



Measurement of RF Emissions from a Model BMW L7 FLA/ZNAV/HL Transceiver

For	Gentex Corporation 600 N.Centennial Street Zeeland, MI 49464
P.O. Number	108677
Date Tested	October 11 through November 10, 2010
Test Personnel	Richard King
Test Specification	FCC "Code of Federal Regulations" Title 47 Part15, Subpart B, for Receivers and Subpart C Industry Canada RSS-GEN Industry Canada RSS-210

Test Report By:

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REVISION HISTORY

Revision	Date	Description
—	22 Nov 2010	Initial release

Measurement of RF Emissions from a Transceiver, Model No. BMW L7 FLA/ZNAV/HL Transmitter

1. INTRODUCTION

1.1. Scope of Tests

This report presents the results of the RF emissions measurements performed on a Transceiver, Model No. BMW L7 FLA/ZNAV/HL, (hereinafter referred to as the Equipment Under Test (EUT)). The EUT operates on the legal frequencies in the range from 288MHz through 418MHz. It has an internal antenna. The EUT was manufactured and submitted for testing by Gentex Corporation located in Zeeland, MI.

1.2. Purpose

The test series was performed to determine if the receiver portion of EUT meets the conducted and radiated RF emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart B, Section 109 for receivers and Industry Canada RSS-GEN.

The test series was performed to determine if the transmitter portion EUT meets the conducted and radiated RF emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Section 15.231 for Intentional Radiators and Industry Canada RSS-GEN and RSS-210.

Testing was performed in accordance with ANSI C63.4-2003.

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 22.1°C and the relative humidity was 43.1%.

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
- Federal Communications Commission "Code of Federal Regulations", Title 47, Part 15, Subpart B for Receivers, 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
- Industry Canada Radio Standards Specification, RSS-210, "Low-power Licence-exempt



3. EUT SETUP AND OPERATION

3.1. General Description

The EUT is a Gentex Corporation, Transceiver, Model No. BMW L7 FLA/ZNAV/HL. A block diagram of the EUT setup is shown as Figure 1.

3.1.1. Power Input

The EUT obtained 13.6VDC from an external DC power supply. The EUT is typically power with 12VDC from an automotive battery.

3.1.2. Peripheral Equipment

The EUT does not require peripheral equipment.

3.1.3. Signal Input/Output Leads

The following interconnect cables were submitted with the EUT:

Item	Description
Power harness	1 meter long, two lead input power harness

3.1.4. Grounding

The EUT was grounded only through the return lead of its input power lead.

3.2. Operational Mode

For all tests, the EUT was placed on an 80cm high non-conductive stand. The EUT and all peripheral equipment were energized.

The EUT was set at each of the following frequencies: 288MHz, 310MHz, and 418MHz. In addition, radiated emissions were measured with the EUT set to transmit at 321MHz, 340MHz, 365MHz, and 390MHz. Training was performed using a signal generator and pulse modulation to set the transmit frequency and the modulation to 30%, 50% or 80%.

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. Receiver Radiated Measurements

5.1.1. Requirements

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

RADIATION LIMITS FOR RECEIVER

Frequency MHz	Distance between EUT and Antenna in Meters	Field Strength uV/m	Field Strength dBuV/m
30-88	3	100	40
88-216	3	150	43.5
216-960	3	200	46
Above 960	3	500	54

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

5.1.2. 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 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.

Since a quasi-peak detector and an average detector require(s) long integration times, it is not practical to automatically sweep through the quasi-peak and average 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 or average detector.

The broadband measuring antenna was positioned at a 3 meter distance from the EUT. The frequency range from 30MHz to 1GHz was investigated using a peak detector function with the bilog antenna at several

heights, horizontal and vertical polarization, and with several different orientations of the EUT with respect to the antenna. The frequency range from 1GHz to 2GHz was investigated using a peak detector function with the double ridged waveguide antenna at several heights, horizontal and vertical polarization, and with several different orientations of the EUT with respect to the antenna. The maximum levels for each antenna polarization were plotted. The resultant field strength (FS) is a summation in decibels (dB) of the receiver meter reading (MTR), the antenna correction factor (AF), and the cable loss factor (CF). If an external pre-amplifier is used, the total is reduced by its gain (-PA). If a distance correction (DC) is required, it is added to the total.

Formula 1: $FS \text{ (dBuV/m)} = MTR \text{ (dBuV)} + AF \text{ (dB/m)} + CF \text{ (dB)} + (-PA \text{ (dB)}) + DC \text{ (dB)}$

To convert the Field Strength dBuV/m term to uV/m, the dBuV/m is first divided by 20. The Base 10 AntiLog is taken of this quotient. The result is the Field Strength value in uV/m terms.

Formula 2: $FS \text{ (uV/m)} = \text{AntiLog} [(FS \text{ (dBuV/m)})/20]$

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

- 1) Measurements from 30MHz to 1GHz were made using a quasi-peak detector and a broadband bilog antenna. Measurements above 1GHz were made using an average detector and a broadband double ridged waveguide antenna.
- 2) To ensure that 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

5.1.3.Results

The preliminary plots are presented on pages 16 through 31. The plots are presented for a reference only, and are not used to determine compliance. The final radiated levels are presented on pages 32 through 36. As can be seen from the data, all emissions measured from the EUT were within the specification limits. Photographs of the test setup are shown in Figures 2 and 3.

5.2. Periodic Operation Measurements

5.2.1.Requirements

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

5.2.2.Procedures

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

5.2.3.Results

The plot of the periodic timing is shown on data page 37. The data shows that the EUT ceases operation within the allotted time.



5.3. Duty Cycle Factor Measurements

5.3.1. Procedures

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

With the transmitter set up to transmit for maximum pulse density, the time domain trace is displayed on the spectrum analyzer. This trace is obtained by tuning center frequency to the transmitter frequency and then setting a zero span width with 10msec/div. The amplitude settings are adjusted so that the on/off transitions clear the 4th division from the bottom of the display. The markers are set at the beginning and end of a word period. If the word period exceeds 100 msec the word period is set to 100 msec. The on-time and off-time are then measured. The on-time is total time signal level exceeds the 4th division. Off-time is time under for the word period. The duty cycle is then computed as the (On-time/ word period) where the word period = (On-time + Off-time).

The EUT is a learned transmitter and was trained using 500Hz pulse modulation at 30%, 50% and 80% duty cycles.

The duty cycle factor to apply was determined for the duty cycles of 30%, 50% and 80% as Follows:

For 30% (0.30): duty cycle factor = $20 \cdot \log((600 \text{ uS} \cdot 50)/100\text{mS}) = -10.46 \text{ dB}$

For 50% (0.50): duty cycle factor = $20 \cdot \log((1.002\text{mS} \cdot 50)/100\text{mS}) = -6.00 \text{ dB}$

For 80% (0.80): duty cycle factor = $20 \cdot \log((1.599\text{mS} \cdot 50)/100\text{mS}) = -1.94 \text{ dB}$

5.3.2. Results

Representative plots of the duty cycle are shown on pages 38 through 43

5.4. Radiated Measurements

5.4.1. Requirements

The EUT must comply with the requirements of FCC "Code of Federal Regulations Title 47", Part 15, Subpart C, Section 15.205 et seq.

Paragraph 15.231(b) has the following radiated emission limits:

Fundamental Frequency MHz	Field Intensity uV/m @ 3 meters	Field Strength Harmonics and Spurious @ 3 meters
260 to 470	3,750 to 12,500*	375 to 1,250*

* - Linear Interpolation

For 288MHz, the limit at the fundamental is 4916.7uV/m @ 3m. The limit for the harmonics is 491.6uV/m @ 3m or the general limit shown in 15.209 whichever limit permits a higher field strength.

For 310MHz, the limit at the fundamental is 5833.3uV/m @ 3m. The limit for the harmonics is 583.3uV/m @ 3m or the general limit shown in 15.209 whichever limit permits a higher field strength.

For 340MHz, the limit at the fundamental is 7083.3uV/m @ 3m. The limit for the harmonics is 708.3uV/m @ 3m or the general limit shown in 15.209 whichever limit permits a higher field strength.

For 365MHz, the limit at the fundamental is 8125.0uV/m @ 3m. The limit for the harmonics is 812.5uV/m @ 3m or the general limit shown in 15.209 whichever limit permits a higher field strength.

For 390MHz, the limit at the fundamental is 9166.7uV/m @ 3m. The limit for the harmonics is 916.7uV/m @ 3m or the general limit shown in 15.209 whichever limit permits a higher field strength.

For 418MHz, the limit at the fundamental is 10333.3uV/m @ 3m. The limit for the harmonics is 1033.3uV/m @ 3m or the general limit shown in 15.209 whichever limit permits a higher field strength.



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

5.4.2.Procedures

All tests were performed in a 32ft. x 20ft. x 18ft. hybrid ferrite-tile/anechoic absorber lined test chamber. The walls and ceiling of the shielded chamber are lined with ferrite tiles. Anechoic absorber material is installed over the ferrite tile. The floor of the chamber is used as the ground plane. The chamber complies with ANSI C63.4-2003 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.

A preliminary radiated emissions test was performed to determine the emission characteristics of the EUT. For the preliminary test, a broadband measuring antenna was positioned at a 3 meter distance from the EUT. The entire frequency range from 30MHz to 5.0GHz was investigated using a peak detector function. The data was then processed by the computer to calculate equivalent field intensity. * Replace with the proper frequency range.

The final open field emission tests were then manually performed over the frequency range of 30MHz to 5000MHz. Between 30MHz and 1000MHz, a bilog antenna was used as the pick-up device. A broadband double ridged waveguide antenna was used as the pick-up device for all frequencies above 1GHz. All significant broadband and narrowband signals were measured and recorded. The peak detected levels were converted to average levels using a duty cycle factor which was computed from the pulse train.

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

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

5.4.3.Results

The preliminary plots, with the EUT transmitting at 288MHz, 310MHz and 418MHz, are presented on data pages 44 through 79. The plots are presented for a reference only, and are not used to determine compliance.

The radiated emission levels with the EUT transmitting at 288MHz, 310MHz and 418MHz, are presented on data pages 80 through 88. In addition, the radiated emission levels with the EUT transmitting 321 MHz 340MHz, 365MHz and 390MHz are shown on data pages 89 through 90. As can be seen from the data, all emissions measured from the EUT were within the specification limits.

Photographs of the EUT set-up radiated emission levels are shown on Figure 2 and Figure 3.

5.5. Occupied Bandwidth Measurements

5.5.1.Requirement

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

5.5.2.Procedures

The EUT was placed on an 80cm high non-conductive stand. The unit was set to transmit continuously. With an antenna positioned nearby, occupied bandwidth emissions were displayed on the spectrum analyzer. The



resolution bandwidth was set to 50 kHz and span was set to 2 MHz. The frequency spectrum near the fundamental was plotted. The 99% bandwidth was measured to be 505kHz.

5.5.3.Results

The plot of the emissions near the fundamental frequency is presented on data pages 91 through 99. As can be seen from this data page, the transmitter met the occupied bandwidth requirements.

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 Gentex Corporation upon completion of the tests.

7. CONCLUSIONS

It was determined that the receiver portion of Gentex Corporation Transceiver, Model No. BMW L7 FLA/ZNAV/HL, did fully meet the radiated interference requirements of Section 15.109 of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart B for Receivers and the Industry Canada Radio Standards Specification, RSS-Gen, for Receivers.

It was determined that the transmitter portion Gentex Corporation Transceiver, Model No. BMW L7 FLA/ZNAV/HL, did fully meet the radiated emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Section 15.205 et seq. for Intentional Radiators, and Industry Canada Radio Standards Specification, RSS-210 when tested per ANSI C63.4-2003.

8. CERTIFICATION

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

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

This report must not be used to claim product 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
CMA1	Controllers	EMCO	2090	9701-1213	---	N/A	
GRE0	SIGNAL GENERATOR	AGILENT TECHNOLOGIES	E4438C	MY42083127	250KHZ-6GHZ	2/16/2010	2/16/2011
NTA2	BILOG ANTENNA	TESEQ	6112D	28040	25-1000MHz	6/7/2010	6/7/2011
NWH0	RIDGED WAVE GUIDE	TENSOR	4105	2081	1-12.4GHZ	8/31/2010	8/31/2011
RAKG	RF SECTION	HEWLETT PACKARD	85462A	3549A00284	0.009-6500MHZ	2/16/2010	2/16/2011
RAKH	RF FILTER SECTION	HEWLETT PACKARD	85460A	3448A00324	---	2/16/2010	2/16/2011
RBB0	EMI TEST RECEIVER 20HZ TO 40 GHZ.	ROHDE & SCHWARZ	ESIB40	100250	20 HZ TO 40GHZ	3/16/2010	3/16/2011
SSP0	POWER SUPPLY, 80 VOLTS, 33 AMPERES	SORENSEN	DCR 80-33B2	9537131	80 VOLTS, 33 AMPERES	NOTE 1	

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.

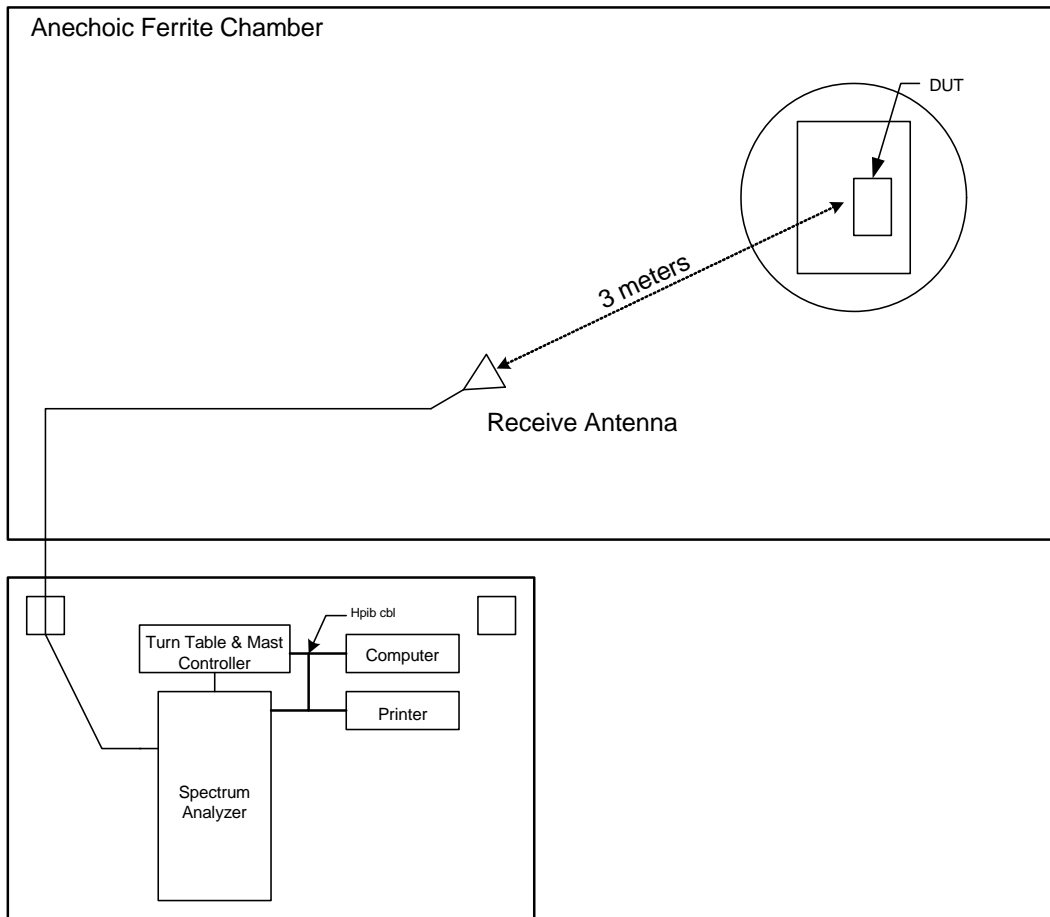


FIGURE 1 BLOCKDIAGRAM OF TEST SETUP

Figure 2



Test Setup for Radiated Emissions below 1000MHz Horizontal Polarity



Test Setup for Radiated Emissions below 1000MHz Vertical Polarity

Figure 3



Test Setup for Radiated Emissions above 1000MHz Horizontal Polarity

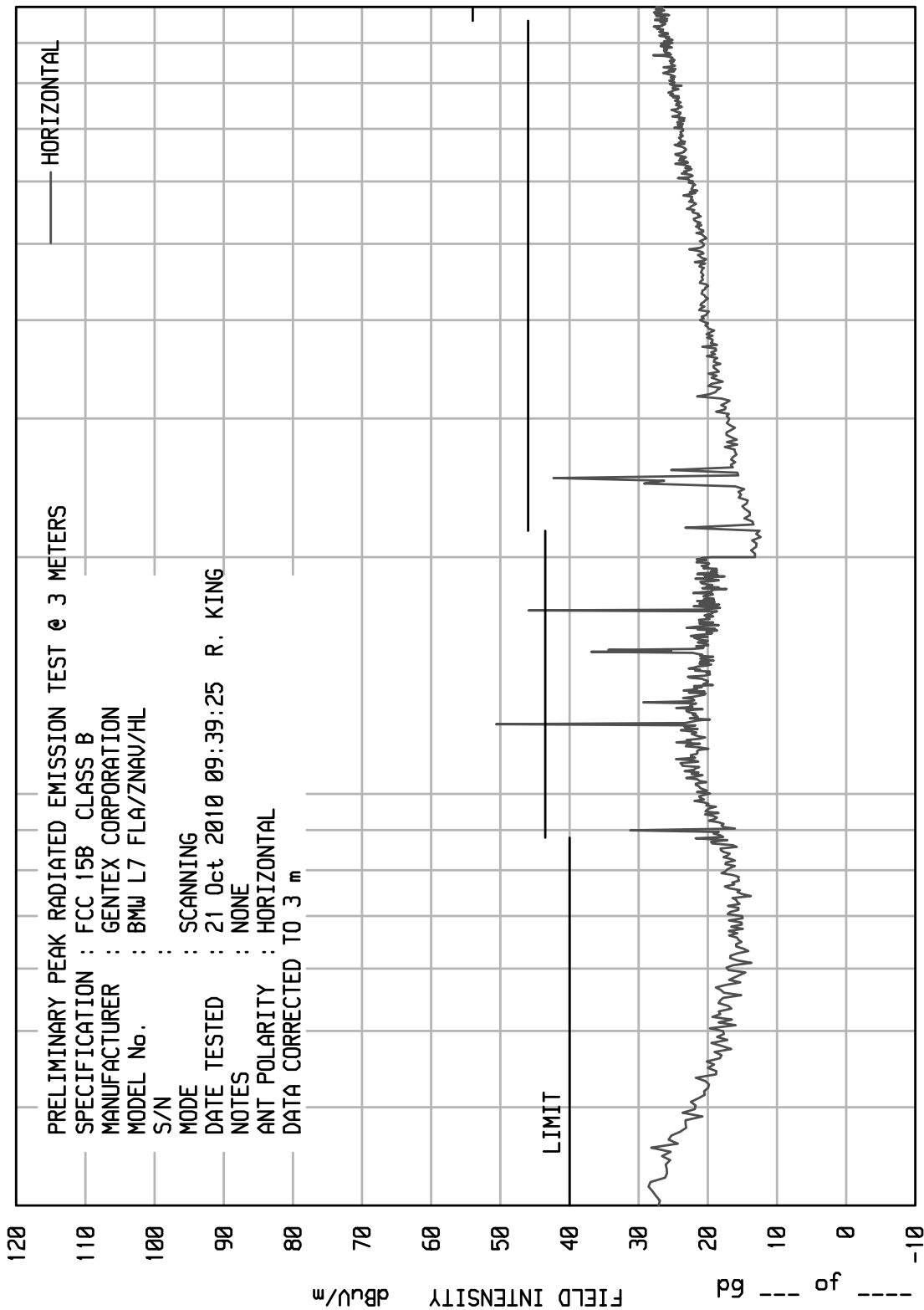


Test Setup for Radiated Emissions above 1000MHz Vertical Polarity

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515

W080 11/24/08

8546A RE RUN 8



START = 30

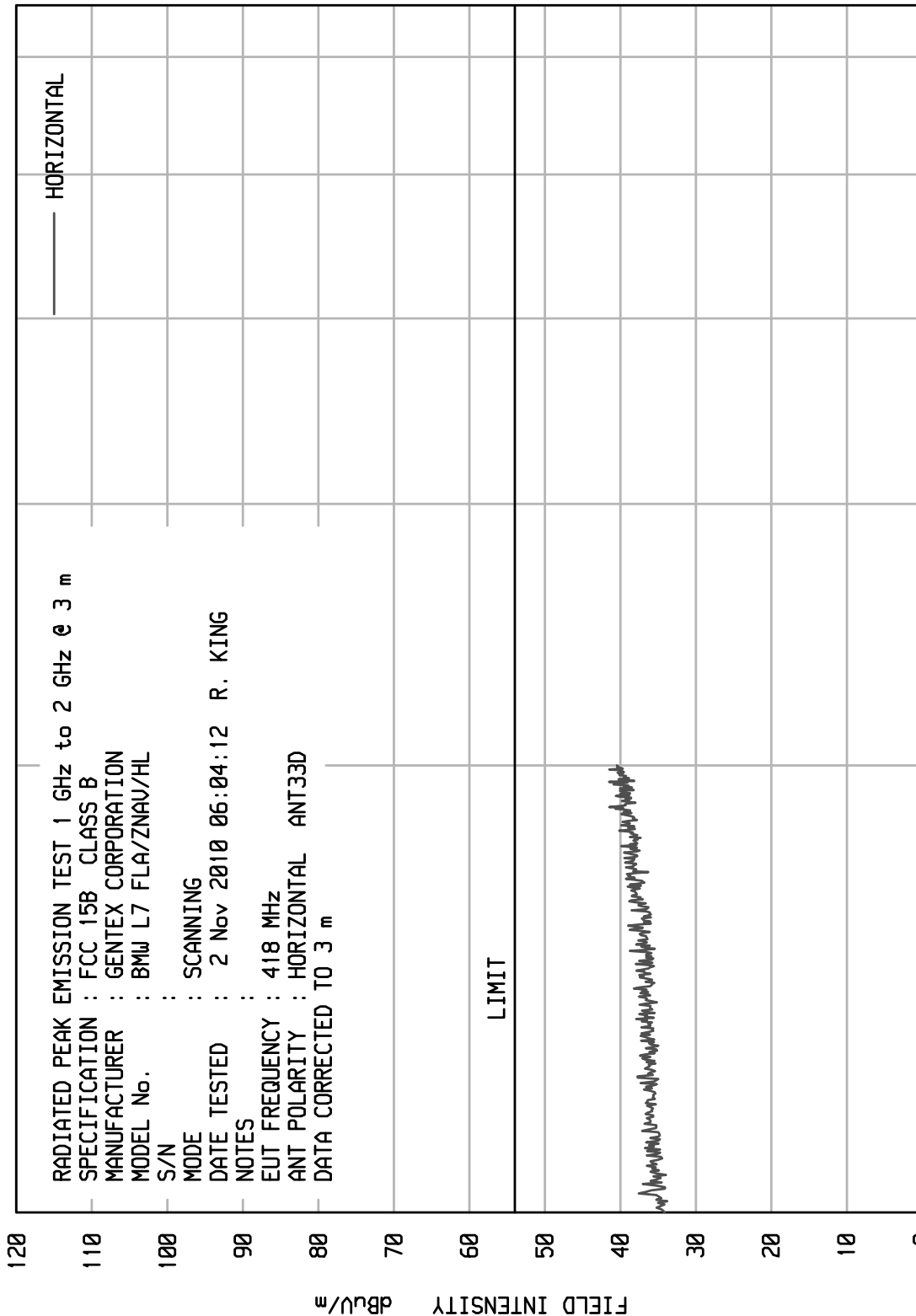
STOP = 1000



ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515

8546A HF RUN 4

WQC0 03/19/09



START = 1000

FREQUENCY - MHz

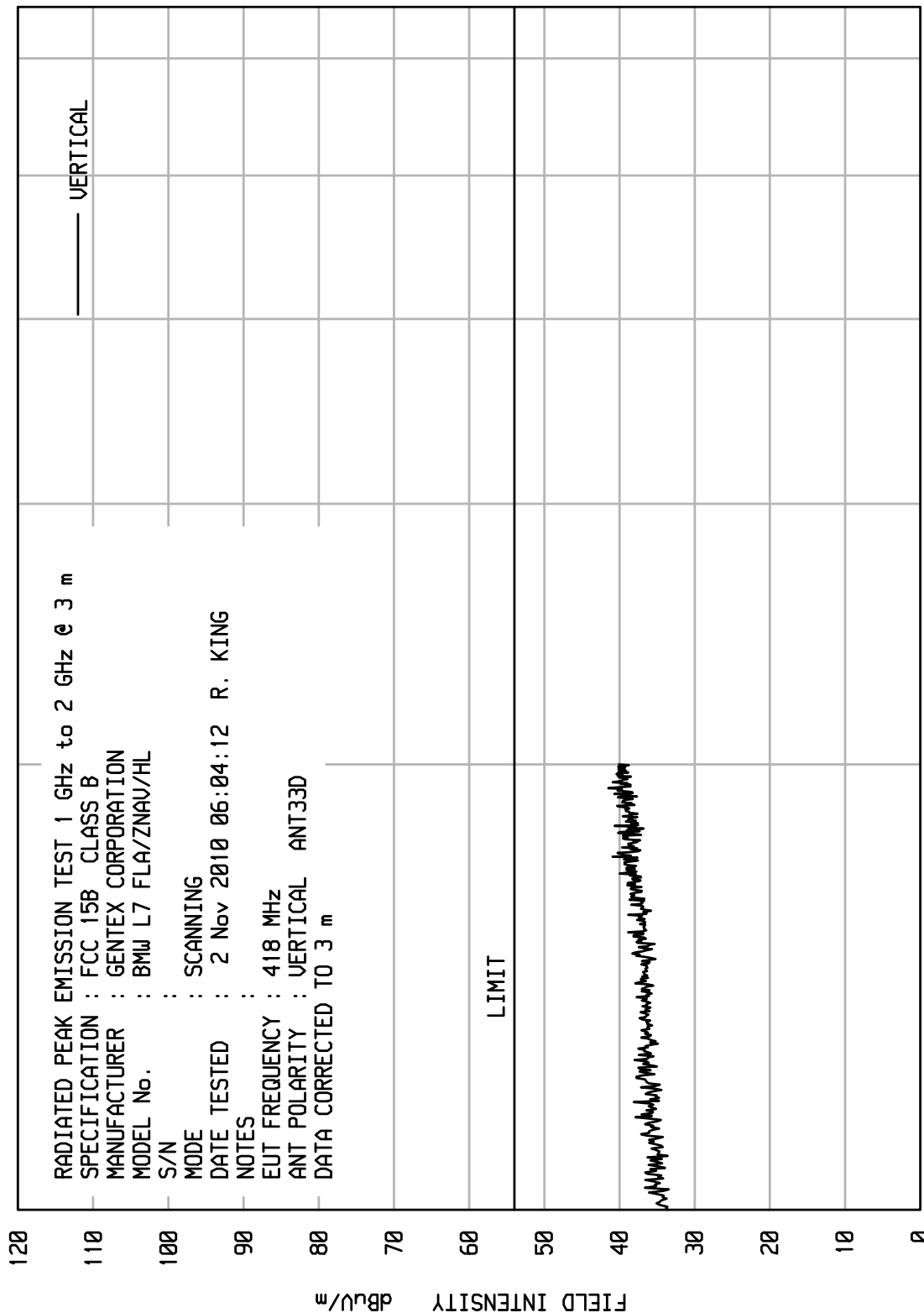
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ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515

