Measurement of RF Interference from an V2Z Transceiver

For	California Eastern Laboratories 1253 N. Old Rand Road Wauconda, IL 60084
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Test Personnel	Mark Longinotti
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Test Report By: MARK E. LONGINOTTI

Mark Longinotti
EMC Engineer

Requested By: Dave Wilde
California Eastern Laboratories

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
—	06/30/2016	Initial release

Measurement of RF Emissions from a V2Z Transceiver

1. INTRODUCTION

1.1 Scope of Tests

This document represents the results of the series of radio interference measurements performed on a California Eastern Laboratories V2Z, transceiver (hereinafter referred to as the EUT). The EUT is a digital modulation transceiver. The transceiver was designed to transmit and receive in the 2400-2483.5 MHz band using a PCB Trace Antenna with nominal gain of -2.0dBi. Serial Number 15 was assigned to the EUT used for all radiated tests. Serial Number 16 was assigned to the EUT used for all conducted output power tests and antenna port spurious radiated emissions tests (Serial Number 16 was modified for testing purposes. A coaxial connector was added to the antenna port so that conducted output power tests and antenna port spurious emissions tests could be performed.) The EUT was manufactured and submitted for testing by California Eastern Laboratories located in Wauconda, IL.

1.2 Purpose

The test series was performed to determine if the EUT meets the conducted RF emission requirements, radiated RF emissions requirements, and additional provisions 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 2400-2483.5 MHz band.

The test series was also performed to determine if the EUT meets the conducted RF emission requirements, radiated RF emissions requirements, and additional provisions of the Industry Canada Radio Standards Specification RSS-Gen Section 8.8 and Section 7.1.2 for receivers and Industry Canada Radio Standards Specification RSS-Gen Section 8.8 and Industry Canada Radio Standards Specification RSS-247 for Transmitters.

Testing was performed in accordance with ANSI C63.4-2014 and ANSI C63.10-2013.

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 Lab Code: 1786-01.

1.5 Laboratory Conditions

The temperature at the time of the test was 23C and the relative humidity was 31%.

2. APPLICABLE DOCUMENTS

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

- Federal Communications Commission "Code of Federal Regulations", Title 47, Part 15, Subparts B and C, dated 1 October 2015
- 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”

- Federal Communications Commission Office of Engineering and Technology Laboratory Division, Guidance For Performing Compliance Measurements On Digital Transmissions Systems (DTS) Operating Under §15.247
  April 8, 2016

- Industry Canada RSS-247, Issue 1, May 2015, "Spectrum Management and Telecommunications Radio Standards Specification, Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs), and License-Exempt Local Area Network (LE-LAN) Devices"

- Industry Canada RSS-GEN, Issue 4, November 2014, "Spectrum Management and Telecommunications Radio Standards Specification, General Requirements for Compliance of Radio Apparatus"

3. EUT SETUP AND OPERATION

3.1 General Description

The EUT is a V2Z transceiver. A block diagram of the EUT setup is shown as Figure 1 and Figure 2.

3.1.1 Power Input

The EUT obtained 115V 60Hz by plugging directly into a standard 115V, 60Hz outlet. For power line conducted emissions tests, the high and low leads were connected through a line impedance stabilization network (LISN) which was located on the ground plane. The network complies with the requirements of Paragraph 4.3 of ANSI C63.4-2014.

3.1.2 Peripheral Equipment

The following peripheral equipment was submitted with the EUT:

Item	Description
CEL Mesh Connect	CEL Mesh Connect daughter board connected to a CEL EVAL motherboard
Notebook PC	ASPIRE ONE

The CEL Mesh Connect was powered with 5VDC via a USB cable from the Notebook PC. The Notebook PC was running Maui_Radio_control2.vi software which was used to select the test mode for the EUT. The CEL Mesh Connect sent the commands from the PC to the EUT wirelessly. Once the EUT was programmed in the correct mode, the CEL Mesh Connect and the Notebook PC were removed from the test chamber.

3.1.3 Interconnect Cables

No interconnect cables were submitted with the EUT.

3.1.4 Grounding

The EUT was ungrounded during the tests.

3.2 Software

For all tests the EUT had Firmware Version RF_JASCO_45852 loaded onto the device to provide correct load characteristics.

3.3 Operational Mode

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

- Transmit at Channel 11 (2405MHz), Power setting = 4
- Transmit at Channel 18 (2440MHz), Power setting = 4
- Transmit at Channel 25 (2475MHz), Power setting = 2

- Transmit at Channel 26 (2480MHz), Power setting = -20

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 C63.4-2014 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 tests were performed with an EMI receiver utilizes the bandwidths and detectors specified in the requirements.

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	1.06	-1.06
Expanded Uncertainty (95% confidence)	2.12	-2.12

Radiated Emissions Measurements		
Combined Standard Uncertainty	2.09	-2.09
Expanded Uncertainty (95% confidence)	4.19	-4.19

5. TEST PROCEDURES

5.1 Receiver

5.1.1.1 Requirements

Per the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart B, Section 15.101(b), receivers operating above 960MHz are exempt from complying with the technical provisions of part 15.

Per the Industry Canada, RSS-Gen, only stand-alone receivers that operate in the band 30 MHz-960 MHz shall comply with the limits for receiver–spurious emissions set out in RSS-Gen. Since the EUT is not a stand-alone receiver operating in the 30MHz – 960MHz band, no testing is required.

5.2 Transmitter

5.2.1 Powerline Conducted Emissions

5.2.1.1 Requirements

Per the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Per 15.207(a), all radio frequency voltages on the power lines of a transmitter shall be below the values shown below when using a quasi-peak or average detector:

Frequency MHz	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 – 0.5	66 decreasing with logarithm of frequency to 56	56 decreasing with logarithm of frequency to 46
0.5 - 5	56	46
5 - 30	60	50

Note 1: The lower limit shall apply at the transition frequencies.
Note 2: If the levels measured using the QP detector meet both the QP and the Average limits, the EUT is considered to have met both requirements and measurements do not need to be performed using the Average detector.

5.2.1.2 Procedures

The interference on each power lead of the EUT was measured by connecting the measuring equipment to the appropriate meter terminal of the Line Impedance Stabilization Network (LISN). The meter terminal of the LISN not under test was terminated with 50 ohms.

a) The EUT was operated in the Transmit at 2440MHz, Power setting = 4 mode.

b) Measurements were first made on the 115V, 60Hz high line.

c) The frequency range from 150 kHz to 30 MHz was broken up into smaller frequency sub-bands.

d) Conducted emissions measurements were taken on the first frequency sub-band using a peak detector.

e) The data thus obtained was then searched by the computer for the highest levels. Any emissions levels that were within 10dB of the average limit were then measured again using both a quasi-peak detector and an average detector. (If no peak readings were within 10dB of the average limit, quasi-peak and average readings were taken on the highest emissions levels measured during the peak detector scan.)

f) Steps (d) and (e) were repeated for the remainder of the frequency sub-bands until the entire frequency range from 150kHz to 30MHz was investigated. The peak trace was automatically plotted. The plot also shows quasi-peak and average readings that were taken on discrete frequencies. A table showing the quasi-peak and average readings was also generated. This tabular data compares the quasi-peak and average conducted emissions to the applicable conducted emissions limits.

g) Steps (c) through (f) were repeated on the 115V, 60Hz return line.

5.2.1.3 Results

The plots of the peak, quasi-peak, and average conducted voltage levels acquired from each input power line with the EUT operated in the Transmit at 2440MHz, Power setting = 4 mode are shown on pages 23 and 25. The tabular quasi-peak and average results from each input power line with the EUT operated in the Transmit at 2440MHz, Power setting = 4 mode are shown on pages 22 and 24. All power line conducted emissions measured from the EUT were within the specification limits. The emissions level closest to the limit (worst case) occurred at 563kHz. The emissions level at this frequency was 13.3dB within the limit. A photograph of the test configuration which yielded the highest or worst case, conducted emission levels are shown on Figure 2.

5.2.2 6dB Bandwidth

5.2.2.1 Requirements

Per 15.247(a)(2),the minimum 6dB bandwidth shall be at least 500kHz for all systems using digital modulation techniques.

5.2.2.2 Procedures

The EUT was setup inside the chamber. The EUT was allowed to transmit continuously. The transmit channel was set separately to low, middle, and high channels. The resolution bandwidth (RBW) was set to 100kHz, the video bandwidth (VBW) was set to the same as or 3 times greater than the RBW, and the span was set to 3 times the RBW.

The 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined. The analyzer's display was plotted using a 'screen dump' utility.

5.2.2.3 Results

The plots on pages 26 through 28 show that the minimum 6 dB bandwidth was 1.57MHz which is greater than minimum allowable 6dB bandwidth requirement of 500kHz for systems using digital modulation techniques. The 99% bandwidth was measured to be 2.48MHz.

5.2.3 Average Output Power and EIRP

5.2.3.1 Requirements

Per section 15.247(b)(3), for systems using digital modulation the maximum peak output conducted power shall not be greater than 1.0W (30dBm). Per section 15.247(b)(4), this limit is based on the use of antennas with directional gains that do not exceed 6dBi. Since the limit allows for a 6dBi antenna gain, the maximum EIRP can be increased by 6dB to 4 Watt (36dBm).

Alternatively, per section 15.247(b)(3), compliance with the 1 Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

5.2.3.2 Procedures

5.2.3.2.1 Average Output Power

The antenna port of the EUT was connected to the spectrum analyzer through 40dB of attenuation. The EUT was set to transmit separately at the low, middle, and high channels. The resolution bandwidth (RBW) was set to greater than the 6dB bandwidth. The RMS detector was enabled. The 'Max-Hold' function was engaged. The maximum meter reading was recorded. The average power output was calculated for the low, middle and high channels.

5.2.3.2.2 EIRP

The EUT was placed on the 1.5 meter tall non-conductive stand and set to transmit. A double ridged waveguide antenna was placed at a test distance of 3 meters from the EUT. The resolution bandwidth (RBW) of the spectrum analyzer was set to greater than the 99% bandwidth. The RMS detector was selected. The EUT was maximized for worst case emissions (or maximum output power) at the measuring antenna. The maximum meter reading was recorded. The average power output was measured for the low, middle and high channels.

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

5.2.3.3 Results

The average antenna port output power results are presented on pages 29. The maximum average antenna port conducted output power from the transmitter was 0.163W (22.12 dBm) which is below the 1 Watt limit.

The average EIRP results are presented on pages 30 through 33. The maximum average EIRP measured from the transmitter was 0.1318W (21.2 dBm) which is below the 4 Watt limit.

5.2.4 Duty Cycle Factor Measurements

5.2.4.1 Requirements

Per 15.35(c), 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.

5.2.4.2 Procedures

At the time of testing, the EUT was configured for approximately 100% duty cycle and not configured to show normal duty cycle. The normal duty cycle factor calculations were provided by California Eastern Laboratories personnel.

5.2.4.3 Results

The duty cycle factor calculations are presented on 34. The worst case duty cycle is 0.04256 sec transmit “on-time” in a 0.0644 second time period. The duty cycle correction factor was calculated to be -3.6dB (-3.6dB = 20*log(0.04256sec/0.0644sec)).

5.2.5 Antenna Conducted Spurious Emissions

5.2.5.1 Requirements

Per section 15.247(c), the spurious emissions in any 100 kHz BW outside the frequency band of operation must be at least 30dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power.

5.2.5.2 Procedures

The antenna port of the EUT was connected to the spectrum analyzer through 40dB of attenuation. The resolution bandwidth (RBW) was set to 100kHz. The peak detector and 'Max-Hold' function were engaged. The emissions in

the frequency range from 30MHz to 25GHz were observed and plotted separately with the EUT transmitting at low, middle and high channels.

5.2.5.3 Results

The results of the antenna conducted emissions levels were plotted. These plots are presented on pages 35 through 43. These plots show that the spurious emissions were at least 30 dB below the level of the fundamental.

5.2.6 Radiated Spurious Emissions Measurements

5.2.6.1 Requirements

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must comply with the radiated emission limits specified in §15.209(a).

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

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

5.2.6.2 Procedures

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

Preliminary radiated emissions tests were performed to determine the emission characteristics of the EUT. For the preliminary test, a broadband measuring antenna was positioned at a 3 meter distance from the EUT. The entire frequency range from 30MHz to 25GHz was investigated using a peak detector function.

The final emission tests were then manually performed over the frequency range of 30MHz to 25GHz.

a) The field strengths of all emissions below 1 GHz were measured using a bi-log antenna. The bi-log antenna was positioned at a 3 meter distance from the EUT. The EUT was placed on an 80cm high non-conductive stand. A peak detector with a resolution bandwidth of 100 kHz was used on the spectrum analyzer.

b) The field strengths of all emissions above 1 GHz were measured using a double-ridged waveguide antenna. The waveguide antenna was positioned at a 3 meter distance from the EUT. The EUT was placed on a 1.5 meter high non-conductive stand. A peak detector with a resolution bandwidth of 1 MHz was used on the spectrum analyzer.

c) To ensure that maximum or worst case emission levels were measured, the following steps were taken when taking all measurements:

   i) The EUT was rotated so that all of its sides were exposed to the receiving antenna.

   ii) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.

   iii) The measuring antenna was raised and lowered for each antenna polarization to maximize the

readings.

iv) In instances where it was necessary to use a shortened cable between the measuring antenna and the spectrum analyzer. The measuring antenna was not raised or lowered to ensure maximized readings, instead the EUT was rotated through all axis to ensure the maximum readings were recorded for the EUT.

d) For all radiated emissions measurements below 1 GHz, if the peak reading is below the limits listed in 15.209(a), no further measurements are required. If however, the peak readings exceed the limits listed in 15.209(a), then the emissions are remeasured using a quasi-peak detector.

e) For all radiated emissions measurements above 1 GHz, the peak readings must comply with the 15.35(b) limits. 15.35(b) states that when average radiated emissions measurements are specified, there also is a limit on the peak level of the radiated emissions. The limit on the peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test. Therefore, all peak readings above 1 GHz must be no greater than 20 dB above the limits specified in 15.209(a).

f) Next, for all radiated emissions measurements above 1GHz, the resolution bandwidth was set to 1MHz. The analyzer was set to linear mode with a 10Hz video bandwidth in order to simulate an average detector. An average reading was taken.

5.2.6.3 Results

Preliminary radiated emissions plots with the EUT transmitting at Low Frequency, Middle Frequency, and High Frequency are shown on pages 44 through 67. Final radiated emissions data are presented on data pages 68 through 73. 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 7320MHz. The emissions level at this frequency was 5.7dB within the limit. Photographs of the test configuration which yielded the highest, or worst case, radiated emission levels are shown on Figures 4 through 6.

5.2.7 Band Edge Compliance

5.2.7.1 Requirements

Per section 15.247(d), the emissions at the band-edges must be at least 30dB below the highest level measured within the band but attenuation below the general limits listed in 15.209(a) is not required.

In addition, the radiated emissions which fall in the restricted band beginning at 2483.5 MHz must meet the general limits of 15.209(a).

5.2.7.2 Procedures

5.2.7.2.1 Low Band Edge

1) The EUT was set up inside the test chamber on a non-conductive stand.
2) A broadband measuring antenna was placed at a test distance of 3 meters from the EUT.
3) The EUT was set to transmit continuously at the channel closest to the low band-edge.
4) The EUT was maximized for worst case emissions at the measuring antenna. The maximum meter reading was recorded.
5) To determine the band edge compliance, the following spectrum analyzer settings were used:
    a. Center frequency = low band-edge frequency.
    b. Span = Wide enough to capture the peak level of the emission operating on the channel closest to the band-edge, as well as any modulation products which fall outside of the authorized band of operation.
    c. Resolution bandwidth (RBW) = 100kHz.
    d. The 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined.
    e. The marker was set on the peak of the in-band emissions. A display line was placed 30dB down from the peak of the in-band emissions. All emissions which fall outside of the

authorized band of operation must be below the 30dB down display line. (All emissions to the left of the center frequency (band-edge) must be below the display line.)

f. The analyzer's display was plotted using a 'screen dump' utility.

5.2.7.2.2 High Band-Edge

1) The EUT was set to transmit continuously at the channel closest to the high band-edge.
2) A double ridged waveguide was placed 3 meters away from the EUT. The antenna was connected to the input of a spectrum analyzer.
3) The center frequency of the analyzer was set to the high band edge (2483.5MHz)
4) The resolution bandwidth was set to 1MHz.
5) To ensure that the maximum or worst case emission level was 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.

6) The highest measured peak reading was recorded.
7) The highest measured average reading was recorded.

5.2.7.3 Results

Pages 74 through 79 show the band-edge compliance results. As can be seen from these plots, the radiated emissions at the low end band edge are within the 30 dB down limits. The radiated emissions at the high end band edge are within the general limits.

5.2.8 Power Spectral Density

5.2.8.1 Requirement

Per section 15.247(e), the peak power spectral density from the intentional radiator shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

5.2.8.2 Procedures

1) The antenna port of the EUT was connected to the spectrum analyzer through a 40dB pad.
2) The EUT was set to transmit continuously at the low, mid and high channel.
3) To determine the power spectral density, the following spectrum analyzer settings were used:
   a. Center frequency = transmit frequency
   b. Span = 1.5 times the 99% bandwidth
   c. Resolution bandwidth (RBW): 3kHz
   d. Sweep time = auto
   e. The RMS detector was employed over a minimum of 100 traces.
   f. The Peak marker function was used to determine the maximum amplitude level.
   g. The analyzer's display was plotted using a 'screen dump' utility.

5.2.8.3 Results

Pages 80 through 82 show the power spectral density results. As can be seen from these plots, the average power spectral density is less than 8dBm in a 3kHz band during any time interval of continuous transmission.

6. CONCLUSIONS

It was determined that the California Eastern Laboratories Transceiver, Part No. V2Z digital modulation transceiver, did fully meet the conducted and radiated emission requirements of the FCC "Code of Federal

Regulations" Title 47, Part 15, Subpart B, Sections 15.107 and 15.109 for receivers and Subpart C, Sections 15.207 and 15.247 for Intentional Radiators Operating within the 2400-2483.5 MHz band, when tested per ANSI C63.4-2014 and C63.10-2013.

It was also determined that the California Eastern Laboratories Transceiver, Part No. V2Z digital modulation transceiver, did fully meet the conducted and radiated RF emission requirements of the Industry Canada Radio Standards Specification, RSS-Gen, Section 8.8 and Section 7.1.2 for receivers and the Industry Canada Radio Standards Specification RSS-Gen Section 8.8 and Radio Standards Specification RSS-247 for transmitters, when tested per ANSI C63.4-2014 and C63-10-2013.

7. CERTIFICATION

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

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

8. ENDORSEMENT DISCLAIMER

This report must not be used to claim product certification, approval, or endorsement by A2LA, 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
APW0	PREAMPLIFIER	PLANAR ELECTRONICS	PE2-30-20G20R6G	PL2926/0646	20GHZ-26.5GHZ	3/2/2016	3/2/2017
APW11	PREAMPLIFIER	PMI	PE2-35-120-5R0-10-12-SFF	PL11685/1241	1GHZ-20GHZ	4/18/2016	4/18/2017
CDU2	LAPTOP COMPUTER	DELL	PRECISION	---	---	N/A	
CDY0	WORKSTATION	ELITE	WORKSTATION		WINDOWS 7	N/A	
GRE0	SIGNAL GENERATOR	AGILENT TECHNOLOGIES	E4438C	MY42083127	250KHZ-6GHZ	2/25/2016	2/25/2017
NHG0	STANDARD GAIN HORN ANTENNA	NARDA	638	---	18-26.5GHZ	NOTE 1	
NTA2	BILOG ANTENNA	TESEQ	6112D	28040	25-1000MHz	10/27/2015	10/27/2016
NWQ0	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS LINDGREN	3117	66657	1GHZ-18GHZ	5/18/2016	5/18/2018
NWQ2	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS LINDGREN	3117	66659	1GHZ-18GHZ	3/2/2016	3/2/2018
PLF1	CISPR16 50UH LISN	ELITE	CISPR16/70A	001	.15-30MHz	5/16/2016	5/16/2017
PLF3	CISPR16 50UH LISN	ELITE	CISPER16/70A	003	.15-30MHz	5/16/2016	5/16/2017
RBB0	EMI TEST RECEIVER 20HZ TO 40 GHZ.	ROHDE & SCHWARZ	ESIB40	100250	20 HZ TO 40GHZ	2/16/2016	2/16/2017
SES1	24VDC POWER SUPPLY	P TRANS	FS-32024-1M	002	18-27VDC	NOTE 1	
T2D8	20DB, 25W ATTENUATOR	WEINSCHEL	46-20-43	AY9247	DC-18GHZ	9/21/2015	9/21/2016
T2DP	20DB, 25W ATTENUATOR	WEINSCHEL	46-20-34	BS0921	DC-18GHZ	8/3/2015	8/3/2016
T2Q0	20DB, 20W ATTENUATOR	AEROFLEX/WEINSCHEL	89-20-21	337	DC-40GHZ	8/20/2015	8/20/2017
T2Q1	20DB/20W ATTENUATOR	AEROFLEX/WEINSCHEL	89-20-21	335	DC-40GHZ	8/20/2015	8/20/2017
XOB2	ADAPTER	HEWLETT PACKARD	K281C,012	09407	18-26.5GHZ	NOTE 1	
XPR0	HIGH PASS FILTER	K&L MICROWAVE	11SH10-4800/X20000	001	4.8-20GHZ	9/22/2015	9/22/2016

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.

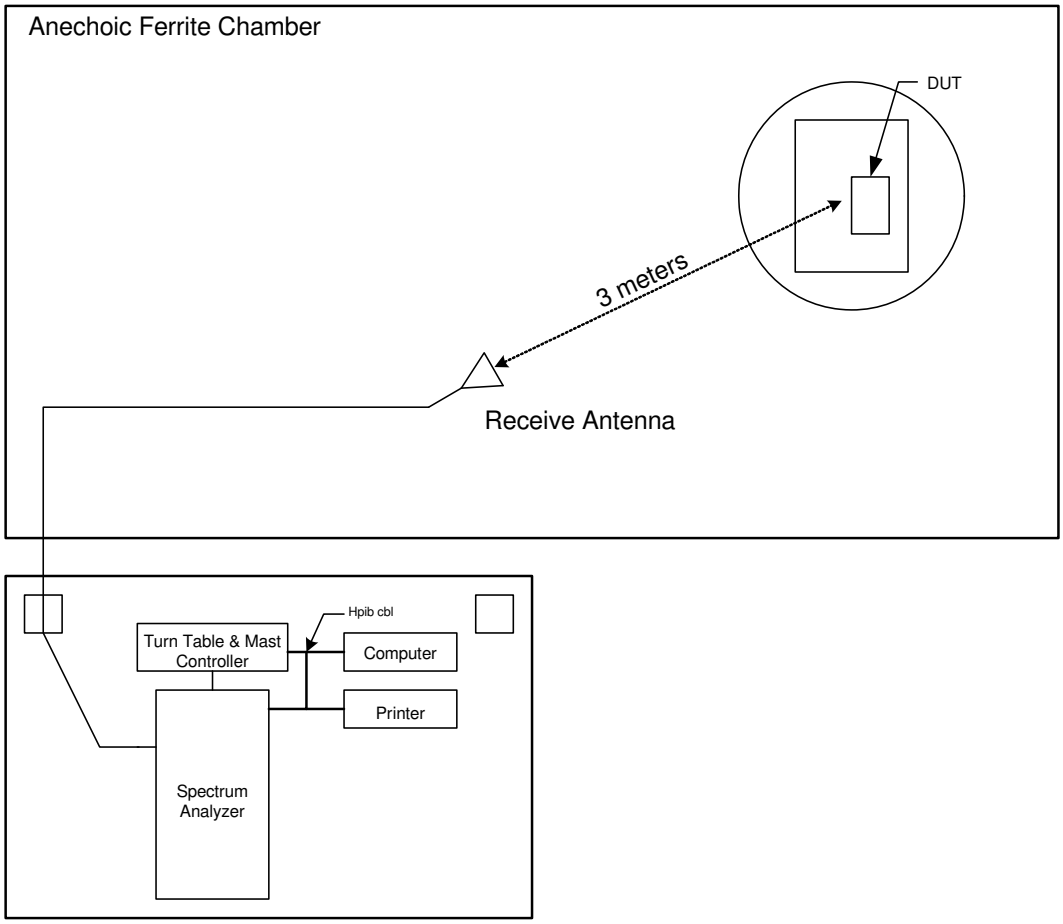


FIGURE 1 BLOCKDIAGRAM OF TEST SETUP

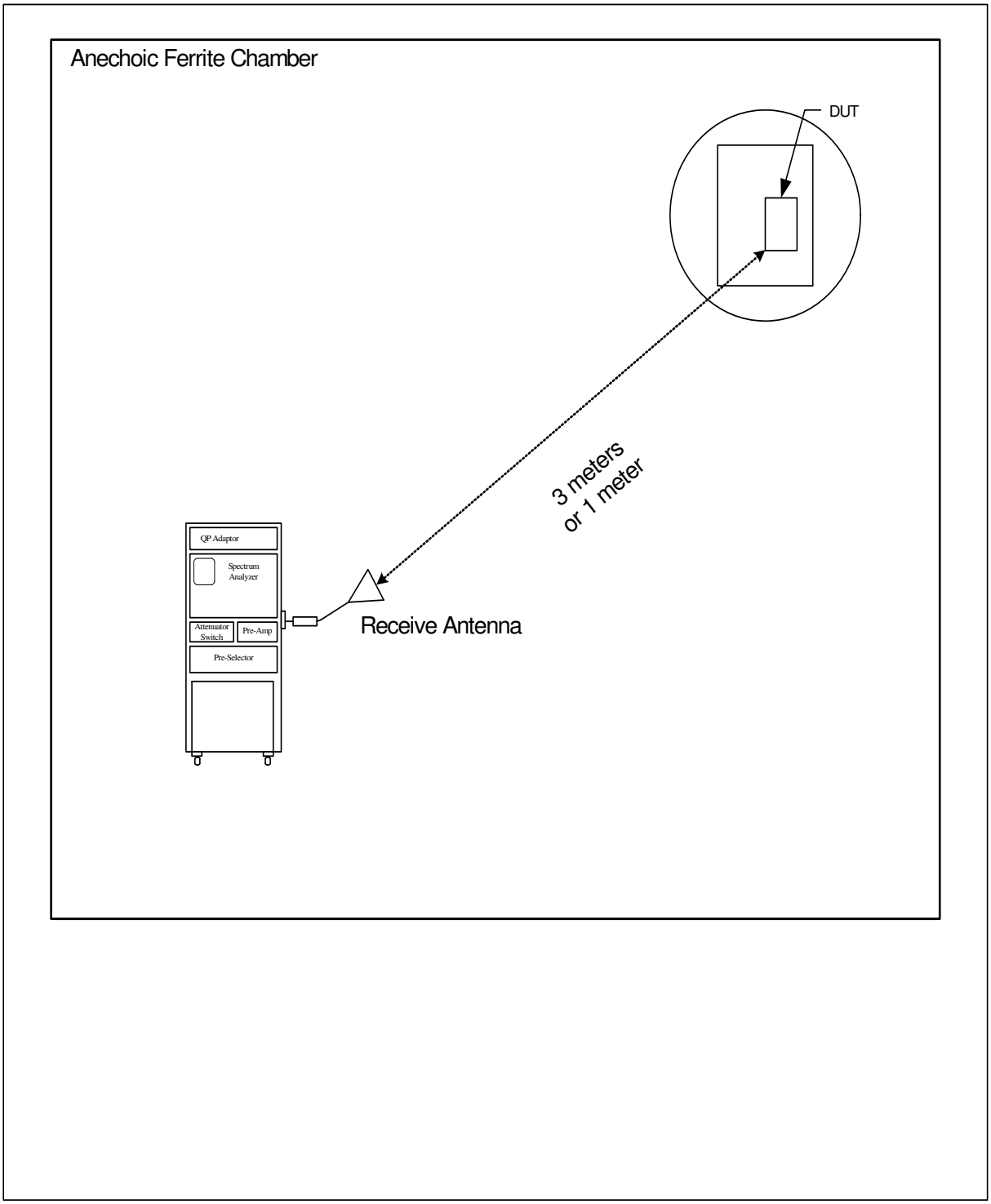
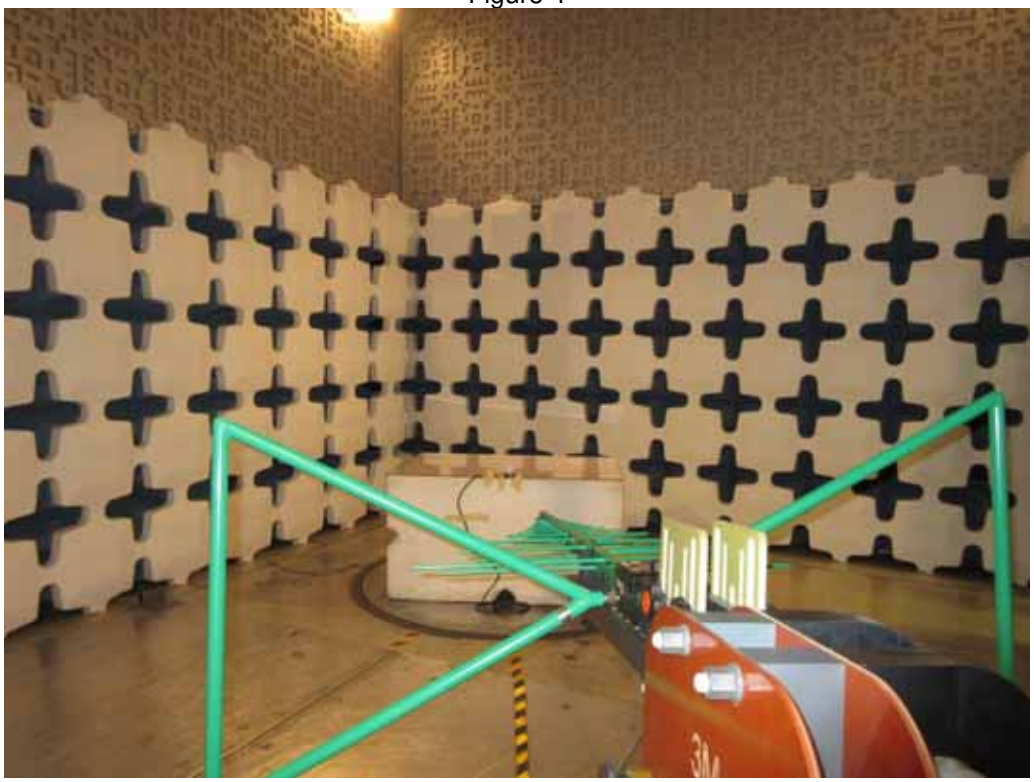


