



Measurement of RF Interference from a Model
RRLR-01 Transceiver

For : Responsive Innovations
Akron, OH

P.O. No. : 1065

Date Received: July 31, 2006

Date Tested : July 31, 2006 through August 8, 2006

Test Personnel: Mark E. Longinotti

Specification : FCC "Code of Federal Regulations" Title 47
Part 15, Subpart B and
Subpart C, Section 15.249 for Intentional Radiators
Operating within the 2400-2483.5MHz band

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



REVISION HISTORY

Revision	Date	Description
—	August 11, 2006	Initial release
A	November 17, 2006	Changed model number from RCRL-01 to RRLR-01



Measurement of RF Emissions from a Transceiver, Model No. RRLR-01

1.0 INTRODUCTION:

1.1 Description of Test Item - This document represents the results of the series of radio interference measurements performed on a transceiver, Model No. RRLR-01, (hereinafter referred to as the test item). Serial No. 3 was used for all tests except duty cycle factor measurement tests. Serial No. 4 was used for duty cycle factor measurement tests. The test item was designed to transmit and receive in the 2400MHz to 2483.5MHz band using an external, 6cm-long, non-detachable antenna. The test item was manufactured and submitted for testing by Responsive Innovations located in Akron, OH.

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, Sections 15.207 and 15.249 for Intentional Radiators Operating within the 2400-2483.5MHz band. 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, dated 1 October 2004

- 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 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 23C and the relative humidity was 61%.

2.0 TEST ITEM SET-UP AND OPERATION:

The test item is a transceiver, Model No. RRLR-01. A block diagram of the test item set-up is shown as Figure 1.

2.1 Power Input - The test item obtained 3VDC power from the USB port of a laptop computer. The laptop computer was powered with 20VDC via a 1.8 meter-long, 2 wire, unshielded cable from an AC adaptor. The AC adaptor obtained 115V 60Hz power through a 1.8 meter-long, 2 wire, unshielded power cable. For conducted emissions tests, each AC power lead to the AC adaptor was connected through a line impedance stabilization network (LISN) which was located on the ground plane. The network complies with the requirements of Paragraph 4.1.2 of ANSI C63.4-2003.

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

2.3 Peripheral Equipment - The following peripheral equipment was submitted with the test item:

Item	Description
Laptop Computer	Dell PPI Inspiron 7000
AC Adaptor for computer	Dell ADP-70BB Model PA-4, P/N: 1243C, 20VDC output

2.4 Interconnect Cables - The following interconnect cables were submitted with the test item:

Item	Description
USB Cable	9.85m Standard USB Cable used for radiated emissions 4.85m Standard USB Cable used for conducted emissions

2.5 Operational Mode - For conducted emissions tests, the laptop computer was placed on an 80cm high non-conductive stand. The test item was connected to the USB port of the laptop computer via a 4.85m USB cable. Conducted emissions tests were performed with the test item transmitting at 2441MHz.

For radiated emissions tests, the test item was placed on an 80cm high non-conductive stand. The test item was connected to the USB port of the laptop computer via a 9.85m USB cable. The laptop computer was external to the test chamber. Radiated emissions tests were performed separately with the test item transmitting at 2401MHz, 2441MHz, and 2474MHz.

2.6 Test Item Modifications - No modifications were required for compliance to the FCC

"Code of Federal Regulations" Title 47, Part 15, Subpart B, Sections 15.107 and 15.109, and Subpart C, Sections 15.207 and 15.249 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 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 - Per 15.101(b), receivers operating above 960MHz are exempt from complying with the conducted emissions requirements of 15.107. Therefore no conducted emissions tests are required with the test item operating in the receive mode.

All radio frequency voltages on the power lines for any frequency or frequencies of an

intentional radiator shall not exceed the limits in the following table:

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 - 0.5	66 to 56*	56 to 46*
0.5 - 5	56	46
5 - 30	60	50

4.1.2 Procedures - The interference on each power lead of the laptop computer was measured by connecting the measuring equipment to the appropriate meter terminal of the LISN. The meter terminal of the LISN not under test was terminated with 50 ohm. Measurements were first made over the entire frequency range from 150kHz through 30MHz with a peak detector and the results were automatically plotted. The data thus obtained was then searched by the computer for the highest levels. Quasi-peak measurements were automatically performed at the frequencies selected from the highest peak measurements, and the results printed. Photographs of the test setup are shown as Figure 2.

4.1.3 Results - The plots of the peak preliminary conducted voltage levels on each power line from the Dell laptop computer **without** the test item installed in the USB port, are presented on pages 15 and 16. The conducted limits for intentional radiators and Class B devices are shown as a reference. The final quasi-peak results are presented on pages 17 and 18.

The plots of the peak preliminary conducted voltage levels on each power line from the Dell laptop computer **with** the test item installed in the USB port and transmitting at 2441MHz, are presented on pages 19 and 20. The conducted limits for intentional radiators are shown as a reference. The final quasi-peak results are presented on pages 21 and 22.

As can be seen from the data, all conducted emission levels met the requirements for Class B devices and for intentional radiators. The emissions level closest to the limit (worst case) occurred at 621kHz. The emissions level at this frequency was 7.5dB within the limit.

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 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 is less than 100msec, the display is set to show at least one word. 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: Plots of the duty cycle at 2401MHz, 2441MHz, and 2474MHz are shown on data pages 23 through 25. The duty cycle factor was computed to be -40dB at all three frequencies.

4.3 Radiated Measurements

4.3.1 Requirements - Per 15.101(b), receivers operating above 960MHz are exempt from complying with the radiated emissions requirements of 15.109. Therefore no radiated emissions tests are required with the test item operating in the receive mode.

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 15.249 has the following radiated emission limits:

Fundamental Frequency MHz	Field Intensity uV/m @ 3 meters	Field Strength Harmonics and Spurious @ 3 meters
2400-2483.5	50,000	500

The field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits by more than 20 dB under any condition of modulation.

4.3.2 Procedures - Radiated emissions 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.

A preliminary radiated emissions test was 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 frequency range from 30MHz to 18GHz was investigated using a peak detector function. The data was then processed by the computer to calculate equivalent field intensity.

The final radiated emission tests were then manually performed over the frequency range of 30MHz to 25GHz. A broadband double ridged waveguide antenna was used as the pick-up device for all

frequencies above 1GHz. All significant broadband and narrowband signals were measured and recorded. The peak detected levels were converted to average levels using a duty cycle factor which was computed from the pulse train.

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

- (1) The test item was rotated so that all of its sides were exposed to the receiving antenna.
- (2) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.
- (3) The measuring antenna was raised and lowered from 1 to 4 meters for each antenna polarization to maximize the readings.
- (4) For hand-held or body-worn devices, the test item was rotated through three orthogonal axes to determine which orientation produces the highest emission relative to the limit.

4.3.3 Results - The preliminary plots, with the test item transmitting at 2401MHz through 2474MHz, are presented on data pages 26 through 34. The plots are presented for a reference only, and are not used to determine compliance.

The final radiated levels, with the test item transmitting, are presented on data pages 35 through 40. 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 2401MHz. The emissions level at this frequency was 7.3dB within the limit. See data page 35 for details. Photographs of the test configuration which yielded the highest, or worst case, radiated emission levels are shown on Figure 3.

4.4 Band Edge Compliance

4.4.1 Requirement - In accordance with paragraph 15.249(d), emissions outside of the specified frequency bands shall be below the general radiated emissions limits of 15.209. Therefore the radiated emissions at the band edges (2400MHz and 2483.5MHz) must meet the general limits of 15.209.

4.4.2 Procedures - For radiated emissions at the band edges, the “marker-delta” method described in Public Notice DA 00-705 was used.

The test item was placed on an 80cm high non-conductive stand. The unit was set to transmit continuously. A broadband measuring antenna was placed at a test distance of 3 meters from the test



item. Initially radiated emissions were performed at the lowest transmit frequency and the highest transmit frequency using a 1MHz bandwidth. Next, the band edge emissions were plotted using a peak detector and a 30kHz bandwidth. The “max-hold” function was engaged. The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined. The analyzer’s display was plotted using a “screen-dump” utility. The “delta” limit was applied to this plot to determine compliance at the band edge.

4.4.3 Results - Pages 41 and 42 show the radiated band-edge compliance results using the marker-delta method. As can be seen from these plots, the emissions at the band-edge are within the general limits. The 99% bandwidth was measured to be 741.5kHz using a 30 kHz measurement BW and a 2 MHz span.

5.0 CONCLUSIONS:

It was determined that the Responsive Innovations Transceiver, Model No. RRLR-01, (Serial No. 4 was used for duty cycle factor measurements and Serial No. 3 was used for all other tests) 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, Sections 15.207 and 15.249 for Intentional Radiators Operating within the 2400-2483.5MHz 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

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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								
XPR0	HIGH PASS FILTER	K&L MICROWAVE	11SH10-4800/	001	4.8-20GHZ	07/27/06	12	07/27/07
XZG3	ATTENUATOR/SWITCH DRIVER	HEWLETT PACKARD	11713A	2421A03059	---		N/A	
XZG4	ATTENUATOR/SWITCH DRIVER	HEWLETT PACKARD	11713A	2223A01683	---		N/A	
Equipment Type: AMPLIFIERS								
APK3	PREAMPLIFIER	AGILENT TECHNOL	8449B	3008A01593	1-26.5GHZ	06/12/06	12	06/12/07
APK4	PREAMPLIFIER OPT H02	HEWLETT PACKARD	8449B	3008A00329	1-26.5GHZ	01/31/06	12	01/31/07
Equipment Type: ANTENNAS								
NTA0	BILOG ANTENNA	CHASE EMC LTD.	BILOG CBL611	2057	0.03-2GHZ	08/15/05	12	08/15/06
NW11	RIDGED WAVE GUIDE	AEL	H1498	154	2-18GHZ	10/01/05	12	10/01/06
NWN0	DOUBLE RIDGED GUIDE ANTENN	ETS-LINDGREN	3116	00026778	18 TO 40 GHZ	09/06/05	12	09/06/06
Equipment Type: ATTENUATORS								
T1N1	10DB 20W ATTENUATOR	NARDA	766-10		DC-4GHZ	09/07/05	12	09/07/06
Equipment Type: CONTROLLERS								
CDW6	DESKTOP COMPUTER	ELITE	PENTIUM 4	007	3.8 GHZ		NOTE 1	
Equipment Type: PROBES; CLAMP-ON & LISNS								
PLL2	50UH LISN 462D	ELITE	462D/70A	003	0.01-400MHZ	01/09/06	12	01/09/07
PLL5	50UH LISN 462D	ELITE	462D/70A	006	0.01-400MHZ	03/21/06	12	03/21/07
Equipment Type: PRINTERS AND PLOTTERS								
HRG1	LASERJET 2100XI	HEWLETT PACKARD	C4170A	USCD047809	---		N/A	
Equipment Type: RECEIVERS								
RAC2	SPECTRUM ANALYZER	HEWLETT PACKARD	85660B	3638A08770	100HZ-22GHZ	02/10/06	12	02/10/07
RACA	RF PRESELECTOR	HEWLETT PACKARD	85685A	2926A00980	20HZ-2GHZ	02/11/06	12	02/11/07
RACD	RF PRESELECTOR	HEWLETT PACKARD	85685A	3010A01205	20HZ-2GHZ	12/23/05	12	12/23/06
RAEC	SPECTRUM ANALYZER	HEWLETT PACKARD	85666B	3014A06690	100HZ-22GHZ	02/10/06	12	02/10/07
RAF4	QUASIPeAK ADAPTER	HEWLETT PACKARD	85650A	2043A00320	0.01-1000MHZ	02/10/06	12	02/10/07
RAF5	QUASIPeAK ADAPTER W/ RECEI	HEWLETT PACKARD	85650A	2043A00151	0.01-1000MHZ	02/11/06	12	02/11/07
RBA0	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESIB26	100145	20HZ-26.5GHZ	03/25/06	12	03/25/07

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.

