Measurement of RF Interference from a Model 940 Universal Multi-Frequency Keypad Transmitter

For	:	The Chamberlain Group, Inc. 845 Larch Ave Elmhurst, IL 60126
P.O. No.	:	862519
Date Tested	:	May 27 through June 19, 2009
Test Personnel	:	Richard King
Specification	:	FCC "Code of Federal Regulations" Title 47 Part 15, Subpart C
	:	Industry Canada RSS-210
	:	Industry Canada RSS-GEN

Test Report By : Richard King

Approved By : Craig W. Fanning
Sr. EMC Engineer
iNARTE®: ATL-0188-E
and EMC-000296-NT

Elite Electronic Engineering Inc.
1516 Centre Circle
Downers Grove, IL 60515
Tel : (630) 495-9770
Fax: (630) 495-9785
www.elitetest.com

TABLE OF CONTENTS

Revision History

Revision	Date	Description
—	June 22, 2009	Initial release

Measurement of RF Emissions from a Model 940 Universal Multi-Frequency Keypad Transmitter Part No. 001C6805-1

1 INTRODUCTION

1.1 Scope of Tests

This document represents the results of the series of radio interference measurements performed on a model 940 Universal Multi-Frequency Keypad transmitter, Part No. 001C6805-1, Serial No. N/A (hereinafter referred to as the test item). The test item was designed to transmit at approximately 315 and 390 MHz using an internal. The test item was manufactured and submitted for testing by The Chamberlain Group, Inc. located in Elmhurst, 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 C63.4-2003.

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 22.1°C and the relative humidity was 34%.

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 2008

- 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 6, September 2005, “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 1, September 2005, “Spectrum Management and Telecommunications Radio Standards Specification, General Requirements and Information for the Certification of radio communication equipment”

3 TEST ITEM SET-UP AND OPERATION

3.1 General Description

The test item is a model 940 Universal Multi-Frequency Keypad , Part No. 001C6805-1. A block diagram of the test item set-up is shown as Figure 1.

3.1.1 Power Input

The test item obtained 9VDC from a 9 volt battery.

3.1.2 Peripheral Equipment

The test item does not require peripheral equipment to operate properly.

3.1.3 Interconnect Cables

The test item does not require interconnect cables to operate properly.

3.1.4 Grounding

Since the test item was powered with 9VDC from a 9 volt battery, it was ungrounded during the tests.

3.2 Operational Mode

For all tests the test item was placed on an 80cm high non-conductive stand. The test item was energized.

3.3 Test Item Modifications

The test item was not modified to meet the FCC Part 15C requirements.

4 TEST FACILITY AND TEST INSTRUMENTATION

4.1 Shielded Enclosure

All tests were performed in a 32ft. x 20ft. x 18ft. hybrid ferrite-tile/anechoic absorber lined test chamber. With the exception of the floor, the reflective surfaces of the shielded chamber are lined with ferrite tiles on the walls and ceiling. Anechoic absorber material is installed over the ferrite tile. The floor of the chamber is used as the ground plane. The chamber complies with ANSI C63.4-2003 for site attenuation.

4.2 Test Instrumentation

The test instrumentation and auxiliary equipment used during the tests are listed in Table 9-1. All equipment was calibrated per the instruction manuals supplied by the manufacturer.

Conducted emission tests were performed with a spectrum analyzer in conjunction with a quasi-peak adapter.

Radiated emissions were performed with a spectrum analyzer. This receiver allows measurements with the bandwidths specified by the FCC and with the quasi-peak detector function. The receiver bandwidth was 120kHz for the 30MHz to 1000MHz radiated emissions data.

4.3 Calibration Traceability

Test equipment is maintained and calibrated on a regular basis. All calibrations are traceable to the National Institute of Standards and Technology (NIST).

4.4 Measurement Uncertainty

All measurements are an estimate of their true value. The measurement uncertainty characterizes, with a specified confidence level, the spread of values which may be possible for a given measurement system.

The measurement uncertainty for these tests is presented below:

Conducted Emission Measurements		
Combined Standard Uncertainty	1.07	-1.07
Expanded Uncertainty (95% confidence)	2.1	-2.1

Radiated Emission Measurements		
Combined Standard Uncertainty	2.26	-2.18
Expanded Uncertainty (95% confidence)	4.5	-4.4

5 TEST PROCEDURES

5.1 Powerline Conducted Emissions

5.1.1 Requirements

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

5.2 Duty Cycle Factor Measurements

5.2.1 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).

5.2.2 Results

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). The test item utilized rolling BCODE (390MHz) and rolling DCODE (315MHz) transmission. The Duty Cycle was measured and is shown on Page 14 and 15 of this report. However, since the test item utilized rolling code technology, the data presented is not at maximum duty cycle. The DC correction factor, at maximum duty cycle, was calculated based upon information provided by the manufacturer.

The following information was supplied by Chamberlain Manufacturing:

The 315MHz transmitter utilizes a rolling DCODE transmission

Rolling DCODE consists of the following: First Sync (0.5msec), 20 trinary bits (2msec each, 1.5msec on time), Blank Time (59.5msec), Second Sync (1.5msec), 20 Trinary bits (2msec each) and blank time (58.5msec)

The trinary bits change and roll over time via a proprietary coding scheme. Since the bits will change on a key press, a best and worst case situation is looked at. The best and worst case is then averaged. However the worst case situation is used when computing the rolling code modulation factor.

Worst Case- 31msec ON time over 100msec
Best Case- 11 msec ON time over 100msec
Average- 21 msec over 100msec
20 log (31/100) = **-10.17dB**. (315 MHz ROLLING CODE MODULATION FACTOR)

The 390MHz transmitter utilizes a rolling BCODE transmission

B Code is a touch code version where Billion Code is a hand held transmitter.
For B Code, the code is as follows. First Sync (1msec), 10 trinary bits (4msec each), blank time (39msec) and that's it.

80 msec total time for one message with a potential for 30 msec ON time.

A trit can be a 0, 1 or 2. No matter what kind of trit you have, the entire length will be 4msec or 1msec for each unit length.

So for a 0, you get 3 msec OFF time and 1 msec ON. For a 1, you get 2 msec OFF time and 2 msec ON. So for a 2, you get 1 msec OFF time and 3 msec ON.

So the entire message is 1 sync (1msec) + 10 trits + 39msec blank time = 80msec.

The ON time is a worst case,
1msec Sync + 9 trits * 3msec + 1 trit * 2msec = 30 msec ON time MAX
The last trit is fixed for B-code, but the other 9 can change.

20 log (30/80msec) = **-8.52dB.** (390MHz ROLLING CODE MODULATION FACTOR)

5.3 Radiated Measurements

5.3.1 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 315MHz, the limit at the fundamental is 6041.7uV/m @ 3m and the limit on the harmonics is 604.7uV/m @ 3m. For 390MHz, the limit at the fundamental is 9166.7uV/m @ 3m and the limit on the harmonics is 916.7uV/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.

5.3.2 Procedures

Radiated measurements were performed in a 32ft. x 20ft. x 14ft. high shielded enclosure. The shielded enclosure prevents emissions from other sources, such as radio and TV stations from interfering with the measurements. All powerlines and signal lines entering the enclosure pass through filters on the enclosure wall. The powerline filters prevent extraneous signals from entering the enclosure on these leads.

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 entire frequency range from 30MHz to 4.0GHz was investigated using a peak detector function. The data was then processed by the computer to calculate equivalent field intensity.

The final open field emission tests were then manually performed over the frequency range of 30MHz to 4000MHz. Between 30MHz and 1000MHz, a tuned dipole antenna was used as the pick-up device. 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.
5) In instances were it was necessary to use a shortened cable between the measuring antenna and the spectrum analyzer and the antenna cannot be raised to 4 meters. The measuring antenna is raised or lowered as much as the cable will allow and the test item is rotated through all axes to ensure the maximum readings are recorded.

5.3.3 Results

The preliminary plots, with the test item transmitting at 315 and 390 MHz, are presented on data pages 16 through 23. 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 315 and 390 MHz, are presented on data pages 24 and 25. As can be seen from the data, all emissions measured from the test item were within the specification limits. The emissions level closet to the limit (worst case) occurred at 390MHz. The emissions level at this frequency was .5 dB within the limit. See data page 25 for details. Photographs of the test configuration which yielded the highest, or worst case, radiated emission levels are shown on Figures 2 and 3.

5.4 Occupied Bandwidth Measurements

5.4.1 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. In addition the 20 dB bandwidth of both transmitters added together must also be within a band less than 0.25% of the center frequency of the lowest transmitter frequency.

5.4.2 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.

5.4.3 Results

The plot of the emissions near the fundamental frequency is presented on data pages 26 and 27. As can be seen from these data pages, the transmitter met the occupied bandwidth requirements. In addition the 20 dB bandwidth of both transmitters added together equals 320.63 kHz. The lowest transmit frequency was 315MHz 0.25% of this frequency is 787.5kHz. The emissions from both transmitters together meet the 787.5kHz requirement.

6 OTHER TEST CONDITIONS

6.1 Test Personnel and Witnesses

All tests were performed by qualified personnel from Elite Electronic Engineering Incorporated.

6.2 Disposition of the Test Item

The test item and all associated equipment were returned to The Chamberlain Group, Inc. upon completion of the tests.

7 CONCLUSIONS

It was determined that The Chamberlain Group, Inc. Universal Multi-Frequency Keypad transmitter, Model No. 940, Part No. 001C6805-1, Serial No. N/A, 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 C63.4-2003.

