



Measurement of RF Interference from a  
1/18 Scale 1963 Impala Lowrider RC Car  
Transmitter  
FCC ID: Q8R-7320249

---

For : Craft House Corporation  
Toledo, OH

Date Received: June 2, 2004

Date Tested : June3, 2004

Test Personnel: Mark E. Longinotti, NARTE® Certified EMC Test  
Engineer, ATL-0154-E

Specification : FCC "Code of Federal Regulations" Title 47  
Part 15, Subpart C

Test Report By : *Mark E Longinotti*  
Mark E. Longinotti  
NARTE® Certified EMC  
Test Engineer, ATL-0154-E

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



TABLE OF CONTENTS

<u>PARAGRAPH</u>	<u>DESCRIPTION OF CONTENTS</u>	<u>PAGE NO.</u>
1.0 INTRODUCTION .....		3
1.1 Description of Test Item.....		3
1.2 Purpose.....		3
1.3 Deviations, Additions and Exclusions .....		3
1.4 Applicable Documents .....		3
1.5 Subcontractor Identification .....		3
1.6 Laboratory Conditions.....		3
2.0 TEST ITEM SETUP AND OPERATION .....		3
2.1 Power Input .....		3
2.2 Grounding.....		3
2.3 Peripheral Equipment.....		4
2.4 Interconnect Cables.....		4
2.5 Operational Mode .....		4
3.0 TEST EQUIPMENT .....		4
3.1 Test Equipment List.....		4
3.2 Calibration Traceability .....		4
3.3 Measurement Uncertainty.....		4
4.0 REQUIREMENTS, PROCEDURES AND RESULTS.....		4
4.1 Powerline Conducted Emissions .....		4
4.1.1 Requirements.....		4
4.2 Duty Cycle Factor Measurements .....		5
4.2.1 Procedures .....		5
4.2.2 Results .....		5
4.3 Radiated Measurements.....		5
4.3.1 Requirements.....		5
4.3.2 Procedures .....		5
4.3.2.1 Preliminary Radiated Measurements .....		5
4.3.2.2 Final Radiated Measurements.....		6
4.3.3 Results .....		6
4.4 Band Edge Measurements .....		7
4.4.1 Requirement .....		7
4.4.2 Procedures .....		7
4.4.3 Results .....		7
5.0 CONCLUSIONS.....		7
6.0 CERTIFICATION .....		7
7.0 ENDORSEMENT DISCLAIMER .....		7
TABLE I - EQUIPMENT LIST.....		9

## Measurement of RF Emissions from a 1/18 Scale 1963 Impala Lowrider RC Car Transmitter

### **1.0 INTRODUCTION:**

**1.1 Description of Test Item** - This document represents the results of the series of radio interference measurements performed on a model 1/18 Scale 1963 Impala Lowrider RC Car Transmitter, (hereinafter referred to as the test item). The test item was designed to transmit at approximately 49.8MHz using an external antenna. The test item was manufactured and submitted for testing by Craft House Corporation located in Toledo, OH.

**1.2 Purpose** - The test series was performed to determine if the test item meets the radiated RF emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Sections 15.235 for Intentional Radiators. Testing was performed in accordance with ANSI C63.4-2001.

**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 15, Subpart C, dated 1 October 2003
- ANSI C63.4-2001, "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 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.

**1.6 Laboratory Conditions** The temperature at the time of the test was 21°C and the relative humidity was 44%.

### **2.0 TEST ITEM SETUP AND OPERATION:**

The test item is a 1/18 Scale 1963 Impala Lowrider RC Car Transmitter. A block diagram of the test item setup is shown as Figure 1.

**2.1 Power Input** - The test item obtained 9VDC from a battery.

**2.2 Grounding** - The test item was ungrounded during the tests.

**2.3 Peripheral Equipment** - No peripheral equipment was submitted with the test item.

**2.4 Interconnect Cables** - No interconnect cables were submitted with the test item.

**2.5 Operational Mode** - For all tests the test item was placed on an 80cm high non-conductive stand. Preliminary measurements were performed and it was determined that the highest emissions were generated with the test item antenna vertical and fully extended and the operational switch set to the Cruise position. All measurements were performed with the test item in this configuration.

