



Measurement of RF Emissions from a Wireless Module, Model No. IPPAN3 Transmitter

For	Amatis Controls 210 Aspen Airport Business Center, Suite A Aspen, CO 81611
P.O. Number	00312
Date Tested	April 27 - May 8, 2018
Test Personnel	Tylar Jozefczyk
Test Specification	FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Section 15.247 for Digital Modulation Intentional Radiators Operating within the bands 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz Industry Canada RSS-GEN Industry Canada RSS-247

Test Report By:

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REVISION HISTORY

Revision	Date	Description
—	24 May 2018	Initial release

Measurement of RF Emissions from a Wireless Module, Model No. IPPAN3 Transmitter

1. INTRODUCTION

1.1. Scope of Tests

This report represents the results of the series of radio interference measurements performed on an Amatis Controls Wireless Module, Model No. IPPAN3 transmitter (hereinafter referred to as the EUT). The EUT is a digital modulation transmitter. The transmitter was designed to transmit in the 2400-2483.5MHz band using 2 antennas: a Johanson Technology 2450AT18A100E ZigBee Antenna and a Molex 0479480001 BLE Antenna. The EUT was manufactured and submitted for testing by Amatis Controls located in Aspen, CO.

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, Sections 15.207 and 15.247 for Intentional Radiators. The test series was also performed to determine if the EUT meets the conducted RF emission requirements of the Industry Canada Radio Standards Specification, RSS-Gen, Section 8.8 and the radiated RF emission requirements of the Industry Canada Radio Standards Specification, RSS-247, Annex 8 for transmitters. 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 23°C and the relative humidity was 18%.

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"
- Federal Communications Commission Office of Engineering and Technology Laboratory Division Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under Section 15.247, October 4, 2012
- Industry Canada Radio Standards Specification, RSS-Gen, "General Requirements for Compliance of Radio Apparatus", Issue 5, April 2018
- Industry Canada Radio Standards Specification, RSS-247, "Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and License-Exempt Local Area Network (LE-LAN) Devices", Issue 2, February 2017

3. EUT SETUP AND OPERATION

3.1. General Description

The EUT is an Amatis Controls Wireless Module, Model No. IPPAN3. A block diagram of the EUT setup is shown as Figure 1. The EUT contained two antennas:

- One (1) Johanson Technology 2450AT18A100E ZigBee Antenna (also known as 'Antenna 1').
- One (1) Molex 0479480001 BLE Antenna (also known as 'Antenna 2').

3.1.1. Power Input

The EUT obtained 3VDC power through 2 1.5 meter long unshielded wires.

3.1.2. Grounding

Since only two wires were used to provide the input power, the EUT was ungrounded during the tests.

3.2. Operational Mode

For all tests, the EUT was placed on an 80cm high non-conductive stand. The EUT was energized. The unit was programmed to operate in one of the following modes:

- Transmit at one of the following ZigBee frequencies:
 - 2405MHz
 - 2425MHz
 - 2480MHz
- Transmit at one of the following Bluetooth Low Energy frequencies:
 - 2402MHz
 - 2446MHz
 - 2480MHz

Test Mode Designations:

802.15.4 Zigbee – The EUT was set to transmit a modulated ZigBee 802.15.4 signal.

BLE – The EUT was set to transmit a BLE signal.

3.3. EUT Modifications

No modifications were required for compliance to FCC Part 15, Subpart C, Section 15.247.

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 by the FCC. 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

Per the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Per 15.207(a) and Industry Canada RSS-Gen section 7.2.4, 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 (dB μ V)	
	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.

5.1.2. 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.

- 1) The EUT was operated in the 802.15.4 Zigbee mode.
- 2) Measurements were first made on the 3VDC high line.
- 3) The frequency range from 150 kHz to 30 MHz was broken up into smaller frequency sub-bands.

- 4) Conducted emissions measurements were taken on the first frequency sub-band using a peak detector.
- 5) 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.)
- 6) Steps (4) and (5) 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.
- 7) Steps (3) through (6) were repeated on the 3VDC neutral line.

5.1.3. Results

The plots and tabular results of the peak, quasi-peak, and average conducted voltage levels acquired from each input power line with the EUT operated in the 802.15.4 Zigbee mode are shown on pages 22 through 25. 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 0.150MHz. The emissions level at this frequency was 22.0dB within the limit. Photographs of the test configuration which yielded the highest or worst case, conducted emission levels are shown in Figure 2.

5.2. 6dB Bandwidth

5.2.1. Requirement

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

5.2.2. Procedures

The output of the EUT was connected to the spectrum analyzer through 40dB of attenuation.

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 and the span was set to greater than 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.

5.2.3. Results

The plots on pages 26 through 31 show that the minimum 6 dB bandwidth of the 802.15.4 Zigbee mode was 1.54MHz, which is greater than minimum allowable 6dB bandwidth requirement of 500kHz for systems using digital modulation techniques. The 99% bandwidth was measured to be 2.69MHz.

The plots on pages 32 through 37 show that the minimum 6 dB bandwidth of the BLE mode was 831.68kHz, which is greater than the minimum allowable 6dB bandwidth requirement of 500kHz for systems using digital modulation techniques. The 99% bandwidth was measured to be 1.34MHz.

5.3. Peak Output Power

5.3.1. 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).

A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released. Also, a transmitter activated automatically shall cease transmission within 5 seconds after activation.

5.3.2. Procedures

For the antenna conducted emissions method, the output 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 'Max-Hold' function was engaged. The maximum meter reading was recorded. The peak power output was calculated for the low, middle and high channels.

For the radiated emissions method, the EUT was placed on the 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 6dB bandwidth. The EUT was maximized for worst case emissions (or maximum output power) at the measuring antenna. The maximum meter reading was recorded. The peak 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 second 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.

5.3.3. Results

For the antenna conducted emissions method for the 802.15.4 Zigbee mode, the results are presented on pages 38 through 41. The maximum peak conducted output power from the transmitter was 0.0063W (8.0dBm), which is below the 1 Watt limit.

For the radiated emissions method for the 802.15.4 Zigbee mode, the results are presented on pages 46 and 47. The maximum EIRP measured from the transmitter was 0.0061W (7.9dBm), which is below the 1 Watt limit.

For the antenna conducted emissions method for the BLE mode, the results are presented on pages 42 through 45. The maximum peak conducted output power from the transmitter was 0.083W (19.2dBm), which is below the 1 Watt limit.

For the radiated emissions method for the BLE mode, the results are presented on pages 48 through 49. The maximum EIRP measured from the transmitter was 0.022W (13.5dBm), which is below the 1 Watt limit.

5.4. Radiated Spurious Emissions Measurements

5.4.1. Requirements

Per section 15.247(d), in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated emissions measurement. Attenuation below the general limits specified in §15.209(a) is not required. In addition, 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

5.4.2. 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.

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

1) For all harmonics not in the restricted bands, the following procedure was used:

- a) The field strength of the fundamental was measured using a double ridged waveguide antenna. The waveguide antenna was positioned at a 3 meter distance from the EUT. A peak detector with a resolution bandwidth of 100kHz was used on the spectrum analyzer.
- b) The field strengths of all of the harmonics not in the restricted band were then measured using a double-ridged waveguide antenna. The waveguide antenna was positioned at a 3 meter distance from the EUT. A peak detector with a resolution bandwidth of 100kHz was used on the spectrum analyzer.
- c) To ensure that maximum or worst case emission levels at the fundamental and harmonics were measured, the following steps were taken when measuring the fundamental emissions and the spurious emissions:
 - 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 axes to ensure the maximum readings were recorded for the EUT.
- d) All harmonics not in the restricted bands must be at least 20dB below levels measured at the fundamental. However, attenuation below the general limits specified in §15.209(a) is not required.

2) For all emissions in the restricted bands, the following procedure was used:

- a) The field strengths of all emissions below 1GHz were measured using a bi-log antenna. The bi-log antenna was positioned at a 3 meter distance from the EUT. A peak detector with a resolution

- bandwidth of 100kHz was used on the spectrum analyzer.
- b) The field strengths of all emissions above 1GHz were measured using a double-ridged waveguide antenna. The waveguide antenna was positioned at a 3 meter distance from the EUT. A peak detector with a resolution bandwidth of 1MHz 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 axes to ensure the maximum readings were recorded for the EUT.
 - d) For all radiated emissions measurements below 1GHz, 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 1GHz, 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 20dB above the maximum permitted average emission limit applicable to the equipment under test. Therefore, all peak readings above 1GHz must be no greater than 20dB 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.

If the emission is pulsed, the reading can be adjusted by a “duty cycle correction factor” derived from $20 \times \log_{10}(\text{on time}/100\text{msec})$. These readings must be no greater than the limits specified in 15.209(a).

5.4.3. Results

Preliminary radiated emissions plots with the EUT transmitting at 2405MHz, 2425MHz, and 2480MHz in the 802.15.4 Zigbee mode are shown on pages 50 through 97. Final radiated emissions data are presented on data pages 145 through 162. As can be seen from the data, all emissions measured from the EUT were within the specification limits. The emissions level closest to the limit (worst case) occurred at 12400MHz. The emissions level at this frequency was 14.1dB within the limit.

Preliminary radiated emissions plots with the EUT transmitting at 2402MHz, 2442MHz, and 2480MHz in the BLE mode are shown on pages 98 through 144. Final radiated emissions data are presented on data pages 163 through 180. As can be seen from the data, all emissions measured from the EUT were within the specification limits. The emissions level closest to the limit (worst case) occurred at 7326MHz. The emissions level at this frequency was 3.1dB within the limit.

Photographs of the test configuration which yielded the highest (or worst case) radiated emission levels are shown in Figures 3 through 5.

5.5. Band Edge Compliance

5.5.1. Requirement

Per section 15.247(d), the emissions at the band-edges must be at least 20dB below the highest level measured within the band but attenuation below the general limits listed in 15.209(a) is not required.

5.5.2 Procedures

5.5.2.1 Low Band Edge

- 1) The EUT was setup 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:
 - Center frequency = low band-edge frequency.
 - 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.
 - Resolution bandwidth (RBW) = $\geq 1\%$ of the span.
 - 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined.
- 6) The marker was set on the peak of the in-band emissions. A display line was placed 20dB down from the peak of the in-band emissions. All emissions which fall outside of the authorized band of operation must be below the 20dB down display line. (All emissions to the left of the center frequency (band-edge) must be below the display line.)
- 7) The analyzer's display was plotted using a 'screen dump' utility.

5.5.2.2 High Band Edge

- 1) The EUT was setup 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 maximized for worst case emissions at the measuring antenna. A peak reading was taken with a resolution bandwidth of 1MHz and a video bandwidth of 1MHz or greater. An average reading was then taken with a resolution bandwidth of 1MHz and a video bandwidth of 10Hz. The maximum peak and average meter readings were recorded.
- 4) To determine the band edge compliance, the following spectrum analyzer settings were used:
 - Center frequency = high band-edge frequency.
 - Span = Wide enough to capture both the peak level of the fundamental emission and the band-edge emission under investigation.
 - RBW = 1% of the span (but never less than 30kHz).
 - 'Max-Hold' function was engaged.
- 5) The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined.
- 6) The marker was set on the peak of the in-band emissions. This level corresponds to the maximized peak (or average) reading previously taken. The "marker-delta" method described in Public Notice DA 00-705 was then used to determine band-edge compliance. The delta between the marker and the general limit (74dB_V/m or 54dB_V/m) was calculated by subtracting the general limit (74dB_V/m or 54dB_V/m) from the maximum reading taken with a 1MHz bandwidth. This delta represents how far below the marker the emissions outside of the authorized band of operation must be. A display line was placed at this level. All emissions which fall outside of the authorized band of operation must be below the display line. (All emissions to the right of the center frequency (band-edge) must be below the display line.)
- 7) The analyzer's display was plotted using a 'screen dump' utility.

In accordance with paragraph 15.231(c), all emissions within 20dB of the peak amplitude level of the center frequency are required to be within a band less than 0.5% of the center frequency wide.

5.5.3 Results

Pages 181 through 190 show the radiated band-edge compliance results for the 802.15.4 Zigbee mode. As can be seen from these plots, the radiated emissions at the low end band-edge are within the 20 dB down limits. The radiated emissions at the high end band-edge are within the general limits.

Pages 191 through 200 show the radiated band-edge compliance results for the BLE mode. As can be seen from these plots, the radiated emissions at the low end band-edge are within the 20 dB down limits. The radiated emissions at the high end band-edge are within the general limits.

5.6. Power Spectral Density

5.6.1. Requirements

Per section 15.247(d), 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.

5.6.2. Procedures

- 1) The output of the EUT was connected to the spectrum analyzer through 30dB of attenuation.
- 2) The EUT was set to transmit at a mid-channel.
- 3) To determine the power spectral density, the following spectrum analyzer settings were used:
 - Center frequency = transmit frequency
 - Resolution bandwidth (RBW) = greater than the 6dB bandwidth
 - Sweep time = Auto
 - a) The peak detector and 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined.
 - b) The analyzer's display was plotted using a 'screen dump' utility.
- 4) This reading corresponds to the peak EIRP measured for the mid channel.
- 5) Turn on Display Line 1 and place it at the peak of the measured level. Turn on Display Line 2 and place it at the corresponding +8dBm level (e.g. if the peak output power is +18dBm then the +8dBm level will be 10dB down from the radiated level and if the peak output power is +6dBm then the +8dBm level will be 2dB above the radiated level.)
- 6) The EUT was then placed in the 802.15.4 Zigbee mode.
- 7) To determine the power spectral density, the following spectrum analyzer settings were used:
 - Center frequency = transmit frequency
 - Span = 1.5× the channel bandwidth
 - RBW = ≥ 3kHz
 - VBW = ≥ 3 × RBW
 - Sweep time = Auto couple
 - a) The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined. The peak detector and 'Max-Hold' function was engaged.
 - b) The analyzer's display was plotted using a 'screen dump' utility.
 - c) If the measured value exceeds the +8dBm limit, reduce the RBW (no less than 3kHz) and repeat step (7).
- 8) Repeat step (7) for the EUT placed in the BLE mode.

5.6.3. Results

Pages 201 through 204 show the power spectral density results for the 802.15.4 Zigbee mode. As can be seen from the plots, the peak power density is less than 8dBm in a 3kHz band during any time interval of continuous transmission.

Pages 205 through 208 show the power spectral density results for the BLE mode. As can be seen from the plots, the peak power density is less than 8dBm in a 3kHz band during any time interval of continuous transmission.

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 Amatis Controls upon completion of the tests.

7. CONCLUSIONS

It was determined that the Amatis Controls Wireless Module, Model No. IPPAN3, digital modulation transmitter did fully meet the conducted and radiated emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Sections 15.207 and 15.247 for Intentional Radiators Operating within the 2400-2483.5 MHz band, when tested per ANSI C63.4-2014.

It was also determined that the Amatis Controls Wireless Module, Model No. IPPAN3, digital modulation transmitter did fully meet the conducted and radiated RF emission requirements of the Industry Canada Radio Standards Specification, RSS-Gen Section 8.8 and RSS-247 Annex 8, 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

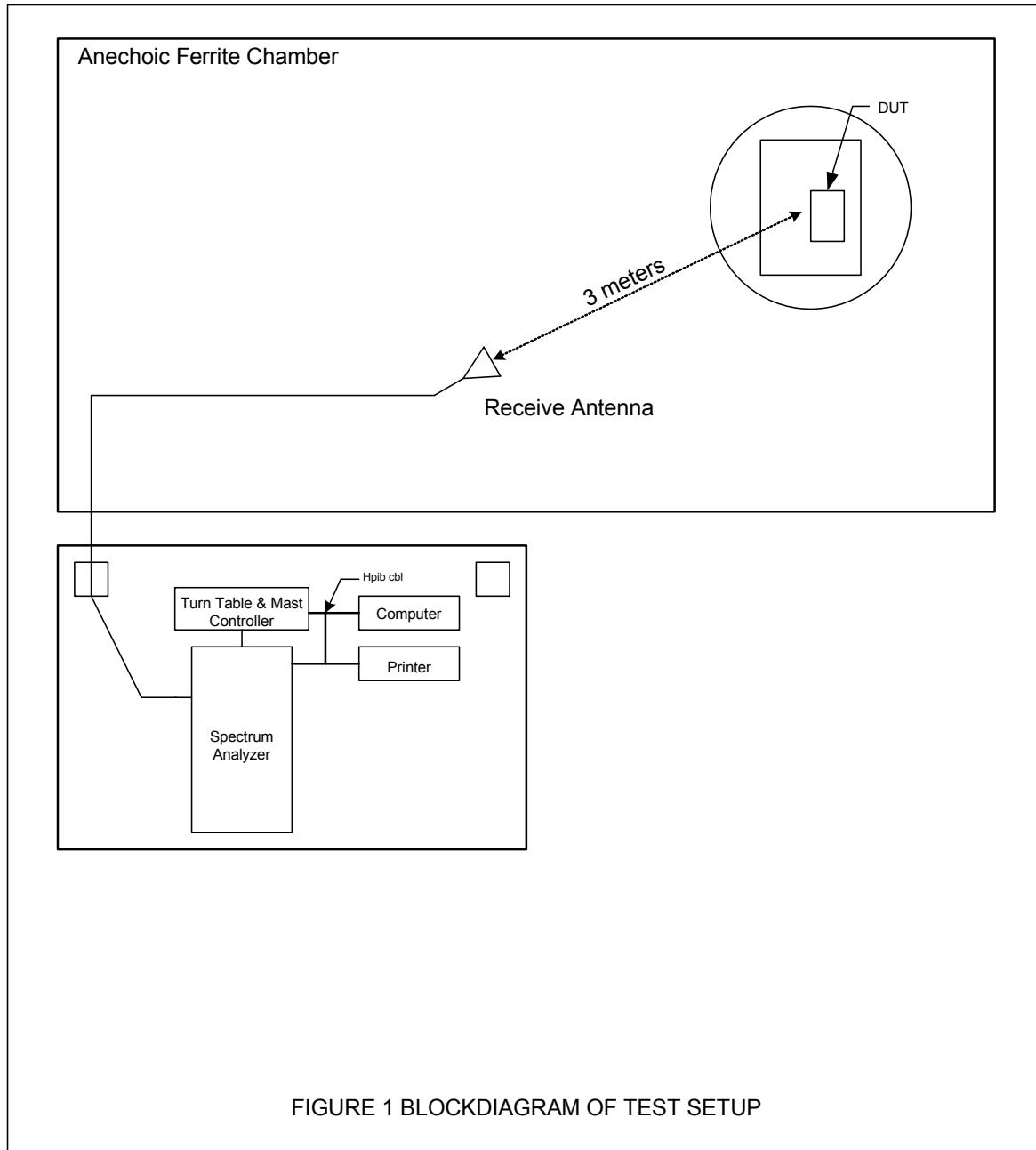
Table 9-1 Equipment List

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Due Date
APW0	PREAMPLIFIER	PLANAR ELECTRONICS	PE2-30-20G20R6G	PL2926/0646	20GHZ-26.5GHZ	4/5/2018	4/5/2019
APW11	PREAMPLIFIER	PMI	PE2-35-120-5R0-10-12-SFF	PL11685/1241	1GHZ-20GHZ	4/5/2018	4/5/2019
CDW8	DESKTOP COMPUTER	ELITE ELECTRONIC ENG	PENTIUM 4	009	3.8GHZ	N/A	
CDY0	WORKSTATION	ELITE	WORKSTATION		WINDOWS 7	N/A	
CDY6	LAB COMPUTER	ELITE	WORKSTATION		WINDOWS 7	N/A	
GRB0	1MHZ, LISN SIGNAL CHECKER	ELITE	LISNCHKR1M	1	1MHZ	1/12/2018	1/12/2019
GSFB	OSP120 BASE UNIT	ROHDE & SCHWARZ	OSP120	101246	---	10/10/2017	10/10/2018
NHG1	STANDARD GAIN HORN ANTENNA	NARDA	638	---	18-26.5GHZ	NOTE 1	
NTA4	BILOG ANTENNA	TESEQ	6112D	46660	20-2000GHZ	8/18/2017	8/18/2018
NWQ2	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS LINDGREN	3117	66659	1GHZ-18GHZ	3/22/2018	3/22/2020
PLF1	CISPR16 50UH LISN	ELITE	CISPR16/70A	001	.15-30MHz	5/7/2018	5/7/2019
PLF3	CISPR16 50UH LISN	ELITE	CISPER16/70A	003	.15-30MHz	5/7/2018	5/7/2019
RBE1	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESU26	100096	20Hz-26GHz	6/8/2017	6/8/2018
RBG0	EMI ANALYZER	ROHDE & SCHWARZ	ESW44	101533	10HZ-44GHz	12/7/2017	12/7/2018
SES0	24VDC POWER SUPPLY	P-TRANS	FS-32024-1M	001	18-27VDC	NOTE 1	
SMAA	POWER SUPPLY	MASTECH	HY3020EX	020177896	30V/20A	NOTE 1	
VBR8	CISPR EN FCC CE VOLTAGE.exe						
WKA1	SOFTWARE, UNIVERSAL RCV EMI	ELITE	UNIV_RCV_EMI	1	---	I/O	
XLTA	5W, 50 OHM TERMINATION	JFW INDUSRTRIES	50T-052	---	DC-2GHZ	1/9/2018	1/9/2020
XPQ4	HIGH PASS FILTER	K&L MICROWAVE	11SH10-4800/X20000-O/C	1	4.8-20GHz	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.



Anechoic Ferrite Chamber

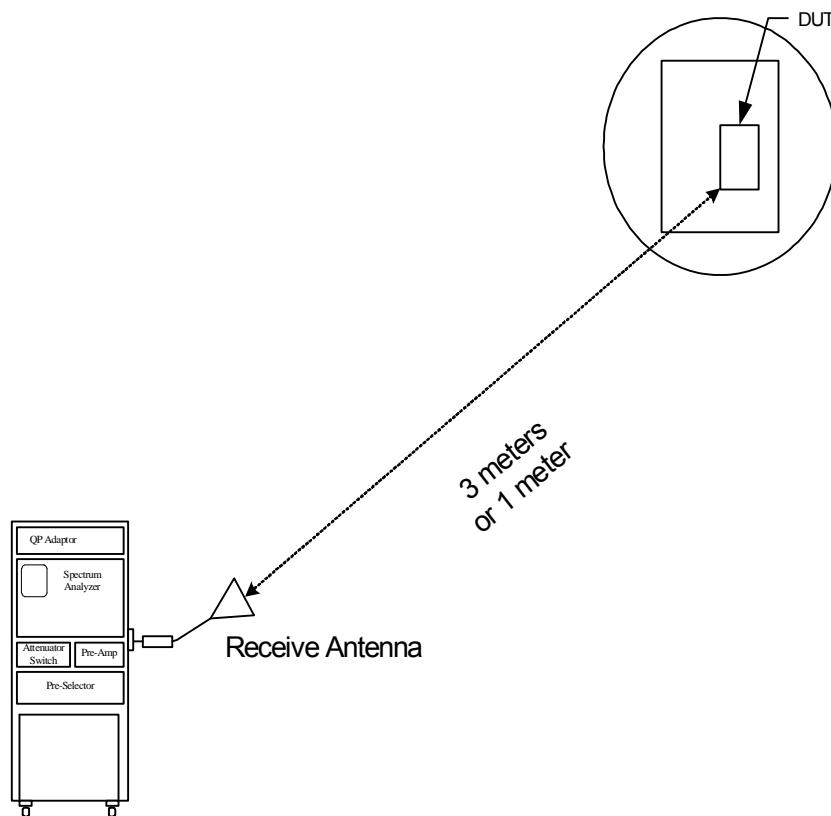
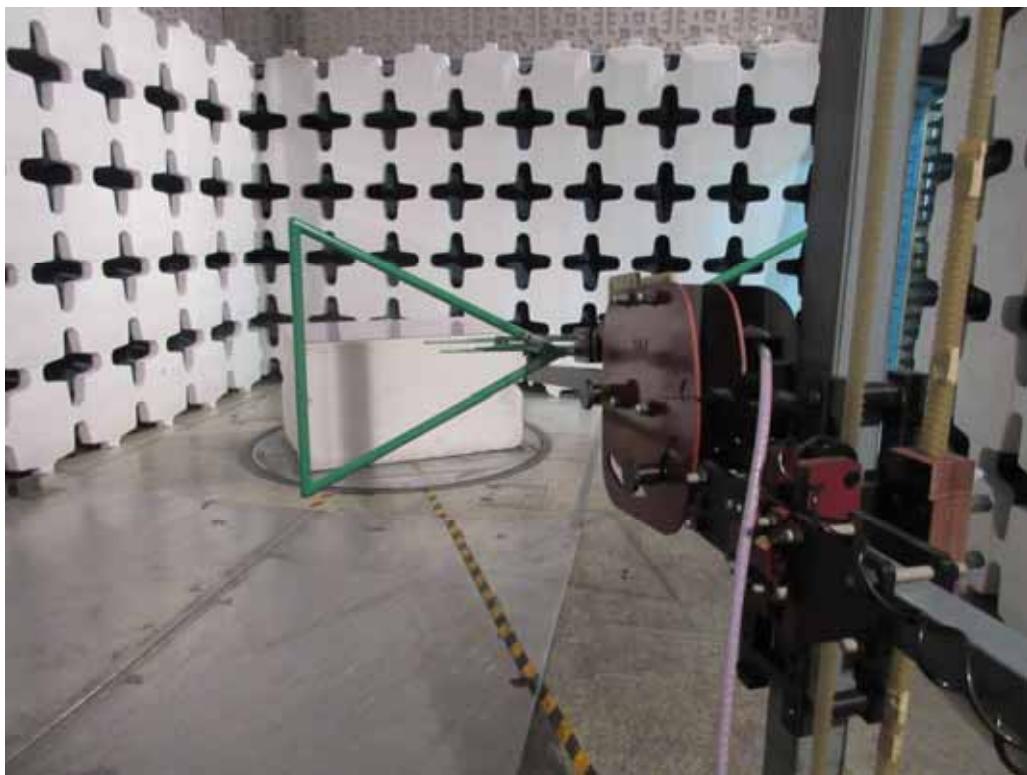


Figure 2

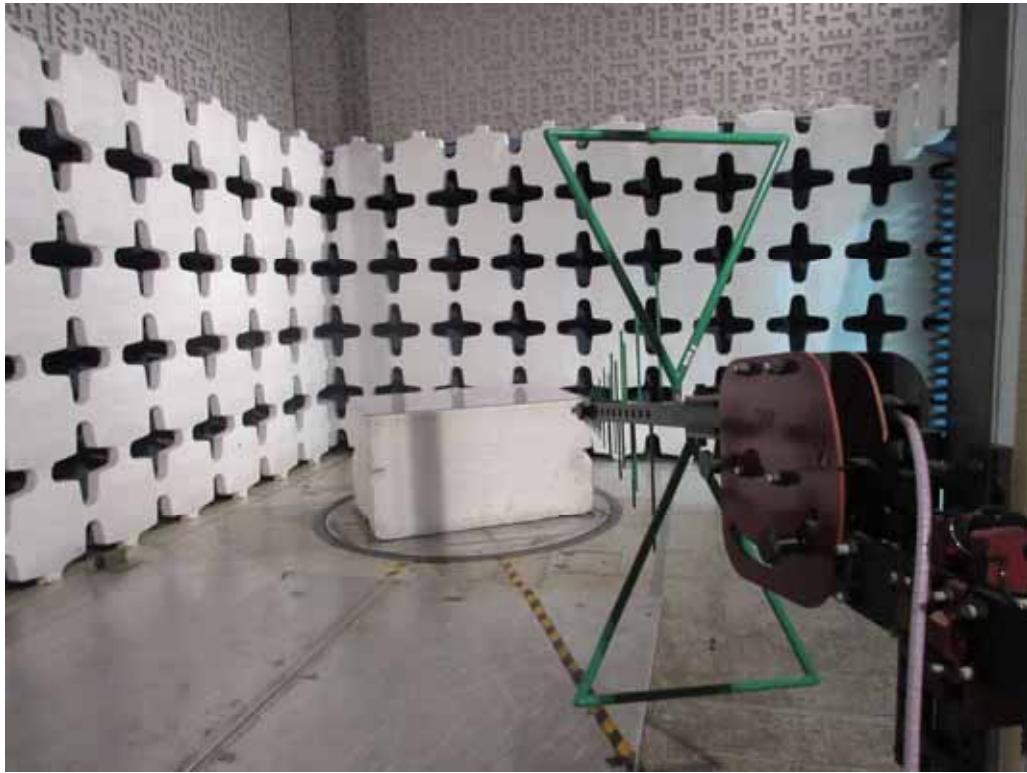


Test Setup for Conducted Emissions

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, 1 to 18GHz – Horizontal Polarization

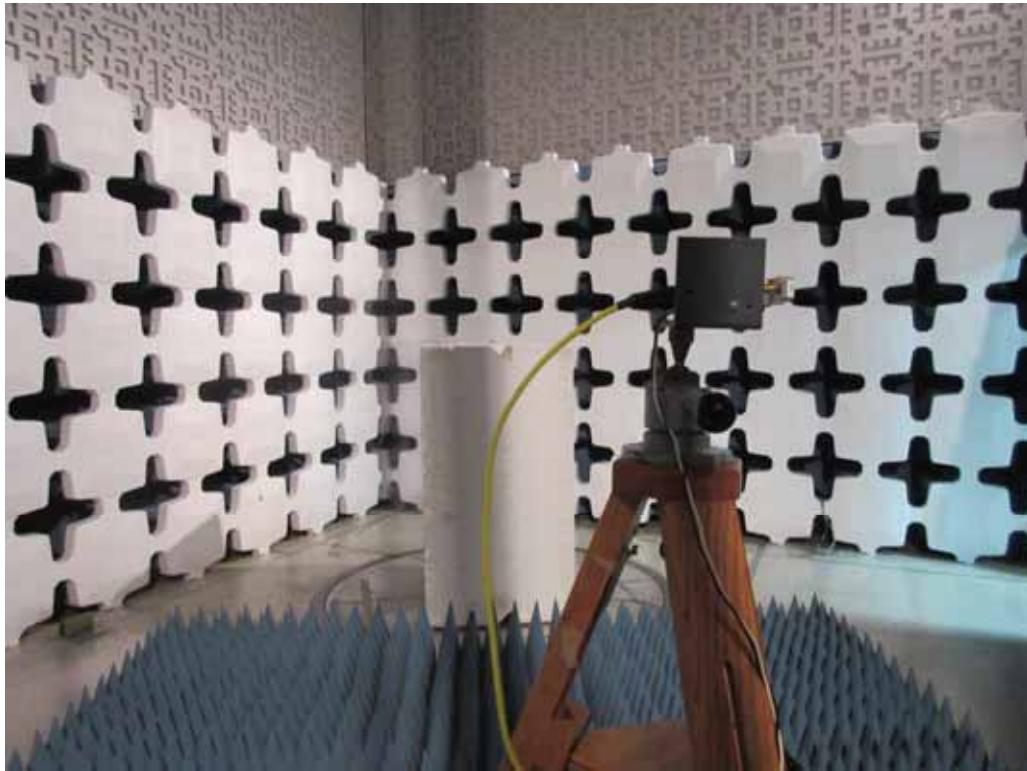


Test Setup for Radiated Emissions, 1 to 18GHz – Vertical Polarization

Figure 5



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



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

FCC Part 15 Subpart B Conducted Emissions Test

Significant Emissions Data

VBR8 04/23/2015

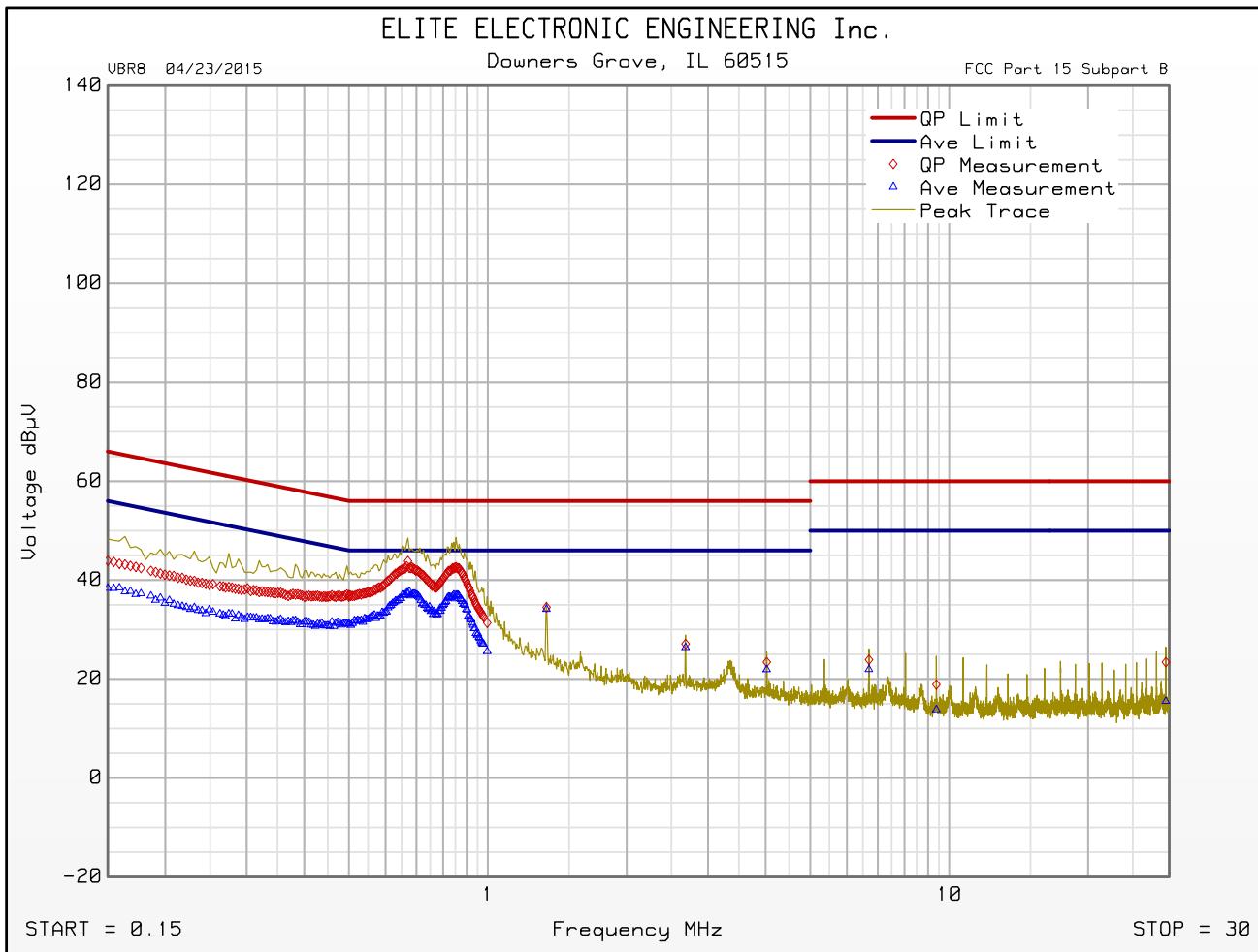
Manufacturer : AMATIS CONTROLS
 Model : IPPAN3
 DUT Revision : 1.0
 Serial Number : 540
 DUT Mode : TX
 Line Tested : 12VDC HIGH LINE
 Scan Step Time [ms] : 30
 Meas. Threshold [dB] : -10
 Notes :
 Test Engineer : T. Jozefczyk
 Limit : Class B
 Test Date : April 27, 2018 12:11:35 PM
 Data Filter : Up to 80 maximum levels detected with 6 dB level excursion threshold over 10 dB margin below limit

Freq MHz	Quasi-peak Level dB μ V	Quasi-peak Limit dB μ V	Excessive Quasi-peak Emissions	Average Level dB μ V	Average Limit dB μ V	Excessive Average Emissions
0.155	43.7	65.8		38.4	55.8	
0.495	37.1	56.1		31.3	46.1	
0.644	41.8	56.0		36.3	46.0	
0.653	42.2	56.0		37.0	46.0	
0.667	42.8	56.0		37.4	46.0	
0.676	42.5	56.0		37.7	46.0	
0.689	42.3	56.0		37.2	46.0	
0.822	41.9	56.0		36.6	46.0	
0.844	42.4	56.0		37.0	46.0	
0.853	42.6	56.0		37.0	46.0	
1.340	34.5	56.0		34.1	46.0	
2.682	27.1	56.0		26.4	46.0	
4.022	23.4	56.0		21.9	46.0	
6.701	23.9	60.0		21.9	50.0	
9.378	18.9	60.0		13.8	50.0	
29.489	23.4	60.0		15.5	50.0	

FCC Part 15 Subpart B Conducted Emissions Test Cumulative Data

VBR8 04/23/2015

Manufacturer : AMATIS CONTROLS
Model : IPPAN3
DUT Revision : 1.0
Serial Number : 540
DUT Mode : TX
Line Tested : 12VDC HIGH LINE
Scan Step Time [ms] : 30
Meas. Threshold [dB] : -10
Notes :
Test Engineer : T. Jozefczyk
Limit : Class B
Test Date : Apr 27, 2018 12:11:35 PM



Emissions Meet QP Limit
Emissions Meet Ave Limit

FCC Part 15 Subpart B Conducted Emissions Test

Significant Emissions Data

VBR8 04/23/2015

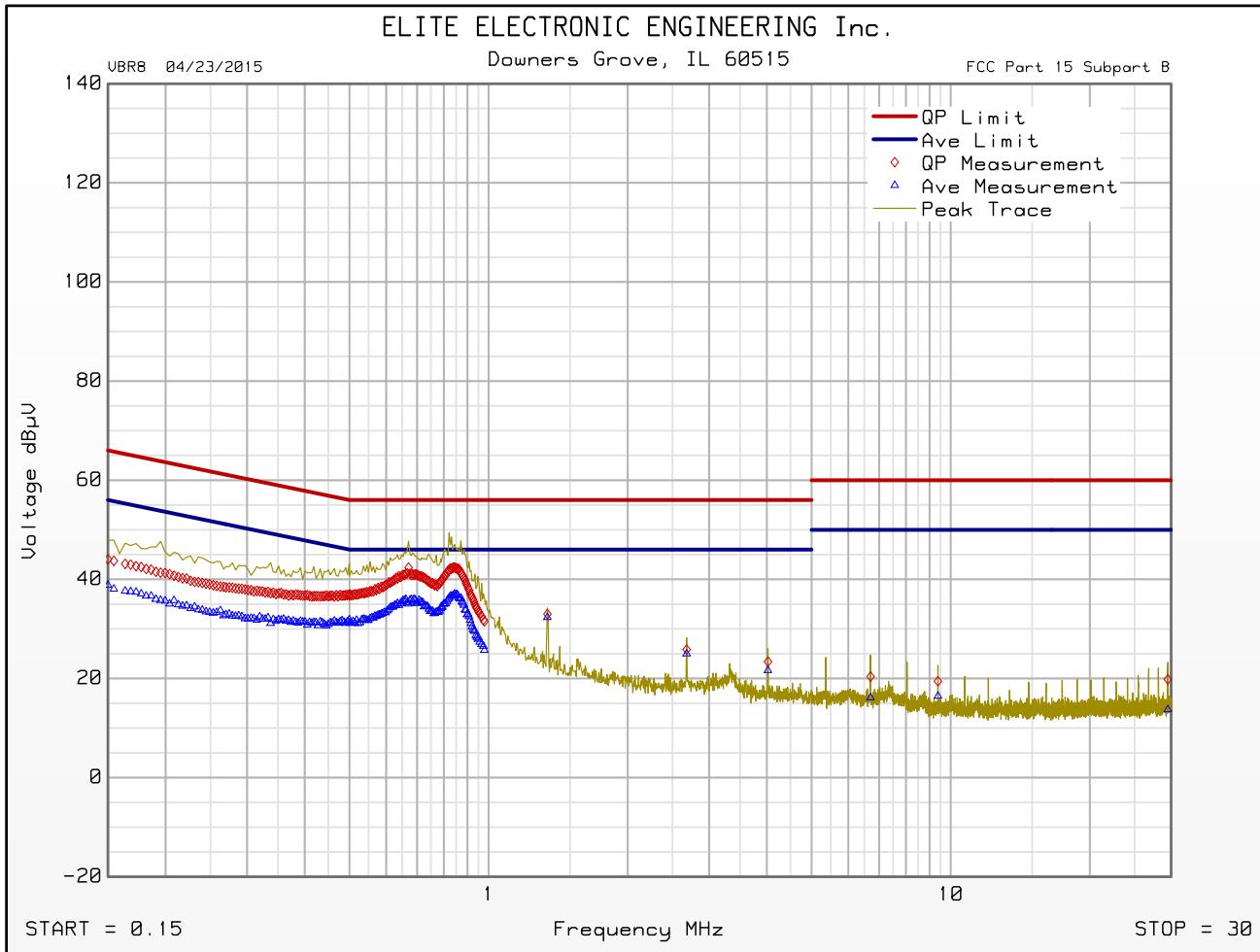
Manufacturer : AMATIS CONTROLS
Model : IPPAN3
DUT Revision : 1.0
Serial Number : 540
DUT Mode : TX
Line Tested : 12VDC NEUTRAL LINE
Scan Step Time [ms] : 30
Meas. Threshold [dB] : -10
Notes :
Test Engineer : T. Jozefczyk
Limit : Class B
Test Date : April 27, 2018 12:01:10 PM
Data Filter : Up to 80 maximum levels detected with 6 dB level excursion threshold over 10 dB margin below limit

Freq MHz	Quasi-peak Level dB μ V	Quasi-peak Limit dB μ V	Excessive Quasi-peak Emissions	Average Level dB μ V	Average Limit dB μ V	Excessive Average Emissions
0.150	44.0	66.0		38.8	56.0	
0.500	37.0	56.0		31.2	46.0	
0.826	42.2	56.0		36.6	46.0	
0.844	42.4	56.0		37.1	46.0	
0.853	42.2	56.0		37.0	46.0	
0.871	41.3	56.0		36.3	46.0	
1.340	33.0	56.0		32.3	46.0	
2.682	25.8	56.0		25.0	46.0	
4.022	23.4	56.0		21.6	46.0	
6.706	20.4	60.0		16.1	50.0	
9.383	19.5	60.0		16.5	50.0	
29.498	19.8	60.0		13.7	50.0	

FCC Part 15 Subpart B Conducted Emissions Test Cumulative Data

VBR8 04/23/2015

Manufacturer : AMATIS CONTROLS
Model : IPPAN3
DUT Revision : 1.0
Serial Number : 540
DUT Mode : TX
Line Tested : 12VDC NEUTRAL LINE
Scan Step Time [ms] : 30
Meas. Threshold [dB] : -10
Notes :
Test Engineer : T. Jozefczyk
Limit : Class B
Test Date : Apr 27, 2018 12:01:10 PM



Emissions Meet QP Limit
Emissions Meet Ave Limit

DATA PAGE

Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : 802.15.4 Zigbee – Johanson Technology 2450AT18A100E ZigBee Antenna
 Test Specification : FCC-15.247, RSS-247 6dB & 99% Bandwidth
 Date : May 7, 2018

6dB Bandwidth

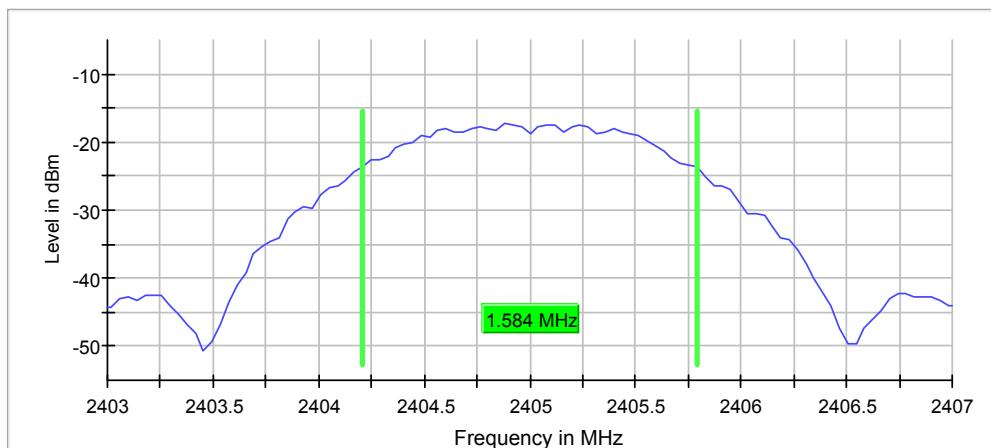
DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Max Level (dBm)	Result
2405.000000	1.584158	0.500000	---	2404.207921	2405.792079	-17.4	PASS
2425.000000	1.623762	0.500000	---	2424.168317	2425.792079	-16.2	PASS
2480.000000	1.623762	0.500000	---	2479.168317	2480.792079	-17.9	PASS

99% Bandwidth

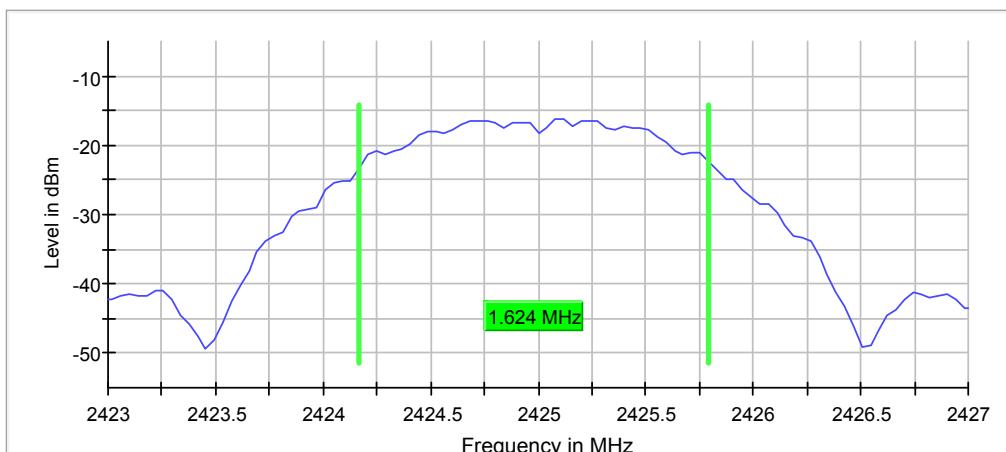
DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Max Level (dBm)	Result
2405.000000	2.653466	---	---	2403.653465	2406.306931	-17.1	PASS
2425.000000	2.653466	---	---	2423.653465	2426.306931	-16.3	PASS
2480.000000	2.653466	---	---	2478.653465	2481.306931	-17.8	PASS

6dB Bandwidth

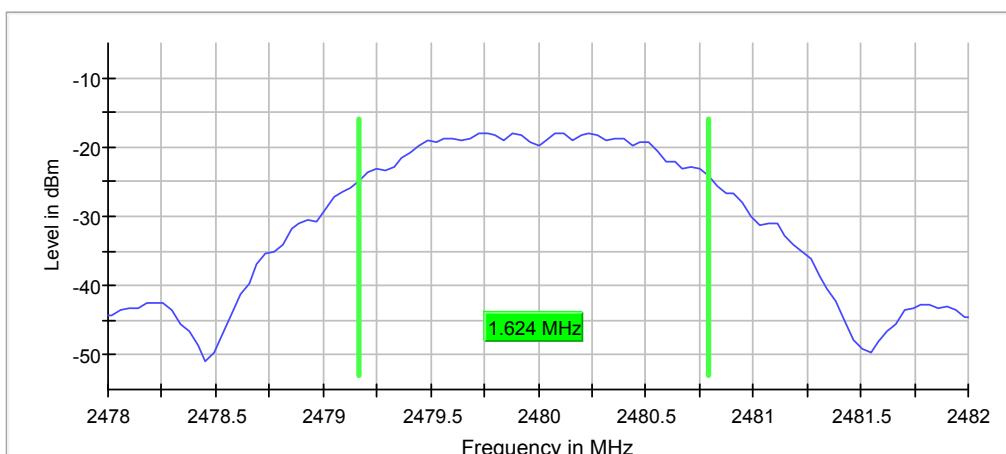
Low Frequency:



Mid Frequency:

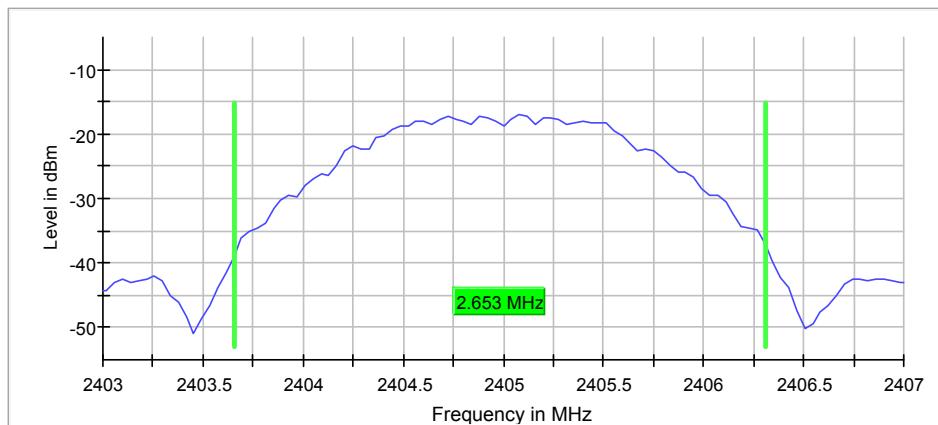


High Frequency:

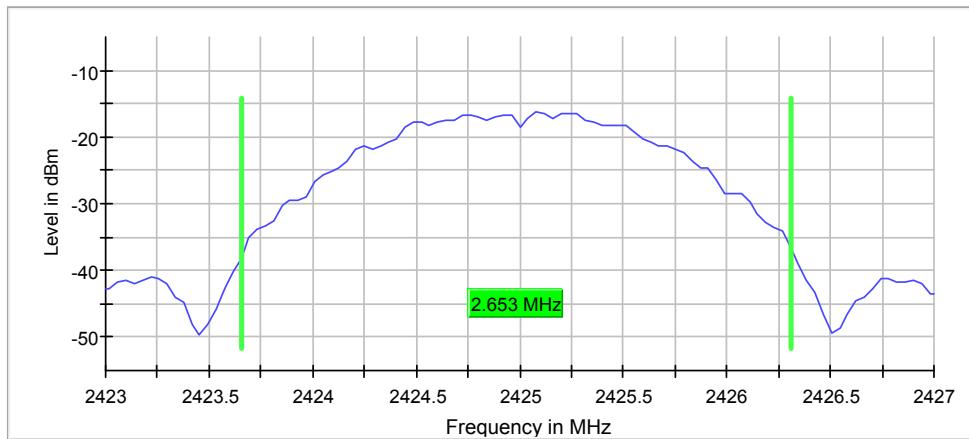


99% Bandwidth

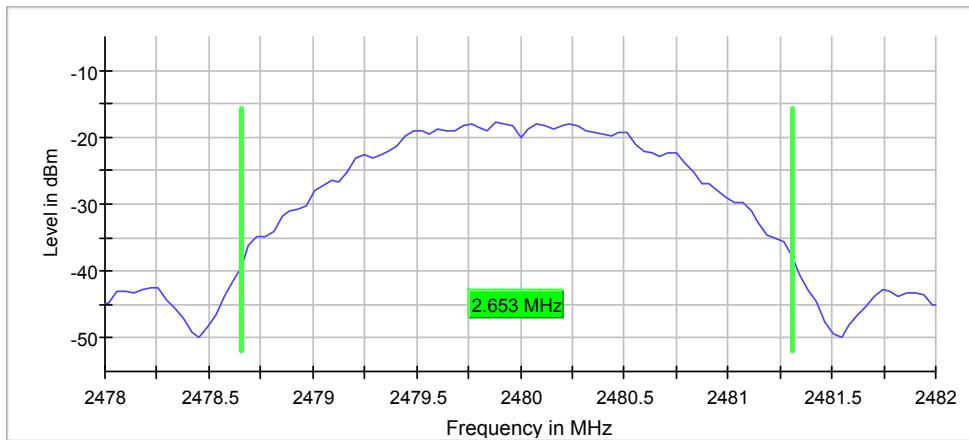
Low Frequency:



Mid Frequency:



High Frequency:



DATA PAGE

Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : 802.15.4 Zigbee – Molex 0479480001 BLE Antenna
 Test Specification : FCC-15.247, RSS-247 6dB & 99% Bandwidth
 Date : May 7, 2018

6dB Bandwidth

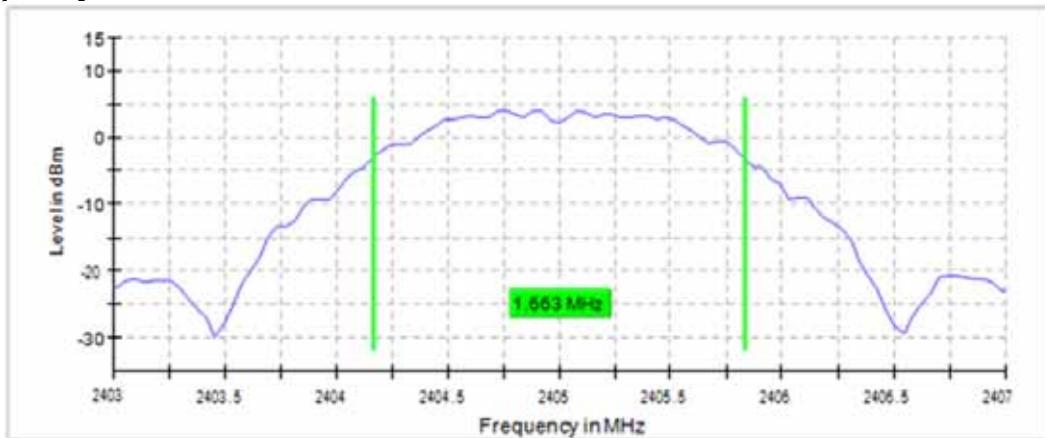
DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Max Level (dBm)	Result
2405.000000	1.663366	0.500000	---	2404.168317	2405.831683	4.1	PASS
2425.000000	1.544554	0.500000	---	2424.247525	2425.792079	1.3	PASS
2480.000000	1.663366	0.500000	---	2479.168317	2480.831683	4.5	PASS

99% Bandwidth

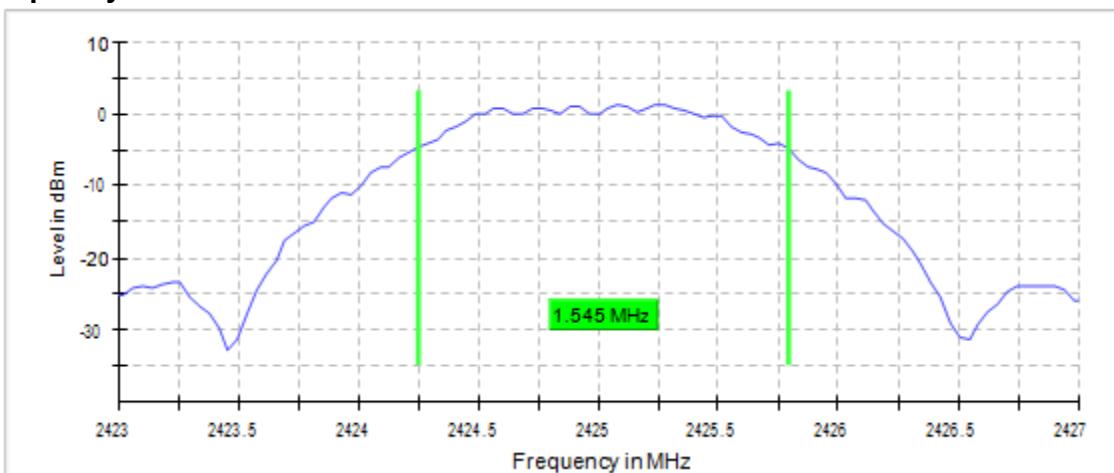
DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Max Level (dBm)	Result
2405.000000	2.613862	---	---	2403.693069	2406.306931	4.4	PASS
2425.000000	2.693070	---	---	2423.653465	2426.346535	1.4	PASS
2480.000000	2.693070	---	---	2478.653465	2481.346535	4.5	PASS

6dB Bandwidth

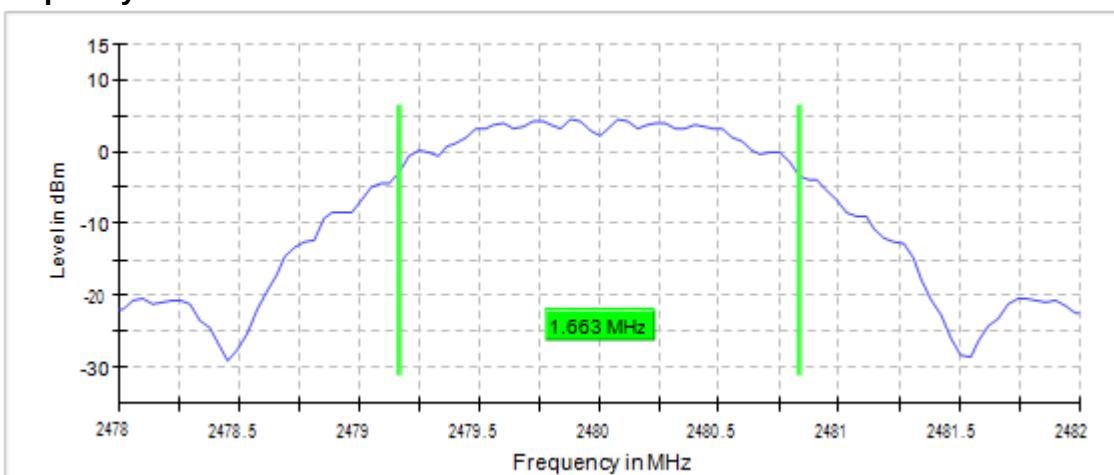
Low Frequency:



Mid Frequency:

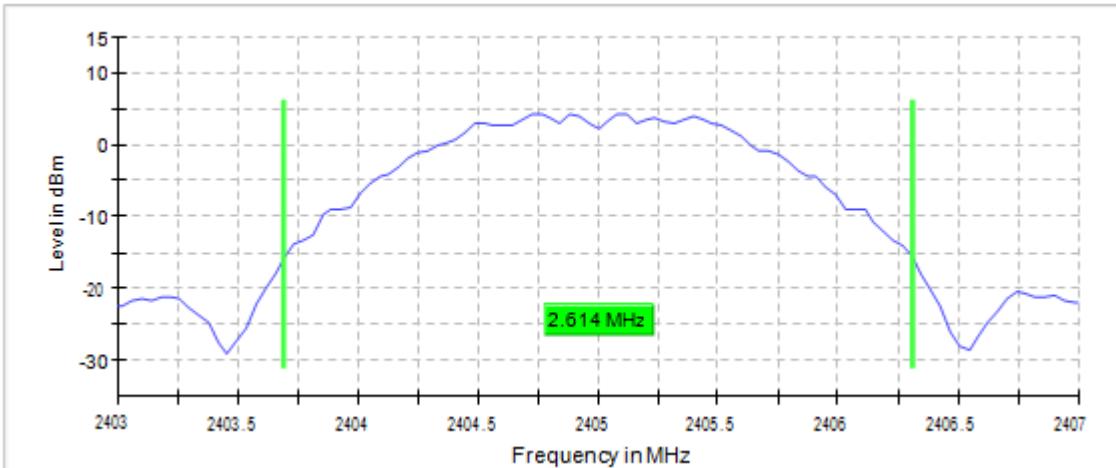


High Frequency:

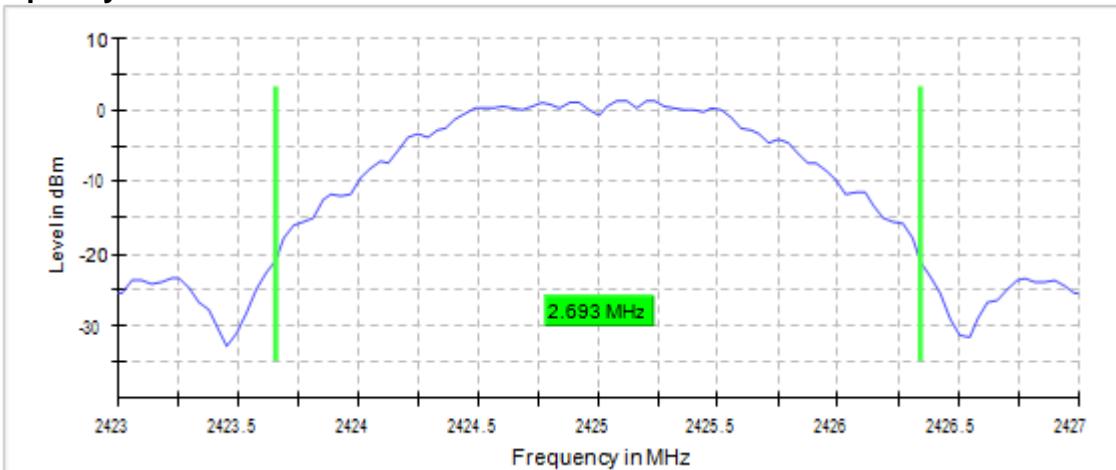


99% Bandwidth

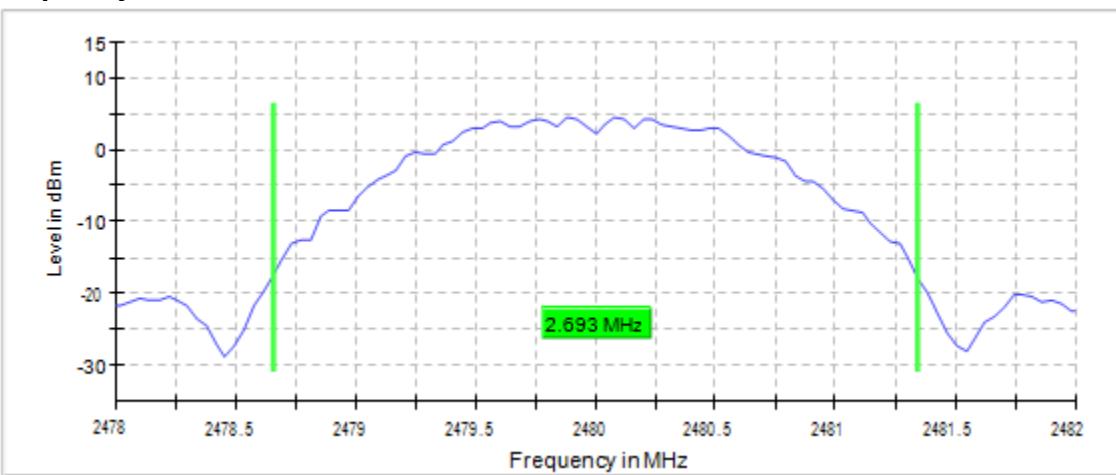
Low Frequency:



Mid Frequency:



High Frequency:



DATA PAGE

Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : BLE – Johanson Technology 2450AT18A100E ZigBee Antenna
 Test Specification : FCC-15.247, RSS-247 6dB & 99% Bandwidth
 Date : May 8, 2018

6dB Bandwidth

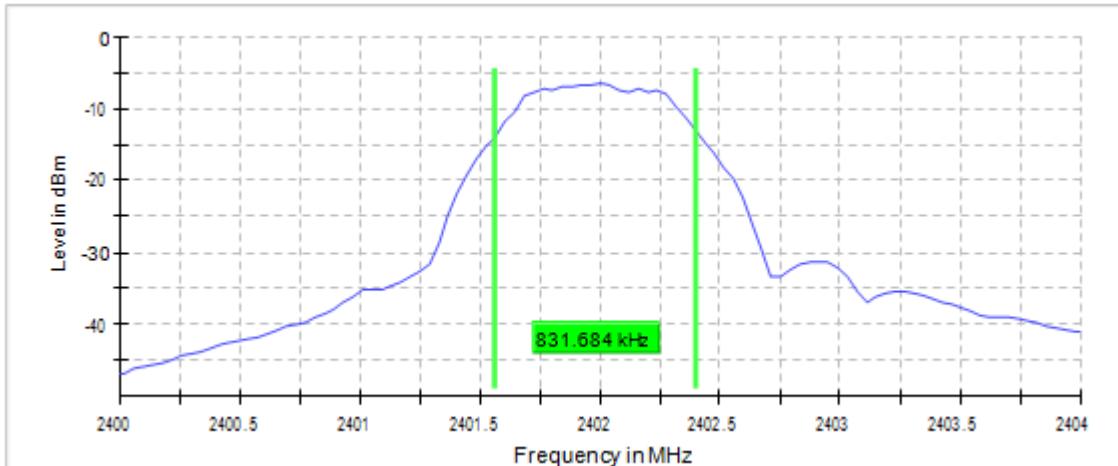
DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Max Level (dBm)	Result
2402.000000	0.831684	0.500000	---	2401.564356	2402.396040	-6.3	PASS
2442.000000	0.831684	0.500000	---	2441.564356	2442.396040	-6.3	PASS
2480.000000	0.831684	0.500000	---	2479.564356	2480.396040	-5.7	PASS

99% Bandwidth

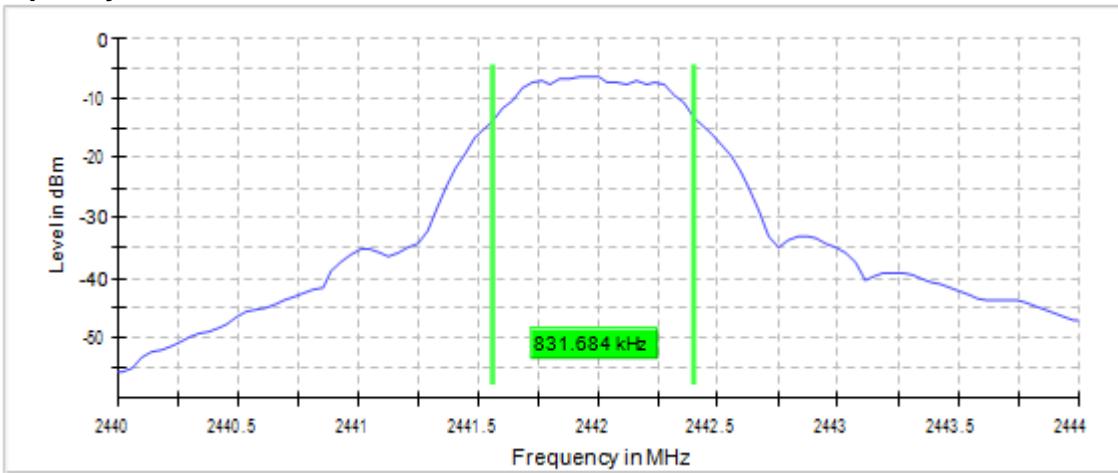
DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Max Level (dBm)	Result
2402.000000	1.346534	---	---	2401.326733	2402.673267	-6.6	PASS
2442.000000	1.346534	---	---	2441.326733	2442.673267	-6.7	PASS
2480.000000	1.346534	---	---	2479.326733	2480.673267	-5.9	PASS

6dB Bandwidth

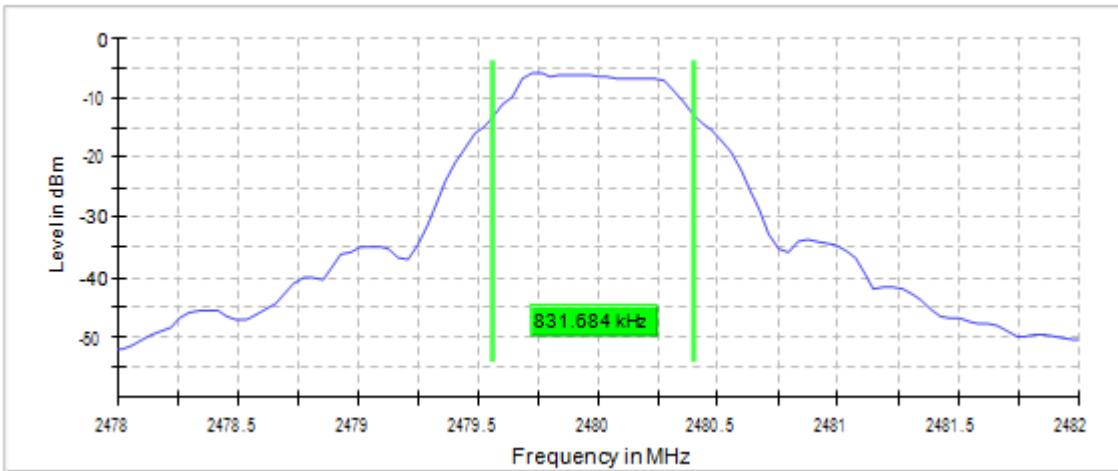
Low Frequency:



Mid Frequency:

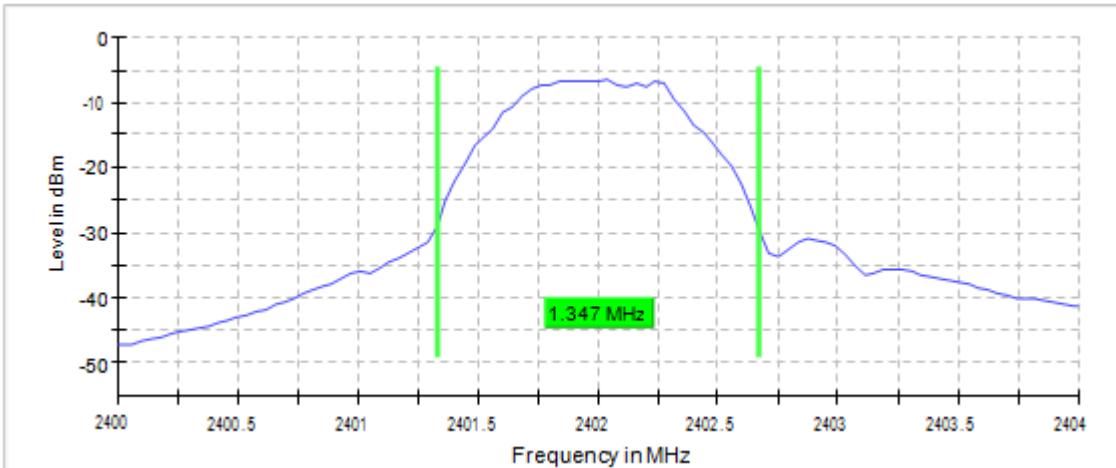


High Frequency:

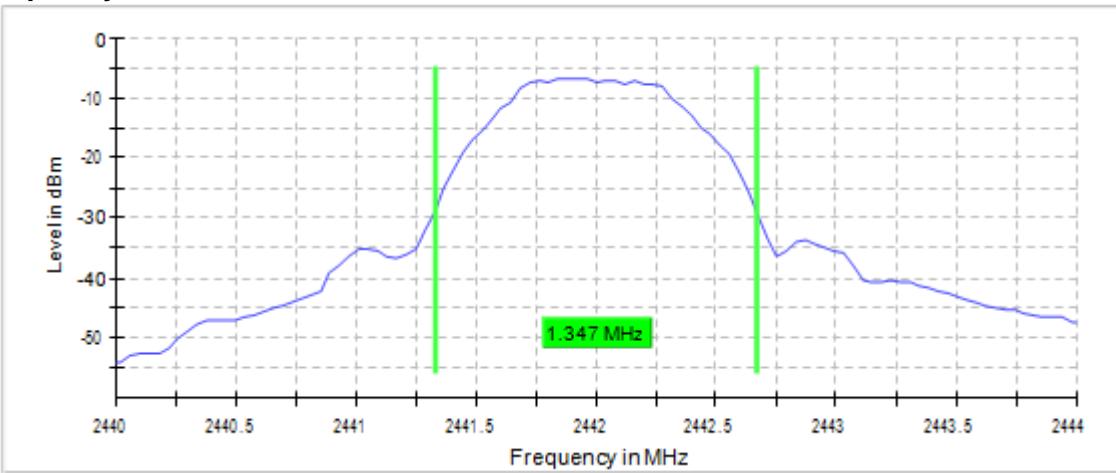


99% Bandwidth

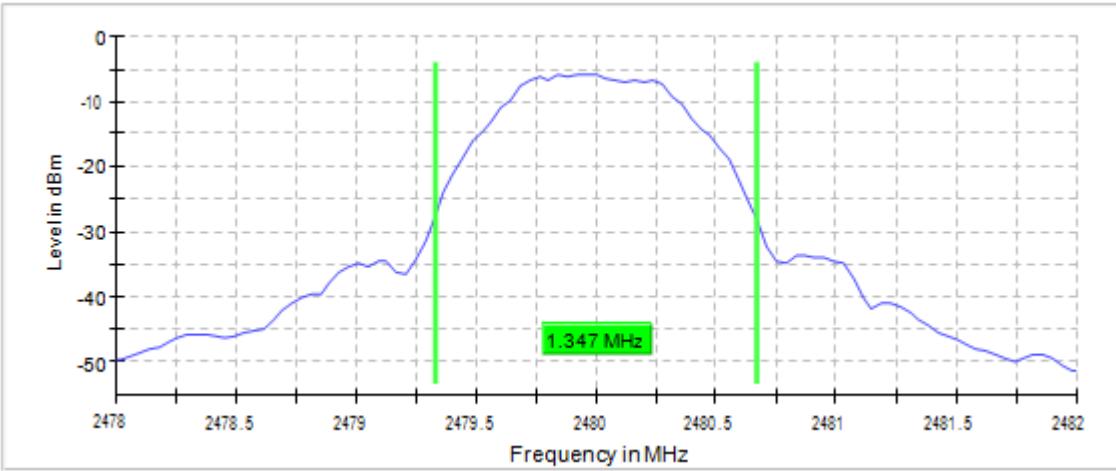
Low Frequency:



Mid Frequency:



High Frequency:



DATA PAGE

Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : BLE – Molex 0479480001 BLE Antenna
 Test Specification : FCC-15.247, RSS-247 6dB & 99% Bandwidth
 Date : May 8, 2018

6dB Bandwidth

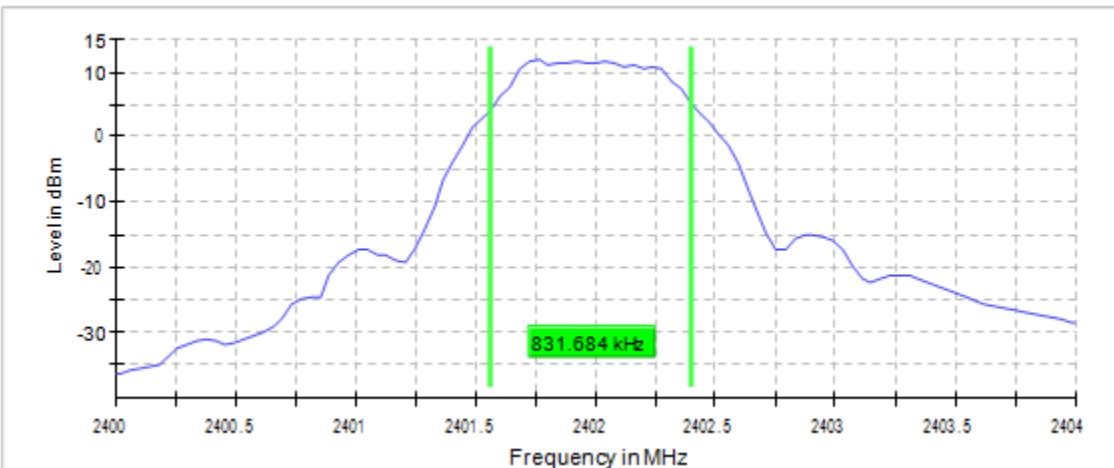
DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Max Level (dBm)	Result
2402.000000	0.831684	0.500000	---	2401.564356	2402.396040	11.9	PASS
2442.000000	0.831684	0.500000	---	2441.564356	2442.396040	16.4	PASS
2480.000000	0.752476	0.500000	---	2479.603960	2480.356436	18.9	PASS

99% Bandwidth

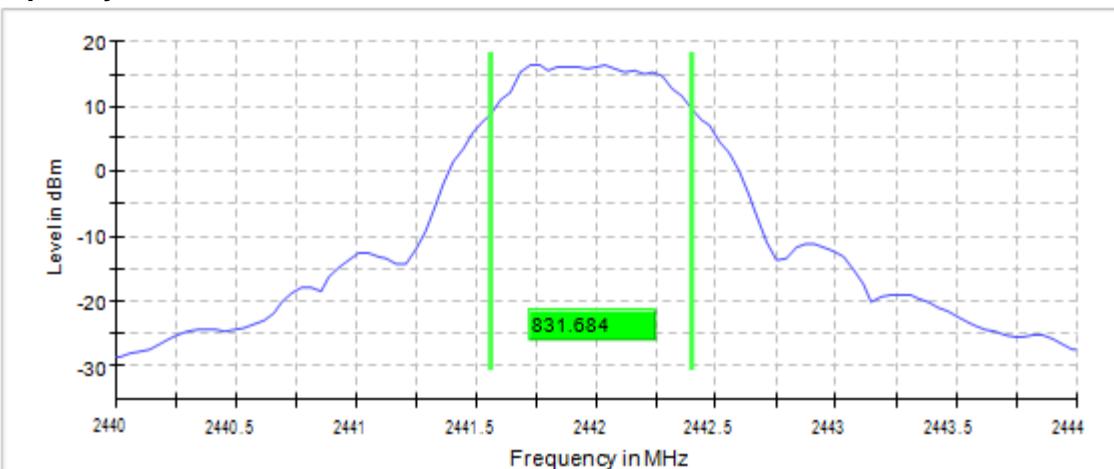
DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Max Level (dBm)	Result
2402.000000	1.346534	---	---	2401.326733	2402.673267	11.6	PASS
2442.000000	1.346534	---	---	2441.326733	2442.673267	16.2	PASS
2480.000000	1.346534	---	---	2479.326733	2480.673267	17.3	PASS

6dB Bandwidth

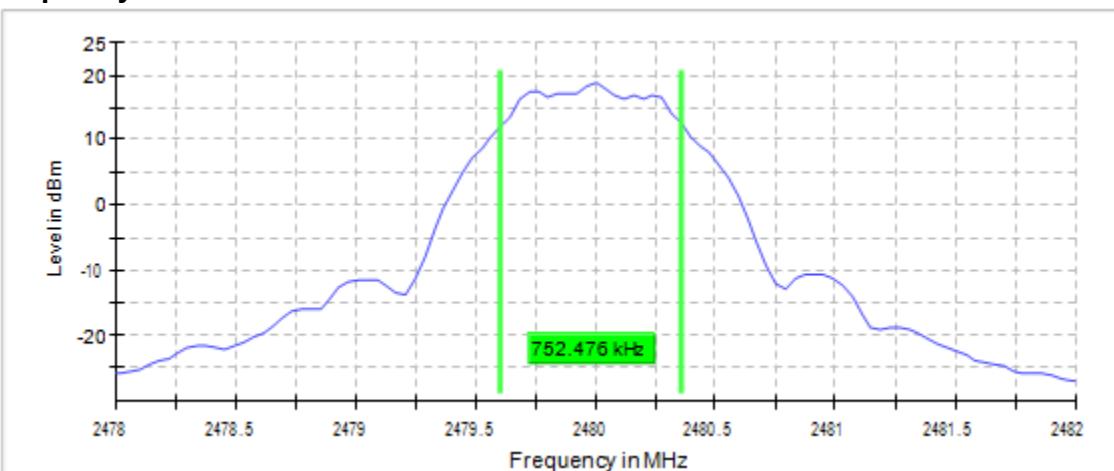
Low Frequency:



Mid Frequency:

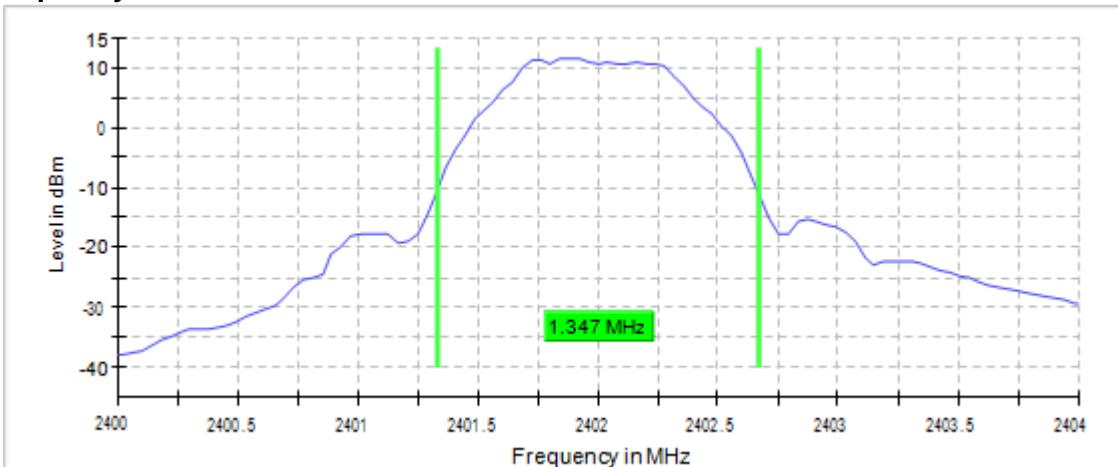


High Frequency:

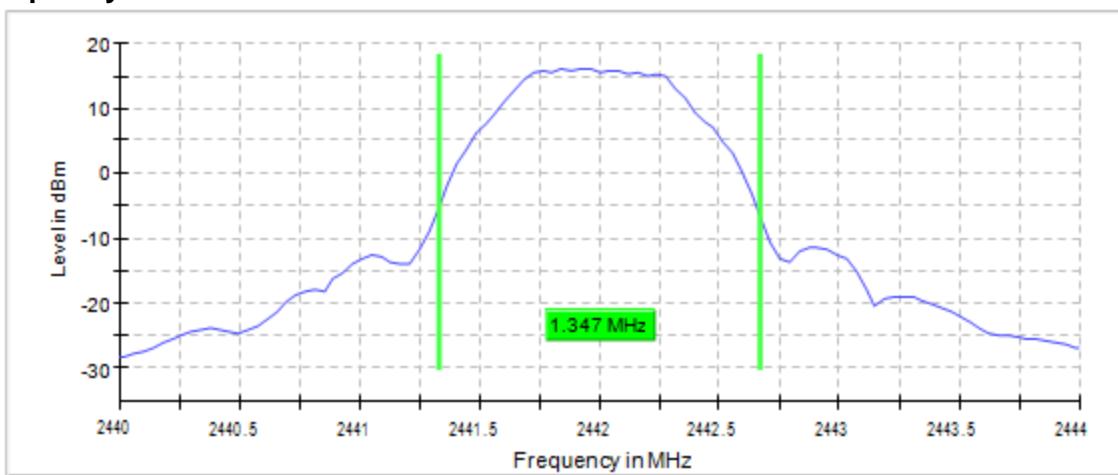


99% Bandwidth

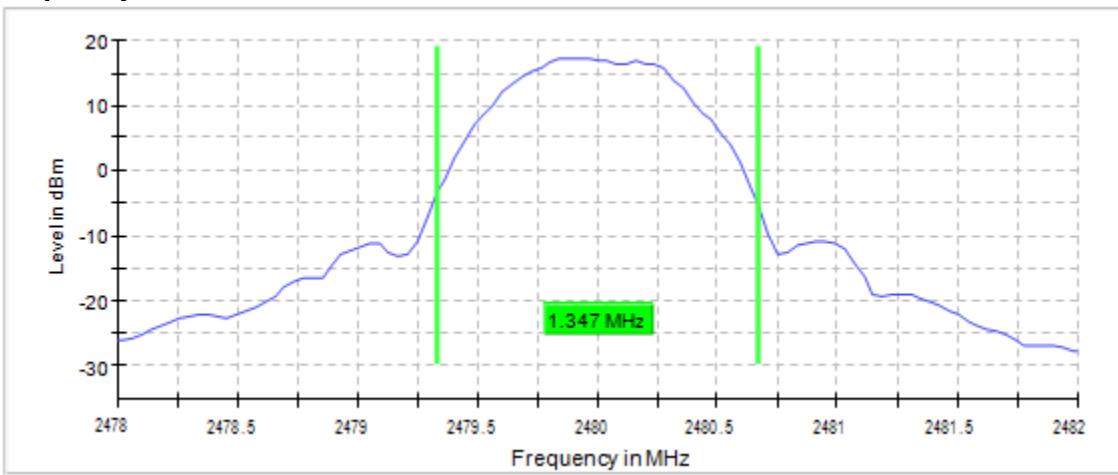
Low Frequency:



Mid Frequency:



High Frequency:



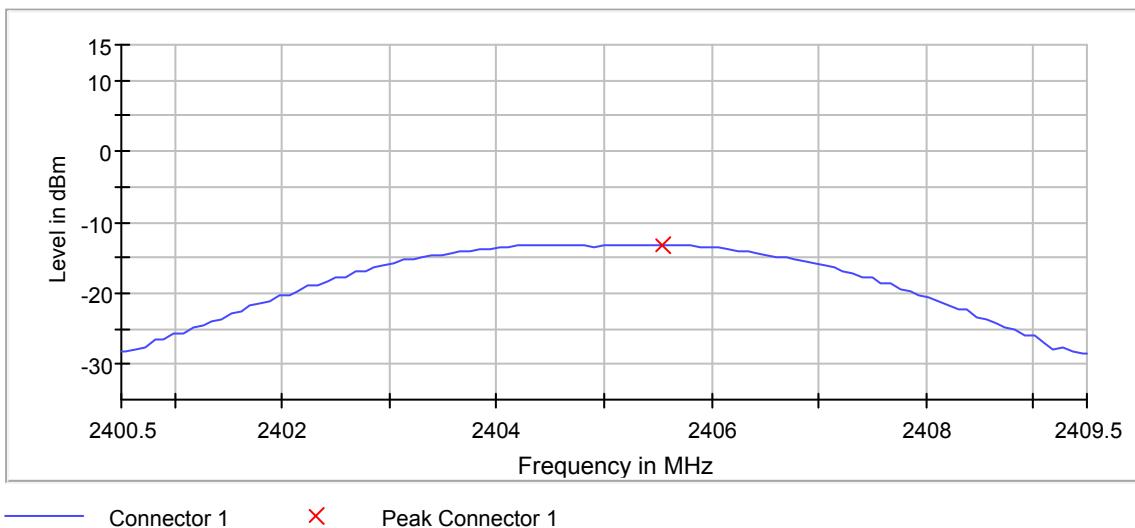
DATA PAGE

Manufacturer : Amatis Controls
Test Item : Wireless Module
Model No. : IPPAN3
Mode : 802.15.4 Zigbee – Johanson Technology 2450AT18A100E ZigBee Antenna
Test Specification : FCC-15.247, RSS-247 Peak Output Power
Date : May 7, 2018

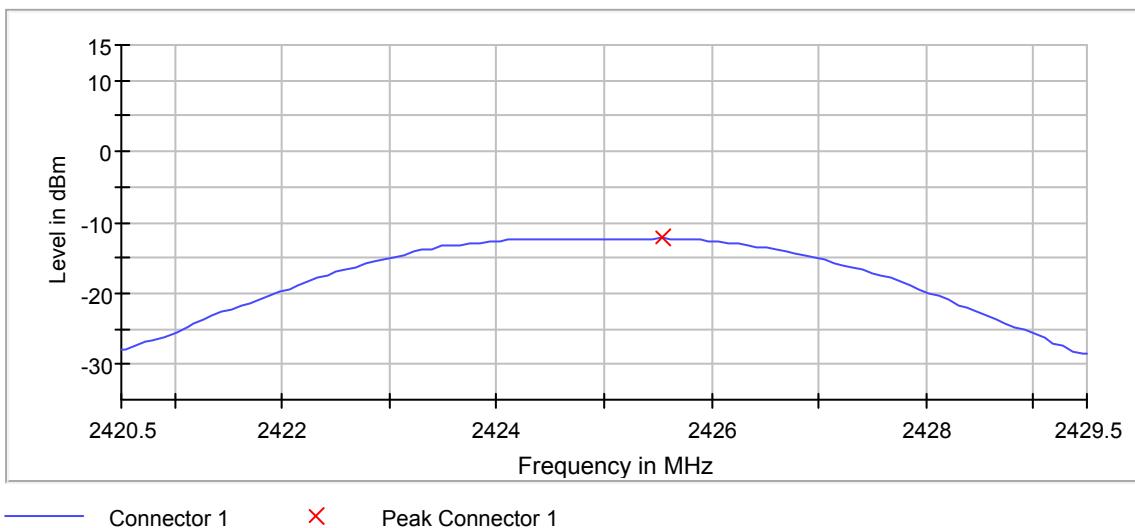
Peak Output Power

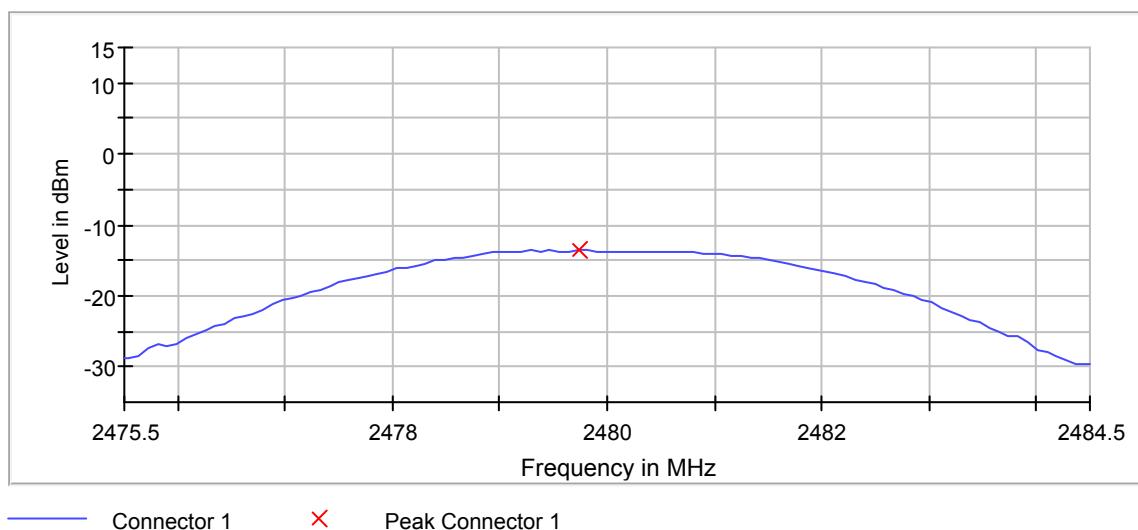
DUT Frequency (MHz)	Peak Power (dBm)	Limit Max (dBm)	Result
2405.000000	-13.2	30.0	PASS
2425.000000	-12.2	30.0	PASS
2480.000000	-13.5	30.0	PASS

Low Frequency:



Mid Frequency:



High Frequency:

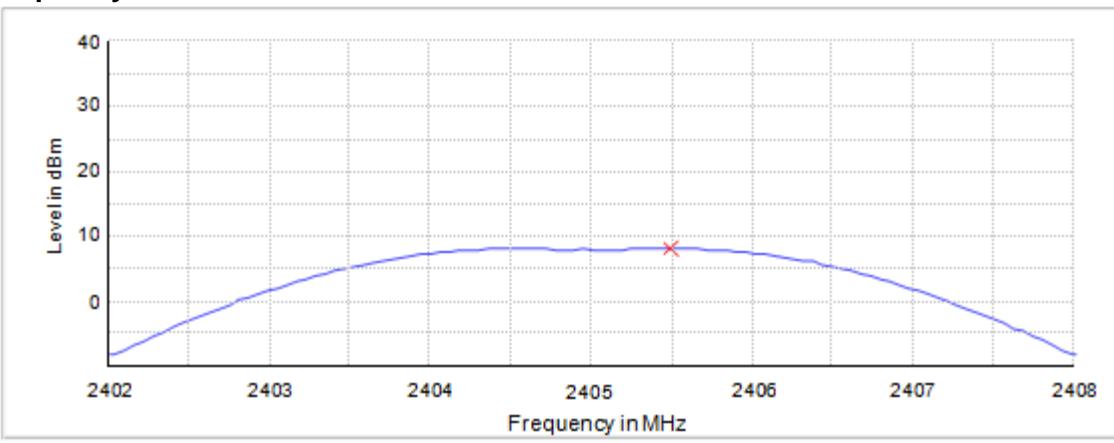
DATA PAGE

Manufacturer : Amatis Controls
Test Item : Wireless Module
Model No. : IPPAN3
Mode : 802.15.4 Zigbee – Molex 0479480001 BLE Antenna
Test Specification : FCC-15.247, RSS-247 Peak Output Power
Date : May 7, 2018

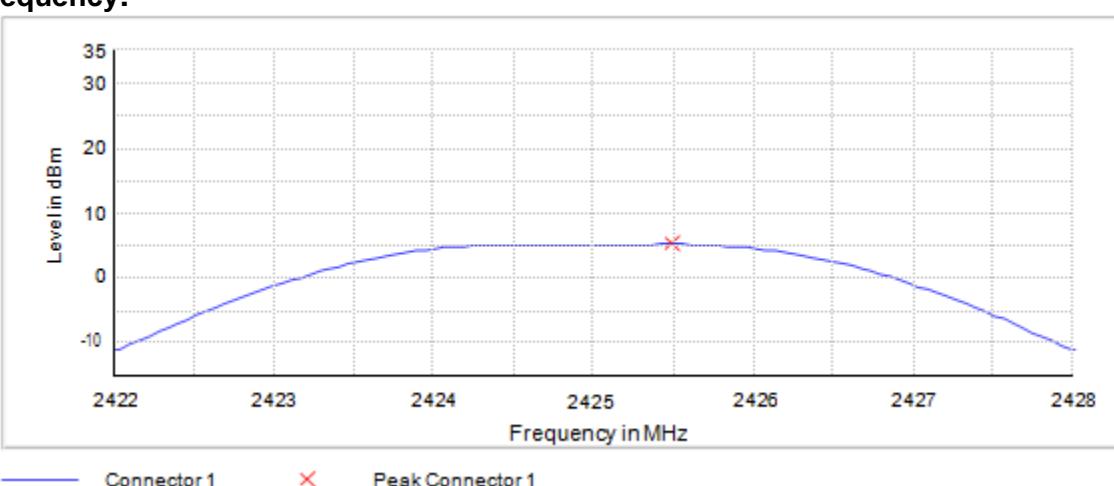
Peak Output Power

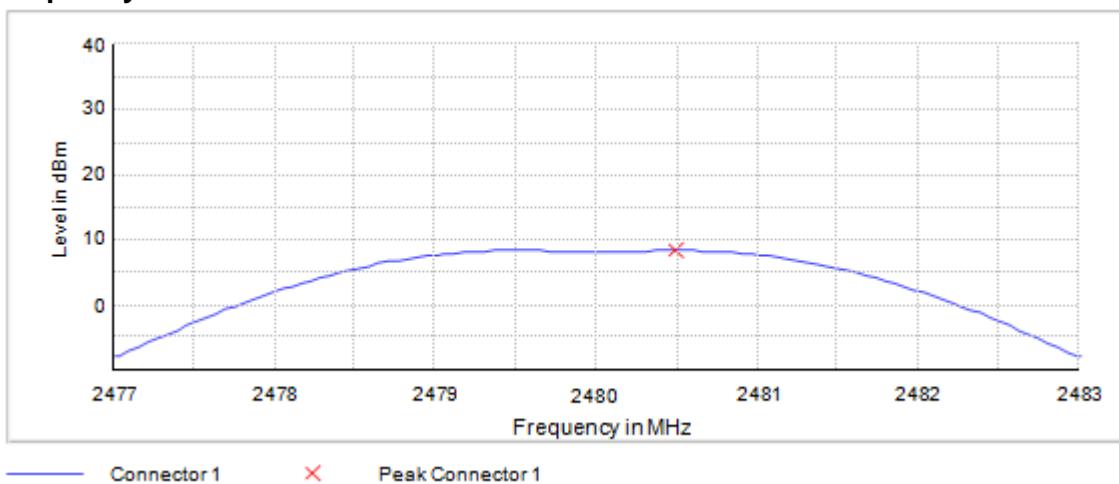
DUT Frequency (MHz)	Peak Power (dBm)	Limit Max (dBm)	Result
2405.000000	7.8	30.0	PASS
2425.000000	5.0	30.0	PASS
2480.000000	8.0	30.0	PASS

Low Frequency:



Mid Frequency:



High Frequency:

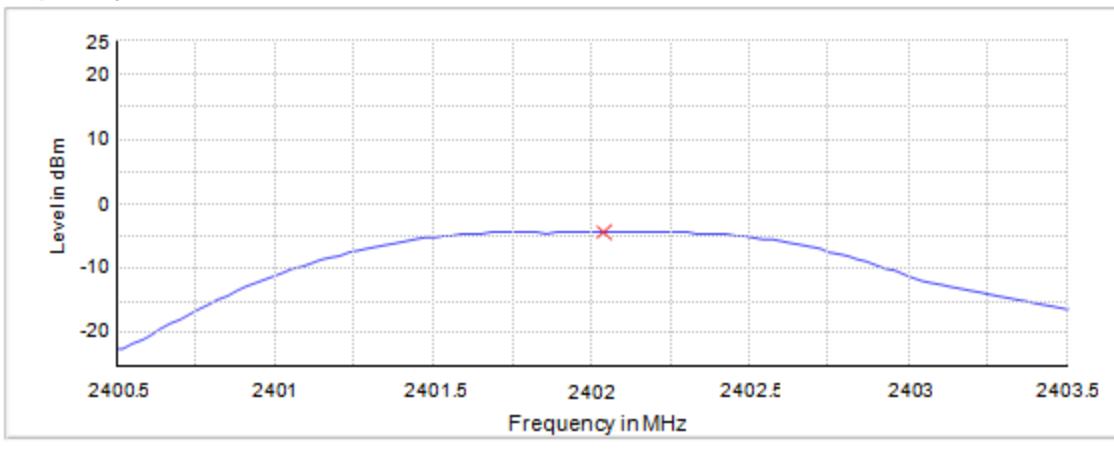
DATA PAGE

Manufacturer : Amatis Controls
Test Item : Wireless Module
Model No. : IPPAN3
Mode : BLE – Johanson Technology 2450AT18A100E ZigBee Antenna
Test Specification : FCC-15.247, RSS-247 Peak Output Power
Date : May 8, 2018

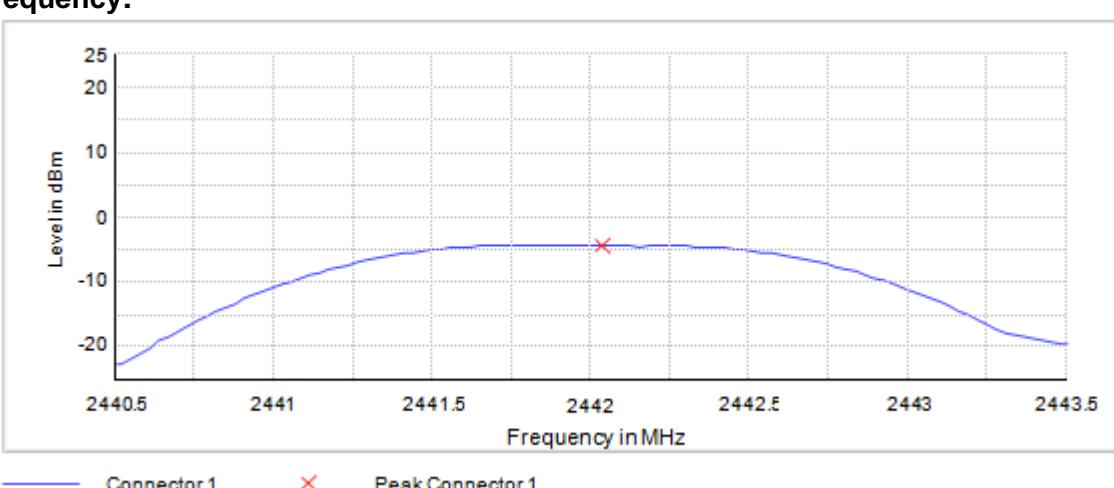
Peak Output Power

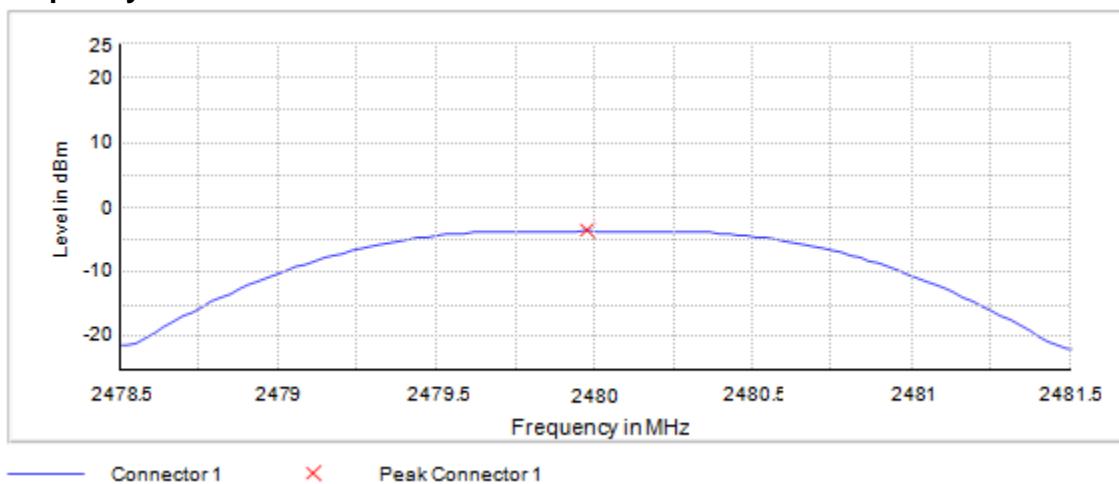
DUT Frequency (MHz)	Peak Power (dBm)	Limit Max (dBm)	Result
2402.000000	-4.7	30.0	PASS
2442.000000	-4.6	30.0	PASS
2480.000000	-4.0	30.0	PASS

Low Frequency:



Mid Frequency:



High Frequency:

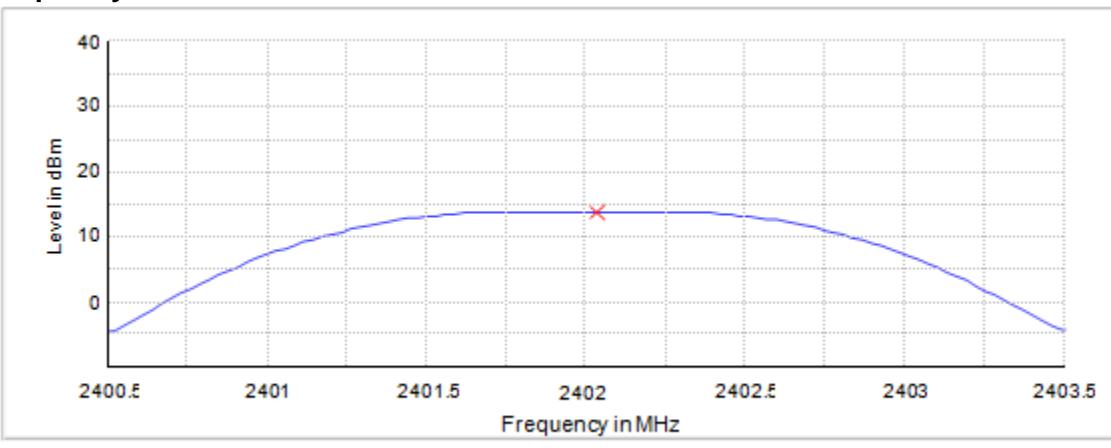
DATA PAGE

Manufacturer : Amatis Controls
Test Item : Wireless Module
Model No. : IPPAN3
Mode : BLE – Molex 0479480001 BLE Antenna
Test Specification : FCC-15.247, RSS-247 Peak Output Power
Date : May 8, 2018

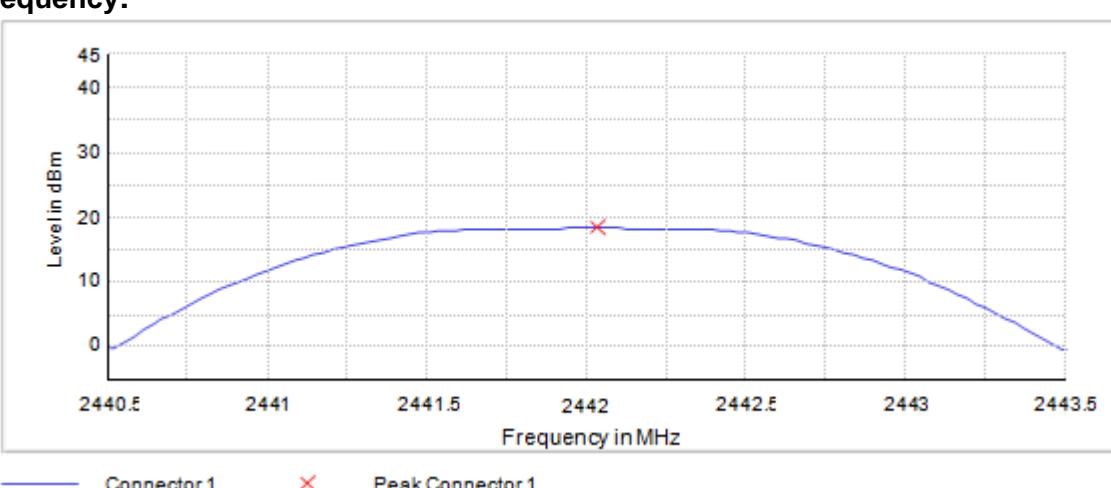
Peak Output Power

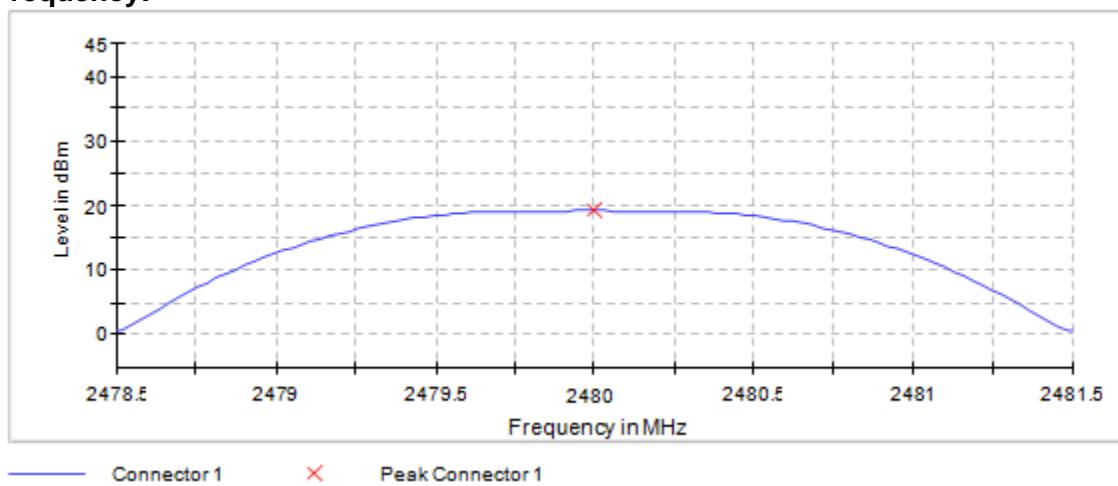
DUT Frequency (MHz)	Peak Power (dBm)	Limit Max (dBm)	Result
2402.000000	13.6	30.0	PASS
2442.000000	18.1	30.0	PASS
2480.000000	19.2	30.0	PASS

Low Frequency:



Mid Frequency:



High Frequency:

DATA PAGE

Manufacturer : Amatis Controls
Test Item : Wireless Module
Model No. : IPPAN3
Mode : 802.15.4 Zigbee – Johanson Technology 2450AT18A100E ZigBee Antenna
Test Specification : FCC-15.247, RSS-247 Peak Output Power
Date : May 3-5, 2018

Freq. (MHz)	Ant Pol	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
2405.00	H	0.1	5.7	2.8	3.0	36.0	-33.0
2405.00	V	-3.7	5.7	2.8	-0.8	36.0	-36.8
2425.00	H	2.6	5.6	2.8	5.4	36.0	-30.6
2425.00	V	-1.5	5.6	2.8	1.3	36.0	-34.7
2480.00	H	4.7	5.6	2.8	7.5	36.0	-28.5
2480.00	V	2.1	5.6	2.8	4.9	36.0	-31.1

DATA PAGE

Manufacturer : Amatis Controls
Test Item : Wireless Module
Model No. : IPPAN3
Mode : 802.15.4 Zigbee – Molex 0479480001 BLE Antenna
Test Specification : FCC-15.247, RSS-247 Peak Output Power
Date : May 3-5, 2018

Freq. (MHz)	Ant Pol	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
2405.00	H	0.4	5.7	2.8	3.3	36.0	-32.7
2405.00	V	-1.0	5.7	2.8	1.9	36.0	-34.1
2425.00	H	2.4	5.6	2.8	5.2	36.0	-30.8
2425.00	V	-1.6	5.6	2.8	1.2	36.0	-34.8
2480.00	H	5.0	5.6	2.8	7.9	36.0	-28.1
2480.00	V	-0.4	5.6	2.8	2.4	36.0	-33.6

DATA PAGE

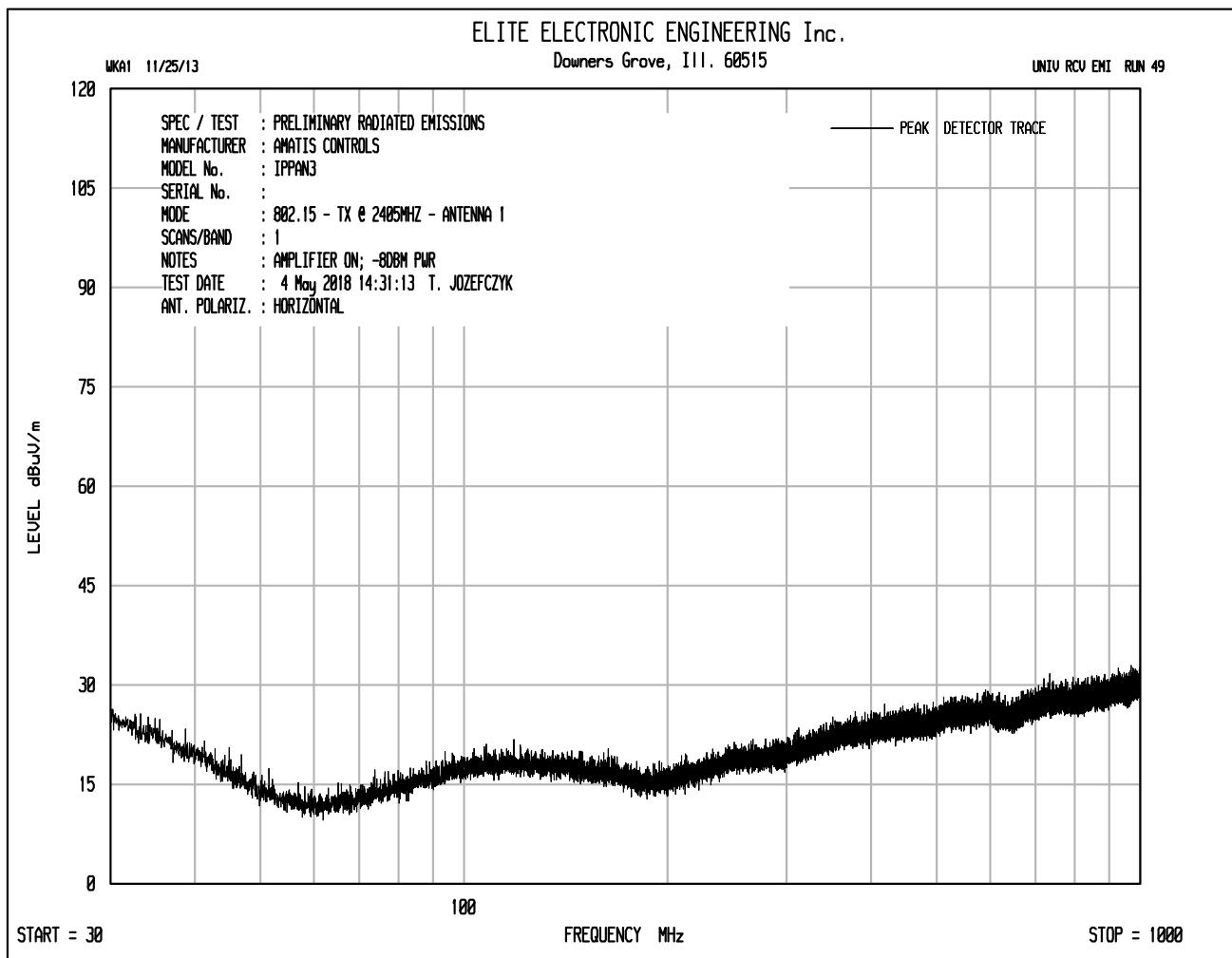
Manufacturer : Amatis Controls
Test Item : Wireless Module
Model No. : IPPAN3
Mode : BLE – Johanson Technology 2450AT18A100E ZigBee Antenna
Test Specification : FCC-15.247, RSS-247 Peak Output Power
Date : May 3-5, 2018

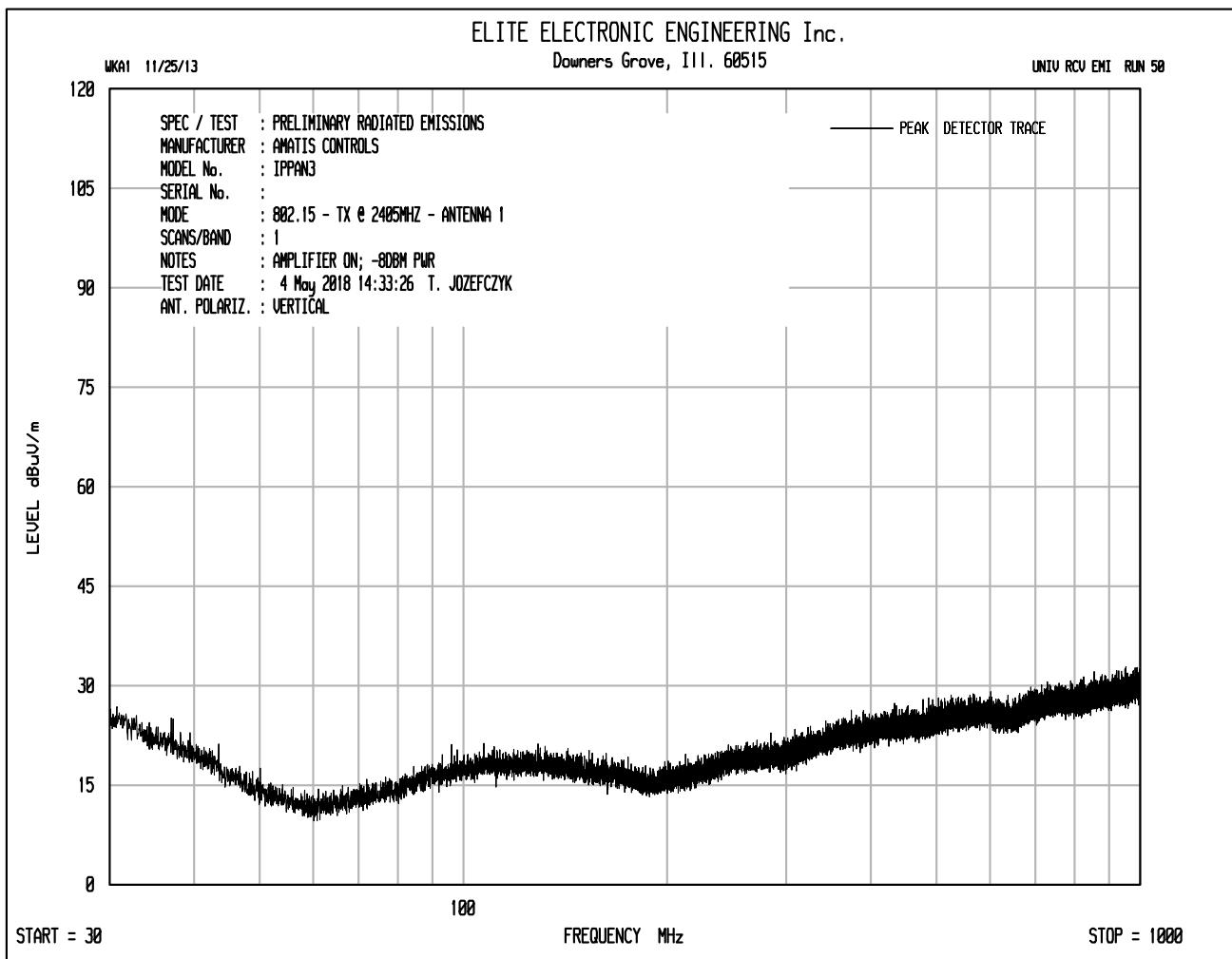
Freq. (MHz)	Ant Pol	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
2402.00	H	8.1	5.7	2.7	11.1	36.0	-24.9
2402.00	V	10.6	5.7	2.7	13.5	36.0	-22.5
2442.00	H	6.8	5.5	2.8	9.6	36.0	-26.4
2442.00	V	8.6	5.5	2.8	11.4	36.0	-24.6
2480.00	H	7.2	5.6	2.8	10.0	36.0	-26.0
2480.00	V	8.8	5.6	2.8	11.6	36.0	-24.4

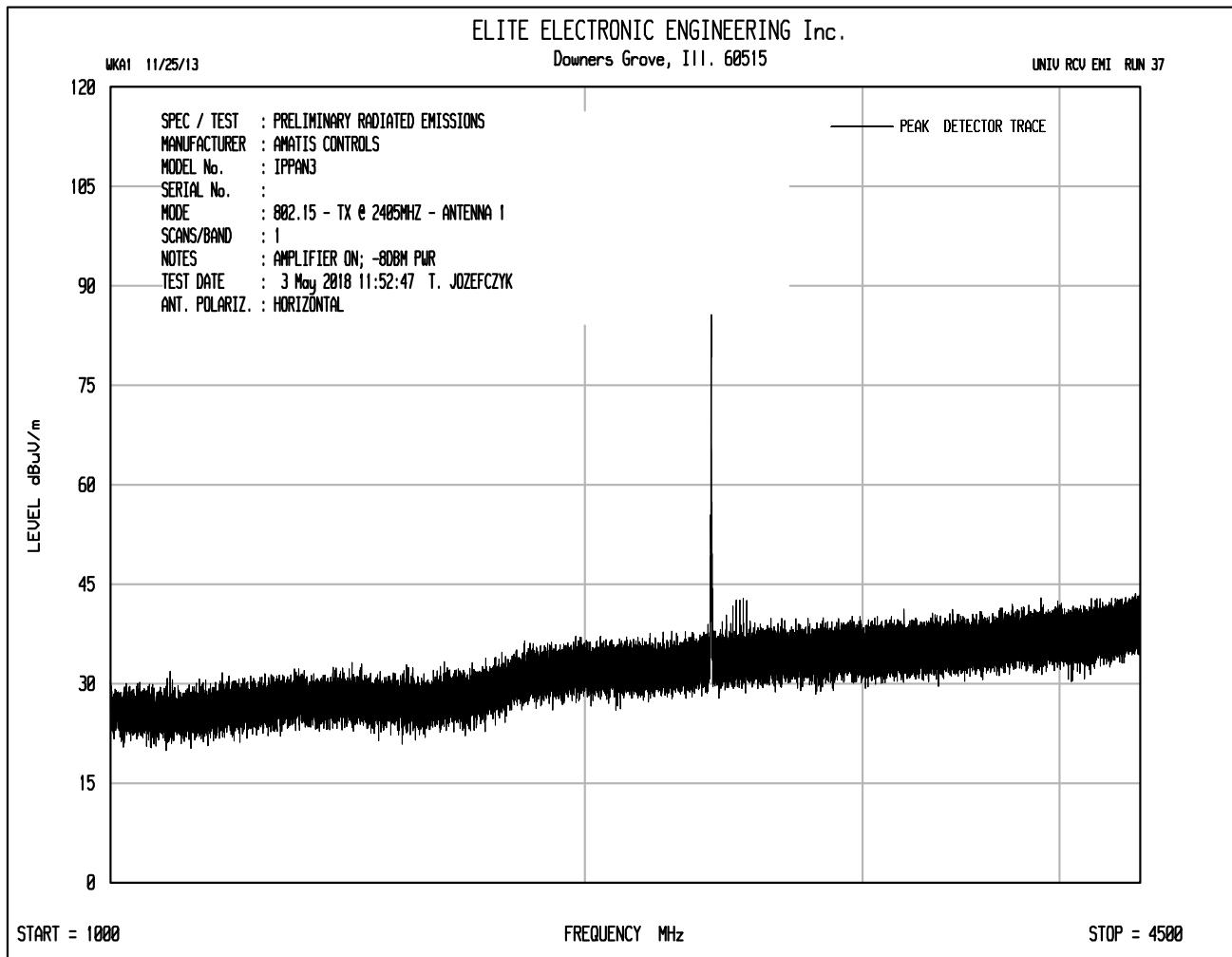
DATA PAGE

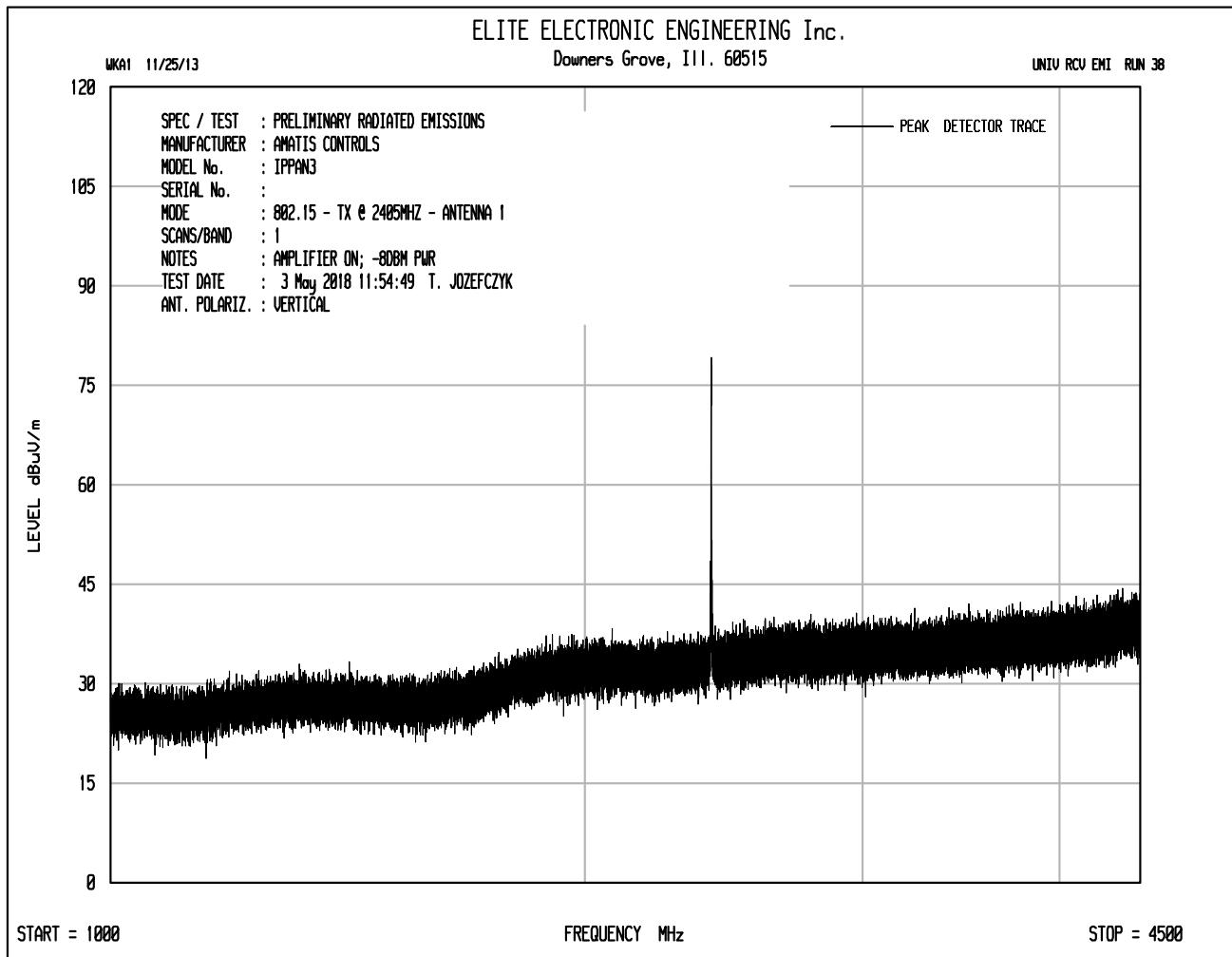
Manufacturer : Amatis Controls
Test Item : Wireless Module
Model No. : IPPAN3
Mode : BLE – Molex 0479480001 BLE Antenna
Test Specification : FCC-15.247, RSS-247 Peak Output Power
Date : May 3-5, 2018

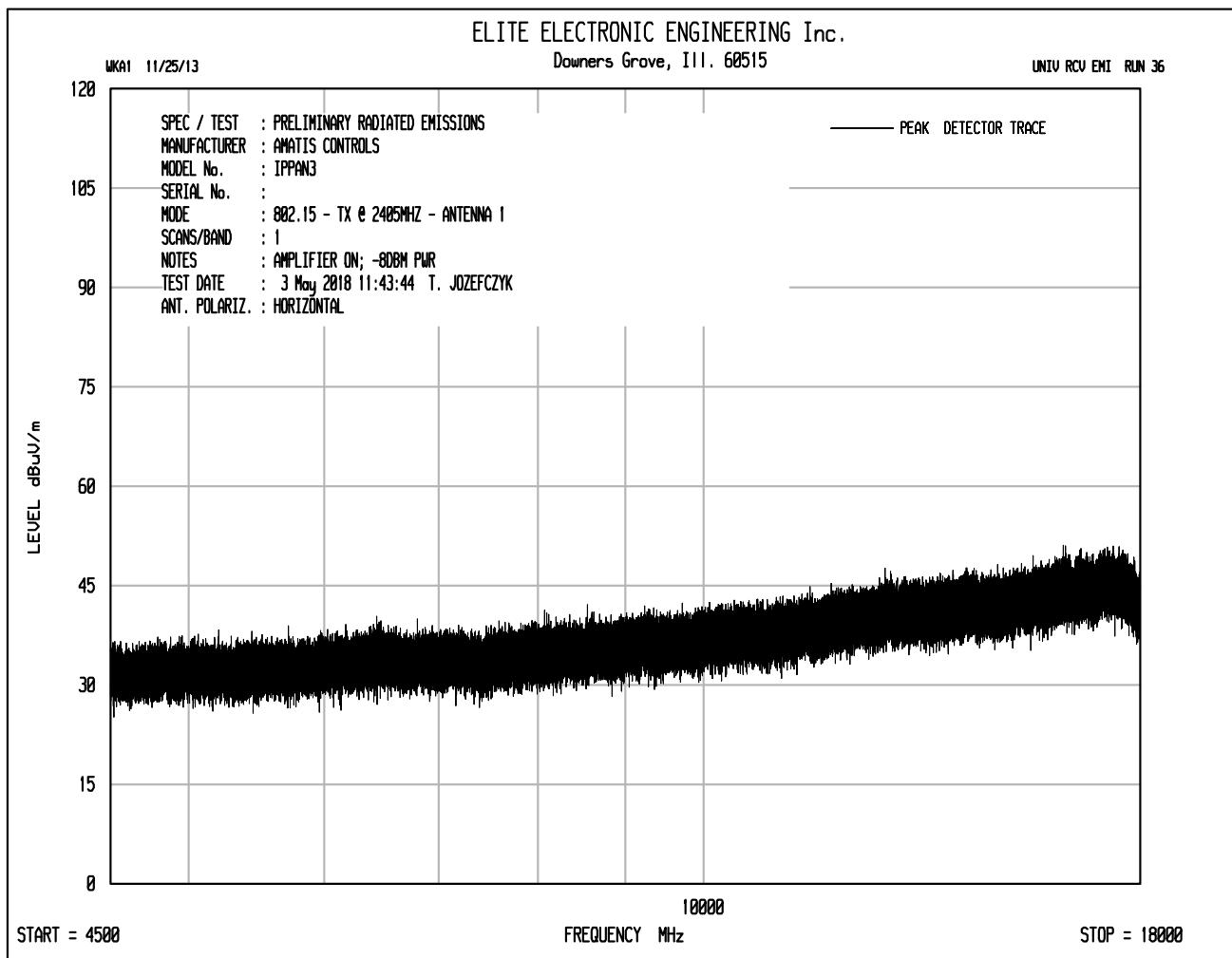
Freq. (MHz)	Ant Pol	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
2402.00	H	6.6	5.7	2.7	9.5	36.0	-26.5
2402.00	V	9.2	5.7	2.7	12.1	36.0	-23.9
2442.00	H	7.1	5.5	2.8	9.9	36.0	-26.1
2442.00	V	10.7	5.5	2.8	13.5	36.0	-22.5
2480.00	H	7.1	5.6	2.8	9.9	36.0	-26.1
2480.00	V	7.7	5.6	2.8	10.5	36.0	-25.5

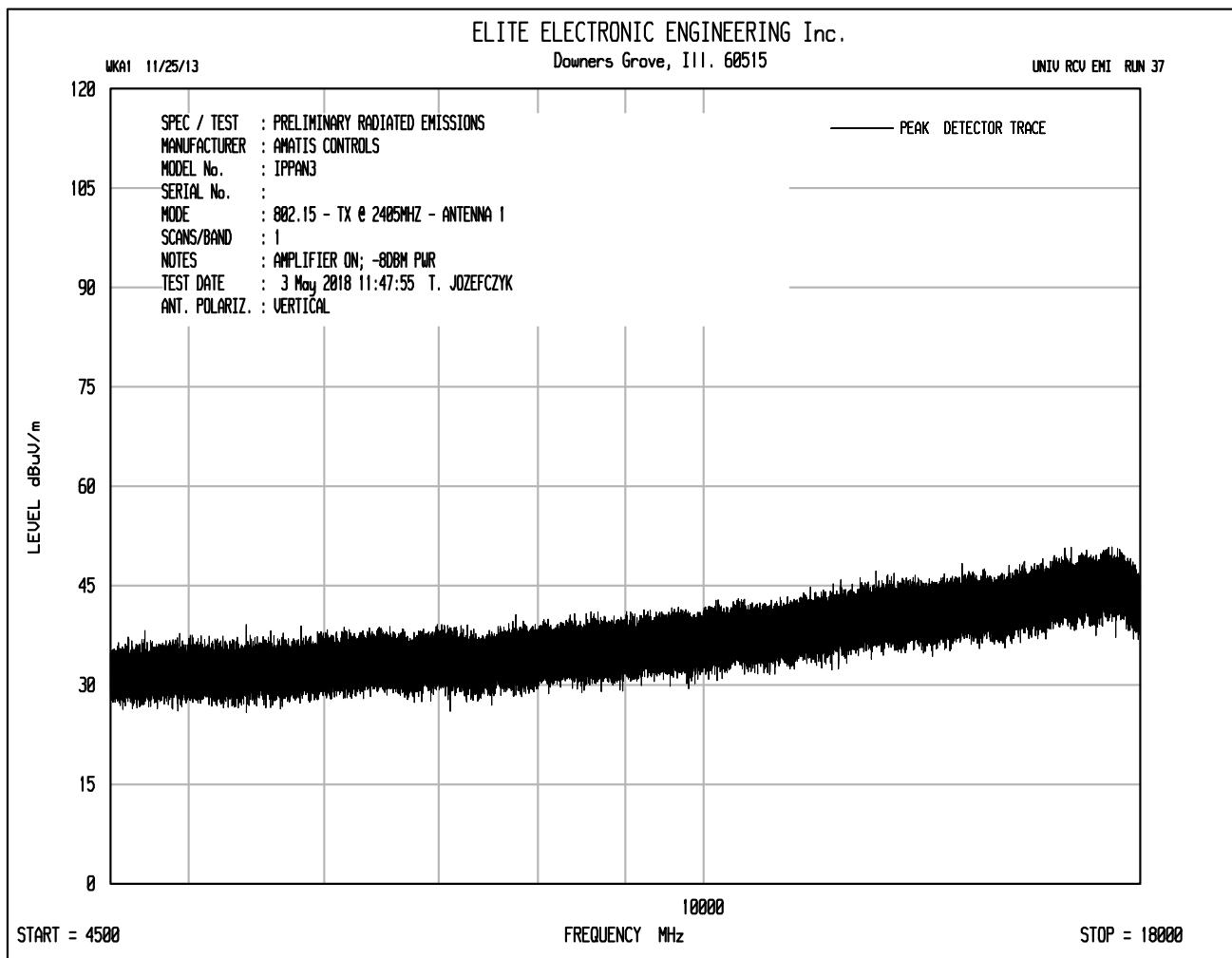










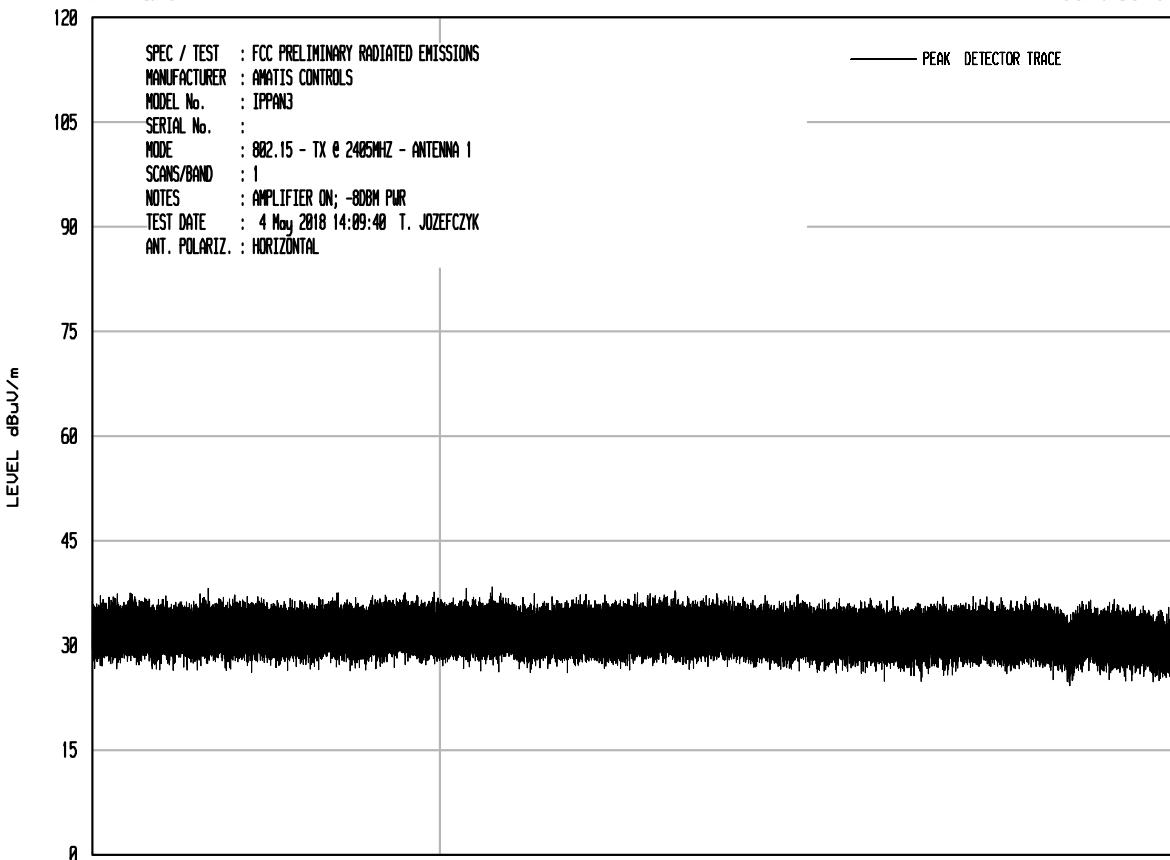


ELITE ELECTRONIC ENGINEERING Inc.