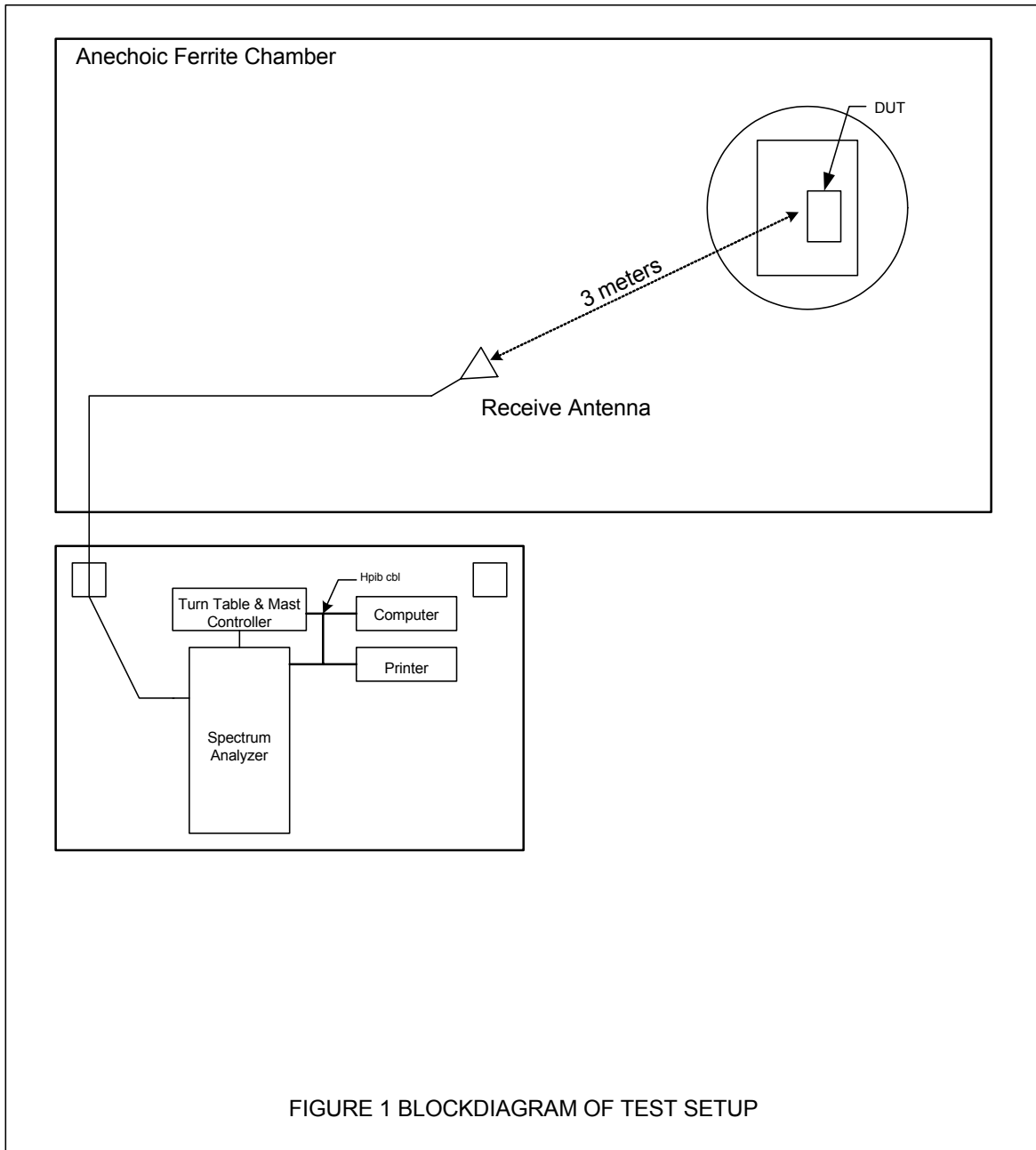
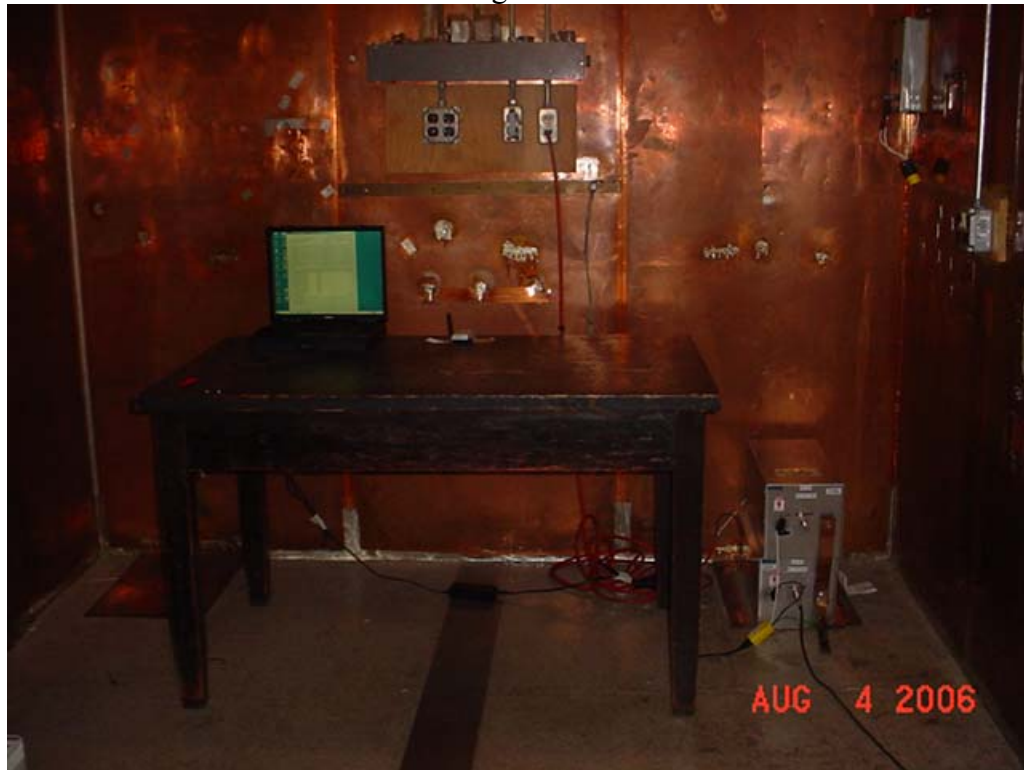


Figure 2

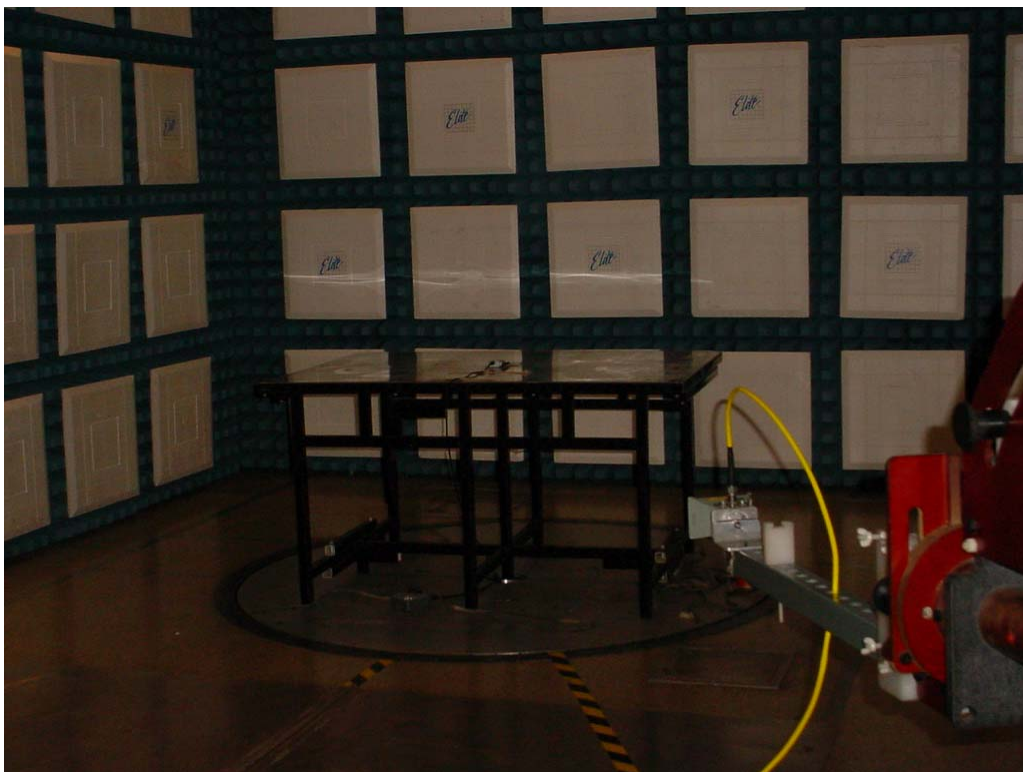


Test Set-up for Conducted Emissions

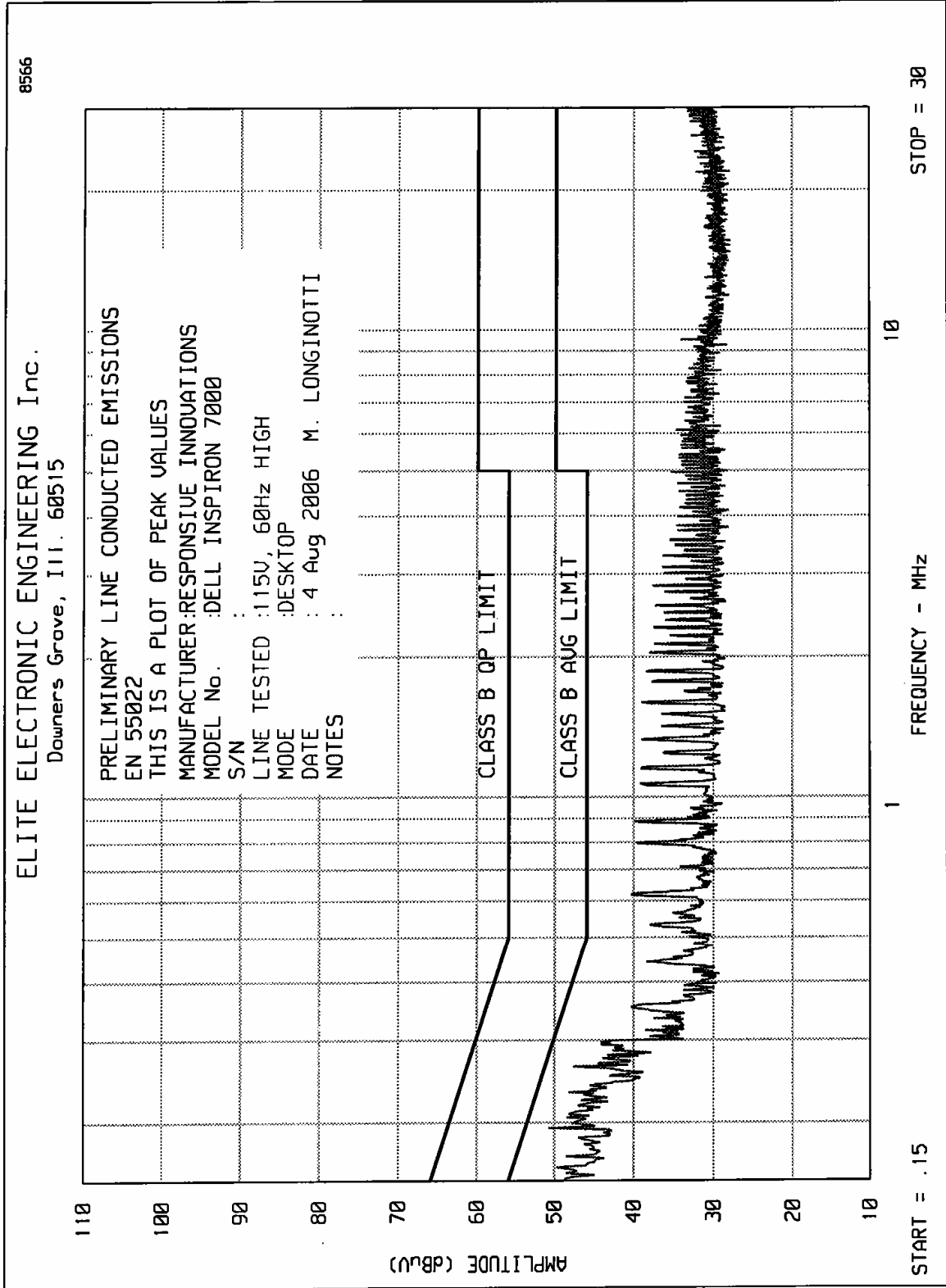
Figure 3

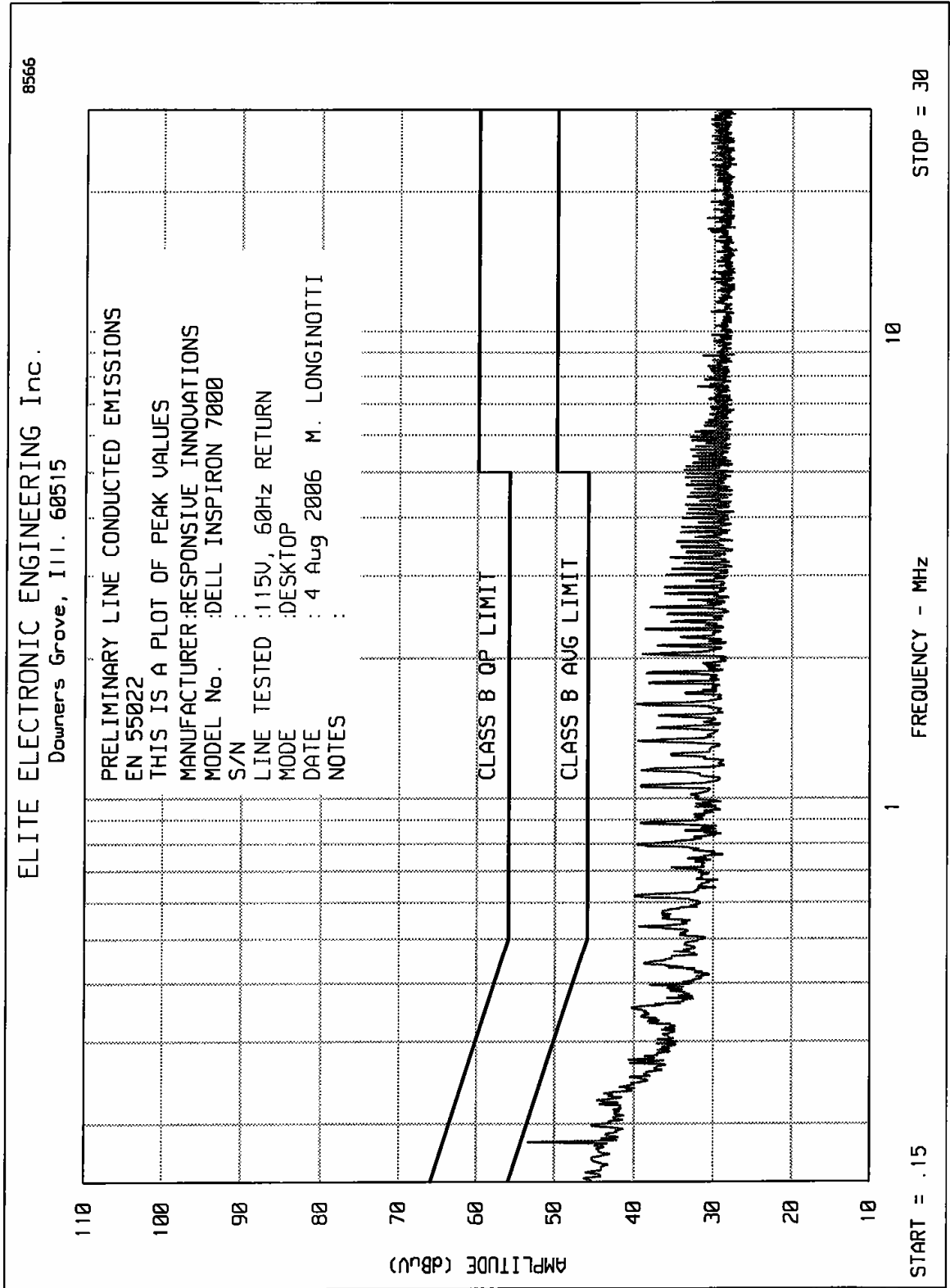


Test Set-up for Radiated Emissions – Horizontal Polarization



Test Set-up for Radiated Emissions – Vertical Polarization







ETR No.
ELITE ELECTRONIC ENGINEERING CO.