WQC0 03/19/09

8546A HF RUN 4



START = 1000

FREQUENCY - MHz

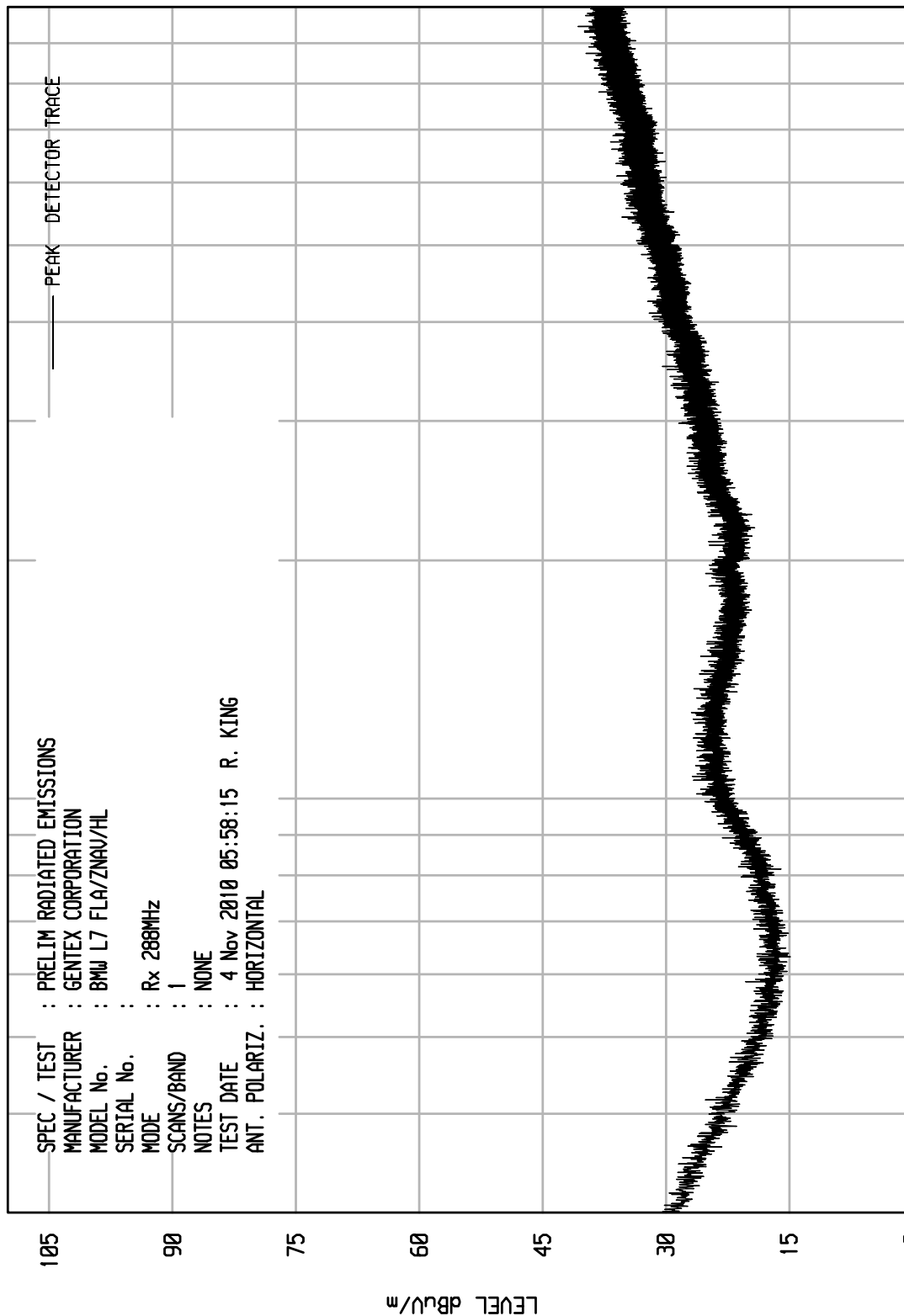
STOP = 6500

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515

UNIU RCU EMI RUN 53

UKA1 01/25/10

SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : GENTEX CORPORATION
MODEL No. : BMW L7 FLA/ZNAU/HL
SERIAL No. :
MODE : Rx 288MHz
SCANS/BAND : 1
NOTES : NONE
TEST DATE : 4 Nov 2010 05:58:15 R. KING
ANT. POLARIZ. : HORIZONTAL



START = 30

100

FREQUENCY MHz

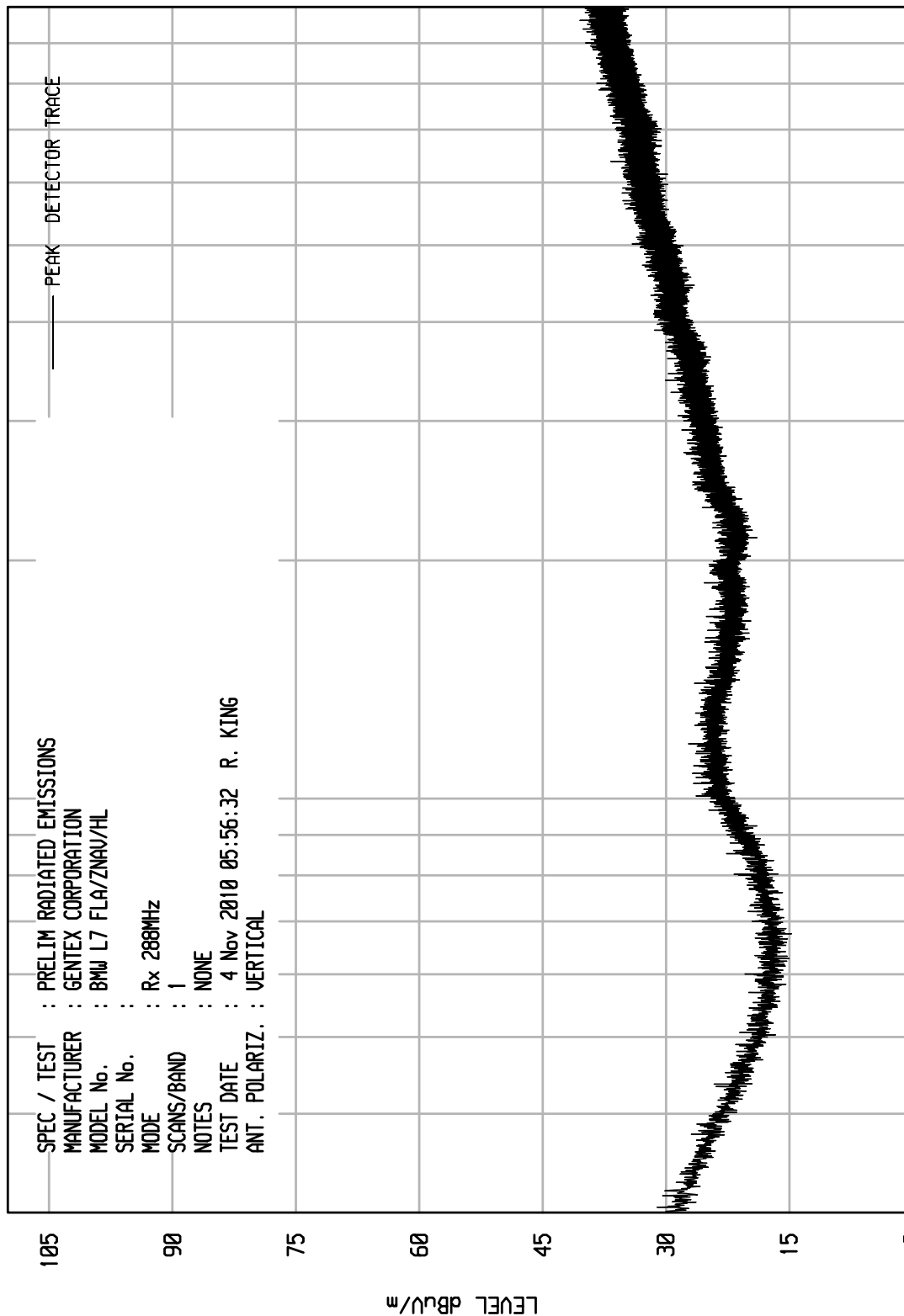
STOP = 1000

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515

UNIU RCU EMI RUN 52

UKA1 01/25/10

SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : GENTEX CORPORATION
MODEL No. : BMW L7 FLA/ZNAU/HL
SERIAL No. :
MODE : Rx 288MHz
SCANS/BAND : 1
NOTES : NONE
TEST DATE : 4 Nov 2010 05:56:32 R. KING
ANT. POLARIZ. : VERTICAL



START = 30

100

FREQUENCY MHz

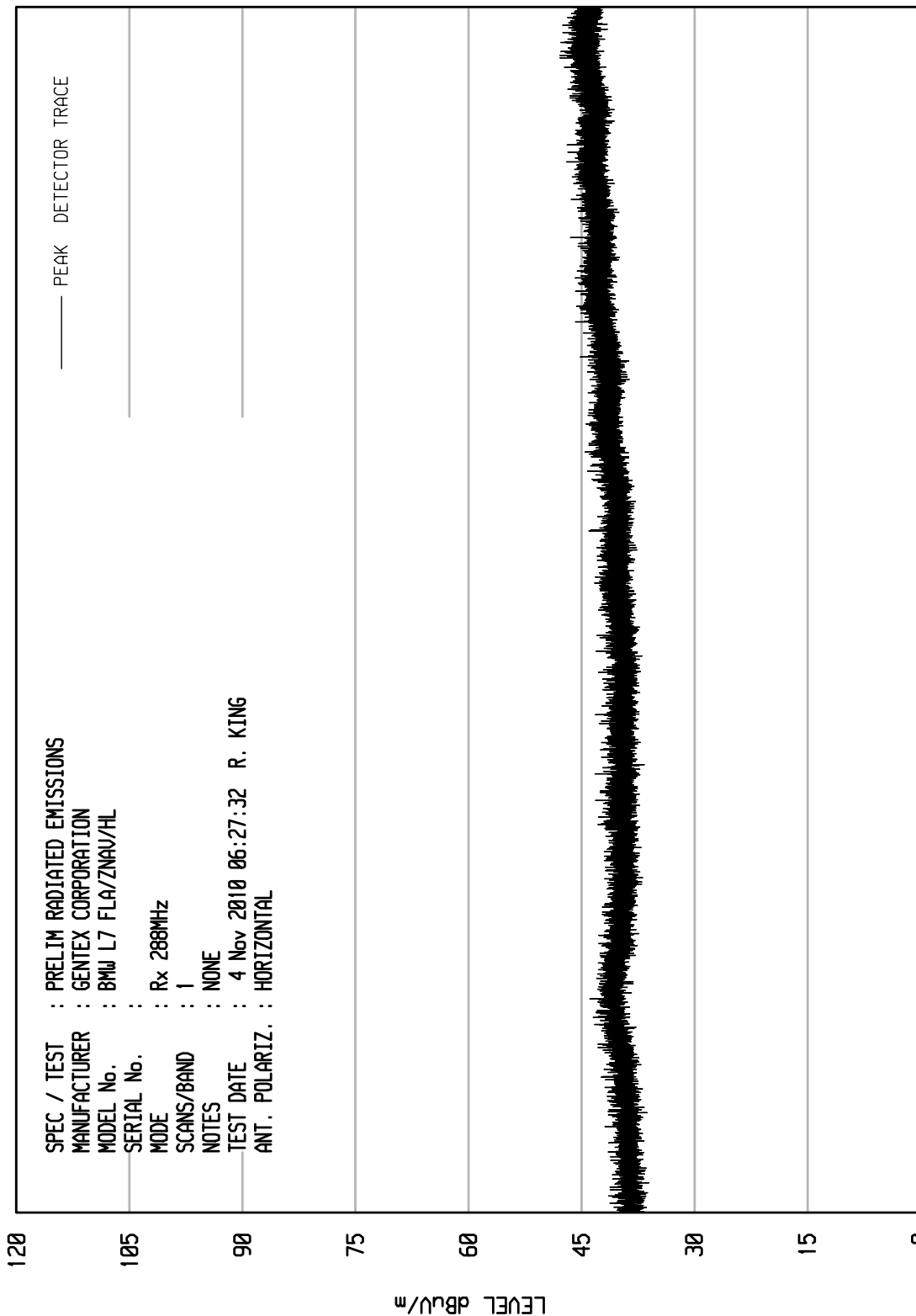
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ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515

UKA1 01/25/10

UNITV RCU EMI RUN 71



START = 1000

STOP = 2000

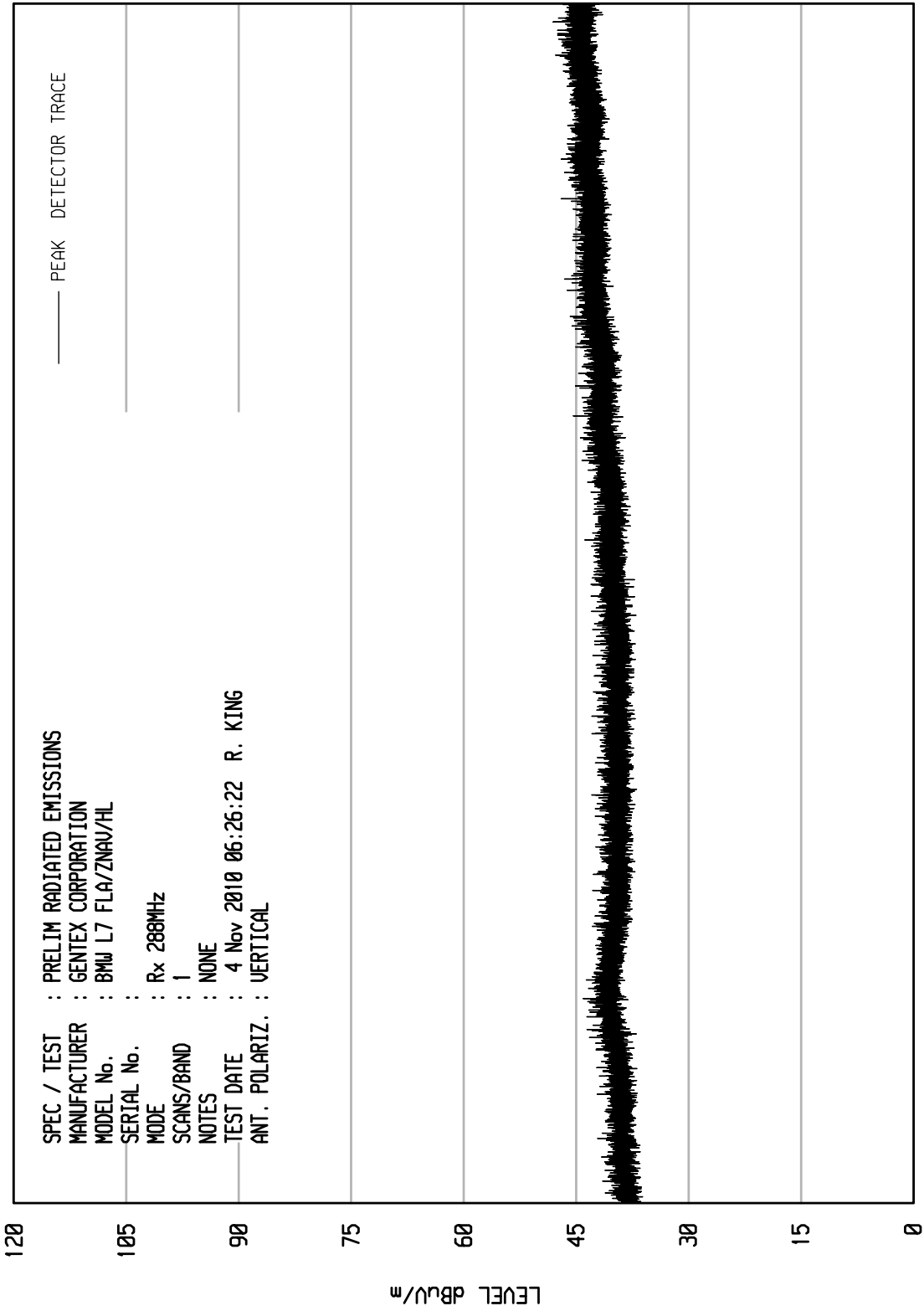


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515

UNIU RCU EMI RUN 70

UKA1 01/25/10

SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : GENTEX CORPORATION
MODEL No. : BMW L7 FLA/ZNAU/HL
SERIAL No. :
MODE : Rx 288MHz
SCANS/BAND : 1
NOTES : NONE
TEST DATE : 4 Nov 2010 06:26:22 R. KING
ANT. POLARIZ. : VERTICAL

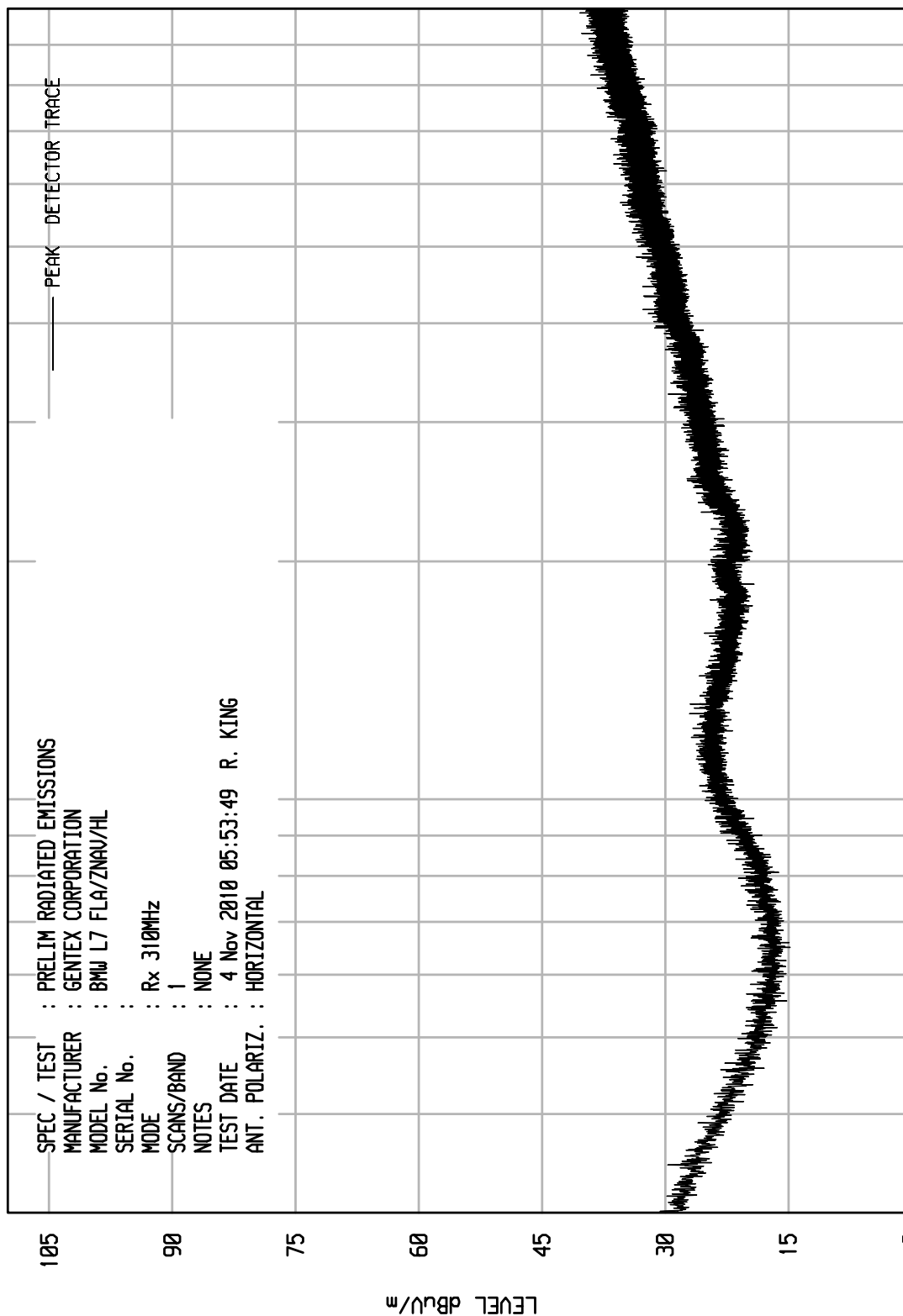




ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515

UKA1 01/25/10

UNIV RCU EMI RUN 50



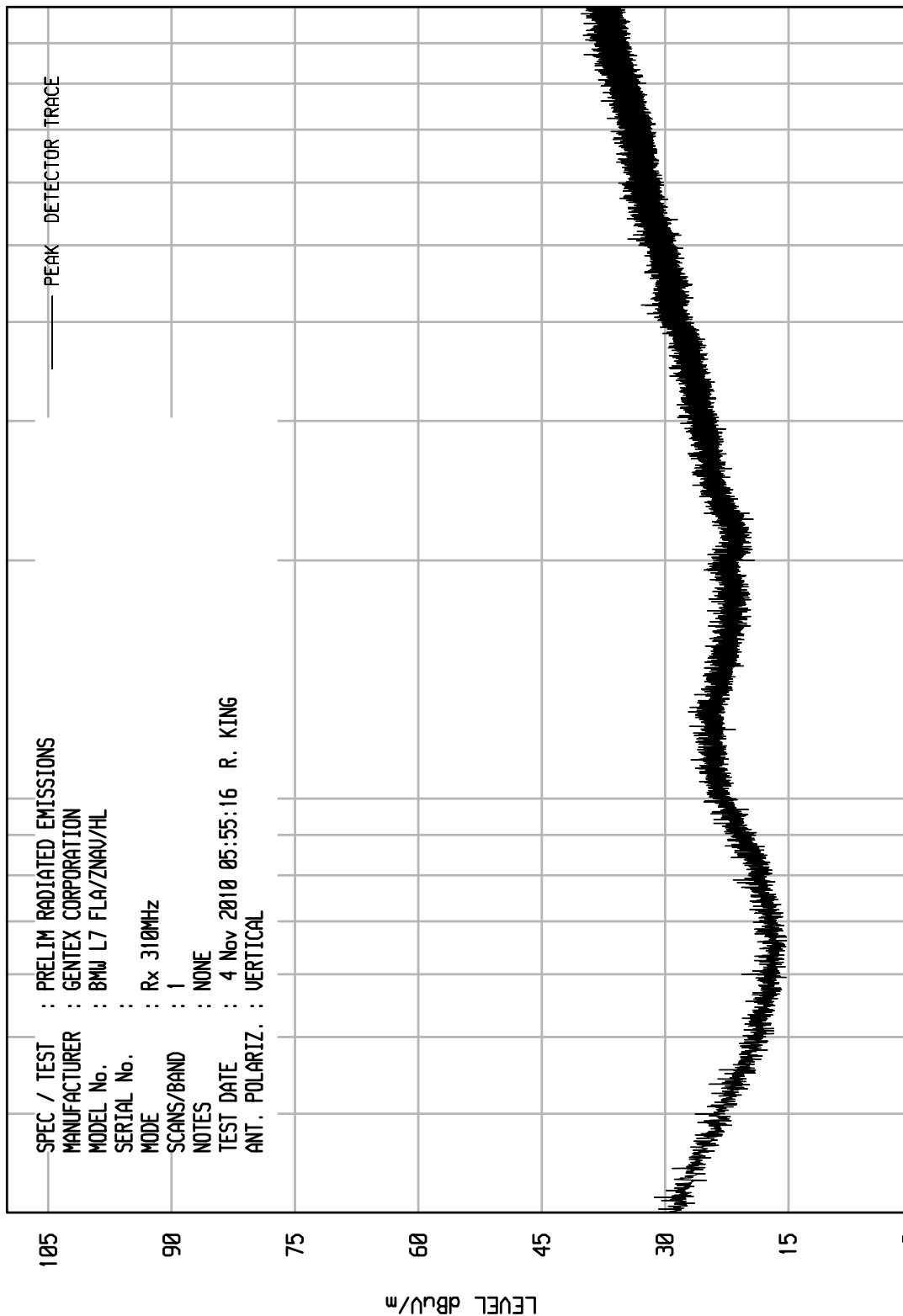
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STOP = 1000

