



Measurement of RF Emissions from a AT71K3 Digital Television Transmitter

For : Linear Industries, Inc.
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Elgin, IL 60124

P.O. No. : 1020/2006
Date Tested : August 20, 2008
Test Personnel : Mark E. Longinotti
Specification : FCC Part 74, Subpart G

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TABLE OF CONTENTS		
PARAGRAPH	DESCRIPTION OF CONTENTS	PAGE NO.
1	INTRODUCTION	4
1.1	Scope of Tests	4
1.2	Purpose.....	4
1.3	Deviations, Additions and Exclusions	4
1.4	EMC Laboratory Identification.....	4
1.5	Laboratory Conditions	4
2	APPLICABLE DOCUMENTS.....	4
3	TEST ITEM SET-UP AND OPERATION	4
3.1	General Description	4
3.1.1	Power Input.....	4
3.1.2	Peripheral Equipment	4
3.1.3	Signal Input/Output Leads	5
3.1.4	Grounding.....	5
3.2	Operational Mode	5
3.3	Test Item Modifications	5
4	TEST FACILITY AND TEST INSTRUMENTATION	5
4.1	Shielded Enclosure.....	5
4.2	Test Instrumentation	5
4.3	Calibration Traceability	5
4.4	Measurement Uncertainty	5
5	TEST PROCEDURES	6
5.1	Field Strength of Spurious Emissions	6
5.1.1	Requirements	6
5.1.2	Procedures.....	6
5.1.3	Results	6
6	OTHER TEST CONDITIONS	7
6.1	Test Personnel and Witnesses	7
6.2	Disposition of the Test Item.....	7
7	CONCLUSIONS.....	7
8	CERTIFICATION	7
9	EQUIPMENT LIST	8



REVISION HISTORY

Revision	Date	Description
—	August 21, 2008	Initial release

Measurement of RF Emissions from a Digital Television Transmitter, Model No. AT71K3**1 INTRODUCTION****1.1 Scope of Tests**

This report presents the results of the RF emissions measurements performed on a Digital Television Transmitter, Part No. AT71K3, Serial No. 0001, (hereinafter referred to as the test item). The test item is designed to transmit at 575MHz using an external antenna. The test item has a rated output power of 1300W. The test item was manufactured and submitted for testing by Linear Industries, Inc. located in Elgin, IL.

1.2 Purpose

The test series was performed to determine if the test item meets the field strength of spurious emissions requirements of the Code of Federal Regulations Title 47, 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 EMC Laboratory Identification

This series of tests was performed by Elite Electronic Engineering Incorporated of Downers Grove, Illinois. The laboratory is accredited by the National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP). NVLAP Lab Code: 100278-0.

1.5 Laboratory Conditions

The temperature at the time of the test was 24°C and the relative humidity was 50%.

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 74, dated 1 October 2007
- TIA-603-C-2004, "Land Mobile FM or PM – Communications Equipment – Measurement and Performance Standards"

3 TEST ITEM SET-UP AND OPERATION**3.1 General Description**

The test item is a Linear Industries, Inc., Digital Television Transmitter, Model No. AT71K3. The test item is designed to transmit at 575MHz. A block diagram of the test item set-up is shown as Figure 1.

3.1.1 Power Input

The test item was powered by 240V, 60Hz single phase power.

3.1.2 Peripheral Equipment

The following peripheral equipment was submitted with the test item:

Item	Description
Filter	Com Tech, 6 Pole, 2.5kW Filter, S/N: 035853, was connected to the output of the test item
Dummy Load	UHF Digital Altronic Research Inc. (Model No. 6710DE3) 10kW dummy load was connected to the output of the 6 pole filter

3.1.3 Signal Input/Output Leads

The following interconnect cables were submitted with the test item:

Item	Description
Coaxial Cable	Used to connect the output of the 6 pole filter to the dummy load.

3.1.4 Grounding

The test item was grounded only through the third wire of its input power cord.

3.2 Operational Mode

For all tests, the test item was transmitting at 575MHz. The test was performed with the test item transmitting at 1300 Watts.

3.3 Test Item Modifications

No modifications were required to comply with the test series.

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.

4.2 Test Instrumentation

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

4.3 Calibration Traceability

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

4.4 Measurement Uncertainty

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

The measurement uncertainty budgets were based on guidelines in "ISO Guide to the Expression of Uncertainty in Measurements" and NAMAS NIS81 "The Treatment of Uncertainty in EMC Measurements".

