Measurement of RF Interference from a Model AT7200 UHF Digital Transmitter

For : Linear Industries, Inc.
Geneva, IL

P.O. No. : 1020/2006
Date Received : November 15, 2006
Date Tested : November 16, 2006
Test Personnel : Daniel E. Crowder, NARTE® Certified EMC Test Engineer, ATL-0152-E
Specification : FCC "Code of Federal Regulations" Title 47 Part 74, Subpart G

Test Report By : Daniel E. Crowder

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

Elite Electronic Engineering Inc.
1516 Centre Circle
Downers Grove, IL 60515
Tel : (630) 495-9770
Fax: (630) 495-9785
www.elitetest.com

TABLE OF CONTENTS

REVISION HISTORY

Revision	Date	Description
—	11/17/2006	Initial release

Measurement of RF Emissions from a Model AT7200 UHF Digital Transmitter

1.0 INTRODUCTION:

1.1 Description of Test Item - This document presents the results of the series of radio interference measurements performed on a Model AT7200 UHF Digital Transmitter, (hereinafter referred to as the test item). The Model AT7200 UHF Digital Transmitter is designed to transmit in the UHF frequency range of using an external antenna. The test item was submitted for testing by Linear Industries, Inc. located in Geneva, IL.

1.2 Purpose - The test series was performed to determine if the test item meets the field strength of spurious emissions of Part 74, Subpart G. Testing was performed in accordance with 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 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 74, dated 1 October 2005

- TIA-603-C-2004, "Land Mobile FM or PM – Communications Equipment – Measurement and Performance Standards"

1.5 EMC Laboratory Identification - This series of tests was performed by Elite Electronic Engineering Incorporated of Downers Grove, Illinois.

1.6 Laboratory Conditions The temperature at the time of the test was 23°C and the relative humidity was 42%.

2.0 TEST ITEM SET-UP AND OPERATION:

The test item is a Model AT7200 UHF Digital Transmitter. The test item is designed to transmit in the UHF band.

2.1 Power Input - The test item was powered by 240V, 60Hz single phase power.

2.2 Grounding - The test item was grounded through its power cord during testing.

2.3 Peripheral Equipment - The test item does not connect to any peripheral equipment.

2.4 Interconnect Cables - The test item does not have any interconnect cables.

2.5 Operational Mode - For all tests, the test item was transmitting at UHF Channel 24

(531.25MHz). The test was performed with the test item transmitting at 200 Watts.

2.6 Test Item Modifications - No modifications were required to comply with the test series.

3.0 TEST EQUIPMENT:

3.1 Test Equipment List - 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.

3.2 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).

3.3 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.

4.0 REQUIREMENTS, PROCEDURES AND RESULTS:

4.1 Field Strength of Spurious Emissions:

4.1.1 Requirements - Per 74.750(2), Radio frequency harmonics of the visual and aural carriers, measured at the output terminals of the transmitter, shall be attenuated no less than 60 dB below the peak visual output power within the assigned channel. All other emissions appearing on frequencies more than 3 megacycles above or below the upper and lower edges, respectively, of the assigned channel shall be attenuated no less than:

(i) 30 dB for transmitters rated at no more than 1 watt power output.

(ii) 50 dB for transmitters rated at more than 1 watt power output.

(iii) 60 dB for transmitters rated at more than 100 watts power output.

4.1.2 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.

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 test item. The entire frequency range from 30MHz to 10GHz was investigated using a peak detector function. All preliminary tests were performed with the test item transmitting at 531.25MHz mode.

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 bilog or double ridged waveguide antenna over the frequency range of 30MHz to 10GHz.

3. To ensure that maximum emission levels were measured, the following steps were taken:

    a. The test item 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 test item 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.

4.1.3 Results - The preliminary radiated emissions plots are presented on pages 10 through 13. Factors for the antennas and cables were added to the data before it was plotted. This data is only presented for a reference, and is not used as official data.