ELITE ELECTRONIC ENGINEERING Inc.
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UKA1 01/25/10

UNIU RCU EMI RUN 51



START = 30

100

FREQUENCY MHz

STOP = 1000

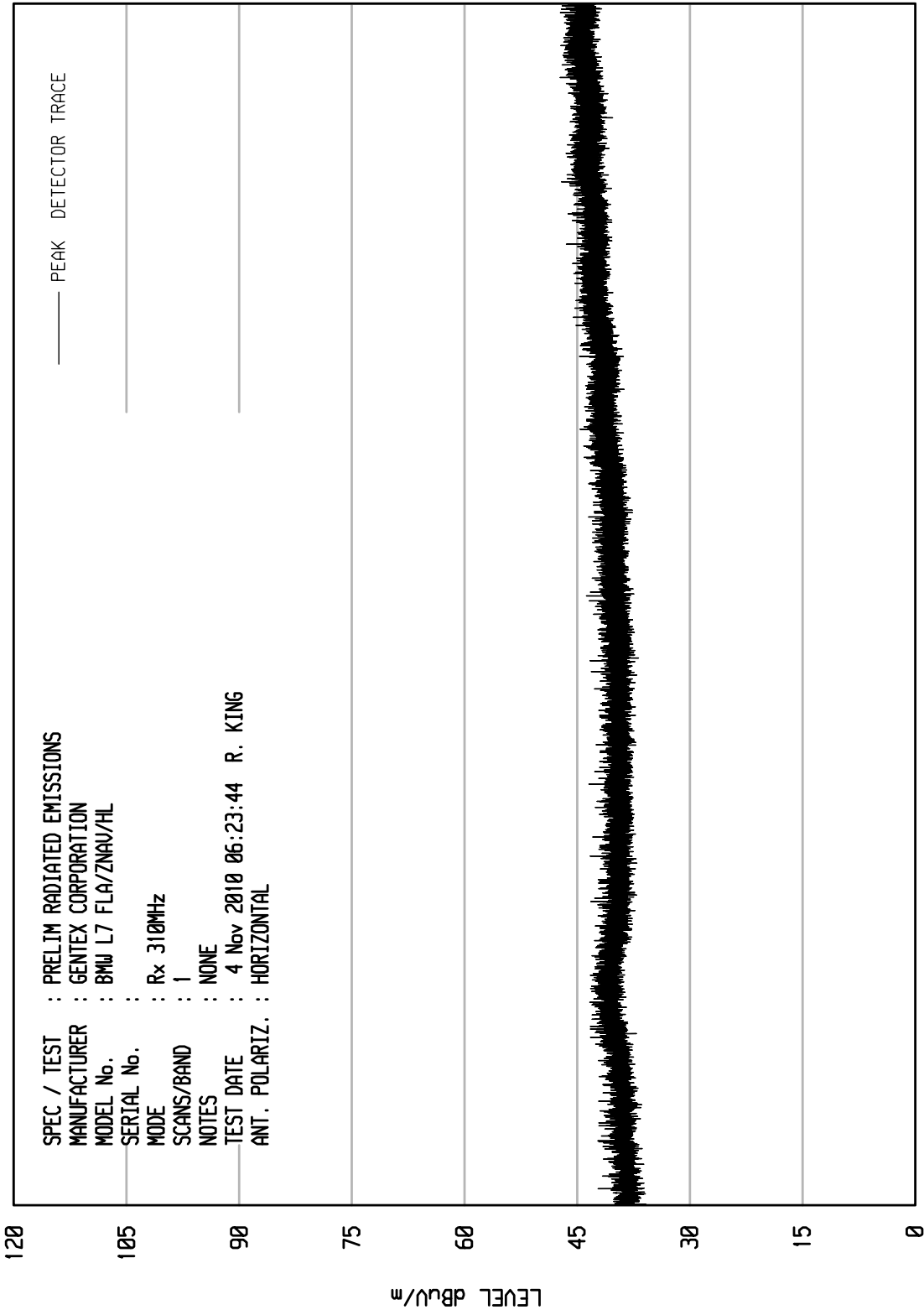


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UNIU RCU EMI RUN 68

UKA1 01/25/10

SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : GENTEX CORPORATION
MODEL No. : BMW L7 FLA/ZNAU/HL
SERIAL No. :
MODE : Rx 310MHz
SCANS/BAND : 1
NOTES : NONE
TEST DATE : 4 Nov 2010 06:23:44 R. KING
ANT. POLARIZ. : HORIZONTAL

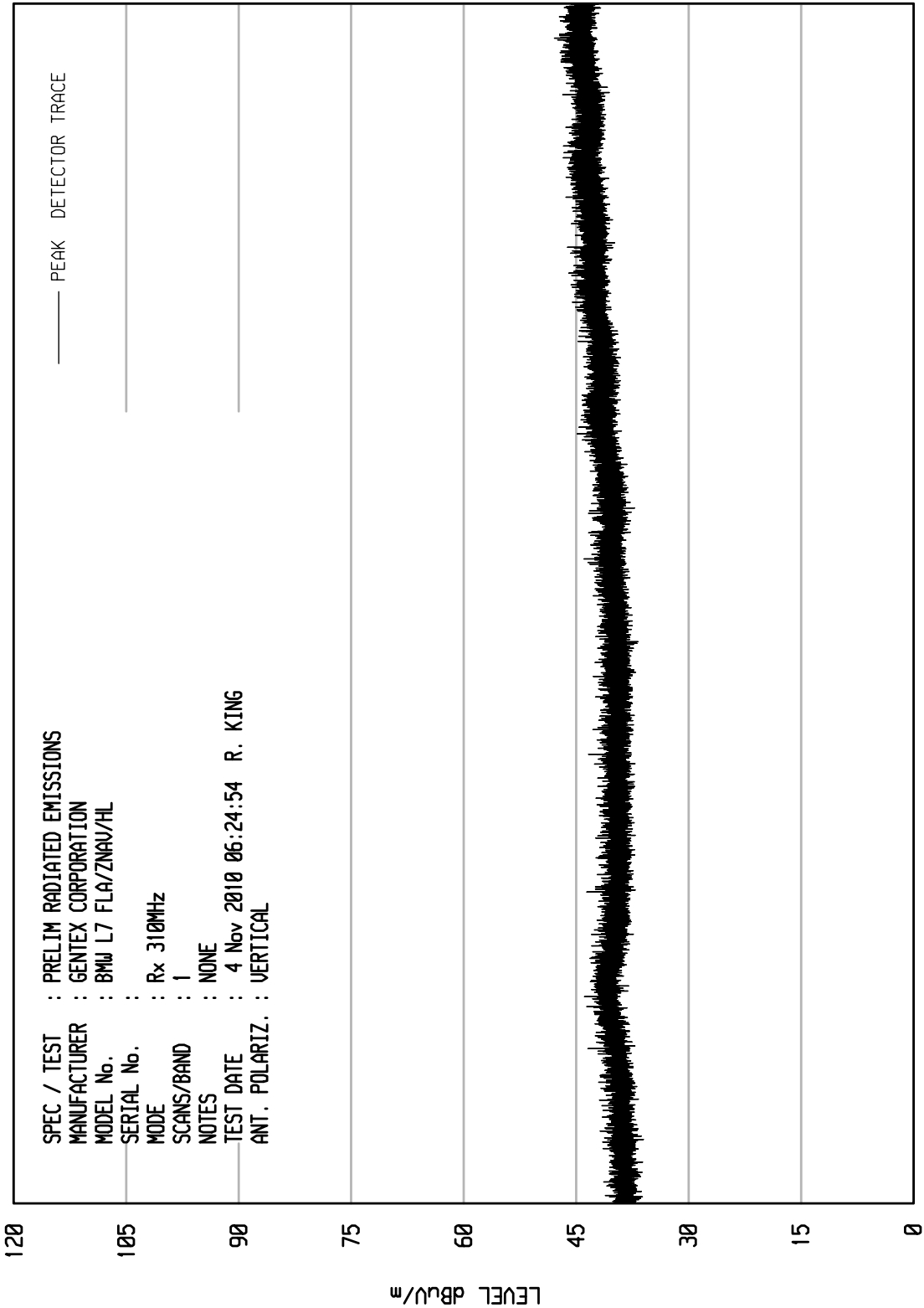




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UKA1 01/25/10

UNIV RCU EMI RUN 69



START = 1000

FREQUENCY MHz

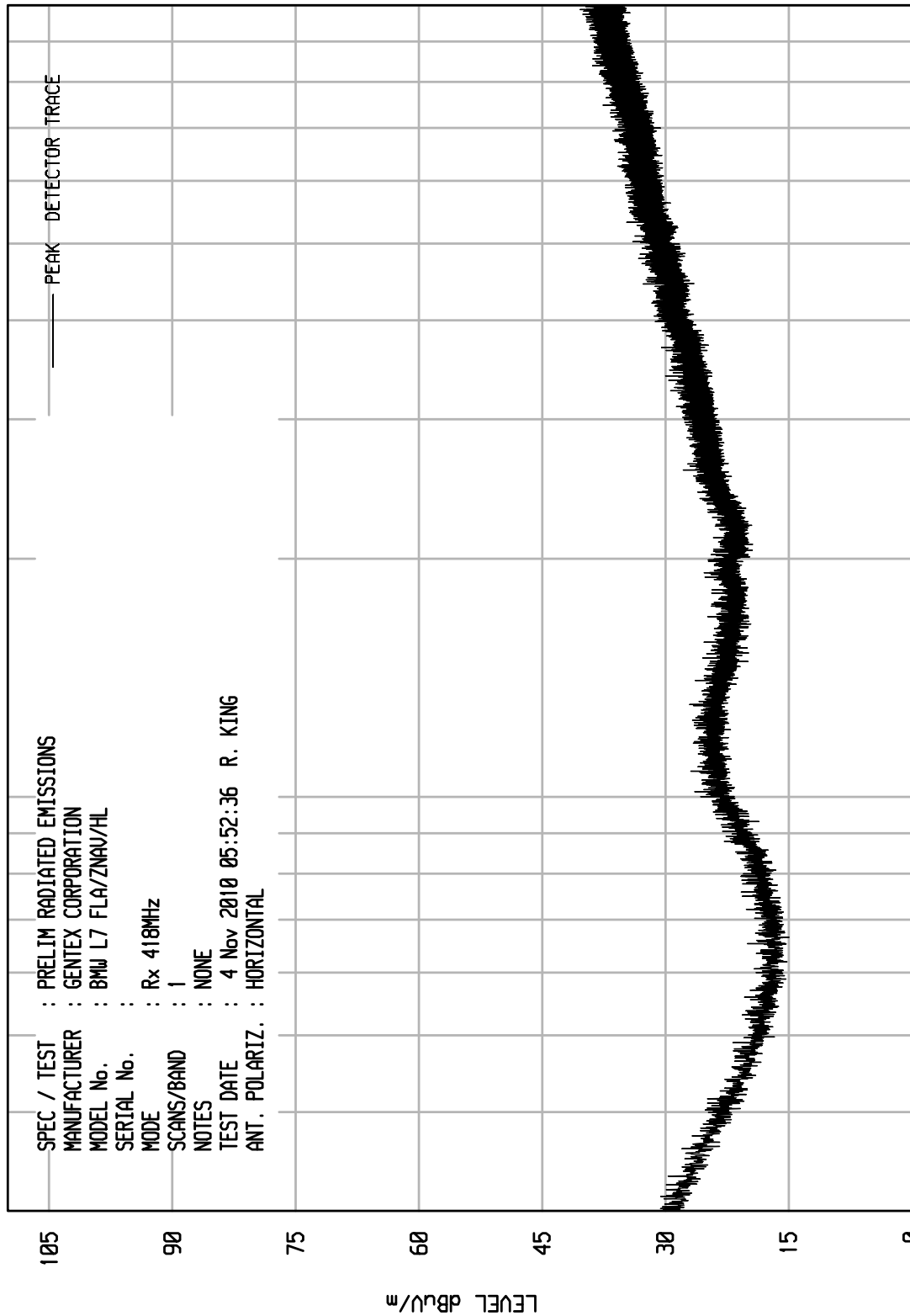
STOP = 2000



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UKA1 01/25/10

UNIV RCU EMI RUN 49



START = 30

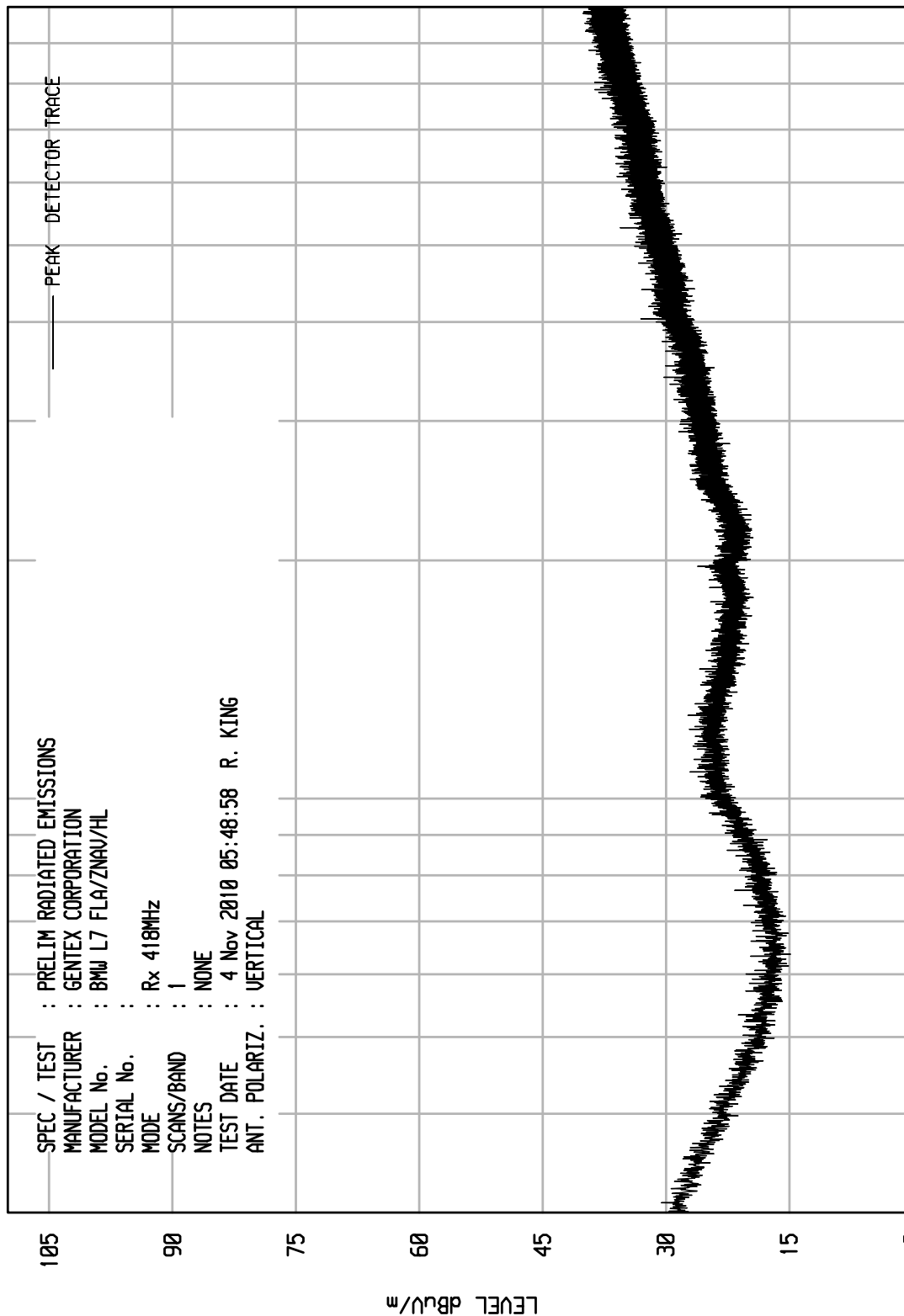
STOP = 1000



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UKA1 01/25/10

UNIU RCU EMI RUN 48

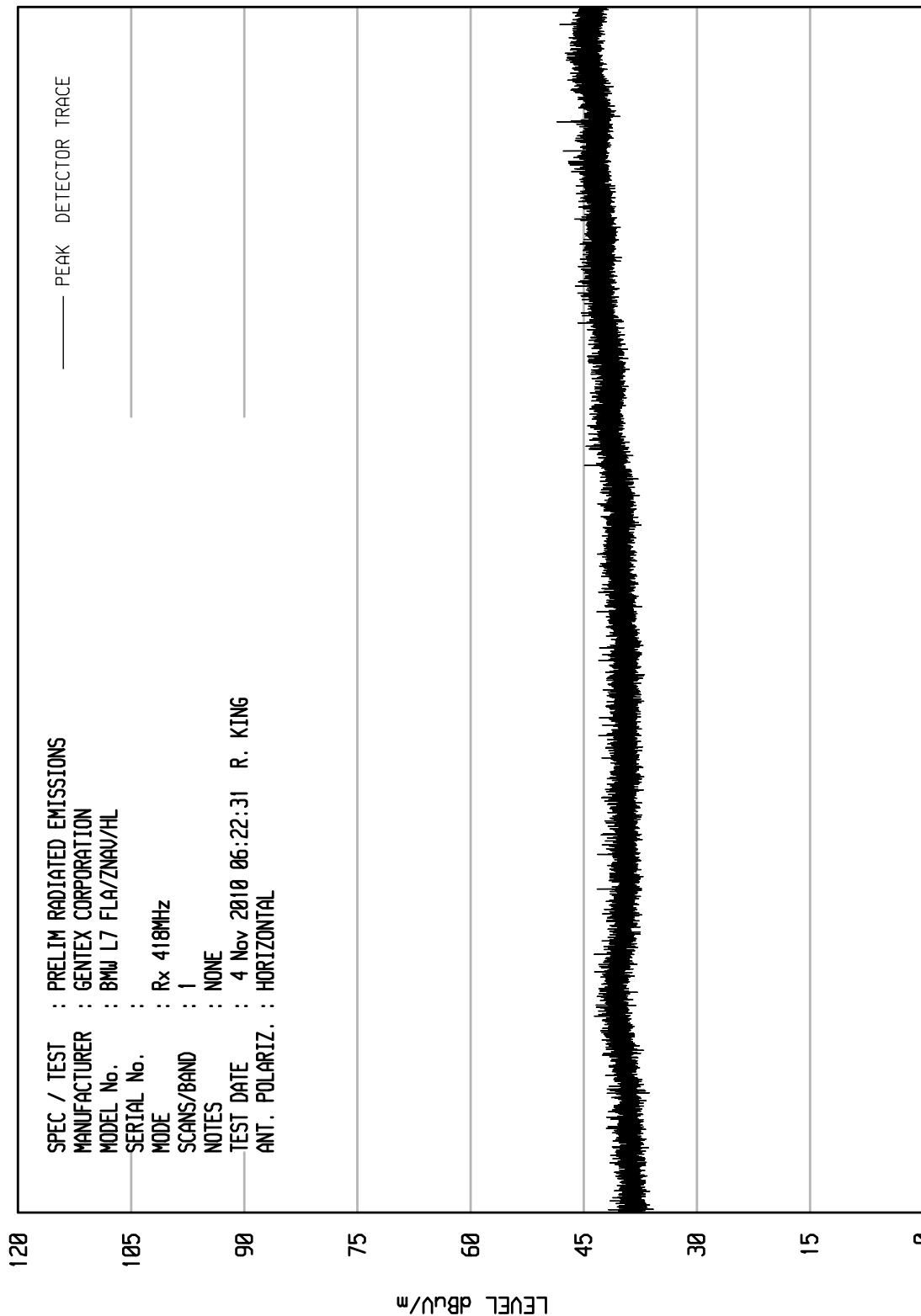




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UKA1 01/25/10

UNIV RCU EMI RUN 67

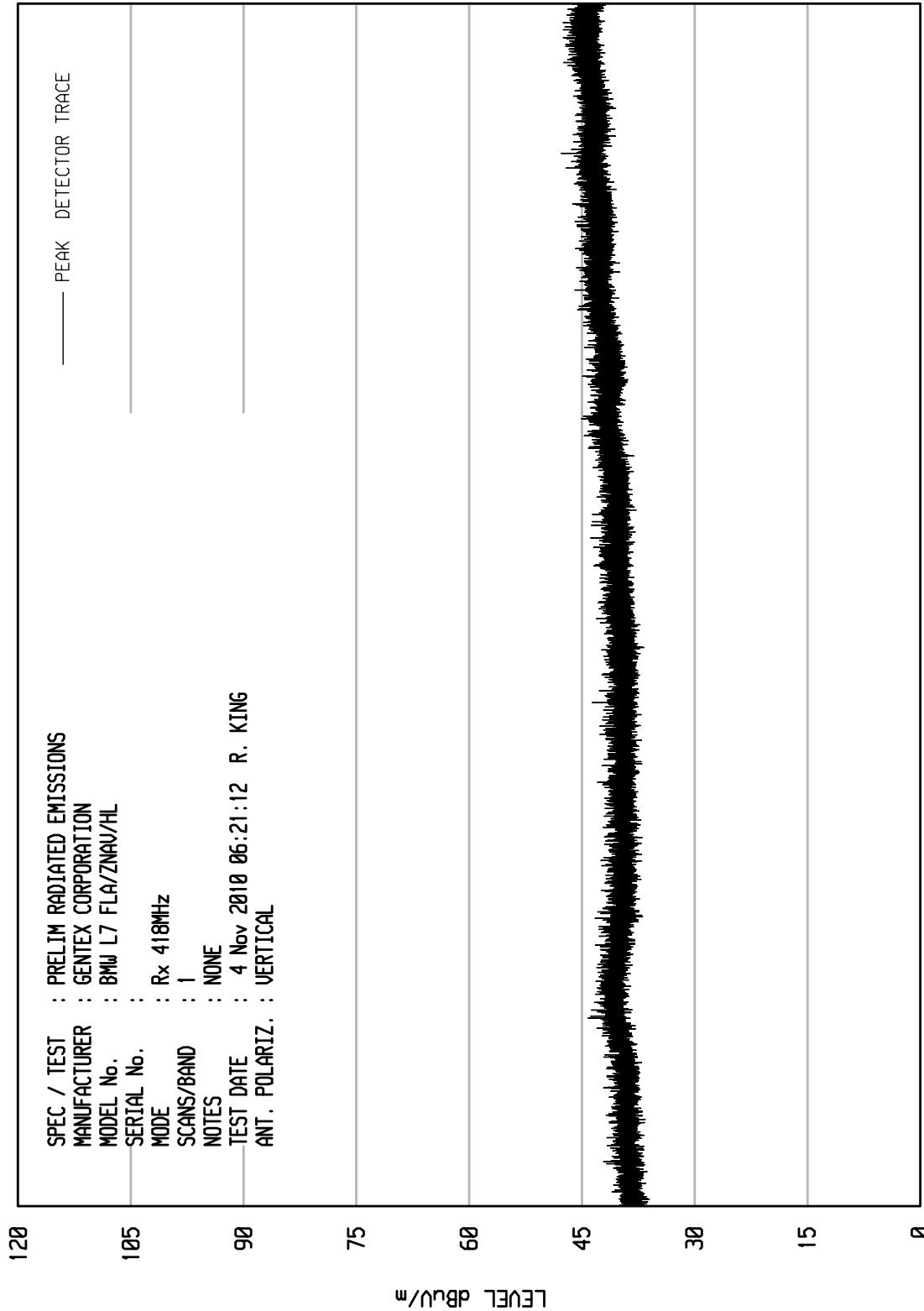




ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515

UKA1 01/25/10

UNIV RCU EMI RUN 66



START = 1000

FREQUENCY MHz

STOP = 2000



ETR No.