8 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.

9 EQUIPMENT LIST

Table 9-1 Equipment List

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Due Date
APK4	PREAMPLIFIER OPT H02	HEWLETT PACKARD	8449B	3008A00329	1-26.5GHZ	4/6/2009	4/6/2010
CMA1	Controllers	EMCO	2090	9701-1213	---	N/A	
HRE1	LASER JET 5P	HEWLETT PACKARD	C3150A	USHB061052	---	N/A	
NTA1	BILOG ANTENNA	CHASE EMC LTD.	BILOG CBL6112	2054	0.03-2GHZ	9/2/2008	9/2/2009
PHA0	MAGNETIC FIELD PROBE	ELECTRO-METRICS	EM-6882	134	22-230MHZ	NOTE 1	
RACA	RF PRESELECTOR	HEWLETT PACKARD	85685A	2926A00980	20HZ-2GHZ	2/20/2009	2/20/2010
RAEC	SPECTRUM ANALYZER	HEWLETT PACKARD	8566B	3014A06690	100HZ-22GHZ	2/20/2009	2/20/2010
RAF5	QUASIPEAK ADAPTOR	HEWLETT PACKARD	85650A	2043A00151	0.01-1000MHZ	2/20/2009	2/20/2010
RAKG	RF SECTION	HEWLETT PACKARD	85462A	3549A00284	0.009-6500MHZ	1/23/2009	1/23/2010
RAKH	RF FILTER SECTION	HEWLETT PACKARD	85460A	3448A00324	---	1/23/2009	1/23/2010
RBB0	EMI TEST RECEIVER 20HZ TO 40 GHZ.	ROHDE & SCHWARZ	ESIB40	100250	20 HZ TO 40GHZ	3/11/2009	3/11/2010
XLQJ	5W, 50 OHM TERMINATION	JFW INDUSTRIES	50T-052	56	DC-2GHZ	8/29/2008	8/29/2009
XZG4	ATTENUATOR/SWITCH DRIVER	HEWLETT PACKARD	11713A	2223A01683	---	N/A	

I/O: Initial Only
N/A: Not Applicable
Note 1: For the purpose of this test, the equipment was calibrated over the specified frequency range, pulse rate, or modulation prior to the test or monitored by a calibrated instrument.

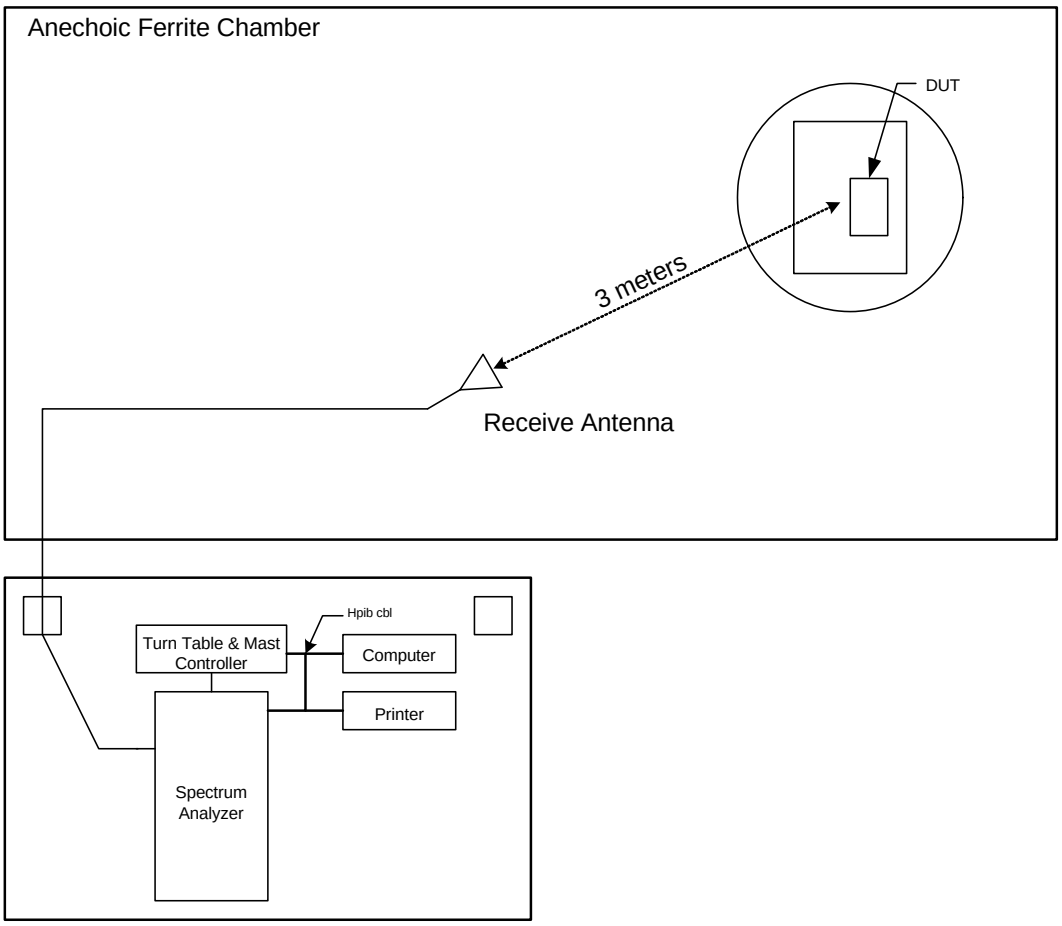
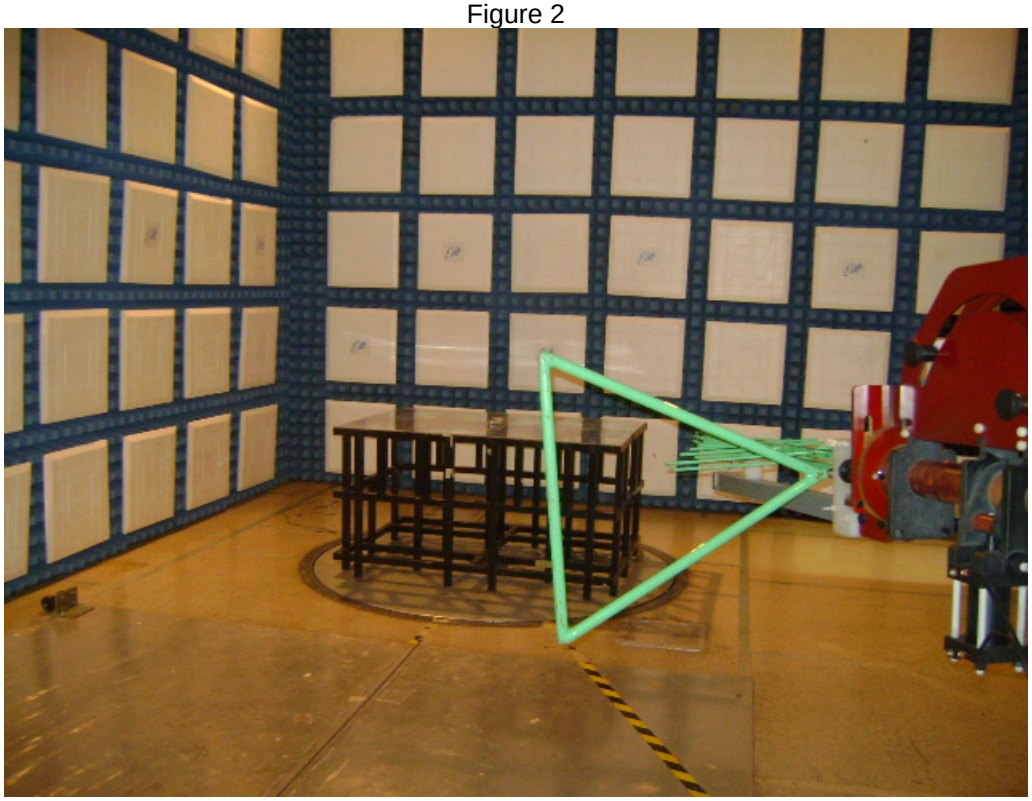


