Measurement of RF Emissions from an Event Tag Transmitter, Model Numbers: 3520 and 3522

For	Versus Technology, Inc. 2600 Miller Creek Road Traverse City, MI 49684
P.O. Number	VTI-2014-272
Date Tested	May 7, 2014, May 8, 2014, and February 17, 2015
Test Personnel	Mark E. Longinotti
Test Specification	FCC "Code of Federal Regulations" Title 47 Part15, Subpart C Industry Canada RSS-GEN Industry Canada RSS-210

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EMC Engineer

Requested By: Robert Wiser
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Engineer of Illinois - 44894

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REVISION HISTORY

Revision	Date	Description
—	18 February 2015	Initial release

Measurement of RF Emissions from an Event Tag Transmitter, Model Nos. 3520 and 3522

1. INTRODUCTION

1.1. Scope of Tests

This report presents the results of the RF emissions measurements performed on an Event Tag, Model Nos. 3520 and 3522, Serial No. None Assigned, (hereinafter referred to as the Equipment Under Test (EUT)). The EUT was designed to transmit at approximately 433.9 MHz using an integral antenna. The EUT was manufactured and submitted for testing by Versus Technology, Inc. located in Traverse City, MI.

1.2. Purpose

The test series was performed to determine if the EUT meets the conducted and radiated RF emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Section15.231 for Intentional Radiators.

The test series was also performed to determine if the EUT meets the technical requirements of the Industry Canada Radio Standards Specification, RSS-Gen, and RSS-210 Annex 1, for transmitters.

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

1.3. Deviations, Additions and Exclusions

There were no deviations, additions to, or exclusions from the test specification during this test series.

1.4. EMC Laboratory Identification

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

1.5. Laboratory Conditions

The temperature at the time of the test was 26^{o}C and the relative humidity was 41%.

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 2013
- 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, “License-exempt Radio Apparatus (All Frequency Bands): Category I Equipment”, RSS-210, Issue 8, December 2010
- Industry Canada, “General Requirements and Information for the Certification of Radio Apparatus”, RSS-Gen, Issue 4, November 2014

3. EUT Setup and Operation

3.1. General Description

The EUT is an Event Tag Transmitter, Model Nos. 3520 and 3522. A block diagram of the EUT is shown in Figure 1.

3.1.1. Power Input

The Model No. 3520 EUT was powered with 3.6VDC from a single 3.6V lithium thionyl chloride battery.

The Model No. 3522 EUT was powered with 3.6VDC from two (2) each 3.6V lithium thionyl chloride batteries.

3.1.2. Peripheral Equipment

There was no peripheral equipment submitted with the EUT.

3.1.3. Signal Input/Output Leads

There were no signal leads submitted with the EUT.

3.1.4. Grounding

The EUT was not grounded.

3.2. Software

The EUT ran using firmware version VTI452011_RF_20_ET_0_A.hex 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 programmed so that once a battery was inserted it would continuously transmit at 433.92MHz.

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:

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

5. TEST PROCEDURES

5.1. Timing Measurements

5.1.1. Requirements

Per 15.231(a)(2), a transmitter activated automatically shall cease transmission within 5 seconds after activation.

5.1.2. Procedures

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

5.1.3. Results

Per Versus Technology, there are two ways that the Event Tag can be activated to send an RF transmission. The first is by detecting the presence of an object in front of the Event Tag detection window. The second type of RF transmission occurs when a contact closure occurs.

The plot of the timing measurements are shown on page 18. As can be seen from the data, the EUT meets the requirements for automatically activated transmitters.

5.2. Duty Cycle Factor Measurements

5.2.1. Procedures

The duty cycle factor is used to convert peak detected readings to average readings. This factor is computed from the time domain trace of the pulse modulation signal.

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

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

b) The pulse width is measured and a plot of this measurement is recorded.

c) Next the number of pulses in the word period is measured and a plot is recorded.

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

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

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

5.2.2. Results

Representative plots of the duty cycle are shown on pages 19 and 20. Since the EUT uses a rolling code, the duty cycle correction factor used was calculated based on the maximum case. The following maximum case information was supplied by Versus Technology, Inc.:

An encoded transmission consists of defined train of Forty-four 206uSec pulses.

The encoding of the logical 1's and 0's is determined by the space (off time) between the pulses.
The off time of approximately 1.04mSec determines the logical "0" (zero).
The off time of approximately 1.61mSec determines the logical "1" (one).
The pulse train consists of:

1. Four Preamble pulses separated by approximately 1.04mSec off time
2. An 'off' time of approximately 6.2mSec.
3. Forty-Two pulses separated by 'off' time of either 1.04mSec or 1.61mS.

If all forty-two encoding pulses are separated by 1.04mS, then the maximum value of the emission is calculated as follows:

Pulse on time:

1. Total on time 46 x 0.206mS 9.48 mS

Pulse word period:

1. Preamble on time 4 x .206mS 0.824 mS
2. Preamble off time 3 x 1.04mS 3.12 mS
3. Preamble space time 6.20mS 6.20 mS
4. Encoded pulses 42 x 0.206mS 8.652 mS
5. Encoded off time 41 x 1.04mS 42.64 mS

TOTAL pulse word period: 61.44 mS

Duty cycle factor (maximum time on) is:

1. Duty cycle: (9.48mS / 61.44mS) = 0.154
2. Duty cycle factor: 20 * log (0.16) = -16.2dB

With the EUT transmitting at 433.9MHz, the worst case (highest emissions) duty cycle correction factor was calculated to be -16.2dB.

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 15.231 for automatically activated transmitters.

Paragraph 15.231(b) has the following radiated emission limits:

Fundamental Frequency MHz	Field Intensity uV/m @ 3 meters	Field Strength Harmonics and Spurious @ 3 meters
260 to 470	3750 to 12500*	375 to 1250*

* - Linear Interpolation

For 433.9MHz, the limit at the fundamental is 10995.8uV/m @ 3m and the limit on the harmonics is 1099.6uV/m @ 3m.

In addition, emissions appearing in the Restricted Bands of Operation listed in paragraph 15.205(a) shall not exceed the general requirements shown in paragraph 15.209.

5.3.2.Procedures

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 5.0GHz was investigated using a peak detector function. The data was then processed by the computer to calculate equivalent field intensity.

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.

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]

5.3.3.Results

The preliminary plots with EUTs transmitting at 433.9 MHz are presented on data pages 21 through 28. The plots are presented for a reference only, and are not used to determine compliance.

The final data EUTs transmitting at 433.9 MHz are show on data pages 29 and 30. As can be seen from the data, all emissions measured from the EUTs 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 through Figure 6.

5.4. Occupied Bandwidth Measurements

5.4.1.Requirement

In accordance with paragraph 15.231(c), all emissions within 20dB of the peak amplitude level of the center frequency are required to be within a band less than 0.25% of the center frequency wide.

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 frequency spectrum near the fundamental was plotted.

5.4.3.Results

The plots of the emissions near the fundamental frequency are presented on data pages 31 and 32. As can be seen from this data page, the EUTs meet the occupied bandwidth requirements. The 99% bandwidth was measured to be 91.4 kHz.

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 Versus Technology, Inc. upon completion of the tests.

7. CONCLUSIONS

It was determined that the Versus Technology, Inc. Event Tag, Model Nos. 3520 and 3522, Serial No. None Assigned, did fully meet the technical requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Section 231 for Intentional Radiators, when tested per ANSI C63.4-2009.

It was determined that the Versus Technology, Inc. Event Tag, Model Nos. 3520 and 3522, Serial No. None Assigned, did fully meet the technical requirements of the Industry Canada Radio Standards Specification, RSS-Gen, and RSS-210 Annex 1, 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
CDX8	COMPUTER	ELITE	WORKSTATION			N/A	
CDY0	WORKSTATION	ELITE	WORKSTATION		WINDOWS 7	N/A	
NTA2	BILOG ANTENNA	TESEQ	6112D	28040	25-1000MHz	10/10/2014	10/10/2015
NTA3	BILOG ANTENNA	TESEQ	6112D	32853	25-1000MHz	2/19/2014	2/19/2015
NWQ0	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS LINDGREN	3117	66657	1GHZ-18GHZ	3/11/2014	3/11/2015
NWQ2	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS LINDGREN	3117	66659	1GHZ-18GHZ	3/20/2014	3/20/2015
RBA0	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESIB26	100145	20HZ-26.5GHZ	3/7/2014	3/7/2015
RBB0	EMI TEST RECEIVER 20HZ TO 40 GHZ.	ROHDE & SCHWARZ	ESIB40	100250	20 HZ TO 40GHZ	3/11/2014	3/11/2015

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.