MANUFACTURER : RESPONSIVE INNOVATIONS
MODEL : DELL INSPIRON 7000
S/N :
SPECIFICATION : EN 55022, CLASS B
TEST : LINE CONDUCTED EMISSIONS
LINE TESTED : 115V, 60Hz HIGH
MODE : DESKTOP
DATE : 4 Aug 2006
NOTES :
RECEIVER : HP 8566 w/ HP85650A QP ADAPTOR
VALUES MEASURED WITH QP DETECTOR USING 9kHz BANDWIDTH

FREQUENCY MHz	METER RDG. dBuV	QP LIMIT dBuV	AVG RDG dBuV	AVG LIMIT dBuV	NOTES
.199	38.7	63.7		53.7	
.266	28.9	61.2		51.2	
.355	35.7	58.8		48.8	
.620	36.1	56.0		46.0	
.797	34.6	56.0		46.0	
.886	35.1	56.0		46.0	
1.063	35.0	56.0		46.0	
1.328	35.3	56.0		46.0	
1.858	34.0	56.0		46.0	
2.035	33.9	56.0		46.0	
2.831	32.3	56.0		46.0	
3.008	32.4	56.0		46.0	
3.096	31.4	56.0		46.0	
4.688	29.8	56.0		46.0	
4.953	29.5	56.0		46.0	
6.102	28.5	60.0		50.0	
9.486	25.6	60.0		50.0	
12.909	23.6	60.0		50.0	
16.113	23.4	60.0		50.0	
19.018	23.6	60.0		50.0	
20.582	23.6	60.0		50.0	
24.139	24.1	60.0		50.0	
28.031	25.1	60.0		50.0	

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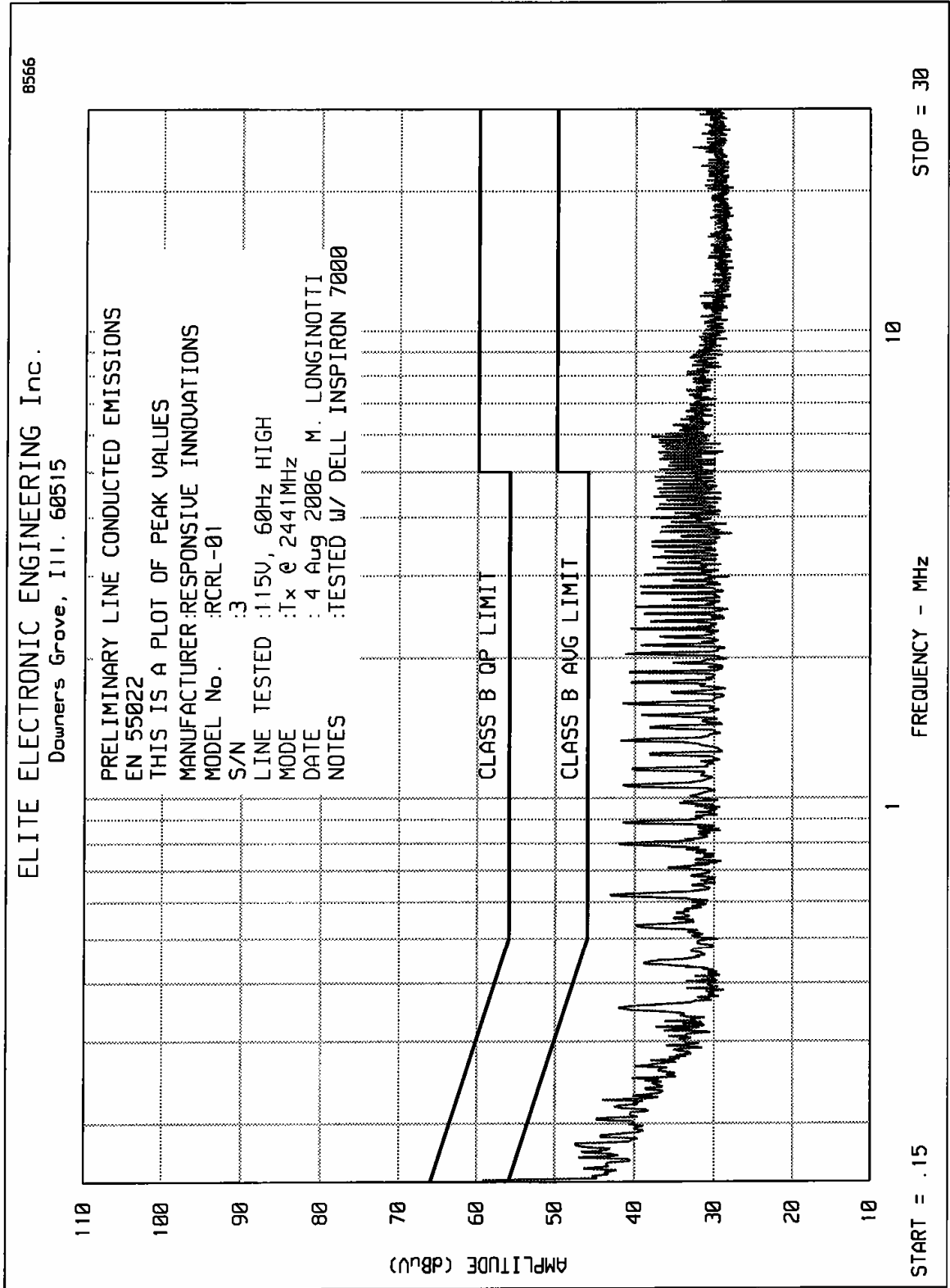


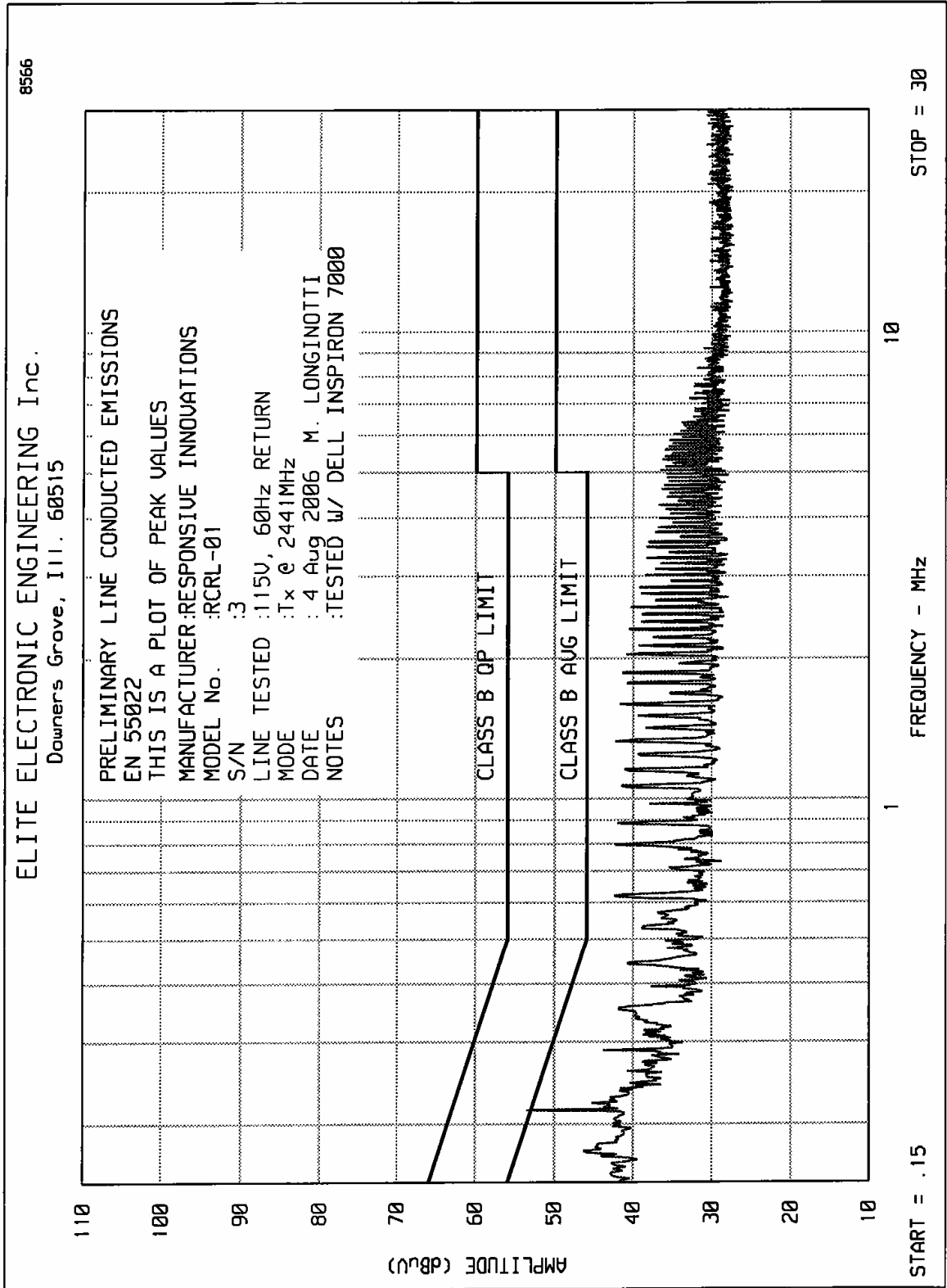
ETR No.
ELITE ELECTRONIC ENGINEERING CO.

MANUFACTURER : RESPONSIVE INNOVATIONS
MODEL : DELL INSPIRON 7000
S/N :
SPECIFICATION : EN 55022, CLASS B
TEST : LINE CONDUCTED EMISSIONS
LINE TESTED : 115V, 60Hz RETURN
MODE : DESKTOP
DATE : 4 Aug 2006
NOTES :
RECEIVER : HP 8566 w/ HP85650A QP ADAPTOR
VALUES MEASURED WITH QP DETECTOR USING 9kHz BANDWIDTH

FREQUENCY MHz	METER RDG. dBuV	QP LIMIT dBuV	AVG RDG dBuV	AVG LIMIT dBuV	NOTES
.172	36.8	64.8		54.8	
.266	29.5	61.3		51.3	
.355	35.1	58.8		48.8	
.620	35.7	56.0		46.0	
.797	34.7	56.0		46.0	
.886	35.2	56.0		46.0	
1.593	35.3	56.0		46.0	
2.035	34.5	56.0		46.0	
2.300	34.1	56.0		46.0	
2.565	33.6	56.0		46.0	
3.007	32.1	56.0		46.0	
3.272	31.6	56.0		46.0	
4.244	29.4	56.0		46.0	
4.952	29.1	56.0		46.0	
6.543	26.1	60.0		50.0	
9.284	24.0	60.0		50.0	
12.818	22.9	60.0		50.0	
16.093	22.9	60.0		50.0	
18.978	22.9	60.0		50.0	
20.230	22.9	60.0		50.0	
24.512	22.9	60.0		50.0	
27.848	23.6	60.0		50.0	

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M. LONGINOTTI







ETR No.
ELITE ELECTRONIC ENGINEERING CO.

MANUFACTURER : RESPONSIVE INNOVATIONS
MODEL : RCRL-01
S/N : 3
SPECIFICATION : EN 55022, CLASS B
TEST : LINE CONDUCTED EMISSIONS
LINE TESTED : 115V, 60Hz HIGH
MODE : Tx @ 2441MHz
DATE : 4 Aug 2006
NOTES : TESTED W/ DELL INSPIRON 7000
RECEIVER : HP 8566 w/ HP85650A QP ADAPTOR
VALUES MEASURED WITH QP DETECTOR USING 9kHz BANDWIDTH

FREQUENCY MHz	METER RDG. dBuV	QP LIMIT dBuV	AVG RDG dBuV	AVG LIMIT dBuV	NOTES
.150	35.8	66.0		56.0	
.267	30.2	61.2		51.2	
.355	37.8	58.8		48.8	
.621	38.5	56.0		46.0	
.798	37.6	56.0		46.0	
.886	37.6	56.0		46.0	
1.064	37.8	56.0		46.0	
1.329	38.1	56.0		46.0	
2.036	36.7	56.0		46.0	
2.568	36.0	56.0		46.0	
3.009	35.0	56.0		46.0	
4.424	32.4	56.0		46.0	
5.928	30.4	60.0		50.0	
6.018	31.0	60.0		50.0	
8.053	26.8	60.0		50.0	
10.706	24.0	60.0		50.0	
14.667	23.4	60.0		50.0	
17.518	23.3	60.0		50.0	
21.267	24.6	60.0		50.0	
24.773	23.4	60.0		50.0	
27.777	23.4	60.0		50.0	

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M. LONGINOTTI



ETR No.
ELITE ELECTRONIC ENGINEERING CO.