The measurement uncertainty for these tests is presented below:

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

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

5 TEST PROCEDURES

5.1 Field Strength of Spurious Emissions

5.1.1 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:

- 1) 30 dB for transmitters rated at no more than 1 watt power output.
- 2) 50 dB for transmitters rated at more than 1 watt power output.
- 3) 60 dB for transmitters rated at more than 100 watts power output.

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 shielded enclosure prevents emissions from other sources, such as radio and TV stations from interfering with the measurements. All powerlines and signal lines entering the enclosure pass through filters on the enclosure wall. The powerline filters prevent extraneous signals from entering the enclosure on these leads. Preliminary radiated emissions 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 6GHz was investigated using a peak detector function. All preliminary tests were performed with the test item transmitting at 575MHz into a dummy load.

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 bilog or double ridged waveguide antenna over the frequency range of 30MHz to 6GHz. To ensure that maximum emission levels were measured, the following steps were taken:

- 1) The test item was rotated so that all of its sides were exposed to the receiving antenna.
- 2) Since the measuring antennas are 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.

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.

5.1.3 Results

The preliminary radiated emissions plots are presented on pages 11 through 14. 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 page 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. Photographs of the test configuration which yielded the highest or worst case, radiated emission levels are shown on Figure 2.

6 OTHER TEST CONDITIONS

6.1 Test Personnel and Witnesses

All tests were performed by qualified personnel from Elite Electronic Engineering Incorporated. The test series was witnessed by Linear Industries, Inc. personnel.

6.2 Disposition of the Test Item

The test item and all associated equipment were returned to Linear Industries, Inc. upon completion of the tests.

7 CONCLUSIONS

It was determined that the Linear Industries, Inc. Digital Television Transmitter, Part No. AT71K3, Serial No. 0001, 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.

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 test item at the test date as operated by Linear Industries, Inc. personnel. 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.



9 EQUIPMENT LIST

Table 9-1 Equipment List

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Due Date
CDS2	COMPUTER	GATEWAY	MFATXPNT NMZ 500L	0028483108	1.8GHZ	N/A	
CMA0	MULTI-DEVICE CONTROLLER	EMCO	2090	9701-1213	---	N/A	
GSD0	SIGNAL GENERATOR	ROHDE & SCHWARZ	SMB 100A	100395	9KHZ-6GHZ	12/28/2007	12/28/2008
NWF0	RIDGED WAVE GUIDE	EMCO	3105	2035	1-12.4GHZ	10/13/2007	10/13/2008
NWH0	RIDGED WAVE GUIDE	TENSOR	4105	2081	1-12.4GHZ	10/13/2007	10/13/2008
RBB0	EMI TEST RECEIVER 20HZ TO 40 GHZ.	ROHDE & SCHWARZ	ESIB40	100250	20 HZ TO 40GHZ	11/5/2007	11/5/2008

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.

