ELITE ELECTRONIC ENGINEERING COMPANY
1516 CENTRE CIRCLE
DOWNERS GROVE, ILLINOIS 60515-1082

ELITE PROJECT: 27694 DATES TESTED: May 3, 1999

TEST PERSONNEL: Daniel E. Crowder

TEST SPECIFICATION: Federal Communication Commission (FCC) Part 90

ENGINEERING TEST REPORT NO. 21661

MEASUREMENT OF RF INTERFERENCE FROM

A MODEL NO. A125310936B 125 WATT AMPLIFIER

FOR: TRL Technologies
Hoffman Estates, Illinois

PURCHASE ORDER NO: 98-220

Report By: Richard E. King
Richard E. King

Approved By: Raymond J. Klouda
Raymond J. Klouda
Registered Professional
Engineer of Illinois - 44894

ENGINEERING TEST REPORT NO. 21661

ADMINISTRATIVE DATA AND SUMMARY OF TESTS

DESCRIPTION OF TEST ITEM: 125 Watt Amplifier for single channel operation

MODEL NO: A125310936B

SERIAL NO: N/A

FCC ID: OEUHPA460M250W

MANUFACTURER: TRL Technologies

APPLICABLE SPECIFICATIONS: FCC Parts 2 and 90

QUANTITY OF ITEMS TESTED: One (1)

TEST PERFORMED BY: ELITE ELECTRONIC ENGINEERING COMPANY
Radio Interference Consultants
Downers Grove, Illinois 60515

DATES TESTED: May 3, 1999

PERSONNEL (OPERATORS, OBSERVERS, AND CO-ORDINATORS):

CUSTOMER: Hiep Lam and Ken Cao of TRL Technologies personnel were present for all testing.

ELITE ELECTRONIC: Daniel E. Crowder

ELITE JOB NO.: 27694

ABSTRACT: The Model No. A125310936B, 125 Watt Amplifier complies with the occupied bandwidth and spurious radiated emissions requirements in FCC PART 90. See test results and data pages for more details.

ENGINEERING TEST REPORT NO. 21661

TABLE OF CONTENTS

ENGINEERING TEST REPORT NO. 21661

MEASUREMENT OF RF INTERFERENCE FROM

A MODEL NO. A125310936B 125 WATT AMPLIFIER

1.0 INTRODUCTION:

1.1 DESCRIPTION OF TEST ITEM: This report present the results of the radio interference measurements were performed on a 125 Watt Amplifier for single channel paging applications, Model No. A125310936B, Serial No. N/A, (hereinafter referred to as the test item). The tests were performed for TRL Technologies of Hoffman Estates, Illinois.

1.2 PURPOSE: The test series was performed to determine if the test item meets the occupied bandwidth, spurious emissions at antenna terminals and spurious radiated emissions requirements of the FCC Part 90 for 928-944MHz Amplifiers.

1.3 DEVIATIONS, ADDITIONS AND EXCLUSIONS: There were no deviations, additions to, or exclusions from the test specification during this test series.

1.4 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 90
- Federal Communications Commission "Code of Federal Regulations", Title 47, Part 2
- ANSI C63.4-1992, "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"

1.5 SUBCONTRACTOR IDENTIFICATION: This series of tests was performed by the Elite Electronic Engineering Company, radio

interference consultants of Downers Grove, Illinois.

2.0 TEST ITEM SETUP AND OPERATION:

2.1 SETUP: The test item was powered with 26VDC from a power supply.

An input signal from a Hewlett Packard model 8648C signal generator (used in conjunction with a Hewlett Packard 8111A function generator) was fed into a Ophir model GRF5064 RF power amplifier. The 35 Watt output of the Ophir amplifier was used to drive the test item. The level of the input signal was adjusted until the power output was at the maximum level.

2.2 MODULATION: The test signal was frequency modulated (FM) with a 3.5 kHz audio tone at 14.0kHz deviation which is a typical modulation for 928-944MHz radio services.

2.3 FREQUENCY SELECTION: A single frequency in the center of the frequency band was selected.

The specific test frequencies are designated as follows:

Modulation Type	Frequency (MHz)
FM	936.0

3.0 TEST EQUIPMENT:

A list of the test equipment used can be found on Table I. All equipment was calibrated per the instruction manuals supplied by the manufacturer.

4.0 REQUIREMENTS, PROCEDURES AND RESULTS:

4.1 OCCUPIED BANDWIDTH MEASUREMENTS:

4.1.1 REQUIREMENTS: In accordance with Paragraph 90.209(b)(5), the maximum authorized bandwidth shall be 20kHz for operations in the bands 902MHz to 928MHz.

In accordance with paragraph 90.210(b), the peak power of any emission shall be attenuated below the unmodulated carrier power (P) in accordance with the following schedule:

(1) On any frequency removed from the assigned frequency by more than 50 percent but not more than 100 percent of the authorized bandwidth: At least 25 dB.

(2) On any frequency removed from the assigned frequency by more than 100 percent but not more than 250 percent of the authorized bandwidth: At least 35 dB.

(3) On any frequency removed from the assigned frequency by more than 250 percent: At least 43 + 10log (P) dB.

4.1.2 PROCEDURES:

(a) The input signal was set to 936.0MHz. The input signal level was adjusted to provide the maximum level at the test item output.

(b) The input signal was FM modulated.

(c) A spectrum analyzer was connected to the output of the test item. With a bandwidth of the spectrum analyzer set to 1kHz, the output of the test item was measured and recorded.

(d) The input signal from the signal generator was measured with the spectrum analyzer and recorded over the same frequency range.

4.1.3 RESULTS: The plots of the occupied bandwidth measured with the FM modulation of the carrier are presented on data pages 101 through 103.

The limits, shown on the plots, are referenced to the power measured from the unmodulated carrier.

As can be seen from the data, the test item output met the occupied bandwidth requirements with the FM modulation of the carrier. The sideband emissions measured at the test item output were similar to the sideband emissions measured from the input signals.

