L.S. Compliance, Inc.
W66 N220 Commerce Court
Cedarburg, WI 53012
262-375-4400 Fax: 262-375-4248

COMPLIANCE TESTING OF:
Apex Pro CH

PREPARED FOR:

GE Medical Systems Information Technologies
8200 Tower Avenue
Milwaukee, WI 53223

TEST REPORT NUMBER:
303299 Rev. 1

TEST DATE(S):

June 26, 2003

Table of Contents

1. L. S. Compliance In Review

L. S. Compliance, Inc. is located in Cedarburg, Wisconsin – United States.

We may be contacted by:

Mail: L. S. Compliance, Inc.
W66 N220 Commerce Court
Cedarburg, Wisconsin 53012

Phone: 262-375-4400
Fax: 262-375-4248
E-mail: eng@lsr.com

As an EMC Testing Laboratory, our Accreditation and Assessments are recognized through the following:

A2LA – American Association for Laboratory Accreditation
Accreditation based on ISO/IEC 17025 : 2001
with Electrical (EMC) Scope of Accreditation
A2LA Certificate Number: **1255.01**

U. S. Conformity Assessment Body (CAB) Validation
Validated by the European Commission as a U. S. Conformity Assessment Body operating under the U. S. /EU, Mutual Recognition Agreement (MRA) operating under the European Union EMC Directive 89/336/EEC, Article 10.2.
Date of Validation: **January 16, 2001**

Federal Communications Commission (FCC) – USA
Listing of 3 Meter Semi-Anechoic Chamber based on 47CFR 2.948
FCC Registration Number: **90756**

Listing of 3 and 10 meter OATS based on 47CFR 2.948
FCC Registration Number: **90757**

Industry Canada
On-file, 3 Meter Semi-Anechoic Chamber based on 47CFR 2.948
File Number: **IC 3088**

On-file 3 and 10 Meter OATS based on RSS-210
File Number: **IC 3088-A**

2. A2LA Certificate of Accreditation

THE AMERICAN
ASSOCIATION
FOR LABORATORY
ACCREDITATION

ACCREDITED LABORATORY

A2LA has accredited

L.S. COMPLIANCE, INC.
Cedarburg, WI

for technical competence in the field of

Electrical Testing

The accreditation covers the specific tests and types of tests listed on the agreed scope of accreditation. This laboratory meets the requirements of ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration Laboratories" and any additional program requirements in the identified field of testing. Testing and calibration laboratories that comply with this International Standard also operate in accordance with ISO 9001 or ISO 9002 (1994).

Presented this 26th day of March 2003.

President
For the Accreditation Council
Certificate Number 1255.01
Valid to January 31, 2005

For tests or types of tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

3. A2LA Scope of Accreditation

American Association for Laboratory Accreditation

SCOPE OF ACCREDITATION TO ISO/IEC 17025-1999

L.S. COMPLIANCE, INC.
W66 N220 Commerce Court
Cedarburg, WI 53012
James Blaha Phone: 262 375 4400

ELECTRICAL (EMC)

Valid to: January 31, 2005 Certificate Number: 1255-01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following tests:

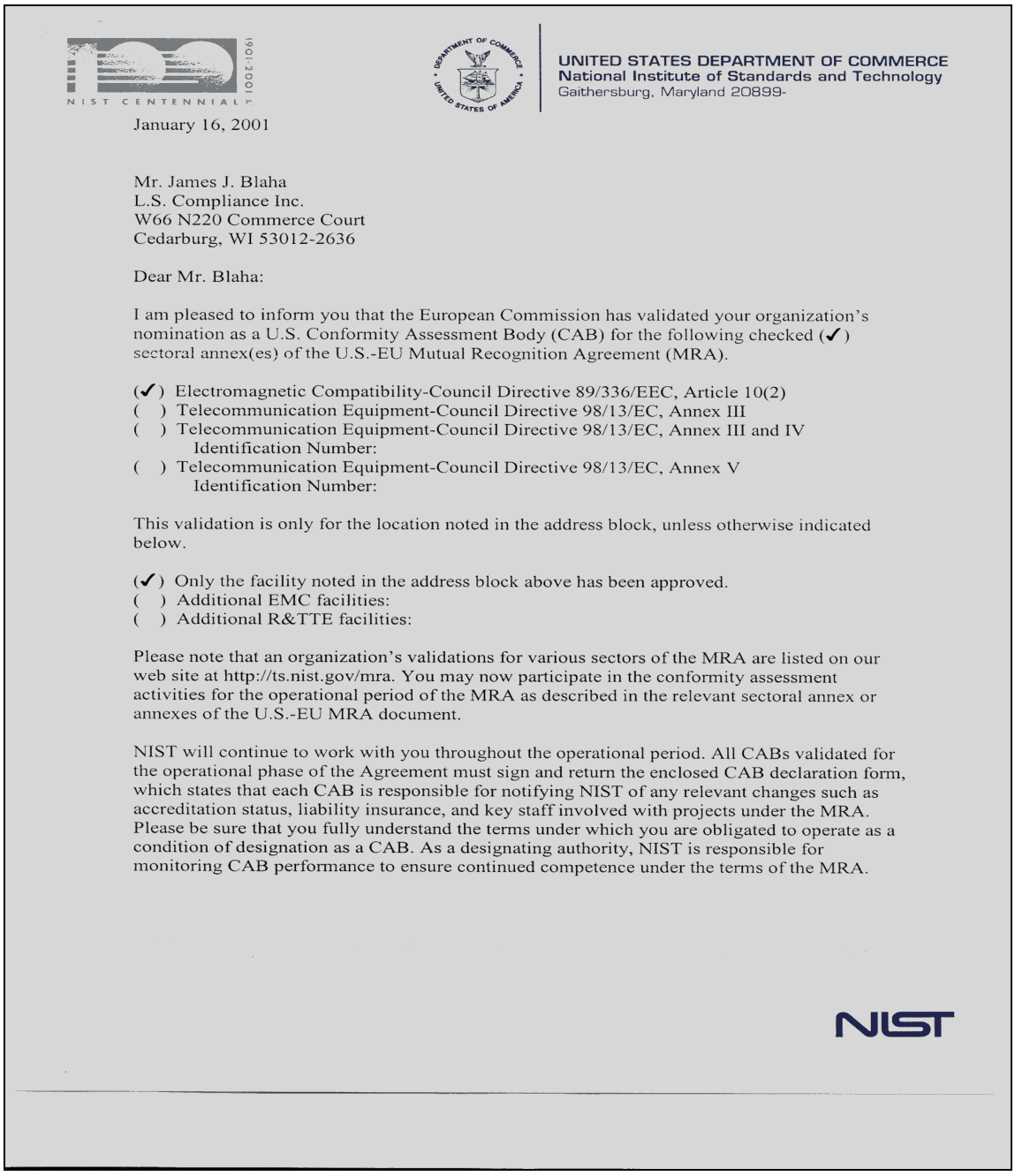
Test	Test Method(s)
Emissions	
Conducted Emissions Continuous/Discontinuous	Code of Federal Regulations (CFR) 47, FCC Method Parts 15 and 18 using ANSI C63.4; EN: 55011, 55022, 55081-1, 55081-2; CISPR: 11, 22; CNS 13438
Radiated Emissions	Code of Federal Regulations (CFR) 47, FCC Method Parts 15 and 18 using ANSI C63.4; EN: 55011, 55022, 55081-1, 55081-2; CISPR: 11,22; CNS 13438
Current Harmonics	EN 61000-3-2
Voltage Fluctuations & Flicker	EN 61000-3-3
Immunity	
Conducted Immunity Fast Transients/Burst	IEC: 1000-4-4, 801-4; EN: 61000-4-4, 50082-1, 50082-2
Surge	IEC: 1000-4-5, 801-5; ENV 50142; EN: 61000-4-5, 50082-1, 50082-2
RF Fields	IEC: 1000-4-6, 801-6; ENV 50141; EN: 61000-4-6, 50082-1, 50082-2
Voltage Dips/Interruptions	IEC 1000-4-11; EN: 61000-4-11, 50082-1, 50082-2

Lorraine M. Robinson

(A2LA Cert. No. 1255.01) 03/26/03 Page 1 of 2

5301 Buckeystown Pike, Suite 350 • Frederick, MD 21704-8373 • Phone: 301-644 3248 • Fax: 301-662 2974

4. Validation Letter – U.S. Competent Body for EMC Directive 89/336/EEC



UNITED STATES DEPARTMENT OF COMMERCE
National Institute of Standards and Technology
Gaithersburg, Maryland 20899-

January 16, 2001

Mr. James J. Blaha
L.S. Compliance Inc.
W66 N220 Commerce Court
Cedarburg, WI 53012-2636

Dear Mr. Blaha:

I am pleased to inform you that the European Commission has validated your organization's nomination as a U.S. Conformity Assessment Body (CAB) for the following checked (✓) sectoral annex(es) of the U.S.-EU Mutual Recognition Agreement (MRA).

