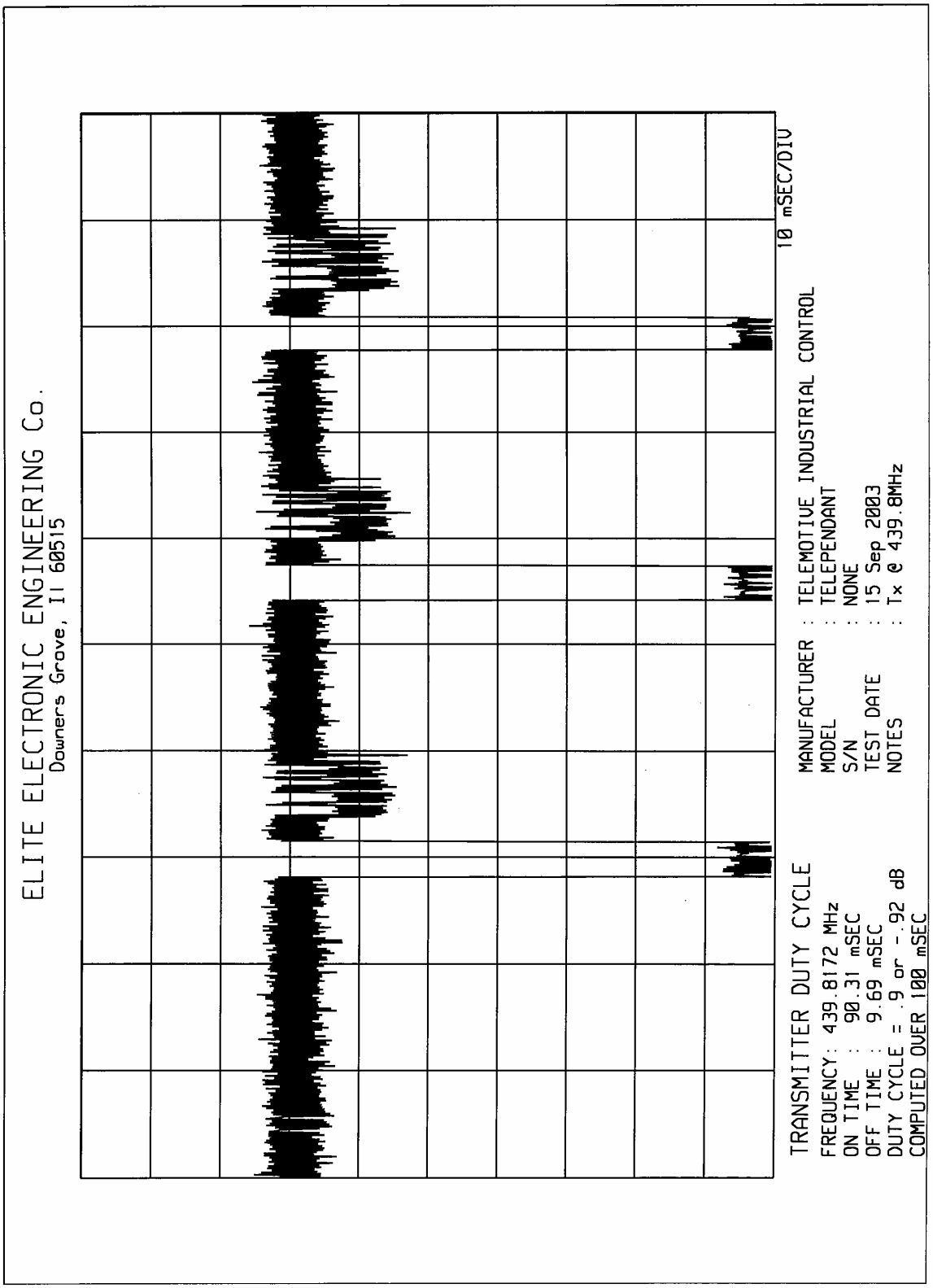
FIGURE 1 BLOCKDIAGRAM OF TEST SETUP

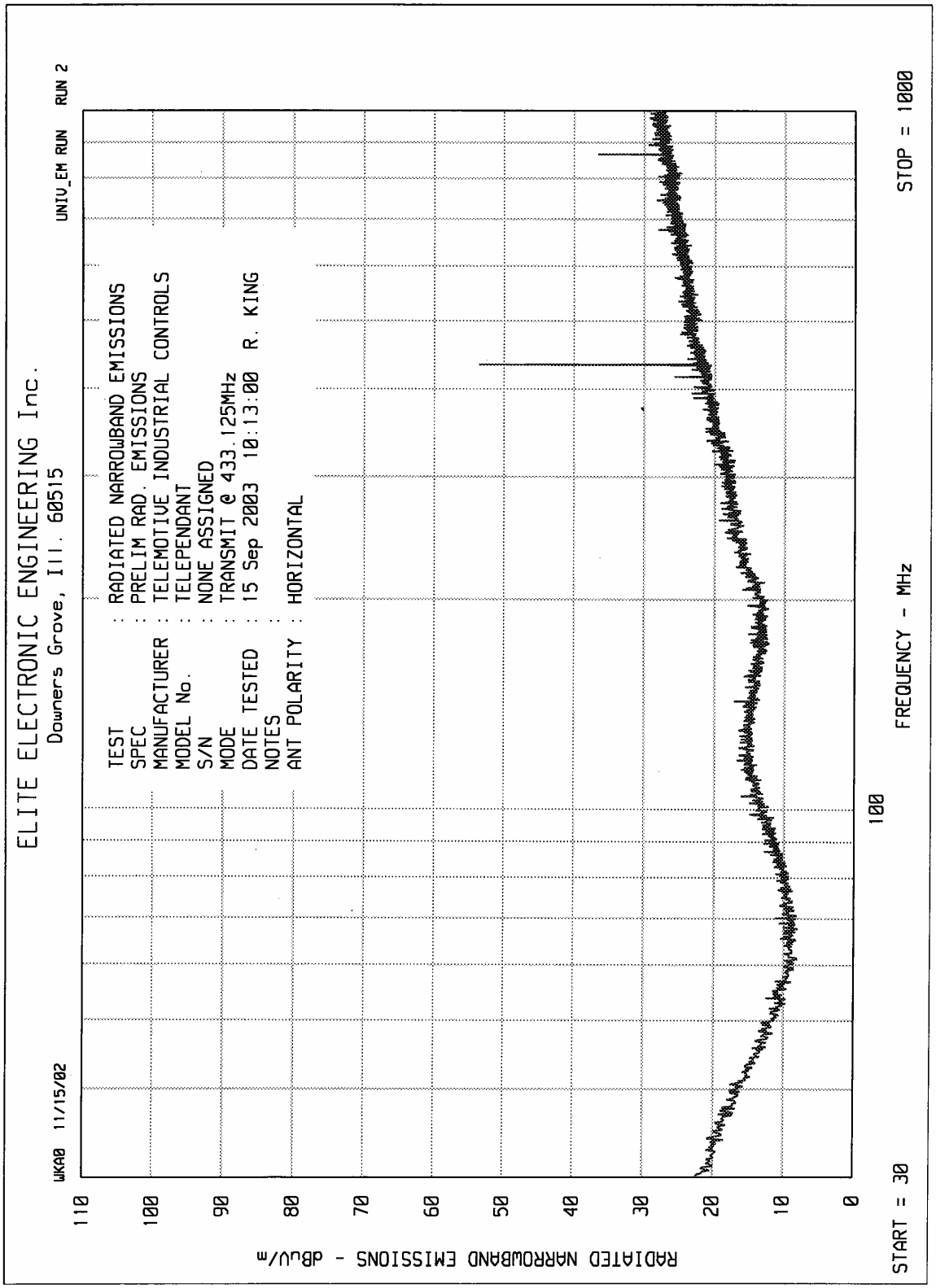
Radiated Emissions Horizontal Polarity

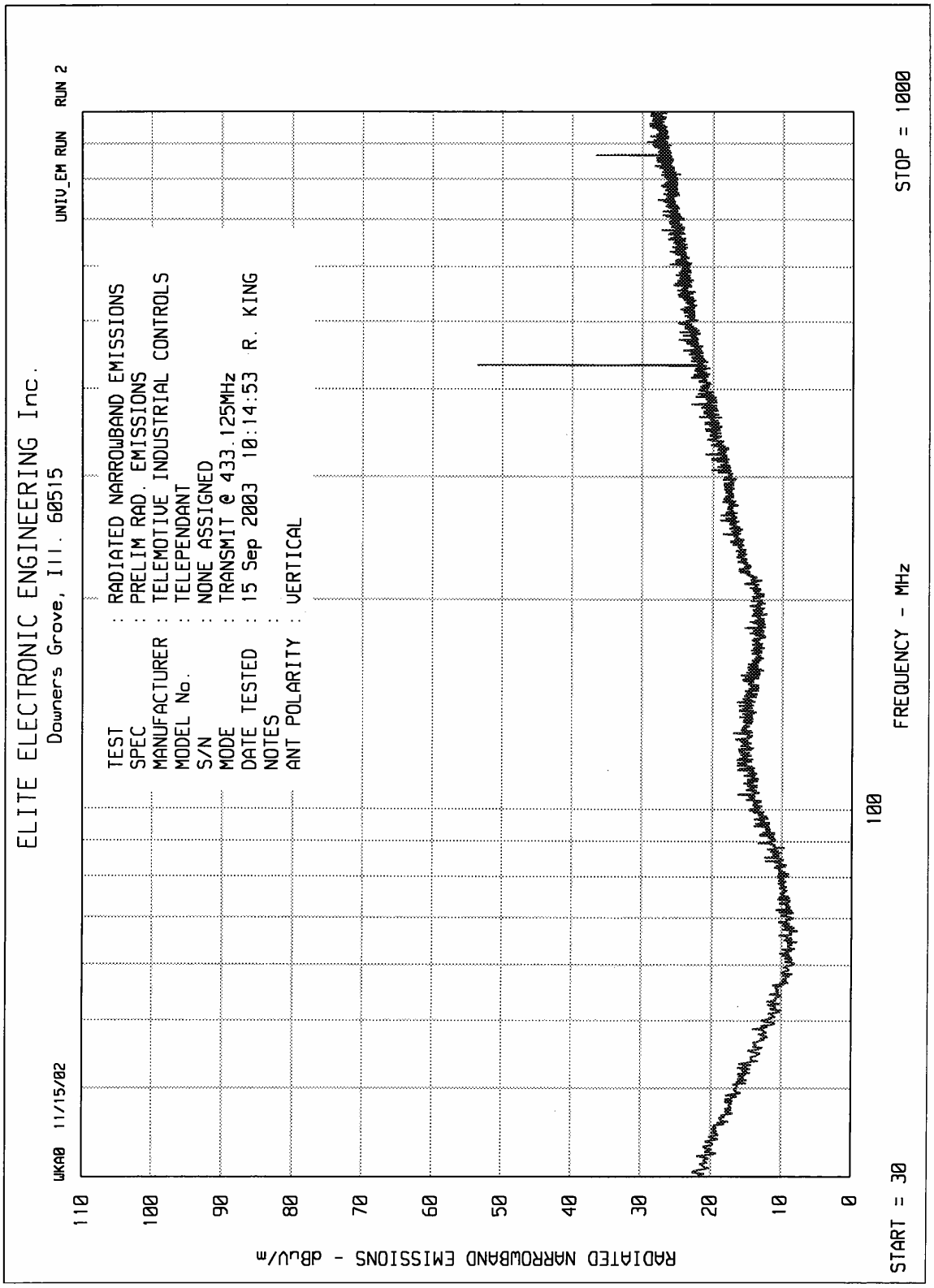
Radiated Emissions Vertical Polarity

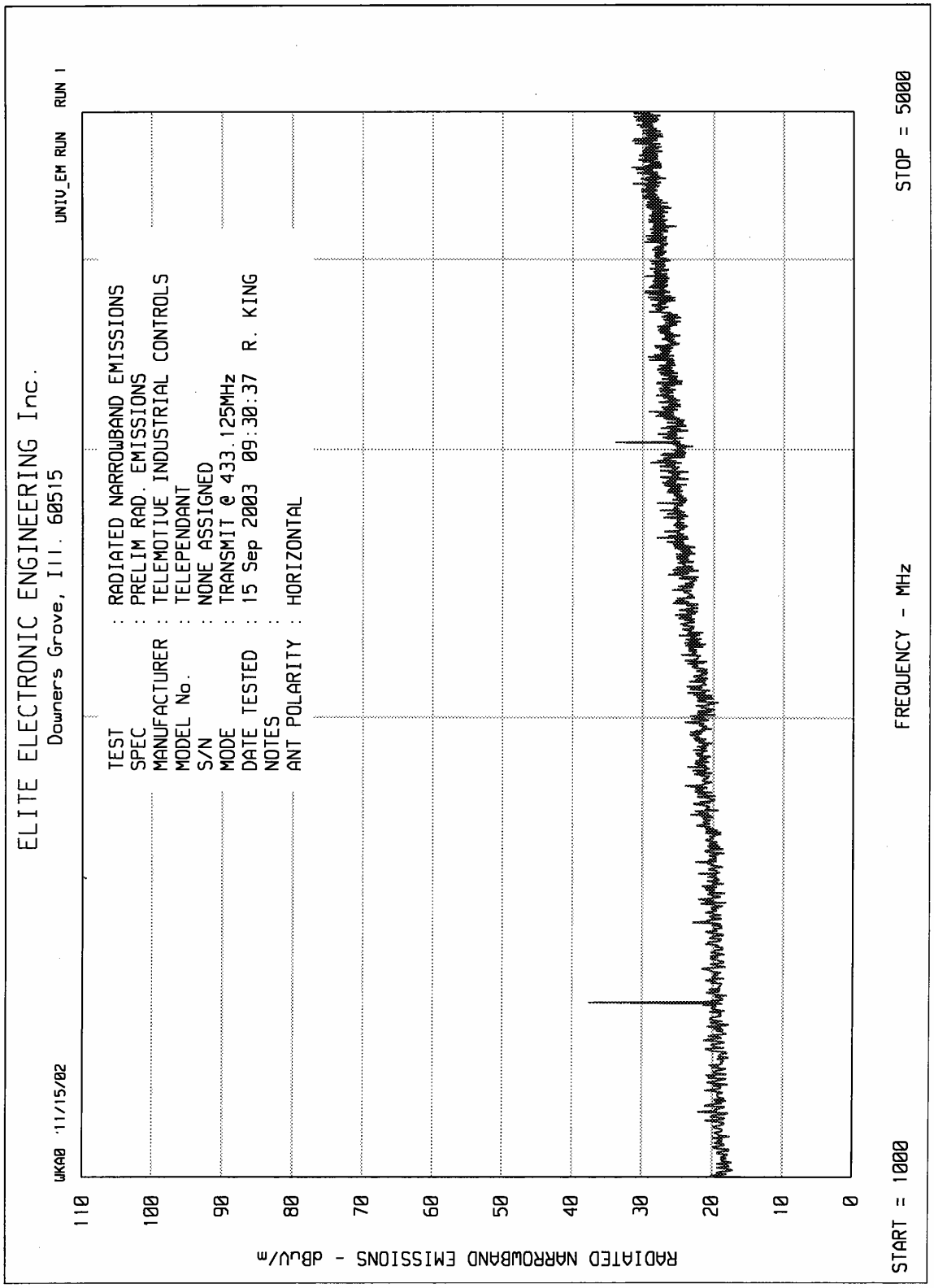

ELITE ELECTRONIC ENGINEERING Co.
Downers Grove, Il 60515
TRANSMITTER DUTY CYCLE
FREQUENCY: 433.177 MHz
ON TIME : 93.107 mSEC
OFF TIME : 6.893 mSEC
DUTY CYCLE = .93 or -.63 dB
COMPUTED OVER 100 mSEC
MANUFACTURER : TELEMOTIVE INDUSTRIAL CONTROL
MODEL : TELEPENDANT
S/N : NONE
TEST DATE : 15 Sep 2003
NOTES :
10 mSEC/DIV

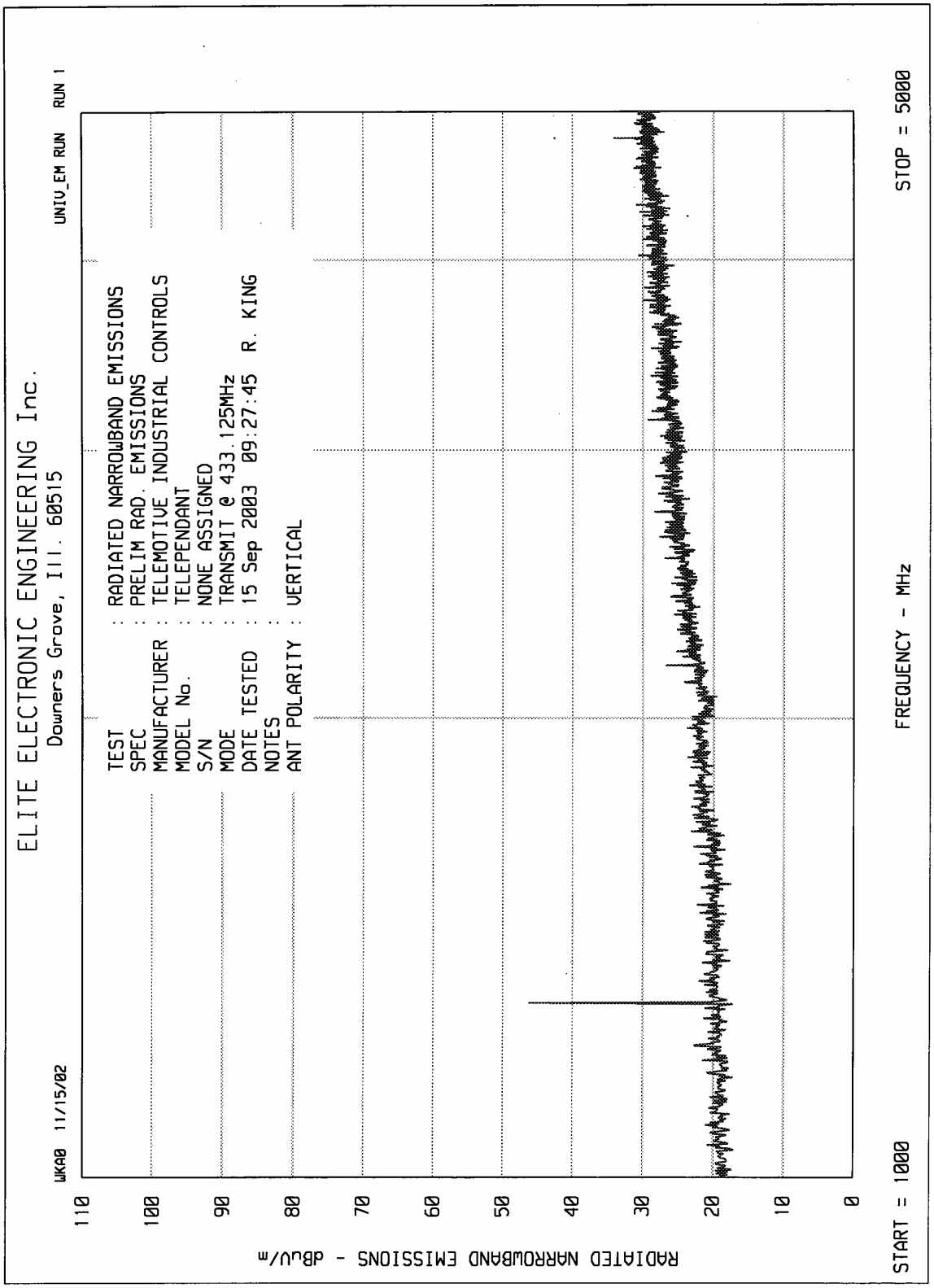

ELITE ELECTRONIC ENGINEERING Co.
Downers Grove, Il 60515
10 mSEC/DIV
TRANSMITTER DUTY CYCLE
FREQUENCY: 436.0182 MHz
ON TIME : 90.11 mSEC
OFF TIME : 9.89 mSEC
DUTY CYCLE = .9 or -.92 dB
COMPUTED OVER 100 mSEC
MANUFACTURER : TELEMOTIVE INDUSTRIAL CONTROL
MODEL : TELEPENDANT
S/N : NONE
TEST DATE : 15 Sep 2003
NOTES : Tx @ 436.0MHz


