Measurement of RF Emissions from a Model VL4B ID Badge Transmitter

For	Versus Technology, Inc. 2600 Miller Creek Road Traverse City, MI 49684
P.O. Number	VTl-2018-1 34
Date Tested	March 23-26, 2018
Test Personnel	Richard King
Test Specification	FCC "Code of Federal Regulations" Title 47 Part15, Subpart C Industry Canada RSS-GEN Industry Canada RSS-210

Test Report By: Richard E. King

Richard King
EMC Engineer

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

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REVISION HISTORY

Revision	Date	Description
—	13 April 2018	Initial release
A	16 April 2018 By Rick King	- Added Rev A to the report number on the cover and throughout the report. - Removed all data and references to serial number 111 blue front EUT throughout report.

Measurement of RF Emissions from a Model No. VL4B ID Badge Transmitter

1. INTRODUCTION

1.1. Scope of Tests

This report presents the results of the RF emissions measurements performed on an ID Badge Transmitter, Model No. VL4B, Serial No. 222, (hereinafter referred to as the Equipment Under Test (EUT)). The EUT was designed to transmit at approximately 433.92MHz 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, Section 15.231 for Intentional Radiators and the Innovation, Science and Economic Development (ISED) Canada, Radio Standards Specification RSS-210. Testing was performed in accordance with ANSI C63.4-2014.

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 24^{o}C and the relative humidity was 16%.

2. APPLICABLE DOCUMENTS

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

- Federal Communications Commission "Code of Federal Regulations", Title 47, Part 15, Subpart C, dated 1 October 2017
-
- ANSI C63.4-2014, "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"
- ANSI C63.10-2013, " American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices"
- Innovation, Science and Economic Development (ISED) Canada Radio Standards Specification, RSS-Gen, “General Requirements for Compliance of Radio Apparatus”, Issue 4, November 2014
- Innovation, Science and Economic Development (ISED) Canada Radio Standards Specification, RSS-210, “License-Exempt Radio Apparatus: Category I Equipment”, Issue 9, August 2016

3. EUT SETUP AND OPERATION

3.1. General Description

The EUT is a Versus Technology, Inc., ID Badge Transmitter Model No. VL4B. A block diagram of the EUT

setup is shown as Figure 1.

3.1.1. Power Input

The EUT was powered with 3VDC from a single 3V lithium battery.

3.1.2. Peripheral Equipment

No peripheral equipment was submitted with the EUT.

3.1.3. Signal Input/Output Leads

No interconnect cables were submitted with the EUT.

3.1.4. Grounding

The EUT was ungrounded during the tests.

3.2. Software

For all tests, the EUT had Firmware Versus V-Direct Badge 0_29.hex loaded onto the device to provide correct load characteristics.

3.3. Operational Mode

For all tests the EUT was placed on an 80cm high non-conductive stand below 1000MHz. Above 1000MHz the EUT was placed on a 150cm high non-conductive stand. The EUT was energized and the EUT's transmit button was held down there by setting the device to transmit continuously at 433.92MHz.

3.4. EUT Modifications

No modifications were required for compliance to the 15.231(b) requirements.

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 C63.4-2014 for site attenuation.

4.2. Test Instrumentation

The test instrumentation and auxiliary equipment used during the tests are listed in Table 9-1.

Conducted and radiated emission measurements were performed with a spectrum analyzer. This receiver allows measurements with the bandwidths and detector functions specified in the requirements. The receiver bandwidth was 120kHz for the 30MHz to 1000MHz radiated emissions data and 1MHz for the 1000MHz to 5000MHz radiated emissions data.

4.3. Calibration Traceability

Test equipment is maintained and calibrated on a regular basis with a calibration interval not greater than two years. 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.

Values of Expanded Measurement Uncertainty (95% Confidence) are presented below:

Measurement Type	Expanded Measurement Uncertainty
Conducted disturbance (mains port) (150 kHz – 30 MHz)	2.7
Radiated disturbance (electric field strength on an open area test site or alternative test site) (30 MHz – 1000 MHz)	4.3
Radiated disturbance (electric field strength on an open area test site or alternative test site) (1 GHz – 6 GHz)	3.1
Radiated disturbance (electric field strength on an open area test site or alternative test site) (6 GHz – 18 GHz)	3.2

5. TEST PROCEDURES

5.1. Powerline Conducted Emissions

5.1.1. Requirements

Since the EUT was powered by internal batteries and has no connections to AC mains, no conducted emissions tests are required.

5.2. Periodic Operation Measurements

5.2.1. Requirements

A transmitter activated automatically shall cease transmission within 5 seconds after activation.

5.2.2. Procedures

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

5.2.3. Results

The plots of the transmitter's on-time are shown on data page 17. The data shows that the EUT ceased operation within the allotted time.

5.3. Duty Cycle Factor Measurements

5.3.1. Procedures

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

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

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

b) The 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.

5.3.2.Results

Representative plots of the duty cycle are shown on data pages 18 through 22. 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 200uSec 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 988 uSec determines the logical "0" (zero).
The off time of approximately 1.68 mSec determines the logical "1" (one).
The pulse train consists of:

1. Four Preamble pulses separated by approximately .988 mS off time
2. An 'off' time of approximately 6.18 mS
3. Forty-two pulses separated by 'off' time of either .988 mS or 1.68 mS

If all forty-two encoding pulses are separated by .936mS, then the maximum value of the emission is calculated as follows:

Pulse on time:

1. Total on time 46 x 0.200mS 9.2 mS

Pulse word period:

1. Preamble on time 4 x .200 mS .800 mS
2. Preamble off time 3 x 1.01 mS 3.03 mS
3. Preamble space time 6.188 mS 6.188 mS
4. Encoded pulses 42 x 0.200 mS 8.400 mS
5. Encoded off time 22 x .988 mS 21.56 mS
5. Encoded off time 19 x 1.68 mS 31.92 mS

TOTAL pulse word period: 71.898 mS

Duty cycle factor (maximum time on) is:

1. Duty cycle: (9.2 mS / 71.89 mS) = 0.128 mS
2. Duty cycle factor: 20 * log (0.128) = -17.8 dB

With the EUT transmitting at 433.9MHz, the worst case (highest emissions) duty cycle correction factor was calculated to be -17.8 dB.

5.4. Radiated Measurements

5.4.1.Requirements

The EUT must comply with the requirements of FCC "Code of Federal Regulations Title 47", Part 15, Subpart C, Section 15.231 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
260-470	3,750 to 12,500	375 to 1,250

* - Linear Interpolation

For 433.92MHz, the limit at the fundamental is 10996.7uV/m @ 3m and the limit on the harmonics is 1099.7uV/m @ 3m.

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

5.4.2.Procedures

All tests were performed in a 32ft. x 20ft. x 18ft. hybrid ferrite-tile/anechoic absorber lined test chamber. The walls and ceiling of the shielded chamber are lined with ferrite tiles. Anechoic absorber material is installed over the ferrite tile. The floor of the chamber is used as the ground plane. The chamber complies with ANSI C63.4-2014 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.

The final open field emission tests were then manually performed over the frequency range of 30MHz to 4000MHz. Between 30MHz and 1000MHz, a tuned dipole antenna was used as the pick-up device. A broadband double ridged waveguide antenna was used as the pick-up device for all frequencies above 1GHz. All significant broadband and narrowband signals were measured and recorded. The peak detected levels were converted to average levels using a duty cycle factor which was computed from the pulse train.

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

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

5.4.3.Results

The preliminary plots and final open area radiated levels, with the EUT transmitting at 433.92MHz, are presented on data pages 23 through 27. The plots are presented for a reference only and are not used to determine compliance. 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 as Figure 2.

5.5. Occupied Bandwidth Measurements

5.5.1. Requirement

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

5.5.2. Procedures

The EUT was placed on an 80cm high non-conductive stand. The unit was set to transmit continuously. With an antenna positioned nearby, occupied bandwidth emissions were displayed on the spectrum analyzer. The resolution bandwidth was set to 30 kHz and span was set to 2 MHz. The frequency spectrum near the fundamental was plotted. The 99% bandwidth was measured.

5.5.3. Results

The plot of the emissions near the fundamental frequency is presented on data page 28. As can be seen from this data page, the transmitter met the occupied bandwidth requirements. The 99% bandwidth measured 132kHz.

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. ID Badge Transmitter, Model No. VL4B did fully meet the conducted and radiated emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Section 15.205 et seq. for International Radiators, when tested per ANSI C63.4-2014.