4.2 FIELD STRENGTH OF SPURIOUS EMISSIONS:

4.2 1 REQUIREMENTS: In accordance with Paragraph 90.210, on any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: by at least 43 + 10 log(P)dB. This requirement translates to a field strength limit of -13dBm (ERP). The emissions

shall be measured from 30MHz up to the 10th harmonic of the fundamental frequency.

4.2.2 PROCEDURES: The radiated 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 63.4 and CISPR 16 requirements for site attenuation.

Preliminary radiated measurements are performed to determine the frequencies where the significant emissions might be found. With the test item at one set position and the measurement antenna at a set height (i.e. without maximizing), the radiated emissions were measured using peak detection. This data was then automatically plotted. The frequencies where significant emission levels found were remeasured taking the extra pains to maximize the emission levels.

Measurements were performed with the input signal modulated.

(a) The test item was placed on a 0.8 meter high non-conductive stand at a 3 meter test distance from the receive antenna.

(b) The input frequency was set to 936.0MHz with (CW) no modulation. The level was adjusted for 125 Watts output. The output was terminated in 50 Ohm load. The modulation was reapplied.

(c) Preliminary emission levels were measured over the frequency range from 30MHz to 5GHz. These preliminary levels were then plotted. The readings were taken with a peak detector function. The measurement BW was 100kHz up to 1GHz and 1MHz up to 5GHz.

(d) Significant emissions were maximized at each frequency by rotating the test item and adjusting the receive antenna height and polarization. The maximum meter reading was recorded. Measurement BW was 1MHz for frequencies above 1GHz and 100kHz for frequencies 1GHz or less. Peak reading were recorded. No averaging methods or corrections were applied. As a minimum measurements were

made at each harmonic of the transmit frequency up through the tenth harmonic. If no signal was detected above the noise floor, the noise level was recorded and noted as ambient.

4.2.3 RESULTS: The preliminary plots are presented on data pages 104 and 105. This data is only presented for a reference, and is not used as to determine compliance. All significant radiated emissions were subsequently remeasured manually maximizing the level.

The final radiated levels are presented on data page 106. The radiated emissions were measured through the 10th harmonic. Field strength levels are presented as equivalent radiated power from a standard tuned dipole.

The radiated emission levels for the harmonics were below the specification limit.

4.3 SPURIOUS EMISSIONS AT ANTENNA TERMINAL:

4.3.1 REQUIREMENTS: This test determines whether the test item produces excessive spurious emissions at the antenna terminals.

In accordance with paragraph FCC 90.209(b), the mean power of emissions must be attenuated below the mean power of the unmodulated carrier (P) on any frequency removed from the assigned frequency by more than 250 percent of the autherized bandwidth: at least 43 + 10 Log (P). The peak power of the emissions shall be measured at the antenna terminal from 30MHz up to the 10th harmonic of the fundamental frequency.

4.3.2 PROCEDURES:

In general, this test will measure spurious emissions at the antenna terminals.

(a) The test item was setup per para 2.0.

(b) The frequency span was adjusted to cover 30 MHz up to 1000 MHz. The emission levels over this frequency range were measured and recorded.

(c) Next, the emissions over the frequency range from 1000 MHz up to 9000 MHz were measured and recorded. This range covers up through the 10th harmonic.

4.3.3 RESULTS: The plots of the antenna conducted output measurements are presented on data pages 107 through 111.

As can be seen from the data, the test item did not produce spurious emissions in excess of 65 dB below unmodulated carrier level with the nominal output power of 125 Watts.

5.0 CONCLUSION:

The Model No. A125310936B 125 Watt Amplifier for 928-944MHz, complies with the Occupied Bandwidth and the Field Strength of Spurious Emissions requirements of the FCC Part 90 and 2.

6.0 CERTIFICATION:

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

The data presented in this test report pertains to the test item at the test date. Any electrical or mechanical modification made to the test item 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.