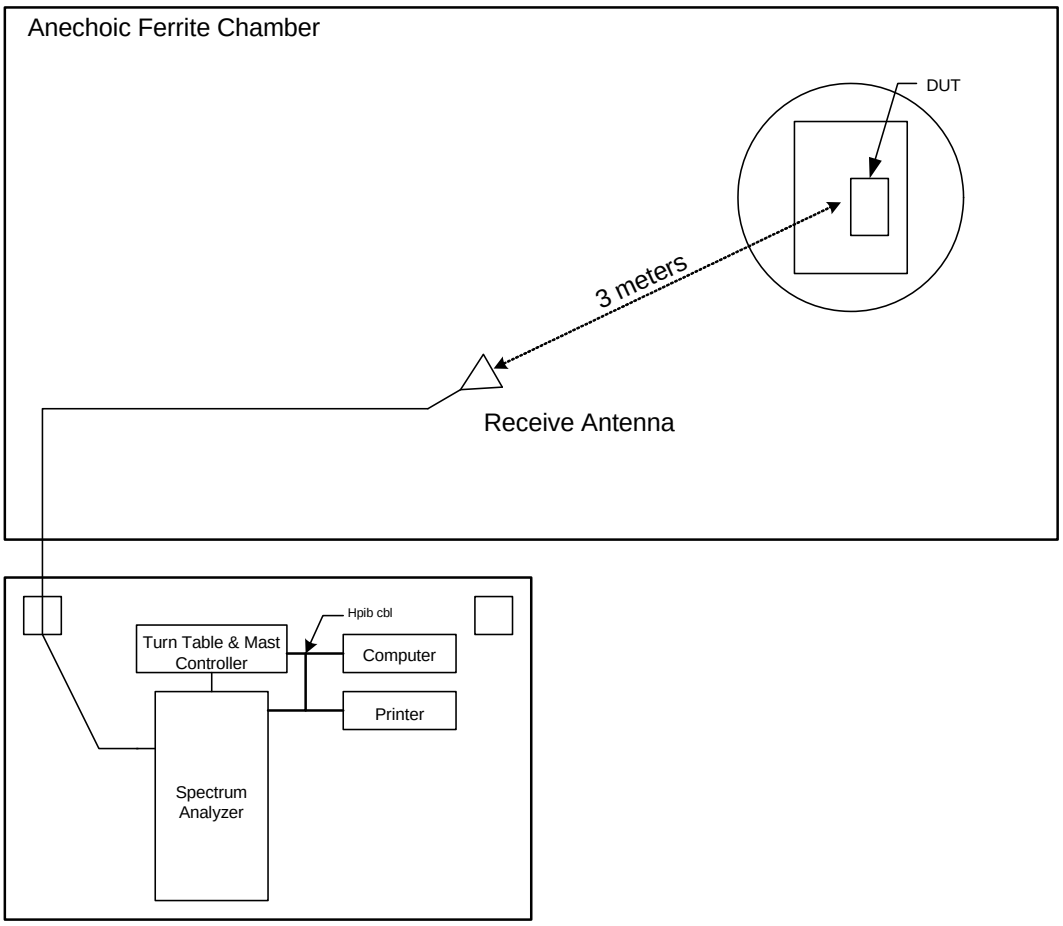


FIGURE 1 BLOCKDIAGRAM OF TEST SETUP

Figure 2

Test Setup for Radiated Emissions, 3520

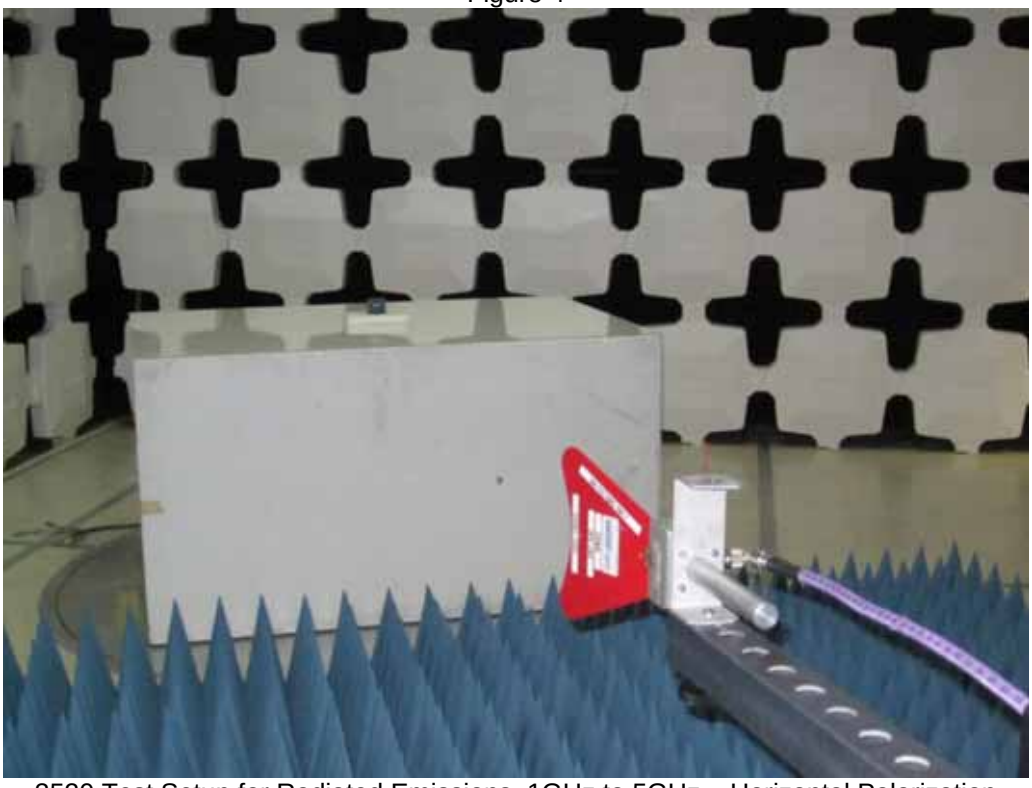
Test Setup for Radiated Emissions, 3522

Figure 3

3520 Test Setup for Radiated Emissions, 30MHz to 1GHz – Horizontal Polarization

3520 Test Setup for Radiated Emissions, 30MHz to 1GHz – Vertical Polarization

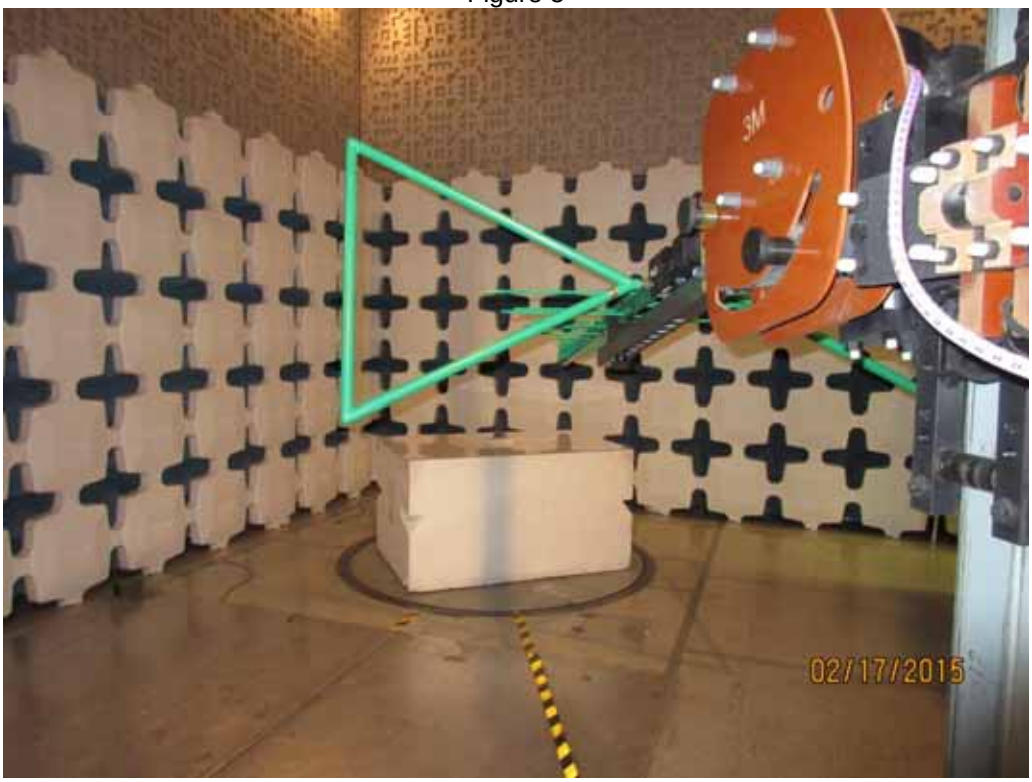
Figure 4



3520 Test Setup for Radiated Emissions, 1GHz to 5GHz – Horizontal Polarization

3520 Test Setup for Radiated Emissions, 1GHz to 5GHz – Vertical Polarization

Figure 5



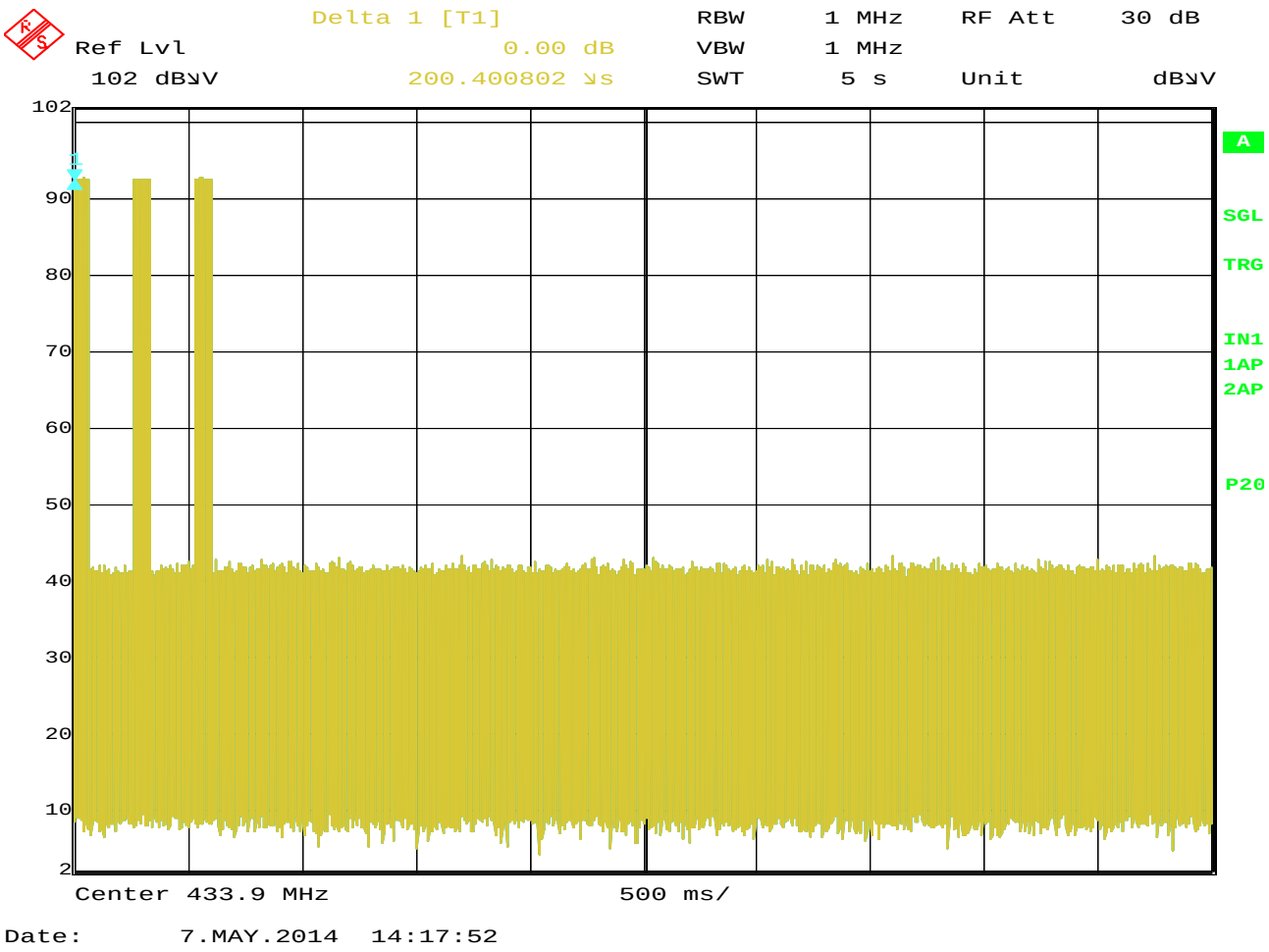