Figure 2: BLOCK DIAGRAM OF TEST SETUP FOR RADIATED EMISSIONS ABOVE 18GHZ

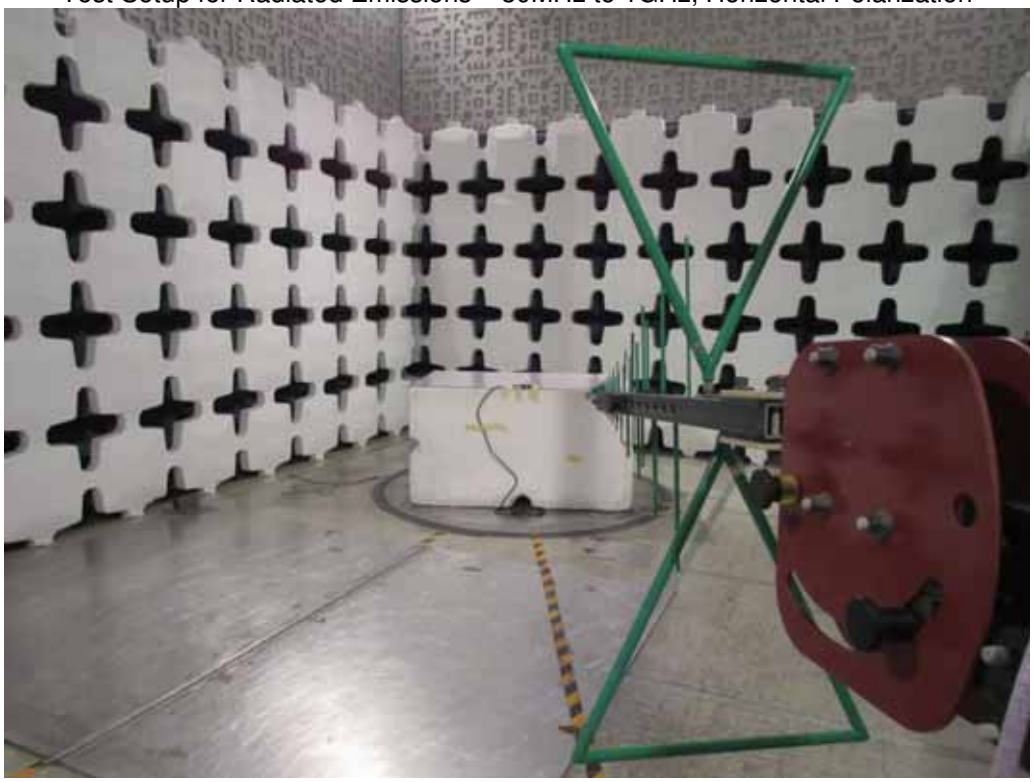
Figure 3

Test Setup for Conducted Emissions

Figure 4



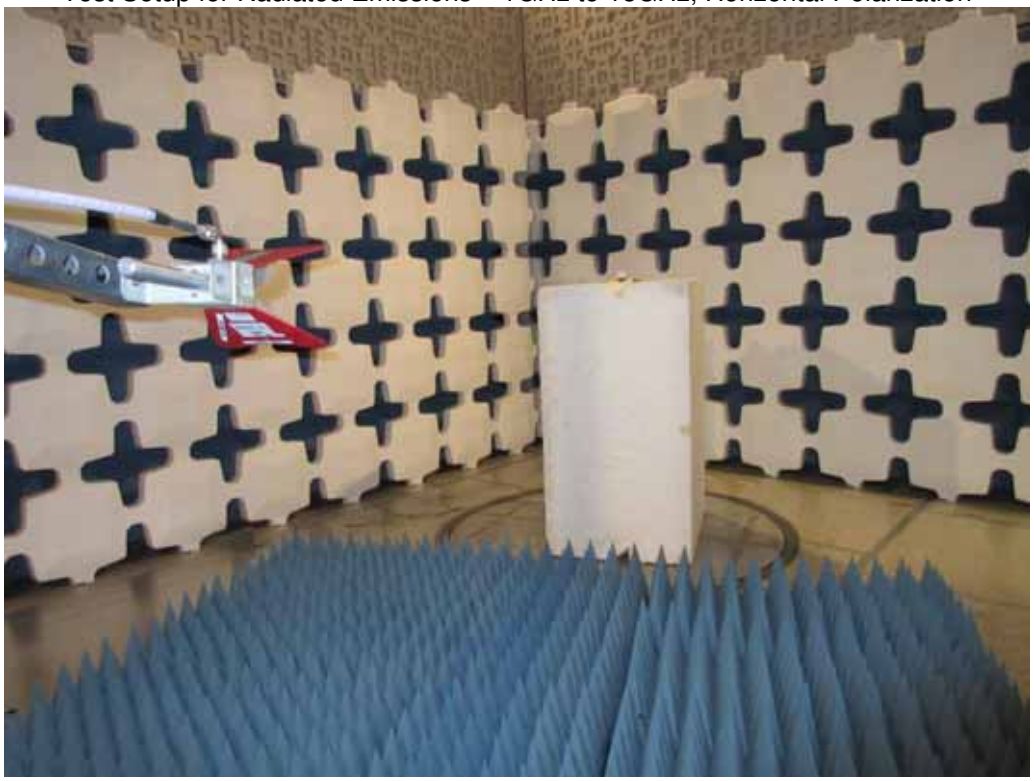
Test Setup for Radiated Emissions – 30MHz to 1GHz, Horizontal Polarization



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

Figure 5

Test Setup for Radiated Emissions – 1GHz to 18GHz, Horizontal Polarization



Test Setup for Radiated Emissions – 1GHz to 18GHz, Vertical Polarization

Figure 6

Test Setup for Radiated Emissions – 18GHz to 25GHz, Horizontal Polarization

Test Setup for Radiated Emissions – 18GHz to 25GHz, Vertical Polarization

FCC Part 15 Subpart B Conducted Emissions Test

Significant Emissions Data

VBR8 04/23/2015

Manufacturer	:	CEL
Model	:	V2Z
DUT Revision	:	
Serial Number	:	15
DUT Mode	:	Tx @ 2440MHz POWER=4
Line Tested	:	115V 60 Hz HIGH
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-10
Notes	:	
Test Engineer	:	M. Longinotti
Limit	:	Class B
Test Date	:	Jun 28, 2016 03:48:57 PM
Data Filter	:	Up to 80 maximum levels detected with 6 dB level excursion threshold over 10 dB margin below limit

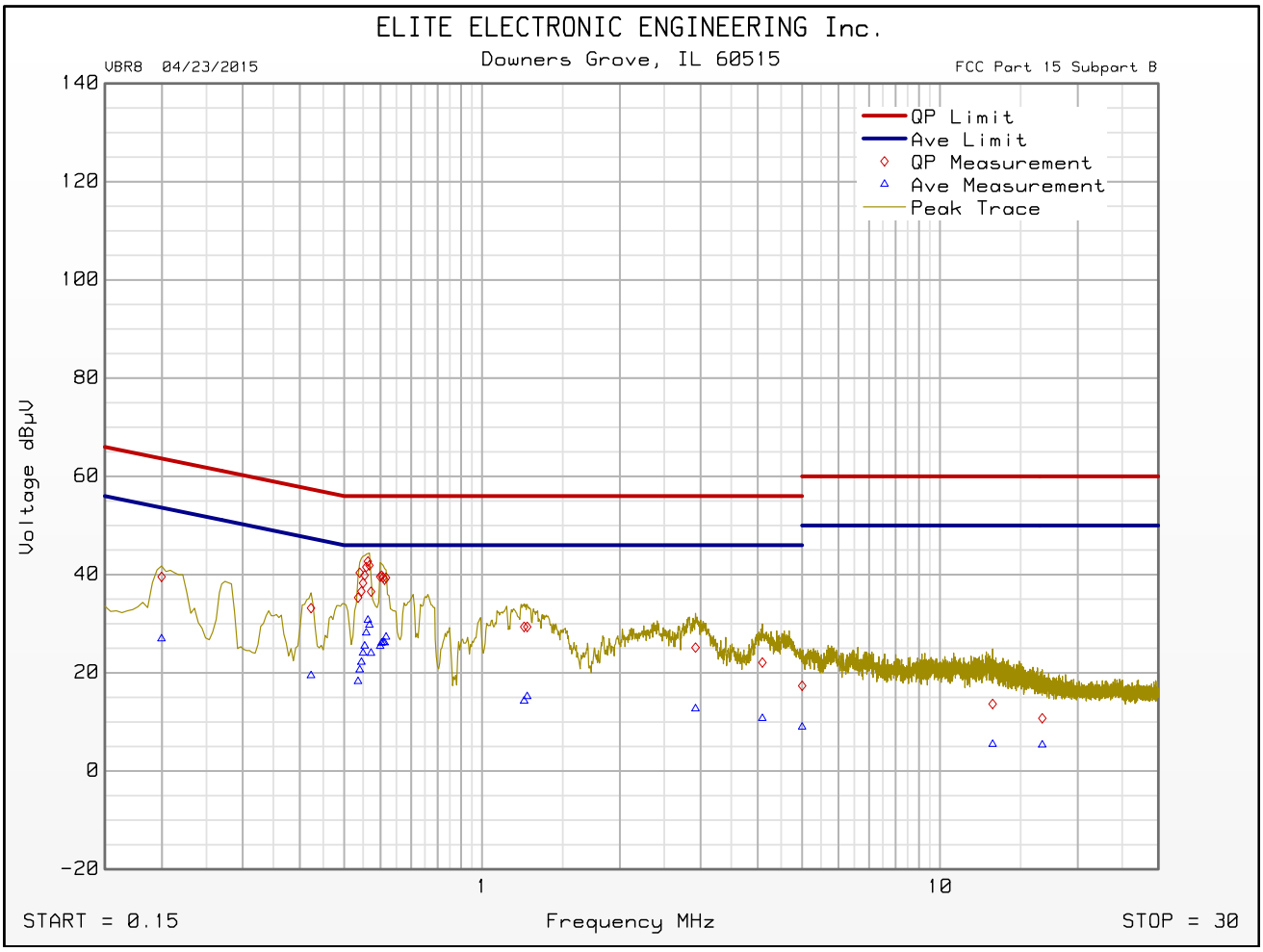
Freq MHz	Quasi-peak Level dBµV	Quasi-peak Limit dBµV	Excessive Quasi-peak Emissions	Average Level dBµV	Average Limit dBµV	Excessive Average Emissions
0.200	39.5	63.6		27.0	53.6	
0.423	33.2	57.4		19.5	47.4	
0.563	42.7	56.0		30.7	46.0	
1.236	29.4	56.0		14.3	46.0	
1.255	29.4	56.0		15.2	46.0	
2.925	25.1	56.0		12.7	46.0	
4.094	22.1	56.0		10.7	46.0	
5.000	17.4	56.0		9.0	46.0	
13.032	13.7	60.0		5.5	50.0	
16.727	10.7	60.0		5.3	50.0	

FCC Part 15 Subpart B Conducted Emissions Test

Cumulative Data

VBR8 04/23/2015

Manufacturer	:	CEL
Model	:	V2Z
DUT Revision	:	
Serial Number	:	15
DUT Mode	:	Tx @ 2440MHz POWER=4
Line Tested	:	115V 60 Hz HIGH
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-10
Notes	:	
Test Engineer	:	M. Longinotti
Limit	:	Class B
Test Date	:	Jun 28, 2016 03:48:57 PM



Emissions Meet QP Limit
Emissions Meet Ave Limit

FCC Part 15 Subpart B Conducted Emissions Test

Significant Emissions Data

VBR8 04/23/2015

Manufacturer	:	CEL
Model	:	V2Z
DUT Revision	:	
Serial Number	:	15
DUT Mode	:	Tx @ 2440MHz POWER=4
Line Tested	:	115V 60 Hz RETURN
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-10
Notes	:	
Test Engineer	:	M. Longinotti
Limit	:	Class B
Test Date	:	Jun 28, 2016 03:59:35 PM
Data Filter	:	Up to 80 maximum levels detected with 6 dB level excursion threshold over 10 dB margin below limit

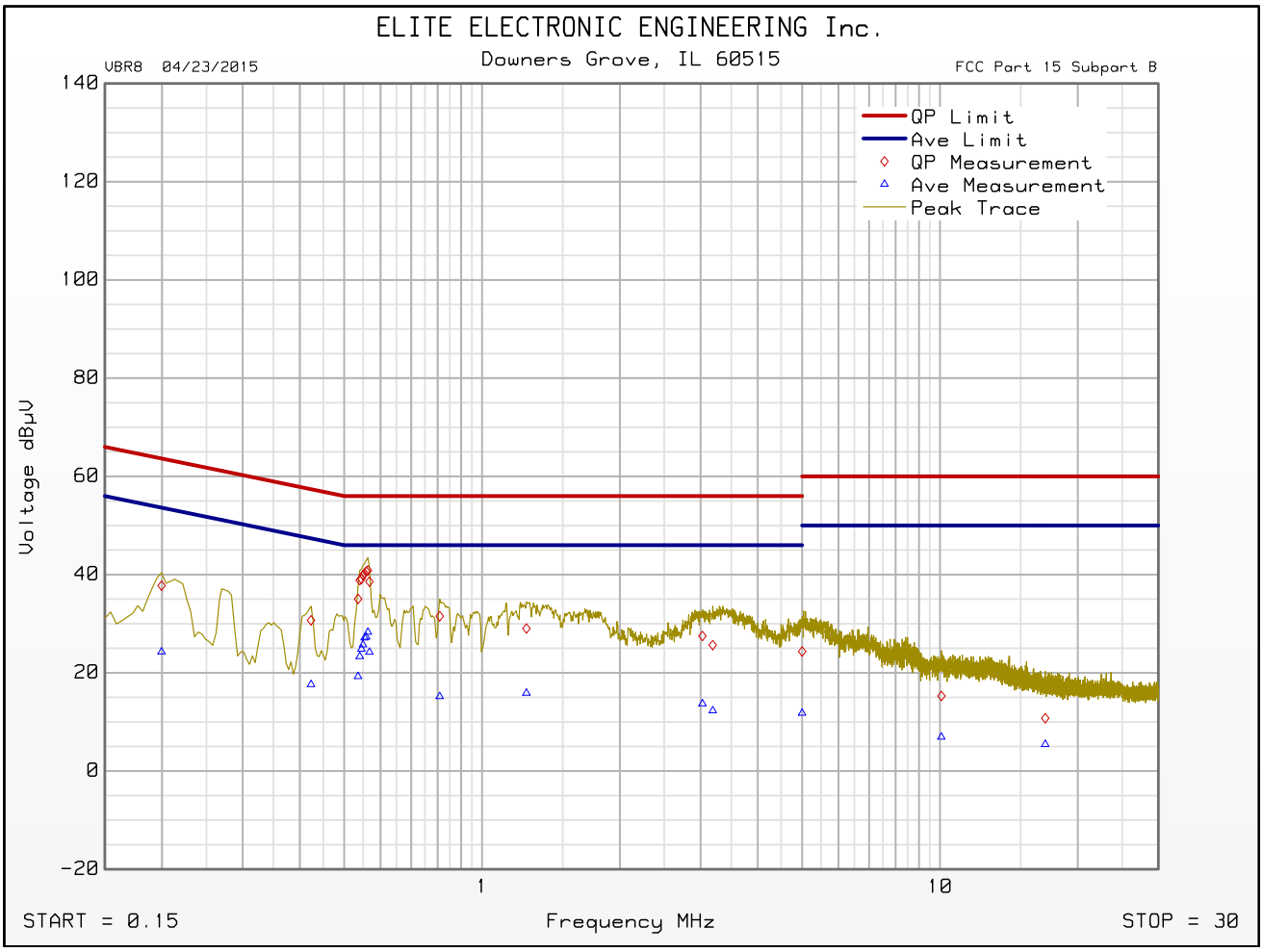
Freq MHz	Quasi-peak Level dBµV	Quasi-peak Limit dBµV	Excessive Quasi-peak Emissions	Average Level dBµV	Average Limit dBµV	Excessive Average Emissions
0.200	37.8	63.6		24.3	53.6	
0.423	30.7	57.4		17.6	47.4	
0.563	40.9	56.0		28.3	46.0	
0.808	31.5	56.0		15.2	46.0	
1.250	29.0	56.0		15.9	46.0	
3.029	27.5	56.0		13.7	46.0	
3.190	25.7	56.0		12.3	46.0	
5.000	24.3	56.0		11.8	46.0	
10.071	15.3	60.0		6.9	50.0	
16.979	10.8	60.0		5.4	50.0	

FCC Part 15 Subpart B Conducted Emissions Test

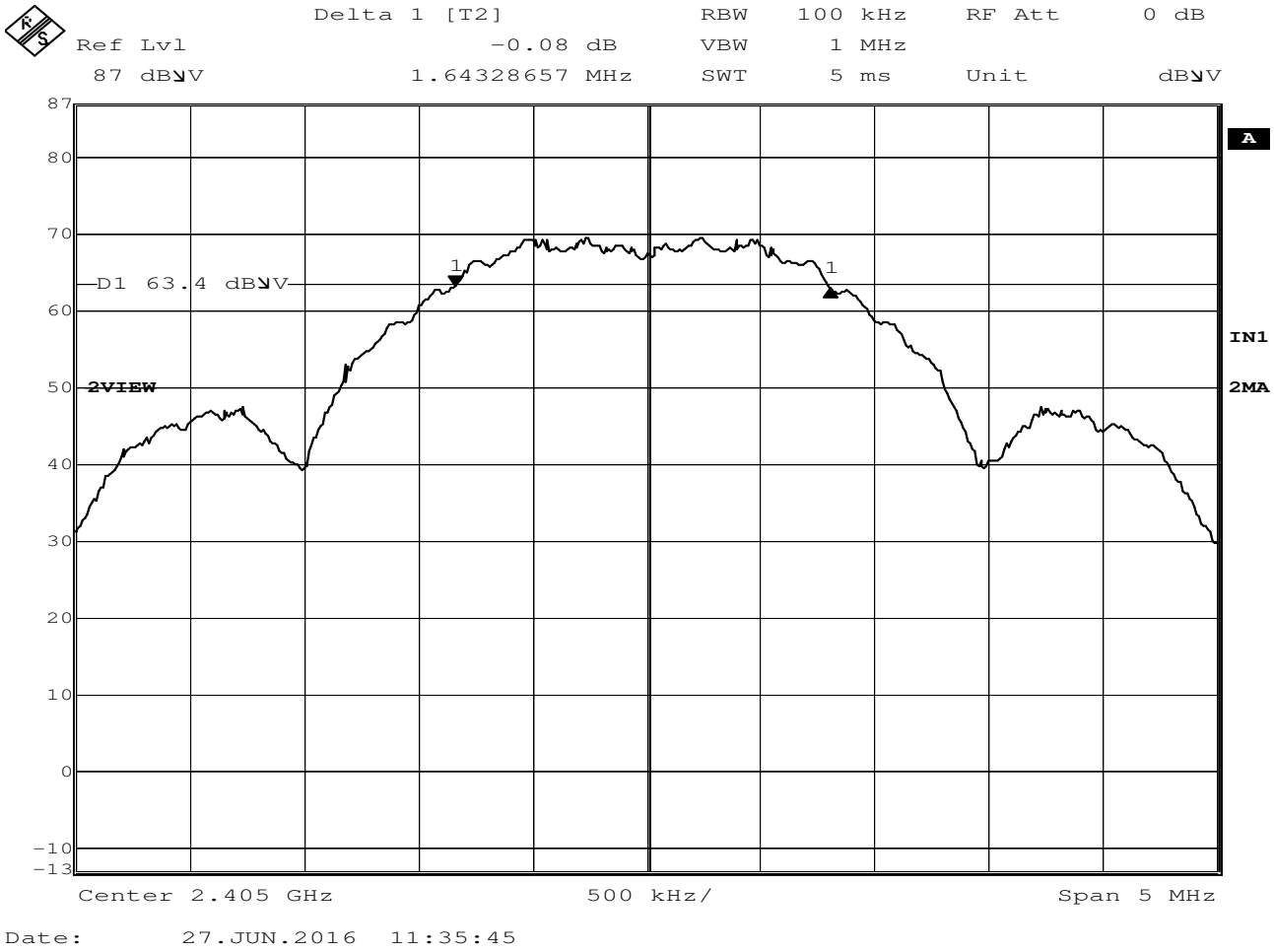
Cumulative Data

VBR8 04/23/2015

Manufacturer	:	CEL
Model	:	V2Z
DUT Revision	:	
Serial Number	:	15
DUT Mode	:	Tx @ 2440MHz POWER=4
Line Tested	:	115V 60 Hz RETURN
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-10
Notes	:	
Test Engineer	:	M. Longinotti
Limit	:	Class B
Test Date	:	Jun 28, 2016 03:59:35 PM

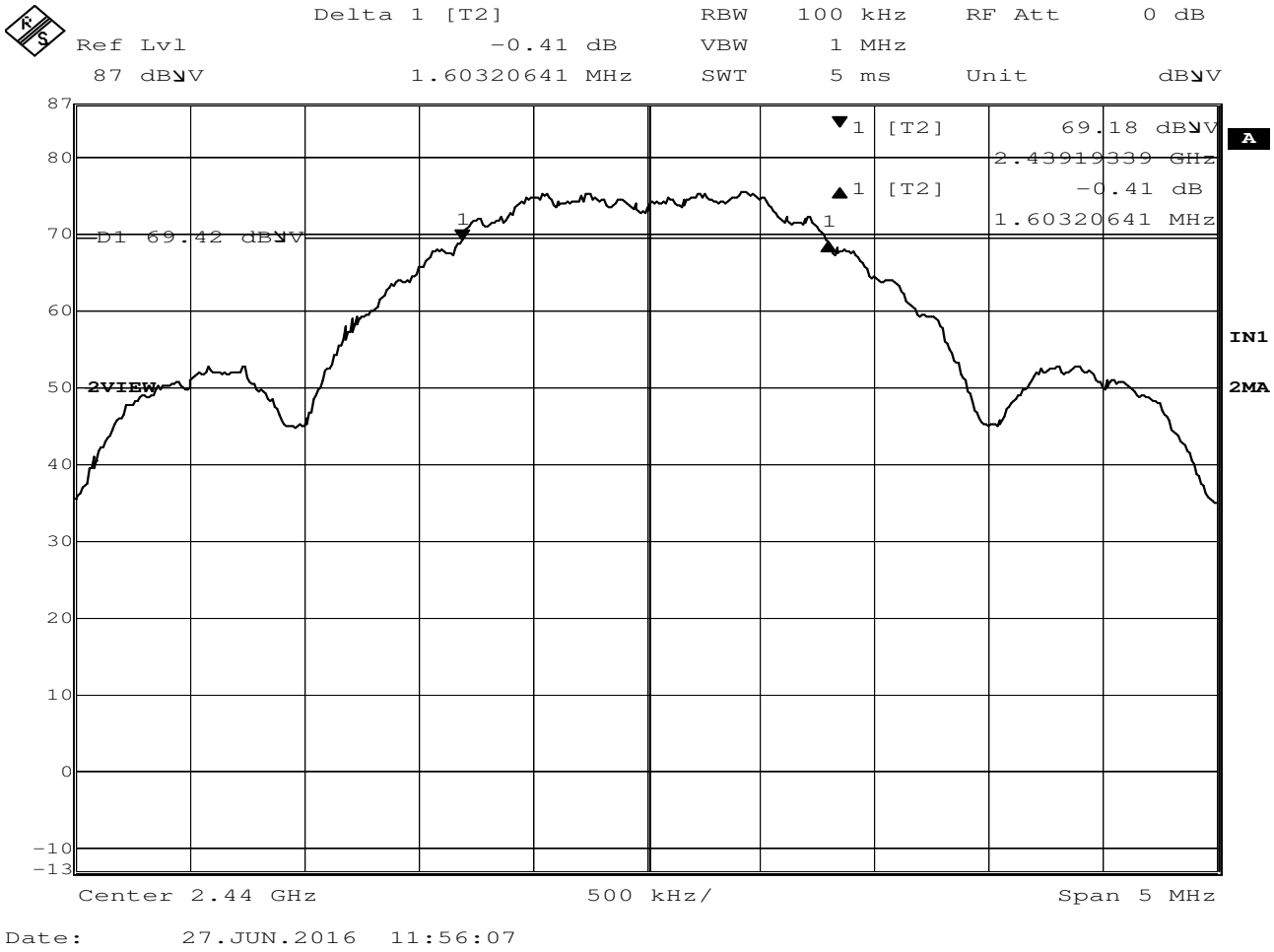


Emissions Meet QP Limit
Emissions Meet Ave Limit



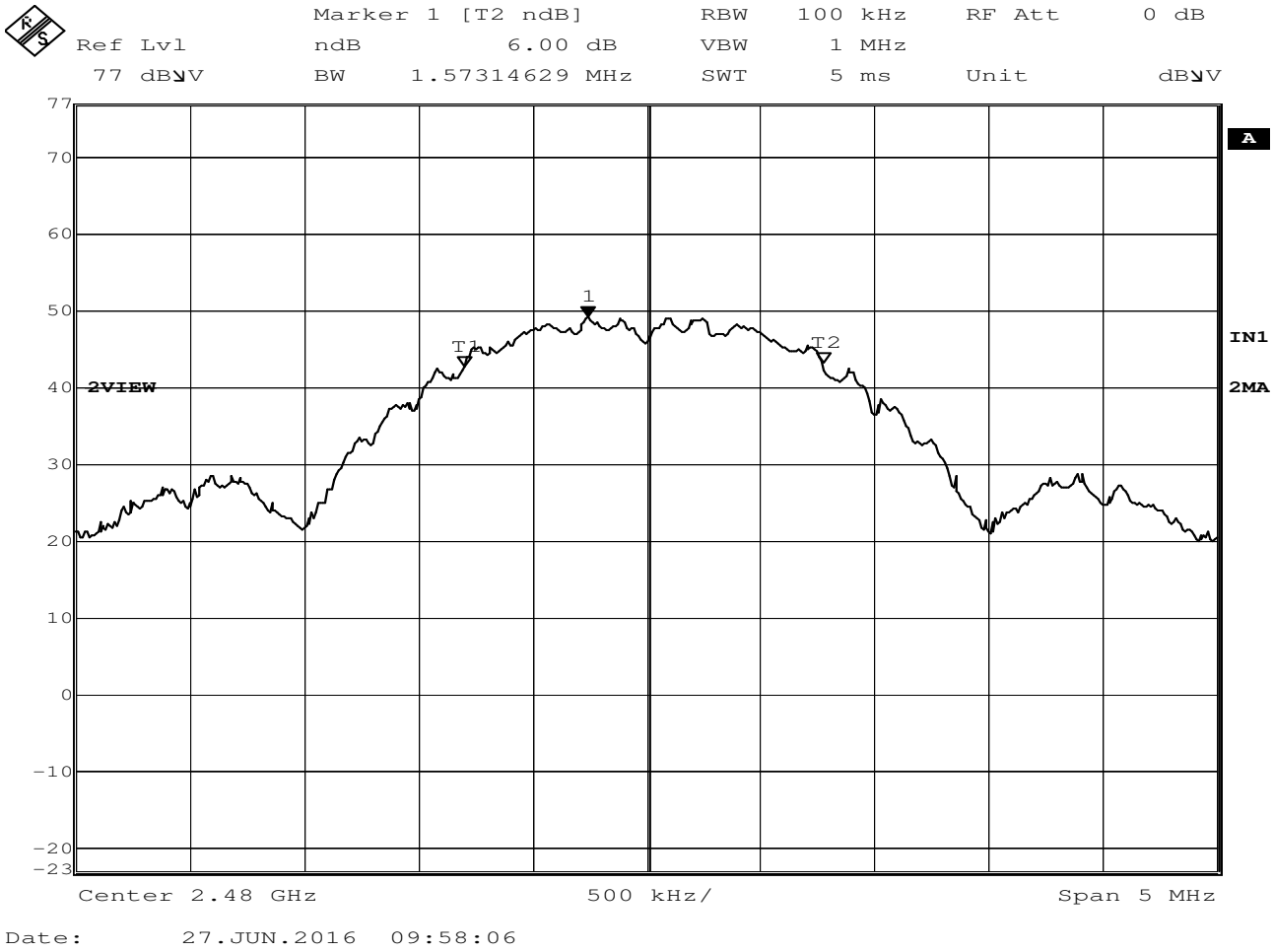
FCC 15.247 DTS (6dB bandwidth)