8546A

DATA SHEET

TEST NO. 8

RADIATED QP EMISSION MEASUREMENTS in a 3 m SEMI-ANECHOIC ROOM

SPECIFICATION : FCC 15B CLASS B

MANUFACTURER : GENTEX CORPORATION

MODEL NO. : BMW L7 FLA/ZNAV/HL

SERIAL NO. :

TEST MODE : SCANNING

NOTES : NONE

TEST DATE : 21 Oct 2010 09:39:25

TEST DISTANCE : 3 m (DATA EXTRAPOLATED TO 3 m)

FREQUENCY	QP	ANT	CBL	EXT	DIST	TOTAL	QP	AZ	ANT	POLAR
MHz	READING	FAC	FAC	ATTN	FAC	dBuV/m	LIMIT	deg	HT	
	dBuV	dB	dB	dB	dB		dBuV/m		cm	
57.10	-7.0	7.0	.7	0.0	0.0	.7	40.0	270	120	H
90.09	-6.4	9.4	.9	0.0	0.0	3.9	43.5	-0	340	H
108.20	-8.0	12.5	1.0	0.0	0.0	5.5	43.5	270	120	H
121.86	3.5	13.0	1.0	0.0	0.0	17.4	43.5	135	340	H
152.54	-7.6	11.0	1.0	0.0	0.0	4.4	43.5	-0	340	H
172.26	-7.9	10.3	1.0	0.0	0.0	3.3	43.5	225	340	H
246.43	4.3	12.8	1.3	0.0	0.0	18.4	46.0	45	120	H
317.62	-2.0	14.5	1.5	0.0	0.0	14.0	46.0	225	120	H
420.29	-6.6	17.2	1.6	0.0	0.0	12.2	46.0	45	340	V
575.44	-7.7	19.0	1.9	0.0	0.0	13.3	46.0	225	200	H
664.43	-6.7	19.9	2.2	0.0	0.0	15.3	46.0	225	200	H
783.71	-7.1	20.6	2.5	0.0	0.0	16.0	46.0	45	120	V
863.91	-7.2	21.4	2.5	0.0	0.0	16.7	46.0	135	120	H
936.00	-7.2	22.0	2.5	0.0	0.0	17.3	46.0	225	340	H

Checked BY RICHARD E. King :Richard E. King



ETR No.

DATA SHEET

HF TEST NO. 3

RADIATED AVG EMISSION MEASUREMENTS ≥ 1000 MHz in a 3 m ANECHOIC ROOM

SPECIFICATION : FCC 15B CLASS B

MANUFACTURER : GENTEX CORPORATION

MODEL NO. : BMW L7 FLA/ZNAV/HL

SERIAL NO. :

TEST MODE : SCANNING

NOTES :

TEST DATE : 2 Nov 2010 06:04:12

EUT FREQUENCY : 418 MHz

TEST DISTANCE : 3 m (DATA EXTRAPOLATED TO 3 m

ANTENNA : ANT33D

FREQUENCY	AVG	ANT	CBL	DIST	TOTAL	AVG	PASS/	AZ	ANT	POLAR
MHz	READING	FAC	FAC	FAC		LIMIT	FAIL		HT	
	dBuV	dB	dB	dB	dBuV/m	dBuV/m		deg	cm	
1060.90	7.0	24.1	2.6	0.0	33.7	54.0		45	340	V
1133.99	-3.0	24.5	2.7	0.0	24.3	54.0		135	340	H
1308.39	7.9	24.9	2.9	0.0	35.7	54.0		135	120	V
1539.23	8.3	25.2	3.1	0.0	36.7	54.0		45	200	V
1679.03	-2.7	26.2	3.2	0.0	26.8	54.0		90	200	V
1750.36	-2.3	26.4	3.3	0.0	27.4	54.0		225	200	V
1924.69	-2.8	27.5	3.4	0.0	28.2	54.0		225	200	H
1965.11	7.9	27.6	3.5	0.0	39.0	54.0		225	120	H

Checked BY RICHARD E. King :Richard E. King



DATA PAGE

MANUFACTURER : Gentex Corporation
MODEL : BMW L7 FLA/ZNAV/HL
S/N : None Assigned
SPECIFICATION : FCC-15B Radiated Emissions
DATE : October 28, 2010
NOTES : Tuned @ 288MHz
: 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 30M	Margin (dB)
277.3	H	-2.4	*	1.3	13.6	12.5	4.2	200.0	-33.5
277.3	V	-2.4	*	1.3	13.6	12.5	4.2	200.0	-33.5
554.6	H	-1.5	*	1.9	18.9	19.3	9.2	200.0	-26.7
554.6	V	-1.5	*	1.9	18.9	19.3	9.2	200.0	-26.7
831.9	H	-0.5	*	2.3	21.2	23.0	14.2	200.0	-23.0
831.9	V	-0.5	*	2.3	21.2	23.0	14.2	200.0	-23.0
1109.2	H	10.4	*	2.6	25.2	38.3	82.1	500.0	-15.7
1109.2	V	10.4	*	2.6	25.2	38.3	82.1	500.0	-15.7
1386.5	H	10.6	*	3.0	25.8	39.4	93.6	500.0	-14.6
1386.5	V	10.6	*	3.0	25.8	39.4	93.6	500.0	-14.6
1663.8	H	11.0	*	3.3	26.8	41.1	113.5	500.0	-12.9
1663.8	V	11.0	*	3.3	26.8	41.1	113.5	500.0	-12.9
1941.1	H	11.4	*	3.6	27.9	42.9	139.9	500.0	-11.1
1941.1	V	11.4	*	3.6	27.9	42.9	139.9	500.0	-11.1

Checked BY RICHARD E. King :

Richard E. King



DATA PAGE

MANUFACTURER : Gentex Corporation
MODEL : BMW L7 FLA/ZNAV/HL
S/N : None Assigned
SPECIFICATION : FCC-15B Radiated Emissions
DATE : October 28, 2010
NOTES : Tuned @ 310MHz
: 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 30M	Margin (dB)
299.3	H	-2.4	*	1.3	14.1	13.0	4.5	200.0	-33.0
299.3	V	-2.4	*	1.3	14.1	13.0	4.5	200.0	-33.0
598.6	H	-1.4	*	2.0	19.2	19.8	9.7	200.0	-26.2
598.6	V	-1.4	*	2.0	19.2	19.8	9.7	200.0	-26.2
897.9	H	-0.8	*	2.4	21.8	23.3	14.7	200.0	-22.7
897.9	V	-0.8	*	2.4	21.8	23.3	14.7	200.0	-22.7
1197.2	H	10.1	*	2.8	25.4	38.3	82.3	500.0	-15.7
1197.2	V	10.1	*	2.8	25.4	38.3	82.3	500.0	-15.7
1496.5	H	10.4	*	3.1	26.0	39.5	94.9	500.0	-14.4
1496.5	V	10.4	*	3.1	26.0	39.5	94.9	500.0	-14.4
1795.8	H	11.1	*	3.4	27.4	41.9	124.5	500.0	-12.1
1795.8	V	11.1	*	3.4	27.4	41.9	124.5	500.0	-12.1

Checked BY RICHARD E. King :

Richard E. King



DATA PAGE

MANUFACTURER : Gentex Corporation
MODEL : BMW L7 FLA/ZNAV/HL
S/N : None Assigned
SPECIFICATION : FCC-15B Radiated Emissions
DATE : October 28, 2010
NOTES : Tuned @ 418MHz
: TEST DISTANCE IS 3 METERS

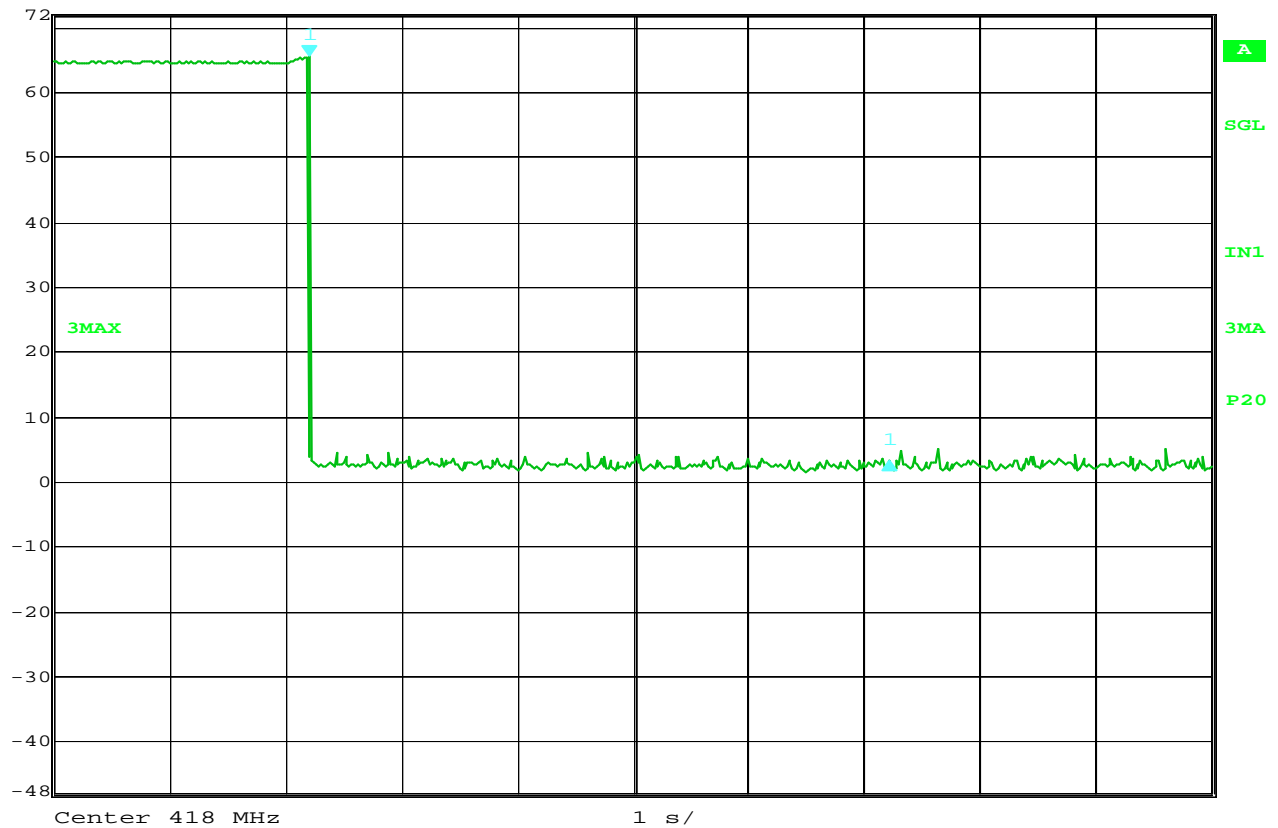
Freq (MHz)	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Total dBuV/m at 3 M	Total uV/m at 3M	Limit uV/m at 30M	Margin (dB)
407.3	H	-1.4	*	1.6	17.1	17.3	7.4	200.0	-28.7
407.3	V	-1.4	*	1.6	17.1	17.3	7.4	200.0	-28.7
814.6	H	-0.5	*	2.3	21.0	22.8	13.7	200.0	-23.3
814.6	V	-0.5	*	2.3	21.0	22.8	13.7	200.0	-23.3
1221.9	H	10.2	*	2.8	25.5	38.5	84.1	500.0	-15.5
1221.9	V	10.2	*	2.8	25.5	38.5	84.1	500.0	-15.5
1629.2	H	10.4	*	3.3	26.6	40.3	103.6	500.0	-13.7
1629.2	V	10.4	*	3.3	26.6	40.3	103.6	500.0	-13.7

Checked BY RICHARD E. King :

Richard E. King



Delta 1 [T3] RBW 100 kHz RF Att 0 dB
Ref Lvl -62.16 dB VBW 1 MHz
72 dBV 5.011619 s SWT 10 s Unit dBV



Date: 10.NOV.2010 15:35:47

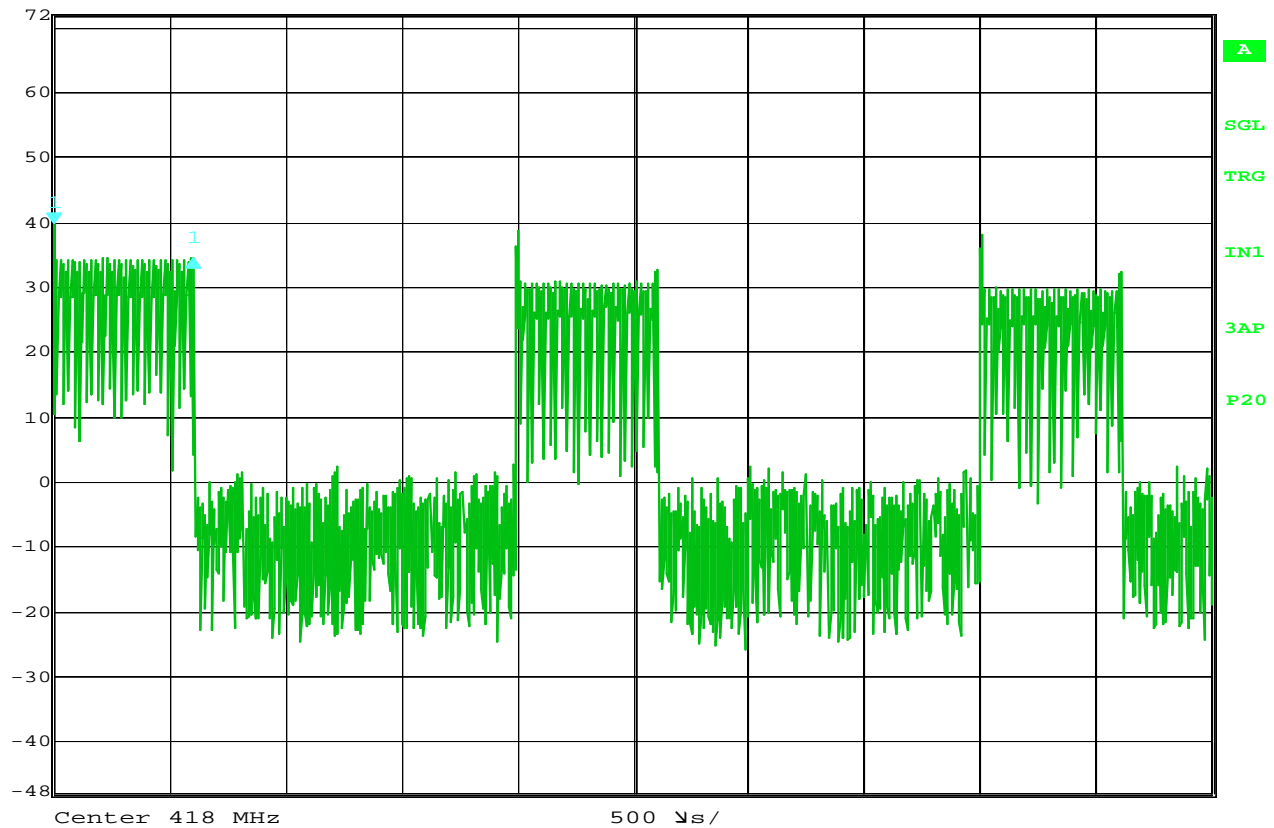
Periodic Operation

MANUFACTURER : Gentex Corporation
MODEL NUMBER : BMW L7 FLA/ZNAV/HL
TEST MODE : Tx @ 418MHz
TEST PARAMETERS : 30%
TEST PARAMETERS : Ceases operation within 5 seconds of the button being released.
: First marker is the moment the button was released
: Second marker shows an elapsed time of 5 seconds.

NOTES



Delta 1 [T3] RBW 100 kHz RF Att 0 dB
Ref Lvl -5.40 dB VBW 1 MHz
72 dBμV 601.202405 μs SWT 5 ms Unit dBμV



Date: 10.NOV.2010 14:58:25

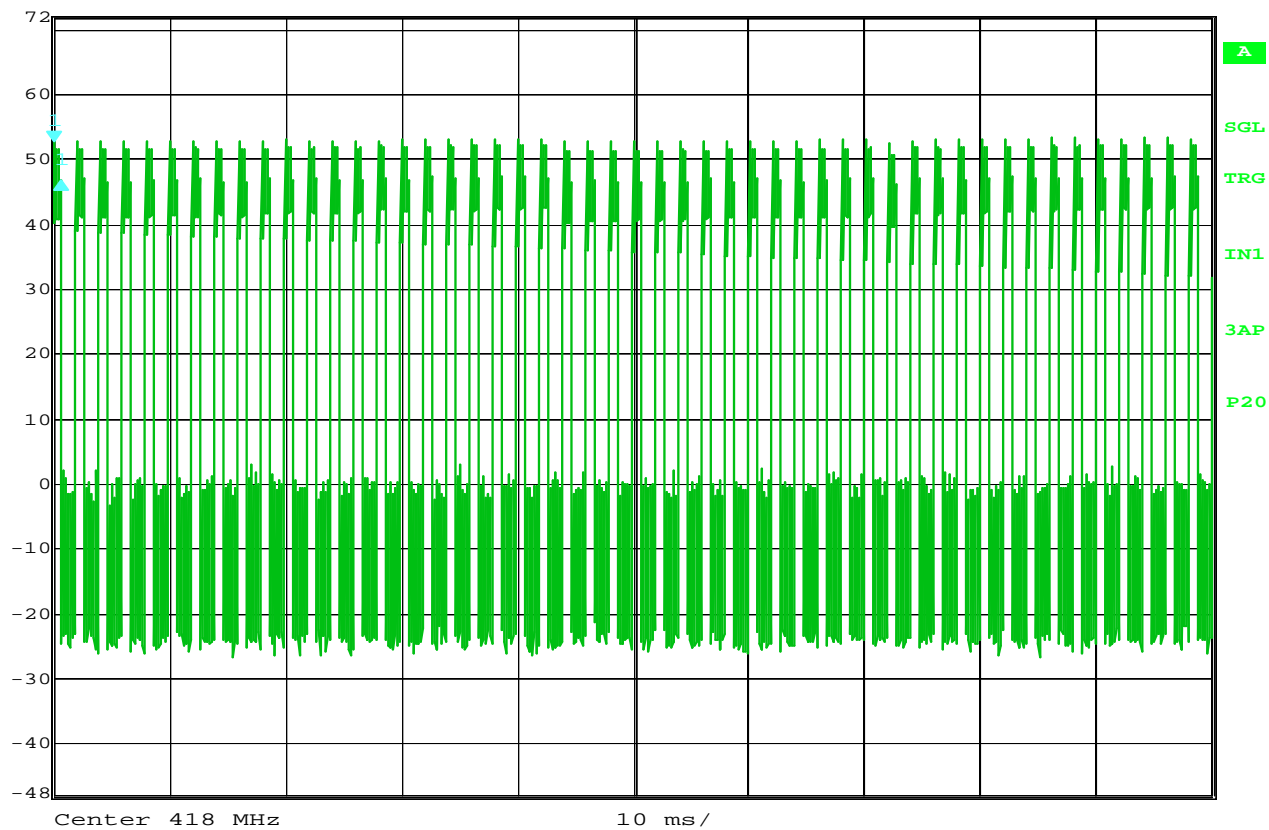
Duty Cycle Factor

MANUFACTURER : Gentex Corporation
MODEL NUMBER : BMW L7 FLA/ZNAV/HL
TEST MODE : Tx @ 418MHz
TEST PARAMETERS : 30%
TEST PARAMETERS : pulse width = 601.2 uS

NOTES



Delta 1 [T3] RBW 100 kHz RF Att 0 dB
Ref Lvl -6.05 dB VBW 1 MHz
72 dBμV 601.202405 μs SWT 100 ms Unit dBμV



Date: 10.NOV.2010 15:06:17

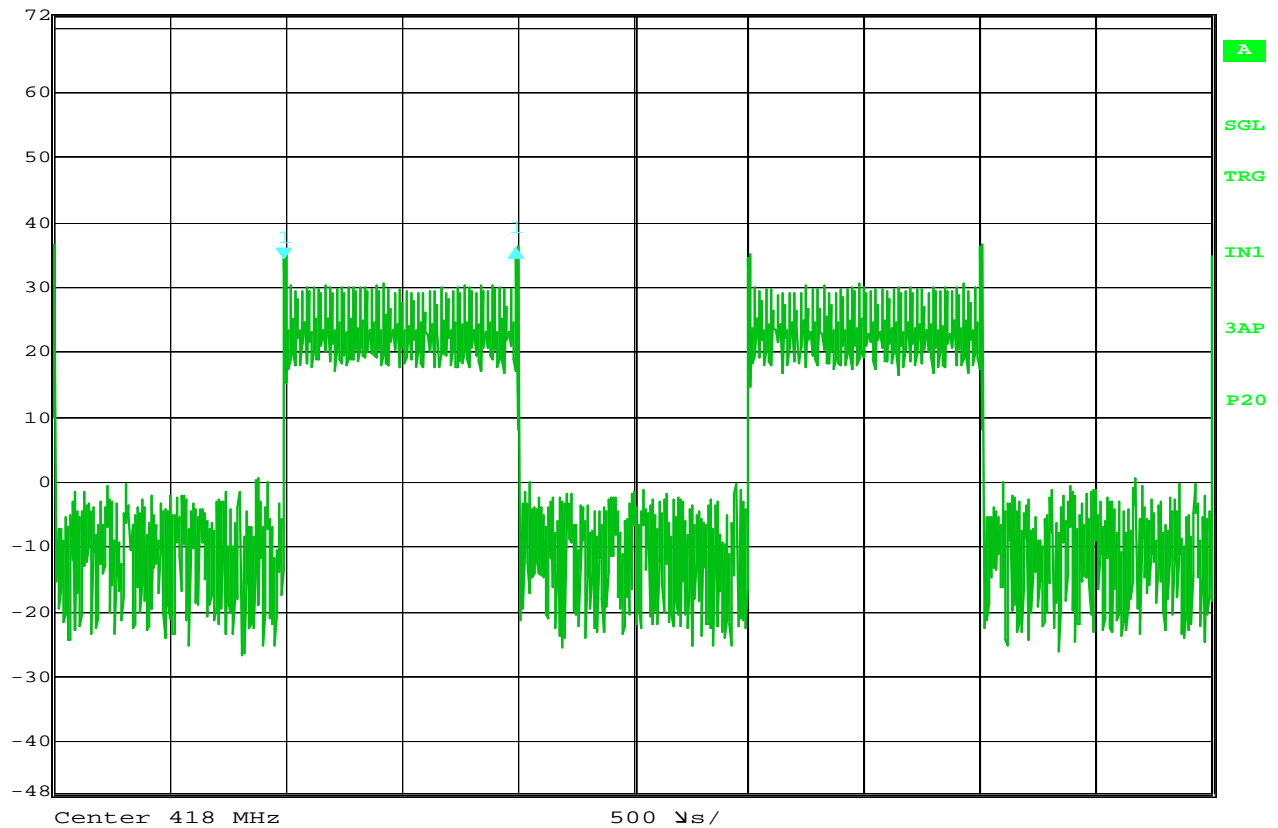
Duty Cycle Factor

MANUFACTURER : Gentex Corporation
MODEL NUMBER : BMW L7 FLA/ZNAV/HL
TEST MODE : Tx @ 418MHz
TEST PARAMETERS : 30%
TEST PARAMETERS : number of pulses in 100mS = 50

NOTES



Delta 1 [T3] RBW 100 kHz RF Att 0 dB
Ref Lvl 1.44 dB VBW 1 MHz
72 dBμV 1.002004 ms SWT 5 ms Unit dBμV



Date: 10.NOV.2010 15:16:58

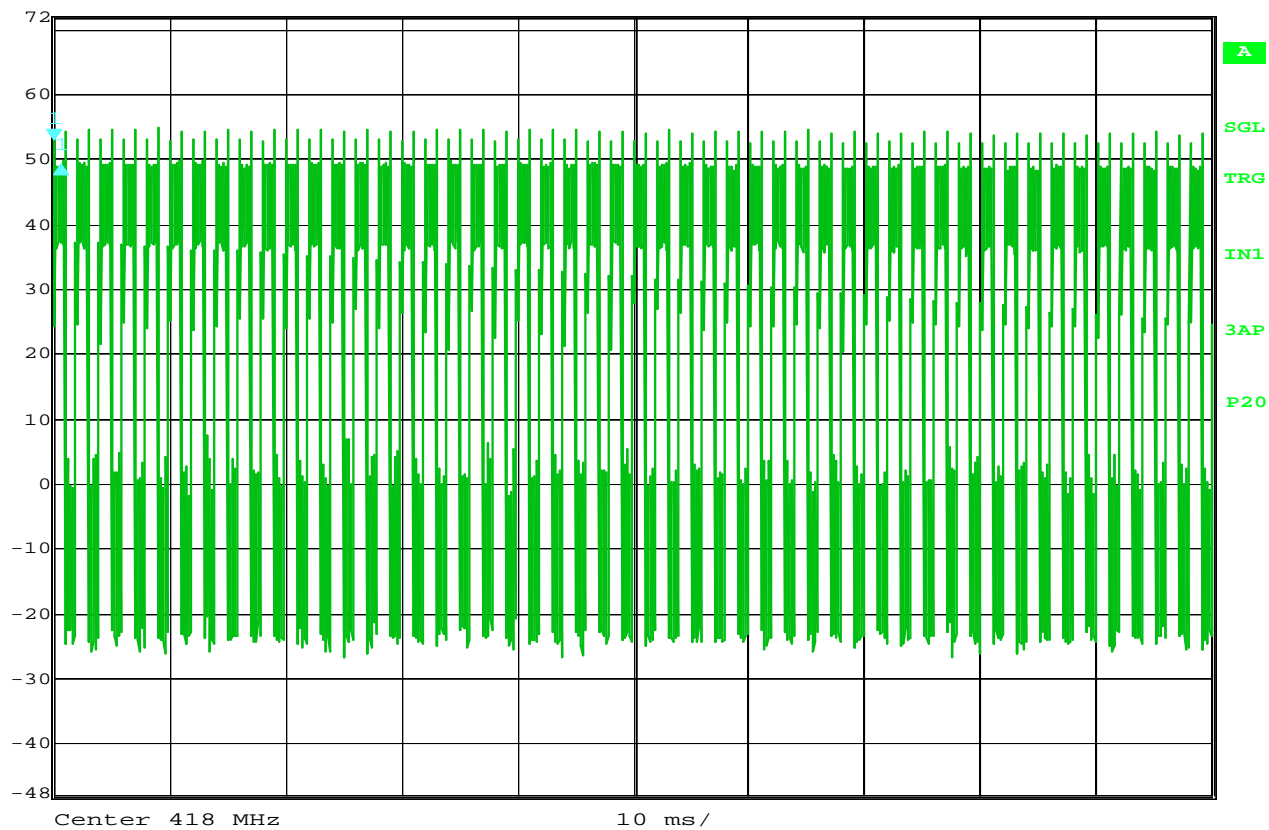
Duty Cycle Factor

MANUFACTURER : Gentex Corporation
MODEL NUMBER : BMW L7 FLA/ZNAV/HL
TEST MODE : Tx @ 418MHz
TEST PARAMETERS : 50%
TEST PARAMETERS : Pulse width = 1.002mS

