Measurement of RF Emissions from a RVITPS Transceiver

For	Canfield Connector 8510 Foxwood Court Youngstown, OH 44514
P.O. Number	1079
Date Tested	May 28, 2013
Test Personnel	Mark Longinotti
Test Specification	FCC "Code of Federal Regulations" Title 47 Part 15B and Part 15C, Section 15.249 Industry Canada RSS-GEN Industry Canada RSS-210

Test Report By: MARK E. LONGINOTTI

Mark Longinotti
EMC Engineer

Requested By: Mike Phillips
Canfield Connector

Approved By: Raymond J Klouda

Raymond J. Klouda
Registered Professional
Engineer of Illinois - 44894

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

TABLE OF CONTENTS

TABLE OF CONTENTS

REVISION HISTORY

Revision	Date	Description
—	June 10, 2013	Initial release

Measurement of RF Emissions from a Transceiver, Model No. RVITPS

1. INTRODUCTION

1.1. Scope of Tests

This report presents the results of the RF emissions measurements performed on a Transceiver, Model No. RVITPS, Serial No. None Assigned, (hereinafter referred to as the Equipment Under Test (EUT)). The EUT was designed to transmit and receive at approximately 915MHz using an internal antenna. The EUT was manufactured and submitted for testing by Canfield Connector located in Youngstown, OH.

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 for receivers and the Industry Canada Radio Standards Specification RSS-Gen Section 7.2.4 and RSS-210 Annex 2, section A2.9 for transmitters.

Testing was performed in accordance with ANSI C63.4-2009.

1.3. EMC Laboratory Identification

This series of tests was performed by Elite Electronic Engineering Incorporated of Downers Grove, Illinois. The laboratory is accredited by The American Association for Laboratory Accreditation (A2LA). A2LA Certificate Number: 1786.01.

1.4. Laboratory Conditions

The temperature at the time of the test was 23^{o}C and the relative humidity was 45%.

2. APPLICABLE DOCUMENTS

The following documents of the exact issue designated form part of this document to the extent specified herein:

- Federal Communications Commission "Code of Federal Regulations", Title 47, Part 15, Subpart C, dated 1 October 2012
- ANSI C63.4-2009, "American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz"
- Industry Canada Radio Standards Specification, RSS-Gen, “General Requirements and Information for the Certification of Radiocommunication Equipment”, Issue 3, December 2010
- Industry Canada Radio Standards Specification, RSS-210, “Low-power License-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment”, Issue 8, December 2010

3. EUT SETUP AND OPERATION

3.1. General Description

The EUT is a Canfield Connector, Tire Pressure Monitoring System Transceiver, Model No. RVITPS. A block

diagram of the EUT setup is shown as Figure 1.

3.1.1. Power Input

The EUT obtained 3VDC from an internal battery.

3.1.2. Peripheral Equipment

The EUT was submitted for testing with no peripheral equipment.

3.1.3. Signal Input/Output Leads

The EUT was submitted for testing with no signal leads.

3.1.4. Grounding

The EUT was not grounded during the tests.

3.2. Software

The EUT requires Software Version FCC test rev00 to control the device during testing.

3.3. Operational Mode

For all tests the EUT was placed on an 80cm high non-conductive stand. The EUT was energized. The EUT was configured with an external power switch. When the power switch was moved to the “ON” position, the EUT was continuously transmitting at 915MHz. When the power switch was toggled from the “OFF” position to the “ON” position, the EUT was continuously receiving at 915MHz.

3.4. 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 C63.4-2009 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 Emissions Measurements		
Combined Standard Uncertainty	1.07	-1.07
Expanded Uncertainty (95% confidence)	2.1	-2.1

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

5. TEST PROCEDURES

5.1. Receiver

5.1.1. Powerline Conducted Emissions

5.1.1.1 Requirements

Since the EUT was powered by internal batteries and does not connect to AC power, no conducted emissions tests are required.

5.1.2. Radiated Emissions

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

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-ANSI year 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. The resultant field strength (FS) is a summation in decibels (dB) of the receiver meter reading (MTR), the antenna correction factor (AF), and the cable loss factor (CF). If an external pre-amplifier is used, the total is reduced by its gain (-PA). If a distance correction (DC) is required, it is added to the total.

Formula 1: FS (dBuV/m) = MTR (dBuV) + AF (dB/m) + CF (dB) + (- PA (dB)) + DC (dB)

To convert the Field Strength dBuV/m term to uV/m, the dBuV/m is first divided by 20. The Base 10 AntiLog is taken of this quotient. The result is the Field Strength value in uV/m terms.

Formula 2: FS (uV/m) = AntiLog [(FS (dBuV/m))/20]

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 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 pages 20 and 21.

As can be seen from the data, all emissions measured from the EUT were within the specification limits. The emissions level closet to the limit (worst case) occurred at 4772.27MHz. The emissions level at this frequency was 18.9dB within the limit. 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 required.

5.2.2. Duty Cycle Factor Measurements

5.2.2.1 Requirements

Unless otherwise specified, when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value. The exact method of calculating the average field strength shall be submitted with any application for certification or shall be retained in the measurement data file for equipment subject to notification or verification.

5.2.3. Procedures

a. The EUT was placed on the non-conductive stand and set to transmit continuously.
b. A bilog antenna was positioned at a 3 meter distance from the EUT. The output of the antenna was connected to the input of a spectrum analyzer.
c. The center frequency of the spectrum analyzer was set to the transmit frequency of the EUT.
d. The frequency span of the spectrum analyzer was set to 0Hz so that the time domain trace of the transmitted pulse of the EUT was displayed on the spectrum analyzer.
e. The sweep time of the spectrum analyzer was then adjusted to 100msec.
f. The single sweep function of the spectrum analyzer was used multiple times to determine the maximum number of transmitted pulses that occurred in a 100msec time period.
g. The maximum number of pulses transmitted in a 100msec time period was recorded and then plotted using a ‘screen dump’ utility.
h. The duty cycle correction was calculated using the following equation:

Duty Cycle Correction Factor (dB) = D.C. (dB)
D.C. (dB) = 20 x log [((pulse width (msec)) x (#pulses in a 100msecperiod)) / 100msec]

5.2.4. Results

The plot of the duty cycle is shown on data page 22. The duty cycle factor was computed to be -3.8dB.

5.3. Radiated Measurements

5.3.1. Requirements

The EUT must comply with the requirements of FCC "Code of Federal Regulations Title 47", Part 15, Subpart C, Section 15.249(a) and Industry Canada Radio Standards Specification RSS-210 Annex 2, section A2.9 for transmitters:

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

Note: The limits shown in the above table are based on measurements using an average detector, except for the fundamental emission in the frequency band 902-928 MHz, which is based on measurements using a CISPR quasi-peak detector. In addition, the peak field strength of any emission shall not exceed the maximum permitted average limits by more than 20 dB under any condition of modulation. Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits, whichever is the lesser attenuation.

5.3.2.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 C63.4-2009 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.

A preliminary radiated emissions test was performed to determine the emission characteristics of the EUT. For the preliminary test, a broadband measuring antenna was positioned at a 3 meter distance from the EUT. The entire frequency range from 30MHz to 10.0GHz 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 bilog 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 EUT was rotated so that all of its sides were exposed to the receiving antenna.
2) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.
3) The measuring antenna was raised and lowered from 1 to 4 meters for each antenna polarization to maximize the readings.
4) For hand-held or body-worn devices, the EUT was rotated through three orthogonal axes to determine which orientation produces the highest emission relative to the limit.

5.3.3.Results

The preliminary plots, with the EUT transmitting at 915MHz, are presented on data pages 23 through 26. The plots are presented for a reference only, and are not used to determine compliance.

The final radiated levels, with the EUT transmitting at 915MHz, are presented on data pages 27 and 28. As can be seen from the data, all emissions measured from the EUT were within the specification limits. The emissions level closet to the limit (worst case) occurred at 1829.9MHz. The emissions level at this frequency was 1.2dB within the limit. Photographs of the test configuration which yielded the highest, or worst case, radiated emission levels are shown on Figure 2 and Figure 3.

5.4. Occupied Bandwidth Measurements

5.4.1.Requirement

In accordance with paragraph of FCC "Code of Federal Regulations Title 47", Part 15, Subpart C, Section 15.249(d) and Industry Canada Radio Standards Specification RSS-210 Annex 2, section A2.9(d), emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general field strength limits, whichever is less stringent.

5.4.2.Procedures

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

5.4.3.Results

The plot of the emissions near the fundamental frequency is presented on data page 29. As can be seen from this data page, the transmitter met the occupied bandwidth requirements. The 99% bandwidth was measured to be 336.7kHz.

6. OTHER TEST CONDITIONS

6.1. Test Personnel and Witnesses

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

6.2. Disposition of the EUT

The EUT and all associated equipment were returned to Canfield Connector upon completion of the tests.

7. CONCLUSIONS

It was determined that the Canfield Connector Transceiver, Model No. RVITPS, 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 15.249 for Intentional Radiators Operating within the 902-928 MHz band, when tested per ANSI C63.4-2009.

It was also determined that the Canfield Connector Transceiver, Model No. RVITPS, Serial No. None Assigned, did fully meet the conducted and radiated emission requirements of the Industry Canada Radio Standards Specification, RSS-Gen, Section 7.2.4 and Section 6 for receivers and the Industry Canada Radio Standards Specification RSS-Gen Section 7.2.4 and RSS-210 Annex 2, section A2.9 for transmitters, when tested per ANSI C63.4-2009

8. CERTIFICATION

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

The data presented in this test report pertains to the EUT at the test date. Any electrical or mechanical modification made to the EUT subsequent to the specified test date will serve to invalidate the data and void this certification.