ENGINEERING TEST REPORT NO. 21661

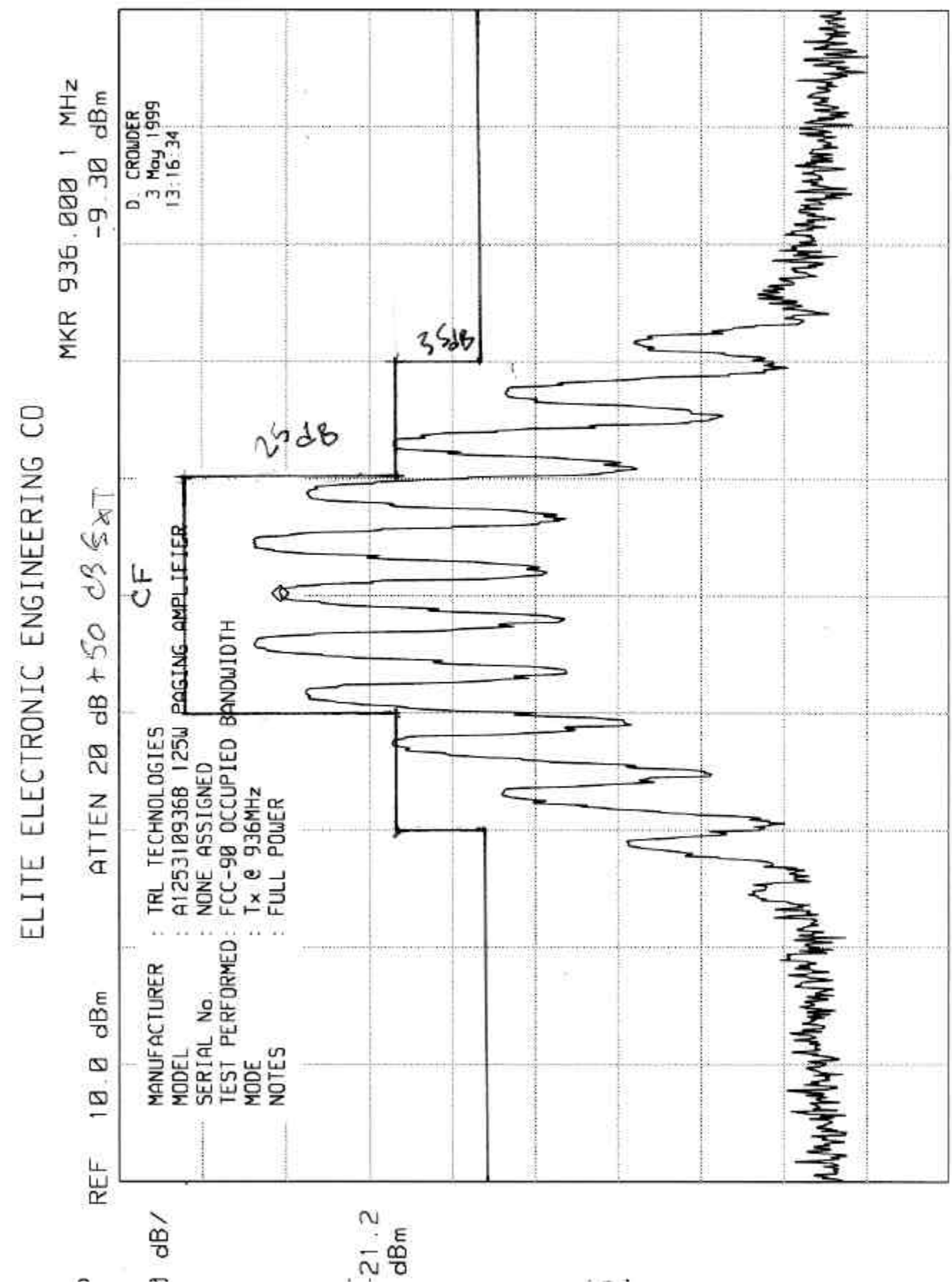
TABLE I: TEST EQUIPMENT LIST

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Cal Inv	Due Date
Equipment Type: ACCESSORIES, MISCELLANEOUS								
XZG0	ATTENUATOR/SWITCH DRIVER	HEWLETT PACKARD	11713A	3439A02724	---	01/29/99	12	01/29/00
Equipment Type: AMPLIFIERS								
APK0	PRE-AMPLIFIER	HEWLETT PACKARD	8449B	3008A00662	1-26.5GHZ	01/29/99	12	01/29/00
Equipment Type: ANTENNAS								
NTA1	BILOG ANTENNA	CHASE EMC LTD.	BILOG CBL611	2054	.03-2GHZ	05/12/98	12	05/12/99
NWF0	DOUBLE RIDGED WAVEGUIDE -	EMCO	3105	2035	1-12.4GHZ	08/26/98	12	08/26/99
Equipment Type: CONTROLLERS								
CDD2	COMPUTER	HEWLETT PACKARD	D4171A#ABA	US61654645	---		N/A	
CMA0	MULTI-DEVICE CONTROLLER	EMCO	2090	9701-1213	---		N/A	
Equipment Type: PRINTERS AND PLOTTERS								
HRE3	LASER JET 5P	HEWLETT PACKARD	C3150A	USHB061226	---		N/A	
Equipment Type: RECEIVERS								
RAC1	SPECTRUM ANALYZER	HEWLETT PACKARD	85660B	3407A08369	100HZ-22GHZ	01/26/99	12	01/26/00
RACB	RF PRESELECTOR	HEWLETT PACKARD	85685A	3506A01491	20HZ-2GHZ	01/28/99	12	01/28/00
RAF3	QUASIPEAK ADAPTER	HEWLETT PACKARD	85650A	3303A01775	0.01-1000MHZ	01/28/99	12	01/28/00

Cal. Interval: Listed in Months I/O: Initial Only N/A: Not Applicable

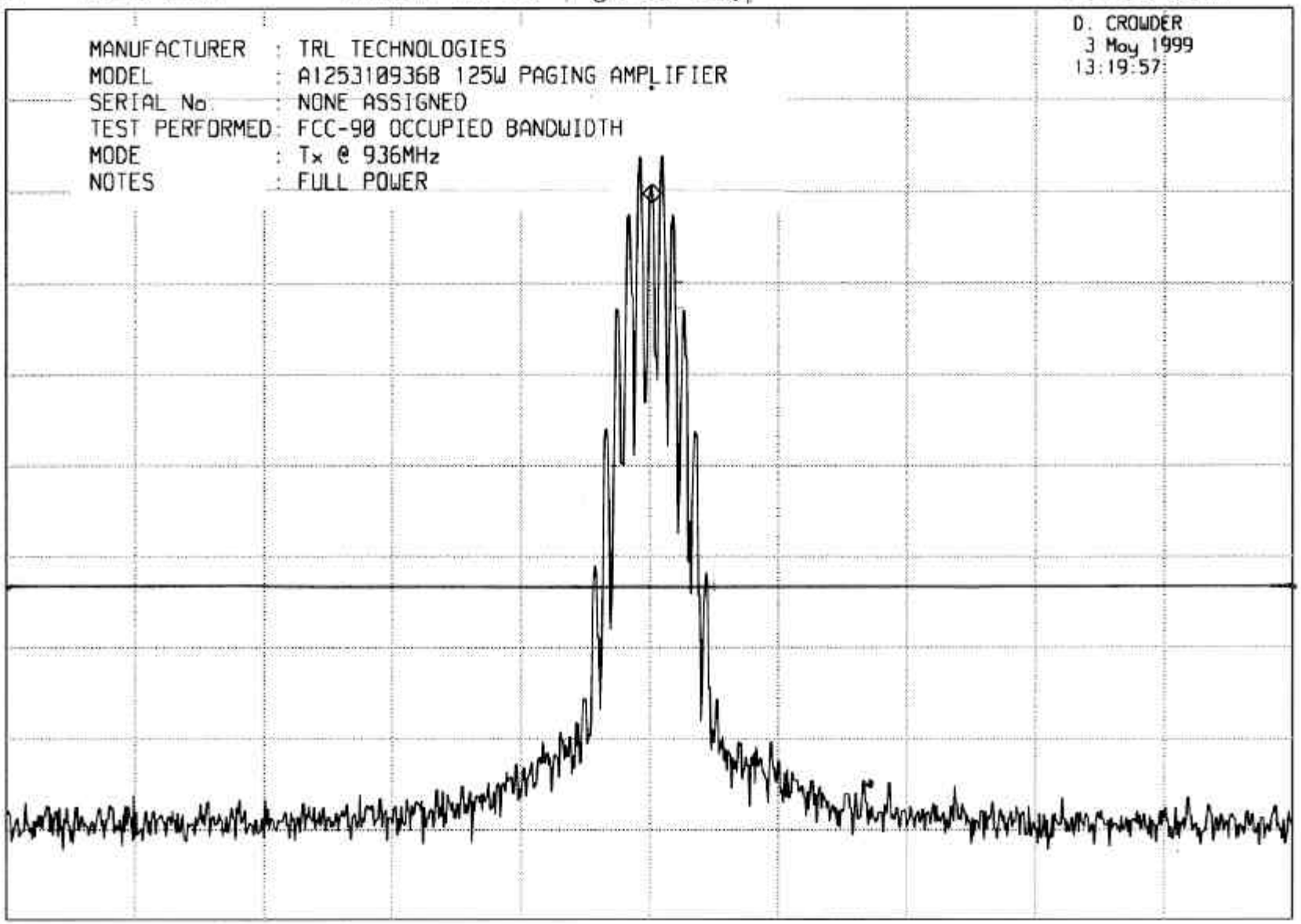
Note 1: For the purpose of this test, the equipment was calibrated over the specified frequency range, pulse rate, or modulation prior to the test or monitored by a calibrated instrument.