### **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.

The fundamental, harmonics and spurious emissions were measured with a spectrum analyzer. All measurements were taken with the resolution and video bandwidth of the measuring instrument adjusted to 10kHz below 30MHz, 120kHz between 30MHz and 1GHz and 1MHz above 1GHz.

**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.

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

### **4.0 REQUIREMENTS, PROCEDURES AND RESULTS:**

#### **4.1 Powerline Conducted Emissions**

**4.1.1 Requirements** –Since the test item was powered by internal batteries, no conducted

emissions tests were performed.

## 4.2 Duty Cycle Factor Measurements

**4.2.1 Procedures** - The duty cycle factor is used to convert peak detector 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, 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).

**4.2.2 Results** - The plot of the duty cycle is shown on data page 12. The duty cycle factor was computed to be -5.6 dB.

## 4.3 Radiated MeasurementsError! Bookmark not defined.

### 4.3.1 RequirementsError! Bookmark not defined.Error! Bookmark not defined. -

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

Per paragraph 15.235, radiated emissions within the band of 49.82MHz to 49.90MHz shall not exceed 10,000uV/m (80dBuV/m) at 3 meters. The field strength of any emissions which appear outside of this band shall not exceed the general radiated emission limits in paragraph 15.209:

Frequency MHz	Distance between Test Item 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.

### 4.3.2 ProceduresError! Bookmark not defined. -

#### 4.3.2.1 Preliminary Radiated Measurements Error! Bookmark not defined.-

All preliminary tests were performed in a 32ft. x 20ft. x 14ft. high shielded enclosure. 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.

The broadband measuring antenna was positioned at a 3 meter distance from the test item. The entire frequency range from 30MHz to 1GHz was investigated using a peak detector function. The data was then processed by the computer to equivalent field intensity at the required test distance.

#### 4.3.2.2 Final Radiated MeasurementsError! Bookmark not defined.Error!

**Bookmark not defined.** - Final open field measurements were manually performed in a 32ft. x 20ft. x 14ft. high shielded enclosure.

The broadband measuring antenna was positioned at a 3 meter distance from the test item. The entire frequency range from 30MHz to 1GHz was investigated. To ensure that maximum emission levels were measured, the following steps were taken:

- 1) From 49.82MHz to 49.90MHz, measurements were made using a peak detector and a bi-log antenna. The peak readings were converted to average readings using the duty cycle correction factor.
- 2) From 50MHz to 1GHz, measurements were made using a quasi-peak detector and a broadband bi-log antenna.
- 3) To ensure that maximum, or worst case, 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.
  - (d) For hand-held or body-worn devices, the test item was rotated through three orthogonal axes to determine which orientation produces the highest emission relative to the limit.

**4.3.3 ResultsError! Bookmark not defined.** - The preliminary plot, with the test item transmitting at 49.8MHz, is presented on page and 13. The plots are presented for a reference only, and are not used to determine compliance.

The final radiated levels, with the test item transmitting at 49.8MHz, are presented on page 14.

As can be seen from the data, all emissions measured from the test item were within the specification limits. The emissions level closest to the limit (worst case) occurred at 99.7MHz. The emissions level at this frequency was 11.3dB within the limit. See page 14 for details. Photographs of the test configuration which yielded the highest, or worst case, radiated emission levels are shown on Figure 2.

#### **4.4 Band Edge Measurements**

**4.4.1 Requirement** - In accordance with paragraph 15.235, all emissions appearing between the band edges and up to 10kHz above and below the band edges shall be attenuated at least 26dB below the level of the unmodulated carrier or to the general limits in 15.209, whichever permits the higher emission levels. Based on the radiated emissions results shown on page 14, the general limits in 15.209 will permit the higher emission levels. Therefore, all emissions appearing between the band edges and up to 10kHz above and below the band edges shall be below the general limits in 15.209 .