FIGURE 1 BLOCKDIAGRAM OF TEST SETUP

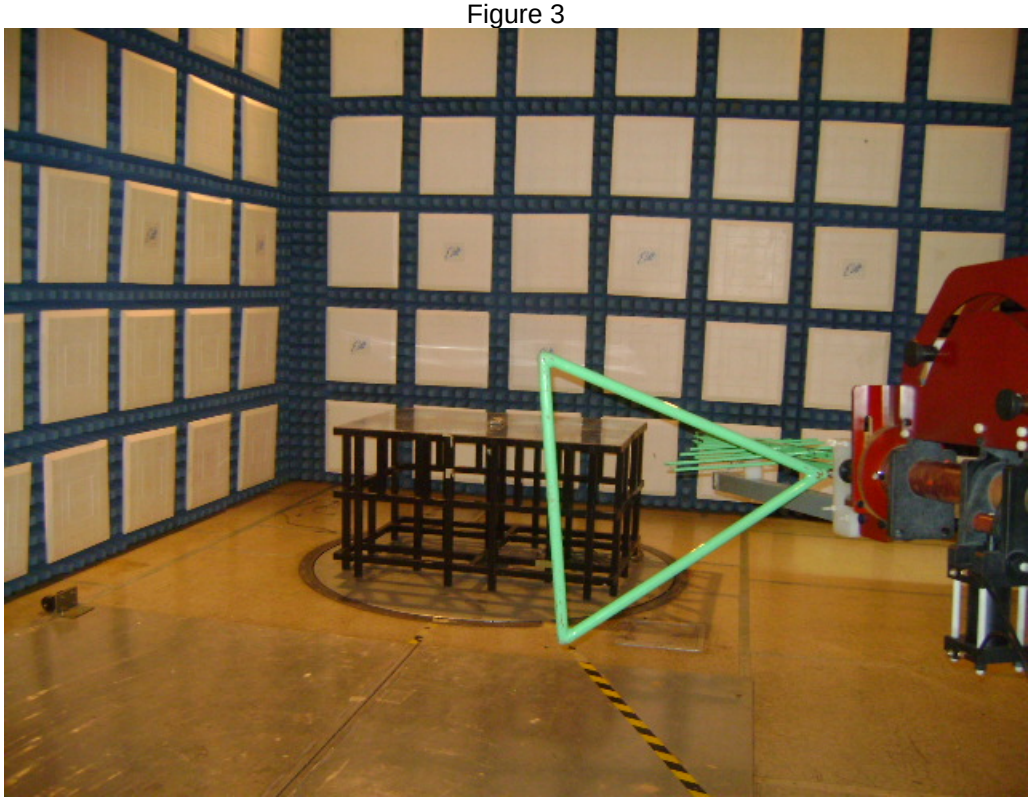
Figure 2



Test Set-up for Radiated Emissions 315MHz – Horizontal Polarity

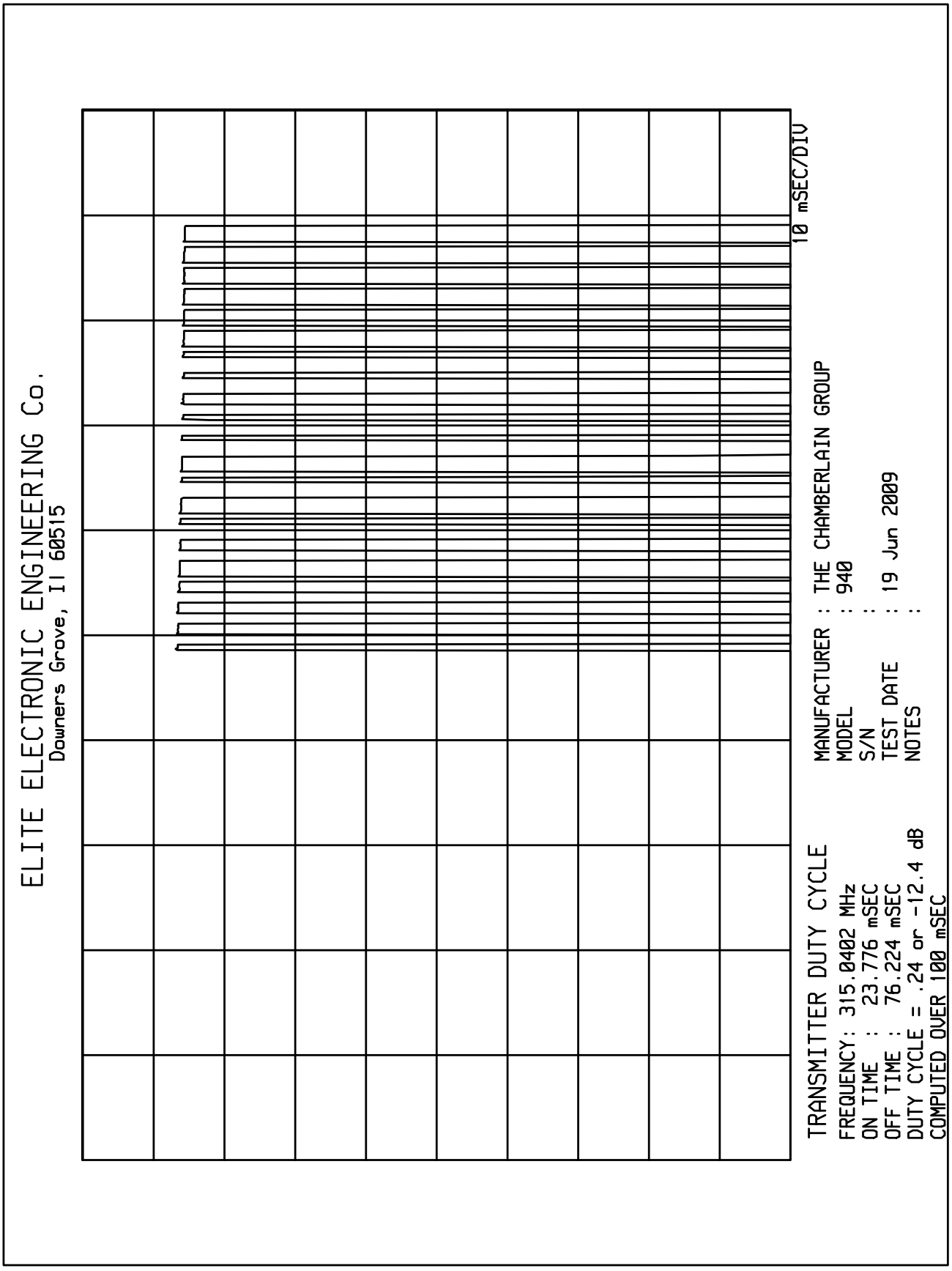
Test Set-up for Radiated Emissions 315MHz – Vertical Polarity