The final radiated levels are presented on pages 14 and 15. The radiated emissions were measured through the 10th harmonic. As can be seen from the data, all emissions measured from the test item were within the specification limits.

5.0 CONCLUSIONS:

It was determined that the Linear Industries, Inc., Model AT7200 UHF Digital Transmitter, Serial Number 001 did fully meet the spurious radiated emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 74, Subpart G, when tested per TIA-603-C-2004.

6.0 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 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.

7.0 ENDORSEMENT DISCLAIMER:

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

TABLE I: TEST EQUIPMENT LIST

ELITE ELECTRONIC ENG. INC. Page: 1

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Cal Inv	Due Date
Equipment Type: ACCESSORIES, MISCELLANEOUS								
XZG3	ATTENUATOR/SWITCH DRIVER	HEWLETT PACKARD	11713A	2421A03059	---		N/A	
Equipment Type: AMPLIFIERS								
APK3	PREAMPLIFIER	AGILENT TECHNOL	8449B	3008A01593	1-26.5GHZ	06/03/06	12	06/03/07
Equipment Type: ANTENNAS								
NTA0	BILOG ANTENNA	CHASE EMC LTD.	BILOG CBL611	2057	0.03-2GHZ	08/15/06	12	08/15/07
NWF0	RIDGED WAVE GUIDE	EMCO	3105	2035	1-12.4GHZ	10/01/06	12	10/01/07
NWG0	RIDGED WAVE GUIDE	AEL	H1479	104	1-12.4GHZ	10/01/06	12	10/01/07
Equipment Type: ATTENUATORS								
T1EE	10DB 25W ATTENUATOR	WEINSCHEL	46-10-34	BN2321	DC-18GHZ	12/05/05	12	12/05/06
T2D9	20DB, 25W ATTENUATOR	WEINSCHEL	46-20-34	BH5445	DC-18HGZ	12/05/05	12	12/05/06
T2E0	20DB, 100W ATTENUATOR	BIRD ELECTRONIC	8343-200	1228	DC-1GHZ	02/08/06	12	02/08/07
Equipment Type: CONTROLLERS								
CDS2	COMPUTER	GATEWAY	MFATXPNT NMZ	0028483108	1.8GHZ		N/A	
CMA0	MULTI-DEVICE CONTROLLER	EMCO	2090	9701-1213	---		N/A	
Equipment Type: METERS								
MPA0	POWER METER	HEWLETT PACKARD	432A	1141A08696	0.01-40GHZ	06/22/06	12	06/22/07
MPAA	THERMISTOR MOUNT	HEWLETT PACKARD	8478B	1144A08340	0.01-18GHZ	10/20/06	24	10/20/08
Equipment Type: PRINTERS AND PLOTTERS								
HRE1	LASER JET 5P	HEWLETT PACKARD	C3150A	USHB061052	---		N/A	
Equipment Type: RECEIVERS								
RAC2	SPECTRUM ANALYZER	HEWLETT PACKARD	85660B	3638A08770	100HZ-22GHZ	02/09/06	12	02/09/07
RACD	RF PRESELECTOR	HEWLETT PACKARD	85685A	3010A01205	20HZ-2GHZ	12/23/05	12	12/23/06
RAF4	QUASIPEAK ADAPTER	HEWLETT PACKARD	85650A	2043A00320	0.01-1000MHZ	02/09/06	12	02/09/07
Equipment Type: SIGNAL GENERATORS								
GBR7	SIGNAL GENERATOR	HEWLETT PACKARD	8648B	3836U01992	9KHZ-4GHZ	06/16/06	12	06/16/07
GDJ0	SIGNAL GENERATOR	HEWLETT PACKARD	E4432B	US38080222	2GHZ-18.0GHZ	09/28/06	12	09/28/07

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.