3522 Test Setup for Radiated Emissions, 30MHz to 1GHz – Horizontal Polarization

3522 Test Setup for Radiated Emissions, 30MHz to 1GHz – Vertical Polarization

Figure 6

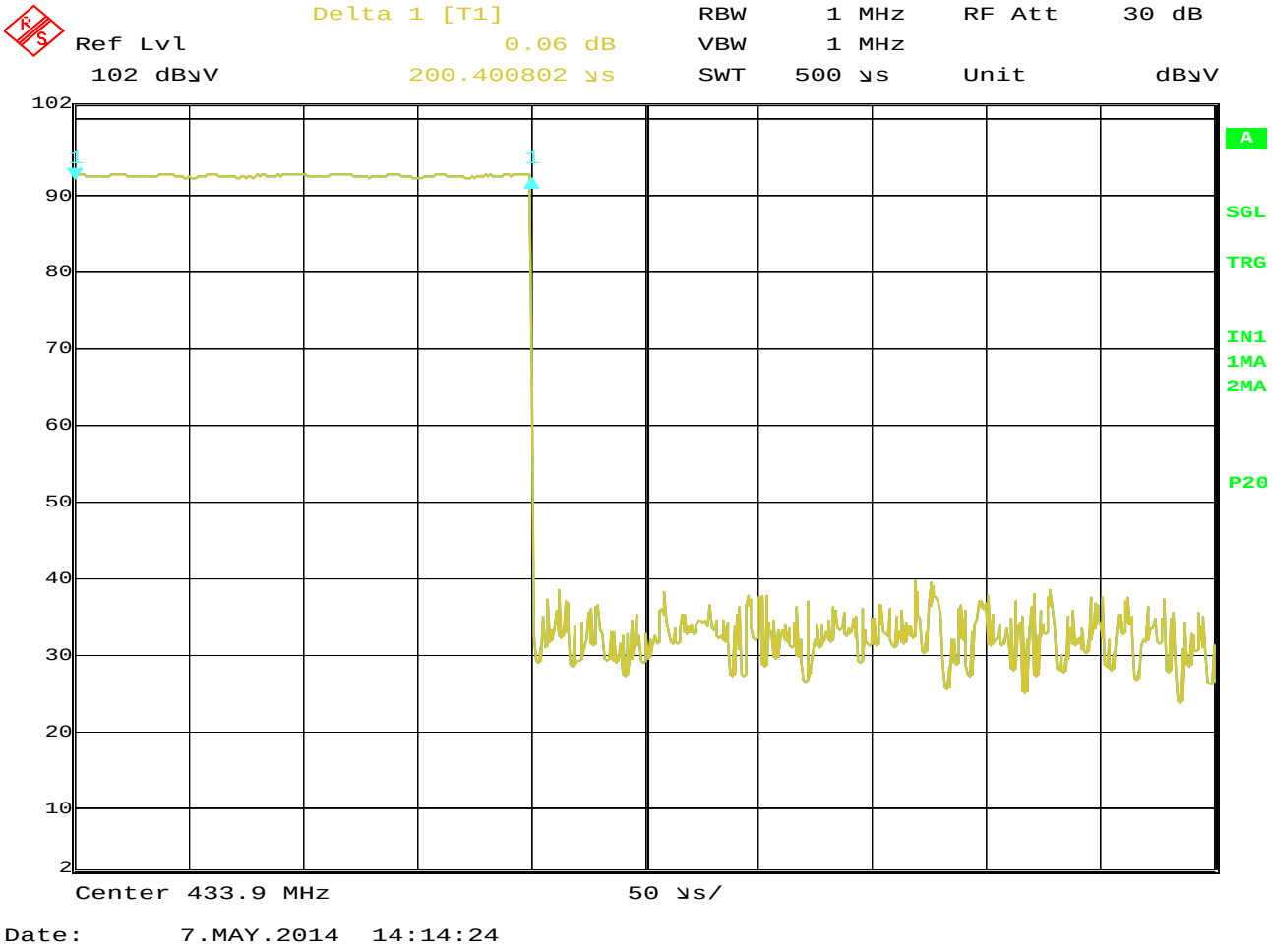
3522 Test Setup for Radiated Emissions, 1GHz to 5GHz – Horizontal Polarization

3522 Test Setup for Radiated Emissions, 1GHz to 5GHz – Vertical Polarization



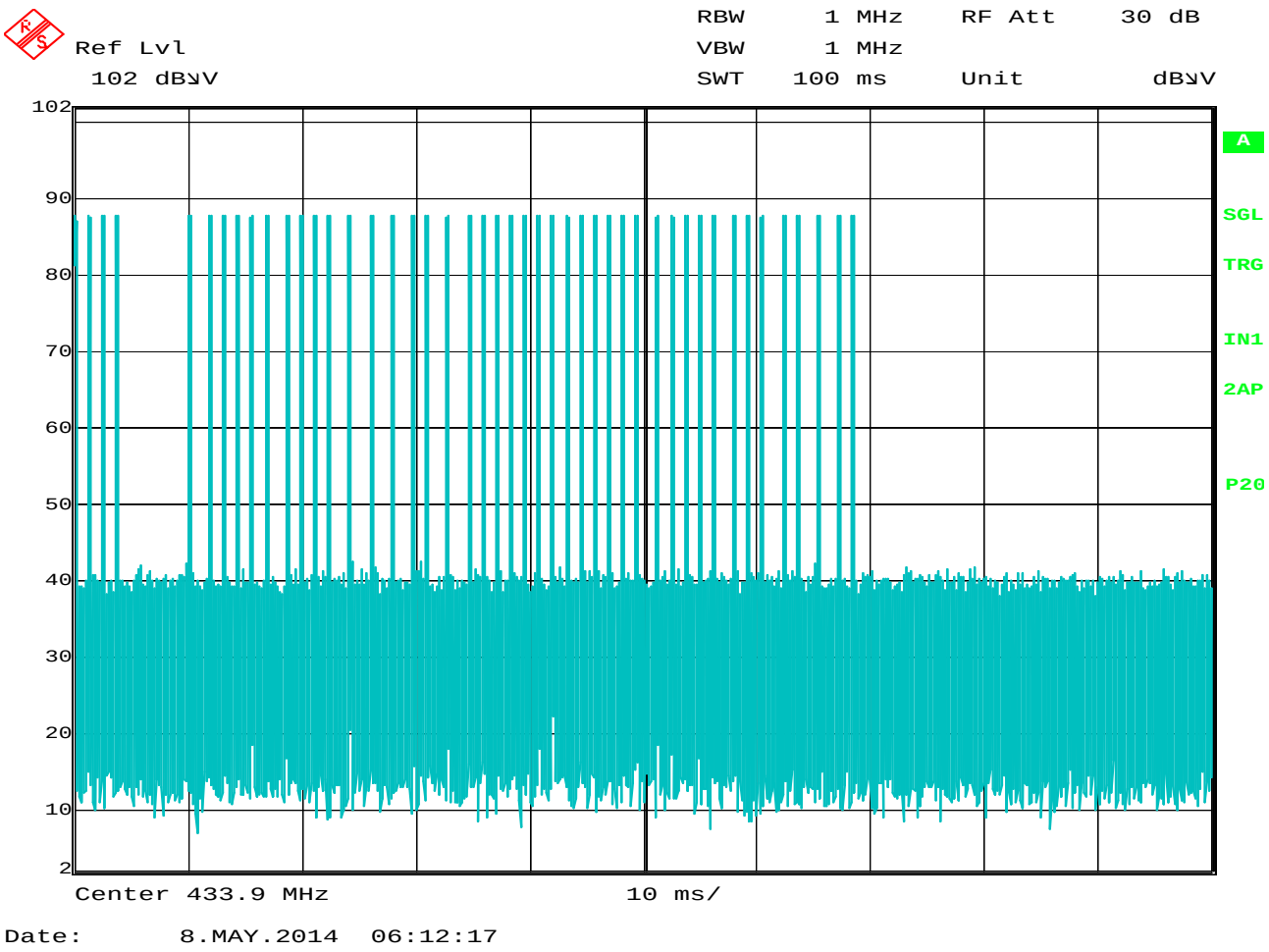
FCC 15.231(a) Deactivation Timing

MANUFACTURER	:	Versus
MODEL NUMBER	:	3520
SERIAL NUMBER	:	
TEST MODE	:	Tx @ 433.9MHz
TEST PARAMETER	:	Deactivation Timing
EQUIPMENT USED	:	RBA0, NTA3
NOTES	:	A transmitter activated automatically shall cease transmission within 5 seconds
	:	after activation.



