Measurement of RF Emissions from an LRS400S-C Transceiver

For	Free Wave Technologies 1800 S. Flatiron Crt. Boulder, CO 80301
P.O. Number	33393
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Test Personnel	Richard King
Test Specification	FCC "Code of Federal Regulations" Title 47 Part 15, Subpart B and Part 90, Subpart I RSS-119 Issue 10 April 2010

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TABLE OF CONTENTS

PARAGRAPH	DESCRIPTION OF CONTENTS	PAGE NO.
1.	Introduction	5
1.1.	Scope of Tests	5
1.2.	Purpose	5
1.3.	Deviations, Additions and Exclusions	5
1.4.	EMC Laboratory Identification	5
1.5.	Laboratory Conditions	5
2.	Applicable Documents	5
3.	EUT Setup and Operation	6
3.1.	General Description	6
3.1.1.	Power Input	6
3.1.2.	Peripheral Equipment	6
3.1.3.	Signal Input/Output Leads	6
3.1.4.	Grounding	6
3.2.	Operational Mode	6
3.3.	EUT Modifications	6
4.	Test Facility and Test Instrumentation	6
4.1.	Shielded Enclosure	6
4.2.	Test Instrumentation	6
4.3.	Calibration Traceability	6
4.4.	Measurement Uncertainty	7
5.	Test Procedures	7
5.1.	Reciever	7
5.1.1.	Antenna Conducted Emission Measurements	7
5.1.1.1.	Requirements	7
5.1.1.2.	Procedures	7
5.1.1.3.	Results	7
5.1.2.	Radiated Measurements	7
5.1.2.1.	Requirements	7
5.1.2.2.	Procedures	8
5.1.2.3.	Results	8
5.2.	Transmitter	9
5.2.1.	RF Power Output	9
5.2.1.1.	Requirements	9
5.2.1.2.	Procedures	9
5.2.1.3.	Results	9
5.2.2.	Emission Mask	9
5.2.2.1.	Requirements	9
5.2.2.2.	Procedures	9
5.2.2.3.	Results	10
5.2.3.	Spurious Emissions at the Antenna Terminals	10
5.2.3.1.	Requirements	10
5.2.3.2.	Procedures	10
5.2.3.3.	Results	10
5.2.4.	Field Strength of Spurious Emissions	10

TABLE OF CONTENTS

PARAGRAPH	DESCRIPTION OF CONTENTS	PAGE NO.
5.2.4.1.	Requirements	10
5.2.4.2.	Procedures	10
5.2.4.3.	Results	11
5.2.5.	Frequency Stability	11
5.2.5.1.	Requirements	11
5.2.5.2.	Procedures	11
5.2.5.3.	Results	12
5.2.6.	Transient Frequency Behavior	12
5.2.6.1.	Requirements	12
5.2.6.2.	Procedures	12
5.2.6.3.	Results	13
6.	Other Test Conditions	13
6.1.	Test Personnel and Witnesses	13
6.2.	Disposition of the EUT	13
7.	Conclusions	13
8.	Certification	14
9.	Equipment List	15

REVISION HISTORY

Revision	Date	Description
—	November 4, 2010	Initial release

Measurement of RF Emissions from a Model No. LRS400S-C Transceiver

1. INTRODUCTION

1.1. Scope of Tests

This report presents the results of the RF emissions measurements performed on a Transceiver, Model No. LRS400S-C, No serial number was assigned to the EUT (hereinafter referred to as the Equipment Under Test (EUT)). The EUT is designed to transmit in the frequency range 406.1MHz to 430MHz and receive in the frequency ranges of 406.1MHz to 417MHz and 410MHz to 430 MHz . The EUT uses an external antenna. The receiver contained one local oscillator at 45.0MHz below the carrier. The EUT was manufactured and submitted for testing by Free Wave Technologies located in Boulder, CO.

1.2. Purpose

The test series was performed to determine if the EUT meets FCC and Industry Canada (IC) technical requirements for receivers and transmitter. The EUT shall comply with the technical requirements of FCC Part 15 and 90; and IC RSS-119. The testing includes the conducted and radiated RF emission requirements for receivers, and the RF power output, emissions mask, spurious emissions at antenna terminal, field strength of spurious emissions, transient frequency behavior and frequency stability requirements for the transmitters. Testing was performed in accordance with ANSI C63.4-2003 and TIA-603-C-2004.

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 22.4^{o}C and the relative humidity was 23%.

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 2010
- ANSI C63.4-2003, "American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz"
- Industry Canada Radio Standards Specification, RSS-Gen, “General Requirements and Information for the Certification of Radiocommunication Equipment”, Issue 2, June 2007
- RSS-119 - Land Mobile and Fixed Radio Transmitters and Receivers Operating in the Frequency Range 27.41- 960 MHz Issue 10 April 2010
- TIA-603-C-2004, “Land Mobile FM or PM – Communications Equipment – Measurement and Performance Standards”

3. EUT Setup and Operation

3.1. General Description

The EUT is a Free Wave Technologies, Transceiver, Model No. LRS400S-C. A block diagram of the EUT setup is shown as Figure 1.

3.1.1. Power Input

A Sceptre AC Adaptor, P/N: PS-1230APL05, M/N: SA-036121A-3, was used to provide 12VDC to the EUT via a 1.85 meter long 2 wire power cable. The Sceptre AC Adaptor was powered with 115V, 60Hz via a 1.7 meter long 3 wire power cable.

3.1.2. Peripheral Equipment

The EUT was submitted for testing with the following peripheral equipment:

- Sony Viao Laptop Computer M/N: PCG-8N2L, P/N: 28398098, S/N: 3000596.

3.1.3. Signal Input/Output Leads

The EUT was submitted for testing with a 10 wire, 85 cm long cable. Eight (8) of those wires went to the serial port of the Toshiba laptop computer. The other two (2) wires went to the output of the Sceptre AC Adaptor and were used to provide 12VDC power to the EUT.

3.1.4. Grounding

The EUT was ungrounded during testing.

3.2. Operational Mode

For all receiver tests, the model LRS400S-C-1 was set to receive separately at 406.1MHz, 410.0MHz, and 417.0MHz. The model LRS400S-C-2 was set to receive separately at 410.0MHz, 417.0MHz, and 430.0MHz.

For all transmitter tests, the EUT was set to transmit separately at 406.1MHz, 410.0MHz, 417.0MHz, and 430.0MHz.

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 C63.4-2003 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.

4.3. Calibration Traceability

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

4.4. Measurement Uncertainty

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

The measurement uncertainty for these tests is presented below:

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

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

5. TEST PROCEDURES

5.1. Reciever

5.1.1. Antenna Conducted Emission Measurements

5.1.1.1. Requirements

This test is performed to determine the EUT configuration during the radiated RF emissions tests. The power at the antenna terminal over the frequency range 30MHz to 2000MHz may be measured. If the emissions at the antenna terminal exceed 2 nanowatts, it is necessary to perform the radiated RF emissions tests with the antenna port terminated with an equivalent antenna. If the EUT does meet the 2 nanowatt requirement, the radiated emissions tests can be performed with the antenna port terminated with a shielded load.

5.1.1.2. 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.

5.1.1.3. Results

The results of the antenna conducted measurements are presented on data pages 21 through 32. The reference line shown on the data pages represents the 2 nanowatt requirement. As can be seen from the data pages, all emissions from the EUT were below the 2 nanowatt requirement. Since the emissions were below the 2 nanowatt limit, the antenna port was terminated with a shielded load for radiated emissions measurements.

5.1.2. Radiated Measurements

5.1.2.1. Requirements

All emanations from a receiver shall be below the levels shown on the following table:

RADIATION LIMITS FOR RECIEVERS

Frequency (MHz)	Distance between EUT And Antenna in Meters	Field Strength (uV/m)
30-88	3	100

88-216	3	150
216-960	3	200
Above 960	3	500

Note: The tighter limit shall apply at the edge between the two frequency bands.

5.1.2.2. 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 C63.4-2003 for site attenuation.

The shielded enclosure prevents emissions from other sources, such as radio and TV stations from interfering with the measurements. All power lines and signal lines entering the enclosure pass through filters on the enclosure wall. The power line filters prevent extraneous signals from entering the enclosure on these leads.

Since a quasi-peak detector requires long integration times, it is not practical to automatically sweep through the quasi-peak levels. Therefore, radiated emissions from the EUT were first scanned using a peak detector and automatically plotted. The frequencies where significant emission levels were noted were then remeasured using the quasi-peak detector.

The broadband measuring antenna was positioned at a 3 meter distance from the EUT. The frequency range from 30 MHz to 2000 MHz was investigated using a peak detector function with a bilog antenna. The maximum levels were plotted.

Final radiated emissions were performed on all significant broadband and narrowband emissions found in the preliminary sweeps using the following methods:

1) For all frequencies 1GHz and below, measurements were made using a broadband bi-log antenna.

2) For all frequencies above 1GHz, measurements were made using a waveguide antenna.

3) To ensure that the maximum, or worst case, emission levels were 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

.

5.1.2.3. Results

The preliminary plots are presented on pages 33 through 47. These plots are presented for a reference only, and are not used to determine compliance. The final radiated levels are presented on pages 48 through 51. 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 Figures 2 and 3.

5.2. Transmitter

5.2.1. RF Power Output

5.2.1.1. Requirements

In accordance with paragraph 90.205(r), the output power shall not exceed by more than 20 percent the manufacturer's rated output power for the particular transmitter specifically listed on the authorization.

5.2.1.2. Procedures

With the EUT transmitting, the antenna port of the EUT was connected to a spectrum analyzer through a 50 dB attenuator. The resolution bandwidth of the spectrum analyzer was set wider than the bandwidth of the EUT. The output power of the item was then measured. This procedure was repeated separately with the EUT transmitting at the frequencies listed in paragraph 3.2.

5.2.1.3. Results

The output power plots are shown on pages 52 through 55. The output power measurements are shown in a tabular form on page 56. As can be seen from the data, the power output at each frequency is below the maximum allowable power of 20% above the manufacturer's rated output power.

5.2.2. Emission Mask

5.2.2.1. Requirements

Per 90.210, for equipment with a 12.5 kHz channel bandwidth, any emissions must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

(1) On any frequency from the center of the authorized bandwidth f_0 to 5.625 kHz removed from f_0: Zero dB.
(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least $7.25(f_d – 2.88kHz)$ dB.
(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz; At least 50 + 10log (P) dB or 70 dB whichever is the lesser attenuation:

5.2.2.2. Procedures

The EUT was set to transmit.

(a) The antenna port of the EUT was connected to a spectrum analyzer through a 50 dB attenuator.
(b) The following spectrum analyzer settings were employed:
- trace 1 = on
- center frequency = transmit frequency of the EUT
- resolution bandwidth = 1 MHz
- video bandwidth > resolution bandwidth
- frequency span = 125 kHz
- sweep = Auto
- detector function = peak
- trace = max hold

(c) Several sweeps were made with the settings listed above.
(d) Trace 1 was changed from max hold to view
(e) The following spectrum analyzer settings were employed:
- trace 2 = on
- resolution bandwidth = 100 Hz
- video bandwidth = 300 Hz
- sweep = Auto

- detector function = peak
- trace = max hold

(f) Several sweeps were made with the settings listed above.

(g) Steps (a) through (f) were repeated with the EUT set to transmit all the frequencies in paragraph 3.2.

5.2.2.3. Results

The spectrum analyzer plots of the emissions of the EUT are shown on pages 57 through 64. The limits, shown on the plots, are referenced to the power measured with a 1MHz resolution bandwidth. As can be seen from the data, the EUT did not produce spurious emissions in excess of the limit.

5.2.3. Spurious Emissions at the Antenna Terminals

5.2.3.1. Requirements

Per 90.210, on any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz the emissions must be attenuated by at least 50 + 10log (P) dB or 70dB whichever is the lesser attenuation.

5.2.3.2. Procedures

The EUT was set to transmit.

(a) The antenna port of the EUT was connected to a spectrum analyzer through a 50dB attenuator.

(b) The resolution bandwidth of the spectrum analyzer was set to 100 kHz.

(c) A sweep was made from 30 MHz to 1 GHz.

(d) The resolution bandwidth of the spectrum analyzer was set to 1 MHz.

(e) A sweep was made from 1 GHz to 5 GHz.

(f) Steps (a) through (e) were repeated with the EUT set to transmit all the frequencies in paragraph 3.2.

5.2.3.3. Results

The plots of the antenna conducted output measurements are presented on pages 65 through 80. The limits, shown on the plots, are referenced to the RF power output measurements made on the EUT.As can be seen from the data, the EUT did not produce spurious emissions in excess of the limit.

5.2.4. Field Strength of Spurious Emissions

5.2.4.1. Requirements

Per 90.210, on any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz the emissions must be attenuated by at least 50 + 10log (P) dB or 70dB whichever is the lesser attenuation.

5.2.4.2. Procedures

All tests were performed in a 32 ft. x 20 ft. x 18 ft. 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 2003 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.

1. Preliminary radiated emissions measurements were first performed using a peak

detector and automatically plotted. The broadband measuring antenna was positioned at a 3 meter distance from the EUT. The entire frequency range from 30 MHz to 5 GHz was investigated using a peak detector function. All preliminary tests were performed separately with the EUT transmitting at the frequencies listed in paragraph 3.2.

2. All significant broadband and narrowband signals found in the preliminary sweeps were then measured using a peak detector at a test distance of 3 meters. The measurements were made with a tuned dipole or double ridged waveguide antenna over the frequency range of 30 MHz to 5 GHz.

3. To ensure that maximum emission levels were 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 antennas are 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.

4. The equivalent power was determined from the field intensity levels measured at 3 meters using the substitution method. To determine the emission power a tuned dipole or double ridged waveguide antenna was 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 corrected to compensate for cable loss, as required, and when the double ridged waveguide antenna was used, increased by the difference in gain between the dipole and the waveguide antenna.

5.2.4.3. Results

The preliminary radiated emissions plots are presented on pages 81 through 93. This data is only presented for a reference, and is not used as official data. The final radiated levels are presented on pages 95 through 98. The radiated emissions were measured through the 10th harmonic. As can be seen from the data, all emissions measured from the EUT were within the specification limits. Photographs of the test configuration are shown on Figures 2 and 3.

5.2.5. Frequency Stability

5.2.5.1. Requirements

In accordance with paragraph 90.213(a), mobile stations operating at 2 watts or less with a 12.5 kHz channel bandwidth must have a frequency stability of 2.5 ppm.

5.2.5.2. Procedures

The antenna port of the EUT was connected to a frequency counter through a 50 dB attenuator. The EUT was then placed in a humidity temperature chamber.

(a) The EUT was set to transmit at 410MHz. The transmit frequency was measured and recorded at ambient temperature.
(b) The temperature chamber was then set to -30ºC.
(c) Once the temperature chamber had reached -30ºC, the EUT was allowed to soak for 30 minutes.
(d) After soaking at -30ºC for thirty minutes, the EUT was turned on and set to transmit and the transmit frequency was measured and recorded.
(e) Steps (b) through (d) were repeated at -20ºC.

(f) Steps (b) through (d) were repeated at -10ºC.
(g) Steps (b) through (d) were repeated at 0ºC.
(h) Steps (b) through (d) were repeated at +10ºC.
(i) Steps (b) through (d) were repeated at +20ºC.
(j) Steps (b) through (d) were repeated at +30ºC.
(k) Steps (b) through (d) were repeated at +40ºC.
(l) Steps (b) through (d) were repeated at +50ºC.
(m) Steps (b) through (l) were repeated with the EUT set to transmit at 417 MHz.
(n) The EUT was then removed from the temperature chamber and allowed to adjust to nominal room temperature.
(o) The supply voltage was checked and adjusted to the nominal level (12.0 VDC). The EUT was turned on and set to transmit. The transmit frequency was measured and recorded at ambient temperature.
(p) The supply voltage was then varied to 85% of its nominal level (10.2 VDC). The EUT was turned on and set to transmit. The transmit frequency was measured and recorded at ambient temperature.
(q) The supply voltage was then varied to 115% of its nominal level (13.8 VDC). The EUT was turned on and set to transmit. The transmit frequency was measured and recorded at ambient temperature.
(r) Steps (o) through (q) were repeated with the EUT set to transmit at 410 MHz.

5.2.5.3. Results

The frequency stability measurements are presented on pages 99 through 102. As can be seen from the data, all frequency deviations were within the 2.5 ppm limit. A photograph of the test setup is shown on Figure 4.

5.2.6. Transient Frequency Behavior

5.2.6.1. Requirements

Per 90.214, transmitters with 12.5 kHz channel spacing must maintain transient frequencies within the maximum frequency difference limits during the time intervals indicated:

Time intervals	Maximum Frequency Difference	Time (ms)
t_1	+/-12.5 kHz	10.0
t_2	+/-6.25 kHz	25.0
t_3	+/-12.5 kHz	10.0

Where:

t_1 is the time period immediately following t_{on}

t_2 is the time period immediately following t_1

t_3 is the time period from the instant when the transmitter is turned off until t_{off}

5.2.6.2. Procedures

Two test signals were connected to the test discriminator via a combining network. The transmitter was connected to a 50 ohm power attenuator. The output of the power attenuator was connected to the test discriminator via one input of the combining network. A test signal was connected to the second input of the combining network.

(a) The test signal was adjusted to the nominal frequency of the transmitter.

(b) The test signal was modulated by a 1 kHz signal with a deviation equal to the value of the relevant channel separation (12.5 kHz).

(c) The test signal was adjusted to correspond to 0.5% of the power of the transmitter under test measured at the input of the test discriminator. This level was maintained throughout the measurement.

(d) The amplitude difference (ad) and the frequency difference (f_d) output of the test discriminator were connected to a storage oscilloscope.

(e) The storage oscilloscope was set to display the channel corresponding to the (f_d) input up to ±1 channel frequency difference, corresponding to the relevant channel separation, from the nominal frequency.

(f) The storage oscilloscope was set to a rate of 5 ms/div and set so that the triggering occurs at 1 div from the left edge of the display.

(g) The 1 kHz test signal was shown continuously. The storage oscilloscope was set to trigger on the channel corresponding to the amplitude difference (ad) input at a low input level, rising.

(h) The transmitter was then switched on, without modulation, to produce the trigger pulse and a picture on the display. The result of the change in the ratio of power between the test signal and the transmitter output produced two separate sides, one showing the 1 kHz test signal, the other the frequency difference of the transmitter versus time.

(i) The transmit signal suppresses the 1 kHz test signal and produces the start of the test or t_{on}. During this test time the frequency difference was measured and recorded verses time.

(j) The transmitter was then switched off to produce the trigger pulse and a picture of the display. The result of the change in the ratio of power between the test signal and the transmitter output produced two separate sides, one showing the frequency difference of the transmitter versus time and the other showing the 1 kHz test signal.

(k) The transmitter signal no longer suppresses the 1 kHz test signal and produces t_3

5.2.6.3. Results

The plots of the transient frequency behavior are shown on pages 103 and 104. As can be seen from the data, all transient frequencies were within the maximum frequency difference limits. A photograph of the test setup is shown on Figure 5.

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 Free Wave Technologies upon completion of the tests.

7. Conclusions

It was determined that the Free Wave Technologies, Model No. LRS400S-C, Transceiver, did fully meet the conducted and radiated emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart B, Sections 15.107 and 15.109 for receivers when tested per ANSI C63.4-2003.

It was determined that the Free Wave Technologies, Model No. LRS400S-C, Transceiver did fully meet the RF power output, emissions mask, spurious emissions at antenna terminal, field strength of spurious emissions, frequency stability, and transient frequency behavior, requirements of the FCC "Code of Federal Regulations" Title 47, Part 90, Subpart I, when tested per TIA-603-C-2004.

It was determined that the Free Wave Technologies, Model No. LRS400S-C, Transceiver did fully meet the RF power output, emissions mask, spurious emissions at antenna terminal, field strength of spurious emissions, frequency stability, and transient frequency behavior, requirements of the RSS-119 - Land Mobile and Fixed Radio Transmitters and Receivers Operating in the Frequency Range 27.41- 960 MHz Issue 10 April 2010.

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. Any electrical or mechanical modification made to the EUT subsequent to the specified test date will serve to invalidate the data and void this certification.

This report must not be used to claim product endorsement by NVLAP or any agency of the US Government.

9. EQUIPMENT LIST

Table 9-1 Equipment List

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Due Date
ETD0	ENV Chambers For Auto Dept Use Only	Thermotron	S-8	15461	-70 to 150 degrees C	Note 1	
ETDA	HONEYWELL CHART RECORDER	HONEYWELL	DR45AT-1100	0825Y878133300009	PROGRAMMABLE	12/7/2009	12/7/2010
GBQ0	SIGNAL GENERATOR WITH I/Q MOD.	ROHDE & SCHWARZ	SMHU-58	843558/039	1KHZ-4320MHZ	9/10/2010	9/10/2011
MDA1	MULTIMETER (D. CROWDER)	FLUKE CORPORATION	26	72030992	I;VDC;VAC;R	2/19/2010	2/19/2011
MFC0	MICROWAVE FREQ. COUNTER	HEWLETT PACKARD	5343A	2133A00591	10HZ-26GHZ	8/19/2010	8/19/2011
MSP4	8 CHANNEL DIGITAL OSCILLOSCOPE	YOKOGAWA	DL708	27VJ0035	---	1/27/2010	1/27/2011
NTA2	BILOG ANTENNA	TESEQ	6112D	28040	25-1000MHz	6/7/2010	6/7/2011
NWF0	RIDGED WAVE GUIDE	EMCO	3105	2035	1-12.4GHZ	12/5/2009	12/5/2010
NWH0	RIDGED WAVE GUIDE	TENSOR	4105	2081	1-12.4GHZ	8/31/2010	8/31/2011
RBA1	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESIB26	100146	20HZ-26.5GHZ	9/8/2010	9/8/2011
RBD1	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESU40	100009	20Hz-40GHz	8/25/2010	8/25/2011
RYE0	MODULATION ANALYZER	HEWLETT PACKARD	8901B	3104A03410	0.15-1300MHZ	7/9/2010	7/9/2011
SGB0	TRI-OUTPUT POWER SUPPLY	BK PRECISION	1650	1001	0-25V DC/5A	NOTE 1	
T1D2	10DB 20W ATTENUATOR	NARDA	768-10	6	DC-11GHZ	1/5/2010	1/5/2011
T2DM	20DB, 25W ATTENUATOR	WEINSCHEL	46-20-34	BS2141	DC-18GHZ	8/9/2010	8/9/2011
T2S1	20DB 25W ATTENUATOR	WEINSCHEL	46-20-34	BU8140	DC-18GHZ	1/5/2010	1/5/2011
XLQE	5W, 50 OHM TERMINATION	JFW INDUSTRIES	50T-052	49	DC-2GHZ	8/11/2010	8/11/2011

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

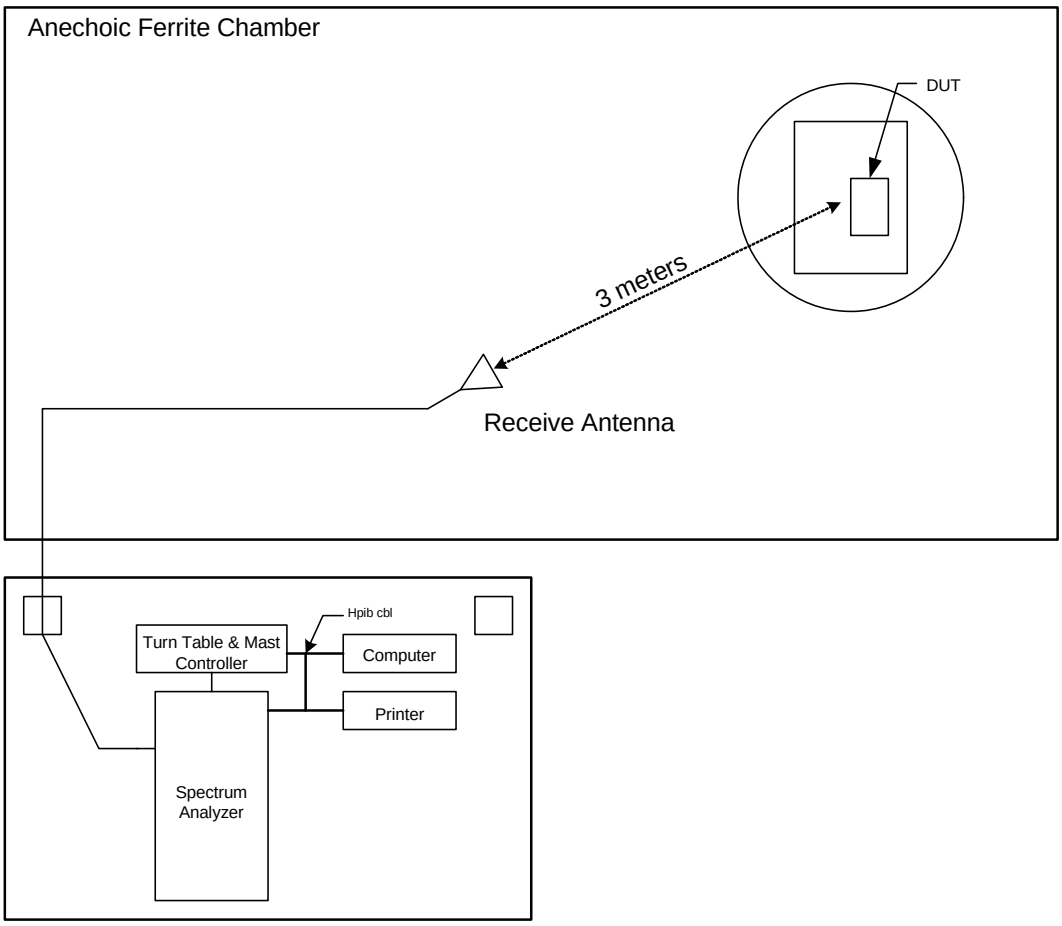
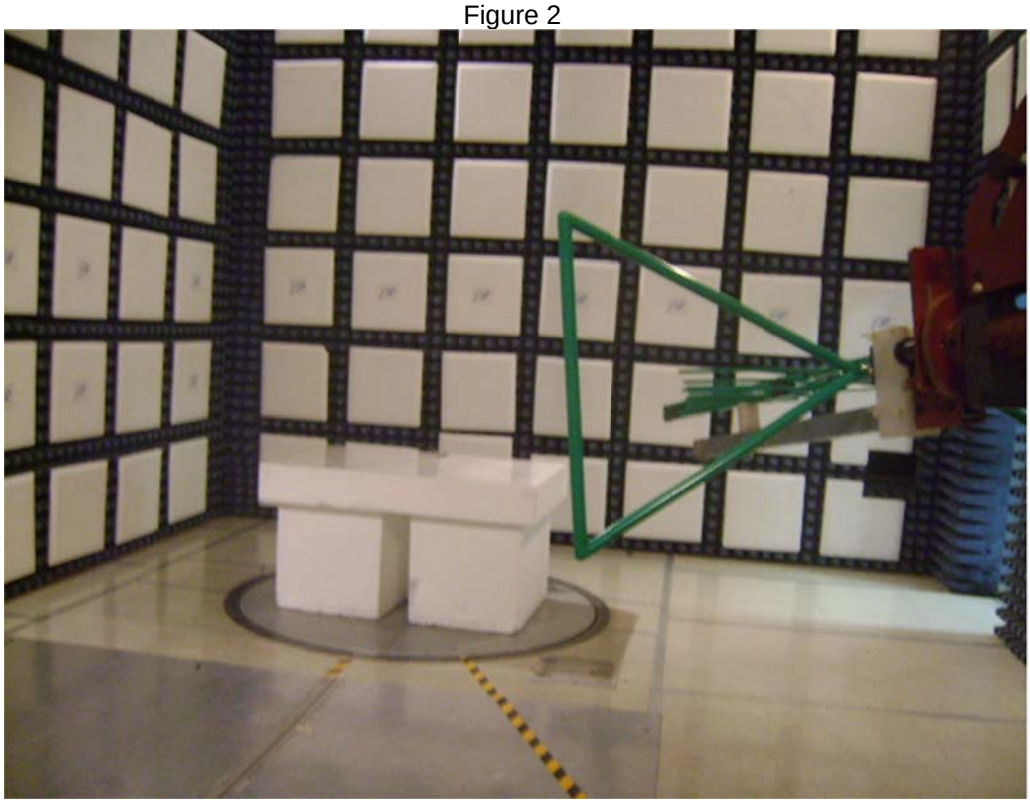
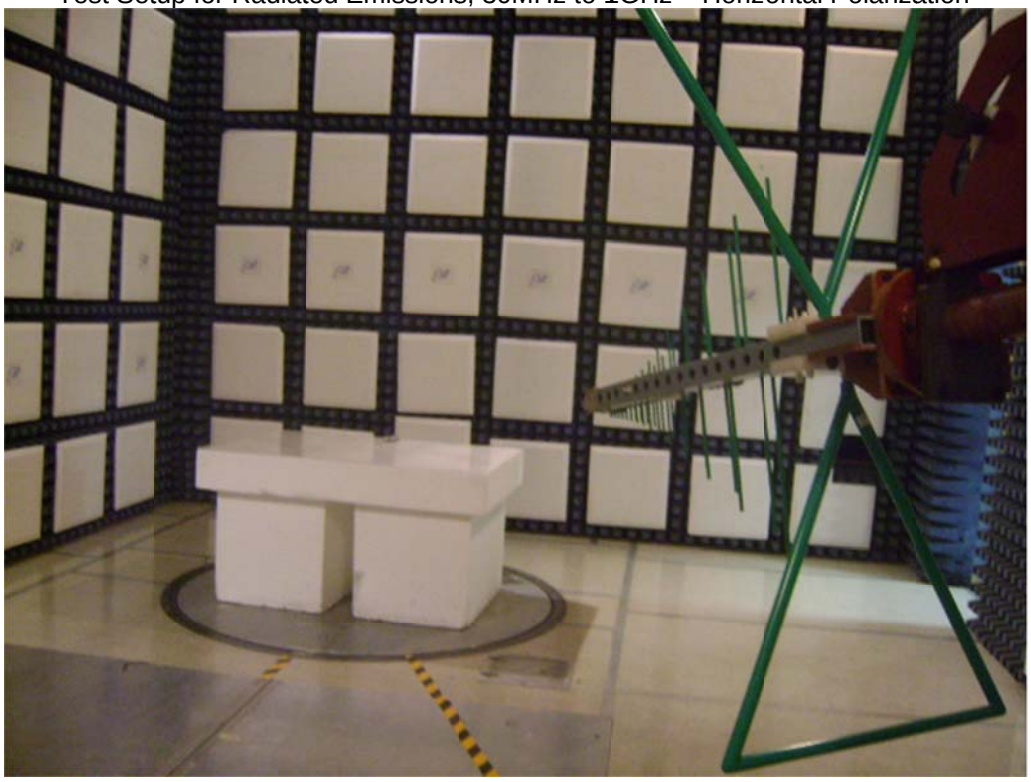


