

EXHIBIT E
REPORT OF MEASUREMENTS

A. TEST REPORT

The FCC ID: GXZE13653-P transmitter was tested and found to comply with the limits imposed by the FCC "Code of Federal Regulations", Title 47, Part 15, Subpart C, for intentional radiators.

The attached test report describes the results of the test in detail.

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

ELITE PROJECT: 26678 DATES TESTED: May 4, 1998

TEST PERSONNEL: Daniel E. Crowder

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

ENGINEERING TEST REPORT NO. 20736

MEASUREMENT OF RF EMISSIONS FROM A

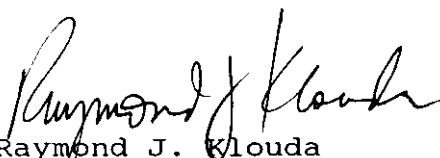
MODEL E13653-P TRANSMITTER

FCC ID: GXZE13653-P

FOR: Telemotive
Glendale Heights, Illinois

PURCHASE ORDER NO.: 429762

Report By: 
Daniel E. Crowder
Andrew V. Savikas

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

ENGINEERING TEST REPORT NO. 20736

ADMINISTRATIVE DATA AND SUMMARY OF TESTS

DESCRIPTION OF TEST ITEM: Transmitter

MODEL NO: E13653-P

SERIAL NO: None Assigned

MANUFACTURER: Telemotive

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

QUANTITY OF ITEMS TESTED: Two (2)

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

DATE TESTED: May 4, 1998

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

CUSTOMER: No Telemotive personnel were present.

ELITE ELECTRONIC: Daniel E. Crowder

ELITE JOB NO.: 26678

ABSTRACT: The model E13653-P Transmitter, does meet radiated emission requirements of the FCC "Code of Federal Regulations", Title 47, Part 15. The radiated emissions level closest to the limit occurred at 436.0MHz. The emissions level at this frequency was 2.6 dB within the limit. See data pages 105 and 106 for more details.

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MEASUREMENT OF RF EMISSIONS

FROM A MODEL E13653-P TRANSMITTER

FCC ID: GXZE13653-M-T

1.0 INTRODUCTION:

1.1 DESCRIPTION OF TEST ITEM: A series of radio interference measurements were performed on the model E13653-P Transmitter, (hereinafter referred to as the test item). No serial number was assigned to the test item. The test item is designed to transmit between approximately 436 - 440 MHz using an internal antenna. Two units were provided to cover the frequency range. One of the test items was set to transmit at 436.0MHz and the other was set to transmit at 439.8MHz. The tests were performed for Telemotive of Glendale Heights, Illinois.

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, for Intentional Radiators. The test methods prescribed in ANSI C63.4-1992 were used.

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 1994

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- 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 of Downers Grove, Illinois.

2.0 TEST ITEM SETUP AND OPERATION:

For all tests the test item was placed on a 80 cm meter high non-conductive stand.

Power to the transmitter was supplied by an internal 7.5 VDC battery supply.

Since the test item was powered with batteries, it was ungrounded during the tests.

For all tests, the test item was specially programmed to transmit continuously when the on/off switch was activated. The transmitter was deactivated when the on/off switch was activated a second time. The battery voltage was periodically checked to ensure proper operation at maximum level. The tests were performed with the test item operating at both 436.0MHz and 439.8MHz (using two separate transmitters).

3.0 TEST SITE AND INSTRUMENTATION:

3.1 TEST SITE: All tests were performed in a 32ft. x 20ft. x 18ft. hybrid ferrite-tile/anechoic absorber lined test chamber. The floor 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

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complies with ANSI C63.4 1992 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.

3.2 TEST INSTRUMENTATION: 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. All open field measurements below 1000MHz were made with tuned dipole antennas. All measurements above 1000MHz were made with a ridged waveguide antenna.

The fundamental and harmonics were measured with a Hewlett Packard 8566B spectrum analyzer. The spectrum analyzer readings were corrected to average readings using a duty cycle factor. It should be noted that all measurements were taken with the resolution and video bandwidth of the measuring instrument adjusted to 100kHz below 1GHz and 1MHz above 1GHz.

