



## Measurement of RF Interference from a Model PE953 Hand Held Transmitter Transceiver

For : Intermatic  
7777 Winn Road  
Spring Grove, IL 60081

P.O. No. : 910645  
Date Tested : December 14 and 15, 2009  
Test Personnel : Mark E. Longinotti  
: FCC "Code of Federal Regulations" Title 47  
: Part 15, Subpart B, for receivers and Subpart C,  
: Section 15.249 for Intentional Radiators  
: Operating within the 902MHz to 928MHz band  
: Industry Canada RSS-210  
: Industry Canada RSS-GEN

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



**REVISION HISTORY**

Revision	Date	Description
—	December 18, 2009	Initial release

## Measurement of RF Emissions from a PE953 Hand Held Transmitter

### 1 INTRODUCTION

#### 1.1 Scope of Tests

This document represents the results of the series of radio interference measurements performed on a Hand Held Transmitter, Part No. PE953, Serial No. None Assigned transceiver, (hereinafter referred to as the test item). The test item was designed to transmit and receive at approximately 908.42MHz using an internal antenna. The test item was manufactured and submitted for testing by Intermatic located in Spring Grove, IL.

#### 1.2 Purpose

The test series was performed to determine if the test item meets the conducted and radiated RF emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart B, Sections 15.107 and 15.109 for receivers, and Subpart C, Sections 15.207 and 15.249 for intentional radiators operating within the 902MHz - 928MHz band. Testing was performed in accordance with ANSI C63.4-2003.

The test series was also performed to determine if the test item meets the conducted RF emission requirements of the Industry Canada Radio Standards Specification, RSS-Gen, Section 7.2.2 and the radiated RF emission requirements of the Industry Canada Radio Standards Specification, RSS-210, Annex 2 for transmitters operating within the 902MHz – 928MHz band. Testing was performed in accordance with ANSI C63.4-2003.

The test series was also performed to determine if the test item meets the conducted and radiated RF emission requirements of the Industry Canada Radio Standards Specification, RSS-Gen, Section 7.2.2 and Section 7.2.3 for receivers. 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 23°C and the relative humidity was 21%.

### 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 B for Receivers, dated 1 October 2008
- ANSI C63.4-2003, "American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz"
- Industry Canada RSS-210, Issue 7, June 2007, "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 2, June 2007, "Spectrum Management and Telecommunications Radio Standards Specification, General Requirements and Information for the Certification of radio communication equipment"



### 3 TEST ITEM SETUP AND OPERATION

#### 3.1 General Description

The test item is an Intermatic Hand Held Transmitter transceiver, Part No. PE953. A block diagram of the test item setup is shown as Figure 1.

##### 3.1.1 Power Input

The test item was powered with 4.5VDC from 3 each "AA" batteries.

##### 3.1.2 Peripheral Equipment

The test item was submitted for testing with no peripheral equipment.

##### 3.1.3 Interconnect Cables

The test item was submitted for testing with no interconnect cables.

##### 3.1.4 Grounding

The test item was ungrounded during the test.

#### 3.2 Operational Mode

For all tests, the test item was placed on an 80cm high non-conductive stand. The test item was energized. One of the units submitted for testing was set up so that upon power up it would receive continuously at 908.42MHz. The second unit submitted for testing was set up so that upon power up it would transmit continuously at 908.42MHz.

#### 3.3 Test Item 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.

#### 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
<b>Radiated Emission Measurements</b>		
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 Receiver

##### 5.1.1.1 Requirements

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

#### 5.1.2 Transmitter

##### 5.1.2.1 Requirements

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

### 5.2 Radiated Measurements

#### 5.2.1 Receiver

##### 5.2.1.1 Requirements

Per CFR 47, Part 15 section 109(a) and Industry Canada RSS-Gen section 7.2.3, all emanations from a receiver shall be below the levels shown on the following table:

Frequency MHz	Distance between Test Item 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.

##### 5.2.1.2 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 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 quasi-peak and average measurements require long integration times, it is not practical to automatically sweep through the quasi-peak or average levels. Therefore, radiated emissions from the test item 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 or average detector.

For preliminary radiated emissions sweeps from 30MHz to 5GHz, the broadband measuring antenna was positioned at a 3 meter distance from the test item. The frequency range from 30MHz to 5GHz was investigated using a peak detector function with the bilog antenna below 1GHz and the double-ridged waveguide antenna above 1GHz. The maximum levels 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 below 1GHz were made using a quasi-peak detector and a bilog antenna. Measurements above 1GHz were made using an average detector and a double ridged waveguide antenna.
- 2) To ensure that maximum or worst case, emission levels were measured, the following steps were taken:
  - a. The test item was rotated so that all of its sides were exposed to the receiving antenna.
  - b. Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.
  - c. The measuring antenna was raised and lowered from 1 to 4 meters for each antenna polarization to maximize the readings.
  - d. For hand-held or body-worn devices, the test item was rotated through three orthogonal axes to determine which orientation produces the highest emission relative to the limit.

### 5.2.1.3 Results

The preliminary plots are presented on pages 16 through 19. The plots are presented for a reference only, and are not used to determine compliance. The final radiated levels are presented on page 20. As can be seen from the data, all emissions measured from the test item were within the specification limits for receivers. The emissions level closest to the limit (worst case) occurred at 1817.2MHz. The emissions level at this frequency was 9.5dB within the limit. Photographs of the test configuration are shown on Figure 2 through Figure 4.

## 5.2.2 Transmitter

### 5.2.2.1 Requirements

Per CFR 47, Part 15 section 249(a) and Industry Canada RSS-210 Annex 2, section A2.9, all emanations from a transmitter shall be below the levels shown on the following table:

Fundamental Frequency MHz	Field Intensity mV/m @ 3 meter	Field Strength of Harmonics and Spurious uV/m @ 3 meter
902 to 928	50	500

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.

### 5.2.2.2 Procedures

All 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. The floor of the chamber is used as the ground plane. The chamber complies with ANSI C63.4-2003 for site attenuation.

A preliminary radiated emissions test was performed to determine the emission characteristics of the test item. For the preliminary test, a broadband measuring antenna was positioned at a 3 meter distance from the test item.

The entire frequency range from 30MHz to 10GHz was investigated using a peak detector function. The data was then processed by the computer to calculate equivalent field intensity.

The final emission tests were then manually performed over the frequency range of 30MHz to 10GHz. 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.

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

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

#### 5.2.2.3 Results

The preliminary plots are presented on data pages 21 through 24. The plots are presented for a reference only, and are not used to determine compliance. The final radiated levels are presented on data page 25. As can be seen from the data, all emissions measured from the test item were within the specification limits. The emissions level closest to the limit (worst case) occurred at 908.42MHz. The emissions level at this frequency was 1.0dB within the limit. Photographs of the test configuration which yielded the highest or worst case, radiated emission levels are shown on Figure 2 through Figure 4.

### 5.3 Occupied Bandwidth Measurements

#### 5.3.1 Requirements

In accordance with paragraph 15.249(d), all emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuate by at least 50dB below the level of the fundamental or to the general radiated emissions limits in 15.209, which ever is the lesser attenuation.

#### 5.3.2 Procedure

The test item was placed on an 80cm high non-conductive stand. The unit was set to transmit continuously. With an antenna positioned 3 meters away, occupied bandwidth emissions were displayed on the spectrum analyzer. The resolution bandwidth was set to 100 kHz and span was set to 30 MHz. The frequency spectrum near the fundamental was plotted.