ETR 21661


ELITE ELECTRONIC ENGINEERING CO
REF 10.0 dBm
ATTEN 20 dB + 50 dB EXT
MKR 936.000 1 MHz
-9.30 dBm
D. CROWDER
3 May 1999
13:16:34
MANUFACTURER : TRL TECHNOLOGIES
MODEL : A1253109368 125W PAGING AMPLIFIER
SERIAL No. : NONE ASSIGNED
TEST PERFORMED : FCC-90 OCCUPIED BANDWIDTH
MODE : Tx @ 936MHz
NOTES : FULL POWER
CF
25dB
35dB
dB/
21.2
dBm
NTER 936.000 MHz
RES BW 1 kHz(i)
VBW 10 kHz
SPAN 100 kHz
SWP 750 msec

ELITE ELECTRONIC ENGINEERING CO

MKR 936.000 5 MHz
REF 10.0 dBm ATTEN 20 dB +50 dB Ext -10.20 dBm



dB/

-21.2 dBm

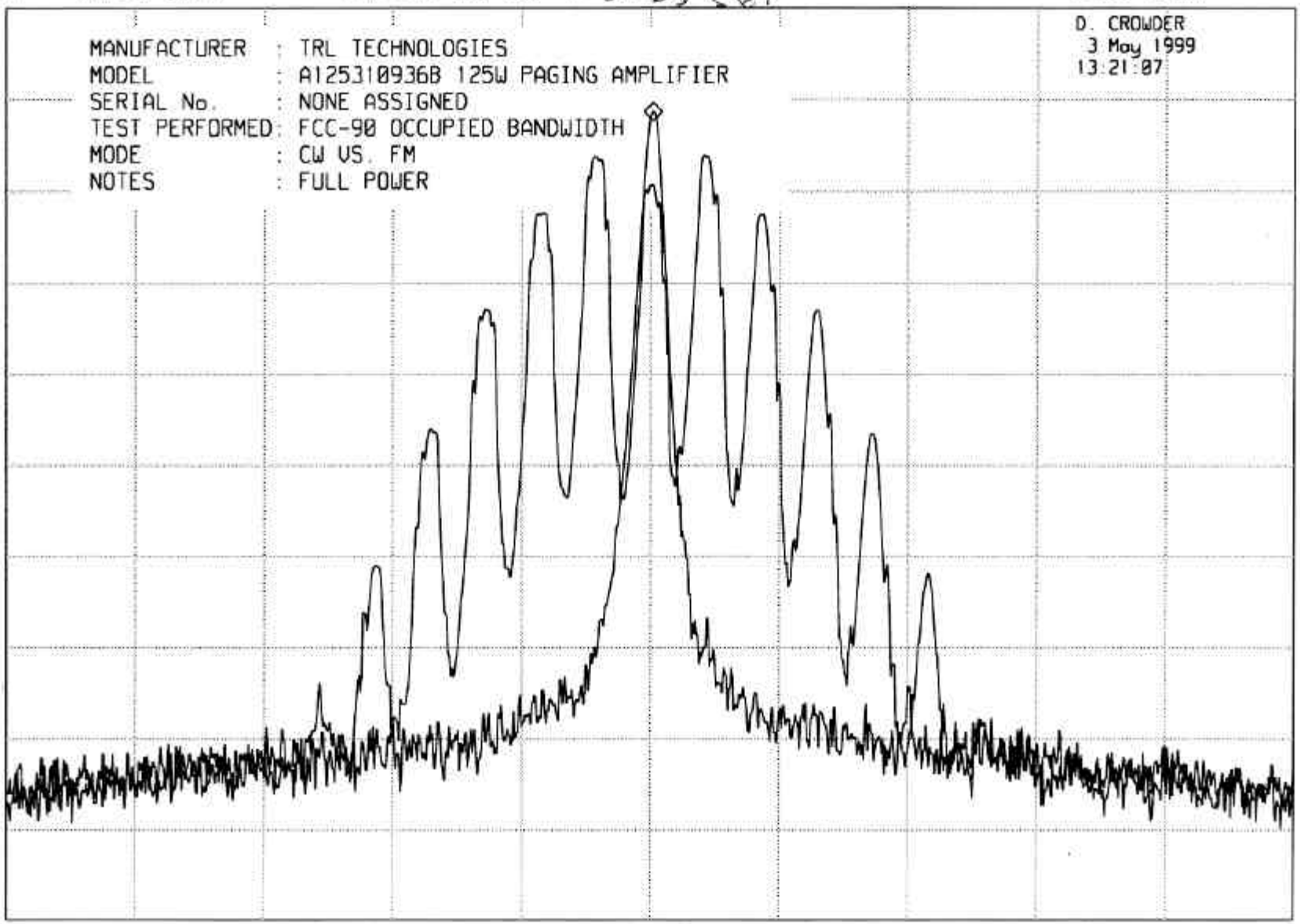
ETR 21661

CENTER 936.000 MHz SPAN 500 kHz
RES BW 1 kHz(i) VBW 10 kHz SWP 3.75 sec

ELITE ELECTRONIC ENGINEERING CO

MKR 936.000 1 MHz
-1.30 dBm

REF 10.0 dBm ATTEN 20 dB + 50 dB EXT



dB/

-21.2 dBm

CENTER 936.000 MHz
SPAN 100 kHz
RES BW 1 kHz(i)
VBW 10 kHz
SWP 750 msec

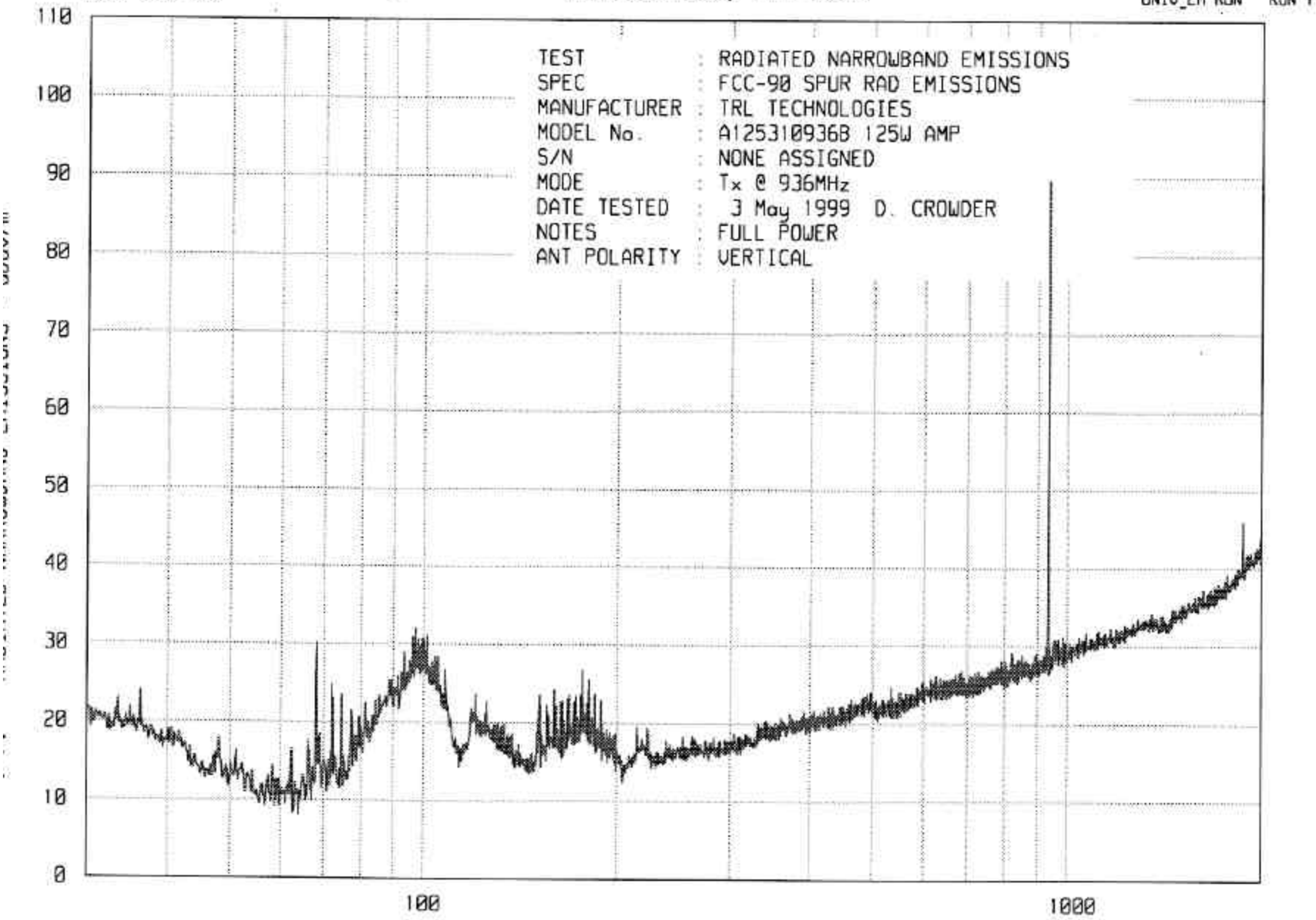
ETR 21661

ELITE ELECTRONIC ENGINEERING Co.

