DLS ELECTRONIC SYSTEMS, INC.
NVLAP 100276-0

1250 Peterson Dr., Wheeling, IL 60090

Company: Iowa Export-Import
Model Tested: WSS1
Report Number: 10035

FCC Rules and Regulations / Intentional Radiators

Periodic operational in the 40.66-40.70 MHz Band and above 70 MHz.

Part 15, Subpart C, Section 15.231

THE FOLLOWING **"MEETS"** THE ABOVE TEST SPECIFICATION

THE CONDUCTED EMISSIONS TESTS WAS NOT RUN SINCE THIS DEVICE IS BATTERY OPERATED

Formal Name:	WSS Magnetic Wireless Sensor
Kind of Equipment:	Wireless Sensor/transmitter
Test Configuration:	Tested at 3 vdc
Model Number(s):	WSS1
Model(s) Tested:	WSS1
Serial Number(s):	NA
Date of Tests:	February 3, 4 & 10, 2003
Test Conducted For:	Iowa Export-Import 512 Tuttle Street Des Moines, Illinois 50309

1250 Peterson Dr., Wheeling, IL 60090

SIGNATURE PAGE

Report By:

Arnom C. Rowe
Test Engineer
EMC-001375-NE

Reviewed By:

William Stumpf
OATS Manager

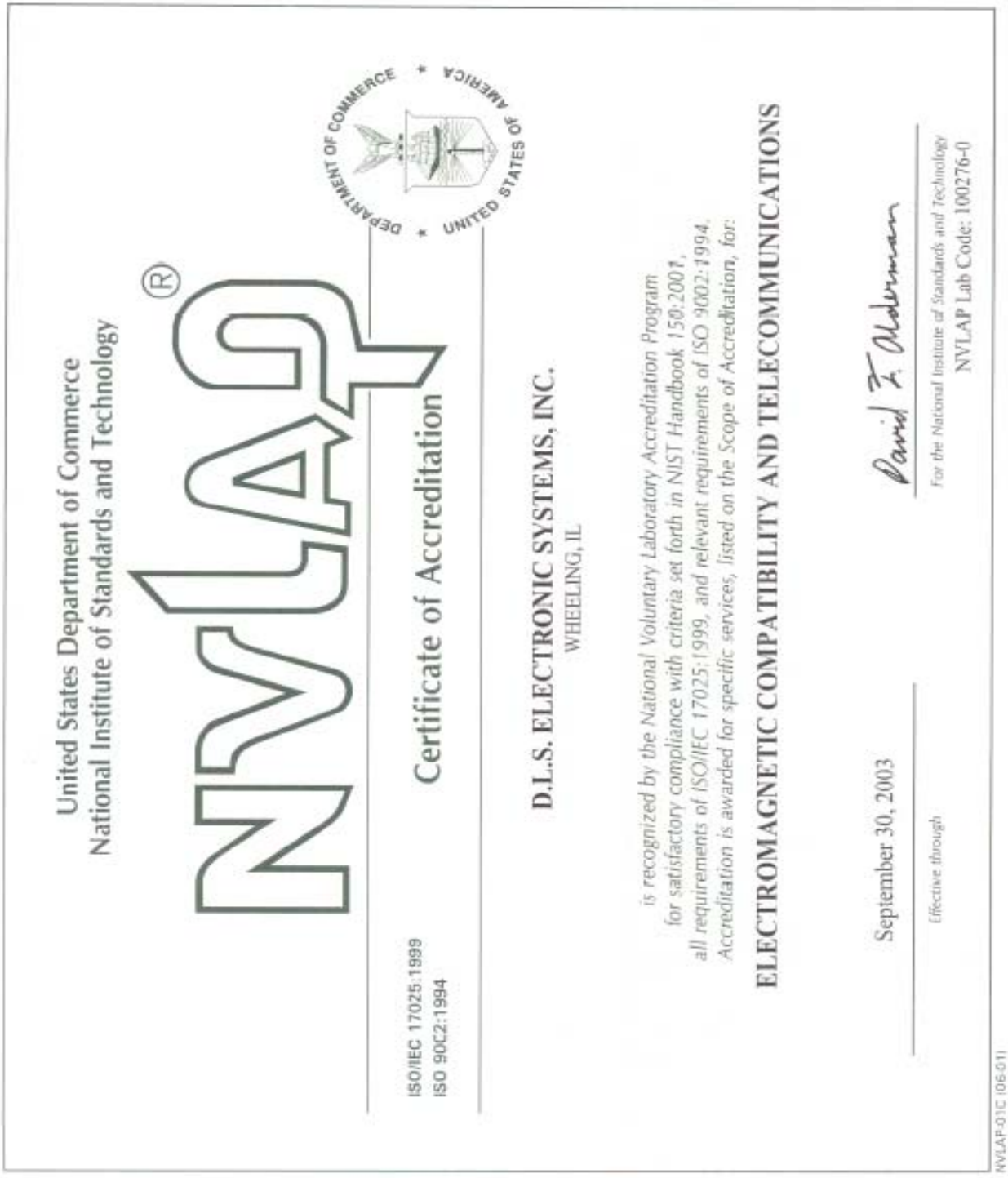
Approved By:

Brian Mattson
General Manager

Company Official:

Iowa Export-Import

1250 Peterson Dr., Wheeling, IL 60090



United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

Certificate of Accreditation

ISO/IEC 17025:1999
ISO 9002:1994

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

is recognized by the National Voluntary Laboratory Accreditation Program for satisfactory compliance with criteria set forth in NIST Handbook 150:2001, all requirements of ISO/IEC 17025:1999, and relevant requirements of ISO 9002:1994. Accreditation is awarded for specific services, listed on the Scope of Accreditation, for:

ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS

September 30, 2003
Effective through

For the National Institute of Standards and Technology
NVLAP Lab Code: 100276-0

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

D.L.S. ELECTRONIC SYSTEMS, INC.
1250 Peterson Drive
Wheeling, IL 60090-6454
Mr. Brian J. Mattson
Phone: 847-537-6400 Fax: 847-537-6488
E-Mail: bmattson@dlsemc.com
URL: http://www.dlsemc.com

NVLAP Code	*Designation / Description*
Emissions Test Methods:	
12/CIS14	CISPR 14-1 (March 30, 2000): Limits and methods of measurement of radio interference characteristics of household electrical appliances, portable tools and similar electrical apparatus - Part 1: Emissions
12/CIS14a	EN 55014-1 (1993) with Amendments A1 (1997) & A2 (1999)
12/CIS14b	AS/NZS 1044 (1995)
12/CIS14c	CNS 13783-1
12/CIS22	IEC/CISPR 22 (1997) and EN 55022 (1998): Limits and methods of measurement of radio disturbance characteristics of information technology equipment
12/CIS22a	IEC/CISPR 22:1993: Limits and methods of measurement of radio disturbance characteristics of information technology equipment, Amendment 1:1995, and Amendment 2:1996.

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NVLAP Code	*Designation / Description*
12/CIS22b	CNS 13438:1997: Limits and Methods of Measurement of Radio Interference Characteristics of Information Technology Equipment
12/F01	ANSI C63.4 (2001) - cited in FCC Method - 47 CFR Part 15 - Digital Devices
12/F01a	Conducted Emissions, Power Lines, 150 KHz to 30 MHz
12/F01b	Radiated Emissions
12/T51	AS/NZS 3548: Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment
Immunity Test Methods:	
12/I01	IEC 61000-4-2 (1995) and Amendment 1 (1998): Electrostatic Discharge Immunity Test
12/I02	IEC 61000-4-3 (1995) and Amendment 1 (1998): Radiated, Radio-Frequency Electromagnetic Field Immunity Test
12/I03	IEC 61000-4-4 (1995): Electrical Fast Transient/Burst Immunity Test
12/I04	IEC 61000-4-5 (1995): Surge Immunity Test
12/I05	IEC 61000-4-6 (1996): Immunity to Conducted Disturbances, Induced Radio-Frequency Fields

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ISO 9002:1994

Scope of Accreditation

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

D.L.S. ELECTRONIC SYSTEMS, INC.

NVLAP Code	*Designation / Description*
12/I06	IEC 61000-4-8 (1993): Power Frequency Magnetic Field Immunity Test
12/I07	IEC 61000-4-11 (1994): Voltage Dips, Short Interruptions and Voltage Variations Immunity Tests

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NVLAP-01S (06-01)

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1.0 SUMMARY OF TEST REPORT

It was found that the WSS Magnetic Wireless Sensor, Model Number(s) WSS1, **"meets"** the radio interference conducted and radiated emission requirements of the FCC "Rules and Regulations", Part 15, Subpart C, Section 15.231 for periodic operational in the 40.66-40.70 MHz Band and above 70 MHz. The conducted emissions test was not required because the WSS Magnetic Wireless Sensor is powered from a D.C. power source. It does not have a line cord to plug into the A.C. power line.

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

Text:	48
Charts:	8

2.0 INTRODUCTION

On February 3, 4 & 10, 2003, a series of radio frequency interference measurements was performed on WSS Magnetic Wireless Sensor, Model Number(s) WSS1, Serial Number: NA. The tests were performed according to the procedures of the FCC as stated in the "Methods of Measurement of Radio-Noise Emissions for Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" found in the American National Standards Institute, ANSI C63.4-2000. 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 emission requirements of the FCC "Rules and Regulations", Part 15, Subpart C, Sections 15.33, 15.35, 15.205, 15.209 & 15.231 for Intentional Radiators operating in the Band 40.66-40.70 and above 70 MHz.

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4.0 TEST SET-UP

All emission tests were performed at D.L.S. Electronic Systems, Inc. and set up according to the American National Standards Institute, ANSI C63.4-2000, Section 8, (Figures 11a and 11b).

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 C63.4-2000, Sections 6 and 8.

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5.0 TEST EQUIPMENT (Bandwidths and Detector Function)

All preliminary data was taken using Peak 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 Peak Detector.

Below 1000 MHz, final data was taken using the HP Spectrum Analyzer. These plots were made using the Peak Detector functions, with manual measurements performed on the questionable frequencies using the Peak Detector Function of the Analyzer as required. Above 1000 MHz, final data was taken using the Peak Detector on the Spectrum Analyzer.

The bandwidths shown below are specified by ANSI C63.4-2000, 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 CONDUCTED EMISSION MEASUREMENTS

The WSS Magnetic Wireless Sensor is powered from a D.C. power source and will not at any time be directly plugged into the public utility lines, therefore the conducted emissions test was not performed.

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7.0 RADIATED EMISSION MEASUREMENTS

Preliminary radiated emission measurements were performed at a 3 meter test distance with the limits adjusted linearly when required. The frequency range from 9 kHz to over 960 MHz, depending upon the fundamental frequency as stated in Part 15.33a, was automatically scanned and plotted at various angles.

Measurements for the WSS Magnetic Wireless Sensor were made up to 4500 MHz, in accordance with Section 15.33a for Intentional Radiators with a fundamental frequency of 434 MHz. For intentional radiators, the frequency range to be investigated is determined by the lowest radio frequency generated by the device without going below 9 kHz, up to at least the tenth harmonic of the highest fundamental frequency or 1000 MHz, whichever is lower.

At those frequencies where significant signals were detected, measurements were made at an open field test site, located at Genoa City, Wisconsin, FCC file number 31040/SIT, to determine the actual radiated levels.

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7.0 RADIATED EMISSION MEASUREMENTS (CON'T)

All signals in the frequency range of 30 MHz to 200 MHz were measured with a Biconical Antenna or Tuned Dipoles as the pickup device. From 200 MHz to 1000 MHz, a Log Periodic or Tuned Dipoles were used, and above 1000 MHz a Double Ridge Horn Antenna was used. During the test, below 1000 MHz the equipment was rotated and the antenna was raised and lowered from 1 meter to 4 meters to find the maximum level. In order to find maximum emissions, the cables were moved through all the positions the equipment would be expected to experience in the field. Tests were made in both the horizontal and vertical planes of polarization with the Loop (rotated 360º around its vertical axis), Biconical and Log Periodic. The table was rotated to find the maximum emissions. Above 1000 MHz the antenna was set one meter off the ground plane and three meters from the test item. The table was rotated to find the maximum emissions.

When the equipment is out of limit at 3 meters, and the signals from the equipment at 30 meters cannot be recorded due to the background, a representative sample of these frequencies was measured at various distances such as 4, 5, 6, 8, 15 meters and the greatest distance that can be measured to demonstrate graphically that the emissions are dropping off and will be under the limit at the specified distance.

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

8.1 Description:

The WSS Wireless Magnetic Sensor (SPAL PN: 35600022) comes as two parts, a sensor/transmitter and a magnet. The transmitter sends out an alarm signal when the magnet is separated from the sensor. This system is similar to what you may have in your car, alerting you that you have a door ajar. It can be installed in all types of vans, mobile homes, recreational vehicles, cars and trucks. The WSS is also ideal for utility trucks with multiple compartments and businesses having several entry/exit doors. The WSS can also be configured to protect windows and doors in garages, homes, and businesses.

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8.0 DESCRIPTION OF TEST SAMPLE: (CON'T)

8.2 PHYSICAL DIMENSIONS OF EQUIPMENT UNDER TEST

Length: 2.4" x Width: 1.25" x Height: .5"

8.3 LINE FILTER USED:

NA

8.4 INTERNAL CLOCK FREQUENCIES:

Switching Power Supply Frequencies:

NA

Clock Frequencies:

NA

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8.0 DESCRIPTION OF TEST SAMPLE: (CON'T)

8.5 DESCRIPTION OF ALL CIRCUIT BOARDS:

1. SPAL 0082-B

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

1: There were no changes made at D.L.S. Electronic Systems, Inc.

I certify that the above, as described in paragraph 8.0, describes the equipment tested and 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 WSS Magnetic Wireless Sensor
Model Number: WSS1 Serial Number: NA

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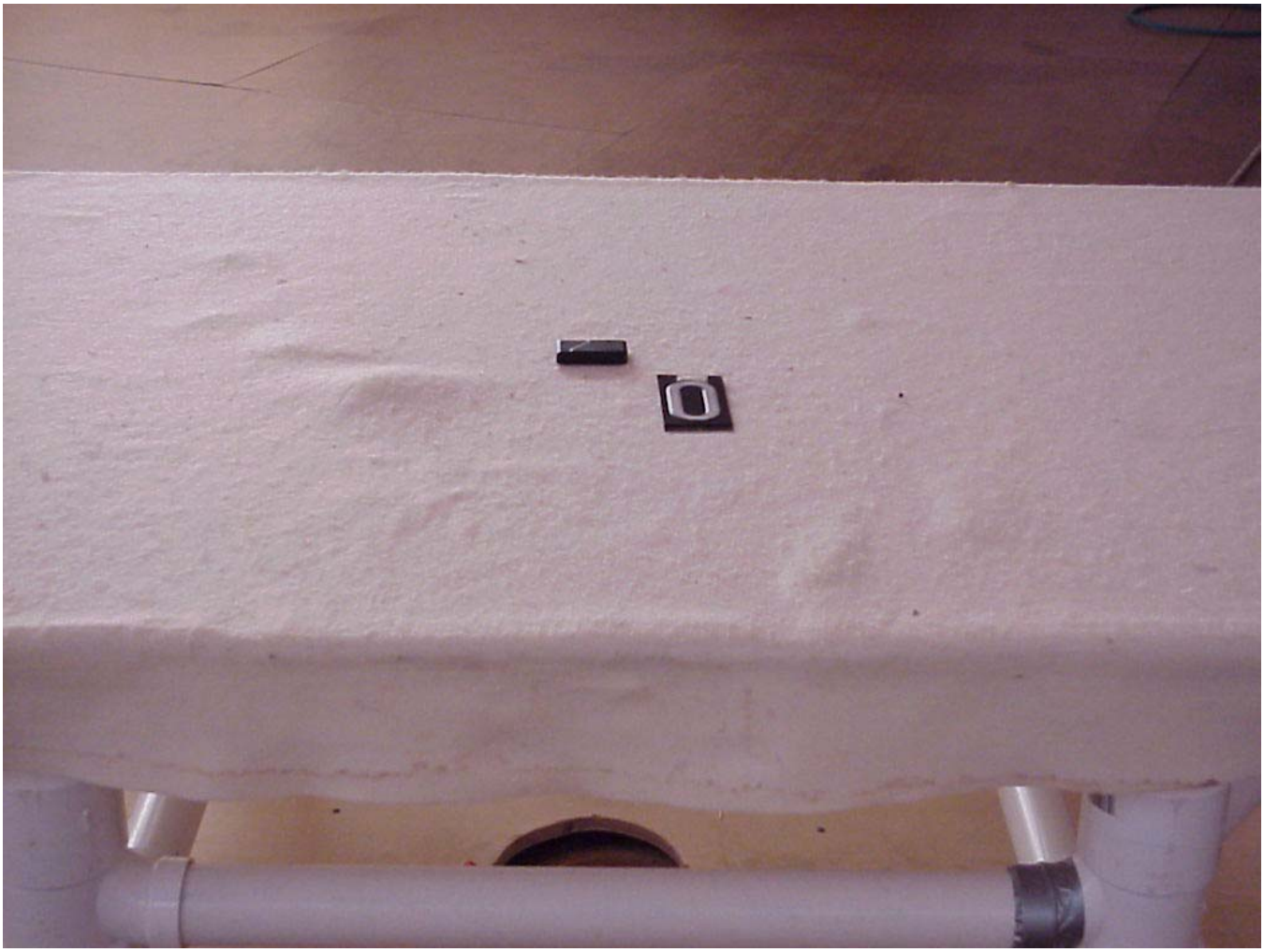
11.0 RADIATED PHOTOS TAKEN DURING TESTING



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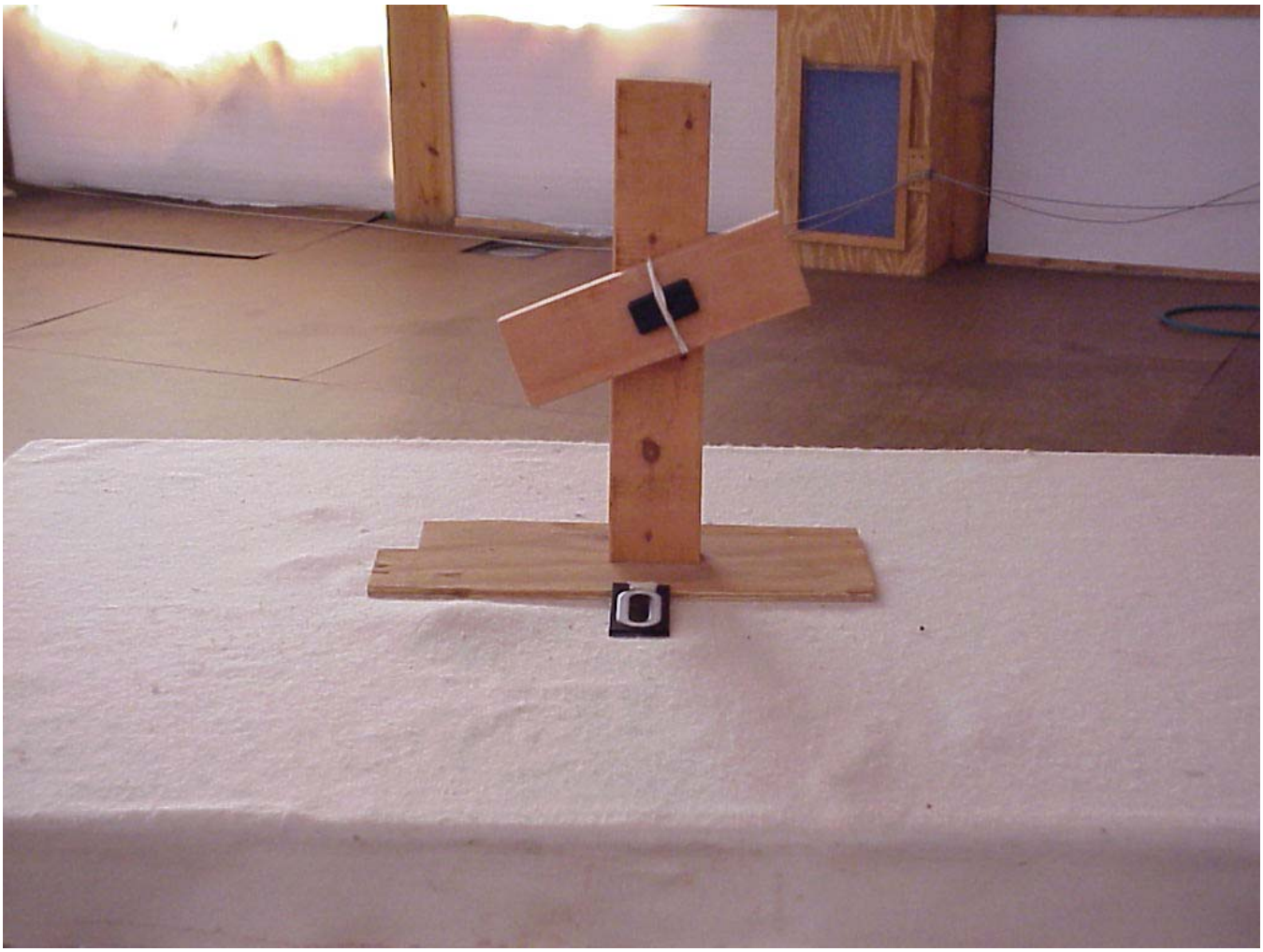
11.0 RADIATED PHOTOS TAKEN DURING TESTING (CON'T)



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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. Those points on the emission charts shown with a yellow mark are background frequencies which were verified during testing.

13.0 CONCLUSION

It was found that the WSS Magnetic Wireless Sensor, Model Number(s) WSS1 **"meets"** the radio interference conducted and radiated emission requirements of the FCC "Rules and Regulations", Part 15, Subpart C, Section 15.231 for periodic operational in the 40.66-40.70 MHz Band and above 70 MHz.The conducted emissions test was not required because the WSS Magnetic Wireless Sensor is powered from a D.C. power source. It does not have a line cord to plug into the A.C. power line.

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TABLE 1 – EQUIPMENT LIST

Test Equipment	Manufacturer	Model Number	Serial Number	Frequency Range	Cal Due Dates
Spectrum Analyzer	Hewlett/ Packard	8566B	2240A002041	100 Hz – 22 GHz	10/03
Quasi-Peak Adapter	Hewlett/ Packard	85650A	2043A00121	10 kHz – 1 GHz	10/03
Spectrum Analyzer	Hewlett/ Packard	8566B	2421A00452	100 Hz – 22 GHz	2/03
Quasi-Peak Adapter	Hewlett/ Packard	85650A	2043A00450	10 kHz – 1 GHz	2/03
Spectrum Analyzer	Hewlett/ Packard	8591A	3009A00700	9 kHz – 1.8 GHz	3/03
Receiver	Electrometrics	EMC-30	44168	10 kHz – 1 GHz	9/03
Receiver	Rohde & Schwarz	ESI 26	837491/010	20 Hz – 26 GHz	11/03
Receiver	Rohde & Schwarz	ESI 40	837808/006	20 Hz – 40 GHz	12/03
Receiver	Rohde & Schwarz	ESI 40	837808/005	20 Hz – 40 GHz	12/03
Antenna	EMCO	3104C	00054891	20 MHz – 200 MHz	2/03
Antenna	Electrometrics	LPA-25	1114	200 MHz – 1 GHz	3/03
Antenna	EMCO	3104C	00054892	20 MHz – 200 MHz	3/03

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
Antenna	Electrometrics	3146	1205	200 MHz – 1 GHz	3/03
Antenna	EMCO	3104C	97014785	20 MHz – 200 MHz	2/03
Antenna	EMCO	3146	97024895	200 MHz – 1 GHz	3/03
Antenna	EMCO	3115	2479	1 GHz – 18 GHz	8/03
Antenna	EMCO	3115	99035731	1 GHz – 18 GHz	4/03
Antenna	Rohde & Schwarz	HUF-Z1	829381001	20 MHz – 1 GHz	2/03
Antenna	Rohde & Schwarz	HUF-Z1	829381005	20 MHz – 1 GHz	8/03
LISN	Solar	8012-50-R-24-BNC	8305116	10 MHz – 30 MHz	8/03
LISN	Solar	8012-50-R-24-BNC	814548	10 MHz – 30 MHz	8/03
LISN	Solar	9252-50-R-24-BNC	961019	10 MHz – 30 MHz	12/03
LISN	Solar	9252-50-R-24-BNC	971612	10 MHz – 30 MHz	10/03
LISN	Solar	9252-50-R-24-BNC	92710620	10 MHz – 30 MHz	7/03

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

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APPENDIX A

TEST PROCEDURE

Part 15, Subpart C, Section 15.231a-d

ELECTRIC FIELD RADIATED EMISSIONS TEST

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APPENDIX A

TEST PROCEDURE

ELECTRIC FIELD RADIATED EMISSIONS TEST

1.0 BANDWIDTHS

The bandwidth of the transmitter shall be confined to the following specifications as specified in Section 15.231c & d:

40.66 MHz to 40.7 MHz	±.01% within the band edges
70 MHz to 900 MHz	.25% of the center frequency
Above 900 MHz	.50% of the center frequency

The bandwidth is determined at the points 20 dB down from the modulated carrier.

As shown by the graph(s) on the following page(s), the bandwidth for the WSS Magnetic Wireless Sensor was measured at 38.22097 kHz, which meets the above specification. With a fundamental frequency of 433.9665 MHz, the FCC Bandwidth limit is 1046 kHz when multiplying the fundamental by 0.25%.

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APPENDIX A

TEST PROCEDURE

ELECTRIC FIELD RADIATED EMISSIONS TEST

GRAPH(S) TAKEN OF THE FUNDAMENTAL FREQUENCY AND BANDWIDTH

PART 15.231c & d

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APPENDIX A

TEST PROCEDURE

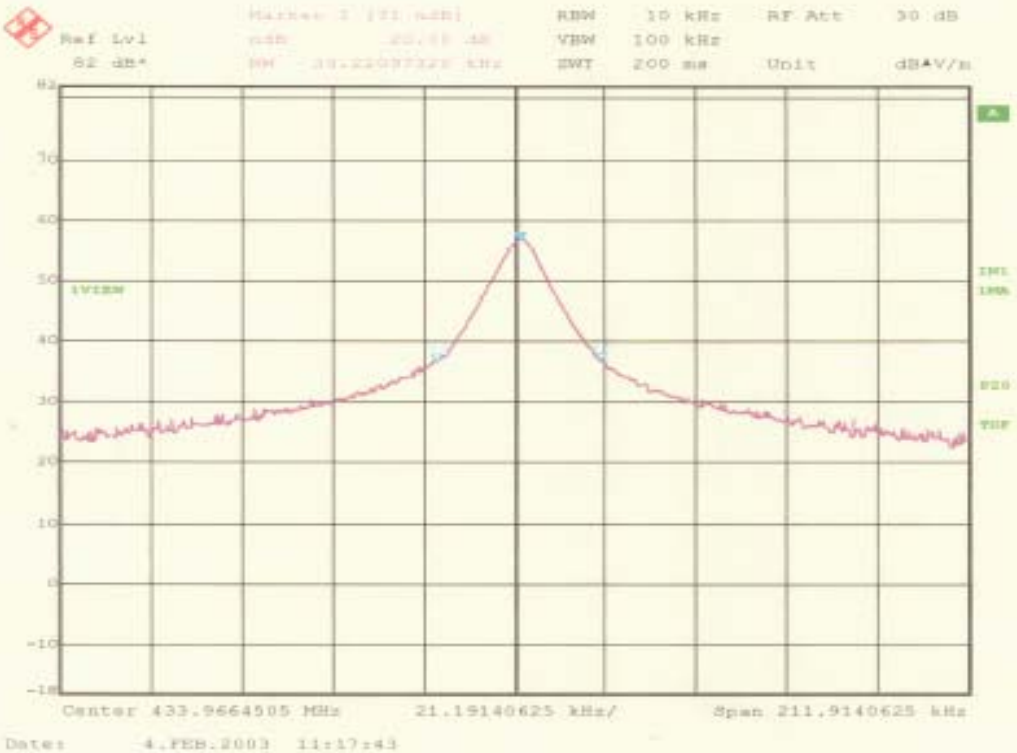
ELECTRIC FIELD RADIATED EMISSIONS TEST

DLS Electronic Systems, Inc.

FCC Part 15.231

Bandwidth Measurement

EUT:	WSS1 Magnetic Wireless Sensor
Manufacturer:	Iowa Export/Import
Date:	02-04-03
Limit.	1.085 MHz



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APPENDIX A

TEST PROCEDURE

ELECTRIC FIELD RADIATED EMISSIONS TEST

2.0 FIELD STRENGTH OF SPURIOUS EMISSION MEASUREMENTS (SECTION 15.231b)

For operation in the band 40.66 to 40.70 MHz and above 70 MHz the field strength of any emissions within this band shall not exceed the following table at a distance of 3 meters as specified in FCC, Part 15, Section 15.231(b), based on the average value of the measured emissions. The limits are shown in the following table.

Fundamental Frequency in MHz	Field Strength of Fundamental (uV/m at 3m)	Field Strength of Harmonics (uV/m at 3m)
40.66 to 40.70	2250 (67.04 dBuV)	225 (47.04 dBuV)
70 to 130	1250 (61.94 dBuV)	125 (41.94 dBuV)
130 to 174	1250 (61.94 dBuV) to 3750 (71.48 dBuV)	125 (41.94 dBuV) to 375 (51.48 dBuV)
174 to 260	3750 (71.48 dBuV)	375 (51.48 dBuV)
260 to 470	3750 (71.48 dBuV) to 12500 (81.84 dBuV)	375 (51.48 dBuV) to 1250 (61.94 dBuV)
470 and above	12500 (81.84 dBuV)	1250 (61.94 dBuV)

NOTE:

Preliminary radiation measurements may have been performed at a 3 meter or ten meter test distance. The frequency range from 30 MHz to 1000 MHz was scanned at receive antenna heights from one to four meters, and with a 360° rotation of the EUT. Plots were made and the worst-case emissions were recorded.

As stated in 15.35b the 20 dB peak-to-average limit is applicable to all devices measured using an average detector.

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APPENDIX A

TEST PROCEDURE

ELECTRIC FIELD RADIATED EMISSIONS TEST

‘‘RADIATED DATA AND CHARTS

TAKEN OF THE SPURIOUS EMISSIONS DURING TESTING’’

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APPENDIX A

TEST PROCEDURE

ELECTRIC FIELD RADIATED EMISSIONS TEST

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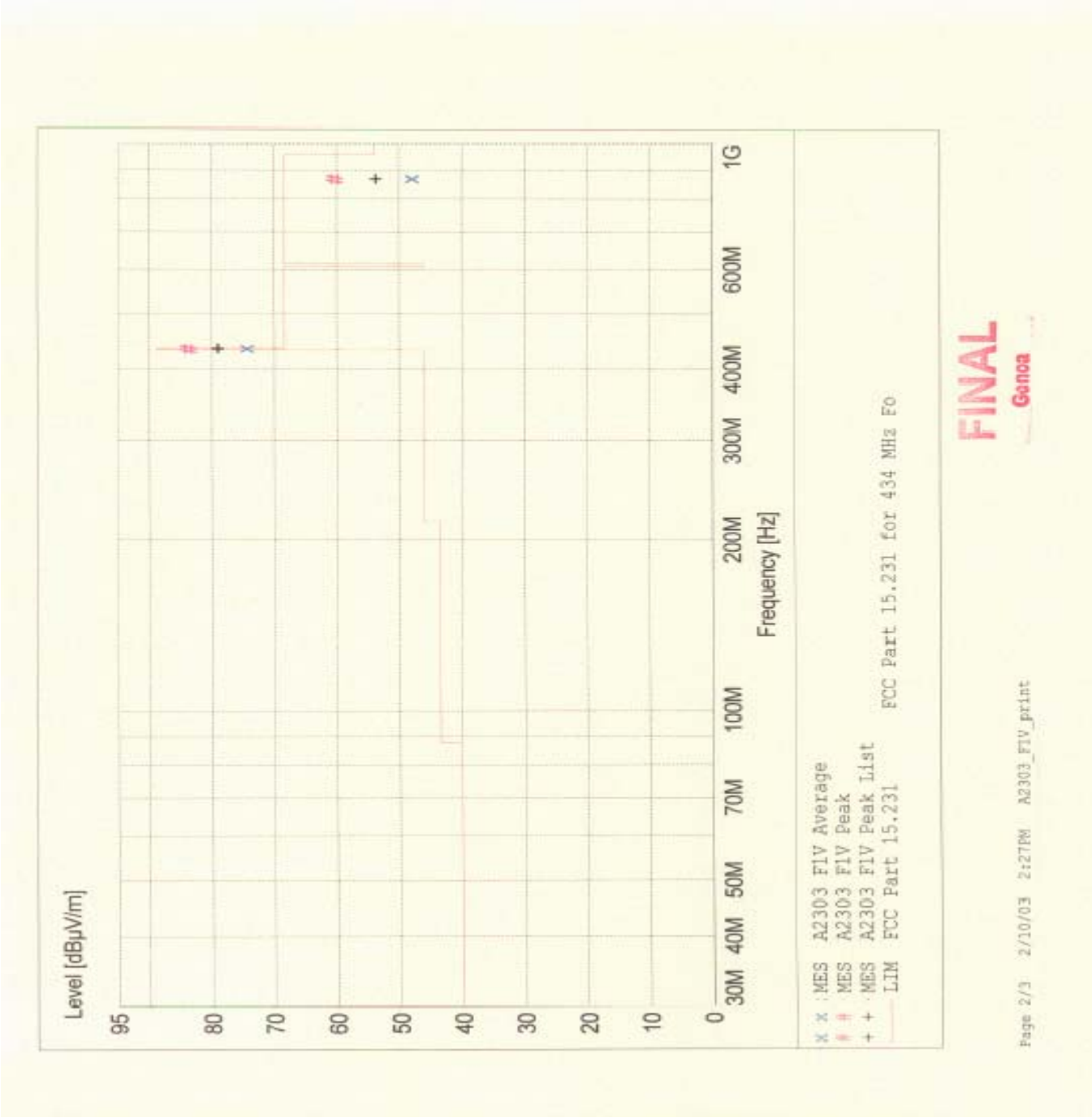
APPENDIX A

TEST PROCEDURE

ELECTRIC FIELD RADIATED EMISSIONS TEST



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APPENDIX A

TEST PROCEDURE

ELECTRIC FIELD RADIATED EMISSIONS TEST

MEASUREMENT RESULT: "A2303_F1V_Final"

2/3/03 4:10PM

Frequency	Level	Antenna Factor	System Loss	Total Level	Limit	Margin	Height Ant.	EuT Angle	Final Detector	Comment
MHz	dBuV	dBuV/m	dB	dBuV/m	dBuV/m	dB	m	deg		
433.960000	64.21	15.11	4.3	83.6	88.7	5.1	1.00	260	MAX PEAK	Fundamental
867.960000	31.92	22.07	6.2	60.2	68.3	8.1	1.00	125	MAX PEAK	Spurious
433.960000	55.14	15.11	4.3	74.5	88.7	14.2	1.00	260	AVERAGE	Fundamental
867.960000	19.78	22.07	6.2	48.1	68.3	20.2	1.00	125	AVERAGE	Spurious

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APPENDIX A

TEST PROCEDURE

ELECTRIC FIELD RADIATED EMISSIONS TEST

FCC Part 15.231

Fundamental and Spurious Emissions

EUT: WSS1 Magnetic Wireless Sensor
Manufacturer: Iowa Export Import
Operating Condition: 68degF; 25%R.H.
Test Site: Site 3
Operator: JL
Test Specification:
Comment: Fundamental Tx Freq 434 MHz
Date: 2/3/2003

TEXT: "Part 15.231 H3M"

Short Description: Test Set-up Vert30-1000MHz
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 26 SN: 837491/010

Antennas ---
Biconical -- EMCO 3104C SN: 9701-4785
Log Periodic -- EMCO 3146 SN: 9702-4895

TEST SET-UP: EuT Measured at 3 Meters with HORIZONTAL Antenna Polarization

LIMIT MODIFICATION: Limit Modified to account for 7.9 dB Duty Cycle Correction

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ELECTRONIC SYSTEMS, INC.
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APPENDIX A

TEST PROCEDURE

ELECTRIC FIELD RADIATED EMISSIONS TEST

FCC Part 15.231

Fundamental and Spurious Emissions

EUT: WSS1 Magnetic Wireless Sensor
Manufacturer: Iowa Export Import
Operating Condition: 68degF; 25%R.H.
Test Site: Site 3
Operator: JL
Test Specification: Fundamental Tx Freq 434 MHz
Comment: Date: 2/3/2003

TEXT: "Part 15.231 H3M"

Short Description: Test Set-up Vert30-1000MHz
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 26 SN: 837491/010

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TEST SET-UP: EuT Measured at 3 Meters with HORIZONTAL Antenna Polarization

LIMIT MODIFICATION: Limit Modified to account for 7.9 dB Duty Cycle Correction

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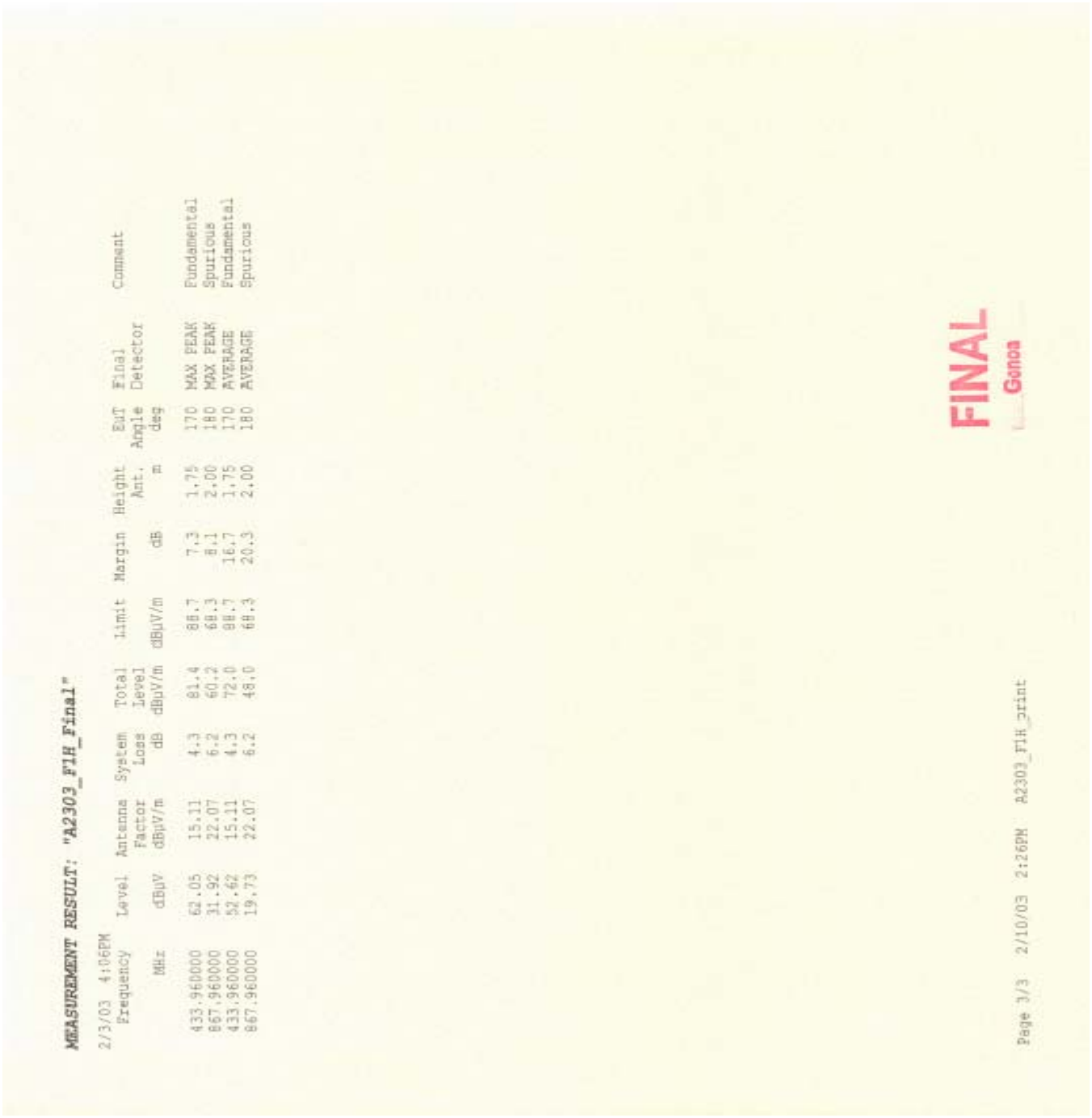
APPENDIX A

TEST PROCEDURE

ELECTRIC FIELD RADIATED EMISSIONS TEST



MEASUREMENT RESULT: "A2303_FIH_Final"

2/3/03 4:06PM

Frequency	Level	Antenna Factor	System Loss	Total Level	Limit	Margin	Height Ant.	EuT Angle	Final Detector	Comment
MHz	dBuV	dBuV/m	dB	dBuV/m	dBuV/m	dB	m	deg		
433.960000	62.05	15.11	4.3	81.4	88.7	7.3	1.75	170	MAX PEAK	Fundamental
867.960000	31.92	22.07	6.2	60.2	68.3	8.1	2.00	180	MAX PEAK	Spurious
433.960000	52.62	15.11	4.3	72.0	88.7	16.7	1.75	170	AVERAGE	Fundamental
867.960000	19.73	22.07	6.2	48.0	68.3	20.3	2.00	180	AVERAGE	Spurious

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TEST PROCEDURE

ELECTRIC FIELD RADIATED EMISSIONS TEST

FCC Part 15.231

Fundamental and Spurious Emissions

EUT: WSS1 Magnetic Wireless Sensor
Manufacturer: Iowa Export Import
Operating Condition: 66degF; 24%R.H.
Test Site: Site 3
Operator: Craig Brandt
Test Specification:
Comment: Fundamental Tx Freq 434 MHz
Date: 2/4/2003

TEXT: "Part 15.231 V3MhF"

Short Description: Test Set-up Vert1GHz-
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 26 SN: 837491/010
Horn Antenna --- EMCO 3115 SN: 9903-5731
Pre-Amps ---
1 - 18 GHz -- Miteq AMF-6D-010100-50 SN: 682425
18 - 26 GHz -- Miteq AMF-6P-100200-50-10P SN: 660382

TEST SET-UP: EuT Measured at 3 Meters with VERTICAL Antenna Polarization

LIMIT MODIFICATION: Limit Modified to account for 7.9 dB Duty Cycle Correction

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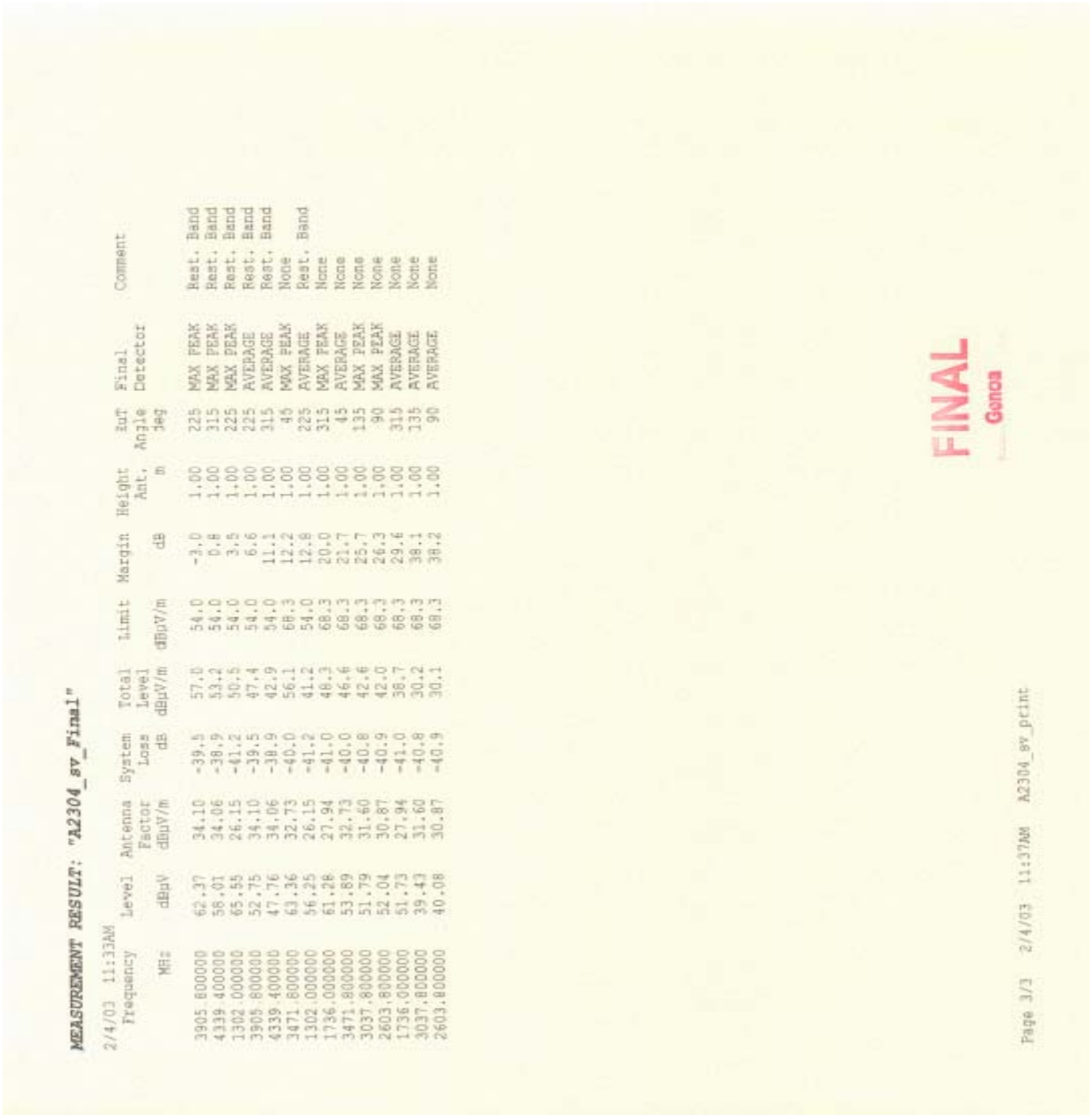
ELECTRIC FIELD RADIATED EMISSIONS TEST



MEASUREMENT RESULT: "A2304_sv_Final"

2/4/03 11:33AM

Frequency	Level	Antenna Factor	System Loss	Total Level	Limit	Margin	Height Ant.	Azt Angle	Final Detector	Comment
MHz	dBµV	dBµV/m	dB	dBµV/m	dBµV/m	dB	m	deg		
3905.800000	62.37	34.10	-39.5	57.0	54.0	-3.0	1.00	225	MAX PEAK	Rest. Band
4339.400000	58.01	34.06	-38.9	53.2	54.0	0.8	1.00	315	MAX PEAK	Rest. Band
1302.000000	65.55	26.15	-41.2	50.5	54.0	3.5	1.00	225	MAX PEAK	Rest. Band
3905.800000	52.75	34.10	-39.5	47.4	54.0	6.6	1.00	225	AVERAGE	Rest. Band
4339.400000	47.76	34.06	-38.9	42.9	54.0	11.1	1.00	315	AVERAGE	Rest. Band
3471.800000	63.36	32.73	-40.0	56.1	68.3	12.2	1.00	45	MAX PEAK	None
1302.000000	56.25	26.15	-41.2	41.2	54.0	12.8	1.00	225	AVERAGE	Rest. Band
1736.000000	61.28	27.94	-41.0	48.3	68.3	20.0	1.00	315	MAX PEAK	None
3471.800000	53.89	32.73	-40.0	46.6	68.3	21.7	1.00	45	AVERAGE	None
3037.800000	51.79	31.60	-40.8	42.6	68.3	25.7	1.00	135	MAX PEAK	None
2603.800000	52.04	30.87	-40.9	42.0	68.3	26.3	1.00	90	MAX PEAK	None
1736.000000	51.73	27.94	-41.0	38.7	68.3	29.6	1.00	315	AVERAGE	None
3037.800000	39.43	31.60	-40.8	30.2	68.3	38.1	1.00	135	AVERAGE	None
2603.800000	40.08	30.87	-40.9	30.1	68.3	38.2	1.00	90	AVERAGE	None

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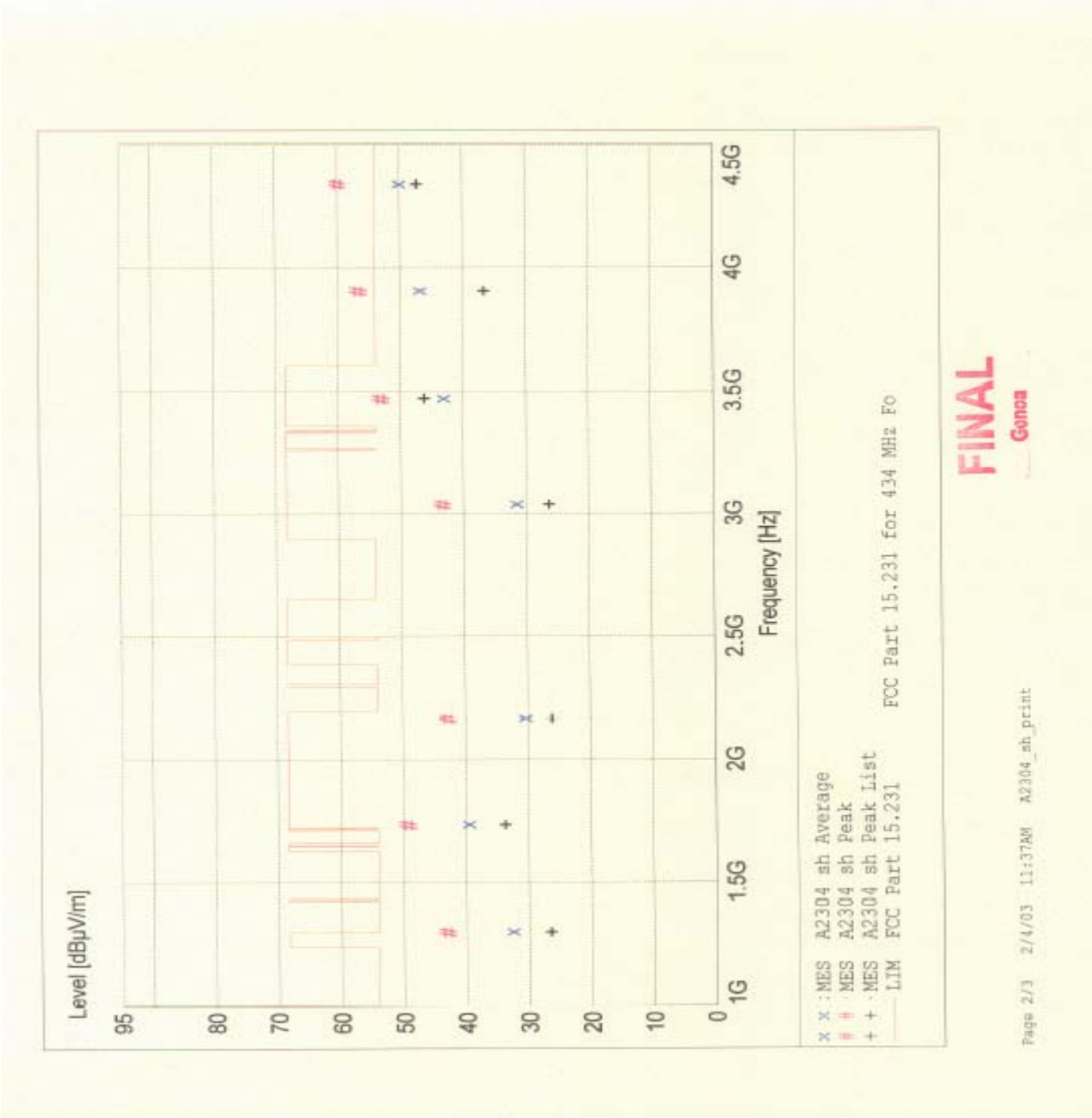
ELECTRIC FIELD RADIATED EMISSIONS TEST



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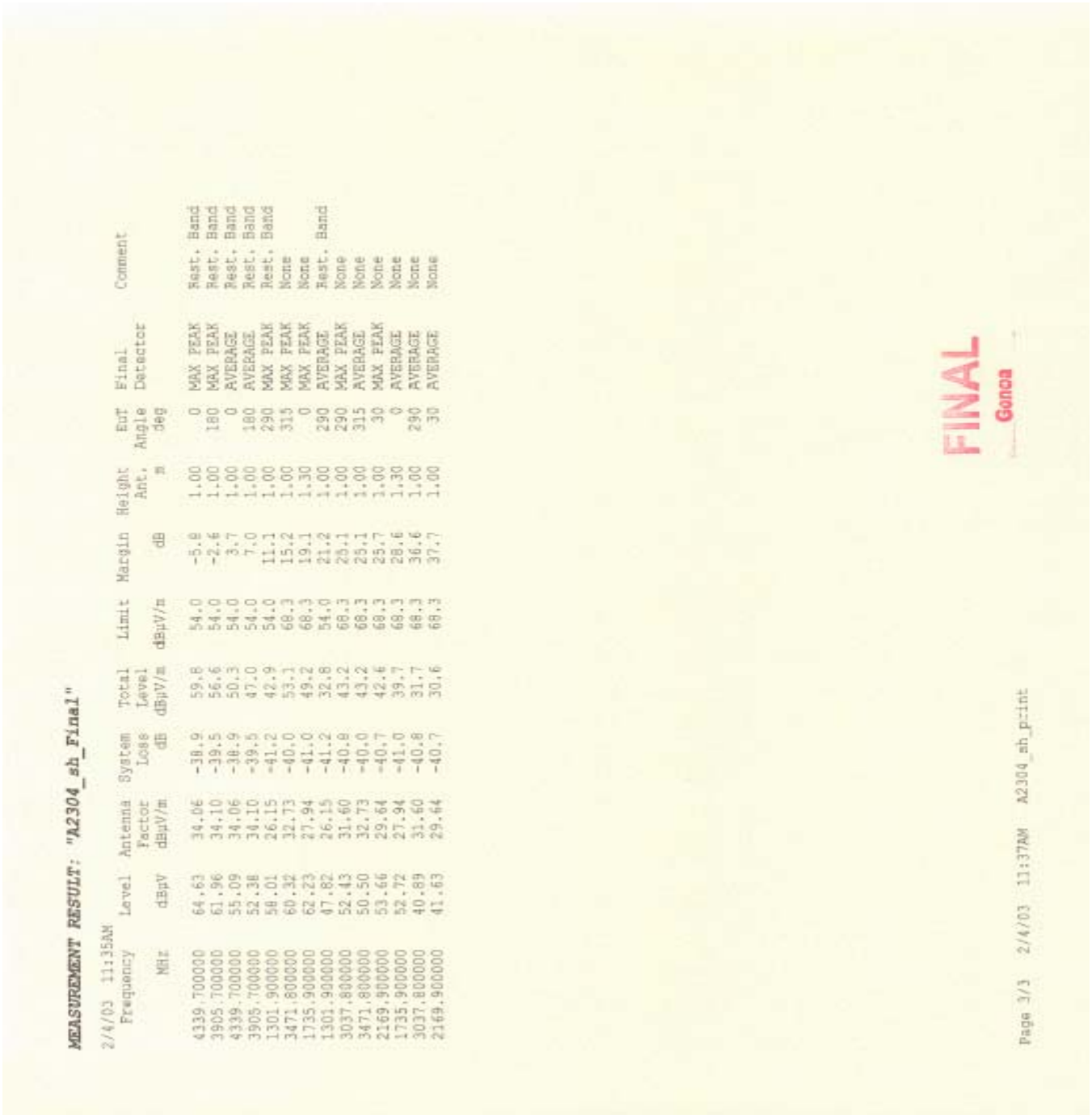
TEST PROCEDURE

ELECTRIC FIELD RADIATED EMISSIONS TEST



MEASUREMENT RESULT: "A2304_sh_Final"

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Frequency	Level	Antenna Factor	System Loss	Total Level	Limit	Margin	Height Ant.	EuT Angle	Final Detector	Comment
MHz	dBµV	dBµV/m	dB	dBµV/m	dBµV/m	dB	m	deg		
4339.700000	64.63	34.06	-38.9	59.8	54.0	-5.8	1.00	0	MAX PEAK	Rest. Band
3905.700000	61.96	34.10	-39.5	56.6	54.0	-2.6	1.00	180	MAX PEAK	Rest. Band
4339.700000	55.09	34.06	-38.9	50.3	54.0	3.7	1.00	0	AVERAGE	Rest. Band
3905.700000	52.38	34.10	-39.5	47.0	54.0	7.0	1.00	180	AVERAGE	Rest. Band
1301.900000	58.01	26.15	-41.2	42.9	54.0	11.1	1.00	290	MAX PEAK	Rest. Band
3471.800000	60.32	32.73	-40.0	53.1	68.3	15.2	1.00	315	MAX PEAK	None
1735.900000	62.23	27.94	-41.0	49.2	68.3	19.1	1.30	0	MAX PEAK	None
1301.900000	47.82	26.15	-41.2	32.8	54.0	21.2	1.00	290	AVERAGE	Rest. Band
3037.800000	52.43	31.60	-40.8	43.2	68.3	25.1	1.00	290	MAX PEAK	None
3471.800000	50.50	32.73	-40.0	43.2	68.3	25.1	1.00	315	AVERAGE	None
2169.900000	53.66	29.64	-40.7	42.6	68.3	25.7	1.00	30	MAX PEAK	None
1735.900000	52.72	27.94	-41.0	39.7	68.3	28.6	1.30	0	AVERAGE	None
3037.800000	40.89	31.60	-40.8	31.7	68.3	36.6	1.00	290	AVERAGE	None
2169.900000	41.63	29.64	-40.7	30.6	68.3	37.7	1.00	30	AVERAGE	None

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TEST PROCEDURE

ELECTRIC FIELD RADIATED EMISSIONS TEST

4.0 PULSED OPERATION (Duty Cycle Correction Factor)

The radiated emission tests made at D.L.S. Electronic Systems, Inc. for the WSS Magnetic Wireless Sensor, Model Number WSS1, are shown by the graphs on the following pages. The actual total "on-time" during the 100 msec is 0.039898 sec with a total "off-time" of 60.1 msec resulting in a **7.98 Duty Cycle Correction Factor**.

To find the actual "on-time" during the 100 msec period, the data word is multiplied by the number of data words per 100 msec, yielding actual on time. Taking this number and dividing it by the 100 msec period gives us the Duty Cycle. We than take the Log of the Duty Cycle and multiply it by 20. This gives us the Duty Cycle Correction Factor. The following method was used to determine the Duty Cycle Correction Factor:

Total “on-time” during 100 msec.

0.000311 sec/pulse on-time * 38 pulses = 0.011818 sec (data word on-time)

0.000702 sec/pulse on-time * 40 pulses = 0.02808 sec (data word on-time)

0.011818 sec (data on-time) + 0.02808 sec (data on-time) = 0.039898 sec total "on-time"

0.039898 sec (total "on-time") / 100 msec = 0.39898 Duty Cycle

20*LOG10 0.39898 = **7.98 dB Duty Cycle Correction Factor**

NOTE:

For pulsed operation, the switches were set to generate their maximum “on-time”, and measurements were made with the peak detector. As stated in Docket 86-422, the duty cycle of the pulse is determined from the total “on-time” for the worst case condition during 100 msec. Using the percentage of the total “on-time” over a 100 msec period, the total absolute average value was determined. As stated in Section 3, a maximum of 20 dB can be used.

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

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TEST PROCEDURE

ELECTRIC FIELD RADIATED EMISSIONS TEST

GRAPH(S) TAKEN OF THE PULSED OPERATION

PART 15.231

GRAPHS TAKEN OF THE PULSE TRAIN SHOWING THE FOLLOWING:

1. Number of Bits per Data Word
2. Number of Pulses per 100 msec
3. Off Time between Data Words
4. Data Word On-Time

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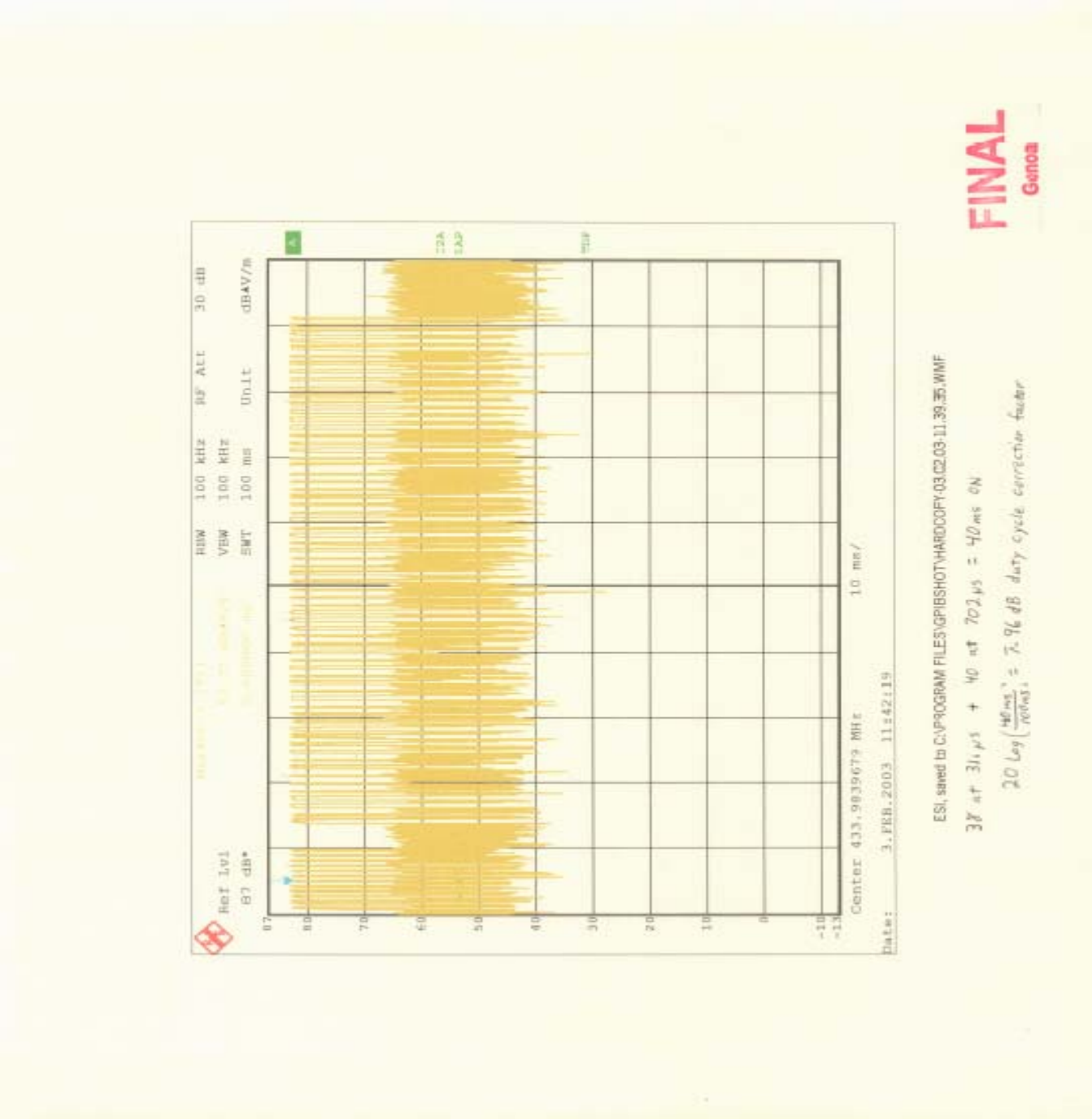

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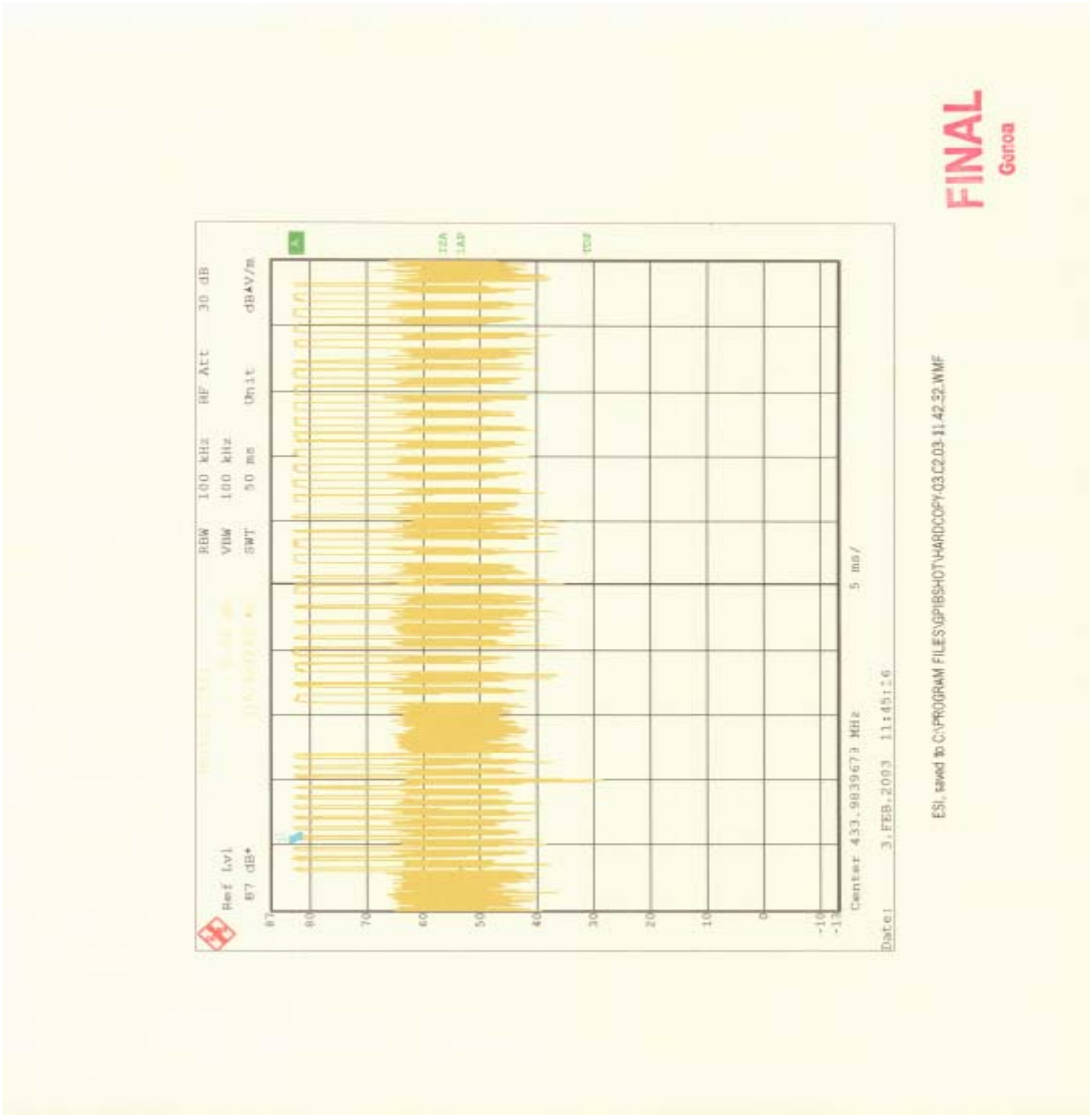

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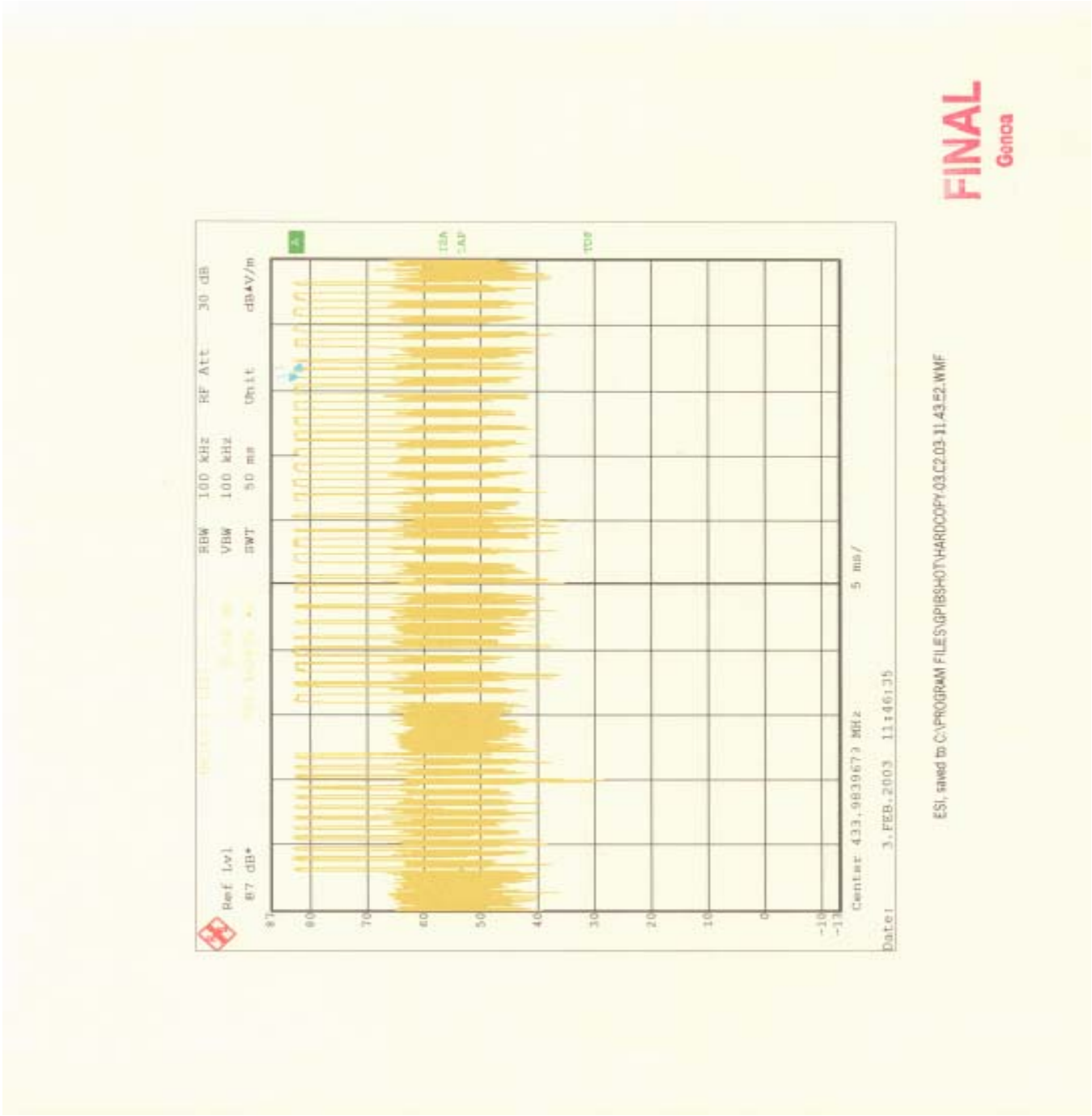

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TEST PROCEDURE

ELECTRIC FIELD RADIATED EMISSIONS TEST

4.0 RESTRICTED BANDS

As stated in Section 15.205a, the fundamental emission from the WSS Magnetic Wireless Sensor shall not fall within any of the bands listed below:

Frequency in MHz	Frequency in MHz	Frequency in MHz	Frequency in GHz
.0900 to .1100	162.0125 to 167.17	2310.0 to 2390	9.30 to 9.50
.4900 to .5100	167.7200 to 173.20	2483.5 to 2500	10.60 to 12.70
2.1735 to 2.1905	240.000 to 285.00	2655.0 to 2900	13.25 to 13.40
8.362 to 8.3660	322.200 to 335.40	3260.0 to 3267	14.47 to 14.50
13.36 to 13.410	399.900 to 410.00	3332.0 to 3339	15.35 to 16.20
25.50 to 25.670	608.000 to 614.00	3345.8 to 3358	17.70 to 21.40
37.50 to 38.250	960.000 to 1240.00	3600.0 to 4400	22.01 to 23.13
73.00 to 75.500	1300.000 to 1427.00	4500.0 to 5250	23.60 to 24.00
108.00 to 121.94	1435.000 to 1626.50	5350.0 to 5450	31.20 to 31.80
123.00 to 138.00	1660.000 to 1710.00	7250.0 to 7750	36.43 to 36.50
149.90 to 150.00	1718.800 to 1722.20	8025.0 to 8500	ABOVE 38.60
156.70 to 156.90	2200.000 to 2300.00	9000.0 to 9200	

NOTE:

The noise floor within the Restricted Bands for the EMC Receiver and HP Spectrum Analyzer will typically lay 20 dB below the limit.