ELITE ELECTRONIC ENGINEERING Co.
Downers Grove, Il 60515
TRANSMITTER DUTY CYCLE
FREQUENCY: 439.8172 MHz
ON TIME : 90.31 mSEC
OFF TIME : 9.69 mSEC
DUTY CYCLE = .9 or -.92 dB
COMPUTED OVER 100 mSEC
MANUFACTURER : TELEMOTIVE INDUSTRIAL CONTROL
MODEL : TELEPENDANT
S/N : NONE
TEST DATE : 15 Sep 2003
NOTES : Tx @ 439.8MHz
10 mSEC/DIV


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA0 11/15/02
UNIV_EM RUN RUN 2
TEST : RADIATED NARROWBAND EMISSIONS
SPEC : PRELIM RAD. EMISSIONS
MANUFACTURER : TELEMOTIVE INDUSTRIAL CONTROLS
MODEL No. : TELEPENDANT
S/N : NONE ASSIGNED
MODE : TRANSMIT @ 433.125MHz
DATE TESTED : 15 Sep 2003 10:13:00 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
WKA0 11/15/02
UNIV_EM RUN RUN 2
TEST : RADIATED NARROWBAND EMISSIONS
SPEC : PRELIM RAD. EMISSIONS
MANUFACTURER : TELEMOTIVE INDUSTRIAL CONTROLS
MODEL No. : TELEPENDANT
S/N : NONE ASSIGNED
MODE : TRANSMIT @ 433.125MHz
DATE TESTED : 15 Sep 2003 10:14:53 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
WKA0 11/15/02
UNIV_EM RUN RUN 1
TEST : RADIATED NARROWBAND EMISSIONS
SPEC : PRELIM RAD. EMISSIONS
MANUFACTURER : TELEMOTIVE INDUSTRIAL CONTROLS
MODEL No. : TELEPENDANT
S/N : NONE ASSIGNED
MODE : TRANSMIT @ 433.125MHz
