DLS ELECTRONIC SYSTEMS, INC.

1250 Peterson Dr., Wheeling, IL 60090

Company: Highway Information Systems, Inc.
Model Tested: DRTXM4
Report Number: 11911

FCC Rules and Regulations / Intentional Radiators

Part 90, Subpart J

Non-Voice and Other Specialized Operations

Part 90, Subpart J, Section 90.242

Travelers' Information Stations

THE FOLLOWING **''MEETS''** THE ABOVE TEST SPECIFICATION

Formal Name:	AM Transmitter Module
Kind of Equipment:	AM Broadcast Transmitter
Test Configuration:	Low and High channels tested (Tested at 12 vdc)
Model Number(s):	DRTXM4
Model(s) Tested:	DRTXM4
Serial Number(s):	0119061523 (0.53 MHz Unit) & 0119061524 (1.61 MHz Unit)
Date of Tests:	January 10, 11, 12, 13, 16 & 17, 2006
Test Conducted For:	Highway Information Systems, Inc. 4021 Stirrup Creek Drive, Suite 100 Durham, North Carolina 27703

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SIGNATURE PAGE

Report By:

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Test Engineer
EMC-001375-NE

Reviewed By:

William Stumpf
OATS Manager

Approved By:

Brian Mattson
General Manager

Company Official:

Highway Information Systems, Inc.

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United States Department of Commerce
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SCOPE OF ACCREDITATION TO ISO/IEC 17025:1999

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ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS **NVLAP LAB CODE 100276-0**

NVLAP Code	*Designation / Description*
Emissions Test Methods:	
12/160D21	RTCA/DO-160D (1997): Environmental Conditions and Test Procedures for Airborne Equipment - Section 21 - Emission of Radio Frequency Energy
12/300220a	EN 300 220-1 V1.3.1 (2000-09): Electromagnetic compatibility and Radio spectrum Matters; Short Range Devices; Radio equipment to be used in the 25 MHz to 1000 MHz frequency range with power levels ranging up to 500 mW; Part 1: Technical characteristics and test methods
12/300386a	EN 300 386 V.1.2.1: Electromagnetic compatibility and radio spectrum matter (ERM); Telecommunication network equipment; Electromagnetic compatibility (EMC) requirements
12/C63.17	ANSI C63.17-1998: American National Standard for Methods of Measurement of the Electromagnetic and Operational Compatibility of Unlicensed Personal Communications Services (UPCS) Devices
12/C6317a	ANSI C63.17-1998: American National Standard for Methods of Measurement of the Electromagnetic and Operational Compatibility of Unlicensed Personal Communications Services (UPCS) Devices
12/CIS11	IEC/CISPR 11 + A1 (1997), EN 55011 (1998), AS/NZS CISPR 11 (2002), and CNS 13803 (1997): Limits and Methods of Measurement of Electromagnetic Disturbance Characteristics of Industrial, Scientific, and Medical Radio-Frequency Equipment

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NVLAP Code	*Designation / Description*
12/CIS13	IEC/CISPR 13 (2001-04), EN 55013 (2001), AS/NZS CISPR 13 (2003), and CNS 13439 (2001): Sound and television broadcast receivers and associated equipment - Radio disturbance characteristics - Limits and methods of measurement
12/CIS14	CISPR 14-1 (March 30, 2000): Limits and Methods of Measurement of Radio interference Characteristics of Household Electrical Appliances, Portable Tools and Similiar Electrical Apparatus - Part 1: Emissions
12/CIS14a	EN 55014-1 (1993), A1 (1997), A2 (1999):
12/CIS14d	IEC/CISPR 14-1 (2001) and A1 (2001): Electromagnetic Compatibility - Requirements for household appliances, electric tools and similar apparatus - Part 1: Emissions
12/CIS14e	EN 55014-1 (2001) and A1 (2001): Electromagnetic Compatibility - Requirements for household appliances, electric tools and similar apparatus - Part 1: Emission
12/CIS14f	AS/NZS 1044 (2001) and A1 (2001): Electromagnetic Compatibility - Requirements for household appliances, electric tools and similar apparatus - Part 1: Emission
12/CIS14g	CNS 13783-1 (2001) and A1 (2001): Electromagnetic Compatibility - Requirements for household appliances, electric tools and similar apparatus - Part 1: Emission
12/CIS15	IEC/CISPR 15 (2000) + A1 (2001): Limits and methods of measurements of radio disturbance characteristics of electrical lighting and similar equipment
12/CIS15a	AS/NZS CISPR 15 (2002): Limits and methods of measurements of radio disturbance characteristics of electrical lighting and similar equipment
12/CIS15b	CNS 13439 (2000) + A1 (2001): Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment
12/CIS15c	EN 55015 (2000) + A1 (2001): Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment
12/CIS22	IEC/CISPR 22 (1997) & EN 55022 (1998) + A1(2000): Limits and methods of measurement of radio disturbance characteristics of information technology equipment

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NVLAP Code	*Designation / Description*
12/CIS22a	IEC/CISPR 22 (1993) and EN 55022 (1994): 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
12/EM02a	IEC 61000-3-2, Edition 2.1 (2001-10), EN 61000-3-2 (2000), and AS/NZS 2279.1 (2000): Electromagnetic compatibility (EMC) Part 3-2: Limits - Limits for harmonic current emissions (equipment input current <= 16 A)
12/EM03	IEC 61000-3-3(1995); EN 61000-3-3(1995); AS/NZS 2279.3(1995): EMC - Part 3: Limits - Section 3. Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current up to 16A
12/F18	FCC OST/MP-5 (1986): FCC Methods of Measurement of Radio Noise Emissions for ISM Equipment (cited in FCC Method 47 CFR Part 18 - Industrial, Scientific, and Medical Equipment)
12/FCC15b	ANSI C63.4 (2003) with FCC Method 47 CFR Part 15, Subpart B: Unintentional Radiators
12/FCC15c	ANSI C63.4 (2003) with FCC Method 47 CFR Part 15, Subpart C: Intentional Radiators
12/FCC15d	ANSI C63.17(1998) and ANSI C63.4 (2003): with FCC Method - 47 CFR Part 15, Subpart D: Unlicensed Personal Communications Service Devices
12/FCC15e	ANSI C63.4 (2003) with FCC Method 47 CFR Part 15, Subpart E: Unlicensed National Information Infrastructure Service Devices
12/T51a	AS/NZS CISPR 22 (2004): Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement
12/VCCIa	VCCI: Agreement of Voluntary Control Council for Interference by Information Technology Equipment - Technical Requirements: V-3/2005.04

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NVLAP Code	*Designation / Description*
Immunity Test Methods:	
12/1089a	GR-1089-CORE, Issue 3, October 2002: Electromagnetic Compatibility and Electrical Safety - Generic Criteria for Network Telecommunications Equipment (sections 2, 3.3, and 3.5)
12/160D16	RTCA/DO-160D (1997): Environmental Conditions and Test Procedures for Airborne Equipment - Section 16 - Power Input
12/160D17	RTCA/DO-160D (1997): Environmental Conditions and Test Procedures for Airborne Equipment - Section 17 - Voltage Spike
12/160D18	RTCA/DO-160D (1997): Environmental Conditions and Test Procedures for Airborne Equipment - Section 18 - Audio Frequency Conducted Susceptibility - Power Inputs
12/160D19	RTCA/DO-160D (1997): Environmental Conditions and Test Procedures for Airborne Equipment - Section 19 - Induced Signal Susceptibility
12/160D20	RTCA/DO-160D (1997): Environmental Conditions and Test Procedures for Airborne Equipment - Section 20 - Radio Frequency Susceptibility (Radiated and Conducted)
12/160D22	RTCA/DO-160D (1997): Environmental Conditions and Test Procedures for Airborne Equipment - Section 22 - Lightning Induced Transient Susceptibility
12/160D25	RTCA/DO-160D (1997): Environmental Conditions and Test Procedures for Airborne Equipment - Section 25 - Electrostatic Dischare (ESD)
12/I01	IEC 61000-4-2, Ed. 1.2 (2001) + A1, A2; EN 61000-4-2: Electrostatic Discharge Immunity Test
12/I02	IEC 61000-4-3, Ed. 2.0 (2002-03); EN 61000-4-3 (2002): Radiated Radio-Frequency Electromagnetic Field Immunity Test
12/I03	IEC 61000-4-4(1995), A1(2000), A2(2001); EN 61000-4-4: Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical Fast Transient/Burst Immunity Test

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NVLAP Code	*Designation / Description*
12/I04	IEC 61000-4-5, Ed. 1.1 (2001-04); EN 61000-4-5: Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test
12/I05	IEC 61000-4-6, Ed. 2.0 (2003-05); EN 61000-4-6: Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields
12/I06	IEC 61000-4-8, Ed. 1.1 (2001); EN 61000-4-8: Electromagnetic compatibility (EMC) - Part 4-8: Testing and measurement techniques - Power frequency magnetic field immunity test
12/I07	IEC 61000-4-11, Ed. 1.1 (2001-03); EN 61000-4-11: Voltage Dips, Short Interruptions and Voltage Variations Immunity Tests
12/J111324	SAE J1113/24: Immunity to radiated electromagnetic fields; 10 kHz to 200 MHz - Crawford TEM cell and 10 kHz to 5 GHz - Wideband TEM cell
12/J111341	SAE J1113/41 (1995-07): Limits and methods of measurement of radio disturbance characteristics of components and modules for the protection of receivers used on board vehicles

Radio Test Methods

12/RSS119	RSS-119, Issue 6 (March 25, 2000): Land Mobile and Fixed Radio Transmitters and Receivers, 27.41 to 960 MHz
12/RSS123	RSS-123, Issue 1, Rev. 2 (November 6, 1999): Low Power Licensed Radiocommunication Devices
12/RSS125	RSS-125 (March 25, 2000): Land Mobile and Fixed Radio Transmitters and Receivers, 1.705 to 50.0 MHz, Primarily Amplitude Modulated
12/RSS131	RSS-131, Issue 2 (July 2003): Zone Enhancers for the Land Mobile Service
12/RSS132	RSS-132, Issue 1 (August 2002): 800 MHz Cellular Telephones Employing New Technologies
12/RSS133	RSS-133, Issue 3 (June 2005): 2GHz Personal Communications Services

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NVLAP Code	*Designation / Description*
12/RSS134	RSS-134, Issue 1, Rev. 1 (March 25, 2000): 900 MHz Narrowband Personal Communication Service
12/RSS135	RSS-135, Issue 1 (October 26, 1996): Digital Scanner Receivers
12/RSS136	RSS-136, Issue 5 (October 2002): Land and Mobile Station Radiotelephone Transmitters and Receivers Operating in the 26.960 - 27.410 MHz General Radio Service Band
12/RSS137	RSS-137, Issue 1, Rev. 1 (September 25, 1999): Location and Monitoring Service (902 - 928 MHz)
12/RSS139	RSS-139, Isssue 1 (February 5, 2000): Licensed Radiocommunications Devices in the Band 2400 - 2483.5 MHz
12/RSS141	RSS-141, Issue 1, Revision 1 (February 7, 2004): Aeronautical Radiocommunication Equipment in the Frequency Band 117.975 - 137 MHz
12/RSS142	RSS-142, Issue 2 (August 2002): Narrowband Multipoint Communication Systems in the 1,427 - 1,430 MHz and 1,493.5 - 1,496.5 MHz Bands
12/RSS170	RSS-170, Issue 1, Rev. 1 (November 6, 1999): Satellite Mobile Earth Stations
12/RSS191	RSS-191, Issue 2 (August 2002): Local Multipoint Communication Systems in the 28 GHz Band; Point-to-Point and Point-to-Multipoint Broadband Communication Systems in the 24 GHz and 38 GHz Bands
12/RSS192	RSS-192, Issue 2 (2004): Fixed Wireless Access Systems in the Band 3450 - 3650 MHz
12/RSS193	RSS-193, Issue 1 (July 2003): Multipoint and Point-to-Point Communication Systems (MCS) in the Fixed Service Operating in the 2,150 - 2,160 MHz, 2,500 - 2,596 MHz and 2,686 - 2,690 MHz Bands
12/RSS210	RSS-210, Issue 6 (Sept. 2005): Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands): Category 1 Equipment
12/RSS212	RSS-212, Issue 1 (February 27, 1999): Test Facilities and Test Methods for Radio Equipment

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NVLAP Code	*Designation / Description*
12/RSS213	RSS-213, Issue 1 (April 24, 1999): 2 GHz Licence-Exempt Personal Communications Service Devices (PCS)
12/RSS215	RSS-215, Issue 1 (November 6, 1999): Analogue Scanner Receivers
12/RSS310	RSS-310, Issue 1 (Sept. 2005): Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands): Category II Equipment
12/RSSgen	RSS-Gen, Issue 1 (Sept. 2005): General Requirements and Information for the Certification of Radiocommunication Equipment
Telecommunications Test Methods:	
12/FCC2a2	TIA/EIA 603-B (2002) with 47 CFR Part 2: Public Mobile Services in 47 CFR Part 22
12/FCC2b2	TIA/EIA 603-B (2002) with 47 CFR Part 2: Private Land Mobile Radio Services in 47 CFR Part 90
12/FCC2d1	TIA/EIA 603-B (2002) with 47 CFR Part 2: Experimental Radio, Auxiliary, Special Broadcast and Other Program Distributional Services in 47 CFR Part 74
12/FCC2e1	TIA/EIA 603-B (2002) with 47 CFR Part 2: International Fixed Public Radiocommunication Services in 47 CFR Part 23
MIL-STD-462 : Conducted Emissions:	
12/A13	MIL-STD-462 Version D Method CE101
12/A14	MIL-STD-462 Version D Method CE102
12/A16	MIL-STD-461 Version E Method CE101
12/A17	MIL-STD-461 Version E Method CE102
12/A18	MIL-STD-461 Version E Method CE106
MIL-STD-462 : Conducted Susceptibility:	
12/B12	MIL-STD-462 Version D Method CS101

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NVLAP Code	*Designation / Description*
12/B13	MIL-STD-462 Version D Method CS103
12/B25	MIL-STD-461 Version E Method CS114
12/B26	MIL-STD-461 Version E Method CS115
12/B27	MIL-STD-461 Version E Method CS116
MIL-STD-462 : Radiated Emissions:	
12/D04	MIL-STD-462 Version D Method RE101
12/D05	MIL-STD-462 Version D Method RE102
12/D06	MIL-STD-462 Version D Method RE103
MIL-STD-462 : Radiated Susceptibility:	
12/E08	MIL-STD-462 Version D Method RS101
12/E09	MIL-STD-462 Version D Method RS103

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1.0 SUMMARY OF TEST REPORT

It was found that the AM Transmitter Module, Model Number(s) DRTXM4, **''meets''** the radio interference conducted emission requirements of the FCC "Rules and Regulations", Part 90, Subpart J, Section 90.242, for travelers' information stations.

This test report relates only to the items tested and contains the following number of pages.

Text: 113

2.0 INTRODUCTION

On January 10, 11, 12, 13, 16 & 17, 2006, a series of radio frequency interference measurements was performed on AM Transmitter Module, Model Number(s) DRTXM4, Serial Number: 0119061523 (0.53 MHz Unit) & 0119061524 (1.61 MHz Unit). The tests were performed according to the procedures of the FCC as stated in Part 2 - Frequency Allocations and Radio Treaty Matters: General Rules and Regulations, Subpart J, Equipment Authorization Procedures of the Code of Federal Regulations 47. Tests were performed by personnel of D.L.S. Electronic Systems, Inc. who are responsible to Donald L. Sweeney, Senior EMC Engineer.

3.0 OBJECT

The purpose of this series of tests was to determine if the test sample could meet the radio frequency interference requirements of the FCC "Rules and Regulations", Part 90, Subpart J, Section 90.242, for travelers' information stations.

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4.0 TEST SET-UP

All tests were performed at D.L.S. Electronic Systems, Inc. and set up according to the American National Standards Institute, ANSI C63.4-2003, Section 7, (Figures 10a, 10b, 10c and 10d). The conducted tests if required were performed with the test item placed on a non-conductive table (table top equipment), located in the test room. Equipment normally operated on the floor was tested by placing it on the metal ground plane. The ground plane has an electrical isolation layer over its surface approximately 7mm thick. The power line supplied was connected to a dual line impedance stabilization network electrically bonded to the ground plane, located on the floor. The networks were constructed per the requirements of the American National Standards Institute, ANSI C63.4-2003, Section 4, (Figure 2).

All radiated emissions tests were performed with the test item placed on a 80 cm high rotating non-conductive table, located in the test room. Equipment normally operated on the floor was placed on a metal covered turntable, which is flush with the surrounding conducting ground plane. The ground plane has an electrical isolation layer over its surface approximately 7 mm thick. The EUT is separated from the turntable ground plane by a non-conductive layer. The equipment under test was set up according to ANSI C63.4-2003, Sections 6 and 8.

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5.0 TEST EQUIPMENT (Bandwidths and Detector Function)

All preliminary data below 1000 MHz was automatically plotted using the HP Spectrum Analyzer or ESI 26/ESI 40 Fixed Tuned Receiver. The data was taken using Peak, Quasi-Peak or the Average Detector Functions as required. This information was then used to determine the frequencies of maximum emissions. Above 1000 MHz, final data was taken using the Average Detector.

Below 1000 MHz, final data was taken using the HP Spectrum Analyzer and or ESI 26/ESI 40 fixed tuned receiver. These plots were made using the Peak or Quasi-Peak Detector functions, with manual measurements performed on the questionable frequencies using the Quasi-Peak or the Average Detector Function of the Analyzer or ESI 26/ESI 40 Receiver as required. Above 1000 MHz, final data was taken using the Average Detector on the ESI 26/ESI 40 Fixed Tuned Receiver.

The bandwidths shown below are specified by ANSI C63.4-2003, Section 4.2.

Frequency Range	Bandwidth (-6 dB)
10 to 150 kHz	200 Hz
150 kHz to 30 MHz	9 kHz
30 MHz to 1 GHz	120 kHz
Above 1 GHz	1 MHz

A list of the equipment used can be found in Table 1. All primary equipment was calibrated against known reference standards with a verified traceable path to NIST.

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6.0 AMBIENT MEASUREMENTS

For emissions measurements, broadband antennas and an EMI Test Receiver with a panoramic spectrum display are used. First the frequency range is scanned and displayed on the test receiver display. Next the scanned frequency range is divided into smaller ranges, and then it is manually tuned through to determine the emissions from the EUT. A headset or loudspeaker is connected to the test receiver's AM/FM demodulated output as an aid in detecting ambient signals and finding frequencies of significant emission from the EUT. If there is any doubt as to the source of the emission, it is further investigated by rotating the EUT, or by disconnecting the power from the EUT.

The EUT is set up in its typical configuration and operated in its various modes. For tabletop systems, cables are manipulated within the range of likely configurations. For floor-standing equipment, the cables or are located in the same manner as the user would install them and no further manipulation is made. If the manner of cable installation is not known, or if it changes with each installation, cables or wires for floor-standing equipment shall be manipulated to the extent possible to produce the maximum level of emissions. For each mode of operation, the frequency spectrum is monitored. Variations in antenna height, antenna polarization, EUT azimuth, and cable or wire placement (each variable within bounds specified elsewhere) are explored to produce the emission that has the highest amplitude relative to the limit. These methods are performed to the specifications in ANSI C63.4: 2003.

7.0 CONDUCTED EMISSION MEASUREMENTS

As stated in FCC Part 90, Subpart J, Sections 90.231 to 90.250, AC power line conducted emissions are not required for non-voice and other specialized operations.

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8.0 DESCRIPTION OF TEST SAMPLE: (See also Paragraph 9.0)

8.1 Description:

AM broadcast transmitter with GPS synchronization. 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.

8.2 PHYSICAL DIMENSIONS OF EQUIPMENT UNDER TEST

Length: 9.2" x Width: 3.2" x Height: 10.3"

8.3 LINE FILTER USED:

NA

8.4 INTERNAL CLOCK FREQUENCIES:

Switching Power Supply Frequencies:

NA

Clock Frequencies:

12.72 MHz (0.53 MHz Unit) & 12.88 MHz (1.61 MHz Unit)

8.5 DESCRIPTION OF ALL CIRCUIT BOARDS:

1. Main PCB PN: DRTXM4 Rev C
2. Daughter PCB PN: DRTXM2DTR Rev 1998

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9.0 ADDITIONAL DESCRIPTION OF TEST SAMPLE:
(See also Paragraph 8.0)

1: There were no additional descriptions noted at the time of test.

I certify that the above, combined with paragraph 8.0, describes the equipment tested and that the equipment will be manufactured as stated.

By: _____ _____
Signature Title

For: _____ _____
Company Date

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10.0 PHOTO INFORMATION AND TEST SET-UP

Item 0 AM Transmitter Module
Model Number: DRTXM4 Serial Number: 0119061523 (0.53 MHz Unit) & 0119061524 (1.61 MHz Unit)

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11.0 PHOTOS TAKEN DURING TESTING

RF CONDUCTED AT THE ANTENNA TERMINAL

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12.0 RESULTS OF TESTS

The radio interference emission charts results can be seen on the pages at the end of this report. Data sheets indicating the test measurements taken during testing can also be found at the end of this report. Points on the emission charts shown with a yellow mark are background frequencies that were verified during testing.

13.0 CONCLUSION

It was found that the AM Transmitter Module, Model Number(s) DRTXM4 **''meets''** the radio interference emission requirements of the FCC "Rules and Regulations", Part 90, Subpart J, Section 90.233, for non-voice and other specialized operations.

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TABLE 1 – EQUIPMENT LIST

Test Equipment	Manufacturer	Model Number	Serial Number	Frequency Range	Cal Due Dates
Receiver	Rohde & Schwarz	ESI 26	837491/010	20 Hz – 26 GHz	11/06
Receiver	Rohde & Schwarz	ESI 40	837808/006	20 Hz – 40 GHz	12/06
Receiver	Rohde & Schwarz	ESI 40	837808/005	20 Hz – 40 GHz	12/06
Antenna	EMCO	3104C	00054891	20 MHz – 200 MHz	2/06
Antenna	Electrometrics	LPA-25	1114	200 MHz – 1 GHz	3/06
Antenna	EMCO	3104C	00054892	20 MHz – 200 MHz	3/06
Antenna	Electrometrics	3146	1205	200 MHz – 1 GHz	3/06
Antenna	EMCO	3104C	97014785	20 MHz – 200 MHz	2/06
Antenna	EMCO	3146	97024895	200 MHz – 1 GHz	3/06
Antenna	EMCO	3115	2479	1 GHz – 18 GHz	8/06
Antenna	EMCO	3115	99035731	1 GHz – 18 GHz	4/06
Antenna	Rohde & Schwarz	HUF-Z1	829381001	20 MHz – 1 GHz	2/06
Antenna	Rohde & Schwarz	HUF-Z1	829381005	20 MHz – 1 GHz	8/06

All primary equipment is calibrated against known reference standards with a verified traceable path to NIST.

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TABLE 1 – EQUIPMENT LIST

Test Equipment	Manufacturer	Model Number	Serial Number	Frequency Range	Cal Due Dates
LISN	Solar	8012-50-R-24-BNC	8305116	10 MHz – 30 MHz	8/06
LISN	Solar	8012-50-R-24-BNC	814548	10 MHz – 30 MHz	8/06
LISN	Solar	9252-50-R-24-BNC	961019	10 MHz – 30 MHz	12/06
LISN	Solar	9252-50-R-24-BNC	971612	10 MHz – 30 MHz	10/06
LISN	Solar	9252-50-R-24-BNC	92710620	10 MHz – 30 MHz	7/06

All primary equipment is calibrated against known reference standards with a verified traceable path to NIST.

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

SUBPART J

Section 90.242

TRAVELERS' INFORMATION STATIONS

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

1.0 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.

2.0 RF-POWER OUTPUT – PART 2.1046

As stated in Part 90, Section 90.242 the RF output power should not exceed 10 watts. The RF output of the AM Transmitter Module was connected to a Spectrum Analyzer through suitable attenuation. All cables, connectors, and attenuators were calibrated prior to testing. The RF output power was measured with the results shown on the following pages.

LIMIT:

Manufacturer's rated output power = 10 watts

1250 Peterson Dr., Wheeling, IL 60090

GRAPH(S) TAKEN OF THE RF POWER

OUTPUT MEASUREMENT

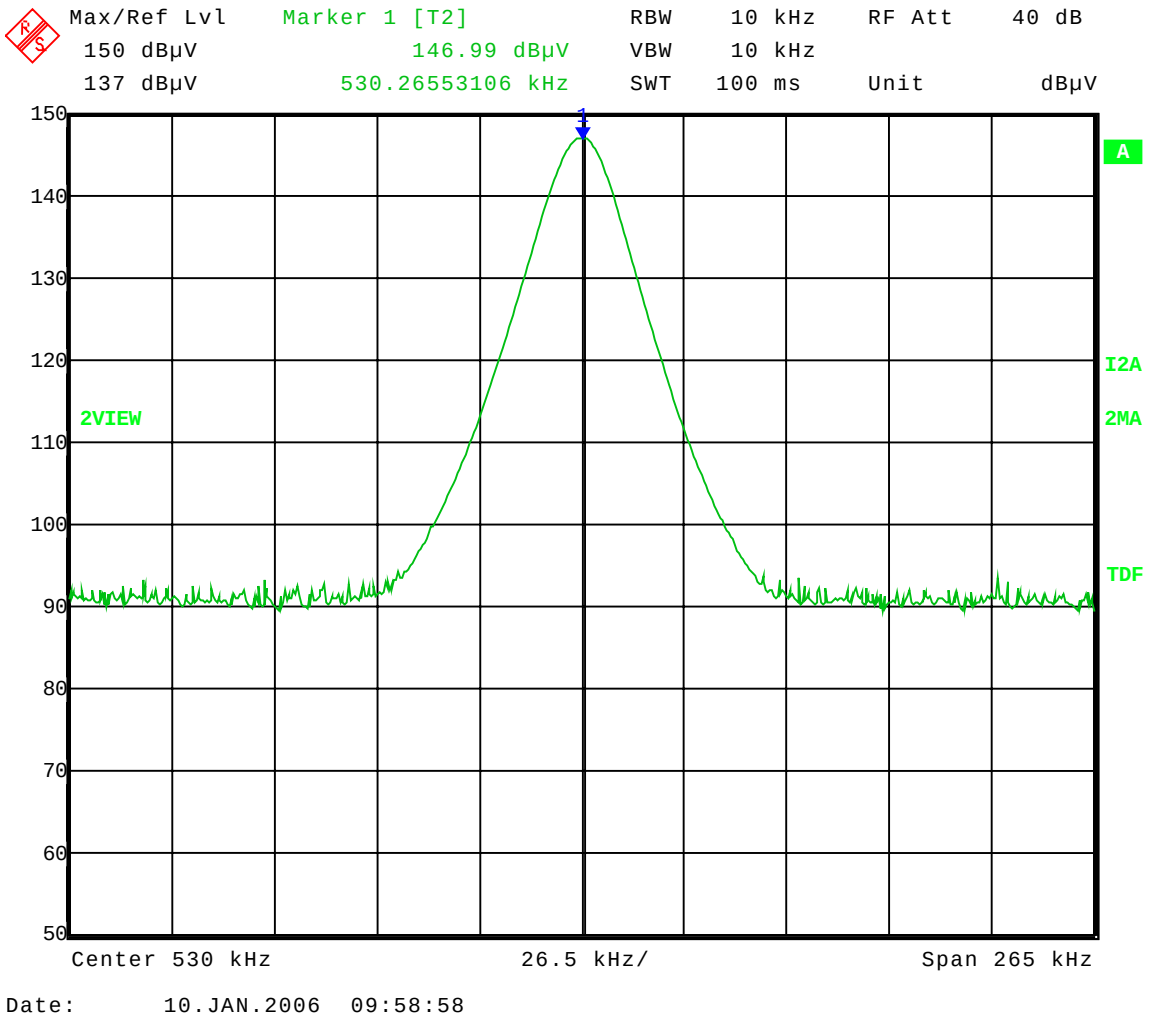
PART 2.1046

ELECTRONIC SYSTEMS, INC.
1250 Peterson Dr., Wheeling, IL 60090

Company: Highway Information Systems, Inc.
Model Tested: DRTXM4
Report Number: 11911

Test Date: 01-10-2006
Company: Highway Information Systems, Inc.
EUT: DRTXM4 with GPS-1
Test: RF Power Output
Operator: Craig Brandt
Comment: **530 kHz** Unmodulated
Single Supply mode at 12.65 V DC
Locked mode

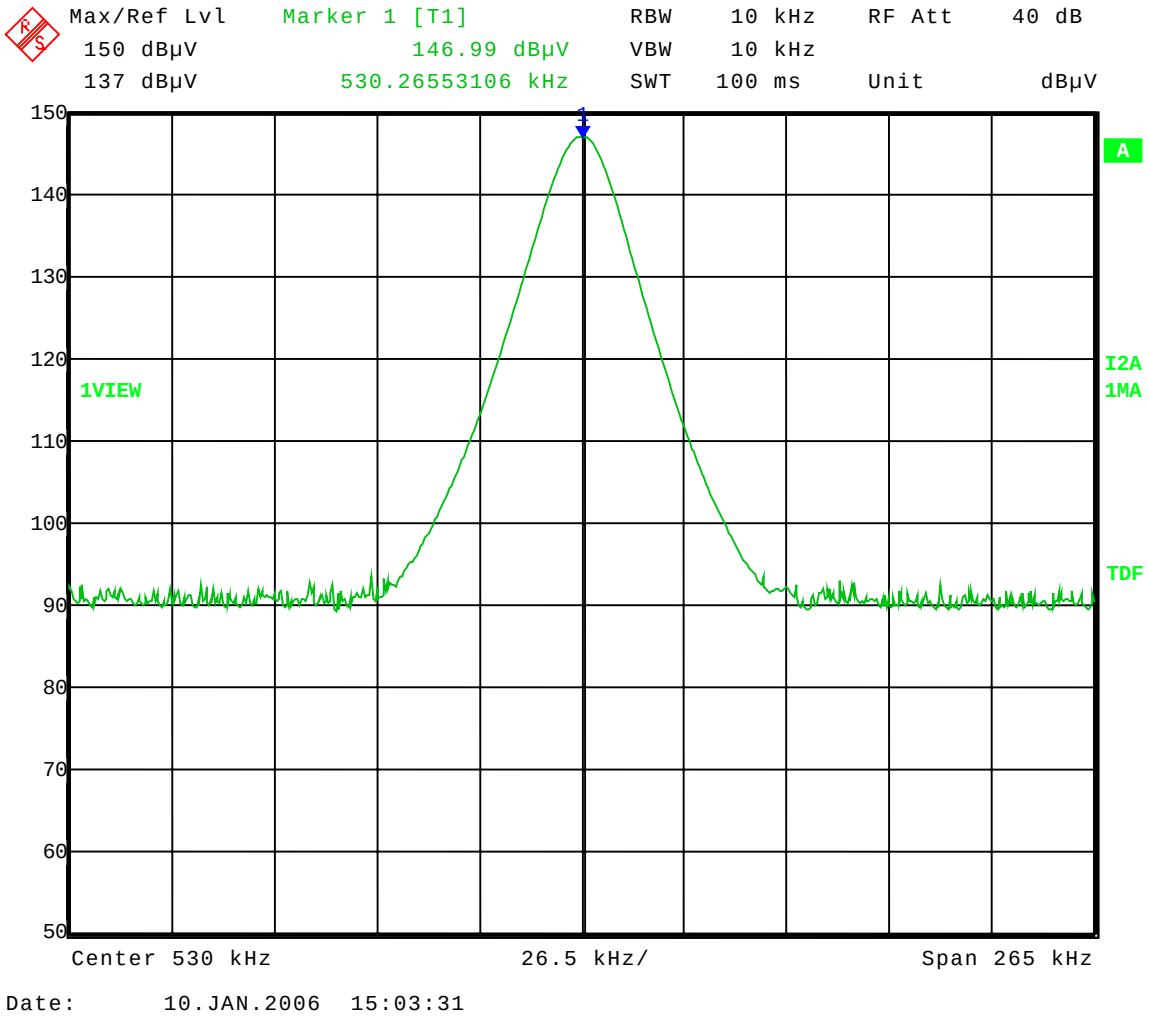
146.99 dBµV = 10.0 Watts



1250 Peterson Dr., Wheeling, IL 60090

Test Date: 01-10-2006
Company: Highway Information Systems, Inc.
EUT: DRTXM4 with GPS-1
Test: RF Power Output
Operator: Craig Brandt
Comment: **530 kHz** Unmodulated
Dual Supply mode RF Driver power at 12.58 V DC
.....Locked mode

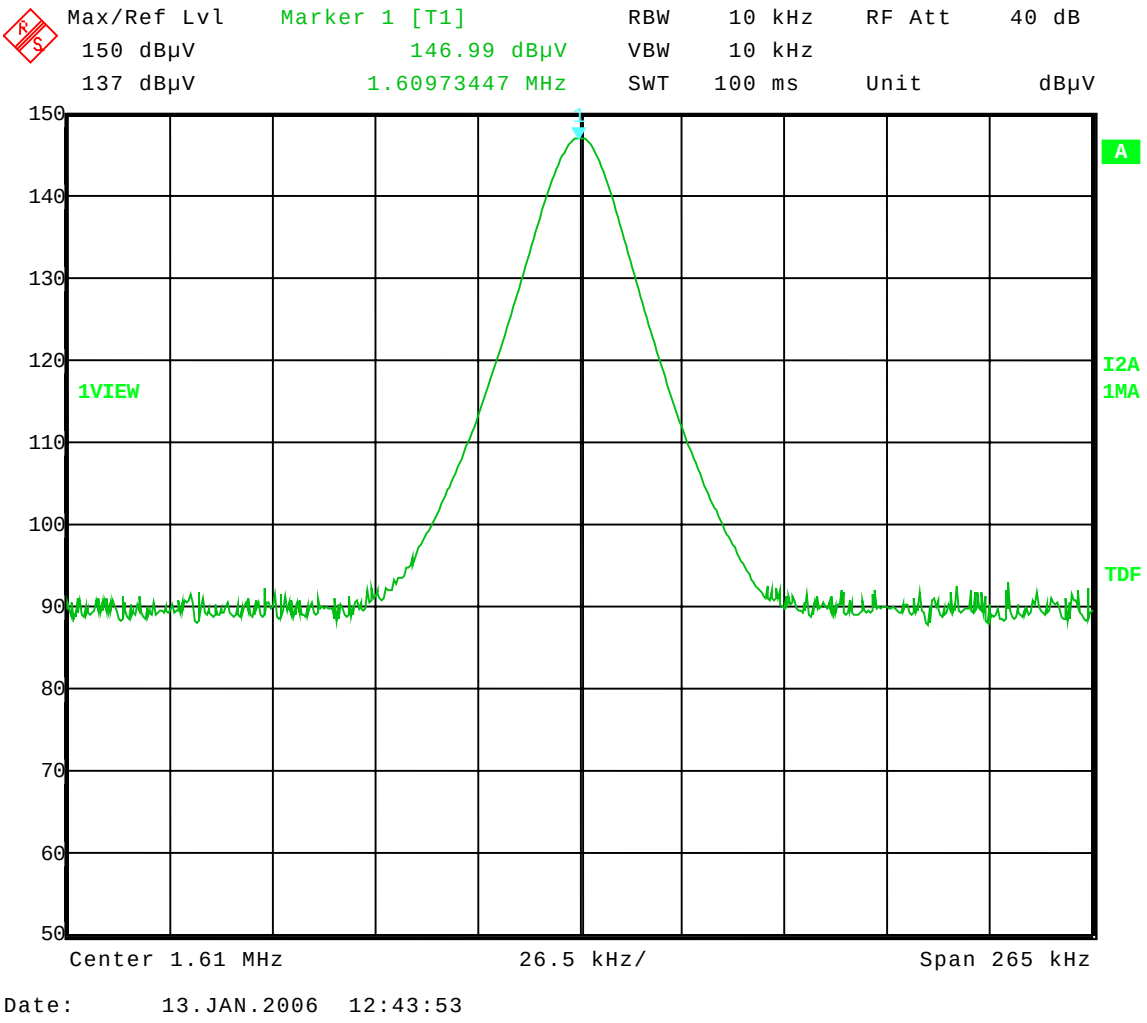
146.99 dBµV = 10.0 Watts



1250 Peterson Dr., Wheeling, IL 60090

Test Date: 01-13-2006
Company: Highway Information Systems, Inc.
EUT: DRTXM4 with GPS-1
Test: RF Power Output
Operator: Craig Brandt
Comment: **1610 kHz** Unmodulated
Single Supply mode at 11.58 V DC
Fully Locked mode

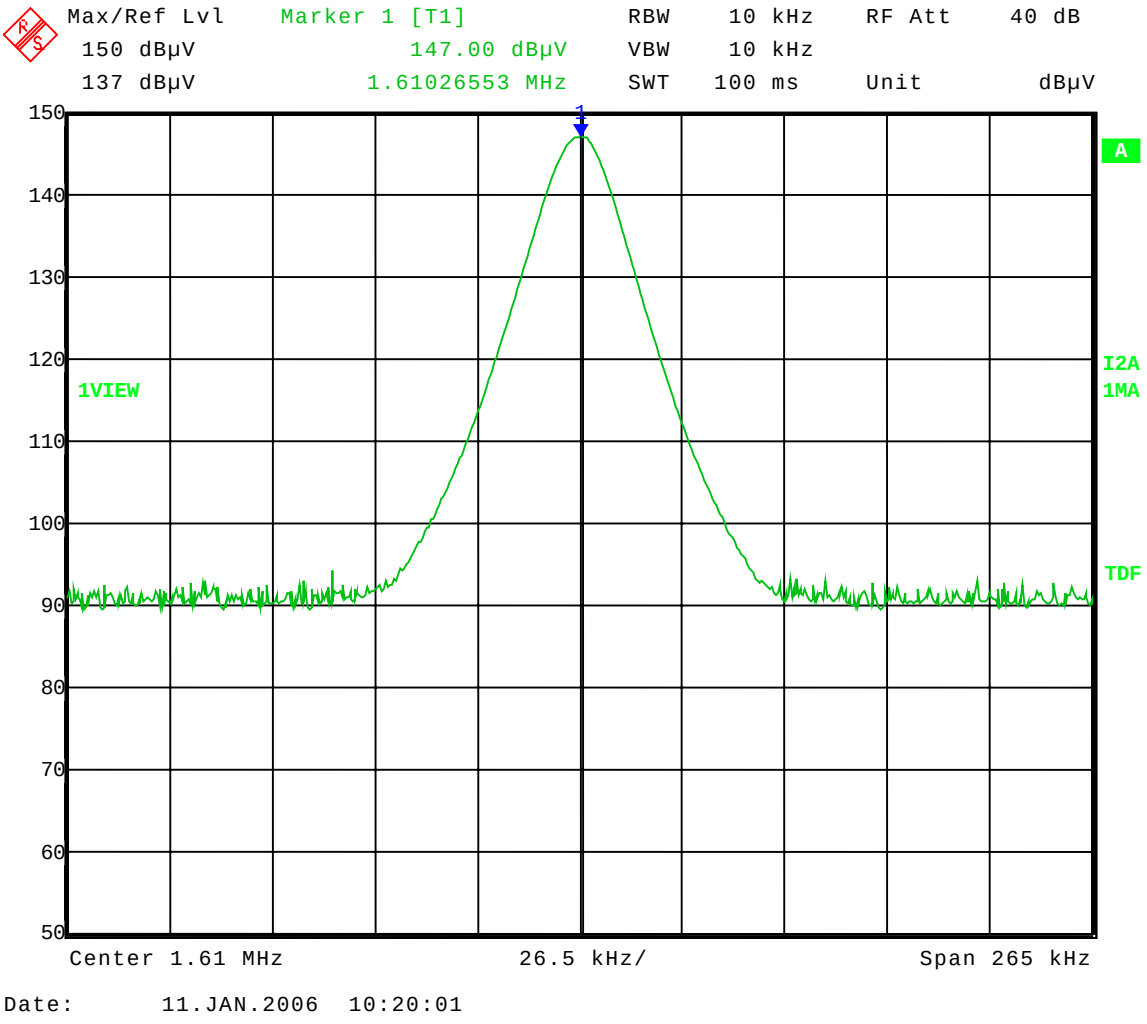
146.99 dBµV = 10.0 Watts



1250 Peterson Dr., Wheeling, IL 60090

Test Date: 01-11-2006
Company: Highway Information Systems, Inc.
EUT: DRTXM4 with GPS-1
Test: ..... RF Power Output
Operator: Craig Brandt
Comment: **1610 kHz** Unmodulated
Dual Supply mode RF Driver power at 11.04 V DC
Fully Locked mode

147.00 dBµV = 10.0 Watts



1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

3.0 MODULATION CHARACTERISTICS – PART 2.1047

a. Voice modulated communication equipment.

A curve showing the frequency response of the audio modulating circuit over a range of 0 mV to 900 mV for the Voltage Amplitude Modulation is submitted with this report.

b. Equipment which employs modulation limiting

A family of curves showing the percentage of modulation versus the modulation input voltage with sufficient information showing the modulation limiting capability throughout the range of modulating frequencies and input modulating signal levels employed.

c. Single sideband and independent sideband radiotelephone transmitters that employ a device or circuit to limit peak envelop power.

A curve showing the peak envelop power output versus the modulation input voltage.

d. Other types of equipment.

A curve or equivalent data which shows that the equipment meets the modulation requirements of the rules under which the equipment is to be licensed.