4.0 REQUIREMENTS, PROCEDURES AND RESULTS:

4.1 POWERLINE CONDUCTED EMISSIONS:

4.1.1 REQUIREMENTS: The test item was powered by a 7.5 VDC volt internal battery and not through the public power lines; therefore, conducted emissions measurements were not required.

4.2 RADIATED EMISSIONS:

4.2.1 REQUIREMENTS: 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.

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Paragraph 15.231(b) has the following radiated emission limits:

Fundamental Frequency MHz	Field Intensity uV/m @ 3 meters	Field Strength Harmonics and Spurious @ 3 meters
260 to 470	3,750 to 12,500*	375 to 1,250*

* - Linear Interpolation

For 436 MHz, the limit at the fundamental is 11083.3uV/m @ 3m and the limit on the harmonics is 1108uV/m @ 3m.

For 439.8 MHz, the limit at the fundamental is 11241.7 V/m @ 3m and the limit on the harmonics is 1124uV/m @ 3m.

In addition, paragraph 15.205(a) imposes the emissions levels in the Restricted Bands of operation.

4.2.2 PROCEDURES:

Since the test item uses pulse code modulation, the duty cycle factor was used to convert the peak signal levels to average signal level. The duty cycle was calculated from the pulse train modulation. The duty cycle was calculated as the on time over sum of the on time plus the off time.

With the spectrum analyzer tuned to the fundamental, the span was set to 0 Hz to observe the pulse modulation. The amplitude and sweep time were adjusted to properly view the pulse train. This pulse train was then plotted. The data was dumped to a computer that determine the on-time and the off-time, and then calculated the duty cycle and the duty cycle factor in dB. The pulse train was selected for the worst case (maximum) duty cycle. The duty cycle factor was computed using the word-on time in a 100.0 millisecond word-period if the data word exceeded 100 msec.

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For the open field radiated tests, the test item was placed on an 80 cm meter high non-conductive turntable, the test distance was 3 meters.

All measurements were made with a spectrum analyzer. The peak detected level of the fundamental and harmonics were corrected to average levels using a duty cycle factor which was mathematically determined.

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.

4.2.3 RESULTS: Preliminary radiated emission test results are presented on data pages 103 and 104. Preliminary radiated emission test results show harmonics and spurious which was subsequently investigated during the open field test.

The duty cycle factor was determined to be -11.1 dB. The plot of the pulse train used to make this determination is presented on data pages 101 and 102. The on-time and the off-time used for the calculations are listed on this data page. Since the transmitter uses a random pulse period. The duty cycle was determined for the maximum number of pulses that appeared in any 100 msec period. Four pulses was the maximum number of pulses found in a 100 msec sequence. In most cases, the number of pulses was less than four.

The data for the open field measurements is presented on data

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page 105 and 106. As can be seen from the data, no excessive readings were detected. The radiated emissions level closest to the limit occurred at 436 MHz. The emissions level at this frequency was 2.6 dB within the limit. The open field results reflect the final test configuration.

4.3 OCCUPIED BANDWIDTH MEASUREMENTS:

4.3.1 REQUIREMENTS: In accordance with paragraph 15.231(c), all emissions within 20dB of the peak amplitude level of the center frequency are required to be within a band less than 0.25% of the center frequency wide.

4.3.2 PROCEDURES: The test item was placed on an 80 centimeter high non-conductive stand. The unit was set to transmit continuously. An antenna was positioned nearby and the emissions displayed on the HP model 8566B spectrum analyzer. The frequency spectrum was then plotted.

4.3.3 RESULTS: The plot of the emissions near the fundamental frequency of 436 MHz is presented on data page 107. The plot of the emissions near the fundamental frequency of 439.8 MHz is presented on data page 108. As can be seen from this data page, the transmitter met the occupied bandwidth requirements.

5.0 CONCLUSION:

It was found that the Telemotive model E13653-P Transmitter does comply with the limits imposed by the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C for Intentional Radiators.

6.0 CERTIFICATION:

Elite Electronic Engineering Company certifies that the information contained in this report was obtained under conditions

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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.