DATE TESTED : 15 Sep 2003 09:30:37 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 = 5000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA0 11/15/02
UNIV_EM RUN RUN 1
TEST : RADIATED NARROWBAND EMISSIONS
SPEC : PRELIM RAD. EMISSIONS
MANUFACTURER : TELEMOTIVE INDUSTRIAL CONTROLS
MODEL No. : TELEPENDANT
S/N : NONE ASSIGNED
MODE : TRANSMIT @ 433.125MHz
DATE TESTED : 15 Sep 2003 09:27:45 R. KING
NOTES :
ANT POLARITY : VERTICAL
RADIATED NARROWBAND EMISSIONS - dBuV/m
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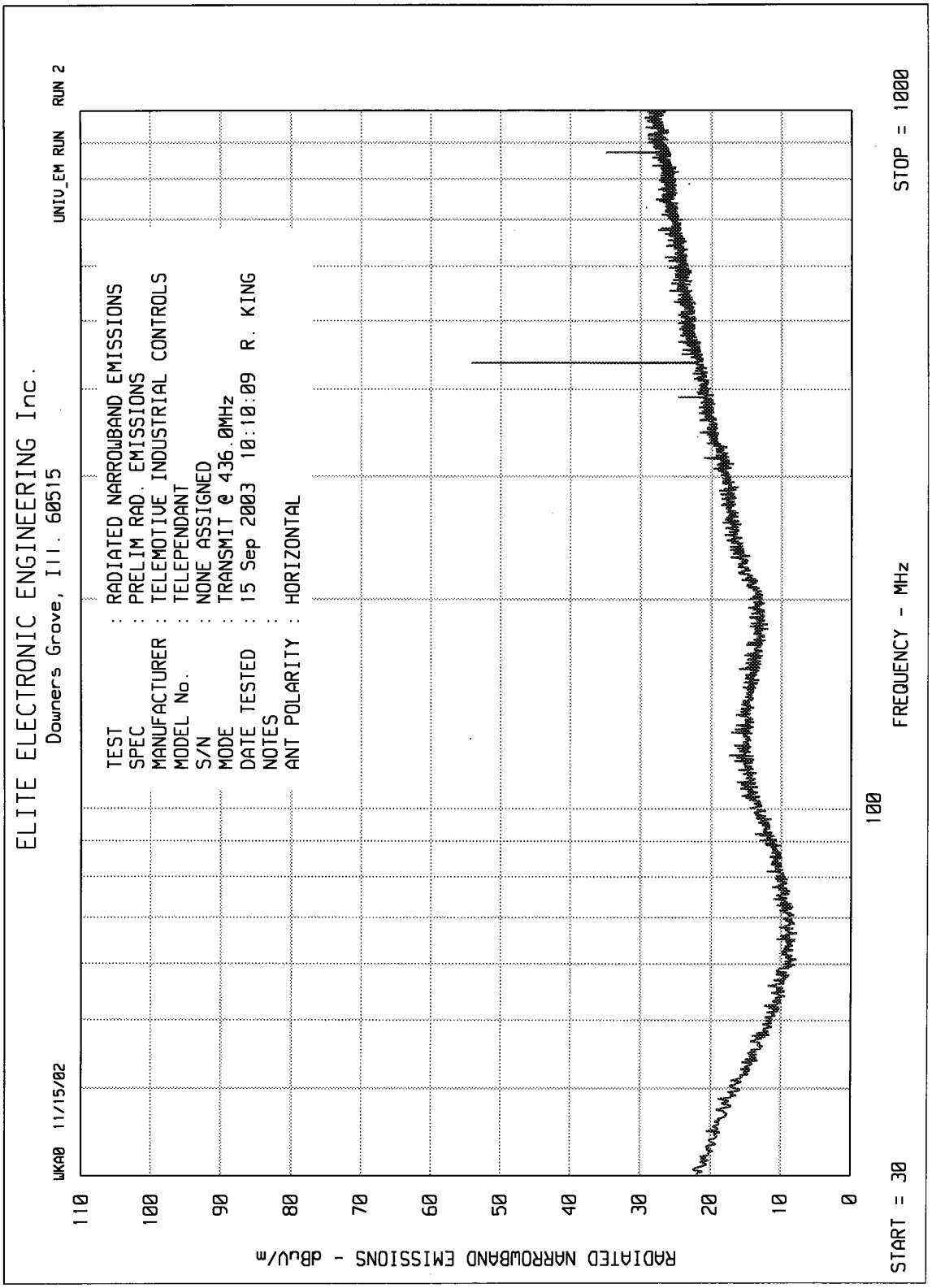
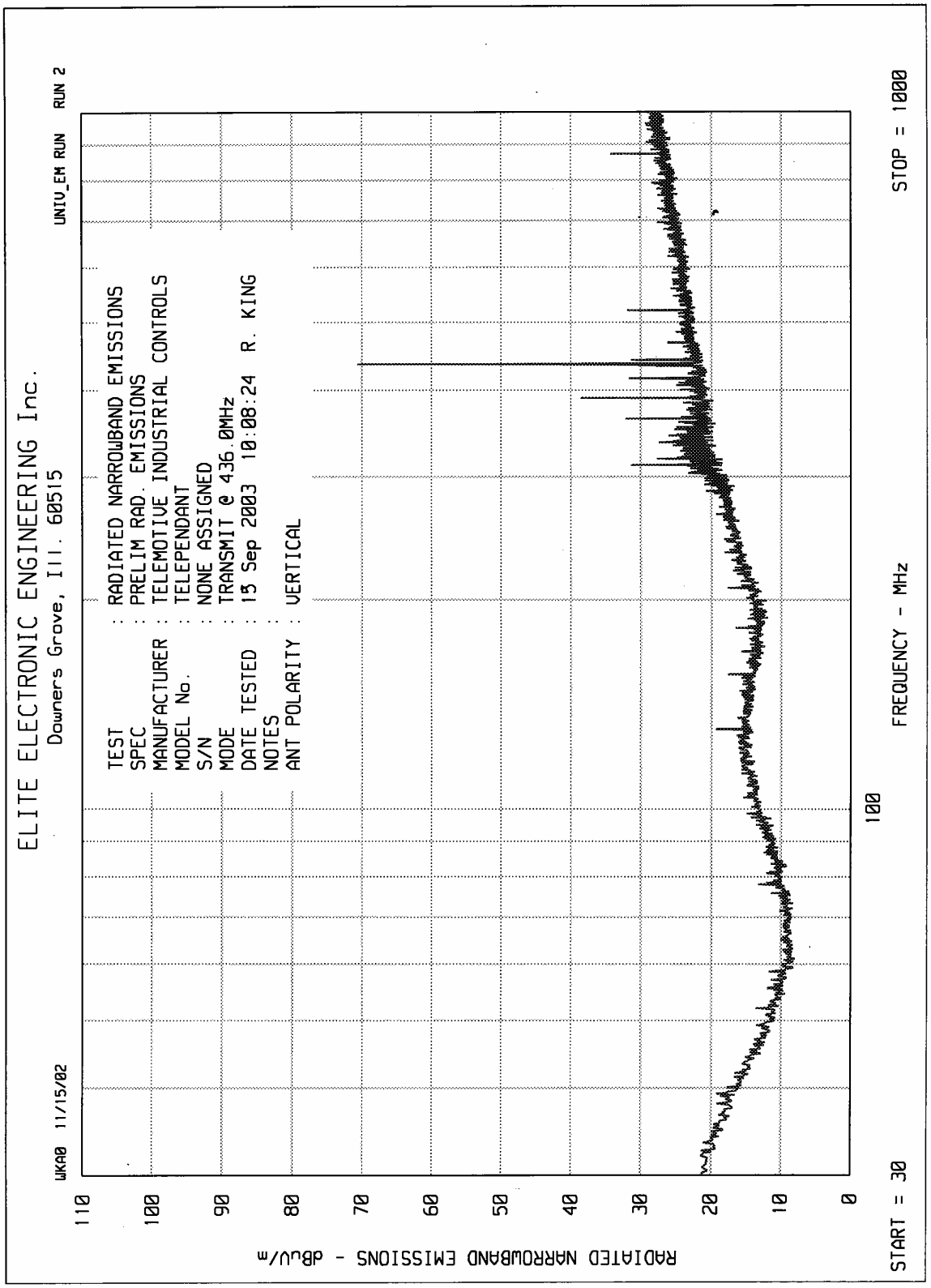
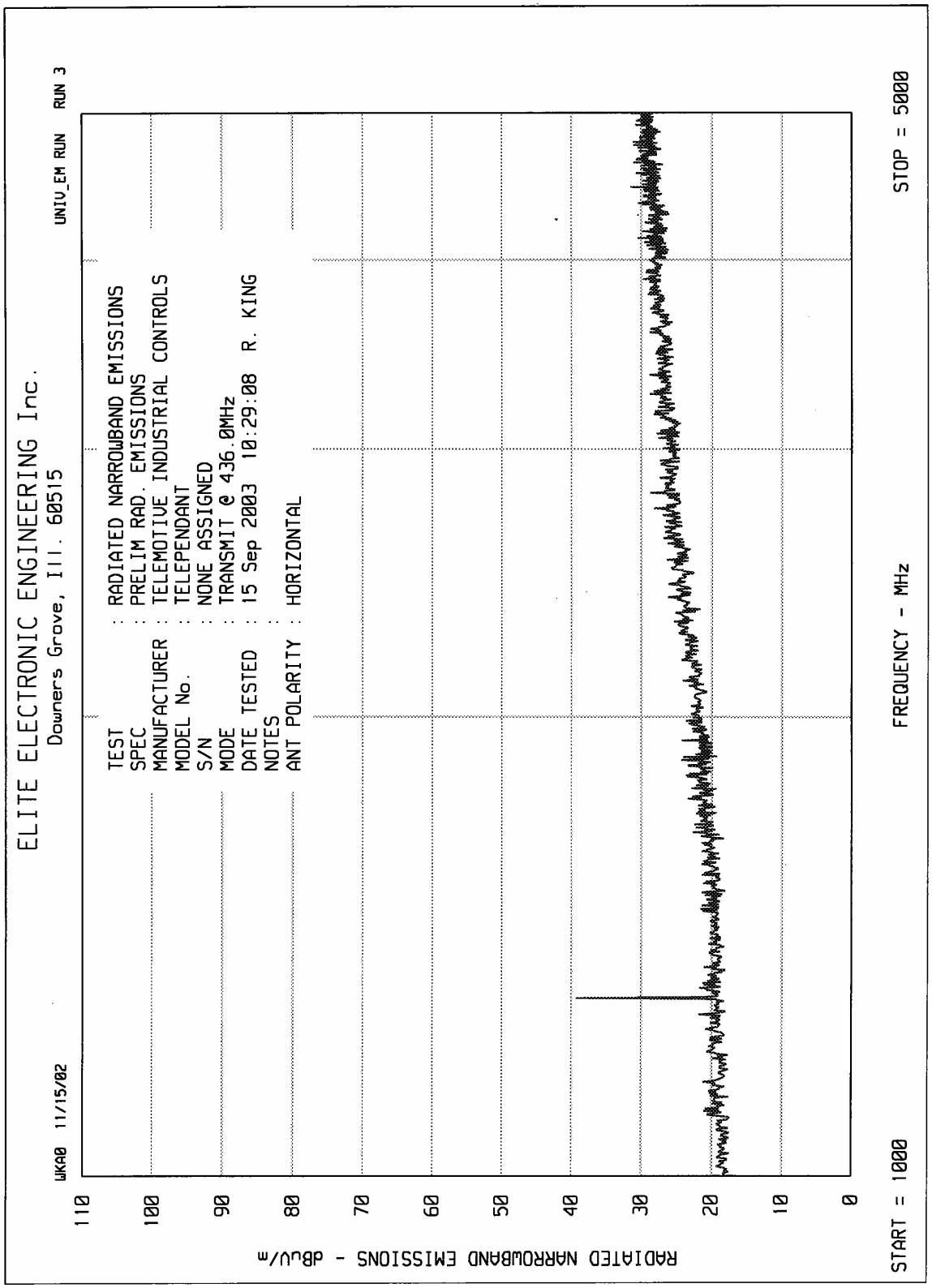
100
90
80
70
60
50
40
30
20
10
0
START = 1000
FREQUENCY - MHz
STOP = 5000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA0 11/15/02
UNIV_EM RUN RUN 2
TEST : RADIATED NARROWBAND EMISSIONS
SPEC : PRELIM RAD. EMISSIONS
MANUFACTURER : TELEMOTIVE INDUSTRIAL CONTROLS
MODEL No. : TELEPENDANT
S/N : NONE ASSIGNED
MODE : TRANSMIT @ 436.0MHz
DATE TESTED : 15 Sep 2003 10:10:09 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
WKA0 11/15/02
UNIV_EM RUN RUN 2
TEST : RADIATED NARROWBAND EMISSIONS
SPEC : PRELIM RAD. EMISSIONS
MANUFACTURER : TELEMOTIVE INDUSTRIAL CONTROLS