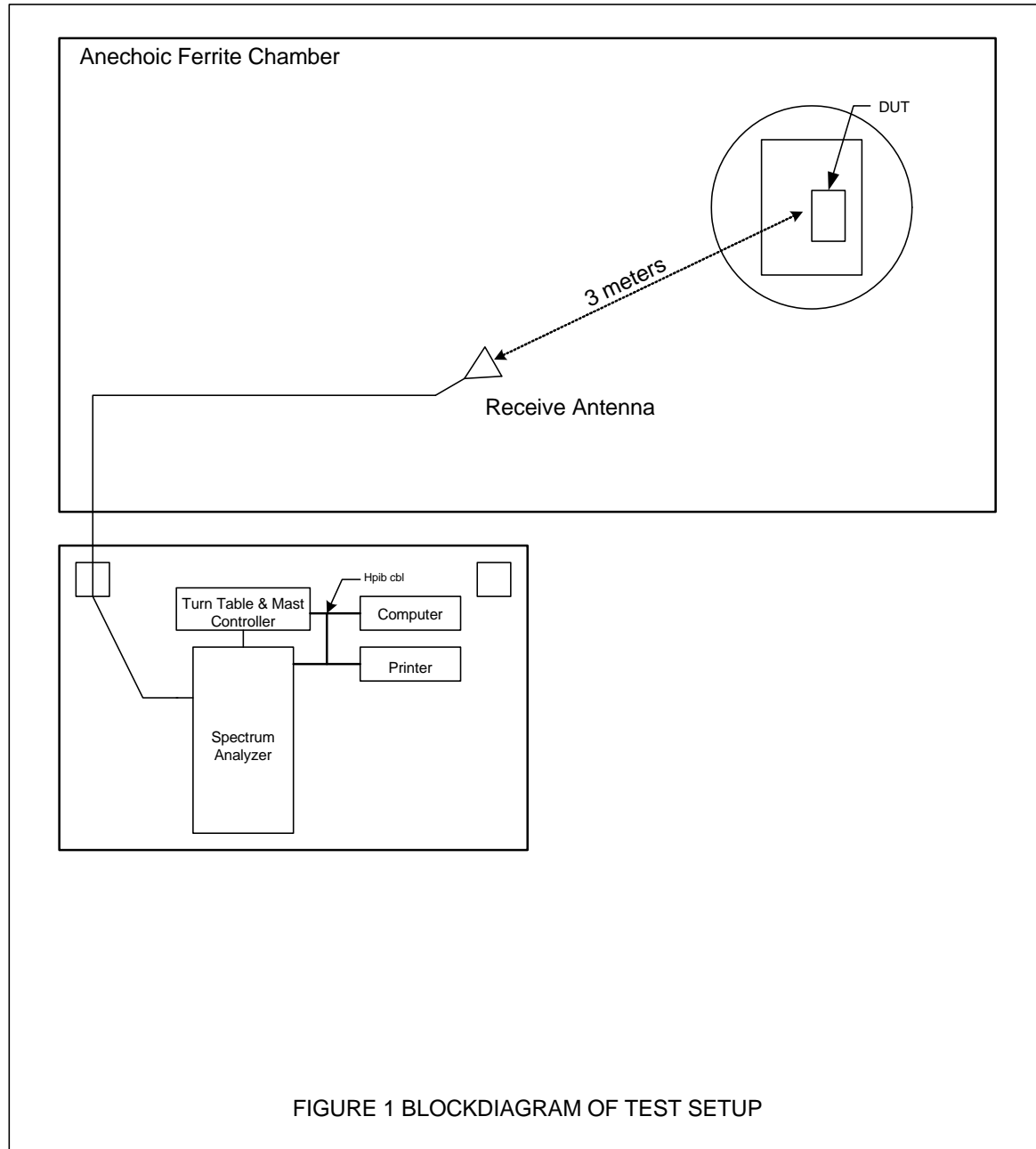
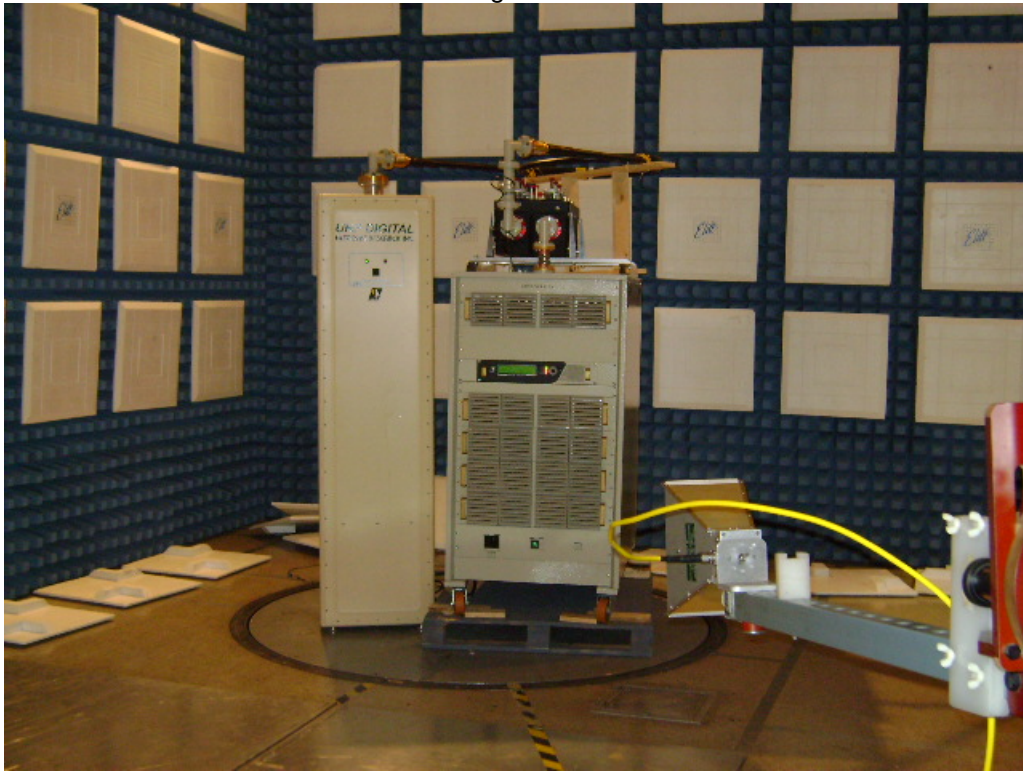