FIGURE 1 BLOCKDIAGRAM OF TEST SETUP

Figure 2

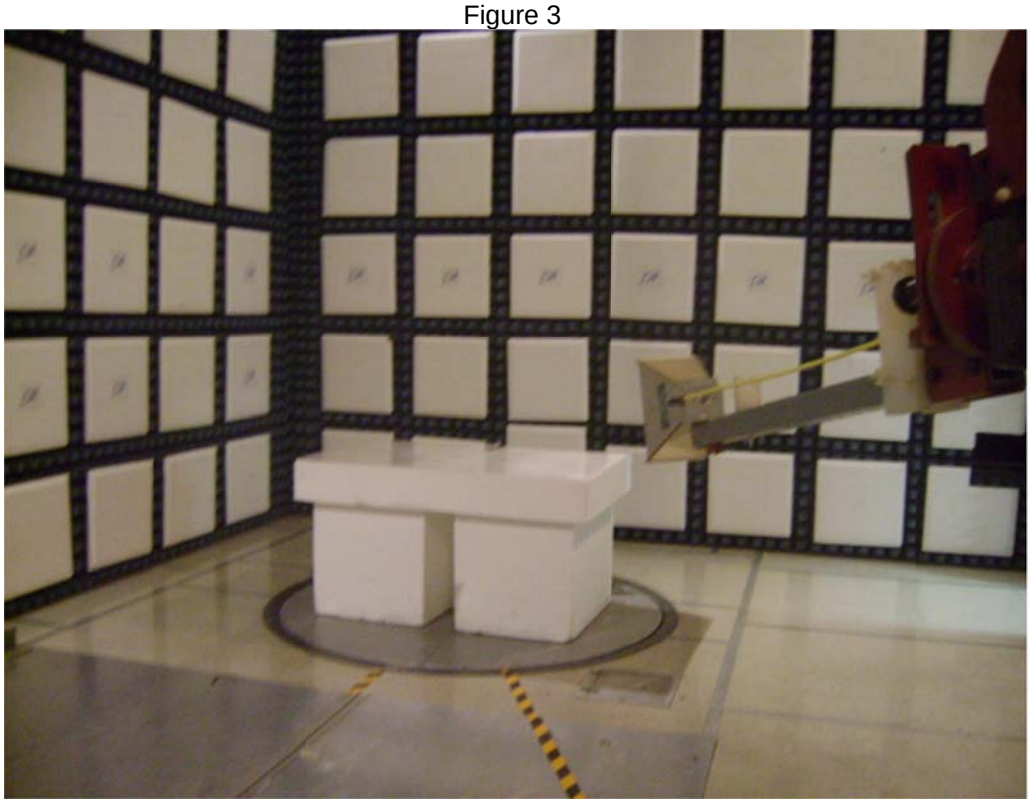


Test Setup for Radiated Emissions, 30MHz to 1GHz – Horizontal Polarization



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

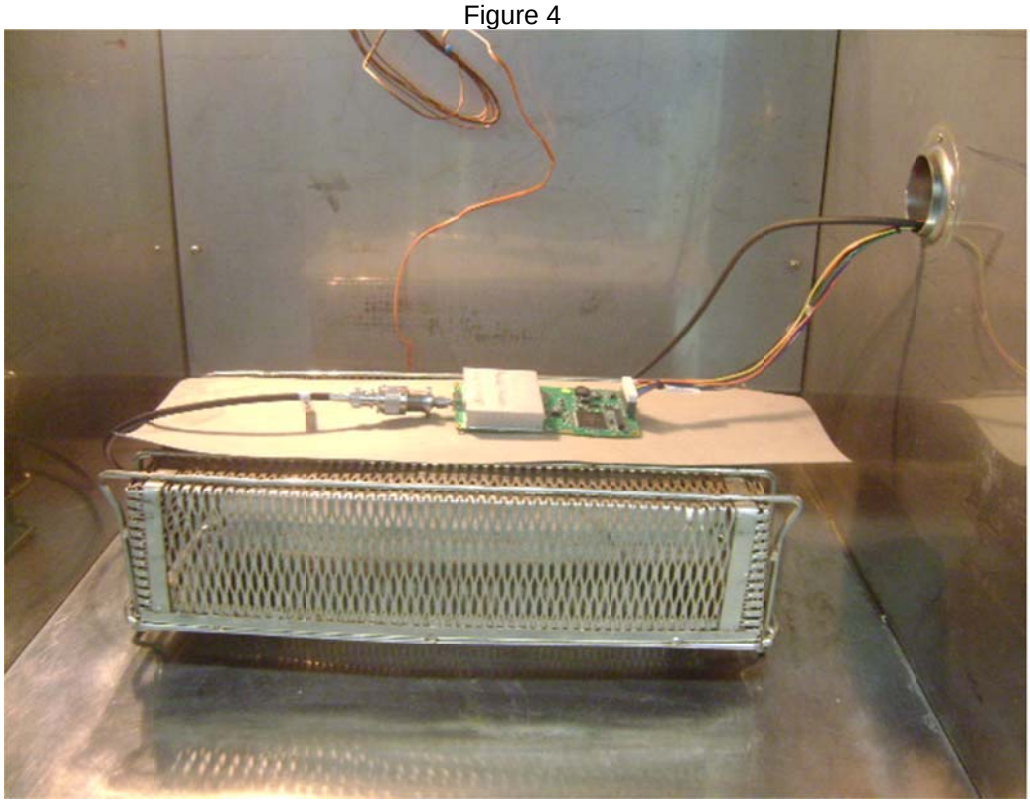
Figure 3



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

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

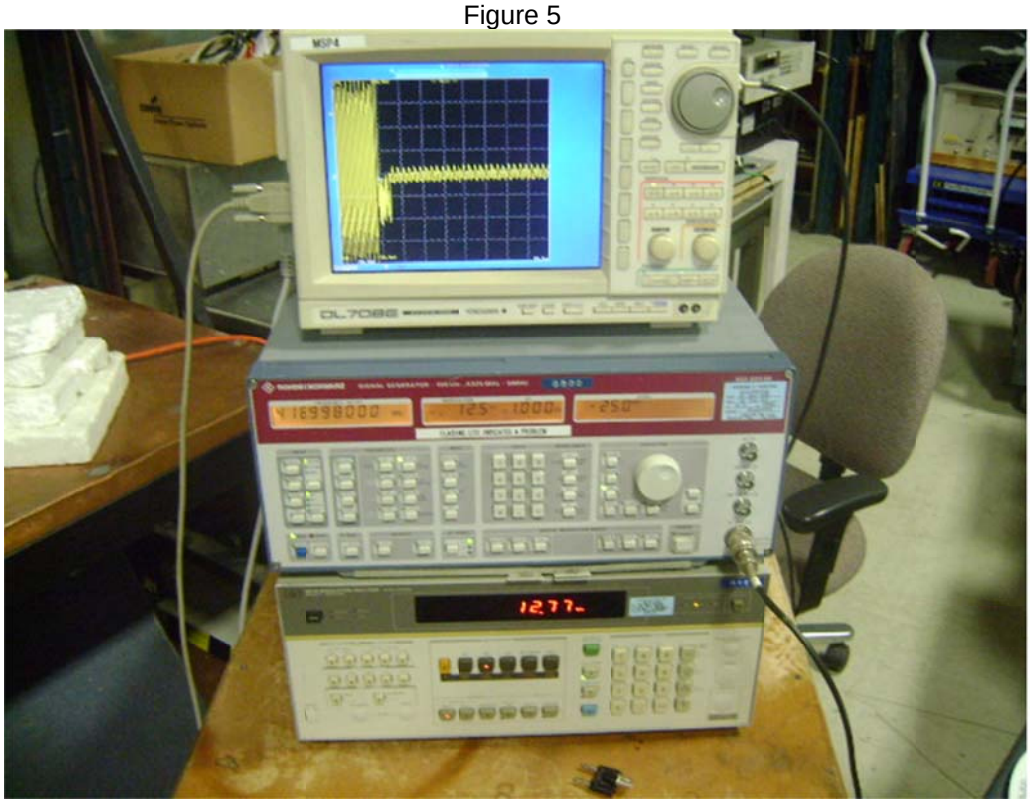
Figure 4



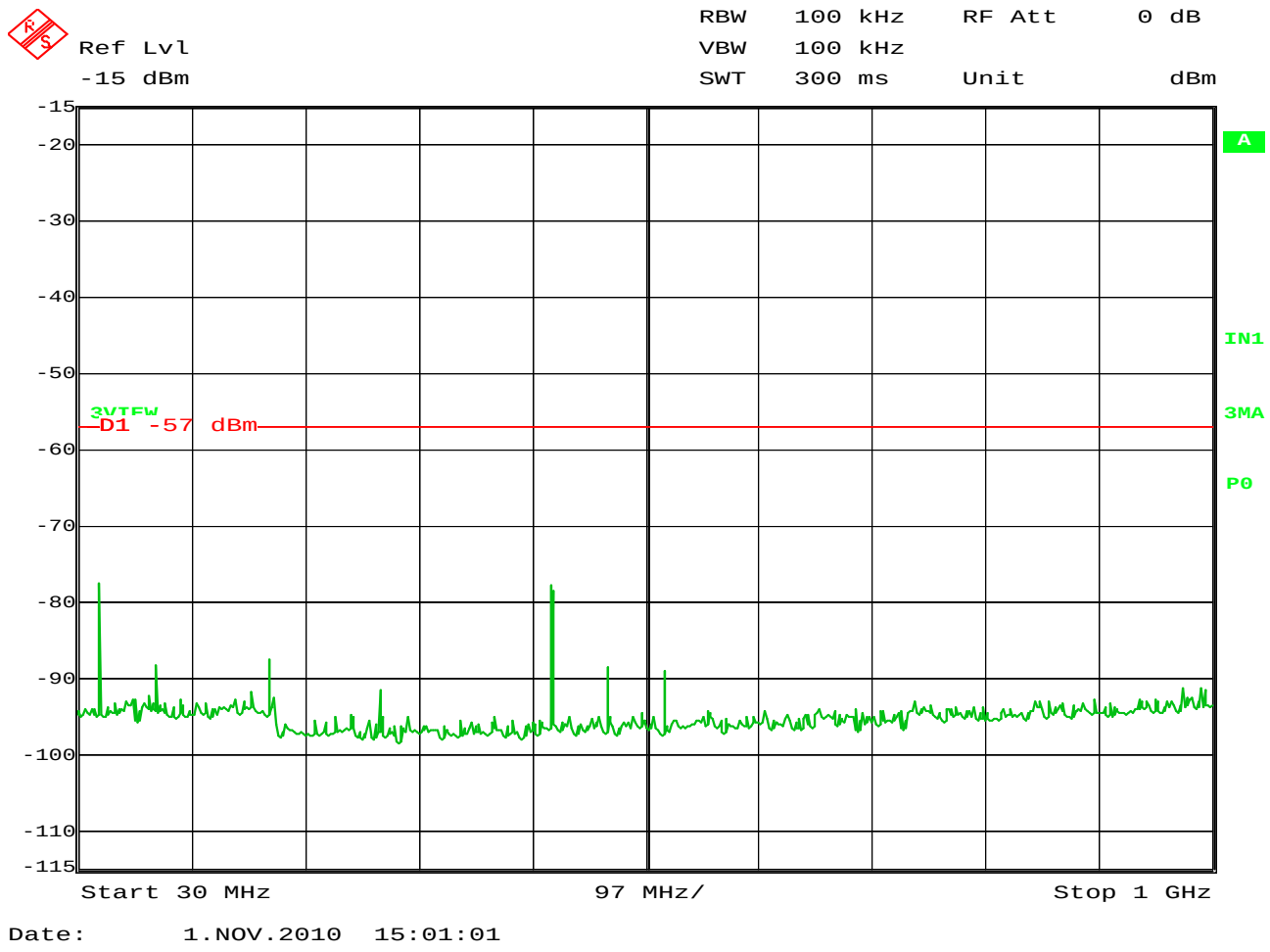
Test Setup for Frequency Stability

Test Setup for Frequency Stability

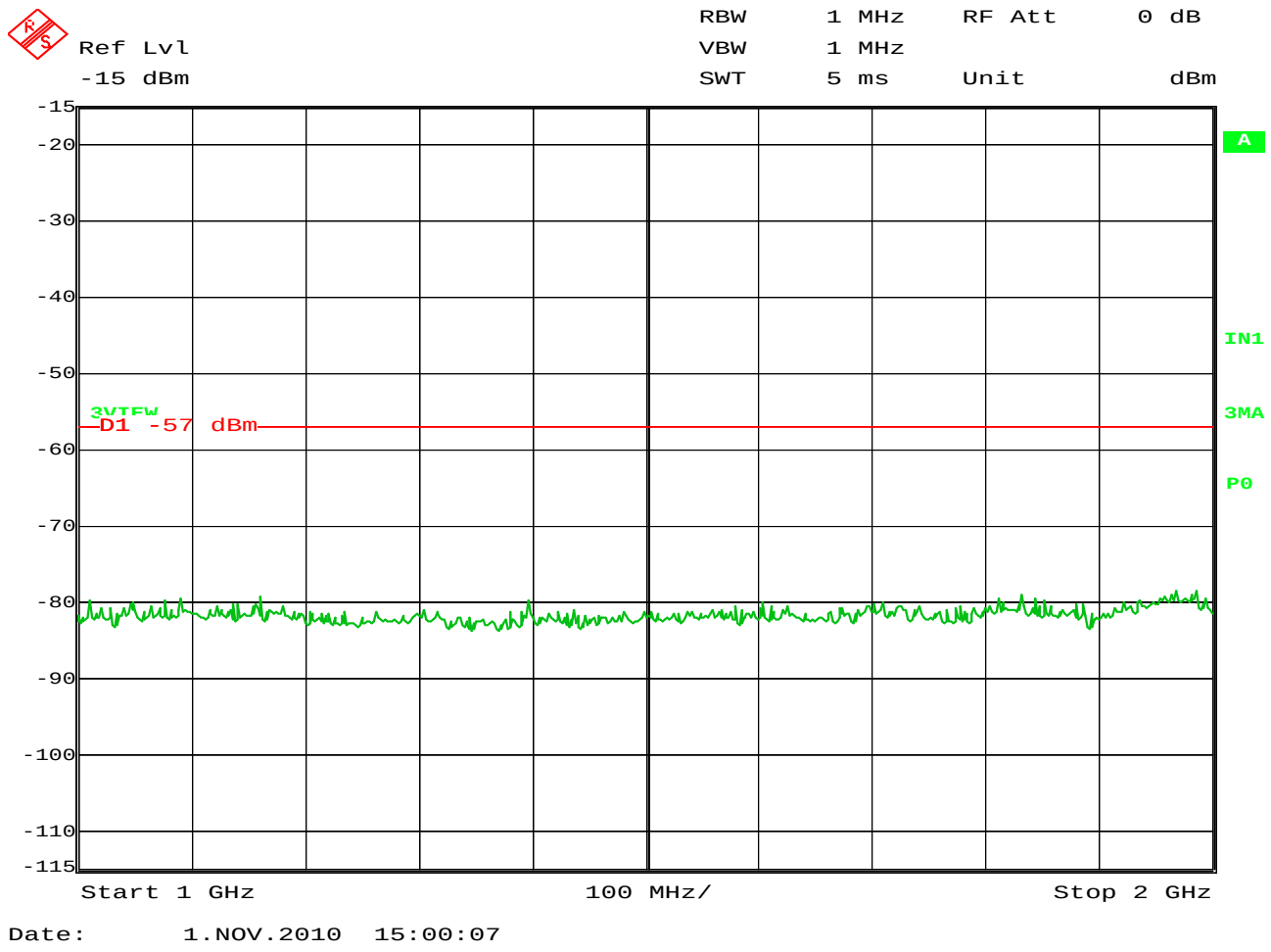
Figure 5



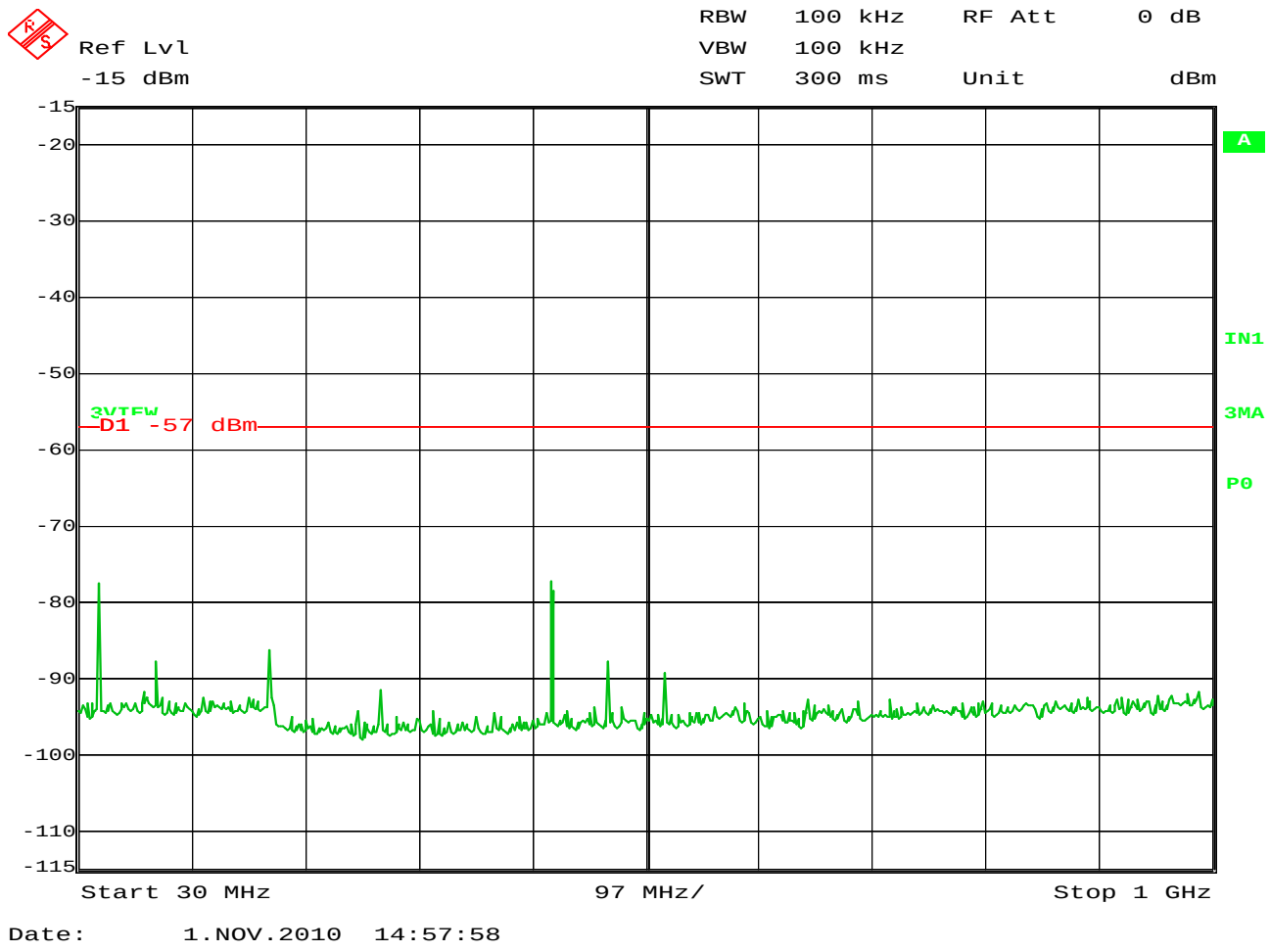
Test Setup for Transient Frequency Behavior



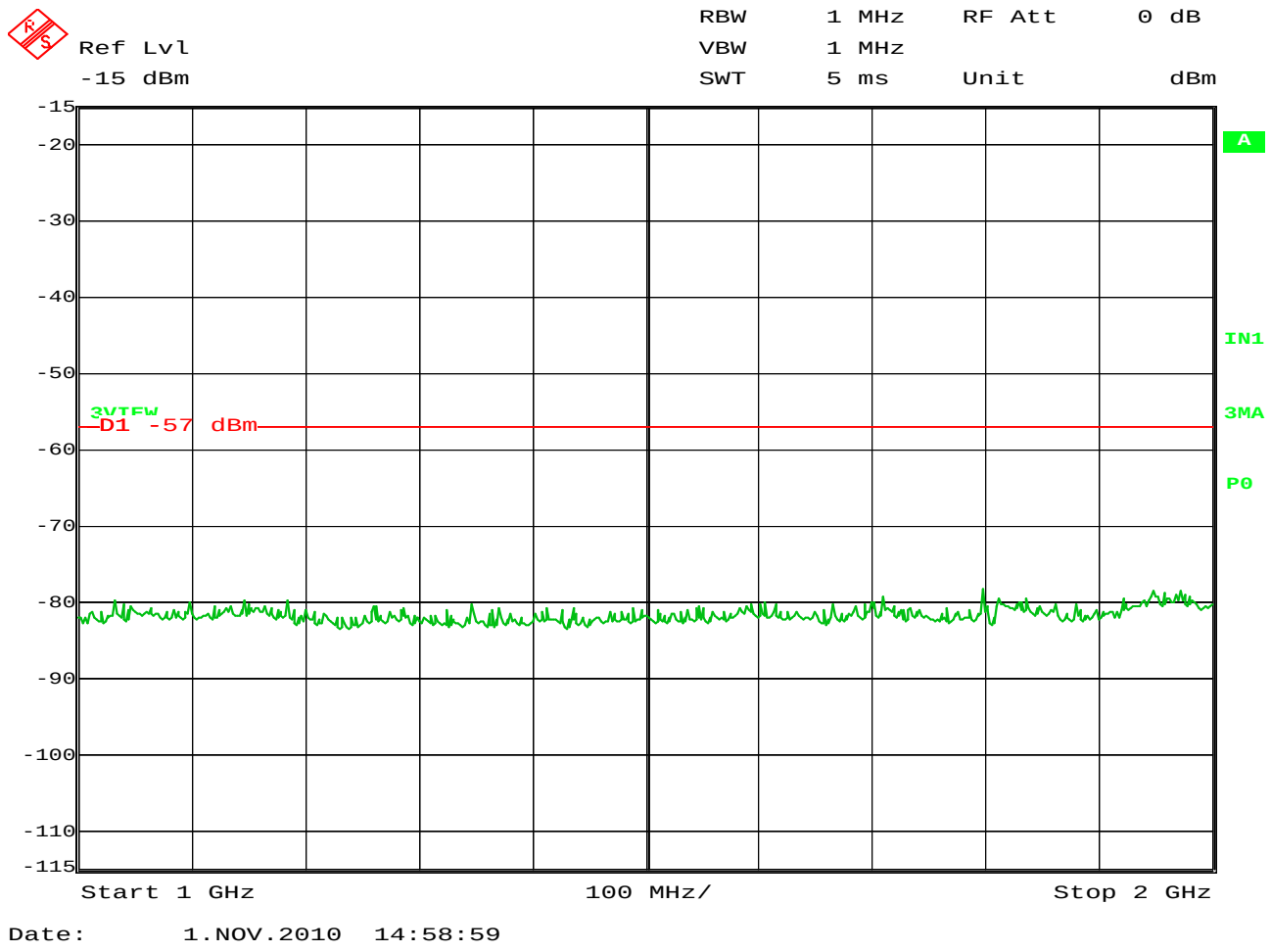
MANUFACTURER	:Free Wave Technologies
MODEL NUMBER	:LRS400S-C-1
SERIAL NUMBER	:none assigned
TEST MODE	:Receive at 406.1MHz
TEST PARAMETERS	:Antenna Conducted
NOTES	:
EQUIPMENT USED	:RBA1



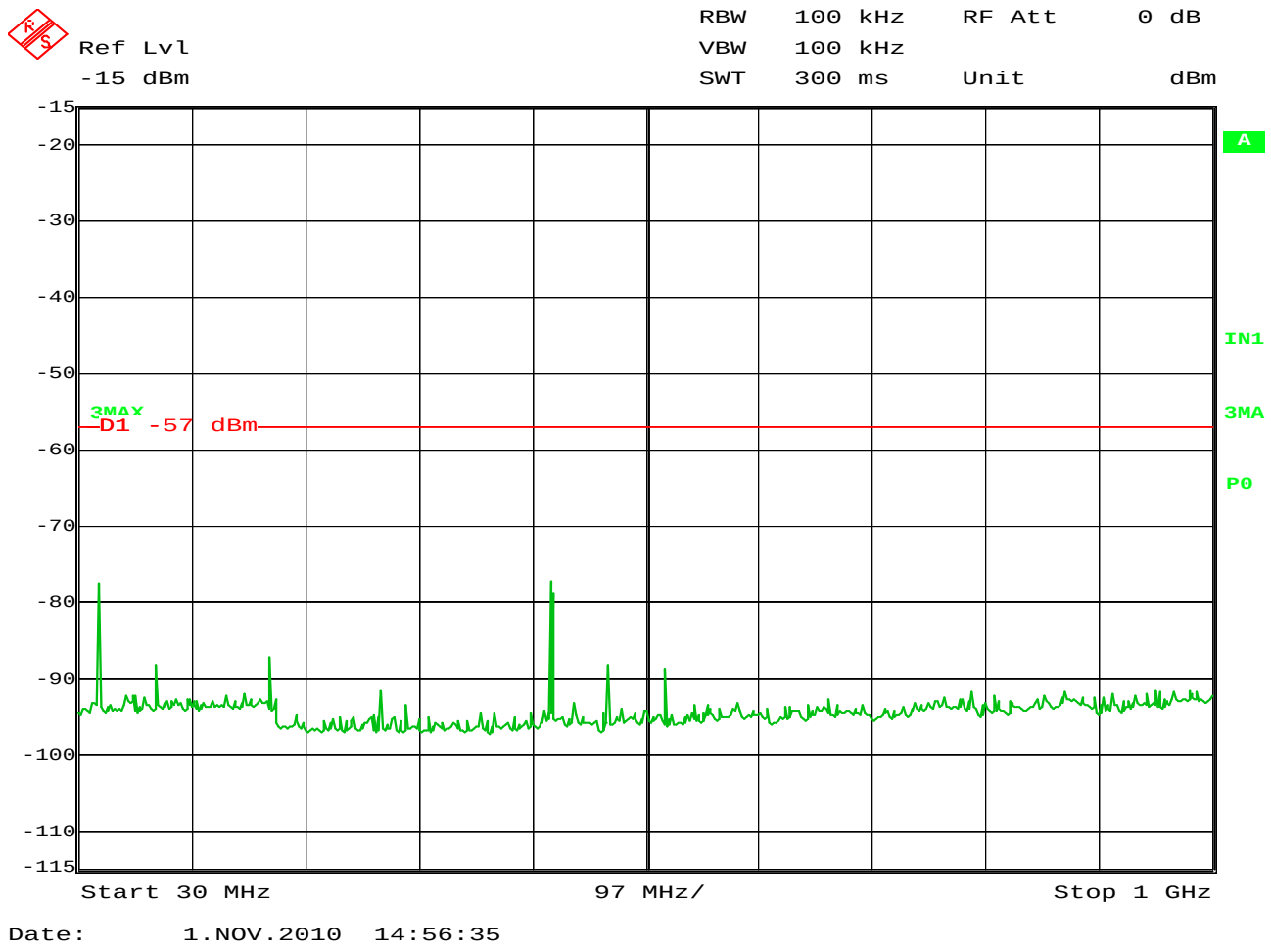
MANUFACTURER	:Free Wave Technologies
MODEL NUMBER	:LRS400S-C-1
SERIAL NUMBER	:none assigned
TEST MODE	:Receive at 406.1MHz
TEST PARAMETERS	:Antenna Conducted
NOTES	:
EQUIPMENT USED	:RBA1



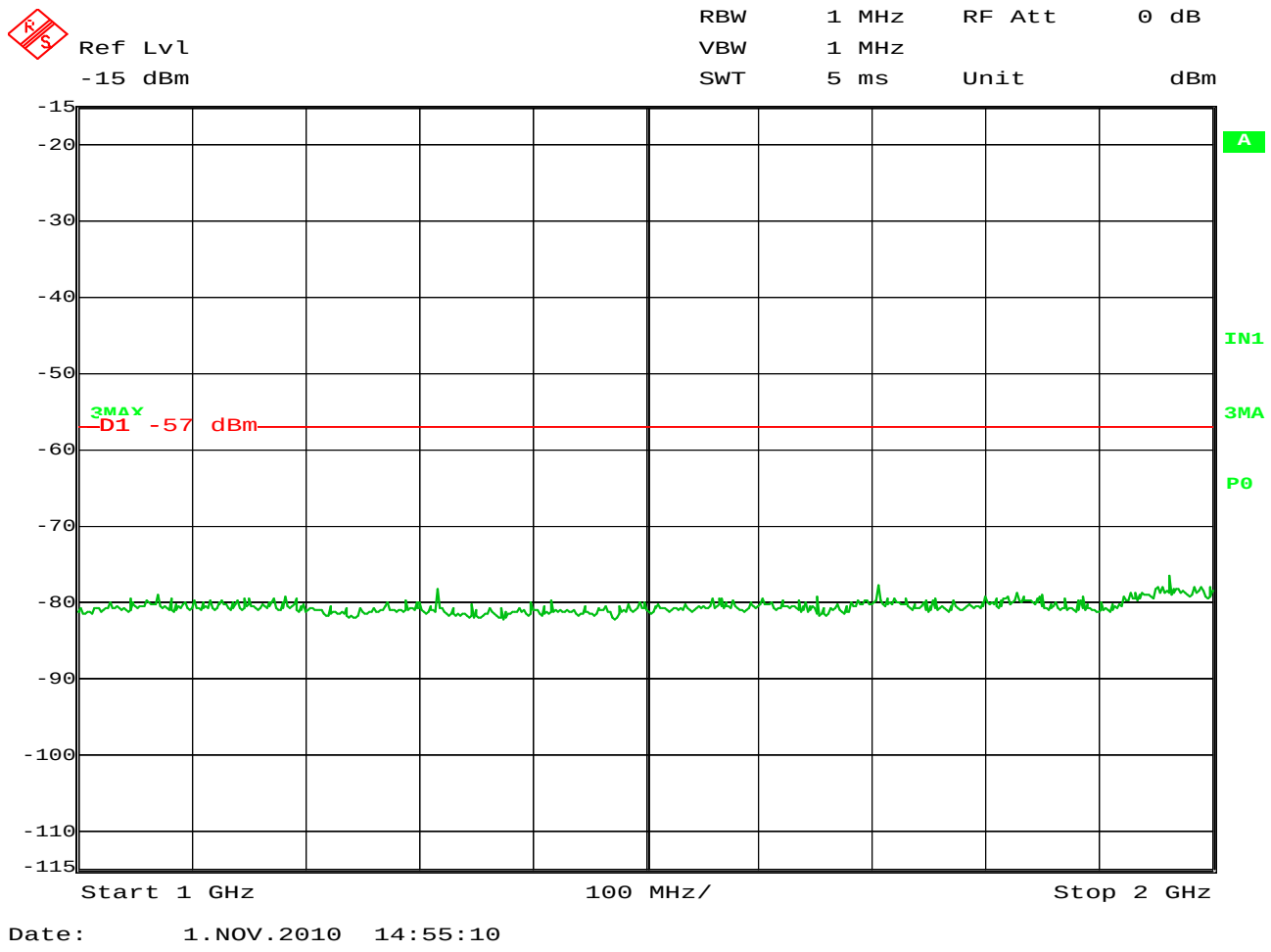
MANUFACTURER	:Free Wave Technologies
MODEL NUMBER	:LRS400S-C-1
SERIAL NUMBER	:none assigned
TEST MODE	:Receive at 410MHz
TEST PARAMETERS	:Antenna Conducted
NOTES	:
EQUIPMENT USED	:RBA1



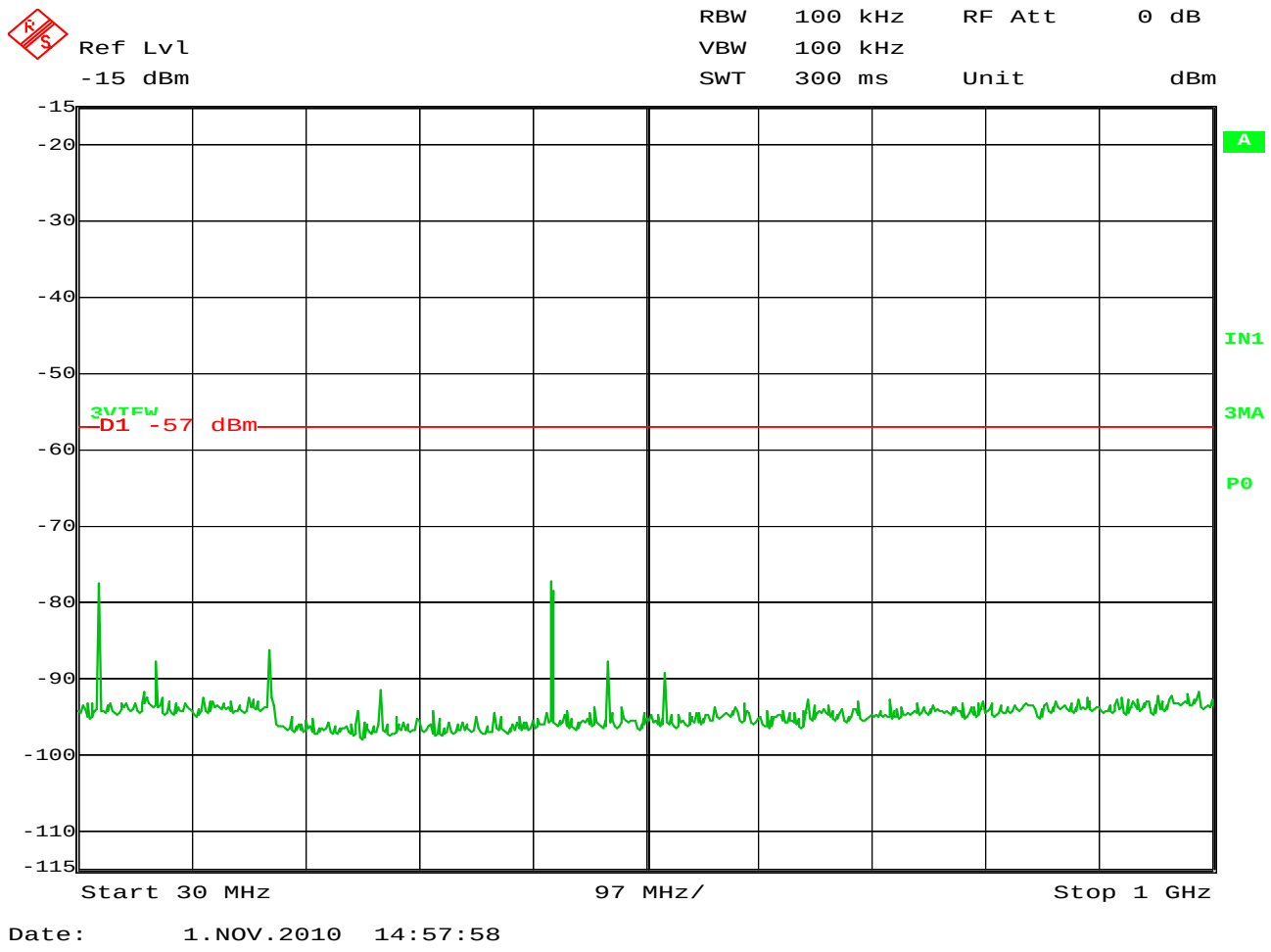
MANUFACTURER	:Free Wave Technologies
MODEL NUMBER	:LRS400S-C-1
SERIAL NUMBER	:none assigned
TEST MODE	:Receive at 410MHz
TEST PARAMETERS	:Antenna Conducted
NOTES	:
EQUIPMENT USED	:RBA1



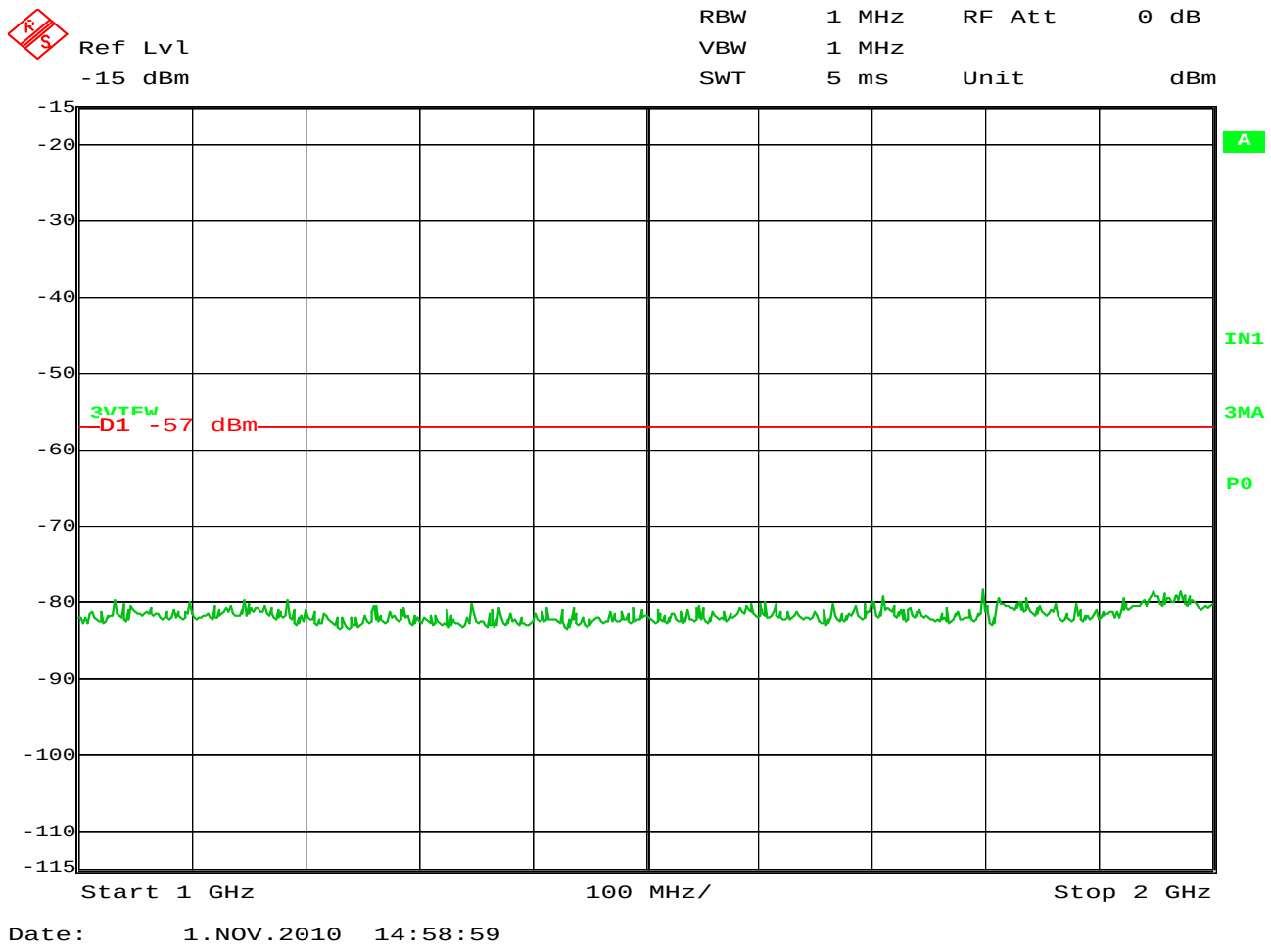
MANUFACTURER	:Free Wave Technologies
MODEL NUMBER	:LRS400S-C-1
SERIAL NUMBER	:none assigned
TEST MODE	:Receive at 417MHz
TEST PARAMETERS	:Antenna Conducted
NOTES	:
EQUIPMENT USED	:RBA1



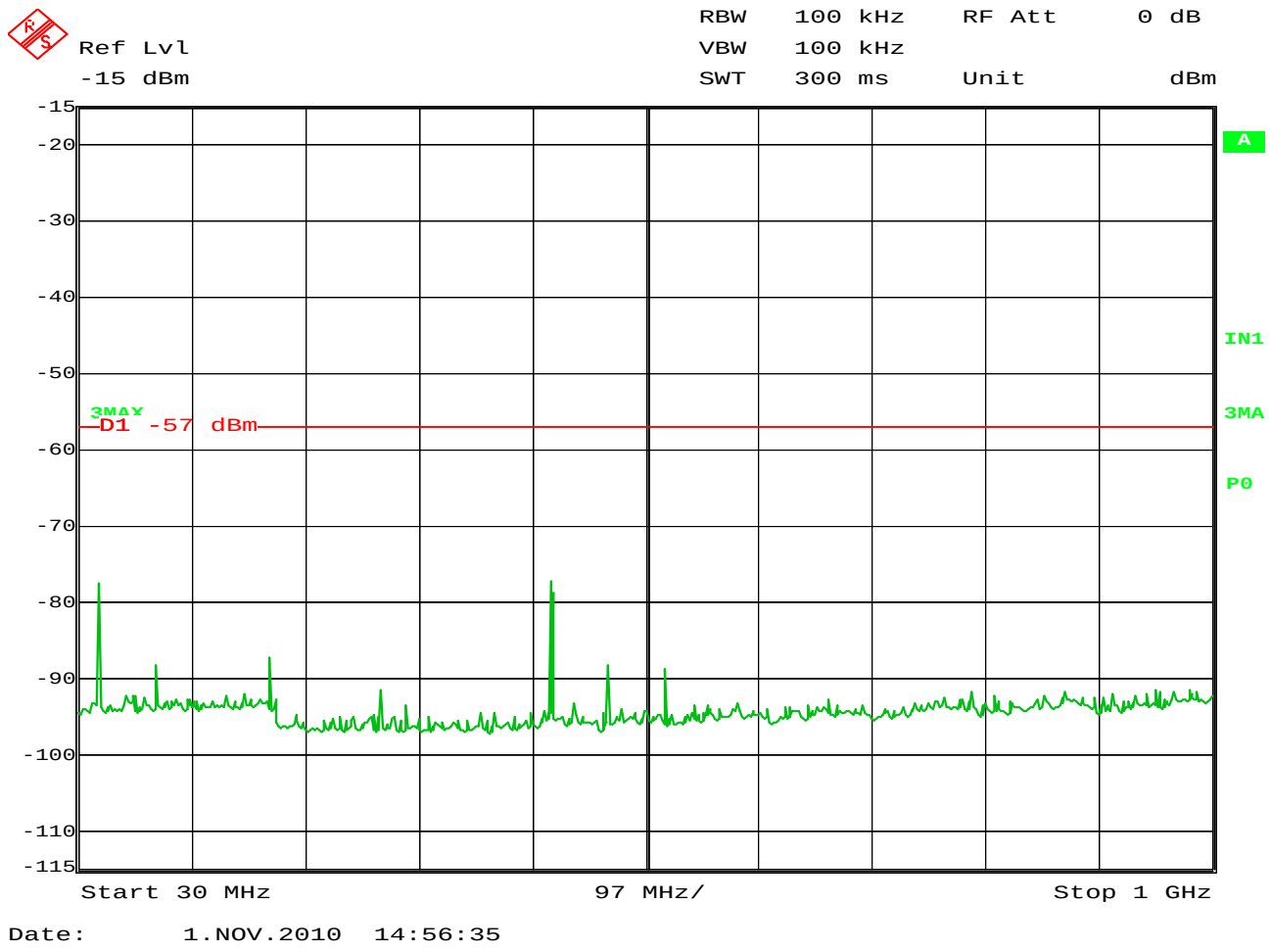
MANUFACTURER	:Free Wave Technologies
MODEL NUMBER	:LRS400S-C-1
SERIAL NUMBER	:none assigned
TEST MODE	:Receive at 417MHz
TEST PARAMETERS	:Antenna Conducted
NOTES	:
EQUIPMENT USED	:RBA1



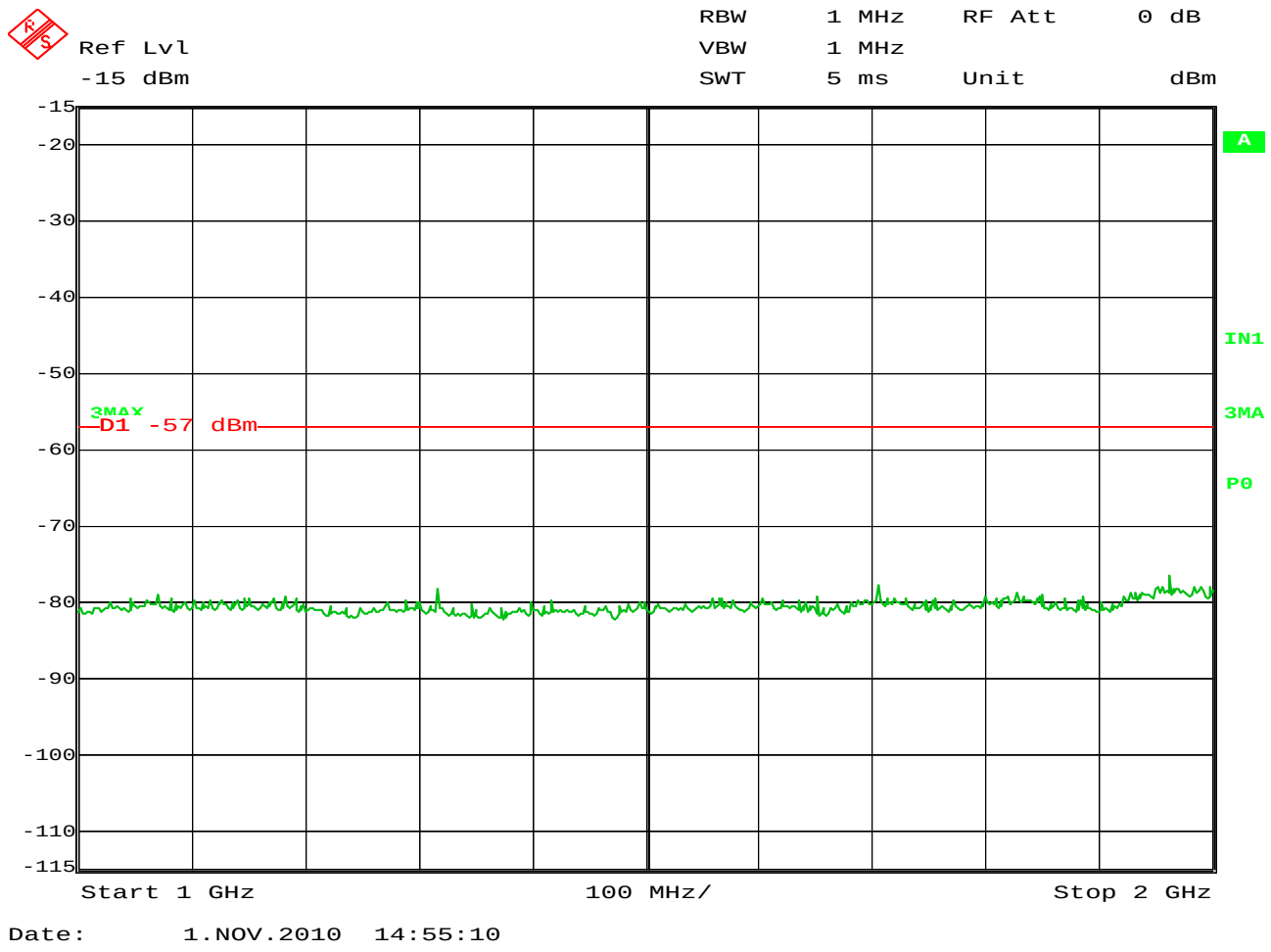
MANUFACTURER	:Free Wave Technologies
MODEL NUMBER	:LRS400S-C-2
SERIAL NUMBER	:none assigned
TEST MODE	:Receive at 410MHz
TEST PARAMETERS	:Antenna Conducted
NOTES	:
EQUIPMENT USED	:RBA1



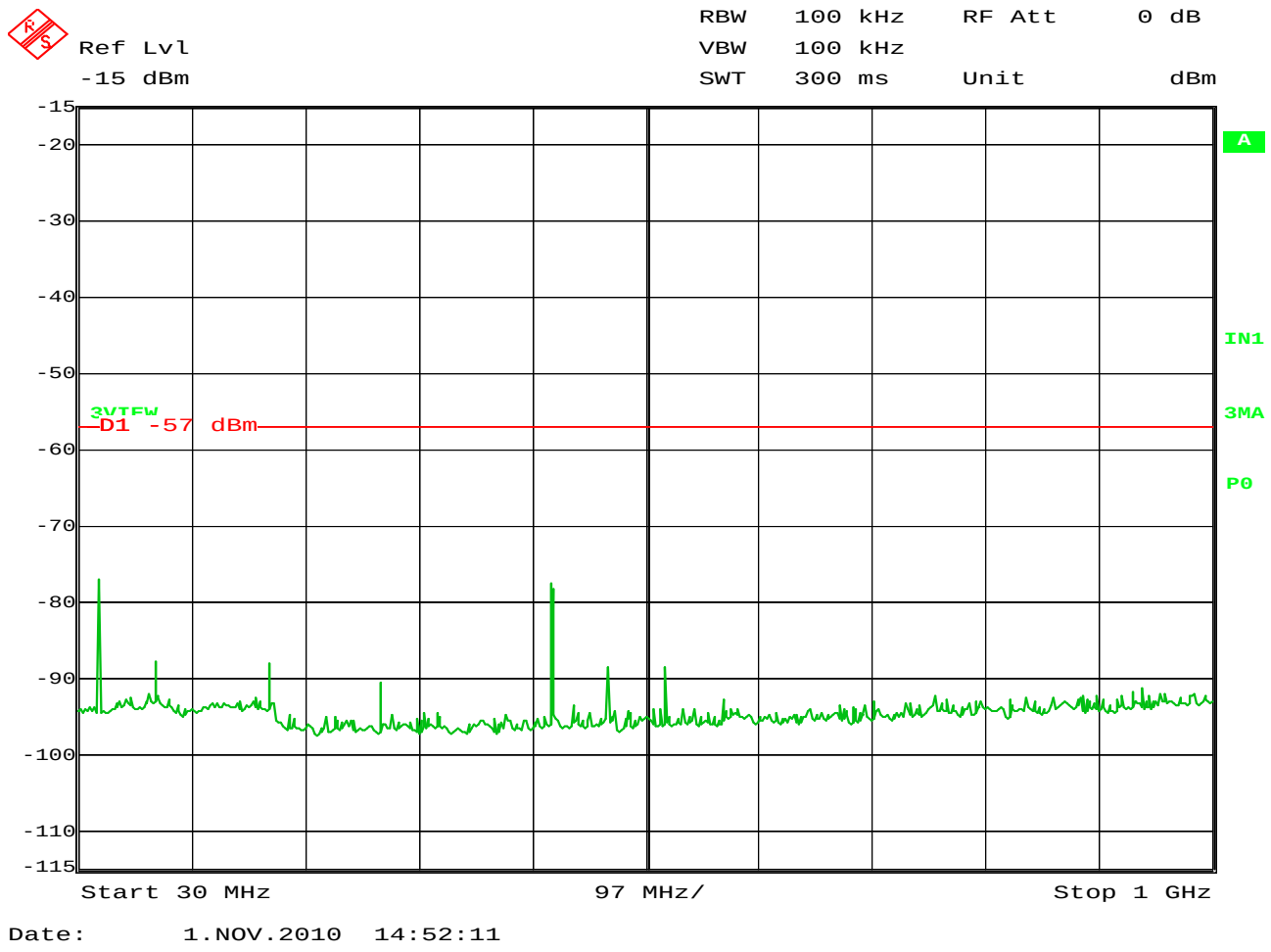
MANUFACTURER	:Free Wave Technologies
MODEL NUMBER	:LRS400S-C-2
SERIAL NUMBER	:none assigned
TEST MODE	:Receive at 410MHz
TEST PARAMETERS	:Antenna Conducted
NOTES	:
EQUIPMENT USED	:RBA1



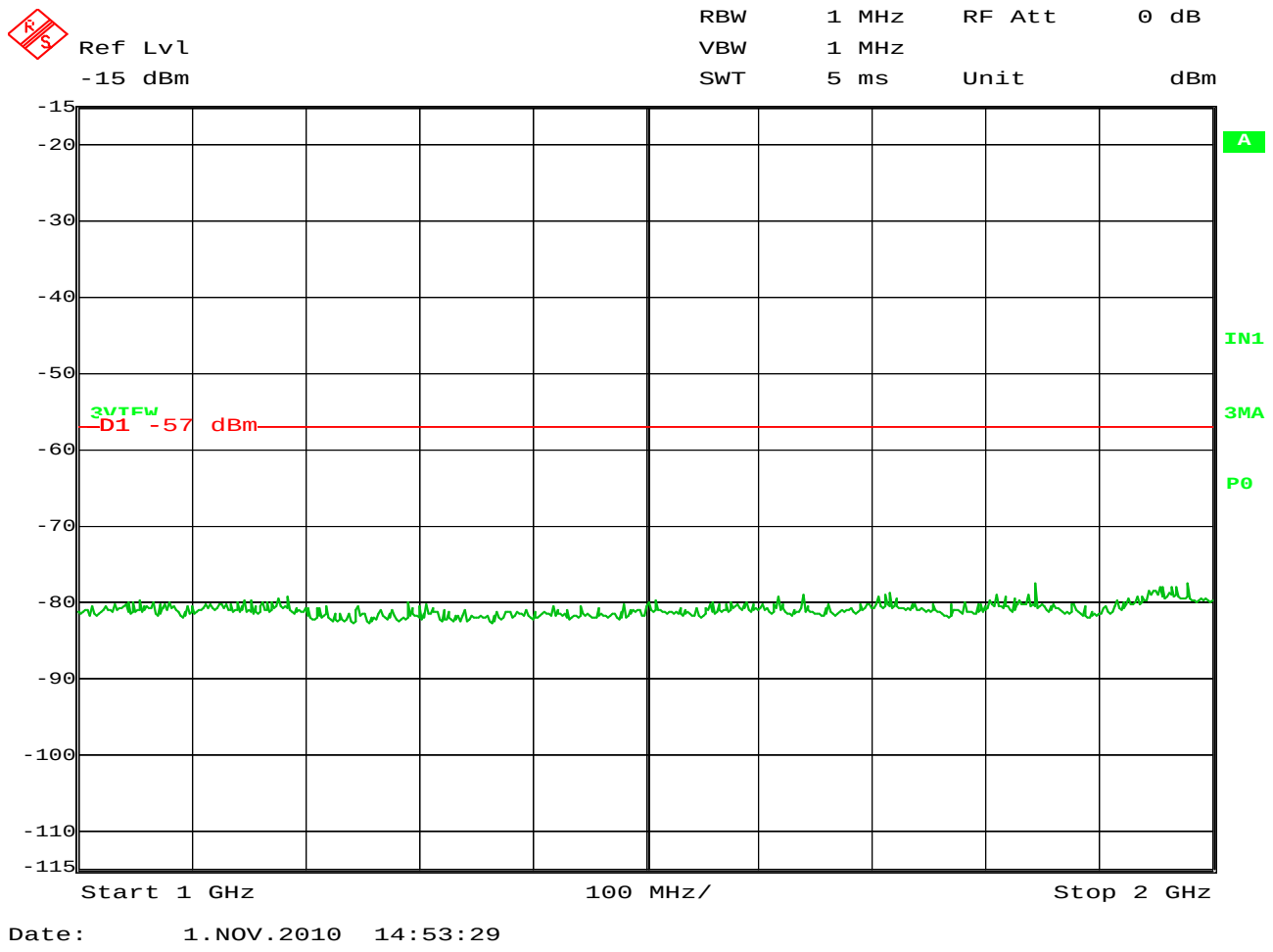
MANUFACTURER	:Free Wave Technologies
MODEL NUMBER	:LRS400S-C-2
SERIAL NUMBER	:none assigned
TEST MODE	:Receive at 417MHz
TEST PARAMETERS	:Antenna Conducted
NOTES	:
EQUIPMENT USED	:RBA1



