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

Compliance Testing of the Pyxis Transmitter

Prepared For:

David Heffron
Pyxis Corporation
3750 Torrey View Court
San Diego, CA 92130

Test Report Number:

302306TX

Test Dates:

July 24th and 30th, 2002

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 53102

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 (EMC) Testing

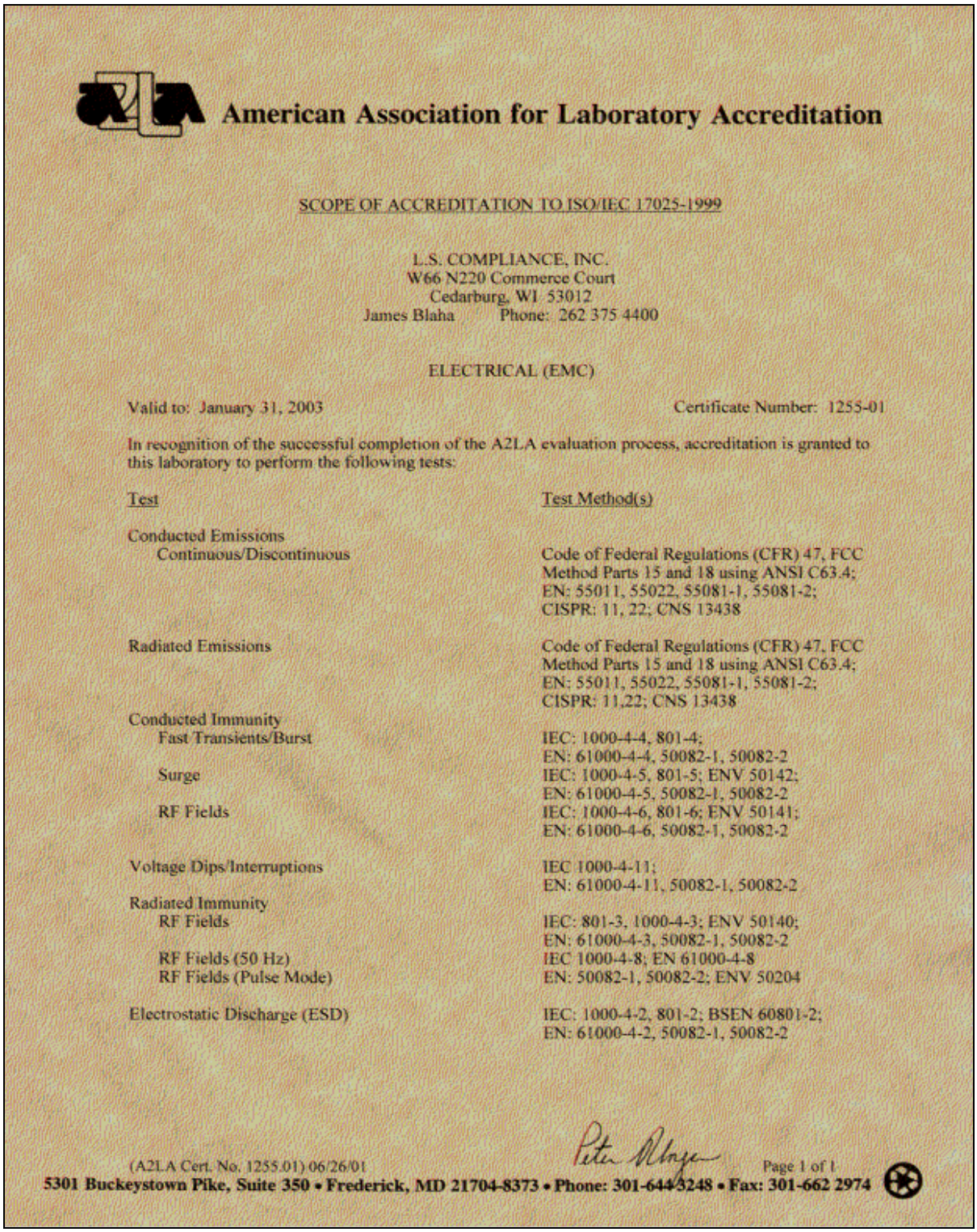
The accreditation covers the specific tests and types of tests listed on the agreed scope of accreditation. This laboratory meets the requirements of ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration Laboratories" and any additional program requirements in the identified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

Presented this 26th day of June, 2001.

President
For the Accreditation Council
Certificate Number 1255.01
Valid to January 31, 2003

For tests or types of tests to which this accreditation applies, please refer to the laboratory's Electrical (EMC) 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, 2003 Certificate Number: 1255-01

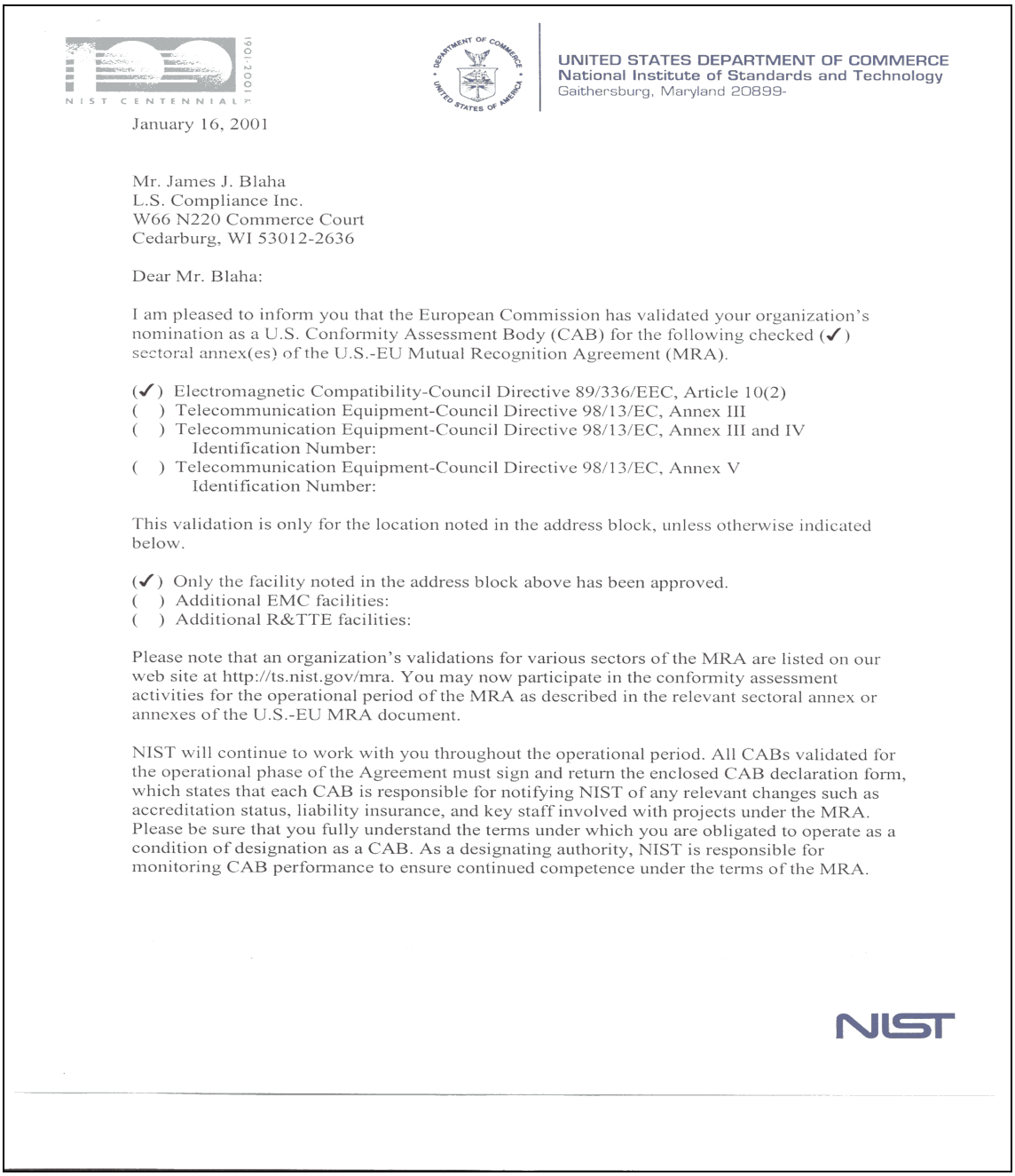
In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following tests:

Test	Test Method(s)
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
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
Radiated Immunity RF Fields	IEC: 801-3, 1000-4-3; ENV 50140; EN: 61000-4-3, 50082-1, 50082-2
RF Fields (50 Hz)	IEC 1000-4-8; EN 61000-4-8
RF Fields (Pulse Mode)	EN: 50082-1, 50082-2; ENV 50204
Electrostatic Discharge (ESD)	IEC: 1000-4-2, 801-2; BSEN 60801-2; EN: 61000-4-2, 50082-1, 50082-2

(A2LA Cert. No. 1255.01) 06/26/01 Page 1 of 1

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.

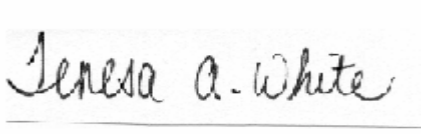
(✓) Only the facility noted in the address block above has been approved.
( ) Additional EMC facilities:
( ) Additional R&TTE facilities:

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

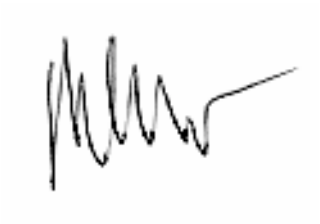
5. Signature Page



August 30, 2002

Prepared By: _____

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



August 30, 2002

Tested By: _____

Michael Stone, EMC Technician **Date**

August 30, 2002

Tested By: _____

Abtin Spantman, EMC Engineer **Date**

August 30, 2002

Approved By: _____

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:	**Pyxis Corporation**
Model Number:	**JITrBud Transmitter, Model 109699-02, Rev 1**
Serial Number:	**(315MHz)S/N:124, (434MHz)S/N:101**
Frequency Range:	**315 MHz and 434 MHz**
Test Voltage:	**3.0 VDC**

Environmental Conditions in the Test Lab:

Temperature:	20-25◦ C
Atmospheric Pressure:	30-60%
Humidity:	86kPa-106kPa

7. Introduction

On July 24th, and 30th 2002, a series of Radiated Emissions tests were performed on two samples of the Pyxis transmitter, Serial Numbers 101 and 124. This product operates by means of RF transmission of short burst of data containing a command code, with a redundant format, on two separate frequency bands. The transmitter serial number 101 was configured to operate at 434 MHz, and the transmitter serial number 124 was configured to operate at 315 MHz.

These tests were performed using the test procedure outlined in ANSI C63.4, 2001 for intentional radiators, and in accordance with the limits set forth in FCC Part 15.231, for a periodic operation of a low power transmitter.

8. Purpose

The above-mentioned tests were performed in order to determine the compliance of the equipment under test (EUT), with limits contained in various provisions of Title 47CFR, FCC Part 15, including: 15.205, 15.209, 15.231a, 15.231b, and 15.231c.

All radiated emission tests were performed to measure the emissions in the frequency bands described in section 12i of this report, and to determine whether said emissions are below the limits established by the aforementioned standards.

These tests were performed in accordance with the procedures described in the American National Standard for methods of measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ANSI C63.4, 2001).

Also used as a reference, for the EMI Receiver specification, is the International Special Committee on Radio Interference – CISPR 16-1, 1999.

9. Product Description

The Pyxis system is an inventory control device for hospital supply rooms. The transmitter has two buttons labeled "Take" and "Return". The system operates by allowing the user, typically a nurse or orderly, to handle the task of inventory management and update, by simply pressing a button. The user logs on to the computer and proceeds to get the supplies that they need. When an item is taken from the shelf or bin, the "Take" button is pressed, once, by the user, and the computer debits the inventory by one unit. When an item is returned, or the shelves are re-stocked, the "Return" button is pressed, once per item, and the computer credits the inventory by one unit.

Detailed description:

The system utilizes a standard RKE scheme, but with redundancy built in for improved reliability in harsh environments. The system operates on two radio bands, 315 MHz and 434 MHz, in case one or the other is blocked by interference. Each transmitter within the system, sends redundant packets, multiple times, on both bands to further assure data is received.

There are two bands used, 315 MHz and 434 MHz, with two channels in each band. Any single transmitter will transmit a total of 4 packets; two in the 315 band and two in the 434 band. When a button is pressed the transmitter randomly picks either 315 or 434 as the starting point then sends a packet on that band. It follows by sending the same packet on the other band and repeats the process. The result is 4 total packets alternating between the two bands.

There are also multiple channels available. The frequencies are 315.00 MHz, 315.40 MHz, 433.92 MHz, and 434.30 MHz. They are arranged into 2 groups simply called "A" and "B". Group A is 315.00 and 433.92, group B is 315.40 and 434.30. When a transmitter is built at the factory, it is set to be a group A or group B device, by the selection of the reference oscillator crystal frequency. This frequency selection can not be changed in the field by a normal service person.

The receivers are built as either 315 MHz or 434 MHz units, and they are field selectable between group A and B. The receivers will be shipped from the factory, set for the appropriate group as requested by the customer, but a field service technician can change the group assignment, in the field, if desired.

Packets are approximately 62ms in length, and composed of 98 binary encoded data bits. The bits are transmitted using a data rate of 1.64 kbits/sec using frequency modulation techniques at a peak deviation of 45 kHz.

10. Test Requirements

The Pyxis JITrBud was to be tested for radiated emissions, and compliance with the limits set forth by 47 CFR, part 15.205, 15.209, 15.231a, 15.231b, and 15.231c, for manually operated periodic transmitters, as well as for compliance with Industry Canada, RSS-210, for low power license-exempt radio-communication devices.

11. Summary of Test Report

The Pyxis JITrBud was found to **MEET** the requirements as described within the specifications of Title 47 CFR, Part 15.231 and RSS-210, Section 6.1 for a low power transmitter.

12. Radiated Emission Test

12a. Test Setup

The equipment under test (EUT) was operated within the 3 Meter FCC listed Semi-Anechoic Chamber, located at L.S. Compliance, Inc., Cedarburg, Wisconsin. The EUT was placed on an 80cm high non-conductive pedestal, which was centered on the flush-mounted 2m diameter metal turntable. The test sample was operated in continuous transmit CW mode for the radiated emissions measurements, and in normal mode for all other measurements.

The EUT was configured to run in a continuous transmit CW mode during the 15.231a and 15.231b measurements. One sample transmitter, serial number 124, was modified to transmit continuously for tests of the fundamental and spurious/harmonic emissions at 315 MHz, and one sample transmitter, serial number 101, was modified to transmit continuously at 434 MHz. These units were then returned to normal operation for testing of the data packet length and occupied bandwidth.

