



Company: Highway Information Systems, Inc.

Model Tested: DRTXM3

Report Number: 9982

1250 Peterson Drive, Wheeling, Illinois 60090

TEST SPECIFICATION:

**FCC "Rules and Regulations", Part 90, Subpart J**

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 DRTXM3 Transmitter                                                              |
| Kind of Equipment:   | Transmitter                                                                                                |
| Test Configuration:  | DRTXM3 Transmitter connect to the GPS-1 Synchronizer via a Circular Cable, powered by 12 vdc Bench Supply. |
| Emission Designator: | 6K00A3E                                                                                                    |
| Transmitter FCC ID:  | O2Q-DRTXM3                                                                                                 |
| FCC Equipment Type:  | TIS Low Power AM Transmitter                                                                               |
| Model Number:        | DRTXM3                                                                                                     |
| Serial Number:       | DRTXM3-0001                                                                                                |
| Dates of Test:       | January 2, 3, & 6, 2003                                                                                    |
| Test Conducted For:  | Highway Information Systems, Inc.<br>4021 Stirrup Creek Drive, Suite 100<br>Durham, North Carolina 27703   |

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## SIGNATURE PAGE

Report Written By:

A handwritten signature in black ink that reads "Arnom C. Rowe".

Arnom C. Rowe  
Test Engineer  
EMC-001375-NE

Report Reviewed by:

A handwritten signature in black ink that reads "William Stumpf".

William Stumpf  
OATS Manager

Report Approved by:

A handwritten signature in black ink that reads "Brian J. Mattson".

Brian J. Mattson  
General Manager

Company Official:

Highway Information Systems, Inc.



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**NVLAP Certificate of Accreditation available upon request.**



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## 1.0 SUMMARY OF TEST REPORT

It was found that the Highway Information System DRTXM3 Transmitter, S/N: DRTXM3-0001 **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.

## 2.0 INTRODUCTION

On January 2, 3, & 6, 2003, a series of radio frequency interference measurements were performed on the Highway Information System DRTXM3 Transmitters, S/N: DRTXM3-0001. 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 the Highway Information System DRTXM3 Transmitter manufactured by Highway Information Systems, Inc

## 3.0 OBJECT

The purpose of this series of tests was to verify whether the transmitter meets the requirements for conducted spurious emissions as specified in Part 90.242 of the FCC "Rules and Regulations".

## 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.

See the following pages for the tests run and the configurations of each test mode.



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Report Number: 9982

1250 Peterson Drive, Wheeling, Illinois 60090

Highway Information Systems, Inc

4021 Stirrup Creek Dr. Suite 100

Durham, NC 27703 USA

Tel 800.849.4447

Fax 800.849.2947

18 December 2002

Rev 1.0

## **1. Model GPS-1 Operating Modes for Testing**

### **1.1 Summary of Frequency Control Operating Modes**

The GPS synchronization system has several frequency control modes to ensure continuous operation of the system even when the mode of being fully locked to GPS time is not available. The following subsections describe these modes starting with the system operating in the fully-locked mode and continuing sequentially to the transmitter operating in stand-alone mode.

#### **1.1.1 Fully-Locked Mode (Test Mode #1)**

In the fully-locked mode, the precision oscillator in the GPS receiver is phase locked to timing signals coming from the GPS satellites. Both the GPS 10 MHz and GPS 1 PPS signals from the internal oscillator are processed by the synchronizer circuit so that the GPS local oscillator is phase locked to GPS time. The RF timing signals derived from the local oscillator are fed to the transmitter and control the RF driver so that the RF power output is phase locked to the GPS time, as desired.

#### **1.1.2 Operating Mode Without GPS-1 Synchronizer Signal to Transmitter (Test Mode #2)**

If the frequency control signals from the GPS-1 synchronizer are not present at the transmitter, the GPS interface adapter board automatically switches over to the transmitter's local oscillator. Operation in this mode is indicated by the front-panel "Transmitter Lock" LED being off. In this mode the phase of the system will drift so that there may be a waffling sound depending on the frequency error of the DRTXM3 local oscillator.

FOR TESTING PURPOSES THE OPERATING MODE WITHOUT GPS-1 SYNCHRONIZER SIGNAL TO TRANSMITTER CAN BE ACHIEVED BY DISCONNECTING THE FRONT PANEL CIRCULAR CONNECTOR ON THE GPS-1 LABELED "OUTPUT TO TRANSMITTER."



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#### 1.1.3 Operating Mode Without 1 PPS Timing Signal **(Test Mode #3)**

If the 1 PPS timing signal is not present, the system continues to operate at a *frequency* that is exactly locked to GPS time, but it may not be operating at a *phase* exactly locked to GPS time. Operation in this mode is indicated by the front-panel "GPS 1 PPS" LED being off. Operating in this mode will produce only a slight change in overall system operation. This change will be that the exact geographical locations of the nodes in the overlap region between two transmitters will be different from the positions when the phase is exactly locked. In general the positions of these nodes will remain fixed until the power to the GPS-1 is turned off and then back on again.

FOR TESTING PURPOSES THE OPERATING MODE WITHOUT 1 PPS TIMING SIGNAL CAN BE ACHIEVED BY OPENING THE CABINET OF THE GPS-1 AND DISCONNECTING THE COAXIAL CABLE FROM THE 1 PPS JACK ON THE TRIMBLE TIMING RECEIVER.

#### 1.1.4 Operating Mode Without 10 MHz Timing Signal **(Test Mode #4)**

If the 10 MHz timing signal from the GPS timing receiver is not present, the system automatically switches over to the local oscillator in the GPS-1 Synchronizer. Operation in this mode is indicated by the front-panel "GPS 10 MHz" LED being off. The frequency error in this mode will be on the order of  $10^{-6}$  or less. In this mode the phase of the system will drift so that there may be a waffling sound depending on the frequency error of the GPS-1 local oscillator,

FOR TESTING PURPOSES THE OPERATING MODE WITHOUT 10 MHz TIMING SIGNAL CAN BE ACHIEVED BY OPENING THE CABINET OF THE GPS-1 AND DISCONNECTING THE COAXIAL CABLE FROM THE 10 MHz JACK ON THE TRIMBLE TIMING RECEIVER.



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#### 1.1.5 Operating Mode Without Satellite Reception (**Test Mode #5**)

If there is no satellite reception, the system will continue to operate with the frequency and phase controlled by the ovenized oscillator in the GPS receiver. Operation in this mode can be detected by running the Trimble monitor program through the front panel RS-232C port. The frequency error in this mode will be on the order of  $10^{-8}$  or less. Depending on the frequency error, the phase of the system will drift slightly so that, for example, two transmitters might be in phase one minute and out of phase a few minutes later. This change will mean that the exact geographical locations of the nodes in the overlap region between two transmitters will move slowly, or alternatively, with an AM receiver fixed in place, the signal will drift slowing in and out of phase. In general, this will produce little audible difference except for the short period of time when the signals are exactly out of phase, at which point there may be some slight fuzziness to the audio signal.

FOR TESTING PURPOSES THE OPERATING MODE WITHOUT SATELLITE RECEPTION CAN BE ACHIEVED BY SHIELDING THE GPS ANTENNA FROM THE SATELLITE SIGNALS.



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## 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 DRTXM3 Transmitter was connected to a Spectrum Analyzer through suitable attenuation. All cables, connectors, and attenuators were calibrated prior to testing.

### **Actual Measurements Taken:**

107.27 dBuV Measured output of the transmitter  
+ 39.70 dB includes measured pads & cable loss  
146.97 dBuV equals 10 watts

### **LIMIT:**

Manufacturer's rated output power = 10 watts

### **MARGIN:**

10 watts – 10 watts = 0 watts

### **NOTE:**

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



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## **GRAPH(S) TAKEN OF THE RF POWER**

### **OUTPUT MEASUREMENT**

#### **PART 2.1046**

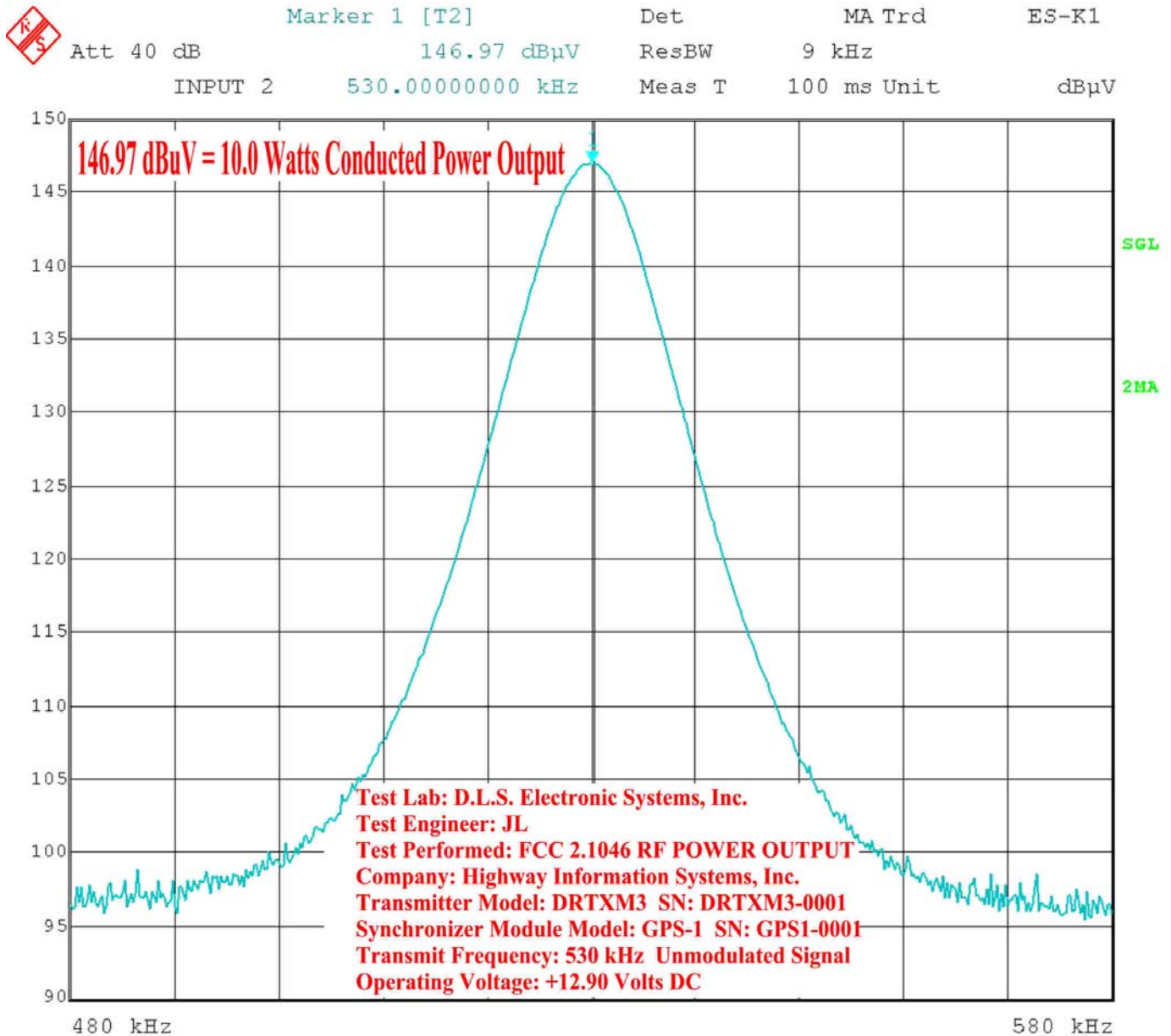


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Date: 4.FEB.2003 10:44:14



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## 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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Model Tested: DRTXM3

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**GRAPH(S) TAKEN SHOWING THE FREQUENCY**

**RESPONSE OF THE**

**AUDIO MODULATING CIRCUIT**

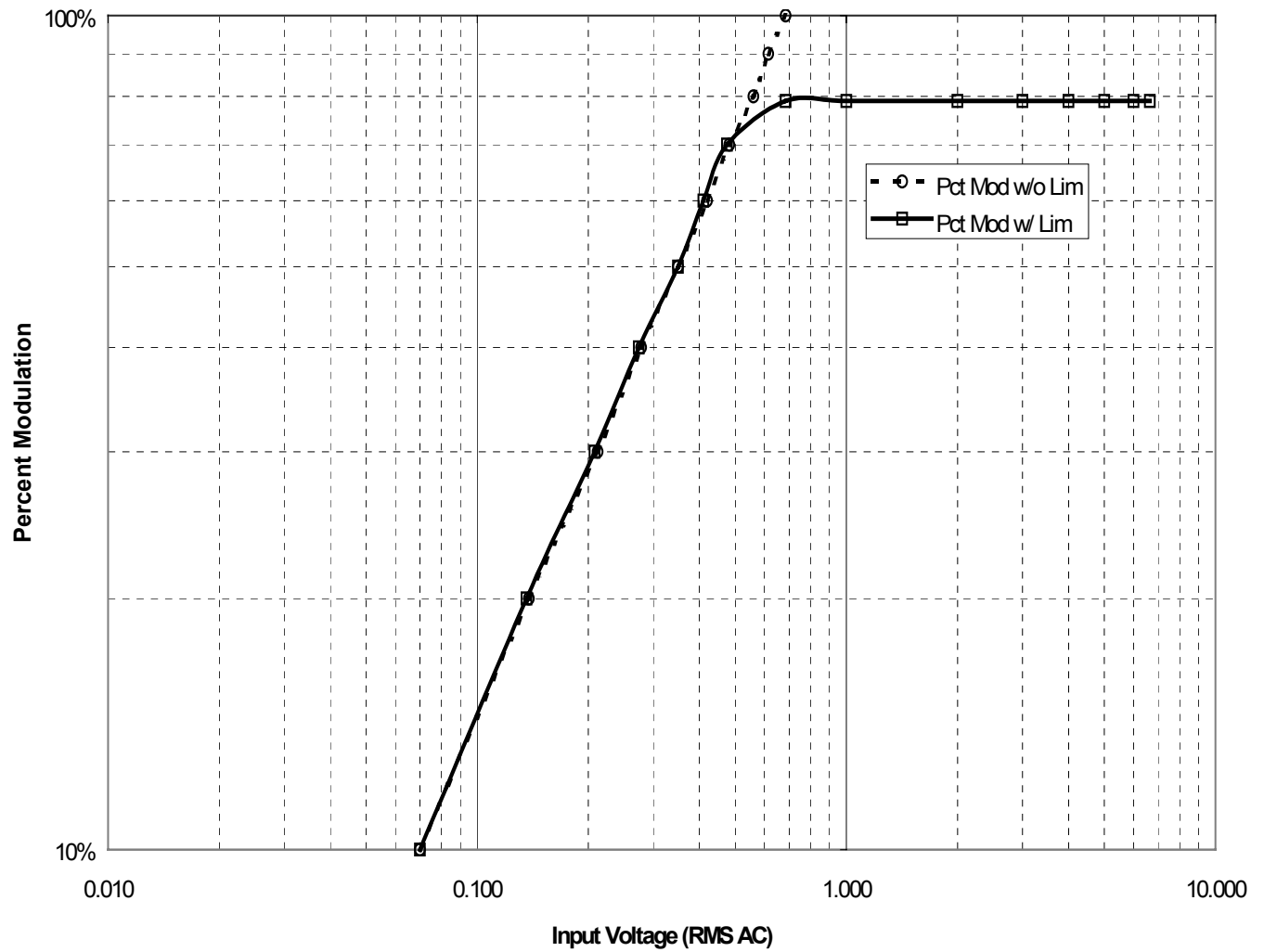
**PART 2.1047**



Company: Highway Information Systems, Inc.  
Model Tested: DRTXM3  
Report Number: 9982

