



## Measurement of RF Interference from a 001D7644 Wall Switch Transceiver

For Chamberlain Group, Inc.  
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Elmhurst, IL 60126

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Frequency Hopping Spread Spectrum Intentional  
Radiators Operating within the bands 902-928MHz  
FCC "Code of Federal Regulations" Title 47, Part 15,  
Subpart 15B, Section 15.107 and 15.109 for Receivers  
Industry Canada RSS-210  
Industry Canada RSS-GEN

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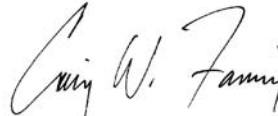
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REVISION HISTORY

Revision	Date	Description
—	9 August 2011	Initial release

## Measurement of RF Emissions from a Wall Switch, Part No. 001D7644 Transceiver

### 1 INTRODUCTION

#### 1.1 Scope of Tests

This document represents the results of the series of radio interference measurements performed on a Chamberlain Group, Inc. Wall Switch, Part No. 001D7644, Serial No. None Assigned, transceiver (hereinafter referred to as the EUT). The EUT is a frequency hopping spread spectrum transceiver. The EUT was designed to transmit in the 902.25MHz to 926.75MHz band using an 8 inch external, permanent wire antenna. The receive portion of the EUT is a super-heterodyne type receiver designed to receive over the 310MHz to 926.75MHz band. The EUT contains a tuner which utilizes one local oscillator (LO) and an intermediate frequency (IF) at 937.5kHz below the tuned frequency. The EUT was manufactured and submitted for testing by 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 B, Sections 15.107 and 15.109, for receivers and Subpart C, Sections 15.207 and 15.249 for Intentional Radiators Operating within the 902-928 MHz band.

The test series was also performed to determine if the EUT meets the conducted and radiated RF emission requirements of the Industry Canada Radio Standards Specification, RSS-Gen, Section 7.2.4 and Section 6.1 for receivers and the Industry Canada Radio Standards Specification RSS-Gen Section 7.2.4 and RSS-210 Annex 8, for Transmitters.

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 25C and the relative humidity was 62%.

### 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, Subparts B and 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"
- FCC Public Notice, DA 00-705, "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems", Released March 30, 2000
- Industry Canada RSS-210, Issue 8, December 2010, "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 3, December 2010, “Spectrum Management and Telecommunications Radio Standards Specification, General Requirements and Information for the Certification of radio communication equipment”

### 3 EUT SET-UP AND OPERATION

#### 3.1 General Description

The EUT is a Wall Switch, Part No. 001D7644. A block diagram of the EUT setup is shown as Figure 1.

##### 3.1.1 Power Input

The EUT was powered by 6VDC from 4 “AA” batteries.

##### 3.1.2 Peripheral Equipment

No peripheral equipment was submitted with the EUT:

##### 3.1.3 Interconnect Cables

No interconnect cables were submitted with the EUT:

##### 3.1.4 Grounding

The EUT 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 all peripheral equipment were energized. The unit was programmed to operate in one of the following modes:

- Receive at 902.25MHz
- Receive at 914.75MHz
- Receive at 926.75MHz
- Scanning Receiver Mode
- Transmit at 902.25MHz
- Transmit at 914.75MHz
- Transmit at 926.75MHz
- Frequency Hopping Enabled

#### 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. 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 and average detector functions.

#### 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 Receiver

##### 5.1.1 Powerline Conducted Emissions

###### 5.1.1.1 Requirements

Since the EUT was powered by batteries, no conducted emissions tests were performed.

##### 5.1.2 Radiated Measurements

###### 5.1.2.1 Requirements

Per the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart B, Section 15.109(a) and Industry Canada RSS-Gen, Section 6.1, all radio frequency emissions from a receiver shall be below the limits shown on the following table:

## RADIATION LIMITS FOR A RECEIVER

Frequency MHz	Distance between EUT And Antenna in Meters	Field Strength uV/m	Field Strength dBuV/m
30-88	3	100	40
88-216	3	150	43.5
216-960	3	200	46
Above 960	3	500	54

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

## 5.1.2.2 Procedures

For FCC, testing was performed separately on a low, middle, and high channel. The emissions in the frequency range of 30MHz to 5GHz were measured and plotted using a 'screen-dump' utility. Testing was performed with the antenna of the EUT in place.

For Industry Canada, testing was performed on a middle channel. The emissions in the frequency range of 30MHz to 3 times the highest tuneable or local oscillator frequency, whichever is the higher, were measured and plotted. Testing was performed with the antenna of the EUT in place.

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 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.

Since a quasi-peak detector and an average detector require long integration times, it is not practical to automatically sweep through the quasi-peak and average levels. Therefore, radiated emissions from the EUT were first scanned using a peak detector and automatically plotted. The frequencies where significant emission levels were noted were then remeasured using the quasi-peak detector or average detector.

The broadband measuring antenna was positioned at a 3 meter distance from the EUT. The frequency range from 30MHz to 1GHz was investigated using a peak detector function with the bilog antenna at several heights, horizontal and vertical polarization, and with several different orientations of the EUT with respect to the antenna. The frequency range from 1GHz to 5GHz was investigated using a peak detector function with the double ridged waveguide antenna at several heights, horizontal and vertical polarization, and with several different orientations of the EUT with respect to the antenna. The maximum levels for each antenna polarization were plotted.

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

- 1) Measurements from 30MHz to 1GHz were made using a quasi-peak detector and a broadband bilog antenna. Measurements above 1GHz were made using an average detector and a broadband double ridged waveguide antenna.
- 2) To ensure that maximum or worst case, emission levels were measured, the following steps were taken:
  - a) The EUT was rotated so that all of its sides were exposed to the receiving antenna.



- b) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.
- c) The measuring antenna was raised and lowered from 1 to 4 meters for each antenna polarization to maximize the readings.
- d) 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.

#### 5.1.2.3 Results

The preliminary plots with the EUT operating in the scanning receiver mode are presented on pages 20 through 23. The plots are presented for a reference only, and are not used to determine compliance. The final radiated levels with the EUT operating in the scanning receiver mode are presented on pages 24 and 25. As can be seen from the data, all emissions measured from the EUT were within the specification limits. Photographs of the test configuration which yielded the highest or worst case, radiated emission levels are shown on Figure 2 and Figure 3.

The preliminary plots with the EUT receiving at 902.25MHz, 914.75MHz, and 926.75MHz are shown on pages 26 through 37. The plots are presented for a reference only, and are not used to determine compliance. The final radiated levels with the EUT receiving at 902.25MHz, 914.75MHz, and 926.75MHz are presented on pages 38 through 40. As can be seen from the data, all emissions measured from the EUT were within the specification limits. Photographs of the test configuration which yielded the highest or worst case, radiated emission levels are shown on Figure 2 and Figure 3.

## 5.2 Transmitter

### 5.2.1 Powerline Conducted Emissions

#### 5.2.1.1 Requirements

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

### 5.2.2 20dB Bandwidth

#### 5.2.2.1 Requirements

Per 15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Per section 15.247(a)(1)(i), for frequency hopping systems operating in the 902-928MHz band, the 20dB bandwidth shall be measured for determination of the carrier frequency separation limits and must not exceed 500 kHz. If the 20dB bandwidth of the hopping channel is less than 250kHz, the system shall use at least 50 hopping channels. If the 20dB bandwidth of the hopping channel is 250kHz or greater (but not greater than 500kHz), the system shall use at least 25 hopping channels.

#### 5.2.2.2 Procedures

The EUT was setup inside the chamber. With the hopping function disabled, the EUT was allowed to transmit continuously. The frequency hopping channel was set separately to low, middle, and high hopping channels. The resolution bandwidth (RBW) was set to  $\geq 1\%$  of the 20 dB BW. The span was set to approximately 2 to 3 times the 20 dB 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.

### 5.2.2.3 Results

The plots on pages 41 through 43 show that the maximum 20 dB bandwidth was 240.5kHz. The 99% bandwidth was measured to be 201.4kHz. Therefore, since the 20dB bandwidth of the hopping channel is less than 250kHz, the system shall use at least 50 hopping channels.

## 5.2.3 Carrier Frequency Separation

### 5.2.3.1 Requirements

Per section 15.247 (a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater.

### 5.2.3.2 Procedures

The EUT was setup inside the chamber. With the hopping function enabled, the EUT was allowed to transmit continuously. The resolution bandwidth (RBW) was set to  $>$  to 1% of the span. The peak detector and 'Max-Hold' function were engaged. The span was set wide enough to capture the peaks of at least two adjacent channels. When the trace had stabilized after multiple scans, the marker-delta function was used to determine the separation between the peaks of the adjacent channels. The analyzer's display was plotted using a 'screen dump' utility.

### 5.2.3.3 Results

Page 44 shows the carrier frequency separation. As can be seen from this plot, the carrier frequency separation is 500kHz, which is greater than the 20dB bandwidth (240.5kHz).

## 5.2.4 Number of Hopping Frequencies

### 5.2.4.1 Requirements

Per section 15.247(a)(1)(i), for frequency hopping systems operating in the 902-928MHz band, the 20dB bandwidth shall be measured for determination of the carrier frequency separation limits and must not exceed 500 kHz. If the 20dB bandwidth of the hopping channel is less than 250kHz, the system shall use at least 50 hopping channels. If the 20dB bandwidth of the hopping channel is 250kHz or greater (but not greater than 500kHz), the system shall use at least 25 hopping channels.

### 5.2.4.2 Procedures

The EUT was setup inside the chamber. With the hopping function enabled, the EUT was allowed to transmit continuously. The resolution bandwidth (RBW) was set to  $\geq$  to 1% of the span. The peak detector and 'Max-Hold' function were engaged. The span was set wide enough to capture the entire frequency band of operation. The EUT's signal was allowed to stabilize after multiple scans. The number of hopping frequencies was counted. The analyzer's display was plotted using a 'screen dump' utility.

### 5.2.4.3 Results

Page 45 shows the number of hopping frequencies. As can be seen from this plot, the number of hopping frequencies is 50 which is greater than 25 which is the minimum number of required hopping frequencies for systems with a 20dB bandwidth greater than 250kHz.

## 5.2.5 Time of Occupancy

### 5.2.5.1 Requirements

Per section 15.247(a)(1)(i), for frequency hopping systems operating in the 902-928MHz band, if the 20dB bandwidth of the hopping channel is 250kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period.

### 5.2.5.2 Procedures

The EUT was setup inside the chamber. With the hopping function enabled, the EUT was allowed to transmit continuously. The resolution bandwidth (RBW) was set to 100kHz. The peak detector and 'Max-Hold' function were engaged. With the span set to 0Hz, the sweep time was adjusted to capture a single event in order to measure the dwell time per hop. The analyzer's display was plotted using a 'screen dump' utility. Then, the sweep time was expanded to 10 seconds.

### 5.2.5.3 Results

Pages 46 and 47 show the plots for the time of occupancy. As can be seen from the plots, the time of occupancy can be determined by (dwell time/hop) multiplied by (# of hops in a 10second period). This calculated value is equal to 0.0559 seconds which is less than the 0.4 seconds maximum allowed.

## 5.2.6 Peak Output Power

### 5.2.6.1 Requirements

Per section 15.247(b)(2), for frequency hopping systems operating in the 902-928MHz band and employing at least 50 hopping channels, the maximum peak output conducted power shall not be greater than 1W (30dBm). Per section 15.247(b)(4), this limit is based on the use of antennas with directional gains that do not exceed 6dBi. Since the limit allows for a 6dBi antenna gain, the maximum EIRP can be increased by 6dB to 4 Watt (36dBm). If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below 30dBm by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### 5.2.6.2 Procedures

The EUT was placed on the non-conductive stand and set to transmit. A dipole antenna was placed at a test distance of 3 meters from the EUT. The resolution bandwidth (RBW) of the spectrum analyzer was set to greater than the 20dB bandwidth. The span was set to approximately 5 times the 20 dB bandwidth. The EUT was maximized for worst case emissions (or maximum output power) at the measuring antenna. The maximum meter reading was recorded. The peak power output was measured for the low, middle and high hopping frequencies.

The equivalent power was determined from the field intensity levels measured at 3 meters using the substitution method. To determine the emission power, a second dipole antenna was then set in place of the EUT and connected to a calibrated signal generator. The output of the signal generator was adjusted to match the received level at the spectrum analyzer. The signal level was recorded. The reading was then corrected to compensate for cable loss as required. The peak power output was calculated for low, middle, and high hopping frequencies.

### 5.2.6.3 Results

The results are presented on page 48. The maximum EIRP measured from the transmitter was 10.9dBm or 0.0123W which is below the 4 Watt limit.

## 5.2.7 Duty Cycle Factor Measurements

### 5.2.7.1 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 200usec/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 the "on-time". The trace is recorded.

Next the spectrum analyzer center frequency is set to the transmitter frequency with a zero span width and 10msec/div. This shows if the word is longer than 100msec or shorter than 100msec. 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).

### 5.2.7.2 Results

The plots of the duty cycle are shown on data pages 49 and 50. The EUT transmits only one 1.3msec pulse in any 100msec period. The duty cycle correction factor was calculated to be -37.7dB (-37.7dB = 20\*log(1.3msec/100msec)).

## 5.2.8 Radiated Spurious Emissions Measurements

### 5.2.8.1 Requirements

Per section 15.247(d), in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated emissions measurement. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must comply with the radiated emission limits specified in §15.209(a).

Paragraph 15.209(a) has the following radiated emission limits:

Frequency MHz	Field Strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	3
30.0-88.0	100	3
88.0-216.0	150	3
216.0-960.0	200	3
Above 960	500	3

### 5.2.8.2 Procedures

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

Preliminary radiated emissions tests were performed to determine the emission characteristics of the 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 10.0GHz was investigated using a peak detector function.

The final open field emission tests were then manually performed over the frequency range of 30MHz to 10.0GHz

- 1) For all harmonics not in the restricted bands, the following procedure was used:
  - a) The field strength of the fundamental was measured using a bilog antenna. The bilog antenna was positioned at a 3 meter distance from the EUT. A peak detector with a resolution bandwidth of 100 kHz was used on the spectrum analyzer.
  - b) The field strengths of all of the harmonics not in the restricted band were then measured using a double-ridged waveguide antenna. The waveguide antenna was positioned at a 3 meter distance from the EUT. A peak detector with a resolution bandwidth of 100 kHz was used on the spectrum analyzer.
  - c) To ensure that maximum or worst case emission levels at the fundamental and harmonics were measured, the following steps were taken when measuring the fundamental emissions and the spurious emissions:
    - i) The EUT was rotated so that all of its sides were exposed to the receiving antenna.
    - ii) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.
    - iii) The measuring antenna was raised and lowered for each antenna polarization to maximize the readings.
    - iv) In instances where it was necessary to use a shortened cable between the measuring antenna and the spectrum analyzer. The measuring antenna was not raised or lowered to ensure maximized readings, instead the EUT was rotated through all axis to ensure the maximum readings were recorded for the EUT.
  - d) All harmonics not in the restricted bands must be at least 20 dB below levels measured at the fundamental. However, attenuation below the general limits specified in §15.209(a) is not required.
- 2) For all emissions in the restricted bands, the following procedure was used:
  - a) The field strengths of all emissions below 1 GHz were measured using a bi-log antenna. The bi-log antenna was positioned at a 3 meter distance from the EUT. A peak detector with a resolution bandwidth of 100 kHz was used on the spectrum analyzer.
  - b) The field strengths of all emissions above 1 GHz were measured using a double-ridged waveguide antenna. The waveguide antenna was positioned at a 3 meter distance from the EUT. A peak detector with a resolution bandwidth of 1 MHz was used on the spectrum analyzer.
  - c) To ensure that maximum or worst case emission levels were measured, the following steps were taken when taking all measurements:
    - i) The EUT was rotated so that all of its sides were exposed to the receiving antenna.
    - ii) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.
    - iii) The measuring antenna was raised and lowered for each antenna polarization to maximize the readings.
    - iv) In instances where it was necessary to use a shortened cable between the measuring antenna and the spectrum analyzer. The measuring antenna was not raised or lowered to ensure maximized readings, instead the EUT was rotated through all axis to ensure the maximum readings were recorded for the EUT.
  - d) For all radiated emissions measurements below 1 GHz, if the peak reading is below the limits listed in 15.209(a), no further measurements are required. If however, the peak readings exceed the limits listed in 15.209(a), then the emissions are remeasured using a quasi-peak detector.
  - e) For all radiated emissions measurements above 1 GHz, the peak readings must comply with the 15.35(b) limits. 15.35(b) states that when average radiated emissions measurements are specified, there also is a limit on the peak level of the radiated emissions. The limit on the peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test. Therefore,

all peak readings above 1 GHz must be no greater than 20 dB above the limits specified in 15.209(a).

- f) Next, for all radiated emissions measurements above 1GHz, the resolution bandwidth was set to 1MHz. The analyzer was set to linear mode with a 10Hz video bandwidth in order to simulate an average detector. An average reading was taken. If the dwell time per channel of the hopping signal is less than 100msec, then the reading obtained with the 10 Hz video bandwidth may be further adjusted by a "duty cycle correction factor", derived from  $20 \cdot \log(\text{dwell time}/100\text{msec})$ . These readings must be no greater than the limits specified in 15.209(a).

### 5.2.8.3 Results

Preliminary radiated emissions plots with the EUT transmitting at 902.25MHz, 914.75MHz, and 926.75MHz are shown on pages 51 through 62. Final radiated emissions data are presented on data pages 63 through 68. As can be seen from the data, all emissions measured from the EUT were within the specification limits. Photographs of the test configuration which yielded the highest or worst case, radiated emission levels are shown on Figure 2 and Figure 3.

## 5.2.9 Band Edge Compliance

### 5.2.9.1 Requirements

Per section 15.247(d), the emissions at the band-edges must be at least 20dB below the highest level measured within the band but attenuation below the general limits listed in 15.209(a) is not required.

### 5.2.9.2 Procedures

#### 5.2.9.2.1 Low Band Edge

- 1) The EUT was setup inside the test chamber on a non-conductive stand.
- 2) A broadband measuring antenna was placed at a test distance of 3 meters from the EUT.
- 3) The EUT was set to transmit continuously at the channel closest to the low band-edge (hopping function disabled).
- 4) The EUT was maximized for worst case emissions at the measuring antenna. The maximum meter reading was recorded.
- 5) To determine the band edge compliance, the following spectrum analyzer settings were used:
  - a. Center frequency = low band-edge frequency.
  - b. Span = Wide enough to capture the peak level of the emission operating on the channel closest to the band-edge, as well as any modulation products which fall outside of the authorized band of operation.
  - c. Resolution bandwidth (RBW)  $\geq$  1% of the span.
  - d. The 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined.
  - e. The marker was set on the peak of the in-band emissions. A display line was placed 20dB down from the peak of the in-band emissions. All emissions which fall outside of the authorized band of operation must be below the 20dB down display line. (All emissions to the left of the center frequency (band-edge) must be below the display line.)
  - f. The analyzer's display was plotted using a 'screen dump' utility.
- 6) Step 5) was repeated with the frequency hopping function enabled.

#### 5.2.9.2.2 High Band Edge

- 1) The EUT was setup inside the test chamber on a non-conductive stand.
- 2) A broadband measuring antenna was placed at a test distance of 3 meters from the EUT.
- 3) The EUT was set to transmit continuously at the channel closest to the high band-edge (hopping function disabled).
- 4) The EUT was maximized for worst case emissions at the measuring antenna.
- 5) To determine the band edge compliance, the following spectrum analyzer settings were used:



- a. Center frequency = high band-edge frequency.
  - b. Span = Wide enough to capture the peak level of the emission operating on the channel closest to the band-edge, as well as any modulation products which fall outside of the authorized band of operation.
  - c. Resolution bandwidth (RBW)  $\geq$  1% of the span.
  - d. The 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined.
  - e. The marker was set on the peak of the in-band emissions. A display line was placed 20dB down from the peak of the in-band emissions. All emissions which fall outside of the authorized band of operation must be below the 20dB down display line. (All emissions to the right of the center frequency (band-edge) must be below the display line.)
  - f. The analyzer's display was plotted using a 'screen dump' utility.
- 6) Step 5) was repeated with the frequency hopping function enabled.

#### 5.2.9.3 Results

Pages 69 through 72 show the radiated band-edge compliance results. As can be seen from these plots, the emissions at the low end band edge and the high end band edge are within the 20 dB down limits.

## 6 CONCLUSIONS

It was determined that the Chamberlain Group, Inc. Wall Switch, Part No. 001D7644 frequency hopping spread spectrum transceiver, Serial No. None Assigned, 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 for receivers and Subpart C, Sections 15.207 and 15.247 for Intentional Radiators Operating within the 902-928 MHz band, when tested per ANSI C63.4-2003.

It was also determined that the Chamberlain Group, Inc. Wall Switch, Part No. 001D7644 frequency hopping spread spectrum transceiver, Serial No. None Assigned, did fully meet the conducted and radiated RF emission requirements of the Industry Canada Radio Standards Specification, RSS-Gen, Section 7.2.4 and Section 6.1 for receivers and the Industry Canada Radio Standards Specification RSS-Gen Section 7.2.4 and RSS-210 Annex 8, for transmitters when tested per ANSI C63.4-2003.

## 7 CERTIFICATION

Elite Electronic Engineering Incorporated certifies that the information contained in this report was obtained under conditions which meet or exceed those specified in the test specifications.

The data presented in this test report pertains to the 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.

## 8 ENDORSEMENT DISCLAIMER

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
APW3	PREAMPLIFIER	PLANAR ELECTRONICS	PE2-35-120-5R0-10-12	PL2924	1GHZ-20GHZ	8/27/2010	8/27/2011
CMA1	Controllers	EMCO	2090	9701-1213	---	N/A	
GRE0	SIGNAL GENERATOR	AGILENT TECHNOLOGIES	E4438C	MY42083127	250KHZ-6GHZ	3/31/2011	3/31/2012
NDQ1	TUNED DIPOLE ANTENNA	EMCO	3121C-DB4	313	400-1000MHZ	4/20/2011	4/20/2012
NTA2	BILOG ANTENNA	TESEQ	6112D	28040	25-1000MHZ	6/29/2011	6/29/2012
NWH0	RIDGED WAVE GUIDE	SENSOR	4105	2081	1-12.4GHZ	8/31/2010	8/31/2011
RBA0	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESIB26	100145	20HZ-26.5GHZ	3/9/2011	3/9/2012
SES1	24VDC POWER SUPPLY	P TRANS	FS-32024-1M	002	18-27VDC	NOTE 1	
XPQ2	HIGH PASS FILTER	K&L MICROWAVE	4IH30-1804/T10000-0	3	1.8-10GHZ	10/28/2010	10/28/2011

Create your equipment list using the database on the mainframe. Create a test equipment list. The output of this list will have a "J" prefix, followed by the job and phase number. FTP this output file to your local computer. Open the file using Word; select and copy the text here using Edit, then Paste Special, and finally Unformatted Text. That way, the text will take on the attributes of the Equipment List Text Style contained in this paragraph. Delete this paragraph when finished.



