Measurement of RF Interference from a AR9350 Transceiver

For	Horizon Hobby 4105 Fieldstone Rd. Champaign, IL 61822
P.O. Number	20150505GA-01
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Test Personnel	Richard King
Specification	FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Sections 15.207 and 15.247 for Frequency Hopping Spread Spectrum Intentional Radiators Operating within the band 2400-2483.5MHz FCC “Code of Federal Regulations” Title 47, Part15, Subpart 15B, Section 15.107 and 15.109 for Receivers Industry Canada RSS-247 Industry Canada RSS-GEN

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REVISION HISTORY

Revision	Date	Description
—	11 September 2015	Initial release
A	18 September 2015	Changed RSS-210 to RSS-247 throughout report.

Measurement of RF Emissions from an AR9350 Transceiver

1 INTRODUCTION

1.1 Scope of Tests

This document represents the results of the series of radio interference measurements performed on a Horizon Hobby Test Item, Part No. AR9350, Serial No. AR9-2, transceiver (hereinafter referred to as the EUT). The EUT is a frequency hopping spread spectrum transceiver. The transceiver was designed to transmit and receive in the 2400-2483.5 MHz band using a dipole antenna. The EUT was manufactured and submitted for testing by Horizon Hobby located in Champaign, IL.

Horizon Hobby attests that all three SKU variations AR9350, AR9360, AR7350 and AR7360 are electrically identical. Please see the Attestation of Equivalence on page 15.

1.2 Purpose

The test series was performed to determine if the EUT meets the conducted and radiated RF emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart B, Sections 15.107 and 15.109, for receivers and Subpart C, Sections 15.207 and 15.247 for Intentional Radiators Operating within the 2400-2483.5 MHz band. Testing was performed in accordance with ANSI C63.10.

The test series was also performed to determine if the EUT meets the conducted and radiated RF emission requirements of the Industry Canada Radio Standards Specification, RSS-Gen, Section 8.8 and Section 7.1.2 for receivers and the Industry Canada Radio Standards Specification RSS-Gen Section 8.8 and RSS-247, for transmitters. Testing was performed in accordance with ANSI C63.10.

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 National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP). NVLAP Lab Code: 100278-0.

1.5 Laboratory Conditions

The temperature at the time of the test was 22C and the relative humidity was 35%.

2 APPLICABLE DOCUMENTS

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

- Federal Communications Commission "Code of Federal Regulations", Title 47, Part 15, Subparts B and C, dated 1 October 2014

- ANSI C63.10-2013, "American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices".

- FCC Public Notice, DA 00-705, "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems", Released March 30, 2000.

- Industry Canada RSS-247, Issue 1, May 2015, “Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices”.

- Industry Canada RSS-GEN, Issue 4, June 2014, “Spectrum Management and Telecommunications Radio Standards Specification, General Requirements and Information for the Certification of radio

communication equipment".

3 EUT SET-UP AND OPERATION

3.1 General Description

The EUT is a transceiver, Part No. AR9350. A block diagram of the EUT setup is shown as Figure 1 and Figure 2. A photograph of the EUT is shown as Figure 3.

3.1.1 Power Input

The EUT was powered by 6VDC from a Spektrum NiMH Transmitter Battery Pack.

3.1.2 Peripheral Equipment

The EUT was submitted for testing with no peripheral equipment.

3.1.3 Interconnect Cables

The EUT was submitted for testing with no interconnect cables.

3.1.4 Grounding

The EUT was not grounded.

3.2 Operational Mode

All tests were performed with the EUT operated in at least one of the following modes:

Transmit at 2404MHz
Transmit at 2440MHz
Transmit at 2476MHz
Hopping Enabled

3.3 EUT Modifications

No modifications were required for compliance.

4 TEST FACILITY AND TEST INSTRUMENTATION

4.1 Shielded Enclosure

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

4.2 Test Instrumentation

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

4.3 Calibration Traceability

Test equipment is maintained and calibrated on a regular basis. All calibrations are traceable to the National Institute of Standards and Technology (NIST).

4.4 Measurement Uncertainty

All measurements are an estimate of their true value. The measurement uncertainty characterizes, with a specified confidence level, the spread of values which may be possible for a given measurement system.

The measurement uncertainty for these tests is presented below:

Conducted Emission Measurements		
Combined Standard Uncertainty	1.07	-1.07
Expanded Uncertainty (95% confidence)	2.1	-2.1

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

5 TEST PROCEDURES

5.1 Receiver

5.1.1 Powerline Conducted Emissions

5.1.1.1 Requirements

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

5.1.2 Radiated Measurements

5.1.2.1 Requirements

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

Per Industry Canada RSS-Gen, Issue 4, section 5.3: “Only radio communication receivers operating in stand-alone mode within the band 30-960 MHz, as well as scanner receivers, are subject to Industry Canada requirements. All other receivers are exempted from any Industry Canada certification, testing, labeling, and reporting requirements.” Since the receiver operates above 960MHz, the receiver is exempt from complying with the technical provisions of the RSS standards.

5.2 Transmitter

5.2.1 Powerline Conducted Emissions

5.2.1.1 Requirements

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

5.2.2 20dB Bandwidth

5.2.2.1 Requirements

Per section 15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5MHz band may have hopping channel carrier frequencies that are separated by 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater, provided the systems operate within an output power no greater than 125mW.

5.2.2.2 Procedures

The EUT was setup inside the chamber. With the hopping function disabled, the EUT was allowed to transmit continuously. The frequency hopping channel was set separately to low, middle, and high hopping channels. The resolution bandwidth (RBW) was set to ≥ 1% of the 20 dB BW. The span was set to approximately 2 to 3 times the 20 dB bandwidth.

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

5.2.2.3 Results

The plots on pages 20 through 22 show that the maximum 20 dB bandwidth was 1.24MHz. The 99% bandwidth was measured to be 1.1MHz.

5.2.3 Carrier Frequency Separation

5.2.3.1 Requirements

Per section 15.247 (a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater.

Per section 15.247(a)(1), alternatively, frequency hopping systems operating in the 2400-2483.5MHz band may have hopping channel carrier frequencies that are separated by 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater, provided the systems operate within an output power no greater than 125mW.

5.2.3.2 Procedures

The EUT was setup inside the chamber. With the hopping function enabled, the EUT was allowed to transmit continuously. The resolution bandwidth (RBW) was set to > to 1% of the span. The peak detector and 'Max-Hold' function were engaged. The span was set wide enough to capture the peaks of at least two adjacent channels. When the trace had stabilized after multiple scans, the marker-delta function was used to determine the separation between the peaks of the adjacent channels. The analyzer's display was plotted using a 'screen dump' utility.

5.2.3.3 Results

Page 23 shows the carrier frequency separation. As can be seen from this plot, the carrier frequency separation is 3MHz which is greater than the 20dB bandwidth of the hopping channel (1.24MHz).

5.2.4 Number of Hopping Frequencies

5.2.4.1 Requirements

Per section 15.247(a)(1)(iii), frequency hopping systems operating in the 2400-2483.5MHz band that employ at least 15 hopping channels must have a maximum peak conducted output power that does not exceed 0.125W (21dBm).

Per 15.247(b)(1), frequency hopping systems operating in the 2400- 2483.5MHz band that employ at least 75 non-overlapping hopping channels must have a maximum peak conducted output power that does not exceed 1W (30dBm).

5.2.4.2 Procedures

The EUT was setup inside the chamber. With the hopping function enabled, the EUT was allowed to transmit continuously. The resolution bandwidth (RBW) was set to ≥ to 1% of the span. The peak detector and 'Max-Hold' function were engaged. The span was set wide enough to capture the entire frequency band of operation.

The EUT's signal was allowed to stabilize after multiple scans. The number of hopping frequencies was counted.

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

5.2.4.3 Results

Page 24 shows the number of hopping frequencies. As can be seen from this plot, the number of hopping frequencies is 23 which is greater than 15 which is the minimum number of required hopping frequencies for systems operating in the 2400-2483.5MHz band that have a maximum peak conducted output power that does not exceed 0.125W (21dBm).

5.2.5 Time of Occupancy

Per section 15.247(a)(1)(iii), for frequency hopping systems operating in the 2400-2483.5MHz band, the average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

5.2.5.1 Procedures

The EUT was setup inside the chamber. With the hopping function enabled, the EUT was allowed to transmit continuously. The resolution bandwidth (RBW) was set to 1 MHz. The peak detector and 'Max-Hold' function were engaged. With the span set to 0Hz, the sweep time was adjusted to capture a single event in order to measure the dwell time per hop. The analyzer's display was plotted using a 'screen dump' utility. Then, the sweep time was expanded to 0.4 seconds multiplied by the number of hopping channels employed to capture the number of hops in the appropriate sweep time. A single sweep was made. The analyzer's display was plotted using a 'screen dump' utility. The dwell time in the specified time period was then calculated from dwell time per hop multiplied by the number of hops in the specified time period.

5.2.5.2 Results

Pages 25 and 26 show the plots for the time of occupancy (dwell time). As can be seen from the plots, the time of occupancy can be determined by (dwell time/hop) multiplied by (# of hops). This calculated value is equal to 17.2 milliseconds which is less than the 0.4 seconds maximum allowed.

5.2.6 Peak Output Power

5.2.6.1 Requirements

Per section 15.247(b)(1), for frequency hopping systems operating in the 2400-2483.5MHz band that do not employ at least 75 non-overlapping hopping channels, the maximum peak output conducted power shall not be greater than 0.125W (21dBm). 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 0.5 Watt (27dBm). If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below 21dBm by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.2.6.2 Procedures

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 20dB bandwidth. The span was set to approximately 5 times the 20 dB 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 hopping frequencies.

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 for all measurements above 1GHz), as required. The peak power output was calculated for low, middle, and high hopping frequencies.

5.2.6.3 Results

The results are presented on page 27. The maximum EIRP measured from the transmitter was 13.8dBm or 23mW which is below the 0.5 Watt limit.

5.2.7 Duty Cycle Factor Measurements

5.2.7.1 Requirements

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

5.2.7.2 Procedures

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

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

5.2.7.3 Results

Duty cycle plots are shown on page 28 and 29. The EUT transmits a 861.7 usec pulse 1 time in a 100msec period. This results in a duty cycle correction factor of -41.3dB.

5.2.8 Radiated Spurious Emissions Measurements

5.2.8.1 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).

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

emission limits specified in §15.209(a).

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

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

5.2.8.2 Procedures

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

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

The final 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 100 kHz 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 100 kHz 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 axis to ensure the maximum readings were recorded for the EUT.
   d) All harmonics not in the restricted bands must be at least 20 dB 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 1 GHz 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 100 kHz was used on the spectrum analyzer.

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

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

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

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

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

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

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

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

f) Next, for all radiated emissions measurements above 1GHz, the resolution bandwidth was set to 1MHz. The analyzer was set to linear mode with a 10Hz video bandwidth in order to simulate an average detector. An average reading was taken. If the dwell time per channel of the hopping signal is less than 100msec, then the reading obtained with the 10 Hz video bandwidth may be further adjusted by a “duty cycle correction factor”, derived from 20*log(dwell time/100msec). These readings must be no greater than the limits specified in 15.209(a).

If the dwell time per channel of the hopping signal is less than 100msec, then the reading obtained with the 10 Hz video bandwidth may be further adjusted by a “duty cycle correction factor”, derived from 20*log(dwell time/100msec). These readings must be no greater than the limits specified in 15.209(a).

5.2.8.3 Results

Preliminary radiated emissions plots with the EUT transmitting at 2404MHz, 2440MHz, and 2476MHz are shown on pages 30 through 53. Final radiated emissions data are presented on data pages 54 through 62. As can be seen from the data, all emissions measured from the EUT were within the specification limits.

Photographs of the test configuration which yielded the highest, or worst case, radiated emission levels are shown on Figure 3 and Figure 4.

5.2.9 Band Edge Compliance

5.2.9.1 Requirements

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.

In addition, the radiated emissions which fall in the restricted band beginning at 2483.5 MHz must meet the

general limits of 15.209(a).

5.2.9.2 Procedures

5.2.9.2.1 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 (hopping function disabled).
4) The EUT was maximized for worst case emissions at the measuring antenna. The maximum meter reading was recorded.
5) To determine the bandedge compliance, the following spectrum analyzer settings were used:
    a. Center frequency = low band-edge frequency.
    b. Span = Wide enough to capture the peak level of the emission operating on the channel closest to the band-edge, as well as any modulation products which fall outside of the authorized band of operation.
    c. Resolution bandwidth (RBW) ≥ 1% of the span.
    d. The 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined.
    e. The marker was set on the peak of the in-band emissions. A display line was placed 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.)
    f. The analyzer's display was plotted using a 'screen dump' utility.
6) Step 5) was repeated with the frequency hopping function enabled.

5.2.9.2.2 High Band Edge

1) The EUT was set to transmit continuously at the channel closest to the high band-edge (hopping function disabled).
2) A double ridged waveguide was placed 3 meters away from the EUT. The antenna was connected to the input of a spectrum analyzer.
3) The center frequency of the analyzer was set to the high band edge (2483.5MHz)
4) The resolution bandwidth was set to 1MHz.
5) To ensure that the maximum or worst case emission level was measured, the following steps were taken:
    a. The EUT was rotated so that all of its sides were exposed to the receiving antenna.
    b. Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.
    c. The measuring antenna was raised and lowered from 1 to 4 meters for each antenna polarization to maximize the readings.
6) The highest measured peak reading was recorded.
7) The highest measured average reading was recorded.
8) Steps 1 through 7 were repeated with the hopping enabled.

5.2.9.3 Results

Pages 63 through 66 show the radiated band-edge compliance results. 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.

6 CONCLUSIONS

It was determined that the Horizon Hobby Test Item, Part No. AR9350 frequency hopping spread spectrum

transceiver, Serial No. AR9-2, did fully meet the conducted and radiated emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart B, Sections 15.107 and 15.109 for receivers and Subpart C, Sections 15.207 and 15.247 for Intentional Radiators Operating within the 2400-2483.5 MHz band, when tested per ANSI C63.10.

It was also determined that the Horizon Hobby Test Item, Part No. AR9350 frequency hopping spread spectrum transceiver, Serial No. AR9-2, did fully meet the conducted and radiated RF emission requirements of the Industry Canada Radio Standards Specification, RSS-Gen, Section 8.8 and 7.1.2 for receivers and the Industry Canada Radio Standards Specification RSS-Gen Section 8.8 and RSS-247, for transmitters, when tested per ANSI C63.10.

7 CERTIFICATION

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

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

8 ENDORSEMENT DISCLAIMER

This report must not be used to claim product certification, approval, or endorsement by 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	2/17/2015	2/17/2016
APW11	PREAMPLIFIER	PMI	PE2-35-120-5R0-10-12-SFF	PL11685/1241	1GHZ-20GHZ	3/5/2015	3/5/2016
CDX8	COMPUTER	ELITE	WORKSTATION			N/A	
GSD3	SIGNAL GENERATOR	ROHDE & SCHWARZ	SMB100A	104454	9KHZ-6GHZ	9/10/2014	9/10/2015
GXA1	MXG MW ANALOG SIGNAL GENERATOR	AGILENT TECHNOLOGIES	N5183A	MY47420353	250KHz-40GHz	2/10/2015	2/10/2016
NHG1	STANDARD GAIN HORN ANTENNA	NARDA	638	---	18-26.5GHZ	NOTE 1	
NTA3	BILOG ANTENNA	TESEQ	6112D	32853	25-1000MHz	3/27/2015	3/27/2016
NWP1	DOUBLE RIDGED WAVEGUIDE ANTENNA	EATON	3115	2100	1GHZ-12.4GHZ	7/22/2014	7/22/2016
NWQ1	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS-LINDGREN	3117	66655	1GHZ-18GHZ	3/11/2014	3/11/2016
RBA0	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESIB26	100145	20HZ-26.5GHZ	3/3/2015	3/3/2016
SES0	24VDC POWER SUPPLY	P-TRANS	FS-32024-1M	001	18-27VDC	NOTE 1	
XOB2	ADAPTER	HEWLETT PACKARD	K281C,012	09407	18-26.5GHZ	NOTE 1	
XPQ4	HIGH PASS FILTER	K&L MICROWAVE	11SH10-4800/X20000-O/O	1	4.8-20GHZ	10/30/2014	10/30/2015

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

Attestation of Equivalence

Horizon Hobby, LLC hereby attests that the following model(s) are equivalent to the Original Model identified below in regards to Radio Frequency transmission, Electromagnetic Interference and Product Safety regulatory compliance. Differences or variances in design, construction, appearance or features not affecting the regulatory aspect of the products are described below.

Original Model Name/Number: Spektrum™ SPMAR9350

Original Model Description: 2.4GHz GFSK 9-control channel digital radio receiver w/AS3X® flight control software

Equivalent Model(s): SPMAR9360, SPMAR7360, SPMAR7350

Model Name/Number	Variance from Original Model
SPMAR7350	7 Control channels w/AS3X® flight control software
SPMAR7360	7 control channels w/SAFE® flight control software
SPMAR9360	9 control channels w/SAFE® flight control software

Date: August 21, 2015

Mike Dunne
Executive Vice President – Product Development
Horizon Hobby, LLC.