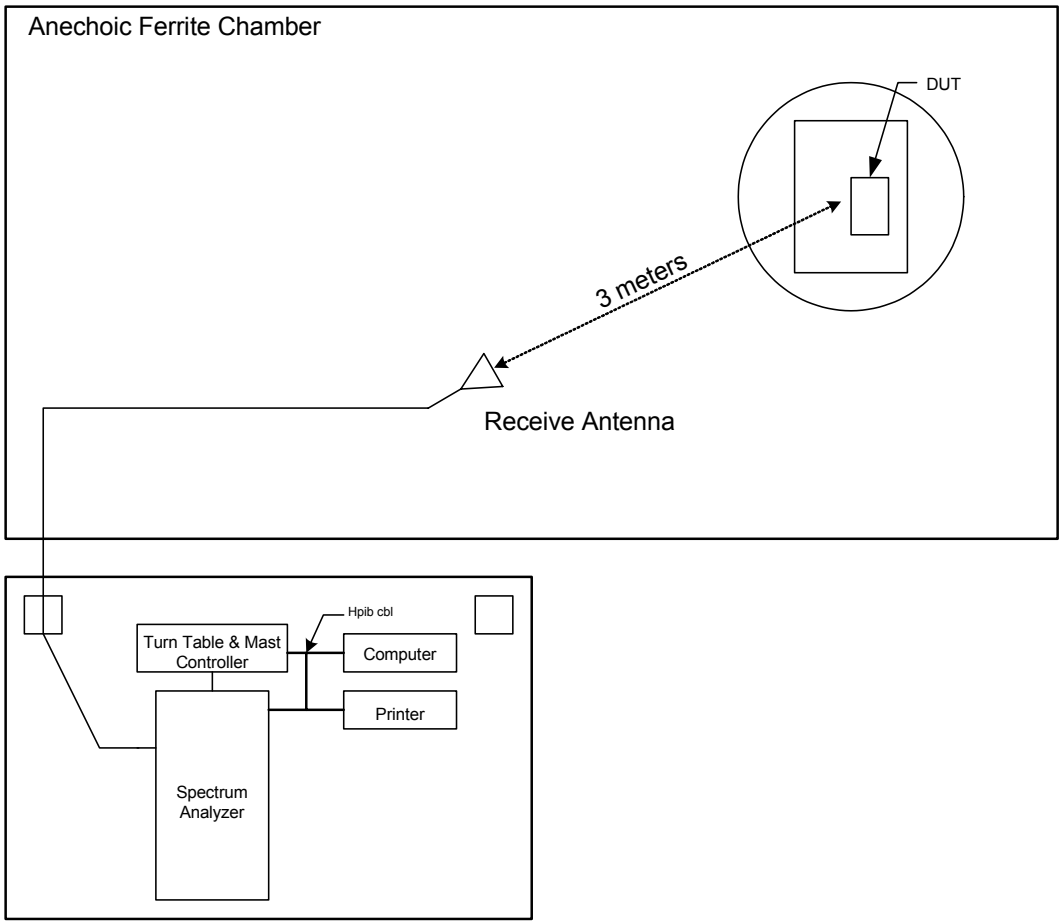