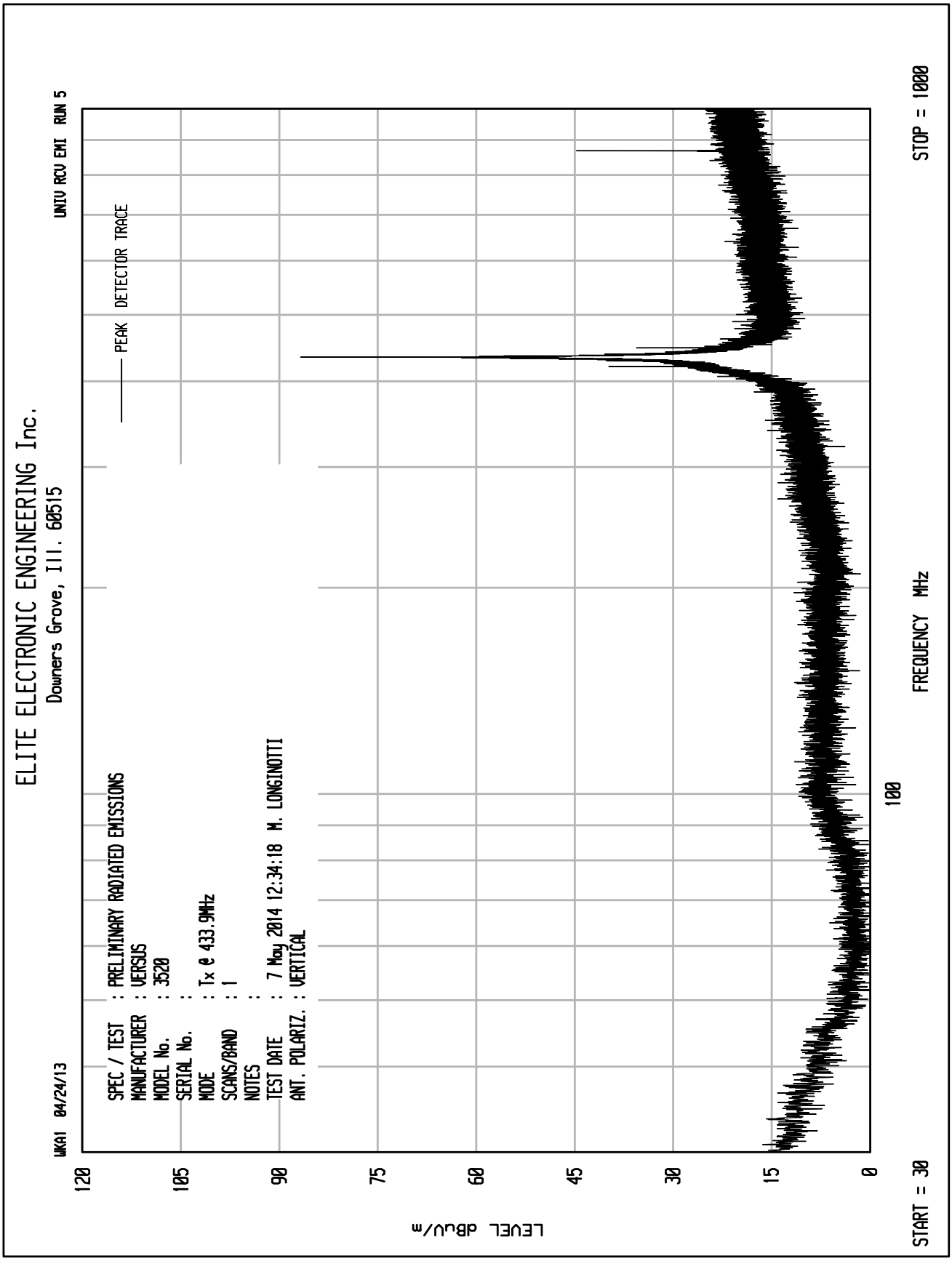
FCC 15.35 Duty Cycle (representative sample)

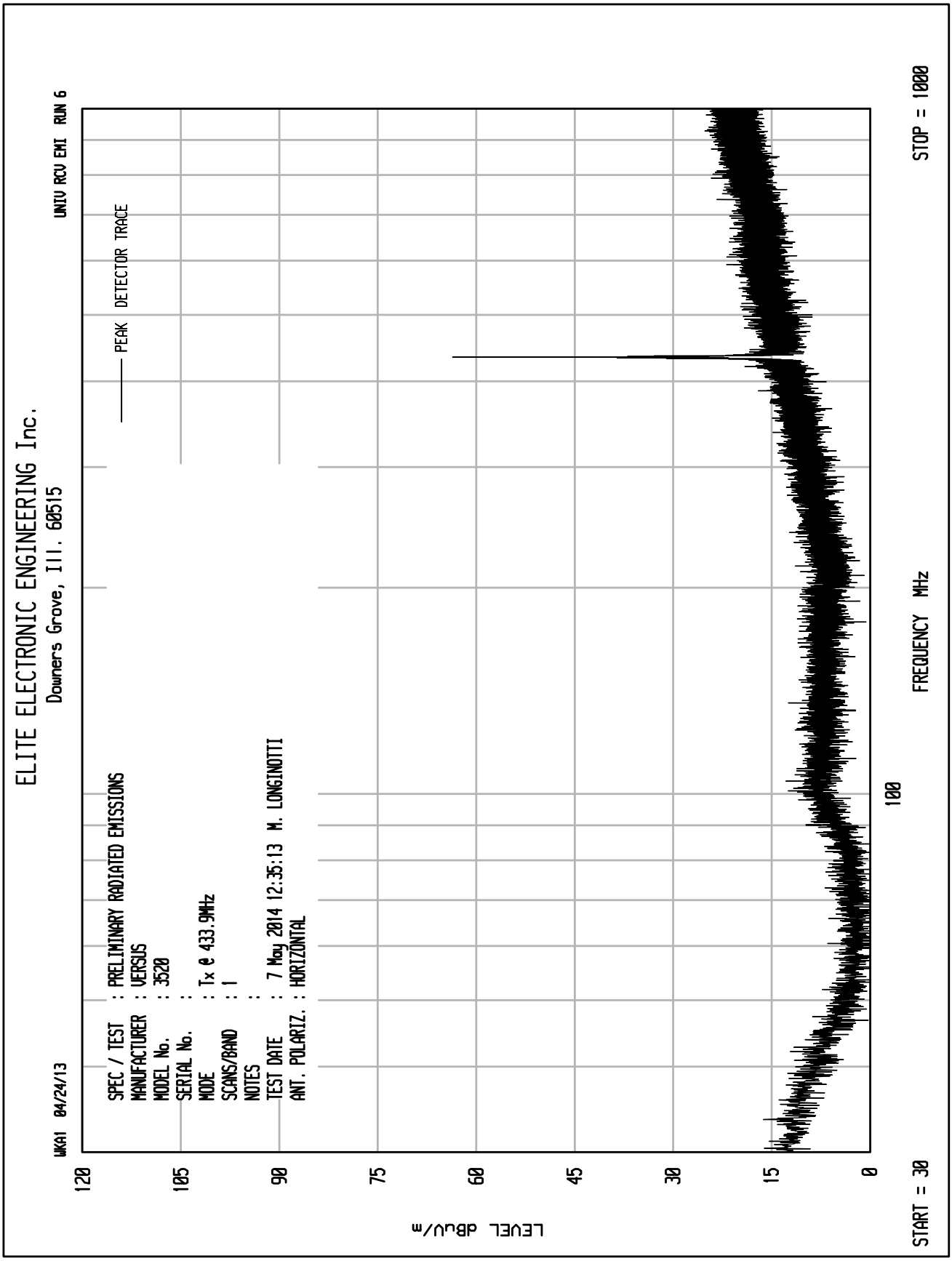
MANUFACTURER	:	Versus
MODEL NUMBER	:	3520
SERIAL NUMBER	:	
TEST MODE	:	Tx @ 433.9MHz
TEST PARAMETER	:	Duty Cycle
EQUIPMENT USED	:	RBA0, NTA3
NOTES	:	Pulse width = 200.4usec



FCC 15.35 Duty Cycle (representative sample)

MANUFACTURER	:	Versus
MODEL NUMBER	:	3520
SERIAL NUMBER	:	111
TEST MODE	:	Tx @ 433.9MHz
TEST PARAMETER	:	Duty Cycle
EQUIPMENT USED	:	RBA0, NTA3
NOTES	:	On time = (pulse width) x (# pulses) = (200.4usec x 46) = 9.218msec