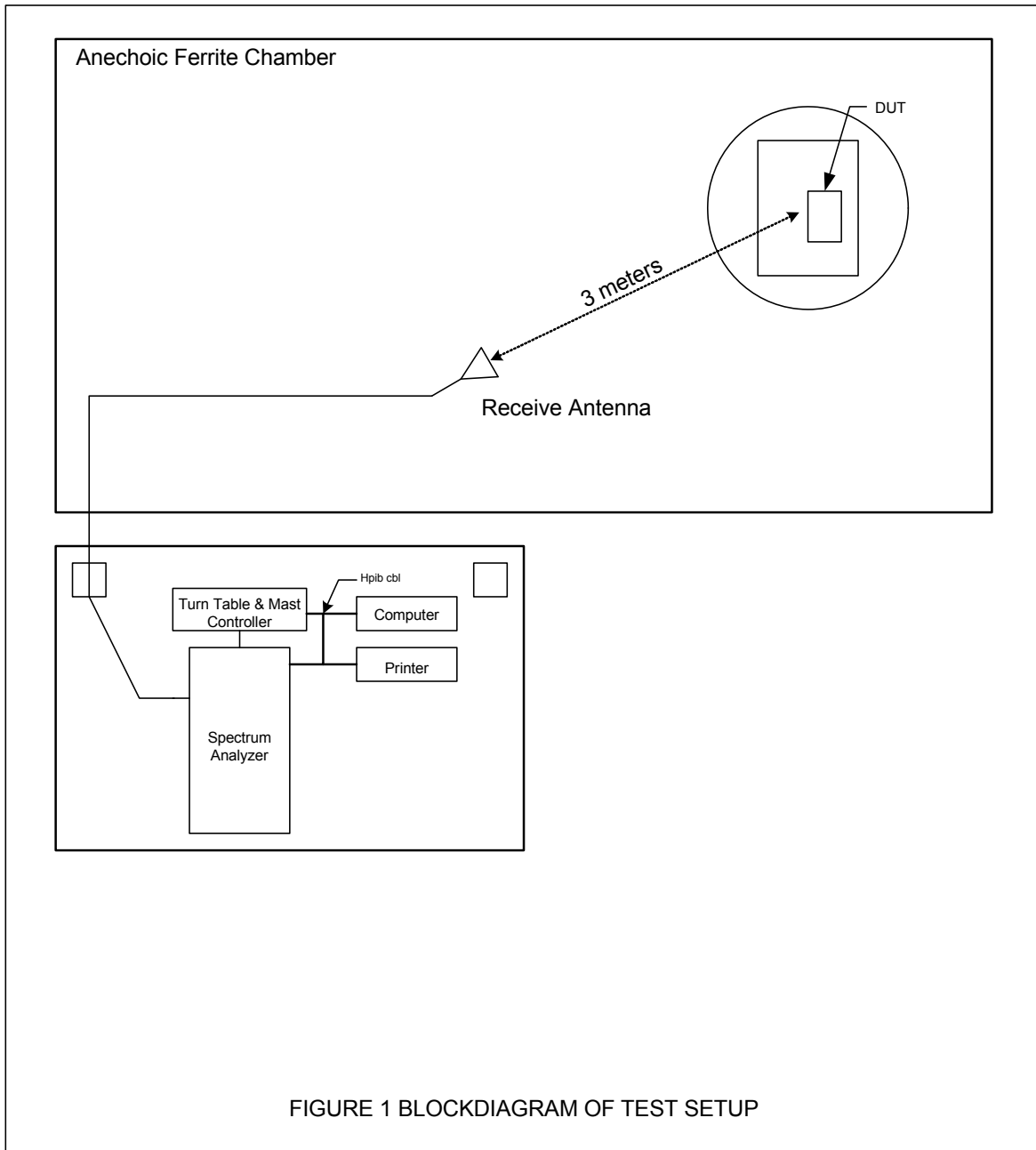
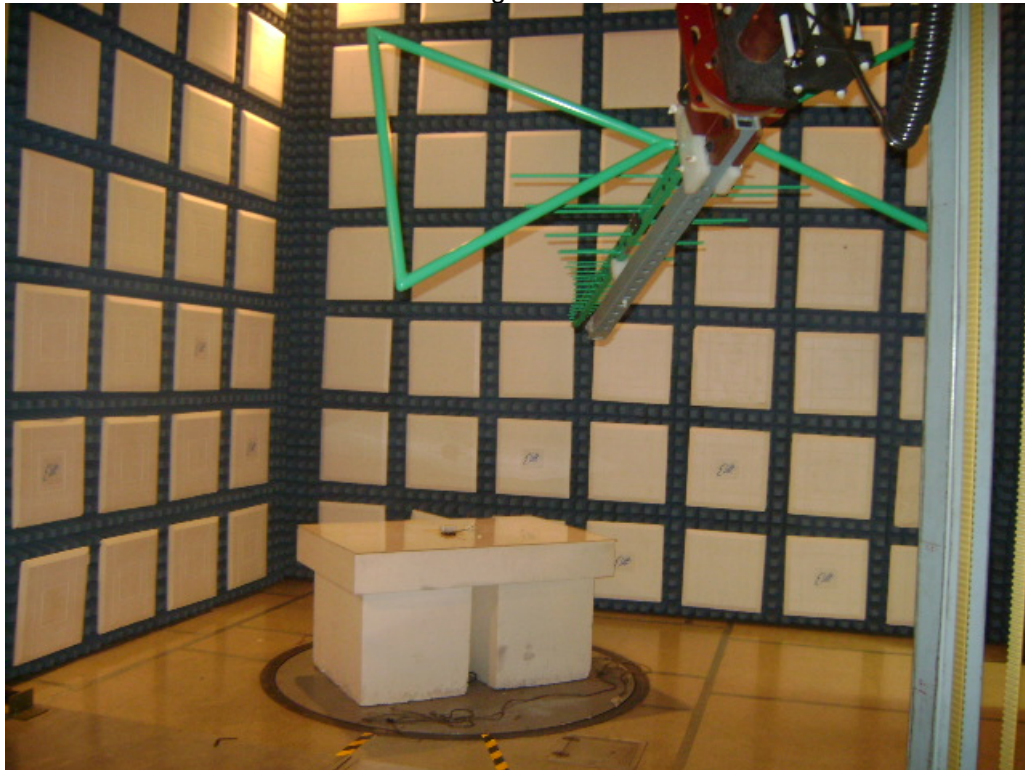
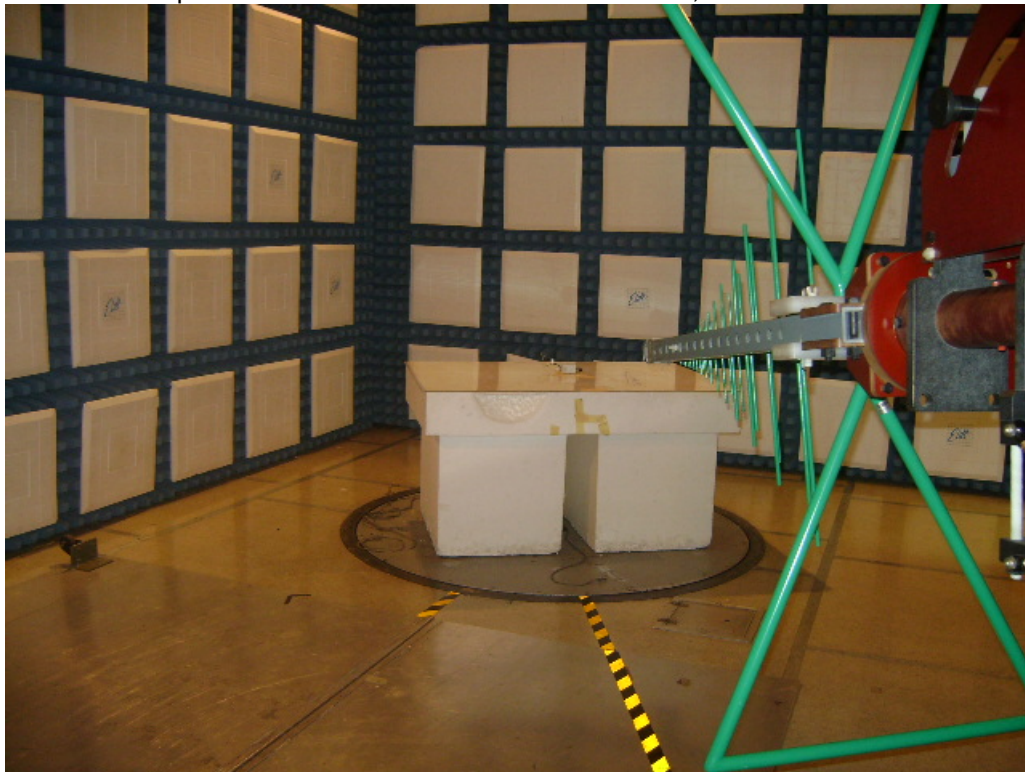


Figure 2

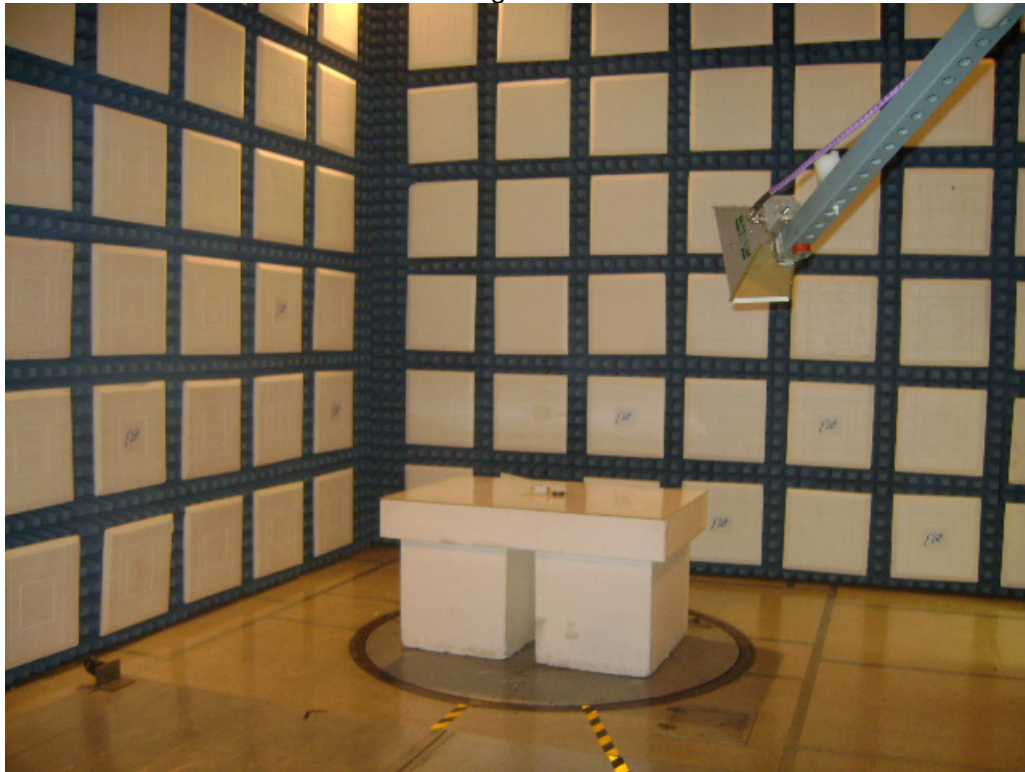


Test Setup for Radiated Emissions – 30MHz to 1GHz, Horizontal Polarization

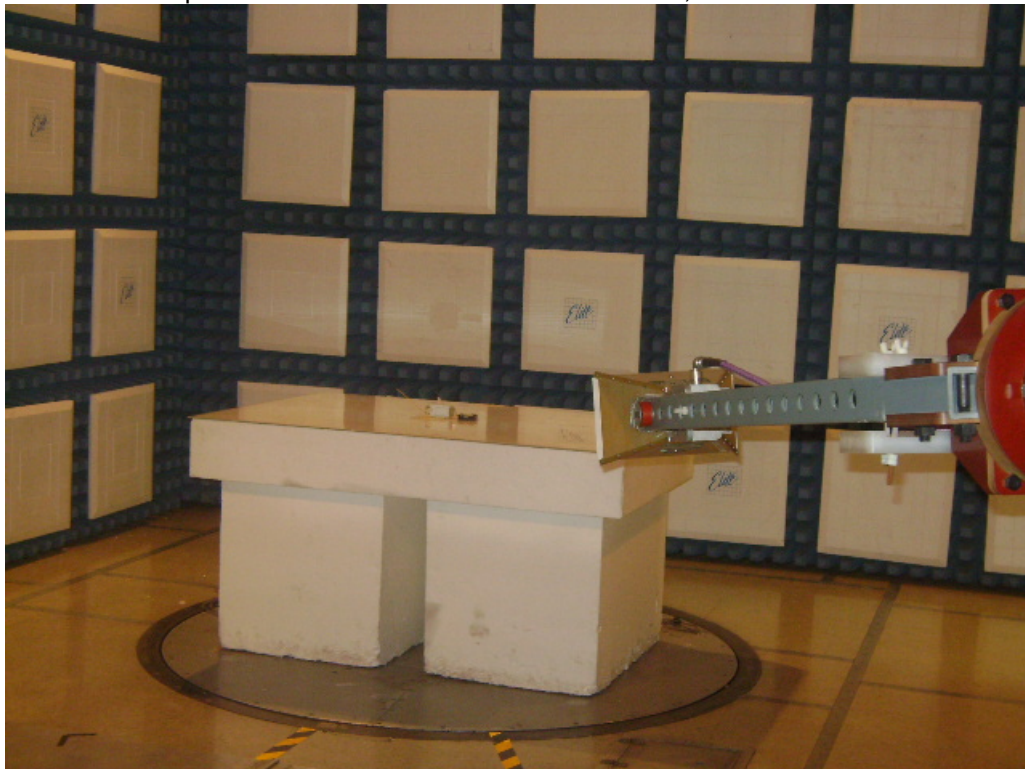


Test Setup for Radiated Emissions – 30MHz to 1GHz, Vertical Polarization

Figure 3



Test Setup for Radiated Emissions – 1GHz to 5GHz, Horizontal Polarization



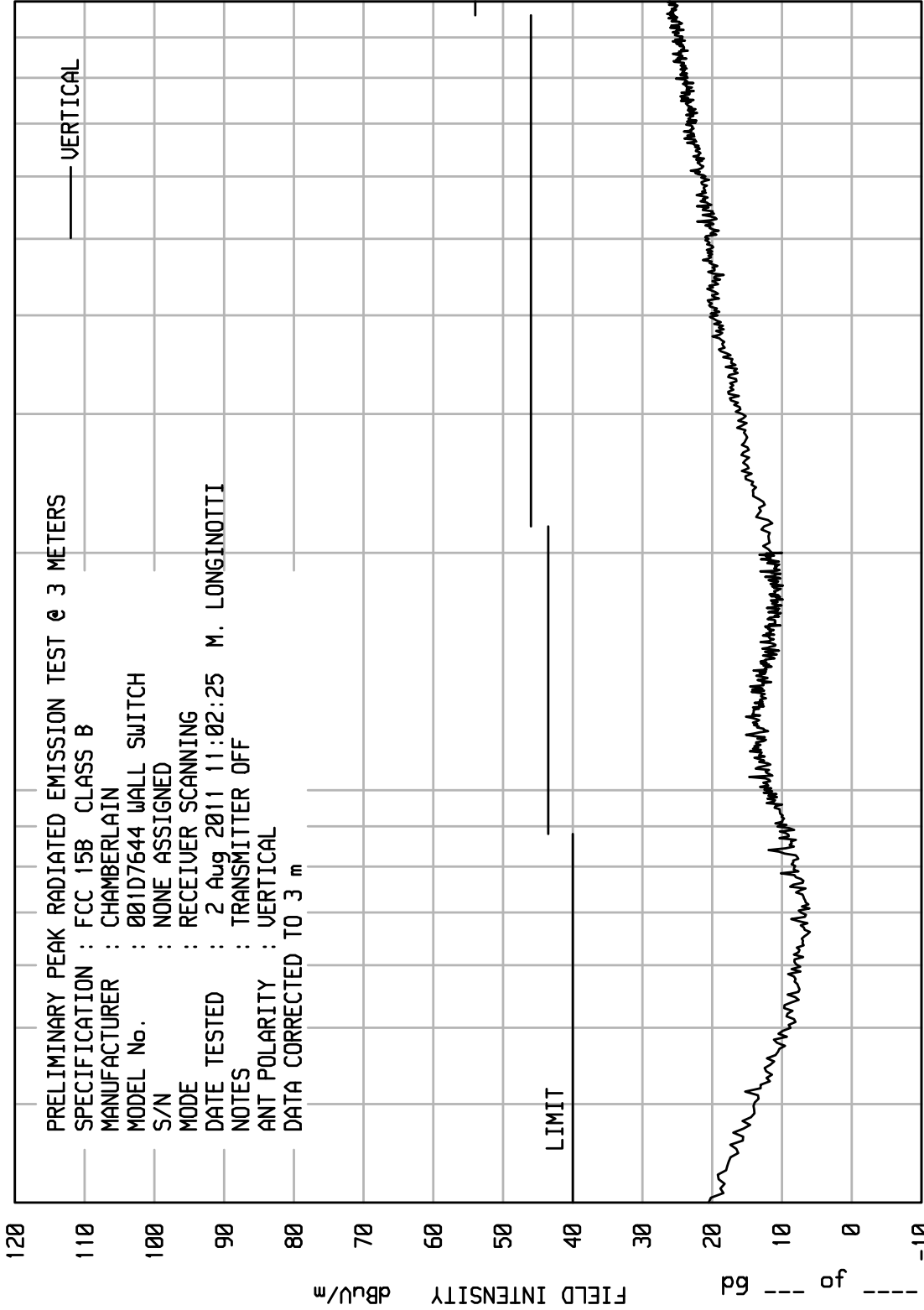
Test Setup for Radiated Emissions – 1GHz to 5GHz, Vertical Polarization

ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

8546A RE RUN 2

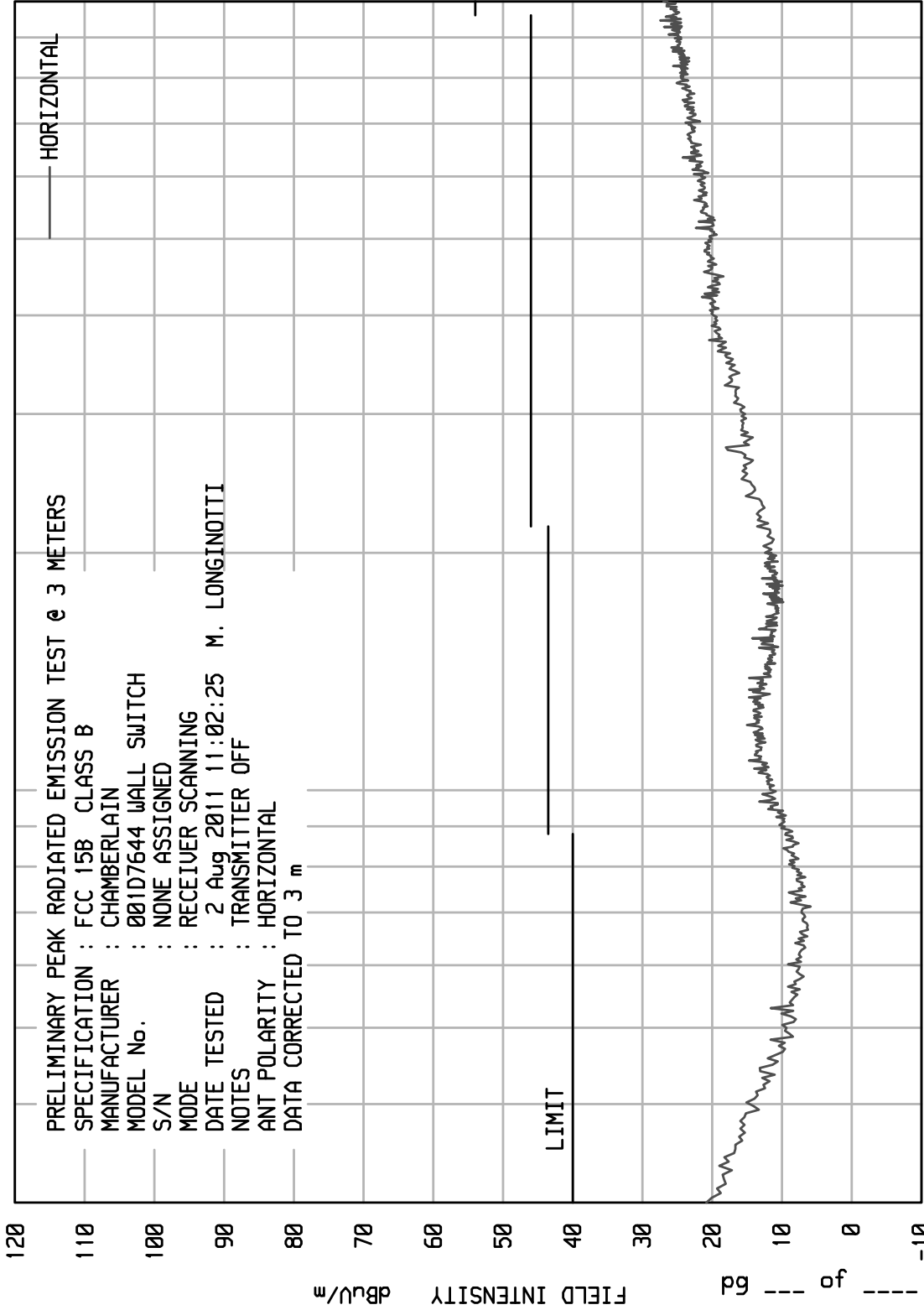
11/24/08



ELITE ELECTRONIC ENGINEERING Inc.  
Downers Grove, Ill. 60515

8546A RE RUN 2

11/24/08



PRELIMINARY PEAK RADIATED EMISSION TEST @ 3 METERS  
 SPECIFICATION : FCC 15B CLASS B  
 MANUFACTURER : CHAMBERLAIN  
 MODEL No. : 001D7644 WALL SWITCH  
 S/N : NONE ASSIGNED  
 MODE : RECEIVER SCANNING  
 DATE TESTED : 2 Aug 2011 11:02:25 M. LONGINOTTI  
 NOTES : TRANSMITTER OFF  
 ANT POLARITY : HORIZONTAL  
 DATA CORRECTED TO 3 m

HORIZONTAL

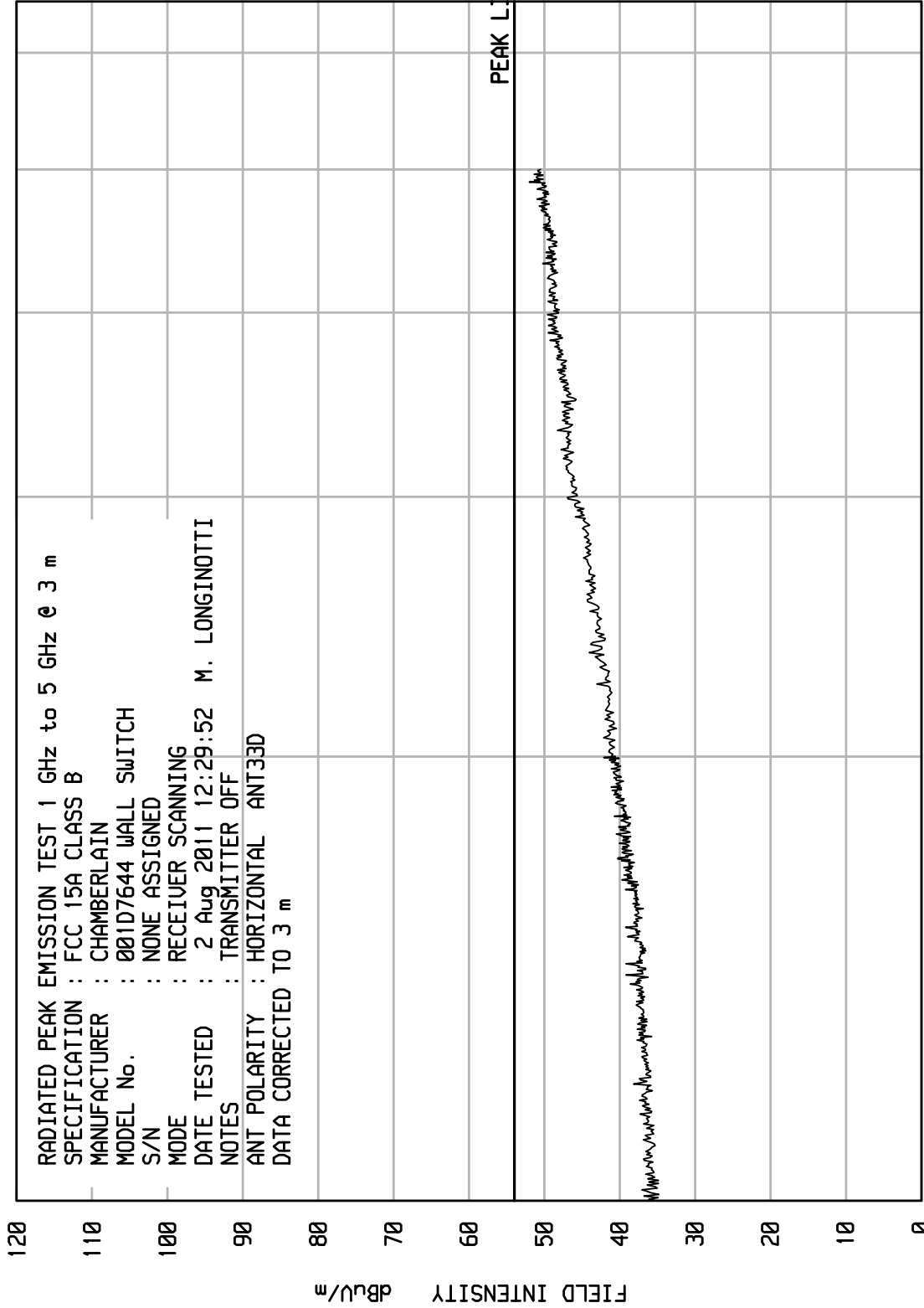
START = 30      STOP = 1000  
 FREQUENCY - MHz



ELITE ELECTRONIC ENGINEERING Inc.  
Downers Grove, Ill. 60515

8546A HF RUN 1

WQC0 11/19/10



RADIATED PEAK EMISSION TEST 1 GHz to 5 GHz @ 3 m  
 SPECIFICATION : FCC 15A CLASS B  
 MANUFACTURER : CHAMBERLAIN  
 MODEL No. : 001D7644 WALL SWITCH  
 S/N : NONE ASSIGNED  
 MODE : RECEIVER SCANNING  
 DATE TESTED : 2 Aug 2011 12:29:52 M. LONGINOTTI  
 NOTES : TRANSMITTER OFF  
 ANT POLARITY : HORIZONTAL ANT33D  
 DATA CORRECTED TO 3 m

STOP = 6500

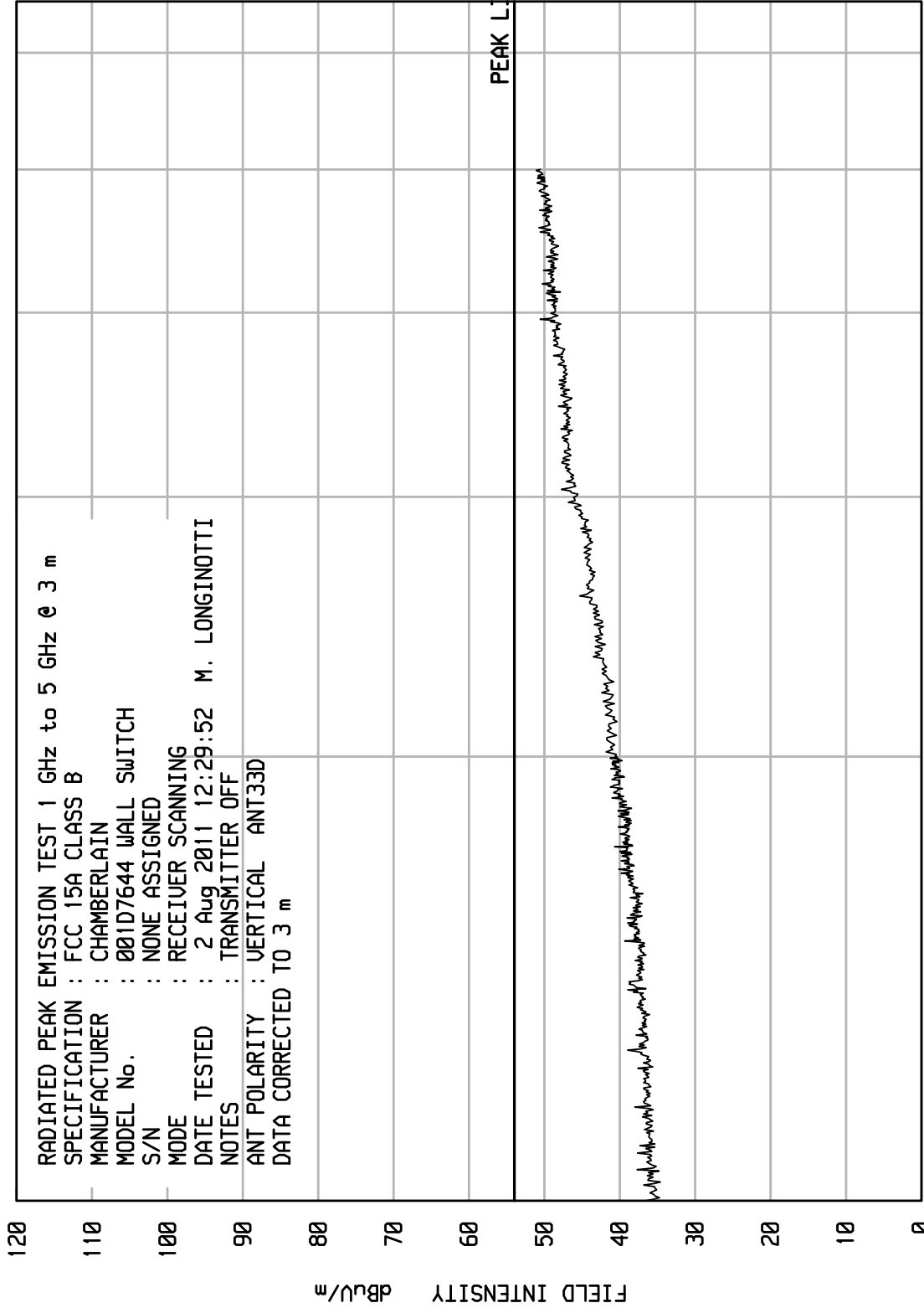
FREQUENCY - MHz

START = 1000

ELITE ELECTRONIC ENGINEERING Inc.  
Downers Grove, Ill. 60515

8546A HF RUN 1

WQ00 11/19/10



START = 1000

FREQUENCY - MHz

STOP = 6500



ETR No.  
DATA SHEET

8546A  
TEST NO. 2

RADIATED QP EMISSION MEASUREMENTS in a 3 m SEMI-ANECHOIC ROOM  
SPECIFICATION : FCC 15B CLASS B  
MANUFACTURER : CHAMBERLAIN  
MODEL NO. : 001D7644 WALL SWITCH  
SERIAL NO. : NONE ASSIGNED  
TEST MODE : RECEIVER SCANNING  
NOTES : TRANSMITTER OFF  
TEST DATE : 2 Aug 2011 11:02:25  
TEST DISTANCE : 3 m (DATA EXTRAPOLATED TO 3 m)