NOTE:

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

1250 Peterson Dr., Wheeling, IL 60090

GRAPH(S) AND DATA TAKEN SHOWING THE

MODULATION PERCENT VERSUS INPUT VOLTAGE

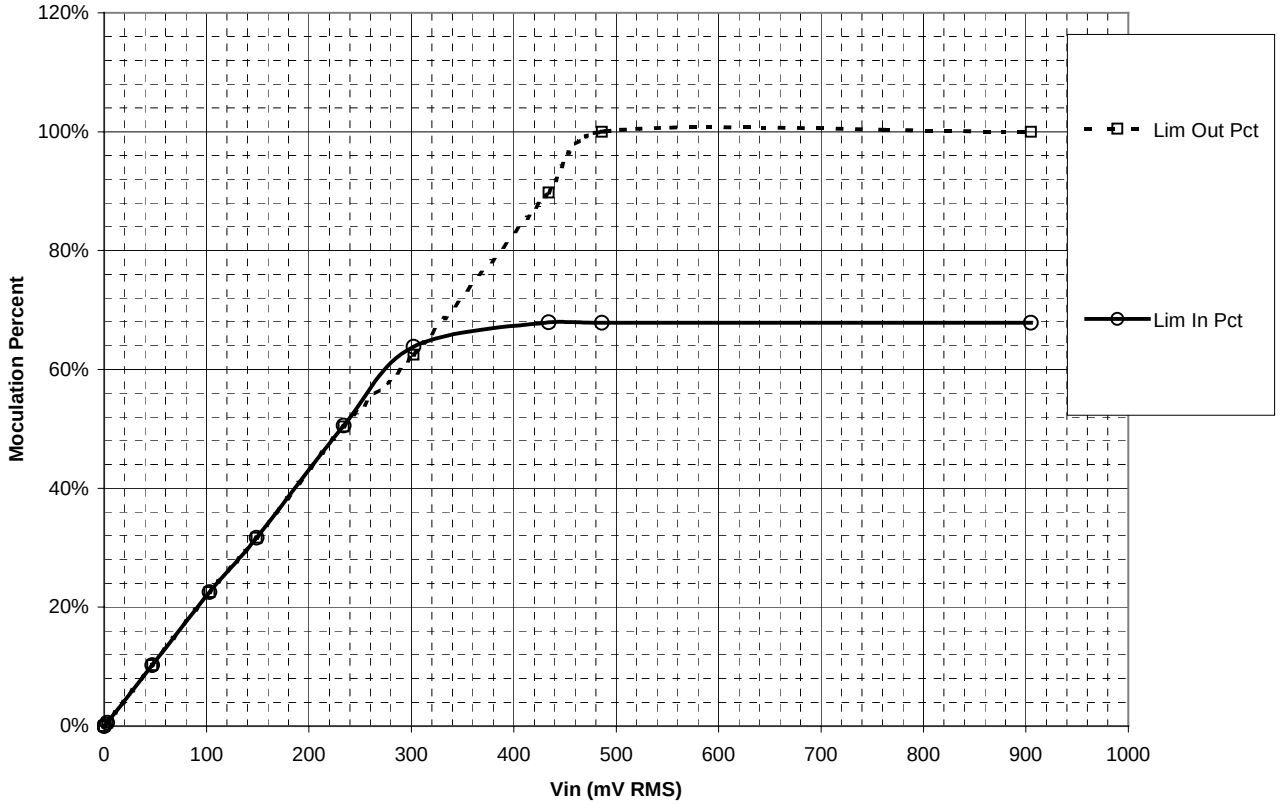
PART 2.1047

ELECTRONIC SYSTEMS, INC.

1250 Peterson Dr., Wheeling, IL 60090

Company: Highway Information Systems, Inc.
Model Tested: DRTXM4
Report Number: 11911

MODULATION PERCENT VERSUS INPUT VOLTAGE



ELECTRONIC SYSTEMS, INC.
1250 Peterson Dr., Wheeling, IL 60090

Company: Highway Information Systems, Inc.
Model Tested: DRTXM4
Report Number: 11911

Vin mV	MOD Lim Out Peak	INPUT Lim Out Valley	RESP Lim In Peak	Lim In Valley	Vin Volts	Lim Out Pct	Lim In Pct
0	18.1	18.1	18.1	18.1	0	0%	0%
3	18.2	18	18.2	18	3	1%	1%
47	19.9	16.2	19.9	16.2	47	10%	10%
103	22.3	14.1	22.3	14.1	103	23%	23%
149	23.9	12.4	23.9	12.4	149	32%	32%
234	27.3	9	27.4	9	234	50%	51%
302	29.9	6.9	29.9	6.6	302	63%	64%
434	35.2	1.9	30.9	5.9	434	90%	68%
486	36.8	0	30.8	5.9	486	100%	68%
905	38.1	0	30.8	5.9	905	100%	68%

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

4.0 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 AM Transmitter Module 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 1 MHz to 200 MHz bands for AM Transmitter Module equipment is found under the emission masks of Part 90, Section 90.210 for Travelers' Information Stations.

Carson's Rule:

Section 2.202 (g)

Bn = 2M+2DK, where K=1	Bn = Bandwidth
M = 2500 Hz,	M = Maximum Modulating Frequency
D = 45 kHz,	D = Peak Deviation

Bn = 2(15) + 2(45)(1) = 120 kHz

1250 Peterson Dr., Wheeling, IL 60090

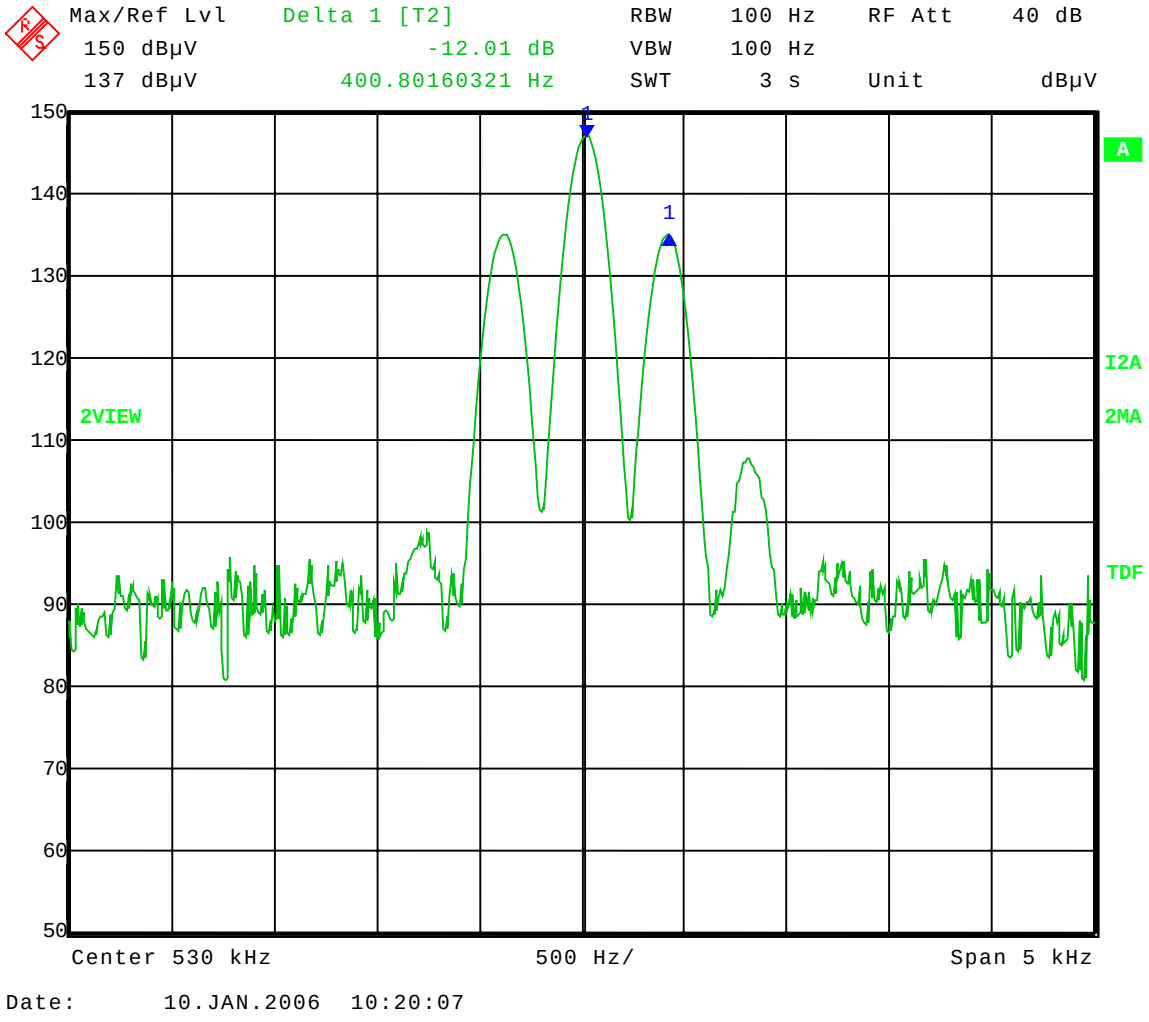
GRAPH(S) TAKEN OF THE OCCUPIED BANDWIDTH

PART 2.1049

1250 Peterson Dr., Wheeling, IL 60090

Test Date: 01-10-2006
Company: Highway Information Systems, Inc.
EUT: DRTXM4 with GPS-1
Test: Occupied Bandwidth
Operator: Craig Brandt
Comment: **530 kHz**
Single Supply mode at 12.65 V DC

50% Modulation at 400 Hz
400 Hz = Frequency of maximum response of the audio modulating circuit.
Input level = 0.56 Vrms

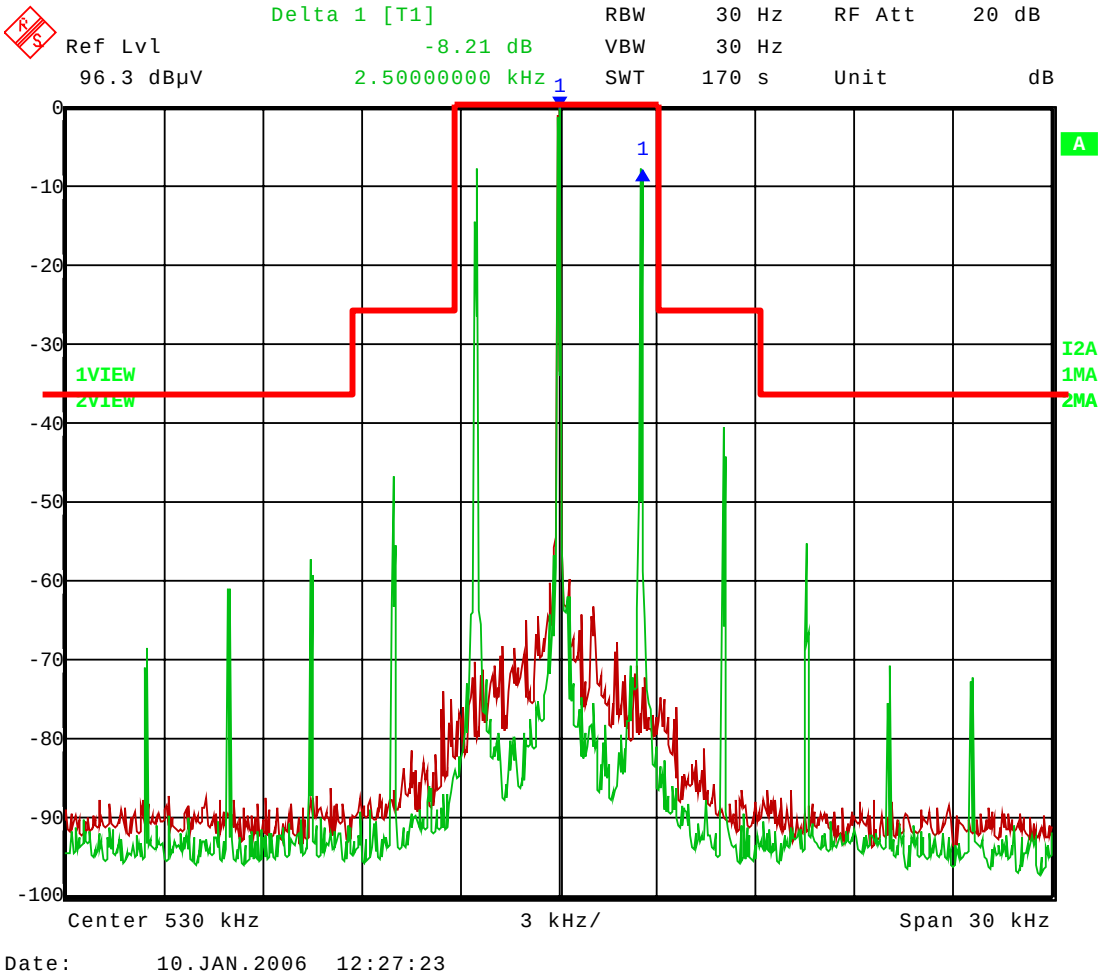


1250 Peterson Dr., Wheeling, IL 60090

Test Date: 01-10-2006
Company: Highway Information Systems, Inc.
EUT: DRTXM4 with GPS-1
Test: Occupied Bandwidth
Operator: Craig Brandt
Comment: **530 kHz**
Single Supply mode at 12.65 V DC
Fully Locked mode

16 dB > 50% Modulation at 2500 Hz
Input level = 3.53 Vrms

Red = Unmodulated
Green = Modulated

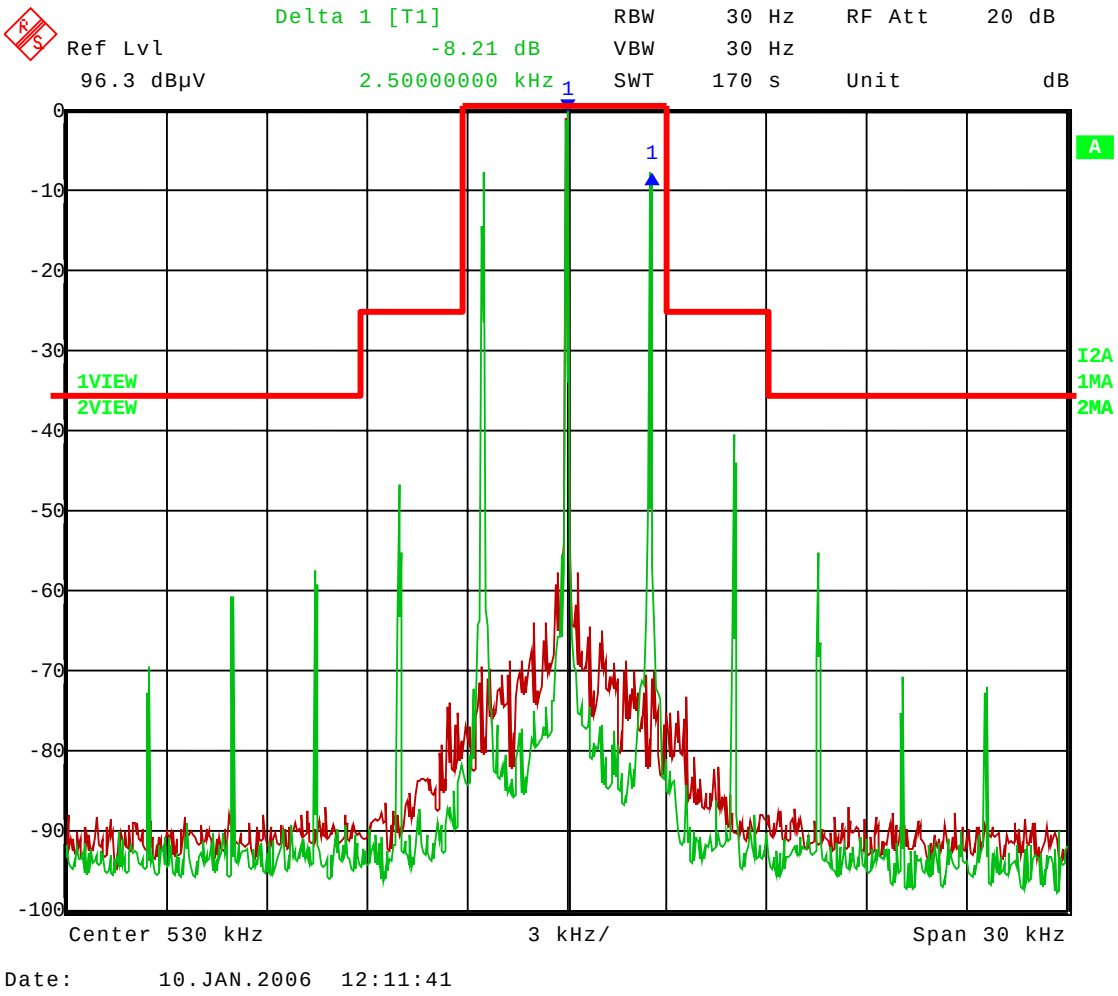


1250 Peterson Dr., Wheeling, IL 60090

Test Date: 01-10-2006
Company: Highway Information Systems, Inc.
EUT: DRTXM4 with GPS-1
Test: Occupied Bandwidth
Operator: Craig Brandt
Comment: **530 kHz**
Single Supply mode at 12.65 V DC
Without Satellite Reception Mode

16 dB > 50% Modulation at 2500 Hz
Input level = 3.53 Vrms

Red = Unmodulated
Green = Modulated



ELECTRONIC SYSTEMS, INC.

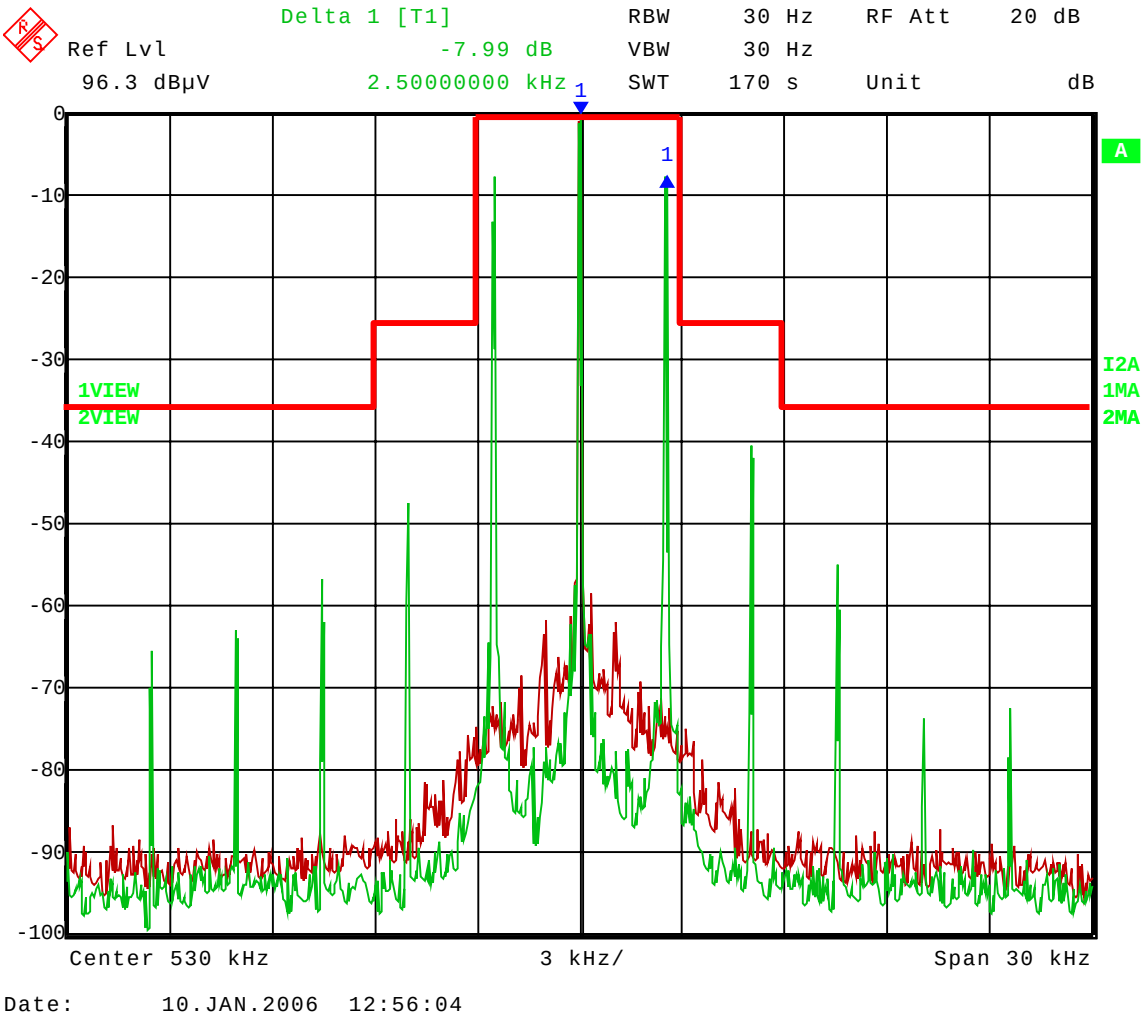
1250 Peterson Dr., Wheeling, IL 60090

Company: Highway Information Systems, Inc.
Model Tested: DRTXM4
Report Number: 11911

Test Date: 01-10-2006
Company: Highway Information Systems, Inc.
EUT: DRTXM4 with GPS-1
Test: Occupied Bandwidth
Operator: Craig Brandt
Comment: **530 kHz**
Single Supply mode at 12.65 V DC
Without GPS-1 Synchronizer Signal to Transmitter Mode

16 dB > 50% Modulation at 2500 Hz
Input level = 3.53 Vrms

Red = Unmodulated
Green = Modulated



ELECTRONIC SYSTEMS, INC.

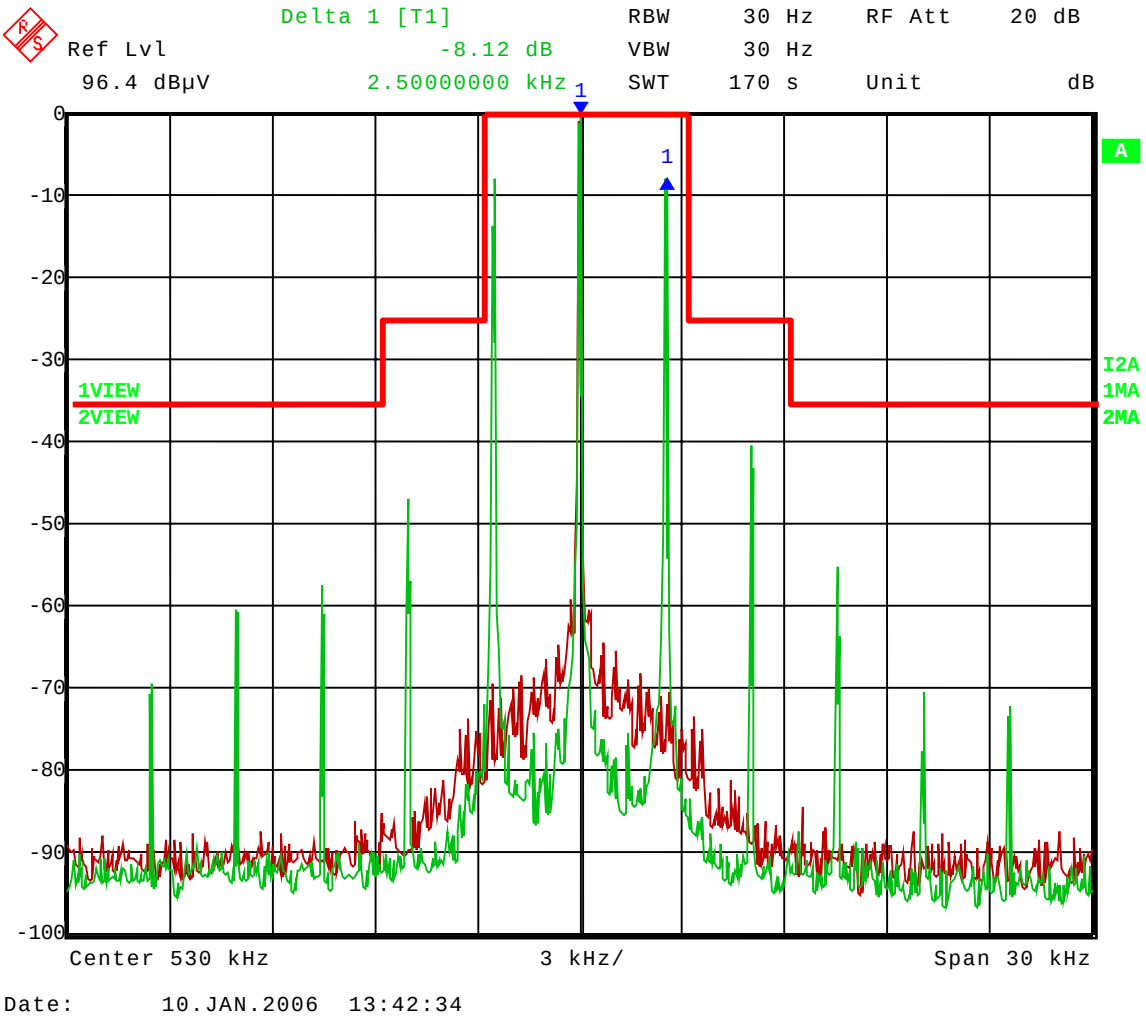
1250 Peterson Dr., Wheeling, IL 60090

Company: Highway Information Systems, Inc.
Model Tested: DRTXM4
Report Number: 11911

Test Date: 01-10-2006
Company: Highway Information Systems, Inc.
EUT: DRTXM4 with GPS-1
Test: Occupied Bandwidth
Operator: Craig Brandt
Comment: **530 kHz**
Single Supply mode at 12.65 V DC
Without 1 PPS Timing Signal Mode

16 dB > 50% Modulation at 2500 Hz
Input level = 3.53 Vrms

Red = Unmodulated
Green = Modulated

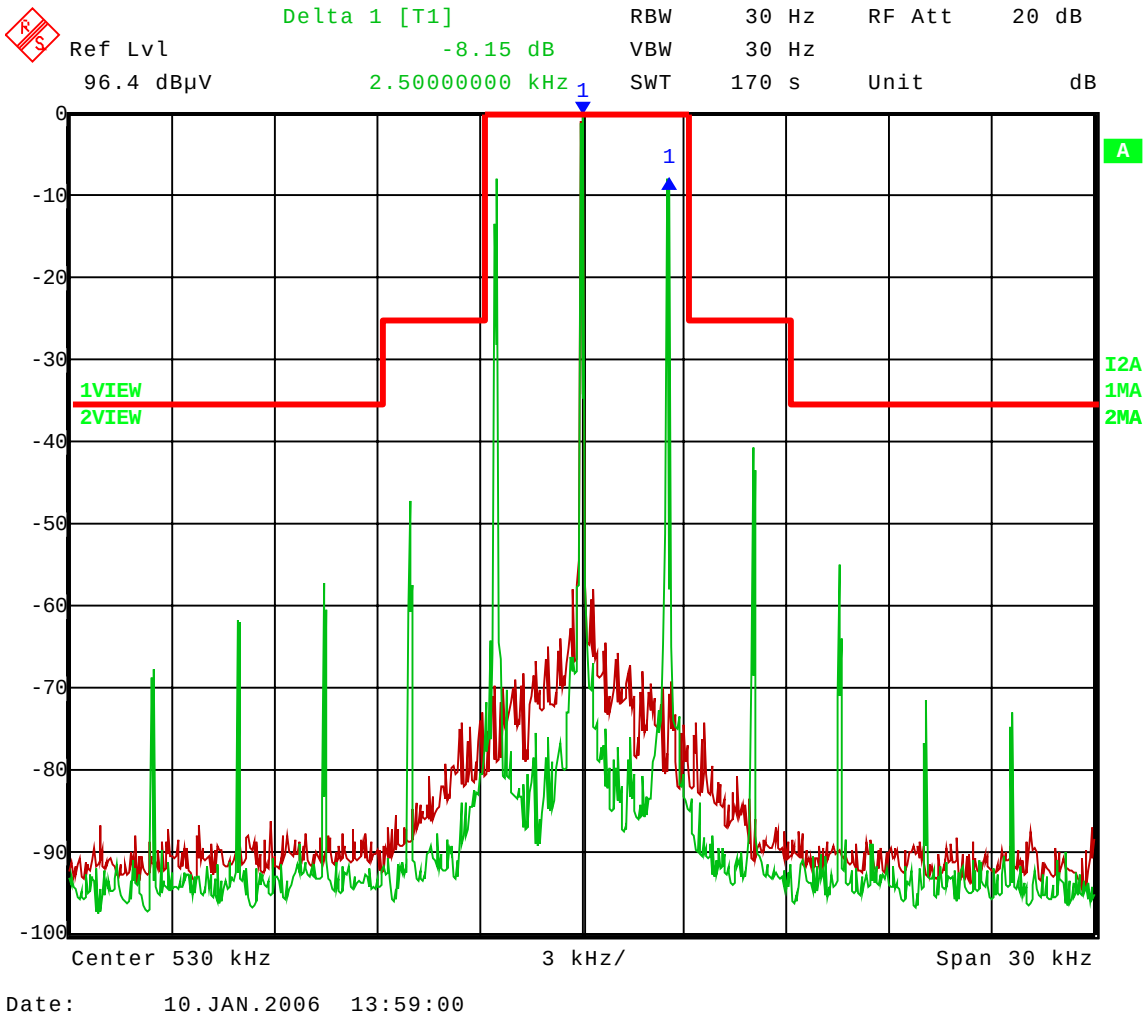


1250 Peterson Dr., Wheeling, IL 60090

Test Date: 01-10-2006
Company: Highway Information Systems, Inc.
EUT: DRTXM4 with GPS-1
Test: Occupied Bandwidth
Operator: Craig Brandt
Comment: **530 kHz**
Single Supply mode at 12.65 V DC
Without 10 MHz Timing Signal Mode

16 dB > 50% Modulation at 2500 Hz
Input level = 3.53 Vrms

Red = Unmodulated
Green = Modulated



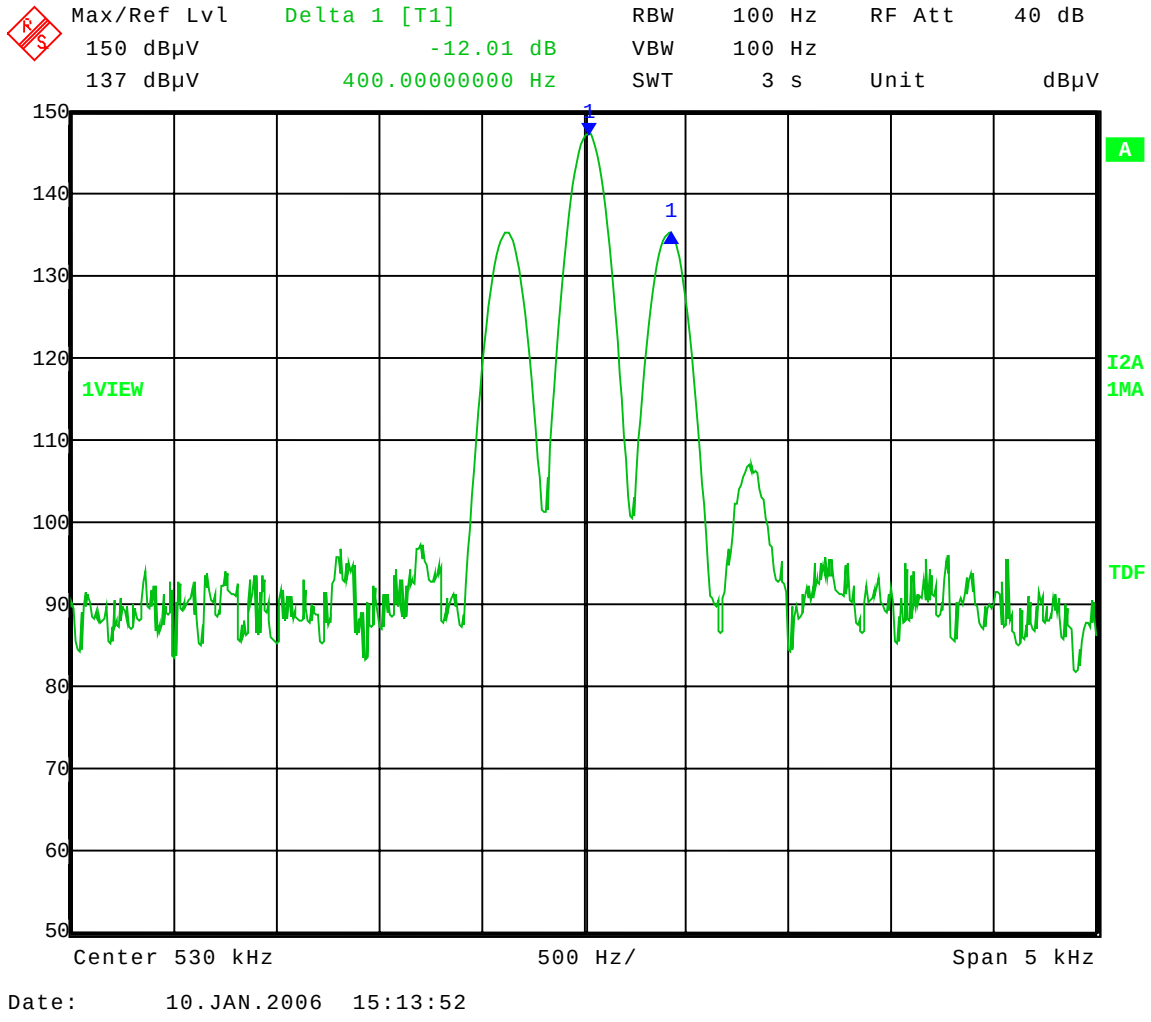
DLS ELECTRONIC SYSTEMS, INC.
NVLAP 100276-0

1250 Peterson Dr., Wheeling, IL 60090

Company: Highway Information Systems, Inc.
Model Tested: DRTXM4
Report Number: 11911

Test Date: 01-10-2006
Company: Highway Information Systems, Inc.
EUT: DRTXM4 with GPS-1
Test: Occupied Bandwidth
Operator: Craig Brandt
Comment: **530 kHz**
Dual Supply Mode at 12.58 V DC

50% Modulation at 400 Hz
400 Hz = Frequency of maximum response of the audio modulating circuit.
Input level = 0.56 Vrms

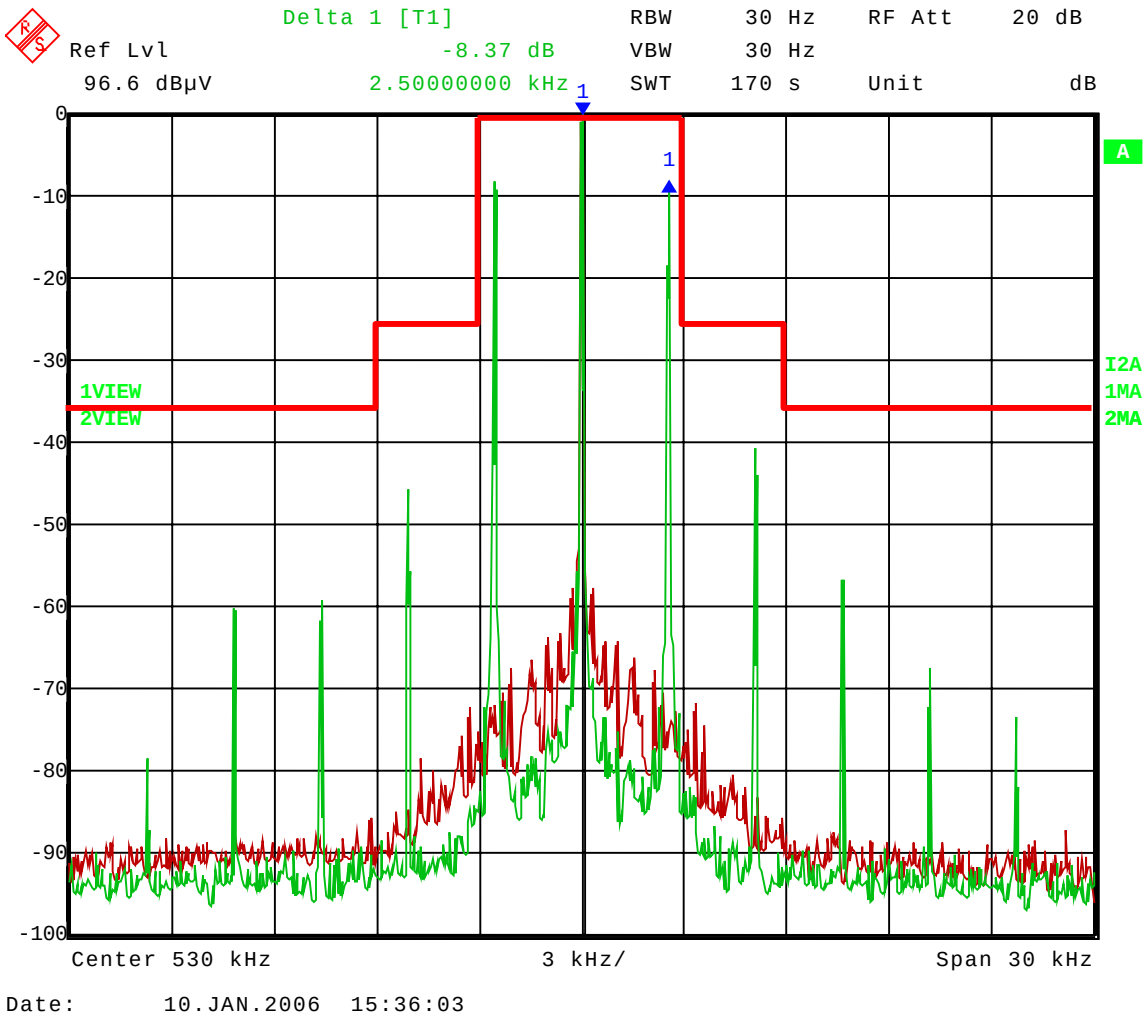


1250 Peterson Dr., Wheeling, IL 60090

Test Date: 01-10-2006
Company: Highway Information Systems, Inc.
EUT: DRTXM4 with GPS-1
Test: Occupied Bandwidth
Operator: .....Craig Brandt
Comment: **530 kHz**
Dual Supply mode at 12.58 V DC
Fully Locked Mode

16 dB > 50% Modulation at 2500 Hz
Input level = 3.53 Vrms

Red = Unmodulated
Green = Modulated



DLS ELECTRONIC SYSTEMS, INC.
NVLAP 100276-0

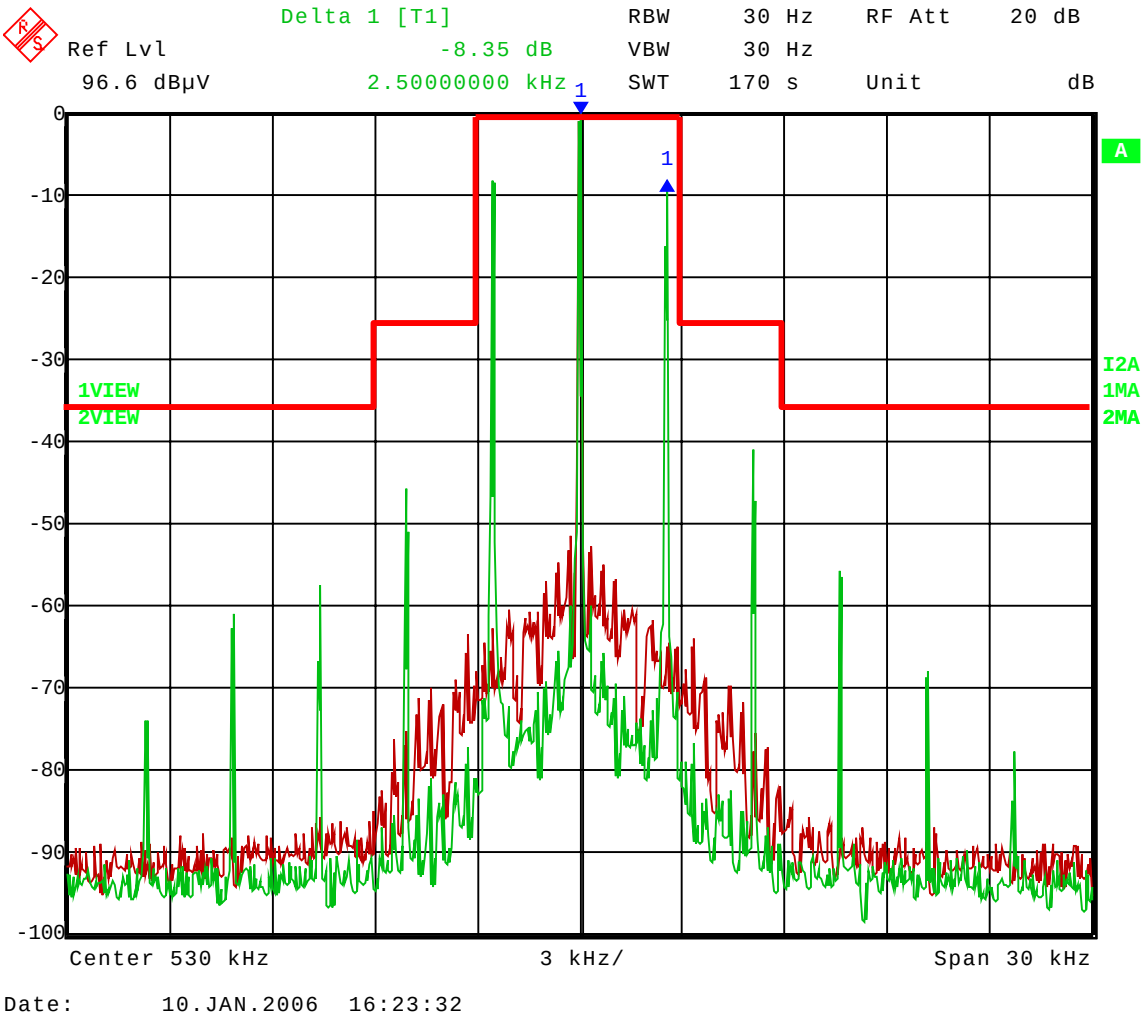
1250 Peterson Dr., Wheeling, IL 60090

Company: Highway Information Systems, Inc.
Model Tested: DRTXM4
Report Number: 11911

Test Date: 01-10-2006
Company: Highway Information Systems, Inc.
EUT: DRTXM4 with GPS-1
Test: Occupied Bandwidth
Operator: Craig Brandt
Comment: **530 kHz**
Dual Supply mode at 12.58 V DC
Without Satellite Reception Mode

16 dB > 50% Modulation at 2500 Hz
Input level = 3.53 Vrms

Red = Unmodulated
Green = Modulated



ELECTRONIC SYSTEMS, INC.