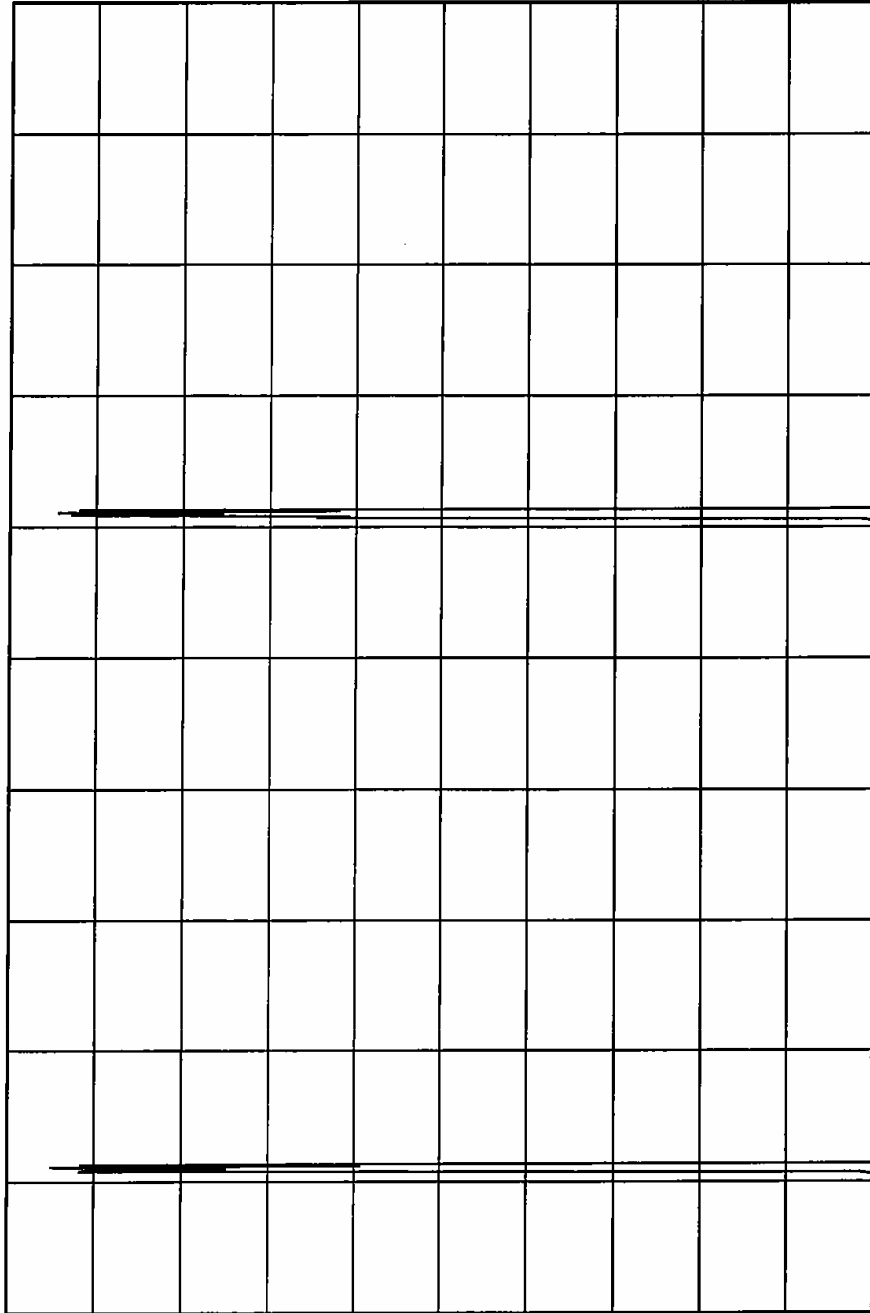
MANUFACTURER : RESPONSIVE INNOVATIONS
MODEL : RCRL-01
S/N : 3
SPECIFICATION : EN 55022, CLASS B
TEST : LINE CONDUCTED EMISSIONS
LINE TESTED : 115V, 60Hz RETURN
MODE : Tx @ 2441MHz
DATE : 4 Aug 2006
NOTES : TESTED W/ DELL INSPIRON 7000
RECEIVER : HP 8566 w/ HP85650A QP ADAPTOR
VALUES MEASURED WITH QP DETECTOR USING 9kHz BANDWIDTH

FREQUENCY MHz	METER RDG. dBuV	QP LIMIT dBuV	AVG RDG dBuV	AVG LIMIT dBuV	NOTES
.222	37.6	62.7		52.7	
.294	28.3	60.4		50.4	
.355	37.6	58.8		48.8	
.621	38.1	56.0		46.0	
.797	37.4	56.0		46.0	
.886	37.6	56.0		46.0	
1.329	38.4	56.0		46.0	
1.594	37.9	56.0		46.0	
1.859	36.9	56.0		46.0	
2.302	36.8	56.0		46.0	
2.567	36.0	56.0		46.0	
3.009	34.9	56.0		46.0	
3.275	34.4	56.0		46.0	
4.248	32.1	56.0		46.0	
4.689	32.0	56.0		46.0	
6.017	30.7	60.0		50.0	
9.643	23.8	60.0		50.0	
12.441	22.9	60.0		50.0	
15.831	22.9	60.0		50.0	
18.952	22.9	60.0		50.0	
21.269	24.5	60.0		50.0	
24.419	23.1	60.0		50.0	
27.958	23.3	60.0		50.0	

CHECKED BY: *Mark E Longinotti*
M. LONGINOTTI



ELITE ELECTRONIC ENGINEERING Co.
Downers Grove, IL 60515



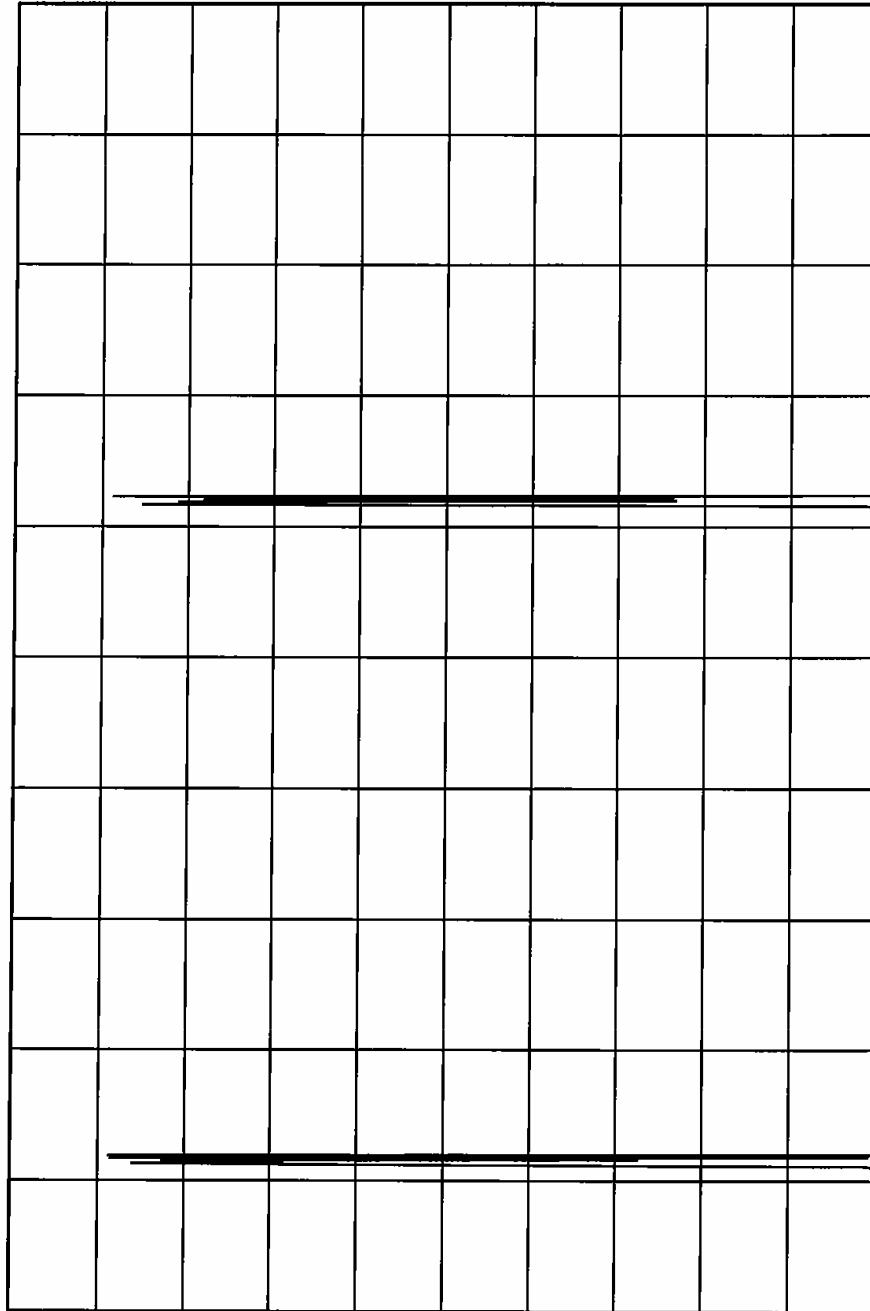
2 mSEC/DIV

TRANSMITTER DUTY CYCLE
 FREQUENCY : 2400.876 MHz
 ON TIME : .14 mSEC
 OFF TIME : 9.85 mSEC
 DUTY CYCLE = .01 or -40 dB
 COMPUTED OVER 1 DATA WORD

MANUFACTURER : RESPONSIVE INNOVATIONS
 MODEL : RCRL-01
 S/N : 4
 TEST DATE : 4 Aug 2006
 NOTES : Tx @ 2401MHz



ELITE ELECTRONIC ENGINEERING Co.
Dawners Grove, IL 60515



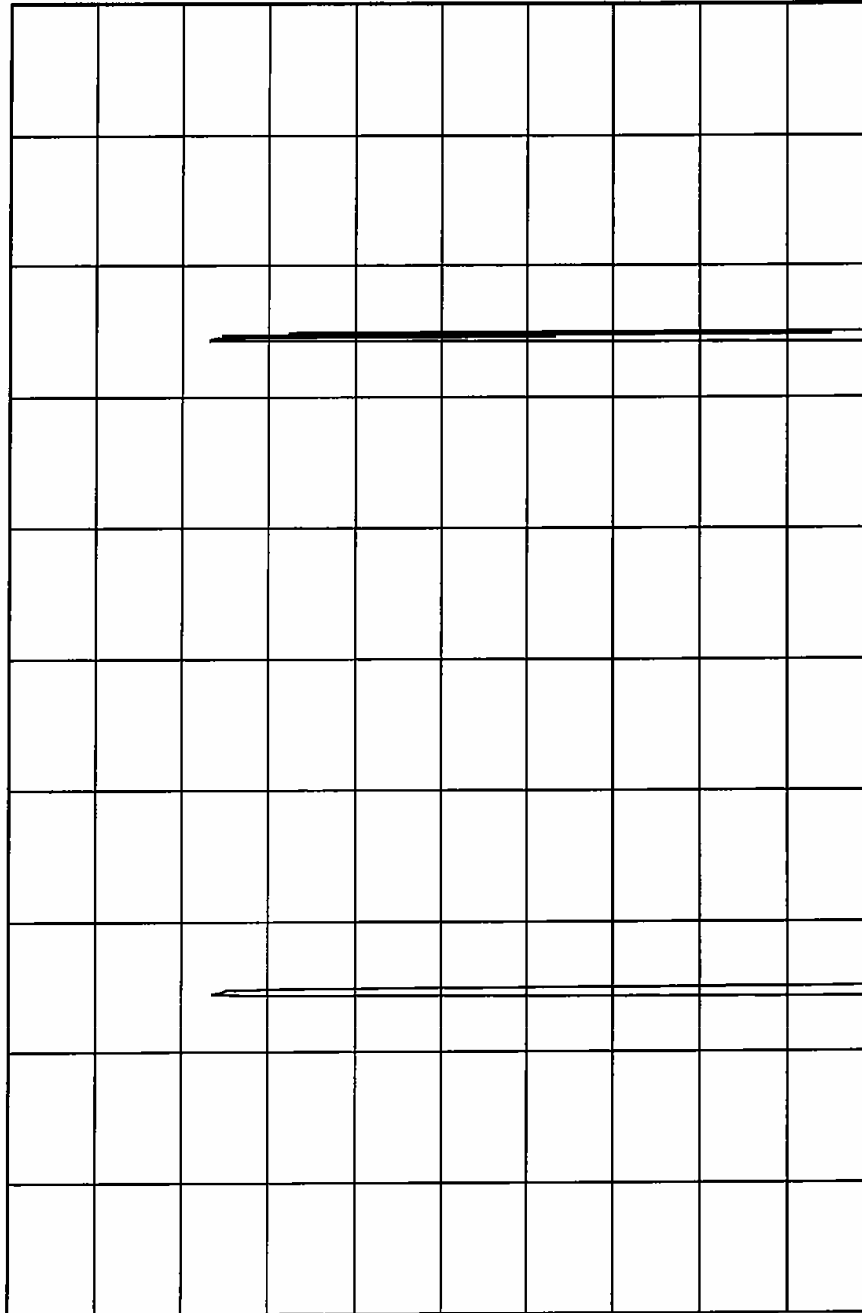
2 mSEC/DIV

MANUFACTURER : RESPONSIVE INNOVATIONS
 MODEL : RCRL-01
 S/N : 4
 TEST DATE : 31 Jul 2006
 NOTES : NORMAL PACKET SIZE

TRANSMITTER DUTY CYCLE
 FREQUENCY : 2441.03 MHz
 ON TIME : .14 mSEC
 OFF TIME : 9.97 mSEC
 DUTY CYCLE = .01 or -40 dB
 COMPUTED OVER 1 DATA WORD



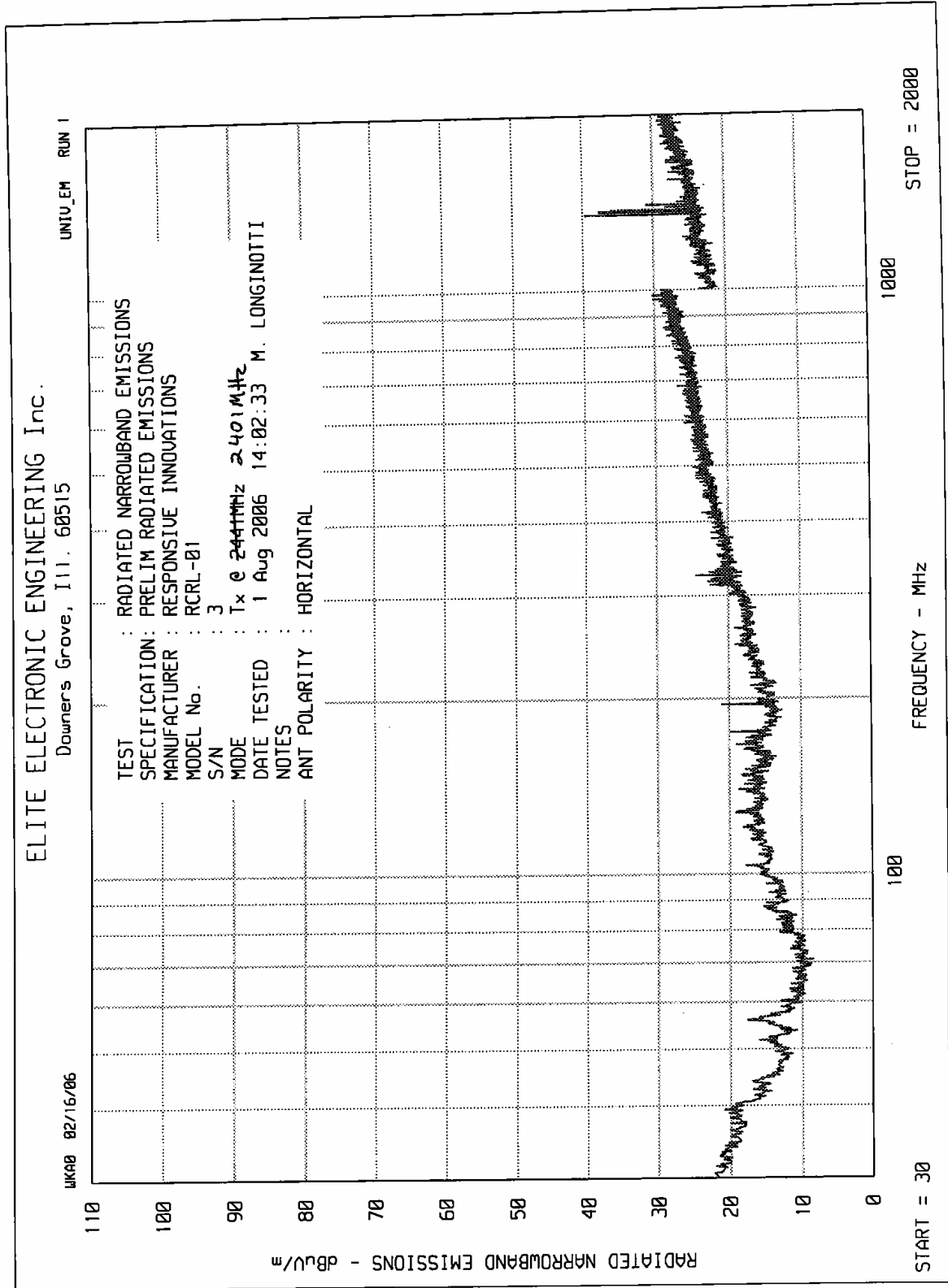
ELITE ELECTRONIC ENGINEERING Co.
Downers Grove, IL 60515