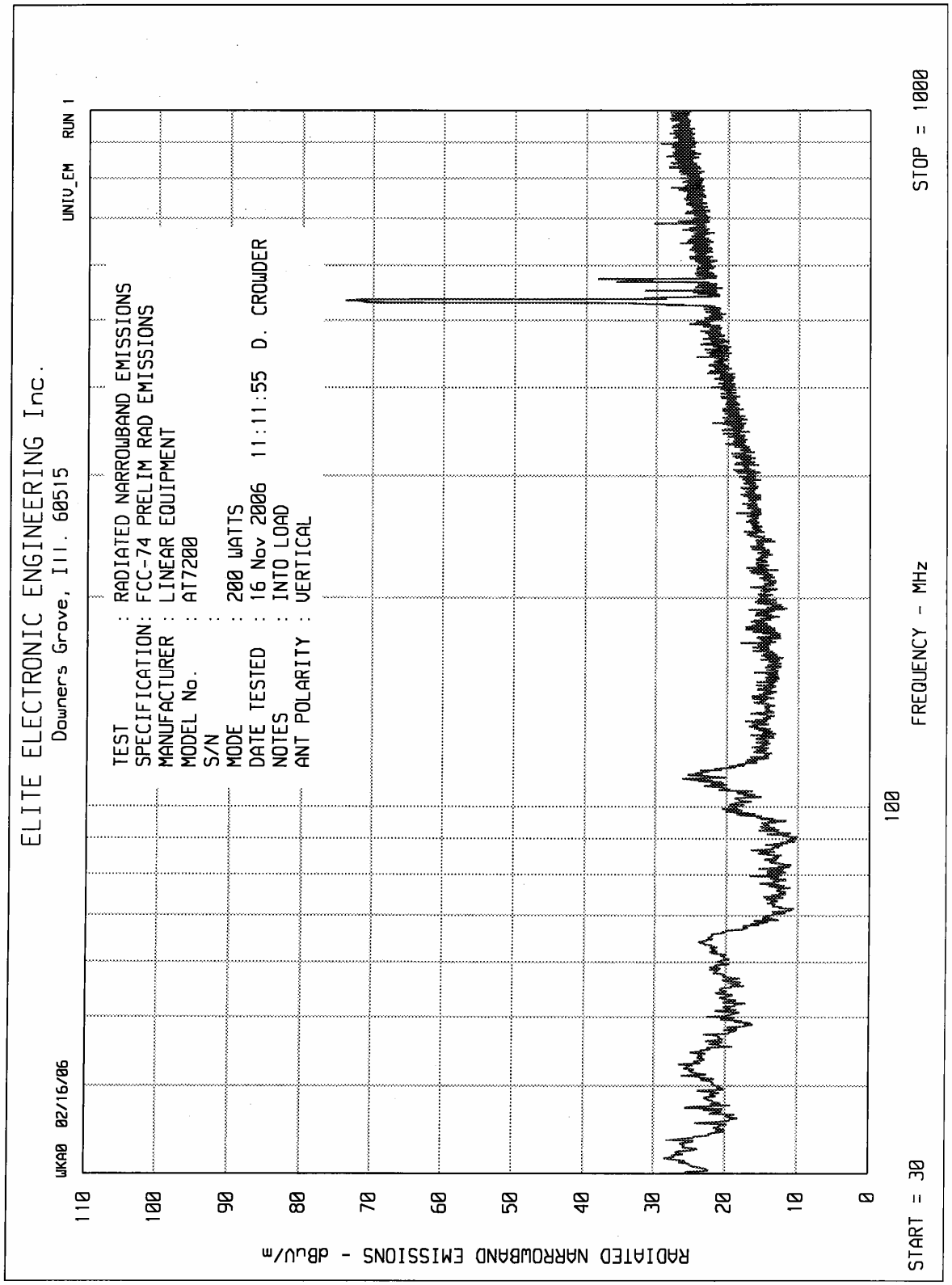