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

9. EQUIPMENT LIST

Table 9-1 Equipment List

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Due Date
APW3	PREAMPLIFIER	PLANAR ELECTRONICS	PE2-35-120-5R0-10-12	PL2924	1GHZ-20GHZ	8/22/2012	8/22/2013
CDX8	COMPUTER	ELITE	WORKSTATION			N/A	
NTA3	BILOG ANTENNA	TESEQ	6112D	28040	25-1000MHz	2/15/2013	2/15/2014
NWQ1	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS-LINDGREN	3117	66655	1GHZ-18GHZ	3/18/2013	3/18/2014
RAKI	RF SECTION	HEWLETT PACKARD	85462A	3411A00181	0.009-6500MHZ	3/15/2013	3/15/2014
RAKJ	RF FILTER SECTION	HEWLETT PACKARD	85460A	3330A00154	---	3/15/2013	3/15/2014
RBA0	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESIB26	100145	20HZ-26.5GHZ	3/12/2013	3/12/2014
WKA1	SOFTWARE, UNIVERSAL RCV EMI	ELITE	UNIV_RCV_EMI	1	---	I/O	
XPQ2	HIGH PASS FILTER	K&L MICROWAVE	4IH30-1804/T10000-0	3	1.8-10GHZ	11/26/2012	11/26/2013

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

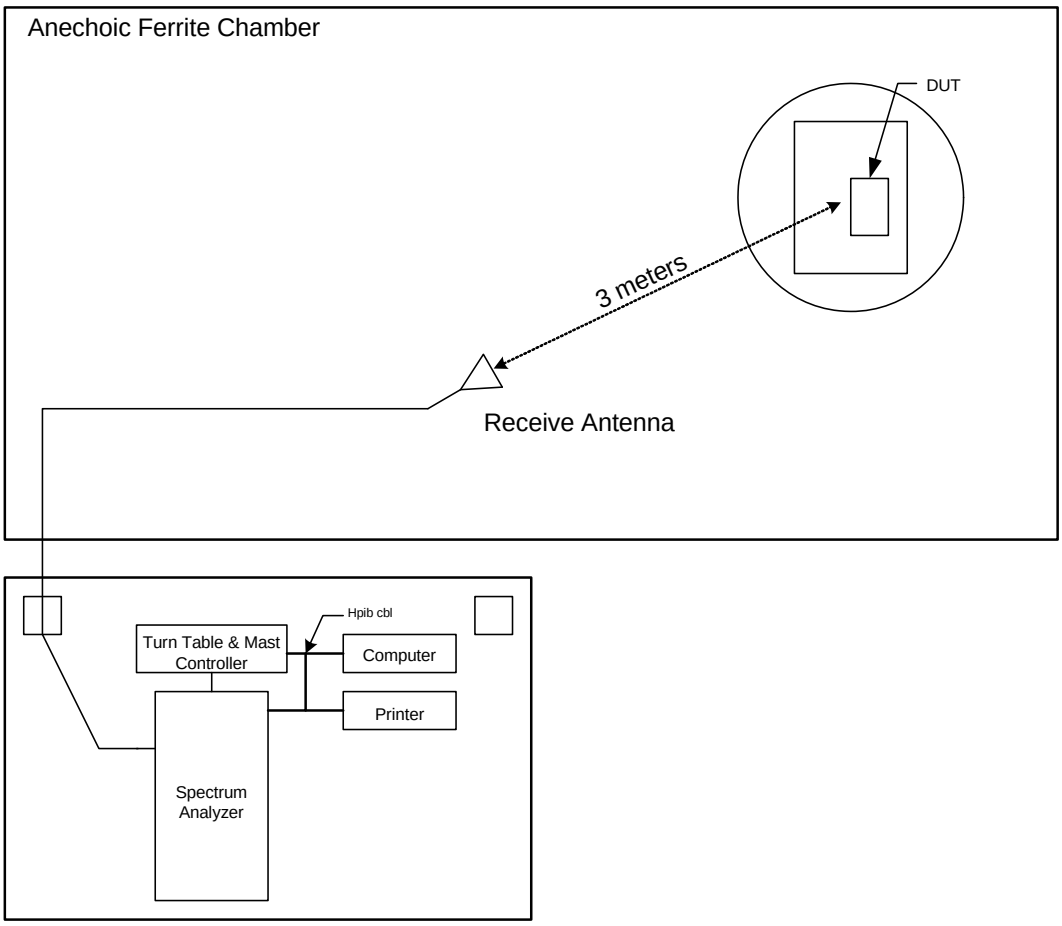
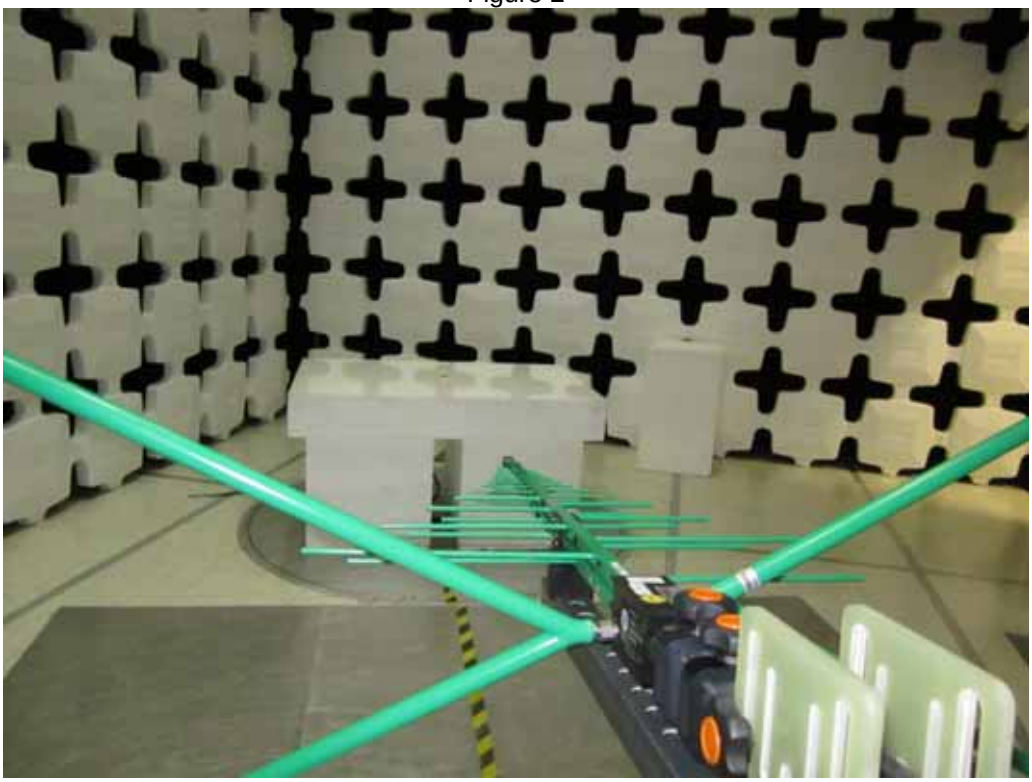