It was determined that the Versus Technology, Inc. ID Badge Transmitter Model No. VL4B did fully meet the technical requirements of the Innovation, Science and Economic Development (ISED) Canada, Radio Standards Specification RSS-210 for transmitters, when tested per ANSI C63.4-2014.

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 certification, approval, or endorsement by NVLAP, NIST or any agency of the Federal Government.

9. EQUIPMENT LIST

Table 9-1 Equipment List

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Due Date
NSDS1	UNIVERSAL SPHERICAL DIPOLE SOURCE	AET	USDS-H	AET-1116		NOTE 1	
NTA4	BILOG ANTENNA	TESEQ	6112D	46660	20-2000GHZ	8/18/2017	8/18/2018
NWQ1	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS-LINDGREN	3117	66655	1GHZ-18GHZ	4/4/2016	4/4/2018
PHA0	MAGNETIC FIELD PROBE	ELECTRO-METRICS	EM-6882	134	22-230MHZ	NOTE 1	
RAKI	RF SECTION	HEWLETT PACKARD	85462A	3411A00181	0.009-6500MHZ	3/1/2018	3/1/2019
RAKJ	RF FILTER SECTION	HEWLETT PACKARD	85460A	3330A00154	---	2/23/2018	2/23/2019
RBG3	EMI ANALYZER	ROHDE & SCHWARZ	ESW44	101592	2HZ-44GHZ	2/20/2018	2/20/2019
XPQ3	HIGH PASS FILTER	K&L MICROWAVE	4IH30-1804/T10000-0	4	1.8GHZ-10GHZ	9/12/2017	9/12/2019

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.

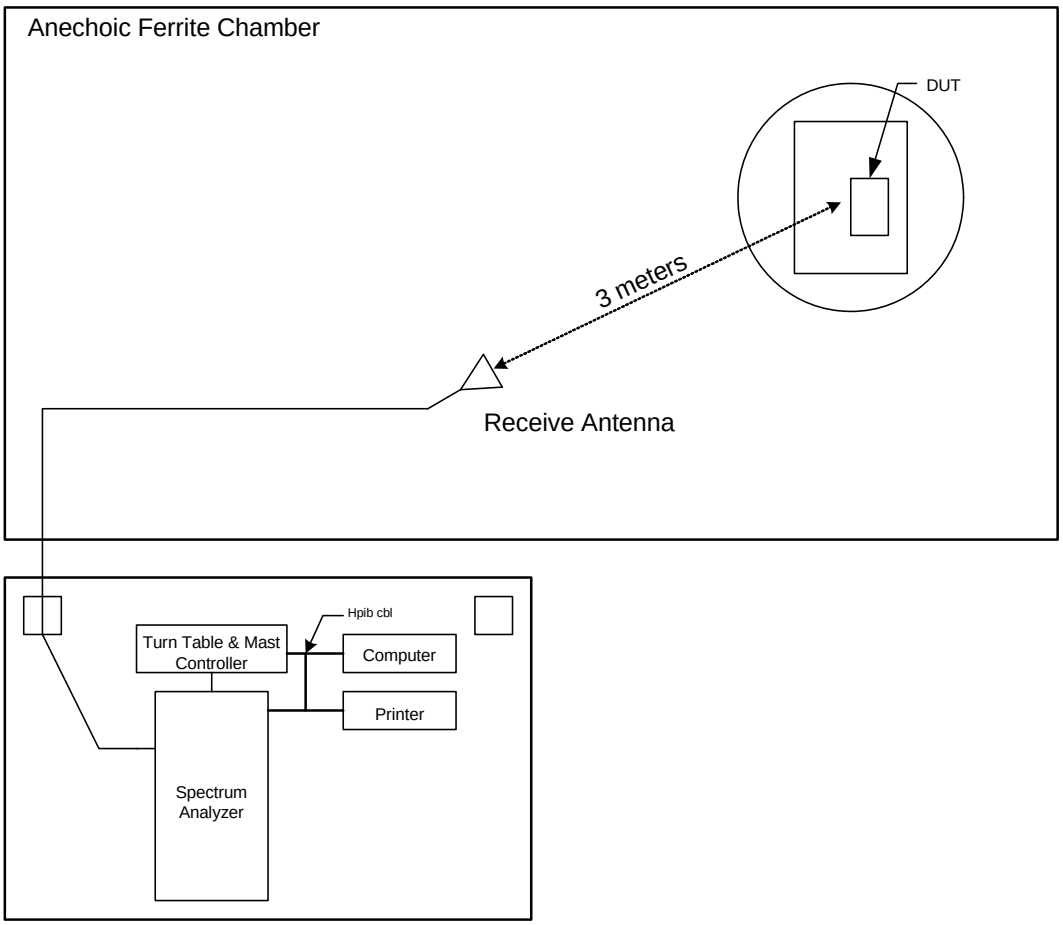


FIGURE 1 BLOCKDIAGRAM OF TEST SETUP

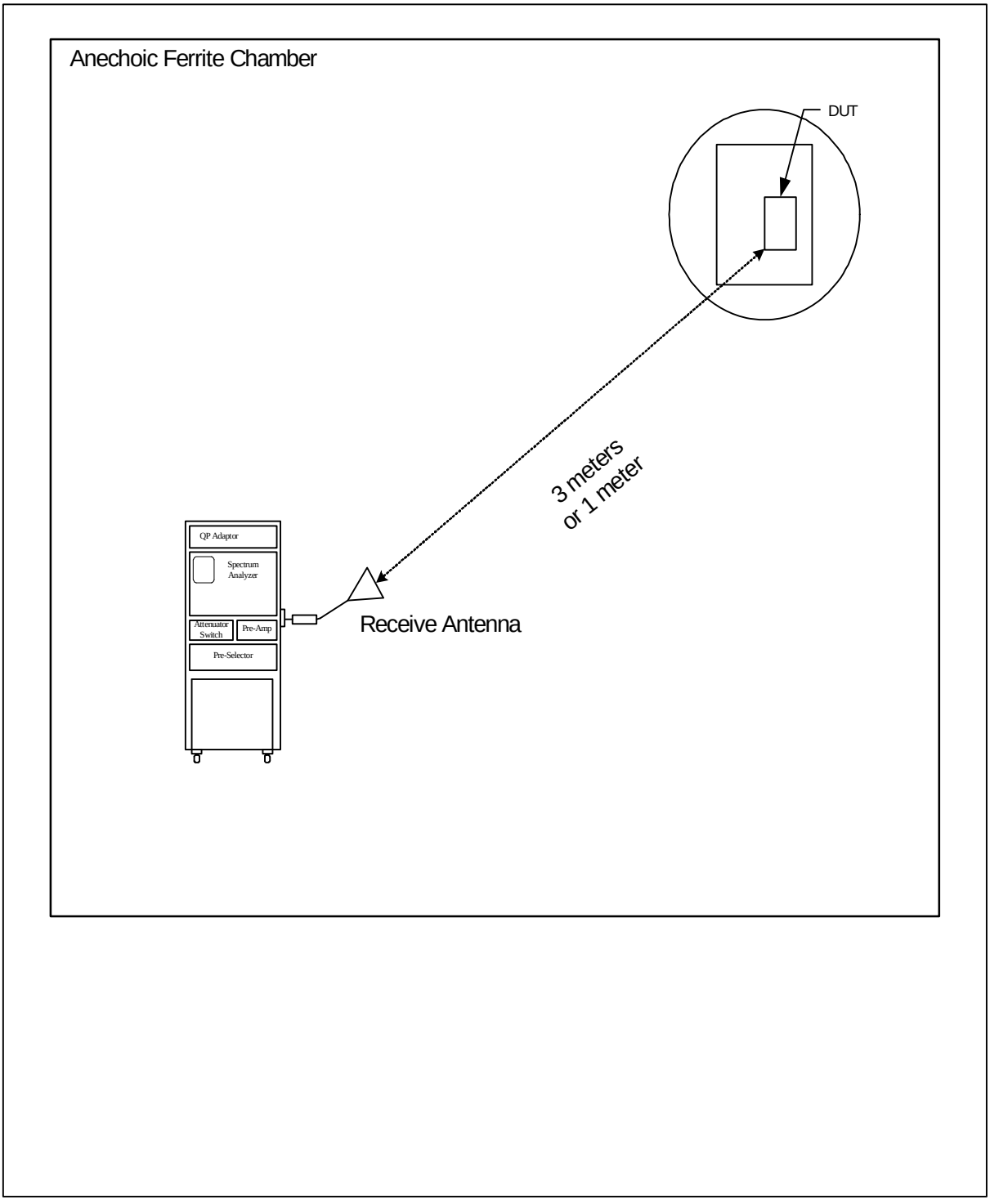
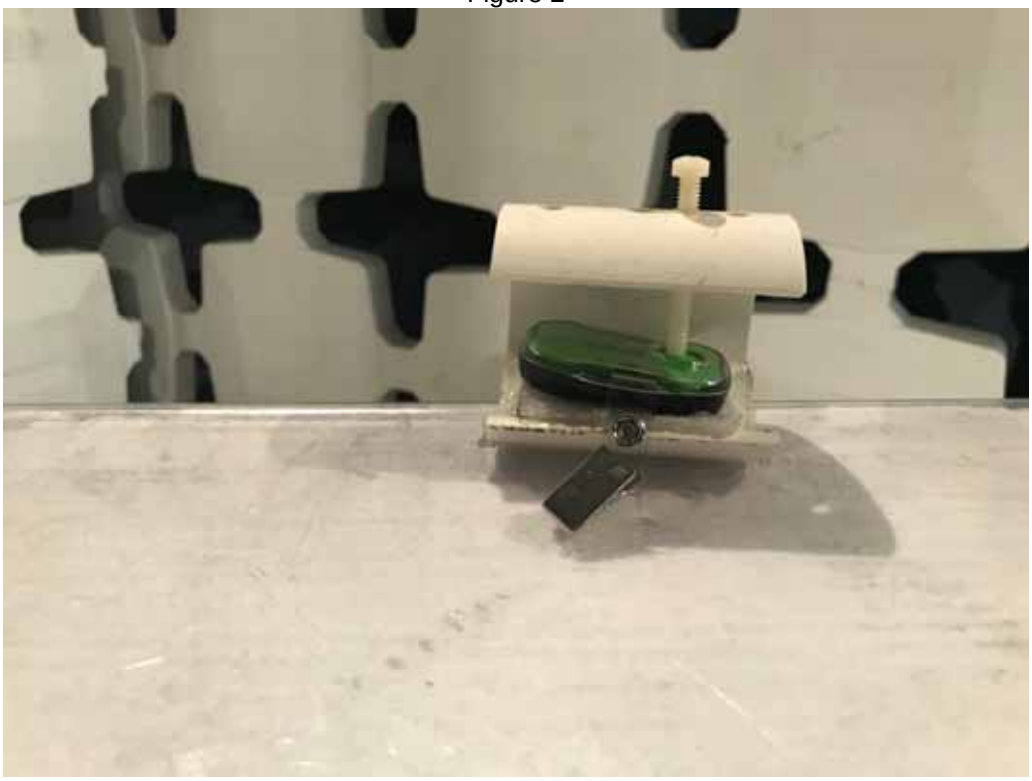