**4.4.2 Procedures** - The test item was placed on an 80cm high non-conductive stand. The unit was set to transmit continuously. With an antenna positioned 3 meters from the test item, the fundamental frequency was displayed on the spectrum analyzer. The resolution bandwidth was set to 1kHz and span was set to 500kHz. The frequency spectrum near the fundamental was plotted with the marker set to the lower and upper band edge frequencies.

**4.4.3 Results** - The plots of the emissions near the fundamental frequency are presented on pages 15 and 16. As can be seen from this data page, all emissions between the band edges and up to 10kHz above and below the band edges met the general radiated emission limits in paragraph 15.209.

### **5.0 CONCLUSIONS:**

It was determined that the Craft House Corporation 1/18 Scale 1963 Impala Lowrider RC Car Transmitter, did fully meet the conducted and radiated emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Section 15.205 et seq. for Intentional Radiators, when tested per ANSI C63.4-2001.

### **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: ANTENNAS									
NTA0	BILOG ANTENNA	CHASE EMC LTD.	BILOG CBL611	2057	0.03-2GHZ	07/03/03	12	07/03/04	
Equipment Type: CONTROLLERS									
CDD2	COMPUTER	HEWLETT PACKARD	D4171A#ABA	US61654645	---		N/A		
CMA0	MULTI-DEVICE CONTROLLER	EMCO	2090	9701-1213	---		N/A		
Equipment Type: METERS									
MSI1	DIGITAL OSCILLOSCOPE (DCC-	LECROY CORP.	9310AM	4546	DC-400MHZ	06/30/03	12	06/30/04	
Equipment Type: PROBES; CLAMP-ON & LISNS									
PHA0	MAGNETIC FIELD PROBE	ELECTRO-METRICS	EM-6882	134	22-230MHZ	05/09/00	NOTE 1		
Equipment Type: PRINTERS AND PLOTTERS									
HRE1	LASER JET 5P	HEWLETT PACKARD	C3150A	USHB061052	---		N/A		
Equipment Type: RECEIVERS									
RAKG	RF SECTION	HEWLETT PACKARD	85462A	3549A00284	0.009-6500MHZ	03/22/04	12	03/22/05	
RAKH	RF FILTER SECTION	HEWLETT PACKARD	85460A	3448A00324	---	03/22/04	12	03/22/05	

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.



ELITE ELECTRONIC ENGINEERING INC.  
ETR 33641-01  
Radiated Emissions Test Setup Anechoic Ferrite Chamber