12b. Test Procedure

The fundamental and spurious (harmonic) emissions of the transmitter were tested for compliance to Title 47CFR, FCC Part 15.231a, and 15.231b limits for manually operated and non-periodic devices.

The EUT was tested from the lowest frequency generated by the transmitter (without going below 9kHz) to the 10th harmonic of the fundamental frequency generated by the device. The appropriate limits were also observed when the fundamental or spurious signals were located within any of the restricted bands as described in Part 15.205a.

The EUT was placed on an 80 cm high pedestal, with the Antenna Mast placed 3 m from the EUT.
A Bi-conical Antenna was used to measure emissions from 30 MHz to 300 MHz, a Log Periodic antenna was used to measure emissions from 300 MHz to 1000 MHz, and a Double Ridged Waveguide Horn Antenna was used to measure emissions above 1 GHz.

The EUT was modified to produce a continuous CW signal. The resultant signals from the fundamental, harmonics, and spurious signals were maximized by rotating the turntable 360 degrees, and by raising and lowering the Antenna between 1 and 4 meters. The EUT was also given different orientations to determine the maximum signal levels, using both horizontal and vertical antenna polarities.

A CR 2032 3.1 V Lithium type battery was used to power the transmitters. The batteries were checked periodically during testing, and replaced with fresh batteries as necessary.

12c. Test Results

No significant emissions were found aside from the transmitter fundamental and harmonics. The units were scanned for emissions, over the range of 30 to 6000 MHz to establish compliance with Part 15.231 and 15.205 while in continuous transmit mode. At frequencies below the fundamental, no spurious signals, other than the noise floor of the system could be found within 20dB of the limits. A numeric list of measured emissions appears in Section 12i.

12d. Occupied Bandwidth

In addition to measuring the levels of radiated emissions, the occupied bandwidth of the transmitter was measured. In accordance with FCC Part 15.231c, the 20dB bandwidth of the transmitted signal should be within a window of 0.25% of the center carrier frequency. The resolution bandwidth was set to the closest available filter setting on the Agilent E4407B Spectrum Analyzer that corresponded to 5% of the allowable bandwidth determined in the calculation mentioned above, without going below the resolution bandwidth of 10 kHz, as dictated in ANSI C63.4-2001 Section 13.1.7.

The sample was activated to transmit in normal mode and was placed on the aforementioned test configuration within the 3 Meter Chamber. The transmitted signal was received on a Log-Periodic Antenna and fed to the Agilent EE4407B Spectrum Analyzer, where the fundamental frequency was displayed, and a plot of the occupied bandwidth was produced. Results can be seen in the following plots, and in Appendix A.

12e. Test Equipment Utilized, Radiated Emissions

A list of the test equipment used for the tests can be found in Appendix B. All equipment is calibrated and used according to the operation manuals supplied by the manufacturers. All antenna calibrations were performed at an N.I.S.T. traceable site, and the resultant correction factors were entered into the HP8546A EMI Receiver software base.

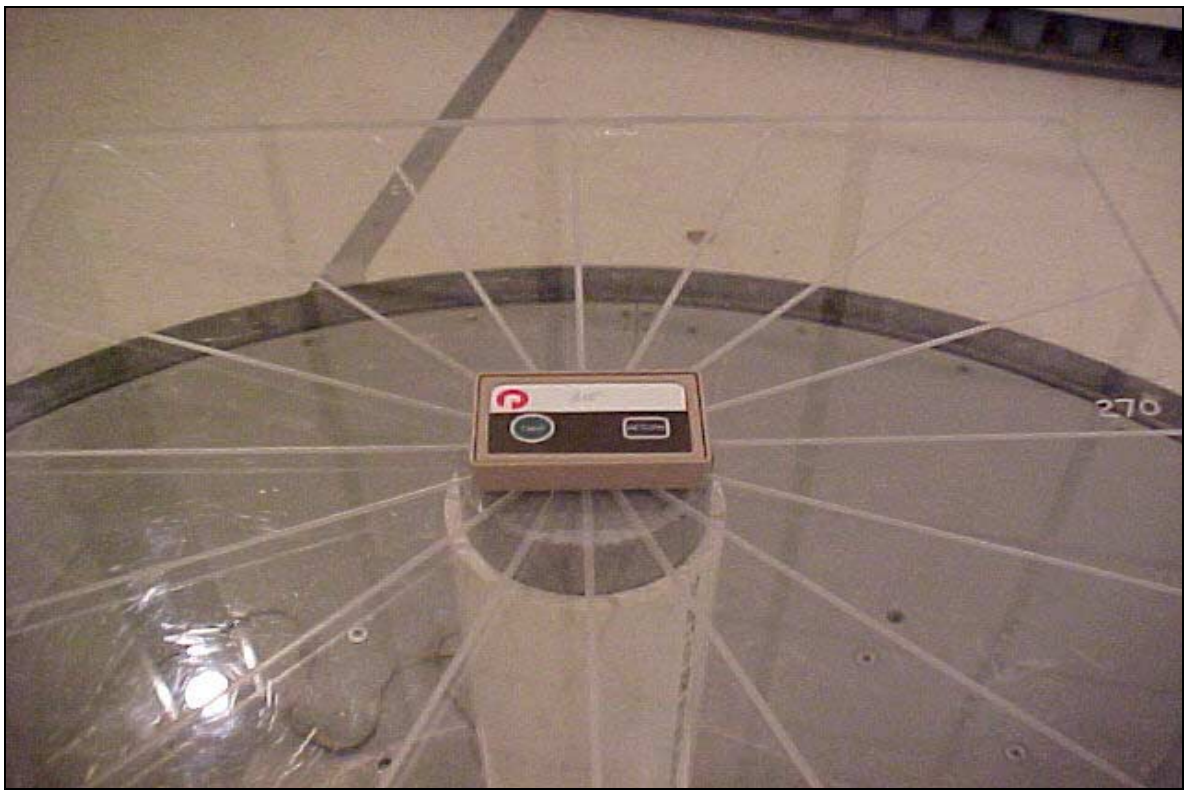
The connecting cables used were also measured for loss using a calibrated Signal Generator and the HP8546A EMI Receiver. The resulting loss factors were entered into the HP8546A EMI Receiver database. This allowed for automatic change in the antenna correction factor. The resulting data taken from the HP8546A EMI Receiver is an actual reading and can be entered into the database as a corrected meter reading.

When a reading is taken using the peak detector, a duty cycle correction factor can be applied for conversion to an average reading. This operation can be used when measuring short-duration bursts of data transmission, under FCC Part 15.231. The resulting average reading can then compared to the appropriate limit in order to determine compliance. The HP8546A EMI Receiver was operated with a bandwidth of 120 kHz when receiving signals below 1 GHz, and with a bandwidth of 1 MHz when receiving signals above 1 GHz, in accordance with CISPR 16.

The Peak, Quasi-Peak and Average detector functions were all used.