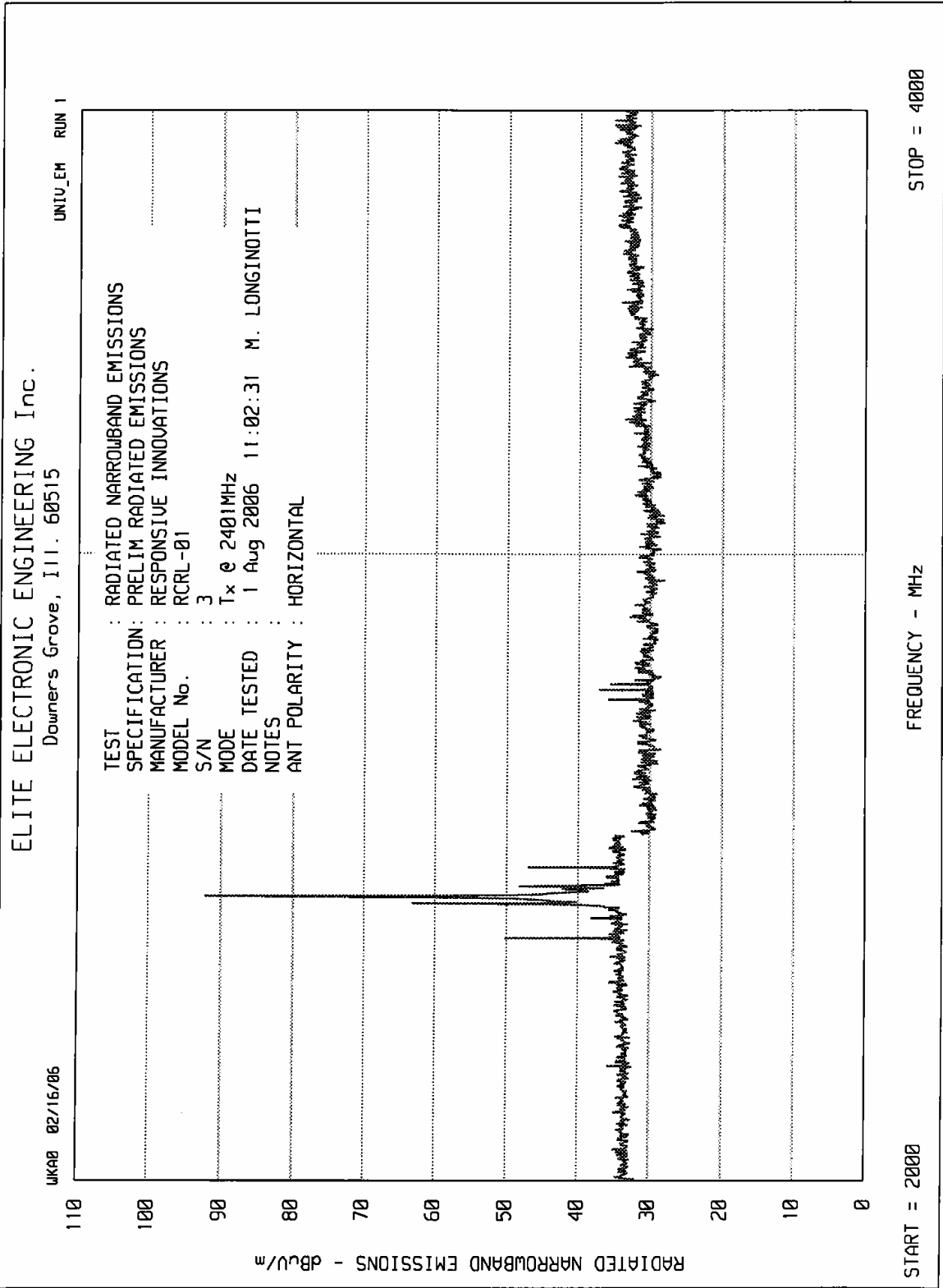


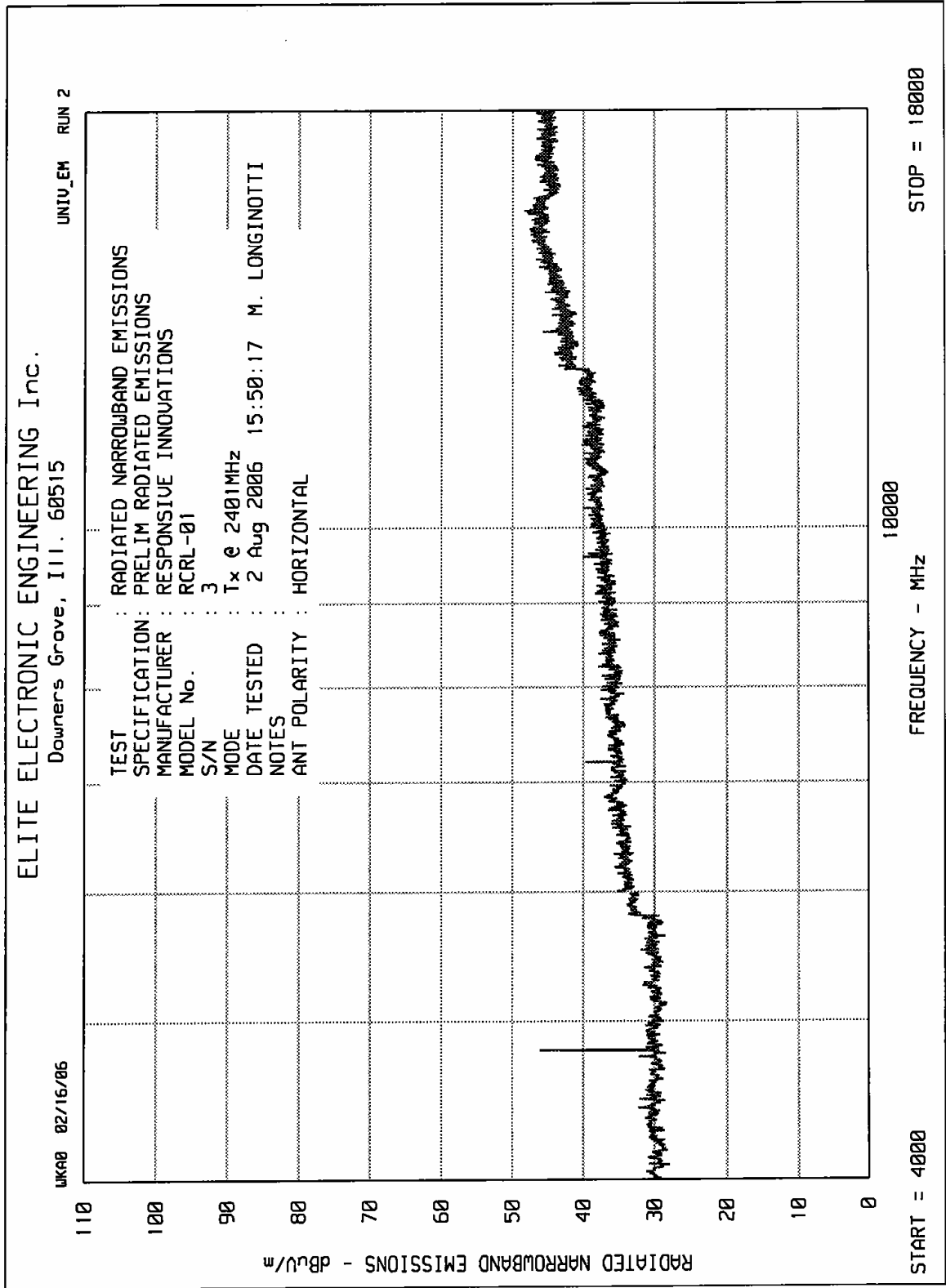
2 mSEC/DIV

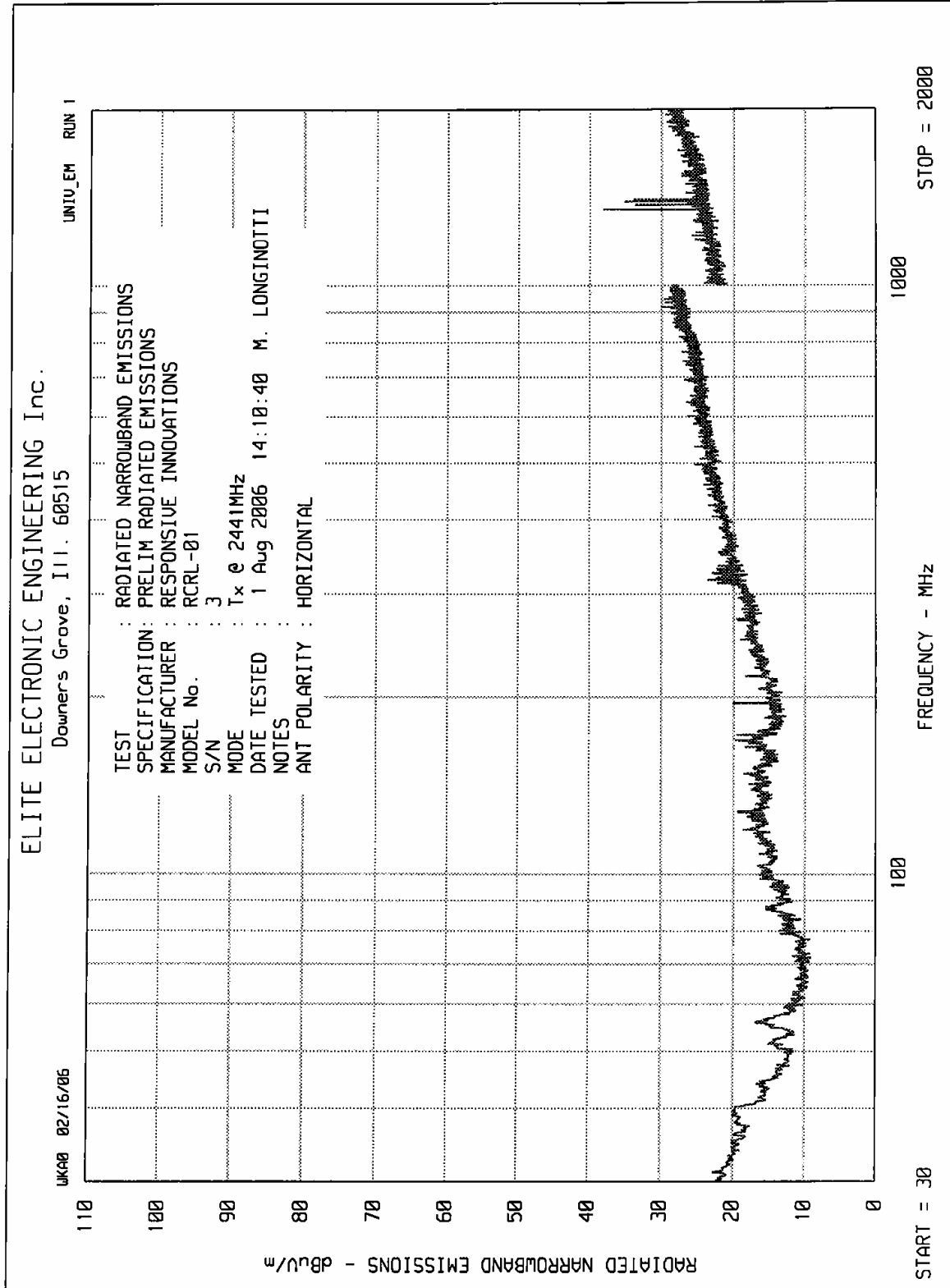
TRANSMITTER DUTY CYCLE
FREQUENCY : 2473.784 MHz
ON TIME : .14 mSEC
OFF TIME : 9.85 mSEC
DUTY CYCLE = .01 or -40 dB
COMPUTED OVER 1 DATA WORD