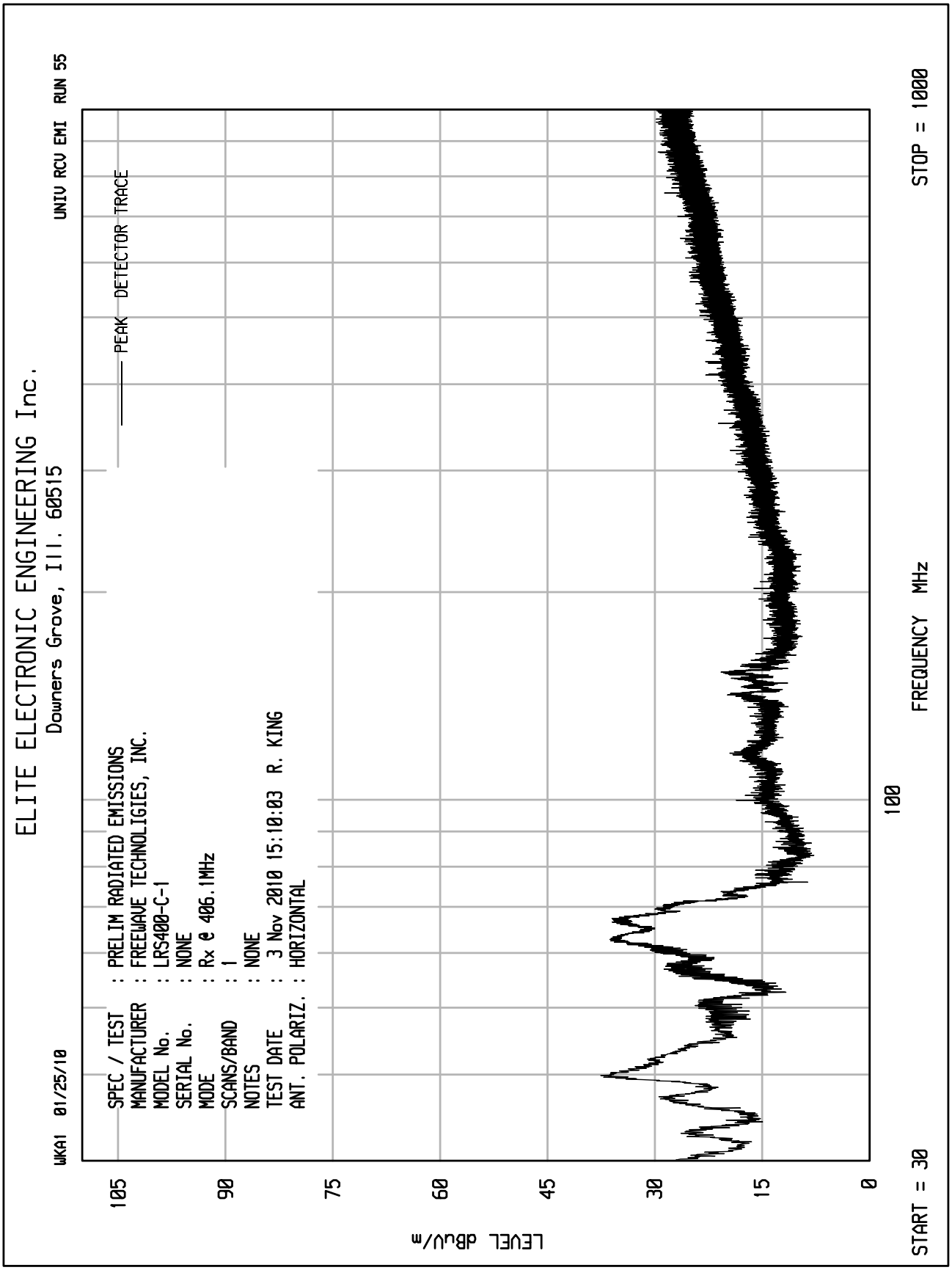
MANUFACTURER	: Free Wave Technologies
MODEL NUMBER	: LRS400S-C-2
SERIAL NUMBER	: none assigned
TEST MODE	: Recive at 417MHz
TEST PARAMETERS	: Antenna Conducted
NOTES	:
EQUIPMENT USED	:RBA1

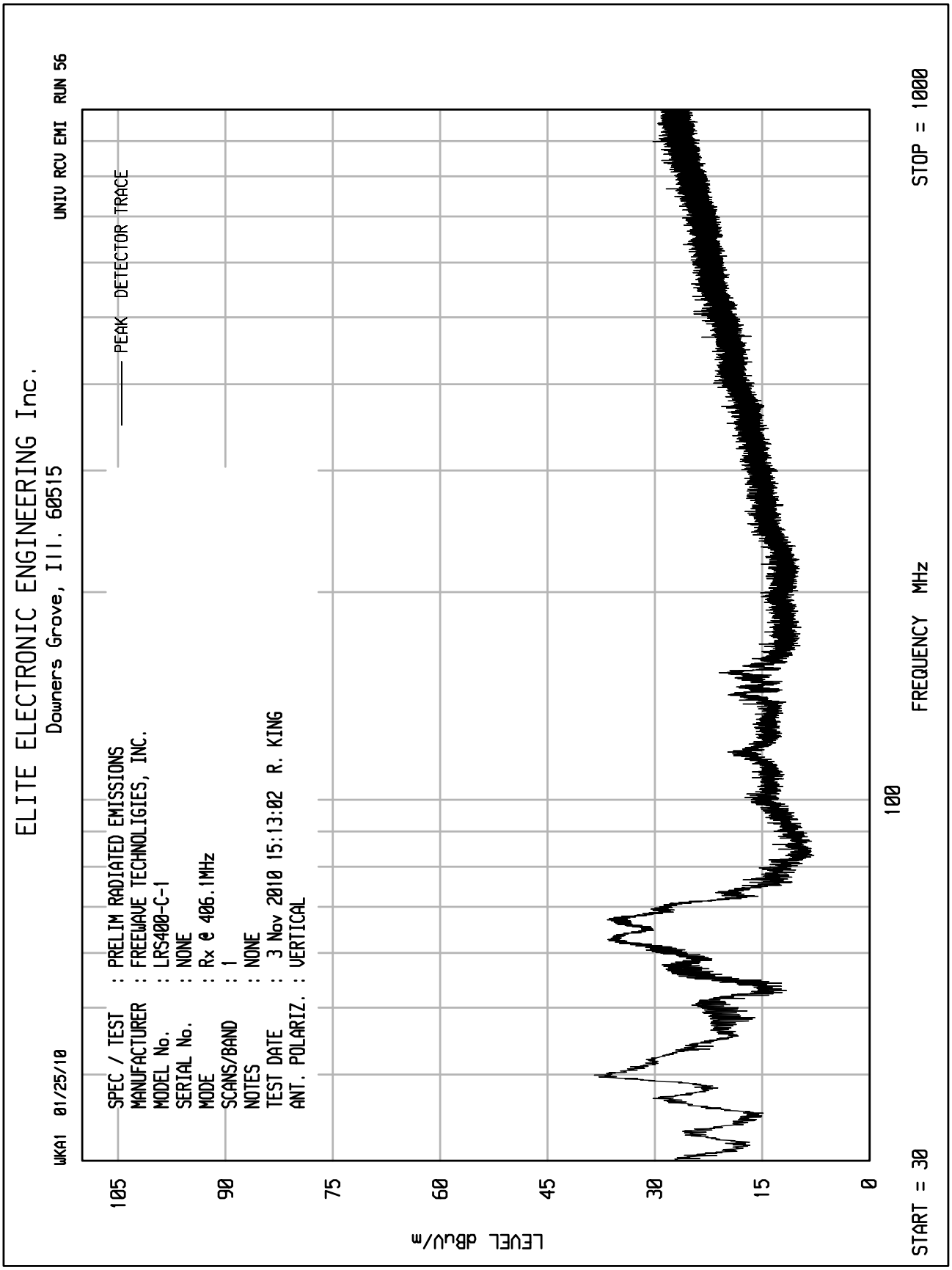


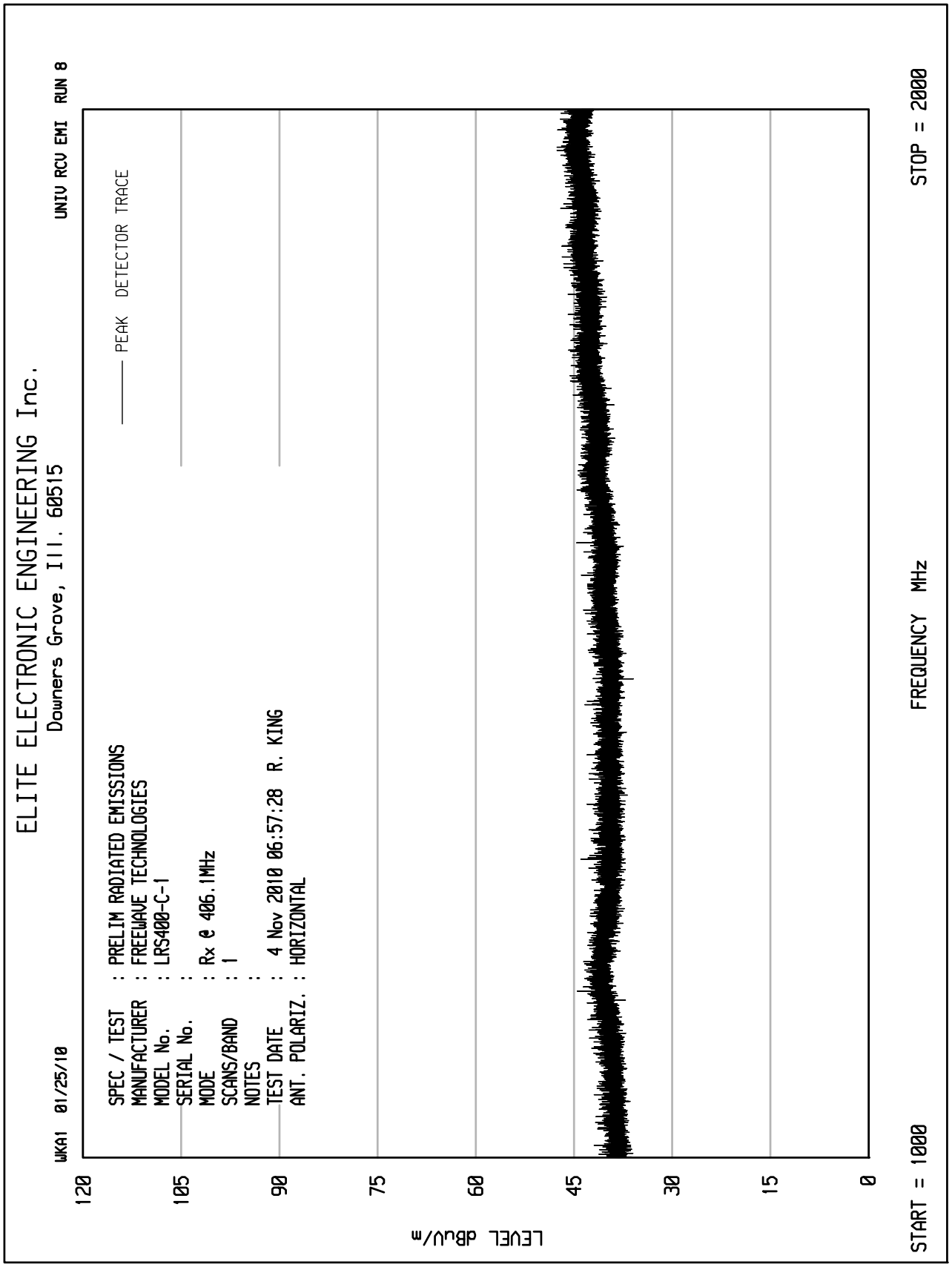
MANUFACTURER	:Free Wave Technologies
MODEL NUMBER	:LRS400S-C-2
SERIAL NUMBER	:none assigned
TEST MODE	:Receive at 430MHz
TEST PARAMETERS	:Antenna Conducted
NOTES	:
EQUIPMENT USED	:RBA1

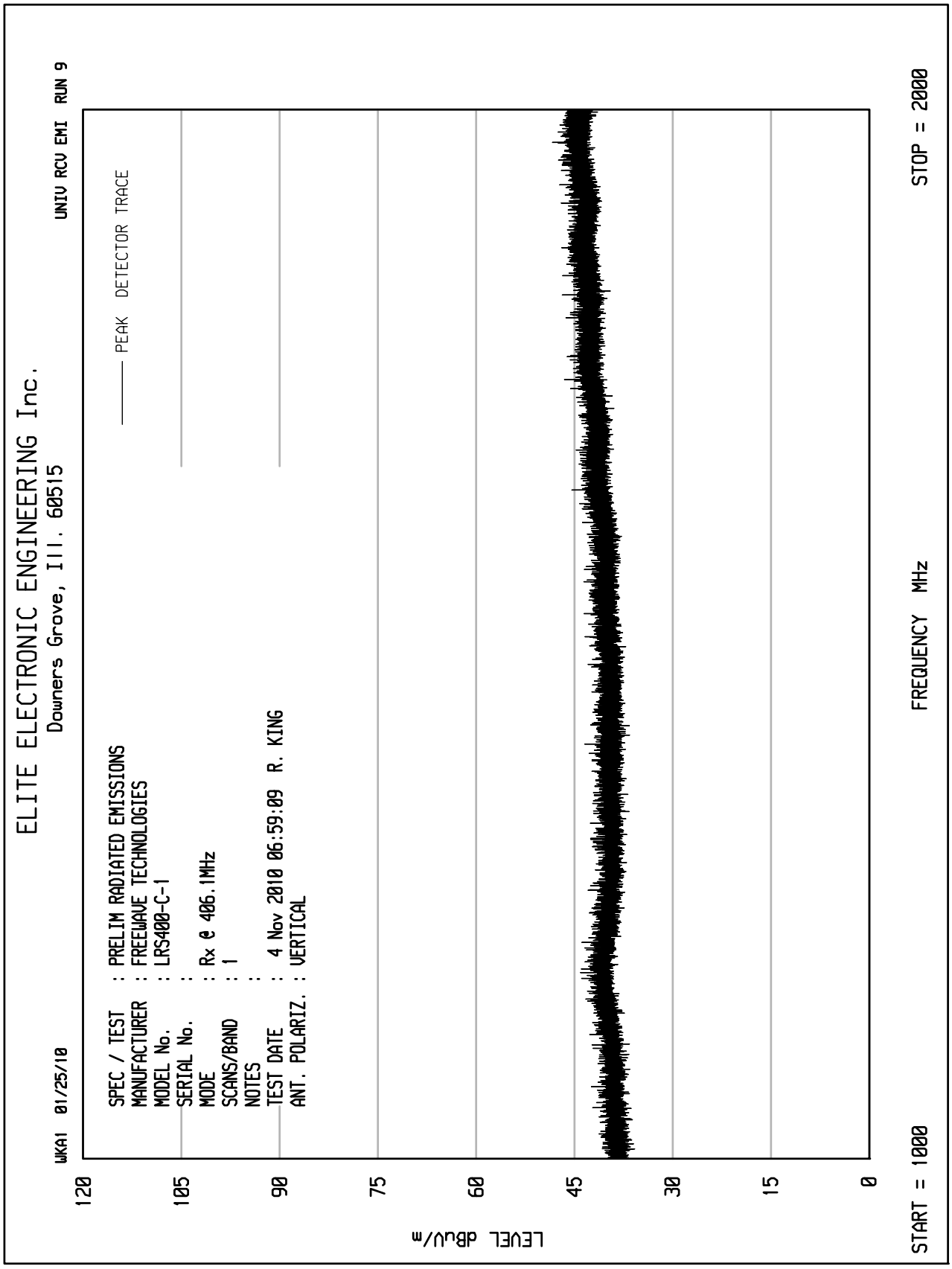


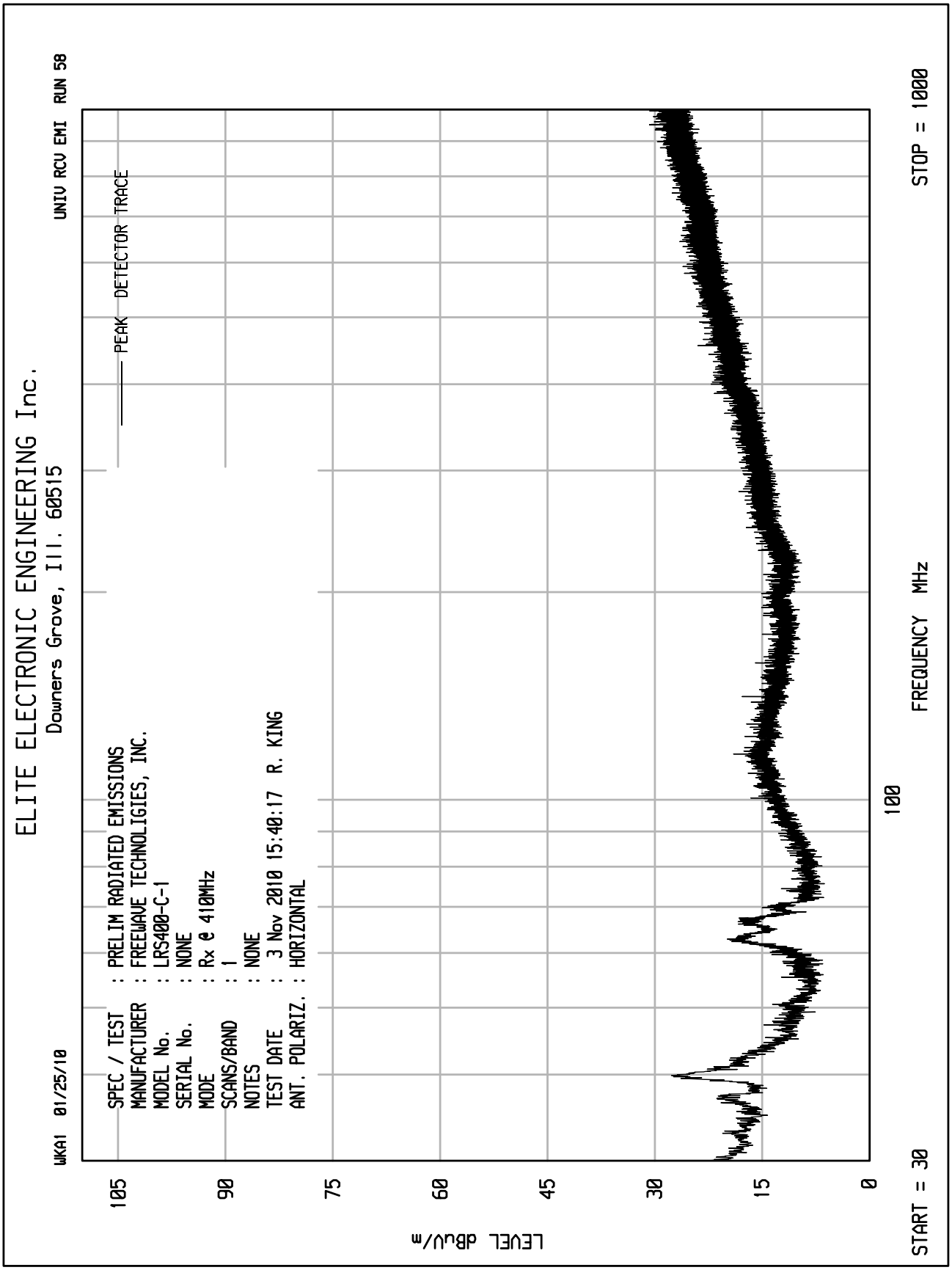
MANUFACTURER	:Free Wave Technologies
MODEL NUMBER	:LRS400S-C-2
SERIAL NUMBER	:none assigned
TEST MODE	:Receive at 430MHz
TEST PARAMETERS	:Antenna Conducted
NOTES	:
EQUIPMENT USED	:RBA1

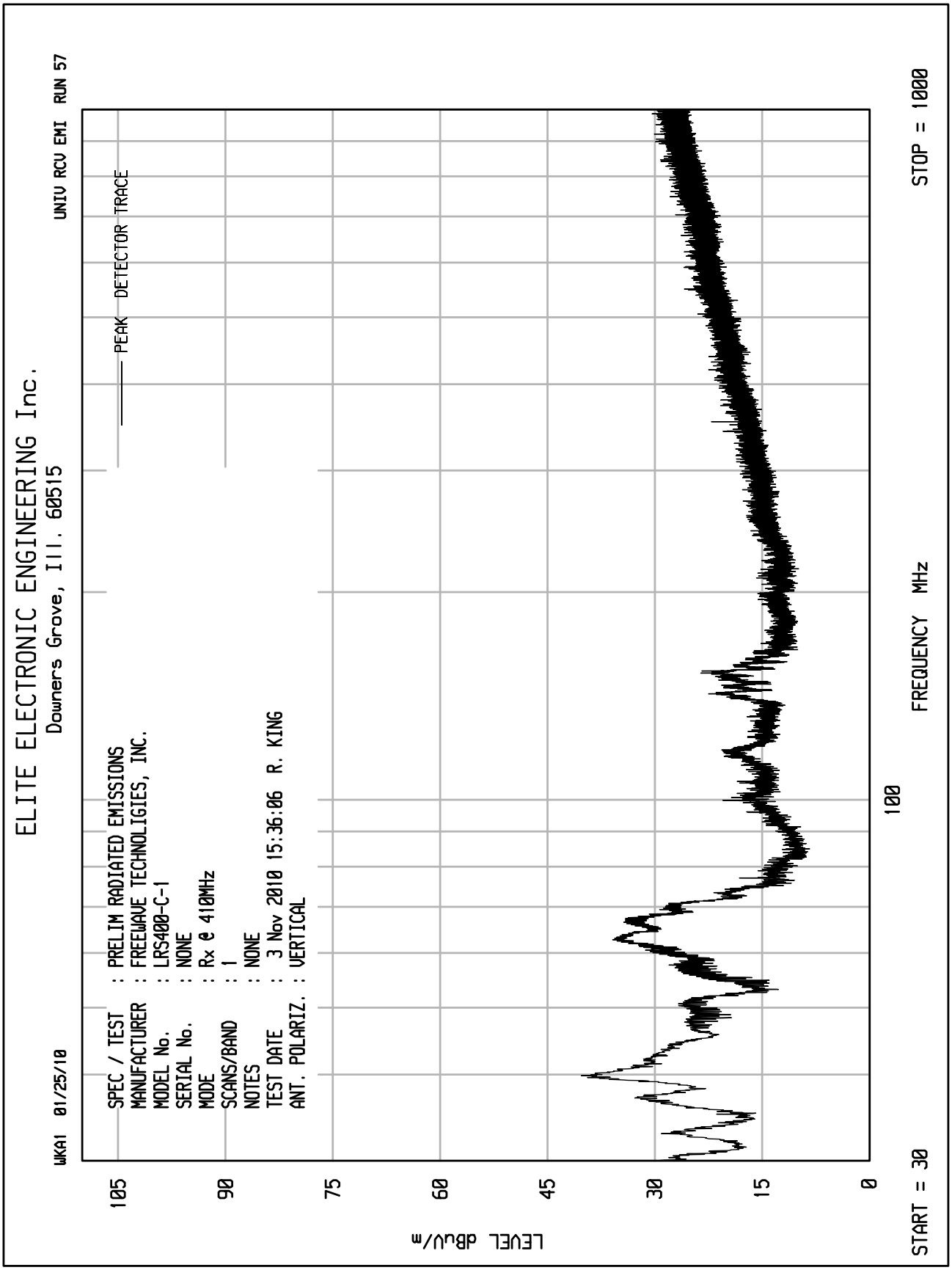

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 55
WKA1 01/25/10
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : FREEWAVE TECHNOLIGIES, INC.
MODEL No. : LRS400-C-1
SERIAL No. : NONE
MODE : Rx @ 406.1MHz
SCANS/BAND : 1
NOTES : NONE
TEST DATE : 3 Nov 2010 15:10:03 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000

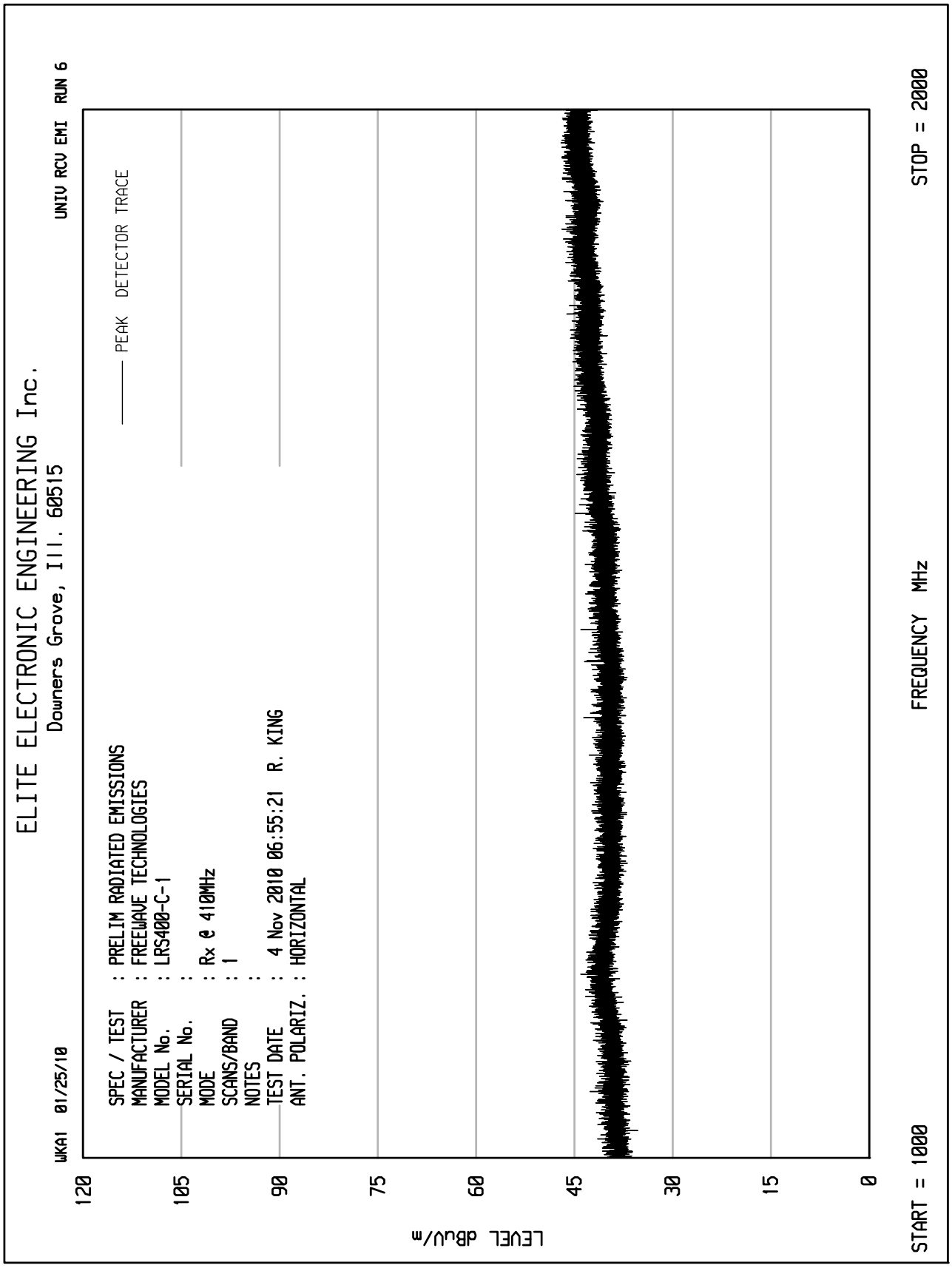

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 56
WKAI 01/25/10
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : FREEWAVE TECHNOLIGIES, INC.
MODEL No. : LRS400-C-1
SERIAL No. : NONE
MODE : Rx @ 406.1MHz
SCANS/BAND : 1
NOTES : NONE
TEST DATE : 3 Nov 2010 15:13:02 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000

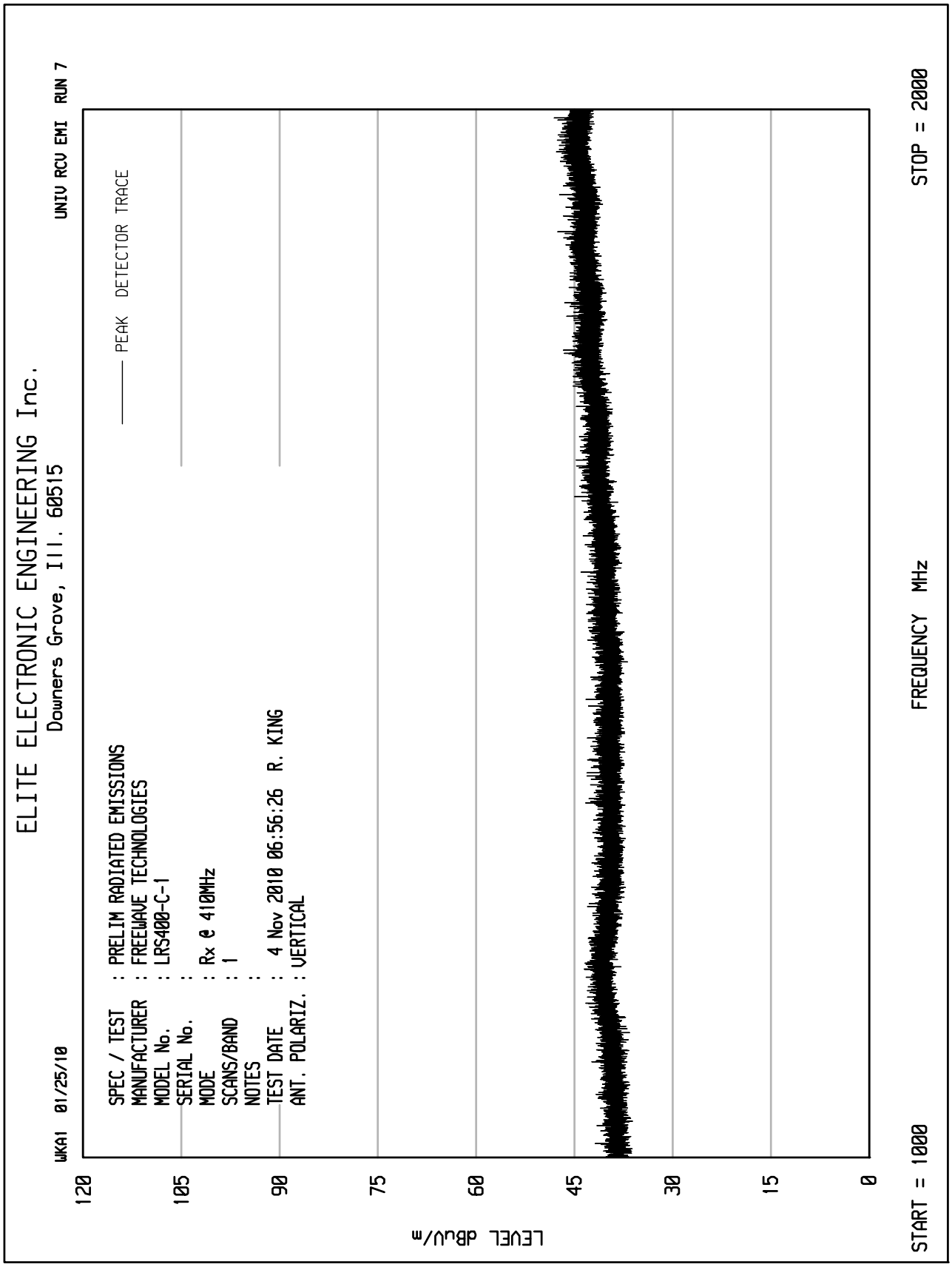

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 8
WKA1 01/25/10
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : FREEWAVE TECHNOLOGIES
MODEL No. : LRS400-C-1
SERIAL No. :
MODE : Rx @ 406.1MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 4 Nov 2010 06:57:28 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 2000

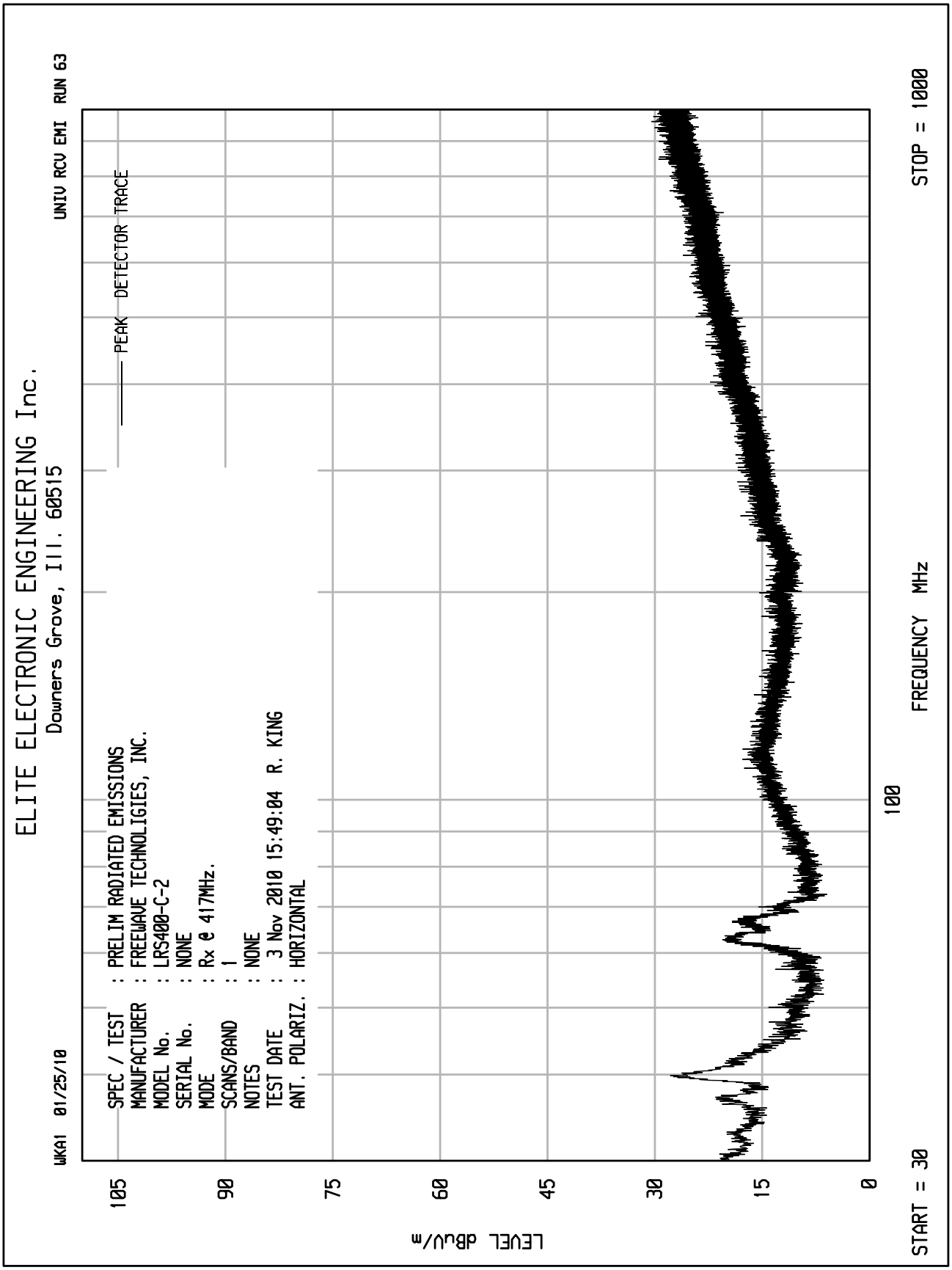

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 9
WKAI 01/25/10
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : FREEWAVE TECHNOLOGIES
MODEL No. : LRS400-C-1
SERIAL No. :
MODE : Rx @ 406.1MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 4 Nov 2010 06:59:09 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 2000

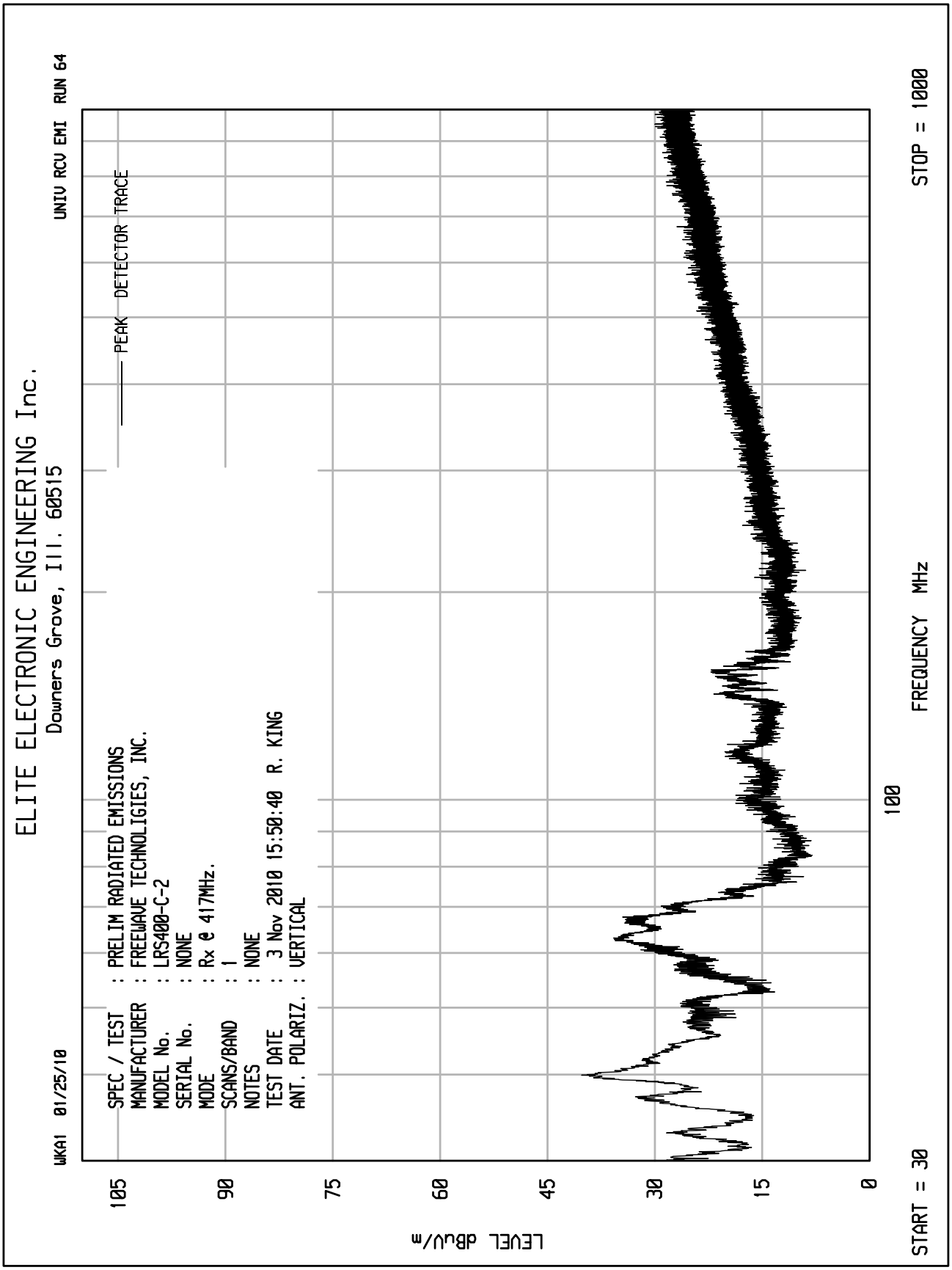

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 58
WKA1 01/25/10
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : FREEWAVE TECHNOLIGIES, INC.
MODEL No. : LRS400-C-1
SERIAL No. : NONE
MODE : Rx @ 410MHz
SCANS/BAND : 1
NOTES : NONE
TEST DATE : 3 Nov 2010 15:40:17 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000