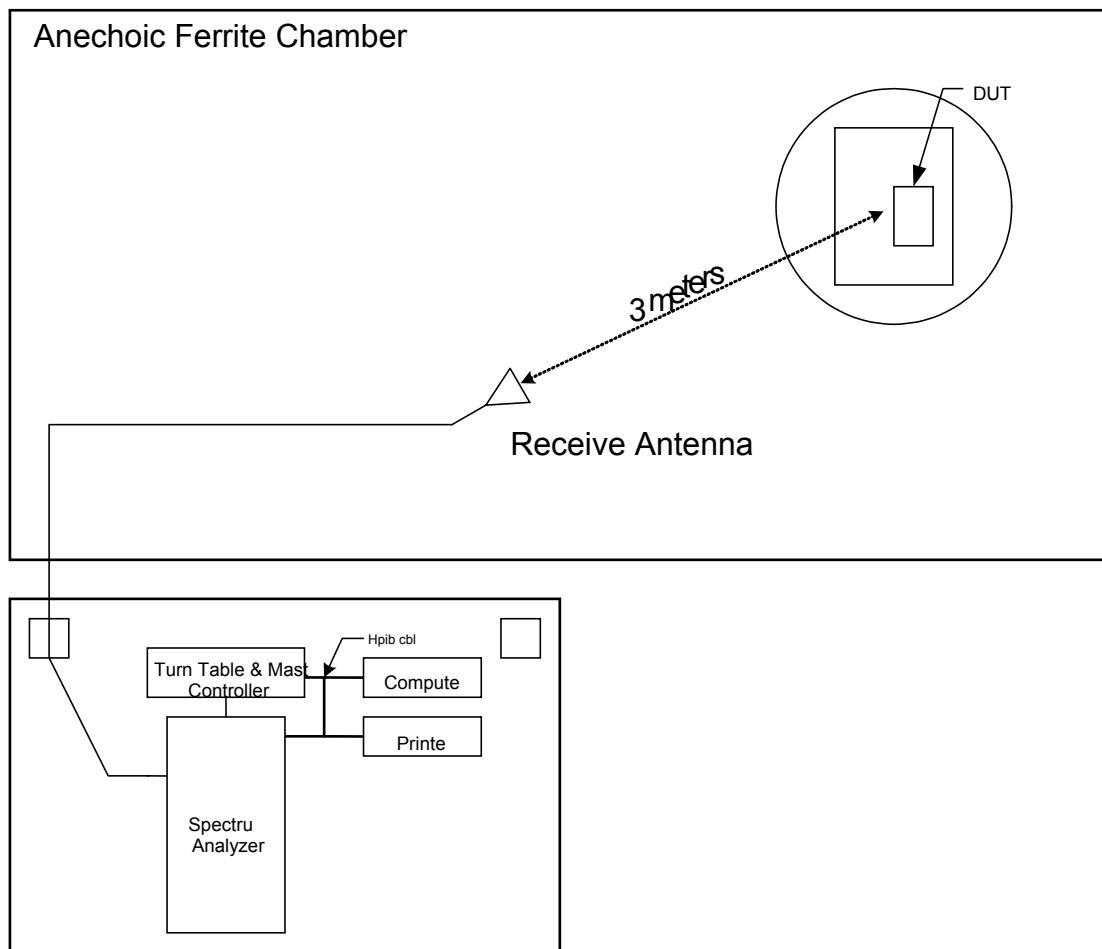
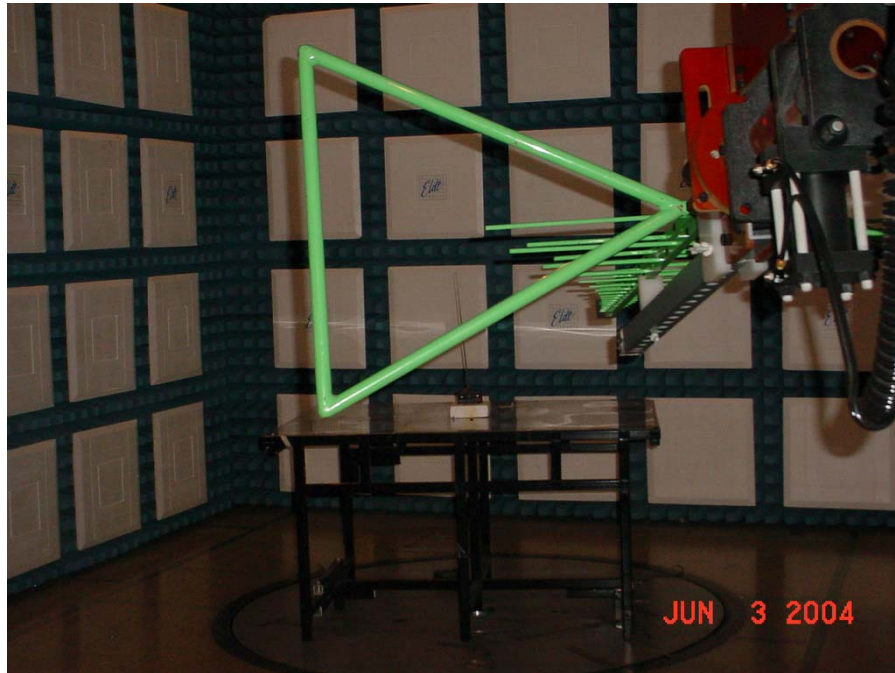
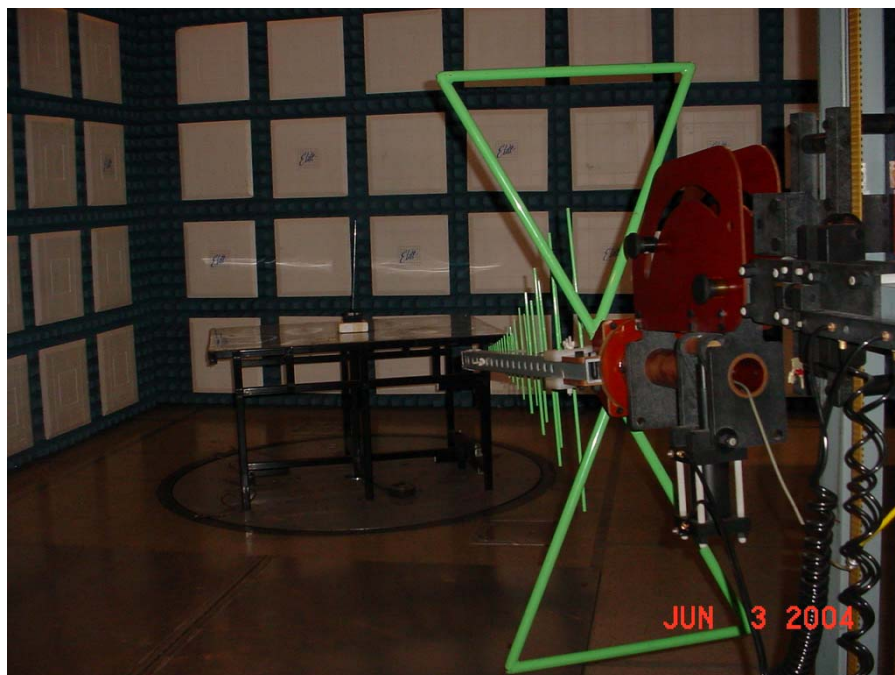