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 5
WKA1 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : VERSUS
MODEL No. : 3520
SERIAL No. :
MODE : Tx @ 433.9MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 7 May 2014 12:34:18 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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Downers Grove, Ill. 60515
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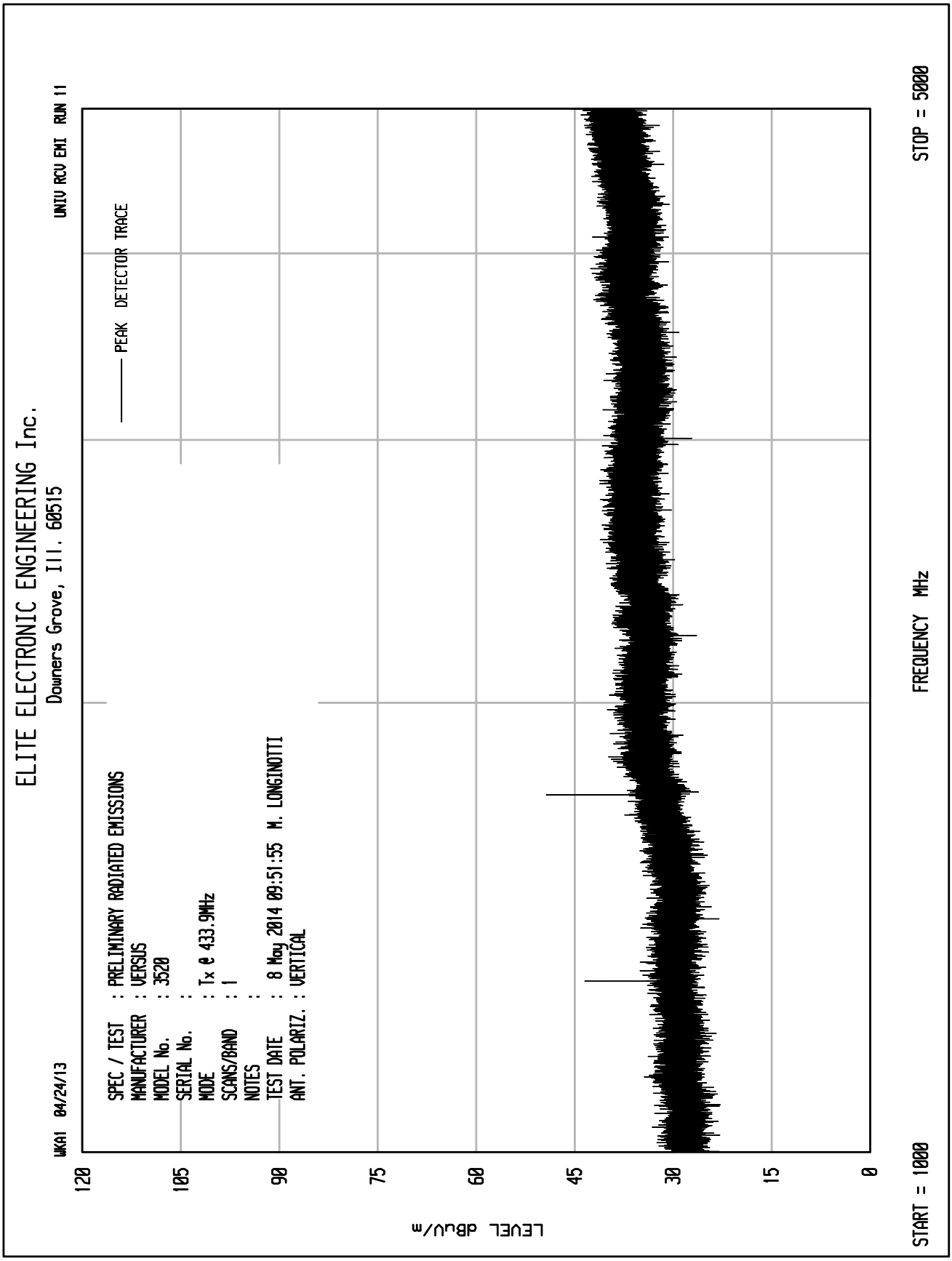
WKA1 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : VERSUS
MODEL No. : 3520
SERIAL No. :
MODE : Tx @ 433.9MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 7 May 2014 12:35:13 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000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Downers Grove, Ill. 60515
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WKA1 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : VERSUS
MODEL No. : 3520
SERIAL No. :
MODE : Tx @ 433.9MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 8 May 2014 09:51:55 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
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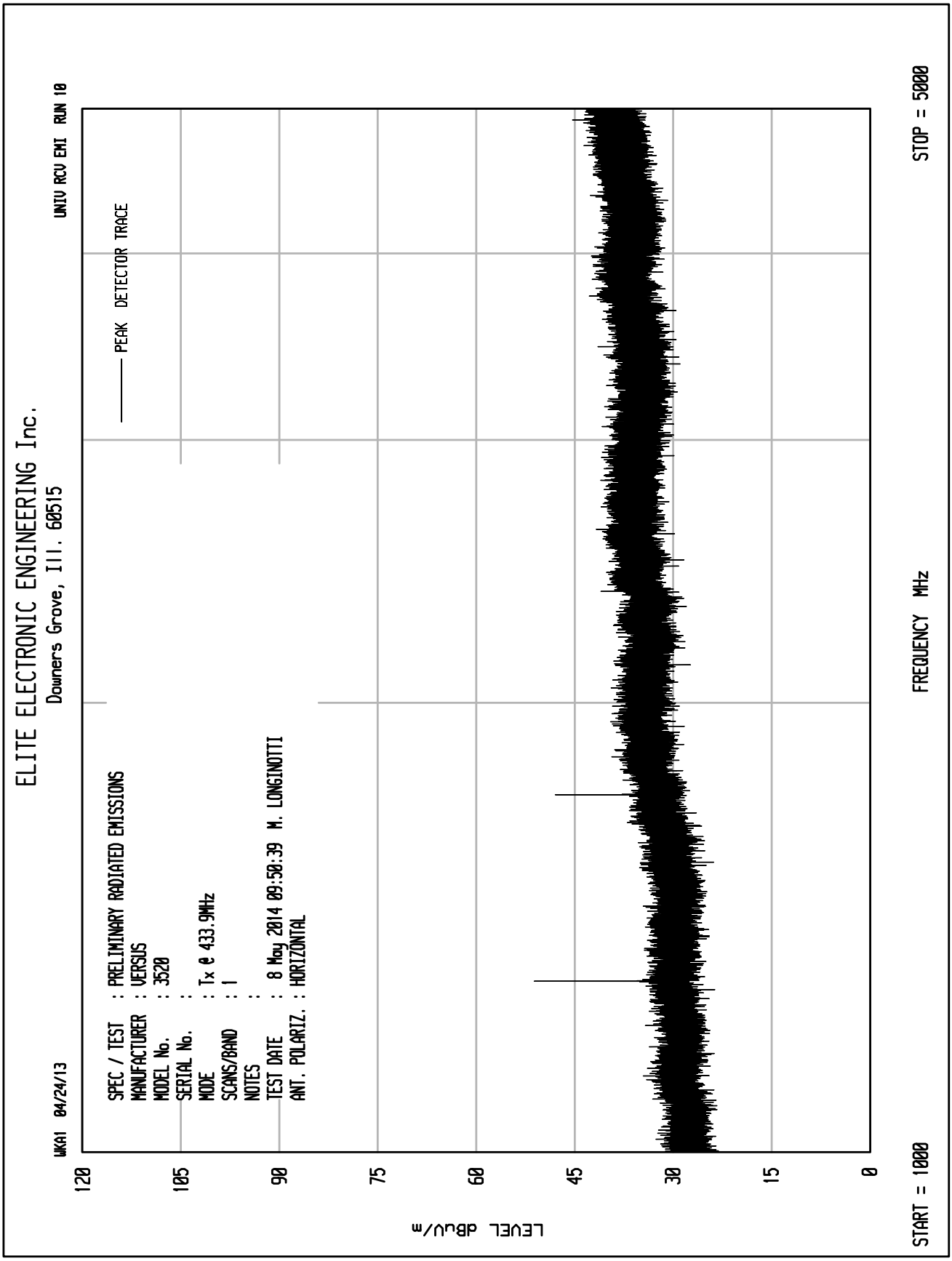
30
15
0
START = 1000
FREQUENCY MHz
STOP = 5000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Downers Grove, Ill. 60515
UNIV RCV EMI RUN 10
WKA1 04/24/13
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : VERSUS
MODEL No. : 3520
SERIAL No. :
MODE : Tx @ 433.9MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 8 May 2014 09:50:39 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
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15
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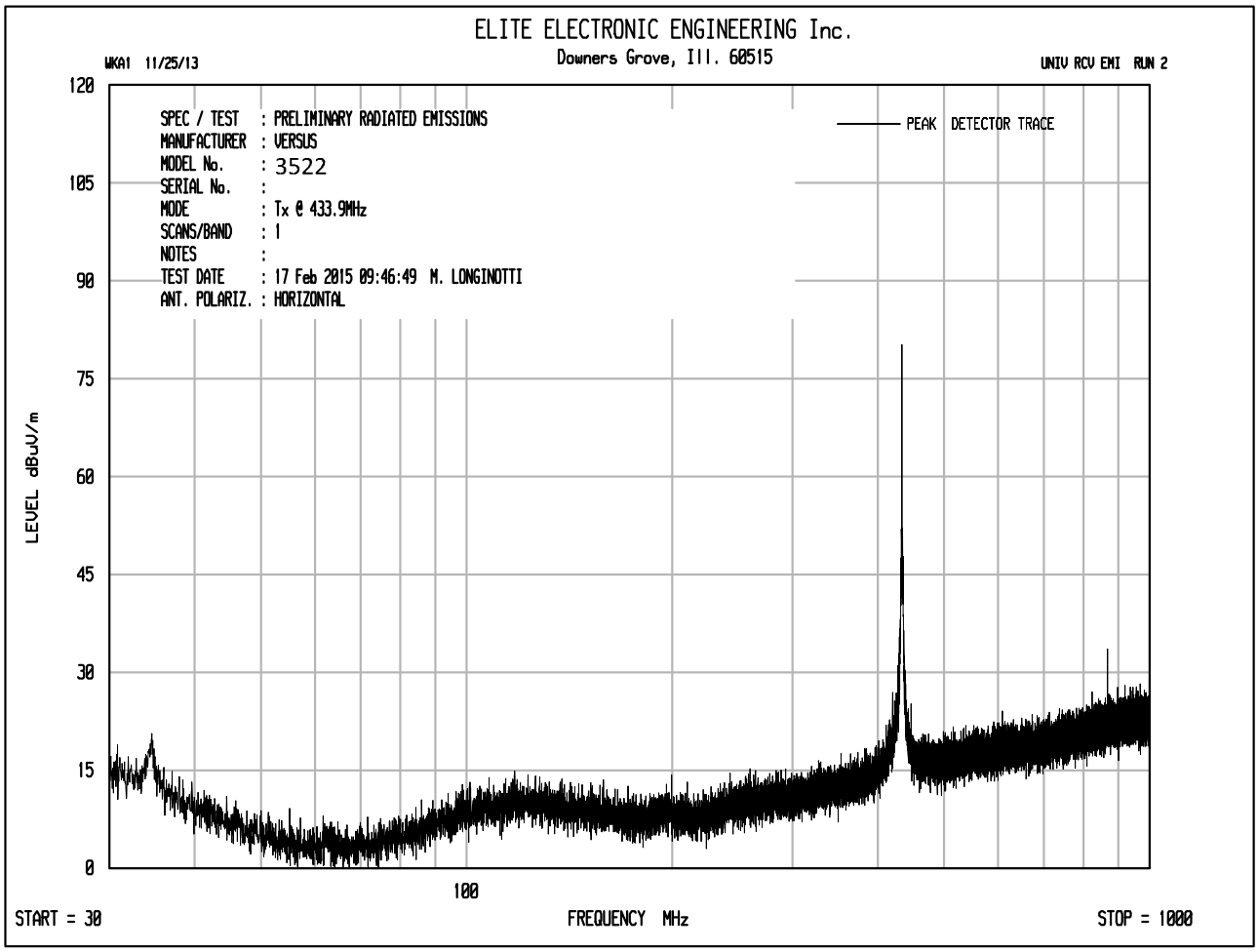
START = 1000
FREQUENCY MHz