MANUFACTURER	:	CEL
MODEL NUMBER	:	V2Z
SERIAL NUMBER	:	#15
TEST MODE	:	Transmit at 2405MHz, power = 4
NOTES	:	6dB bandwidth = 1.64MHz
EQUIPMENT USED	:	RBB0, NTA2



FCC 15.247 DTS (6dB) Bandwidth

MANUFACTURER	:	CEL
MODEL NUMBER	:	V2Z
SERIAL NUMBER	:	#15
TEST MODE	:	Transmit at 2440MHz, power = 4
NOTES	:	6dB bandwidth = 1.6MHz
EQUIPMENT USED	:	RBB0, NTA2



FCC 15.247 DTS (6dB bandwidth)

MANUFACTURER	:	CEL
MODEL NUMBER	:	V2Z
SERIAL NUMBER	:	#15
TEST MODE	:	Transmit at 2480MHz, power = -20
NOTES	:	6dB bandwidth = 1.57MHz
EQUIPMENT USED	:	RBB0, NTA2

Manufacturer : California Eastern Laboratories
Test Item : Transceiver
Model No. : V2Z
Serial No. : #16
Mode : See Below
Test Specification : FCC-15.247, RSS-247 Average Output Power
Date : June 27, 2016
Notes : Antenna Port Conducted Emissions Tests

Frequency MHz	Channel	Power Setting	Average Power Reading dBm	Attenuator dB	Average Output Power dBm	Average Output Power Limit dBm
2405	11	4	-17.48	39.6	22.12	30.0
2440	18	4	-17.56	39.6	22.04	30.0
2475	25	2	-17.67	39.6	21.93	30.0
2480	26	-20	-33.39	39.6	6.21	30.0

Average Output Power (dBm) = Average Power Reading (dbm) + Attenuator (dB)

Checked By: MARK E. LONGINOTTI

Mark E. Longinotti

Manufacturer : California Eastern Laboratories
Test Item : Transceiver
Model No. : V2Z
Serial No. : #15
Mode : Transmit at 2405MHz (Channel 11), Power Setting = 4
Test Specification : FCC-15.247, EIRP
Date : June 27, 2016
Notes : Radiated Emissions Tests
Notes :

Freq. (MHz)	Ant Pol	Wide BW Meter Reading (dBuV)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
2405.00	H	79.4	19.0	5.4	4.1	20.3	36.0	-15.7
2405.00	V	72.7	12.3	5.4	4.1	13.6	36.0	-22.4

EIRP (dBm) = Sig. Gen. Reading (dBm) + Antenna Gain (dB) - Cable Loss (dB)

Checked By: MARK E. LONGINOTTI

Mark E. Longinotti

Manufacturer : California Eastern Laboratories
Test Item : Transceiver
Model No. : V2Z
Serial No. : #15
Mode : Transmit at 2440MHz (Channel 18), Power Setting = 4
Test Specification : FCC-15.247, EIRP
Date : June 27, 2016
Notes : Radiated Emissions Tests
Notes :

Freq. (MHz)	Ant Pol	Wide BW Meter Reading (dBuV)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
2440.00	H	78.5	18.1	5.6	4.2	19.5	36.0	-16.5
2440.00	V	72.8	12.4	5.6	4.2	13.8	36.0	-22.2

EIRP (dBm) = Sig. Gen. Reading (dBm) + Antenna Gain (dB) - Cable Loss (dB)

Checked By: MARK E. LONGINOTTI

Mark E. Longinotti

Manufacturer : California Eastern Laboratories
Test Item : Transceiver
Model No. : V2Z
Serial No. : #15
Mode : Transmit at 2475MHz (Channel 25), Power Setting = 2
Test Specification : FCC-15.247, EIRP
Date : June 27, 2016
Notes : Radiated Emissions Tests
Notes :

Freq. (MHz)	Ant Pol	Wide BW Meter Reading (dBuV)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
2475.00	H	80.2	19.9	5.5	4.2	21.2	36.0	-14.8
2475.00	V	72.4	12.1	5.5	4.2	13.4	36.0	-22.6

EIRP (dBm) = Sig. Gen. Reading (dBm) + Antenna Gain (dB) - Cable Loss (dB)

Checked By: MARK E. LONGINOTTI

Mark E. Longinotti

Manufacturer : California Eastern Laboratories
Test Item : Transceiver
Model No. : V2Z
Serial No. : #15
Mode : Transmit at 2480MHz (Channel 26), Power Setting = -20
Test Specification : FCC-15.247, EIRP
Date : June 27, 2016
Notes : Radiated Emissions Tests
Notes :

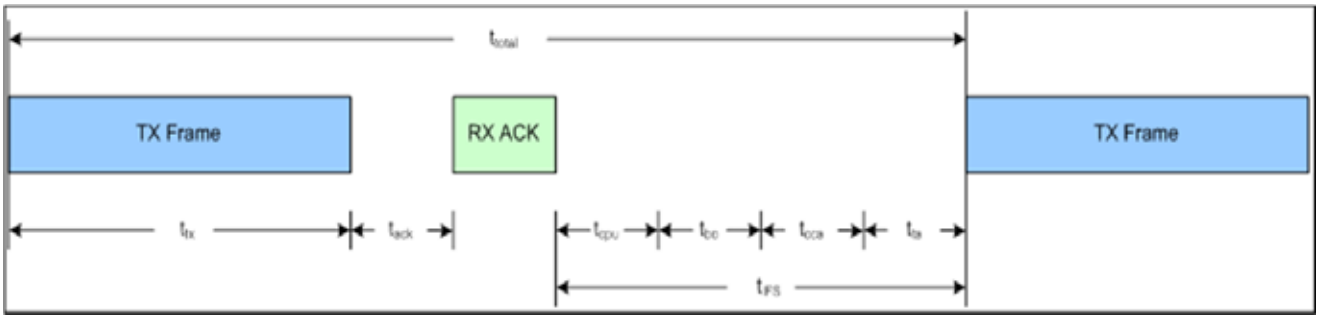
Freq. (MHz)	Ant Pol	Wide BW Meter Reading (dBuV)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
2480.00	H	64.4	4.2	5.5	4.2	5.5	36.0	-30.5
2480.00	V	53.4	-6.8	5.5	4.2	-5.5	36.0	-41.5

EIRP (dBm) = Sig. Gen. Reading (dBm) + Antenna Gain (dB) - Cable Loss (dB)

Checked By: MARK E. LONGINOTTI

Mark E. Longinotti

Manufacturer	: California Eastern Laboratories
Test Item	: Transceiver
Model No.	: V2Z
Serial No.	: N/A
Mode	: See Below
Test Specification	: Worst Case Duty Cycle Correction Factor
Notes	: Data Provided by California Eastern Laboratories personnel



Transmit Time	
TX Time (Packet)	0.004256
Total TX Time (sec)	0.004256

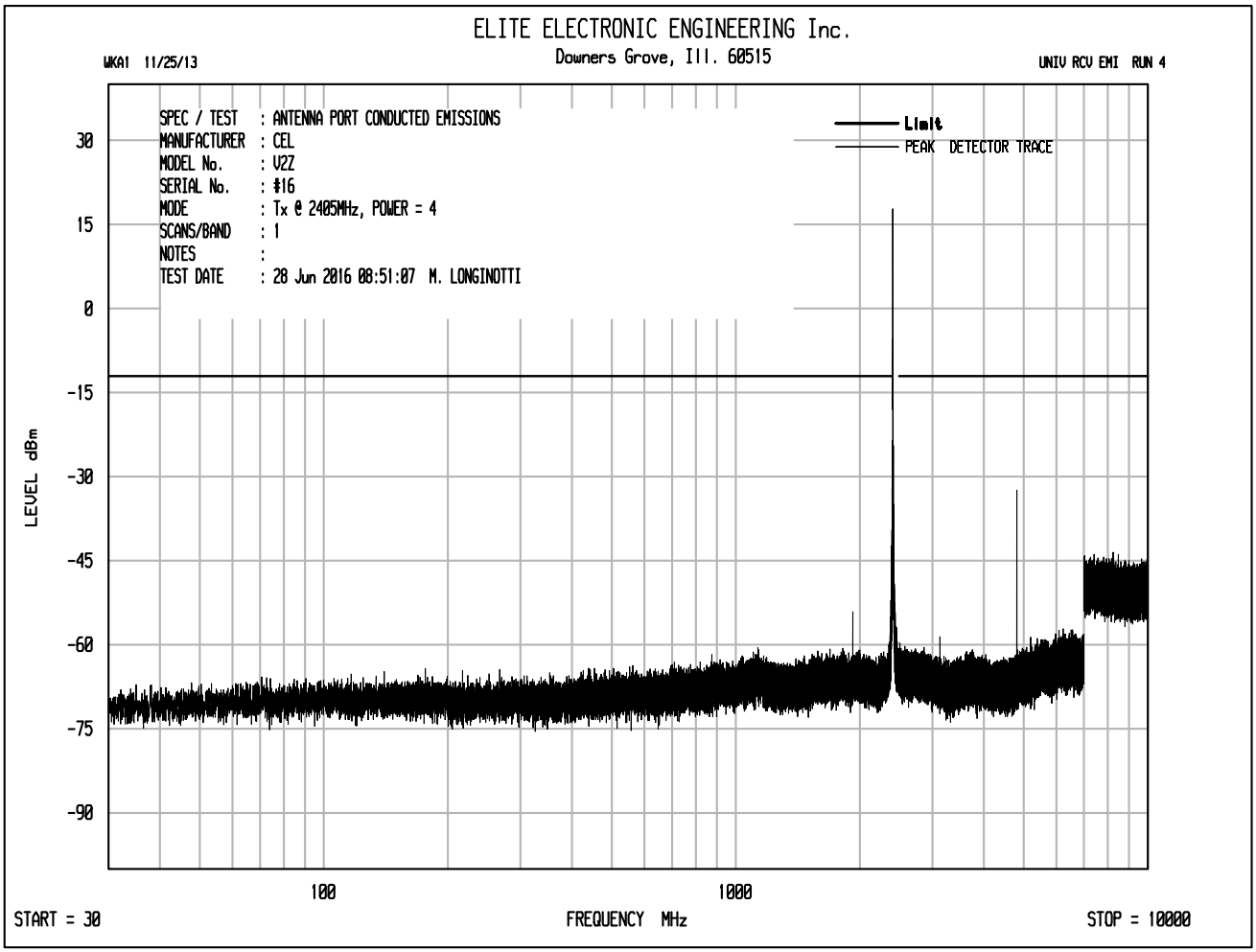
NOT Transmit time (RX or Idle)		
Wait for ACK (tack)	0.000192	
RX Time (ACK)	0.000352	
Backoff Time (tbo)	0.00112	(Backoff Time * Backoff Period)
CPU Processing (tcpu)	0.0002	(0.2ms average on EM2xx running EmberZNet)
CCA Assessment (tcca)	0.000128	(averaged over 8 symbols in RX Mode)
Turn Around Time (RX to TX)	0.000192	(After CCA, Radio turns over to TX in 12 symbols)
Total Off Time (sec)	0.002184	

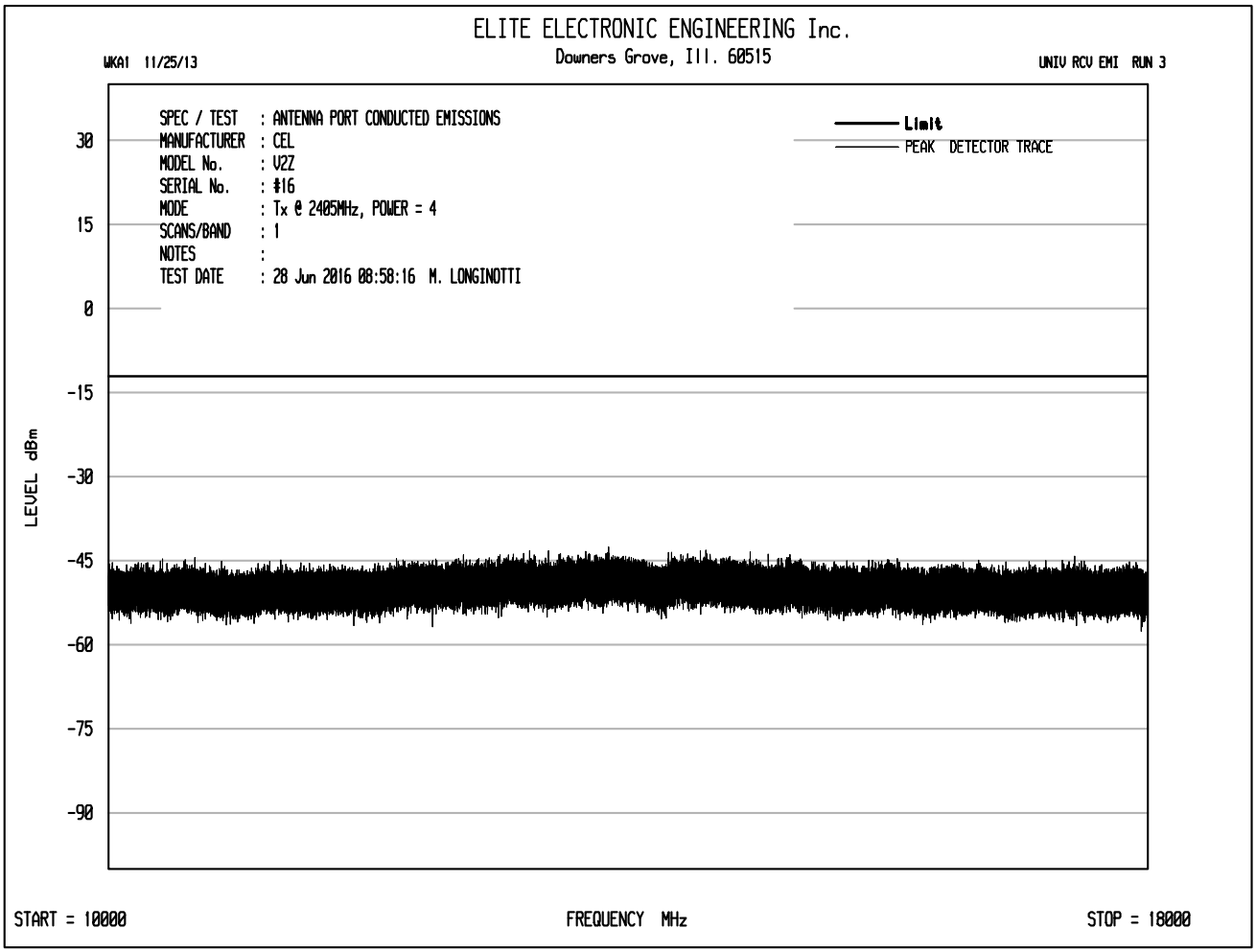
Total Time (ttotal)	0.00644
Number of RX / TX cycles in 100ms	15.5279503

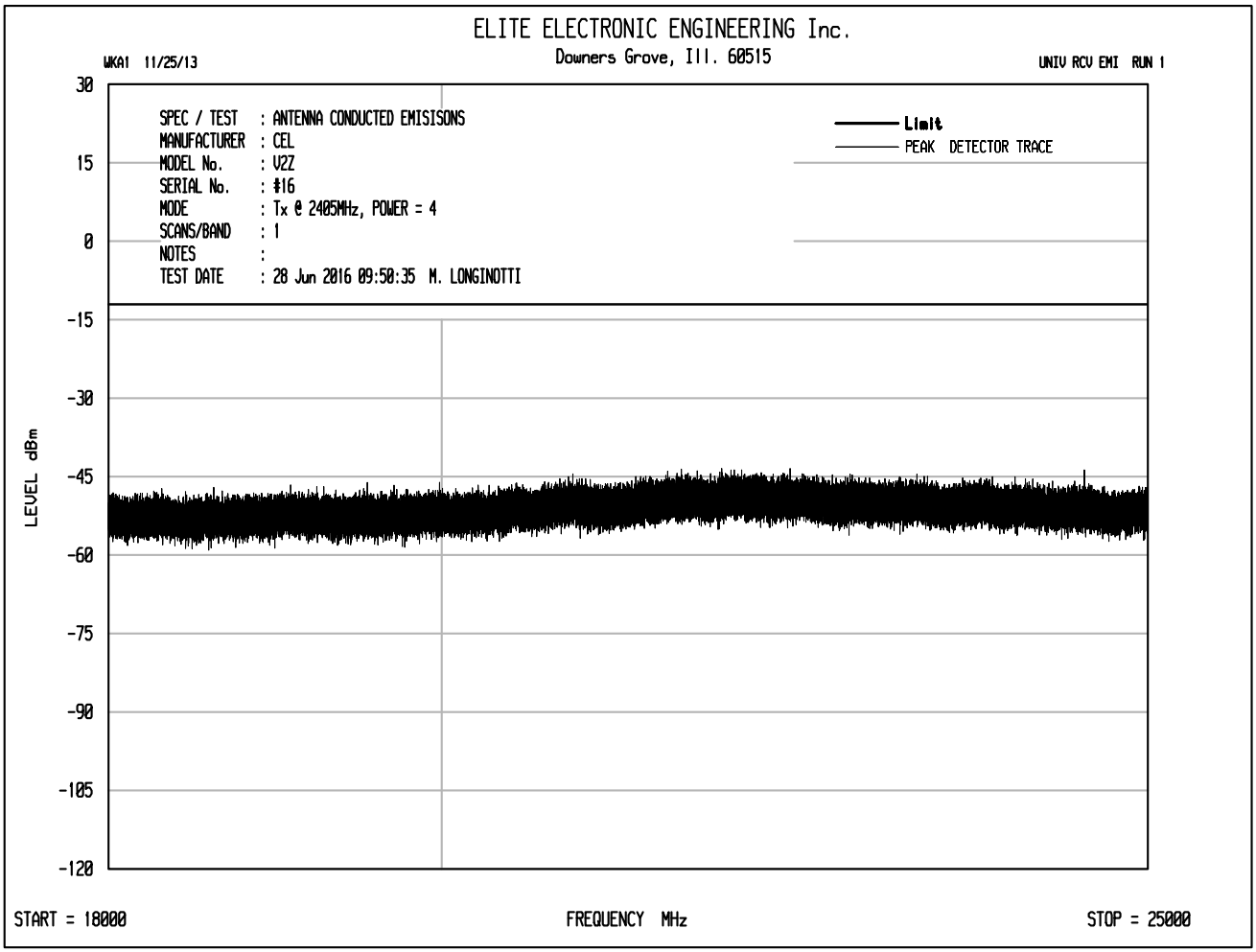
Worse Case (100ms window)

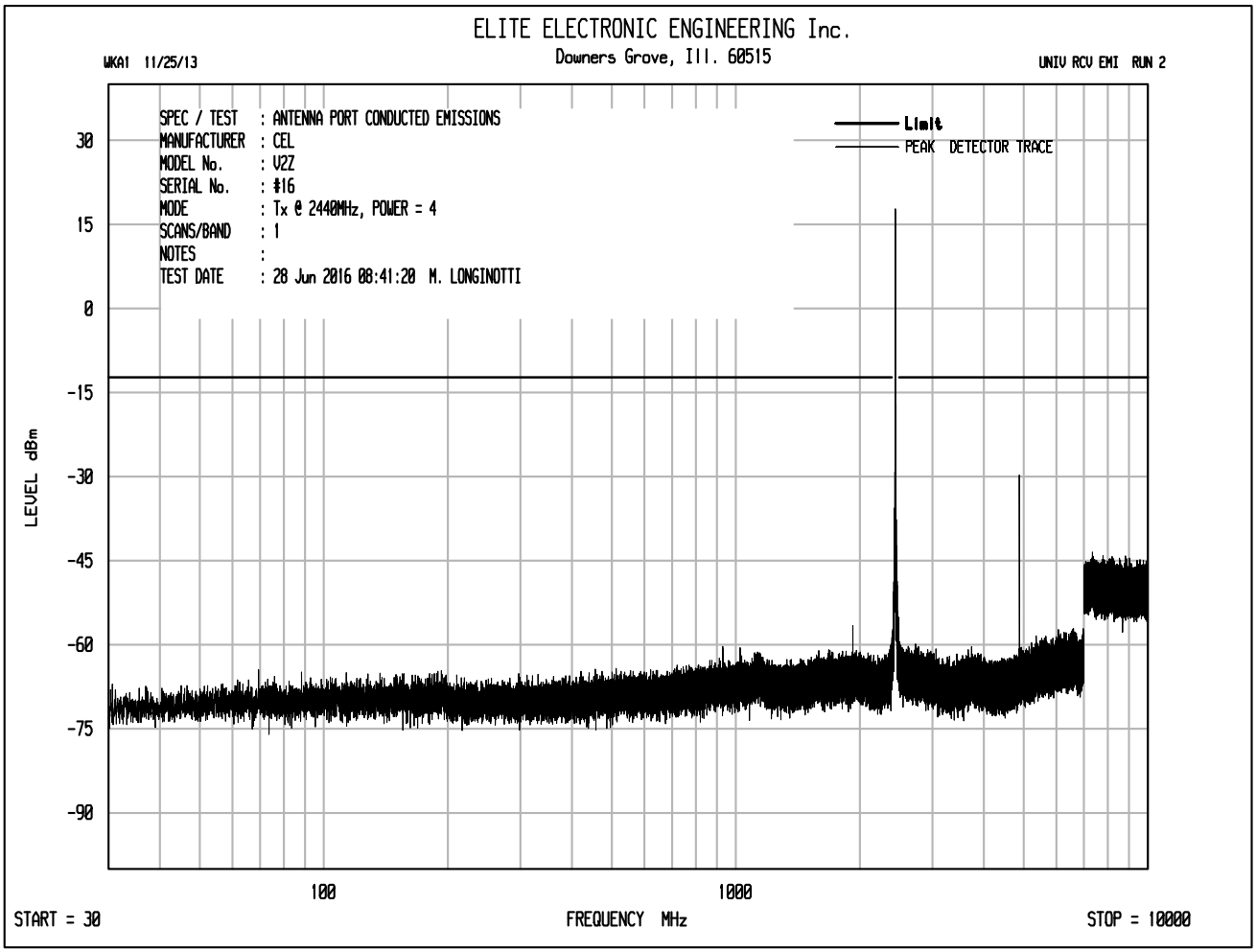
TX Frame 10 times	0.04256
RX or IDLE 10 Times	0.02184
Sum	0.0644

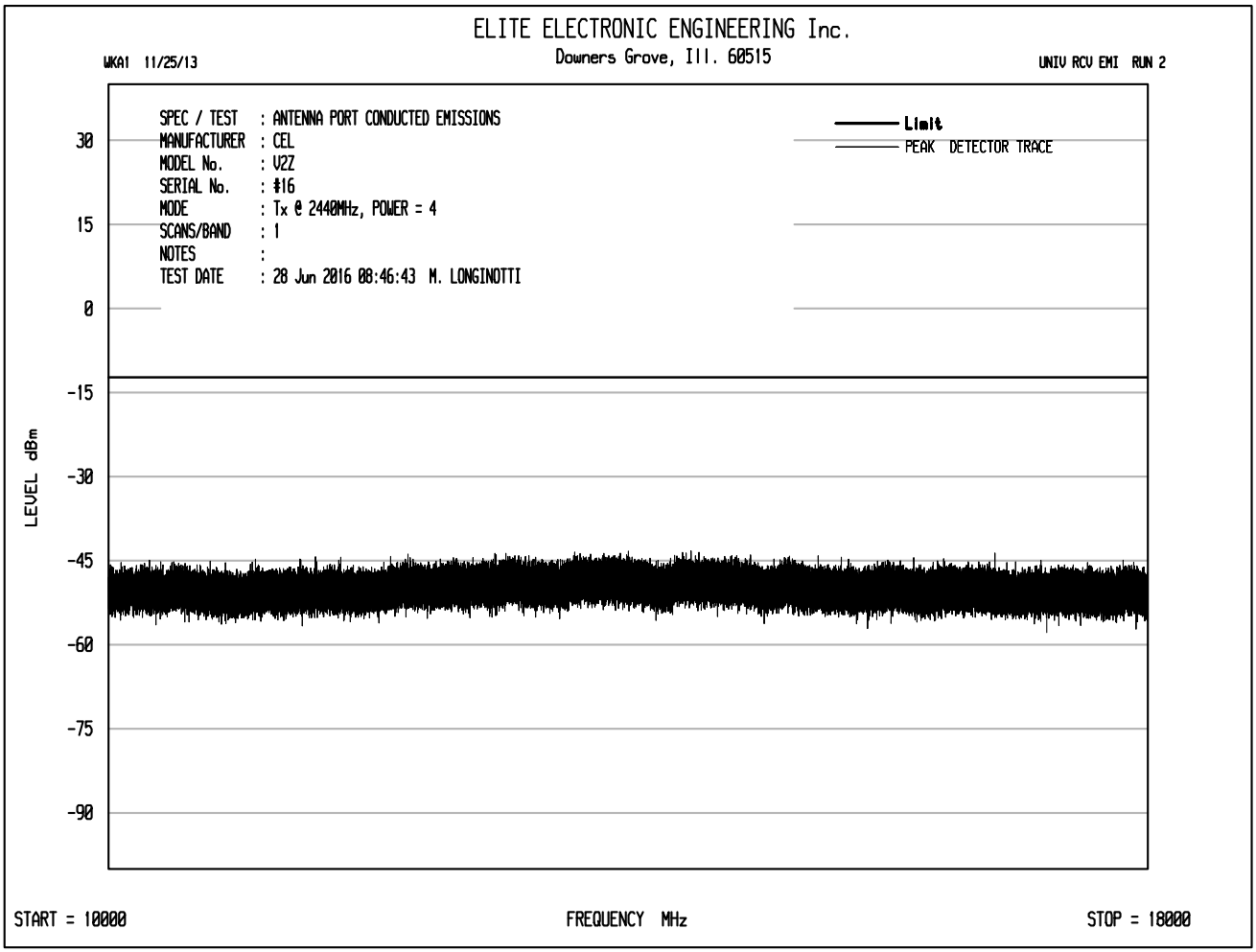
MAC TX Duty Cycle (On /total)	66.09%	
	3.59768496	dB