Anechoic Ferrite Chamber
DUT
3 meters
or 1 meter
QP Adaptor
Spectrum
Analyzer
Attenuator
Switch
Pre-Amp
Pre-Selector
Receive Antenna

Figure 2



Photograph of the EUT

Figure 3

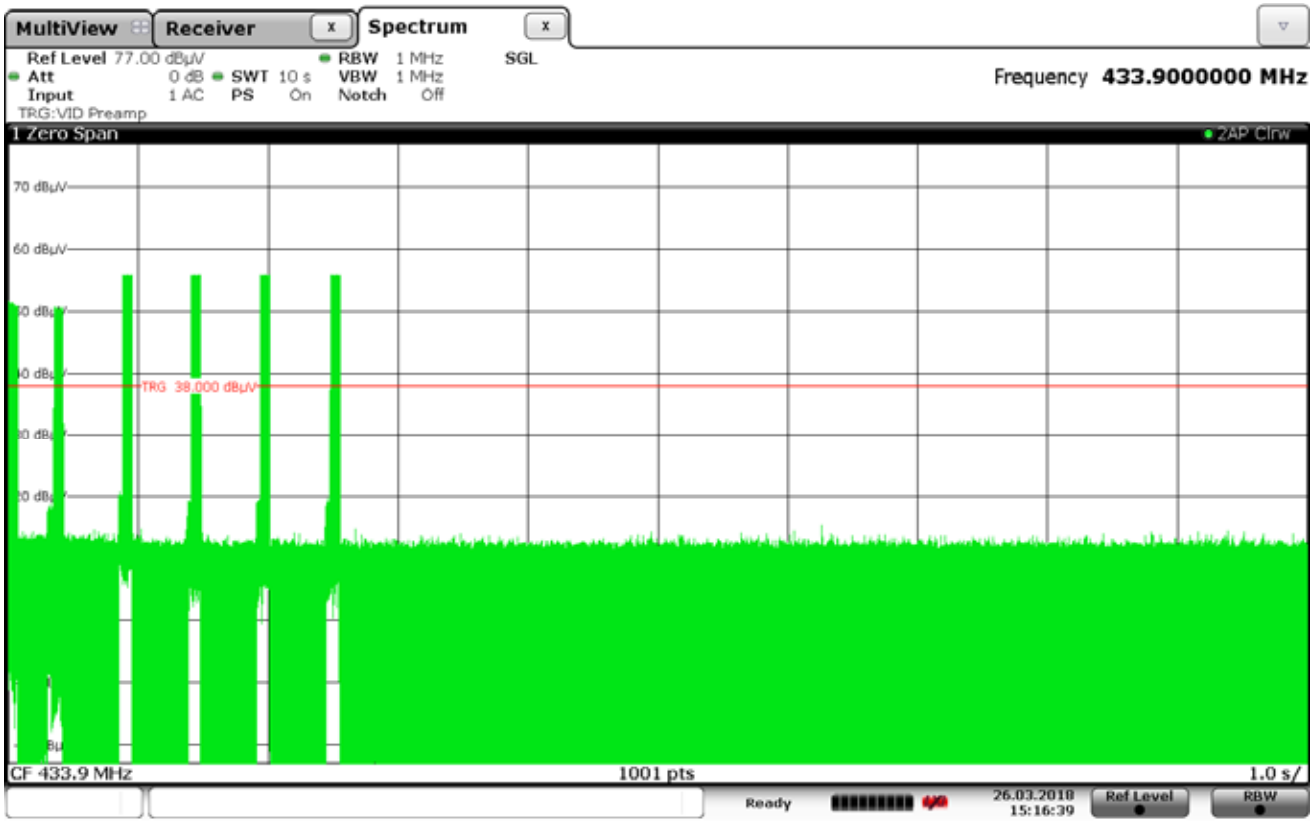
Test Setup for Radiated Emissions, 30MHz to 1GHz – Horizontal Polarization