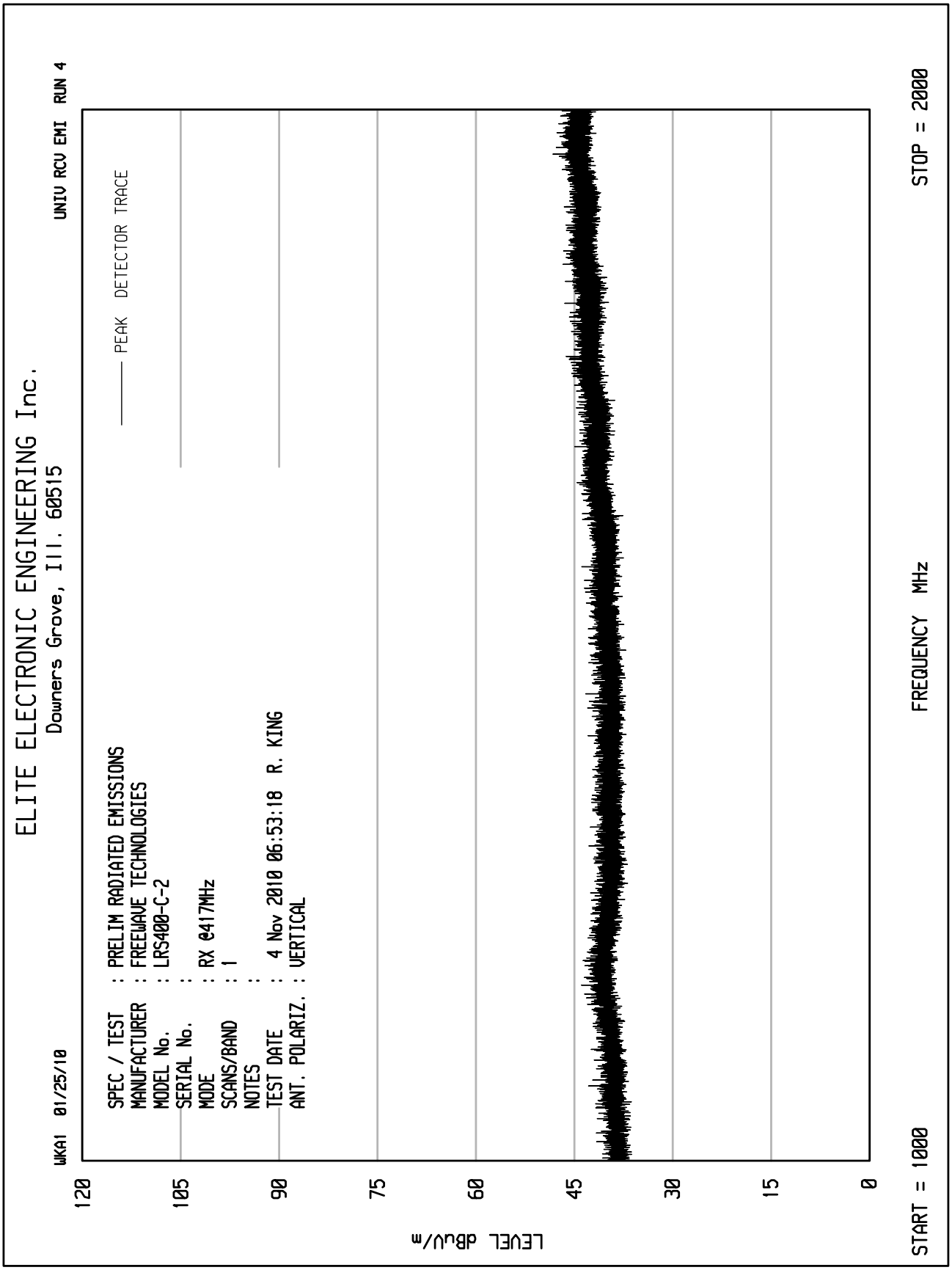

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 57
WKA1 01/25/10
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : FREEWAVE TECHNOLIGIES, INC.
MODEL No. : LRS400-C-1
SERIAL No. : NONE
MODE : Rx @ 410MHz
SCANS/BAND : 1
NOTES : NONE
TEST DATE : 3 Nov 2010 15:36:06 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000

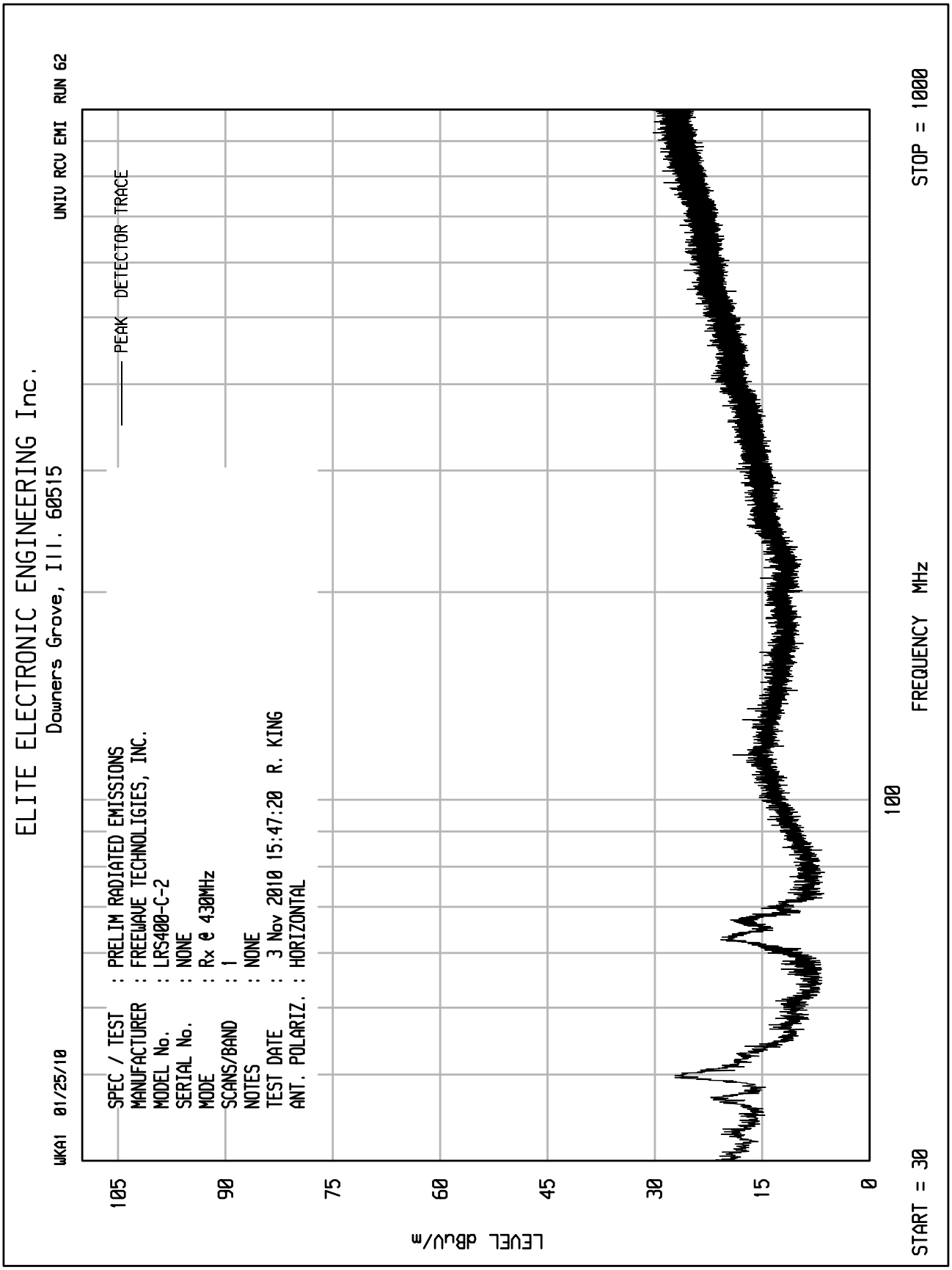

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 6
WKAI 01/25/10
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : FREEWAVE TECHNOLOGIES
MODEL No. : LRS400-C-1
SERIAL No. :
MODE : Rx @ 410MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 4 Nov 2010 06:55:21 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 2000

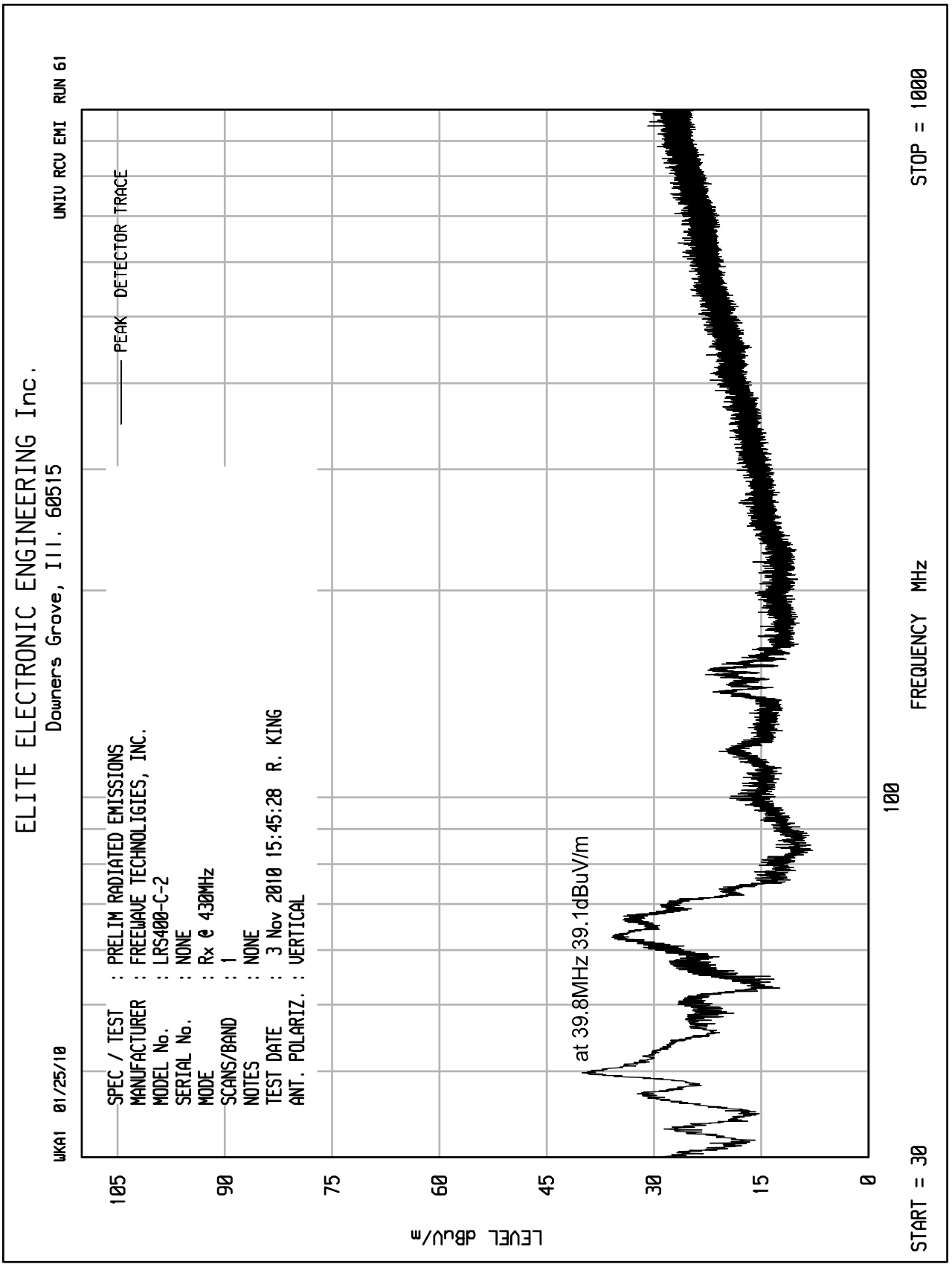

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 7
WKAI 01/25/10
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : FREEWAVE TECHNOLOGIES
MODEL No. : LRS400-C-1
SERIAL No. :
MODE : Rx @ 410MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 4 Nov 2010 06:56:26 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 2000

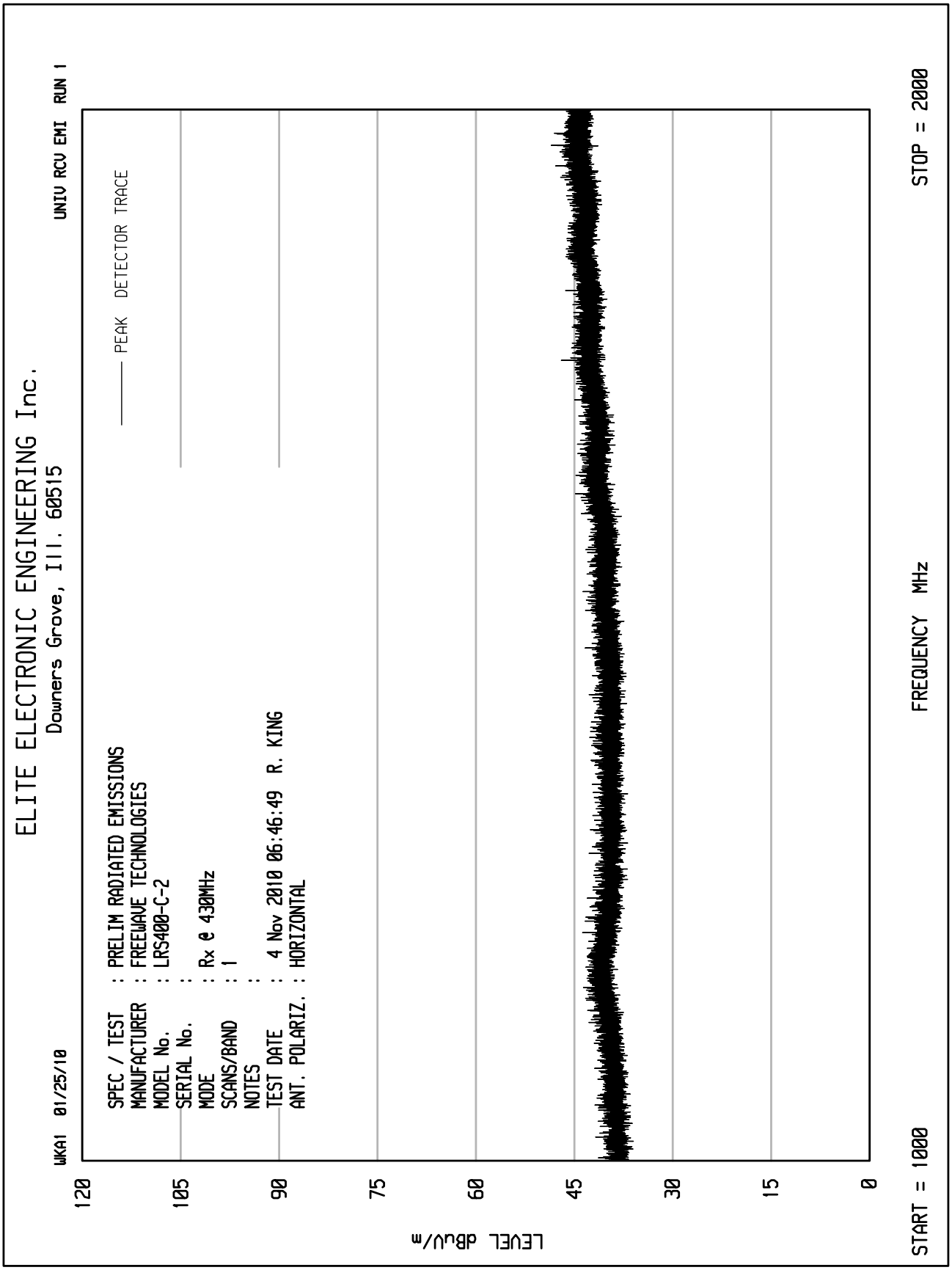

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 63
WKA1 01/25/10
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : FREEWAVE TECHNOLIGIES, INC.
MODEL No. : LRS400-C-2
SERIAL No. : NONE
MODE : Rx @ 417MHz.
SCANS/BAND : 1
NOTES : NONE
TEST DATE : 3 Nov 2010 15:49:04 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000

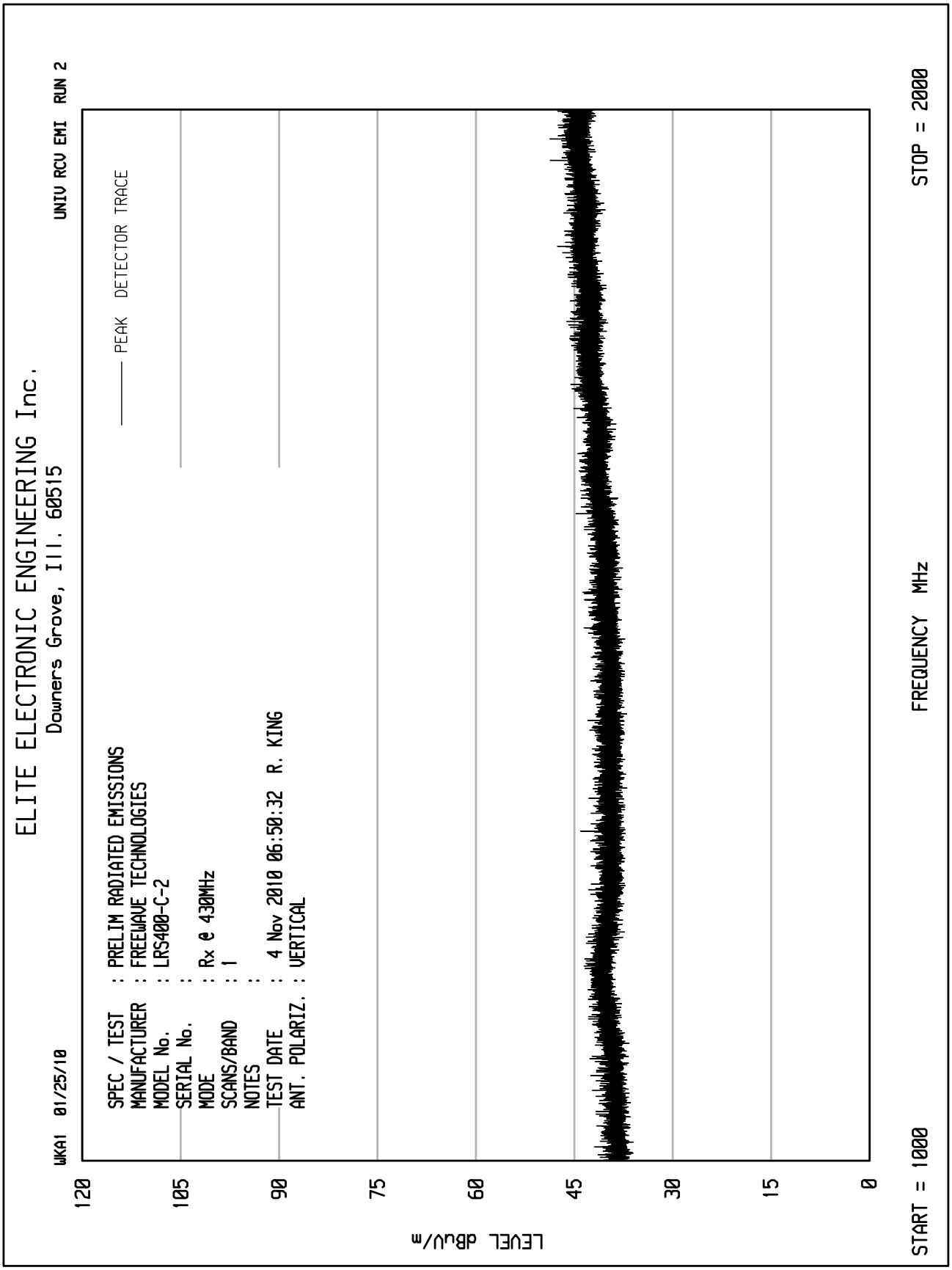

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 64
WKA1 01/25/10
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : FREEWAVE TECHNOLIGIES, INC.
MODEL No. : LRS400-C-2
SERIAL No. : NONE
MODE : Rx @ 417MHz.
SCANS/BAND : 1
NOTES : NONE
TEST DATE : 3 Nov 2010 15:50:40 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 4
WKAI 01/25/10
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : FREEWAVE TECHNOLOGIES
MODEL No. : LRS400-C-2
SERIAL No. :
MODE : RX @417MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 4 Nov 2010 06:53:18 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 = 2000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 62
WKA1 01/25/10
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : FREEWAVE TECHNOLIGIES, INC.
MODEL No. : LRS400-C-2
SERIAL No. : NONE
MODE : Rx @ 430MHz
SCANS/BAND : 1
NOTES : NONE
TEST DATE : 3 Nov 2010 15:47:20 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 61
WKAI 01/25/10
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : FREEWAVE TECHNOLIGIES, INC.
MODEL No. : LRS400-C-2
SERIAL No. : NONE
MODE : Rx @ 430MHz
SCANS/BAND : 1
NOTES : NONE
TEST DATE : 3 Nov 2010 15:45:28 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
at 39.8MHz 39.1dBuV/m
LEVEL dBuV/m
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 1
WKAI 01/25/10
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : FREEWAVE TECHNOLOGIES
MODEL No. : LRS400-C-2
SERIAL No. :
MODE : Rx @ 430MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 4 Nov 2010 06:46:49 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 = 2000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 2
WKAI 01/25/10
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : FREEWAVE TECHNOLOGIES
MODEL No. : LRS400-C-2
SERIAL No. :
MODE : Rx @ 430MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 4 Nov 2010 06:50:32 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 = 2000

MANUFACTURER : Free Wave Technologies
MODEL : LRS400S-C-1
SPECIFICATION : FCC-15B Spurious Radiated Emissions
DATE : October 28, 2010
NOTES : Receive at 406.1MHz
: Test Distance is 3 meters

Freq (MHz)	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Total dBuV/m at 3 M	Total uV/m at 3M	Limit uV/m at 3M	Margin (dB)
361.1	H	-2.4	*	1.5	15.8	14.9	5.6	200.0	-31.1
361.1	V	-2.4	*	1.5	15.8	14.9	5.6	200.0	-31.1
722.2	H	-1.0	*	2.2	20.0	21.1	11.4	200.0	-24.9
722.2	V	-1.0	*	2.2	20.0	21.1	11.4	200.0	-24.9
1083.3	H	10.8	*	2.6	25.2	38.6	85.0	500.0	-15.4
1083.3	V	10.8	*	2.6	25.2	38.6	85.0	500.0	-15.4
1444.4	H	11.1	*	3.1	25.9	40.1	101.1	500.0	-13.9
1444.4	V	11.1	*	3.1	25.9	40.1	101.1	500.0	-13.9
1805.5	H	11.4	*	3.4	27.4	42.3	129.6	500.0	-11.7
1805.5	V	11.4	*	3.4	27.4	42.3	129.6	500.0	-11.7

V – Vertical, H - Horizontal

Total (dBuV/m) = Meter Reading + Cable Factor + Antenna Factor

Checked BY Richard E. King :

Richard E. King

MANUFACTURER : Free Wave Technologies
MODEL : LRS400S-C-1
SPECIFICATION : FCC-15B Spurious Radiated Emissions
DATE : October 28, 2010
NOTES : Receive at 410MHz
: Test Distance is 3 meters

Freq (MHz)	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Total dBuV/m at 3 M	Total uV/m at 3M	Limit uV/m at 3M	Margin (dB)
365.0	H	-2.4	*	1.5	15.8	14.9	5.6	200.0	-31.1
365.0	V	-2.4	*	1.5	15.8	14.9	5.6	200.0	-31.1
730.0	H	-1.0	*	2.2	20.2	21.4	11.7	200.0	-24.7
730.0	V	-1.0	*	2.2	20.2	21.4	11.7	200.0	-24.7
1095.0	H	10.8	*	2.6	25.2	38.6	85.4	500.0	-15.3
1095.0	V	10.8	*	2.6	25.2	38.6	85.4	500.0	-15.3
1460.0	H	11.2	*	3.1	25.9	40.2	102.8	500.0	-13.7
1460.0	V	11.2	*	3.1	25.9	40.2	102.8	500.0	-13.7
1825.0	H	11.5	*	3.5	27.5	42.4	132.6	500.0	-11.5
1825.0	V	11.5	*	3.5	27.5	42.4	132.6	500.0	-11.5

V – Vertical, H - Horizontal

Total (dBuV/m) = Meter Reading + Cable Factor + Antenna Factor

Checked BY Richard E. King :

Richard E. King

MANUFACTURER : Free Wave Technologies
MODEL : LRS400S-C-2
SPECIFICATION : FCC-15B Spurious Radiated Emissions
DATE : October 28, 2010
NOTES : Receive at 417MHz
: Test Distance is 3 meters

Freq (MHz)	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Total dBuV/m at 3 M	Total uV/m at 3M	Limit uV/m at 3M	Margin (dB)
372.0	H	-2.5	*	1.5	15.7	14.8	5.5	200.0	-31.3
372.0	V	-2.5	*	1.5	15.7	14.8	5.5	200.0	-31.3
744.0	H	-1.0	*	2.2	20.4	21.6	12.0	200.0	-24.5
744.0	V	-1.0	*	2.2	20.4	21.6	12.0	200.0	-24.5
1116.0	H	10.7	*	2.7	25.3	38.6	85.2	500.0	-15.4
1116.0	V	10.7	*	2.7	25.3	38.6	85.2	500.0	-15.4
1488.0	H	10.9	*	3.1	26.0	40.0	100.2	500.0	-14.0
1488.0	V	10.9	*	3.1	26.0	40.0	100.2	500.0	-14.0
1860.0	H	11.4	*	3.5	27.6	42.5	133.7	500.0	-11.5
1860.0	V	11.4	*	3.5	27.6	42.5	133.7	500.0	-11.5

V – Vertical, H - Horizontal

Total (dBuV/m) = Meter Reading + Cable Factor + Antenna Factor

Checked BY Richard E. King :

Richard E. King

MANUFACTURER : Free Wave Technologies
MODEL : LRS400S-C-2
SPECIFICATION : FCC-15B Spurious Radiated Emissions
DATE : October 28, 2010
NOTES : Receive at 430MHz
: Test Distance is 3 meters

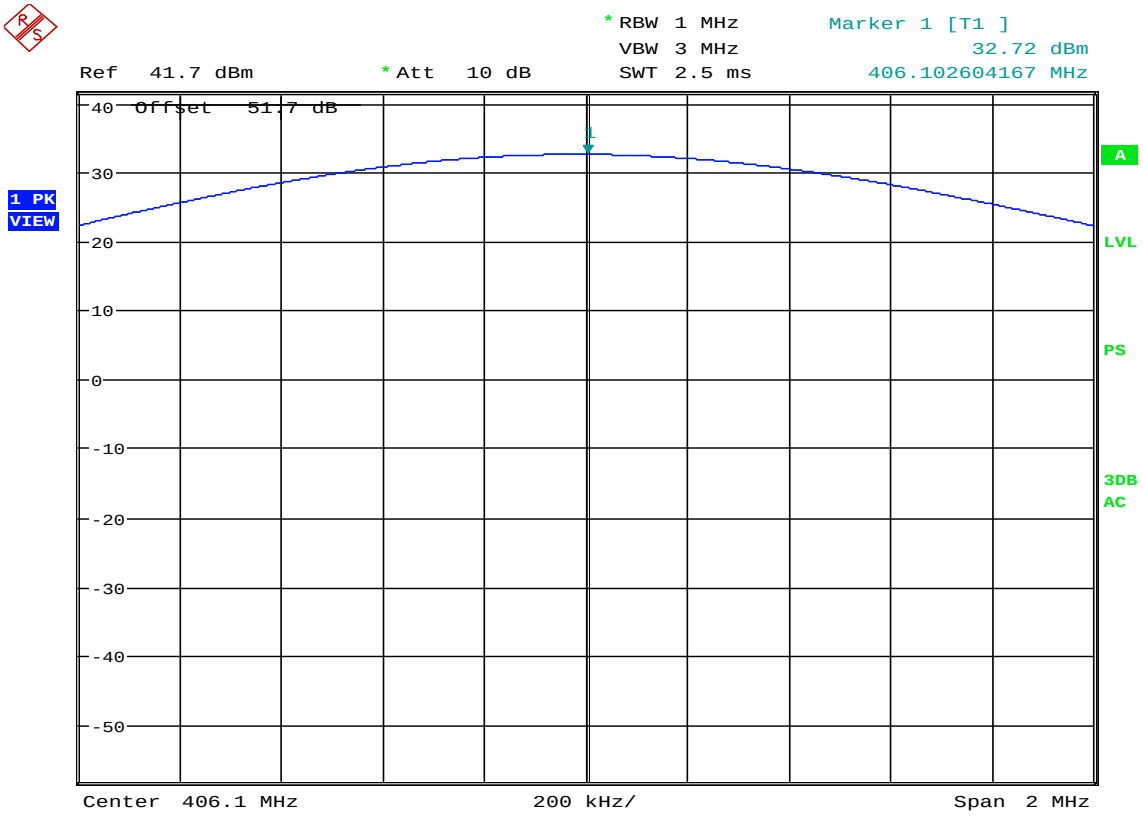
Freq (MHz)	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Total dBuV/m at 3 M	Total uV/m at 3M	Limit uV/m at 3M	Margin (dB)
385.00	H	-2.4	*	1.6	16.2	15.4	5.9	200.0	-30.7
385.00	V	-2.4	*	1.6	16.2	15.4	5.9	200.0	-30.7
770.00	H	-1.0	*	2.2	20.8	22.0	12.6	200.0	-24.0
770.00	V	-1.0	*	2.2	20.8	22.0	12.6	200.0	-24.0
1155.00	H	10.6	*	2.7	25.3	38.7	85.7	500.0	-15.3
1155.00	V	10.6	*	2.7	25.3	38.7	85.7	500.0	-15.3
1540.00	H	11.1	*	3.2	26.2	40.5	105.9	500.0	-13.5
1540.00	V	11.1	*	3.2	26.2	40.5	105.9	500.0	-13.5
1925.00	H	11.4	*	3.6	27.9	42.8	138.6	500.0	-11.1
1925.00	V	11.4	*	3.6	27.9	42.8	138.6	500.0	-11.1

V – Vertical, H - Horizontal

Total (dBuV/m) = Meter Reading + Cable Factor + Antenna Factor

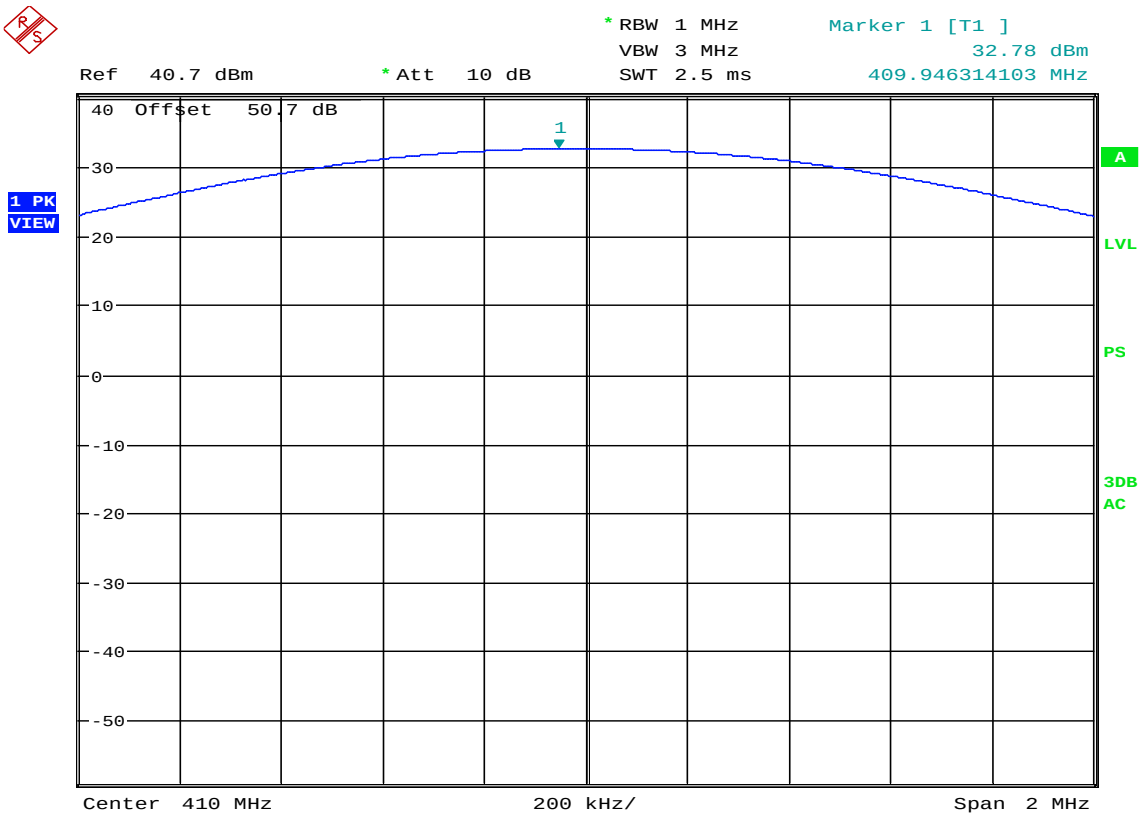
Checked BY Richard E. King :

Richard E. King



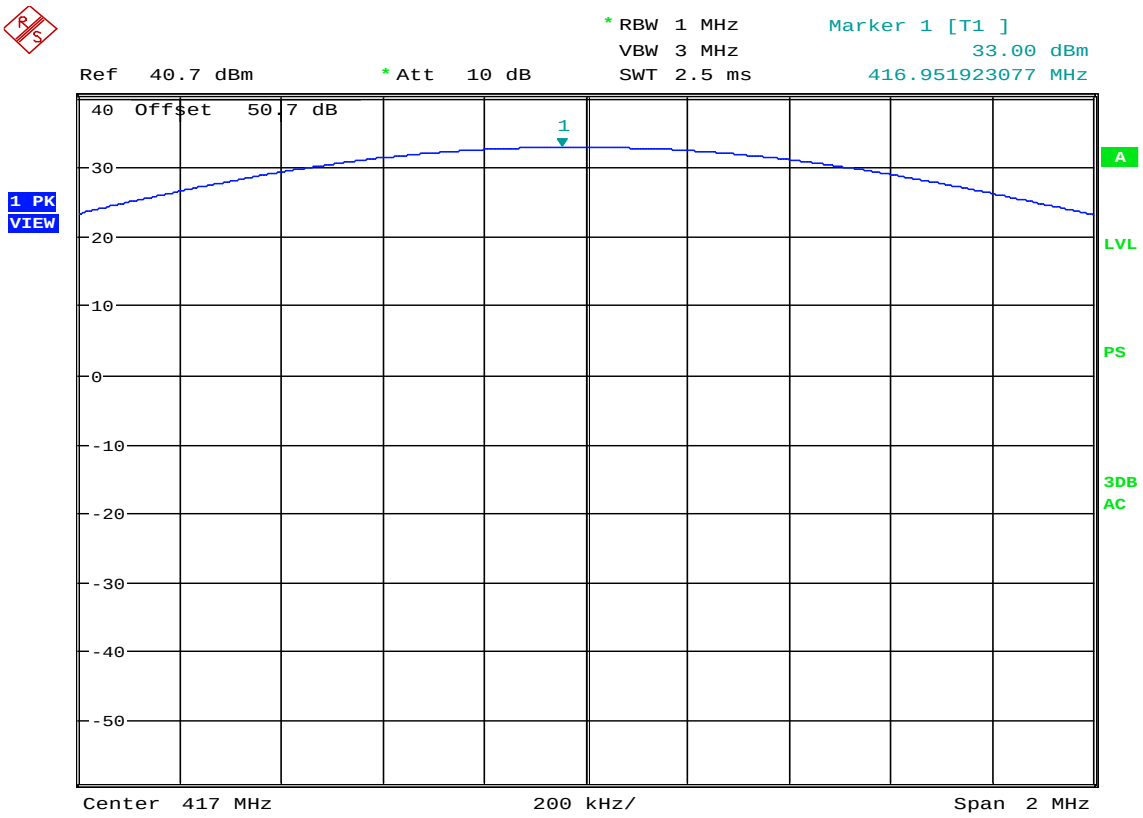
Date: 2.NOV.2010 14:47:00

MANUFACTURER	:Free Wave Technologies
MODEL NUMBER	:LRS400S-C
TEST MODE	:Transmit at 406.1MHz
TEST PARAMETERS	:Power Output
NOTES	:2 Watt Setting
EQUIPMENT USED	:RBD1, T1D2, T2S1, T2DM



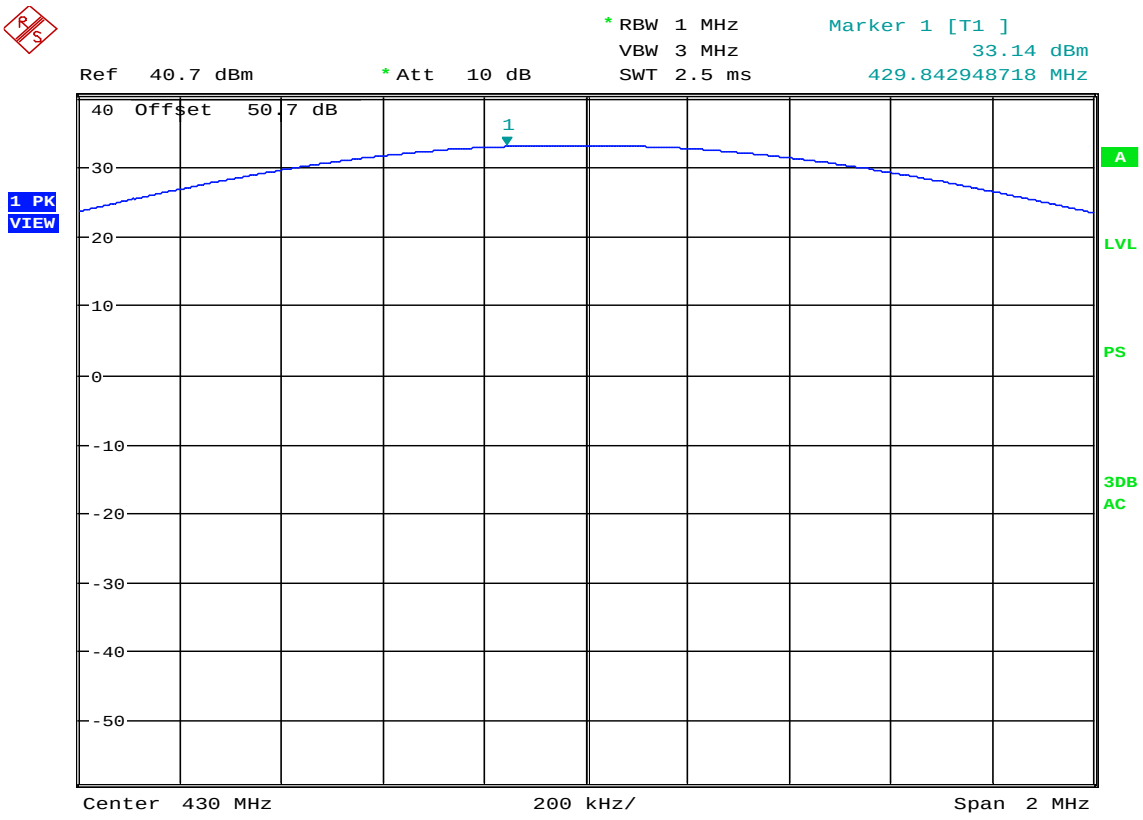
Date: 1.NOV.2010 16:25:40

MANUFACTURER	:Free Wave Technologies
MODEL NUMBER	:LRS400S-C
TEST MODE	:Transmit at 410MHz
TEST PARAMETERS	:Power Output
NOTES	:2 Watt Setting
EQUIPMENT USED	:RBD1, T1D2, T2S1, T2DM



Date: 1.NOV.2010 16:29:04

MANUFACTURER	:Free Wave Technologies
MODEL NUMBER	:LRS400S-C
TEST MODE	:Transmit at 417MHz
TEST PARAMETERS	:Power Output
NOTES	:2 Watt Setting
EQUIPMENT USED	:RBD1, T1D2, T2S1, T2DM



Date: 1.NOV.2010 16:31:12

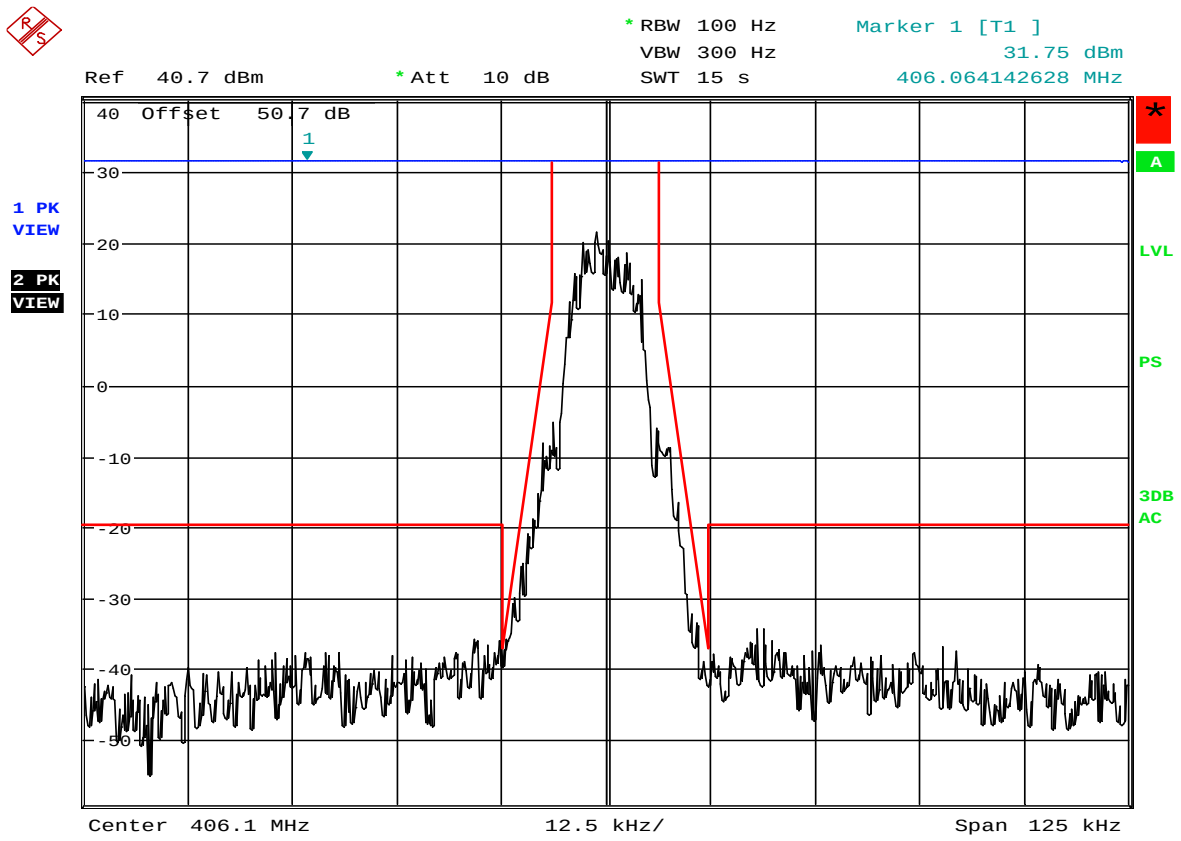
MANUFACTURER	:Free Wave Technologies
MODEL NUMBER	:LRS400S-C
TEST MODE	:Transmit at 430MHz
TEST PARAMETERS	:Power Output
NOTES	:2 Watt Setting
EQUIPMENT USED	:RBD1, T1D2, T2S1, T2DM