FREQUENCY MHZ	QP READING dBuV	ANT FAC dB	CBL FAC dB	EXT ATTN dB	DIST FAC dB	TOTAL dBuV/m	QP LIMIT dBuV/m	AZ deg	ANT HT cm	POLAR
53.97	-2.3	7.6	.5	0.0	0.0	5.8	40.0	0	120	H
82.50	-2.9	7.9	.5	0.0	0.0	5.6	40.0	0	120	V
115.52	-2.6	12.9	.6	0.0	0.0	10.9	43.5	315	340	V
123.67	-2.5	12.9	.7	0.0	0.0	11.1	43.5	270	340	V
158.13	-2.2	10.8	.8	0.0	0.0	9.4	43.5	90	200	H
189.97	-2.3	10.5	1.0	0.0	0.0	9.2	43.5	135	120	V
216.38	-1.9	10.5	1.0	0.0	0.0	9.7	46.0	315	200	H
365.80	-1.3	15.6	1.3	0.0	0.0	15.6	46.0	225	120	H
428.08	-1.8	17.0	1.5	0.0	0.0	16.7	46.0	90	120	H
557.99	-2.1	18.9	1.5	0.0	0.0	18.4	46.0	45	200	H
628.15	-2.0	19.7	1.6	0.0	0.0	19.2	46.0	270	200	H
791.20	-1.2	20.7	2.0	0.0	0.0	21.5	46.0	90	120	V
871.40	-1.4	21.5	2.0	0.0	0.0	22.0	46.0	225	340	H
947.09	-1.2	22.1	2.0	0.0	0.0	22.9	46.0	135	200	H

tested by: MARK E. LONGINOTTI  
M. LONGINOTTI





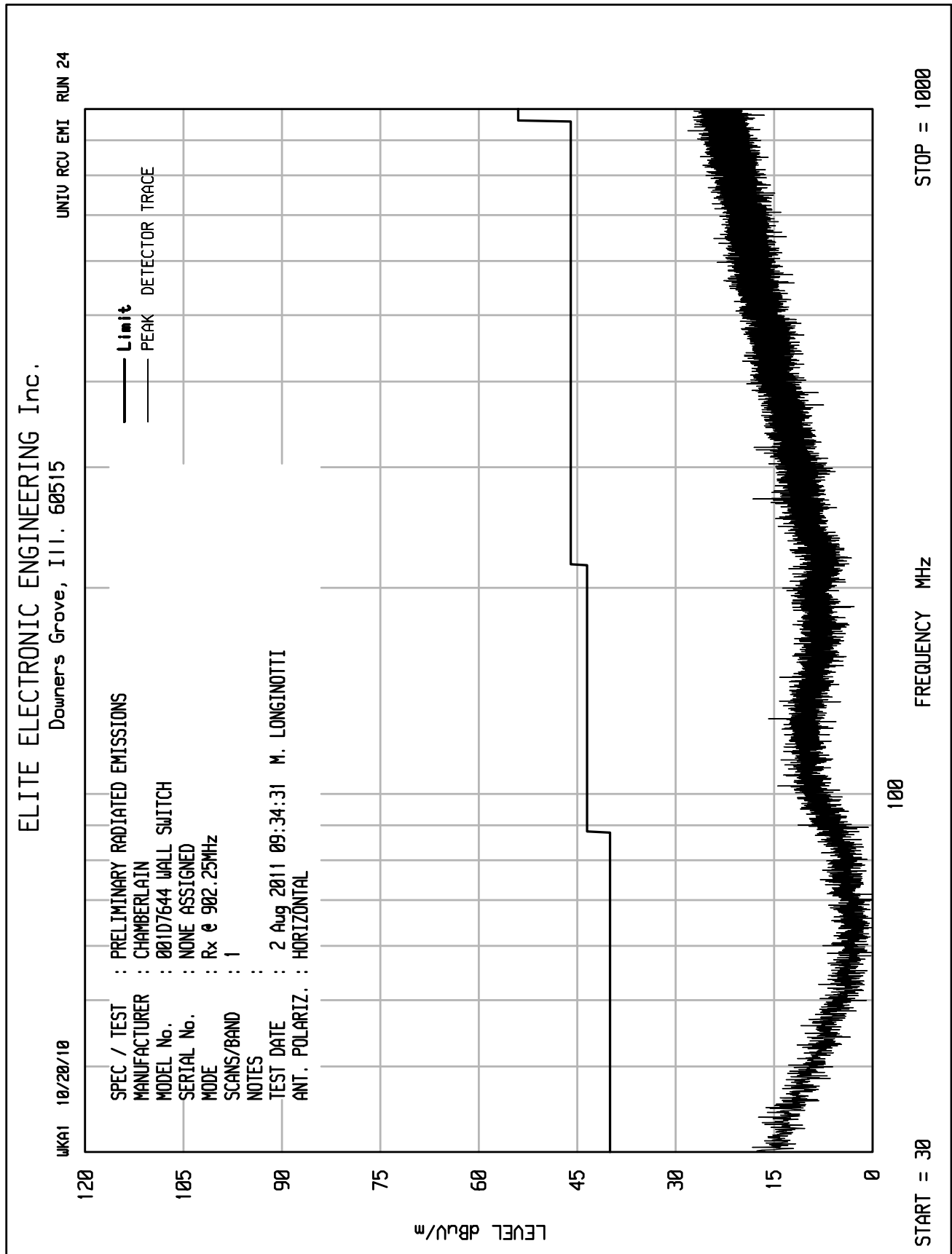
DATA SHEET

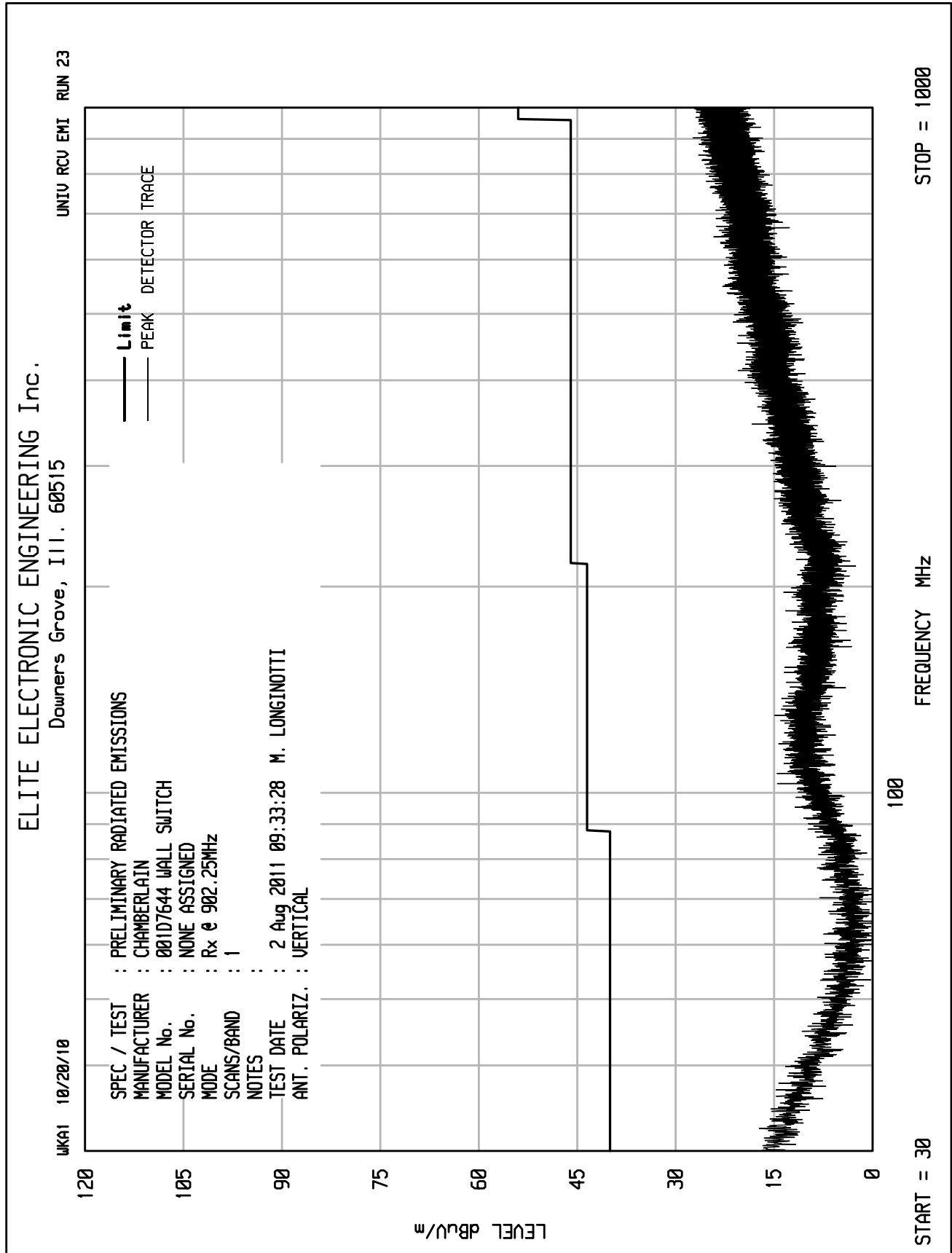
HF TEST NO. 1

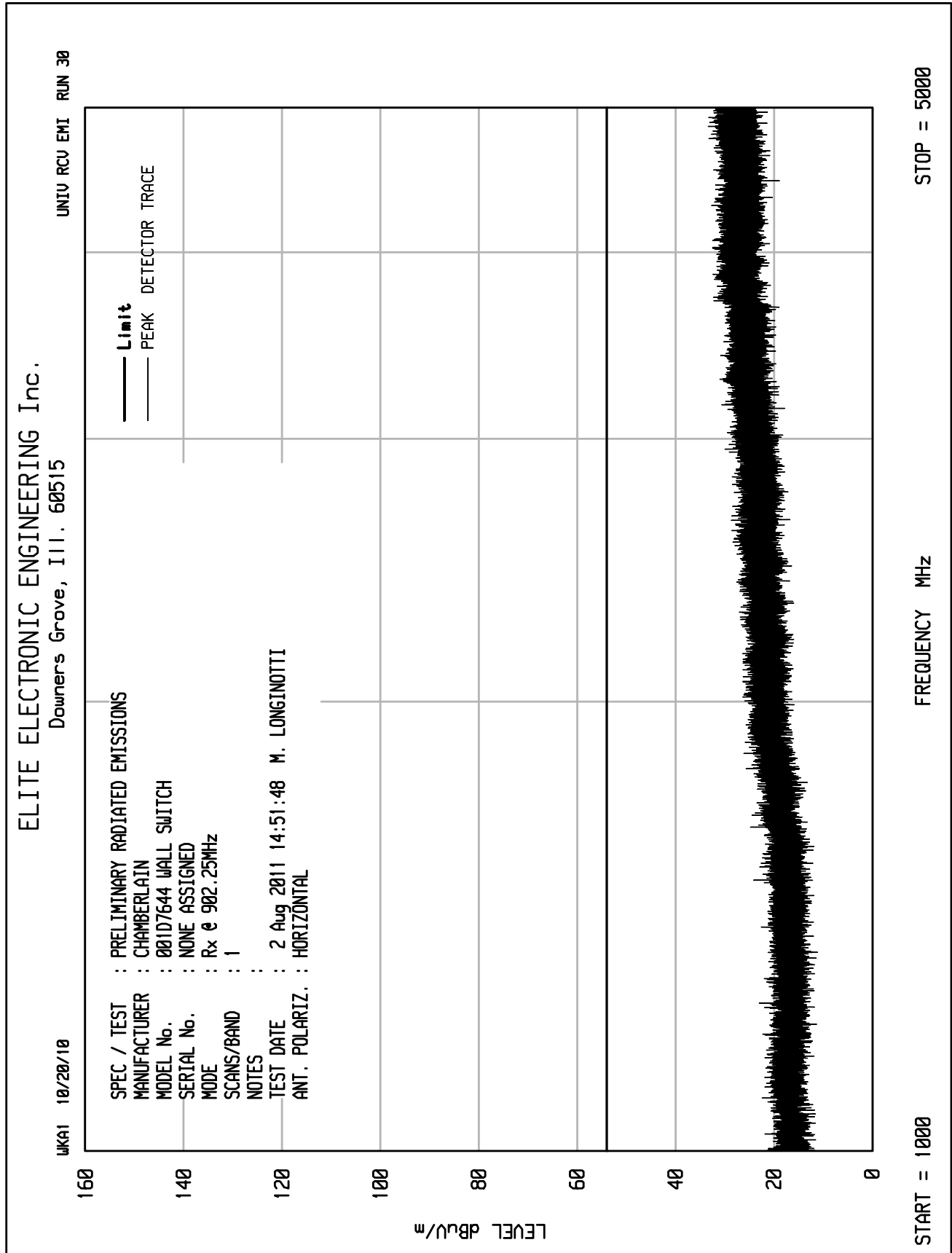
RADIATED AVG EMISSION MEASUREMENTS  $\geq 1000$  MHz in a 3 m ANECHOIC ROOM  
 SPECIFICATION : FCC 15A CLASS B  
 MANUFACTURER : CHAMBERLAIN  
 MODEL NO. : 001D7644 WALL SWITCH  
 SERIAL NO. : NONE ASSIGNED  
 TEST MODE : RECEIVER SCANNING  
 NOTES : TRANSMITTER OFF  
 TEST DATE : 2 Aug 2011 12:29:52  
 TEST DISTANCE : 3 m  
 ANTENNA : ANT33D

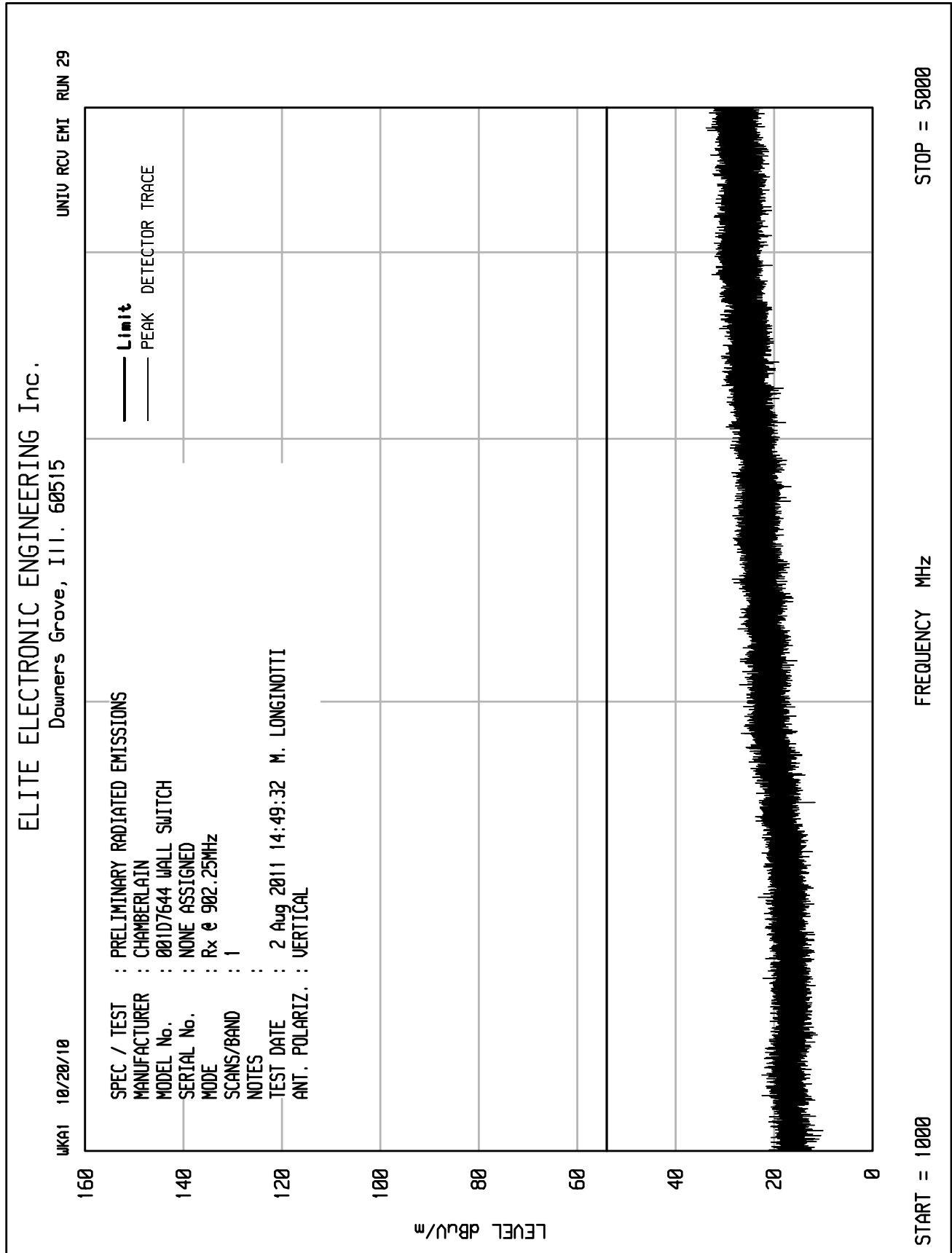
FREQUENCY MHz	AVG READING dBuV	ANT FAC dB	CBL FAC dB	DIST FAC dB	TOTAL dBuV/m	AVG LIMIT dBuV/m	PASS/ FAIL	AZ deg	ANT HT cm	POLAR
1058.11	-2.9	24.1	2.1	0.0	23.2	54.0		315	120	V
1252.99	-3.2	24.8	2.3	0.0	23.9	54.0		315	120	V
1393.79	-3.2	25.0	2.5	0.0	24.3	54.0		90	120	V
1532.24	-2.9	25.2	2.6	0.0	24.9	54.0		315	120	V
1684.00	-2.9	26.3	2.8	0.0	26.1	54.0		180	120	V
1762.00	-2.8	26.4	2.8	0.0	26.4	54.0		-0	120	V
1919.32	-3.6	27.5	2.9	0.0	26.9	54.0		-0	200	V
2227.54	-2.9	27.7	3.2	0.0	28.0	54.0		315	120	V
2551.12	-2.9	29.4	3.5	0.0	30.1	54.0		270	120	V
3010.95	-2.5	30.7	3.9	0.0	32.1	54.0		-0	120	H
3323.87	-2.8	31.9	4.1	0.0	33.3	54.0		135	200	H
3817.58	-2.5	32.8	4.4	0.0	34.7	54.0		180	340	H
3927.75	-2.4	33.1	4.5	0.0	35.2	54.0		270	340	V
4580.92	-1.8	33.2	4.8	0.0	36.1	54.0		90	200	V
4892.03	-1.8	34.1	5.0	0.0	37.2	54.0		0	200	H

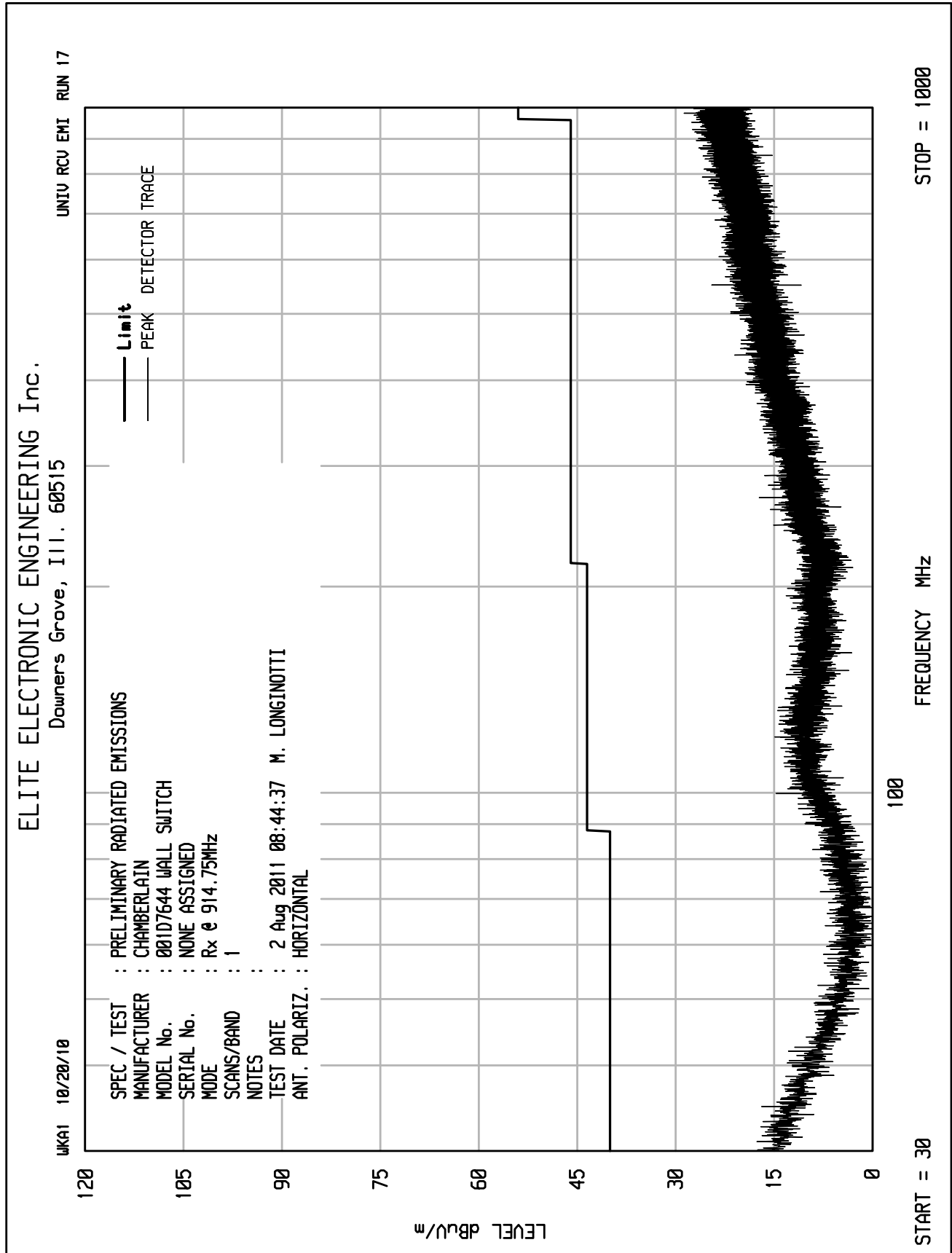
tested by: MARK E. LONGINOTTI  
 M. LONGINOTTI

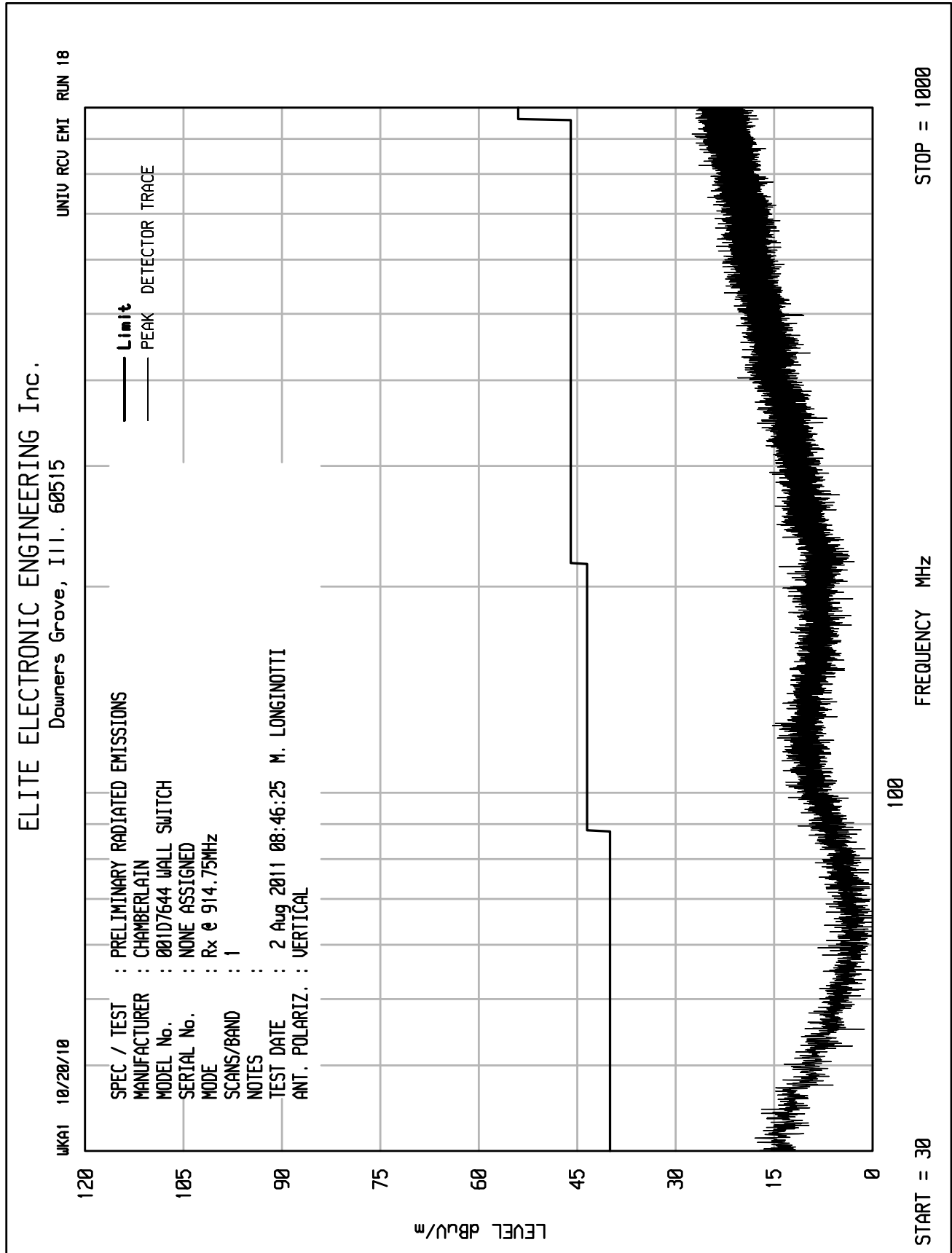












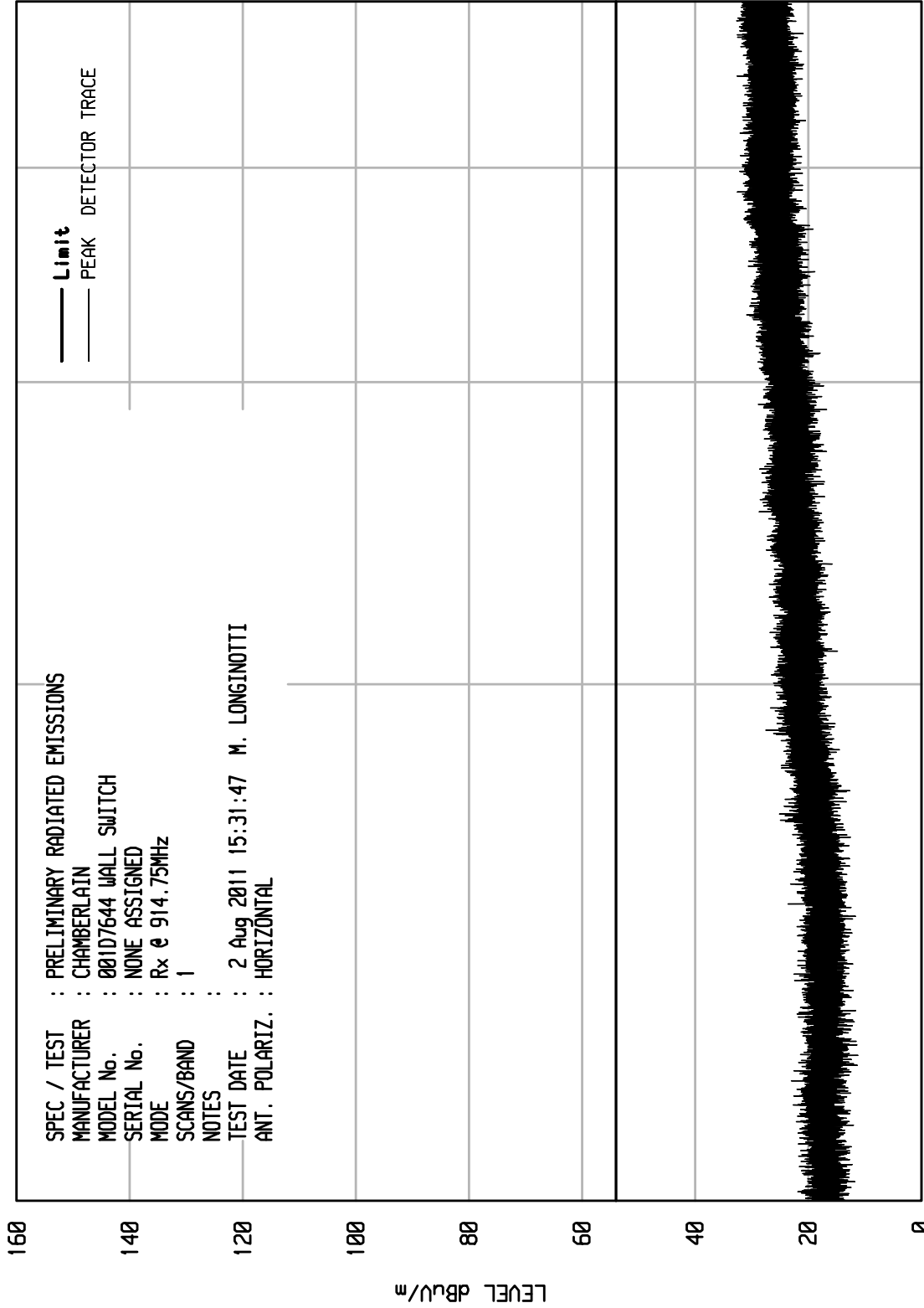


ELITE ELECTRONIC ENGINEERING Inc.