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UNIV RCV EMI RUN 25

WKA1 11/25/13



START = 18000

FREQUENCY MHz

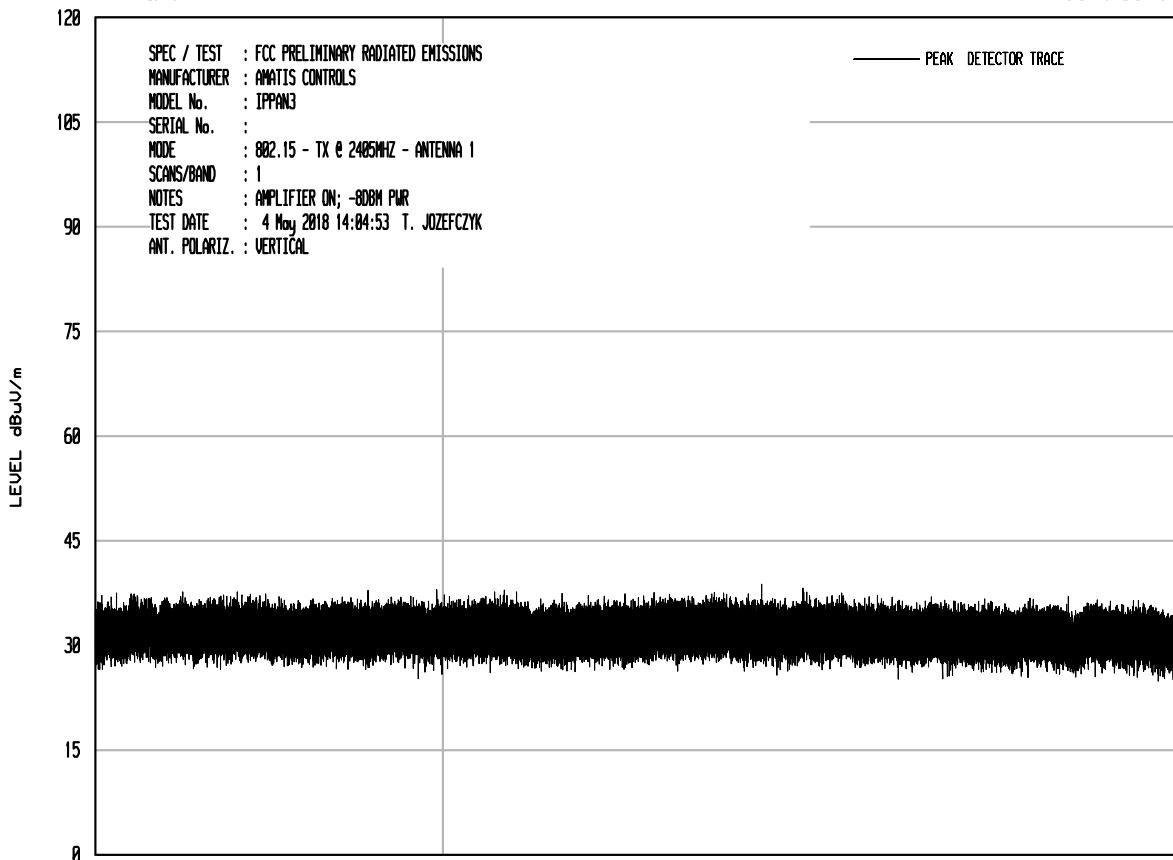
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UNIV RCV EMI RUN 24

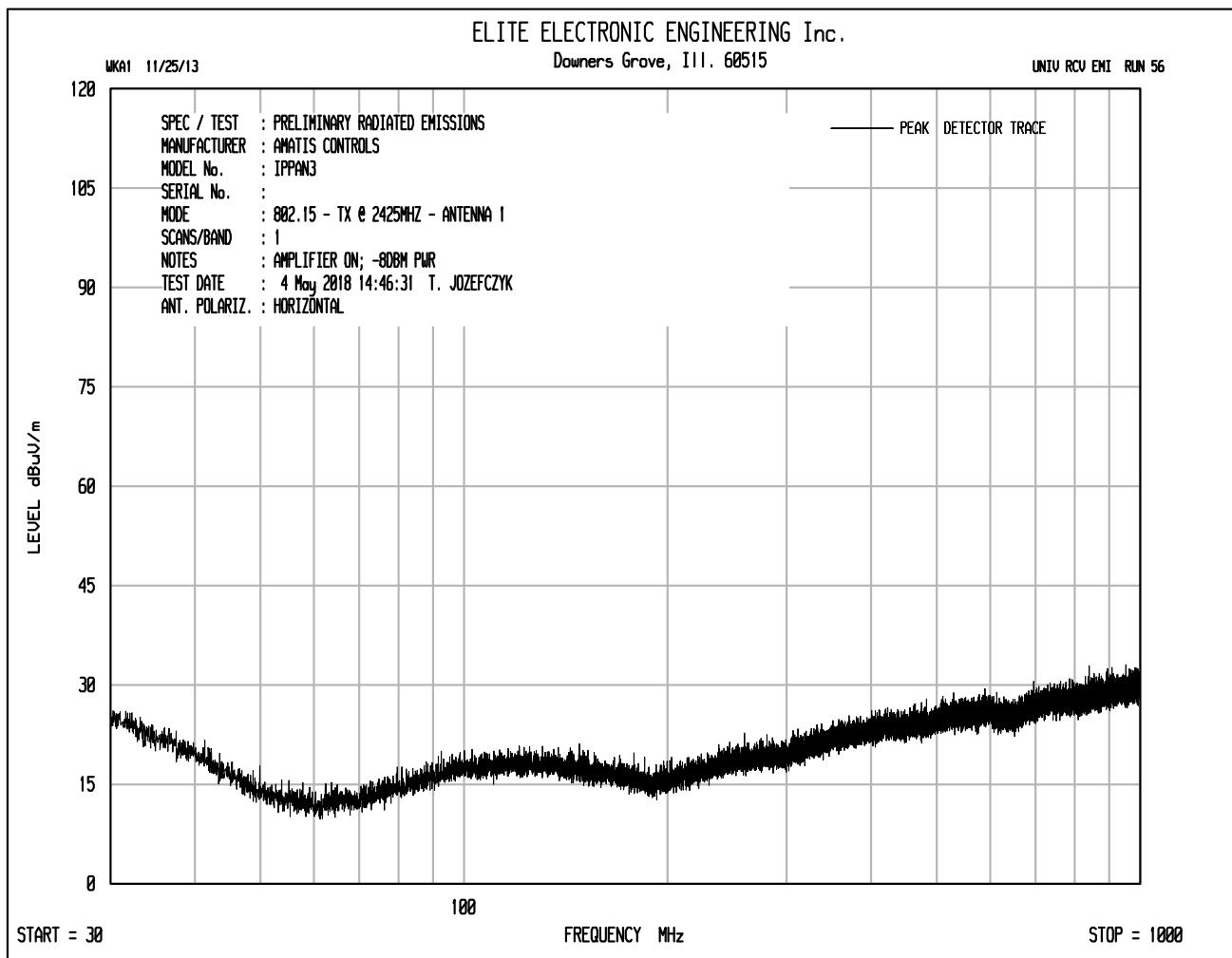
WKA1 11/25/13

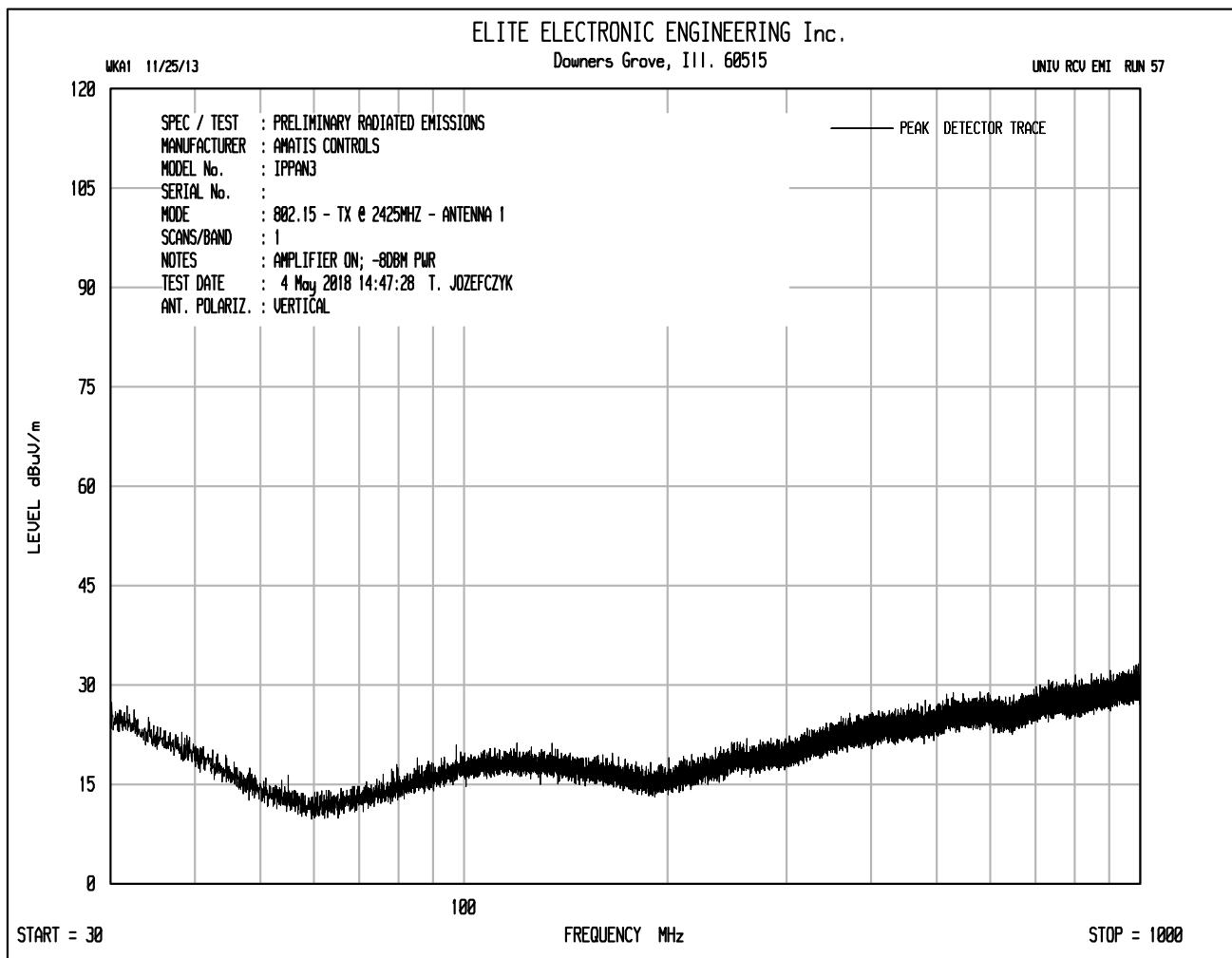


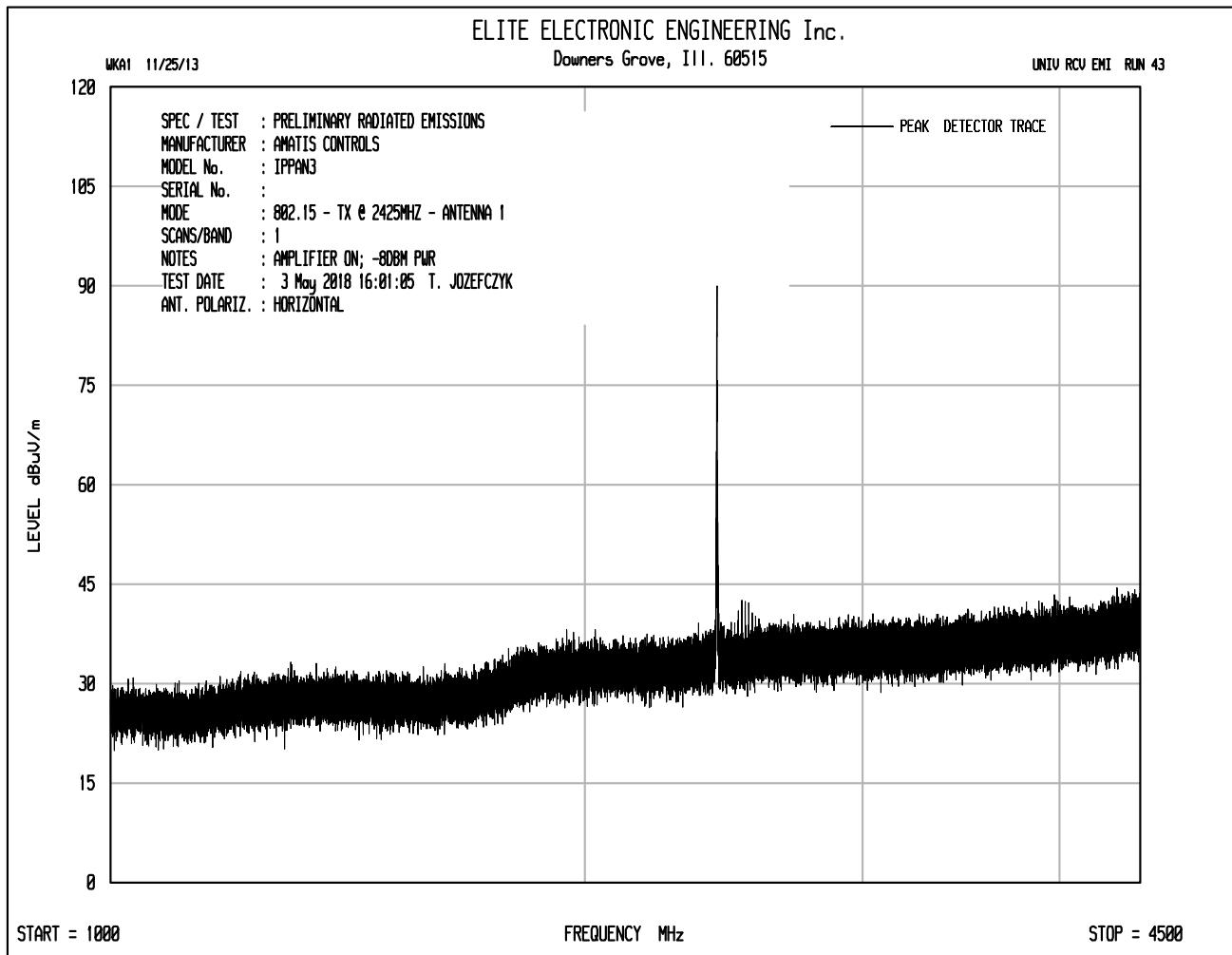
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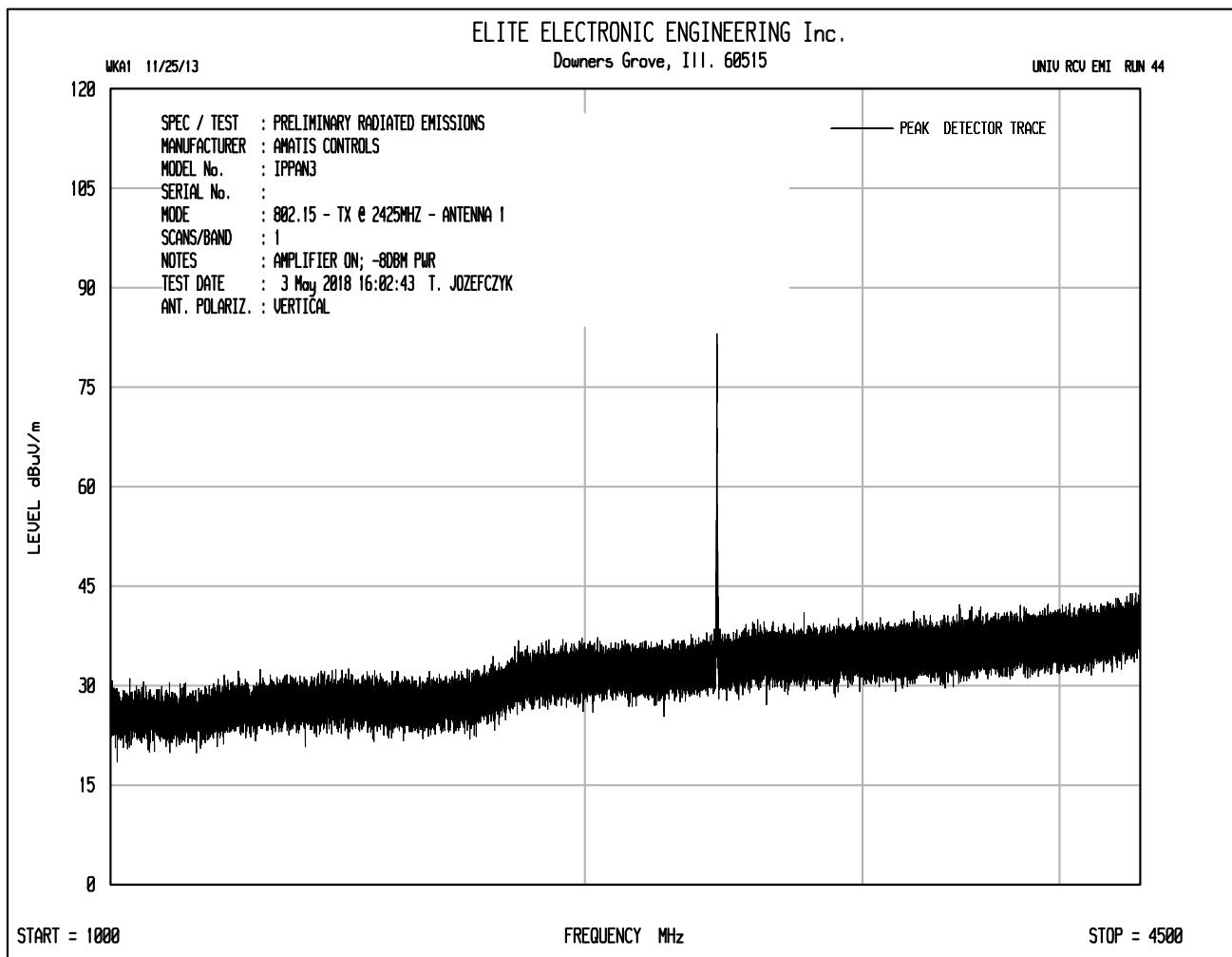
FREQUENCY MHz

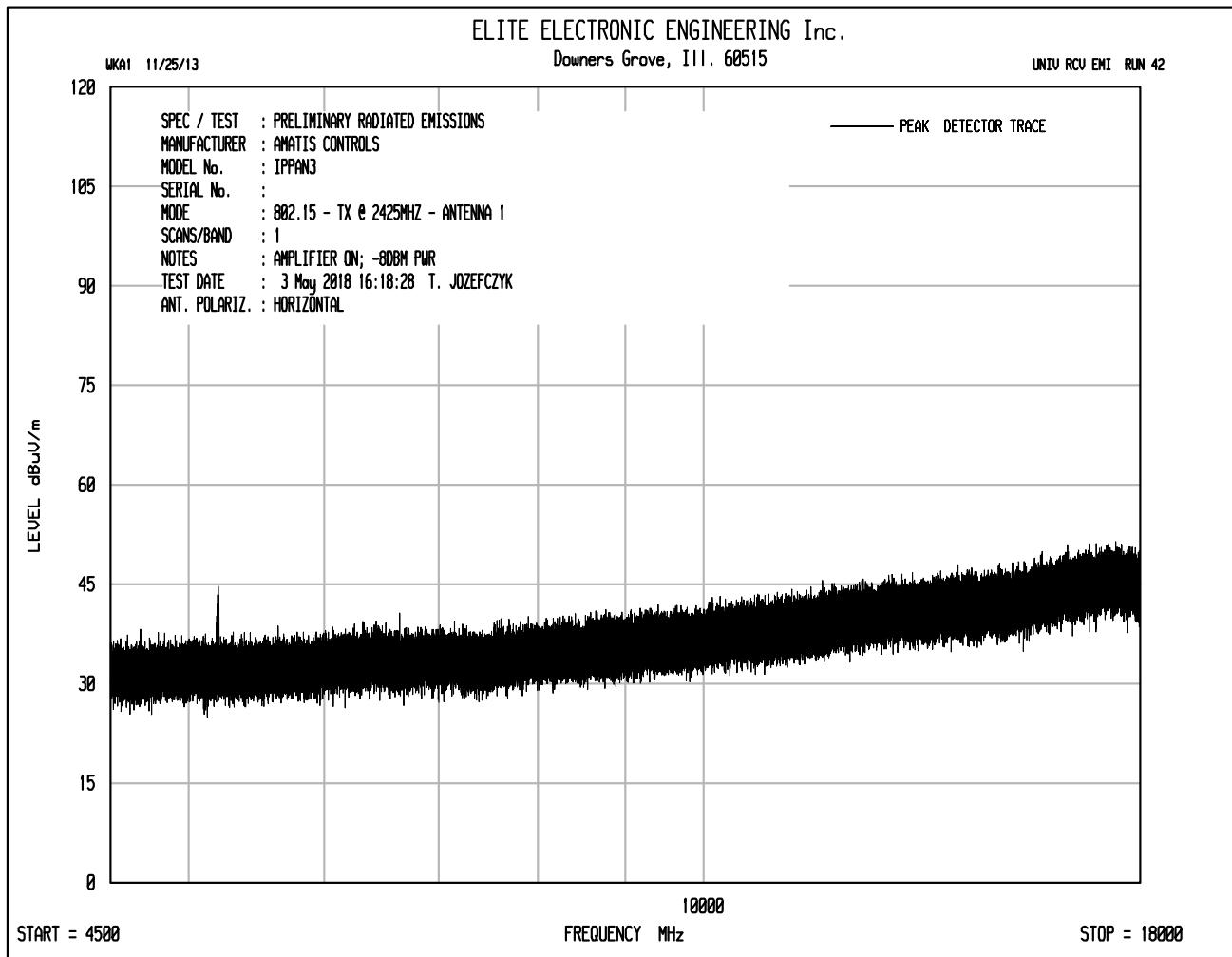
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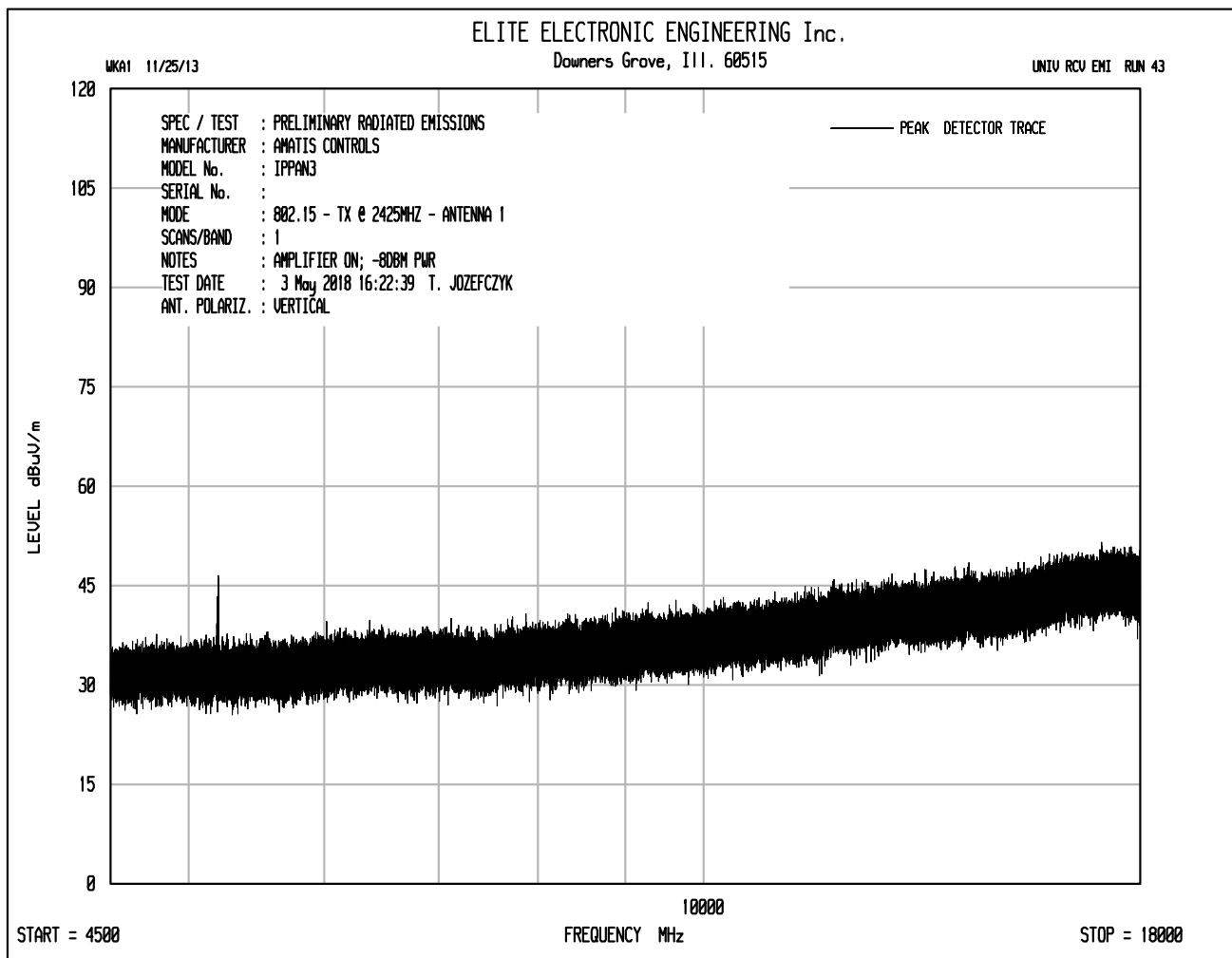










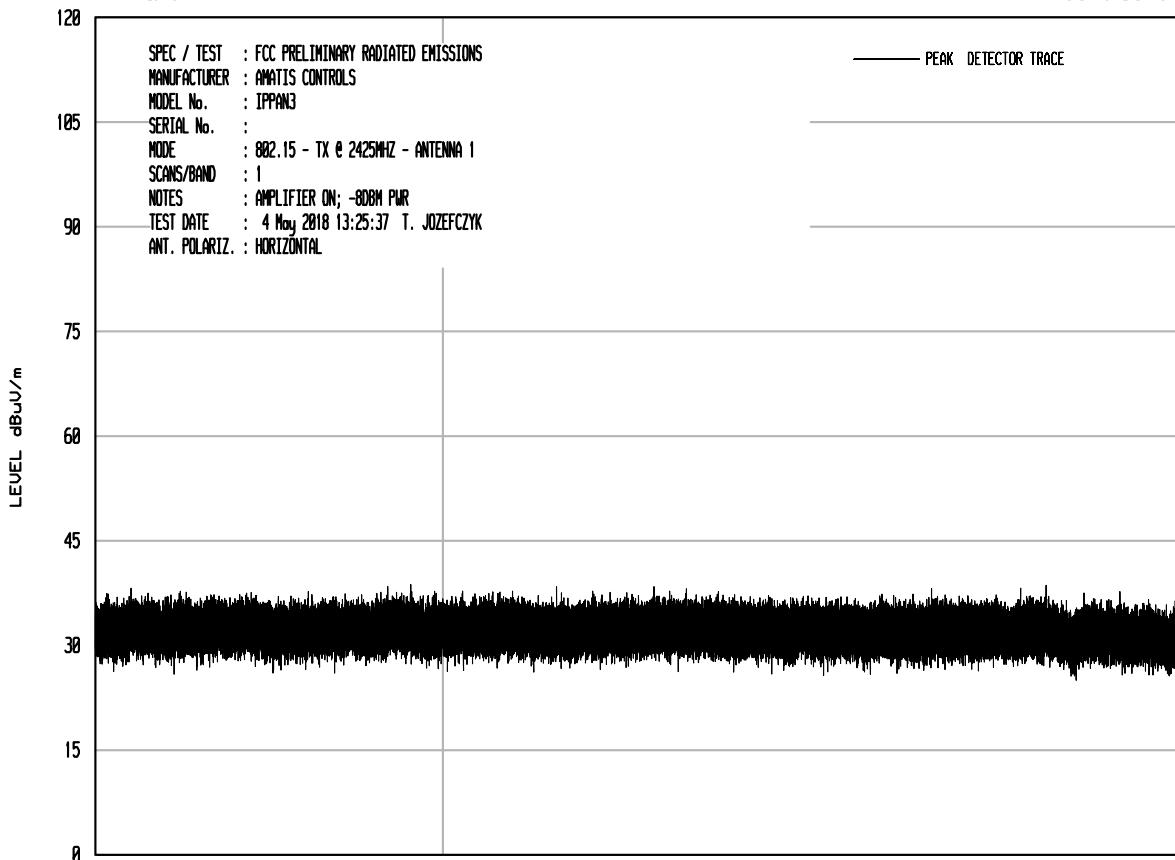


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UNIV RCV EMI RUN 18

WKA1 11/25/13



START = 18000

FREQUENCY MHz

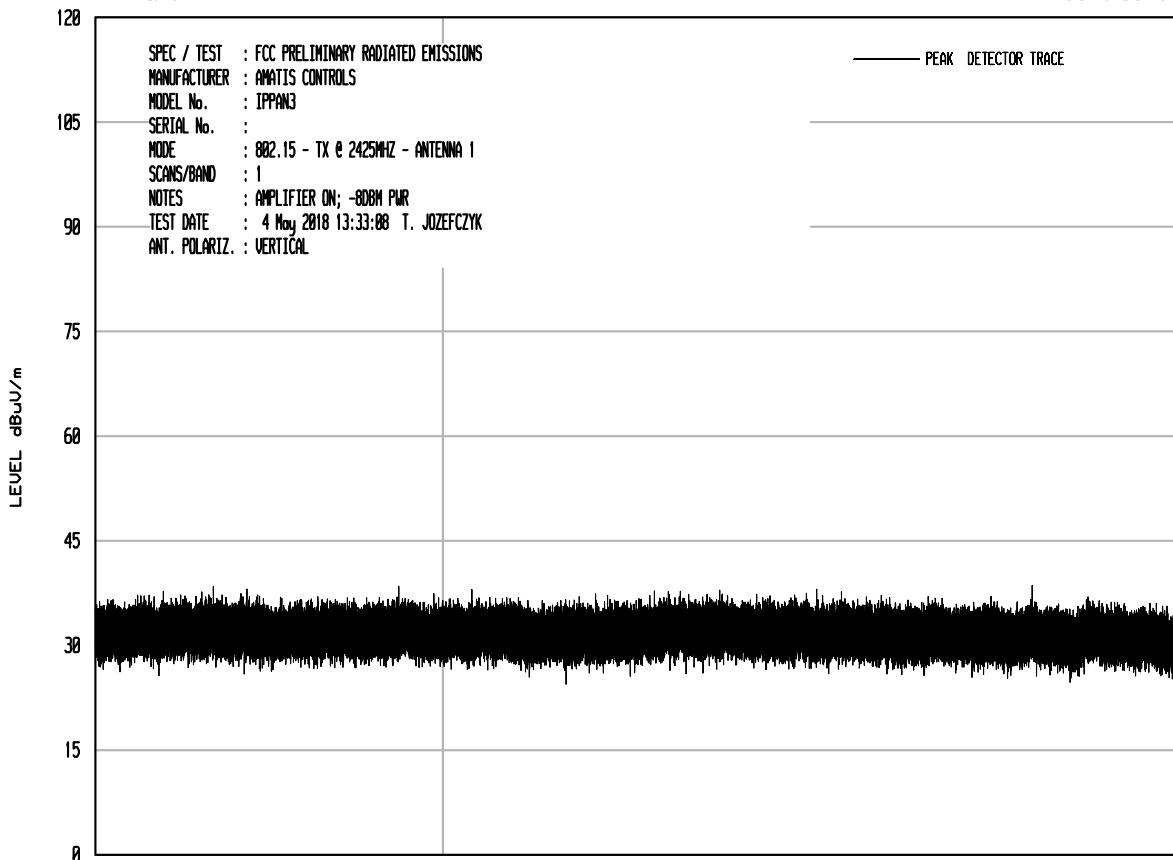
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UNIV RCV EMI RUN 19

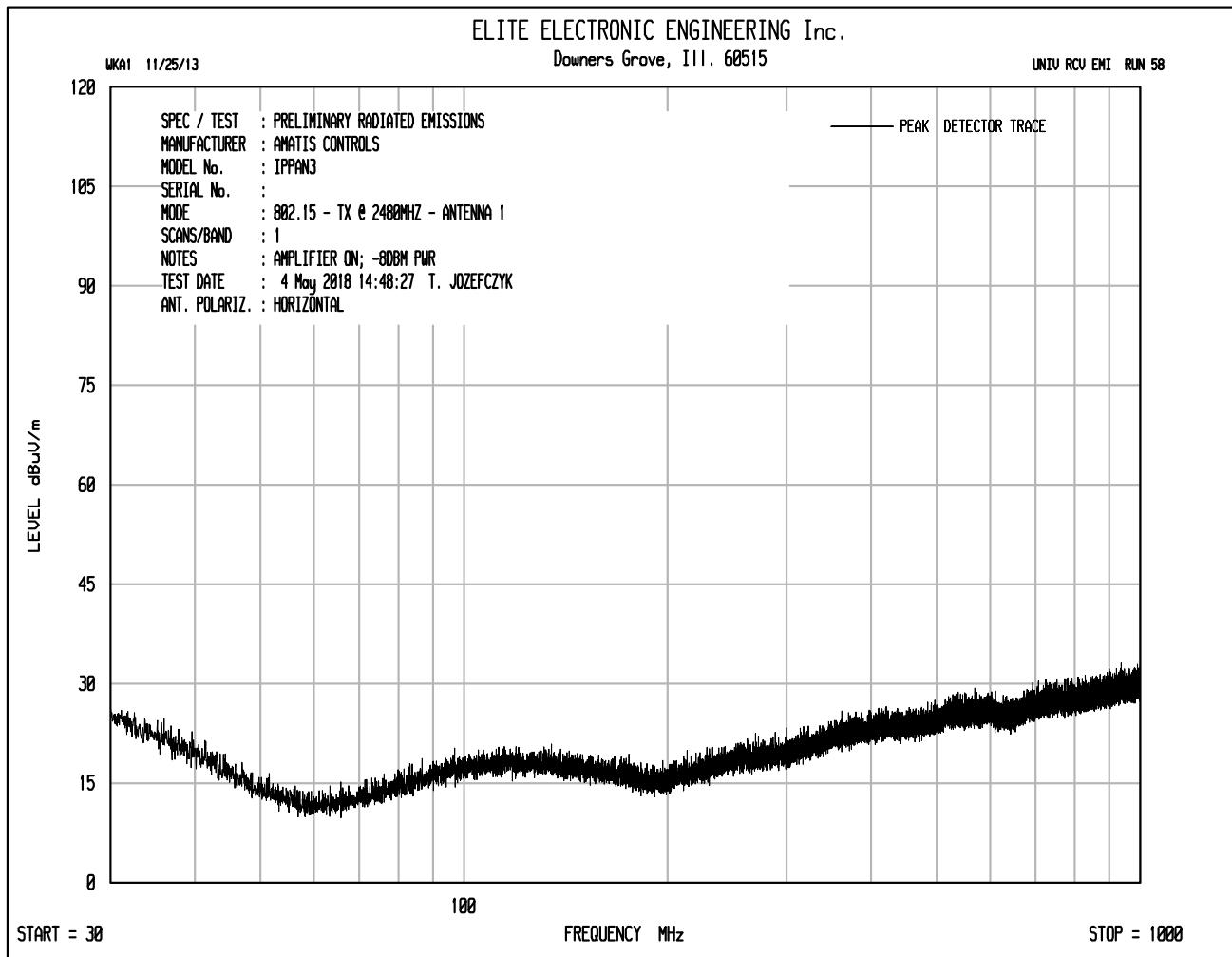
WKA1 11/25/13

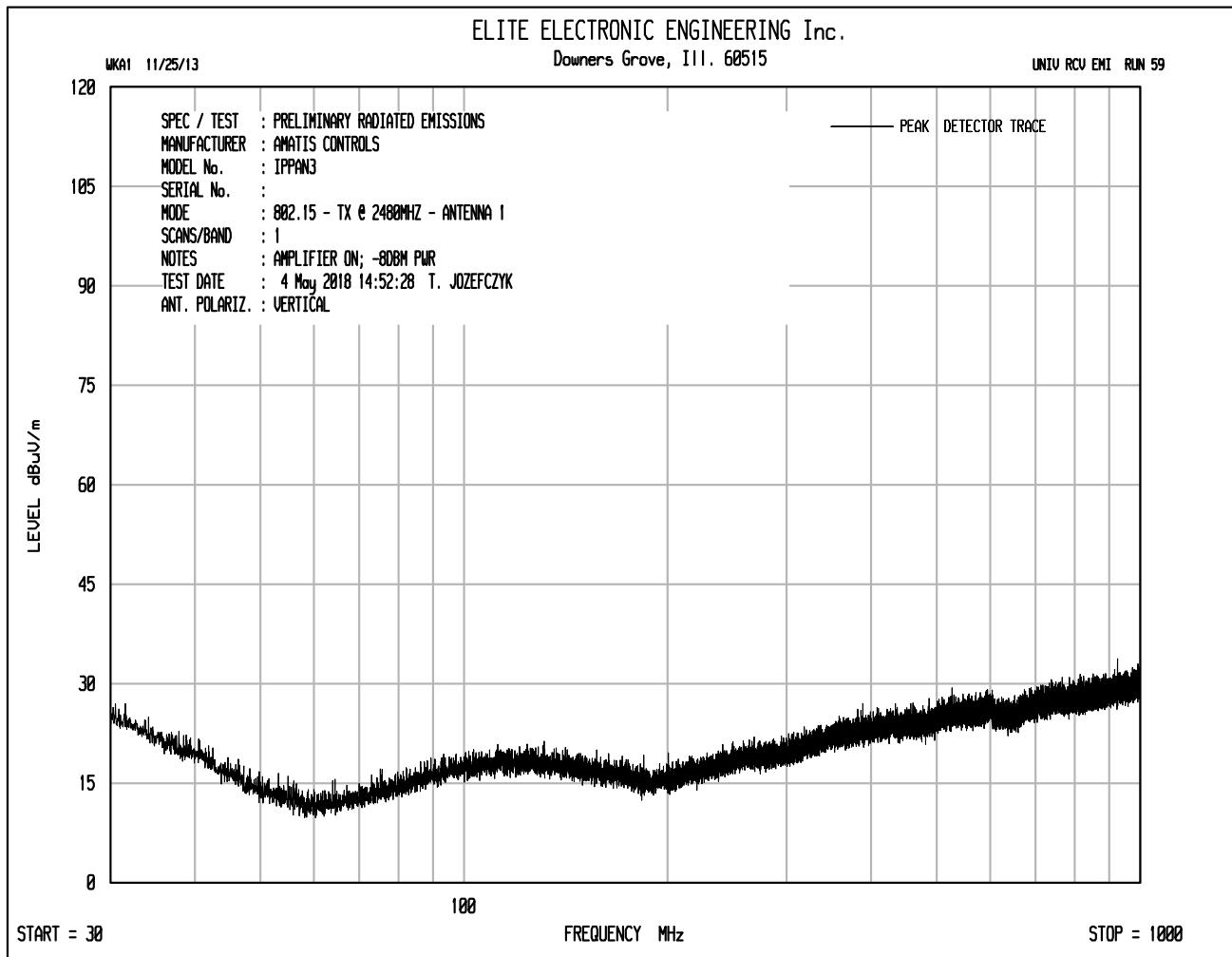


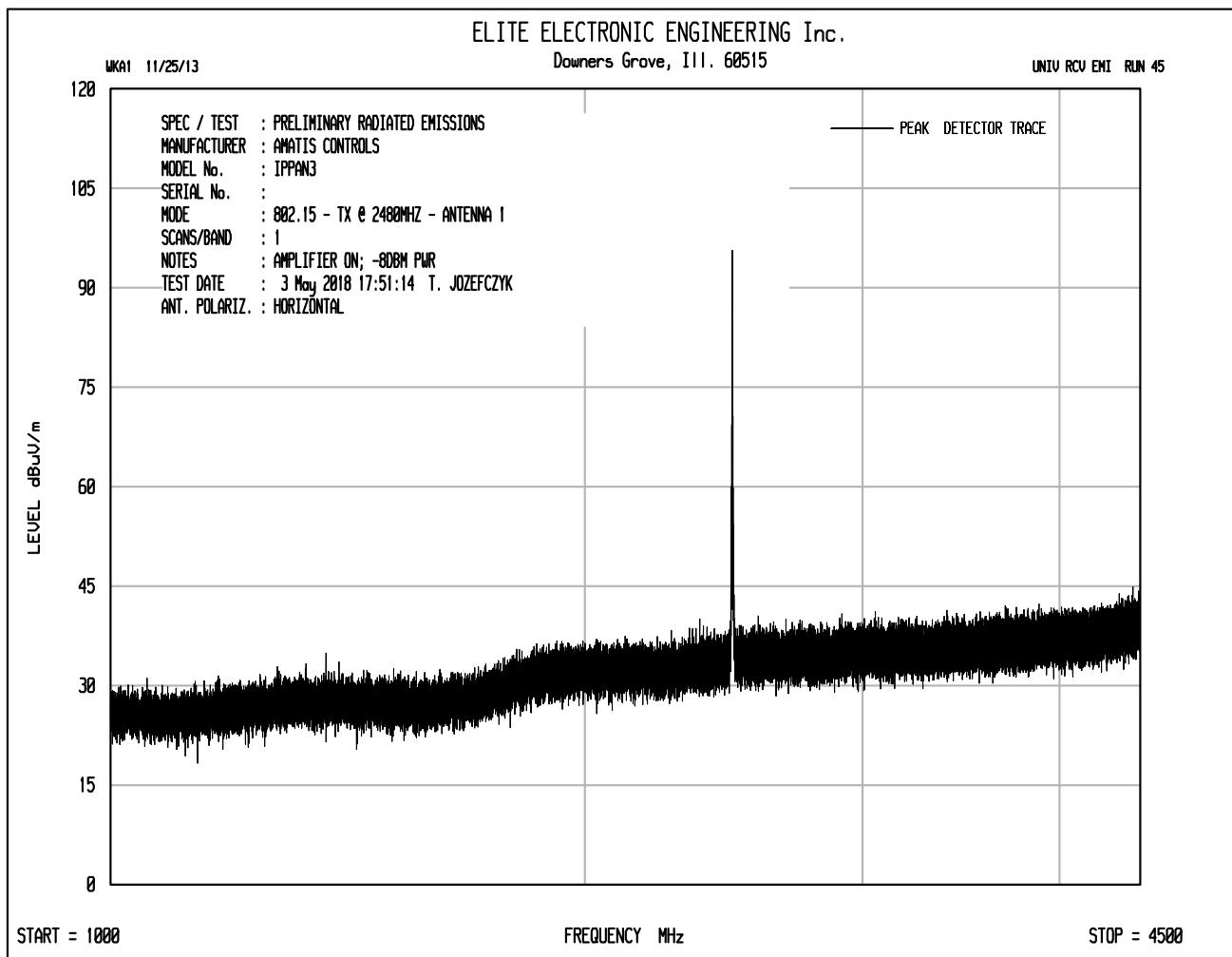
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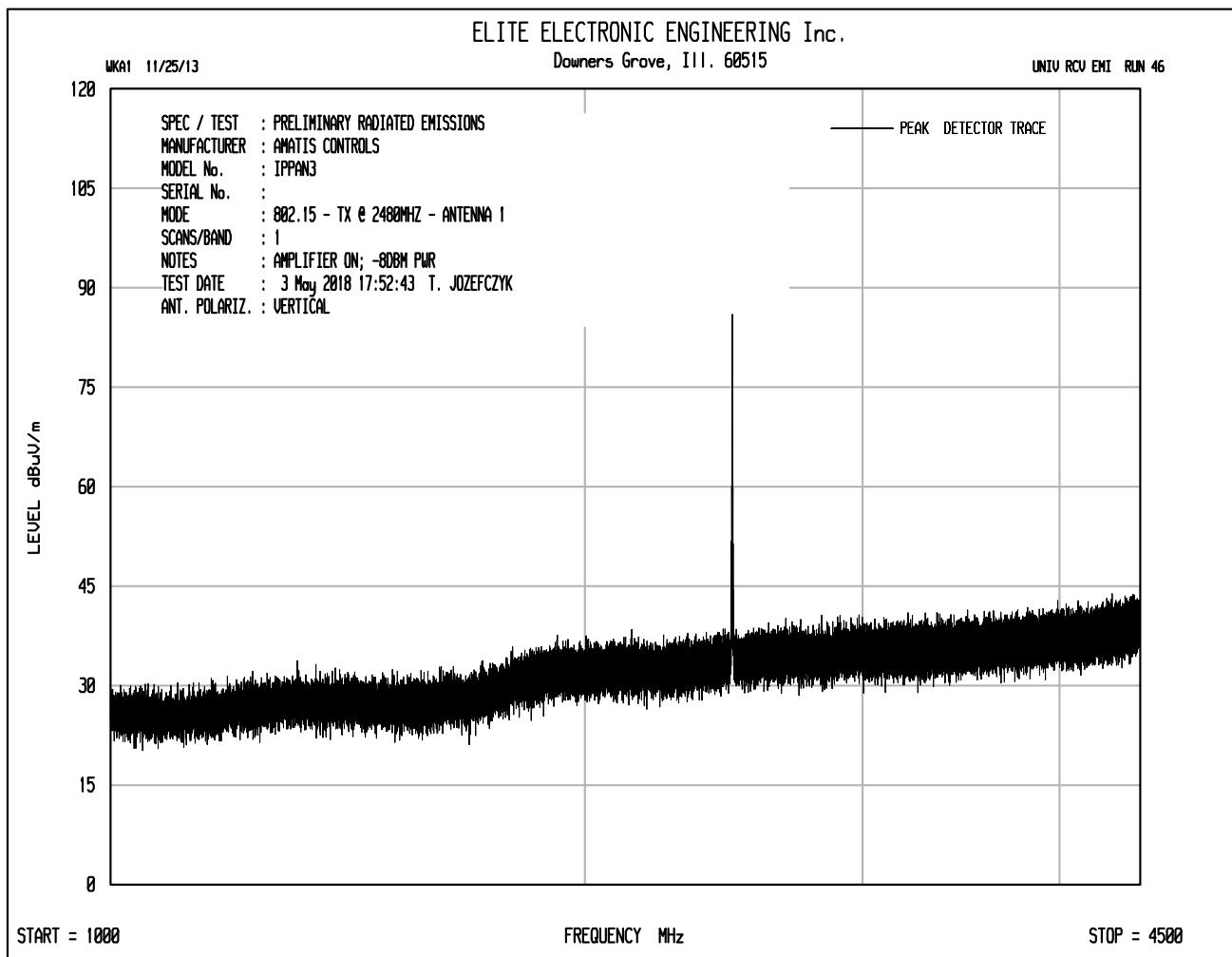
FREQUENCY MHz

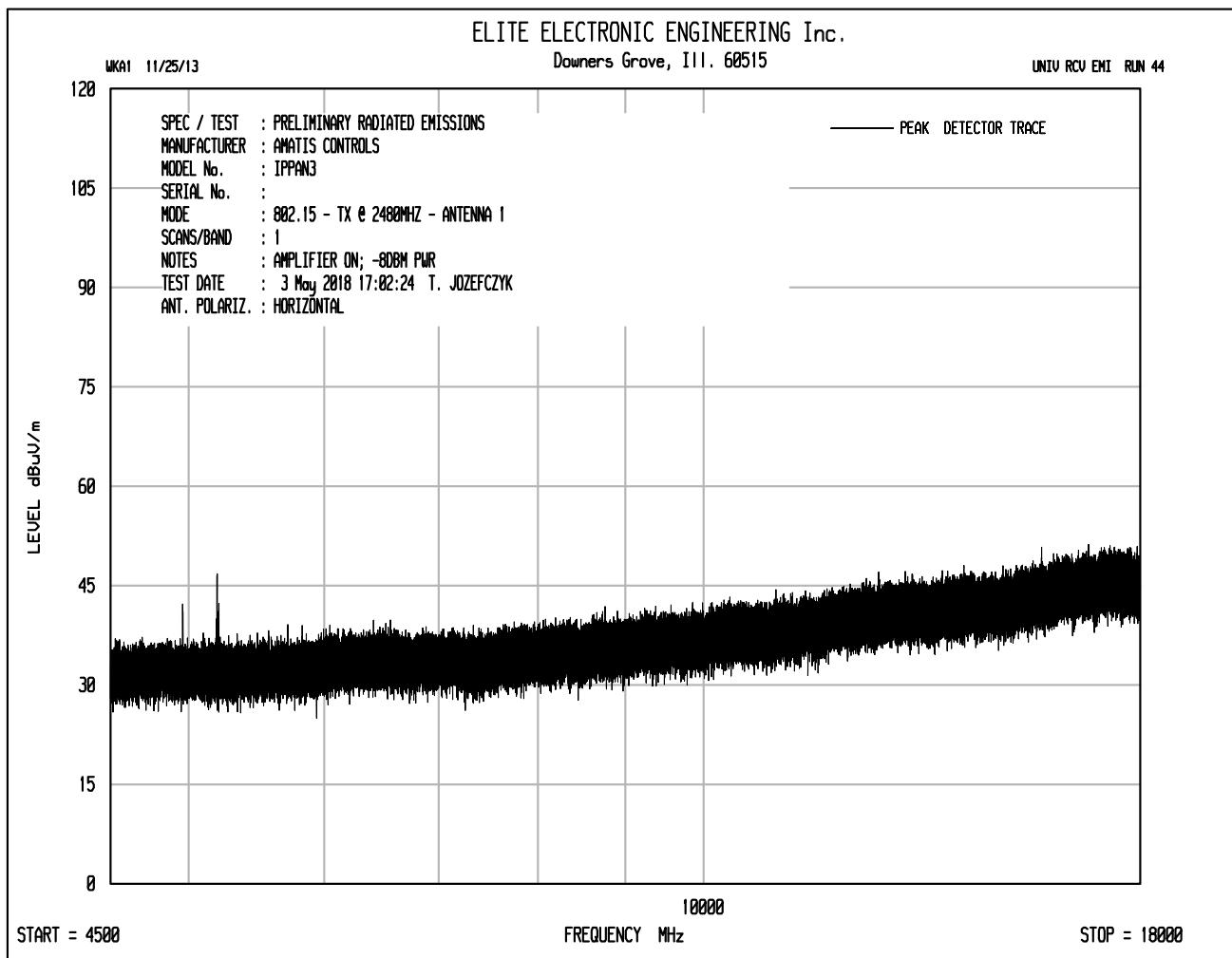
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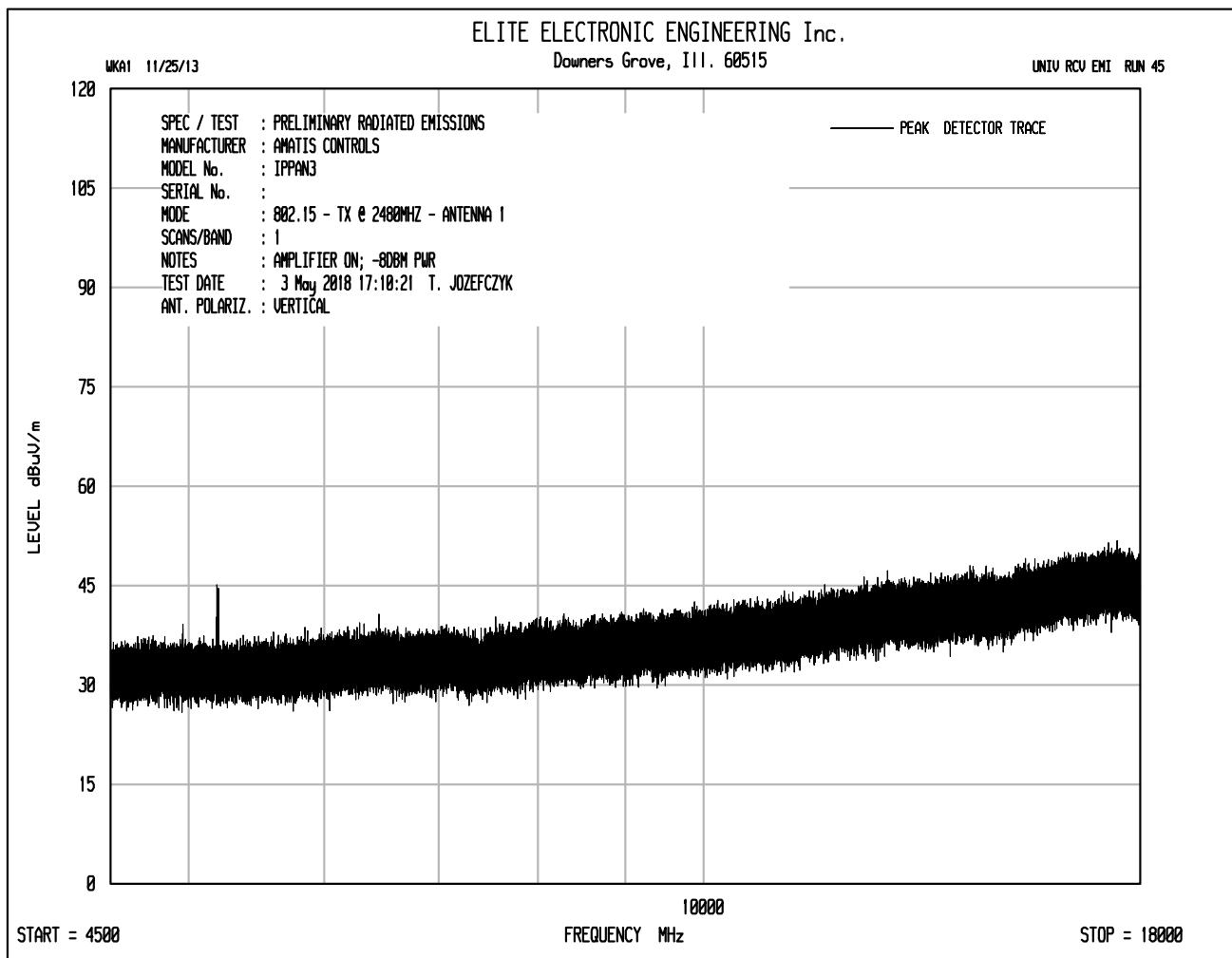


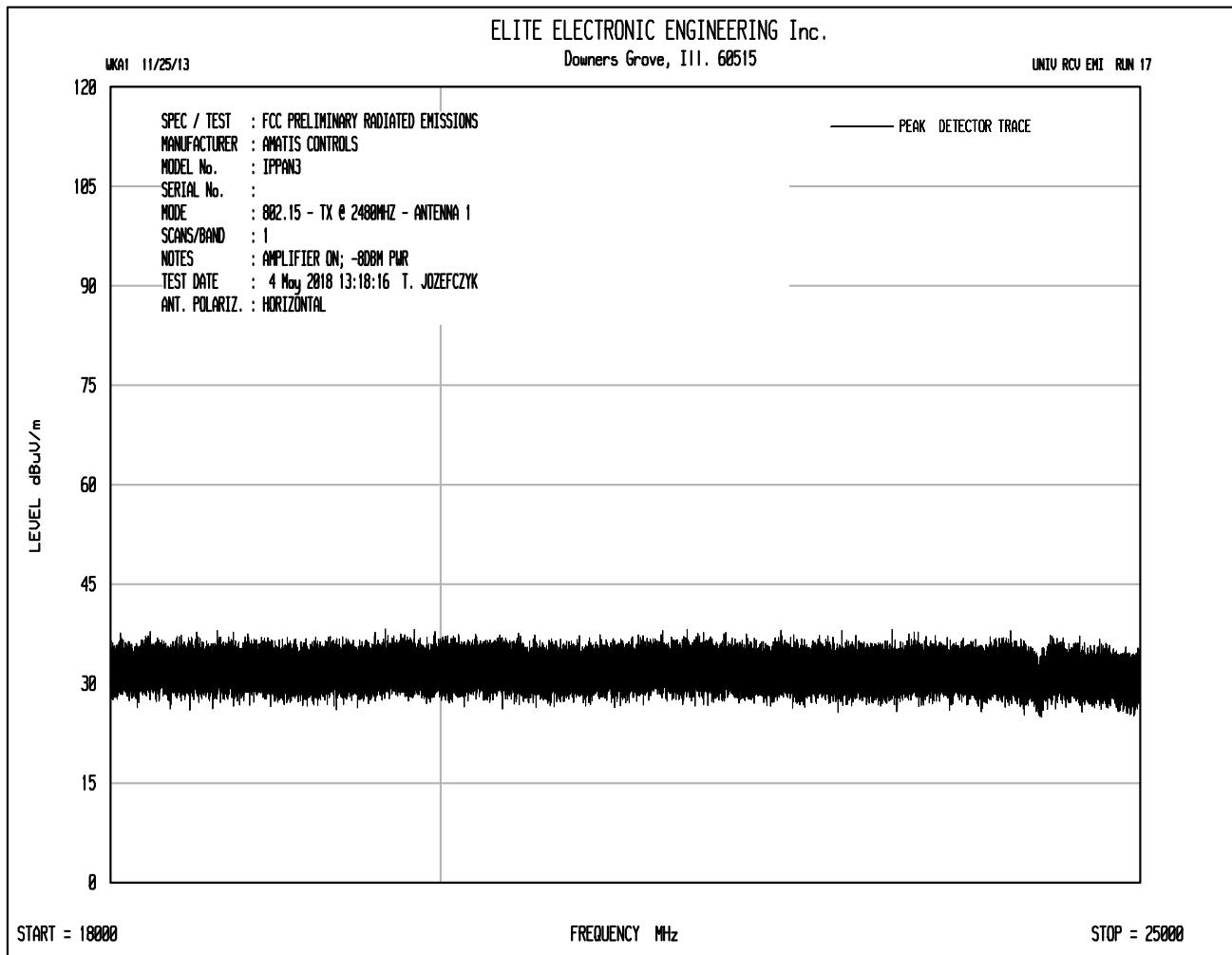








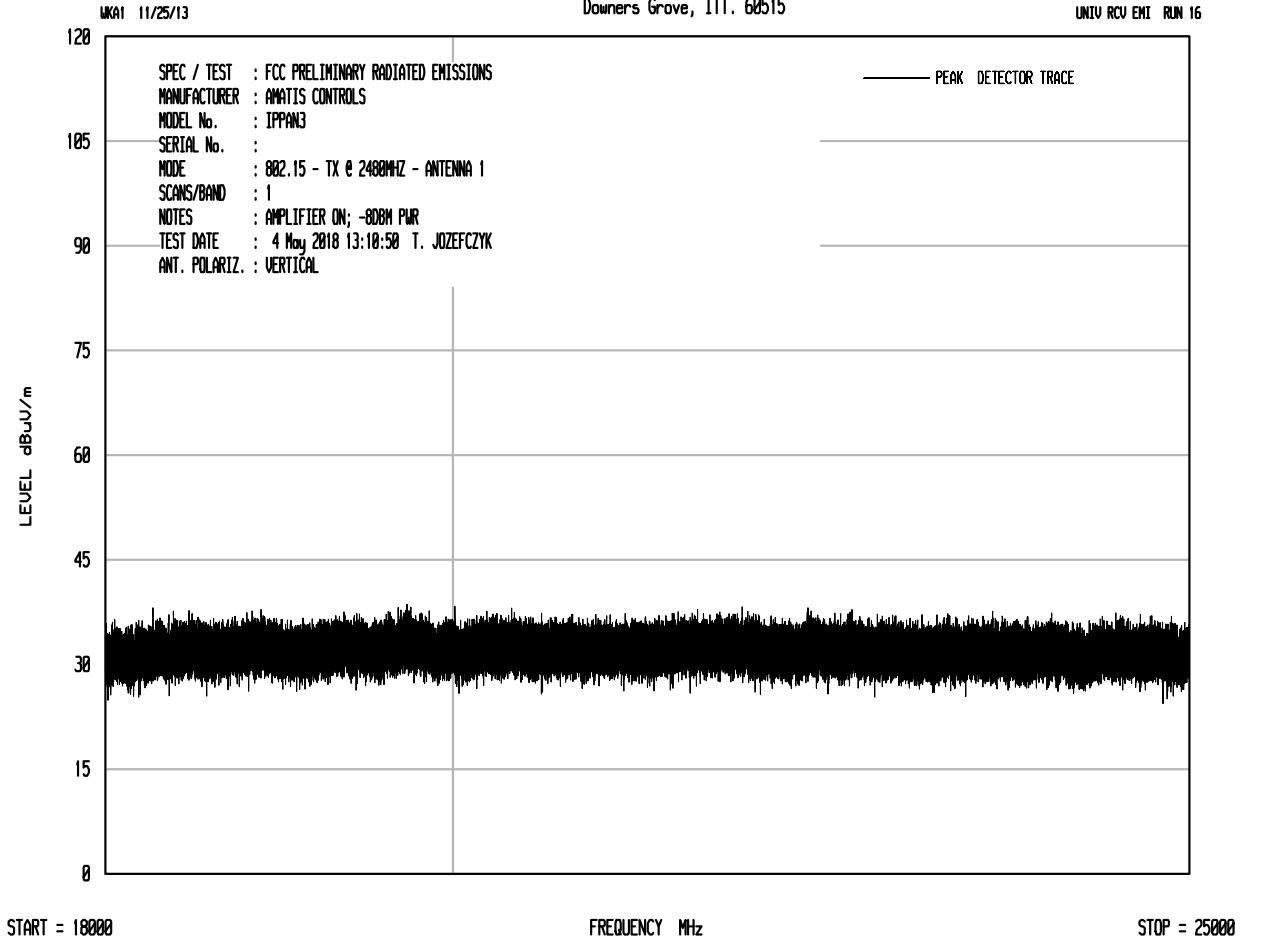


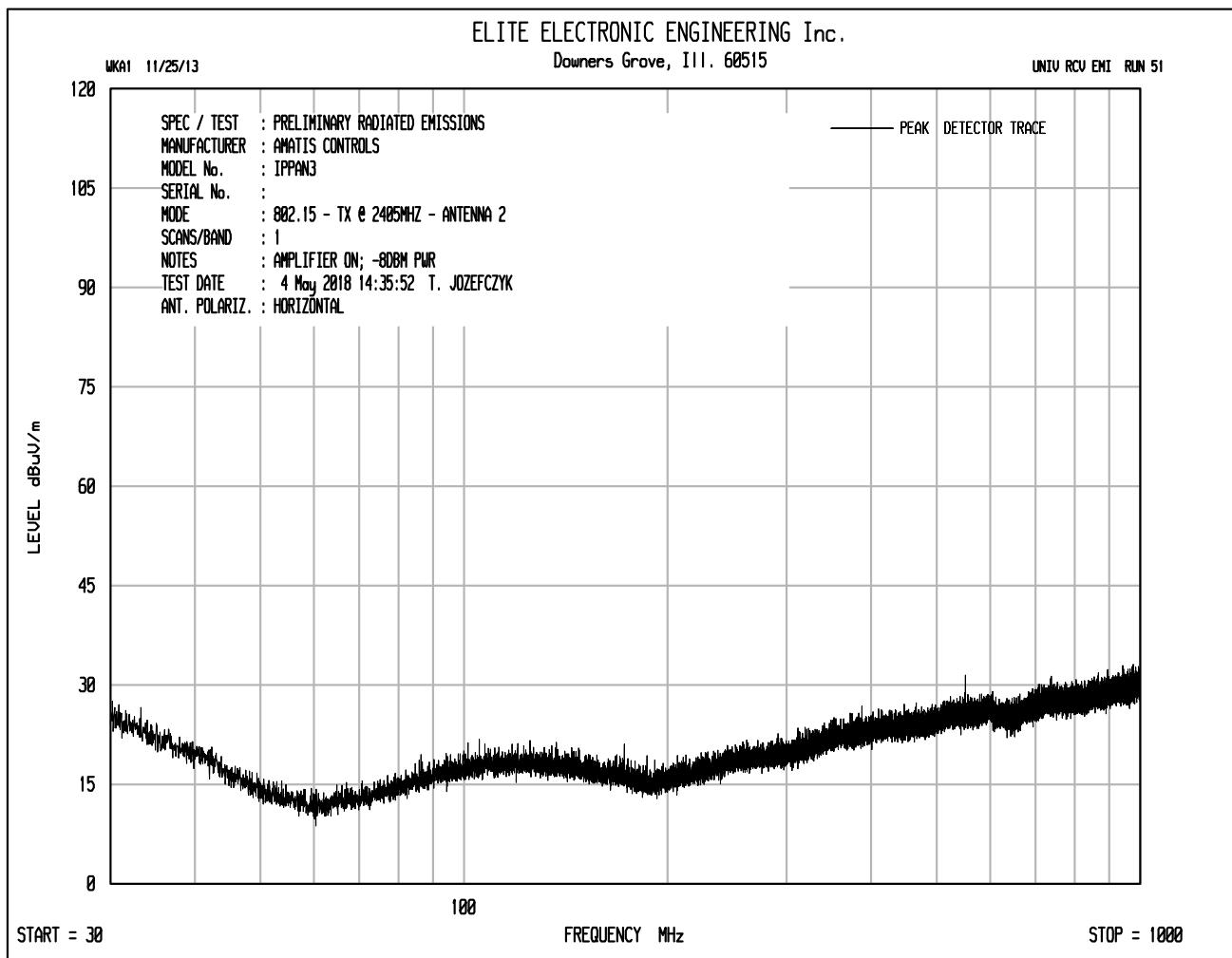


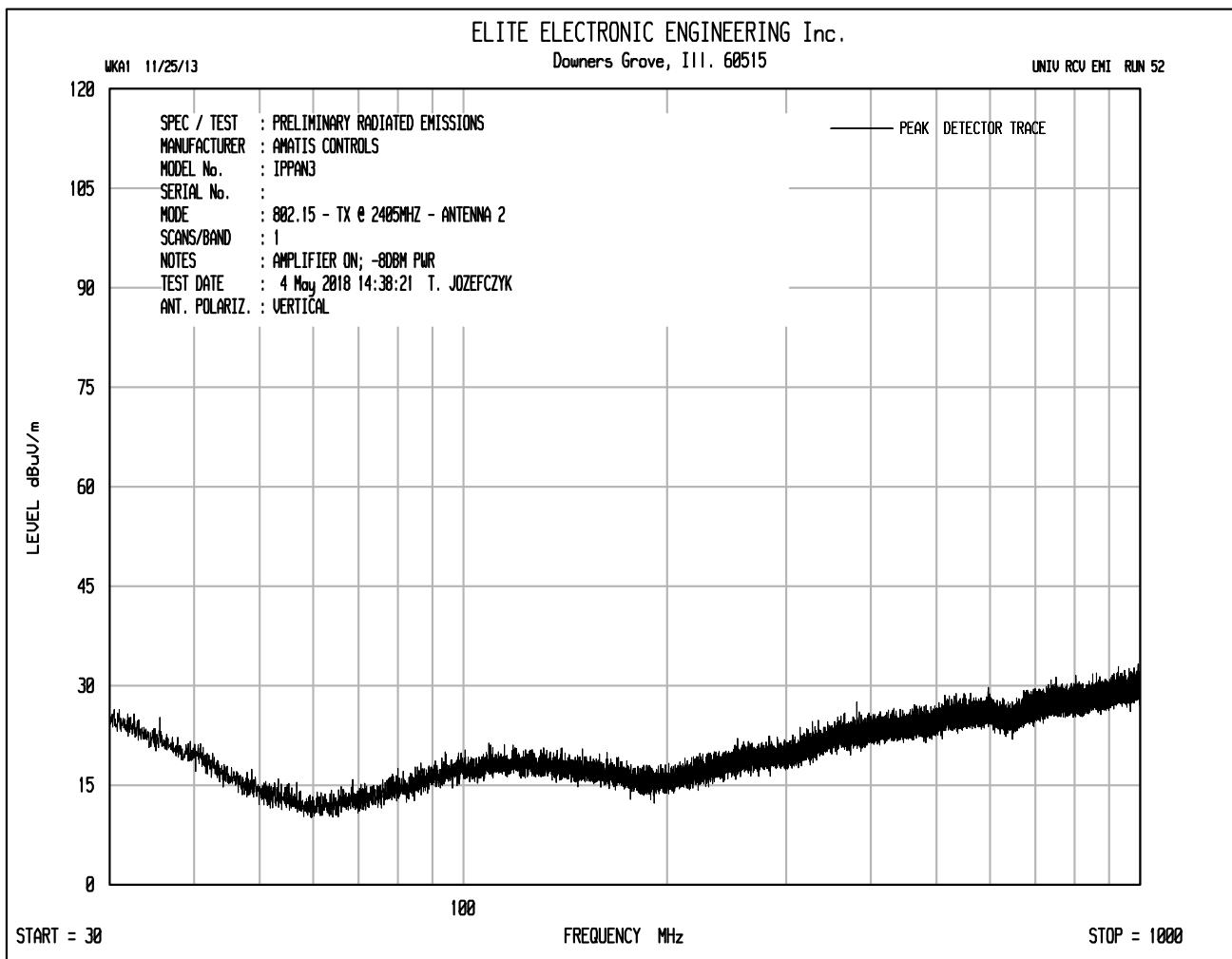
ELITE ELECTRONIC ENGINEERING Inc.

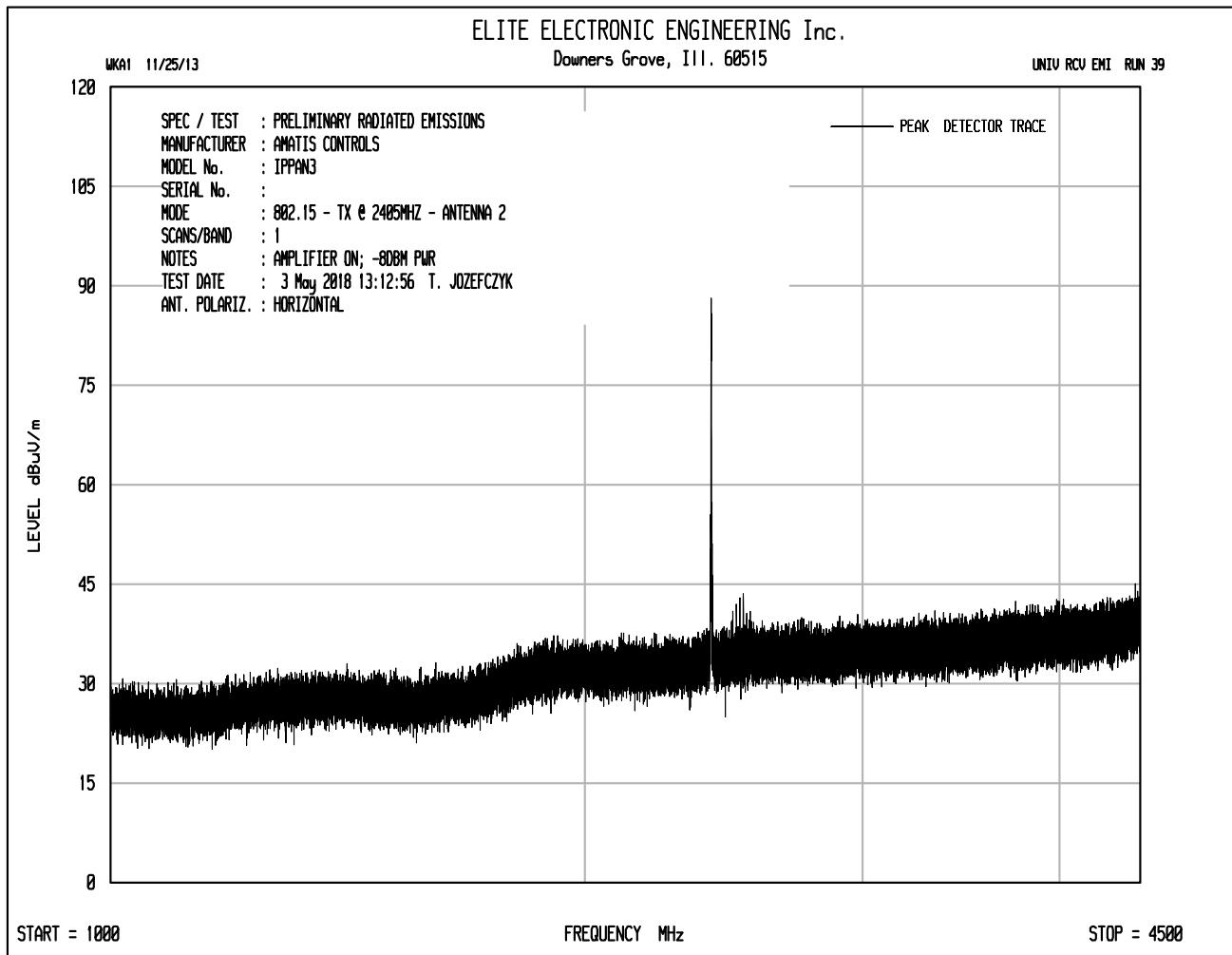
Downers Grove, Ill. 60515

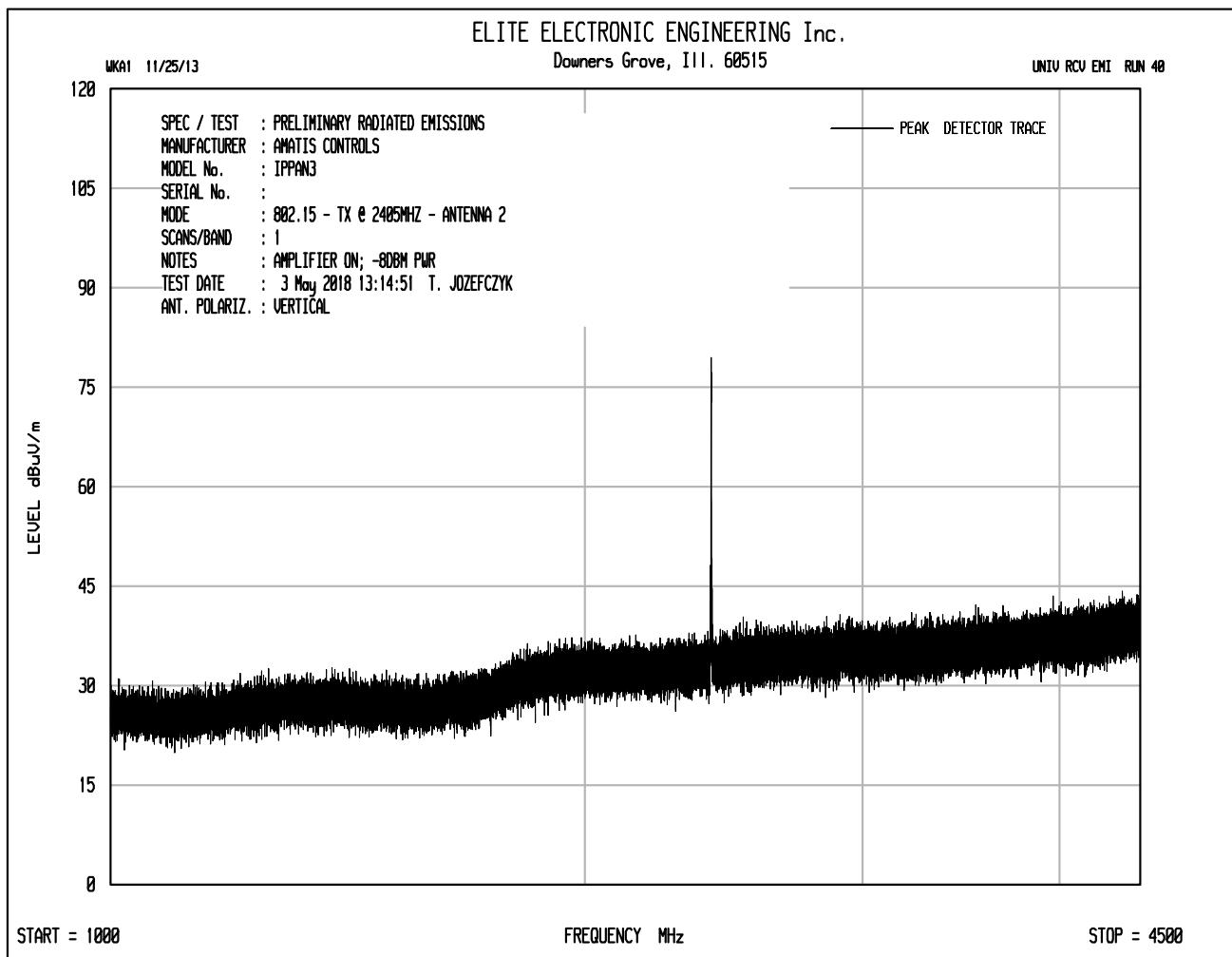
UNIV RCV EMI RUN 16

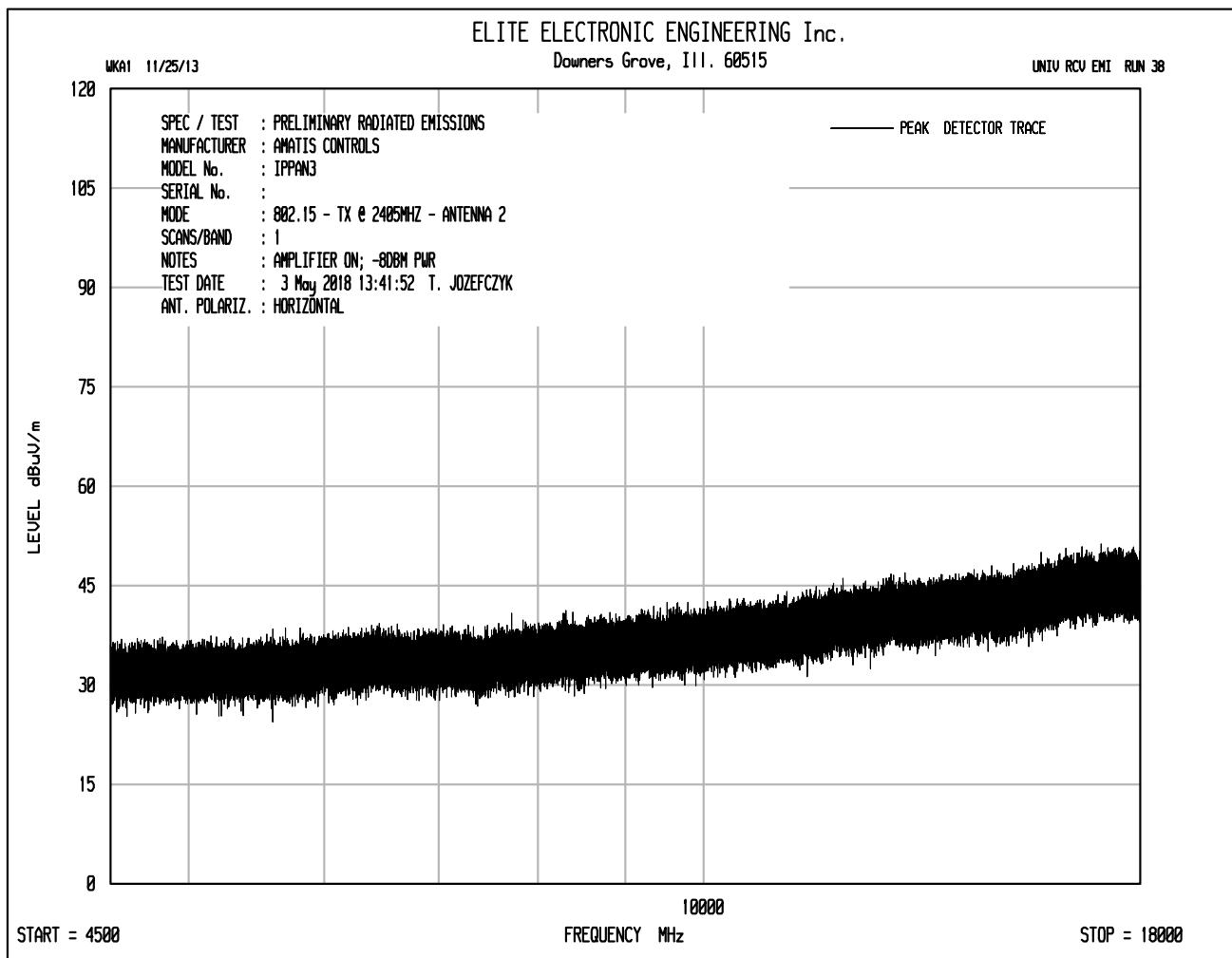


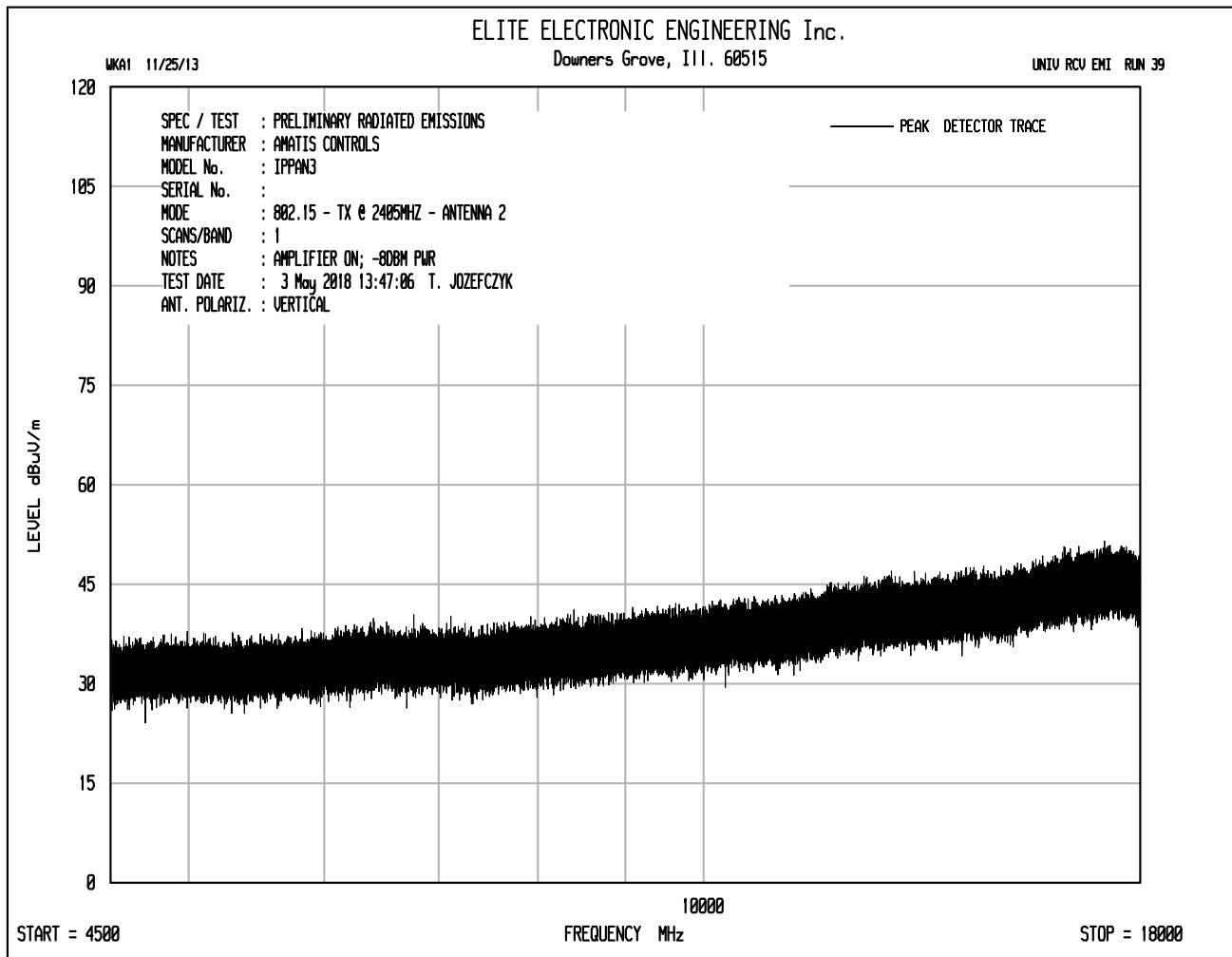








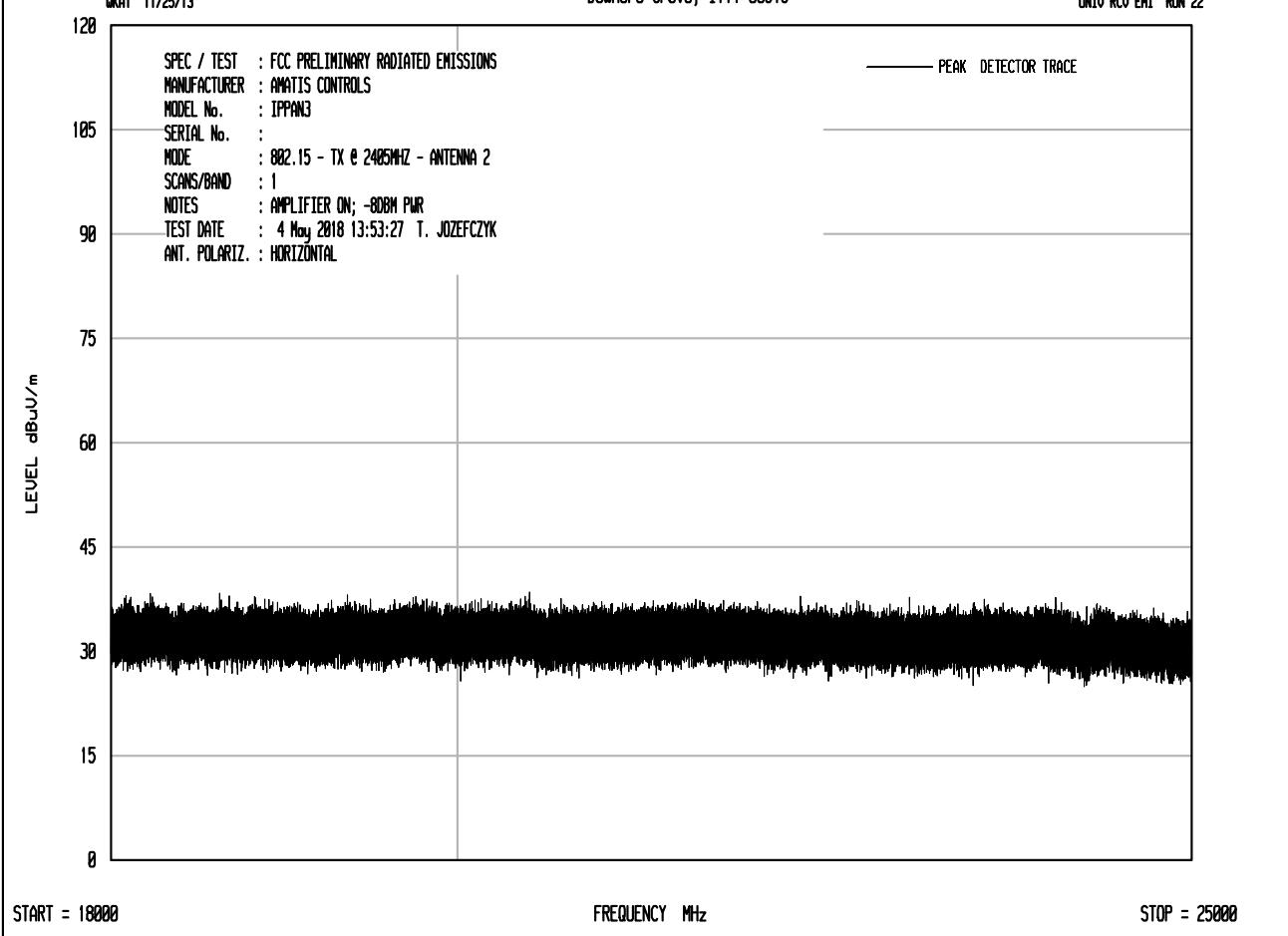




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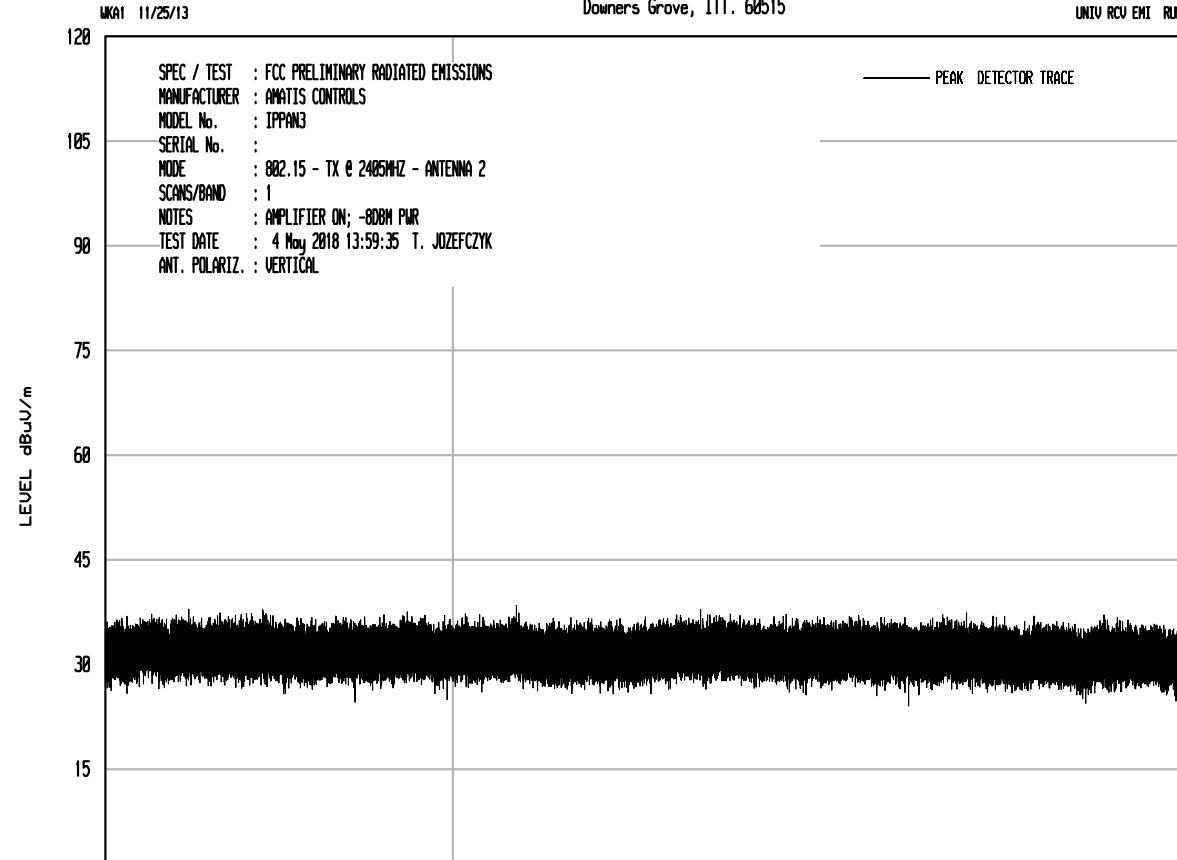
UNIV RCV EMI RUN 22