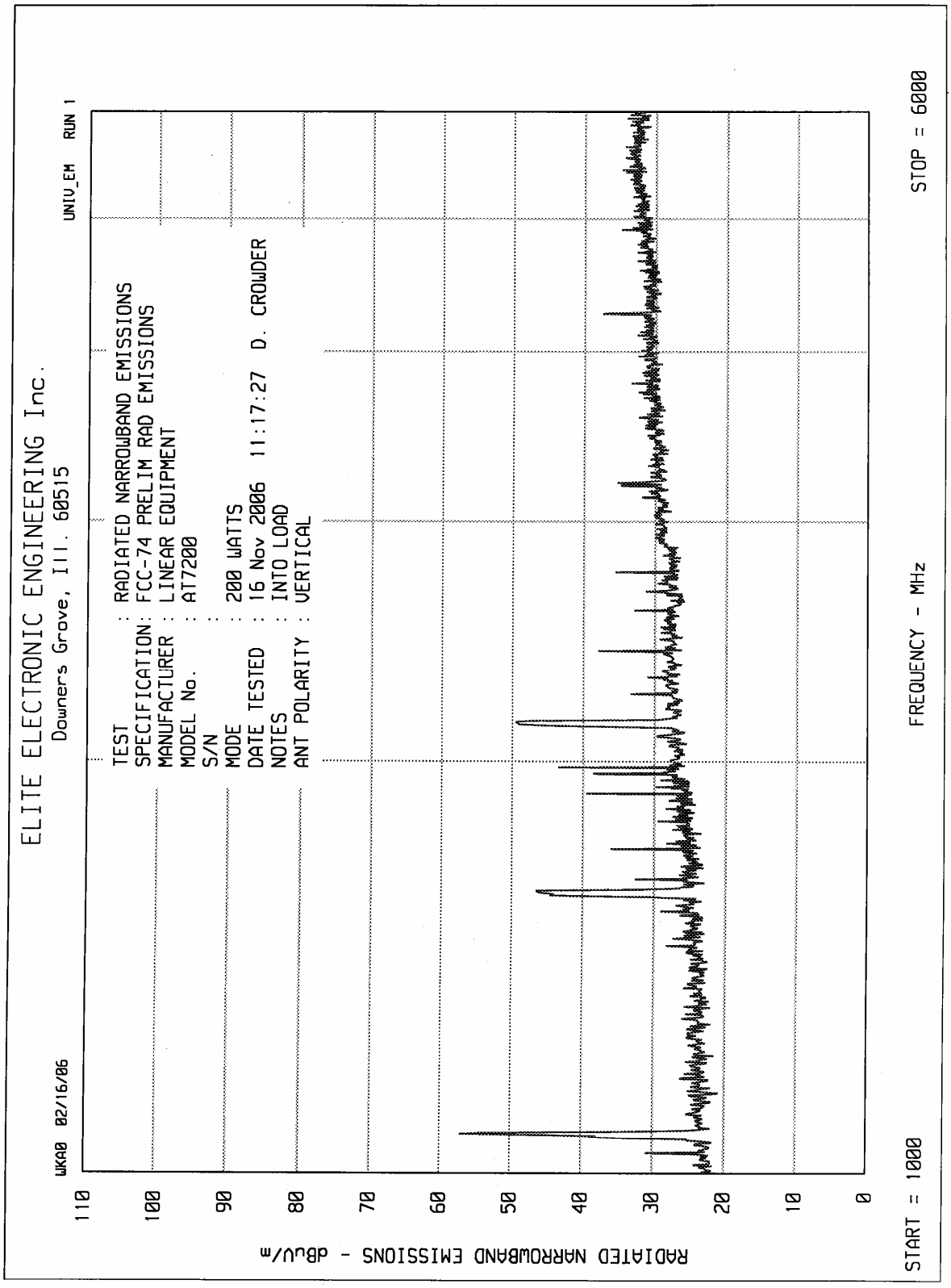