MODEL No. : TELEPENDANT
S/N : NONE ASSIGNED
MODE : TRANSMIT @ 436.0MHz
DATE TESTED : 15 Sep 2003 10:08:24 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
WKA0 11/15/02
UNIV_EM RUN RUN 3
TEST : RADIATED NARROWBAND EMISSIONS
SPEC : PRELIM RAD. EMISSIONS
MANUFACTURER : TELEMOTIVE INDUSTRIAL CONTROLS
MODEL No. : TELEPENDANT
S/N : NONE ASSIGNED
MODE : TRANSMIT @ 436.0MHz
DATE TESTED : 15 Sep 2003 10:29:08 R. KING
NOTES :
ANT POLARITY : HORIZONTAL
RADIATED NARROWBAND EMISSIONS - dBuV/m
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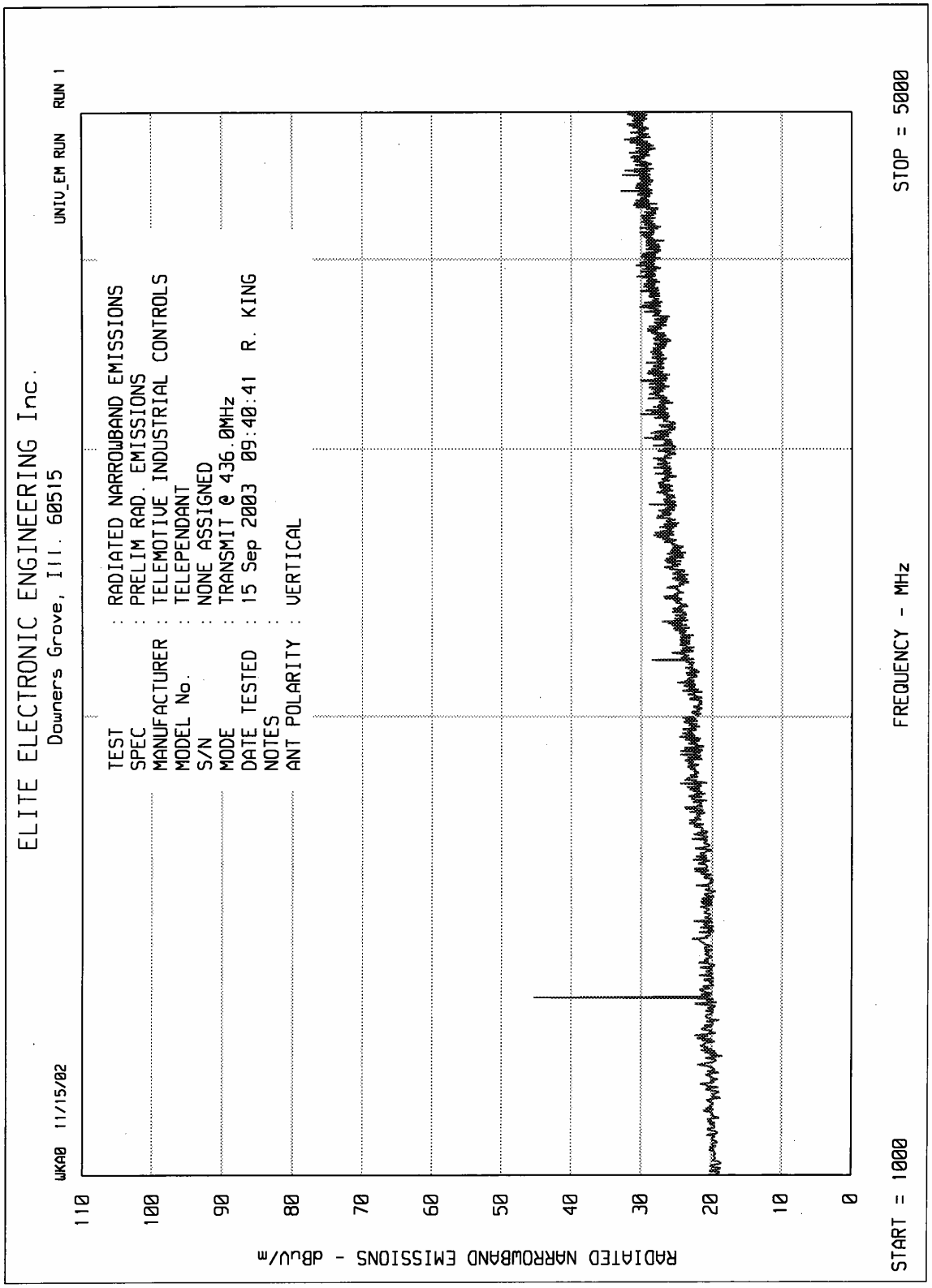
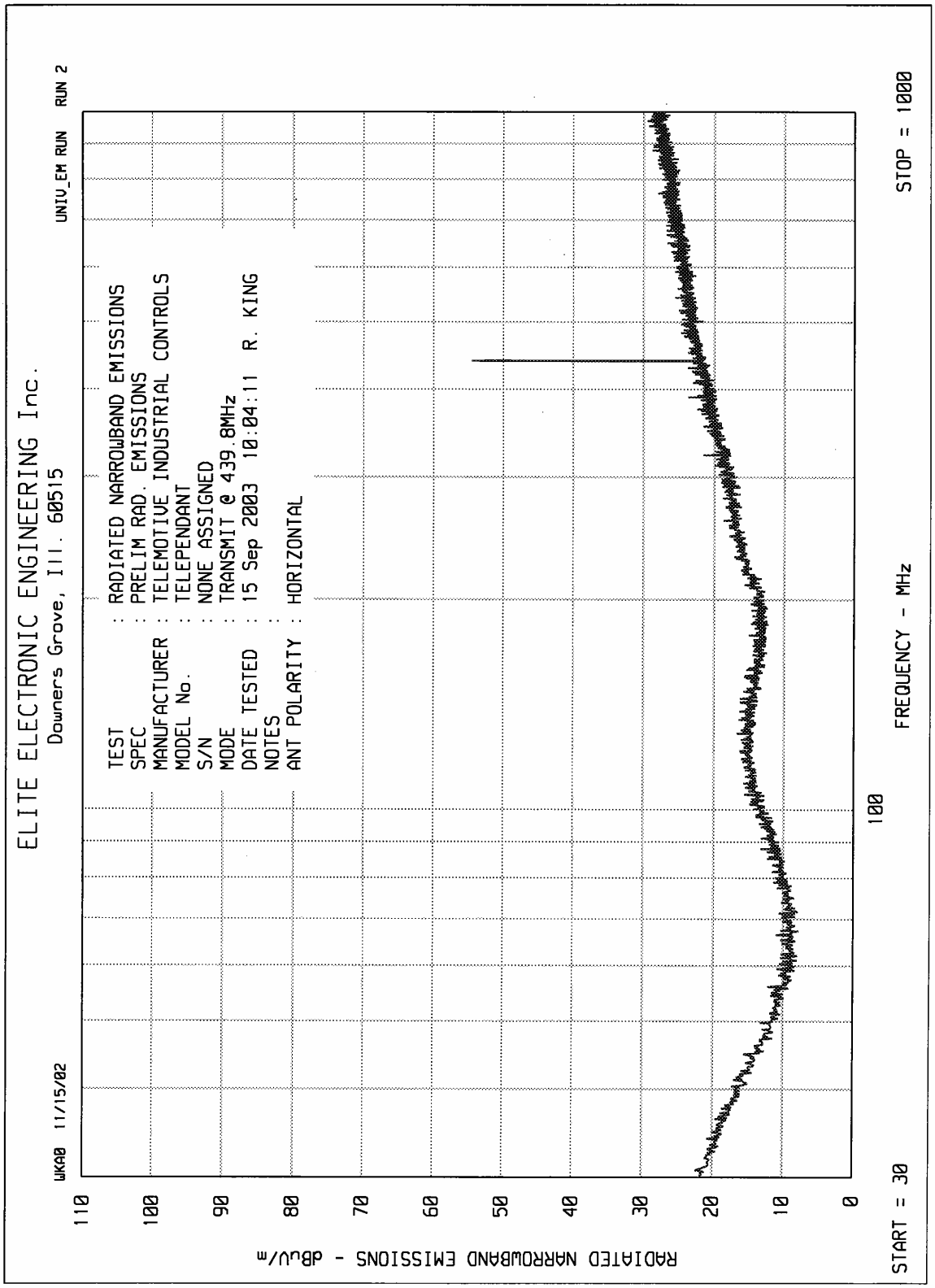
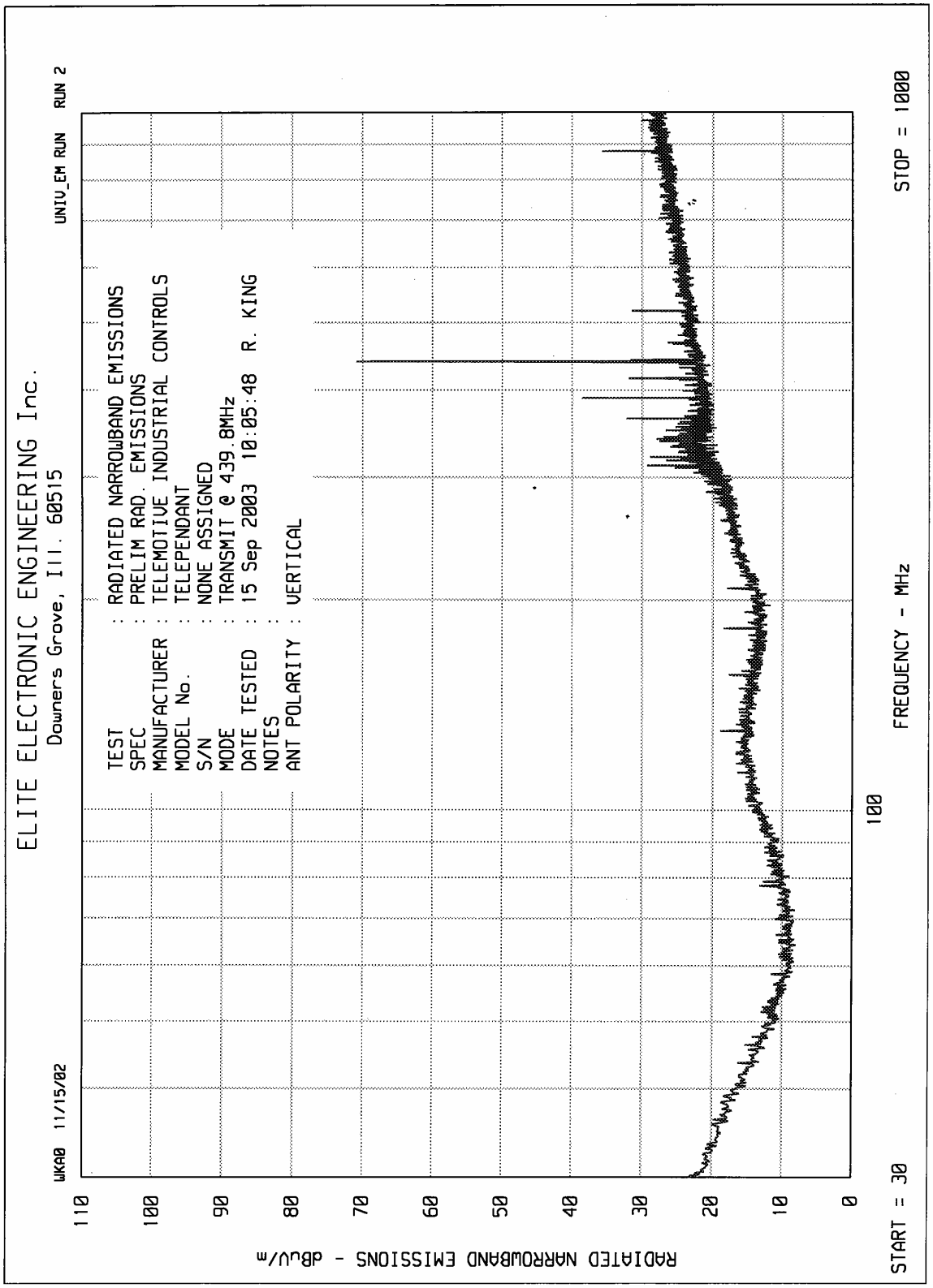
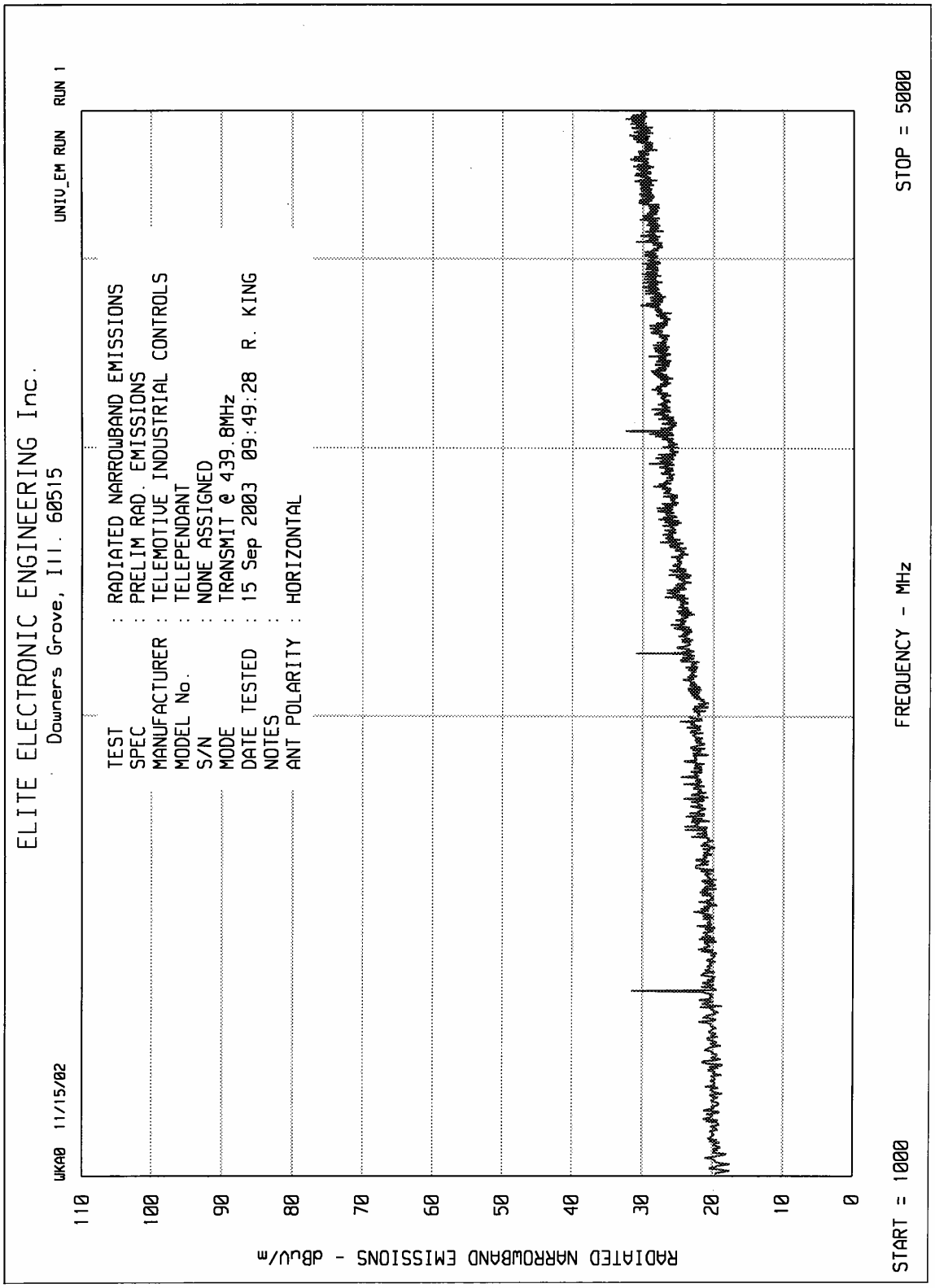
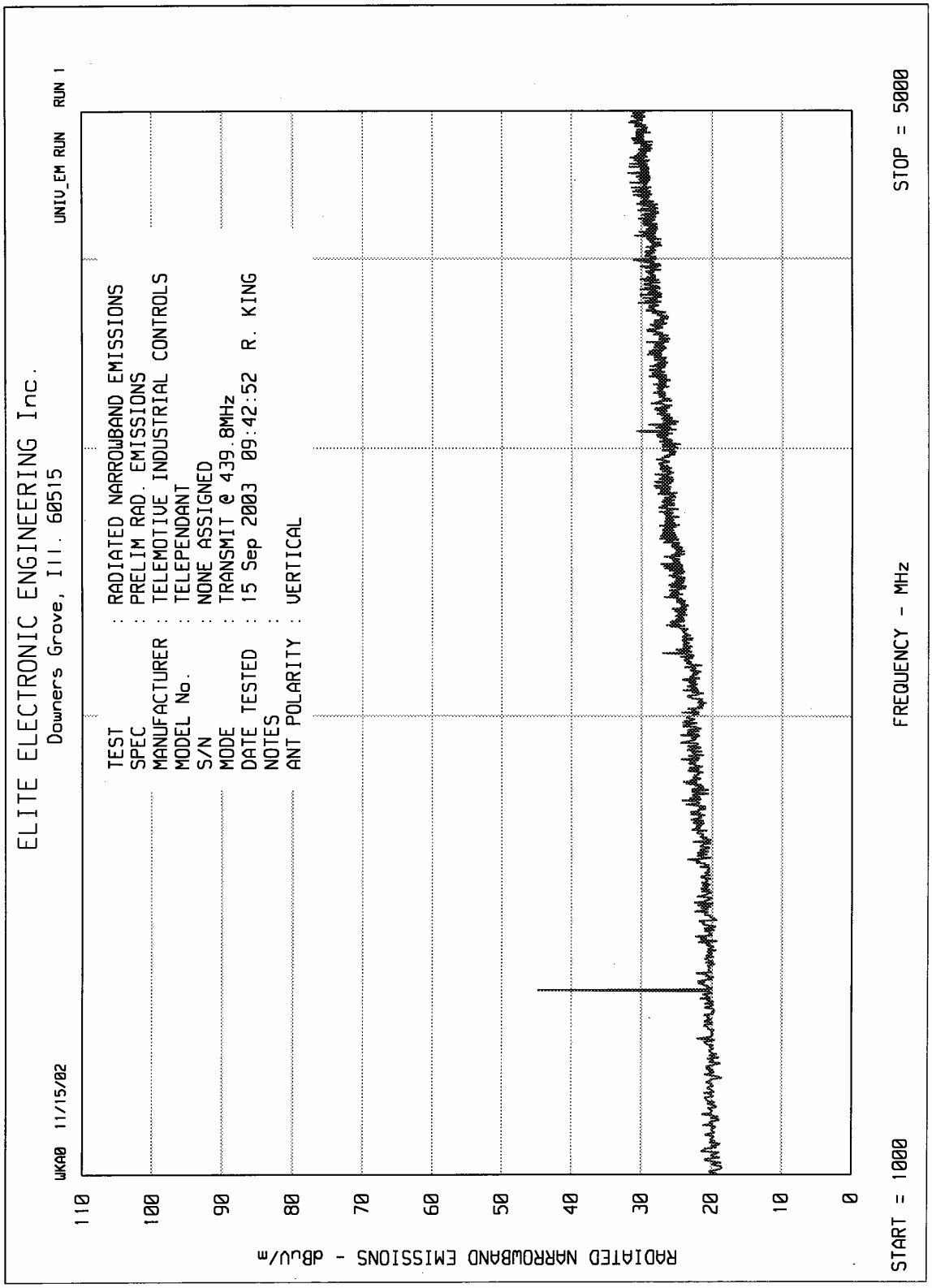
100
90
80
70
60
50
40
30
20
10
0
START = 1000
FREQUENCY - MHz
STOP = 5000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA0 11/15/02
UNIV_EM RUN RUN 1
TEST : RADIATED NARROWBAND EMISSIONS
SPEC : PRELIM RAD. EMISSIONS
MANUFACTURER : TELEMOTIVE INDUSTRIAL CONTROLS
MODEL No. : TELEPENDANT
S/N : NONE ASSIGNED
MODE : TRANSMIT @ 436.0MHz
DATE TESTED : 15 Sep 2003 09:40:41 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 = 5000