#### 5.3.3 Results

The plots of the emissions near the fundamental frequency are presented on data pages 26. As can be seen from this data page, the transmitter met the occupied bandwidth requirements. The 99% bandwidth was measured to be 160.3kHz.

## 6 OTHER TEST CONDITIONS

### 6.1 Test Personnel and Witnesses

All tests were performed by qualified personnel from Elite Electronic Engineering Incorporated. The test series was partially witnessed by Intermatic personnel.

### 6.2 Disposition of the Test Item

The test item and all associated equipment were returned to Intermatic upon completion of the tests.





## 7 CONCLUSIONS

It was determined that the Intermatic Hand Held Transmitter, Part No. PE953, 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 and the conducted emission requirements of Section 7.2.2 and the radiated emissions requirements of Section 7.2.3 of the Industry Canada Radio Standards Specification, RSS-Gen for receivers.

It was also determined that the Intermatic Hand Held Transmitter, Part No. PE953, 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 C, Sections 15.207 and 15.249 for Intentional Radiators Operating within the 902MHz -928MHz band and the conducted emission requirements of Section 7.2.2 of the Industry Canada Radio Standards Specification RSS-Gen and the radiated emissions requirements of Industry Canada's RSS-210, Annex 2 section A2.9 for low-power license-exempt radio communication devices.

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 test item at the test date as operated by Intermatic personnel. Any electrical or mechanical modification made to the test item subsequent to the specified test date will serve to invalidate the data and void this certification.

This report must not be used to claim product endorsement by NVLAP or any agency of the US Government.



## 9 EQUIPMENT LIST

Table 9-1 Equipment List

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Due Date
APW2	PREAMPLIFIER	PLANAR ELECTRONICS	PE2-35-120-5R0-10	PL2925	1GHZ-20GHZ	7/28/2009	7/28/2010
CDS2	COMPUTER	GATEWAY	MFATXPNT NMZ 500L	0028483108	1.8GHZ	N/A	
CMA1	Controllers	EMCO	2090	9701-1213	---	N/A	
NDQ0	TUNED DIPOLE ANTENNA	EMCO	3121C-DB4	311	400-1000MHZ	3/12/2009	3/12/2010
NTA1	BILOG ANTENNA	CHASE EMC LTD.	BILOG CBL6112	2054	0.03-2GHZ	9/10/2009	9/10/2010
NWH0	RIDGED WAVE GUIDE	TENSOR	4105	2081	1-12.4GHZ	8/11/2009	8/11/2010
RBB0	EMI TEST RECEIVER 20HZ TO 40 GHZ.	ROHDE & SCHWARZ	ESIB40	100250	20 HZ TO 40GHZ	3/11/2009	3/11/2010
SEK1	DC POWER SUPPLY	LABORNETZGERAT	L3205	94081004	0-32VDC;0-5A	NOTE 1	

N/A: Not Applicable

Note 1: For the purpose of this test, the equipment was calibrated over the specified frequency range, pulse rate, or modulation prior to the test or monitored by a calibrated instrument.

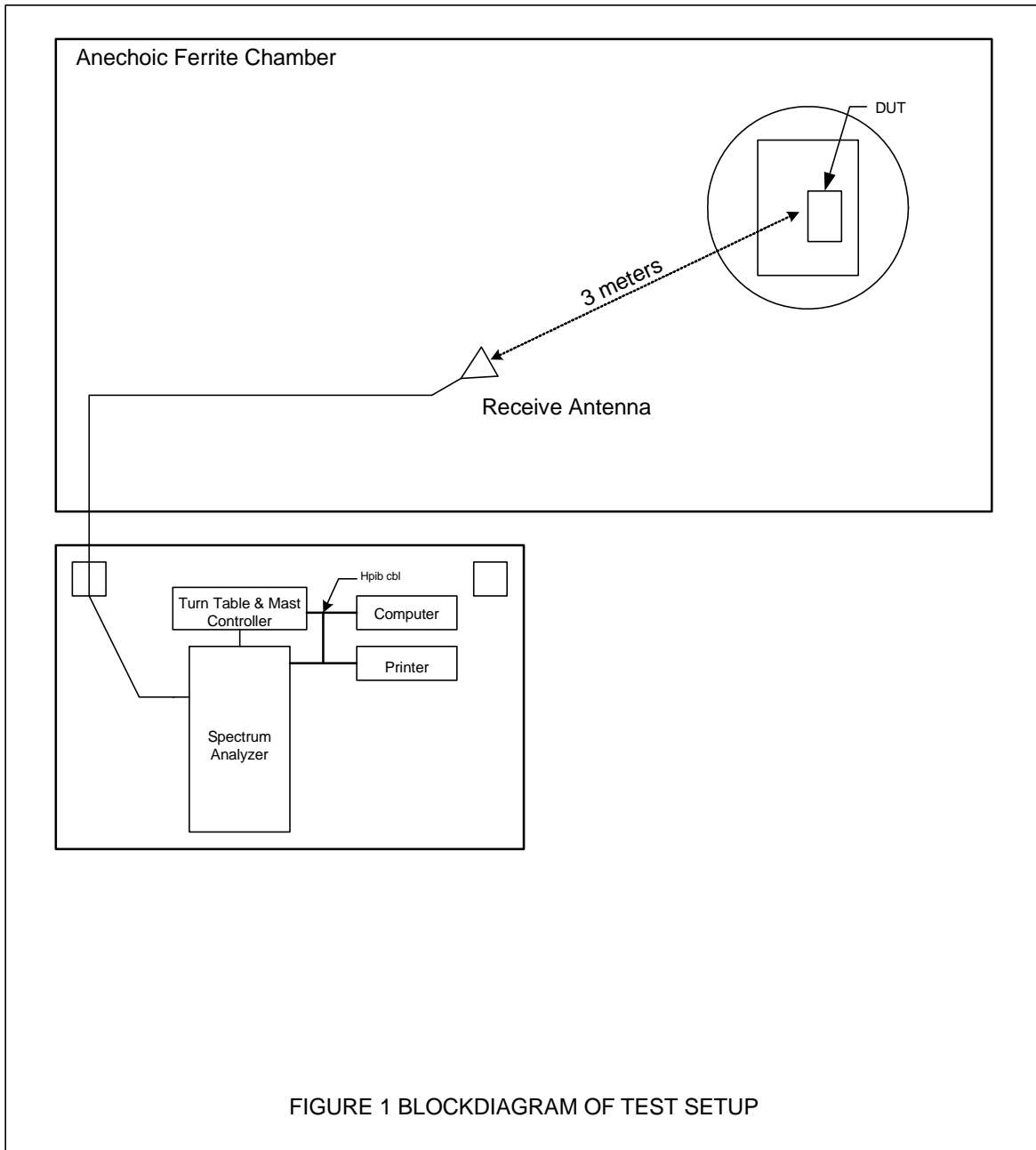
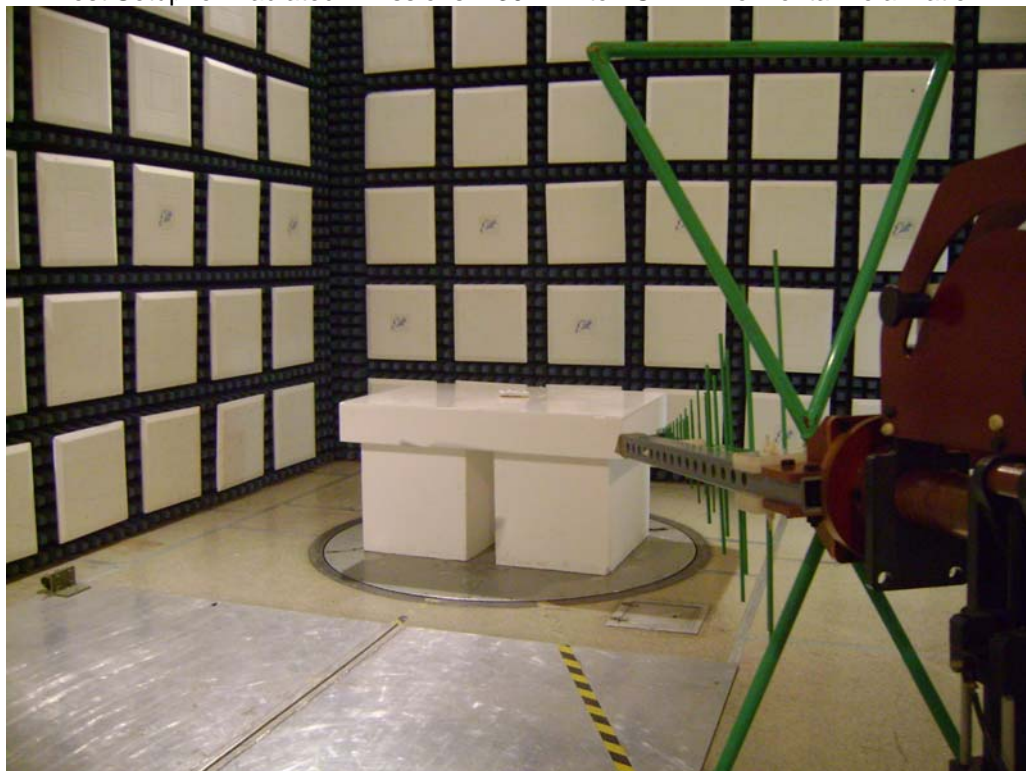