MANUFACTURER : Free Wave Technologies
MODEL : LRS400S-C
SPECIFICATION : FCC 90.205 Power Output
DATE : November 1, 2010

Frequency MHz	Measured Output Power dBm	Measured Output Power Watts	Manufacturer's Rated Power Watts	Manufacturer's Rated Power + 20% Watts
406.1	32.72	1.9	2.0	2.4
410.0	32.78	1.9	2.0	2.4
417.0	33.0	2.0	2.0	2.4
430.0	33.14	2.1	2.0	2.4

Checked BY Richard E. King :

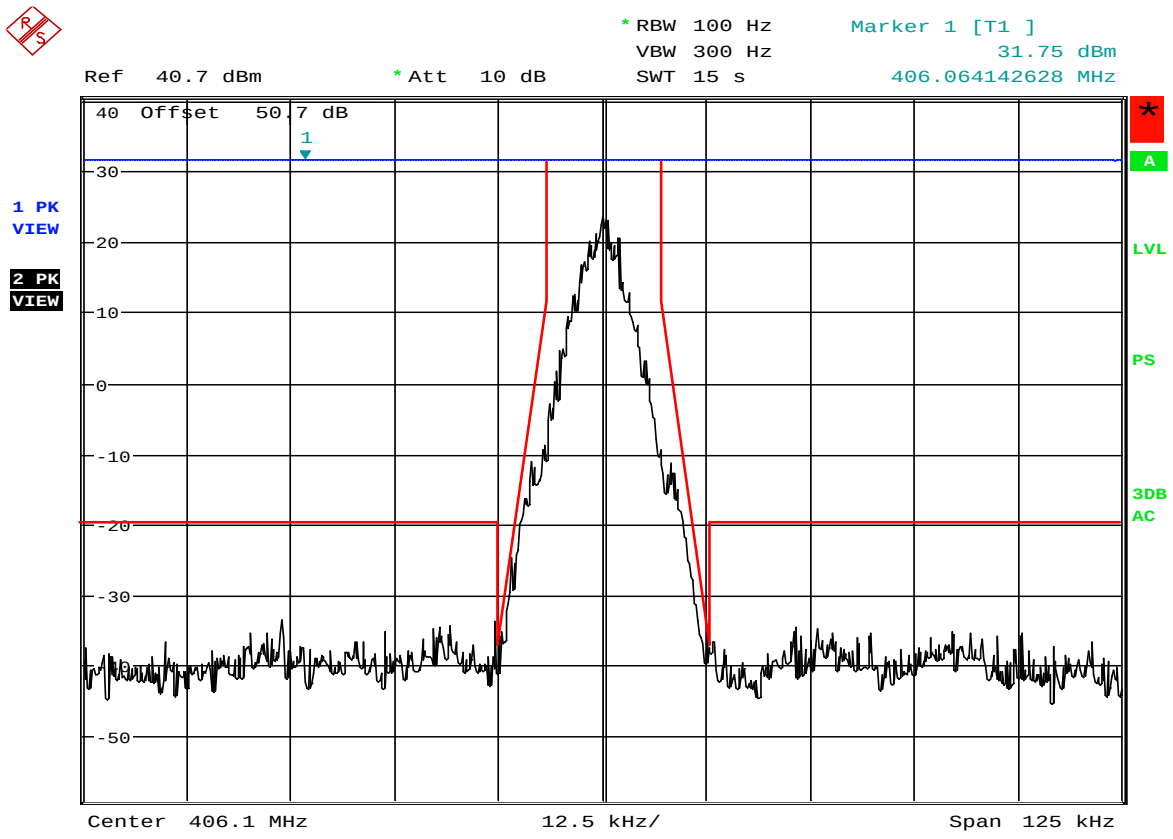
Richard E. King



Date: 2.NOV.2010 14:43:37

MANUFACTURER	:Free Wave Technologies
MODEL NUMBER	:LRS400S-C
TEST MODE	:Transmit at 406.1MHz
TEST PARAMETERS	:Occupied Bandwidth
NOTES	:2 WATT SETTING, 2 LEVEL GFSK
EQUIPMENT USED	:RBD1, T1D2, T2S1, T2DM

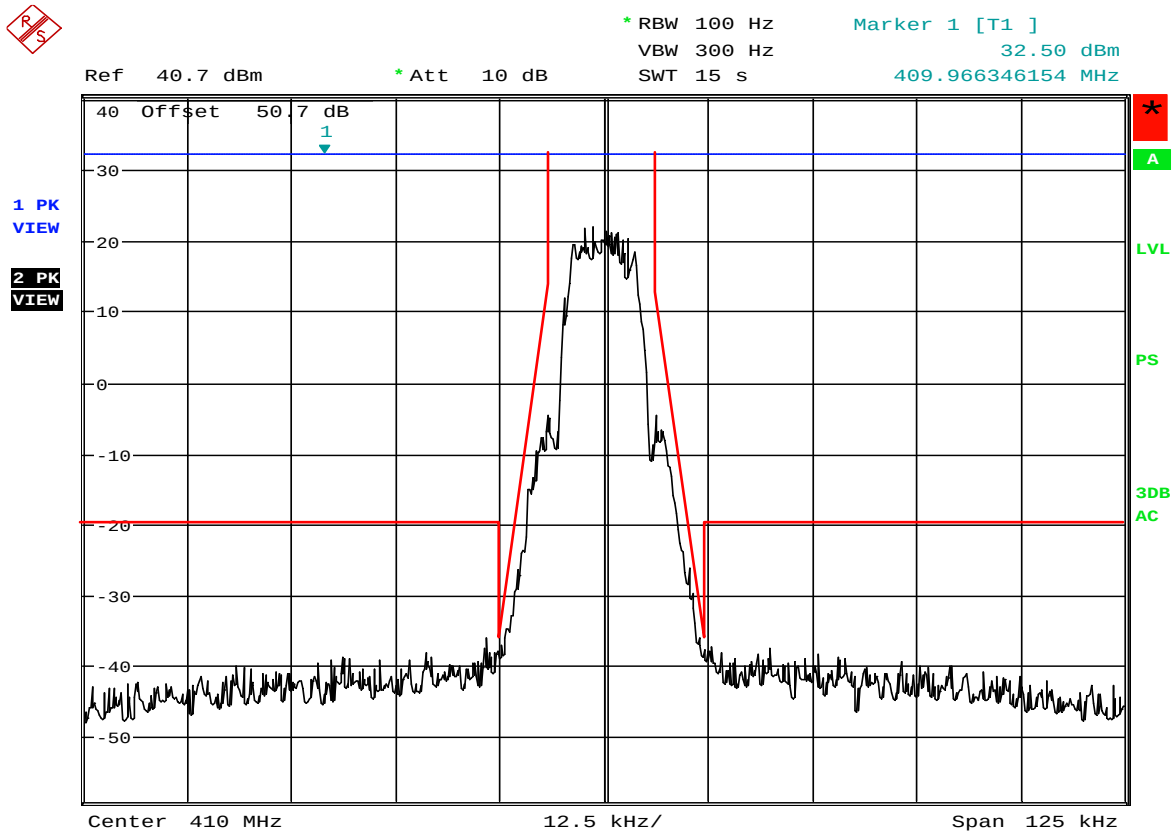
NOTES



Date: 2.NOV.2010 14:40:31

MANUFACTURER	:Free Wave Technologies
MODEL NUMBER	:LRS400S-C
TEST MODE	:TRANSMIT AT 406.1MHz
TEST PARAMETERS	:OCCUPIED BANDWIDTH
NOTES	:2 WATT SETTING, 4 LEVEL GFSK
EQUIPMENT USED	:RBD1, T1D2, T2S1, T2DM

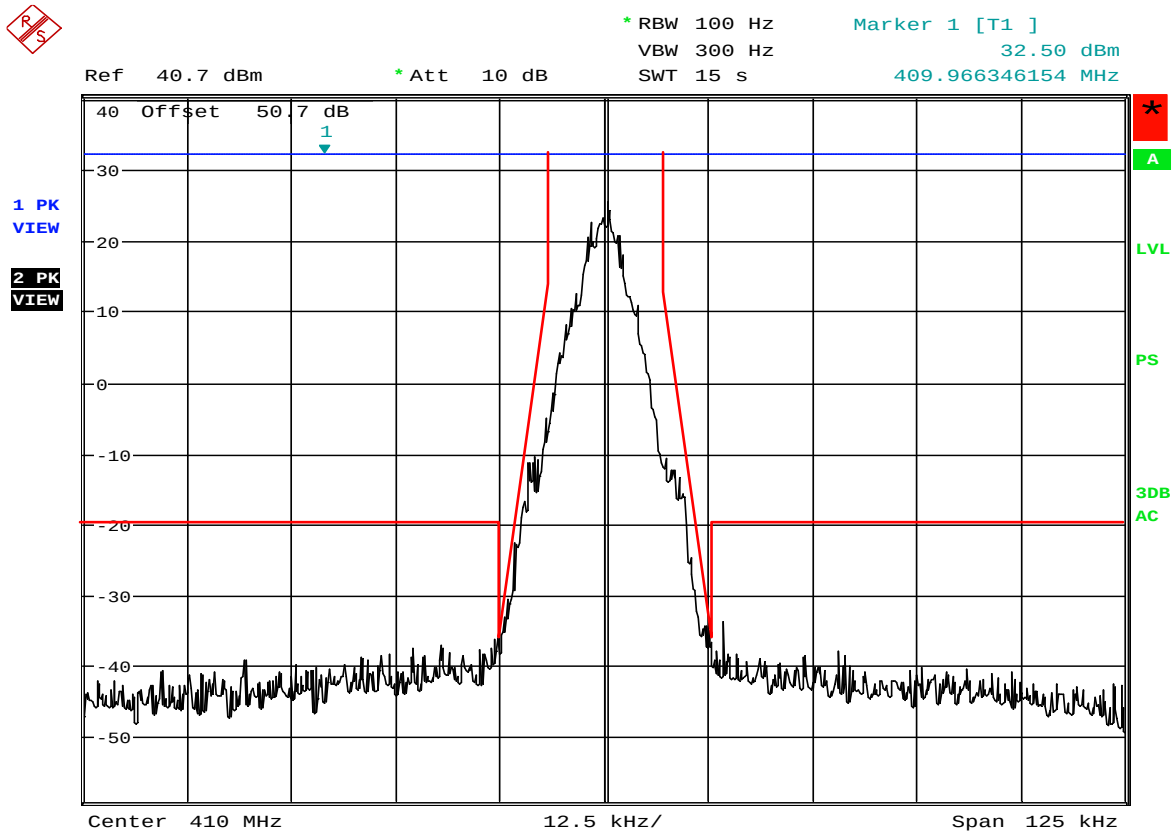
NOTES



Date: 1.NOV.2010 16:21:21

MANUFACTURER	:Free Wave Technologies
MODEL NUMBER	:LRS400S-C
TEST MODE	:TRANSMIT AT 410MHz
TEST PARAMETERS	:OCCUPIED BANDWIDTH
NOTES	:2 WATT SETTING, 2 LEVEL GFSK
EQUIPMENT USED	:RBD1, T1D2, T2S1, T2DM

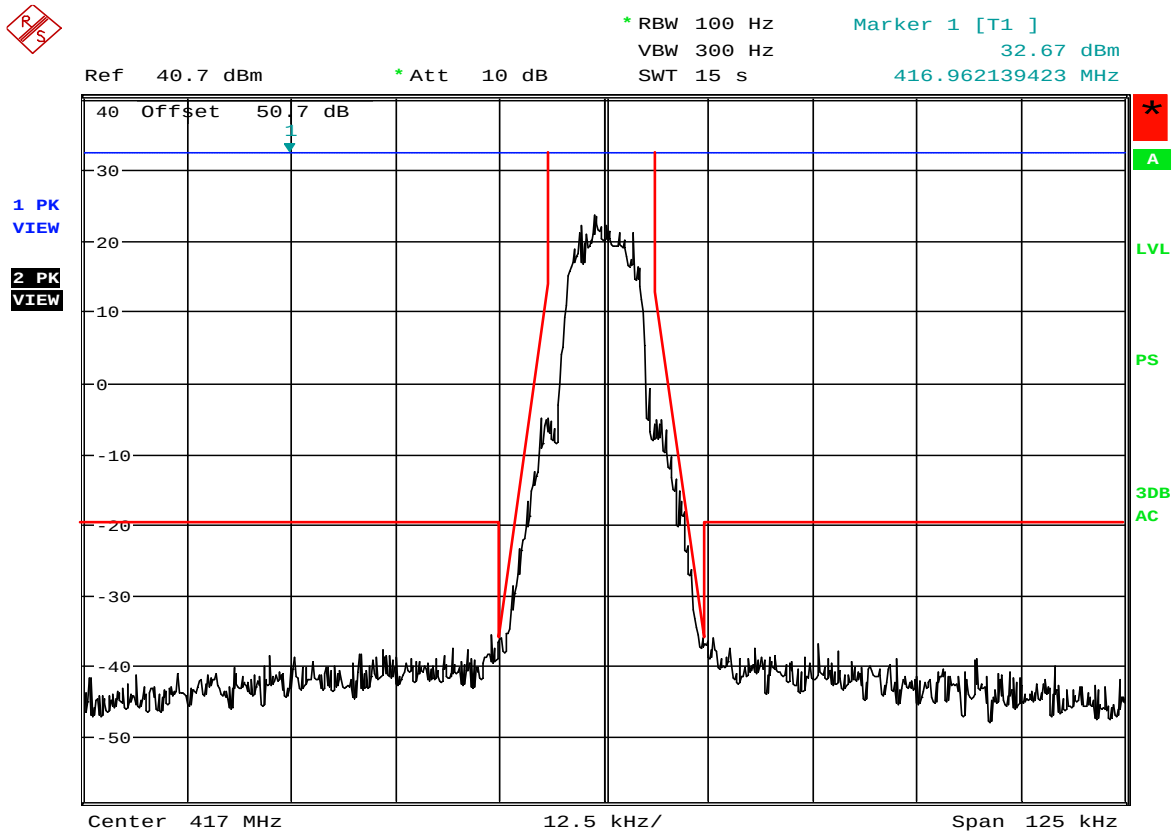
NOTES



Date: 1.NOV.2010 16:23:18

MANUFACTURER	:Free Wave Technologies
MODEL NUMBER	:LRS400S-C
TEST MODE	:TRANSMIT AT 410MHz
TEST PARAMETERS	:OCCUPIED BANDWIDTH
NOTES	:2 WATT SETTING, 4 LEVEL GFSK
EQUIPMENT USED	:RBD1, T1D2, T2S1, T2DM

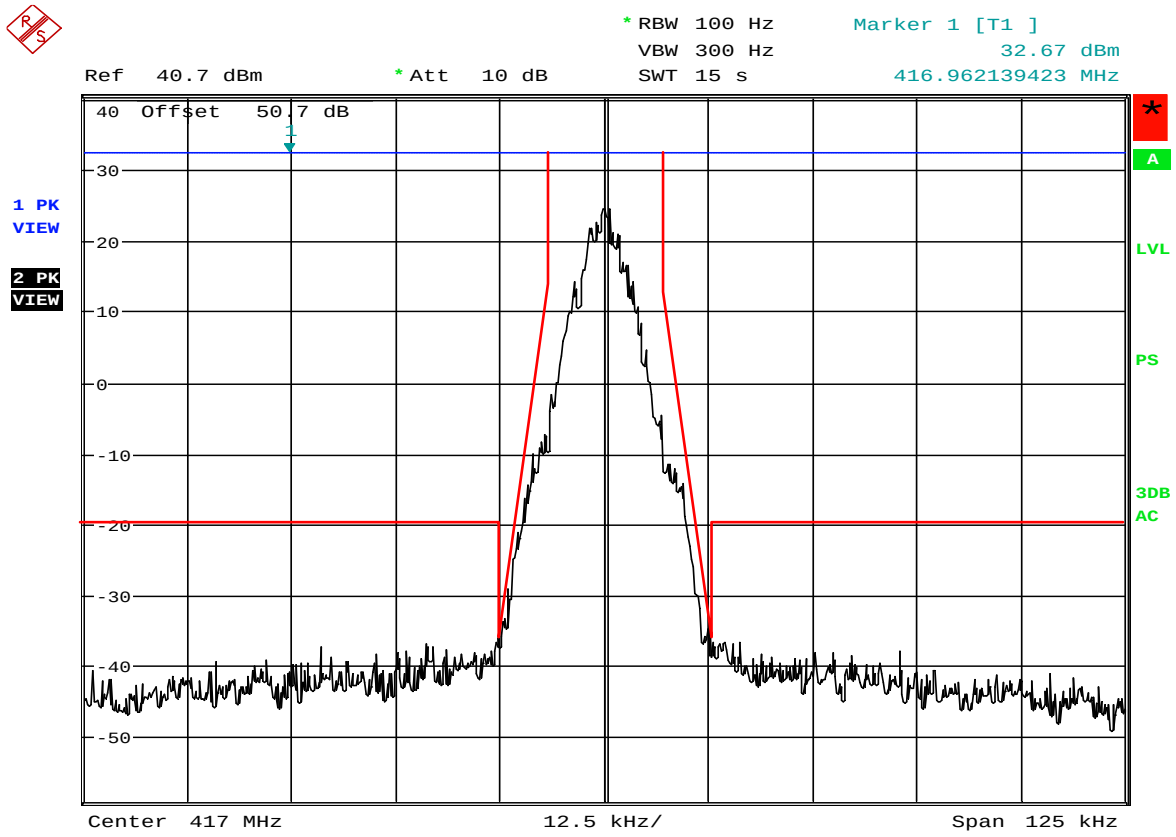
NOTES



Date: 1.NOV.2010 16:07:50

MANUFACTURER	:Free Wave Technologies
MODEL NUMBER	:LRS400S-C
TEST MODE	:TRANSMIT AT 417MHz
TEST PARAMETERS	:OCCUPIED BANDWIDTH
NOTES	:2 WATT SETTING, 2 LEVEL GFSK
EQUIPMENT USED	:RBD1, T1D2, T2S1, T2DM

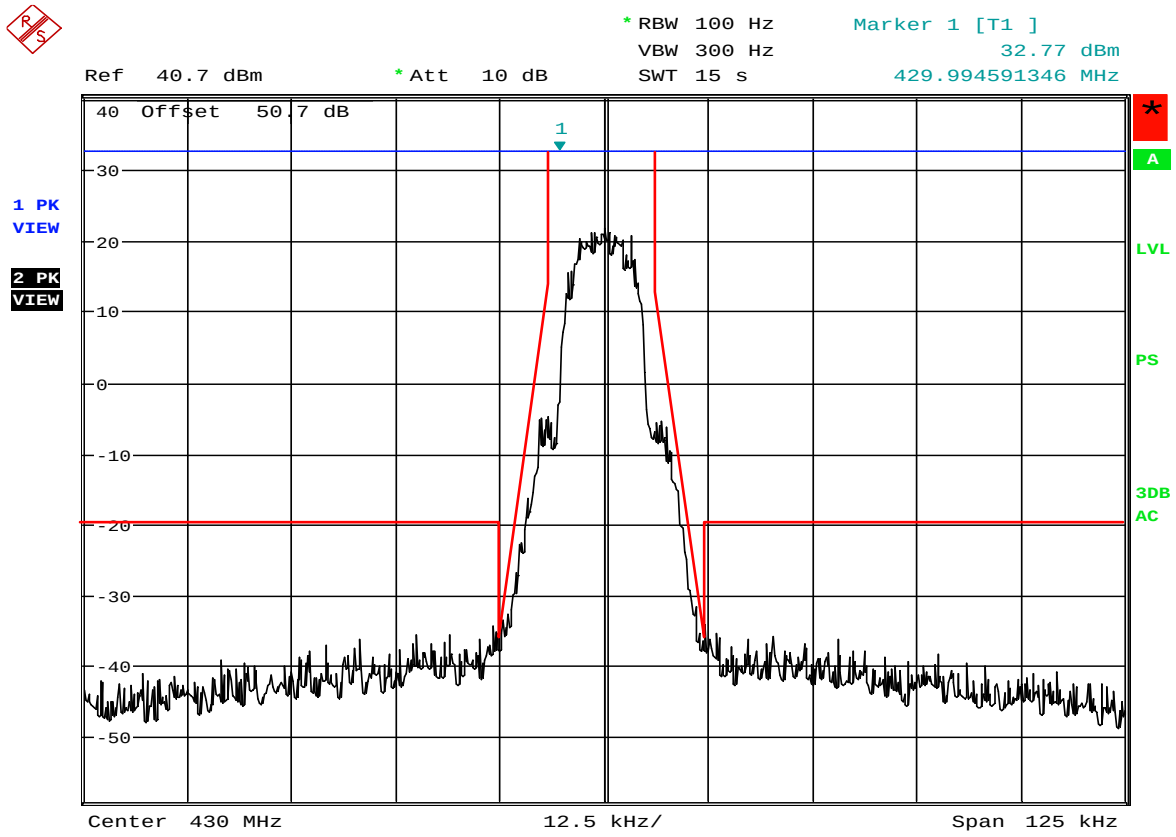
NOTES



Date: 1.NOV.2010 16:11:22

MANUFACTURER	:Free Wave Technologies
MODEL NUMBER	:LRS400S-C
TEST MODE	:TRANSMIT AT 417MHz
TEST PARAMETERS	:OCCUPIED BANDWIDTH
NOTES	:2 WATT SETTING, 4 LEVEL GFSK
EQUIPMENT USED	:RBD1, T1D2, T2S1, T2DM

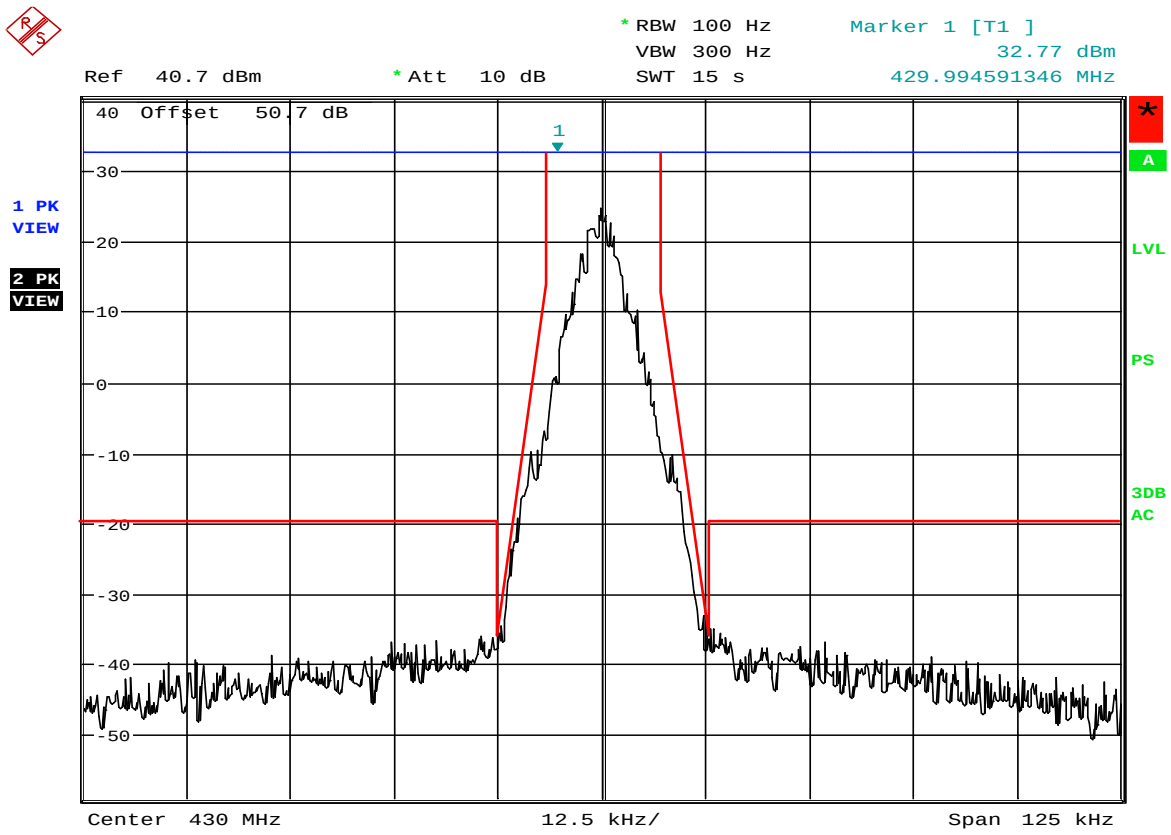
NOTES



Date: 1.NOV.2010 16:17:55

MANUFACTURER	:Free Wave Technologies
MODEL NUMBER	:LRS400S-C
TEST MODE	:TRANSMIT AT 430MHz
TEST PARAMETERS	:OCCUPIED BANDWIDTH
NOTES	:2 WATT SETTING, 2 LEVEL GFSK
EQUIPMENT USED	:RBD1, T1D2, T2S1, T2DM

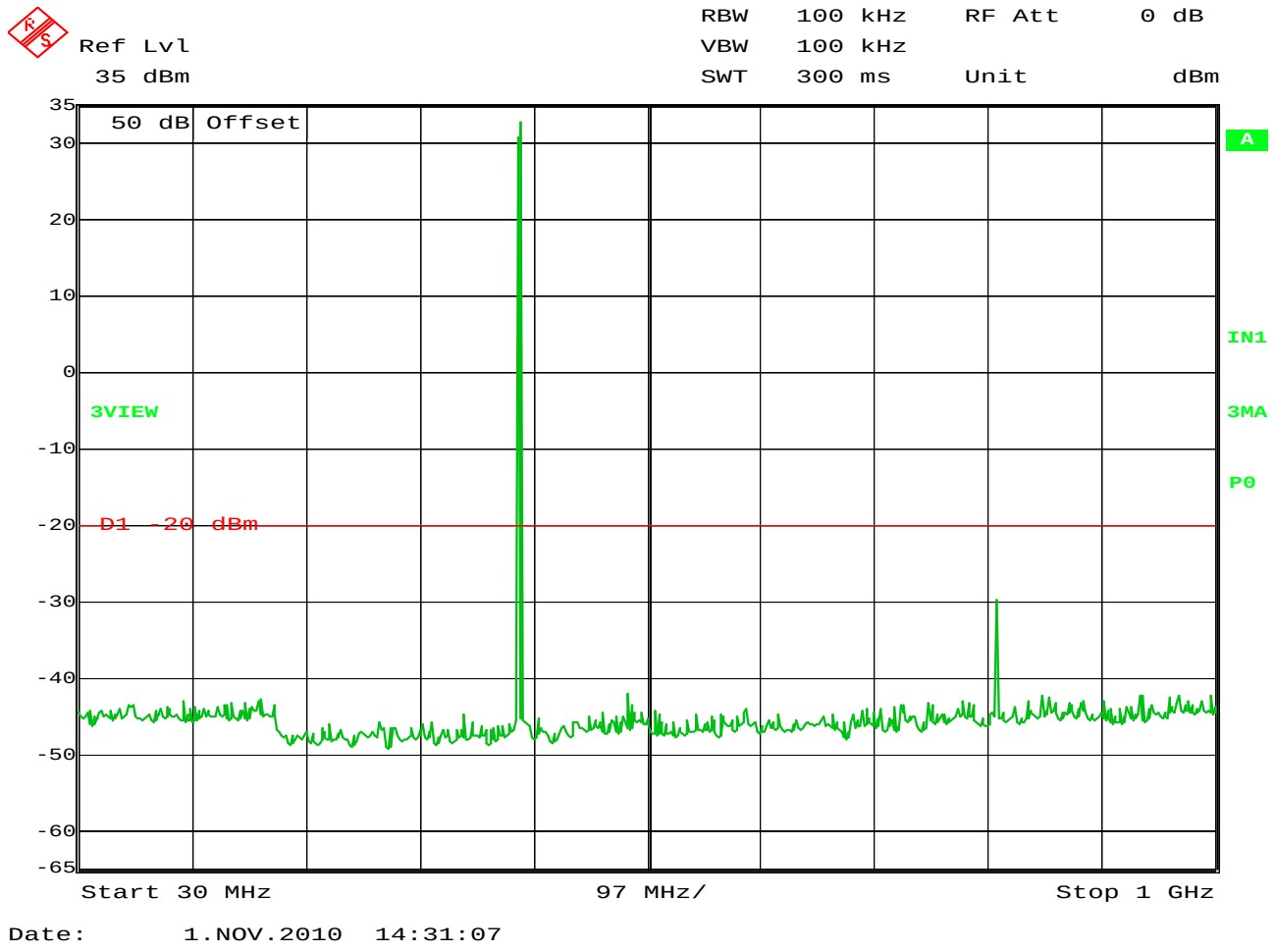
NOTES



Date: 1.NOV.2010 16:15:59

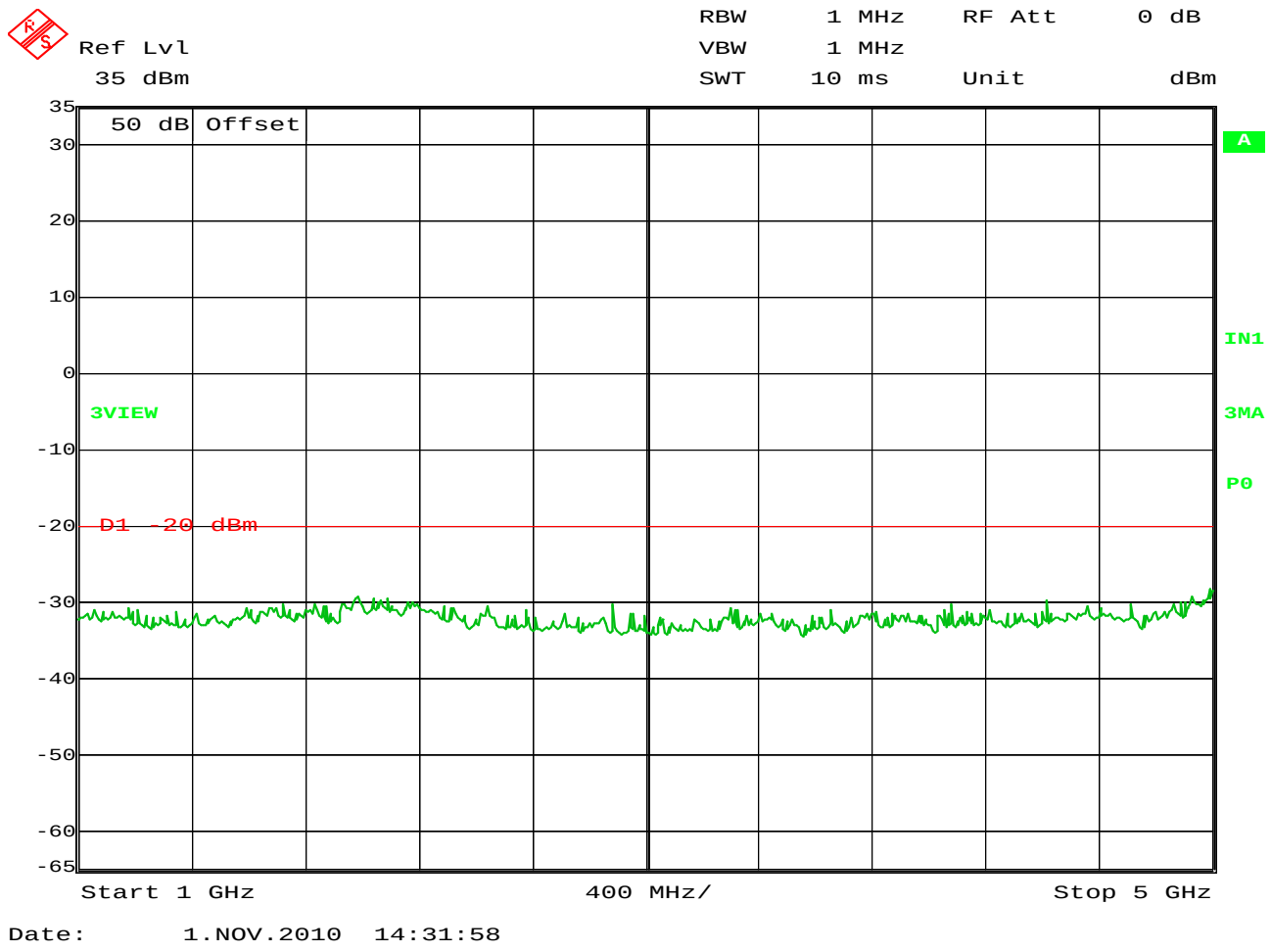
MANUFACTURER	:Free Wave Technologies
MODEL NUMBER	:LRS400S-C
TEST MODE	:TRANSMIT AT 430MHz
TEST PARAMETERS	:OCCUPIED BANDWIDTH
NOTES	:2 WATT SETTING, 4 LEVEL GFSK
EQUIPMENT USED	:RBD1, T1D2, T2S1, T2DM

NOTES



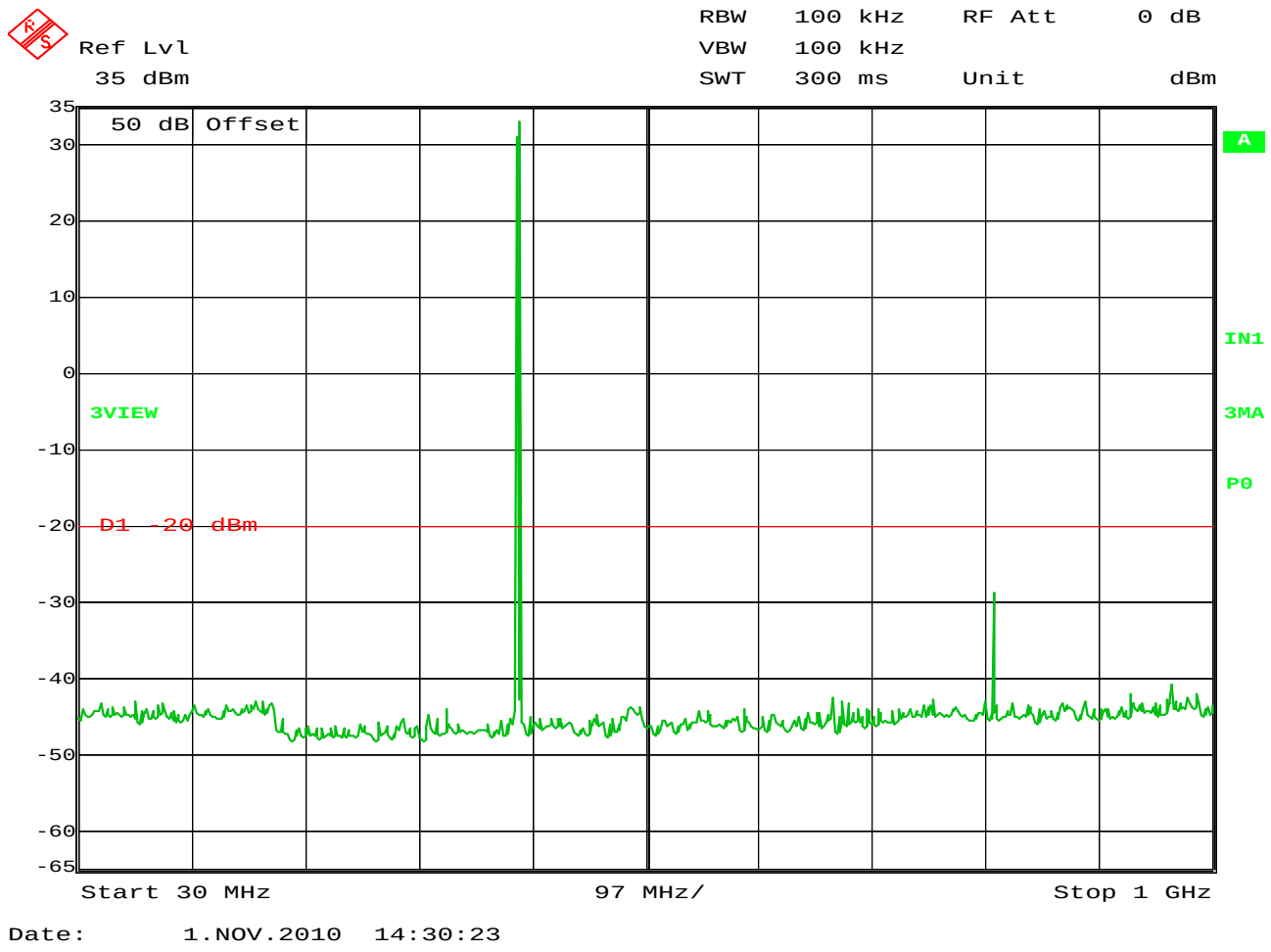
MANUFACTURER	:Free Wave Technologies
MODEL NUMBER	:LRS400S-C
TEST MODE	:TRANSMIT AT 406.1MHz
TEST PARAMETERS	:ANTENNA CONDUCTED
NOTES	:2 WATT SETTING, 2 LEVEL GFSK
EQUIPMENT USED	:RBA1, T1D2, T2S1, T2DM

NOTES



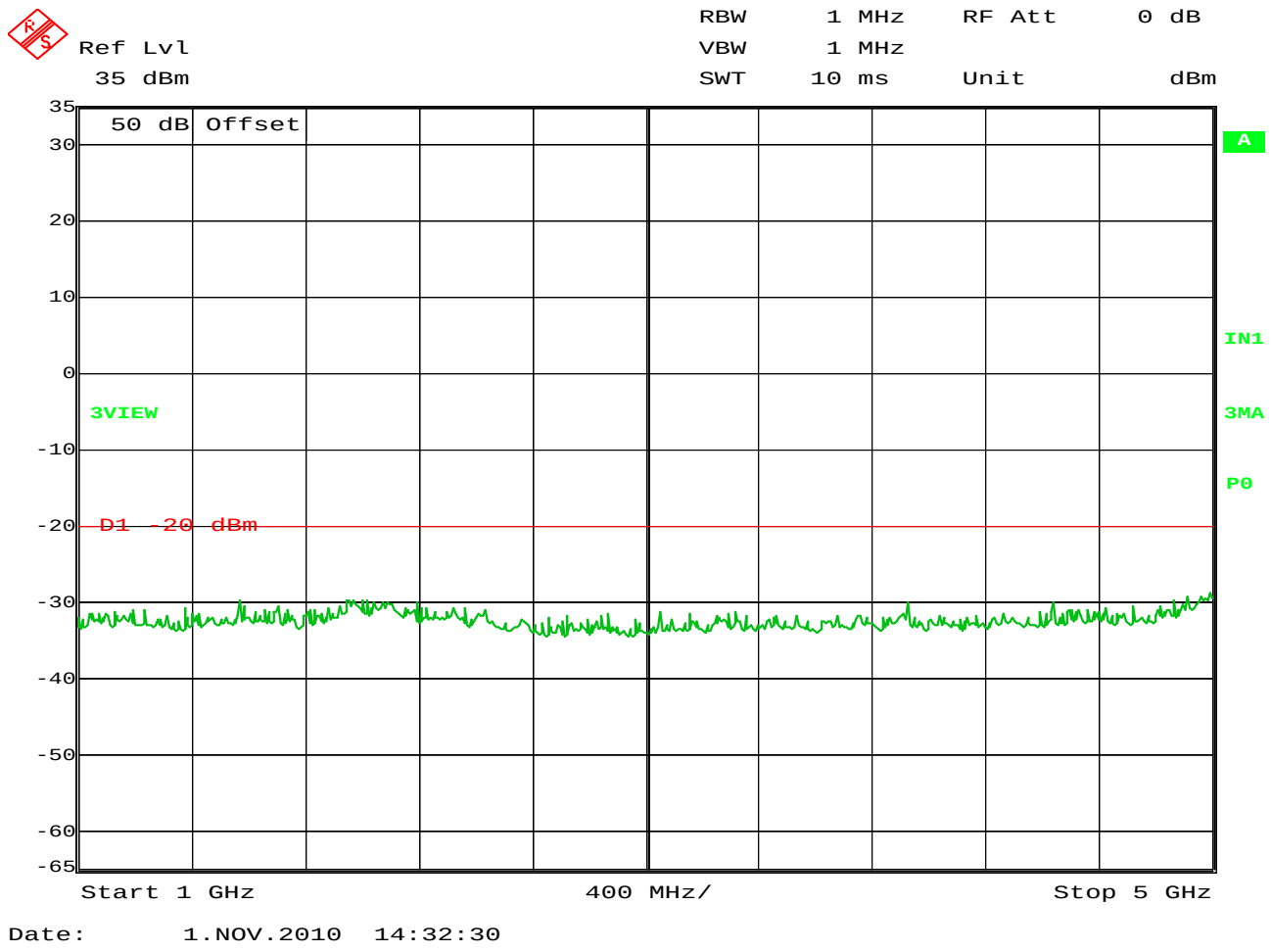
MANUFACTURER	:Free Wave Technologies
MODEL NUMBER	:LRS400S-C
TEST MODE	:TRANSMIT AT 406.1MHz
TEST PARAMETERS	:ANTENNA CONDUCTED
NOTES	:2 WATT SETTING, 2 LEVEL GFSK
EQUIPMENT USED	:RBA1, T1D2, T2S1, T2DM

