



TEST SPECIFICATION:

**FCC "Rules and Regulations", Part 90**  
Sections 90.205 to 90.210 & 90.242

Private Land Mobile Radio Services

Travelers' Information Stations

530 kHz to 1700 kHz Band

THE FOLLOWING **MEETS** THE ABOVE TEST SPECIFICATION

Formal Name: Highway Information System DRTXM2 Transmitter

Kind of Equipment: Transmitter

Test Configuration: Stand-alone, powered by 12 vdc bench supply

Emission Designator: 6K00A3E

Transmitter FCC ID: O2Q- DRTXM2

FCC Equipment Type: TIS Low Power AM Transmitter

Model Number: DRTXM2

Serial Number: 041300902 & 051900907

Dates of Test: April 19, 20, & May 3, 19, & 23, 2000

Test Conducted For: Highway Information Systems, Inc.

4021 Stirrup Creek Drive, Suite 100

Durham, North Carolina 27703

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EMC Test Services  
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Report No. 8180  
05/26/00

## SIGNATURE PAGE

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General Manager

Company Official:

Highway Information Systems, Inc.

United States Department of Commerce  
National Institute of Standards and Technology



ISO/IEC GUIDE 25:1990  
ISO 9002:1987

Certificate of Accreditation



**D.L.S. ELECTRONIC SYSTEMS, INC.**  
WHEELING, IL

*is recognized under the National Voluntary Laboratory Accreditation Program for satisfactory compliance with criteria established in Title 15, Part 285 Code of Federal Regulations. These criteria encompass the requirements of ISO/IEC Guide 25 and the relevant requirements of ISO 9002 (ANSI/ASQC Q92-1987) as suppliers of calibration or test results. Accreditation is awarded for specific services, listed on the Scope of Accreditation for:*

**ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS  
FCC**

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NVLAP Lab Code: 100276-0

NVLAP-01C (11-95)

## Scope of Accreditation



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### ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS

NVLAP LAB CODE 100276-0

#### D.L.S. ELECTRONIC SYSTEMS, INC.

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#### NVLAP Code Designation / Description

##### International Special Committee on Radio Interference (CISPR) Methods

- |           |  |
|-----------|--|
| 12/CIS22  | IEC/CISPR 22:1993: Limits and methods of measurement of radio disturbance characteristics of information technology equipment  |
| 12/CIS22a | IEC/CISPR 22:1993: Limits and methods of measurement of radio disturbance characteristics of information technology equipment, Amendment 1:1995, and Amendment 2:1996. |
| 12/CIS22b | CNS 13438:1997: Limits and Methods of Measurement of Radio Interference Characteristics of Information Technology Equipment  |

##### Federal Communications Commission (FCC) Methods

- |         |   |
|---------|---|
| 12/F01  | FCC Method - 47 CFR Part 15 - Digital Devices       |
| 12/F01a | Conducted Emissions, Power Lines, 450 KHz to 30 MHz |
| 12/F01b | Radiated Emissions                                  |

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## 1.0 SUMMARY OF TEST REPORT

It was found that the Highway Information System DRTXM2 Transmitters (all four transmitters, two with the old RF filter design, S/N 041300902 & 051900907 two with the new RF filter design) **meets** the requirements for conducted spurious emissions as specified in the FCC "Rules and Regulations", Part 90, Private Land Mobile Services, Subpart J, Sections 90.205 to 90.210 & 90.242 for Travelers' Information Stations, operating in the 530 kHz to 1700 kHz Frequency Band.

The 530 kHz and 1610 kHz transmitters with the new RF filter design (SN: 041300902 & 051900907) significantly reduces the conducted spurious emissions relative to the performance of the 1610 kHz transmitter with the old filter design (SN: 022699786).

## 2.0 INTRODUCTION

On April 19, 20, & May 3, 19, & 23, 2000, a series of radio frequency interference measurements were performed on the Highway Information System DRTXM2 Transmitters, S/N 041300902 & 051900907. The tests were performed according to the procedures of FCC as stated in Part 2 Subpart J, Equipment Authorization Procedures of the Code of Federal Regulations 47, by personnel of D.L.S. Electronic Systems, Inc. who are responsible to Donald L. Sweeney, Senior EMC Engineer. Tests were performed on four transmitters (FCC Equipment Type 34-366, Model DRTXM2) manufactured by Highway Information Systems, Inc. as identified in the table below:

	Frequency	RF Filter	Serial Number
1	530 kHz	Old design	032599796
2	1610 kHz	Old design	022699786
3	530 kHz	New design	051900907
4	1610 kHz	New Design	041300902

## 3.0 OBJECT

The purpose of this series of tests was to verify whether the transmitters with the old RF filter design meet the requirements for conducted spurious emissions as specified in Part 90.242 of the FCC "Rules and Regulations" and to determine whether the new transmitter with the new RF filter design further reduces the conducted spurious emissions relative to the performance of the old RF filter design.

## 4.0 TEST SET-UP

All tests were performed at D.L.S. Electronic Systems, Inc. The tests were made with the test item placed on a non-conductive table located in the Test Room.



## 5.0 TEST EQUIPMENT (Bandwidths and Detector Function)

All data was automatically plotted using peak detector function. This information was then used to determine the frequencies of maximum emissions. Manual measurements were performed on those frequencies using a peak detector function of the Analyzer with the bandwidths specified by the FCC. From 500 kHz to 30 MHz, a bandwidth of 10 kHz was used (except for Occupied Bandwidth), and 100 kHz bandwidth was used from 30 MHz to 200 MHz. A list of the equipment used can be found in Table 1. All equipment was calibrated per the instruction manuals supplied by the manufacturer.

## 6.0 RF POWER OUTPUT - PART 2.1046

As stated in PART 90.242 (b)(4)(iii), the RF output power should not exceed 10 watts. The RF output power was measured at the RF output terminal of the transmitter with the transmitter unmodulated. The RF output power was measured using the following test method:

The RF output of the Highway Information System DRTXM2 Transmitter was connected to a Spectrum Analyzer through suitable attenuation. All cables, connectors, and attenuators were calibrated prior to testing.

### **Actual Measurements Taken:**

106.8 Measured output of the transmitter  
+ 39.7.0 dBuV which includes measured pads & cable loss  
146.50 dBuV which equals 8.91 watts

### **LIMIT:**

Manufacturer's rated output power = 10 watts

### **MARGIN:**

10 watts - 8.91 watts = 1.09 watts

### **NOTE:**

See the following page for the graph of the actual measurement made:



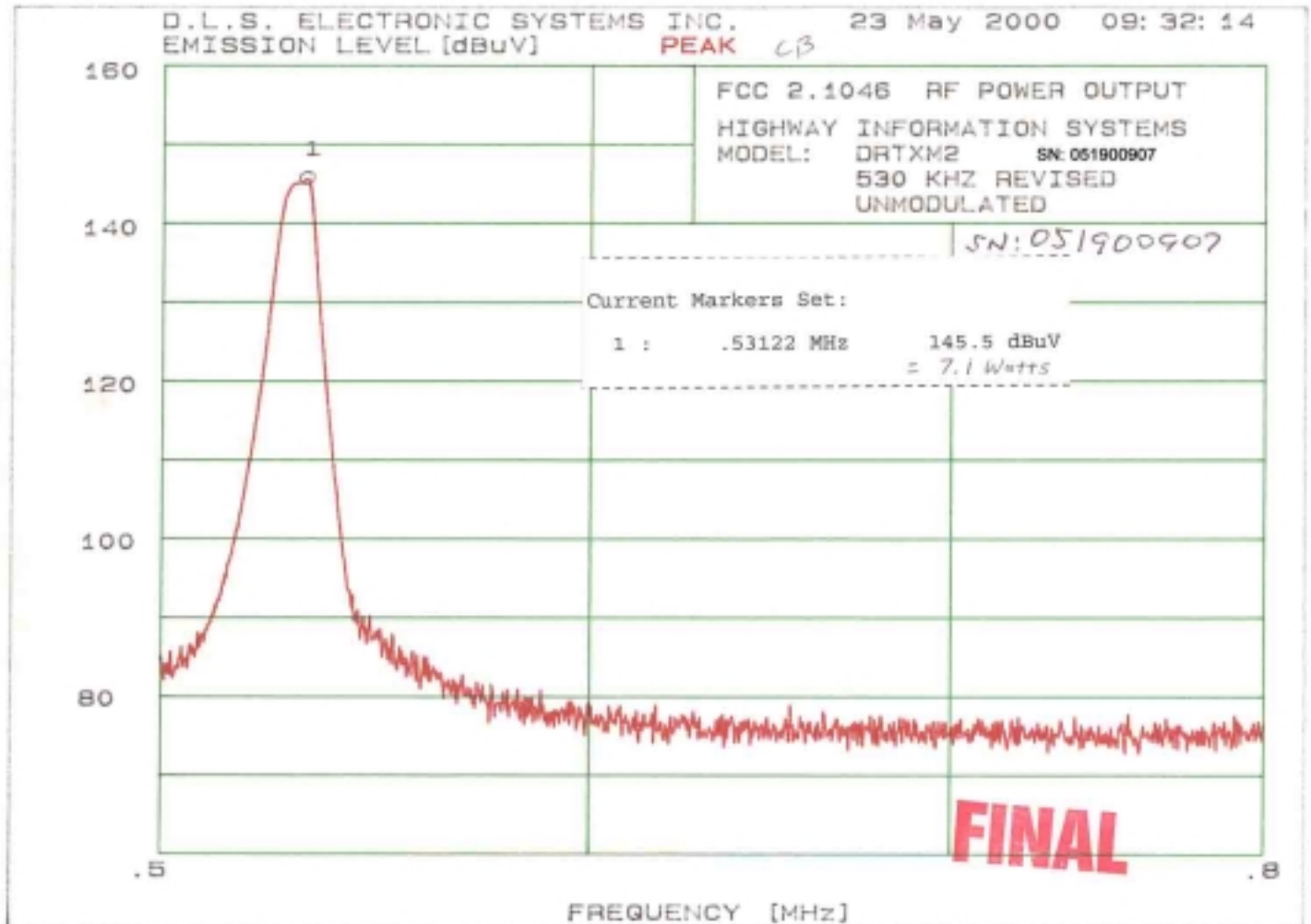
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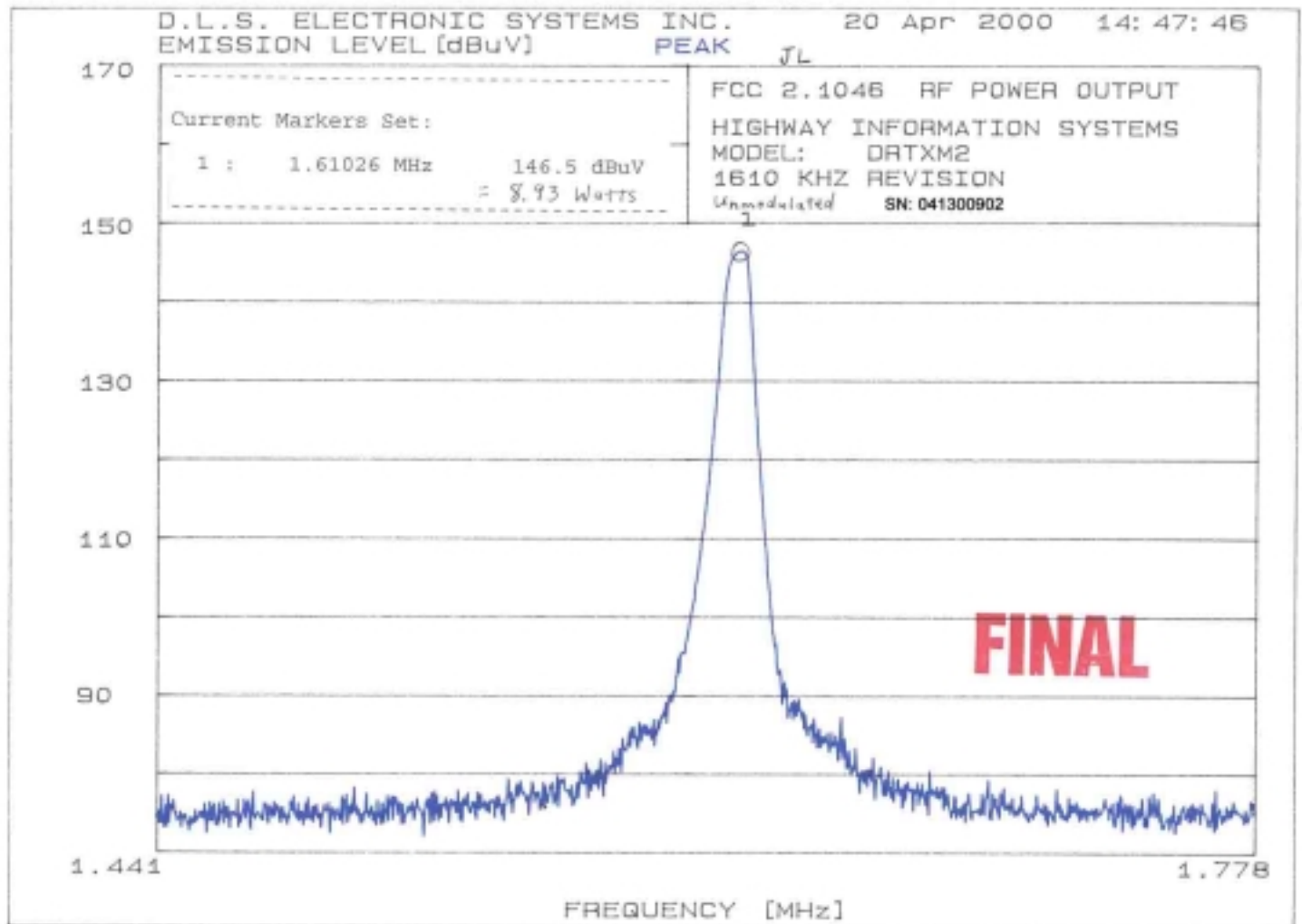
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## **GRAPH TAKEN OF THE RF POWER**

### **OUTPUT MEASUREMENT**

**PART 2.1046**







## 7.0 Modulation Characteristics - Part 2.1047

Voice modulated communication equipment.

A curve showing the frequency response of the audio modulating circuit over a range of 50 to 10000 Hz is submitted with this report.

### **NOTE:**

**See the following pages for the graphs of the actual measurements made:**



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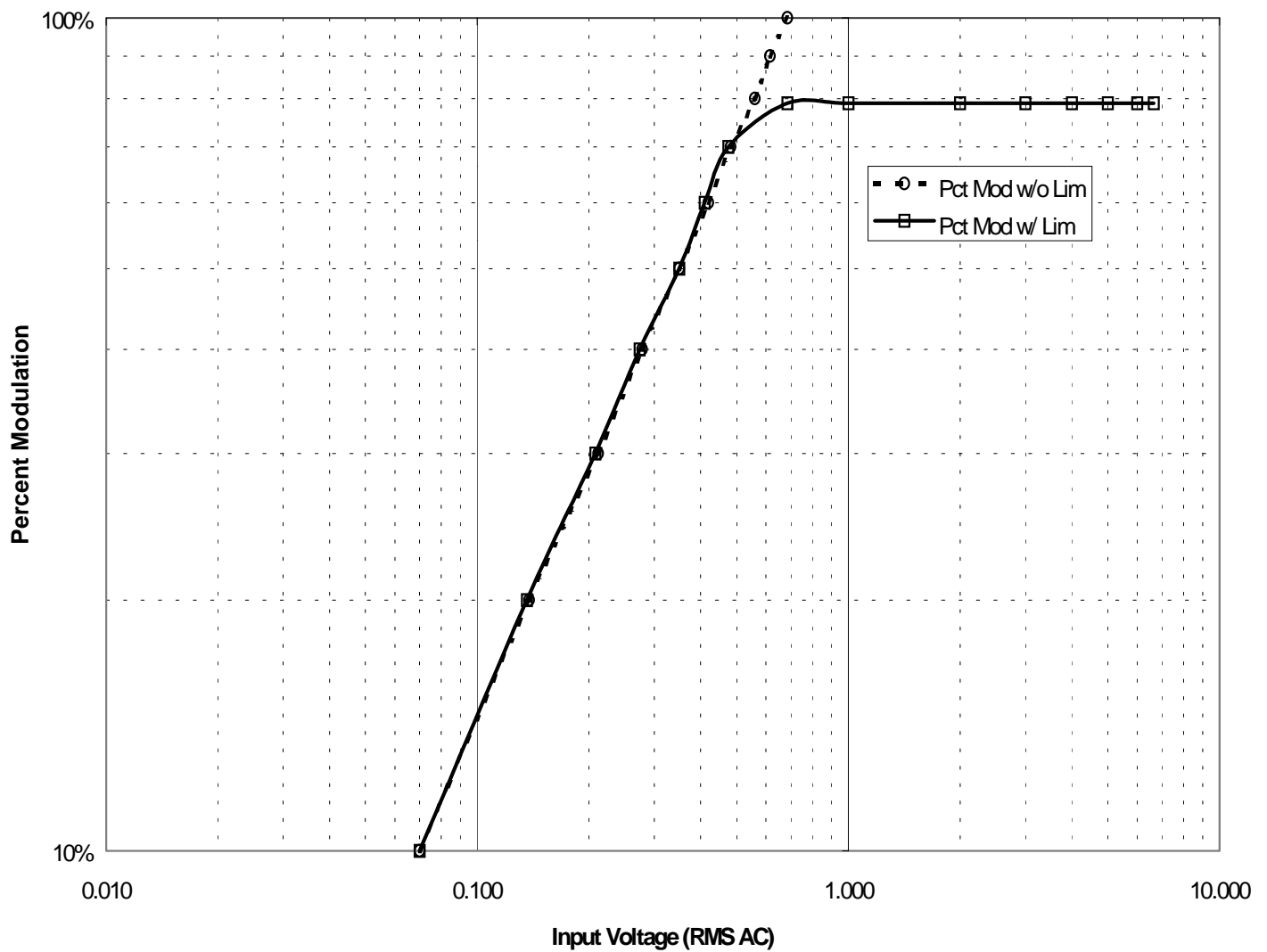
**GRAPHS TAKEN SHOWING THE FREQUENCY**

**RESPONSE OF THE**

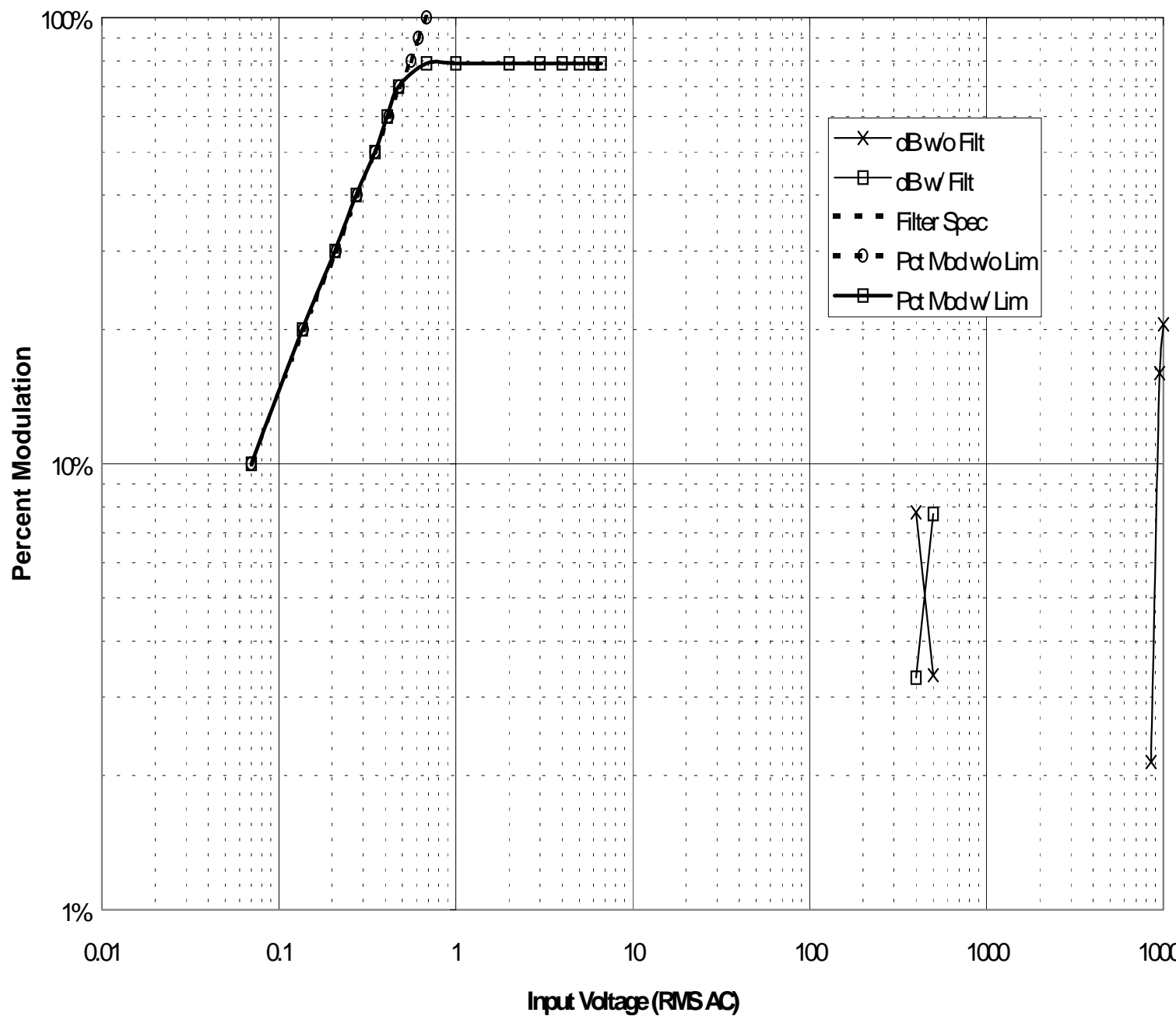
**AUDIO MODULATING CIRCUIT**

**PART 2.1047**

### MODULATION FREQUENCY RESPONSE



## MODULATION FREQUENCY RESPONSE







## 8.0 OCCUPIED BANDWIDTH – PART 2.1049

The occupied bandwidth is that between the lower and upper limits of the signal where the mean power is 99.0% of the total mean power and measured under the following conditions:

As stated in Part 2.1049 c-1 the Highway Information System DRTXM2 Transmitter was modulated by a 2500 Hz tone at an input level 16 dB greater than that necessary to produce 50 percent modulation. This input level was established at the frequency of maximum response of the audio modulating circuit.

The allowed radiated emissions for transmitters operating in the 530 kHz to 1700 kHz bands for Highway Information System DRTXM2 Transmitter equipment is found under Part 90, Section 90.210 (b) for Travelers' Information Stations.

Per Herbert Zeiler of the FCC, the maximum authorized bandwidth shall be 6 kHz for the Travelers' Information Stations.

**NOTE:** See the following pages for the graphs of the actual measurements made

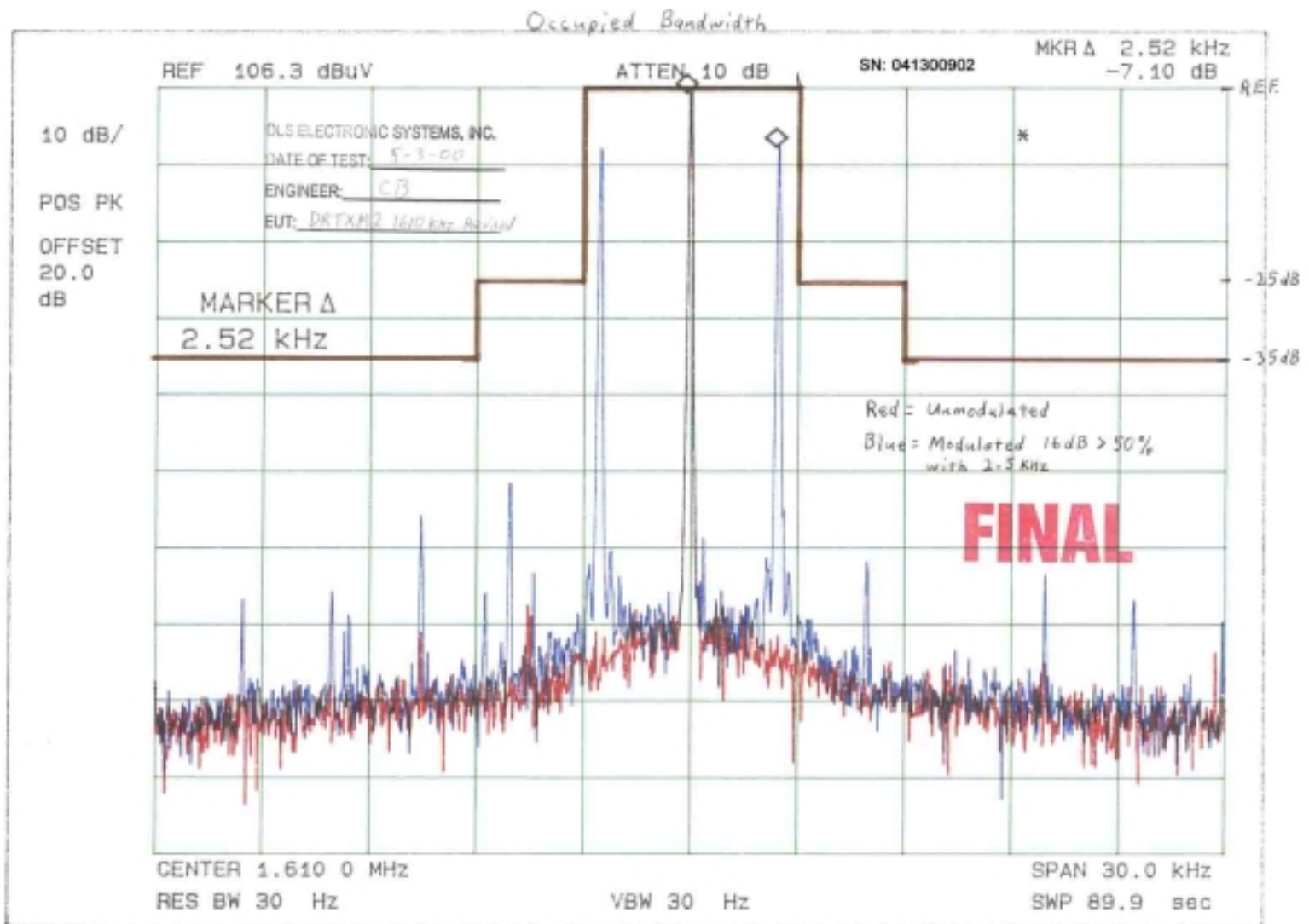


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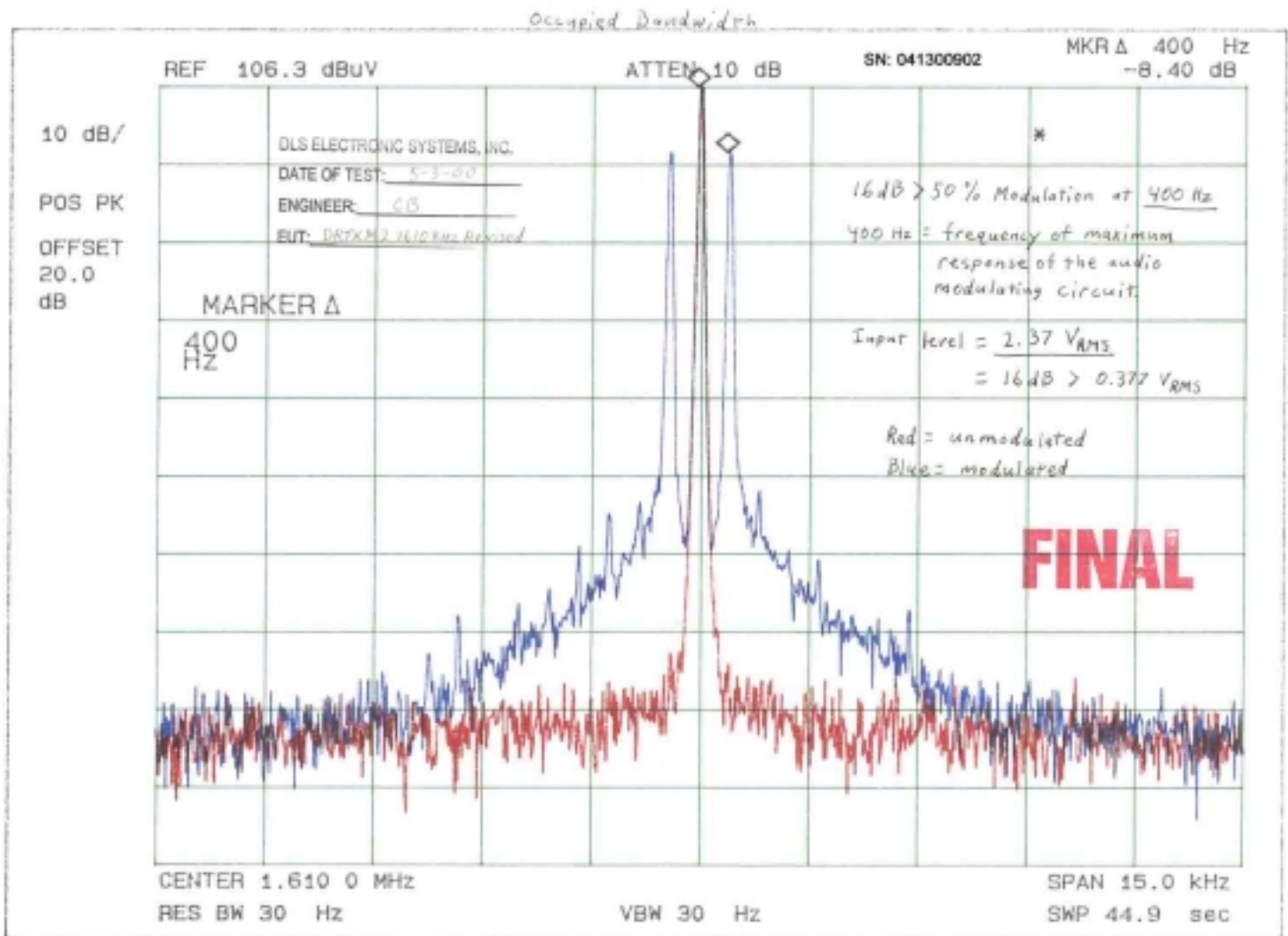
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## **GRAPHS TAKEN OF THE OCCUPIED BANDWIDTH**

### **PART 2.1049**

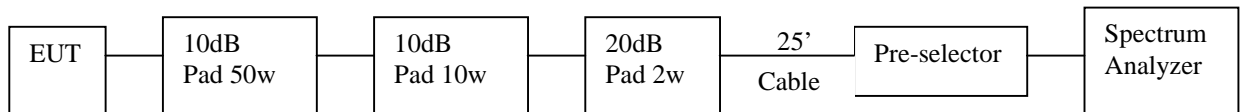






9.0 SPURIOUS CONDUCTED EMISSION MEASUREMENTS AT ANTENNA TERMINALS  
PART 2.1051

Spurious conducted emissions were measured at the antenna terminals using an artificial load. Plots were made showing the amplitude of harmonic and spurious emissions with the equipment operated as specified in 2.1049(c)(1). Measurements were made up to the 124 harmonic of the fundamental. The following setup was used showing placement of the attenuators:



The limit for conducted emissions at the antenna terminal is stated in Part 90, Section 90.210, Paragraph b-3. It states the power of any emission shall be below the unmodulated carrier power on any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: at least  $43 + 10 \cdot \log_{10}(\text{power in watts})$  dB.

**NOTE:** See the following pages for the data and graphs of the actual measurements made:



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**CONDUCTED EMISSION DATA TAKEN FOR**

**SPURIOUS EMISSION MEASUREMENTS MADE**

**AT THE ANTENNA TERMINALS**

**PART 2.1051**



## SUMMARY DATA SHEET OF **OUT-OF-BAND** CONDUCTED EMISSIONS

TEST DATE:----- May 23, 2000  
MANUFACTURER:----- Highway Information Systems, Inc.  
MODEL NO:----- DRTXM2  
S/N:----- 051900907 & 041300902  
CONFIGURATION:----- **530 kHz New Filter**  
DETECTOR:----- **QUASI-PEAK**

TEST SPECIFICATION: FCC "RULES AND REGULATION", PART 90  
SUBPART I / SECTION 90.201

### \*\*\*\***LOW POWER AUXILIARY STATIONS**\*\*\*\*

TEST EQUIPMENT: Spectrum Analyzer ----- HP 8566B  
Quasi Peak Adapter ----- HP 85650A  
TYPE OF TEST: MEASUREMENTS MADE AT THE ANTENNA TERMINALS

THE FOLLOWING ARE SIGNIFICANT CONDUCTED LEVELS FOUND:

FREQ IN MHz.	MEASURED dBuV	CABLE & PAD LOSSES	TOTAL dB	LIMIT dB	MARGIN dB
1.28	41.60	39.60	81.20	94.00	12.80
1.60	45.70	39.60	85.30	94.00	8.70
73.25	35.97	40.83	76.80	94.00	17.20





## SUMMARY DATA SHEET OF **OUT-OF-BAND** CONDUCTED EMISSIONS

TEST DATE:----- May 3, 2000  
MANUFACTURER:----- Highway Information Systems, Inc.  
MODEL NO:----- DRTXM2  
S/N:----- 051900907 & 041300902  
CONFIGURATION:----- **1610 kHz New Filter**  
DETECTOR:----- **QUASI-PEAK**

TEST SPECIFICATION: FCC "RULES AND REGULATION", PART 90  
SUBPART I / SECTION 90.201

### \*\*\*\***LOW POWER AUXILIARY STATIONS**\*\*\*\*

TEST EQUIPMENT: Spectrum Analyzer ----- HP 8566B  
Quasi Peak Adapter ----- HP 85650A

TYPE OF TEST: MEASUREMENTS MADE AT THE ANTENNA TERMINALS

THE FOLLOWING ARE SIGNIFICANT CONDUCTED LEVELS FOUND:

FREQ IN MHz.	MEASURED dBuV	CABLE & PAD LOSSES	TOTAL dB	LIMIT dB	MARGIN dB
3.23	47.60	39.90	87.50	94.00	6.50
4.84	49.00	40.10	89.10	94.00	4.90
74.23	38.60	40.80	79.40	94.00	14.60



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**CONDUCTED EMISSION GRAPHS TAKEN FOR**

**SPURIOUS EMISSION MEASUREMENTS MADE**

**AT THE ANTENNA TERMINALS**

**PART 2.1051**