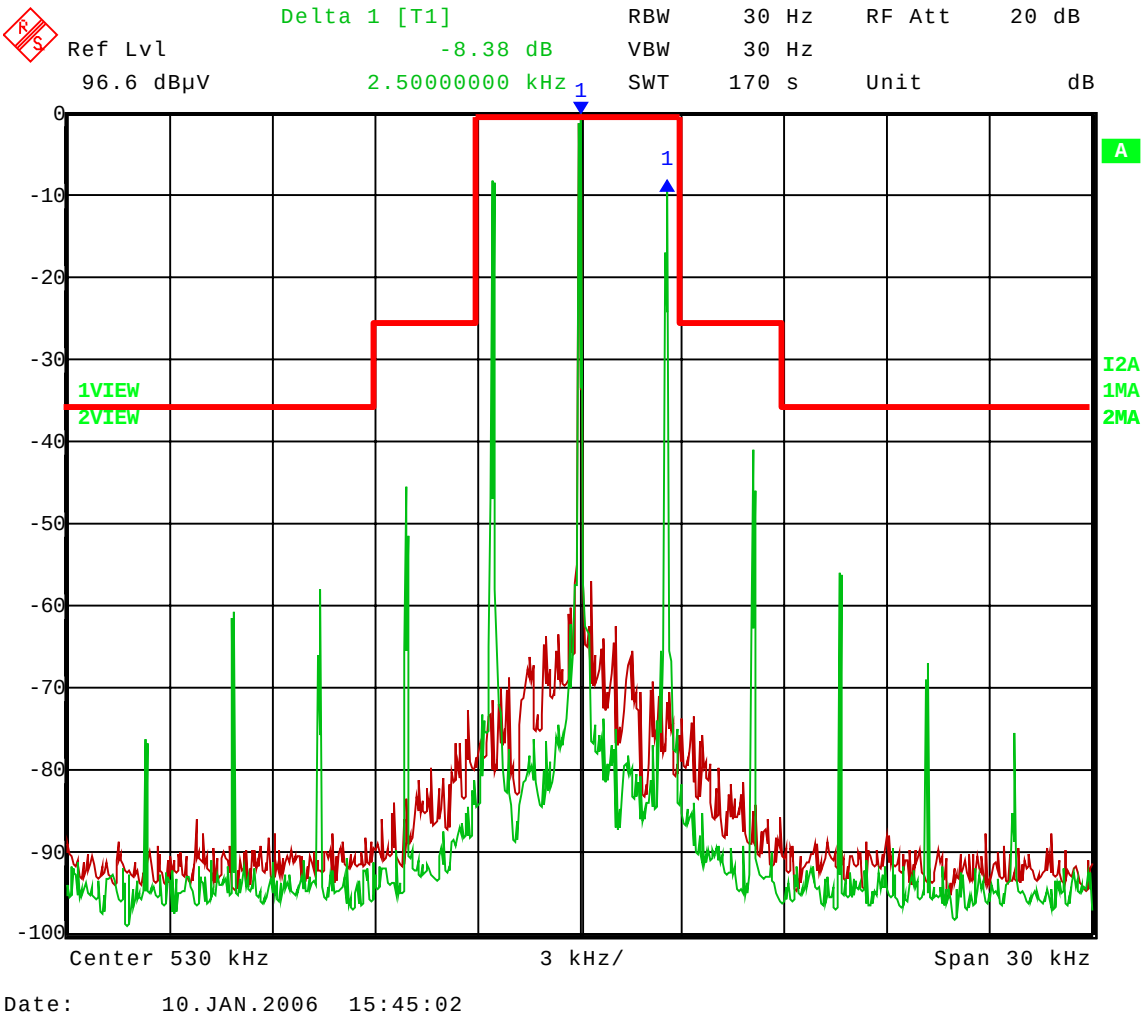
1250 Peterson Dr., Wheeling, IL 60090

Company: Highway Information Systems, Inc.
Model Tested: DRTXM4
Report Number: 11911

Test Date: 01-10-2006
Company: Highway Information Systems, Inc.
EUT: DRTXM4 with GPS-1
Test: Occupied Bandwidth
Operator: Craig Brandt
Comment: **530 kHz**
Dual Supply mode at 12.58 V DC
Without GPS-1 Synchronizer Signal to Transmitter Mode

16 dB > 50% Modulation at 2500 Hz
Input level = 3.53 Vrms

Red = Unmodulated
Green = Modulated

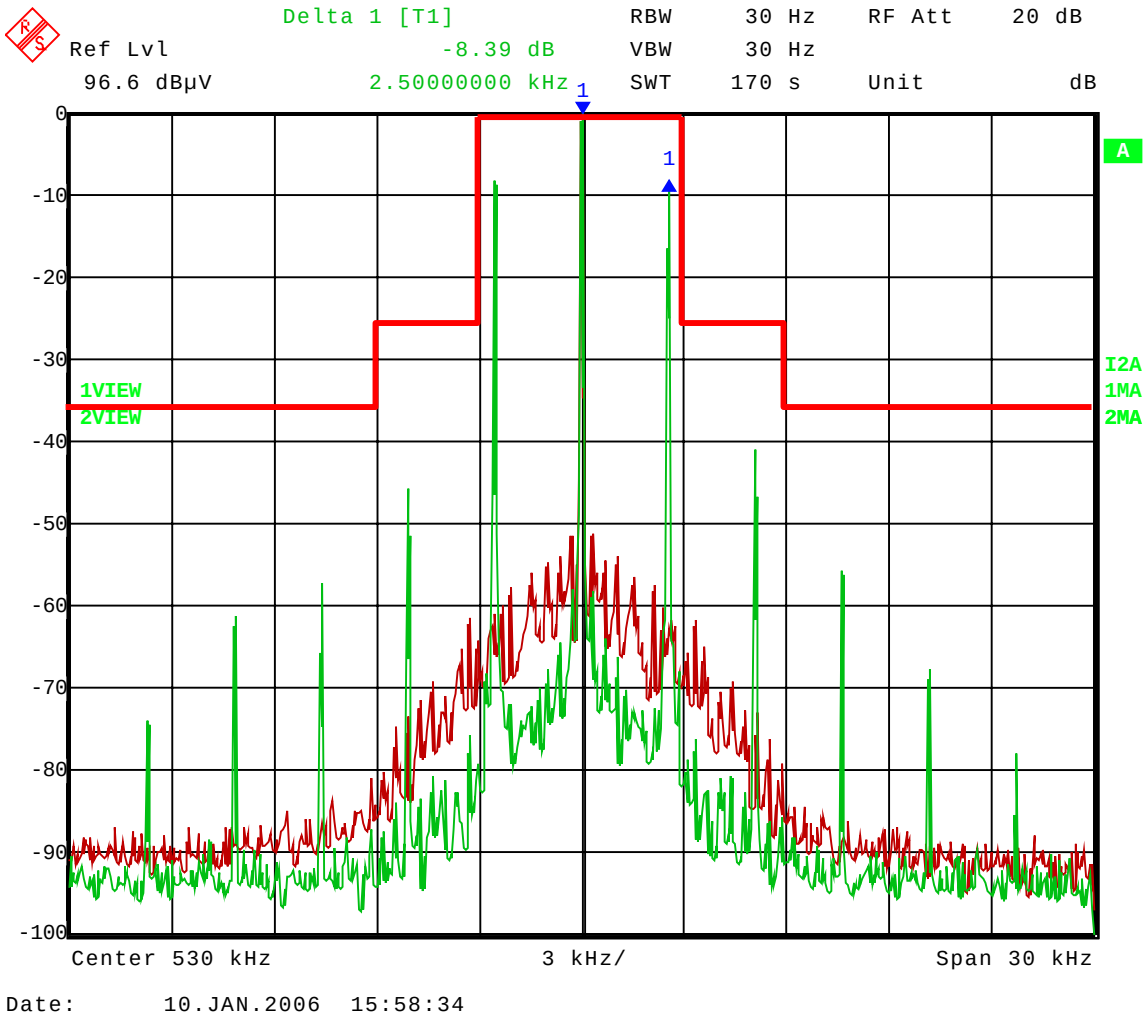


1250 Peterson Dr., Wheeling, IL 60090

Test Date: 01-10-2006
Company: Highway Information Systems, Inc.
EUT: DRTXM4 with GPS-1
Test: Occupied Bandwidth
Operator: Craig Brandt
Comment: **530 kHz**
Dual Supply mode at 12.58 V DC
Without 1 PPS Timing Signal Mode

16 dB > 50% Modulation at 2500 Hz
Input level = 3.53 Vrms

Red = Unmodulated
Green = Modulated

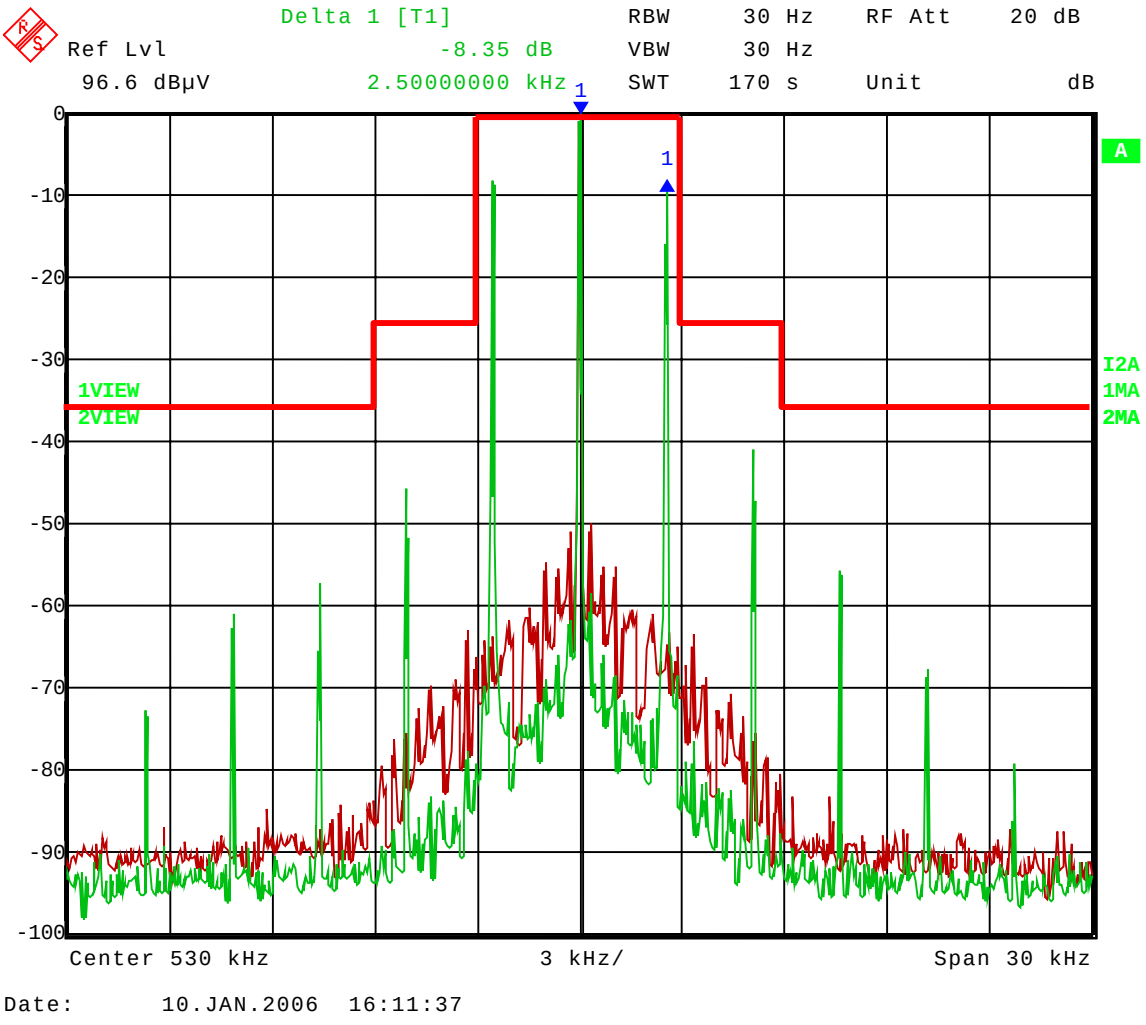


1250 Peterson Dr., Wheeling, IL 60090

Test Date: 01-10-2006
Company: Highway Information Systems, Inc.
EUT: DRTXM4 with GPS-1
Test: Occupied Bandwidth
Operator: Craig Brandt
Comment: **530 kHz**
Dual Supply mode at 12.58 V DC
Without 10 MHz Timing Signal Mode

16 dB > 50% Modulation at 2500 Hz
Input level = 3.53 Vrms

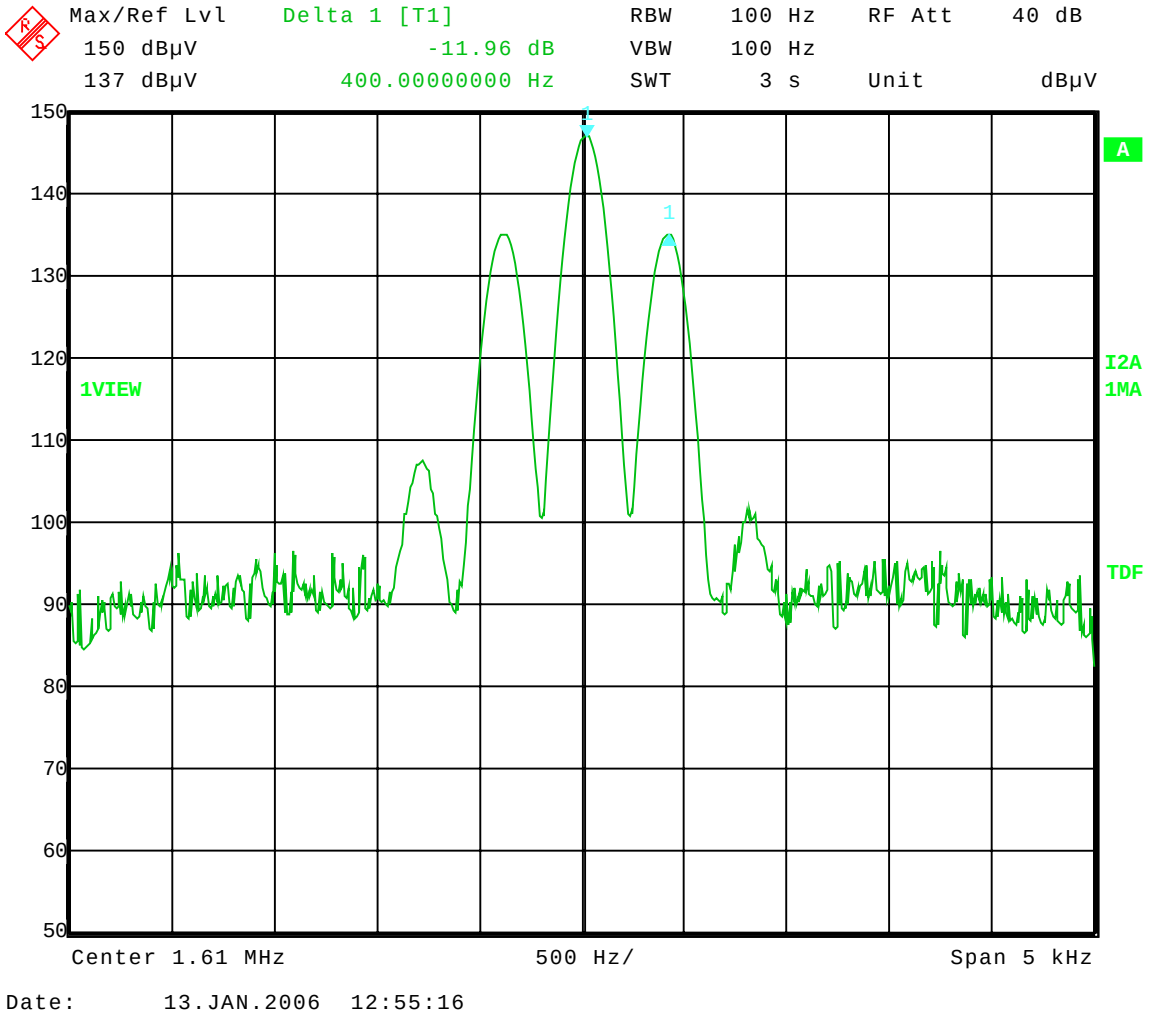
Red = Unmodulated
Green = Modulated



1250 Peterson Dr., Wheeling, IL 60090

Test Date: 01-13-2006
Company: Highway Information Systems, Inc.
EUT: DRTXM4 with GPS-1
Test: Occupied Bandwidth
Operator: Craig Brandt
Comment: **1610 kHz**
Single Supply Mode at 11.58 V DC

50% Modulation at 400 Hz
400 Hz = Frequency of maximum response of the audio modulating circuit.
Input level = 0.49 Vrms

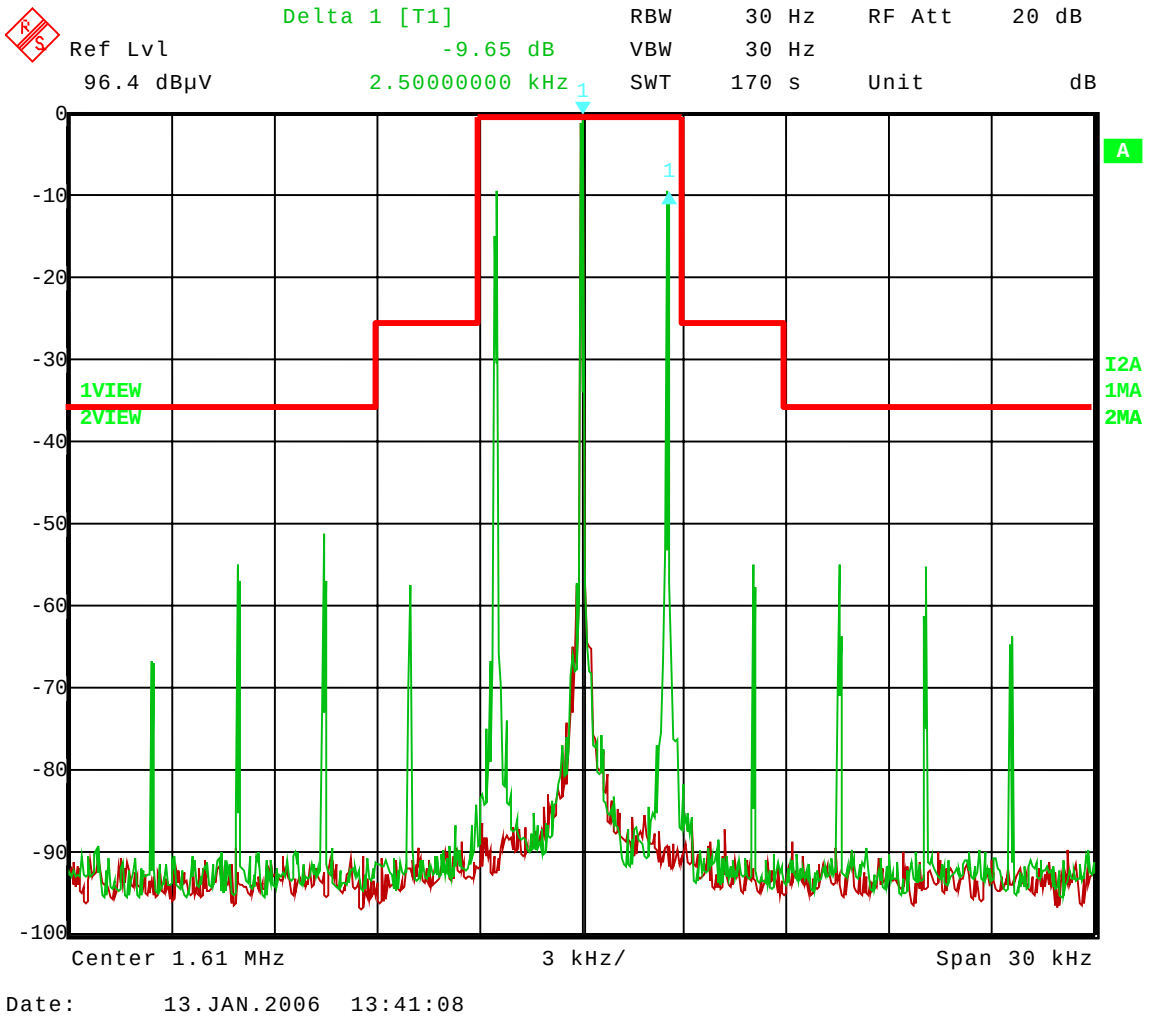


1250 Peterson Dr., Wheeling, IL 60090

Test Date: 01-13-2006
Company: Highway Information Systems, Inc.
EUT: DRTXM4 with GPS-1
Test: Occupied Bandwidth
Operator: Craig Brandt
Comment: **1610 kHz**
Single Supply mode at 11.58 V DC
Fully Locked Mode

16 dB > 50% Modulation at 2500 Hz
Input level = 3.12 Vrms

Red = Unmodulated
Green = Modulated



ELECTRONIC SYSTEMS, INC.

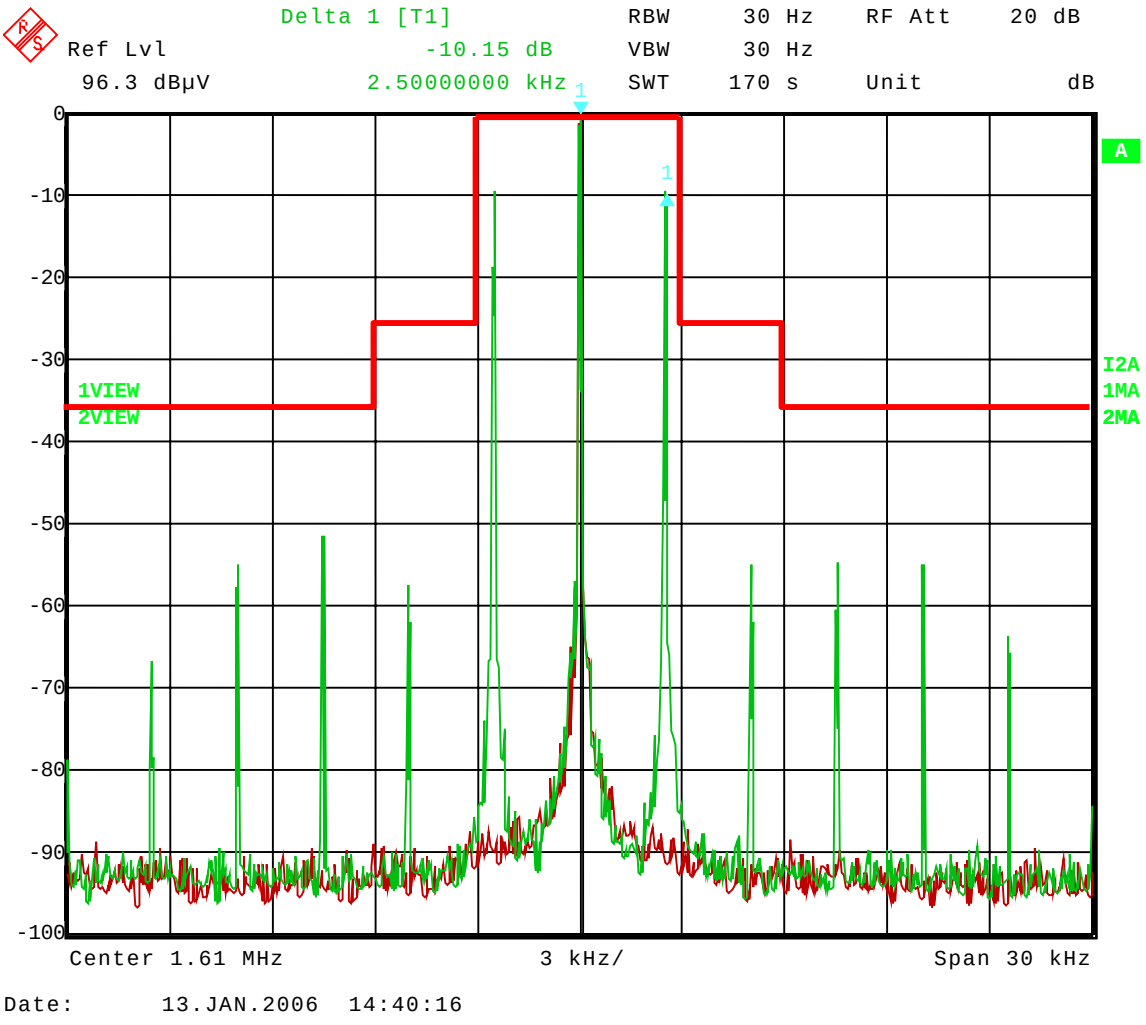
1250 Peterson Dr., Wheeling, IL 60090

Company: Highway Information Systems, Inc.
Model Tested: DRTXM4
Report Number: 11911

Test Date: 01-13-2006
Company: Highway Information Systems, Inc.
EUT: DRTXM4 with GPS-1
Test: Occupied Bandwidth
Operator: Craig Brandt
Comment: **1610 kHz**
Single Supply mode at 11.58 V DC
Without Satellite Reception Mode

16 dB > 50% Modulation at 2500 Hz
Input level = 3.12 Vrms

Red = Unmodulated
Green = Modulated

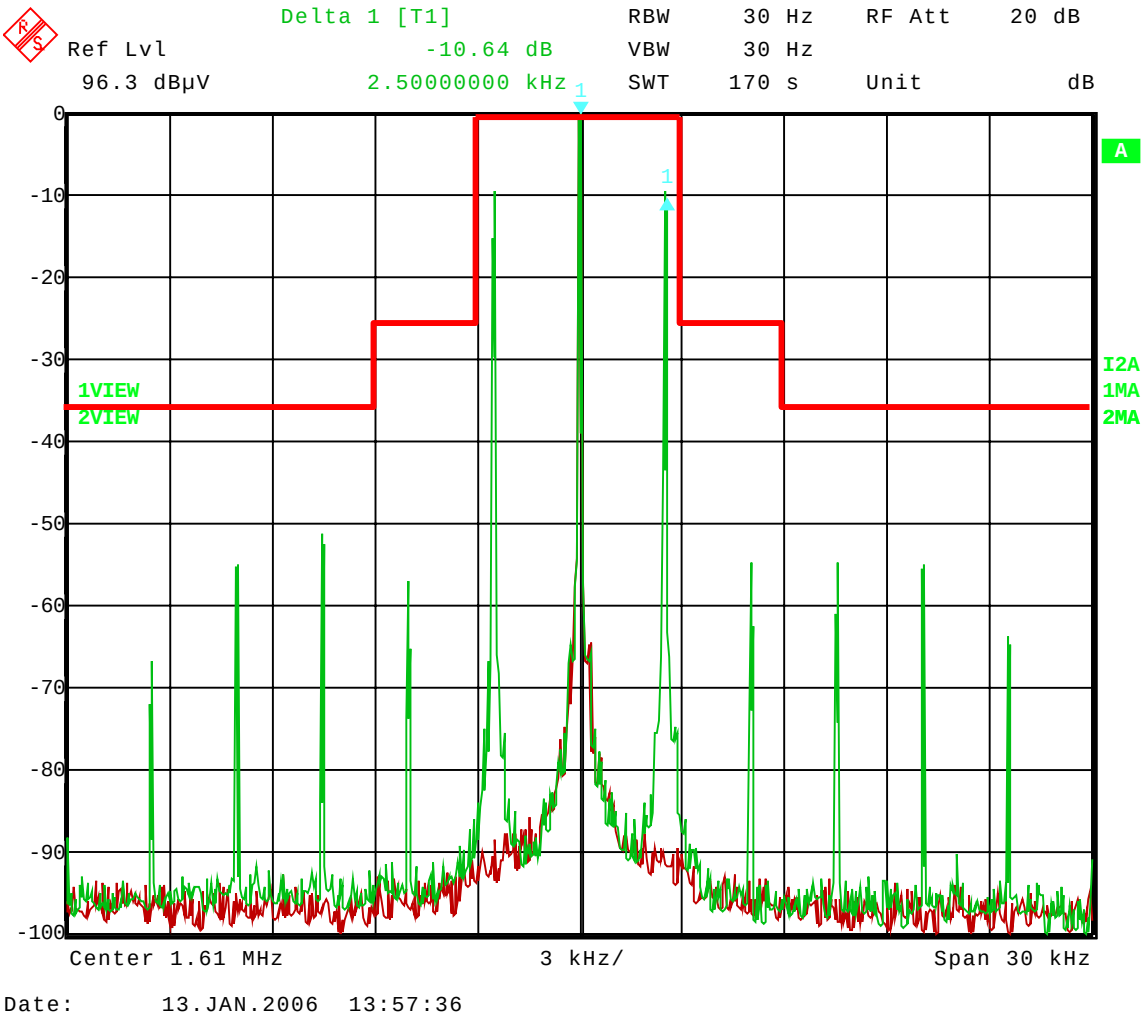


1250 Peterson Dr., Wheeling, IL 60090

Test Date: 01-13-2006
Company: Highway Information Systems, Inc.
EUT: DRTXM4 with GPS-1
Test: Occupied Bandwidth
Operator: Craig Brandt
Comment: **1610 kHz**
Single Supply mode at 11.58 V DC
Without GPS-1 Synchronizer Signal to Transmitter Mode

16 dB > 50% Modulation at 2500 Hz
Input level = 3.12 Vrms

Red = Unmodulated
Green = Modulated

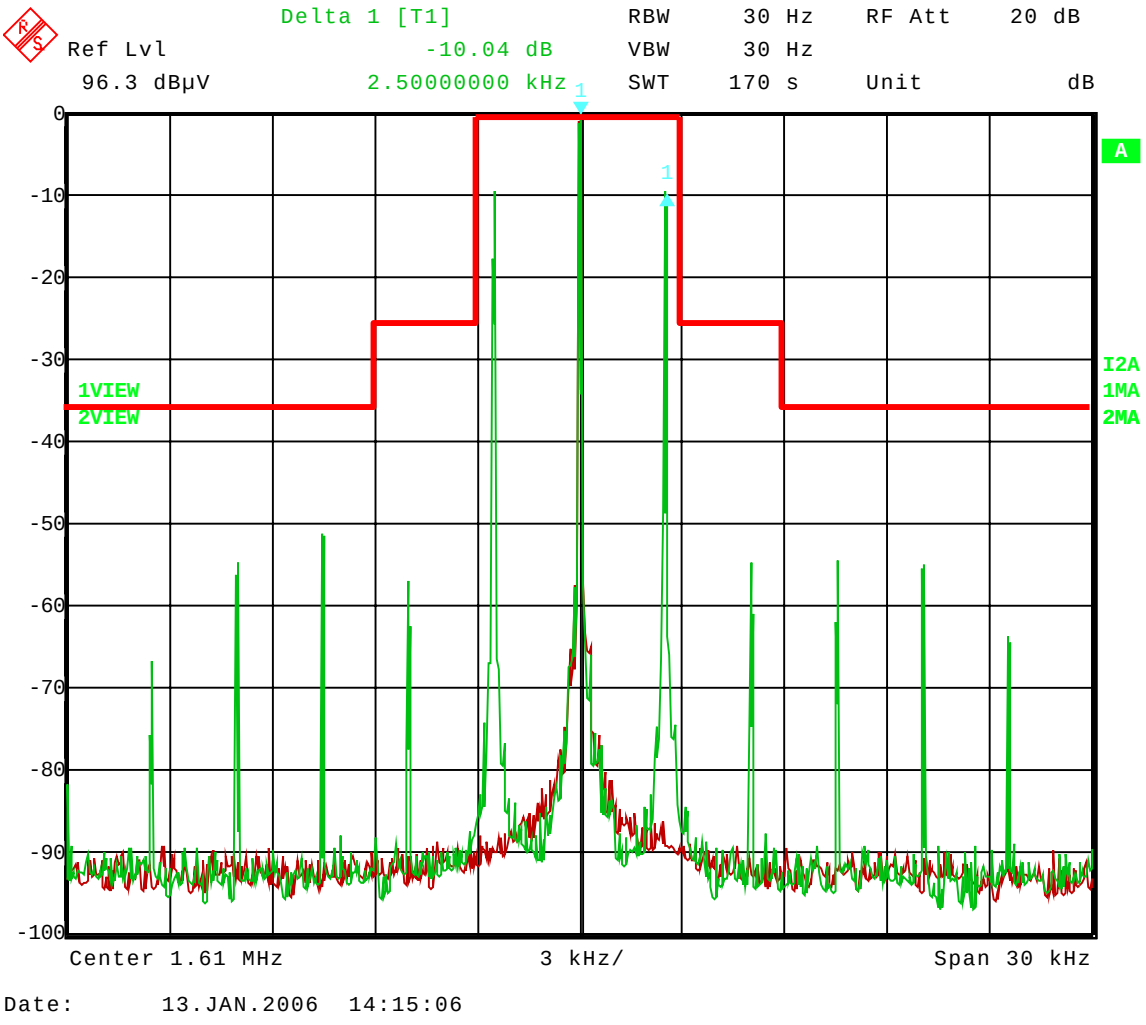


1250 Peterson Dr., Wheeling, IL 60090

Test Date: 01-13-2006
Company: Highway Information Systems, Inc.
EUT: DRTXM4 with GPS-1
Test: Occupied Bandwidth
Operator: Craig Brandt
Comment: **1610 kHz**
Single Supply mode at 11.58 V DC
Without 1 PPS Timing Signal Mode

16 dB > 50% Modulation at 2500 Hz
Input level = 3.12 Vrms

Red = Unmodulated
Green = Modulated

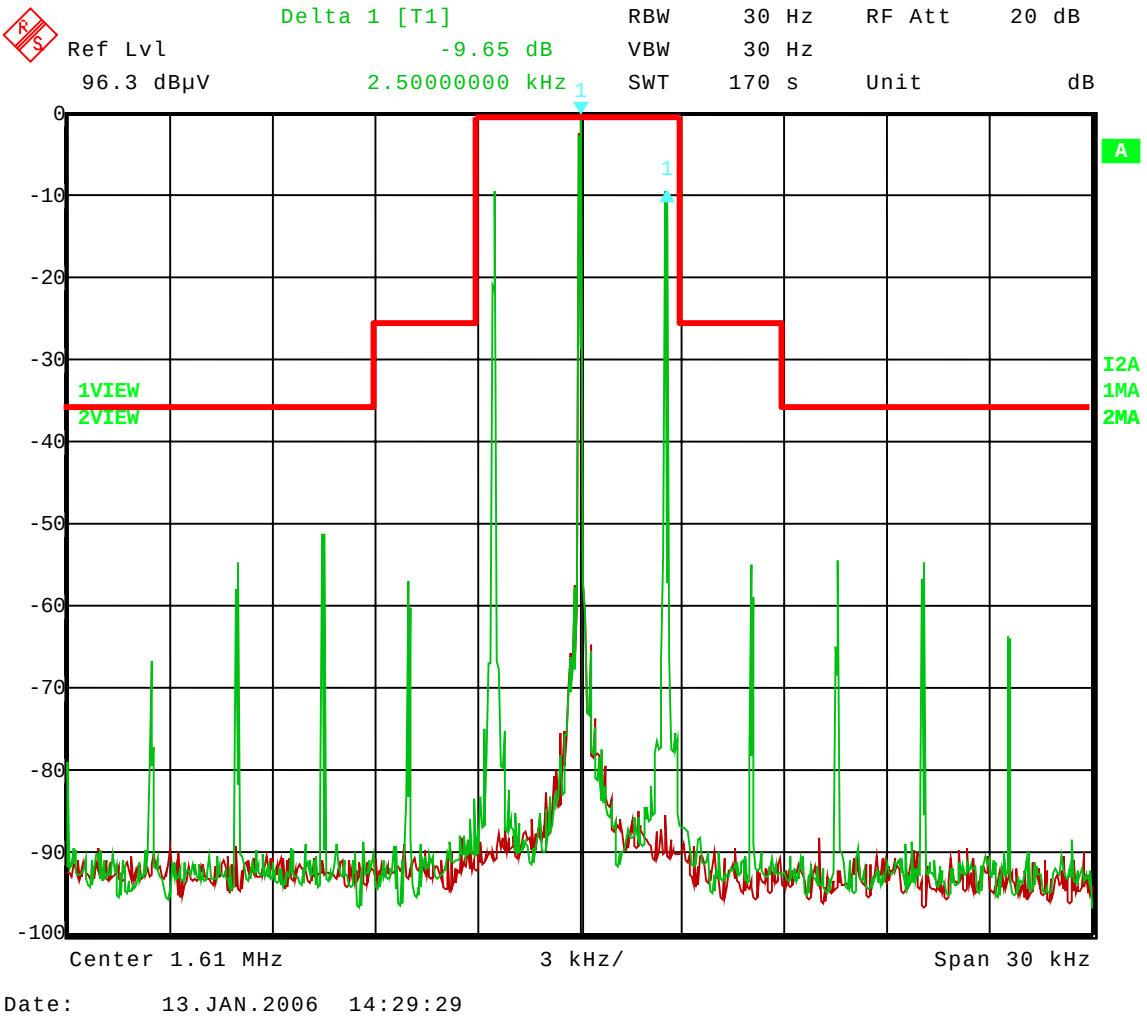


1250 Peterson Dr., Wheeling, IL 60090

Test Date: 01-13-2006
Company: Highway Information Systems, Inc.
EUT: DRTXM4 with GPS-1
Test: Occupied Bandwidth
Operator: Craig Brandt
Comment: **1610 kHz**
Single Supply mode at 11.58 V DC
Without 10 MHz Timing Signal Mode

16 dB > 50% Modulation at 2500 Hz
Input level = 3.12 Vrms

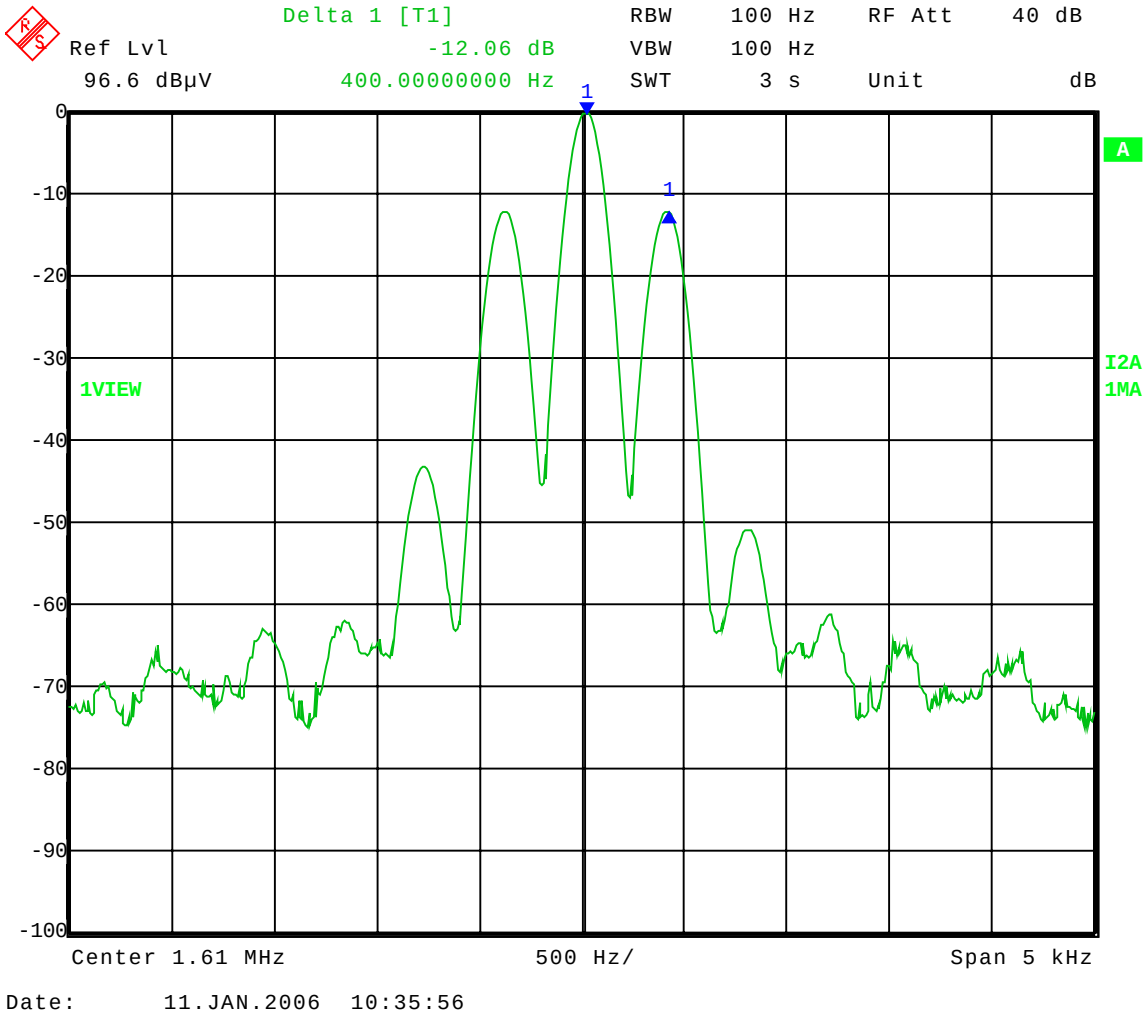
Red = Unmodulated
Green = Modulated



1250 Peterson Dr., Wheeling, IL 60090

Test Date: 01-11-2006
Company: Highway Information Systems, Inc.
EUT: DRTXM4 with GPS-1
Test: Occupied Bandwidth
Operator: Craig Brandt
Comment: **1610 kHz**
Dual Supply Mode at 11.04 V DC

50% Modulation at 400 Hz
400 Hz = Frequency of maximum response of the audio modulating circuit.
Input level = 0.50 Vrms