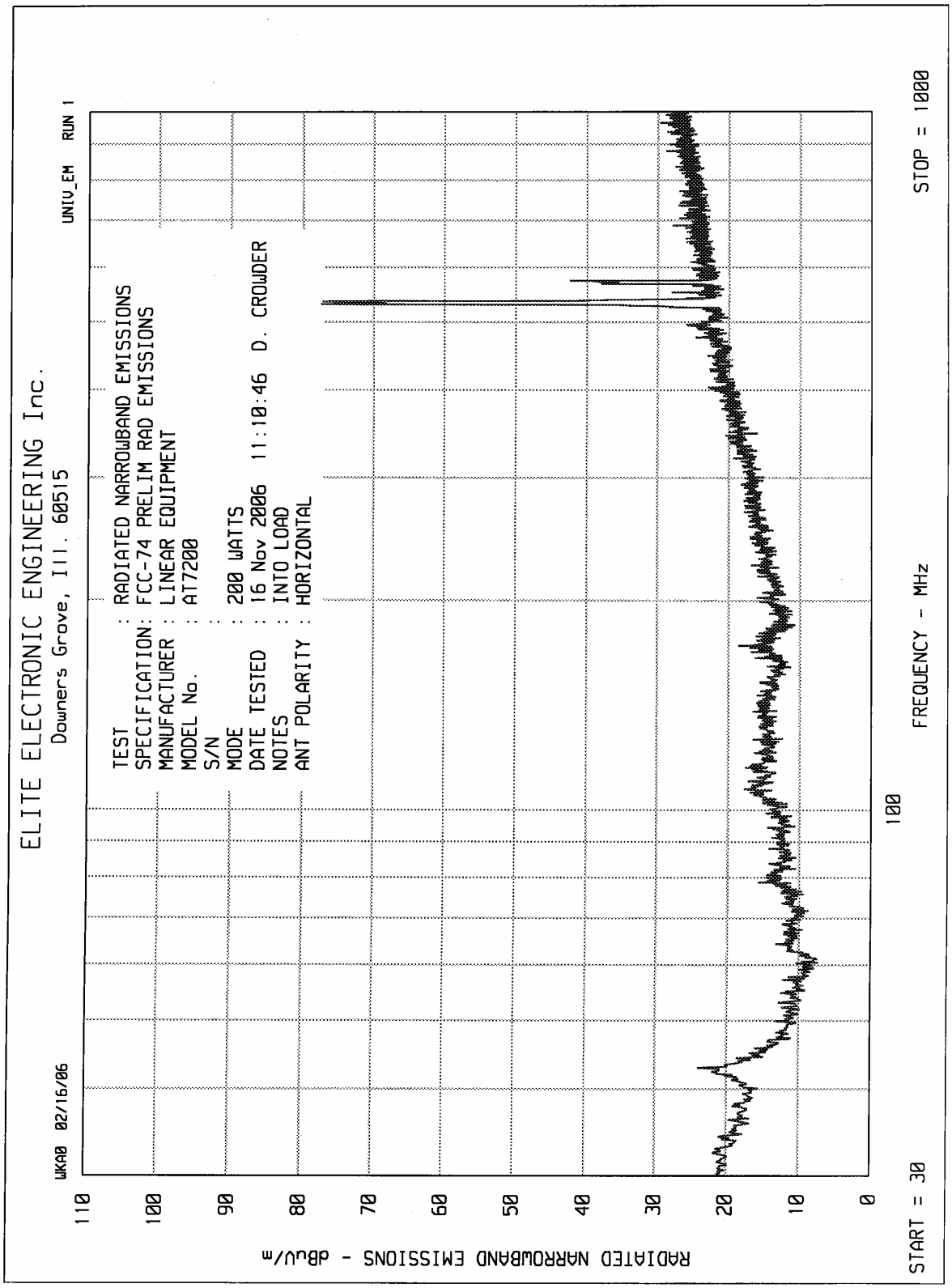
