



Company: Stryker Instruments
Model Tested: 5100-050-000
Report Number: 11418

1250 Peterson Dr., Wheeling, IL 60090

FCC Rules and Regulations / Intentional Radiators

Operational in the Band 13.553-13.567 MHz

Part 15, Subpart C, Section 15.225

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

Formal Name: TPS Irrigation Console w/ Stryker Electronics Control Board

Kind of Equipment: Medical Electrical Equipment

Test Configuration: The TPS Irrigation Console is connected to the footswitch (with a metal console and footswitch connector) and handpieces via cables plugged into its ports. Formula Shaver is run via the footswitch and an SE5 and a Saber are plugged in. (Tested at 120 vac, 60 Hz)

Model Number(s): 5100-001-000, 5100-050-000

Model(s) Tested: 5100-050-000

Serial Number(s): NA

Date of Tests: May 31, 2005

Test Conducted For: Stryker Instruments
4100 E. Milham Ave
Kalamazoo, Michigan 49001

NOTICE: "This report must not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government". Please see the "Additional Description of Equipment Under Test" page listed inside of this report. This report must not be reproduced (except in full), without the approval of D.L.S. Electronic Systems.



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Report Number: 11418

1250 Peterson Dr., Wheeling, IL 60090

SIGNATURE PAGE

Report By:

Arnorn C. Rowe
Test Engineer
EMC-001375-NE

Reviewed By:

William Stumpf
OATS Manager

Approved By:

Brian Mattson
General Manager

Company Official:

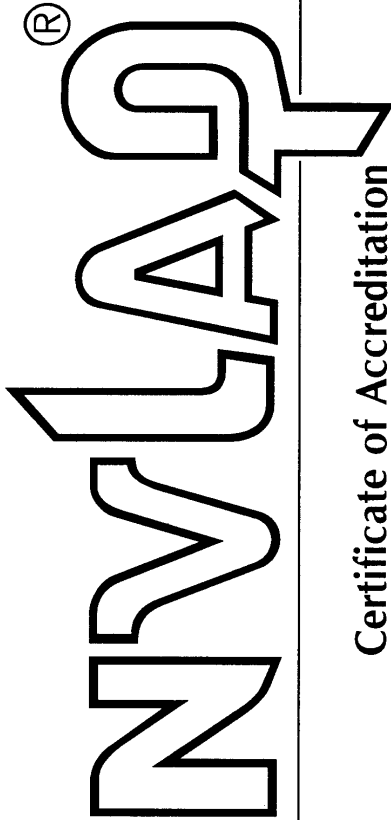
Stryker Instruments



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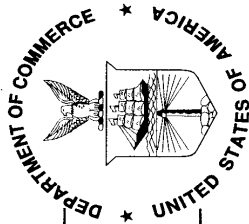
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United States Department of Commerce
National Institute of Standards and Technology



ISO/IEC 17025:1999
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Certificate of Accreditation



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, 2005

Effective through

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

NVLAP-01C (06-01)



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D.L.S. ELECTRONIC SYSTEMS, INC.

1250 Peterson Drive
Wheeling, IL 60090-6454
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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:

12/160D21	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

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<i>NVLAP Code</i>	<i>Designation / Description</i>
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
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

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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
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)

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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 (2001) with FCC Method 47 CFR Part 15, Subpart B: Unintentional Radiators
12/FCC15c	ANSI C63.4 (2001) with FCC Method 47 CFR Part 15, Subpart C: Intentional Radiators
12/FCC15d	ANSI C63.4(2001) with FCC Method 47 CFR Part 15, Subpart D: Unlicensed Personal Communications Service Devices

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<i>NVLAP Code</i>	<i>Designation / Description</i>
12/FCC15e	ANSI C63.4 (2001) with FCC Method 47 CFR Part 15, Subpart E: Unlicensed National Information Infrastructure Service Devices
12/T51	AS/NZS CISPR 22 (2002) and AS/NZS 3548 (1997): Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment
12/VCCIa	Agreement of Voluntary Control Council for Interference by Information Technology Equipment - Technical Requirements: V-3/02.04

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

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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 Discharge (ESD)
12/I01	IEC 61000-4-2, Ed. 2.1 (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
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

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- | | |
|------------|--|
| 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 |

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<i>NVLAP Code</i>	<i>Designation / Description</i>
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 2, Rev. 1 (November 6, 1999): 2GHz Personal Communications Services
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, Issue 1 (February 5, 2000): Licensed Radiocommunications Devices in the Band 2400 - 2483.5 MHz

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D.L.S. ELECTRONIC SYSTEMS, INC.

<i>NVLAP Code</i>	<i>Designation / Description</i>
12/RSS141	RSS-141, Issue 1 (July 2003): 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 1 (November 6, 1999): Fixed Wireless Access Systems in the Band 3400 - 3700 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 5 (November 2001): Low Power Licence-Exempt Radiocommunication Devices
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

Telecommunications Test Methods:

12/FCC2a2 TIA/EIA 603A (2001) with 47 CFR Part 2: Public Mobile Services in 47 CFR Part 22

12/FCC2b2 TIA/EIA 603A (2001) with 47 CFR Part 2: Private Land Mobile Radio Services in 47 CFR Part 90

12/FCC2d1 TIA/EIA 603A (2001) with 47 CFR Part 2: Experimental Radio, Auxiliary, Special Broadcast and Other Program Distributional Services in 47 CFR Part 74

12/FCC2e1 TIA/EIA 603A (2001) with 47 CFR Part 2: International Fixed Public Radiocommunication Services in 47 CFR Part 23

12/CIS15c EN 55015 (2000) + A1 (2001): Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment

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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
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

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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 TPS Irrigation Console w/ Stryker Electronics Control Board, Model Number(s) 5100-050-000, "meets" the radio interference conducted and radiated emission requirements of the FCC "Rules and Regulations", Part 15, Subpart C, Section 15.225 for operational in the 13.553-13.567 MHz Band.

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

Text: 60

2.0 INTRODUCTION

On May 31, 2005, a series of radio frequency interference measurements was performed on TPS Irrigation Console w/ Stryker Electronics Control Board, Model Number(s) 5100-050-000, 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 C63.4-2003. 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 15.209 & 15.225 for Intentional Radiators operating in the Band 13.553-13.567 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 C63.4-2003, Section 8, (Figures 11a and 11b).

All 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, 7 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 26/40 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 26/40 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 26/40 Fixed Tuned Receiver as required. Above 1000 MHz, final data was taken using the Average Detector on the Spectrum Analyzer.

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 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 emissions that have the highest amplitude relative to the limit. These methods are performed to the specifications in MP-5 or ANSI C63.4-2003, as appropriate.



Company: Stryker Instruments
Model Tested: 5100-050-000
Report Number: 11418

1250 Peterson Dr., Wheeling, IL 6009

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

7.1 Description:

The TPS Irrigation Console 5100-050-000 was the unit used during testing. The standard TPS 5100-001-000, 5100-050-000 are considered to fall under this testing as they are identical to each other plus or minus the irrigation pump. The TPS system is used for drilling, cutting and shaping bone for surgical procedures. The handpieces may be controlled via a handswitch or foot operated footswitch control. The handpiece motor speeds are user selectable via a touch screen on the TPS console display and they vary from 900 rpm to 75,000 rpm. The irrigation version also incorporates an irrigation pump which operates in one of two modes. On demand when the handpiece is activated or in Flush Mode which is a continuous run operation. The TPS (Plus) system also has the capability of recognizing which cutters are placed into the handpiece via RF.

7.2 PHYSICAL DIMENSIONS OF EQUIPMENT UNDER TEST

Length: 0.98 feet x Width: 0.75 feet x Height: 0.5 feet

7.3 LINE FILTER USED:

Corcom 6ED4C

7.4 INTERNAL CLOCK FREQUENCIES:

Switching Power Supply Frequencies:

100 kHz

Clock Frequencies:

6, 12, 24, 0.285, 13.56 MHz



Company: Stryker Instruments
Model Tested: 5100-050-000
Report Number: 11418

1250 Peterson Dr., Wheeling, IL 60090

7.0 DESCRIPTION OF TEST SAMPLE: (CON'T)

7.5 DESCRIPTION OF ALL CIRCUIT BOARDS:

- | | |
|---------------------------------------|---------------------------|
| 1. TPS + Control Board Assembly | PN: 5100-002-161 Rev F |
| 2. LCD Screen Interface Assembly | PN: 5100-002-162 Rev None |
| 3. TPS Irrigation Pump Board Assembly | PN: 5100-001-327 Rev C |
| 4. Universal 400 Watt Power Supply | PN: 5100-002-345 Rev E |



Company: Stryker Instruments
Model Tested: 5100-050-000
Report Number: 11418

1250 Peterson Dr., Wheeling, IL 60090

8.0 ADDITIONAL DESCRIPTION OF TEST SAMPLE:
(See also Paragraph 7.0)

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

I certify that the above, as described in paragraph 7.0, describes the equipment tested and will be manufactured as stated.

By: _____
Signature Title

For: _____
Company Date



Company: Stryker Instruments
Model Tested: 5100-050-000
Report Number: 11418

1250 Peterson Dr., Wheeling, IL 60090

9.0 PHOTO INFORMATION AND TEST SET-UP

Item 0 TPS Irrigation Console w/ Stryker Electronics Control Board
Model Number: 5100-050-000 Serial Number: NA

Item 1 Stryker SE5/TPS Tool

Item 2 Stryker Formula Tool

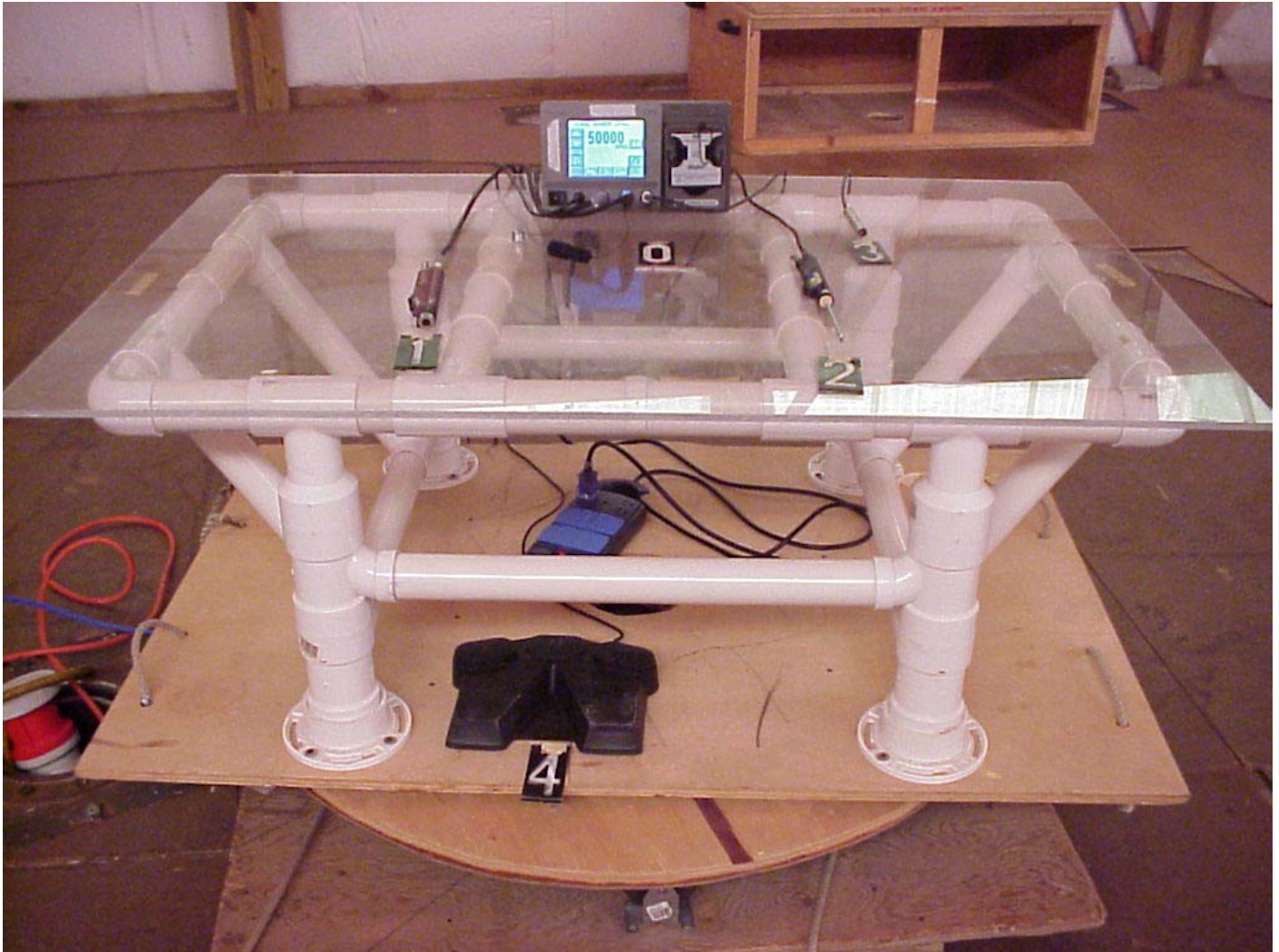
Item 3 Stryker Saber Drill Tool

Item 4 Stryker Foot Switch
SN: 0415900853

Item 5 Shielded AC Power Cord. 3.5m

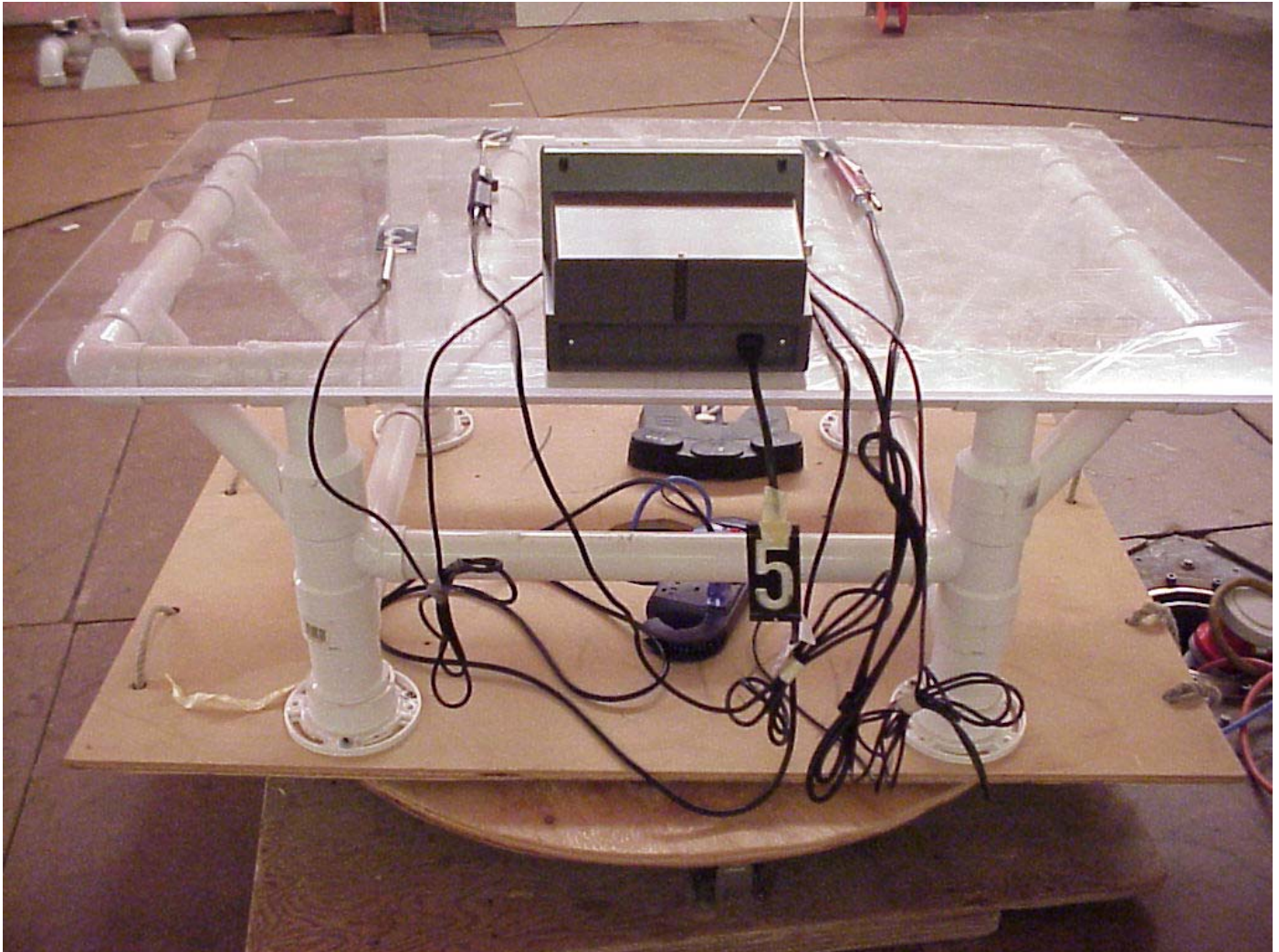
1250 Peterson Dr., Wheeling, IL 60090

10.0 RADIATED PHOTOS TAKEN DURING TESTING



1250 Peterson Dr., Wheeling, IL 60090

10.0 RADIATED PHOTOS TAKEN DURING TESTING: (CON'T)



1250 Peterson Dr., Wheeling, IL 60090

10.0 CONDUCTED PHOTOS TAKEN DURING TESTING





Company: Stryker Instruments
Model Tested: 5100-050-000
Report Number: 11418

1250 Peterson Dr., Wheeling, IL 60090

10.0 CONDUCTED PHOTOS TAKEN DURING TESTING: (CON'T)





Company: Stryker Instruments
Model Tested: 5100-050-000
Report Number: 11418

1250 Peterson Dr., Wheeling, IL 60090

11.0 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.

12.0 CONCLUSION

It was found that the TPS Irrigation Console w/ Stryker Electronics Control Board, Model Number(s) 5100-050-000 "**meets**" the radio interference conducted and radiated emission requirements of the FCC "Rules and Regulations", Part 15, Subpart C, Section 15.225 for operational in the 13.553-13.567 MHz Band.



Company: Stryker Instruments
 Model Tested: 5100-050-000
 Report Number: 11418

1250 Peterson Dr., Wheeling, IL 60090

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	10/05
Quasi-Peak Adapter	Hewlett/Packard	85650A	2043A00121	10 kHz – 1 GHz	10/05
Spectrum Analyzer	Hewlett/Packard	8566B	2421A00452	100 Hz – 22 GHz	2/06
Quasi-Peak Adapter	Hewlett/Packard	85650A	2043A00450	10 kHz – 1 GHz	2/06
Spectrum Analyzer	Hewlett/Packard	8591A	3009A00700	9 kHz – 1.8 GHz	3/06
Receiver	Electrometrics	EMC-30	44168	10 kHz – 1 GHz	9/05
Receiver	Rohde & Schwarz	ESI 26	837491/010	20 Hz – 26 GHz	11/05
Receiver	Rohde & Schwarz	ESI 40	837808/006	20 Hz – 40 GHz	12/05
Receiver	Rohde & Schwarz	ESI 40	837808/005	20 Hz – 40 GHz	12/05
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

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



Company: Stryker Instruments
 Model Tested: 5100-050-000
 Report Number: 11418

1250 Peterson Dr., Wheeling, IL 60090

TABLE 1 – EQUIPMENT LIST

Test Equipment	Manufacturer	Model Number	Serial Number	Frequency Range	Cal Due Dates
Antenna	Electrometrics	3146	1205	200 MHz – 1 GHz	3/06
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	8/05
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	8/05
LISN	Solar	8012-50-R-24-BNC	8305116	10 MHz – 30 MHz	8/05
LISN	Solar	8012-50-R-24-BNC	814548	10 MHz – 30 MHz	8/05
LISN	Solar	9252-50-R-24-BNC	961019	10 MHz – 30 MHz	12/05
LISN	Solar	9252-50-R-24-BNC	971612	10 MHz – 30 MHz	10/05
LISN	Solar	9252-50-R-24-BNC	92710620	10 MHz – 30 MHz	7/05

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



Company: Stryker Instruments
Model Tested: 5100-050-000
Report Number: 11418

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APPENDIX A

TEST PROCEDURE

Part 15, Subpart C, Section 15.225a-c

OPERATION WITHIN THE BAND 13.553-13.567 MHz



Company: Stryker Instruments
Model Tested: 5100-050-000
Report Number: 11418

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

1.0 CONDUCTED EMISSION MEASUREMENTS

The conducted emissions were measured over the frequency range from 150 kHz to 30 MHz in accordance with the power line measurements, as specified in ANSI C63.4-2003. Since the device is operated from the public utility lines, the 120 Vac, 60 Hz power leads, high and low sides were measured by connecting the measuring equipment to the appropriate meter terminal of the LISN. All signals were then recorded. The allowed levels for Intentional Radiators cannot exceed 250 uV (47.96 dBuV) at any frequency between 150 kHz and 30 MHz, as stated in Section 15.207a.



Company: Stryker Instruments
Model Tested: 5100-050-000
Report Number: 11418

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

CONDUCTED DATA AND GRAPHS

TAKEN DURING TESTING

PART 15.207

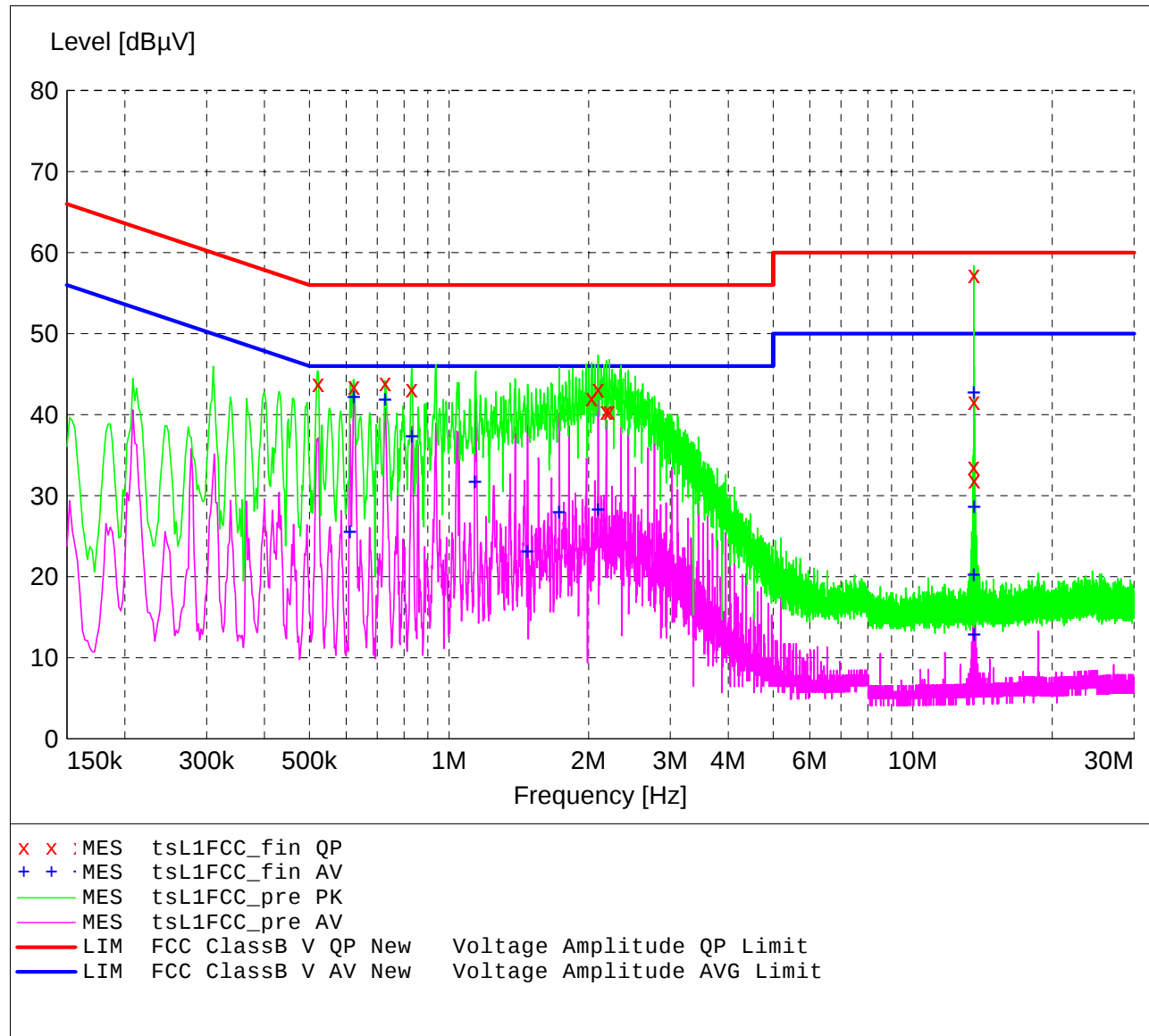
FCC Part 15 Class B

Voltage Mains Test

EUT: TPS Plus new control board
Manufacturer: Stryker
Operating Condition: 70 deg. F, 44% R.H.
Test Site: DLS O.F. Screen Room
Operator: Craig Brandt
Test Specification: 120 VAC; 60 Hz
Comment: Line 1
Date: 05-31-2005

SCAN TABLE: "FCC ClassB Voltage"

Short Description:			FCC Class B Voltage			
Start	Stop	Step	Detector	Meas.	IF	Transducer
Frequency	Frequency	Width		Time	Bandw.	
150.0 kHz	30.0 MHz	2.0 kHz	MaxPeak	10.0 ms	9 kHz	LISN DLS#128
			Average			



MEASUREMENT RESULT: "tsL1FCC_fin QP"

5/31/2005 12:09PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.522000	43.90	10.3	56	12.1	---	---
0.624000	43.50	10.3	56	12.5	---	---
0.728000	44.00	10.3	56	12.0	---	---
0.830000	43.20	10.3	56	12.8	---	---
2.032000	42.10	10.4	56	13.9	---	---
2.096000	43.20	10.4	56	12.8	---	---
2.184000	40.40	10.3	56	15.6	---	---
2.216000	40.50	10.3	56	15.5	---	---
13.548000	33.60	10.7	60	26.4	---	---
13.560000	57.30	10.7	60	2.7	---	Tx fundamental
13.568000	41.70	10.7	60	18.3	---	---
13.576000	32.00	10.7	60	28.0	---	---

MEASUREMENT RESULT: "tsL1FCC_fin AV"

5/31/2005 12:09PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.612000	25.60	10.3	46	20.4	---	---
0.624000	42.20	10.3	46	3.8	---	---
0.728000	41.90	10.3	46	4.1	---	---
0.832000	37.40	10.3	46	8.6	---	---
1.138000	31.70	10.3	46	14.3	---	---
1.476000	23.10	10.3	46	22.9	---	---
1.728000	28.00	10.3	46	18.0	---	---
2.096000	28.30	10.4	46	17.7	---	---
13.548000	20.30	10.7	50	29.7	---	---
13.558000	42.80	10.7	50	7.2	---	Tx fundamental
13.568000	28.60	10.7	50	21.4	---	---
13.578000	12.90	10.7	50	37.1	---	---

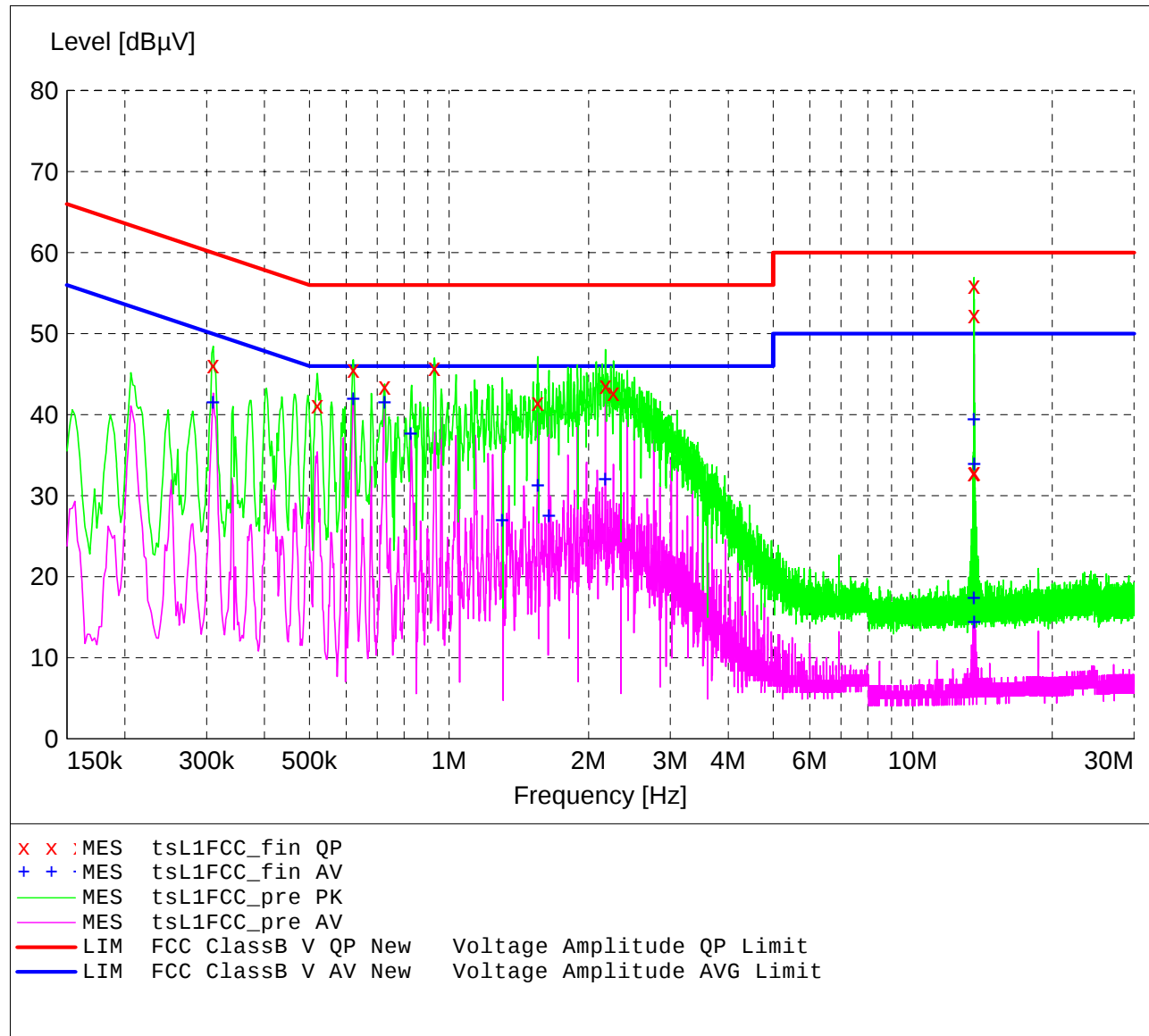
FCC Part 15 Class B

Voltage Mains Test

EUT: TPS Plus new control board
Manufacturer: Stryker
Operating Condition: 70 deg. F, 44% R.H.
Test Site: DLS O.F. Screen Room
Operator: Craig Brandt
Test Specification: 120 VAC; 60 Hz
Comment: Line 2
Date: 05-31-2005

SCAN TABLE: "FCC ClassB Voltage"

Short Description:			FCC Class B Voltage			
Start	Stop	Step	Detector	Meas. Time	IF Bandw.	Transducer
Frequency	Frequency	Width				
150.0 kHz	30.0 MHz	2.0 kHz	MaxPeak Average	10.0 ms	9 kHz	LISN DLS#128



MEASUREMENT RESULT: "tsL1FCC_fin QP"

5/31/2005 12:16PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.310000	46.20	10.5	60	13.7	---	---
0.520000	41.20	10.3	56	14.8	---	---
0.622000	45.60	10.3	56	10.4	---	---
0.726000	43.50	10.3	56	12.5	---	---
0.930000	45.80	10.3	56	10.2	---	---
1.554000	41.50	10.3	56	14.5	---	---
2.174000	43.60	10.3	56	12.4	---	---
2.262000	42.80	10.3	56	13.2	---	---
13.546000	32.80	10.7	60	27.2	---	---
13.558000	56.00	10.7	60	4.0	---	Tx fundamental
13.564000	52.40	10.7	60	7.6	---	---
13.574000	33.00	10.7	60	27.0	---	---

MEASUREMENT RESULT: "tsL1FCC_fin AV"

5/31/2005 12:16PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.310000	41.50	10.5	50	8.5	---	---
0.622000	42.00	10.3	46	4.0	---	---
0.726000	41.50	10.3	46	4.5	---	---
0.828000	37.70	10.3	46	8.3	---	---
1.302000	27.00	10.3	46	19.0	---	---
1.554000	31.30	10.3	46	14.7	---	---
1.642000	27.50	10.3	46	18.5	---	---
2.172000	32.10	10.3	46	13.9	---	---
13.546000	17.40	10.7	50	32.6	---	---
13.556000	39.40	10.7	50	10.6	---	Tx fundamental
13.566000	33.90	10.7	50	16.1	---	---
13.576000	14.40	10.7	50	35.6	---	---



Company: Stryker Instruments
Model Tested: 5100-050-000
Report Number: 11418

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

2.0 BAND EDGE AND RESTRICT BAND COMPLIANCE

The field strength of any emissions appearing outside the 13.553 to 13.567 MHz band shall not exceed the general radiated emissions limits as stated Section 15.209. The fundamental from the TPS Irrigation Console w/ Stryker Electronics Control Board transmitter shall not be inside the restrict band 13.36 to 13.41 MHz.

NOTE: See the following page (s) for the graph (s) made showing compliance for Band Edge and Restrict Band:



Company: Stryker Instruments
Model Tested: 5100-050-000
Report Number: 11418

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

GRAPH (s) TAKEN SHOWING THE BAND EDGE AND
RESTRICT BAND COMPLIANCE

PART 15.225 (b)

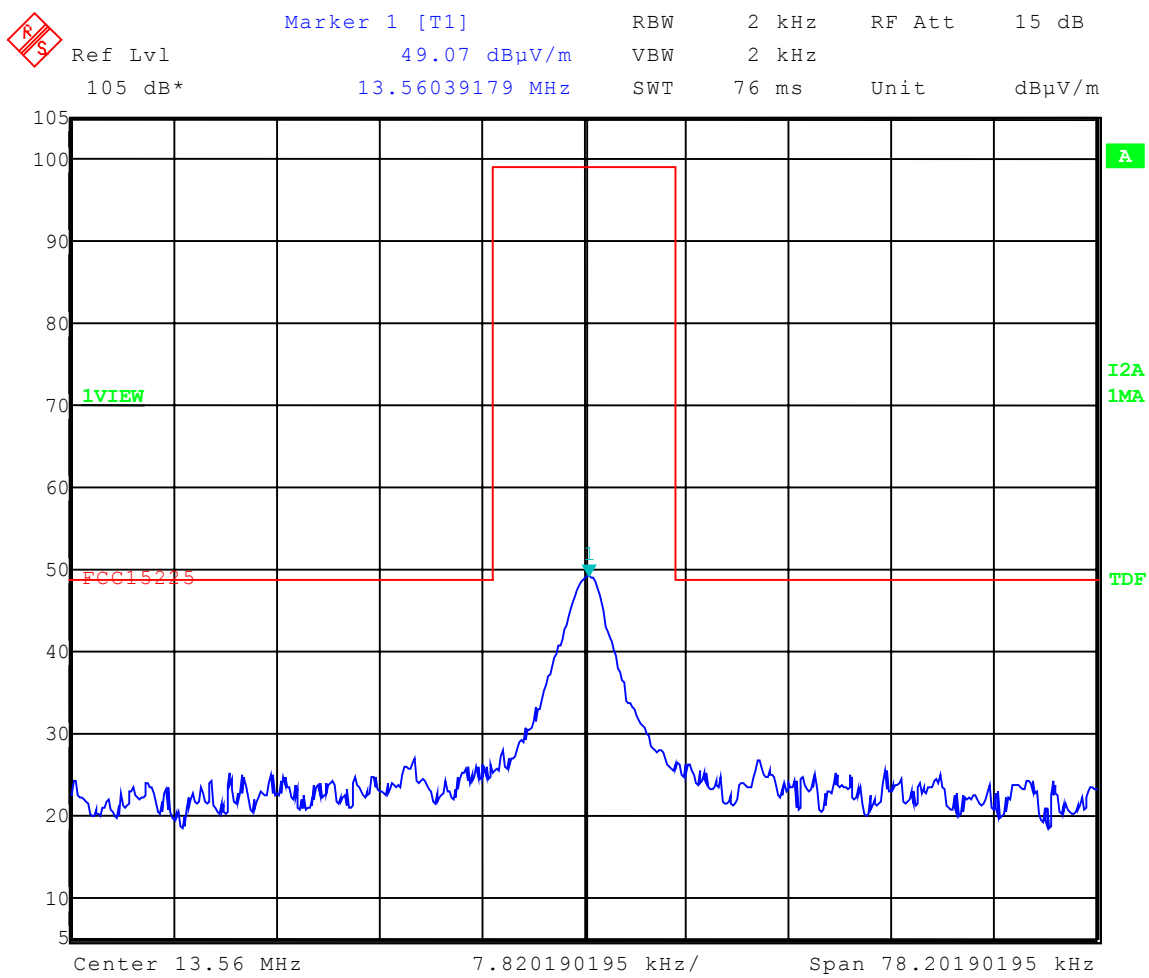


Company: Stryker Instruments
Model Tested: 5100-050-000
Report Number: 11418

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APPENDIX A

Test Date: 05-31-2005
Company: Stryker
EUT: TPS Plus New Control Board
Test: Fundamental and Band Edges
Operator: Craig Brandt



Date: 31.MAY.2005 15:21:11



Company: Stryker Instruments
Model Tested: 5100-050-000
Report Number: 11418

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

3.0 FIELD STRENGTH OF SPURIOUS EMISSION MEASUREMENTS (SECTION 15.225a & b)

The radiated measurements made at D.L.S. Electronic Systems, Inc., for the TPS Irrigation Console w/ Stryker Electronics Control Board, Model Number: 5100-050-000, are shown in tabulated and graph form. Preliminary radiation 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 TPS Irrigation Console w/ Stryker Electronics Control Board were made up to 1000 MHz, in accordance with Section 15.33a for Intentional Radiators with a fundamental frequency of 13.56 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 radiation levels.

All signals in the frequency range of 9 kHz to 30 MHz were measured with a low frequency Loop Antenna as a pickup device. From 30 to 200 MHz, a Biconical Antenna or tuned dipoles were used and from 200 MHz to 1000 MHz, a Log Periodic or Tuned Dipoles were used. During the test 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 the vertical polarization with the Loop Antenna, rotated 360° around its vertical axis. Tests were also made in both the horizontal and vertical planes of polarization with the Biconical and Log Periodic. In each case, 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 were re-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. All signals were then recorded. The allowed levels for Intentional Radiators in the 13.553 MHz to 13.567 MHz band shall not exceed 10,000 uV measured at 30 meters. The field strength of any emissions appearing outside of this band shall not exceed the radiated emissions limits shown in Section 15.209.



Company: Stryker Instruments
Model Tested: 5100-050-000
Report Number: 11418

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APPENDIX A

RADIATED DATA AND GRAPHS TAKEN FOR

FUNDAMENTAL FIELD STRENGTH

SPURIOUS EMISSION MEASUREMENTS

PART 15.225

Spurious Radiated Emissions

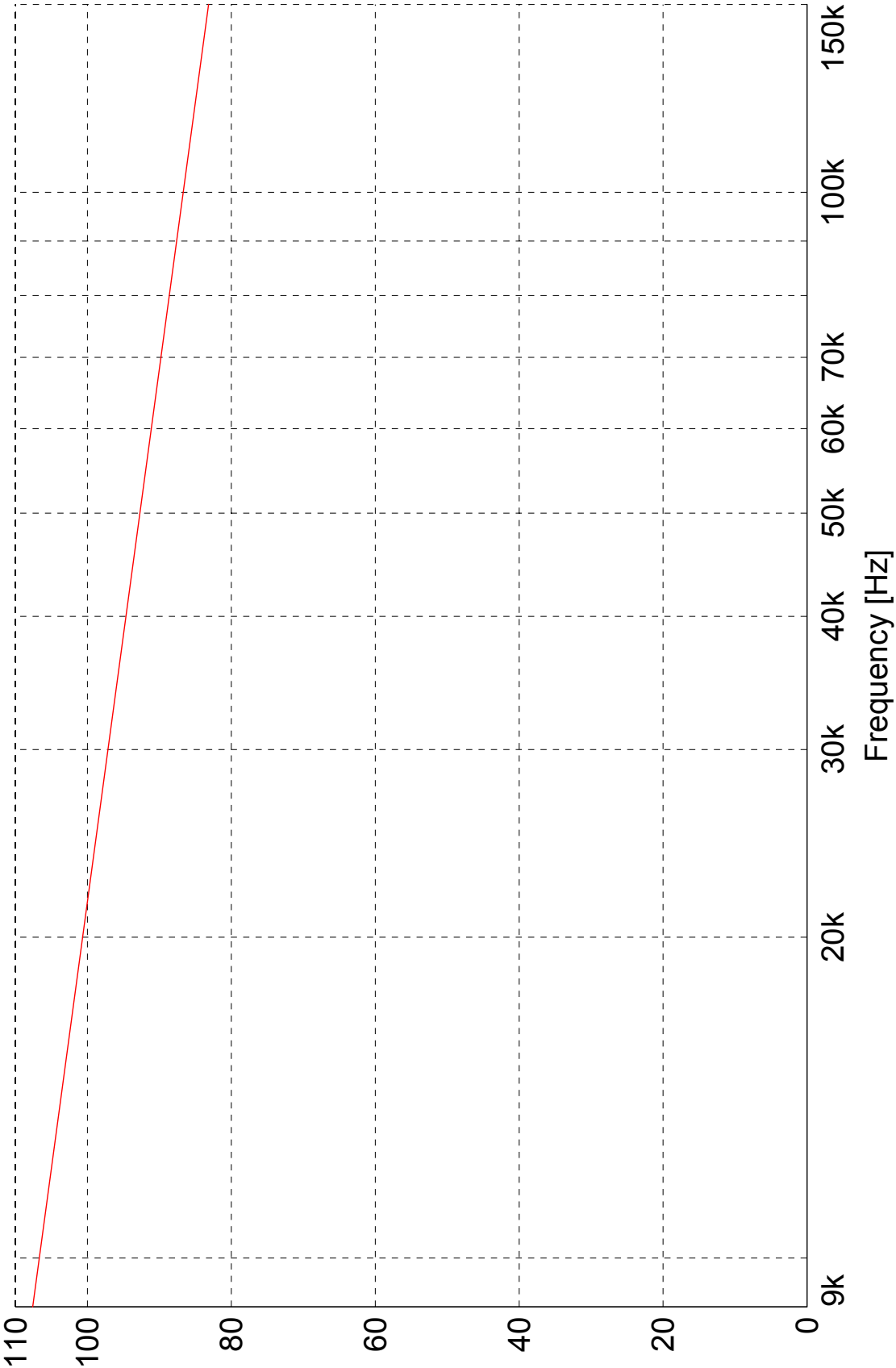
EUT: TPS Plus new control board
Manufacturer: Stryker
Operating Condition: 75 degF ; 47%R.H.
Test Site: D.L.S. O.F. Site 2
Operator: Craig Brandt
Test Specification: 120 VAC; 60 Hz
Comment:
Date: 5/31/2005

TEXT: "Site 2 LowH 10M Act"

Short Description: Test Set-up 9kHz to 30MHz H
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005
Antennas --- EMCO Active Loop Model: 6502 SN: 2038

TEST SET-UP: EUT Measured at 10 Meters with Loop Antenna

Level [dBμV/m]



+ + MES Ats2_sv_Peak_List
— LIM Part 15-209 10m FCC15.209 Field Strength Limit

Spurious Radiated Emissions

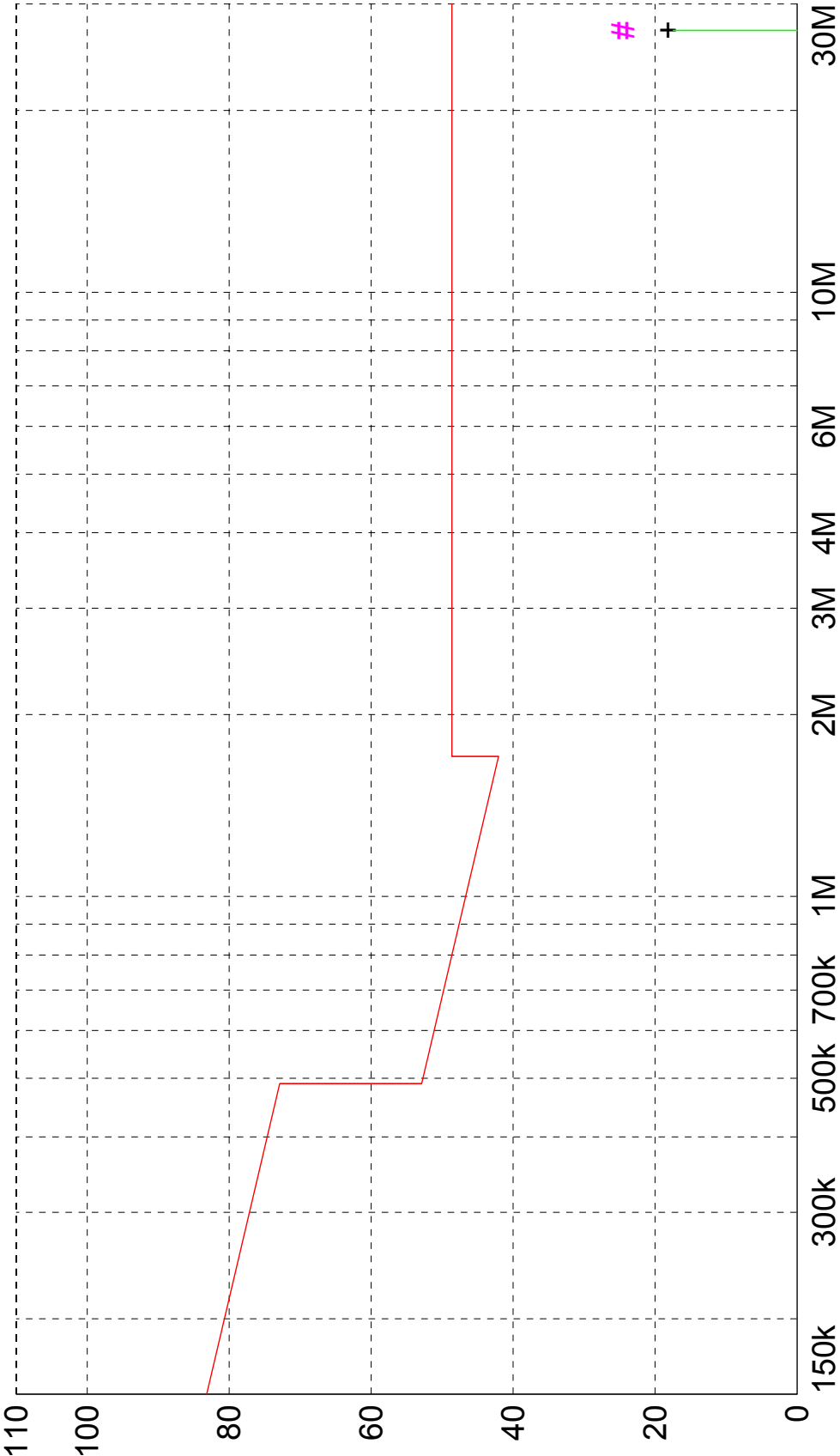
EUT: TPS Plus new control board
Manufacturer: Stryker
Operating Condition: 75 degF ; 47%R.H.
Test Site: D.L.S. O.F. Site 2
Operator: Craig Brandt
Test Specification: 120 VAC; 60 Hz
Comment:
Date: 5/31/2005

TEXT: "Site 2 LowH 10M Act"

Short Description: Test Set-up 9kHz to 30MHz H
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005
Antennas --- EMCO Active Loop Model: 6502 SN: 2038

TEST SET-UP: EUT Measured at 10 Meters with Loop Antenna

Level [dBμV/m]



MES Ats3_sv_Quasi-Peak
MES Ats3_sv_Peak
+ MES Ats3_sv_Peak_List
LIM Part 15-209 10m

FCC15.209 Field Strength Limit

MEASUREMENT RESULT: "Ats3_sv_Final"

5/31/2005 2:07PM

Frequency	Level	Antenna	System	Total	Limit	Margin	Height	EuT	Final	Comment
MHz	dBμV	Factor	Loss	Level			Ant.	Angle	Detector	
		dBμV/m	dB	dBμV/m	dBμV/m	dB	m	deg		
27.120000	14.12	8.69	1.7	24.5	48.6	24.2	1.00	315	MAX PEAK	None
27.120000	7.08	8.69	1.7	17.4	48.6	31.2	1.00	315	QUASI-PEAK	None



Company: Stryker Instruments
Model Tested: 5100-050-000
Report Number: 11418

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APPENDIX A

RADIATED DATA TAKEN FOR

FIELD STRENGTH

SPURIOUS EMISSION MEASUREMENTS

PART 15.209

FCC Part 15

Electric Field Strength

EUT: TPS Plus new control board
Manufacturer: Stryker
Operating Condition: 64 degF; 57% R.H.
Test Site: DLS O.F. Site 2
Operator: Craig Brandt
Test Specification: 120 VAC; 60 Hz
Comment:
Date: 05/31/2005

TEXT: "Site 2 MidV 3M"

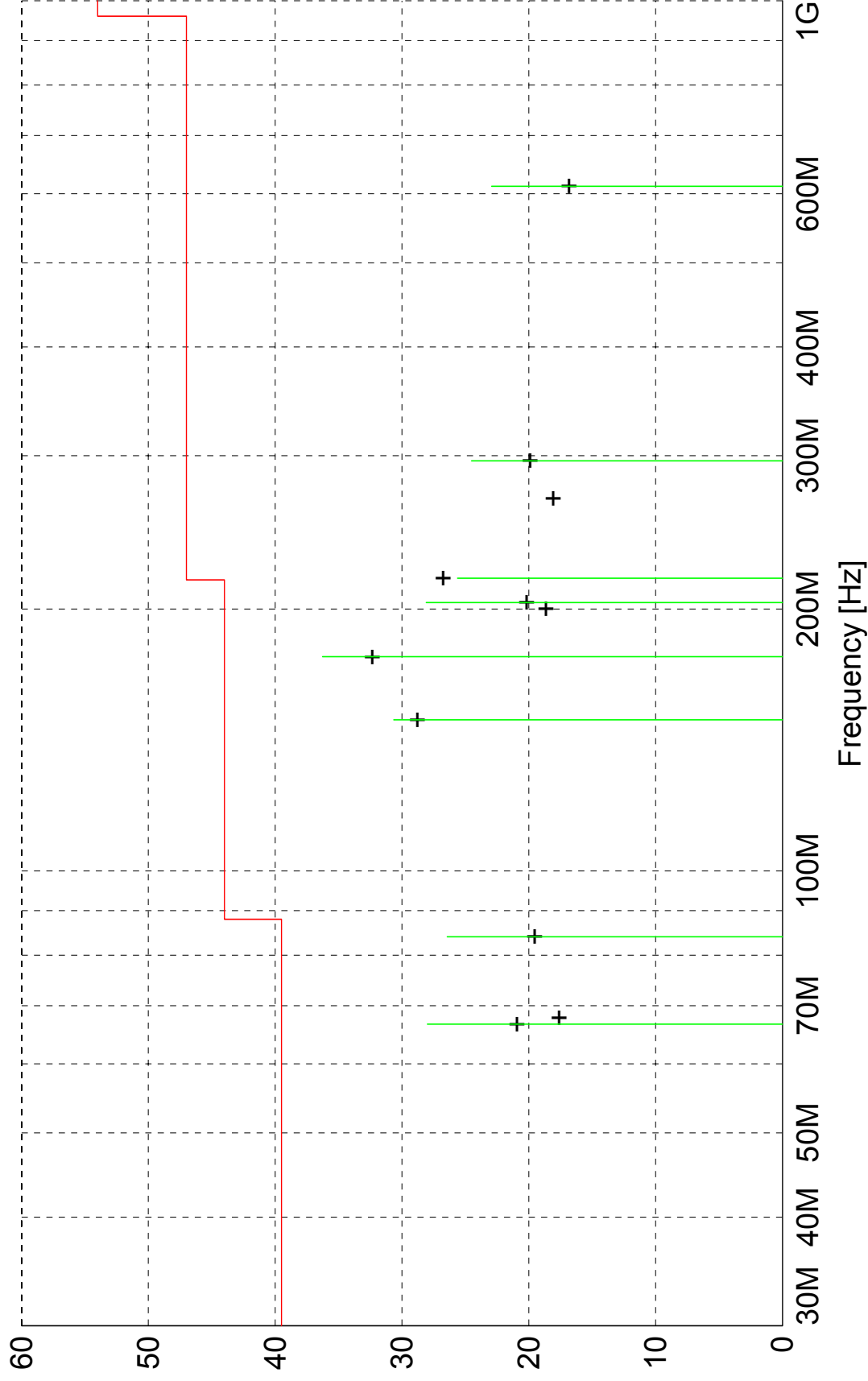
Short Description: Test Set-up Vert30-1000MHz
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005

Antennas ---
Biconical -- EMCO 3104C SN: 0005-4892
Log Periodic -- Electro Metrics LPA-25 SN: 1205

Pre-Amp --- Rohde&Schwarz TS-PR10 SN: 032001/004

TEST SET-UP: EUT Measured at 3 Meters with VERTICAL Antenna Polarisation

Level [dBμV/m]



MES Ats1_F1V_Quasi-Peak
+ · MES Ats1_F1V_Peak_List
— LIM FCC ClassB F 3m

FCC ClassB, field strength 3m

MEASUREMENT RESULT: "Ats1_F1V_Final"

5/31/2005 10:48AM

Frequency	Level	Antenna	System	Total	Limit	Margin	Height	EuT	Final	Comment
MHz	dBμV	Factor	Loss	Level			Ant.	Angle	Detector	
		dBμV/m	dB	dBμV/m	dBμV/m	dB	m	deg		
176.275400	43.09	15.81	-22.6	36.3	44.0	7.7	1.00	180	QUASI-PEAK	None
66.665000	43.89	7.79	-23.7	28.0	39.5	11.5	1.00	180	QUASI-PEAK	None
83.995000	41.96	7.83	-23.3	26.4	39.5	13.1	1.00	45	QUASI-PEAK	None
149.152900	41.41	12.19	-22.9	30.6	44.0	13.4	1.00	180	QUASI-PEAK	None
203.388000	38.99	11.55	-22.4	28.1	44.0	15.9	1.00	135	QUASI-PEAK	None
216.947000	36.67	11.36	-22.4	25.6	47.0	21.4	1.00	270	QUASI-PEAK	None
295.990000	32.23	14.32	-22.0	24.5	47.0	22.5	1.00	270	QUASI-PEAK	None
611.970000	24.02	18.98	-20.1	22.9	47.0	24.1	1.00	200	QUASI-PEAK	None

FCC Part 15

Electric Field Strength

EUT: TPS Plus new control board
Manufacturer: Stryker
Operating Condition: 64 degF; 57% R.H.
Test Site: DLS O.F. Site 2
Operator: Craig Brandt
Test Specification: 120 VAC; 60 Hz
Comment:
Date: 05/31/2005

TEXT: "Site 2 MidH 3M"

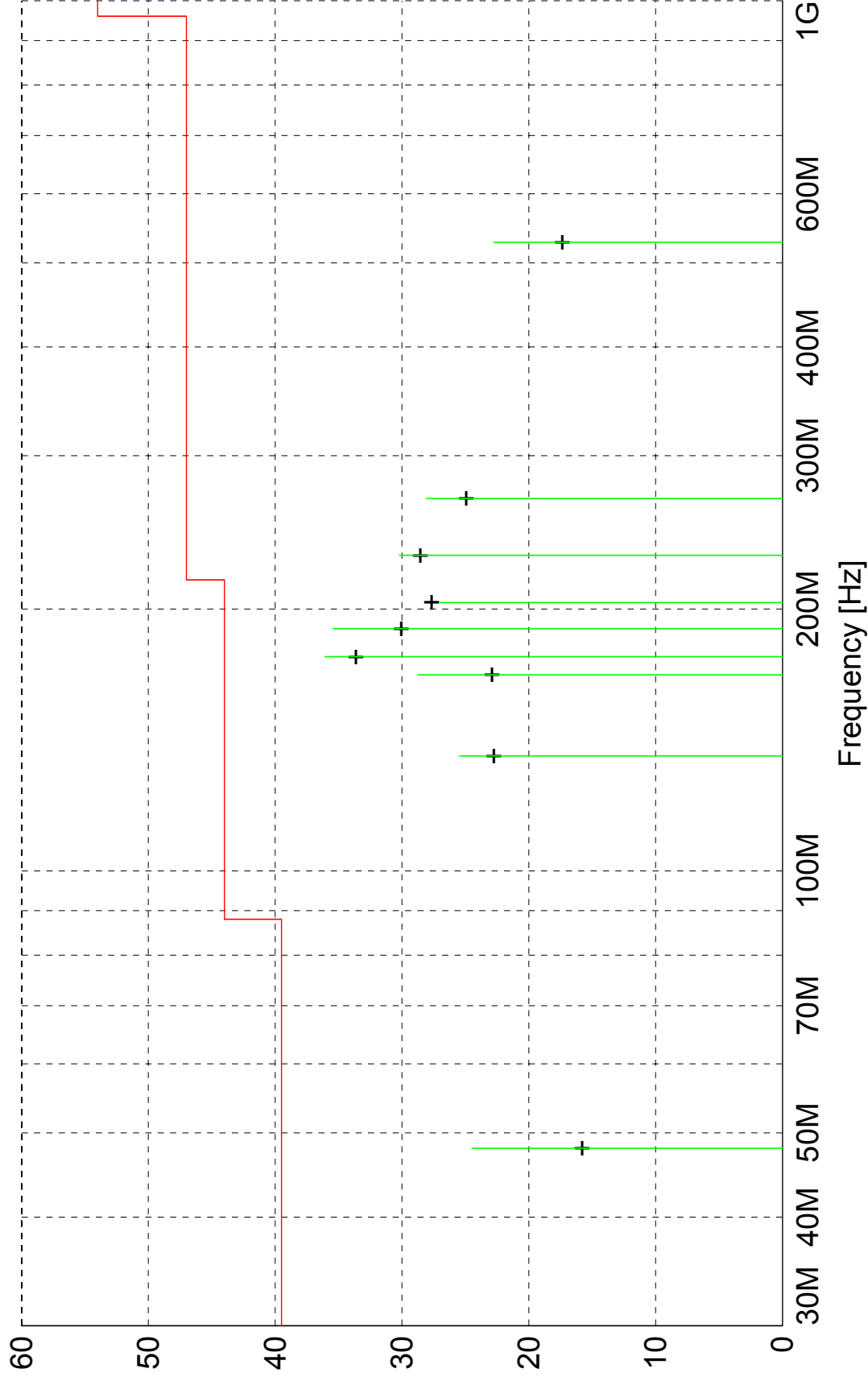
Short Description: Test Set-up Horz30-1000MHz
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005

Antennas ---
Biconical -- EMCO 3104C SN: 0005-4892
Log Periodic -- Electro Metrics LPA-25 SN: 1205

Pre-Amp --- Rohde&Schwarz TS-PR10 SN: 032001/004

TEST SET-UP: EUT Measured at 3 Meters with HORIZONTAL Antenna Polarisation

Level [dBμV/m]



MES Ats1_F1H_Quasi-Peak
+ · MES Ats1_F1H_Peak_List
— LIM FCC ClassB F 3m

FCC ClassB, field strength 3m

MEASUREMENT RESULT: "Ats1_FlH_Final"

5/31/2005 10:41AM

Frequency	Level	Antenna	System	Total	Limit	Margin	Height	EuT	Final	Comment
MHz	dBμV	Factor	Loss	Level			Ant.	Angle	Detector	
		dBμV/m	dB	dBμV/m	dBμV/m	dB	m	deg		
176.270500	42.89	15.81	-22.6	36.1	44.0	7.9	2.00	180	QUASI-PEAK	None
189.825900	40.84	17.05	-22.5	35.4	44.0	8.6	2.00	135	QUASI-PEAK	None
47.990000	36.73	11.64	-23.9	24.5	39.5	15.0	3.00	225	QUASI-PEAK	None
167.995000	37.27	14.29	-22.8	28.8	44.0	15.2	2.00	90	QUASI-PEAK	None
230.509100	41.08	11.44	-22.3	30.2	47.0	16.8	1.00	215	QUASI-PEAK	None
203.388000	37.90	11.55	-22.4	27.0	44.0	17.0	2.00	180	QUASI-PEAK	None
135.584200	36.20	12.27	-23.0	25.5	44.0	18.5	2.50	100	QUASI-PEAK	None
267.984300	37.42	12.91	-22.3	28.1	47.0	18.9	1.00	180	QUASI-PEAK	None
527.980000	25.69	17.71	-20.6	22.8	47.0	24.2	1.00	40	QUASI-PEAK	None



Company: Stryker Instruments
Model Tested: 5100-050-000
Report Number: 11418

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

4.0 FREQUENCY STABILITY - PART 2.1055a (Temperature)

The frequency stability was measured from -30° to +50° centigrade at intervals of 10° centigrade throughout the range. Prior to each frequency measurement, the equipment was left alone for a sufficient period of time (approximately 30 minutes or more) to allow the components of the TPS Irrigation Console w/ Stryker Electronics Control Board oscillator circuitry to stabilize. The following information was taken:

FREQUENCY STABILITY FOR TEMPERATURE VARIATION IN MHz:

-20°	0
-10°	0
0°	0
+10°	0
+20°	0
+30°	0
+40°	0
+50°	0

Worst Case Variance:

0 Hz

As stated in Part 15, Section 15.225 (c), the Frequency Tolerance and Margin for this range are as follows:

Ambient Frequency: = 0.00 Hz

Frequency Tolerance: = 0

0.00 * 0 = 0 Hz

The changes made to the unit do not effect the transmitter circuitry, thereby this test was not performed.



Company: Stryker Instruments
Model Tested: 5100-050-000
Report Number: 11418

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APPENDIX A

GRAPHS TAKEN FOR FREQUENCY

STABILITY WHEN VARYING THE

TEMPERATURE

PART 2.1055A

The changes made to the unit do not effect the transmitter circuitry, thereby this test was not performed.



Company: Stryker Instruments
Model Tested: 5100-050-000
Report Number: 11418

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APPENDIX A

5.0 FREQUENCY STABILITY - PART 2.1055d (Voltage)

The frequency stability of TPS Irrigation Console w/ Stryker Electronics Control Board was measured by varying the primary supply voltage from 85% to 115% of nominal value for all equipment other than hand carried battery equipment.

FREQUENCY STABILITY FOR VOLTAGE VARIATION:

85% 0
100% 0
115% 0

The changes made to the unit do not effect the transmitter circuitry, thereby this test was not performed.

FREQUENCY STABILITY FOR HAND HELD DEVICES:

For hand carried, battery powered equipment, the supply voltage was reduced to the battery operating end point specified by the manufacturer. Readings were taken at the reduced end point and with a fresh battery:

Fresh Battery verses Battery end point:

Frequency #1 **0 Hz**
Frequency #2 **0 Hz**
Frequency #3 **0 Hz**
Frequency #4 **0 Hz**
Frequency #5 **0 Hz**
Frequency #6 **0 Hz**

As stated in Part 15, Section 15.225 (c), the Frequency Tolerance and Margin for this range are as follows:

Frequency Tolerance: 0

Limit: 0 Hz

The changes made to the unit do not effect the transmitter circuitry, thereby this test was not performed.



Company: Stryker Instruments
Model Tested: 5100-050-000
Report Number: 11418

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

GRAPHS TAKEN FOR FREQUENCY

STABILITY WHEN VARYING THE

PRIMARY SUPPLY VOLTAGE

PART 2.1055d

The changes made to the unit do not effect the transmitter circuitry, thereby this test was not performed.