Downers Grove, Ill. 60515

WKA0 02/24/98

UNIV_EM RUN RUN 1



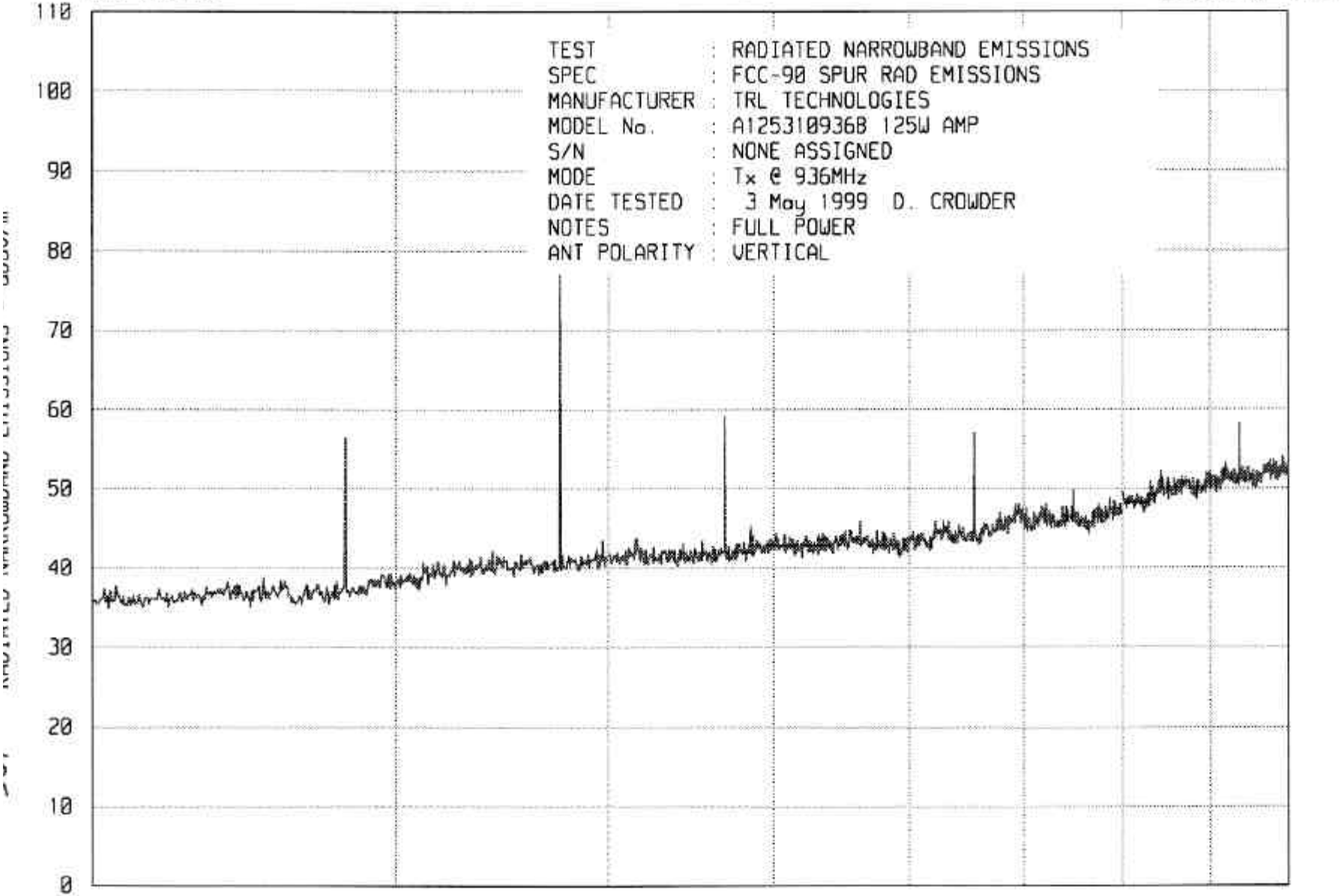
ETR 21461

ELITE ELECTRONIC ENGINEERING Co.

Downers Grove, Ill. 60515

WKA0 02/24/98

UNIV_EM RUN RUN 2



ETR 21691

Elite Electronic Engineering INC.