Figure 2



Test 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 – 908MHz - Horizontal Polarization - Transmitter



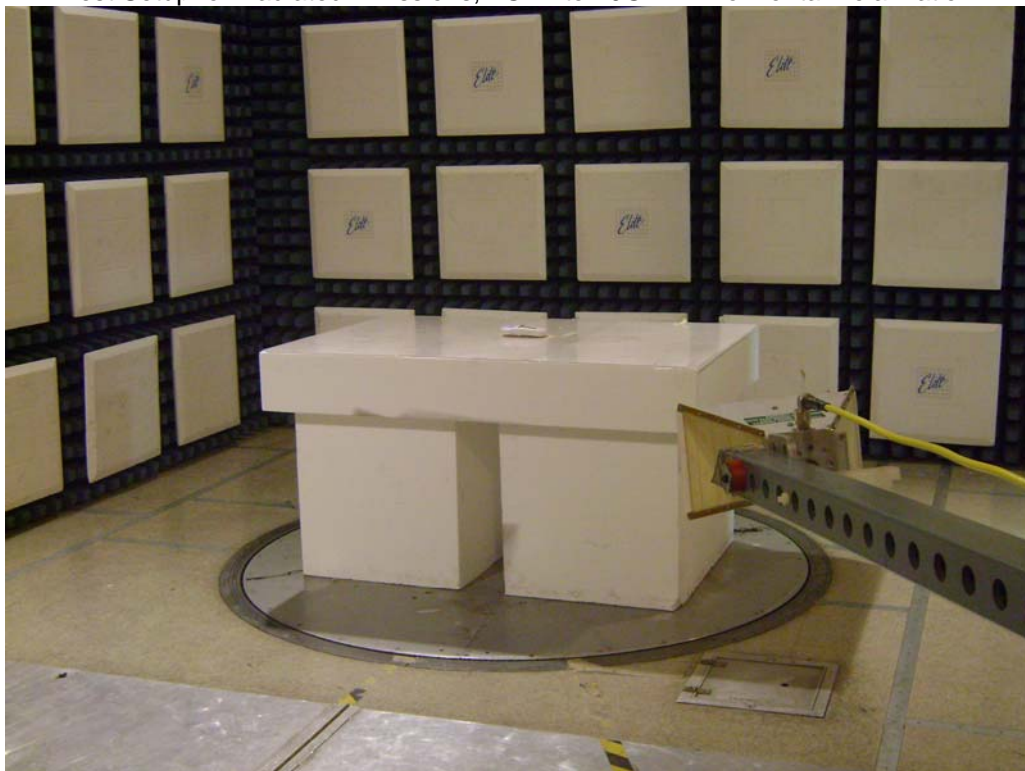
Test Setup for Radiated Emissions – 908MHz – Vertical Polarization - Transmitter