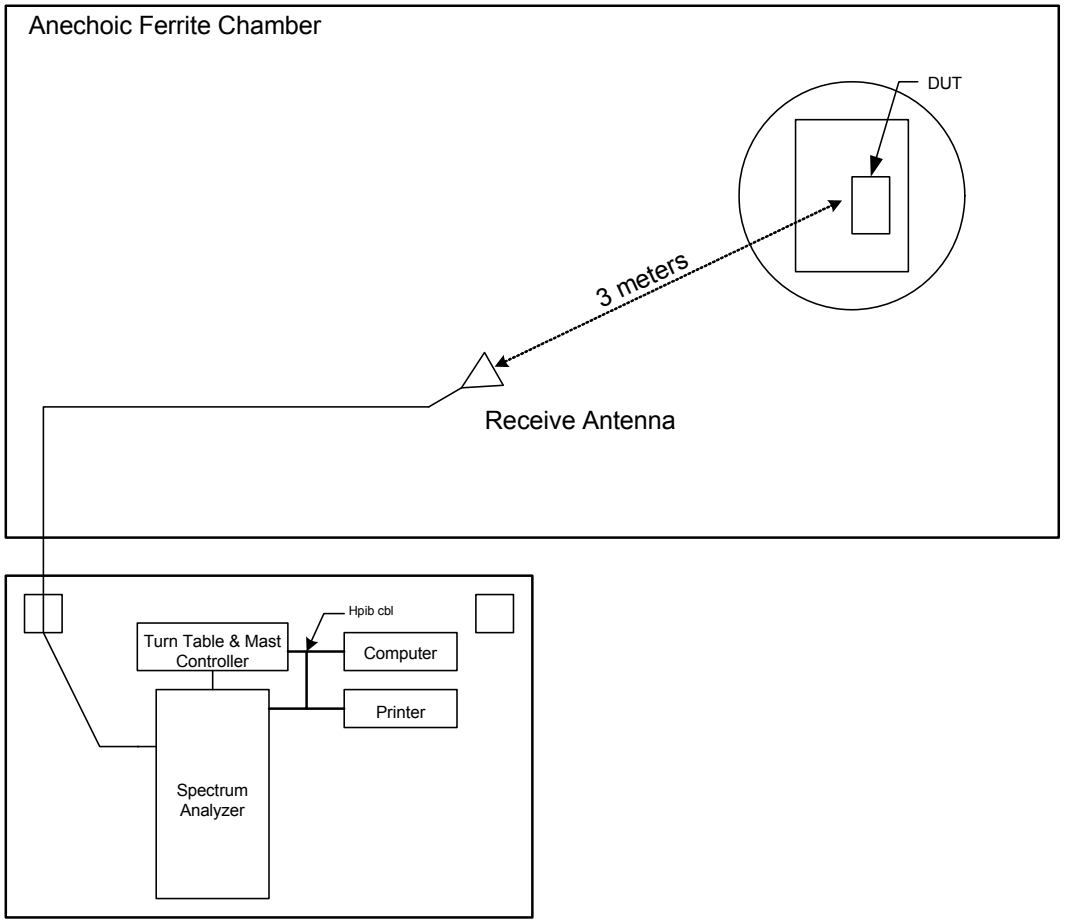


FIGURE 1 BLOCKDIAGRAM OF TEST SETUP

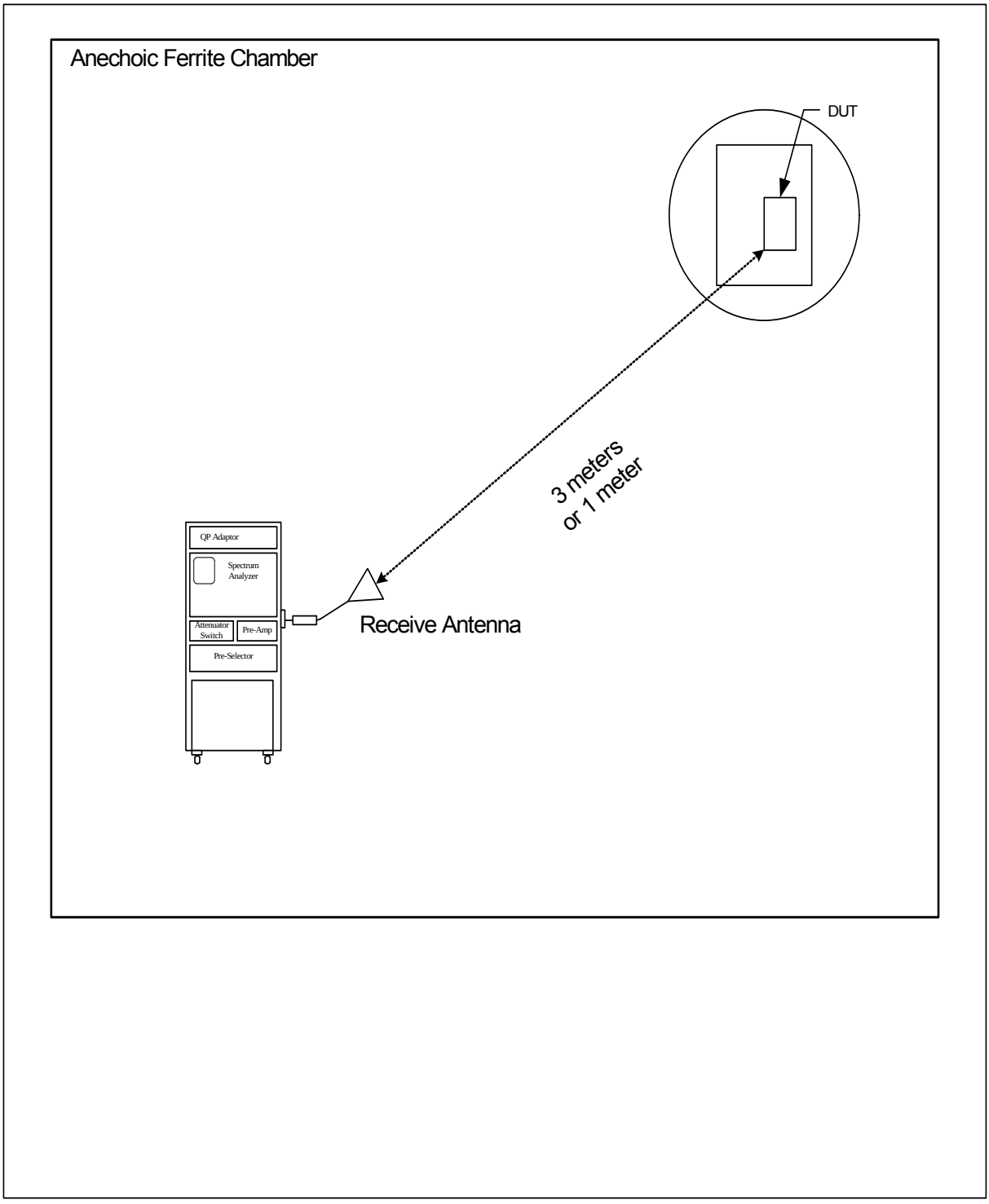
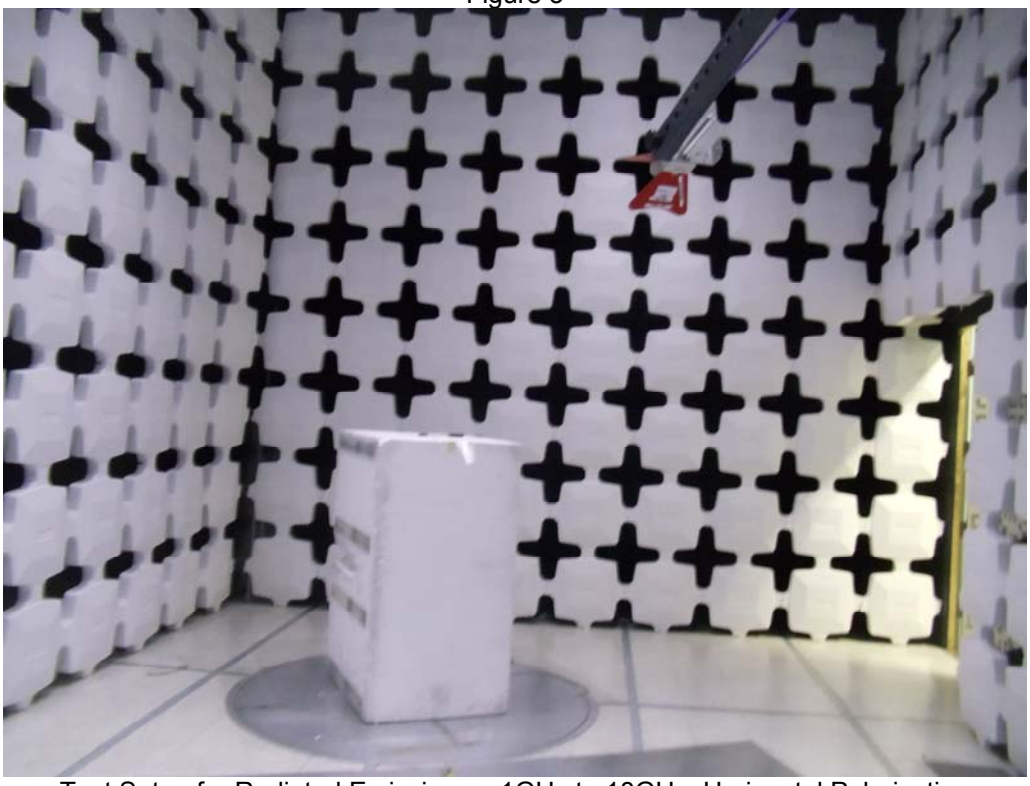
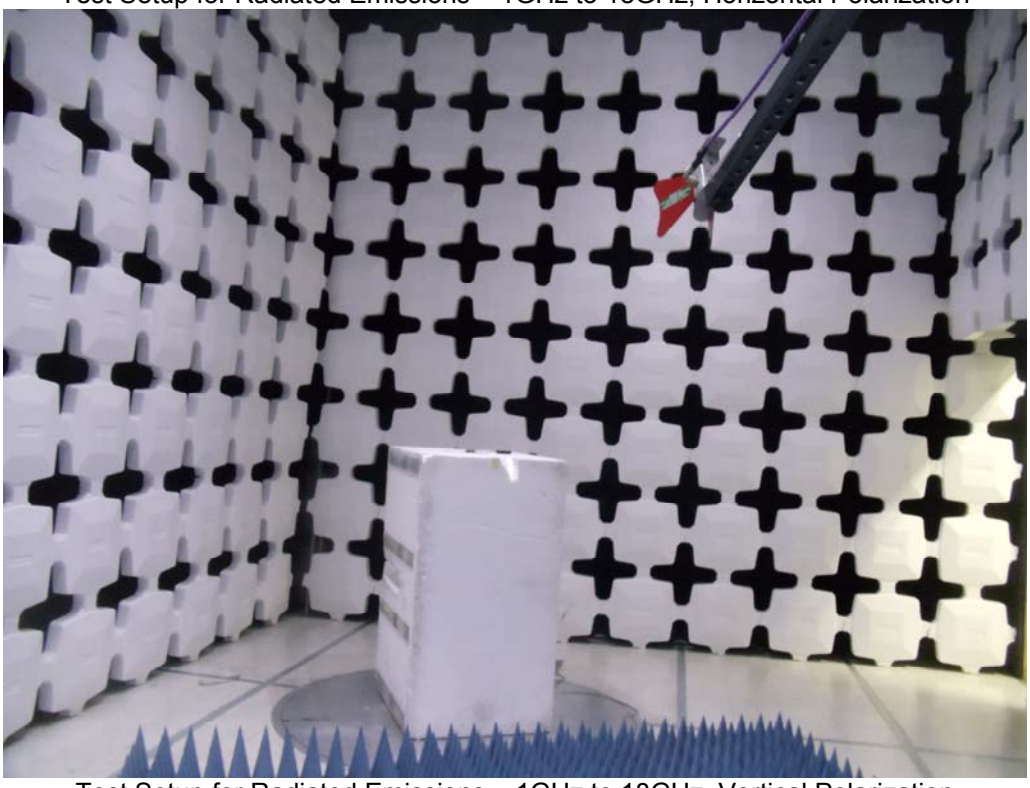


Figure 2: BLOCK DIAGRAM OF TEST SETUP FOR RADIATED EMISSIONS ABOVE 18GHZ

Figure 3

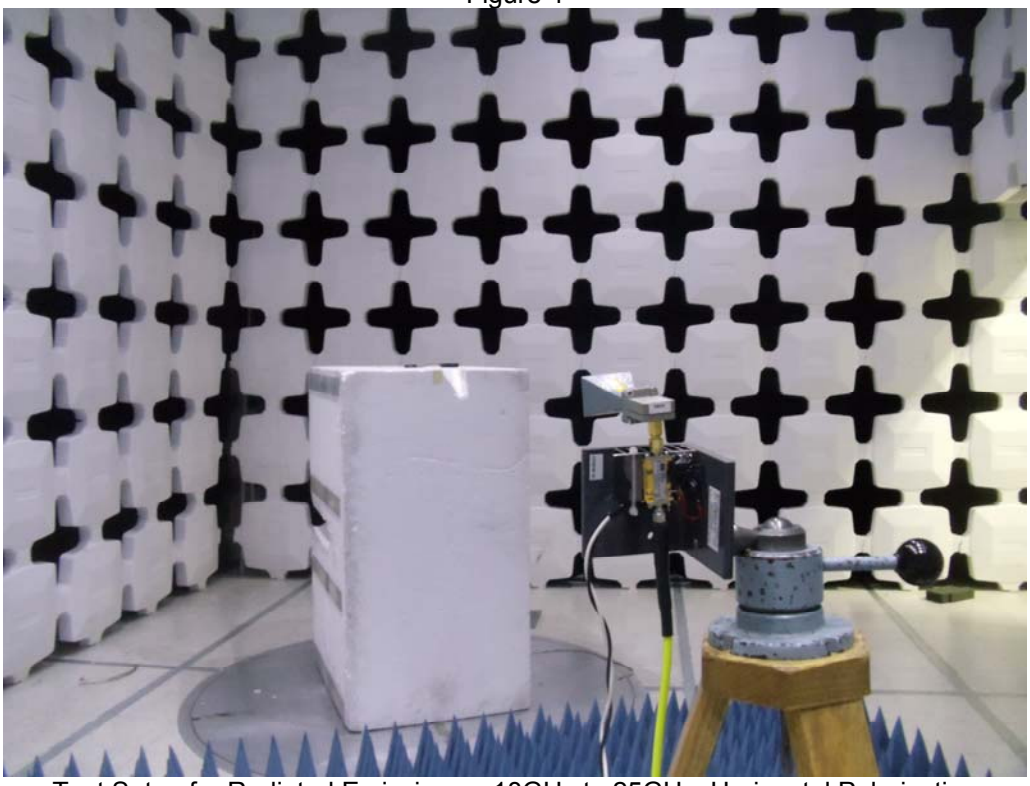


Test Setup for Radiated Emissions – 1GHz to 18GHz, Horizontal Polarization

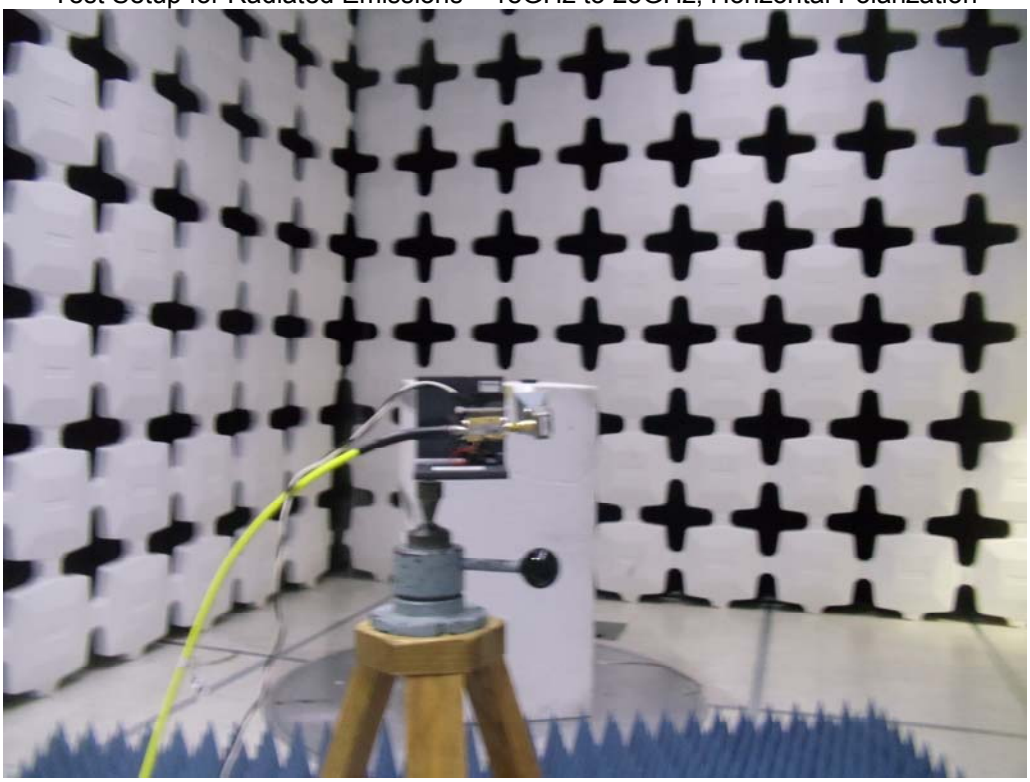


Test Setup for Radiated Emissions – 1GHz to 18GHz, Vertical Polarization

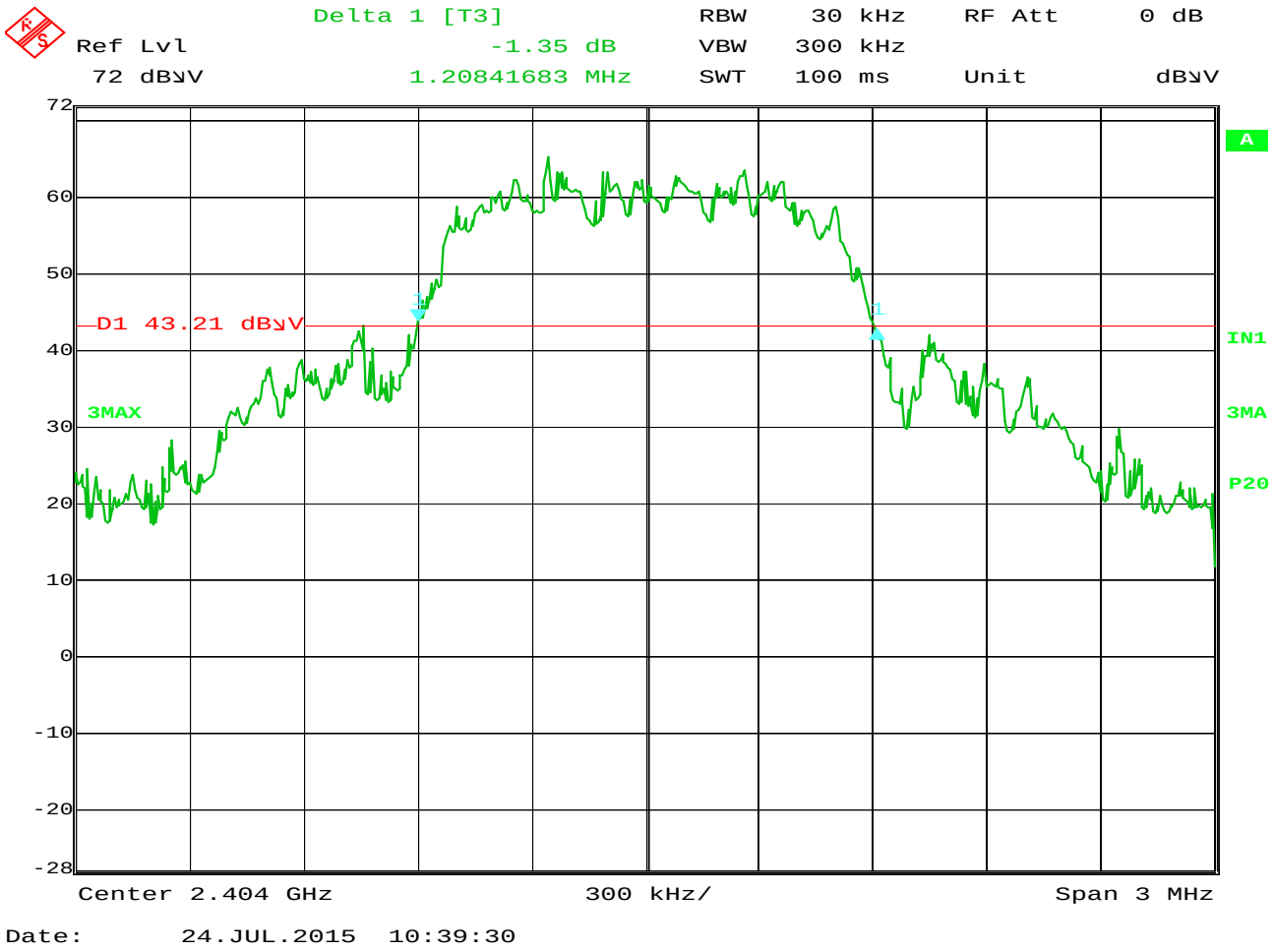
Figure 4



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

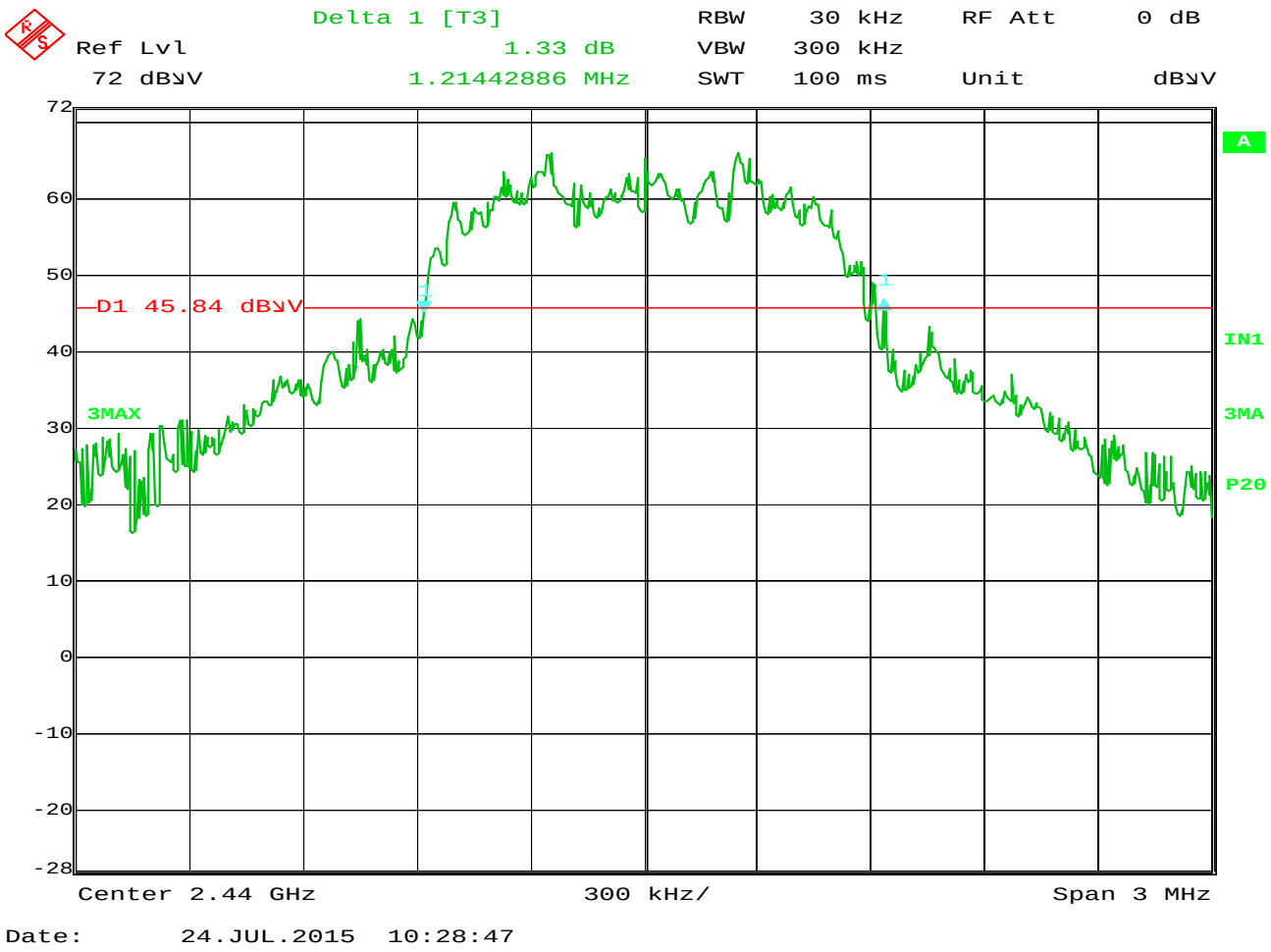


Test Setup for Radiated Emissions – 18GHz to 25GHz, Vertical Polarization



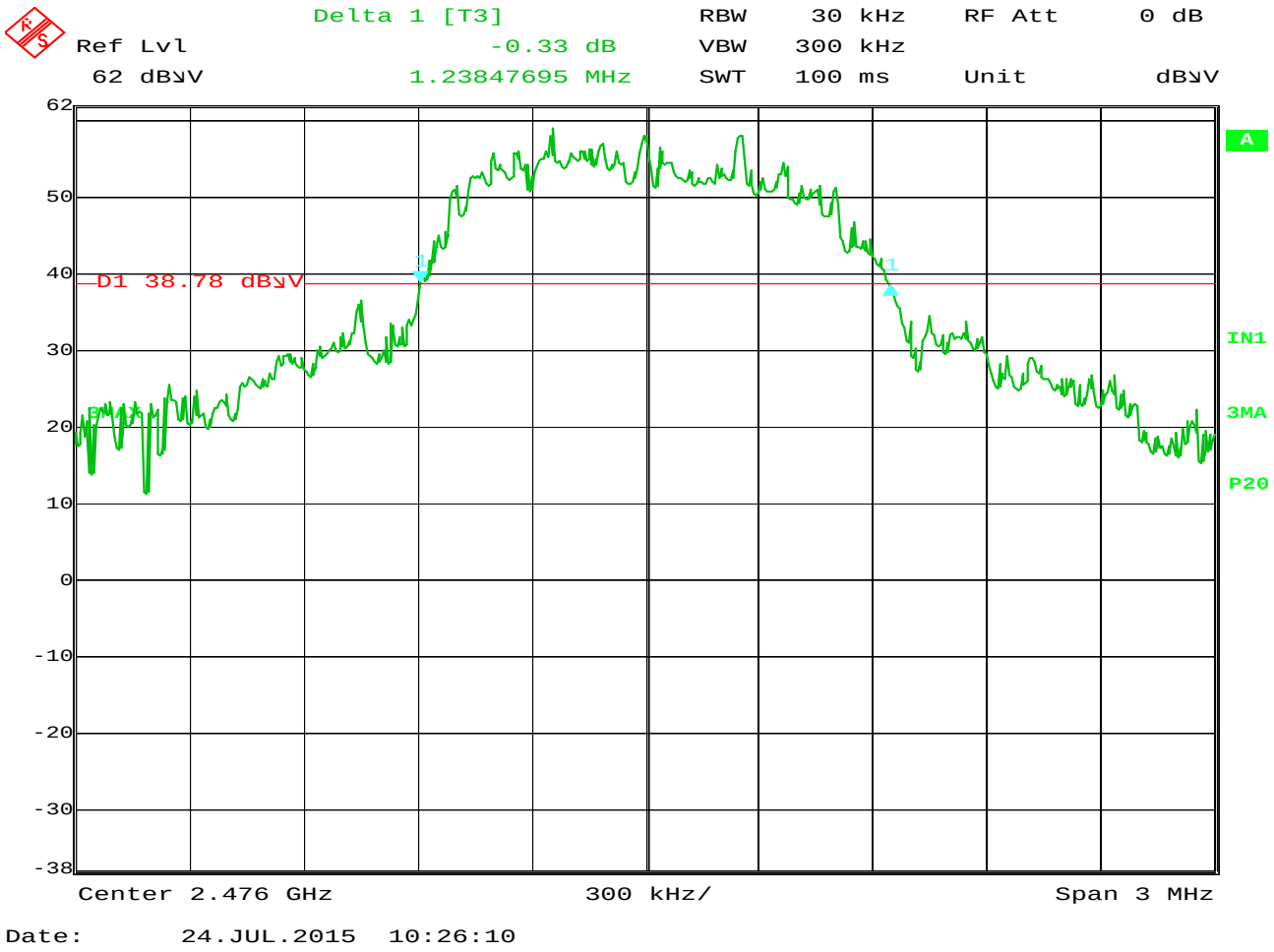
20 dB Bandwidth

Manufacturer	: Horizon Hobby
Model No.	: AR9350
Serial No.	: AR9-2
Date	: JULY 24, 2015
Test Performed	: 20dB Bandwidth
Mode	: Tx @ 2404MHz
Notes	: 20dB bandwidth = 1.2MHz