WKA0 11/15/02
ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV_EM RUN RUN 2
TEST : RADIATED NARROWBAND EMISSIONS
SPEC : PRELIM RAD. EMISSIONS
MANUFACTURER : TELEMOTIVE INDUSTRIAL CONTROLS
MODEL No. : TELEPENDANT
S/N : NONE ASSIGNED
MODE : TRANSMIT @ 439.8MHz
DATE TESTED : 15 Sep 2003 10:04:11 R. KING
NOTES :
ANT POLARITY : HORIZONTAL
RADIATED NARROWBAND EMISSIONS - dBuV/m
110
100
90
80
70
60
50
40
30
20
10
0
START = 30
100
FREQUENCY - MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA0 11/15/02
UNIV_EM RUN RUN 2
TEST : RADIATED NARROWBAND EMISSIONS
SPEC : PRELIM RAD. EMISSIONS
MANUFACTURER : TELEMOTIVE INDUSTRIAL CONTROLS
MODEL No. : TELEPENDANT
S/N : NONE ASSIGNED
MODE : TRANSMIT @ 439.8MHz
DATE TESTED : 15 Sep 2003 10:05:48 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
WKA0 11/15/02
UNIV_EM RUN RUN 1
TEST : RADIATED NARROWBAND EMISSIONS
SPEC : PRELIM RAD. EMISSIONS
MANUFACTURER : TELEMOTIVE INDUSTRIAL CONTROLS
MODEL No. : TELEPENDANT
S/N : NONE ASSIGNED
MODE : TRANSMIT @ 439.8MHz
DATE TESTED : 15 Sep 2003 09:49:28 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 = 5000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA0 11/15/02
UNIV_EM RUN RUN 1
TEST : RADIATED NARROWBAND EMISSIONS
SPEC : PRELIM RAD. EMISSIONS
MANUFACTURER : TELEMOTIVE INDUSTRIAL CONTROLS
MODEL No. : TELEPENDANT
S/N : NONE ASSIGNED
MODE : TRANSMIT @ 439.8MHz
DATE TESTED : 15 Sep 2003 09:42:52 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 = 5000