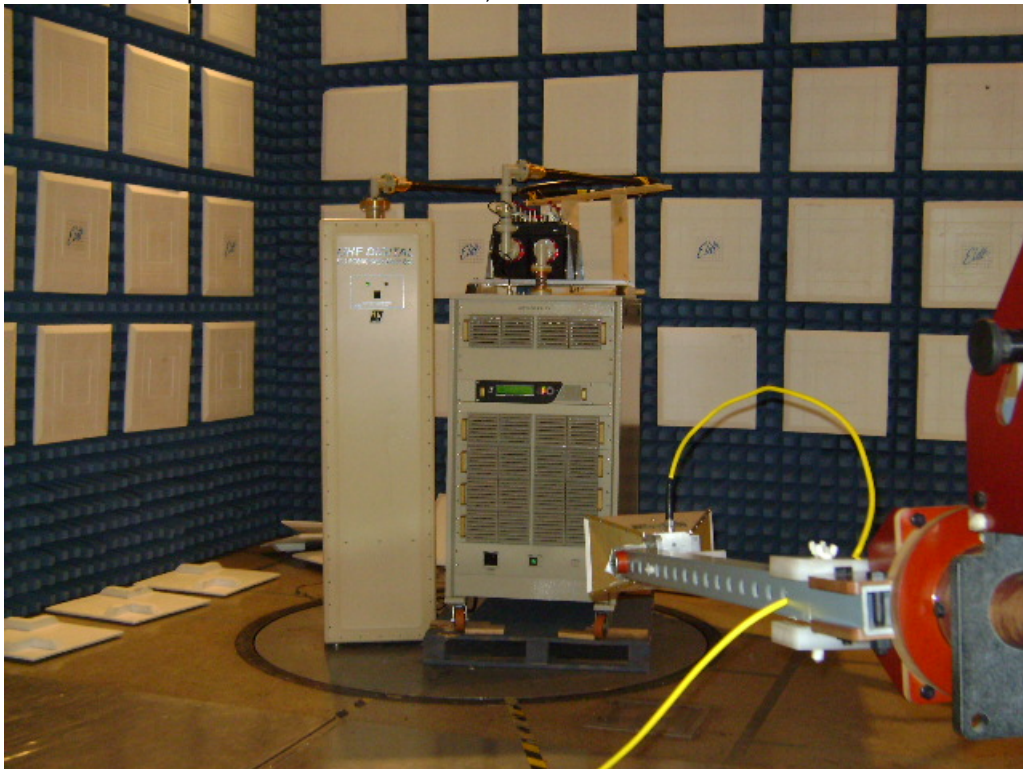