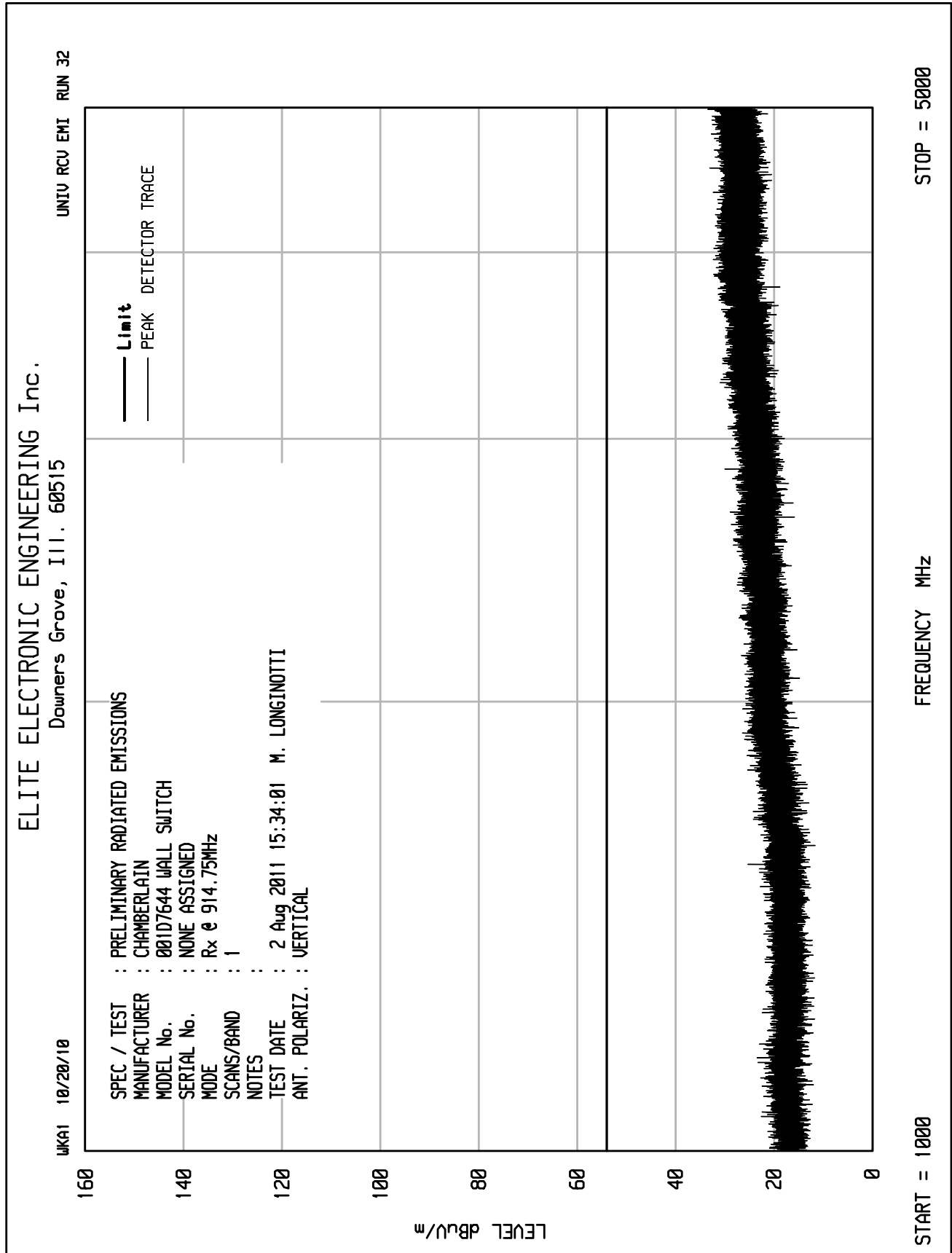
Downers Grove, Ill. 60515

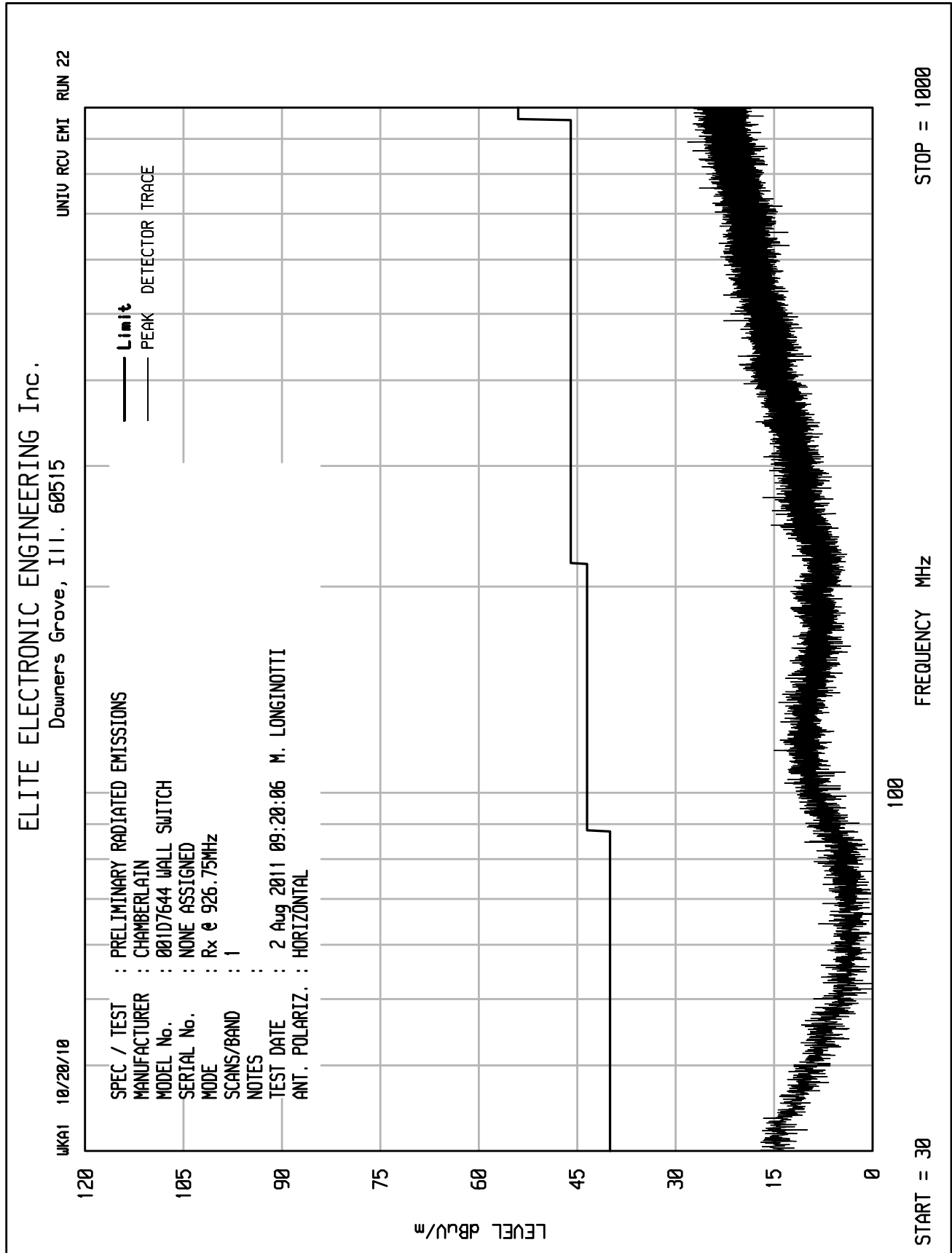
UNIU RCU EMI RUN 31

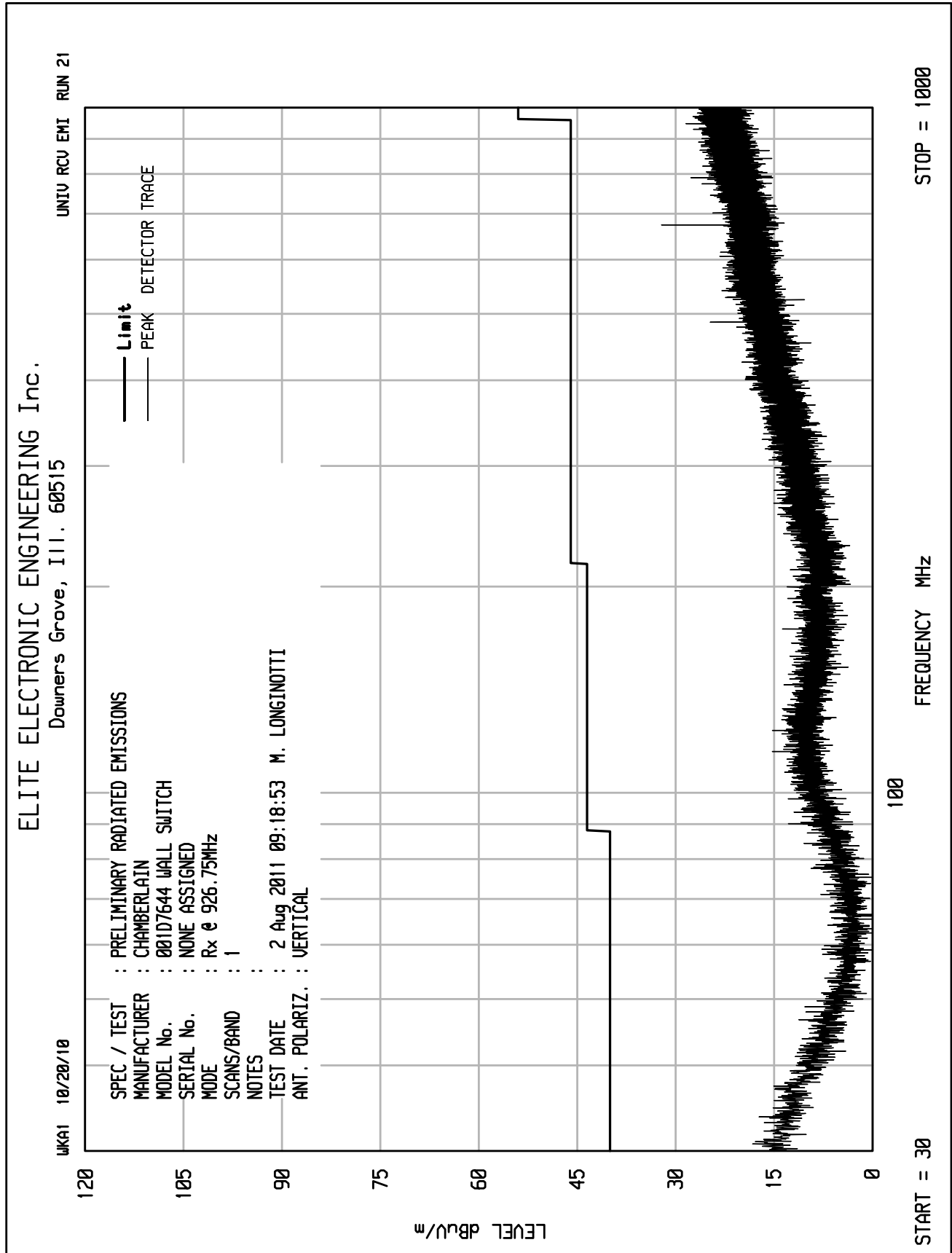
UKA1 10/20/10











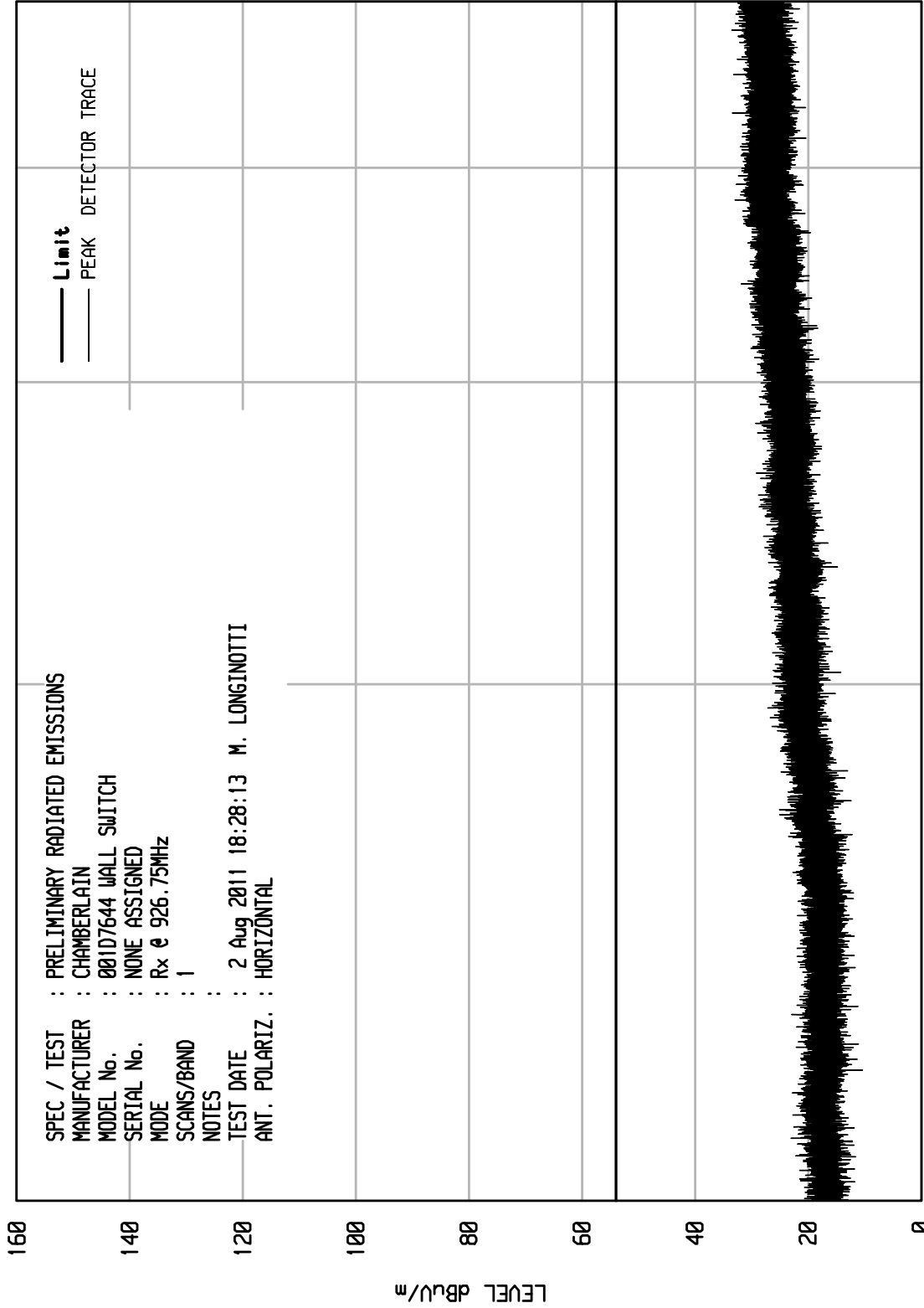


ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

UNIU RCU EMI RUN 39

UKA1 10/20/10

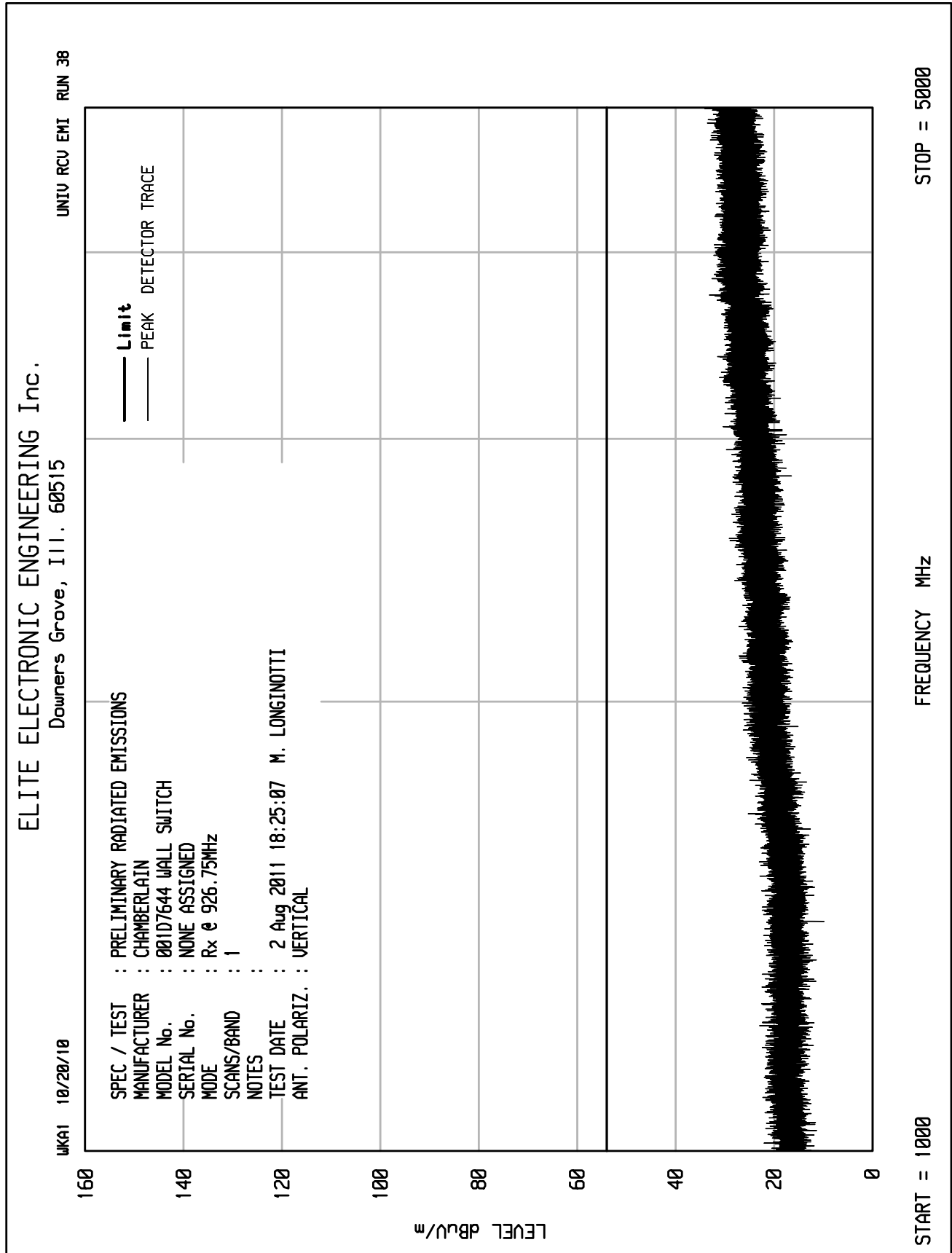


START = 1000

FREQUENCY MHz

STOP = 5000

SPEC / TEST : PRELIMINARY RADIATED EMISSIONS  
 MANUFACTURER : CHAMBERLAIN  
 MODEL No. : 001D7644 WALL SWITCH  
 SERIAL No. : NONE ASSIGNED  
 MODE : Rx @ 926.75MHz  
 SCANS/BAND : 1  
 NOTES :  
 TEST DATE : 2 Aug 2011 18:28:13 M. LONGINOTTI  
 ANT. POLARIZ. : HORIZONTAL





Manufacturer : Chamberlain Group, Inc.  
 EUT : Wall Switch  
 Model No. : 001D7644  
 Serial No. : None Assigned  
 Specification : FCC-15.109 Spurious Radiated Emissions  
 Date : August 2, 2011  
 Mode : Rx @ 902.25MHz  
 Equipment Used : RBA0, NTA2, CMA1, NWH0, APW3, SES1  
 Notes : Test Distance is 3 meters  
 Notes :

Freq (MHz)	Ant Pol	Meter		CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Total dBuV/m at 3 M	Total uV/m at 3M	Limit uV/m at 3M	Margin (dB)
		Reading (dBuV)	Ambient							
901.313	H	4.9	Ambient	2.0	21.8	0.0	28.7	27.2	200.0	-17.3
901.313	V	5.3	Ambient	2.0	21.8	0.0	29.1	28.5	200.0	-16.9
1802.625	H	49.9	Ambient	2.9	26.5	-40.7	38.6	84.9	500.0	-15.4
1802.625	V	49.7	Ambient	2.9	26.5	-40.7	38.4	83.0	500.0	-15.6
2703.938	H	48.4	Ambient	3.7	29.6	-40.3	41.3	116.1	500.0	-12.7
2703.938	V	48.5	Ambient	3.7	29.6	-40.3	41.4	117.5	500.0	-12.6
3605.250	H	46.5	Ambient	4.3	32.0	-39.9	42.9	139.4	500.0	-11.1
3605.250	V	47.6	Ambient	4.3	32.0	-39.9	44.0	158.2	500.0	-10.0
4506.563	H	47.4	Ambient	4.8	32.9	-40.0	45.1	180.1	500.0	-8.9
4506.563	V	46.6	Ambient	4.8	32.9	-40.0	44.3	164.3	500.0	-9.7

H – Horizontal

V – Vertical

Total (dBuV/m) = Meter Reading (dBuV) + Cable Factor (dB) + Antenna Factor (dB) + Pre Amp (dB)



Manufacturer : Chamberlain Group, Inc.  
 EUT : Wall Switch  
 Model No. : 001D7644  
 Serial No. : None Assigned  
 Specification : FCC-15.109 Spurious Radiated Emissions  
 Date : August 2, 2011  
 Mode : Rx @ 914.75MHz  
 Equipment Used : RBA0, NTA2, CMA1, NWH0, APW3, SES1  
 Notes : Test Distance is 3 meters  
 Notes :

Freq (MHz)	Ant Pol	Meter		CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Total dBuV/m at 3 M	Total uV/m at 3M	Limit uV/m at 3M	Margin (dB)
		Reading (dBuV)	Ambient							
913.813	H	4.9	Ambient	2.0	21.8	0.0	28.7	27.2	200.0	-17.3
913.813	V	5.3	Ambient	2.0	21.8	0.0	29.1	28.5	200.0	-16.9
1827.625	H	48.7	Ambient	2.9	26.7	-40.6	37.7	77.0	500.0	-16.2
1827.625	V	48.9	Ambient	2.9	26.7	-40.6	37.9	78.8	500.0	-16.0
2741.438	H	47.8	Ambient	3.7	29.6	-40.3	40.7	108.6	500.0	-13.3
2741.438	V	47.3	Ambient	3.7	29.6	-40.3	40.2	102.5	500.0	-13.8
3655.250	H	47.0	Ambient	4.3	32.2	-39.8	43.8	154.3	500.0	-10.2
3655.250	V	46.8	Ambient	4.3	32.2	-39.8	43.6	150.8	500.0	-10.4
4569.063	H	46.8	Ambient	4.8	33.1	-40.0	44.7	172.1	500.0	-9.3
4569.063	V	46.5	Ambient	4.8	33.1	-40.0	44.4	166.3	500.0	-9.6

H – Horizontal

V – Vertical

Total (dBuV/m) = Meter Reading (dBuV) + Cable Factor (dB) + Antenna Factor (dB) + Pre Amp (dB)



Manufacturer : Chamberlain Group, Inc.  
 EUT : Wall Switch  
 Model No. : 001D7644  
 Serial No. : None Assigned  
 Specification : FCC-15.109 Spurious Radiated Emissions  
 Date : August 2, 2011  
 Mode : Rx @ 926.75MHz  
 Equipment Used : RBA0, NTA2, CMA1, NWH0, APW3, SES1  
 Notes : Test Distance is 3 meters  
 Notes :