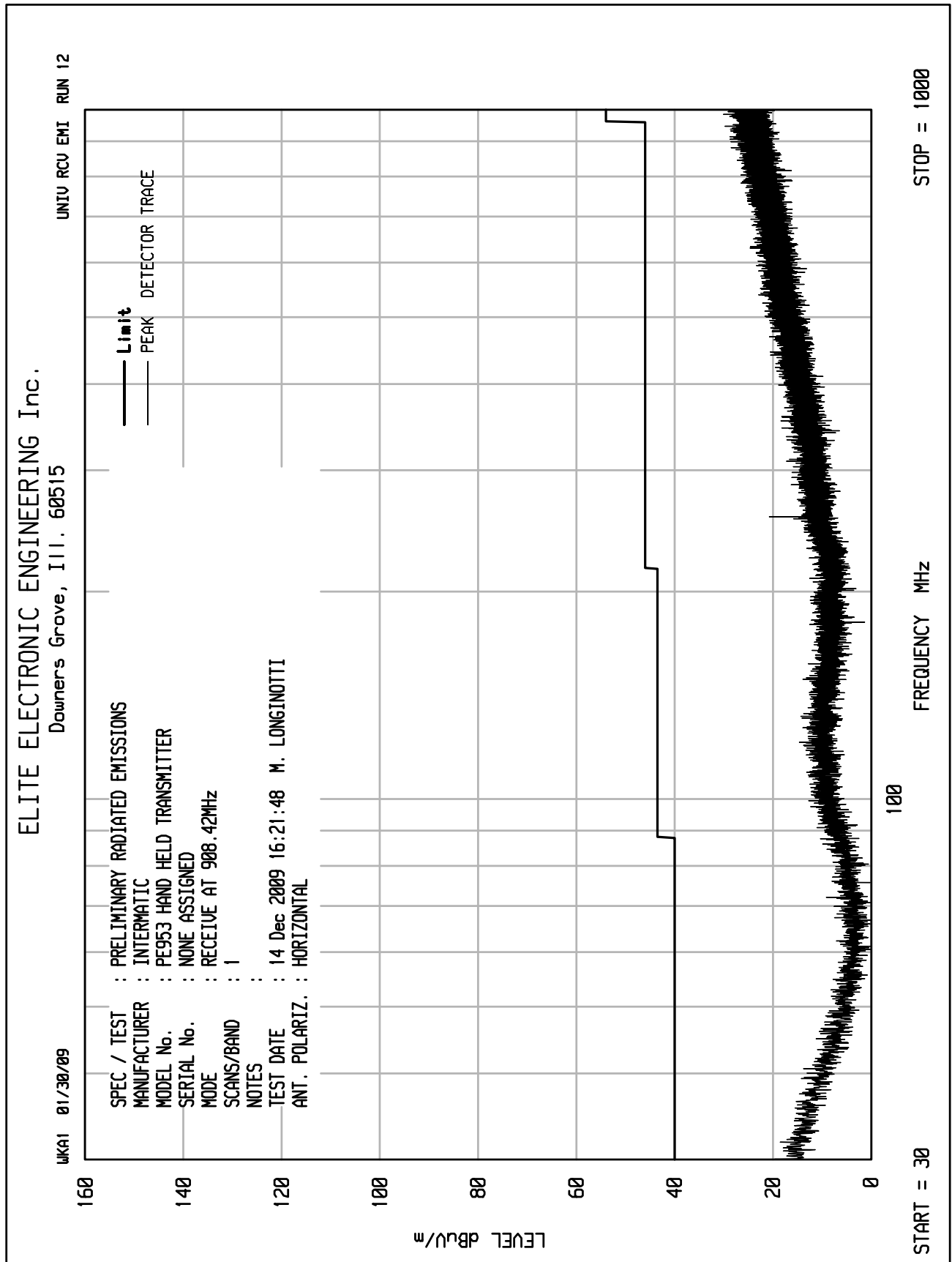
Figure 4



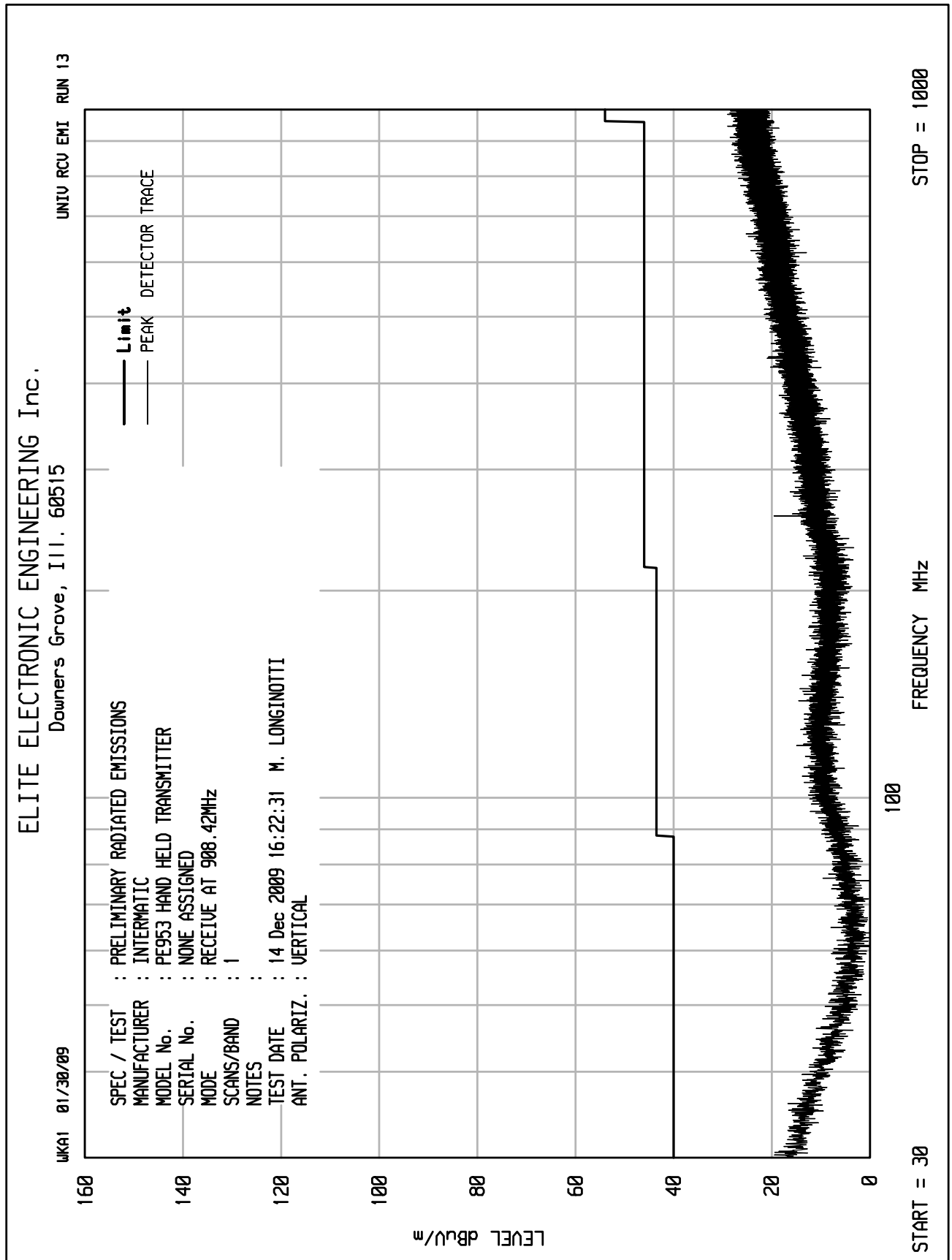
Test Setup for Radiated Emissions, 1GHz to 10GHz – Horizontal Polarization

