Measurement of RF Emissions from a 956EV Mini Garage Door Opener Transmitter

For	The Chamberlain Group, Inc. Elmhurst, IL 60126
P.O. Number	869374
Date Tested	December 2 through 8, 2010
Test Personnel	Richard E. King
Test Specification	FCC "Code of Federal Regulations" Title 47 Part15, Subpart C Industry Canada RSS-GEN Industry Canada RSS-210

Test Report By:

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TABLE OF CONTENTS

TABLE OF CONTENTS

REVISION HISTORY

Revision	Date	Description
—	12/16/2010	Initial release

Measurement of RF Emissions from a Model No. 956EV Mini Garage Door Opener Transmitter

1. INTRODUCTION

1.1. Scope of Tests

This report presents the results of the RF emissions measurements performed on a Garage Door Opener transmitter, Model No. 956EV Mini, (hereinafter referred to as the Equipment Under Test (EUT)). No serial number was assigned to the EUT. The EUT was designed to transmit at approximately 315 and 390 MHz using an antenna. The EUT 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 EUT 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.

The test series was also performed to determine if the EUT meets the technical requirements of the Industry Canada Radio Standards Specification, RSS-Gen, Section 7.2.2 and Section 7.2.3. 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 American Association for Laboratory Accreditation (A2LA). A2LA Certificate Number: 1786.01.

1.5. Laboratory Conditions

The temperature at the time of the test was 22.4^{o}C and the relative humidity was 16%.

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 2010
- 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 Radio Standards Specification, RSS-Gen, “General Requirements and Information for the Certification of Radiocommunication Equipment”, Issue 2, June 2007
- Industry Canada Radio Standards Specification, RSS-210, “Low-power License-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment”, Issue 7, June 2007

3. EUT SETUP AND OPERATION

3.1. General Description

The EUT is a The Chamberlain Group, Inc., Garage Door Opener, Model No. 956EV Mini. A block diagram of

the EUT setup is shown as Figure 1.

3.1.1. Power Input

The EUT obtained 3VDC from a 3 volt battery.

3.1.2. Peripheral Equipment

No peripheral equipment is required for the EUT to work properly.

3.1.3. Signal Input/Output Leads

No interconnect cables were required by the EUT.

3.1.4. Grounding

Since the EUT was powered with 3VDC through a 3VDC battery, it was ungrounded during the tests.

3.2. Operational Mode

For all tests the EUT and all peripheral equipment were placed on an 80cm high non-conductive stand. The EUT and was energized.

The EUTs' transmit button was held down there by setting the device to transmit continuously.

3.3. EUT Modifications

No modifications were required for compliance.

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. The receiver allows measurements with the bandwidths and detector functions specified by the FCC and IC.

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

Radiated Emissions 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 EUT was powered by internal batteries, no conducted emissions tests are required.

5.2. Periodic Operation Measurements

5.2.1. Requirements

A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released. Also, a transmitter activated automatically shall cease transmission within 5 seconds after activation.

5.2.2. Procedures

The spectrum analyzer was setup to display the time domain trace. The EUT was set to transmit normally. The spectrum analyzer was used to record the amount of time that the EUT remained active following activation.

5.2.3. Results

The plot of the periodic timing is shown on data pages 16 through 18. The data shows that the EUT ceases operation within the allotted time.

5.3. Duty Cycle Factor Measurements

5.3.1. 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.

The duty cycle factor was calculated from information supplied by the manufacturer. Since this EUT utilizes a rolling code modulation, the duty is calculated based on the worst case. The following procedure was used to measure a representative sample:

a) With the transmitter set up to transmit for maximum pulse density, the time domain trace is displayed on the spectrum analyzer.

b) The first sync pulse width is measured and a plot of this measurement is recorded along with the number of bits.

c) The second sync pulse width is measured and a plot of this measurement is recorded along with the number of bits.

d) Finally the length of the word period is measured and a third plot is recorded. If the word period exceeds 100 msec, the word period is limited to 100 msec. The blank time is also shown.

e) The pulse width and number of pulses for the word period are used to compute the on-time. The duty cycle is then computed as the (on-time/ word period).

f) The duty cycle factor is computed from the duty cycle.

5.3.2.Results

The manufacturer provided following information to calculate the duty cycle for the Rolling Code D:

Rolling Code D 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 worst case situation is used when computing the rolling code modulation factor.

Worse Case ON time is calculated as the 20 trinary bits multiplied by the largest bit of 1.5mS plus the worse case sync pulse of 1.5mS. This Worse Case ON time equals 20*1.5mS +1.5mS = 31msec.

Worst Case = 31msec On-time over 100msec word period

Duty Cycle Factor = 20 log (31/100) = -10.2 dB.

The manufacturer provided following information to calculate the duty cycle for the Rolling Code A:

Our Billion Code consists of a sync pulse (1msec), 10 trinary numbers (4msec each), blank time (39msec each), synch pulse (3msec), 10 trinary numbers (4msec each) & blank time (37 msec). Looking at a worst case coding scheme, the worst case ON time over 100msec is 46 msec.

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 in 100 msec is 1 sync (1msec) + 10 trits + 39msec blank time + 1 sync (3msec) + 4 trits or (on time in ()) 1(1) + 40(30) + 39 + 3(3) + 17(12) = 100(46)

20 log (46/100) = -6.74dB. (BILLION CODE MODULATION FACTOR)

Representative plots of the duty cycle factor with the EUT transmitting at 315MHz with rolling D code was measured and is shown on Page 19 through 24. Since the plots were made for the rolling code, the duty cycle factor shown on the plots may not show the worst case but was found to be no greater than the worst case duty cycle factor.

Representative plots of the duty cycle factor with the EUT transmitting at 390MHz with rolling A code was measured and is shown on Page 25 through 29. Since the plots were made for the rolling code, the duty cycle factor shown on the plots may not show the worst case but was found to be no greater than the worst case duty cycle factor.

Representative plots of the duty cycle factor with the EUT transmitting at 390MHz with rolling D code was measured and is shown on Page 30 through 35. Since the plots were made for the rolling code, the duty cycle factor shown on the plots may not show the worst case but was found to be no greater than the worst case duty cycle factor.

5.4. Radiated Measurements

5.4.1.Requirements

The EUT must comply with the requirements of FCC "Code of Federal Regulations Title 47", Part 15, Subpart C, Section 15.205 et seq. 15.231.

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 604.2uV/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.

5.4.2.Procedures

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

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

A preliminary radiated emissions test was performed to determine the emission characteristics of the EUT. For the preliminary test, a broadband measuring antenna was positioned at a 3 meter distance from the EUT. 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 EUT 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 EUT was rotated through three orthogonal axes to determine which orientation produces the highest emission relative to the limit.

5.4.3.Results

The preliminary plots, with the EUT transmitting at 315 and 390 MHz, are presented on data pages 36 through 47. The plots are presented for a reference only, and are not used to determine compliance.

The final open area radiated levels, with the EUT transmitting at 315 and 390 MHz, are presented on data pages 48 through 50. As can be seen from the data, all emissions measured from the EUT were within the

specification limits.

The average equivalent isotropically radiated power (e.i.r.p.) with the EUT transmitting at 315MHz using rolling code D was calculated to be -25.4dBm (2.9 uW).

The average equivalent isotropically radiated power (e.i.r.p.) with the EUT transmitting at 390MHz using rolling code A was calculated to be -17.4dBm (18.2 uW).

The average equivalent isotropically radiated power (e.i.r.p.) with the EUT transmitting at 315MHz using rolling code D was calculated to be -23.5dBm (4.5 uW).

Photographs of the test configuration which yielded the highest, or worst case, radiated emission levels are shown on Figures 2 and 3.

5.5. Occupied Bandwidth Measurements

5.5.1.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.

5.5.2.Procedures

The EUT was placed on an 80cm high non-conductive stand. The unit was set to transmit continuously. With a probe positioned nearby, occupied bandwidth emissions were displayed on the spectrum analyzer. The resolution bandwidth was set to 50 kHz and span was set to 2 MHz. The frequency spectrum near the fundamental was plotted. The 99% bandwidth was measured to be 398.6kHz.

5.5.3.Results

The plot of the emissions near the fundamental frequency is presented on data pages 51 through 53. As can be seen from this data page, the transmitter met the occupied bandwidth requirements.

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 EUT

The EUT 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. Garage Door Opener, Model No. 956EV Mini, Serial No. none, 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.

In addition, The Chamberlain Group, Inc. Garage Door Opener, Model No. 956EV Mini, Serial No. none, did also meet the technical requirements of the Industry Canada Radio Standards Specification, RSS-Gen, Section 7.2.2 and Section 7.2.3.

All testing was performed in accordance with 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 EUT at the test date. Any electrical or mechanical modification made to the EUT 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
NTA2	BILOG ANTENNA	TESEQ	6112D	28040	25-1000MHz	6/7/2010	6/7/2011
NWH0	RIDGED WAVE GUIDE	TENSOR	4105	2081	1-12.4GHZ	8/31/2010	8/31/2011
PHA0	MAGNETIC FIELD PROBE	ELECTRO-METRICS	EM-6882	134	22-230MHZ	NOTE 1	
RAKG	RF SECTION	HEWLETT PACKARD	85462A	3549A00284	0.009-6500MHZ	2/16/2010	2/16/2011
RAKH	RF FILTER SECTION	HEWLETT PACKARD	85460A	3448A00324	---	2/16/2010	2/16/2011
RBB0	EMI TEST RECEIVER 20HZ TO 40 GHZ	ROHDE & SCHWARZ	ESIB40	100250	20 HZ TO 40GHZ	3/16/2010	3/16/2011

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.

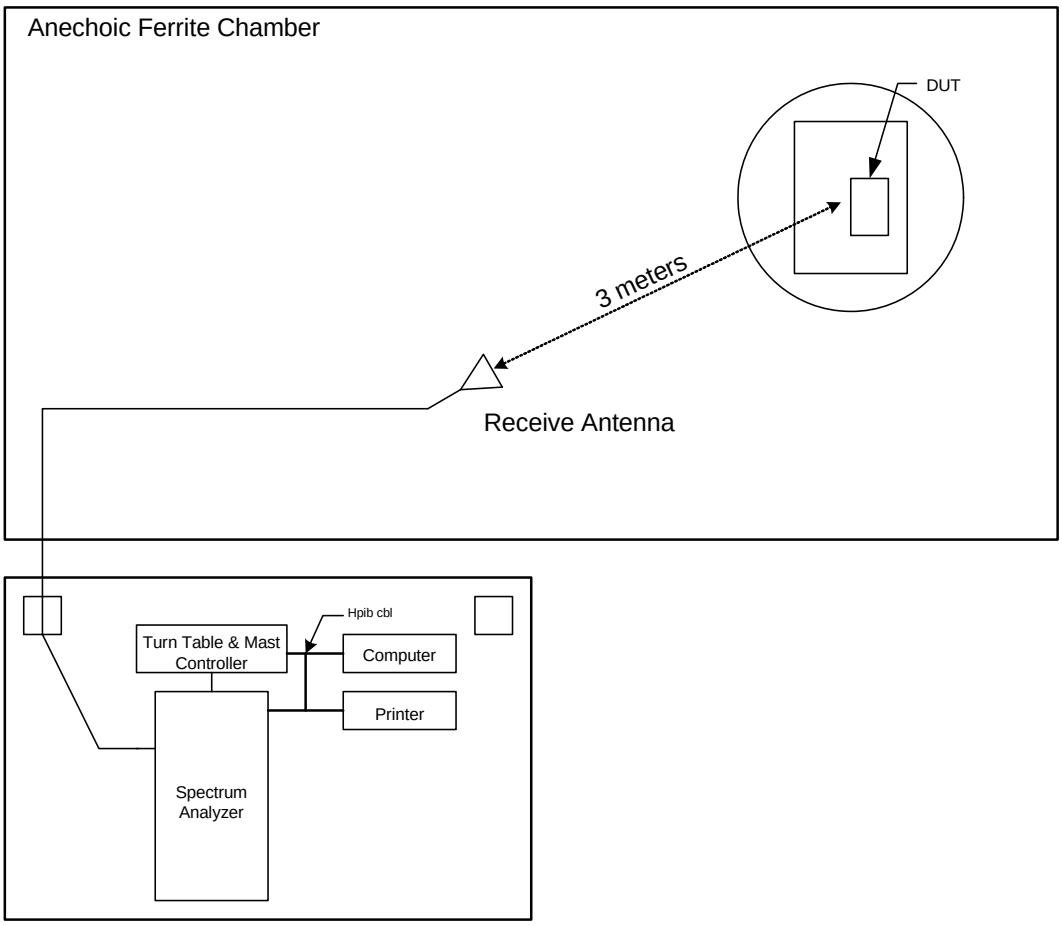


FIGURE 1 BLOCKDIAGRAM OF TEST SETUP

Figure 2

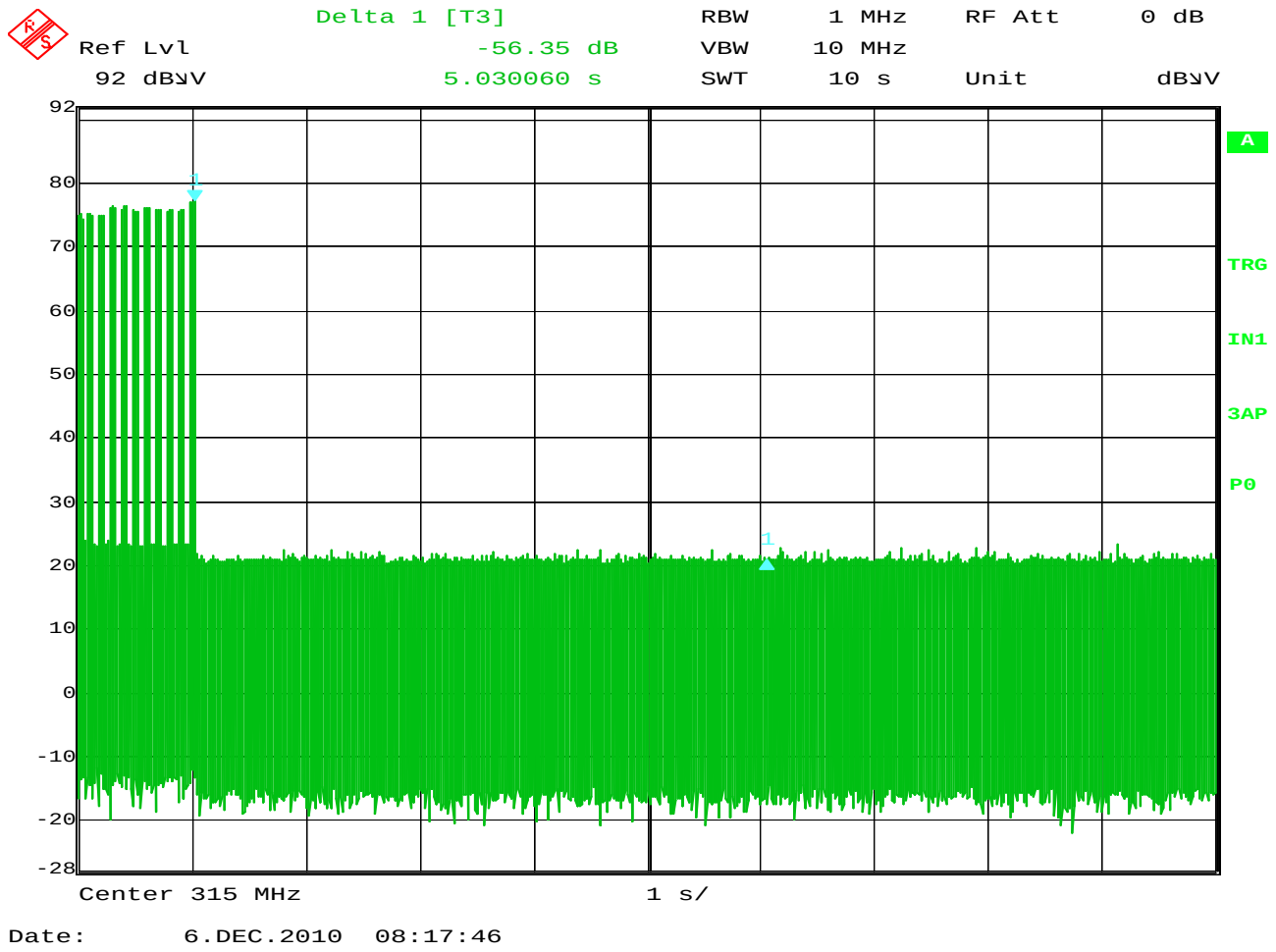
Test Setup for Radiated Emissions, 30MHz to 1GHz – Horizontal Polarization

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

Figure 3

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

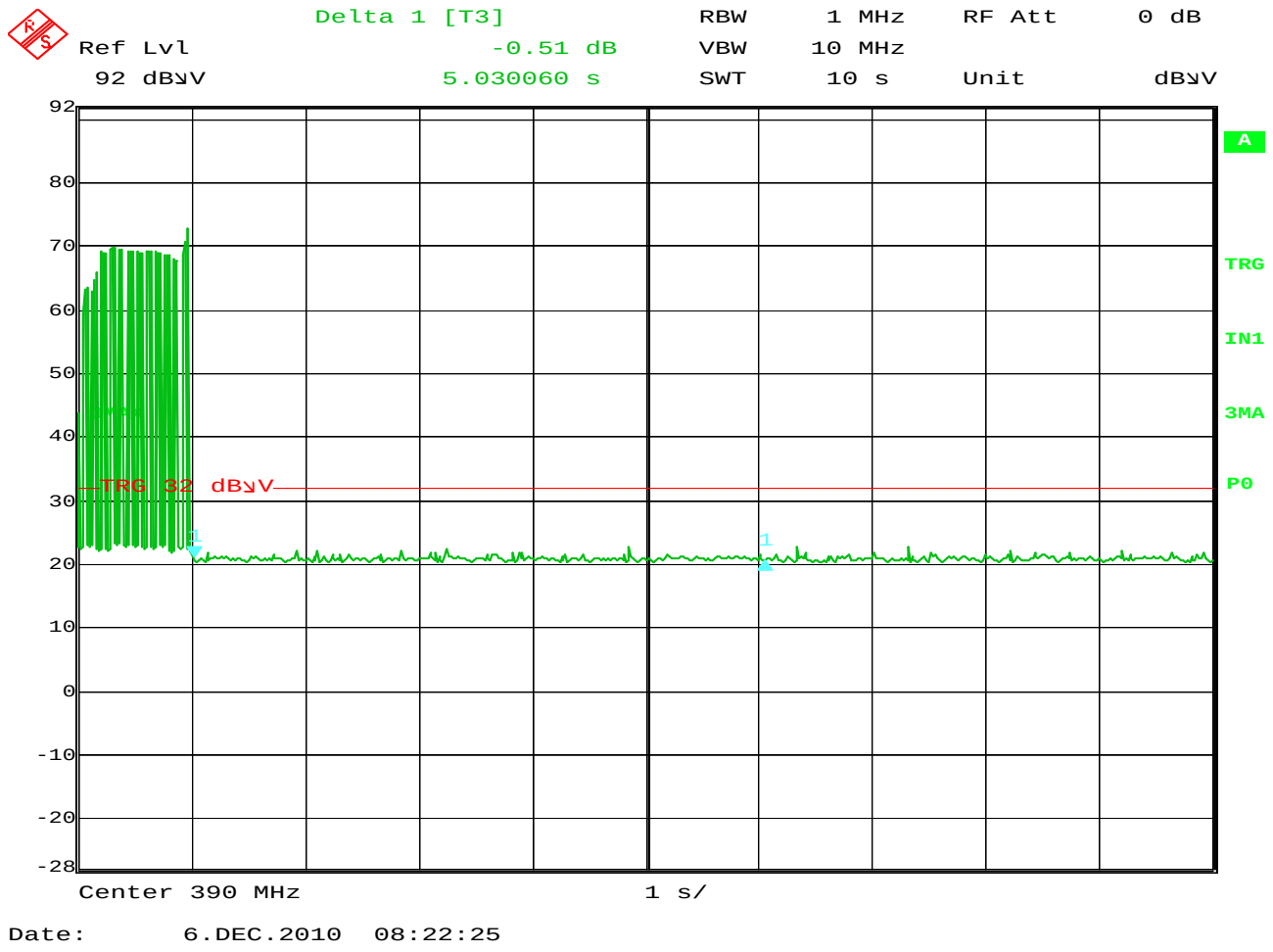
Test Setup for Radiated Emissions, Above 1GHz – Vertical Polarization