(✓) Electromagnetic Compatibility-Council Directive 89/336/EEC, Article 10(2)
( ) Telecommunication Equipment-Council Directive 98/13/EC, Annex III
( ) Telecommunication Equipment-Council Directive 98/13/EC, Annex III and IV
Identification Number:
( ) Telecommunication Equipment-Council Directive 98/13/EC, Annex V
Identification Number:

This validation is only for the location noted in the address block, unless otherwise indicated below.

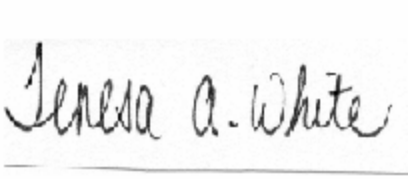
(✓) Only the facility noted in the address block above has been approved.
( ) Additional EMC facilities:
( ) Additional R&TTE facilities:

Please note that an organization's validations for various sectors of the MRA are listed on our web site at http://ts.nist.gov/mra. You may now participate in the conformity assessment activities for the operational period of the MRA as described in the relevant sectoral annex or annexes of the U.S.-EU MRA document.

NIST will continue to work with you throughout the operational period. All CABs validated for the operational phase of the Agreement must sign and return the enclosed CAB declaration form, which states that each CAB is responsible for notifying NIST of any relevant changes such as accreditation status, liability insurance, and key staff involved with projects under the MRA. Please be sure that you fully understand the terms under which you are obligated to operate as a condition of designation as a CAB. As a designating authority, NIST is responsible for monitoring CAB performance to ensure continued competence under the terms of the MRA.

NIST

5. Signature Page



Prepared By: **August 4, 2003**

Teresa A. White, Document Coordinator **Date**

Tested By: **August 4, 2003**

Abtin Spantman, EMC Engineer **Date**

Approved By: **August 4, 2003**

Kenneth L. Boston, EMC Lab Manager **Date**
PE #31926 Licensed Professional Engineer
Registered in the State of Wisconsin, United States

6. Product and General Information

Manufacturer:	GE Medical Systems Information Technologies
Date(s) of Test:	June 26th , 2003
Test Engineer:	Abtin Spantman
Model #:	2014748
Serial #:	Engineering Unit
Operating Mode:	Continuous transmit, with modulation.

7. Product Description (including type of emission)

The ApexPro CH is a telemetry transmitter used in hospitals. The transmitter acquires ECG information and digitizes it for transmission to the antenna system. The transmitter can also transmit information coming from external SpO2 or NIBP devices.

The ApexPro CH is designed to operate on 239 channels, at carrier frequencies between 608 and 614 MHz, with a GFSK modulation format. The ApexPro CH operates on two type AA batteries for a series voltage of 3.0 VDC, and utilizes an external antenna embedded into the patient lead wires.

8. Test Requirements

The above-mentioned tests were performed in order to determine the compliance of the ApexPro CH with limits contained in various provisions of Title 47 CFR, FCC Part 95H, including: 2.1046, 2.1049, 2.1051, 2.1053, 2.1055, 15.207 and 95.1115.

All radiated emissions tests were performed to measure the emissions in the frequency bands described by the above sections, and to determine whether said emissions are below the limits established by the above sections. These tests were performed in accordance with the procedure described in the American National Standard for methods of measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ANSI C63.4-2001). Another document used as reference for the EMI receiver specification was the International Special Committee on Radio Interference (CISPR) Number 16-1 (2002).

9. Summary of Test Report

DECLARATION OF CONFORMITY

The GE Medical System Information Technologies' ApexPro CH was found to **MEET** the requirements as described within the specification of Title 47 CFR FCC, Part 95, Subpart H for a WMTS Transmitter.

10. Introduction

On June 26th, 2003 a series of Radiated and Conducted Emission tests were performed on one sample of the GE Medical System Information Technologies' ApexPro CH, Model Number '2014748', Serial Number 'Engineering Unit 01', here forth referred to as the "*Equipment Under Test*" or "*EUT*". These tests were performed using the procedures outlined in ANSI C63.4-2001 for intentional radiators, and in accordance with the limits set forth in FCC Part 95H for a WMTS transmitter. These tests were performed by Abtin Spantman, EMC Engineer of L.S. Compliance, Inc. and witnessed by Michael Steinike of GE Medical System Information Technologies.

11. Purpose

All Radiated and Conducted Emission tests upon the ApexPro CH were performed to measure the emissions in the frequency bands described in Title 47 CFR, FCC Part 95H to determine whether these emissions are below the limits expressed within the standards. The standard requirements for licensed transmitters found in Part 2 were also consulted. These tests were performed in accordance with the procedures described in the American National Standard for methods of measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ANSI C63.4-2001). Another document used as a reference for the EMI Receiver specification was the Comite International Special Des Perturbations Radioelelectriques (CISPR) Number 16-1, 2002.

12. Radiated Emissions Test, FCC Part 2.1053

Test Setup

The test setup was assembled in accordance with Title 47, CRF FCC Part 95 and ANSI C63.4-2001. The EUT was placed on an 80cm high non-conductive pedestal centered on a flush mounted 2-meter diameter turntable inside the 3 Meter Semi-Anechoic, FCC listed Chamber located at L. S. Compliance, Inc., Cedarburg, Wisconsin. The EUT was powered by two type AA batteries for a series voltage of 3.0VDC. The applicable limits apply at a 3 meter distance, and are found in Section 12. Measurements above 5 GHz were also performed at a 0.3 meter separation distance, and the calculation can also be found in Section 12. The calculations to determine these limits are detailed in the following pages. Please refer to Appendix A for a list of the test equipment. The test sample was operated on one of two (2) standard channels: low (ch:001 at 608.025 MHz), and high (ch:239 at 613.975 MHz) to comply with FCC Part 15.35 and ANSI C63.4 guidelines.

Test Procedure

Radiation measurements were performed on the EUT in the 3 Meter Semi-Anechoic, FCC listed Chamber, located at L. S. Compliance, Inc. in Cedarburg, Wisconsin. The frequency range from 30 MHz to 10,000 MHz was pre-scanned, and levels were manually noted at the various fixed degree settings of azimuth on the turntable and antenna height. The EUT was placed on the non-conductive pedestal in the 3 Meter Semi-Anechoic Chamber, with the antenna mast placed such that the antenna was 3 meters from the EUT. A Biconical Antenna was used to measure emissions from 30 MHz to 300 MHz, and a Log Periodic Antenna was used to measure emissions from 300 MHz to 1000 MHz. A Double Ridged Waveguide Horn Antenna was used from 1 GHz to 10 GHz. The maximum radiated emissions were found by raising and lowering the antenna between 1 and 4 meters in height, using both horizontal and vertical antenna polarities.