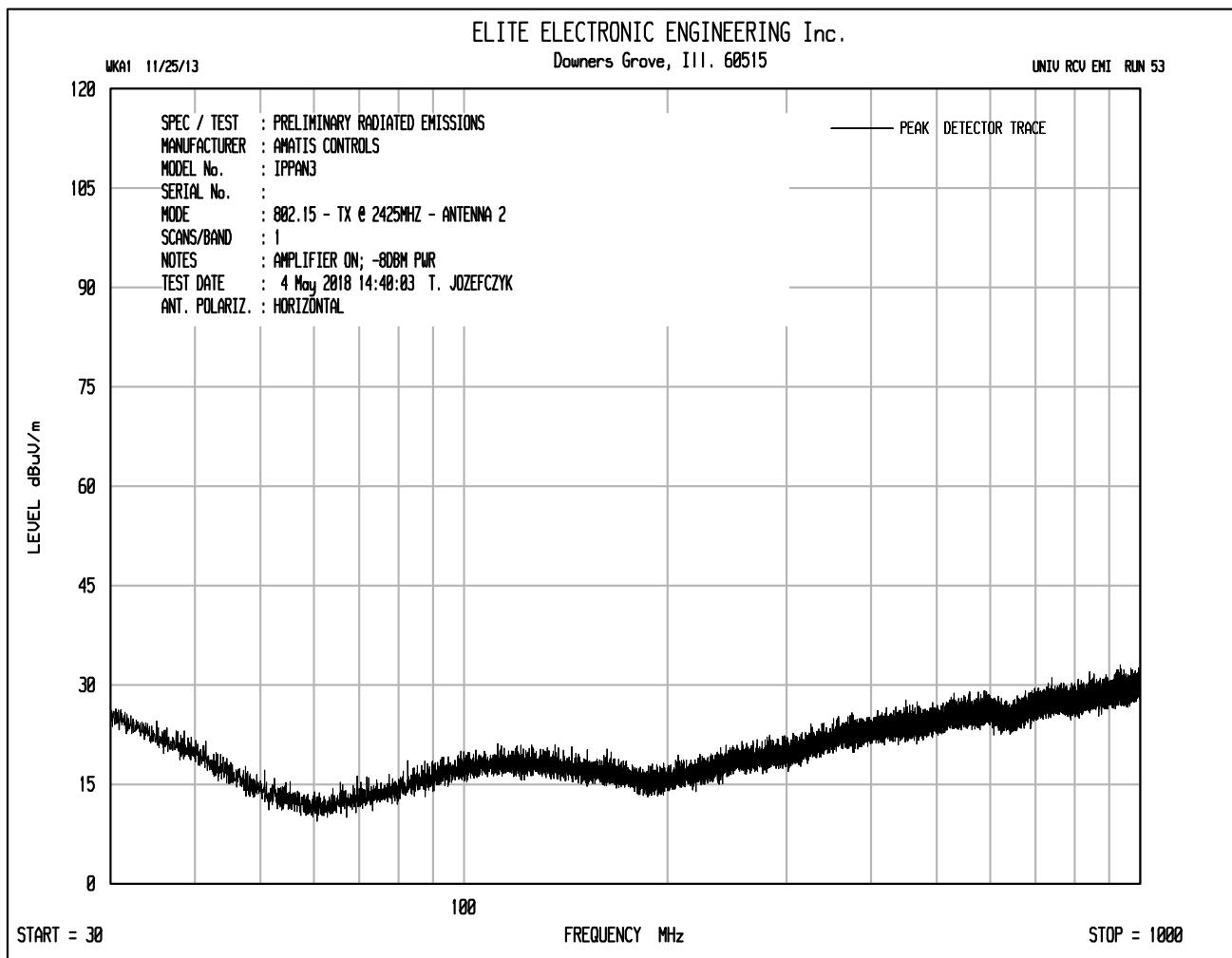


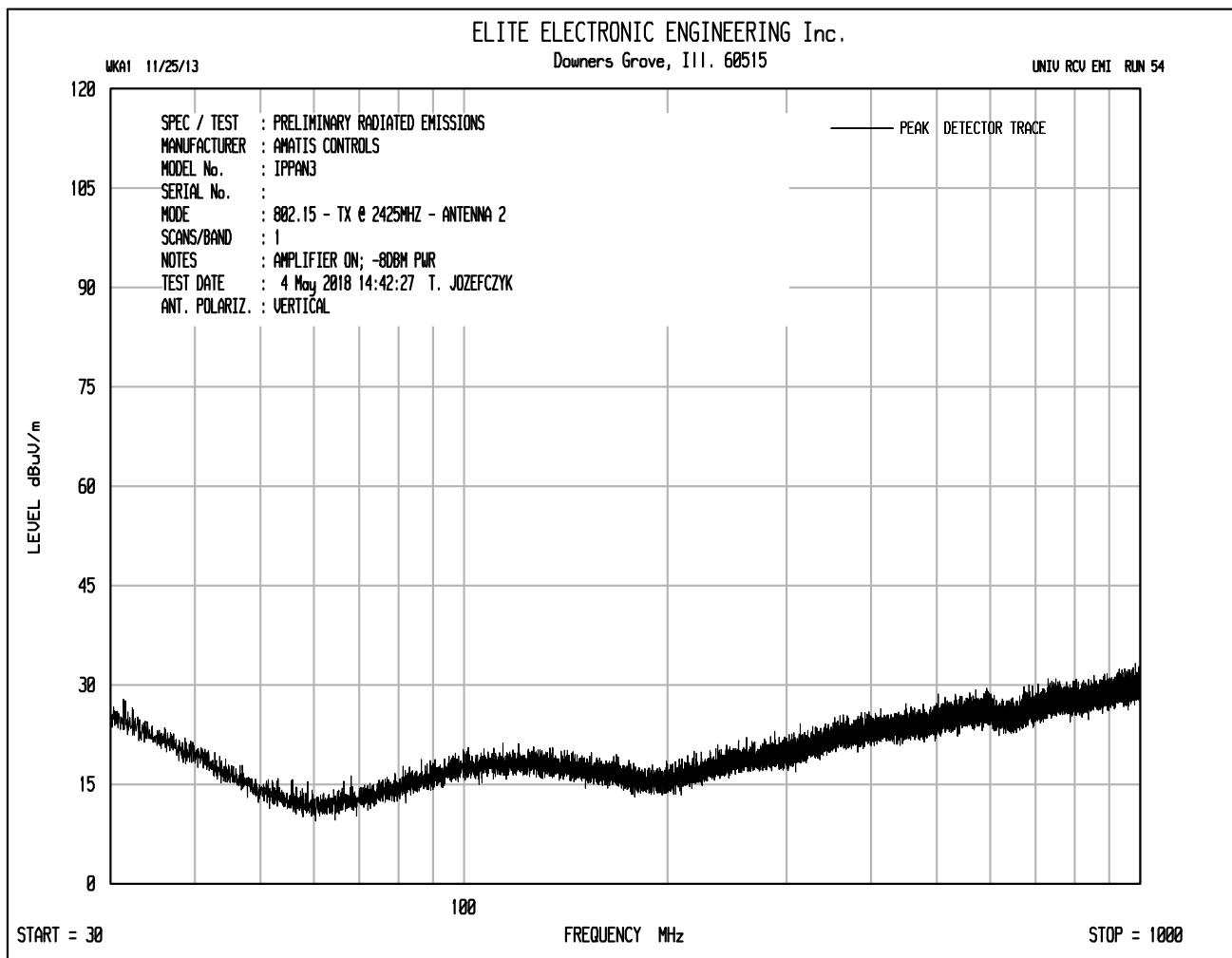
ELITE ELECTRONIC ENGINEERING Inc.

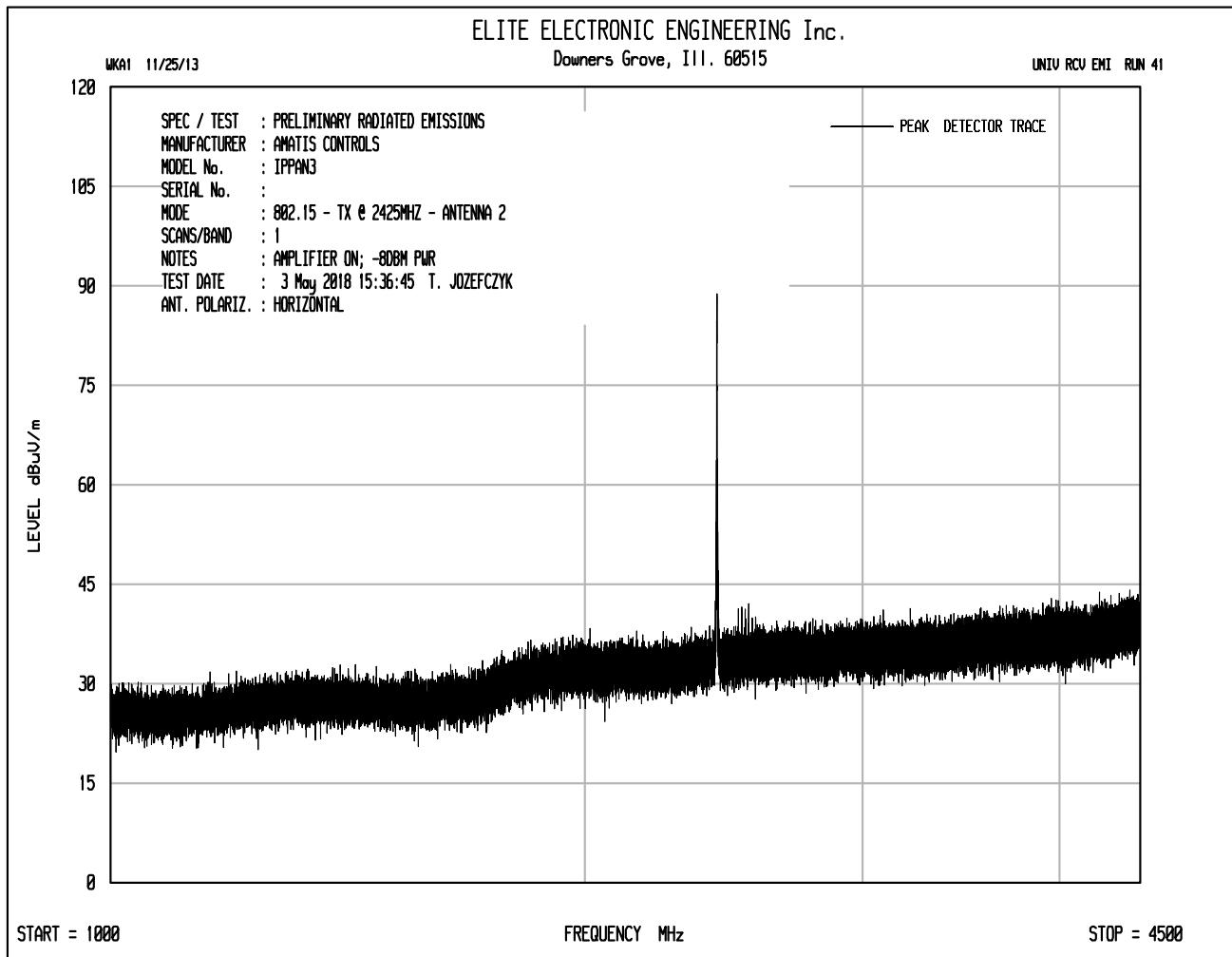
Downers Grove, Ill. 60515

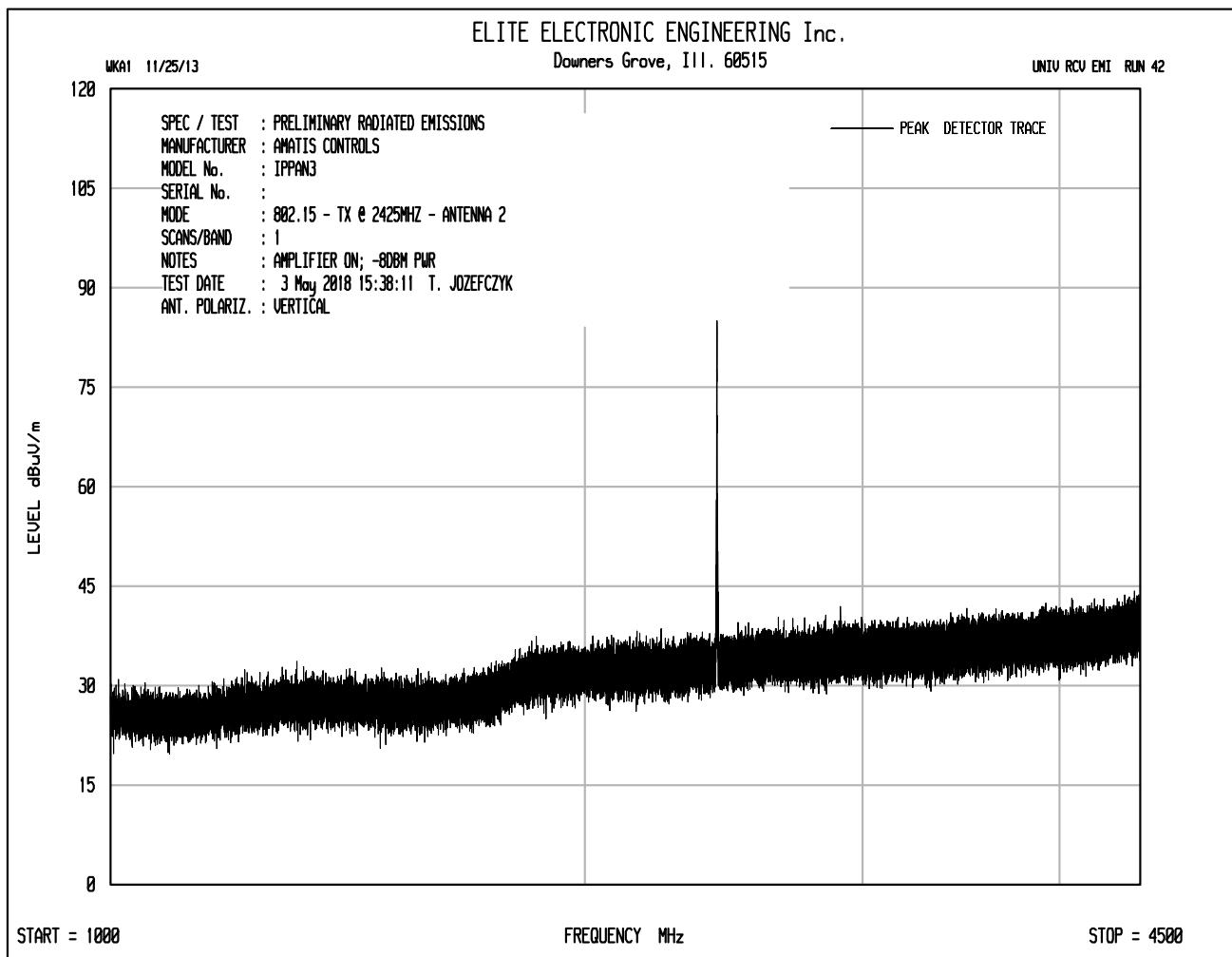
UNIV RCV EMI RUN 23

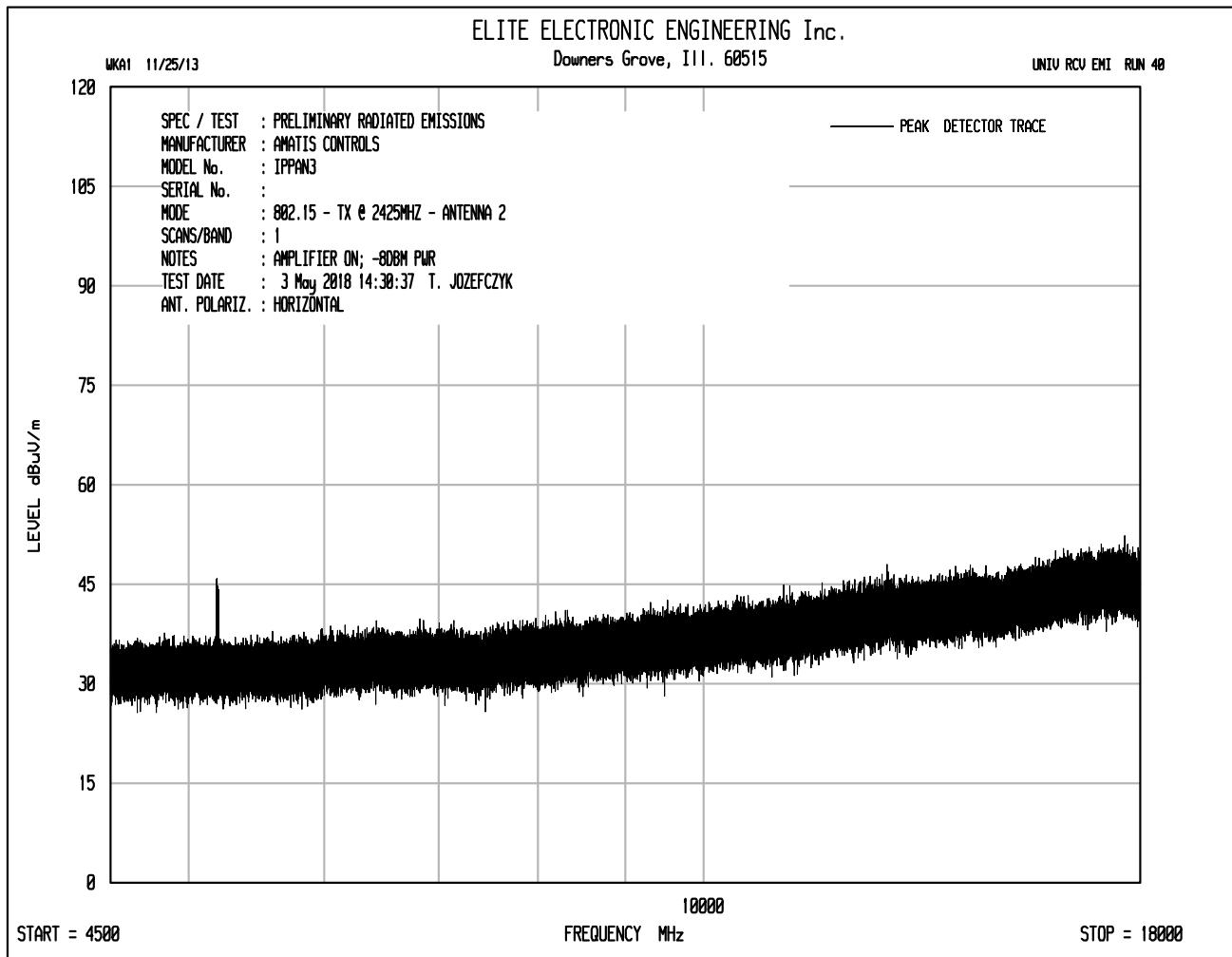


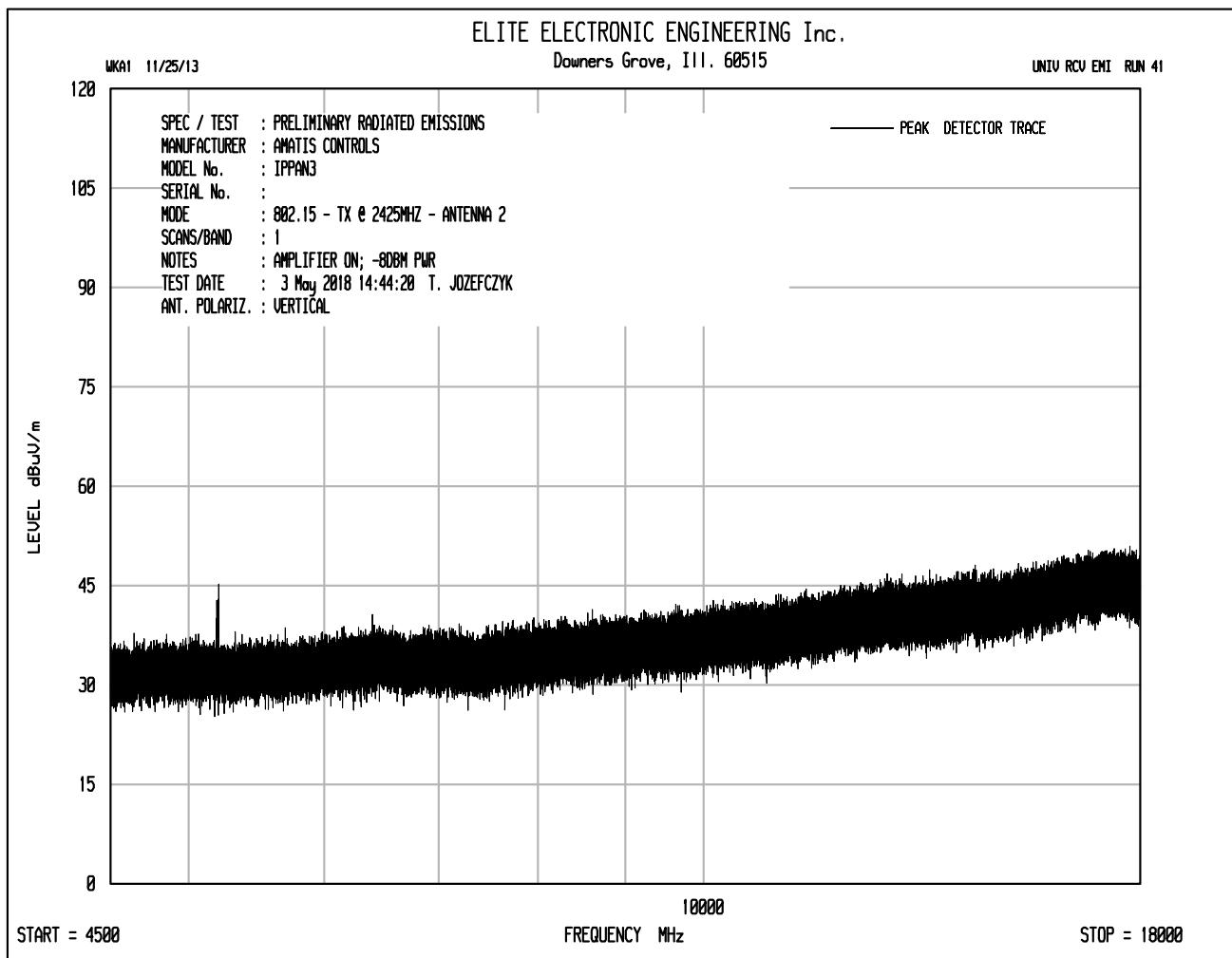










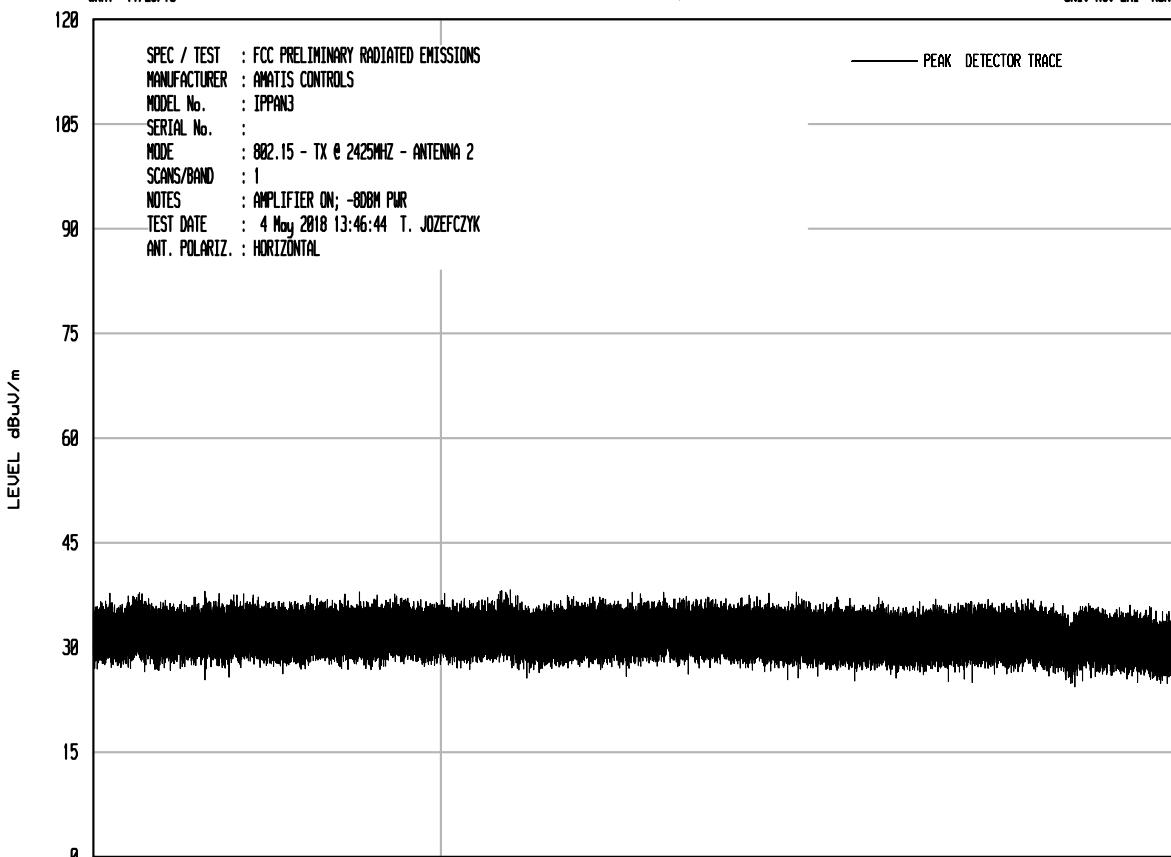


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UNIV RCV EMI RUN 21

WKA1 11/25/13



START = 18000

FREQUENCY MHz

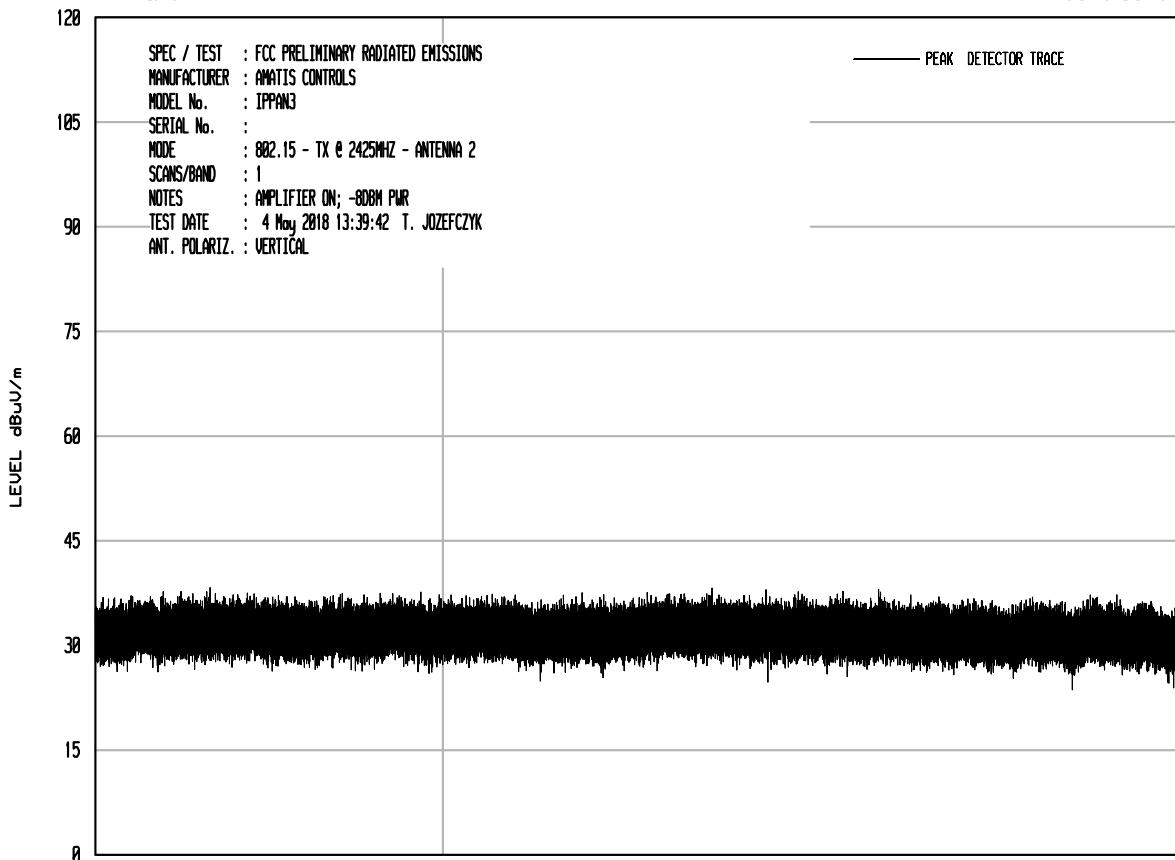
STOP = 25000

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UNIV RCV EMI RUN 28

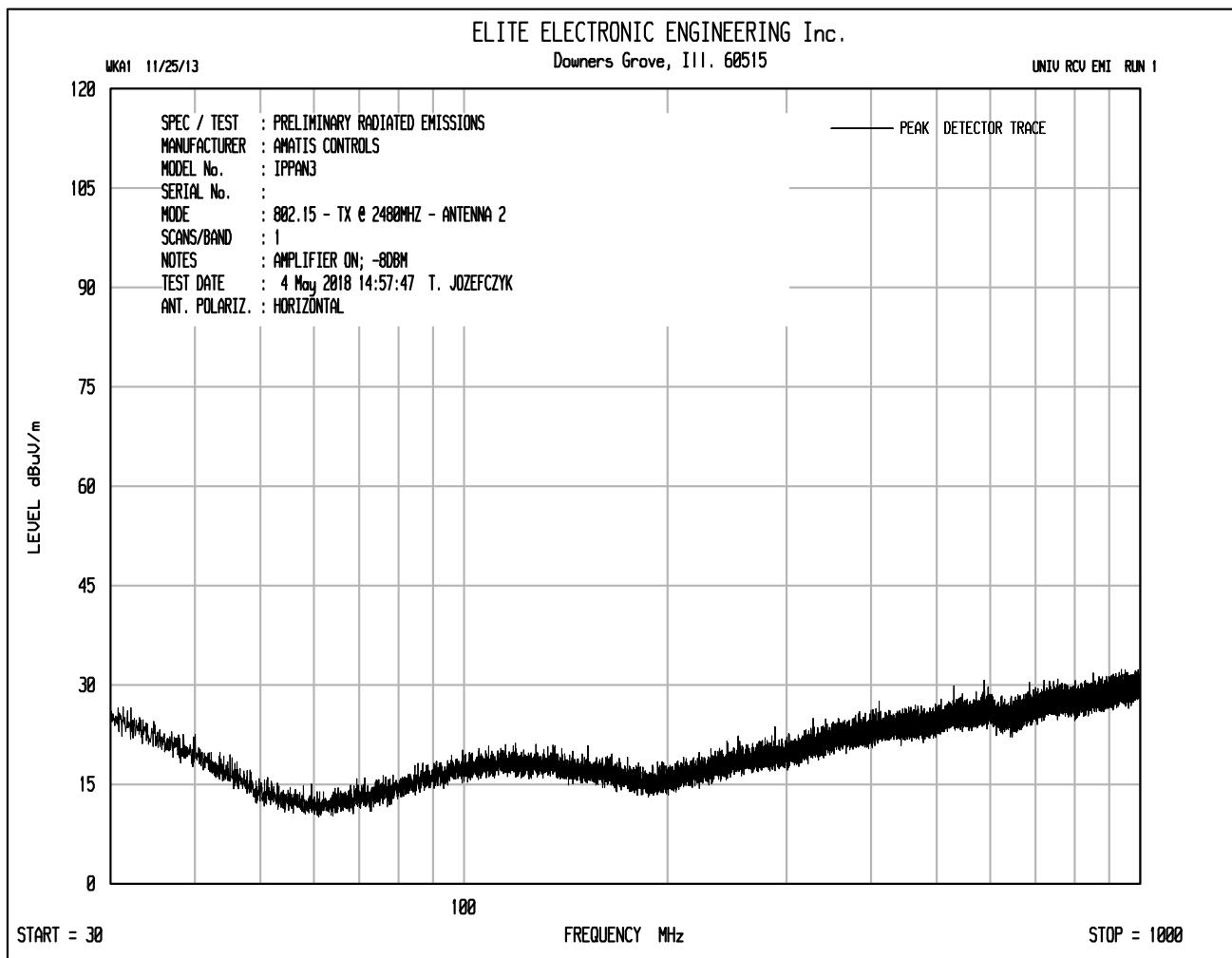
WKA1 11/25/13

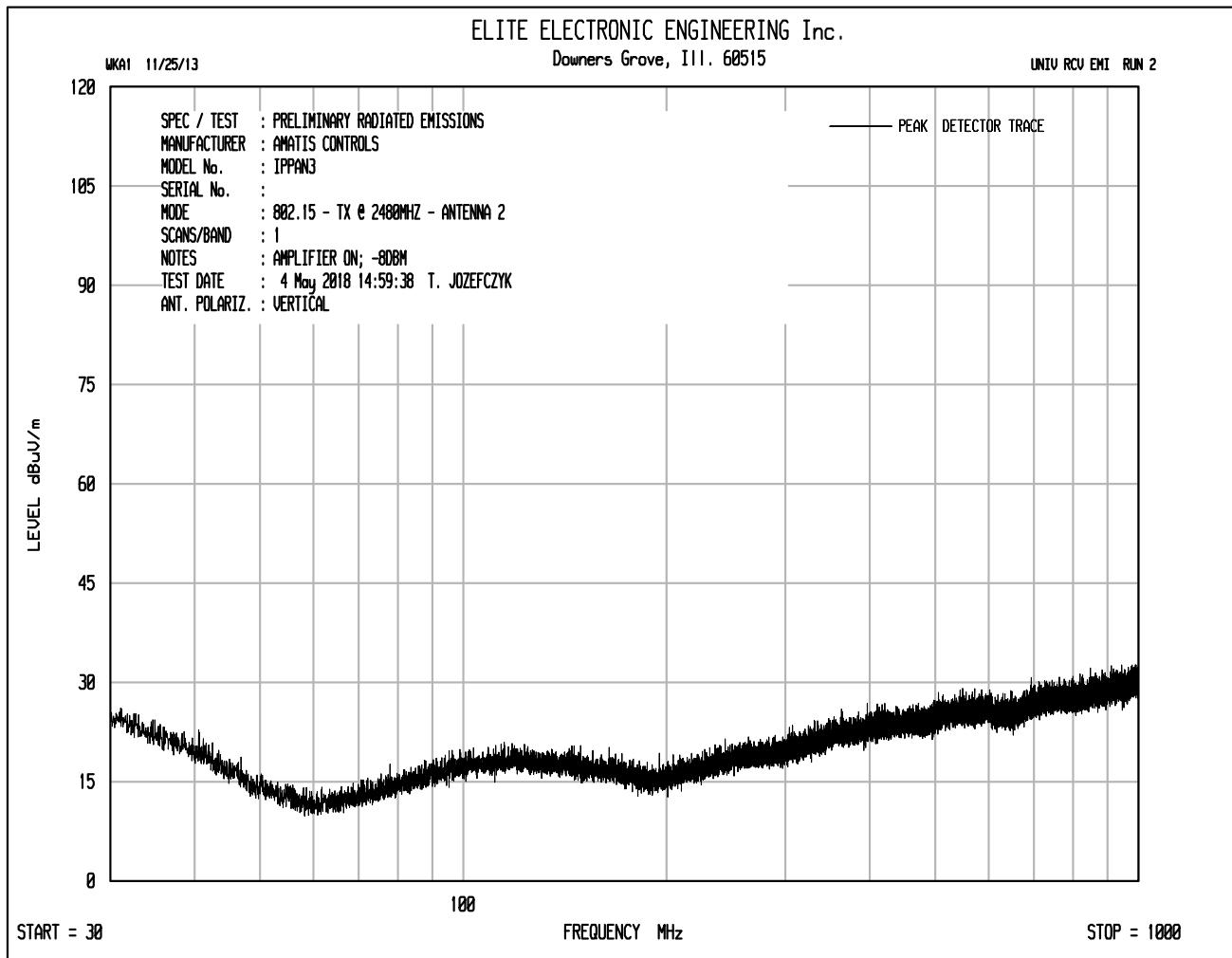


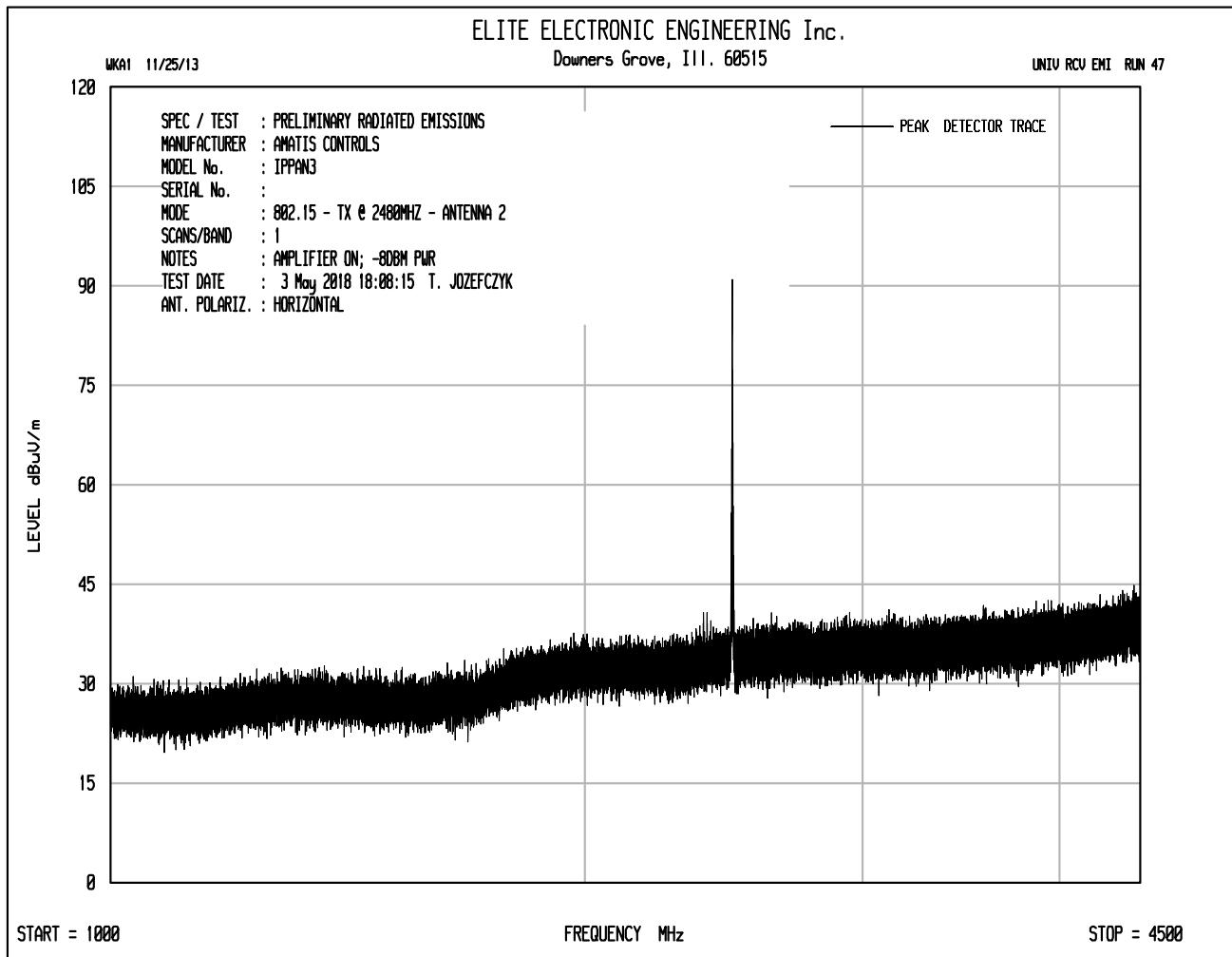
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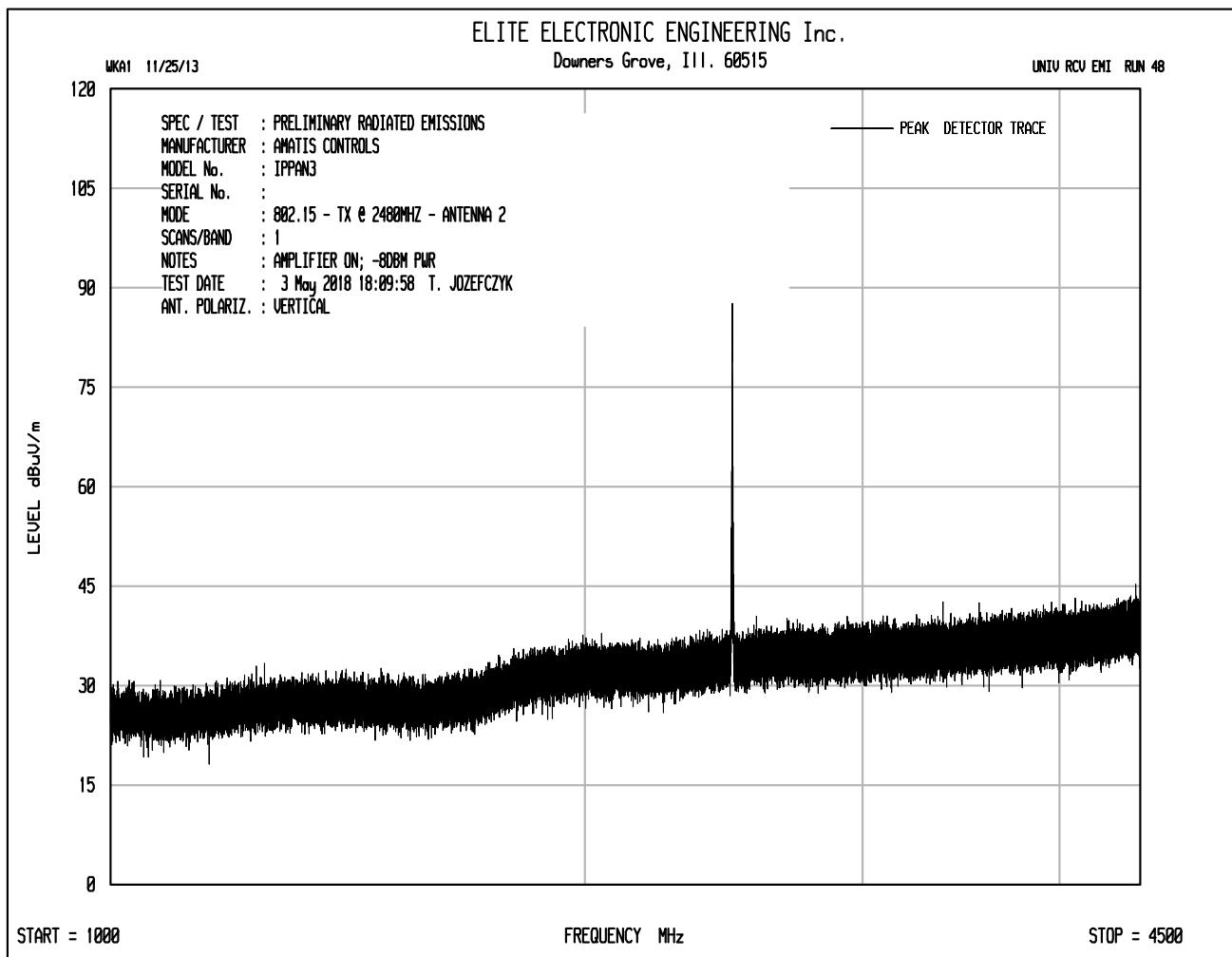
FREQUENCY MHz

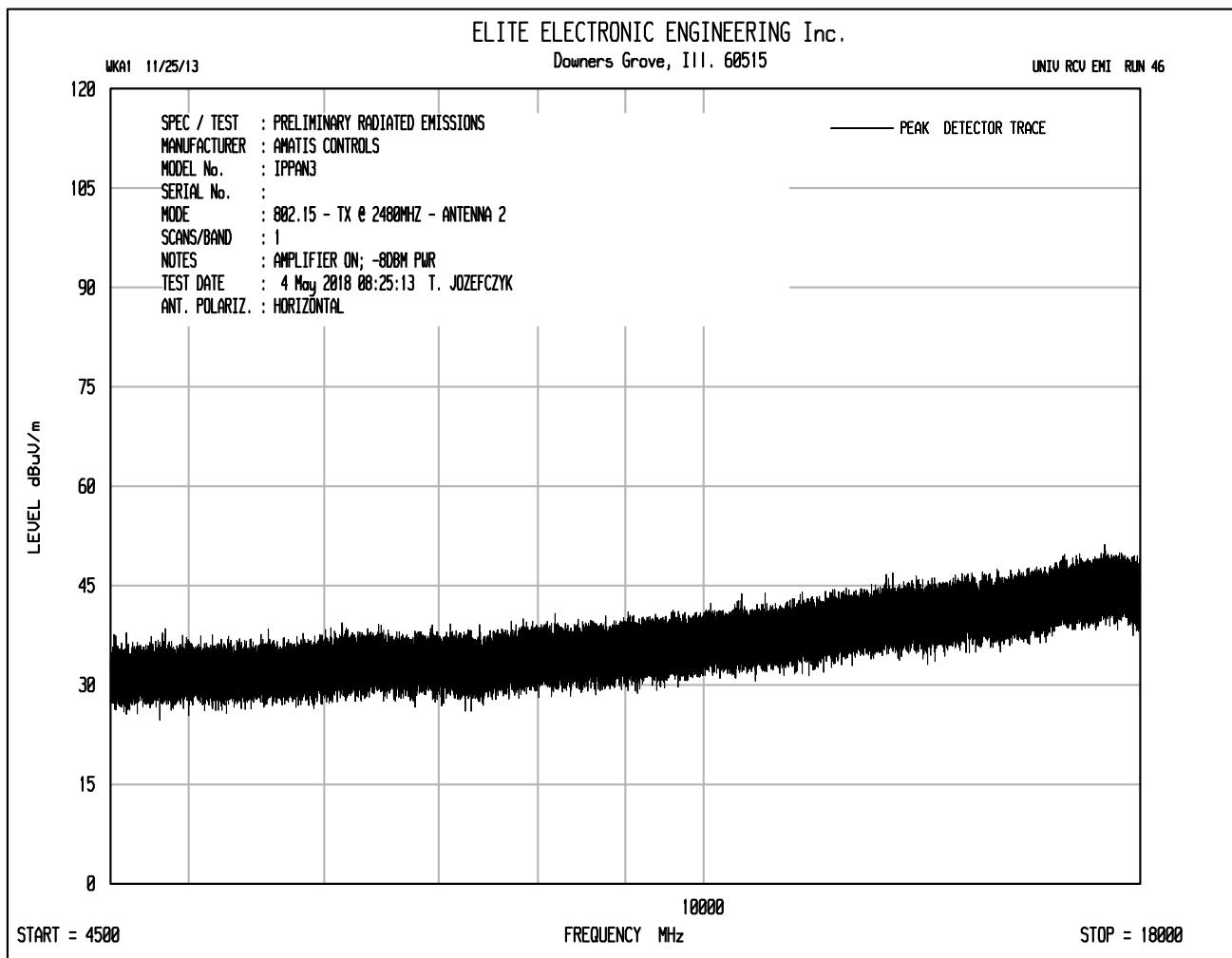
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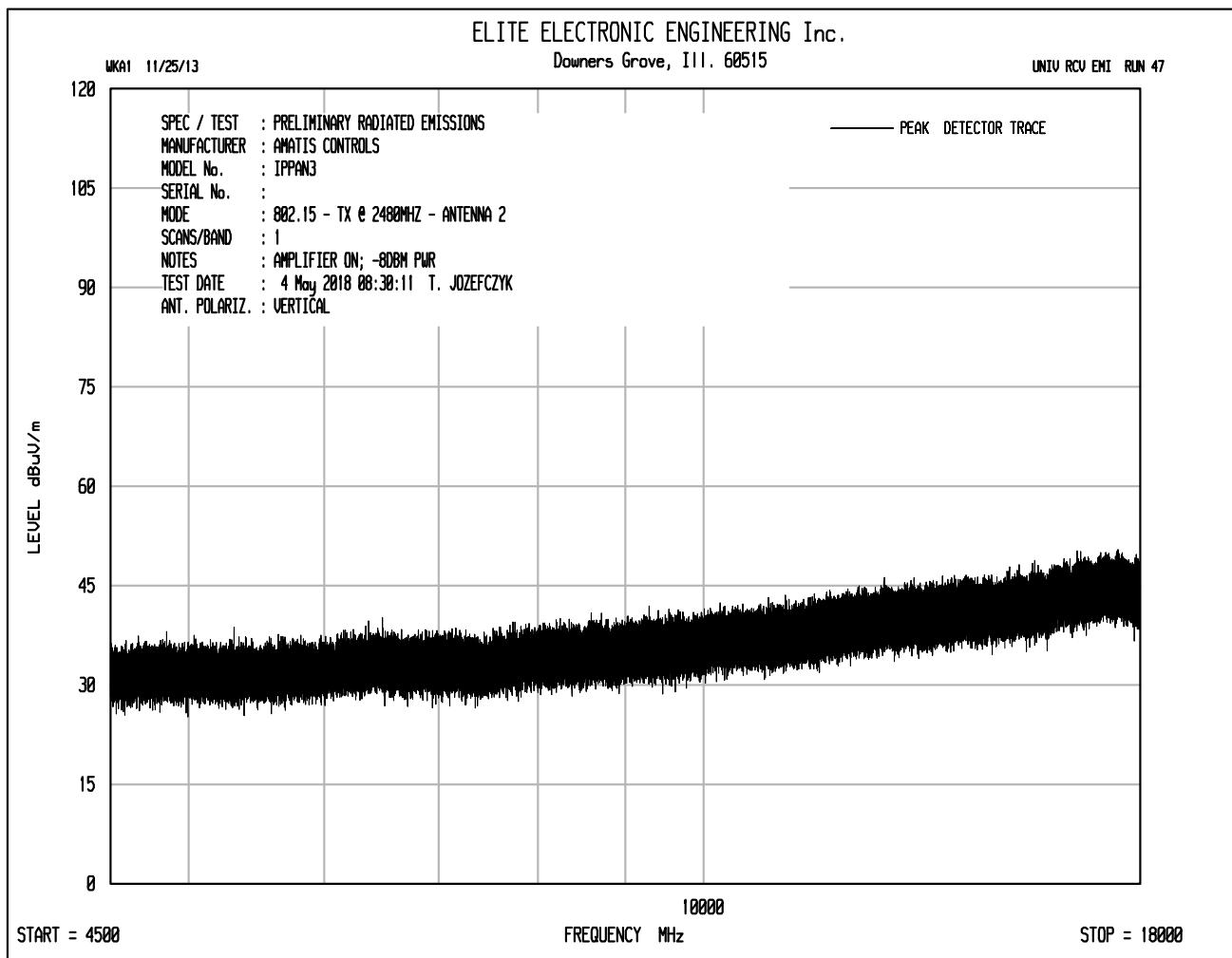










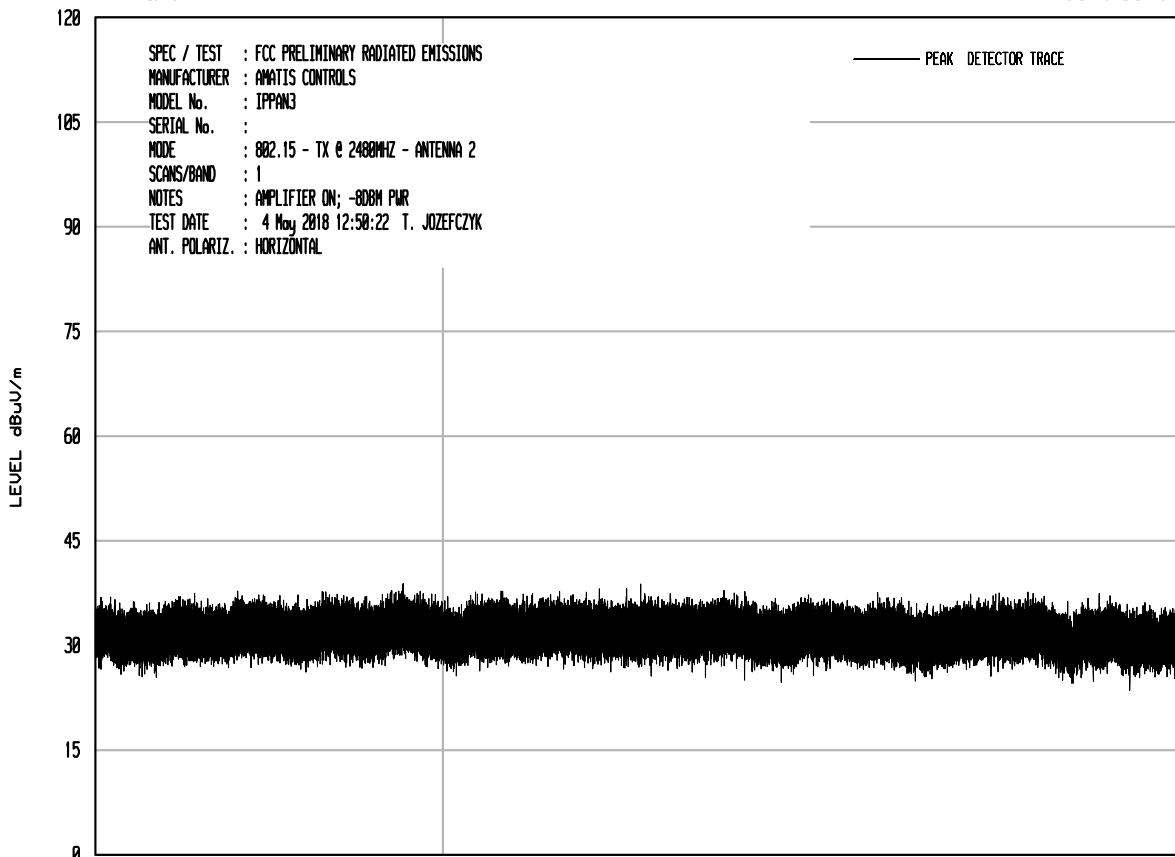


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UNIV RCV EMI RUN 14

WKA1 11/25/13



START = 18000

FREQUENCY MHz

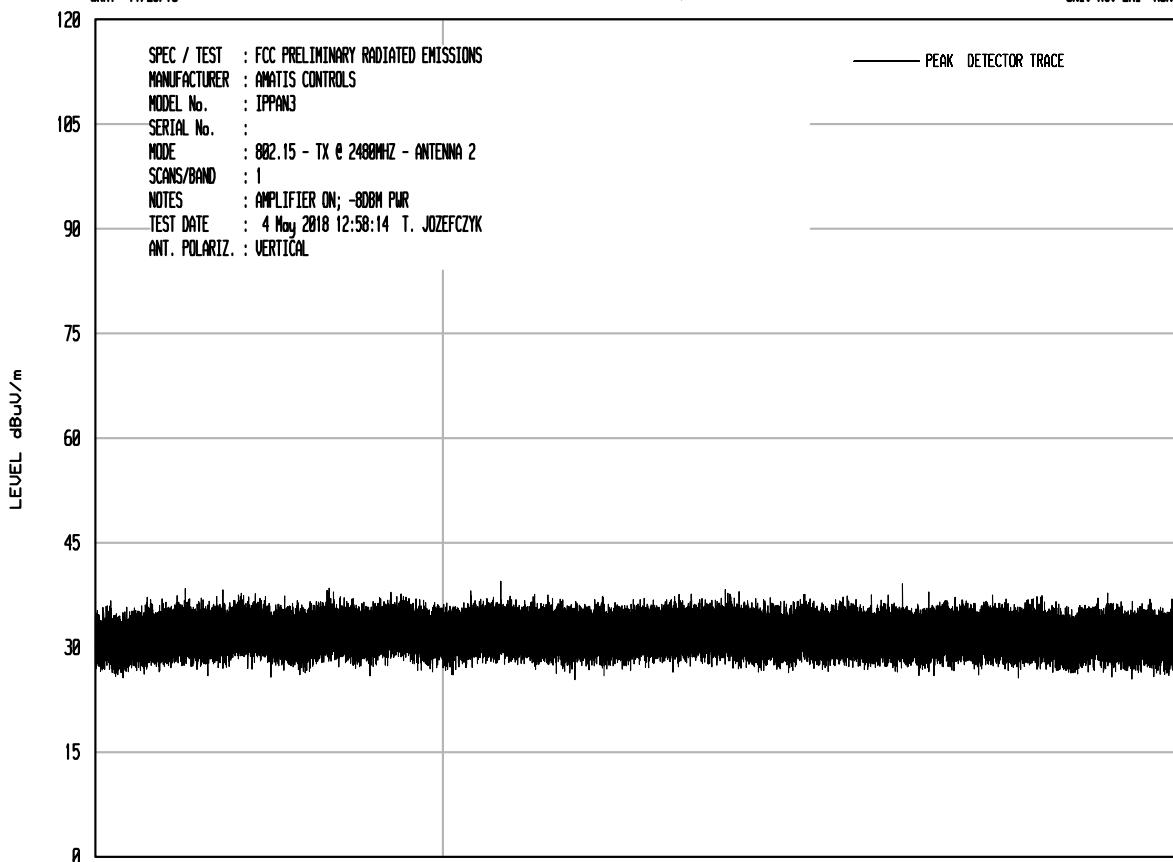
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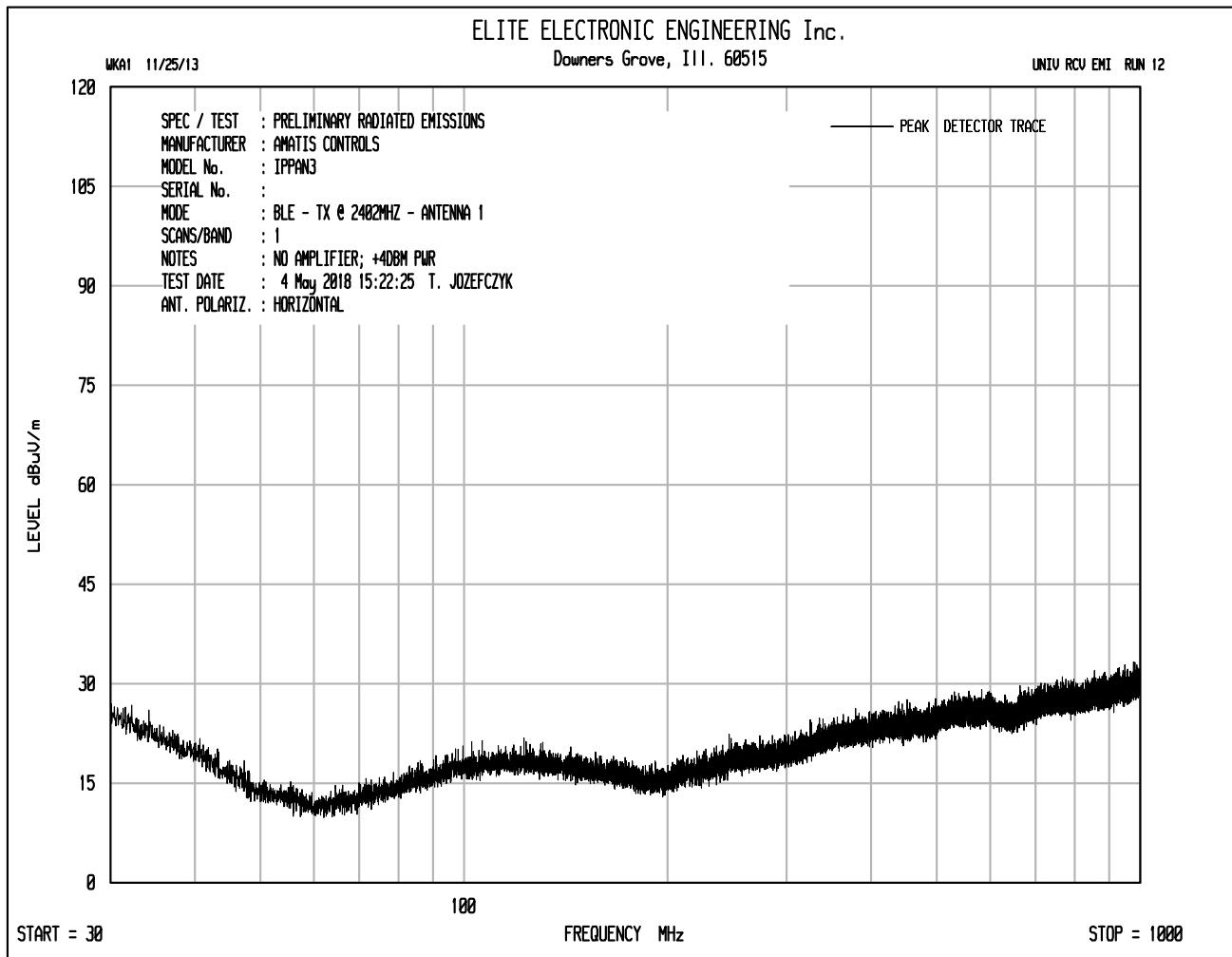
ELITE ELECTRONIC ENGINEERING Inc.