Figure 2



Test Set-up for Radiated Emissions, 1GHz to 6GHz – Horizontal Polarization

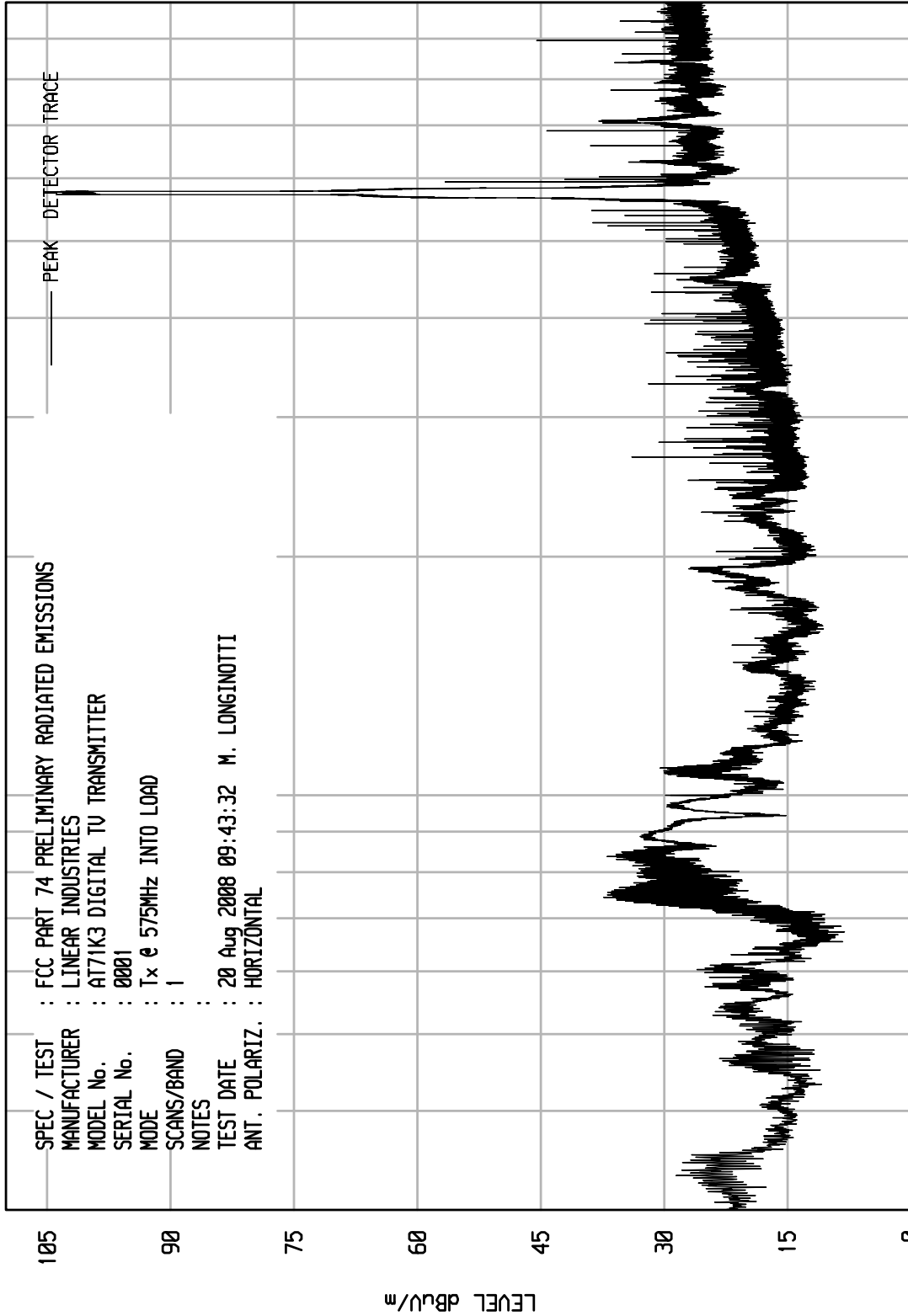


Test Set-up for Radiated Emissions, 1GHz to 6GHz – Vertical Polarization

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Downers Grove, Ill. 60515

UKA1 01/10/08

UNITV RCU EMI RUN 1



START = 30

100

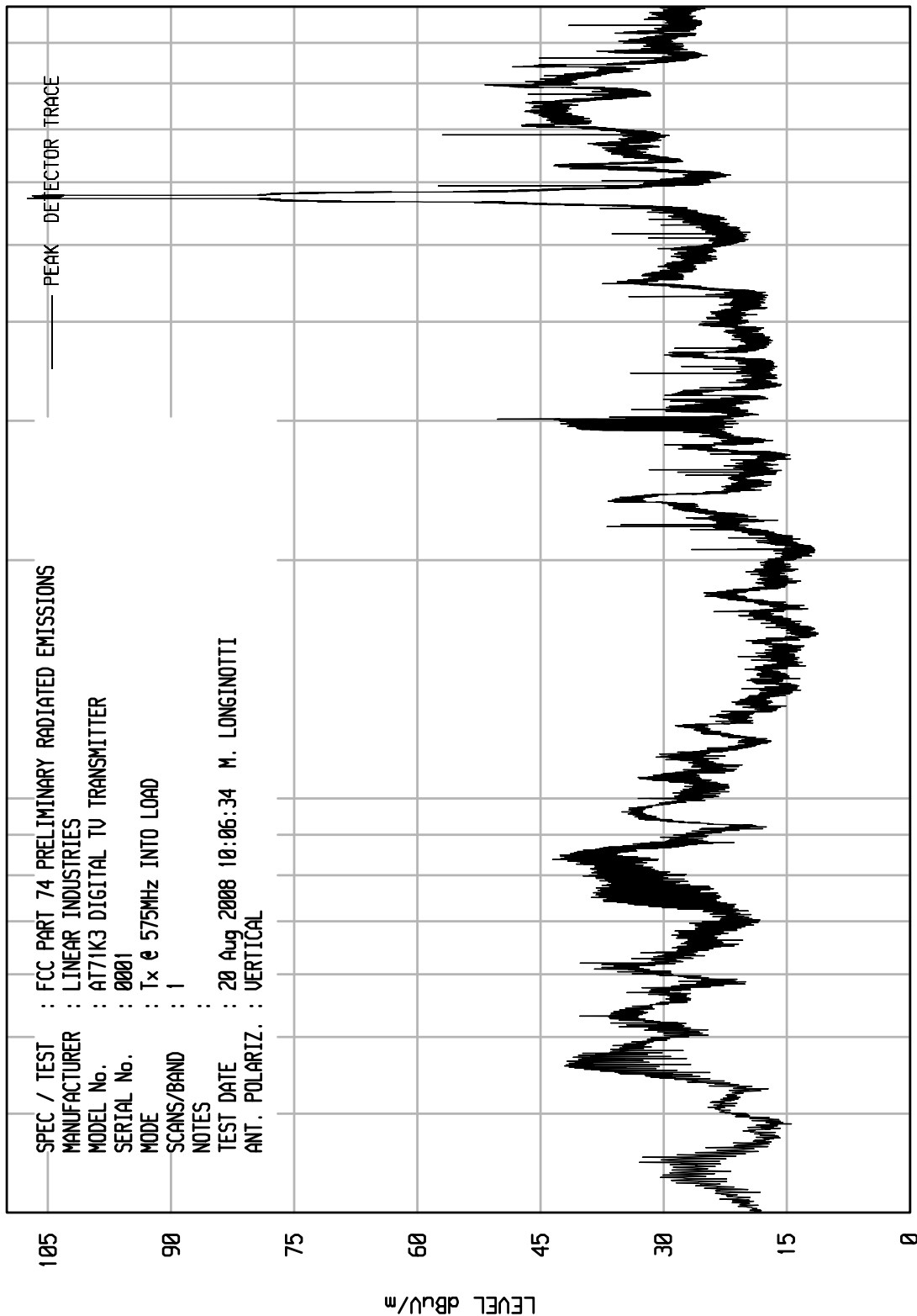
FREQUENCY MHz

STOP = 1000

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UKA1 01/10/08

UNITV RCU EMI RUN 2



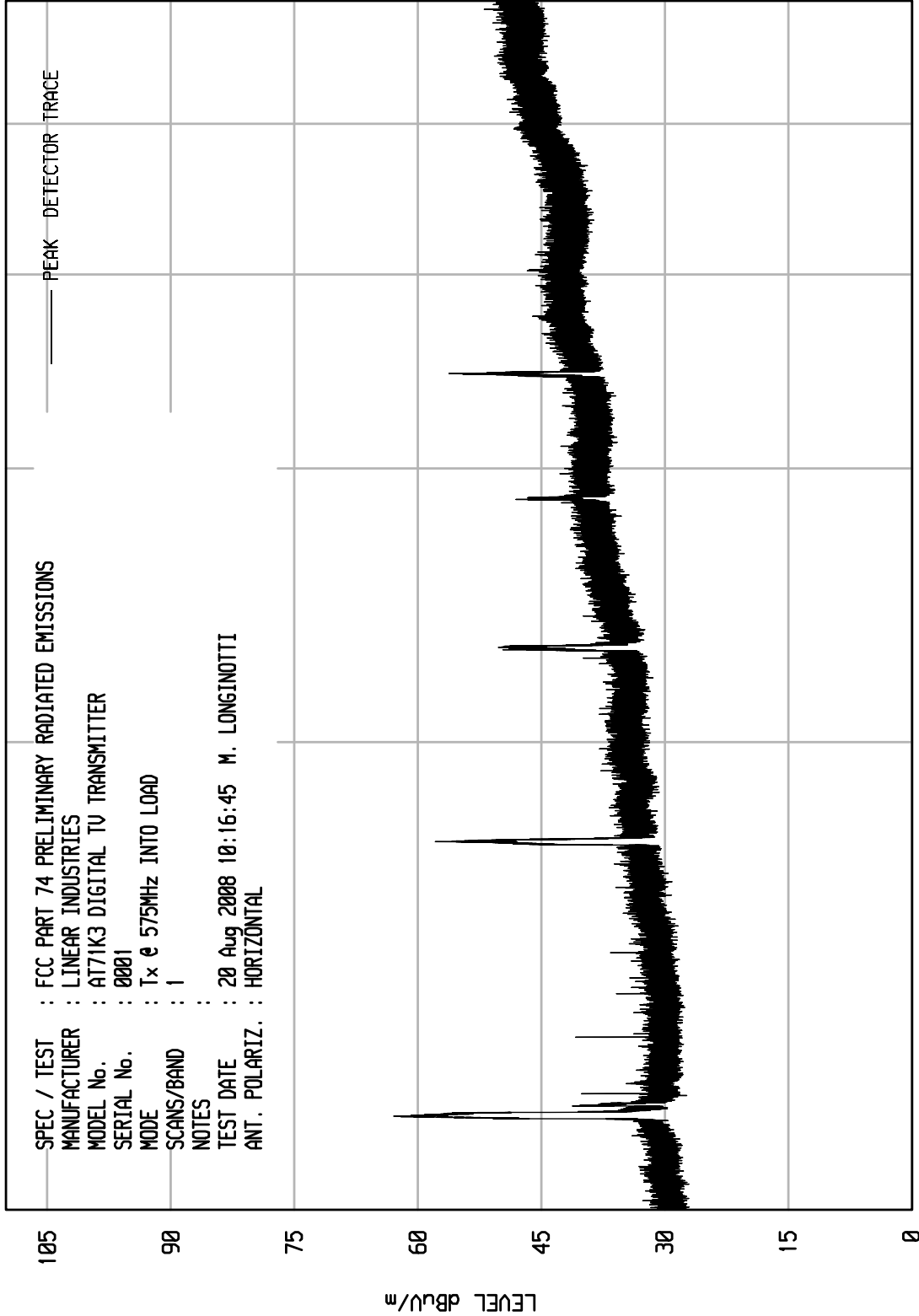