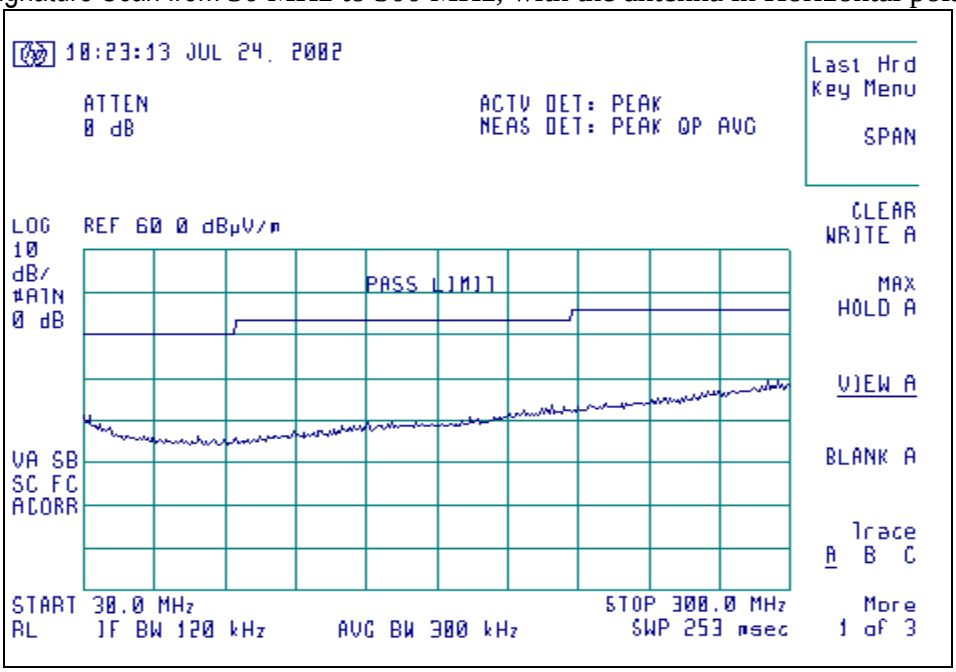
12f. Photo of Setup for Radiated Emissions Test

EUT placed in horizontal orientation inside the 3 Meter Semi-Anechoic Chamber

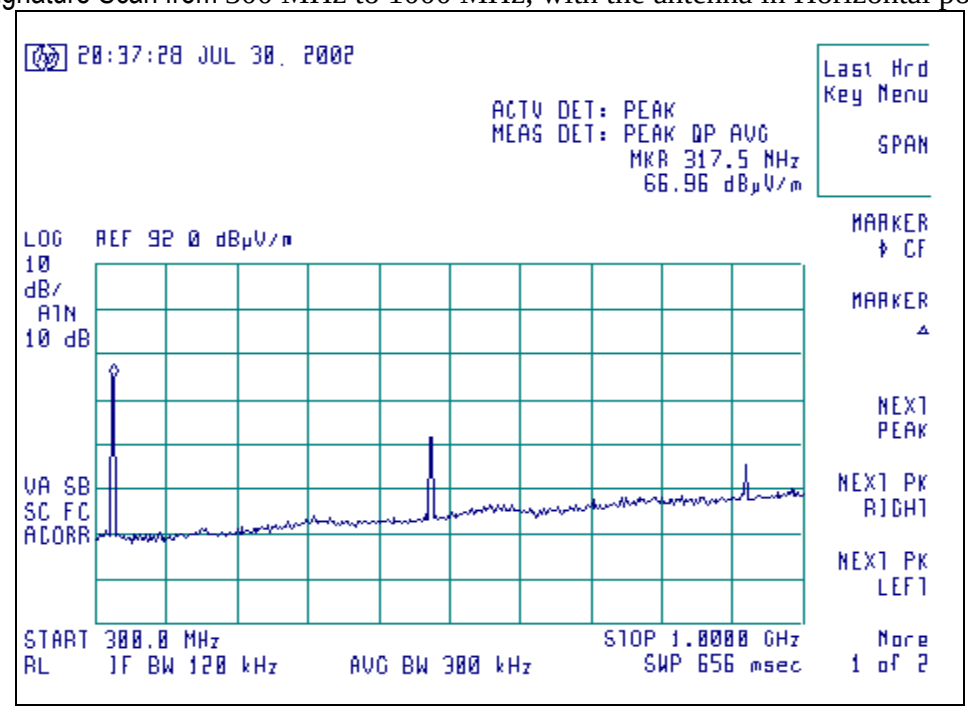


12g. Signature Scans – Radiated Emissions

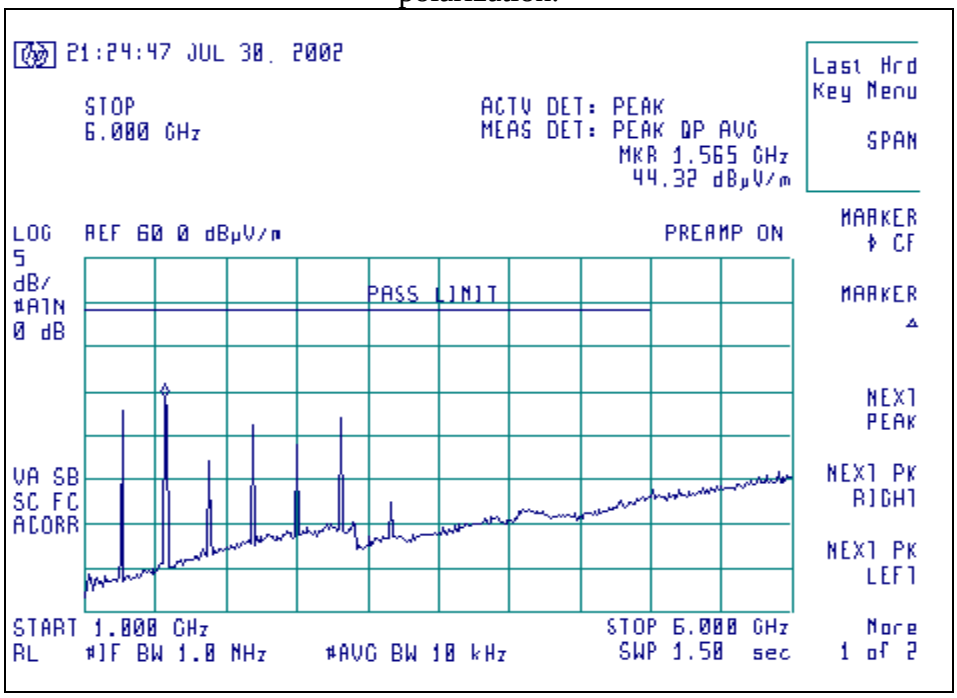
315 MHz Signature Scan from 30 MHz to 300 MHz, with the antenna in Horizontal polarization.



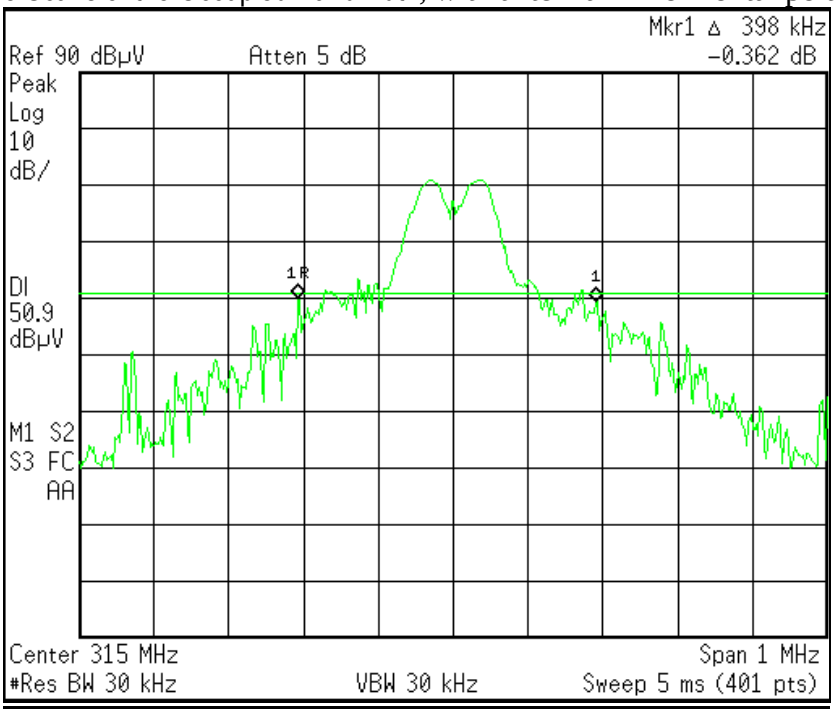
315 MHz Signature Scan from 300 MHz to 1000 MHz, with the antenna in Horizontal polarization.



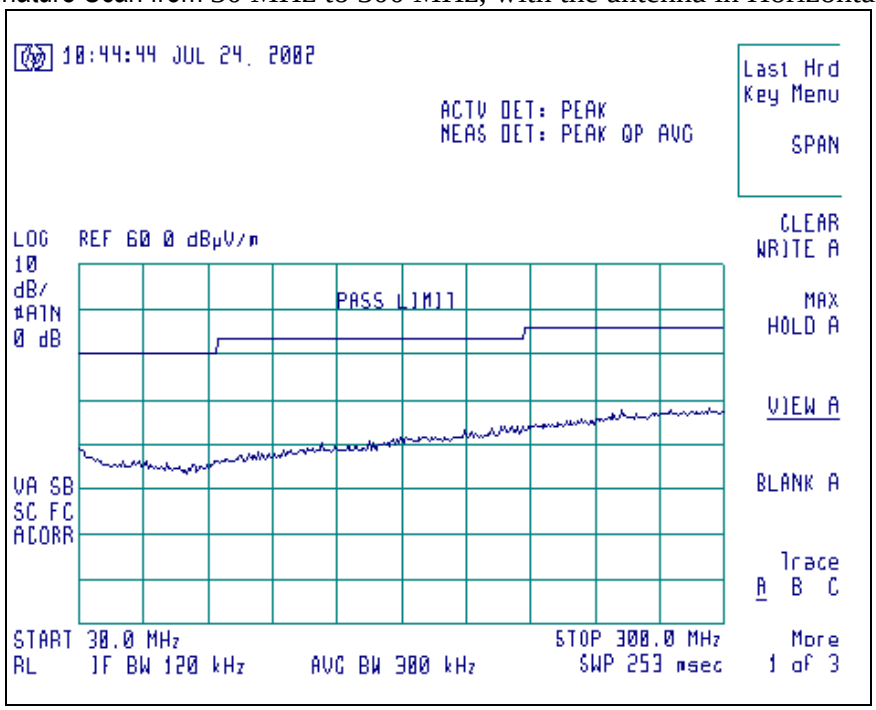
315 MHz Signature Scan from 1000 MHz to 6000 MHz, with the antenna in Horizontal polarization.



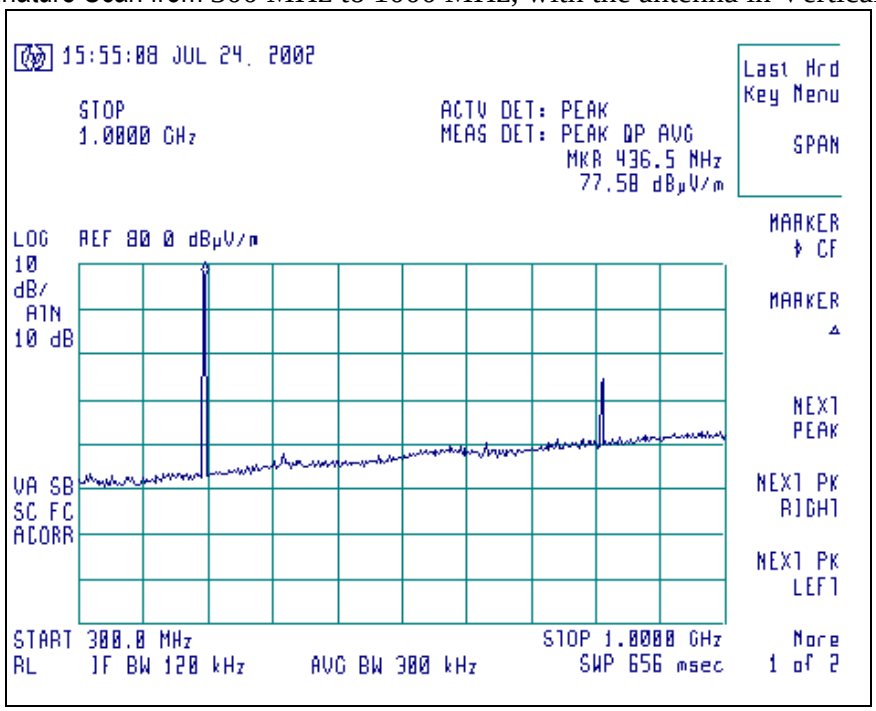
315 MHz Signature Scans of the Occupied Bandwidth, with antenna in Horizontal polarization.



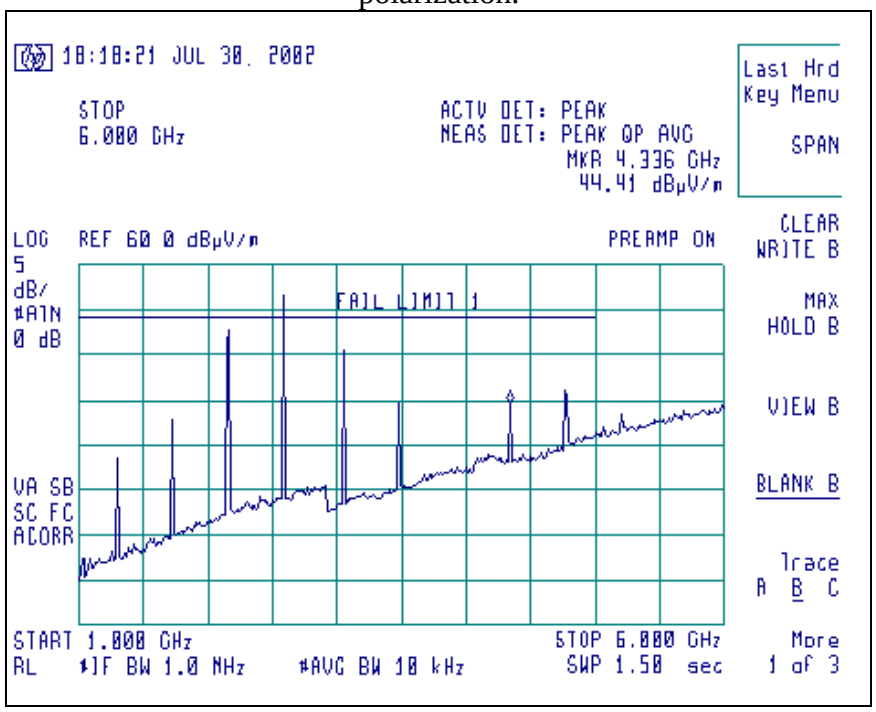
433.92 MHz Signature Scan from 30 MHz to 300 MHz, with the antenna in Horizontal polarization.



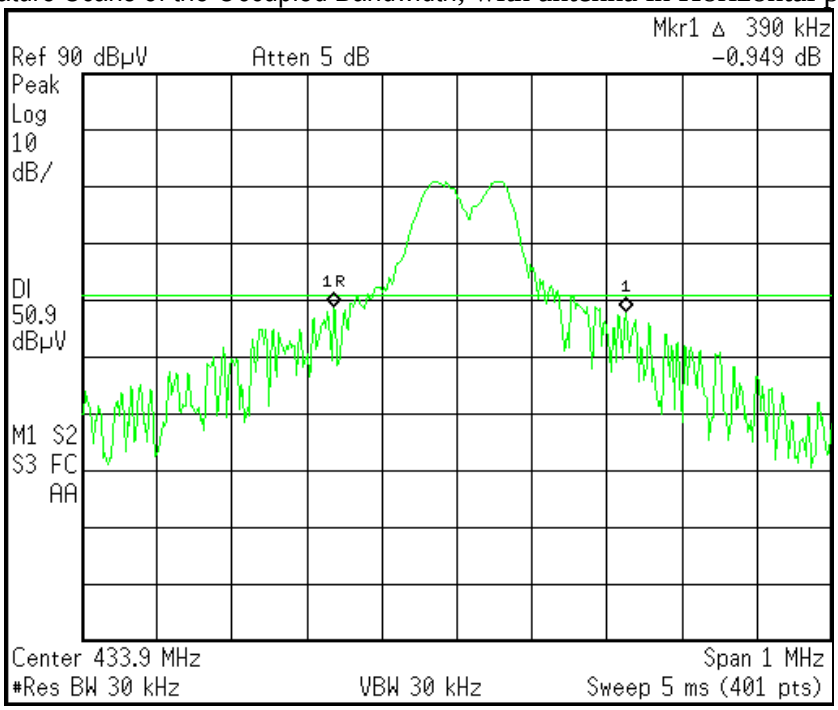
433.92 MHz Signature Scan from 300 MHz to 1000 MHz, with the antenna in Vertical polarization.



433.92 MHz Signature Scan from 1000 MHz to 6000 MHz, with the antenna in Horizontal polarization.

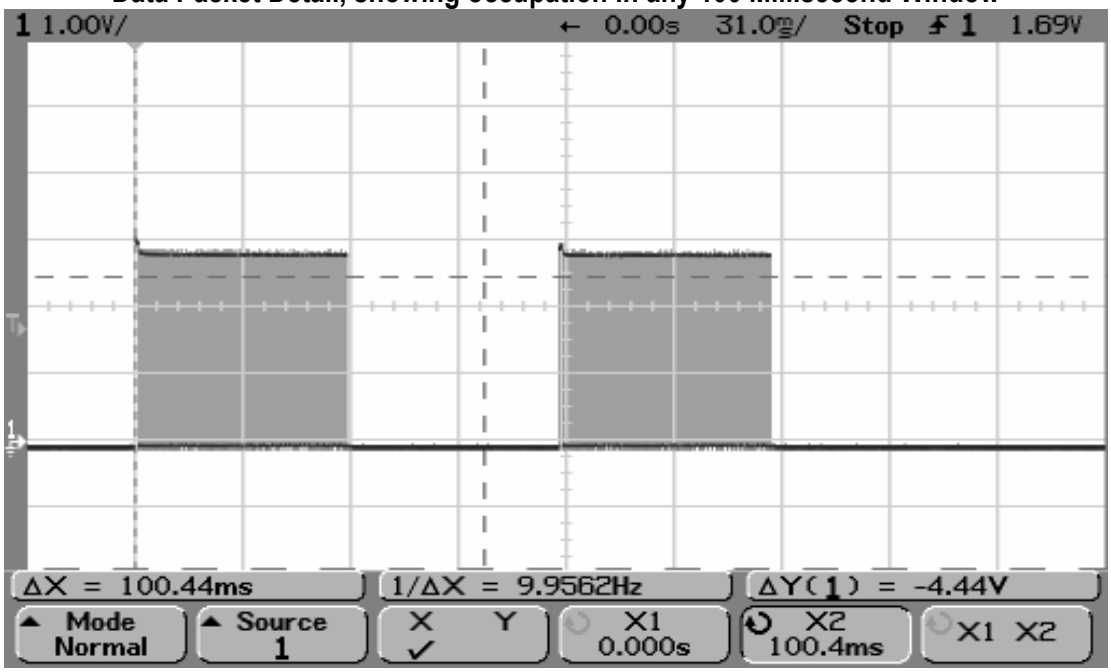


433.92 MHz Signature Scans of the Occupied Bandwidth, with antenna in Horizontal polarization.

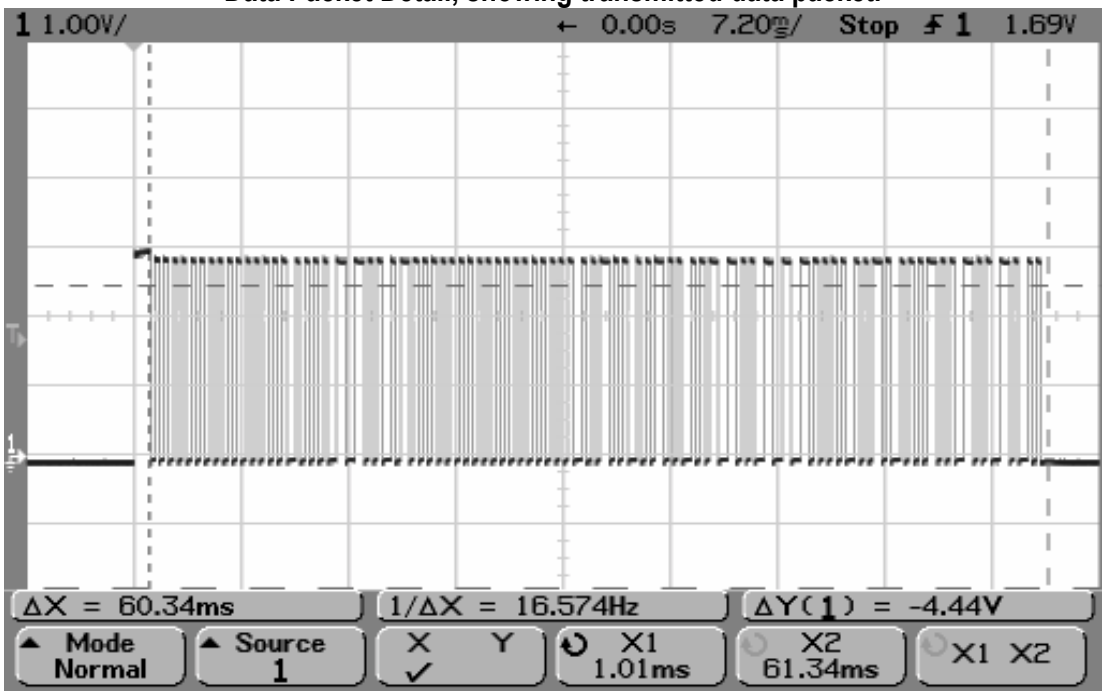


12h. Data Packet Detail – Radiated Emissions

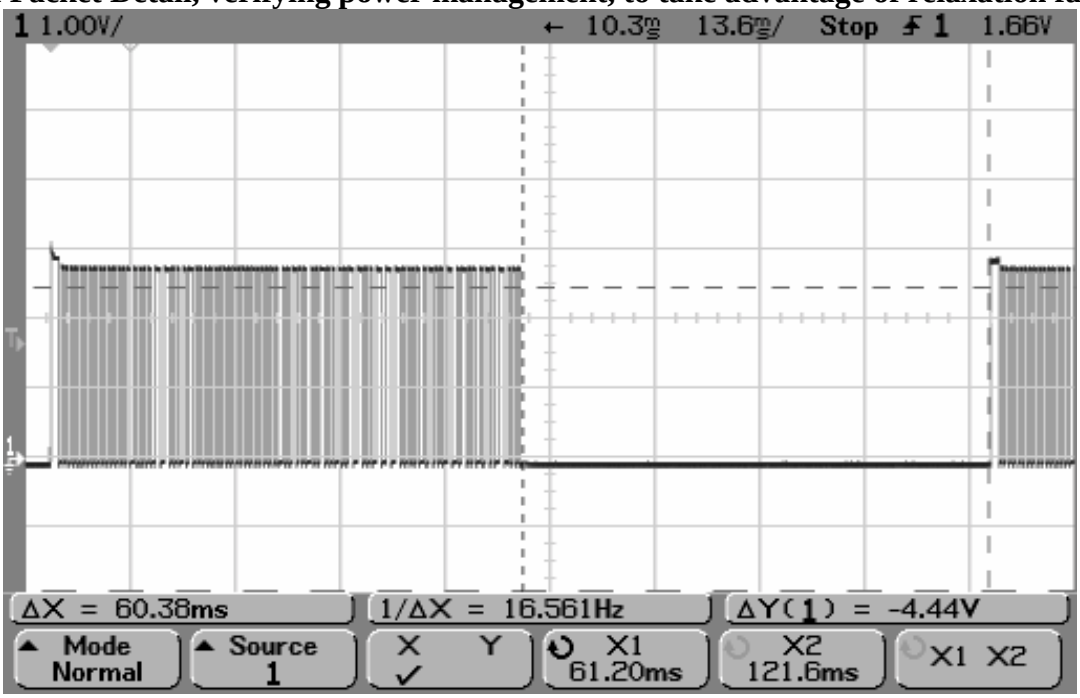
Data Packet Detail, showing occupation in any 100 Millisecond Window



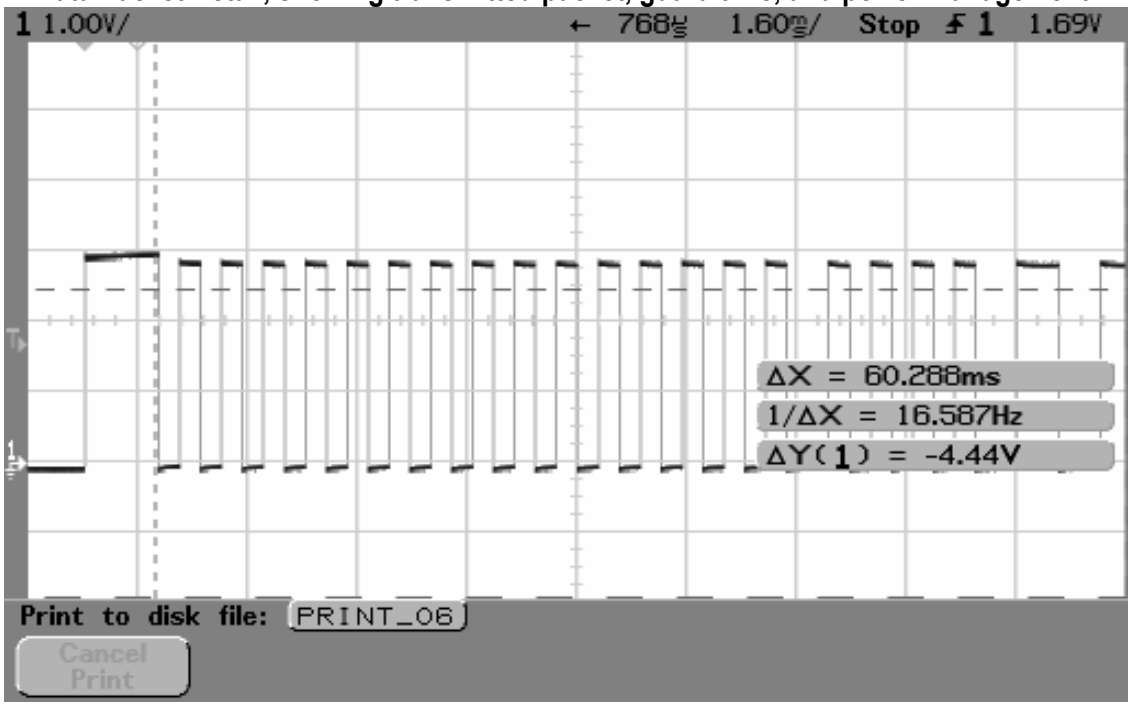
Data Packet Detail, showing transmitted data packet.



Data Packet Detail, verifying power management, to take advantage of relaxation factor.



Data Packet Detail, showing transmitted packet, guard time, and power management.



12i. Measurement of Electromagnetic Radiated Emission

Measurement of Electromagnetic Radiated Emission
Within the 3 Meter Semi-Anechoic FCC Listed Chamber

Manufacturer:	**Pyxis Corporation**
Date of Test:	**24th and 30th July, 2002**
Model:	**JITrBud transmitter, Model 109699-02, Rev 1**
Serial:	**(315MHz)S/N:124, (434MHz)S/N:101**
Test Specifications:	**15.205, 15.209, 15.231a, 15.231b, and 15.231c.**

Distance: 3 Meters			**Frequency Range Inspected:** 30 to 6000 MHz			
Configuration: Normal and CW modes						
Detector(s) Used:	√	Peak	√	Quasi-Peak	√	Average

Test Equipment Used:

EMI Receiver: HP 8546A	Log Periodic Antenna: EMCO 93146
Double-Ridged Horn Antenna: EMCO 3115	Biconical Antenna: EMCO 93110B

The following tables depict the level of significant fundamental and harmonic emissions found in the 315 MHz and 434 MHz bands.

Higher order harmonics were found to be below the noise floor of the receiving system.

315 MHz

Frequency (MHz)	Antenna Polarity	Height (Meters)	Azimuth (0◦-360◦)	EMI Meter Reading (dBµV/m)	Duty Cycle Allowance (dB)	Corrected Reading (dBµV/m)	15.231b Limit (dBµV/m)	Margin (dB)
315.00	H	1.00	190	75.3	4.1	71.2	75.6	4.4
630.00	H	1.40	185	56.5	4.1	52.4	55.6	3.2
945.00	H	1.50	150	48.9	4.1	44.8	55.6	10.8
1260.00	H	1.22	0	51.0	4.1	46.9	55.6	8.7
1575.00	H	1.32	150	50.0	4.1	45.9	54.0	8.1
1890.00	H	1.40	0	42.6	4.1	38.5	55.6	17.1
2205.00	H	1.00	100	45.2	4.1	41.1	54.0	12.9
2520.00	H	1.05	0	44.0	4.1	39.9	55.6	15.7
2835.00	H	1.20	320	41.0	4.1	36.9	54.0	17.1
3150.00	H	1.00	120	40.0	4.1	35.9	55.6	19.7

433.92 MHz

Frequency (MHz)	Antenna Polarity	Height (Meters)	Azimuth (0◦-360◦)	EMI Meter Reading (dBµV/m)	Duty Cycle Allowance (dB)	Corrected Reading (dBµV/m)	15.231b Limit (dBµV/m)	Margin (dB)
433.92	V	1.12	80	78.5	4.1	74.4	80.8	6.4
867.84	H	1.62	0	57.5	4.1	53.4	60.8	7.4
1301.76	H	1.12	40	39.1	4.1	35.0	54.0	19.0
1735.68	V	1.00	285	44.3	4.1	40.2	60.8	20.6
2169.60	H	1.00	330	54.8	4.1	50.7	60.8	10.1
2603.52	H	1.00	245	58.5	4.1	54.4	60.8	6.4
3037.44	H	1.00	45	54.2	4.1	50.1	60.8	10.7
3471.36	H	2.00	0	50.5	4.1	46.4	60.8	14.4
3905.28*	-	-	-	37.0	4.1	32.9	54.0	21.1
4339.20	H	1.70	0	47.7	4.1	43.6	54.0	10.4

* No significant emissions, noise floor only.