Test Equipment Utilized

A list of the test equipment and antennas utilized for the Radiated Emissions test can be found in Appendix A. This list includes calibration information and equipment descriptions. All equipment is calibrated and used according to the operation manuals supplied by the manufacturers. All calibrations of the antennas used were performed at an N.I.S.T. traceable site. In addition, the Connecting Cables were measured for losses using a calibrated Signal Generator and a HP 8546A EMI Receiver. The resulting correction factors and the cable loss factors from these calibrations were entered into the HP 8546A EMI Receiver database. As a result, the data taken from the HP 8546A EMI Receiver accounts for the antenna correction factor as well as cable loss or other corrections, and can therefore be entered into the database as a corrected meter reading. The HP 8546A EMI Receiver was operated with a bandwidth of 120 kHz for measurements below 1 GHz. Both the Peak and Quasi-Peak Detector functions were utilized. From 5 GHz to 10 GHz, an HP E4407B Spectrum Analyzer and an EMCO Double Ridged Horn Antenna were used.

Test Results

The EUT was found to MEET the Radiated Emissions requirements of Title 47 CFR, FCC Part 95 for a WMTS transmitter. The frequencies with significant signals were recorded and plotted as shown in the Data Charts and Graphs.

CALCULATION OF RADIATED EMISSIONS LIMITS

The following table depicts the Part 95H limits for a WMTS transmitter. These limits are obtained from Title 47 CFR, Part 95H, for radiated emissions measurements. These limits were applied to any spurious signals found outside the 608-614 MHz WMTS band, and to the fundamental signal level.

Frequency (MHz)	3 m Limit (mV/m)	3 m Limit (dBmV/m)
30-608	200	46.0
608-614	200,000	106.0
614-960	200	46.0
960-10,000	500	54.0

Sample conversion from field strength μV/m to dBμV/m:

$$Limit(dBmV/m) = 20Log_{10}(Limit(mV/m))$$

For 30-608 MHz, for example,

$$Limit(dBmV/m) = 20Log_{10}(200(mV/m))$$
$$Limit(dBmV/m) = 40.6(dBmV/m)$$

For measurements made at 0.3 meter, a 20 dB correction has been invoked.

$$Limit_{0.3meter}(dBmV/m) = Limit_{3meter} + 20Log_{10}(3m/0.3m)$$

For 960-10,000 MHz, for example,

$$Limit_{0.3meter}(dBmV/m) = 54.0(dBmV/m) + 20(dB)$$
$$Limit_{0.3meter}(dBmV/m) = 74(dBmV/m)$$

Summary of Results and Conclusions

Based on the procedures outlined in this report, and the test results, it can be determined that the EUT does **MEET** the emission requirements of Title 47 CFR, FCC Part 95, Subpart H for an intentional radiator.

The enclosed test results pertain to the samples of the test item listed, and only for the tests performed per the data sheets. Any subsequent modification or changes to the test items could invalidate the data contained herein, and could therefore invalidate the findings of this report.

Measurement of Electromagnetic Radiated Emissions Within the 3 Meter FCC Listed Chamber

Frequency Range Inspected: 30 MHz - 10,000 MHz

Manufacturer:	GE Medical Systems Information Technologies
Date(s) of Test:	June 26th , 2003
Test Engineer:	Abtin Spantman
Model #:	2014748
Serial #:	Engineering Unit
Operating Mode:	Continuous transmit, with modulation.

Test Requirements:

Distance: 3 Meters (Below 6GHz) 0.3 meters (Above 6GHz)	**Configuration:**

Test Equipment Used:

EMI Receiver: HP 8546A (Below 6GHz); HP E4407B (Above 6GHz)	Biconical Antenna: EMCO 3110
Double-Ridged Wave Guide/Horn Antenna: EMCO 3115	Log Periodic Antenna: EMCO 43146A
Standard Gain Horn: EMCO 3160-09	PreAmp: Advanced Microwave WHA6224

Detector(s) Used:		Peak	Ö	Quasi-Peak (Below 960 MHz)	Ö	Average (Above 960 MHz)

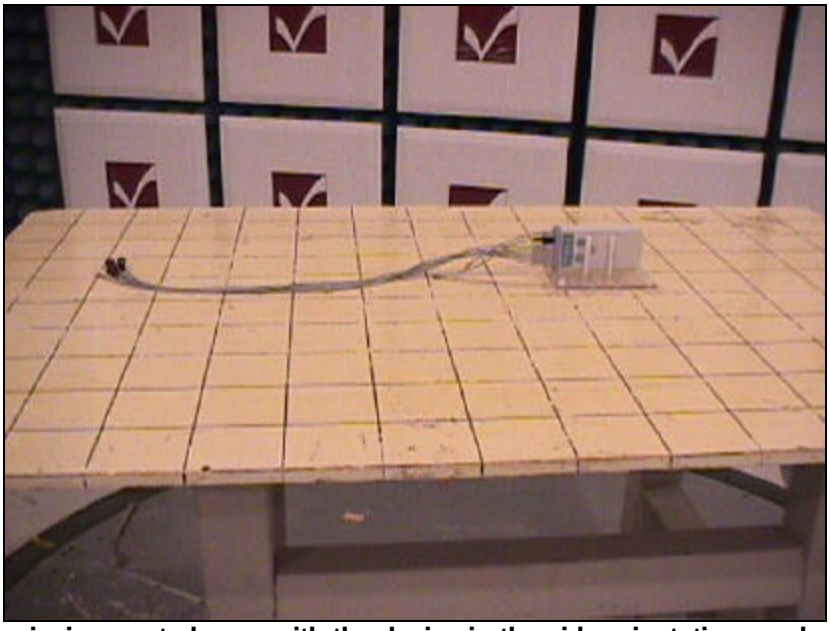
The following table depicts the level of significant radiated emissions found:

Frequency (MHz)	Antenna Polarity	Channel	Height (meters)	Azimuth (0° - 360°)	EMI Meter Reading (dBmV/m)	47CFR95 Limit (dBmV/m)	Margin (dB)
403.2	H	001	1.00	0	21.6	46.0	24.4
410.1	H	239	1.00	0	23.0	46.0	23.0
608.0	H	001	1.15	285	88.5	106.0	17.5
614.0	H	239	1.20	200	89.5	106.0	16.5
622.4	H	001	1.20	0	29.5	46.0	16.5
628.4	H	239	1.30	200	32.5	46.0	13.5
1216	H	001	1.20	175	40.7	54.0	13.3
1228	H	239	1.20	175	35.1	54.0	18.9

Notes: A Quasi-Peak Detector was used in measurements below 960 MHz, and an Average Detector was used in measurements above 960 MHz, as described in 95.1115(b). All other harmonic emissions investigated were at receiving system noise floor, and better than 20 dB below the limit.

Photos Taken During Radiated Emission Testing

Photos of the EUT during Radiated Emission Testing in the 3 Meter FCC Listed Chamber



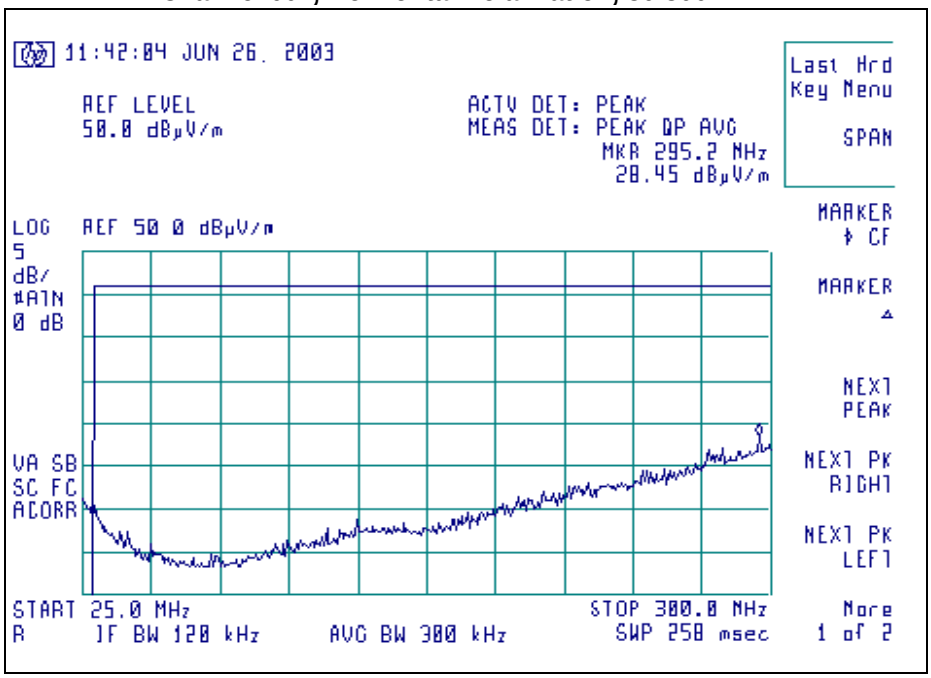
Highest emissions noted were with the device in the side orientation as shown here.