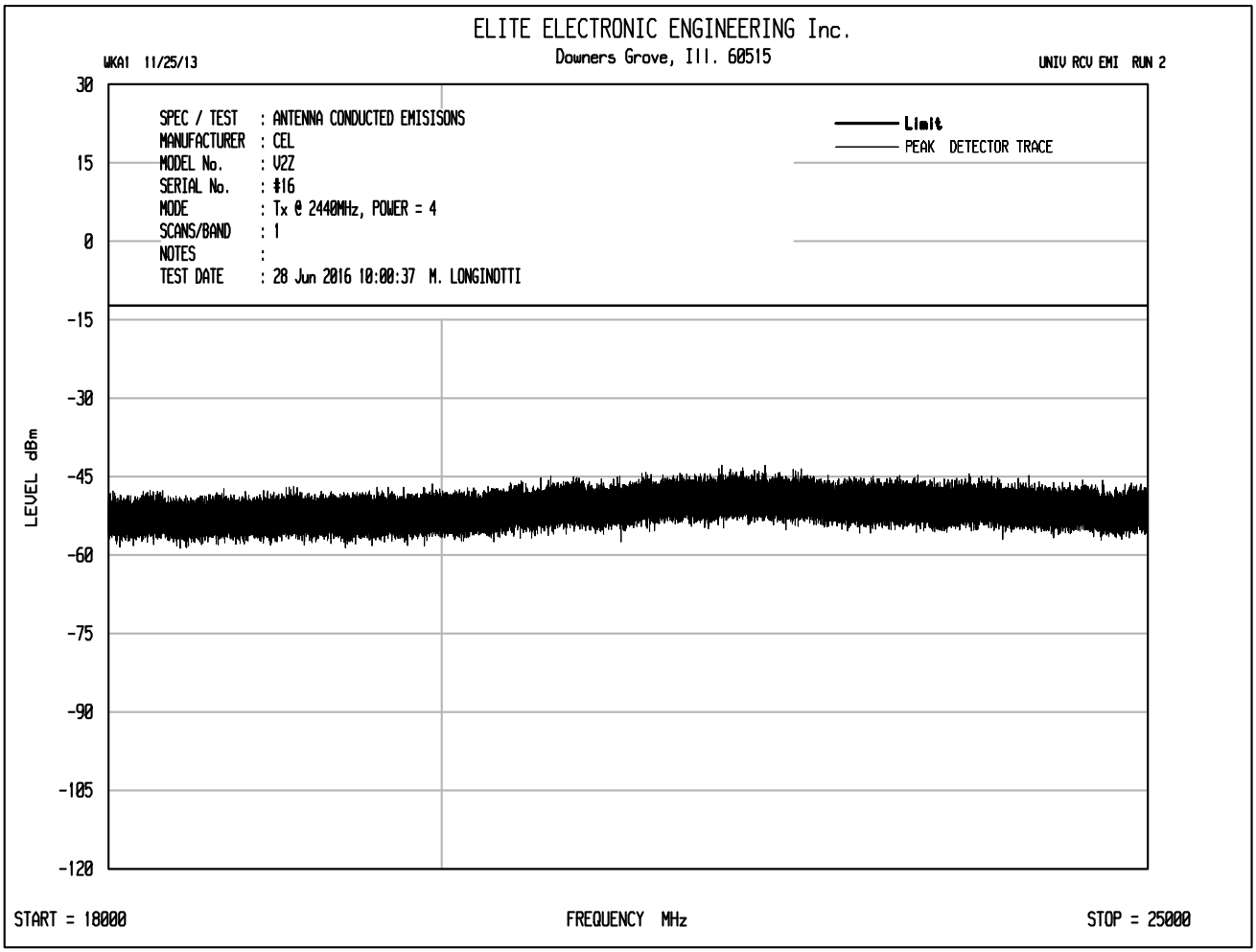

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 4
SPEC / TEST : ANTENNA PORT CONDUCTED EMISSIONS
MANUFACTURER : CEL
MODEL No. : V2Z
SERIAL No. : #16
MODE : Tx @ 2405MHz, POWER = 4
SCANS/BAND : 1
NOTES :
TEST DATE : 28 Jun 2016 08:51:07 M. LONGINOTTI
Limit
PEAK DETECTOR TRACE
30
15
0
-15
-30
-45
-60
-75
-90
LEVEL dBm
100
1000
START = 30
FREQUENCY MHz
STOP = 10000

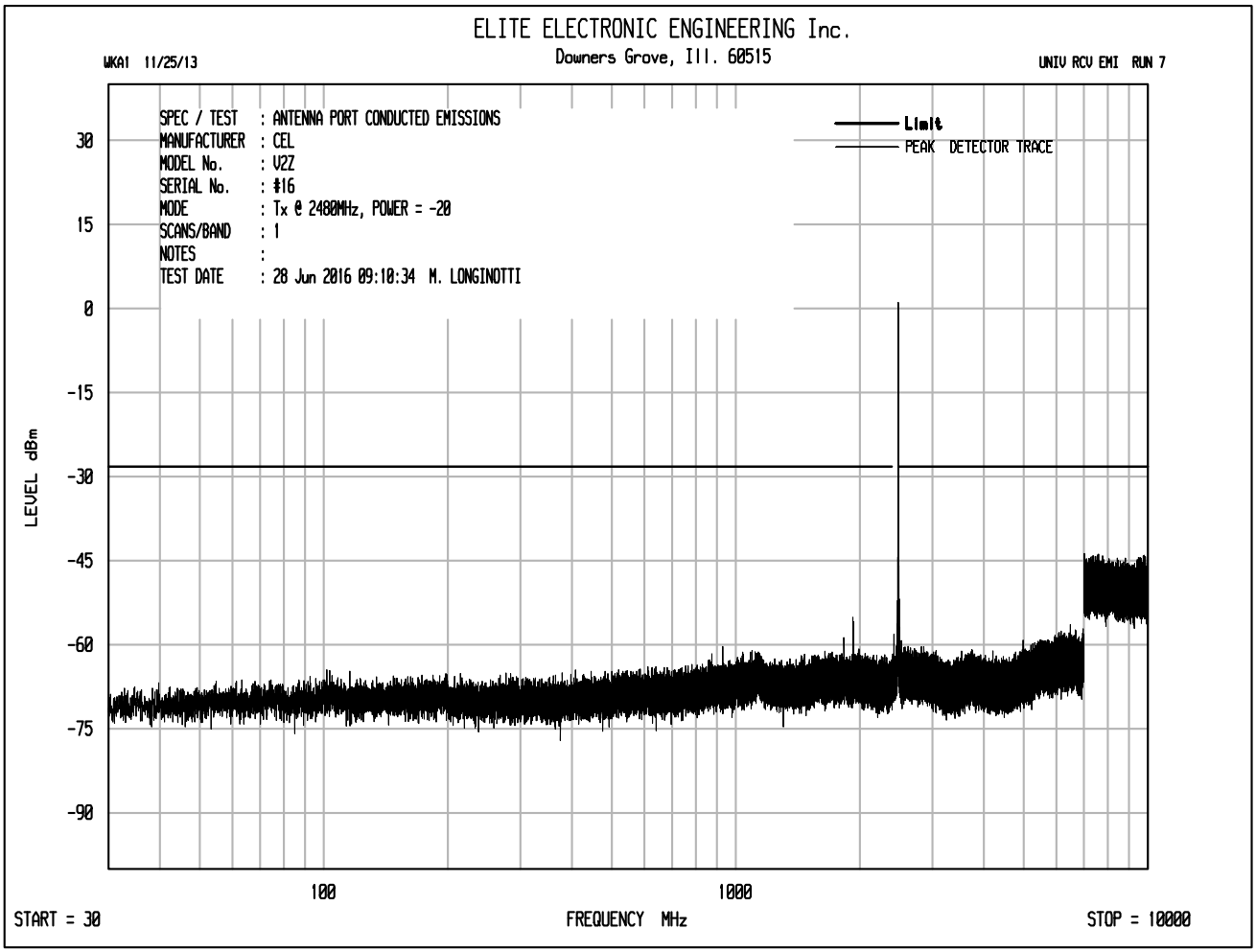

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 3
SPEC / TEST : ANTENNA PORT CONDUCTED EMISSIONS
MANUFACTURER : CEL
MODEL No. : V2Z
SERIAL No. : #16
MODE : Tx @ 2405MHz, POWER = 4
SCANS/BAND : 1
NOTES :
TEST DATE : 28 Jun 2016 08:58:16 M. LONGINOTTI
Limit
PEAK DETECTOR TRACE
30
15
0
-15
-30
-45
-60
-75
-90
LEVEL dBm
START = 10000
FREQUENCY MHz
STOP = 18000

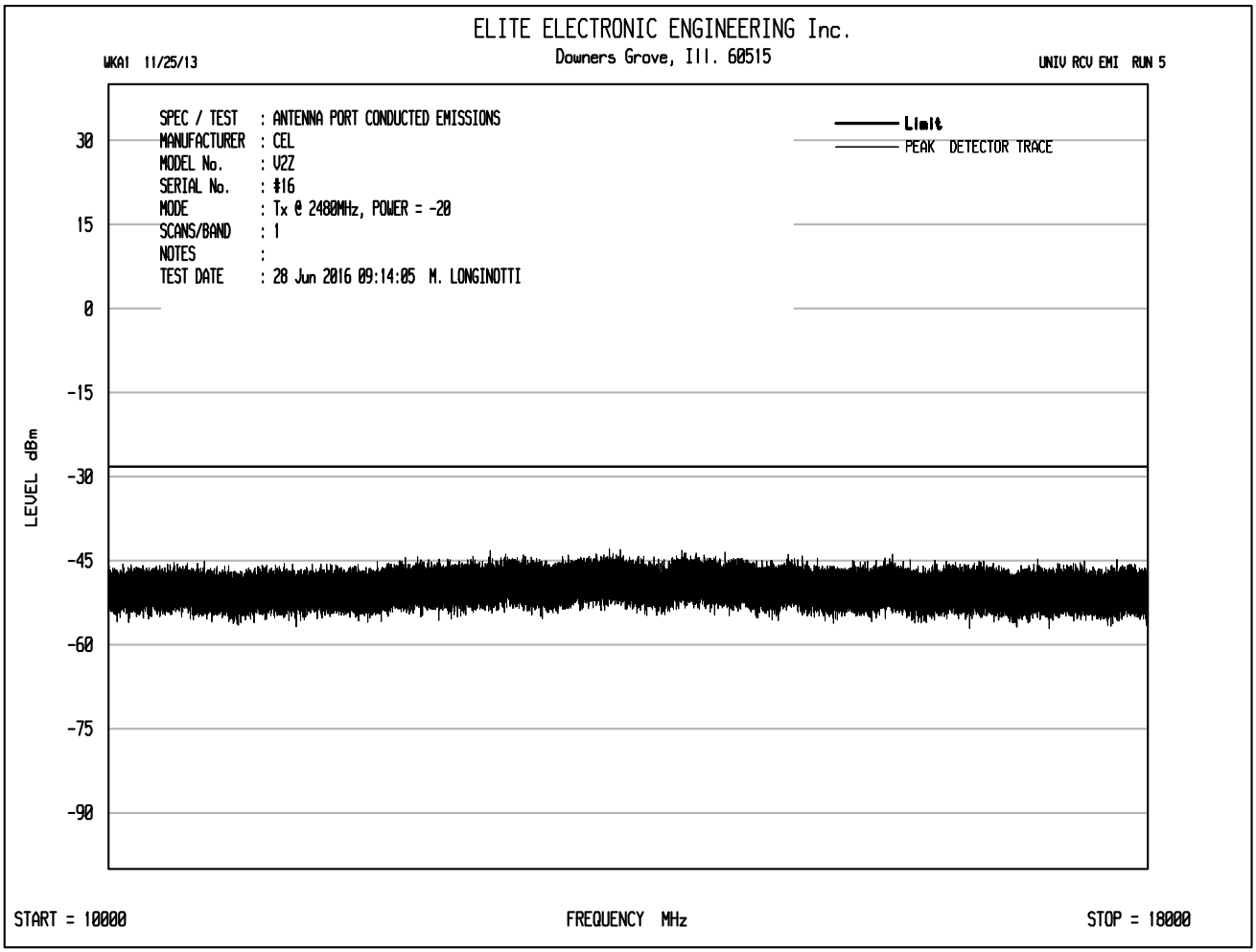

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 1
SPEC / TEST : ANTENNA CONDUCTED EMISISONS
MANUFACTURER : CEL
MODEL No. : V2Z
SERIAL No. : #16
MODE : Tx @ 2405MHz, POWER = 4
SCANS/BAND : 1
NOTES :
TEST DATE : 28 Jun 2016 09:50:35 M. LONGINOTTI
Limit
PEAK DETECTOR TRACE
LEVEL dBm
30
15
0
-15
-30
-45
-60
-75
-90
-105
-120
START = 18000
FREQUENCY MHz
STOP = 25000

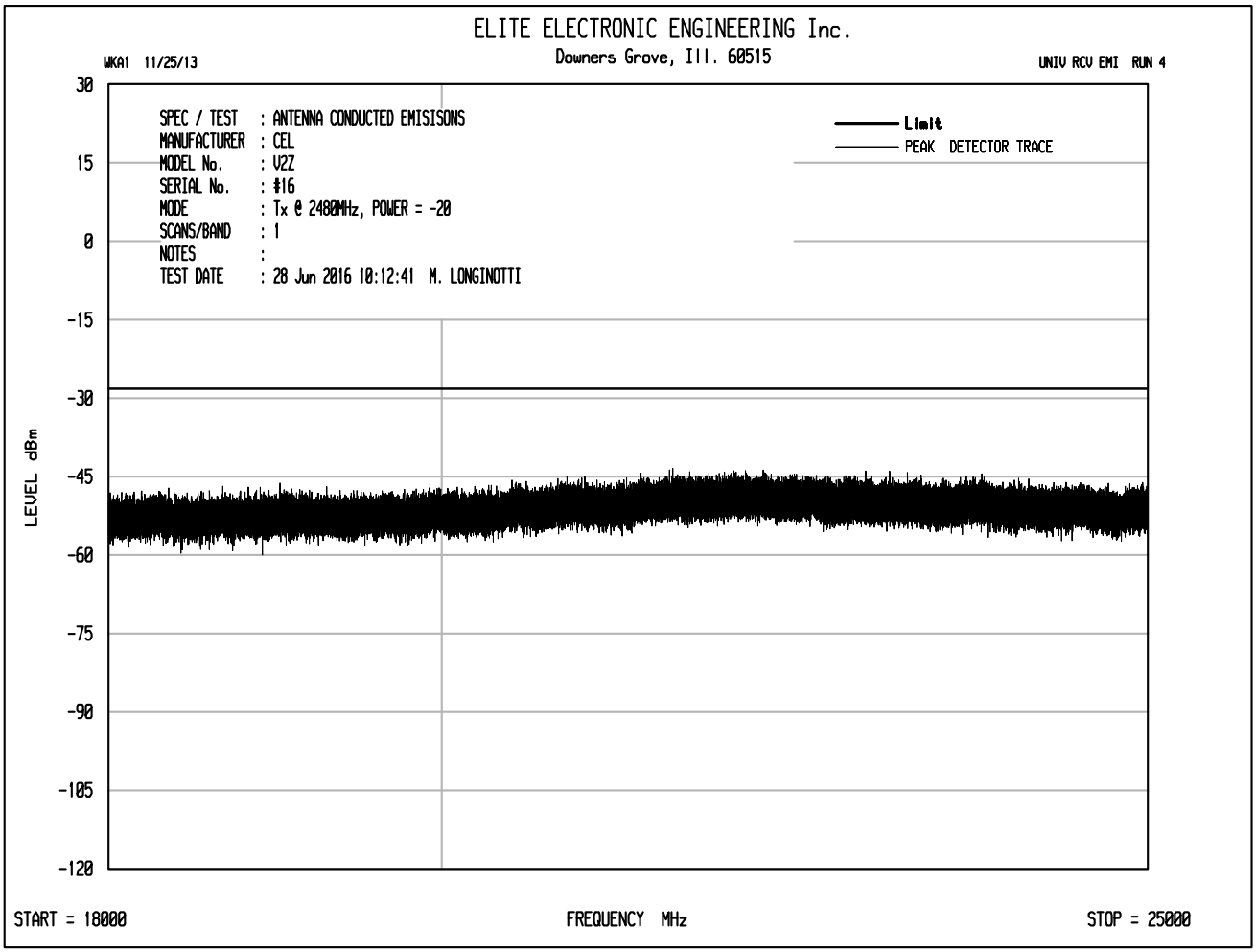

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 2
SPEC / TEST : ANTENNA PORT CONDUCTED EMISSIONS
MANUFACTURER : CEL
MODEL No. : V2Z
SERIAL No. : #16
MODE : Tx @ 2440MHz, POWER = 4
SCANS/BAND : 1
NOTES :
TEST DATE : 28 Jun 2016 08:41:20 M. LONGINOTTI
Limit
PEAK DETECTOR TRACE
30
15
0
-15
-30
-45
-60
-75
-90
LEVEL dBm
100
1000
START = 30
FREQUENCY MHz
STOP = 10000

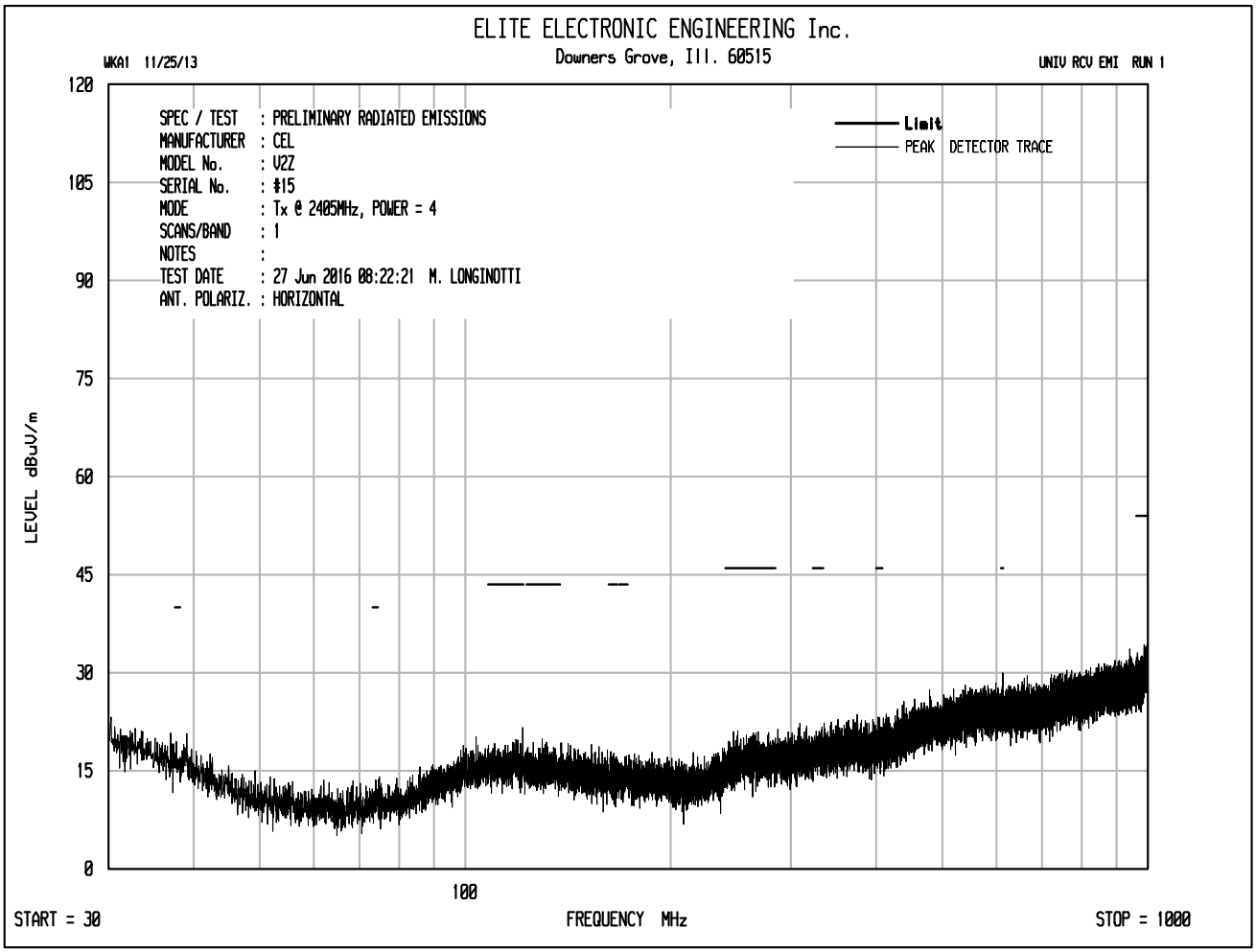

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 2
SPEC / TEST : ANTENNA PORT CONDUCTED EMISSIONS
MANUFACTURER : CEL
MODEL No. : V2Z
SERIAL No. : #16
MODE : Tx @ 2440MHz, POWER = 4
SCANS/BAND : 1
NOTES :
TEST DATE : 28 Jun 2016 08:46:43 M. LONGINOTTI
Limit
PEAK DETECTOR TRACE
30
15
0
-15
-30
-45
-60
-75
-90
LEVEL dBm
START = 10000
FREQUENCY MHz
STOP = 18000

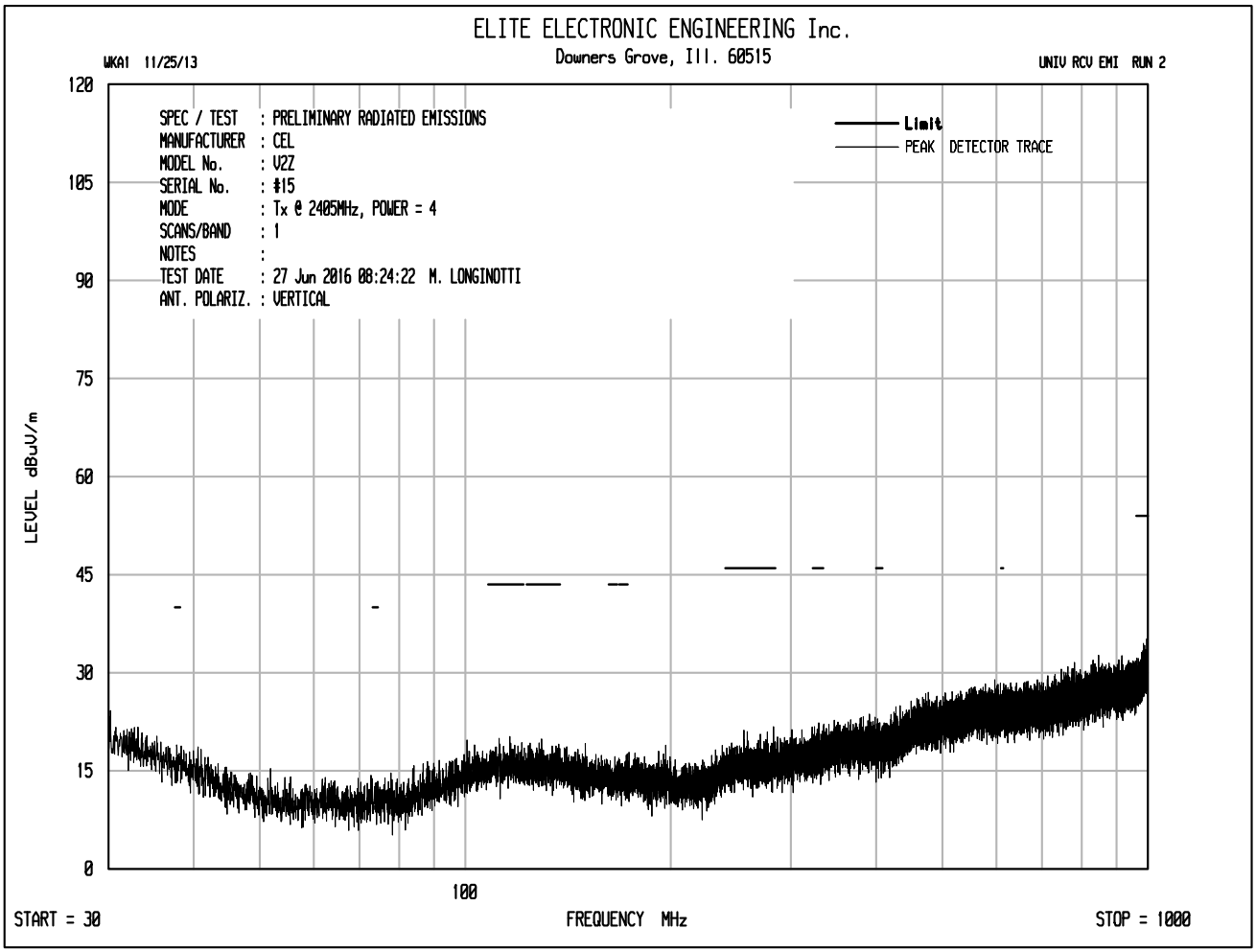

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 2
SPEC / TEST : ANTENNA CONDUCTED EMISISONS
MANUFACTURER : CEL
MODEL No. : V2Z
SERIAL No. : #16
MODE : Tx @ 2440MHz, POWER = 4
SCANS/BAND : 1
NOTES :
TEST DATE : 28 Jun 2016 10:00:37 M. LONGINOTTI
Limit
PEAK DETECTOR TRACE
LEVEL dBm
30
15
0
-15
-30
-45
-60
-75
-90
-105
-120
START = 18000
FREQUENCY MHz
STOP = 25000

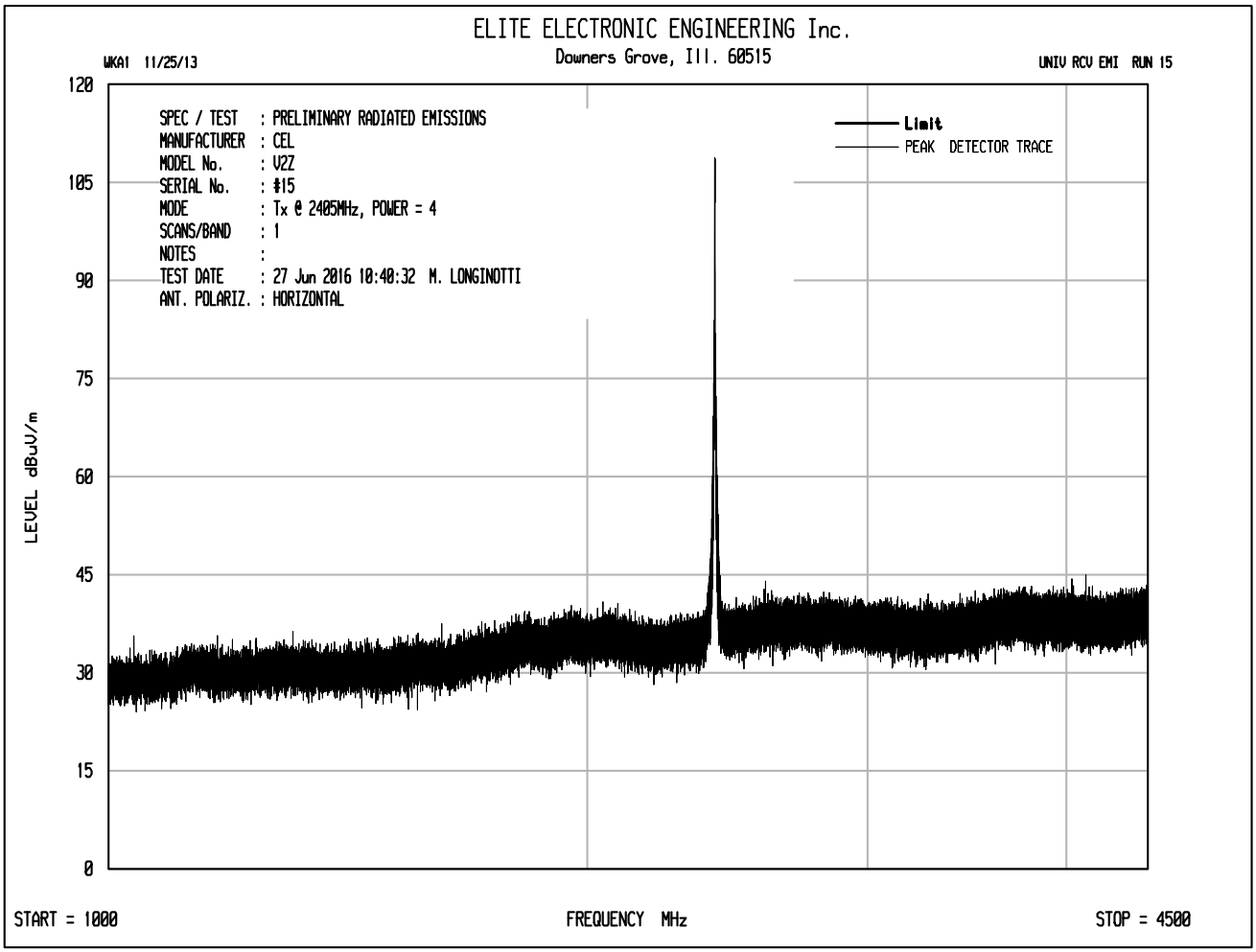

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 7
SPEC / TEST : ANTENNA PORT CONDUCTED EMISSIONS
MANUFACTURER : CEL
MODEL No. : V2Z
SERIAL No. : #16
MODE : Tx @ 2480MHz, POWER = -20
SCANS/BAND : 1
NOTES :
TEST DATE : 28 Jun 2016 09:10:34 M. LONGINOTTI
Limit
PEAK DETECTOR TRACE
LEVEL dBm
30
15
0
-15
-30
-45
-60
-75
-90
100
1000
START = 30
FREQUENCY MHz
STOP = 10000