TABLE I: TEST EQUIPMENT LIST

ELITE ELECTRONIC ENGINEERING							Page: 1	
Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Cal Inv	Due Date
Equipment Type: ACCESSORIES, MISCELLANEOUS								
XZGO	ATTENUATOR/SWITCH DRIVER	HEWLETT PACKARD	11713A	3439A00325	---	01/24/98	12	01/24/99
Equipment Type: AMPLIFIERS								
APKO	PREAMPLIFIER	HEWLETT PACKARD	8449B	3008A00662	1-26.5GHZ	01/27/98	12	01/27/99
Equipment Type: ANTENNAS								
NTAO	BILOG ANTENNA	CHASE EMC LTD.	BILOG CBL611	2057	.03-2GHZ	03/18/98	13	04/18/99
NWF1	DOUBLE RIDGED WAVEGUIDE	EMCO	3105	2041	1-12.4GHZ	10/17/97	12	10/17/98
Equipment Type: CONTROLLERS								
CDD2	COMPUTER	HEWLETT PACKARD	D4171A#ABA	SUS61654645	N/A	N/A		
CMAO	MULTI-DEVICE CONTROLLER	EMCO	2090	9701-1213	---	10/21/97	12	10/21/98
Equipment Type: PRINTERS AND PLOTTERS								
HRE1	LASER JET 5P	HEWLETT PACKARD	C3150A	USHB061052	---	N/A		
Equipment Type: RECEIVERS								
RAC1	SPECTRUM ANALYZER	HEWLETT PACKARD	85660B	3407A08369	100HZ-22GHZ	01/24/98	12	01/24/99
RACB	RF PRESELECTOR	HEWLETT PACKARD	85685A	3506A01491	20HZ-2GHZ	01/24/98	12	01/24/99
RAF3	QUASipeak ADAPTER	HEWLETT PACKARD	85650A	3303A01775	0.01-1000MHZ	01/26/98	12	01/26/99

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.