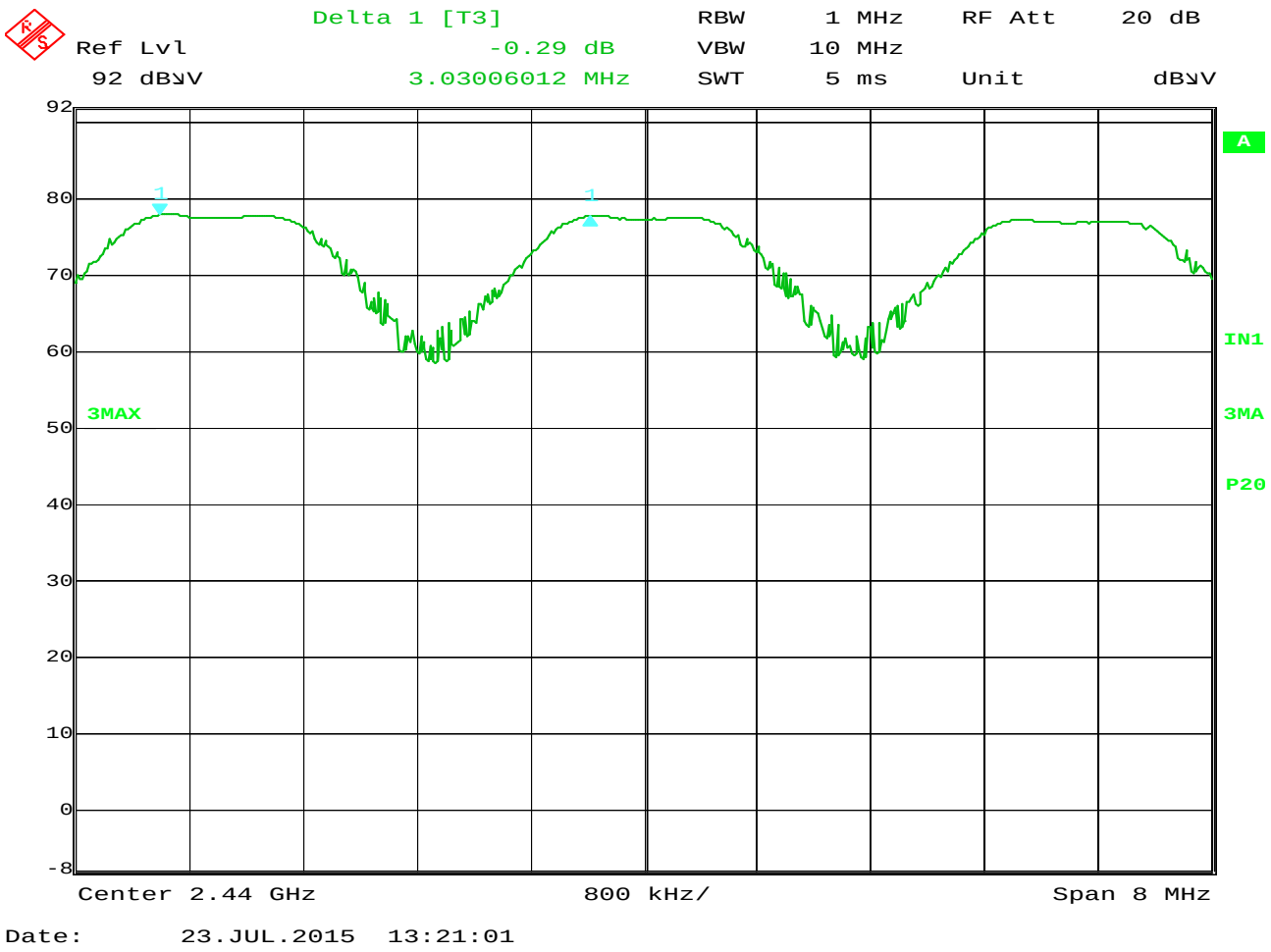
20 dB Bandwidth

Manufacturer	: Horizon Hobby
Model No.	: AR9350
Serial No.	: AR9-2
Date	: JULY 24, 2015
Test Performed	: 20dB Bandwidth
Mode	: Tx @ 2440MHz
Notes	: 20dB bandwidth = 1.2MHz



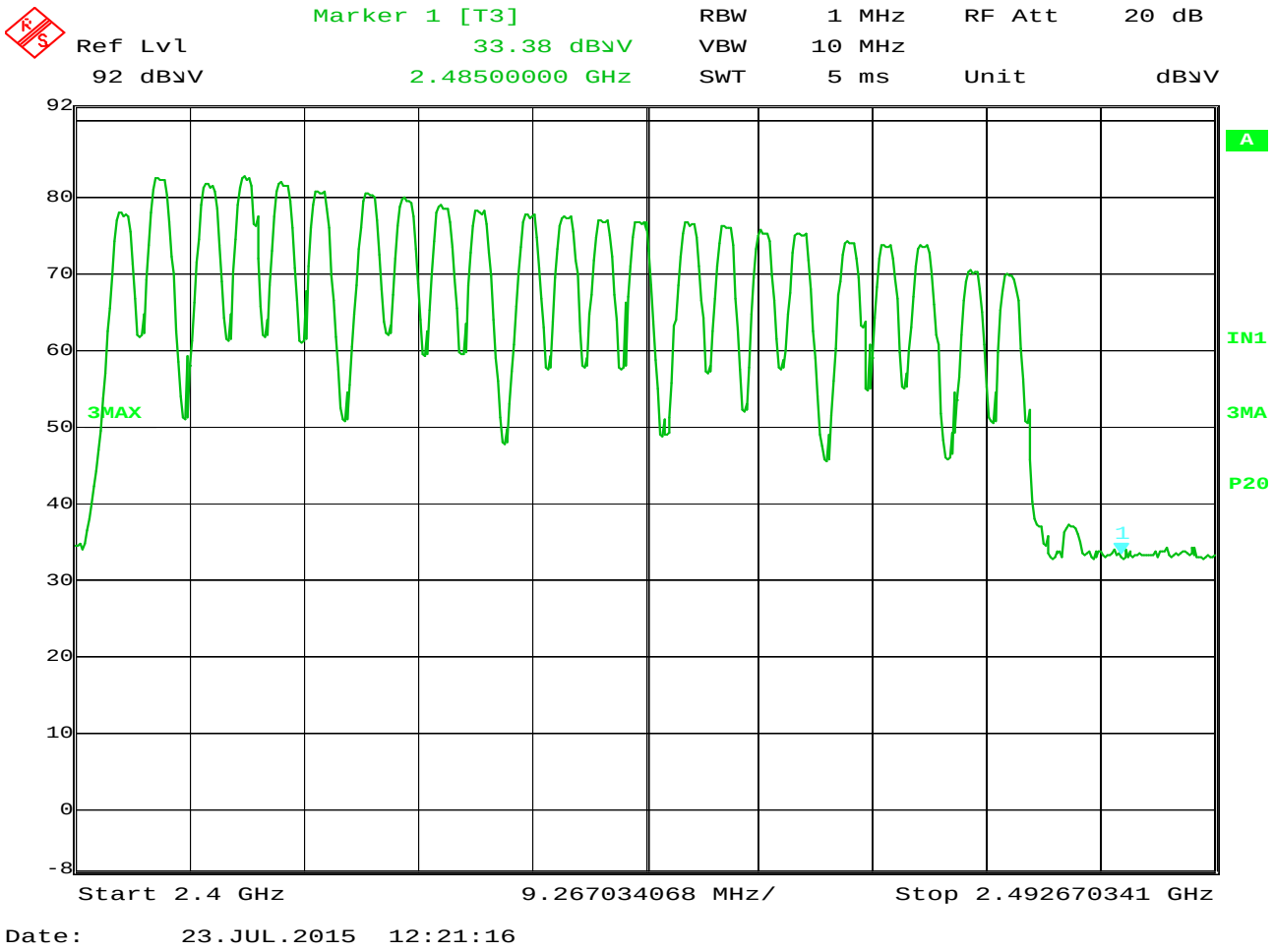
20 dB Bandwidth

Manufacturer	: Horizon Hobby
Model No.	: AR9350
Serial No.	: AR9-2
Date	: JULY 24, 2015
Test Performed	: 20dB Bandwidth
Mode	: Tx @ 2476MHz
Notes	: 20dB bandwidth = 1.24MHz



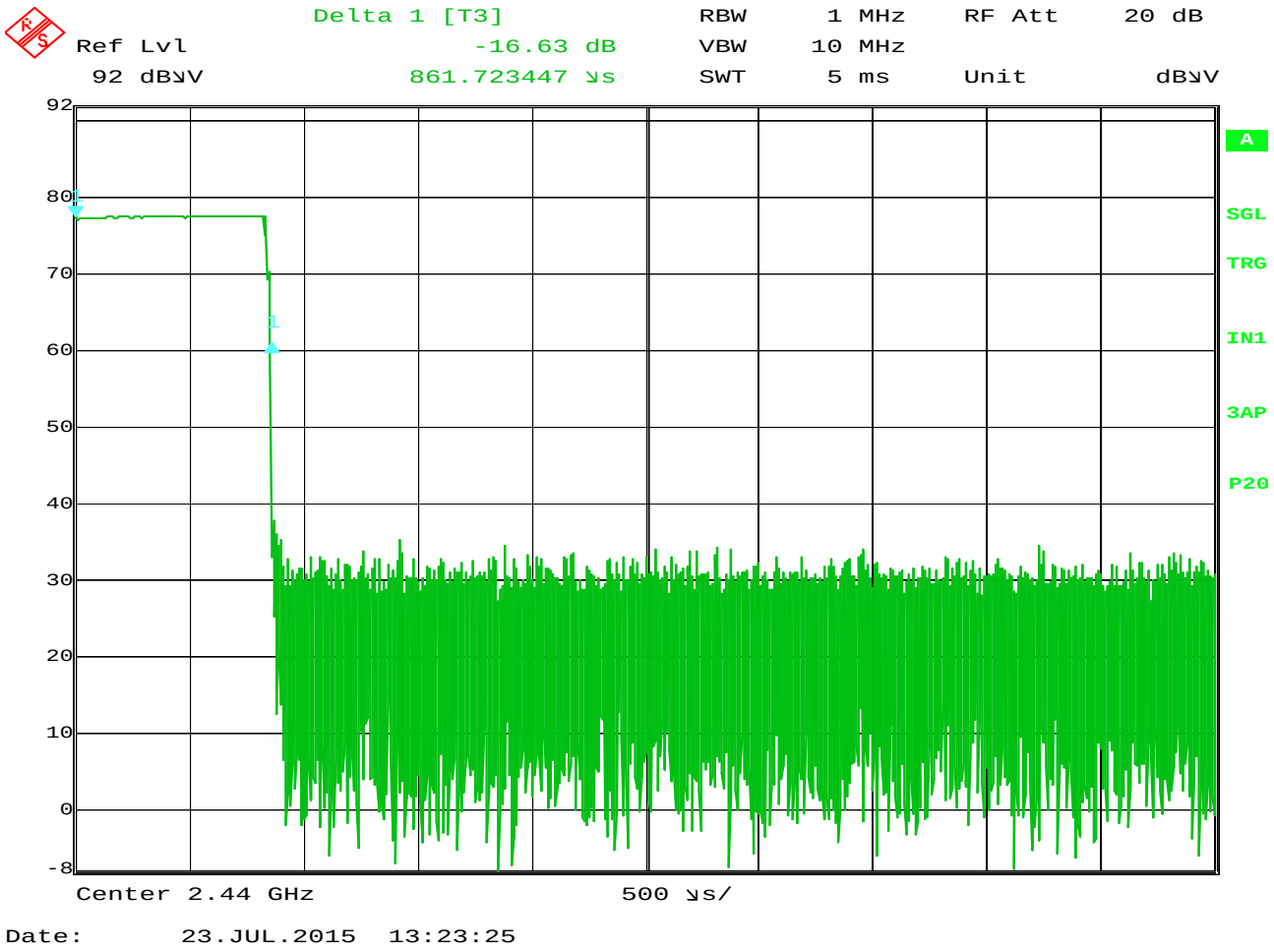
Carrier Frequency Separation

Manufacturer	: Horizon Hobby
Model No.	: AR9350
Serial No.	: AR9-2
Date	: JULY 23, 2015
Test Performed	: Carrier Frequency Separation
Mode	: Hopping Enabled
Notes	: Carrier Frequency Separation = 3MHz



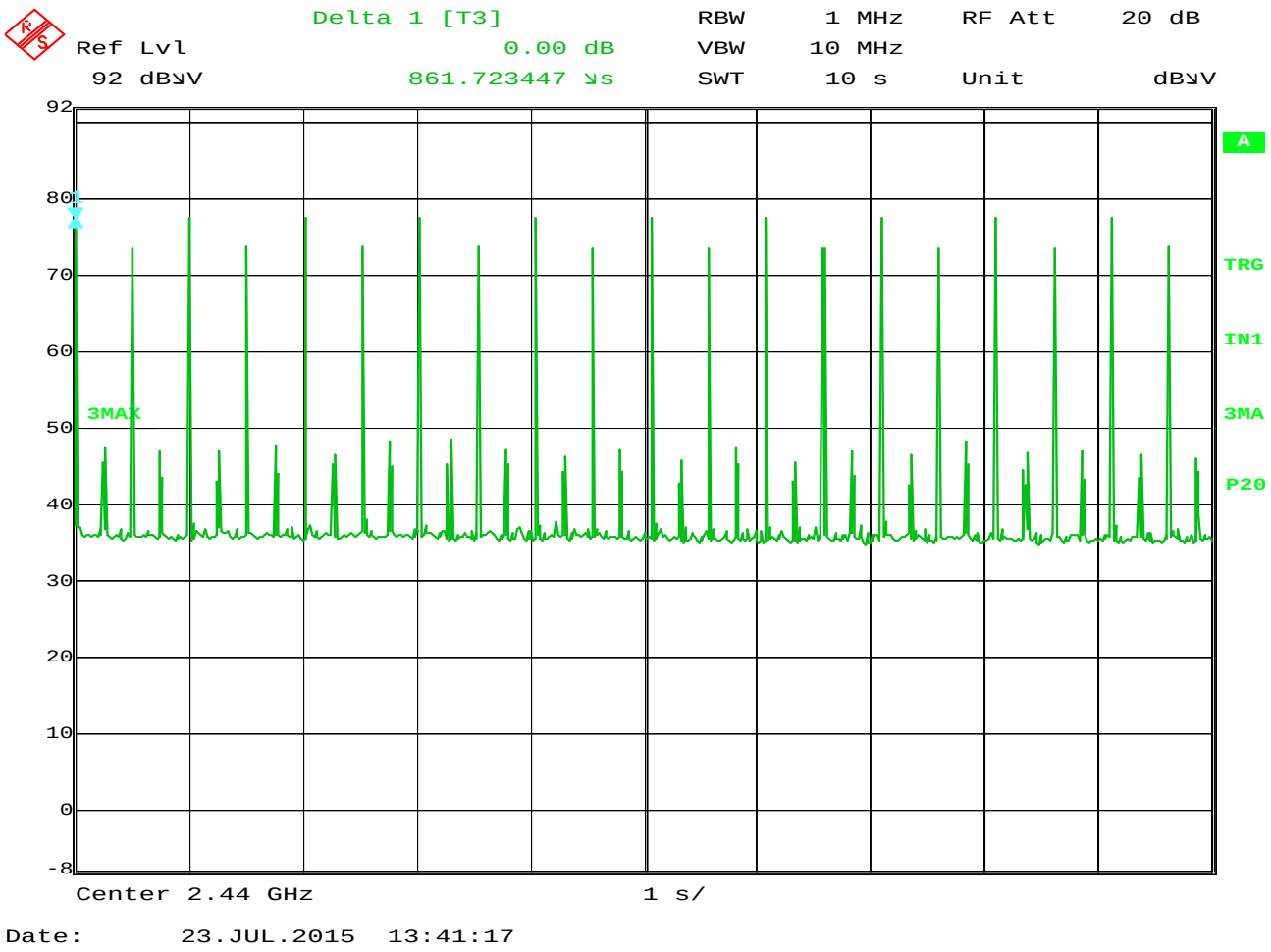
Number of Hopping Frequencies

Manufacturer	: Horizon Hobby
Model No.	: AR9350
Serial No.	: AR9-2
Date	: JULY 23, 2015
Test Performed	: Number of Hopping Frequencies
Mode	: Hopping Enabled
Notes	: Number of Hopping Frequencies = 23



Pulse Width

Manufacturer	: Horizon Hobby
Model No.	: AR9350
Serial No.	: AR9-2
Date	: JULY 23, 2015
Test Performed	: Pulse Width
Mode	: Hopping Enabled
Notes	: Pulse Width = 861.7usec



Time of Occupancy

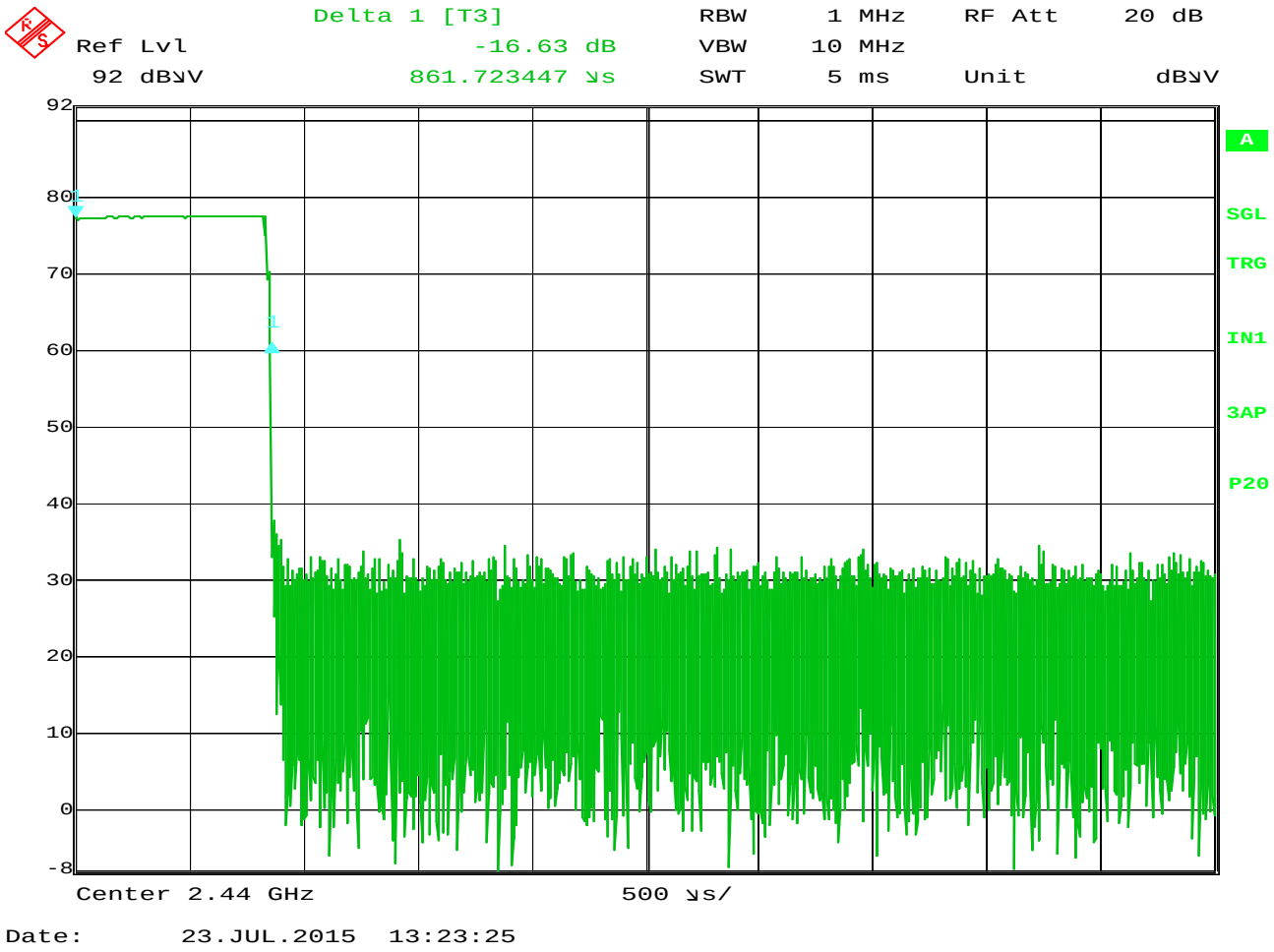
Manufacturer	: Horizon Hobby
Model No.	: AR9350
Serial No.	: AR9-2
Date	: JULY 23, 2015
Test Performed	: Time of Occupancy
Mode	: Hopping Enabled
Notes	: Time of Occupancy = (pulse width) x (#pulses in a period of (# of hopping
	: channels) x (0.4 seconds))
	: Time of Occupancy = 861.7usec x (#pulses in (20 x 0.4 sec)
	: Time of Occupancy = 861.7usec x (# pulses in 9.2 sec period)
	: Time of Occupancy = 0.8617msec x 20 pulses in 9.2 sec period
	: Time of Occupancy = 17.2msec

MANUFACTURER : Horizon Hobby
MODEL NO. : AR9350
SERIAL NO. : AR9-2
DATE : July 24, 2015
TEST PERFORMED : Effective Isotropic Radiated Power (EIRP)
MODE : Transmit
NOTES :

Freq. (MHz)	Ant Pol	Meter Reading (dBuV)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
2404.00	H	76.3	7.8	5.4	3.4	9.7	27.0	-17.3
2404.00	V	68.7	2.7	5.4	3.4	4.6	27.0	-22.4

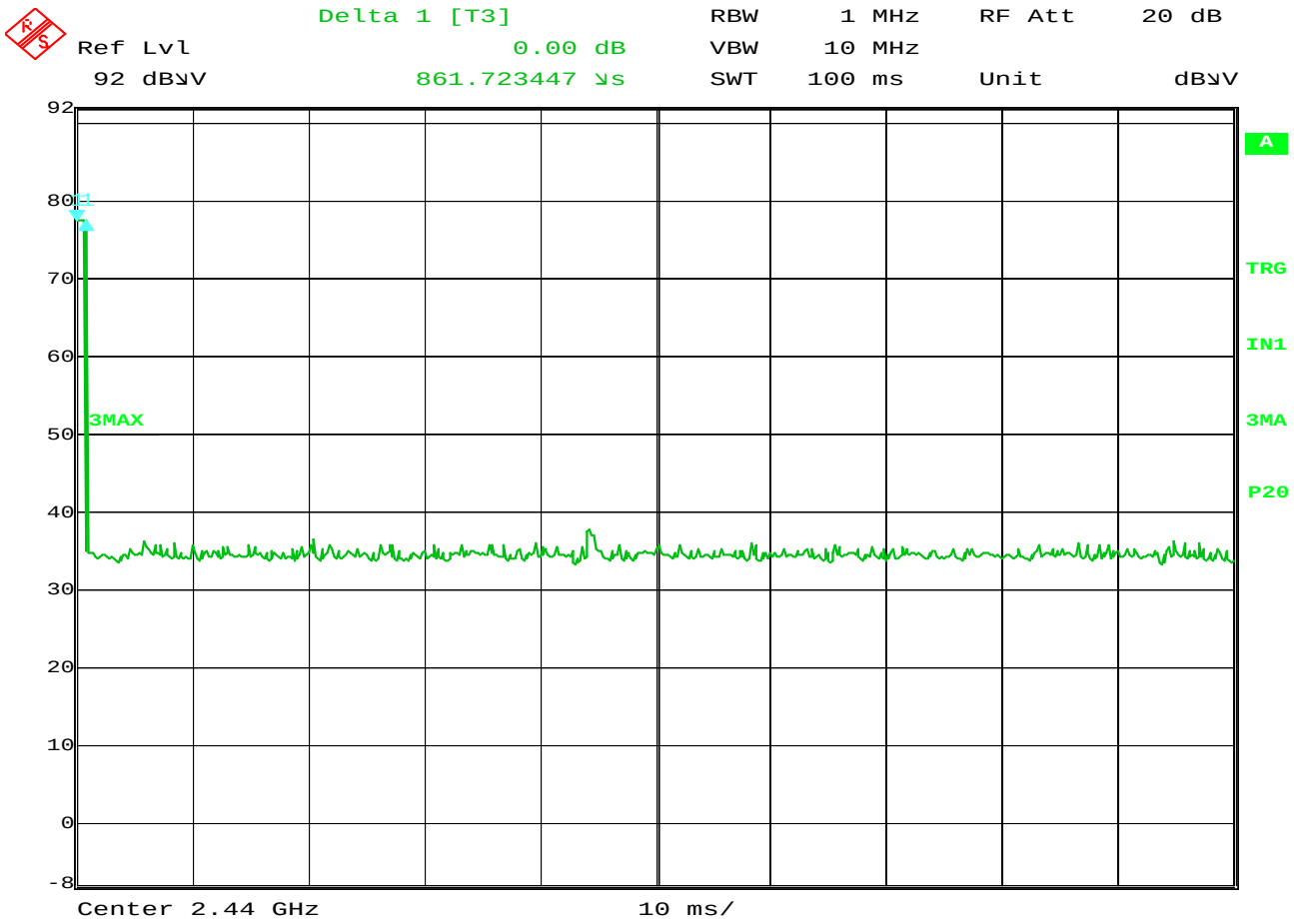
Freq. (MHz)	Ant Pol	Meter Reading (dBuV)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
2440.00	H	79.5	11.7	5.6	3.5	13.8	27.0	-13.2
2440.00	V	70.3	3.4	5.6	3.5	5.5	27.0	-21.5