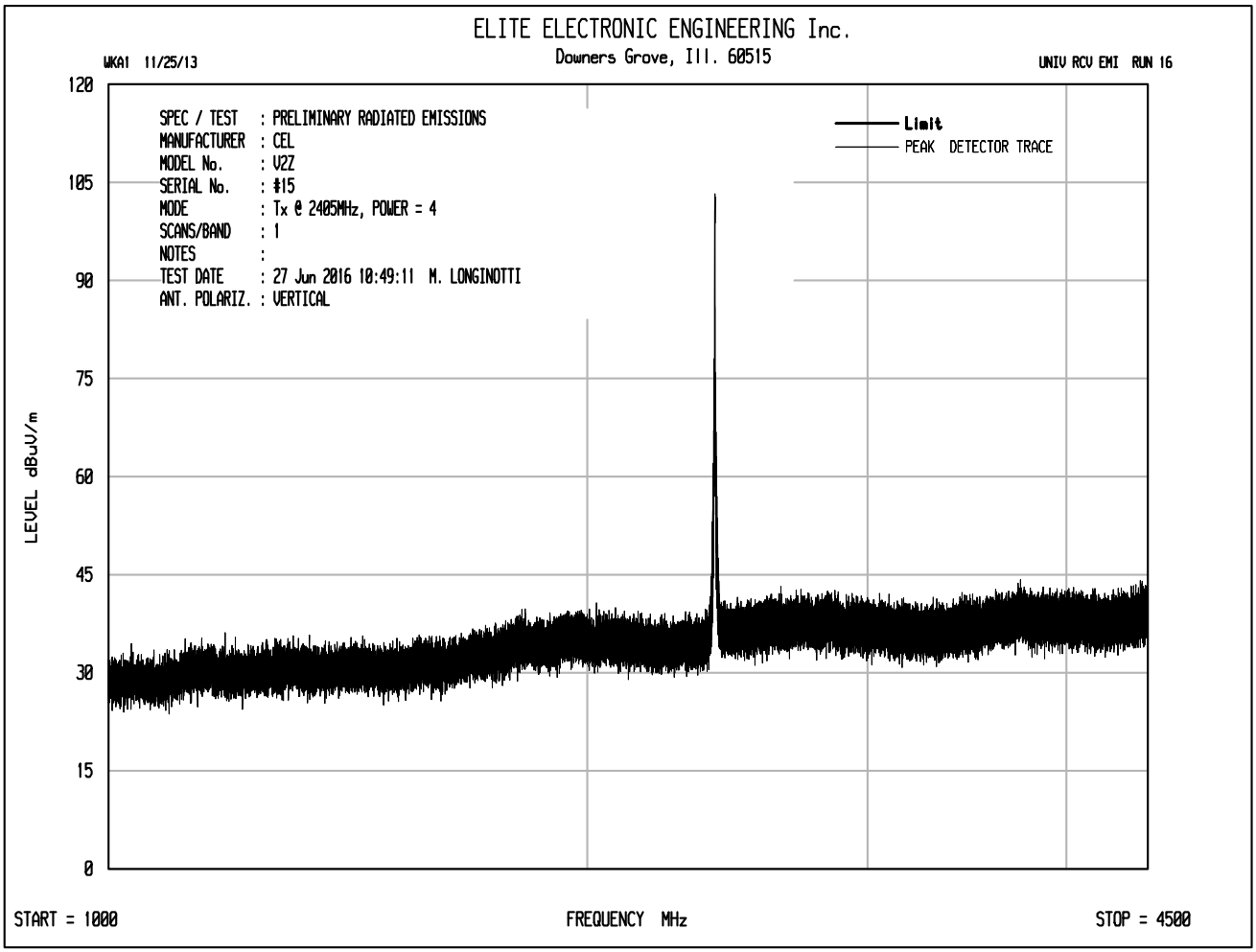

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 5
SPEC / TEST : ANTENNA PORT CONDUCTED EMISSIONS
MANUFACTURER : CEL
MODEL No. : V2Z
SERIAL No. : #16
MODE : Tx @ 2480MHz, POWER = -20
SCANS/BAND : 1
NOTES :
TEST DATE : 28 Jun 2016 09:14:05 M. LONGINOTTI
Limit
PEAK DETECTOR TRACE
30
15
0
-15
-30
-45
-60
-75
-90
LEVEL dBm
START = 10000
FREQUENCY MHz
STOP = 18000

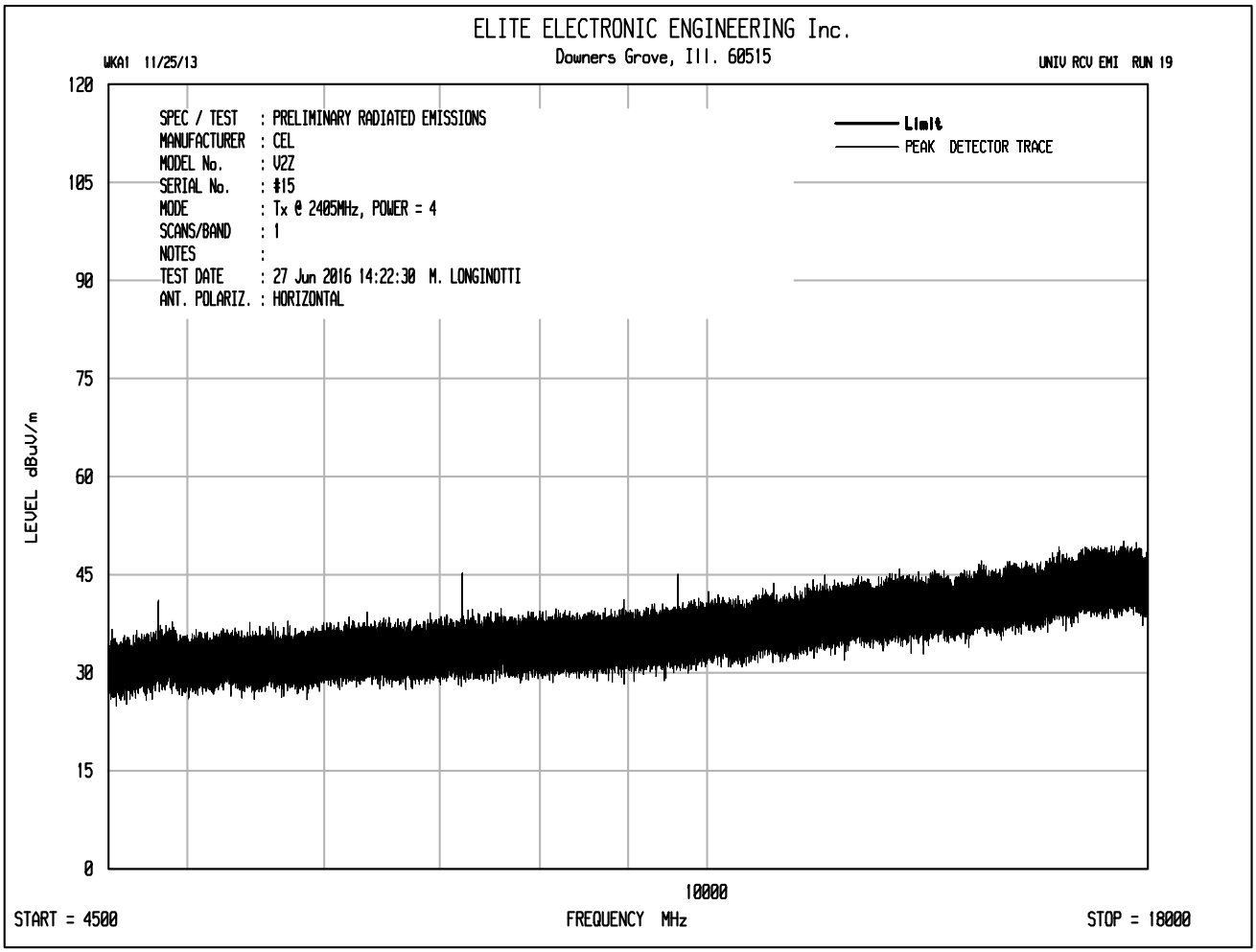

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 4
SPEC / TEST : ANTENNA CONDUCTED EMISISONS
MANUFACTURER : CEL
MODEL No. : V2Z
SERIAL No. : #16
MODE : Tx @ 2480MHz, POWER = -20
SCANS/BAND : 1
NOTES :
TEST DATE : 28 Jun 2016 10:12:41 M. LONGINOTTI
Limit
PEAK DETECTOR TRACE
LEVEL dBm
30
15
0
-15
-30
-45
-60
-75
-90
-105
-120
START = 18000
FREQUENCY MHz
STOP = 25000

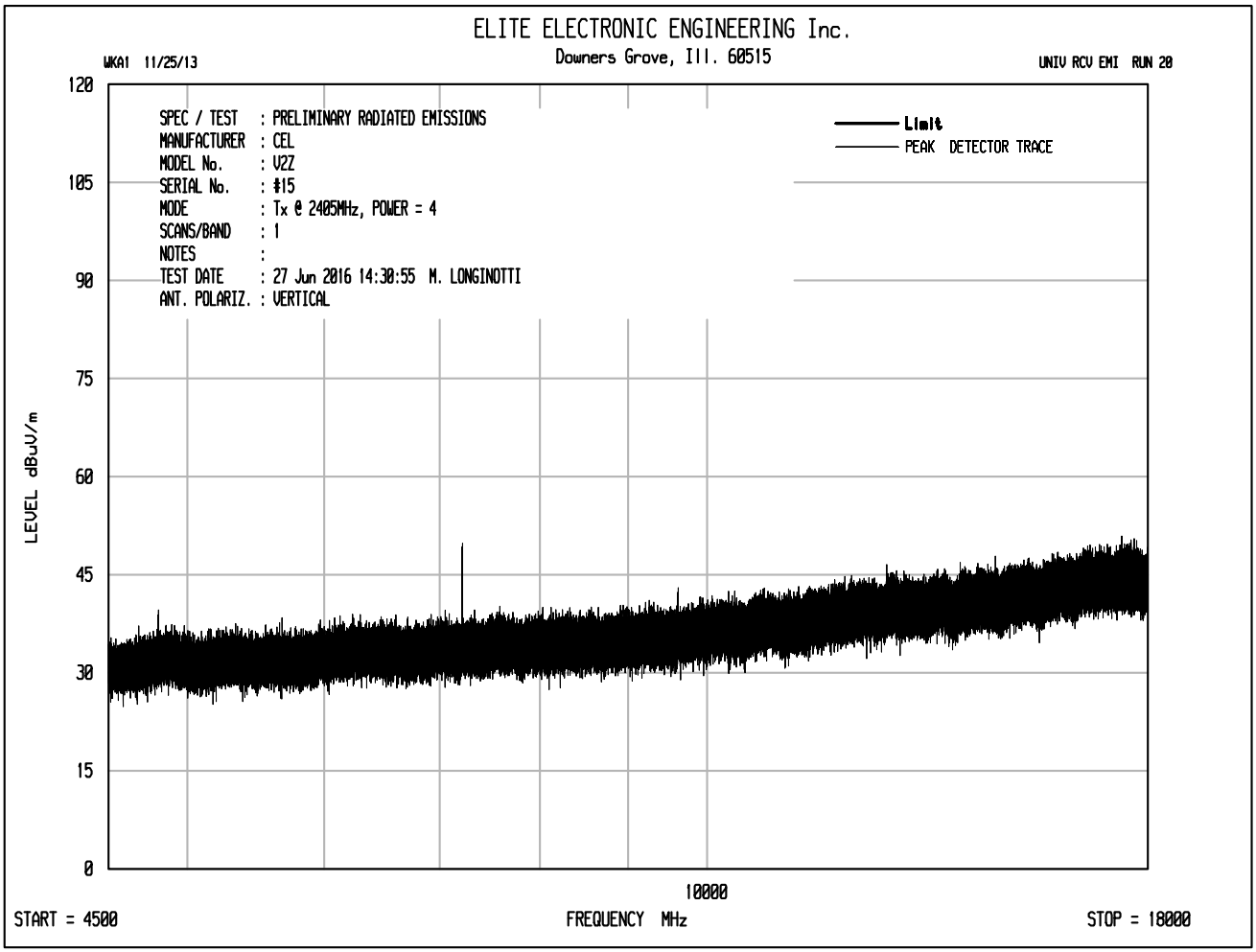

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 1
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CEL
MODEL No. : V2Z
SERIAL No. : #15
MODE : Tx @ 2405MHz, POWER = 4
SCANS/BAND : 1
NOTES :
TEST DATE : 27 Jun 2016 08:22:21 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000

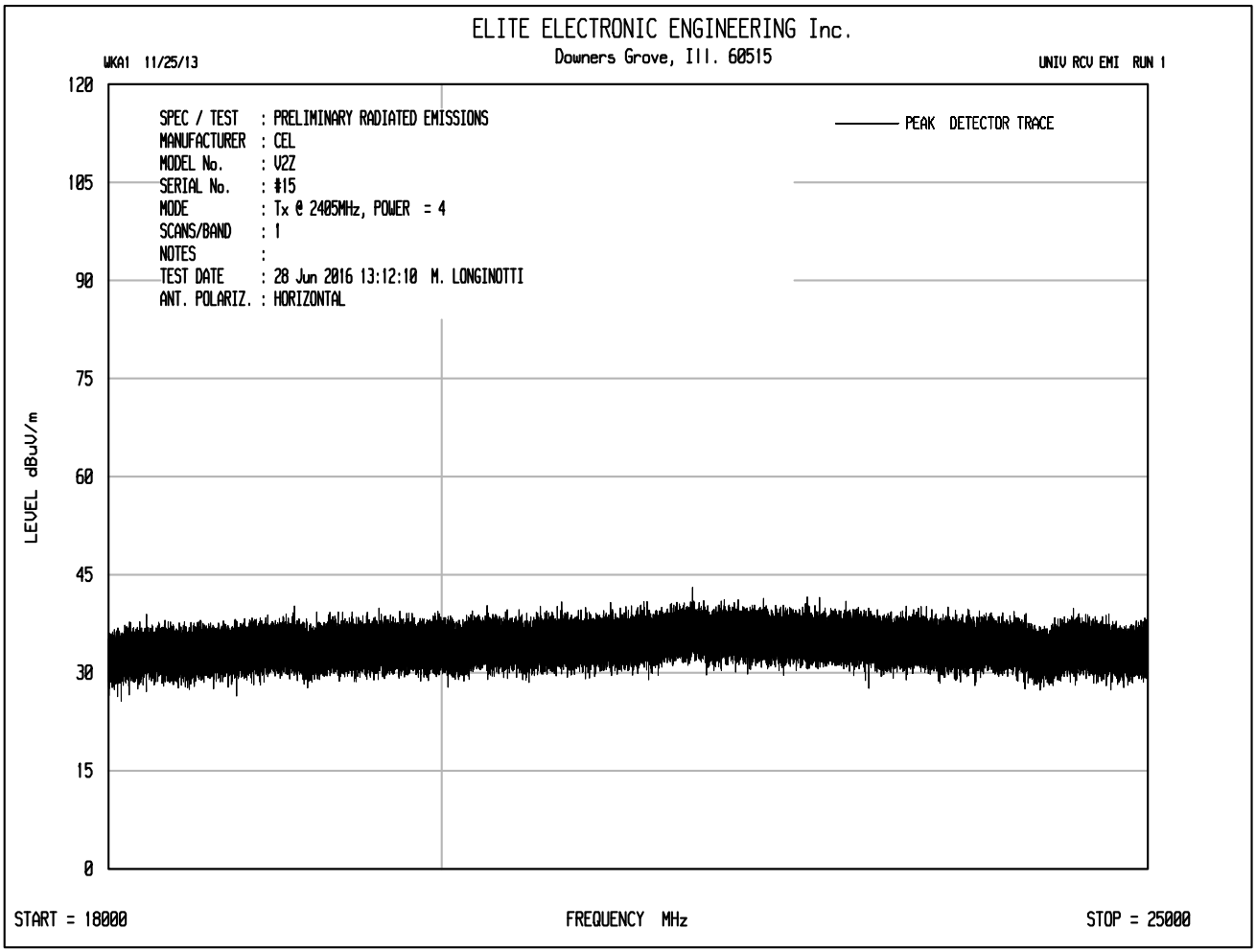

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 2
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CEL
MODEL No. : V2Z
SERIAL No. : #15
MODE : Tx @ 2405MHz, POWER = 4
SCANS/BAND : 1
NOTES :
TEST DATE : 27 Jun 2016 08:24:22 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000

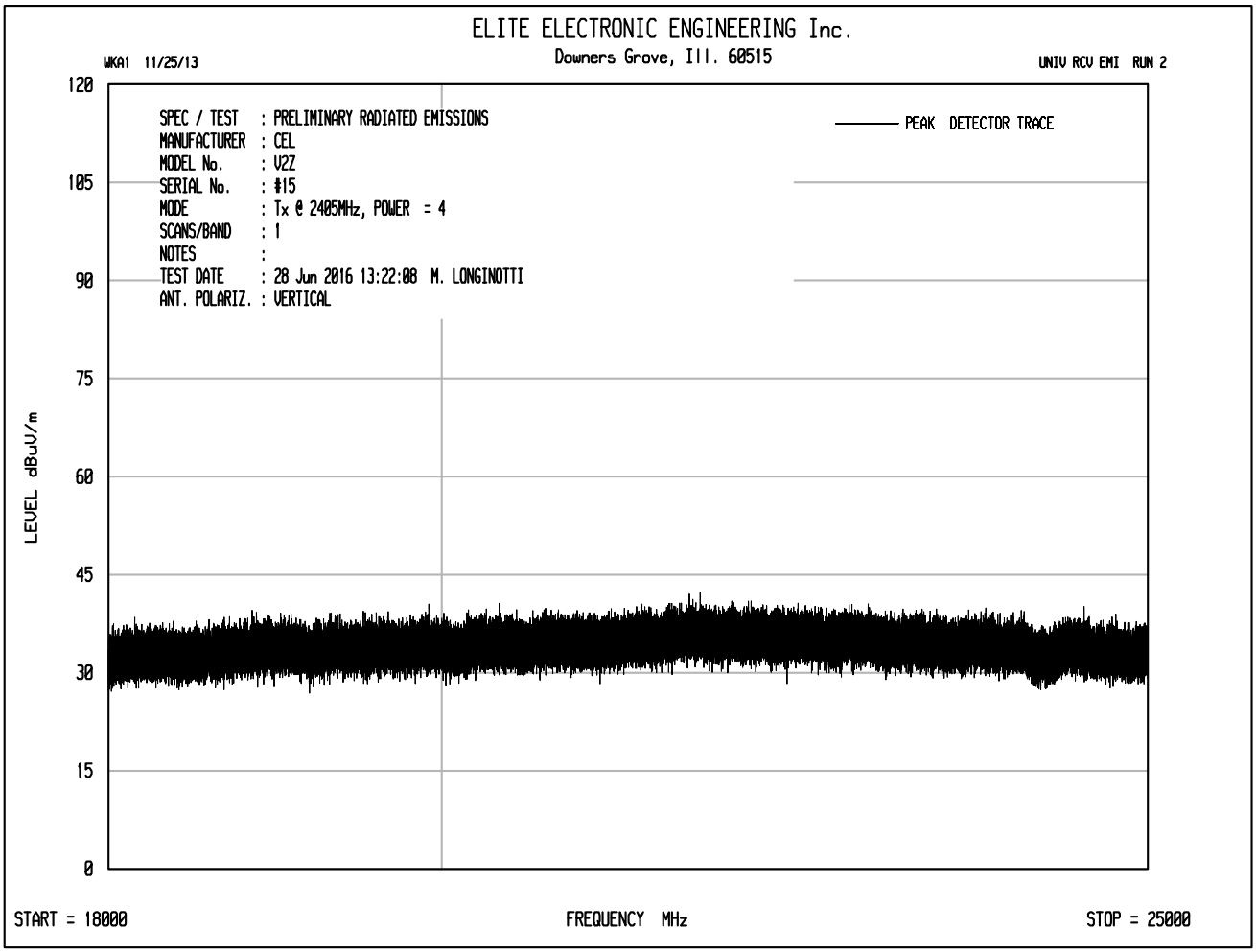

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 15
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CEL
MODEL No. : V2Z
SERIAL No. : #15
MODE : Tx @ 2405MHz, POWER = 4
SCANS/BAND : 1
NOTES :
TEST DATE : 27 Jun 2016 10:40:32 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 4500

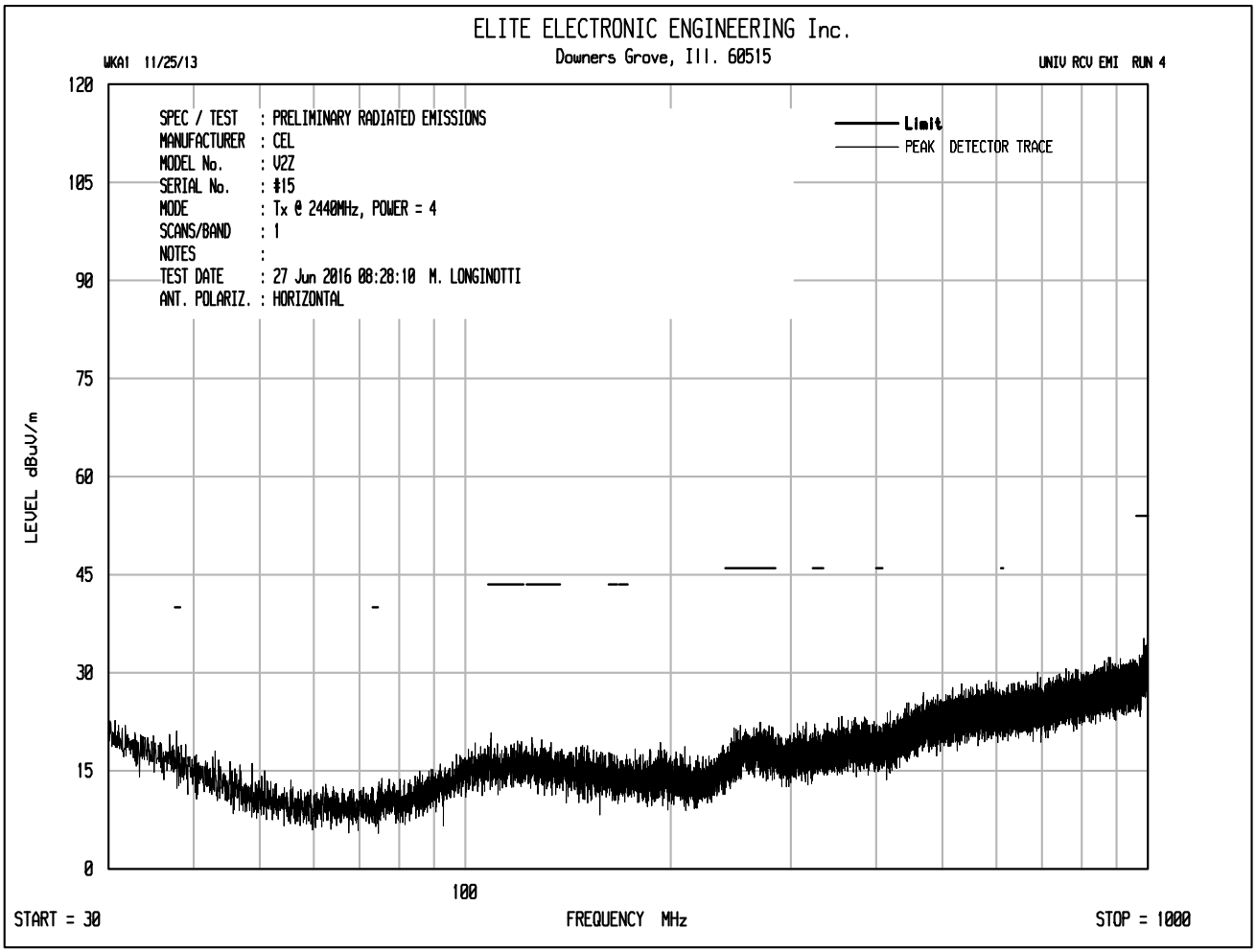

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 16
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CEL
MODEL No. : V2Z
SERIAL No. : #15
MODE : Tx @ 2405MHz, POWER = 4
SCANS/BAND : 1
NOTES :
TEST DATE : 27 Jun 2016 10:49:11 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 4500

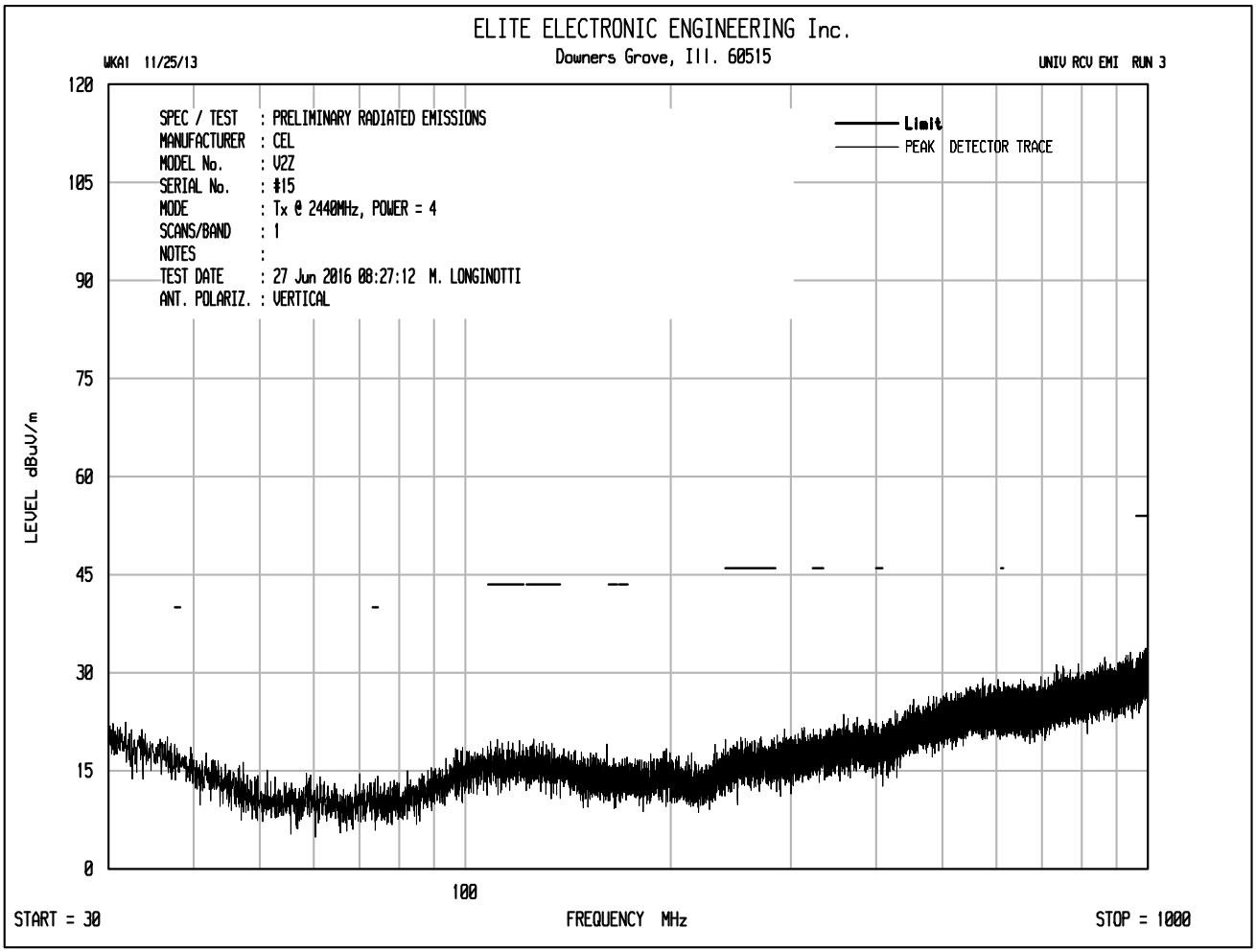

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 19
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CEL
MODEL No. : V2Z
SERIAL No. : #15
MODE : Tx @ 2405MHz, POWER = 4
SCANS/BAND : 1
NOTES :
TEST DATE : 27 Jun 2016 14:22:30 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
10000
START = 4500
FREQUENCY MHz
STOP = 18000