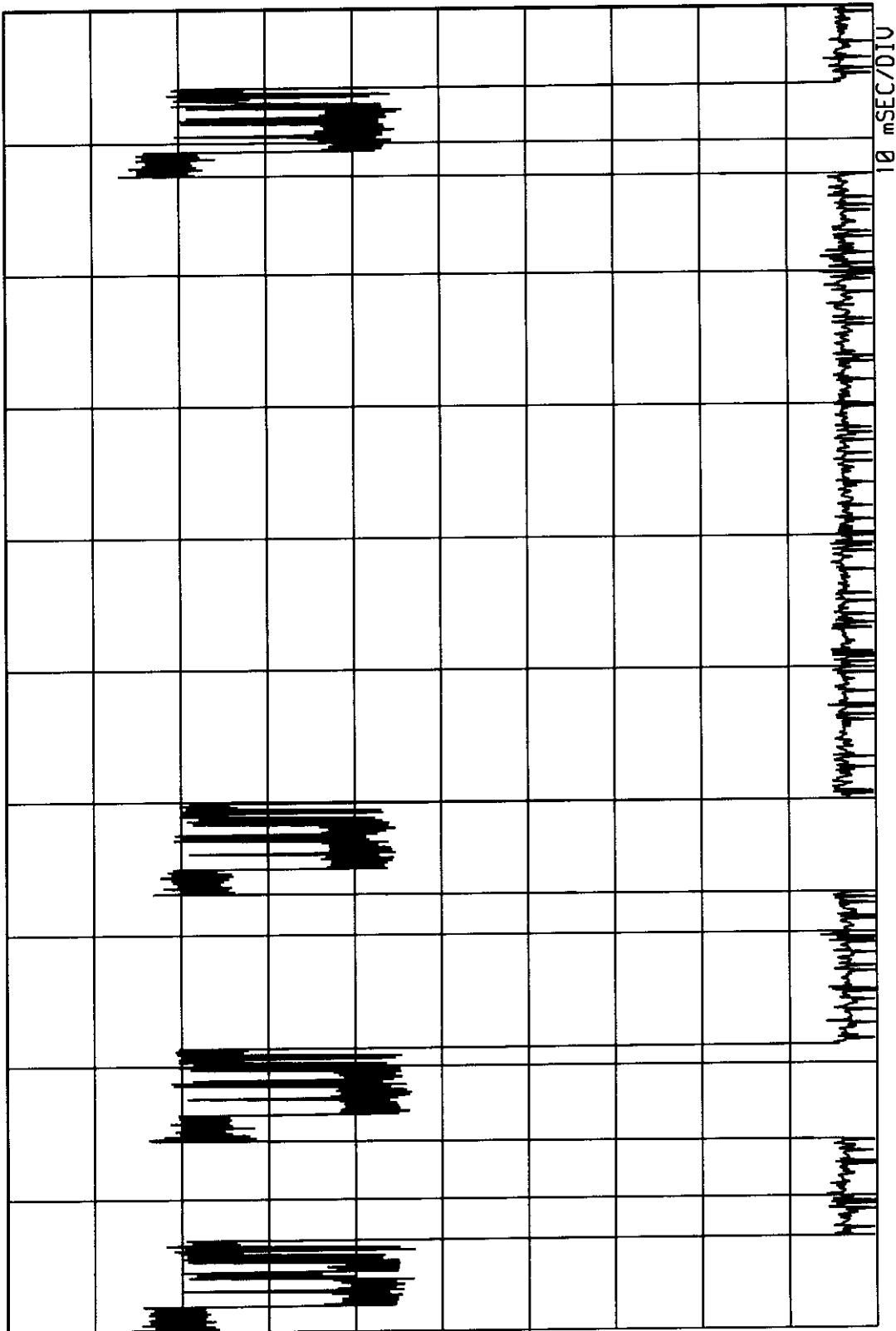
Date: 05/29/98

Location = "EEE" Job Number = "26678"

ELITE ELECTRONIC ENGINEERING Co.
Downers Grove, IL 60515

ETR 20436

FCC ID: GXZE13653-P



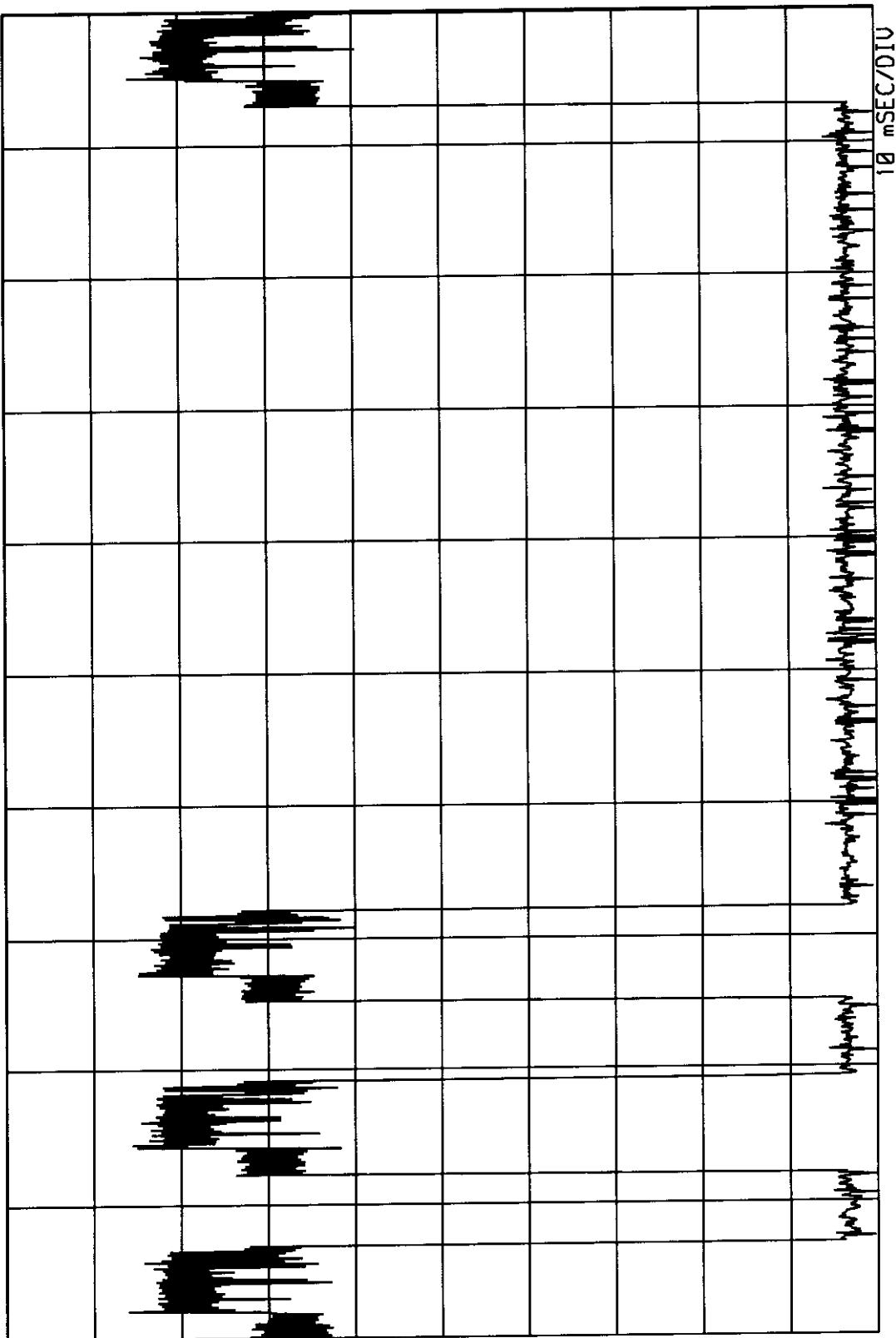
TRANSMITTER DUTY CYCLE
FREQUENCY : 435.994 MHz
ON TIME : 27.572 mSEC
OFF TIME : 72.428 mSEC
DUTY CYCLE = .28 or -11.06 dB
COMPUTED OVER 100 mSEC

MANUFACTURER : TELEMOTIVE
MODEL : E13653-P
S/N : NONE ASSIGNED
TEST DATE : 4 May 1998
Tx AT 436MHz
NOTES

ELITE ELECTRONIC ENGINEERING Co.
Downers Grove, IL 60515

ETR 65-16

FCC ID: GXZE13653-P



TRANSMITTER DUTY CYCLE
FREQUENCY: 439.7526 MHz
ON TIME : 27.672 mSEC
OFF TIME : 72.328 mSEC
DUTY CYCLE = .28 or -1.06 dB
COMPUTED OVER 100 mSEC

MANUFACTURER : TELEMOTIVE
MODEL : E13653-P
S/N : NONE ASSIGNED
TEST DATE : 4 May 1998
NOTES : Tx AT 439.8MHz

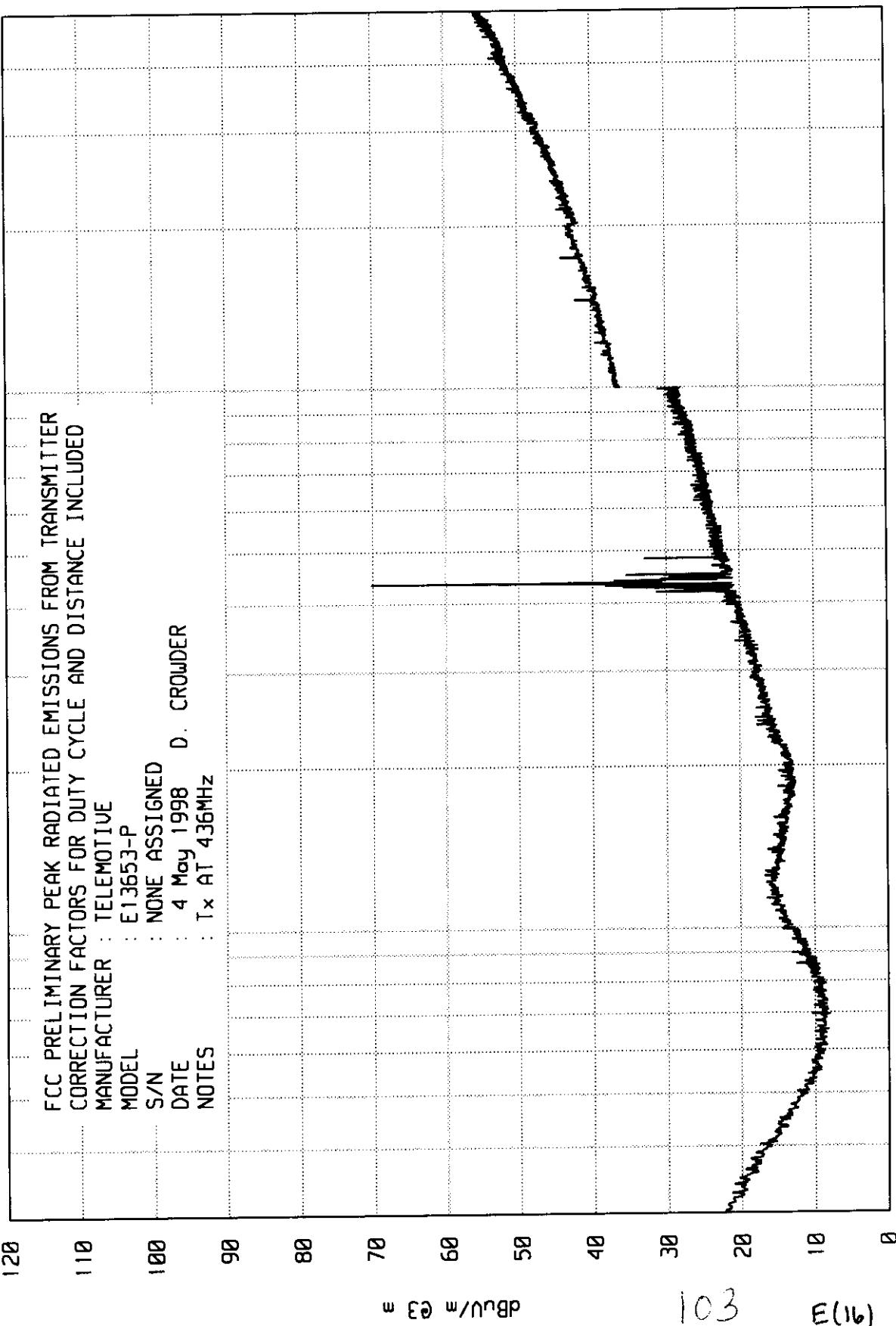
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E(15)