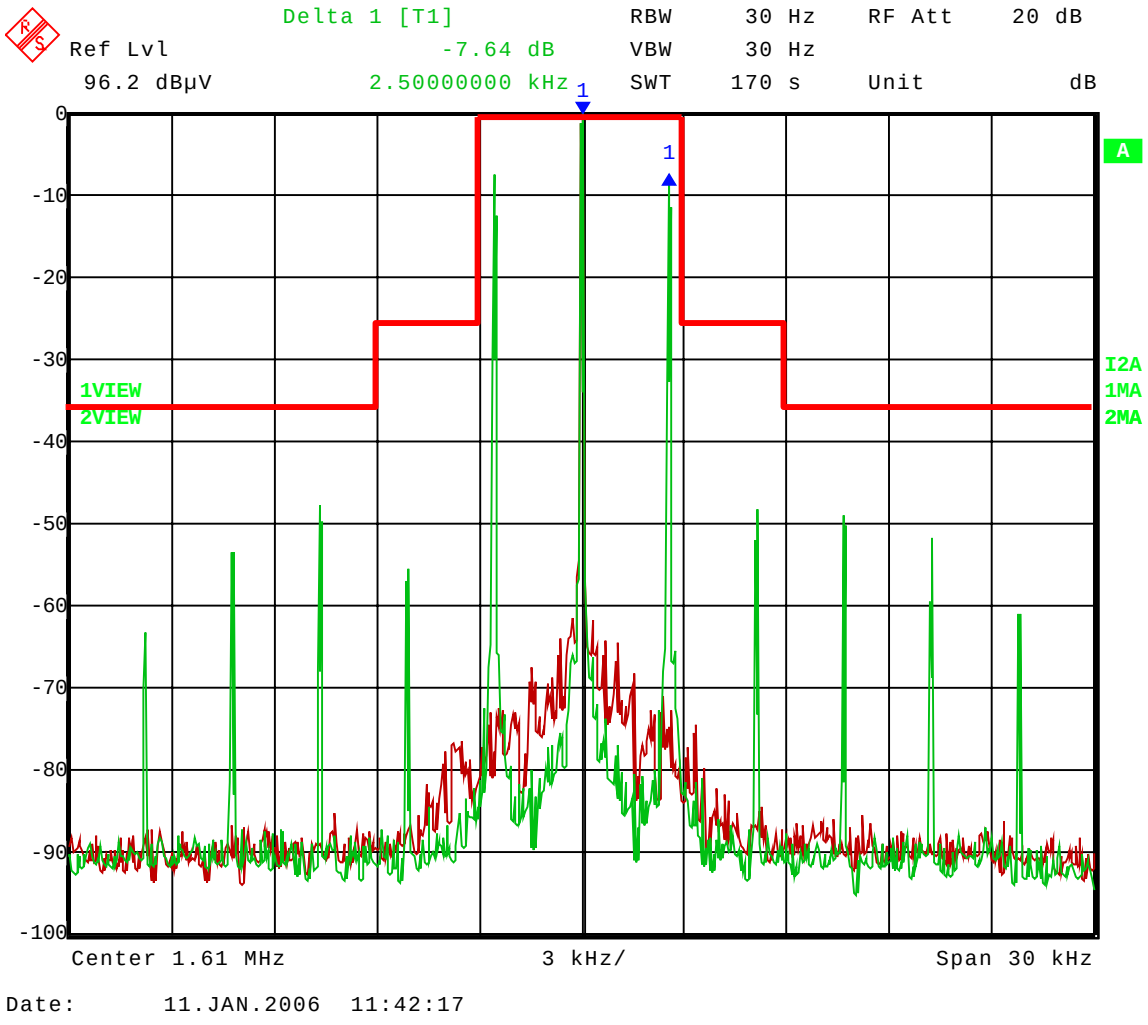


1250 Peterson Dr., Wheeling, IL 60090

Test Date: 01-11-2006
Company: Highway Information Systems, Inc.
EUT: DRTXM4 with GPS-1
Test: Occupied Bandwidth
Operator: Craig Brandt
Comment: **1610 kHz**
Dual Supply mode at 11.04 V DC
Fully Locked Mode

16 dB > 50% Modulation at 2500 Hz
Input level = 3.17 Vrms

Red = Unmodulated
Green = Modulated

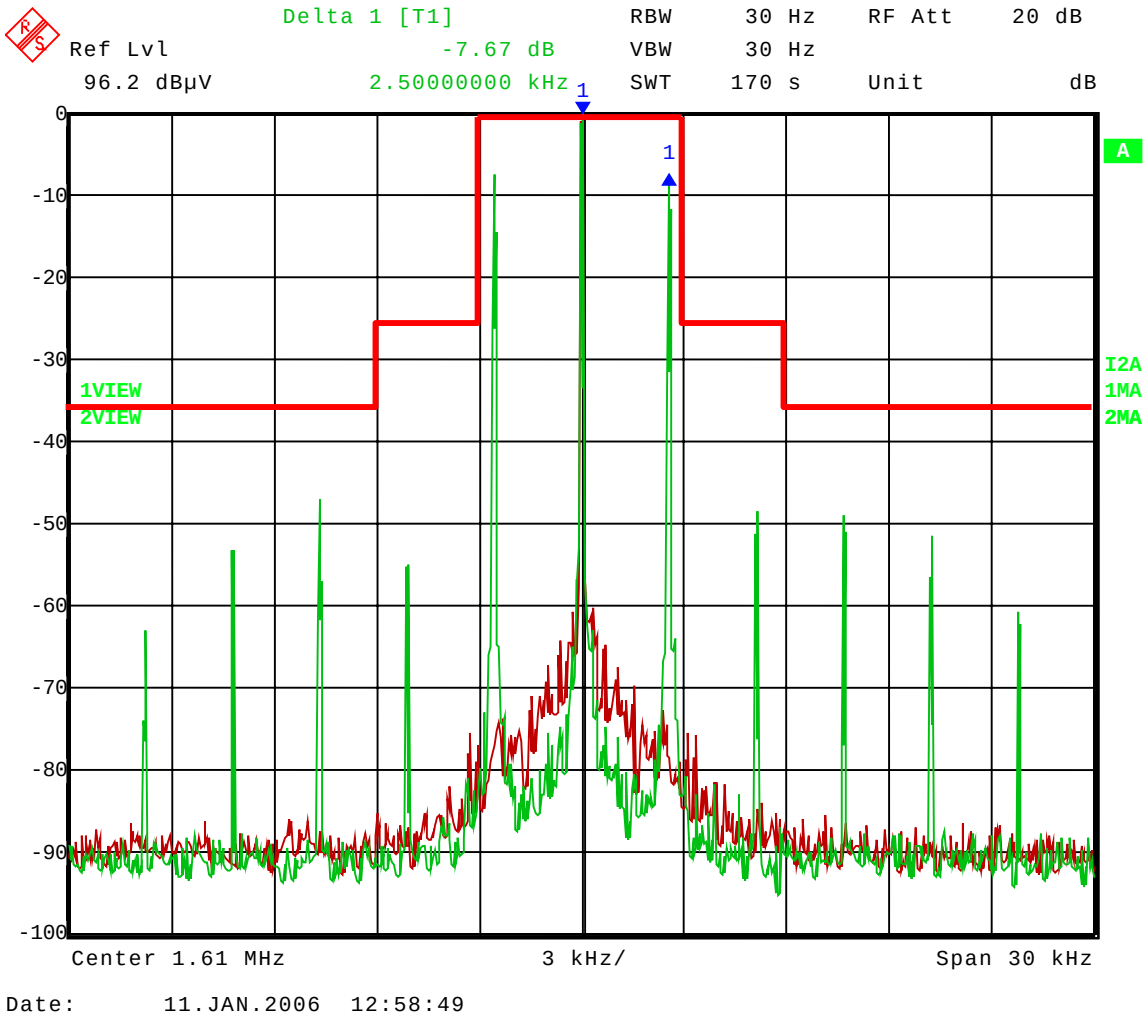


1250 Peterson Dr., Wheeling, IL 60090

Test Date: 01-11-2006
Company: Highway Information Systems, Inc.
EUT: DRTXM4 with GPS-1
Test: Occupied Bandwidth
Operator: Craig Brandt
Comment: **1610 kHz**
Dual Supply mode at 11.04 V DC
Without Satellite Reception Mode

16 dB > 50% Modulation at 2500 Hz
Input level = 3.17 Vrms

Red = Unmodulated
Green = Modulated



ELECTRONIC SYSTEMS, INC.

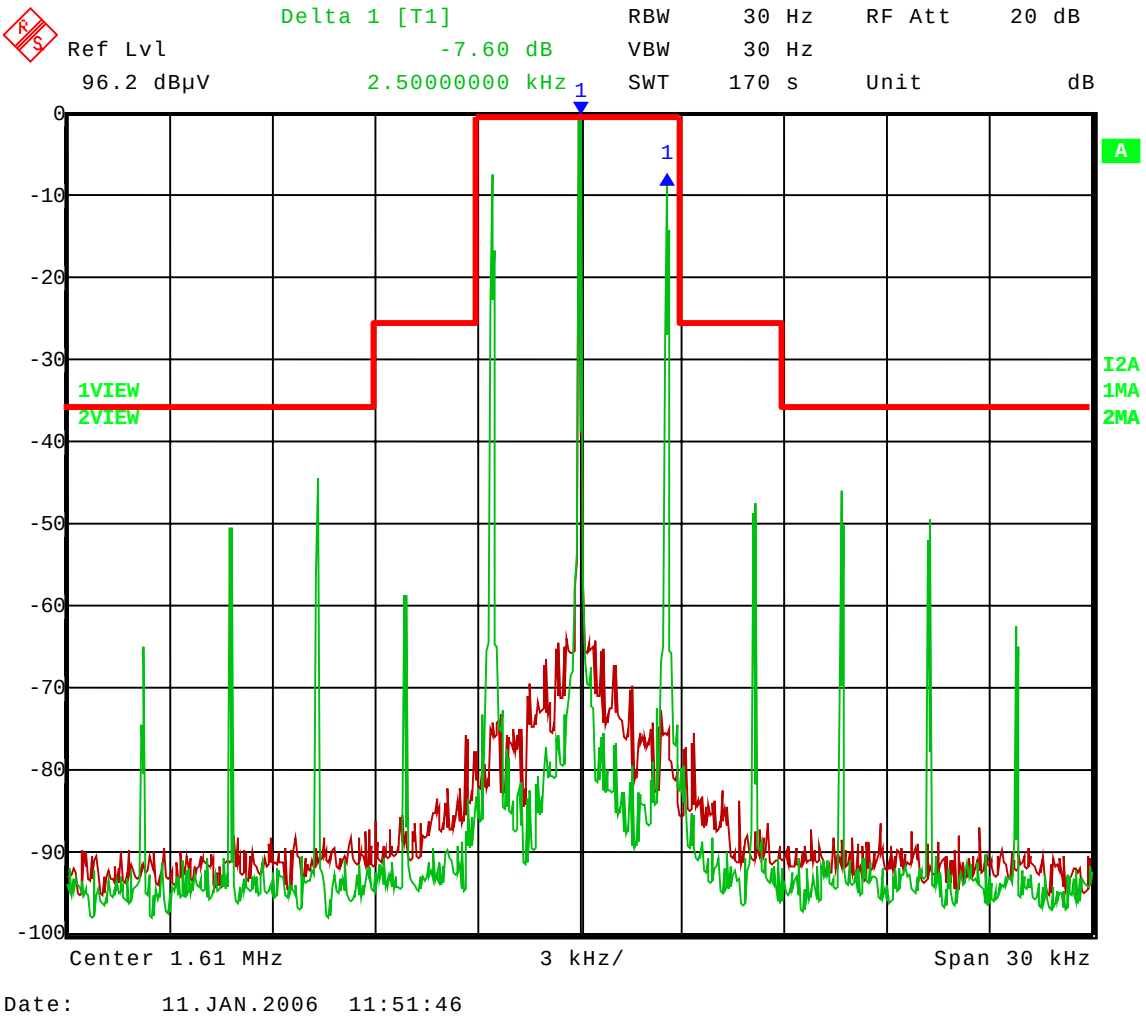
1250 Peterson Dr., Wheeling, IL 60090

Company: Highway Information Systems, Inc.
Model Tested: DRTXM4
Report Number: 11911

Test Date: 01-11-2006
Company: Highway Information Systems, Inc.
EUT: DRTXM4 with GPS-1
Test: Occupied Bandwidth
Operator: Craig Brandt
Comment: **1610 kHz**
Dual Supply mode at 11.04 V DC
Without GPS-1 Synchronizer Signal to Transmitter Mode

16 dB > 50% Modulation at 2500 Hz
Input level = 3.17 Vrms

Red = Unmodulated
Green = Modulated

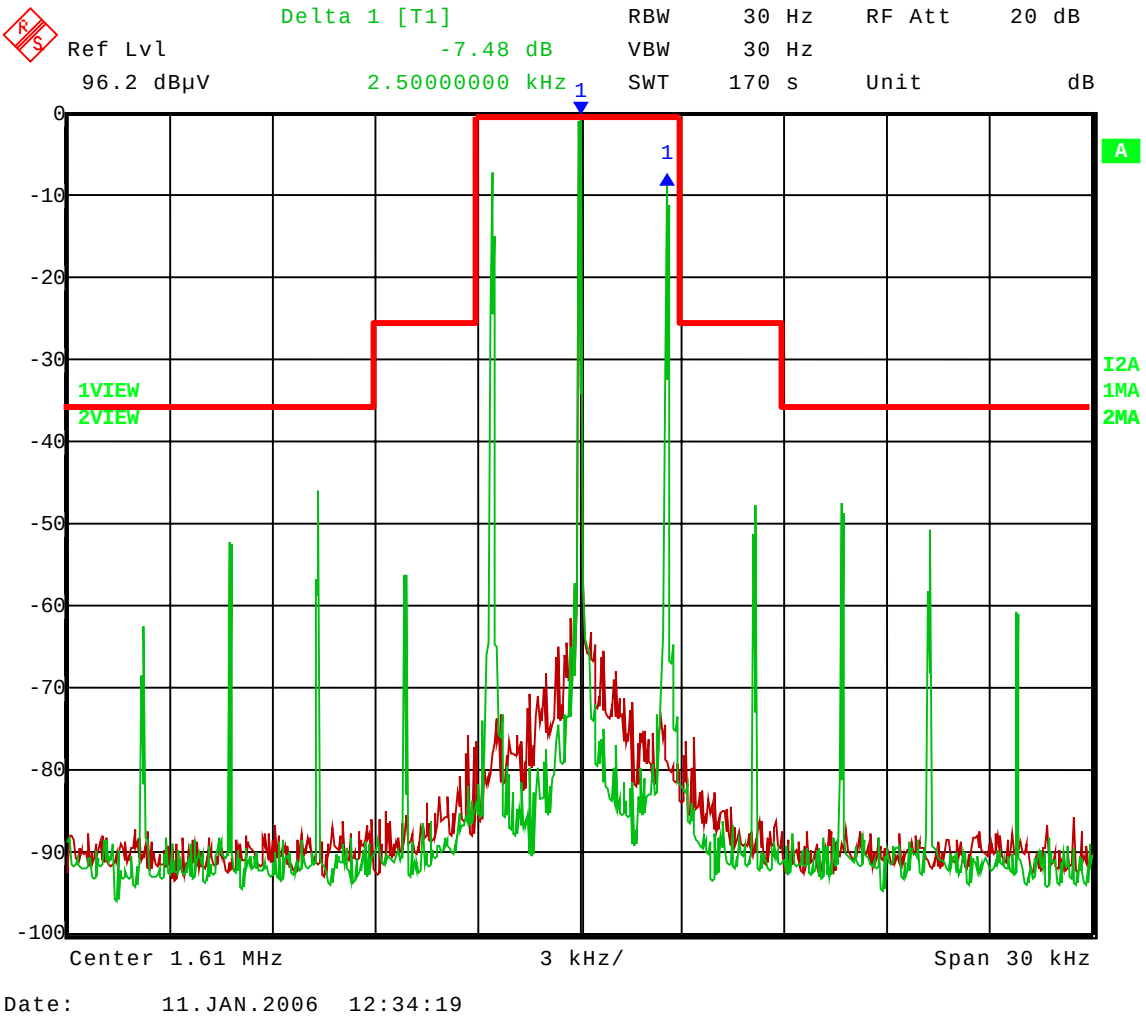


1250 Peterson Dr., Wheeling, IL 60090

Test Date: 01-11-2006
Company: Highway Information Systems, Inc.
EUT: DRTXM4 with GPS-1
Test: Occupied Bandwidth
Operator: Craig Brandt
Comment: **1610 kHz**
Dual Supply mode at 11.04 V DC
Without 1 PPS Timing Signal Mode

16 dB > 50% Modulation at 2500 Hz
Input level = 3.17 Vrms

Red = Unmodulated
Green = Modulated

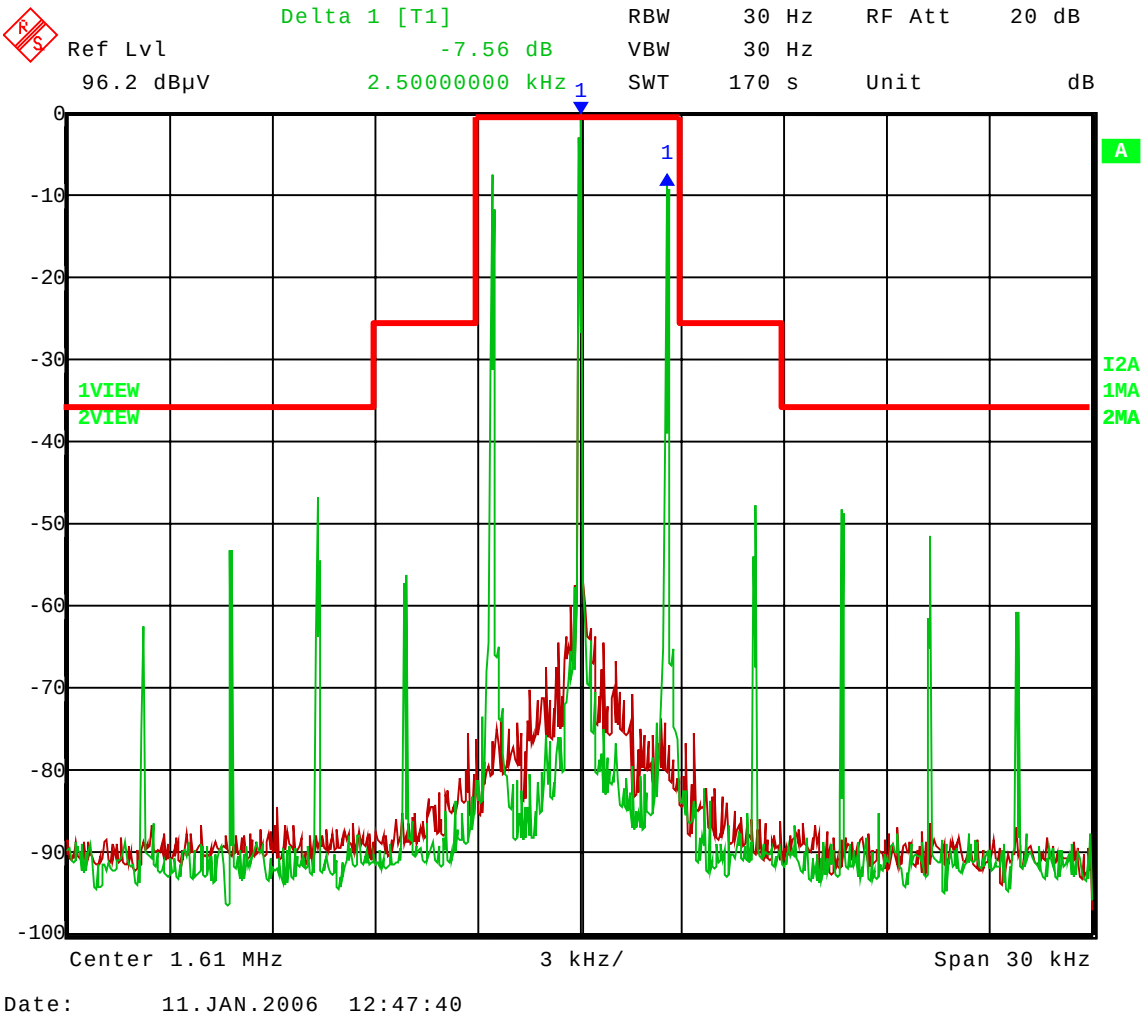


1250 Peterson Dr., Wheeling, IL 60090

Test Date: 01-11-2006
Company: Highway Information Systems, Inc.
EUT: DRTXM4 with GPS-1
Test: Occupied Bandwidth
Operator: Craig Brandt
Comment: **1610 kHz**
Dual Supply mode at 11.04 V DC
Without 10 MHz Timing Signal Mode

16 dB > 50% Modulation at 2500 Hz
Input level = 3.17 Vrms

Red = Unmodulated
Green = Modulated

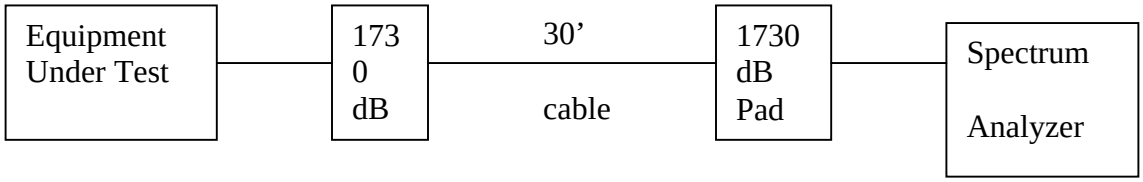


1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

6.0 SPURIOUS EMISSIONS 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 each harmonic emission with the equipment operated as specified in 2.1049. As shown by the radiated charts there was no reason to believe that there were any spurious emissions other than the harmonics that were than individually investigated when doing the conducted test at the antenna terminals. Measurements were made up to the 200 MHz harmonic of the fundamental. The following setup was used showing placement of the attenuators and the Notch Filter (if needed):



The limit for conducted emissions at the antenna terminal is stated in Part 90, Section 90.209, Paragraph c-2 iii. It states the mean power of the emissions shall be attenuated below the mean output power of the transmitter; on any frequency removed from the center of the authorized bandwidth by a displacement frequency equal to or greater than 15 kHz. The following formula is used: at least 43 + 10*Log10 (mean power in watts) or 70 dB, whichever is the lesser attenuation.

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

1250 Peterson Dr., Wheeling, IL 60090

CONDUCTED EMISSION DATA AND CHARTS TAKEN FOR

SPURIOUS EMISSION MEASUREMENTS MADE

AT THE ANTENNA TERMINALS

PART 2.1051

Company: Highway Information Systems, Inc.
Model Tested: DRTXM4
Report Number: 11911

1250 Peterson Dr., Wheeling, IL 60090

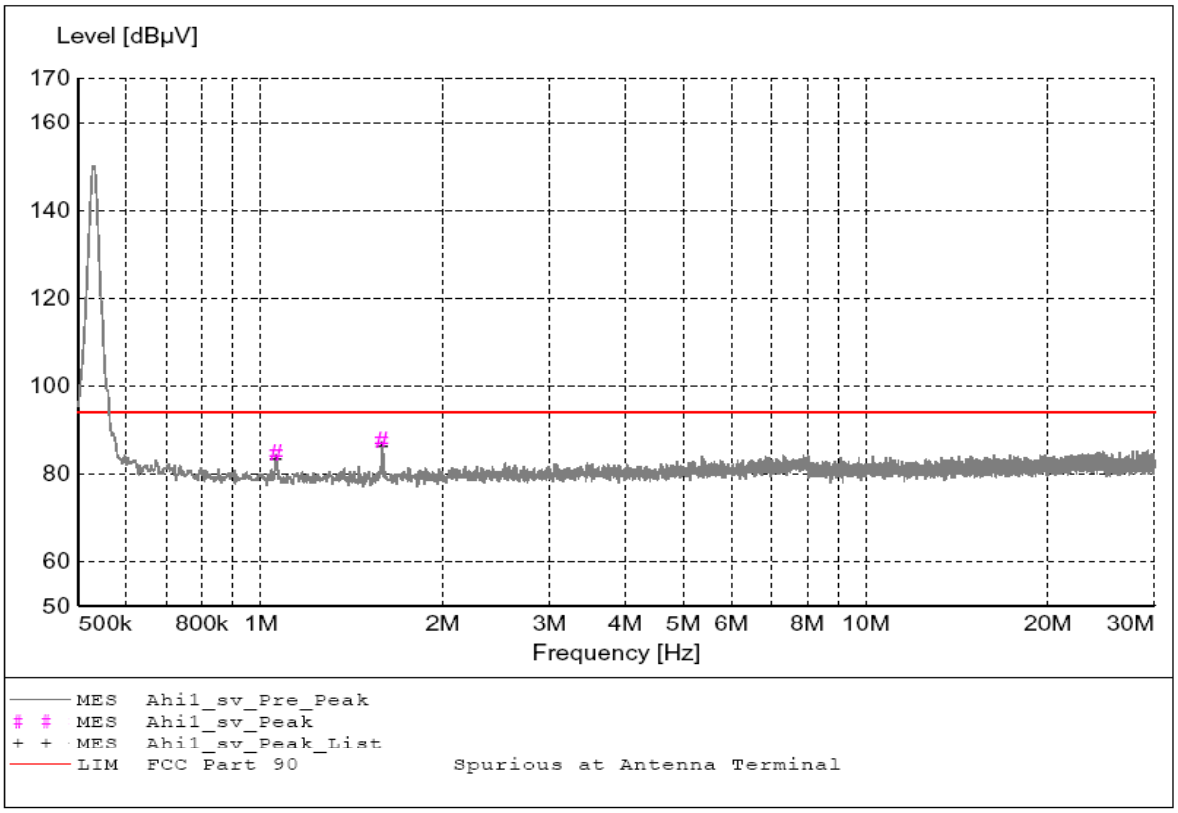
FCC Part 2.1051 For FCC Part 90 Device

Spurious Emissions Measured at Antenna Port

```
EUT:                DRTXM4 and GPS-1
Manufacturer:       Highway Information Systems
Operating Condition: 70 deg F; 30%R.H.
Test Site:          DLS Screenroom     Date: 01-10-06
Operator:           Craig Brandt
Comment:            Transmitter Model: DRTXM4 with Synchronizer Module: GPS-1
                    TX Freq. 530 kHz: MOD 16dB above 50%;  MOD at 2500 Hz
                    Mode: Single Supply; Fully Locked
```

TEXT: "FCC Part 2.1051"

```
  Short Description:           Antenna Port Conducted
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005
```



MEASUREMENT RESULT: "Ahi1_sv_Final"

1/10/2006 11:34AM

Frequency	Level	Antenna Factor	System Loss	Total Level	Limit	Margin	Height Ant.	EuT Angle	Final Detector	Comment
MHz	dBµV	dBµV	dB	dBµV	dBµV	dB	m	deg		
1.588000	36.88	0.00	50.5	87	94	6.6	0.00	0	MAX PEAK	None
1.060000	34.20	0.00	50.4	85	94	9.4	0.00	0	MAX PEAK	None

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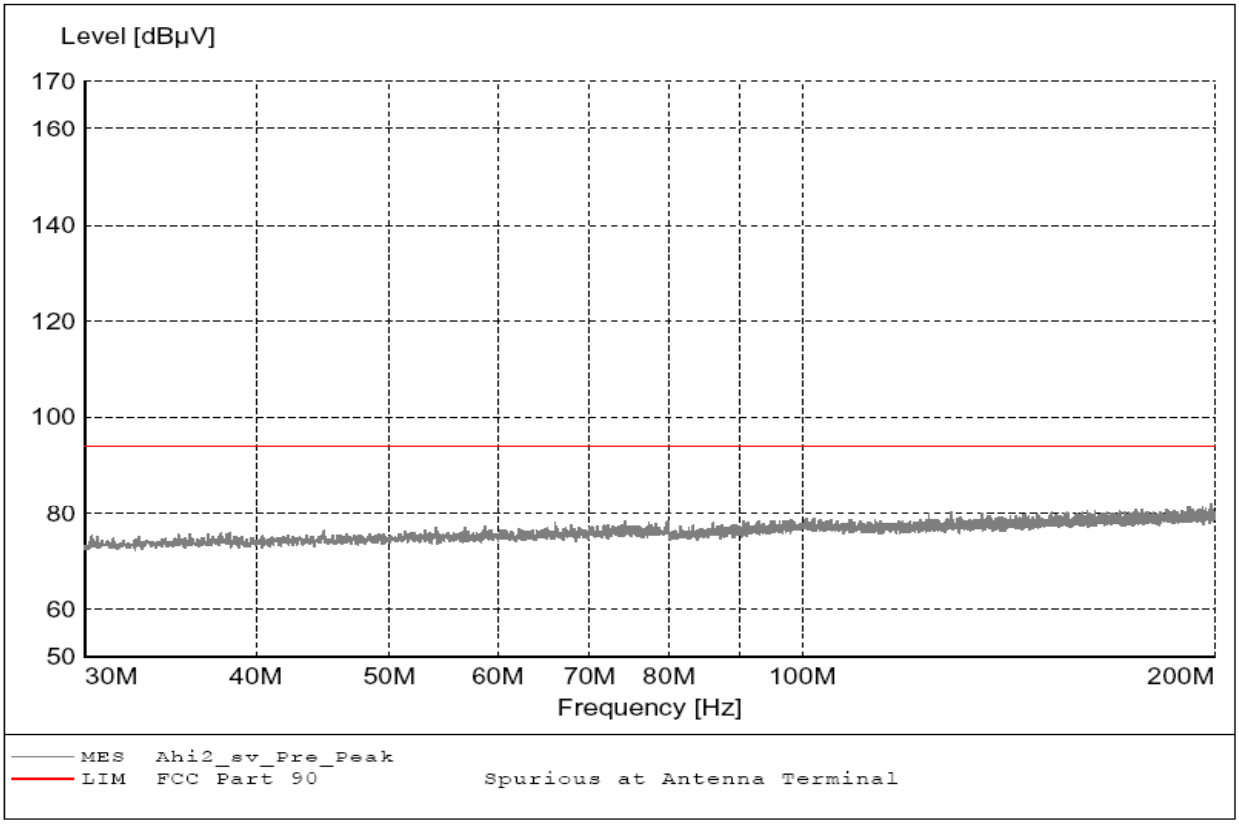
FCC Part 2.1051 For FCC Part 90 Device

Spurious Emissions Measured at Antenna Port

EUT: DRTXM4 and GPS-1
Manufacturer: Highway Information Systems
Operating Condition: 70 deg F; 30%R.H.
Test Site: DLS Screenroom Date: 01-10-06
Operator: Craig Brandt
Comment: Transmitter Model: DRTXM4 with Synchronizer Module: GPS-1
TX Freq. 530 kHz: MOD 16dB above 50%; MOD at 2500 Hz
Mode: Single Supply; Fully Locked

TEXT: "FCC Part 2.1051"

Short Description: Antenna Port Conducted
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005



1250 Peterson Dr., Wheeling, IL 60090

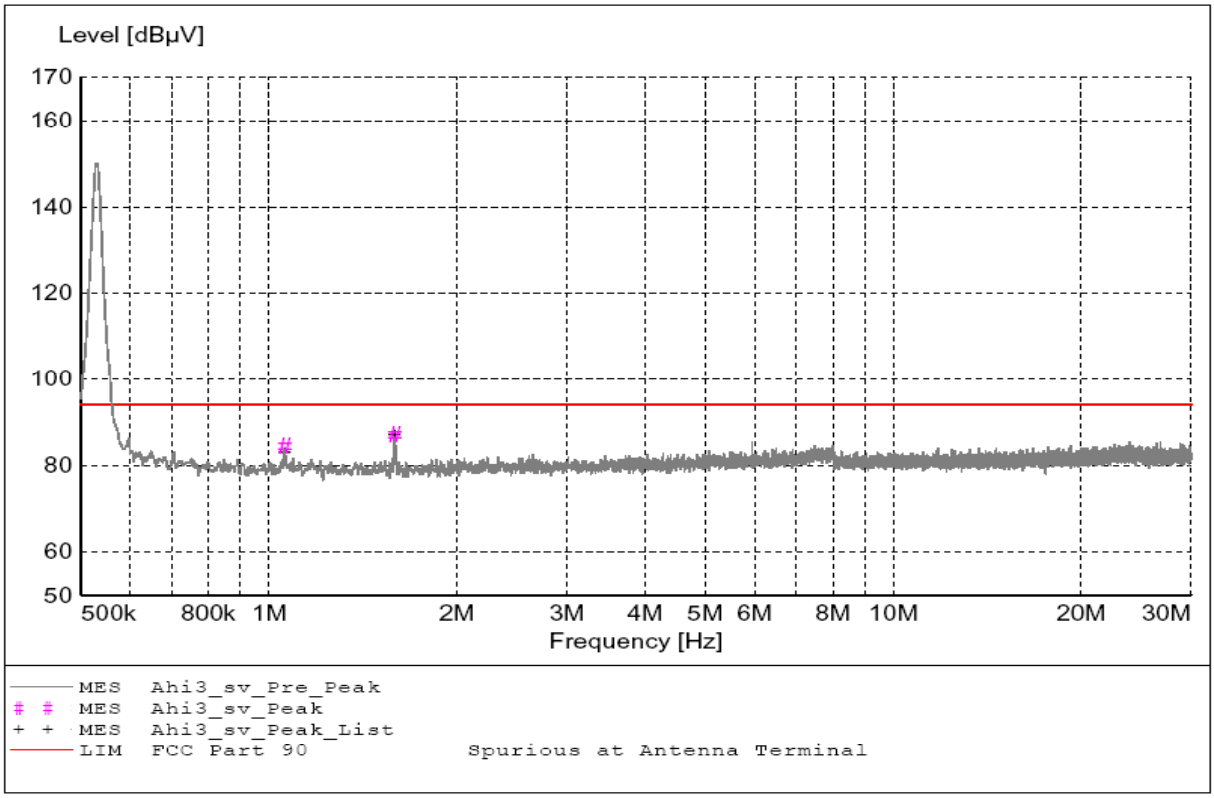
FCC Part 2.1051 For FCC Part 90 Device

Spurious Emissions Measured at Antenna Port

EUT: DRTXM4 and GPS-1
Manufacturer: Highway Information Systems
Operating Condition: 70 deg F; 30%R.H.
Test Site: DLS Screenroom Date: 01-10-06
Operator: Craig Brandt
Comment: Transmitter Model: DRTXM4 with Synchronizer Module: GPS-1
TX Freq. 530 kHz: MOD 16dB above 50%; MOD at 2500 Hz
Mode: Single Supply; Without Satellite Reception

TEXT: "FCC Part 2.1051"

Short Description: Antenna Port Conducted
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005



MEASUREMENT RESULT: "Ahi3_sv_Final"

1/10/2006 11:49AM

Frequency	Level	Antenna Factor	System Loss	Total Level	Limit	Margin	Height Ant.	EuT Angle	Final Detector	Comment
MHz	dBµV	dBµV	dB	dBµV	dBµV	dB	m	deg		
1.592000	36.42	0.00	50.5	87	94	7.1	0.00	0	MAX PEAK	None
1.060000	34.00	0.00	50.4	84	94	9.6	0.00	0	MAX PEAK	None

1250 Peterson Dr., Wheeling, IL 60090

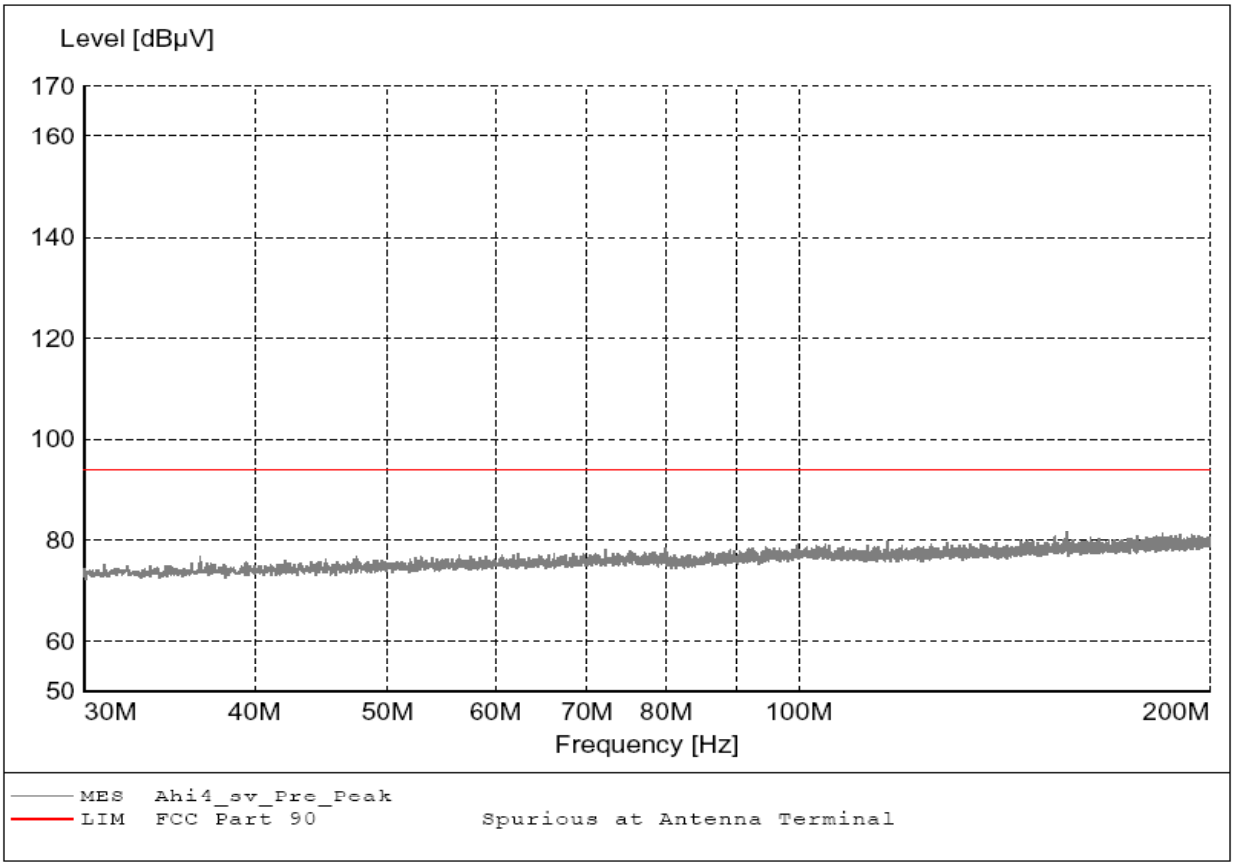
FCC Part 2.1051 For FCC Part 90 Device

Spurious Emissions Measured at Antenna Port

EUT: DRTXM4 and GPS-1
Manufacturer: Highway Information Systems
Operating Condition: 70 deg F; 30%R.H.
Test Site: DLS Screenroom Date: 01-10-06
Operator: Craig Brandt
Comment: Transmitter Model: DRTXM4 with Synchronizer Module: GPS-1
TX Freq. 530 kHz: MOD 16dB above 50%; MOD at 2500 Hz
Mode: Single Supply; Without Satellite Reception

TEXT: "FCC Part 2.1051"

Short Description: Antenna Port Conducted
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005



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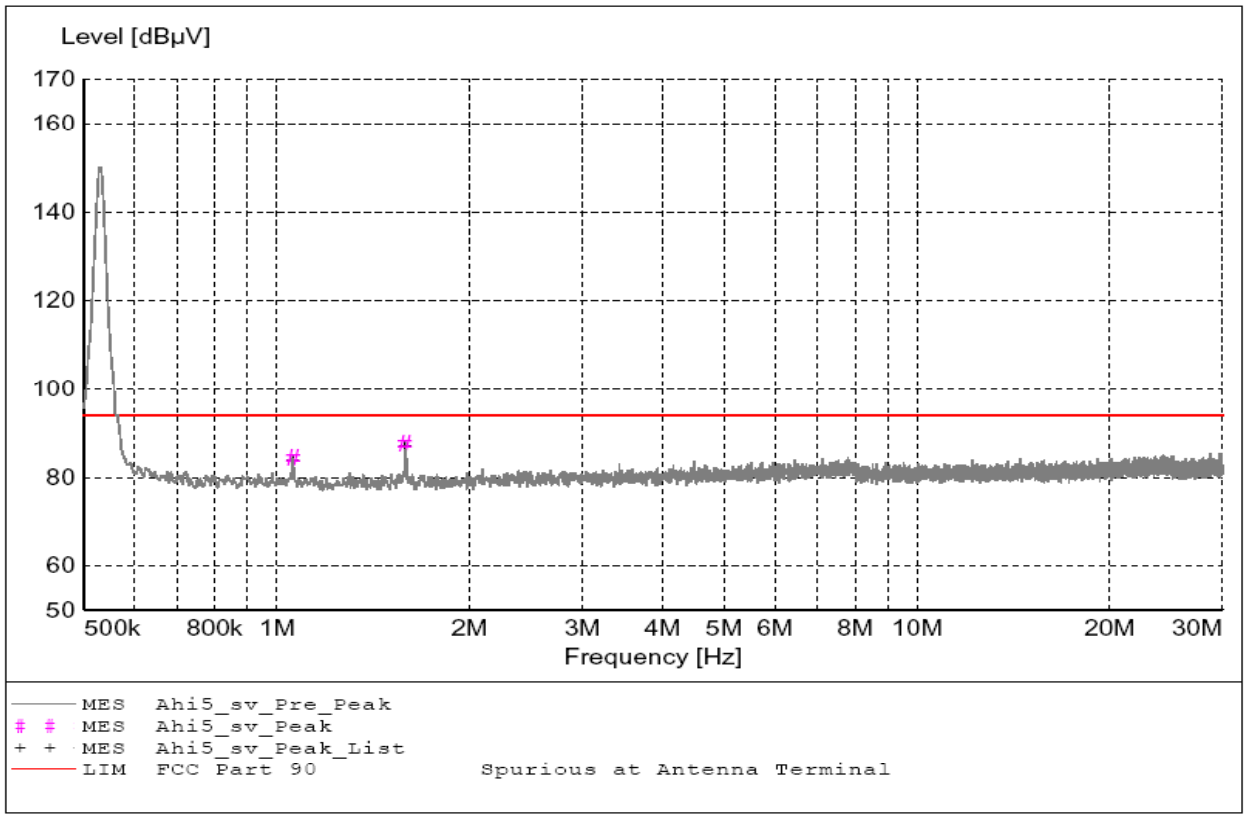
FCC Part 2.1051 For FCC Part 90 Device

Spurious Emissions Measured at Antenna Port

```
EUT:                  DRTXM4 and GPS-1
Manufacturer:         Highway Information Systems
Operating Condition:  70 deg F; 30%R.H.
Test Site:            DLS Screenroom     Date: 01-10-06
Operator:             Craig Brandt
Comment:              Transmitter Model: DRTXM4 with Synchronizer Module: GPS-1
                      TX Freq. 530 kHz: MOD 16dB above 50%;  MOD at 2500 Hz
                      Mode: Single Supply; Without Sync Signal to Transmitter
```

TEXT: "FCC Part 2.1051"

```
  Short Description:            Antenna Port Conducted
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005
```



MEASUREMENT RESULT: "Ahi5_sv_Final"

1/10/2006 12:58PM

Frequency	Level	Antenna Factor	System Loss	Total Level	Limit	Margin	Height Ant.	EuT Angle	Final Detector	Comment
MHz	dBµV	dBµV	dB	dBµV	dBµV	dB	m	deg		
1.588000	36.98	0.00	50.5	88	94	6.5	0.00	0	MAX PEAK	None
1.060000	33.93	0.00	50.4	84	94	9.7	0.00	0	MAX PEAK	None