FIGURE 1 BLOCKDIAGRAM OF TEST SETUP

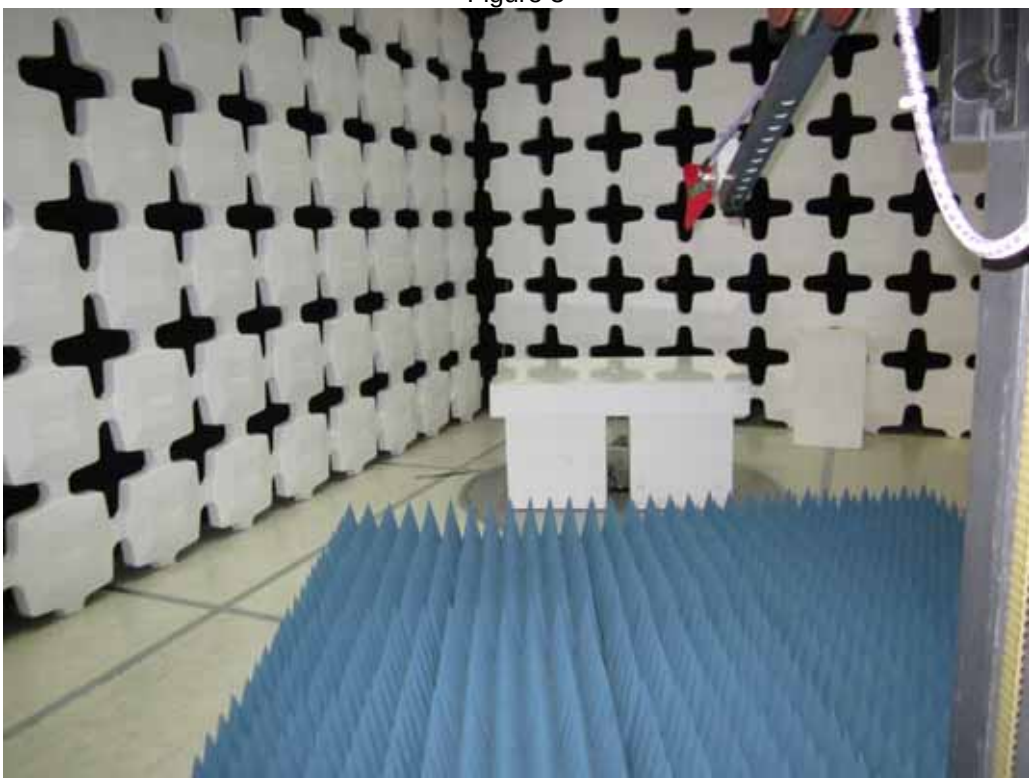
Figure 2



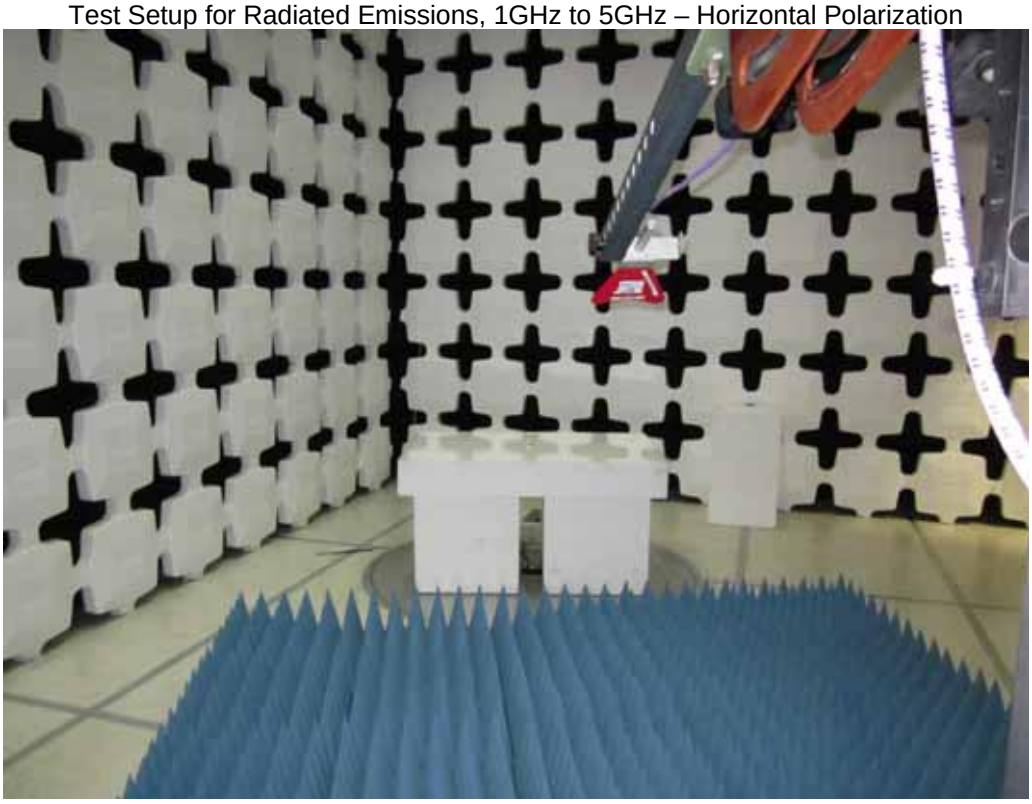
Test Setup for Radiated Emissions, 30MHz to 1GHz – Horizontal Polarization