ETR No. 32677-01
DATA PAGE

SPECIFICATION : FCC PART 15C(REV OCT 1, 94) TRANSMITTER OPEN FIELD DATA
MANUFACTURER : TELEMOTIVE INDUSTRIAL CONTROLS
MODEL : TELEPENDANT
S/N : NONE ASSIGNED
TEST DATE : SEPTEMBER 16, 2003
NOTES : Tx @ 433.125MHz
TEST ANTENNA : ROBERTS DIPOLE & DRWG ANTENNAS

FREQUENCY MHz	ANT POL	MTR RDG dBuV	CBL FAC dB	ANT FAC dB	DUTY CYCLE dB	TOTAL dBuV/m @3m	TOTAL uV/m @3m	LIMIT uV/m @3m	NOTES
433.13	H	51.0	1.5	21.2	-.6	73.1	4540.6	10963.5	
433.13	V	46.1	1.5	21.2	-.6	68.2	2582.9	10963.5	
866.25	H	21.8	1.9	27.3	-.6	50.4	330.6	1096.4	
866.25	V	16.0	1.9	27.3	-.6	44.6	169.6	1096.4	
1299.50	H	23.3	2.4	25.0	-.6	50.1	320.5	1096.4	
1299.50	V	21.1	2.4	25.0	-.6	47.9	248.8	1096.4	
1732.50	H	9.4	2.8	26.6	-.6	38.1	80.8	1096.4	
1732.50	V	11.0	2.8	26.6	-.6	39.7	97.1	1096.4	
2165.60	H	18.9	3.2	28.2	-.6	49.7	304.3	1096.4	
2165.60	V	14.5	3.2	28.2	-.6	45.3	183.4	1096.4	
2598.10	V	8.1	3.6	29.5	-.6	40.7	107.9	1096.4	
2598.75	H	9.1	3.6	29.5	-.6	41.7	121.1	1096.4	
3031.88	H	17.8	4.0	30.8	-.6	52.0	399.5	1096.4	
3031.88	V	17.0	4.0	30.8	-.6	51.2	364.4	1096.4	
3465.00	H	6.9	4.3	32.2	-.6	42.8	137.7	1096.4	
3465.00	V	6.8	4.3	32.2	-.6	42.7	136.1	1096.4	
3898.13	H	7.6	4.5	33.3	-.6	44.8	173.4	500.0	*
3898.13	V	7.4	4.5	33.3	-.6	44.6	169.5	500.0	*
4331.25	H	7.0	4.7	33.2	-.6	44.3	165.0	500.0	*
4331.25	V	7.1	4.7	33.2	-.6	44.4	166.9	500.0	*