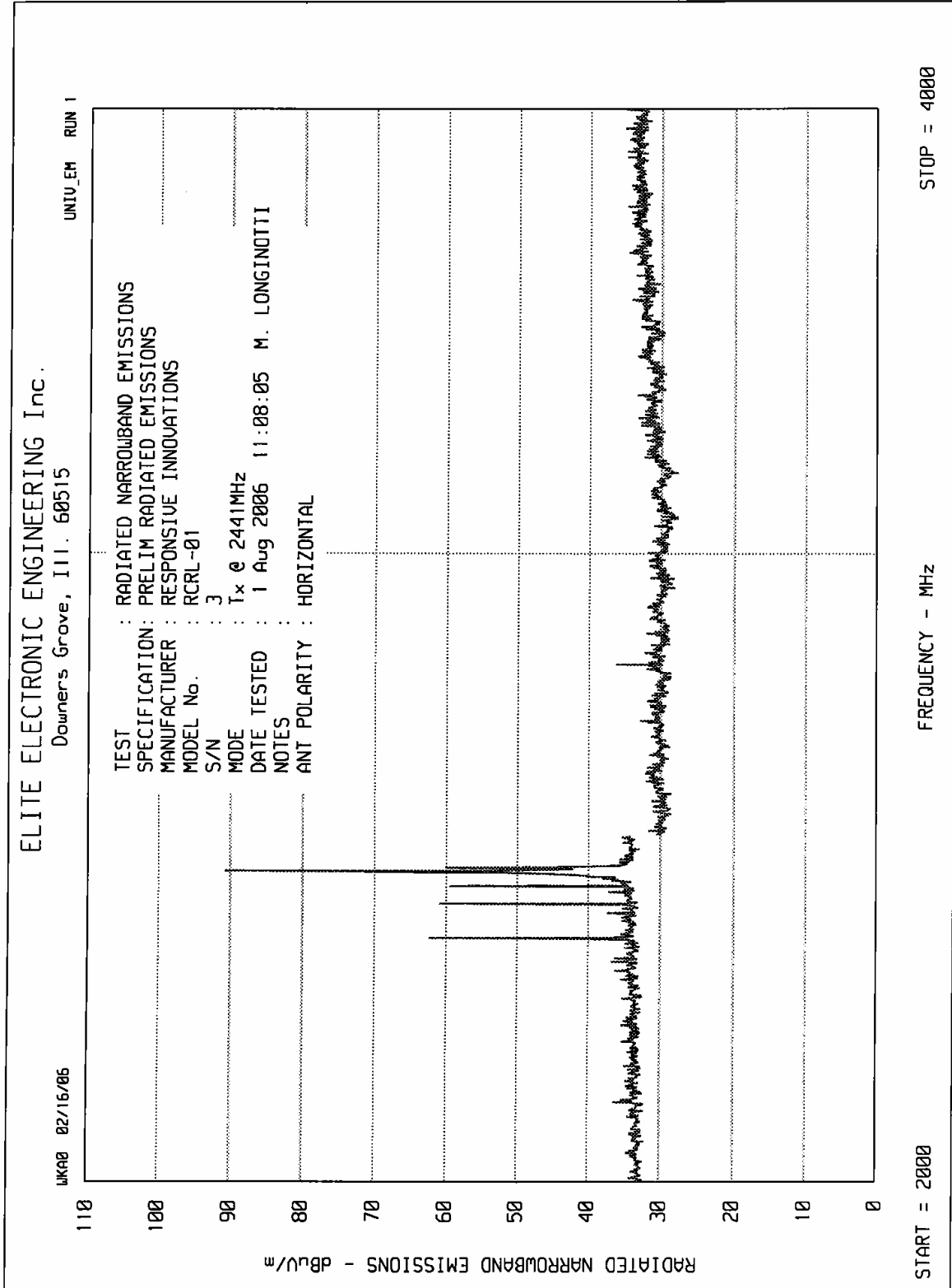
MANUFACTURER : RESPONSIVE INNOVATIONS
MODEL : RCRL-01
S/N : 4
TEST DATE : 4 Aug 2006
NOTES : Tx @ 2474MHz