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

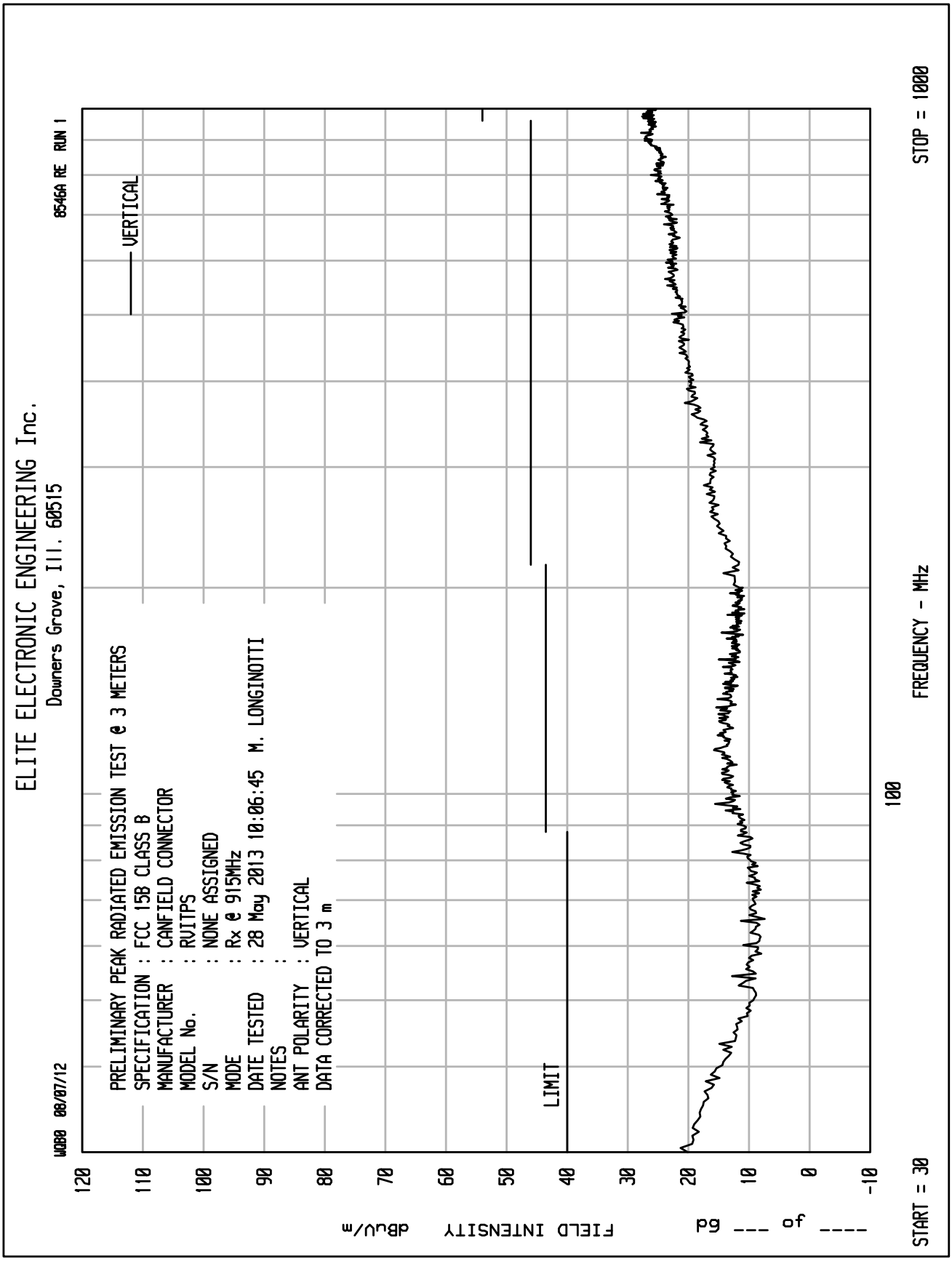
Figure 3

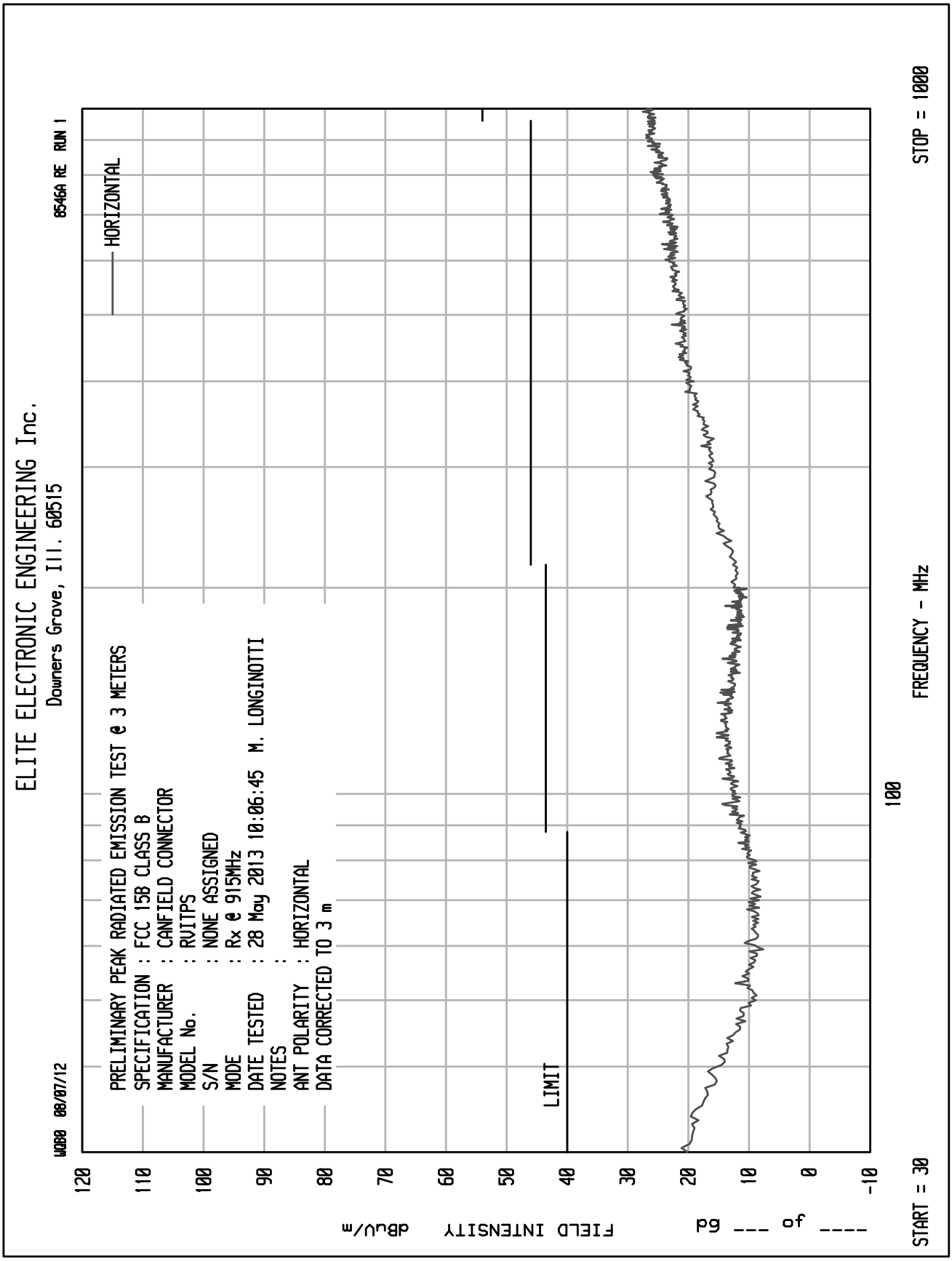


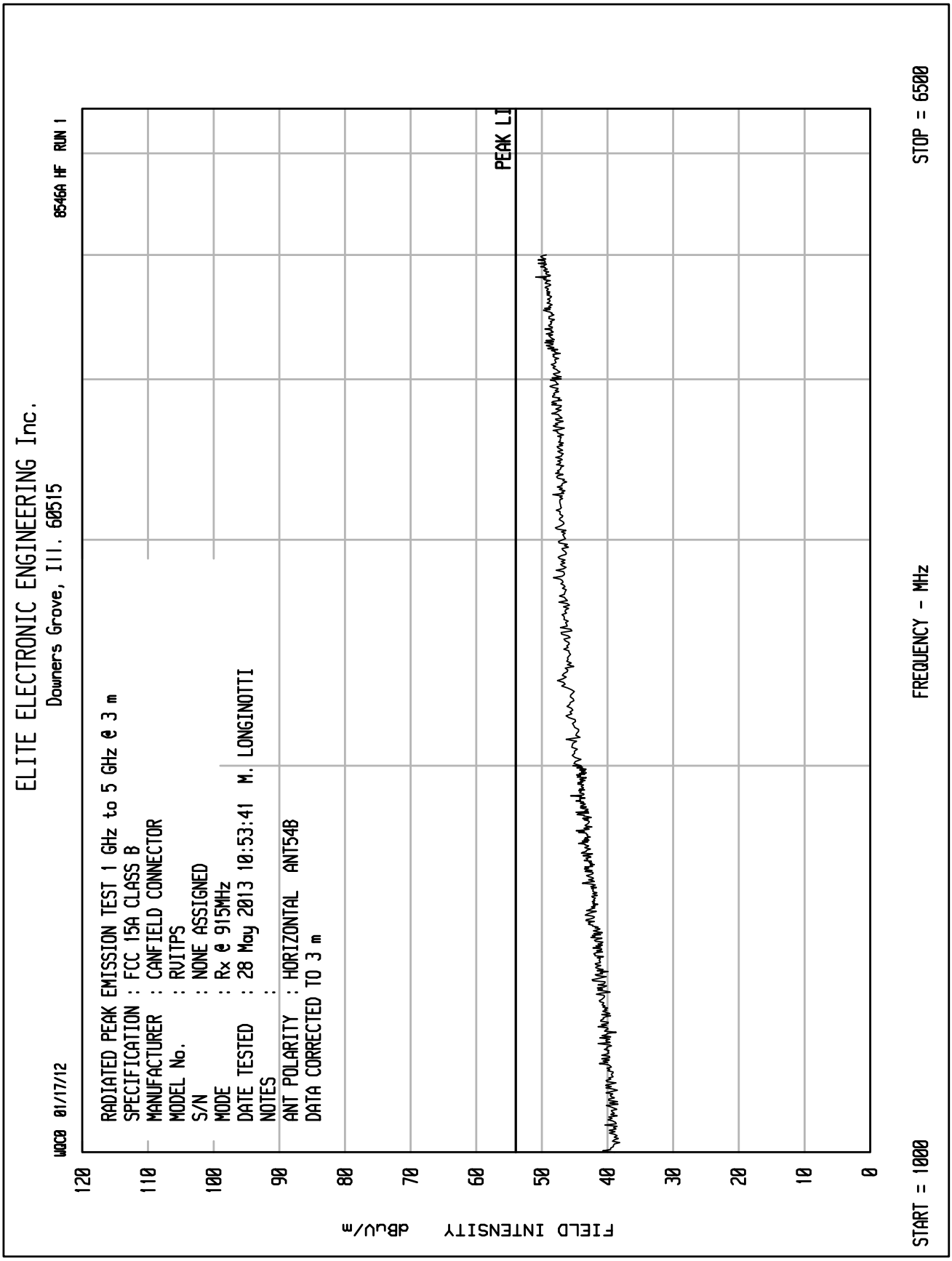
Test Setup for Radiated Emissions, 1GHz to 5GHz – Horizontal Polarization