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

Figure 4

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

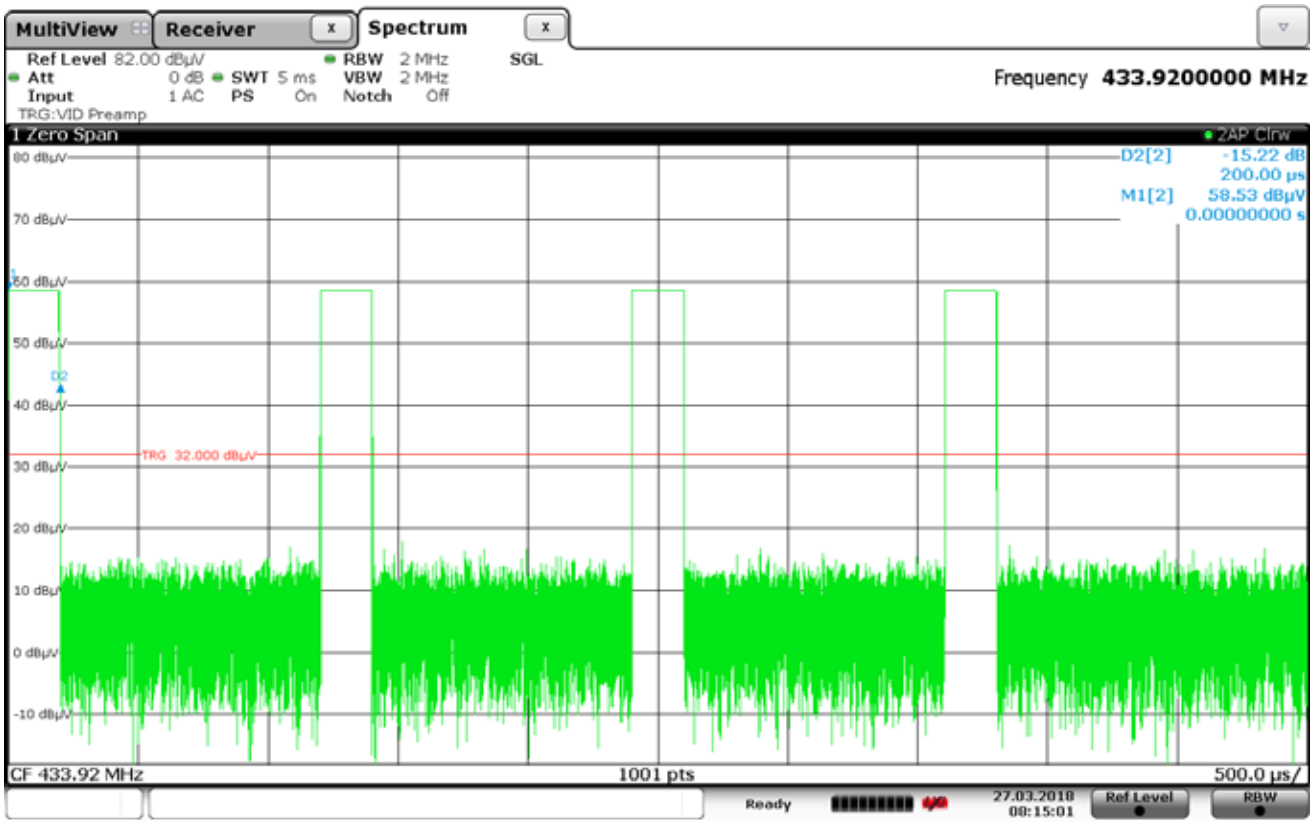
Test Setup for Radiated Emissions, Above 1GHz – Vertical Polarization



Date: 26.MAR.2018 15:16:40

FCC 15.231 Periodic Operation

MANUFACTURER	:	Versus Technology, Inc.
MODEL NUMBER	:	VL4B
SERIAL NUMBER	:	222
TEST MODE	:	Transmit @ 433.92MHz
TEST PARAMETERS	:	Ceases transmission in 5 seconds
EQUIPMENT USED	:	RBG3, PHA0
NOTES	:	Green Front

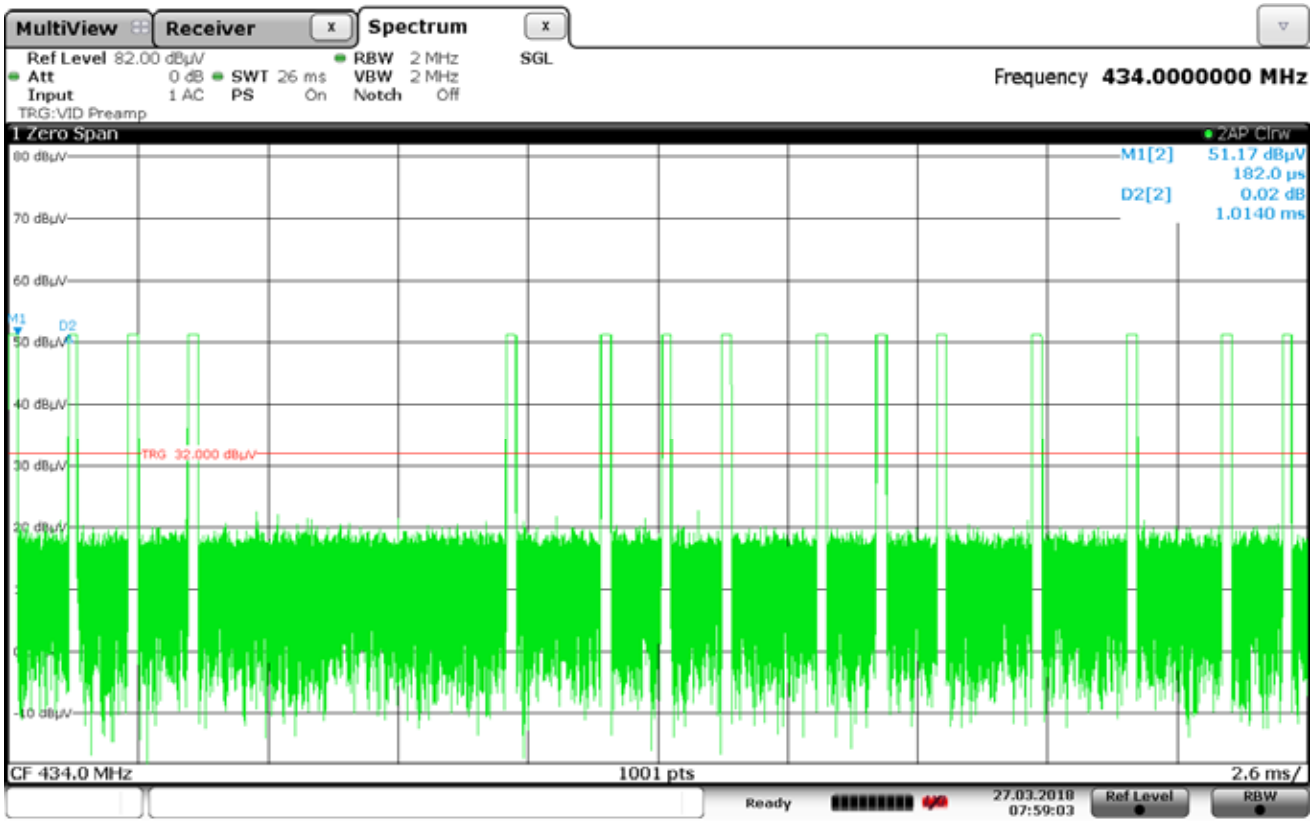


Date: 27.MAR.2018 08:15:01

FCC 15.231 Duty Cycle (Representative Sample)

MANUFACTURER : Versus Technology, Inc.
MODEL NUMBER : VL4B
SERIAL NUMBER : None Assigned
TEST MODE : Transmit @ 433.92MHz
TEST PARAMETERS : Pulse Width 200uS
EQUIPMENT USED : RBG3, PHA0

