



1250 Peterson Dr., Wheeling, IL 60090

Company: Tyco Healthcare / Mallinckrodt
Model Tested: 844003
Report Number: 12456

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: OptiVantage

Kind of Equipment: Medical Equipment - Contrast Injector

Test Configuration: Stand-alone, Standard Pedestal with 1 Console, 2 Hand switches, OptiBolus Key, OEM Interface board (no cable), and Ethernet cable (unconnected).
(Tested at 120 vac, 60 Hz)

Model Number(s): 844003

Model(s) Tested: 844003

Serial Number(s): CI0306B576

Date of Tests: July 11, 12, 17 & 18, 2006

Test Conducted For:
Tyco Healthcare / Mallinckrodt
2111 E. Galbraith Rd.
Cincinnati, Ohio 45237

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.

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Model Tested: 844003
Report Number: 12456

SIGNATURE PAGE

Report By:

Aronom C. Rowe
Test Engineer
EMC-001375-NE

Reviewed By:

William Stumpf
OATS Manager

Approved By:

Brian Mattson
General Manager

Company Official:

Tyco Healthcare / Mallinckrodt



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United States Department of Commerce
National Institute of Standards and Technology



Certificate of Accreditation to ISO/IEC 17025:1999

NVLAP LAB CODE: 100276-0

D.L.S. Electronic Systems, Inc.
Wheeling, IL

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

ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS



2005-10-01 through 2006-09-30
Effective dates

John P. Mull
For the National Institute of Standards and Technology

NVLAP-01C (REV. 2005-05-19)



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1.0 SUMMARY OF TEST REPORT

It was found that the OptiVantage, Model Number(s) 844003, "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: 67

2.0 INTRODUCTION

On July 11, 12, 17 & 18, 2006, a series of radio frequency interference measurements was performed on OptiVantage, Model Number(s) 844003, Serial Number: CI0306B576. 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.

D.L.S. Electronic Systems, Inc. is a full service EMC/Safety Testing Laboratory accredited to ISO 17025. NVLAP Certificate and Scope can be viewed at <http://www.dlsemc.com/certificate>. Our facilities are registered with the FCC, Industry Canada, and VCCI.

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.

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.



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

7.1 Description:

The OptiVantage is designed to inject radio plaque contrast into a patient's blood stream to enhance the image for a CT scanner. The volume, flow rate and pressure are controlled by microprocessors. The injection parameters are entered by the user at the Console using a touch screen display.

7.2 PHYSICAL DIMENSIONS OF EQUIPMENT UNDER TEST

Power Supply: Length: 10.450" x Width: 9.47" x Height: 4.63"
Console: Length: 12.150" x Width: 2.50" x Height: 8.25"
Power head: Length: 13.625" x Width: 12.15" x Height: 6.00"

7.3 LINE FILTER USED:

NA

7.4 INTERNAL CLOCK FREQUENCIES:

Switching Power Supply Frequencies:

650, 200 kHz

Clock Frequencies:

64, 48, 40, 25, 20, 16, 13.56, & 8 MHz



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7.0 DESCRIPTION OF TEST SAMPLE: (CON'T)

7.5 DESCRIPTION OF ALL CIRCUIT BOARDS:

1. PCB ASSY, ADVANTAGE POWER HEAD	PN: 844375-1 Rev D
2. PCB ASSY, OPTIVANTAGE KNOB LED	PN: 844370-1 Rev B
3. PCB ASSY, ADVANTAGE OEM INTERFACE	PN: 844465-1 Rev B
4. PCB ASSY, OPTIVANTAGE POWER SUPPLY	PN: 844460-1 Rev C
5. PCB ASSY, BOLUS SHAPING SECURITY	PN: 844490-1 Rev A
6. PCB ASSY, RFID READER (2)	PN: 844740-1 Rev 2.0



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

- 1: Cut Heater Wires to each of the Face Plates RIFD Second Antenna Heater.
2. Added Fair-Rite PN: 02461164281 on each of the cables interconnect Face Plate RFID Module with Optivantage Power Head placed near the Face Plate.

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 _____



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9.0 PHOTO INFORMATION AND TEST SET-UP

Item 0 OptiVantage

Model Number: 844003 Serial Number: CI0306B576

Item 1 Non-shielded AC Power Line Cord. 3m

Item 2 Non-shielded Ethernet Cable with Plastic Shells. 2m

Item 3 Shielded Hand Switch Cable with Metal Shells. 5m

Item 4 Shielded Hand Switch Cable with Metal Shells. 2m

Item 5 EUT Power Pack

Item 6 EUT Console

Item 7 Shielded Console Cable with Metal Shells. 50'

Item 8 Shielded Power Head Cable with Metal Shells. 50'



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10.0 RADIATED PHOTOS TAKEN DURING TESTING

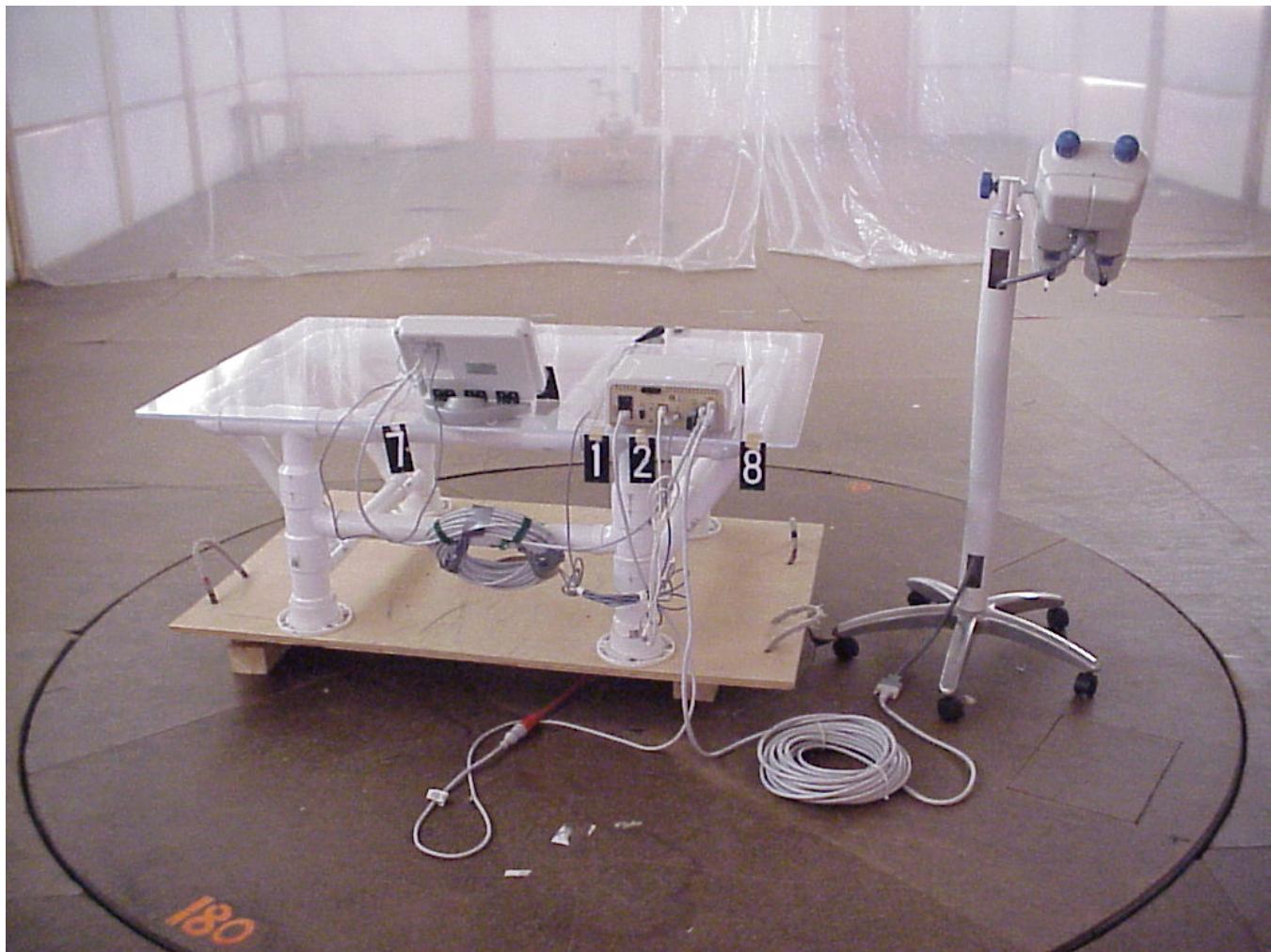




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10.0 RADIATED PHOTOS TAKEN DURING TESTING (CON'T)





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10.0 CONDUCTED PHOTOS TAKEN DURING TESTING





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10.0 CONDUCTED PHOTOS TAKEN DURING TESTING (CON'T)





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10.0 EXTREME CONDITION PHOTOS TAKEN DURING TESTING



EXTREME CONDITION 1



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10.0 EXTREME CONDITION PHOTOS TAKEN DURING TESTING



EXTREME CONDITION 2



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10.0 EXTREME CONDITION PHOTOS TAKEN DURING TESTING



EXTREME CONDITION 3



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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 OptiVantage, Model Number(s) 844003 "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.



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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	2/07
Antenna	Electrometrics	LPA-25	1114	200 MHz – 1 GHz	3/07
Antenna	EMCO	3104C	00054892	20 MHz – 200 MHz	3/07
Antenna	Electrometrics	3146	1205	200 MHz – 1 GHz	3/07
Antenna	EMCO	3104C	97014785	20 MHz – 200 MHz	2/07
Antenna	EMCO	3146	97024895	200 MHz – 1 GHz	3/07
Antenna	EMCO	3115	2479	1 GHz – 18 GHz	8/06
Antenna	EMCO	3115	99035731	1 GHz – 18 GHz	4/07
Antenna	Rohde & Schwarz	HUF-Z1	829381001	20 MHz – 1 GHz	2/07
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	7/07

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 15.225a-c

OPERATION WITHIN THE BAND 13.553-13.567 MHz



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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.



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APPENDIX A

CONDUCTED DATA AND GRAPHS

TAKEN DURING TESTING

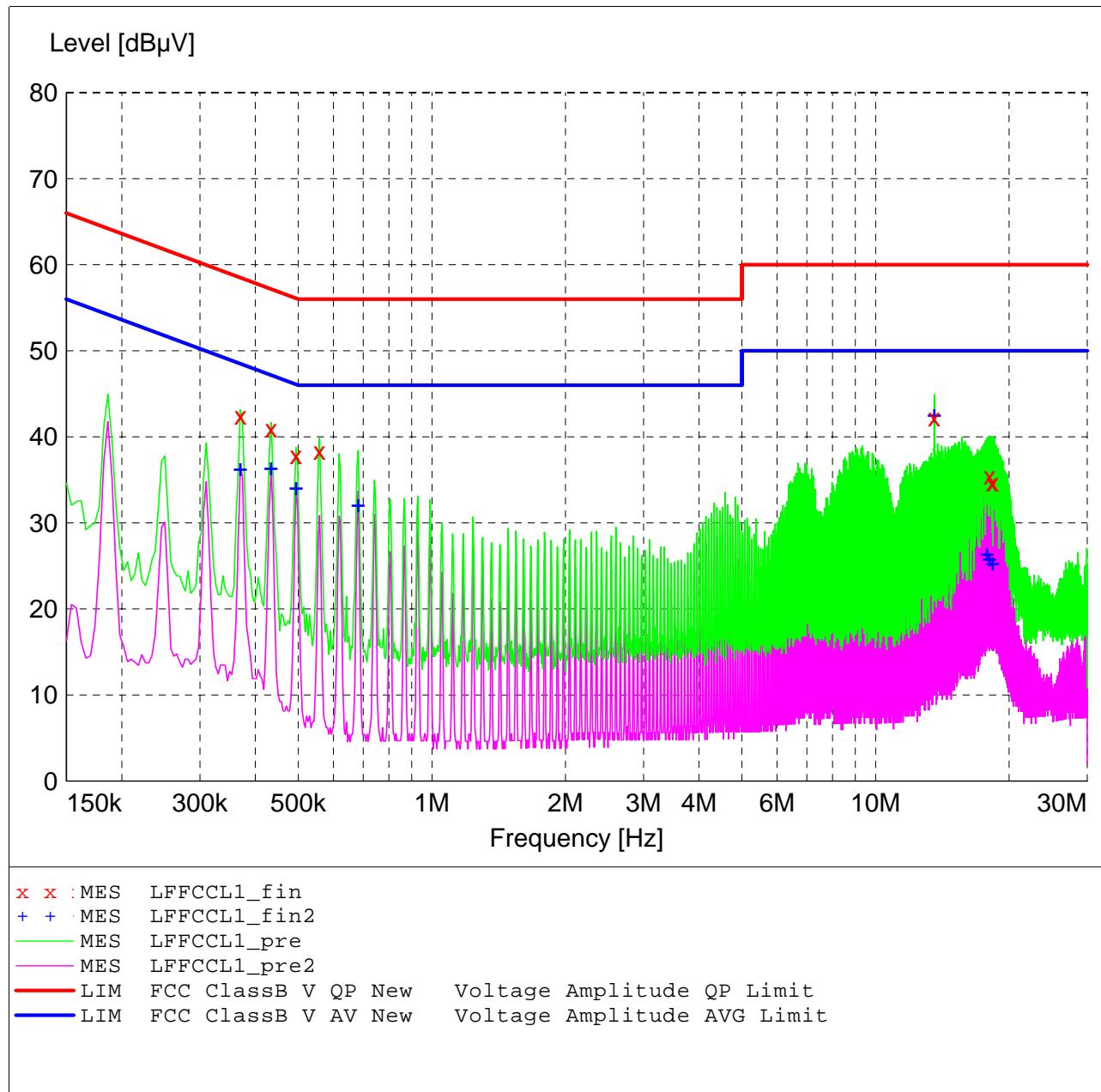
PART 15.207

Voltage Mains Test

EUT: Optivantage with RFID
 Manufacturer: Liebel-Flarsheim
 Operating Condition: 76 deg. F, 65% R.H.
 Test Site: DLS O.F. Site 1 (Screenroom)
 Operator: Jason Lauer
 Test Specification: 120 VAC @ 60 Hz - Line 1
 Comment: Transmit and Receive - 13.56 MHz
 Date: 07-17-2006

SCAN TABLE: "Line Cond Scrn RmFin"

Line Conducted Emissions						
Start Frequency	Stop Frequency	Step Width	Detector	Meas.	IF Time	Transducer
150.0 kHz	30.0 MHz	4.0 kHz	QuasiPeak	10.0 s	9 kHz	LISN DLS#128
CISPR AV						



MEASUREMENT RESULT: "LFFCCL1_fin"

7/17/2006 6:09PM

Frequency MHz	Level dB μ V	Transd dB	Limit dB μ V	Margin dB	Detector	Line	PE
0.370000	42.40	10.3	59	16.1	QP	---	---
0.434000	40.90	10.2	57	16.3	QP	---	---
0.494000	37.90	10.2	56	18.2	QP	---	---
0.558000	38.30	10.2	56	17.7	QP	---	---
13.558000	42.20	10.9	60	17.8	QP	---	---
18.062000	35.50	11.2	60	24.5	QP	---	---
18.310000	34.70	11.2	60	25.3	QP	---	---
18.370000	34.70	11.2	60	25.3	QP	---	---

MEASUREMENT RESULT: "LFFCCL1_fin2"

7/17/2006 6:09PM

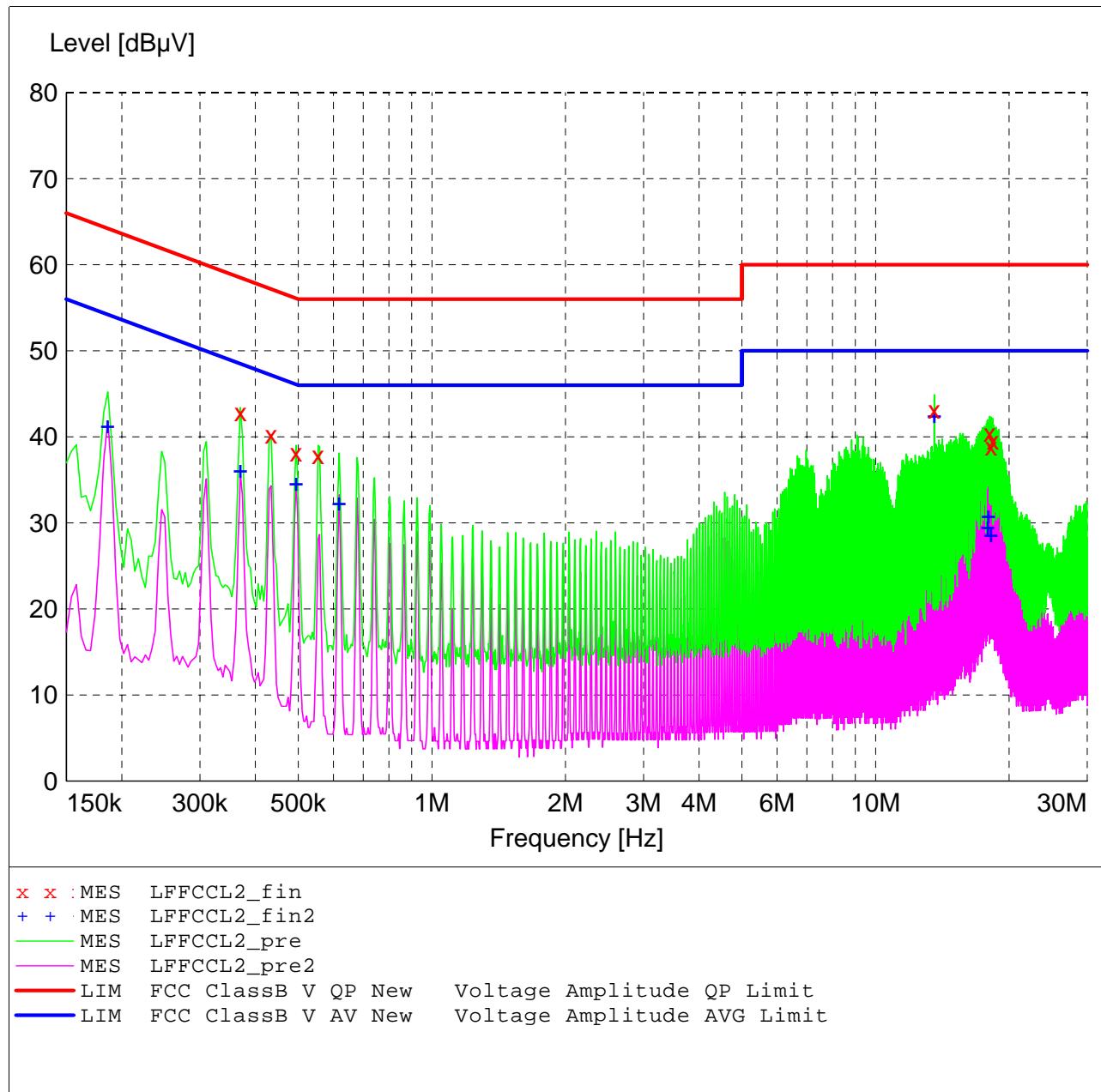
Frequency MHz	Level dB μ V	Transd dB	Limit dB μ V	Margin dB	Detector	Line	PE
0.370000	36.40	10.3	49	12.1	CAV	---	---
0.434000	36.50	10.2	47	10.7	CAV	---	---
0.494000	34.20	10.2	46	11.9	CAV	---	---
0.682000	32.20	10.1	46	13.8	CAV	---	---
13.562000	42.60	10.9	50	7.4	CAV	---	---
17.814000	26.50	11.2	50	23.5	CAV	---	---
18.062000	25.90	11.2	50	24.1	CAV	---	---
18.370000	25.40	11.2	50	24.6	CAV	---	---

Voltage Mains Test

EUT: Optivantage with RFID
 Manufacturer: Liebel-Flarsheim
 Operating Condition: 76 deg. F, 65% R.H.
 Test Site: DLS O.F. Site 1 (Screenroom)
 Operator: Jason Lauer
 Test Specification: 120 VAC @ 60 Hz - Line 2
 Comment: Transmit and Receive - 13.56 MHz
 Date: 07-17-2006

SCAN TABLE: "Line Cond Scrn RmFin"

Line Conducted Emissions						
Start Frequency	Stop Frequency	Step Width	Detector	Meas.	IF Time	Transducer
150.0 kHz	30.0 MHz	4.0 kHz	QuasiPeak	10.0 s	9 kHz	LISN DLS#128
CISPR AV						



MEASUREMENT RESULT: "LFFCCL2_fin"

7/17/2006 6:17PM

Frequency MHz	Level dB μ V	Transd dB	Limit dB μ V	Margin dB	Detector	Line	PE
0.370000	42.80	10.3	59	15.7	QP	---	---
0.434000	40.20	10.2	57	17.0	QP	---	---
0.494000	38.20	10.2	56	17.9	QP	---	---
0.554000	37.90	10.2	56	18.1	QP	---	---
13.562000	43.10	10.9	60	16.9	QP	---	---
18.090000	40.50	11.2	60	19.5	QP	---	---
18.214000	38.90	11.2	60	21.1	QP	---	---
18.398000	39.50	11.2	60	20.5	QP	---	---

MEASUREMENT RESULT: "LFFCCL2_fin2"

7/17/2006 6:17PM

Frequency MHz	Level dB μ V	Transd dB	Limit dB μ V	Margin dB	Detector	Line	PE
0.186000	41.30	11.0	54	12.9	CAV	---	---
0.370000	36.20	10.3	49	12.3	CAV	---	---
0.494000	34.70	10.2	46	11.4	CAV	---	---
0.618000	32.40	10.1	46	13.6	CAV	---	---
13.562000	42.50	10.9	50	7.5	CAV	---	---
17.906000	29.60	11.2	50	20.4	CAV	---	---
17.966000	30.90	11.2	50	19.1	CAV	---	---
18.214000	28.70	11.2	50	21.3	CAV	---	---



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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 OptiVantage 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:



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

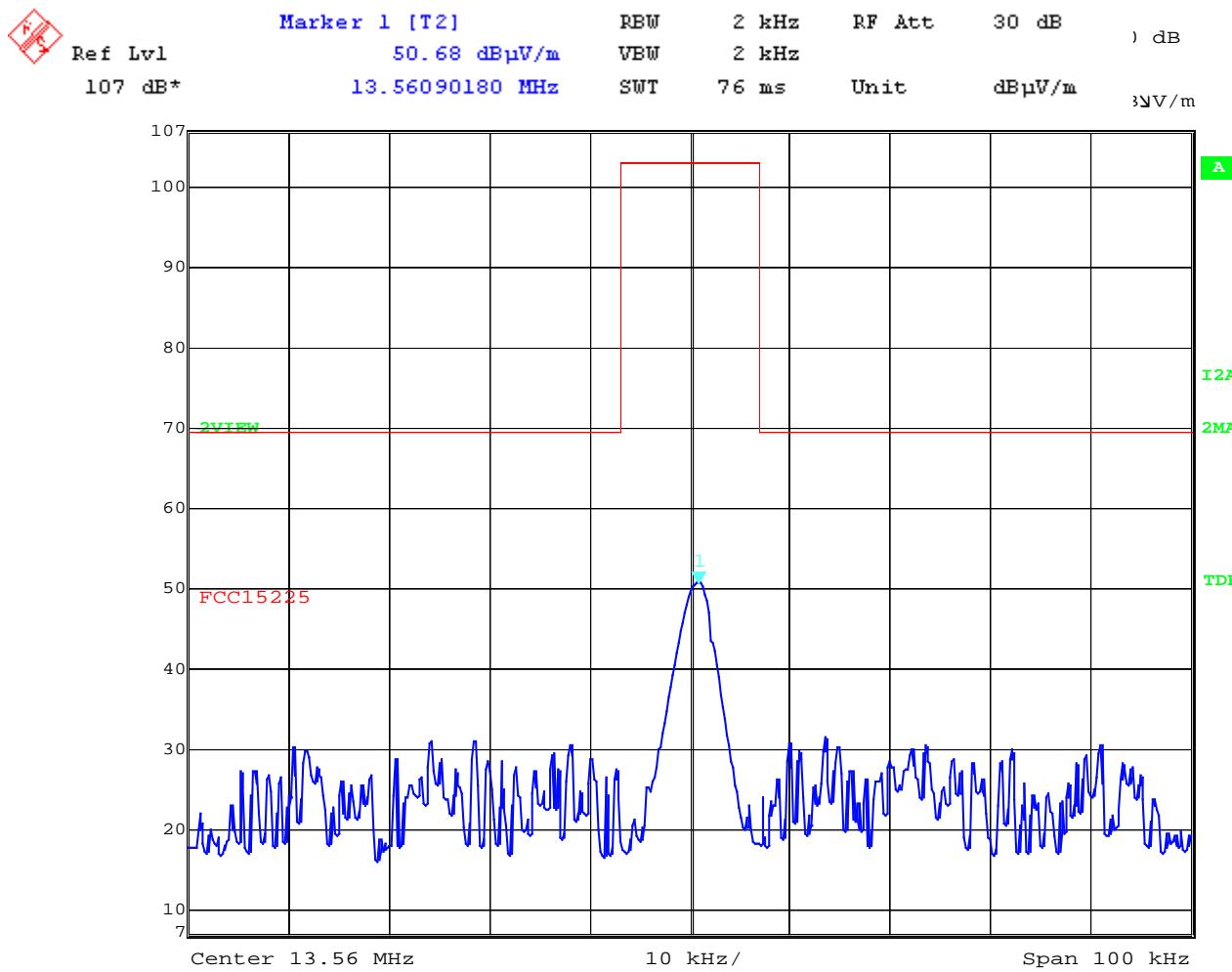
PART 15.225 (b)



Company: Tyco Healthcare / Mallinckrodt
Model Tested: 844003
Report Number: 12456

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Test Date: 07-18-2006
Company: Liebel-Flarsheim
EUT: Optivantage with RFID
Test: Bandwidth / Band Edges
Operator: Jason Lauer
Comment: - 20 deg. C
Comment: 120 VAC; 60 Hz

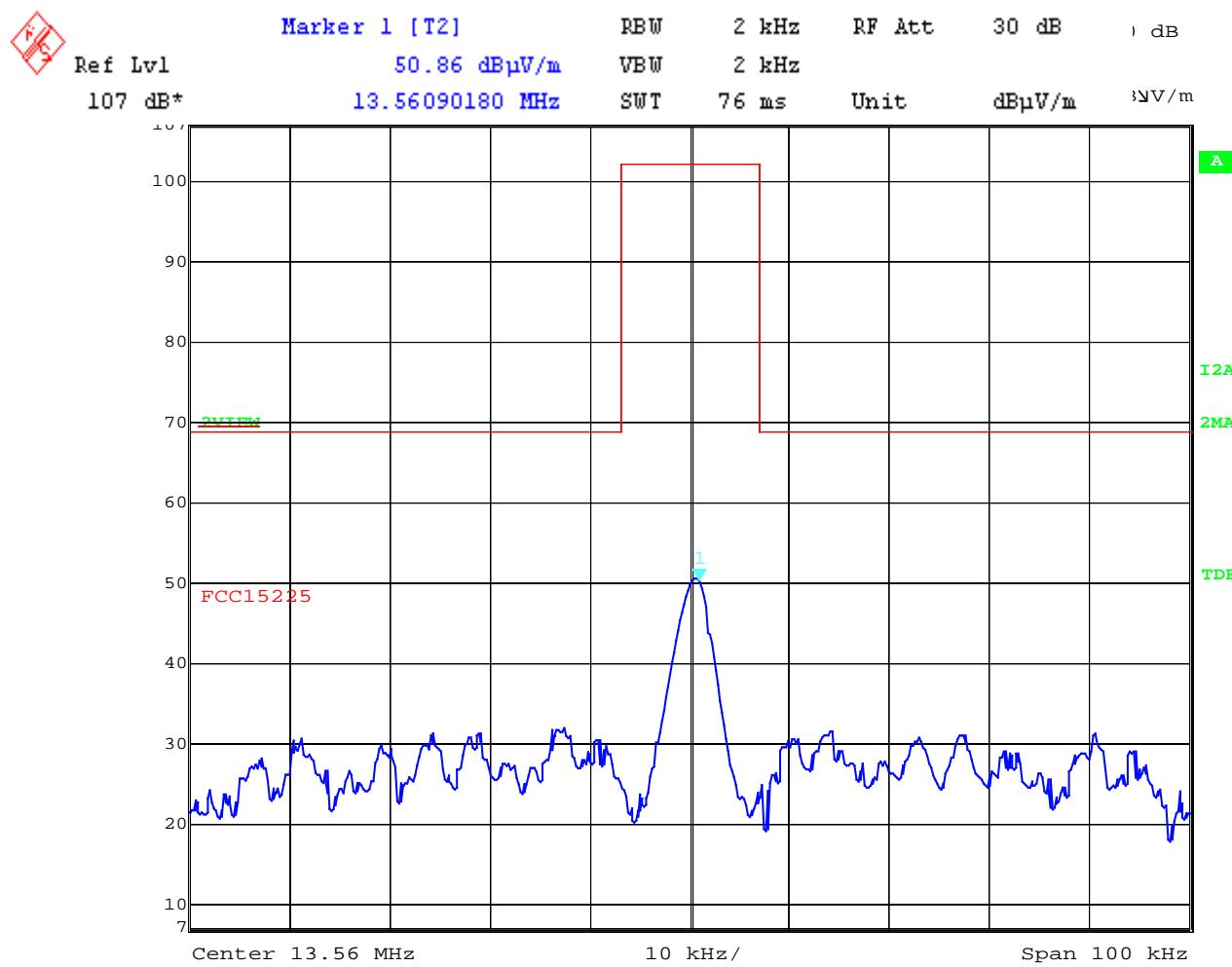




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Test Date: 07-18-2006
Company: Liebel-Flarsheim
EUT: Optivantage with RFID
Test: Bandwidth / Band Edges
Operator: Jason Lauer
Comment: - 10 deg. C
Comment: 120 VAC; 60 Hz

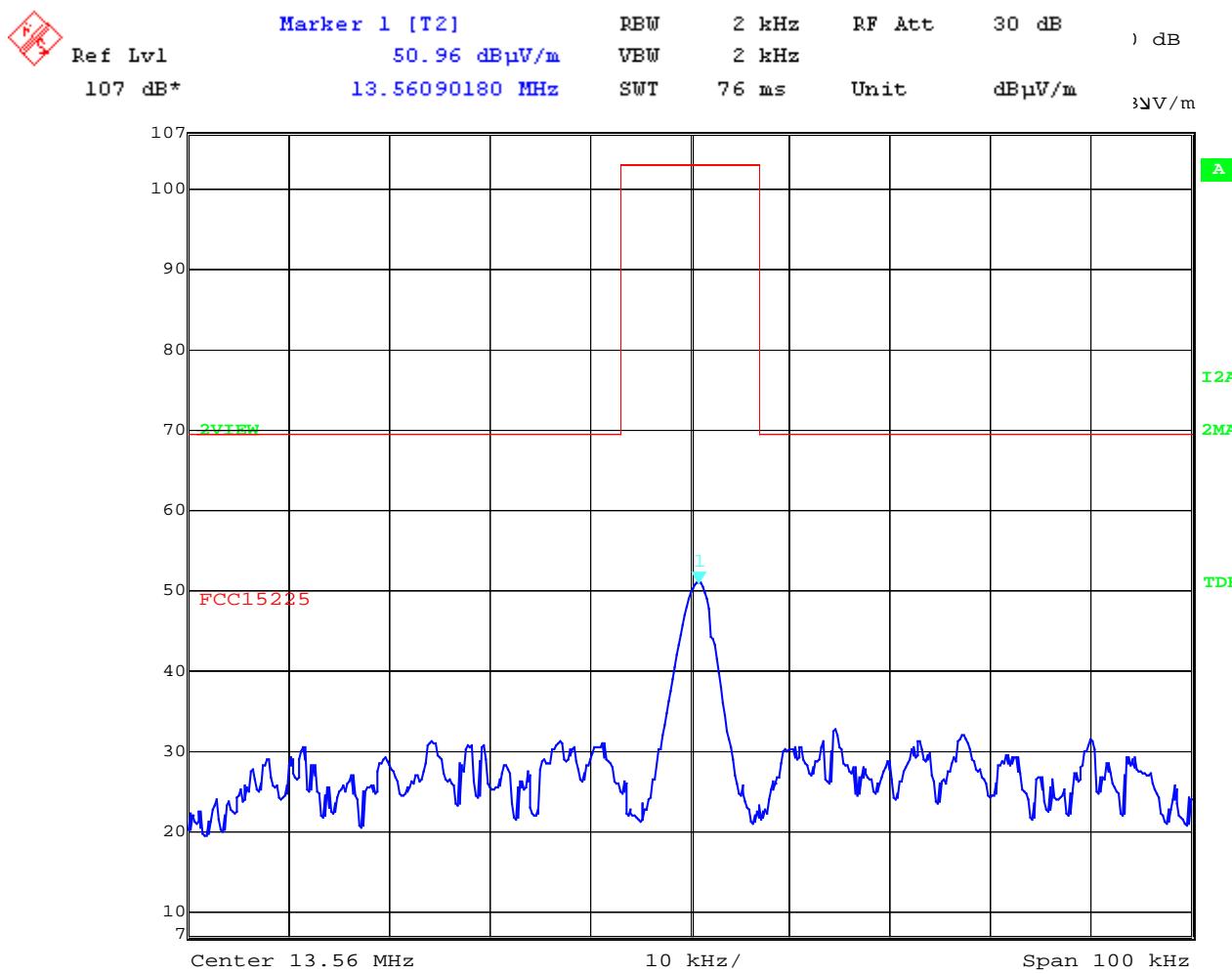




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Test Date: 07-18-2006
Company: Liebel-Flarsheim
EUT: Optivantage with RFID
Test: Bandwidth / Band Edges
Operator: Jason Lauer
Comment: 0 deg. C
Comment: 120 VAC; 60 Hz

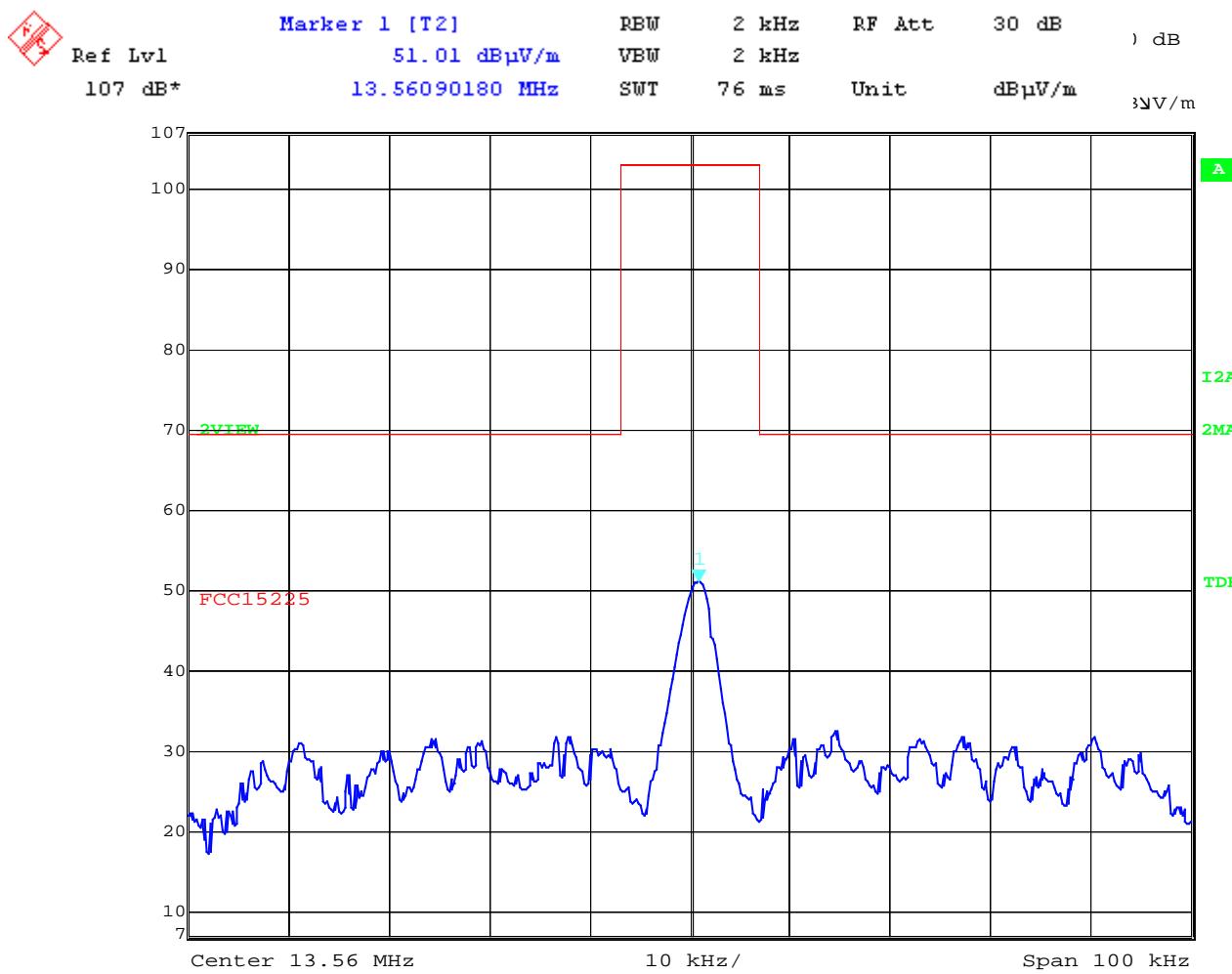




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Test Date: 07-18-2006
Company: Liebel-Flarsheim
EUT: Optivantage with RFID
Test: Bandwidth / Band Edges
Operator: Jason Lauer
Comment: + 10 deg. C
Comment: 120 VAC; 60 Hz



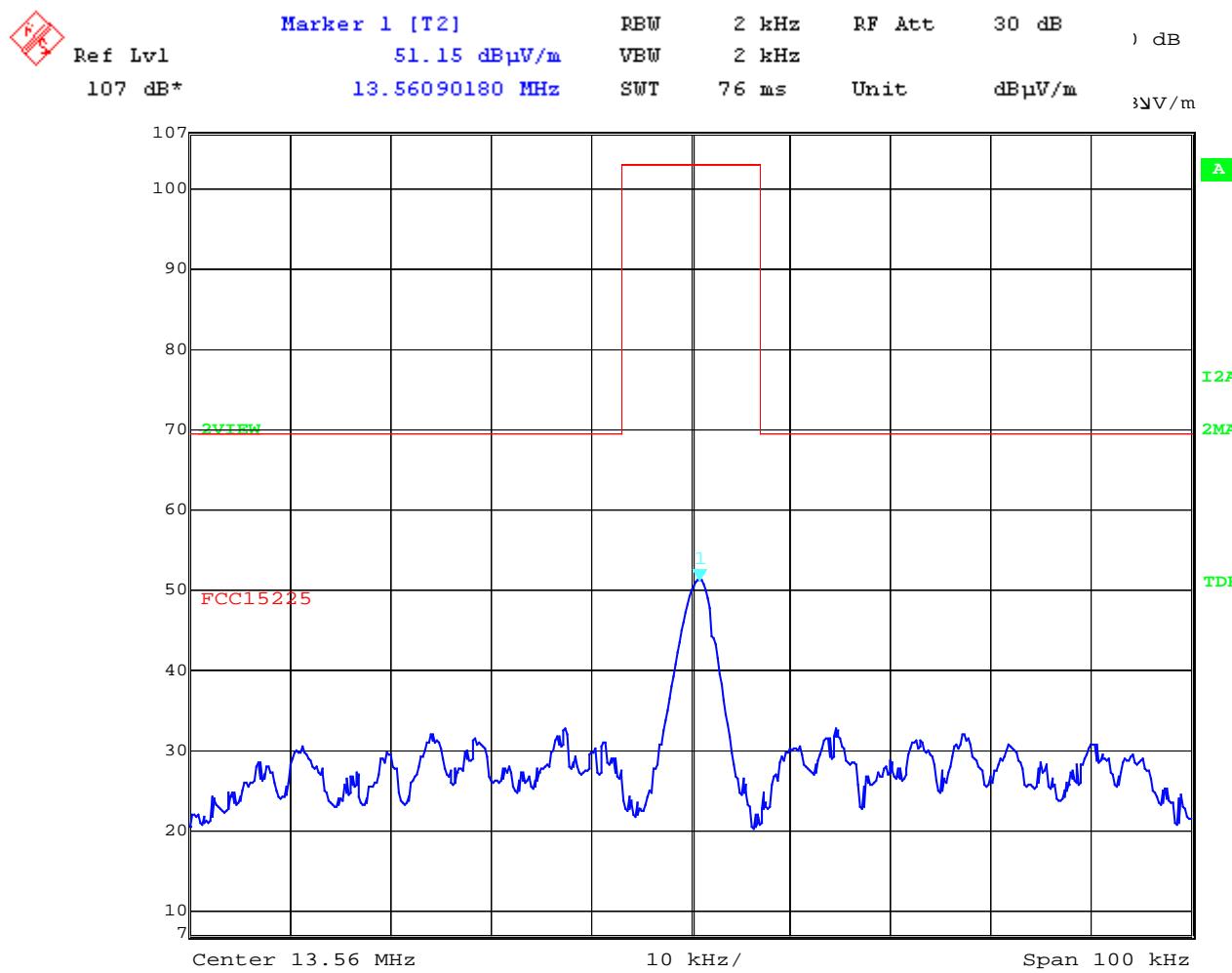
Date: 17.JUL.2006 23:48:32



Company: Tyco Healthcare / Mallinckrodt
Model Tested: 844003
Report Number: 12456

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Test Date: 07-18-2006
Company: Liebel-Flarsheim
EUT: Optivantage with RFID
Test: Bandwidth / Band Edges
Operator: Jason Lauer
Comment: + 20 deg. C
Comment: 120 VAC; 60 Hz

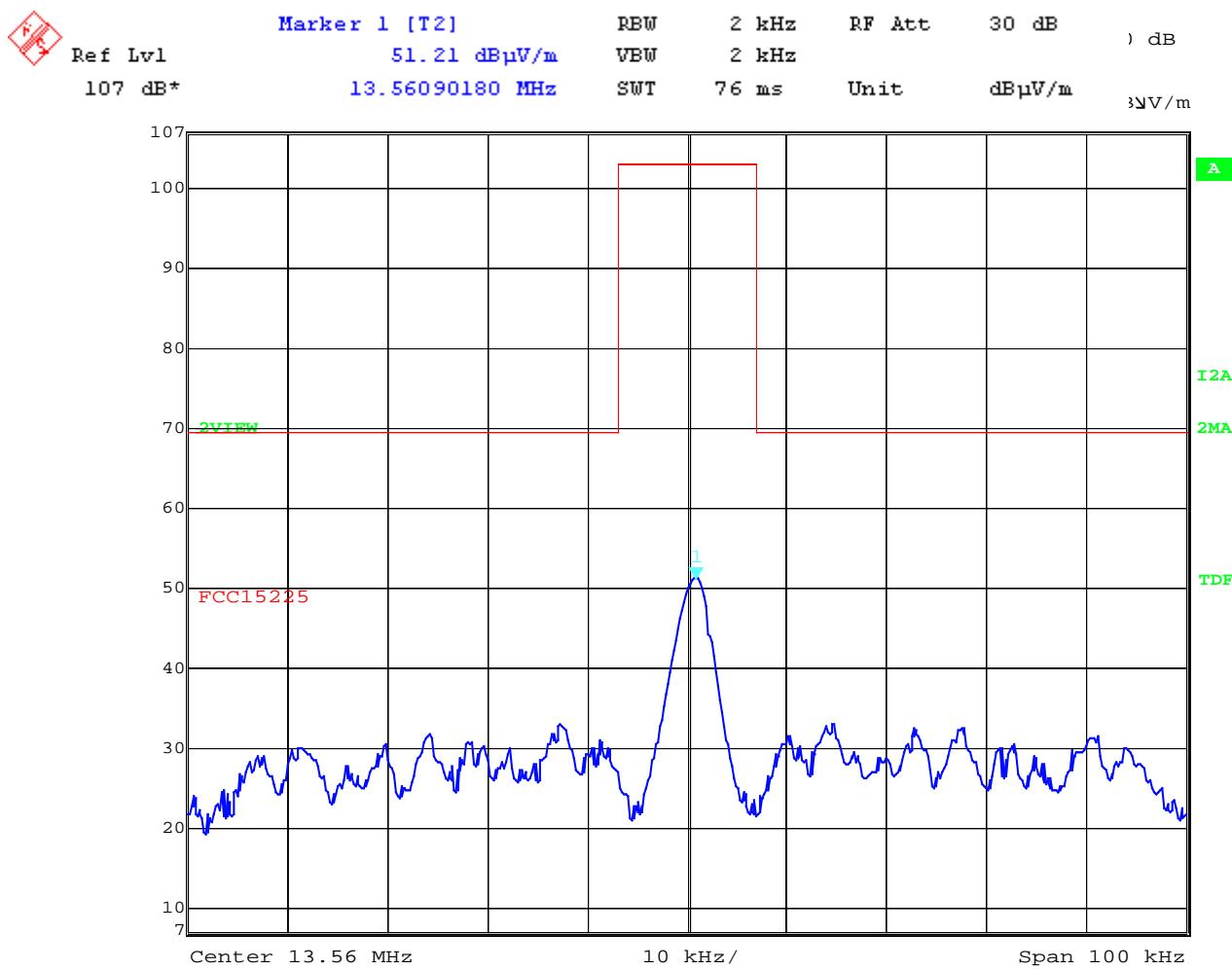




Company: Tyco Healthcare / Mallinckrodt
Model Tested: 844003
Report Number: 12456

1250 Peterson Dr., Wheeling, IL 60090

Test Date: 07-18-2006
Company: Liebel-Flarsheim
EUT: Optivantage with RFID
Test: Bandwidth / Band Edges
Operator: Jason Lauer
Comment: + 30 deg. C
Comment: 120 VAC; 60 Hz



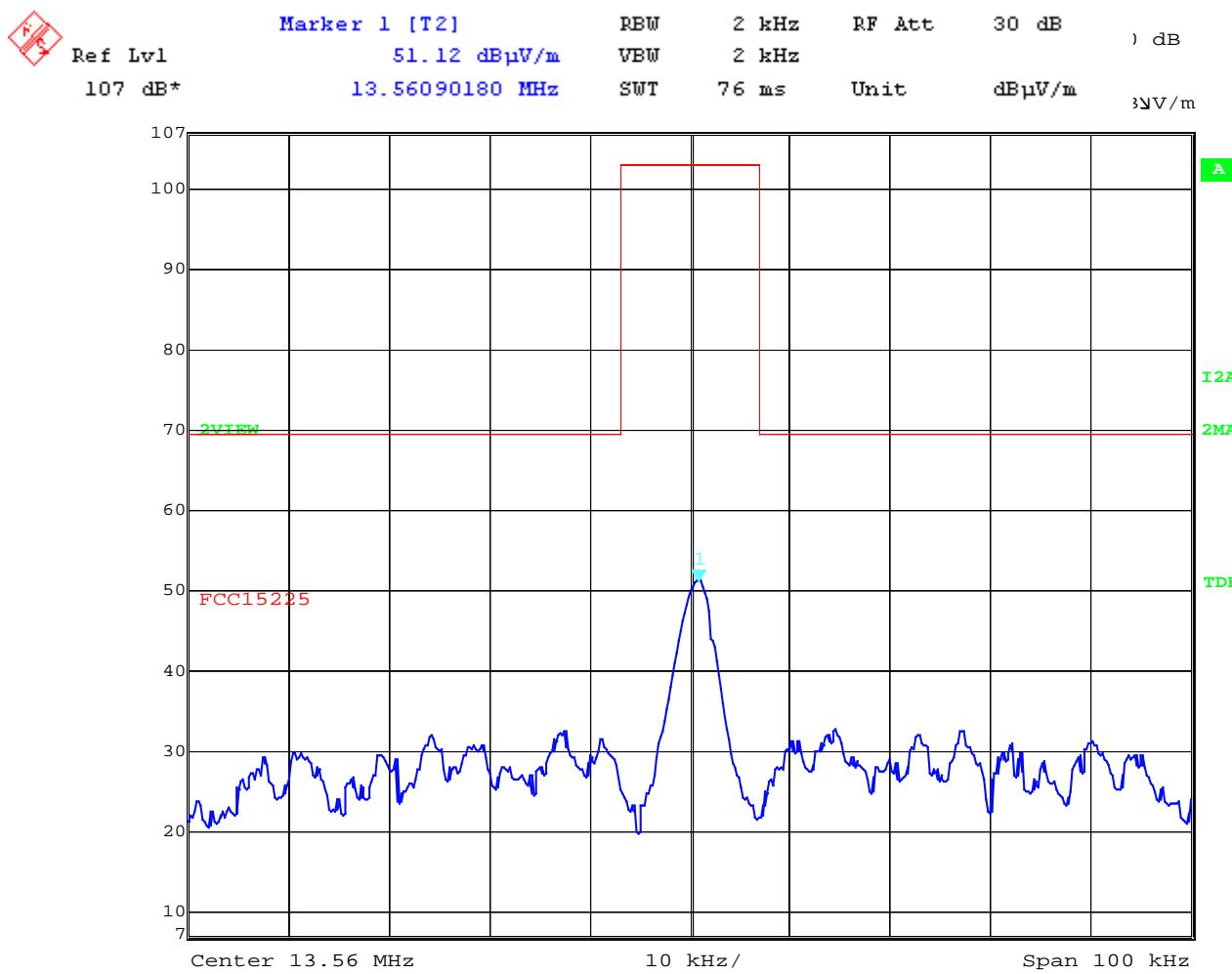
Date: 17.JUL.2006 22:40:19



Company: Tyco Healthcare / Mallinckrodt
Model Tested: 844003
Report Number: 12456

1250 Peterson Dr., Wheeling, IL 60090

Test Date: 07-18-2006
Company: Liebel-Flarsheim
EUT: Optivantage with RFID
Test: Bandwidth / Band Edges
Operator: Jason Lauer
Comment: + 40 deg. C
Comment: 120 VAC; 60 Hz

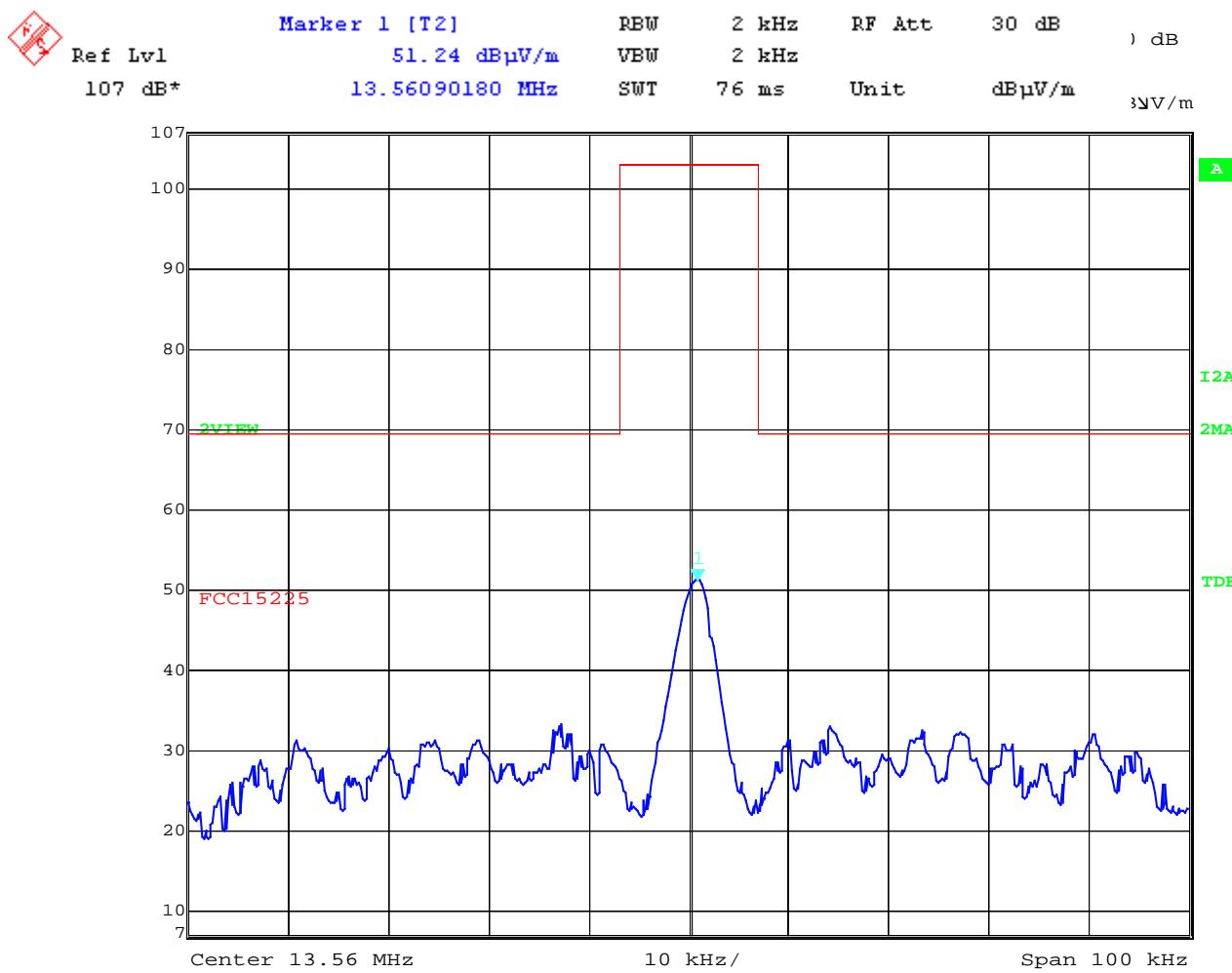




Company: Tyco Healthcare / Mallinckrodt
Model Tested: 844003
Report Number: 12456

1250 Peterson Dr., Wheeling, IL 60090

Test Date: 07-18-2006
Company: Liebel-Flarsheim
EUT: Optivantage with RFID
Test: Bandwidth / Band Edges
Operator: Jason Lauer
Comment: + 50 deg. C
Comment: 120 VAC; 60 Hz



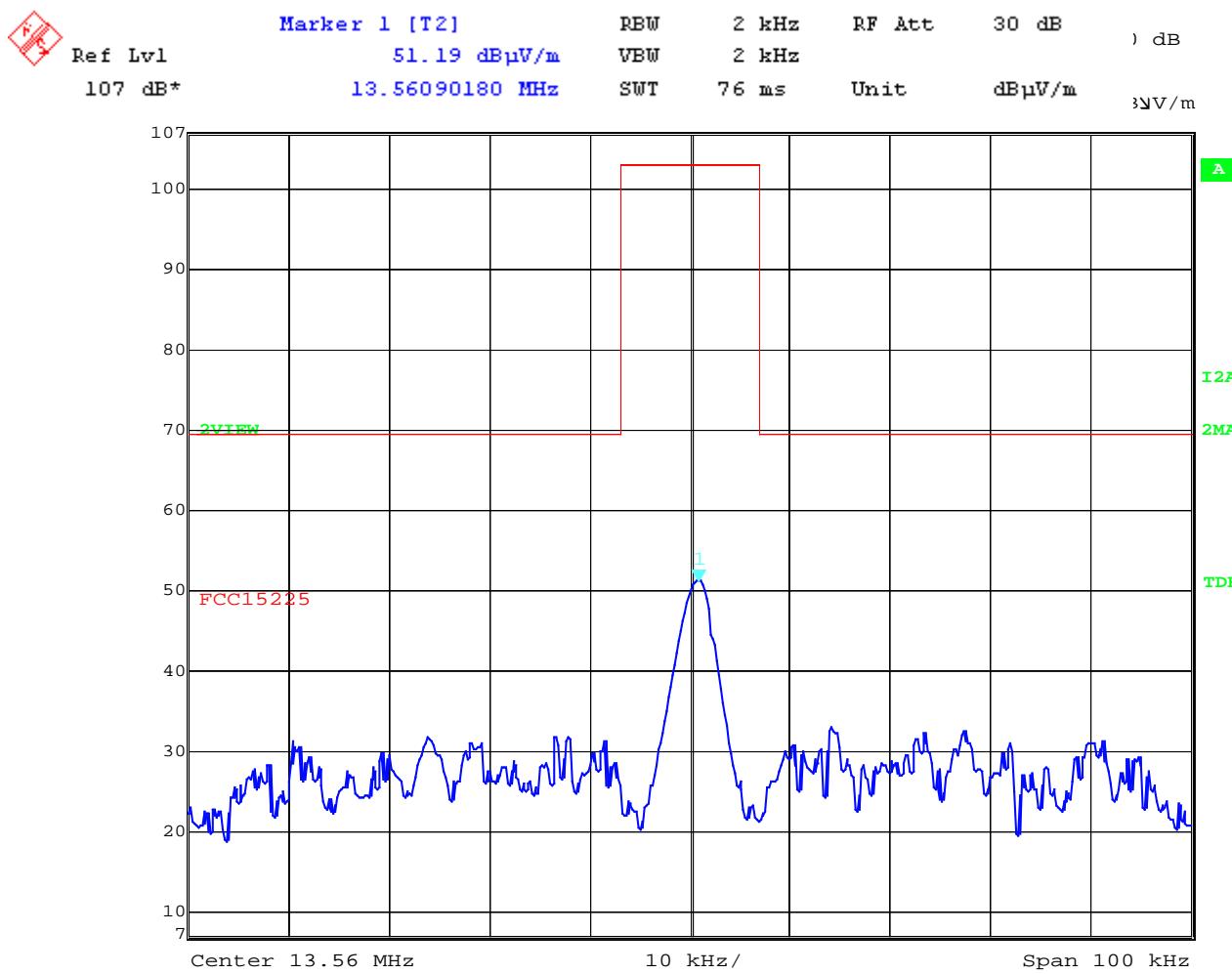
Date: 17.JUL.2006 23:17:13



Company: Tyco Healthcare / Mallinckrodt
Model Tested: 844003
Report Number: 12456

1250 Peterson Dr., Wheeling, IL 60090

Test Date: 07-18-2006
Company: Liebel-Flarsheim
EUT: Optivantage with RFID
Test: Bandwidth / Band Edges
Operator: Jason Lauer
Comment: + 30 deg. C
Comment: 102 VAC; 60 Hz



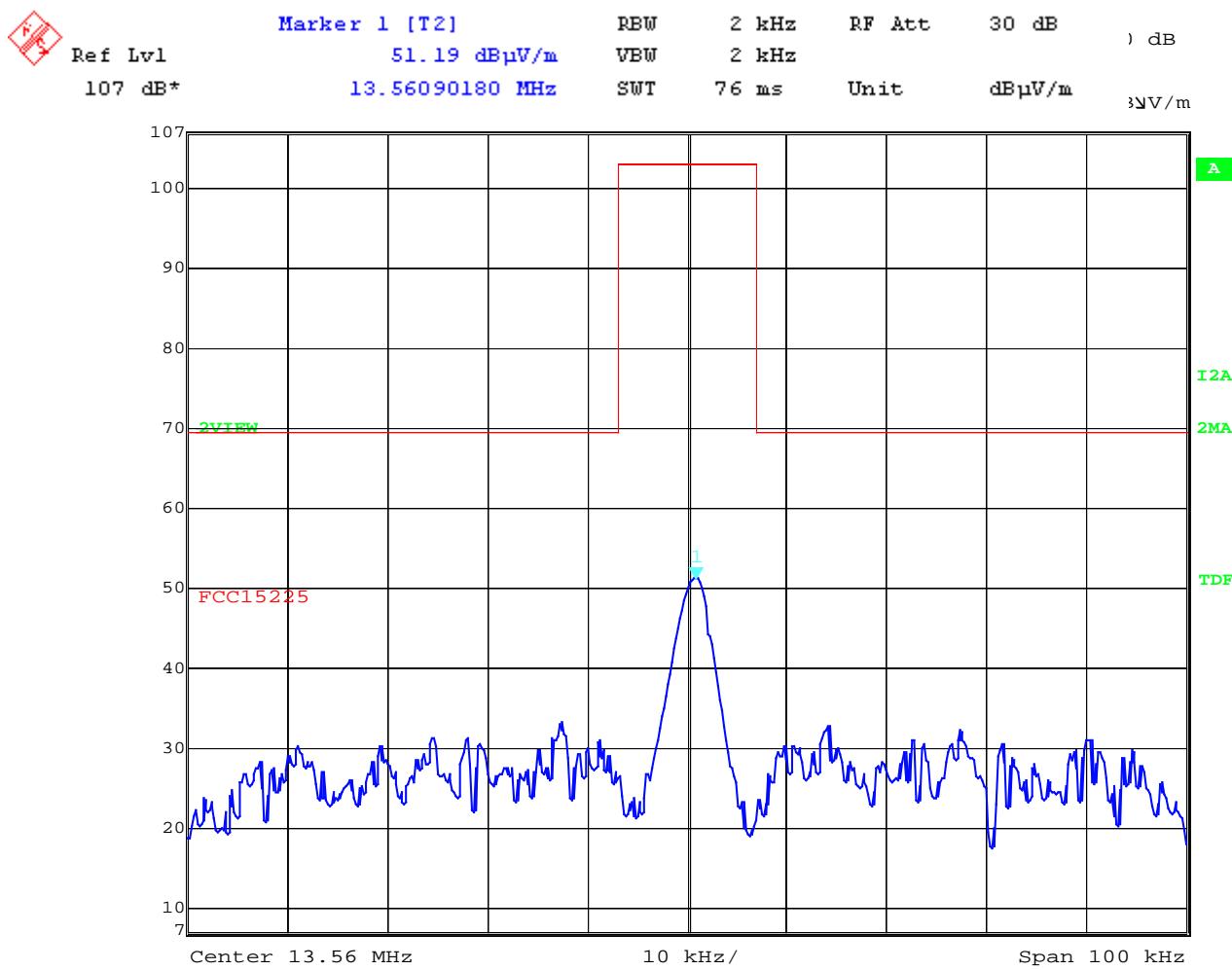
Date: 17.JUL.2006 22:45:25



Company: Tyco Healthcare / Mallinckrodt
Model Tested: 844003
Report Number: 12456

1250 Peterson Dr., Wheeling, IL 60090

Test Date: 07-18-2006
Company: Liebel-Flarsheim
EUT: Optivantage with RFID
Test: Bandwidth / Band Edges
Operator: Jason Lauer
Comment: + 30 deg. C
Comment: 138 VAC; 60 Hz



Date: 17.JUL.2006 22:44:26



Company: Tyco Healthcare / Mallinckrodt
Model Tested: 844003
Report Number: 12456

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 OptiVantage, Model Number: 844003, 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 OptiVantage 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.



1250 Peterson Dr., Wheeling, IL 60090

Company: Tyco Healthcare / Mallinckrodt
Model Tested: 844003
Report Number: 12456

APPENDIX A

RADIATED DATA AND GRAPHS TAKEN FOR

FUNDAMENTAL FIELD STRENGTH

SPURIOUS EMISSION MEASUREMENTS

PART 15.225

Radiated Field Strength

EUT: Optivantage with RFID
Manufacturer: Liebel-Flarsheim
Operating Condition: 70 deg F; 67% R.H.
Test Site: DLS O.F. Site 3
Operator: Jason Lauer
Test Specification: 120 VAC; 60 Hz
Comment: 13.56 MHz Transmit and Receive
DATE: 07/11/2006

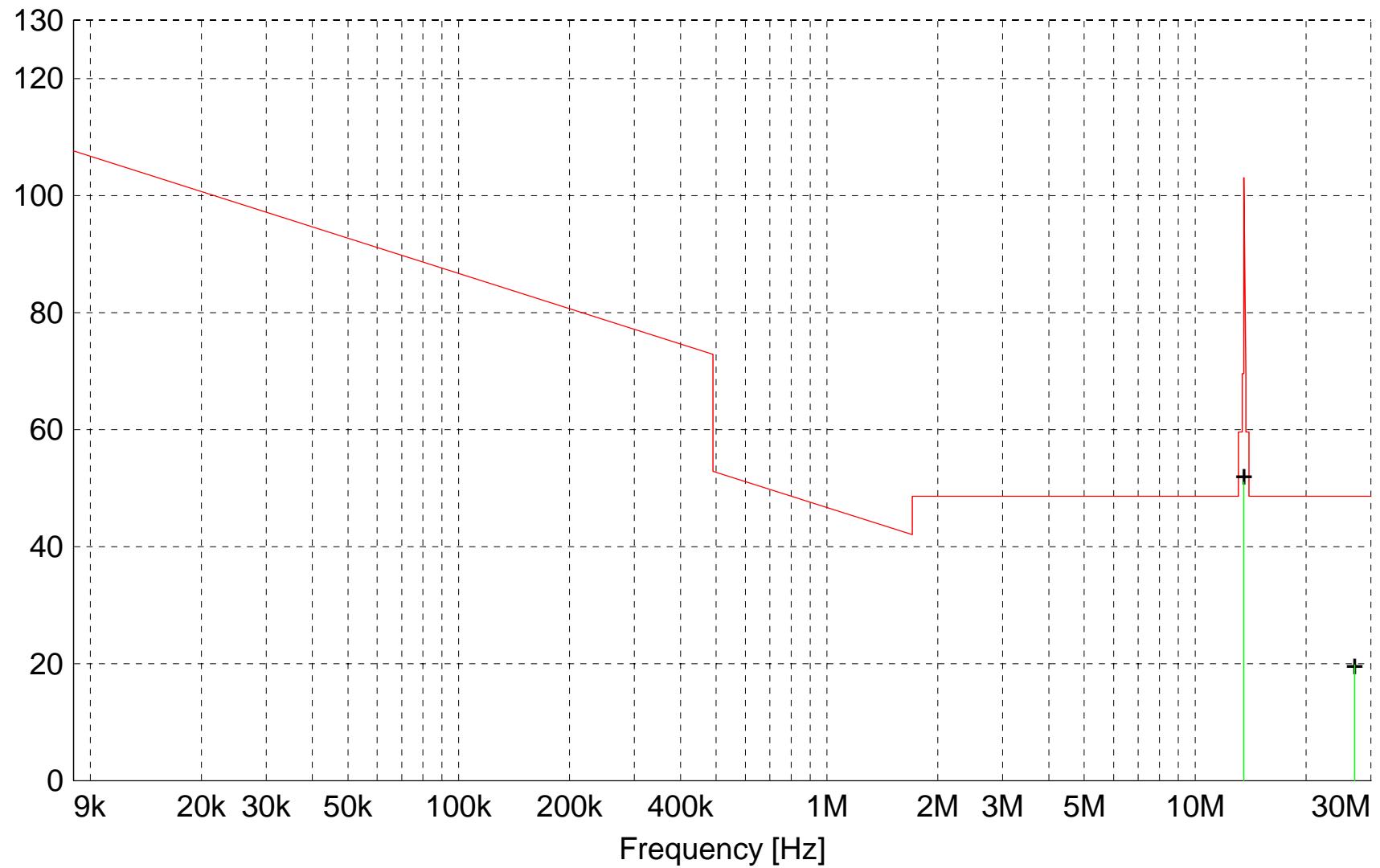
TEXT: "Site 3 LowH 10M Act"

Short Description: Test Set-up 9kHz to 30MHz H
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI40 SN: 837808/005

Antennas --- EMCO Active Loop Model: 6502 SN: 2038

TEST SET-UP: EuT Measured at 10 Meters with H-FIELD Antenna

Level [dB μ V/m]



||||| MES A711a_FE_Quasi-Peak
+ + · MES A711a_FE_Peak_List
— LIM FCC 15.225

FCC Part 15.209/225 Limit

MEASUREMENT RESULT: "A711a_FE_Final"

7/11/2006 9:58AM

Frequency MHz	Level dB μ V	Antenna Factor dB μ V/m	System Loss dB	Total Level dB μ V/m	Limit dB μ V/m	Margin dB	Height m	EuT Ant.	Final Angle deg	Detector	Comment
27.120000	9.61	8.58	1.6	19.8	48.6	28.8	1.00	245	QUASI-PEAK	Harmonic	
13.560000	39.48	10.41	1.2	51.1	103.1	52.0	1.00	245	QUASI-PEAK	Fundamental	



Company: Tyco Healthcare / Mallinckrodt
Model Tested: 844003
Report Number: 12456

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

RADIATED DATA TAKEN FOR

FIELD STRENGTH

SPURIOUS EMISSION MEASUREMENTS

PART 15.209

Radiated Field Strength

EUT: Optivantage with RFID
Manufacturer: Liebel-Flarsheim
Operating Condition: 70 deg F; 67% R.H.
Test Site: DLS O.F. Site 3
Operator: Jason Lauer
Test Specification: 120 VAC; 60 Hz
Comment: 13.56 MHz Transmit and Receive
DATE: 07/12/2006

TEXT: "Site 3 MidV 3M"

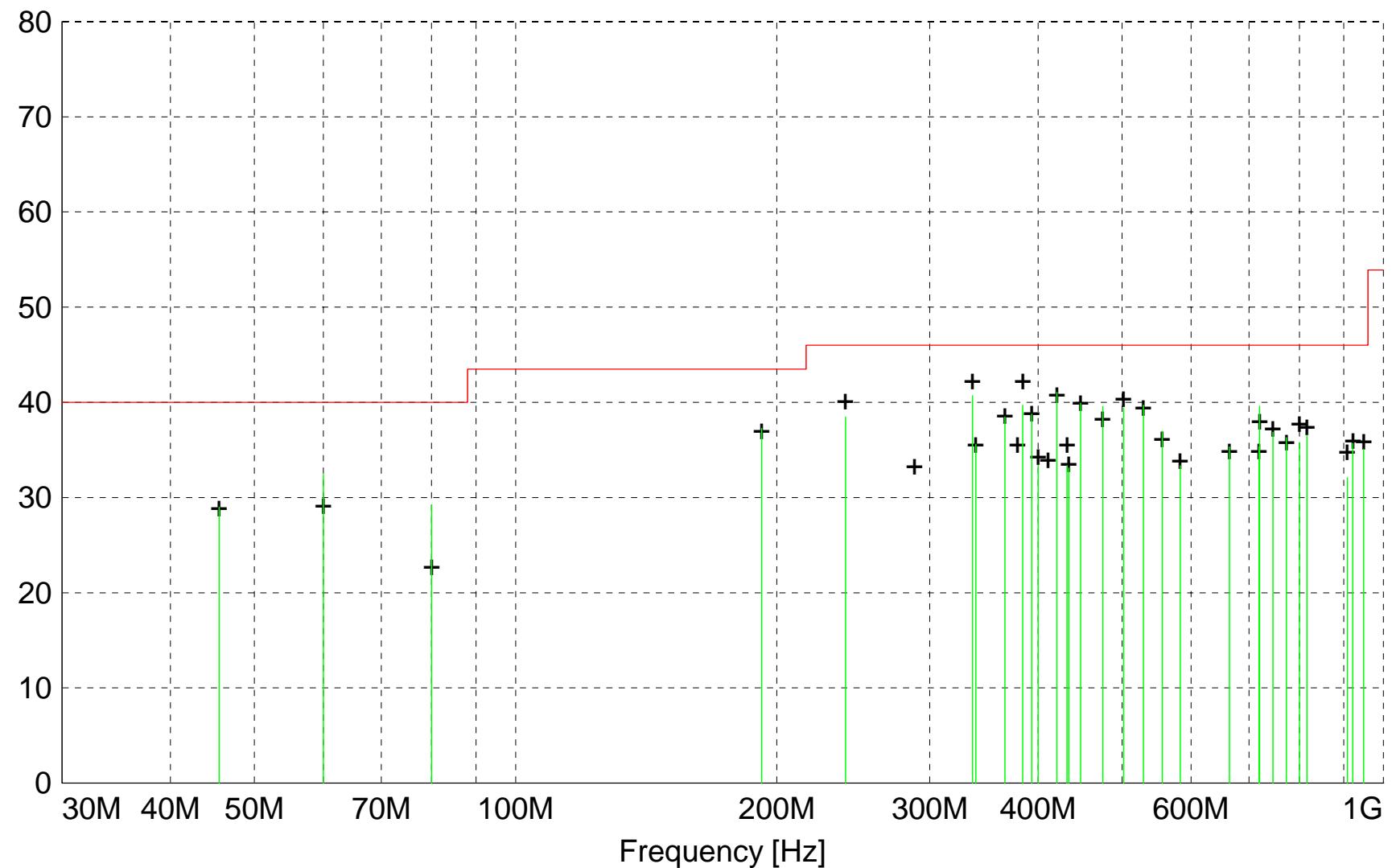
Short Description: Test Set-up Vert30-1000MHz
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005

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

Pre-Amp --- Rohde&Schwarz TS-PR10 SN: 032001/005

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

Level [dB μ V/m]



||||| MES A711f_F1V_Quasi-Peak

++- MES A711f_F1V_Peak_List

— LIM FCC ClassB F QP/AV Field Strength FCC Class B 3m

MEASUREMENT RESULT: "A711f_F1V_Final"

7/12/2006 3:07PM

Frequency MHz	Level dB μ V	Antenna Factor dB μ V/m	System Loss dB	Total Level dB μ V/m	Limit dB μ V/m	Margin dB	Height Ant. m	EuT Angle deg	Final Detector	Comment
420.360000	46.31	15.90	-21.2	41.0	46.0	5.0	1.20	260	QUASI-PEAK	Harmonic
335.990000	47.87	14.34	-21.5	40.7	46.0	5.3	1.50	305	QUASI-PEAK	None
447.500000	44.86	16.15	-21.1	39.9	46.0	6.1	1.20	262	QUASI-PEAK	Harmonic
192.000000	43.35	16.47	-22.6	37.3	43.5	6.2	1.00	332	QUASI-PEAK	None
528.850000	42.60	17.75	-20.6	39.7	46.0	6.3	1.00	235	QUASI-PEAK	Harmonic
384.020000	46.25	14.86	-21.4	39.7	46.0	6.3	1.30	330	QUASI-PEAK	None
720.010000	37.68	20.56	-18.7	39.6	46.0	6.4	1.00	34	QUASI-PEAK	None
474.610000	43.38	17.09	-20.9	39.6	46.0	6.4	1.10	242	QUASI-PEAK	Harmonic
501.720000	42.59	17.60	-20.8	39.4	46.0	6.6	1.00	249	QUASI-PEAK	Harmonic
393.250000	44.94	15.08	-21.3	38.7	46.0	7.3	1.30	264	QUASI-PEAK	Harmonic
240.000000	49.67	11.11	-22.3	38.5	46.0	7.5	1.00	323	QUASI-PEAK	None
366.140000	45.74	14.29	-21.6	38.5	46.0	7.5	1.40	278	QUASI-PEAK	Harmonic
60.000000	47.11	9.31	-24.0	32.4	40.0	7.6	1.00	139	QUASI-PEAK	None
555.970000	39.13	18.29	-20.5	37.0	46.0	9.0	1.00	221	QUASI-PEAK	Harmonic
745.810000	34.38	20.65	-18.2	36.8	46.0	9.2	1.00	343	QUASI-PEAK	Harmonic
816.010000	34.45	21.17	-19.1	36.6	46.0	9.4	1.00	300	QUASI-PEAK	None
772.930000	34.24	20.77	-18.7	36.3	46.0	9.7	1.70	351	QUASI-PEAK	Harmonic
800.040000	34.40	20.57	-19.2	35.8	46.0	10.2	1.00	356	QUASI-PEAK	Harmonic
922.110000	31.39	22.33	-18.0	35.7	46.0	10.3	1.10	294	QUASI-PEAK	Harmonic
339.000000	42.76	14.31	-21.5	35.6	46.0	10.4	1.50	280	QUASI-PEAK	Harmonic
718.690000	33.44	20.57	-18.7	35.3	46.0	10.7	1.50	198	QUASI-PEAK	Harmonic
664.460000	35.26	19.93	-19.9	35.3	46.0	10.7	1.00	202	QUASI-PEAK	Harmonic
80.000000	46.25	6.72	-23.7	29.2	40.0	10.8	1.00	161	QUASI-PEAK	None
949.220000	30.14	22.58	-17.6	35.1	46.0	10.9	1.10	299	QUASI-PEAK	Harmonic
45.510000	41.82	11.32	-24.2	29.0	40.0	11.0	1.00	268	QUASI-PEAK	None
400.010000	39.22	15.40	-21.2	33.4	46.0	12.6	1.50	323	QUASI-PEAK	None
431.990000	38.58	15.88	-21.1	33.3	46.0	12.7	1.50	20	QUASI-PEAK	None
583.110000	35.43	18.41	-20.5	33.3	46.0	12.7	1.00	233	QUASI-PEAK	Harmonic
433.920000	38.31	15.89	-21.1	33.1	46.0	12.9	1.20	250	QUASI-PEAK	Harmonic
908.540000	28.24	22.07	-18.2	32.1	46.0	13.9	1.00	233	QUASI-PEAK	Harmonic

Radiated Field Strength

EUT: Optivantage with RFID
Manufacturer: Liebel-Flarsheim
Operating Condition: 70 deg F; 67% R.H.
Test Site: DLS O.F. Site 3
Operator: Jason Lauer
Test Specification: 120 VAC; 60 Hz
Comment: 13.56 MHz Transmit and Receive
DATE: 07/12/2006

TEXT: "Site 3 MidH 3M"

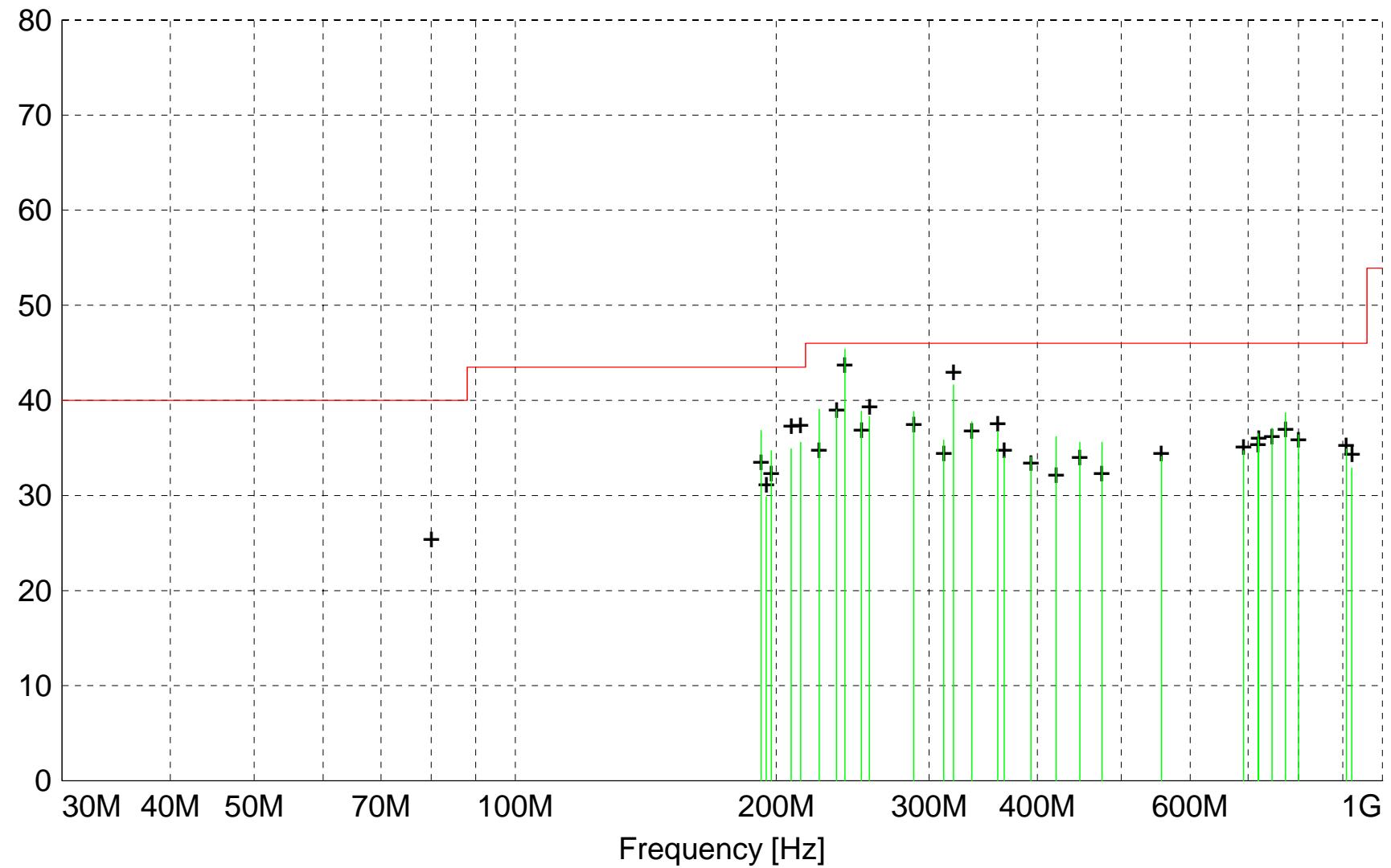
Short Description: Test Set-up Horz30-1000MHz
TEST EQUIPMENT: Receiver --- Rohde&Schwarz ESI 40 SN: 837808/005

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

Pre-Amp --- Rohde&Schwarz TS-PR10 SN: 032001/005

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

Level [dB μ V/m]



||||| MES A711f_F1H_Quasi-Peak
+ + - MES A711f_F1H_Peak_List
— LIM FCC ClassB F QP/AV Field Strength FCC Class B 3m

MEASUREMENT RESULT: "A711f_F1H_Final"

7/12/2006 3:21PM

Frequency MHz	Level dB μ V	Antenna Factor dB μ V/m	System Loss dB	Total Level dB μ V/m	Limit dB μ V/m	Margin dB	Height Ant. m	EuT Angle deg	Final Detector	Comment
240.000000	56.60	11.11	-22.3	45.4	46.0	0.6	1.20	246	QUASI-PEAK	None
320.000000	49.31	14.13	-21.8	41.6	46.0	4.4	1.20	243	QUASI-PEAK	None
192.000000	42.93	16.47	-22.6	36.8	43.5	6.7	1.40	249	QUASI-PEAK	None
224.010000	50.68	10.55	-22.2	39.1	46.0	6.9	1.20	263	QUASI-PEAK	None
234.670000	50.42	10.86	-22.3	39.0	46.0	7.0	1.10	260	QUASI-PEAK	None
250.670000	49.32	11.84	-22.3	38.9	46.0	7.1	1.00	250	QUASI-PEAK	None
288.010000	47.49	13.20	-21.9	38.8	46.0	7.2	1.00	252	QUASI-PEAK	None
772.940000	36.64	20.77	-18.7	38.7	46.0	7.3	1.50	300	QUASI-PEAK	Harmonic
256.030000	48.39	12.12	-22.2	38.3	46.0	7.7	1.00	255	QUASI-PEAK	None
213.330000	47.43	10.42	-22.2	35.6	43.5	7.9	1.50	270	QUASI-PEAK	None
336.010000	44.93	14.34	-21.5	37.7	46.0	8.3	1.00	337	QUASI-PEAK	None
208.020000	46.14	11.17	-22.4	34.9	43.5	8.6	1.50	253	QUASI-PEAK	None
197.340000	41.00	16.21	-22.5	34.7	43.5	8.8	1.40	249	QUASI-PEAK	None
745.810000	34.62	20.65	-18.2	37.1	46.0	8.9	1.70	300	QUASI-PEAK	Harmonic
360.000000	43.98	14.33	-21.6	36.8	46.0	9.2	1.20	254	QUASI-PEAK	None
718.700000	34.63	20.57	-18.7	36.5	46.0	9.5	1.50	234	QUASI-PEAK	Harmonic
800.060000	34.96	20.57	-19.2	36.4	46.0	9.6	1.50	300	QUASI-PEAK	Harmonic
420.370000	41.46	15.90	-21.2	36.2	46.0	9.8	2.00	325	QUASI-PEAK	Harmonic
720.000000	34.01	20.56	-18.7	35.9	46.0	10.1	1.50	0	QUASI-PEAK	None
311.890000	42.56	15.21	-21.9	35.8	46.0	10.2	1.00	270	QUASI-PEAK	Harmonic
474.600000	39.43	17.09	-20.9	35.6	46.0	10.4	2.00	336	QUASI-PEAK	Harmonic
447.500000	40.54	16.15	-21.1	35.6	46.0	10.4	2.00	317	QUASI-PEAK	Harmonic
908.550000	31.06	22.07	-18.2	34.9	46.0	11.1	1.40	240	QUASI-PEAK	Harmonic
691.570000	33.23	20.70	-19.2	34.7	46.0	11.3	1.50	235	QUASI-PEAK	Harmonic
555.980000	36.28	18.30	-20.5	34.1	46.0	11.9	1.50	258	QUASI-PEAK	Harmonic
366.140000	41.35	14.29	-21.6	34.1	46.0	11.9	2.10	247	QUASI-PEAK	Harmonic
393.260000	40.25	15.08	-21.3	34.1	46.0	11.9	2.00	229	QUASI-PEAK	Harmonic
922.090000	28.58	22.33	-18.0	32.9	46.0	13.1	1.50	224	QUASI-PEAK	Harmonic
194.660000	36.00	16.36	-22.5	29.9	43.5	13.6	1.40	256	QUASI-PEAK	None



Company: Tyco Healthcare / Mallinckrodt
Model Tested: 844003
Report Number: 12456

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 OptiVantage oscillator circuitry to stabilize. The following information was taken:

FREQUENCY STABILITY FOR TEMPERATURE VARIATION IN MHz:

-20°	13.56031463
-10°	13.56038677
0°	13.56038677
+10°	13.56038677
+20°	13.56036273
+30°	13.56035872
+40°	13.56035471
+50°	13.56035471

Worst Case Variance:

72.14 Hz

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

Ambient Frequency: = 13560362.73 Hz

Frequency Tolerance: = 0.0001

13560362.73 * 0.0001 = 1356.04 Hz

This is well within the specified limits.



Company: Tyco Healthcare / Mallinckrodt
Model Tested: 844003
Report Number: 12456

1250 Peterson Dr., Wheeling, IL 60090

GRAPHS TAKEN FOR FREQUENCY

STABILITY WHEN VARYING THE

TEMPERATURE

PART 2.1055A

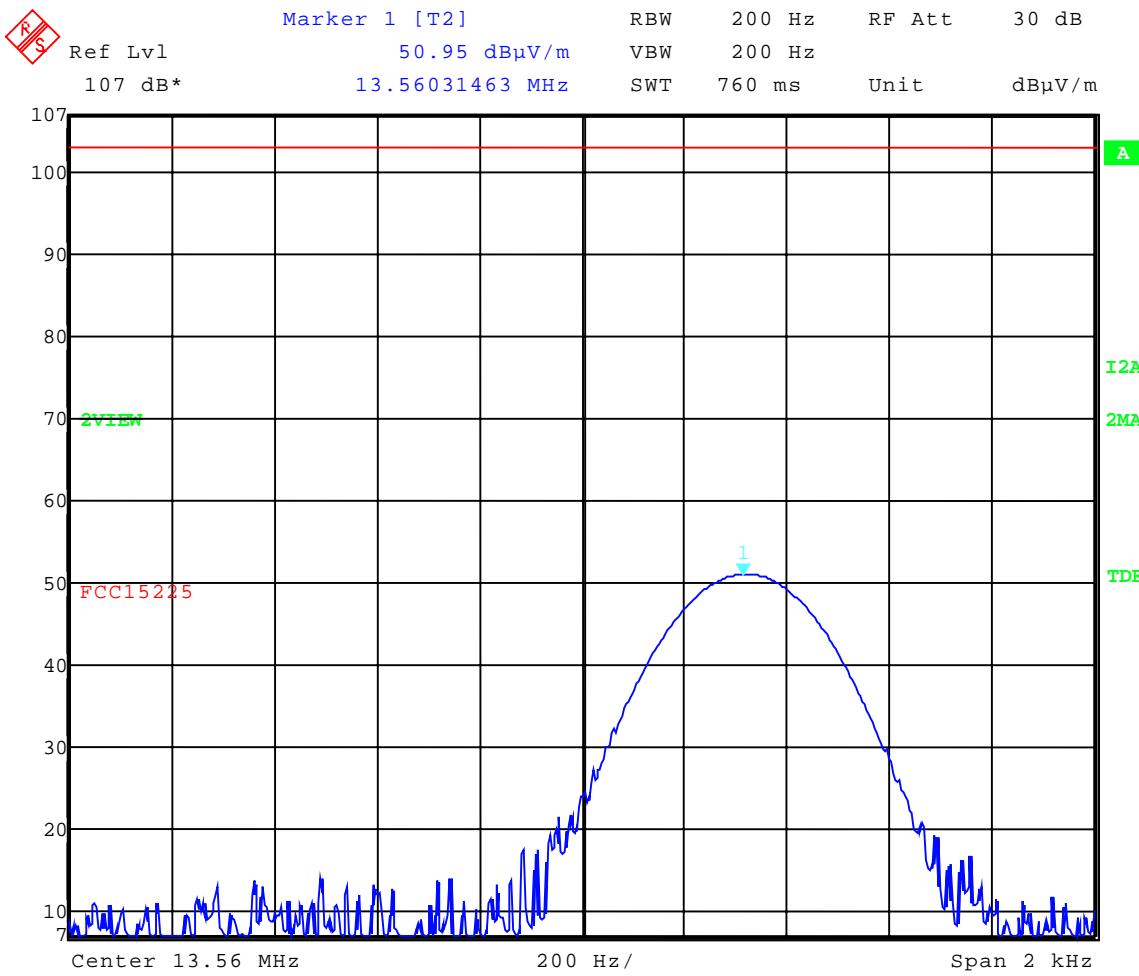
This is well within the specified limits.



Company: Tyco Healthcare / Mallinckrodt
Model Tested: 844003
Report Number: 12456

1250 Peterson Dr., Wheeling, IL 60090

Test Date: 07-18-2006
Company: Liebel-Flarsheim
EUT: Optivantage with RFID
Test: Frequency Stability
Operator: Jason Lauer
Comment: Limit: + or - 1,356 Hz
Comment: - 20 deg. C
Comment: 120 VAC; 60 Hz



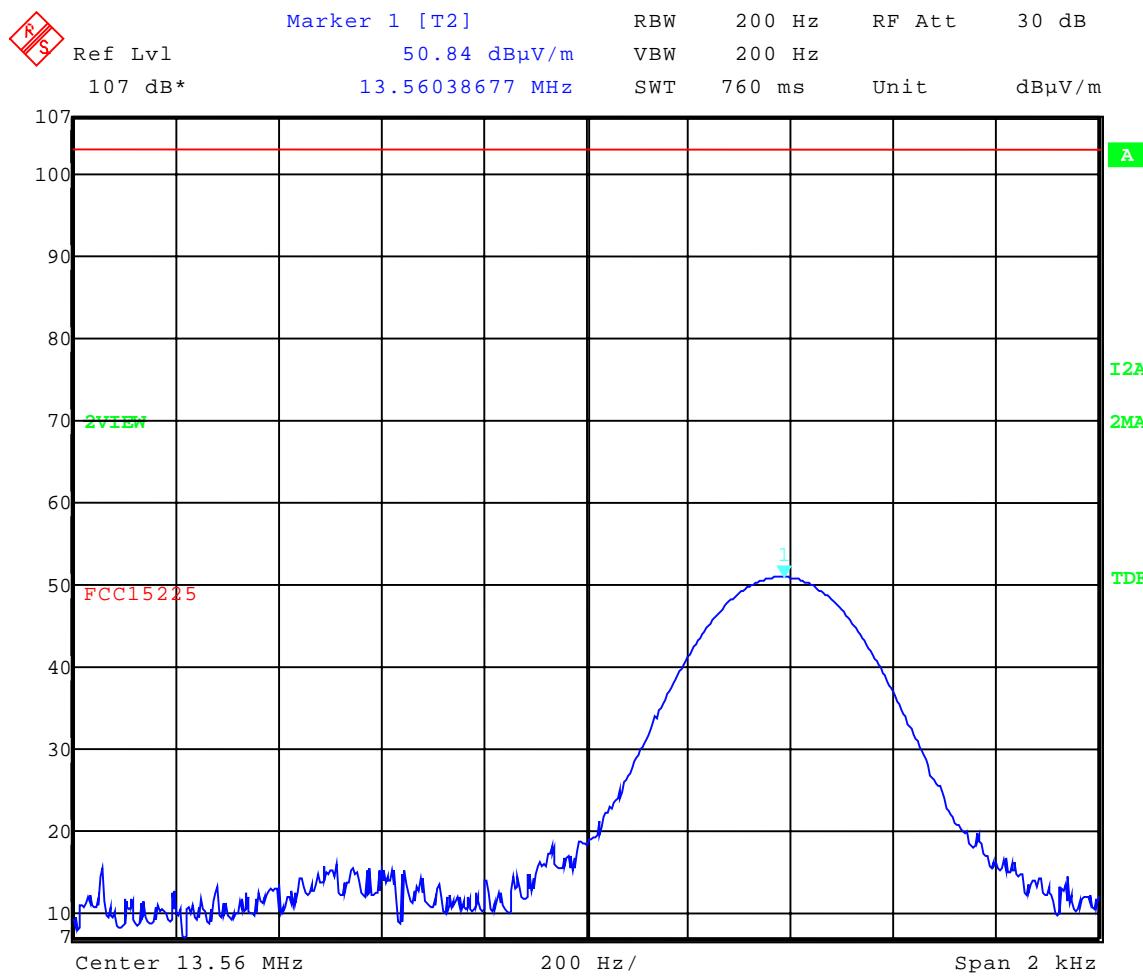
Date: 18.JUL.2006 00:30:05



Company: Tyco Healthcare / Mallinckrodt
Model Tested: 844003
Report Number: 12456

1250 Peterson Dr., Wheeling, IL 60090

Test Date: 07-18-2006
Company: Liebel-Flarsheim
EUT: Optivantage with RFID
Test: Frequency Stability
Operator: Jason Lauer
Comment: Limit: + or - 1,356 Hz
Comment: - 10 deg. C
Comment: 120 VAC; 60 Hz

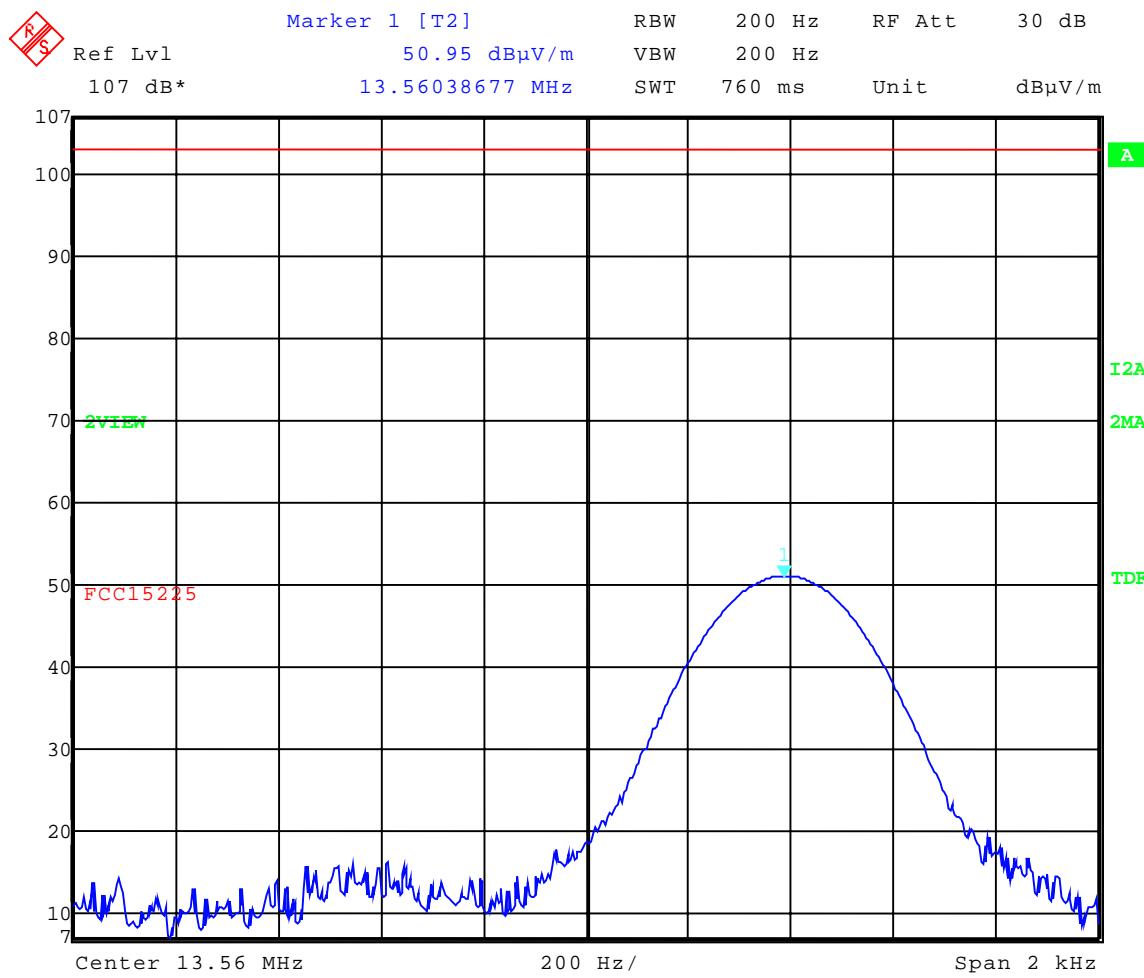




Company: Tyco Healthcare / Mallinckrodt
Model Tested: 844003
Report Number: 12456

1250 Peterson Dr., Wheeling, IL 60090

Test Date: 07-18-2006
Company: Liebel-Flarsheim
EUT: Optivantage with RFID
Test: Frequency Stability
Operator: Jason Lauer
Comment: Limit: + or - 1,356 Hz
Comment: 0 deg. C
Comment: 120 VAC; 60 Hz



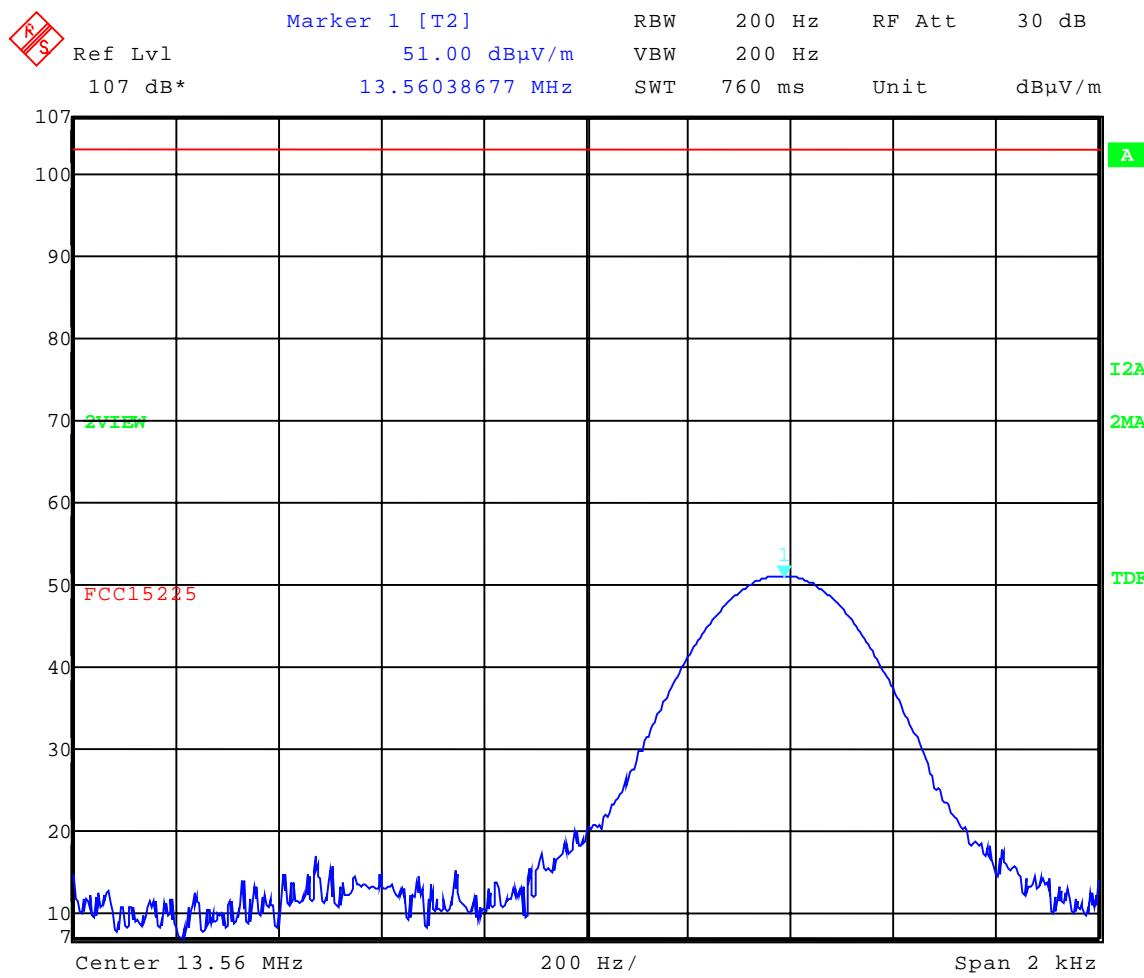
Date: 17.JUL.2006 23:56:09



Company: Tyco Healthcare / Mallinckrodt
Model Tested: 844003
Report Number: 12456

1250 Peterson Dr., Wheeling, IL 60090

Test Date: 07-18-2006
Company: Liebel-Flarsheim
EUT: Optivantage with RFID
Test: Frequency Stability
Operator: Jason Lauer
Comment: Limit: + or - 1,356 Hz
Comment: + 10 deg. C
Comment: 120 VAC; 60 Hz



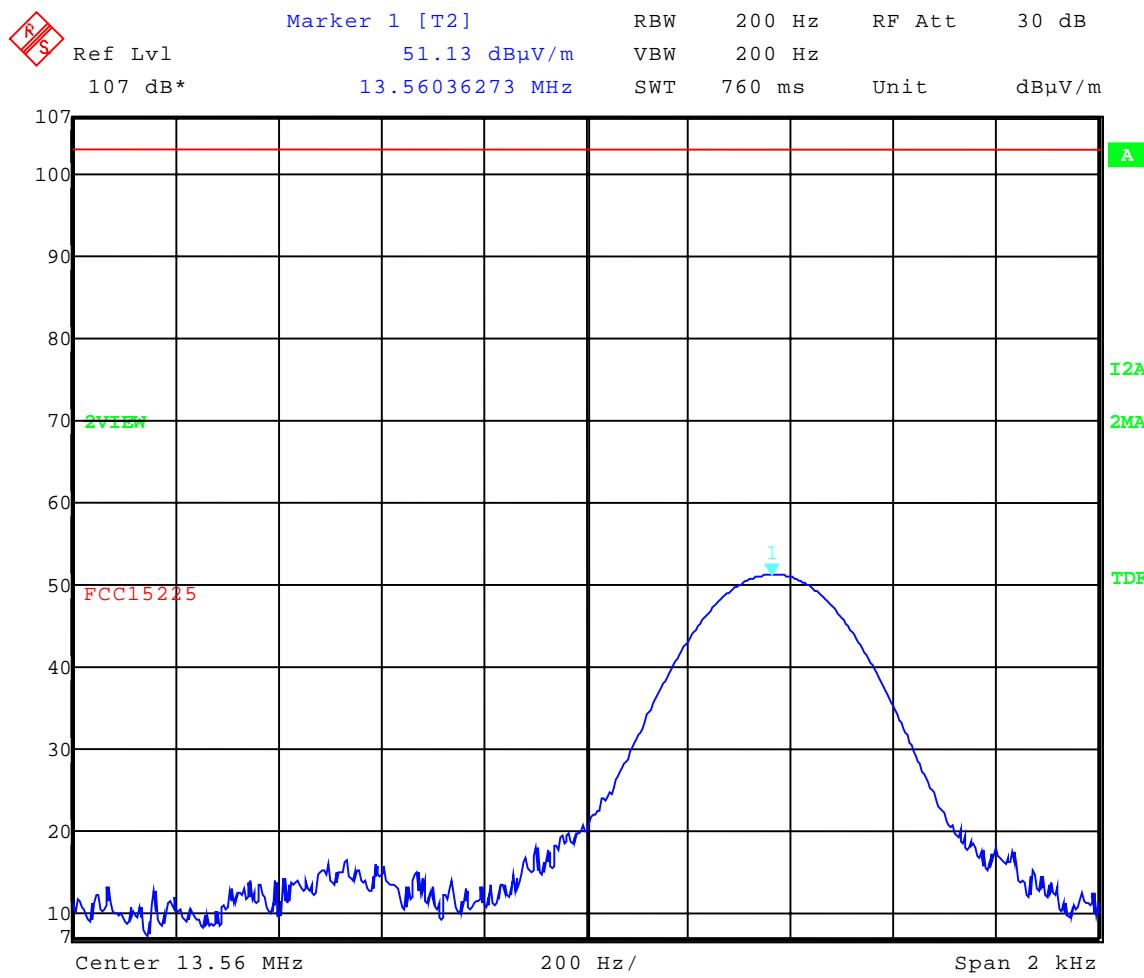
Date: 17.JUL.2006 23:47:22



Company: Tyco Healthcare / Mallinckrodt
Model Tested: 844003
Report Number: 12456

1250 Peterson Dr., Wheeling, IL 60090

Test Date: 07-18-2006
Company: Liebel-Flarsheim
EUT: Optivantage with RFID
Test: Frequency Stability
Operator: Jason Lauer
Comment: Limit: + or - 1,356 Hz
Comment: + 20 deg. C
Comment: 120 VAC; 60 Hz



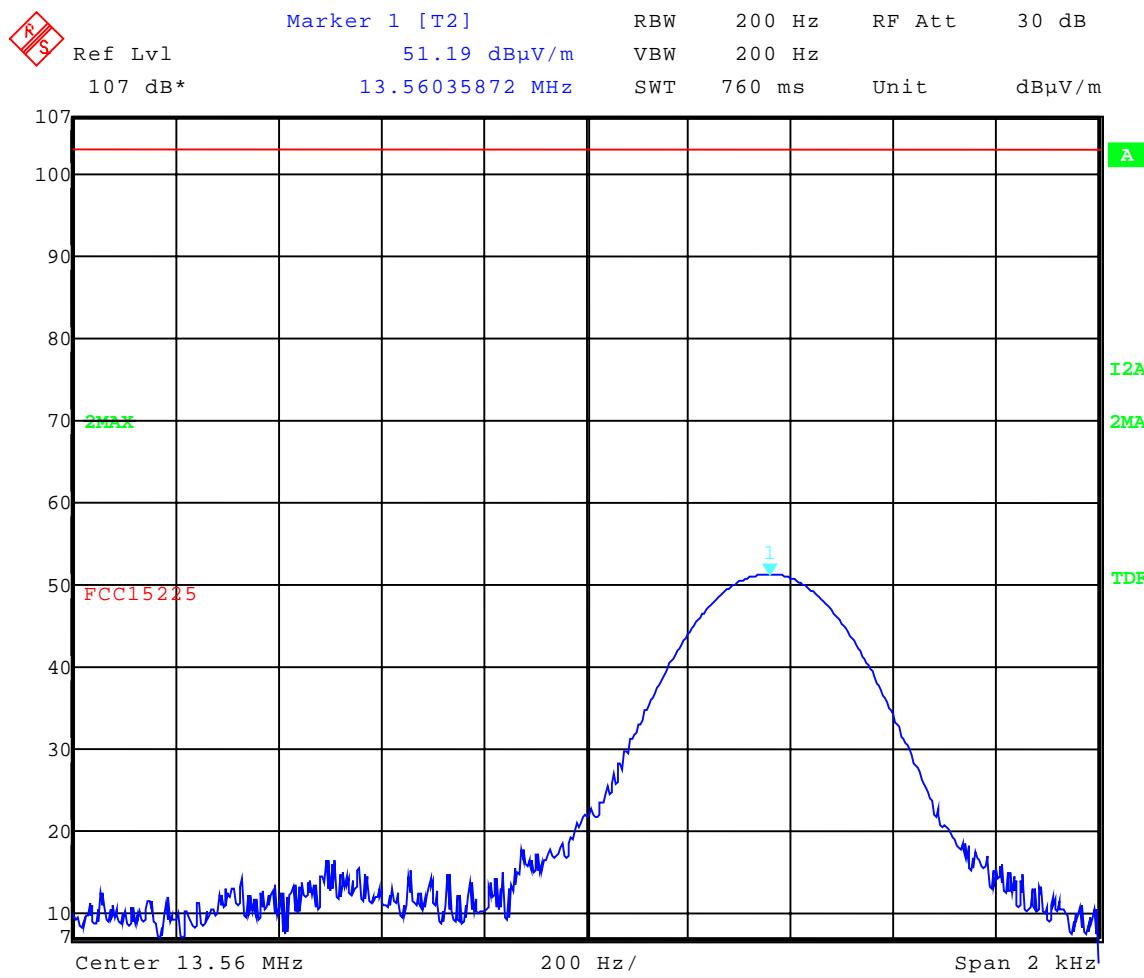
Date: 17.JUL.2006 23:39:31



Company: Tyco Healthcare / Mallinckrodt
Model Tested: 844003
Report Number: 12456

1250 Peterson Dr., Wheeling, IL 60090

Test Date: 07-18-2006
Company: Liebel-Flarsheim
EUT: Optivantage with RFID
Test: Frequency Stability
Operator: Jason Lauer
Comment: Limit: + or - 1,356 Hz
Comment: + 30 deg. C
Comment: 120 VAC; 60 Hz