FIGURE 1 BLOCK DIAGRAM OF TEST SETUP

FIGURE 2



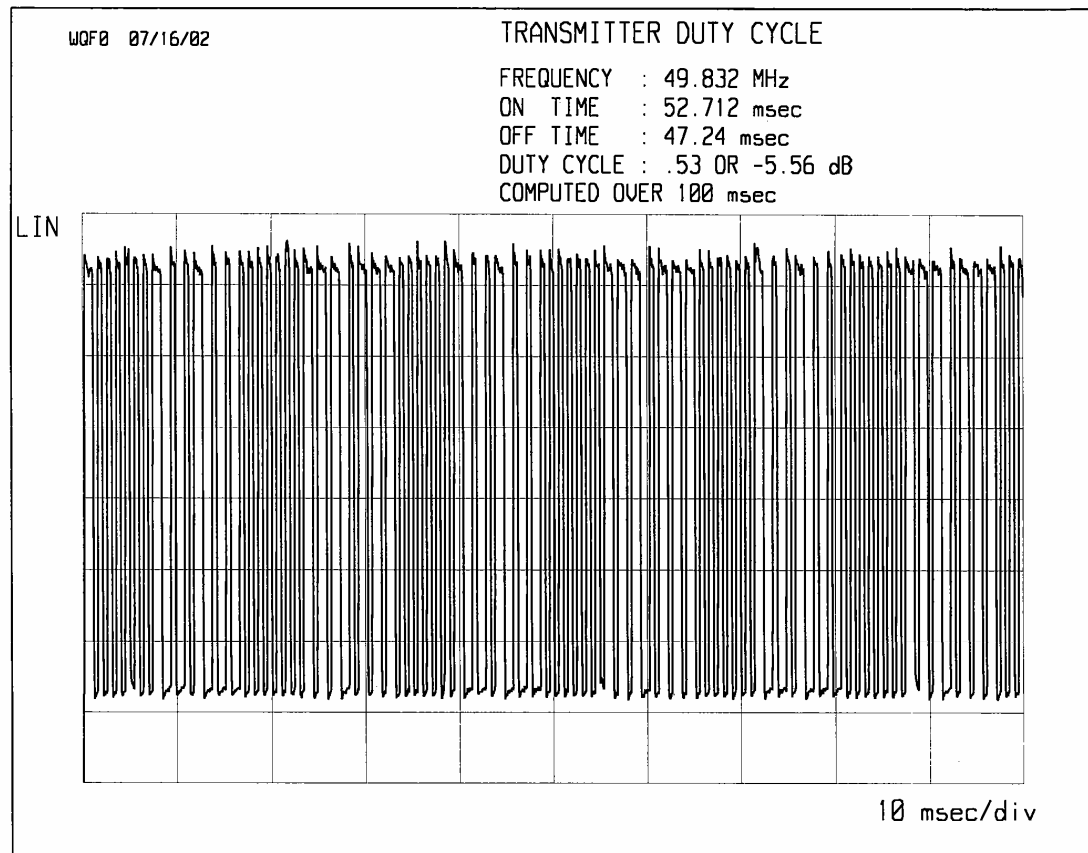
TEST SETUP FOR RADIATED EMISSIONS MEASUREMENTS  
MAXIMIZED FOR MEASUREMENT OF WORST CASE EMISSIONS