NOTES



Delta 1 [T3] RBW 100 kHz RF Att 0 dB
Ref Lvl -3.80 dB VBW 1 MHz
72 dBμV 601.202405 μs SWT 100 ms Unit dBμV



Date: 10.NOV.2010 15:14:31

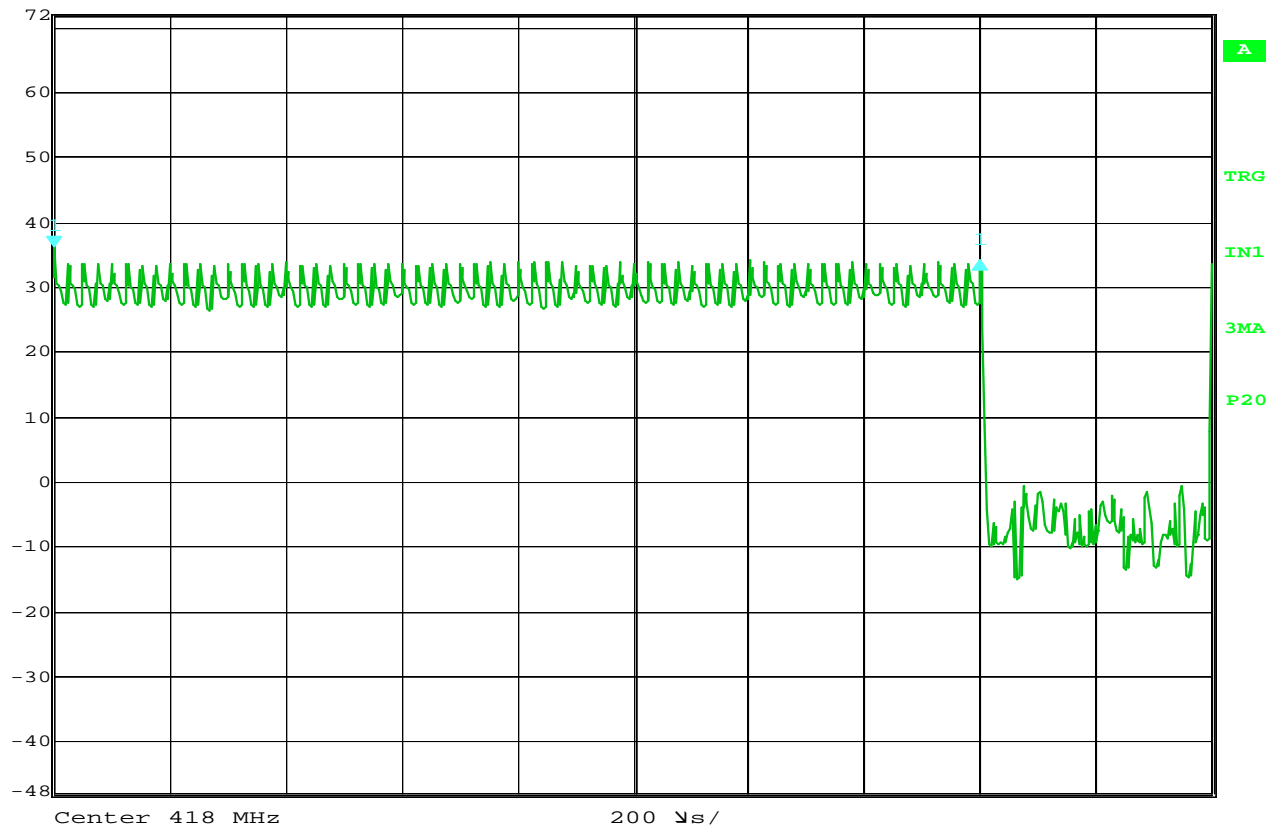
Duty Cycle Factor

MANUFACTURER : Gentex Corporation
MODEL NUMBER : BMW L7 FLA/ZNAV/HL
TEST MODE : Tx @ 418MHz
TEST PARAMETERS : 50%
TEST PARAMETERS : Number of pulses in 100ms = 50

NOTES



Delta 1 [T3] RBW 100 kHz RF Att 0 dB
Ref Lvl -2.22 dB VBW 1 MHz
72 dBμV 1.599198 ms SWT 2 ms Unit dBμV



Date: 10.NOV.2010 15:23:35

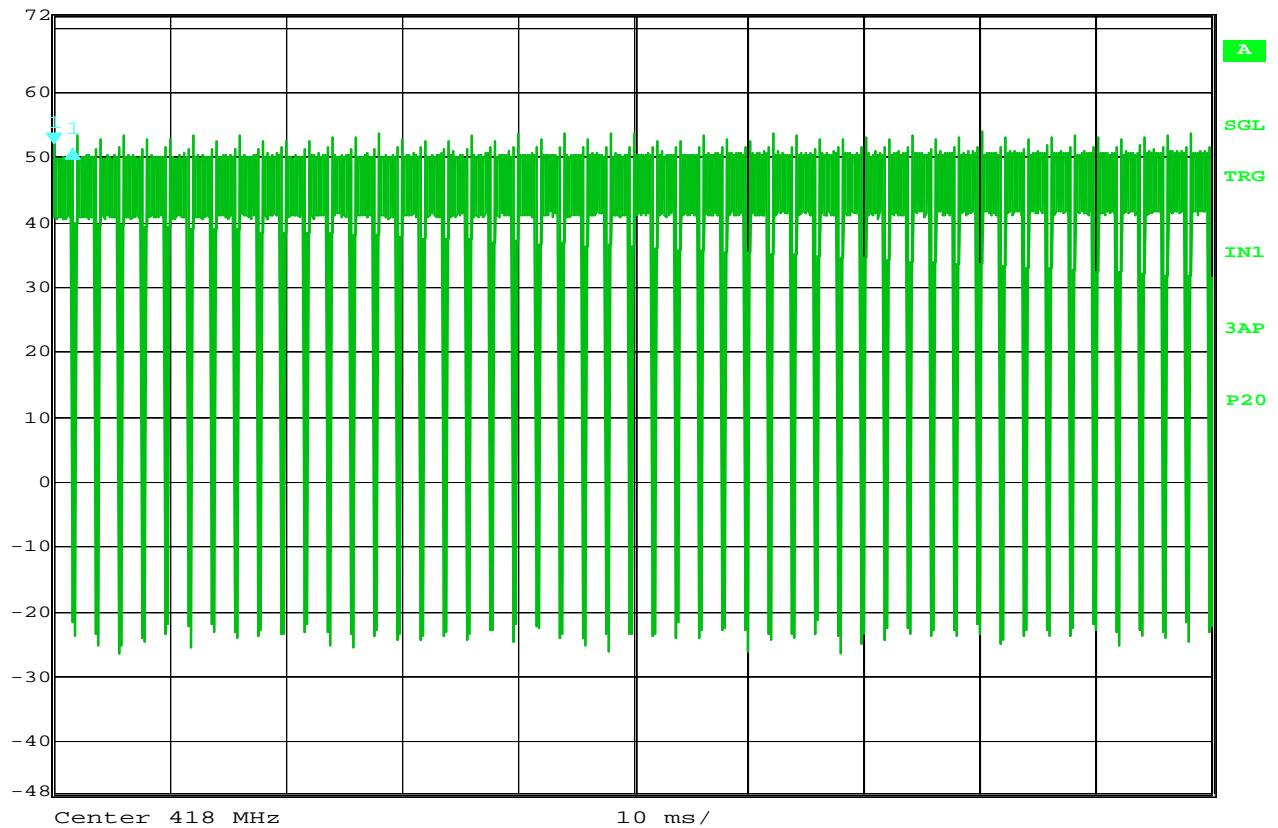
Duty Cycle Factor

MANUFACTURER : Gentex Corporation
MODEL NUMBER : BMW L7 FLA/ZNAV/HL
TEST MODE : Tx @ 418MHz
TEST PARAMETERS : 80%
TEST PARAMETERS : Pulse width = 1.599mS

NOTES



Delta 1 [T3] RBW 100 kHz RF Att 0 dB
Ref Lvl -0.94 dB VBW 1 MHz
72 dBμV 1.599198 ms SWT 100 ms Unit dBμV



Date: 10.NOV.2010 15:26:58

Duty Cycle Factor

MANUFACTURER : Gentex Corporation
MODEL NUMBER : BMW L7 FLA/ZNAV/HL
TEST MODE : Tx @ 418MHz
TEST PARAMETERS : 80%
TEST PARAMETERS : Number of pulses in 100mS = 50

NOTES

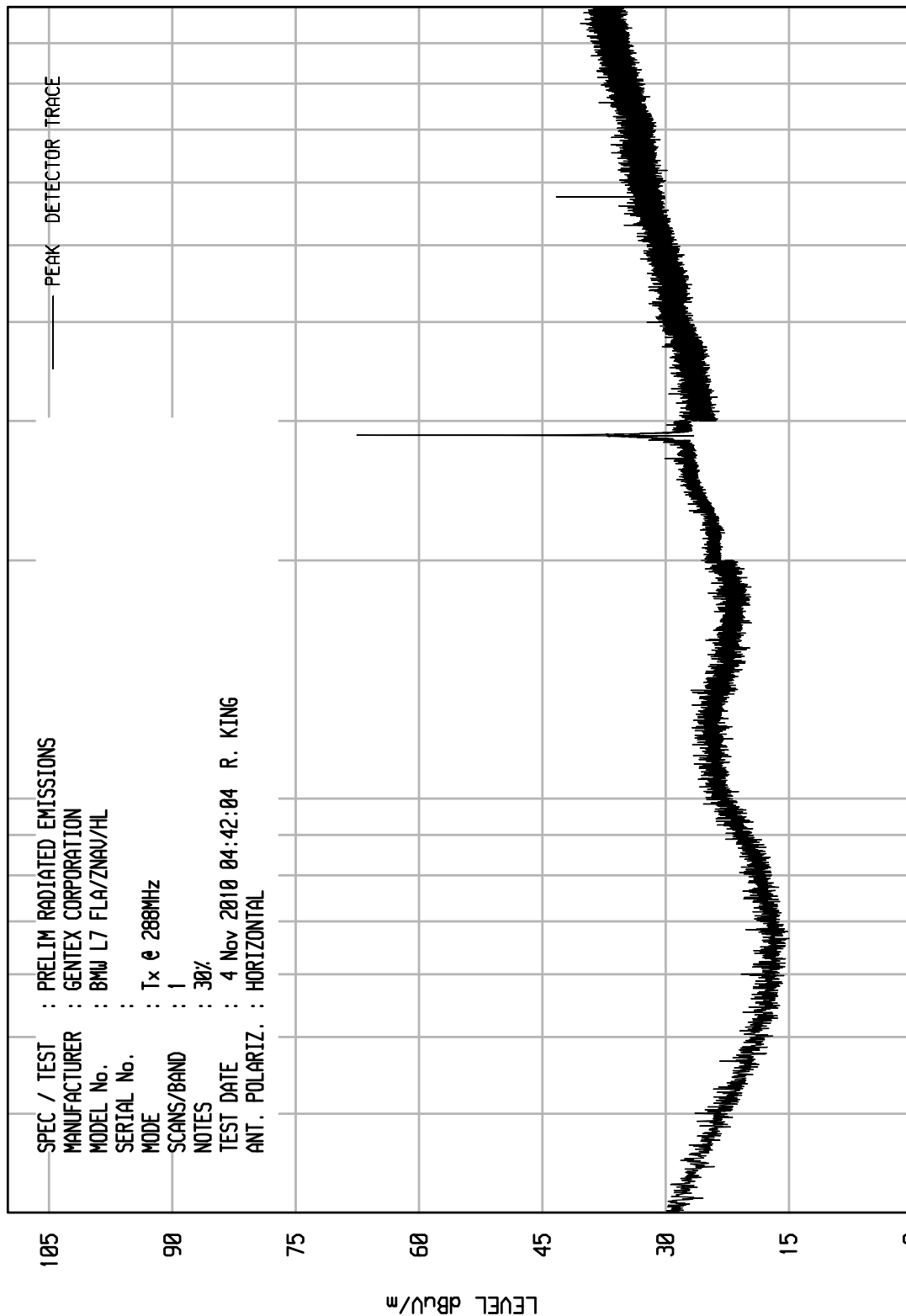


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UKA1 01/25/10

UNIU RCU EMI RUN 24

SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : GENTEX CORPORATION
MODEL No. : BMW L7 FLA/ZNAU/HL
SERIAL No. :
MODE : Tx @ 288MHz
SCANS/BAND : 1
NOTES : 30%
TEST DATE : 4 Nov 2010 04:42:04 R. KING
ANT. POLARIZ. : HORIZONTAL



START = 30

100

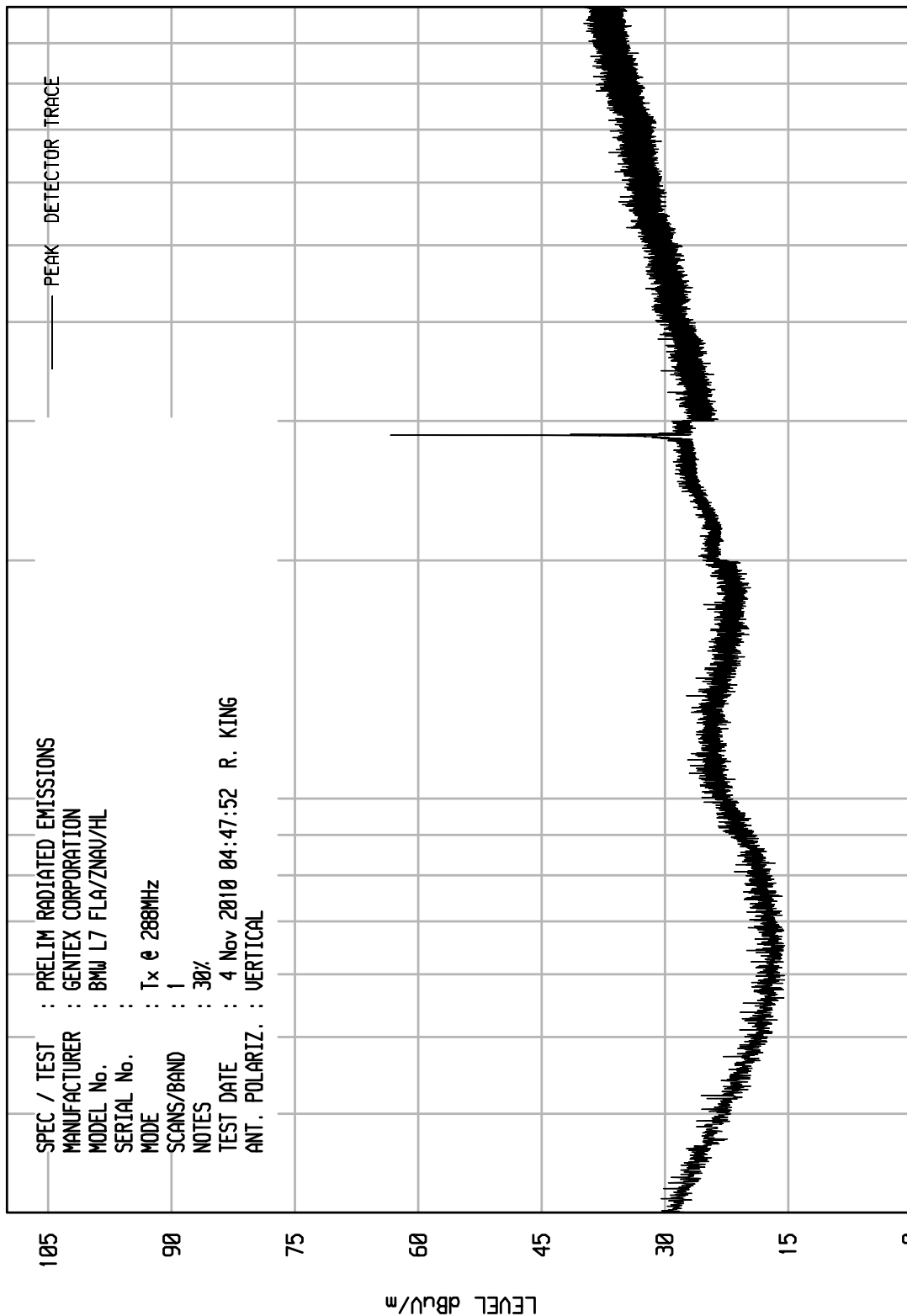
FREQUENCY MHz

STOP = 1000

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UKA1 01/25/10

UNIU RCU EMI RUN 25



START = 30

FREQUENCY MHz

STOP = 1000

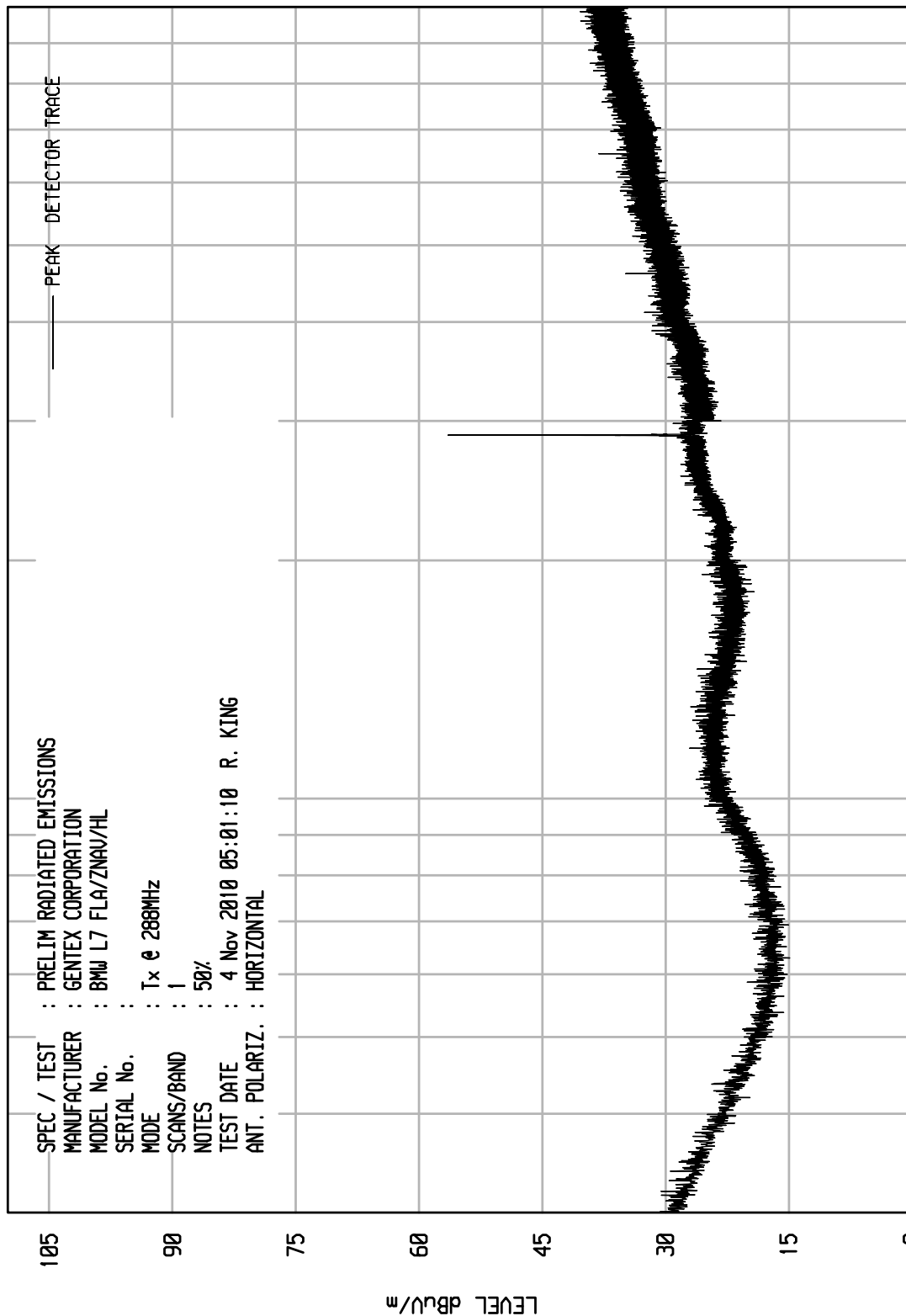


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UKA1 01/25/10

UNIU RCU EMI RUN 28

SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : GENTEX CORPORATION
MODEL No. : BMW L7 FLA/ZNAU/HL
SERIAL No. :
MODE : Tx @ 288MHz
SCANS/BAND : 1
NOTES : 50%
TEST DATE : 4 Nov 2010 05:01:10 R. KING
ANT. POLARIZ. : HORIZONTAL