Freq. (MHz)	Ant Pol	Meter Reading (dBuV)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
2476.00	H	71.4	3.5	5.5	3.5	5.5	27.0	-21.5
2476.00	V	65.0	-1.5	5.5	3.5	0.5	27.0	-26.5



Pulse Width

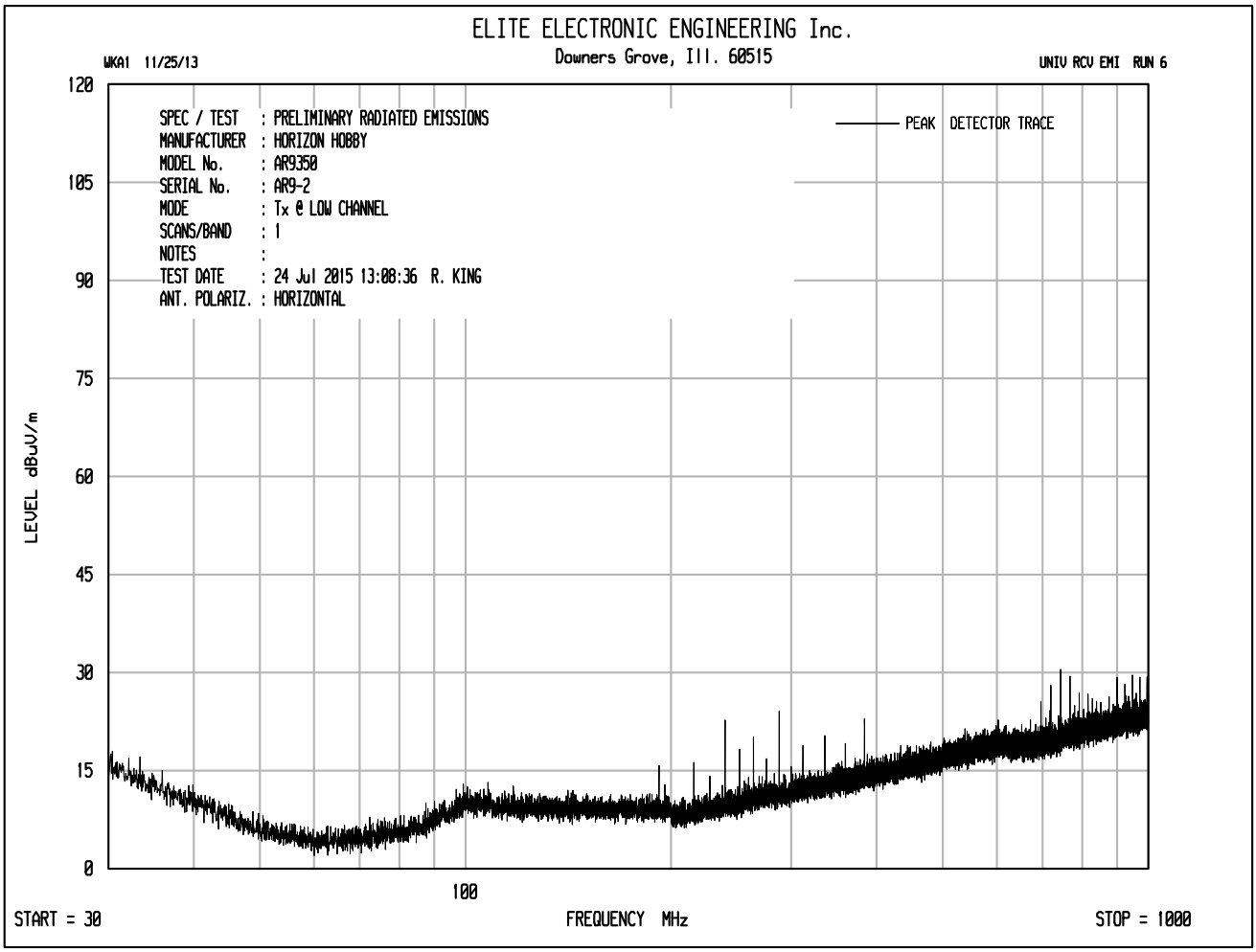
Manufacturer	: Horizon Hobby
Model No.	: AR9350
Serial No.	: AR9-2
Date	: JULY 23, 2015
Test Performed	: Pulse Width
Mode	: Hopping Enabled
Notes	: Pulse Width = 861.7usec

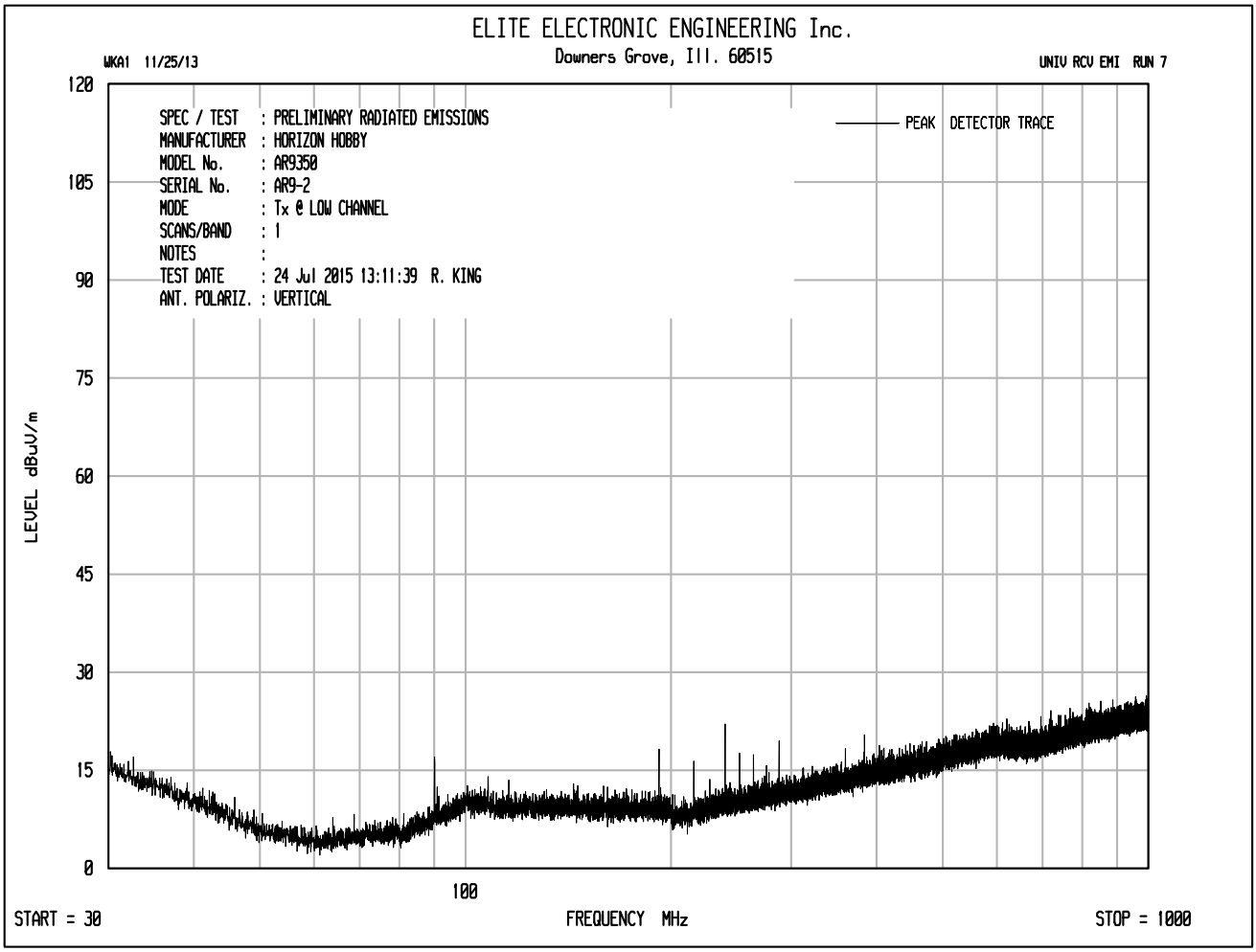


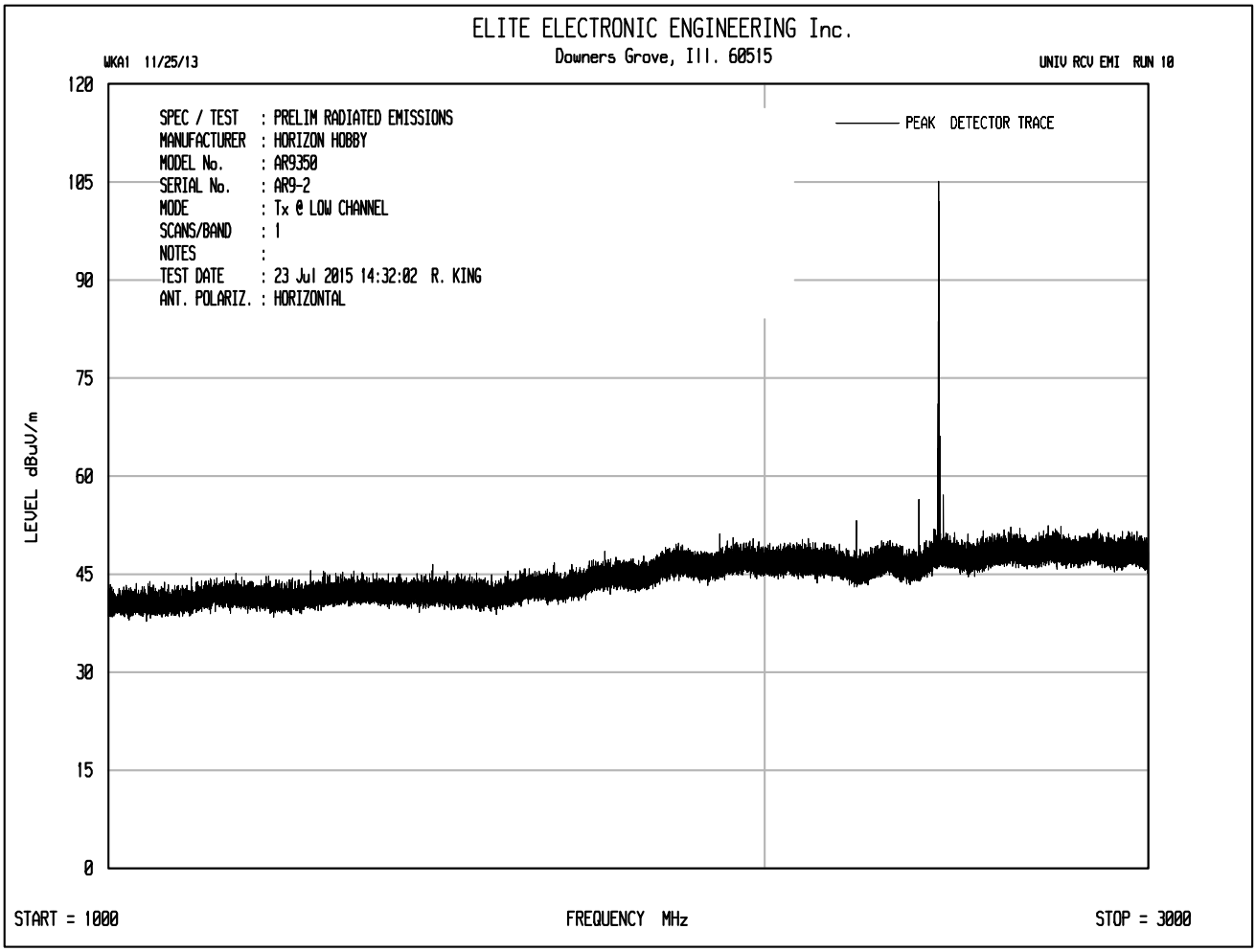
Date: 23.JUL.2015 13:45:06

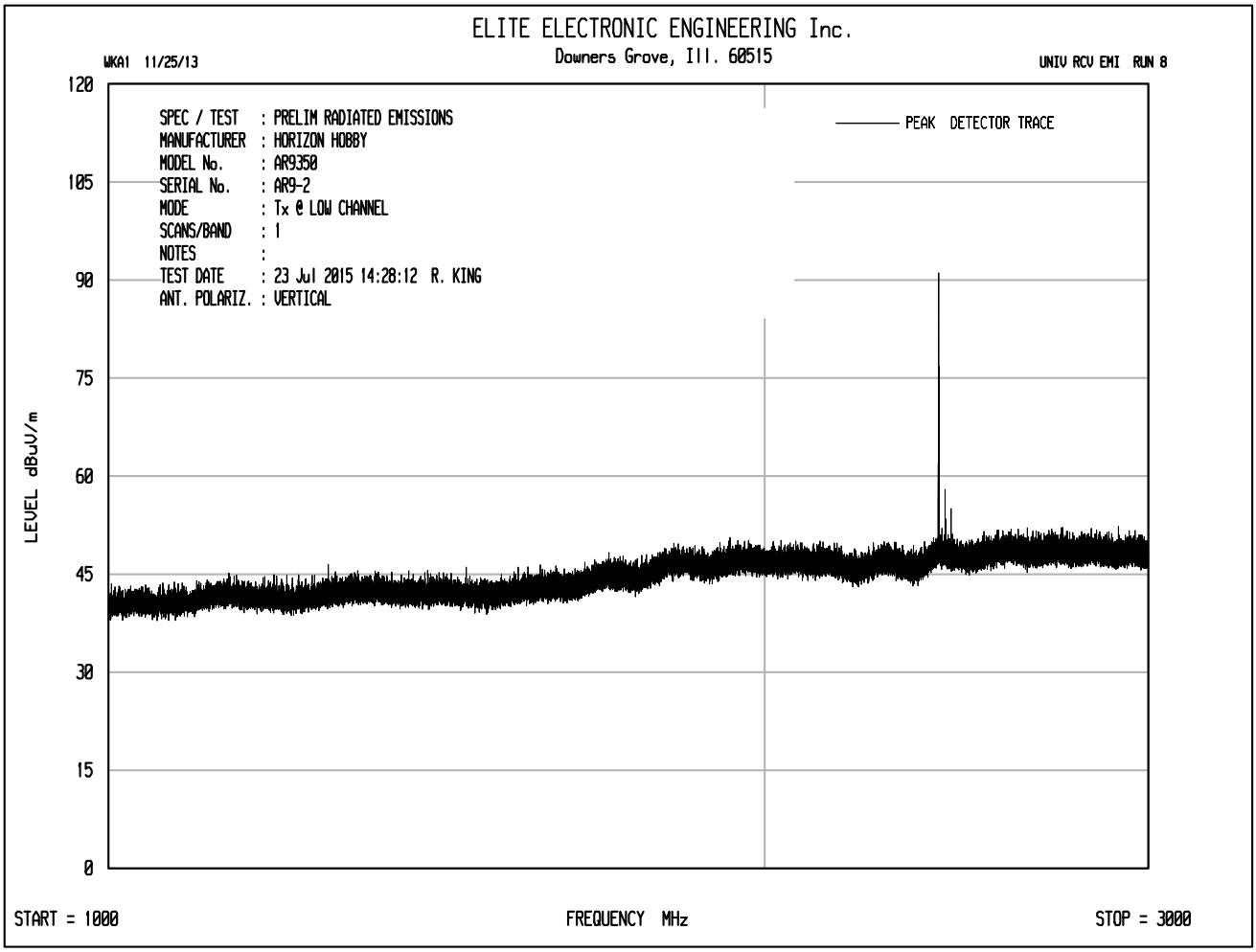
Duty Cycle Correction Factor

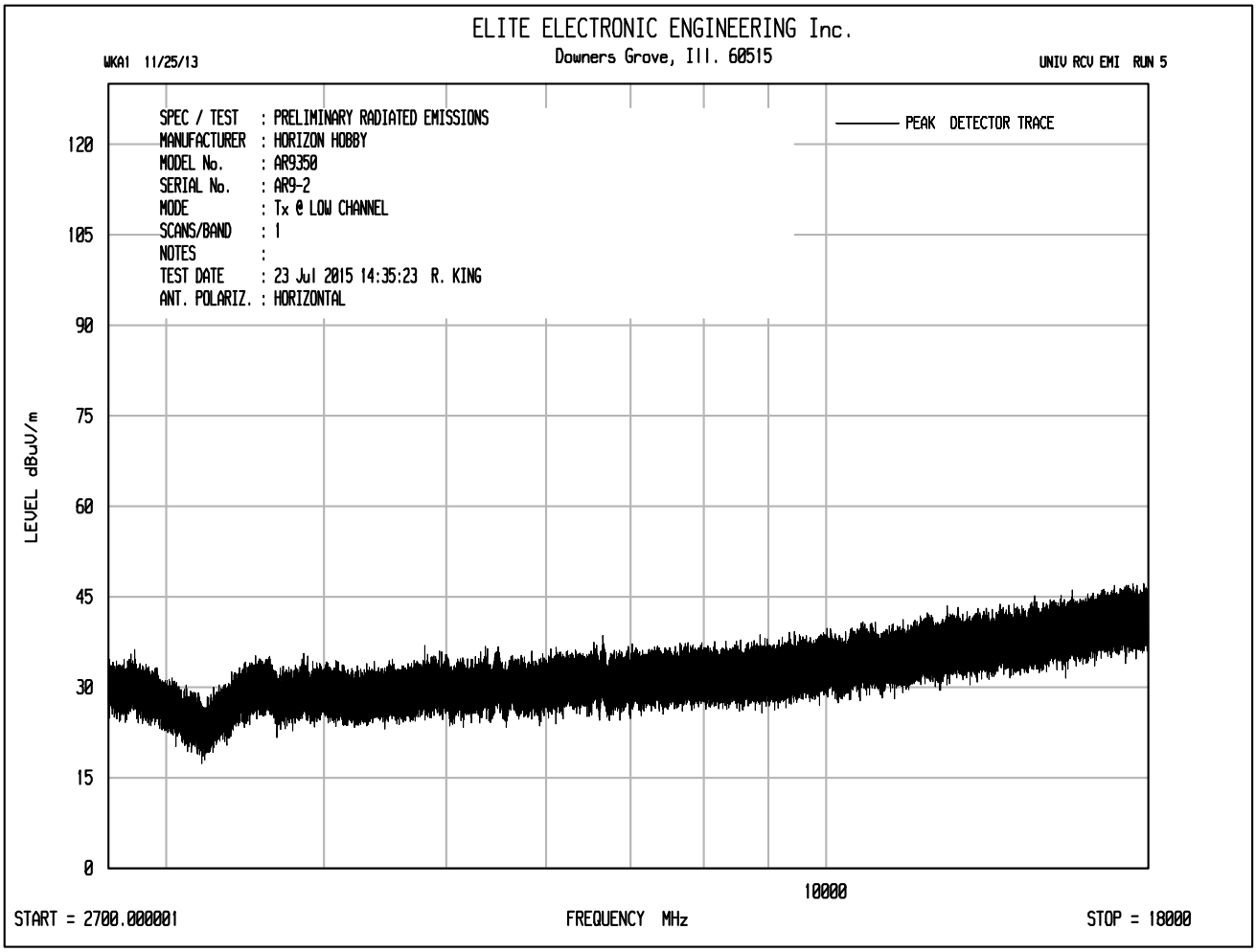
Manufacturer	: Horizon Hobby
Model No.	: AR9350
Serial No.	: AR9-2
Date	: JULY 23, 2015
Test Performed	: Duty Cycle Correction Factor
Mode	: Hopping Enabled
Notes	: Duty Cycle Correction Factor = 20xLog(((pulse width) x (# pulses))/100msec)
	: Duty Cycle Correction Factor = 20xLog(((861.7usec)x(1))/100msec)
	: Duty Cycle Correction Factor = -41.3dB

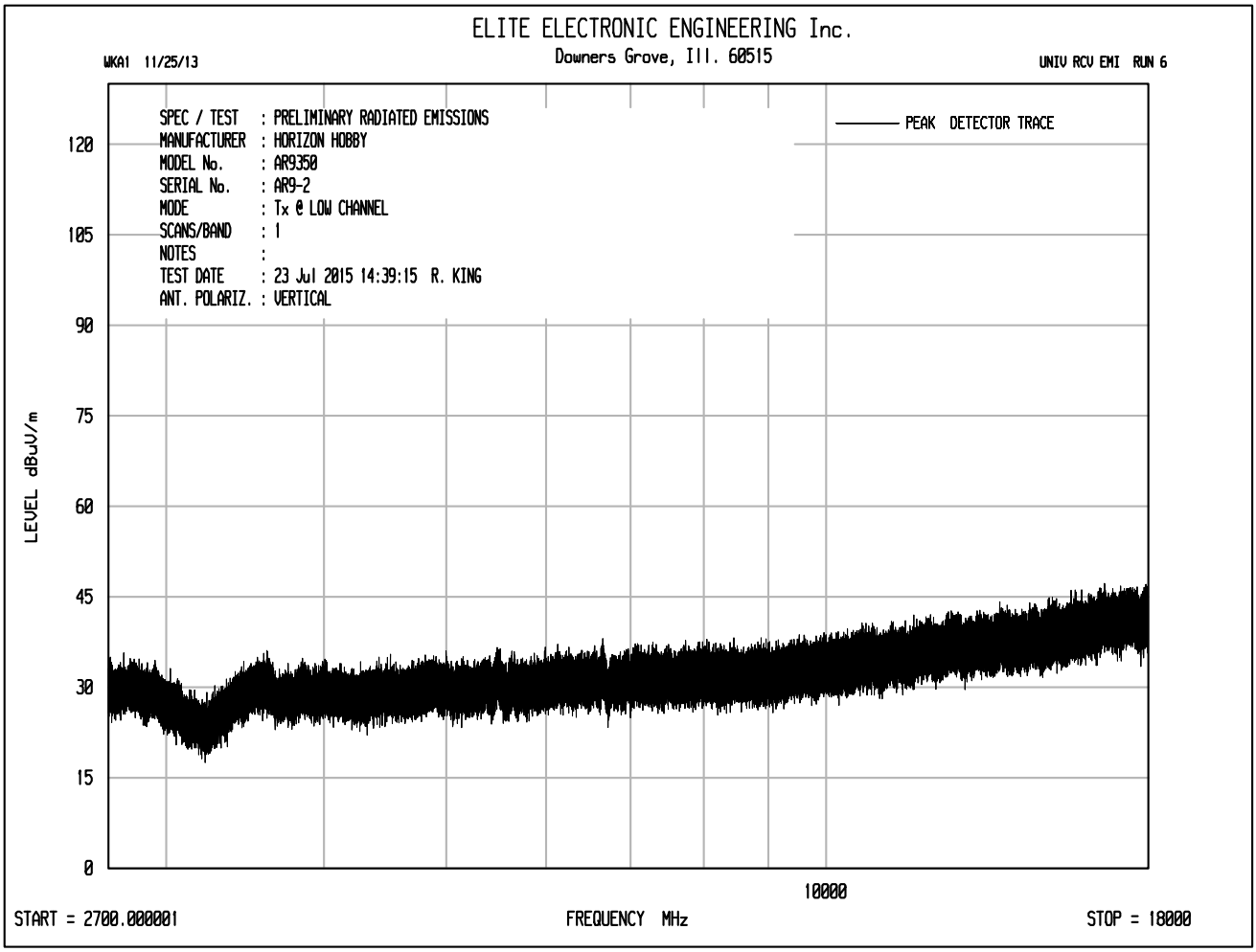

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 6
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : HORIZON HOBBY
MODEL No. : AR9350
SERIAL No. : AR9-2
MODE : Tx @ LOW CHANNEL
SCANS/BAND : 1
NOTES :
TEST DATE : 24 Jul 2015 13:08:36 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000