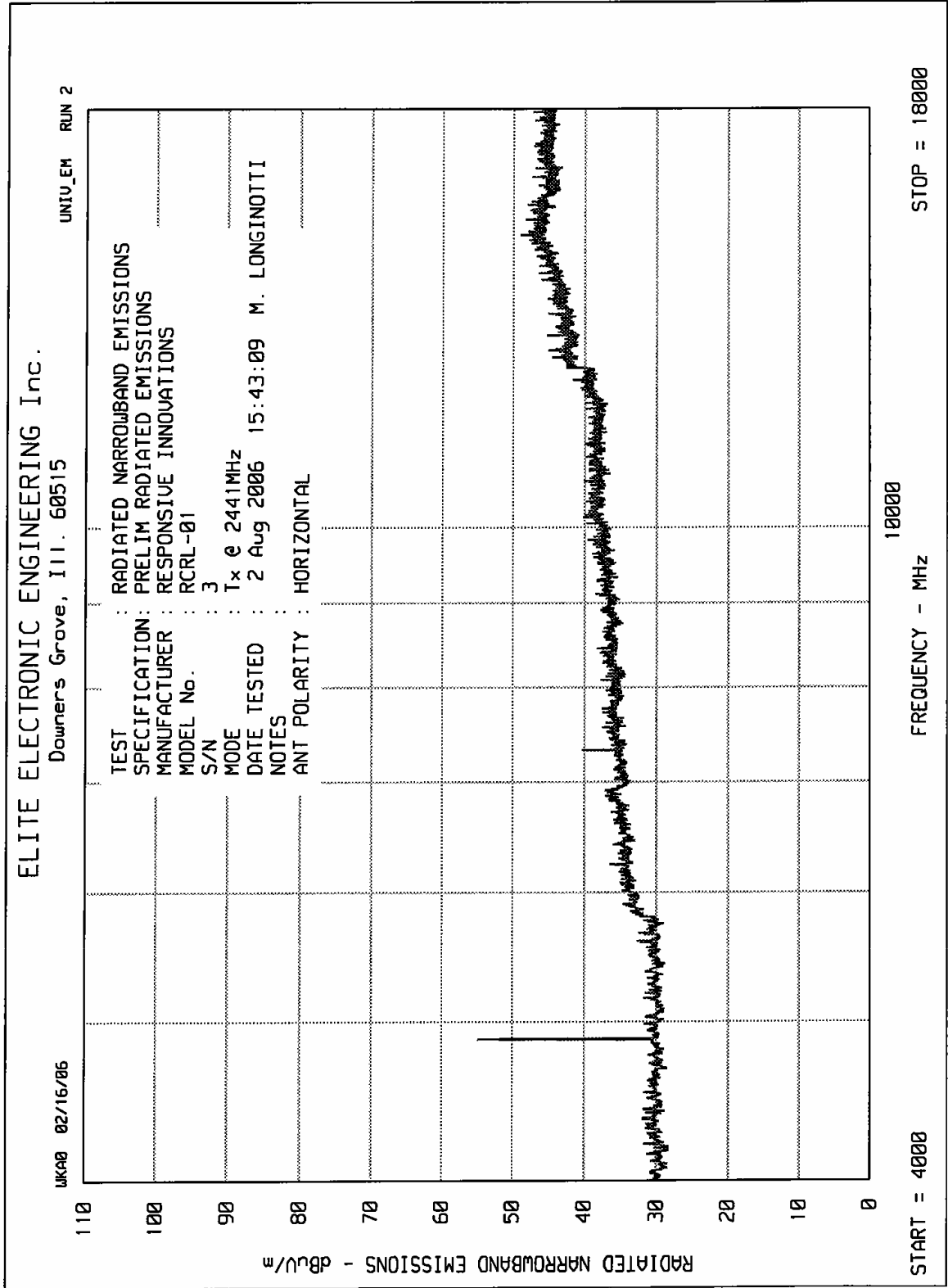


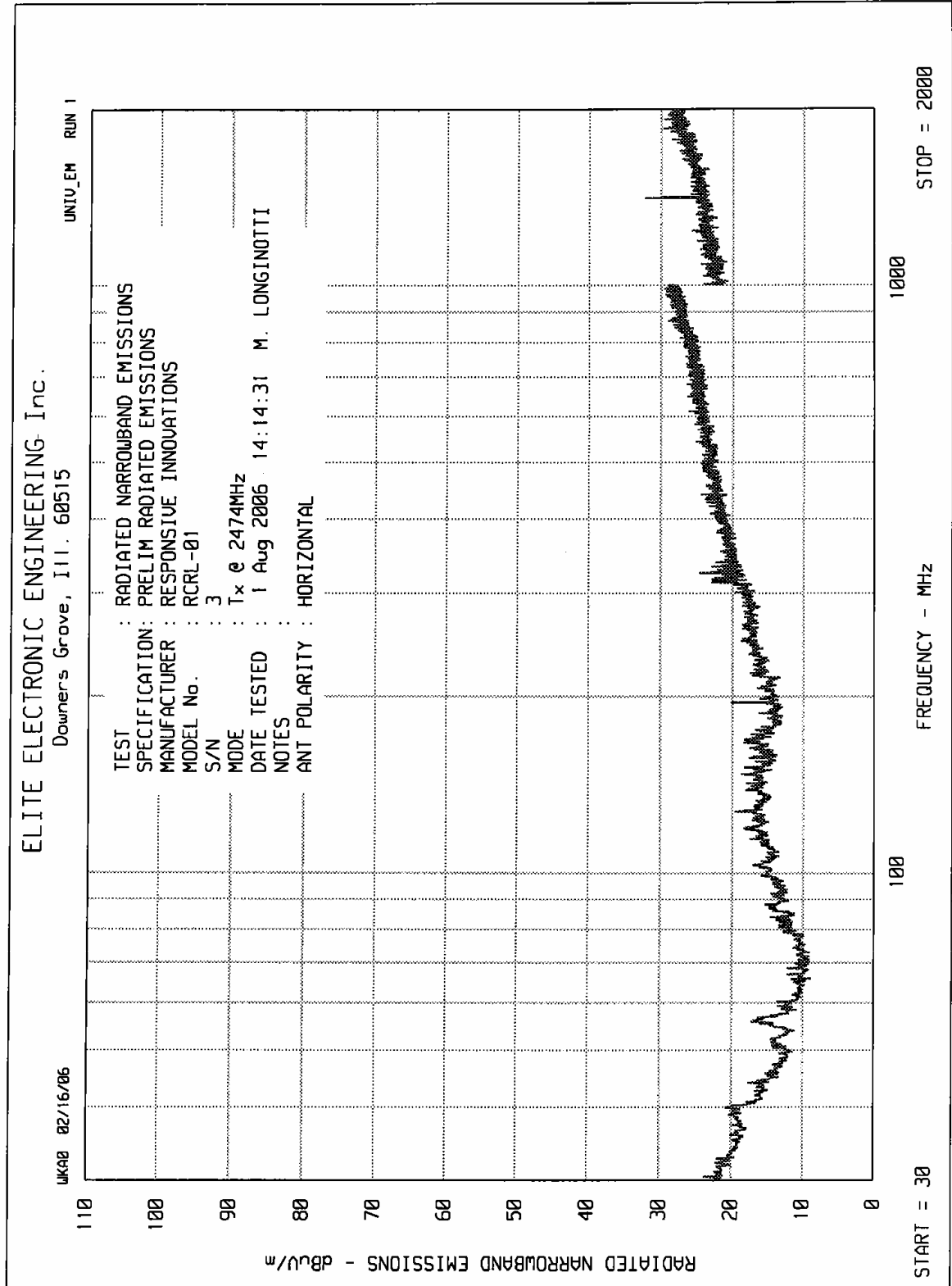


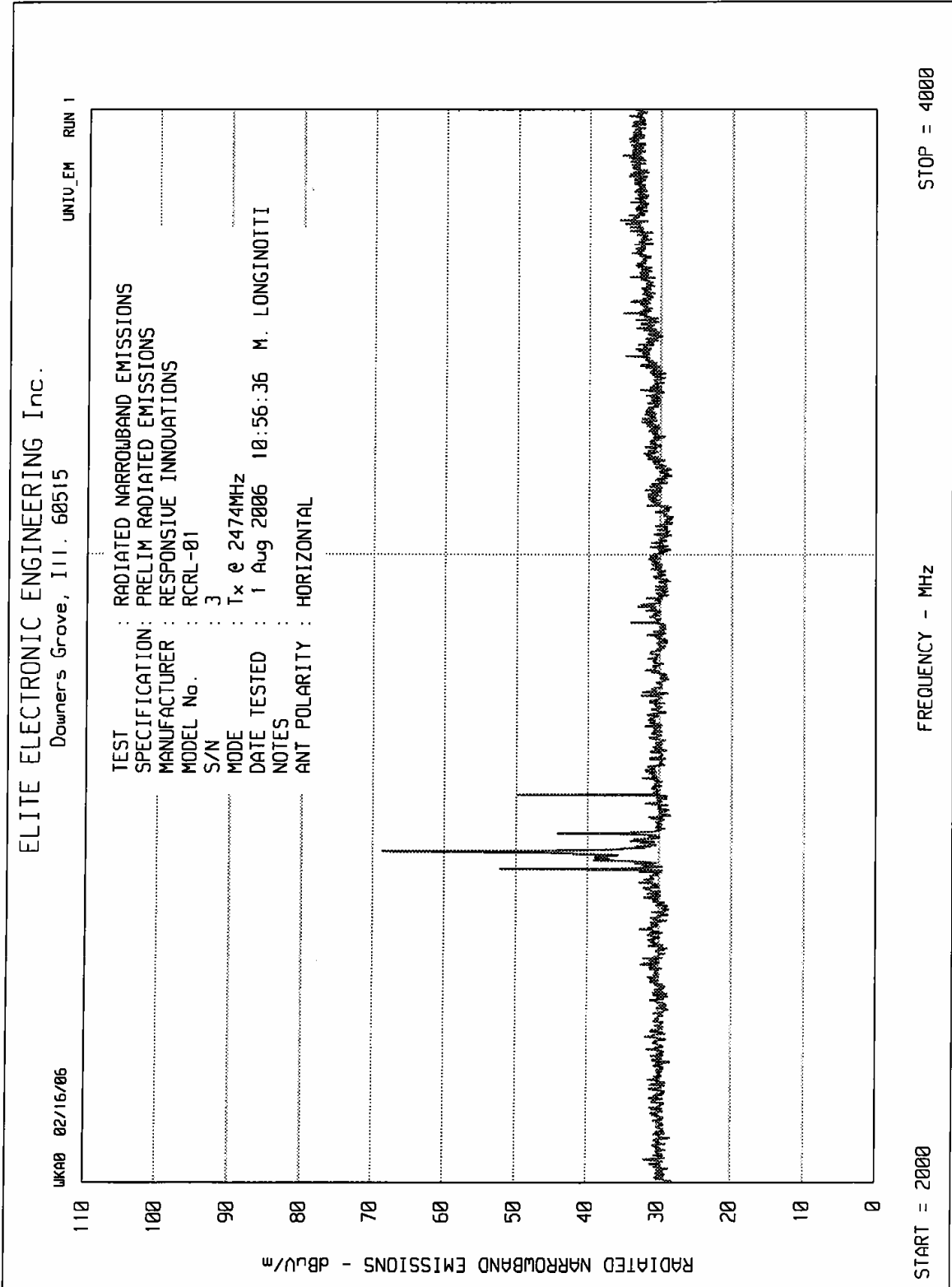


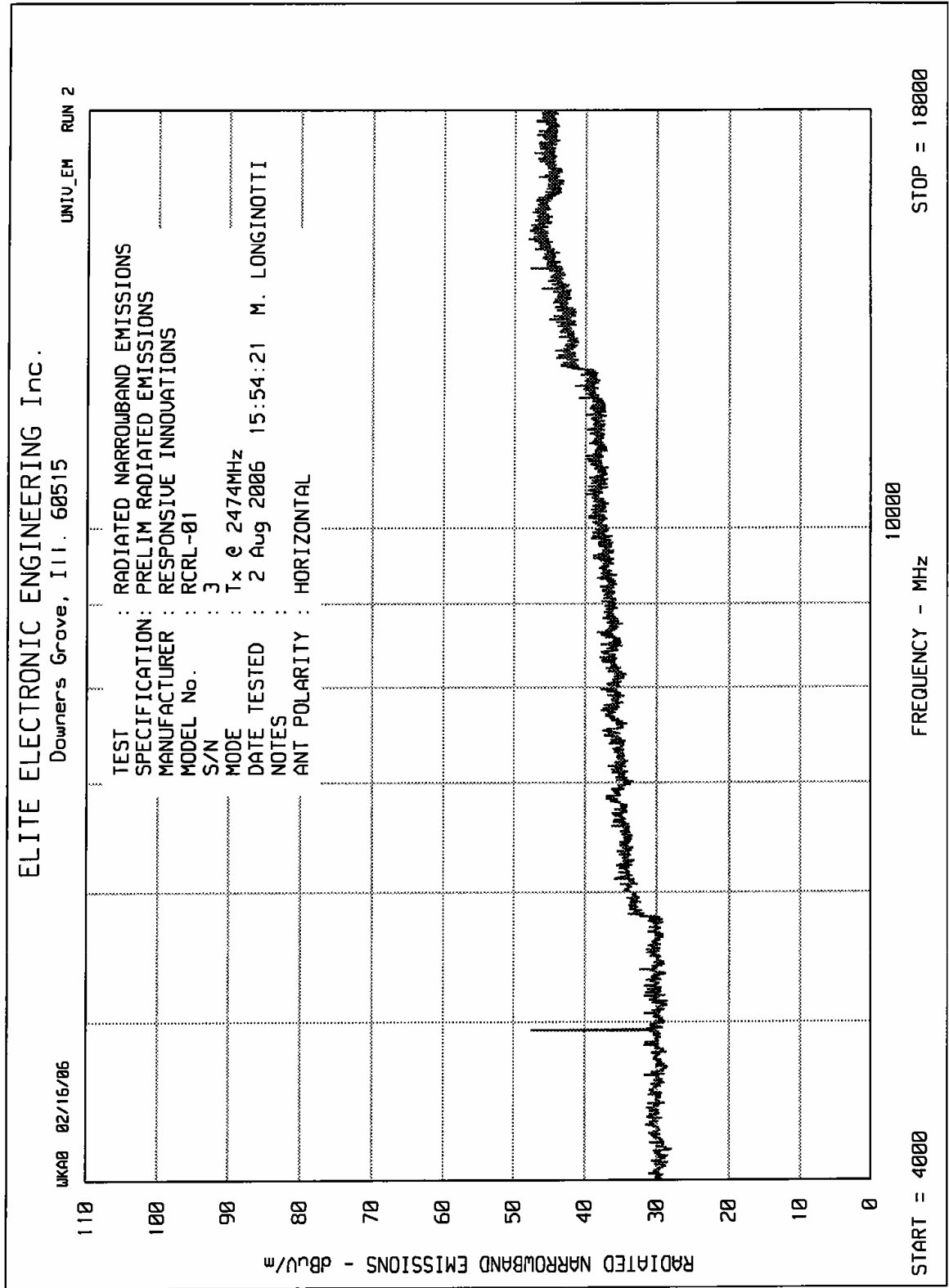














MANUFACTURER : Responsive Innovations
 MODEL NO. : RLLR-01
 SERIAL NO. : 3
 TEST SPECIFICATION : FCC 15.249, Radiated Emissions
 MODE : Transmit @ 2401MHz
 TEST DATE : July 31, 2006 through August 8, 2006
 TEST DISTANCE : 3 meters

Frequency MHz	Antenna Polarity	Peak Meter Reading dBuV	Ambient	Antenna Factor dB	Cable Loss* dB	Preamp Gain dB	Distance Correction Factor dB	Peak Total dBuV/m	Peak Limit dBuV/m
2401	H	71.8		31.4	3.5	0	0	106.7	114
2401	V	58.8		31.4	3.5	0	0	93.7	114
4802	H	21.5		34.5	4.9	0	0	60.9	74
4802	V	24.2		34.5	4.9	0	0	63.6	74
7203.0	H	41.6	Ambient	38.0	0.8	-31.4	0	49.0	74
7203.0	V	41.9	Ambient	38.0	0.8	-31.4	0	49.3	74
9604.0	H	45.2		39.7	0.9	-31.9	0	54.0	74
9604.0	V	41.2	Ambient	39.7	0.9	-31.9	0	50.0	74
12005.0	H	40.4	Ambient	41.4	1.0	-30.5	-9.5	42.8	74
12005.0	V	39.8	Ambient	41.4	1.0	-30.5	-9.5	42.2	74
14406.0	H	42.8	Ambient	43.7	1.2	-30.0	-9.5	48.2	74
14406.0	V	42.4	Ambient	43.7	1.2	-30.0	-9.5	47.8	74
16807.0	H	42.3	Ambient	44.6	1.2	-30.2	-9.5	48.5	74
16807.0	V	42.3	Ambient	44.6	1.2	-30.2	-9.5	48.5	74
19208.0	H	34.6	Ambient	45.6	1.1	-21.3	-9.5	50.5	74
19208.0	V	35.9	Ambient	45.6	1.1	-21.3	-9.5	51.8	74
21609.0	H	38.3	Ambient	46.2	4.4	-20.8	-9.5	58.6	74
21609.0	V	38.0	Ambient	46.2	4.4	-20.8	-9.5	58.3	74
24010.0	H	34.6	Ambient	45.8	2.3	-16.6	-9.5	56.6	74
24010.0	V	35.0	Ambient	45.8	2.3	-16.6	-9.5	57.0	74

V – Vertical

H – Horizontal

Peak Total = Peak Meter Reading + Antenna Factor + Cable Loss + Preamp Gain + Distance Correction

Checked By : MARK E. LONGINOTTI



MANUFACTURER : Responsive Innovations
 MODEL NO. : RLLR-01
 SERIAL NO. : 3
 TEST SPECIFICATION : FCC 15.249, Radiated Emissions
 MODE : Transmit @ 2401MHz
 TEST DATE : July 31, 2006 through August 8, 2006
 TEST DISTANCE : 3 meters

Frequency MHz	Antenna Polarity	Peak Meter Reading dBuV	Ambient	Antenna Factor dB	Cable Loss* dB	Preamp Gain dB	Distance Correction Factor dB	Duty Cycle Corr. Factor dB	Average Total dBuV/m	Average Limit dBuV/m
2401	H	71.8		31.4	3.5	0	0	-40	66.7	94
2401	V	58.8		31.4	3.5	0	0	-40	53.7	94
4802	H	21.5		34.5	4.9	0	0	-40	20.9	54
4802	V	24.2		34.5	4.9	0	0	-40	23.6	54
7203.0	H	41.6	Ambient	38.0	0.8	-31.4	0	-40	9.0	54
7203.0	V	41.9	Ambient	38.0	0.8	-31.4	0	-40	9.3	54
9604.0	H	45.2		39.7	0.9	-31.9	0	-40	14.0	54
9604.0	V	41.2	Ambient	39.7	0.9	-31.9	0	-40	10.0	54
12005.0	H	40.4	Ambient	41.4	1.0	-30.5	-9.5	-40	2.8	54
12005.0	V	39.8	Ambient	41.4	1.0	-30.5	-9.5	-40	2.2	54
14406.0	H	42.8	Ambient	43.7	1.2	-30.0	-9.5	-40	8.2	54
14406.0	V	42.4	Ambient	43.7	1.2	-30.0	-9.5	-40	7.8	54
16807.0	H	42.3	Ambient	44.6	1.2	-30.2	-9.5	-40	8.5	54
16807.0	V	42.3	Ambient	44.6	1.2	-30.2	-9.5	-40	8.5	54
19208.0	H	34.6	Ambient	45.6	1.1	-21.3	-9.5	-40	10.5	54
19208.0	V	35.9	Ambient	45.6	1.1	-21.3	-9.5	-40	11.8	54
21609.0	H	38.3	Ambient	46.2	4.4	-20.8	-9.5	-40	18.6	54
21609.0	V	38.0	Ambient	46.2	4.4	-20.8	-9.5	-40	18.3	54
24010.0	H	34.6	Ambient	45.8	2.3	-16.6	-9.5	-40	16.6	54
24010.0	V	35.0	Ambient	45.8	2.3	-16.6	-9.5	-40	17.0	54

V – Vertical

H – Horizontal

Average Total = Peak Meter Reading + Antenna Factor + Cable Loss + Preamp Gain + Distance Correction Factor + Duty Cycle Correction Factor

Checked By : MARK E. LONGINOTTI



MANUFACTURER : Responsive Innovations
 MODEL NO. : RLLR-01
 SERIAL NO. : 3
 TEST SPECIFICATION : FCC 15.249, Radiated Emissions
 MODE : Transmit @ 2441MHz
 TEST DATE : July 31, 2006 through August 8, 2006
 TEST DISTANCE : 3 meters

Frequency MHz	Antenna Polarity	Peak Meter Reading dBuV	Ambient	Antenna Factor dB	Cable Loss* dB	Preamp Gain dB	Distance Correction Factor dB	Peak Total dBuV/m	Peak Limit dBuV/m
2441.0	H	70.5		31.4	3.5	0.0	0.0	105.4	114.0
2441.0	V	57.6		31.4	3.5	0.0	0.0	92.5	114.0
4882.0	H	22.5		34.5	5.0	0.0	0.0	62.0	74.0
4882.0	V	22.7		34.5	5.0	0.0	0.0	62.2	74.0
7323.0	H	48.1		38.1	0.8	-31.4	0.0	55.5	74.0
7323.0	V	47.3		38.1	0.8	-31.4	0.0	54.7	74.0
9764.0	H	41.2	Ambient	39.9	0.9	-31.9	0.0	50.1	74.0
9764.0	V	41.7	Ambient	39.9	0.9	-31.9	0.0	50.6	74.0
12205.0	H	42.0	Ambient	41.4	1.0	-30.4	-9.5	44.5	74.0
12205.0	V	41.8	Ambient	41.4	1.0	-30.4	-9.5	44.3	74.0
14646.0	H	42.3	Ambient	44.1	1.2	-29.9	-9.5	48.1	74.0
14646.0	V	41.7	Ambient	44.1	1.2	-29.9	-9.5	47.5	74.0
17087.0	H	42.7	Ambient	44.5	1.3	-30.5	-9.5	48.5	74.0
17087.0	V	42.8	Ambient	44.5	1.3	-30.5	-9.5	48.6	74.0
19528.0	H	36.5	Ambient	45.8	1.5	-20.9	-9.5	53.4	74.0
19528.0	V	35.8	Ambient	45.8	1.5	-20.9	-9.5	52.7	74.0
21969.0	H	37.6	Ambient	46.4	2.1	-19.0	-9.5	57.6	74.0
21969.0	V	37.3	Ambient	46.4	2.1	-19.0	-9.5	57.3	74.0
24410.0	H	35.5	Ambient	46.2	3.0	-15.9	-9.5	59.3	74.0
24410.0	V	35.8	Ambient	46.2	3.0	-15.0	-9.5	60.5	74.0

V – Vertical

H – Horizontal

Peak Total = Peak Meter Reading + Antenna Factor + Cable Loss + Preamp Gain + Distance Correction

Checked By : MARK E. LONGINOTTI



MANUFACTURER : Responsive Innovations
 MODEL NO. : RLLR-01
 SERIAL NO. : 3
 TEST SPECIFICATION : FCC 15.249, Radiated Emissions
 MODE : Transmit @ 2441MHz
 TEST DATE : July 31, 2006 through August 8, 2006
 TEST DISTANCE : 3 meters

Frequency MHz	Antenna Polarity	Peak Meter Reading dBuV	Ambient	Antenna Factor dB	Cable Loss* dB	Preamp Gain dB	Distance Correction Factor dB	Duty Cycle Corr. Factor dB	Average Total dBuV/m	Average Limit dBuV/m
2441.0	H	70.5		31.4	3.5	0.0	0.0	-40	65.4	94
2441.0	V	57.6		31.4	3.5	0.0	0.0	-40	52.5	94
4882.0	H	22.5		34.5	5.0	0.0	0.0	-40	22.0	54
4882.0	V	22.7		34.5	5.0	0.0	0.0	-40	22.2	54
7323.0	H	48.1		38.1	0.8	-31.4	0.0	-40	15.5	54
7323.0	V	47.3		38.1	0.8	-31.4	0.0	-40	14.7	54
9764.0	H	41.2	Ambient	39.9	0.9	-31.9	0.0	-40	10.1	54
9764.0	V	41.7	Ambient	39.9	0.9	-31.9	0.0	-40	10.6	54
12205.0	H	42.0	Ambient	41.4	1.0	-30.4	-9.5	-40	4.5	54
12205.0	V	41.8	Ambient	41.4	1.0	-30.4	-9.5	-40	4.3	54
14646.0	H	42.3	Ambient	44.1	1.2	-29.9	-9.5	-40	8.1	54
14646.0	V	41.7	Ambient	44.1	1.2	-29.9	-9.5	-40	7.5	54
17087.0	H	42.7	Ambient	44.5	1.3	-30.5	-9.5	-40	8.5	54
17087.0	V	42.8	Ambient	44.5	1.3	-30.5	-9.5	-40	8.6	54
19528.0	H	36.5	Ambient	45.8	1.5	-20.9	-9.5	-40	13.4	54
19528.0	V	35.8	Ambient	45.8	1.5	-20.9	-9.5	-40	12.7	54
21969.0	H	37.6	Ambient	46.4	2.1	-19.0	-9.5	-40	17.6	54
21969.0	V	37.3	Ambient	46.4	2.1	-19.0	-9.5	-40	17.3	54
24410.0	H	35.5	Ambient	46.2	3.0	-15.9	-9.5	-40	19.3	54
24410.0	V	35.8	Ambient	46.2	3.0	-15.0	-9.5	-40	20.5	54