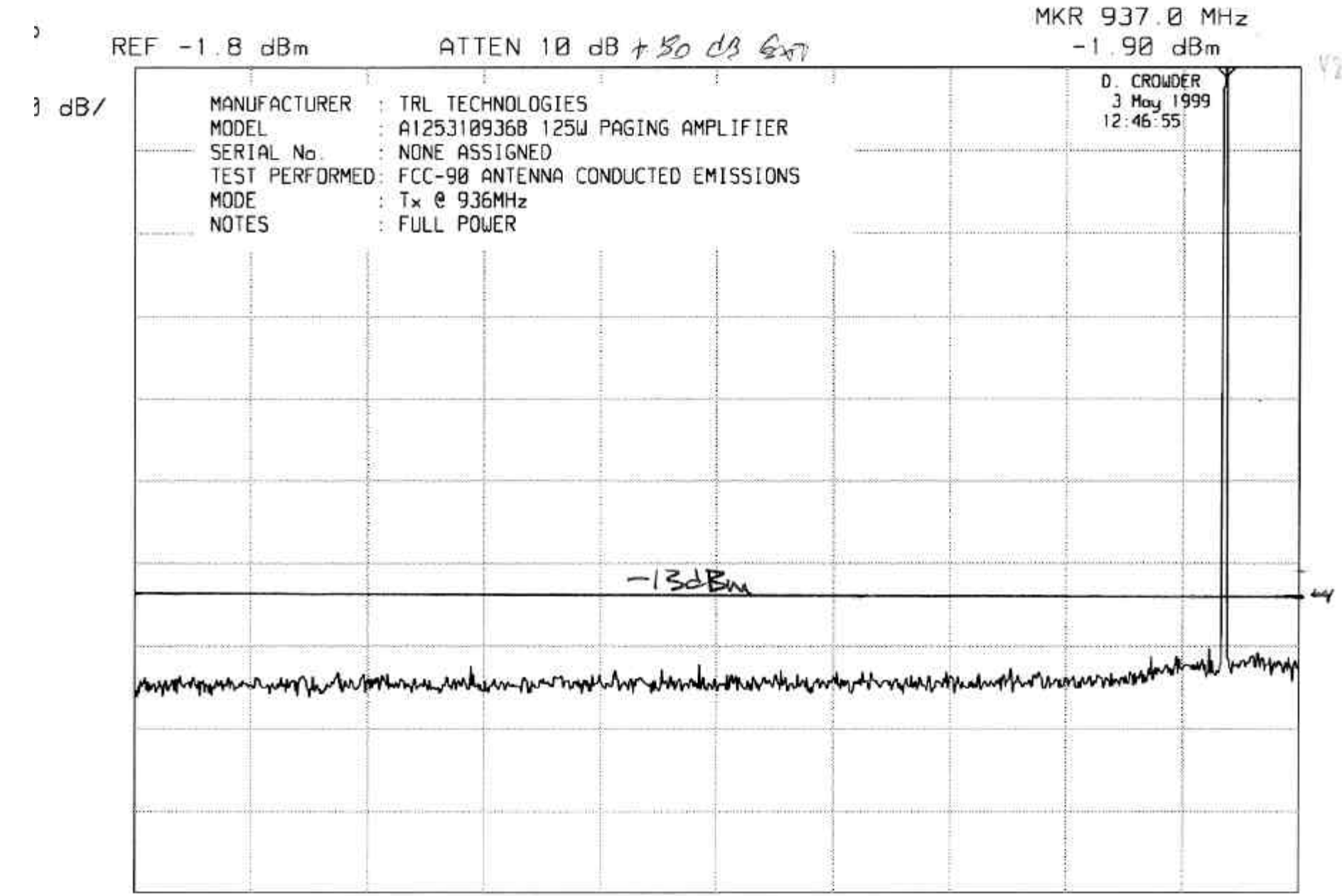
ETR 21661
DATA SHEET

MANUFACTURER	: TRL TECHNOLOGIES
MODEL	: A125310936B 125 Watt PAGING AMPLIFIER
S/N	: NONE ASSIGNED
SPECIFICATION	: FCC-90 OPEN FIELD SPURIOUS RADIATED EMISSIONS
DATE	: MAY 3, 1999
NOTES	: TRANSMIT AT 936.0MHz INTO 50 OHMS
	: TEST DISTANCE IS 3 METERS

FREQ. (MHz)	ANT POL.	MTR RDG (dBuV)	ANT FAC dB	CABLE FAC dB	PRE-AMP GAIN	CONV. F.I. to dBm(dipole)	TOTAL dBm	LIMIT dBm
1872.0	H	75.1	27.8	3.6	36.2	-97.2	-26.9	-13
	V	74.2	27.8	3.6	36.2	-97.2	-27.8	-13
2808.0	H	66.2	30.4	4.3	36.0	-97.2	-32.3	-13
	V	65.5	30.4	4.3	36.0	-97.2	-33.0	-13
3744.0	H	77.0	32.8	5.0	35.8	-97.2	-18.2	-13