NOTES



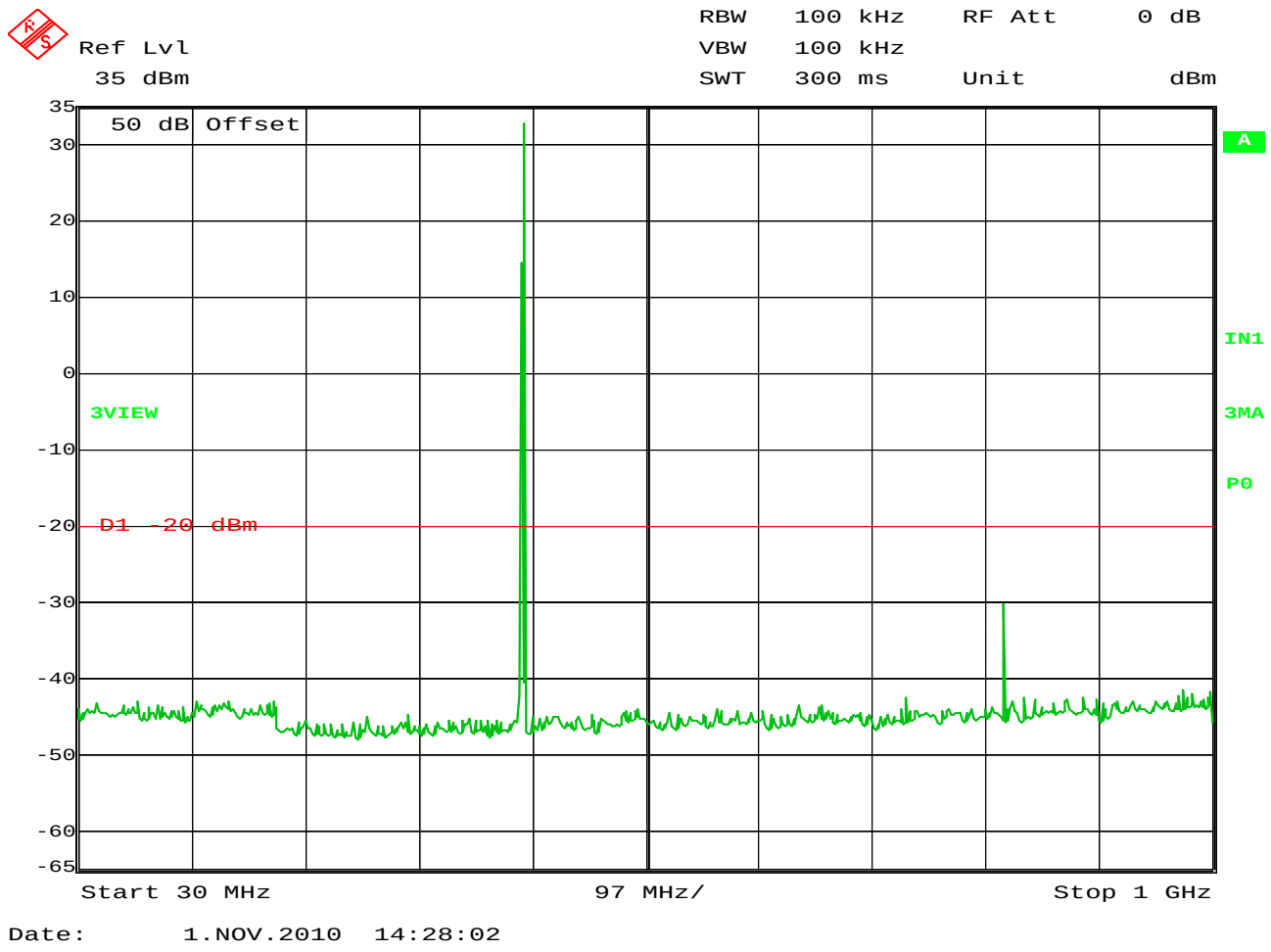
MANUFACTURER	:Free Wave Technologies
MODEL NUMBER	:LRS400S-C
TEST MODE	:TRANSMIT AT 406.1MHz
TEST PARAMETERS	:ANTENNA CONDUCTED
NOTES	:2 WATT SETTING, 4 LEVEL GFSK
EQUIPMENT USED	:RBA1, T1D2, T2S1, T2DM

NOTES



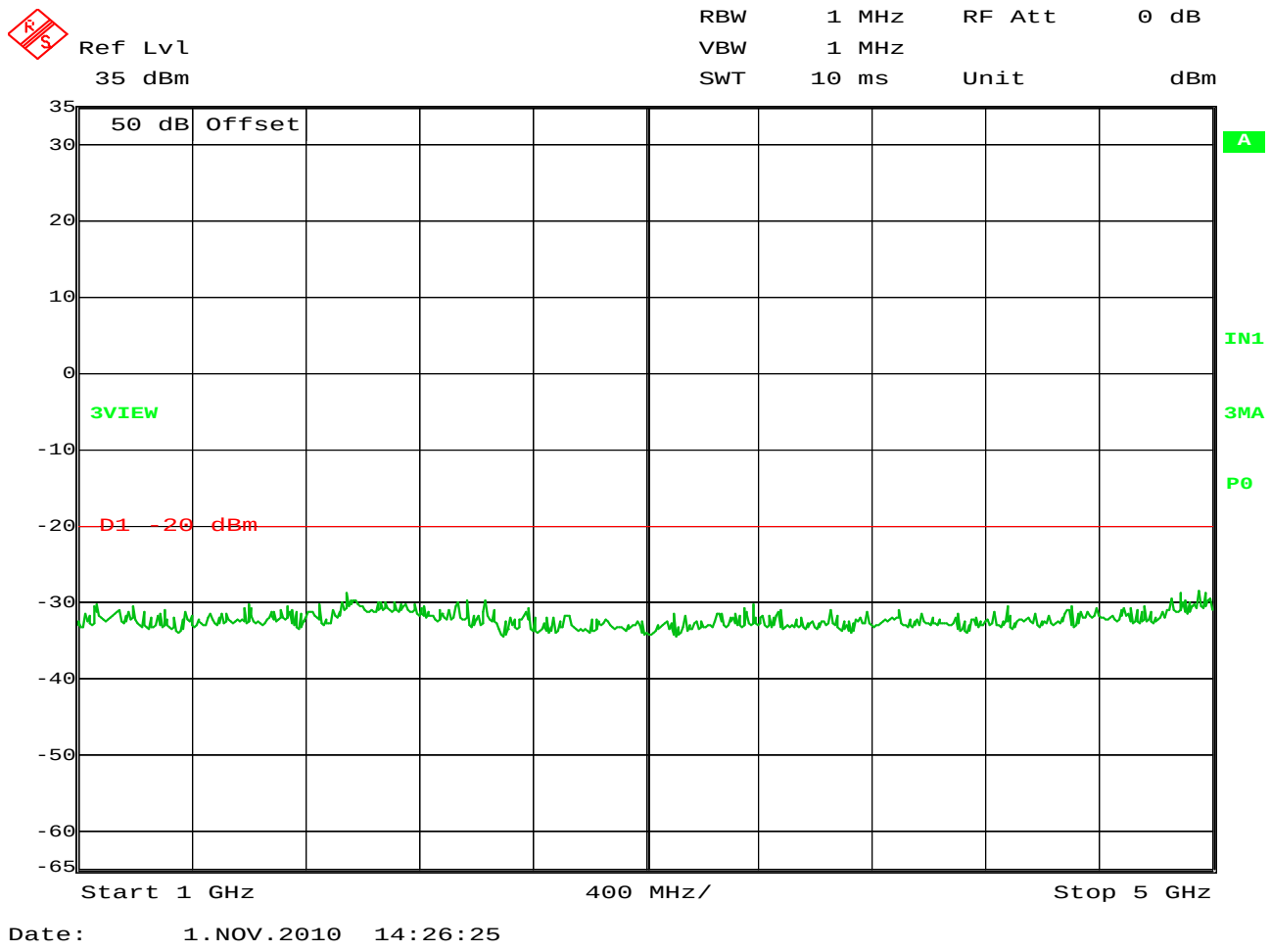
MANUFACTURER	:Free Wave Technologies
MODEL NUMBER	:LRS400S-C
TEST MODE	:TRANSMIT AT 406.1MHz
TEST PARAMETERS	:ANTENNA CONDUCTED
NOTES	:2 WATT SETTING, 4 LEVEL GFSK
EQUIPMENT USED	:RBA1, T1D2, T2S1, T2DM

NOTES



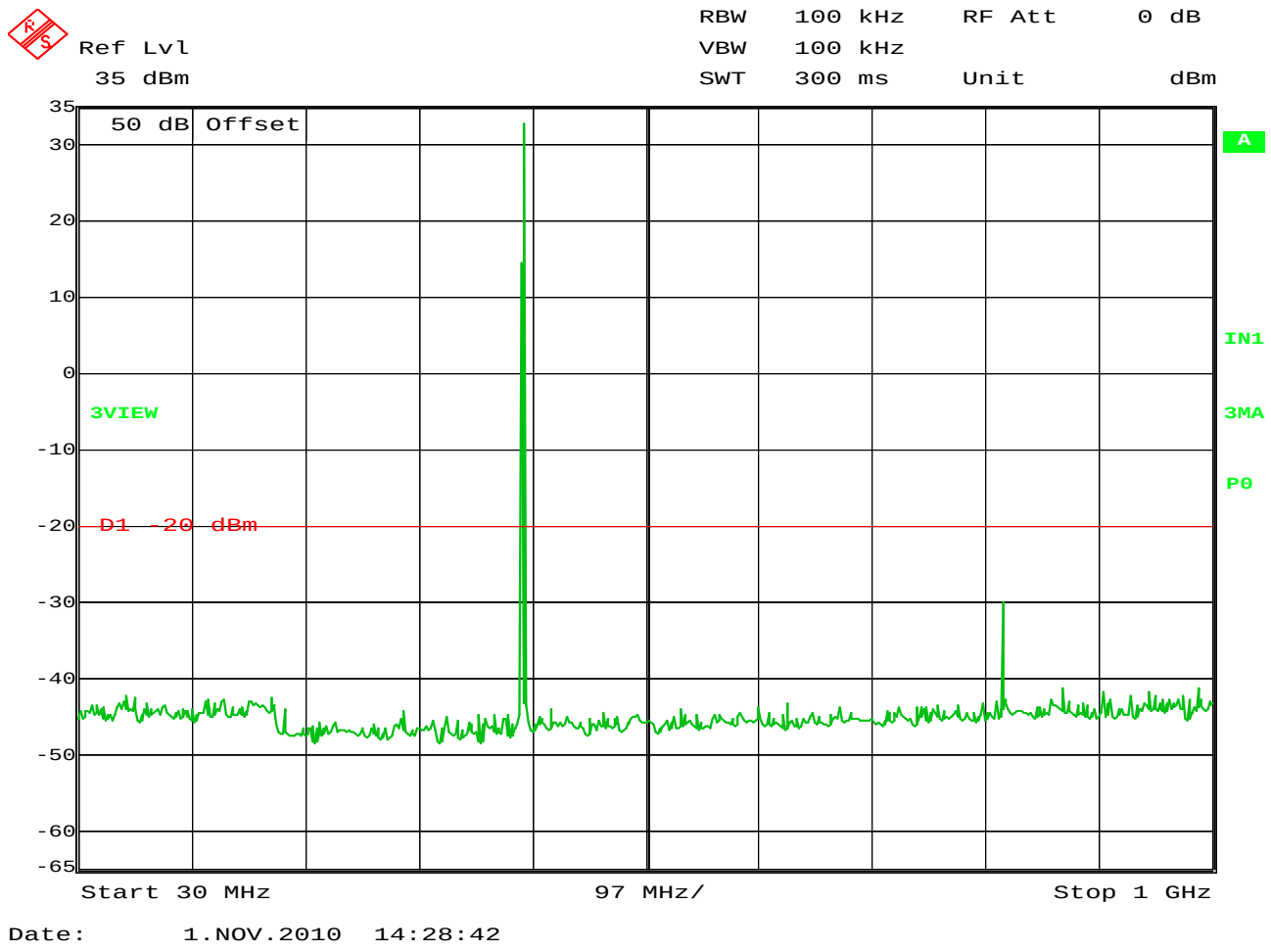
MANUFACTURER	:Free Wave Technologies
MODEL NUMBER	:LRS400S-C
TEST MODE	:TRANSMIT AT 410MHz
TEST PARAMETERS	:ANTENNA CONDUCTED
NOTES	:2 WATT SETTING, 2 LEVEL GFSK
EQUIPMENT USED	:RBA1, T1D2, T2S1, T2DM

NOTES



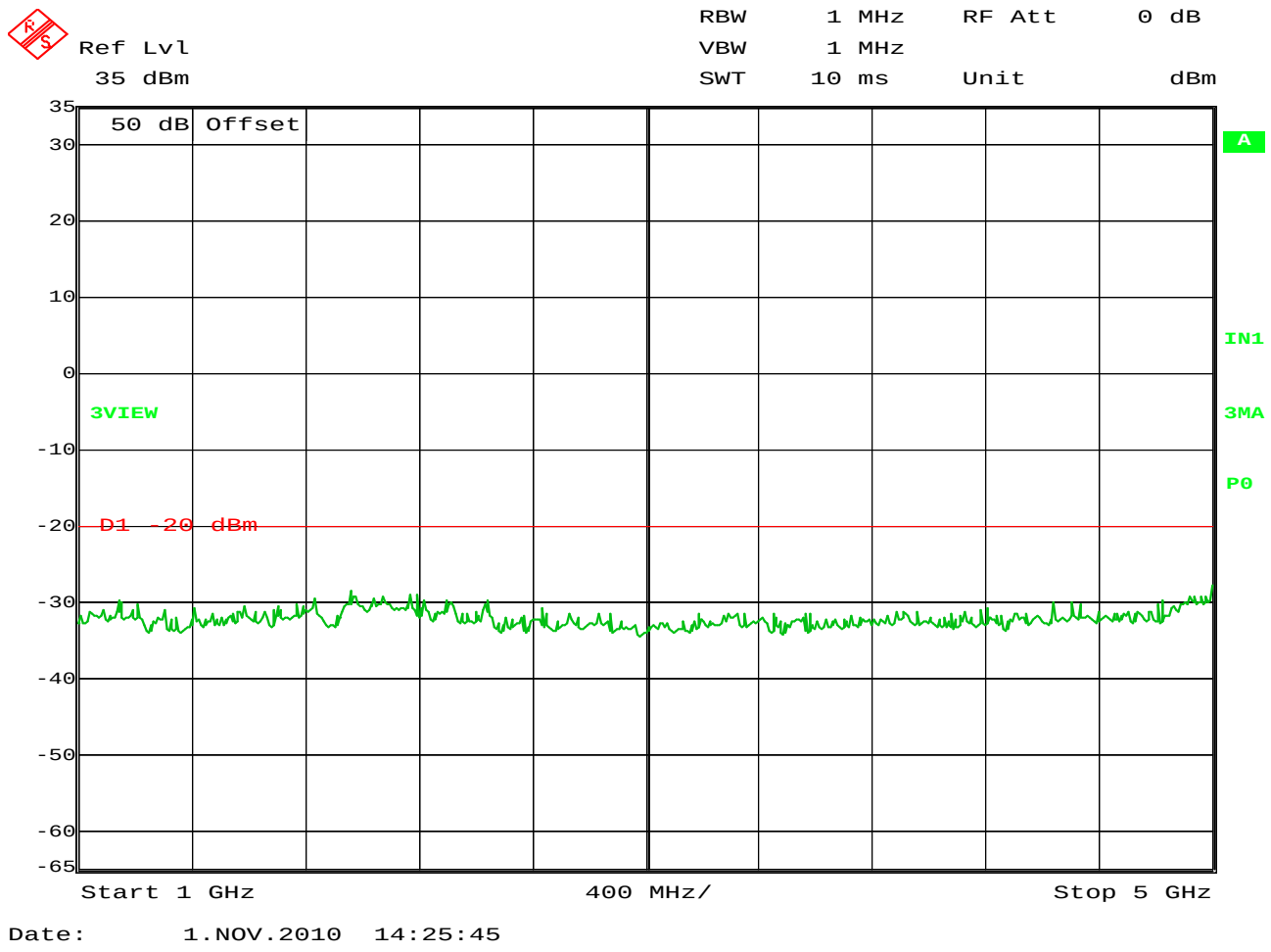
MANUFACTURER	:Free Wave Technologies
MODEL NUMBER	:LRS400S-C
TEST MODE	:TRANSMIT AT 410MHz
TEST PARAMETERS	:ANTENNA CONDUCTED
NOTES	:2 WATT SETTING, 2 LEVEL GFSK
EQUIPMENT USED	:RBA1, T1D2, T2S1, T2DM

NOTES



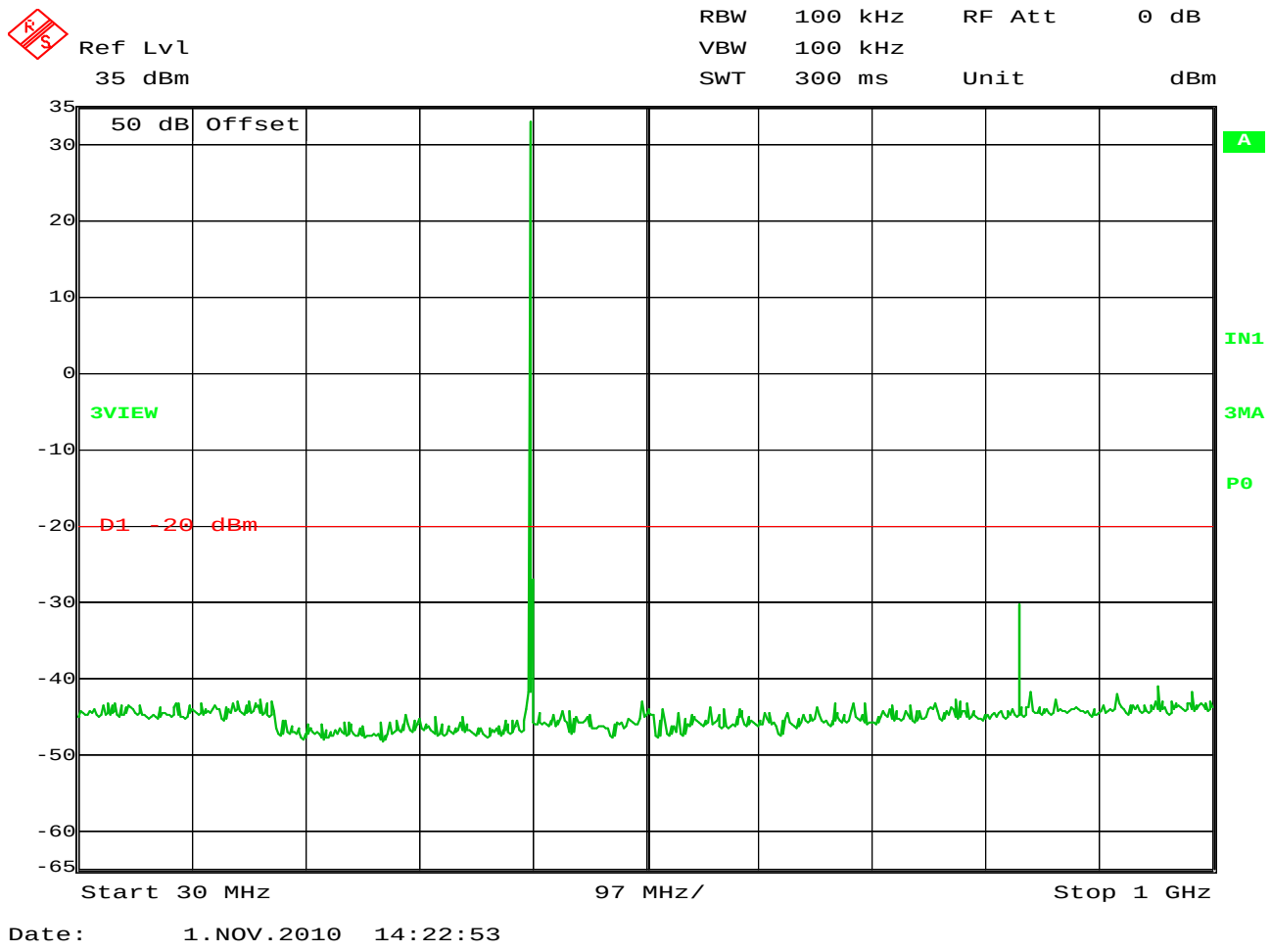
MANUFACTURER	:Free Wave Technologies
MODEL NUMBER	:LRS400S-C
TEST MODE	:TRANSMIT AT 410MHz
TEST PARAMETERS	:ANTENNA CONDUCTED
NOTES	:2 WATT SETTING, 4 LEVEL GFSK
EQUIPMENT USED	:RBA1, T1D2, T2S1, T2DM

NOTES



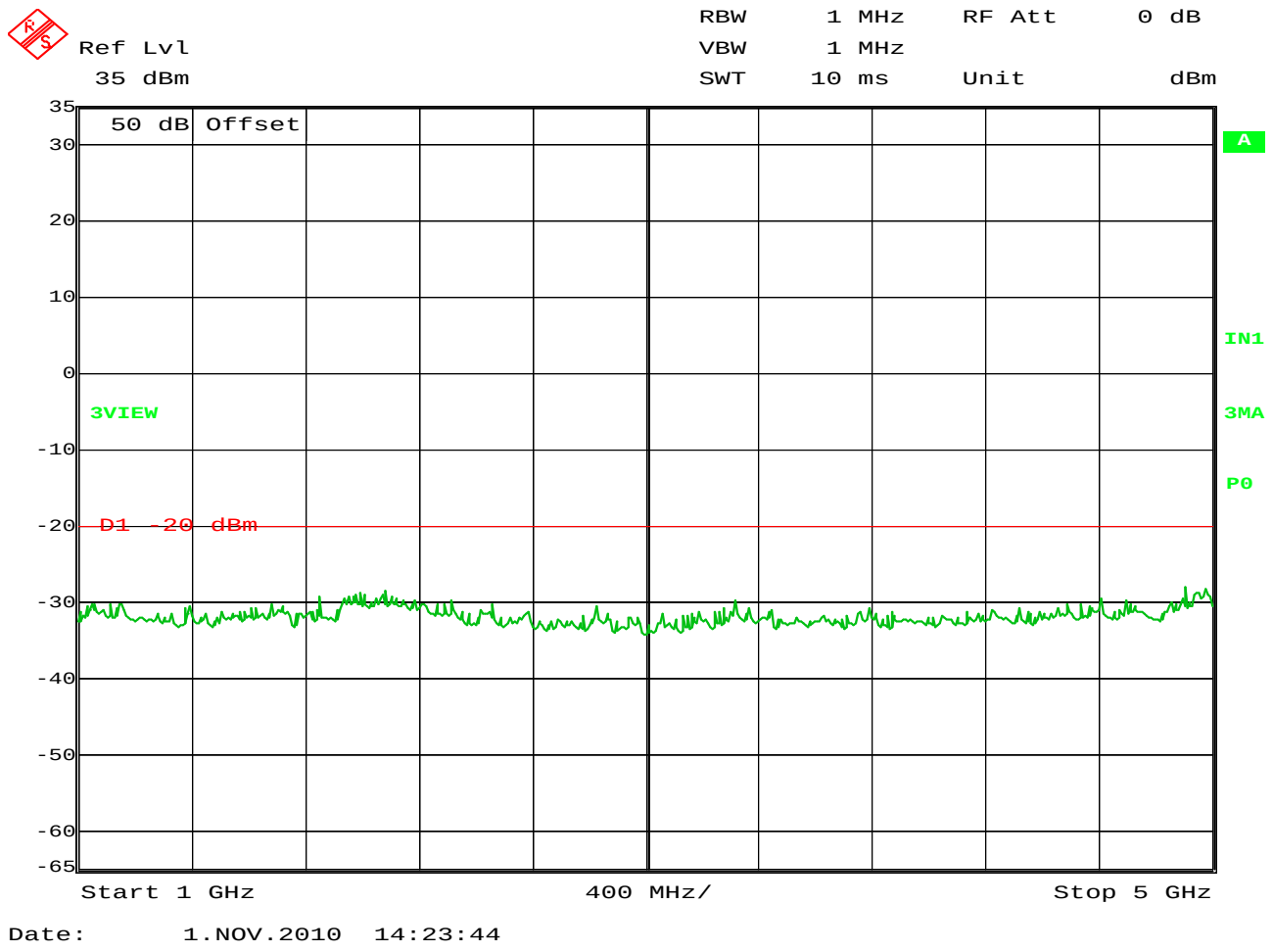
MANUFACTURER	:Free Wave Technologies
MODEL NUMBER	:LRS400S-C
TEST MODE	:TRANSMIT AT 410MHz
TEST PARAMETERS	:ANTENNA CONDUCTED
NOTES	:2 WATT SETTING, 4 LEVEL GFSK
EQUIPMENT USED	:RBA1, T1D2, T2S1, T2DM

NOTES



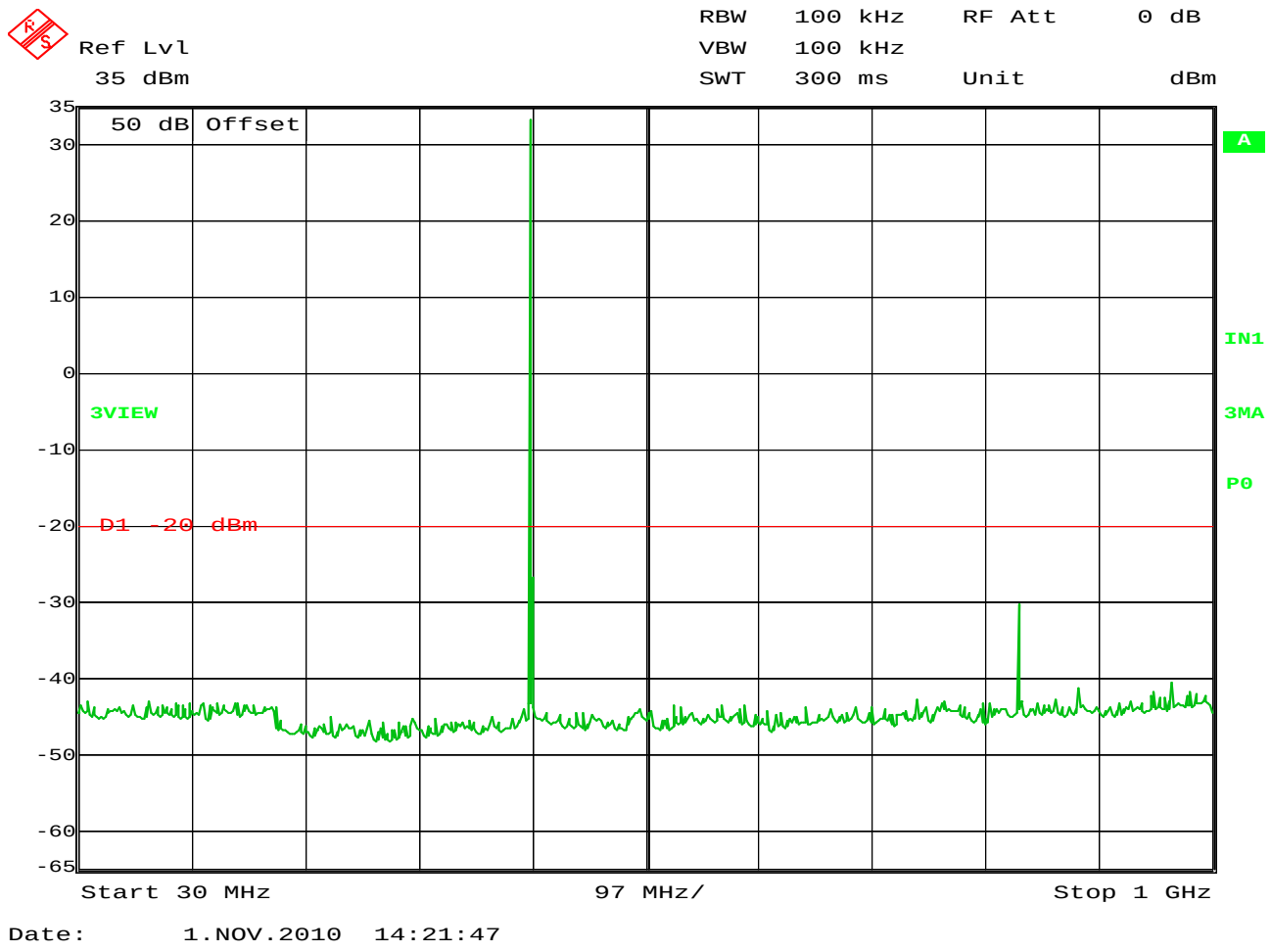
MANUFACTURER	:Free Wave Technologies
MODEL NUMBER	:LRS400S-C
TEST MODE	:TRANSMIT AT 417MHz
TEST PARAMETERS	:ANTENNA CONDUCTED
NOTES	:2 WATT SETTING, 2 LEVEL GFSK
EQUIPMENT USED	:RBA1, T1D2, T2S1, T2DM

NOTES



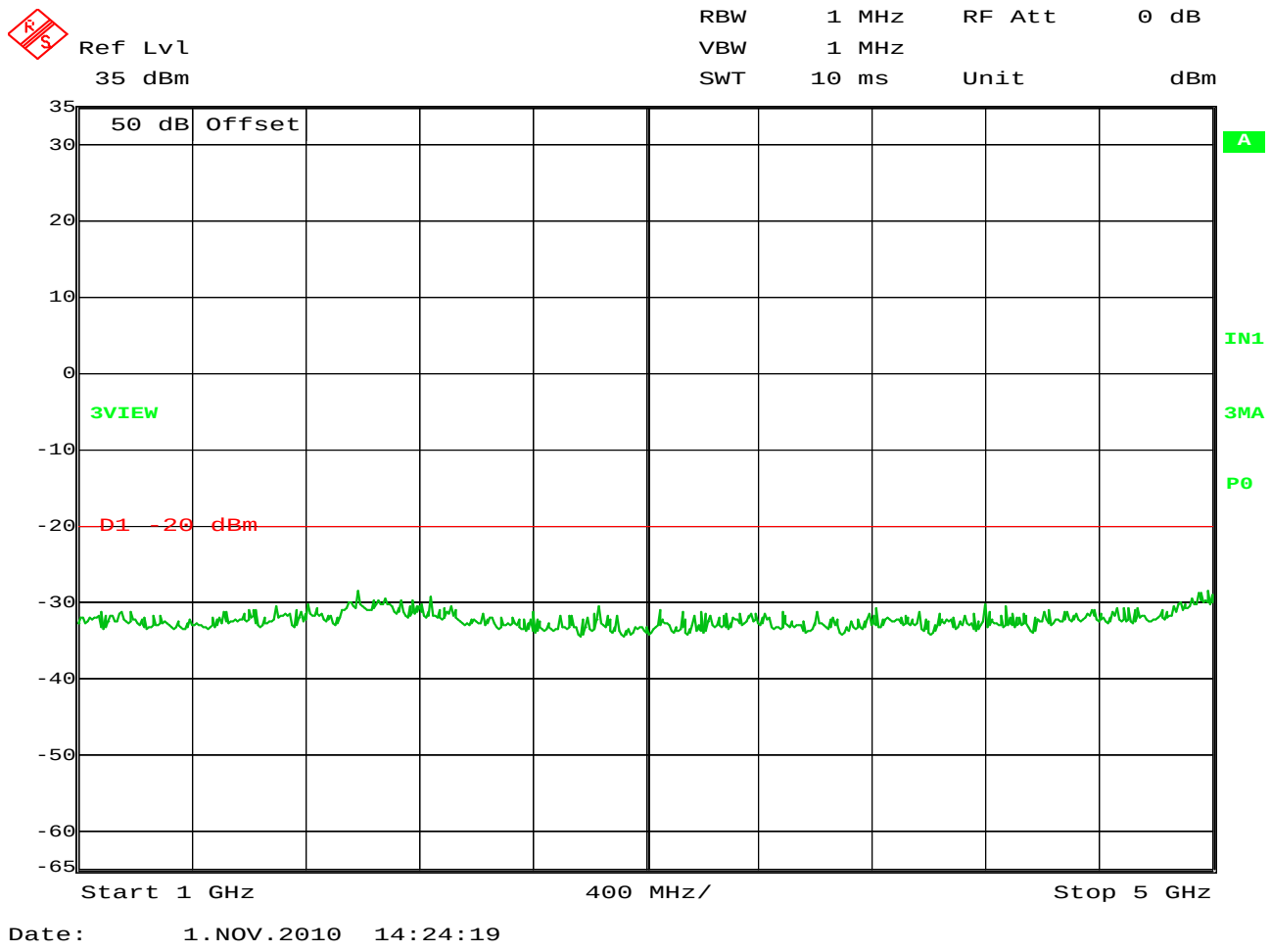
MANUFACTURER	:Free Wave Technologies
MODEL NUMBER	:LRS400S-C
TEST MODE	:TRANSMIT AT 417MHz
TEST PARAMETERS	:ANTENNA CONDUCTED
NOTES	:2 WATT SETTING, 2 LEVEL GFSK
EQUIPMENT USED	:RBA1, T1D2, T2S1, T2DM

NOTES



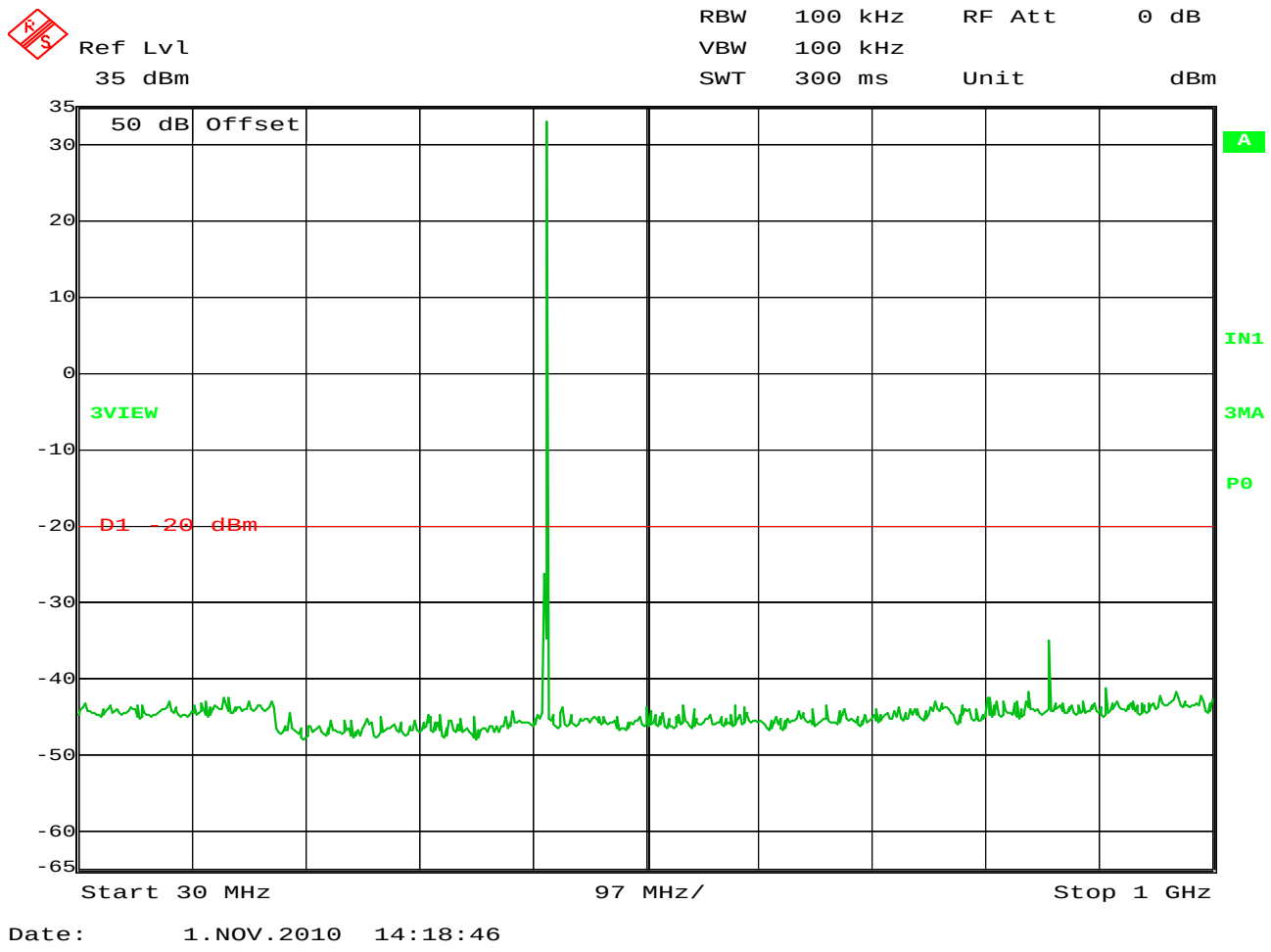
MANUFACTURER	:Free Wave Technologies
MODEL NUMBER	:LRS400S-C
TEST MODE	:TRANSMIT AT 417MHz
TEST PARAMETERS	:ANTENNA CONDUCTED
NOTES	:2 WATT SETTING, 4 LEVEL GFSK
EQUIPMENT USED	:RBA1, T1D2, T2S1, T2DM

NOTES



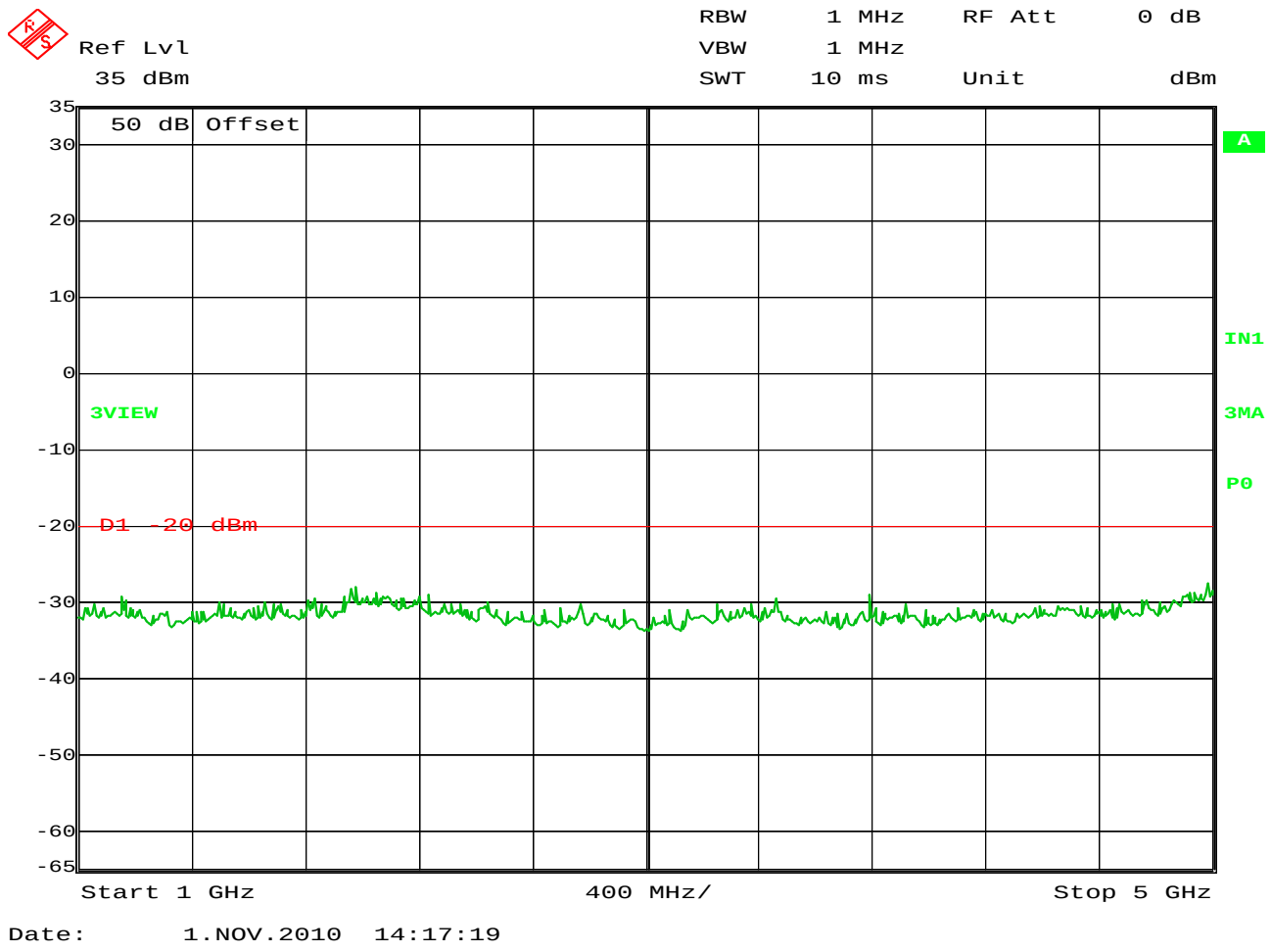
MANUFACTURER	:Free Wave Technologies
MODEL NUMBER	:LRS400S-C
TEST MODE	:TRANSMIT AT 417MHz
TEST PARAMETERS	:ANTENNA CONDUCTED
NOTES	:2 WATT SETTING, 4 LEVEL GFSK
EQUIPMENT USED	:RBA1, T1D2, T2S1, T2DM