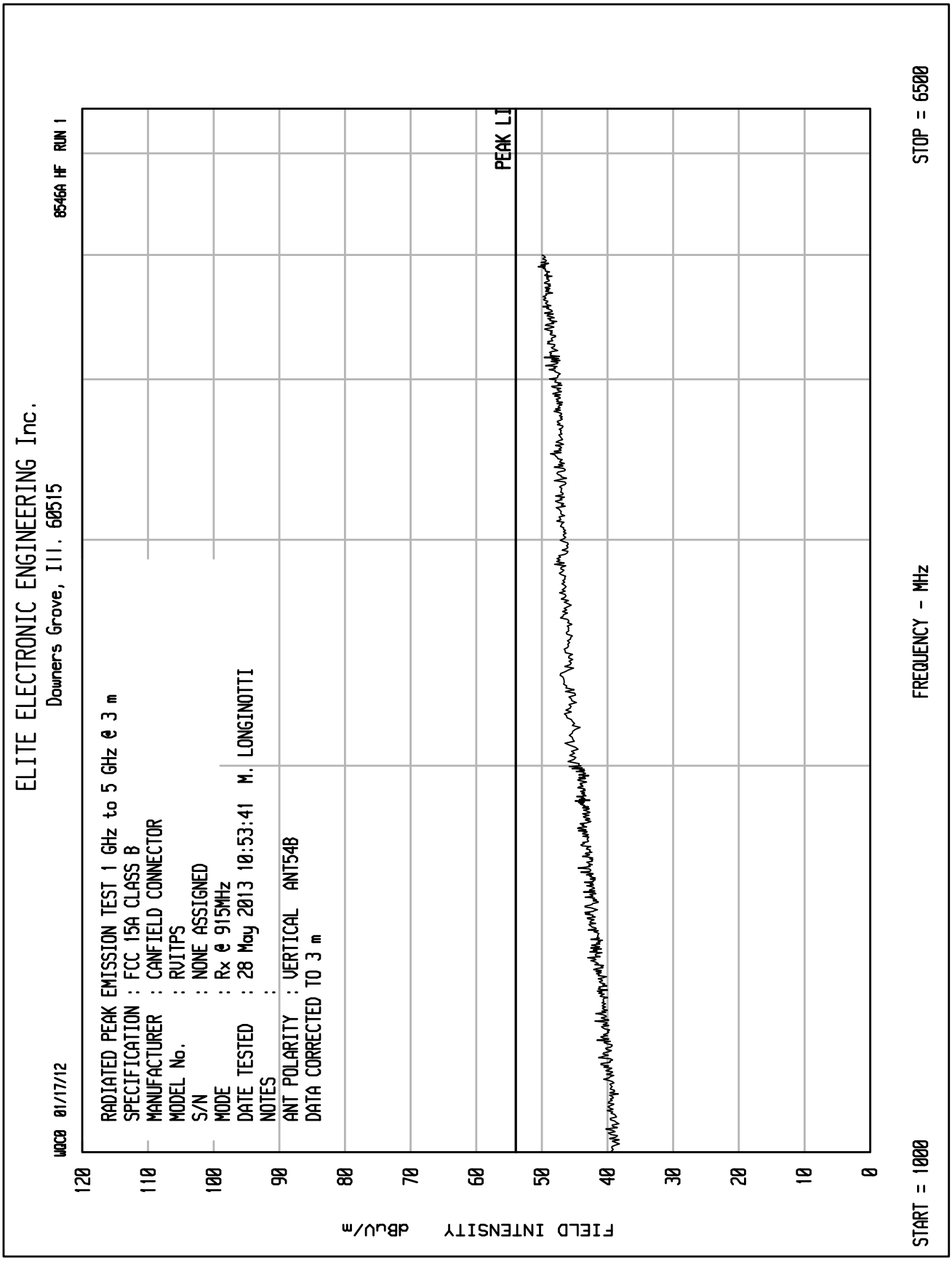


Test Setup for Radiated Emissions, 1GHz to 5GHz – Vertical Polarization


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
8546A RE RUN 1
W080 08/07/12
PRELIMINARY PEAK RADIATED EMISSION TEST @ 3 METERS
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : CANFIELD CONNECTOR
MODEL No. : RVITPS
S/N : NONE ASSIGNED
MODE : Rx @ 915MHz
DATE TESTED : 28 May 2013 10:06:45 M. LONGINOTTI
NOTES :
ANT POLARITY : VERTICAL
DATA CORRECTED TO 3 m
VERTICAL
LIMIT
FIELD INTENSITY dBuV/m
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
dB ___ of ____
START = 30
100
FREQUENCY - MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
8546A RE RUN 1
W080 08/07/12
PRELIMINARY PEAK RADIATED EMISSION TEST @ 3 METERS
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : CANFIELD CONNECTOR
MODEL No. : RVITPS
S/N : NONE ASSIGNED
MODE : Rx @ 915MHz
DATE TESTED : 28 May 2013 10:06:45 M. LONGINOTTI
NOTES :
ANT POLARITY : HORIZONTAL
DATA CORRECTED TO 3 m
HORIZONTAL
LIMIT
FIELD INTENSITY dBuV/m
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
---- of ---- dB
START = 30
100
FREQUENCY - MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WOCO 01/17/12
8546A HF RUN 1
RADIATED PEAK EMISSION TEST 1 GHz to 5 GHz @ 3 m
SPECIFICATION : FCC 15A CLASS B
MANUFACTURER : CANFIELD CONNECTOR
MODEL No. : RVITPS
S/N : NONE ASSIGNED
MODE : Rx @ 915MHz
DATE TESTED : 28 May 2013 10:53:41 M. LONGINOTTI
NOTES :
ANT POLARITY : HORIZONTAL ANT54B
DATA CORRECTED TO 3 m
PEAK LI
FIELD INTENSITY dBuV/m
120
110
100
90
80
70
60
50
40
30
20
10
0
START = 1000
FREQUENCY - MHz
STOP = 6500


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WQCD 01/17/12
8546A HF RUN 1
RADIATED PEAK EMISSION TEST 1 GHz to 5 GHz @ 3 m
SPECIFICATION : FCC 15A CLASS B
MANUFACTURER : CANFIELD CONNECTOR
MODEL No. : RVITPS
S/N : NONE ASSIGNED
MODE : Rx @ 915MHz
DATE TESTED : 28 May 2013 10:53:41 M. LONGINOTTI
NOTES :
ANT POLARITY : VERTICAL ANT54B
DATA CORRECTED TO 3 m
PEAK LI
FIELD INTENSITY dBuV/m
120
110
100
90
80
70
60
50
40
30
20
10
0
START = 1000
FREQUENCY - MHz
STOP = 6500

ETR No. 8546A
DATA SHEET TEST NO. 1

RADIATED QP EMISSION MEASUREMENTS in a 3 m SEMI-ANECHOIC ROOM
SPECIFICATION : FCC 15B CLASS B
MANUFACTURER : CANFIELD CONNECTOR
MODEL NO. : RVITPS
SERIAL NO. : NONE ASSIGNED
TEST MODE : Rx @ 915MHz
NOTES :
TEST DATE : 28 May 2013 10:06:45
TEST DISTANCE : 3 m (DATA EXTRAPOLATED TO 3 m)

FREQUENCY	QP READING	ANT FAC	CBL FAC	EXT ATTN	DIST FAC	TOTAL	QP LIMIT	AZ	ANT HT	POLAR
MHz	dBuV	dB	dB	dB	dB	dBuV/m	dBuV/m	deg	cm	
32.43	-8.1	17.1	.5	0.0	0.0	9.5	40.0	135	120	V
54.89	.9	6.5	.5	0.0	0.0	7.9	40.0	135	340	V
84.07	.5	8.1	.5	0.0	0.0	9.1	40.0	315	340	V
115.50	.4	11.6	.6	0.0	0.0	12.7	43.5	90	340	V
133.26	.5	11.4	.7	0.0	0.0	12.6	43.5	45	340	V
158.40	.6	10.1	.8	0.0	0.0	11.5	43.5	0	120	V
172.63	.5	9.6	.9	0.0	0.0	10.9	43.5	225	120	V
216.61	.7	9.4	1.0	0.0	0.0	11.1	46.0	270	120	V
363.74	.7	14.8	1.3	0.0	0.0	16.8	46.0	315	340	V
452.65	.8	16.8	1.5	0.0	0.0	19.1	46.0	-0	120	H
568.90	-7.3	18.5	1.5	0.0	0.0	12.7	46.0	45	120	V
634.31	1.2	18.4	1.6	0.0	0.0	21.2	46.0	180	340	H
789.02	1.5	20.1	2.0	0.0	0.0	23.6	46.0	0	340	H
900.89	1.9	21.0	2.0	0.0	0.0	24.9	46.0	270	200	V
918.05	1.9	20.9	2.0	0.0	0.0	24.8	46.0	225	340	V

tested by: MARK E. LONGINOTTI
M. LONGINOTTI

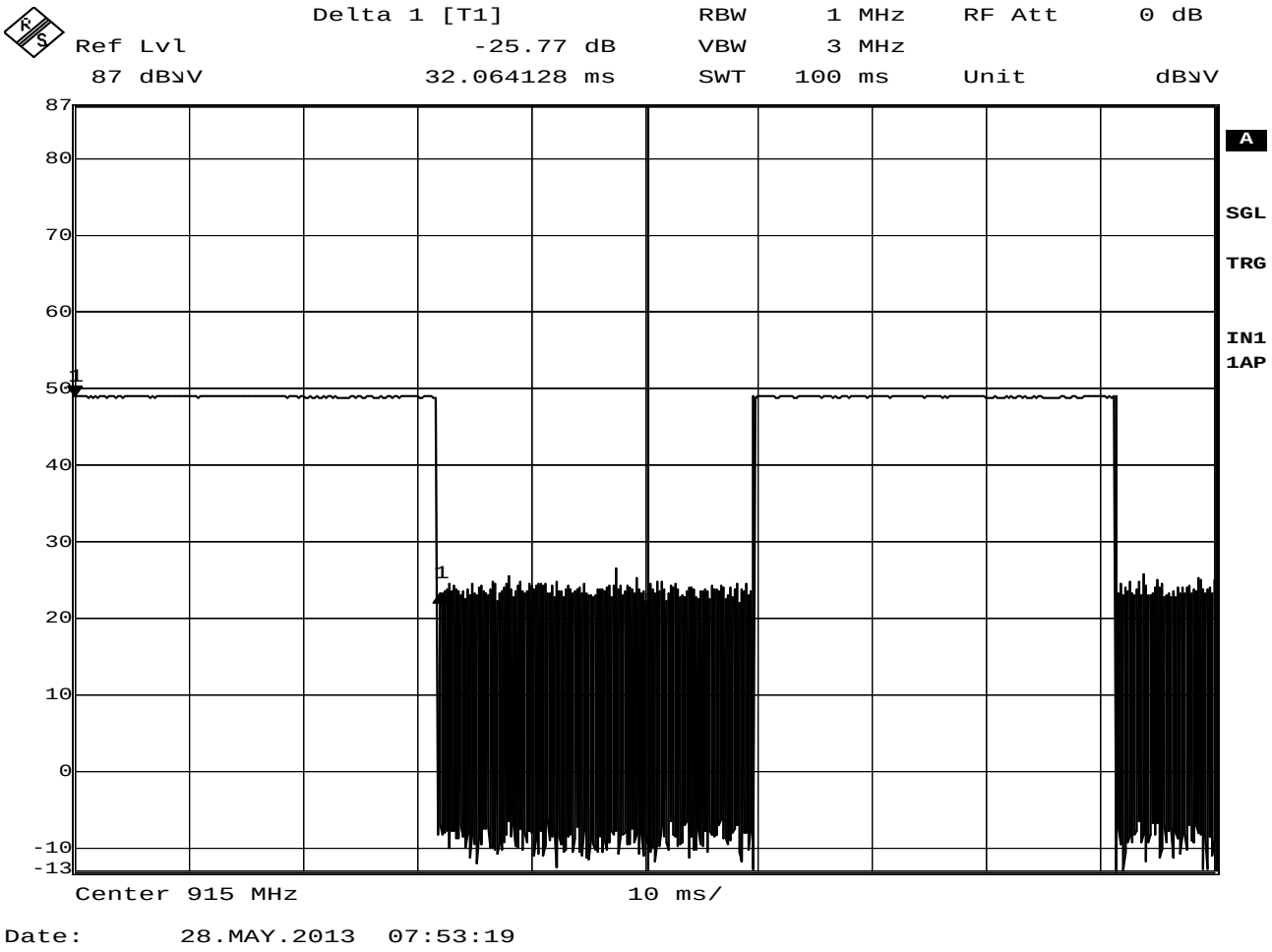
DATA SHEET HF TEST NO. 1

RADIATED AVG EMISSION MEASUREMENTS >=1000 MHz in a 3 m ANECHOIC ROOM

SPECIFICATION : FCC 15A CLASS B
MANUFACTURER : CANFIELD CONNECTOR
MODEL NO. : RVITPS
SERIAL NO. : NONE ASSIGNED
TEST MODE : Rx @ 915MHz
NOTES :
TEST DATE : 28 May 2013 10:53:41
TEST DISTANCE : 3 m
ANTENNA : ANT54B