Freq (MHz)	Ant Pol	Meter		CBL	Ant	Pre	Total	Total	Limit	Margin (dB)
		Reading (dBuV)	Ambient	Fac (dB)	Fac (dB)	Amp (dB)	dBuV/m at 3 M	uV/m at 3M	uV/m at 3M	
925.813	H	4.6	Ambient	2.0	21.9	0.0	28.5	26.5	200.0	-17.6
925.813	V	5.3	Ambient	2.0	21.9	0.0	29.2	28.7	200.0	-16.9
1851.625	H	49.0	Ambient	2.9	27.0	-40.5	38.4	82.9	500.0	-15.6
1851.625	V	48.8	Ambient	2.9	27.0	-40.5	38.2	81.0	500.0	-15.8
2777.438	H	47.8	Ambient	3.7	29.6	-40.4	40.7	108.9	500.0	-13.2
2777.438	V	48.3	Ambient	3.7	29.6	-40.4	41.2	115.3	500.0	-12.7
3703.250	H	47.8	Ambient	4.3	32.4	-39.6	44.9	176.2	500.0	-9.1
3703.250	V	47.4	Ambient	4.3	32.4	-39.6	44.5	168.3	500.0	-9.5
4629.063	H	46.2	Ambient	4.8	33.3	-40.0	44.3	164.3	500.0	-9.7
4629.063	V	46.0	Ambient	4.8	33.3	-40.0	44.1	160.5	500.0	-9.9

H – Horizontal

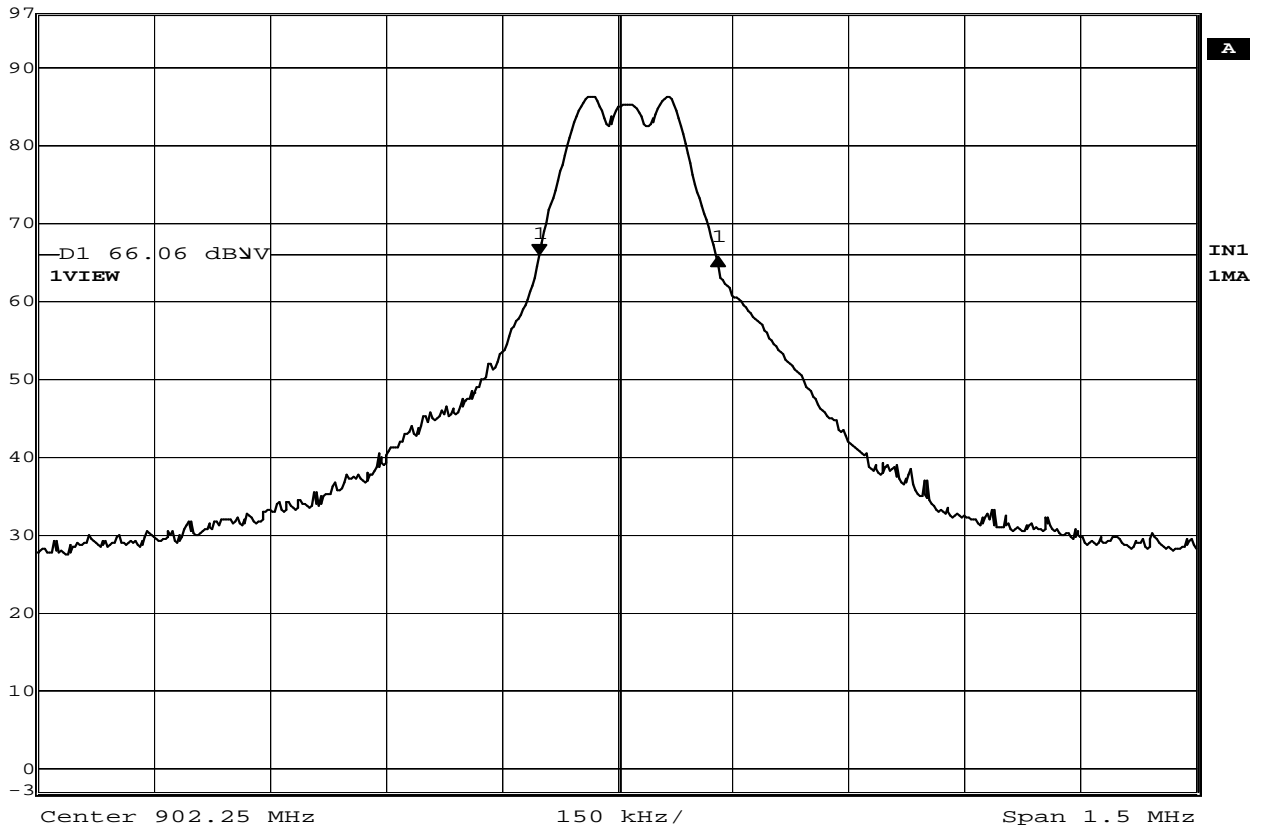
V – Vertical

Total (dBuV/m) = Meter Reading (dBuV) + Cable Factor (dB) + Antenna Factor (dB) + Pre Amp (dB)





Ref Lvl	Delta 1 [T1]	RBW	30 kHz	RF Att	10 dB
97 dB $\mu$ V	-0.27 dB	VBW	30 kHz		
	231.46292585 kHz	SWT	5 ms	Unit	dB $\mu$ V



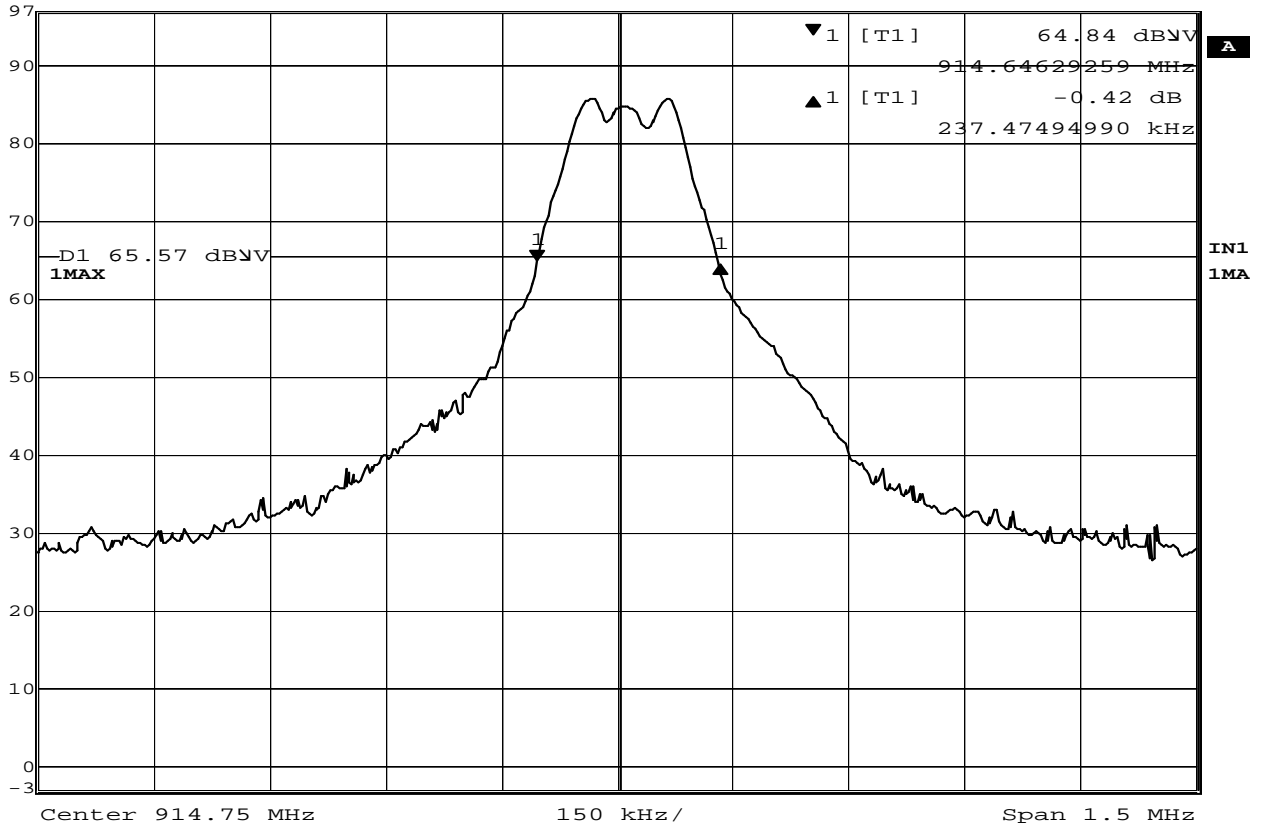
Date: 2.AUG.2011 05:10:50

**15.247(a) 20dB Band Width**

MANUFACTURER	: The Chamberlain Group
MODEL NUMBER	: 001D7664 Wall Switch
SERIAL NUMBER	: None Assigned
TEST MODE	: Tx @ 902.25MHz
NOTES	:
TEST DATE	: August 2, 2011
TEST PARAMETERS	: 20dB bandwidth = 231.5kHz, 99% bandwidth = 195.4kHz
NOTES	:
EQUIPMENT USED	: RBA0, NTA2



Ref Lvl	Delta 1 [T1]	RBW	30 kHz	RF Att	10 dB
97 dBV	-0.42 dB	VBW	30 kHz		
	237.47494990 kHz	SWT	5 ms	Unit	dBV



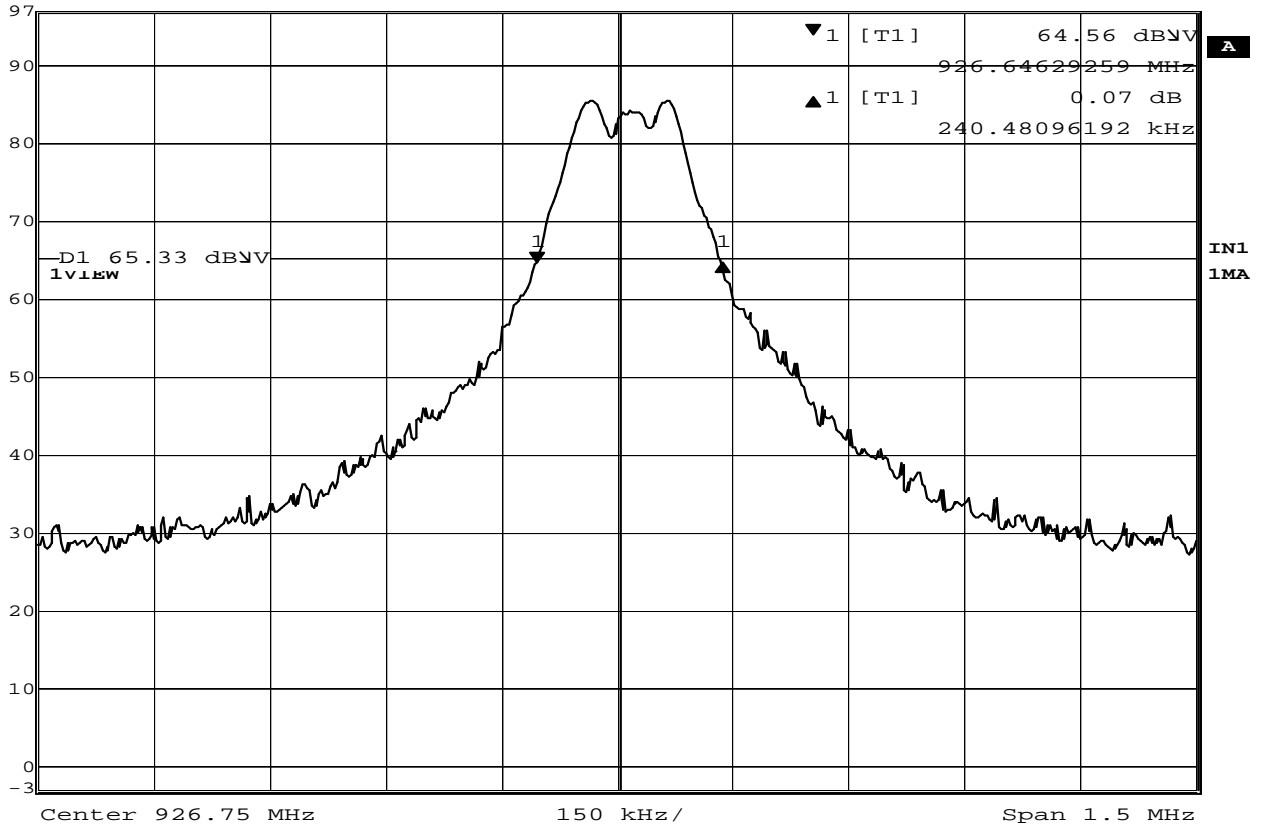
Date: 2.AUG.2011 05:25:03

### 15.247(a) 20dB Band Width

MANUFACTURER	: The Chamberlain Group
MODEL NUMBER	: 001D7664 Wall Switch
SERIAL NUMBER	: None Assigned
TEST MODE	: Tx @ 914.75MHz
NOTES	:
TEST DATE	: August 2, 2011
TEST PARAMETERS	: 20dB bandwidth = 237.5kHz, 99% bandwidth = 198.4kHz
NOTES	:
EQUIPMENT USED	: RBA0, NTA2



Ref Lvl	Delta 1 [T1]	RBW	30 kHz	RF Att	10 dB
97 dB $\mu$ V	0.07 dB	VBW	30 kHz		
	240.48096192 kHz	SWT	5 ms	Unit	dB $\mu$ V



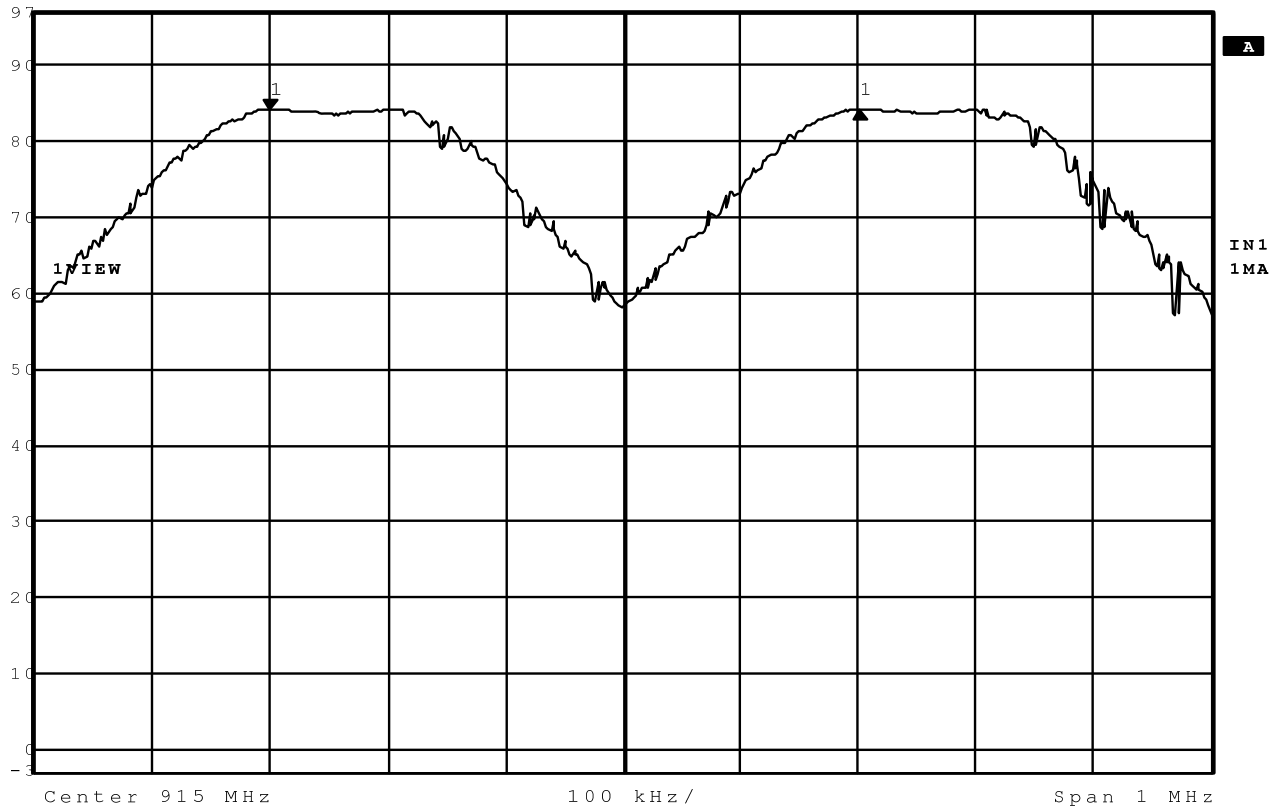
Date: 2.AUG.2011 05:29:26

### 15.247(a) 20dB Band Width

MANUFACTURER	: The Chamberlain Group
MODEL NUMBER	: 001D7664 Wall Switch
SERIAL NUMBER	: None Assigned
TEST MODE	: Tx @ 926.75MHz
NOTES	:
TEST DATE	: August 2, 2011
TEST PARAMETERS	: 20dB bandwidth = 240.5kHz, 99% bandwidth = 201.4kHz
NOTES	:
EQUIPMENT USED	: RBA0, NTA2



Delta 1 [T1] RBW 100 kHz RF Att 10 dB  
 Ref Lvl 0.04 dB VBW 100 kHz  
 97 dBµV 500.00200401 kHz SWT 5 ms Unit dBµV



Date: 1.AUG.2011 16:55:35

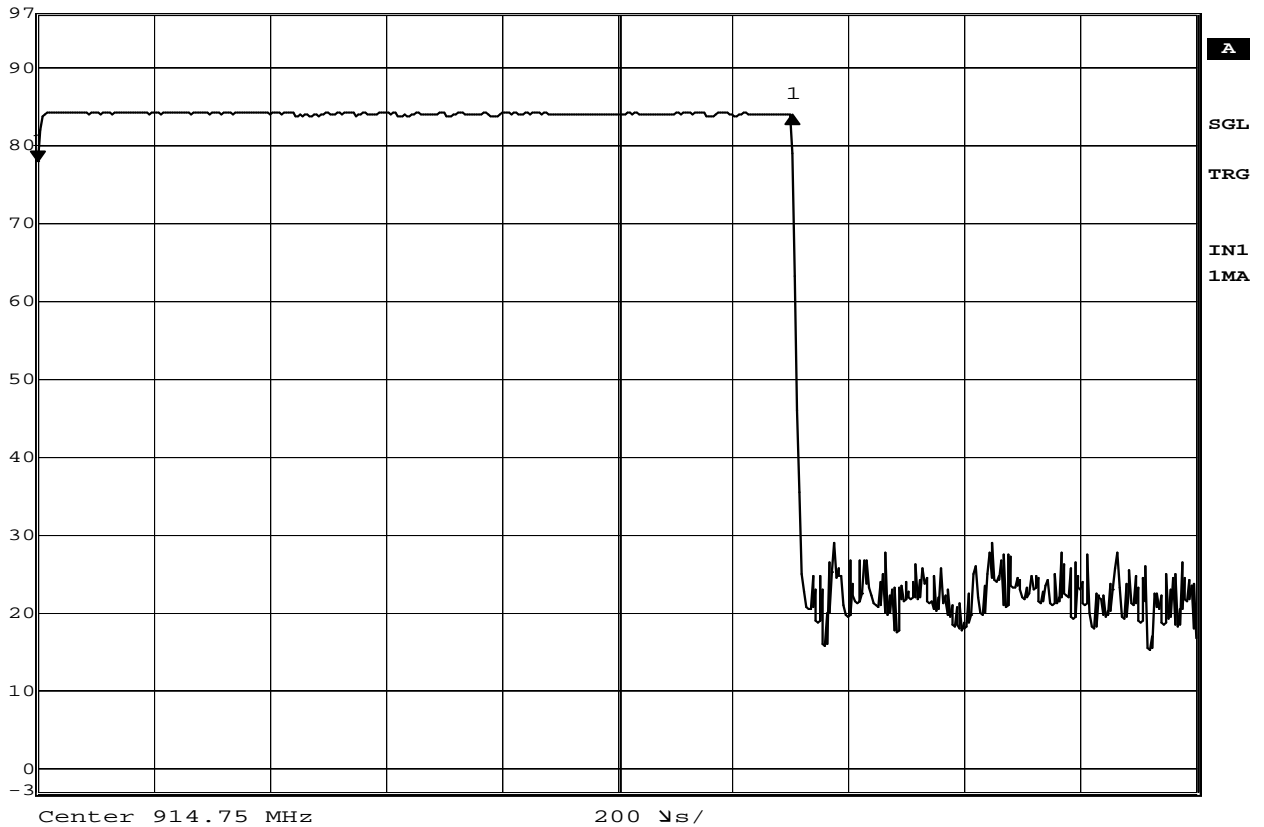
### 15.247(a) Carrier Frequency Separation

MANUFACTURER : The Chamberlain Group  
 MODEL NUMBER : 001D7664 Wall Switch  
 SERIAL NUMBER : None Assigned  
 TEST MODE : Hopping Enabled  
 NOTES :  
 TEST DATE : August 1, 2011  
 TEST PARAMETERS : Carrier Frequency Separation  
 NOTES : Carrier Frequency Separation = 500kHz  
 EQUIPMENT USED : RBA0, NTA2





	Delta 1 [T1]	RBW	300 kHz	RF Att	10 dB
Ref Lvl	6.04 dB	VBW	300 kHz		
97 dB $\mu$ V	1.302605 ms	SWT	2 ms	Unit	dB $\mu$ V



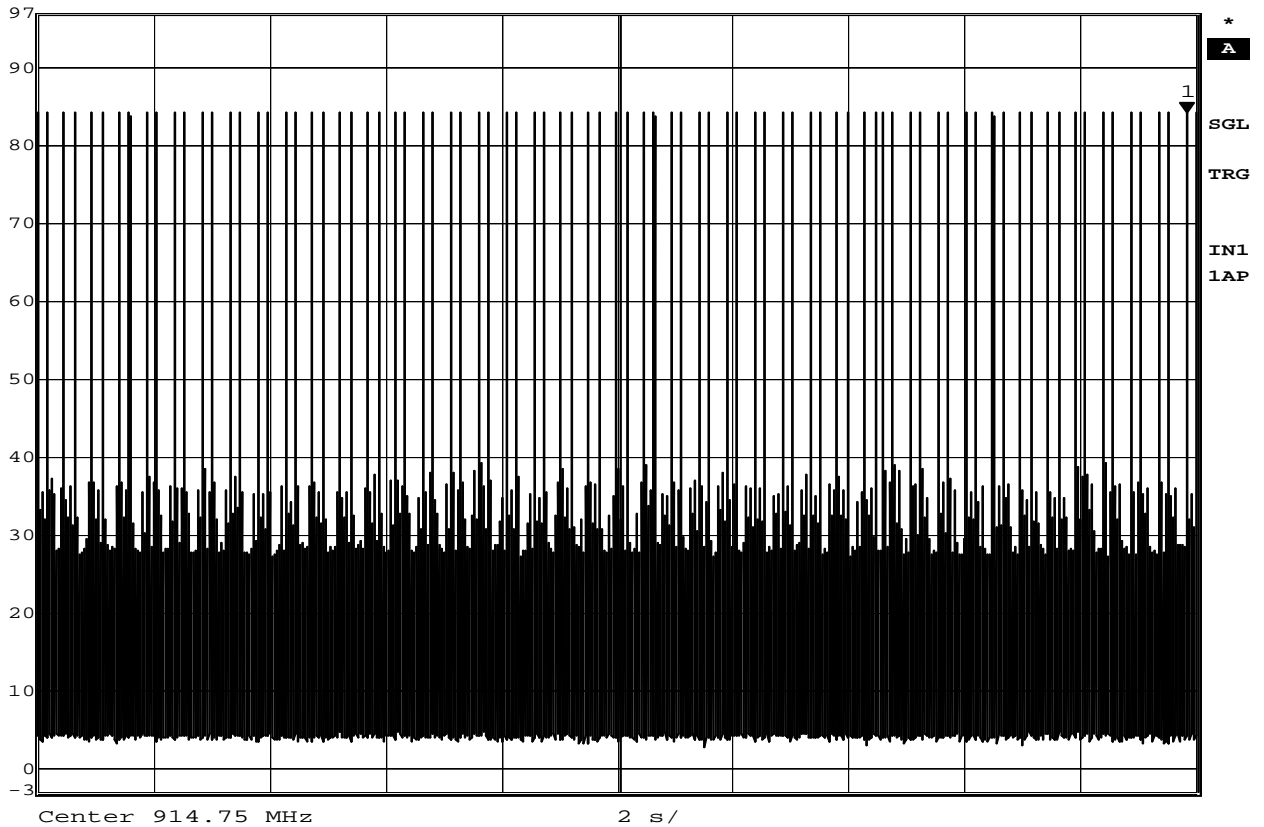
Date: 1.AUG.2011 17:04:25

### 15.247(a) Time of Occupancy

MANUFACTURER	: The Chamberlain Group
MODEL NUMBER	: 001D7664 Wall Switch
SERIAL NUMBER	: None Assigned
TEST MODE	: Hopping Enabled
NOTES	:
TEST DATE	: August 1, 2011
TEST PARAMETERS	: On time per hop is 1.3 msec
NOTES	:
EQUIPMENT USED	: RBA0, NTA2



Marker 1 [T1] RBW 100 kHz RF Att 10 dB  
 Ref Lvl 84.15 dBµV VBW 100 kHz  
 97 dBµV 19.839679 s SWT 20 s Unit dBµV



Date: 1.AUG.2011 17:09:39

### 15.247(a) Time of Occupancy

MANUFACTURER : The Chamberlain Group  
 MODEL NUMBER : 001D7664 Wall Switch  
 SERIAL NUMBER : None Assigned  
 TEST MODE : Hopping Enabled  
 NOTES :  
 TEST DATE : August 1, 2011  
 TEST PARAMETERS : Number of hops in a 20 second period is 85. Therefore the number of hops in a 10 second period is 43. On time per hop is 1.3msec.  
 : Therefore the total time of occupancy is (on time per hop) x (number of hops in a 10 second period)  
 NOTES : Time of occupancy = (1.3msec/hop) x (43hops) = 55.9msec  
 EQUIPMENT USED : RBA0, NTA2



Manufacturer : Chamberlain Group, Inc.  
 EUT : Wall Switch  
 Model No. : 001D7644  
 Serial No. : None Assigned  
 Specification : FCC-15.247 Effective Isotropic Radiated Power (EIRP)  
 Date : August 1, 2011  
 Mode : See Below  
 Equipment Used : RBA0, NTA2, NDQ1, GRE0  
 Notes : Test Distance is 3 meters