STOP = 5000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Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 2
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : VERSUS
MODEL No. : 3522
SERIAL No. :
MODE : Tx @ 433.9MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 17 Feb 2015 09:46:49 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
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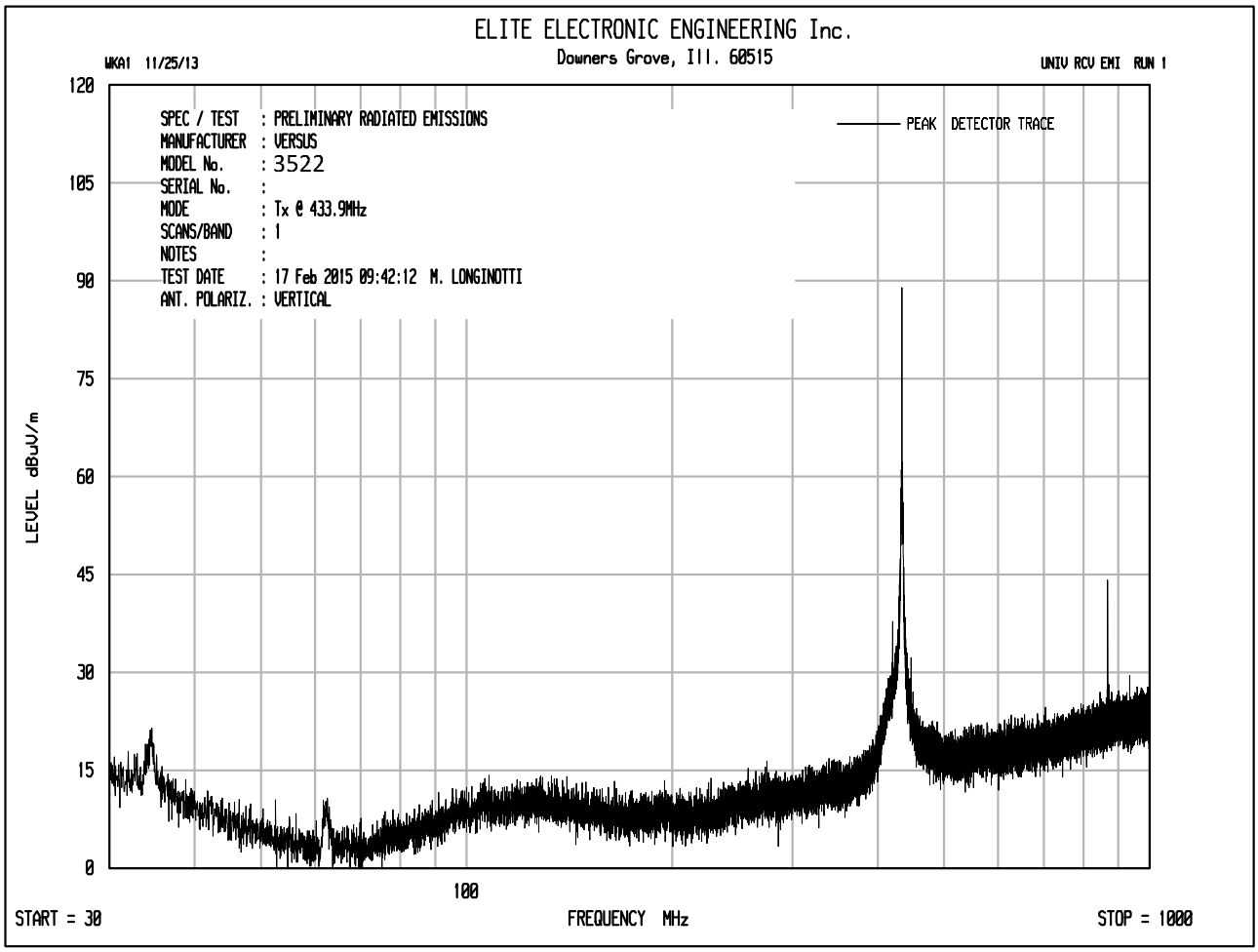
100
START = 30
FREQUENCY MHz
STOP = 1000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Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 1
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MANUFACTURER : VERSUS
MODEL No. : 3522
SERIAL No. :
MODE : Tx @ 433.9MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 17 Feb 2015 09:42:12 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
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105
90
75
60
45
30
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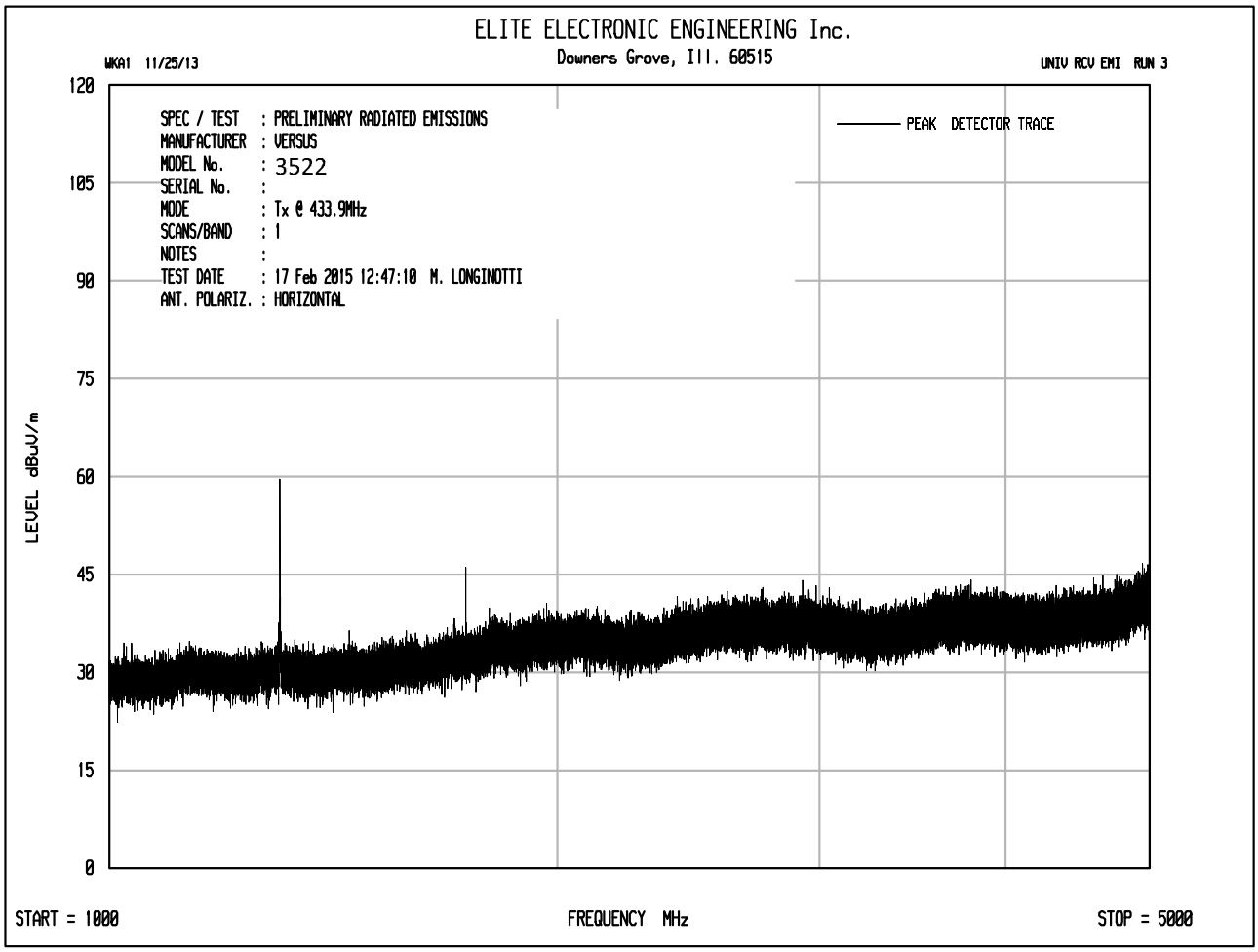
0
100
START = 30
FREQUENCY MHz
STOP = 1000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Downers Grove, Ill. 60515
WKA1 11/25/13
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MANUFACTURER : VERSUS
MODEL No. : 3522
SERIAL No. :
MODE : Tx @ 433.9MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 17 Feb 2015 12:47:10 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
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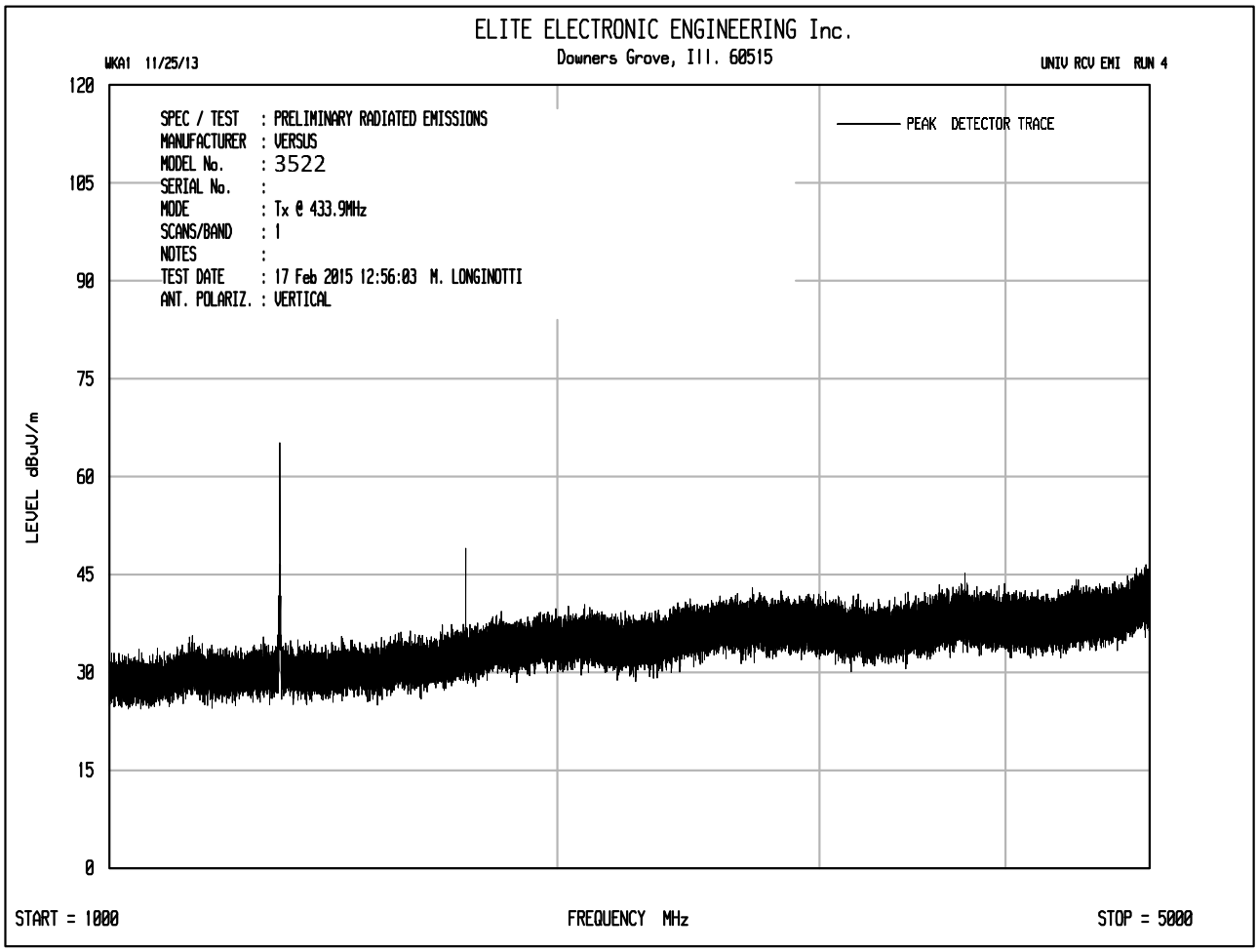
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 5000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 4
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : VERSUS
MODEL No. : 3522
SERIAL No. :
MODE : Tx @ 433.9MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 17 Feb 2015 12:56:03 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 = 5000