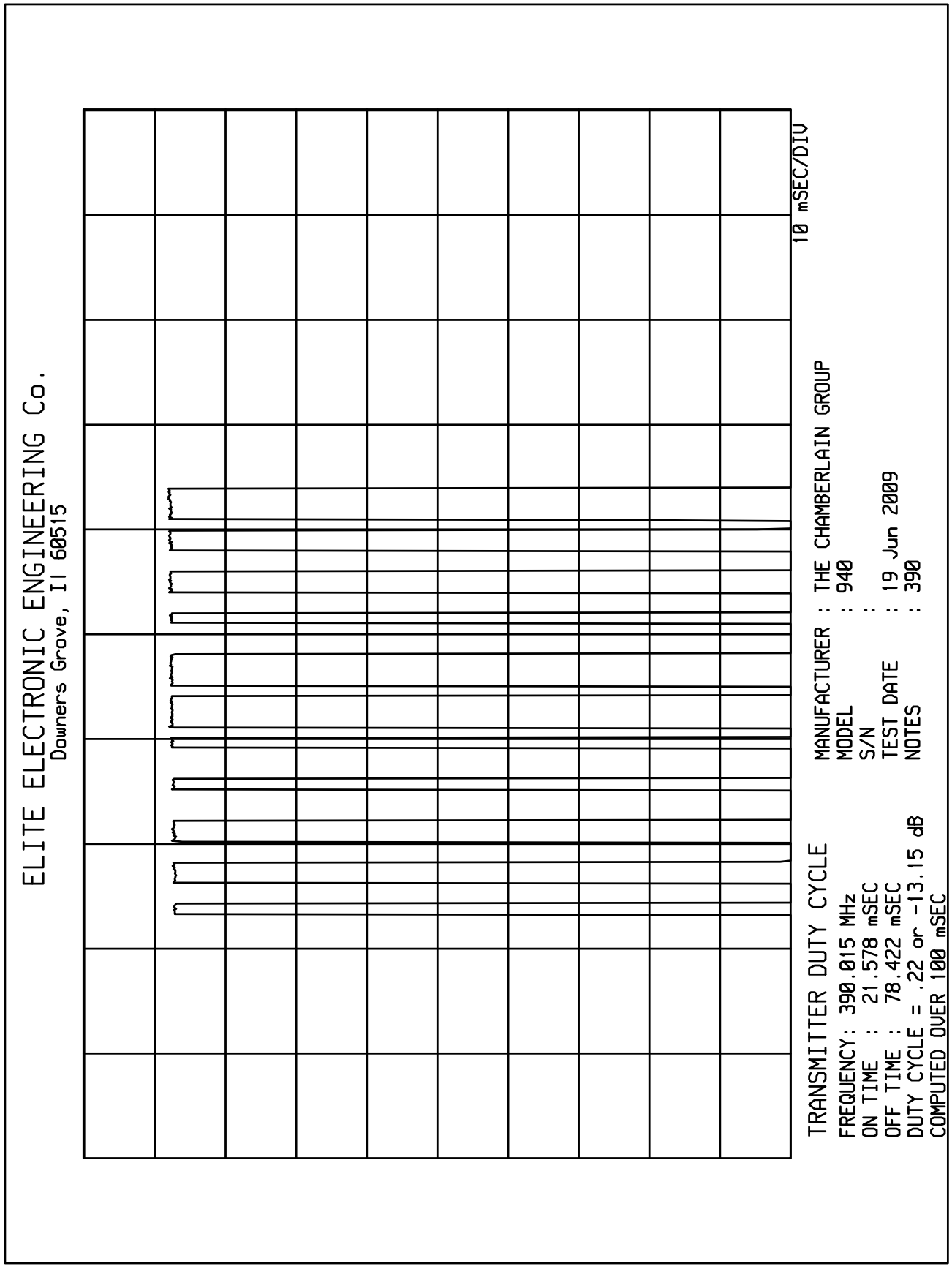
Figure 3

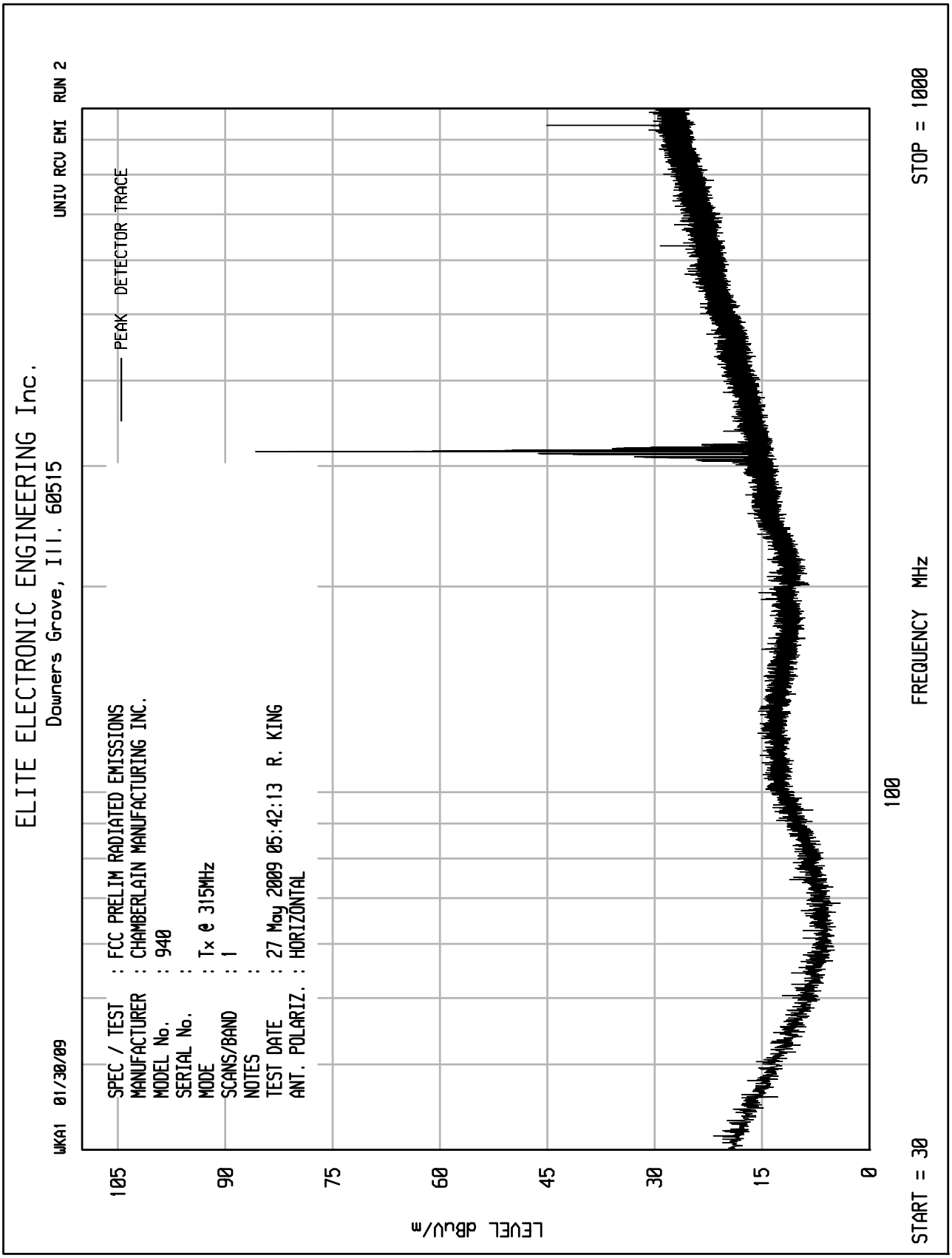


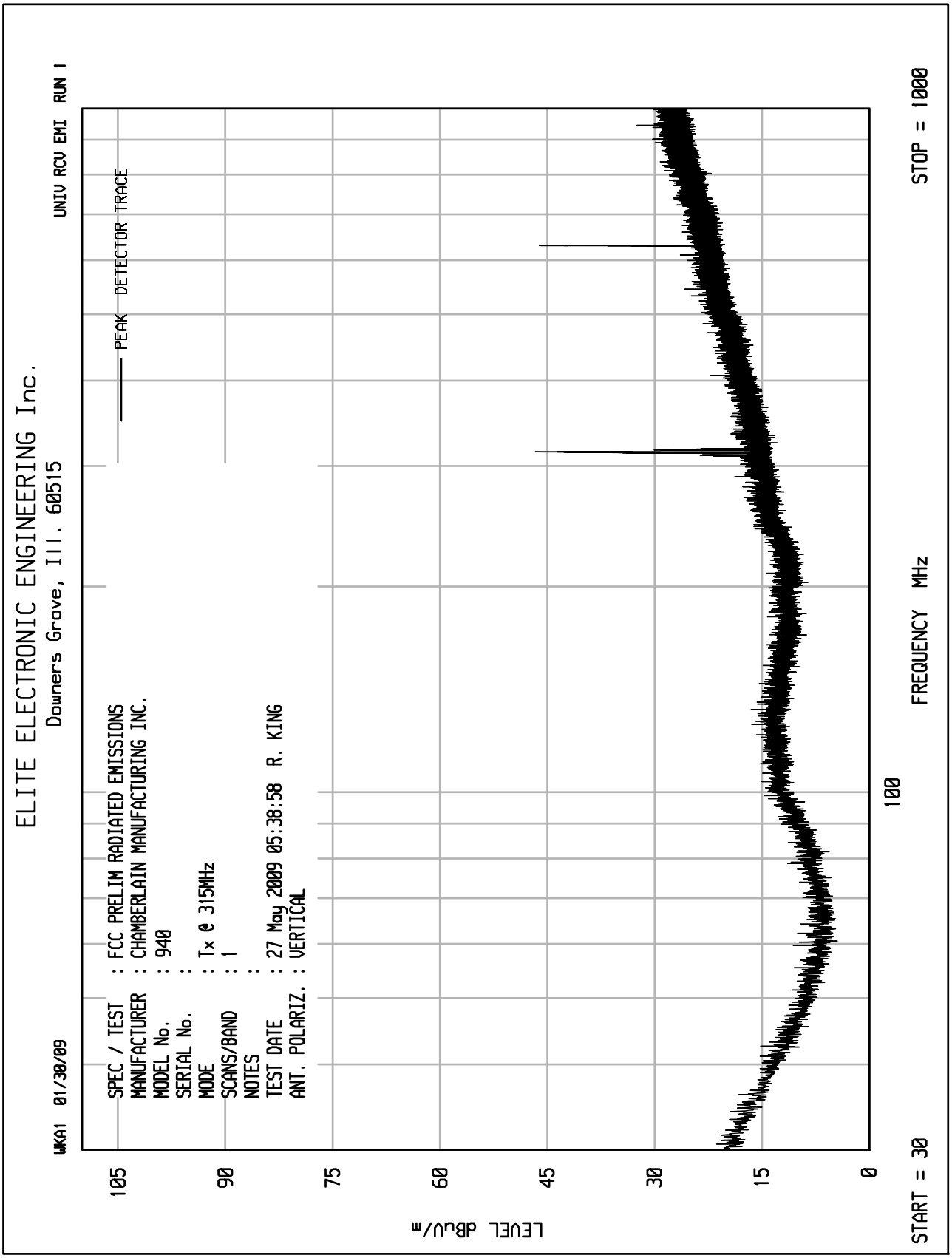
Test Set-up for Radiated Emissions 390MHz – Horizontal Polarity