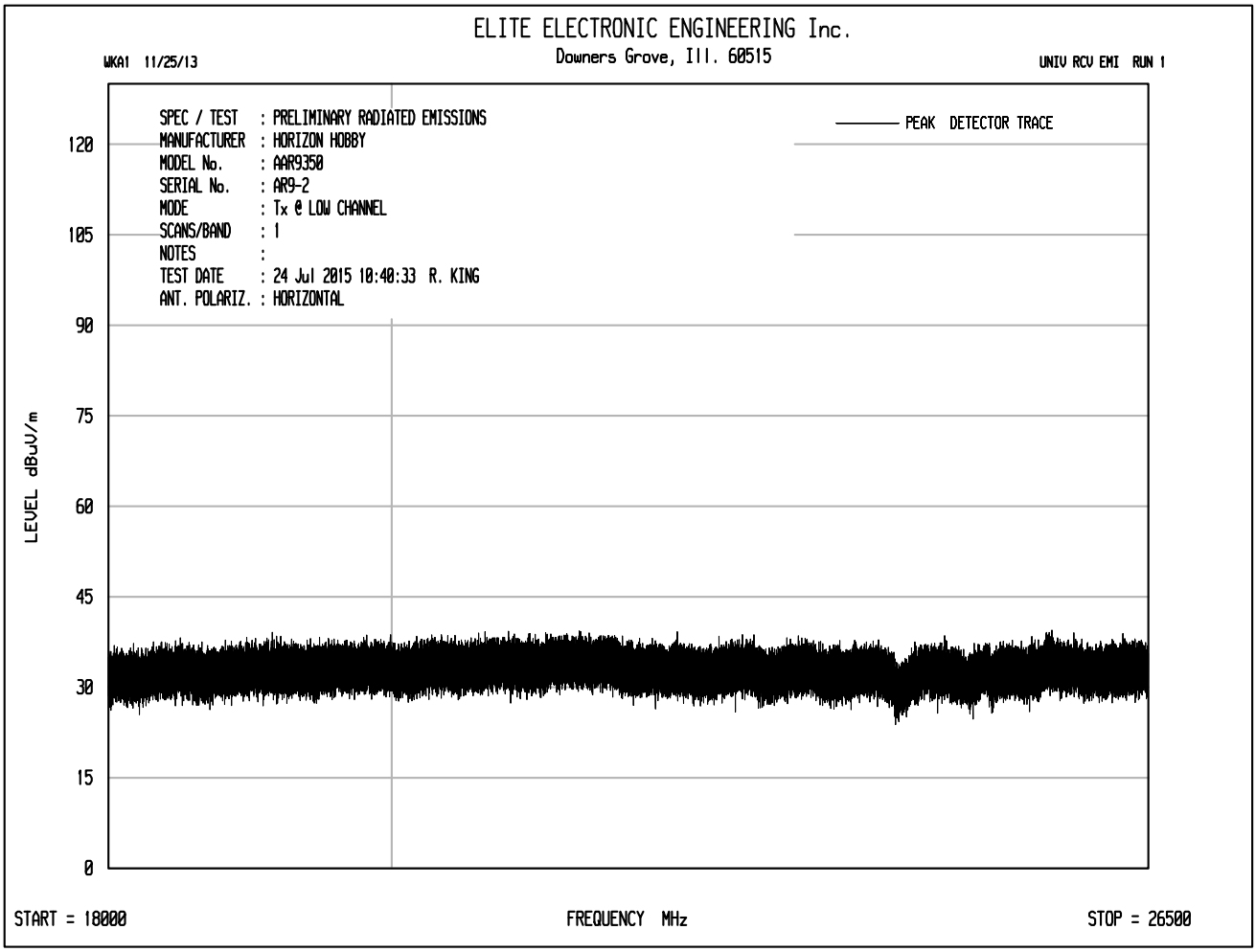

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 7
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : HORIZON HOBBY
MODEL No. : AR9350
SERIAL No. : AR9-2
MODE : Tx @ LOW CHANNEL
SCANS/BAND : 1
NOTES :
TEST DATE : 24 Jul 2015 13:11:39 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000

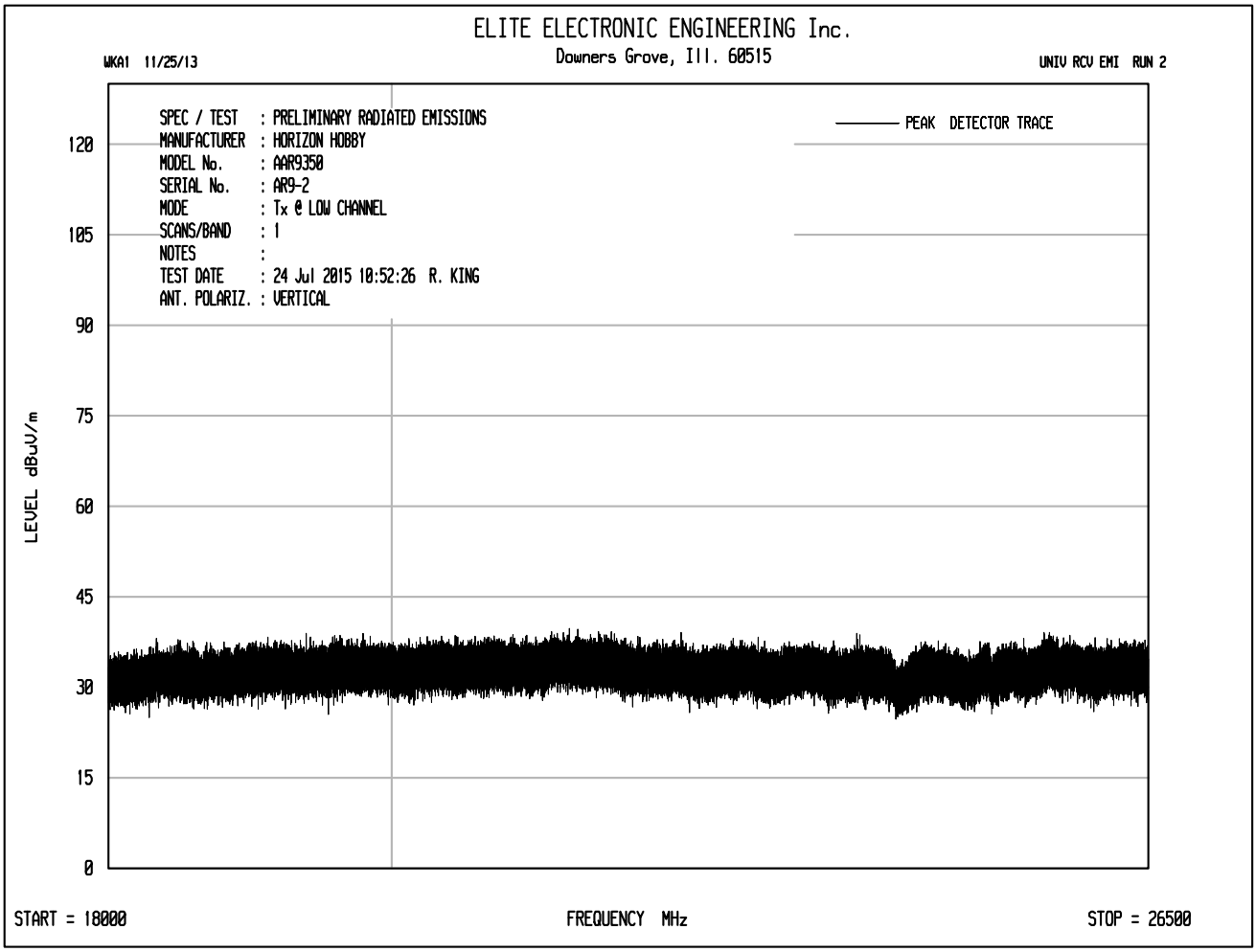

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 10
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : HORIZON HOBBY
MODEL No. : AR9350
SERIAL No. : AR9-2
MODE : Tx @ LOW CHANNEL
SCANS/BAND : 1
NOTES :
TEST DATE : 23 Jul 2015 14:32:02 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 3000

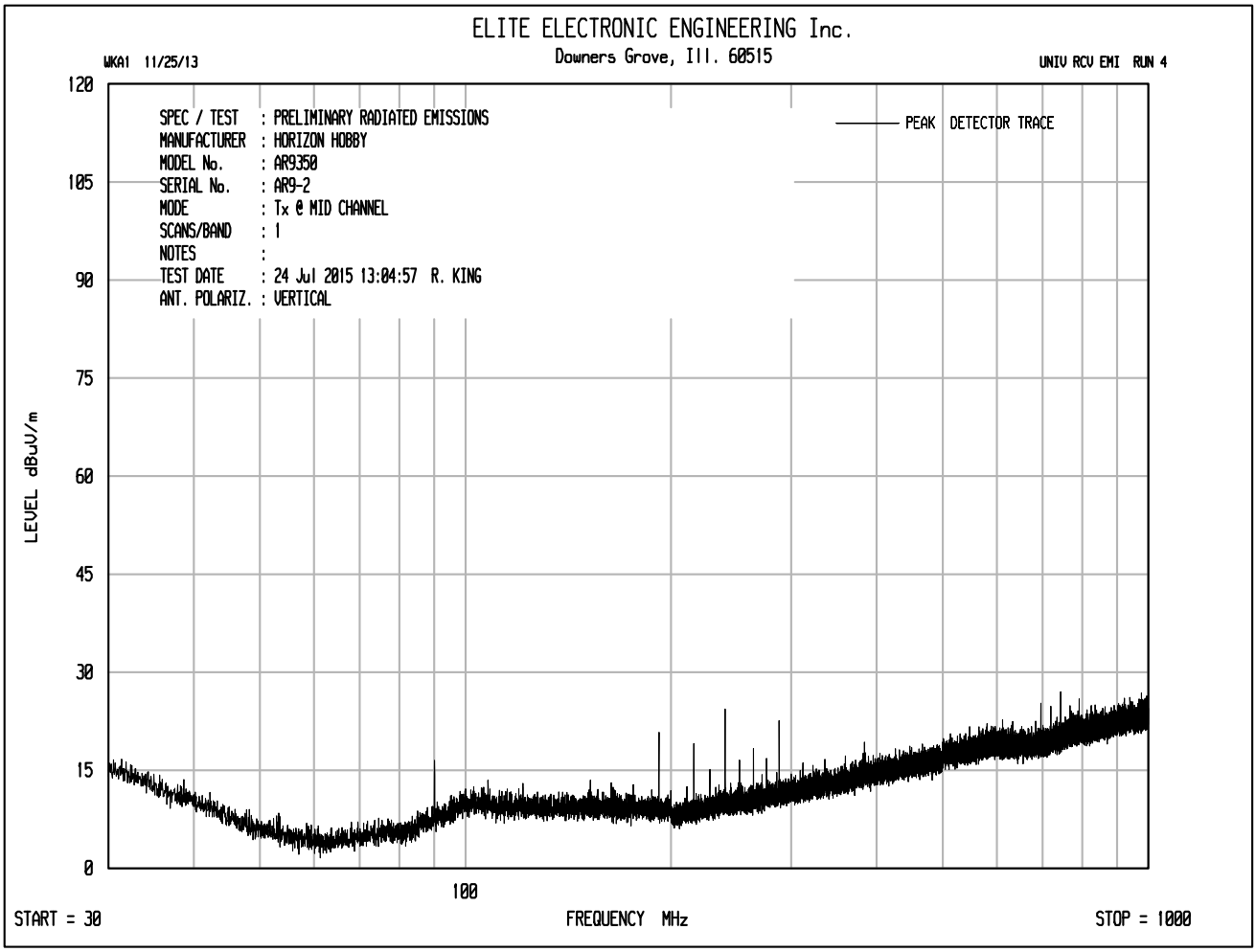

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 8
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : HORIZON HOBBY
MODEL No. : AR9350
SERIAL No. : AR9-2
MODE : Tx @ LOW CHANNEL
SCANS/BAND : 1
NOTES :
TEST DATE : 23 Jul 2015 14:28:12 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 3000

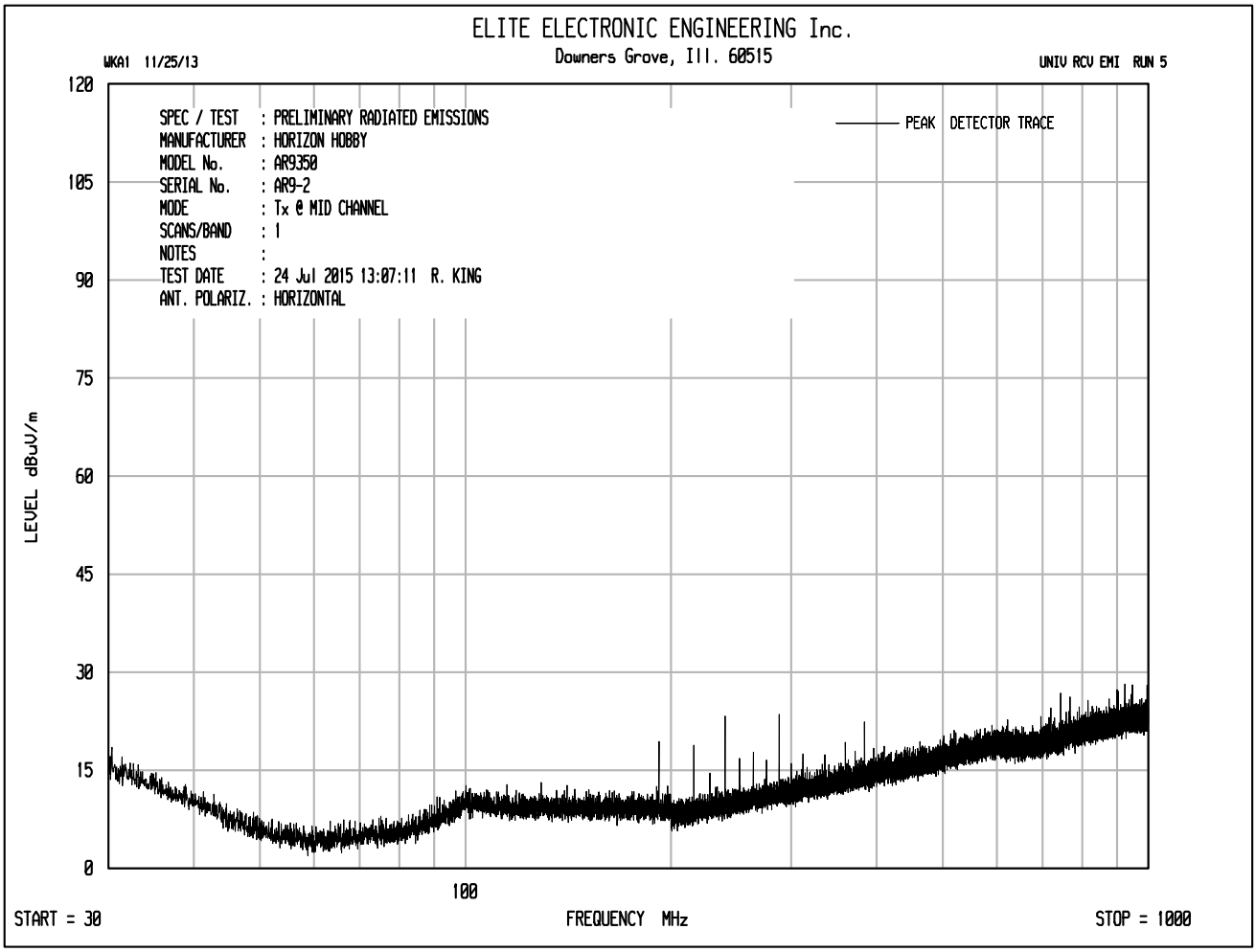

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 5
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : HORIZON HOBBY
MODEL No. : AR9350
SERIAL No. : AR9-2
MODE : Tx @ LOW CHANNEL
SCANS/BAND : 1
NOTES :
TEST DATE : 23 Jul 2015 14:35:23 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
10000
START = 2700.000001
FREQUENCY MHz
STOP = 18000

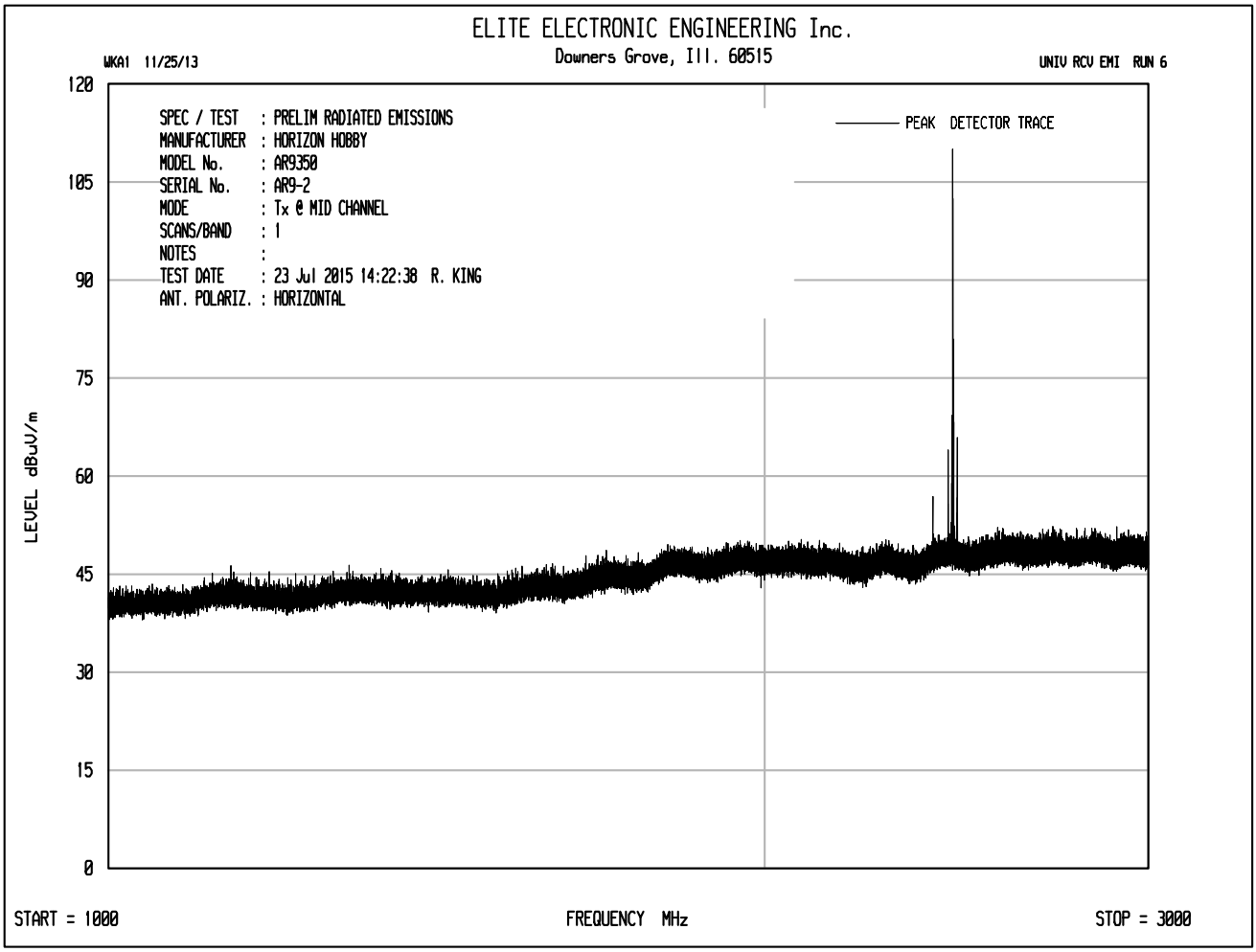

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 6
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : HORIZON HOBBY
MODEL No. : AR9350
SERIAL No. : AR9-2
MODE : Tx @ LOW CHANNEL
SCANS/BAND : 1
NOTES :
TEST DATE : 23 Jul 2015 14:39:15 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
10000
START = 2700.000001
FREQUENCY MHz
STOP = 18000

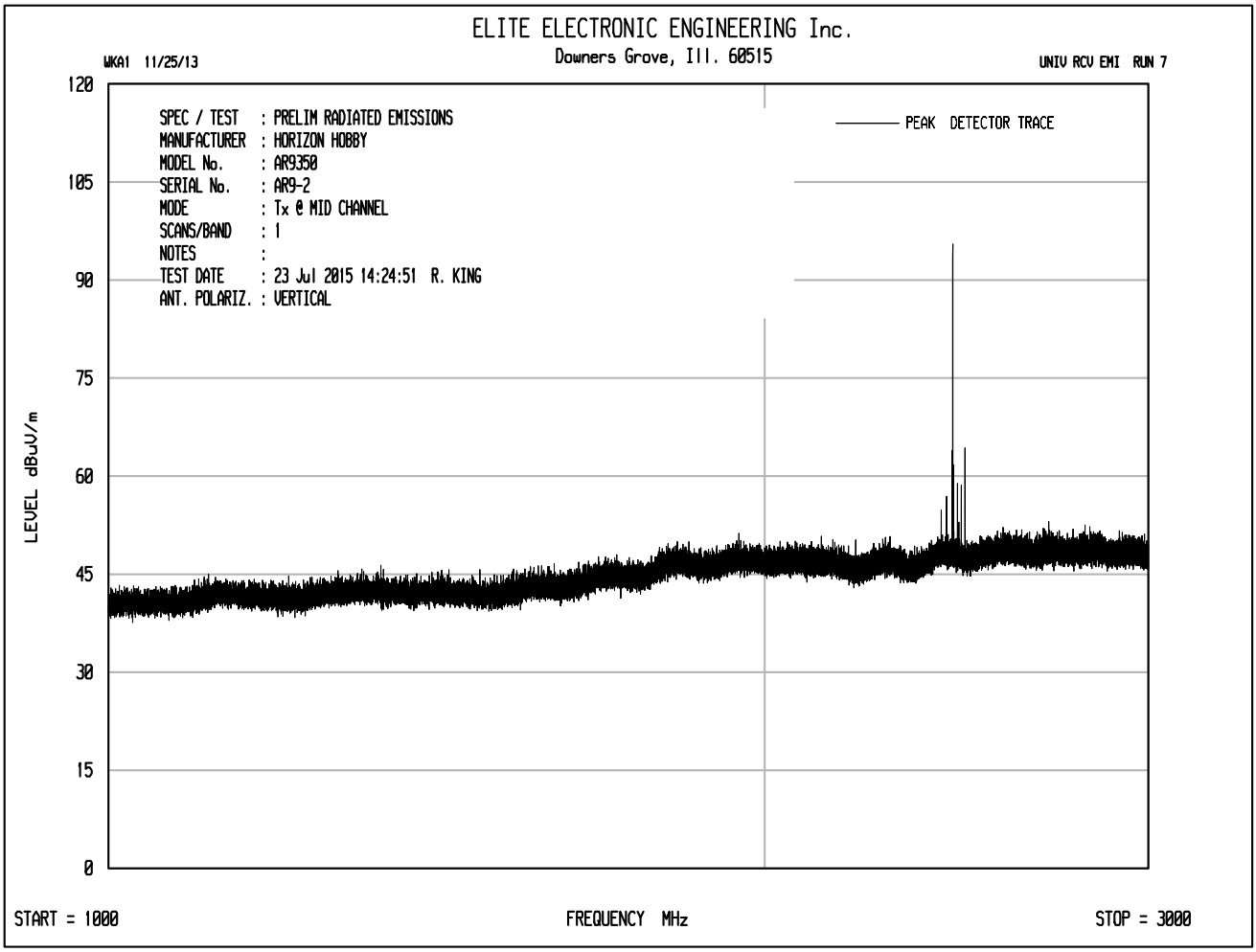

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 1
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : HORIZON HOBBY
MODEL No. : AAR9350
SERIAL No. : AR9-2
MODE : Tx @ LOW CHANNEL
SCANS/BAND : 1
NOTES :
TEST DATE : 24 Jul 2015 10:40:33 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 18000
FREQUENCY MHz
STOP = 26500