START = 30

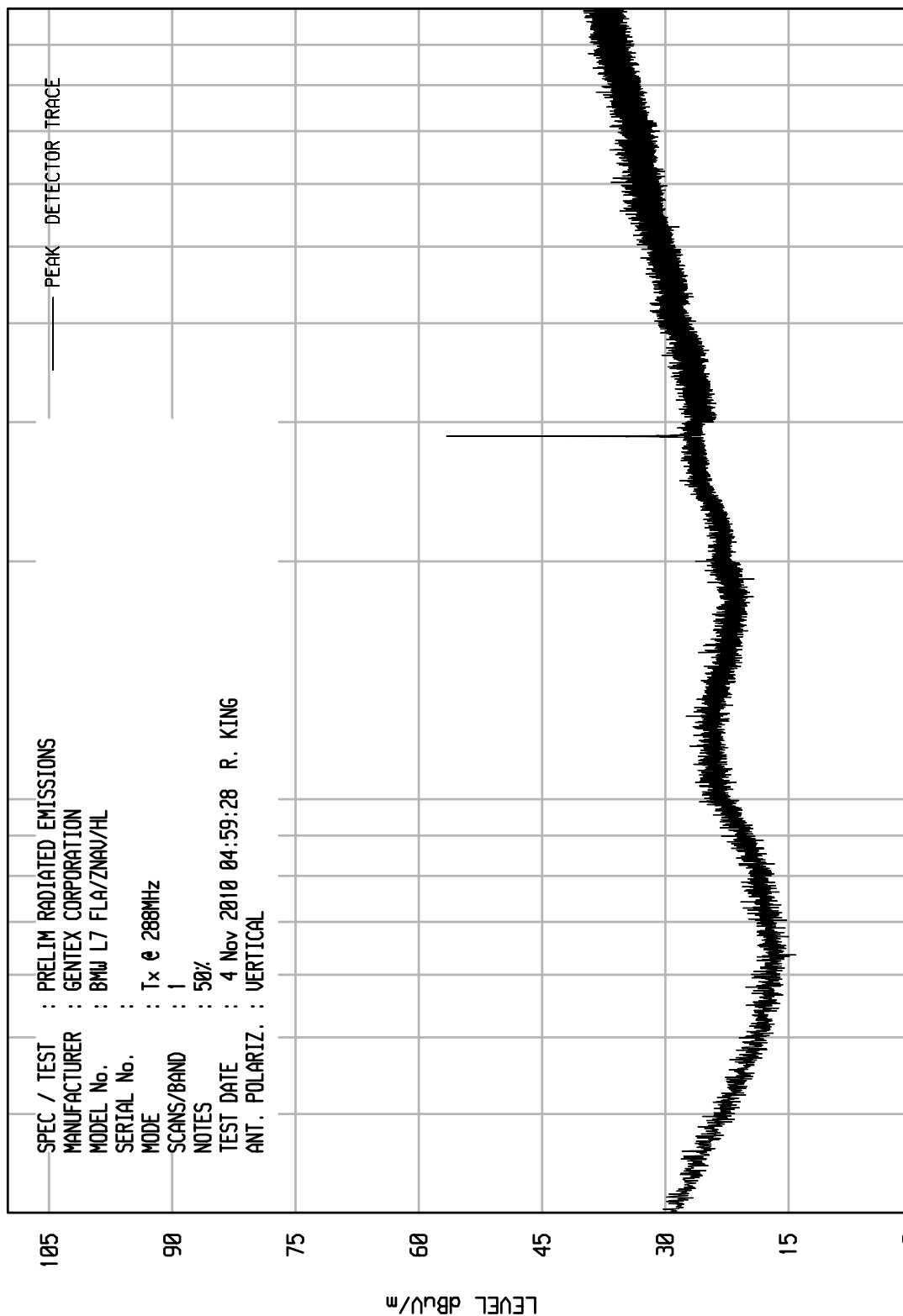
STOP = 1000



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UKA1 01/25/10

UNIU RCU EMI RUN 27

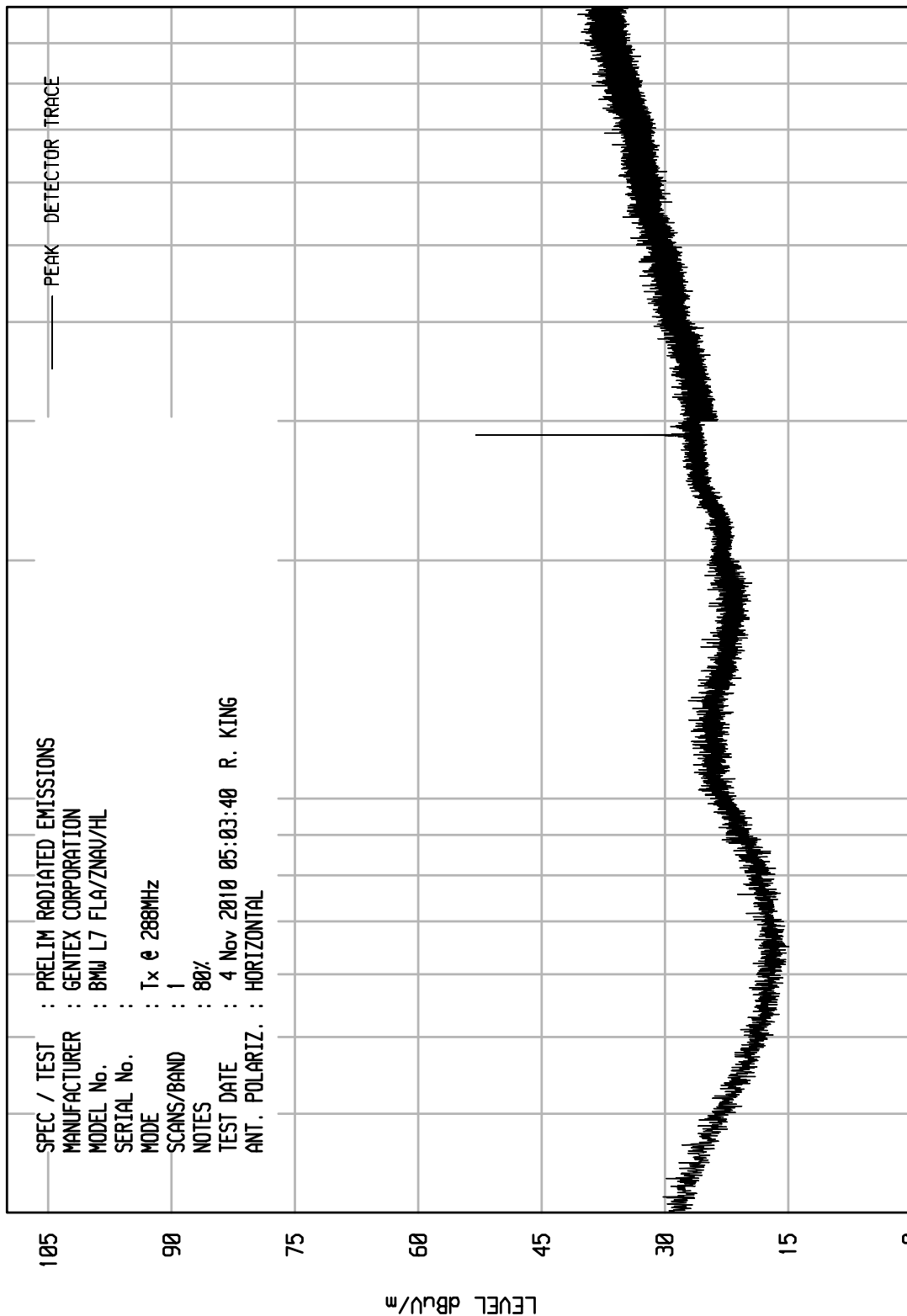


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UNIU RCU EMI RUN 29

UKA1 01/25/10

SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : GENTEX CORPORATION
MODEL No. : BMW L7 FLA/ZNAU/HL
SERIAL No. :
MODE : Tx @ 288MHz
SCANS/BAND : 1
NOTES : 80%
TEST DATE : 4 Nov 2010 05:03:40 R. KING
ANT. POLARIZ. : HORIZONTAL



START = 30

100

FREQUENCY MHz

STOP = 1000

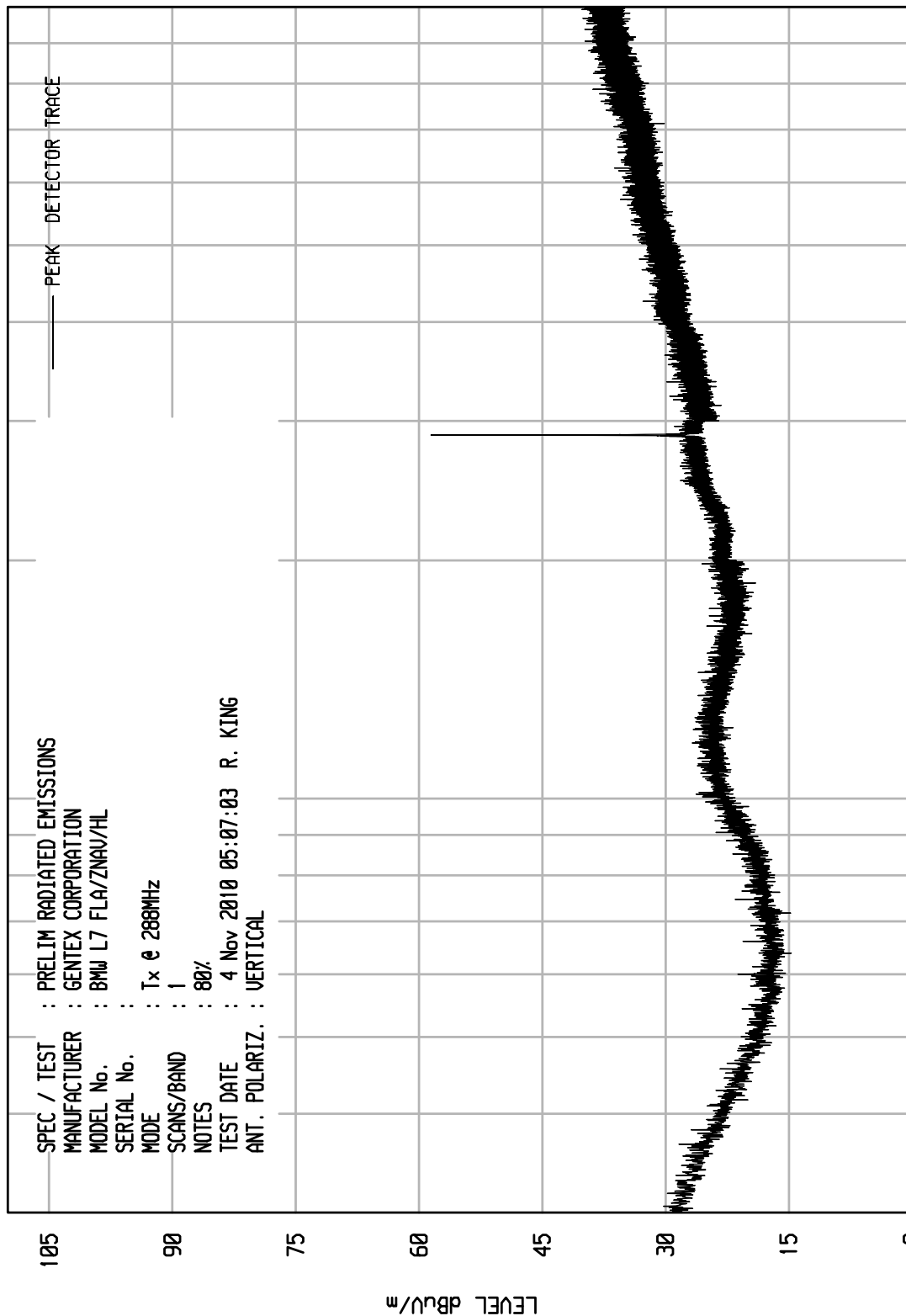


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UKA1 01/25/10

UNIU RCU EMI RUN 31

SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : GENTEX CORPORATION
MODEL No. : BMW L7 FLA/ZNAU/HL
SERIAL No. :
MODE : Tx @ 288MHz
SCANS/BAND : 1
NOTES : 80%
TEST DATE : 4 Nov 2010 05:07:03 R. KING
ANT. POLARIZ. : VERTICAL