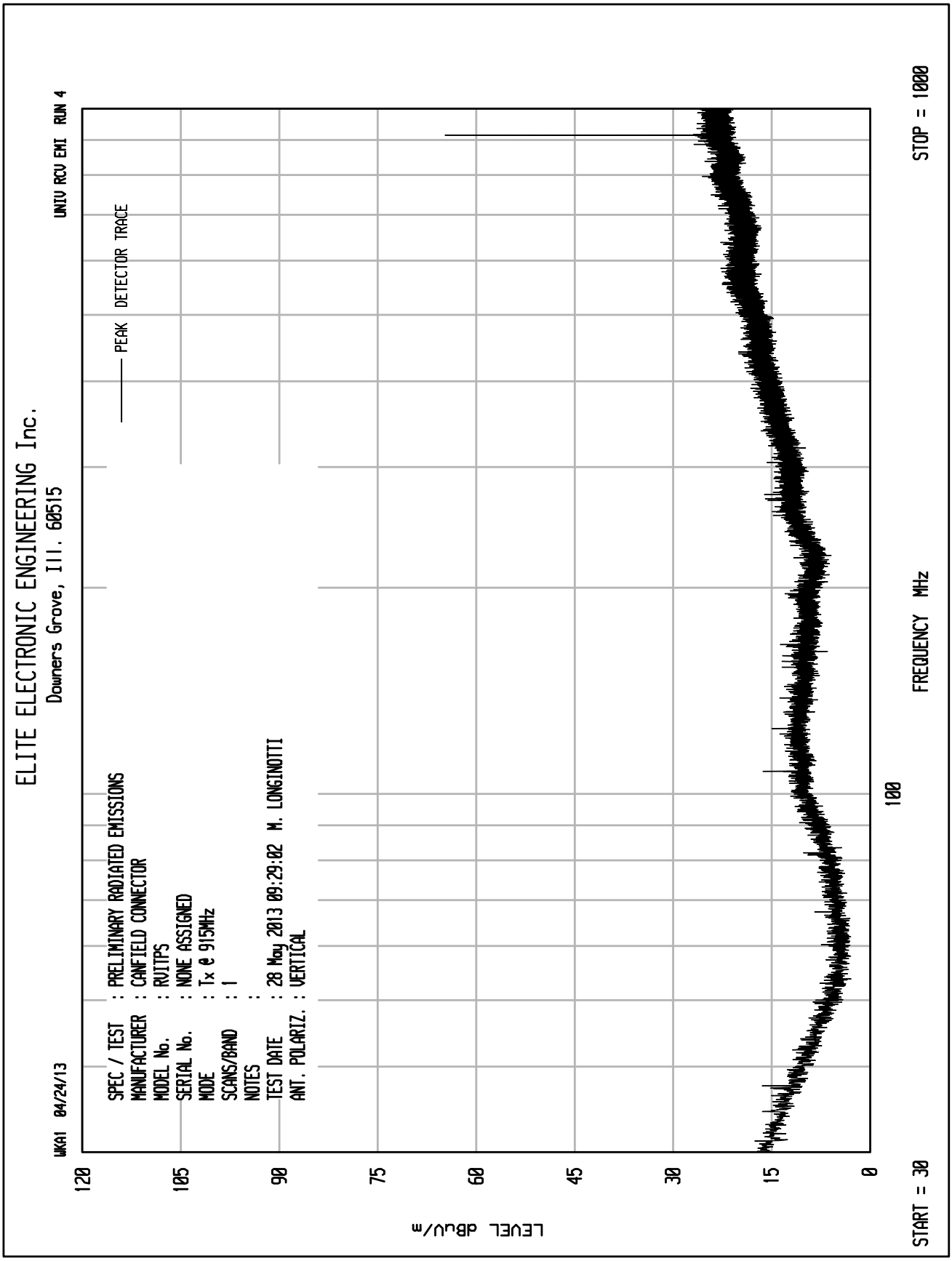
FREQUENCY MHz	AVG READING dBuV	ANT FAC dB	CBL FAC dB	DIST FAC dB	TOTAL dBuV/m	AVG LIMIT dBuV/m	PASS/ FAIL	AZ deg	ANT HT cm	POLAR
1260.88	-4.0	28.8	2.3	0.0	27.2	54.0		0	340	V
1349.89	-4.1	29.2	2.4	0.0	27.6	54.0		225	340	H
1517.09	-4.0	29.9	2.6	0.0	28.5	54.0		45	200	H
1675.94	-4.0	30.5	2.7	0.0	29.2	54.0		180	340	V
1767.11	-3.4	30.8	2.8	0.0	30.2	54.0		90	200	H
1900.21	-4.0	31.2	2.9	0.0	30.1	54.0		0	340	H
2201.85	-3.3	31.8	3.2	0.0	31.7	54.0		135	120	V
2346.85	-2.5	31.9	3.4	0.0	32.8	54.0		45	200	H
2829.97	-3.6	32.5	3.8	0.0	32.6	54.0		45	340	H
3252.49	-4.3	32.9	4.1	0.0	32.7	54.0		315	340	H
3495.53	-4.3	33.2	4.2	0.0	33.2	54.0		180	120	V
4149.43	-5.0	33.9	4.6	0.0	33.5	54.0		45	200	V
4577.52	-4.5	34.6	4.8	0.0	34.9	54.0		315	200	V
4772.27	-4.6	34.8	4.9	0.0	35.1	54.0		0	340	H

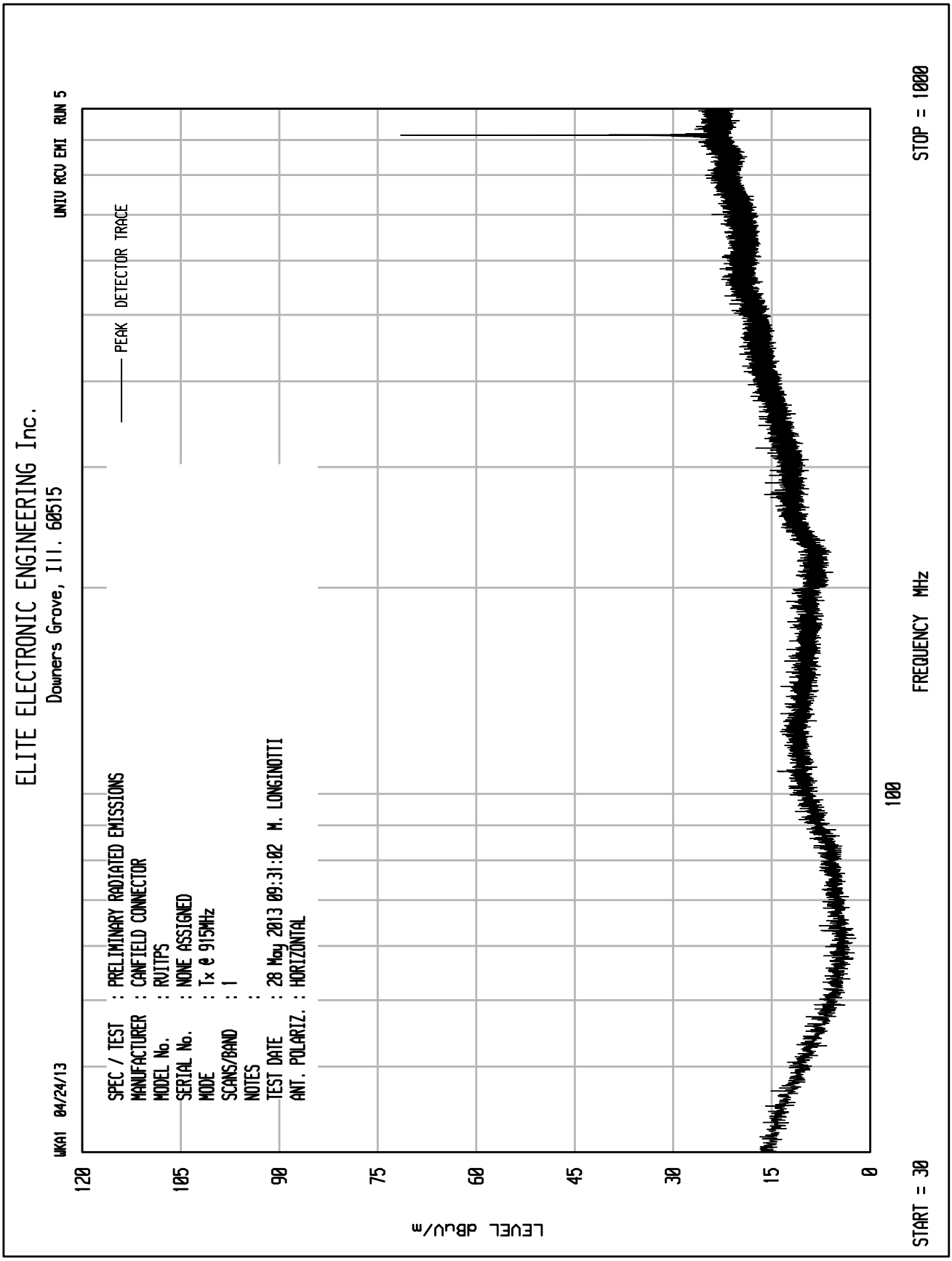
tested by: MARK E. LONGINOTTI
M. LONGINOTTI