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### MODULATION FREQUENCY RESPONSE

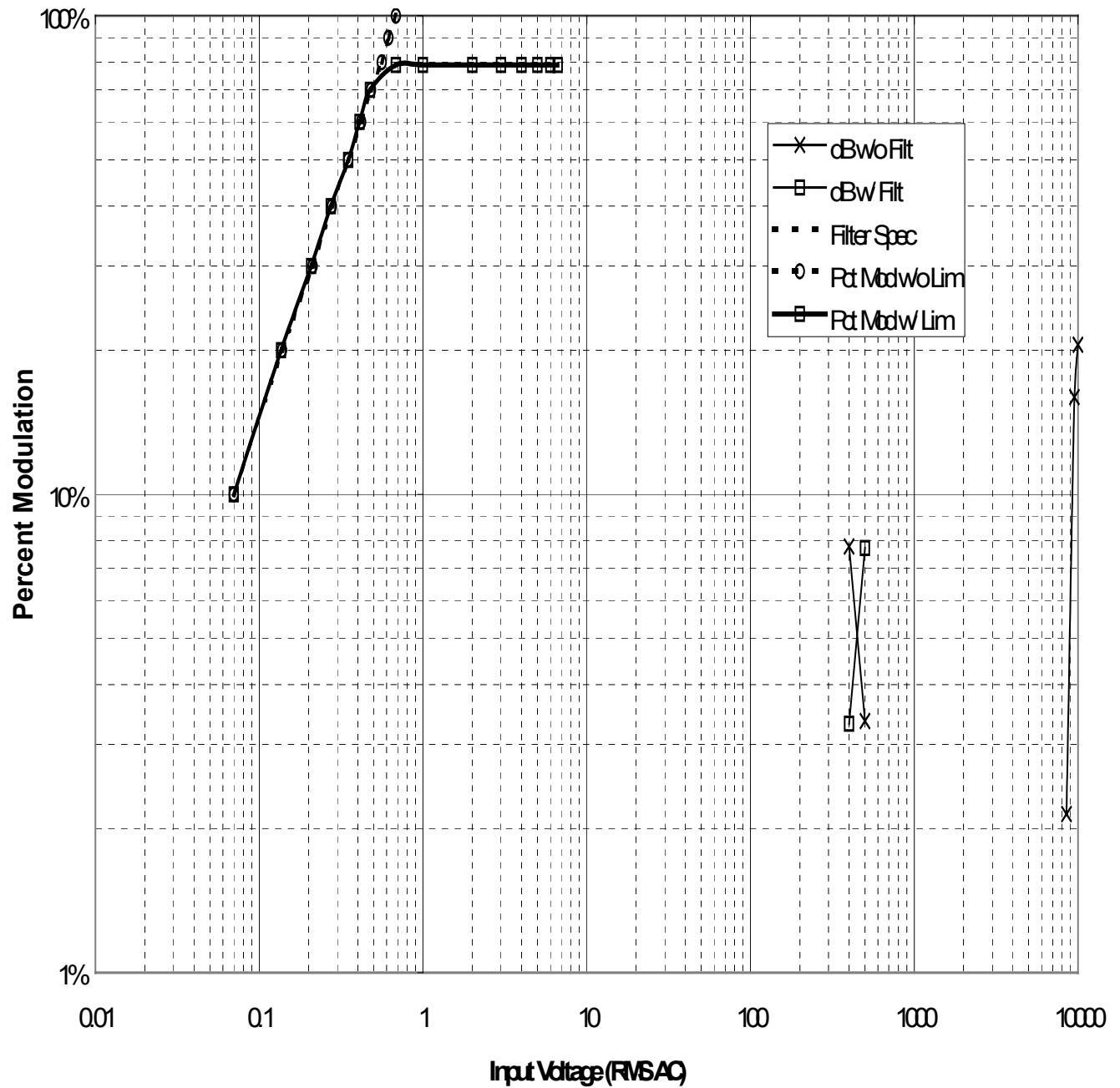




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Model Tested: DRTXM3  
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## MODULATION FREQUENCY RESPONSE





Company: Highway Information Systems, Inc.

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## 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 DRTXM3 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 DRTXM3 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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## **GRAPH(S) TAKEN OF THE OCCUPIED BANDWIDTH**

**PART 2.1049**

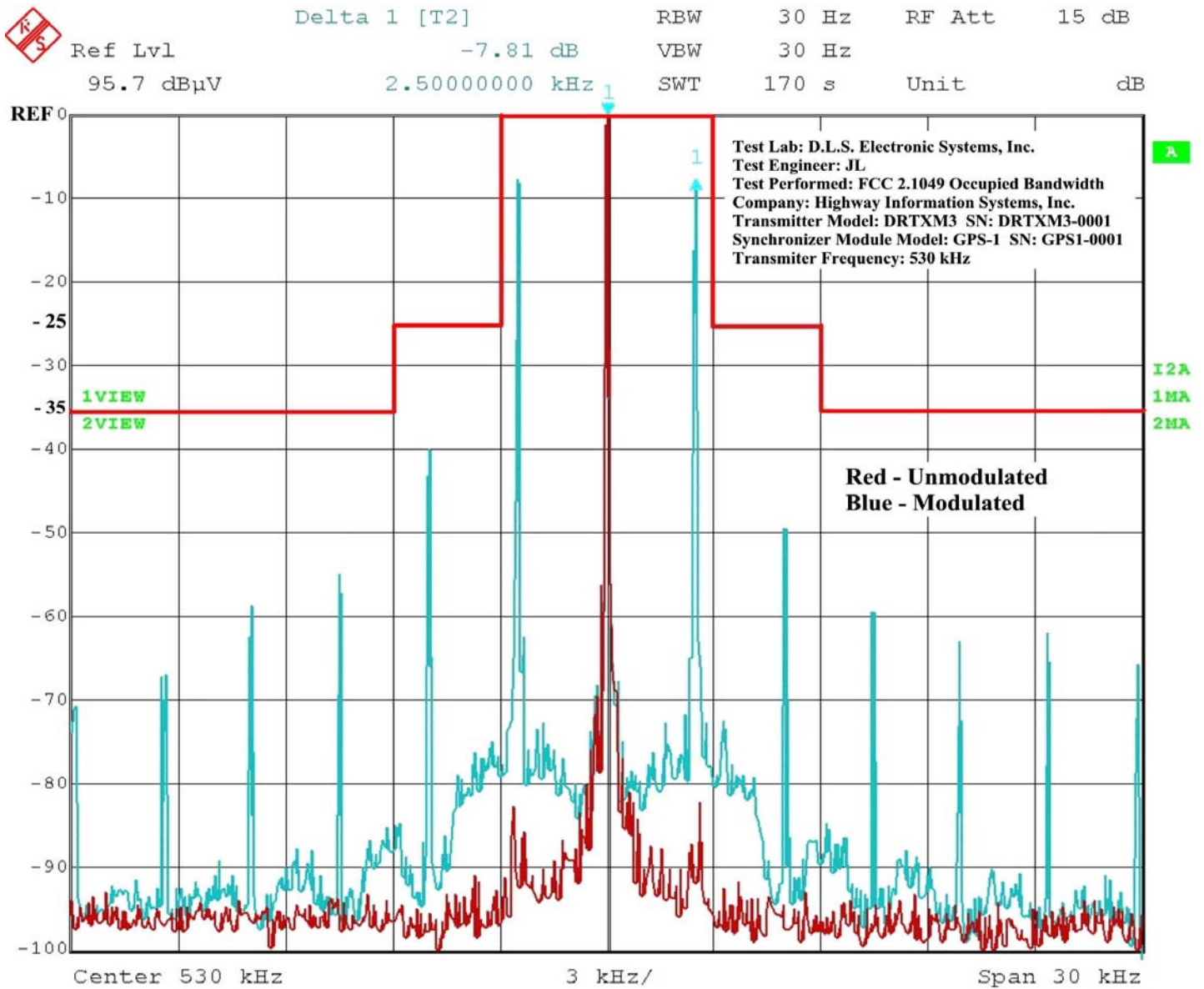


Company: Highway Information Systems, Inc.

Model Tested: DRTXM3

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Date: 2.JAN.2003 15:57:25

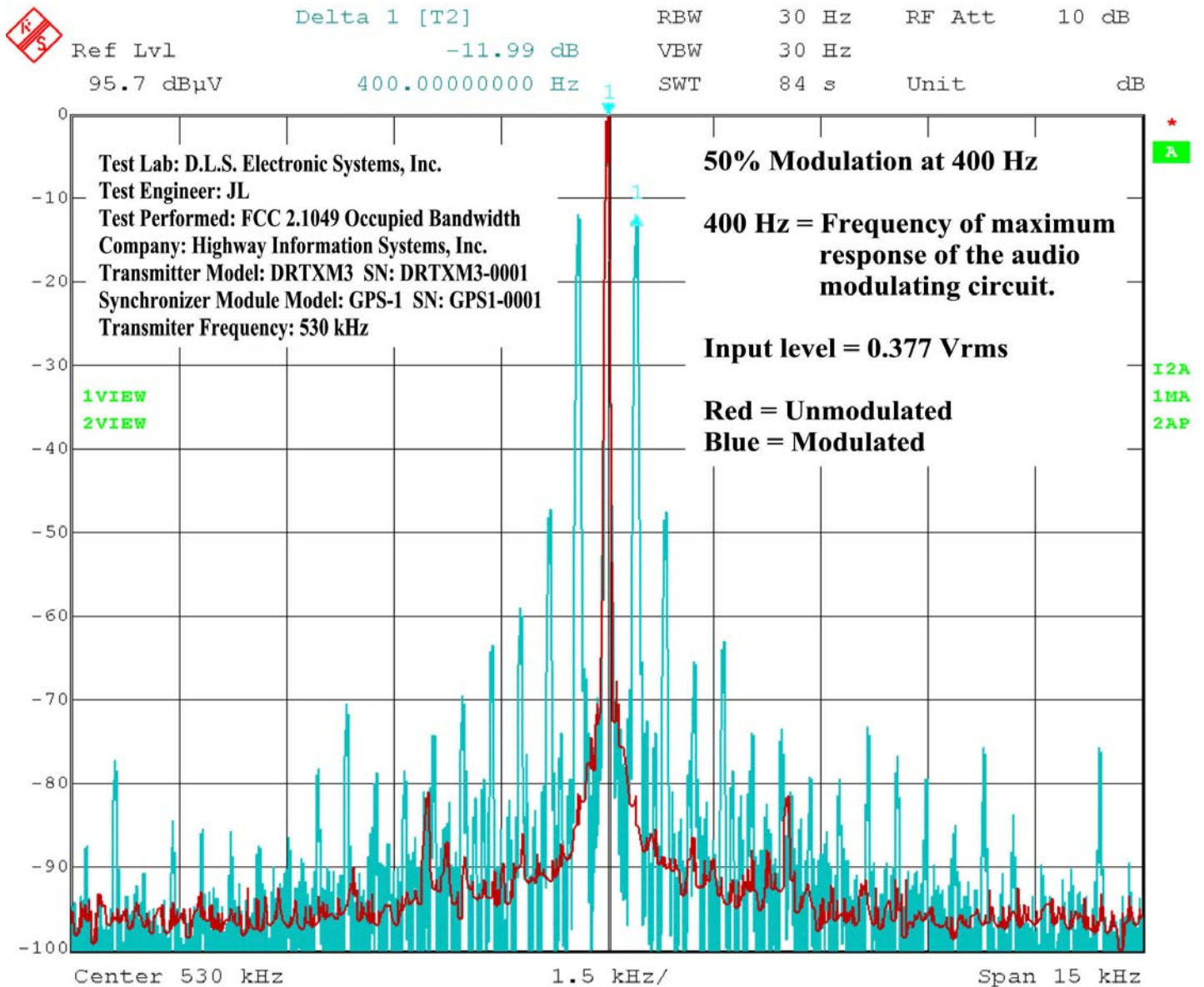


Company: Highway Information Systems, Inc.

Model Tested: DRTXM3

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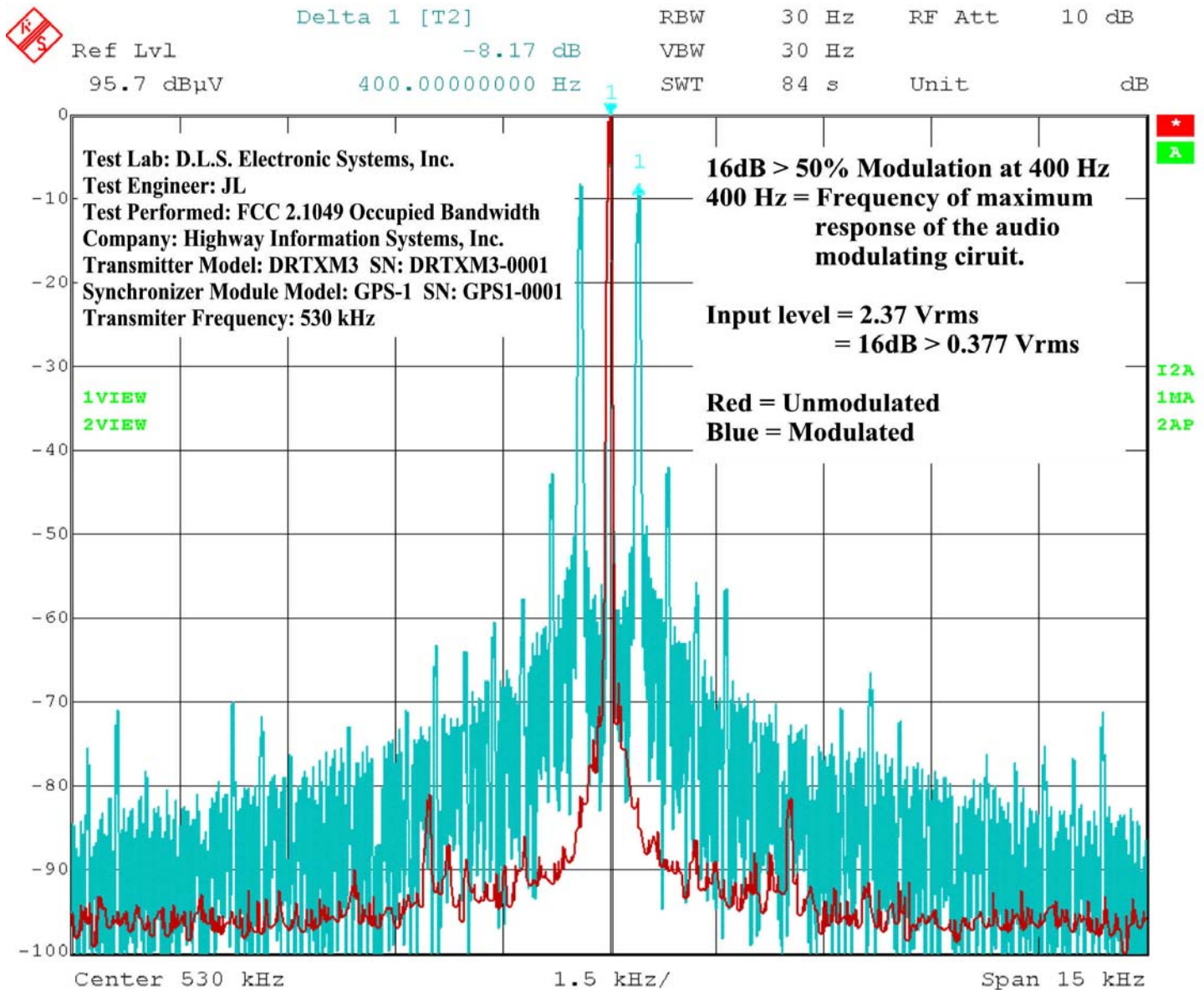
Date: 2.JAN.2003 15:25:58



Company: Highway Information Systems, Inc.  
Model Tested: DRTXM3

Report Number: 9982

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Date: 2.JAN.2003 15:39:50

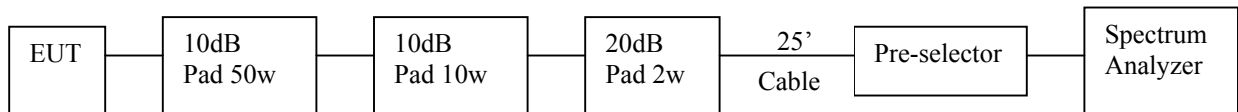


Company: Highway Information Systems, Inc.  
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#### 9.0 SPURIOUS CONDUCTED EMISSION MEASUREMENTS AT THE ANTENNA TERMINALS - PART 2.1051

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<sup>th</sup> 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 AND CHARTS TAKEN FOR**  
**SPURIOUS EMISSION MEASUREMENTS MADE**  
**AT THE ANTENNA TERMINALS**

**PART 2.1051**

**TEST MODES 1 - 5**



Company: Highway Information Systems, Inc.  
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## MODE 1 (Fully-Locked)

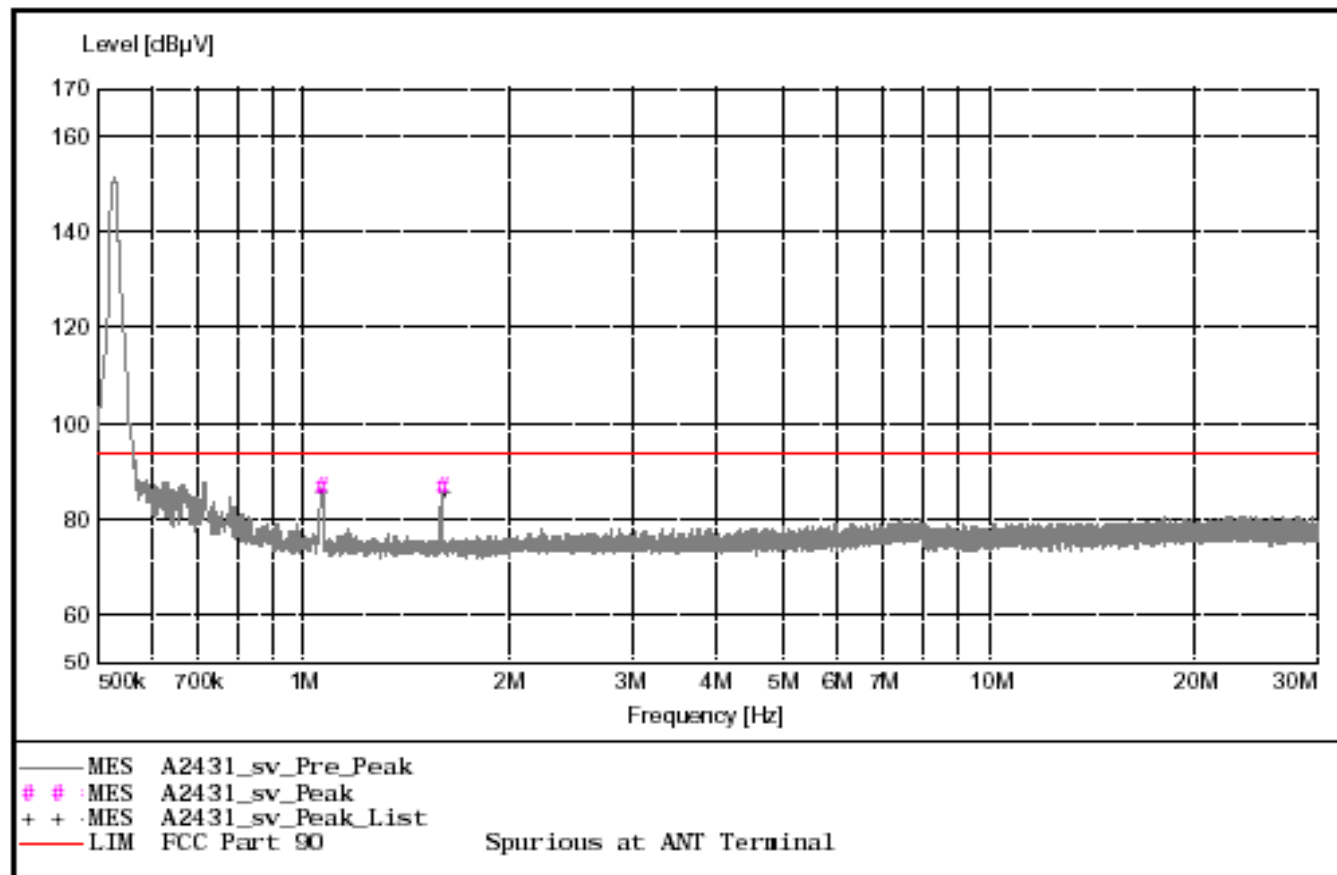
FCC part 2.1051 for FCC part 90 device

spurious emissions measured @ Antenna port

ELT: DRTXM3 (SN: DRTXM3-0001) & GPS-1 (SN: GPS-0001)  
Manufacturer: Highway Information Systems  
Operating Condition: 70 deg F; 25% R.H.  
Test Site: DLS (O.F) Site #1  
Operator: Jason L.  
Test Specification: Transmitter Model: DRTXM3 with Synchronizer Module: GPS-1  
Comment: TX Freq. 530 kHz; MOD 16dB above 50% MOD AT 2500 Hz  
Test Mode Configuration: Fully Locked (DATE:2-4-03)

TEXT: "FCC part 2.1051"

Short Description: Antenna Port Conducted  
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ES1 40 SN: 837808/006



## TEST MODE #1

MEASUREMENT RESULT: "A2431\_sv\_final"

| Frequency<br>MHz | Level<br>dBμV | Antenna<br>Factor<br>dBμV | System<br>Loss<br>dB | Total<br>Level<br>dBμV | Limit<br>dBμV | Margin<br>dB | Height<br>Ant.<br>m | Enf<br>Angle<br>deg | Final<br>Detector | Comment |
|------------------|---------------|---------------------------|----------------------|------------------------|---------------|--------------|---------------------|---------------------|-------------------|---------|
| 1.060000         | 16.37         | 0.00                      | 70.3                 | 87                     | 94            | 7.4          | 0.00                | 0                   | MAX PEAK          | None    |
| 1.590000         | 16.24         | 0.00                      | 70.3                 | 87                     | 94            | 7.4          | 0.00                | 0                   | MAX PEAK          | None    |



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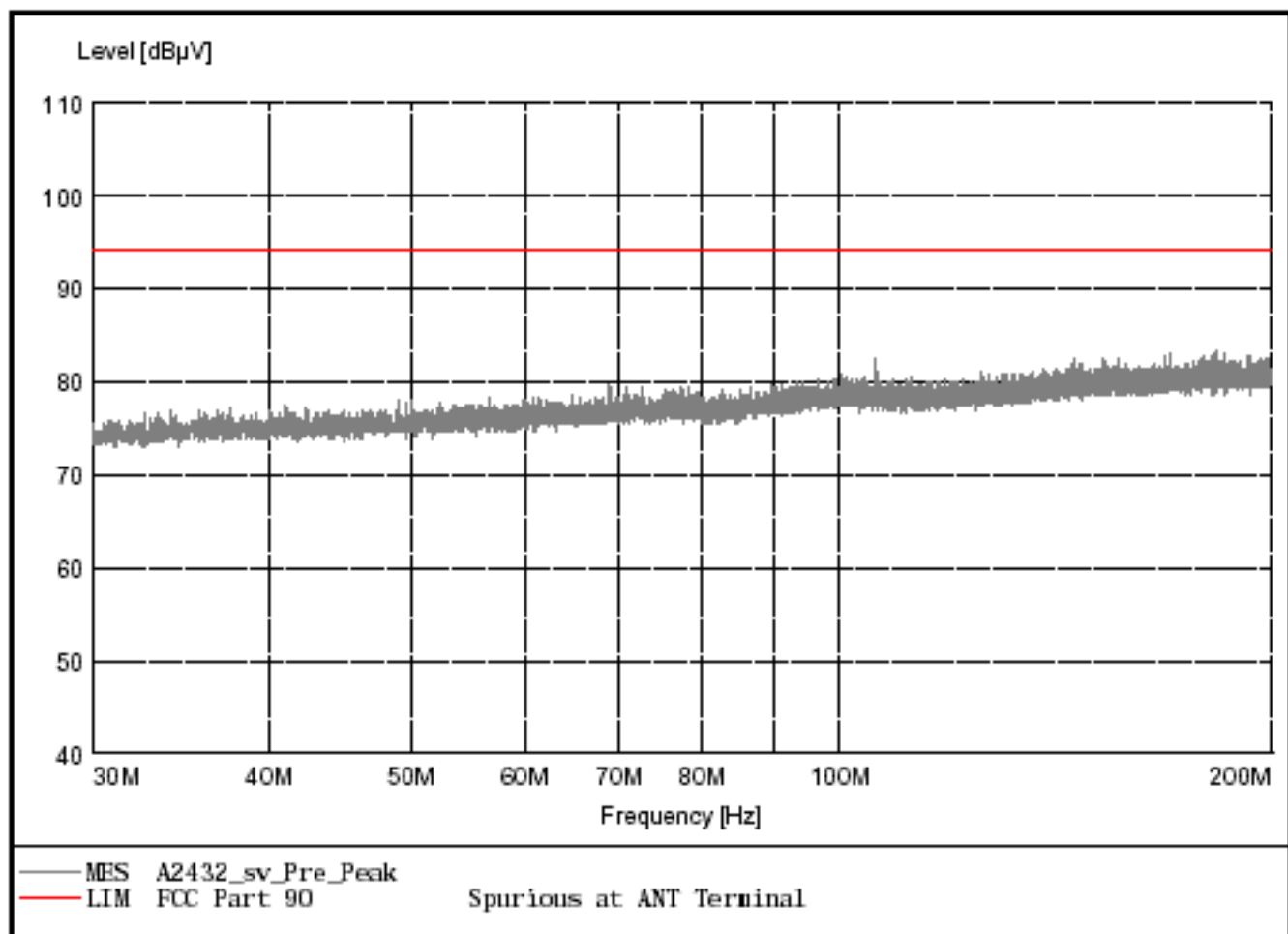
For Part 2.1051 For Part 90 device

spurious emissions measured @ Antenna Port

EUT: DRTXM3 (SN: DRTXM3-0001) & GPS-1 (SN: GPS-0001)  
Manufacturer: Highway Information Systems  
Operating Condition: 70 deg F; 26% R.H.  
Test Site: H.S. (D.F.) Site #1  
Operator: Jason L.  
Test Specification: Transmitter Model: DRTXM3 with Synchronizer Module: GPS-1  
Comment: TX Freq. 530 kHz; MOD 16dB above 50% MOD AT 2500 Hz  
Test Mode Configuration: Fully Locked (DATE:2-4-03)

TEXT: "FCC Part 2.1051"

Short Description: Antenna Port Conducted  
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/006



TEST MODE #1



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## MODE 2 Without GPS-1 Synchronizer Signal to Transmitter

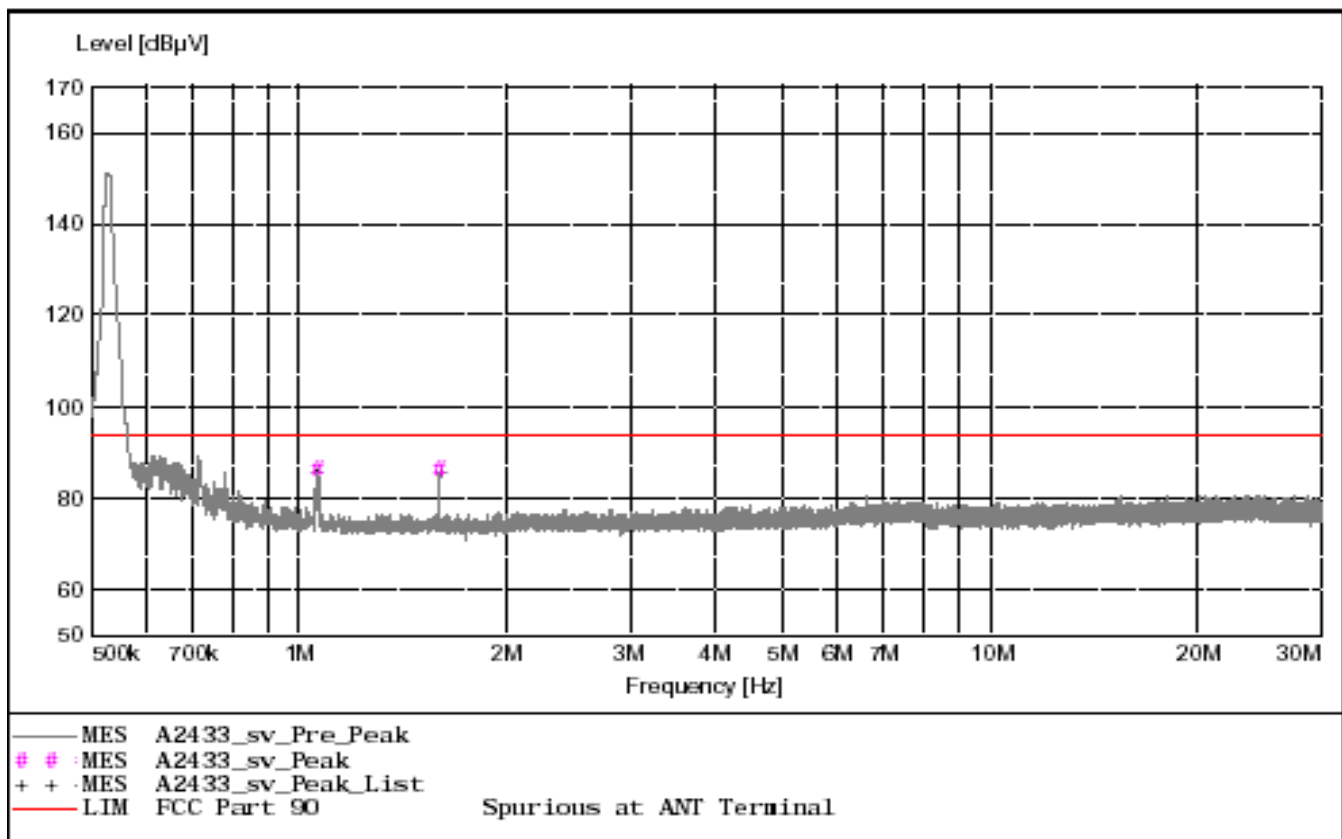
For part 2.1051 For FCC part 90 device

spurious emissions measured @ Antenna port

EUT: DRTXM3 (SN: DRTXM3-0001)  
Manufacturer: Highway Information Systems  
Operating Condition: 72 deg F; 26% R.H.  
Test Site: DLS (O.F) Site #1  
Operator: Jason L.  
Test Specification: Transmitter Model: DRTXM3  
Comment: TX Freq: 530 kHz; MOD 16dB above 50% MOD AT 2500 Hz  
Test Mode Configuration: Without GPS-1 (DATE:2-4-03)

TEXT: "FCC part 2.1051"

Short Description: Antenna Port Conducted  
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ES1 40 SN: 837808/006



## Test Mode #2

MEASUREMENT RESULT: "A2433\_sv\_Final"

2/4/03 12:47PM

| Frequency<br>MHz | Level<br>dBµV | Antenna<br>Factor<br>dBµV | System<br>Loss<br>dB | Total<br>Level<br>dBµV | Limit<br>dBµV | Margin<br>dB | Height<br>Ant.<br>m | EUT<br>Angle<br>deg | Final<br>Detector | Comment |
|------------------|---------------|---------------------------|----------------------|------------------------|---------------|--------------|---------------------|---------------------|-------------------|---------|
| 1.060000         | 16.37         | 0.00                      | 70.3                 | 87                     | 94            | 7.4          | 0.00                | 0                   | MAX PEAK          | None    |
| 1.590000         | 16.11         | 0.00                      | 70.3                 | 86                     | 94            | 7.5          | 0.00                | 0                   | MAX PEAK          | None    |



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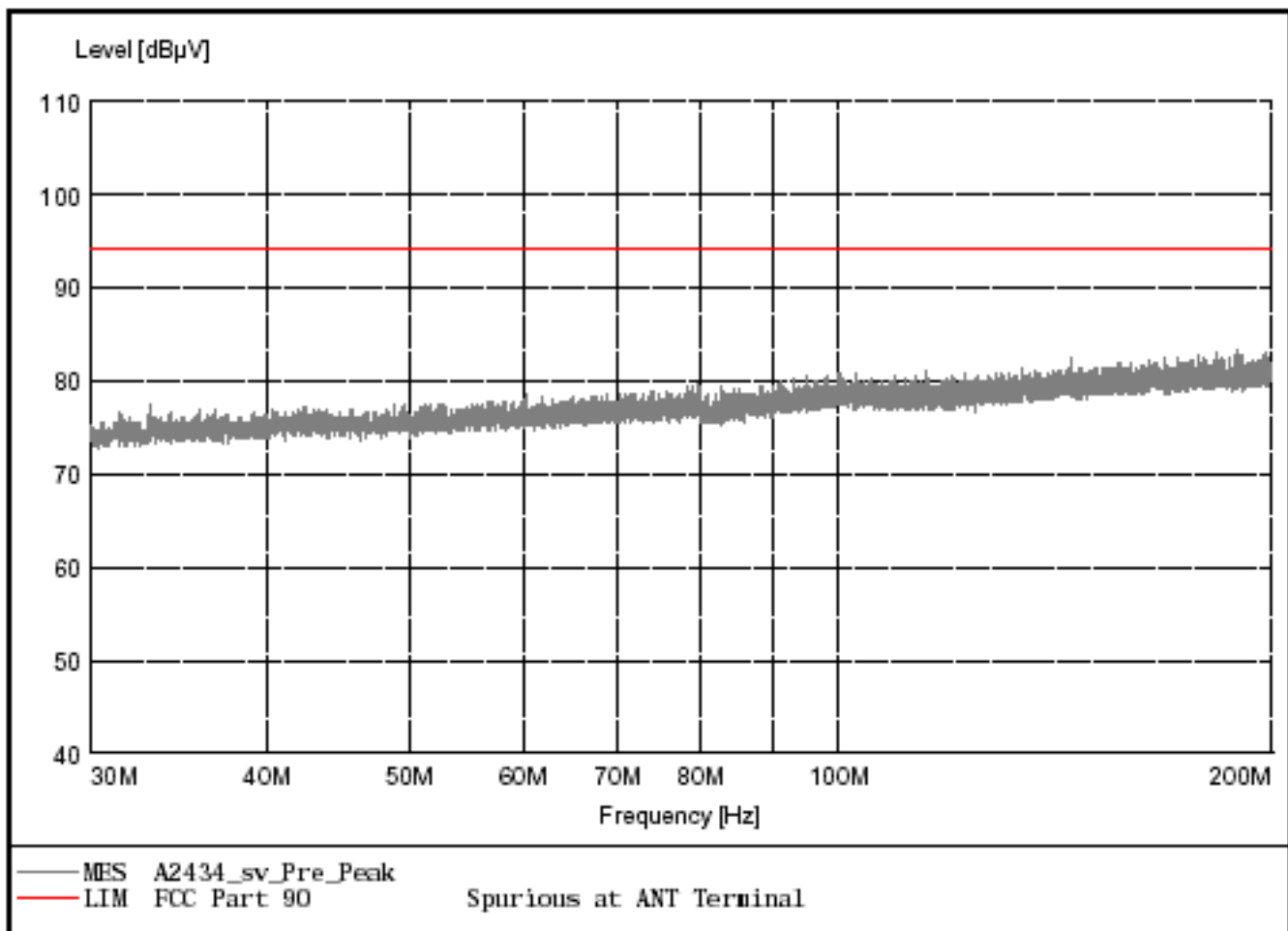
For part 2.1051 for for part 90 device

spurious emissions measured @ Antenna port

EUT: DRTXM3 (SN: DRTXM3-0001)  
Manufacturer: Highway Information Systems  
Operating Condition: 72 deg F; 26% R.H.  
Test Site: ILS (D.F) Site #1  
Operator: Jason L  
Test Specification: Transmitter Model: DRTXM3  
Comment: TX Freq: 530 kHz; MOD 16dB above 50% MOD AT 2500 Hz  
Test Mode Configuration: Without GPS-1 (DATE:2-4-03)

TEXT: "FCC Part 2.1051"

Short Description: Antenna Port Conducted  
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI-40 SN: 837808/006



TEST MODE #2



Company: Highway Information Systems, Inc.  
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### MODE 3 Without PPS Timing Signal

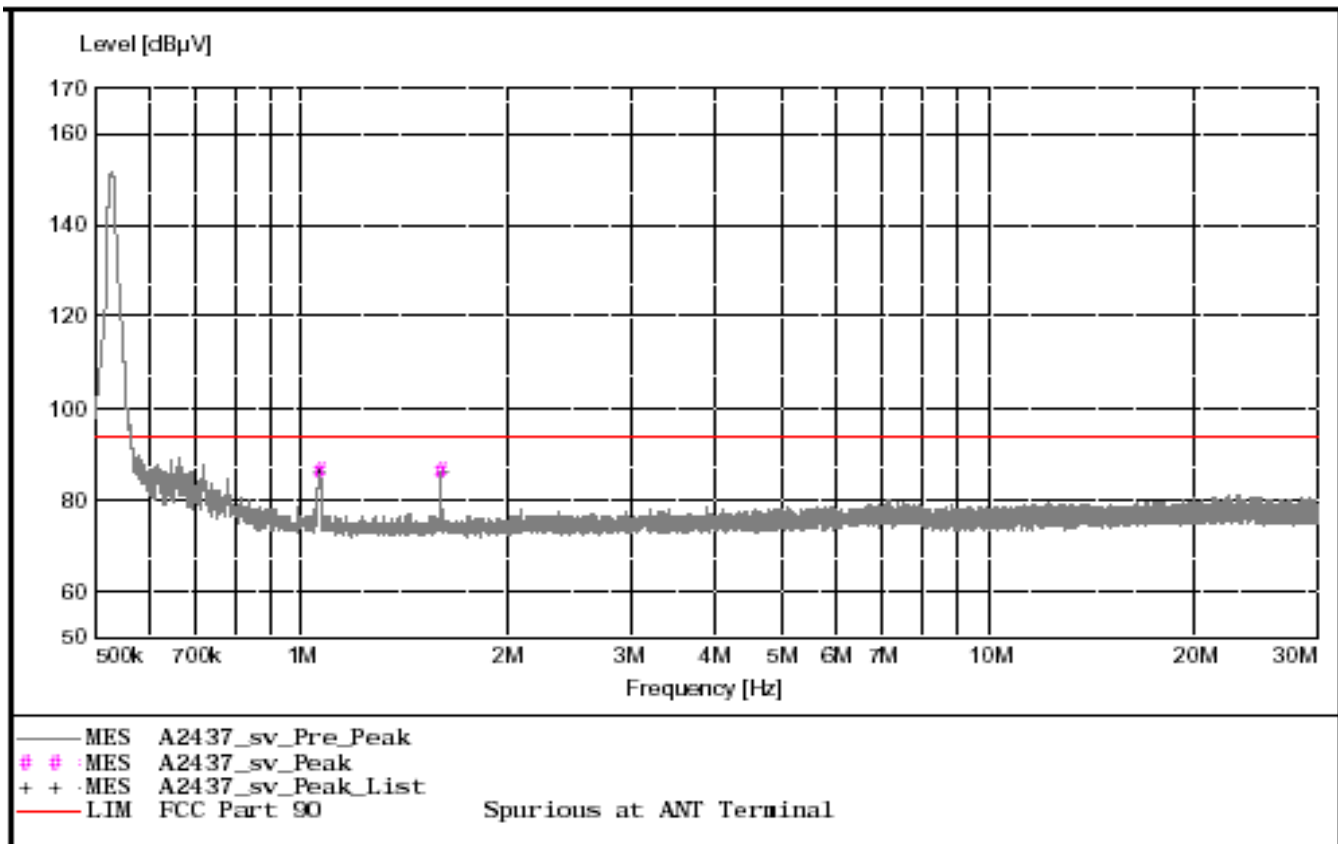
For part 2.1051 For For part 90 device

spurious emissions measured @ Antenna port

EUT: DRTXM3 (SN: DRTXM3-0001) & GPS-1 (SN: GPS-0001)  
Manufacturer: Highway Information Systems  
Operating Condition: 72 deg F; 27% R.H.  
Test Site: DLS (O.F) Site #1  
Operator: Jason L.  
Test Specification: Transmitter Model: DRTXM3 with Synchronizer Module: GPS-1  
Comment: TX Freq: 530 kHz; MOD 16dB above 50% MOD AT 2500 Hz  
Test Mode Configuration: Without 1 PPS Signal (DATE:2-4-03)

TEXT: "For part 2.1051"

Short Description: Antenna Port Conducted  
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ES1 40 SN: 837808/006



### TEST MODE #3

MEASUREMENT RESULT: "A2437\_sv\_final"

2/4/03 1:35PM

| Frequency<br>MHz | Level<br>dBμV | Antenna<br>Factor<br>dBμV | System<br>Loss<br>dB | Total<br>Level<br>dBμV | Limit<br>dBμV | Margin<br>dB | Height<br>Ant.<br>m | EUT<br>Angle<br>deg | Final<br>Detector | Comment |
|------------------|---------------|---------------------------|----------------------|------------------------|---------------|--------------|---------------------|---------------------|-------------------|---------|
| 1.590000         | 16.24         | 0.00                      | 70.3                 | 87                     | 94            | 7.4          | 0.00                | 0                   | MAX PEAK          | None    |
| 1.060000         | 16.11         | 0.00                      | 70.3                 | 86                     | 94            | 7.6          | 0.00                | 0                   | MAX PEAK          | None    |



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Report Number: 9982

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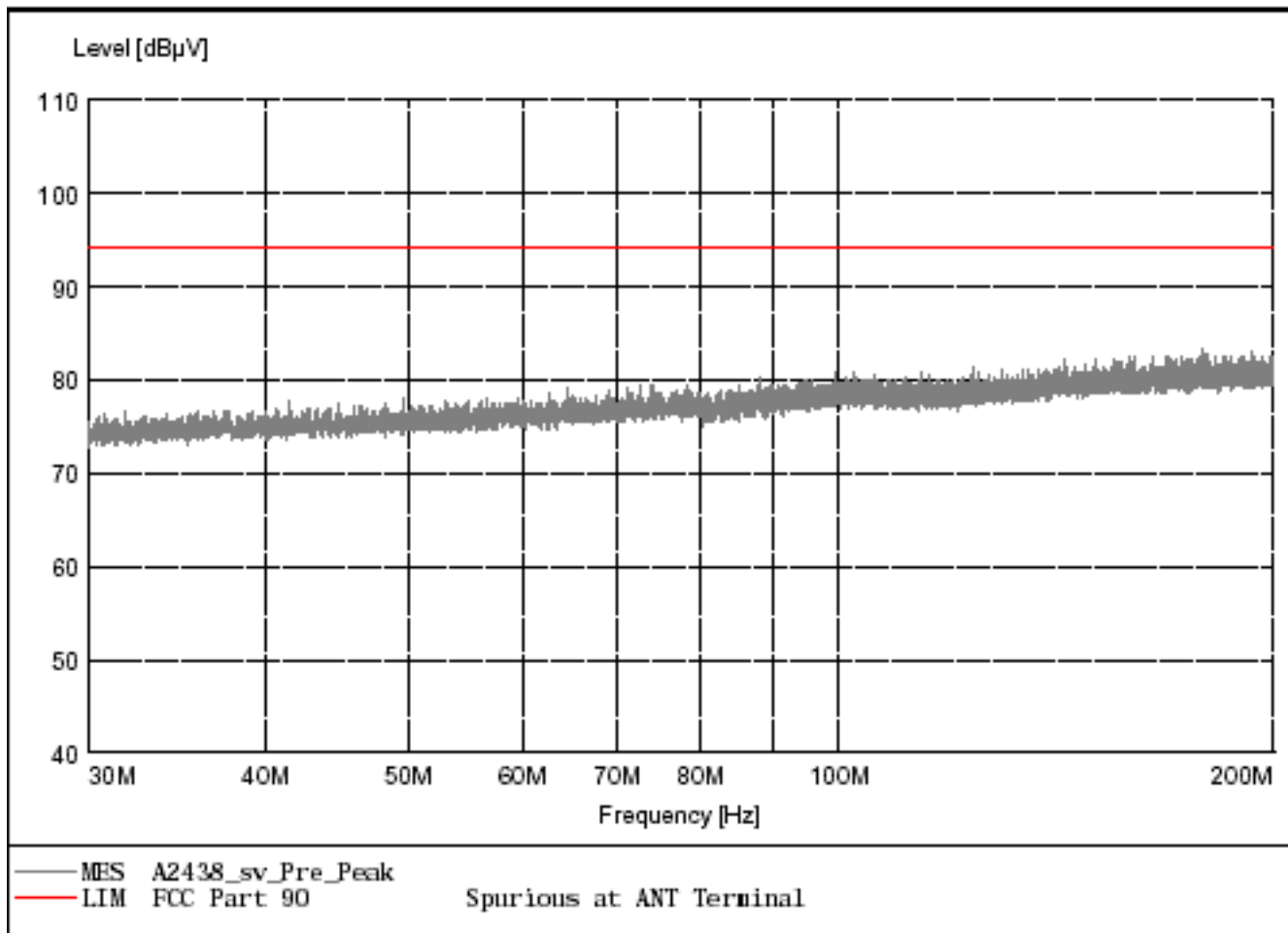
For part 2.1051 for for part 90 device

spurious emissions measured @ Antenna port

EUT: DRTXM3 (SN: DRTXM3-0001) & GPS-1 (SN: GPS-0001)  
Manufacturer: Highway Information Systems  
Operating Condition: 72 deg F; 27% R.H.  
Test Site: ILS (D.F) Site #1  
Operator: Jason L  
Test Specification: Transmitter Model: DRTXM3 with Synchronizer Module: GPS-1  
Comment: TX Freq. 530 kHz; MOD 16dB above 50% MOD AT 2500 Hz  
Test Mode Configuration: Without 1 PPS Signal (DATE:2-4-03)

TEXT: "FCC Part 2.1051"

Short Description: Antenna Port Conducted  
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/006



TEST MODE #3



Company: Highway Information Systems, Inc.  
Model Tested: DRTXM3  
Report Number: 9982

1250 Peterson Drive, Wheeling, Illinois 60090

## MODE 4 Without 10 MHz Timing Sinal

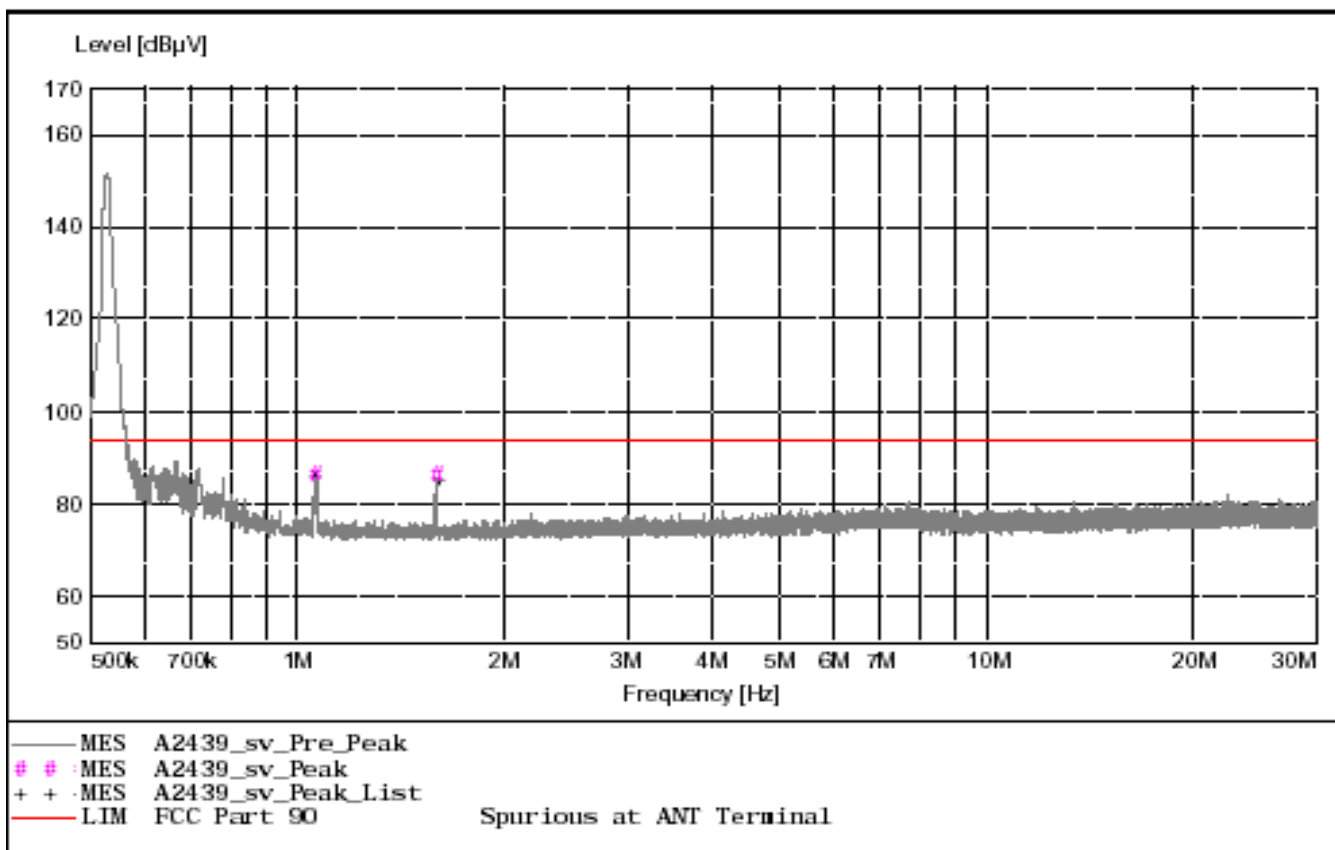
For part 2.1051 For For part 90 device

spurious emissions measured @ Antenna port

EUT: DRTXM3 (SN: DRTXM3-0001) & GPS-1 (SN: GPS-0001)  
Manufacturer: Highway Information Systems  
Operating Condition: 71 deg F; 27% R.H.  
Test Site: DLS (D.F) Site #1  
Operator: Jason L.  
Test Specification: Transmitter Model: DRTXM3 with Synchronizer Module: GPS-1  
Comment: TX Freq: 530 kHz; MOD 16dB above 50% MOD AT 2500 Hz  
Test Mode Configuration: Without 10 MHz Signal (DATE:2-4-03)

TEXT: "FCC Part 2.1051"

Short Description: Antenna Port Conducted  
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ES1 40 SN: 837808/006



## TEST MODE #4

MEASUREMENT RESULT: "A2439\_sv\_Final"

2/4/03 2:21PM

| Frequency<br>MHz | Level<br>dBµV | Antenna<br>Factor<br>dBµV | System<br>Loss<br>dB | Total<br>Level<br>dBµV | Limit<br>dBµV | Margin<br>dB | Height<br>Ant.<br>m | EUT<br>Angle<br>deg | Final<br>Detector | Comment |
|------------------|---------------|---------------------------|----------------------|------------------------|---------------|--------------|---------------------|---------------------|-------------------|---------|
| 1.060000         | 16.50         | 0.00                      | 70.3                 | 87                     | 94            | 7.2          | 0.00                | 0                   | MAX PEAK          | None    |
| 1.590000         | 16.24         | 0.00                      | 70.3                 | 87                     | 94            | 7.4          | 0.00                | 0                   | MAX PEAK          | None    |



Company: Highway Information Systems, Inc.  
Model Tested: DRTXM3  
Report Number: 9982

1250 Peterson Drive, Wheeling, Illinois 60090

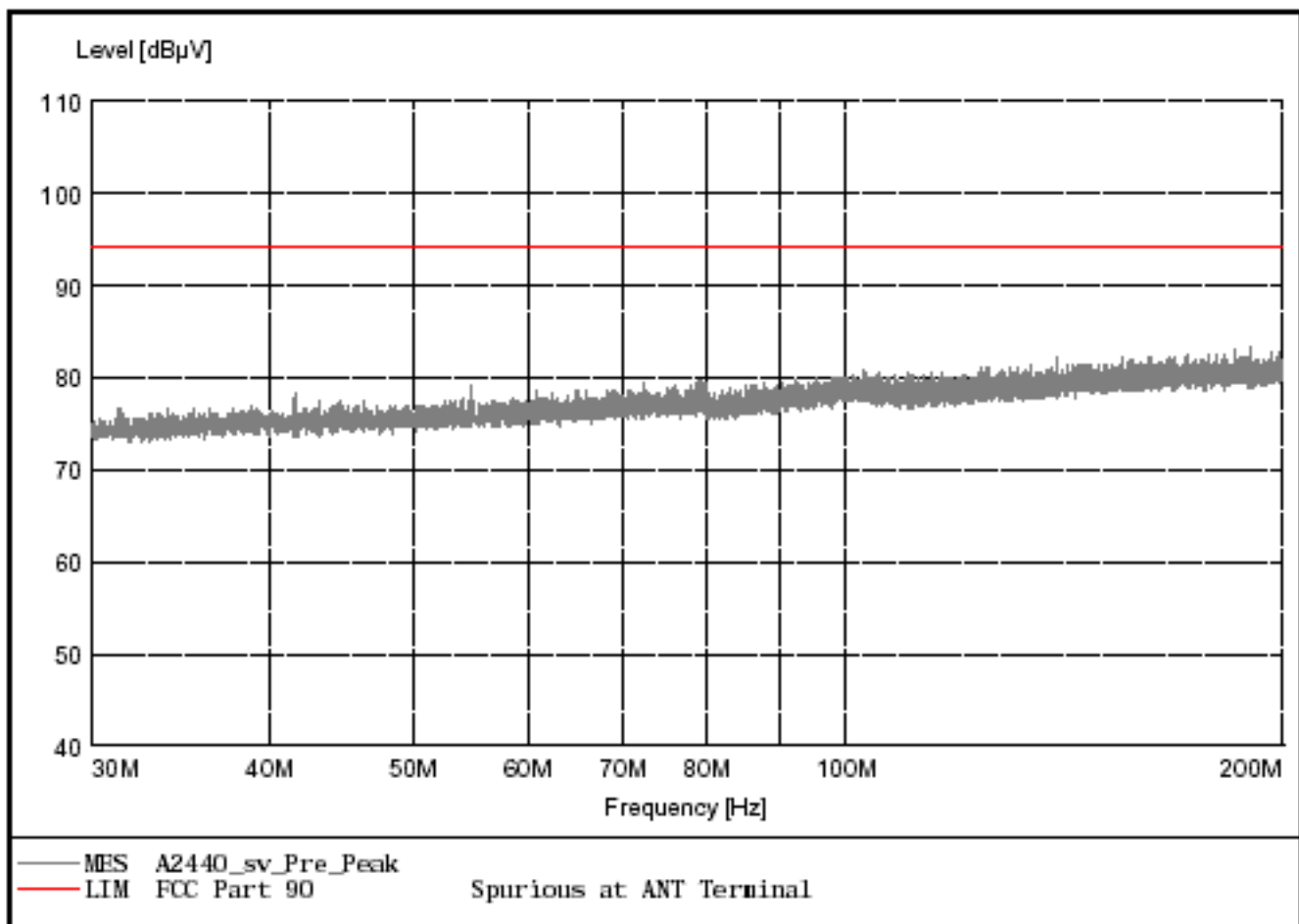
For Part 2.1051 For Part 90 device

spurious emissions measured @ Antenna Port

EUT: DRTXM3 (SN: DRTXM3-0001) & GPS-1 (SN: GPS-0001)  
Manufacturer: Highway Information Systems  
Operating Condition: 71 deg F; 27% R.H.  
Test Site: ILS (O.F) Site #1  
Operator: Jason L.  
Test Specification: Transmitter Model: DRTXM3 with Synchronizer Module: GPS-1  
Comment: TX Freq: 530 kHz; MOD 16dB above 50% MOD AT 2500 Hz  
Test Mode Configuration: Without 10 MHz Signal (DATE:2-4-03)

TEXT: "FCC Part 2.1051"

Short Description: Antenna Port Conducted  
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/006



TEST MODE #4



Company: Highway Information Systems, Inc.  
Model Tested: DRTXM3  
Report Number: 9982

1250 Peterson Drive, Wheeling, Illinois 60090

## MODE 5 Without Satellite Reception

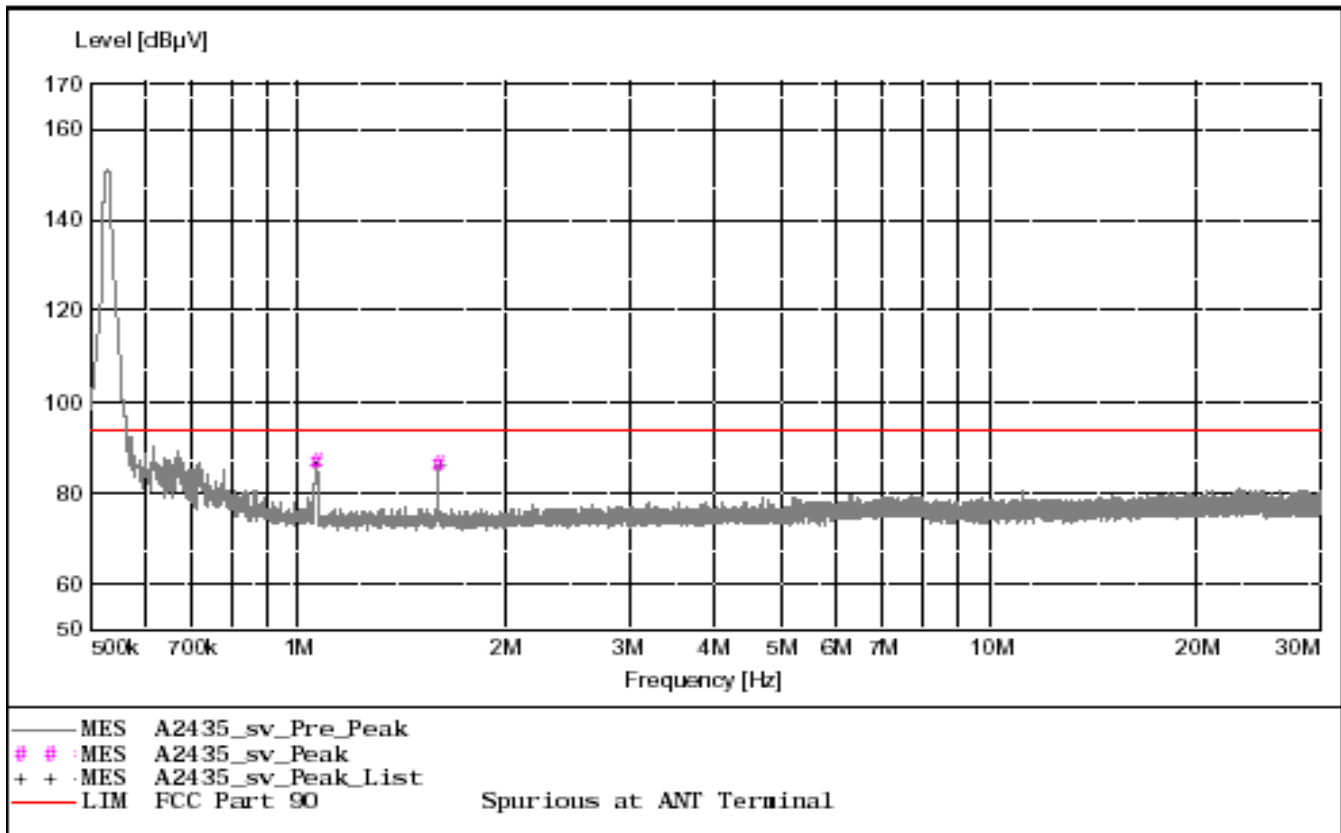
For part 2.1051 for for part 90 device

spurious emissions measured @ Antenna port

EUT: DRTXM3 (SN: DRTXM3-0001) & GPS-1 (SN: GPS-0001)  
Manufacturer: Highway Information Systems  
Operating Condition: 71 deg F; 27% R.H.  
Test Site: H.S. (O.F.) Site #1  
Operator: Jason L.  
Test Specification: Transmitter Model: DRTXM3 with Synchronizer Module: GPS-1  
Comment: TX Freq: 520 kHz; MOD 16dB above 50% MOD AT 2500 Hz  
Test Mode Configuration: Without Satellite Rx (DATE:2-4-03)

TEXT: "FCC Part 2.1051"

Short Description: Antenna Port Conducted  
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ES1-40 SN: 837808/006



## TEST MODE #5

MEASUREMENT RESULT: "A2435\_sv\_final"

2/4/03 1:06PM

| Frequency<br>MHz | Level<br>dBμV | Antenna<br>Factor<br>dBμV | System<br>Loss<br>dB | Total<br>Level<br>dBμV | Limit<br>dBμV | Margin<br>dB | Height<br>Ant.<br>m | EUT<br>Angle<br>deg | Final<br>Detector | Comment |
|------------------|---------------|---------------------------|----------------------|------------------------|---------------|--------------|---------------------|---------------------|-------------------|---------|
| 1.050000         | 16.76         | 0.00                      | 70.3                 | 87                     | 94            | 7.0          | 0.00                | 0                   | MAX PEAK          | None    |
| 1.550000         | 16.11         | 0.00                      | 70.3                 | 86                     | 94            | 7.5          | 0.00                | 0                   | MAX PEAK          | None    |



Company: Highway Information Systems, Inc.  
Model Tested: DRTXM3  
Report Number: 9982

1250 Peterson Drive, Wheeling, Illinois 60090

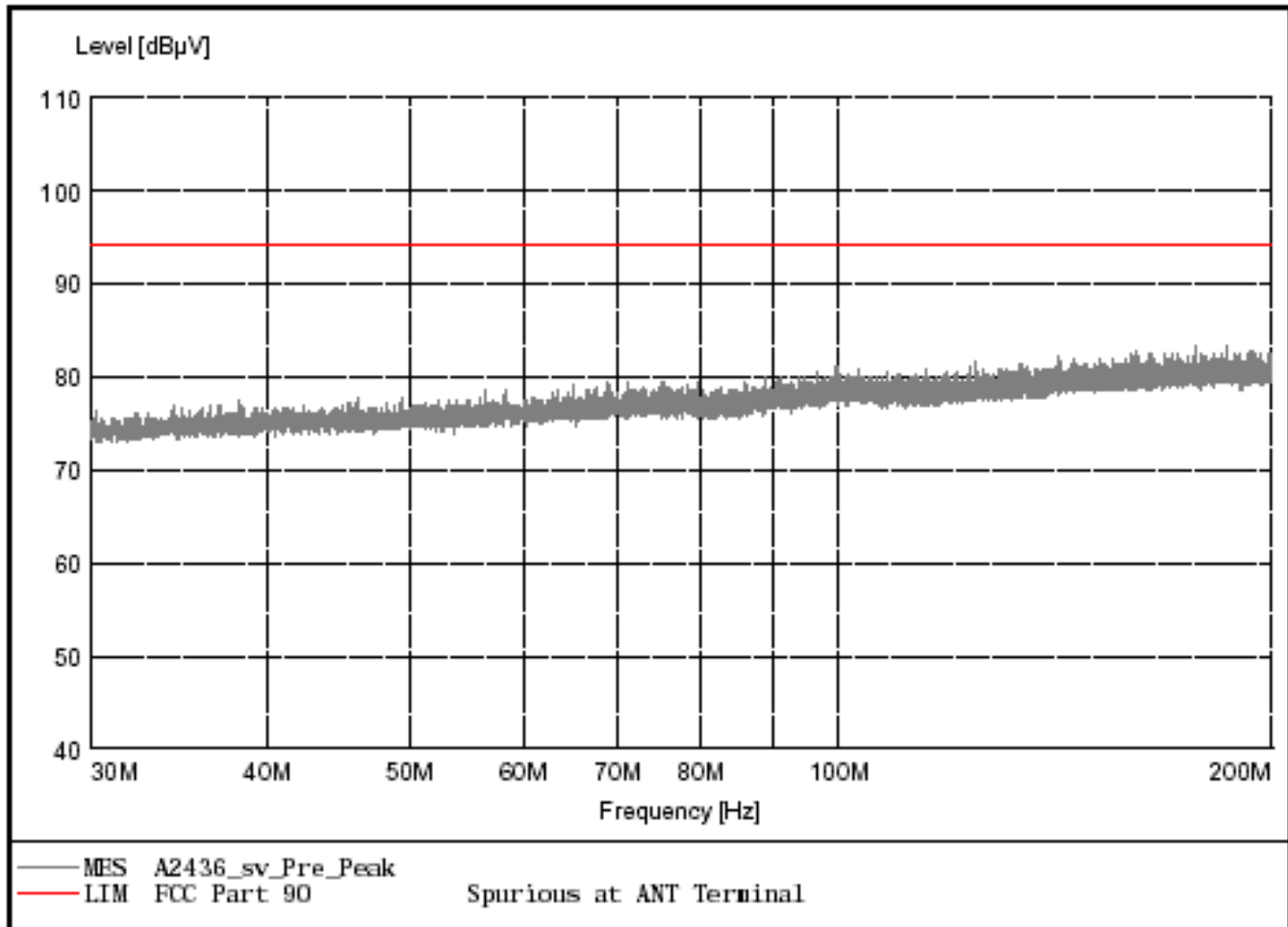
For part 2.1051 For For part 90 device

spurious emissions measured @ antenna port

EUT: DRTXM3 (SN: DRTXM3-0001) & GPS-1 (SN: GPS-0001)  
Manufacturer: Highway Information Systems  
Operating Condition: 71 deg F; 27% R.H.  
Test Site: DLS (D.F) Site #1  
Operator: Jason L  
Test Specification: Transmitter Model: DRTXM3 with Synchronizer Module: GPS-1  
Comment: TX Freq: 530 kHz; MOD 16dB above 50% MOD AT 2500 Hz  
Test Mode Configuration: Without Satellite Rx (DATE:2-4-03)

TEXT: "FCC Part 2.1051"

Short Description: Antenna Port Conducted  
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/006



TEST MODE #5



Company: Highway Information Systems, Inc.  
Model Tested: DRTXM3  
Report Number: 9982

1250 Peterson Drive, Wheeling, Illinois 60090

#### 10.0 FREQUENCY STABILITY - PART 2.1055a (Temperature)

The frequency stability was measured from -30° to +50° centigrade at intervals of 10° centigrade throughout the range. Prior to each frequency measurement, the equipment was left alone for a sufficient period of time (approximately 30 minutes or more) to allow the components of the Highway Information System DRTXM3 Transmitter oscillator circuitry to stabilize. The following information was taken:

##### **FREQUENCY STABILITY FOR TEMPERATURE VARIATION IN kHz:**

|      | Test Mode    | Test Mode    | Test Mode    | Test Mode    | Test Mode    |
|------|--------------|--------------|--------------|--------------|--------------|
|      | #1           | #2           | #3           | #4           | #5           |
| +50° | 530.00250501 | 530.00250501 | 530.00250501 | 529.99649299 | 529.99549098 |
| +40° | 530.00250501 | 530.00250501 | 530.00250501 | 530.99849699 | 529.99649299 |
| +30° | 530.00250501 | 530.00250501 | 530.00250501 | 530.00150301 | 529.99749499 |
| +20° | 530.00250501 | 529.99949900 | 530.00250501 | 530.00350701 | 529.99949900 |
| +10° | 530.00250501 | 530.00150301 | 530.00250501 | 530.00651303 | 530.00150301 |
| 0°   | 530.00250501 | 530.00250501 | 530.00250501 | 530.00851703 | 530.00250501 |
| -10° | 530.00350701 | 530.00350701 | 530.00350701 | 530.00951904 | 530.00350701 |
| -20° | 530.00250501 | 530.00350701 | 530.00250501 | 530.01052104 | 530.00350701 |
| -30° | 530.00250501 | 530.00250501 | 530.00250501 | 530.01052104 | 530.00250501 |
|      |              |              |              |              |              |

##### **Worst Case Variance:**

**8.01603 Hz**

As stated in Part 90.242 (b)(2) the Frequency Tolerance of 100 Hz shall be maintained. Per Frank Coperich of the FCC this takes precedence over Section 90.213.

**Frequency Tolerance:        =        100 Hz**

**Margin:                        =        91.98397 Hz**

**This is well within the specified limits.**



Company: Highway Information Systems, Inc.

Model Tested: DRTXM3

Report Number: 9982

1250 Peterson Drive, Wheeling, Illinois 60090

## **GRAPH(S) TAKEN FOR FREQUENCY**

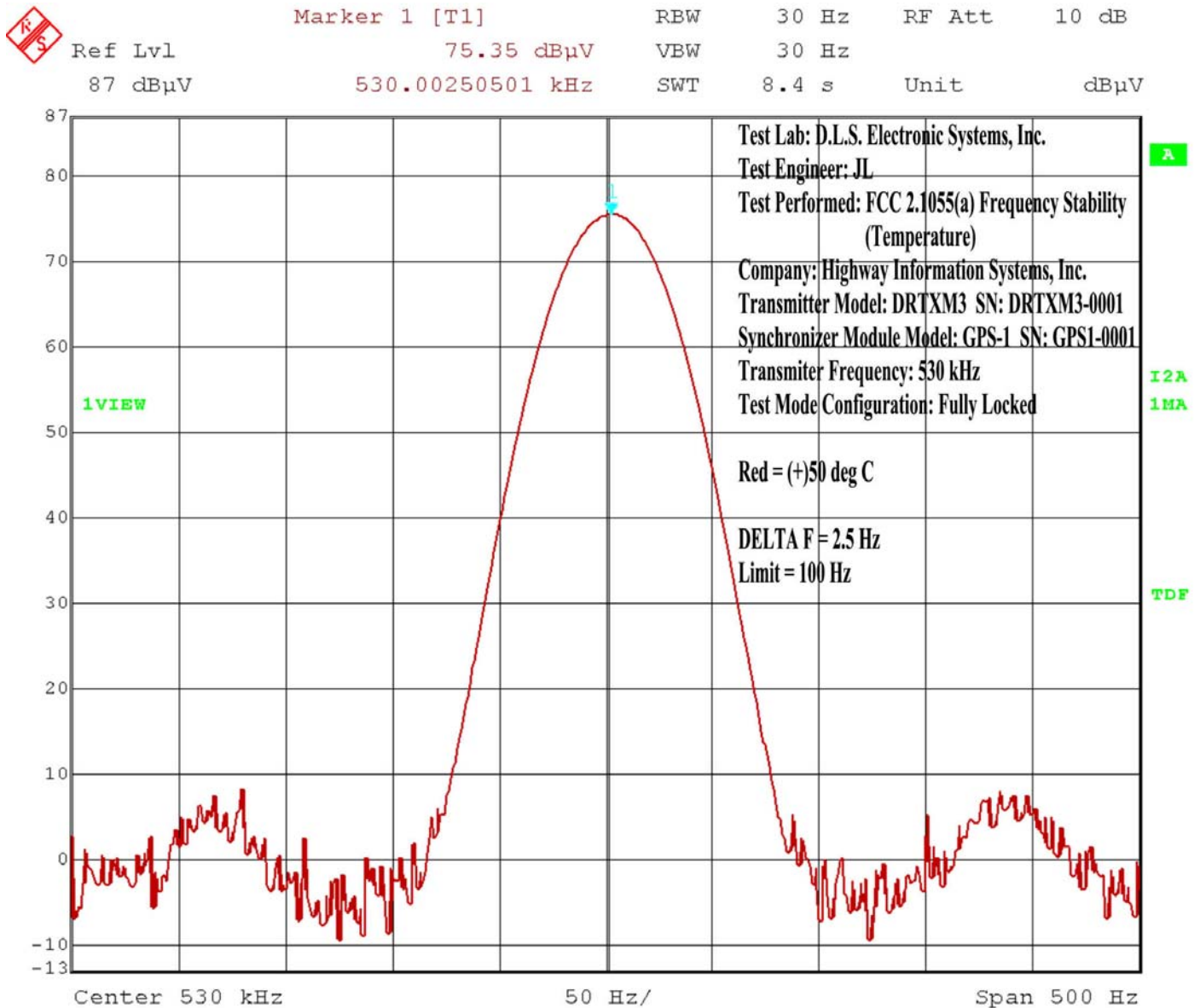
## **STABILITY WHEN VARYING THE TEMPERATURE**

### **PART 2.1055A**



Company: Highway Information Systems, Inc.  
Model Tested: DRTXM3  
Report Number: 9982

1250 Peterson Drive, Wheeling, Illinois 60090



Date: 6.JAN.2003 15:38:07

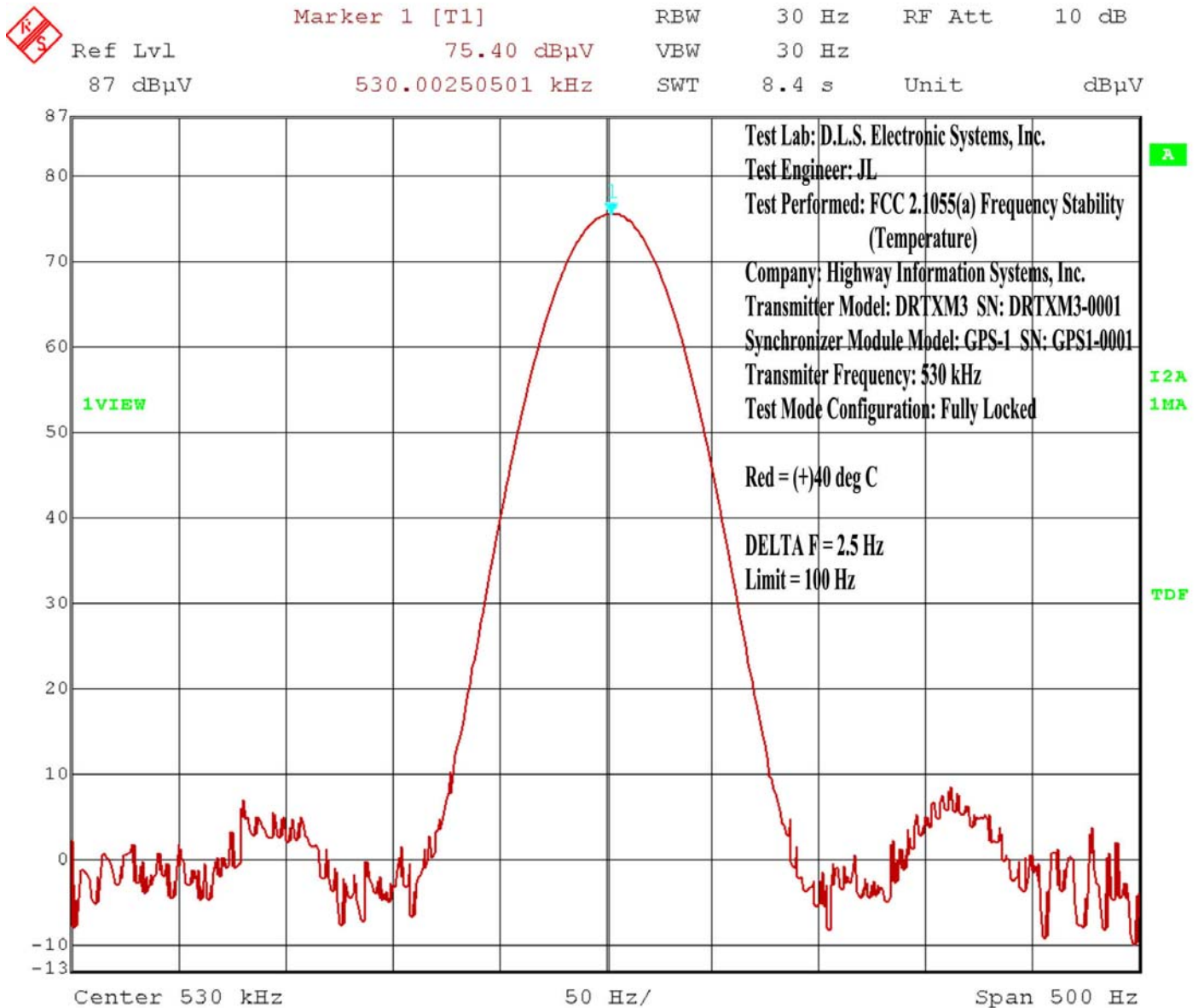
### TEST MODE 1

(Fully Locked)



Company: Highway Information Systems, Inc.  
Model Tested: DRTXM3  
Report Number: 9982

1250 Peterson Drive, Wheeling, Illinois 60090



Date: 6.JAN.2003 15:07:02

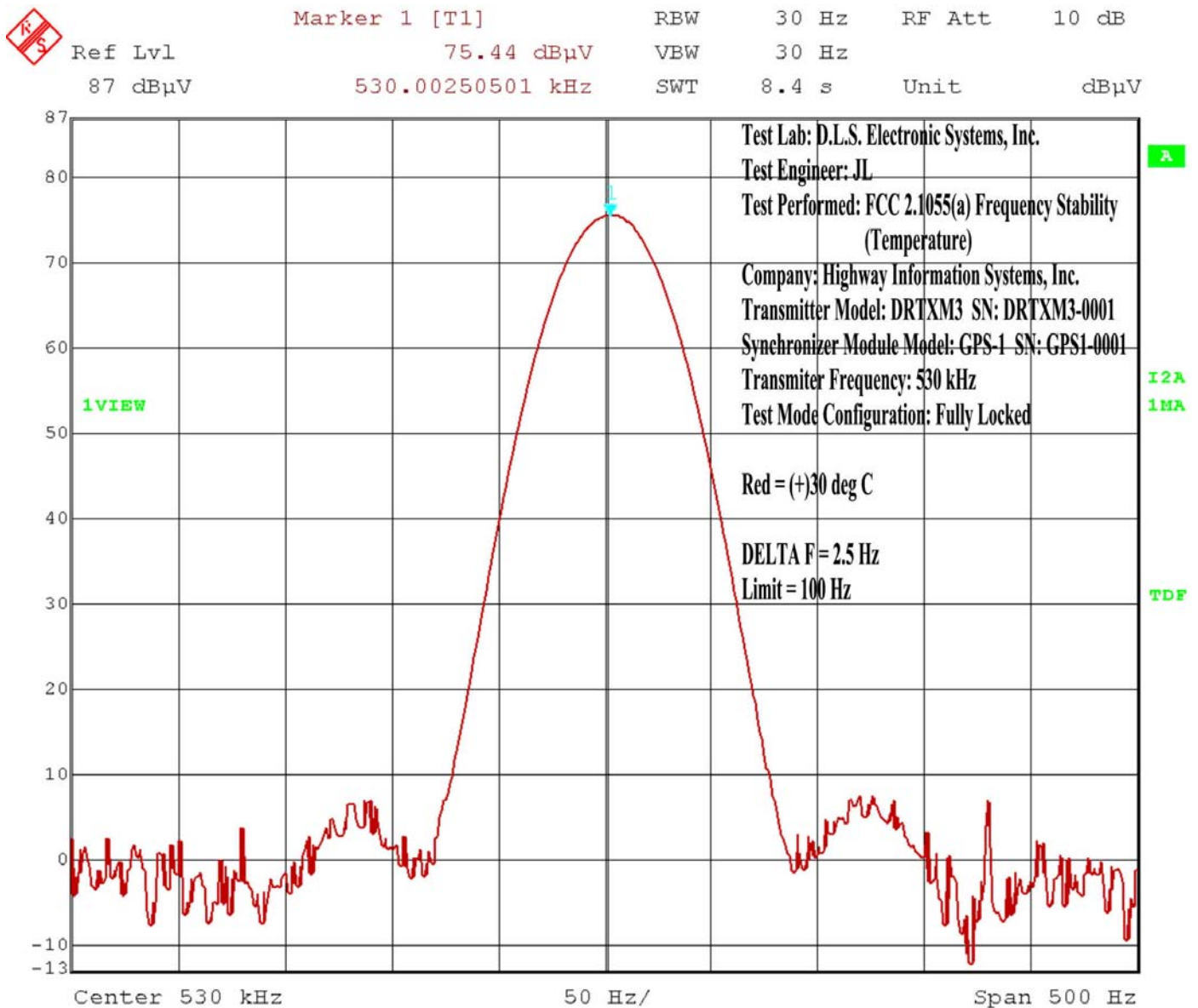
### TEST MODE 1

(Fully Locked)



Company: Highway Information Systems, Inc.  
Model Tested: DRTXM3  
Report Number: 9982

1250 Peterson Drive, Wheeling, Illinois 60090



Date: 6.JAN.2003 14:36:34

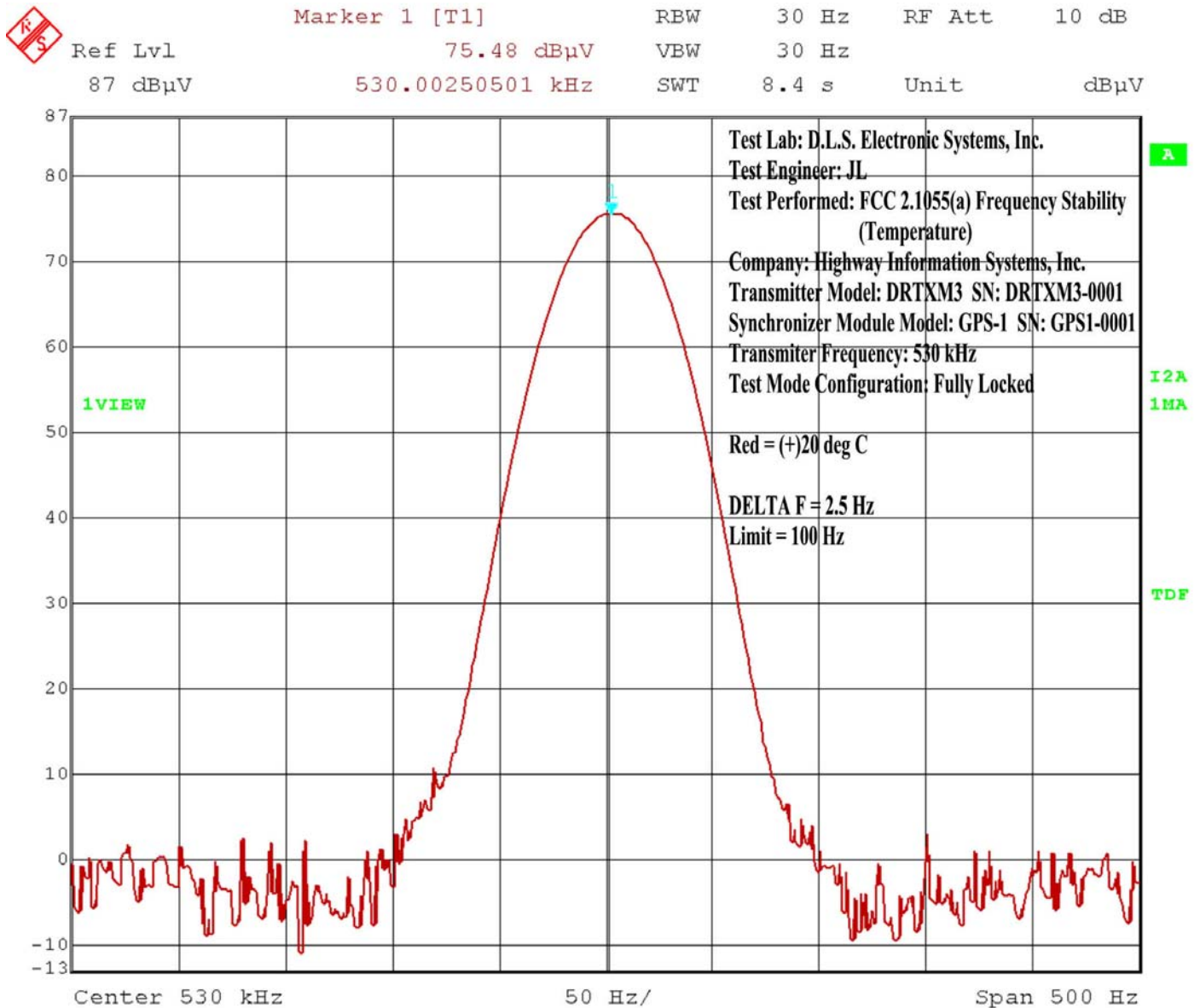
### TEST MODE 1

(Fully Locked)



Company: Highway Information Systems, Inc.  
Model Tested: DRTXM3  
Report Number: 9982

1250 Peterson Drive, Wheeling, Illinois 60090



Date: 6.JAN.2003 14:08:45

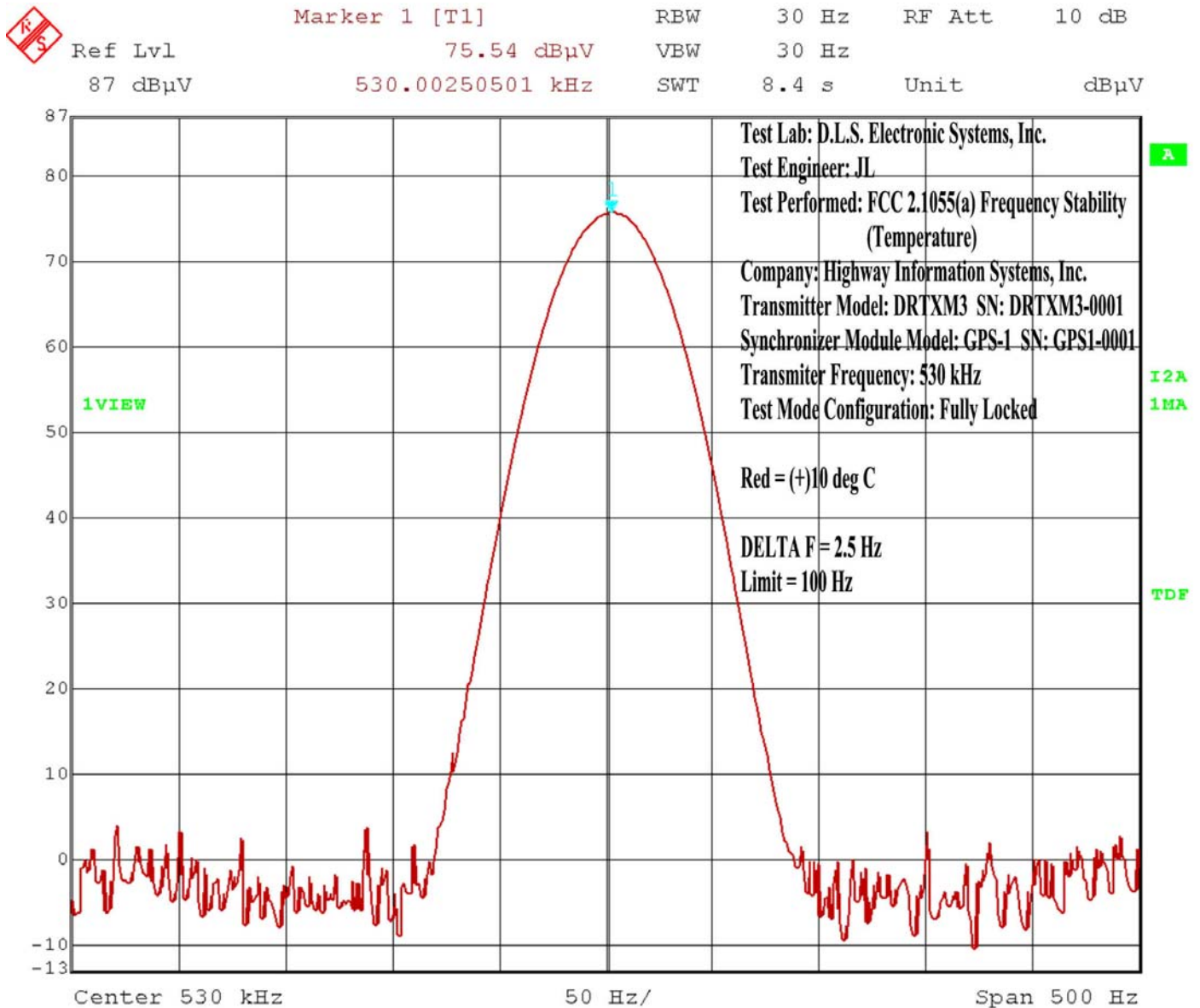
### TEST MODE 1

(Fully Locked)



Company: Highway Information Systems, Inc.  
Model Tested: DRTXM3  
Report Number: 9982

1250 Peterson Drive, Wheeling, Illinois 60090



Date: 6.JAN.2003 13:34:10

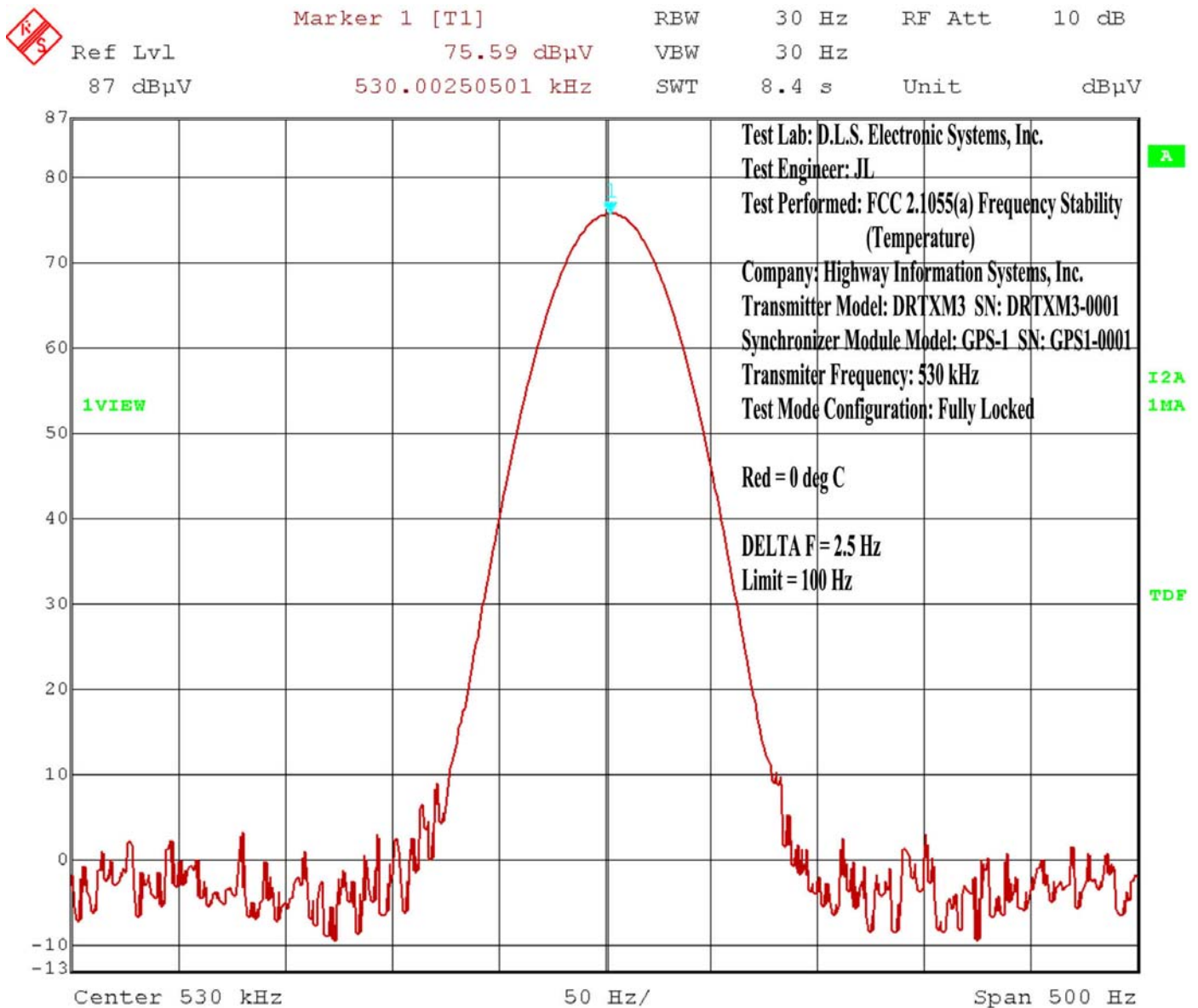
### TEST MODE 1

(Fully Locked)



Company: Highway Information Systems, Inc.  
Model Tested: DRTXM3  
Report Number: 9982

1250 Peterson Drive, Wheeling, Illinois 60090



Date: 6.JAN.2003 12:53:18

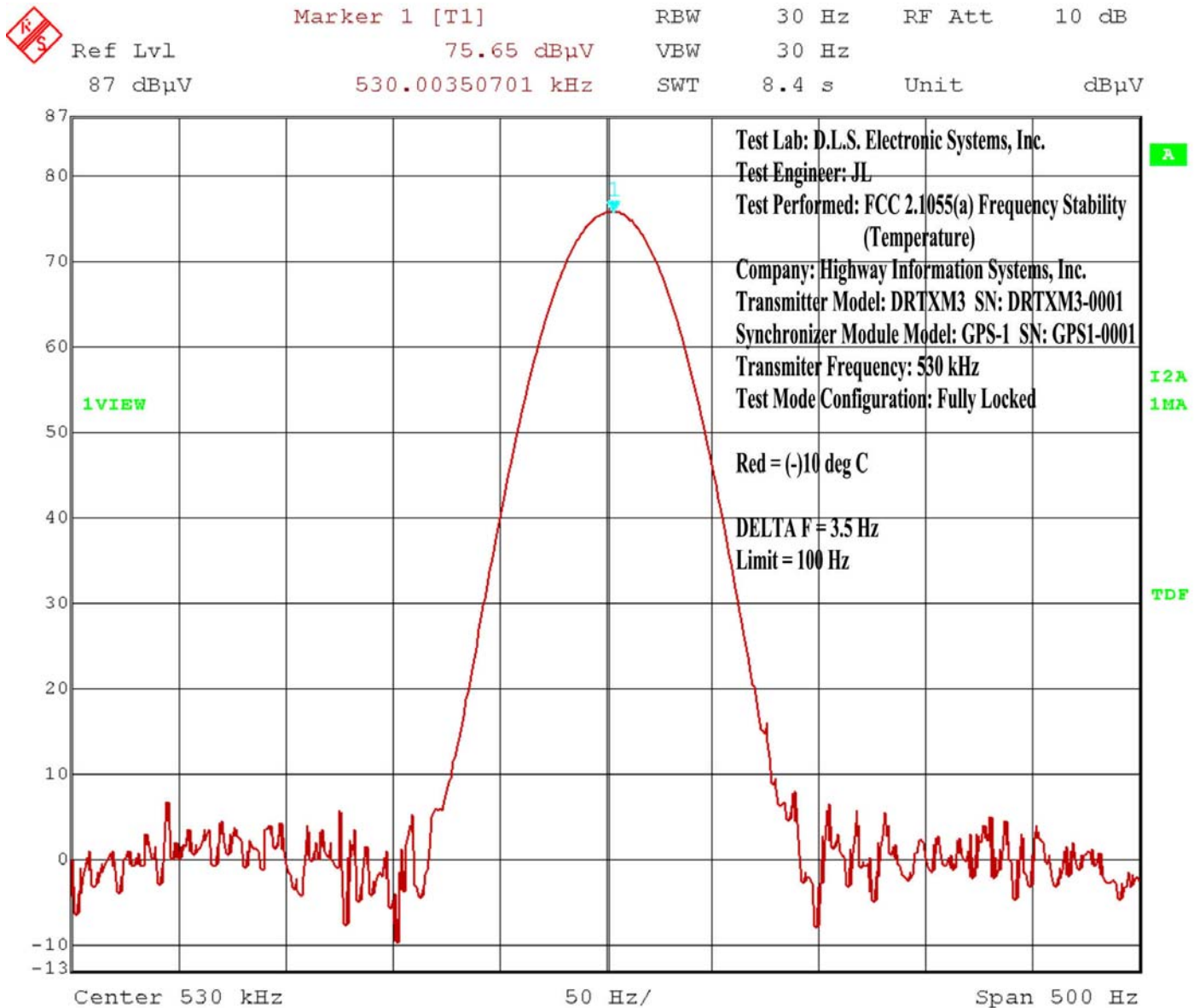
### TEST MODE 1

(Fully Locked)



Company: Highway Information Systems, Inc.  
Model Tested: DRTXM3  
Report Number: 9982

1250 Peterson Drive, Wheeling, Illinois 60090



Date: 6.JAN.2003 12:13:50

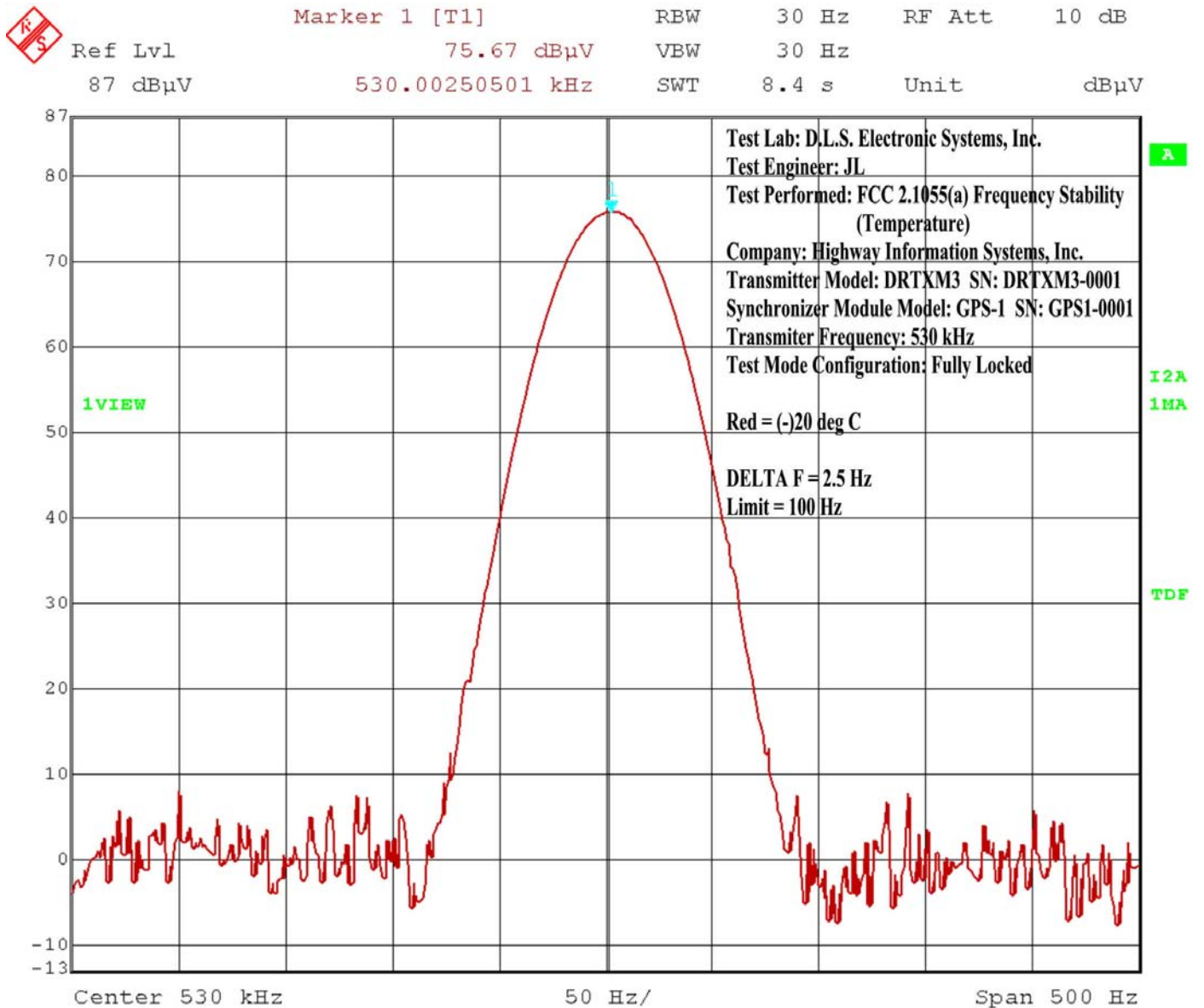
### TEST MODE 1

(Fully Locked)



Company: Highway Information Systems, Inc.  
Model Tested: DRTXM3  
Report Number: 9982

1250 Peterson Drive, Wheeling, Illinois 60090



Date: 6.JAN.2003 11:23:20

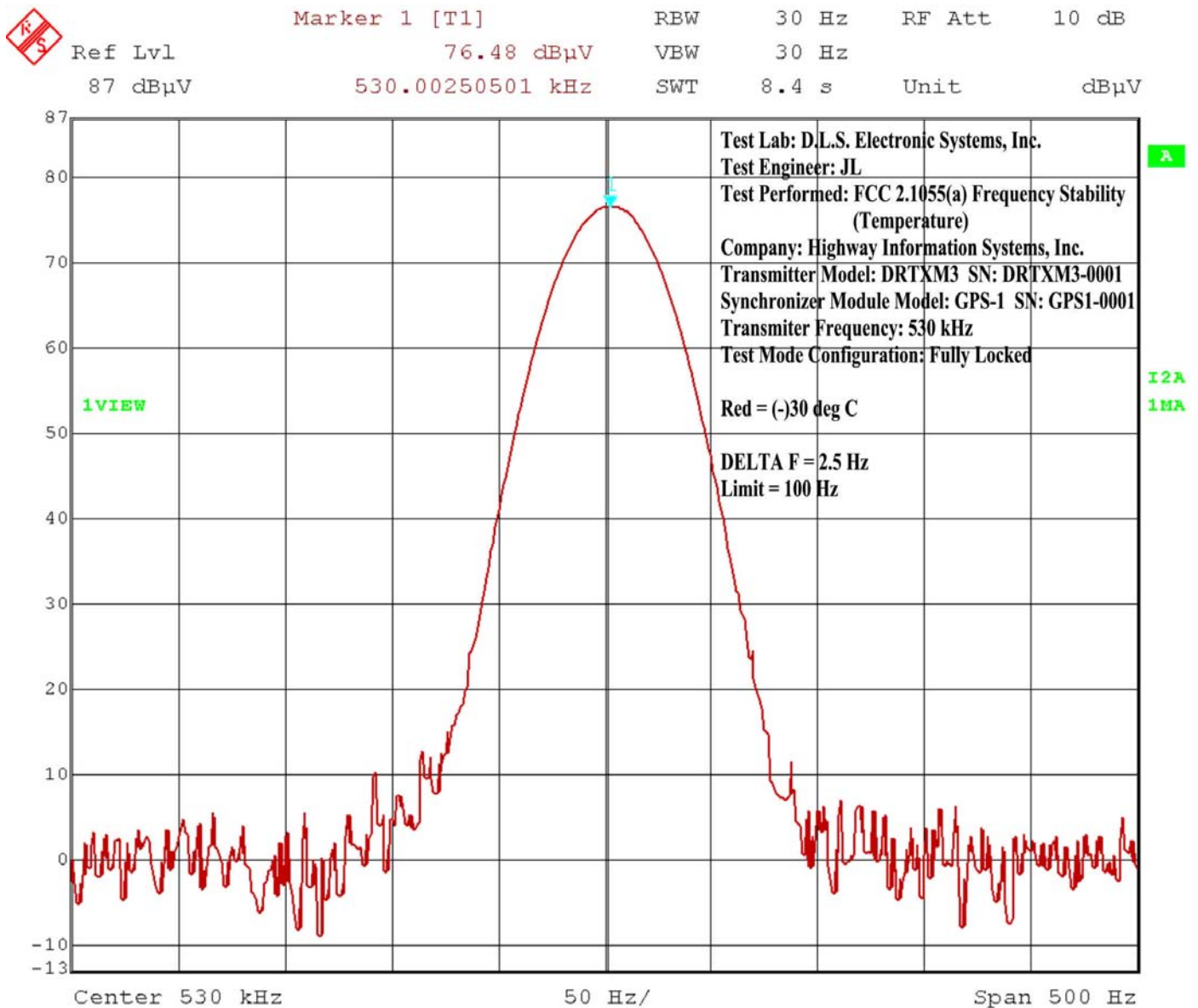
### TEST MODE 1

(Fully Locked)



Company: Highway Information Systems, Inc.  
Model Tested: DRTXM3  
Report Number: 9982

1250 Peterson Drive, Wheeling, Illinois 60090



Date: 6.JAN.2003 10:41:55

### TEST MODE 1

(Fully Locked)