12j. Test Results

No significant emissions were found aside from the transmitter fundamental and several harmonics. The unit was scanned for emissions, over the range of 30 to 6000 MHz to establish compliance with Part 15.205, 15.209, 15.231a, 15.231b, and 15.231c, while in continuous transmit mode. At frequencies below the fundamental, no spurious signals, other than the noise floor of the system could be found within 20dB of the limits.

APPENDIX A

Calculations

Manufacturer: Pyxis Corporation
Model: JITrBud Transmitter, Model 109699-02, Rev 1
Serial: (315MHz)S/N:124, (434MHz)S/N:101

CALCULATION OF RADIATED EMISSIONS LIMITS FOR FCC PART 15.209, and 15.231(b) (260-470 MHz)

FIELD STRENGTH OF FUNDAMENTAL FREQUENCIES:
The calculation involves a linear interpolation of 3750 to 12500 µV/m over 260-470 MHz, where field strength of the fundamental frequency (f_o) when $260 \leq f_o \leq 470$ MHz,
can be found by: $3750 + 41.6667(f_o - 260)$, where f_o is in MHz.

FIELD STRENGTH OF SPURIOUS/HARMONIC FREQUENCIES:
The spurious and harmonic emissions are subject to the limits expressed in FCC 15.205, and 15.209, if within the restricted bands, and dictated by the following calculation elsewhere.
The calculation involves a linear interpolation of 375 to 1250 µV/m over 260 to 470 MHz, where field strength of the harmonic frequencies ($2f_o$, $3f_o$...), when $260 \leq f_o \leq 470$ MHz,
can be found by: $375 + 4.1667(f_o - 260)$, where f_o is in MHz.

Above 470 MHz, the limit on the spurious and harmonic emissions is 1,250 µV/m @ 3m.

At fundamental frequency f_o = 315.00 MHz

Fundamental Limit:	3750 + 41.6667 (315.00-260)	= 6,041.67 µV/m @ 3m
Harmonic Limit:	375 + 4.1667 (315.00-260)	= 604.17 µV/m @ 3m

At fundamental frequency f_o = 433.92 MHz

Fundamental Limit:	3750 + 41.6667 (433.92-260)	= 10,996.67 µV/m @ 3m
Harmonic Limit:	375 + 4.1667 (433.92-260)	= 1,099.67 µV/m @ 3m

Frequency (MHz)	Fundamental Limit (µV/m @ 3m)	Fundamental Limit (dBµV/m @ 3m)	Harmonic Limit (µV/m @ 3m)	Harmonic Limit (dBµV/m @ 3m)
315.00	6,041.7	75.6	604.2	55.6
433.92	10,996.7	80.8	1099.7	60.8

DUTY CYCLE CORRECTION FACTOR CALCULATION

For a graphical presentation of the data packets from the transmitter, refer to section 12h. These images were captured on an oscilloscope, while probing the data line, feeding into the transmitter. The transmitter was functioning in normal operating mode, and activated by pressing one of the transmit buttons.

Average (Relaxation) Factor

Average Factor = 20 * Log_{10} (Worst Case EUT On-time over 100 ms time window)
In this particular case, the transmit packet envelope can be used to calculate the relaxation factor.
The transmit packet occupies 62 ms of time, within any 100 ms window. Therefore, the relaxation factor allowance is calculated as:
Average Factor = 20 * Log_{10} (62 ms / 100 ms) = -4.1
A relaxation factor of 4.15 dB would be allowable for this product.

OCCUPIED BANDWIDTH CALCULATIONS

FCC part 15.231c states that the bandwidth of a manually operated device shall be no wider than 0.25% of the center frequency for devices operating between 70 and 900 MHz.

Said bandwidth is determined at the -20 dB reference to peak carrier points.

For 315.00 MHz, the 20 dB bandwidth is 0.0025 x 315.00 MHz = 0.788 MHz
For 433.92 MHz, the 20 dB bandwidth is 0.0025 x 433.92 MHz = 1.085 MHz

Refer to the set of screen captures in section 12i, showing the actual occupied bandwidth of the transmitters as measured.
The measured occupied bandwidth for the 315 MHz sample was 398 kHz.
The measured occupied bandwidth for the 434 MHz sample was 390 kHz.
Both samples had occupied bandwidths within the limits expressed by FCC part 15.231c.

APPENDIX B

Test Equipment List

Asset #	Manufacturer	Model #	Serial #	Description	Calibration Information	
					Date	Due Date
AA960007	EMCO	3115	9311-4138	Horn Antenna	08-23-01	08-23-02
AA960008	EMCO	3816/2NM	9701-1057	Line Impedance Stabilization	09-11-01	09-11-02
AA960014	Fischer	FCC-801-M3-25	148	Coupler-De-Coupler Network	10-06-01	10-06-02
AA960023	Werlatone	C3910	5167	Directional Coupler 40dB	06-19-01	Note 1*
AA960024	Pasternack	100 Watts	PE 7021-6	DC-1.5 GHz Attenuator	I/O	Note 1*
AA960050	Chase	BiCBL6140A	Bilog 1106	Bilog Antenna	06-19-01	Note 1*
AA960054	Giga-Tronics	80301A	1830164	Power Sensor	08-21-01	08-21-02
CC00181C	HP	33120A	US36013549	Signal Generator	09-29-00	N/A
EE960003	Amplifier Research	100W 1000M1A	19821	100 Watts Amp	06-19-01	Note 1*
EE960005	Giga-Tronics	8542C	1831450	Dual Channel Power Meter	08-15-01	08-15-02
EE960006	Haefely Trench	PESD 1600	H604079	ESD Gun	11-09-01	11-09-02
EE960007	Haefely Trench	P-line 1610	083732-19	Line Fluctuation Generator	11-03-01	11-03-02
EE960010	Haefely Trench	P-Surge-4	083061-08	Power Surge Generator	11-04-01	11-04-02
EE960011	Haefely Trench	PEFT 4010	083180-21	EFT/Burst Generator	11-02-01	11-02-02
EE960013	HP	8546A	3617A00320	Receiver RF Section	11-02-01	11-02-02
EE960014	HP	85460A	3448A00296	Receiver Pre-Selector	11-02-01	11-02-02
EE960015	HP	6843A	3531A-00145	AC Power Source/Analyzer	10-22-00	N/A
EE960016	Marconi	2024	112120/044	Signal Generator	08-15-01	08-15-02
FF666002	Fischer	F201-32mm	347	Absorbing Clamp	11-29-01	11-29-02
FF666003	Fischer	F2031-32mm	361	EM Injection Clamp	06-22-01	N/A
FF666012	EMCO	93146	9701-4855	Log-Periodic Antenna	08-28-01	08-28-02
FF666022	Amplifier Research	75A250	21952	75 Watts Amp	06-22-01	Note 1*
FF666027	EMCO	93110B	9702-2918	Biconical Antenna	09-31-01	09-31-02
CC000221C	Agilent	E4407B	US39160256	Spectrum analyzer	09-24-01	09-24-02

Note 1* - Equipment calibrated within a traceable system.

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

Measurement Type	Particular Configuration	Uc Value in Appropriate Units
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