* DENOTES A FREQUENCY CONFLICT WITH RESTRICTED BANDS

checked by: Richard S. King
R. KING

ETR No. 32677-01
DATA PAGE

SPECIFICATION : FCC PART 15C(REV OCT 1, 94) TRANSMITTER OPEN FIELD DATA
MANUFACTURER : TELEMOTIVE INDUSTRIAL CONTROLS
MODEL : TELEPENDANT
S/N : NONE ASSIGNED
TEST DATE : SEPTEMBER 16, 2003
NOTES : Tx @ 436.0MHz
TEST ANTENNA : ROBERTS DIPOLE & DRWG ANTENNAS

FREQUENCY MHz	ANT POL	MTR RDG dBuV	CBL FAC dB	ANT FAC dB	DUTY CYCLE dB	TOTAL dBuV/m @3m	TOTAL uV/m @3m	LIMIT uV/m @3m	NOTES
436.00	H	51.3	1.5	21.3	-.6	73.5	4739.8	11083.3	
436.00	V	46.3	1.5	21.3	-.6	68.5	2665.4	11083.3	
872.00	H	20.7	1.9	27.3	-.6	49.3	292.2	1108.3	
872.00	V	17.2	1.9	27.3	-.6	45.8	195.3	1108.3	
1308.00	H	27.1	2.4	25.1	-.6	53.9	498.2	500.0	*
1308.00	V	25.1	2.4	25.1	-.6	51.9	395.7	500.0	*
1743.80	H	8.8	2.8	26.6	-.6	37.6	75.9	1108.3	
1743.80	V	12.4	2.8	26.6	-.6	41.2	114.8	1108.3	
2180.00	H	18.5	3.2	28.2	-.6	49.3	292.8	1108.3	
2180.00	V	18.2	3.2	28.2	-.6	49.0	282.8	1108.3	
2616.00	H	9.0	3.7	29.6	-.6	41.6	120.7	1108.3	
2616.00	V	9.2	3.7	29.6	-.6	41.8	123.5	1108.3	
3052.00	H	17.5	4.0	30.9	-.6	51.8	389.6	1108.3	
3052.00	V	16.0	4.0	30.9	-.6	50.3	327.8	1108.3	
3488.00	H	7.2	4.3	32.3	-.6	43.2	143.9	1108.3	
3488.00	V	7.5	4.3	32.3	-.6	43.5	148.9	1108.3	
3924.00	H	8.3	4.5	33.3	-.6	45.6	189.5	500.0	*
3924.00	V	7.3	4.5	33.3	-.6	44.6	168.9	500.0	*
4360.00	H	7.3	4.7	33.2	-.6	44.6	170.6	500.0	*
4360.00	V	6.4	4.7	33.2	-.6	43.7	153.8	500.0	*

* DENOTES A FREQUENCY CONFLICT WITH RESTRICTED BANDS

checked by: Richard E. King
R. KING

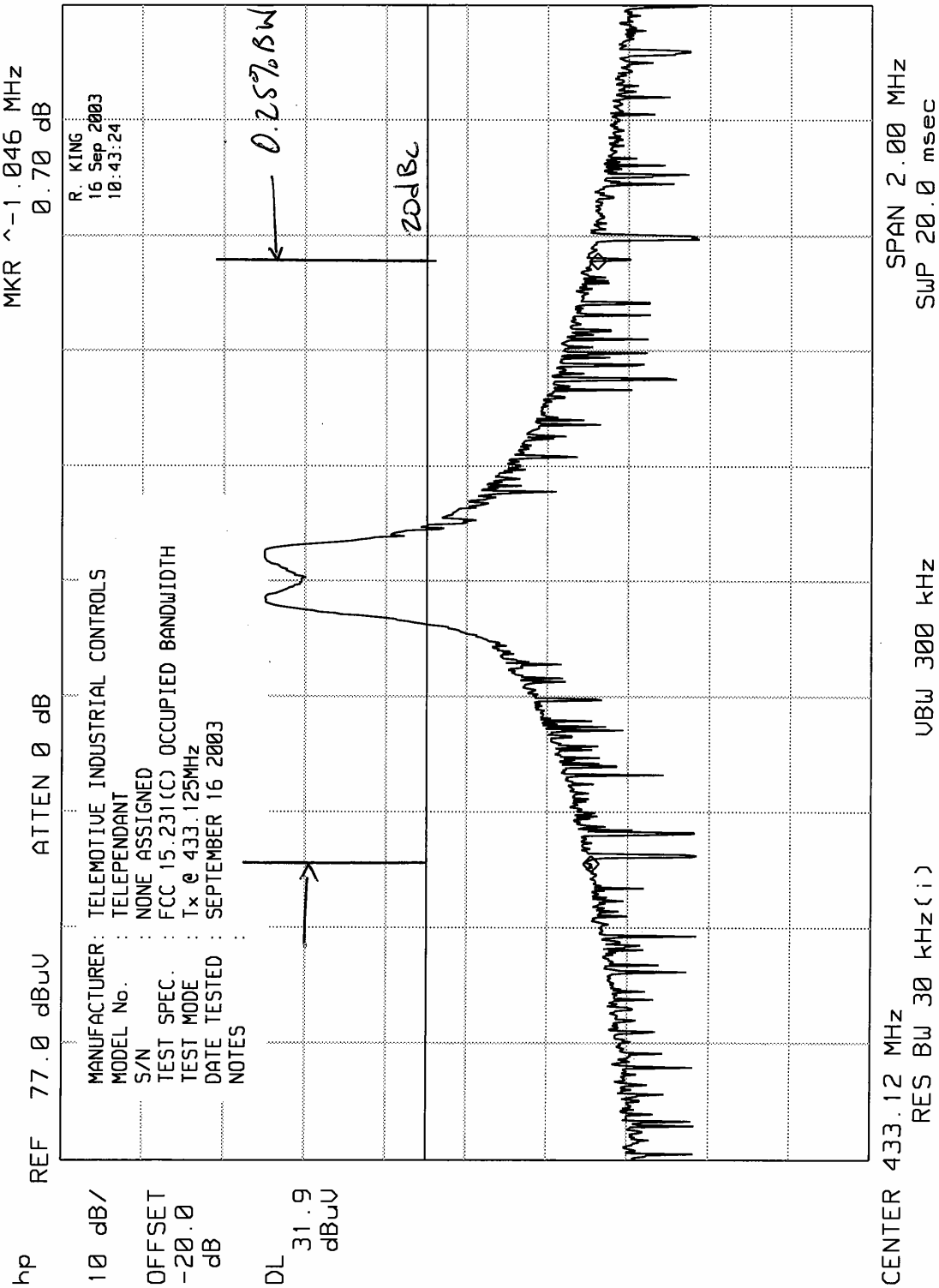
ETR No. 32677-01
DATA PAGE

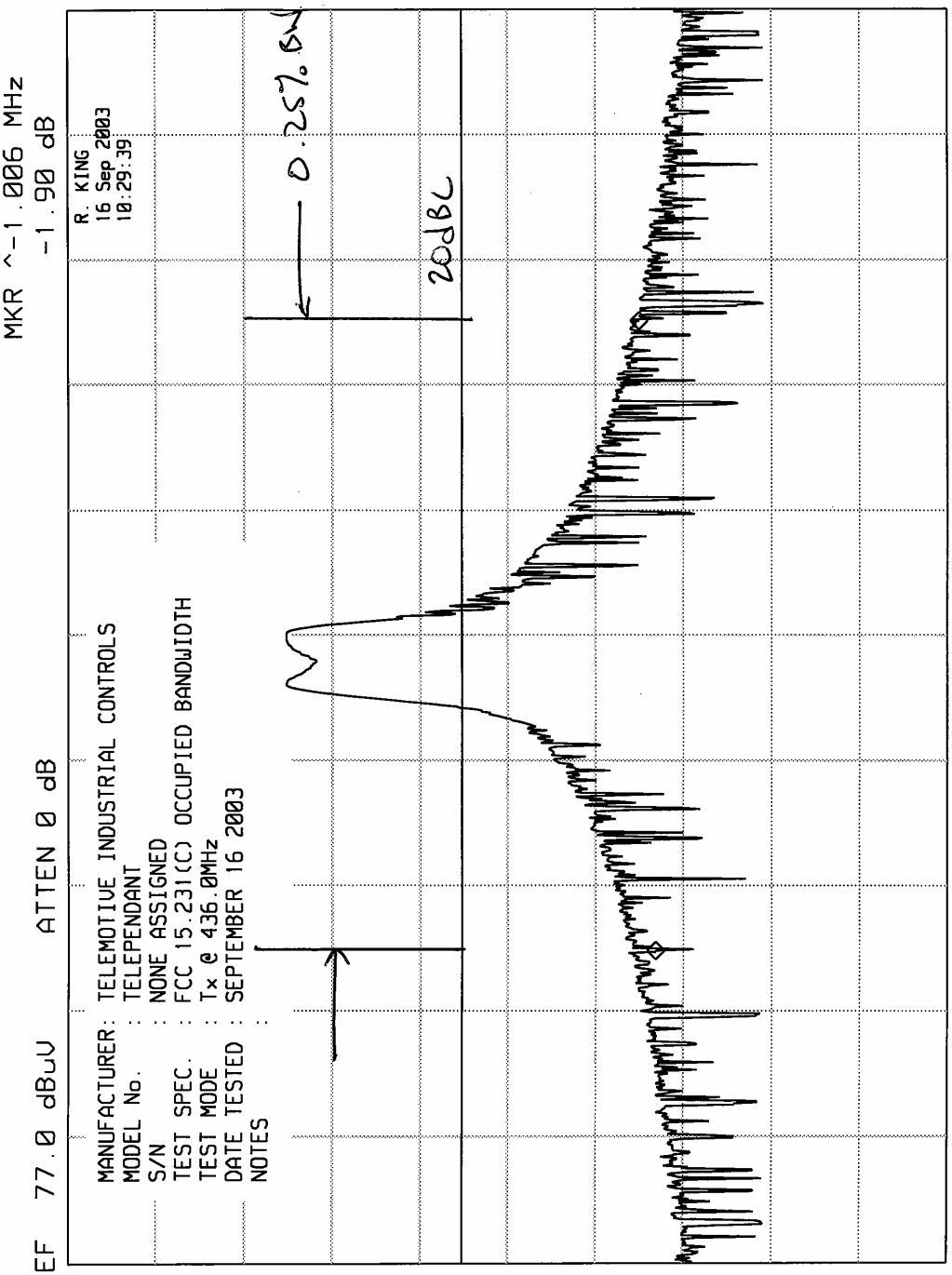
SPECIFICATION : FCC PART 15C(REV OCT 1, 94) TRANSMITTER OPEN FIELD DATA
MANUFACTURER : TELEMOTIVE INDUSTRIAL CONTROLS
MODEL : TELEPENDANT
S/N : NONE ASSIGNED
TEST DATE : SEPTEMBER 16, 2003
NOTES : Tx @ 439.8MHz
TEST ANTENNA : ROBERTS DIPOLE & DRWG ANTENNAS