START = 30

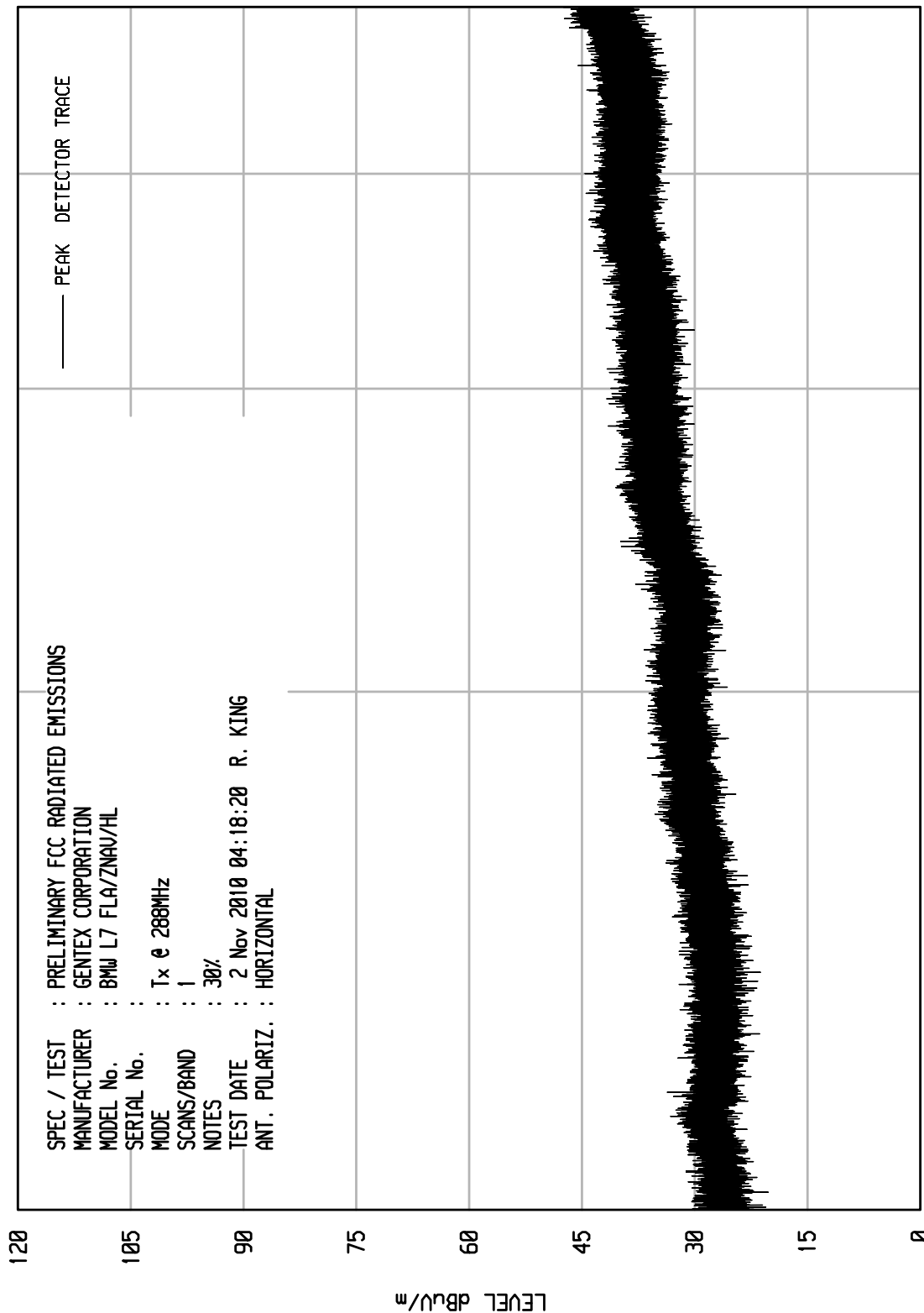
STOP = 1000



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UKA1 01/25/10

UNIU RCU EMI RUN 14



START = 1000

FREQUENCY MHz

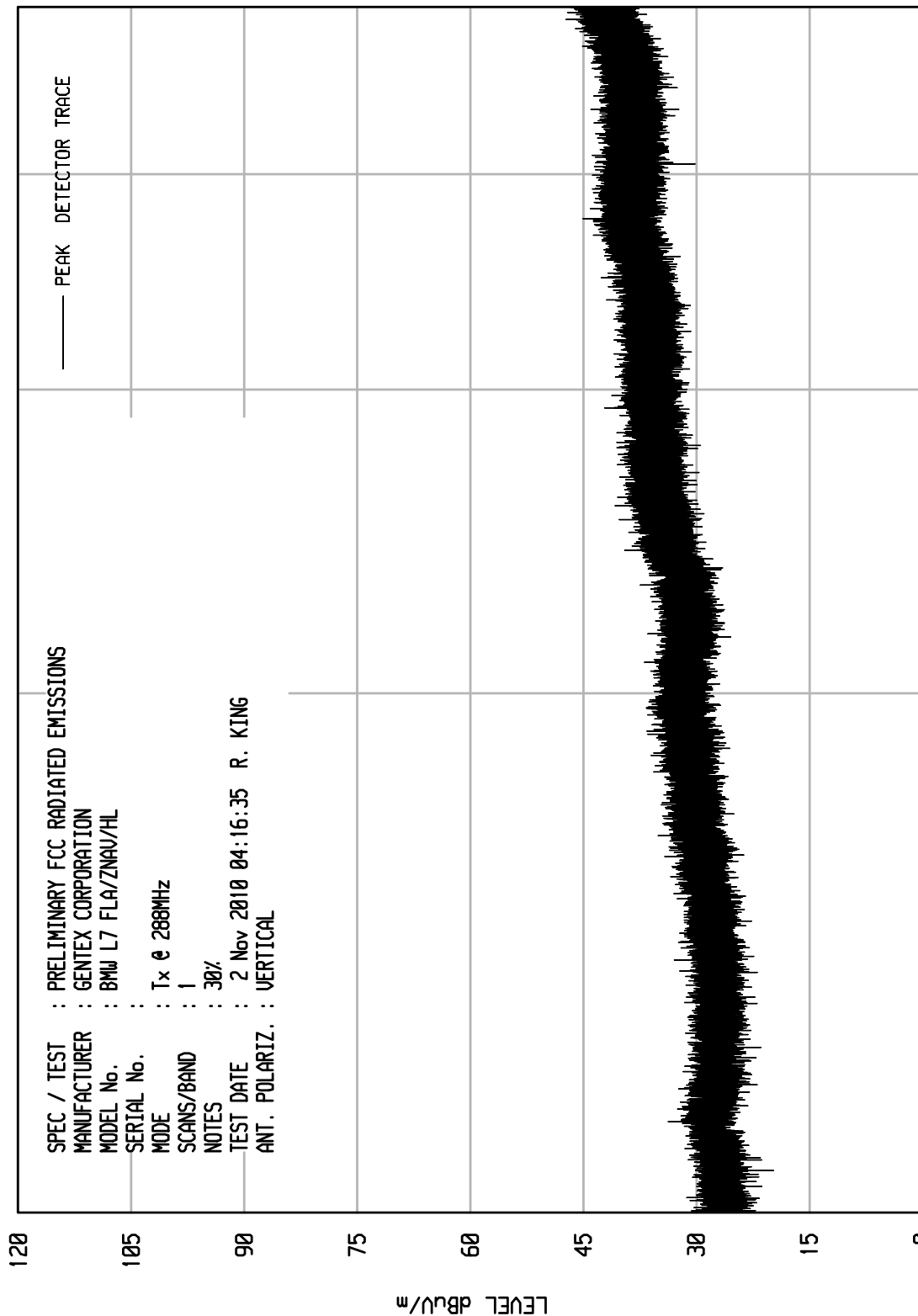
STOP = 5000



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UKA1 01/25/10

UNIV RCU EMI RUN 13



START = 1000

FREQUENCY MHz

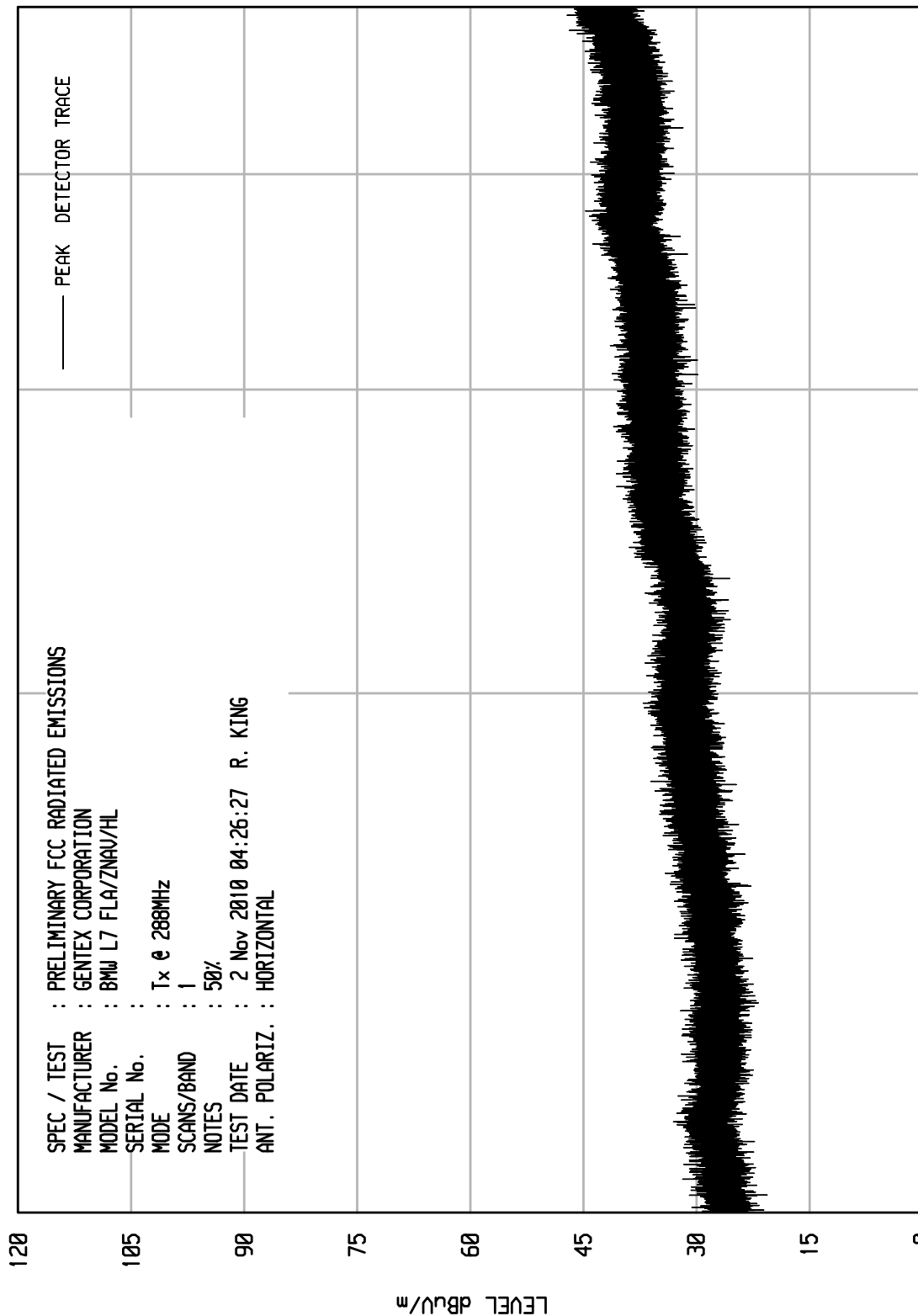
STOP = 5000



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UKA1 01/25/10

UNIU RCU EMI RUN 18

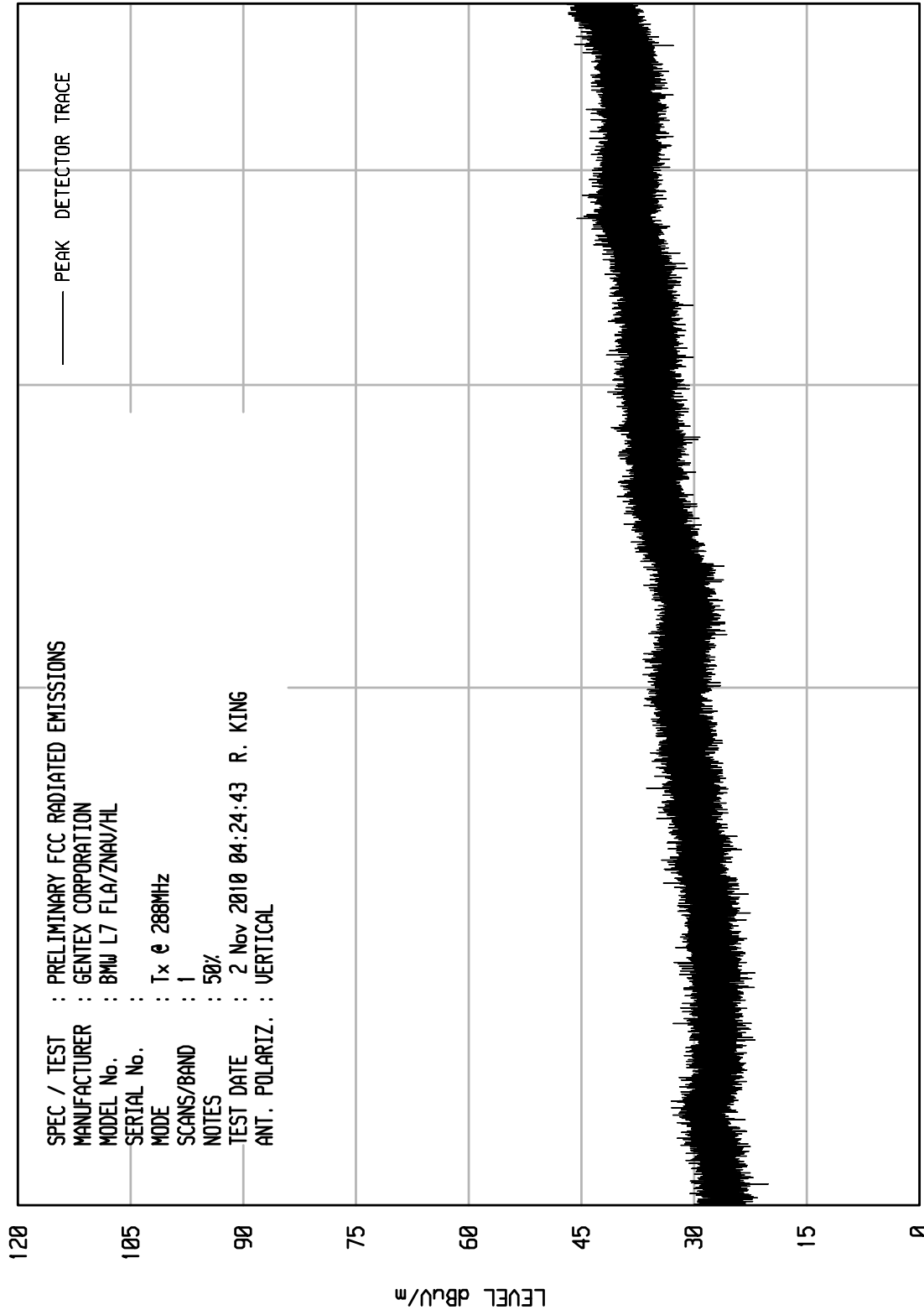




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UNIU RCU EMI RUN 17

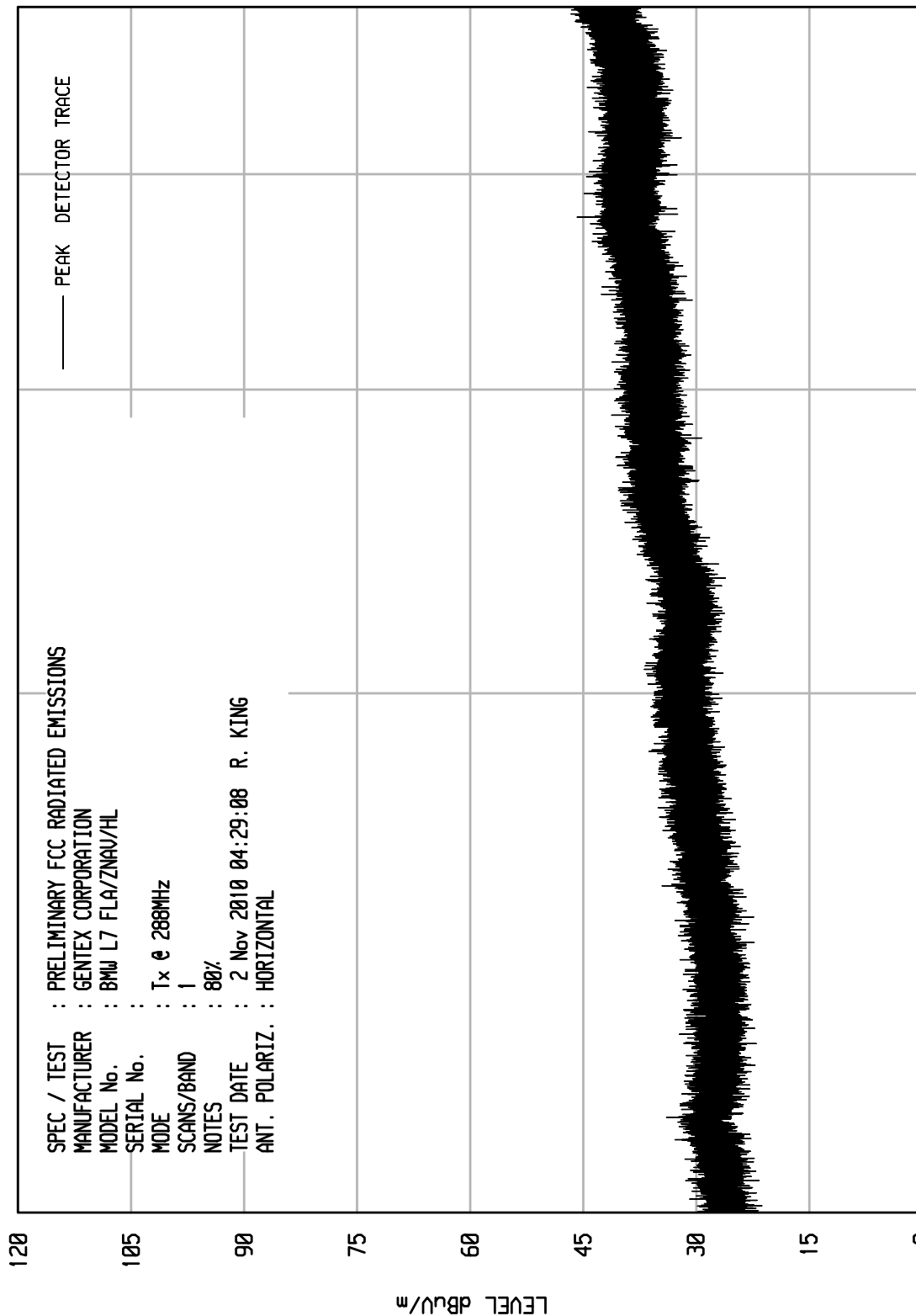




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UKA1 01/25/10

UNIV RCU EMI RUN 19



START = 1000

FREQUENCY MHz

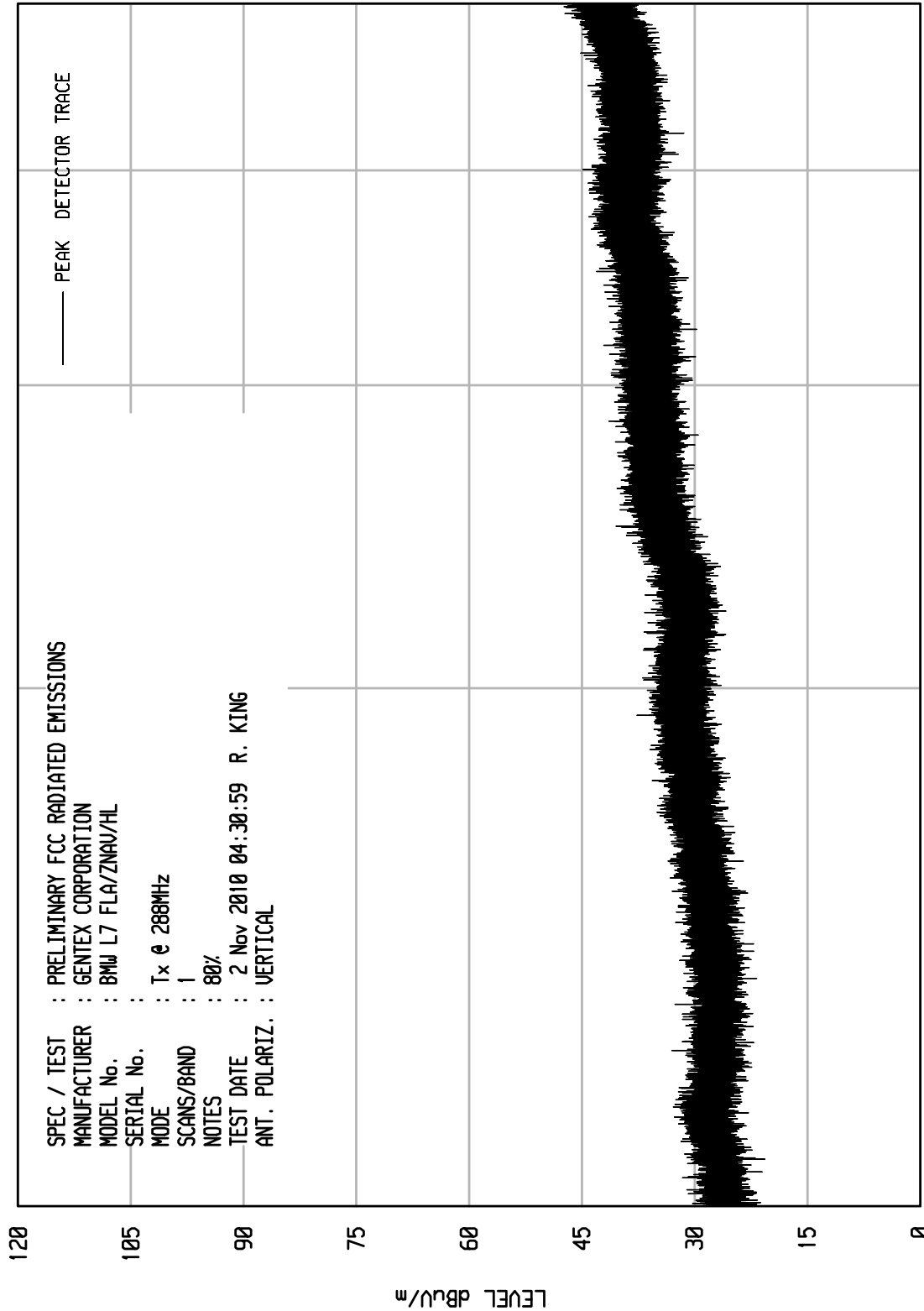
STOP = 5000



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UKA1 01/25/10

UNIU RCU EMI RUN 20



START = 1000

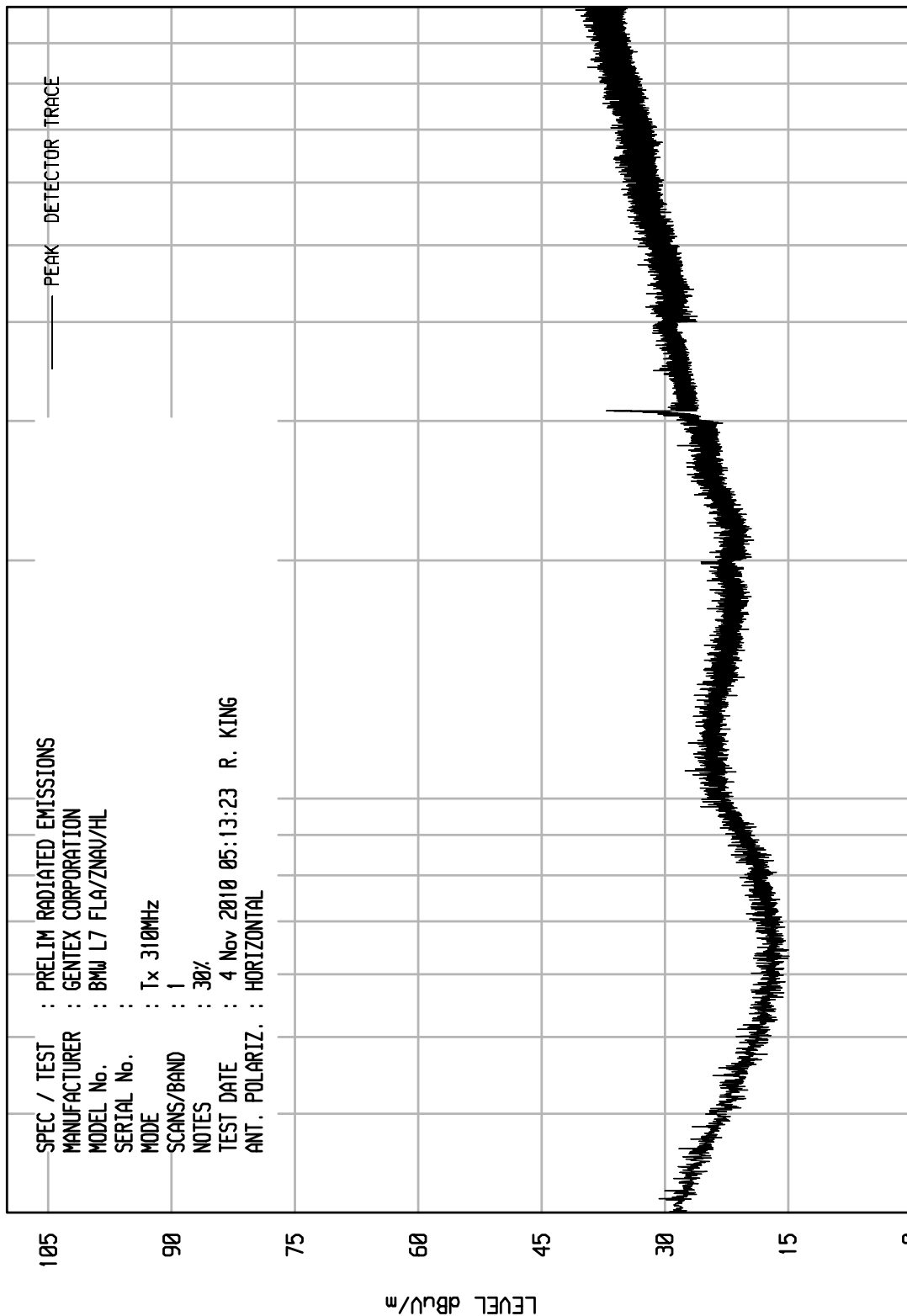
FREQUENCY MHz

STOP = 5000

ELITE ELECTRONIC ENGINEERING Inc.
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UKA1 01/25/10

UNIU RCU EMI RUN 33



START = 30

100

FREQUENCY MHz

STOP = 1000

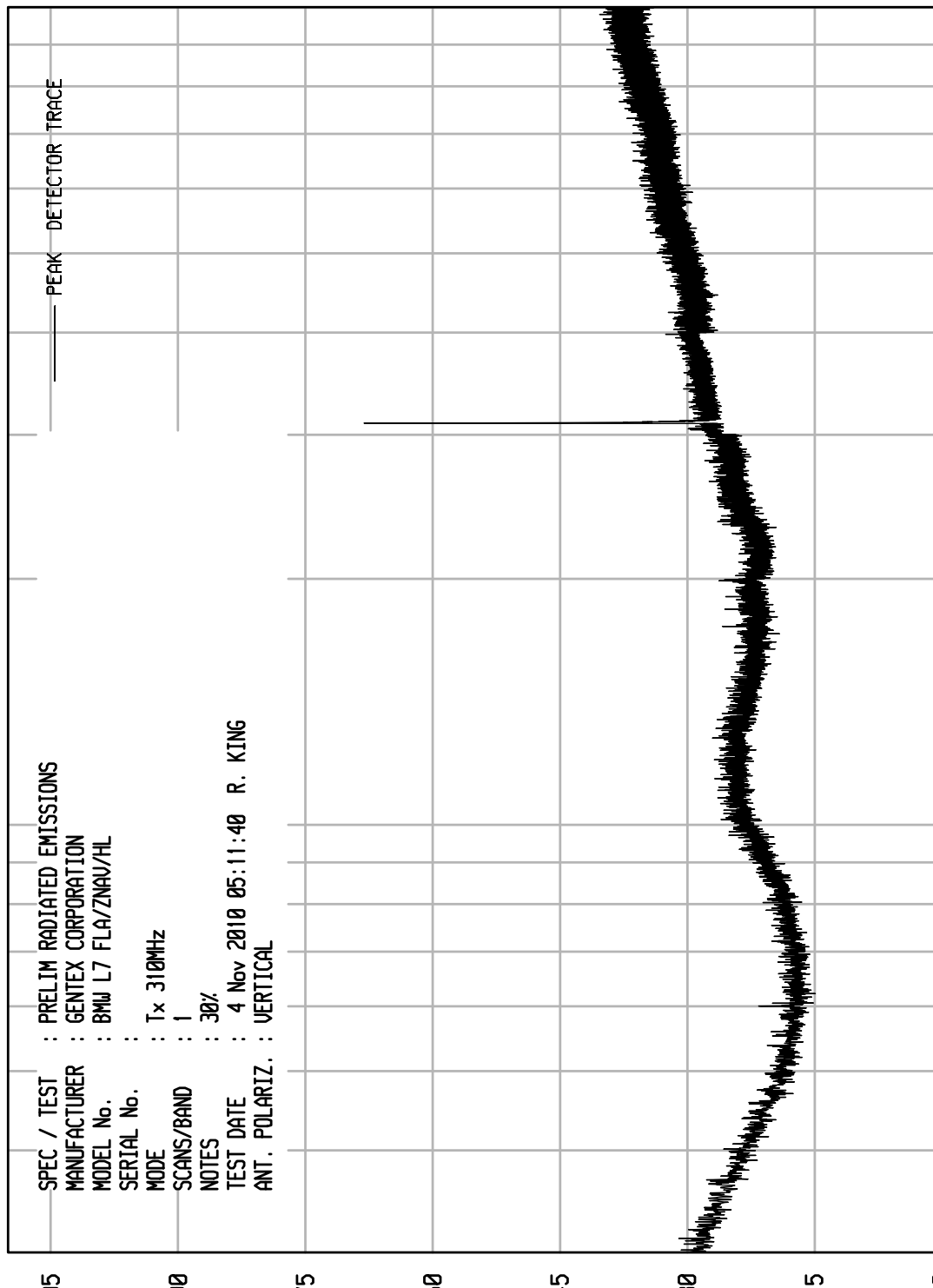
ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515

UNIU RCU EMI RUN 32

UKA1 01/25/10

SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : GENTEX CORPORATION
MODEL No. : BMW L7 FLA/ZNAU/HL
SERIAL No. :
MODE : Tx 310MHz
SCANS/BAND : 1
NOTES : 30%
TEST DATE : 4 Nov 2010 05:11:40 R. KING
ANT. POLARIZ. : VERTICAL

— PEAK DETECTOR TRACE



START = 30

FREQUENCY MHz

100

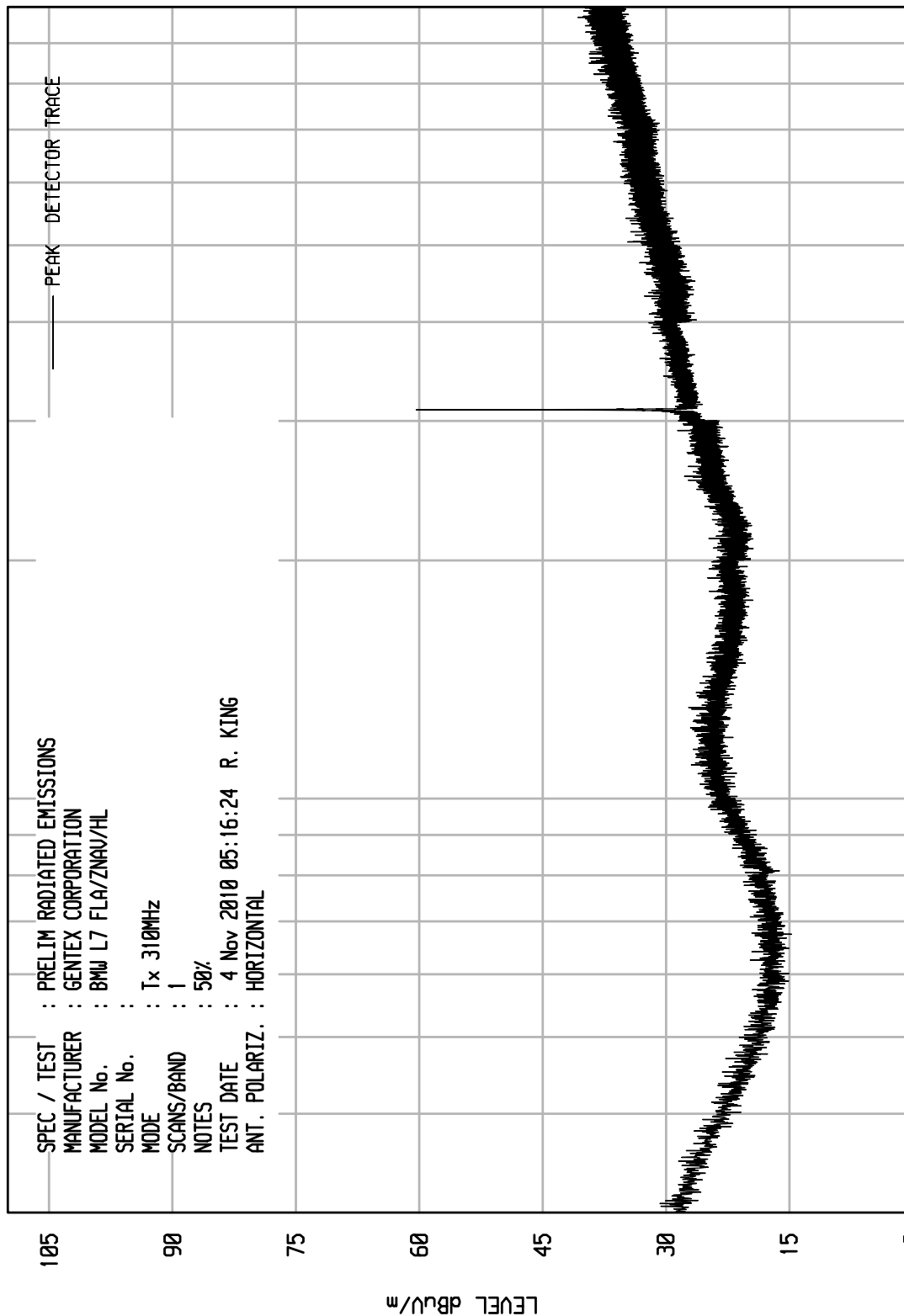
STOP = 1000

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515

UNIU RCU EMI RUN 35

UKA1 01/25/10

SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : GENTEX CORPORATION
MODEL No. : BMW L7 FLA/ZNAU/HL
SERIAL No. :
MODE : Tx 310MHz
SCANS/BAND : 1
NOTES : 50%
TEST DATE : 4 Nov 2010 05:16:24 R. KING
ANT. POLARIZ. : HORIZONTAL