NOTES

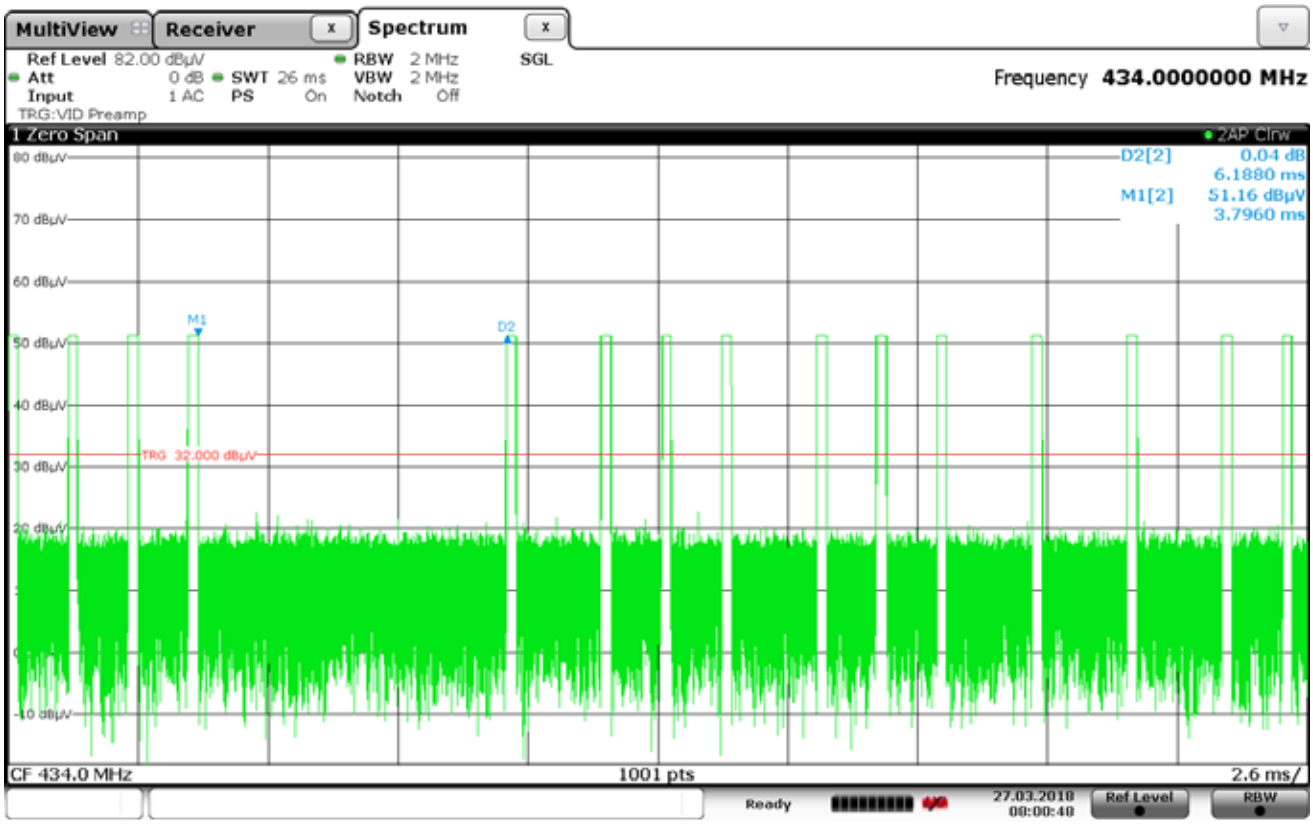


Date: 27.MAR.2018 07:59:03

FCC 15.231 Duty Cycle (Representative Sample)

MANUFACTURER : Versus Technology, Inc.
MODEL NUMBER : VL4B
SERIAL NUMBER : None Assigned
TEST MODE : Transmit @ 433.92MHz
TEST PARAMETERS : Pulse Width 200uS
TEST PARAMETERS : Pulse OFF time: (182uS)
EQUIPMENT USED : RBG3, PHA0

NOTES

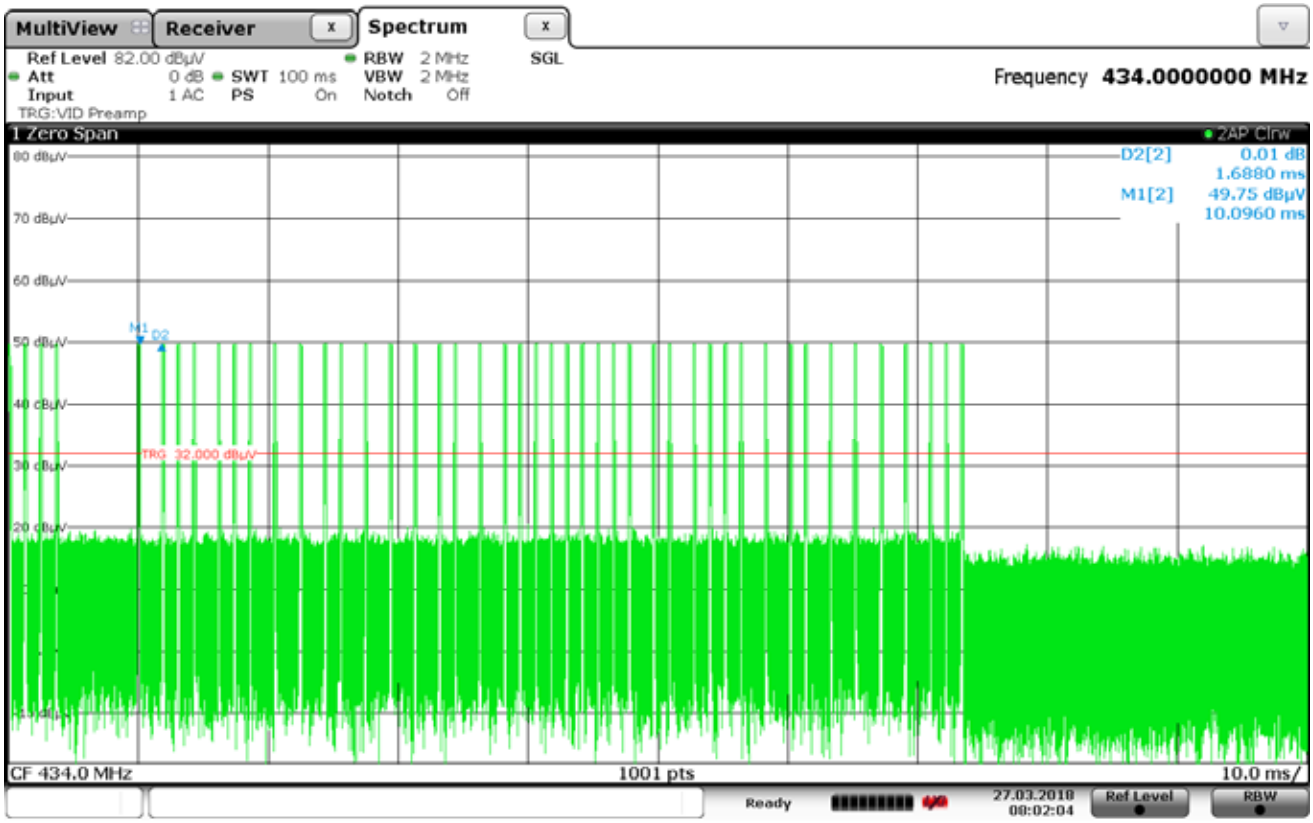


Date: 27.MAR.2018 08:00:48

FCC 15.231 Duty Cycle (Representative Sample)

MANUFACTURER : Versus Technology, Inc.
MODEL NUMBER : VL4B
SERIAL NUMBER : None Assigned
TEST MODE : Transmit @ 433.92MHz
TEST PARAMETERS : Preamble Width 6.18mS
TEST PARAMETERS :
EQUIPMENT USED : RBG3, PHA0

NOTES

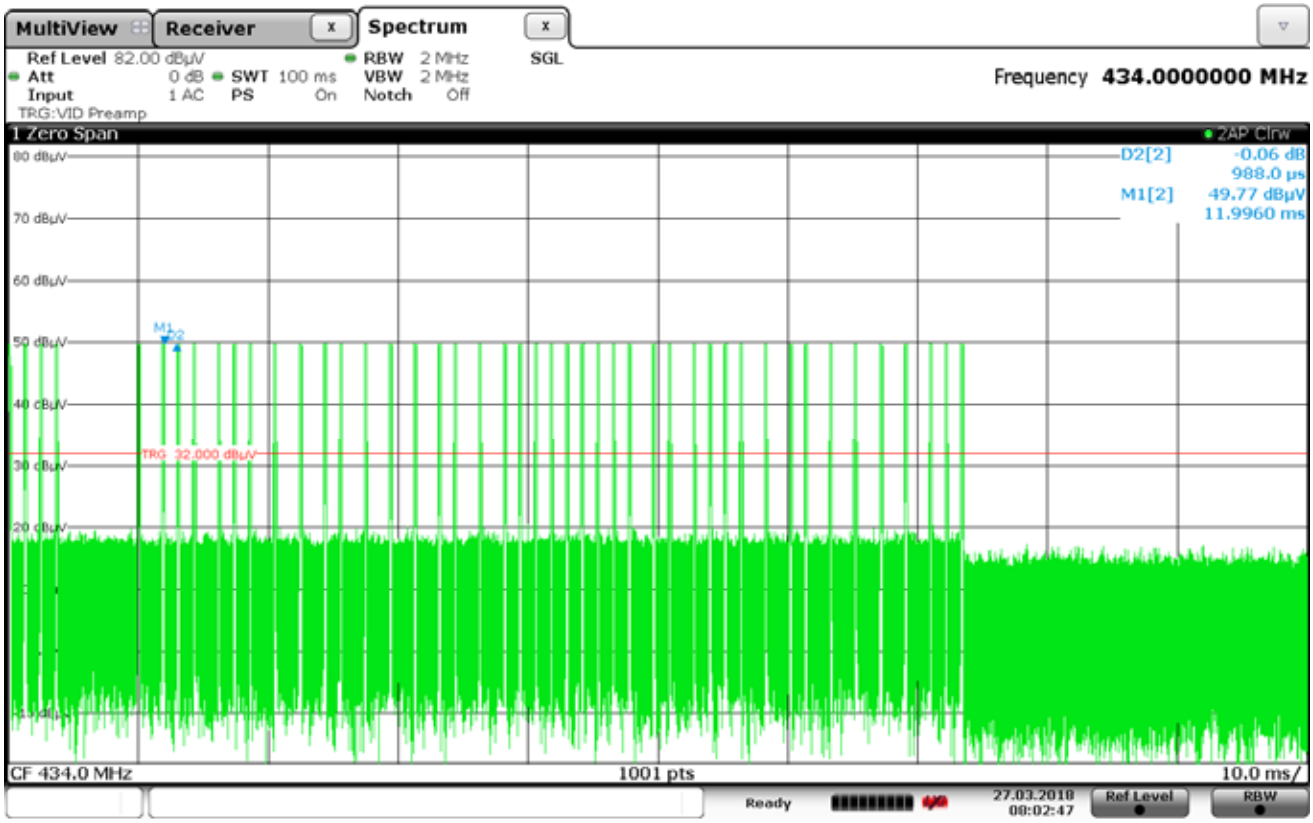


Date: 27.MAR.2018 08:02:04

FCC 15.231 Duty Cycle (Representative Sample)