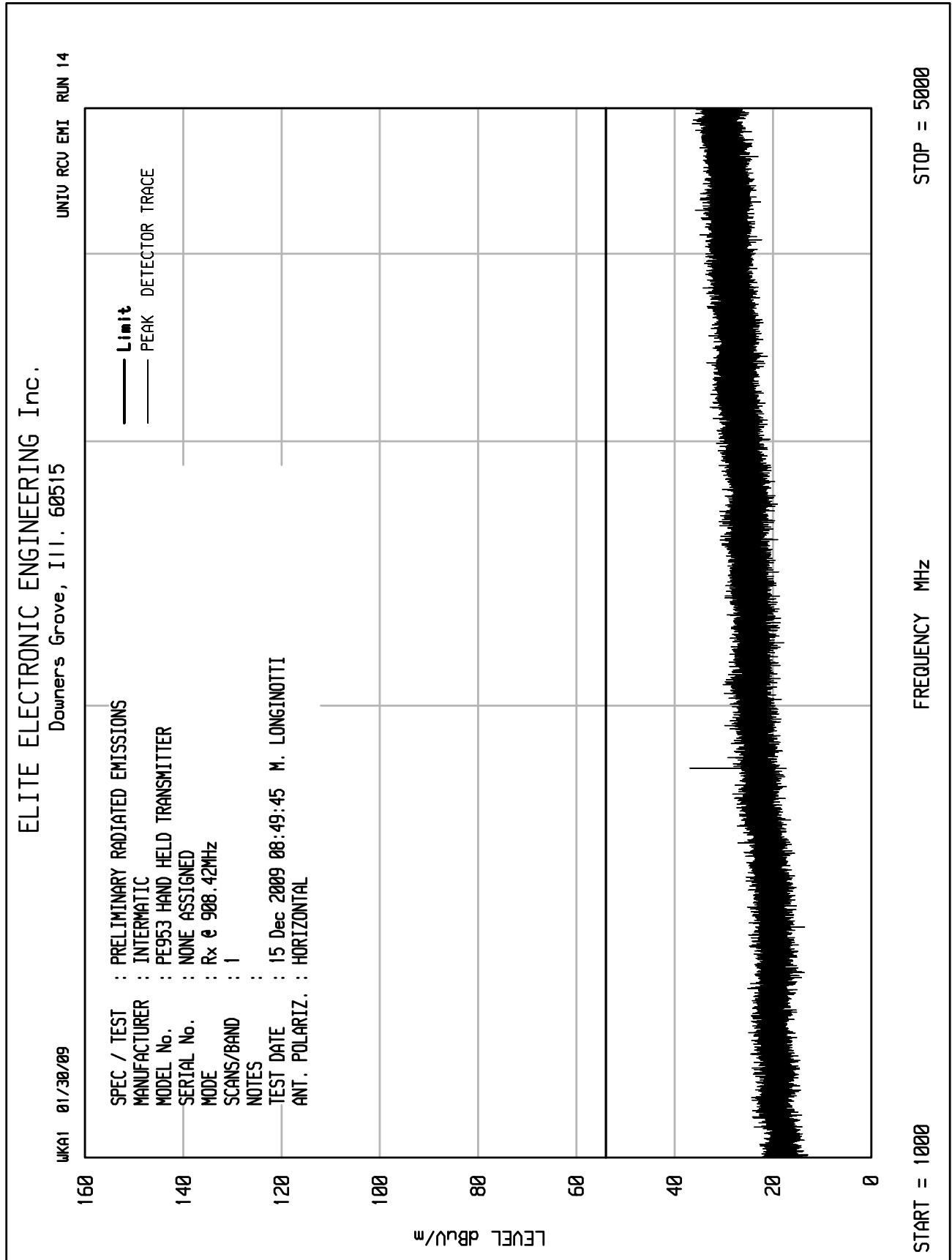


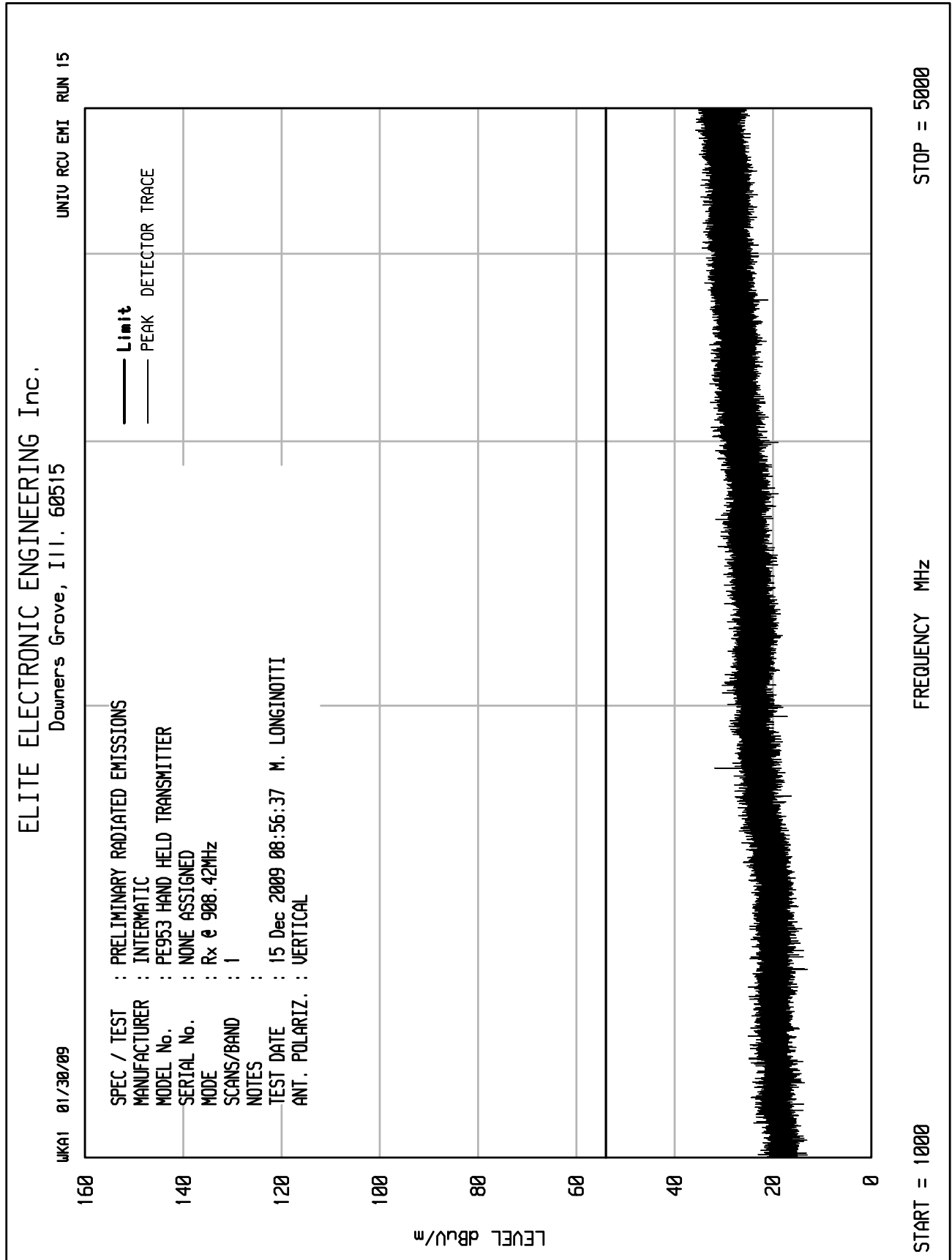
Test Setup for Radiated Emissions, 1GHz to 10GHz – Vertical Polarization