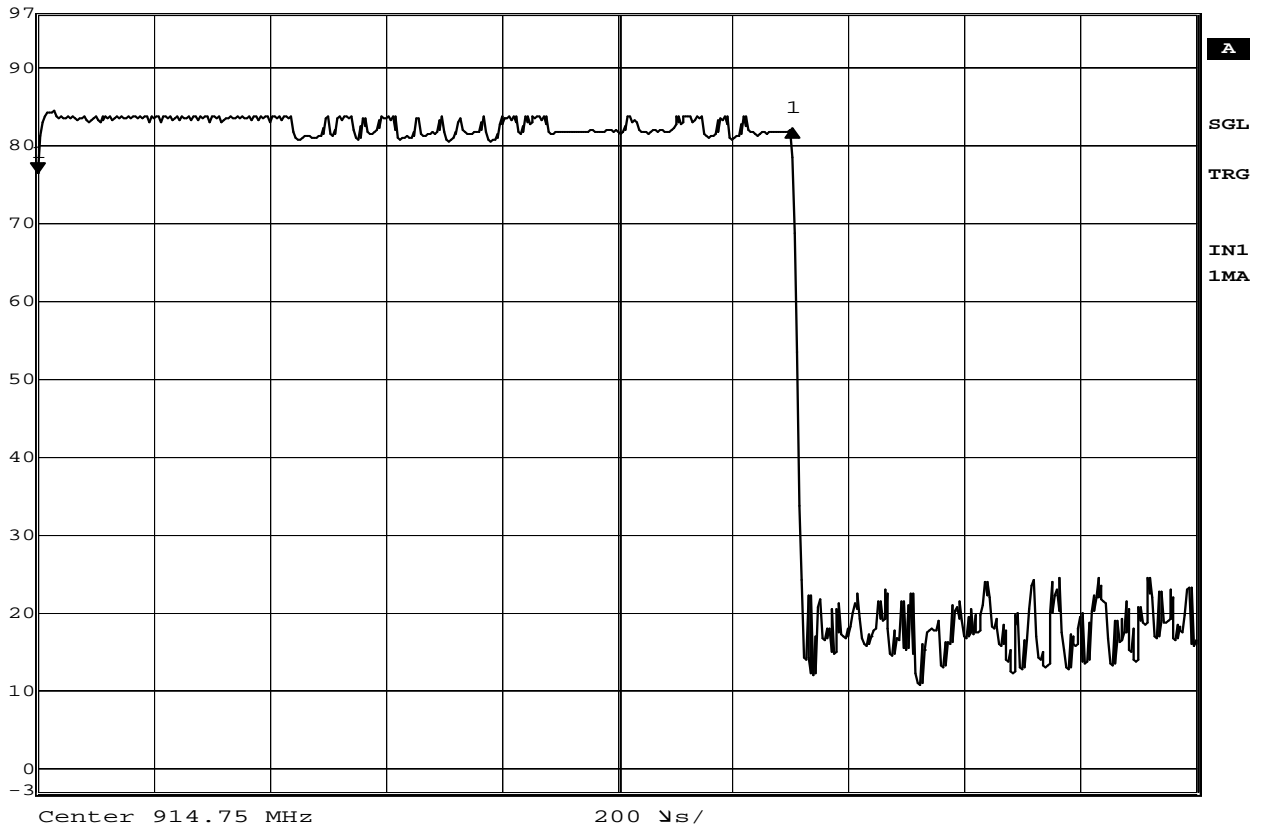
		Matched							
		Meter		SIG.	Ant		EIRP		
Freq	Ant	Reading	Ambient	GEN.	Gain	CBL	Total	Limit	
(MHz)	Pol	(dBuV)		(dBm)	(dB)	(dB)	(dBm)	dBm	
Transmit at 902.25MHz									
902.3	H	85.9		9.2	1.8	2.0	9.0	36.0	
902.3	V	83.9		10.2	1.8	2.0	10.0	36.0	
Transmit at 914.75MHz									
914.8	H	86.0		9.7	1.6	2.0	9.3	36.0	
914.8	V	84.4		11.3	1.6	2.0	10.9	36.0	
Transmit at 926.75MHz									
926.8	H	83.2		7.1	1.6	2.0	6.7	36.0	
926.8	V	85.2		10.6	1.6	2.0	10.2	36.0	

EIRP (dBm) = Matched Signal Generator (dBm) + Antenna Gain (dB) – Antenna Gain (dB)





	Delta 1 [T1]	RBW	100 kHz	RF Att	10 dB
Ref Lvl	5.70 dB	VBW	100 kHz		
97 dB $\mu$ V	1.302605 ms	SWT	2 ms	Unit	dB $\mu$ V



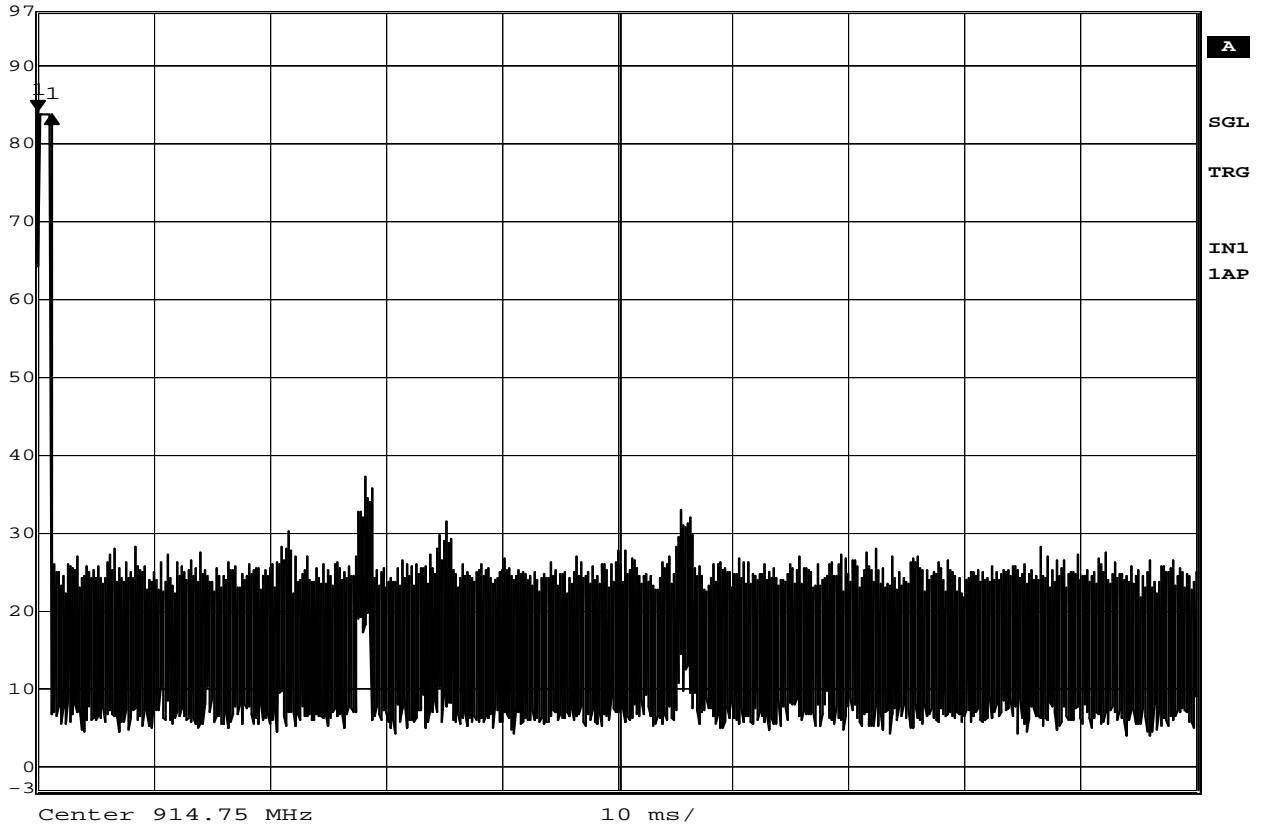
Date: 1.AUG.2011 17:15:04

### 15.247 Duty Cycle Correction Factor

MANUFACTURER	: The Chamberlain Group
MODEL NUMBER	: 001D7664 Wall Switch
SERIAL NUMBER	: None Assigned
TEST MODE	: Hopping Enabled
NOTES	:
TEST DATE	: August 1, 2011
TEST PARAMETERS	: Number of hops in a 20 second period is 85. On time per hop is 1.3msec.
	: Duty Cycle Correction Factor
NOTES	: Pulse Width = 1.3msec
EQUIPMENT USED	: RBA0, NTA2



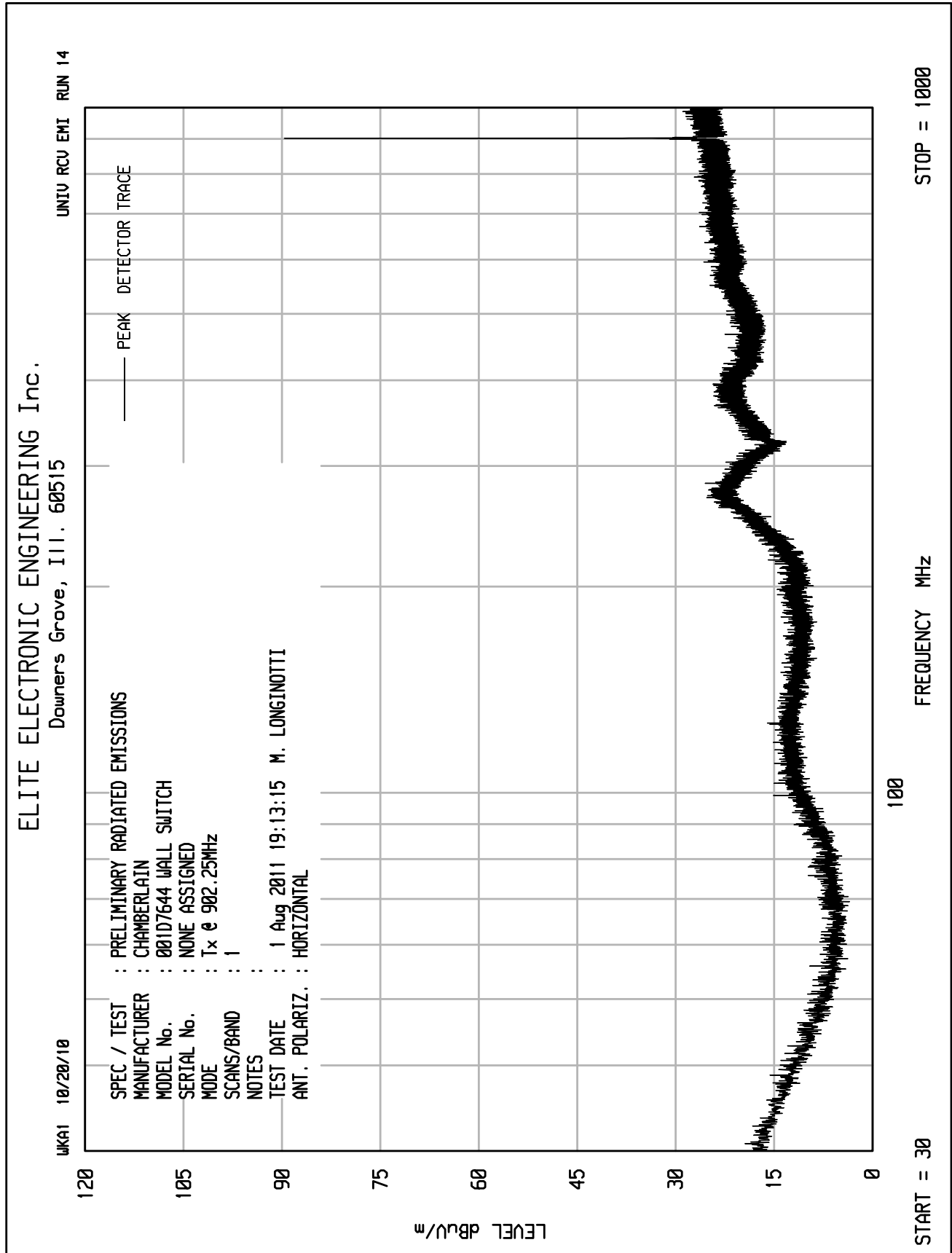
Delta 1 [T1]                      RBW    100 kHz            RF Att    10 dB  
 Ref Lvl                                -0.58 dB            VBW    100 kHz  
 97 dB<sub>N</sub>V                                1.302605 ms        SWT    100 ms            Unit            dB<sub>N</sub>V

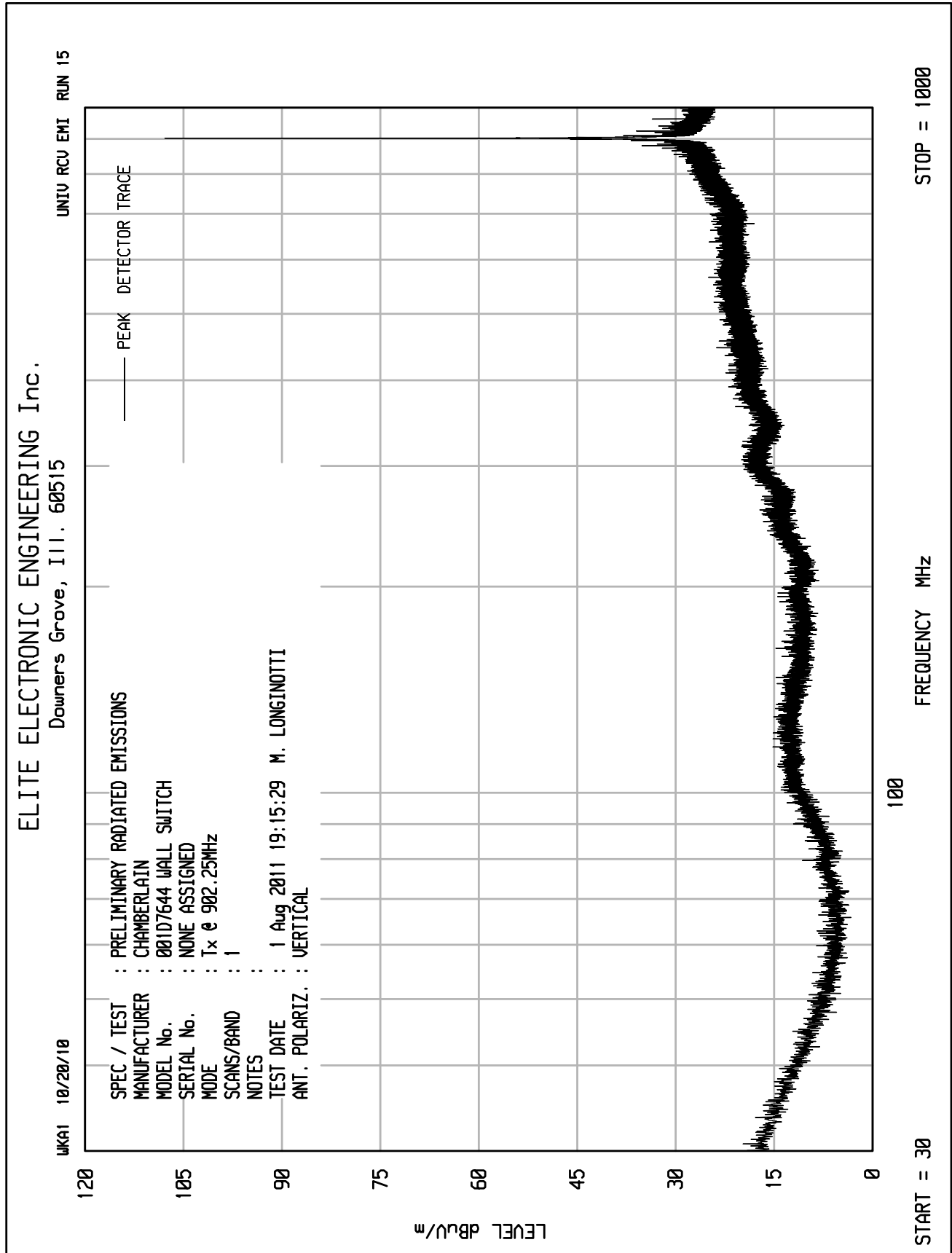


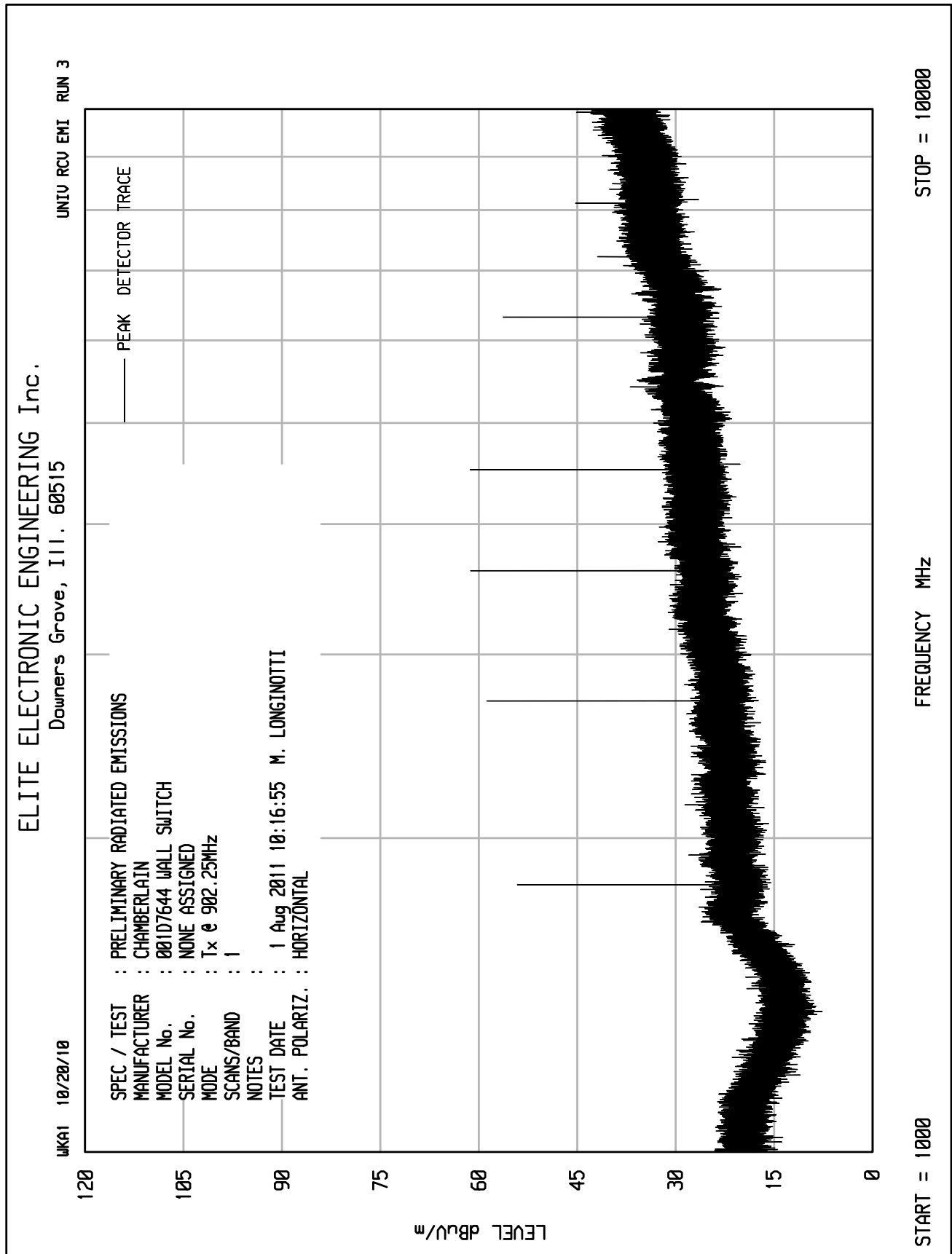
Date: 1.AUG.2011 17:17:22

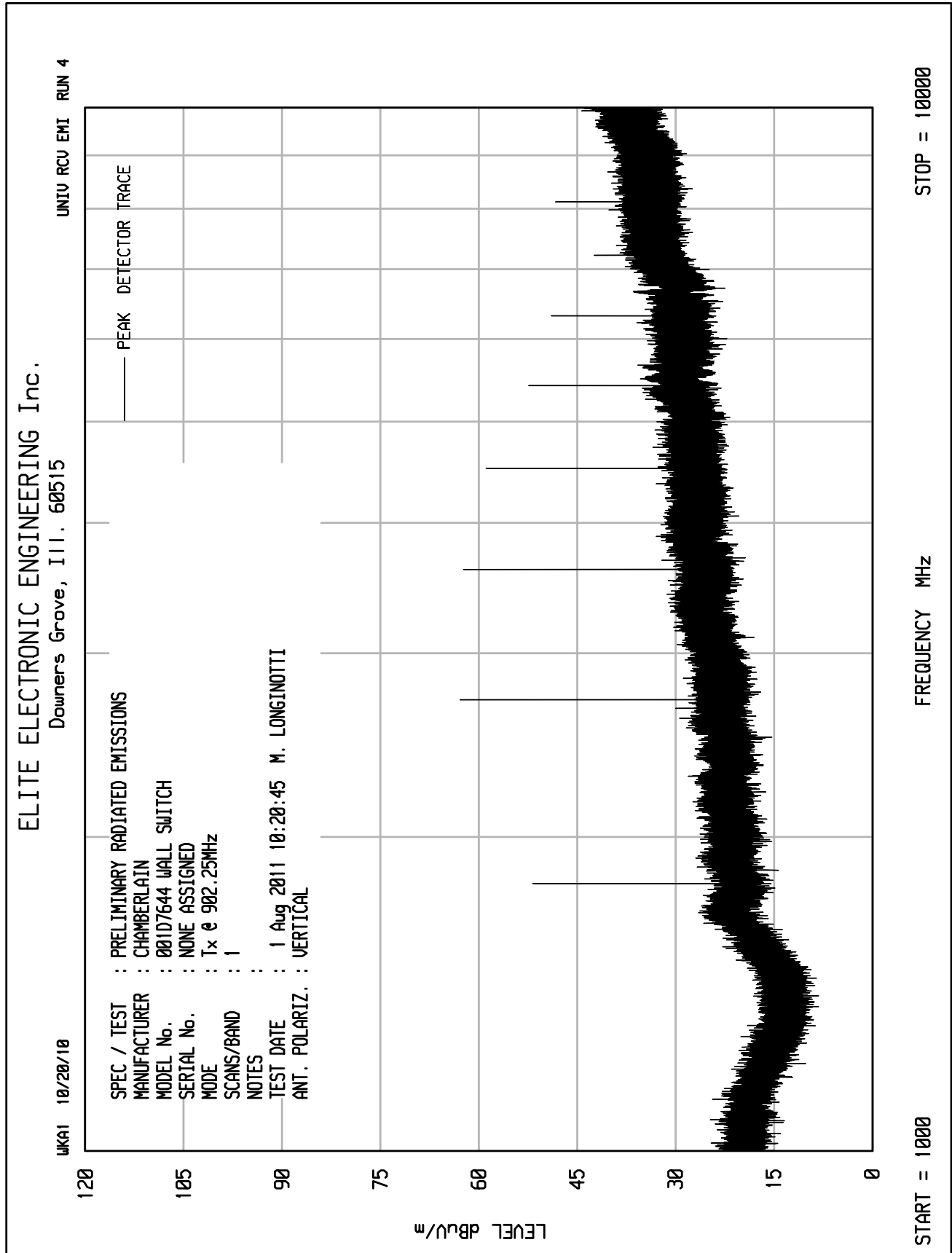
### 15.247 Duty Cycle Correction Factor

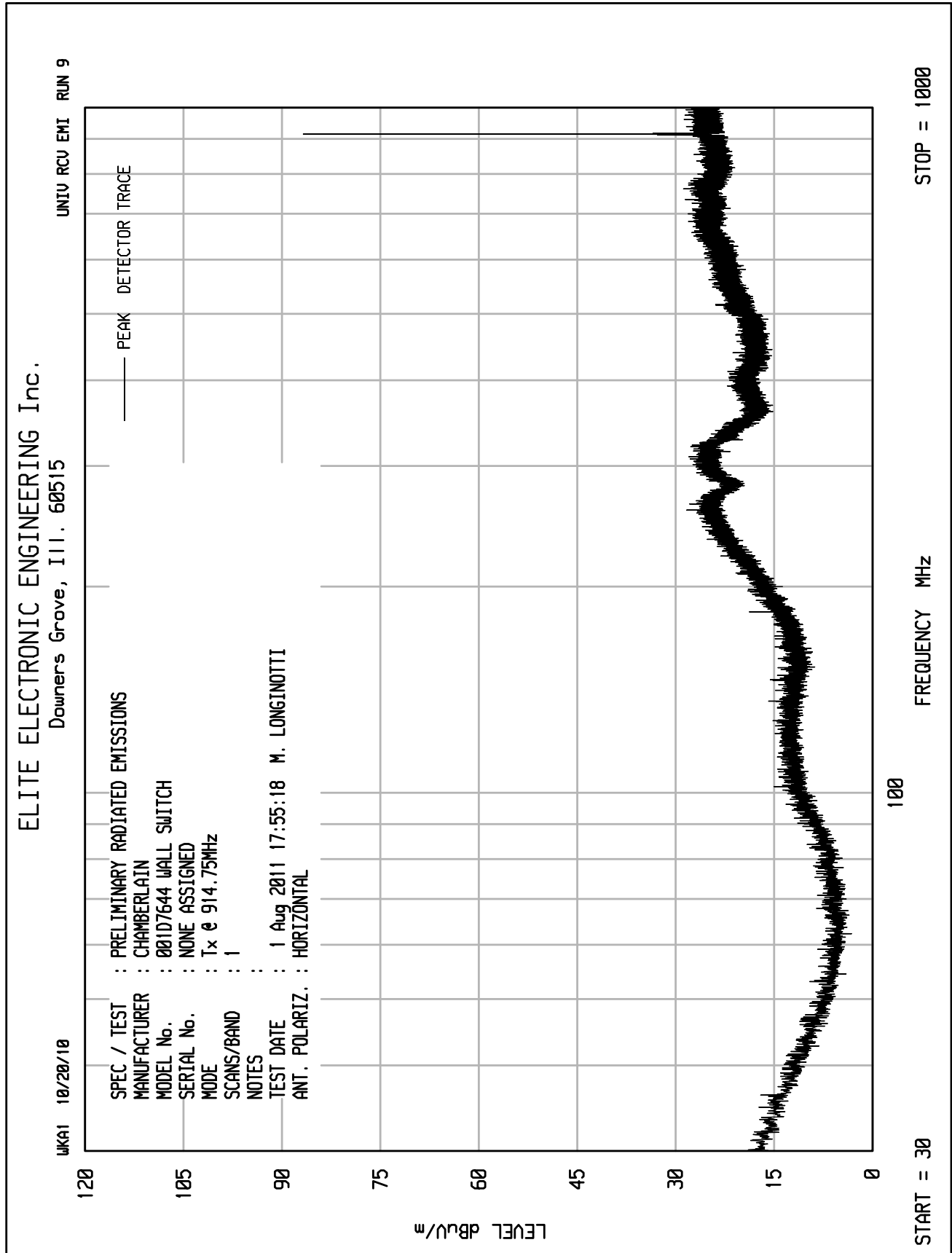
MANUFACTURER : The Chamberlain Group  
 MODEL NUMBER : 001D7664 Wall Switch  
 SERIAL NUMBER : None Assigned  
 TEST MODE : Hopping Enabled  
 NOTES :  
 TEST DATE : August 1, 2011  
 TEST PARAMETERS : Duty Cycle Correction Factor  
 NOTES : Pulse Width = 1.3msec, 1 pulse in 100msec period  
           : Duty Cycle Correction Factor =  $20 \cdot \log(1.3/100\text{msec}) = -37.7\text{dB}$   
 EQUIPMENT USED : RBA0, NTA2