MANUFACTURER	:	Versus Technology, Inc.
MODEL NUMBER	:	VL4B
SERIAL NUMBER	:	None Assigned
TEST MODE	:	Transmit @ 433.92MHz
TEST PARAMETERS	:	Long OFF time width 1.68mS
TEST PARAMETERS	:	
EQUIPMENT USED	:	RBG3, PHA0

NOTES

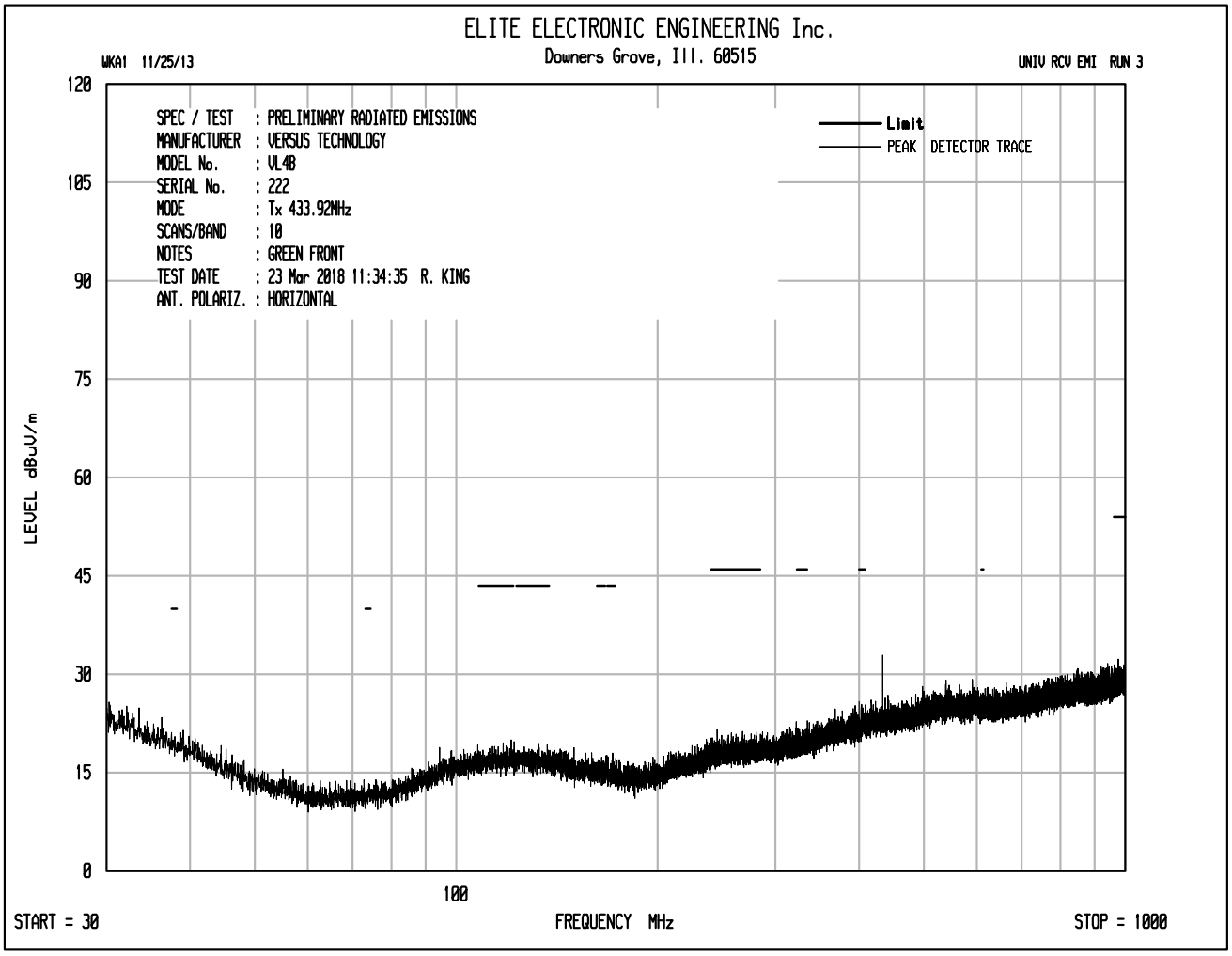


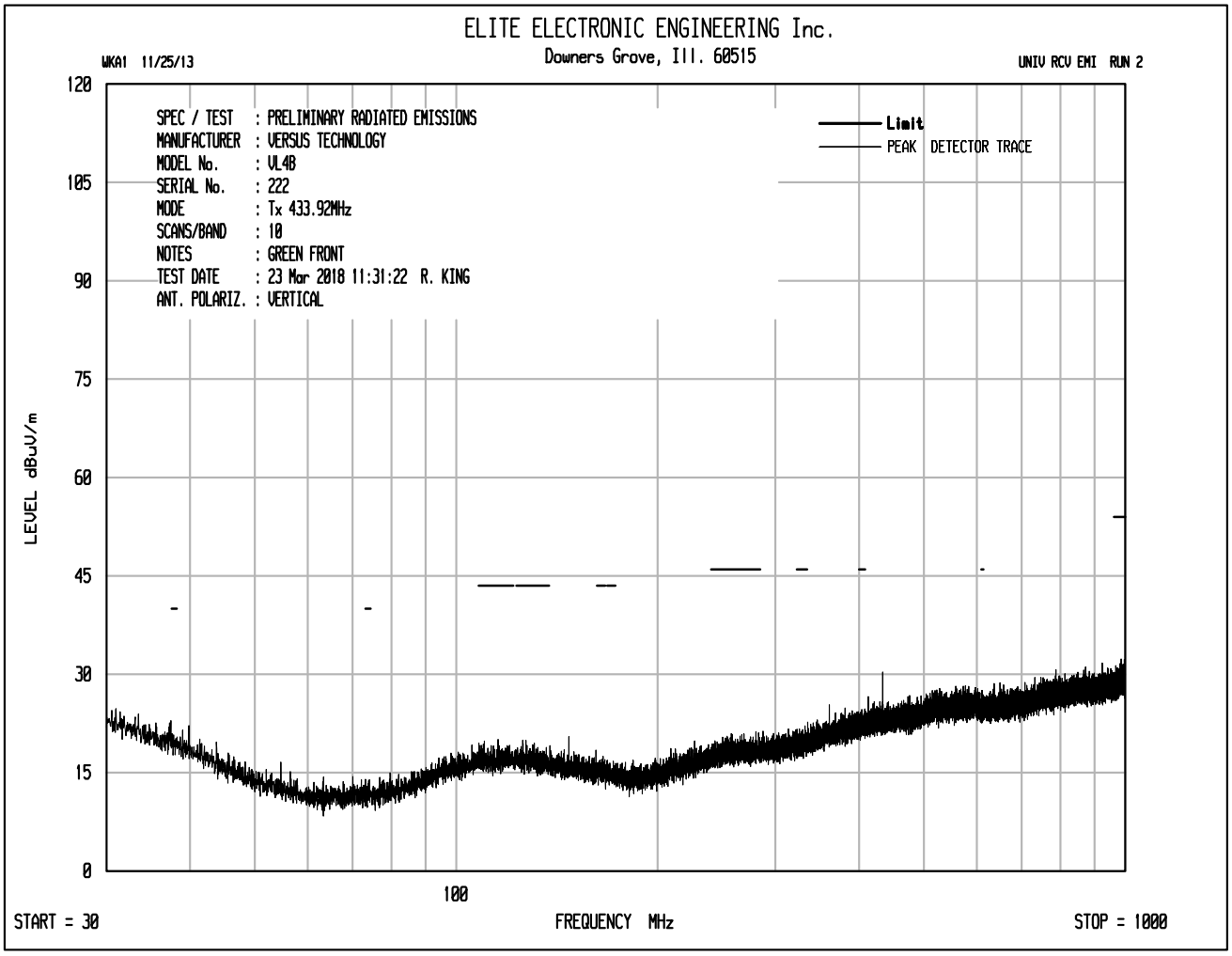
Date: 27.MAR.2018 08:02:48