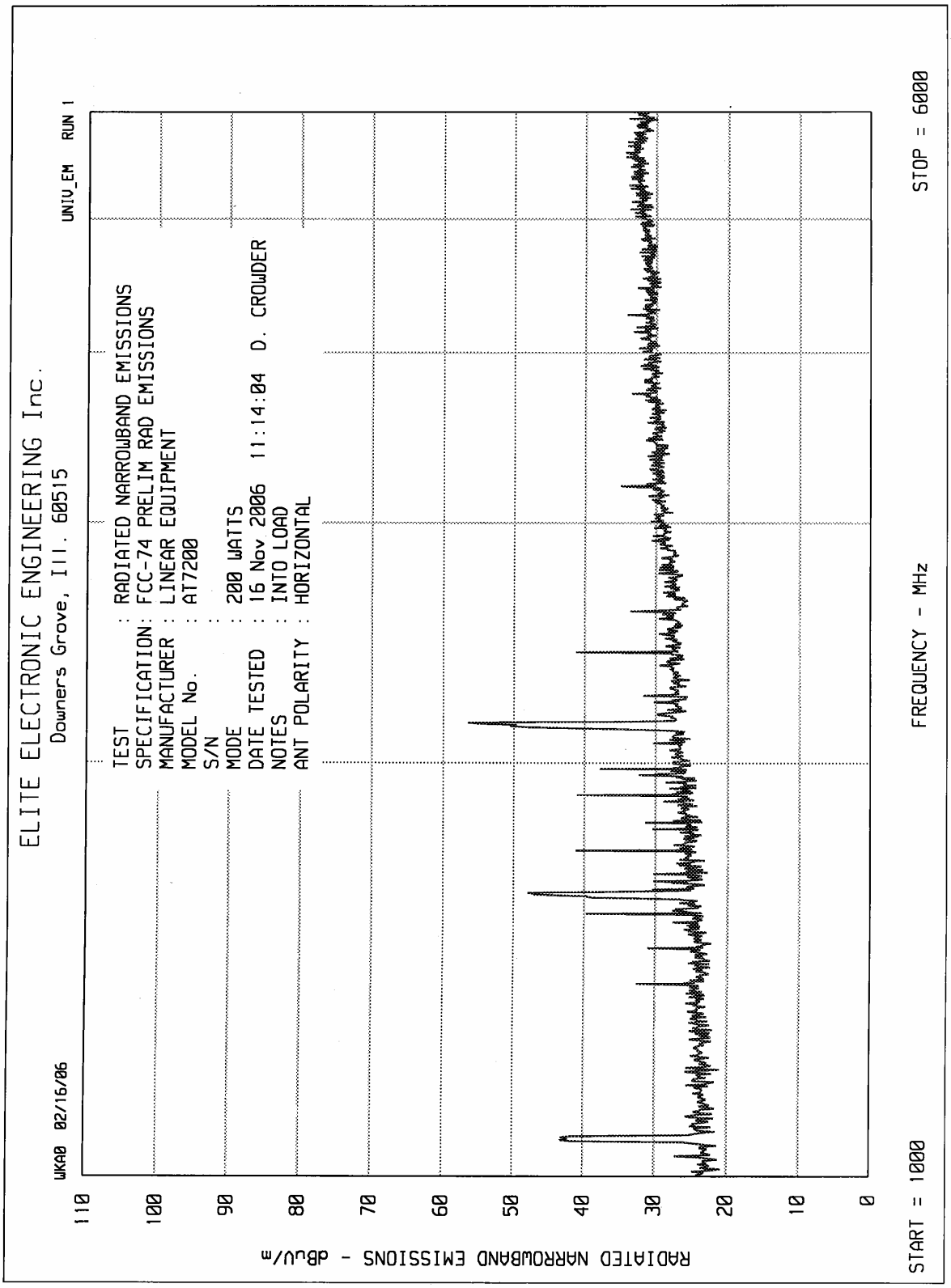