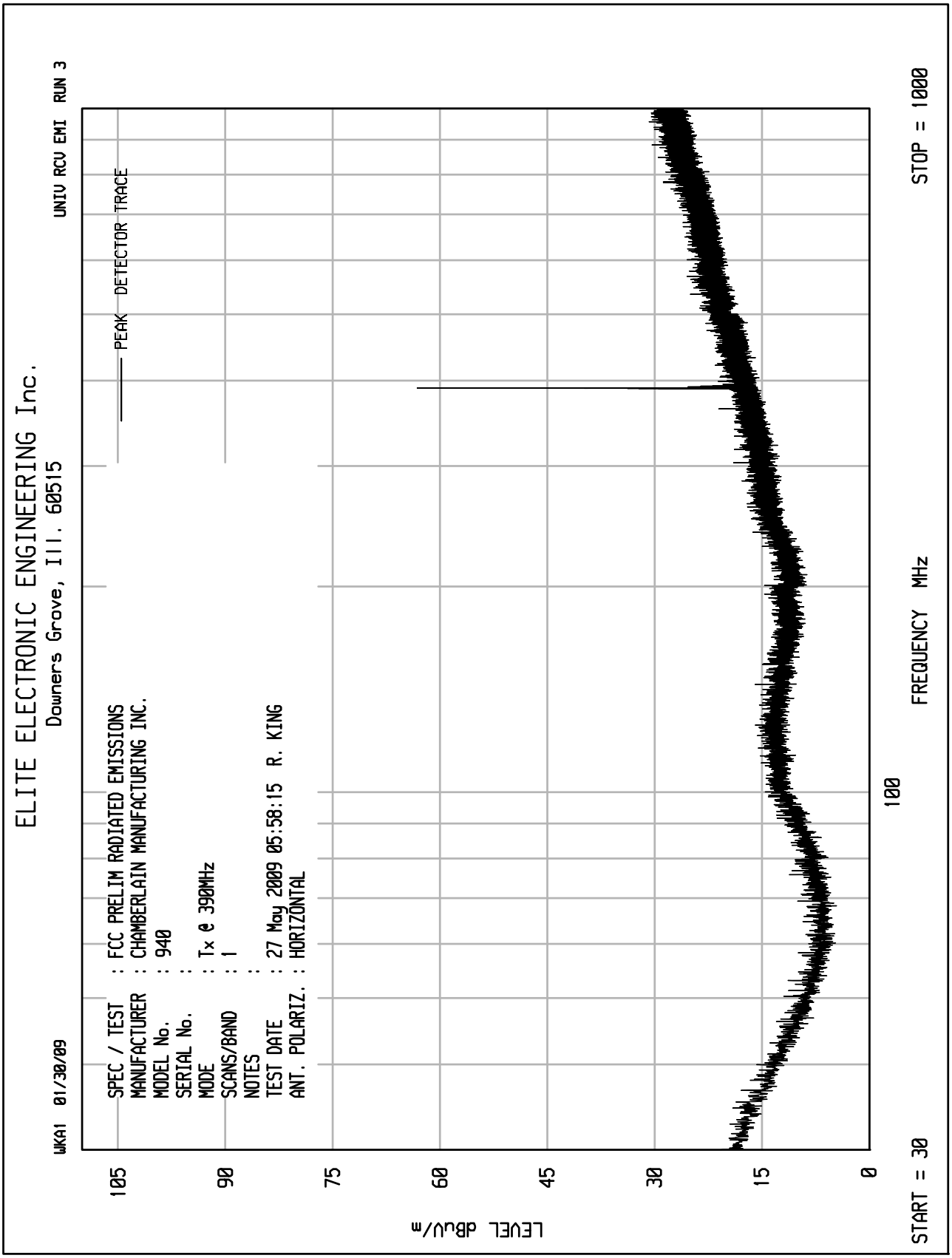
Test Set-up for Radiated Emissions 390MHz – Vertical Polarity

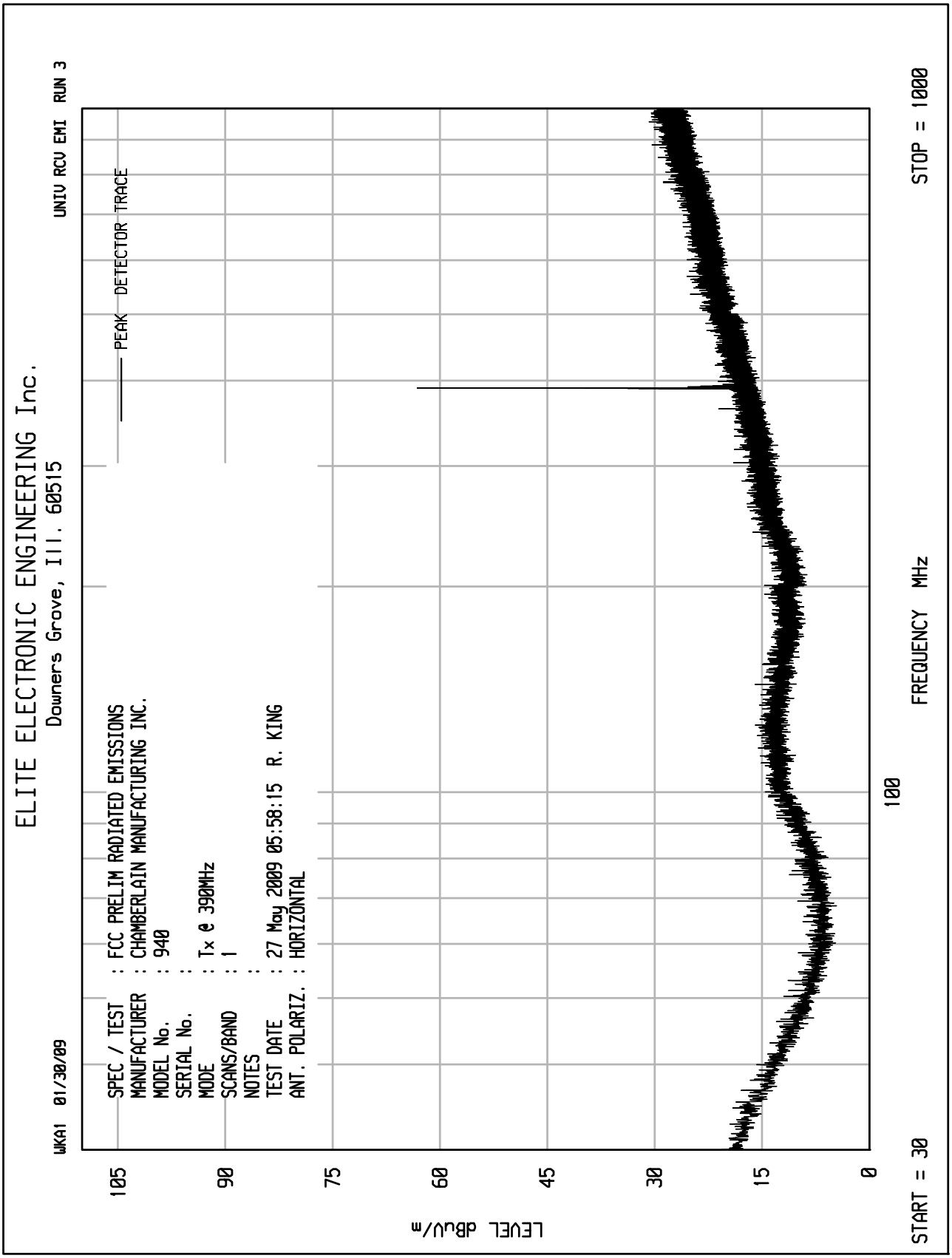

ELITE ELECTRONIC ENGINEERING Co.
Downers Grove, Il 60515
10 mSEC/DIV
TRANSMITTER DUTY CYCLE
FREQUENCY: 315.0402 MHz
ON TIME : 23.776 mSEC
OFF TIME : 76.224 mSEC
DUTY CYCLE = .24 or -12.4 dB
COMPUTED OVER 100 mSEC
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL : 940
S/N : :
TEST DATE : 19 Jun 2009
NOTES : :

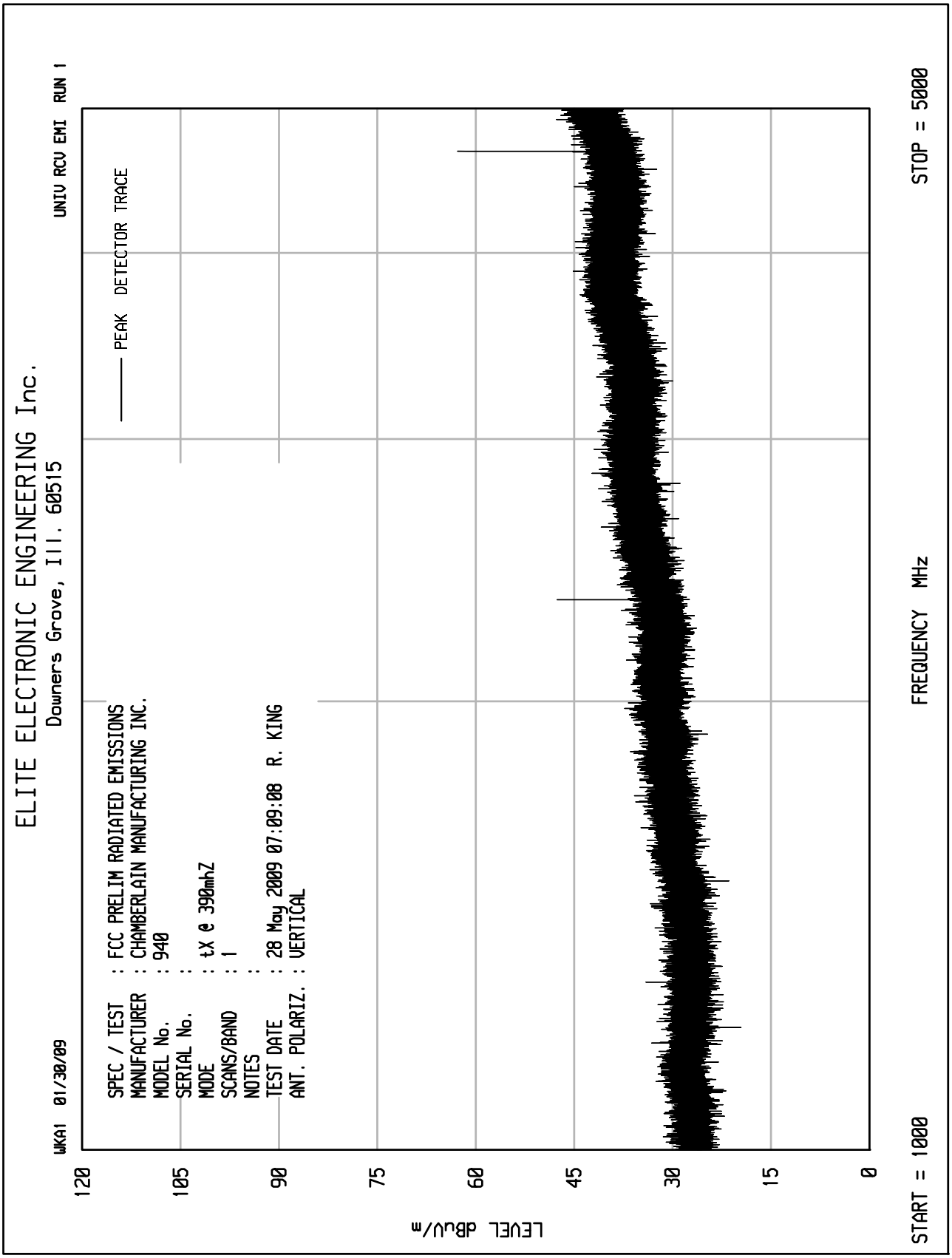

ELITE ELECTRONIC ENGINEERING Co.
Downers Grove, Il 60515
10 mSEC/DIV
TRANSMITTER DUTY CYCLE
FREQUENCY: 390.015 MHz
ON TIME : 21.578 mSEC
OFF TIME : 78.422 mSEC
DUTY CYCLE = .22 or -13.15 dB
COMPUTED OVER 100 mSEC
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL : 940
S/N : :
TEST DATE : 19 Jun 2009
NOTES : 390

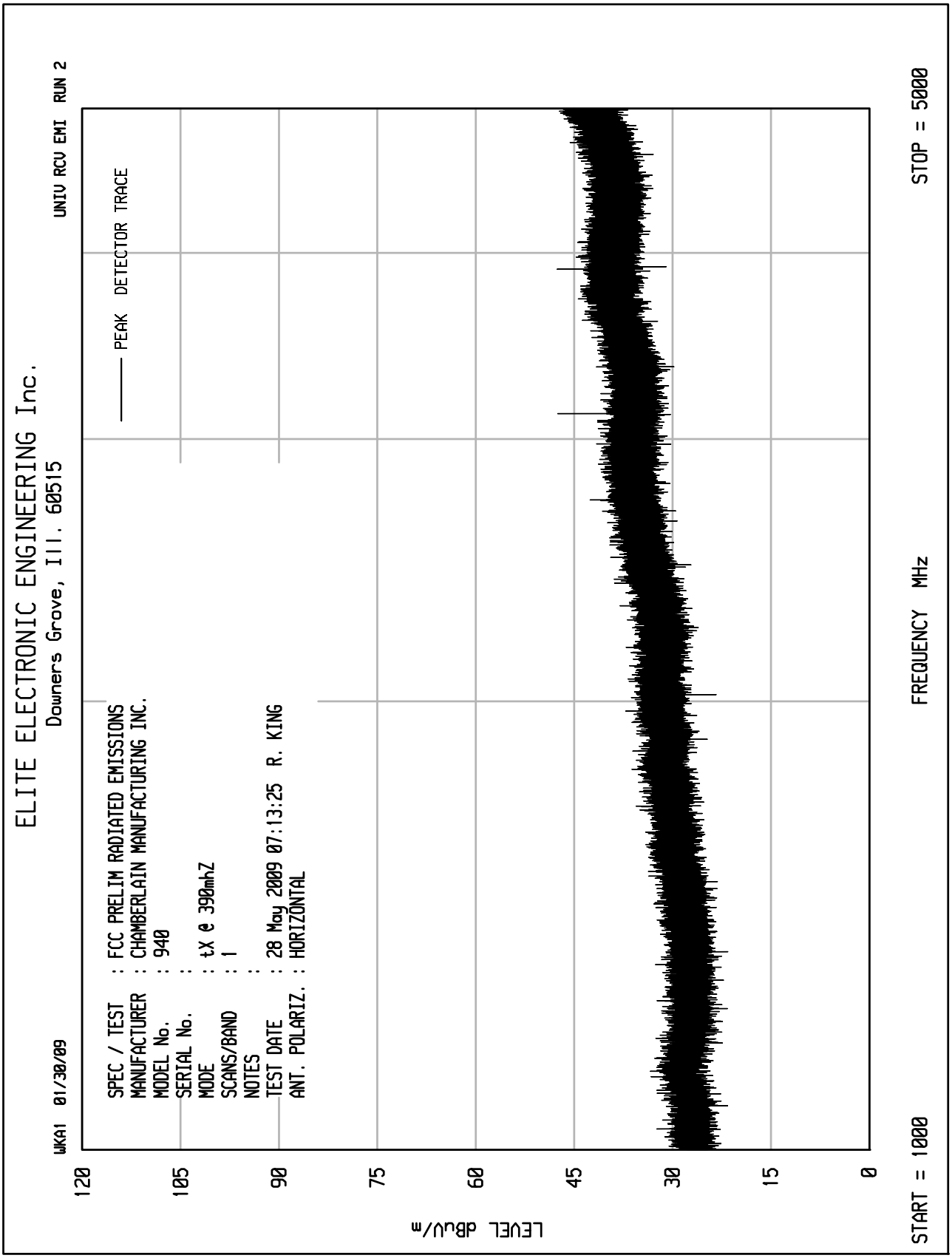

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 2
WKA1 01/30/09
SPEC / TEST : FCC PRELIM RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN MANUFACTURING INC.
MODEL No. : 940
SERIAL No. :
MODE : Tx @ 315MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 27 May 2009 05:42:13 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000

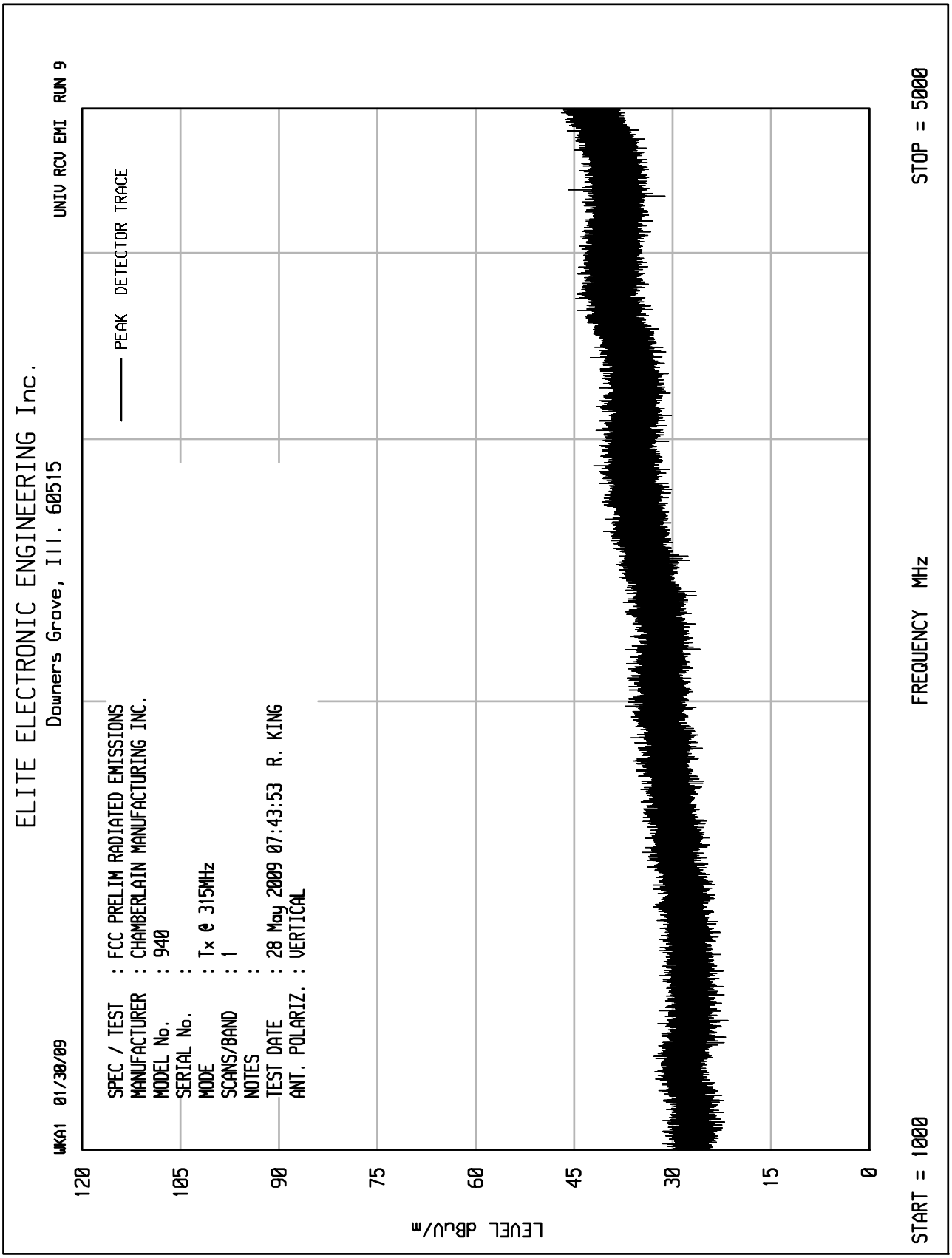

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 1
WKA1 01/30/09
SPEC / TEST : FCC PRELIM RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN MANUFACTURING INC.
MODEL No. : 940
SERIAL No. :
MODE : Tx @ 315MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 27 May 2009 05:38:58 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000

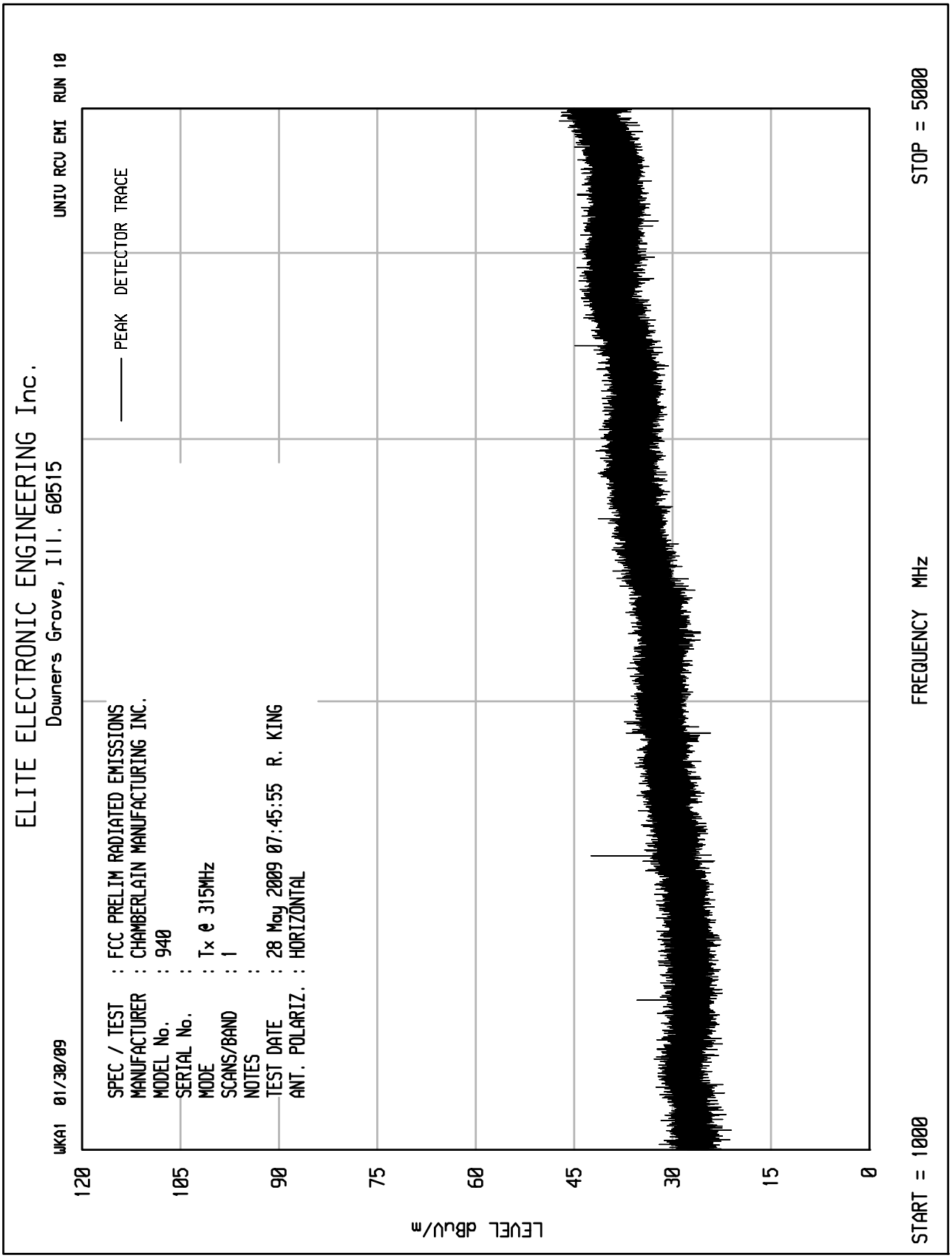

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 3
WKA1 01/30/09
SPEC / TEST : FCC PRELIM RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN MANUFACTURING INC.
MODEL No. : 940
SERIAL No. :
MODE : Tx @ 390MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 27 May 2009 05:58:15 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 3
WKA1 01/30/09
SPEC / TEST : FCC PRELIM RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN MANUFACTURING INC.
MODEL No. : 940
SERIAL No. :
MODE : Tx @ 390MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 27 May 2009 05:58:15 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 1
WKA1 01/30/09
SPEC / TEST : FCC PRELIM RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN MANUFACTURING INC.
MODEL No. : 940
SERIAL No. :
MODE : tX @ 390mhZ
SCANS/BAND : 1
NOTES :
TEST DATE : 28 May 2009 07:09:08 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 5000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 2
WKA1 01/30/09
SPEC / TEST : FCC PRELIM RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN MANUFACTURING INC.
MODEL No. : 940
SERIAL No. :
MODE : tX @ 390mhZ
SCANS/BAND : 1
NOTES :
TEST DATE : 28 May 2009 07:13:25 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 5000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 9
WKA1 01/30/09
SPEC / TEST : FCC PRELIM RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN MANUFACTURING INC.
MODEL No. : 940
SERIAL No. :
MODE : Tx @ 315MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 28 May 2009 07:43:53 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 5000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 10
WKA1 01/30/09
SPEC / TEST : FCC PRELIM RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN MANUFACTURING INC.
MODEL No. : 940
SERIAL No. :
MODE : Tx @ 315MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 28 May 2009 07:45:55 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 5000

ETR No.
DATA PAGE

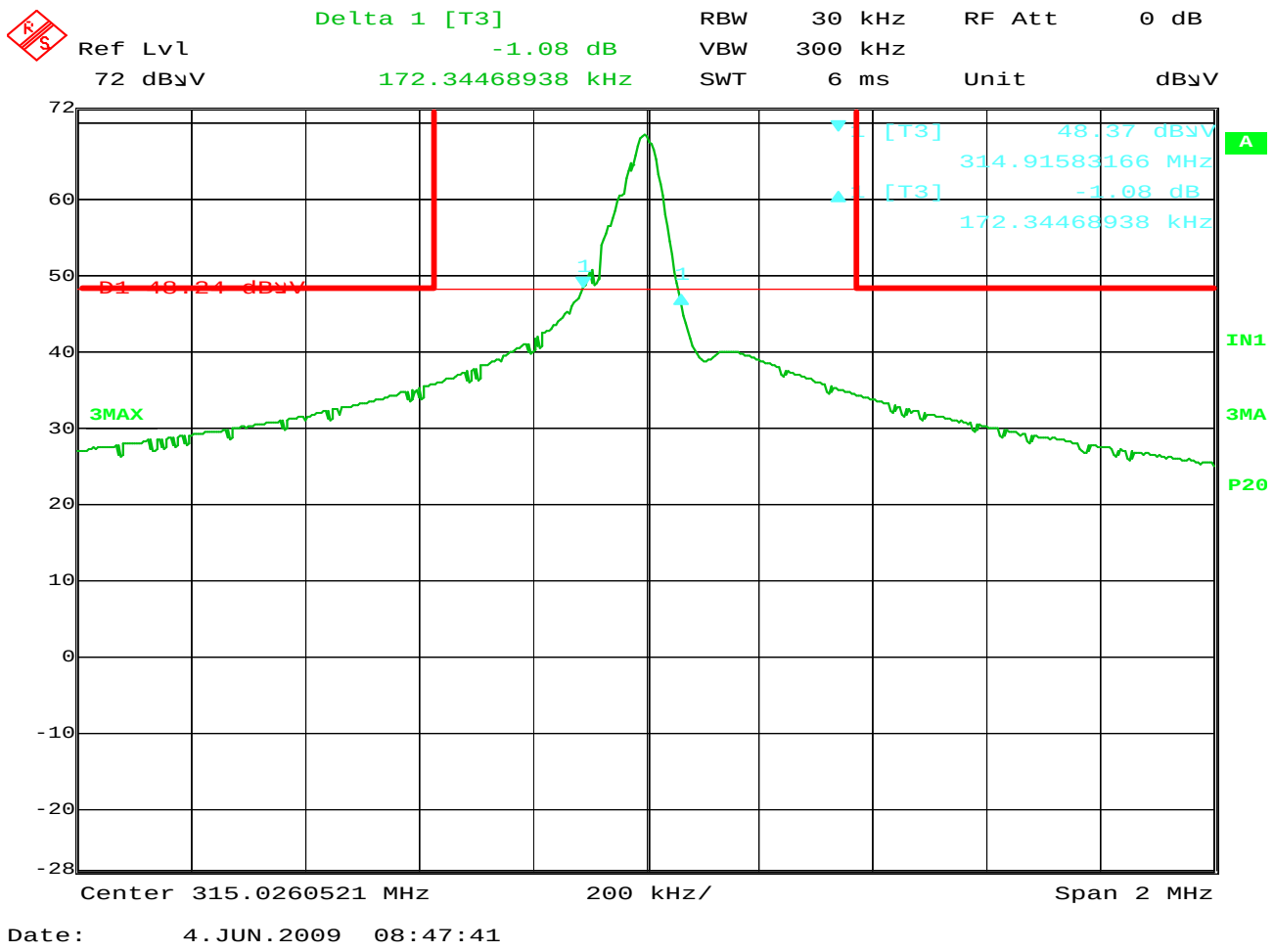
SPECIFICATION : FCC PART 15C TRANSMITTER OPEN FIELD DATA
MANUFACTURER : The Chamberlain Group, Inc.
MODEL : 940
PART NO : 001C6805-1
S/N : NONE ASSIGNED
TEST DATE : 27 May 2009
NOTES : Tx @ 315MHz, NO GROUND
TEST ANTENNA : ROBERTS DIPOLE & DRWG ANTENNAS