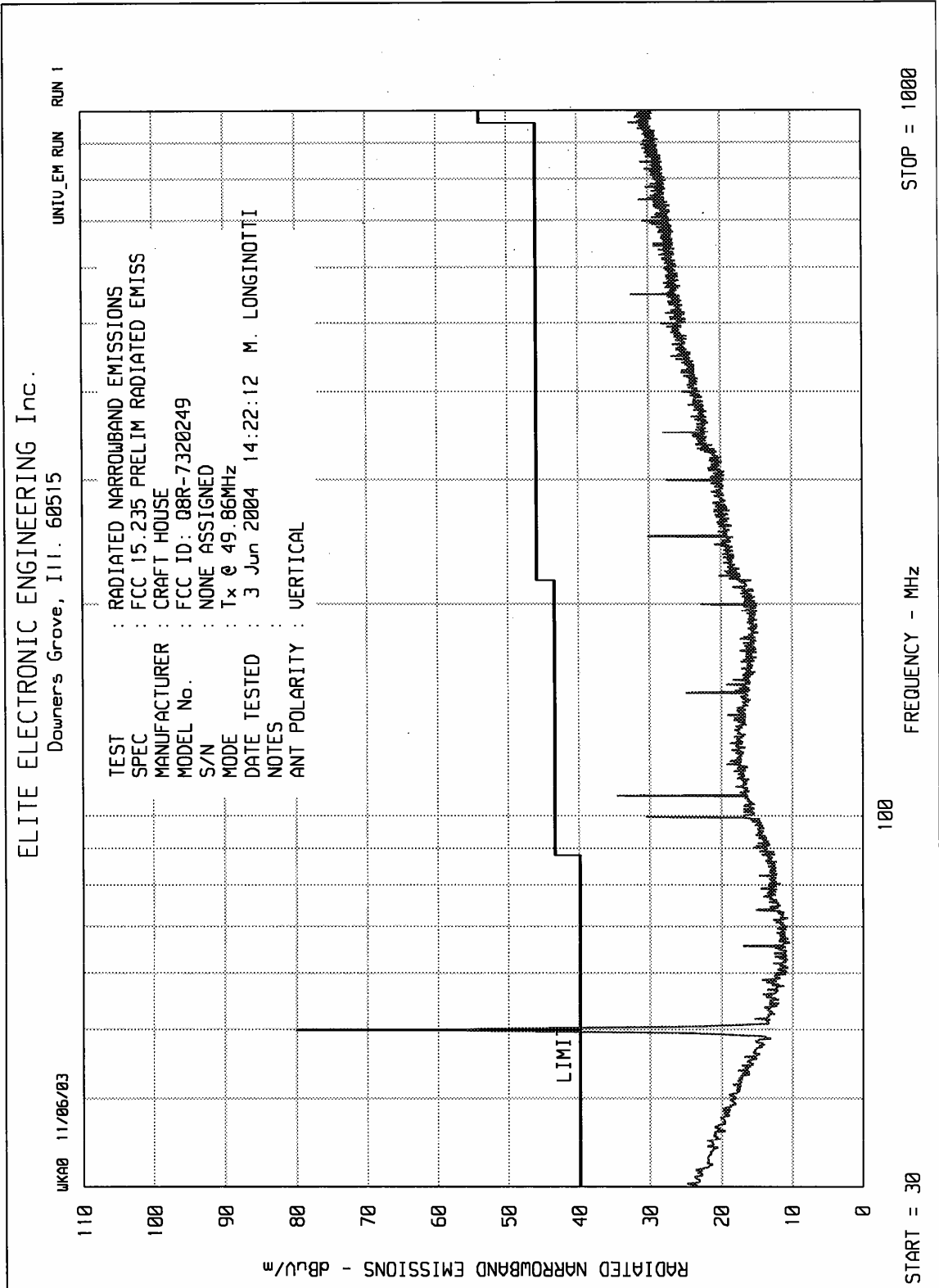
TEST SETUP FOR RADIATED EMISSIONS MEASUREMENTS  
MAXIMIZED FOR MEASUREMENT OF WORST CASE EMISSIONS