	V	68.6	32.8	5.0	35.8	-97.2	-26.6	-13
4680.0	H	60.4	35.0	5.6	35.3	-97.2	-31.5	-13
	V	57.8	35.0	5.6	35.3	-97.2	-34.1	-13
5616.0	H	43.9	35.5	6.2	35.1	-97.2	-46.7	-13
	V	44.3	35.5	6.2	35.1	-97.2	-46.3	-13
6552	H	51.5	36.5	6.6	35.2	-97.2	-37.8	-13
	V	47.2	36.5	6.6	35.2	-97.2	-42.1	-13
7488.0	H	46.2 AMB	37.9	7.3	35.3	-97.2	-41.1	-13
	V	45.4 AMB	37.9	7.3	35.3	-97.2	-41.9	-13
8424.0	H	45.1 AMB	37.9	7.9	35.7	-97.2	-42.0	-13
	V	45.6 AMB	37.9	7.9	35.7	-97.2	-41.5	-13
9360.0	H	45.7 AMB	38.5	8.3	35.8	-97.2	-40.5	-13
	V	46.9 AMB	38.5	8.3	35.8	-97.2	-39.3	-13

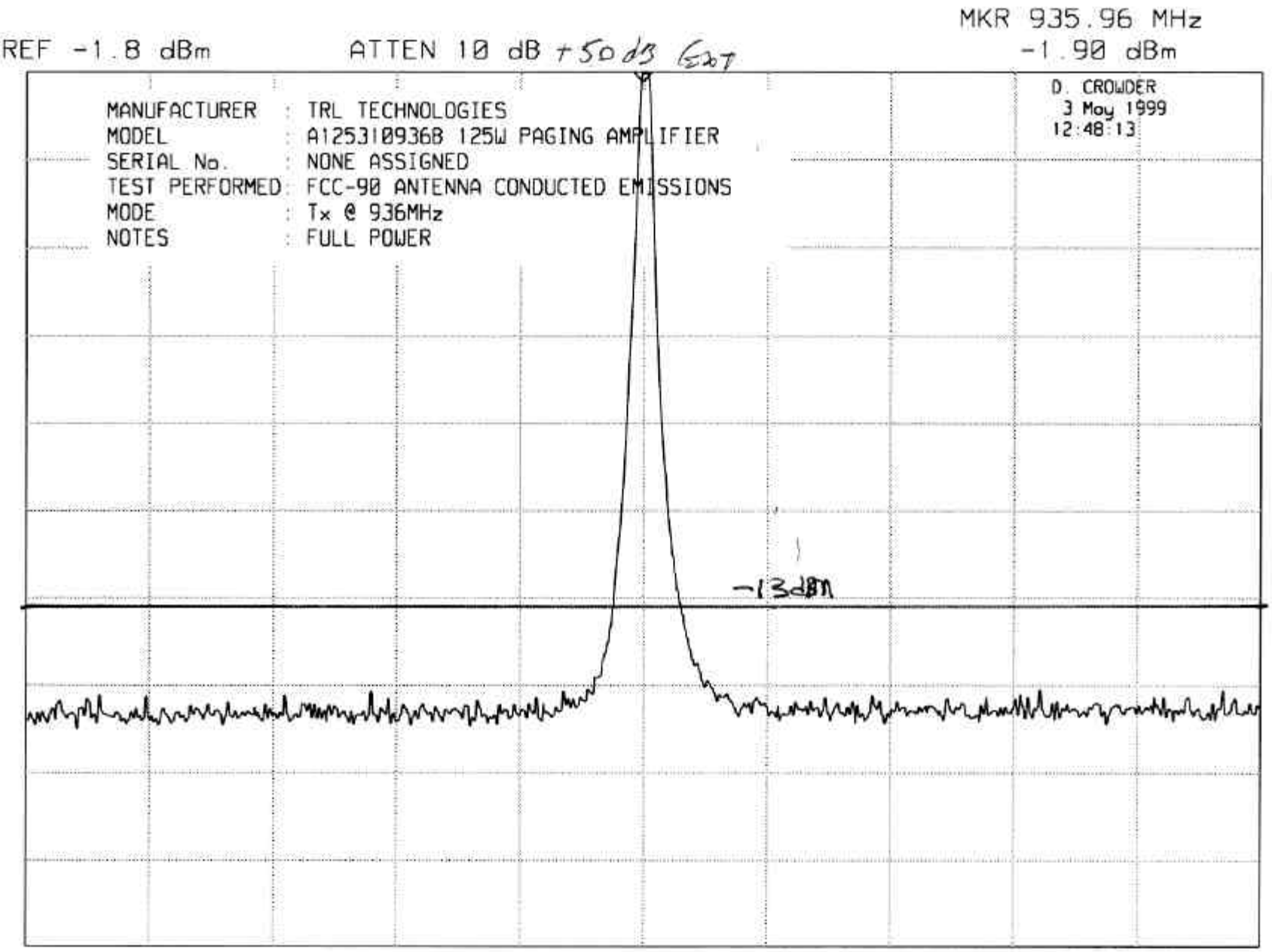
CHECKED BY:

ELITE ELECTRONIC ENGINEERING CO



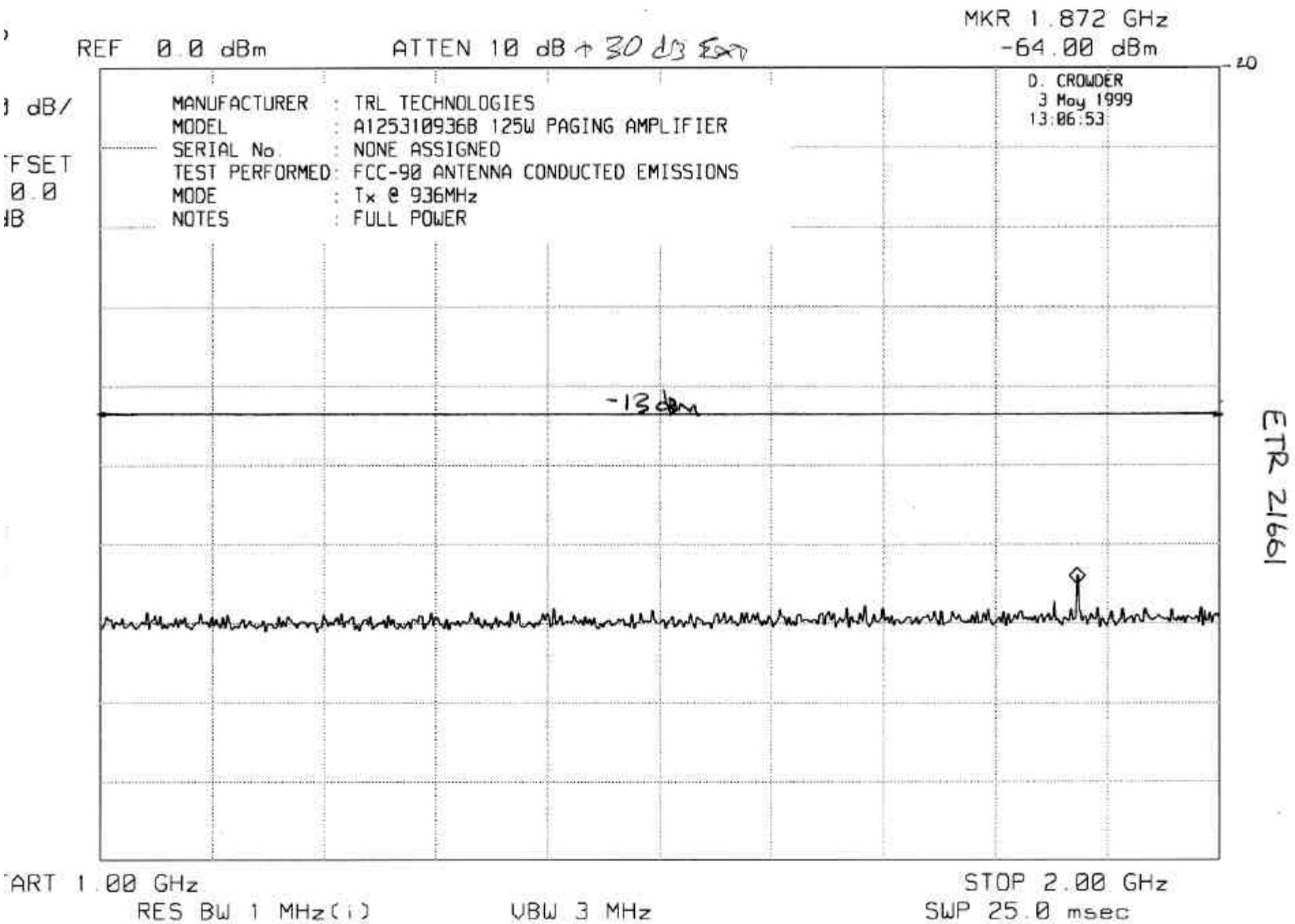
ETR 2661

ELITE ELECTRONIC ENGINEERING CO



ETR 21661

ELITE ELECTRONIC ENGINEERING CO



ETR 21661

ELITE ELECTRONIC ENGINEERING CO