START = 30

STOP = 1000

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515

UNITU RCU EMI RUN 3

UKA1 01/10/08



STOP = 6000

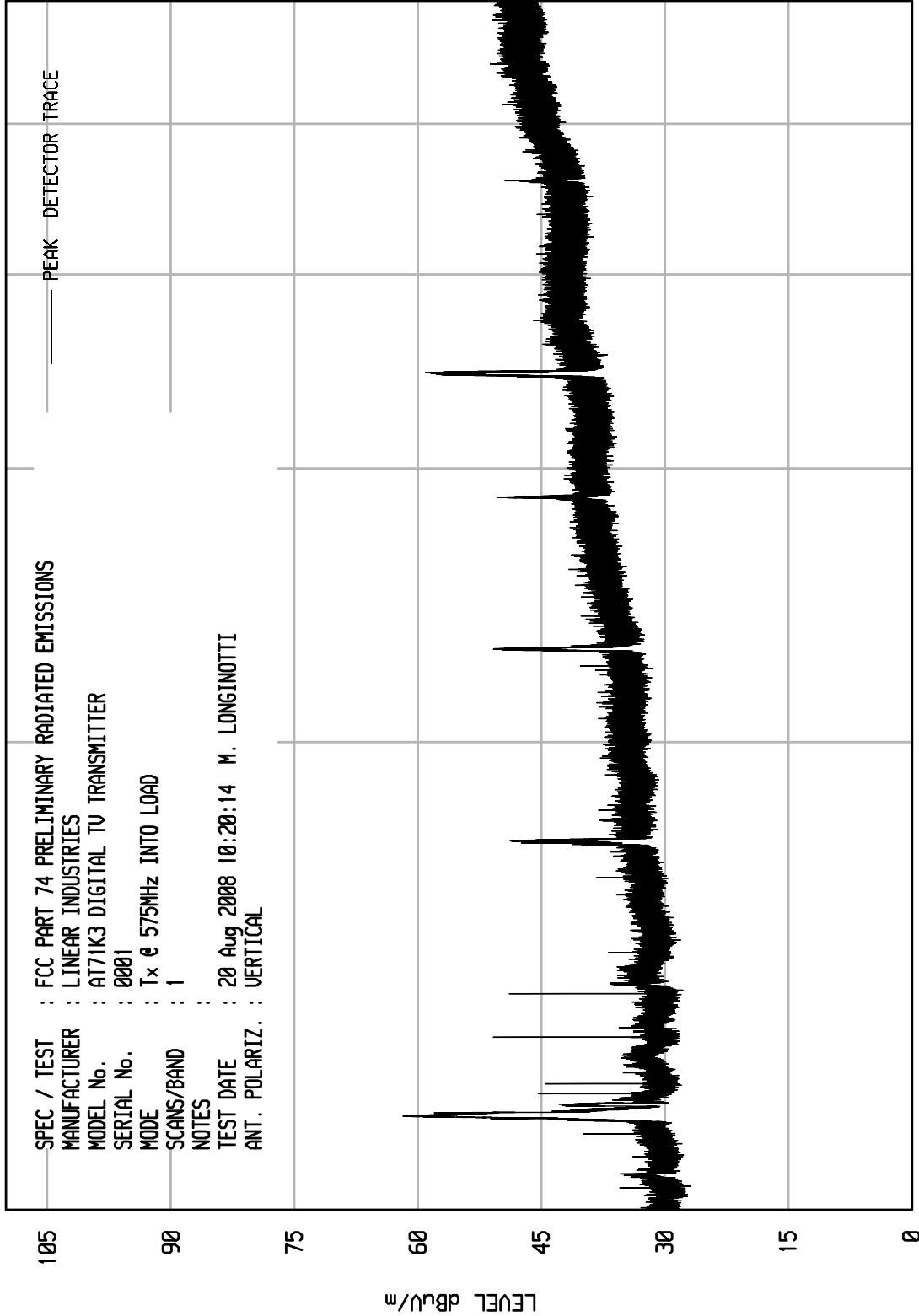
FREQUENCY MHz

START = 1000

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515

UNITU RCU EMI RUN 4

UKA1 01/10/08



STOP = 6000

FREQUENCY MHz

START = 1000



MANUFACTURER : Linear Industries, Inc.
MODEL : AT71K3 Digital Television Transmitter
SPECIFICATION : FCC Part 74 Spurious Radiated Emissions
DATE : August 20, 2008