ELITE ELECTRONIC ENGINEERING Inc.  
Downers Grove, IL 60515



MANUFACTURER : CRAFT HOUSE  
MODEL : FCC ID: Q8R-7320249  
S/N : NONE ASSIGNED  
NOTES : Tx @ 49.86MHz  
DATE : 3 Jun 2004 10:57:50 M. LONGINOTTI





MANUFACTURER : Craft House  
MODEL : 1/18 Scale 1963 Impala Lowrider RC Car 49.85MHz Transmitter  
SERIAL NO. : None Assigned  
TEST SPECIFICATION : FCC 15.235  
DATE : June 3, 2004  
TEST MODE : Transmit @ 49.85MHz  
TEST DISTANCE : 3 meters

Frequency MHz	Antenna Polarity	Meter Reading dBuV/m	Ambient	Duty Cycle Factor dB	Antenna Factor dB	Cable Factor dB	Total dBuV/m	Total uV/m	Limit uV/m
49.86	H	34.0		-5.6	9.4	0.5	38.3	82.2	10000
	V	45.8		-5.6	9.4	0.5	50.1	319.9	10000
99.72	H	14.4			11.0	0.5	25.9	19.7	150
	V	20.7			11.0	0.5	32.2	40.7	150
149.6	H	13.4			11.7	0.8	25.9	19.7	150
	V	9.3			11.7	0.8	21.8	12.3	150
199.4	H	3.2			10.5	1.0	14.7	5.4	150
	V	11.0			10.5	1.0	22.5	13.3	150
249.3	H	3.0			13.4	1.2	17.6	7.6	200
	V	18.7			13.4	1.2	33.3	46.2	200
299.2	H	5.6			14.3	1.3	21.2	11.5	200
	V	10.9			14.3	1.3	26.5	21.1	200
349	H	-0.8	AMBIENT		15.6	1.4	16.2	6.5	200
	V	6.5			15.6	1.4	23.5	15.0	200
398.9	H	-1.9	AMBIENT		16.7	1.5	16.3	6.5	200
	V	5.4			16.7	1.5	23.6	15.1	200
448.7	H	-0.6	AMBIENT		17.7	1.6	18.7	8.6	200
	V	5.4			17.7	1.6	24.7	17.2	200
498.6	H	5.9			18.8	1.6	26.3	20.7	200
	V	5.5			18.8	1.6	25.9	19.7	200

QP readings taken above 50MHz

Peak readings taken below 50MHz with a duty cycle correction factor

Checked By: *Mark E Longinoth*

ELITE ELECTRONIC ENGINEERING Inc.