V – Vertical

H – Horizontal

Average Total = Peak Meter Reading + Antenna Factor + Cable Loss + Preamp Gain + Distance
 Correction Factor + Duty Cycle Correction Factor

Checked By : MARK E. LONGINOTTI



MANUFACTURER : Responsive Innovations
 MODEL NO. : RLLR-01
 SERIAL NO. : 3
 TEST SPECIFICATION : FCC 15.249, Radiated Emissions
 MODE : Transmit @ 2474MHz
 TEST DATE : July 31, 2006 through August 8, 2006
 TEST DISTANCE : 3 meters

Frequency MHz	Antenna Polarity	Peak Meter Reading dBuV	Ambient	Antenna Factor dB	Cable Loss* dB	Preamp Gain dB	Distance Correction Factor dB	Peak Total dBuV/m	Peak Limit dBuV/m
2474.0	H	69.6		31.4	3.5	0.0	0.0	104.5	114.0
2474.0	V	56.5		31.4	3.5	0.0	0.0	91.4	114.0
4948.0	H	23.1		34.5	5.0	0.0	0.0	62.6	74.0
4948.0	V	25.4		34.5	5.0	0.0	0.0	64.9	74.0
7422.0	H	41.9	Ambient	38.1	0.8	-31.5	0.0	49.3	74.0
7422.0	V	41.3	Ambient	38.1	0.8	-31.5	0.0	48.7	74.0
9896.0	H	40.8	Ambient	40.0	0.9	-31.9	0.0	49.8	74.0
9896.0	V	40.4	Ambient	40.0	0.9	-31.9	0.0	49.4	74.0
12370.0	H	39.5	Ambient	41.3	1.1	-30.3	-9.5	42.1	74.0
12370.0	V	40.5	Ambient	41.3	1.1	-30.3	-9.5	43.1	74.0
14844.0	H	41.8	Ambient	44.4	1.2	-29.9	-9.5	48.0	74.0
14844.0	V	42.3	Ambient	44.4	1.2	-29.9	-9.5	48.5	74.0
17318.0	H	42.3	Ambient	44.4	1.3	-30.7	-9.5	47.8	74.0
17318.0	V	42.2	Ambient	44.4	1.3	-30.7	-9.5	47.7	74.0
19792.0	H	35.4	Ambient	45.9	1.0	-20.2	-9.5	52.6	74.0
19792.0	V	36.7	Ambient	45.9	1.0	-20.2	-9.5	53.9	74.0
22266.0	H	36.0	Ambient	46.5	3.0	-19.0	-9.5	57.0	74.0
22266.0	V	36.4	Ambient	46.5	3.0	-19.0	-9.5	57.4	74.0
24740.0	H	36.1	Ambient	46.5	8.8	-18.6	-9.5	63.3	74.0
24740.0	V	36.0	Ambient	46.5	8.8	-18.6	-9.5	63.2	74.0

V – Vertical

H – Horizontal

Peak Total = Peak Meter Reading + Antenna Factor + Cable Loss + Preamp Gain + Distance Correction

Checked By : MARK E. LONGINOTTI



MANUFACTURER : Responsive Innovations
 MODEL NO. : RLLR-01
 SERIAL NO. : 3
 TEST SPECIFICATION : FCC 15.249, Radiated Emissions
 MODE : Transmit @ 2474MHz
 TEST DATE : July 31, 2006 through August 8, 2006
 TEST DISTANCE : 3 meters

Frequency MHz	Antenna Polarity	Peak Meter Reading dBuV	Ambient	Antenna Factor dB	Cable Loss* dB	Preamp Gain dB	Distance Correction Factor dB	Duty Cycle Corr. Factor dB	Average Total dBuV/m	Average Limit dBuV/m
2474	H	69.6		31.4	3.5	0	0	-40	64.5	94
2474	V	56.5		31.4	3.5	0	0	-40	51.4	94
4948	H	23.1		34.5	5	0	0	-40	22.6	54
4948	V	25.4		34.5	5	0	0	-40	24.9	54
7422.0	H	41.9	Ambient	38.1	0.8	-31.5	0	-40	9.3	54
7422.0	V	41.3	Ambient	38.1	0.8	-31.5	0	-40	8.7	54
9896.0	H	40.8	Ambient	40.0	0.9	-31.9	0	-40	9.8	54
9896.0	V	40.4	Ambient	40.0	0.9	-31.9	0	-40	9.4	54
12370.0	H	39.5	Ambient	41.3	1.1	-30.3	-9.5	-40	2.1	54
12370.0	V	40.5	Ambient	41.3	1.1	-30.3	-9.5	-40	3.1	54
14844.0	H	41.8	Ambient	44.4	1.2	-29.9	-9.5	-40	8.0	54
14844.0	V	42.3	Ambient	44.4	1.2	-29.9	-9.5	-40	8.5	54
17318.0	H	42.3	Ambient	44.4	1.3	-30.7	-9.5	-40	7.8	54
17318.0	V	42.2	Ambient	44.4	1.3	-30.7	-9.5	-40	7.7	54
19792.0	H	35.4	Ambient	45.9	1.0	-20.2	-9.5	-40	12.6	54
19792.0	V	36.7	Ambient	45.9	1.0	-20.2	-9.5	-40	13.9	54
22266.0	H	36.0	Ambient	46.5	3.0	-19.0	-9.5	-40	17.0	54
22266.0	V	36.4	Ambient	46.5	3.0	-19.0	-9.5	-40	17.4	54
24740.0	H	36.1	Ambient	46.5	8.8	-18.6	-9.5	-40	23.3	54
24740.0	V	36.0	Ambient	46.5	8.8	-18.6	-9.5	-40	23.2	54

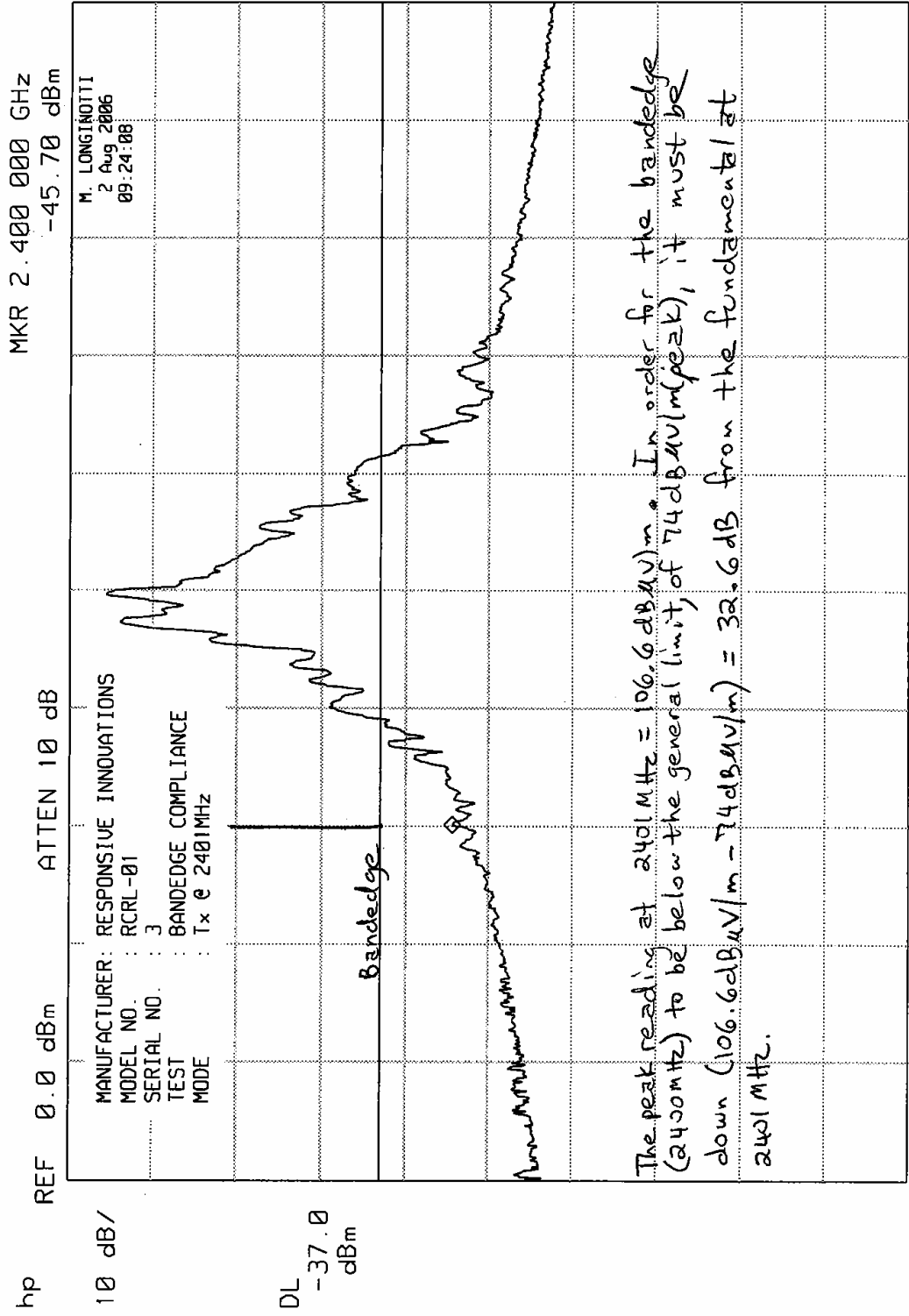
V – Vertical

H – Horizontal

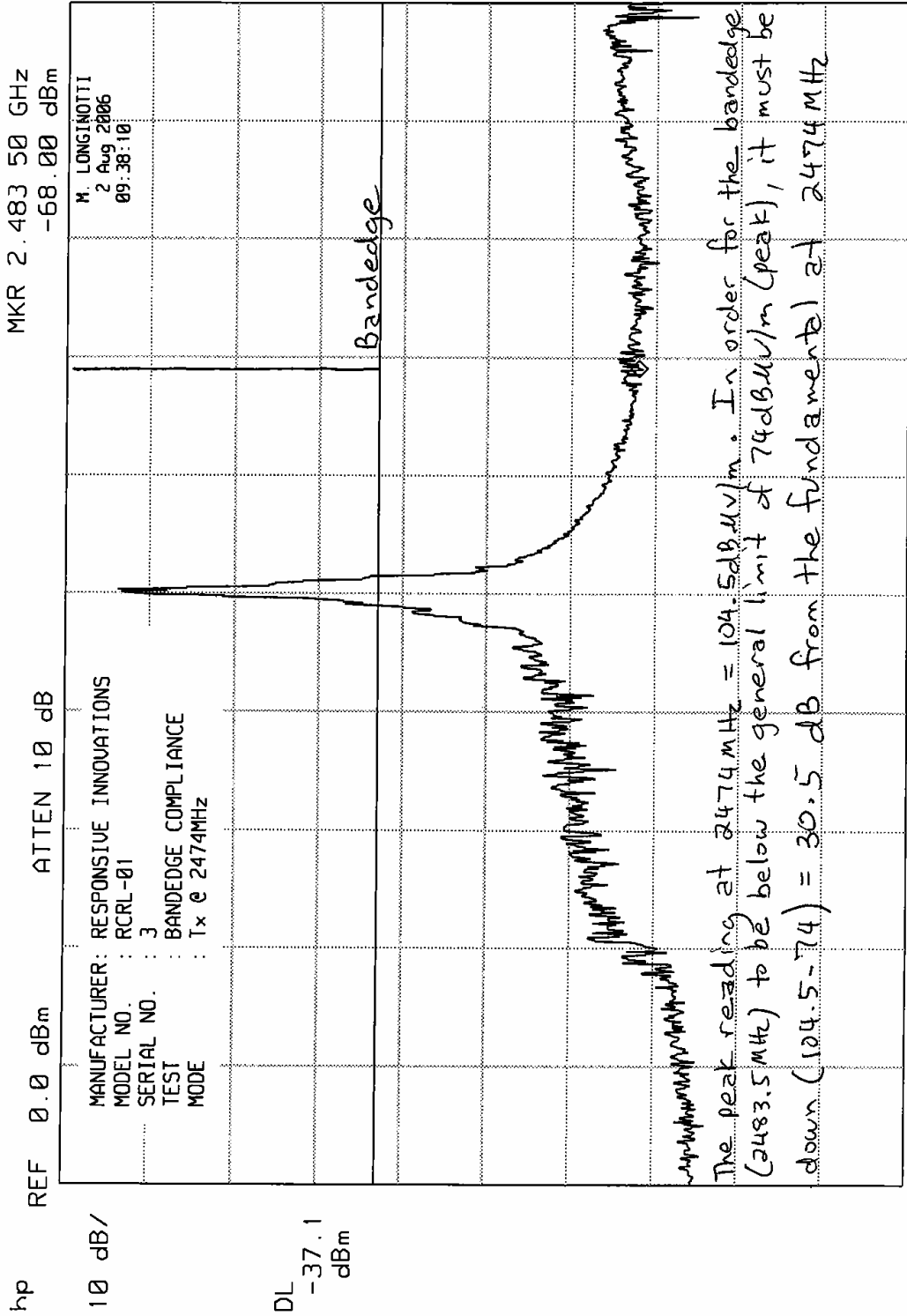
Average Total = Peak Meter Reading + Antenna Factor + Cable Loss + Preamp Gain + Distance Correction Factor + Duty Cycle Correction Factor

Checked By : MARK E. LONGINOTTI

ELITE ELECTRONIC ENGINEERING Inc.



ELITE ELECTRONIC ENGINEERING Inc.



CENTER 2.474 0 GHz SPAN 50.0 MHz
 RES BW 30 kHz(i) VBW 300 kHz SWP 375 msec