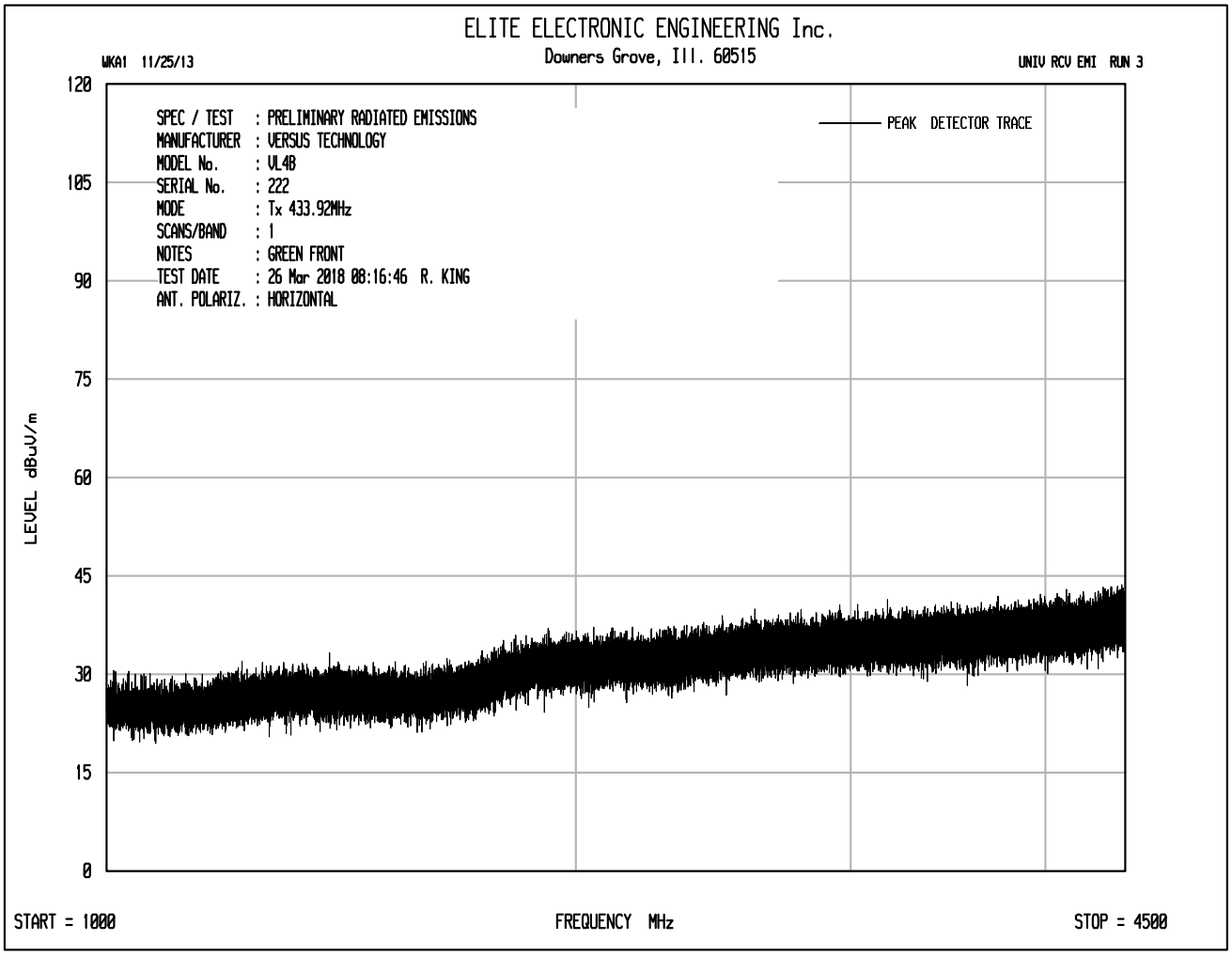
FCC 15.231 Duty Cycle (Representative Sample)

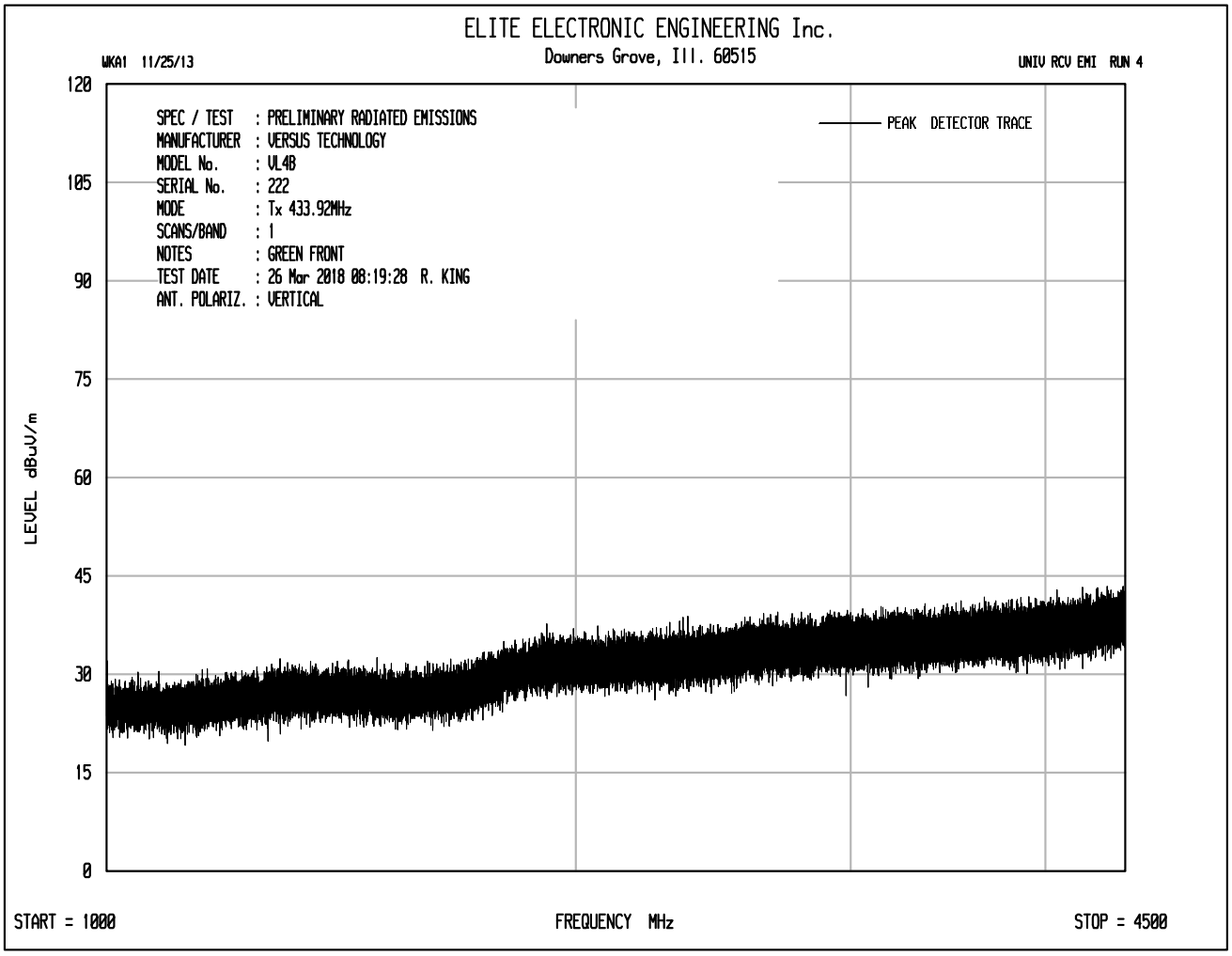
MANUFACTURER	:	Versus Technology, Inc.
MODEL NUMBER	:	VL4B
SERIAL NUMBER	:	None Assigned
TEST MODE	:	Transmit @ 433.92MHz
TEST PARAMETERS	:	Short OFF time width 988uS
TEST PARAMETERS	:	
EQUIPMENT USED	:	RBG3, PHA0