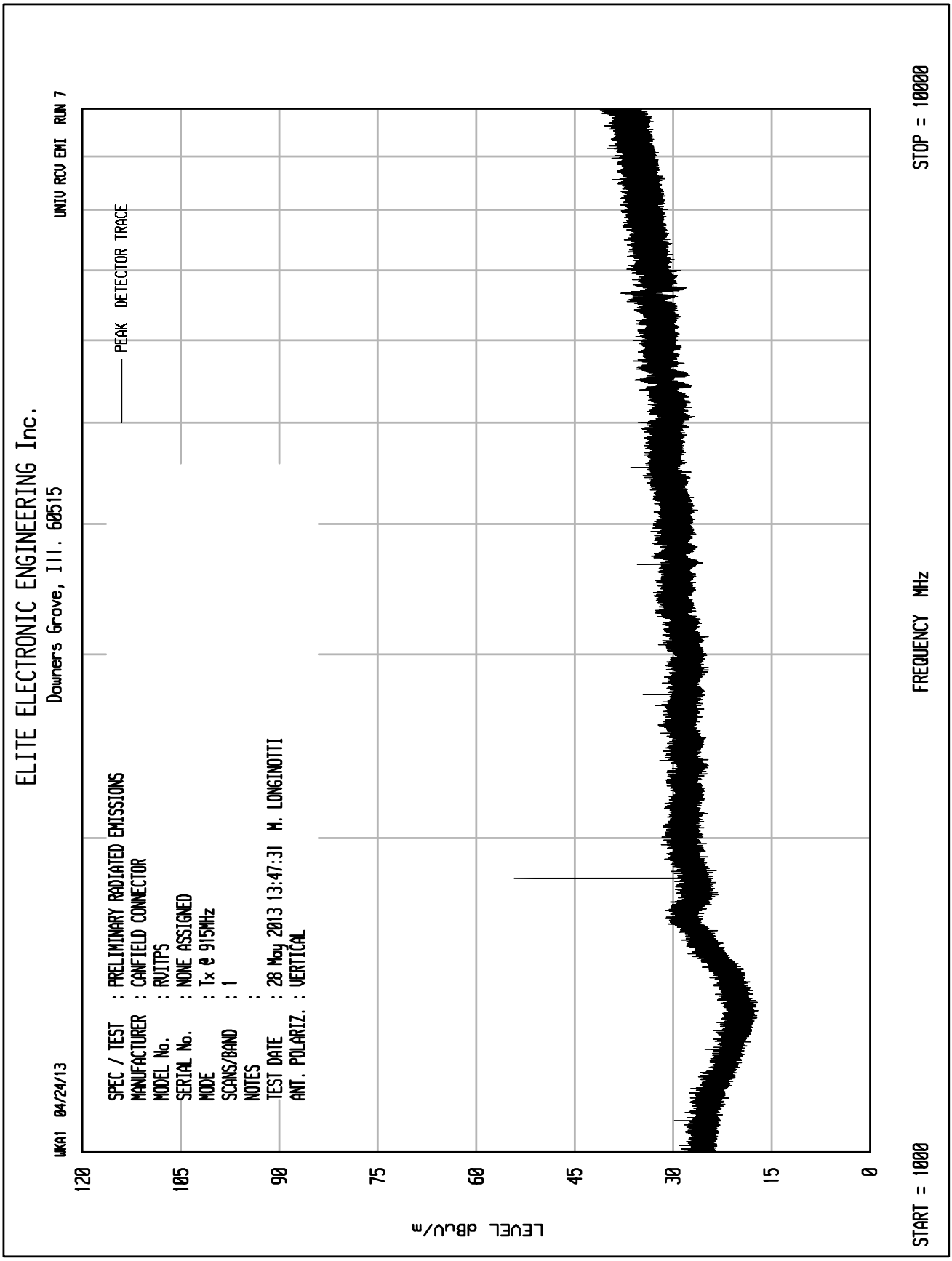


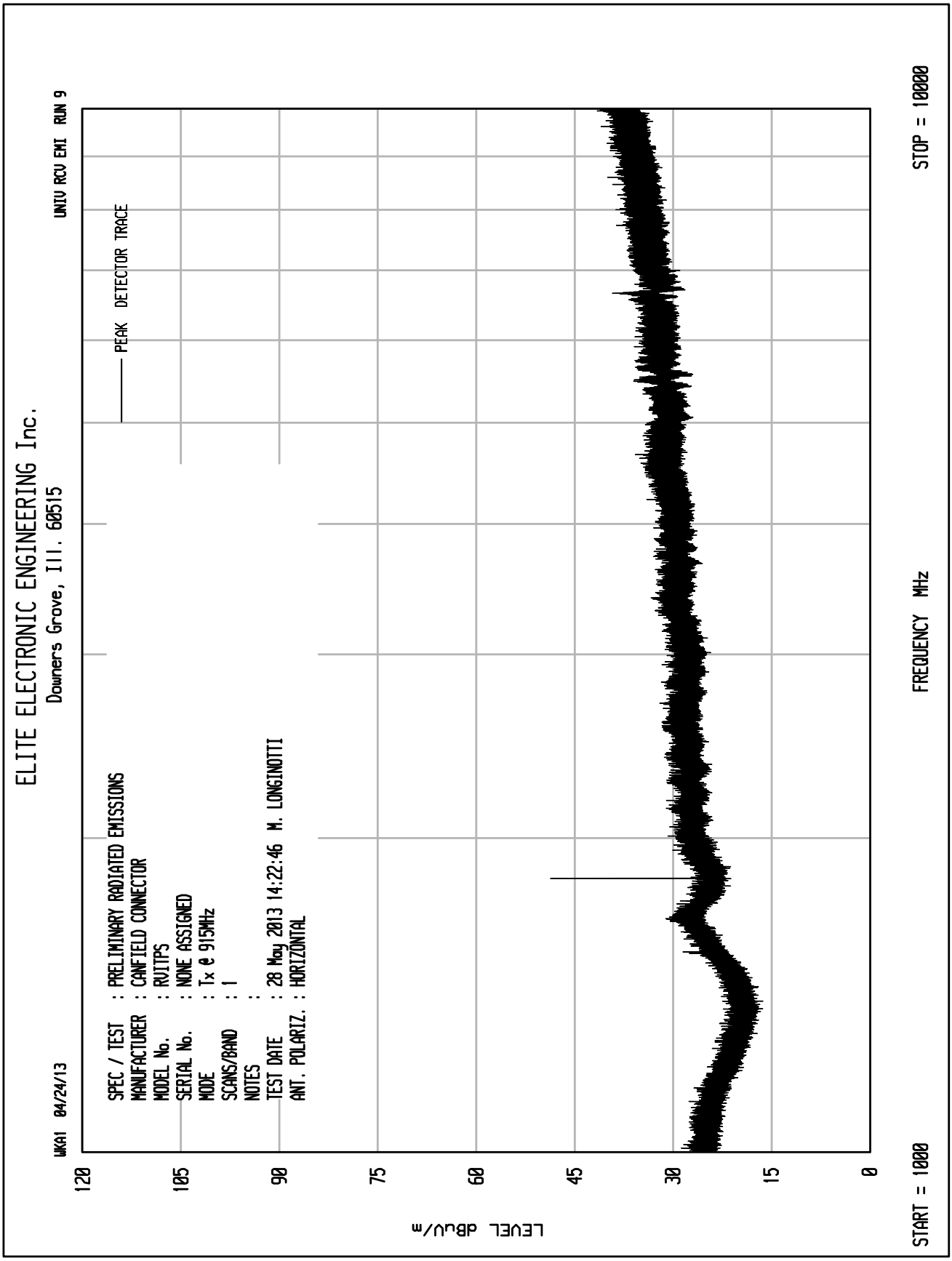
15.231 Duty Cycle

MANUFACTURER	:	Canfield Connector
MODEL NUMBER	:	RVITPS
SERIAL NUMBER	:	None Assigned
TEST MODE	:	Tx @ 915MHz
TEST DATE	:	May 28, 2013
TEST PARAMETERS	:	Pulse width = 32.06msec, 2 pulses in a 100msec period
	:	On time in 100msec = 32.06msec per pulse x 2 pulses = 64.12msec
	:	Duty Cycle = 20 x log(On time in 100msec/100msec)
	:	Duty Cycle = 20 x log (64.12msec/100msec) = -3.8dB
EQUIPMENT USED	:	RBA0, NTA3


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 4
WKA1 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CANFIELD CONNECTOR
MODEL No. : RVITPS
SERIAL No. : NONE ASSIGNED
MODE : Tx @ 915MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 28 May 2013 09:29:02 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 5
WKA1 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CANFIELD CONNECTOR
MODEL No. : RVITPS
SERIAL No. : NONE ASSIGNED
MODE : Tx @ 915MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 28 May 2013 09:31:02 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 7
WKA1 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CANFIELD CONNECTOR
MODEL No. : RVITPS
SERIAL No. : NONE ASSIGNED
MODE : Tx @ 915MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 28 May 2013 13:47:31 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 9
WKA1 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CANFIELD CONNECTOR
MODEL No. : RVITPS
SERIAL No. : NONE ASSIGNED
MODE : Tx @ 915MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 28 May 2013 14:22:46 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000

MANUFACTURER : Canfield Connector
EUT : Transceiver
MODEL NUMBER : RVITPS
SERIAL NUMBER : None Assigned
TEST MODE : Transmit at 915MHz
TEST DATE : May 28, 2013
TEST PARAMETERS : FCC "Code of Federal Regulations Title 47", Part 15, Subpart C, Section 15.249(a) Radiated Emissions
Industry Canada Radio Standards Specification RSS-210 Annex 2, section A2.9 Radiated Emissions
TEST EQUIPMENT : RBA0, APW3, XPQ2, NTA3, NWQ1
NOTES : Quasi-Peak Detector Used Below 1GHz
: Peak Detector Used Above 1GHz