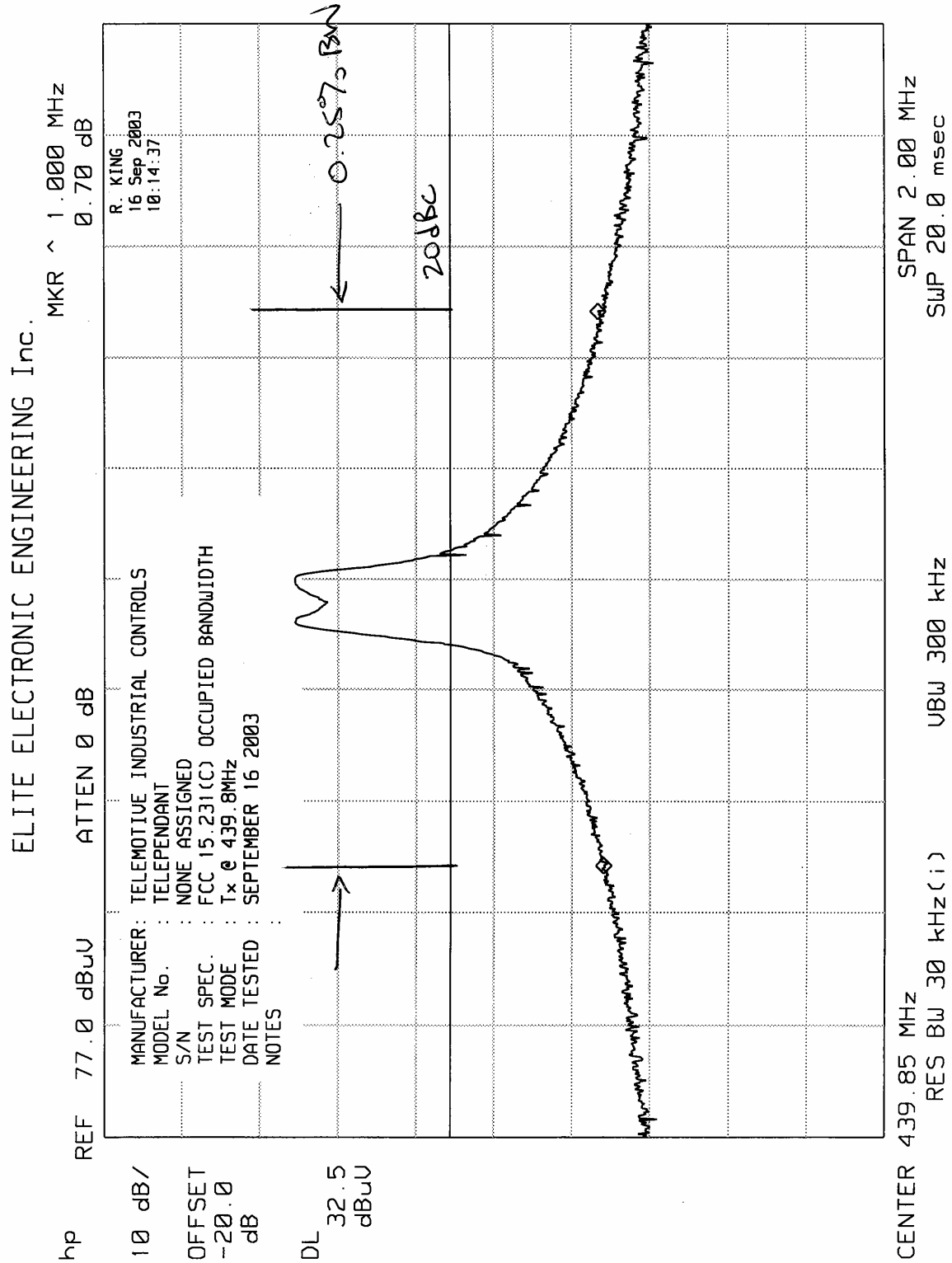
FREQUENCY MHz	ANT POL	MTR RDG dBuV	CBL FAC dB	ANT FAC dB	DUTY CYCLE dB	TOTAL dBuV/m @3m	TOTAL uV/m @3m	LIMIT uV/m @3m	NOTES
439.80	H	51.2	1.6	21.4	-.6	73.5	4737.6	11241.7	
439.80	V	46.4	1.6	21.4	-.6	68.7	2726.2	11241.7	
879.60	H	20.2	1.9	27.3	-.6	48.8	277.0	1124.2	
879.60	V	15.0	1.9	27.3	-.6	43.6	152.2	1124.2	
1319.40	H	26.7	2.4	25.1	-.6	53.6	478.0	500.0	*
1319.40	V	22.3	2.4	25.1	-.6	49.2	288.0	500.0	*
1759.20	H	9.9	2.8	26.7	-.6	38.8	86.9	1124.2	
1759.20	V	11.6	2.8	26.7	-.6	40.5	105.7	1124.2	
2199.00	H	18.3	3.2	28.3	-.6	49.2	288.9	1124.2	
2199.00	V	16.3	3.2	28.3	-.6	47.2	229.5	1124.2	
2638.80	H	8.9	3.7	29.6	-.6	41.6	120.6	1124.2	
2638.80	V	9.0	3.7	29.6	-.6	41.7	122.0	1124.2	
3078.60	H	12.0	4.1	31.0	-.6	46.4	209.4	1124.2	
3078.60	V	14.6	4.1	31.0	-.6	49.0	282.5	1124.2	
3518.40	H	6.7	4.3	32.3	-.6	42.8	137.4	1124.2	
3518.40	V	6.5	4.3	32.3	-.6	42.6	134.3	1124.2	
3958.20	H	7.3	4.5	33.4	-.6	44.6	170.8	500.0	*
3958.20	V	7.1	4.5	33.4	-.6	44.4	166.9	500.0	*
4398.00	H	8.0	4.7	33.2	-.6	45.3	184.6	500.0	*
4398.00	V	7.5	4.7	33.2	-.6	44.8	174.3	500.0	*

* DENOTES A FREQUENCY CONFLICT WITH RESTRICTED BANDS

checked by: Richard E. King
R. KING


hp
REF 77.0 dBuV
ATTEN 0 dB
MKR ^-1.046 MHz
0.70 dB
ELITE ELECTRONIC ENGINEERING Inc.
10 dB/
OFFSET
-20.0
dB
DL
31.9
dBuV
MANUFACTURER: TELEMOTIVE INDUSTRIAL CONTROLS
MODEL No. : TELEPENDANT
S/N : NONE ASSIGNED
TEST SPEC. : FCC 15.231(C) OCCUPIED BANDWIDTH
TEST MODE : Tx @ 433.125MHz
DATE TESTED : SEPTEMBER 16 2003
NOTES :
R. KING
16 Sep 2003
10:43:24
0.25% BW
20dBc
CENTER 433.12 MHz
RES BW 30 kHz(i)
VBW 300 kHz
SPAN 2.00 MHz
SWP 20.0 msec


hp
10 dB/
OFFSET
-20.0
dB
DL
32.2
dBuV
REF 77.0 dBuV
ATTEN 0 dB
ELITE ELECTRONIC ENGINEERING Inc.
MKR ^-1.006 MHz
-1.90 dB
MANUFACTURER: TELEMOTIVE INDUSTRIAL CONTROLS
MODEL No. : TELEPENDANT
S/N : NONE ASSIGNED
TEST SPEC. : FCC 15.231(C) OCCUPIED BANDWIDTH
TEST MODE : Tx @ 436.0MHz
DATE TESTED : SEPTEMBER 16 2003
NOTES :
R. KING
16 Sep 2003
10:29:39
0.257 BW
20dBC
CENTER 436.04 MHz
RES BW 30 kHz(i)
VBW 300 kHz
SPAN 2.00 MHz
SWP 20.0 msec


hp
10 dB/
OFFSET
-20.0
dB
DL
32.5
dBuV
REF 77.0 dBuV
ATTEN 0 dB
ELITE ELECTRONIC ENGINEERING Inc.
MKR ^ 1.000 MHz
0.70 dB
MANUFACTURER: TELEMOTIVE INDUSTRIAL CONTROLS
MODEL No. : TELEPENDANT
S/N : NONE ASSIGNED
TEST SPEC. : FCC 15.231(C) OCCUPIED BANDWIDTH
TEST MODE : Tx @ 439.8MHz
DATE TESTED : SEPTEMBER 16 2003
NOTES :
R. KING
16 Sep 2003
10:14:37
0.25% BW
20dBc
CENTER 439.85 MHz
RES BW 30 kHz(i)
VBW 300 kHz
SPAN 2.00 MHz
SWP 20.0 msec