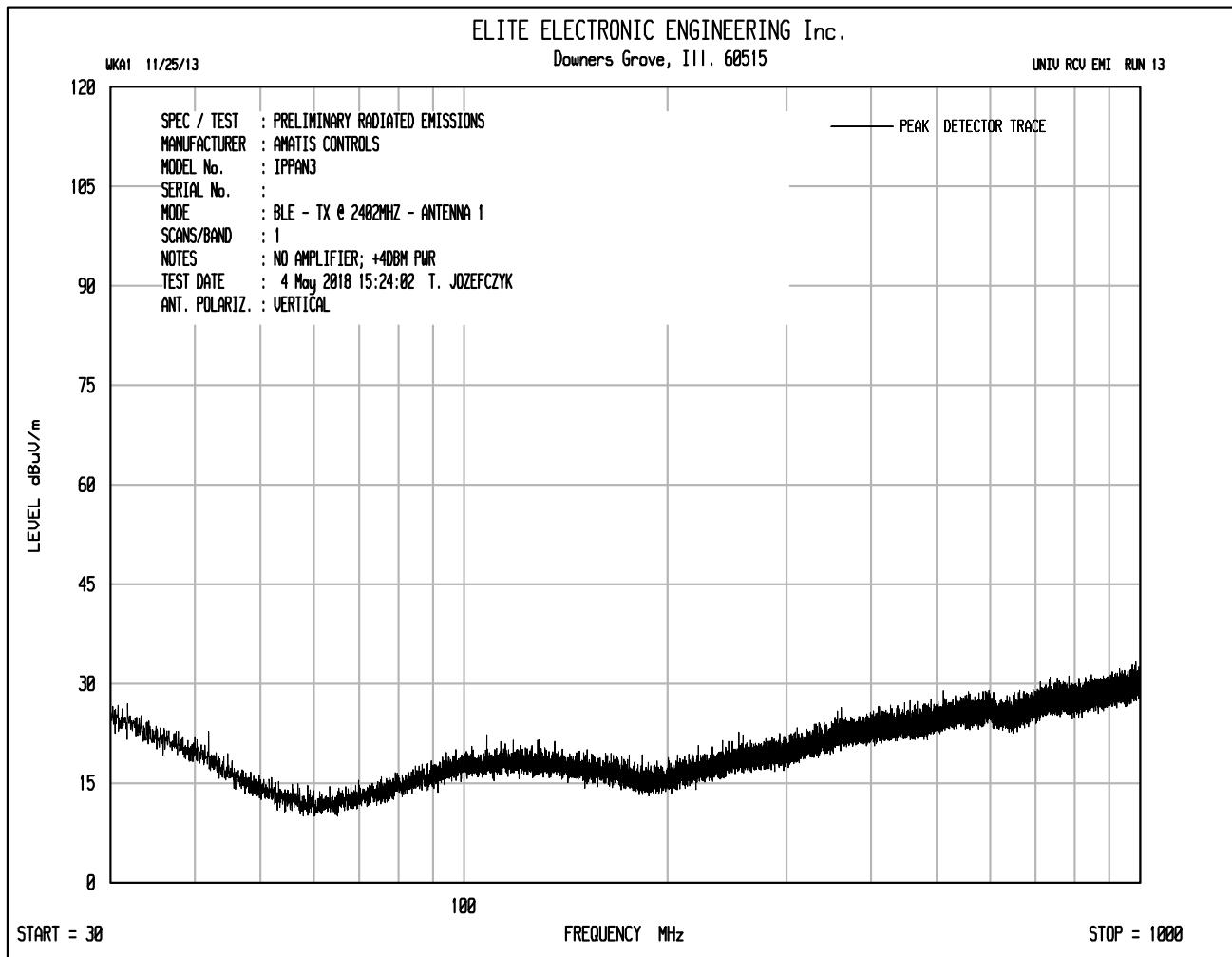
Downers Grove, Ill. 60515

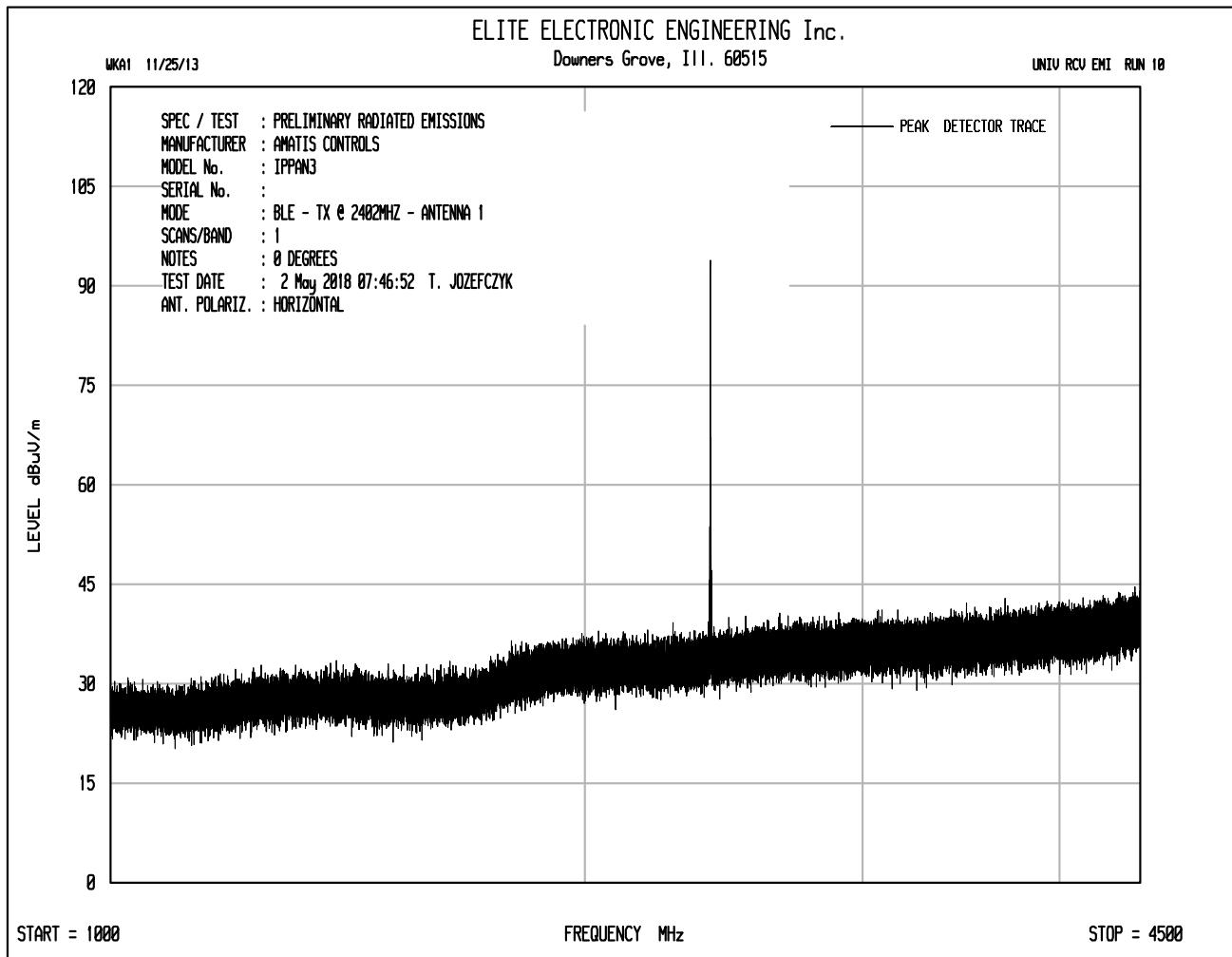
UNIV RCV EMI RUN 15

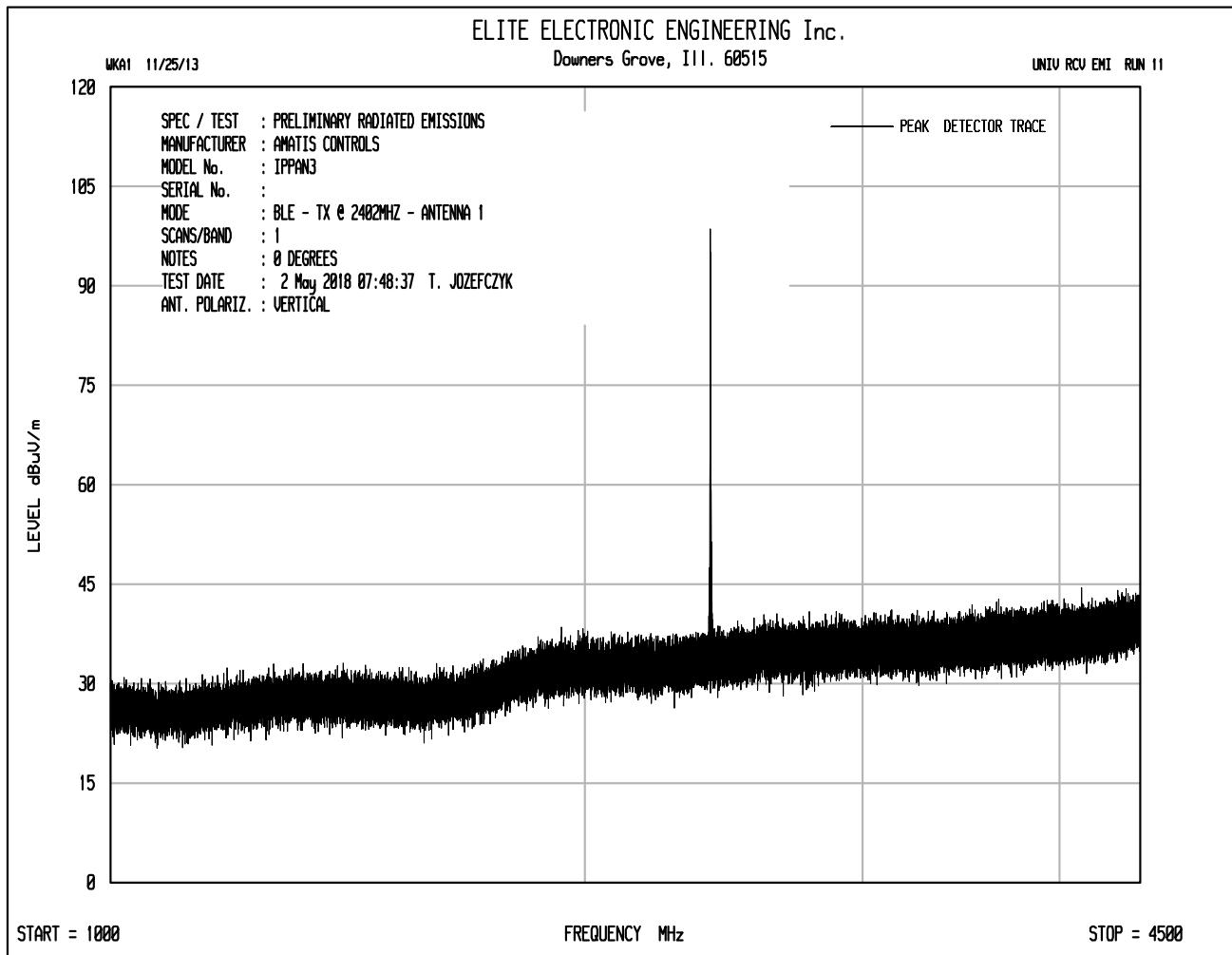
WKA1 11/25/13

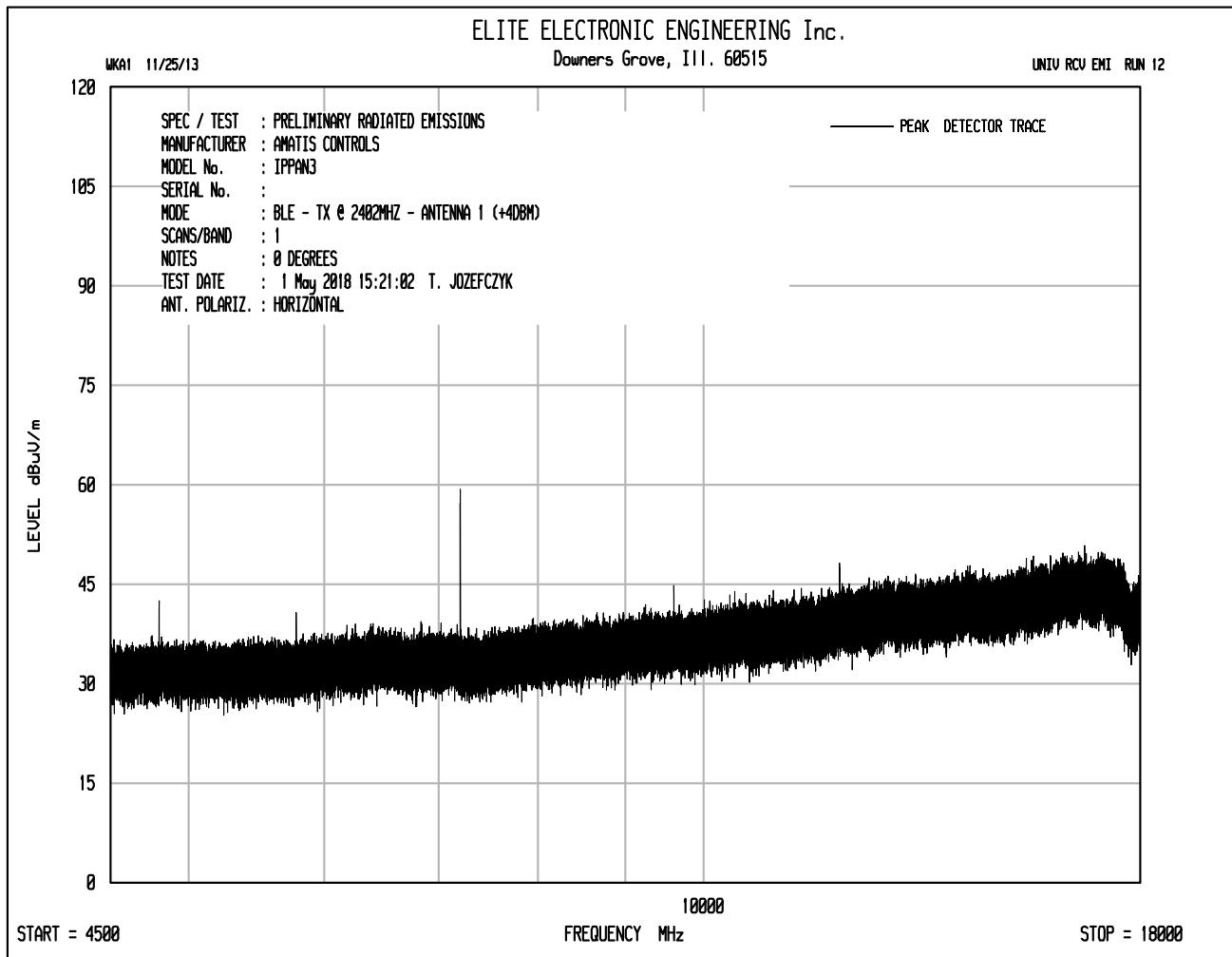


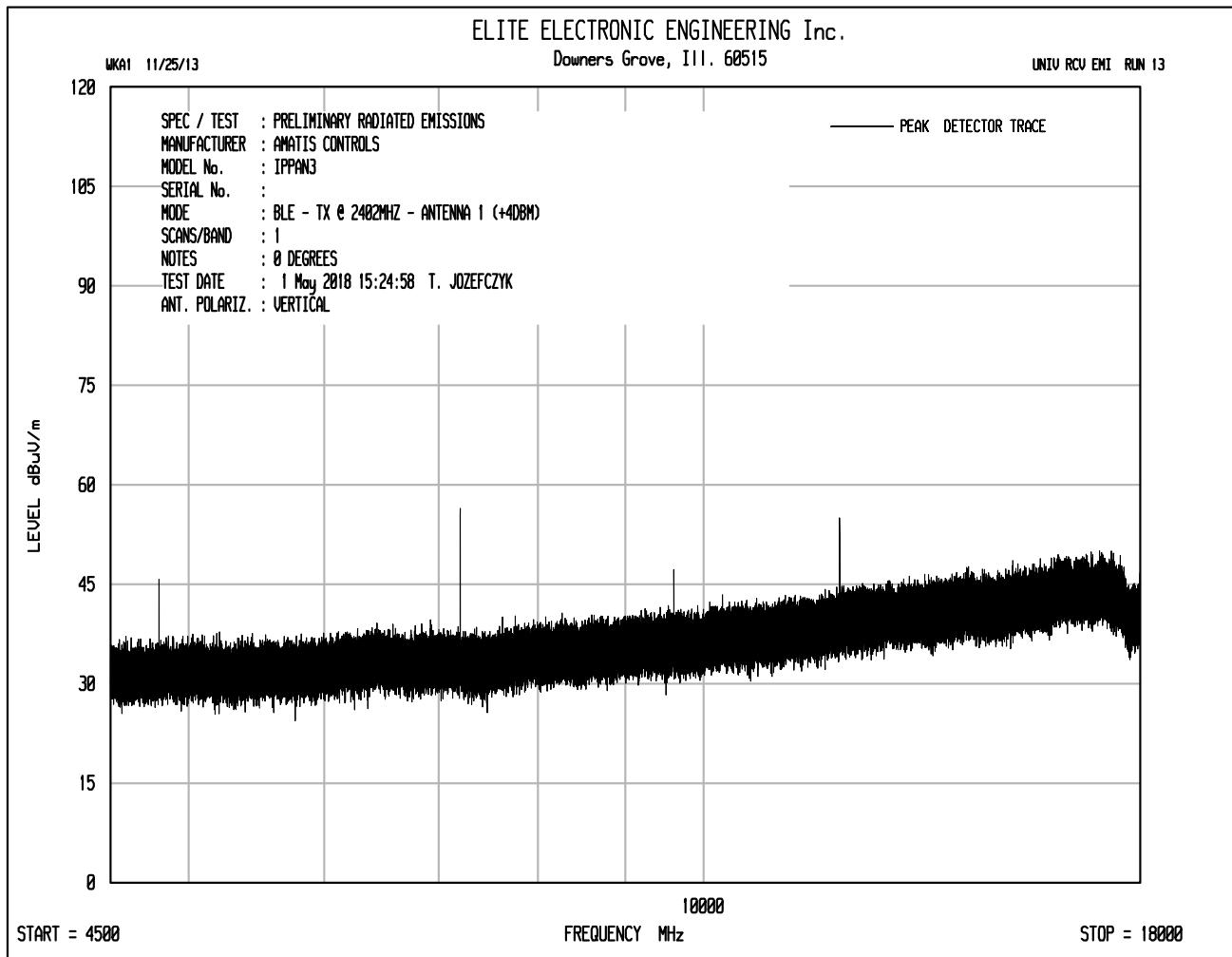










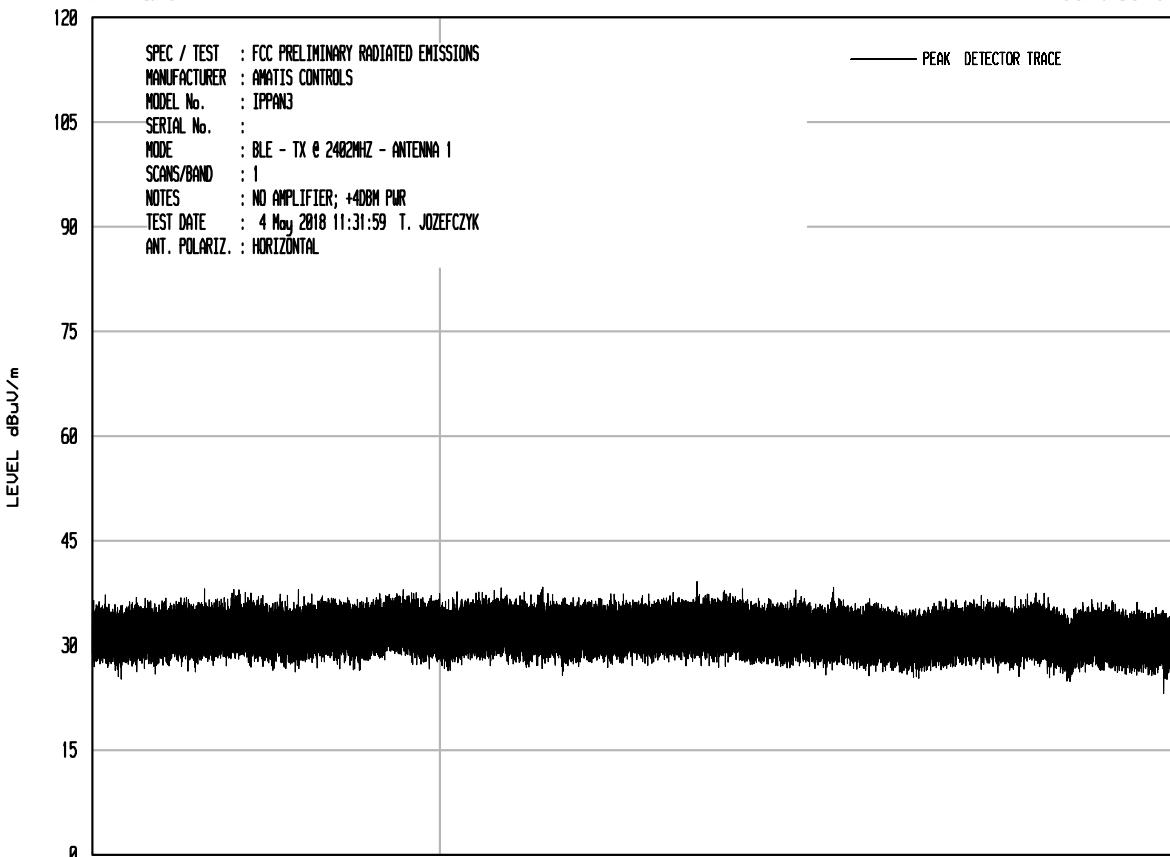


ELITE ELECTRONIC ENGINEERING Inc.

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UNIV RCV EMI RUN 9

WKA1 11/25/13



START = 18000

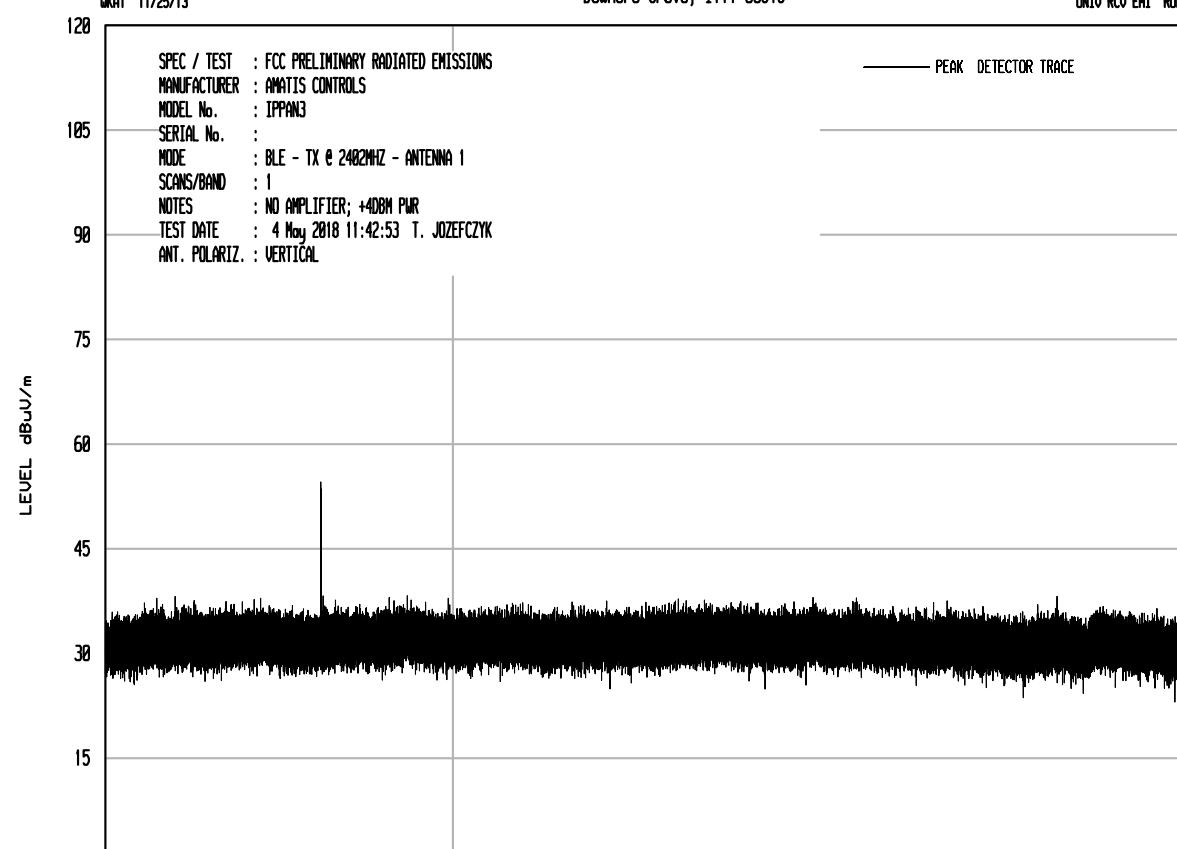
FREQUENCY MHz

STOP = 25000

ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

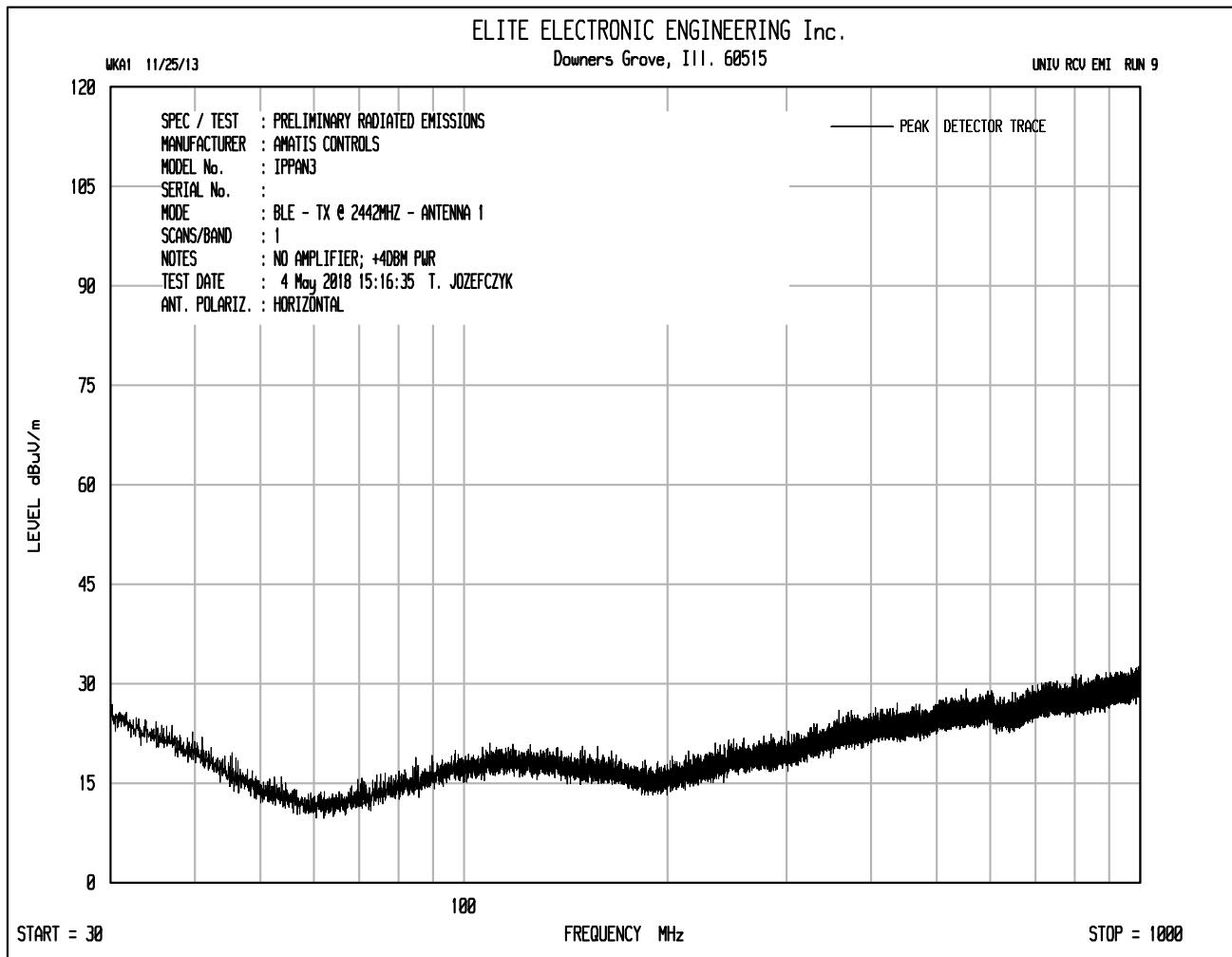
UNIV RCV EMI RUN 10

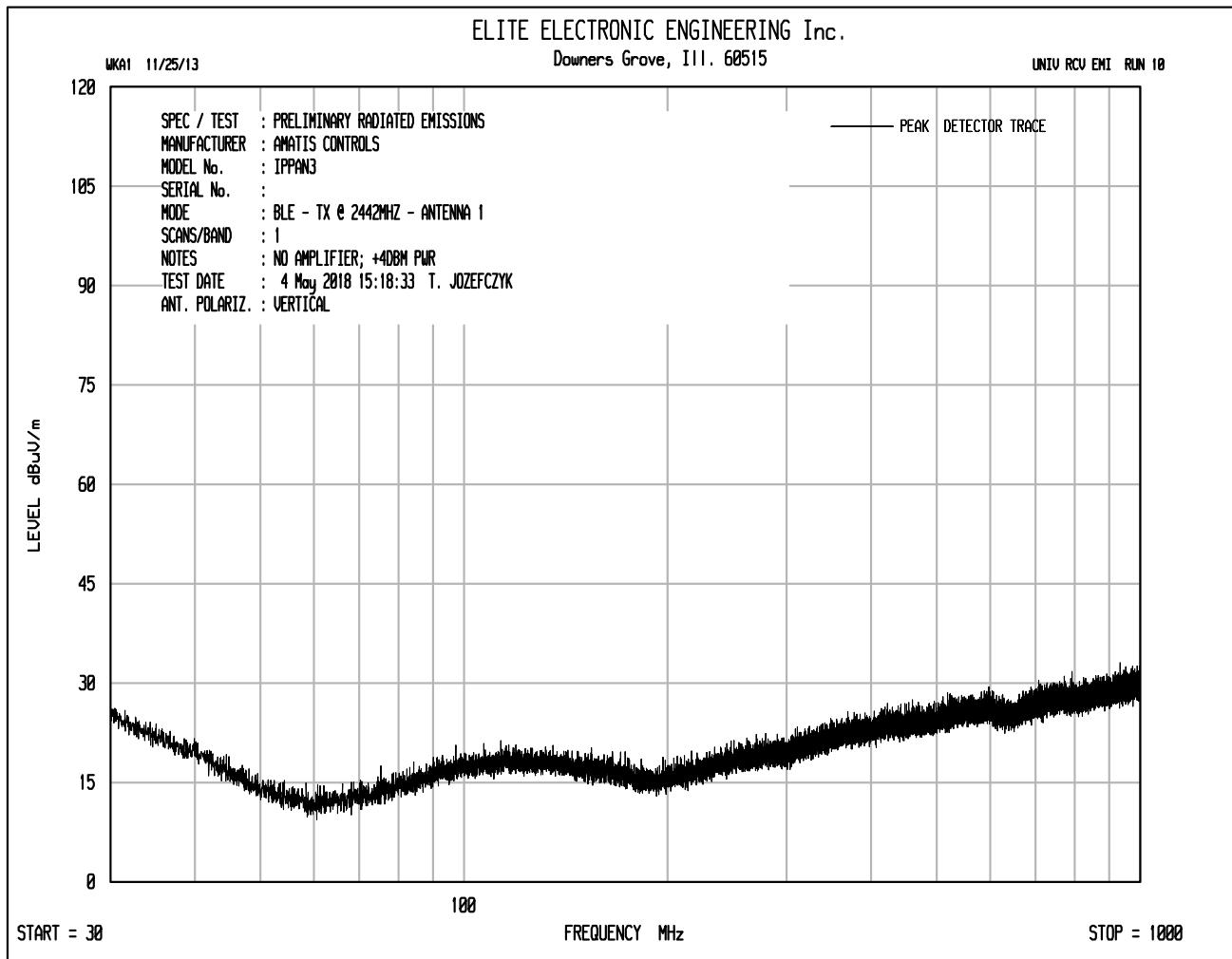


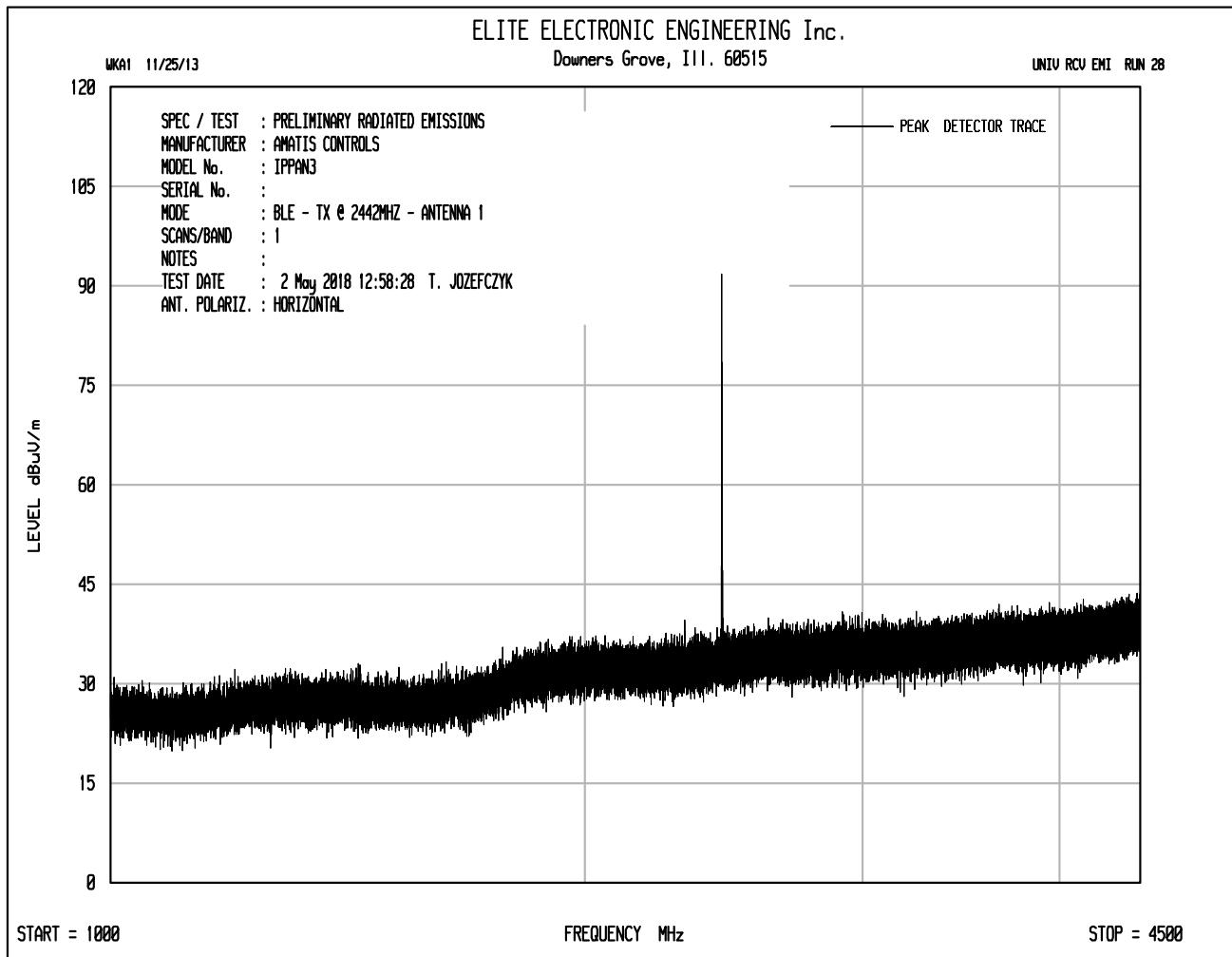
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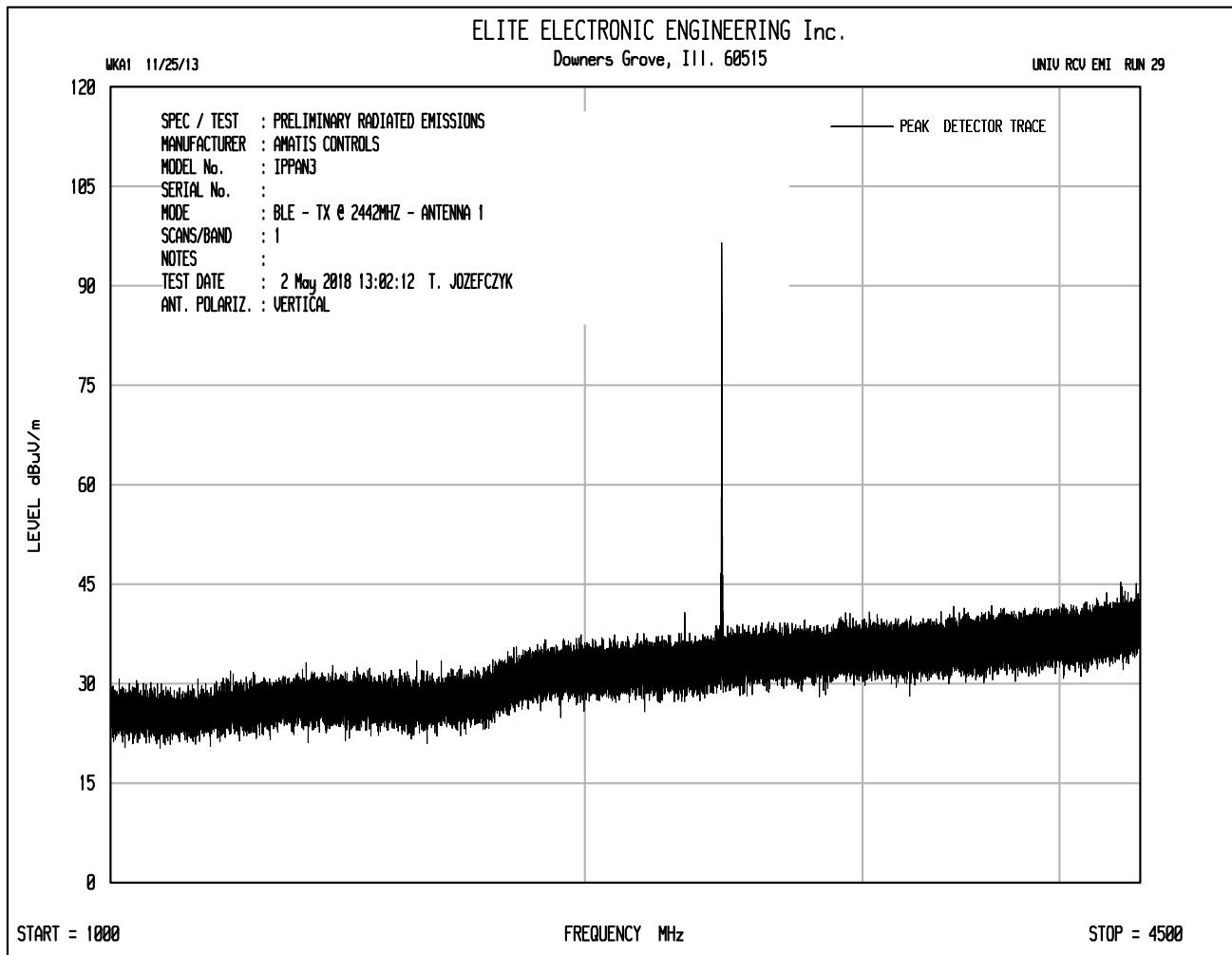
FREQUENCY MHz

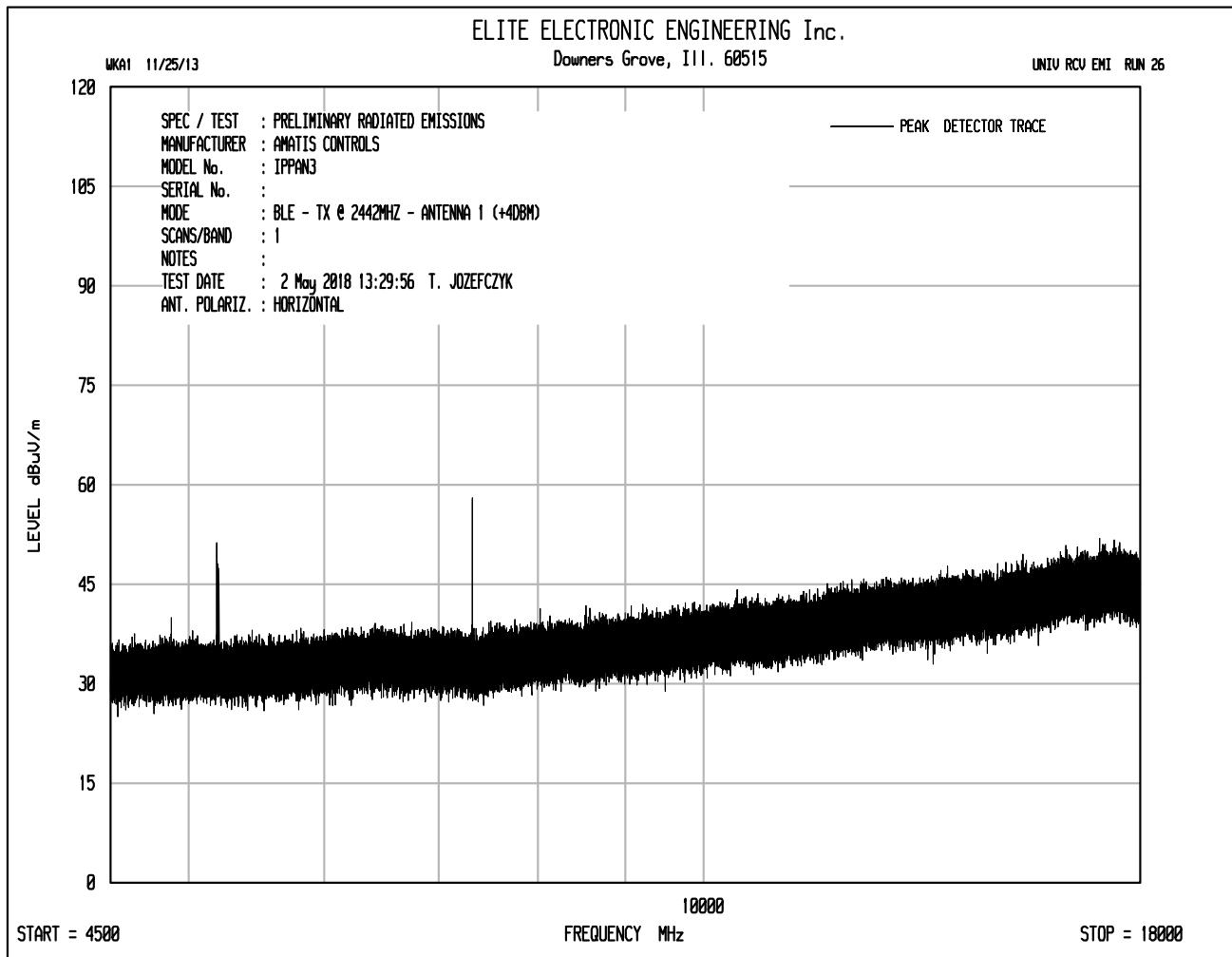
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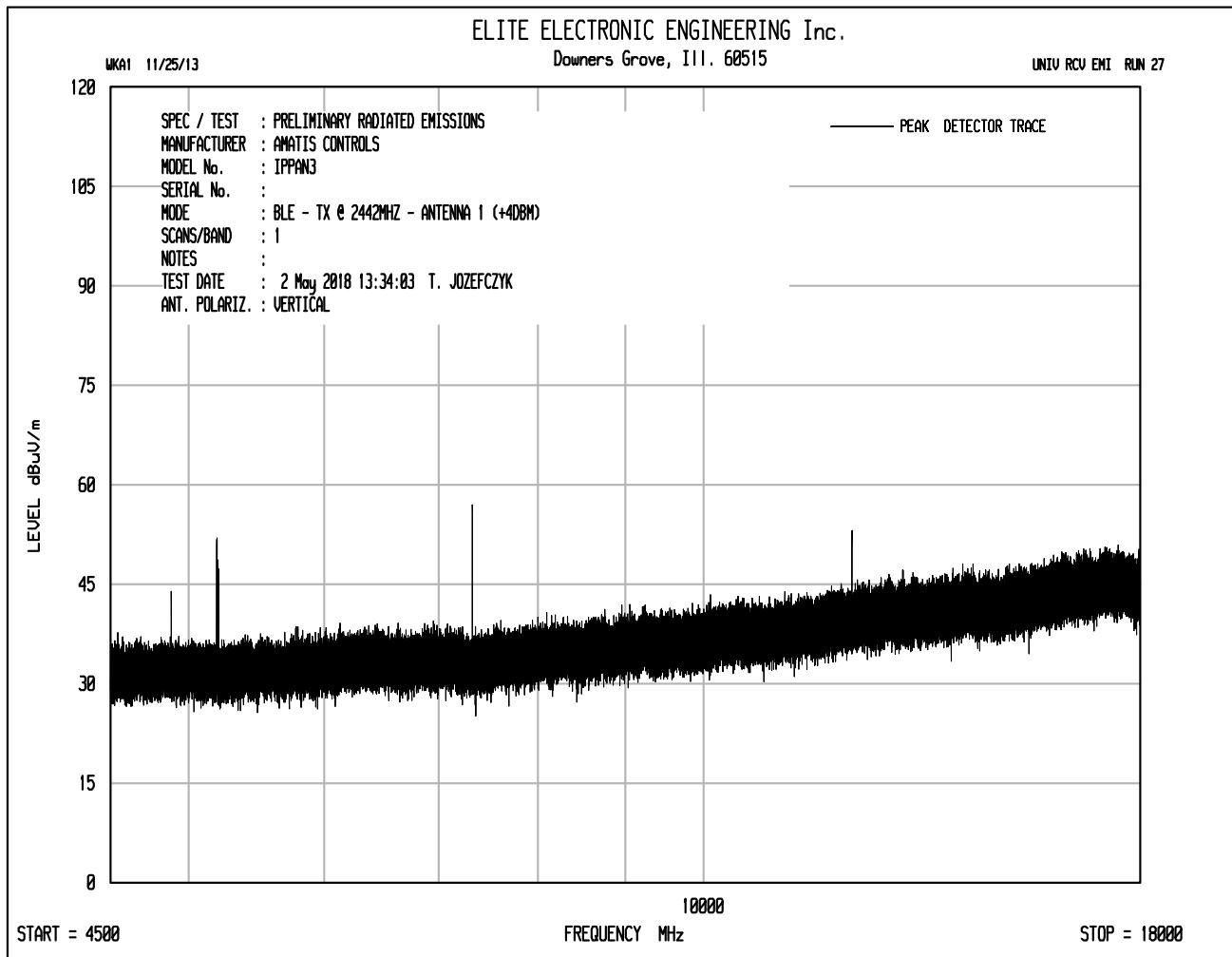










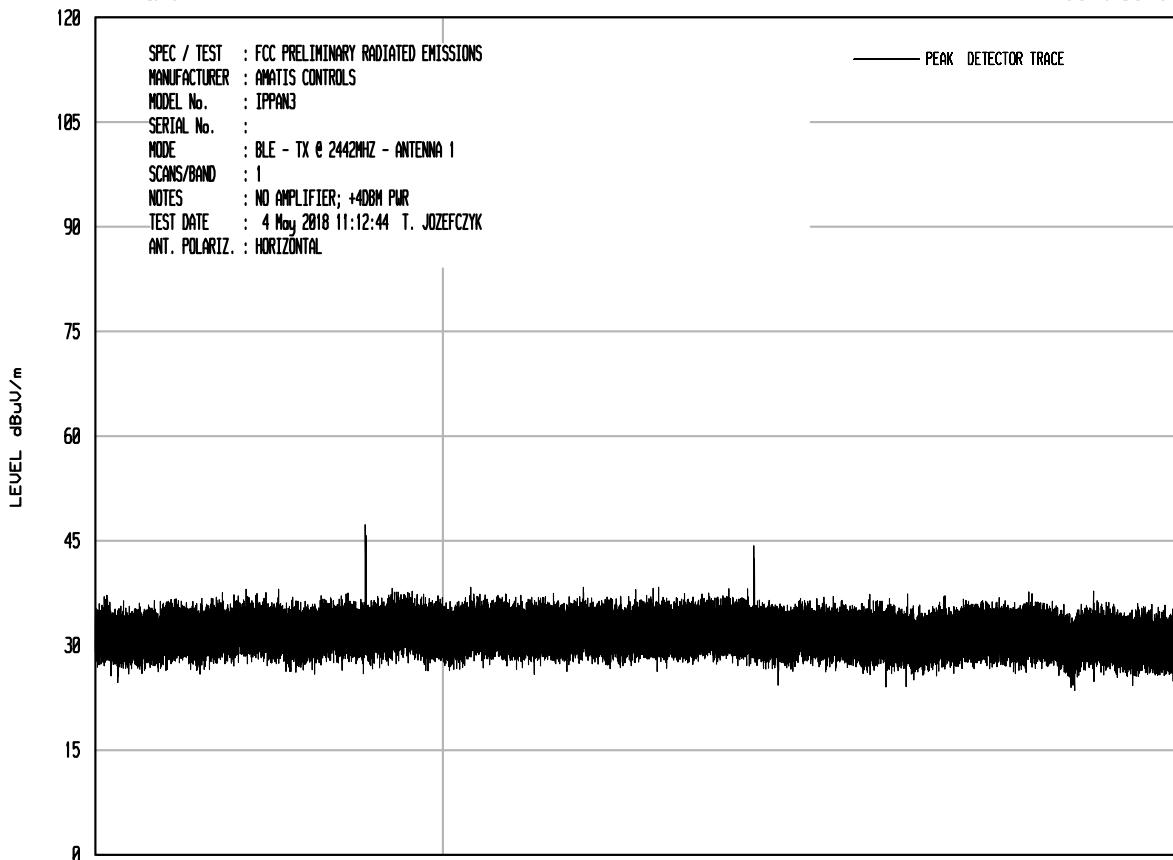


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Downers Grove, Ill. 60515

UNIV RCV EMI RUN 8

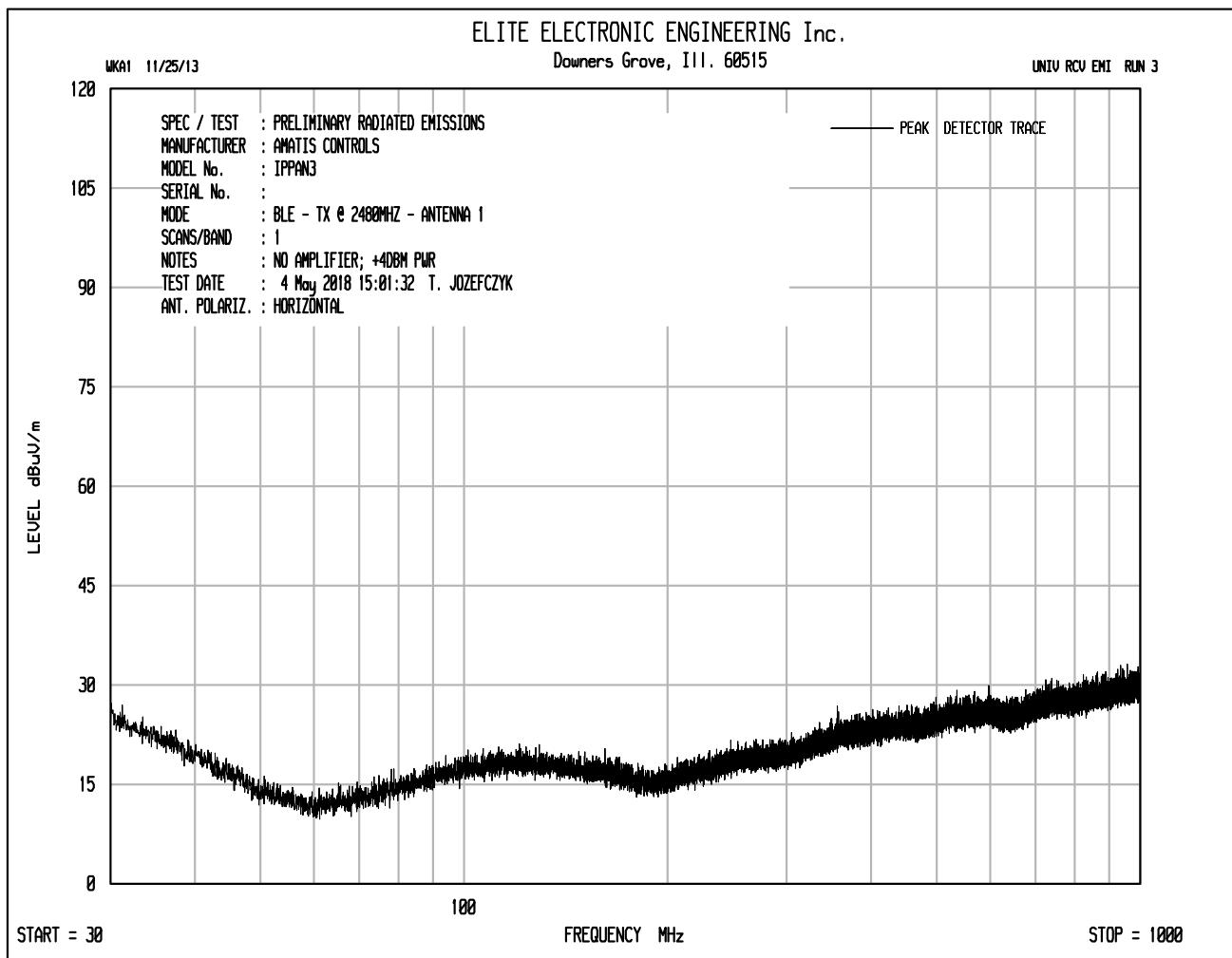
WKA1 11/25/13

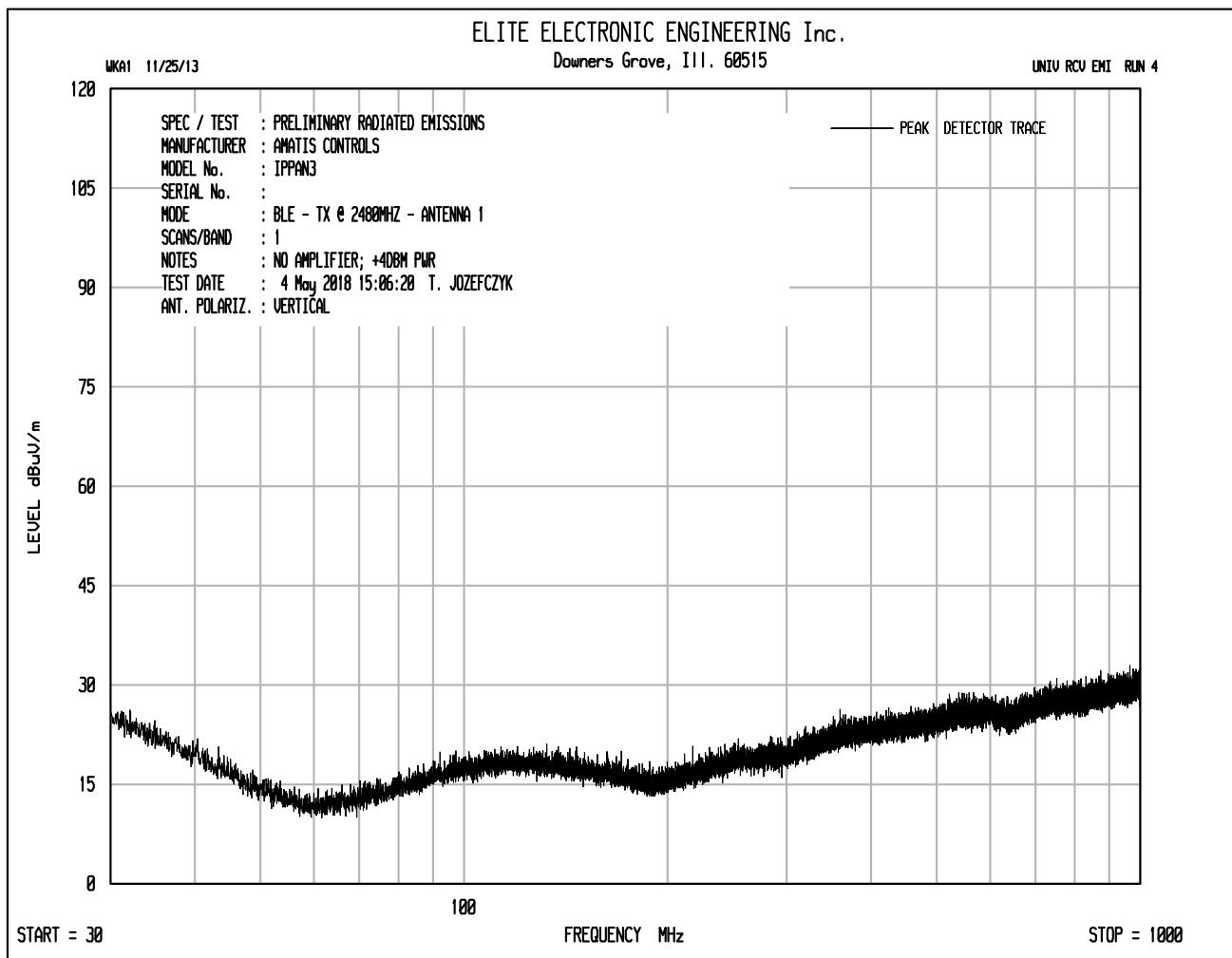


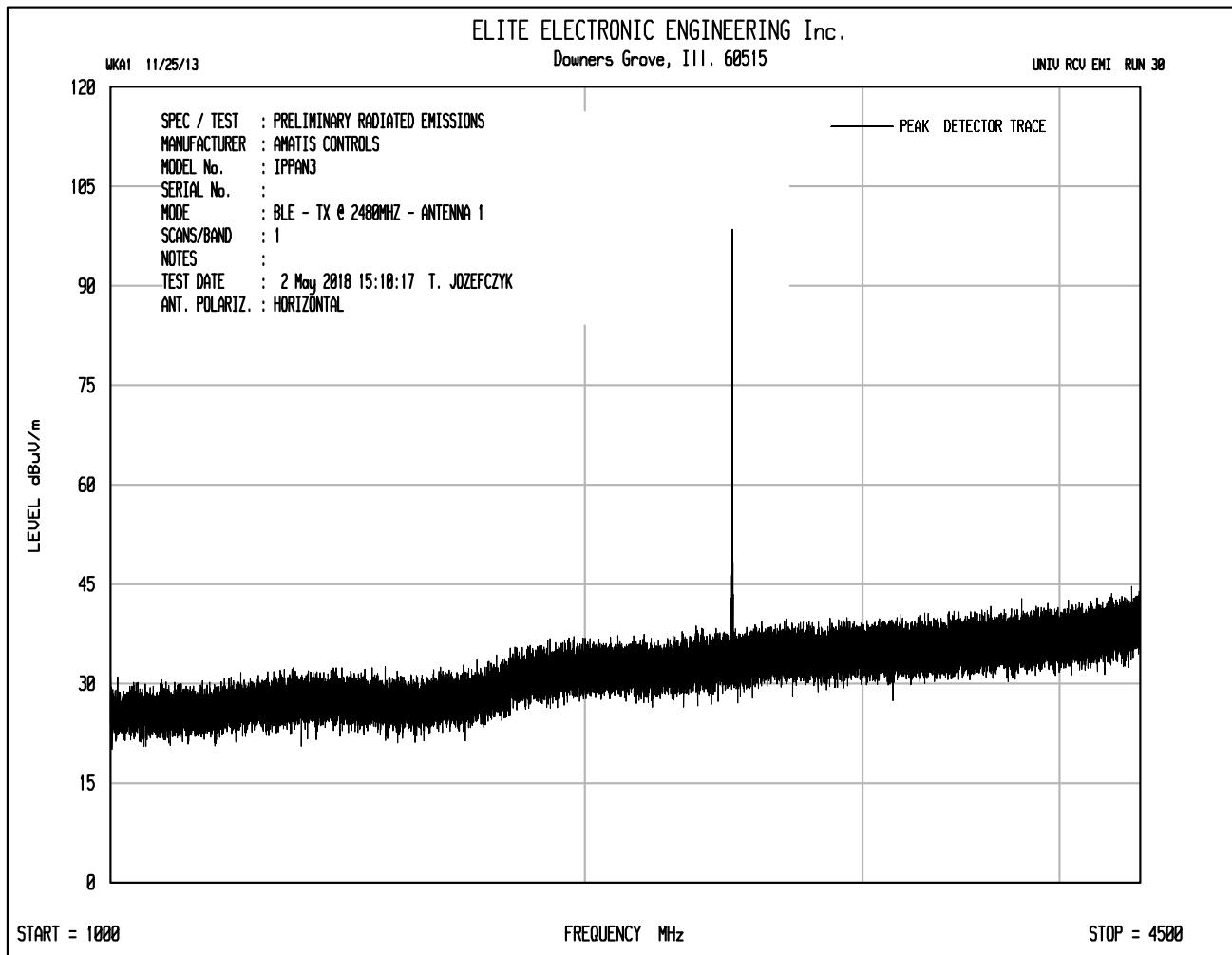
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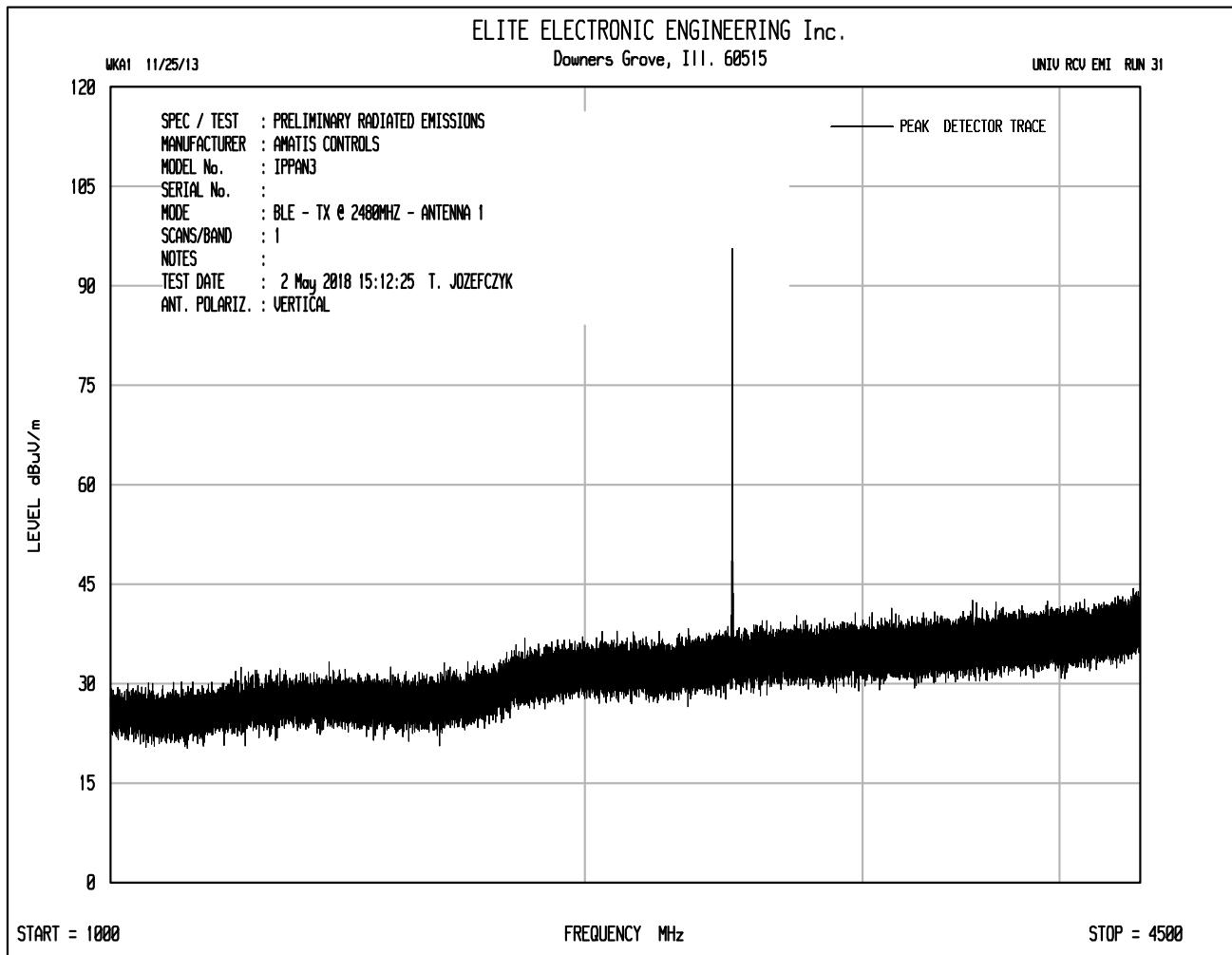
FREQUENCY MHz

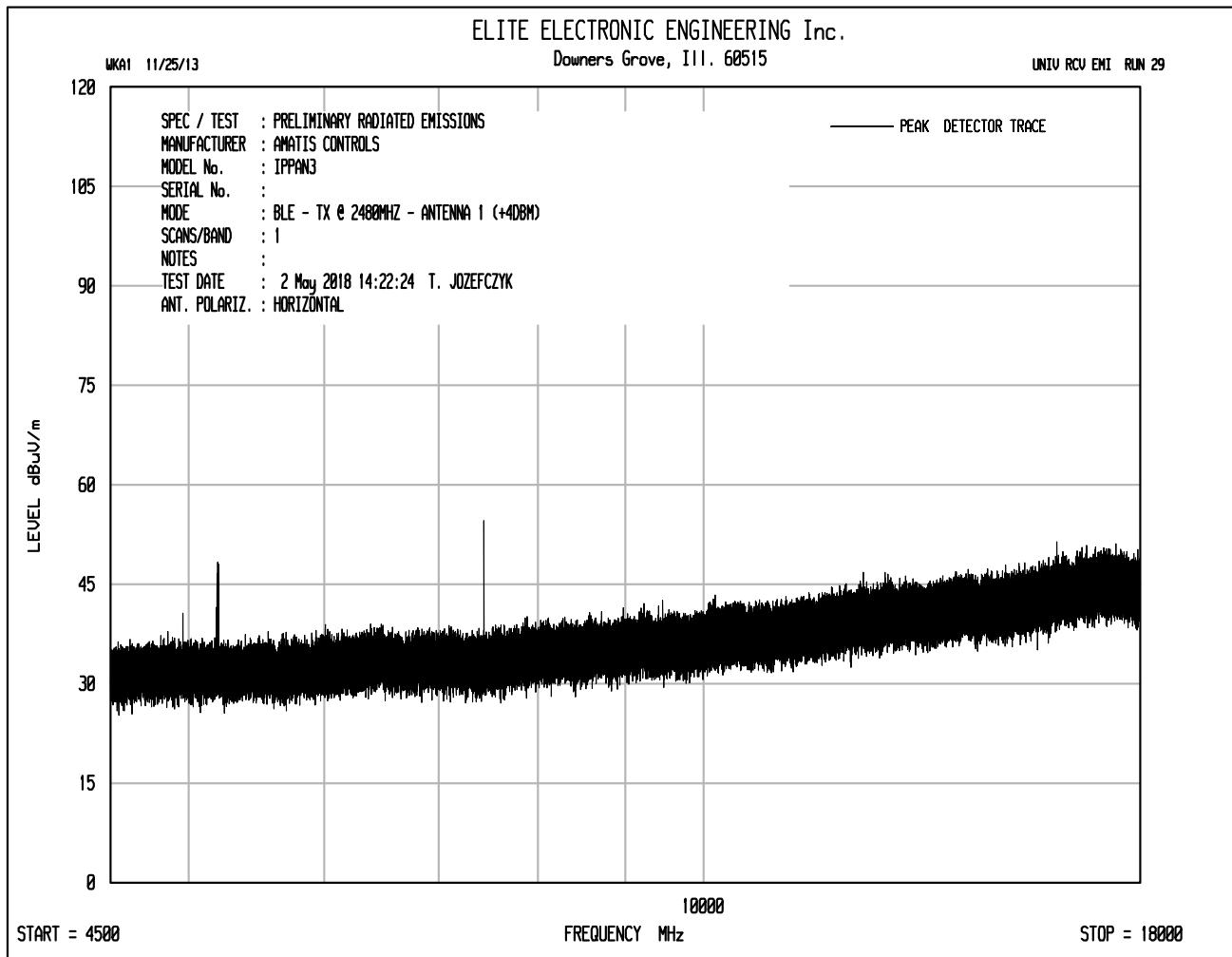
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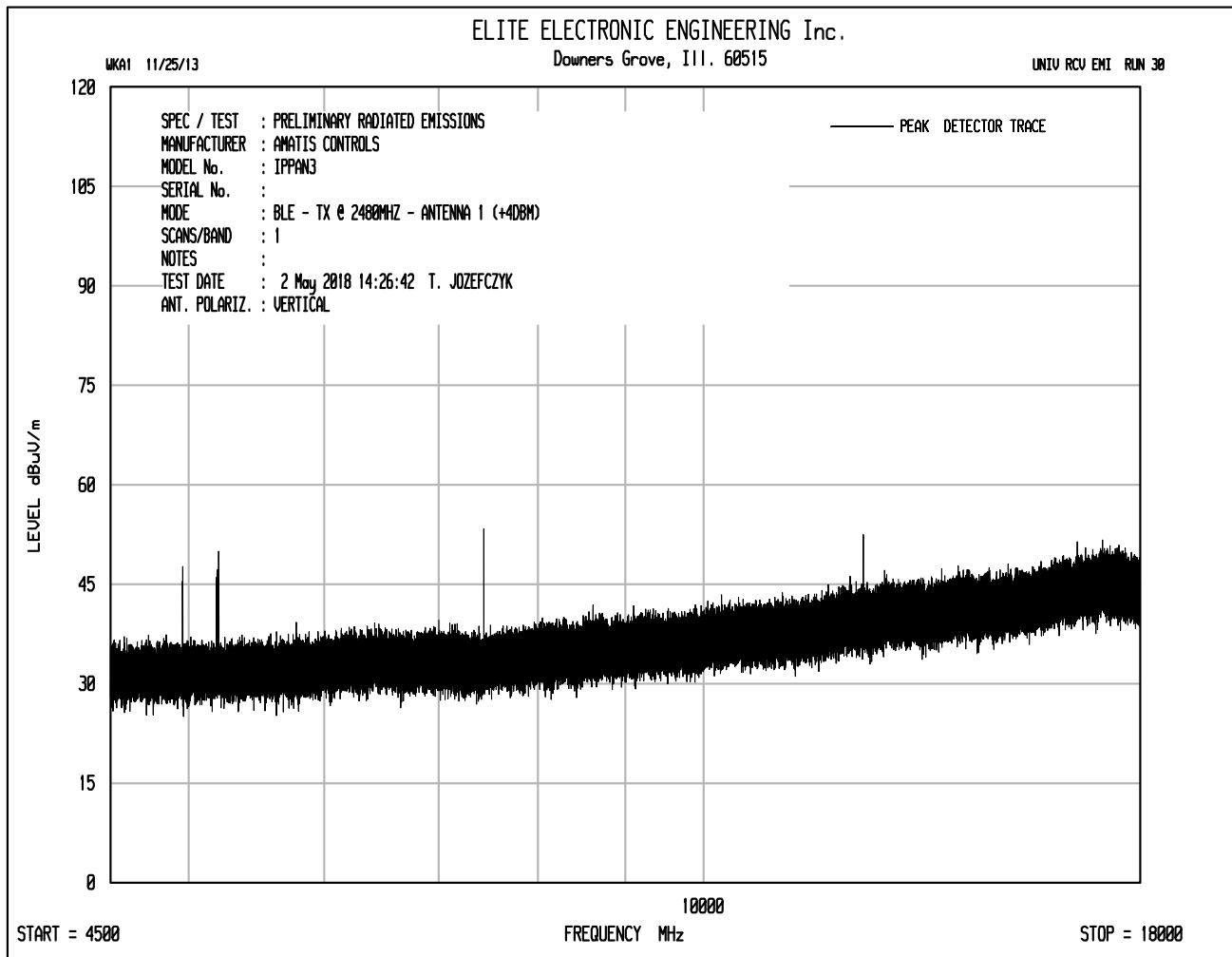










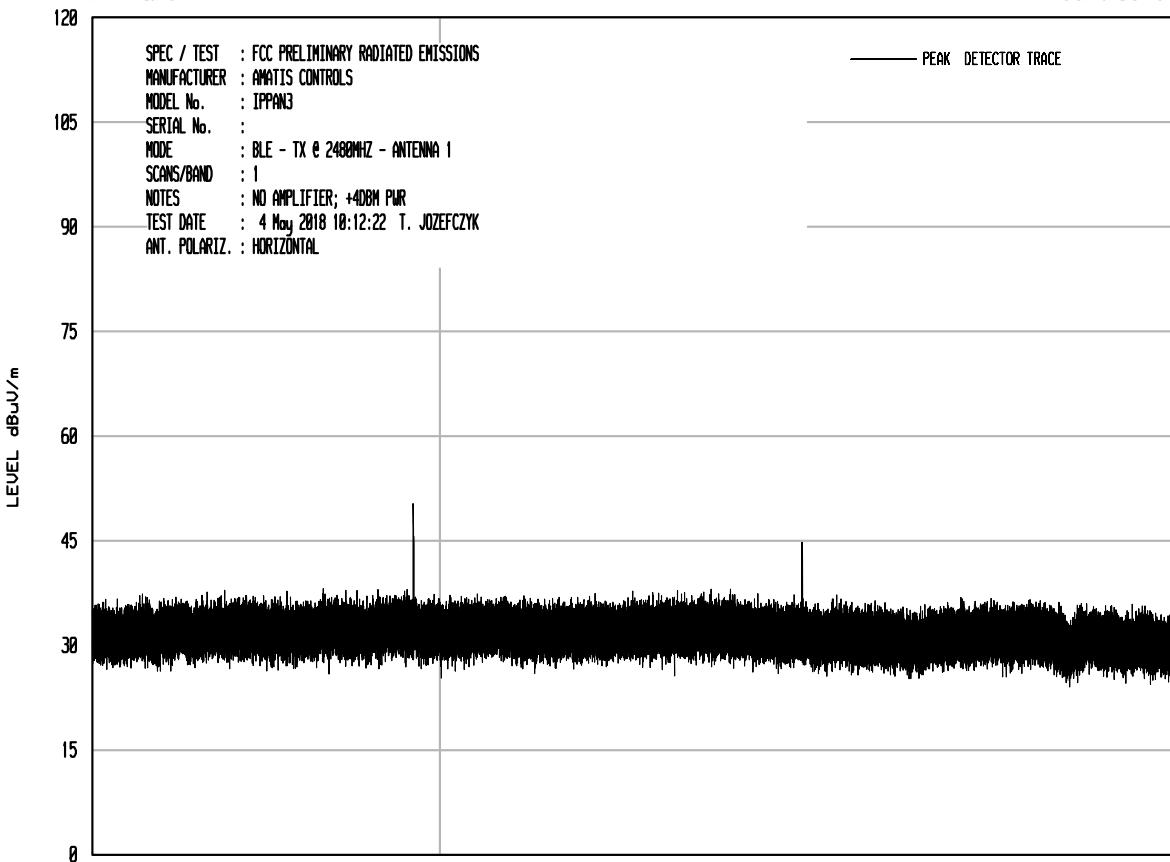


ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

UNIV RCV EMI RUN 1

WKA1 11/25/13



START = 18000

FREQUENCY MHz

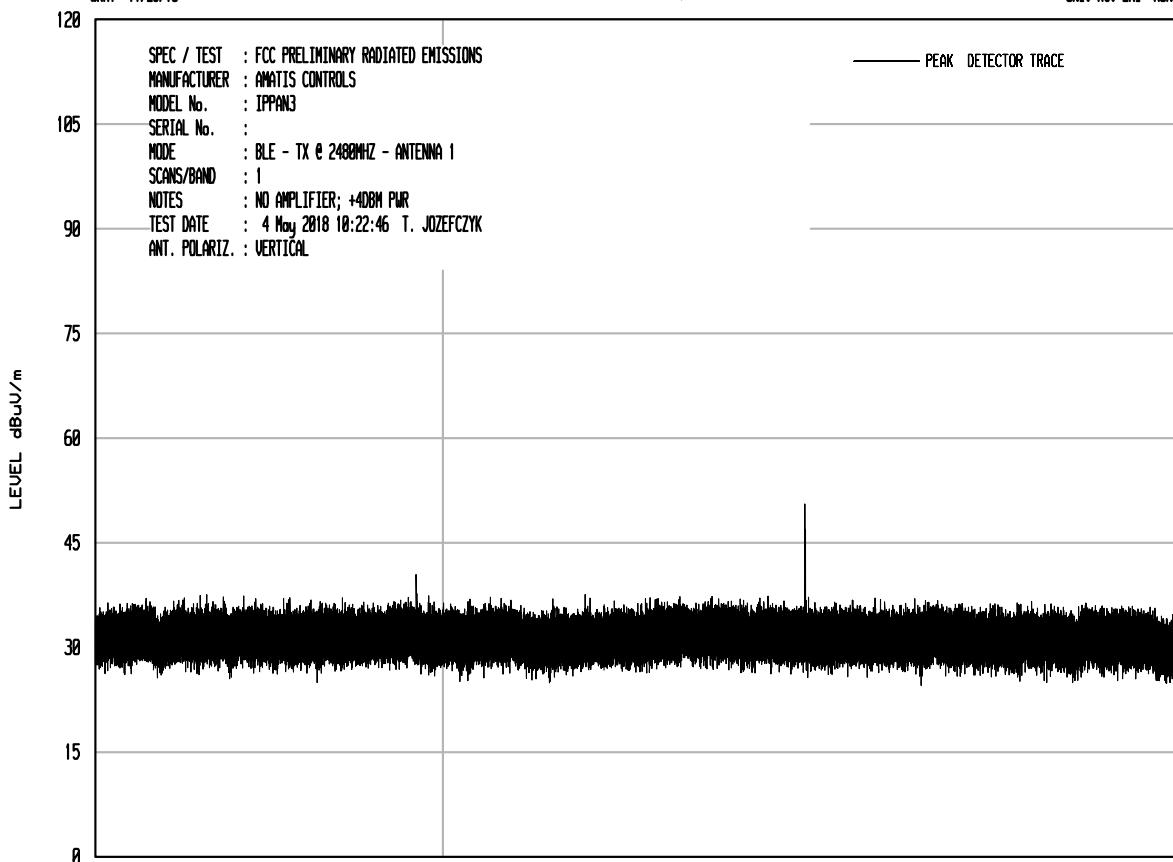
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ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

UNIV RCV EMI RUN 2

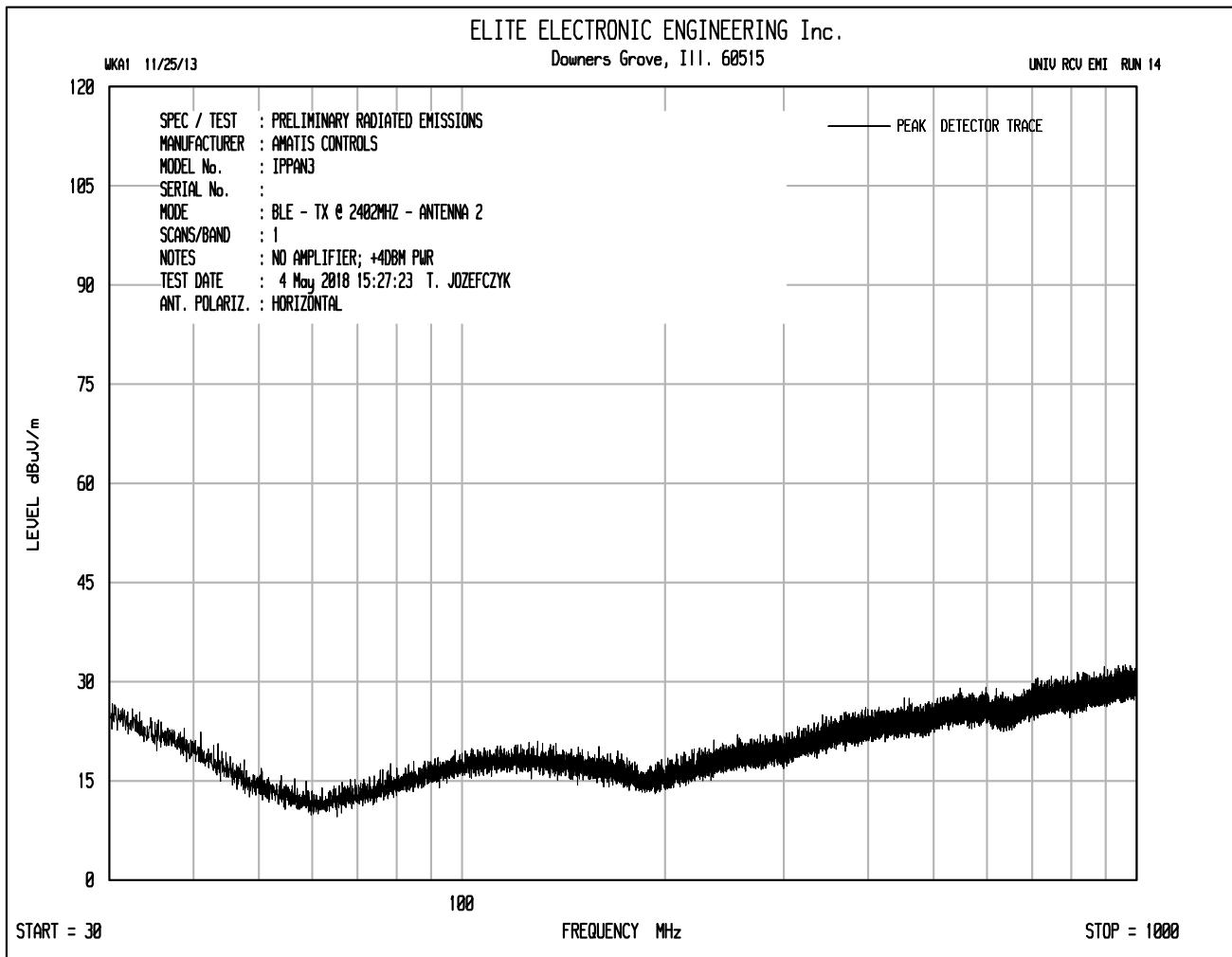
WKA1 11/25/13

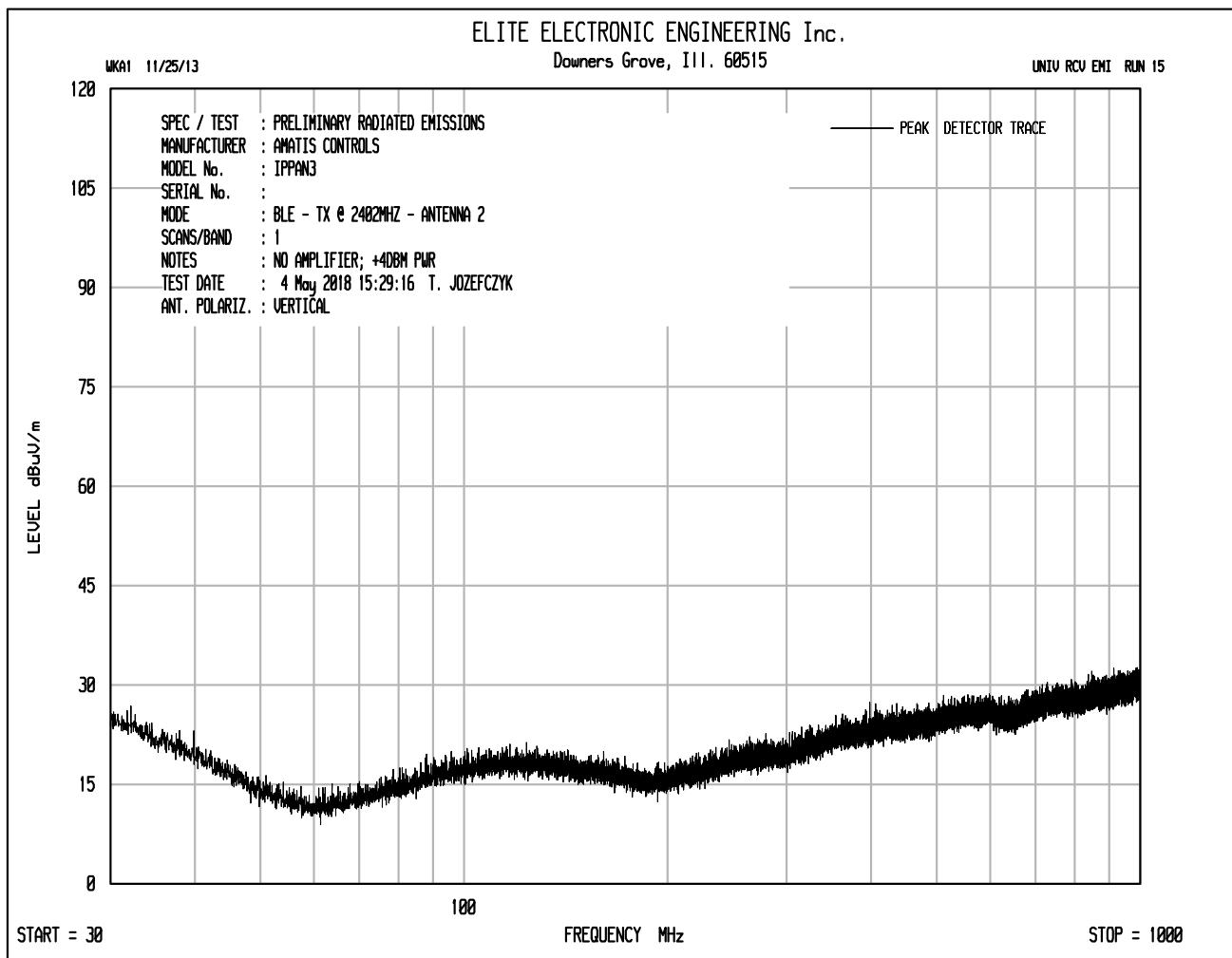


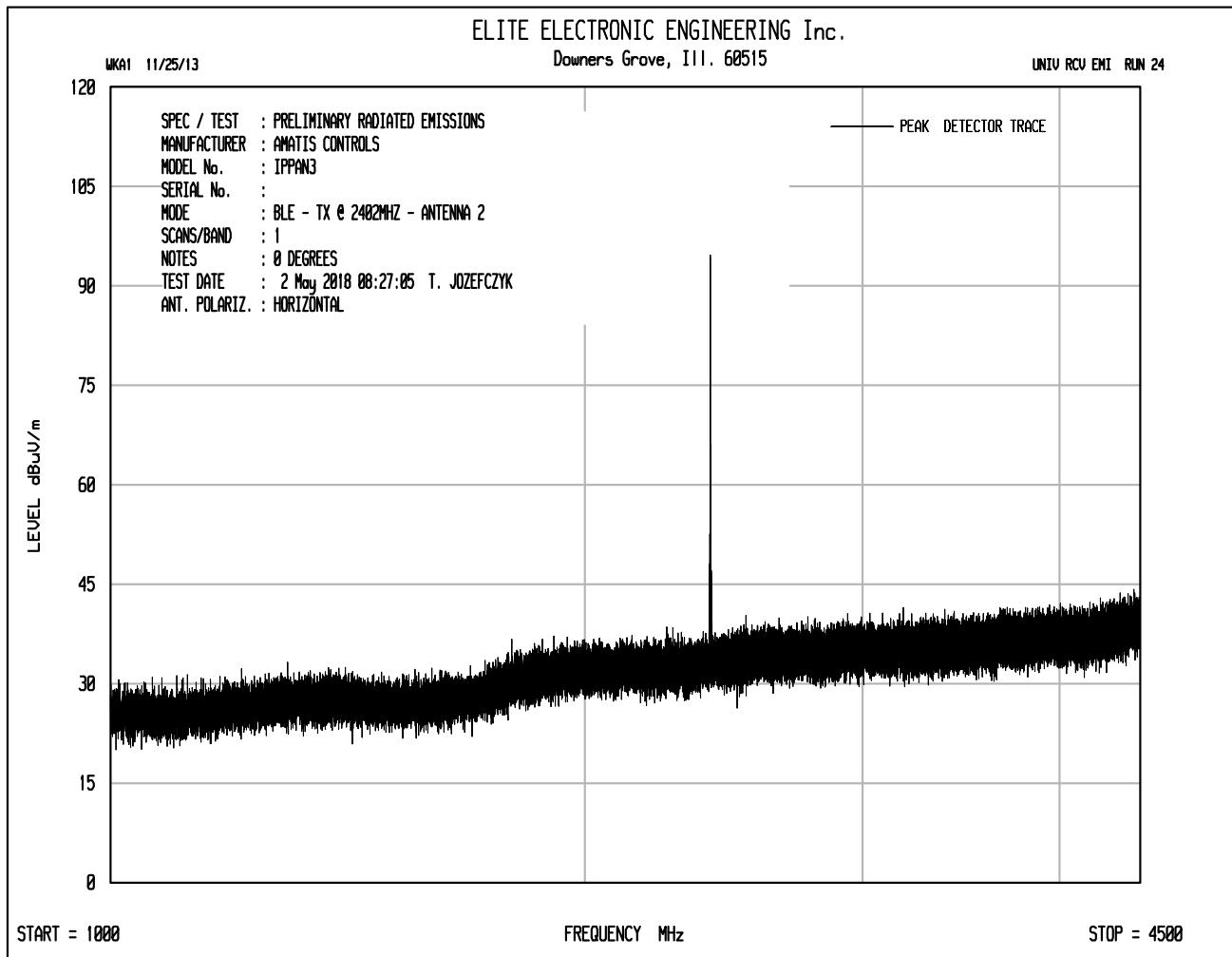
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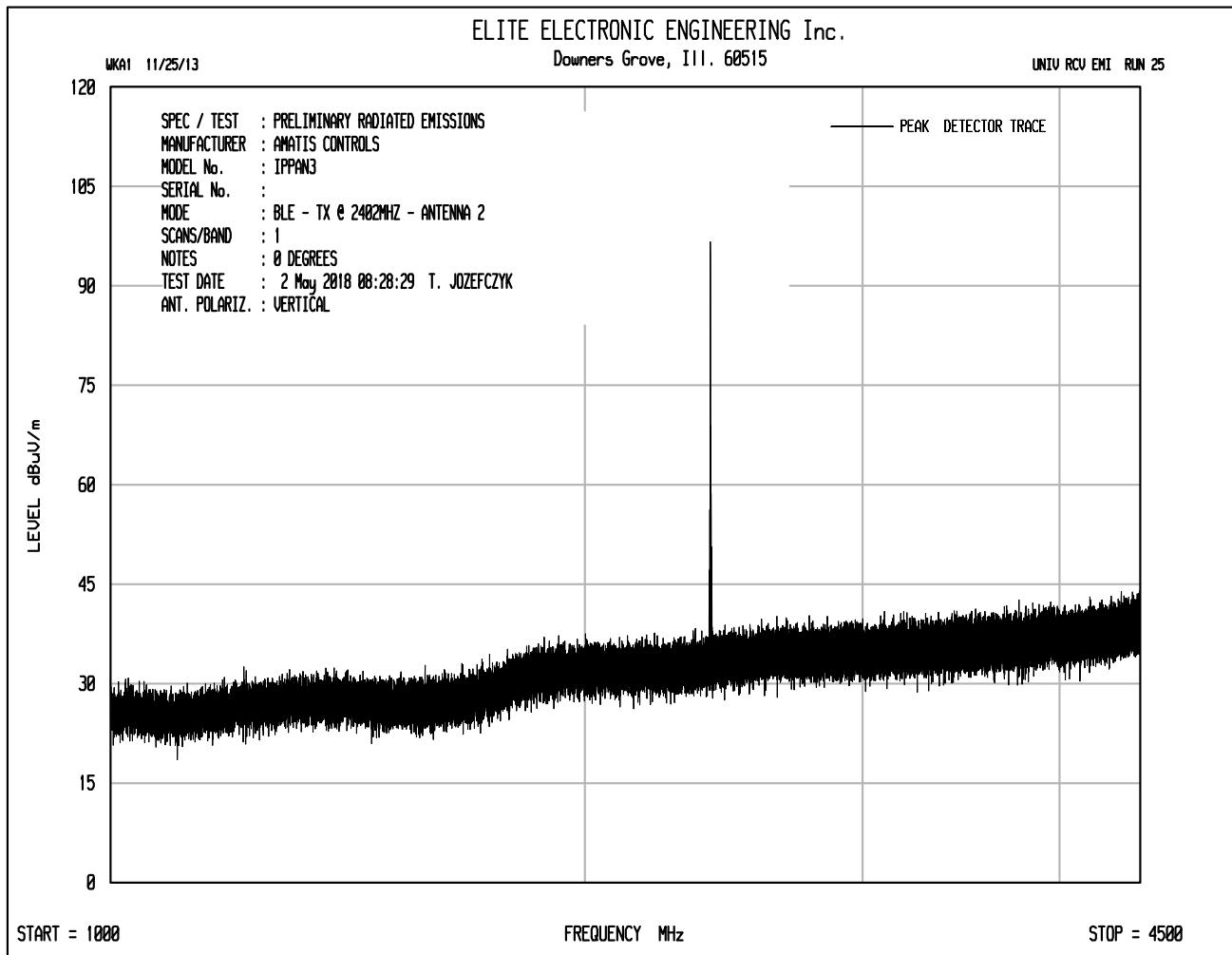
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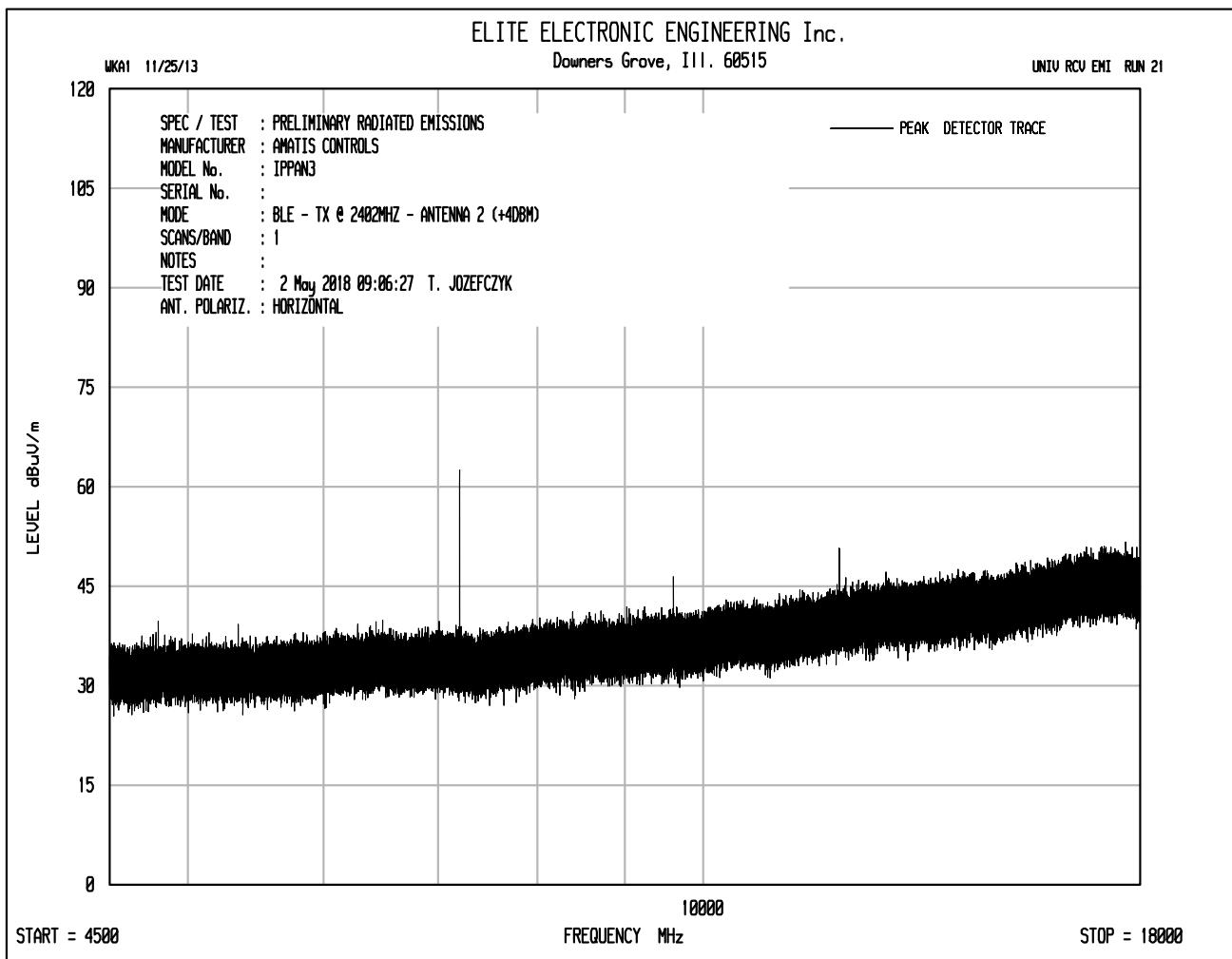
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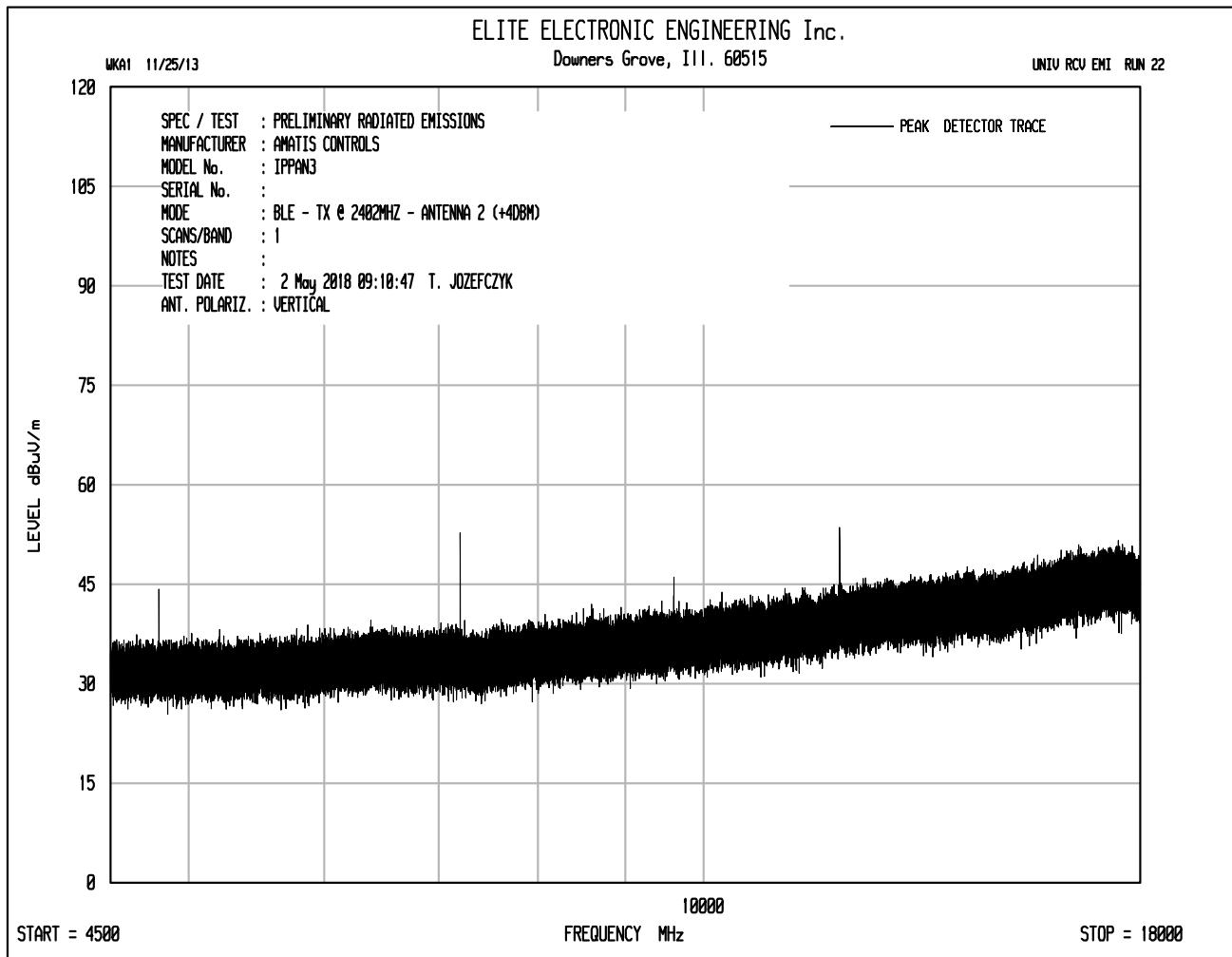










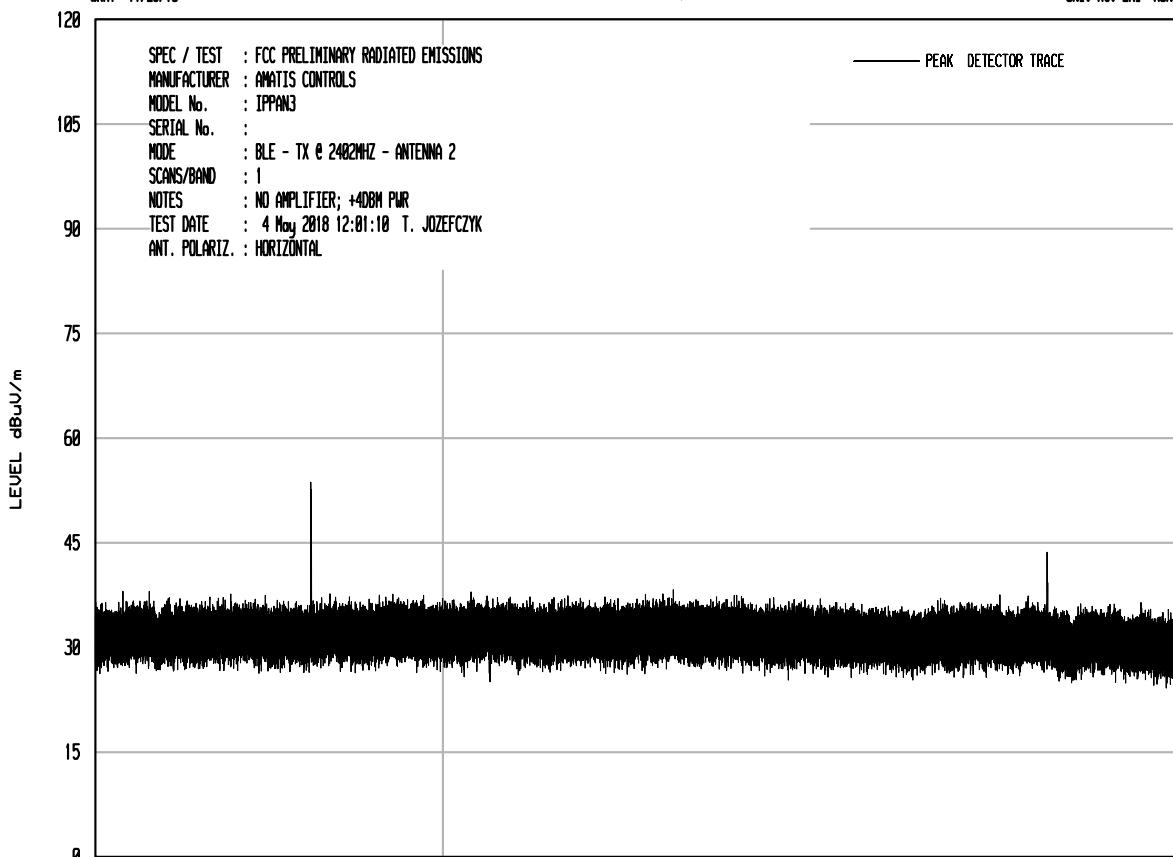


ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

UNIV RCV EMI RUN 13

WKA1 11/25/13



START = 18000

FREQUENCY MHz

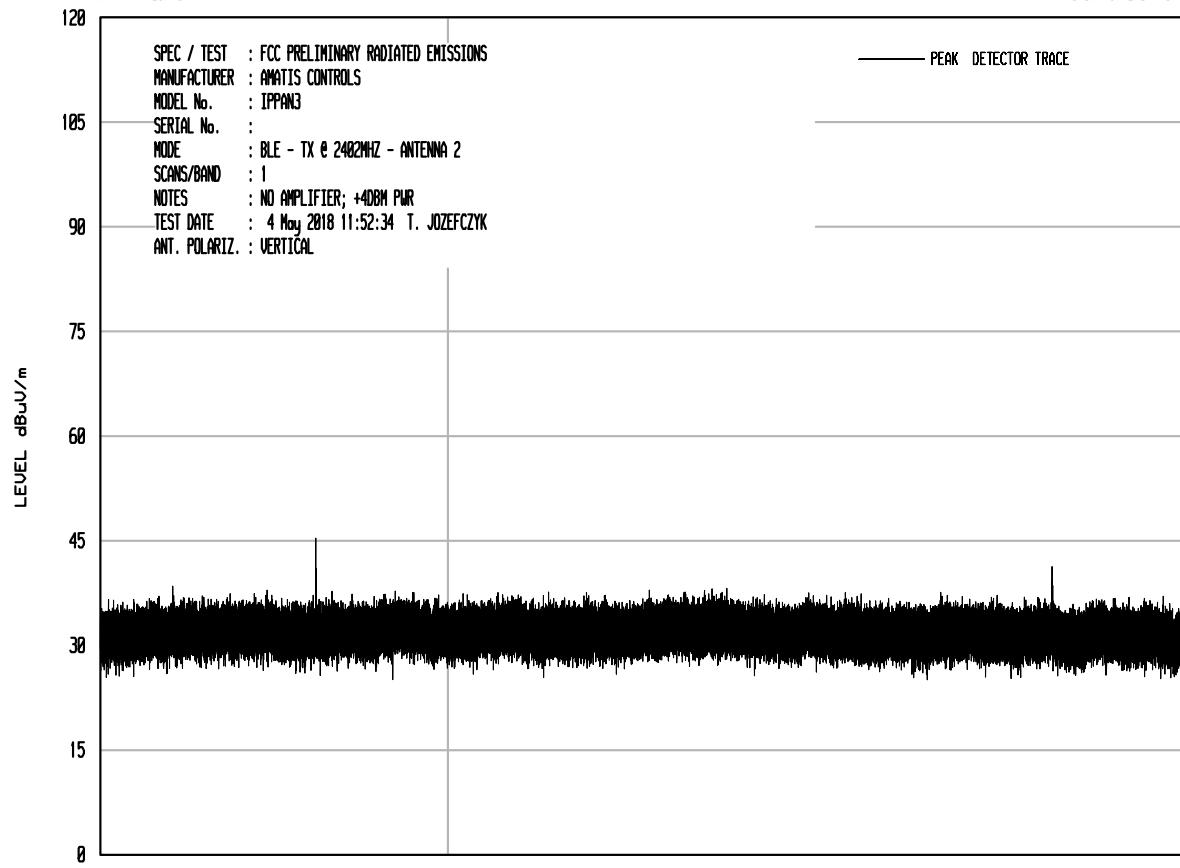
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ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

UNIV RCV EMI RUN 11

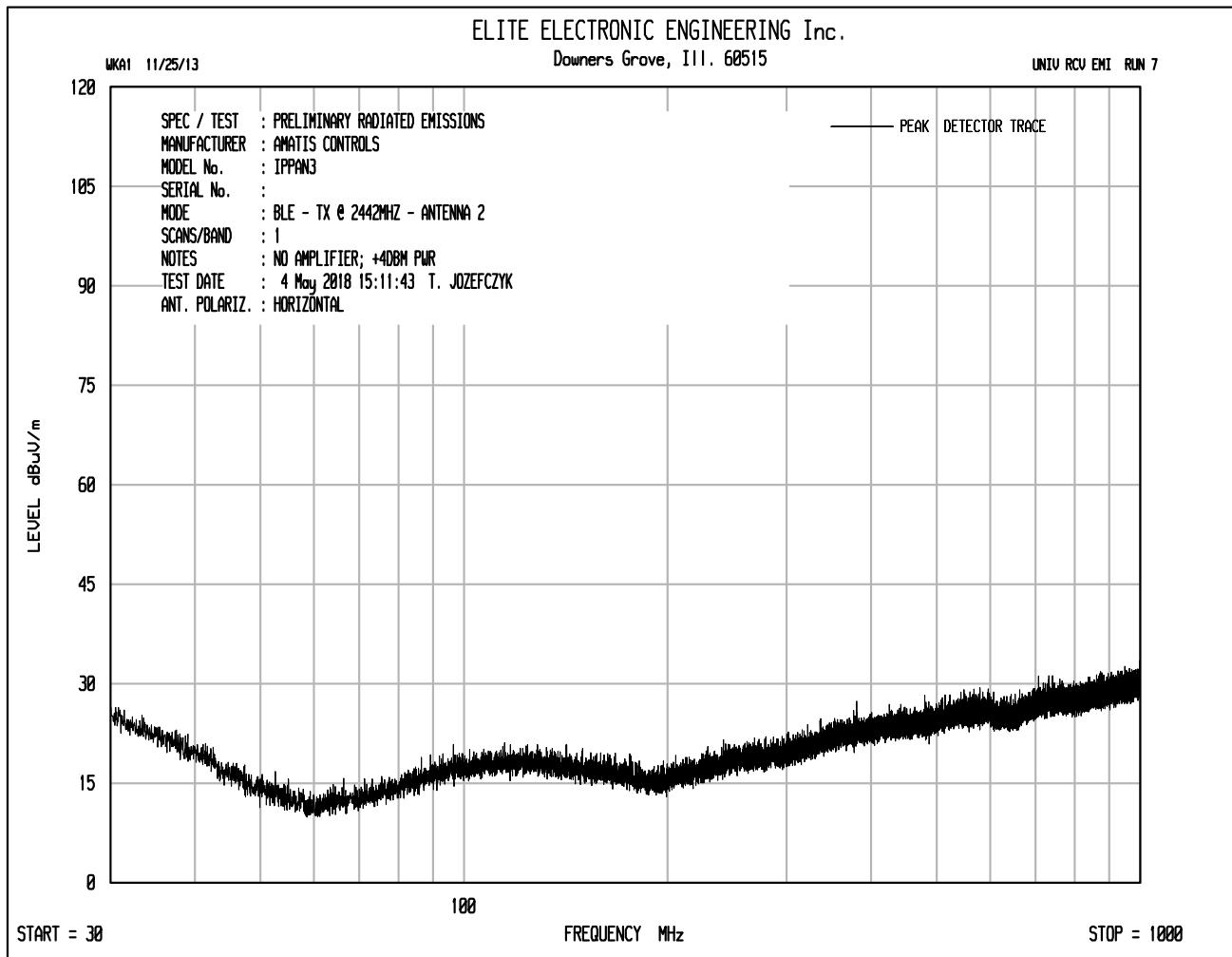
WKA1 11/25/13

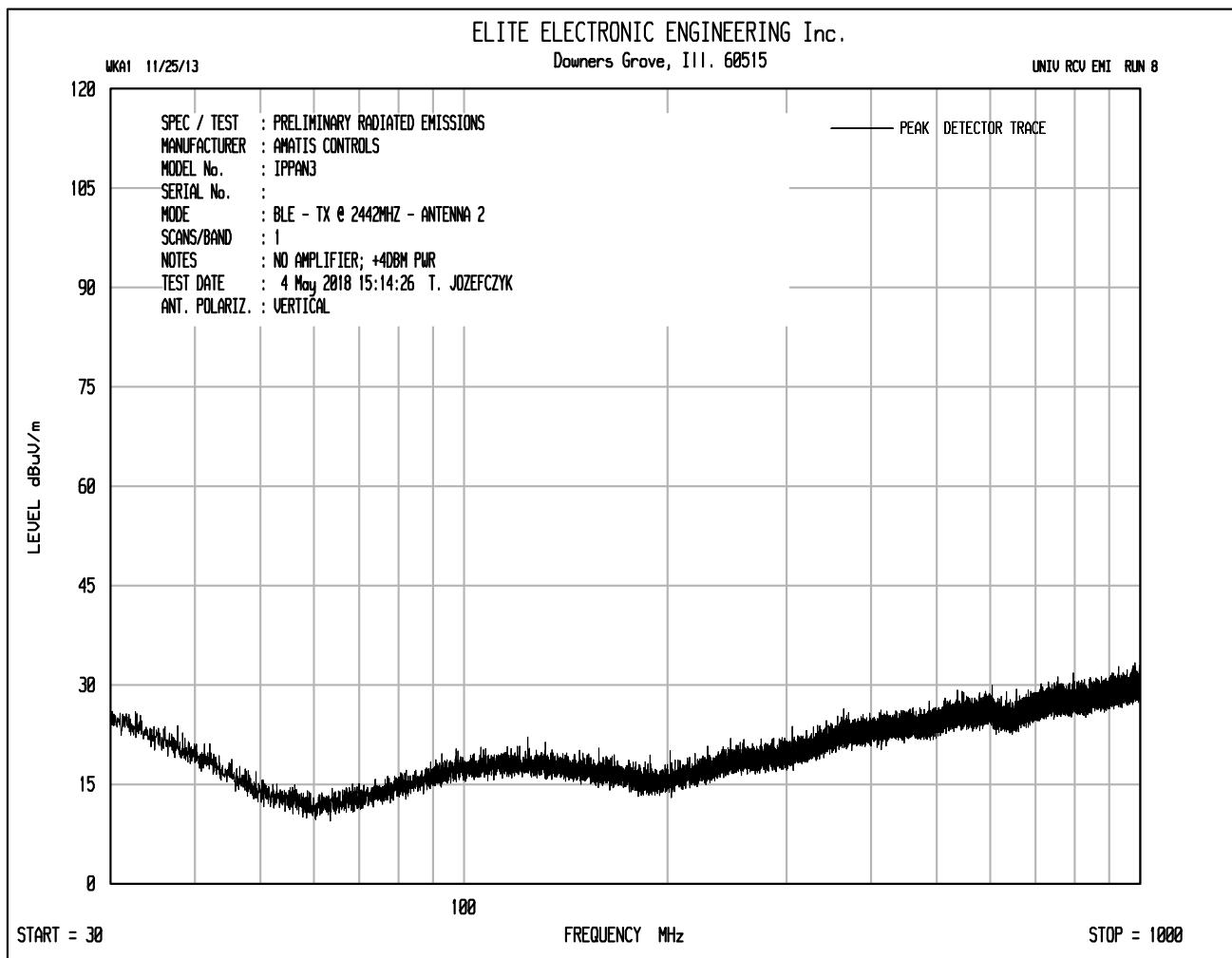


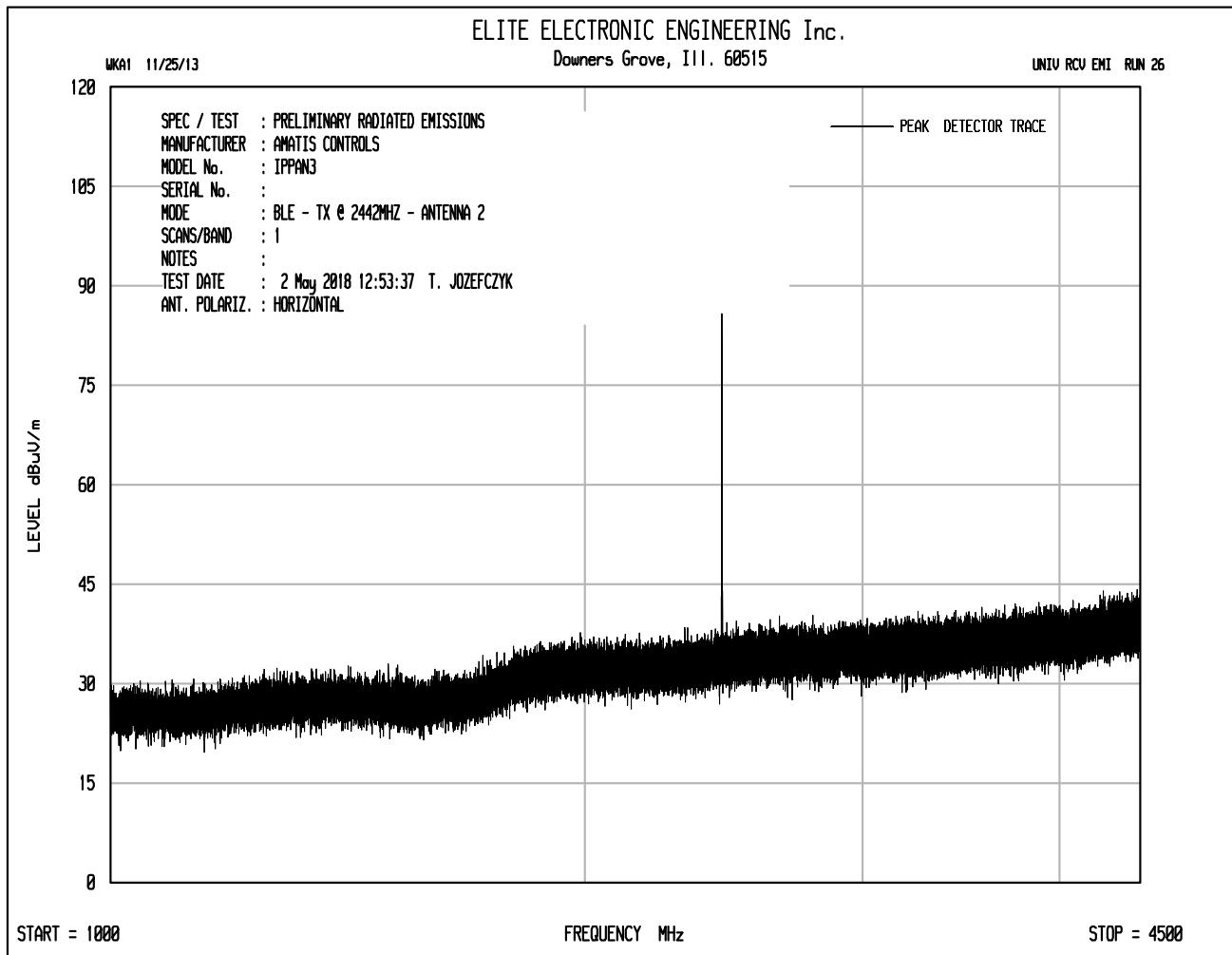
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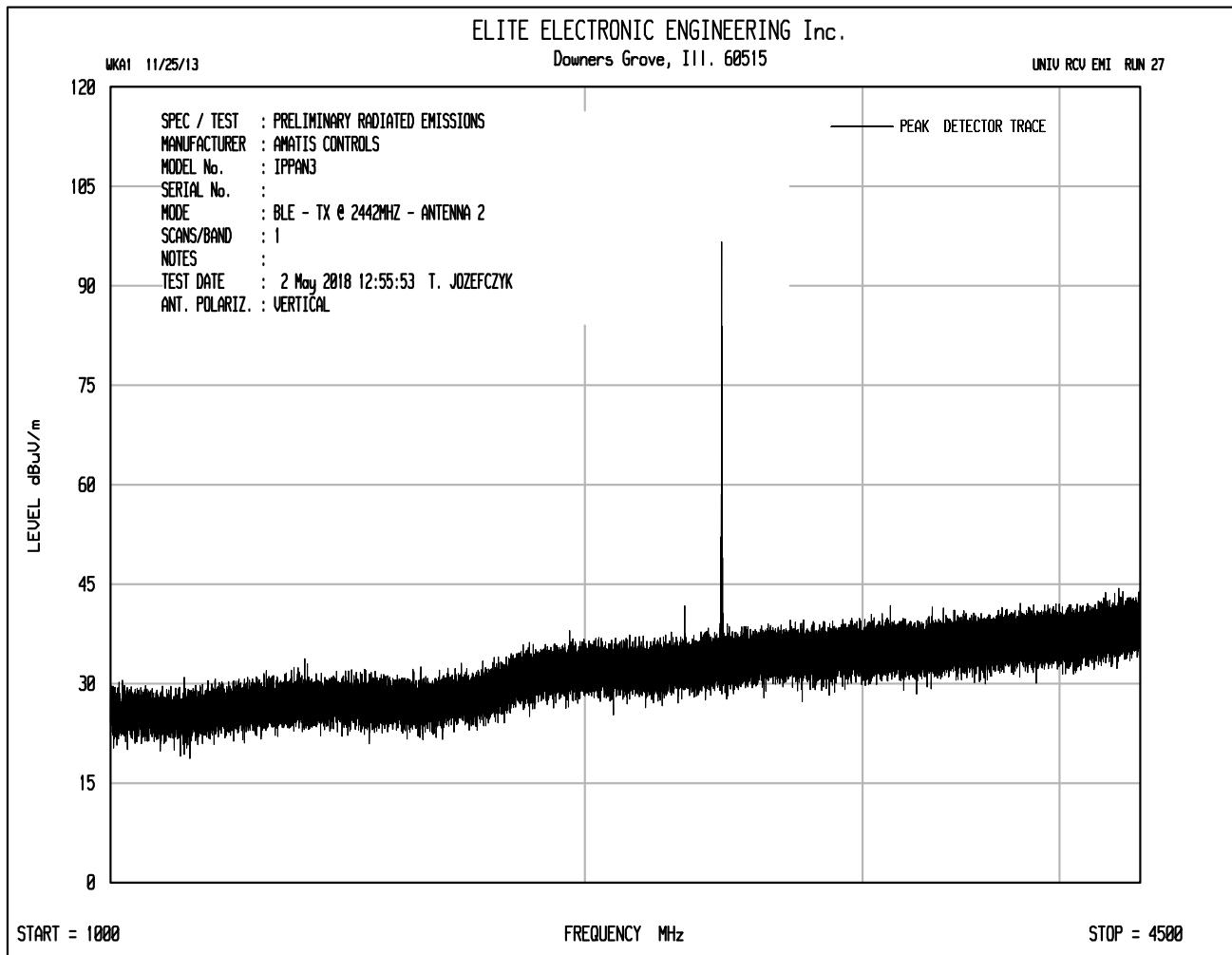
FREQUENCY MHz

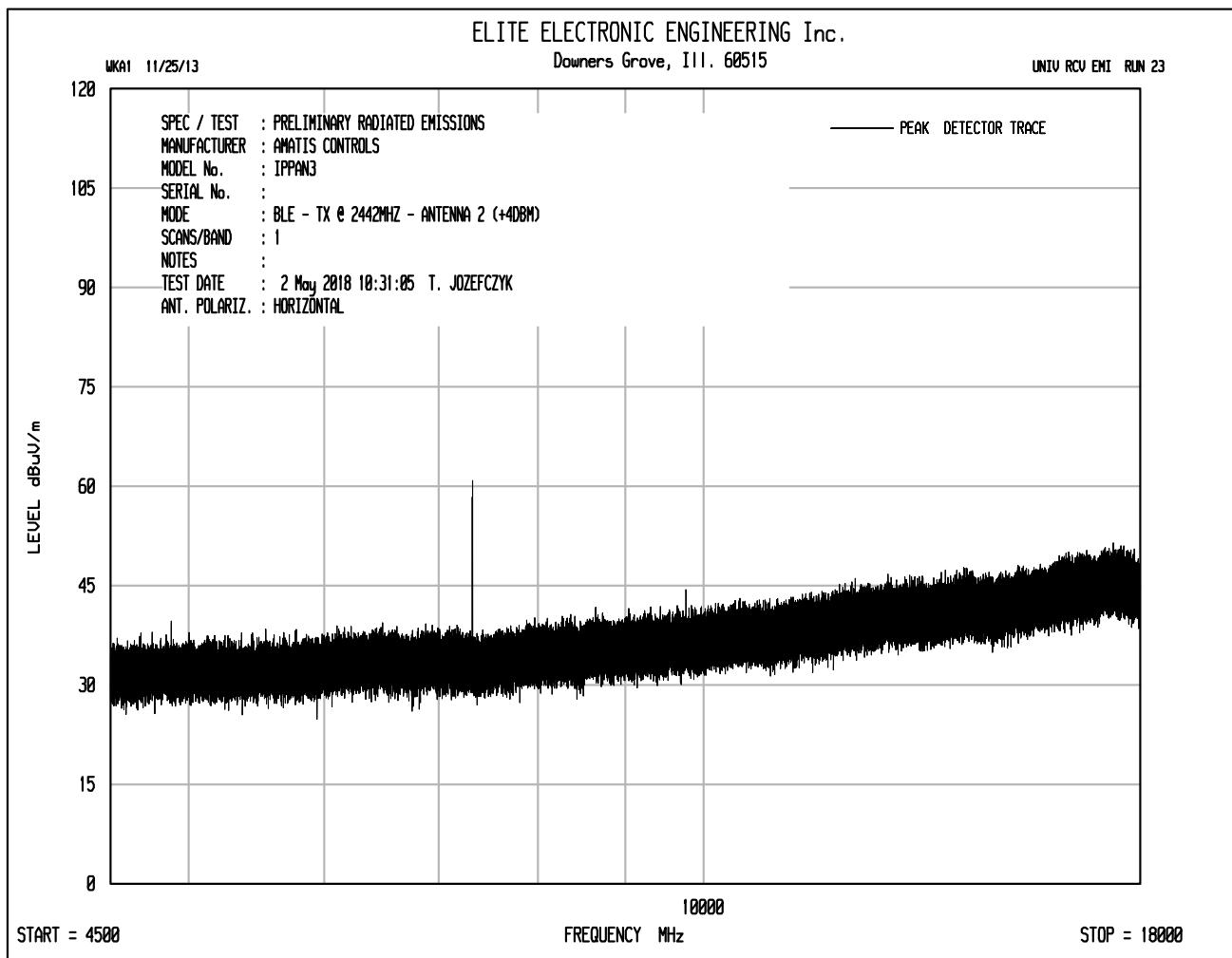
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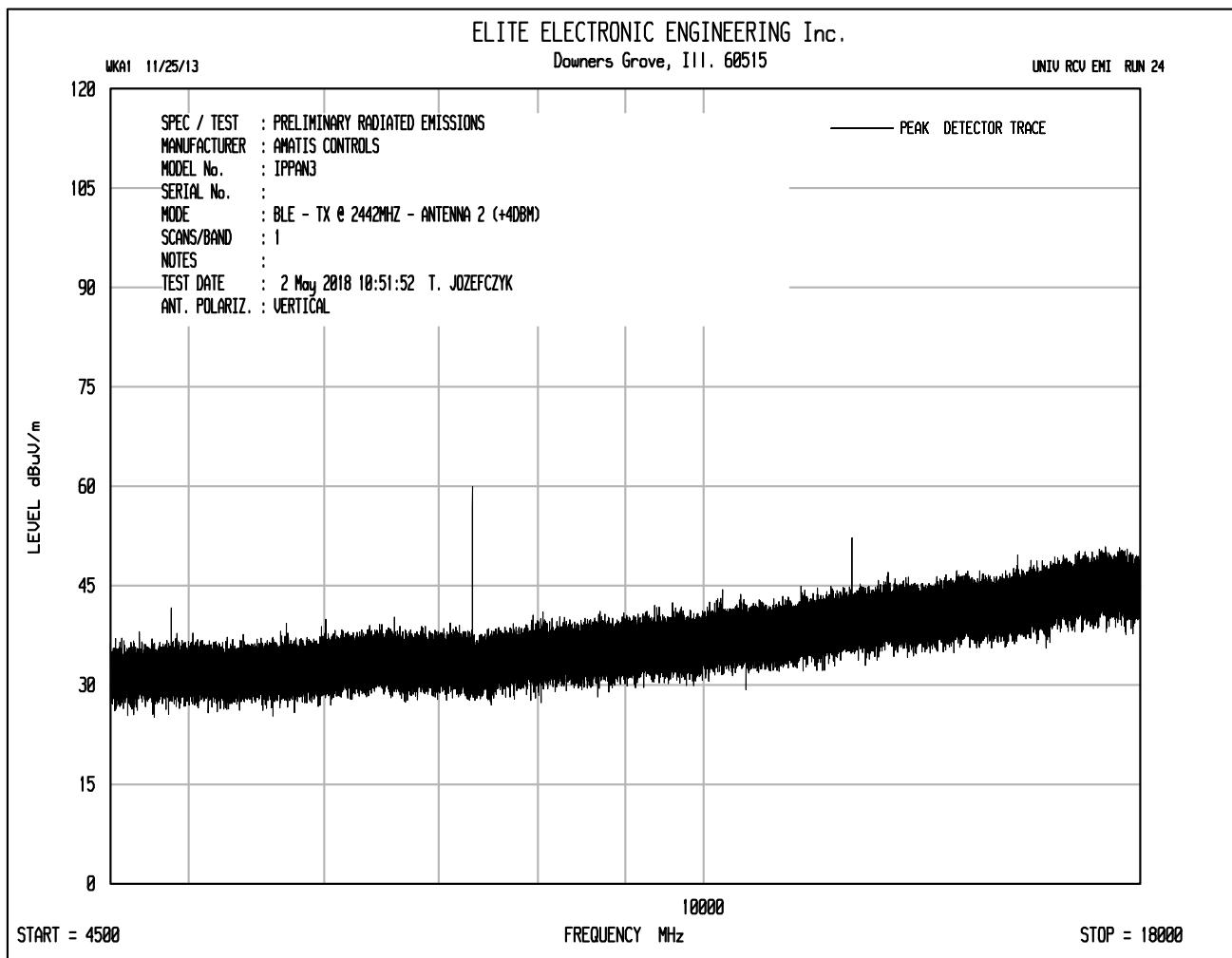








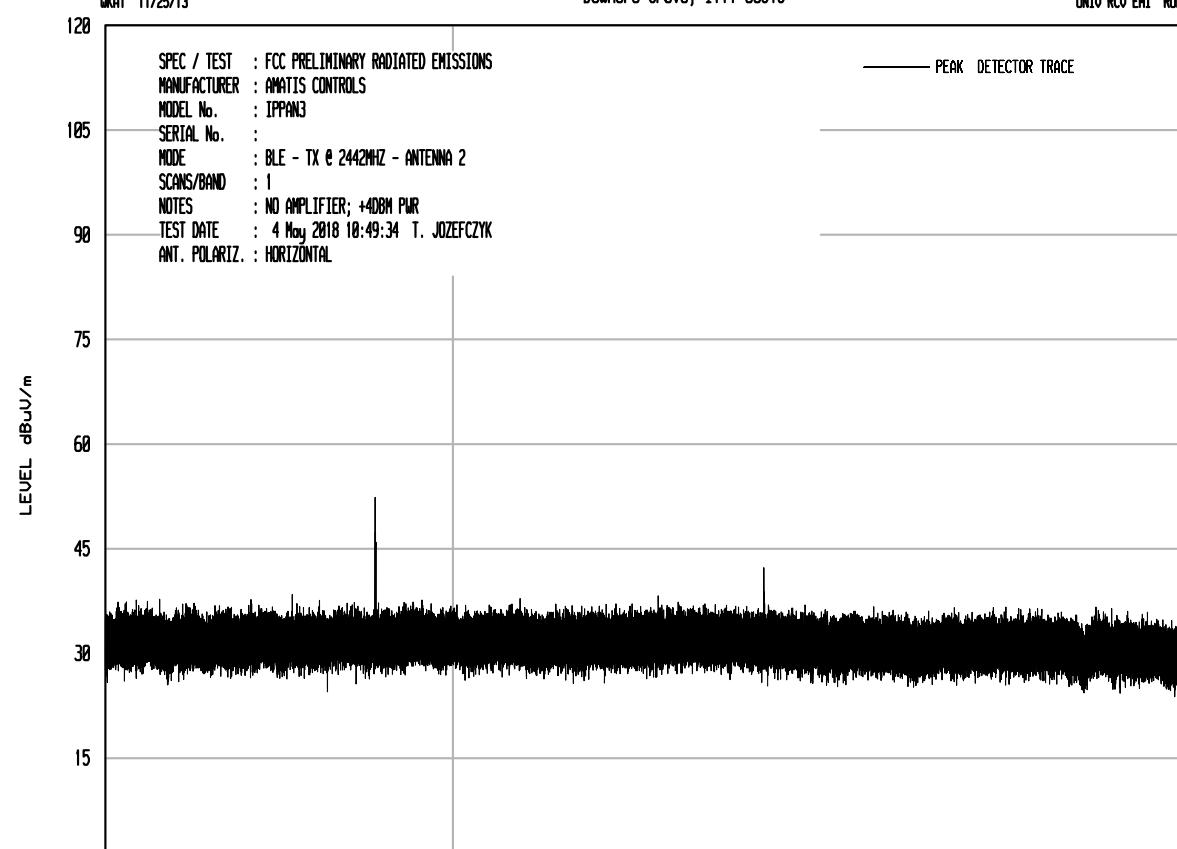




ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

UNIV RCV EMI RUN 5



START = 18000

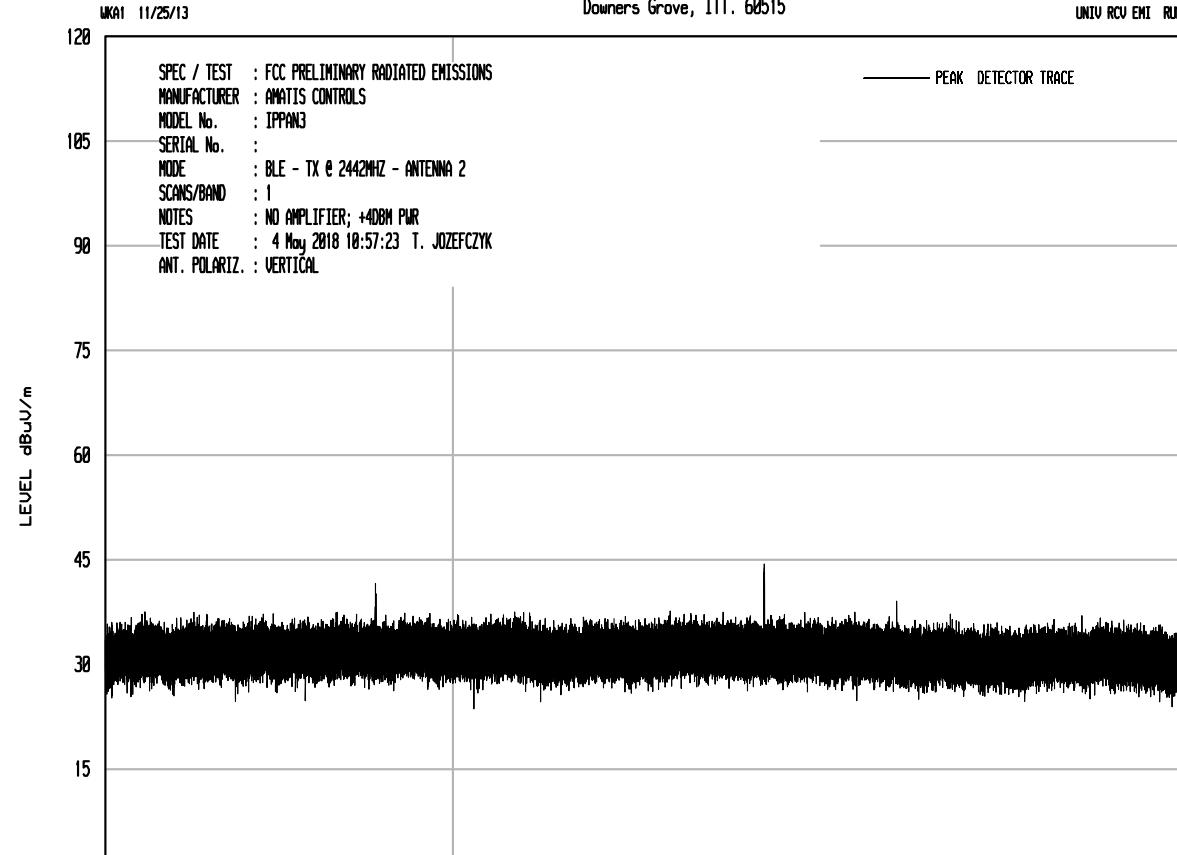
FREQUENCY MHz

STOP = 25000

ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

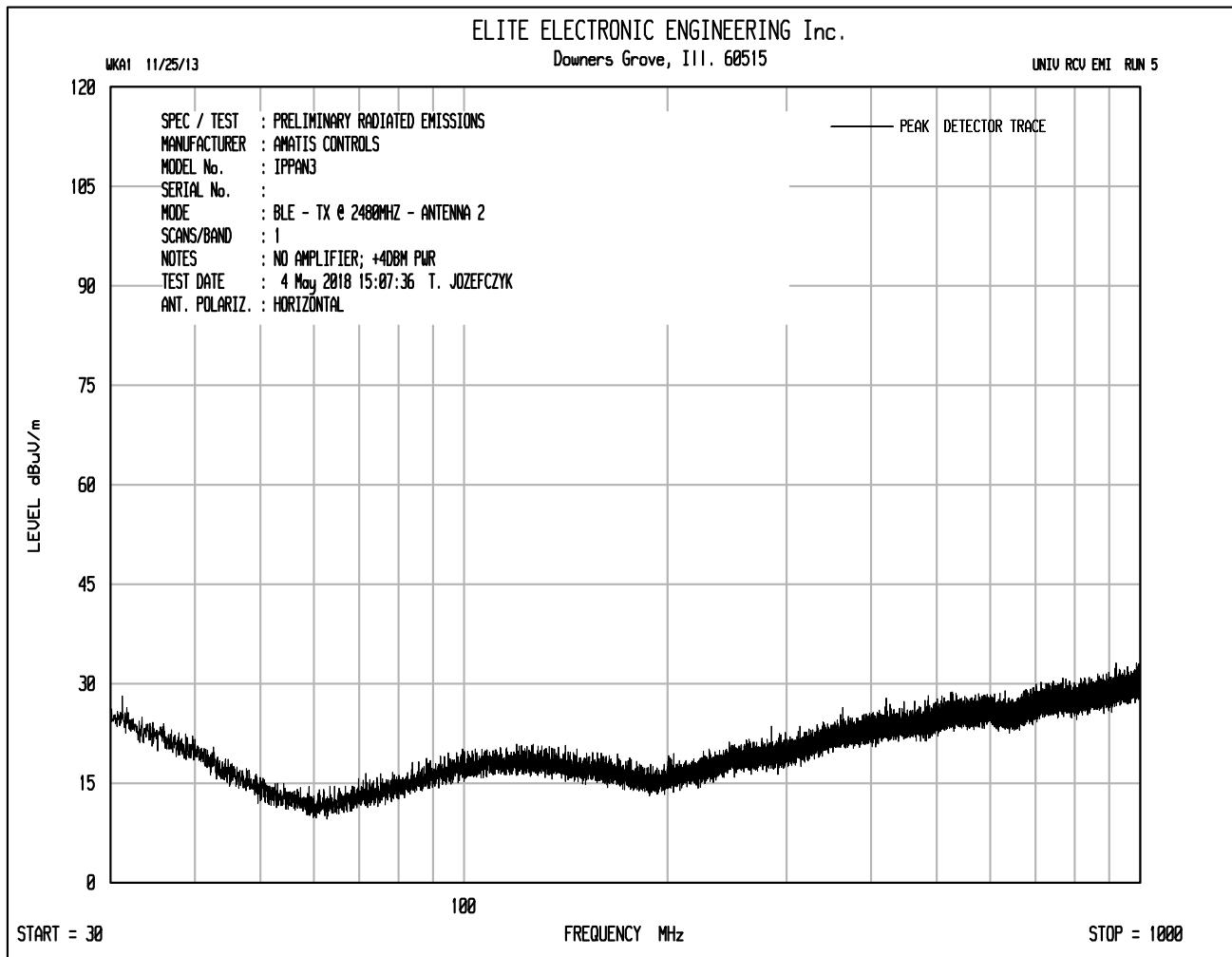
UNIV RCV EMI RUN 6

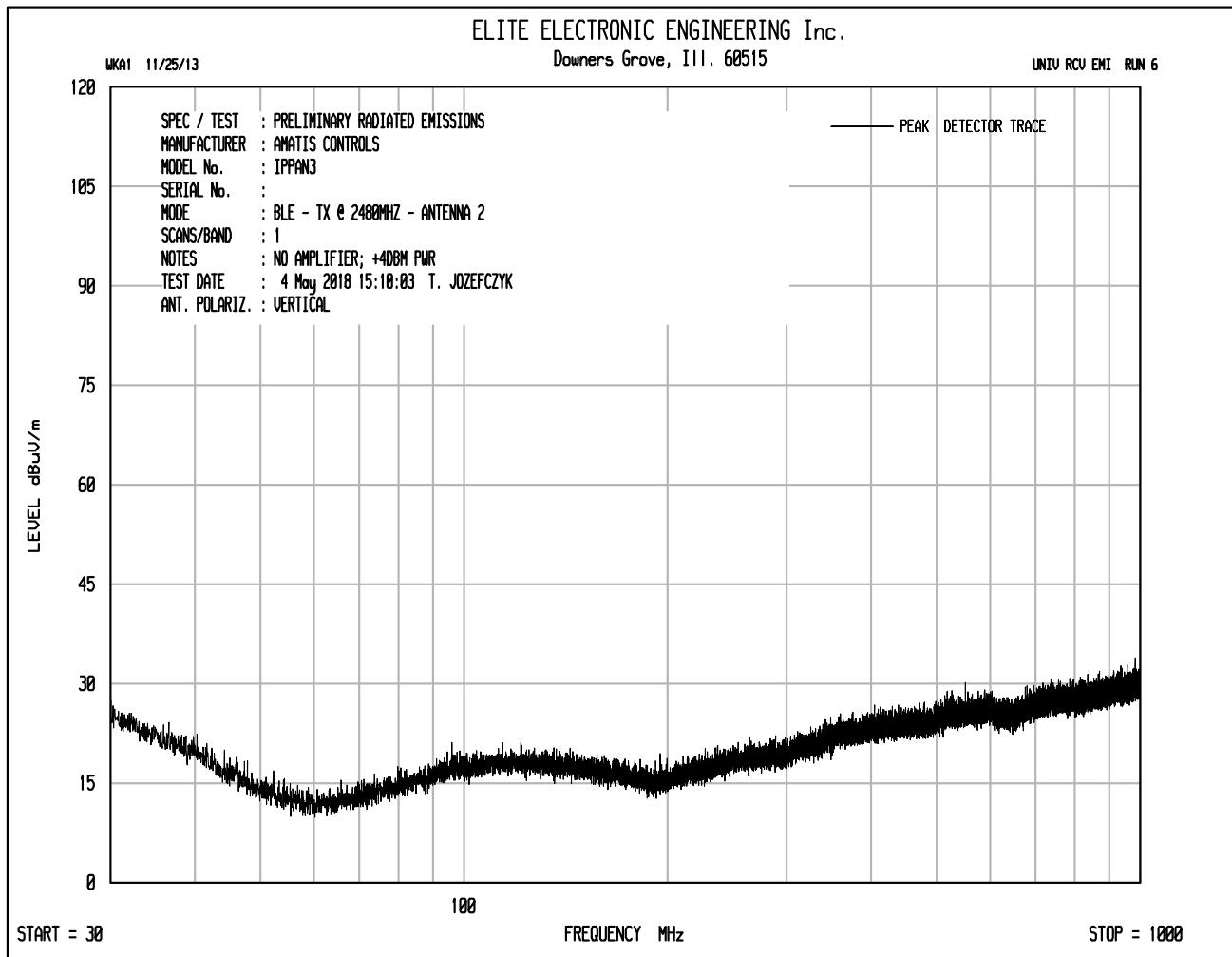


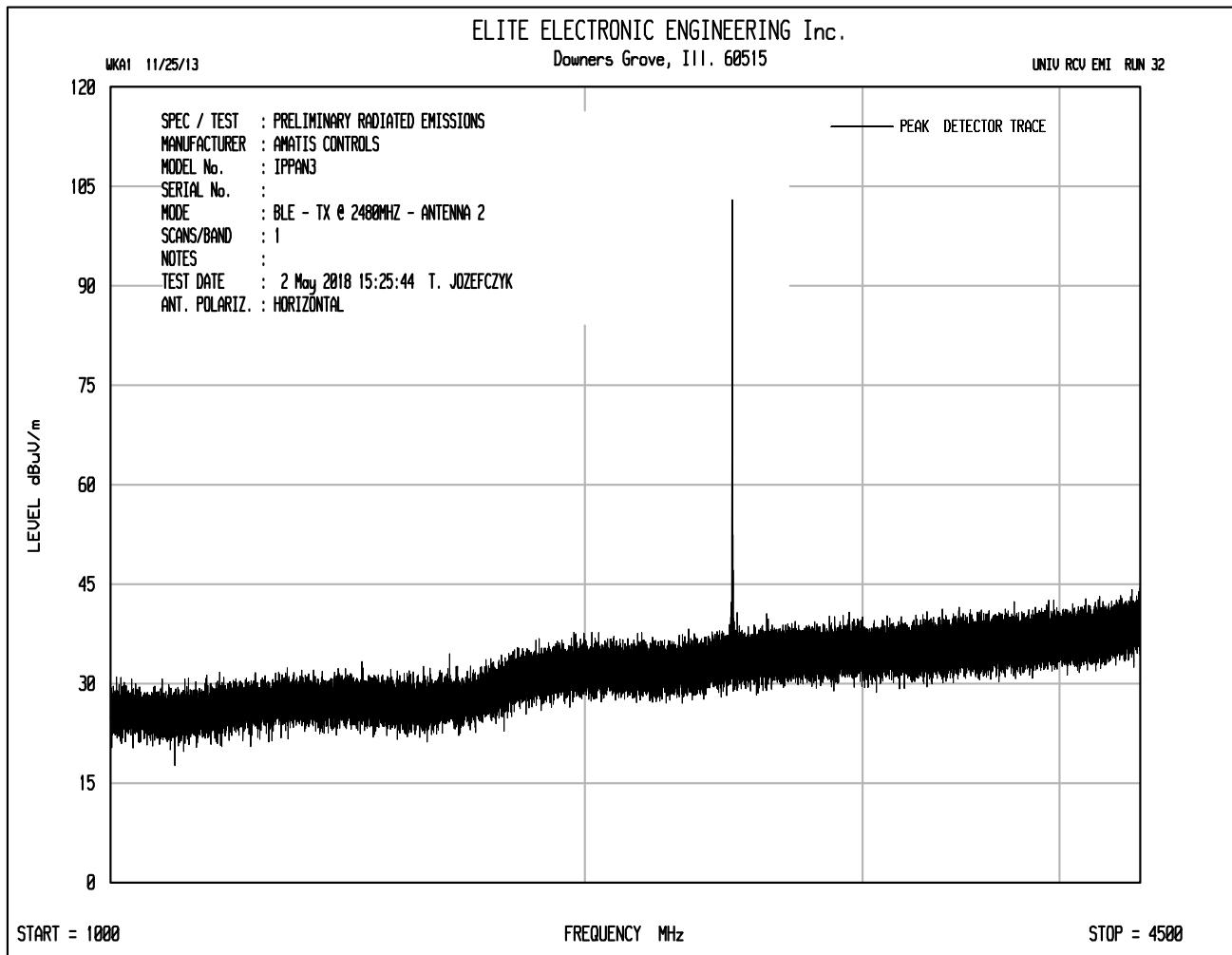
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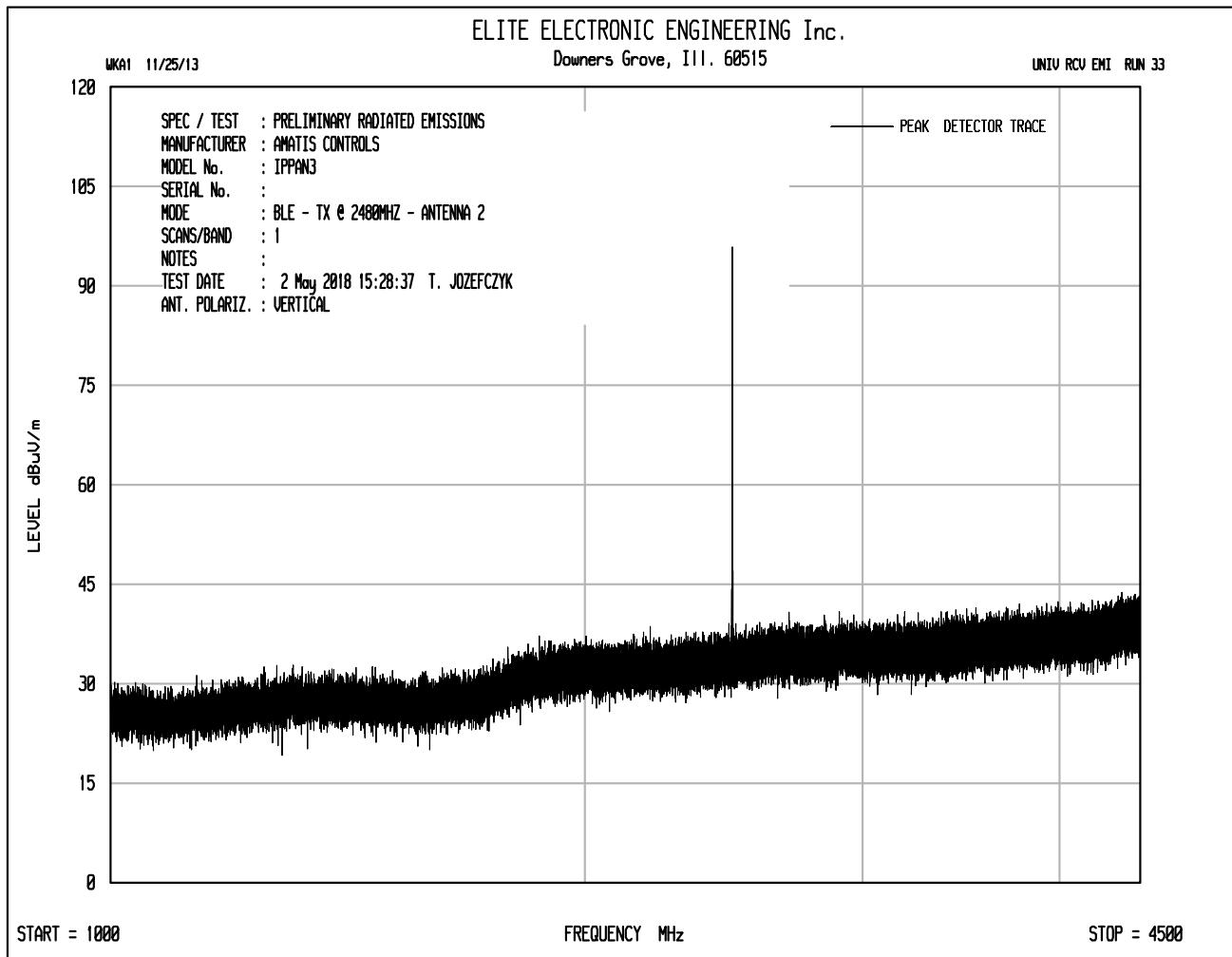
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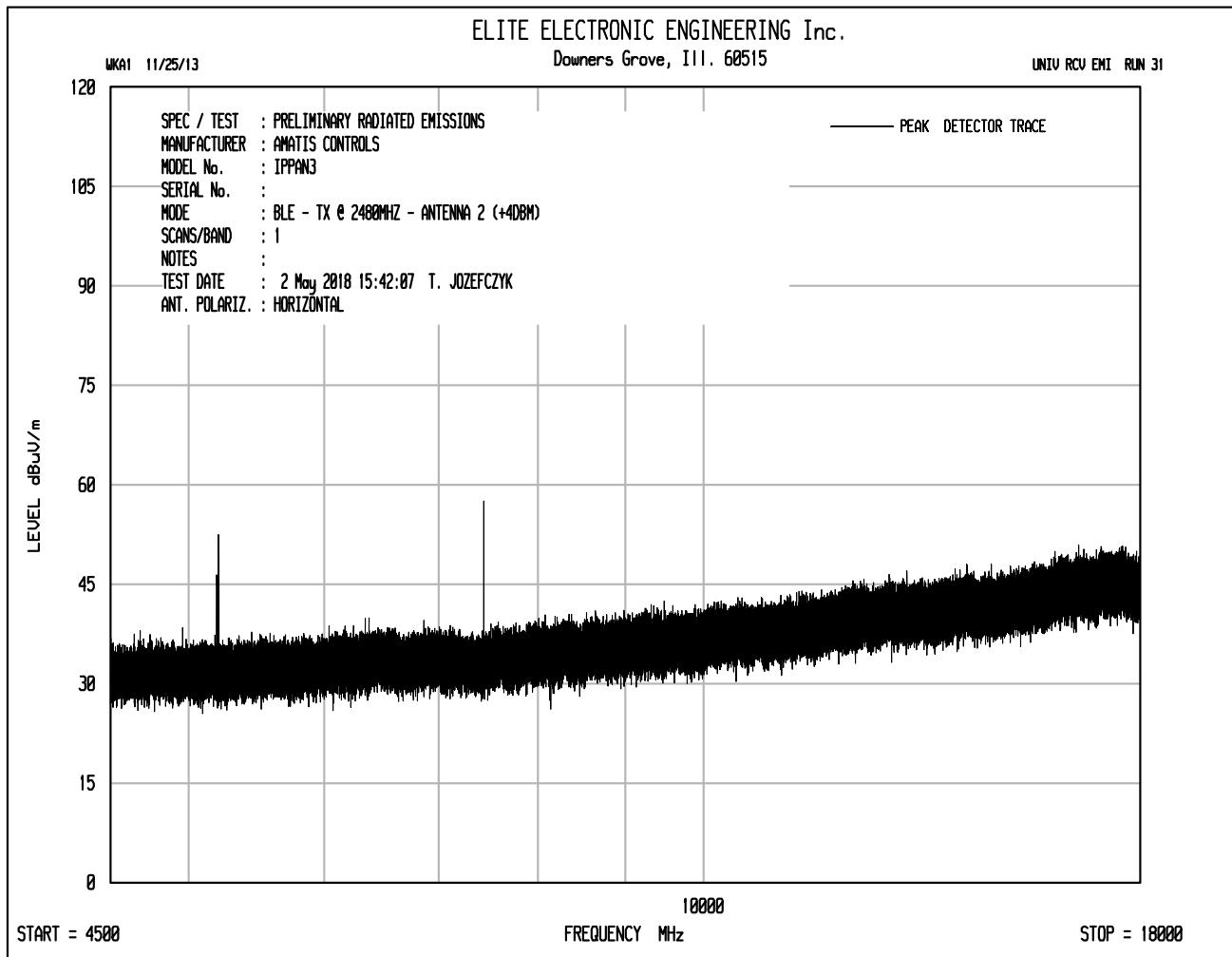
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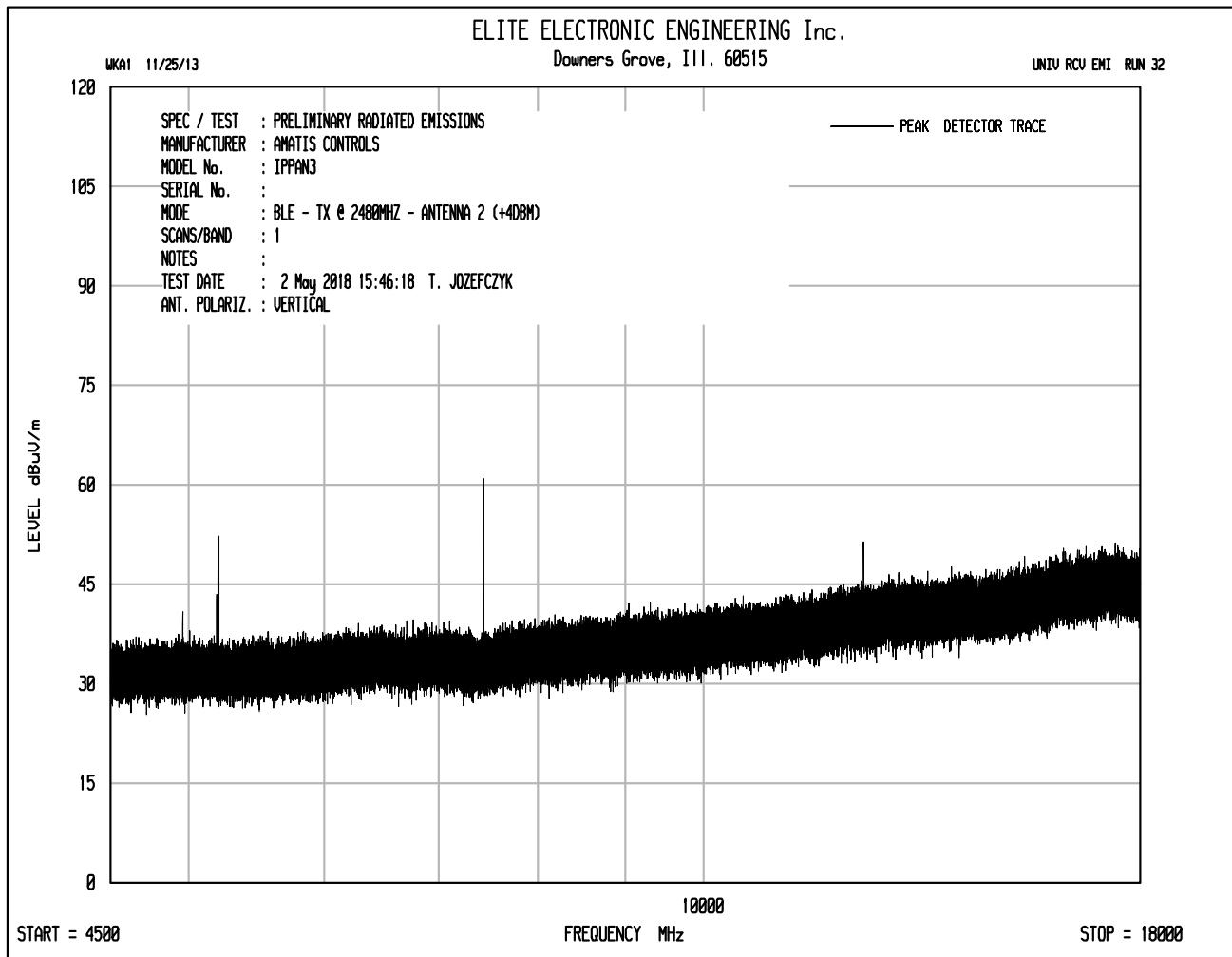










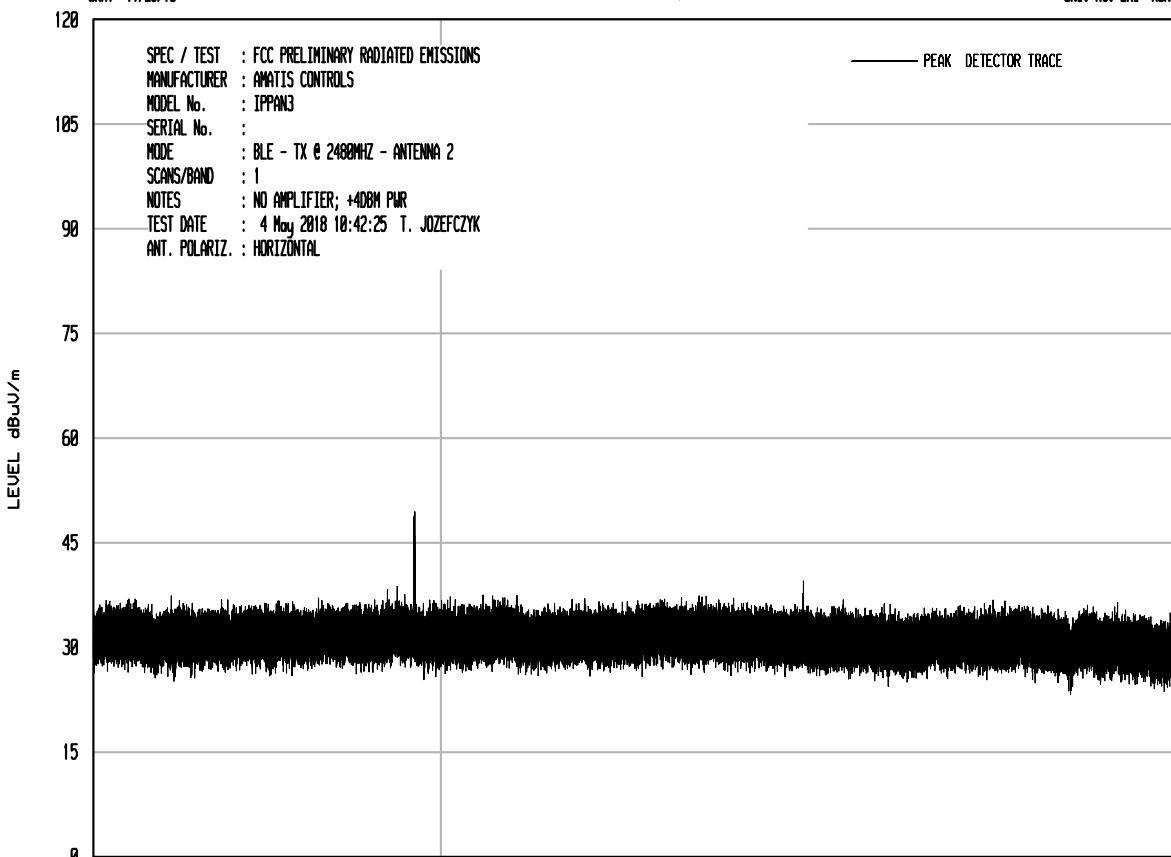


ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

UNIV RCV EMI RUN 4

WKA1 11/25/13



START = 18000

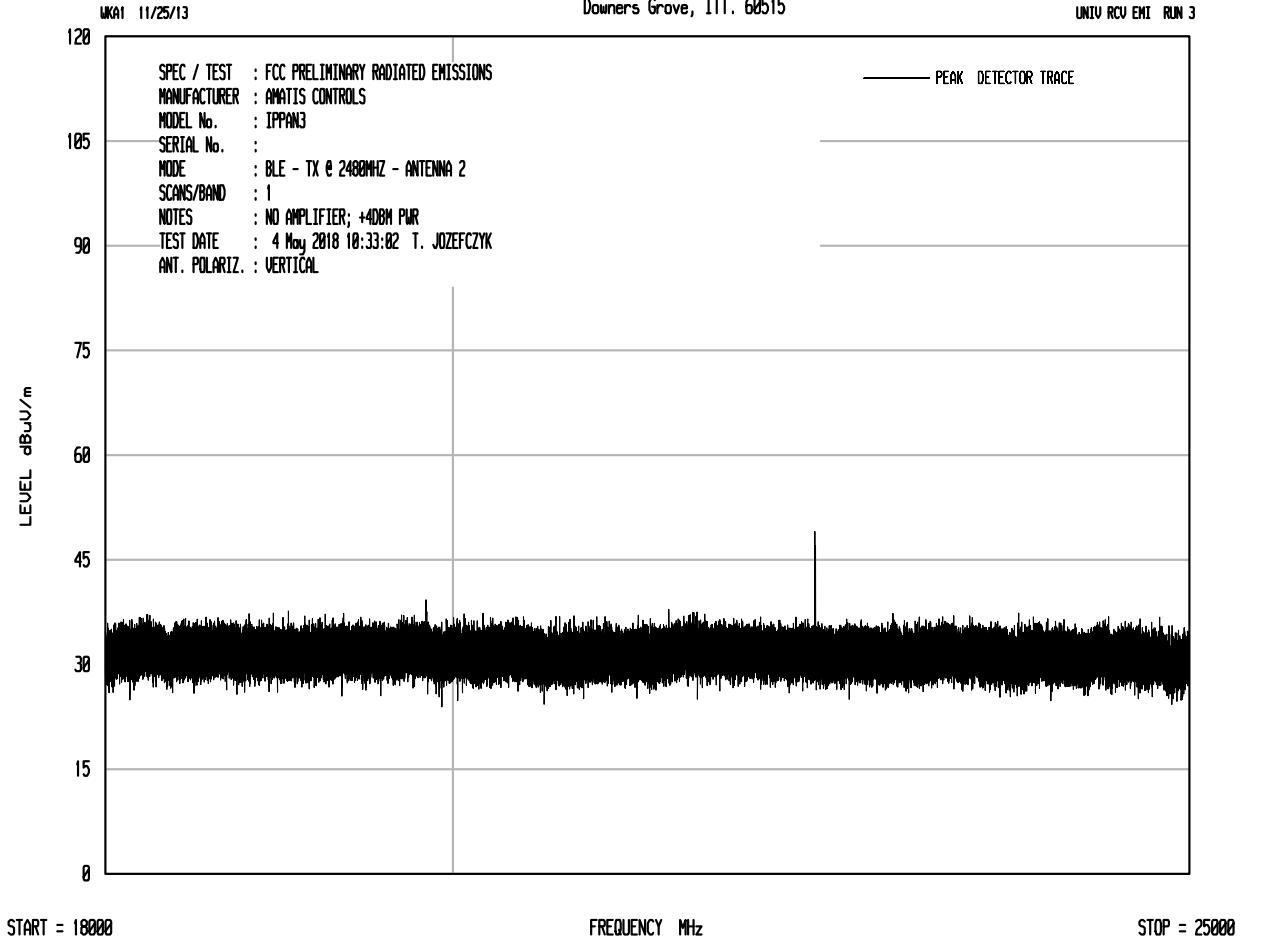
FREQUENCY MHz

STOP = 25000

ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

UNIV RCV EMI RUN 3



DATA PAGE

Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : 802.15.4 Zigbee – Transmit at 2405MHz – Johanson Technology 2450AT18A100E
 ZigBee Antenna
 Test Specification : FCC-15.247, RSS-247 Radiated Spurious Emissions - Harmonics in Non-Restricted Bands
 Date : May 2 - 4, 2018

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dB μ V/m at 3m	Peak Total μ V/m at 3 m	Peak Limit μ V/m at 3 m	Margin (dB)
2405.00	H	58.4		4.3	32.2	0.0	94.8	55093.4		
2405.00	V	54.0		4.3	32.2	0.0	90.5	33504.2		
7215.00	H	43.3		6.9	35.6	-39.4	46.3	207.2	5509.3	-28.5
7215.00	V	41.0		6.9	35.6	-39.4	44.0	159.0	5509.3	-30.8
9620.00	H	39.5	Ambient	8.2	36.6	-39.3	45.0	178.1	5509.3	-29.8
9620.00	V	39.3	Ambient	8.2	36.6	-39.3	44.8	174.0	5509.3	-30.0
14430.00	H	38.2	Ambient	9.6	39.4	-38.3	48.9	279.1	5509.3	-25.9
14430.00	V	38.0	Ambient	9.6	39.4	-38.3	48.7	270.9	5509.3	-26.2
16835.00	H	38.9	Ambient	10.9	42.1	-37.5	54.5	528.0	5509.3	-20.4
16835.00	V	39.2	Ambient	10.9	42.1	-37.5	54.8	547.8	5509.3	-20.0
21645.00	H	24.6	Ambient	2.2	40.6	-28.9	38.5	83.9	5509.3	-36.3
21645.00	V	24.5	Ambient	2.2	40.6	-28.9	38.4	83.5	5509.3	-36.4
24050.00	H	25.0	Ambient	2.2	40.6	-30.3	37.6	75.9	5509.3	-37.2
24050.00	V	25.1	Ambient	2.2	40.6	-30.3	37.7	76.9	5509.3	-37.1

DATA PAGE

Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : 802.15.4 Zigbee – Transmit at 2405MHz – Johanson Technology 2450AT18A100E
 ZigBee Antenna
 Test Specification : FCC-15.247, RSS-247 Radiated Spurious Emissions – Harmonics in Restricted Band
 Date : May 2 - 4, 2018

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dB μ V/m at 3m	Peak Total μ V/m at 3 m	Peak Limit μ V/m at 3 m	Margin (dB)
4810.00	H	50.2	Ambient	5.7	34.5	-39.3	51.1	359.0	5000.0	-22.9
4810.00	V	50.7	Ambient	5.7	34.5	-39.3	51.6	380.7	5000.0	-22.4
12025.00	H	49.7	Ambient	8.6	38.5	-39.2	57.7	769.9	5000.0	-16.3
12025.00	V	49.9	Ambient	8.6	38.5	-39.2	57.9	787.9	5000.0	-16.1
19240.00	H	34.6	Ambient	2.2	40.4	-28.7	48.4	263.9	5000.0	-25.5
19240.00	V	34.3	Ambient	2.2	40.4	-28.7	48.2	256.2	5000.0	-25.8

DATA PAGE

Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : 802.15.4 Zigbee – Transmit at 2405MHz – Johanson Technology 2450AT18A100E
 ZigBee Antenna
 Test Specification : FCC-15.247, RSS-247 Radiated Spurious Emissions – Restricted Band Averages
 Date : May 2 - 4, 2018

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dB μ V/m at 3m	Average Total μ V/m at 3 m	Average Limit μ V/m at 3 m	Margin (dB)
4810.00	H	35.7	Ambient	5.7	34.5	-39.3	0.0	36.6	67.4	500.0	-17.4
4810.00	V	35.6	Ambient	5.7	34.5	-39.3	0.0	36.5	66.8	500.0	-17.5
12025.00	H	35.3	Ambient	8.6	38.5	-39.2	0.0	43.3	146.0	500.0	-10.7
12025.00	V	35.3	Ambient	8.6	38.5	-39.2	0.0	43.3	146.9	500.0	-10.6
19240.00	H	21.1	Ambient	2.2	40.4	-28.7	0.0	35.0	56.0	500.0	-19.0
19240.00	V	20.9	Ambient	2.2	40.4	-28.7	0.0	34.8	54.6	500.0	-19.2

DATA PAGE

Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : 802.15.4 Zigbee – Transmit at 2425MHz – Johanson Technology 2450AT18A100E
 ZigBee Antenna
 Test Specification : FCC-15.247, RSS-247 Radiated Spurious Emissions - Harmonics in Non-Restricted Bands
 Date : May 2 - 4, 2018

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dB μ V/m at 3m	Peak Total μ V/m at 3 m	Peak Limit μ V/m at 3 m	Margin (dB)
2425.00	H	60.8		4.3	32.3	0.0	97.4	74358.9		
2425.00	V	56.9		4.3	32.3	0.0	93.5	47351.4		
9700.00	H	39.7	Ambient	8.2	36.7	-39.3	45.4	185.1	7435.9	-32.1
9700.00	V	39.3	Ambient	8.2	36.7	-39.3	45.0	177.6	7435.9	-32.4
14550.00	H	39.2	Ambient	9.6	39.5	-38.3	50.0	317.7	7435.9	-27.4
14550.00	V	38.4	Ambient	9.6	39.5	-38.3	49.2	289.4	7435.9	-28.2
16975.00	H	38.2	Ambient	10.9	41.9	-37.5	53.5	474.6	7435.9	-23.9
16975.00	V	38.5	Ambient	10.9	41.9	-37.5	53.8	489.0	7435.9	-23.6
21825.00	H	24.9	Ambient	2.2	40.6	-29.2	38.5	83.8	7435.9	-39.0
21825.00	V	25.6	Ambient	2.2	40.6	-29.2	39.2	90.9	7435.9	-38.3
24250.00	H	26.2	Ambient	2.2	40.6	-30.6	38.5	83.7	7435.9	-39.0
24250.00	V	24.7	Ambient	2.2	40.6	-30.6	37.0	70.5	7435.9	-40.5

DATA PAGE

Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : 802.15.4 Zigbee – Transmit at 2425MHz – Johanson Technology 2450AT18A100E
 ZigBee Antenna
 Test Specification : FCC-15.247, RSS-247 Radiated Spurious Emissions – Harmonics in Restricted Band
 Date : May 2 - 4, 2018

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dB μ V/m at 3m	Peak Total μ V/m at 3 m	Peak Limit μ V/m at 3 m	Margin (dB)
4850.00	H	50.2	Ambient	5.7	34.5	-39.3	51.0	356.5	5000.0	-22.9
4850.00	V	50.3	Ambient	5.7	34.5	-39.3	51.2	361.9	5000.0	-22.8
7275.00	H	50.4		6.9	35.6	-39.4	53.4	470.4	5000.0	-20.5
7275.00	V	51.1		6.9	35.6	-39.4	54.1	508.7	5000.0	-19.9
12125.00	H	49.9	Ambient	8.8	38.6	-39.1	58.3	818.8	5000.0	-15.7
12125.00	V	50.3	Ambient	8.8	38.6	-39.1	58.7	857.4	5000.0	-15.3
19400.00	H	36.1	Ambient	2.2	40.4	-28.7	50.0	314.6	5000.0	-24.0
19400.00	V	34.9	Ambient	2.2	40.4	-28.7	48.8	274.0	5000.0	-25.2

DATA PAGE

Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : 802.15.4 Zigbee – Transmit at 2425MHz – Johanson Technology 2450AT18A100E
 ZigBee Antenna
 Test Specification : FCC-15.247, RSS-247 Radiated Spurious Emissions – Restricted Band Averages
 Date : May 2 - 4, 2018

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dB μ V/m at 3m	Average Total μ V/m at 3 m	Average Limit μ V/m at 3 m	Margin (dB)
4850.00	H	36.0	Ambient	5.7	34.5	-39.3	0.0	36.9	69.6	500.0	-17.1
4850.00	V	35.6	Ambient	5.7	34.5	-39.3	0.0	36.4	66.4	500.0	-17.5
7275.00	H	35.79		6.9	35.6	-39.4	0.0	38.9	87.7	500.0	-15.1
7275.00	V	36.5		6.9	35.6	-39.4	0.0	39.5	94.8	500.0	-14.4
12125.00	H	35.6	Ambient	8.8	38.6	-39.1	0.0	43.9	157.3	500.0	-10.0
12125.00	V	35.6	Ambient	8.8	38.6	-39.1	0.0	43.9	157.3	500.0	-10.0
19400.00	H	21.1	Ambient	2.2	40.4	-28.7	0.0	35.0	56.3	500.0	-19.0
19400.00	V	20.9	Ambient	2.2	40.4	-28.7	0.0	34.8	54.7	500.0	-19.2

DATA PAGE

Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : 802.15.4 Zigbee – Transmit at 2480MHz – Johanson Technology 2450AT18A100E
 ZigBee Antenna
 Test Specification : FCC-15.247, RSS-247 Radiated Spurious Emissions - Harmonics in Non-Restricted Bands
 Date : May 2 - 4, 2018

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dB μ V/m at 3m	Peak Total μ V/m at 3 m	Peak Limit μ V/m at 3 m	Margin (dB)
2480.00	H	63.2		4.3	32.5	0.0	100.0	99922.9		
2480.00	V	60.6		4.3	32.5	0.0	97.5	74587.3		
9920.00	H	39.8		8.3	36.7	-39.2	45.5	189.1	9992.3	-34.5
9920.00	V	39.7		8.3	36.7	-39.2	45.4	187.2	9992.3	-34.5
14880.00	H	38.7		9.8	39.7	-38.2	50.1	319.1	9992.3	-29.9
14880.00	V	38.4		9.8	39.7	-38.2	49.7	305.5	9992.3	-30.3
17360.00	H	38.8		11.0	41.1	-37.7	53.1	453.6	9992.3	-26.9
17360.00	V	38.9		11.0	41.1	-37.7	53.1	454.1	9992.3	-26.8
24800.00	H	25.6	Ambient	2.2	40.6	-31.2	37.3	72.9	9992.3	-42.7
24800.00	V	25.5	Ambient	2.2	40.6	-31.2	37.1	71.9	9992.3	-42.9
5195.30	H	59.5		5.9	34.5	-39.4	60.5	1056.2	9992.3	-19.5
5196.30	V	59.5		5.9	34.5	-39.4	60.5	1065.0	9992.3	-19.4

DATA PAGE

Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : 802.15.4 Zigbee – Transmit at 2480MHz – Johanson Technology 2450AT18A100E
 ZigBee Antenna
 Test Specification : FCC-15.247, RSS-247 Radiated Spurious Emissions – Harmonics in Restricted Band
 Date : May 2 - 4, 2018

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dB μ V/m at 3m	Peak Total μ V/m at 3 m	Peak Limit μ V/m at 3 m	Margin (dB)
4960.00	H	51.7		5.8	34.3	-39.3	52.5	420.9	5000.0	-21.5
4960.00	V	51.1		5.8	34.3	-39.3	51.9	392.3	5000.0	-22.1
7440.00	H	49.3		6.9	35.7	-39.4	52.5	420.4	5000.0	-21.5
7440.00	V	49.2		6.9	35.7	-39.4	52.3	413.7	5000.0	-21.6
12400.00	H	48.8		9.4	38.8	-39.0	57.9	787.2	5000.0	-16.1
12400.00	V	48.8		9.4	38.8	-39.0	57.9	789.1	5000.0	-16.0
19840.00	H	35.4	Ambient	2.2	40.4	-28.4	49.6	302.8	5000.0	-24.4
19840.00	V	35.0	Ambient	2.2	40.4	-28.4	49.2	288.8	5000.0	-24.8
22320.00	H	35.7	Ambient	2.2	40.6	-29.3	49.2	290.0	5000.0	-24.7
22320.00	V	36.0	Ambient	2.2	40.6	-29.3	49.5	299.5	5000.0	-24.5

DATA PAGE

Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : 802.15.4 Zigbee – Transmit at 2480MHz – Johanson Technology 2450AT18A100E
 ZigBee Antenna
 Test Specification : FCC-15.247, RSS-247 Radiated Spurious Emissions – Restricted Band Averages
 Date : May 2 - 4, 2018

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dB μ V/m at 3m	Average Total μ V/m at 3 m	Average Limit μ V/m at 3 m	Margin (dB)
4960.00	H	37.8		5.8	34.3	-39.3	0.0	38.5	84.5	500.0	-15.4
4960.00	V	39.1		5.8	34.3	-39.3	0.0	39.9	98.9	500.0	-14.1
7440.00	H	35.55		6.9	35.7	-39.4	0.0	38.7	85.9	500.0	-15.3
7440.00	V	34.9		6.9	35.7	-39.4	0.0	38.0	79.6	500.0	-16.0
12400.00	H	35.1		9.4	38.8	-39.0	0.0	44.3	163.7	500.0	-9.7
12400.00	V	35.2		9.4	38.8	-39.0	0.0	44.4	165.4	500.0	-9.6
19840.00	H	21.1	Ambient	2.2	40.4	-28.4	0.0	35.3	58.4	500.0	-18.7
19840.00	V	20.9	Ambient	2.2	40.4	-28.4	0.0	35.1	56.8	500.0	-18.9
22320.00	H	21.8	Ambient	2.2	40.6	-29.3	0.0	35.3	58.4	500.0	-18.7
22320.00	V	21.9	Ambient	2.2	40.6	-29.3	0.0	35.4	58.9	500.0	-18.6

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Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : 802.15.4 Zigbee – Transmit at 2405MHz – Molex 0479480001 BLE Antenna
 Test Specification : FCC-15.247, RSS-247 Radiated Spurious Emissions - Harmonics in Non-Restricted Bands
 Date : May 2 - 4, 2018

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dB μ V/m at 3m	Peak Total μ V/m at 3 m	Peak Limit μ V/m at 3 m	Margin (dB)
2405.00	H	58.4		4.3	32.2	0.0	94.9	55603.2		
2405.00	V	57.2		4.3	32.2	0.0	93.6	48094.9		
7215.00	H	43.7		6.9	35.6	-39.4	46.7	216.0	5560.3	-28.2
7215.00	V	42.5		6.9	35.6	-39.4	45.5	187.9	5560.3	-29.4
9620.00	H	39.5	Ambient	8.2	36.6	-39.3	45.0	178.3	5560.3	-29.9
9620.00	V	40.0	Ambient	8.2	36.6	-39.3	45.5	188.2	5560.3	-29.4
14430.00	H	37.9	Ambient	9.6	39.4	-38.3	48.6	268.7	5560.3	-26.3
14430.00	V	38.6	Ambient	9.6	39.4	-38.3	49.3	292.2	5560.3	-25.6
16835.00	H	38.7	Ambient	10.9	42.1	-37.5	54.2	515.4	5560.3	-20.7
16835.00	V	39.0	Ambient	10.9	42.1	-37.5	54.5	532.3	5560.3	-20.4
21645.00	H	24.8	Ambient	2.2	40.6	-28.9	38.8	86.6	5560.3	-36.1
21645.00	V	24.9	Ambient	2.2	40.6	-28.9	38.8	86.9	5560.3	-36.1
24050.00	H	26.1	Ambient	2.2	40.6	-30.3	38.6	85.4	5560.3	-36.3
24050.00	V	25.6	Ambient	2.2	40.6	-30.3	38.2	81.0	5560.3	-36.7

DATA PAGE

Manufacturer : Amatis Controls
Test Item : Wireless Module
Model No. : IPPAN3
Mode : 802.15.4 Zigbee – Transmit at 2405MHz – Molex 0479480001 BLE Antenna
Test Specification : FCC-15.247, RSS-247 Radiated Spurious Emissions – Harmonics in Restricted Band
Date : May 2 - 4, 2018

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dB μ V/m at 3m	Peak Total μ V/m at 3 m	Peak Limit μ V/m at 3 m	Margin (dB)
4810.00	H	49.8	Ambient	5.7	34.5	-39.3	50.7	344.0	5000.0	-23.2
4810.00	V	49.7	Ambient	5.7	34.5	-39.3	50.6	338.1	5000.0	-23.4
12025.00	H	50.0	Ambient	8.6	38.5	-39.2	58.0	797.9	5000.0	-15.9
12025.00	V	50.0	Ambient	8.6	38.5	-39.2	58.0	798.8	5000.0	-15.9
19240.00	H	36.2	Ambient	2.2	40.4	-28.7	50.1	319.5	5000.0	-23.9
19240.00	V	34.5	Ambient	2.2	40.4	-28.7	48.4	262.7	5000.0	-25.6

DATA PAGE

Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : 802.15.4 Zigbee – Transmit at 2405MHz – Molex 0479480001 BLE Antenna
 Test Specification : FCC-15.247, RSS-247 Radiated Spurious Emissions – Restricted Band Averages
 Date : May 2 - 4, 2018

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dB μ V/m at 3m	Average Total μ V/m at 3 m	Average Limit μ V/m at 3 m	Margin (dB)
4810.00	H	35.7	Ambient	5.7	34.5	-39.3	0.0	36.6	67.3	500.0	-17.4
4810.00	V	35.6	Ambient	5.7	34.5	-39.3	0.0	36.5	66.5	500.0	-17.5
12025.00	H	35.8	Ambient	8.6	38.5	-39.2	0.0	43.8	154.5	500.0	-10.2
12025.00	V	35.8	Ambient	8.6	38.5	-39.2	0.0	43.8	154.9	500.0	-10.2
19240.00	H	21.1	Ambient	2.2	40.4	-28.7	0.0	35.0	56.4	500.0	-19.0
19240.00	V	20.9	Ambient	2.2	40.4	-28.7	0.0	34.7	54.6	500.0	-19.2

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Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : 802.15.4 Zigbee – Transmit at 2425MHz – Molex 0479480001 BLE Antenna
 Test Specification : FCC-15.247, RSS-247 Radiated Spurious Emissions - Harmonics in Non-Restricted Bands
 Date : May 2 - 4, 2018

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dB μ V/m at 3m	Peak Total μ V/m at 3 m	Peak Limit μ V/m at 3 m	Margin (dB)
2425.00	H	60.7		4.3	32.3	0.0	97.3	73507.8		
2425.00	V	56.5		4.3	32.3	0.0	93.1	45012.5		
9700.00	H	40.0	Ambient	8.2	36.7	-39.3	45.6	190.6	7350.8	-31.7
9700.00	V	40.4	Ambient	8.2	36.7	-39.3	46.0	199.8	7350.8	-31.3
14550.00	H	38.8	Ambient	9.6	39.5	-38.3	49.6	303.1	7350.8	-27.7
14550.00	V	38.6	Ambient	9.6	39.5	-38.3	49.5	297.5	7350.8	-27.9
16975.00	H	38.7	Ambient	10.9	41.9	-37.5	54.0	500.4	7350.8	-23.3
16975.00	V	37.6	Ambient	10.9	41.9	-37.5	52.9	443.9	7350.8	-24.4
21825.00	H	24.9	Ambient	2.2	40.6	-29.2	38.4	83.6	7350.8	-38.9
21825.00	V	25.0	Ambient	2.2	40.6	-29.2	38.6	85.0	7350.8	-38.7
24250.00	H	25.4	Ambient	2.2	40.6	-30.6	37.7	76.6	7350.8	-39.6
24250.00	V	25.4	Ambient	2.2	40.6	-30.6	37.7	77.0	7350.8	-39.6

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Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : 802.15.4 Zigbee – Transmit at 2425MHz – Molex 0479480001 BLE Antenna
 Test Specification : FCC-15.247, RSS-247 Radiated Spurious Emissions – Harmonics in Restricted Band
 Date : May 2 - 4, 2018

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dB μ V/m at 3m	Peak Total μ V/m at 3 m	Peak Limit μ V/m at 3 m	Margin (dB)
4850.00	H	50.3	Ambient	5.7	34.5	-39.3	51.2	364.0	5000.0	-22.8
4850.00	V	50.2	Ambient	5.7	34.5	-39.3	51.1	357.8	5000.0	-22.9
7275.00	H	50.2		6.9	35.6	-39.4	53.3	462.3	5000.0	-20.7
7275.00	V	51.1		6.9	35.6	-39.4	54.1	509.8	5000.0	-19.8
12125.00	H	50.5	Ambient	8.8	38.6	-39.1	58.9	876.4	5000.0	-15.1
12125.00	V	49.8	Ambient	8.8	38.6	-39.1	58.2	808.5	5000.0	-15.8
19400.00	H	35.2	Ambient	2.2	40.4	-28.7	49.1	284.9	5000.0	-24.9
19400.00	V	35.2	Ambient	2.2	40.4	-28.7	49.1	284.6	5000.0	-24.9

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Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : 802.15.4 Zigbee – Transmit at 2425MHz – Molex 0479480001 BLE Antenna
 Test Specification : FCC-15.247, RSS-247 Radiated Spurious Emissions – Restricted Band Averages
 Date : May 2 - 4, 2018

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dB μ V/m at 3m	Average Total μ V/m at 3 m	Average Limit μ V/m at 3 m	Margin (dB)
4850.00	H	36.1	Ambient	5.7	34.5	-39.3	0.0	36.9	70.2	500.0	-17.0
4850.00	V	35.7	Ambient	5.7	34.5	-39.3	0.0	36.6	67.5	500.0	-17.4
7275.00	H	35.78		6.9	35.6	-39.4	0.0	38.8	87.6	500.0	-15.1
7275.00	V	36.7		6.9	35.6	-39.4	0.0	39.8	97.7	500.0	-14.2
12125.00	H	35.7	Ambient	8.8	38.6	-39.1	0.0	44.0	159.1	500.0	-9.9
12125.00	V	35.7	Ambient	8.8	38.6	-39.1	0.0	44.0	159.1	500.0	-9.9
19400.00	H	21.1	Ambient	2.2	40.4	-28.7	0.0	35.0	56.1	500.0	-19.0
19400.00	V	20.9	Ambient	2.2	40.4	-28.7	0.0	34.8	54.9	500.0	-19.2

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Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : 802.15.4 Zigbee – Transmit at 2480MHz – Molex 0479480001 BLE Antenna
 Test Specification : FCC-15.247, RSS-247 Radiated Spurious Emissions - Harmonics in Non-Restricted Bands
 Date : May 2 - 4, 2018

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dB μ V/m at 3m	Peak Total μ V/m at 3 m	Peak Limit μ V/m at 3 m	Margin (dB)
2480.00	H	63.2		4.3	32.5	0.0	100.0	100153.3		
2480.00	V	57.1		4.3	32.5	0.0	93.9	49393.0		
9920.00	H	39.5	Ambient	8.3	36.7	-39.2	45.3	183.5	10015.3	-34.7
9920.00	V	39.1	Ambient	8.3	36.7	-39.2	44.8	174.1	10015.3	-35.2
14880.00	H	38.5	Ambient	9.8	39.7	-38.2	49.8	310.4	10015.3	-30.2
14880.00	V	38.0	Ambient	9.8	39.7	-38.2	49.4	293.7	10015.3	-30.7
17360.00	H	38.6	Ambient	11.0	41.1	-37.7	52.8	438.7	10015.3	-27.2
17360.00	V	38.5	Ambient	11.0	41.1	-37.7	52.8	435.7	10015.3	-27.2
24800.00	H	24.5	Ambient	2.2	40.6	-31.2	36.2	64.5	10015.3	-43.8
24800.00	V	25.6	Ambient	2.2	40.6	-31.2	37.3	73.0	10015.3	-42.7

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Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : 802.15.4 Zigbee – Transmit at 2480MHz – Molex 0479480001 BLE Antenna
 Test Specification : FCC-15.247, RSS-247 Radiated Spurious Emissions – Harmonics in Restricted Band
 Date : May 2 - 4, 2018

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dB μ V/m at 3m	Peak Total μ V/m at 3 m	Peak Limit μ V/m at 3 m	Margin (dB)
4960.00	H	50.0	Ambient	5.8	34.3	-39.3	50.8	345.7	5000.0	-23.2
4960.00	V	49.4	Ambient	5.8	34.3	-39.3	50.2	323.7	5000.0	-23.8
7440.00	H	48.6	Ambient	6.9	35.7	-39.4	51.7	385.2	5000.0	-22.3
7440.00	V	48.8	Ambient	6.9	35.7	-39.4	52.0	396.0	5000.0	-22.0
12400.00	H	49.9	Ambient	9.4	38.8	-39.0	59.1	899.7	5000.0	-14.9
12400.00	V	48.9	Ambient	9.4	38.8	-39.0	58.1	799.1	5000.0	-15.9
19840.00	H	34.9	Ambient	2.2	40.4	-28.4	49.1	285.9	5000.0	-24.9
19840.00	V	35.7	Ambient	2.2	40.4	-28.4	49.9	313.4	5000.0	-24.1
22320.00	H	35.5	Ambient	2.2	40.6	-29.3	49.0	280.8	5000.0	-25.0
22320.00	V	35.9	Ambient	2.2	40.6	-29.3	49.4	295.1	5000.0	-24.6

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Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : 802.15.4 Zigbee – Transmit at 2480MHz – Molex 0479480001 BLE Antenna
 Test Specification : FCC-15.247, RSS-247 Radiated Spurious Emissions – Restricted Band Averages
 Date : May 2 - 4, 2018

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dB μ V/m at 3m	Average Total μ V/m at 3 m	Average Limit μ V/m at 3 m	Margin (dB)
4960.00	H	34.8	Ambient	5.8	34.3	-39.3	0.0	35.6	60.3	500.0	-18.4
4960.00	V	35.8	Ambient	5.8	34.3	-39.3	0.0	36.6	67.4	500.0	-17.4
7440.00	H	34.36	Ambient	6.9	35.7	-39.4	0.0	37.5	74.9	500.0	-16.5
7440.00	V	34.2	Ambient	6.9	35.7	-39.4	0.0	37.4	73.7	500.0	-16.6
12400.00	H	35.1	Ambient	9.4	38.8	-39.0	0.0	44.2	162.4	500.0	-9.8
12400.00	V	35.1	Ambient	9.4	38.8	-39.0	0.0	44.2	162.4	500.0	-9.8
19840.00	H	20.9	Ambient	2.2	40.4	-28.4	0.0	35.1	56.8	500.0	-18.9
19840.00	V	20.9	Ambient	2.2	40.4	-28.4	0.0	35.1	57.1	500.0	-18.8
22320.00	H	21.3	Ambient	2.2	40.6	-29.3	0.0	34.8	55.3	500.0	-19.1
22320.00	V	21.8	Ambient	2.2	40.6	-29.3	0.0	35.3	58.0	500.0	-18.7

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Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : BLE – Transmit at 2402MHz – Johanson Technology 2450AT18A100E ZigBee
 Antenna
 Test Specification : FCC-15.247, RSS-247 Radiated Spurious Emissions - Harmonics in Non-Restricted Bands
 Date : May 2 - 4, 2018

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dB μ V/m at 3m	Peak Total μ V/m at 3 m	Peak Limit μ V/m at 3 m	Margin (dB)
2402.00	H	69.4		4.3	32.2	0.0	105.8	194764.2		
2402.00	V	70.3		4.3	32.2	0.0	106.8	217775.6		
7206.00	H	69.9		6.9	35.6	-39.4	72.8	4389.3	21777.6	-13.9
7206.00	V	67.1		6.9	35.6	-39.4	70.0	3179.7	21777.6	-16.7
9608.00	H	53.8		8.2	36.5	-39.3	59.2	916.9	21777.6	-27.5
9608.00	V	51.8		8.2	36.5	-39.3	57.3	733.4	21777.6	-29.5
14412.00	H	39.2	Ambient	9.6	39.4	-38.3	49.9	311.9	21777.6	-36.9
14412.00	V	38.5	Ambient	9.6	39.4	-38.3	49.2	288.4	21777.6	-37.6
16814.00	H	39.8	Ambient	10.9	42.1	-37.5	55.4	586.7	21777.6	-31.4
16814.00	V	39.4	Ambient	10.9	42.1	-37.5	55.0	561.6	21777.6	-31.8
21618.00	H	26.6		2.2	40.6	-28.9	40.5	105.6	21777.6	-46.3
21618.00	V	25.2		2.2	40.6	-28.9	39.2	90.7	21777.6	-47.6
24020.00	H	29.9		2.2	40.6	-30.2	42.5	133.8	21777.6	-44.2
24020.00	V	28.0		2.2	40.6	-30.2	40.6	107.6	21777.6	-46.1



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Manufacturer : Amatis Controls
Test Item : Wireless Module
Model No. : IPPAN3
Mode : BLE – Transmit at 2402MHz – Johanson Technology 2450AT18A100E ZigBee
Antenna
Test Specification : FCC-15.247, RSS-247 Radiated Spurious Emissions – Harmonics in Restricted Band
Date : May 2 - 4, 2018

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dB μ V/m at 3m	Peak Total μ V/m at 3 m	Peak Limit μ V/m at 3 m	Margin (dB)
4804.00	H	57.8		5.7	34.5	-39.3	58.7	858.4	5000.0	-15.3
4804.00	V	58.8		5.7	34.5	-39.3	59.7	968.7	5000.0	-14.3
12010.00	H	53.9		8.6	38.5	-39.2	61.9	1239.3	5000.0	-12.1
12010.00	V	54.1		8.6	38.5	-39.2	62.1	1271.1	5000.0	-11.9
19216.00	H	35.7	Ambient	2.2	40.4	-28.8	49.5	299.0	5000.0	-24.5
19216.00	V	43.7		2.2	40.4	-28.8	57.5	753.7	5000.0	-16.4

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Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : BLE – Transmit at 2402MHz – Johanson Technology 2450AT18A100E ZigBee
 Antenna
 Test Specification : FCC-15.247, RSS-247 Radiated Spurious Emissions – Restricted Band Averages
 Date : May 2 - 4, 2018

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dB μ V/m at 3m	Average Total μ V/m at 3 m	Average Limit μ V/m at 3 m	Margin (dB)
4804.00	H	44.8		5.7	34.5	-39.3	0.0	45.7	193.1	500.0	-8.3
4804.00	V	45.6		5.7	34.5	-39.3	0.0	46.5	210.5	500.0	-7.5
12010.00	H	39.0		8.6	38.5	-39.2	0.0	47.0	222.7	500.0	-7.0
12010.00	V	39.3		8.6	38.5	-39.2	0.0	47.3	230.8	500.0	-6.7
19216.00	H	21.2	Ambient	2.2	40.4	-28.8	0.0	35.0	55.9	500.0	-19.0
19216.00	V	26.1		2.2	40.4	-28.8	0.0	39.9	98.6	500.0	-14.1

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Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : BLE – Transmit at 2442MHz – Johanson Technology 2450AT18A100E ZigBee Antenna
 Test Specification : FCC-15.247, RSS-247 Radiated Spurious Emissions - Harmonics in Non-Restricted Bands
 Date : May 2 - 4, 2018

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dB μ V/m at 3m	Peak Total μ V/m at 3 m	Peak Limit μ V/m at 3 m	Margin (dB)
2442.00	H	67.9		4.3	32.4	0.0	104.6	169408.5		
2442.00	V	68.5		4.3	32.4	0.0	105.2	181942.9		
9768.00	H	51.2		8.2	36.7	-39.3	56.9	698.4	18194.3	-28.3
9768.00	V	52.6		8.2	36.7	-39.3	58.3	826.3	18194.3	-26.9
14652.00	H	38.5	Ambient	9.7	39.6	-38.2	49.6	301.0	18194.3	-35.6
14652.00	V	38.4	Ambient	9.7	39.6	-38.2	49.5	297.6	18194.3	-35.7
17094.00	H	39.0	Ambient	11.0	41.5	-37.6	54.0	499.2	18194.3	-31.2
17094.00	V	39.8	Ambient	11.0	41.5	-37.6	54.7	546.1	18194.3	-30.5
21978.00	H	30.7		2.2	40.6	-29.4	44.0	159.4	18194.3	-41.1
21978.00	V	32.0		2.2	40.6	-29.4	45.4	186.0	18194.3	-39.8
24420.00	H	27.1		2.2	40.6	-30.4	39.5	94.1	18194.3	-45.7
24420.00	V	31.9		2.2	40.6	-30.4	44.4	165.2	18194.3	-40.8
5192.30	H	57.8		5.9	34.5	-39.4	58.8	871.8	18194.3	-26.4
5204.79	V	58.8		5.9	34.5	-39.4	59.8	974.7	18194.3	-25.4

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Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : BLE – Transmit at 2442MHz – Johanson Technology 2450AT18A100E ZigBee
 Antenna
 Test Specification : FCC-15.247, RSS-247 Radiated Spurious Emissions – Harmonics in Restricted Band
 Date : May 2 - 4, 2018

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dB μ V/m at 3m	Peak Total μ V/m at 3 m	Peak Limit μ V/m at 3 m	Margin (dB)
4884.00	H	54.1		5.7	34.4	-39.3	54.9	556.2	5000.0	-19.1
4884.00	V	54.9		5.7	34.4	-39.3	55.7	612.7	5000.0	-18.2
7326.00	H	67.8		6.9	35.7	-39.4	70.9	3514.2	5000.0	-3.1
7326.00	V	67.1		6.9	35.7	-39.4	70.2	3245.9	5000.0	-3.8
12210.00	H	52.8		8.9	38.7	-39.1	61.3	1167.4	5000.0	-12.6
12210.00	V	53.6		8.9	38.7	-39.1	62.1	1274.2	5000.0	-11.9
19536.00	H	40.5		2.2	40.4	-28.7	54.4	526.1	5000.0	-19.6
19536.00	V	38.2		2.2	40.4	-28.7	52.2	406.1	5000.0	-21.8

DATA PAGE

Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : BLE – Transmit at 2442MHz – Johanson Technology 2450AT18A100E ZigBee
 Antenna
 Test Specification : FCC-15.247, RSS-247 Radiated Spurious Emissions – Restricted Band Averages
 Date : May 2 - 4, 2018

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dB μ V/m at 3m	Average Total μ V/m at 3 m	Average Limit μ V/m at 3 m	Margin (dB)
4884.00	H	40.8		5.7	34.4	-39.3	0.0	41.6	120.4	500.0	-12.4
4884.00	V	42.6		5.7	34.4	-39.3	0.0	43.5	149.4	500.0	-10.5
7326.00	H	49.76		6.9	35.7	-39.4	0.0	52.9	439.9	500.0	-1.1
7326.00	V	48.1		6.9	35.7	-39.4	0.0	51.2	362.9	500.0	-2.8
12210.00	H	37.9		8.9	38.7	-39.1	0.0	46.4	209.3	500.0	-7.6
12210.00	V	38.2		8.9	38.7	-39.1	0.0	46.7	216.9	500.0	-7.3
19536.00	H	24.3		2.2	40.4	-28.7	0.0	38.2	81.1	500.0	-15.8
19536.00	V	23.4		2.2	40.4	-28.7	0.0	37.3	73.4	500.0	-16.7

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Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : BLE – Transmit at 2480MHz – Johanson Technology 2450AT18A100E ZigBee
 Antenna
 Test Specification : FCC-15.247, RSS-247 Radiated Spurious Emissions - Harmonics in Non-Restricted Bands
 Date : May 2 - 4, 2018

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dB μ V/m at 3m	Peak Total μ V/m at 3 m	Peak Limit μ V/m at 3 m	Margin (dB)
2480.00	H	68.6		4.3	32.5	0.0	105.4	186279.5		
2480.00	V	68.5		4.3	32.5	0.0	105.3	184997.2		
9920.00	H	51.7		8.3	36.7	-39.2	57.5	746.9	18628.0	-27.9
9920.00	V	52.1		8.3	36.7	-39.2	57.8	777.6	18628.0	-27.6
14880.00	H	39.9	Ambient	9.8	39.7	-38.2	51.2	365.2	18628.0	-34.2
14880.00	V	38.8	Ambient	9.8	39.7	-38.2	50.1	320.6	18628.0	-35.3
17360.00	H	39.1	Ambient	11.0	41.1	-37.7	53.4	469.0	18628.0	-32.0
17360.00	V	39.3	Ambient	11.0	41.1	-37.7	53.6	476.6	18628.0	-31.8
24800.00	H	25.8	Ambient	2.2	40.6	-31.2	37.5	75.0	18628.0	-47.9
24800.00	V	26.0	Ambient	2.2	40.6	-31.2	37.6	76.2	18628.0	-47.8
5204.90	H	56.8		5.9	34.5	-39.4	57.9	781.4	18628.0	-27.5
5193.71	V	56.6		5.9	34.5	-39.4	57.6	759.6	18628.0	-27.8

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Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : BLE – Transmit at 2480MHz – Johanson Technology 2450AT18A100E ZigBee
 Antenna
 Test Specification : FCC-15.247, RSS-247 Radiated Spurious Emissions – Harmonics in Restricted Band
 Date : May 2 - 4, 2018

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dB μ V/m at 3m	Peak Total μ V/m at 3 m	Peak Limit μ V/m at 3 m	Margin (dB)
4960.00	H	55.7		5.8	34.3	-39.3	56.5	668.6	5000.0	-17.5
4960.00	V	56.4		5.8	34.3	-39.3	57.2	725.5	5000.0	-16.8
7440.00	H	64.0		6.9	35.7	-39.4	67.2	2281.5	5000.0	-6.8
7440.00	V	64.0		6.9	35.7	-39.4	67.1	2263.1	5000.0	-6.9
12400.00	H	52.1		9.4	38.8	-39.0	61.3	1159.1	5000.0	-12.7
12400.00	V	52.8		9.4	38.8	-39.0	61.9	1247.7	5000.0	-12.1
19840.00	H	40.8		2.2	40.4	-28.4	55.0	564.5	5000.0	-18.9
19840.00	V	36.3		2.2	40.4	-28.4	50.5	334.7	5000.0	-23.5
22320.00	H	39.5		2.2	40.6	-29.3	53.0	446.1	5000.0	-21.0
22320.00	V	41.3		2.2	40.6	-29.3	54.8	548.8	5000.0	-19.2

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Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : BLE – Transmit at 2480MHz – Johanson Technology 2450AT18A100E ZigBee
 Antenna
 Test Specification : FCC-15.247, RSS-247 Radiated Spurious Emissions – Restricted Band Averages
 Date : May 2 - 4, 2018

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dB μ V/m at 3m	Average Total μ V/m at 3 m	Average Limit μ V/m at 3 m	Margin (dB)
4960.00	H	41.5		5.8	34.3	-39.3	0.0	42.3	129.8	500.0	-11.7
4960.00	V	44.6		5.8	34.3	-39.3	0.0	45.3	184.6	500.0	-8.7
7440.00	H	47.23		6.9	35.7	-39.4	0.0	50.4	329.8	500.0	-3.6
7440.00	V	46.8		6.9	35.7	-39.4	0.0	50.0	314.6	500.0	-4.0
12400.00	H	36.3		9.4	38.8	-39.0	0.0	45.4	186.9	500.0	-8.5
12400.00	V	37.7		9.4	38.8	-39.0	0.0	46.8	219.1	500.0	-7.2
19840.00	H	24.9		2.2	40.4	-28.4	0.0	39.1	90.3	500.0	-14.9
19840.00	V	21.9		2.2	40.4	-28.4	0.0	36.2	64.2	500.0	-17.8
22320.00	H	24.3		2.2	40.6	-29.3	0.0	37.8	77.8	500.0	-16.2
22320.00	V	25.6		2.2	40.6	-29.3	0.0	39.1	90.5	500.0	-14.9

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Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : BLE – Transmit at 2402MHz – Molex 0479480001 BLE Antenna
 Test Specification : FCC-15.247, RSS-247 Radiated Spurious Emissions - Harmonics in Non-Restricted Bands
 Date : May 2 - 4, 2018

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dB μ V/m at 3m	Peak Total μ V/m at 3 m	Peak Limit μ V/m at 3 m	Margin (dB)
2402.00	H	67.7		4.3	32.2	0.0	104.1	160882.6		
2402.00	V	70.4		4.3	32.2	0.0	106.8	219790.6		
7206.00	H	69.7		6.9	35.6	-39.4	72.7	4299.2	21979.1	-14.2
7206.00	V	68.5		6.9	35.6	-39.4	71.5	3744.5	21979.1	-15.4
9608.00	H	53.6		8.2	36.5	-39.3	59.1	902.3	21979.1	-27.7
9608.00	V	52.2		8.2	36.5	-39.3	57.6	761.8	21979.1	-29.2
14412.00	H	39.2	Ambient	9.6	39.4	-38.3	49.9	312.6	21979.1	-36.9
14412.00	V	38.8	Ambient	9.6	39.4	-38.3	49.4	295.8	21979.1	-37.4
16814.00	H	40.9	Ambient	10.9	42.1	-37.5	56.4	660.5	21979.1	-30.4
16814.00	V	40.0	Ambient	10.9	42.1	-37.5	55.5	598.3	21979.1	-31.3
21618.00	H	24.3	Ambient	2.2	40.6	-28.9	38.2	81.7	21979.1	-48.6
21618.00	V	24.7	Ambient	2.2	40.6	-28.9	38.6	84.9	21979.1	-48.3
24020.00	H	32.3		2.2	40.6	-30.2	44.9	176.8	21979.1	-41.9
24020.00	V	31.7		2.2	40.6	-30.2	44.3	164.0	21979.1	-42.5

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Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : BLE – Transmit at 2402MHz – Molex 0479480001 BLE Antenna
 Test Specification : FCC-15.247, RSS-247 Radiated Spurious Emissions – Harmonics in Restricted Band
 Date : May 2 - 4, 2018

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dB μ V/m at 3m	Peak Total μ V/m at 3 m	Peak Limit μ V/m at 3 m	Margin (dB)
4804.00	H	57.3		5.7	34.5	-39.3	58.2	813.2	5000.0	-15.8
4804.00	V	57.4		5.7	34.5	-39.3	58.3	824.5	5000.0	-15.7
12010.00	H	54.5		8.6	38.5	-39.2	62.5	1331.0	5000.0	-11.5
12010.00	V	53.0		8.6	38.5	-39.2	61.0	1126.4	5000.0	-12.9
19216.00	H	42.9		2.2	40.4	-28.8	56.7	687.4	5000.0	-17.2
19216.00	V	37.7		2.2	40.4	-28.8	51.5	376.9	5000.0	-22.5

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Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : BLE – Transmit at 2402MHz – Molex 0479480001 BLE Antenna
 Test Specification : FCC-15.247, RSS-247 Radiated Spurious Emissions – Restricted Band Averages
 Date : May 2 - 4, 2018

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dB μ V/m at 3m	Average Total μ V/m at 3 m	Average Limit μ V/m at 3 m	Margin (dB)
4804.00	H	44.8		5.7	34.5	-39.3	0.0	45.7	192.4	500.0	-8.3
4804.00	V	44.0		5.7	34.5	-39.3	0.0	44.9	176.5	500.0	-9.0
12010.00	H	40.0		8.6	38.5	-39.2	0.0	48.0	251.3	500.0	-6.0
12010.00	V	39.3		8.6	38.5	-39.2	0.0	47.3	232.4	500.0	-6.7
19216.00	H	25.8		2.2	40.4	-28.8	0.0	39.6	95.1	500.0	-14.4
19216.00	V	22.9		2.2	40.4	-28.8	0.0	36.7	68.7	500.0	-17.2

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Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : BLE – Transmit at 2442MHz – Molex 0479480001 BLE Antenna
 Test Specification : FCC-15.247, RSS-247 Radiated Spurious Emissions - Harmonics in Non-Restricted Bands
 Date : May 2 - 4, 2018

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dB μ V/m at 3m	Peak Total μ V/m at 3 m	Peak Limit μ V/m at 3 m	Margin (dB)
2442.00	H	68.3		4.3	32.4	0.0	105.0	177596.8		
2442.00	V	70.8		4.3	32.4	0.0	107.5	237922.3		
9768.00	H	48.3		8.2	36.7	-39.3	54.0	501.3	23792.2	-33.5
9768.00	V	51.3		8.2	36.7	-39.3	57.0	709.0	23792.2	-30.5
14652.00	H	39.1	Ambient	9.7	39.6	-38.2	50.2	322.2	23792.2	-37.4
14652.00	V	38.6	Ambient	9.7	39.6	-38.2	49.7	304.2	23792.2	-37.9
17094.00	H	39.5	Ambient	11.0	41.5	-37.6	54.4	523.9	23792.2	-33.1
17094.00	V	39.4	Ambient	11.0	41.5	-37.6	54.3	519.1	23792.2	-33.2
21978.00	H	31.8		2.2	40.6	-29.4	45.1	180.5	23792.2	-42.4
21978.00	V	34.2		2.2	40.6	-29.4	47.6	239.6	23792.2	-39.9
24420.00	H	27.2		2.2	40.6	-30.4	39.6	95.9	23792.2	-47.9
24420.00	V	28.9		2.2	40.6	-30.4	41.3	116.5	23792.2	-46.2

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Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : BLE – Transmit at 2442MHz – Molex 0479480001 BLE Antenna
 Test Specification : FCC-15.247, RSS-247 Radiated Spurious Emissions – Harmonics in Restricted Band
 Date : May 2 - 4, 2018

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dB μ V/m at 3m	Peak Total μ V/m at 3 m	Peak Limit μ V/m at 3 m	Margin (dB)
4884.00	H	53.7		5.7	34.4	-39.3	54.5	531.8	5000.0	-19.5
4884.00	V	55.7		5.7	34.4	-39.3	56.6	672.5	5000.0	-17.4
7326.00	H	67.1		6.9	35.7	-39.4	70.2	3249.6	5000.0	-3.7
7326.00	V	65.5		6.9	35.7	-39.4	68.6	2706.0	5000.0	-5.3
12210.00	H	55.5		8.9	38.7	-39.1	64.0	1587.6	5000.0	-10.0
12210.00	V	54.0		8.9	38.7	-39.1	62.5	1331.2	5000.0	-11.5
19536.00	H	42.3		2.2	40.4	-28.7	56.3	649.5	5000.0	-17.7
19536.00	V	37.2		2.2	40.4	-28.7	51.1	360.2	5000.0	-22.8

DATA PAGE

Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : BLE – Transmit at 2442MHz – Molex 0479480001 BLE Antenna
 Test Specification : FCC-15.247, RSS-247 Radiated Spurious Emissions – Restricted Band Averages
 Date : May 2 - 4, 2018

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dB μ V/m at 3m	Average Total μ V/m at 3 m	Average Limit μ V/m at 3 m	Margin (dB)
4884.00	H	40.4		5.7	34.4	-39.3	0.0	41.3	115.9	500.0	-12.7
4884.00	V	43.3		5.7	34.4	-39.3	0.0	44.2	162.1	500.0	-9.8
7326.00	H	49.32		6.9	35.7	-39.4	0.0	52.4	418.2	500.0	-1.6
7326.00	V	48.3		6.9	35.7	-39.4	0.0	51.4	371.0	500.0	-2.6
12210.00	H	39.2		8.9	38.7	-39.1	0.0	47.7	243.6	500.0	-6.2
12210.00	V	39.4		8.9	38.7	-39.1	0.0	47.9	249.6	500.0	-6.0
19536.00	H	25.1		2.2	40.4	-28.7	0.0	39.0	89.3	500.0	-15.0
19536.00	V	22.5		2.2	40.4	-28.7	0.0	36.4	66.0	500.0	-17.6

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Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : BLE – Transmit at 2480MHz – Molex 0479480001 BLE Antenna
 Test Specification : FCC-15.247, RSS-247 Radiated Spurious Emissions - Harmonics in Non-Restricted Bands
 Date : May 2 - 4, 2018

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dB μ V/m at 3m	Peak Total μ V/m at 3 m	Peak Limit μ V/m at 3 m	Margin (dB)
2480.00	H	68.6		4.3	32.5	0.0	105.4	186708.9		
2480.00	V	68.2		4.3	32.5	0.0	105.0	178511.0		
9920.00	H	49.9		8.3	36.7	-39.2	55.7	609.9	18670.9	-29.7
9920.00	V	50.5		8.3	36.7	-39.2	56.3	653.5	18670.9	-29.1
14880.00	H	39.0	Ambient	9.8	39.7	-38.2	50.4	330.4	18670.9	-35.0
14880.00	V	38.2	Ambient	9.8	39.7	-38.2	49.5	298.5	18670.9	-35.9
17360.00	H	39.9	Ambient	11.0	41.1	-37.7	54.2	513.7	18670.9	-31.2
17360.00	V	38.6	Ambient	11.0	41.1	-37.7	52.8	438.7	18670.9	-32.6
24800.00	H	25.6		2.2	40.6	-31.2	37.3	73.3	18670.9	-48.1
24800.00	V	26.0		2.2	40.6	-31.2	37.7	76.6	18670.9	-47.7
5204.90	H	56.3		5.9	34.5	-39.4	57.3	734.3	18670.9	-28.1
5207.30	V	53.6		5.9	34.5	-39.4	54.6	536.6	18670.9	-30.8

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Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : BLE – Transmit at 2480MHz – Molex 0479480001 BLE Antenna
 Test Specification : FCC-15.247, RSS-247 Radiated Spurious Emissions – Harmonics in Restricted Band
 Date : May 2 - 4, 2018

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dB μ V/m at 3m	Peak Total μ V/m at 3 m	Peak Limit μ V/m at 3 m	Margin (dB)
4960.00	H	55.8		5.8	34.3	-39.3	56.6	675.6	5000.0	-17.4
4960.00	V	55.6		5.8	34.3	-39.3	56.3	656.4	5000.0	-17.6
7440.00	H	61.0		6.9	35.7	-39.4	64.2	1615.1	5000.0	-9.8
7440.00	V	63.7		6.9	35.7	-39.4	66.9	2201.5	5000.0	-7.1
12400.00	H	52.4		9.4	38.8	-39.0	61.6	1195.7	5000.0	-12.4
12400.00	V	53.0		9.4	38.8	-39.0	62.1	1278.2	5000.0	-11.8
19840.00	H	42.4		2.2	40.4	-28.4	56.6	678.7	5000.0	-17.3
19840.00	V	36.1		2.2	40.4	-28.4	50.3	329.0	5000.0	-23.6
22320.00	H	37.1		2.2	40.6	-29.3	50.6	339.6	5000.0	-23.4
22320.00	V	41.2		2.2	40.6	-29.3	54.7	542.5	5000.0	-19.3

DATA PAGE

Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : BLE – Transmit at 2480MHz – Molex 0479480001 BLE Antenna
 Test Specification : FCC-15.247, RSS-247 Radiated Spurious Emissions – Restricted Band Averages
 Date : May 2 - 4, 2018

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dB μ V/m at 3m	Average Total μ V/m at 3 m	Average Limit μ V/m at 3 m	Margin (dB)
4960.00	H	42.0		5.8	34.3	-39.3	0.0	42.8	138.1	500.0	-11.2
4960.00	V	42.6		5.8	34.3	-39.3	0.0	43.4	148.1	500.0	-10.6
7440.00	H	44.37		6.9	35.7	-39.4	0.0	47.5	237.3	500.0	-6.5
7440.00	V	45.1		6.9	35.7	-39.4	0.0	48.2	258.1	500.0	-5.7
12400.00	H	35.5		9.4	38.8	-39.0	0.0	44.6	170.3	500.0	-9.4
12400.00	V	37.6		9.4	38.8	-39.0	0.0	46.8	218.3	500.0	-7.2
19840.00	H	25.1		2.2	40.4	-28.4	0.0	39.3	92.2	500.0	-14.7
19840.00	V	21.5		2.2	40.4	-28.4	0.0	35.7	60.9	500.0	-18.3
22320.00	H	22.7		2.2	40.6	-29.3	0.0	36.2	64.9	500.0	-17.7
22320.00	V	25.3		2.2	40.6	-29.3	0.0	38.8	87.0	500.0	-15.2

DATA PAGE

Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : 802.15.4 Zigbee – Johanson Technology 2450AT18A100E ZigBee Antenna
 Test Specification : FCC-15.247, RSS-247 Band Edge Radiated Measurements & Restricted Band Averages
 Date : May 2 - 4, 2018

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dB μ V/m at 3m	Average Total μ V/m at 3 m	Average Limit μ V/m at 3 m	Margin (dB)
2400.00	H	11.5	4.3	32.1	0.0	47.9	247.6	5509.3	-26.9	4.3
2400.00	V	10.3	4.3	32.1	0.0	46.7	216.4	5509.3	-28.1	4.3
2483.50	H	21.2	4.3	32.5	0.0	58.0	798.7	5000.0	-15.9	4.3
2483.50	V	28.1	4.3	32.5	0.0	64.9	1765.6	5000.0	-9.0	4.3

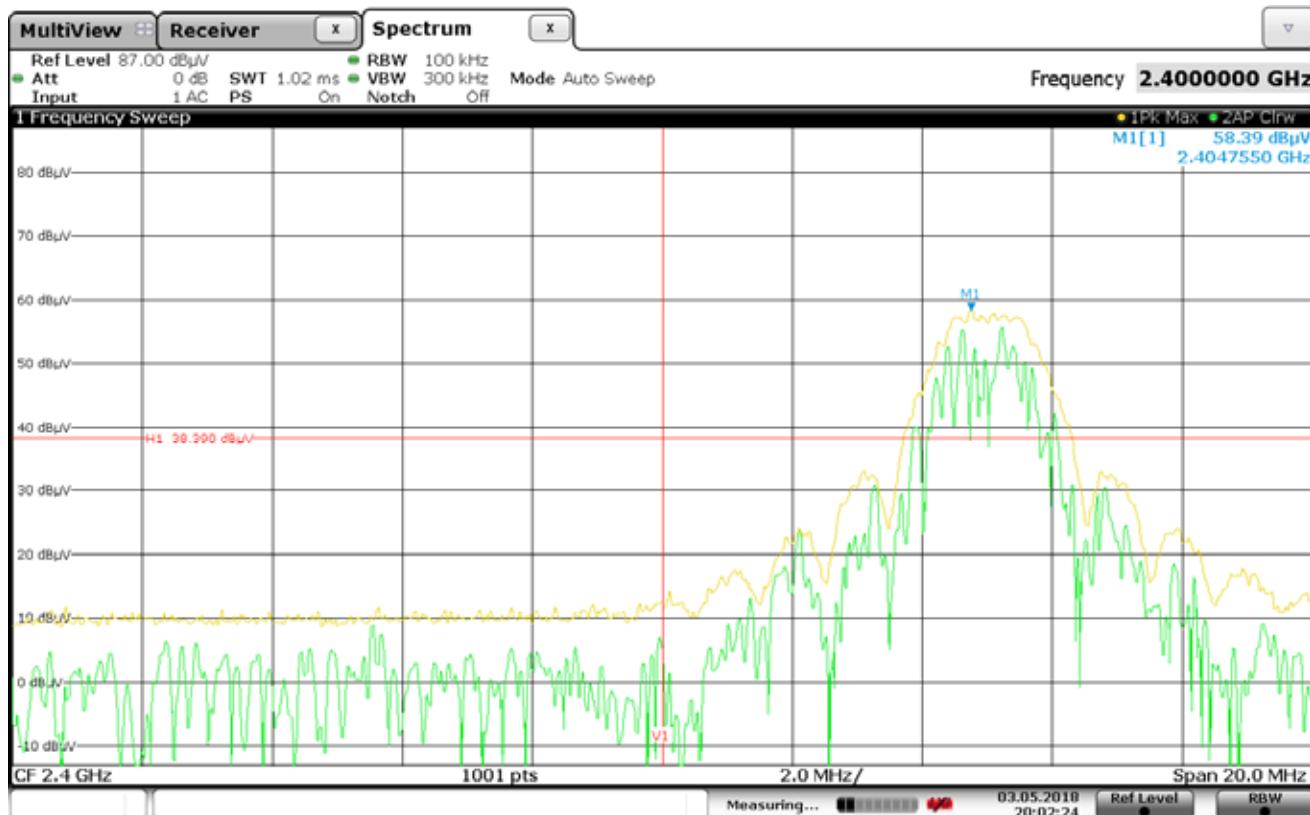
Freq. MHz	Ant Pol	Meter Reading (dB μ V)	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dB μ V/m at 3m	Average Total μ V/m at 3 m	Average Limit μ V/m at 3 m	Margin (dB)
2483.50	H	20.2	4.3	32.5	0.0	-45.0	12.0	4.0	500.0	-42.0
2483.50	V	18.7	4.3	32.5	0.0	-45.0	10.5	3.4	500.0	-43.4

DATA PAGE

Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : 802.15.4 Zigbee – Molex 0479480001 BLE Antenna
 Test Specification : FCC-15.247, RSS-247 Band Edge Radiated Measurements & Restricted Band Averages
 Date : May 2 - 4, 2018

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dB μ V/m at 3m	Average Total μ V/m at 3 m	Average Limit μ V/m at 3 m	Margin (dB)
2400.00	H	12.3	4.3	32.1	0.0	48.7	272.4	5560.3	-26.2	4.3
2400.00	V	10.9	4.3	32.1	0.0	47.3	231.9	5560.3	-27.6	4.3
2483.50	H	29.8	4.3	32.5	0.0	66.7	2154.7	5000.0	-7.3	4.3
2483.50	V	25.2	4.3	32.5	0.0	62.0	1257.1	5000.0	-12.0	4.3

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dB μ V/m at 3m	Average Total μ V/m at 3 m	Average Limit μ V/m at 3 m	Margin (dB)
2483.50	H	20.3	4.3	32.5	0.0	-45.0	12.1	4.0	500.0	-41.8
2483.50	V	15.5	4.3	32.5	0.0	-45.0	7.3	2.3	500.0	-46.7

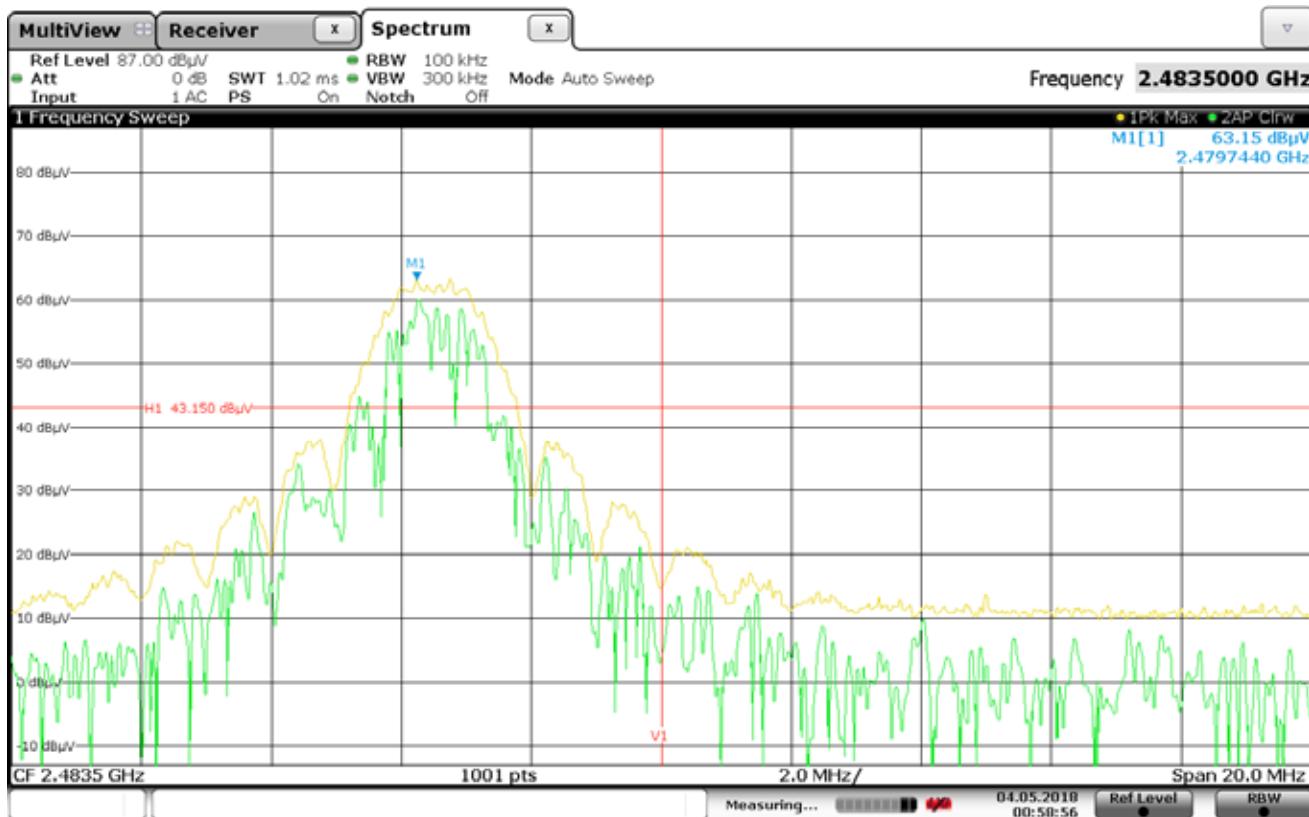


Date: 3.MAY.2018 20:02:24

BAND EDGE – RADIATED

MANUFACTURER : Amatis Controls
 TEST ITEM : Wireless Module
 MODEL NUMBER : IPPAN3
 TEST MODE : 802.15.4 Zigbee – 2400MHz – Johanson Technology 2450AT18A100E ZigBee
 Antenna

NOTES

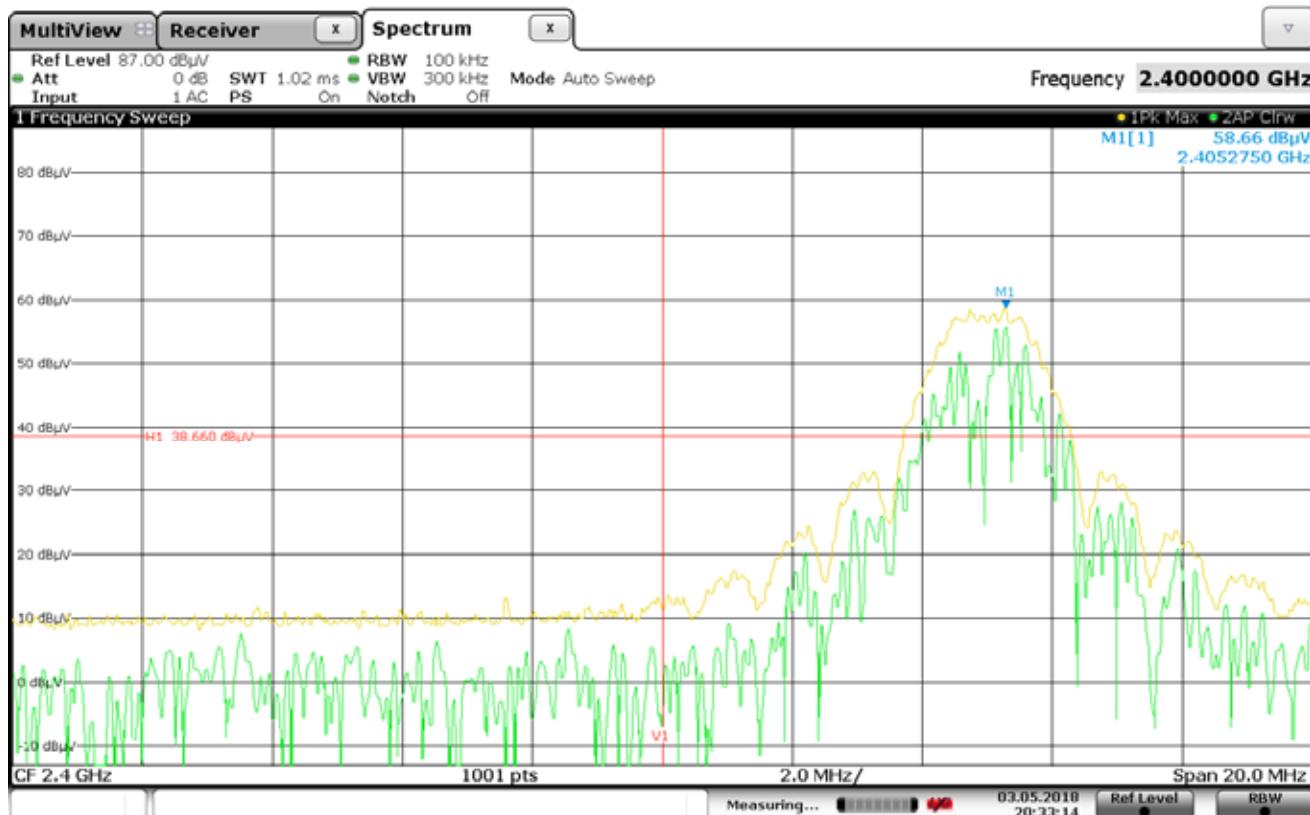


Date: 4.MAY.2018 00:58:56

BAND EDGE – RADIATED

MANUFACTURER : Amatis Controls
 TEST ITEM : Wireless Module
 MODEL NUMBER : IPPAN3
 TEST MODE : 802.15.4 Zigbee – 2483.5MHz – Johanson Technology 2450AT18A100E ZigBee Antenna

NOTES

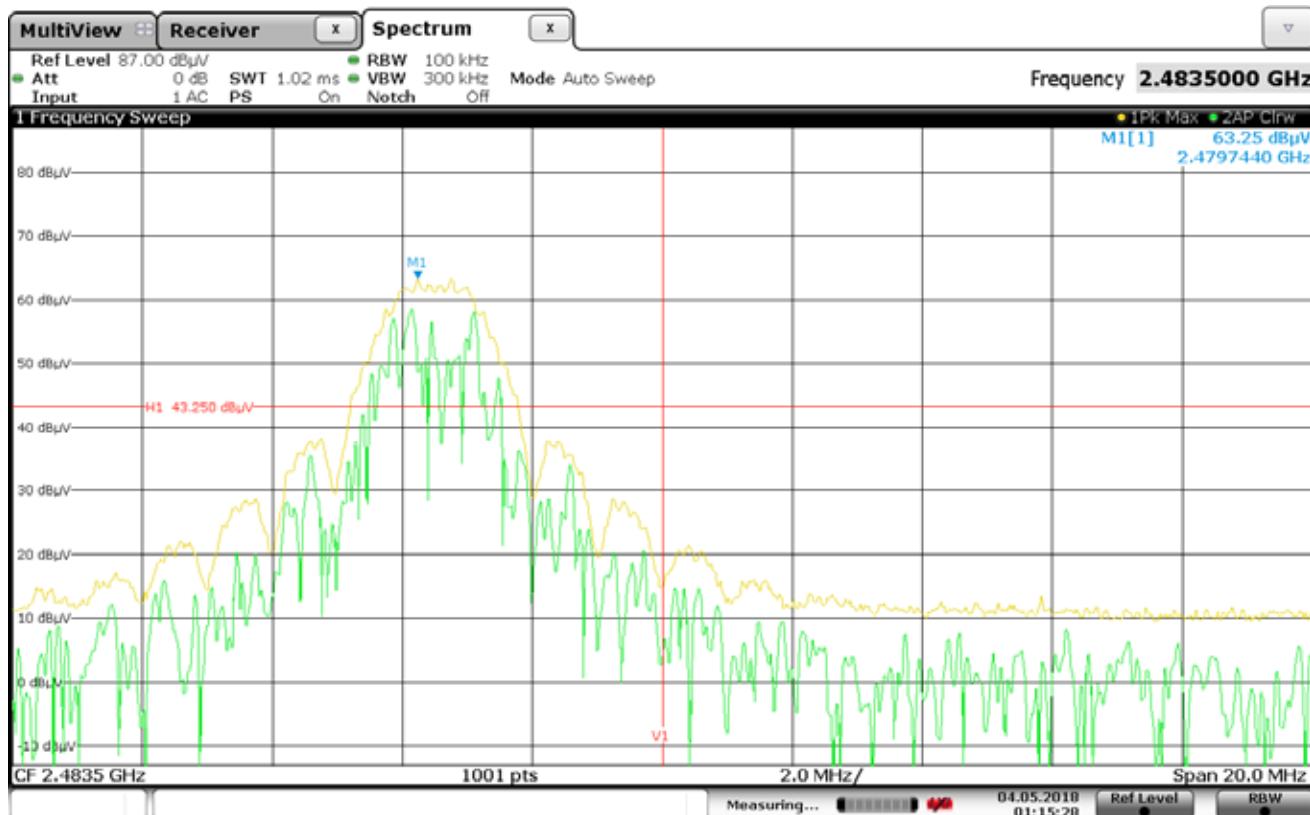


Date: 3.MAY.2018 20:33:14

BAND EDGE – RADIATED

MANUFACTURER : Amatis Controls
 TEST ITEM : Wireless Module
 MODEL NUMBER : IPPAN3
 TEST MODE : 802.15.4 Zigbee – 2400MHz – Molex 0479480001 BLE Antenna

NOTES



Date: 4.MAY.2018 01:15:28

BAND EDGE – RADIATED

MANUFACTURER : Amatis Controls
 TEST ITEM : Wireless Module
 MODEL NUMBER : IPPAN3
 TEST MODE : 802.15.4 Zigbee – 2483.5MHz – Molex 0479480001 BLE Antenna

NOTES

DATA PAGE

Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : 802.15.4 Zigbee – Johanson Technology 2450AT18A100E ZigBee Antenna
 Test Specification : FCC-15.247, RSS-247 Conducted Bandwidth Measurements
 Date : May 7, 2018

Bandwidth – 2400MHz

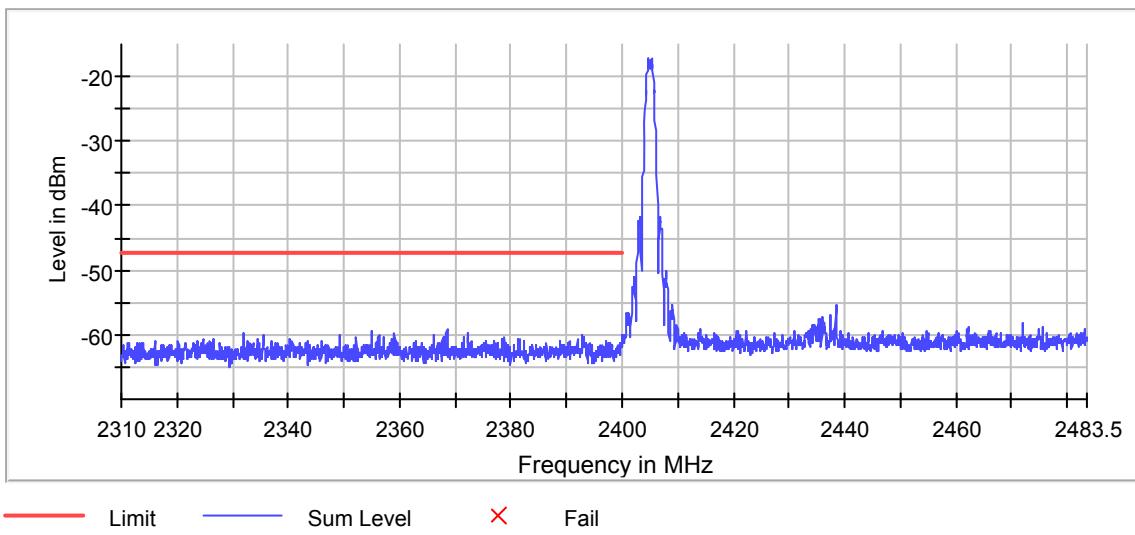
Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2368.525000	-59.1	11.9	-47.2	PASS
2354.875000	-59.6	12.4	-47.2	PASS
2368.475000	-59.6	12.4	-47.2	PASS
2359.125000	-59.8	12.6	-47.2	PASS
2354.925000	-59.8	12.7	-47.2	PASS
2372.225000	-59.8	12.7	-47.2	PASS
2331.925000	-59.9	12.7	-47.2	PASS
2335.475000	-59.9	12.7	-47.2	PASS
2349.275000	-59.9	12.8	-47.2	PASS
2366.225000	-60.0	12.8	-47.2	PASS
2356.275000	-60.0	12.9	-47.2	PASS
2366.275000	-60.1	13.0	-47.2	PASS
2392.675000	-60.2	13.0	-47.2	PASS
2349.325000	-60.2	13.0	-47.2	PASS
2368.575000	-60.2	13.0	-47.2	PASS

Bandwidth – 2483.5MHz

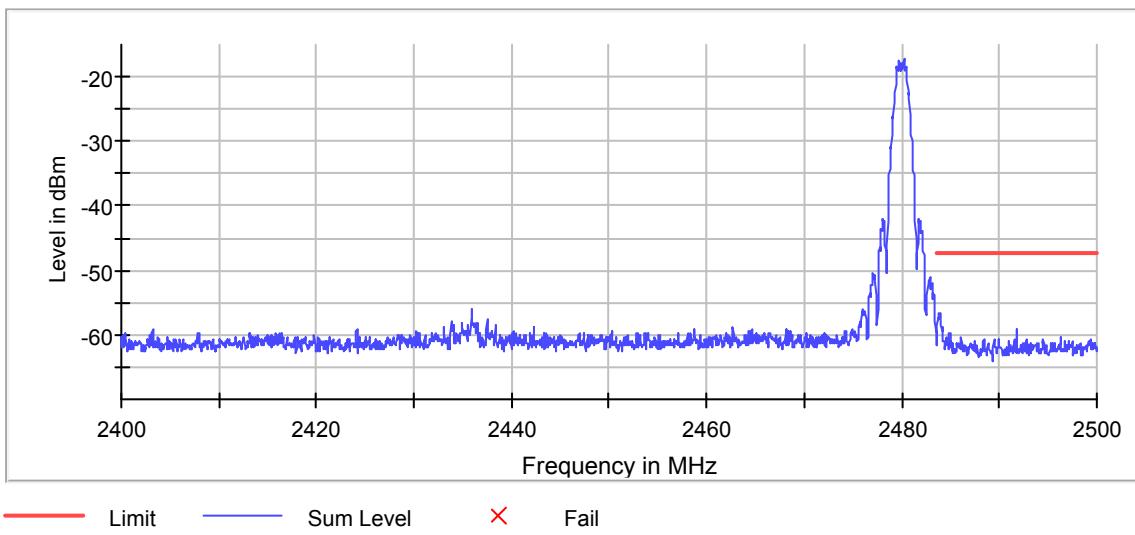
Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2483.925000	-56.6	9.3	-47.3	PASS
2483.875000	-56.7	9.4	-47.3	PASS
2483.725000	-57.2	9.9	-47.3	PASS
2483.775000	-57.3	10.0	-47.3	PASS
2483.825000	-57.5	10.2	-47.3	PASS
2483.975000	-57.6	10.3	-47.3	PASS
2484.025000	-58.2	10.9	-47.3	PASS
2483.675000	-58.5	11.2	-47.3	PASS
2484.075000	-58.6	11.3	-47.3	PASS
2484.175000	-58.9	11.6	-47.3	PASS
2491.825000	-59.0	11.8	-47.3	PASS
2491.775000	-59.1	11.9	-47.3	PASS
2484.125000	-59.5	12.2	-47.3	PASS
2484.875000	-59.6	12.3	-47.3	PASS
2484.925000	-59.7	12.4	-47.3	PASS

Band Edge Measurements

Band Edge Low:



Band Edge High:



DATA PAGE

Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : 802.15.4 Zigbee – Molex 0479480001 BLE Antenna
 Test Specification : FCC-15.247, RSS-247 Conducted Bandwidth Measurements
 Date : May 7, 2018

Bandwidth – 2400MHz

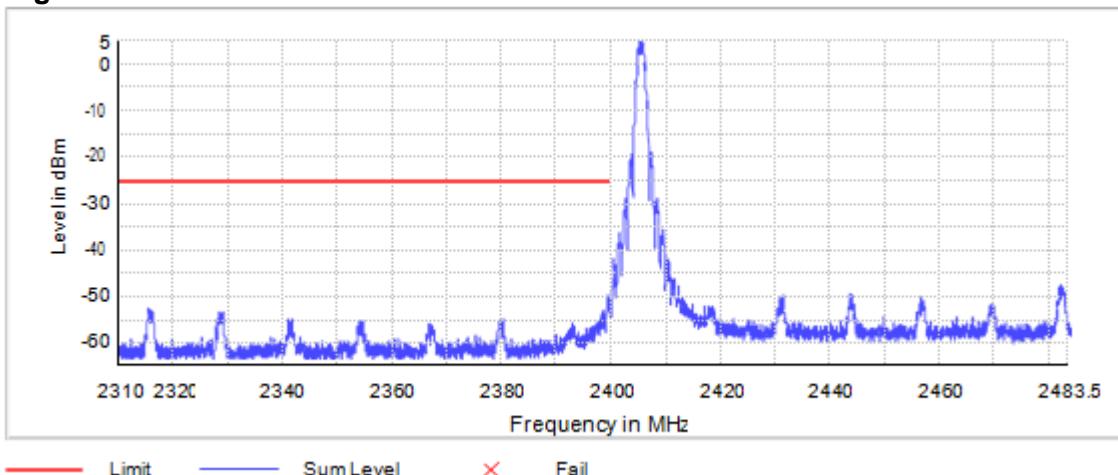
Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2399.925000	-47.3	22.0	-25.3	PASS
2399.875000	-47.6	22.3	-25.3	PASS
2399.825000	-47.6	22.3	-25.3	PASS
2399.975000	-47.7	22.5	-25.3	PASS
2399.775000	-49.4	24.1	-25.3	PASS
2399.725000	-49.5	24.2	-25.3	PASS
2399.675000	-49.8	24.5	-25.3	PASS
2399.125000	-50.8	25.5	-25.3	PASS
2398.875000	-50.8	25.5	-25.3	PASS
2399.075000	-50.9	25.7	-25.3	PASS
2398.925000	-51.3	26.1	-25.3	PASS
2399.175000	-51.7	26.4	-25.3	PASS
2399.025000	-51.7	26.4	-25.3	PASS
2399.625000	-51.8	26.5	-25.3	PASS
2399.225000	-52.0	26.7	-25.3	PASS

Bandwidth – 2483.5MHz

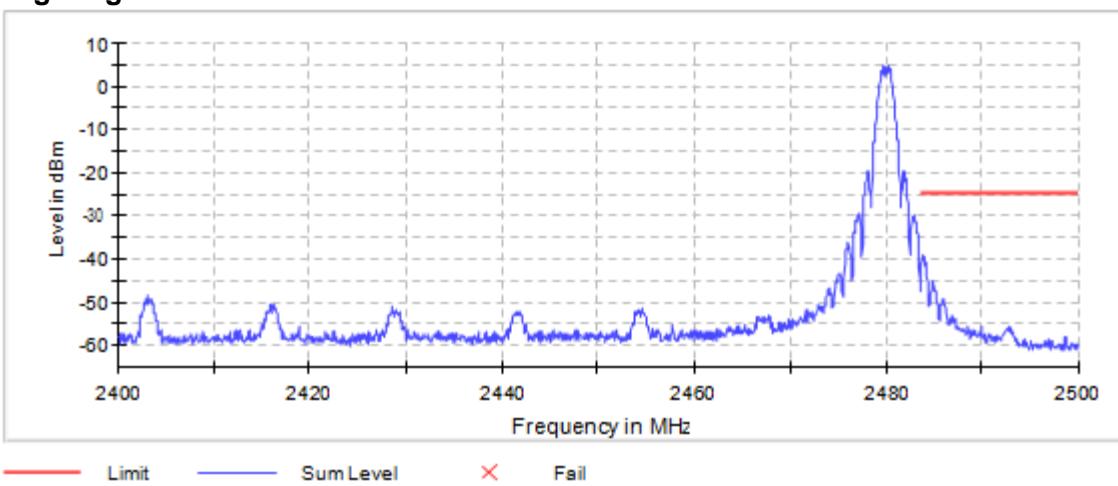
Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2483.875000	-39.4	14.4	-24.9	PASS
2483.925000	-39.7	14.8	-24.9	PASS
2483.725000	-40.0	15.1	-24.9	PASS
2484.075000	-40.4	15.5	-24.9	PASS
2483.775000	-40.5	15.6	-24.9	PASS
2483.825000	-40.5	15.6	-24.9	PASS
2484.125000	-40.8	15.9	-24.9	PASS
2483.675000	-41.3	16.4	-24.9	PASS
2484.025000	-41.5	16.6	-24.9	PASS
2483.975000	-41.5	16.6	-24.9	PASS
2484.175000	-43.2	18.3	-24.9	PASS
2484.225000	-43.3	18.3	-24.9	PASS
2483.625000	-43.7	18.7	-24.9	PASS
2484.275000	-44.4	19.5	-24.9	PASS
2483.575000	-45.0	20.1	-24.9	PASS

Band Edge Measurements

Band Edge Low:



Band Edge High:



DATA PAGE

Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : BLE – Johanson Technology 2450AT18A100E ZigBee Antenna
 Test Specification : FCC-15.247, RSS-247 Band Edge Radiated Measurements & Restricted Band Averages
 Date : May 2 - 4, 2018

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dB μ V/m at 3m	Average Total μ V/m at 3 m	Average Limit μ V/m at 3 m	Margin (dB)
2400.00	H	27.1	4.3	32.1	0.0	63.5	1493.8	21777.6	-23.3	4.3
2400.00	V	25.5	4.3	32.1	0.0	61.9	1245.3	21777.6	-24.9	4.3
2483.50	H	11.5	4.3	32.5	0.0	48.3	261.1	5000.0	-25.6	4.3
2483.50	V	11.4	4.3	32.5	0.0	48.2	257.3	5000.0	-25.8	4.3

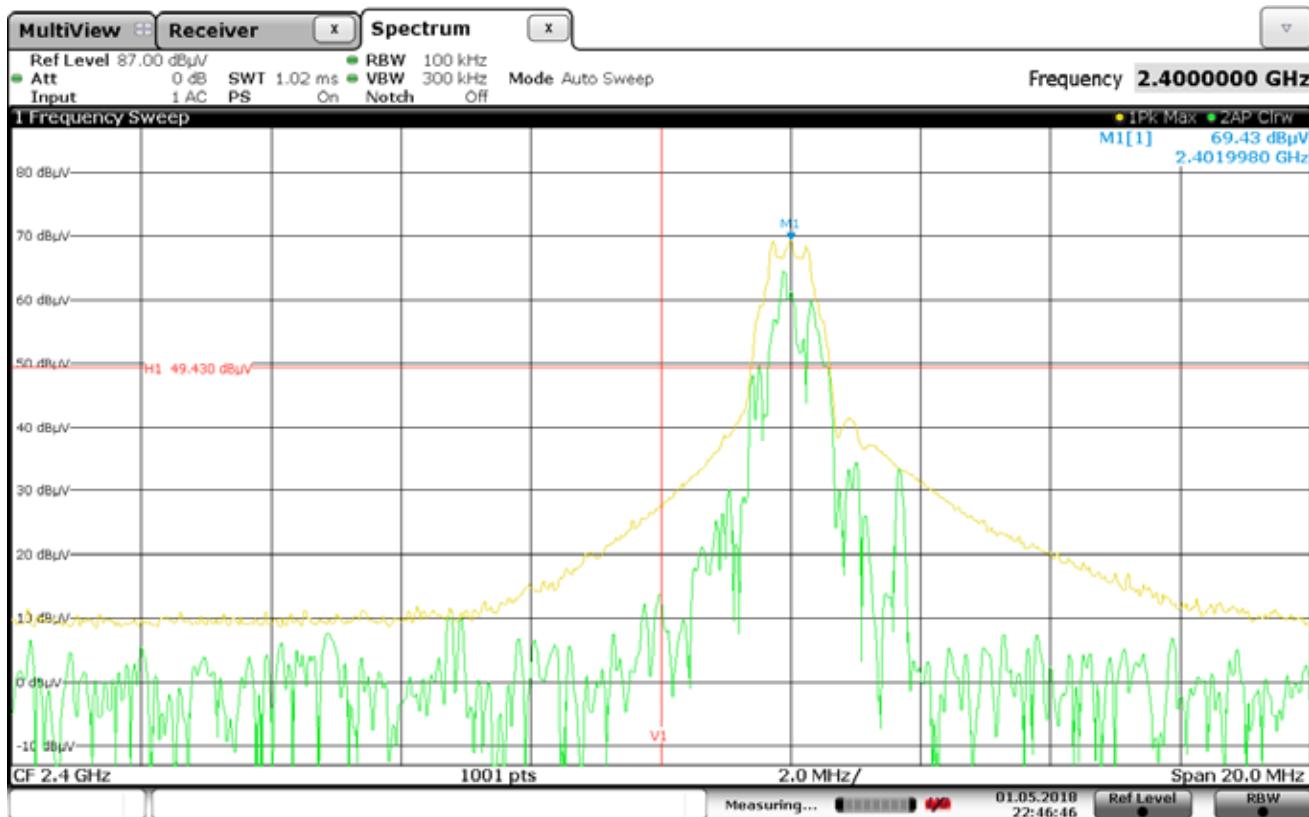
Freq. MHz	Ant Pol	Meter Reading (dB μ V)	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dB μ V/m at 3m	Average Total μ V/m at 3 m	Average Limit μ V/m at 3 m	Margin (dB)
2483.50	H	8.8	4.3	32.5	0.0	0.0	45.7	191.8	500.0	-8.3
2483.50	V	8.7	4.3	32.5	0.0	0.0	45.6	189.8	500.0	-8.4

DATA PAGE

Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : BLE – Molex 0479480001 BLE Antenna
 Test Specification : FCC-15.247, RSS-247 Band Edge Radiated Measurements & Restricted Band Averages
 Date : May 2 - 4, 2018

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dB μ V/m at 3m	Average Total μ V/m at 3 m	Average Limit μ V/m at 3 m	Margin (dB)
2400.00	H	26.5	4.3	32.1	0.0	62.9	1403.7	21979.1	-23.9	4.3
2400.00	V	26.9	4.3	32.1	0.0	63.3	1468.2	21979.1	-23.5	4.3
2483.50	H	14.6	4.3	32.5	0.0	51.5	374.0	5000.0	-22.5	4.3
2483.50	V	12.2	4.3	32.5	0.0	49.0	281.8	5000.0	-25.0	4.3

Freq. MHz	Ant Pol	Meter Reading (dB μ V)	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dB μ V/m at 3m	Average Total μ V/m at 3 m	Average Limit μ V/m at 3 m	Margin (dB)
2483.50	H	9.5	4.3	32.5	0.0	0.0	46.4	208.2	500.0	-7.6
2483.50	V	8.2	4.3	32.5	0.0	0.0	45.0	177.6	500.0	-9.0

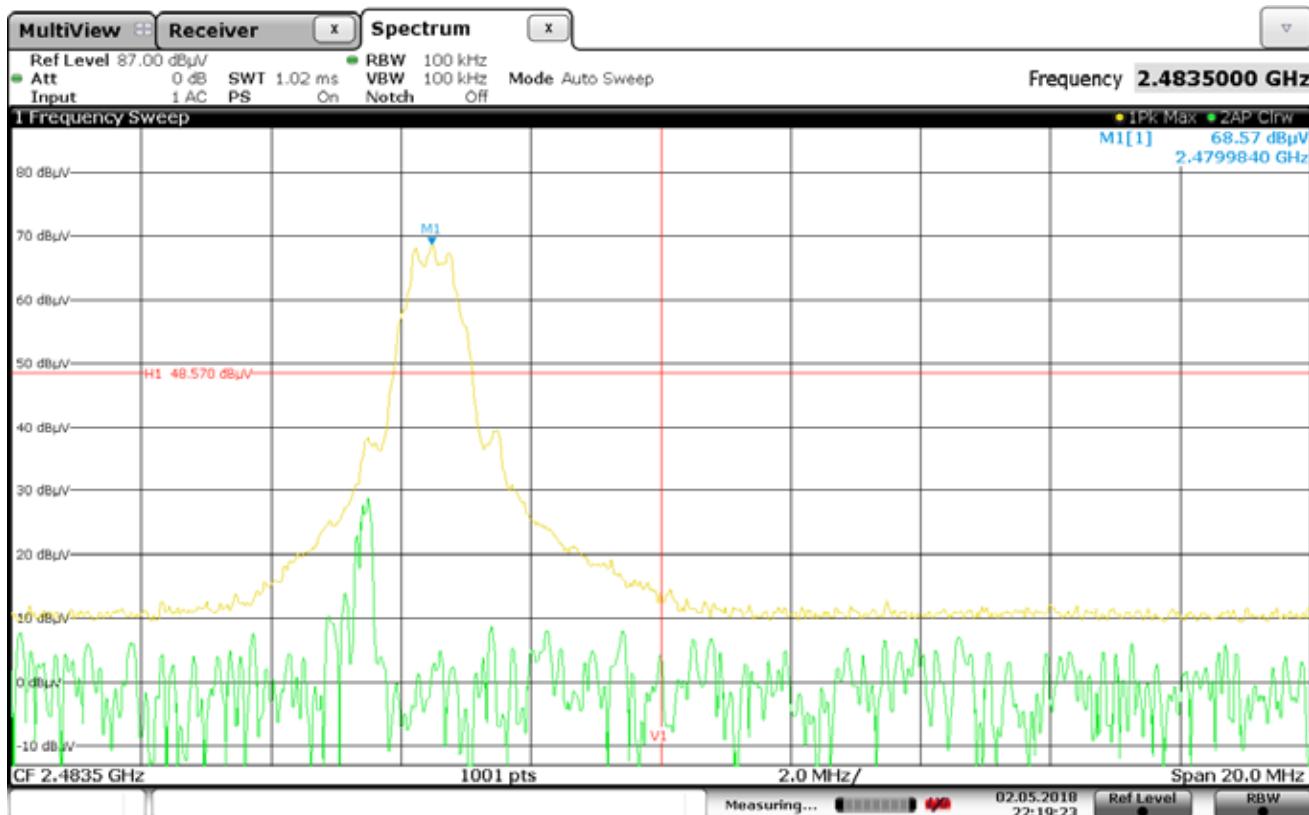


Date: 1.MAY.2018 22:46:46

BAND EDGE – RADIATED

MANUFACTURER : Amatis Controls
 TEST ITEM : Wireless Module
 MODEL NUMBER : IPPAN3
 TEST MODE : BLE – 2400MHz – Johanson Technology 2450AT18A100E ZigBee Antenna

NOTES

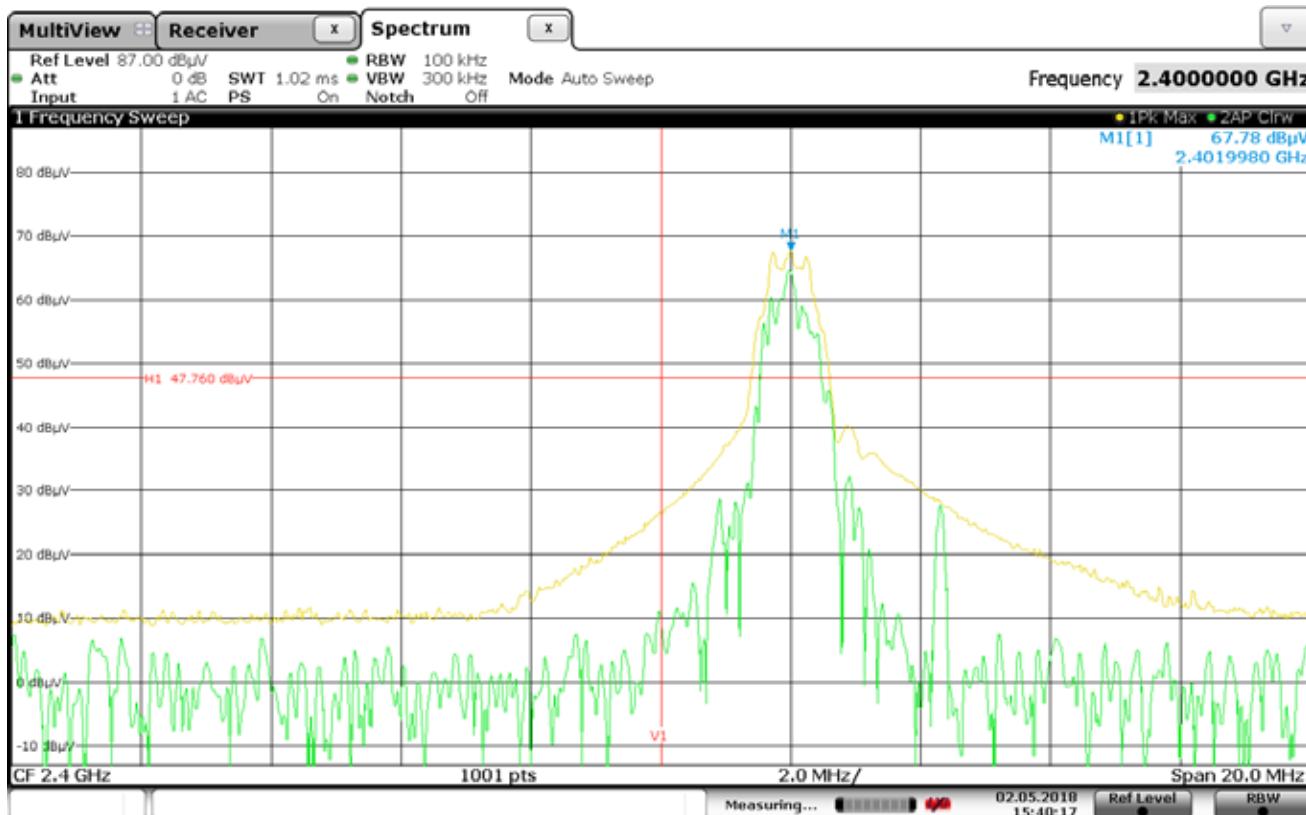


Date: 2 MAY 2018 22:19:23

BAND EDGE – RADIATED

MANUFACTURER : Amatis Controls
 TEST ITEM : Wireless Module
 MODEL NUMBER : IPPAN3
 TEST MODE : BLE – 2483.5MHz – Johanson Technology 2450AT18A100E ZigBee Antenna

NOTES

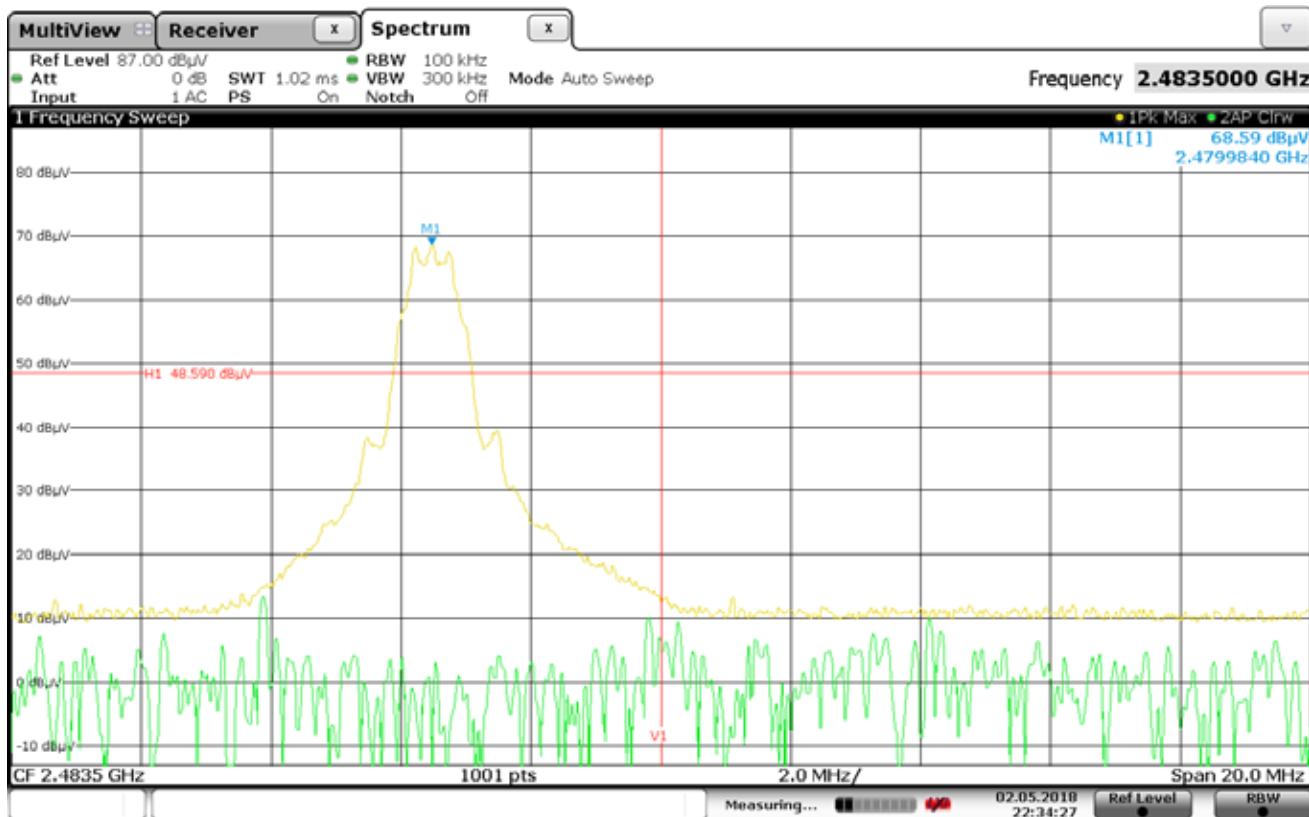


Date: 2 MAY 2018 15:40:17

BAND EDGE – RADIATED

MANUFACTURER : Amatis Controls
 TEST ITEM : Wireless Module
 MODEL NUMBER : IPPAN3
 TEST MODE : BLE – 2400MHz – Molex 0479480001 BLE Antenna

NOTES



Date: 2 MAY 2018 22:34:27

BAND EDGE – RADIATED

MANUFACTURER : Amatis Controls
 TEST ITEM : Wireless Module
 MODEL NUMBER : IPPAN3
 TEST MODE : BLE – 2483.5MHz – Molex 0479480001 BLE Antenna

NOTES

DATA PAGE

Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : BLE – Johanson Technology 2450AT18A100E ZigBee Antenna
 Test Specification : FCC-15.247, RSS-247 Conducted Bandwidth Measurements
 Date : May 8, 2018

Bandwidth – 2400MHz

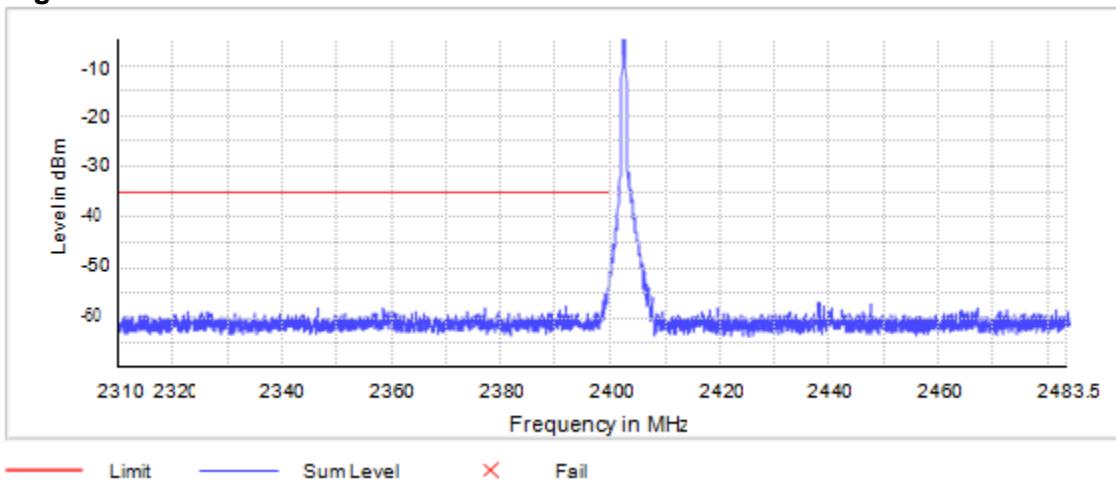
Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2399.975000	-46.9	11.7	-35.2	PASS
2399.925000	-48.4	13.2	-35.2	PASS
2399.875000	-48.5	13.3	-35.2	PASS
2399.775000	-48.8	13.6	-35.2	PASS
2399.825000	-49.1	13.9	-35.2	PASS
2399.725000	-49.2	14.0	-35.2	PASS
2399.675000	-50.5	15.4	-35.2	PASS
2399.625000	-50.8	15.7	-35.2	PASS
2399.575000	-51.1	16.0	-35.2	PASS
2399.475000	-51.3	16.1	-35.2	PASS
2399.425000	-51.3	16.2	-35.2	PASS
2399.525000	-51.6	16.5	-35.2	PASS
2399.375000	-51.9	16.7	-35.2	PASS
2399.325000	-52.1	17.0	-35.2	PASS
2399.275000	-52.8	17.7	-35.2	PASS

Bandwidth – 2483.5MHz

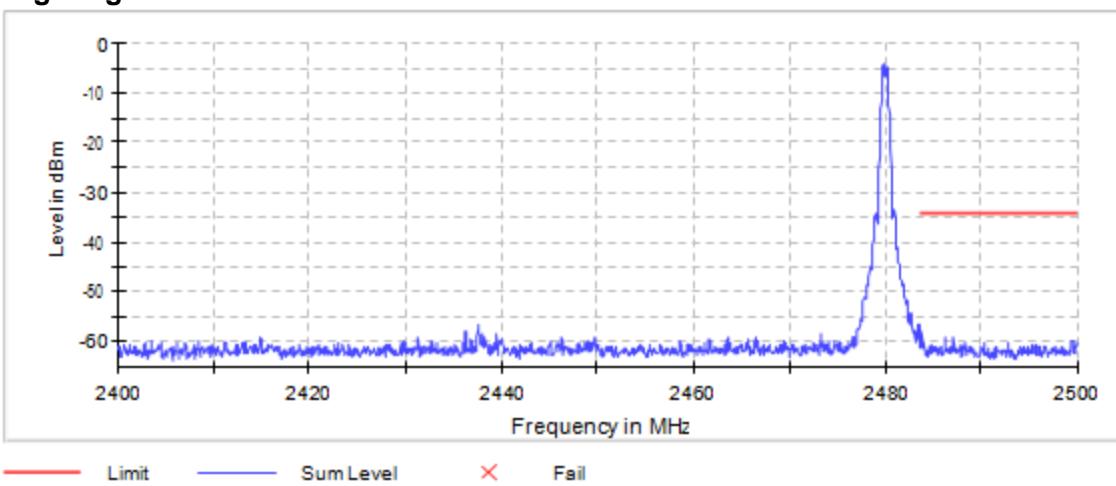
Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2483.675000	-57.3	23.2	-34.1	PASS
2483.875000	-58.2	24.1	-34.1	PASS
2483.825000	-58.3	24.2	-34.1	PASS
2483.725000	-58.3	24.2	-34.1	PASS
2486.275000	-59.1	24.9	-34.1	PASS
2486.225000	-59.1	25.0	-34.1	PASS
2487.125000	-59.1	25.0	-34.1	PASS
2483.625000	-59.1	25.0	-34.1	PASS
2487.075000	-59.5	25.4	-34.1	PASS
2483.575000	-59.7	25.6	-34.1	PASS
2499.525000	-59.7	25.6	-34.1	PASS
2499.475000	-59.8	25.7	-34.1	PASS
2488.325000	-60.1	25.9	-34.1	PASS
2488.375000	-60.1	26.0	-34.1	PASS
2484.075000	-60.2	26.1	-34.1	PASS

Band Edge Measurements

Band Edge Low:



Band Edge High:



DATA PAGE

Manufacturer : Amatis Controls
 Test Item : Wireless Module
 Model No. : IPPAN3
 Mode : BLE – Molex 0479480001 BLE Antenna
 Test Specification : FCC-15.247, RSS-247 Conducted Bandwidth Measurements
 Date : May 8, 2018

Bandwidth – 2400MHz

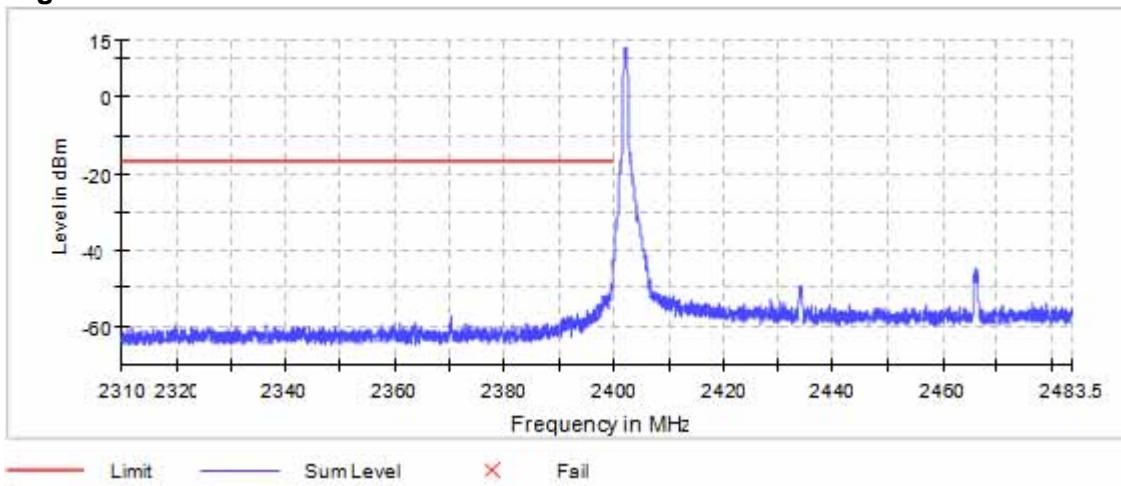
Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2399.975000	-40.5	23.7	-16.8	PASS
2399.925000	-41.4	24.6	-16.8	PASS
2399.875000	-42.6	25.8	-16.8	PASS
2399.825000	-42.6	25.9	-16.8	PASS
2399.725000	-42.9	26.2	-16.8	PASS
2399.775000	-43.4	26.6	-16.8	PASS
2399.675000	-43.9	27.1	-16.8	PASS
2399.625000	-45.9	29.1	-16.8	PASS
2399.575000	-47.7	31.0	-16.8	PASS
2399.425000	-49.0	32.2	-16.8	PASS
2399.375000	-49.1	32.3	-16.8	PASS
2399.475000	-49.5	32.8	-16.8	PASS
2399.525000	-49.8	33.1	-16.8	PASS
2399.325000	-49.9	33.1	-16.8	PASS
2399.275000	-50.9	34.1	-16.8	PASS

Bandwidth – 2483.5MHz

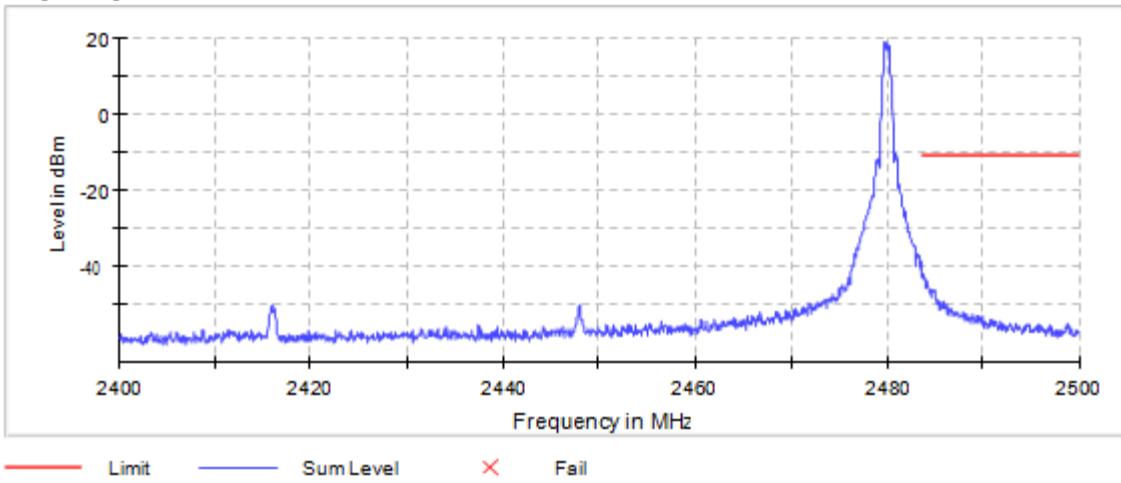
Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2483.525000	-41.8	30.9	-10.9	PASS
2483.825000	-41.9	31.0	-10.9	PASS
2483.675000	-42.1	31.2	-10.9	PASS
2483.625000	-42.2	31.3	-10.9	PASS
2483.875000	-42.3	31.4	-10.9	PASS
2483.725000	-42.4	31.5	-10.9	PASS
2483.575000	-43.1	32.2	-10.9	PASS
2483.775000	-43.3	32.4	-10.9	PASS
2483.925000	-43.6	32.7	-10.9	PASS
2484.225000	-44.1	33.2	-10.9	PASS
2484.275000	-44.7	33.7	-10.9	PASS
2484.175000	-44.7	33.8	-10.9	PASS
2483.975000	-44.8	33.8	-10.9	PASS
2484.125000	-44.9	34.0	-10.9	PASS
2484.025000	-45.3	34.4	-10.9	PASS

Band Edge Measurements

Band Edge Low:



Band Edge High:



DATA PAGE

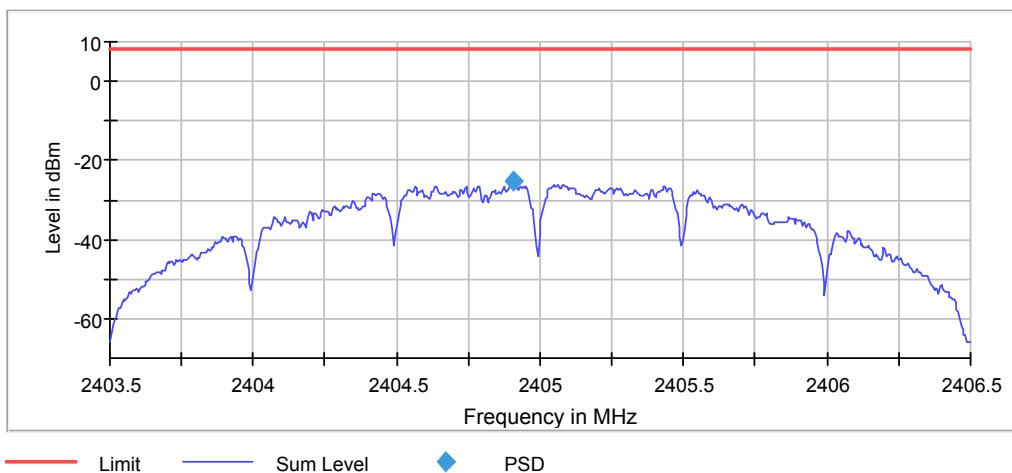
Manufacturer : Amatis Controls
Test Item : Wireless Module
Model No. : IPPAN3
Mode : 802.15.4 Zigbee – Johanson Technology 2450AT18A100E ZigBee Antenna
Test Specification : FCC-15.247, RSS-247 Conducted Power Spectral Density
Date : May 7, 2018

Power Spectral Density

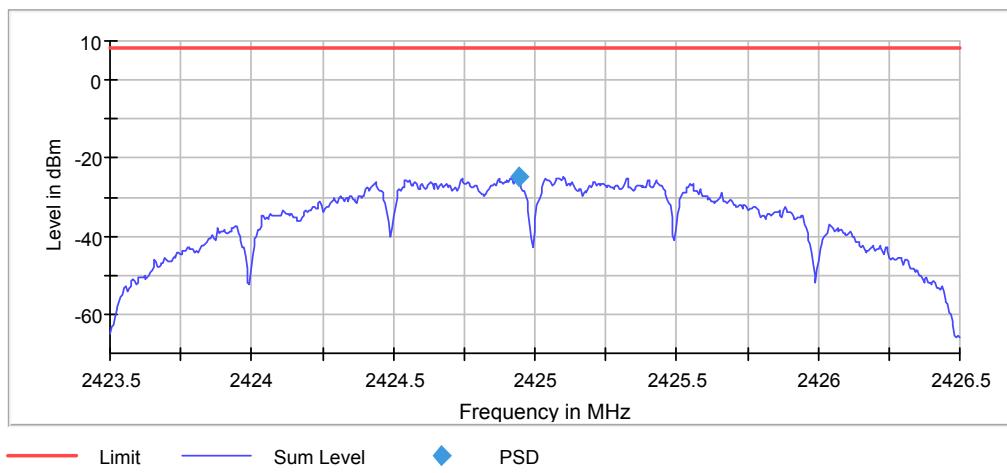
DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2405.000000	2404.907500	-25.177	8.0	PASS
2425.000000	2424.942500	-24.777	8.0	PASS
2480.000000	2480.042500	-25.817	8.0	PASS

Power Spectral Density

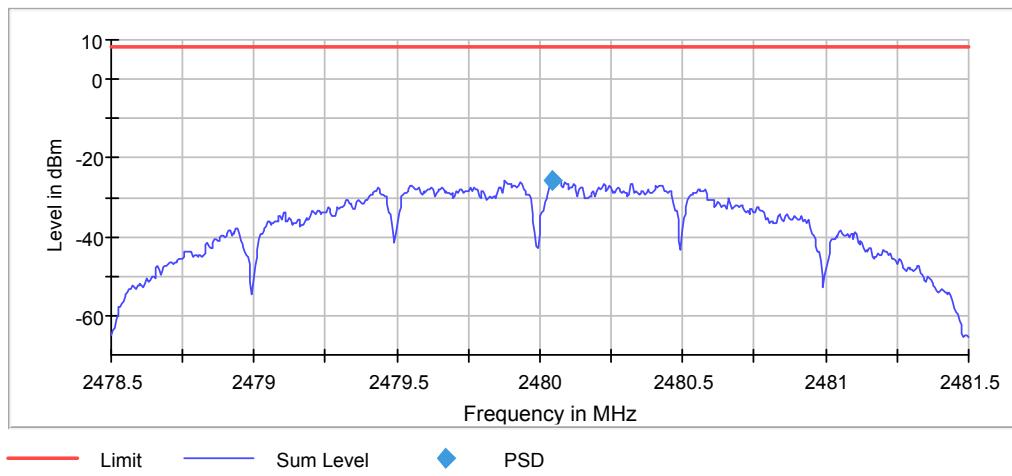
Low Frequency:



Mid Frequency:



High Frequency:



DATA PAGE

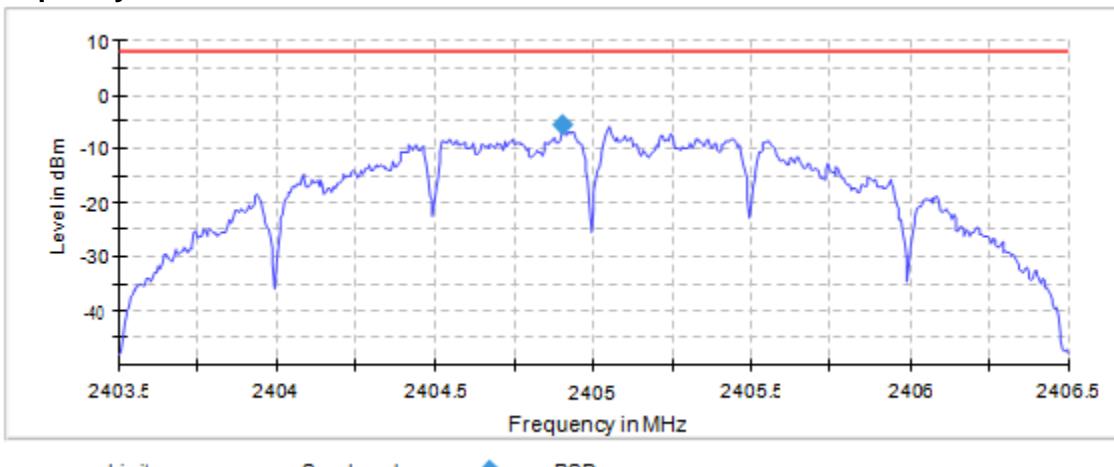
Manufacturer : Amatis Controls
Test Item : Wireless Module
Model No. : IPPAN3
Mode : 802.15.4 Zigbee – Molex 0479480001 BLE Antenna
Test Specification : FCC-15.247, RSS-247 Conducted Power Spectral Density
Date : May 7, 2018

Power Spectral Density

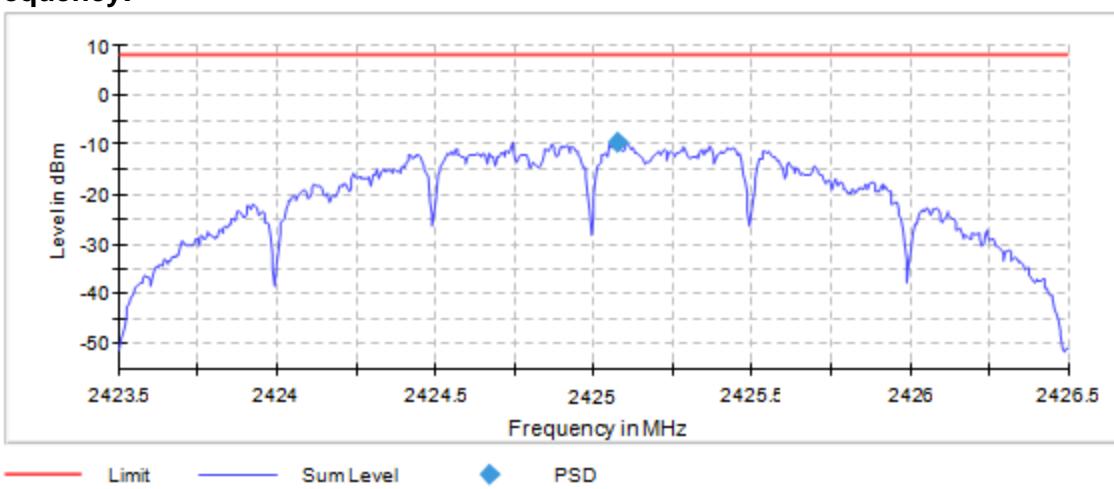
DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2405.000000	2404.902500	-5.750	8.0	PASS
2425.000000	2425.072500	-9.386	8.0	PASS
2480.000000	2480.047500	-5.368	8.0	PASS

Power Spectral Density

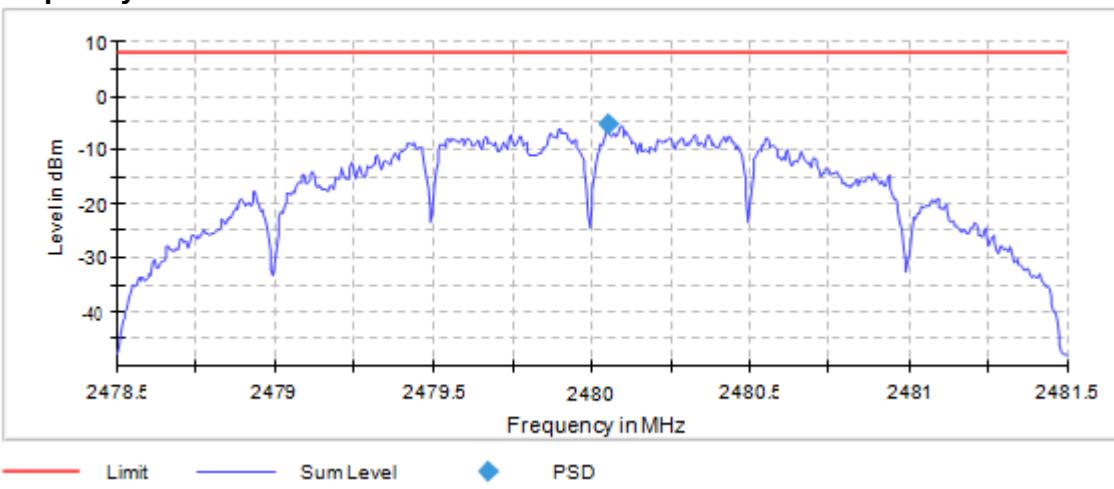
Low Frequency:



Mid Frequency:



High Frequency:



DATA PAGE

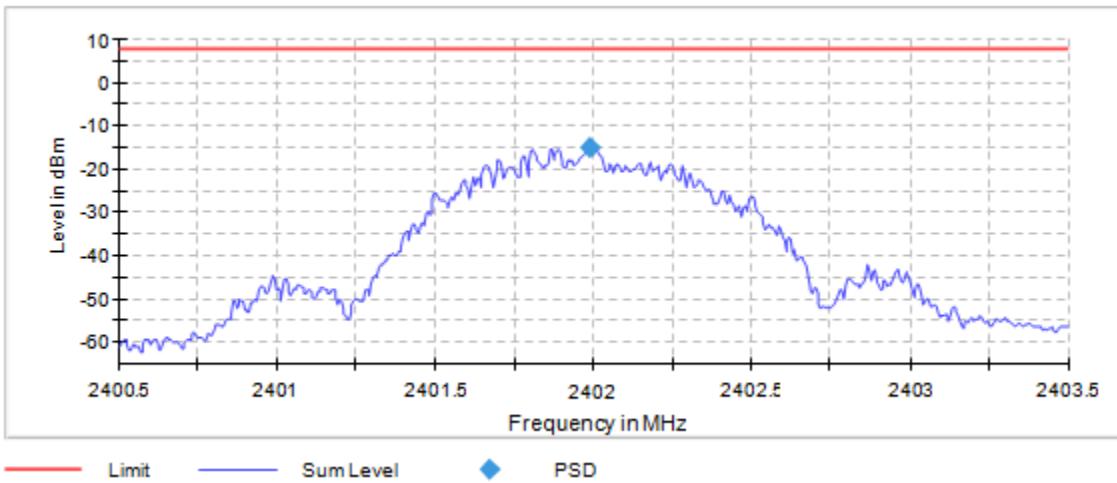
Manufacturer : Amatis Controls
Test Item : Wireless Module
Model No. : IPPAN3
Mode : BLE – Johanson Technology 2450AT18A100E ZigBee Antenna
Test Specification : FCC-15.247, RSS-247 Conducted Power Spectral Density
Date : May 8, 2018

Power Spectral Density

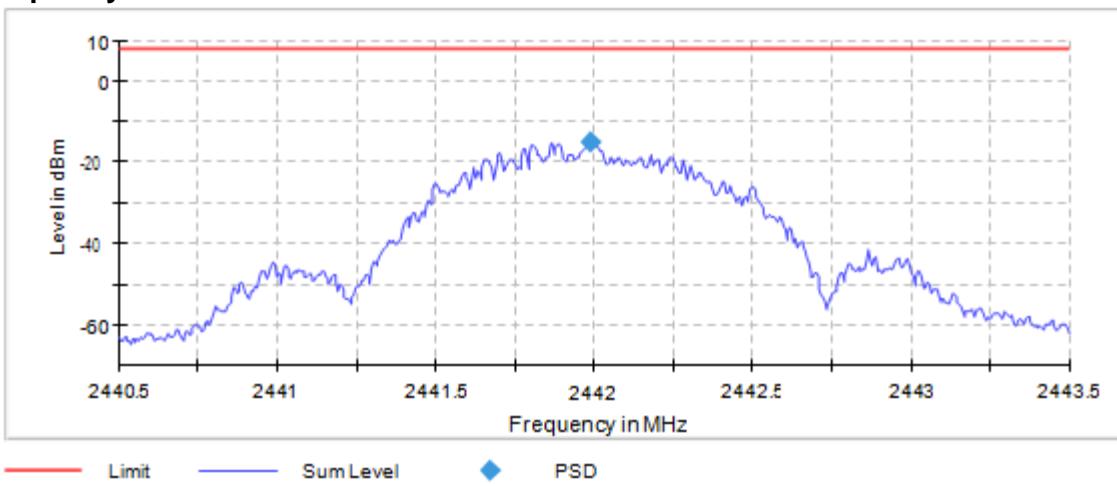
DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2402.000000	2401.987500	-14.928	8.0	PASS
2442.000000	2441.987500	-14.855	8.0	PASS
2480.000000	2479.982500	-14.206	8.0	PASS

Power Spectral Density

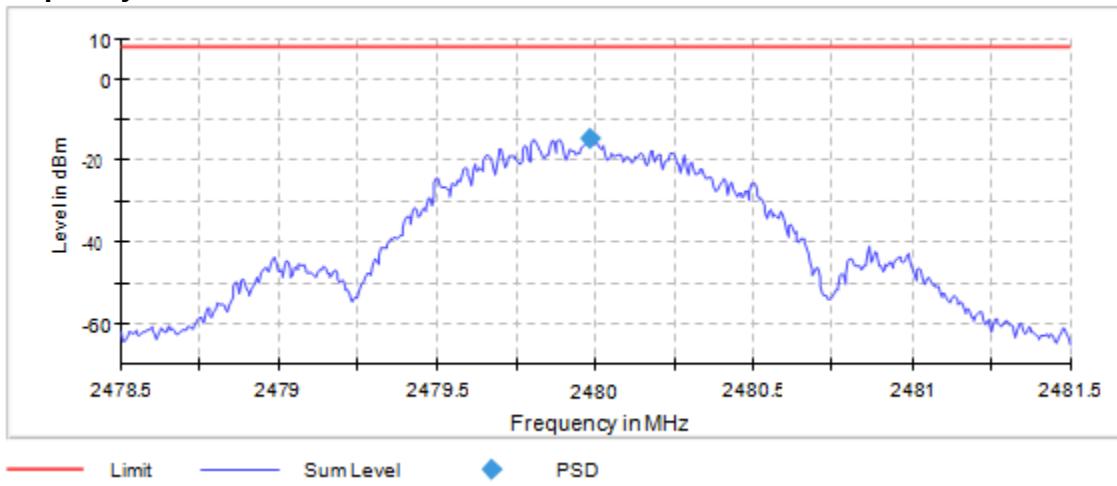
Low Frequency:



Mid Frequency:



High Frequency:



DATA PAGE

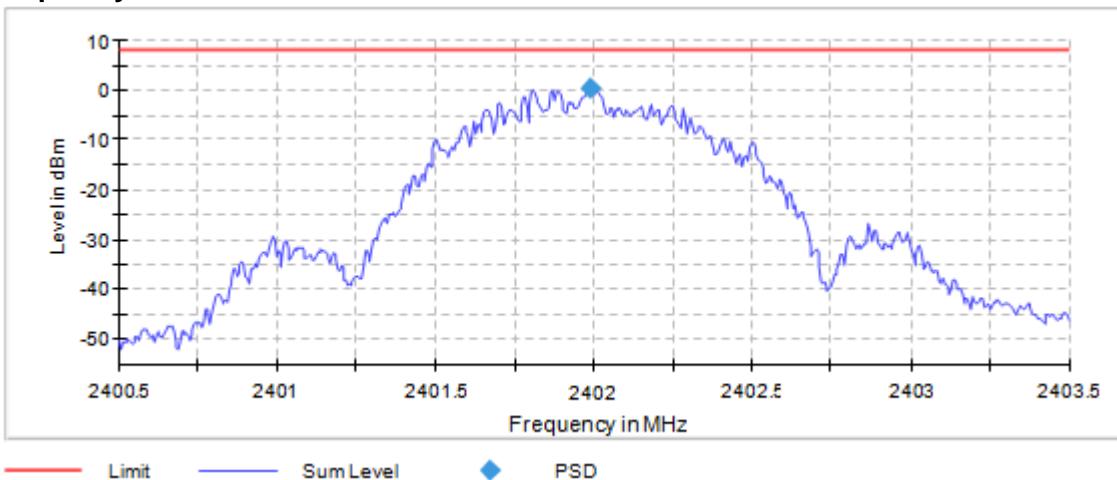
Manufacturer : Amatis Controls
Test Item : Wireless Module
Model No. : IPPAN3
Mode : BLE – Molex 0479480001 BLE Antenna
Test Specification : FCC-15.247, RSS-247 Conducted Power Spectral Density
Date : May 8, 2018

Power Spectral Density

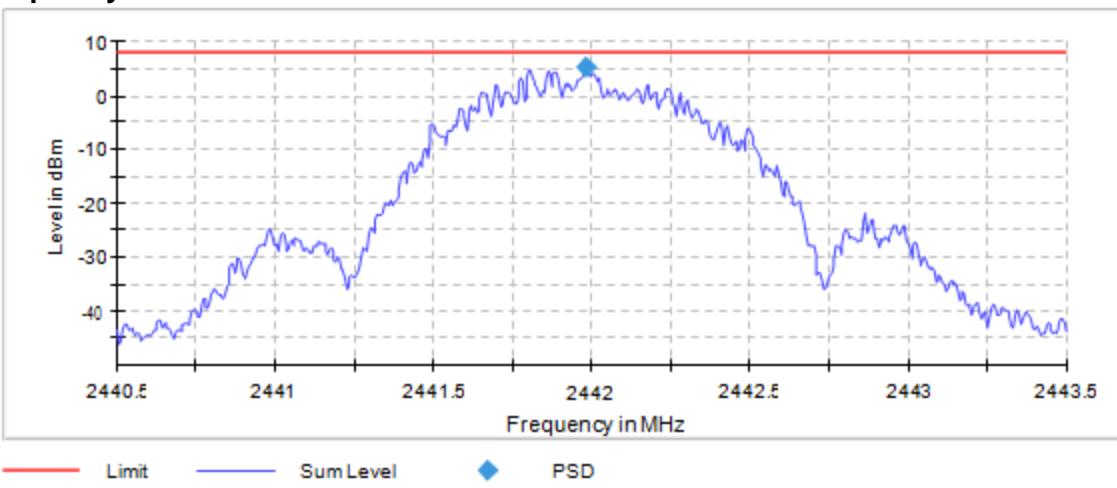
DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2402.000000	2401.987500	0.577	8.0	PASS
2442.000000	2441.982500	5.177	8.0	PASS
2480.000000	2479.982500	6.220	8.0	PASS

Power Spectral Density

Low Frequency:



Mid Frequency:



High Frequency:

