Measurement of RF Interference from a 1/24 Scale 1963 Impala Lowrider RC Car Transmitter
FCC ID: Q8R-7310327

For : Craft House Corporation
Toledo, OH

Date Received : May 28, 2004
Date Tested : June2 and June 3, 2004
Test Personnel : Mark E. Longinoti, NARTE® Certified EMC Test Engineer, ATL-0154-E
Specification : FCC "Code of Federal Regulations" Title 47 Part 15, Subpart C

Test Report By :

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Approved By :

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Measurement of RF Emissions from a 1/24 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 1/24 Scale 1963 Impala Lowrider RC Car Transmitter, (hereinafter referred to as the test item). The test item was designed to transmit at approximately 27MHz 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 15.227 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 22^{o}C and the relative humidity was 36%.

2.0 TEST ITEM SETUP AND OPERATION:

The test item is a 1/124 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 13. 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. - 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 15.227, radiated emissions over the frequency range from 26.96MHz to 27.28MHz 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
20-30	30	30	29.5
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 25MHz 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. - 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 25MHz to 1GHz was investigated. To ensure that maximum emission levels were measured, the following steps were taken:

1) From 20MHz to 30MHz, measurements were made using a peak detector and a loop antenna. The peak readings were converted to average readings using the duty cycle correction factor.
2) From 30MHz 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 27MHz, is presented on page 14. 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 27MHz, are presented on page 15. As can be seen from the data, all emissions measured from the test item were within the specification limits. The emissions level closet to the limit (worst case) occurred at 271.4MHz. The emissions level at this frequency was 7.9dB within the limit. See page 15 for details. Photographs of the test configuration which yielded the highest, or worst case, radiated emission levels are shown on Figures 2 and 3.

4.4 Band Edge MeasurementsError! Bookmark not defined.

4.4.1 RequirementError! Bookmark not defined. - In accordance with paragraph 15.227, all emissions outside of the 26.96MHz to 27.28MHz band shall not exceed the general radiated emission limits in paragraph 15.209. The limits of paragraph 15.209 (30uV/m @ 30 meters) can be converted to the equivalent field intensity at 3 meters using linear extrapolation. A 20dB (20dB = 20 * Log (30m/3m)) distance correction factor has been applied to the limit to allow a direct comparison of the data obtained at 3 meters.

4.4.2 ProceduresError! Bookmark not defined. - 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 10kHz and span was set to 1MHz. The frequency spectrum near the fundamental was plotted with the marker set to the lower and upper band edge frequencies.

4.4.3 Results Error! Bookmark not defined. **-** The plots of the emissions near the fundamental frequency are presented on pages 16 and 17. As can be seen from this data page, all emissions outside of the 26.96MHz to 27.28MHz band met the general radiated emission limits in paragraph 15.209.

5.0 CONCLUSIONS:

It was determined that the Craft House Corporation 1/24 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								
NLS1	24" ACTIVE LOOP ANTENNA	EMCO	6502	8903-2329	0.01-30MHZ	02/09/04	12	02/09/05
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	
Equipment Type: METERS								
MSI2	DIGITAL OSCILLOSCOPE	LECROY CORP.	9310AM	4544	DC-400MHZ	05/05/04	12	05/05/05
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 33593-01
Radiated Emissions Test Setup Anechoic Ferrite Chamber

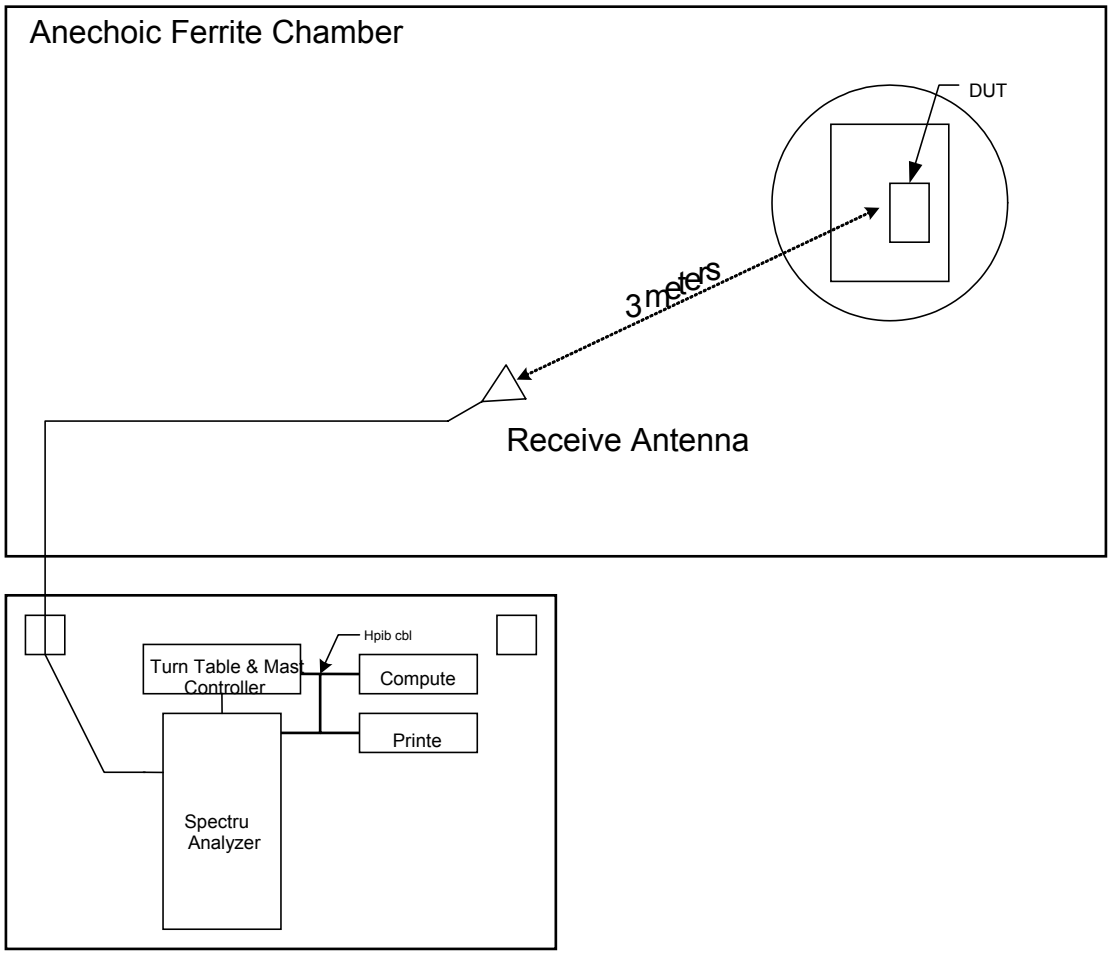


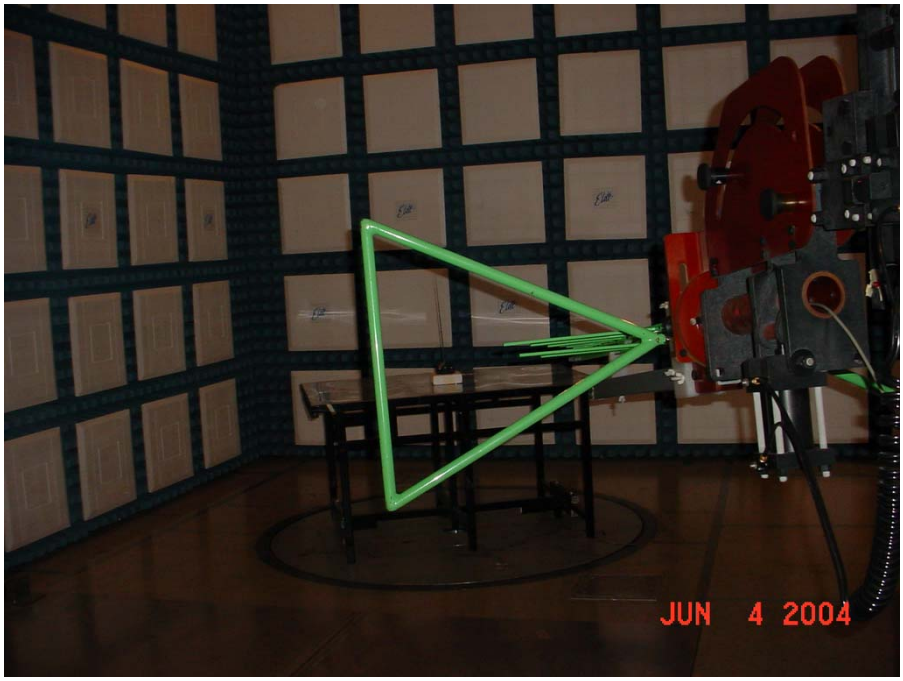
FIGURE 1 BLOCK DIAGRAM OF TEST SETUP

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

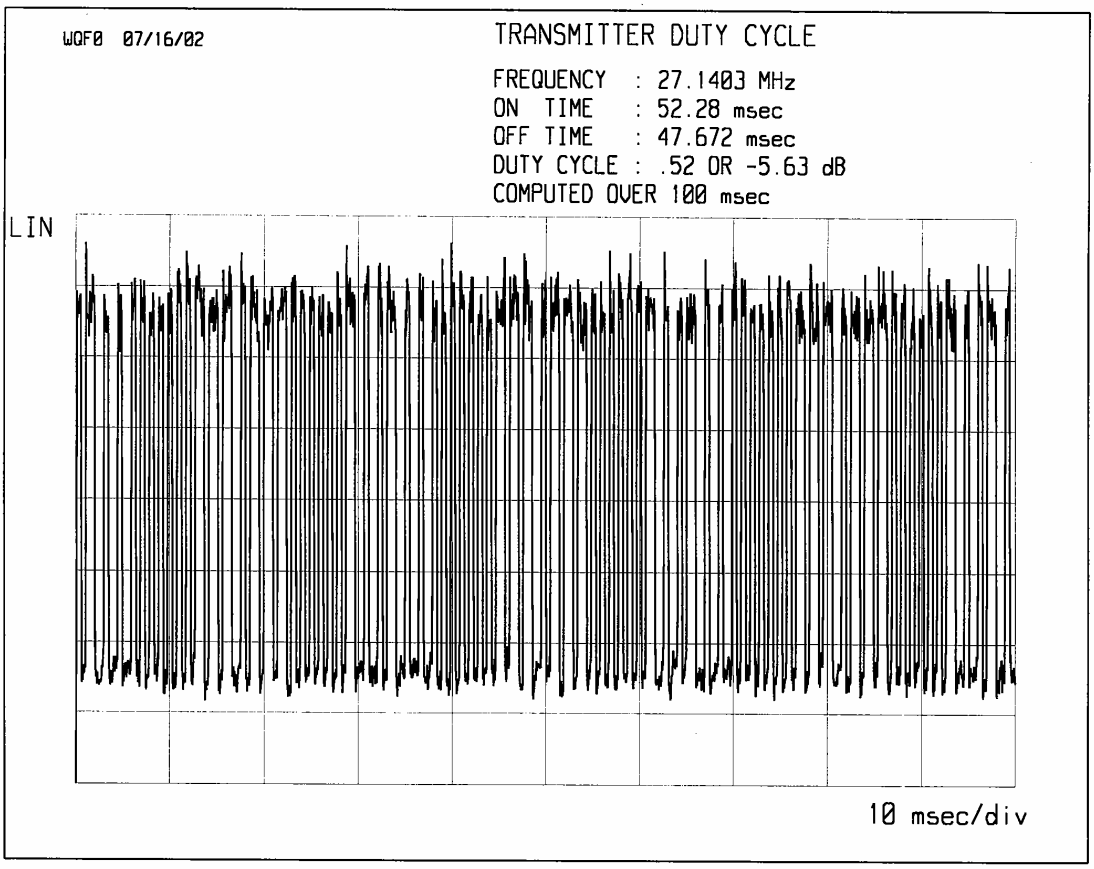
FIGURE 3



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

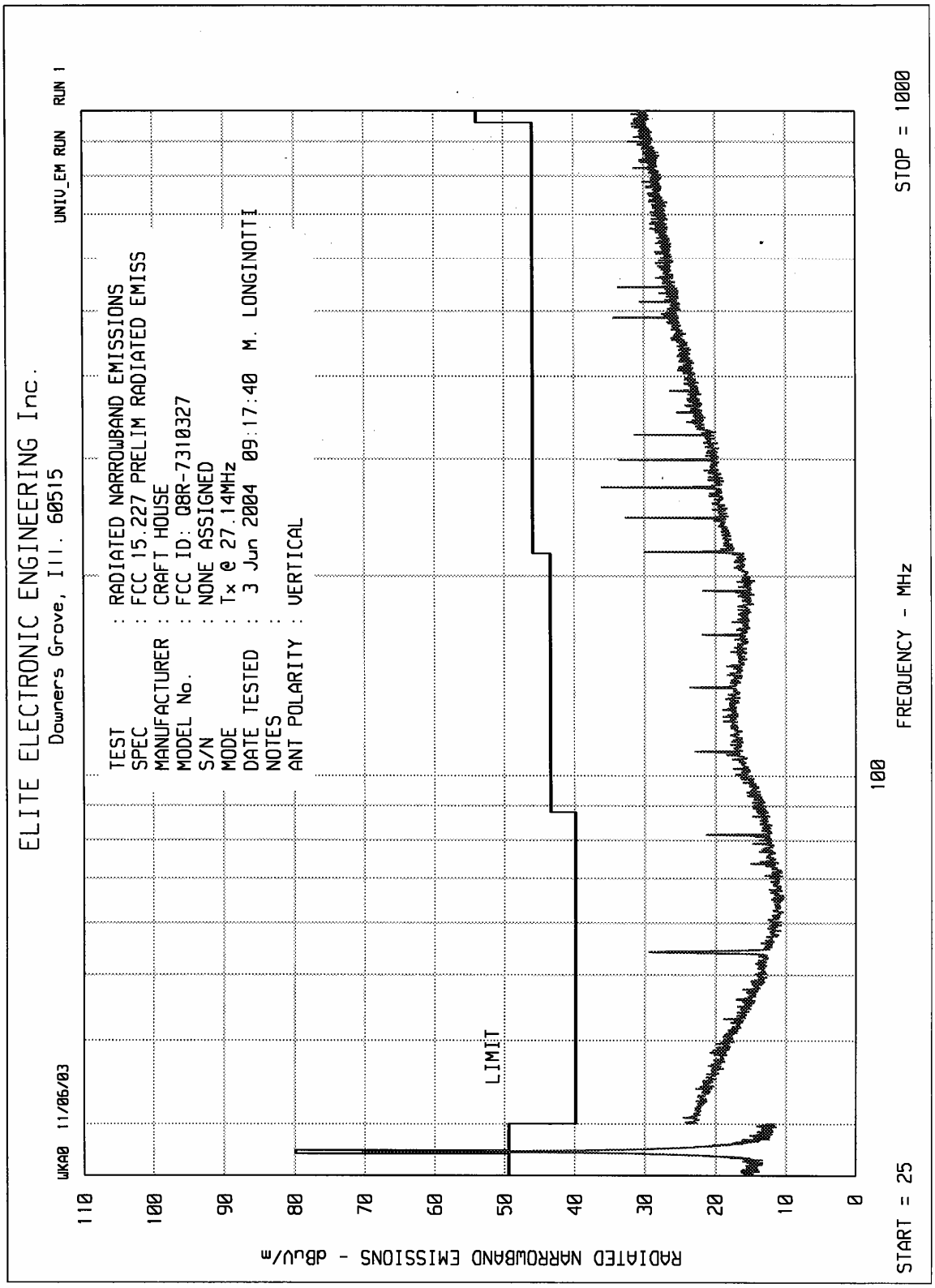
TEST SETUP FOR RADIATED EMISSIONS MEASUREMENTS
MAXIMIZED FOR MEASUREMENT OF WORST CASE EMISSIONS
VERTICAL POLARIZATION

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Il 60515



MANUFACTURER : CRAFT HOUSE
MODEL : FCC ID: Q8R-7310327
S/N : NONE ASSIGNED
NOTES : Tx @ 27.14MHz
DATE : 3 Jun 2004 10:26:35 M. LONGINOTTI

pg ____ of ____


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV_EM RUN RUN 1
WKA0 11/06/03
TEST : RADIATED NARROWBAND EMISSIONS
SPEC : FCC 15.227 PRELIM RADIATED EMISS
MANUFACTURER : CRAFT HOUSE
MODEL No. : FCC ID: Q8R-7310327
S/N : NONE ASSIGNED
MODE : Tx @ 27.14MHz
DATE TESTED : 3 Jun 2004 09:17:40 M. LONGINOTTI
NOTES :
ANT POLARITY : VERTICAL
LIMIT
RADIATED NARROWBAND EMISSIONS - dBuV/m
110
100
90
80
70
60
50
40
30
20
10
0
START = 25
100
FREQUENCY - MHz
STOP = 1000

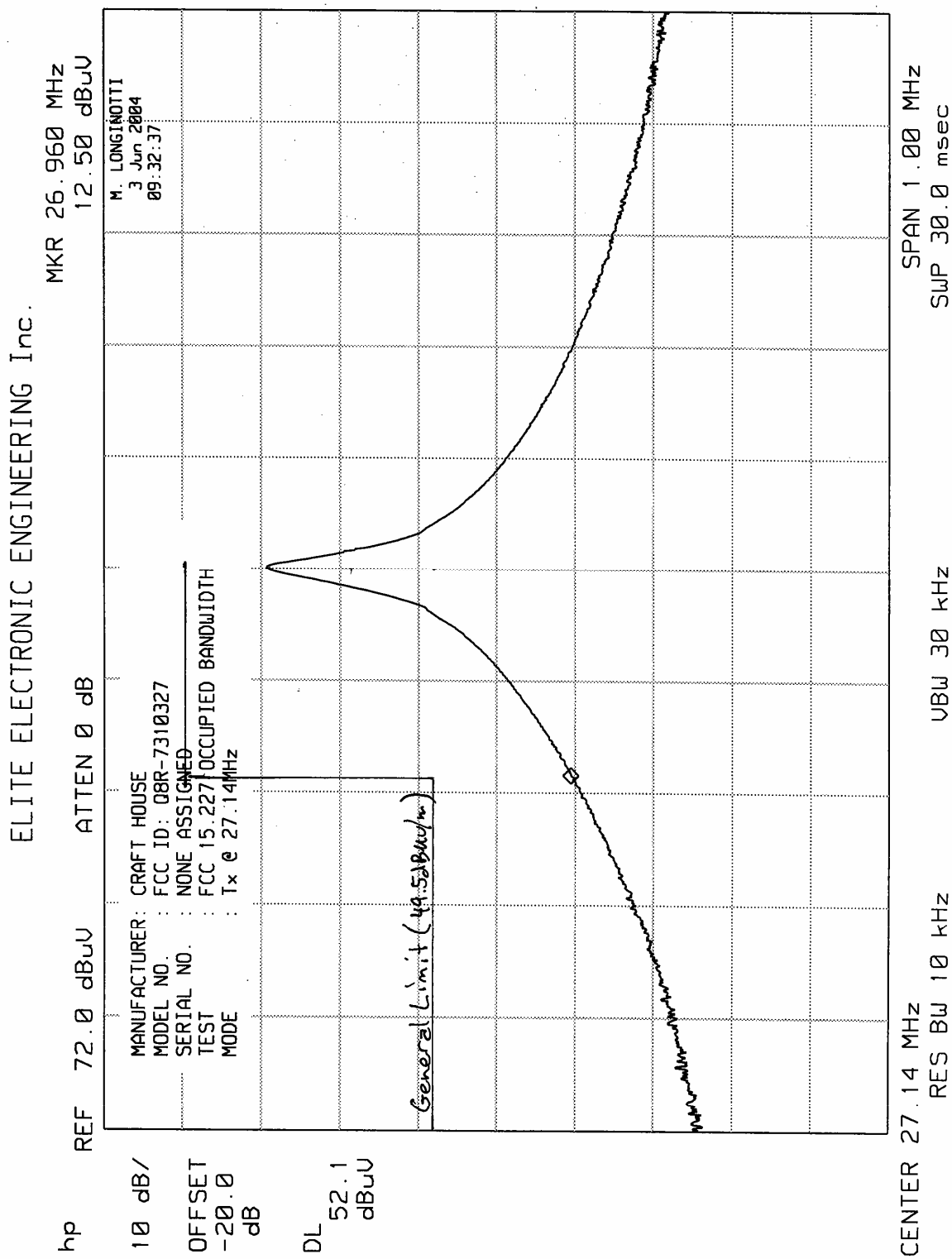
MANUFACTURER : Craft House
MODEL : 1/24 Scale 1963 Impala Lowrider RC Car 27MHz Transmitter
SERIAL NO. : None Assigned
TEST SPECIFICATION : FCC 15.227
DATE : June 2, 2004
TEST MODE : Transmit @ 27MHz
TEST DISTANCE : 3 meters

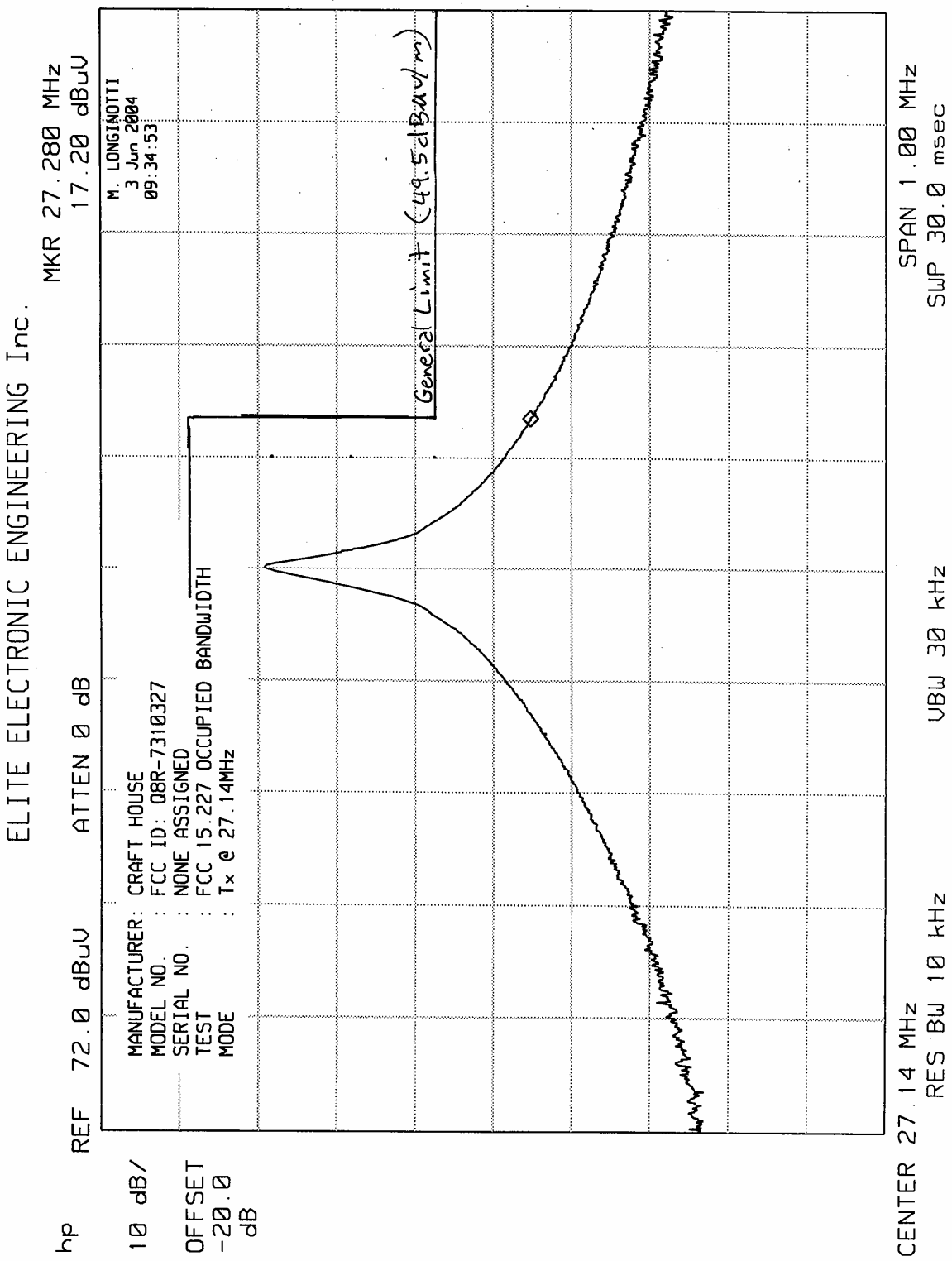
Frequency MHz	Antenna Polarity	Meter Reading dBuV/m	Ambient	Duty Cycle Factor dB	Antenna Factor dB	Cable Factor dB	Total dBuV/m	Total uV/m	Limit uV/m
27.14	H	56.0		-5.6	9.0	0.3	59.7	966.1	10000
	V	61.1		-5.6	9.0	0.3	64.8	1737.8	10000
54.28	H	9.2			8.3	0.5	18.0	7.9	100
	V	21.0			8.3	0.5	29.8	30.9	100
81.42	H	10.8			8.2	0.5	19.5	9.4	100
	V	16.5			8.2	0.5	25.2	18.2	100
108.6	H	7.1			11.9	0.6	19.6	9.5	150
	V	11.1			11.9	0.6	23.6	15.1	150
135.7	H	8.1			12.5	0.7	21.3	11.6	150
	V	11.7			12.5	0.7	24.9	17.6	150
162.9	H	9.1			10.9	0.9	20.9	11.1	150
	V	12.3			10.9	0.9	24.1	16.0	150
190	H	4.9			10.5	1.0	16.4	6.6	150
	V	11.4			10.5	1.0	22.9	14.0	150
217.2	H	8.8			11.6	1.1	21.5	11.9	200
	V	20.4			11.6	1.1	33.1	45.2	200
244.3	H	5.7			13.1	1.1	19.9	9.9	200
	V	22.3			13.1	1.1	36.5	66.8	200
271.4	H	5.2			13.8	1.2	20.2	10.2	200
	V	23.1			13.8	1.2	38.1	80.4	200

QP readings taken above 50MHz

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

Checked By: Mark E Longinotti


ELITE ELECTRONIC ENGINEERING Inc.
MKR 26.960 MHz
12.50 dBuV
M. LONGINOTTI
3 Jun 2004
09:32:37
hp
REF 72.0 dBuV
ATTEN 0 dB
10 dB/
OFFSET
-20.0
dB
DL
52.1
dBuV
MANUFACTURER: CRAFT HOUSE
MODEL NO. : FCC ID: Q8R-7310327
SERIAL NO. : NONE ASSIGNED
TEST : FCC 15.227 OCCUPIED BANDWIDTH
MODE : Tx @ 27.14MHz
General Limit (49.5dBuV)
CENTER 27.14 MHz
RES BW 10 kHz
VBW 30 kHz
SPAN 1.00 MHz
SWP 30.0 msec


ELITE ELECTRONIC ENGINEERING Inc.
hp
REF 72.0 dBuV
ATTEN 0 dB
MKR 27.280 MHz
17.20 dBuV
10 dB/
OFFSET
-20.0
dB
MANUFACTURER: CRAFT HOUSE
MODEL NO. : FCC ID: Q8R-7310327
SERIAL NO. : NONE ASSIGNED
TEST : FCC 15.227 OCCUPIED BANDWIDTH
MODE : Tx @ 27.14MHz
M. LONGINOTTI
3 Jun 2004
09:34:53
General Limit (49.5 dBuV/m)
CENTER 27.14 MHz
RES BW 10 kHz
VBW 30 kHz
SPAN 1.00 MHz
SWP 30.0 msec