Close up view, front of the device.

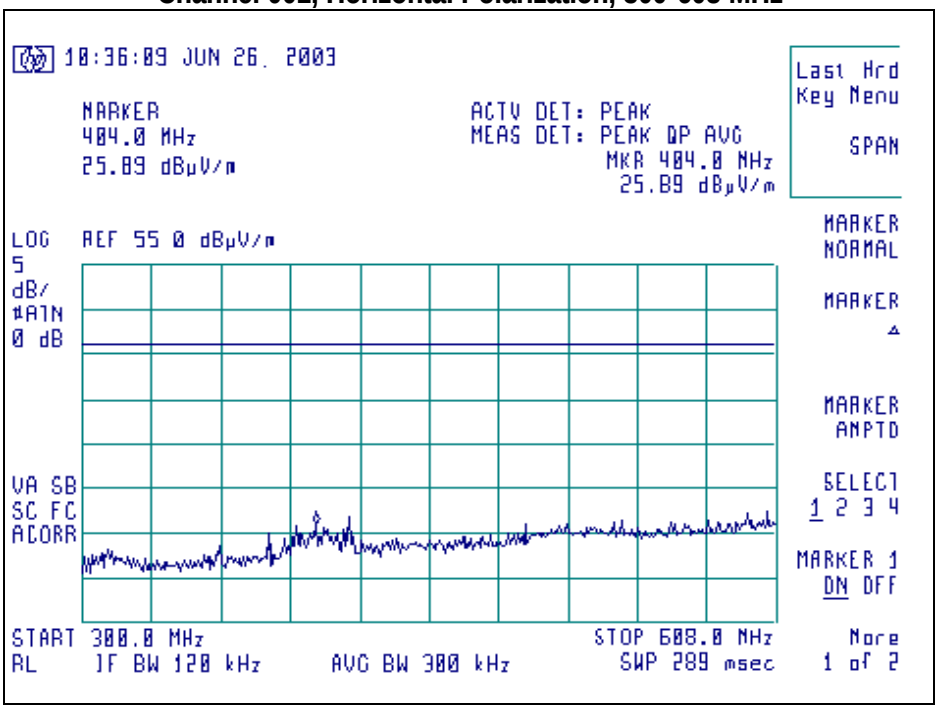
Device pictured in horizontal orientation.

Signature Scan of Radiated Emissions

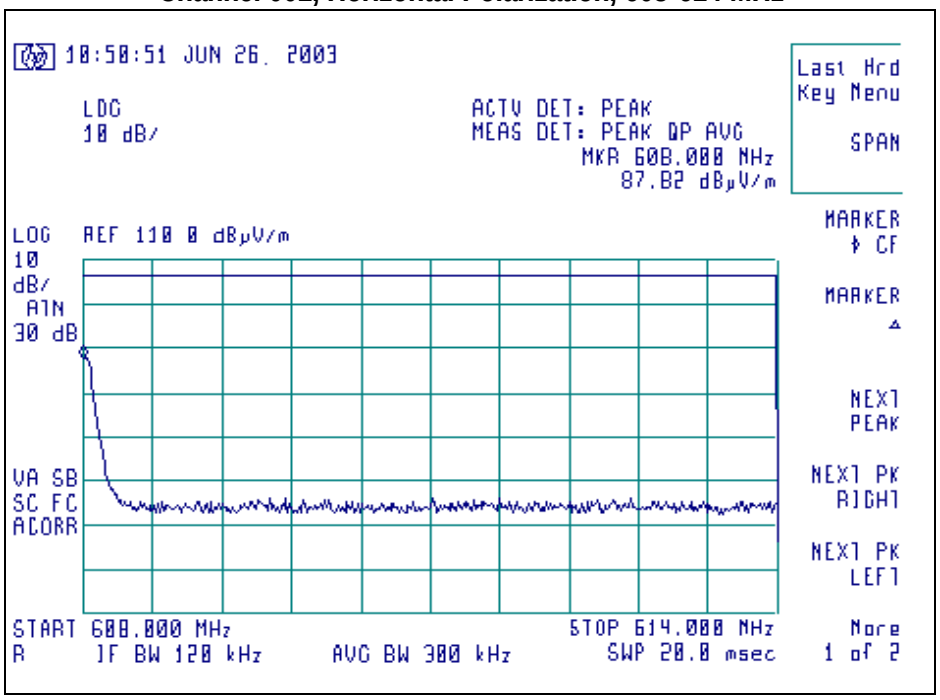
Channel 001, Horizontal Polarization, 30-300 MHz



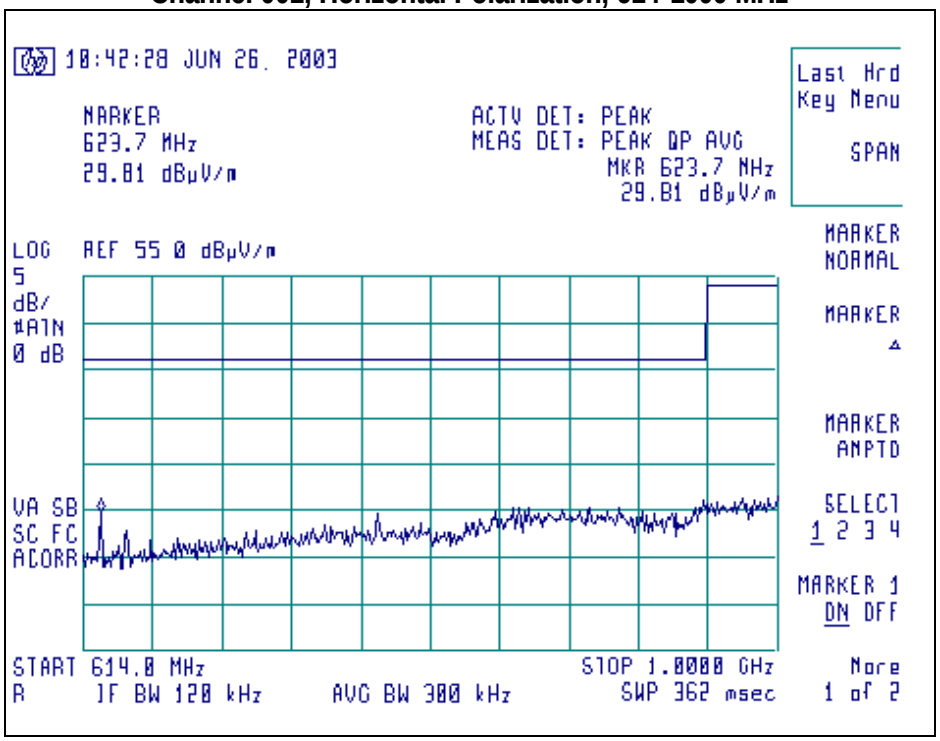
Channel 001, Horizontal Polarization, 300-608 MHz



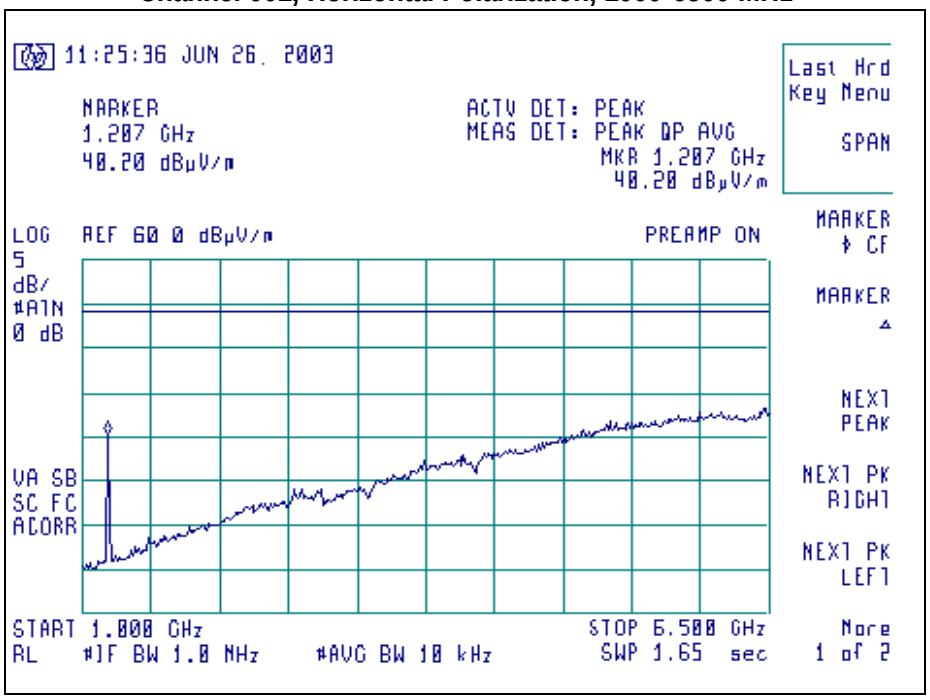
Channel 001, Horizontal Polarization, 608-614 MHz



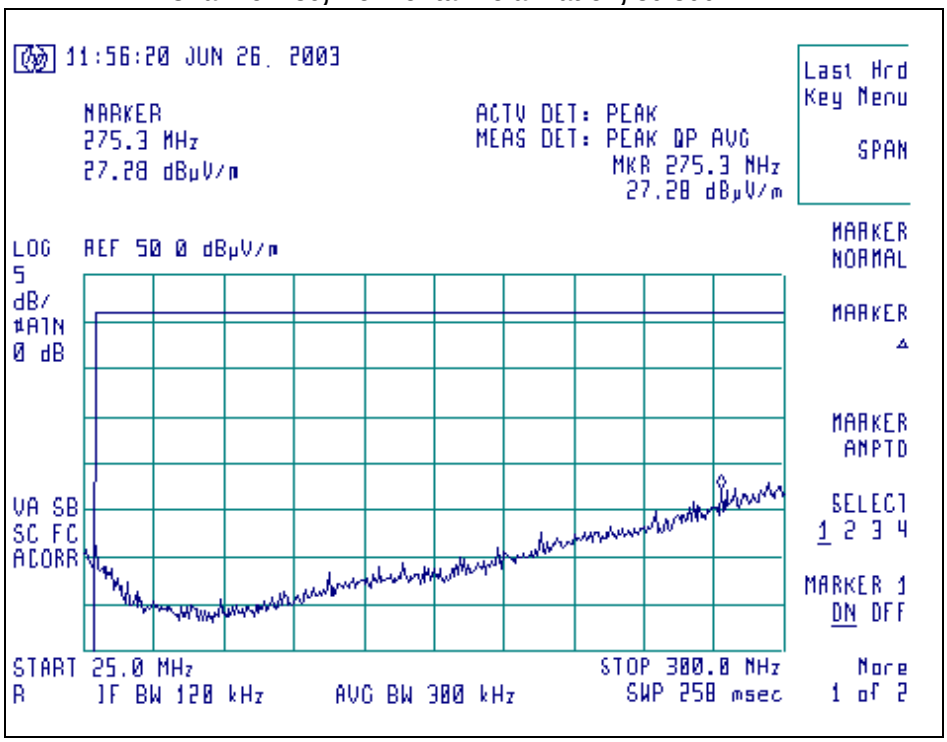
Channel 001, Horizontal Polarization, 614-1000 MHz



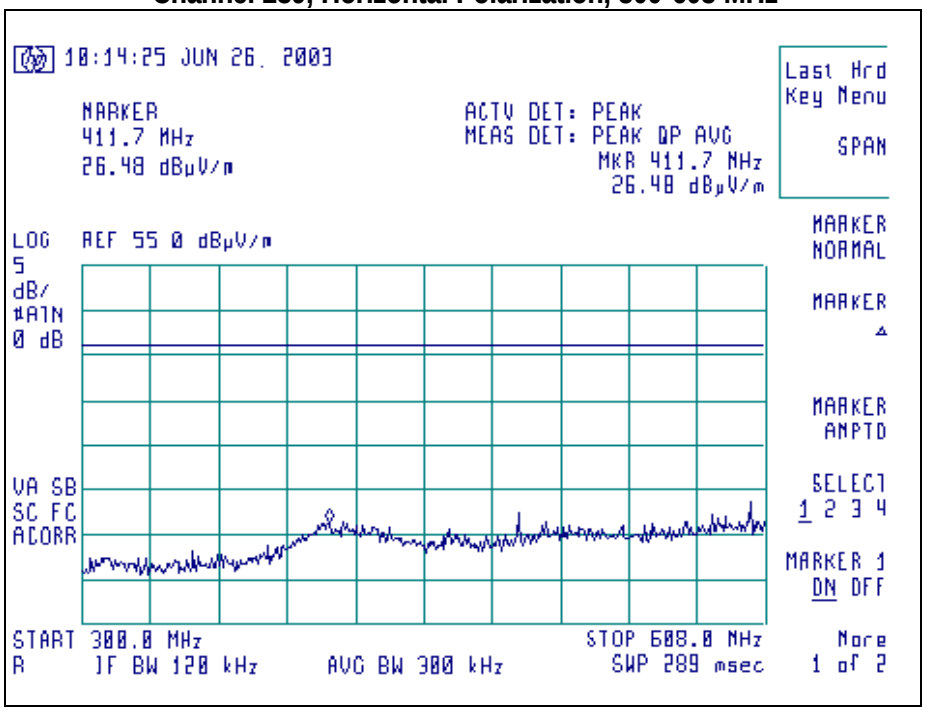
Channel 001, Horizontal Polarization, 1000-6500 MHz



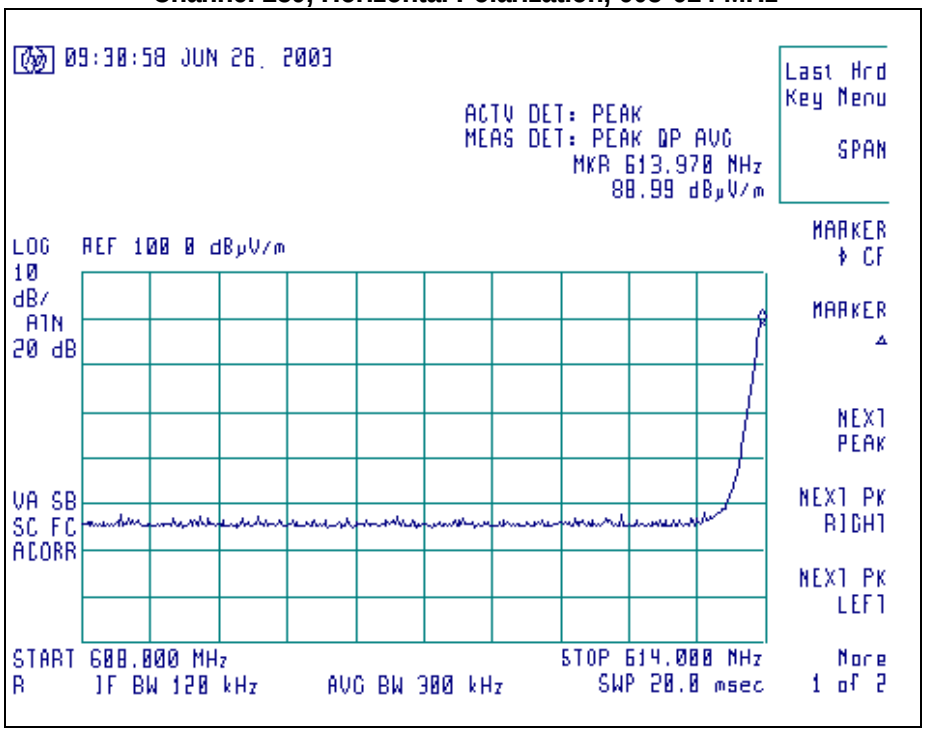
Channel 239, Horizontal Polarization, 30-300 MHz



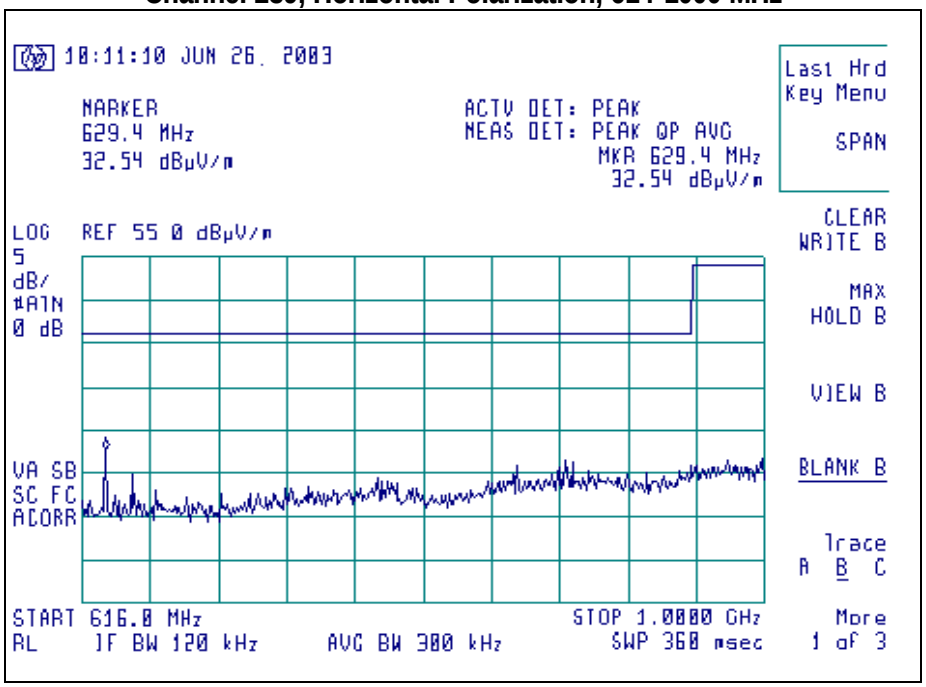
Channel 239, Horizontal Polarization, 300-608 MHz



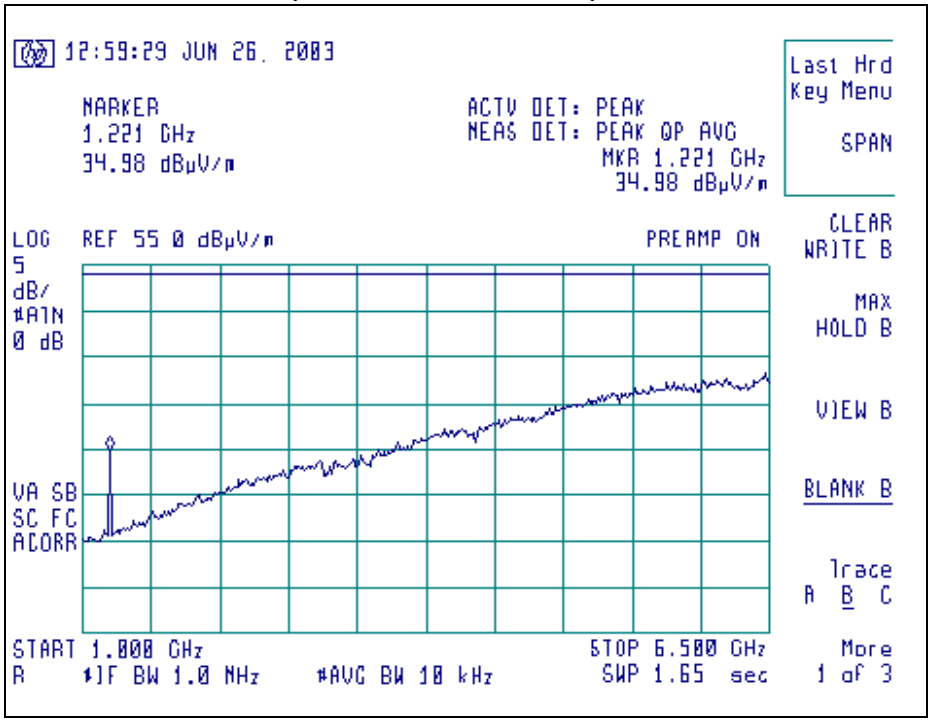
Channel 239, Horizontal Polarization, 608-614 MHz



Channel 239, Horizontal Polarization, 614-1000 MHz



Channel 239, Horizontal Polarization, 1000-6500 MHz



13. Conducted Emissions Test (AC Line) FCC Part 15.207

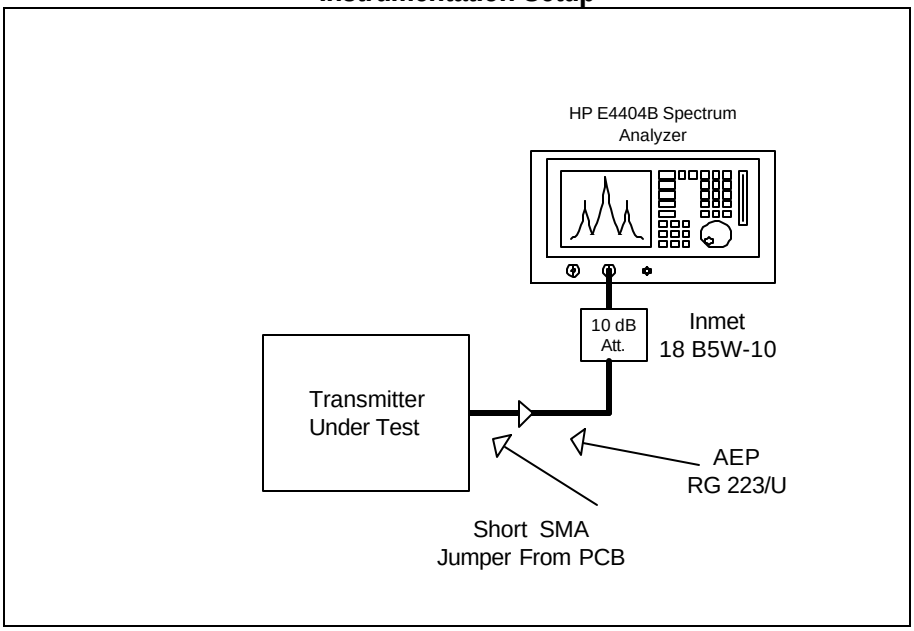
No conducted (AC line) RF emissions tests were performed, as the EUT operates on batteries only.