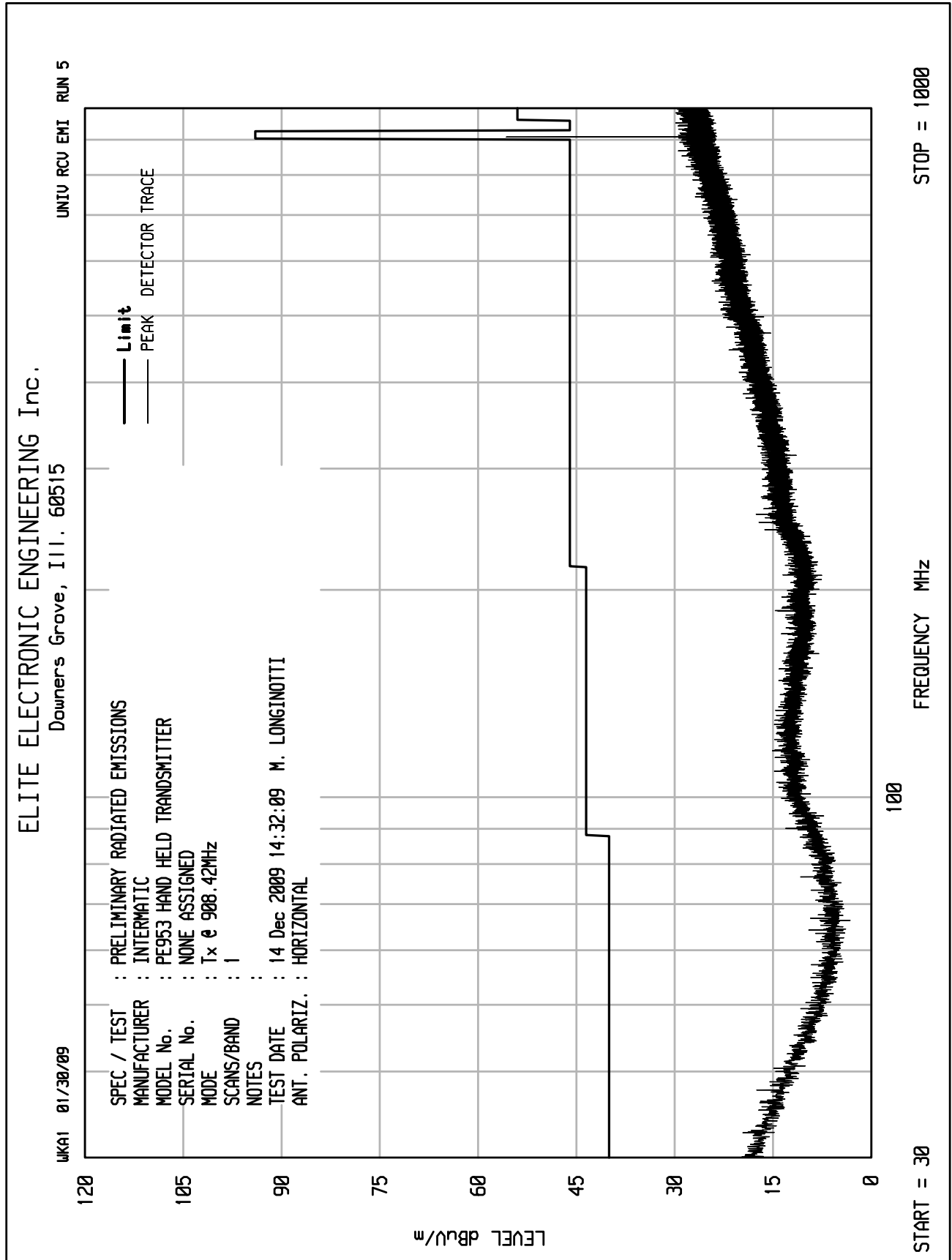
MANUFACTURER : Intermatic  
TEST ITEM : Hand Held Transmitter  
MODEL NO. : PE953  
SERIAL NO. : None Assigned  
TEST SPECIFICATION : FCC 15.109(a), Radiated Emissions  
MODE : Receive at 908.42MHz  
TEST DATE : December 14 and 15, 2009  
TEST DISTANCE : 3 meters

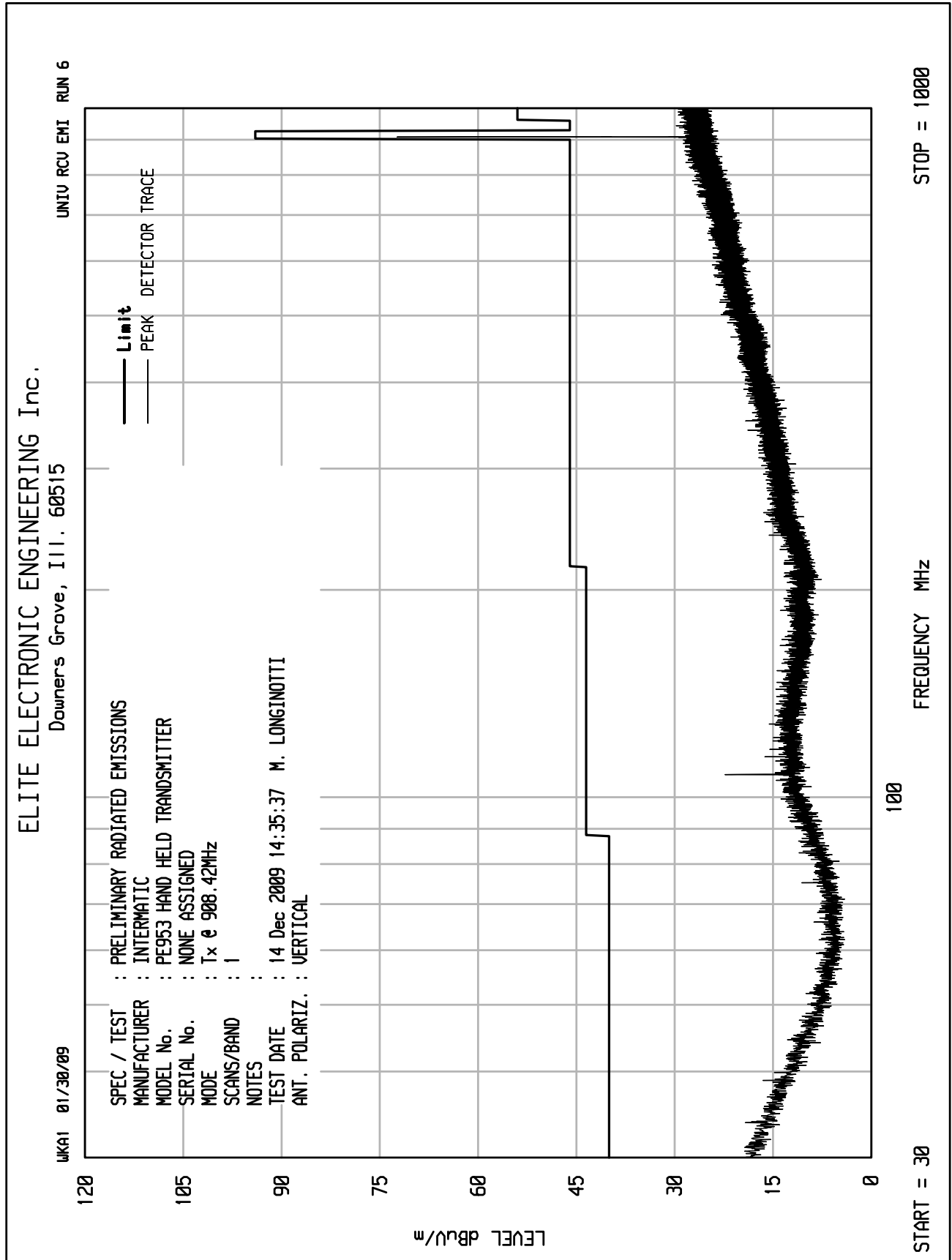
Frequency MHz	Antenna Polarity	Meter Reading dBuV	Ambient	Cable Loss dB	Antenna Factor dB	Preamp Gain dB	Total dBuV/m	Total uV/m	Limit uV/m
908.60	H	5.2	Ambient	2.4	27.8	0.0	35.4	58.8	200.0
908.60	V	5.1	Ambient	2.4	27.8	0.0	35.3	58.1	200.0
1817.20	H	49.7		3.5	28.7	-37.3	44.5	167.5	500.0
1817.20	V	45.0		3.5	28.7	-37.3	39.8	97.5	500.0
2725.80	H	33.2	Ambient	3.9	29.6	-37.0	29.7	30.7	500.0
2725.80	V	34.2	Ambient	3.9	29.6	-37.0	30.7	34.5	500.0
3634.40	H	31.8	Ambient	4.7	32.1	-36.5	32.1	40.4	500.0
3634.40	V	31.9	Ambient	4.7	32.1	-36.5	32.2	40.9	500.0
4543.00	H	31.3	Ambient	5.5	33.0	-35.9	33.9	49.6	500.0
4543.00	V	31.2	Ambient	5.5	33.0	-35.9	33.8	49.0	500.0