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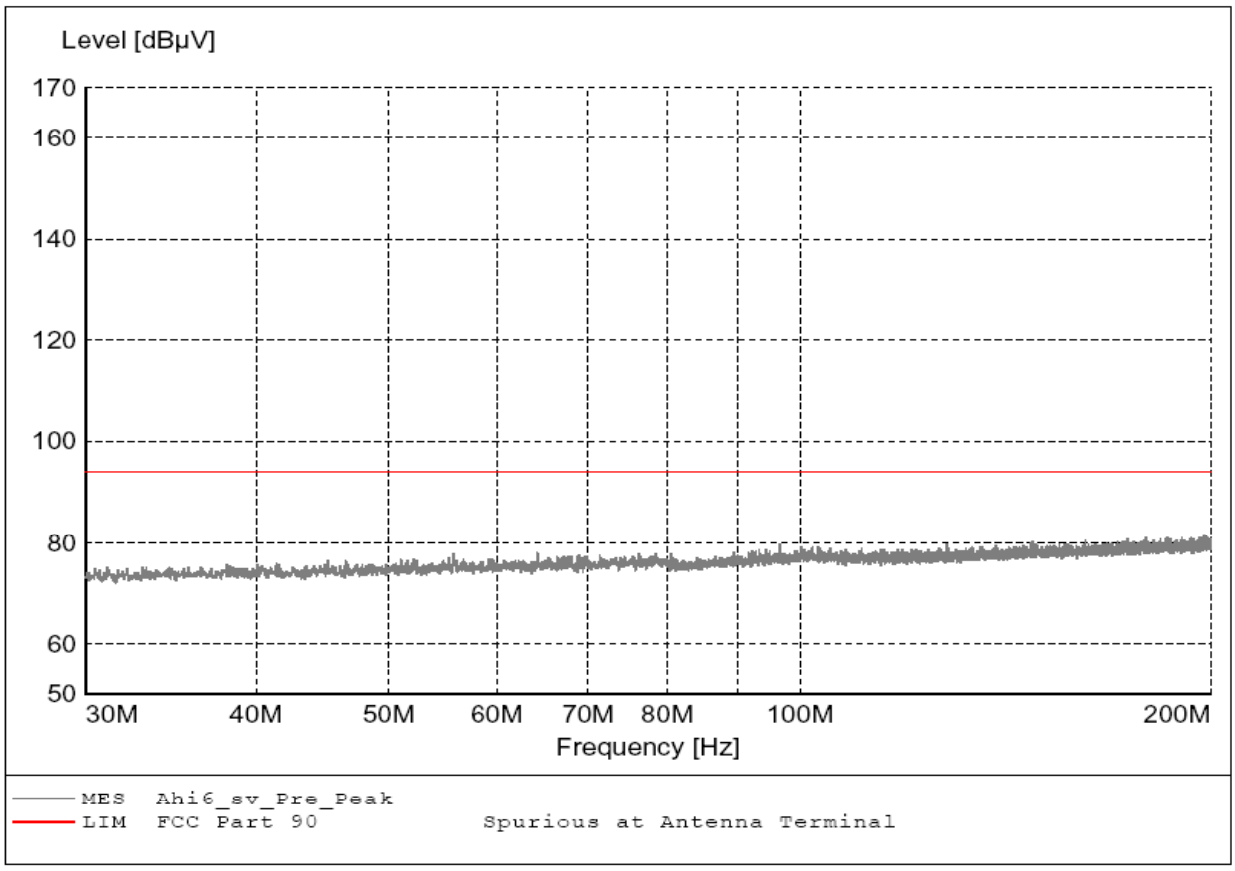
FCC Part 2.1051 For FCC Part 90 Device

Spurious Emissions Measured at Antenna Port

EUT: DRTXM4 and GPS-1
Manufacturer: Highway Information Systems
Operating Condition: 70 deg F; 30%R.H.
Test Site: DLS Screenroom Date: 01-10-06
Operator: Craig Brandt
Comment: Transmitter Model: DRTXM4 with Synchronizer Module: GPS-1
TX Freq. 530 kHz: MOD 16dB above 50%; MOD at 2500 Hz
Mode: Single Supply; Without Sync Signal to Transmitter

TEXT: "FCC Part 2.1051"

Short Description: Antenna Port Conducted
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005



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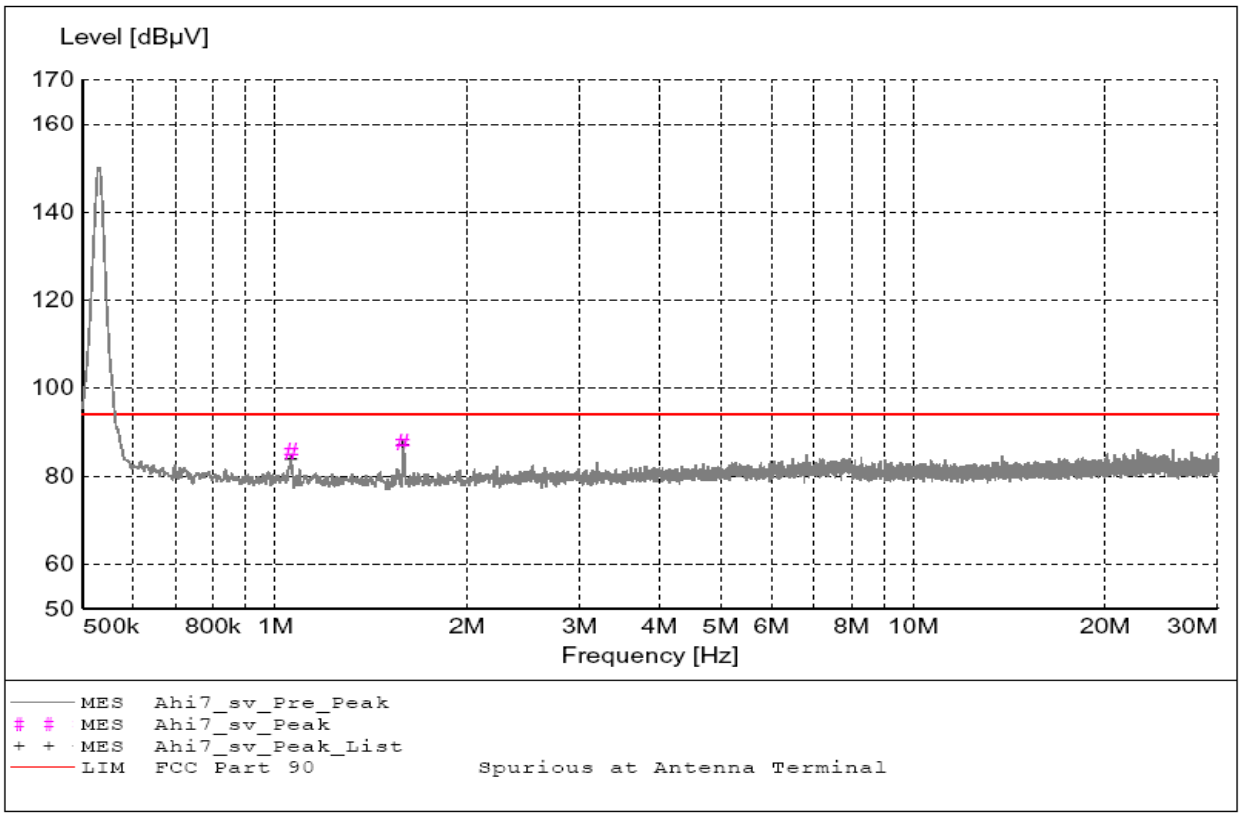
FCC Part 2.1051 For FCC Part 90 Device

Spurious Emissions Measured at Antenna Port

EUT: DRTXM4 and GPS-1
Manufacturer: Highway Information Systems
Operating Condition: 70 deg F; 30%R.H.
Test Site: DLS Screenroom Date: 01-10-06
Operator: Craig Brandt
Comment: Transmitter Model: DRTXM4 with Synchronizer Module: GPS-1;
TX Freq. 530 kHz: MOD 16dB above 50%; MOD at 2500 Hz
Mode: Single Supply; Without 1 PPS Timing Signal

TEXT: "FCC Part 2.1051"

Short Description: Antenna Port Conducted
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005



MEASUREMENT RESULT: "Ahi7_sv_Final"

1/10/2006 1:21PM

Frequency MHz	Level dBµV	Antenna Factor dBµV	System Loss dB	Total Level dBµV	Limit dBµV	Margin dB	Height Ant. m	EuT Angle deg	Final Detector	Comment
1.588000	36.99	0.00	50.5	88	94	6.5	0.00	0	MAX PEAK	None
1.060000	35.01	0.00	50.4	85	94	8.6	0.00	0	MAX PEAK	None

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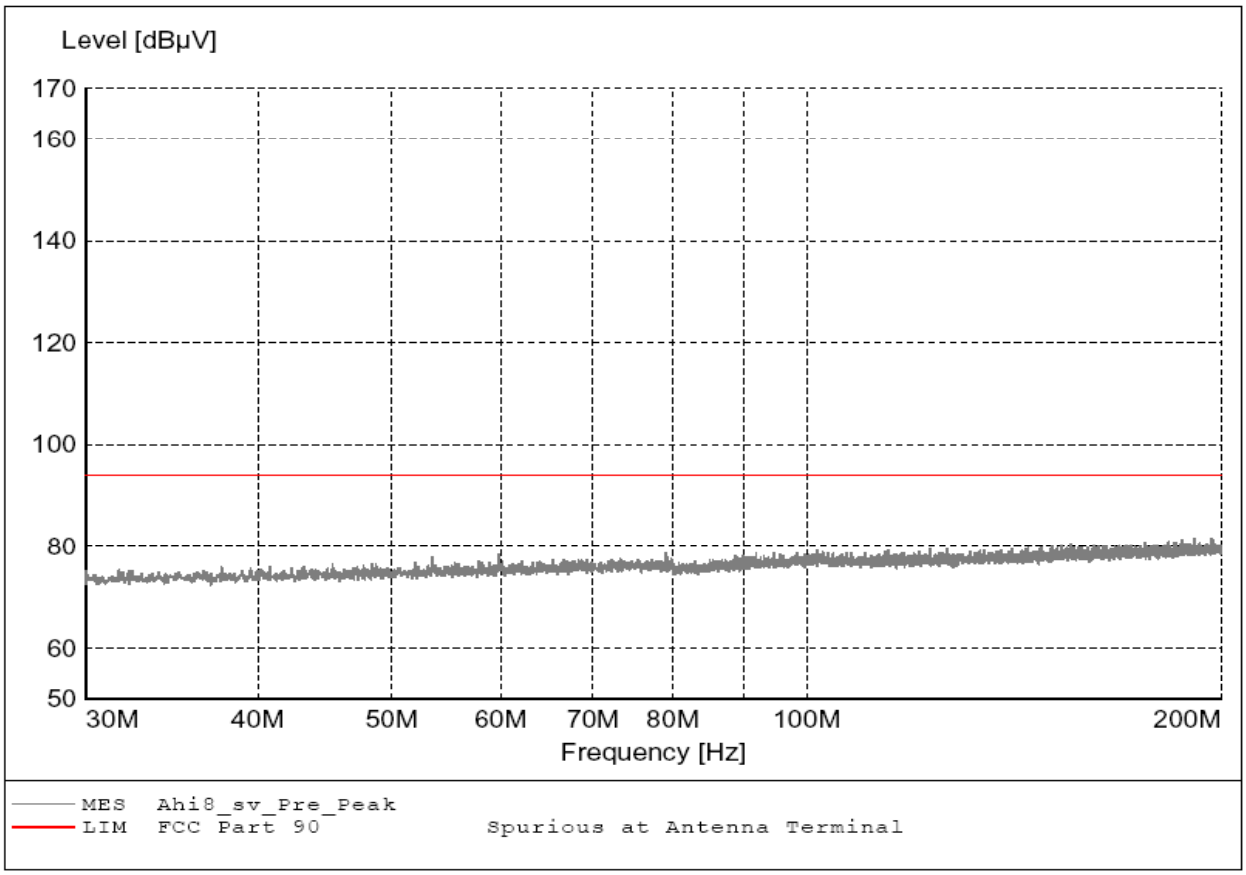
FCC Part 2.1051 For FCC Part 90 Device

Spurious Emissions Measured at Antenna Port

```
EUT:                 DRTXM4 and GPS-1
Manufacturer:        Highway Information Systems
Operating Condition: 70 deg F; 30%R.H.
Test Site:           DLS Screenroom     Date: 01-10-06
Operator:            Craig Brandt
Comment:             Transmitter Model: DRTXM4 with Synchronizer Module: GPS-1;
                     TX Freq. 530 kHz: MOD 16dB above 50%;  MOD at 2500 Hz
                     Mode: Single Supply; Without 1 PPS Timing Signal
```

TEXT: "FCC Part 2.1051"

```
  Short Description:           Antenna Port Conducted
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005
```



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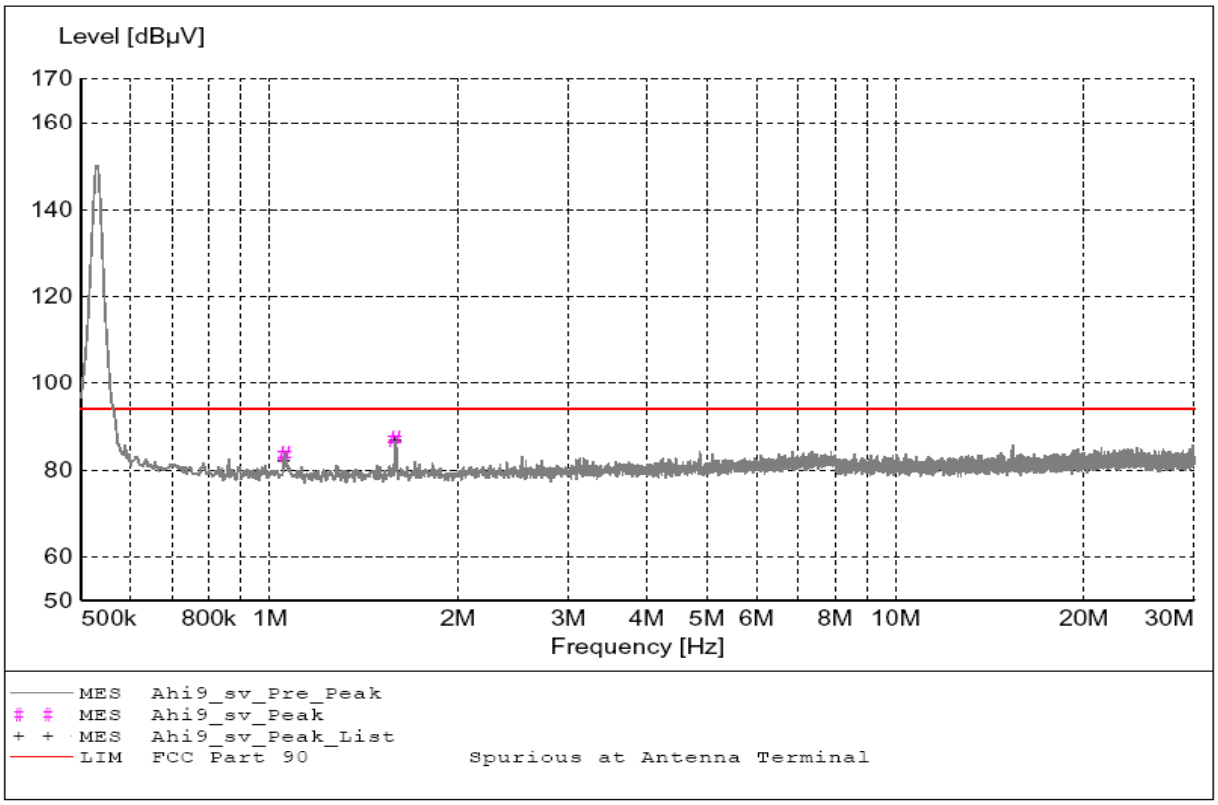
FCC Part 2.1051 For FCC Part 90 Device

Spurious Emissions Measured at Antenna Port

EUT: DRTXM4 and GPS-1
Manufacturer: Highway Information Systems
Operating Condition: 70 deg F; 30%R.H.
Test Site: DLS Screenroom Date: 01-10-06
Operator: Craig Brandt
Comment: Transmitter Model: DRTXM4 with Synchronizer Module: GPS-1
TX Freq. 530 kHz: MOD 16dB above 50%; MOD at 2500 Hz
Mode: Single Supply; Without 10 MHz Timing Signal

TEXT: "FCC Part 2.1051"

Short Description: Antenna Port Conducted
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005



MEASUREMENT RESULT: "Ahi9_sv_Final"

1/10/2006 1:59PM

Frequency	Level	Antenna Factor	System Loss	Total Level	Limit	Margin	Height Ant.	EuT Angle	Final Detector	Comment
MHz	dBµV	dBµV	dB	dBµV	dBµV	dB	m	deg		
1.588000	36.54	0.00	50.5	87	94	6.9	0.00	0	MAX PEAK	None
1.056000	33.03	0.00	50.4	83	94	10.6	0.00	0	MAX PEAK	None

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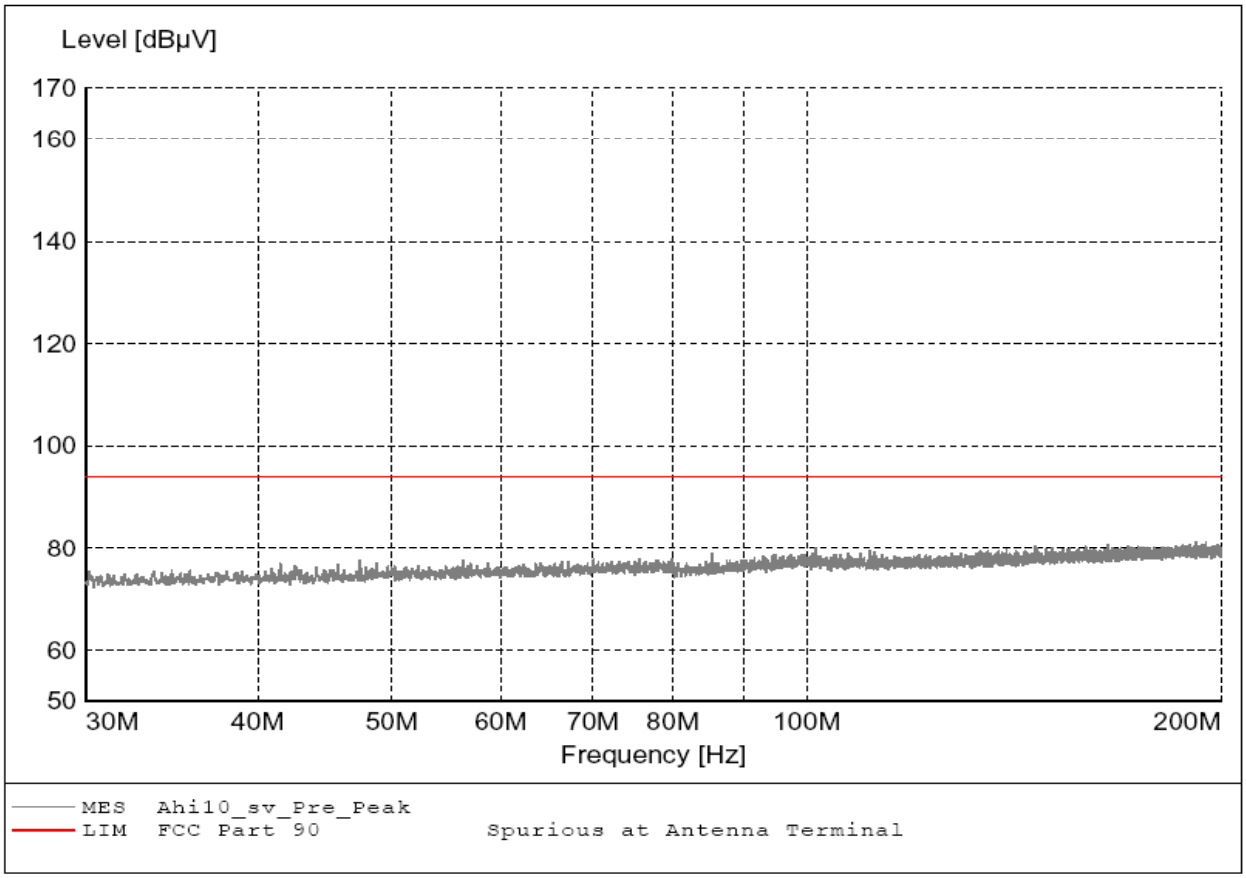
FCC Part 2.1051 For FCC Part 90 Device

Spurious Emissions Measured at Antenna Port

EUT: DRTXM4 and GPS-1
Manufacturer: Highway Information Systems
Operating Condition: 70 deg F; 30%R.H.
Test Site: DLS Screenroom Date: 01-10-06
Operator: Craig Brandt
Comment: Transmitter Model: DRTXM4 with Synchronizer Module: GPS-1
TX Freq. 530 kHz: MOD 16dB above 50%; MOD at 2500 Hz
Mode: Single Supply; Without 10 MHz Timing Signal

TEXT: "FCC Part 2.1051"

Short Description: Antenna Port Conducted
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005



1250 Peterson Dr., Wheeling, IL 60090

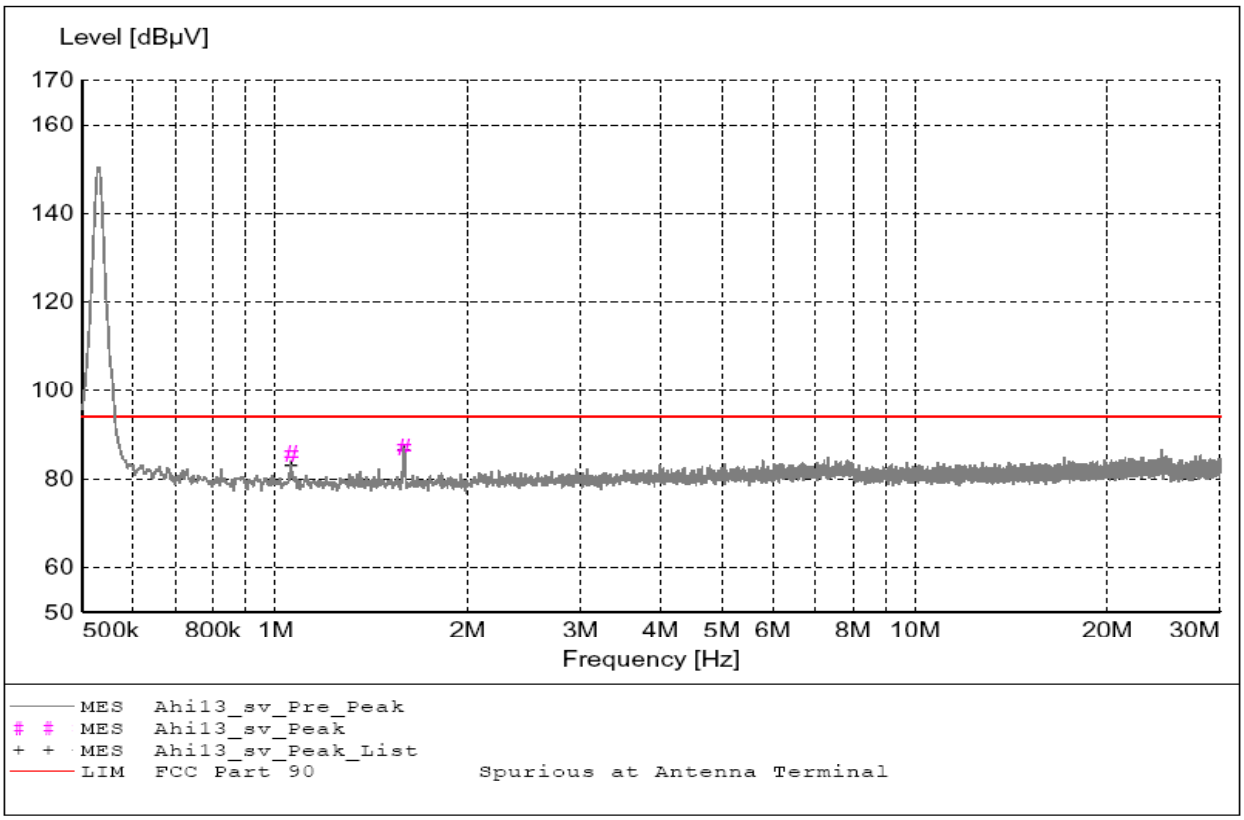
FCC Part 2.1051 For FCC Part 90 Device

Spurious Emissions Measured at Antenna Port

EUT: DRTXM4 and GPS-1
Manufacturer: Highway Information Systems
Operating Condition: 70 deg F; 30%R.H.
Test Site: DLS Screenroom Date: 01-11-06
Operator: Craig Brandt
Comment: Transmitter Model: DRTXM4 with Synchronizer Module: GPS-1
TX Freq. 530 kHz: MOD 16dB above 50%; MOD at 2500 Hz
Mode: Dual Supply; Fully Locked

TEXT: "FCC Part 2.1051"

Short Description: Antenna Port Conducted
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005



MEASUREMENT RESULT: "Ahi13_sv_Final"

1/11/2006 9:07AM

Frequency MHz	Level dBµV	Antenna Factor dBµV	System Loss dB	Total Level dBµV	Limit dBµV	Margin dB	Height Ant. m	EuT Angle deg	Final Detector	Comment
1.592000	36.51	0.00	50.5	87	94	7.0	0.00	0	MAX PEAK	None
1.060000	34.99	0.00	50.4	85	94	8.6	0.00	0	MAX PEAK	None

1250 Peterson Dr., Wheeling, IL 60090

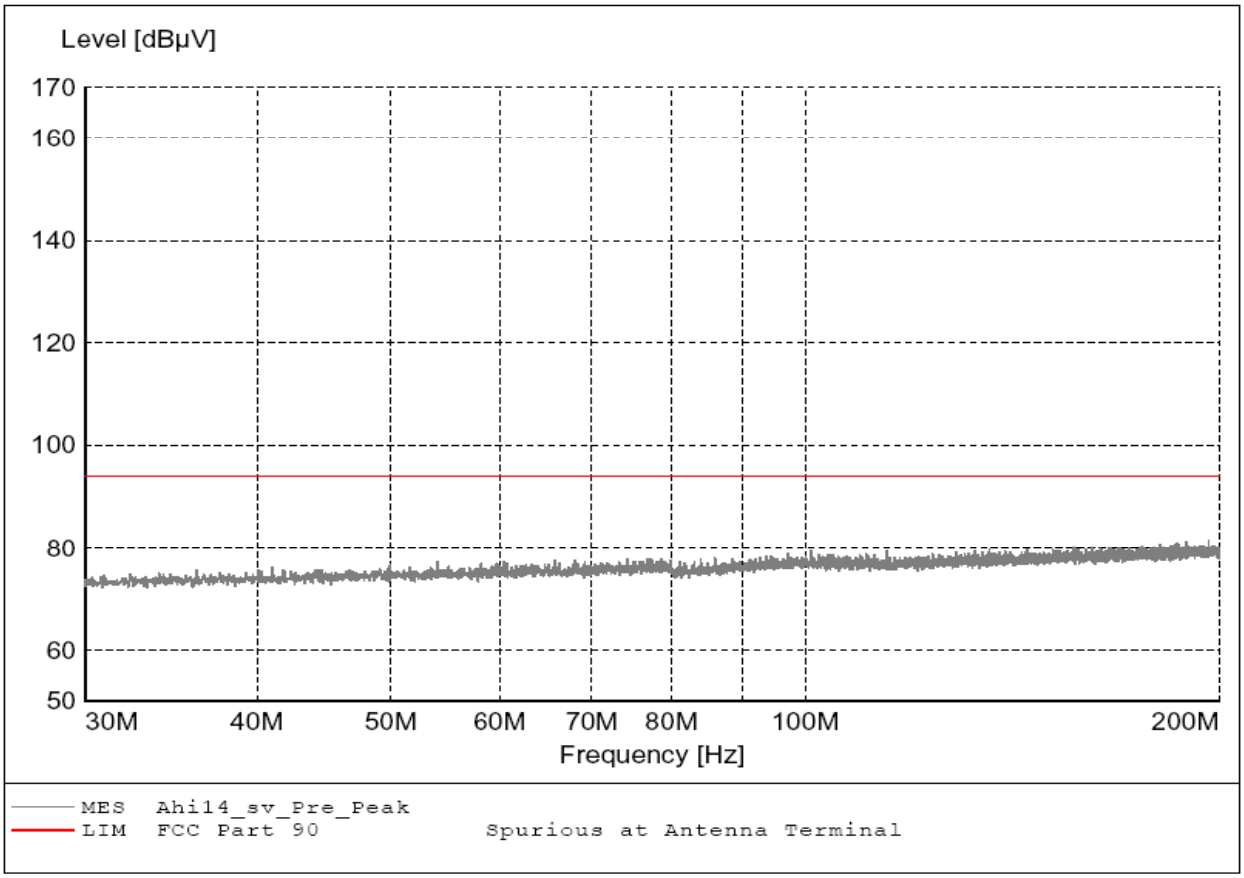
FCC Part 2.1051 For FCC Part 90 Device

Spurious Emissions Measured at Antenna Port

```
EUT:                 DRTXM4 and GPS-1
Manufacturer:        Highway Information Systems
Operating Condition: 70 deg F; 30%R.H.
Test Site:           DLS Screenroom     Date: 01-11-06
Operator:            Craig Brandt
Comment:             Transmitter Model: DRTXM4 with Synchronizer Module: GPS-1
                     TX Freq. 530 kHz: MOD 16dB above 50%;  MOD at 2500 Hz
                     Mode: Dual Supply; Fully Locked
```

TEXT: "FCC Part 2.1051"

```
  Short Description:            Antenna Port Conducted
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005
```



1250 Peterson Dr., Wheeling, IL 60090

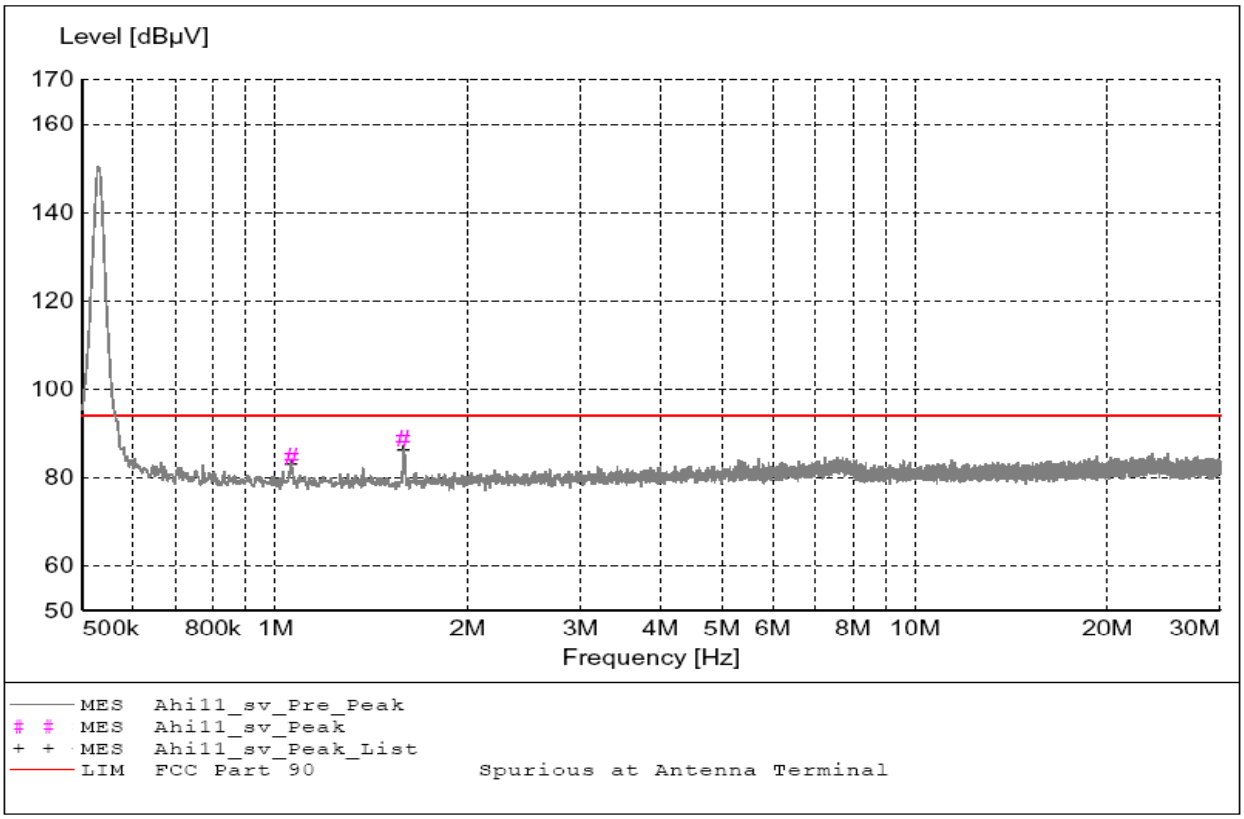
FCC Part 2.1051 For FCC Part 90 Device

Spurious Emissions Measured at Antenna Port

EUT: DRTXM4 and GPS-1
Manufacturer: Highway Information Systems
Operating Condition: 70 deg F; 30%R.H.
Test Site: DLS Screenroom Date: 01-11-06
Operator: Craig Brandt
Comment: Transmitter Model: DRTXM4 with Synchronizer Module: GPS-1
TX Freq. 530 kHz: MOD 16dB above 50%; MOD at 2500 Hz
Mode: Dual Supply; Without Satellite Reception

TEXT: "FCC Part 2.1051"

Short Description: Antenna Port Conducted
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005



MEASUREMENT RESULT: "Ahi11_sv_Final"

1/11/2006 8:54AM

Frequency	Level	Antenna Factor	System Loss	Total Level	Limit	Margin	Height Ant.	EuT Angle	Final Detector	Comment
MHz	dBµV	dBµV	dB	dBµV	dBµV	dB	m	deg		
1.588000	38.06	0.00	50.5	89	94	5.4	0.00	0	MAX PEAK	None
1.060000	34.28	0.00	50.4	85	94	9.3	0.00	0	MAX PEAK	None

1250 Peterson Dr., Wheeling, IL 60090

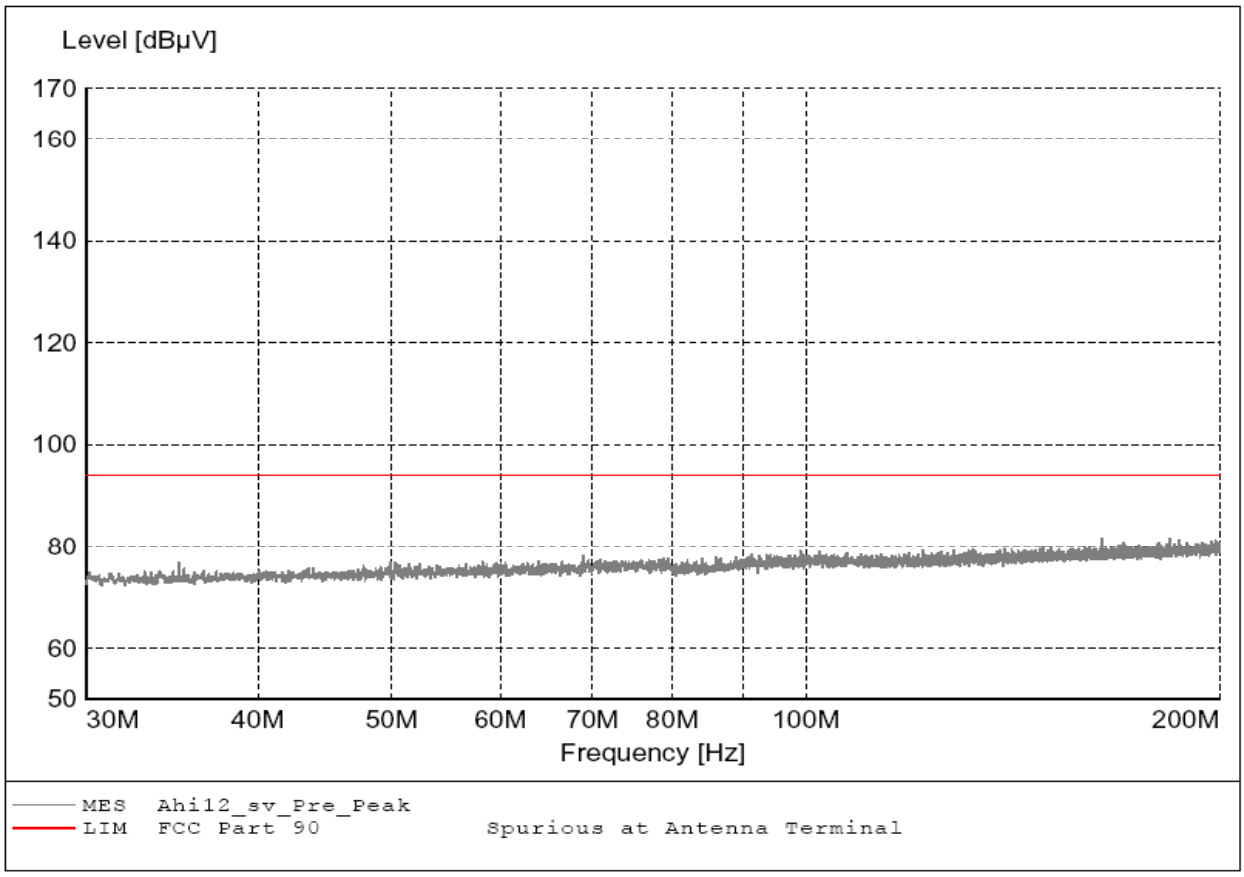
FCC Part 2.1051 For FCC Part 90 Device

Spurious Emissions Measured at Antenna Port

EUT: DRTXM4 and GPS-1
Manufacturer: Highway Information Systems
Operating Condition: 70 deg F; 30%R.H.
Test Site: DLS Screenroom Date: 01-11-06
Operator: Craig Brandt
Comment: Transmitter Model: DRTXM4 with Synchronizer Module: GPS-1
TX Freq. 530 kHz: MOD 16dB above 50%; MOD at 2500 Hz
Mode: Dual Supply; Without Satellite Reception

TEXT: "FCC Part 2.1051"

Short Description: Antenna Port Conducted
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005



1250 Peterson Dr., Wheeling, IL 60090

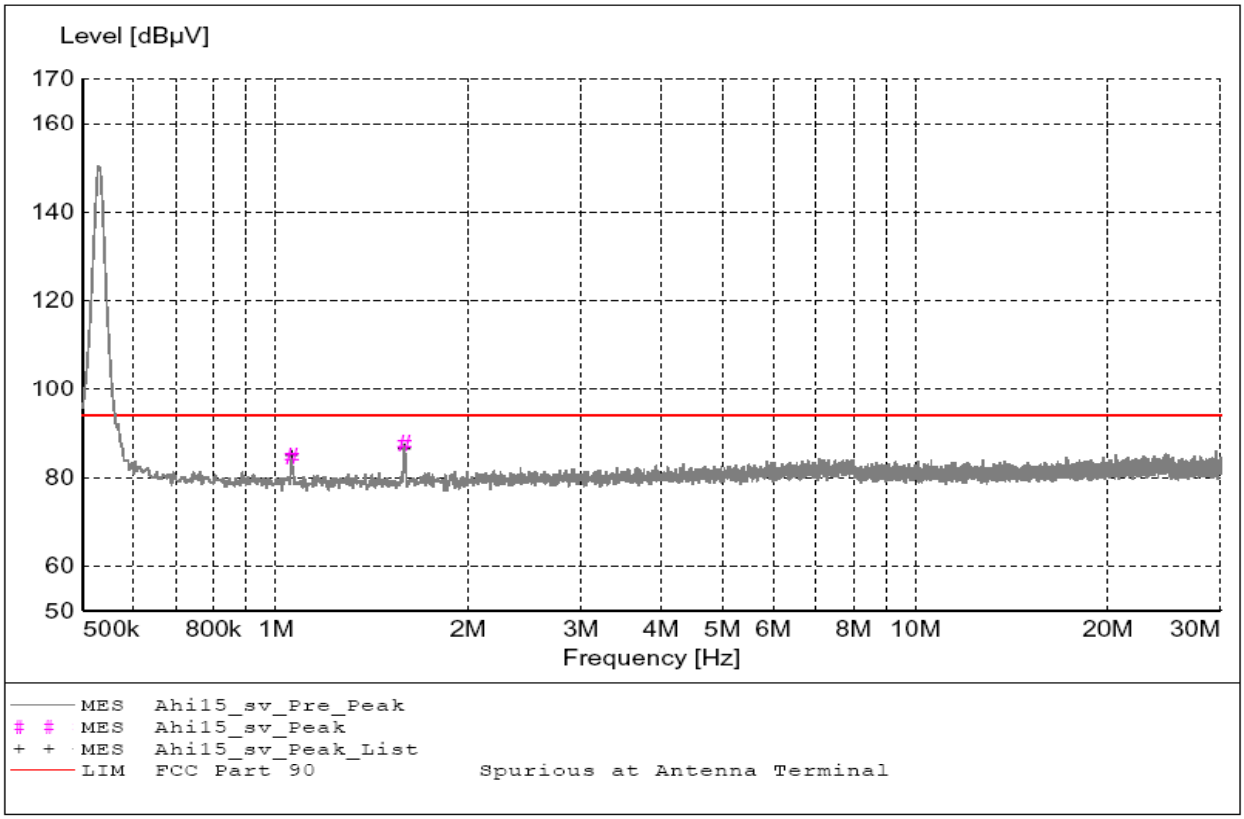
FCC Part 2.1051 For FCC Part 90 Device

Spurious Emissions Measured at Antenna Port

EUT: DRTXM4 and GPS-1
Manufacturer: Highway Information Systems
Operating Condition: 70 deg F; 30%R.H.
Test Site: DLS Screenroom Date: 01-11-06
Operator: Craig Brandt
Comment: Transmitter Model: DRTXM4 with Synchronizer Module: GPS-1
TX Freq. 530 kHz: MOD 16dB above 50%; MOD at 2500 Hz
Mode: Dual Supply; Without Sync Signal to Transmitter

TEXT: "FCC Part 2.1051"

Short Description: Antenna Port Conducted
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005



MEASUREMENT RESULT: "Ahi15_sv_Final"

1/11/2006 9:21AM

Frequency MHz	Level dBµV	Antenna Factor dBµV	System Loss dB	Total Level dBµV	Limit dBµV	Margin dB	Height Ant. m	EuT Angle deg	Final Detector	Comment
1.592000	37.02	0.00	50.5	88	94	6.5	0.00	0	MAX PEAK	None
1.060000	34.22	0.00	50.4	85	94	9.4	0.00	0	MAX PEAK	None

1250 Peterson Dr., Wheeling, IL 60090

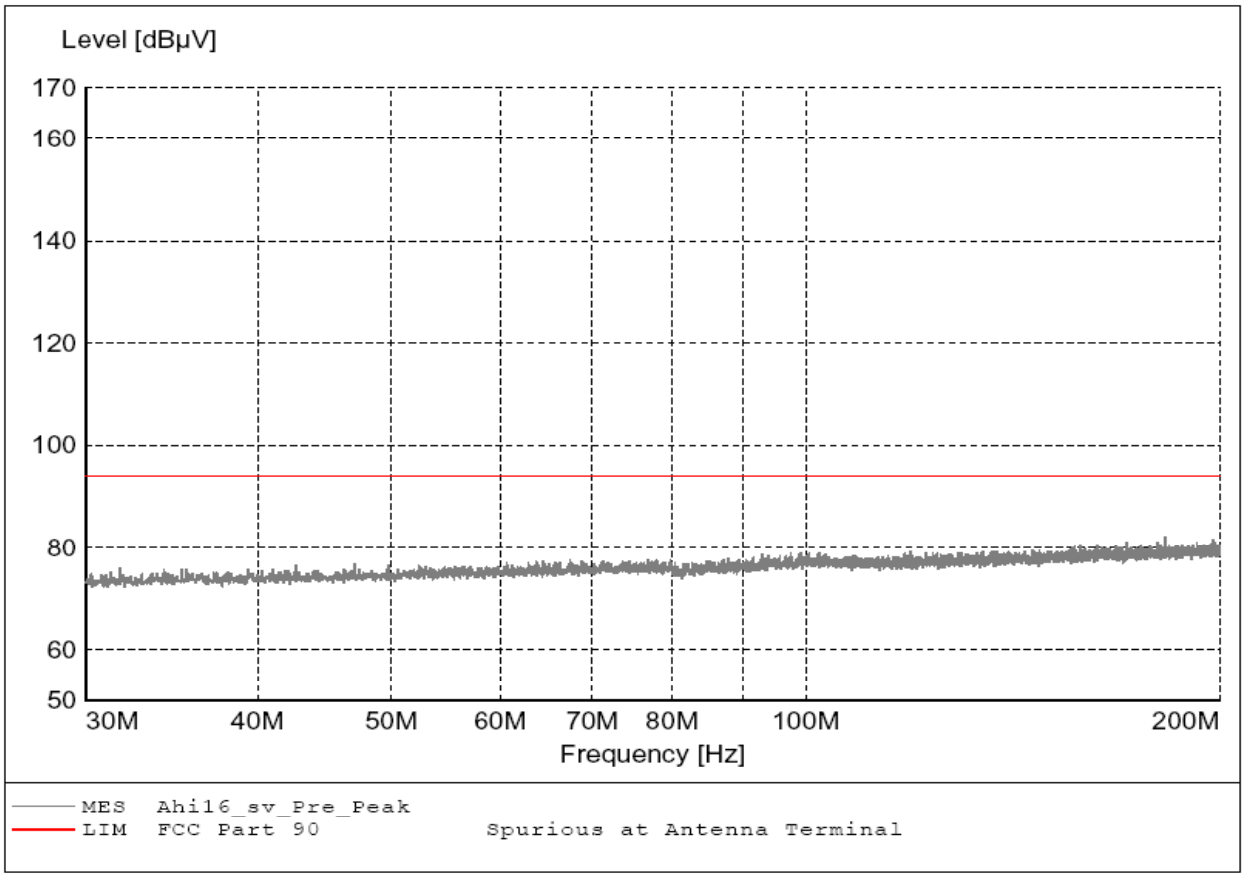
FCC Part 2.1051 For FCC Part 90 Device

Spurious Emissions Measured at Antenna Port

EUT: DRTXM4 and GPS-1
Manufacturer: Highway Information Systems
Operating Condition: 70 deg F; 30%R.H.
Test Site: DLS Screenroom Date: 01-11-06
Operator: Craig Brandt
Comment: Transmitter Model: DRTXM4 with Synchronizer Module: GPS-1
TX Freq. 530 kHz: MOD 16dB above 50%; MOD at 2500 Hz
Mode: Dual Supply; Without Sync Signal to Transmitter

TEXT: "FCC Part 2.1051"

Short Description: Antenna Port Conducted
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005



1250 Peterson Dr., Wheeling, IL 60090

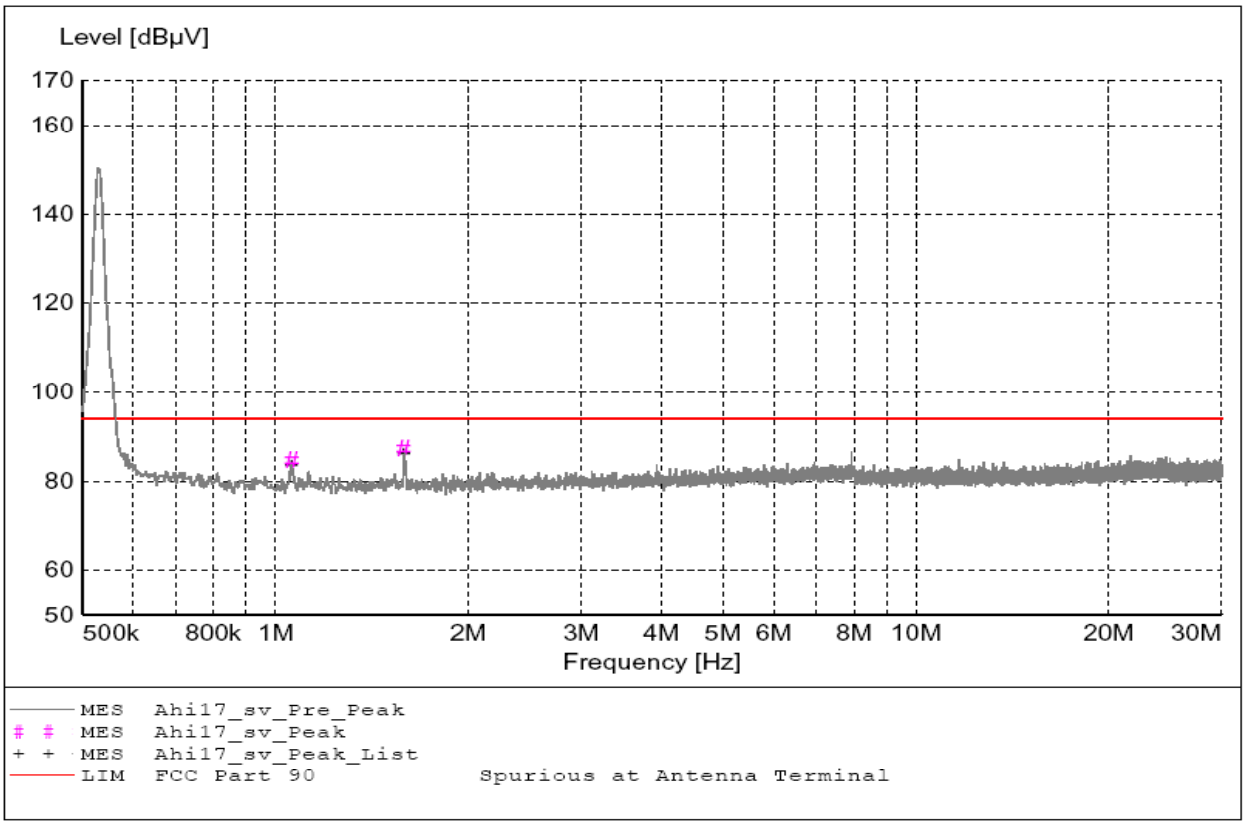
FCC Part 2.1051 For FCC Part 90 Device

Spurious Emissions Measured at Antenna Port

EUT: DRTXM4 and GPS-1
Manufacturer: Highway Information Systems
Operating Condition: 70 deg F; 30%R.H.
Test Site: DLS Screenroom Date: 01-11-06
Operator: Craig Brandt
Comment: Transmitter Model: DRTXM4 with Synchronizer Module: GPS-1
TX Freq. 530 kHz: MOD 16dB above 50%; MOD at 2500 Hz
Mode: Dual Supply; Without 1 PPS Timing Signal

TEXT: "FCC Part 2.1051"

Short Description: Antenna Port Conducted
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005



MEASUREMENT RESULT: "Ahi17_sv_Final"

1/11/2006 9:30AM

Frequency	Level	Antenna Factor	System Loss	Total Level	Limit	Margin	Height Ant.	EuT Angle	Final Detector	Comment
MHz	dBµV	dBµV	dB	dBµV	dBµV	dB	m	deg		
1.588000	36.81	0.00	50.5	87	94	6.7	0.00	0	MAX PEAK	None
1.060000	34.19	0.00	50.4	85	94	9.4	0.00	0	MAX PEAK	None

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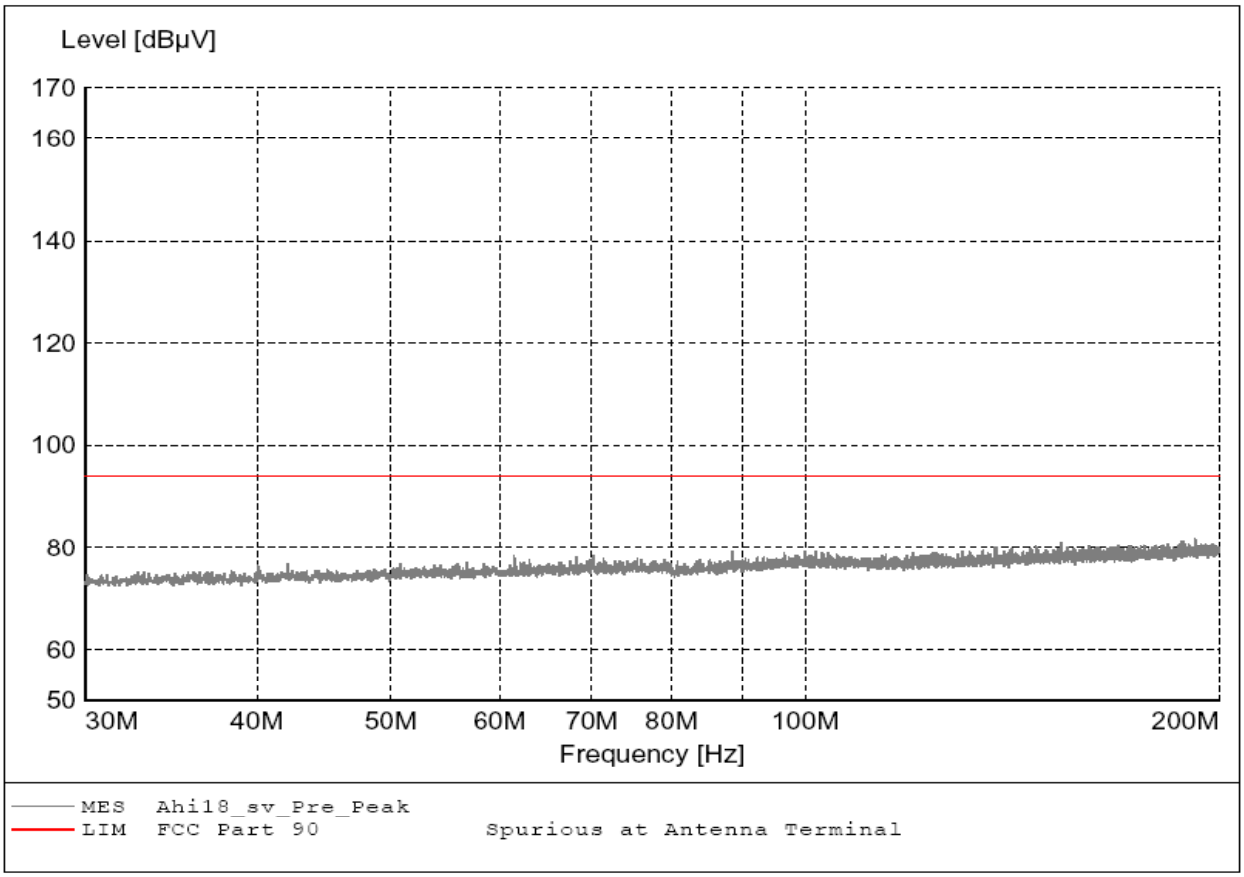
FCC Part 2.1051 For FCC Part 90 Device

Spurious Emissions Measured at Antenna Port

EUT: DRTXM4 and GPS-1
Manufacturer: Highway Information Systems
Operating Condition: 70 deg F; 30%R.H.
Test Site: DLS Screenroom Date: 01-11-06
Operator: Craig Brandt
Comment: Transmitter Model: DRTXM4 with Synchronizer Module: GPS-1
TX Freq. 530 kHz: MOD 16dB above 50%; MOD at 2500 Hz
Mode: Dual Supply; Without 1 PPS Timing Signal

TEXT: "FCC Part 2.1051"

Short Description: Antenna Port Conducted
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005



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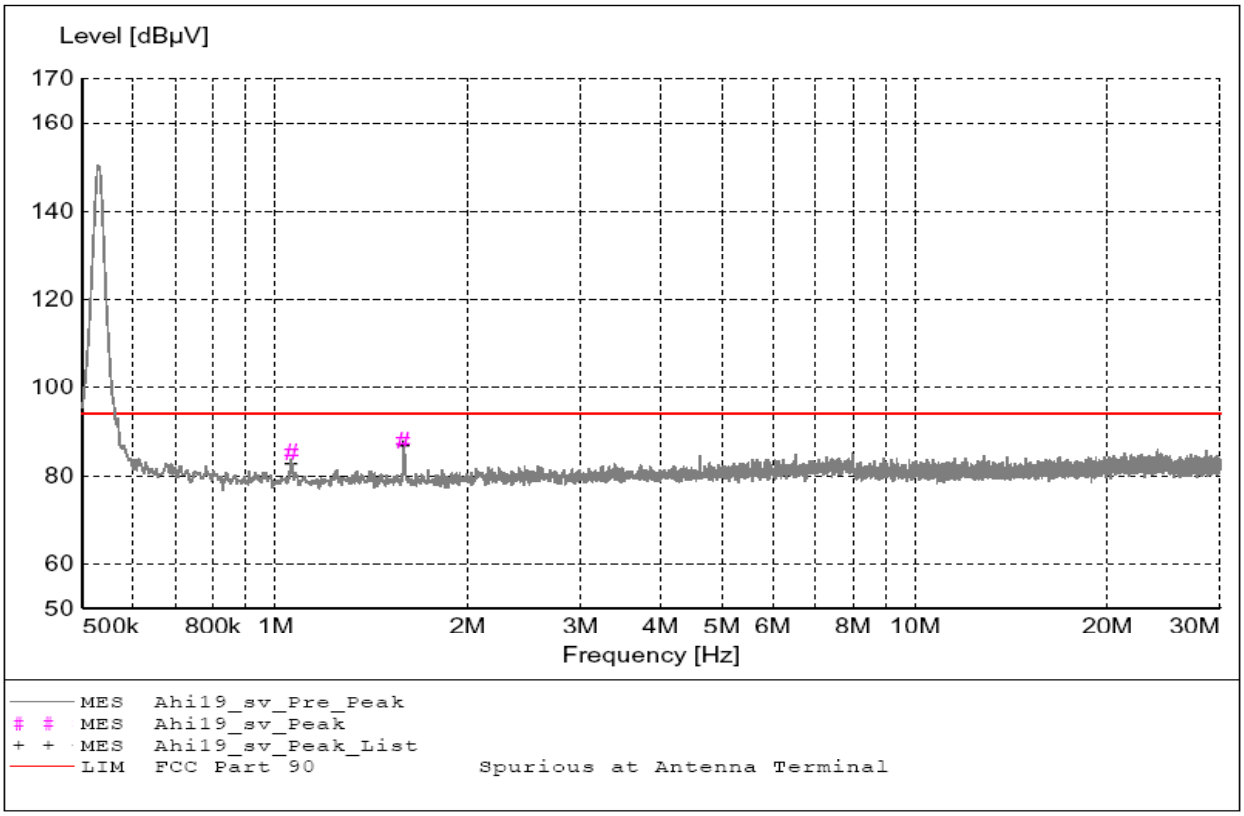
FCC Part 2.1051 For FCC Part 90 Device

Spurious Emissions Measured at Antenna Port

EUT: DRTXM4 and GPS-1
Manufacturer: Highway Information Systems
Operating Condition: 70 deg F; 30%R.H.
Test Site: DLS Screenroom Date: 01-11-06
Operator: Craig Brandt
Comment: Transmitter Model: DRTXM4 with Synchronizer Module: GPS-1
TX Freq. 530 kHz: MOD 16dB above 50%; MOD at 2500 Hz
Mode: Dual Supply; Without 10 MHz Timing Signal

TEXT: "FCC Part 2.1051"

Short Description: Antenna Port Conducted
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005



MEASUREMENT RESULT: "Ahi19_sv_Final"

1/11/2006 9:40AM

Frequency	Level	Antenna Factor	System Loss	Total Level	Limit	Margin	Height Ant.	EuT Angle	Final Detector	Comment
MHz	dBµV	dBµV	dB	dBµV	dBµV	dB	m	deg		
1.588000	37.27	0.00	50.5	88	94	6.2	0.00	0	MAX PEAK	None
1.060000	34.76	0.00	50.4	85	94	8.9	0.00	0	MAX PEAK	None

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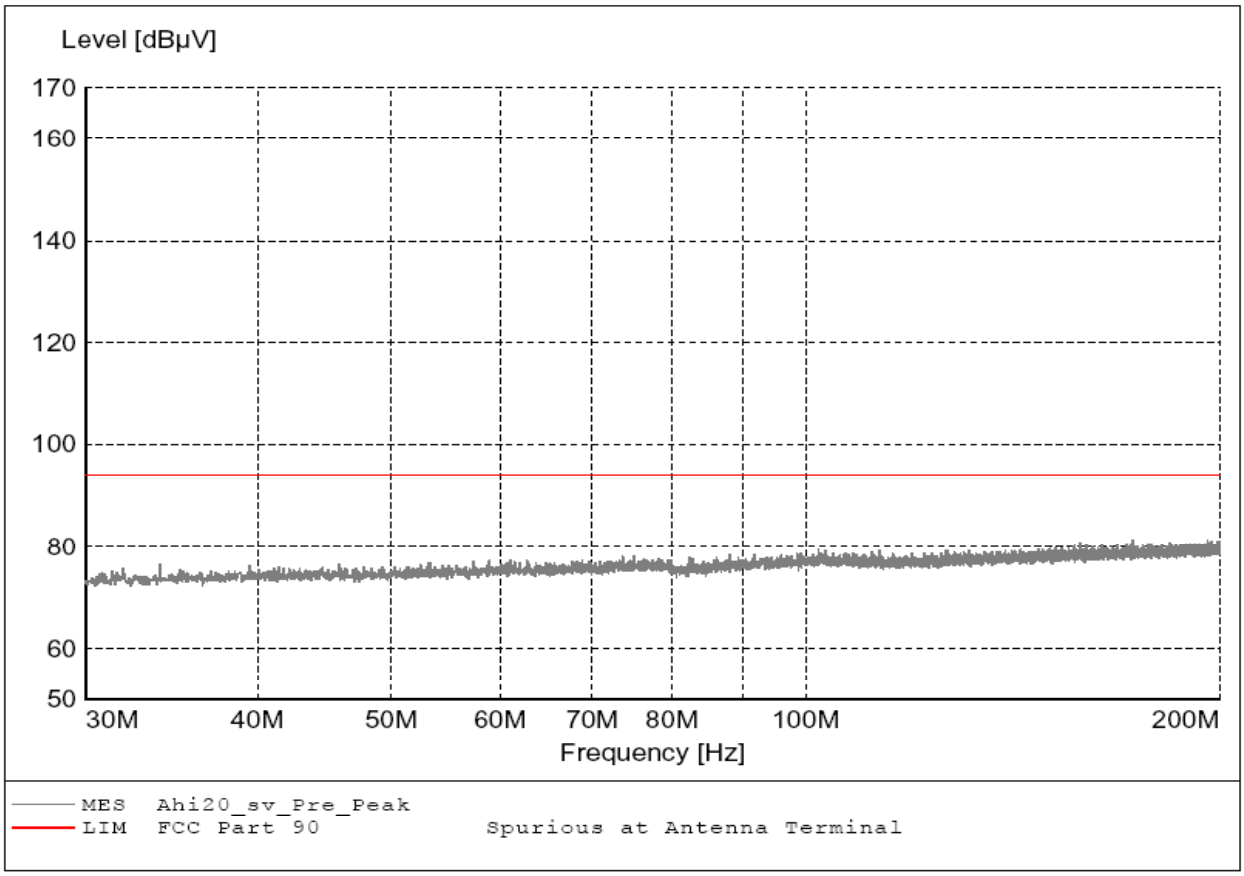
FCC Part 2.1051 For FCC Part 90 Device

Spurious Emissions Measured at Antenna Port

EUT: DRTXM4 and GPS-1
Manufacturer: Highway Information Systems
Operating Condition: 70 deg F; 30%R.H.
Test Site: DLS Screenroom Date: 01-11-06
Operator: Craig Brandt
Comment: Transmitter Model: DRTXM4 with Synchronizer Module: GPS-1
TX Freq. 530 kHz: MOD 16dB above 50%; MOD at 2500 Hz
Mode: Dual Supply; Without 10 MHz Timing Signal

TEXT: "FCC Part 2.1051"

Short Description: Antenna Port Conducted
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005



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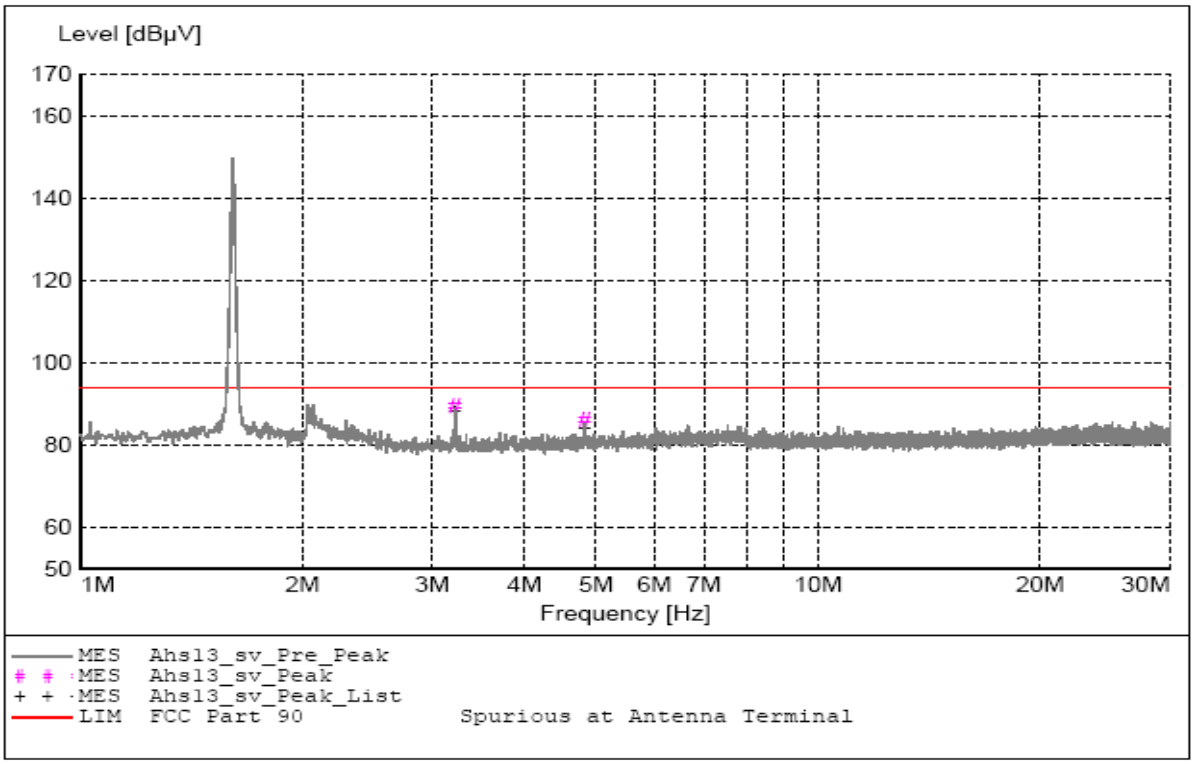
FCC Part 2.1051 For FCC Part 90 Device

Spurious Emissions Measured at Antenna Port

```
EUT:                  DRTXM4 and GPS-1
Manufacturer:         Highway Information Systems
Operating Condition:  69 deg F; 36%R.H.
Test Site:            DLS Screenroom     Date: 01-13-06
Operator:             Craig Brandt
Test Specification:   Transmitter Model: DRTXM4 with Synchronizer Module: GPS-1
Comment:              TX Freq. 1610 kHz; MOD 16dB above 50% MOD at 2500 Hz
                      Mode:  Single Supply; Fully Locked
```

TEXT: "FCC Part 2.1051"

```
  Short Description:            Antenna Port Conducted
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005
```



MEASUREMENT RESULT: "Ahs13_sv_Final"

1/13/2006 2:54PM

Frequency	Level	Antenna Factor	System Loss	Total Level	Limit	Margin	Height Ant.	EuT Angle	Final Detector	Comment
MHz	dBµV	dBµV	dB	dBµV	dBµV	dB	m	deg		
3.220000	38.77	0.00	50.6	89	94	4.7	0.00	0	MAX PEAK	None
4.828000	35.31	0.00	50.8	86	94	7.9	0.00	0	MAX PEAK	None

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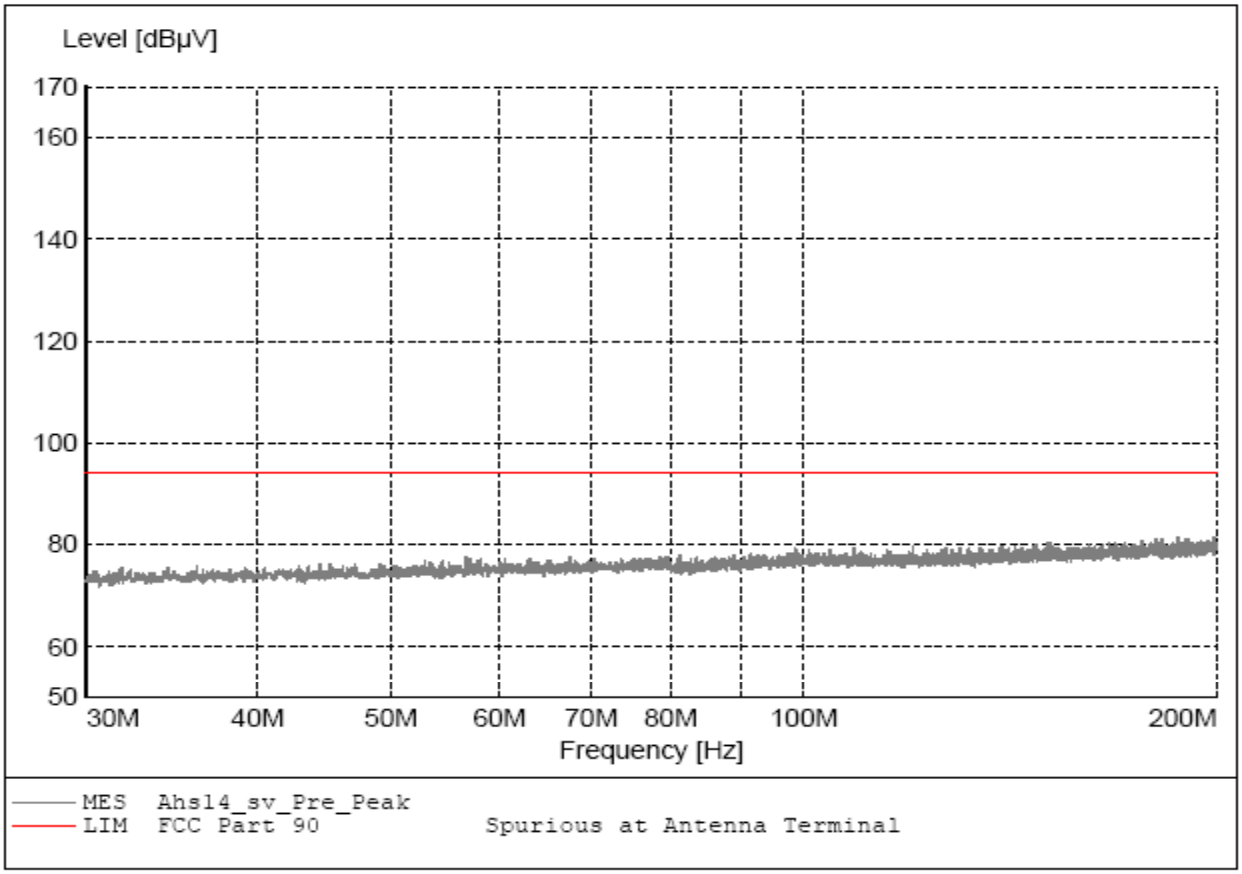
FCC Part 2.1051 For FCC Part 90 Device

Spurious Emissions Measured at Antenna Port

```
EUT:                  DRTXM4 and GPS-1
Manufacturer:         Highway Information Systems
Operating Condition:  69 deg F; 36%R.H.
Test Site:            DLS Screenroom     Date: 01-13-06
Operator:             Craig Brandt
Test Specification:   Transmitter Model: DRTXM4 with Synchronizer Module: GPS-1
Comment:              TX Freq. 1610 kHz; MOD 16dB above 50% MOD at 2500 Hz
                      Mode:  Single Supply; Fully Locked
```

TEXT: "FCC Part 2.1051"

```
  Short Description:            Antenna Port Conducted
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005
```



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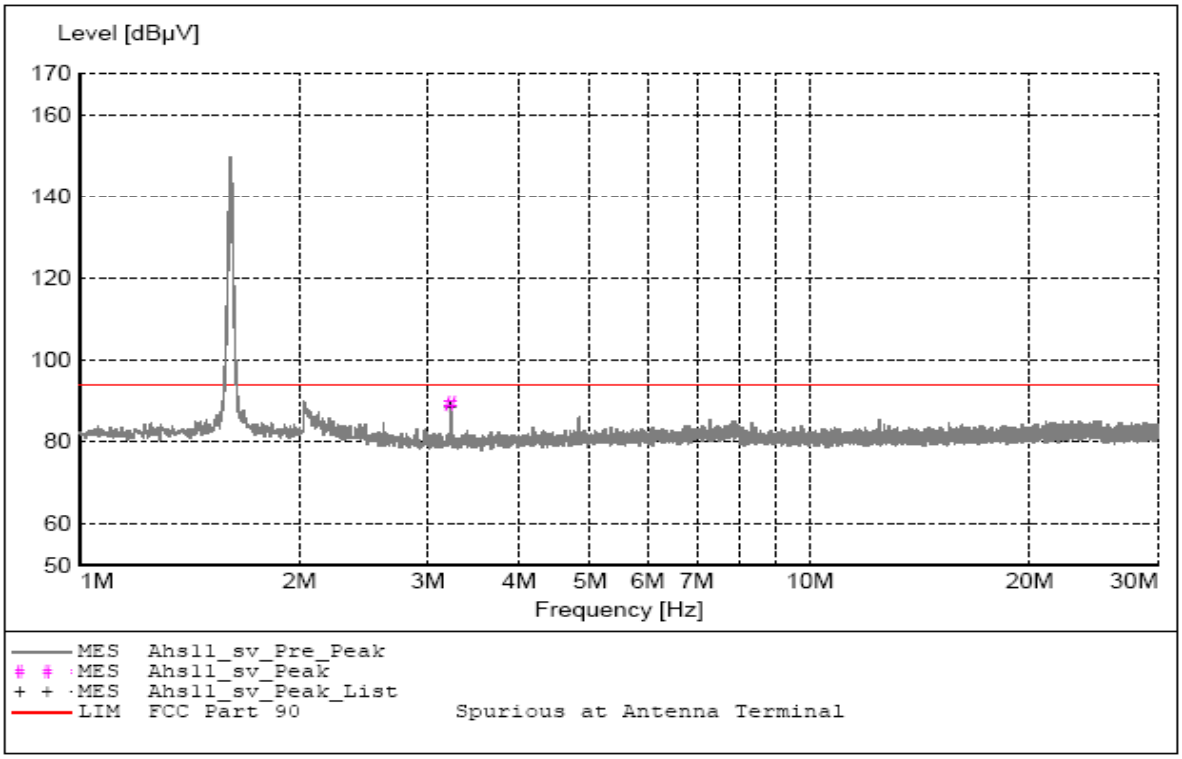
FCC Part 2.1051 For FCC Part 90 Device

Spurious Emissions Measured at Antenna Port

```
EUT:                  DRTXM4 and GPS-1
Manufacturer:         Highway Information Systems
Operating Condition:  69 deg F; 36%R.H.
Test Site:            DLS Screenroom      Date: 01-13-06
Operator:             Craig Brandt
Test Specification:   Transmitter Model: DRTXM4 with Synchronizer Module: GPS-1
Comment:              TX Freq. 1610 kHz; MOD 16dB above 50% MOD at 2500 Hz
                      Mode:  Single Supply; Without Satellite Reception
```

TEXT: "FCC Part 2.1051"

```
  Short Description:            Antenna Port Conducted
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 887808/005
```



MEASUREMENT RESULT: "Ahs11_sv_Final"

1/13/2006 2:38PM

Frequency	Level	Antenna Factor	System Loss	Total Level	Limit	Margin	Height Ant.	EuT Angle	Final Detector	Comment
MHz	dBµV	dBµV	dB	dBµV	dBµV	dB	m	deg		
3.220000	38.60	0.00	50.6	89	94	4.8	0.00	0	MAX PEAK	None

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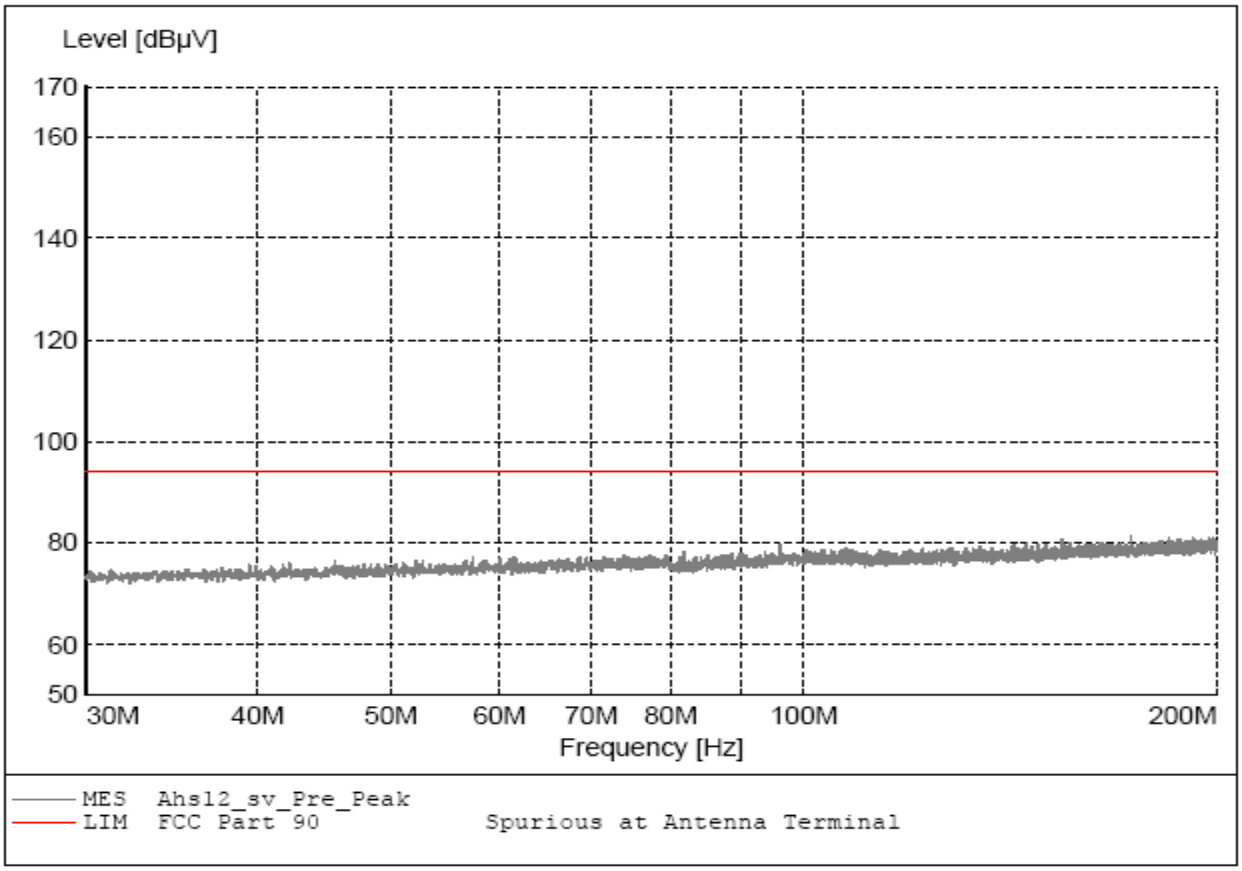
FCC Part 2.1051 For FCC Part 90 Device

Spurious Emissions Measured at Antenna Port

```
EUT:                  DRTXM4 and GPS-1
Manufacturer:         Highway Information Systems
Operating Condition:  69 deg F; 36%R.H.
Test Site:            DLS Screenroom      Date: 01-13-06
Operator:             Craig Brandt
Test Specification:   Transmitter Model: DRTXM4 with Synchronizer Module: GPS-1
Comment:              TX Freq. 1610 kHz; MOD 16dB above 50% MOD at 2500 Hz
                      Mode:  Single Supply; Without Satellite Reception
```

TEXT: "FCC Part 2.1051"

```
  Short Description:            Antenna Port Conducted
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005
```



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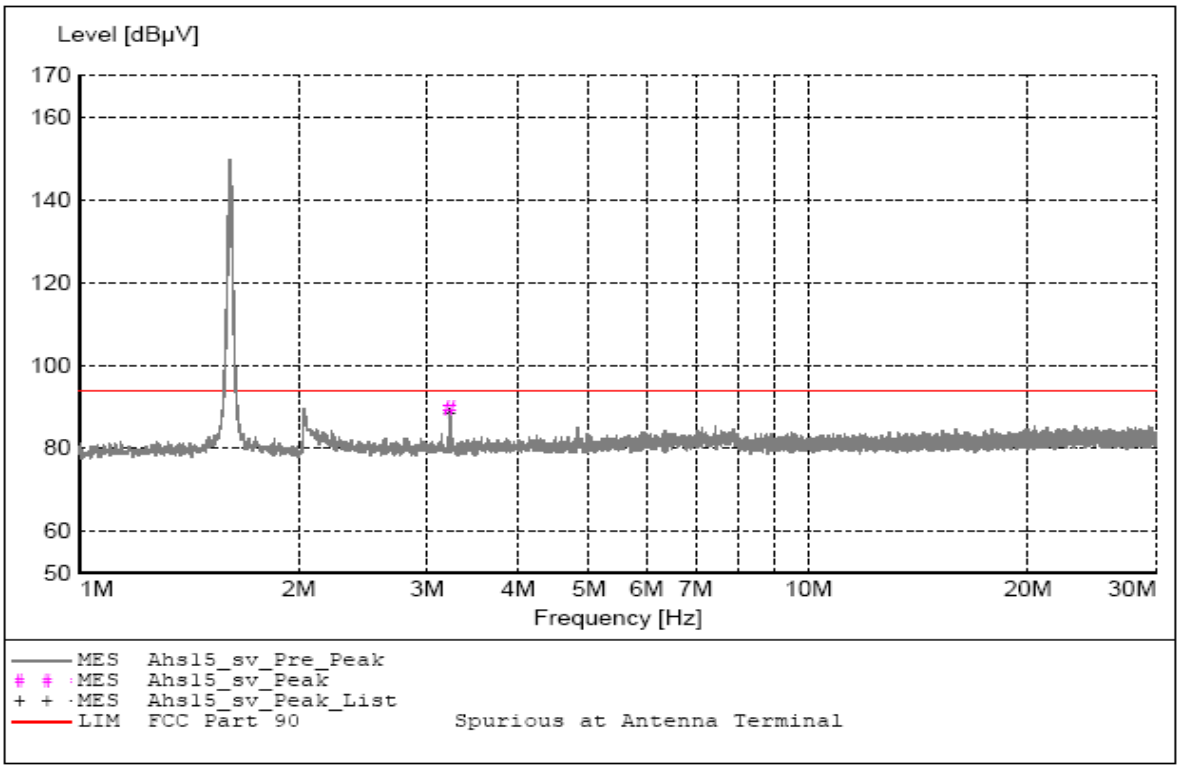
FCC Part 2.1051 For FCC Part 90 Device

Spurious Emissions Measured at Antenna Port

```
EUT:                  DRTXM4 and GPS-1
Manufacturer:         Highway Information Systems
Operating Condition:  69 deg F; 36%R.H.
Test Site:            DLS Screenroom      Date: 01-13-06
Operator:             Craig Brandt
Test Specification:   Transmitter Model: DRTXM4 with Synchronizer Module: GPS-1
Comment:              TX Freq. 1610 kHz; MOD 16dB above 50% MOD at 2500 Hz
                      Mode:  Single Supply; Without Sync Signal to Transmitter
```

TEXT: "FCC Part 2.1051"

```
  Short Description:            Antenna Port Conducted
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005
```



MEASUREMENT RESULT: "Ahs15_sv_Final"

1/13/2006 3:01PM

Frequency	Level	Antenna Factor	System Loss	Total Level	Limit	Margin	Height Ant.	EuT Angle	Final Detector	Comment
MHz	dBµV	dBµV	dB	dBµV	dBµV	dB	m	deg		
3.220000	38.94	0.00	50.6	90	94	4.5	0.00	0	MAX PEAK	None