NOTES



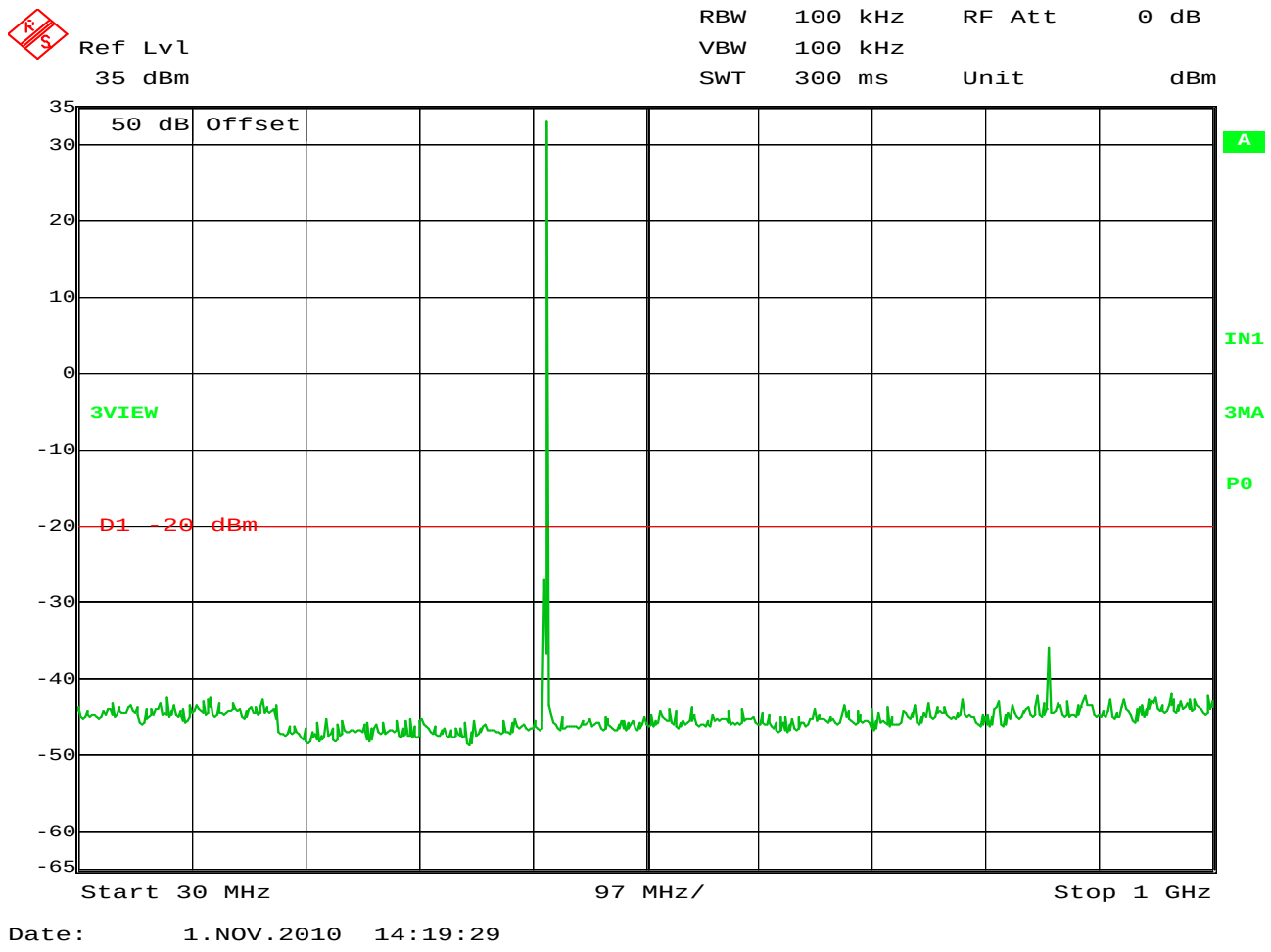
MANUFACTURER	:Free Wave Technologies
MODEL NUMBER	:LRS400S-C
TEST MODE	:TRANSMIT AT 430MHz
TEST PARAMETERS	:ANTENNA CONDUCTED
NOTES	:2 WATT SETTING, 2 LEVEL GFSK
EQUIPMENT USED	:RBA1, T1D2, T2S1, T2DM

NOTES



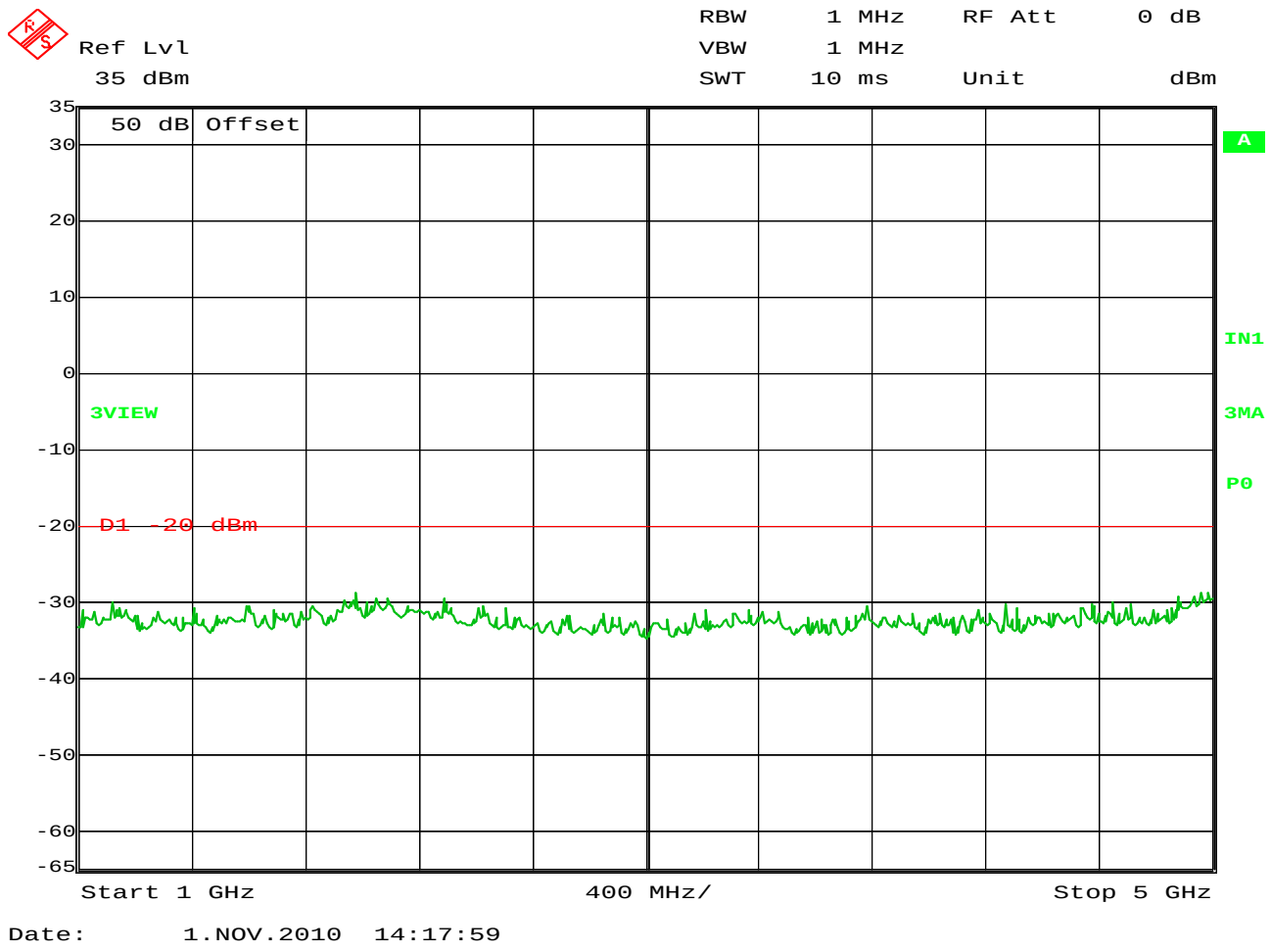
MANUFACTURER	:Free Wave Technologies
MODEL NUMBER	:LRS400S-C
TEST MODE	:TRANSMIT AT 430MHz
TEST PARAMETERS	:ANTENNA CONDUCTED
NOTES	:2 WATT SETTING, 2 LEVEL GFSK
EQUIPMENT USED	:RBA1, T1D2, T2S1, T2DM

NOTES



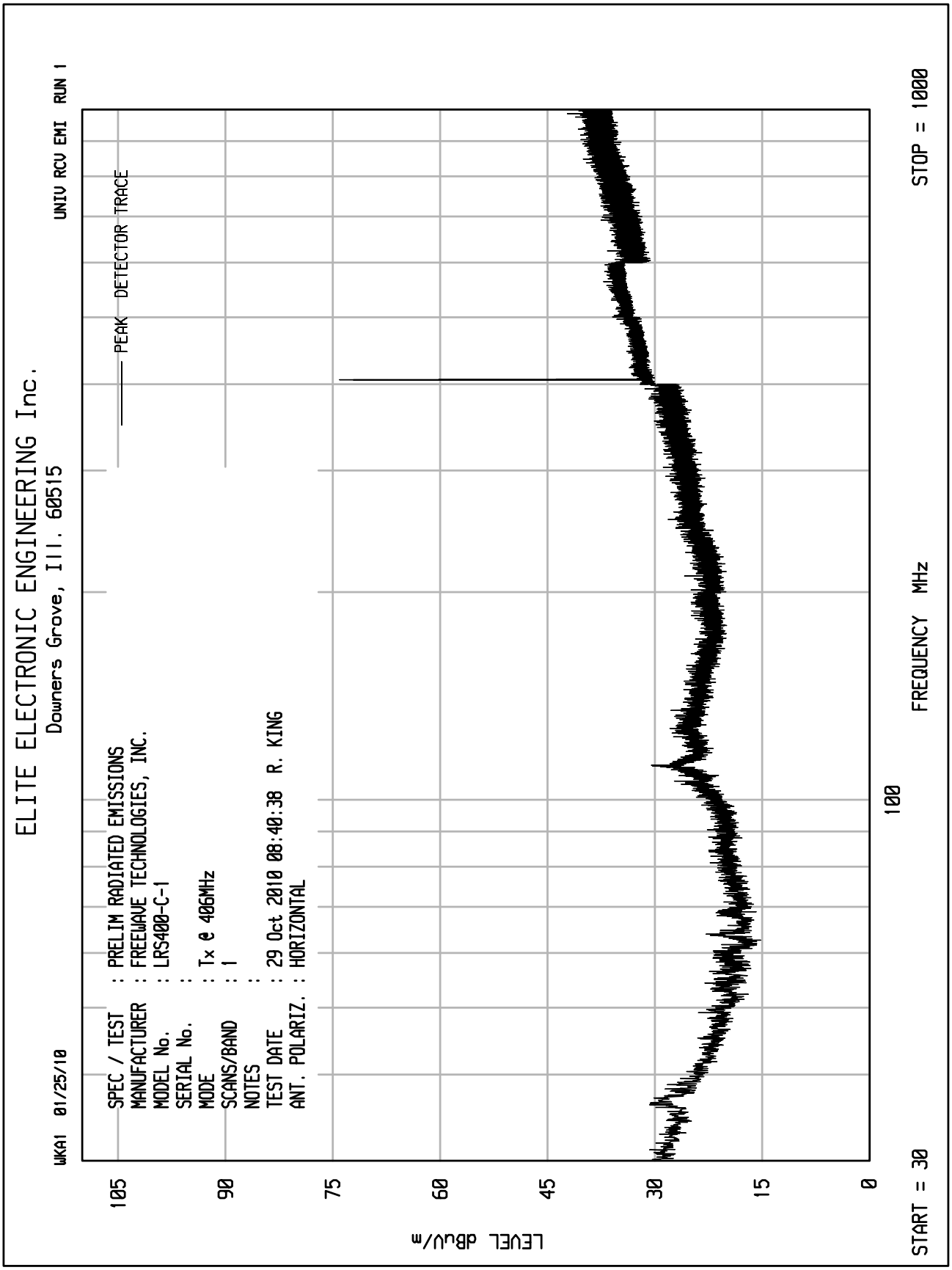
MANUFACTURER	:Free Wave Technologies
MODEL NUMBER	:LRS400S-C
TEST MODE	:TRANSMIT AT 430MHz
TEST PARAMETERS	:ANTENNA CONDUCTED
NOTES	:2 WATT SETTING, 4 LEVEL GFSK
EQUIPMENT USED	:RBA1, T1D2, T2S1, T2DM

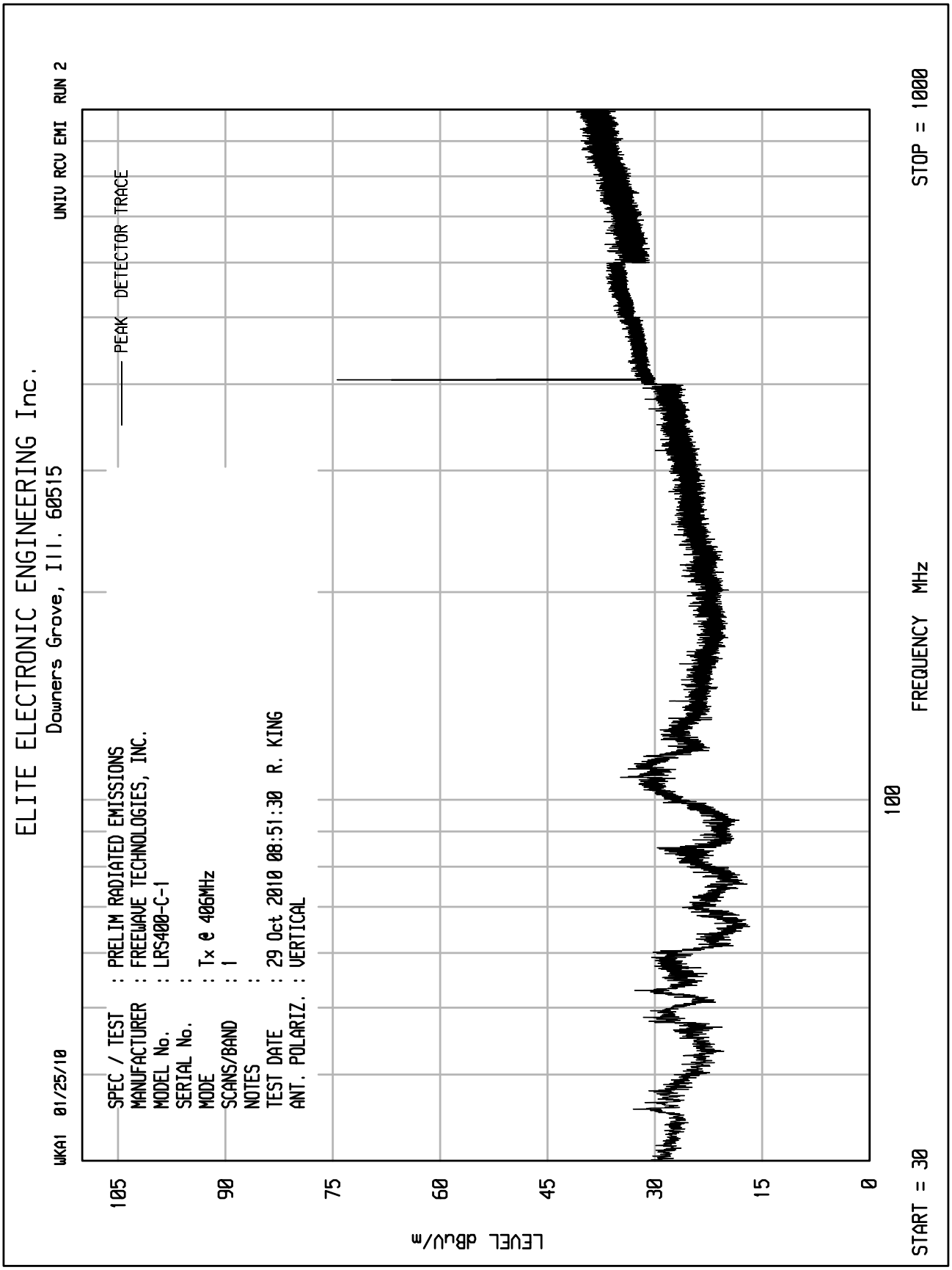
NOTES

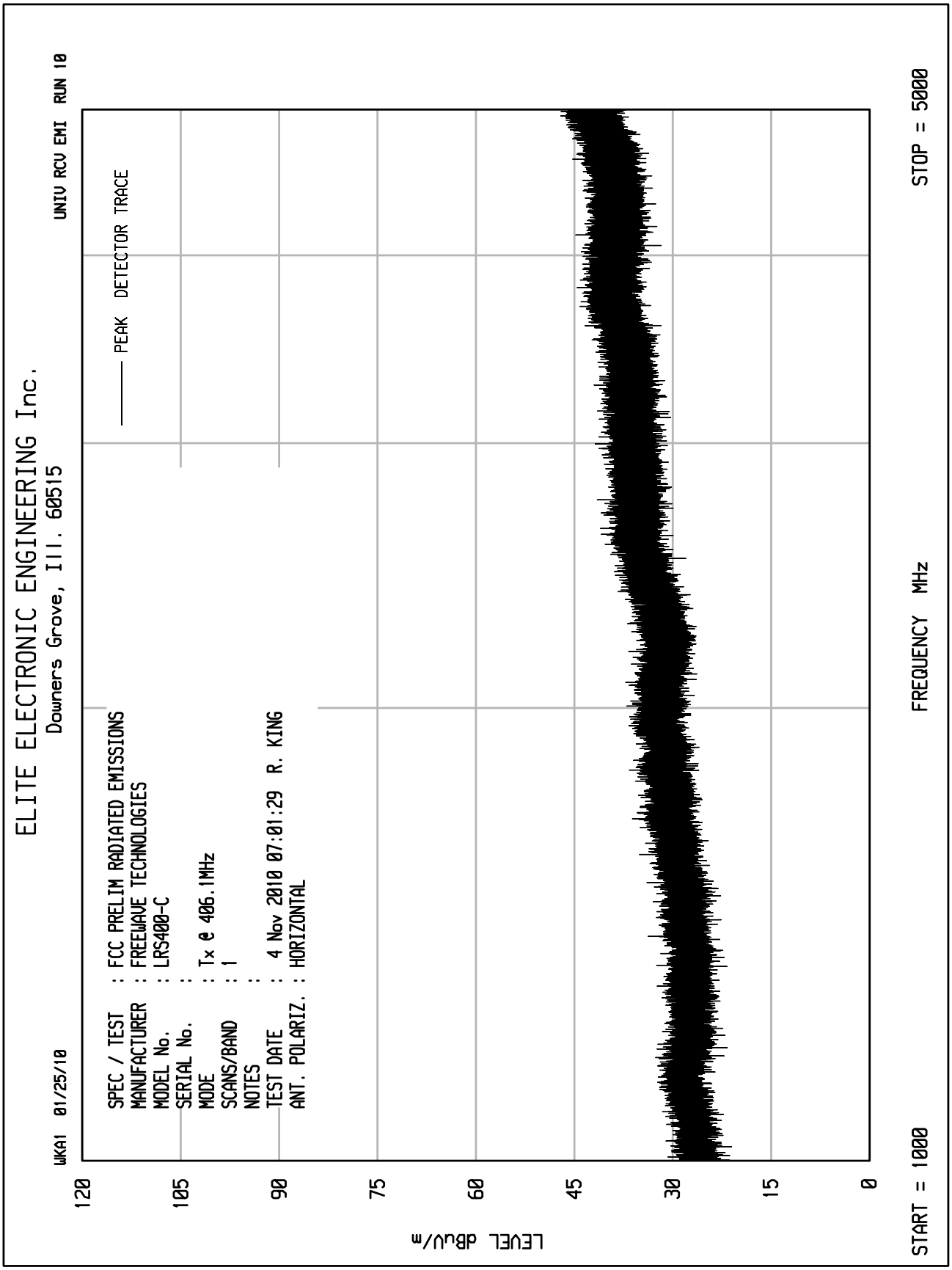


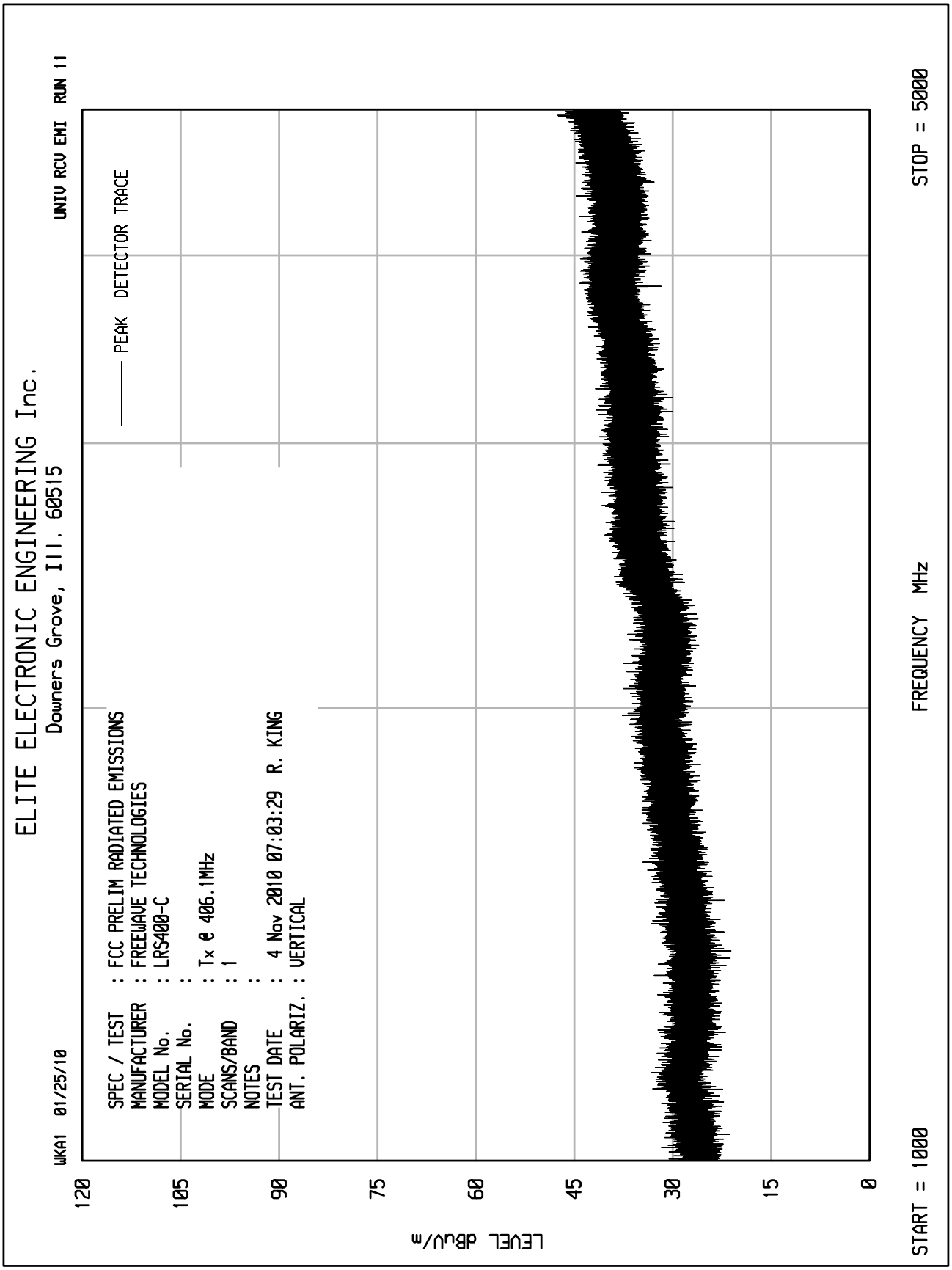
MANUFACTURER	:Free Wave Technologies
MODEL NUMBER	:LRS400S-C
TEST MODE	:TRANSMIT AT 430MHz
TEST PARAMETERS	:ANTENNA CONDUCTED
NOTES	:2 WATT SETTING, 4 LEVEL GFSK
EQUIPMENT USED	:RBA1, T1D2, T2S1, T2DM

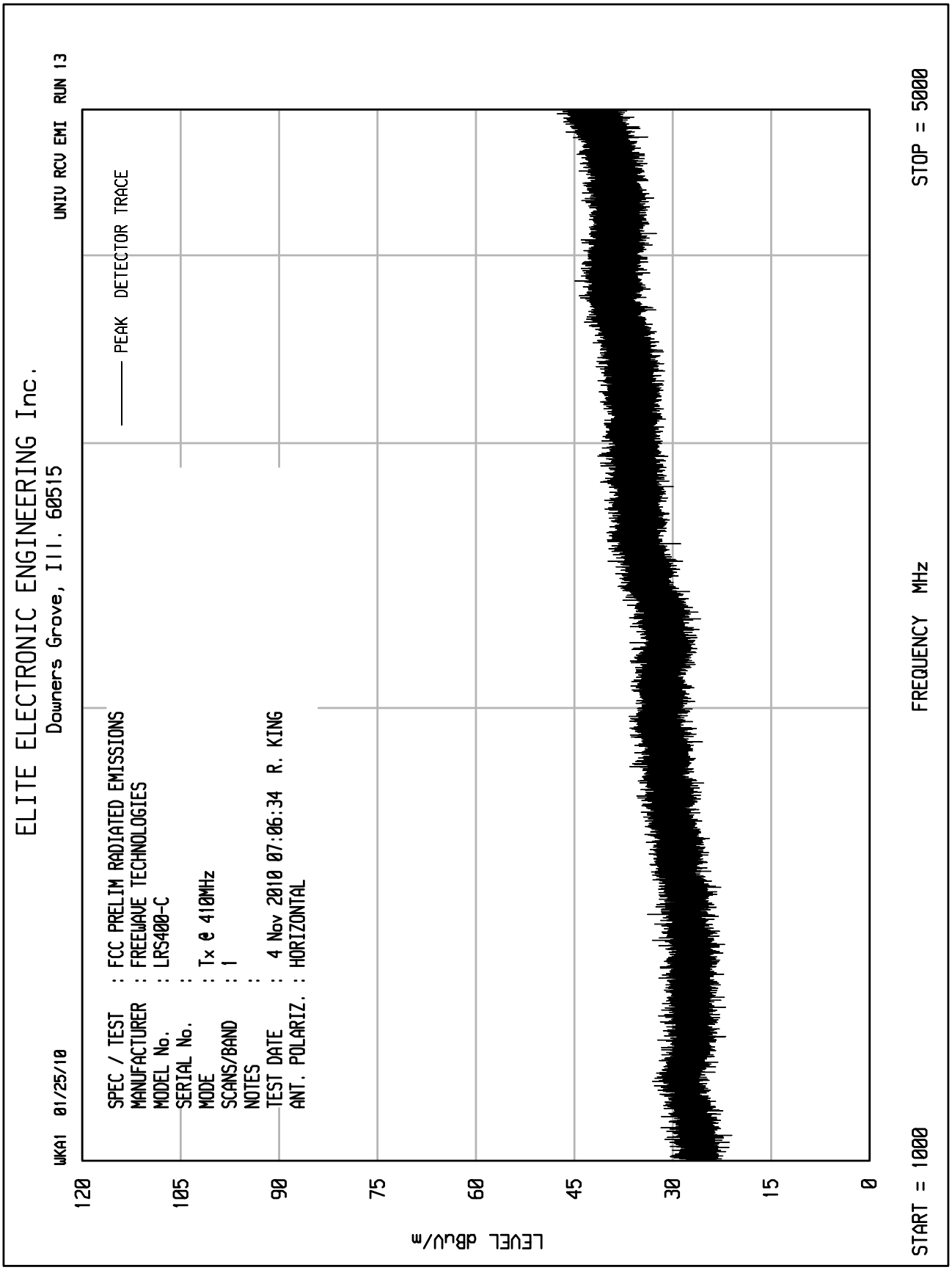
NOTES

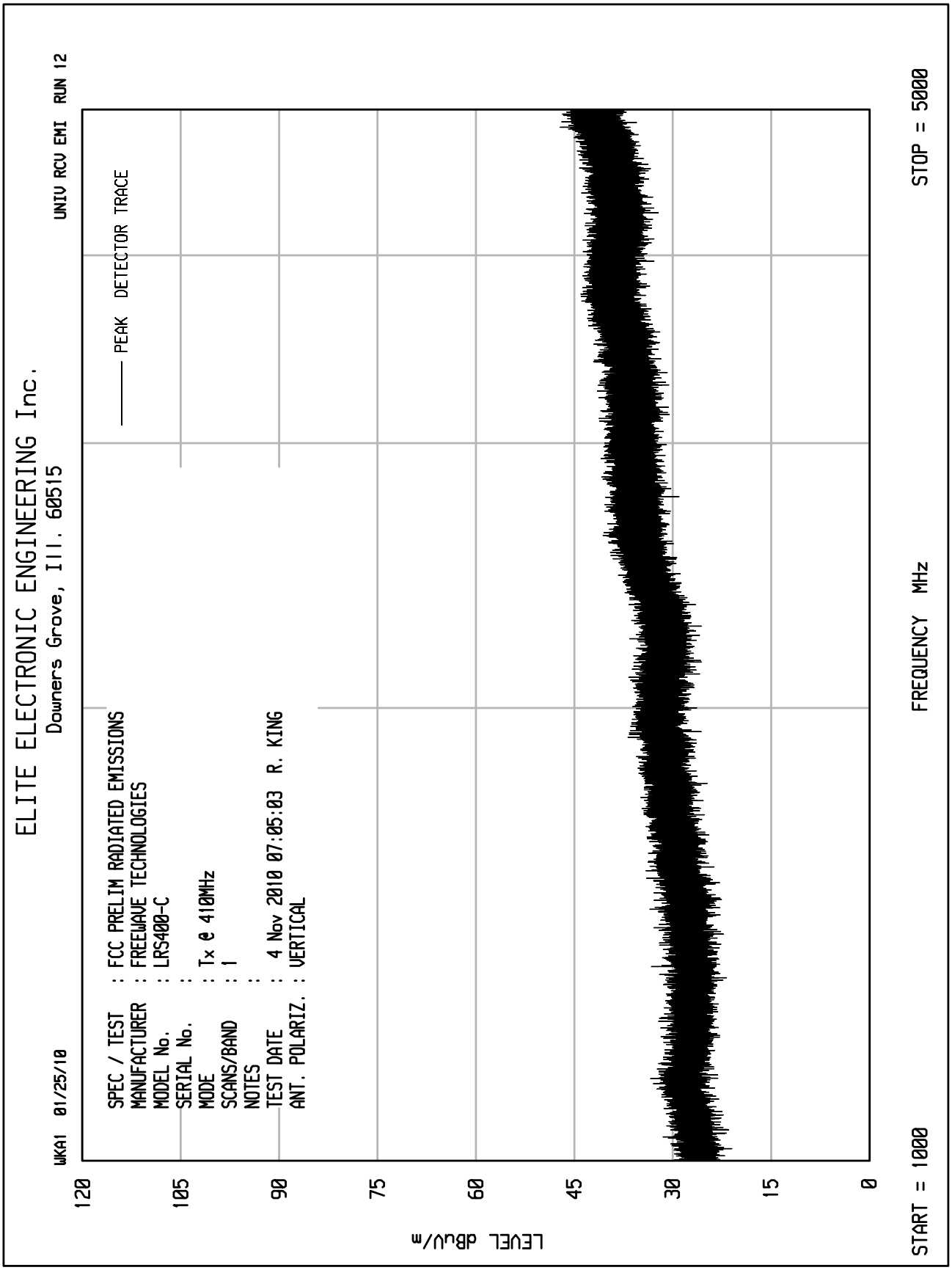

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 1
WKA1 01/25/10
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : FREEWAVE TECHNOLOGIES, INC.
MODEL No. : LRS400-C-1
SERIAL No. :
MODE : Tx @ 400MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 29 Oct 2010 08:40:38 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000

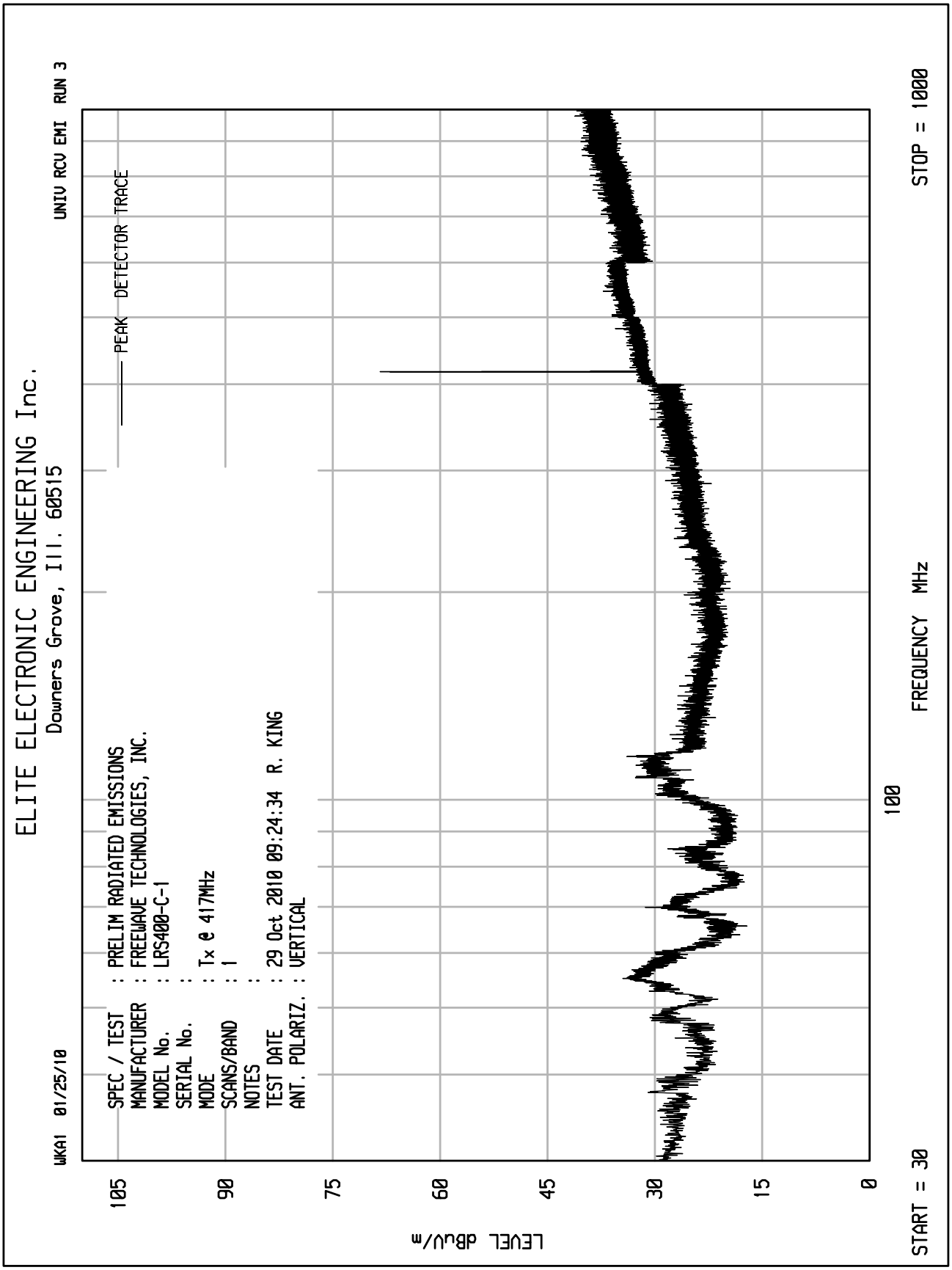

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 2
WKA1 01/25/10
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : FREEWAVE TECHNOLOGIES, INC.
MODEL No. : LRS400-C-1
SERIAL No. :
MODE : Tx @ 400MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 29 Oct 2010 08:51:30 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000

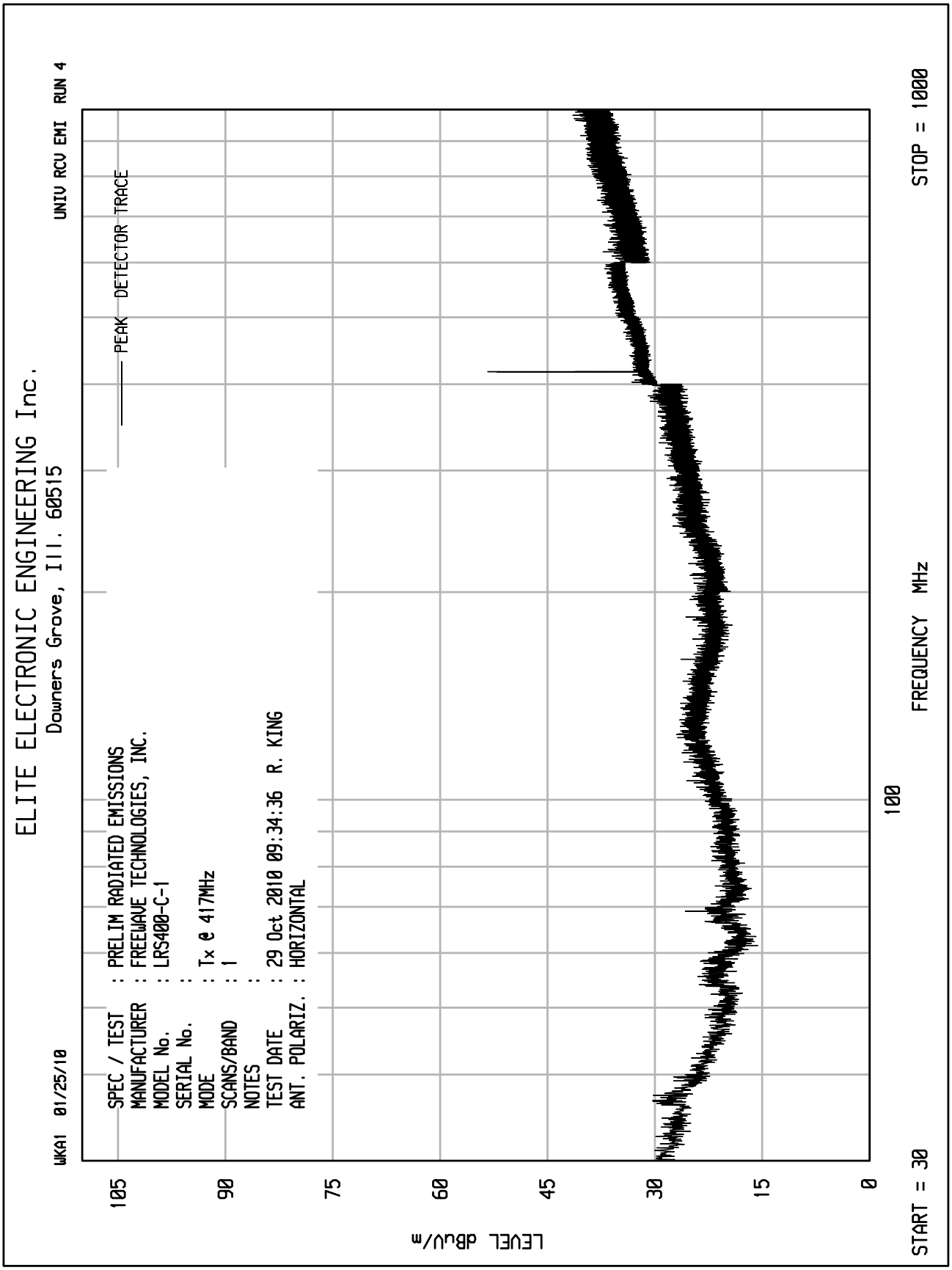

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 10
WKA1 01/25/10
SPEC / TEST : FCC PRELIM RADIATED EMISSIONS
MANUFACTURER : FREEWAVE TECHNOLOGIES
MODEL No. : LRS400-C
SERIAL No. :
MODE : Tx @ 406.1MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 4 Nov 2010 07:01:29 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 5000

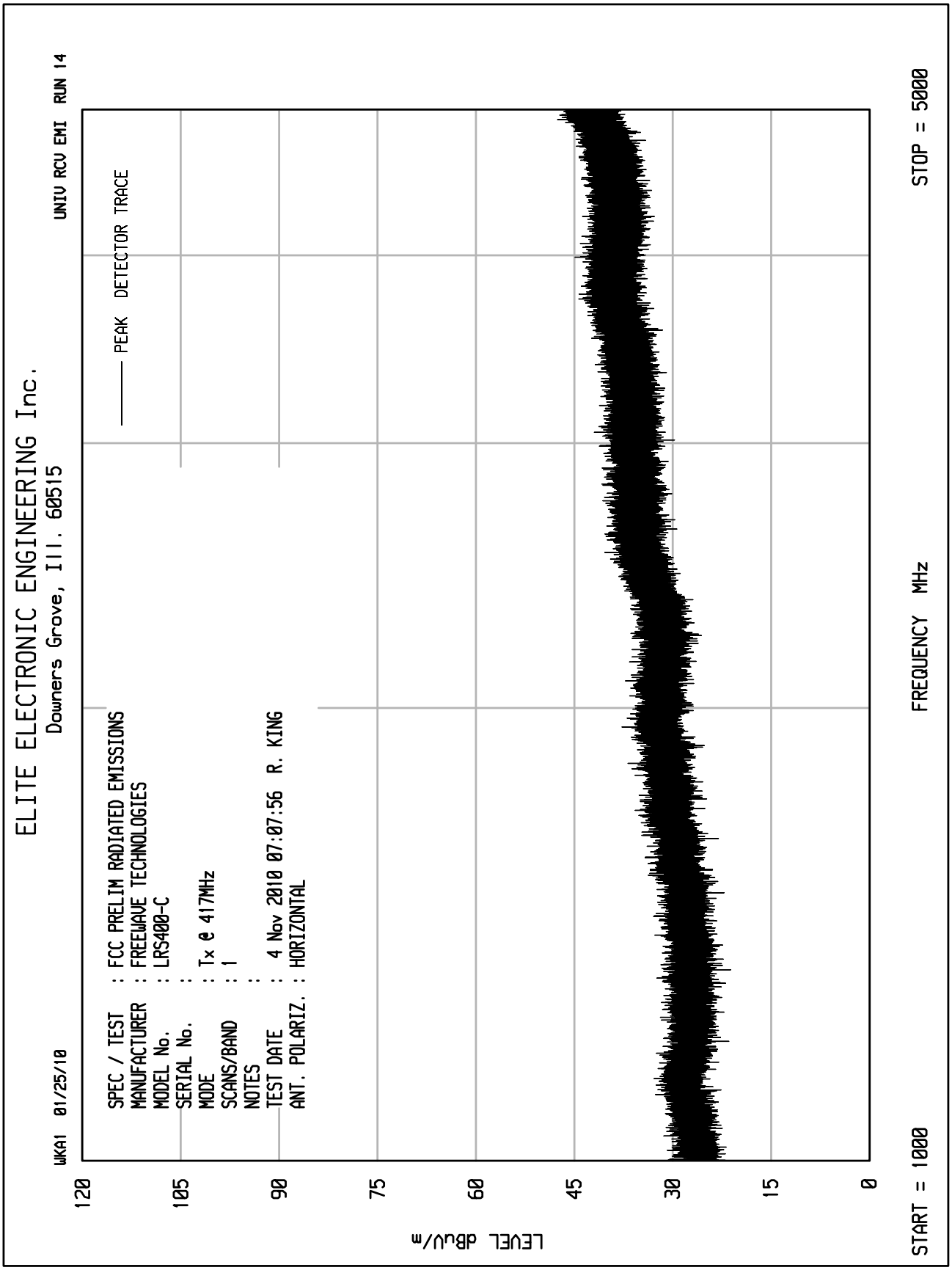

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 11
WKA1 01/25/10
SPEC / TEST : FCC PRELIM RADIATED EMISSIONS
MANUFACTURER : FREEWAVE TECHNOLOGIES
MODEL No. : LRS400-C
SERIAL No. :
MODE : Tx @ 406.1MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 4 Nov 2010 07:03:29 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 5000