NOTES : Transmit at Channel 575MHz, 1300 Watts
: Test Distance is 3 meters

Freq (MHz)	Ant Pol	Meter Reading (dBuV)	Ambient	Matched SIG. GEN. (dB)	Ant Gain (dB)	CBL (dB)	Total* (dBm)	Limit** (dBm)
1150.0	H	49.7		-24.4	3.1	2.2	-23.5	1.1
1150.0	V	55.6		-19.2	3.1	2.2	-18.3	1.1
1725.0	H	37.8		-33.5	5.1	2.7	-31.1	1.1
1725.0	V	40.4		-31.7	5.1	2.7	-29.3	1.1
2300.0	H	39.5		-31.7	5.3	3.0	-29.4	1.1
2300.0	V	41.1		-29.0	5.3	3.0	-26.7	1.1
2875.0	H	33.3		-35.4	5.3	3.2	-33.3	1.1
2875.0	V	34.8		-24.4	5.3	3.2	-22.3	1.1
3450.0	H	40.8		-26.1	6.4	3.6	-23.3	1.1
3450.0	V	42.4		-22.6	6.4	3.6	-19.8	1.1
4025.0	H	26.1		-40.2	7.1	4.1	-37.1	1.1
4025.0	V	24.9		-39.7	7.1	4.1	-36.6	1.1
4600.0	H	24.1		-41.6	8.2	4.4	-37.8	1.1
4600.0	V	23.2		-43.0	8.2	4.4	-39.2	1.1
5175.0	H	21.6	Ambient	-40.4	7.7	4.8	-37.5	1.1
5175.0	V	21.0	Ambient	-42.2	7.7	4.8	-39.3	1.1
5750.0	H	21.7	Ambient	-40.8	7.5	5.2	-38.5	1.1
5750.0	V	20.6	Ambient	-41.7	7.5	5.2	-39.4	1.1

* ERP = matched signal + antenna gain - cable loss

** Limit = Power (dBm) – 60dB = 61.1dBm (1300 W) – 60dB = 1.1dBm

Checked By: MARK E. LONGINOTTI