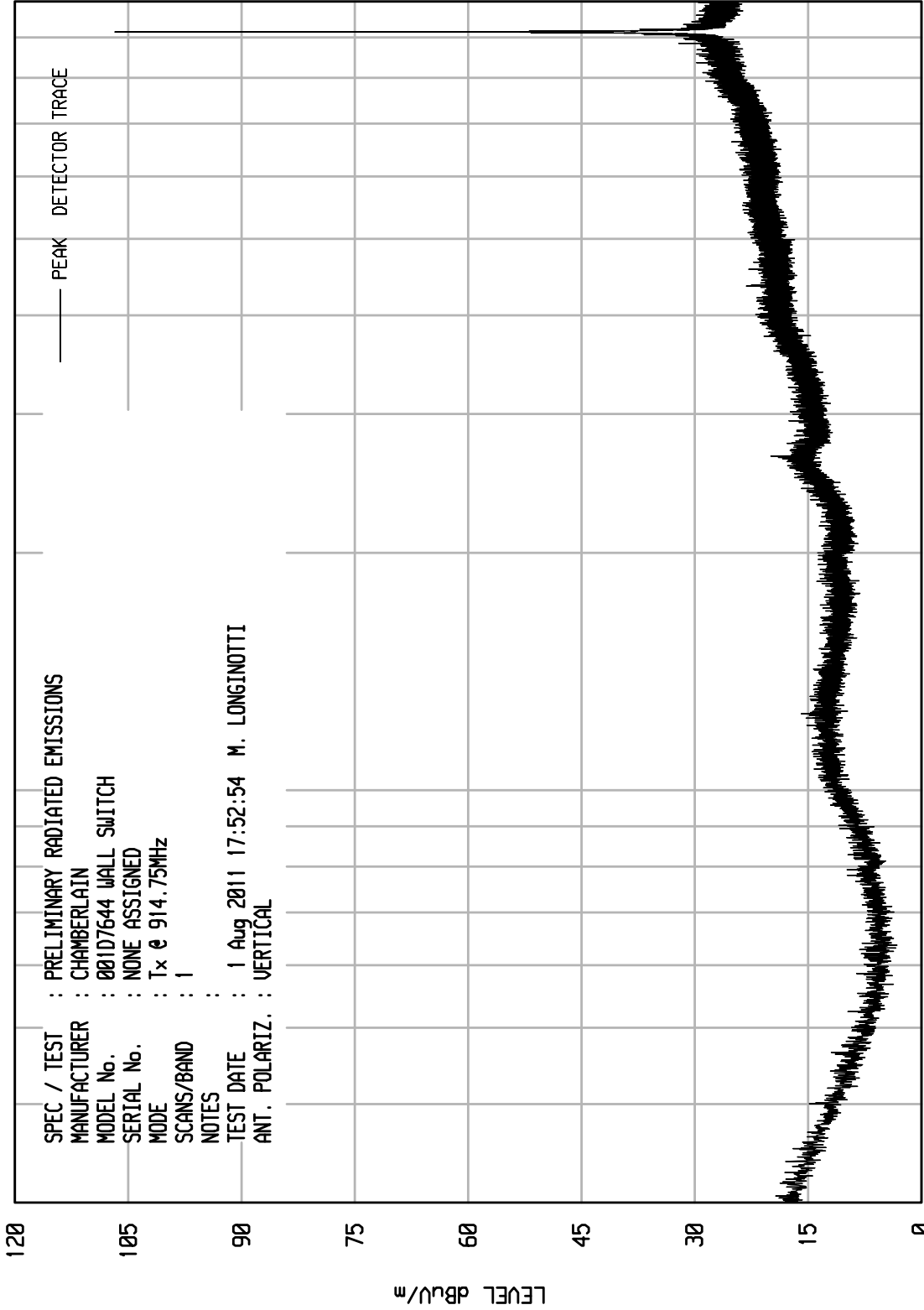


ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

UNIU RCU EMI RUN 8

UKA1 10/20/10



120

105

90

75

60

45

30

15

0

LEVEL dBuV/m

100

FREQUENCY MHz

START = 30

STOP = 1000

SPEC / TEST : PRELIMINARY RADIATED EMISSIONS

MANUFACTURER : CHAMBERLAIN

MODEL No. : 001D7644 WALL SWITCH

SERIAL No. : NONE ASSIGNED

MODE : Tx @ 914.75MHz

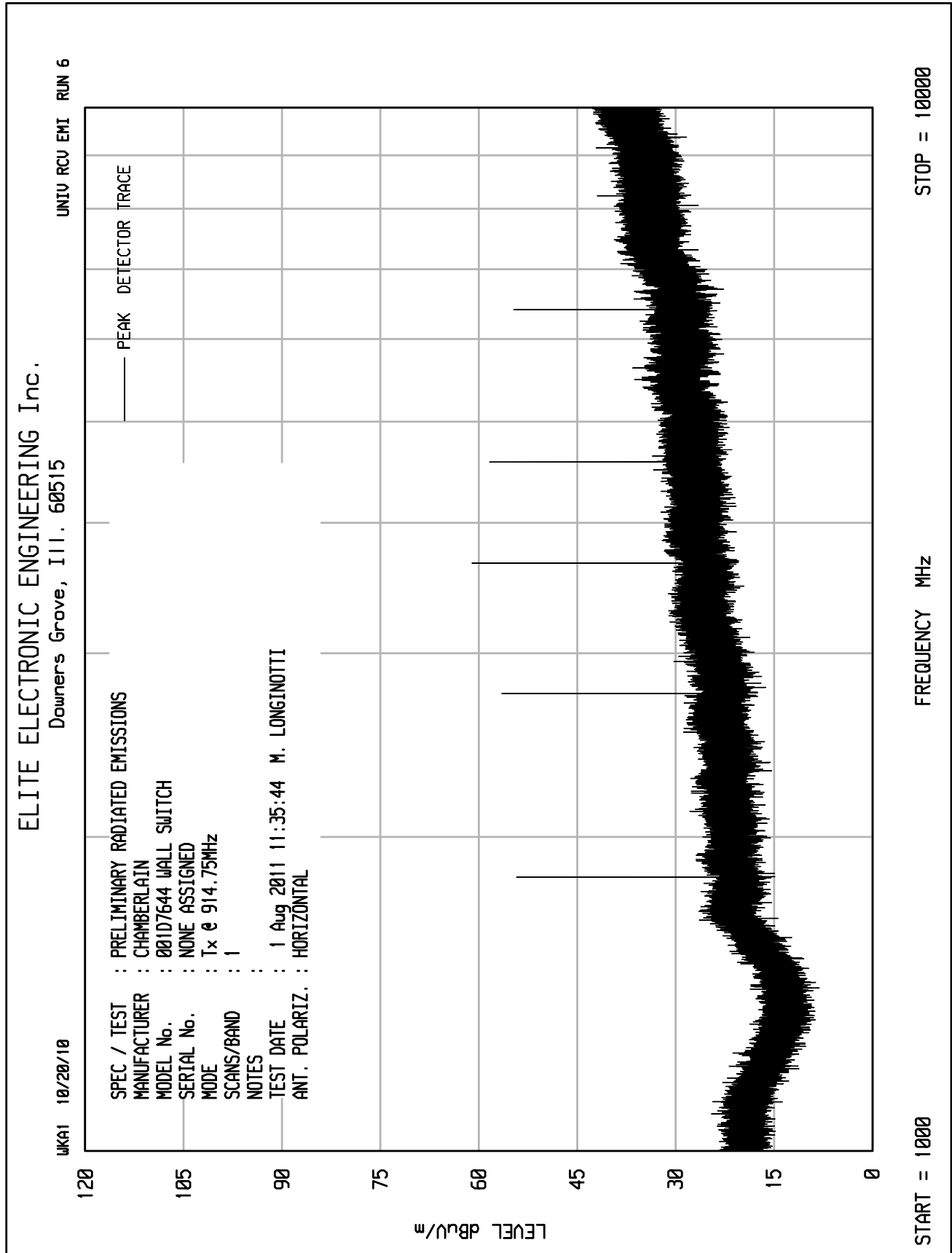
SCANS/BAND : 1

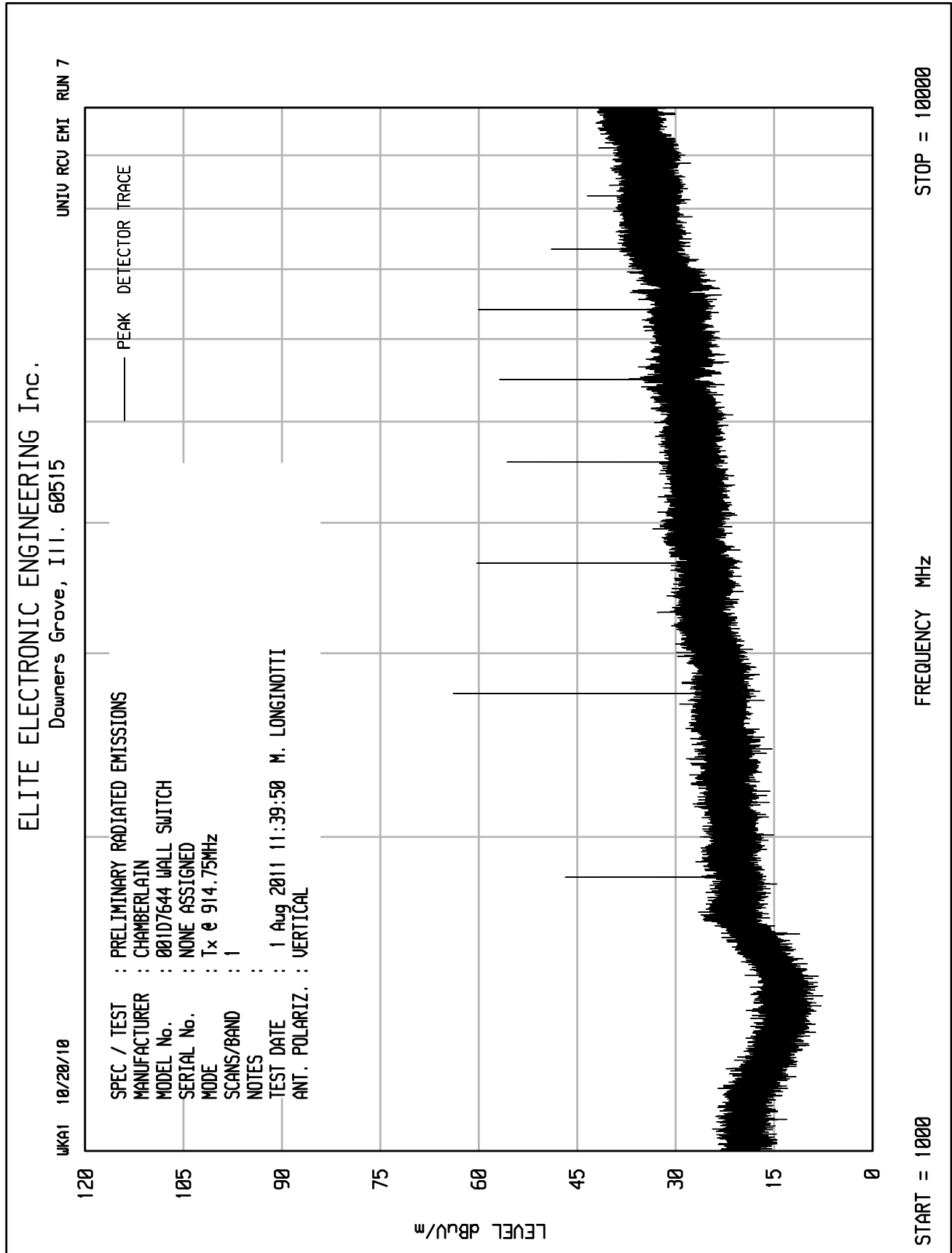
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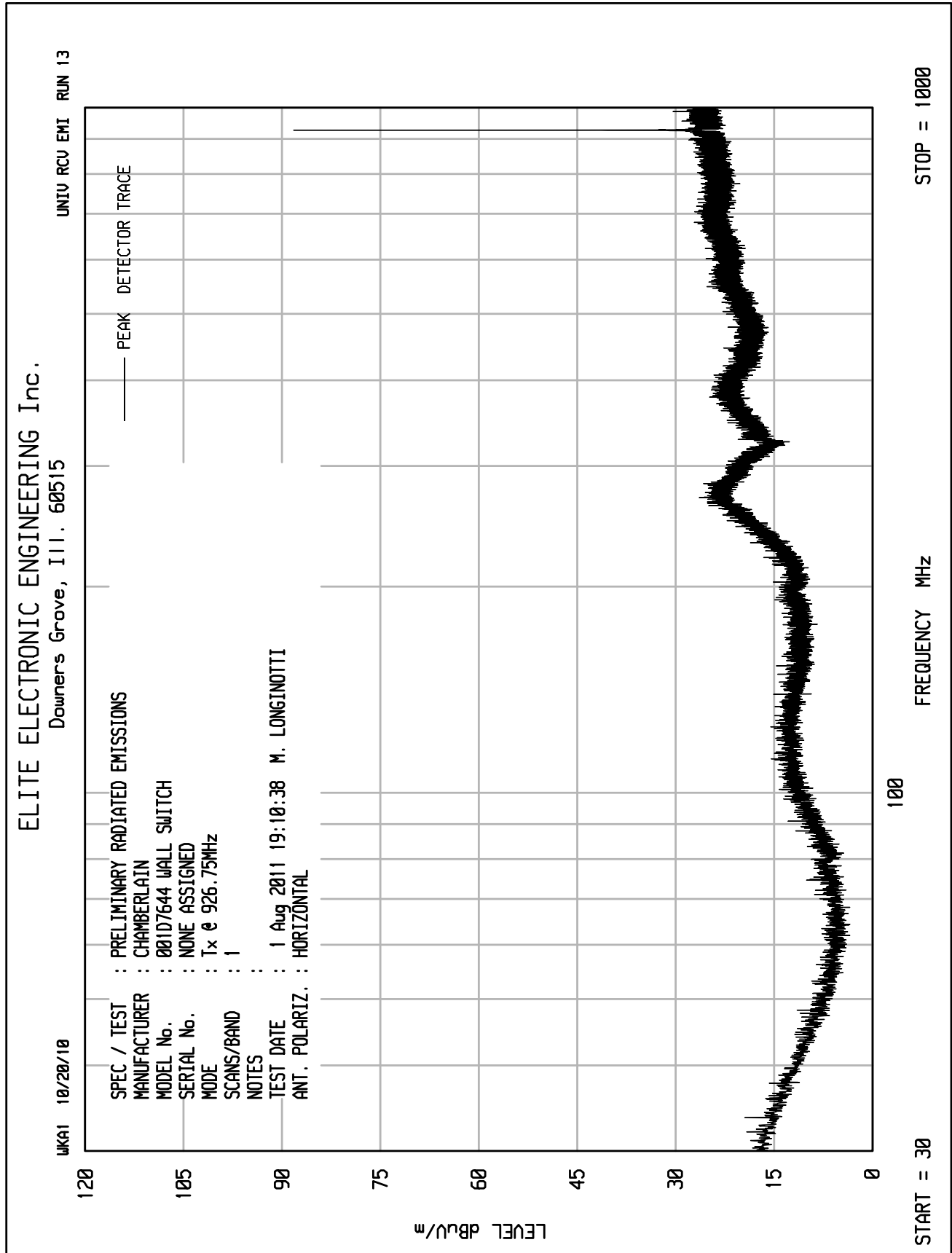
TEST DATE : 1 Aug 2011 17:52:54 M. LONGINOTTI

ANT. POLARIZ. : VERTICAL

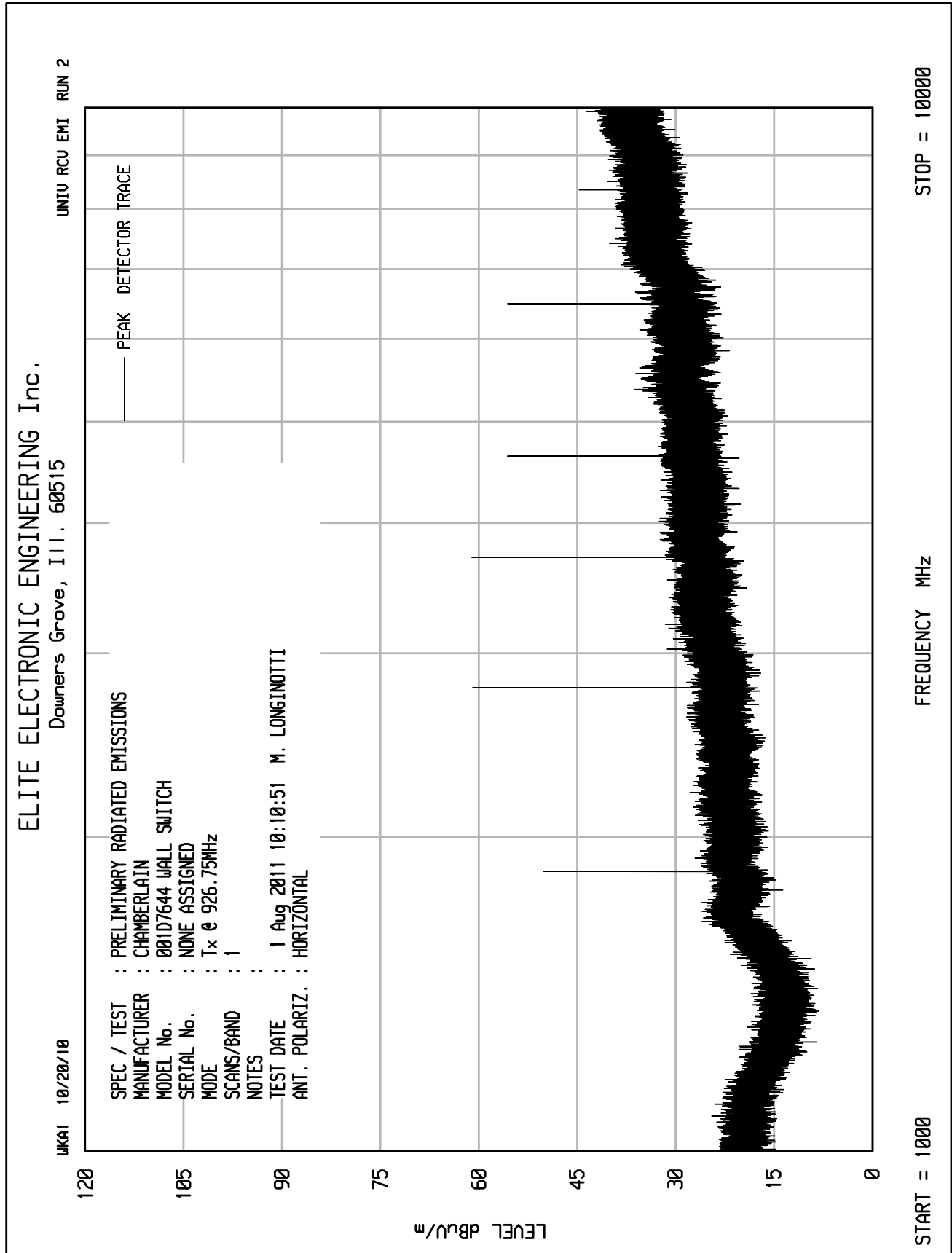


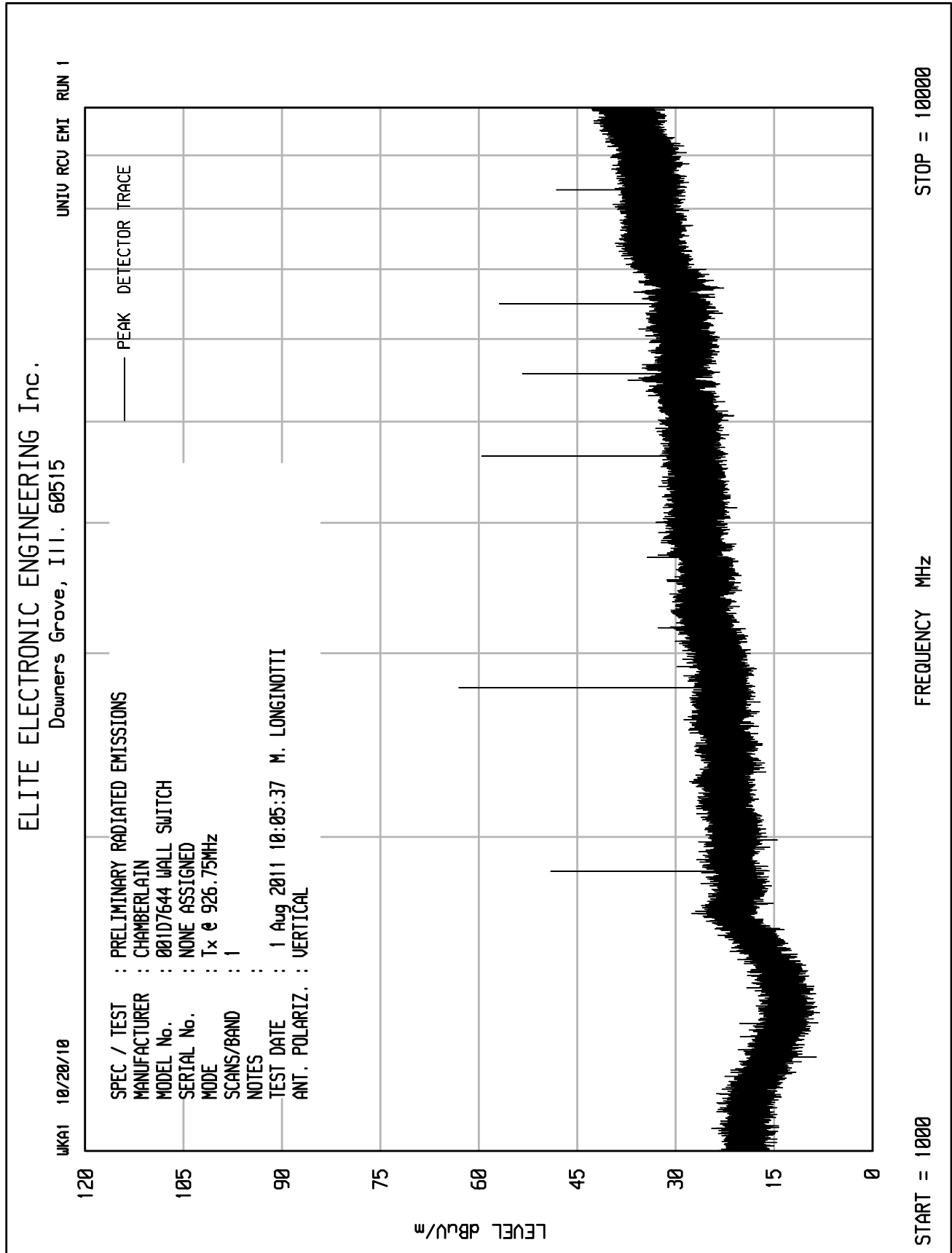














Manufacturer : Chamberlain Group, Inc.  
 EUT : Wall Switch  
 Model No. : 001D7644  
 Serial No. : None Assigned  
 Specification : FCC-15.247 Spurious Radiated Emissions  
 Date : August 1, 2011  
 Mode : Tx @ 902.25MHz  
 Equipment Used : RBA0, NTA2, CMA1, NWH0, APW3, XPQ2, SES1  
 Notes : Test Distance is 3 meters  
 Notes : Peak Readings

Freq (MHz)	Ant Pol	Meter		CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Total dBuV/m at 3 M	Total uV/m at 3M	Limit uV/m at 3M	Margin (dB)
		Reading (dBuV)	Ambient							
902.250	H	85.9		2.0	21.8	0.0	109.7	305492.1		
902.250	V	83.9		2.0	21.8	0.0	107.7	242661.0		
1804.500	H	78.9		2.9	26.5	-40.6	67.6	2400.0	30549.2	-22.1
1804.500	V	78.4		2.9	26.5	-40.6	67.1	2265.8	30549.2	-22.6
2706.750	H	76.6		3.7	29.6	-40.3	69.5	2985.1	5000.0	-4.5
2706.750	V	73.0		3.7	29.6	-40.3	65.9	1972.3	5000.0	-8.1
3609.000	H	72.4		4.3	32.0	-39.9	68.8	2758.8	5000.0	-5.2
3609.000	V	72.7		4.3	32.0	-39.9	69.1	2855.8	5000.0	-4.9
4511.250	H	68.1		4.8	32.9	-40.0	65.8	1956.0	5000.0	-8.2
4511.250	V	67.4		4.8	32.9	-40.0	65.1	1804.5	5000.0	-8.9
5413.500	H	55.5		5.2	35.2	-40.1	55.8	616.1	5000.0	-18.2
5413.500	V	56.8		5.2	35.2	-40.1	57.1	715.6	5000.0	-16.9
6315.750	H	57.9		5.7	35.6	-39.9	59.2	917.2	30549.2	-30.5
6315.750	V	60.4		5.7	35.6	-39.9	61.7	1223.1	30549.2	-28.0
7218.000	H	48.3		6.1	37.1	-39.8	51.8	387.2	30549.2	-37.9
7218.000	V	47.5		6.1	37.1	-39.8	51.0	353.1	30549.2	-38.7
8120.250	H	50.9		6.5	38.4	-39.6	56.3	650.3	5000.0	-17.7
8120.250	V	53.6		6.5	38.4	-39.6	59.0	887.3	5000.0	-15.0
9022.500	H	46.8	Ambient	6.5	39.6	-39.1	53.9	493.5	5000.0	-20.1
9022.500	V	47.0	Ambient	6.5	39.6	-39.1	54.1	505.0	5000.0	-19.9

H – Horizontal

V – Vertical

Total (dBuV/m) = Meter Reading (dBuV) + Cable Factor (dB) + Antenna Factor (dB) + Pre Amp (dB)

Gray rows indicate emissions in restricted bands



Manufacturer : Chamberlain Group, Inc.  
 EUT : Wall Switch  
 Model No. : 001D7644  
 Serial No. : None Assigned  
 Specification : FCC-15.247 Spurious Radiated Emissions in Restricted Bands  
 Date : August 1, 2011  
 Mode : Tx @ 902.25MHz  
 Equipment Used : RBA0, NTA2, CMA1, NWH0, APW3, XPQ2, SES1  
 Notes : Test Distance is 3 meters  
 Notes : Average Readings in Restricted Bands

Freq (MHz)	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Total dBuV/m at 3 M	Total uV/m at 3M	Limit uV/m at 3M	Margin (dB)
2706.8	H	67.6		3.7	29.6	-40.3	-37.7	22.8	13.8	500.0	-31.2
2706.8	V	65.2		3.7	29.6	-40.3	-37.7	20.4	10.5	500.0	-33.6
3609.0	H	61.6		4.3	32.0	-39.9	-37.7	20.3	10.4	500.0	-33.7
3609.0	V	60.5		4.3	32.0	-39.9	-37.7	19.2	9.1	500.0	-34.8
4511.3	H	57.7		4.8	32.9	-40.0	-37.7	17.7	7.7	500.0	-36.3
4511.3	V	57.3		4.8	32.9	-40.0	-37.7	17.3	7.4	500.0	-36.7
5413.5	H	47.3		5.2	35.2	-40.1	-37.7	9.9	3.1	500.0	-44.1
5413.5	V	46.2		5.2	35.2	-40.1	-37.7	8.8	2.8	500.0	-45.2
8120.3	H	39.5		6.5	38.4	-39.6	-37.7	7.2	2.3	500.0	-46.8
8120.3	V	41.8		6.5	38.4	-39.6	-37.7	9.5	3.0	500.0	-44.5
9022.5	H	34.5	Ambient	6.5	39.6	-39.1	-37.7	3.9	1.6	500.0	-50.1
9022.5	V	33.9	Ambient	6.5	39.6	-39.1	-37.7	3.3	1.5	500.0	-50.7