EEC ELITE ELECTRONIC ENGINEERING Co.
Downers Grove, Ill. 60515

L-TR 26736

FCC ID: GXZE13653-P



START = 30

100

1000

FREQUENCY - MHz

STOP = 5000

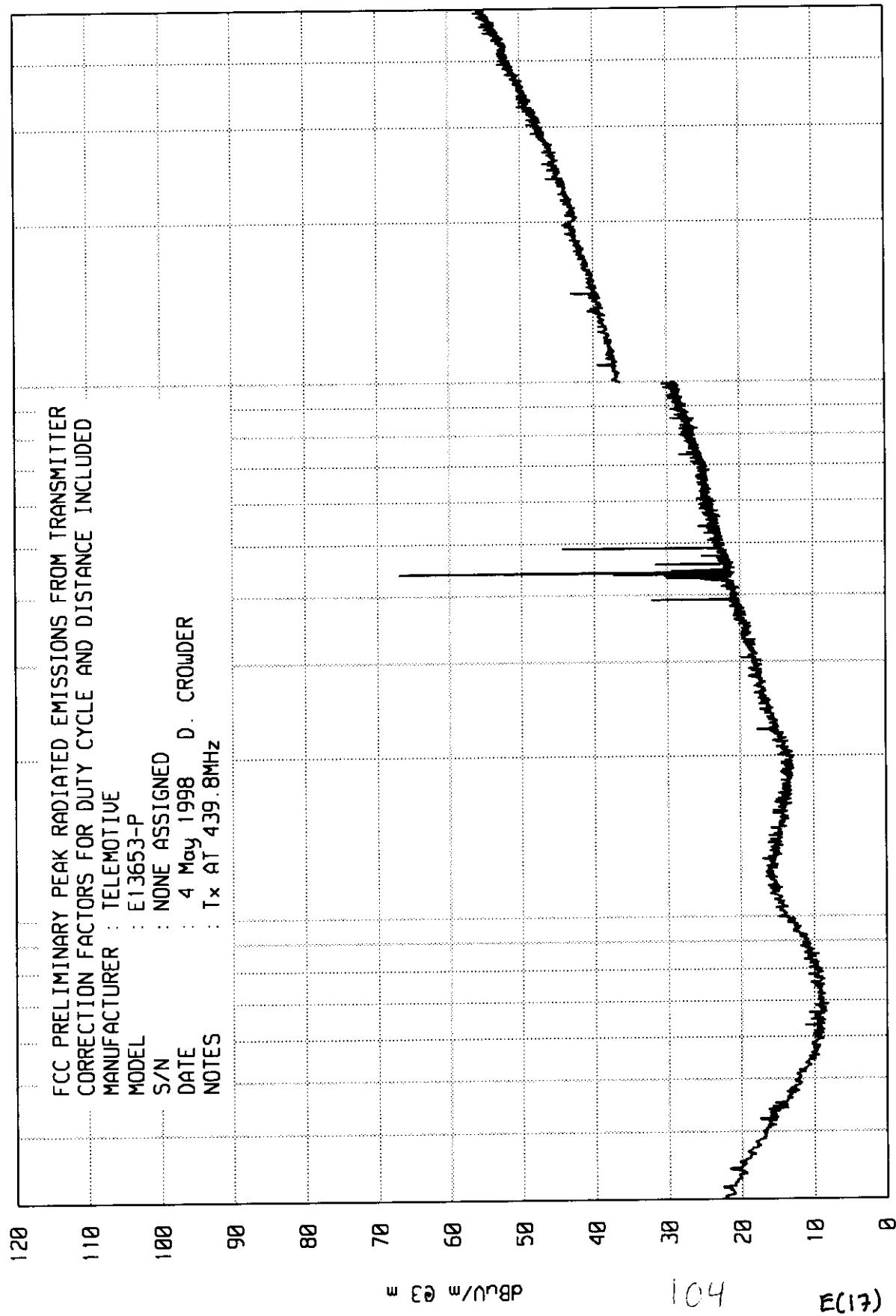
E(16)

103

EEC ELITE ELECTRONIC ENGINEERING Co.
Downers Grove, Ill. 60515

ETR 20-136

FCC ID: GXZE13653-P



ENGINEERING TEST REPORT NO. 20736
ELITE ELECTRONIC ENGINEERING COMPANY

MANUFACTURER : TELEMOBILE
 MODEL : E13653-P
 S/N : NONE ASSIGNED
 SPECIFICATION : FCC-15C OPEN FIELD RADIATED EMISSIONS
 DATE : MAY 4, 1998
 NOTES : TRANSMIT AT 436MHz