NOTES


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 3
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : VERSUS TECHNOLOGY
MODEL No. : VL4B
SERIAL No. : 222
MODE : Tx 433.92MHz
SCANS/BAND : 10
NOTES : GREEN FRONT
TEST DATE : 23 Mar 2018 11:34:35 R. KING
ANT. POLARIZ. : HORIZONTAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 2
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : VERSUS TECHNOLOGY
MODEL No. : VL4B
SERIAL No. : 222
MODE : Tx 433.92MHz
SCANS/BAND : 10
NOTES : GREEN FRONT
TEST DATE : 23 Mar 2018 11:31:22 R. KING
ANT. POLARIZ. : VERTICAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 3
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : VERSUS TECHNOLOGY
MODEL No. : VL4B
SERIAL No. : 222
MODE : Tx 433.92MHz
SCANS/BAND : 1
NOTES : GREEN FRONT
TEST DATE : 26 Mar 2018 08:16:46 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 4500


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 4
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : VERSUS TECHNOLOGY
MODEL No. : VL4B
SERIAL No. : 222
MODE : Tx 433.92MHz
SCANS/BAND : 1
NOTES : GREEN FRONT
TEST DATE : 26 Mar 2018 08:19:28 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 4500

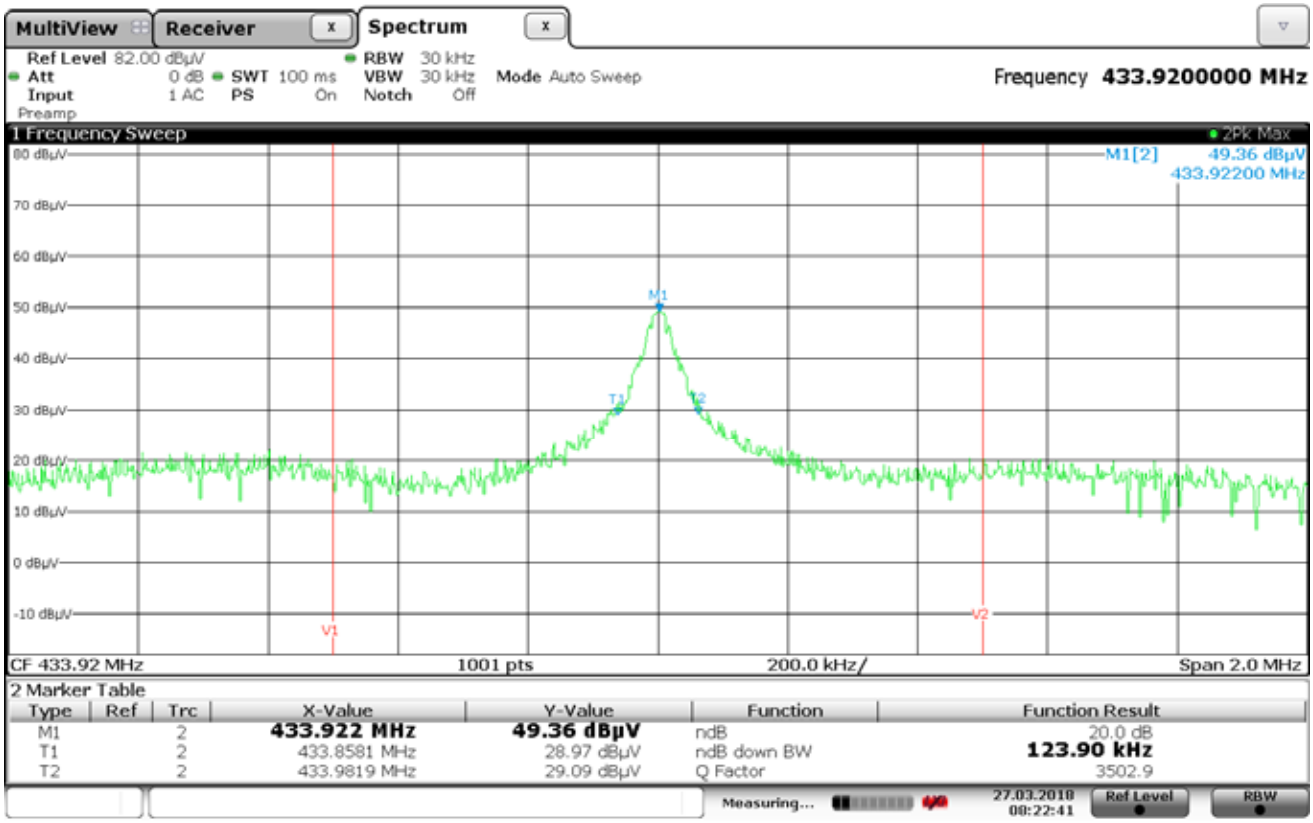
Manufacturer : Versus Technology, Inc.
Test Item : ID Badge
Model No. : VL4B
Mode : Transmit @ 433.92MHz
Serial No. : 222
Test Specification : FCC-15.231(b)
Date : March 23-26, 2018
Test Distance : 3 meters
Notes : Peak Detector with 1MHz Resolution Bandwidth

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

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)
433.920	H	24.1		1.4	22.3	0.0	-17.9	29.9	31.2	10996.7	-50.9
433.920	V	15.1		1.4	22.3	0.0	-17.9	20.9	11.1	10996.7	-59.9
867.840	H	5.8	*	2.0	26.2	0.0	-17.9	16.1	6.4	1099.7	-44.7
867.840	V	5.4	*	2.0	26.2	0.0	-17.9	15.8	6.1	1099.7	-45.1
1301.760	H	13.6	*	2.5	29.6	0.0	-17.9	27.8	24.6	500.0	-26.2
1301.760	V	13.4	*	2.5	29.6	0.0	-17.9	27.6	23.9	500.0	-26.4
1735.680	H	14.2	*	2.9	31.1	0.0	-17.9	30.3	32.8	1099.7	-30.5
1735.680	V	14.4	*	2.9	31.1	0.0	-17.9	30.5	33.6	1099.7	-30.3
2169.600	H	47.0	*	3.2	32.7	-39.9	-17.9	25.2	18.1	1099.7	-35.7
2169.600	V	48.0	*	3.2	32.7	-39.9	-17.9	26.2	20.4	1099.7	-34.6
2603.520	H	48.9	*	3.6	33.6	-39.8	-17.9	28.4	26.3	1099.7	-32.4
2603.520	V	48.0	*	3.6	33.6	-39.8	-17.9	27.5	23.8	1099.7	-33.3
3037.440	H	52.7	*	3.9	34.6	-39.6	-17.9	33.8	48.8	1099.7	-27.1
3037.440	V	52.6	*	3.9	34.6	-39.6	-17.9	33.7	48.4	1099.7	-27.1
3471.360	H	50.3	*	4.2	34.1	-39.2	-17.9	31.4	37.3	1099.7	-29.4
3471.360	V	50.8	*	4.2	34.1	-39.2	-17.9	31.9	39.4	1099.7	-28.9
3905.280	H	47.8	*	4.4	34.6	-39.2	-17.9	29.8	30.7	500.0	-24.2
3905.280	V	48.0	*	4.4	34.6	-39.2	-17.9	29.9	31.1	500.0	-24.1
4339.200	H	51.0	*	4.6	35.6	-39.2	-17.9	34.0	50.3	500.0	-20.0
4339.200	V	51.4	*	4.6	35.6	-39.2	-17.9	34.4	52.8	500.0	-19.5

Checked BY Richard E. King :

Richard E. King



Date: 27.MAR.2018 08:22:40

FCC 15.231 20dB Bandwidth

MANUFACTURER	:	Versus Technology, Inc.
MODEL NUMBER	:	VL4B
SERIAL NUMBER	:	222
TEST MODE	:	Transmit @ 433.92MHz
TEST PARAMETERS	:	20dB Bandwidth
EQUIPMENT USED	:	RBG3 PHA0
NOTES	:	Green Front

NOTES	:	Display lines V1 and V2 represent the 0.25% bandwidth
	:	Display line H1 represents the 20dB down point from the transmit frequency