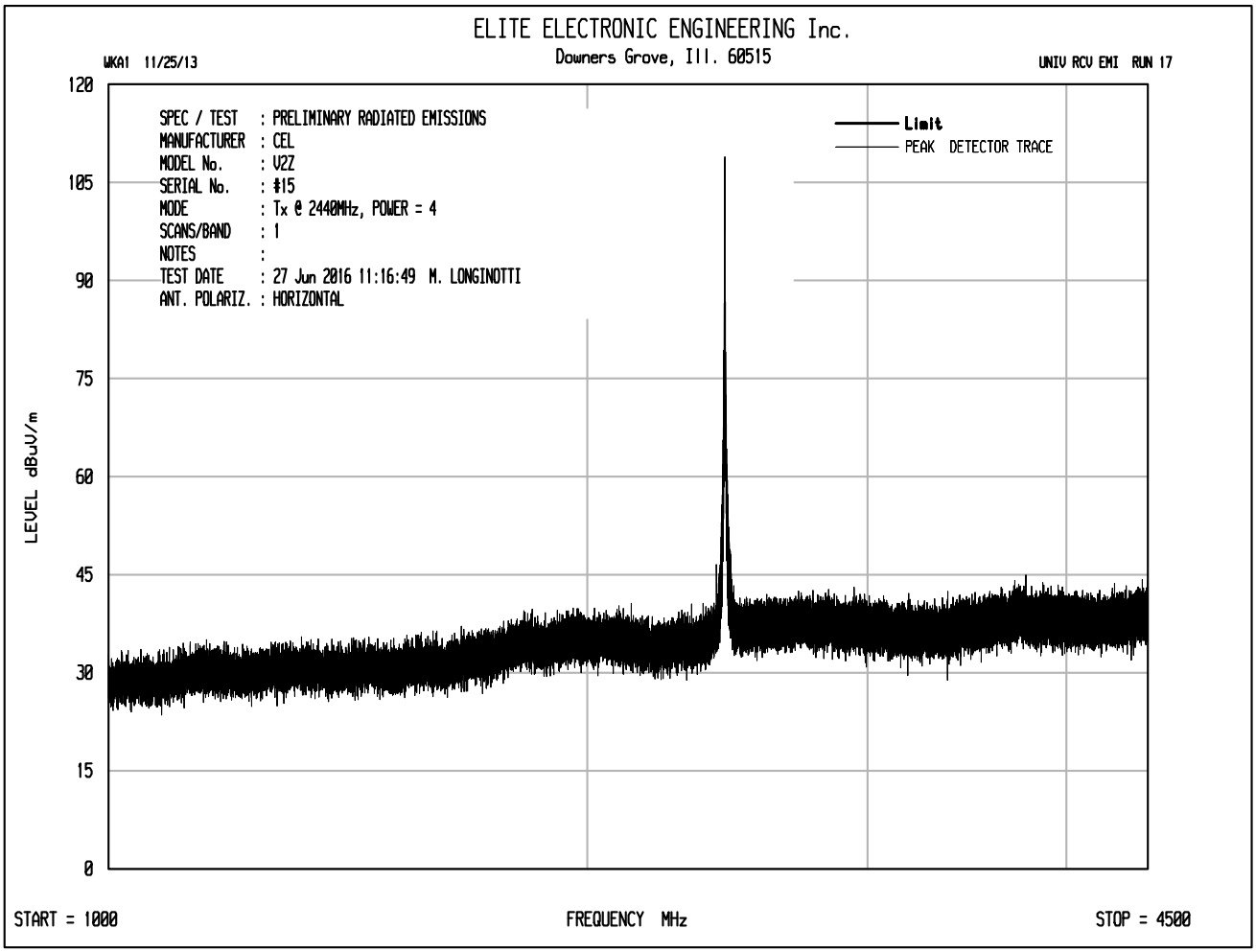

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 20
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CEL
MODEL No. : V2Z
SERIAL No. : #15
MODE : Tx @ 2405MHz, POWER = 4
SCANS/BAND : 1
NOTES :
TEST DATE : 27 Jun 2016 14:30:55 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
10000
START = 4500
FREQUENCY MHz
STOP = 18000

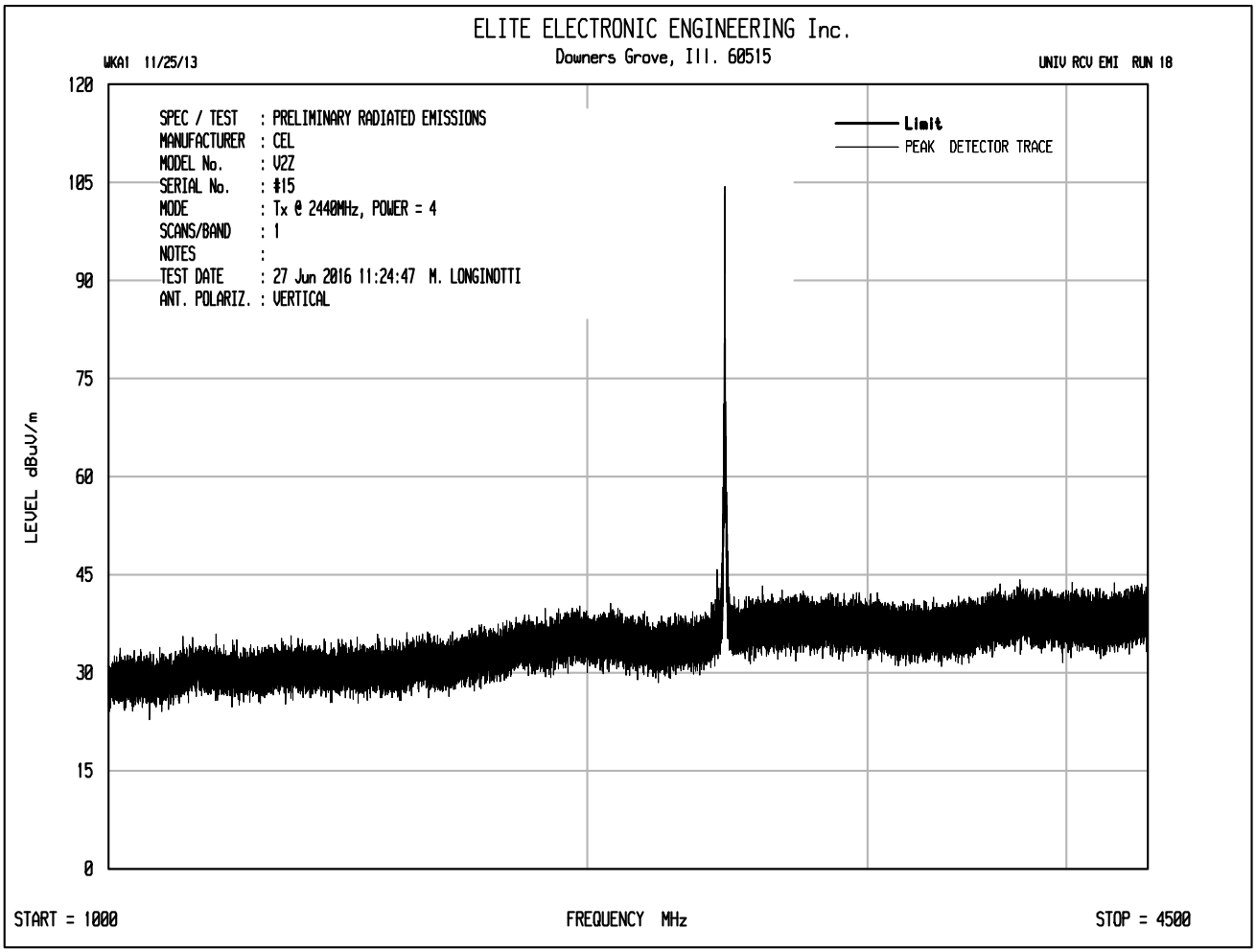

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 1
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CEL
MODEL No. : V2Z
SERIAL No. : #15
MODE : Tx @ 2405MHz, POWER = 4
SCANS/BAND : 1
NOTES :
TEST DATE : 28 Jun 2016 13:12:10 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 18000
FREQUENCY MHz
STOP = 25000

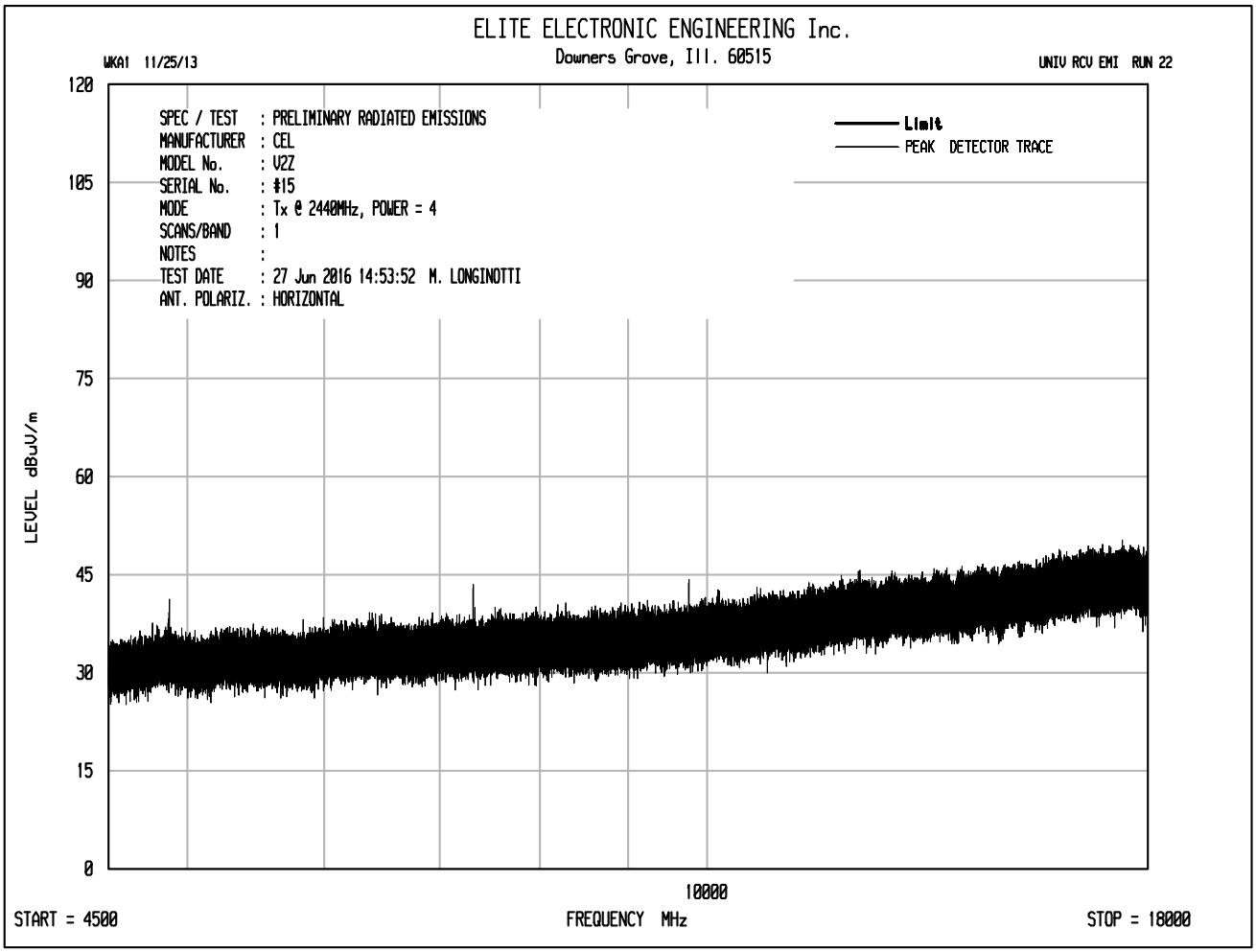

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 2
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CEL
MODEL No. : V2Z
SERIAL No. : #15
MODE : Tx @ 2405MHz, POWER = 4
SCANS/BAND : 1
NOTES :
TEST DATE : 28 Jun 2016 13:22:08 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 18000
FREQUENCY MHz
STOP = 25000

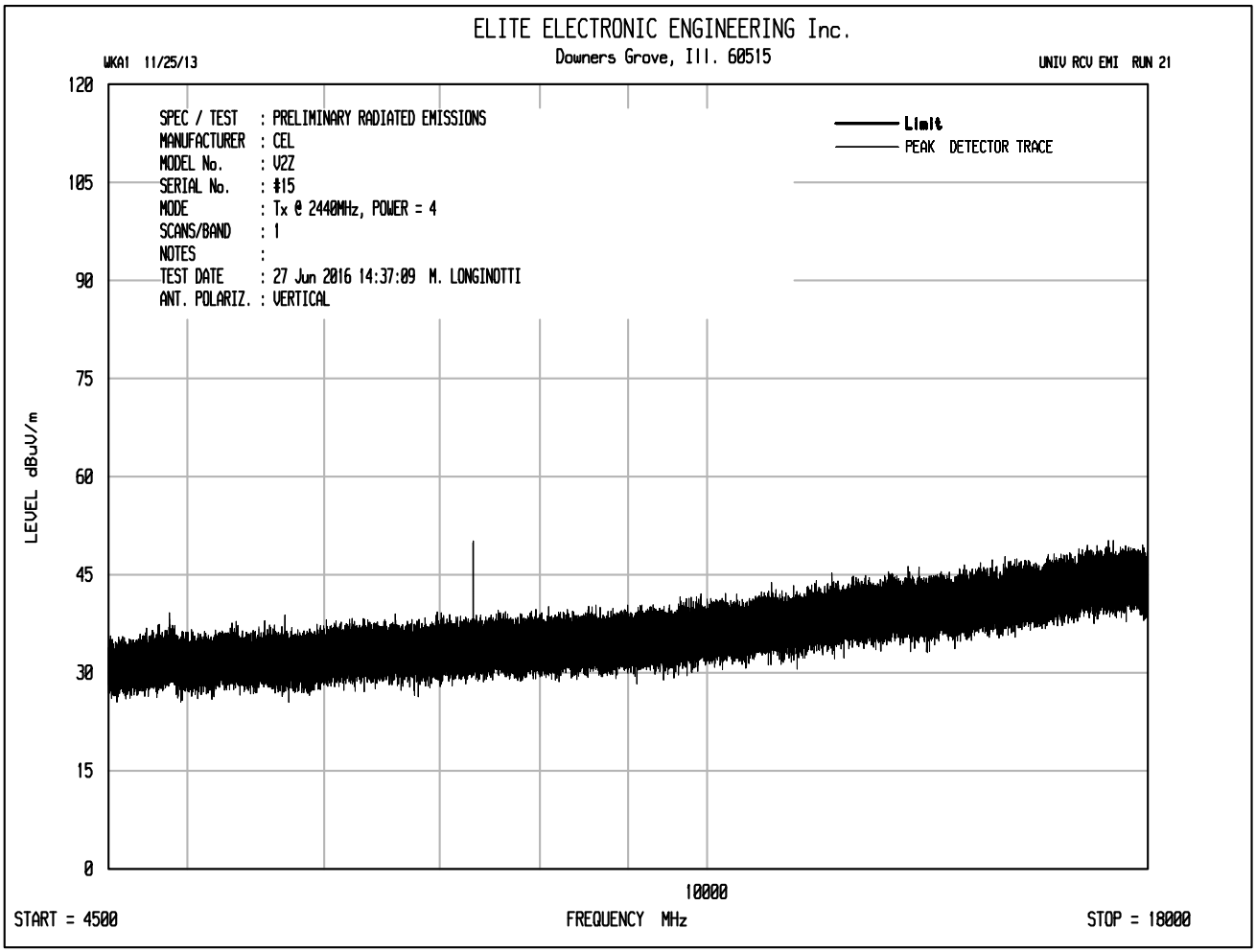

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 4
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CEL
MODEL No. : V2Z
SERIAL No. : #15
MODE : Tx @ 2440MHz, POWER = 4
SCANS/BAND : 1
NOTES :
TEST DATE : 27 Jun 2016 08:28:10 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000

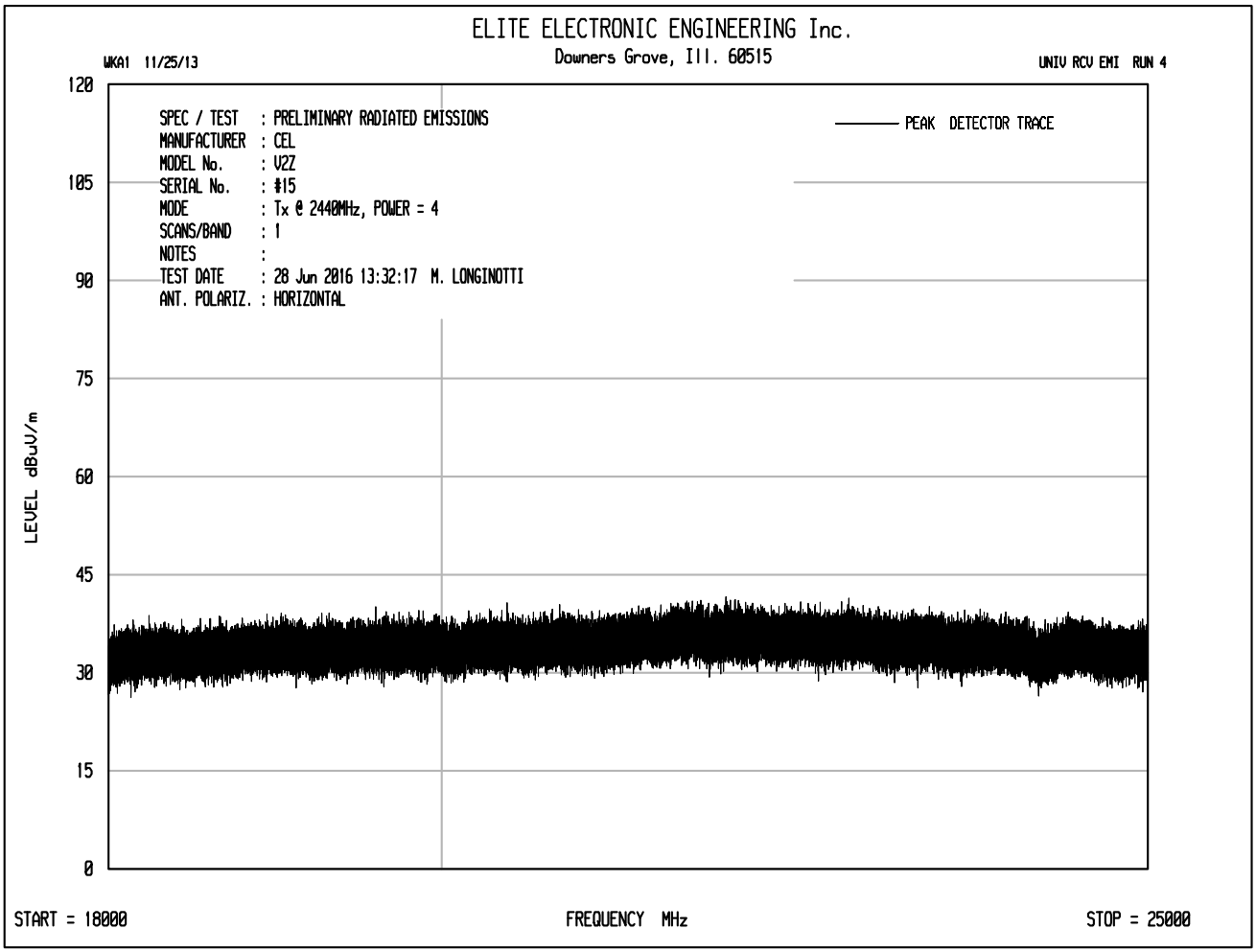

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 3
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CEL
MODEL No. : V2Z
SERIAL No. : #15
MODE : Tx @ 2440MHz, POWER = 4
SCANS/BAND : 1
NOTES :
TEST DATE : 27 Jun 2016 08:27:12 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000

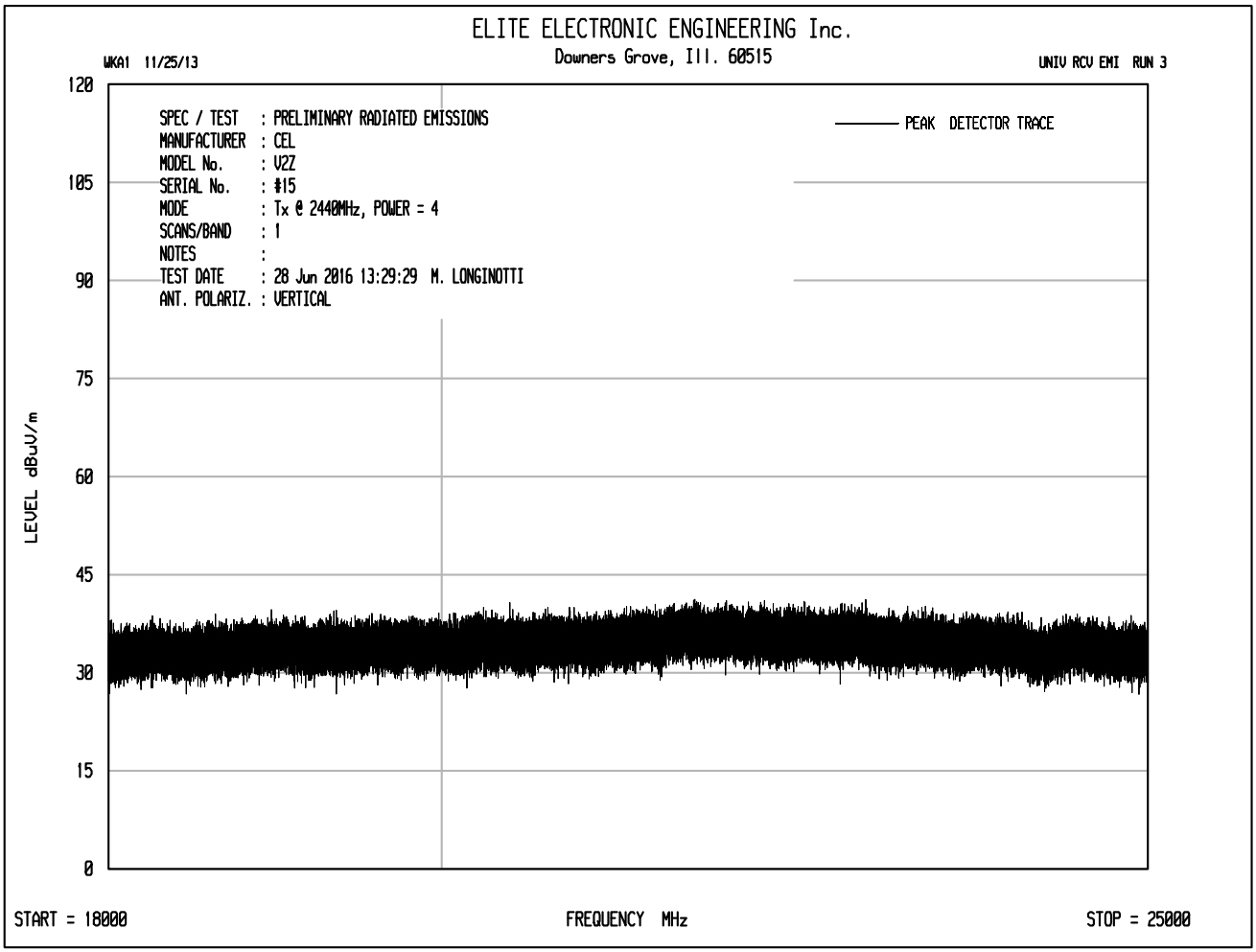

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 17
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CEL
MODEL No. : V2Z
SERIAL No. : #15
MODE : Tx @ 2440MHz, POWER = 4
SCANS/BAND : 1
NOTES :
TEST DATE : 27 Jun 2016 11:16:49 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 4500

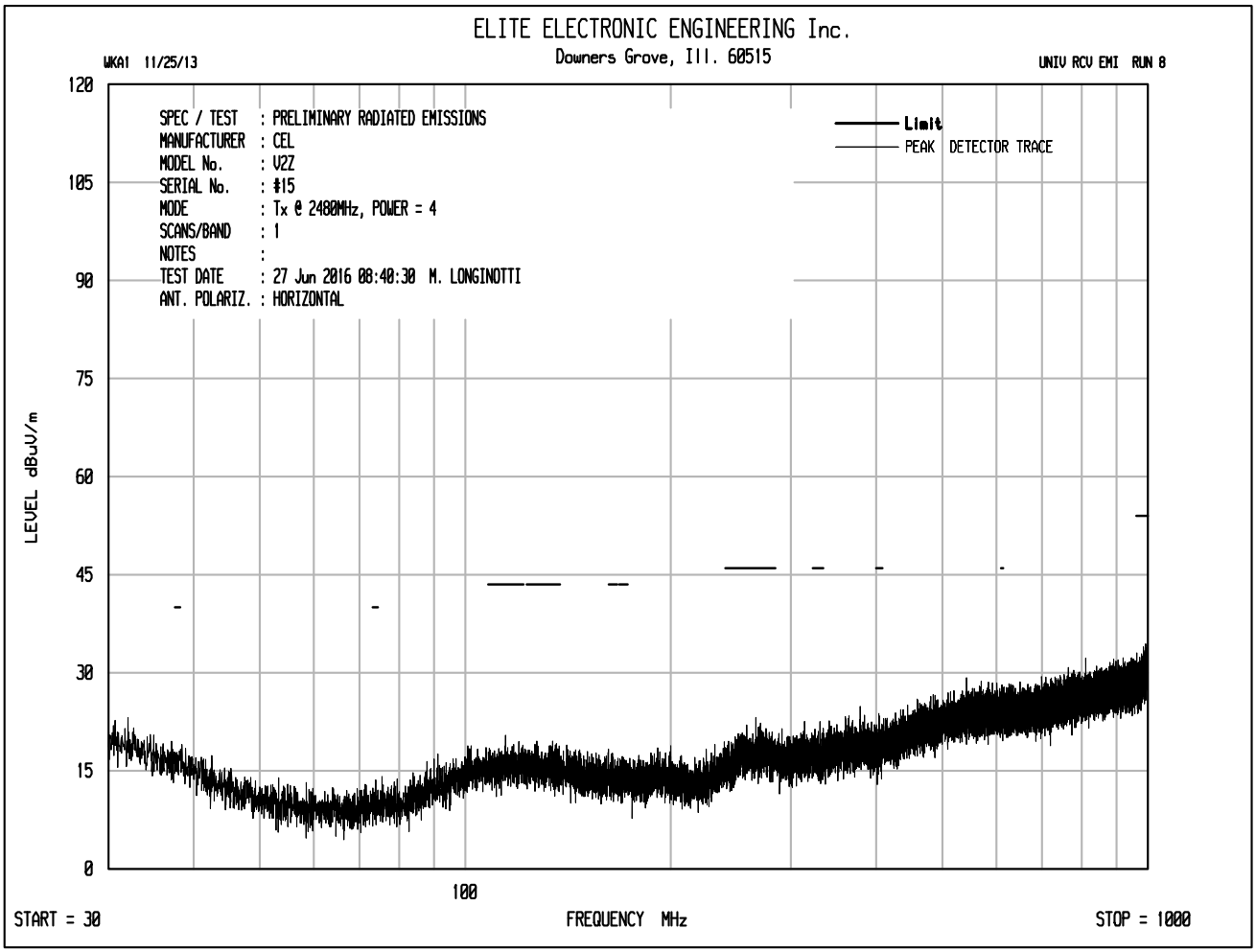

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 18
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CEL
MODEL No. : V2Z
SERIAL No. : #15
MODE : Tx @ 2440MHz, POWER = 4
SCANS/BAND : 1
NOTES :
TEST DATE : 27 Jun 2016 11:24:47 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 4500

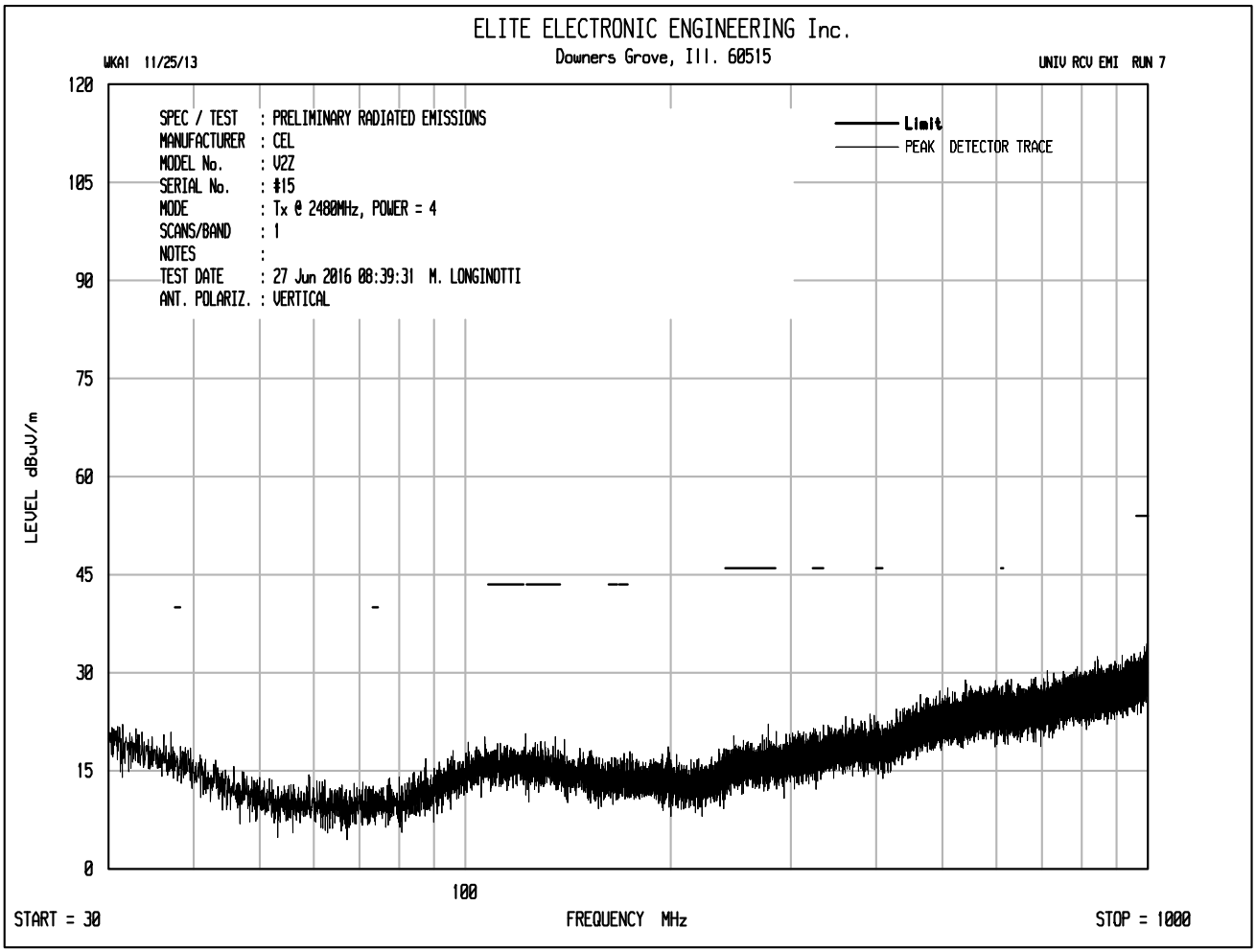

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 22
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CEL
MODEL No. : V2Z
SERIAL No. : #15
MODE : Tx @ 2440MHz, POWER = 4
SCANS/BAND : 1
NOTES :
TEST DATE : 27 Jun 2016 14:53:52 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
10000
START = 4500
FREQUENCY MHz
STOP = 18000