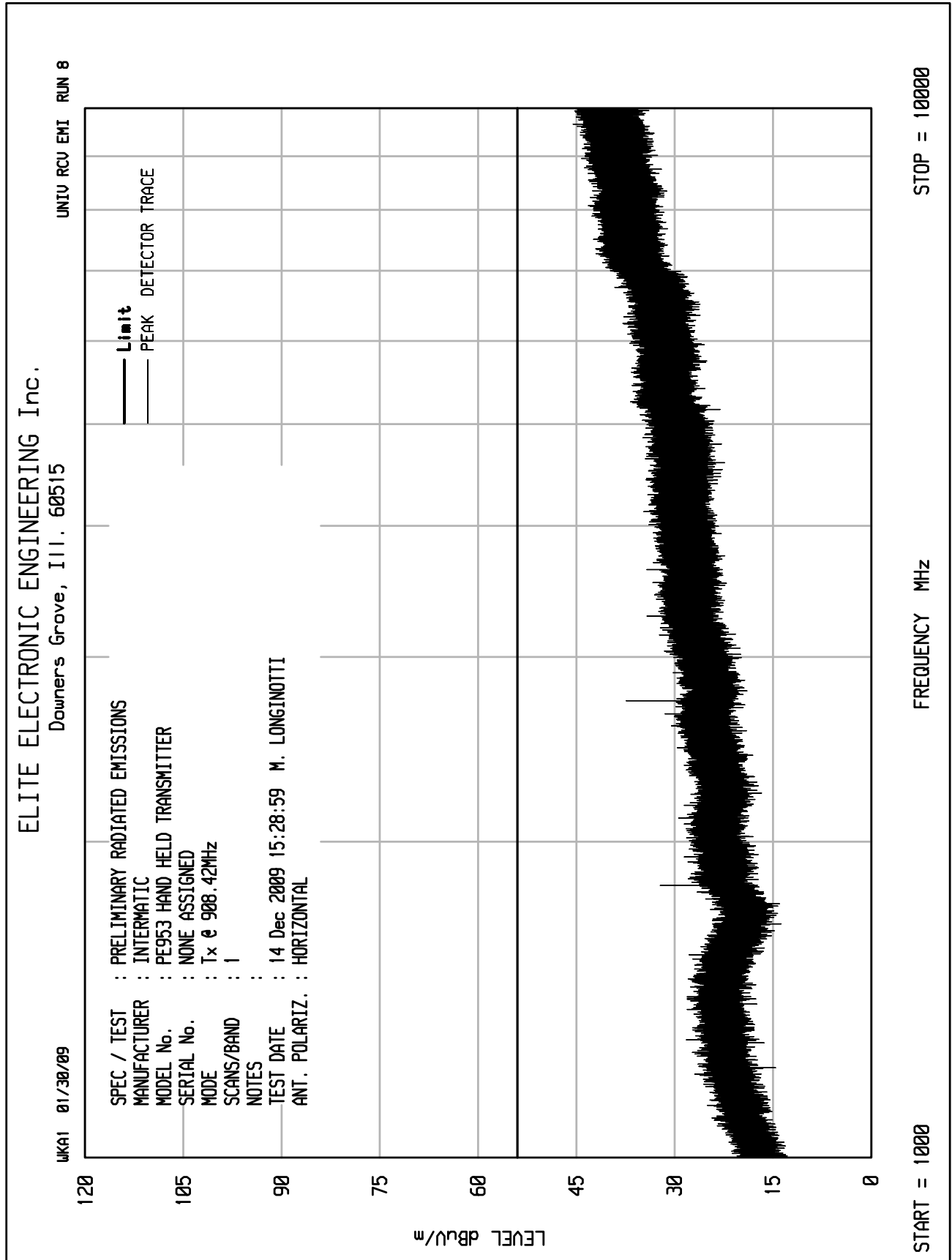
H – Horizontal  
V = Vertical

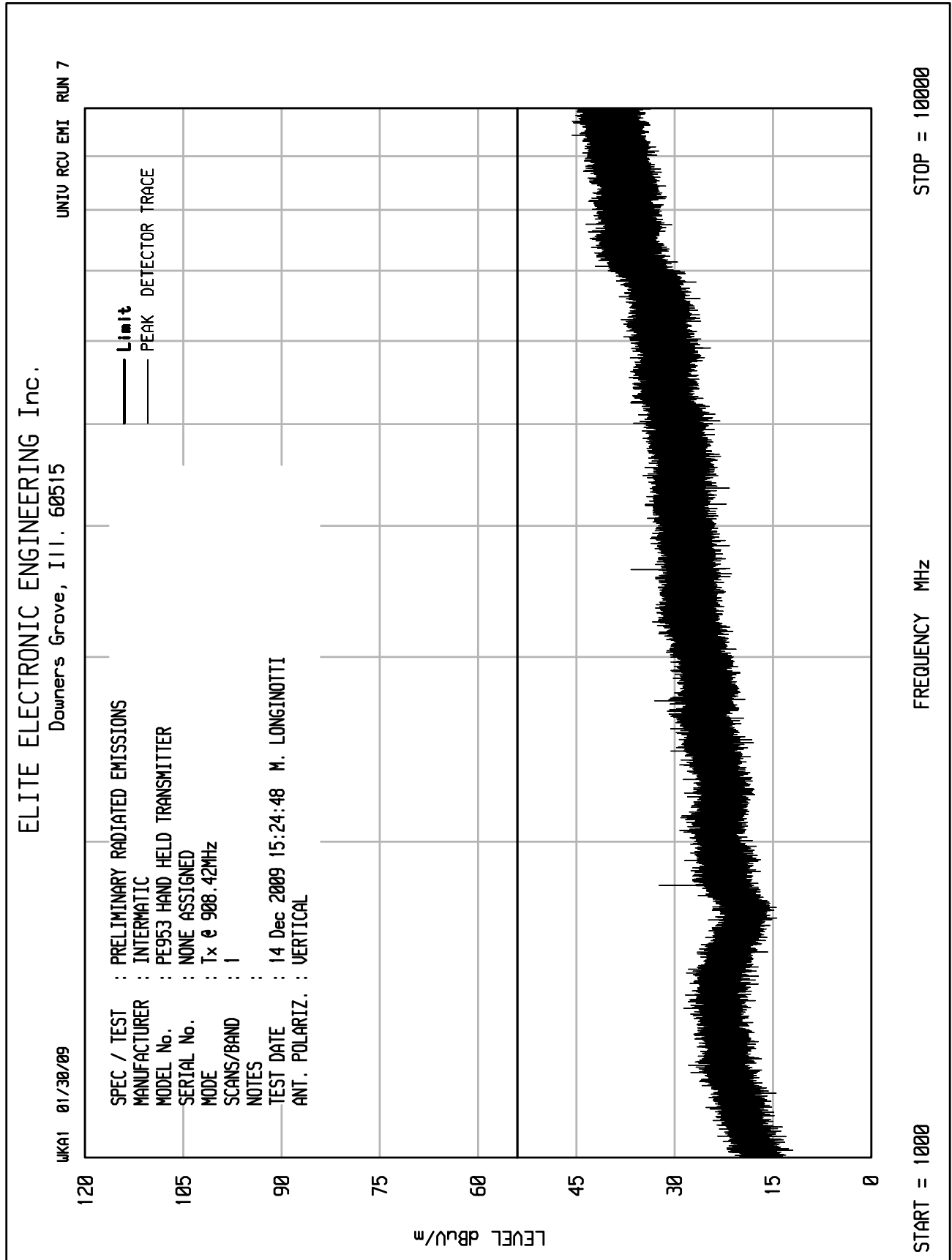
Total = Meter Reading + Cable Loss + Antenna Factor + Preamp Gain