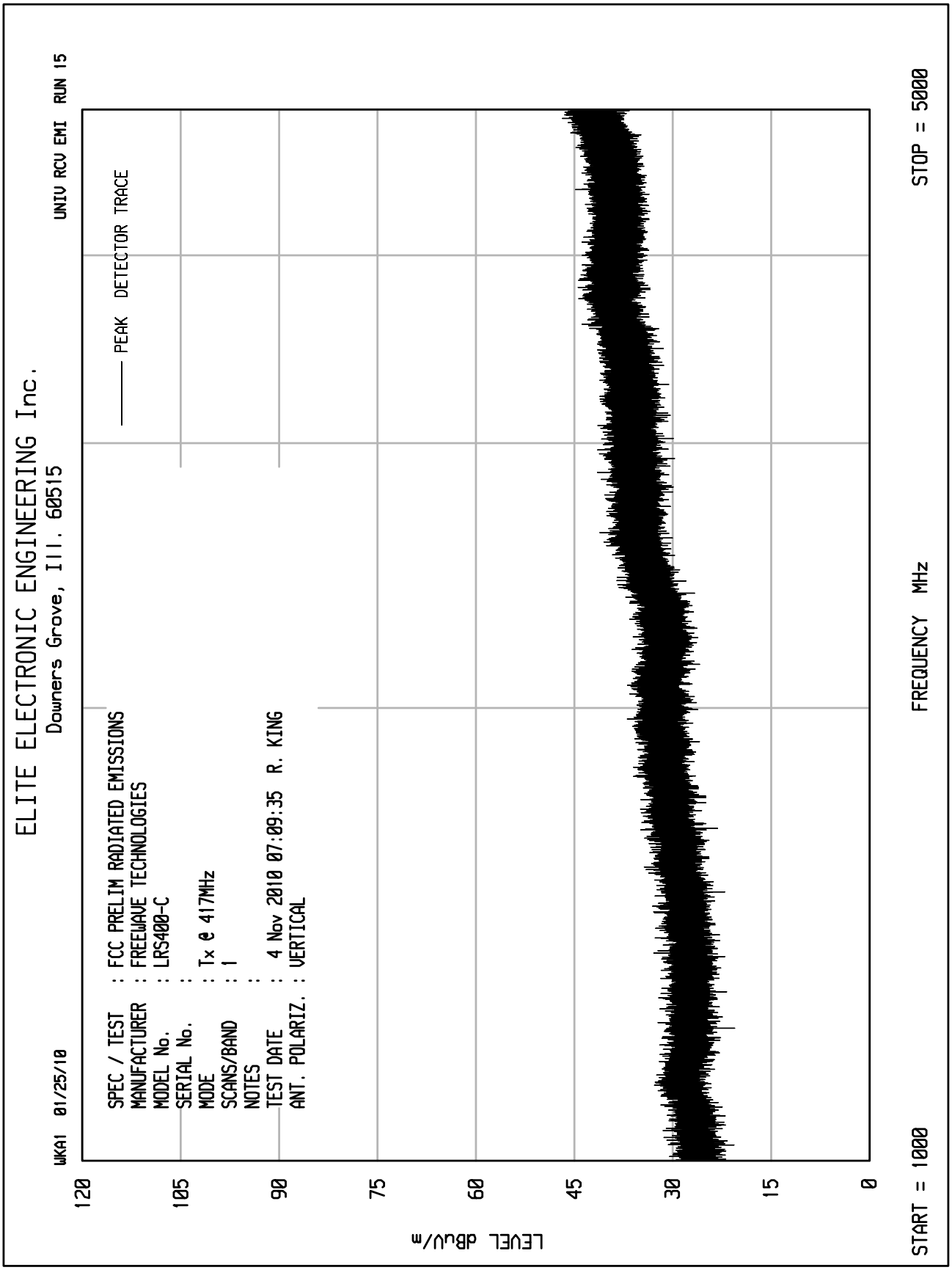

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 13
WKAI 01/25/10
SPEC / TEST : FCC PRELIM RADIATED EMISSIONS
MANUFACTURER : FREEWAVE TECHNOLOGIES
MODEL No. : LRS400-C
SERIAL No. :
MODE : Tx @ 410MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 4 Nov 2010 07:06:34 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 5000

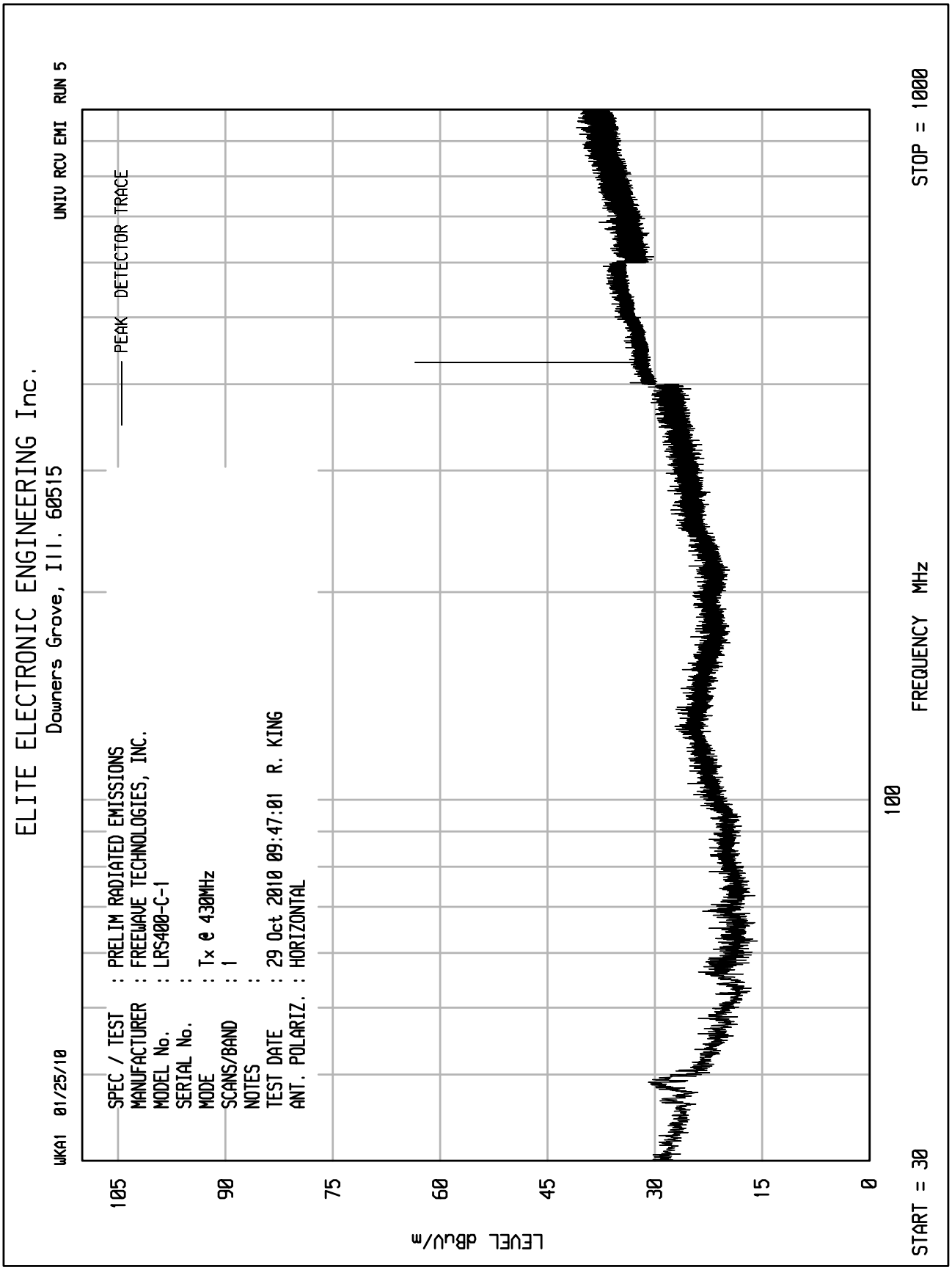

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 12
WKAI 01/25/10
SPEC / TEST : FCC PRELIM RADIATED EMISSIONS
MANUFACTURER : FREEWAVE TECHNOLOGIES
MODEL No. : LRS400-C
SERIAL No. :
MODE : Tx @ 410MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 4 Nov 2010 07:05:03 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 5000

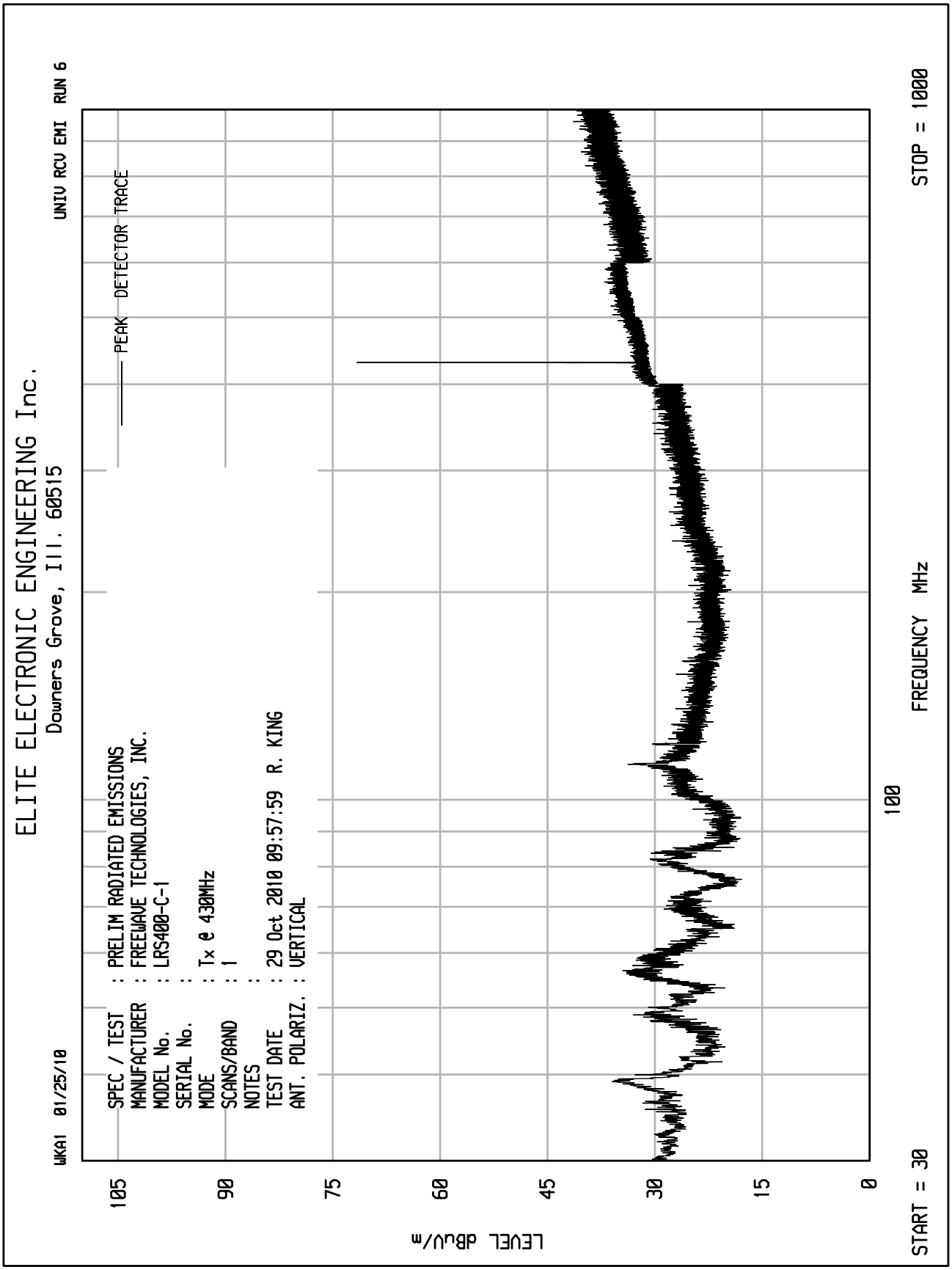

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 3
WKA1 01/25/10
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : FREEWAVE TECHNOLOGIES, INC.
MODEL No. : LRS400-C-1
SERIAL No. :
MODE : Tx @ 417MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 29 Oct 2010 09:24:34 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000

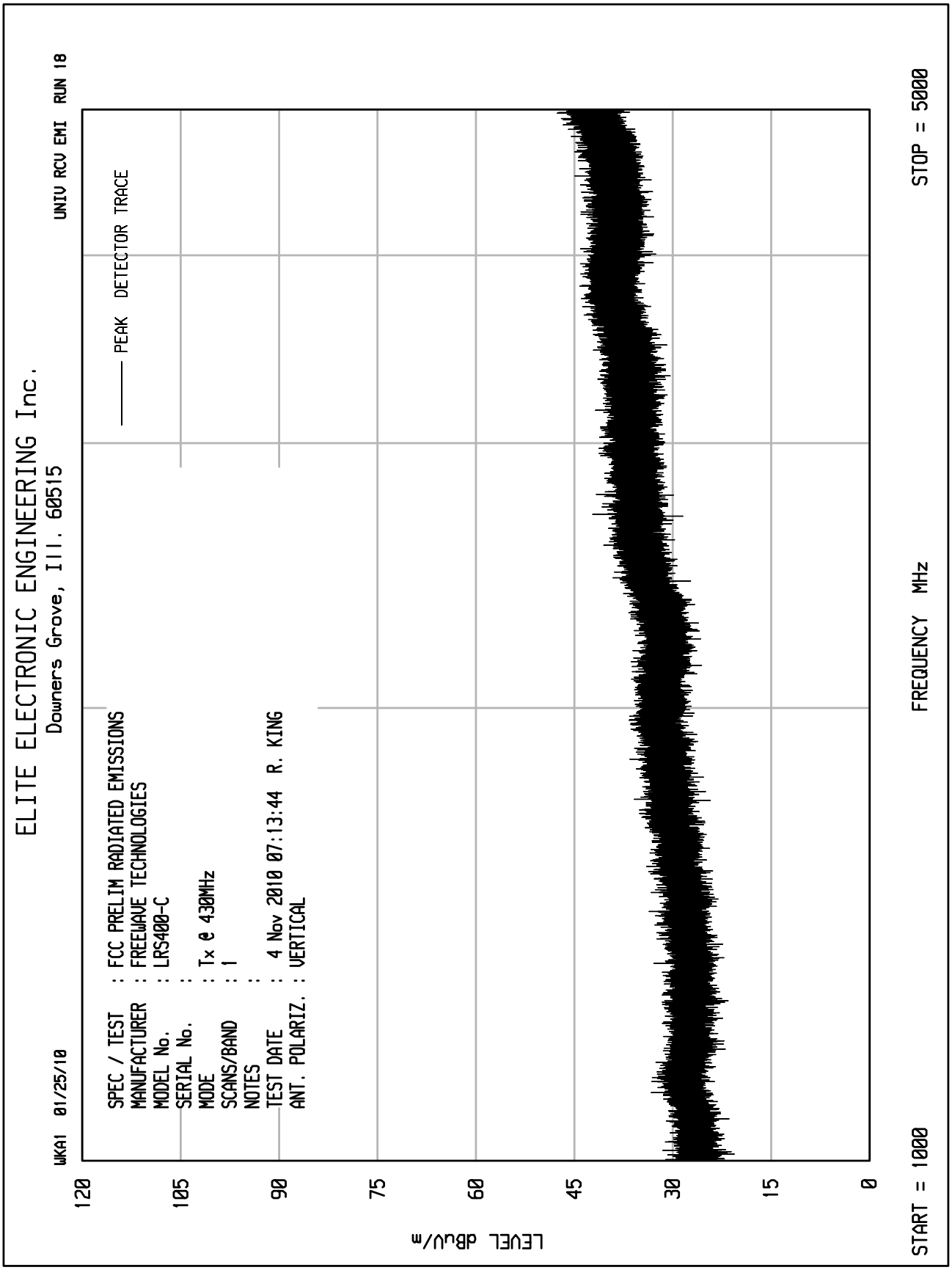

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 4
WKA1 01/25/10
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : FREEWAVE TECHNOLOGIES, INC.
MODEL No. : LRS400-C-1
SERIAL No. :
MODE : Tx @ 417MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 29 Oct 2010 09:34:36 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000

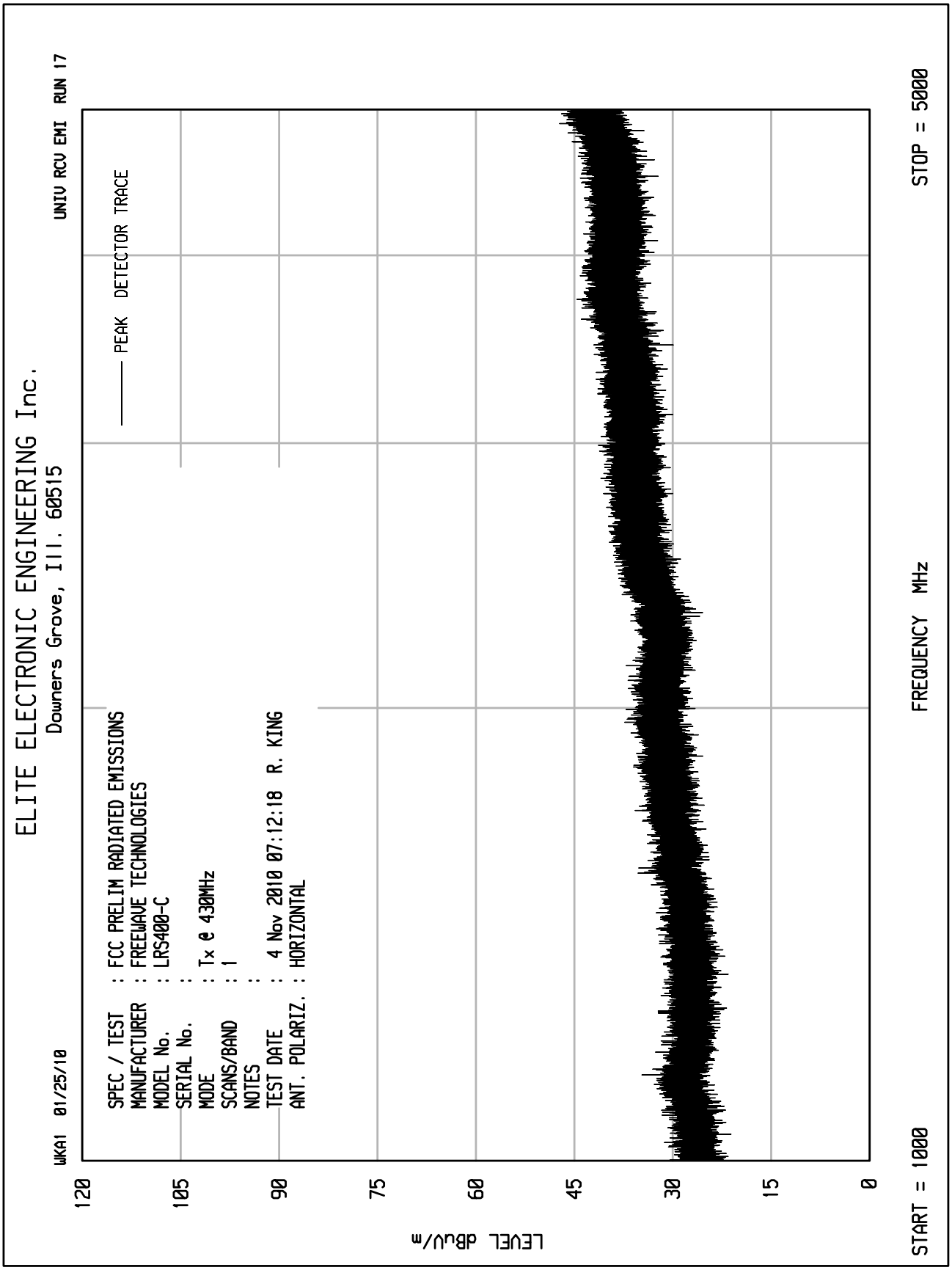

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 14
WKAI 01/25/10
SPEC / TEST : FCC PRELIM RADIATED EMISSIONS
MANUFACTURER : FREEWAVE TECHNOLOGIES
MODEL No. : LRS400-C
SERIAL No. :
MODE : Tx @ 417MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 4 Nov 2010 07:07:56 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 5000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 15
WKAI 01/25/10
SPEC / TEST : FCC PRELIM RADIATED EMISSIONS
MANUFACTURER : FREEWAVE TECHNOLOGIES
MODEL No. : LRS400-C
SERIAL No. :
MODE : Tx @ 417MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 4 Nov 2010 07:09:35 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 = 5000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 5
WKA1 01/25/10
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : FREEWAVE TECHNOLOGIES, INC.
MODEL No. : LRS400-C-1
SERIAL No. :
MODE : Tx @ 430MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 29 Oct 2010 09:47:01 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 6
WKA1 01/25/10
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : FREEWAVE TECHNOLOGIES, INC.
MODEL No. : LRS400-C-1
SERIAL No. :
MODE : Tx @ 430MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 29 Oct 2010 09:57:59 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
105
90
75
60
45
30
15
0
START = 30
100
FREQUENCY MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 18
WKA1 01/25/10
SPEC / TEST : FCC PRELIM RADIATED EMISSIONS
MANUFACTURER : FREEWAVE TECHNOLOGIES
MODEL No. : LRS400-C
SERIAL No. :
MODE : Tx @ 430MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 4 Nov 2010 07:13:44 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 = 5000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 17
WKAI 01/25/10
SPEC / TEST : FCC PRELIM RADIATED EMISSIONS
MANUFACTURER : FREEWAVE TECHNOLOGIES
MODEL No. : LRS400-C
SERIAL No. :
MODE : Tx @ 430MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 4 Nov 2010 07:12:18 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 = 5000

MANUFACTURER : Free Wave Technologies
MODEL : LRS400S-C
SPECIFICATION : FCC Part 90/RSS-119 Spurious Radiated Emissions
DATE : October 29, 2010
NOTES : Transmit at 406.1MHz
: Test Distance is 3 meters

Freq (MHz)	Ant Pol	Meter Reading (dBuV)	Ambient	Matched SIG. GEN. (dB)	Equilent Ant Gain (dB)	CBL (dB)	Total (dBm)	MIN ATTEN	FCC Minimum Attenuation
812.00	H	17.3		-58.1	0.0	1.8	-59.9	92.9	53
812.00	V	16.2		-58.3	0.0	1.8	-60.1	93.1	53
1218.00	H	27.8		-48.9	3.7	2.2	-47.3	80.4	53
1218.00	V	28.7		-47.2	3.7	2.2	-45.7	78.7	53
1624.00	H	17.4		-58.5	5.0	2.6	-56.0	89.1	53
1624.00	V	13.6		-61.9	5.0	2.6	-59.5	92.5	53
2030.00	H	14.9		-58.9	5.3	2.9	-56.5	89.5	53
2030.00	V	14.9		-57.9	5.3	2.9	-55.5	88.5	53
2436.00	H	16.0	*	-56.6	5.8	3.1	-53.9	86.9	53
2436.00	V	17.4		-53.0	5.8	3.1	-50.3	83.3	53
2842.00	H	17.5		-53.6	5.8	3.2	-51.0	84.0	53
2842.00	V	16.5		-52.2	5.8	3.2	-49.6	82.6	53
3248.00	H	15.4	*	-54.4	6.3	3.5	-51.6	84.7	53
3248.00	V	16.8		-51.1	6.3	3.5	-48.3	81.3	53
3654.00	H	16.4	*	-51.7	6.8	3.8	-48.7	81.7	53
3654.00	V	15.9	*	-51.0	6.8	3.8	-48.0	81.0	53
4060.00	H	15.6	*	-50.1	7.1	4.1	-47.0	80.0	53
4060.00	V	15.3	*	-49.9	7.1	4.1	-46.8	79.9	53

MIN ATTEN = (matched signal + antenna gain - cable loss) – power in dBm
FCC minimum attenuation = 50+ 10*log(Power in watts) = 50 + 10*log(2W) = 53

Checked BY Richard E. King :

Richard E. King

MANUFACTURER : Free Wave Technologies
MODEL : LRS400S-C
SPECIFICATION : FCC Part 90/RSS-119 Spurious Radiated Emissions
DATE : October 29, 2010
NOTES : Transmit at 410MHz
: Test Distance is 3 meters

Freq (MHz)	Ant Pol	Meter Reading (dBuV)	Ambient	Matched SIG. GEN. (dB)	Equilent Ant Gain (dB)	CBL (dB)	Total (dBm)	MIN ATTEN	FCC Minimum Attenuation
820.00	H	17.3		-58.0	0.0	1.8	-59.8	92.8	53
820.00	V	16.2		-58.1	0.0	1.8	-59.9	92.9	53
1230.00	H	22.0		-54.6	3.8	2.2	-53.0	86.1	53
1230.00	V	24.7		-51.3	3.8	2.2	-49.7	82.7	53
1640.00	H	15.9		-59.9	5.1	2.6	-57.4	90.5	53
1640.00	V	14.6		-60.7	5.1	2.6	-58.3	91.3	53
2050.00	H	18.6		-55.2	5.4	2.9	-52.7	85.7	53
2050.00	V	17.5		-55.2	5.4	2.9	-52.7	85.7	53
2460.00	H	15.3		-57.2	5.8	3.1	-54.5	87.5	53
2460.00	V	16.0		-54.2	5.8	3.1	-51.5	84.5	53
2870.00	H	18.0		-53.0	5.8	3.2	-50.4	83.4	53
2870.00	V	17.9		-50.7	5.8	3.2	-48.1	81.1	53
3280.00	H	15.2	*	-54.6	6.3	3.5	-51.8	84.8	53
3280.00	V	14.8	*	-53.2	6.3	3.5	-50.3	83.3	53
3690.00	H	16.0	*	-51.8	6.8	3.8	-48.8	81.8	53
3690.00	V	16.0	*	-50.7	6.8	3.8	-47.7	80.7	53
4100.00	H	16.0	*	-49.6	7.3	4.1	-46.5	79.5	53
4100.00	V	14.6	*	-50.6	7.3	4.1	-47.5	80.5	53

MIN ATTEN = (matched signal + antenna gain - cable loss) – power in dBm
FCC minimum attenuation = 50+ 10*log(Power in watts) = 50 + 10*log(2W) = 53

Checked BY Richard E. King :

Richard E. King

MANUFACTURER : Free Wave Technologies
MODEL : LRS400S-C
SPECIFICATION : FCC Part 90/RSS-119 Spurious Radiated Emissions
DATE : October 29, 2010
NOTES : Transmit at 417MHz
: Test Distance is 3 meters

Freq (MHz)	Ant Pol	Meter Reading (dBuV)	Ambient	Matched SIG. GEN. (dB)	Equilent Ant Gain (dB)	CBL (dB)	Total (dBm)	MIN ATTEN	FCC Minimum Attenuation
834.00	H	21.4		-53.7	0.0	1.8	-55.5	88.5	53
834.00	V	15.6		-58.4	0.0	1.8	-60.2	93.2	53
1251.00	H	24.7		-51.9	3.9	2.3	-50.3	83.3	53
1251.00	V	29.0		-47.1	3.9	2.3	-45.4	78.4	53
1668.00	H	17.6		-57.9	5.1	2.7	-55.5	88.5	53
1668.00	V	17.6		-57.5	5.1	2.7	-55.1	88.1	53
2085.00	H	17.6		-56.0	5.4	2.9	-53.5	86.5	53
2085.00	V	16.3		-56.2	5.4	2.9	-53.7	86.7	53
2502.00	H	14.8		-57.6	5.8	3.1	-54.9	87.9	53
2502.00	V	15.2		-54.8	5.8	3.1	-52.1	85.1	53
2919.00	H	15.6		-55.3	5.8	3.2	-52.7	85.7	53
2919.00	V	15.9		-52.6	5.8	3.2	-50.0	83.0	53
3336.00	H	13.9	*	-55.8	6.4	3.5	-52.9	85.9	53
3336.00	V	13.4	*	-54.5	6.4	3.5	-51.6	84.6	53
3753.00	H	16.1	*	-51.3	6.8	3.9	-48.3	81.3	53
3753.00	V	14.9	*	-51.5	6.8	3.9	-48.5	81.5	53
4170.00	H	13.5	*	-52.1	7.4	4.2	-48.8	81.8	53
4170.00	V	14.4	*	-51.0	7.4	4.2	-47.7	80.7	53

MIN ATTEN = (matched signal + antenna gain - cable loss) – power in dBm
FCC minimum attenuation = 50+ 10*log(Power in watts) = 50 + 10*log(2W) = 53

Checked BY Richard E. King :

Richard E. King

MANUFACTURER : Free Wave Technologies
MODEL : LRS400S-C
SPECIFICATION : FCC Part 90/RSS-119 Spurious Radiated Emissions
DATE : October 29, 2010
NOTES : Transmit at 430MHz
: Test Distance is 3 meters

Freq (MHz)	Ant Pol	Meter Reading (dBuV)	Ambient	Matched SIG. GEN. (dB)	Equilent Ant Gain (dB)	CBL (dB)	Total (dBm)	MIN ATTEN	FCC Minimum Attenuation
860.00	H	23.0		-52.0	0.0	1.9	-53.9	86.9	53
860.00	V	16.8		-56.8	0.0	1.9	-58.7	91.7	53
1290.00	H	25.5		-51.1	4.1	2.3	-49.4	82.4	53
1290.00	V	26.7		-49.5	4.1	2.3	-47.7	80.7	53
1720.00	H	16.5		-58.7	5.1	2.7	-56.2	89.2	53
1720.00	V	17.2		-57.4	5.1	2.7	-55.0	88.0	53
2150.00	H	16.0		-57.4	5.5	3.0	-54.9	87.9	53
2150.00	V	14.1		-58.0	5.5	3.0	-55.5	88.5	53
2580.00	H	15.7	*	-56.4	5.8	3.1	-53.7	86.7	53
2580.00	V	15.4	*	-54.3	5.8	3.1	-51.6	84.6	53
3010.00	H	14.9	*	-55.7	5.8	3.2	-53.1	86.1	53
3010.00	V	17.0		-51.2	5.8	3.2	-48.7	81.7	53
3440.00	H	15.7	*	-53.6	6.6	3.6	-50.7	83.7	53
3440.00	V	14.0	*	-53.8	6.6	3.6	-50.8	83.8	53
3870.00	H	14.3	*	-52.3	6.9	3.9	-49.4	82.4	53
3870.00	V	15.6	*	-50.2	6.9	3.9	-47.2	80.2	53
4300.00	H	14.8	*	-50.8	7.8	4.2	-47.2	80.2	53
4300.00	V	14.8	*	-50.8	7.8	4.2	-47.3	80.3	53

MIN ATTEN = (matched signal + antenna gain - cable loss) – power in dBm
FCC minimum attenuation = 50+ 10*log(Power in watts) = 50 + 10*log(2W) = 53

Checked BY Richard E. King :

Richard E. King

MANUFACTURER : Free Wave Technologies
MODEL : LRS400S-C
SPECIFICATION : FCC Part 90/RSS-119 Frequency Stability vs. Temperature
DATE : November 2, 2010
EQUIPMENT USED : MFC0, SGB0, MDA1, T2S1, ETD0, ETDA
NOTES : Transmit at 410MHz

Temperature °C	Measured Frequency Hz	Frequency Error Hz	Limit Hz
+23	409999878		
-30	409999880	2	1025
-20	409999978	98	1025
-10	409999960	18	1025
0	409999995	35	1025
+10	409999983	12	1025
+20	409999925	58	1025
+30	409999875	50	1025
+40	409999976	101	1025
+50	409999909	67	1025

Limit = 2.5ppm = 409,999,878* 2.5ppm = 1025Hz

Checked BY Richard E. King :

Richard E. King

MANUFACTURER : Free Wave Technologies
MODEL : LRS400S-C
SPECIFICATION : FCC Part 90/RSS-119 Frequency Stability vs. Temperature
DATE : November 2, 2010
EQUIPMENT USED : MFC0, SGB0, MDA1, T2S1, ETD0, ETDA
NOTES : Transmit at 410MHz

Supply Voltage VDC	Measured Frequency Hz	Frequency Error Hz	Limit Hz
10.2(85%)	409999899	10	1025
12.0	409999909		
13.8(115%)	409999967	58	1025

Limit = 2.5ppm = 409,999,909* 2.5ppm = 1025Hz

Checked BY Richard E. King :

Richard E. King

MANUFACTURER : Free Wave Technologies
MODEL : LRS400S-C
SPECIFICATION : FCC Part 90/RSS-119 Frequency Stability vs. Temperature
DATE : November 2, 2010
EQUIPMENT USED : MFC0, SGB0, MDA1, T2S1, ETD0, ETDA
NOTES : Transmit at 417MHz

Temperature °C	Measured Frequency Hz	Frequency Error Hz	Limit Hz
+23	416999883		
-30	416999896	-13	1042.5
-20	416999977	-81	1042.5
-10	416999973	4	1042.5
0	416999986	-13	1042.5
+10	416999981	5	1042.5
+20	416999926	55	1042.5
+30	416999978	-52	1042.5
+40	416999877	101	1042.5
+50	416999916	-39	1042.5

Limit = 2.5ppm = 416,999,912* 2.5ppm = 1042.5Hz

Checked BY Richard E. King :

Richard E. King

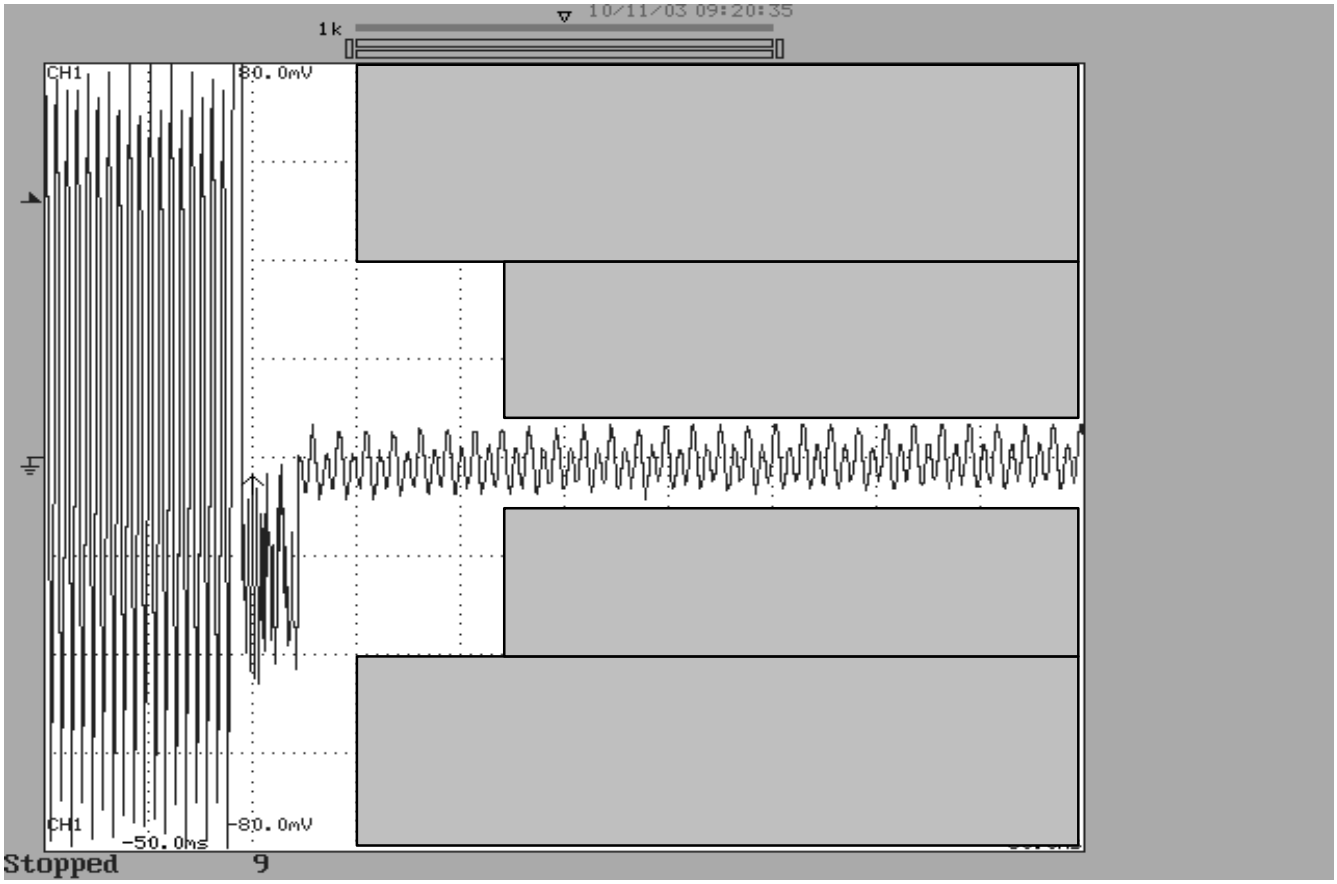
MANUFACTURER : Free Wave Technologies
MODEL : LRS400S-C
SPECIFICATION : FCC Part 90/RSS-119 Frequency Stability vs. Temperature
DATE : November 2, 2010
EQUIPMENT USED : MFC0, SGB0, MDA1, T2S1, ETD0, ETDA
NOTES : Transmit at 417MHz

Supply Voltage VDC	Measured Frequency Hz	Frequency Error Hz	Limit Hz
10.2 (85%)	416,999,943	31	1042.5
12.0	416,999,912		
13.8 (115%)	419,999,928	16	1042.5

Limit = 2.5ppm = 416,999,912* 2.5ppm = 1042.5Hz

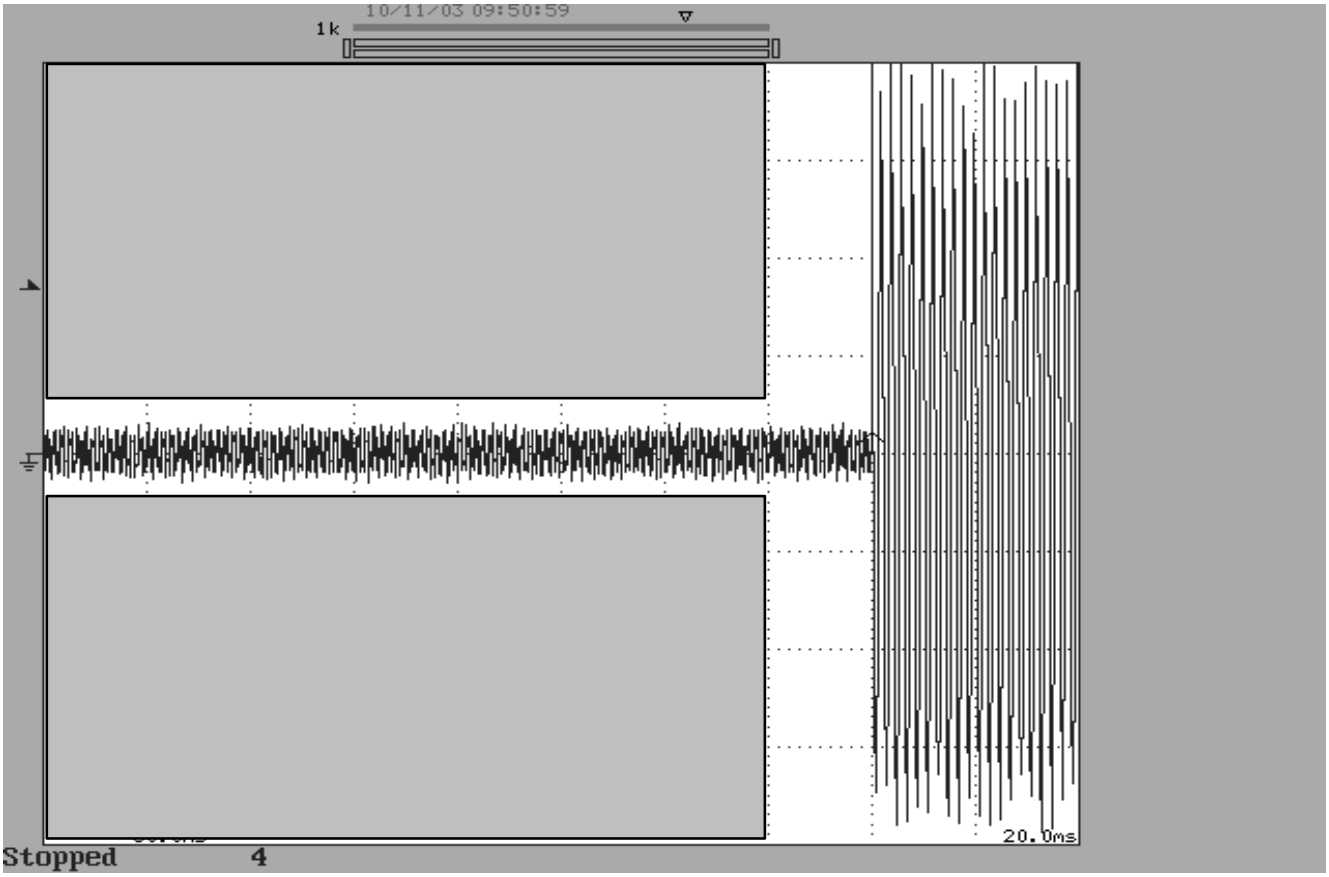
Checked BY Richard E. King :

Richard E. King



PART 90/RSS-119 - TRANSIENT FREQUENCY BEHAVIOR, ON TIME

MANUFACTURER	: Free Wave Technologies
MODEL NUMBER	: LRS400S-C
TEST	: Transient Frequency Behavior, On-time
TEST MODE	: Tx @ 410MHz, 12.5kHz channel spacing
TEST	: Transmit on Time, t1= 10ms, t2=25ms
EQUIPMENT USED	: MSP4, GBQ0, RYE0, T1D2



PART 90/RSS-119 - TRANSIENT FREQUENCY BEHAVIOR, ON TIME

MANUFACTURER	: Free Wave Technologies
MODEL NUMBER	: LRS400S-C
TEST	: Transient Frequency Behavior, OFF-time
TEST MODE	: Tx @ 410MHz, 12.5kHz channel spacing
TEST	: Transmit off Time, t3=10msec
EQUIPMENT USED	: MSP4, GBQ0, RYE0, T1D2