H – Horizontal

V – Vertical

Total (dBuV/m) = Meter Reading (dBuV) + Cable Factor (dB) + Antenna Factor (dB) + Pre Amp (dB) + Duty Cycle (dB)





Manufacturer : Chamberlain Group, Inc.  
 EUT : Wall Switch  
 Model No. : 001D7644  
 Serial No. : None Assigned  
 Specification : FCC-15.247 Spurious Radiated Emissions  
 Date : August 1, 2011  
 Mode : Tx @ 914.75MHz  
 Equipment Used : RBA0, NTA2, CMA1, NWH0, APW3, XPQ2, SES1  
 Notes : Test Distance is 3 meters  
 Notes : Peak Readings

Freq (MHz)	Ant Pol	Meter Reading (dBuV)	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Total dBuV/m at 3 M	Total uV/m at 3M	Limit uV/m at 3M	Margin (dB)
914.750	H	86.0		2.0	21.8	0.0	109.8	309029.5	
914.750	V	84.4		2.0	21.8	0.0	108.2	257039.6	
1829.500	H	70.8		2.9	26.8	-40.6	59.9	983.9	30903.0
1829.500	V	72.8		2.9	26.8	-40.6	61.9	1238.6	30903.0
2744.250	H	76.0		3.7	29.6	-40.3	68.9	2792.6	5000.0
2744.250	V	74.4		3.7	29.6	-40.3	67.3	2322.8	5000.0
3659.000	H	68.1		4.3	32.2	-39.8	64.9	1756.6	5000.0
3659.000	V	71.7		4.3	32.2	-39.8	68.5	2658.7	5000.0
4573.750	H	69.4		4.8	33.1	-40.0	67.3	2325.9	5000.0
4573.750	V	67.1		4.8	33.1	-40.0	65.0	1784.8	5000.0
5488.500	H	56.0		5.3	35.2	-40.1	56.4	662.9	30903.0
5488.500	V	59.1		5.3	35.2	-40.1	59.5	947.1	30903.0
6403.250	H	58.6		5.7	35.8	-39.9	60.2	1019.2	30903.0
6403.250	V	60.4		5.7	35.8	-39.9	62.0	1253.9	30903.0
7318.000	H	50.9		6.2	37.3	-39.8	54.6	535.8	5000.0
7318.000	V	50.5		6.2	37.3	-39.8	54.2	511.7	5000.0
8232.750	H	53.2		6.5	38.6	-39.5	58.8	869.2	5000.0
8232.750	V	52.3		6.5	38.6	-39.5	57.9	783.7	5000.0
9147.500	H	47.5	Ambient	6.6	39.8	-39.0	54.9	552.8	5000.0
9147.500	V	47.9	Ambient	6.6	39.8	-39.0	55.3	578.8	5000.0

H – Horizontal

V – Vertical

Total (dBuV/m) = Meter Reading (dBuV) + Cable Factor (dB) + Antenna Factor (dB) + Pre Amp (dB)

Gray rows indicate emissions in restricted bands



Manufacturer : Chamberlain Group, Inc.  
 EUT : Wall Switch  
 Model No. : 001D7644  
 Serial No. : None Assigned  
 Specification : FCC-15.247 Spurious Radiated Emissions in Restricted Bands  
 Date : August 1, 2011  
 Mode : Tx @ 914.75MHz  
 Equipment Used : RBA0, NTA2, CMA1, NWH0, APW3, XPQ2, SES1  
 Notes : Test Distance is 3 meters  
 Notes : Average Readings in Restricted Bands

Freq (MHz)	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Total dBuV/m at 3 M	Total uV/m at 3M	Limit uV/m at 3M	Margin (dB)
2744.3	H	66.9		3.7	29.6	-40.3	-37.7	22.1	12.8	500.0	-31.9
2744.3	V	64.8		3.7	29.6	-40.3	-37.7	20.0	10.0	500.0	-34.0
3659.0	H	60.9		4.3	32.2	-39.8	-37.7	20.0	10.0	500.0	-34.0
3659.0	V	60.4		4.3	32.2	-39.8	-37.7	19.5	9.4	500.0	-34.5
4573.8	H	59.5		4.8	33.1	-40.0	-37.7	19.7	9.7	500.0	-34.2
4573.8	V	59.2		4.8	33.1	-40.0	-37.7	19.4	9.4	500.0	-34.5
7318.0	H	36.2		6.2	37.3	-39.8	-37.7	2.2	1.3	500.0	-51.8
7318.0	V	34.4		6.2	37.3	-39.8	-37.7	0.4	1.0	500.0	-53.6
8232.8	H	41.4		6.5	38.6	-39.5	-37.7	9.3	2.9	500.0	-44.7
8232.8	V	40.8		6.5	38.6	-39.5	-37.7	8.7	2.7	500.0	-45.3
9147.5	H	34.0	Ambient	6.6	39.8	-39.0	-37.7	3.7	1.5	500.0	-50.3
9147.5	V	34.1	Ambient	6.6	39.8	-39.0	-37.7	3.8	1.5	500.0	-50.2

H – Horizontal

V – Vertical

Total (dBuV/m) = Meter Reading (dBuV) + Cable Factor (dB) + Antenna Factor (dB) + Pre Amp (dB) + Duty Cycle (dB)



Manufacturer : Chamberlain Group, Inc.  
 EUT : Wall Switch  
 Model No. : 001D7644  
 Serial No. : None Assigned  
 Specification : FCC-15.247 Spurious Radiated Emissions  
 Date : August 1, 2011  
 Mode : Tx @ 926.75MHz  
 Equipment Used : RBA0, NTA2, CMA1, NWH0, APW3, XPQ2, SES1  
 Notes : Test Distance is 3 meters  
 Notes : Peak Readings

Freq (MHz)	Ant Pol	Meter Reading (dBUV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Total dBuV/m at 3 M	Total uV/m at 3M	Limit uV/m at 3M	Margin (dB)
926.750	H	83.2		2.0	21.9	0.0	107.1	225631.2		
926.750	V	85.2		2.0	21.9	0.0	109.1	284052.8		
1853.500	H	70.3		2.9	27.0	-40.5	59.7	965.5	28405.3	-29.4
1853.500	V	68.1		2.9	27.0	-40.5	57.5	749.4	28405.3	-31.6
2780.250	H	77.0		3.7	29.6	-40.4	69.9	3140.6	5000.0	-4.0
2780.250	V	76.3		3.7	29.6	-40.4	69.2	2897.4	5000.0	-4.7
3707.000	H	69.6		4.3	32.4	-39.6	66.7	2173.7	5000.0	-7.2
3707.000	V	71.7		4.3	32.4	-39.6	68.8	2768.2	5000.0	-5.1
4633.750	H	68.0		4.8	33.3	-40.0	66.1	2024.3	5000.0	-7.9
4633.750	V	69.1		4.8	33.3	-40.0	67.2	2297.7	5000.0	-6.8
5560.500	H	54.5		5.3	35.1	-40.1	54.9	554.2	28405.3	-34.2
5560.500	V	56.5		5.3	35.1	-40.1	56.9	697.7	28405.3	-32.2
6487.250	H	58.3		5.8	35.9	-39.9	60.1	1008.0	28405.3	-29.0
6487.250	V	56.7		5.8	35.9	-39.9	58.5	838.5	28405.3	-30.6
7414.000	H	50.1		6.2	37.4	-39.7	54.0	500.7	5000.0	-20.0
7414.000	V	50.8		6.2	37.4	-39.7	54.7	542.7	5000.0	-19.3
8340.750	H	53.6		6.5	38.7	-39.5	59.4	932.4	5000.0	-14.6
8340.750	V	52.6		6.5	38.7	-39.5	58.4	831.0	5000.0	-15.6
9267.500	H	40.4		6.6	39.9	-39.0	48.0	251.8	28405.3	-41.0
9267.500	V	40.8		6.6	39.9	-39.0	48.4	263.7	28405.3	-40.6

H – Horizontal

V – Vertical

Total (dBUV/m) = Meter Reading (dBUV) + Cable Factor (dB) + Antenna Factor (dB) + Pre Amp (dB)

Gray rows indicate emissions in restricted bands



Manufacturer : Chamberlain Group, Inc.  
 EUT : Wall Switch  
 Model No. : 001D7644  
 Serial No. : None Assigned  
 Specification : FCC-15.247 Spurious Radiated Emissions in Restricted Bands  
 Date : August 1, 2011  
 Mode : Tx @ 926.75MHz  
 Equipment Used : RBA0, NTA2, CMA1, NWH0, APW3, XPQ2, SES1  
 Notes : Test Distance is 3 meters  
 Notes : Average Readings in Restricted Bands

Freq (MHz)	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Total dBuV/m at 3 M	Total uV/m at 3M	Limit uV/m at 3M	Margin (dB)
2780.3	H	68.1		3.7	29.6	-40.4	-37.7	23.3	14.7	500.0	-30.6
2780.3	V	66.2		3.7	29.6	-40.4	-37.7	21.4	11.8	500.0	-32.5
3707.0	H	60.7		4.3	32.4	-39.6	-37.7	20.1	10.2	500.0	-33.8
3707.0	V	57.1		4.3	32.4	-39.6	-37.7	16.5	6.7	500.0	-37.4
4633.8	H	58.9		4.8	33.3	-40.0	-37.7	19.3	9.3	500.0	-34.7
4633.8	V	57.3		4.8	33.3	-40.0	-37.7	17.7	7.7	500.0	-36.3
7414.0	H	36.3		6.2	37.4	-39.7	-37.7	2.5	1.3	500.0	-51.5
7414.0	V	37.5		6.2	37.4	-39.7	-37.7	3.7	1.5	500.0	-50.3
8340.8	H	41.6		6.5	38.7	-39.5	-37.7	9.7	3.1	500.0	-44.3
8340.8	V	40.2		6.5	38.7	-39.5	-37.7	8.3	2.6	500.0	-45.7

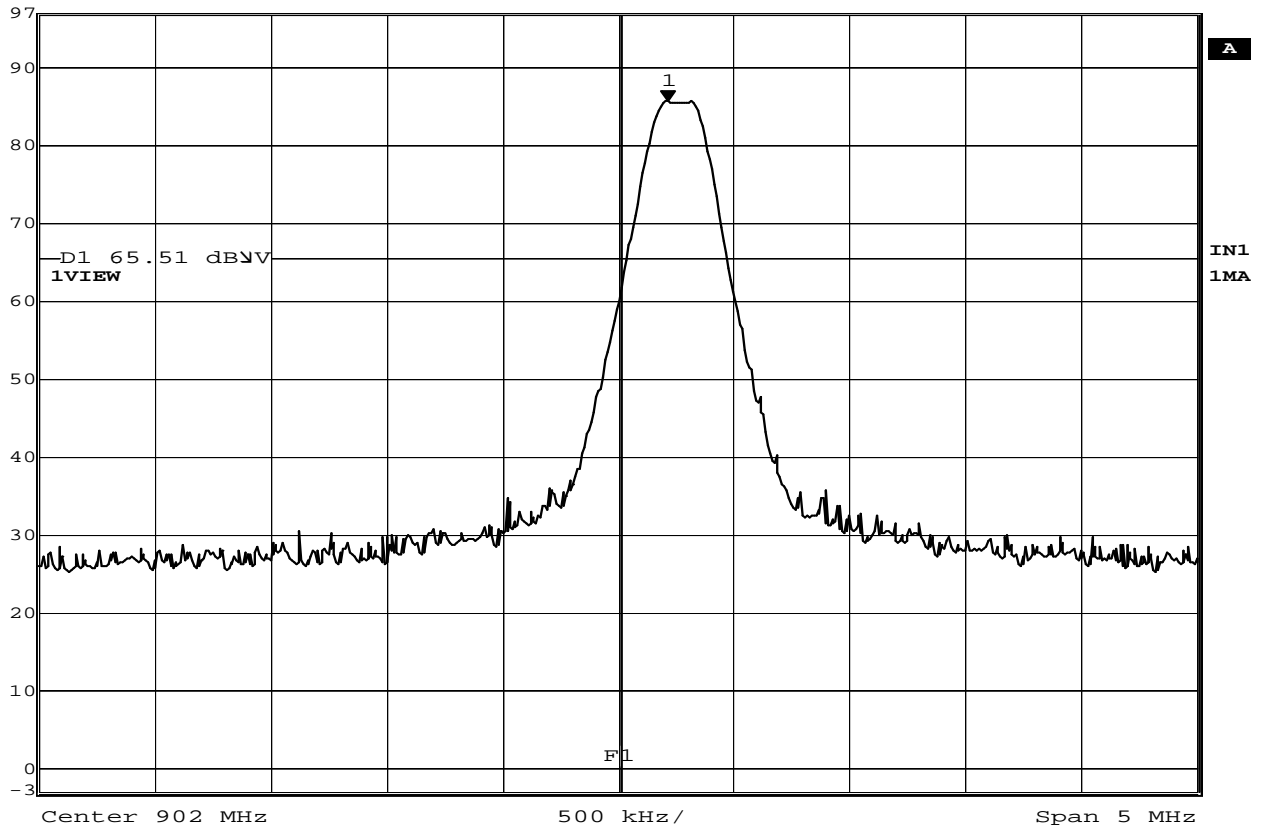
H – Horizontal

V – Vertical

Total (dBuV/m) = Meter Reading (dBuV) + Cable Factor (dB) + Antenna Factor (dB) + Pre Amp (dB) + Duty Cycle (dB)



Marker 1 [T1]                      RBW    100 kHz            RF Att    10 dB  
 Ref Lvl                                85.51 dBµV        VBW    100 kHz  
 97 dBµV                                902.21543086 MHz    SWT    5 ms            Unit            dBµV



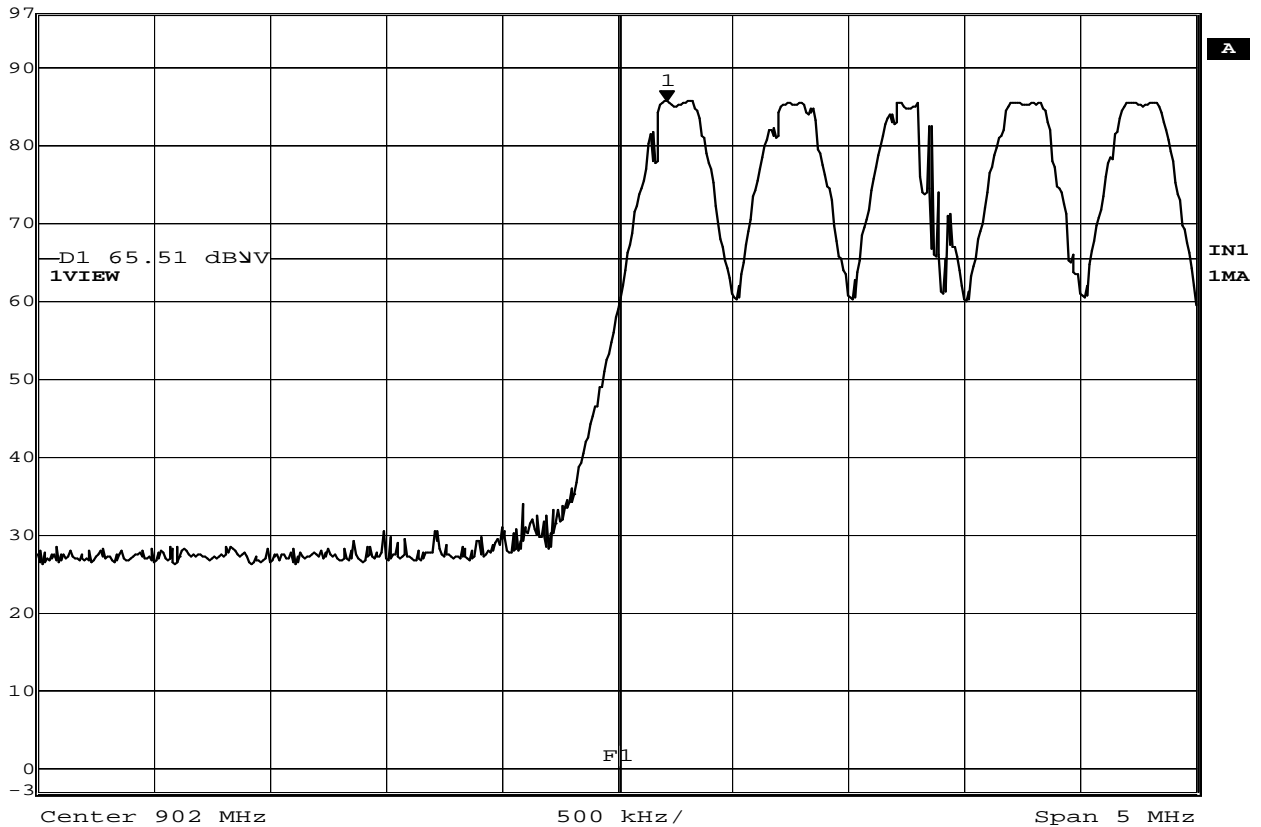
Date: 1.AUG.2011 17:39:45

### 15.247(d) Band Edge Compliance

MANUFACTURER : The Chamberlain Group  
 MODEL NUMBER : 001D7664 Wall Switch  
 SERIAL NUMBER : None Assigned  
 TEST MODE : Tx @ 902.25MHz  
 NOTES :  
 TEST DATE : August 1, 2011  
 TEST PARAMETERS : Band Edge Compliance  
 NOTES : Display line D1 represents the 20dB down point from the in band emissions in a  
 : 100kHz bandwidth. Display line F1 represents the band edge (902MHz)  
 EQUIPMENT USED : RBA0, NTA2



Marker 1 [T1]                      RBW    100 kHz            RF Att    10 dB  
 Ref Lvl                                85.54 dBµV        VBW    100 kHz  
 97 dBµV                                902.21543086 MHz    SWT    5 ms            Unit            dBµV



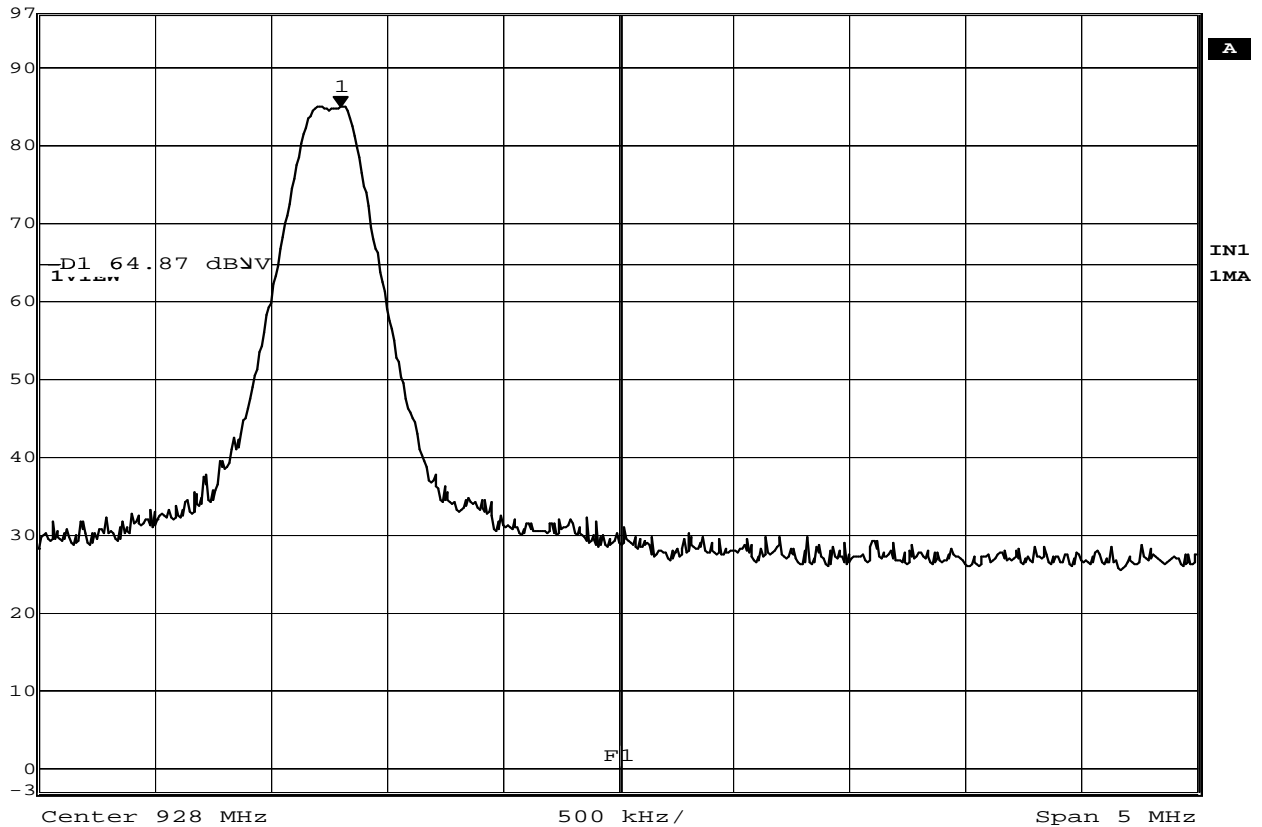
Date: 1.AUG.2011 17:43:28

### 15.247(d) Band Edge Compliance

MANUFACTURER : The Chamberlain Group  
 MODEL NUMBER : 001D7664 Wall Switch  
 SERIAL NUMBER : None Assigned  
 TEST MODE : Hopping Enabled  
 NOTES :  
 TEST DATE : August 1, 2011  
 TEST PARAMETERS : Band Edge Compliance  
 NOTES : Display line D1 represents the 20dB down point from the in band emissions in a  
 : 100kHz bandwidth. Display line F1 represents the band edge (902MHz)  
 EQUIPMENT USED : RBA0, NTA2



Ref Lvl	Marker 1 [T1]	RBW	100 kHz	RF Att	10 dB
97 dB $\mu$ V	84.87 dB $\mu$ V	VBW	100 kHz		
	926.80260521 MHz	SWT	5 ms	Unit	dB $\mu$ V



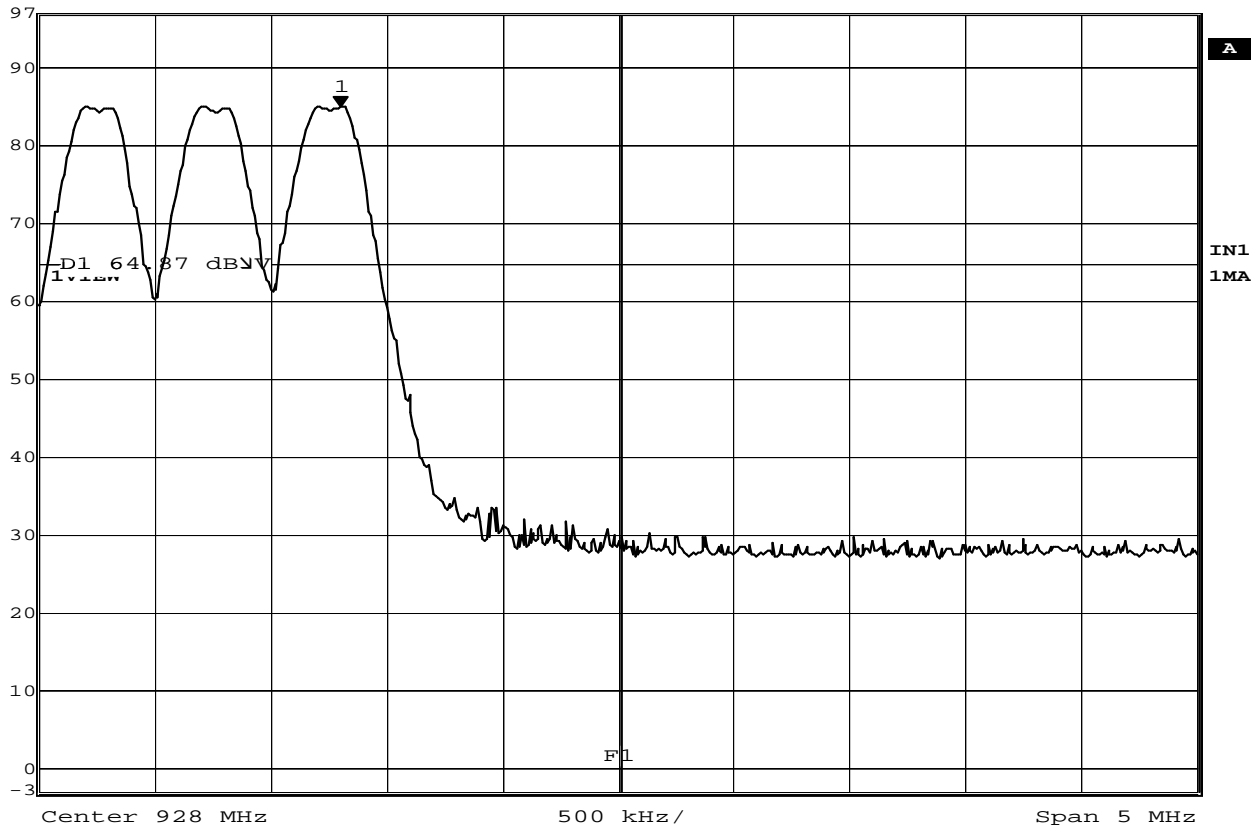
Date: 1.AUG.2011 16:43:51

**15.247(d) Band Edge Compliance**

MANUFACTURER	: The Chamberlain Group
MODEL NUMBER	: 001D7664 Wall Switch
SERIAL NUMBER	: None Assigned
TEST MODE	: Tx @ 926.75MHz
NOTES	:
TEST DATE	: August 1, 2011
TEST PARAMETERS	: Band Edge Compliance
NOTES	: Display line D1 represents the 20dB down point from the in band emissions in a 100kHz bandwidth. Display line F1 represents the band edge (928MHz)
EQUIPMENT USED	: RBA0, NTA2



Ref Lvl 97 dBV  
 Marker 1 [T1] 84.79 dBV  
 926.80260521 MHz  
 RBW 100 kHz  
 VBW 100 kHz  
 SWT 5 ms  
 RF Att 10 dB  
 Unit dBV



Date: 1.AUG.2011 16:48:54

**15.247(d) Band Edge Compliance**

MANUFACTURER : The Chamberlain Group  
 MODEL NUMBER : 001D7664 Wall Switch  
 SERIAL NUMBER : None Assigned  
 TEST MODE : Hopping Enabled  
 NOTES :  
 TEST DATE : August 1, 2011  
 TEST PARAMETERS : Band Edge Compliance  
 NOTES : Display line D1 represents the 20dB down point from the in band emissions in a 100kHz bandwidth. Display line F1 represents the band edge (928MHz)  
 EQUIPMENT USED : RBA0, NTA2