MKR 49.910 5 MHz  
3.30 dBuV

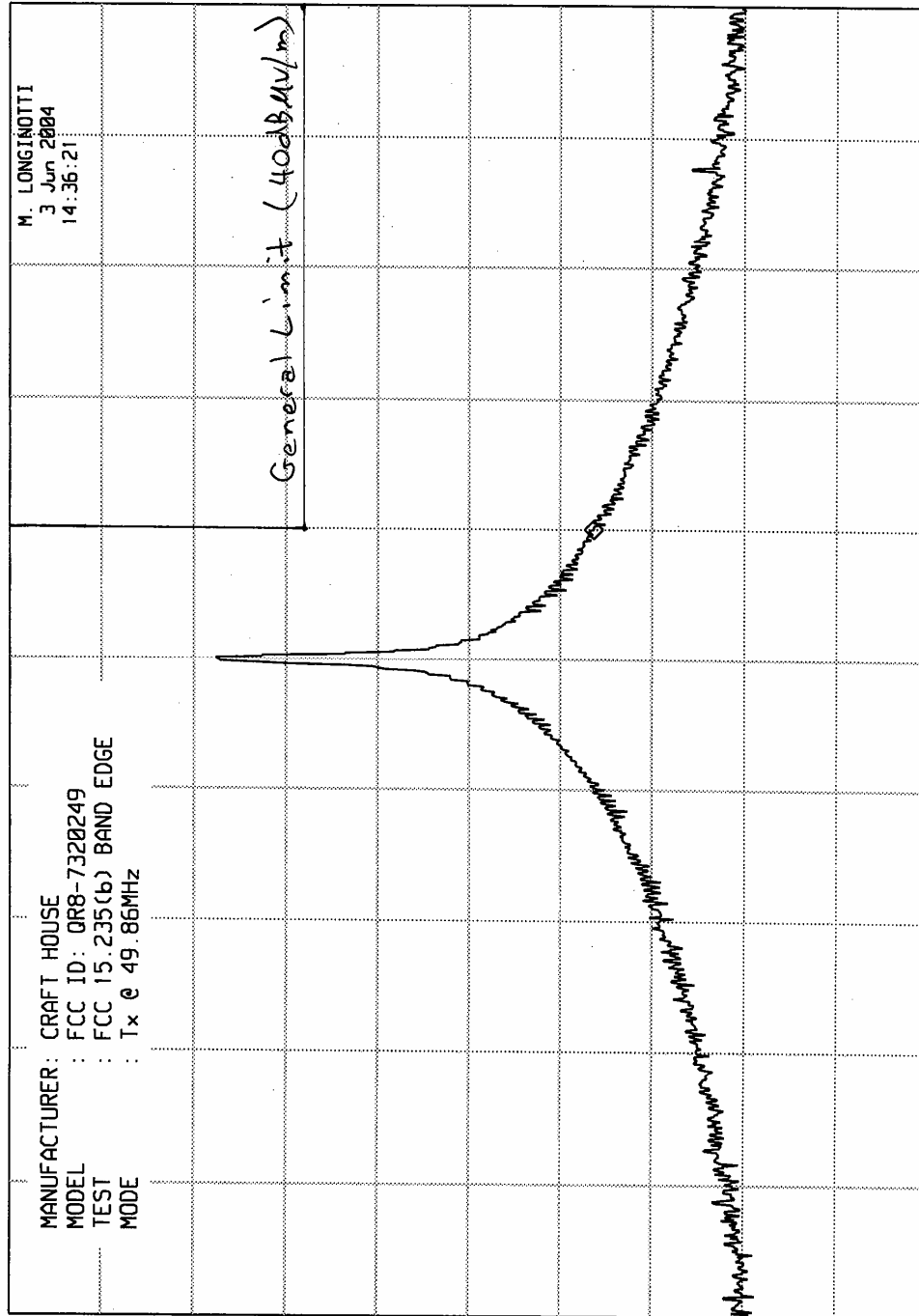
hp

REF 67.0 dBuV

ATTEN 0 dB

10 dB/

OFFSET  
-20.0  
dB



CENTER 49.861 MHz  
RES BW 1 kHz

VBW 3 kHz

SPAN 500 kHz  
SWP 1.50 sec

ELITE ELECTRONIC ENGINEERING Inc.

MKR 49.810 0 MHz  
3.20 dBuV