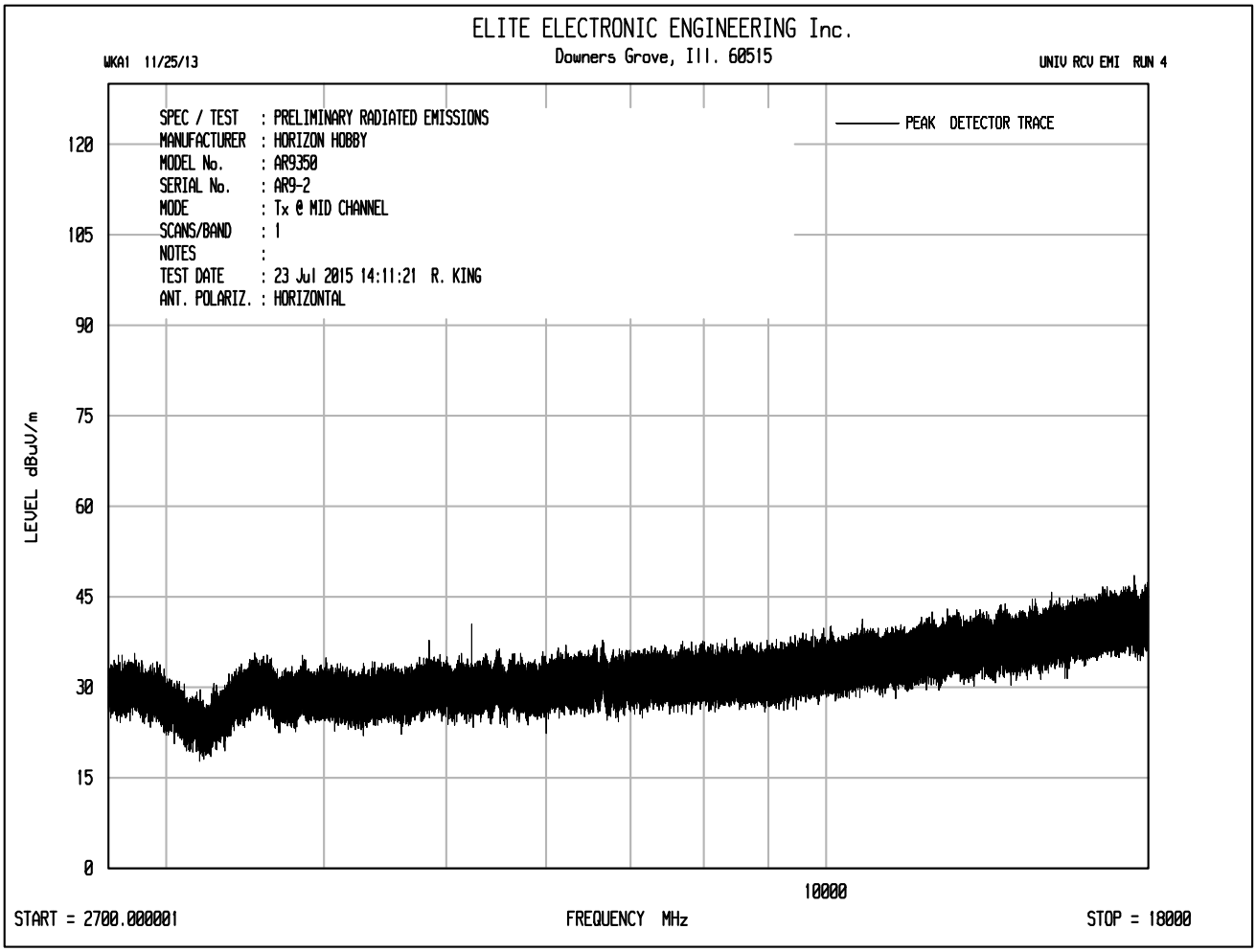

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 2
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : HORIZON HOBBY
MODEL No. : AAR9350
SERIAL No. : AR9-2
MODE : Tx @ LOW CHANNEL
SCANS/BAND : 1
NOTES :
TEST DATE : 24 Jul 2015 10:52:26 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 18000
FREQUENCY MHz
STOP = 26500

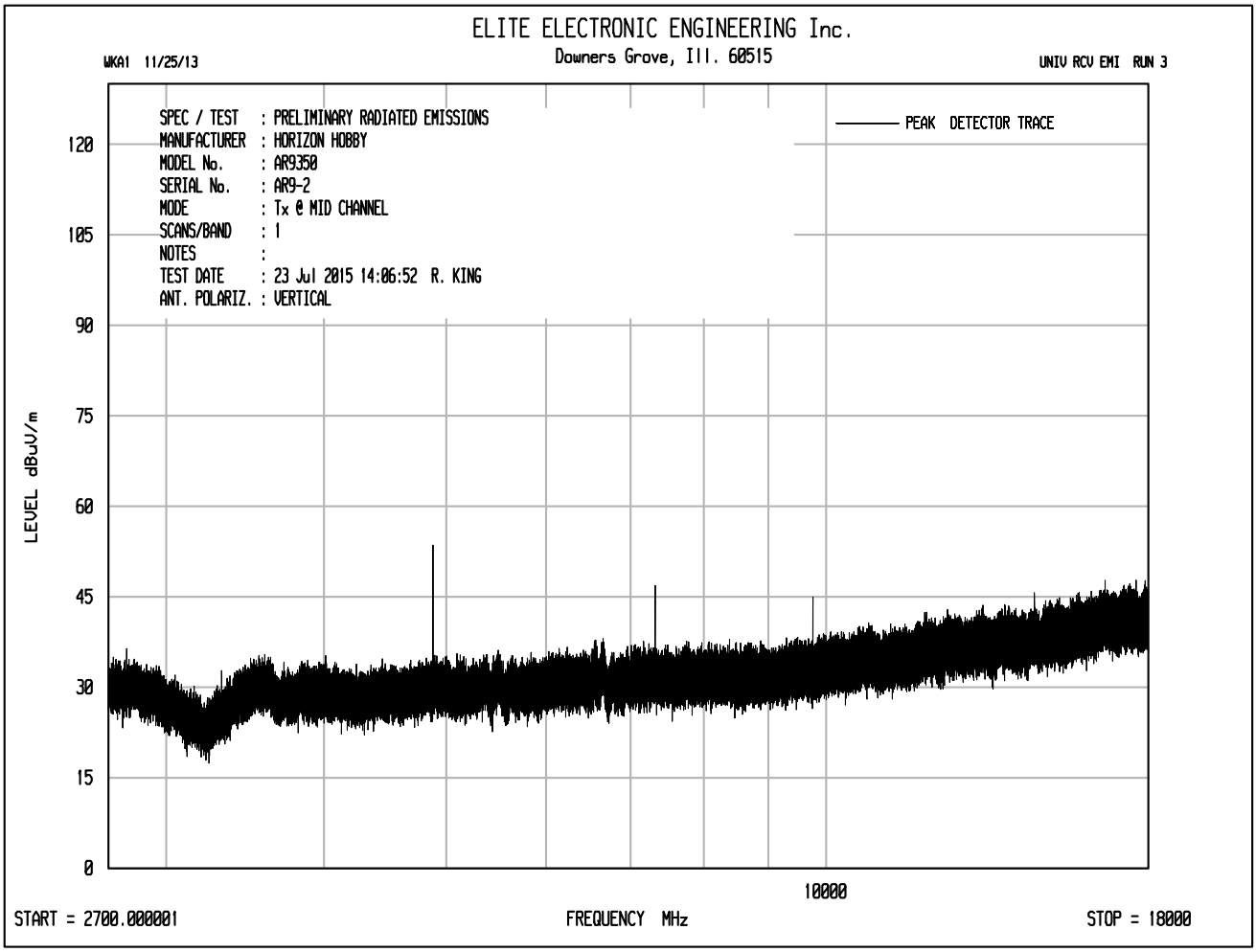

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 4
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : HORIZON HOBBY
MODEL No. : AR9350
SERIAL No. : AR9-2
MODE : Tx @ MID CHANNEL
SCANS/BAND : 1
NOTES :
TEST DATE : 24 Jul 2015 13:04:57 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000

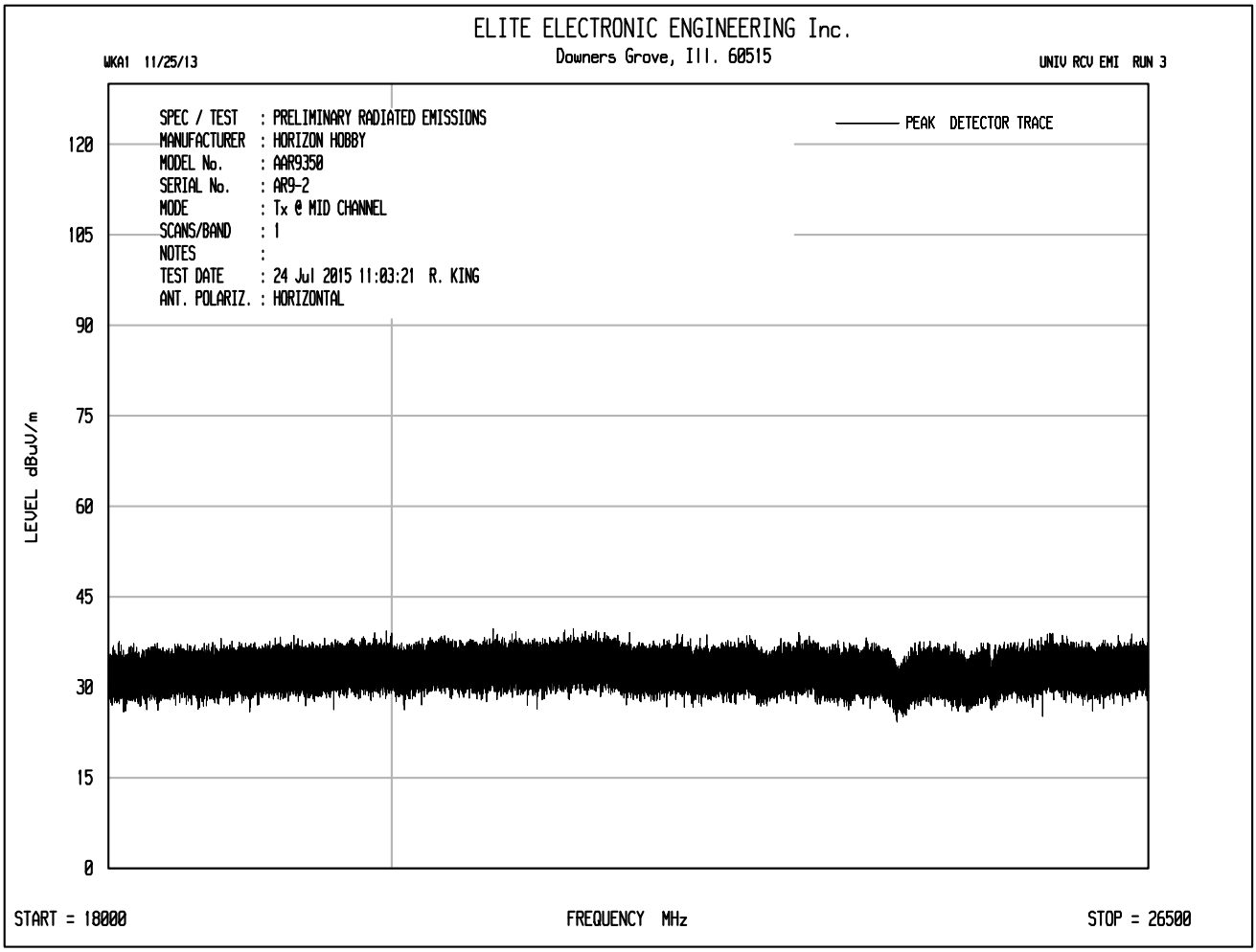

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 5
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : HORIZON HOBBY
MODEL No. : AR9350
SERIAL No. : AR9-2
MODE : Tx @ MID CHANNEL
SCANS/BAND : 1
NOTES :
TEST DATE : 24 Jul 2015 13:07:11 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000

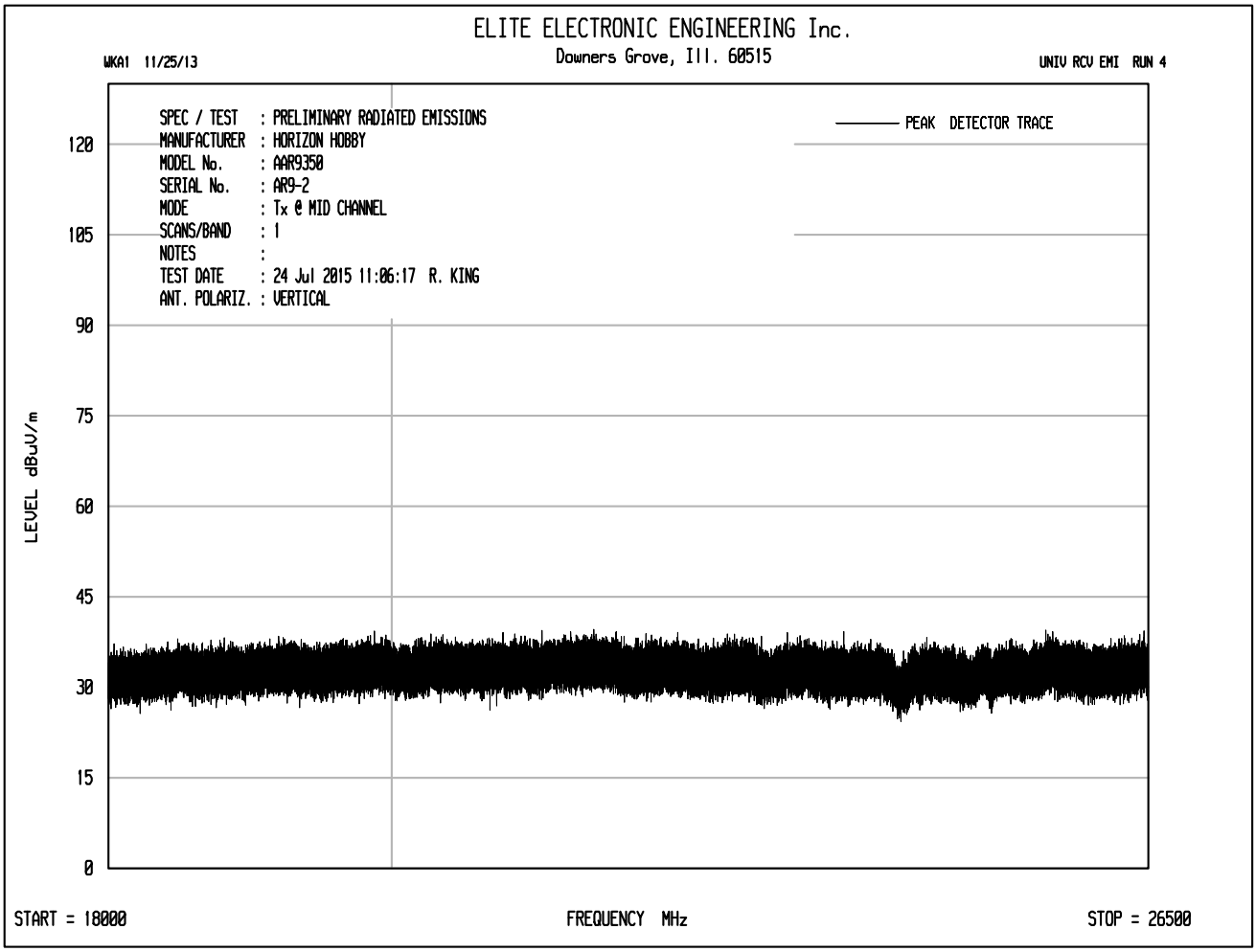

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 6
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : HORIZON HOBBY
MODEL No. : AR9350
SERIAL No. : AR9-2
MODE : Tx @ MID CHANNEL
SCANS/BAND : 1
NOTES :
TEST DATE : 23 Jul 2015 14:22:38 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 3000

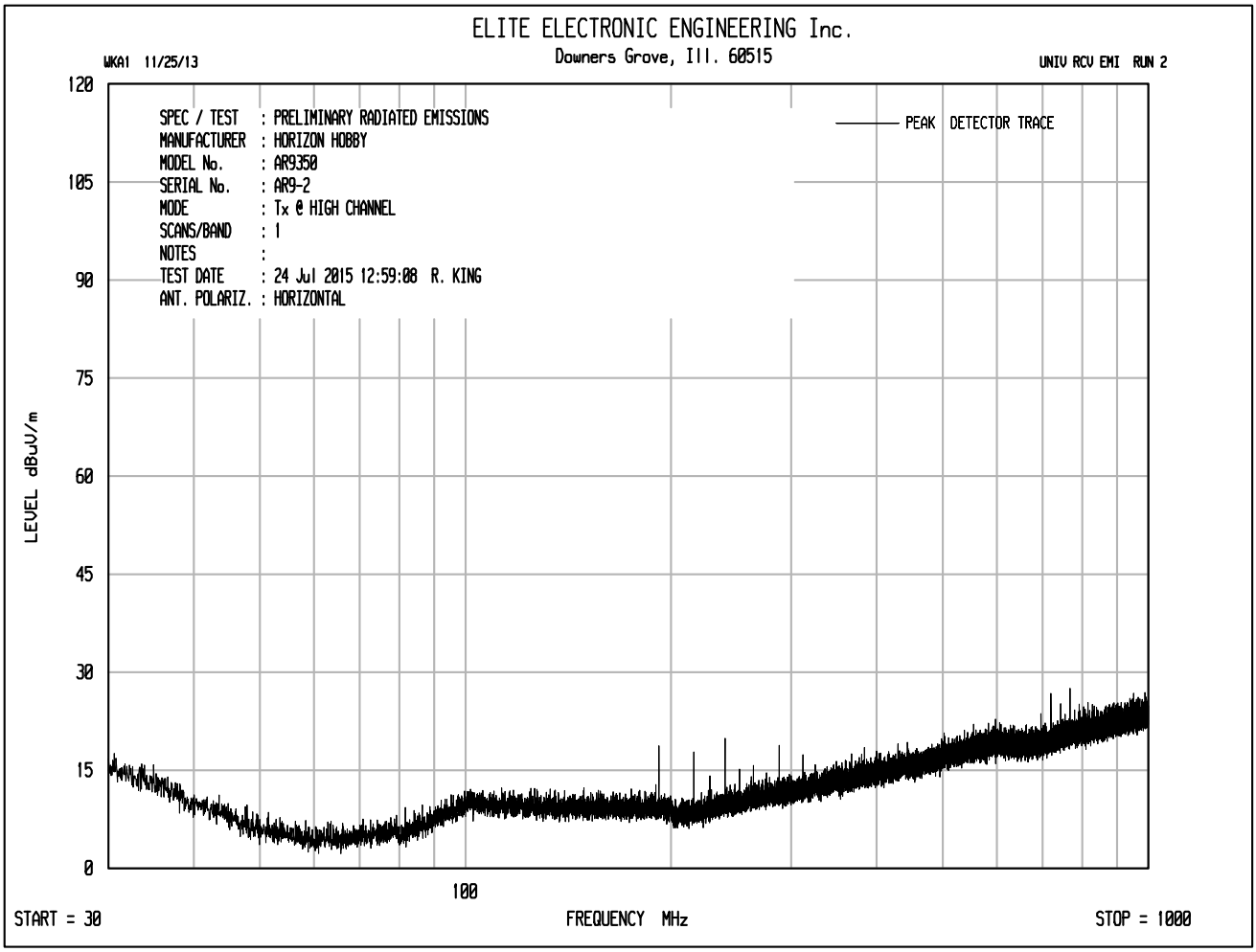

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 7
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : HORIZON HOBBY
MODEL No. : AR9350
SERIAL No. : AR9-2
MODE : Tx @ MID CHANNEL
SCANS/BAND : 1
NOTES :
TEST DATE : 23 Jul 2015 14:24:51 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 3000

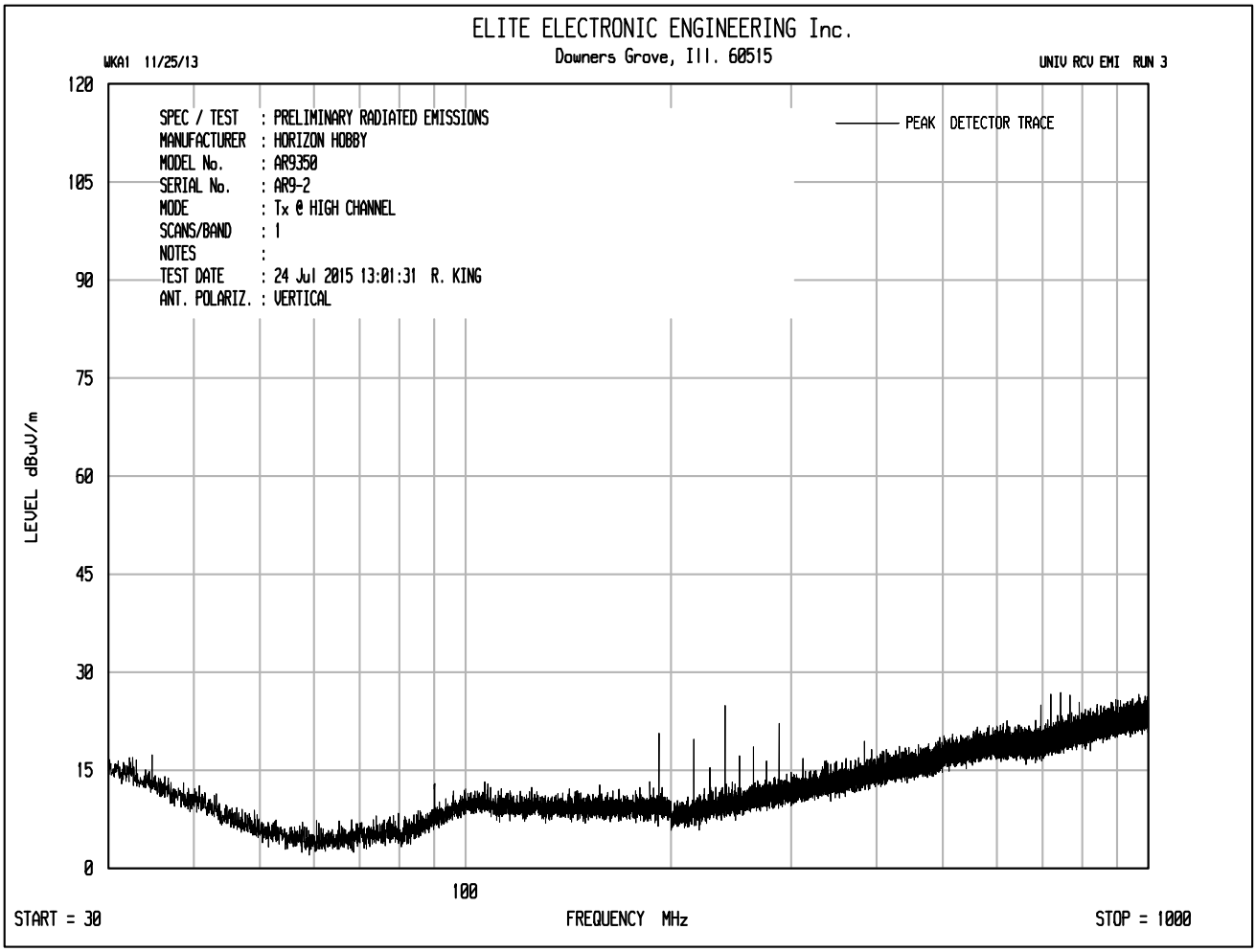

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 4
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : HORIZON HOBBY
MODEL No. : AR9350
SERIAL No. : AR9-2
MODE : Tx @ MID CHANNEL
SCANS/BAND : 1
NOTES :
TEST DATE : 23 Jul 2015 14:11:21 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
10000
START = 2700.000001
FREQUENCY MHz
STOP = 18000

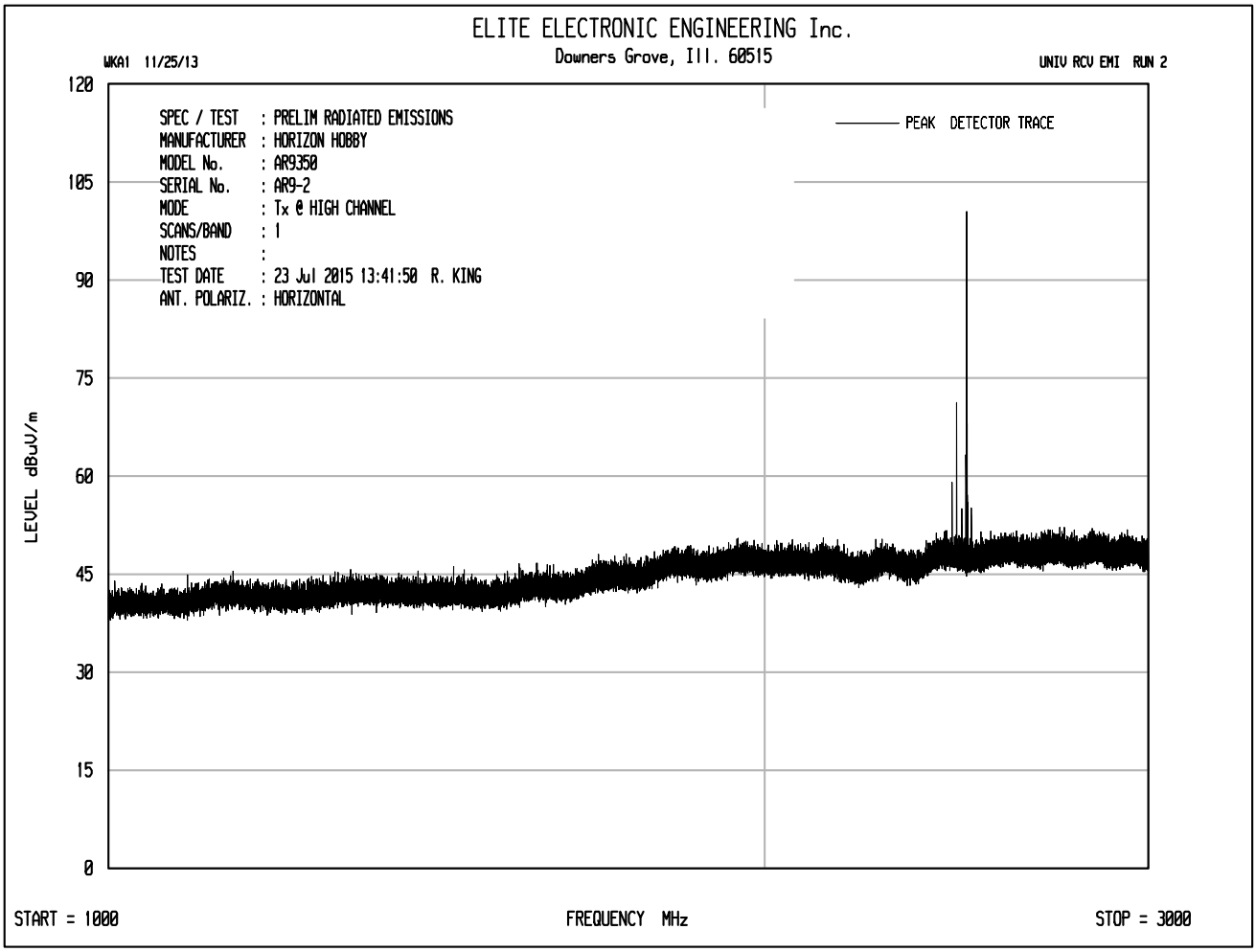

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 3
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : HORIZON HOBBY
MODEL No. : AR9350
SERIAL No. : AR9-2
MODE : Tx @ MID CHANNEL
SCANS/BAND : 1
NOTES :
TEST DATE : 23 Jul 2015 14:06:52 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
10000
START = 2700.000001
FREQUENCY MHz
STOP = 18000

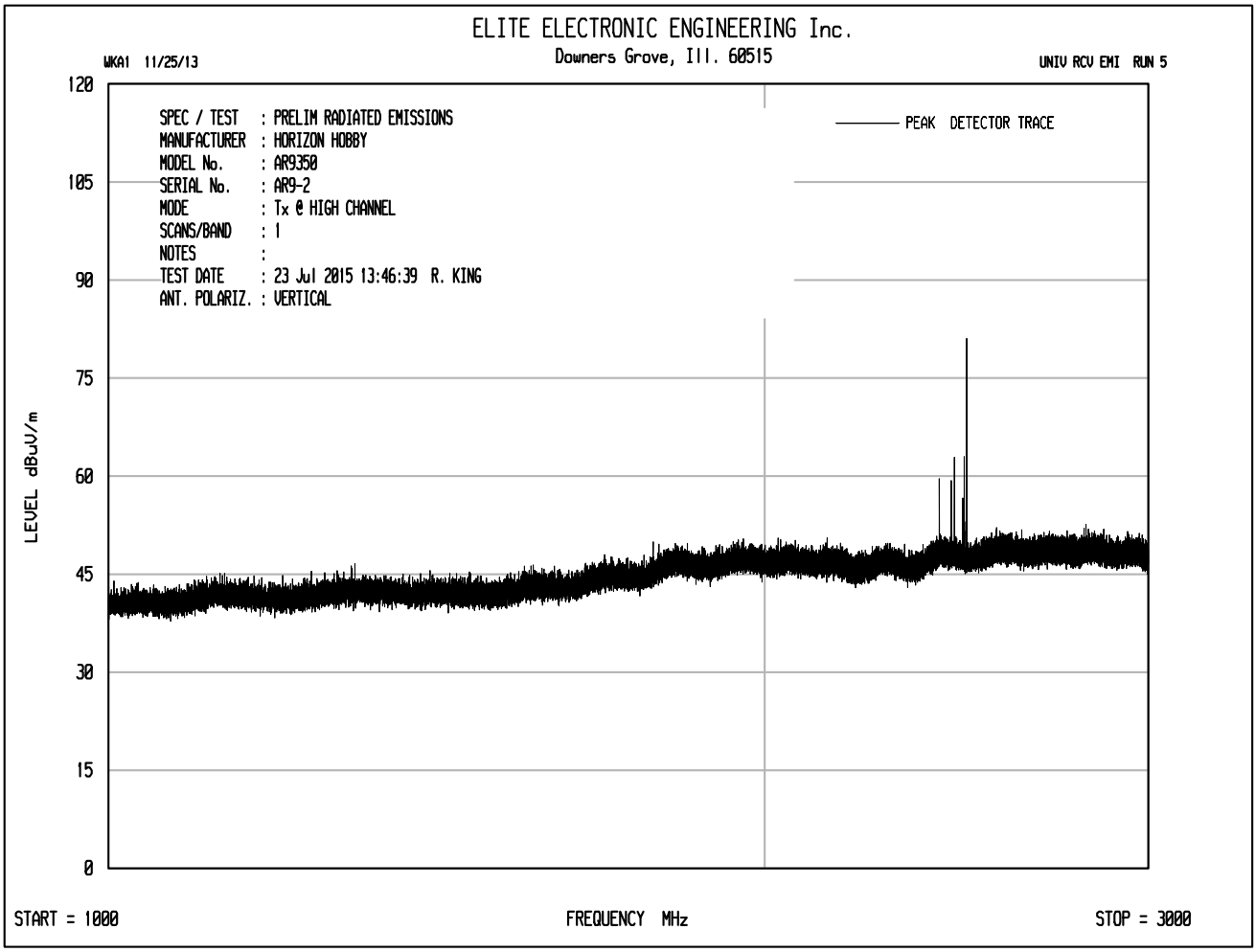

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 3
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : HORIZON HOBBY
MODEL No. : AAR9350
SERIAL No. : AR9-2
MODE : Tx @ MID CHANNEL
SCANS/BAND : 1
NOTES :
TEST DATE : 24 Jul 2015 11:03:21 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 18000
FREQUENCY MHz
STOP = 26500

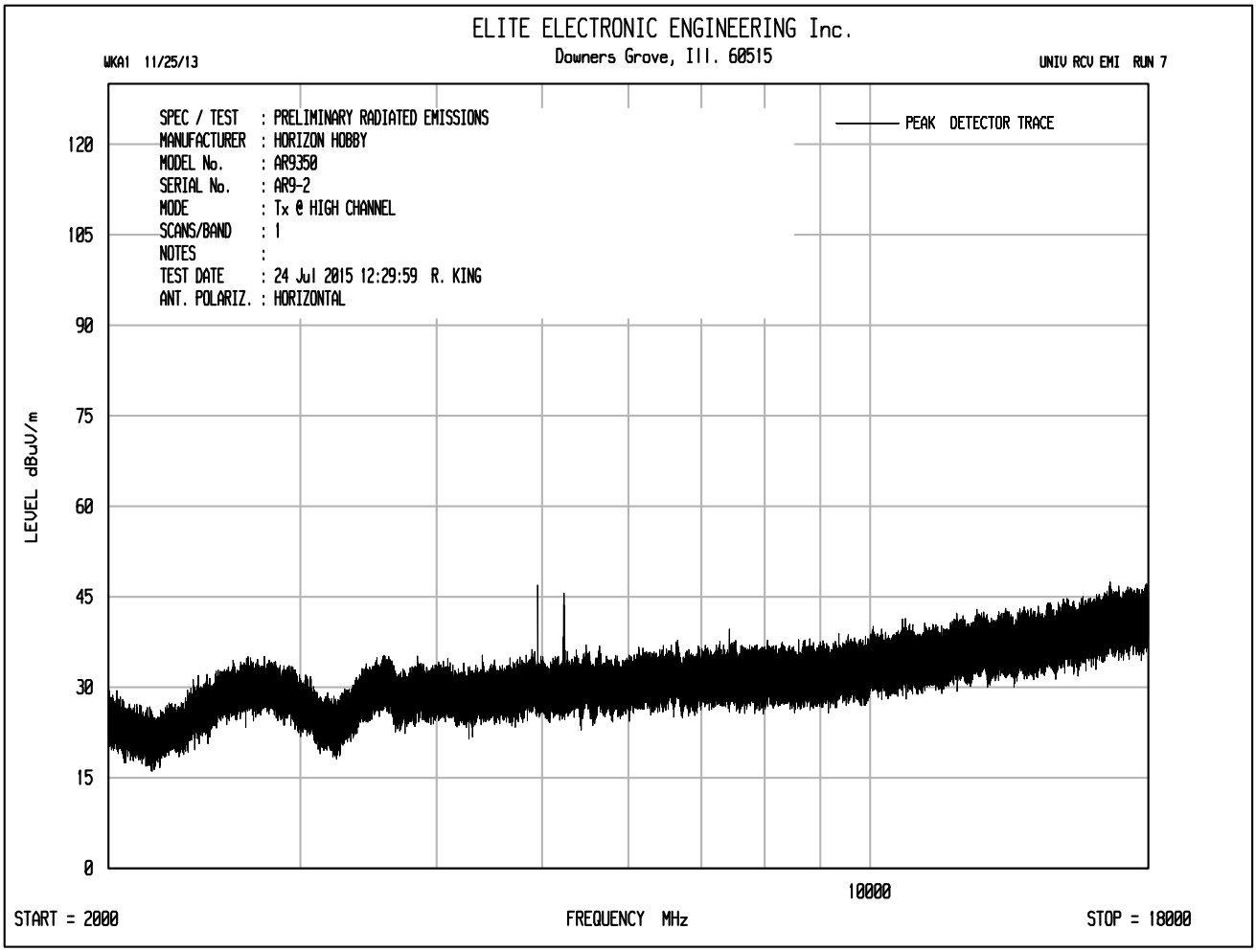

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 4
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : HORIZON HOBBY
MODEL No. : AAR9350
SERIAL No. : AR9-2
MODE : Tx @ MID CHANNEL
SCANS/BAND : 1
NOTES :
TEST DATE : 24 Jul 2015 11:06:17 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 18000
FREQUENCY MHz
STOP = 26500

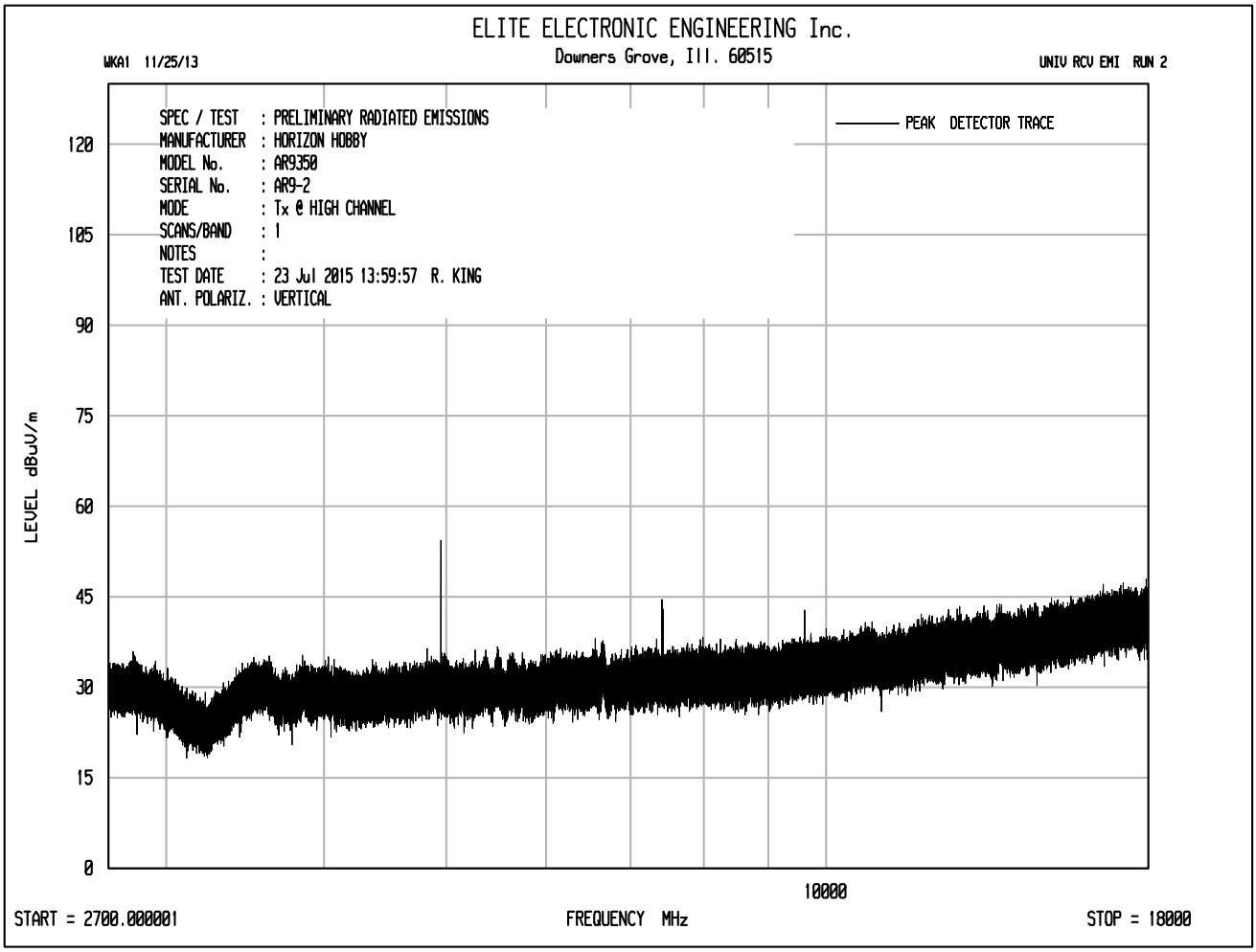

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 2
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : HORIZON HOBBY
MODEL No. : AR9350
SERIAL No. : AR9-2
MODE : Tx @ HIGH CHANNEL
SCANS/BAND : 1
NOTES :
TEST DATE : 24 Jul 2015 12:59:08 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000

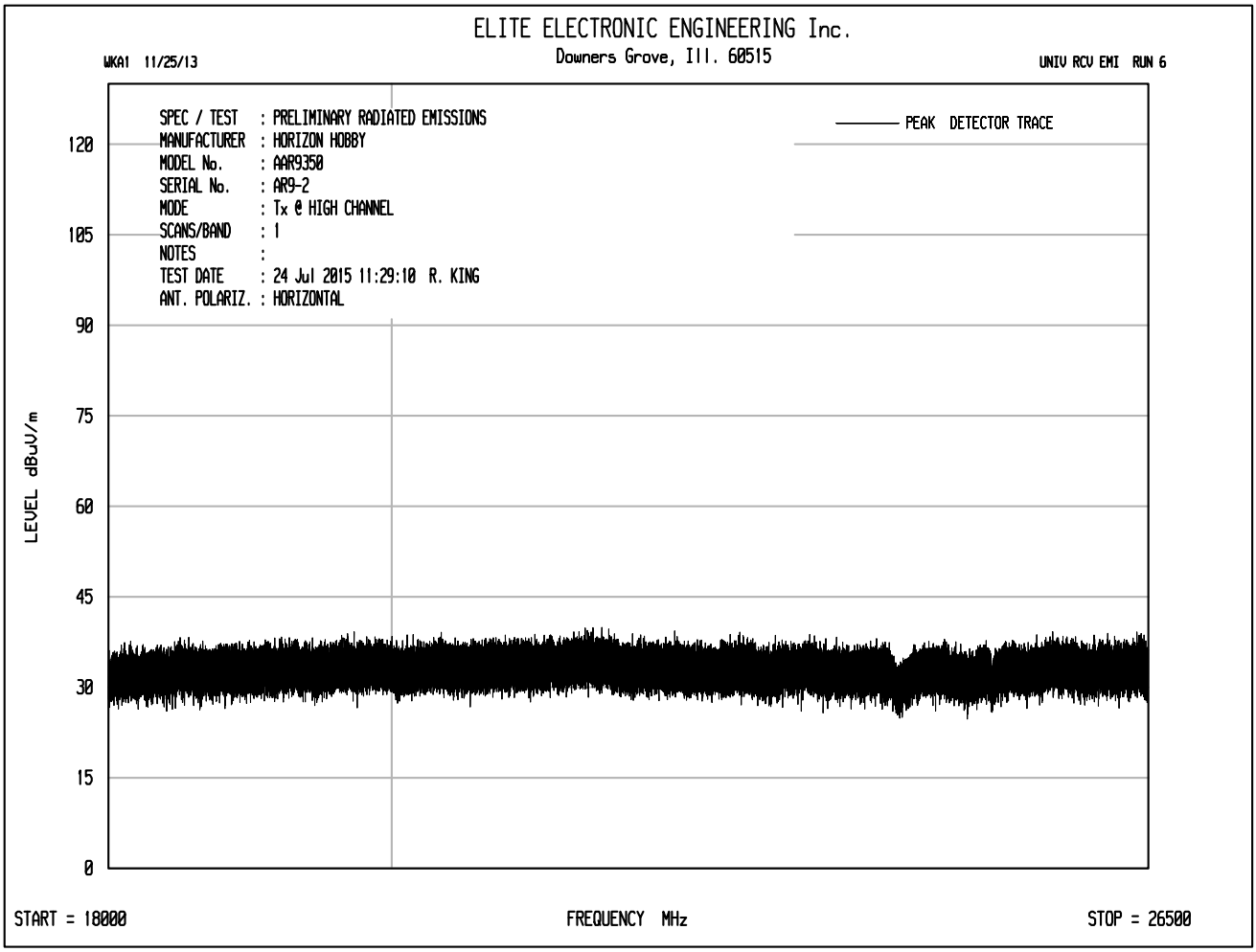

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 3
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : HORIZON HOBBY
MODEL No. : AR9350
SERIAL No. : AR9-2
MODE : Tx @ HIGH CHANNEL
SCANS/BAND : 1
NOTES :
TEST DATE : 24 Jul 2015 13:01:31 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000

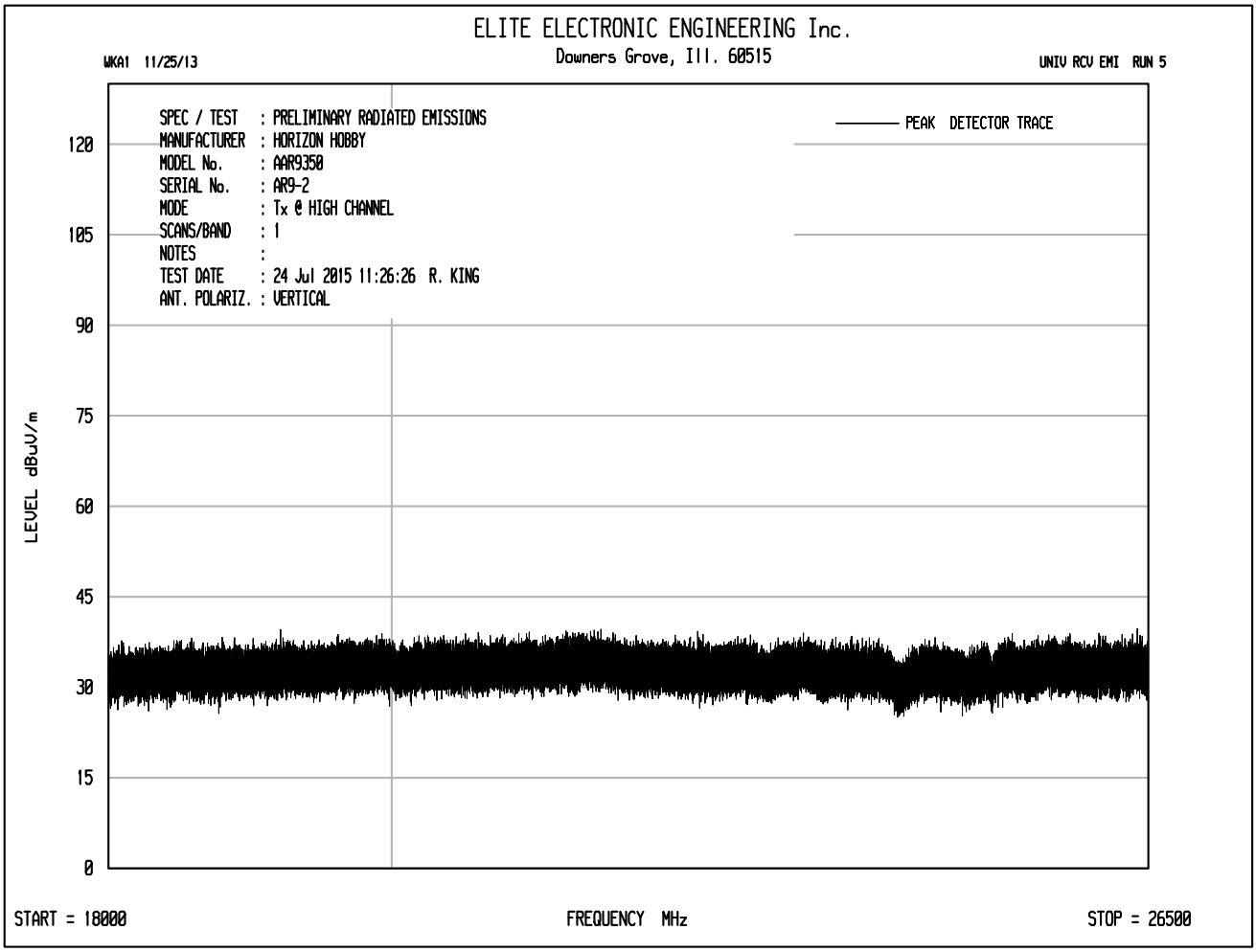

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 2
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : HORIZON HOBBY
MODEL No. : AR9350
SERIAL No. : AR9-2
MODE : Tx @ HIGH CHANNEL
SCANS/BAND : 1
NOTES :
TEST DATE : 23 Jul 2015 13:41:50 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 3000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 5
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : HORIZON HOBBY
MODEL No. : AR9350
SERIAL No. : AR9-2
MODE : Tx @ HIGH CHANNEL
SCANS/BAND : 1
NOTES :
TEST DATE : 23 Jul 2015 13:46:39 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 3000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 7
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : HORIZON HOBBY
MODEL No. : AR9350
SERIAL No. : AR9-2
MODE : Tx @ HIGH CHANNEL
SCANS/BAND : 1
NOTES :
TEST DATE : 24 Jul 2015 12:29:59 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
10000
START = 2000
FREQUENCY MHz
STOP = 18000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 2
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : HORIZON HOBBY
MODEL No. : AR9350
SERIAL No. : AR9-2
MODE : Tx @ HIGH CHANNEL
SCANS/BAND : 1
NOTES :
TEST DATE : 23 Jul 2015 13:59:57 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
10000
START = 2700.000001
FREQUENCY MHz
STOP = 18000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 6
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : HORIZON HOBBY
MODEL No. : AAR9350
SERIAL No. : AR9-2
MODE : Tx @ HIGH CHANNEL
SCANS/BAND : 1
NOTES :
TEST DATE : 24 Jul 2015 11:29:10 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 18000
FREQUENCY MHz
STOP = 26500