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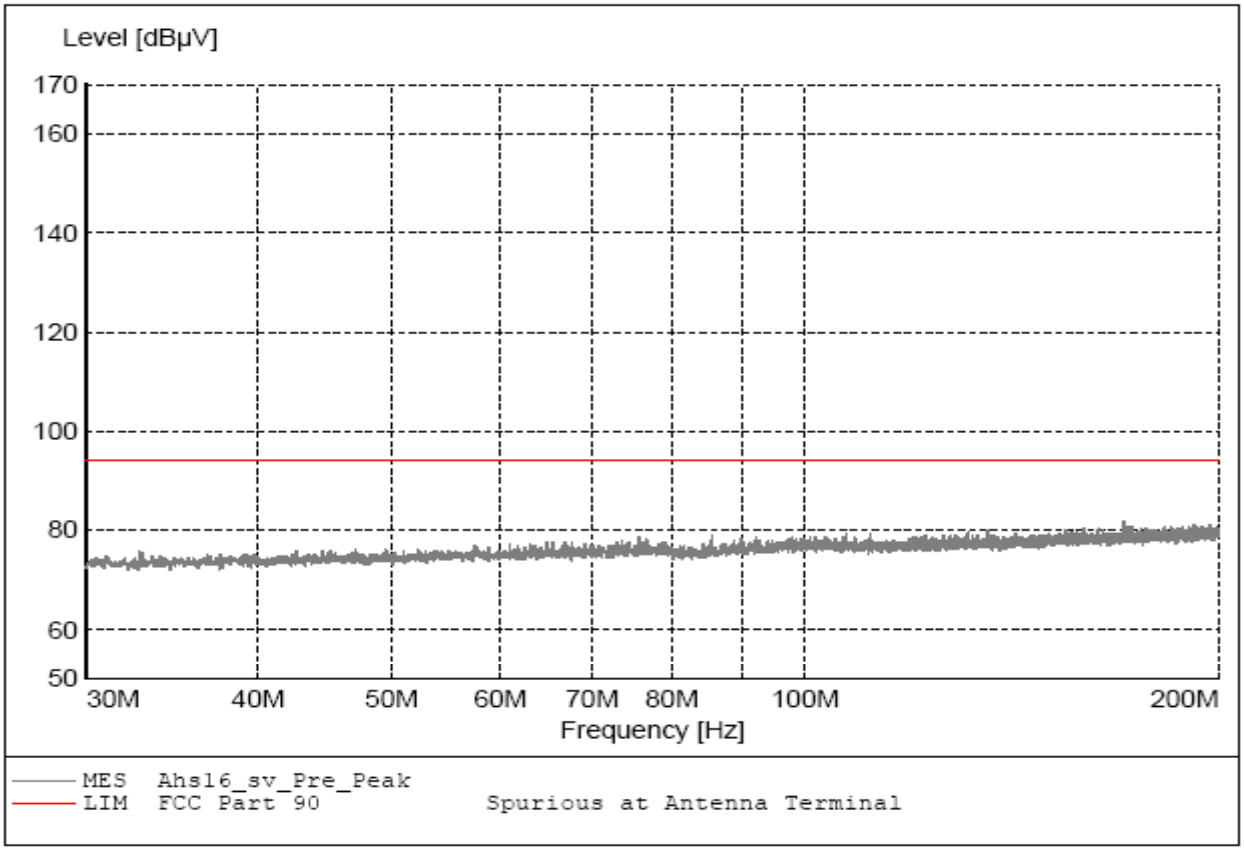
FCC Part 2.1051 For FCC Part 90 Device

Spurious Emissions Measured at Antenna Port

```
EUT:                  DRTXM4 and GPS-1
Manufacturer:         Highway Information Systems
Operating Condition:  69 deg F; 36%R.H.
Test Site:            DLS Screenroom     Date: 01-13-06
Operator:             Craig Brandt
Test Specification:   Transmitter Model: DRTXM4 with Synchronizer Module: GPS-1
Comment:              TX Freq. 1610 kHz; MOD 16dB above 50% MOD at 2500 Hz
                      Mode:  Single Supply; Without Sync Signal to Transmitter
```

TEXT: "FCC Part 2.1051"

```
  Short Description:            Antenna Port Conducted
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005
```



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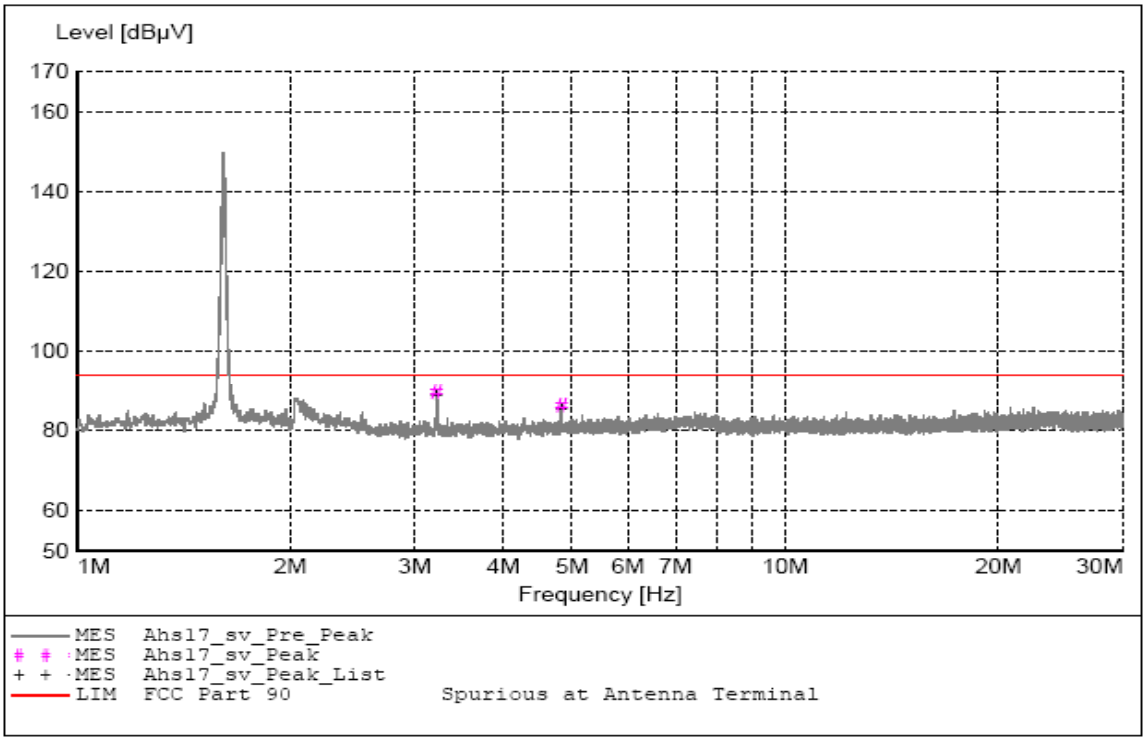
FCC Part 2.1051 For FCC Part 90 Device

Spurious Emissions Measured at Antenna Port

```
EUT:                  DRTXM4 and GPS-1
Manufacturer:         Highway Information Systems
Operating Condition:  69 deg F; 36%R.H.
Test Site:            DLS Screenroom      Date: 01-13-06
Operator:             Craig Brandt
Test Specification:   Transmitter Model: DRTXM4 with Synchronizer Module: GPS-1
Comment:              TX Freq. 1610 kHz; MOD 16dB above 50% MOD at 2500 Hz
                      Mode:  Single Supply; Without 1 PPS Timing Signal
```

TEXT: "FCC Part 2.1051"

```
  Short Description:           Antenna Port Conducted
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005
```



MEASUREMENT RESULT: "Ahs17_sv_Final"

1/13/2006 3:10PM

Frequency MHz	Level dBµV	Antenna Factor dBµV	System Loss dB	Total Level dBµV	Limit dBµV	Margin dB	Height Ant. m	EuT Angle deg	Final Detector	Comment
3.220000	38.88	0.00	50.6	89	94	4.5	0.00	0	MAX PEAK	None
4.832000	35.34	0.00	50.8	86	94	7.9	0.00	0	MAX PEAK	None

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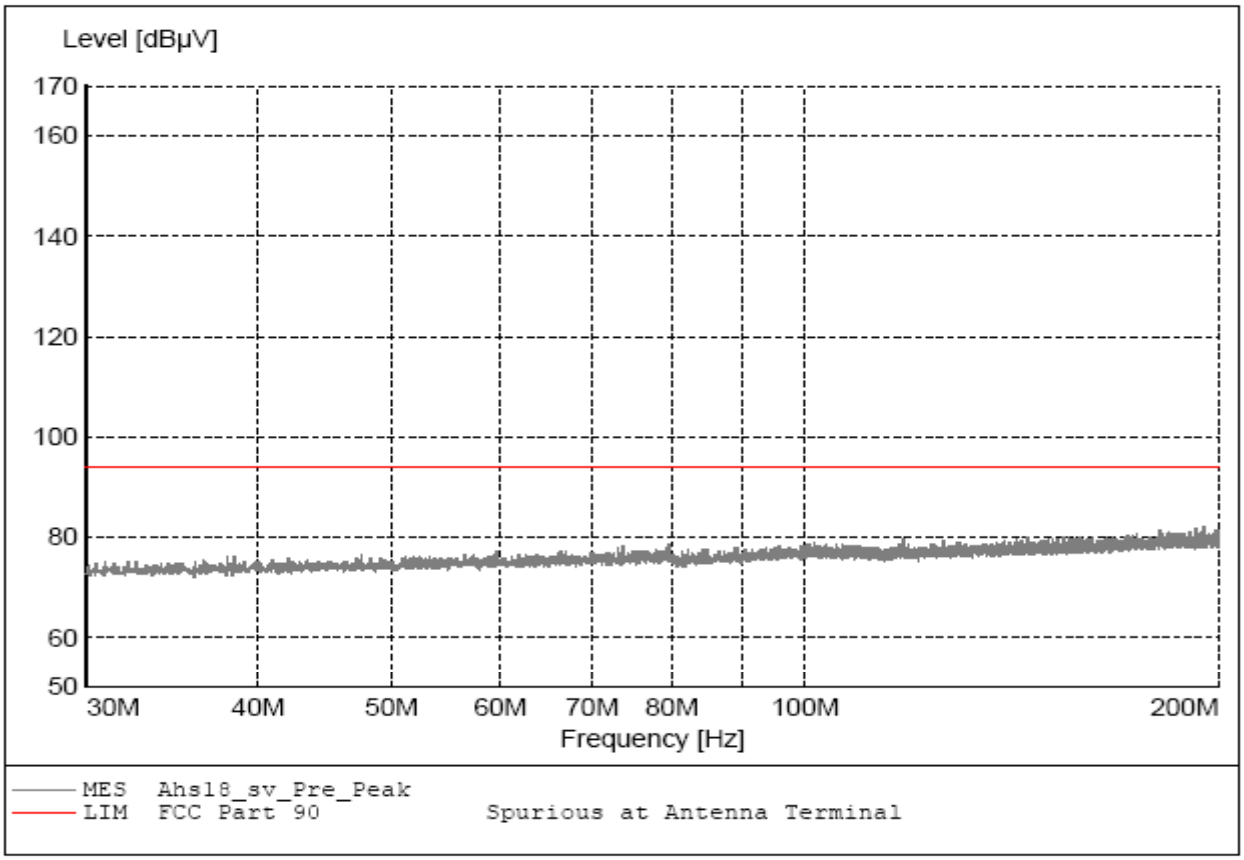
FCC Part 2.1051 For FCC Part 90 Device

Spurious Emissions Measured at Antenna Port

```
EUT:                  DRTXM4 and GPS-1
Manufacturer:         Highway Information Systems
Operating Condition:  69 deg F; 36%R.H.
Test Site:            DLS Screenroom     Date: 01-13-06
Operator:             Craig Brandt
Test Specification:   Transmitter Model: DRTXM4 with Synchronizer Module: GPS-1
Comment:              TX Freq. 1610 kHz; MOD 16dB above 50% MOD at 2500 Hz
                      Mode:  Single Supply; Without 1 PPS Timing Signal
```

TEXT: "FCC Part 2.1051"

```
  Short Description:            Antenna Port Conducted
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005
```



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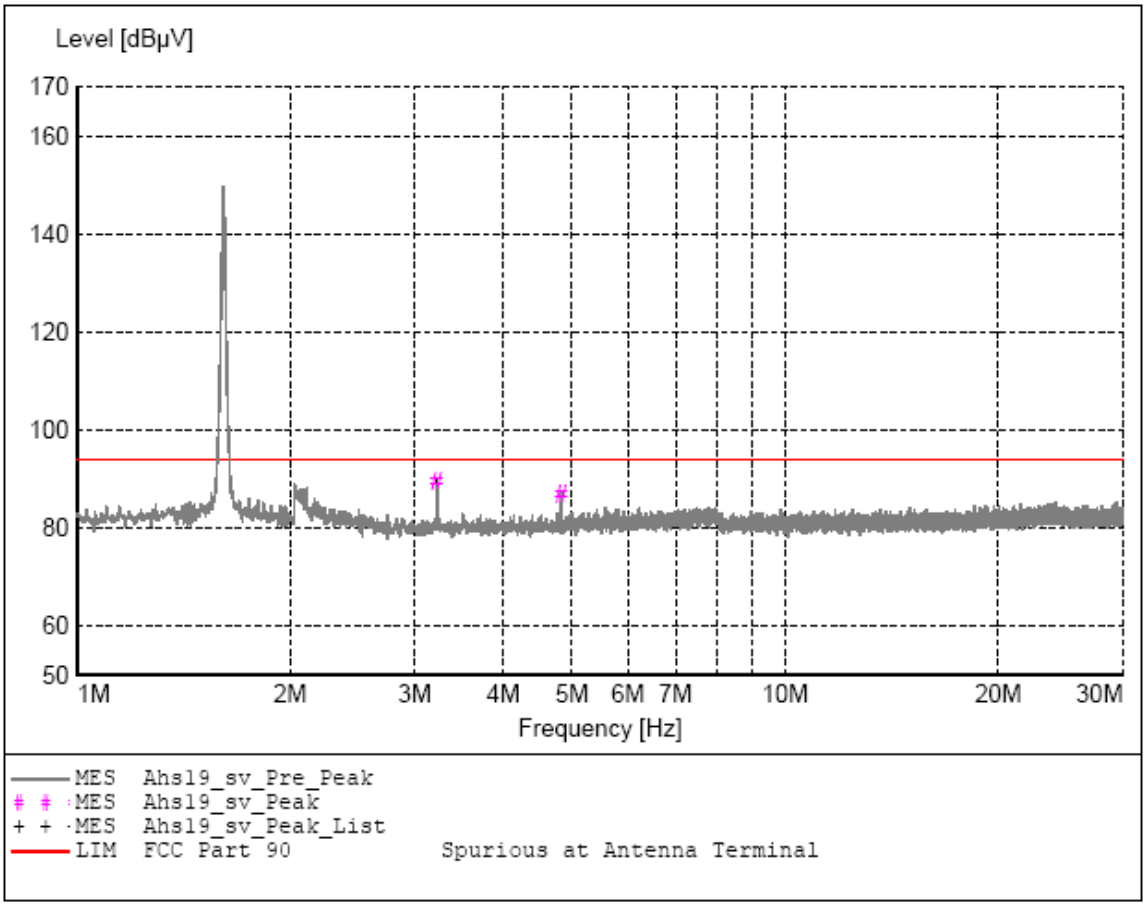
FCC Part 2.1051 For FCC Part 90 Device

Spurious Emissions Measured at Antenna Port

```
EUT:                  DRTXM4 and GPS-1
Manufacturer:         Highway Information Systems
Operating Condition:  69 deg F; 36%R.H.
Test Site:            DLS Screenroom     Date: 01-13-06
Operator:             Craig Brandt
Test Specification:   Transmitter Model: DRTXM4 with Synchronizer Module: GPS-1
Comment:              TX Freq. 1610 kHz; MOD 16dB above 50% MOD at 2500 Hz
                      Mode:  Single Supply; Without 10 MHz Timing Signal
```

TEXT: "FCC Part 2.1051"

```
  Short Description:           Antenna Port Conducted
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005
```



MEASUREMENT RESULT: "Ahs19_sv_Final"

1/13/2006 3:19PM

Frequency	Level	Antenna Factor	System Loss	Total Level	Limit	Margin	Height Ant.	EuT Angle	Final Detector	Comment
MHz	dBµV	dBµV	dB	dBµV	dBµV	dB	m	deg		
3.220000	38.90	0.00	50.6	89	94	4.5	0.00	0	MAX PEAK	None
4.828000	36.04	0.00	50.8	87	94	7.2	0.00	0	MAX PEAK	None

Company: Highway Information Systems, Inc.
Model Tested: DRTXM4
Report Number: 11911

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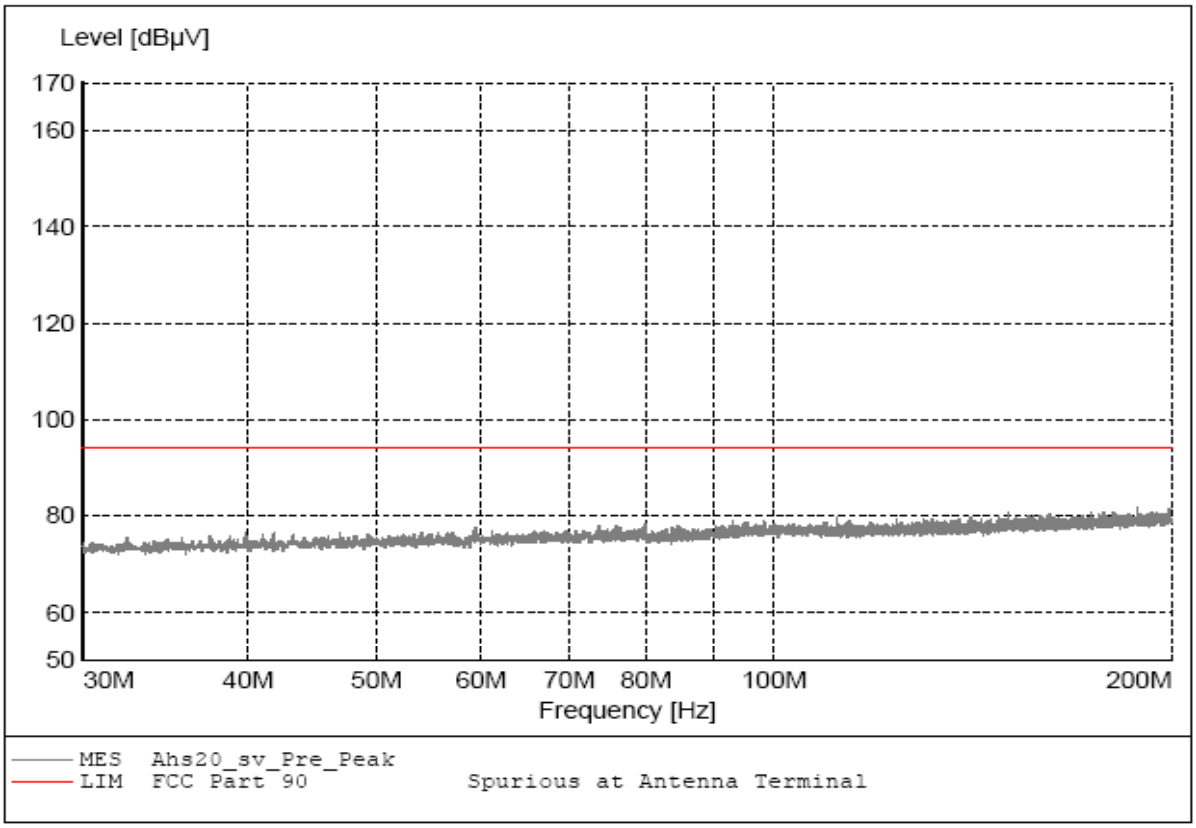
FCC Part 2.1051 For FCC Part 90 Device

Spurious Emissions Measured at Antenna Port

```
EUT:                  DRTXM4 and GPS-1
Manufacturer:         Highway Information Systems
Operating Condition:  69 deg F; 36%R.H.
Test Site:            DLS Screenroom     Date: 01-13-06
Operator:             Craig Brandt
Test Specification:   Transmitter Model: DRTXM4 with Synchronizer Module: GPS-1
Comment:              TX Freq. 1610 kHz; MOD 16dB above 50% MOD at 2500 Hz
                      Mode:  Single Supply; Without 10 MHz Timing Signal
```

TEXT: "FCC Part 2.1051"

```
  Short Description:            Antenna Port Conducted
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005
```



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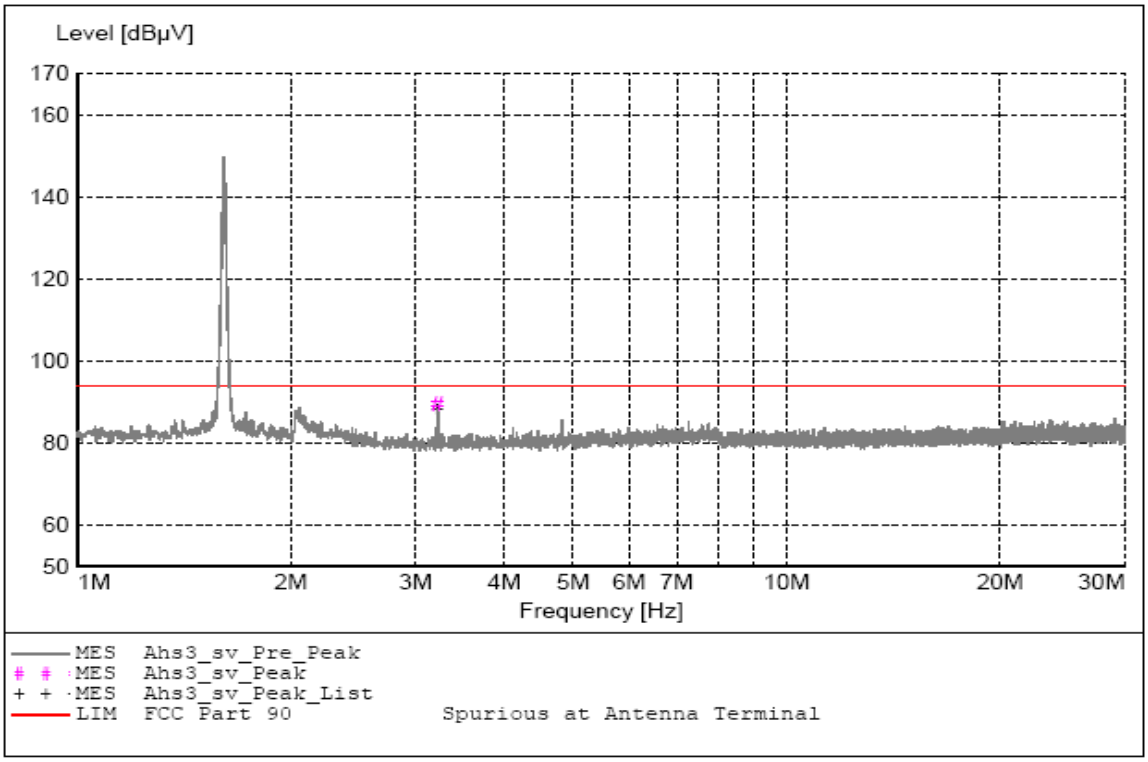
FCC Part 2.1051 For FCC Part 90 Device

Spurious Emissions Measured at Antenna Port

```
EUT:                  DRTXM4 and GPS-1
Manufacturer:         Highway Information Systems
Operating Condition:  69 deg F; 36%R.H.
Test Site:            DLS Screenroom      Date: 01-13-06
Operator:             Craig Brandt
Test Specification:   Transmitter Model: DRTXM4 with Synchronizer Module: GPS-1
Comment:              TX Freq. 1610 kHz; MOD 16dB above 50% MOD at 2500 Hz
                      Mode:  Dual Supply; Fully Locked
```

TEXT: "FCC Part 2.1051"

```
  Short Description:            Antenna Port Conducted
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005
```



MEASUREMENT RESULT: "Ahs3_sv_Final"

1/13/2006 11:13AM

Frequency	Level	Antenna Factor	System Loss	Total Level	Limit	Margin	Height Ant.	EuT Angle	Final Detector	Comment
MHz	dBµV	dBµV	dB	dBµV	dBµV	dB	m	deg		
3.220000	38.65	0.00	50.6	89	94	4.8	0.00	0	MAX PEAK	None

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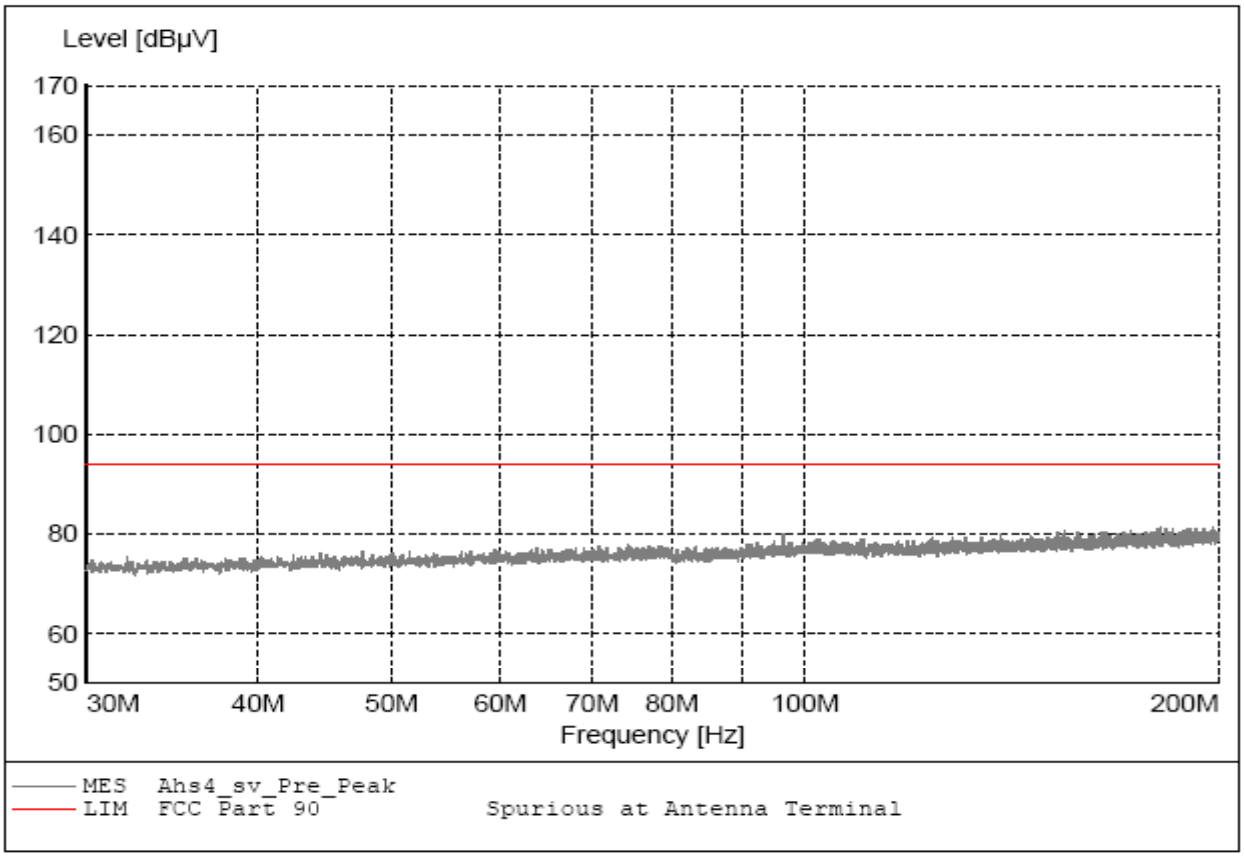
FCC Part 2.1051 For FCC Part 90 Device

Spurious Emissions Measured at Antenna Port

```
EUT:                  DRTXM4 and GPS-1
Manufacturer:         Highway Information Systems
Operating Condition:  69 deg F; 36%R.H.
Test Site:            DLS Screenroom     Date: 01-13-06
Operator:             Craig Brandt
Test Specification:   Transmitter Model: DRTXM4 with Synchronizer Module: GPS-1
Comment:              TX Freq. 1610 kHz; MOD 16dB above 50% MOD at 2500 Hz
                      Mode:  Dual Supply; Fully Locked
```

TEXT: "FCC Part 2.1051"

```
  Short Description:            Antenna Port Conducted
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005
```



1250 Peterson Dr., Wheeling, IL 60090

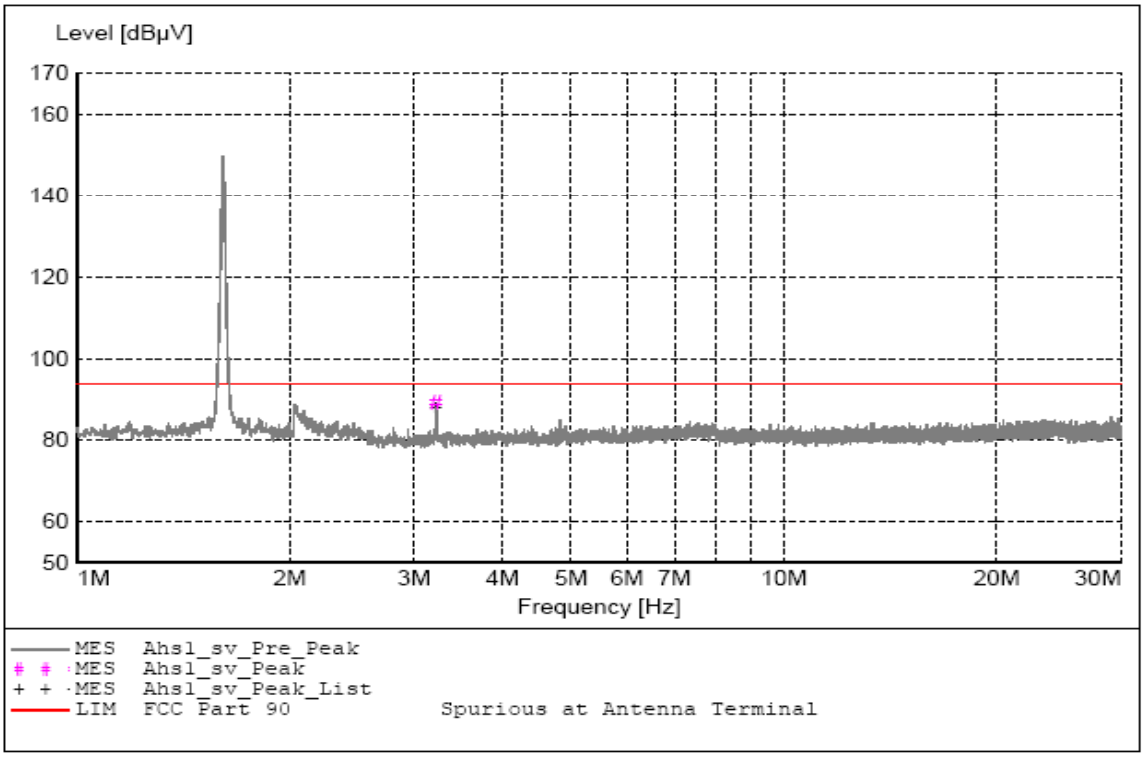
FCC Part 2.1051 For FCC Part 90 Device

Spurious Emissions Measured at Antenna Port

```
EUT:                  DRTXM4 and GPS-1
Manufacturer:         Highway Information Systems
Operating Condition:  69 deg F; 36%R.H.
Test Site:            DLS Screenroom     Date: 01-13-06
Operator:             Craig Brandt
Test Specification:   Transmitter Model: DRTXM4 with Synchronizer Module: GPS-1
Comment:              TX Freq. 1610 kHz; MOD 16dB above 50% MOD at 2500 Hz
                      Mode:  Dual Supply; Without Sattelite Reception
```

TEXT: "FCC Part 2.1051"

```
  Short Description:            Antenna Port Conducted
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005
```



MEASUREMENT RESULT: "Ahs1_sv_Final"

1/13/2006 11:08AM

Frequency	Level	Antenna Factor	System Loss	Total Level	Limit	Margin	Height Ant.	EuT Angle	Final Detector	Comment
MHz	dBµV	dBµV	dB	dBµV	dBµV	dB	m	deg		
3.220000	38.48	0.00	50.6	89	94	4.9	0.00	0	MAX PEAK	None

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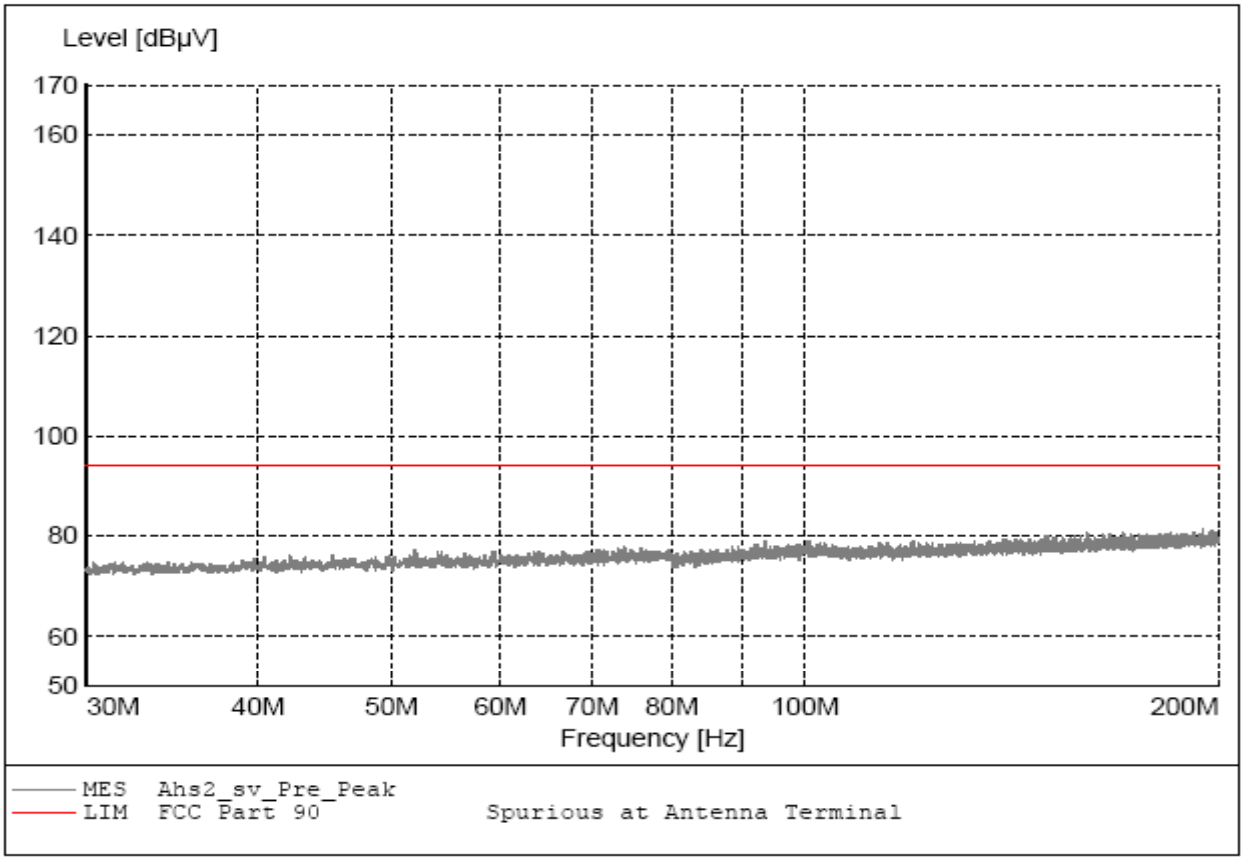
FCC Part 2.1051 For FCC Part 90 Device

Spurious Emissions Measured at Antenna Port

```
EUT:                  DRTXM4 and GPS-1
Manufacturer:         Highway Information Systems
Operating Condition:  69 deg F; 36%R.H.
Test Site:            DLS Screenroom     Date: 01-13-06
Operator:             Craig Brandt
Test Specification:   Transmitter Model: DRTXM4 with Synchronizer Module: GPS-1
Comment:              TX Freq. 1610 kHz; MOD 16dB above 50% MOD at 2500 Hz
                      Mode:  Dual Supply; Without Satellite Reception
```

TEXT: "FCC Part 2.1051"

```
  Short Description:            Antenna Port Conducted
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005
```



1250 Peterson Dr., Wheeling, IL 60090

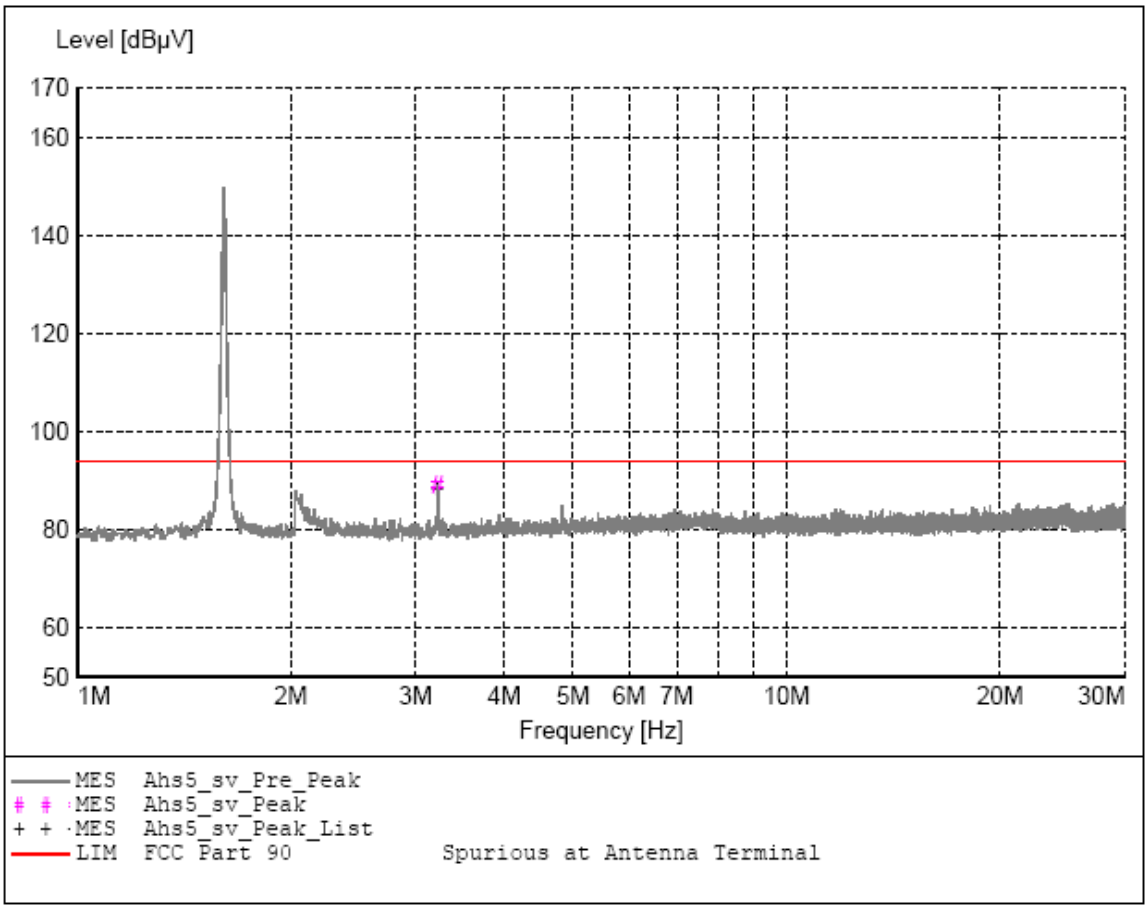
FCC Part 2.1051 For FCC Part 90 Device

Spurious Emissions Measured at Antenna Port

```
EUT:                  DRTXM4 and GPS-1
Manufacturer:         Highway Information Systems
Operating Condition:  69 deg F; 36%R.H.
Test Site:            DLS Screenroom     Date: 01-13-06
Operator:             Craig Brandt
Test Specification:   Transmitter Model: DRTXM4 with Synchronizer Module: GPS-1
Comment:              TX Freq. 1610 kHz; MOD 16dB above 50% MOD at 2500 Hz
                      Mode:  Dual Supply; Without Sync Signal to Transmitter
```

TEXT: "FCC Part 2.1051"

```
  Short Description:            Antenna Port Conducted
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005
```



MEASUREMENT RESULT: "Ahs5_sv_Final"

1/13/2006 11:26AM

Frequency	Level	Antenna Factor	System Loss	Total Level	Limit	Margin	Height Ant.	EuT Angle	Final Detector	Comment
MHz	dBµV	dBµV	dB	dBµV	dBµV	dB	m	deg		
3.220000	38.56	0.00	50.6	89	94	4.9	0.00	0	MAX PEAK	None