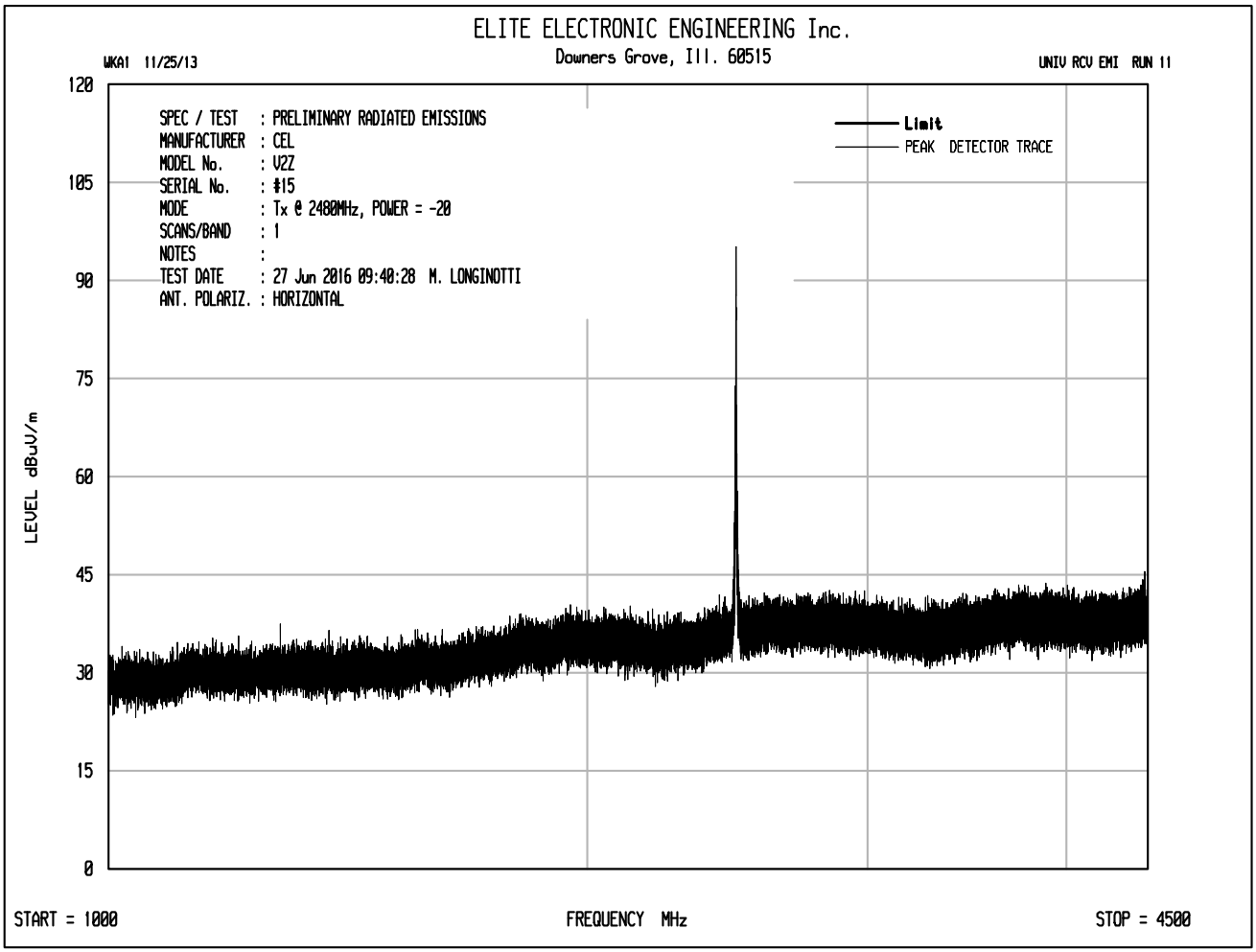

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 21
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CEL
MODEL No. : V2Z
SERIAL No. : #15
MODE : Tx @ 2440MHz, POWER = 4
SCANS/BAND : 1
NOTES :
TEST DATE : 27 Jun 2016 14:37:09 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
10000
START = 4500
FREQUENCY MHz
STOP = 18000

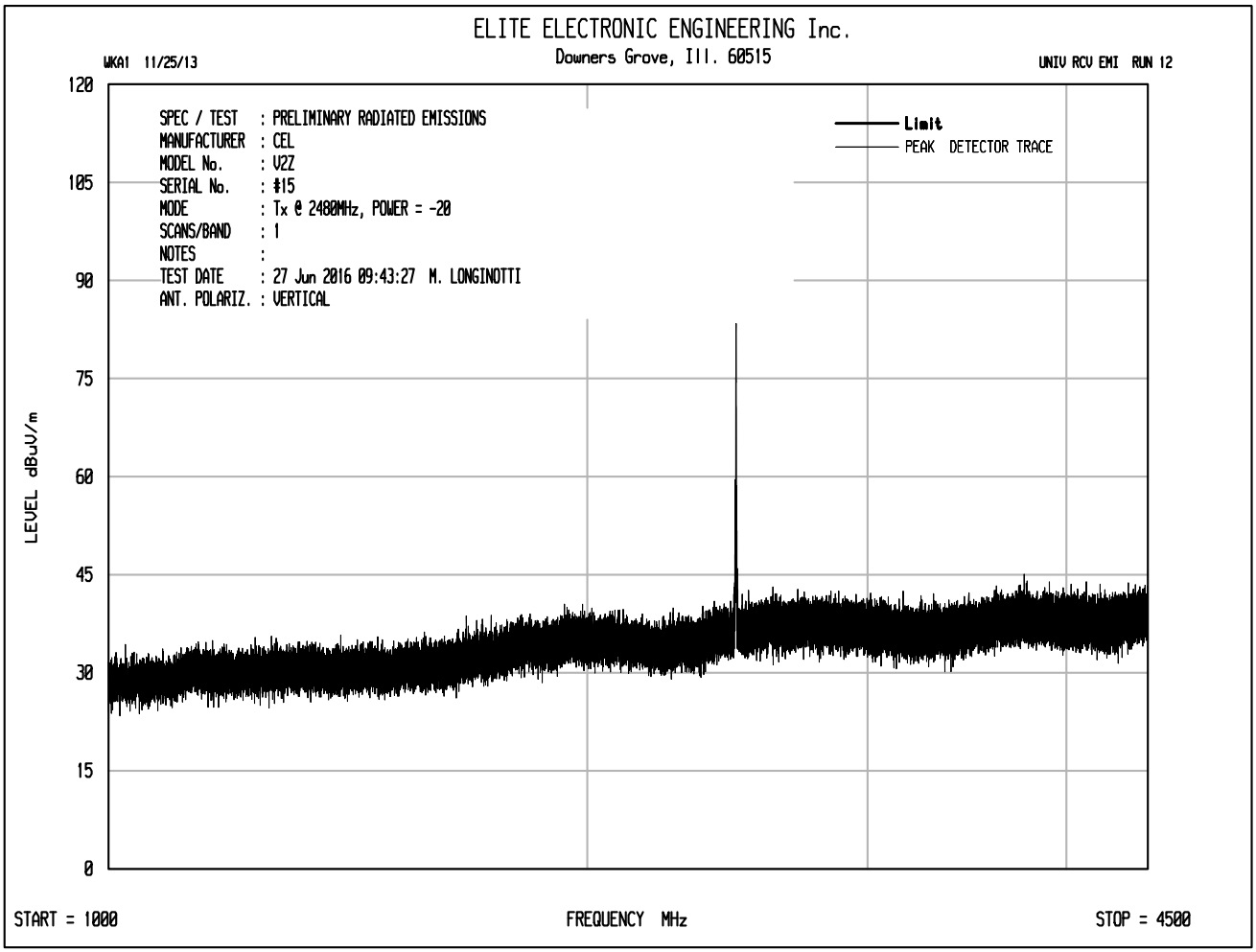

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 4
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CEL
MODEL No. : V2Z
SERIAL No. : #15
MODE : Tx @ 2440MHz, POWER = 4
SCANS/BAND : 1
NOTES :
TEST DATE : 28 Jun 2016 13:32:17 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 18000
FREQUENCY MHz
STOP = 25000

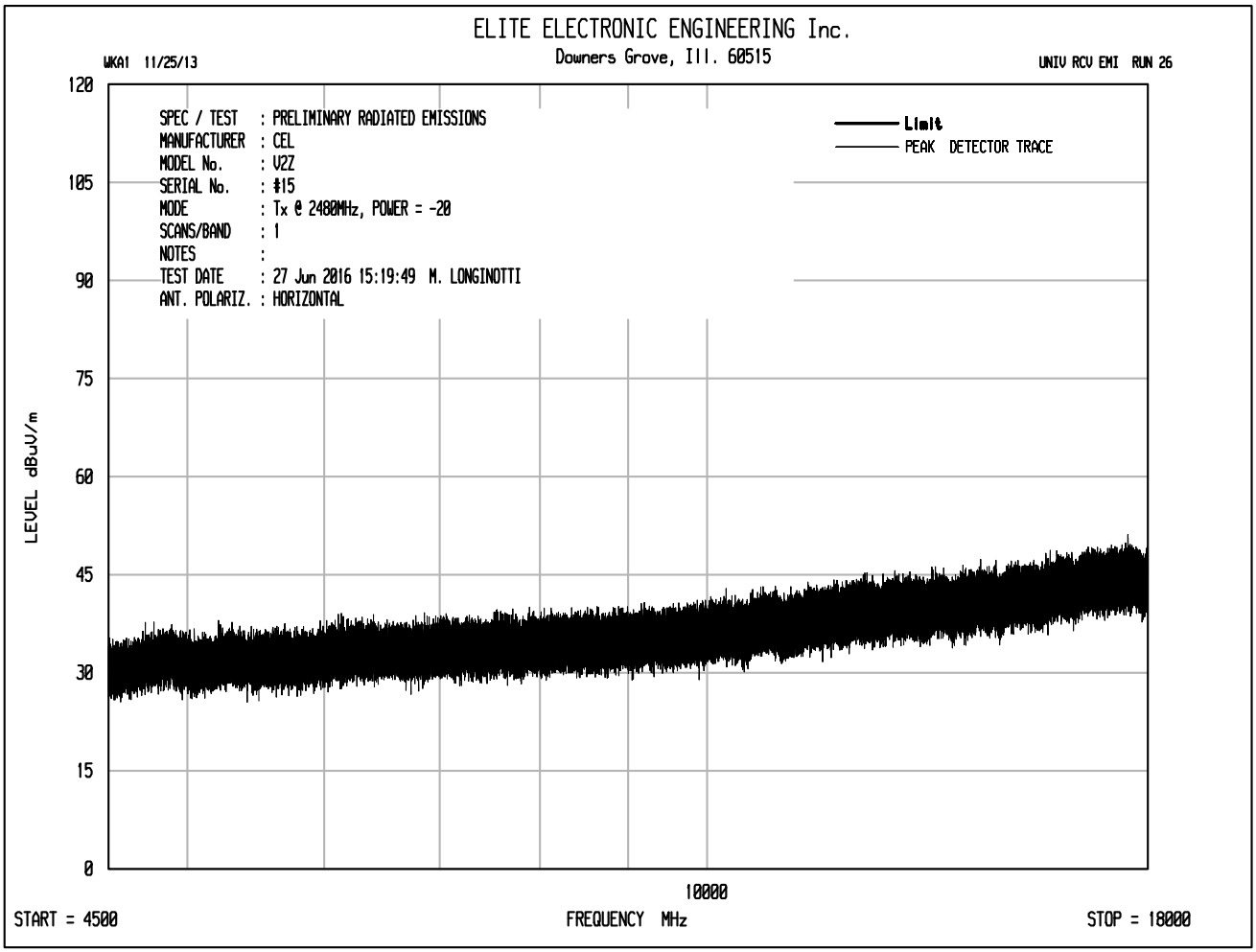

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 3
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CEL
MODEL No. : V2Z
SERIAL No. : #15
MODE : Tx @ 2440MHz, POWER = 4
SCANS/BAND : 1
NOTES :
TEST DATE : 28 Jun 2016 13:29:29 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 18000
FREQUENCY MHz
STOP = 25000

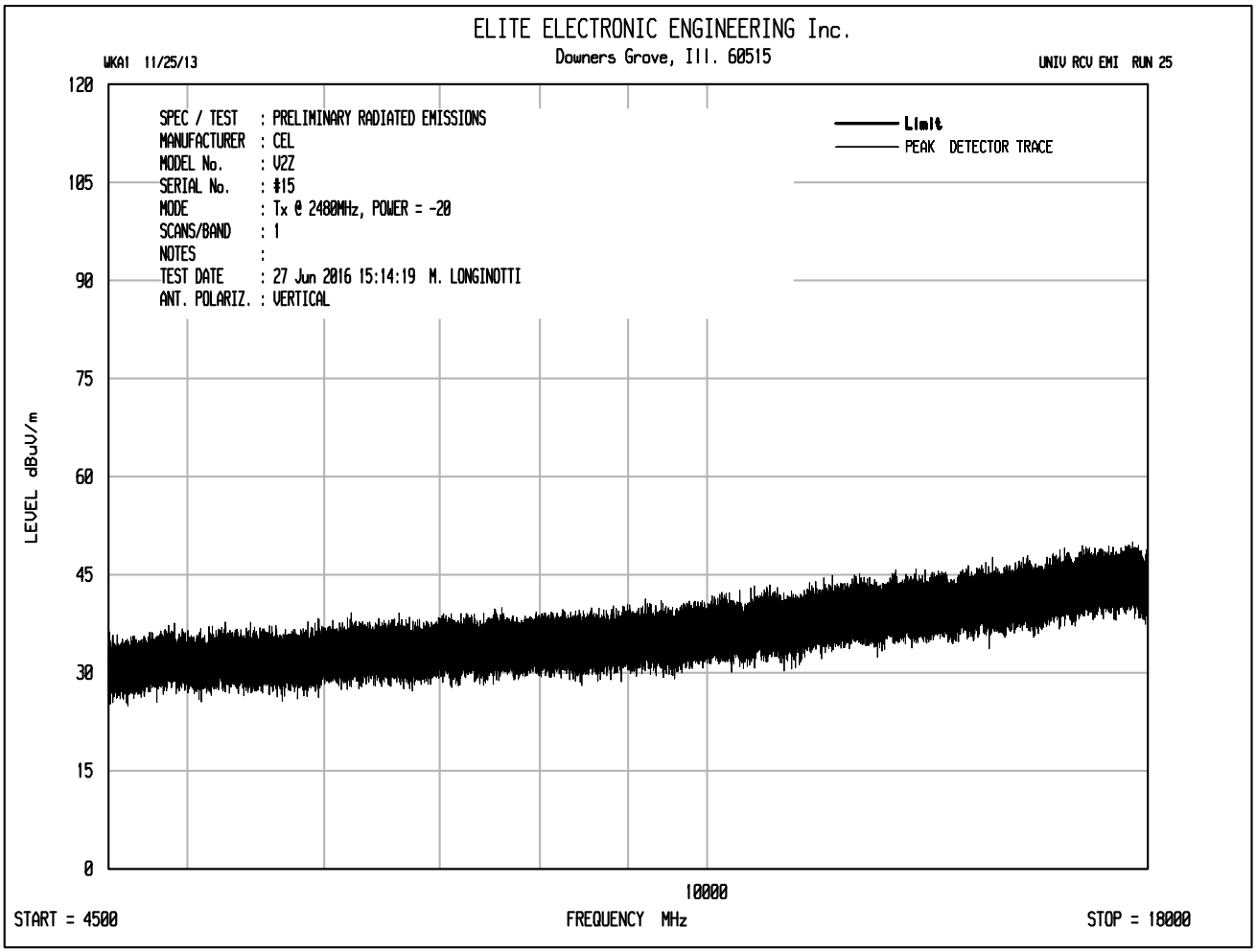

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 8
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CEL
MODEL No. : V2Z
SERIAL No. : #15
MODE : Tx @ 2480MHz, POWER = 4
SCANS/BAND : 1
NOTES :
TEST DATE : 27 Jun 2016 08:40:30 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000

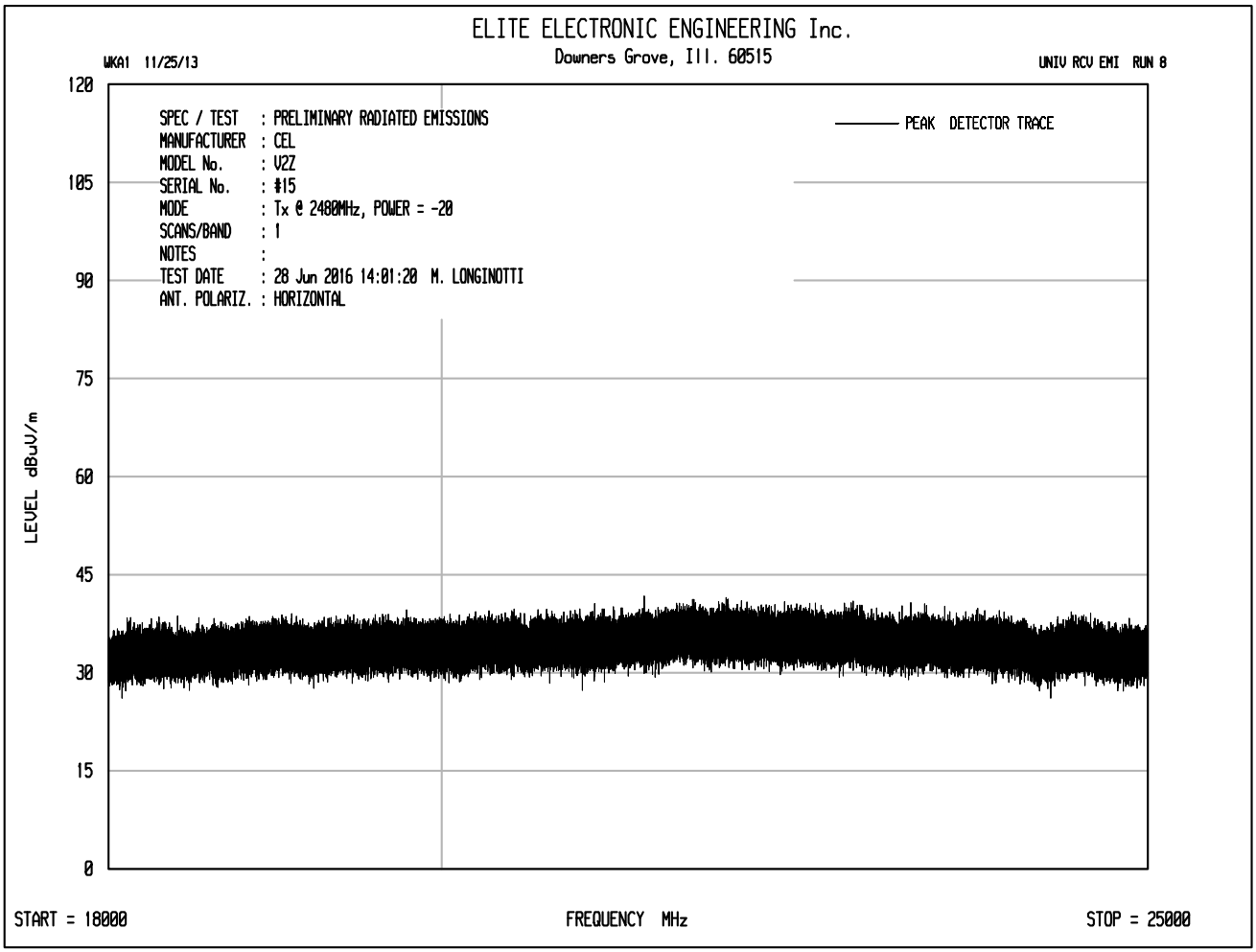

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 7
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CEL
MODEL No. : V2Z
SERIAL No. : #15
MODE : Tx @ 2480MHz, POWER = 4
SCANS/BAND : 1
NOTES :
TEST DATE : 27 Jun 2016 08:39:31 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000

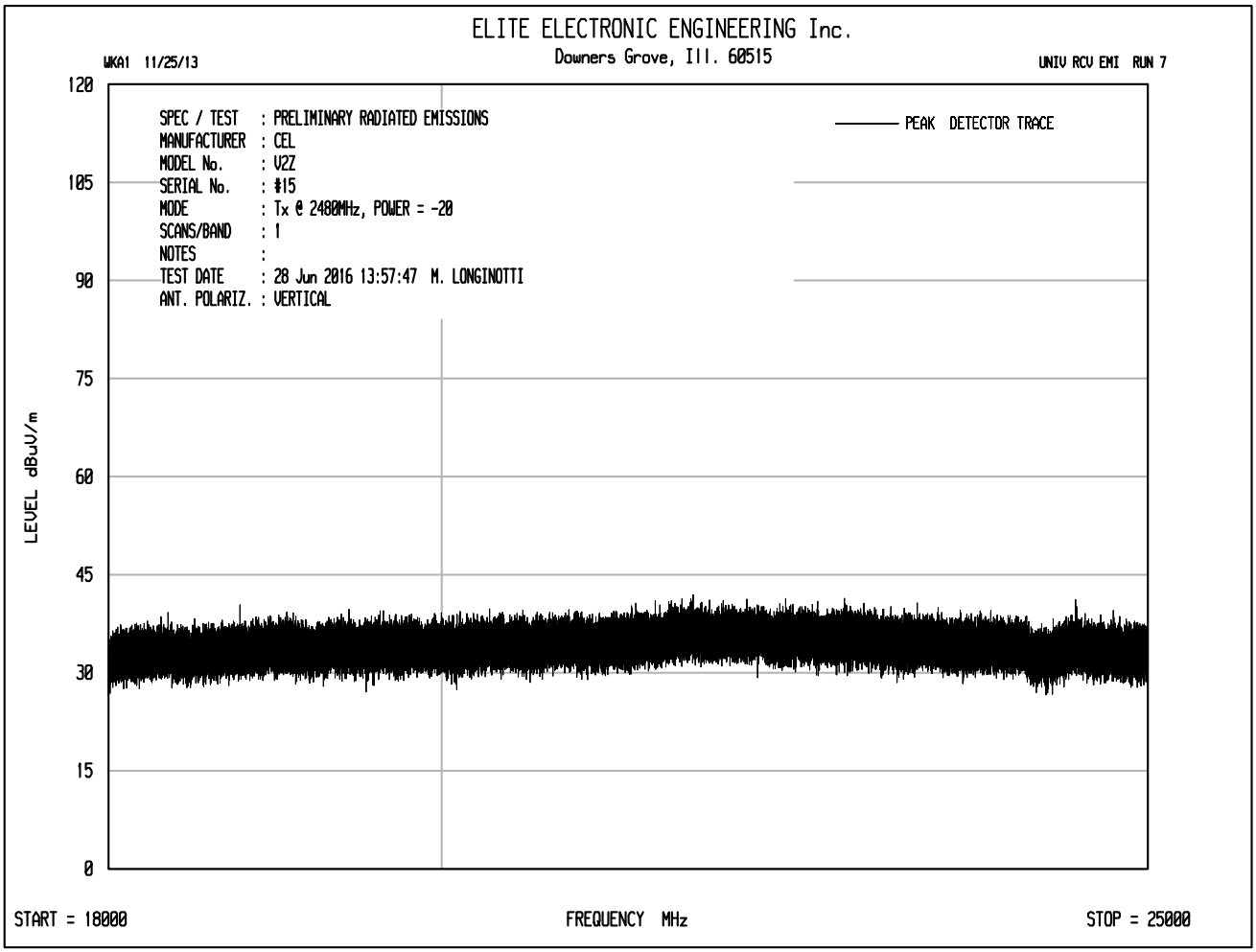

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 11
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CEL
MODEL No. : V2Z
SERIAL No. : #15
MODE : Tx @ 2480MHz, POWER = -20
SCANS/BAND : 1
NOTES :
TEST DATE : 27 Jun 2016 09:40:28 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
Limit
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 12
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CEL
MODEL No. : V2Z
SERIAL No. : #15
MODE : Tx @ 2480MHz, POWER = -20
SCANS/BAND : 1
NOTES :
TEST DATE : 27 Jun 2016 09:43:27 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
Limit
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 26
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CEL
MODEL No. : V2Z
SERIAL No. : #15
MODE : Tx @ 2480MHz, POWER = -20
SCANS/BAND : 1
NOTES :
TEST DATE : 27 Jun 2016 15:19:49 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
10000
START = 4500
FREQUENCY MHz
STOP = 18000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 25
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CEL
MODEL No. : V2Z
SERIAL No. : #15
MODE : Tx @ 2480MHz, POWER = -20
SCANS/BAND : 1
NOTES :
TEST DATE : 27 Jun 2016 15:14:19 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
10000
START = 4500
FREQUENCY MHz
STOP = 18000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 8
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CEL
MODEL No. : V2Z
SERIAL No. : #15
MODE : Tx @ 2480MHz, POWER = -20
SCANS/BAND : 1
NOTES :
TEST DATE : 28 Jun 2016 14:01:20 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 18000
FREQUENCY MHz
STOP = 25000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 7
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CEL
MODEL No. : V2Z
SERIAL No. : #15
MODE : Tx @ 2480MHz, POWER = -20
SCANS/BAND : 1
NOTES :
TEST DATE : 28 Jun 2016 13:57:47 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 18000
FREQUENCY MHz
STOP = 25000

Manufacturer : California Eastern Laboratories
Test Item : Transceiver
Model No. : V2Z
Serial No. : 15
Mode : Transmit at 2405MHz, Power Setting = 4
Test Specification : FCC-15.247, RSS-247 Peak Radiated Emissions in Restricted Bands
Date : June 27, 2016 and June 28, 2016
Test Distance : 3 meters
Notes : Peak Detector with 1MHz Resolution Bandwidth

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
4810.00	H	50.2		4.8	34.2	-39.3	49.9	313.8	5000.0	-24.0
4810.00	V	51.5		4.8	34.2	-39.3	51.2	364.5	5000.0	-22.7
12025.00	H	48.8	Ambient	8.0	39.1	-39.2	56.8	689.4	5000.0	-17.2
12025.00	V	49.3	Ambient	8.0	39.1	-39.2	57.3	730.3	5000.0	-16.7
19240.00	H	35.2	Ambient	2.2	40.4	-28.5	49.3	292.1	5000.0	-24.7
19240.00	V	35.0	Ambient	2.2	40.4	-28.5	49.1	285.4	5000.0	-24.9

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

Checked By: MARK E. LONGINOTTI

Mark E. Longinotti

Manufacturer : California Eastern Laboratories
Test Item : Transceiver
Model No. : V2Z
Serial No. : 15
Mode : Transmit at 2405MHz, Power Setting = 4
Test Specification : FCC-15.247, RSS-247 Average Radiated Emissions in Restricted Bands
Date : June 27, 2016 and June 28, 2016
Test Distance : 3 meters
Notes : Average Detector with 1MHz Resolution Bandwidth

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)
4810.00	H	39.7		4.8	34.2	-39.3	-3.6	35.8	61.9	500.0	-18.1
4810.00	V	41.2		4.8	34.2	-39.3	-3.6	37.3	73.6	500.0	-16.6
12025.00	H	36.0	Ambient	8.0	39.1	-39.2	-3.6	40.4	104.3	500.0	-13.6
12025.00	V	35.9	Ambient	8.0	39.1	-39.2	-3.6	40.3	103.2	500.0	-13.7
19240.00	H	23.3	Ambient	2.2	40.4	-28.5	-3.6	33.8	49.0	500.0	-20.2
19240.00	V	23.4	Ambient	2.2	40.4	-28.5	-3.6	33.9	49.6	500.0	-20.1

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

Checked By: MARK E. LONGINOTTI

Mark E. Longinotti

Manufacturer : California Eastern Laboratories
Test Item : Transceiver
Model No. : V2Z
Serial No. : 15
Mode : Transmit at 2440MHz, Power Setting = 4
Test Specification : FCC-15.247, RSS-247 Peak Radiated Emissions in Restricted Bands
Date : June 27, 2016 and June 28, 2016
Test Distance : 3 meters
Notes : Peak Detector with 1MHz Resolution Bandwidth