Manufacturer : Versus Technology, Inc.
EUT : Event Tag
Model No. : 3520
Serial No. :
Mode : Transmit at 433.9MHz
Test Specification : FCC 15.231b
Date : May 7 and 8, 2013
Test Distance : 3 meters
Notes : Peak Detector

Freq. (MHz)	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Total (dBuV/m)	Total (uV/m)	Limit (uV/m)	Margin (dB)
433.900	H	64.3		1.1	16.5	0.0	-16.2	65.7	1918.3	10995.8	-15.2
433.900	V	69.4		1.1	16.5	0.0	-16.2	70.8	3450.7	10995.8	-10.1
867.800	H	18.2	Ambient	1.5	19.9	0.0	-16.2	23.4	14.8	1099.6	-37.4
867.800	V	27.4		1.5	19.9	0.0	-16.2	32.6	42.8	1099.6	-28.2
1301.700	H	23.7		1.9	28.8	0.0	-16.2	38.2	81.1	500.0	-15.8
1301.700	V	19.2		1.9	28.8	0.0	-16.2	33.7	48.3	500.0	-20.3
1735.600	H	24.1		2.2	30.0	0.0	-16.2	40.1	100.9	1099.6	-20.7
1735.600	V	24.4		2.2	30.0	0.0	-16.2	40.4	104.5	1099.6	-20.4
2169.500	H	16.4	Ambient	2.5	31.9	0.0	-16.2	34.5	53.1	1099.6	-26.3
2169.500	V	16.9	Ambient	2.5	31.9	0.0	-16.2	35.0	56.3	1099.6	-25.8
2603.400	H	16.7	Ambient	2.7	32.5	0.0	-16.2	35.8	61.3	1099.6	-25.1
2603.400	V	17.0	Ambient	2.7	32.5	0.0	-16.2	36.1	63.5	1099.6	-24.8
3037.300	H	16.4	Ambient	3.0	32.8	0.0	-16.2	36.0	63.1	1099.6	-24.8
3037.300	V	17.8	Ambient	3.0	32.8	0.0	-16.2	37.4	74.1	1099.6	-23.4
3471.200	H	15.5	Ambient	3.2	32.9	0.0	-16.2	35.4	58.8	1099.6	-25.4
3471.200	V	15.9	Ambient	3.2	32.9	0.0	-16.2	35.8	61.5	1099.6	-25.0
3905.100	H	17.0	Ambient	3.4	33.3	0.0	-16.2	37.4	74.3	500.0	-16.6
3905.100	V	17.5	Ambient	3.4	33.3	0.0	-16.2	37.9	78.7	500.0	-16.1
4339.000	H	16.9	Ambient	3.5	33.6	0.0	-16.2	37.8	78.0	500.0	-16.1
4339.000	V	16.7	Ambient	3.5	33.6	0.0	-16.2	37.6	76.3	500.0	-16.3