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 5
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : HORIZON HOBBY
MODEL No. : AAR9350
SERIAL No. : AR9-2
MODE : Tx @ HIGH CHANNEL
SCANS/BAND : 1
NOTES :
TEST DATE : 24 Jul 2015 11:26:26 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 18000
FREQUENCY MHz
STOP = 26500

MANUFACTURER : Horizon Hobby
MODEL NO. : AR9350
SERIAL NO. : AR9-2
DATE : July 24, 2015
TEST PERFORMED : Spurious Radiated Emissions NOT in a Restricted Band
MODE : Transmit at 2404MHz
NOTES : 3 meter test distance
: Peak Readings in a 100kHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
2404.00	H	75.4	2.6	32.1	0.0	110.2	322061.4		
2404.00	V	65.8	2.6	32.1	0.0	100.6	106767.4		
7212.00	H	48.7	4.6	35.7	-39.4	49.6	301.8	32206.1	-40.6
7212.00	V	43.9	4.6	35.7	-39.4	44.7	172.5	32206.1	-45.4
9616.00	H	38.0	5.2	36.7	-39.3	40.7	107.9	32206.1	-49.5
9616.00	V	38.5	5.2	36.7	-39.3	41.1	113.8	32206.1	-49.0
14424.00	H	35.8	6.6	39.8	-38.3	43.9	156.3	32206.1	-46.3
14424.00	V	34.8	6.6	39.8	-38.3	42.9	139.4	32206.1	-47.3
16828.00	H	36.1	7.2	41.6	-37.5	47.3	232.0	32206.1	-42.9
16828.00	V	35.9	7.2	41.6	-37.5	47.2	228.8	32206.1	-43.0
21636.00	H	22.9	4.5	40.6	-28.6	39.3	92.2	32206.1	-50.9
21636.00	V	22.9	4.5	40.6	-28.6	39.3	92.2	32206.1	-50.9
24040.00	H	22.5	4.5	40.6	-30.0	37.6	75.6	32206.1	-52.6
24040.00	V	22.3	4.5	40.6	-30.0	37.4	73.9	32206.1	-52.8

Checked BY Richard E. King :

Richard E. King

MANUFACTURER : Horizon Hobby
MODEL NO. : AR9350
SERIAL NO. : AR9-2
DATE : July 24, 2015
TEST PERFORMED : Spurious Radiated Emissions in a Restricted Band
MODE : Transmit at 2404MHz
NOTES : 3 meter test distance
: Peak Readings in a 1MHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
4808.00	H	59.9	3.7	34.8	-39.3	59.1	900.6	5000.0	-14.9
4808.00	V	55.8	3.7	34.8	-39.3	55.0	559.8	5000.0	-19.0
12020.00	H	46.8	6.1	38.8	-39.2	52.6	426.5	5000.0	-21.4
12020.00	V	48.8	6.1	38.8	-39.2	54.6	534.5	5000.0	-19.4
19232.00	H	30.2	4.4	40.4	-28.5	46.5	212.2	5000.0	-27.4
19232.00	V	30.3	4.4	40.4	-28.5	46.6	213.7	5000.0	-27.4

Checked BY Richard E. King :

Richard E. King

MANUFACTURER : Horizon Hobby
MODEL NO. : AR9350
SERIAL NO. : AR9-2
DATE : July 24, 2015
TEST PERFORMED : Spurious Radiated Emissions in Restricted Bands
MODE : Transmit at 2404MHz
NOTES : 3 meter test distance
: Avg Readings in a 1MHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dBuV/m at 3m	Average Total uV/m at 3 m	Average Limit uV/m at 3 m	Margin (dB)
4808.00	H	37.2	3.7	34.8	-39.3	-41.3	-5.0	0.6	500.0	-58.9
4808.00	V	35.5	3.7	34.8	-39.3	-41.3	-6.7	0.5	500.0	-60.6
12020.00	H	33.4	6.1	38.8	-39.2	-41.3	-2.2	0.8	500.0	-56.2
12020.00	V	33.4	6.1	38.8	-39.2	-41.3	-2.2	0.8	500.0	-56.2
19232.00	H	18.3	4.4	40.4	-28.5	-41.3	-6.7	0.5	500.0	-60.7
19232.00	V	18.3	4.4	40.4	-28.5	-41.3	-6.7	0.5	500.0	-60.7

Checked BY Richard E. King :

Richard E. King

MANUFACTURER : Horizon Hobby
MODEL NO. : AR9350
SERIAL NO. : AR9-2
DATE : July 24, 2015
TEST PERFORMED : Spurious Radiated Emissions NOT in a Restricted Band
MODE : Transmit at 2440MHz
NOTES : 3 meter test distance
: Peak Readings in a 100kHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
2440.00	H	76.5	2.6	32.2	0.0	111.3	366571.6		
2440.00	V	67.8	2.6	32.2	0.0	102.6	134325.6		
9760.00	H	62.9	5.2	36.9	-39.3	65.8	1952.6	36657.2	-25.5
9760.00	V	59.9	5.2	36.9	-39.3	62.8	1385.5	36657.2	-28.5
14640.00	H	36.9	6.7	39.9	-38.2	45.3	183.1	36657.2	-46.0
14640.00	V	35.4	6.7	39.9	-38.2	43.8	154.4	36657.2	-47.5
17080.00	H	35.4	7.3	41.5	-37.6	46.6	214.5	36657.2	-44.7
17080.00	V	35.2	7.3	41.5	-37.6	46.4	209.9	36657.2	-44.8
21960.00	H	29.3	4.4	40.6	-29.2	45.1	180.8	36657.2	-46.1
21960.00	V	29.1	4.4	40.6	-29.2	44.9	175.3	36657.2	-46.4
24400.00	H	30.5	4.4	40.6	-30.2	45.4	185.8	36657.2	-45.9
24400.00	V	30.5	4.4	40.6	-30.2	45.4	185.8	36657.2	-45.9

Checked BY Richard E. King :

Richard E. King

MANUFACTURER : Horizon Hobby
MODEL NO. : AR9350
SERIAL NO. : AR9-2
DATE : July 24, 2015
TEST PERFORMED : Spurious Radiated Emissions in a Restricted Band
MODE : Transmit at 2440MHz
NOTES : 3 meter test distance
: Peak Readings in a 1MHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
4880.00	H	66.3	3.7	34.8	-39.3	65.5	1876.5	5000.0	-8.5
4880.00	V	69.4	3.7	34.8	-39.3	68.5	2675.1	5000.0	-5.4
7320.00	H	71.3	4.7	35.6	-39.4	72.1	4032.5	5000.0	-1.9
7320.00	V	64.6	4.7	35.6	-39.4	65.5	1877.5	5000.0	-8.5
12200.00	H	47.1	6.1	39.0	-39.1	53.1	450.6	5000.0	-20.9
12200.00	V	47.1	6.1	39.0	-39.1	53.1	452.2	5000.0	-20.9
19520.00	H	36.1	4.4	40.4	-28.5	52.4	415.6	5000.0	-21.6
19520.00	V	36.1	4.4	40.4	-28.5	52.4	415.6	5000.0	-21.6

Checked BY Richard E. King :

Richard E. King

MANUFACTURER : Horizon Hobby
MODEL NO. : AR9350
SERIAL NO. : AR9-2
DATE : July 24, 2015
TEST PERFORMED : Spurious Radiated Emissions in Restricted Bands
MODE : Transmit at 2404MHz
NOTES : 3 meter test distance
: Avg Readings in a 1MHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dBuV/m at 3m	Average Total uV/m at 3 m	Average Limit uV/m at 3 m	Margin (dB)
4880.00	H	39.5	3.7	34.8	-39.3	-41.3	-2.7	0.7	500.0	-56.6
4880.00	V	42.4	3.7	34.8	-39.3	-41.3	0.2	1.0	500.0	-53.8
7320.00	H	40.9	4.7	35.6	-39.4	-41.3	0.5	1.1	500.0	-53.5
7320.00	V	37.9	4.7	35.6	-39.4	-41.3	-2.6	0.7	500.0	-56.6
12200.00	H	33.2	6.1	39.0	-39.1	-41.3	-2.1	0.8	500.0	-56.1
12200.00	V	33.2	6.1	39.0	-39.1	-41.3	-2.1	0.8	500.0	-56.1
19520.00	H	24.0	4.4	40.4	-28.5	-41.3	-1.0	0.9	500.0	-55.0
19520.00	V	24.0	4.4	40.4	-28.5	-41.3	-0.9	0.9	500.0	-54.9

Checked BY Richard E. King :

Richard E. King

MANUFACTURER : Horizon Hobby
MODEL NO. : AR9350
SERIAL NO. : AR9-2
DATE : July 24, 2015
TEST PERFORMED : Spurious Radiated Emissions NOT in a Restricted Band
MODE : Transmit at 2476MHz
NOTES : 3 meter test distance
: Peak Readings in a 100kHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
2476.00	H	69.8	2.7	32.3	0.0	104.8	173050.9		
2476.00	V	61.8	2.7	32.3	0.0	96.7	68655.3		
9904.00	H	42.8	5.3	36.9	-39.2	45.7	193.7	17305.1	-39.0
9904.00	V	43.5	5.3	36.9	-39.2	46.4	209.2	17305.1	-38.4
14856.00	H	33.1	6.8	39.8	-38.2	41.6	119.5	17305.1	-43.2
14856.00	V	35.9	6.8	39.8	-38.2	44.3	164.3	17305.1	-40.5
17332.00	H	36.2	7.3	41.6	-37.7	47.5	236.2	17305.1	-37.3
17332.00	V	36.9	7.3	41.6	-37.7	48.2	255.7	17305.1	-36.6
24760.00	H	29.7	4.4	40.6	-30.7	44.0	158.2	17305.1	-40.8
24760.00	V	29.7	4.4	40.6	-30.7	44.0	158.2	17305.1	-40.8

Checked BY Richard E. King :

Richard E. King

MANUFACTURER : Horizon Hobby
MODEL NO. : AR9350
SERIAL NO. : AR9-2
DATE : July 24, 2015
TEST PERFORMED : Spurious Radiated Emissions in a Restricted Band
MODE : Transmit at 2476MHz
NOTES : 3 meter test distance
: Peak Readings in a 1MHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
4952.00	H	65.5	3.7	34.7	-39.3	64.7	1710.6	5000.0	-9.3
4952.00	V	59.3	3.7	34.7	-39.3	58.4	830.1	5000.0	-15.6
7428.00	H	55.6	4.7	35.6	-39.4	56.5	669.7	5000.0	-17.5
7428.00	V	54.2	4.7	35.6	-39.4	55.1	566.1	5000.0	-18.9
12380.00	H	45.9	6.1	39.1	-39.0	52.0	398.0	5000.0	-22.0
12380.00	V	46.1	6.1	39.1	-39.0	52.2	407.3	5000.0	-21.8
19808.00	H	31.2	4.5	40.4	-28.1	48.0	250.7	5000.0	-26.0
19808.00	V	31.2	4.5	40.4	-28.1	48.0	250.7	5000.0	-26.0
22284.00	H	31.9	4.4	40.6	-29.0	47.9	248.7	5000.0	-26.1
22284.00	V	31.9	4.4	40.6	-29.0	47.9	248.7	5000.0	-26.1

Checked BY Richard E. King :

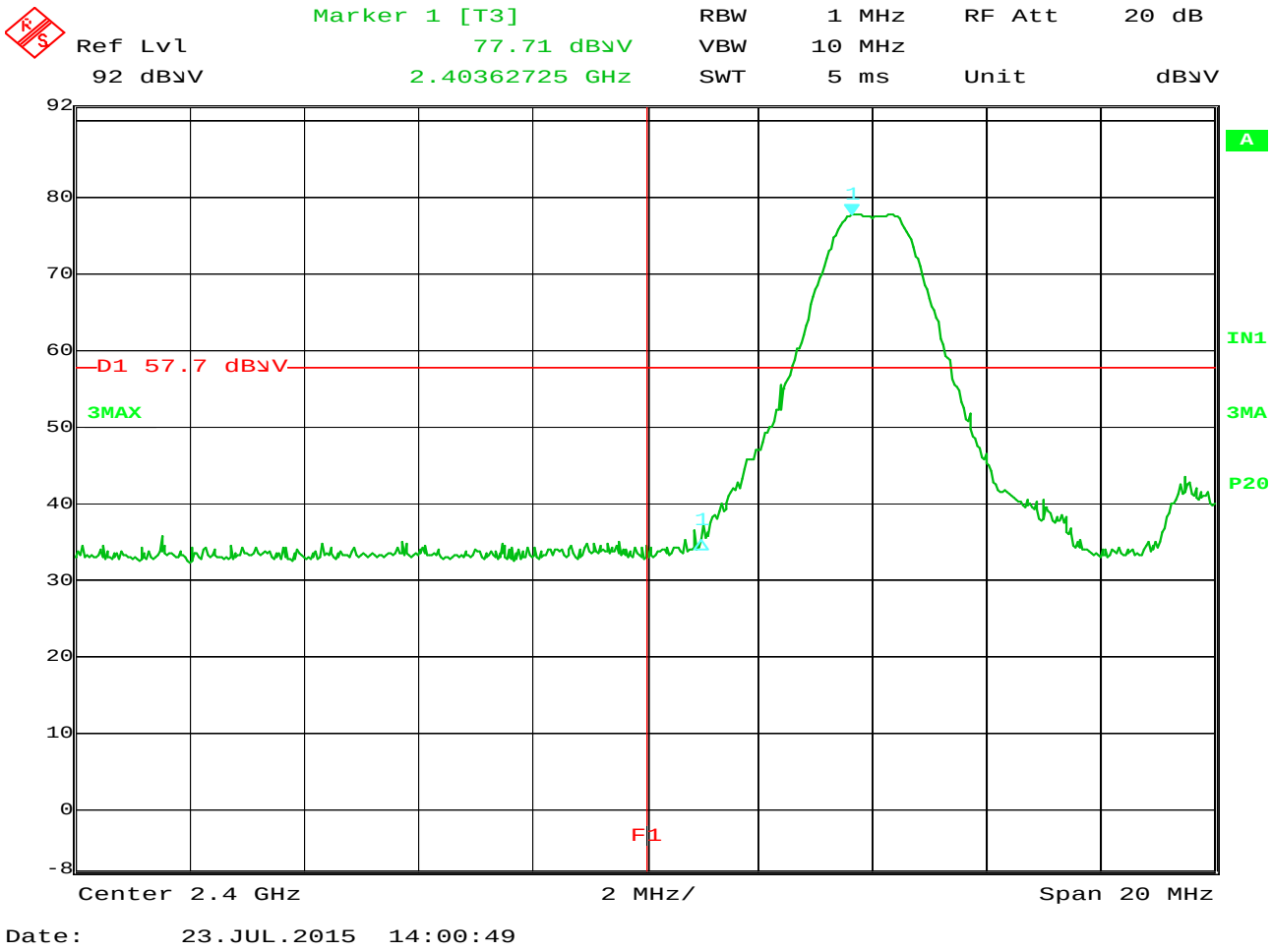
Richard E. King

MANUFACTURER : Horizon Hobby
MODEL NO. : AR9350
SERIAL NO. : AR9-2
DATE : July 24, 2015
TEST PERFORMED : Spurious Radiated Emissions in Restricted Bands
MODE : Transmit at 2404MHz
NOTES : 3 meter test distance
: Avg Readings in a 1MHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dBuV/m at 3m	Average Total uV/m at 3 m	Average Limit uV/m at 3 m	Margin (dB)
4952.00	H	40.4	3.7	34.7	-39.3	-41.3	-1.8	0.8	500.0	-55.8
4952.00	V	37.2	3.7	34.7	-39.3	-41.3	-4.9	0.6	500.0	-58.9
7428.00	H	35.2	4.7	35.6	-39.4	-41.3	-5.2	0.5	500.0	-59.2
7428.00	V	32.2	4.7	35.6	-39.4	-41.3	-8.2	0.4	500.0	-62.2
12380.00	H	32.8	6.1	39.1	-39.0	-41.3	-2.4	0.8	500.0	-56.3
12380.00	V	32.8	6.1	39.1	-39.0	-41.3	-2.3	0.8	500.0	-56.3
19808.00	H	18.6	4.5	40.4	-28.1	-41.3	-6.0	0.5	500.0	-59.9
19808.00	V	18.6	4.5	40.4	-28.1	-41.3	-6.0	0.5	500.0	-59.9
22284.00	H	18.8	4.4	40.6	-29.0	-41.3	-6.5	0.5	500.0	-60.5
22284.00	V	18.8	4.4	40.6	-29.0	-41.3	-6.5	0.5	500.0	-60.5

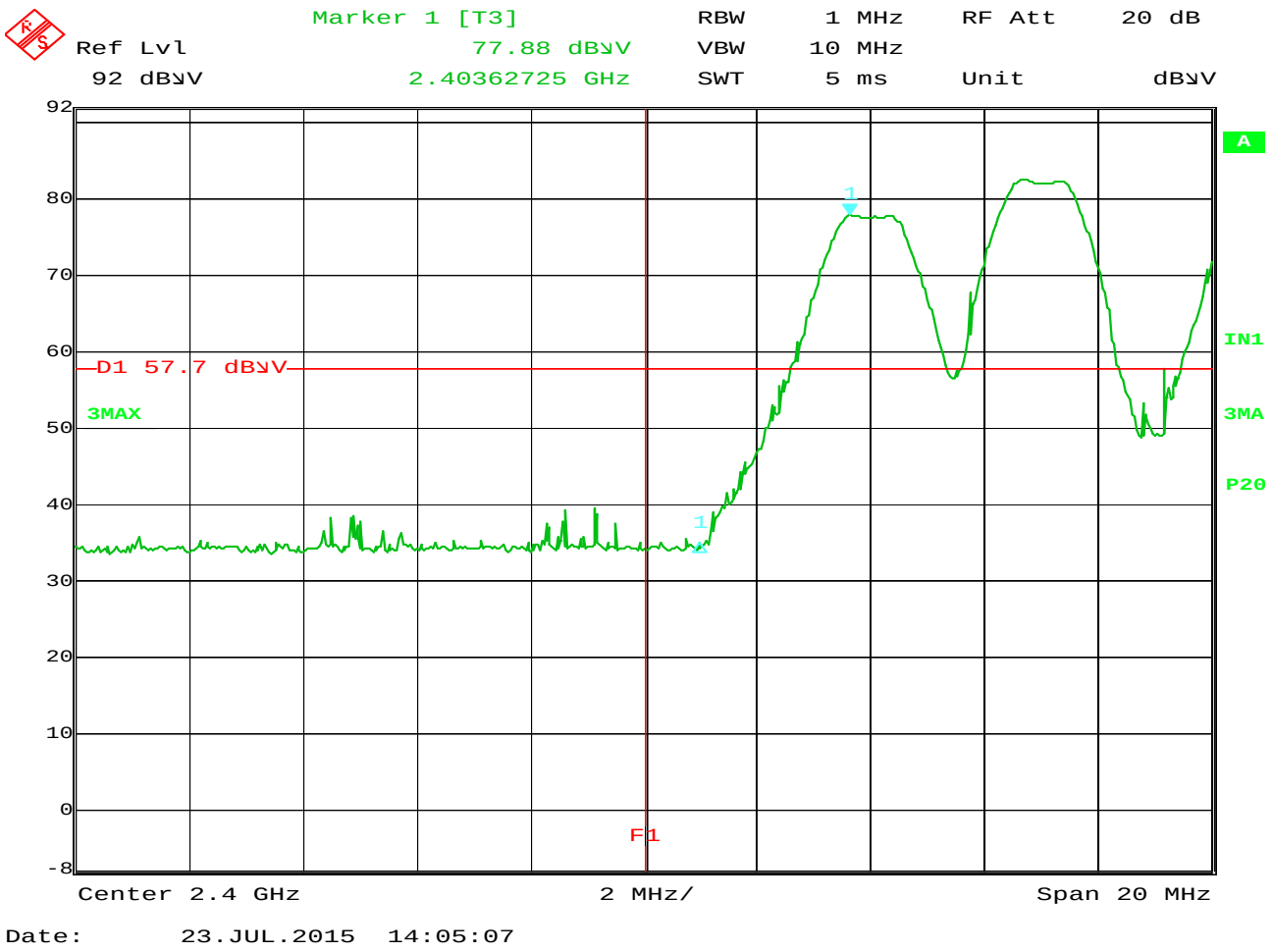
Checked BY Richard E. King :

Richard E. King



Band Edge

Manufacturer	: Horizon Hobby
Model No.	: AR9350
Serial No.	: AR9-2
Date	: JULY 23, 2015
Test Performed	: Band Edge
Mode	: Tx @ 2404MHz
Notes	: Display Line F1 represents the low band edge (2400MHz). Display Line D1 : represents the 20dB down level



Band Edge

Manufacturer	: Horizon Hobby
Model No.	: AR9350
Serial No.	: AR9-2
Date	: JULY 23, 2015
Test Performed	: Band Edge
Mode	: Hopping Enabled
Notes	: Display Line F1 represents the band edge (2400MHz). Display Line D1 represents : the 20dB down point.

MANUFACTURER : Horizon Hobby
MODEL NO. : AR9350
SERIAL NO. : AR9-2
DATE : July 24, 2015
TEST PERFORMED : Band Edge Test
MODE : Transmit at 2476MHz
NOTES : 3 meter test distance
: Peak Readings in a 1MHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
2483.50	H	29.7	2.7	32.4	0.0	64.8	1728.9	5000.0	-9.2
2487.70	H	31.1	2.7	32.4	0.0	66.2	2038.0	5000.0	-7.8

Checked BY Richard E. King :

Richard E. King

MANUFACTURER : Horizon Hobby
MODEL NO. : AR9350
SERIAL NO. : AR9-2
DATE : July 24, 2015
TEST PERFORMED : Band Edge Test
MODE : Transmit at 2476MHz
NOTES : 3 meter test distance
: Average Readings in a 1MHz RBW, 10Hz VBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dBuV/m at 3m	Average Total uV/m at 3 m	Average Limit uV/m at 3 m	Margin (dB)
2483.50	H	7.5	2.7	32.4	0.0	-41.3	1.2	1.2	500.0	-52.7
2487.70	H	7.8	2.7	32.4	0.0	-41.3	1.6	1.2	500.0	-52.4

Checked BY Richard E. King :

Richard E. King