Periodic Operation

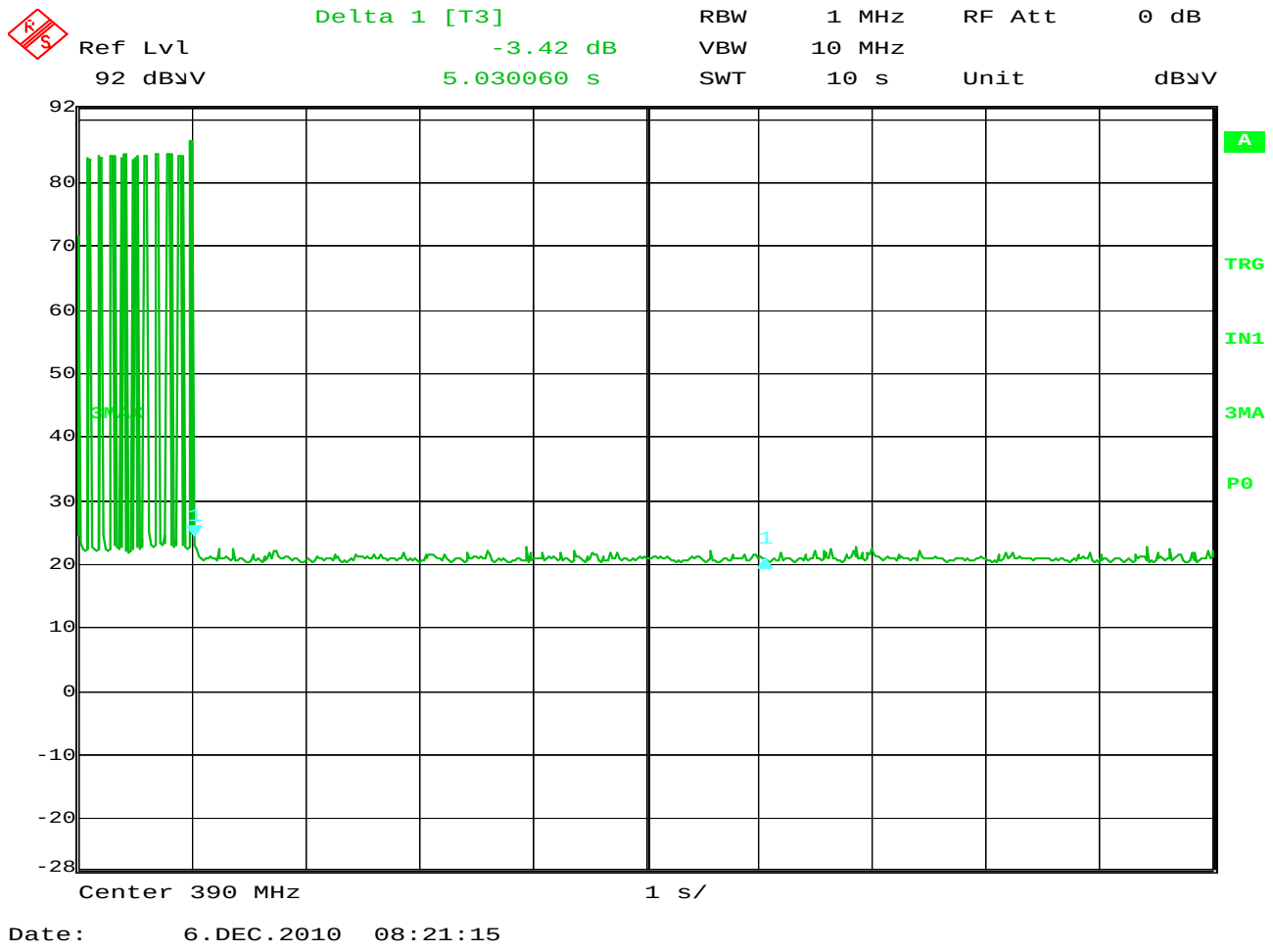
MANUFACTURER	:	The Chamberlain Group
MODEL NUMBER	:	956EV mini
TEST SPEC.	:	15.231 Periodic Operation
TEST PARAMETERS	:	Must deactivate within 5 seconds
EUT FREQUENCY	:	Transmit at 315MHz
NOTES	:	Rolling Code D

NOTES



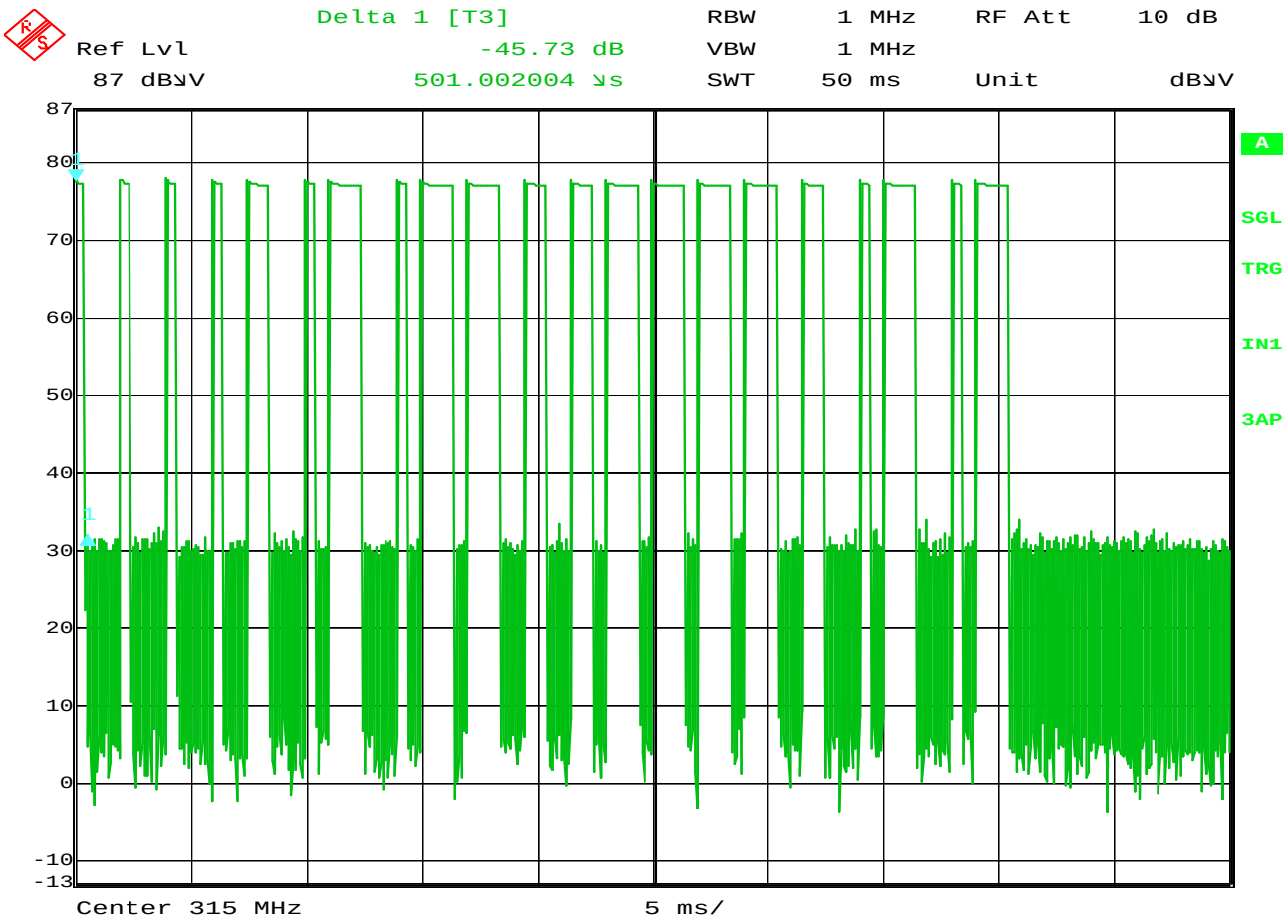
Periodic Operation

MANUFACTURER : The Chamberlain Group
MODEL NUMBER : 956EV mini
TEST SPEC. : 15.231 Periodic Operation
TEST PARAMETERS : Must deactivate within 5 seconds
EUT FREQUENCY : Transmit at 390MHz
NOTES : Rolling Code A



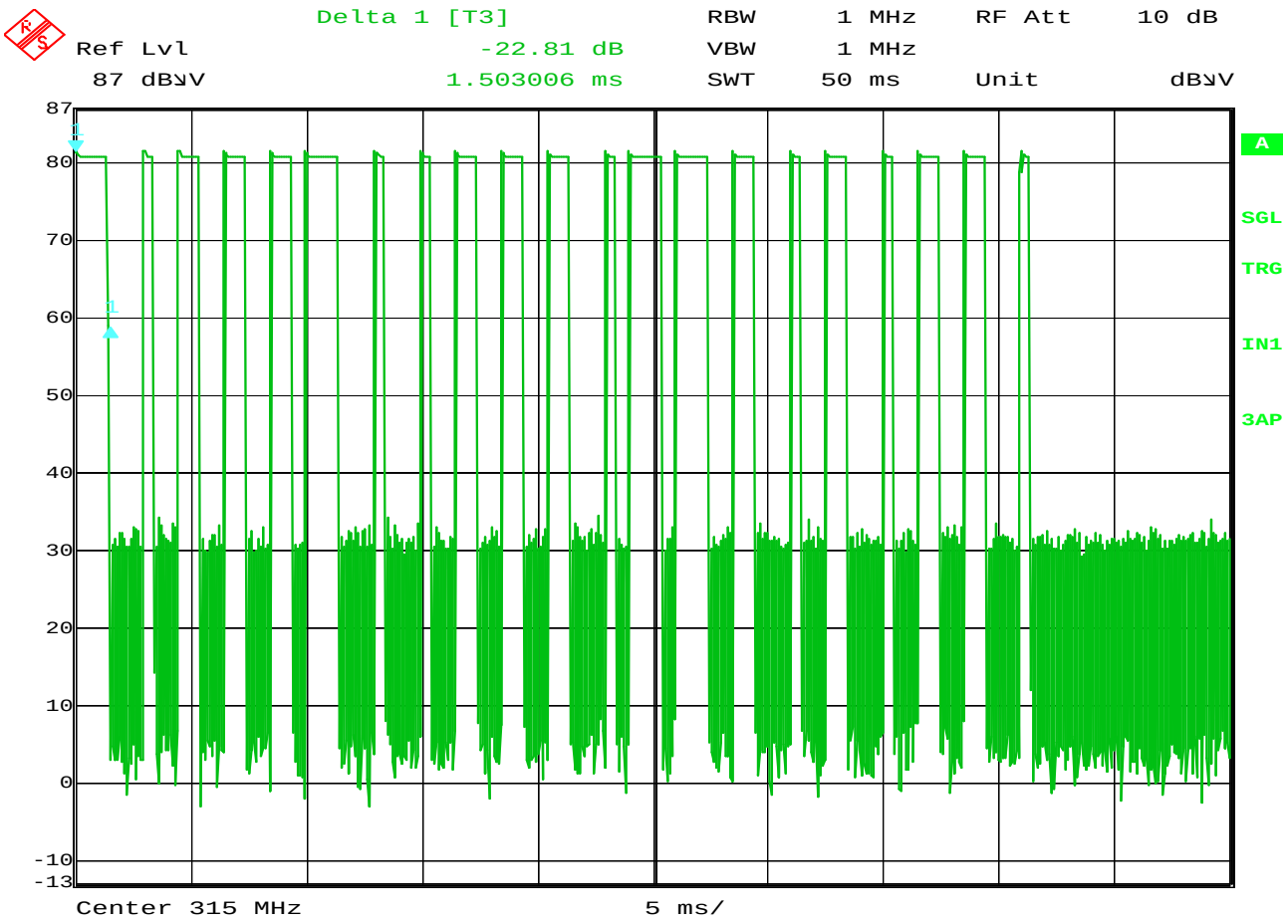
Periodic Operation

MANUFACTURER : The Chamberlain Group
MODEL NUMBER : 956EV mini
TEST SPEC. : 15.231 Periodic Operation
TEST PARAMETERS : Must deactivate within 5 seconds
EUT FREQUENCY : Transmit at 390MHz
NOTES : Rolling Code D



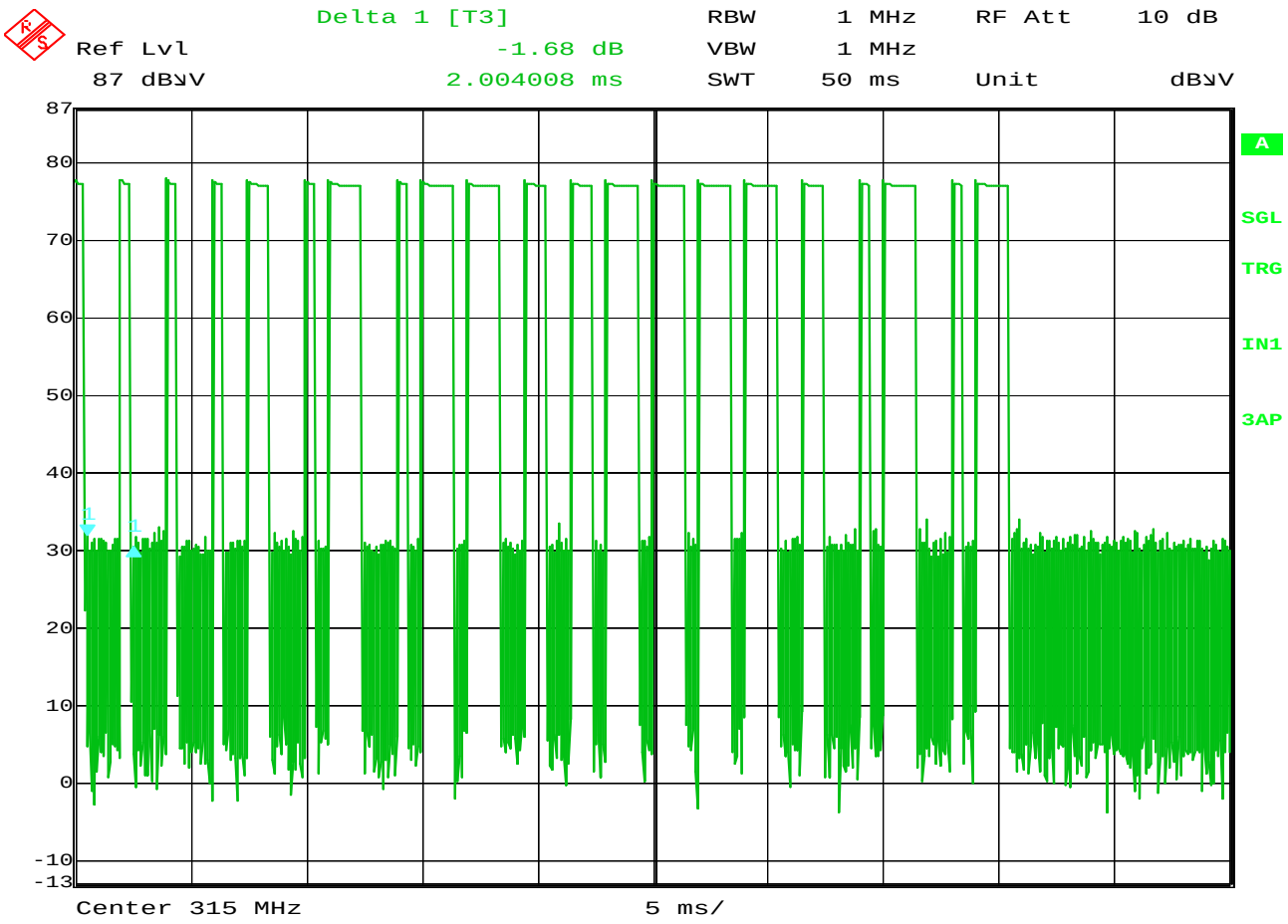
Duty Cycle

MANUFACTURER	:	The Chamberlain Group
MODEL NUMBER	:	956EV mini
TEST SPEC.	:	15.231 Duty Cycle
TEST PARAMETERS	:	Rolling Code D
EUT FREQUENCY	:	Transmit at 315MHz
NOTES	:	



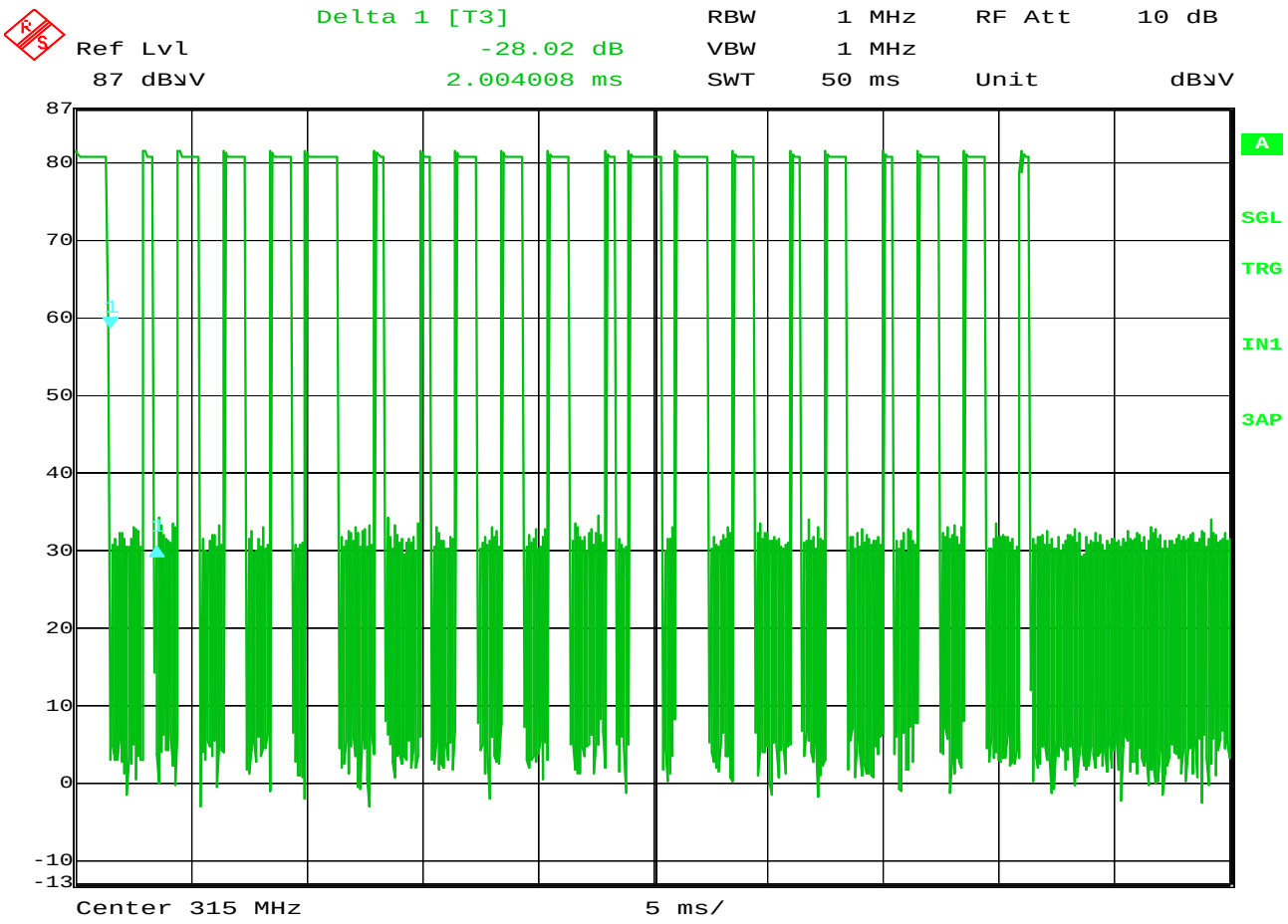
Duty Cycle

MANUFACTURER	:	The Chamberlain Group
MODEL NUMBER	:	956EV mini
TEST SPEC.	:	15.231 Duty Cycle
TEST PARAMETERS	:	Rolling Code D
EUT FREQUENCY	:	Transmit at 315MHz
NOTES	:	1.5mS sync pulse



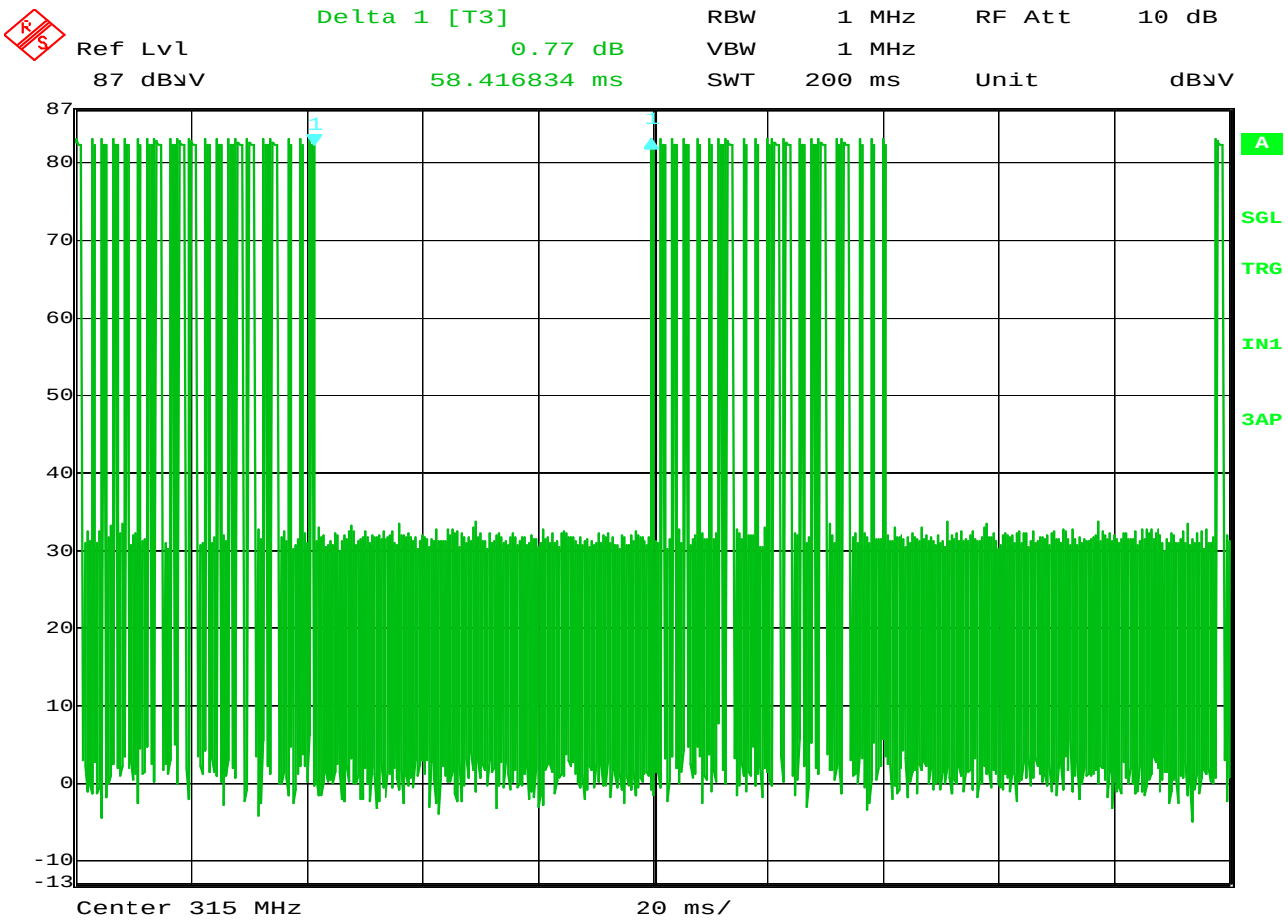
Duty Cycle

MANUFACTURER	:	The Chamberlain Group
MODEL NUMBER	:	956EV mini
TEST SPEC.	:	15.231 Duty Cycle
TEST PARAMETERS	:	Rolling Code D
EUT FREQUENCY	:	Transmit at 315MHz
NOTES	:	20 trinary bits 2mS wide with .5mS sync pulse



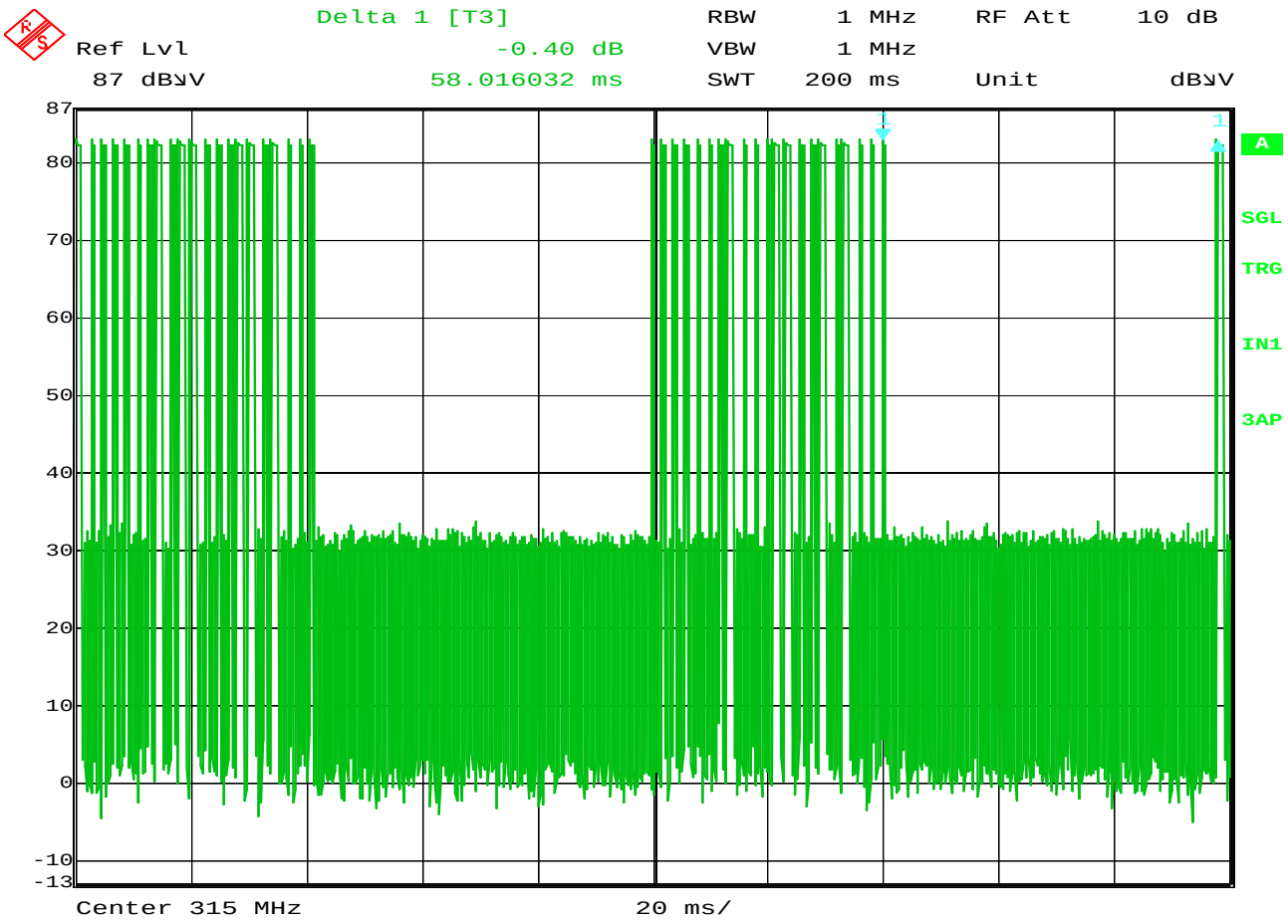
Duty Cycle

MANUFACTURER	:	The Chamberlain Group
MODEL NUMBER	:	956EV mini
TEST SPEC.	:	15.231 Duty Cycle
TEST PARAMETERS	:	Rolling Code D
EUT FREQUENCY	:	Transmit at 315MHz
NOTES	:	20 trinary bits 2mS wide 1.5mS sync



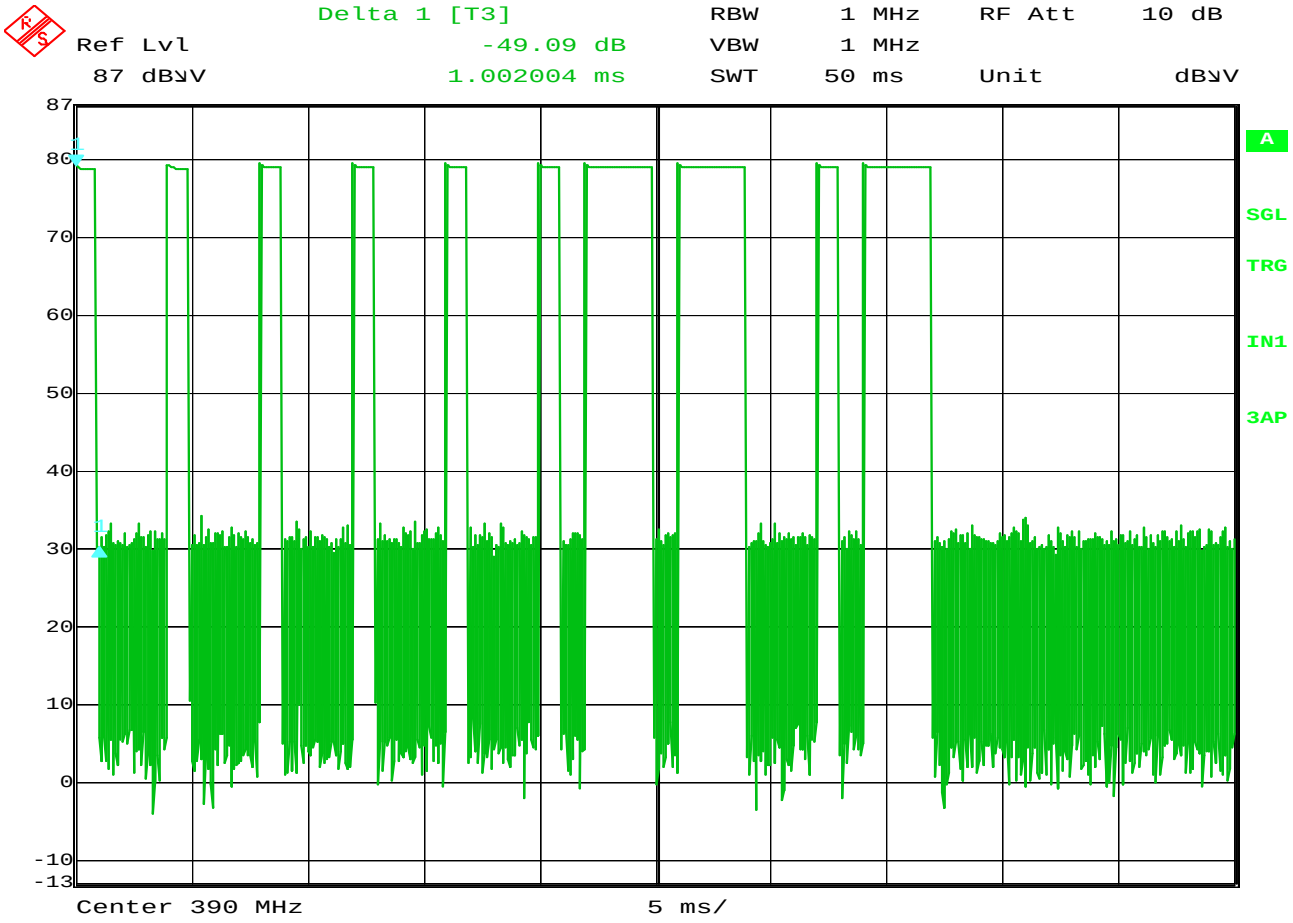
Duty Cycle

MANUFACTURER	:	The Chamberlain Group
MODEL NUMBER	:	956EV mini
TEST SPEC.	:	15.231 Duty Cycle
TEST PARAMETERS	:	Rolling Code D
EUT FREQUENCY	:	Transmit at 315MHz
NOTES	:	58.5mS blank time



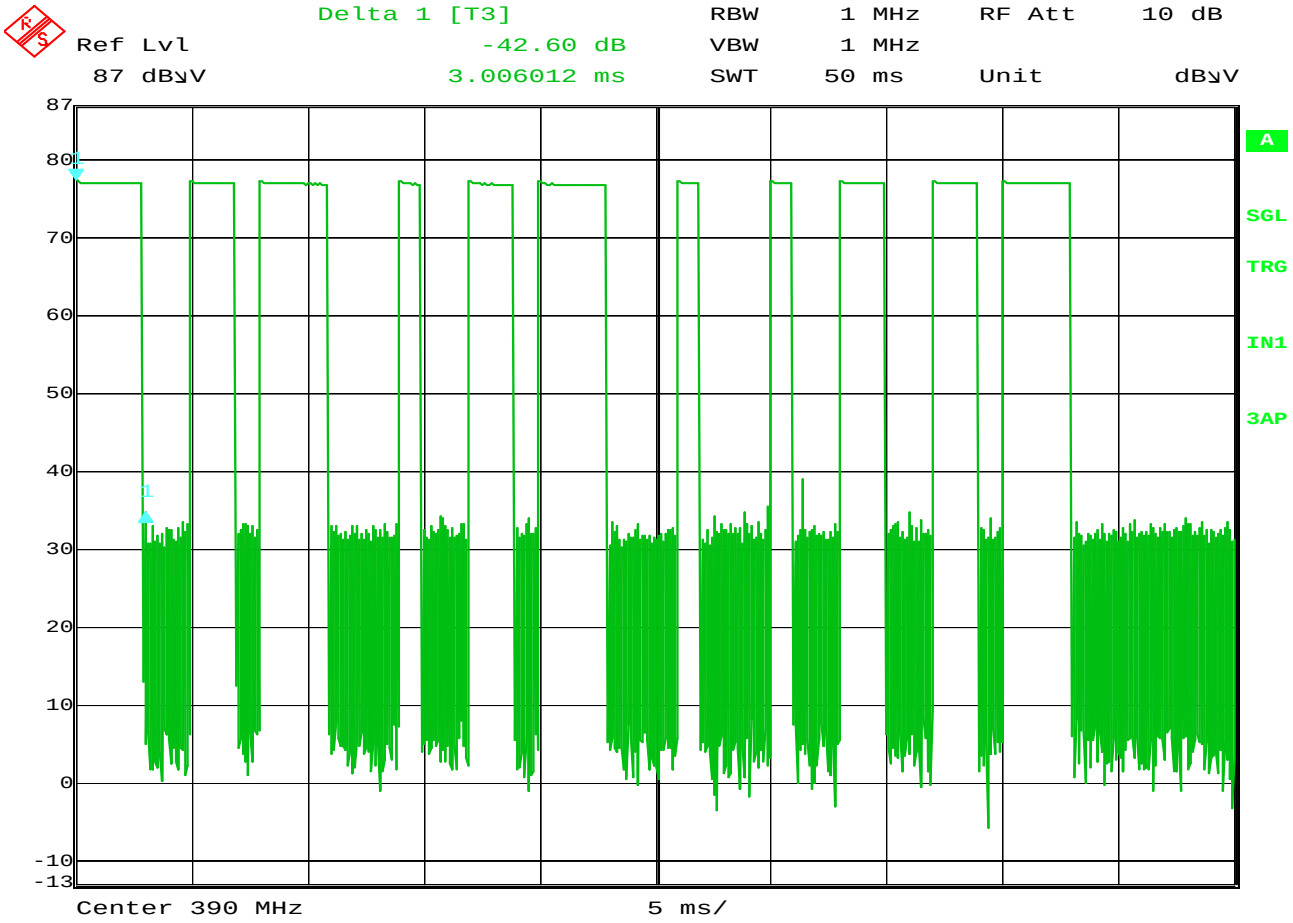
Duty Cycle

MANUFACTURER	:	The Chamberlain Group
MODEL NUMBER	:	956EV mini
TEST SPEC.	:	15.231 Duty Cycle
TEST PARAMETERS	:	Rolling Code D
EUT FREQUENCY	:	Transmit at 315MHz
NOTES	:	59.0 mS blank time



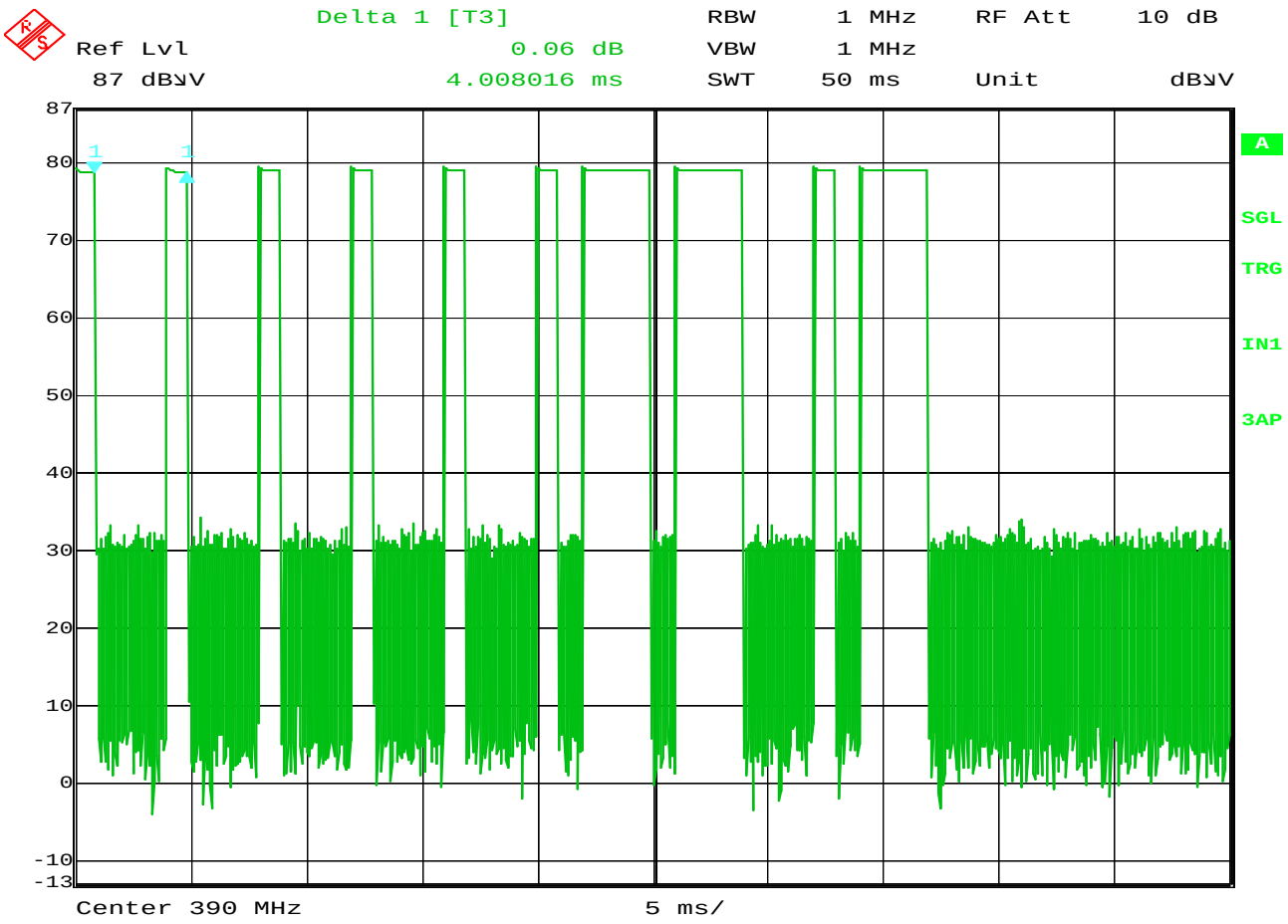
Duty Cycle

MANUFACTURER	:	The Chamberlain Group
MODEL NUMBER	:	956EV mini
TEST SPEC.	:	15.231 Duty Cycle
TEST PARAMETERS	:	Rolling Code A
EUT FREQUENCY	:	Transmit at 390MHz
NOTES	:	10 trinary bits 4mS with 3 mS sync pulse



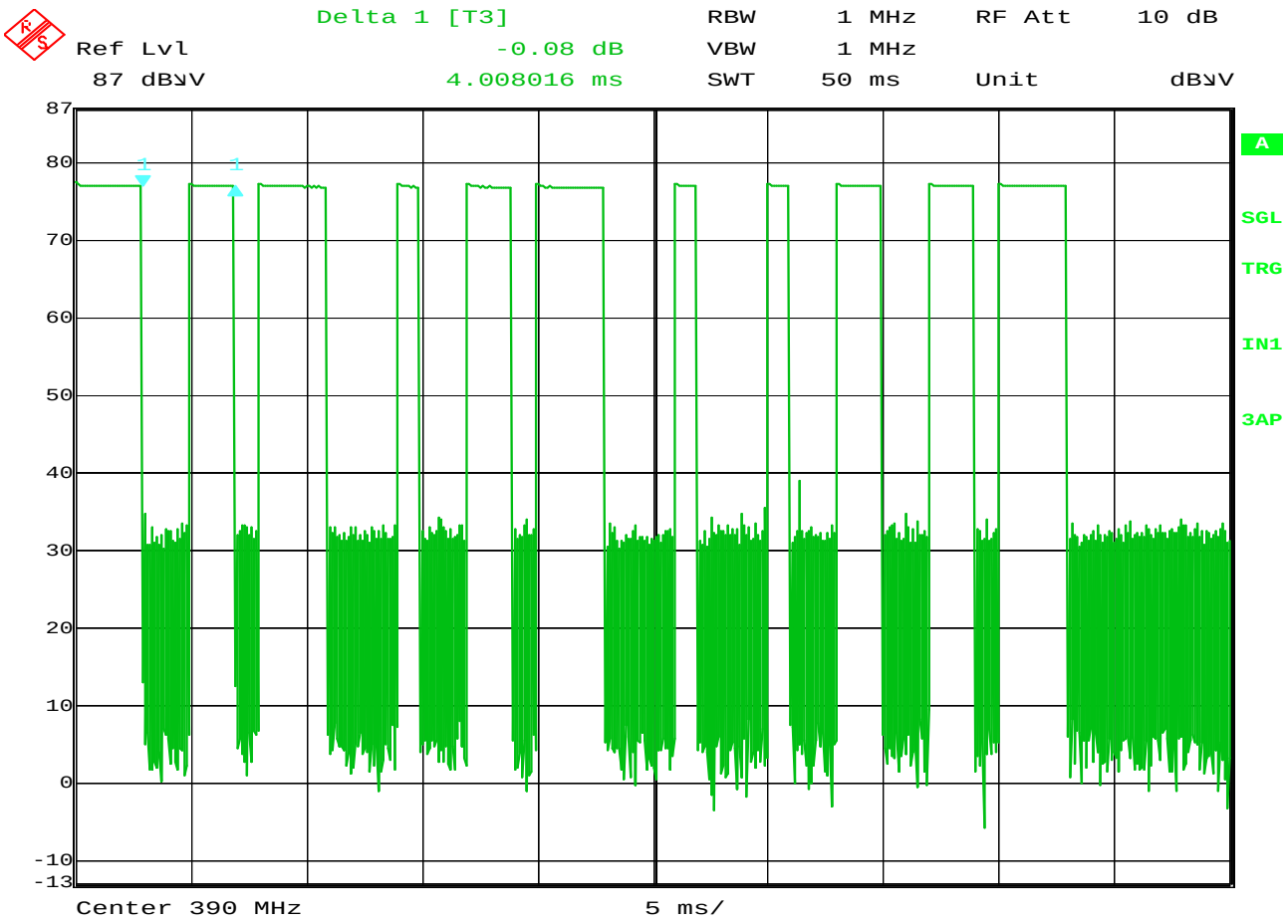
Duty Cycle

MANUFACTURER	:	The Chamberlain Group
MODEL NUMBER	:	956EV mini
TEST SPEC.	:	15.231 Duty Cycle
TEST PARAMETERS	:	Rolling Code A
EUT FREQUENCY	:	Transmit at 390MHz
NOTES	:	20 trinary bits with .5 mS sync pulse



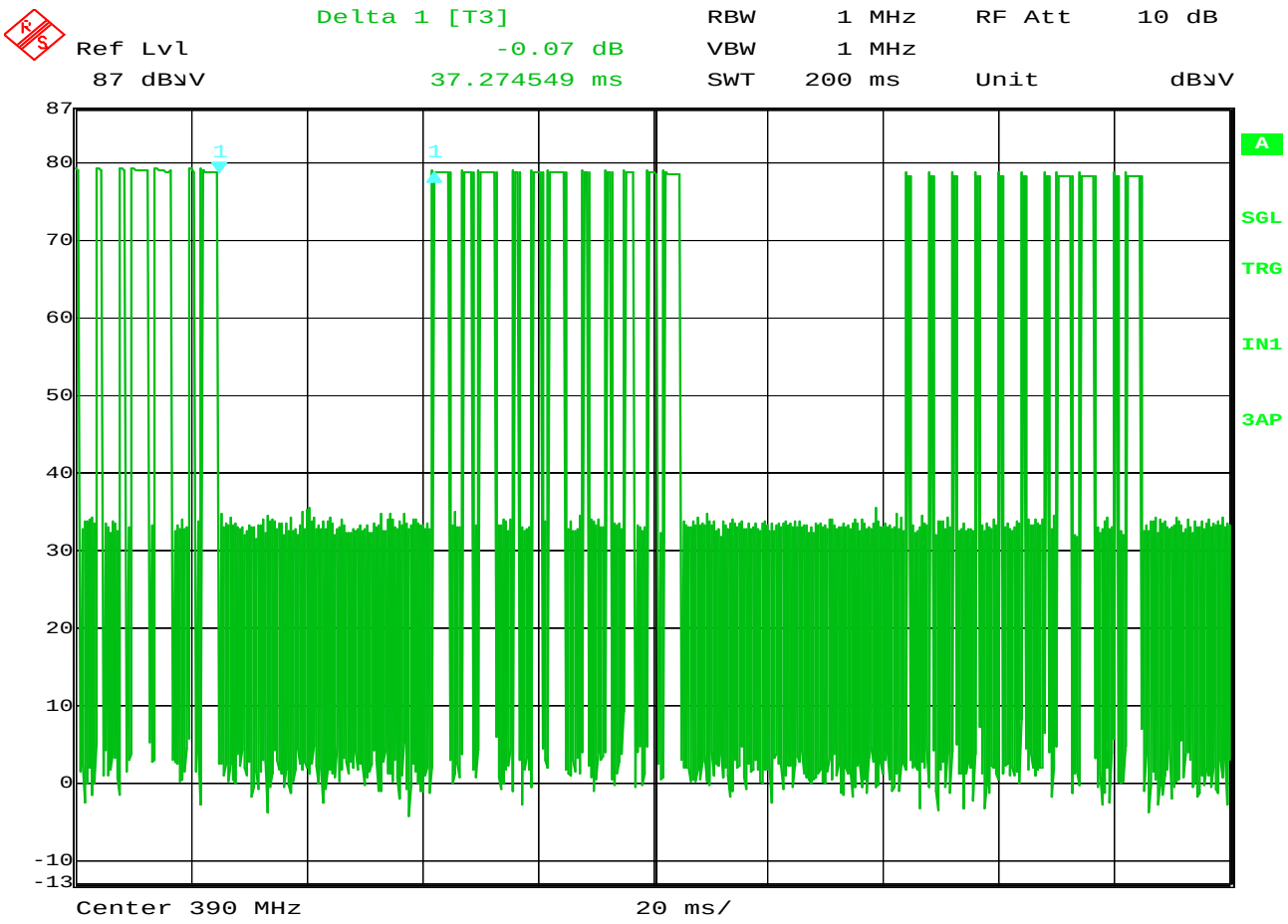
Duty Cycle

MANUFACTURER	:	The Chamberlain Group
MODEL NUMBER	:	956EV mini
TEST SPEC.	:	15.231 Duty Cycle
TEST PARAMETERS	:	Rolling Code A
EUT FREQUENCY	:	Transmit at 390MHz
NOTES	:	10 trinary bits 4mS with 1 mS sync pulse



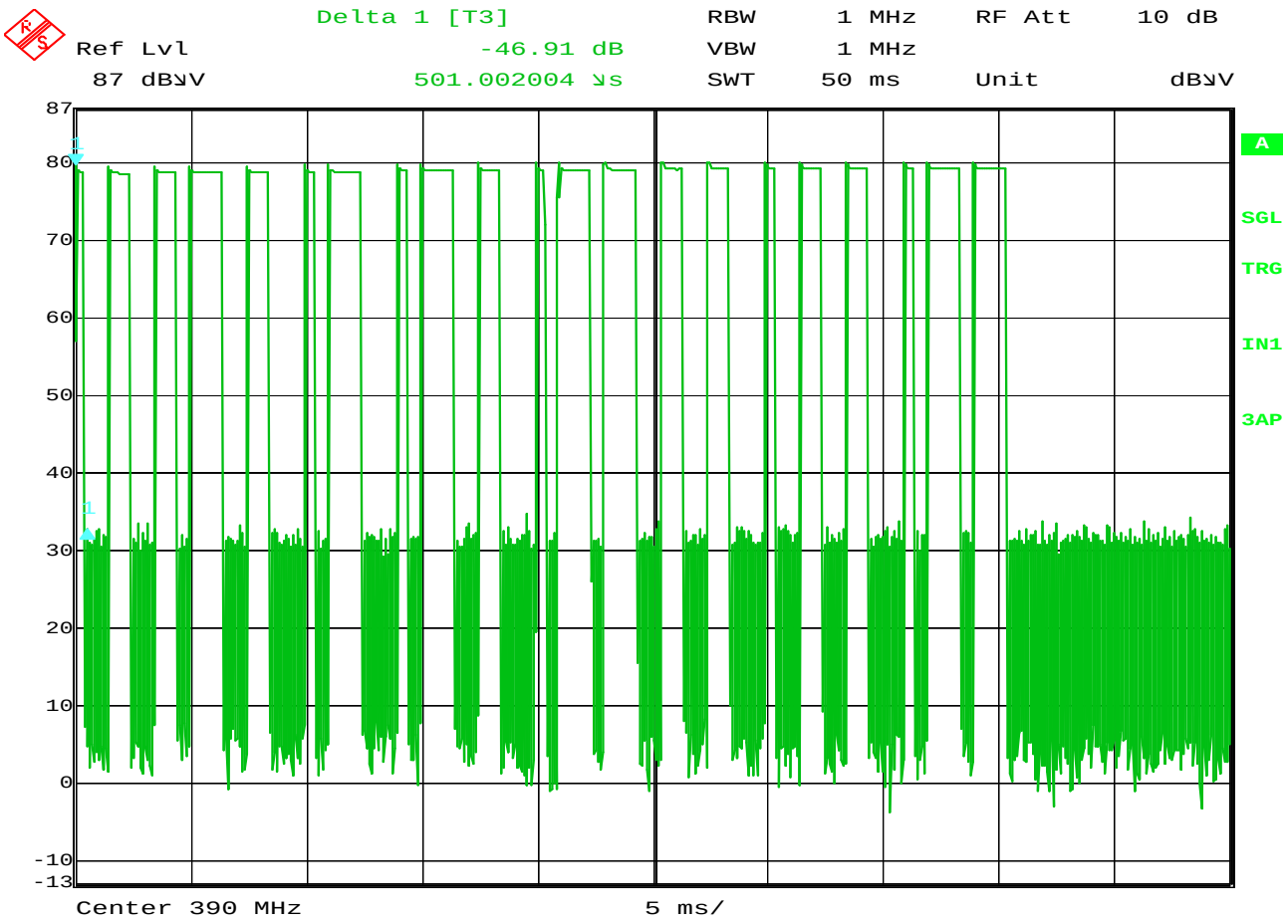
Duty Cycle

MANUFACTURER	:	The Chamberlain Group
MODEL NUMBER	:	956EV mini
TEST SPEC.	:	15.231 Duty Cycle
TEST PARAMETERS	:	Rolling Code A
EUT FREQUENCY	:	Transmit at 390MHz
NOTES	:	10 trinary bits 4mS with 3 mS sync pulse



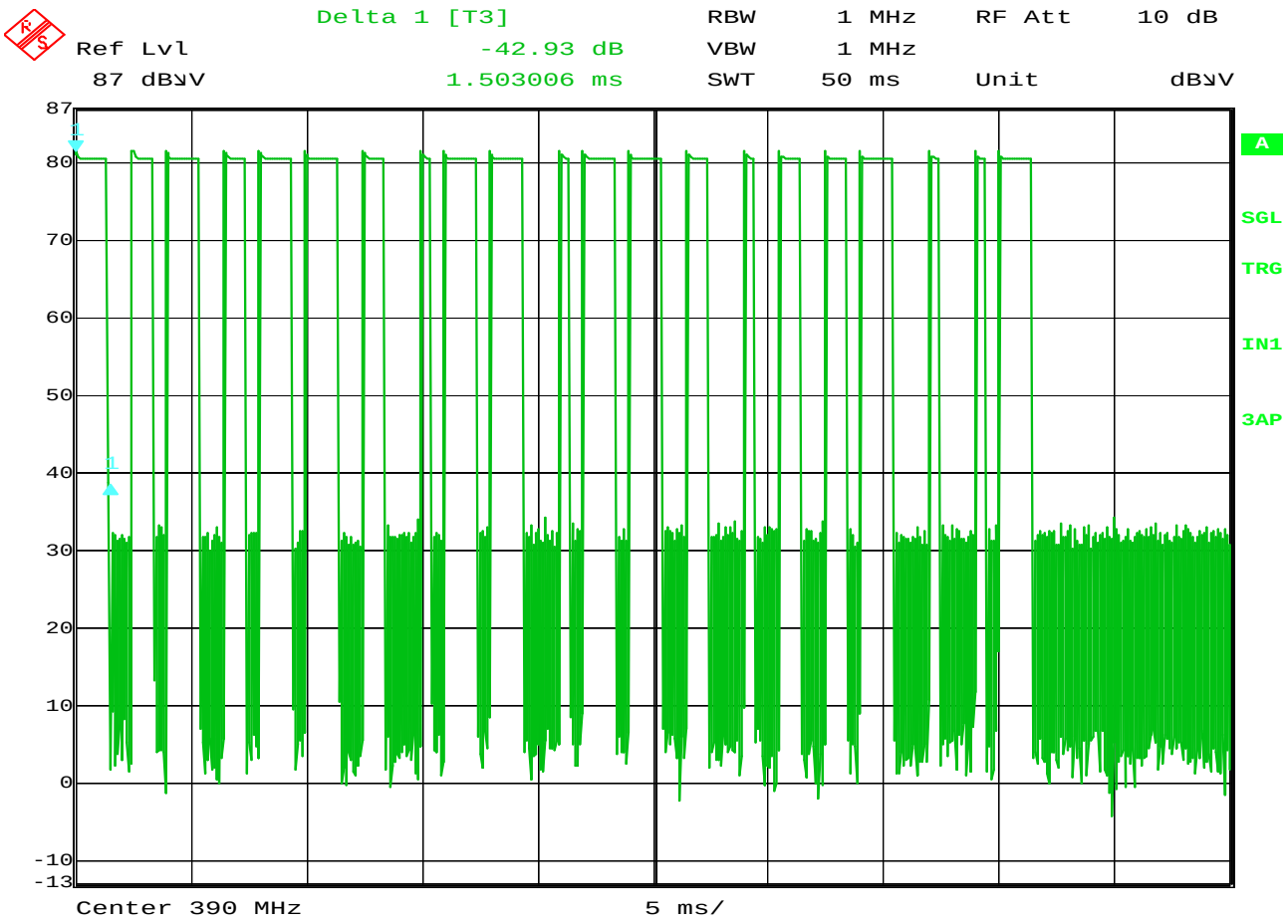
Duty Cycle

MANUFACTURER	:	The Chamberlain Group
MODEL NUMBER	:	956EV mini
TEST SPEC.	:	15.231 Duty Cycle
TEST PARAMETERS	:	Rolling Code A
EUT FREQUENCY	:	Transmit at 390MHz
NOTES	:	37mS blank time



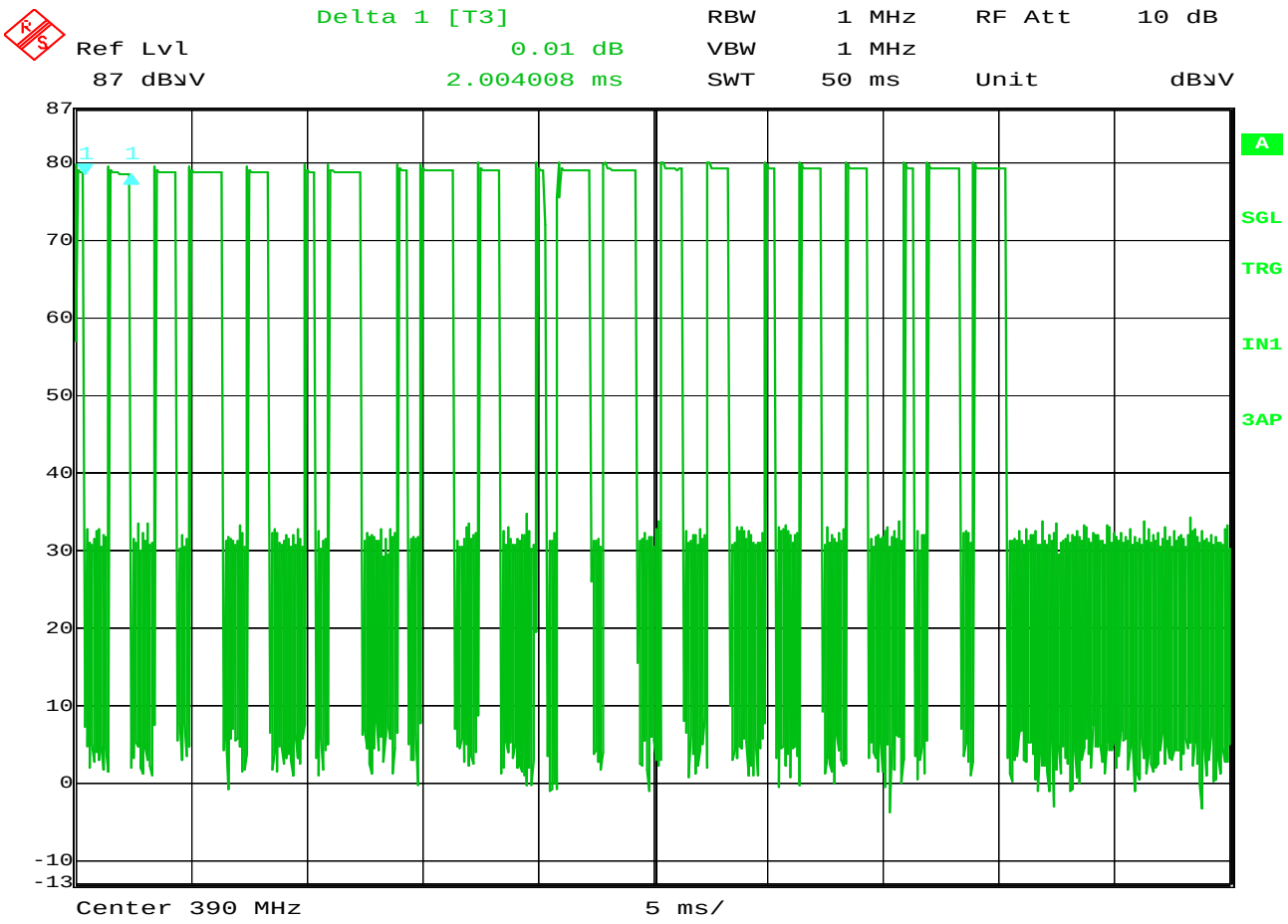
Duty Cycle

MANUFACTURER	:	The Chamberlain Group
MODEL NUMBER	:	956EV mini
TEST SPEC.	:	15.231 Duty Cycle
TEST PARAMETERS	:	Rolling Code D
EUT FREQUENCY	:	Transmit at 390MHz
NOTES	:	.5 mS sync pulse



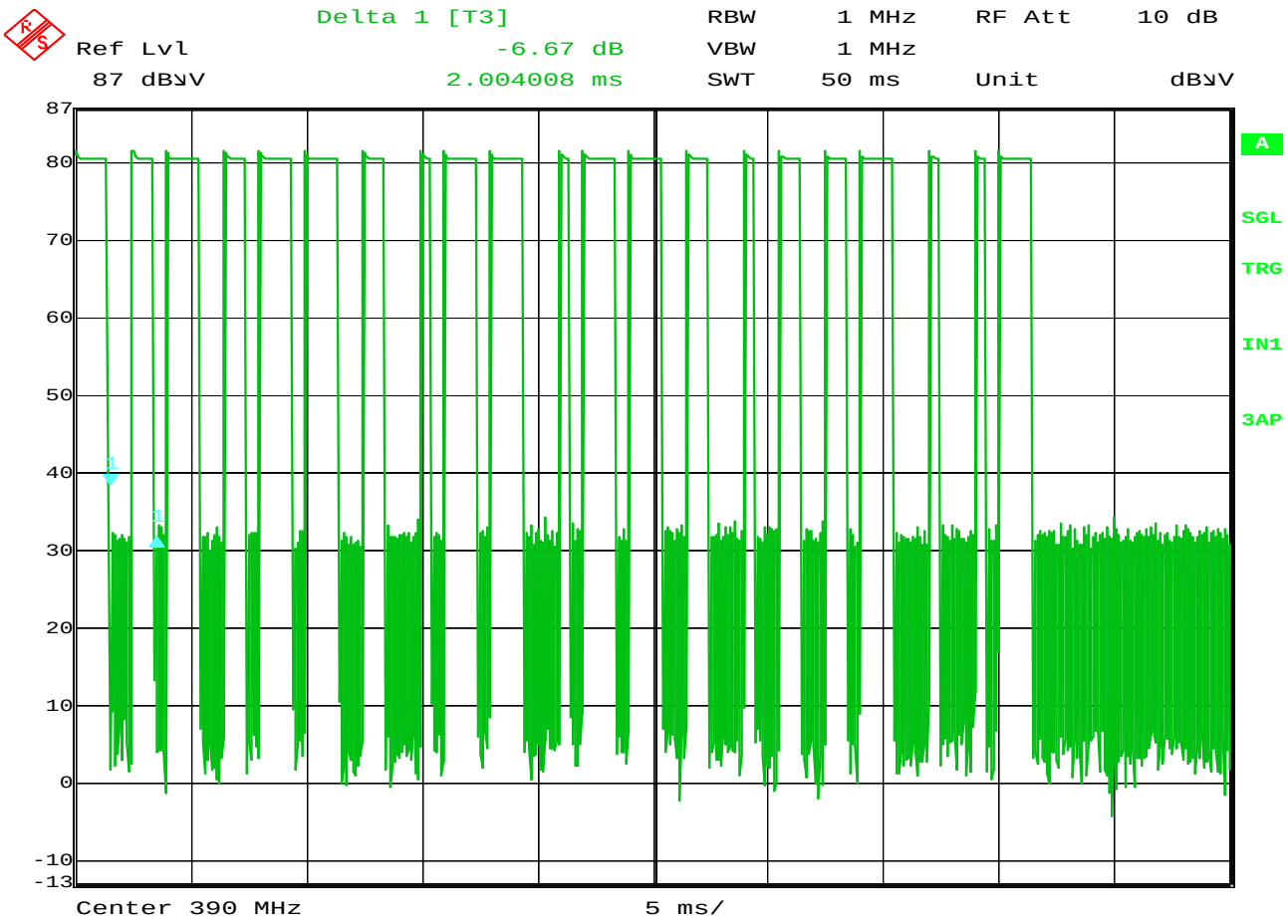
Duty Cycle

MANUFACTURER	:	The Chamberlain Group
MODEL NUMBER	:	956EV mini
TEST SPEC.	:	15.231 Duty Cycle
TEST PARAMETERS	:	Rolling Code D
EUT FREQUENCY	:	Transmit at 390MHz
NOTES	:	1.5 mS sync pulse



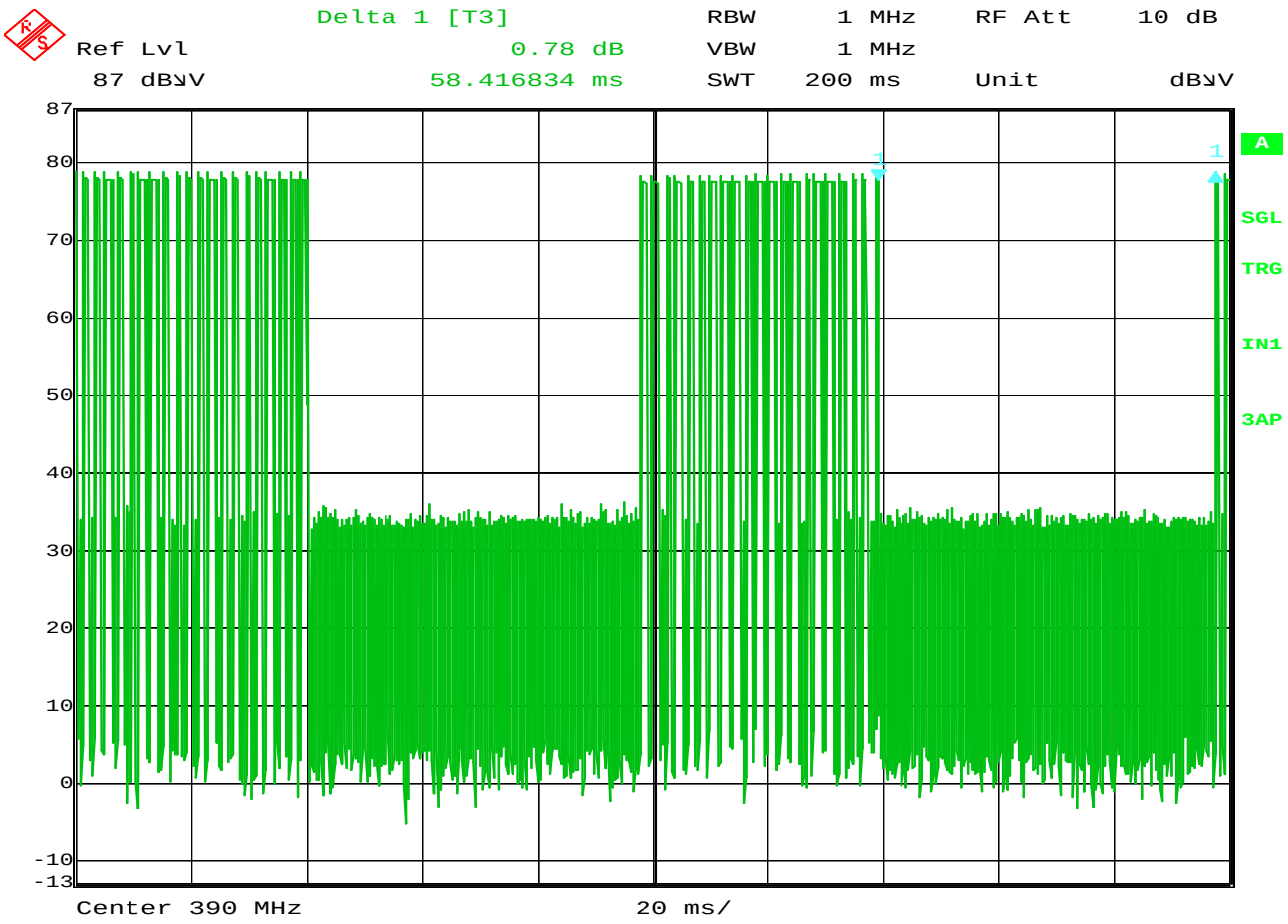
Duty Cycle

MANUFACTURER	:	The Chamberlain Group
MODEL NUMBER	:	956EV mini
TEST SPEC.	:	15.231 Duty Cycle
TEST PARAMETERS	:	Rolling Code D
EUT FREQUENCY	:	Transmit at 390MHz
NOTES	:	20 trinary bits with .5 mS sync pulse



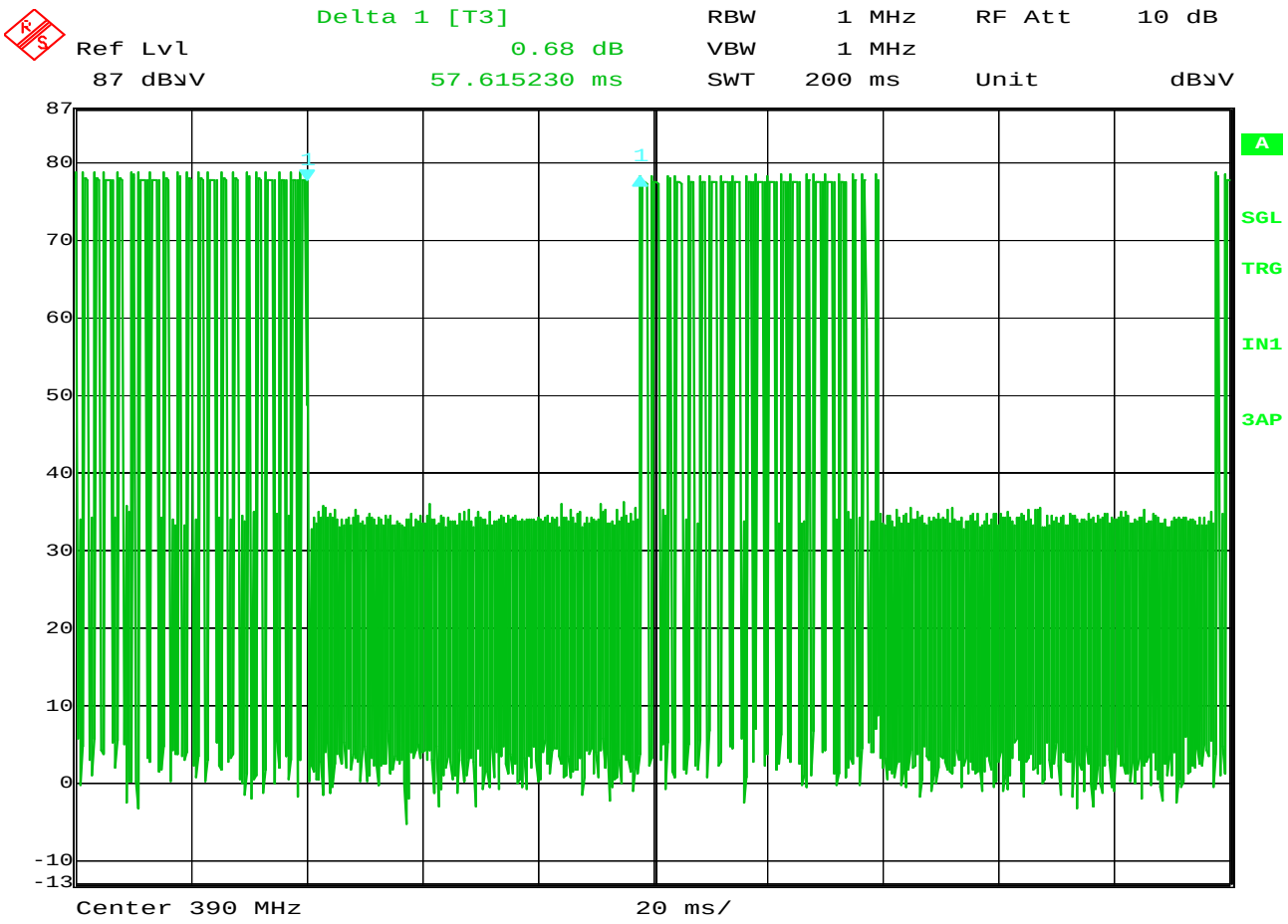
Duty Cycle

MANUFACTURER	:	The Chamberlain Group
MODEL NUMBER	:	956EV mini
TEST SPEC.	:	15.231 Duty Cycle
TEST PARAMETERS	:	Rolling Code D
EUT FREQUENCY	:	Transmit at 390MHz
NOTES	:	20 trinary bits 2mS with 1.5 mS sync pulse



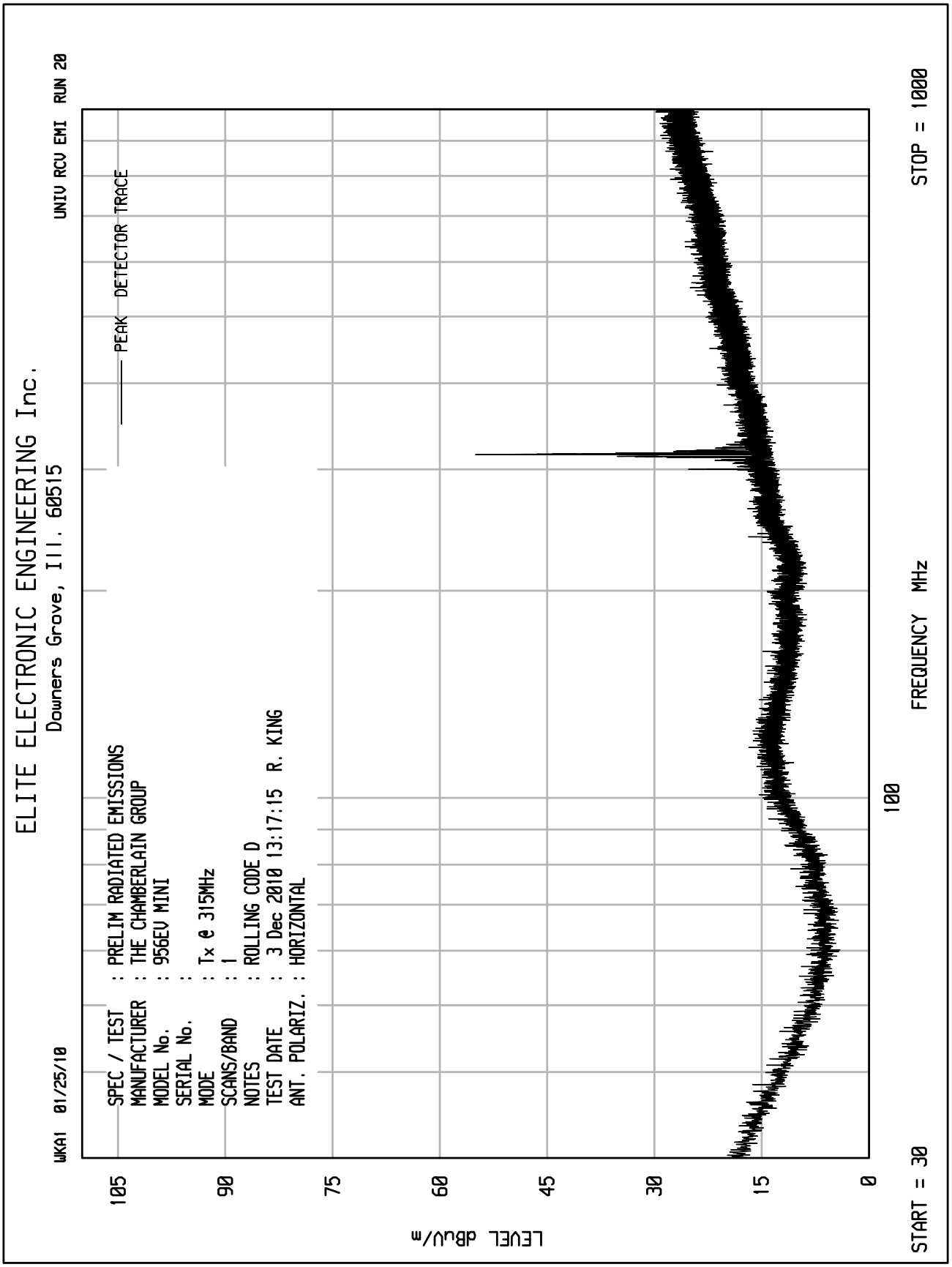
Duty Cycle

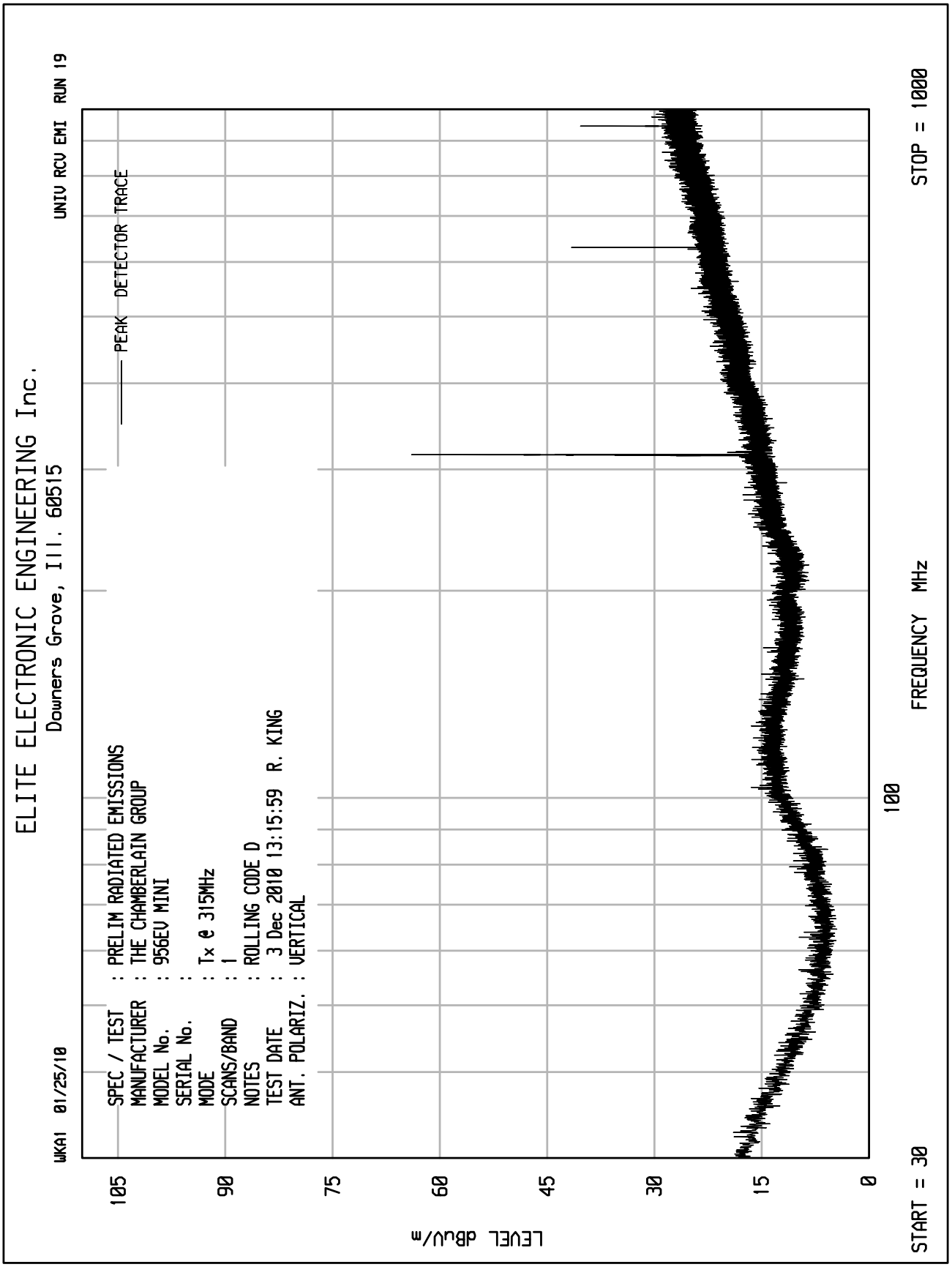
MANUFACTURER	:	The Chamberlain Group
MODEL NUMBER	:	956EV mini
TEST SPEC.	:	15.231 Duty Cycle
TEST PARAMETERS	:	Rolling Code D
EUT FREQUENCY	:	Transmit at 390MHz
NOTES	:	58.5 mS blank time

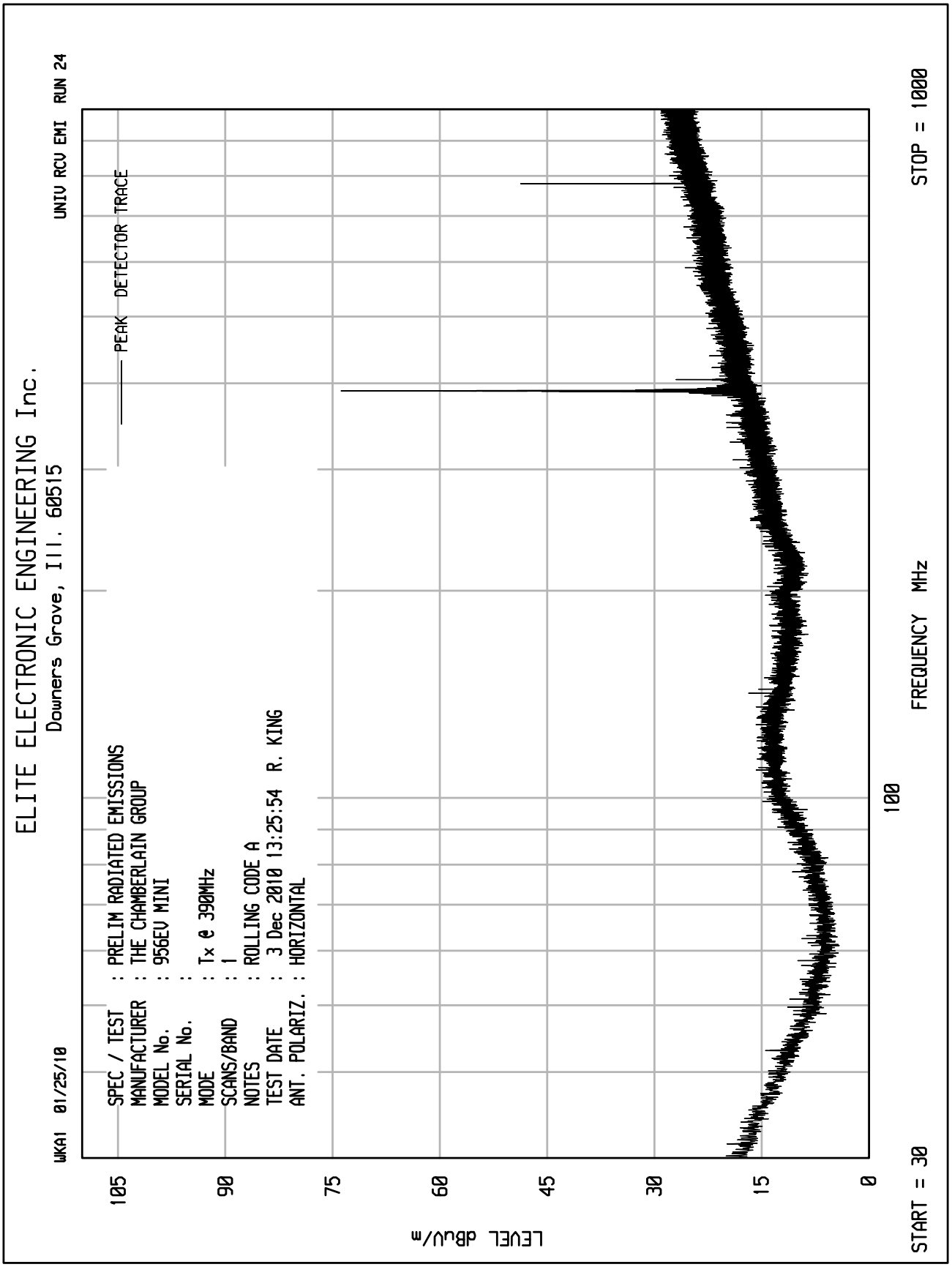


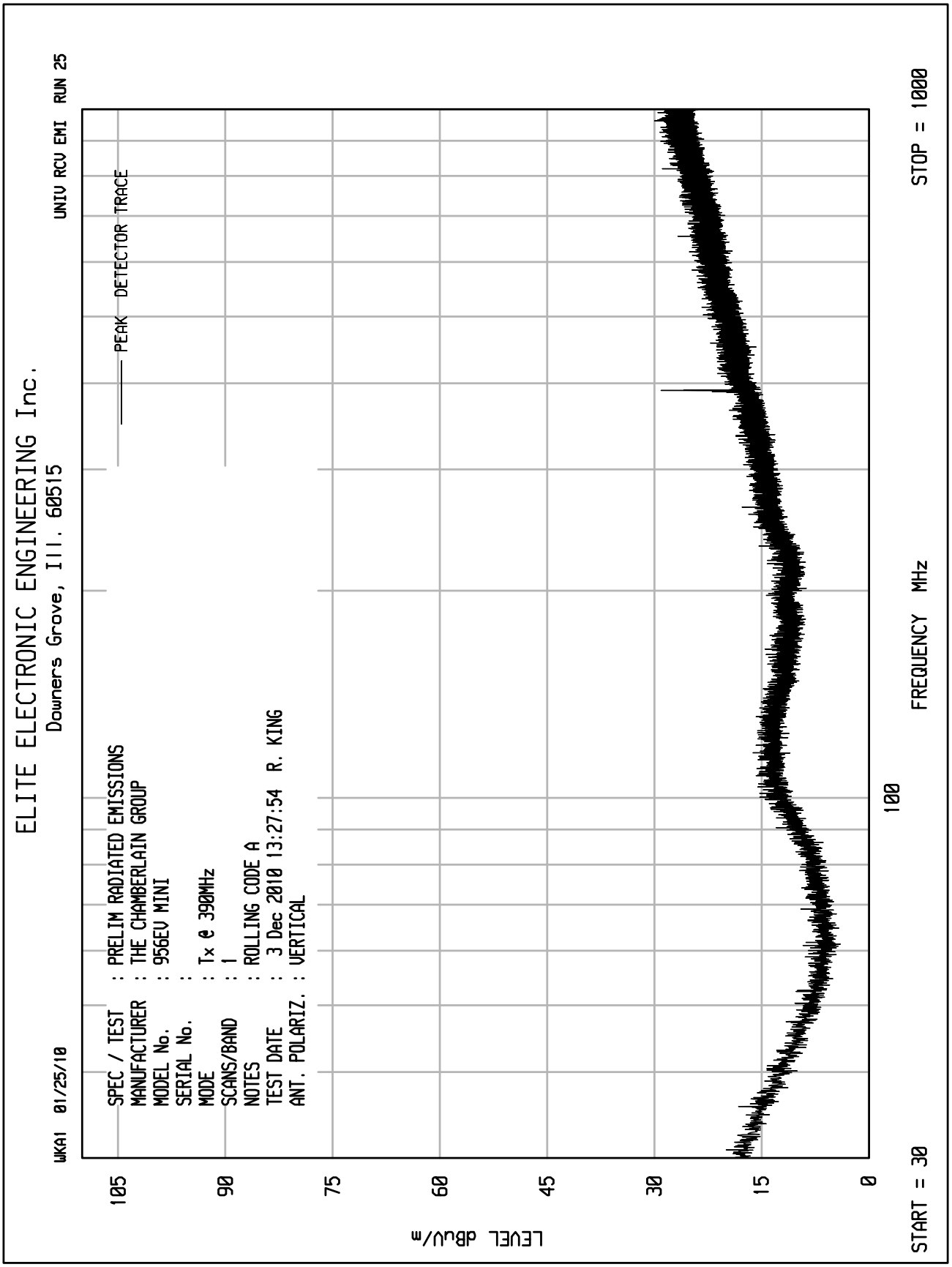
Duty Cycle

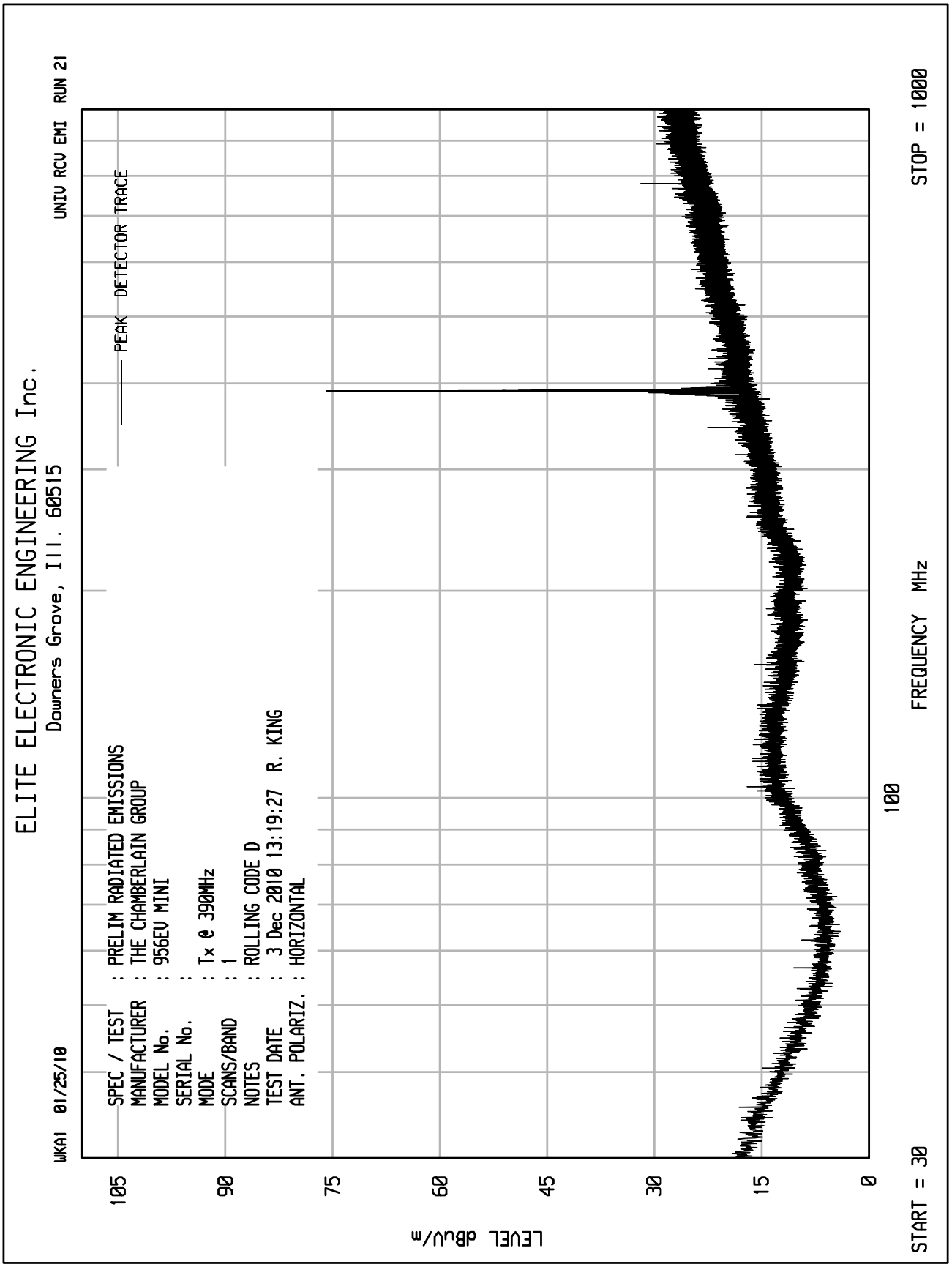
MANUFACTURER	:	The Chamberlain Group
MODEL NUMBER	:	956EV mini
TEST SPEC.	:	15.231 Duty Cycle
TEST PARAMETERS	:	Rolling Code D
EUT FREQUENCY	:	Transmit at 390MHz
NOTES	:	59.0 mS blank time

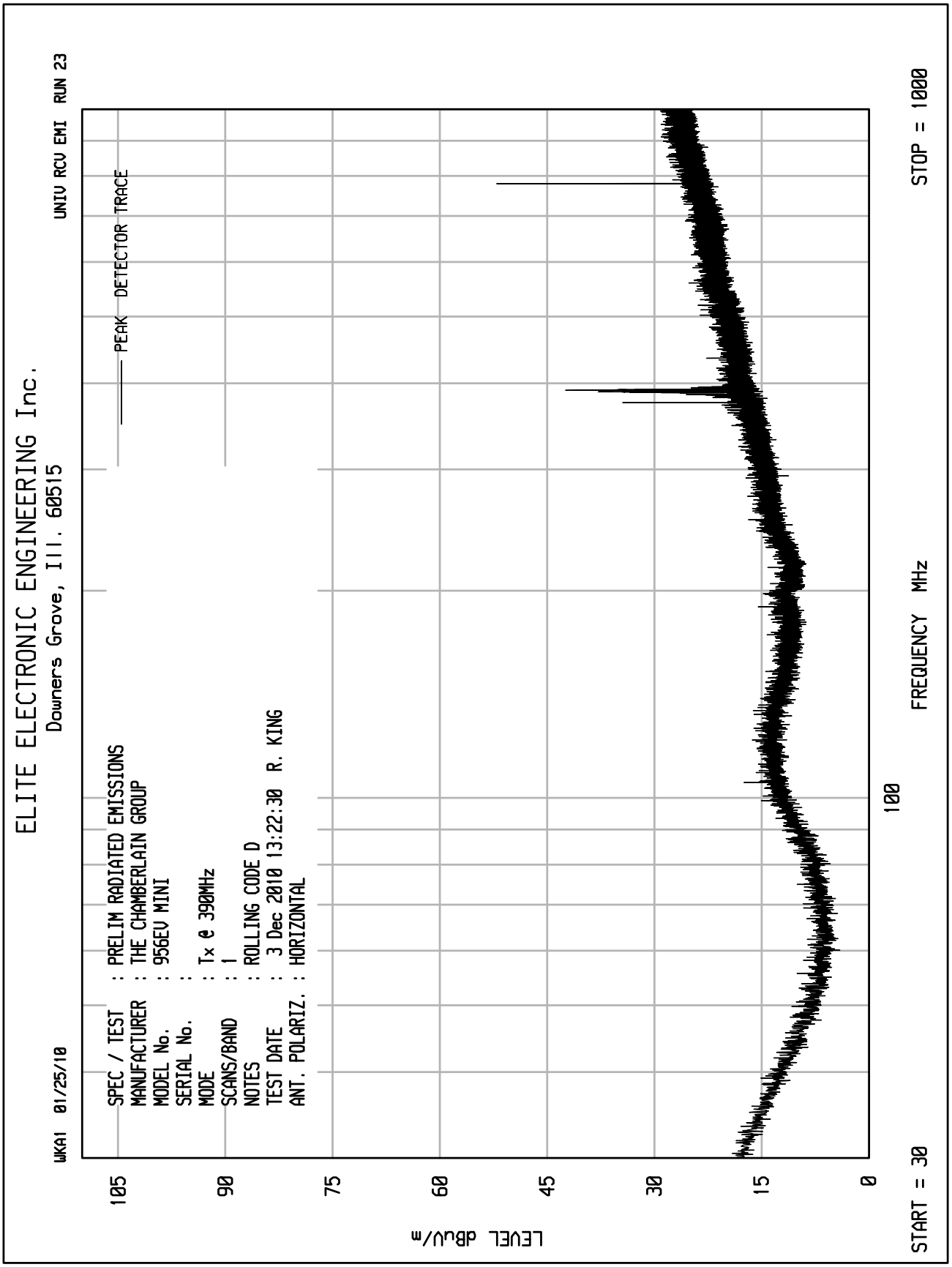

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 20
WKAI 01/25/10
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : 956EV MINI
SERIAL No. :
MODE : Tx @ 315MHz
SCANS/BAND : 1
NOTES : ROLLING CODE D
TEST DATE : 3 Dec 2010 13:17:15 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000

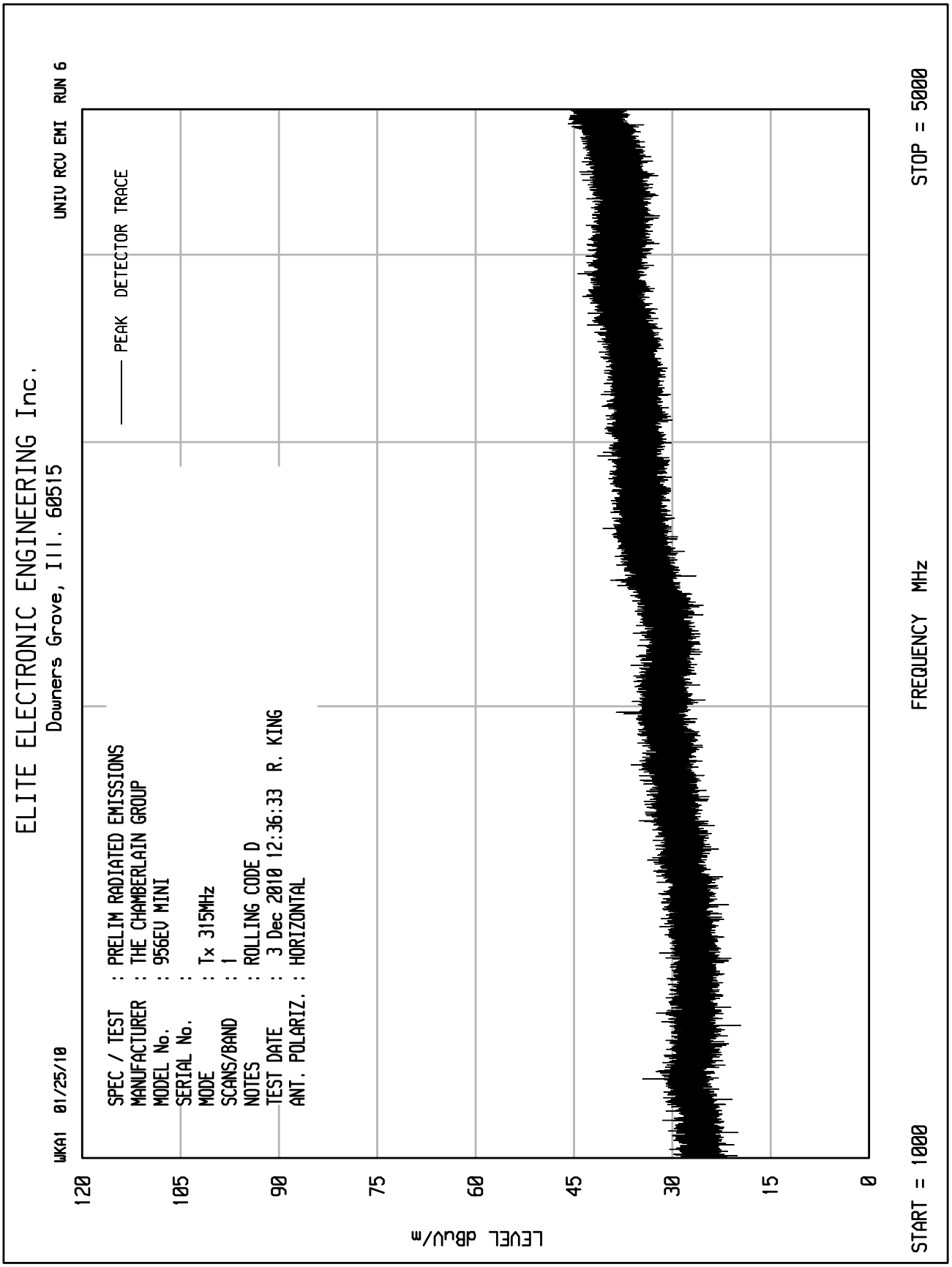

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 19
WKAI 01/25/10
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : 956EV MINI
SERIAL No. :
MODE : Tx @ 315MHz
SCANS/BAND : 1
NOTES : ROLLING CODE D
TEST DATE : 3 Dec 2010 13:15:59 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000

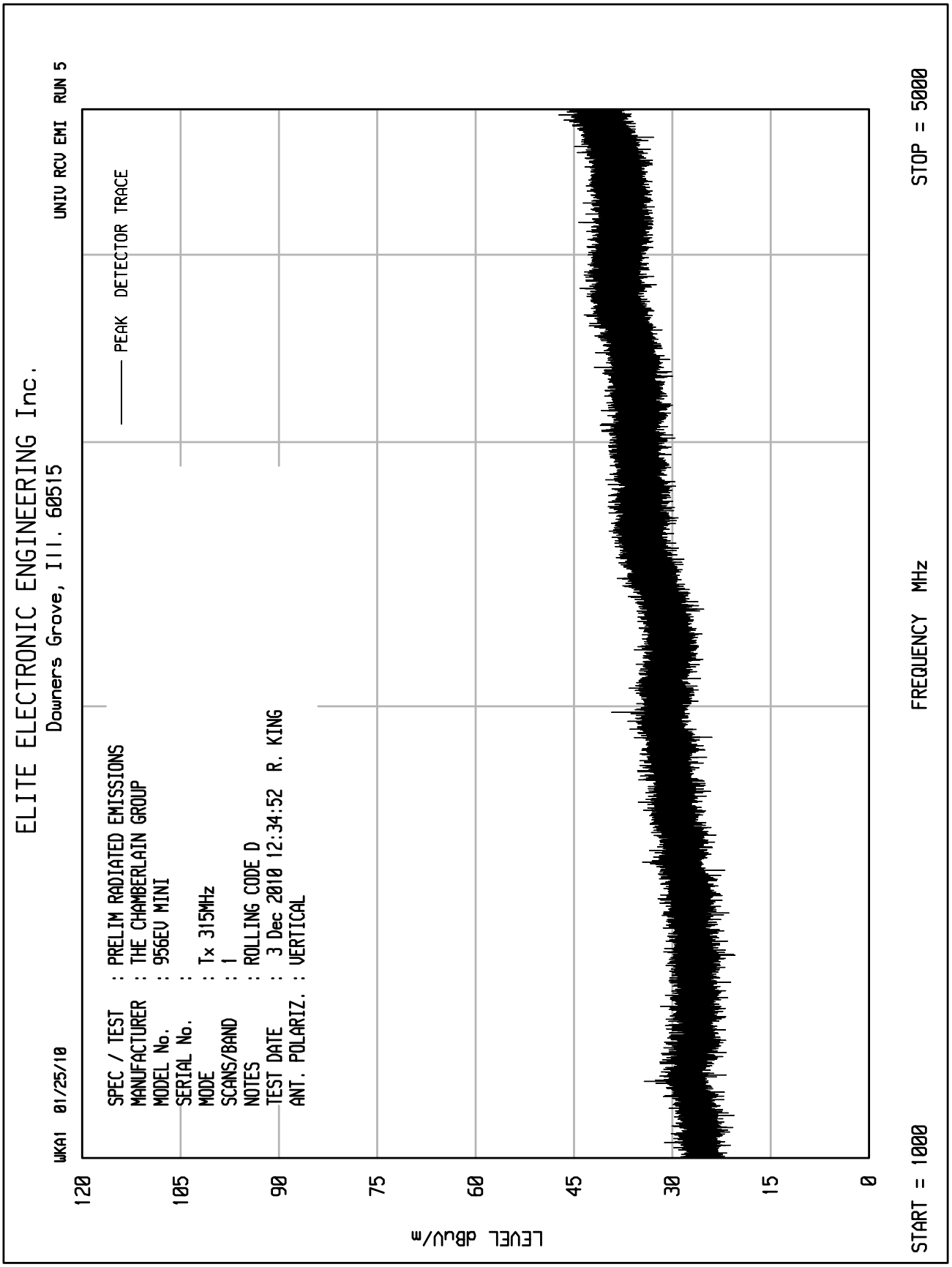

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 24
WKA1 01/25/10
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : 956EV MINI
SERIAL No. :
MODE : Tx @ 390MHz
SCANS/BAND : 1
NOTES : ROLLING CODE A
TEST DATE : 3 Dec 2010 13:25:54 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000

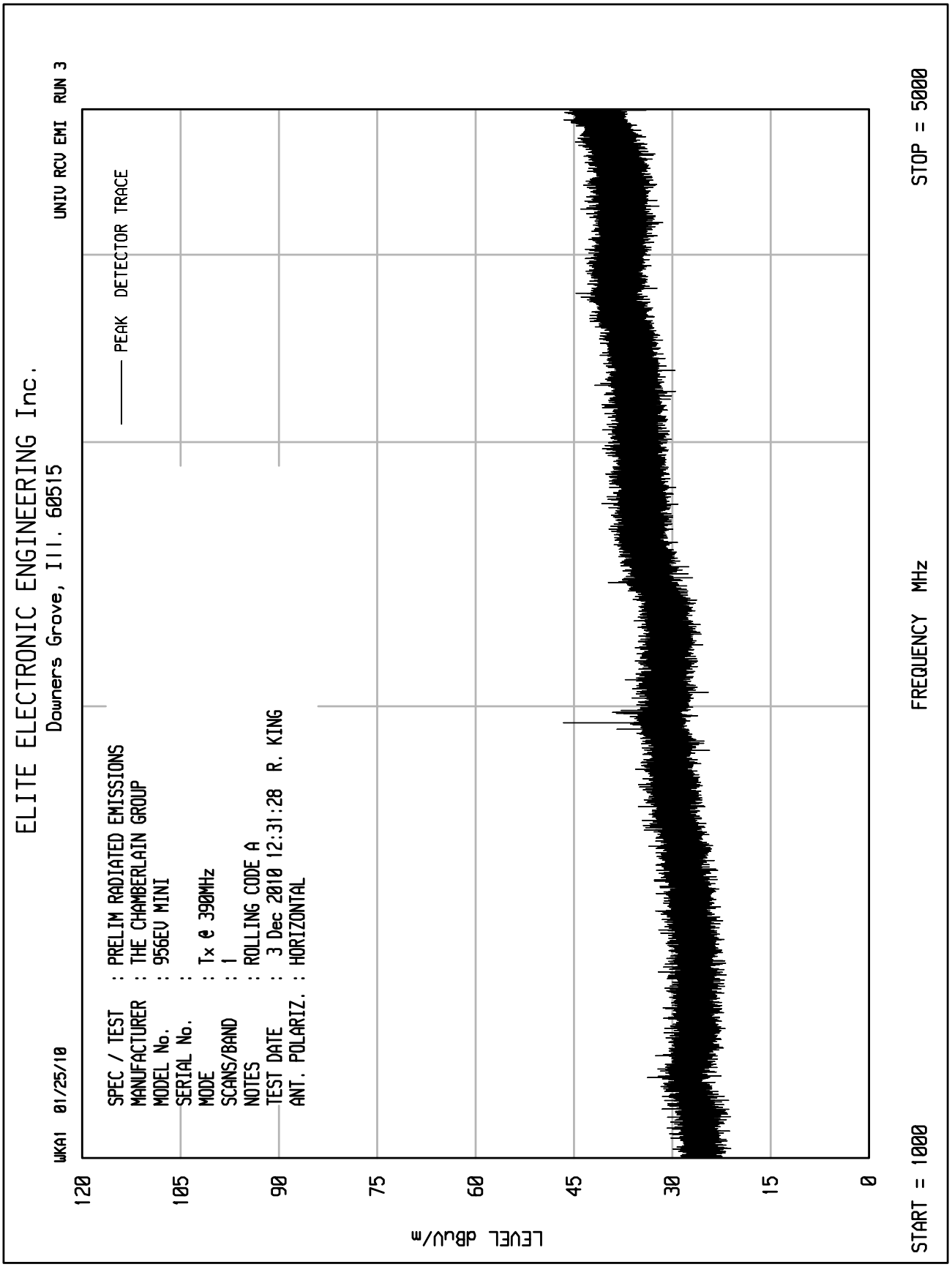

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 25
WKAI 01/25/10
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : 956EV MINI
SERIAL No. :
MODE : Tx @ 390MHz
SCANS/BAND : 1
NOTES : ROLLING CODE A
TEST DATE : 3 Dec 2010 13:27:54 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000

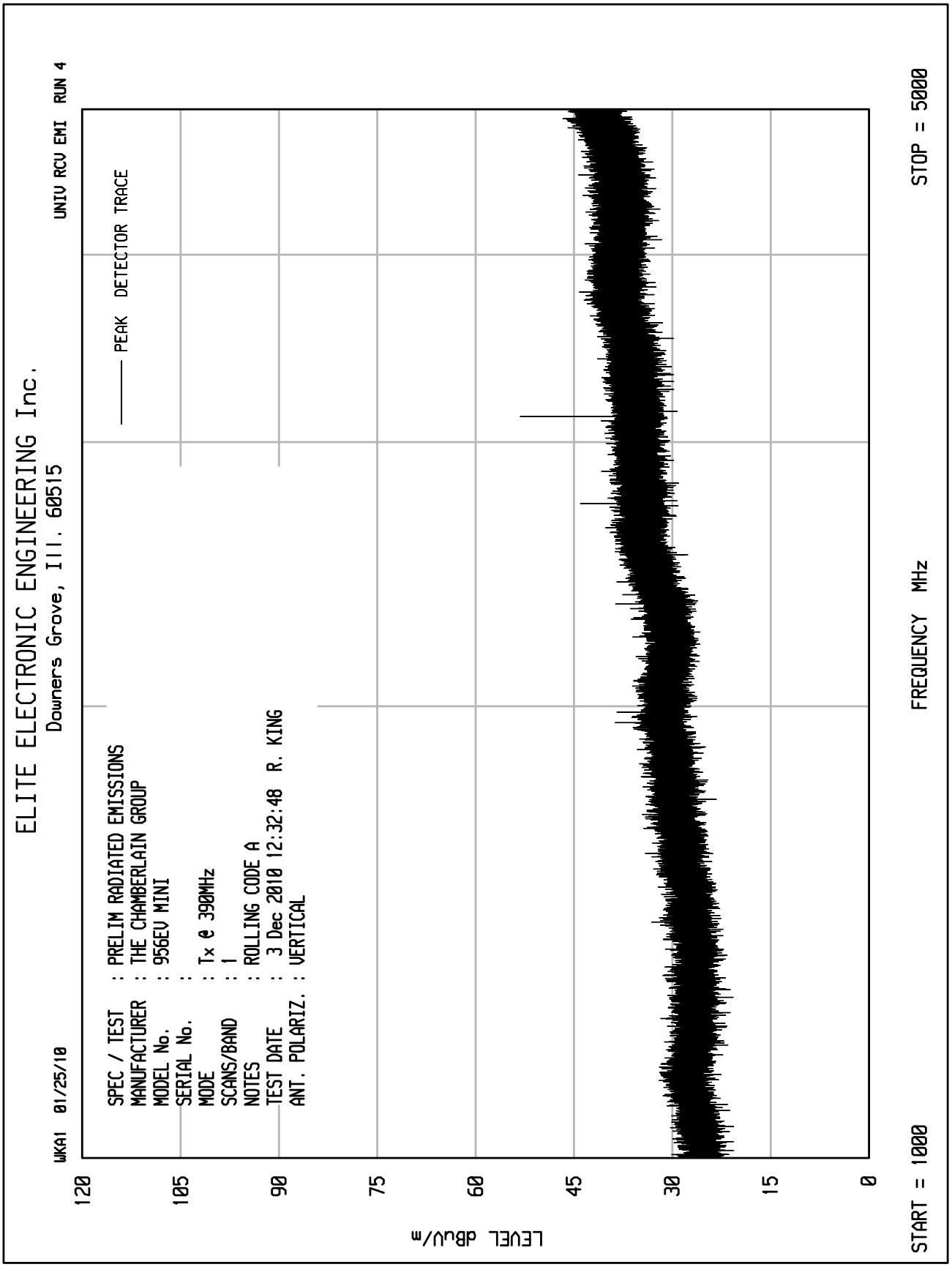

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 21
WKA1 01/25/10
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : 956EV MINI
SERIAL No. :
MODE : Tx @ 390MHz
SCANS/BAND : 1
NOTES : ROLLING CODE D
TEST DATE : 3 Dec 2010 13:19:27 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000

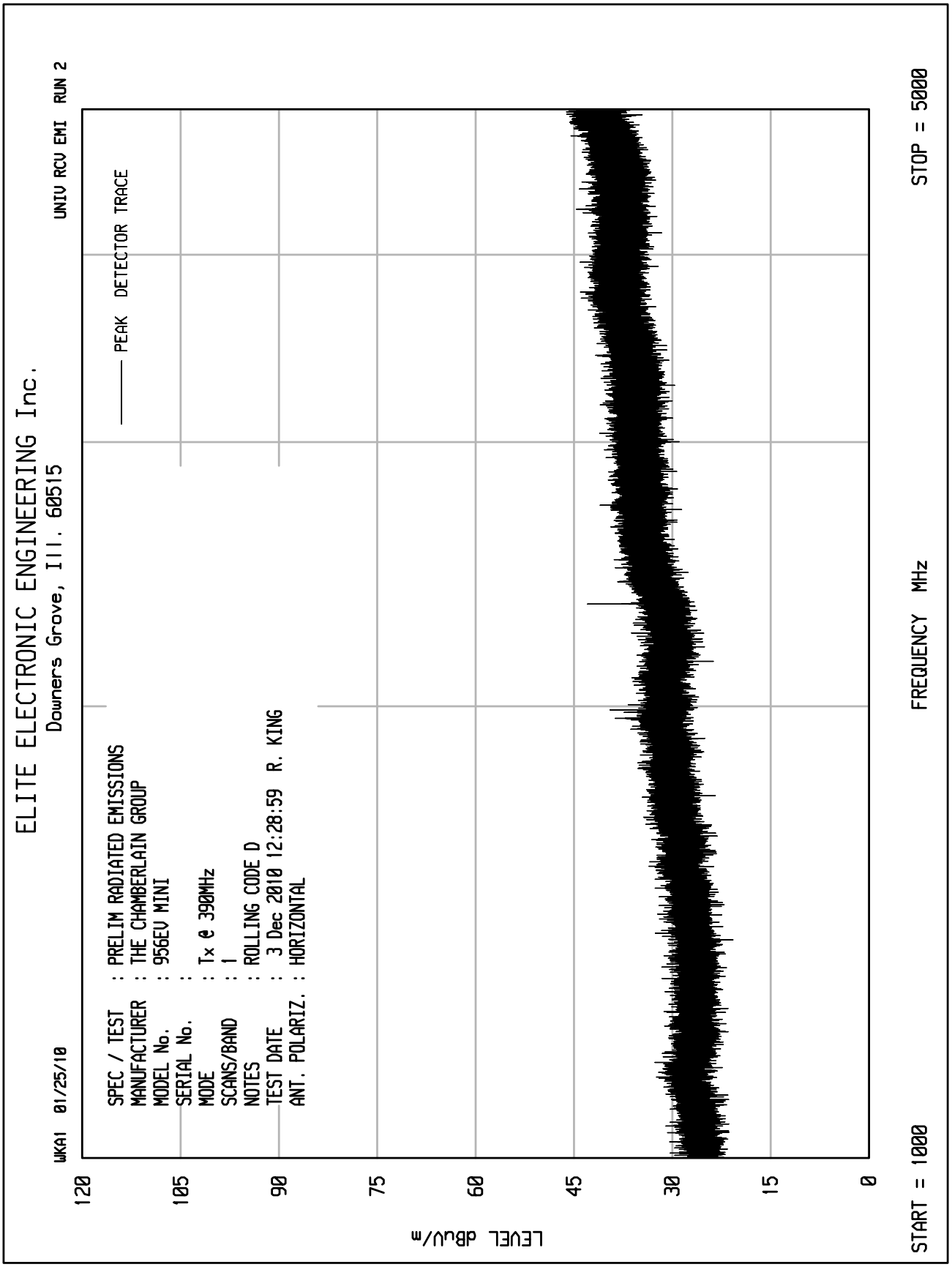

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 23
WKAI 01/25/10
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : 956EV MINI
SERIAL No. :
MODE : Tx @ 390MHz
SCANS/BAND : 1
NOTES : ROLLING CODE D
TEST DATE : 3 Dec 2010 13:22:30 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000

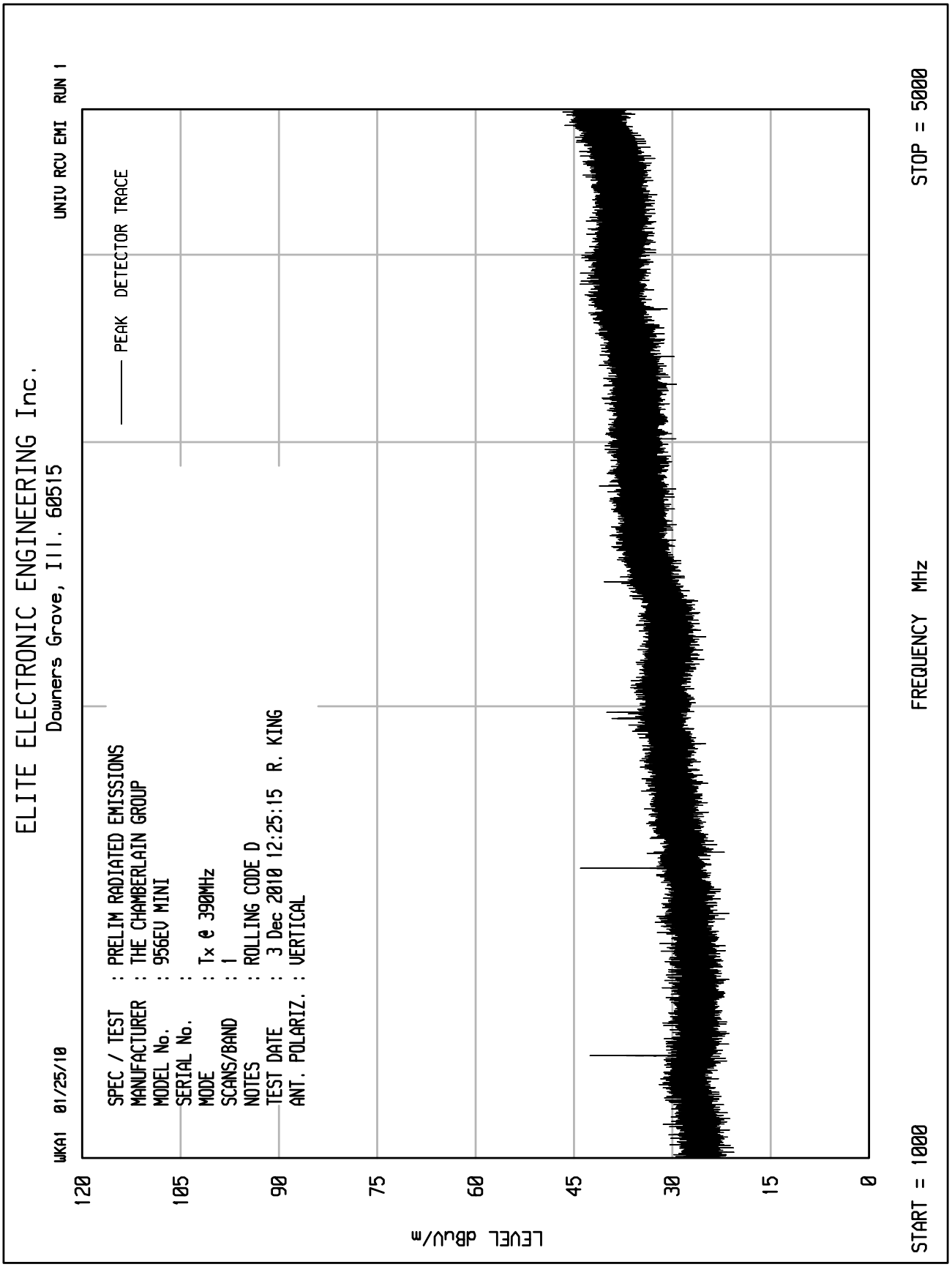

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 6
WKAI 01/25/10
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : 956EV MINI
SERIAL No. :
MODE : Tx 315MHz
SCANS/BAND : 1
NOTES : ROLLING CODE D
TEST DATE : 3 Dec 2010 12:36:33 R. KING
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 5
WKAI 01/25/10
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : 956EV MINI
SERIAL No. :
MODE : Tx 315MHz
SCANS/BAND : 1
NOTES : ROLLING CODE D
TEST DATE : 3 Dec 2010 12:34:52 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 3
WKAI 01/25/10
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : 956EV MINI
SERIAL No. :
MODE : Tx @ 390MHz
SCANS/BAND : 1
NOTES : ROLLING CODE A
TEST DATE : 3 Dec 2010 12:31:28 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 4
WKAI 01/25/10
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : 956EV MINI
SERIAL No. :
MODE : Tx @ 390MHz
SCANS/BAND : 1
NOTES : ROLLING CODE A
TEST DATE : 3 Dec 2010 12:32:48 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
WKAI 01/25/10
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : 956EV MINI
SERIAL No. :
MODE : Tx @ 390MHz
SCANS/BAND : 1
NOTES : ROLLING CODE D
TEST DATE : 3 Dec 2010 12:28:59 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 1
WKAI 01/25/10
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : 956EV MINI
SERIAL No. :
MODE : Tx @ 390MHz
SCANS/BAND : 1
NOTES : ROLLING CODE D
TEST DATE : 3 Dec 2010 12:25:15 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

RADIATED EMISSION MEASUREMENTS in a 3 m ANECHOIC ROOM

MANUFACTURER	:	The Chamberlain Group, Inc.
MODEL NO.	:	956EV Mini
SERIAL NO.	:	
TEST MODE	:	Tx @ 315MHz
NOTES	:	Rolling Code D
TEST DATE	:	December 2, 2010

Freq (MHz)	Ant Pol	Meter Reading (dBuV)	Ambient	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)
315.00	H	63.9		1.4	14.5	-10.2	69.6	3018.9	6041.7	-6.0
315.00	V	52.5		1.4	14.5	-10.2	58.2	815.4	6041.7	-17.4
630.00	H	28.6		2.0	19.5	-10.2	39.9	98.8	604.2	-15.7
630.00	V	31.8		2.0	19.5	-10.2	43.1	143.5	604.2	-12.5
945.00	H	23.3		2.4	22.1	-10.2	37.6	76.2	604.2	-18.0
945.00	V	17.2		2.4	22.1	-10.2	31.5	37.6	604.2	-24.1
1260.00	H	12.6		2.9	25.6	-10.2	30.8	34.8	604.2	-24.8
1260.00	V	14.1		2.9	25.6	-10.2	32.3	41.1	604.2	-23.3
1575.00	H	15.4		3.2	26.4	-10.2	34.8	54.7	500.0	-19.2
1575.00	V	19.0		3.2	26.4	-10.2	38.4	83.4	500.0	-15.6
1890.00	H	16.6		3.5	27.7	-10.2	37.7	76.5	604.2	-18.0
1890.00	V	18.9		3.5	27.7	-10.2	40.0	99.5	604.2	-15.7
2205.00	H	12.8	*	3.7	28.7	-10.2	35.0	56.0	500.0	-19.0
2205.00	V	14.1	*	3.7	28.7	-10.2	36.3	65.1	500.0	-17.7
2520.00	H	17.7		3.9	29.5	-10.2	40.8	109.8	604.2	-14.8
2520.00	V	20.4		3.9	29.5	-10.2	43.5	150.3	604.2	-12.1
2835.00	H	19.0		4.0	30.6	-10.2	43.4	148.0	500.0	-10.6
2835.00	V	18.4		4.0	30.6	-10.2	42.8	137.4	500.0	-11.2
3150.00	H	15.1	*	4.2	31.7	-10.2	40.8	109.1	604.2	-14.9
3150.00	V	15.9		4.2	31.7	-10.2	41.6	120.2	604.2	-14.0

Checked BY Richard E. King :

Richard E. King

RADIATED EMISSION MEASUREMENTS in a 3 m ANECHOIC ROOM

MANUFACTURER	:	The Chamberlain Group, Inc.
MODEL NO.	:	956EV Mini
SERIAL NO.	:	
TEST MODE	:	Tx @ 390MHz
NOTES	:	Rolling Code A
TEST DATE	:	December 2, 2010

Freq (MHz)	Ant Pol	Meter Reading (dBuV)	Ambient	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)
390.00	H	66.5		1.6	16.2	-6.7	77.6	7584.5	9166.7	-1.6
390.00	V	52.2		1.6	16.2	-6.7	63.3	1458.6	9166.7	-16.0
780.00	H	29.7		2.2	20.5	-6.7	45.7	193.7	916.7	-13.5
780.00	V	35.2		2.2	20.5	-6.7	51.2	363.6	916.7	-8.0
1170.00	H	16.2		2.7	25.4	-6.7	37.6	75.8	500.0	-16.4
1170.00	V	18.4		2.7	25.4	-6.7	39.8	97.5	500.0	-14.2
1560.00	H	16.6		3.2	26.3	-6.7	39.4	93.5	500.0	-14.6
1560.00	V	16.5		3.2	26.3	-6.7	39.3	92.0	500.0	-14.7
1950.00	H	21.5		3.6	28.0	-6.7	46.4	208.6	916.7	-12.9
1950.00	V	25.8		3.6	28.0	-6.7	50.7	341.0	916.7	-8.6
2340.00	H	17.7		3.8	29.0	-6.7	43.8	154.9	500.0	-10.2
2340.00	V	24.4		3.8	29.0	-6.7	50.4	333.0	500.0	-3.5
2730.00	H	20.4		3.9	30.2	-6.7	47.9	248.6	500.0	-6.1
2730.00	V	17.6		3.9	30.2	-6.7	45.0	178.6	500.0	-8.9
3120.00	H	26.5		4.2	31.6	-6.7	55.5	596.0	916.7	-3.7
3120.00	V	28.6		4.2	31.6	-6.7	57.6	762.5	916.7	-1.6
3510.00	H	19.2		4.6	32.8	-6.7	49.8	309.9	916.7	-9.4
3510.00	V	20.2		4.6	32.8	-6.7	50.9	349.7	916.7	-8.4
3900.00	H	13.9	*	5.0	33.7	-6.7	45.9	198.1	500.0	-8.0
3900.00	V	16.2		5.0	33.7	-6.7	48.2	257.0	500.0	-5.8

Checked BY Richard E. King :

Richard E. King

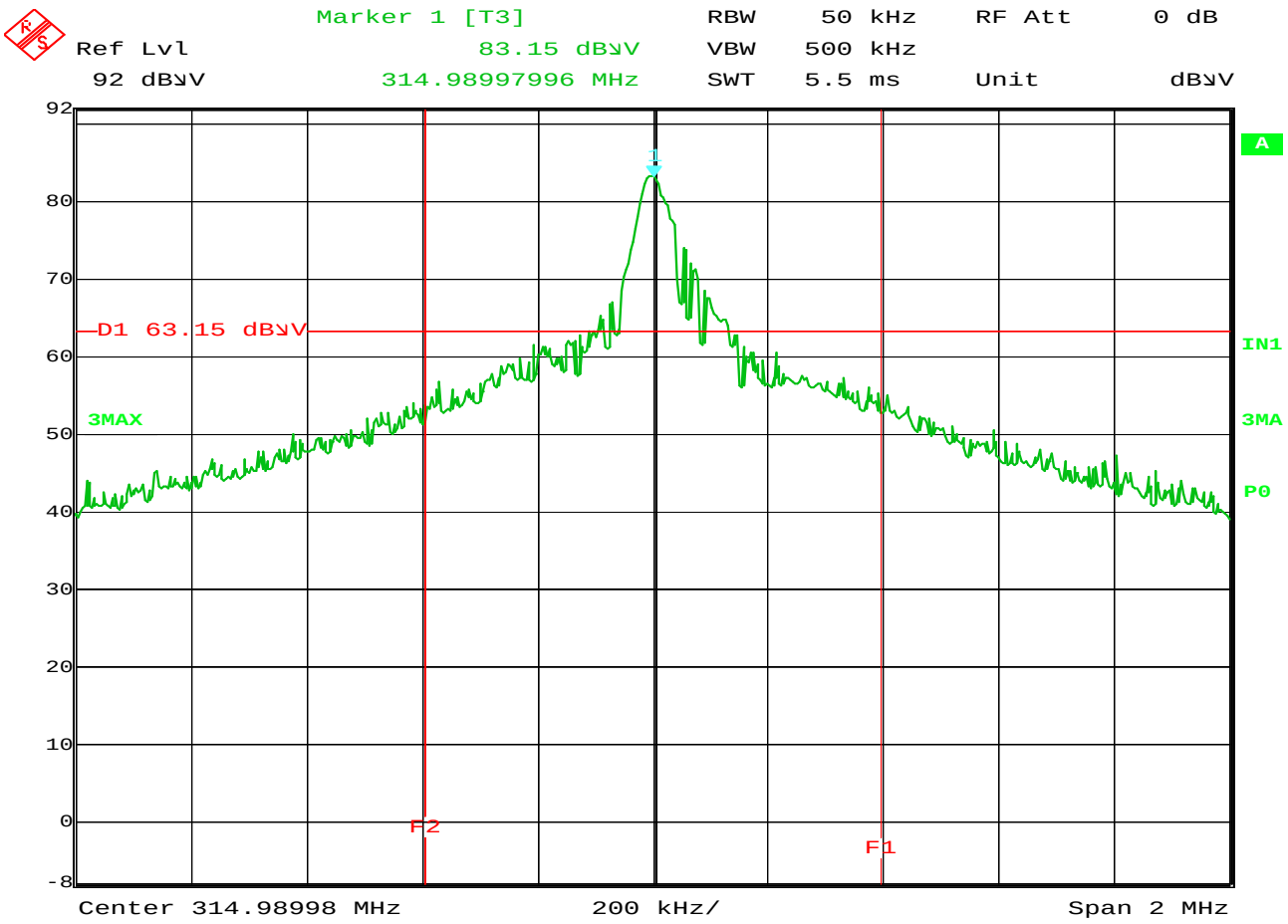
RADIATED EMISSION MEASUREMENTS in a 3 m ANECHOIC ROOM

MANUFACTURER	:	The Chamberlain Group, Inc.
MODEL NO.	:	956EV Mini
SERIAL NO.	:	
TEST MODE	:	Tx @ 390MHz
NOTES	:	Rolling Code D
TEST DATE	:	December 2, 2010

Freq (MHz)	Ant Pol	Meter Reading (dBuV)	Ambient	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)
390.00	H	63.9		1.6	16.2	-10.2	71.5	3744.8	9166.7	-7.8
390.00	V	51.4		1.6	16.2	-10.2	59.0	888.0	9166.7	-20.3
780.00	H	25.5		2.2	20.5	-10.2	38.1	79.9	916.7	-21.2
780.00	V	33.6		2.2	20.5	-10.2	46.1	202.8	916.7	-13.1
1170.00	H	20.6		2.7	25.4	-10.2	38.5	83.8	500.0	-15.5
1170.00	V	22.3		2.7	25.4	-10.2	40.2	102.2	500.0	-13.8
1560.00	H	17.7		3.2	26.3	-10.2	37.0	70.9	500.0	-17.0
1560.00	V	22.7		3.2	26.3	-10.2	42.0	125.5	500.0	-12.0
1950.00	H	13.8		3.6	28.0	-10.2	35.1	57.2	916.7	-24.1
1950.00	V	20.0		3.6	28.0	-10.2	41.4	117.4	916.7	-17.8
2340.00	H	18.1		3.8	29.0	-10.2	40.7	108.5	500.0	-13.3
2340.00	V	27.9		3.8	29.0	-10.2	50.5	335.3	500.0	-3.5
2730.00	H	19.0		3.9	30.2	-10.2	43.0	141.2	500.0	-11.0
2730.00	V	20.2		3.9	30.2	-10.2	44.2	161.6	500.0	-9.8
3120.00	H	29.3		4.2	31.6	-10.2	54.8	549.2	916.7	-4.5
3120.00	V	32.2		4.2	31.6	-10.2	57.7	771.3	916.7	-1.5
3510.00	H	21.9		4.6	32.8	-10.2	49.1	283.9	916.7	-10.2
3510.00	V	23.7		4.6	32.8	-10.2	50.9	350.1	916.7	-8.4
3900.00	H	18.5	*	5.0	33.7	-10.2	47.0	224.1	500.0	-7.0
3900.00	V	14.8	*	5.0	33.7	-10.2	43.3	146.7	500.0	-10.7

Checked BY Richard E. King :

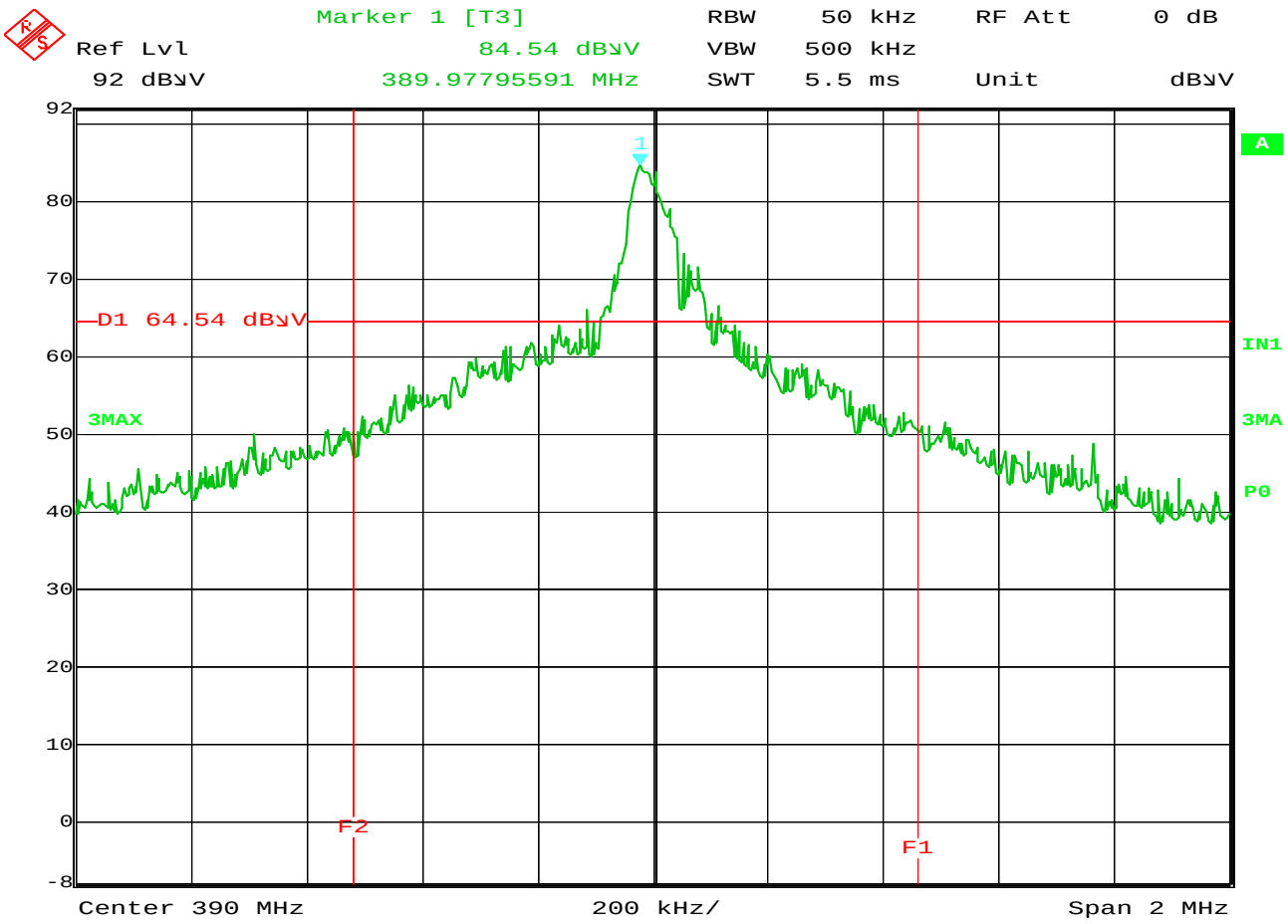
Richard E. King



Occupied Bandwidth

MANUFACTURER	:	The Chamberlain Group, Inc.
MODEL NUMBER	:	956EV mini
TEST MODE	:	15.231(c) Occupied Bandwidth
TEST PARAMETERS	:	20dBc at .025% of the fundamental frequency
TEST FREQUENCY	:	Transmit at 315MHz
TEST MODULATION	:	Rolling Code D
	:	

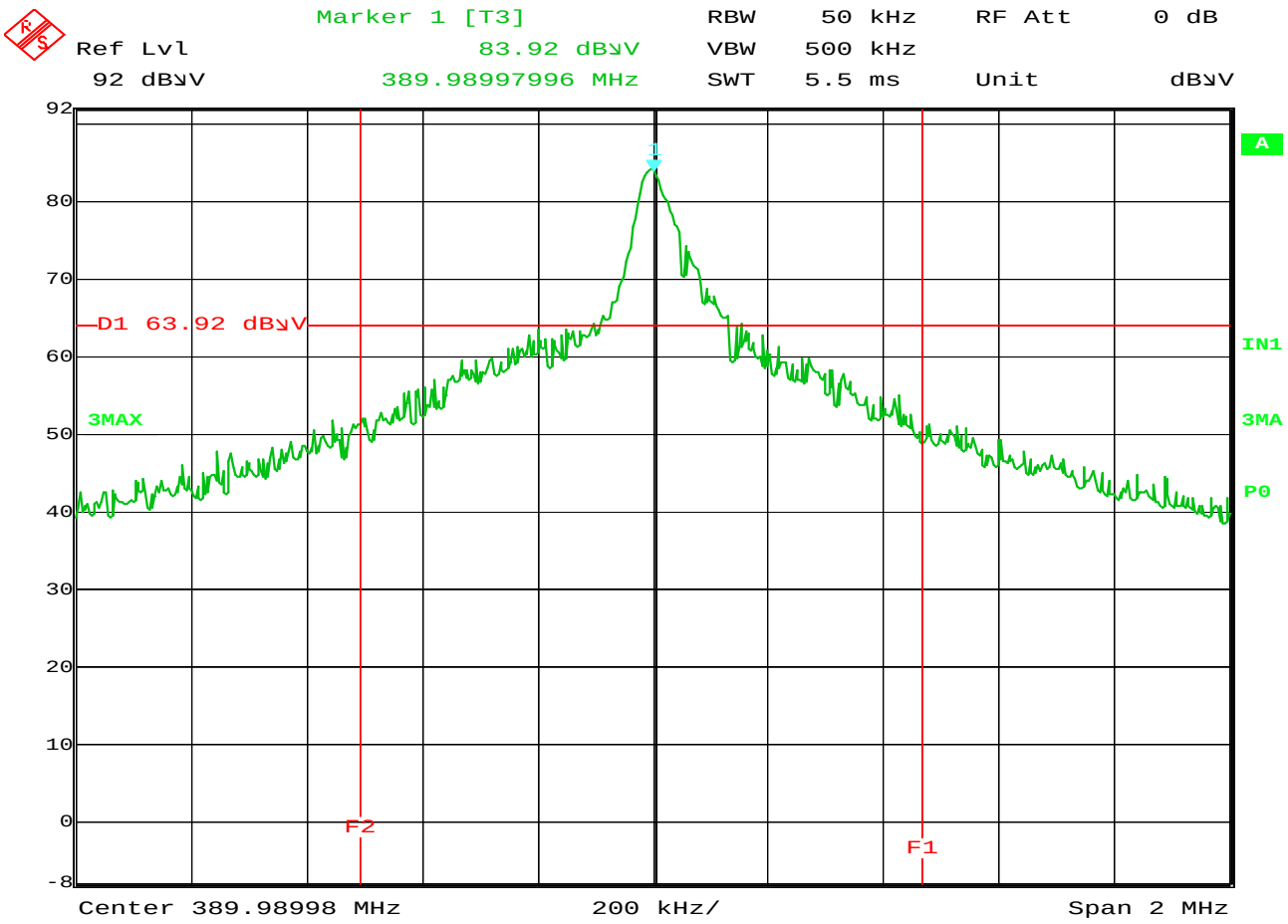
NOTES



Occupied Bandwidth

MANUFACTURER	:	The Chamberlain Group, Inc.
MODEL NUMBER	:	956EV mini
TEST SPEC.	:	15.231(c) Occupied Bandwidth
TEST PARAMETERS	:	20dBc at .025% of the fundamental frequency
TEST FREQUENCY	:	Transmit at 390MHz
TEST MODULATION	:	Rolling Code A
	:	

NOTES



Occupied Bandwidth

MANUFACTURER	:	The Chamberlain Group, Inc.
MODEL NUMBER	:	956EV mini
TEST SPEC.	:	15.231(c) Occupied Bandwidth
TEST PARAMETERS	:	20dBc at .025% of the fundamental frequency
TEST FREQUENCY	:	Transmit at 390MHz
TEST MODULATION	:	Rolling Code D
	:	

NOTES