Freq (MHz)	Ant Pol	Meter Reading (dBuV)	CBL Fac (dB)	Ant Fac (dB)	Duty Cycle Factor (dB)	Total dBuV/m at 3 M	Total uV/m at 3M	Limit uV/m at 3M	Margin (dB)
315.0	H	64.8	1.4	18.8	-10.2	74.7	5456.5	6041.7	-0.9
315.0	V	60.0	1.4	18.8	-10.2	69.9	3125.5	6041.7	-5.7
630.0	H	38.1	2.0	20.2	-10.2	50.1	321.2	604.2	-5.5
630.0	V	34.3	2.0	20.2	-10.2	46.3	206.7	604.2	-9.3
945.0	H	19.7	2.4	23.6	-10.2	35.5	59.5	604.2	-20.1
945.0	V	14.6	2.4	23.6	-10.2	30.4	33.2	604.2	-25.2
1260.0	H	26.2	2.9	24.9	-10.2	43.7	153.1	604.2	-11.9
1260.0	V	20.0	2.9	24.9	-10.2	37.6	75.4	604.2	-18.1
1575.0	H	22.7	3.2	26.4	-10.2	42.1	127.9	500	-11.8
1575.0	V	16.8	3.2	26.4	-10.2	36.2	64.9	500	-17.7
1890.0	H	13.8	3.5	27.8	-10.2	34.9	55.7	604.2	-20.7
1890.0	V	15.3	3.5	27.8	-10.2	36.5	66.6	604.2	-19.2
2205.0	H	13.2	3.7	28.8	-10.2	35.6	60.1	500	-18.4
2205.0	V	13.2	3.7	28.8	-10.2	35.6	60.1	500	-18.4
2520.0	H	13.8	3.9	29.6	-10.2	37.0	70.9	604.2	-18.6
2520.0	V	13.1	3.9	29.6	-10.2	36.4	65.7	604.2	-19.3
2835.0	H	22.1	4.0	30.6	-10.2	46.5	210.4	500	-7.5
2835.0	V	20.5	4.0	30.6	-10.2	44.9	175.2	500	-9.1
3150.0	H	20.4	4.2	31.9	-10.2	46.3	205.7	604.2	-9.4
3150.0	V	17.4	4.2	31.9	-10.2	43.3	145.4	604.2	-12.4

ETR No.
DATA PAGE

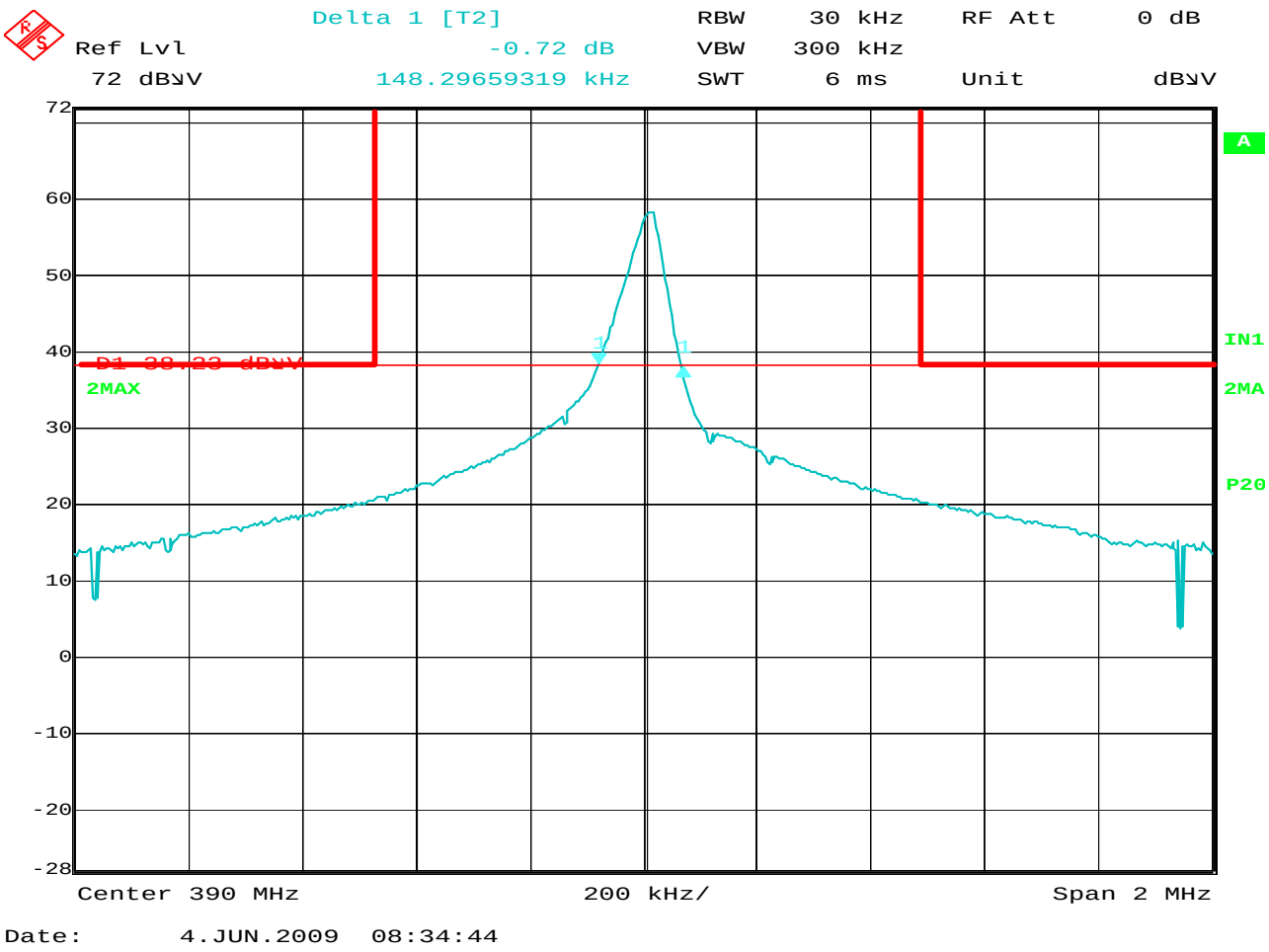
SPECIFICATION : FCC PART 15C TRANSMITTER OPEN FIELD DATA
MANUFACTURER : The Chamberlain Group, Inc.
MODEL : 940
PART NO : 001C6805-1
S/N : NONE ASSIGNED
TEST DATE : 27 May 2009
NOTES : Tx @ 390MHz, NO GROUND
TEST ANTENNA : ROBERTS DIPOLE & DRWG ANTENNAS

Freq (MHz)	Ant Pol	Meter Reading (dBuV)	CBL Fac (dB)	Ant Fac (dB)	Duty Cycle Factor (dB)	Total dBuV/m at 3 M	Total uV/m at 3M	Limit uV/m at 3M	Margin (dB)
390.0	H	65.1	1.6	20.6	-8.5	78.7	8648.2	9166.7	-0.5
390.0	V	56.5	1.6	20.6	-8.5	70.2	3231.7	9166.7	-9.1
780.0	H	37.9	2.2	21.6	-8.5	53.2	458.7	916.7	-6.0
780.0	V	33.2	2.2	21.6	-8.5	48.5	267.0	916.7	-10.7
1170.0	H	26.3	2.7	24.5	-8.5	45.0	178.2	500	-9.0
1170.0	V	21.6	2.7	24.5	-8.5	40.3	103.6	500	-13.7
1560.0	H	24.3	3.2	26.9	-8.5	45.9	197.6	500	-8.1
1560.0	V	22.9	3.2	26.9	-8.5	44.5	168.0	500	-9.5
1950.0	H	21.7	3.6	28.1	-8.5	44.9	175.0	916.7	-14.4
1950.0	V	22.1	3.6	28.1	-8.5	45.3	183.5	916.7	-14.0
2340.0	H	27.2	3.8	29.2	-8.5	51.7	383.0	500	-2.3
2340.0	V	20.7	3.8	29.2	-8.5	45.1	180.0	500	-8.9
2730.0	H	25.0	3.9	30.3	-8.5	50.7	341.3	500	-3.3
2730.0	V	24.7	3.9	30.3	-8.5	50.4	331.2	500	-3.6
3120.0	H	28.5	4.2	31.7	-8.5	55.9	624.9	916.7	-3.3
3120.0	V	27.7	4.2	31.7	-8.5	55.1	569.9	916.7	-4.1
3510.0	H	23.7	4.6	33.7	-8.5	53.4	469.5	916.7	-5.8
3510.0	V	23.1	4.6	33.7	-8.5	52.9	441.7	916.7	-6.3
3900.0	H	21.9	5.0	34.4	-8.5	52.7	432.2	500	-1.3
3900.0	V	17.7	5.0	34.4	-8.5	48.5	266.2	500	-5.5



FCC 15.231 20dB bandwidth

MANUFACTURER : The Chamberlain Group, Inc.
TEST ITEM : Universal Multi-Frequency Keypad
MODEL NUMBER : 940
PART NUMBER : 001C6805-1
TEST MODE : Tx @ 315MHz
NOTES : Display line D1 represents the 20dB down point. Display lines F1 and F2 represent the 0.25% span from the center frequency



FCC 15.231 20dB bandwidth

MANUFACTURER	: The Chamberlain Group, Inc.
TEST ITEM	: Universal Multi-Frequency Keypad
MODEL NUMBER	: 940
PART NUMBER	: 001C6805-1
TEST MODE	: Tx @ 390MHz
NOTES	: Display line D1 represents the 20dB down point. Display lines F1 and F2 represent the 0.25% span from the center frequency