14. Power Output Test, FCC Part 2.1046

For the FCC Part 2.1046 measurement, the output of the ApexPro CH was connected via a short jumper cable created only for this measurement, into the input of the HP E4407B Spectrum Analyzer. The unit was configured to run in a continuous transmit mode, while being supplied with psuedo-random generator as a modulation source. The HP Receiver was set to a 1 MHz Bandwidth, and the transmit signal was then stored, with the peak signal level stored. This power level was collected for the low and high channels, compared to the conducted power level derived from the field strength limit of 95.1115(a), and can be seen in the chart presented below.

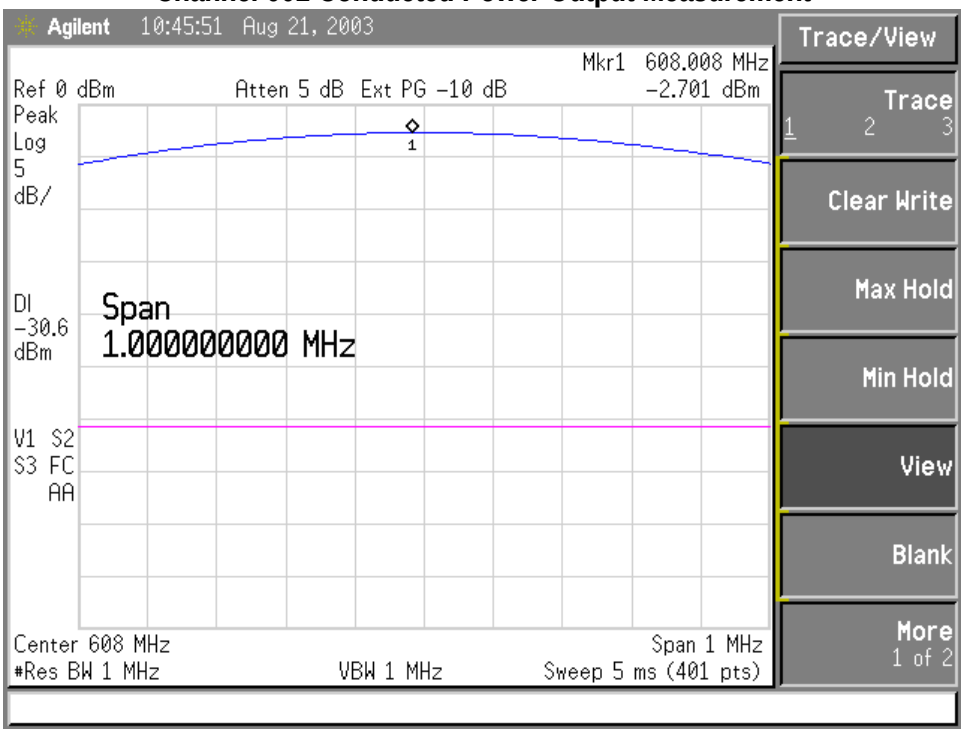
CHANNEL	CENTER FREQ (MHz)	EQUIVALENT CONDUCTED LIMIT (dBm)	MEASURED CONDUCTED POWER (dBm)	MARGIN (dB)
1	608.025	+10.8	-2.7	13.5
239	613.975	+10.8	-2.0	12.8

Instrumentation Setup

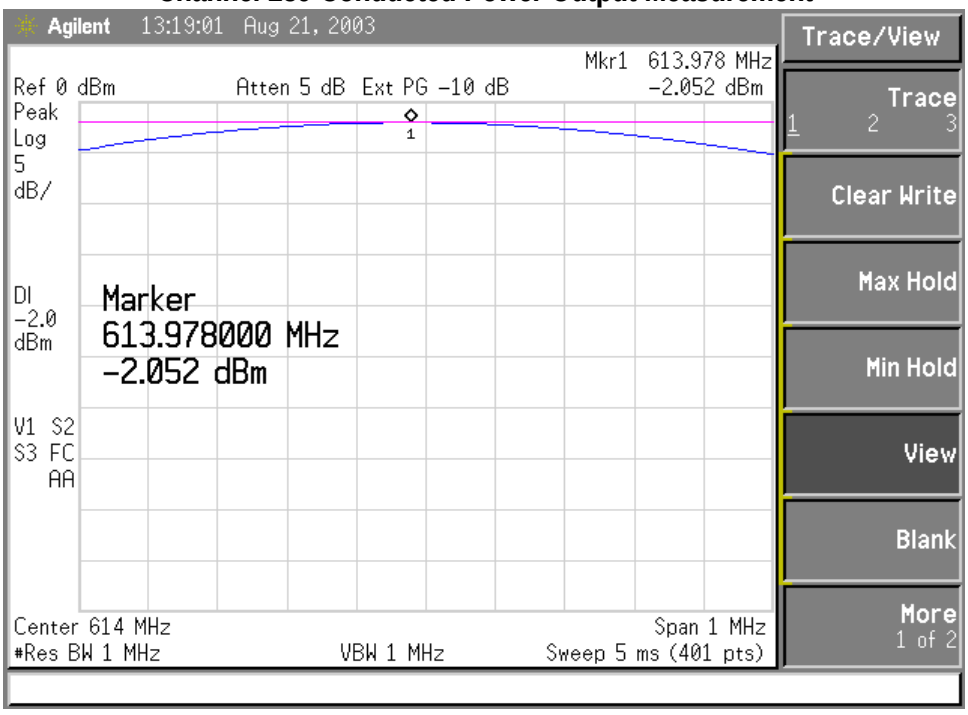


Note: According to 95.1115(a), radiated field strength limit is 200,000 µV/m or 106dBµV/m, at 3 meters. To convert from field strength to an equivalent conducted power in dBm, subtract 95.2dB. (106.0 - 95.2 = 10.8)

Channel 001 Conducted Power Output Measurement



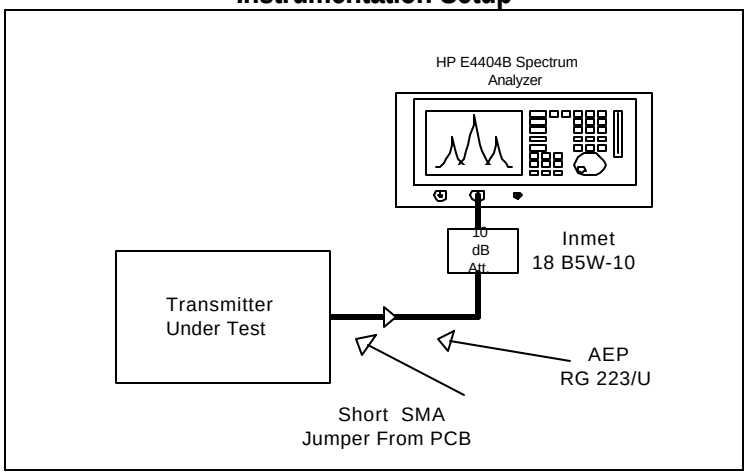
Channel 239 Conducted Power Output Measurement



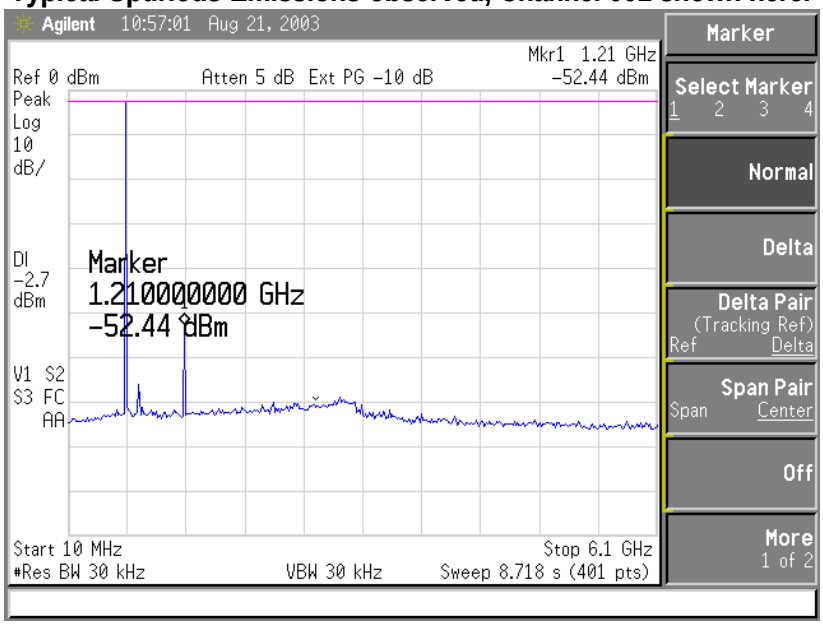
15. Conducted Emissions Test, spurious emissions, FCC Part 2.1053

FCC Part 2.1053 requires a conducted measurement of conducted harmonic and spurious levels, at the antenna port, as referenced to the carrier frequency, in a 100 kHz bandwidth. For this test, the ApexPro CH was directly connected to the HP E4407B Spectrum Analyzer, through a very short Coaxial Cable and a 10 DB Attenuator. Plots were then taken, with any noticeable spurious or harmonic signals identified. No significant levels at any spurious products could be found within -20 dBc of the fundamental of the transmitter. Signals that were observed were 40 dB below the fundamental at the second harmonic, and greater than 50 dB down, and within the system noise floor at all other frequencies. (In the 100 kHz bandwidth)

Instrumentation Setup



Typical Spurious Emissions observed, Channel 001 shown here.



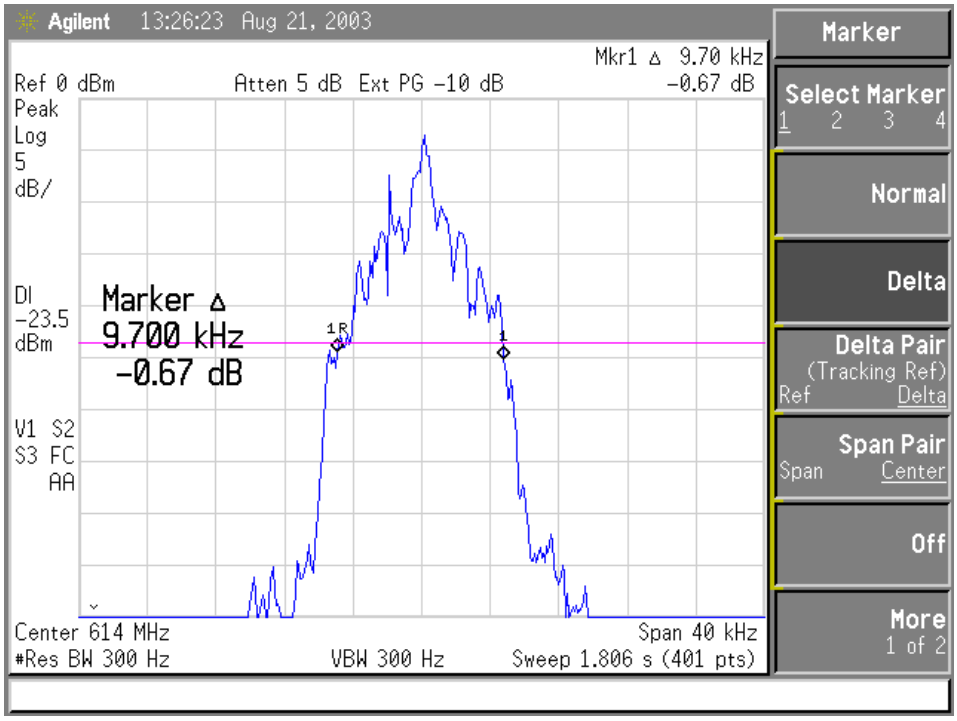
16. Conducted Emissions Test, occupied bandwidth, FCC Part 2.1049

The 20 dB bandwidth requirement described by FCC Part 2.1049 is designated for this product to be contained within the 608 – 614 MHz bands. The transmitted signal was measured with modulation to determine the signal bandwidth, while observing the lowest and highest channels, next to the band edges. The plots demonstrate that the transmitter is compliant with the occupied bandwidth and the band-edge requirements.

CHANNEL	CENTER FREQ (MHz)	MEASURED 20 dB BW (kHz)
001	608.025	9.8
239	613.975	9.7

Plot of Occupied Bandwidth
Channel 001

Plot of Band-Edge performance
Channel 239



17. Frequency Stability, FCC Part 2.1055

Frequency Stability vs. Temperature

The data showing the frequency stability of the transmitter, with respect to temperature variations, was provided by the manufacturer, and the worst case is reported below.

The EUT was connected to an external DC power supply and the RF output was connected to a frequency counter, while the EUT was placed inside the temperature chamber. After the temperature stabilized for appropriate length of time, the frequency of the output signal was recorded from the counter.

Frequency Stability vs. Voltage

At room temperature (25 ±5°C), an external variable DC power supply was connected to the EUT. The frequency of the transmitter was measured for 115%, 100%, and 85% of the nominal operating input voltage.

Frequency Stability vs. Temperature	
Temperature (C)	Frequency Error (Hz)
+50	-58
+22	-203
+00	-299

Stability vs. Voltage		
Voltage (VDC)	Frequency (Hz)	ERP (dBµV/m)
3.45	608,024,955	88.1
3.00	608,024,950	88.5
2.55	608,024,970	86.0

Results: Maximum frequency error across the temperature range was 241 Hz
Maximum frequency error across the voltage range was 20 Hz
No spurious emissions or other unexpected anomalies were observed during the tests.

Appendix A

Test Equipment List

Asset #	Manufacturer	Model #	Serial #	Description	Date	Due
AA960008	EMCO	3816/2NM	9701-1057	Line Impedance Stabilization Network	9/19/02	9/19/03
AA960031	HP	119474A	3107A01708	Transient Limiter	6/19/03	6/19/04
AA960077	EMCO	93110B	9702-2918	Biconical Antenna	9/19/02	9/19/03
AA960078	EMCO	93146	9701-4855	Log-Periodic Antenna	9/19/02	9/19/03
AA960081	EMCO	3115	6907	Double Ridge Horn Antenna	11/12/02	11/12/03
CC00221C	Agilent	E4407B	US39160256	Spectrum Analyzer	10/28/02	10/28/03
EE960004	EMCO	2090	9607-1164	Device Controller	N/A	N/A
EE960013	HP	8546A	3617A00320	Receiver RF Section	9/20/02	9/20/03
EE960014	HP	85460A	3448A00296	Receiver Pre-Selector	9/20/02	9/20/03
N/A	LSC	Cable	0011	3 Meter ½" Armored Cable	6/19/03	6/19/04
N/A	LSC	Cable	0038	1 Meter RG 214 Cable	6/19/03	6/19/04
N/A	LSC	Cable	0050	10 Meter RG 214 Cable	6/19/03	6/19/04
N/A	Pasternack	Attenuator	N/A	10 dB Attenuator	6/19/03	6/19/04

Table of Expanded Uncertainty Values, (K=2) for Specified Measurements

Measurement Type	Particular Configuration	Uncertainty Values
Radiated Emissions	3 – Meter chamber, Biconical Antenna	4.24 dB
Radiated Emissions	3-Meter Chamber, Log Periodic Antenna	4.8 dB
Radiated Emissions	10-Meter OATS, Biconical Antenna	4.18 dB
Radiated Emissions	10-Meter OATS, Log Periodic Antenna	3.92 dB
Conducted Emissions	Shielded Room/EMCO LISN	1.60 dB
Radiated Immunity	3 Volts/Meter in 3-Meter Chamber	1.128 Volts/Meter
Conducted Immunity	3 Volts level	1.0 V