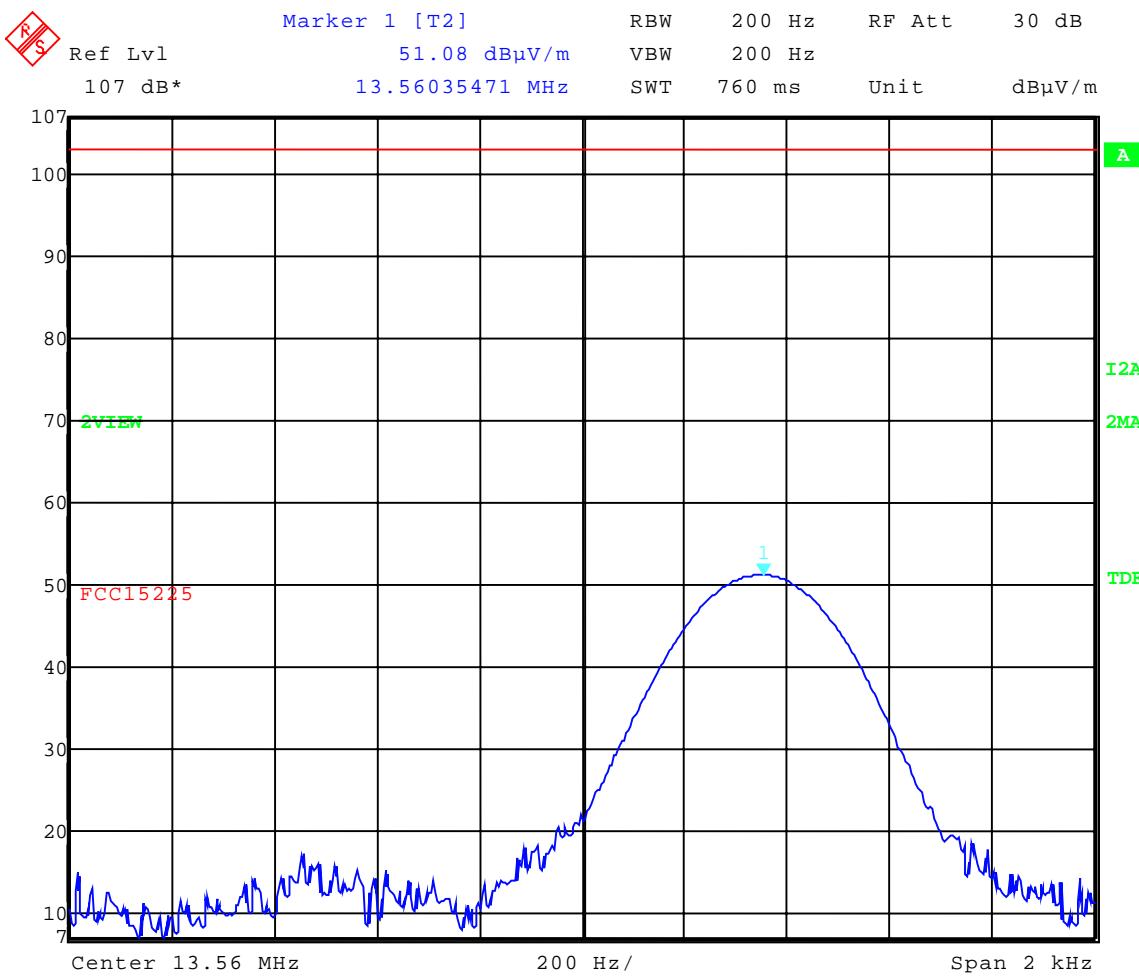
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Company: Tyco Healthcare / Mallinckrodt
Model Tested: 844003
Report Number: 12456

1250 Peterson Dr., Wheeling, IL 60090

Test Date: 07-18-2006
Company: Liebel-Flarsheim
EUT: Optivantage with RFID
Test: Frequency Stability
Operator: Jason Lauer
Comment: Limit: + or - 1,356 Hz
Comment: + 40 deg. C
Comment: 120 VAC; 60 Hz



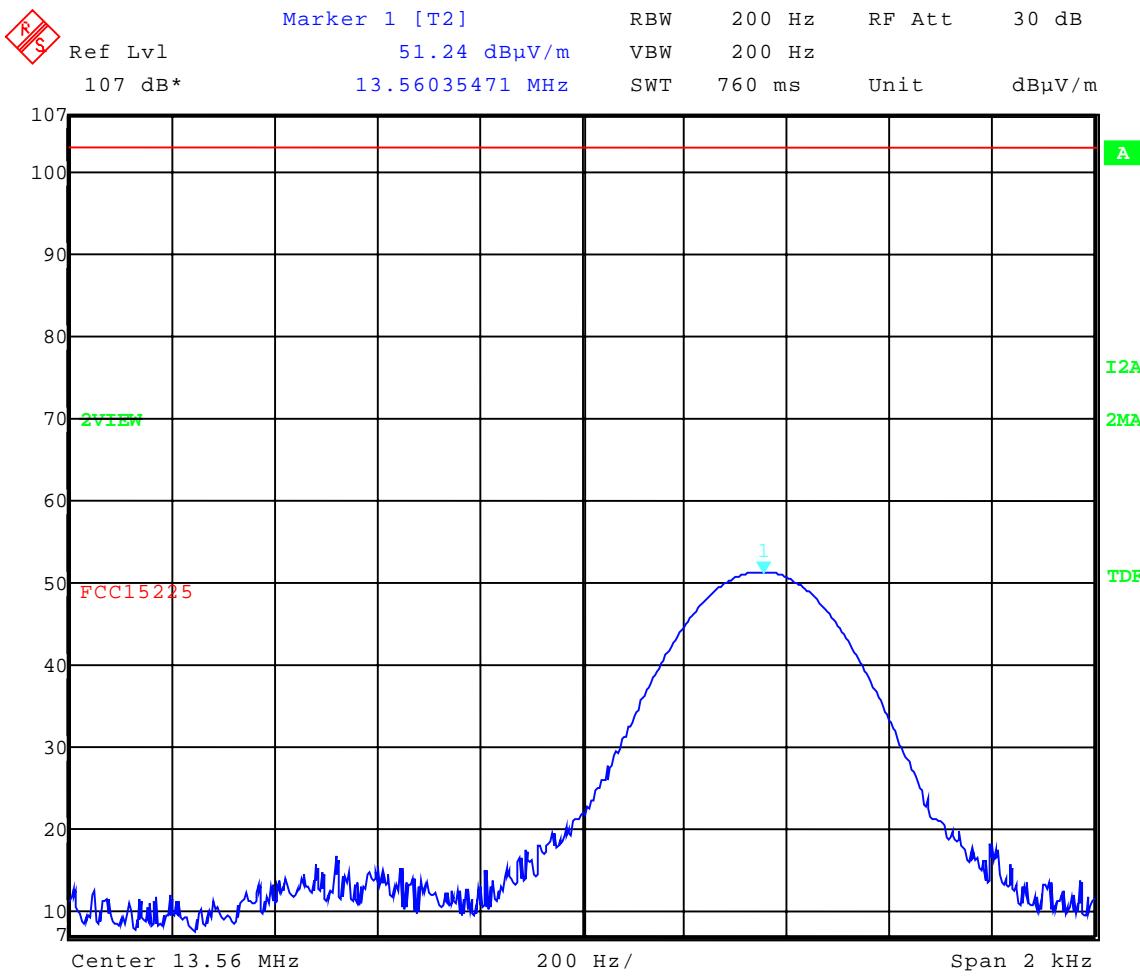
Date: 17.JUL.2006 23:28:19



Company: Tyco Healthcare / Mallinckrodt
Model Tested: 844003
Report Number: 12456

1250 Peterson Dr., Wheeling, IL 60090

Test Date: 07-18-2006
Company: Liebel-Flarsheim
EUT: Optivantage with RFID
Test: Frequency Stability
Operator: Jason Lauer
Comment: Limit: + or - 1,356 Hz
Comment: + 50 deg. C
Comment: 120 VAC; 60 Hz



Date: 17.JUL.2006 23:18:25



Company: Tyco Healthcare / Mallinckrodt
Model Tested: 844003
Report Number: 12456

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

5.0 FREQUENCY STABILITY - PART 2.1055d (Voltage)

The frequency stability of OptiVantage 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%	13.56035471
115%	13.56035070

Worst Case Variance:

4.04 Hz

This is well within the specified limits.

NOTE:

See the following page(s) for the graph(s) of the actual measurement made:



Company: Tyco Healthcare / Mallinckrodt
Model Tested: 844003
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1250 Peterson Dr., Wheeling, IL 60090

GRAPHS TAKEN FOR FREQUENCY

STABILITY WHEN VARYING THE

PRIMARY SUPPLY VOLTAGE

PART 2.1055d

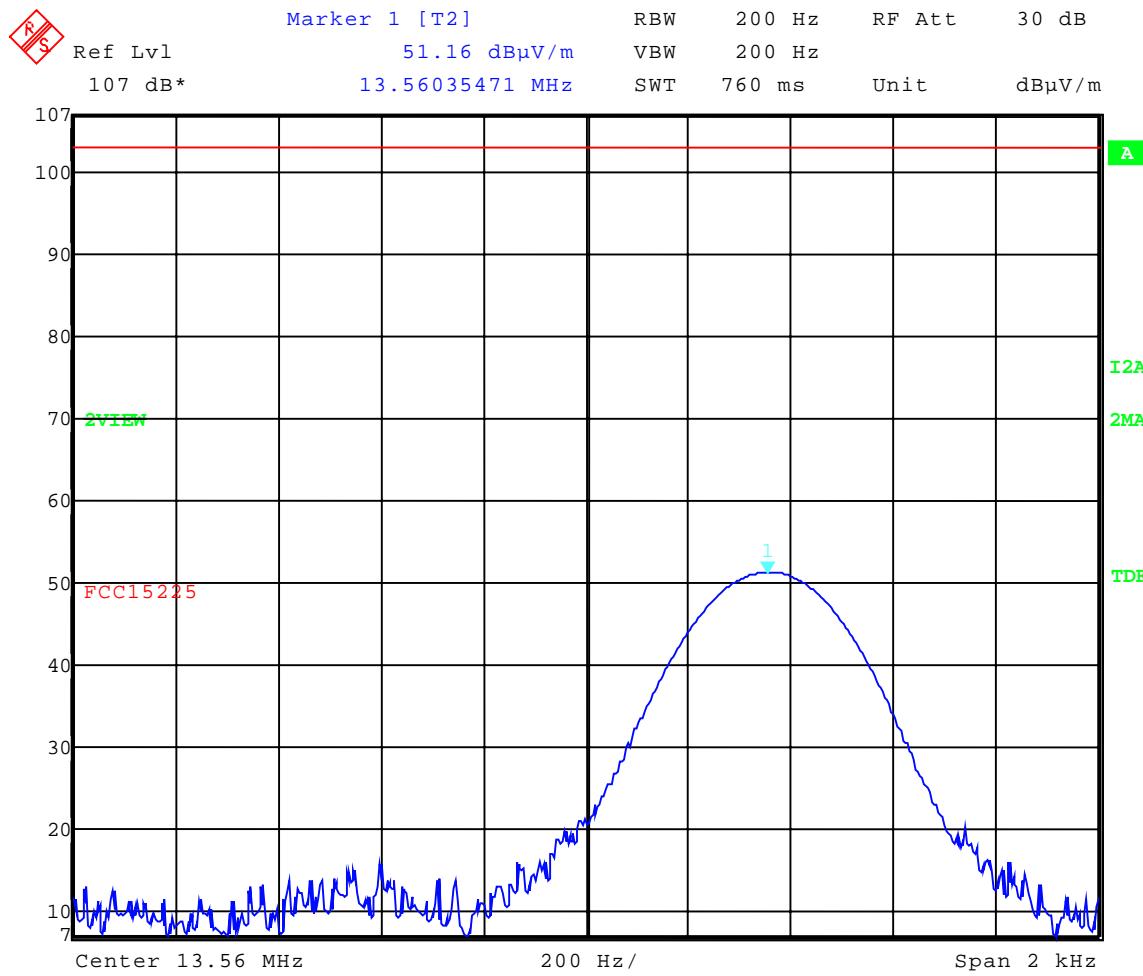
This is well within the specified limits.



Company: Tyco Healthcare / Mallinckrodt
Model Tested: 844003
Report Number: 12456

1250 Peterson Dr., Wheeling, IL 60090

Test Date: 07-18-2006
Company: Liebel-Flarsheim
EUT: Optivantage with RFID
Test: Frequency Stability
Operator: Jason Lauer
Comment: Limit: + or - 1,356 Hz
Comment: + 30 deg. C
Comment: 102 VAC; 60 Hz



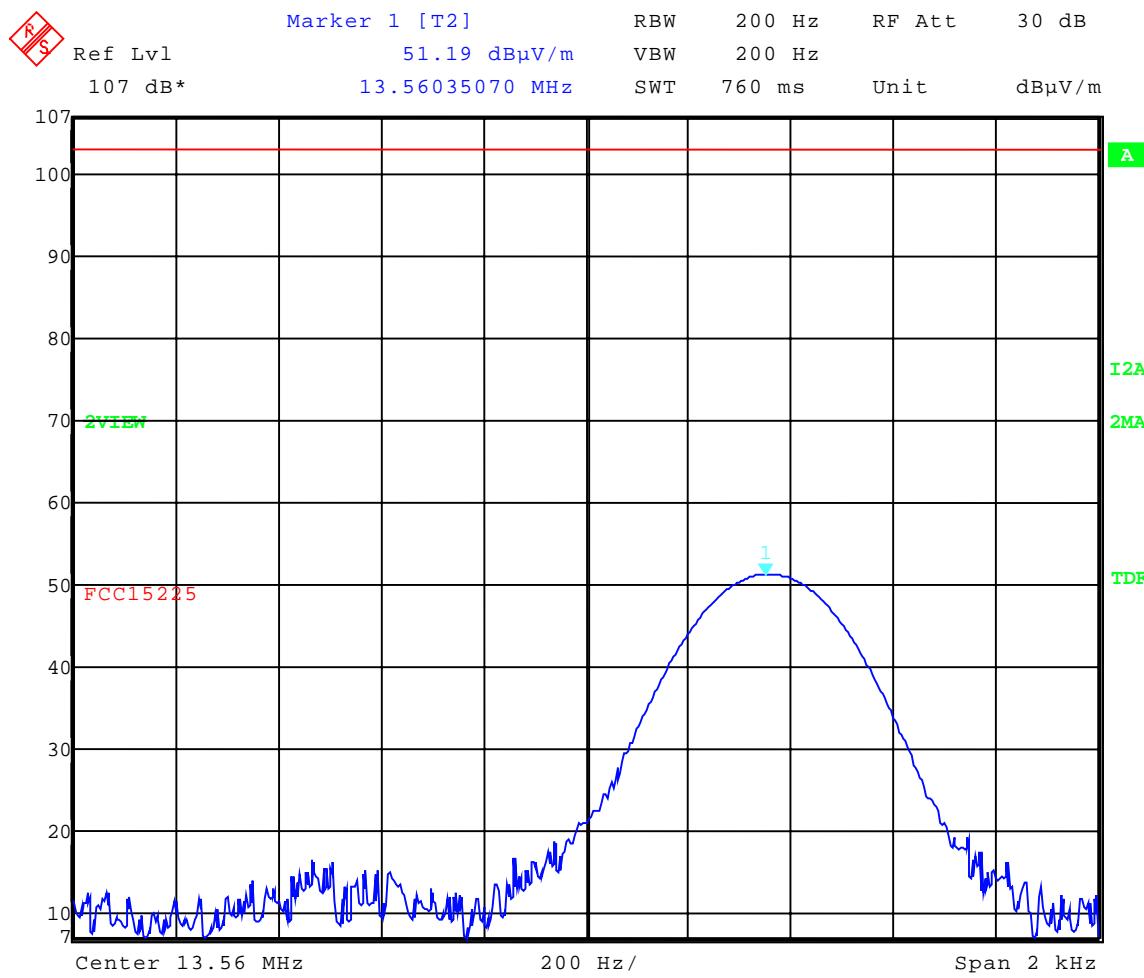
Date: 17.JUL.2006 22:42:32



Company: Tyco Healthcare / Mallinckrodt
Model Tested: 844003
Report Number: 12456

1250 Peterson Dr., Wheeling, IL 60090

Test Date: 07-18-2006
Company: Liebel-Flarsheim
EUT: Optivantage with RFID
Test: Frequency Stability
Operator: Jason Lauer
Comment: Limit: + or - 1,356 Hz
Comment: + 30 deg. C
Comment: 138 VAC; 60 Hz



Date: 17.JUL.2006 22:43:25