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

Checked By: MARK E. LONGINOTTI

Mark E. Longinotti

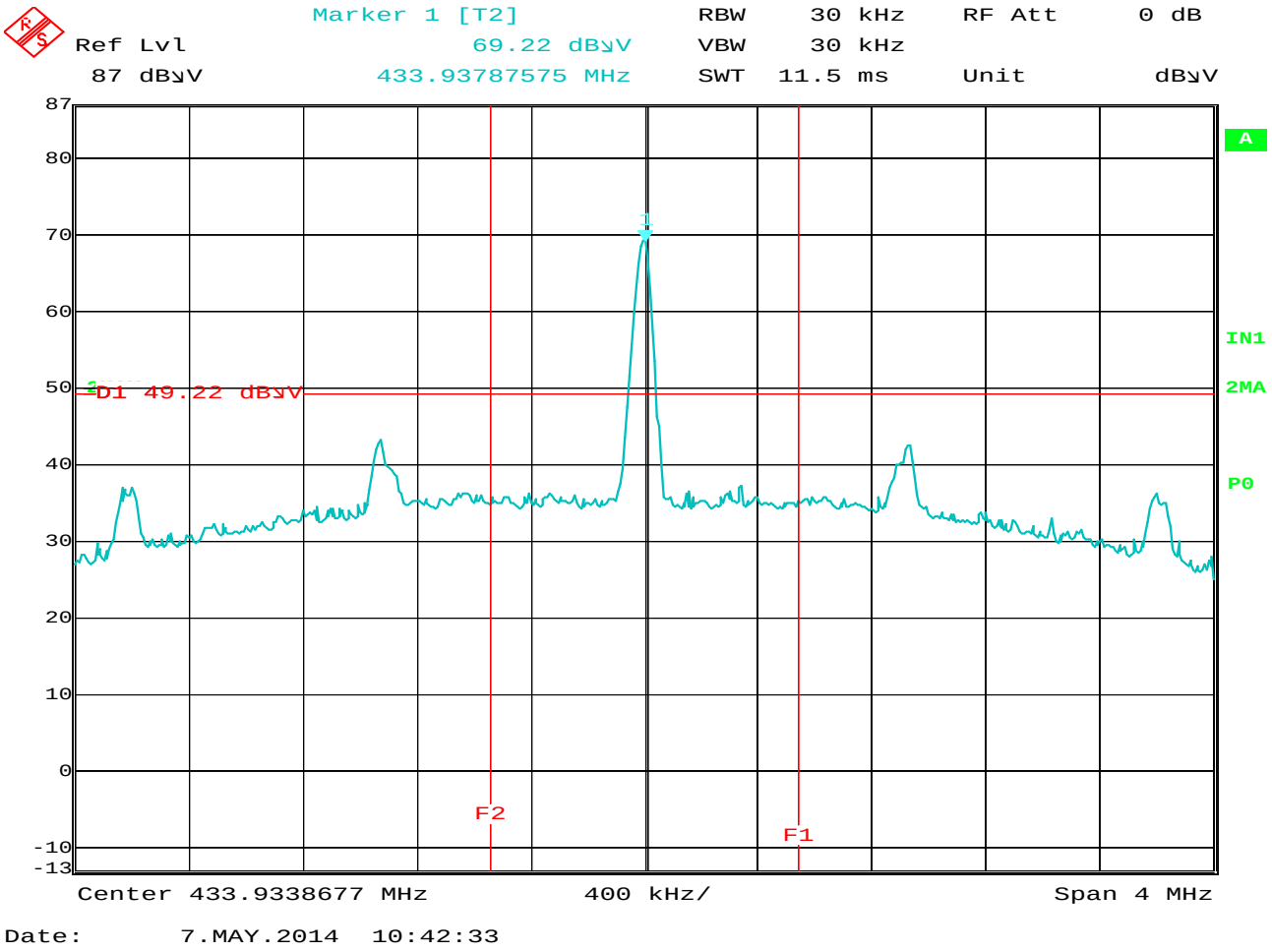
Manufacturer : Versus Technology, Inc.
EUT : Event Tag
Model No. : 3522
Serial No. :
Mode : Transmit at 433.9MHz
Test Specification : FCC 15.231b
Date : February 17, 2015
Test Distance : 3 meters
Note : Peak Detector

Freq. (MHz)	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Total (dBuV/m)	Total (uV/m)	Limit (uV/m)	Margin (dB)
433.912	H	61.7		1.4	16.3	0.0	-16.2	63.2	1452.6	10996.3	-17.6
433.912	V	69.8		1.4	16.3	0.0	-16.2	71.3	3691.0	10996.3	-9.5
867.824	H	23.3		2.0	19.6	0.0	-16.2	28.7	27.3	1099.6	-32.1
867.824	V	23.7		2.0	19.6	0.0	-16.2	29.1	28.5	1099.6	-31.7
1301.736	H	29.1		2.5	28.4	0.0	-16.2	43.8	154.7	500.0	-10.2
1301.736	V	34.2		2.5	28.4	0.0	-16.2	48.9	278.3	500.0	-5.1
1735.647	H	21.6		2.9	30.5	0.0	-16.2	38.8	86.6	1099.6	-22.1
1735.647	V	23.5		2.9	30.5	0.0	-16.2	40.7	107.8	1099.6	-20.2
2169.559	H	15.4	Ambient	3.2	32.5	0.0	-16.2	34.9	55.6	1099.6	-25.9
2169.559	V	15.4	Ambient	3.2	32.5	0.0	-16.2	34.9	55.6	1099.6	-25.9
2603.471	H	16.5	Ambient	3.6	32.8	0.0	-16.2	36.7	68.0	1099.6	-24.2
2603.471	V	16.4	Ambient	3.6	32.8	0.0	-16.2	36.6	67.3	1099.6	-24.3
3037.383	H	15.7	Ambient	3.9	33.3	0.0	-16.2	36.7	68.5	1099.6	-24.1
3037.383	V	16.0	Ambient	3.9	33.3	0.0	-16.2	37.0	70.9	1099.6	-23.8
3471.295	H	15.8	Ambient	4.2	33.4	0.0	-16.2	37.2	72.2	1099.6	-23.6
3471.295	V	16.2	Ambient	4.2	33.4	0.0	-16.2	37.6	75.6	1099.6	-23.2
3905.207	H	16.7	Ambient	4.4	34.1	0.0	-16.2	39.0	88.9	500.0	-15.0
3905.207	V	17.1	Ambient	4.4	34.1	0.0	-16.2	39.4	93.1	500.0	-14.6
4339.118	H	16.6	Ambient	4.6	34.8	0.0	-16.2	39.8	97.6	500.0	-14.2
4339.118	V	17.2	Ambient	4.6	34.8	0.0	-16.2	40.4	104.5	500.0	-13.6

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

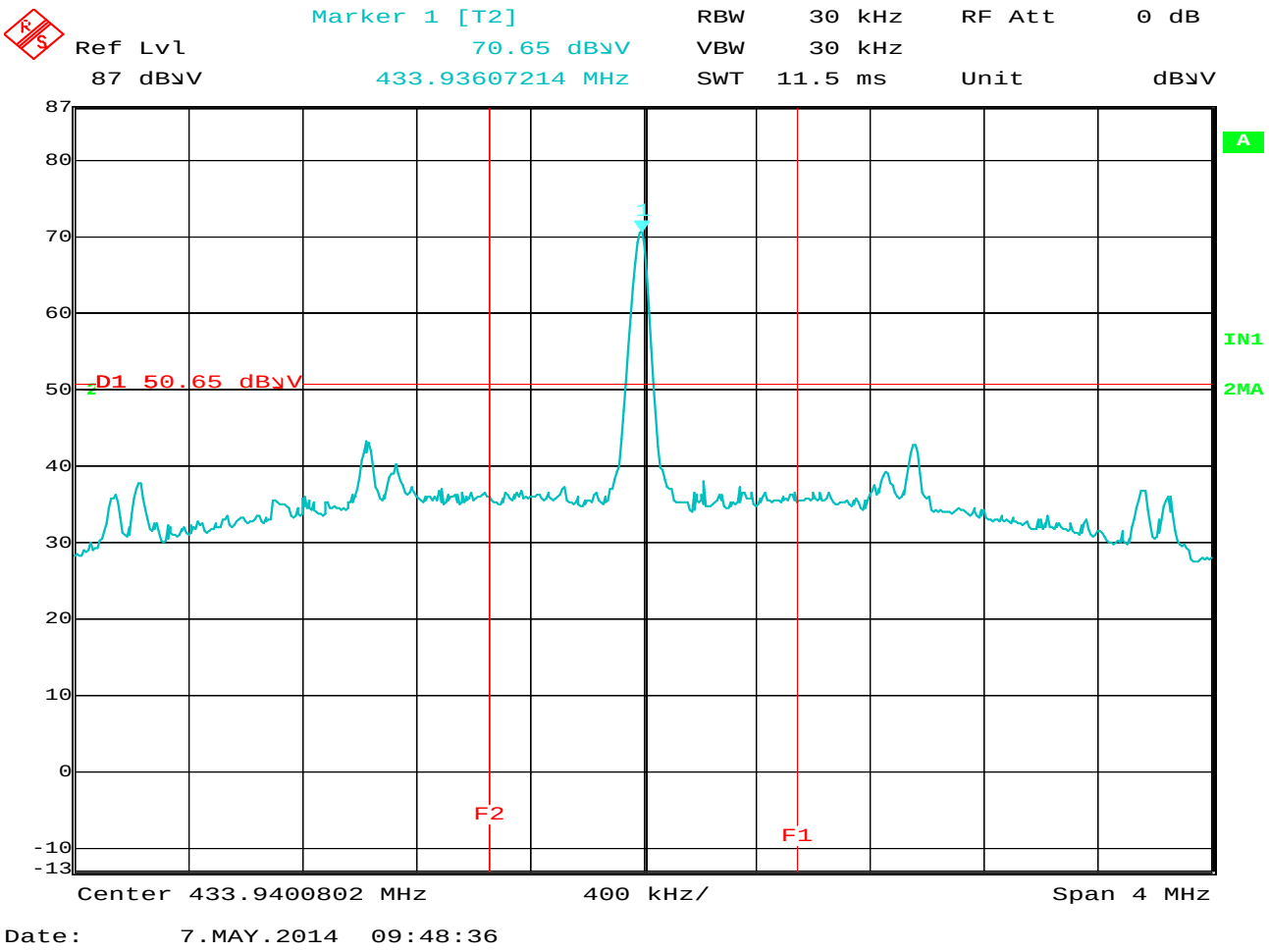
Checked By: MARK E. LONGINOTTI

Mark E. Longinotti



FCC 15.231 20dB bandwidth

MANUFACTURER	:	Versus
MODEL NUMBER	:	3520
SERIAL NUMBER	:	
TEST MODE	:	Tx @ 433.9MHz
TEST PARAMETER	:	20dB bandwidth
EQUIPMENT USED	:	RBA0, NTA3
NOTES	:	Display lines F1 and F2 represent the 0.25% bandwidth
	:	Display line D1 represents the 20dB down point from the transmit frequency



FCC 15.231 20dB bandwidth

MANUFACTURER	:	Versus
MODEL NUMBER	:	3522
SERIAL NUMBER	:	
TEST MODE	:	Tx @ 433.9MHz
TEST PARAMETER	:	20dB bandwidth
EQUIPMENT USED	:	RBA0, NTA3
NOTES	:	Display lines F1 and F2 represent the 0.25% bandwidth
	:	Display line D1 represents the 20dB down point from the transmit frequency