START = 30

FREQUENCY MHz

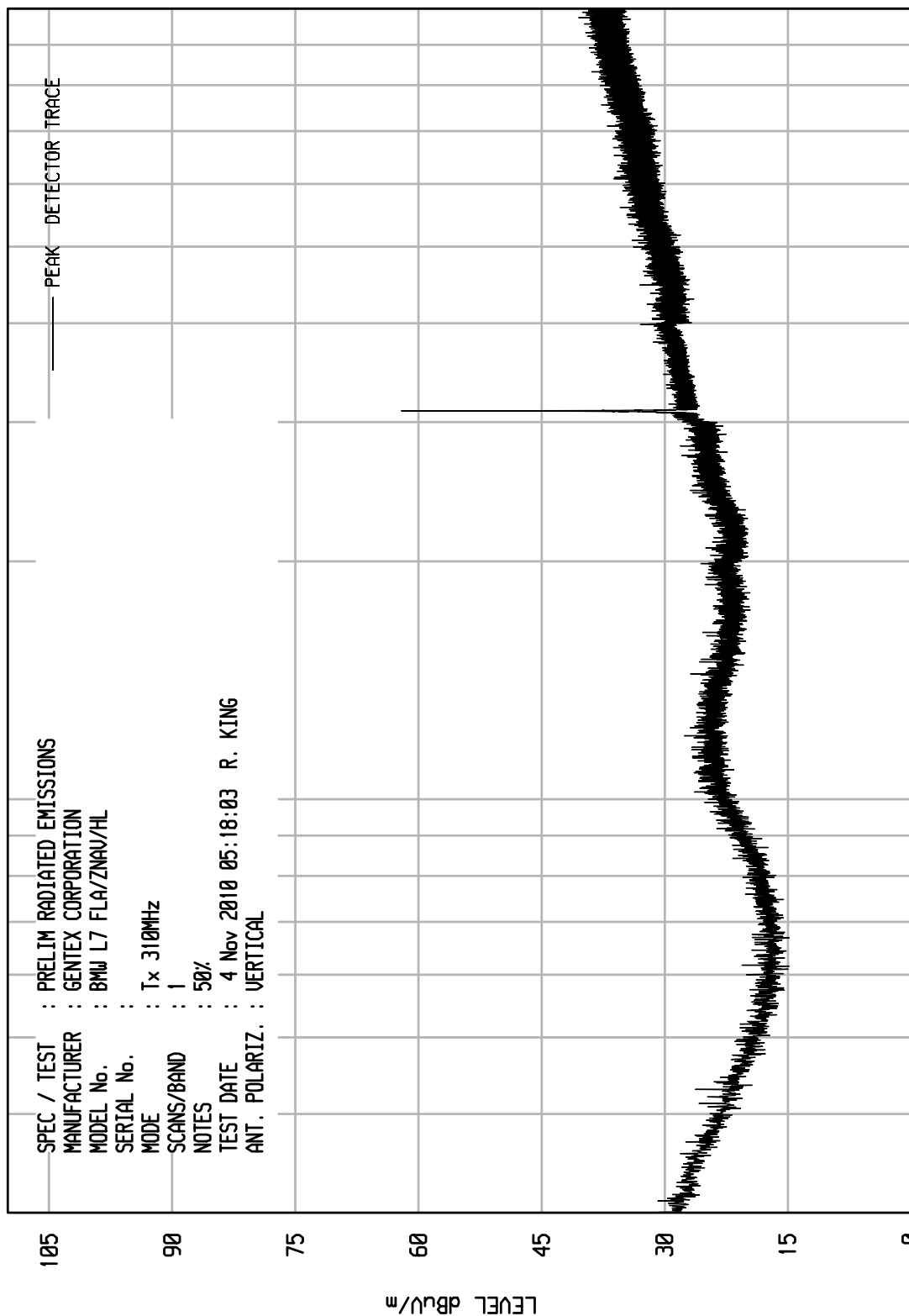
100

STOP = 1000

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515

UKA1 01/25/10

UNIV RCU EMI RUN 36



START = 30

100

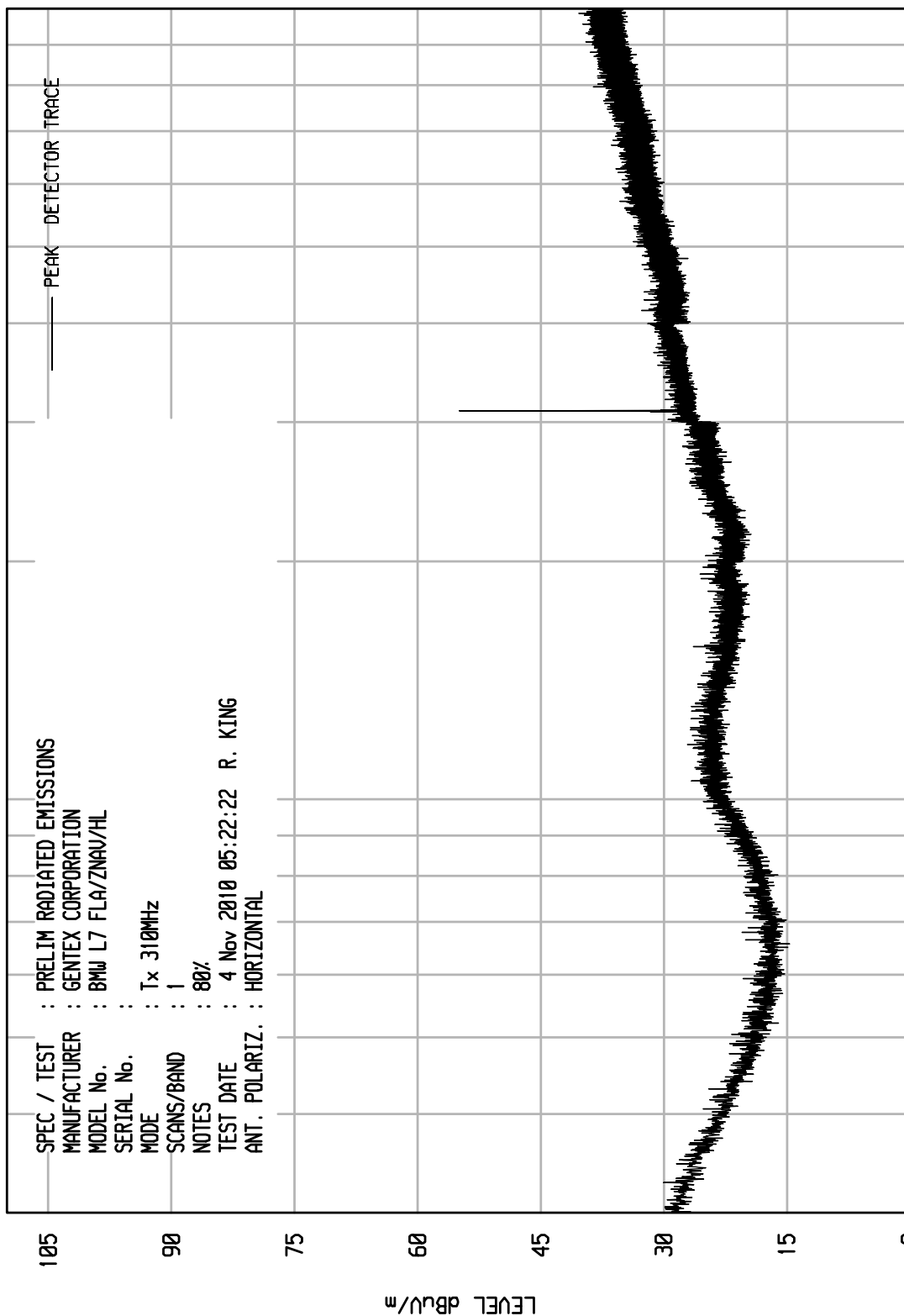
FREQUENCY MHz

STOP = 1000

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515

UKA1 01/25/10

UNIV RCU EMI RUN 38



START = 30

FREQUENCY MHz

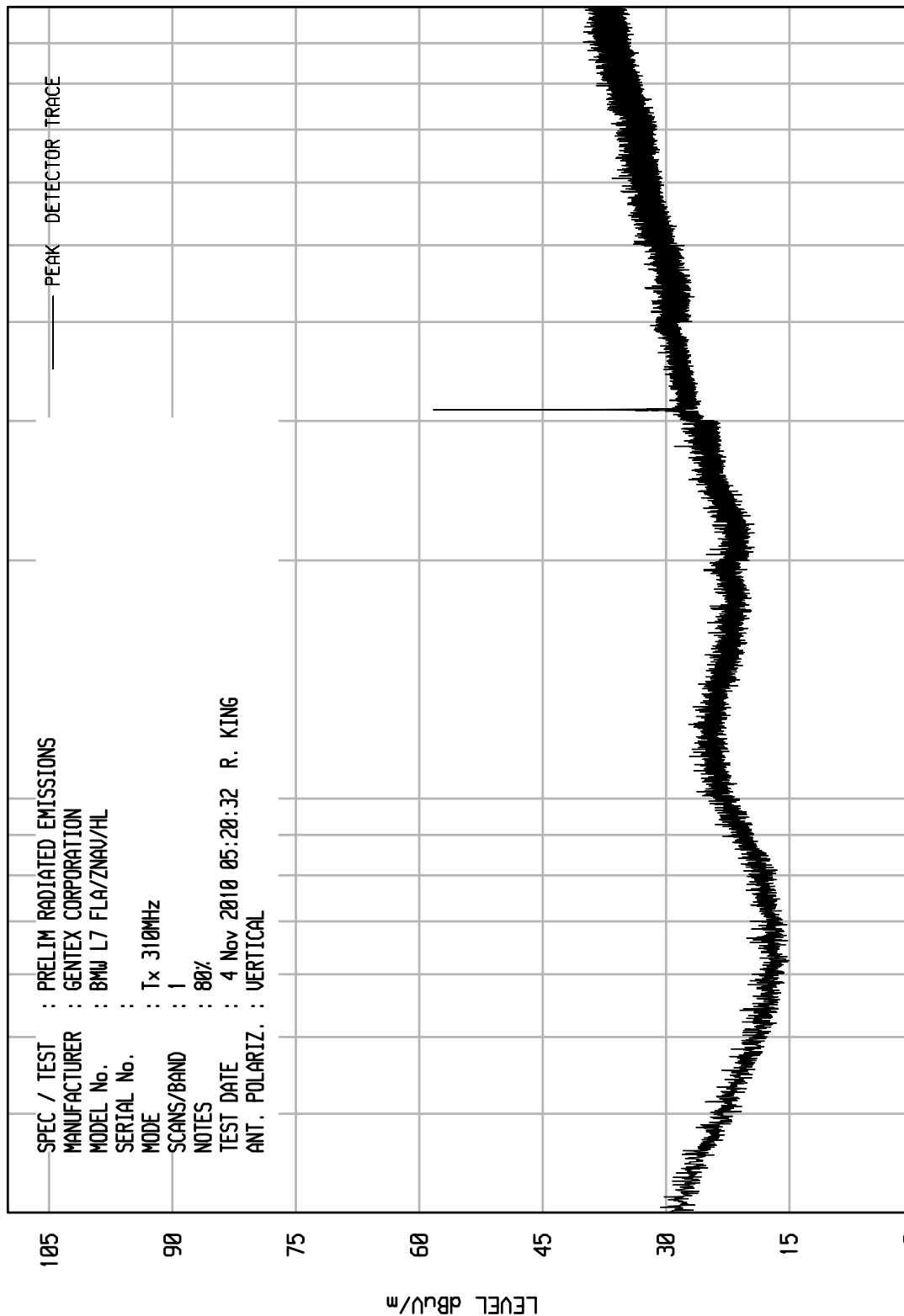
STOP = 1000

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515

UNIU RCU EMI RUN 37

UKA1 01/25/10

SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : GENTEX CORPORATION
MODEL No. : BMW L7 FLA/ZNAU/HL
SERIAL No. :
MODE : Tx 310MHz
SCANS/BAND : 1
NOTES : 80%
TEST DATE : 4 Nov 2010 05:20:32 R. KING
ANT. POLARIZ. : VERTICAL



START = 30

FREQUENCY MHz

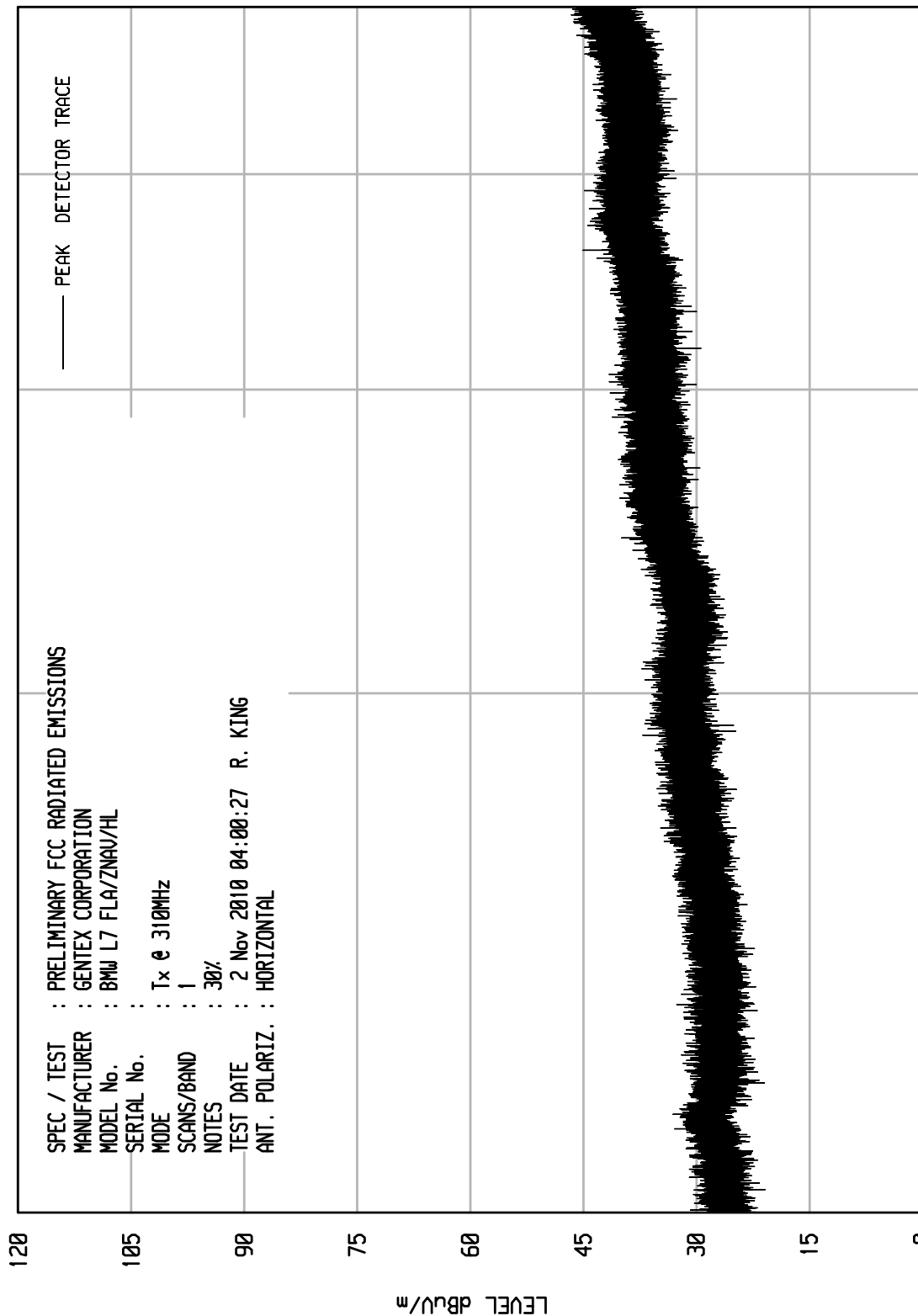
STOP = 1000



ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515

UKA1 01/25/10

UNIU RCU EMI RUN 7



START = 1000

FREQUENCY MHz

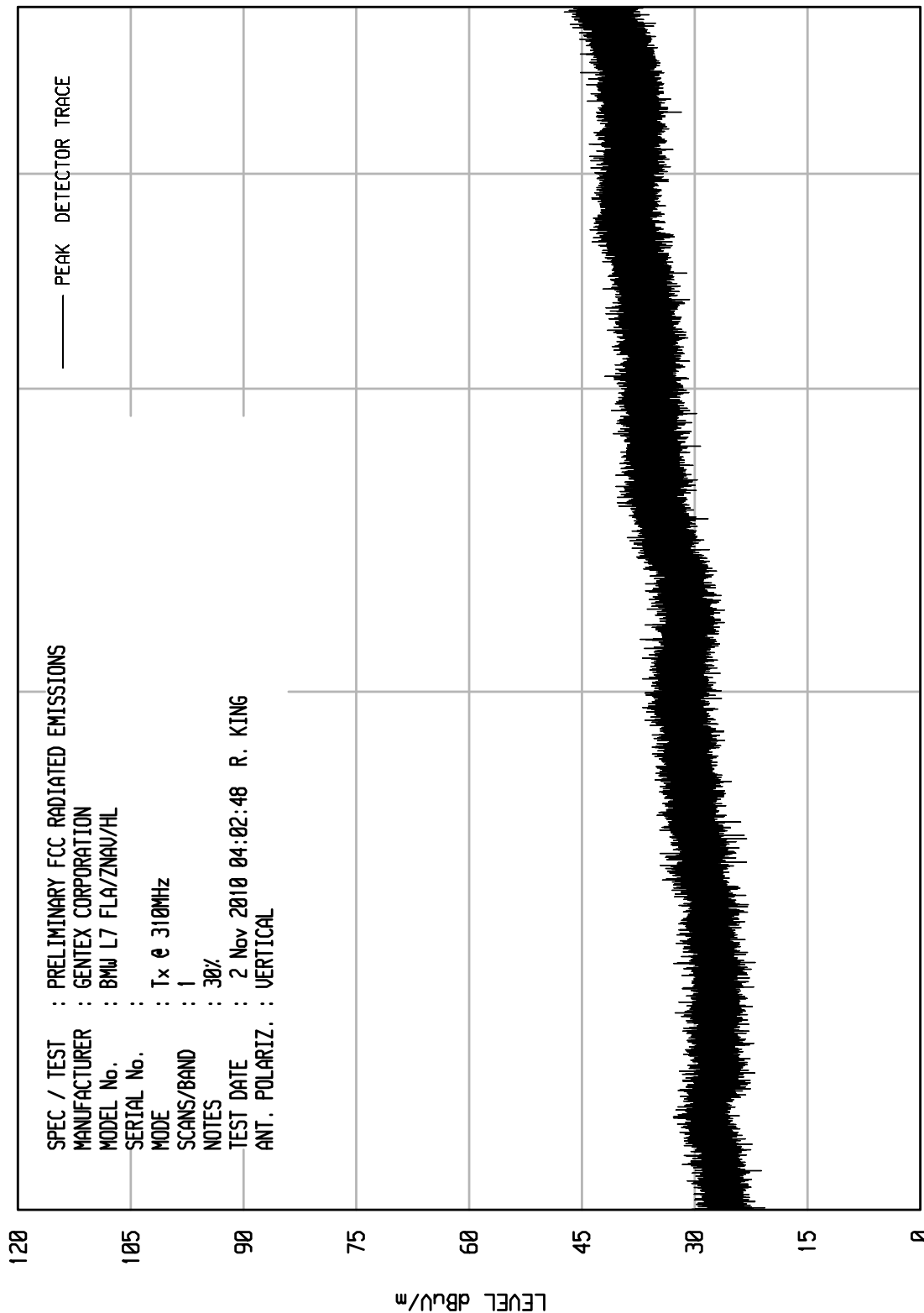
STOP = 5000



ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515

UKA1 01/25/10

UNIU RCU EMI RUN 8



START = 1000

FREQUENCY MHz

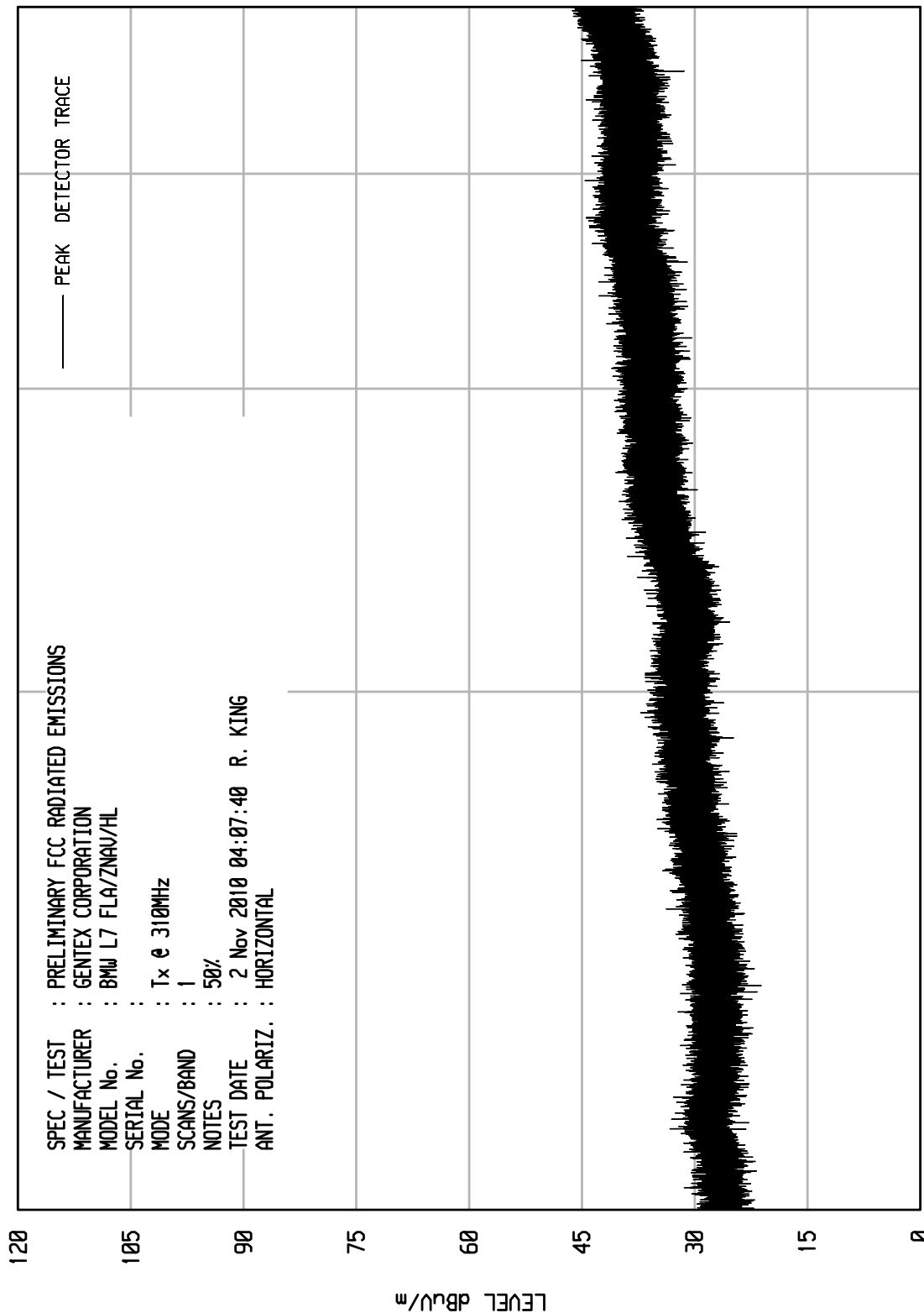
STOP = 5000



ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515

UKA1 01/25/10

UNIU RCU EMI RUN 10



START = 1000

FREQUENCY MHz

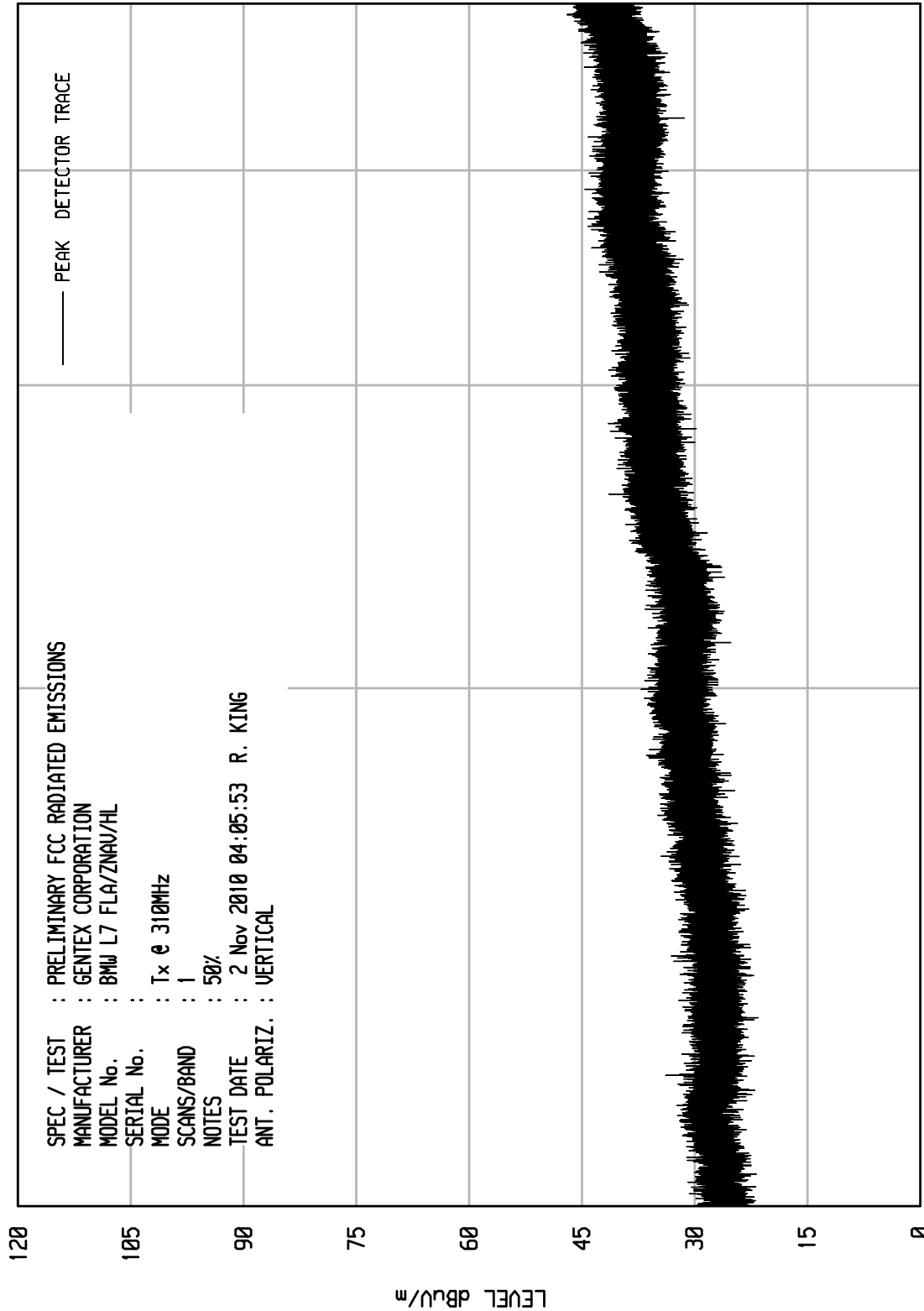
STOP = 5000



ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515

UKA1 01/25/10

UNIV RCU EMI RUN 9



START = 1000

FREQUENCY MHz

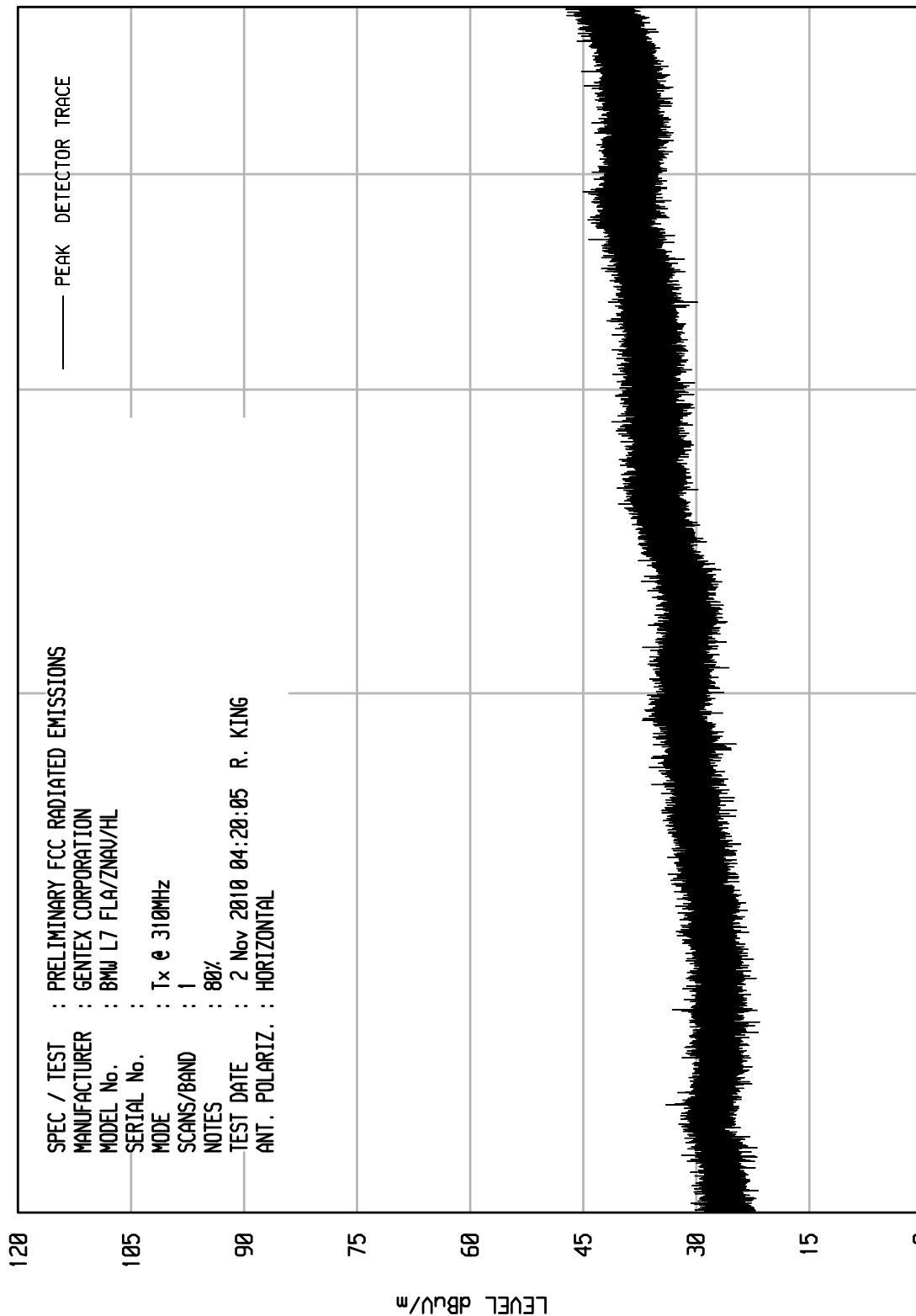
STOP = 5000



ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515

UKA1 01/25/10

UNIU RCU EMI RUN 15



START = 1000

FREQUENCY MHz

STOP = 5000