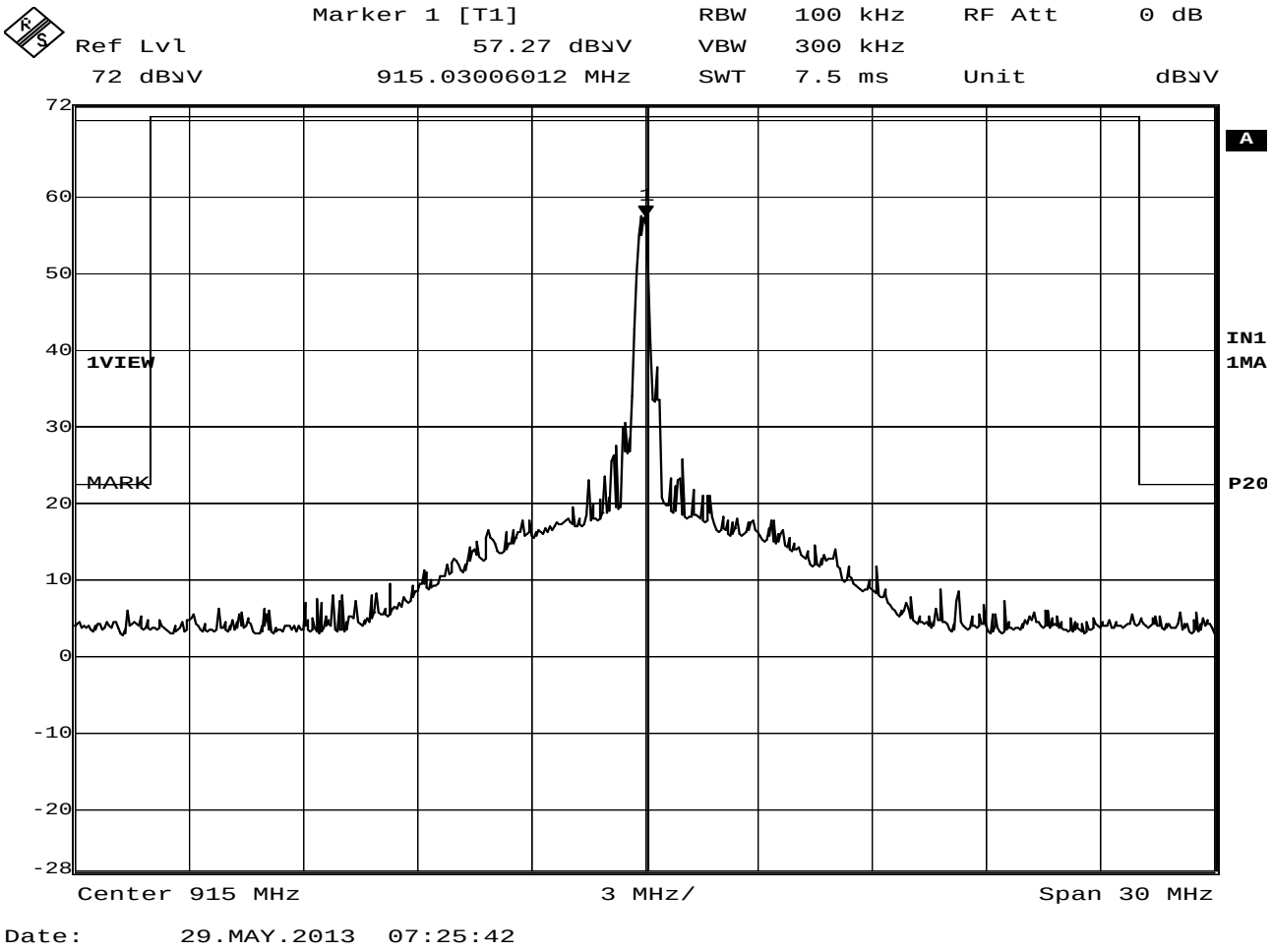
Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	QP/Peak Total dBuV/m at 3m	QP/Peak Total uV/m at 3 m	QP/Peak Limit uV/m at 3 m	Margin (dB)
914.950	H	58.2		2.1	20.7	0.0	81.0	11162.7	50000.0	-13.0
914.950	V	47.1		2.1	20.7	0.0	69.9	3110.1	50000.0	-24.1
1829.900	H	63.4		2.9	30.8	-40.6	56.5	671.7	5000.0	-17.4
1829.900	V	57.0		2.9	30.8	-40.6	50.1	321.5	5000.0	-23.8
2744.850	H	48.3	Ambient	3.7	32.8	-40.3	44.4	166.3	5000.0	-29.6
2744.850	V	48.3	Ambient	3.7	32.8	-40.3	44.4	166.3	5000.0	-29.6
3659.800	H	53.3		4.3	33.5	-40.1	51.0	354.4	5000.0	-23.0
3659.800	V	48.0	Ambient	4.3	33.5	-40.1	45.7	192.6	5000.0	-28.3
4574.750	H	47.4	Ambient	4.7	34.5	-40.0	46.7	216.0	5000.0	-27.3
4574.750	V	47.2	Ambient	4.7	34.5	-40.0	46.5	211.1	5000.0	-27.5
5489.700	H	48.1	Ambient	5.2	34.9	-40.1	48.1	253.0	5000.0	-25.9
5489.700	V	48.5	Ambient	5.2	34.9	-40.1	48.5	264.9	5000.0	-25.5
6404.650	H	45.9	Ambient	5.7	35.9	-39.9	47.6	240.2	5000.0	-26.4
6404.650	V	46.7	Ambient	5.7	35.9	-39.9	48.4	263.4	5000.0	-25.6
7319.600	H	47.6	Ambient	6.2	35.6	-39.8	49.7	304.0	5000.0	-24.3
7319.600	V	46.3	Ambient	6.2	35.6	-39.8	48.4	261.7	5000.0	-25.6
8234.550	H	46.8	Ambient	6.5	35.9	-39.5	49.7	306.7	5000.0	-24.2
8234.550	V	47.2	Ambient	6.5	35.9	-39.5	50.1	321.1	5000.0	-23.8
9149.500	H	47.3	Ambient	6.6	36.2	-39.0	51.0	356.3	5000.0	-22.9
9149.500	V	47.5	Ambient	6.6	36.2	-39.0	51.2	364.6	5000.0	-22.7

Total (dBuV/m) = Meter Reading (dBuV) + Cbl Fac (dB) + Ant Fac (dB) + Pre Amp Gain (dB)

MANUFACTURER : Canfield Connector
EUT : Transceiver
MODEL NUMBER : RVITPS
SERIAL NUMBER : None Assigned
TEST MODE : Transmit at 915MHz
TEST DATE : May 28, 2013
TEST PARAMETERS : FCC "Code of Federal Regulations Title 47", Part 15, Subpart C, Section 15.249(a) Radiated Emissions
Industry Canada Radio Standards Specification RSS-210 Annex 2, section A2.9 Radiated Emissions
TEST EQUIPMENT : RBA0, APW3, XPQ2, NTA3, NWQ1
NOTES : Average Readings

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dBuV/m at 3m	Average Total uV/m at 3 m	Average Limit uV/m at 3 m	Margin (dB)
1829.90	H	63.4		2.9	30.8	-40.6	-3.8	52.7	433.7	500.0	-1.2
1829.90	V	57		2.9	30.8	-40.6	-3.8	46.3	207.6	500.0	-7.6
2744.85	H	48.3		3.7	32.8	-40.3	-3.8	40.6	107.4	500.0	-13.4
2744.85	V	48.3		3.7	32.8	-40.3	-3.8	40.6	107.4	500.0	-13.4
3659.80	H	53.3		4.3	33.5	-40.1	-3.8	47.2	228.8	500.0	-6.8
3659.80	V	48		4.3	33.5	-40.1	-3.8	41.9	124.3	500.0	-12.1
4574.75	H	47.4		4.7	34.5	-40.0	-3.8	42.9	139.5	500.0	-11.1
4574.75	V	47.2		4.7	34.5	-40.0	-3.8	42.7	136.3	500.0	-11.3
5489.70	H	48.1		5.2	34.9	-40.1	-3.8	44.3	163.3	500.0	-9.7
5489.70	V	48.5		5.2	34.9	-40.1	-3.8	44.7	171.0	500.0	-9.3
6404.65	H	45.9		5.7	35.9	-39.9	-3.8	43.8	155.1	500.0	-10.2
6404.65	V	46.7		5.7	35.9	-39.9	-3.8	44.6	170.1	500.0	-9.4
7319.60	H	47.6		6.2	35.6	-39.8	-3.8	45.9	196.3	500.0	-8.1
7319.60	V	46.3		6.2	35.6	-39.8	-3.8	44.6	169.0	500.0	-9.4
8234.55	H	46.8		6.5	35.9	-39.5	-3.8	45.9	198.0	500.0	-8.0
8234.55	V	47.2		6.5	35.9	-39.5	-3.8	46.3	207.3	500.0	-7.6
9149.50	H	47.3		6.6	36.2	-39.0	-3.8	47.2	230.1	500.0	-6.7
9149.50	V	47.5		6.6	36.2	-39.0	-3.8	47.4	235.4	500.0	-6.5

Total (dBuV/m) = Meter Reading (dBuV) + Cbl Fac (dB) + Ant Fac (dB) + Pre Amp Gain (dB) + Duty Cycle(dB)



15.249(d) Occupied Bandwidth

MANUFACTURER	:	Canfield Connector
MODEL NUMBER	:	RVITPS
SERIAL NUMBER	:	None Assigned
TEST MODE	:	Tx @ 915MHz
TEST DATE	:	May 28, 2013
TEST PARAMETERS	:	The trace represents the maximum radiated emissions of 81dBuV/m at 3 meters from the EUT. The display lines represent the 50mV/m (94dBuV/m) limit in the 902MHz to 928MHz range and the general limits (46dBuV/m) outside of that band.
EQUIPMENT USED	:	RBA0, NTA3