1250 Peterson Dr., Wheeling, IL 60090

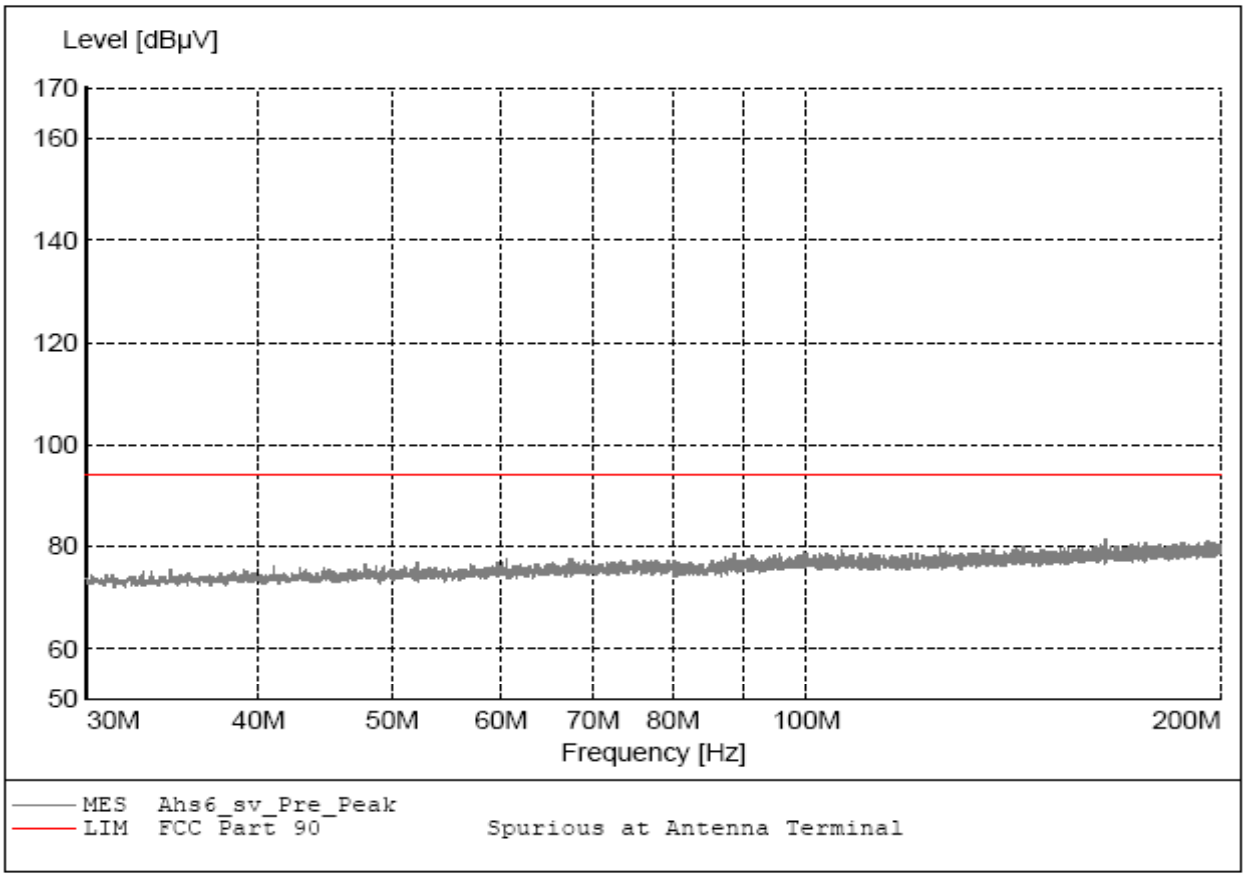
FCC Part 2.1051 For FCC Part 90 Device

Spurious Emissions Measured at Antenna Port

```
EUT:                  DRTXM4 and GPS-1
Manufacturer:         Highway Information Systems
Operating Condition:  69 deg F; 36%R.H.
Test Site:            DLS Screenroom      Date: 01-13-06
Operator:             Craig Brandt
Test Specification:   Transmitter Model: DRTXM4 with Synchronizer Module: GPS-1
Comment:              TX Freq. 1610 kHz; MOD 16dB above 50% MOD at 2500 Hz
                      Mode:  Dual Supply; Without Sync Signal to Transmitter
```

TEXT: "FCC Part 2.1051"

```
  Short Description:            Antenna Port Conducted
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005
```



1250 Peterson Dr., Wheeling, IL 60090

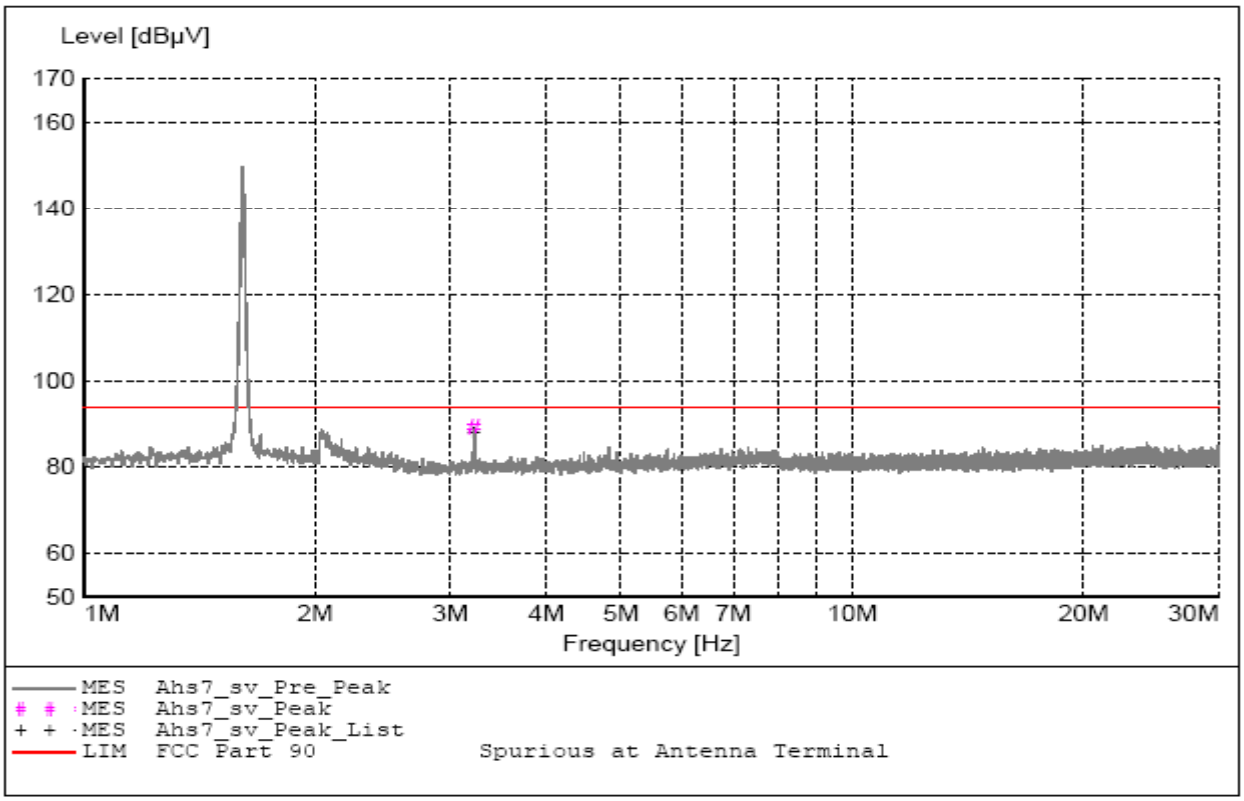
FCC Part 2.1051 For FCC Part 90 Device

Spurious Emissions Measured at Antenna Port

```
EUT:                  DRTXM4 and GPS-1
Manufacturer:         Highway Information Systems
Operating Condition:  69 deg F; 36%R.H.
Test Site:            DLS Screenroom     Date: 01-13-06
Operator:             Craig Brandt
Test Specification:   Transmitter Model: DRTXM4 with Synchronizer Module: GPS-1
Comment:              TX Freq. 1610 kHz; MOD 16dB above 50% MOD at 2500 Hz
                      Mode:  Dual Supply; Without 1 PPS Timing Signal
```

TEXT: "FCC Part 2.1051"

```
  Short Description:           Antenna Port Conducted
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005
```



MEASUREMENT RESULT: "Ahs7_sv_Final"

1/13/2006 11:41AM

Frequency	Level	Antenna Factor	System Loss	Total Level	Limit	Margin	Height Ant.	EuT Angle	Final Detector	Comment
MHz	dBµV	dBµV	dB	dBµV	dBµV	dB	m	deg		
3.220000	38.43	0.00	50.6	89	94	5.0	0.00	0	MAX PEAK	None

1250 Peterson Dr., Wheeling, IL 60090

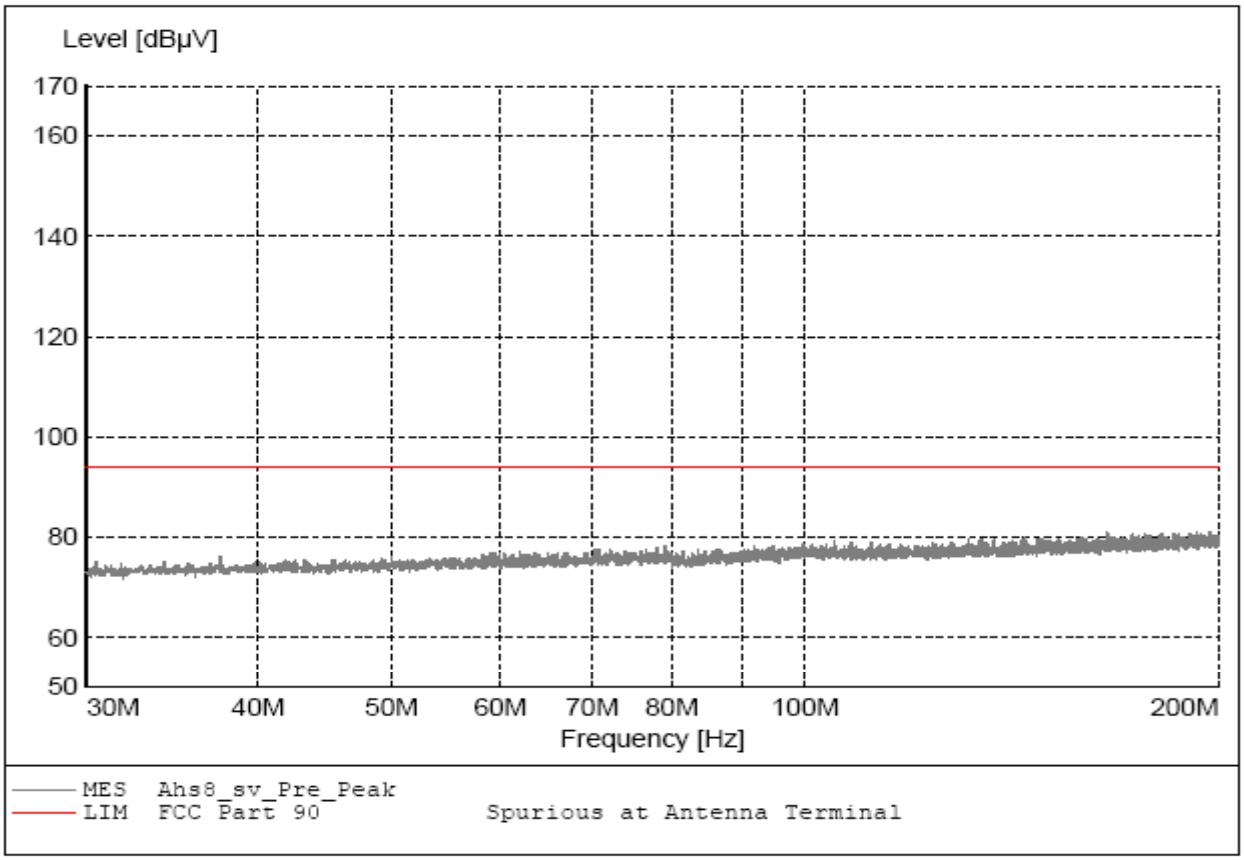
FCC Part 2.1051 For FCC Part 90 Device

Spurious Emissions Measured at Antenna Port

```
EUT:                  DRTXM4 and GPS-1
Manufacturer:         Highway Information Systems
Operating Condition:  69 deg F; 36%R.H.
Test Site:            DLS Screenroom     Date: 01-13-06
Operator:             Craig Brandt
Test Specification:   Transmitter Model: DRTXM4 with Synchronizer Module: GPS-1
Comment:              TX Freq. 1610 kHz; MOD 16dB above 50% MOD at 2500 Hz
                      Mode:  Dual Supply; Without 1 PPS Timing Signal
```

TEXT: "FCC Part 2.1051"

```
  Short Description:            Antenna Port Conducted
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005
```



Company: Highway Information Systems, Inc.
Model Tested: DRTXM4
Report Number: 11911

1250 Peterson Dr., Wheeling, IL 60090

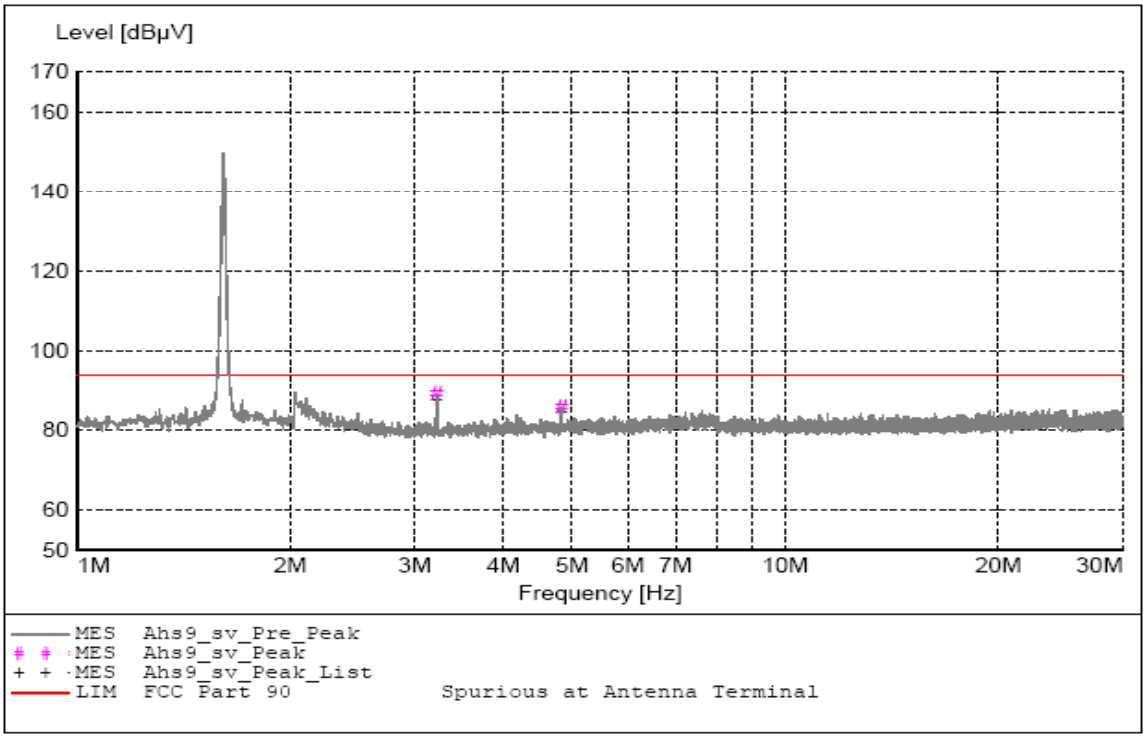
FCC Part 2.1051 For FCC Part 90 Device

Spurious Emissions Measured at Antenna Port

```
EUT:                  DRTXM4 and GPS-1
Manufacturer:         Highway Information Systems
Operating Condition:  69 deg F; 36%R.H.
Test Site:            DLS Screenroom     Date: 01-13-06
Operator:             Craig Brandt
Test Specification:   Transmitter Model: DRTXM4 with Synchronizer Module: GPS-1
Comment:              TX Freq. 1610 kHz; MOD 16dB above 50% MOD at 2500 Hz
                      Mode:  Dual Supply; Without 10 MHz Timing Signal
```

TEXT: "FCC Part 2.1051"

```
  Short Description:           Antenna Port Conducted
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005
```



MEASUREMENT RESULT: "Ahs9_sv_Final"

1/13/2006 11:52AM

Frequency MHz	Level dBµV	Antenna Factor dBµV	System Loss dB	Total Level dBµV	Limit dBµV	Margin dB	Height Ant. m	EuT Angle deg	Final Detector	Comment
3.220000	38.35	0.00	50.6	89	94	5.1	0.00	0	MAX PEAK	None
4.832000	34.61	0.00	50.8	86	94	8.4	0.00	0	MAX PEAK	None

Company: Highway Information Systems, Inc.
Model Tested: DRTXM4
Report Number: 11911

1250 Peterson Dr., Wheeling, IL 60090

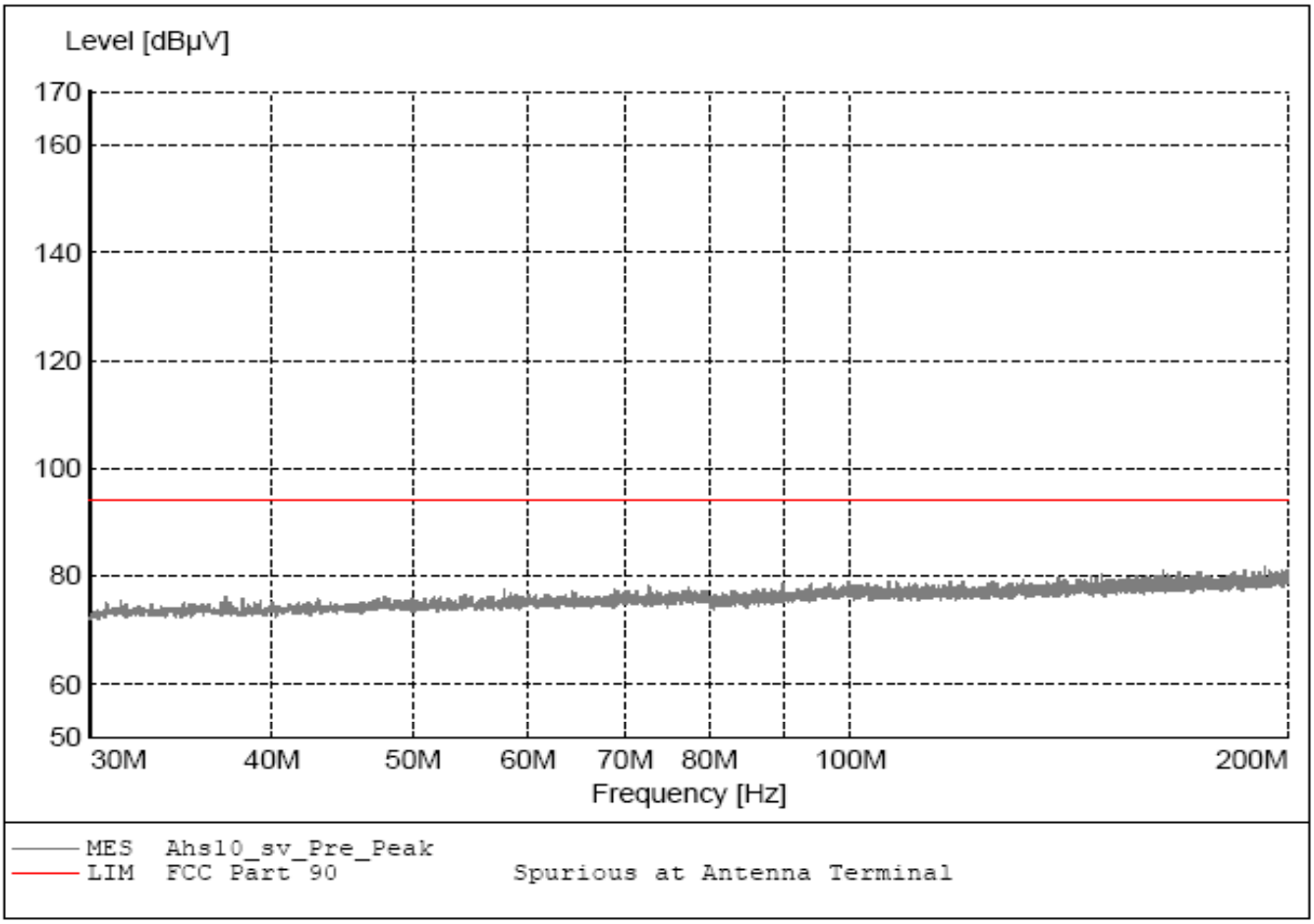
FCC Part 2.1051 For FCC Part 90 Device

Spurious Emissions Measured at Antenna Port

```
EUT:                 DRTXM4 and GPS-1
Manufacturer:        Highway Information Systems
Operating Condition: 69 deg F; 36%R.H.
Test Site:           DLS Screenroom     Date: 01-13-06
Operator:            Craig Brandt
Test Specification:  Transmitter Model: DRTXM4 with Synchronizer Module: GPS-1
Comment:             TX Freq. 1610 kHz; MOD 16dB above 50% MOD at 2500 Hz
                     Mode:  Dual Supply; Without 10 MHz Timing Signal
```

TEXT: "FCC Part 2.1051"

```
  Short Description:            Antenna Port Conducted
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005
```



1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

7.0 FREQUENCY STABILITY (TEMPERATURE) – PART 2.1055(a1) and (Voltage) – PART 2.1055d

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 AM Transmitter Module oscillator circuitry to stabilize.

NOTE:

This is well within the specified limits.

The frequency stability of AM Transmitter Module was measured by varying the primary supply voltage from 85% to 115% of nominal value for all equipment **other than hand carried battery equipment.**

NOTE:

This is well within the specified limits.

See the following pages for data taken during testing:

ELECTRONIC SYSTEMS, INC.
1250 Peterson Dr., Wheeling, IL 60090

DATA TAKEN FOR FREQUENCY

STABILITY WHEN VARYING THE TEMPERATURE

AND

THE PRIMARY SUPPLY VOLTAGE

PART 2.1055a and PART 2.1055d

This is well within the specified limits.

DLS ELECTRONIC SYSTEMS, INC.
NVLAP 100276-0

1250 Peterson Dr., Wheeling, IL 60090

Company: Highway Information Systems, Inc.
Model Tested: DRTXM4
Report Number: 11911

COMPANY:	Highway Information Systems, Inc.
EUT:	DRTXM4 with GPS-1
TEST DATE:	Janaury 16 & 17, 2006
TYPE OF TEST:	Frequency Temperature & Volatge Stability
FREQUENCY TESTED:	**530 kHz**
POWER SUPPLY:	**Single Supply**

Assigned Frequency: 530000 Hz
Frequency Tolerance: 0.00005 %
Limit: 26.5 Hz

MODES OF OPERATION: Fully Locked

		Frequency Temperature Stability in kHz
Temperature	-30°	530.00250501
In Celsius	-20°	530.00250501
	-10°	530.00250501
	0°	530.00250501
	+10°	530.00250501
	+20°	530.00250501
	+30°	530.00250501
	+40°	530.00250501
	+50°	530.00250501

Frequency Voltage Stability in kHz
10.2 VDC 530.00250501
13.8 VDC 530.00250501
Worst Case Voltage Variance: 0.00000000 Hz
This well within the specified Limits.

Worst Case Temperature Variance:
0.00000000 Hz This well within the specified Limits.

MODES OF OPERATION: without Satelite Reception

		Frequency Temperature Stability in kHz
Temperature	-30°	530.00250501
In Celsius	-20°	529.97845691
	-10°	530.00751503
	0°	529.98647295
	+10°	530.00250501
	+20°	529.99749499
	+30°	530.00250501
	+40°	529.99849699
	+50°	530.00250501

Frequency Voltage Stability in kHz
10.2 VDC 530.00250501
13.8 VDC 530.00250501
Worst Case Voltage Variance: 0.00000000 Hz
This well within the specified Limits.

Worst Case Temperature Variance:
0.02905812 Hz This well within the specified Limits.

MODES OF OPERATION: without GPS-1 Synchronizer Signal to Transmitter

		Frequency Temperature Stability in kHz
Temperature	-30°	530.00551102
In Celsius	-20°	530.00450902
	-10°	530.00250501
	0°	530.00250501
	+10°	530.00350701
	+20°	530.00350701
	+30°	530.00350701
	+40°	530.00350701
	+50°	530.00250501

Frequency Voltage Stability in kHz
10.2 VDC 530.00250501
13.8 VDC 530.00250501
Worst Case Voltage Variance: 0.00000000 Hz
This well within the specified Limits.

Worst Case Temperature Variance:
0.00300601 Hz This well within the specified Limits.

DLS ELECTRONIC SYSTEMS, INC.
NVLAP 100276-0

1250 Peterson Dr., Wheeling, IL 60090

Company: Highway Information Systems, Inc.
Model Tested: DRTXM4
Report Number: 11911

COMPANY:	Highway Information Systems, Inc.
EUT:	DRTXM4 with GPS-1
TEST DATE:	Janaury 16 & 17, 2006
TYPE OF TEST:	Frequency Temperature & Volatge Stability
FREQUENCY TESTED:	**530 kHz**
POWER SUPPLY:	**Single Supply**

Assigned Frequency: 530000 Hz
Frequency Tolerance: 0.00005 %
Limit: 26.5 Hz

MODES OF OPERATION: without 1pps Timing Signal

		Frequency Temperature Stability in kHz
Temperature	-30°	530.00250501
In Celsius	-20°	530.00250501
	-10°	530.00250501
	0°	530.00250501
	+10°	530.00250501
	+20°	530.00250501
	+30°	530.00250501
	+40°	530.00250501
	+50°	530.00250501

Frequency Voltage Stability in kHz
10.2 VDC 530.00250501
13.8 VDC 530.00250501
Worst Case Voltage Variance: 0.00000000 Hz
This well within the specified Limits.

Worst Case Temperature Variance:
0.00000000 Hz This well within the specified Limits.

MODES OF OPERATION: without 10 MHz Timing Signal

		Frequency Temperature Stability in kHz
Temperature	-30°	530.00751503
In Celsius	-20°	530.00751503
	-10°	530.00751503
	0°	530.00651303
	+10°	530.00551102
	+20°	530.00350701
	+30°	530.00250501
	+40°	530.00050100
	+50°	529.99949900

Frequency Voltage Stability in kHz
10.2 VDC 530.00250501
13.8 VDC 530.00350701
Worst Case Voltage Variance: -0.00100200 Hz
This well within the specified Limits.

Worst Case Temperature Variance:
0.00801603 Hz This well within the specified Limits.

ELECTRONIC SYSTEMS, INC.

1250 Peterson Dr., Wheeling, IL 60090

Company: Highway Information Systems, Inc.
Model Tested: DRTXM4
Report Number: 11911

COMPANY:	Highway Information Systems, Inc.
EUT:	DRTXM4 with GPS-1
TEST DATE:	Janaury 16 & 17, 2006
TYPE OF TEST:	Frequency Temperature & Volatge Stability
FREQUENCY TESTED:	**530 kHz**
POWER SUPPLY:	**Dual Supply**

Assigned Frequency: 530000 Hz
Frequency Tolerance: 0.00005 %
Limit: 26.5 Hz

MODES OF OPERATION: Fully Locked

		Frequency Temperature Stability in kHz
Temperature	-30°	530.00250501
In Celsius	-20°	530.00250501
	-10°	530.00350701
	0°	530.00250501
	+10°	530.00250501
	+20°	530.00250501
	+30°	530.00250501
	+40°	530.00250501
	+50°	530.00250501

Frequency Voltage Stability in kHz
10.2 VDC 530.00250501
13.8 VDC 530.00350701
Worst Case Voltage Variance: -0.00100200 Hz
This well within the specified Limits.

Worst Case Temperature Variance:
0.00100200 Hz This well within the specified Limits.

MODES OF OPERATION: without Satelite Reception

		Frequency Temperature Stability in kHz
Temperature	-30°	530.00250501
In Celsius	-20°	530.00050100
	-10°	530.00751503
	0°	530.00250501
	+10°	530.00250501
	+20°	530.00250501
	+30°	530.00250501
	+40°	530.00250501
	+50°	530.00250501

Frequency Voltage Stability in kHz
10.2 VDC 530.00250501
13.8 VDC 530.00250501
Worst Case Voltage Variance: 0.00000000 Hz
This well within the specified Limits.

Worst Case Temperature Variance:
0.00701403 Hz This well within the specified Limits.

MODES OF OPERATION: without GPS-1 Synchronizer Signal to Transmitter

		Frequency Temperature Stability in kHz
Temperature	-30°	530.00551102
In Celsius	-20°	530.00350701
	-10°	530.00350701
	0°	530.00350701
	+10°	530.00250501
	+20°	530.00350701
	+30°	530.00350701
	+40°	530.00250501
	+50°	530.00250501

Frequency Voltage Stability in kHz
10.2 VDC 530.00250501
13.8 VDC 530.00250501
Worst Case Voltage Variance: 0.00000000 Hz
This well within the specified Limits.

Worst Case Temperature Variance:
0.00300601 Hz This well within the specified Limits.

ELECTRONIC SYSTEMS, INC.

1250 Peterson Dr., Wheeling, IL 60090

Company: Highway Information Systems, Inc.
Model Tested: DRTXM4
Report Number: 11911

COMPANY:	Highway Information Systems, Inc.			
EUT:	DRTXM4 with GPS-1			
TEST DATE:	Janaury 16 & 17, 2006			
TYPE OF TEST:	Frequency Temperature & Volatge Stability			
FREQUENCY TESTED:	**530 kHz**			
POWER SUPPLY:	**Dual Supply**	Assigned Frequency:	530000	Hz
		Frequency Tolerance:	0.00005	%
		Limit:	**26.5**	**Hz**

MODES OF OPERATION: without 1pps Timing Signal

	Frequency Temperature Stability in kHz		Frequency Voltage Stability in kHz	
Temperature	-30°	530.00250501	10.2 VDC	530.00250501
In Celsius	-20°	530.00250501	13.8 VDC	530.00250501
	-10°	530.00250501	Worst Case Voltage Variance:	0.00000000 Hz
	0°	530.00250501	This well within the specified Limits.	
	+10°	530.00250501		
	+20°	530.00250501		
	+30°	530.00250501		
	+40°	530.00250501	Worst Case Temperature Variance:	
	+50°	530.00250501	0.00000000 Hz This well within the specified Limits.	

MODES OF OPERATION: without 10 MHz Timing Signal

	Frequency Temperature Stability in kHz		Frequency Voltage Stability in kHz	
Temperature	-30°	530.00651303	10.2 VDC	530.00250501
In Celsius	-20°	530.00751503	13.8 VDC	530.00250501
	-10°	530.00751503	Worst Case Voltage Variance:	0.00000000 Hz
	0°	530.00651303	This well within the specified Limits.	
	+10°	530.00551102		
	+20°	530.00350701		
	+30°	530.00250501		
	+40°	530.00050100	Worst Case Temperature Variance:	
	+50°	529.99949900	0.00801603 Hz This well within the specified Limits.	

ELECTRONIC SYSTEMS, INC.

1250 Peterson Dr., Wheeling, IL 60090

Company: Highway Information Systems, Inc.
Model Tested: DRTXM4
Report Number: 11911

COMPANY:	Highway Information Systems, Inc.
EUT:	DRTXM4 with GPS-1
TEST DATE:	Janaury 17, 2006
TYPE OF TEST:	Frequency Temperature & Volatge Stability
FREQUENCY TESTED:	**1610 kHz**
POWER SUPPLY:	**Single Supply**

Assigned Frequency: 1600000 Hz
Frequency Tolerance: 0.00005 %
Limit: 80 Hz

MODES OF OPERATION: Fully Locked

	Frequency Temperature Stability in kHz	
Temperature In Celsius	-30°	1.61000351
	-20°	1.61000251
	-10°	1.61000251
	0°	1.61000251
	+10°	1.61000251
	+20°	1.61000251
	+30°	1.61000351
	+40°	1.61000251
	+50°	1.61000351

Frequency Voltage Stability in kHz
10.2 VDC 1.61000251
13.8 VDC 1.61000251
Worst Case Voltage Variance: 0.00000000 Hz
This well within the specified Limits.

Worst Case Temperature Variance:
0.00000100 Hz This well within the specified Limits.

MODES OF OPERATION: without Satelite Reception

	Frequency Temperature Stability in kHz	
Temperature In Celsius	-30°	1.60996844
	-20°	1.60995842
	-10°	1.60996743
	0°	1.60997846
	+10°	1.61000351
	+20°	1.61000251
	+30°	1.61000251
	+40°	1.60999349
	+50°	1.61000351

Frequency Voltage Stability in kHz
10.2 VDC 1.61000251
13.8 VDC 1.61000251
Worst Case Voltage Variance: 0.00000000 Hz
This well within the specified Limits.

Worst Case Temperature Variance:
0.00004509 Hz This well within the specified Limits.

MODES OF OPERATION: without GPS-1 Synchronizer Signal to Transmitter

	Frequency Temperature Stability in kHz	
Temperature In Celsius	-30°	1.61000952
	-20°	1.61000351
	-10°	1.61000050
	0°	1.60999950
	+10°	1.60999850
	+20°	1.60999950
	+30°	1.60999850
	+40°	1.60999950
	+50°	1.60999950

Frequency Voltage Stability in kHz
10.2 VDC 1.60999850
13.8 VDC 1.60999850
Worst Case Voltage Variance: 0.00000000 Hz
This well within the specified Limits.

Worst Case Temperature Variance:
0.00001102 Hz This well within the specified Limits.

ELECTRONIC SYSTEMS, INC.

1250 Peterson Dr., Wheeling, IL 60090

Company: Highway Information Systems, Inc.
Model Tested: DRTXM4
Report Number: 11911

COMPANY:	Highway Information Systems, Inc.
EUT:	DRTXM4 with GPS-1
TEST DATE:	Janaury 17, 2006
TYPE OF TEST:	Frequency Temperature & Volatge Stability
FREQUENCY TESTED:	**1610 kHz**
POWER SUPPLY:	**Single Supply**

Assigned Frequency: 1600000 Hz
Frequency Tolerance: 0.00005 %
Limit: 80 Hz

MODES OF OPERATION: without 1pps Timing Signal

	Frequency Temperature Stability in kHz	
Temperature In Celsius	-30°	1.61000251
	-20°	1.61000251
	-10°	1.61000251
	0°	1.61000251
	+10°	1.61000251
	+20°	1.61000251
	+30°	1.61000251
	+40°	1.61000251
	+50°	1.61000251

Frequency Voltage Stability in kHz

10.2 VDC	1.61000251
13.8 VDC	1.61000251

Worst Case Voltage Variance: 0.00000000 Hz
This well within the specified Limits.

Worst Case Temperature Variance:
0.00000000 Hz This well within the specified Limits.

MODES OF OPERATION: without 10 MHz Timing Signal

	Frequency Temperature Stability in kHz	
Temperature In Celsius	-30°	1.61003156
	-20°	1.61003156
	-10°	1.61003056
	0°	1.61002555
	+10°	1.61002054
	+20°	1.61001453
	+30°	1.61000551
	+40°	1.60999850
	+50°	1.60999148

Frequency Voltage Stability in kHz

10.2 VDC	1.61001253
13.8 VDC	1.61001152

Worst Case Voltage Variance: 0.00000101 Hz
This well within the specified Limits.

Worst Case Temperature Variance:
0.00004008 Hz This well within the specified Limits.

DLS ELECTRONIC SYSTEMS, INC.
NVLAP 100276-0

1250 Peterson Dr., Wheeling, IL 60090

Company: Highway Information Systems, Inc.
Model Tested: DRTXM4
Report Number: 11911

COMPANY:	Highway Information Systems, Inc.
EUT:	DRTXM4 with GPS-1
TEST DATE:	Janaury 17, 2006
TYPE OF TEST:	Frequency Temperature & Volatge Stability
FREQUENCY TESTED:	**1610 kHz**
POWER SUPPLY:	**Dual Supply**

Assigned Frequency: 1600000 Hz
Frequency Tolerance: 0.00005 %
Limit: 80 Hz

MODES OF OPERATION: Fully Locked

		Frequency Temperature Stability in kHz
Temperature	-30°	1.61000251
In Celsius	-20°	1.61000351
	-10°	1.61000251
	0°	1.61000251
	+10°	1.61000251
	+20°	1.61000251
	+30°	1.61000251
	+40°	1.61000251
	+50°	1.61000251

Frequency Voltage Stability in kHz
10.2 VDC 1.61000251
13.8 VDC 1.61000251
Worst Case Voltage Variance: 0.00000000 Hz
This well within the specified Limits.

Worst Case Temperature Variance:
0.00000100 Hz This well within the specified Limits.

MODES OF OPERATION: without Satelite Reception

		Frequency Temperature Stability in kHz
Temperature	-30°	1.61000150
In Celsius	-20°	1.61000351
	-10°	1.61000351
	0°	1.61000251
	+10°	1.61000251
	+20°	1.61000351
	+30°	1.61000251
	+40°	1.61000251
	+50°	1.60999749

Frequency Voltage Stability in kHz
10.2 VDC 1.61000251
13.8 VDC 1.61000251
Worst Case Voltage Variance: 0.00000000 Hz
This well within the specified Limits.

Worst Case Temperature Variance:
0.00000602 Hz This well within the specified Limits.

MODES OF OPERATION: without GPS-1 Synchronizer Signal to Transmitter

		Frequency Temperature Stability in kHz
Temperature	-30°	1.61000952
In Celsius	-20°	1.61000451
	-10°	1.61000150
	0°	1.60999950
	+10°	1.60999850
	+20°	1.60999950
	+30°	1.60999850
	+40°	1.60999850
	+50°	1.60999950

Frequency Voltage Stability in kHz
10.2 VDC 1.60999850
13.8 VDC 1.60999850
Worst Case Voltage Variance: 0.00000000 Hz
This well within the specified Limits.

Worst Case Temperature Variance:
0.00001102 Hz This well within the specified Limits.

DLS ELECTRONIC SYSTEMS, INC.
NVLAP 100276-0

Company: Highway Information Systems, Inc.
Model Tested: DRTXM4
Report Number: 11911

1250 Peterson Dr., Wheeling, IL 60090

COMPANY:	Highway Information Systems, Inc.
EUT:	DRTXM4 with GPS-1
TEST DATE:	Janaury 17, 2006
TYPE OF TEST:	Frequency Temperature & Volatge Stability
FREQUENCY TESTED:	**1610 kHz**
POWER SUPPLY:	**Dual Supply**

Assigned Frequency: 1600000 Hz
Frequency Tolerance: 0.00005 %
Limit: 80 Hz

MODES OF OPERATION: without 1pps Timing Signal

	Frequency Temperature Stability in kHz	
Temperature In Celsius	-30°	1.61000251
	-20°	1.61000251
	-10°	1.61000251
	0°	1.61000251
	+10°	1.61000251
	+20°	1.61000251
	+30°	1.61000351
	+40°	1.61000251
	+50°	1.61000251

Frequency Voltage Stability in kHz

10.2 VDC	1.61000251
13.8 VDC	1.61000251

Worst Case Voltage Variance: 0.00000000 Hz
This well within the specified Limits.

Worst Case Temperature Variance:
0.00000100 Hz This well within the specified Limits.

MODES OF OPERATION: without 10 MHz Timing Signal

	Frequency Temperature Stability in kHz	
Temperature In Celsius	-30°	1.61003056
	-20°	1.61003257
	-10°	1.61003056
	0°	1.61002655
	+10°	1.61002054
	+20°	1.61001353
	+30°	1.61000651
	+40°	1.60999850
	+50°	1.60999148

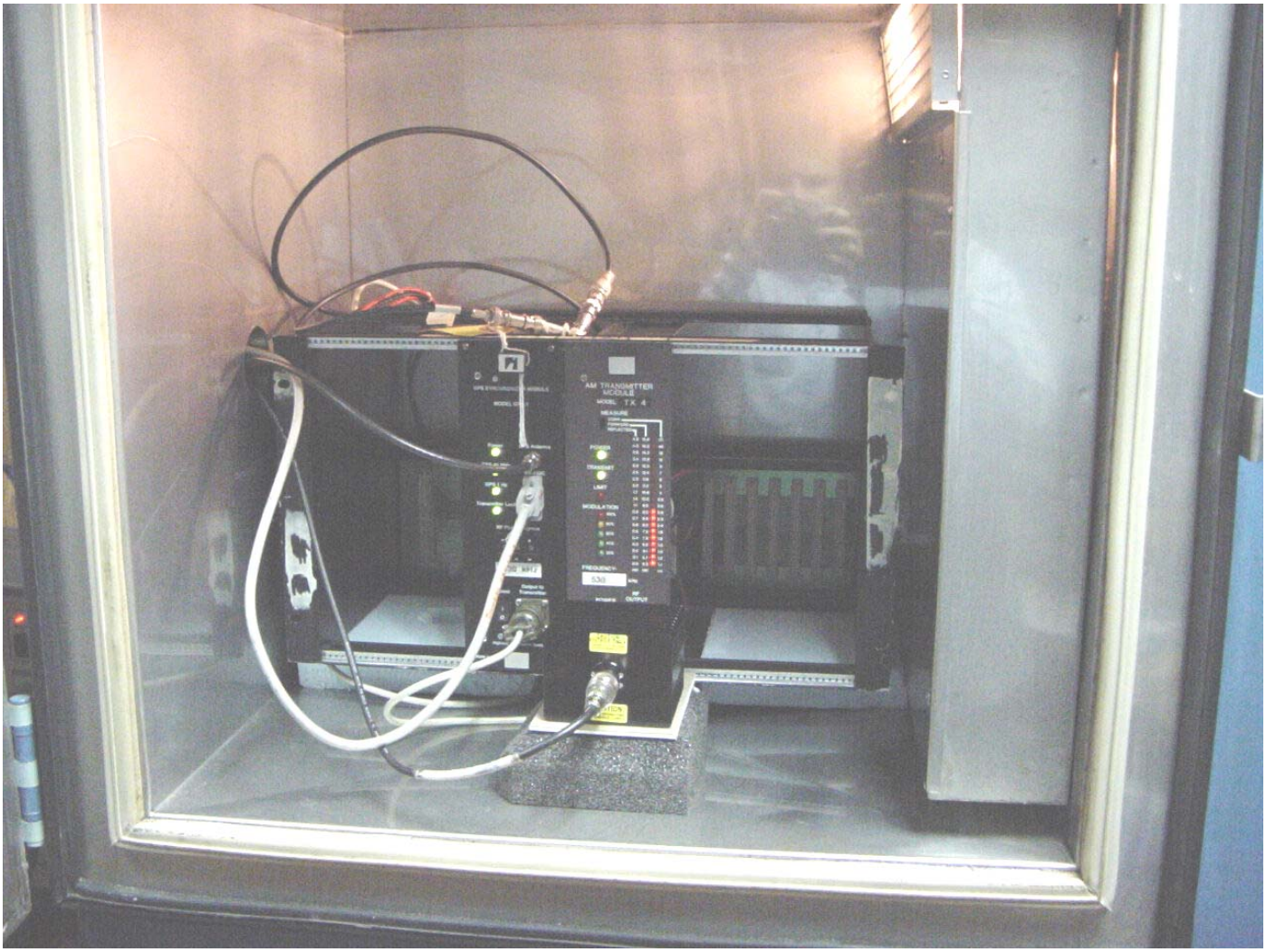
Frequency Voltage Stability in kHz

10.2 VDC	1.61000952
13.8 VDC	1.61000952

Worst Case Voltage Variance: 0.00000000 Hz
This well within the specified Limits.

Worst Case Temperature Variance:
0.00004109 Hz This well within the specified Limits.

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

8.0 FREQUENCY STABILITY (TEMPERATURE AND VOLTAGE) PHOTOS TAKEN DURING TESTING