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
4880.00	H	50.9		4.9	34.2	-39.3	50.6	340.6	5000.0	-23.3
4880.00	V	51.0		4.9	34.2	-39.3	50.7	344.5	5000.0	-23.2
7320.00	H	54.7		6.2	36.2	-39.4	57.6	758.5	5000.0	-16.4
7320.00	V	56.7		6.2	36.2	-39.4	59.6	954.9	5000.0	-14.4
12200.00	H	49.3	Ambient	8.0	39.3	-39.1	57.5	747.7	5000.0	-16.5
12200.00	V	49.6	Ambient	8.0	39.3	-39.1	57.8	774.0	5000.0	-16.2
19520.00	H	35.6	Ambient	2.2	40.4	-28.5	49.7	305.6	5000.0	-24.3
19520.00	V	35.5	Ambient	2.2	40.4	-28.5	49.6	302.1	5000.0	-24.4

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

Checked By: MARK E. LONGINOTTI

Mark E. Longinotti

Manufacturer : California Eastern Laboratories
Test Item : Transceiver
Model No. : V2Z
Serial No. : 15
Mode : Transmit at 2440MHz, Power Setting = 4
Test Specification : FCC-15.247, RSS-247 Average Radiated Emissions in Restricted Bands
Date : June 27, 2016 and June 28, 2016
Test Distance : 3 meters
Notes : Average Detector with 1MHz Resolution Bandwidth

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)
4880.00	H	40.1		4.9	34.2	-39.3	-3.6	36.2	64.9	500.0	-17.7
4880.00	V	39.5		4.9	34.2	-39.3	-3.6	35.6	60.6	500.0	-18.3
7320.00	H	45.20		6.2	36.2	-39.4	-3.6	44.5	167.9	500.0	-9.5
7320.00	V	49.0		6.2	36.2	-39.4	-3.6	48.3	260.0	500.0	-5.7
12200.00	H	36.4	Ambient	8.0	39.3	-39.1	-3.6	41.0	111.9	500.0	-13.0
12200.00	V	36.5	Ambient	8.0	39.3	-39.1	-3.6	41.1	113.2	500.0	-12.9
19520.00	H	23.6	Ambient	2.2	40.4	-28.5	-3.6	34.1	50.7	500.0	-19.9
19520.00	V	23.9	Ambient	2.2	40.4	-28.5	-3.6	34.4	52.5	500.0	-19.6

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

Checked By: MARK E. LONGINOTTI

Mark E. Longinotti

Manufacturer : California Eastern Laboratories
Test Item : Transceiver
Model No. : V2Z
Serial No. : 15
Mode : Transmit at 2480MHz, Power Setting = -20
Test Specification : FCC-15.247, RSS-247 Peak Radiated Emissions in Restricted Bands
Date : June 27, 2016 and June 28, 2016
Test Distance : 3 meters
Notes : Peak Detector with 1MHz Resolution Bandwidth

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
4960.00	H	48.1	Ambient	4.9	34.2	-39.3	47.9	247.0	5000.0	-26.1
4960.00	V	48.6	Ambient	4.9	34.2	-39.3	48.4	261.7	5000.0	-25.6
7440.00	H	49.0	Ambient	6.2	36.3	-39.4	52.1	400.6	5000.0	-21.9
7440.00	V	47.9	Ambient	6.2	36.3	-39.4	51.0	352.9	5000.0	-23.0
12400.00	H	47.7	Ambient	8.0	39.4	-39.0	56.0	634.5	5000.0	-17.9
12400.00	V	47.5	Ambient	8.0	39.4	-39.0	55.8	620.0	5000.0	-18.1
19840.00	H	35.3	Ambient	2.2	40.4	-28.2	49.8	308.1	5000.0	-24.2
19840.00	V	35.2	Ambient	2.2	40.4	-28.2	49.7	304.6	5000.0	-24.3
22320.00	H	36.8	Ambient	2.2	40.6	-29.1	50.5	336.8	5000.0	-23.4
22320.00	V	37.2	Ambient	2.2	40.6	-29.1	50.9	352.7	5000.0	-23.0

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

Checked By: MARK E. LONGINOTTI

Mark E. Longinotti

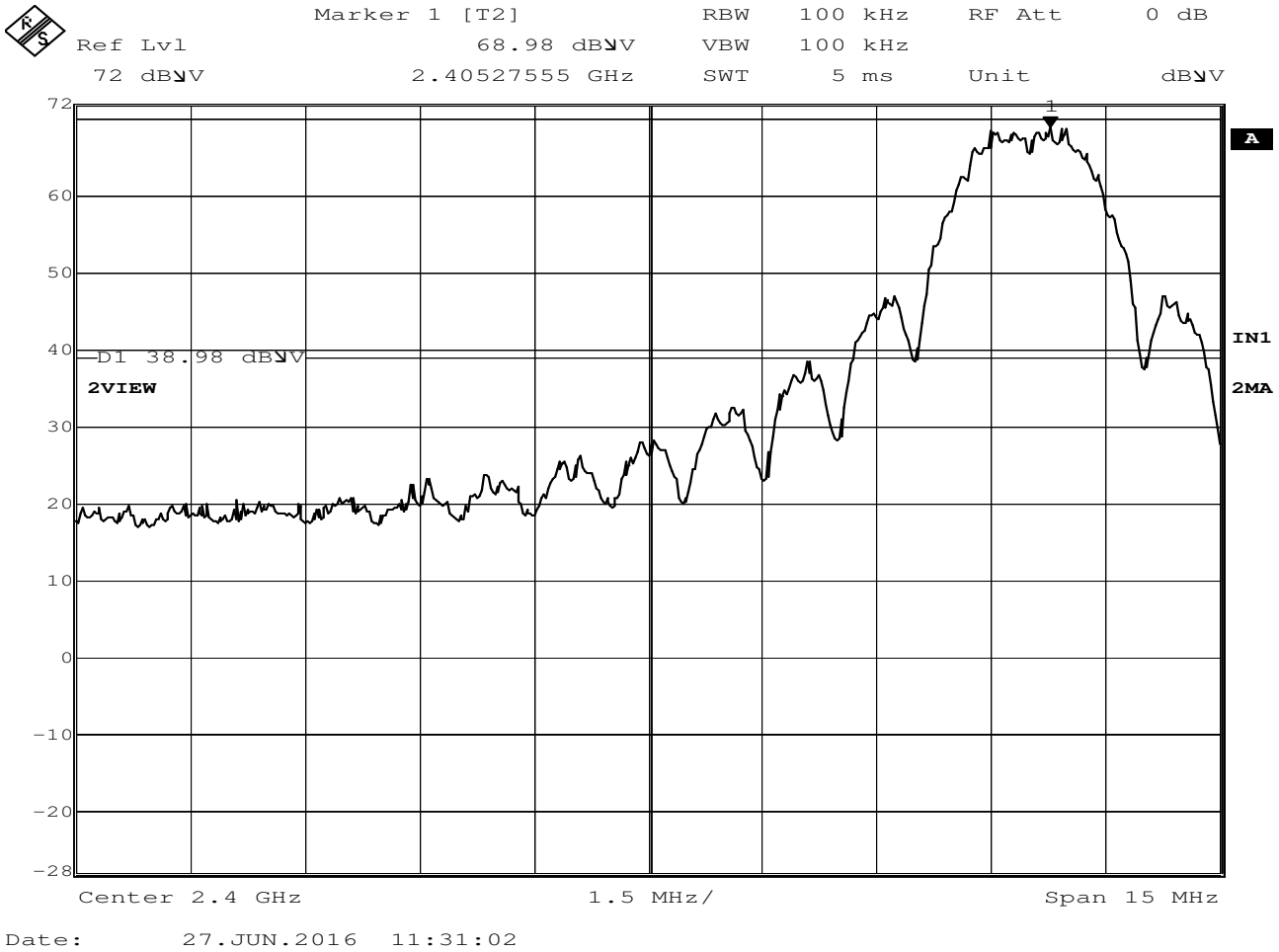
Manufacturer : California Eastern Laboratories
Test Item : Transceiver
Model No. : V2Z
Serial No. : 15
Mode : Transmit at 2480MHz, Power Setting = -20
Test Specification : FCC-15.247, RSS-247 Average Radiated Emissions in Restricted Bands
Date : June 27, 2016 and June 28, 2016
Test Distance : 3 meters
Notes : Average Detector with 1MHz Resolution Bandwidth

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)
4960.00	H	35.7	Ambient	4.9	34.2	-39.3	-3.6	31.9	39.2	500.0	-22.1
4960.00	V	35.7	Ambient	4.9	34.2	-39.3	-3.6	31.9	39.2	500.0	-22.1
7440.00	H	34.40	Ambient	6.2	36.3	-39.4	-3.6	33.9	49.3	500.0	-20.1
7440.00	V	35.4	Ambient	6.2	36.3	-39.4	-3.6	34.9	55.3	500.0	-19.1
12400.00	H	35.2	Ambient	8.0	39.4	-39.0	-3.6	39.9	99.4	500.0	-14.0
12400.00	V	35.2	Ambient	8.0	39.4	-39.0	-3.6	39.9	99.4	500.0	-14.0
19840.00	H	23.4	Ambient	2.2	40.4	-28.2	-3.6	34.3	51.7	500.0	-19.7
19840.00	V	23.2	Ambient	2.2	40.4	-28.2	-3.6	34.1	50.5	500.0	-19.9
22320.00	H	25.1	Ambient	2.2	40.6	-29.1	-3.6	35.2	57.9	500.0	-18.7
22320.00	V	24.9	Ambient	2.2	40.6	-29.1	-3.6	35.0	56.5	500.0	-18.9

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

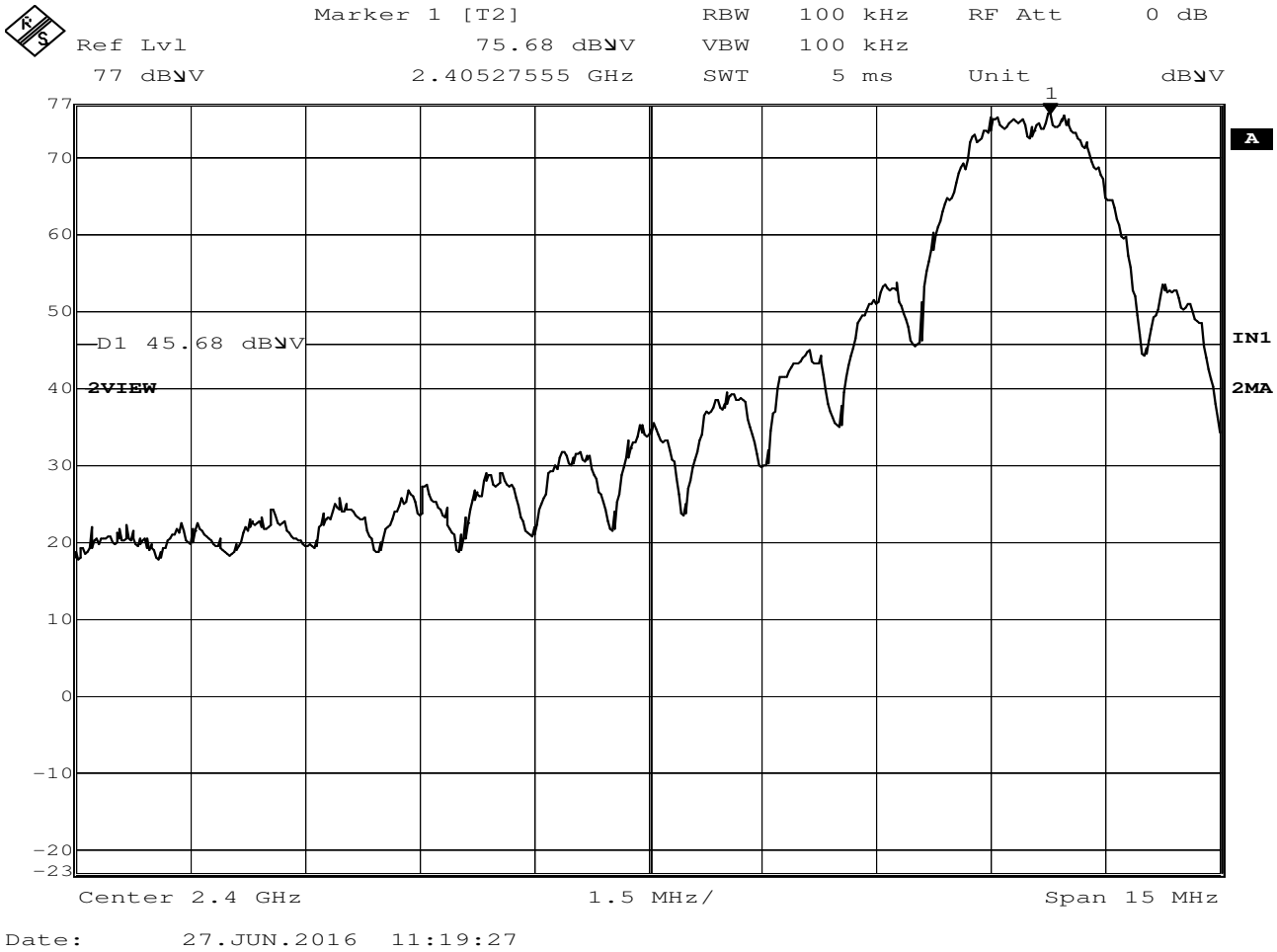
Checked By: MARK E. LONGINOTTI

Mark E. Longinotti



FCC 15.247 Low Band Edge (Vertical)

MANUFACTURER	:	CEL
MODEL NUMBER	:	V2Z
SERIAL NUMBER	:	#15
TEST MODE	:	Transmit at 2405MHz, power = 4
NOTES	:	Display Line D1 represents the 30dB down level
EQUIPMENT USED	:	RBB0, NTA2



FCC 15.247 Low Band Edge (Horizontal)

MANUFACTURER	:	CEL
MODEL NUMBER	:	V2Z
SERIAL NUMBER	:	#15
TEST MODE	:	Transmit at 2405MHz, power = 4
NOTES	:	Display Line D1 represents the 30dB down level
EQUIPMENT USED	:	RBB0, NTA2

Manufacturer : California Eastern Laboratories
Test Item : Transceiver
Model No. : V2Z
Serial No. : 15
Mode : Transmit at 2475MHz, Power Setting = 2
Test Specification : FCC-15.247, RSS-247 Band Edge
Date : June 27, 2016 and June 28, 2016
Test Distance : 3 meters
Notes : Peak Detector with 1MHz Resolution Bandwidth

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
2483.50	H	31.5		3.5	32.6	0.0	67.6	2391.1	5000.0	-6.4
2483.50	V	27.6		3.5	32.6	0.0	63.7	1526.1	5000.0	-10.3

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

Checked By: MARK E. LONGINOTTI

Mark E. Longinotti

Manufacturer : California Eastern Laboratories
Test Item : Transceiver
Model No. : V2Z
Serial No. : 15
Mode : Transmit at 2475MHz, Power Setting = 2
Test Specification : FCC-15.247, RSS-247 Average Band Edge
Date : June 27, 2016 and June 28, 2016
Test Distance : 3 meters
Notes : Average Detector with 1MHz Resolution Bandwidth

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)
2483.50	H	21.3		3.5	32.6	0.0	-3.6	53.8	488.2	500.0	-0.2
2483.50	V	16.6		3.5	32.6	0.0	-3.6	49.1	284.2	500.0	-4.9

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

Checked By: MARK E. LONGINOTTI

Mark E. Longinotti

Manufacturer : California Eastern Laboratories
Test Item : Transceiver
Model No. : V2Z
Serial No. : 15
Mode : Transmit at 2480MHz, Power Setting = -20
Test Specification : FCC-15.247, RSS-247 Band Edge
Date : June 27, 2016 and June 28, 2016
Test Distance : 3 meters
Notes : Peak Detector with 1MHz Resolution Bandwidth

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
2483.50	H	31.5		3.5	32.6	0.0	67.6	2391.1	5000.0	-6.4
2483.50	V	26.8		3.5	32.6	0.0	62.9	1391.9	5000.0	-11.1

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

Checked By: MARK E. LONGINOTTI

Mark E. Longinotti

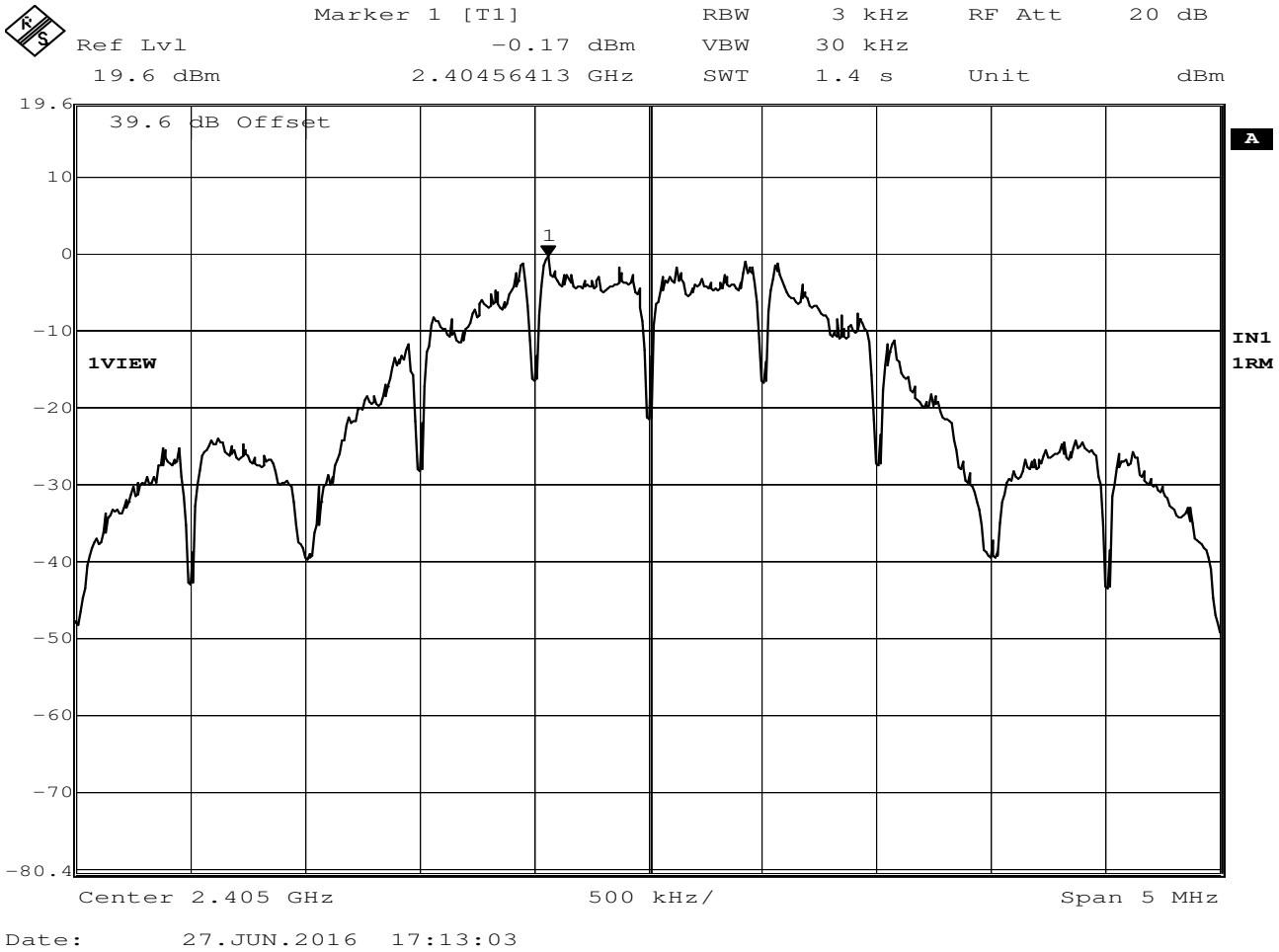
Manufacturer : California Eastern Laboratories
Test Item : Transceiver
Model No. : V2Z
Serial No. : 15
Mode : Transmit at 2480MHz, Power Setting = -20
Test Specification : FCC-15.247, RSS-247 Average Band Edge
Date : June 27, 2016 and June 28, 2016
Test Distance : 3 meters
Notes : Average Detector with 1MHz Resolution Bandwidth

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)
2483.50	H	21.0		3.5	32.6	0.0	-3.6	53.5	471.6	500.0	-0.5
2483.50	V	15.5		3.5	32.6	0.0	-3.6	48.0	250.4	500.0	-6.0

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

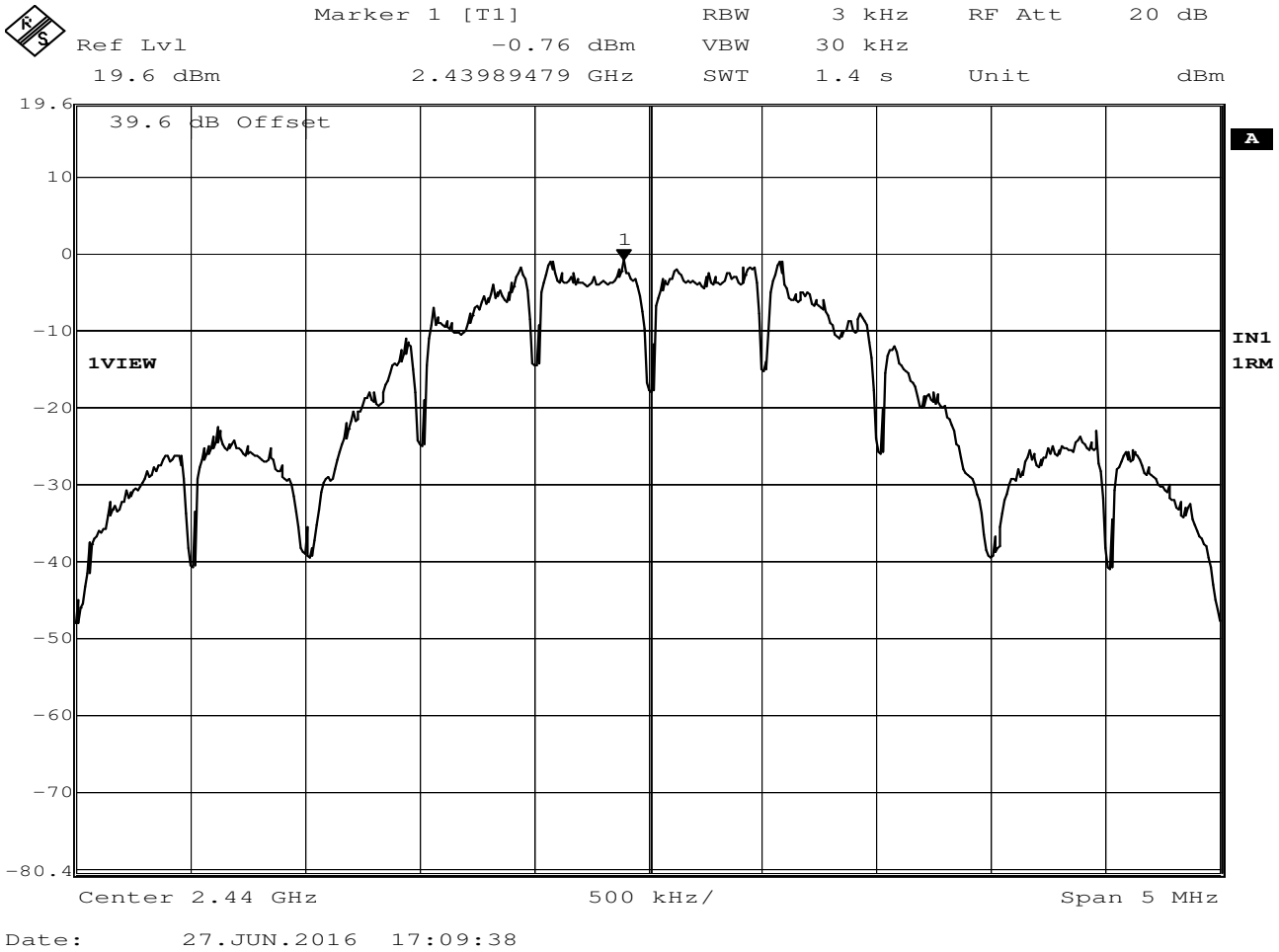
Checked By: MARK E. LONGINOTTI

Mark E. Longinotti



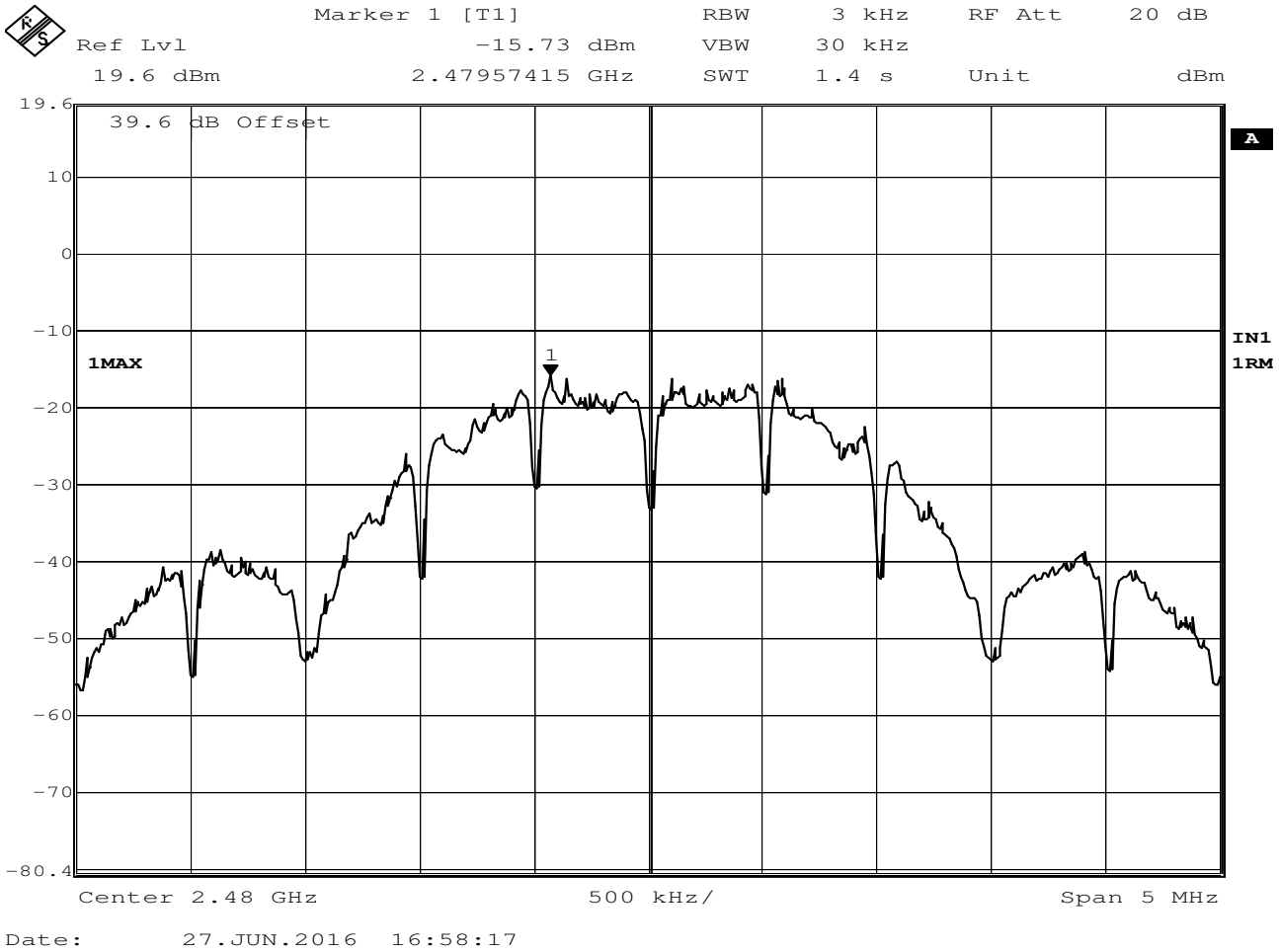
FCC 15.247 Power Spectral Density

MANUFACTURER	:	CEL
MODEL NUMBER	:	V2Z
SERIAL NUMBER	:	#16
TEST MODE	:	Transmit at 2405MHz, power = 4
NOTES	:	Power Spectral Density = -0.17 dBm
EQUIPMENT USED	:	RBB0, T2D8, T2DP



FCC 15.247 Power Spectral Density

MANUFACTURER	:	CEL
MODEL NUMBER	:	V2Z
SERIAL NUMBER	:	#16
TEST MODE	:	Transmit at 2440MHz, power = 4
NOTES	:	Power Spectral Density = -0.76 dBm
EQUIPMENT USED	:	RBB0, T2D8, T2DP



FCC 15.247 Power Spectral Density

MANUFACTURER	:	CEL
MODEL NUMBER	:	V2Z
SERIAL NUMBER	:	#16
TEST MODE	:	Transmit at 2480MHz, power = -20
NOTES	:	Power Spectral Density = -15.73 dBm
EQUIPMENT USED	:	RBB0, T2D8, T2DP