Checked By : MARK E. LONGINOTTI













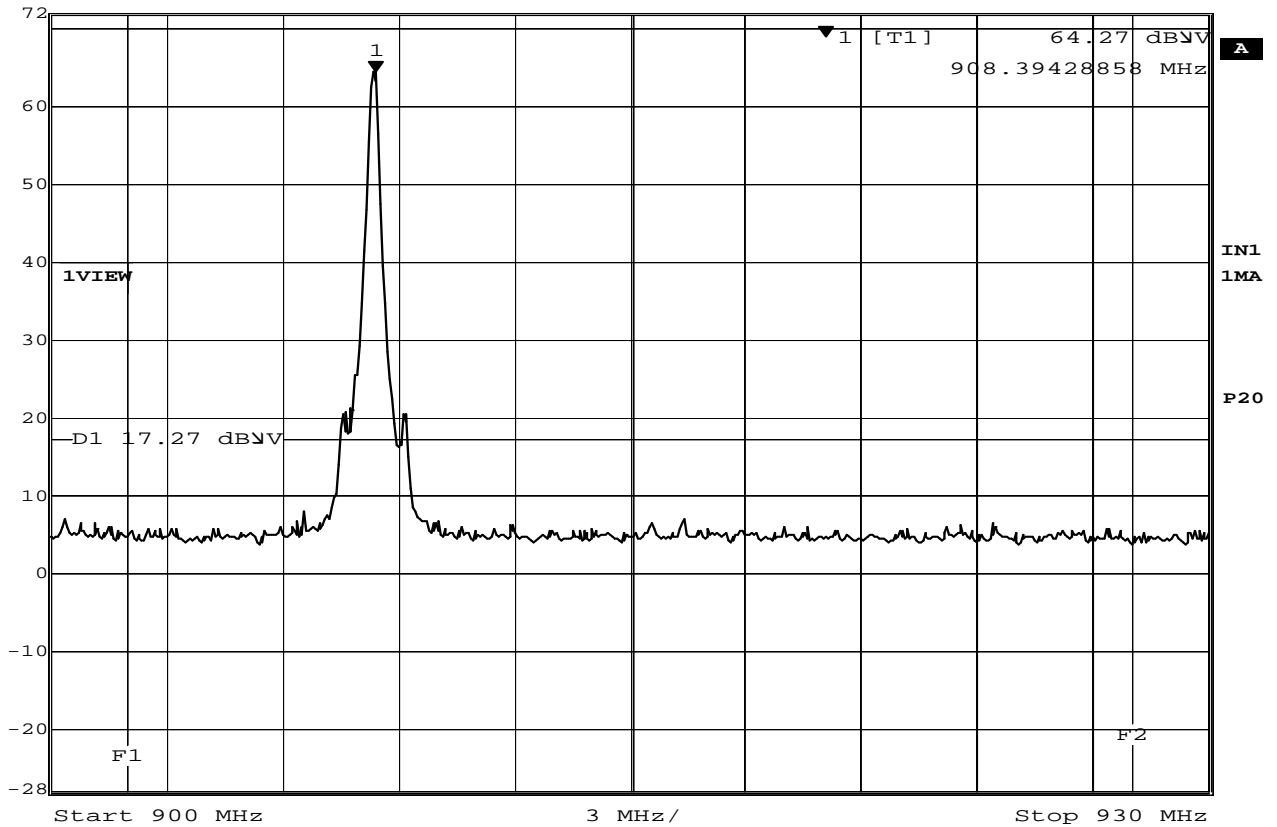
MANUFACTURER : Intermatic  
TEST ITEM : Hand Held Transmitter  
MODEL NO. : PE953  
SERIAL NO. : None Assigned  
TEST SPECIFICATION : FCC 15.249, Radiated Emissions  
MODE : Transmit at 908.42MHz  
TEST DATE : December 14 and 15, 2009  
TEST DISTANCE : 3 meters

Frequency MHz	Antenna Polarity	Meter Reading dBuV	Ambient	Cable Loss dB	Antenna Factor dB	Preamp Gain dB	Total dBuV/m	Total uV/m	Limit uV/m
908.42	H	62.8		2.4	27.8	0.0	93.0	44564.2	50000.0
908.42	V	55.1		2.4	27.8	0.0	85.3	18364.8	50000.0
1816.84	H	47.3		3.5	28.7	-37.3	42.1	127.1	500.0
1816.84	V	40.3		3.5	28.7	-37.3	35.1	56.8	500.0
2725.26	H	45.7		3.9	29.6	-37.0	42.2	129.5	500.0
2725.26	V	41.7		3.9	29.6	-37.0	38.2	81.7	500.0
3633.68	H	47.7		4.7	32.1	-36.5	48.0	252.1	500.0
3633.68	V	33.5		4.7	32.1	-36.5	33.8	49.1	500.0
4542.10	H	30.6	Ambient	5.5	33.0	-35.9	33.2	45.7	500.0
4542.10	V	29.9	Ambient	5.5	33.0	-35.9	32.5	42.2	500.0
5450.52	H	31.6	Ambient	6.2	35.2	-35.8	37.2	72.5	500.0
5450.52	V	28.8	Ambient	6.2	35.2	-35.8	34.4	52.6	500.0
6358.94	H	31.1	Ambient	7.0	35.1	-35.6	37.6	75.8	500.0
6358.94	V	30.9	Ambient	7.0	35.1	-35.6	37.4	74.1	500.0
7267.36	H	32.3	Ambient	7.7	37.6	-35.5	42.1	127.4	500.0
7267.36	V	32.3	Ambient	7.7	37.6	-35.5	42.1	127.4	500.0
8175.78	H	32.2	Ambient	8.0	37.6	-35.4	42.5	133.5	500.0
8175.78	V	32.2	Ambient	8.0	37.6	-35.4	42.5	133.5	500.0
9084.20	H	31.9	Ambient	8.8	37.8	-35.2	43.2	145.2	500.0
9084.20	V	32.0	Ambient	8.8	37.8	-35.2	43.3	146.9	500.0

Checked By : MARK E. LONGINOTTI



Marker 1 [T1] RBW 100 kHz RF Att 0 dB  
 Ref Lvl 64.27 dBµV VBW 200 kHz  
 72 dBµV 908.39428858 MHz SWT 7.5 ms Unit dBµV



Date: 14.DEC.2009 21:37:48

**FCC 15.249 Occupied Bandwidth**

MANUFACTURER : Intermatic  
 PART NUMBER : PE953  
 SERIAL NUMBER : None Assigned  
 TEST MODE : Tx @ 908.42MHz  
 TEST PARAMETER : Emissions radiated outside of the specified frequency bands, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

NOTE : The peak reading at 908.42MHz represents the 93BumV/m reading. In order to meet the general limits at 902MHz and 928MHz, the emissions must be down 47dB from the peak (93dB – 46dB). This reading corresponds to 17.27dB (64.27-47)  
 Display line D1 represents the general limit. Display line F1 represents the lower band edge (902MHz). Display line F2 represents the upper band edge (928MHz).

EQUIPMENT USED : RBB0, NTA1