80.7
60.2
54

FREQ. (MHz)	ANT POL	MTR	ANT	CABLE	DUTY	PRE-AMP		TOTAL uV/m	LIMIT uV/m
		RDG (dBuV)	FAC dB	FAC dB	CYCLE dB	GAIN dB	TOTAL dBuV/m		
436.0	H	70.3	16.7	2.4	-11.1		78.3	8222.4	11083.3
	V	57.8	16.7	2.4	-11.1		65.8	1949.8	11083.3
872.0	H	25.2	21.7	3.7	-11.1		39.5	94.4	1108
	V	23.7	21.7	3.7	-11.1		38.0	79.4	1108
1308.0	H	56.8	24.9	5.0	-11.1	36.7	38.9	88.1	500
	V	56.2	24.9	5.0	-11.1	36.7	38.3	82.2	500
1744.0	H	58.0	26.3	6.2	-11.1	36.2	43.2	144.5	1108
	V	59.5	26.3	6.2	-11.1	36.2	44.7	171.8	1108
2180.0	H	46.9	27.9	7.1	-11.1	36.2	34.6	53.7	1108
	V	49.4	27.9	7.1	-11.1	36.2	37.1	71.6	1108
2616.0	H	43.1 AMB	29.3	7.8	-11.1	36.0	33.1	45.2	1108
	V	43.2 AMB	29.3	7.8	-11.1	36.0	33.2	45.7	1108
3052.0	H	43.0 AMB	30.6	8.5	-11.1	36.0	35.0	56.2	1108
	V	42.7 AMB	30.6	8.5	-11.1	36.0	34.7	54.3	1108
3488.0	H	43.0 AMB	31.7	9.5	-11.1	35.8	37.3	73.3	1108
	V	43.2 AMB	31.7	9.5	-11.1	35.8	37.5	75.0	1108
3924.0	H	42.2 AMB	32.7	10.4	-11.1	35.3	38.9	88.1	500
	V	42.8 AMB	32.7	10.4	-11.1	35.3	39.5	94.4	500
4360.0	H	41.8 AMB	32.8	11.3	-11.1	35.3	39.5	94.4	500
	V	41.9 AMB	32.8	11.3	-11.1	35.3	39.6	95.5	500

CHECKED BY: *DeL*

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E(18)

ENGINEERING TEST REPORT NO. 20736
ELITE ELECTRONIC ENGINEERING COMPANY

MANUFACTURER : TELEMOBILE
 MODEL : E13653-P
 S/N : NONE ASSIGNED
 SPECIFICATION : FCC-15C OPEN FIELD RADIATED EMISSIONS
 DATE : MAY 4, 1998
 NOTES : TRANSMIT AT 439.8MHz

FREQ. (MHz)	ANT POL	MTR RDG (dBuV)	ANT FAC dB	CABLE FAC dB	DUTY CYCLE dB	PRE-AMP		TOTAL dBuV/m	TOTAL uV/m	LIMIT uV/m
						GAIN dB	TOTAL dBuV/m			
439.8	H	69.2	16.7	2.4	-11.1		77.2	7244.4	11241.7	
	V	54.6	16.7	2.4	-11.1		62.6	1349.0	11241.7	
879.6	H	15.8	21.8	3.7	-11.1		30.2	32.4	1124	
	V	14.8	21.8	3.7	-11.1		29.2	28.8	1124	
1319.4	H	54.6	24.9	5.1	-11.1	36.7	36.8	69.2	500	
	V	56.8	24.9	5.1	-11.1	36.7	49.0	89.1	500	
1759.2	H	51.9	26.4	6.2	-11.1	36.2	37.2	72.4	1124	
	V	49.2	26.4	6.2	-11.1	36.2	34.5	53.1	1124	
2199.0	H	44.2	27.9	7.1	-11.1	36.2	31.9	39.4	1124	
	V	45.4	27.9	7.1	-11.1	36.2	33.1	45.2	1124	
2638.8	H	42.0 AMB	29.4	7.8	-11.1	36.0	32.1	40.3	1124	
	V	41.4 AMB	29.4	7.8	-11.1	36.0	31.5	37.6	1124	
3078.6	H	42.4 AMB	30.7	8.6	-11.1	36.0	34.6	53.6	1124	
	V	43.1 AMB	30.7	8.6	-11.1	36.0	35.3	58.2	1124	
3518.4	H	42.8 AMB	31.7	9.6	-11.1	35.8	37.2	72.4	1124	
	V	42.4 AMB	31.7	9.6	-11.1	35.8	36.8	69.2	1124	
3958.2	H	41.9 AMB	32.8	10.5	-11.1	35.3	38.8	87.1	500	
	V	41.8 AMB	32.8	10.5	-11.1	35.3	38.7	86.1	500	
4398.0	H	42.1 AMB	32.7	11.3	-11.1	35.3	39.7	96.6	500	
	V	41.7 AMB	32.7	11.3	-11.1	35.3	39.3	92.3	500	

CHECKED BY: 

ELITE ELECTRONIC ENGINEERING CO

FCC ID: GXZE13653-P

FIG. 207 (b)