FIGURE 1 BLOCK DIAGRAM OF RADIATED EMISSIONS TEST SETUP


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV_EM RUN 1
WKA0 02/16/06
TEST : RADIATED NARROWBAND EMISSIONS
SPECIFICATION: FCC-74 PRELIM RAD EMISSIONS
MANUFACTURER : LINEAR EQUIPMENT
MODEL No. : A17200
S/N : :
MODE : 200 WATTS
DATE TESTED : 16 Nov 2006 11:11:55 D. CROWDER
NOTES : INTO LOAD
ANT POLARITY : VERTICAL
RADIATED NARROWBAND EMISSIONS - dBuV/m
110
100
90
80
70
60
50
40
30
20
10
0
START = 30
100
FREQUENCY - MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV_EM RUN 1
WKA0 02/16/06
TEST : RADIATED NARROWBAND EMISSIONS
SPECIFICATION: FCC-74 PRELIM RAD EMISSIONS
MANUFACTURER : LINEAR EQUIPMENT
MODEL No. : AT7200
S/N :
MODE : 200 WATTS
DATE TESTED : 16 Nov 2006 11:17:27 D. CROWDER
NOTES : INTO LOAD
ANT POLARITY : VERTICAL
RADIATED NARROWBAND EMISSIONS - dBuV/m
110
100
90
80
70
60
50
40
30
20
10
0
START = 1000
FREQUENCY - MHz
STOP = 6000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV_EM RUN 1
WKA0 02/16/06
TEST : RADIATED NARROWBAND EMISSIONS
SPECIFICATION: FCC-74 PRELIM RAD EMISSIONS
MANUFACTURER : LINEAR EQUIPMENT
MODEL No. : AT7200
S/N :
MODE : 200 WATTS
DATE TESTED : 16 Nov 2006 11:10:46 D. CROWDER
NOTES : INTO LOAD
ANT POLARITY : HORIZONTAL
RADIATED NARROWBAND EMISSIONS - dBuV/m
110
100
90
80
70
60
50
40
30
20
10
0
START = 30
100
FREQUENCY - MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV_EM RUN 1
WKA0 02/16/06
TEST : RADIATED NARROWBAND EMISSIONS
SPECIFICATION: FCC-74 PRELIM RAD EMISSIONS
MANUFACTURER : LINEAR EQUIPMENT
MODEL No. : AT7200
S/N :
MODE : 200 WATTS
DATE TESTED : 16 Nov 2006 11:14:04 D. CROWDER
NOTES : INTO LOAD
ANT POLARITY : HORIZONTAL
RADIATED NARROWBAND EMISSIONS - dBuV/m
110
100
90
80
70
60
50
40
30
20
10
0
START = 1000
FREQUENCY - MHz
STOP = 6000

MANUFACTURER : Linear Industries, Inc.
MODEL : Model AT7200 UHF Digital Transmitter
SPECIFICATION : FCC Part 74 Spurious Radiated Emissions
DATE : November 16, 2006
NOTES : Transmit at Channel 24, 531.25MHz, 200 Watts
: Test Distance is 3 meters

Frequency MHz	Antenna Polarity	Ambient	Matched Signal dBm	Antenna Gain dB	Cable Loss dB	ERP* dBm	Limit** dBm
1062.5	H		-42.0	3.5	1.8	-40.3	-7.0
1062.5	V		-39.4	3.5	1.8	-37.7	-7.0
1593.8	H		-50.0	5.4	2.2	-46.8	-7.0
1593.8	V		-51.0	5.4	2.2	-47.8	-7.0
2125.0	H		-41.0	5.6	2.6	-38.0	-7.0
2125.0	V		-41.0	5.6	2.6	-38.0	-7.0
2656.3	H		-68.0	6.4	3.0	-64.6	-7.0
2656.3	V		-69.0	6.4	3.0	-65.6	-7.0
3187.5	H	Ambient	-53.0	6.4	3.3	-49.9	-7.0
3187.5	V	Ambient	-56.0	6.4	3.3	-52.9	-7.0
3718.8	H	Ambient	-65.0	6.2	3.5	-62.4	-7.0
3718.8	V	Ambient	-65.0	6.2	3.5	-62.4	-7.0
4250.0	H	Ambient	-66.0	6.9	3.8	-62.9	-7.0
4250.0	V	Ambient	-56.0	6.9	3.8	-52.9	-7.0
4781.3	H	Ambient	-68.0	7.5	4.0	-64.5	-7.0
4781.3	V	Ambient	-68.0	7.5	4.0	-64.5	-7.0
5312.5	H	Ambient	-69.0	7.4	4.3	-65.9	-7.0
5312.5	V	Ambient	-69.0	7.4	4.3	-65.9	-7.0

* ERP = matched signal + antenna gain - cable loss
** Limit = power (dBm) – 60dB

Checked By: