

Test Site Services. Inc.



EMI Test Report

For Phoenix Controls, Inc
Sash Transmitter

**Radiated Emissions
Duty Cycle
Occupied Bandwidth**

**FCC, Part 15 Subpart C
Section 15.231 a, b, c**

Test # B03025

Test Site Services, Inc.
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U.S.A.
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The test results stated in this report are valid only for the specific items tested



Nemko

ELA No. 174



EMC001677-NE
EMC000142-NE



Reg. No. R-1145
Reg. No. C-1205



BSMI Lab No. SL2-IN-E-1018



Cert. No. 00-016



Reg. No. 91007
Reg. No. 91008



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EMI Test Report

for

Phoenix Controls

Test Number : B03025

Product Name : Sash Transmitter

Regulation : FCC, Part 15, Subpart C Section 15.231 a, b, c

Date : 1/28-29/03, 4/29/03

Report Reviewed

& Accepted by: _____

Phoenix Controls
75 Discovery Way
Acton, MA 01720
Phone: 1-978-795-1285
Fax : 1-978-795-1112

Report Issued By:



Richard L. Wiedeman, Laboratory Director

Tested By:



T. Charron, Test Engineer

This test report is not valid without the signatures of Test Site Services, Inc. personnel.

Administrative Data

Regulation : FCC, Part 15, Subpart C Section 15.231 a, b, c; 15.205

Level : 15.231 b, 15.209, 15.35

Test Method : ANSI C63.4-1992

Test Type : Qualification

EUT Classification : Intentional Radiator

Modulation : on / off

Manufacturer : Phoenix Controls

EUT Type/Model # : Sash Transmitter / 830-100-146

Date(s) of Test : 1/28-29/03, 4/29/03

Customer Personnel : John Nelson

TSS Personnel : R. Wiedeman EMC Engineer
: T. Charron Test Engineer

Test Location : Open Area Test Site
Test Site Services, Inc.
30 Birch St.
Milford, MA 01757 U.S.A.

NOTICE	: FCC Rule 2.955 requires that a Verification Report for a Class A Computing Device must be signed by "an Official of the Company responsible for the device". A signature block has been provided on the first page for this purpose.
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EUT Description

The EUT (Sash Transmitter) is a device to control the air flow of a chamber.

A complete description of the EUT may be found on block identifier 1 page.

The tests were run in a typical configuration including the following equipment:

- 1) Sash Transmitter (EUT)
- 2) Sensor Bar

REASON FOR TEST:

Qualification

CHANGES MADE DURING TEST:

- 1) EUT Firmware was modified to continuously transmit to facilitate R.F. measurement
For Radiated Emissions

DEVIATIONS FROM STANDARD TEST METHOD:

None

Test Summary

The EUT (Sash Transmitter) complied with the FCC Part 15 Subpart C, Section 15.231 requirements for an intentional radiator when tested in the system configuration defined herein.

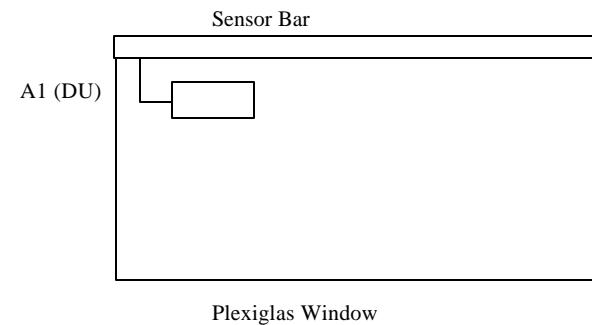
- Radiated Emissions (15.231b, 15.209)

The following table indicates the margins (i.e. difference between measurement point and limit) of the twenty one (10) worst case data points:

TEST CLASS	MARGIN TO SPEC (db)	FREQUENCY (MHz)
<i>Radiated Emissions E Field</i>		
<i>(3.6 VDC)</i>		
Fundamental Frequency	-8.8	433.84
Spurious / Unwanted	-7.8	1301.58
Emissions	-9.7	400.03
	-10.8	244.08
	-12.4	2169.26
	-12.6	280.00
	-15.0	120.03
	-16.7	3904.76
	-19.1	1735.28
	-20.9	4338.43

- Duty Cycle (15.231 a)
15.231, a 2 : Device operational mode, EUT transmits 4 packets in 1.26 seconds when activated.
15.231, a 3 : During Supervisory mode, rate of transmission is 3 packets in less than 1 second every 72 minutes.
- Occupied Bandwidth (15.231, c)
The 20 dB bandwidth of the fundamental and all sidebands is less than .25% of the center frequency. Center Frequency= 433.9 MHz, Bandwidth= 760 KHz

Block Diagram for Sash Transmitter



Ground Plane

Control Room



EUT Technical Data – Block Identifier 1

Description : Horizontal Sash Transmitter

Manufacturer : Phoenix Controls

Model Number : 830-100-146

Part#/Rev : 01

Serial # : 11

FCC/FTZ Ident. :

Power (Rated) : 3.6 VDC **Current** : 4mA peak

Power (Tested) : 3.6 VDC **Current** : 4mA peak

Internal Options:

Description	Manufacturer	Model Number	Serial Number	Part Number
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External Options:

Description 13" Sensor Bar	Manufacturer Phoenix	Model Number	Serial Number	Part Number 250-220-050
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Frequencies Generated:

433.84 MHz 4.0 MHz

Comments:

Cable Descriptions

Cable ID	Number of Cables	Function	Type Shielded Y/N	Length	Number of Conductors	Connector Shell Shielded Y/N	Part Number	Miscellaneous
A1	1	Data	Y	3"	N/A	N		Shield unterminated

•

Test Software Description

Software

Title : Sash Transmitter Firmware

Rev.# : 2.01

Function : Field Measurements

Repeat Time : Continuous; 4 packets / sec. for radiated emissions
3 Packets every 72 minutes for supervisory mode

Run Instructions

: Move the contact strip device in close proximity to the magnet behind it.

Operational Mode(s) During Test

Operational Mode(s) Available : Transmit when activated by sash.
Supervisory mode

Mode(s) Tested : Both

Function : Set fan speed control for fume hood exhaust.

Rationale : System is activated by movement of fume hood sash opening which causes movement of magnet across sash sensor bar, which closes reed switch(s), which causes resistance change presented to transmitter unit, which activates transmission. Normal operation of system.

EUT I/O Ports – Cable Configuration

All testing was performed with the following cables/terminators connected to the EUT I/O ports:

NOTE: FCC Tests : ONE of each TYPE of PORT must be cabled.

CISPR Tests : ONE of each TYPE of PORT must be cabled.

Test Equipment List

#	Equipment Type	Manufacturer	Model #	Serial #	Cal Date	Cal Due	Used
Radiated/Conducted Emissions							
1	Spectrum Analyzer	Hewlett-Packard	8568B	2207A01917	16-Oct-02	16-Oct-03	X
2	Quasi-Peak Adapter	Hewlett-Packard	85650A	2043A00249	16-Oct-02	16-Oct-03	X
3	RF Pre-Selector	Hewlett-Packard	85685A	2648A00500	16-Oct-02	16-Oct-03	X
4	Spectrum Analyzer	Hewlett-Packard	8566B	2532A02250	29-Aug-02	29-Aug-03	
5	Quasi-Peak Adapter	Hewlett-Packard	85650A	2521A00665	30-Sep-02	30-Sep-03	
6	RF Pre-Selector	Hewlett-Packard	85685A	2510A00186	03-Oct-02	03-Oct-03	
7	RF Probe	Fischer	F-33-1	367	12-Mar-02	12-Mar-03	
8	RF Pre-Amplifier	Hewlett Packard	8447D	1937A02850	22-May-02	22-May-03	
9	Pre-Amplifier	Hewlett-Packard	8449B	3008A00952	12-May-02	12-May-03	
10	Biconical Antenna	Schwarzbeck	BBA9106	0101	04-Jun-02	04-Jun-03	X
11	Biconical Antenna	Schwarzbeck	BBA9106	0102	04-Jun-02	04-Jun-03	
12	Log Periodic Antenna	Schwarzbeck	UHALP9107	9107718	17-Jun-02	17-Jun-03	X
13	Log Periodic Antenna	Schwarzbeck	UHALP9107	0103	17-Jun-02	17-Jun-03	
14	Mag Loop Antenna	EMCO	6502	9307-2841	15-Jan-02	15-Jan-03	
15	Horn Antenna	EMCO	3115	9308-4132	19-Nov-02	19-Nov-03	X
16	Active Monopole Ant.	EMCO	3301B	9510-3625	14-Jan-02	14-Jan-03	
17	Tuned Dipole Antenna	Comp Design	A100	445	20-Dec-01	20-Dec-03	X
18	Tuned Dipole Antenna	Comp Design	A100	494	01-Mar-02	10-Mar-03	
19	Antenna Mast	EMCO			Daily	Daily	X
20	Mast Controller	EMCO	1050	1267	Daily	Daily	X
24	Turntable	Macton			Daily	Daily	X
25	LISN 4 x 25 A	Schwarzbeck	NNLA8120	8120458A	14-Jan-02	14-Jan-03	
26	LISN 4 x 100 A	Schwarzbeck	NNLK8121	8121237	26-Mar-02	26-Mar-03	
27	LISN 2 x 25A	EMCO	3825/2	8904-1483	18-Oct-02	18-Oct-03	
28	4 Wire ISN	Rhode & Schwarz	ENY41	833824/012	10-Jul-02	10-Jul-03	
29	Receiver	Rhode & Schwarz	ESBI	827061/005	13-Nov-02	13-Nov-03	
30	Display	Rhode & Schwarz	ESAI	825316/018	13-Nov-02	13-Nov-03	
31	Comb Generator	Com Power	CG-520	20129	5/18/01	5/18/02	
32	Signal Generator	Hewlett Packard	8642B	2551A0053	21-Feb-02	21-Feb-03	
33	Recorder	Graphtec	WR 3101	4017152	15-Apr-03	15-Apr-04	X
34	Oscilloscope	Tektronixs	TDS 360	B017022	02-Dec-02	02-Dec-03	X
Harmonics / Flicker Emissions							
35	Power Source	Cal. Instruments	5001 I	HK 52375	04-Dec-02	04-Dec-03	
36	Power Controller	Cal. Instruments	PACS1(V.1.7)	X71406	04-Dec-02	04-Dec-03	

Appendix A Test Data

TEST DATA

EUT: Phoenix Controls

Receiver BW: 120 KHz, 30-1000 MHz

: 1 MHz, 1-40 GHz

No signals observed above: 4338 MHz

RADIATED EMISSIONS E FIELD

Data by Test Site Services Co

Engineer: R. Wiedeman

Tech : T. Charron

Antenna Ht.: 1-4 Meters

Antenna Sep: 3 Meters, 30-1000 MHz

Antenna Sep: 3 Meters, 1 – 40 GHz

Test: B03025

Date: 1/28-29/03

Power: 3.6 VDC

Spec: FCC Sec. 15.231 b

Antennas Used:

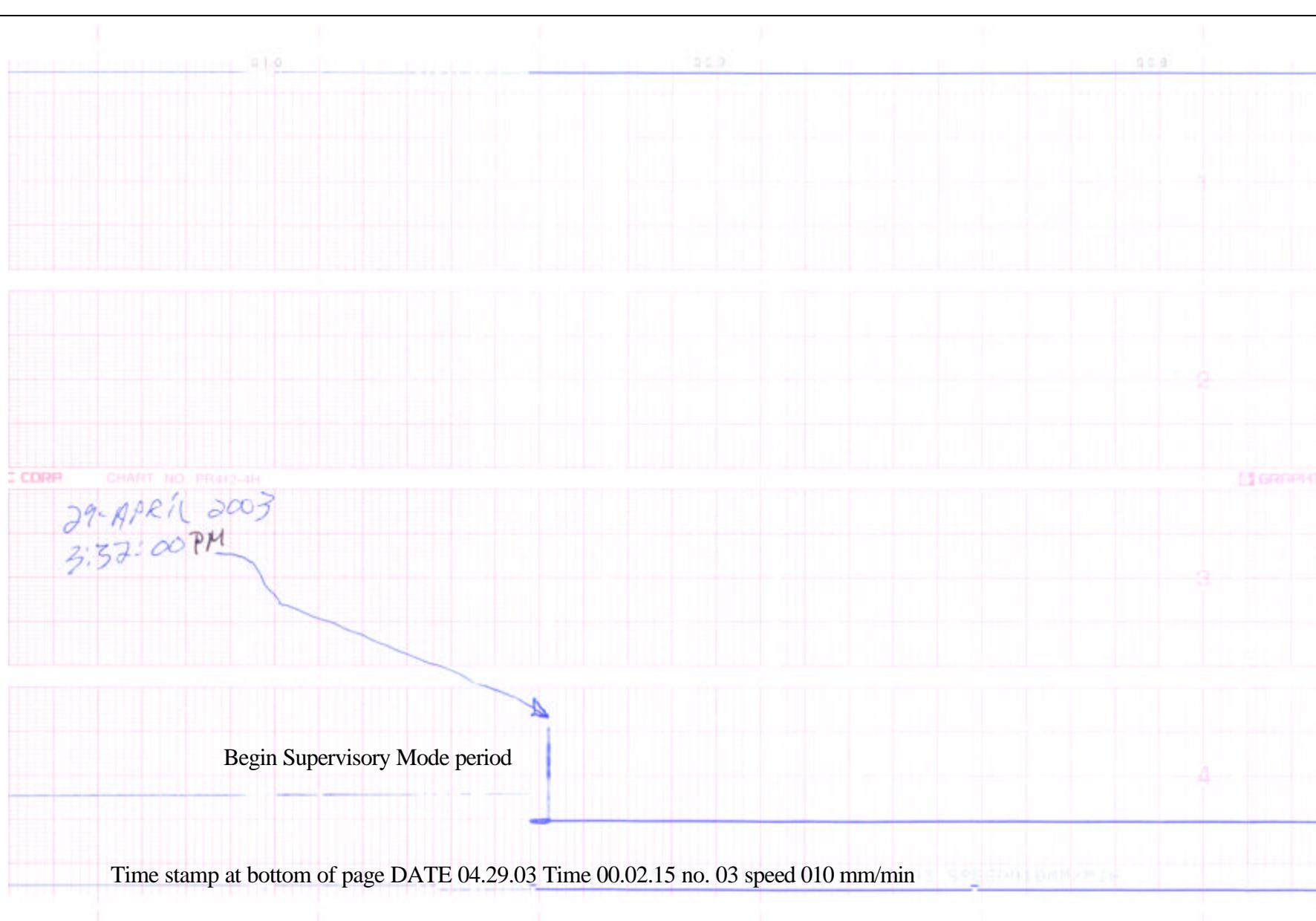
Horn_A

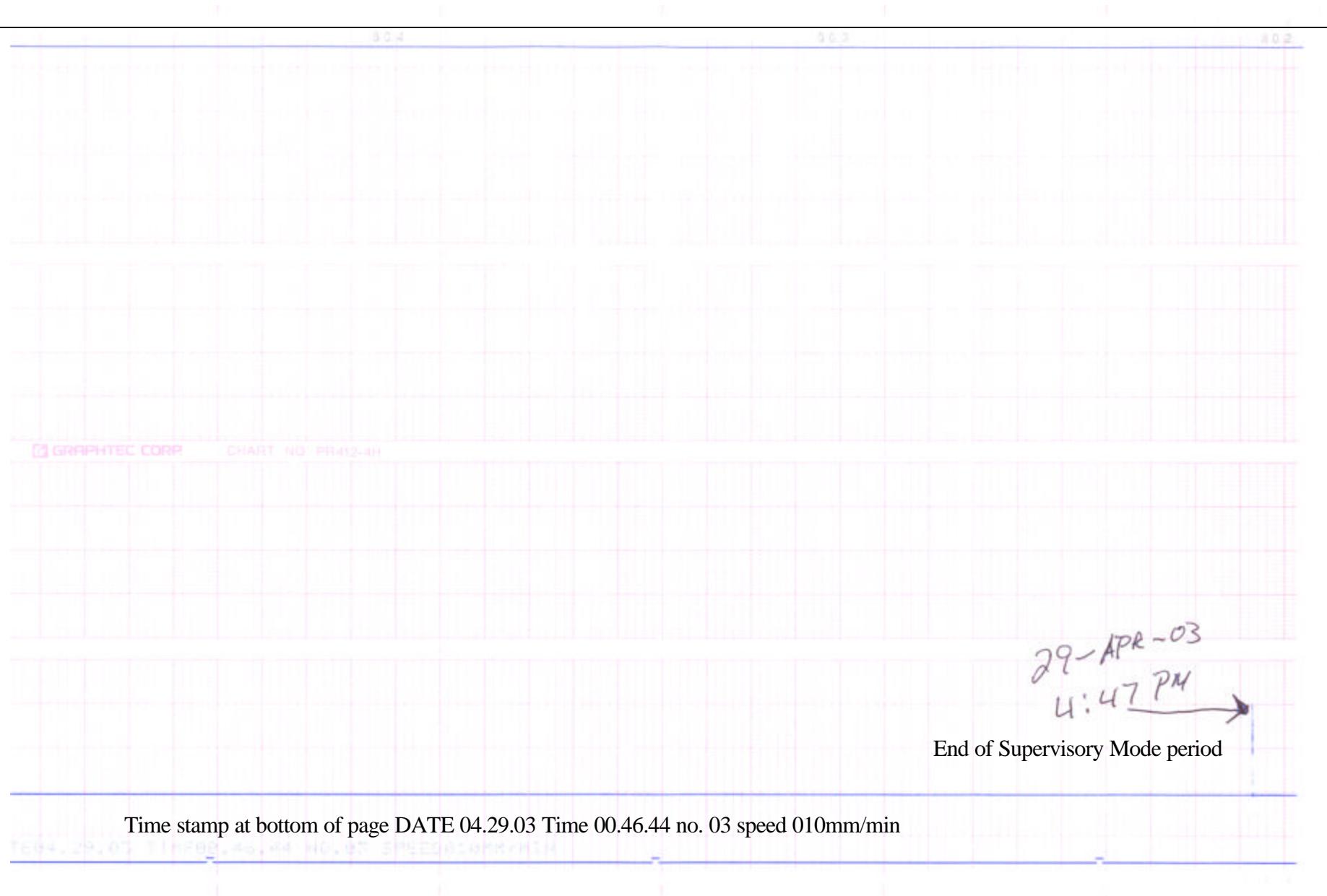
Biconical_A

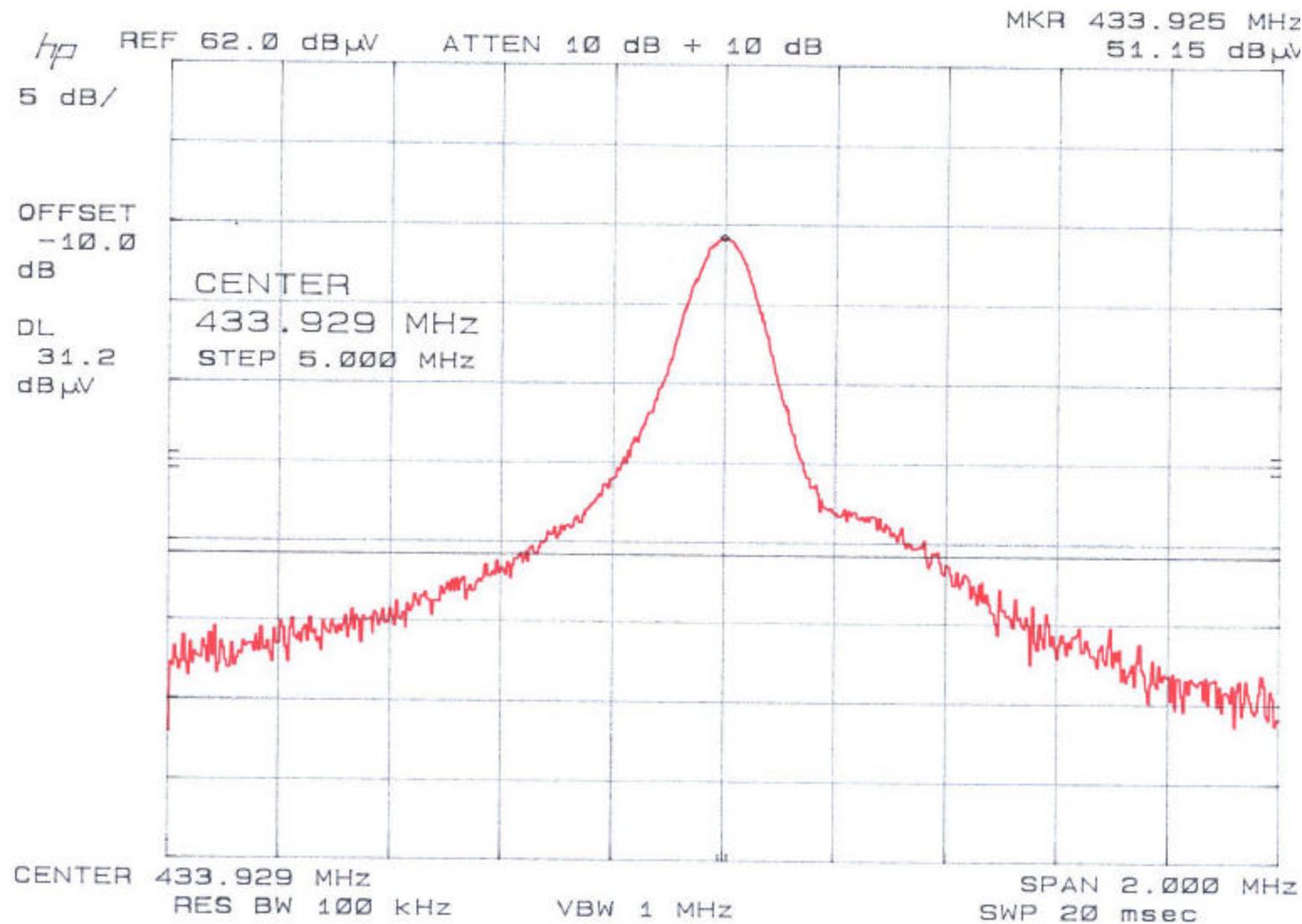
Log Periodic_A

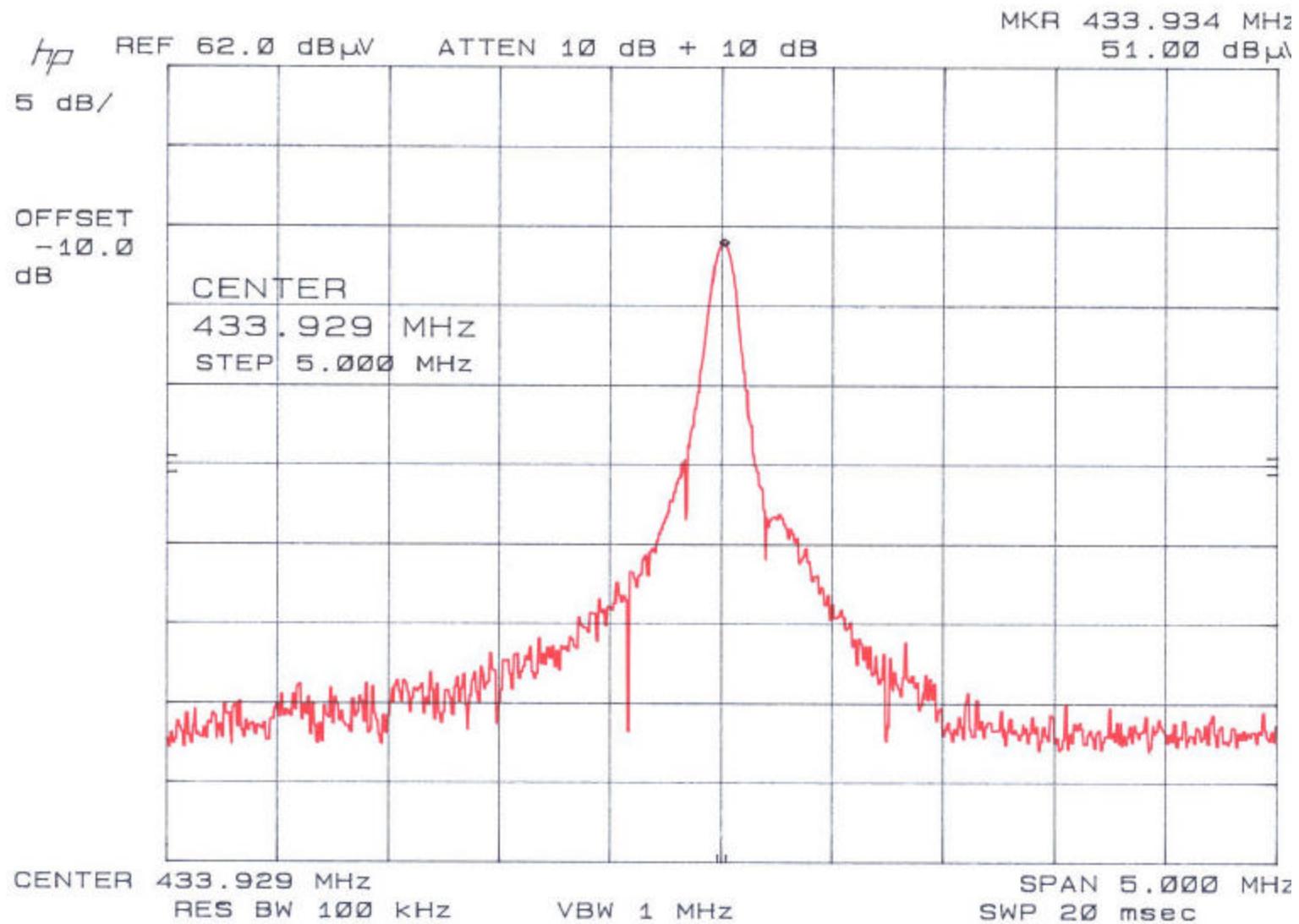
Tuned Dipole

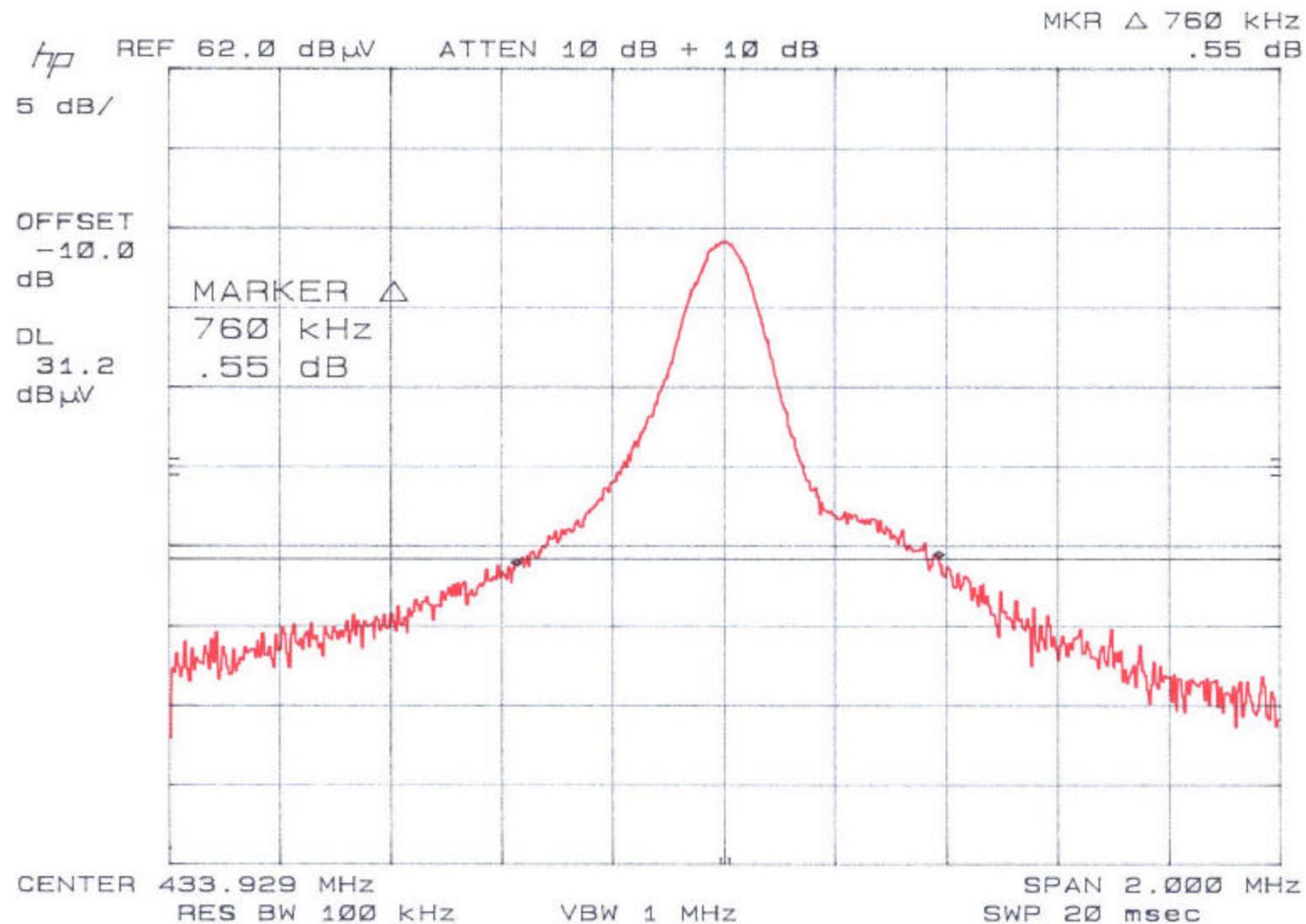
Freq MHz	Signal Level dBuV	Antenna Polariz H/V	Antenna Height cm	Table Azimuth Degrees	Detector P/QP	Antenna Factor dB	Cable Loss dB	Amp. Factor dB	Product Level dBuV/M	Limit 15.231b AVG dBuV/M	Margin 15.231b dB	Limit 15.209 QP dBuV/M	Margin 15.209 dB	Comments
433.84	53.3	H	150	165	PK	16.7	2.5	0.0	72.5	80.8	-8.3			Fundamental
433.84	53.1	H	150	165	QP	16.7	2.5	0.0	72.3	80.8	-8.5			Fundamental
Tuned Dipole Reading														
433.84	49.2	H	159	161	QP	20.3	2.5	0.0	72.0	80.8	-8.8			Fundamental
Spurious / Unwanted Emissions														
120.03	14.3	V	100	156	PK	13.0	1.2	0.0	28.5			43.5	-15.0	
159.96	10.9	H	230	385	PK	14.9	1.4	0.0	27.2	60.8	-33.6			
200.00	9.8	H	358	232	PK	16.6	1.7	0.0	28.1	60.8	-32.8			
220.00	9.5	H	335	0	PK	17.1	1.7	0.0	28.3	60.8	-32.6			
244.08	15.7	H	310	56	PK	17.7	1.8	0.0	35.2			46.0	-10.8	
280.00	12.6	H	238	414	PK	18.8	2.0	0.0	33.4			46.0	-12.6	
320.00	15.5	H	255	414	PK	16.0	2.1	0.0	33.6	60.8	-27.2			
339.65	16.2	H	398	81	PK	16.0	2.2	0.0	34.4	60.8	-26.4			
400.03	18.0	H	373	223	PK	15.9	2.4	0.0	36.3			46.0	-9.7	
560.00	14.2	H	163	350	PK	18.6	2.9	0.0	35.7	60.8	-25.1			
867.69	10.5	H	174	134	PK	24.1	3.9	0.0	38.5	60.8	-22.4			
1301.58	50.9	H	185	376	PK	26.2	5.0	-35.9	46.2			54.0	-7.8	
1735.42	58.0	H	140	144	PK	28.0	5.8	-35.3	56.5	80.8	-24.3			Per 15.35
1735.28	43.2	H	140	144	AV	28.0	5.8	-35.3	41.7	60.8	-19.1			
2169.26	47.6	H	103	180	PK	29.6	6.4	-35.2	48.4	60.8	-12.4			
2603.11	49.6	H	102	407	PK	30.9	7.1	-35.2	52.4	80.8	-28.4			Per 15.35
2603.02	36.7	H	102	407	AV	30.9	7.1	-35.2	39.5	60.8	-21.3			
3036.95	47.8	H	100	237	PK	32.1	7.7	-35.2	52.4	80.8	-28.4			Per 15.35
3037.11	35.2	H	100	237	AV	32.1	7.7	-35.2	39.8	60.8	-21.0			
3470.80	46.8	H	100	244	PK	32.8	8.6	-35.2	53.0	80.8	-27.8			Per 15.35
3470.77	33.5	H	100	244	AV	32.8	8.6	-35.2	39.7	60.8	-21.1			
3904.63	51.0	H	175	171	PK	34.4	9.0	-34.5	59.9	80.8	-20.9			Per 15.35
3904.76	35.2	H	175	171	AV	34.4	9.0	-34.5	44.1	60.8	-16.7			
4338.43	30.5	H	100	152	PK	34.2	10.0	-34.8	39.9	60.8	-20.9			
50.00	10.3	V	100	0	PK	12.6	0.8	0.0	23.7	60.8	-37.2			

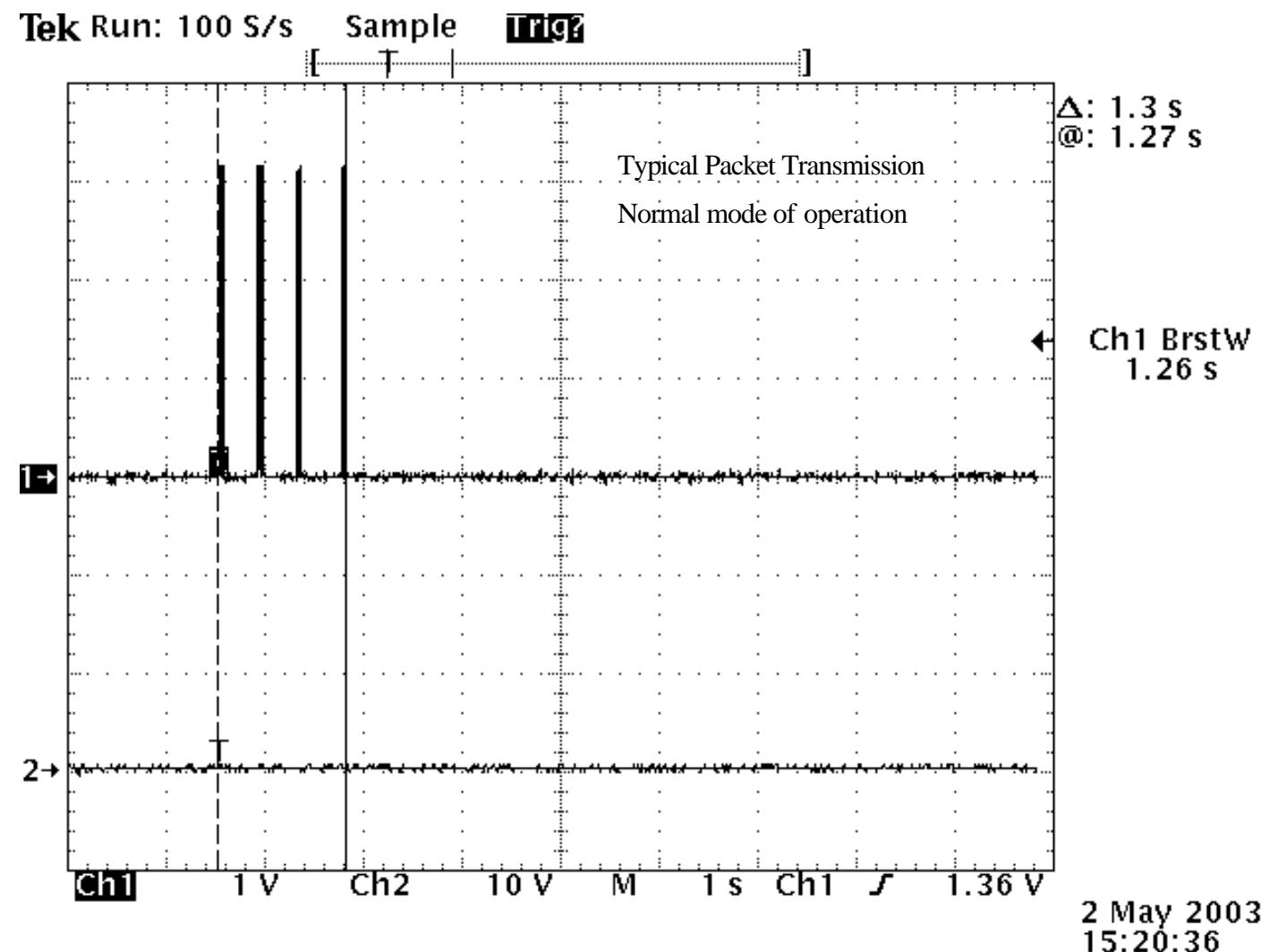


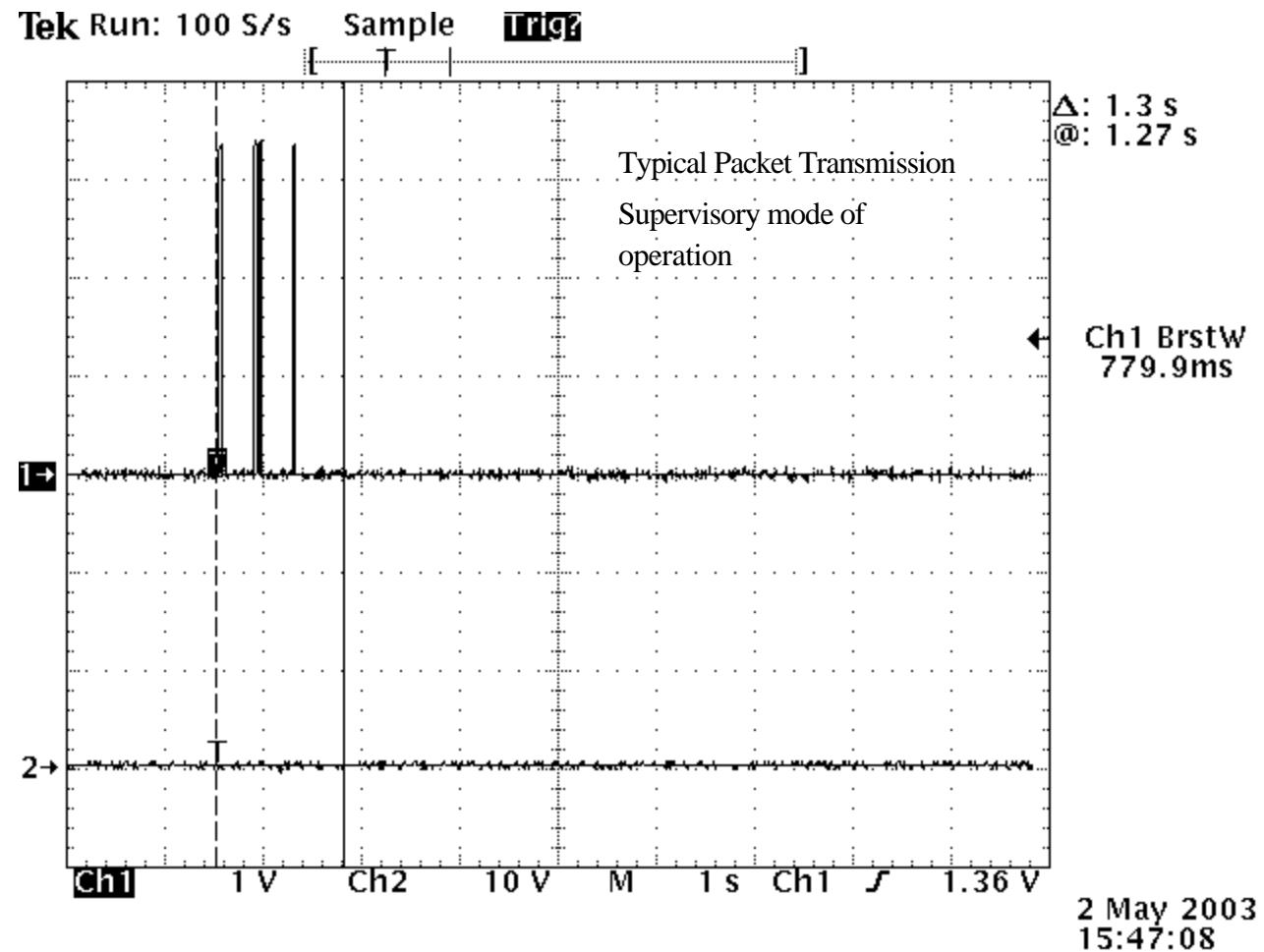












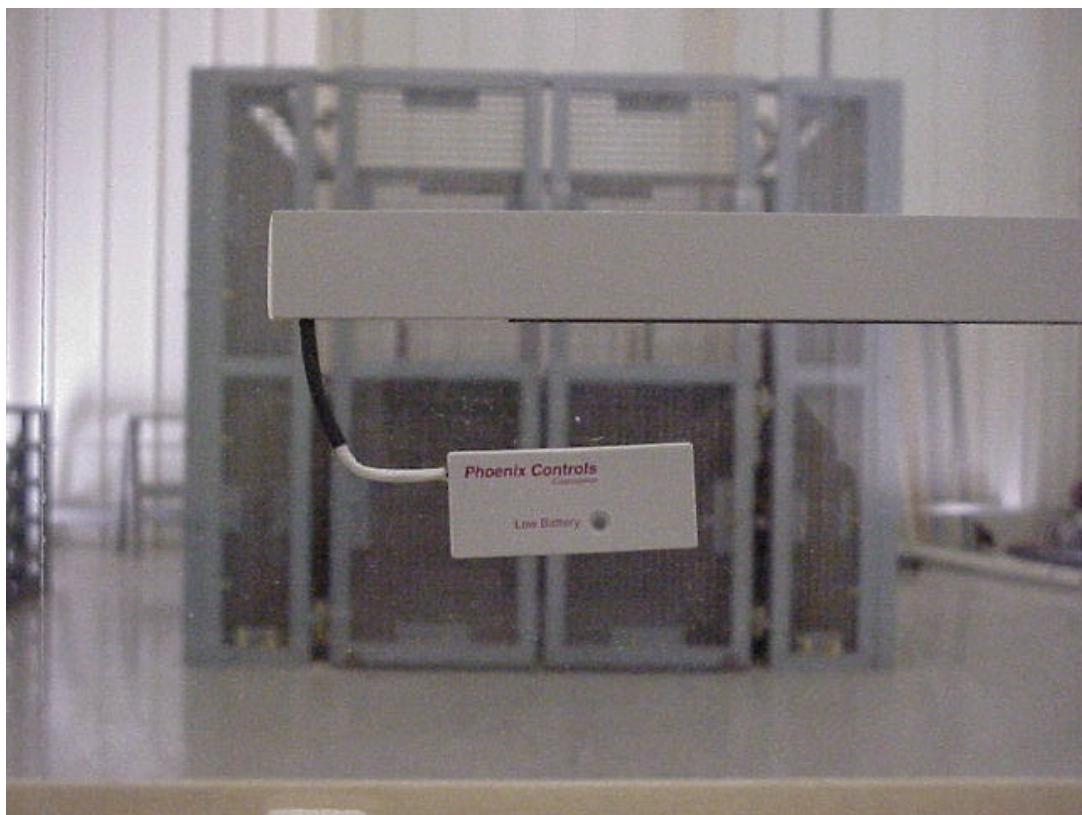
Appendix B Test Photographs

TEST PHOTOGRAPHS

RADIATED EMISSIONS PHOTOGRAPHS

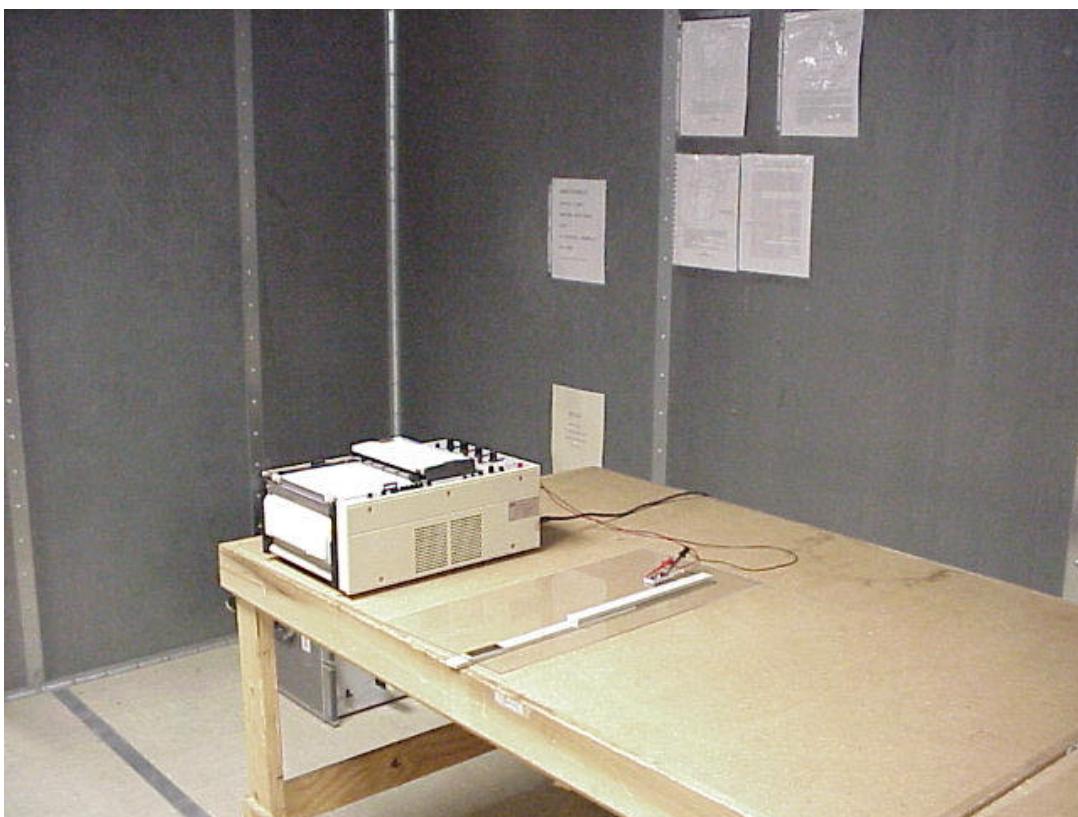


RADIATED EMISSIONS PHOTOGRAPHS



RADIATED EMISSIONS PHOTOGRAPHS

RADIATED EMISSIONS PHOTOGRAPHS



Appendix C Test Procedures

TEST PROCEDURES

Test Procedures - EMI Operational Description

GENERAL

For each emission signal, maximum level is achieved for both horizontal and vertical polarizations as well as (0-360) degrees turntable rotation.

Antenna Test Distances are selected at either 3, 10 or 30 meters separation from the EUT in accordance with applicable specification requirements.

Antenna Scan Heights are varied from 1-4 meters at Antenna Test Distances of 3, 10 and 30 meters.

FCC RADIATED EMISSIONS (E-FIELD)

EMI test procedures are performed in accordance with the requirements of ANSI C63.4 (1992). Measurements are initially obtained using broad band antennas and PEAK detection. In addition, cables are manipulated to maximize emissions within constraints of a typical system configuration. All measured data within 3 db of the Radiated Limits are retaken using Tuned Dipole Antennas (Roberts Type) and QUASI-PEAK (CISPR) Detection. Each EUT is powered from a 60Hz AC source.

FCC CONDUCTED EMISSIONS

EMI test procedures are performed in accordance with the requirements ANSI C63.4 (1992). Measurements are initially obtained with PEAK Detection. In addition, cables are manipulated to maximize emissions within constraints of a typical system configuration. All measured data within 3 db of the Conducted Limits are retaken using QUASI-PEAK (CISPR) Detection. Each EUT is powered from a 60Hz AC source.

CISPR22/EN55022 RADIATED EMISSIONS (E FIELD)

EMI test procedures are operated in accordance with the requirements of the CISPR22 (1997) and EN55022 (1998) Documents. Measurements are initially obtained with PEAK Detection. In addition, cables are manipulated to maximize emissions within constraints of a typical system configuration. All measured data within 3 db of the Radiated Limits are retaken using QUASI-PEAK (CISPR) detection. Each EUT is powered from a 50Hz AC source.

CISPR22/EN55022 CONDUCTED EMISSIONS

EMI test procedures are operated in accordance with the requirements of the CISPR22 (1997) and EN55022 (1998) Documents. Measurements are initially obtained with PEAK Detection. In addition, cables are arranged per the specification within constraints of a typical system configuration. All measured data exceeding 3 db below the Conducted QP Limit are retaken using QUASI-PEAK (CISPR) Detection. All measured data exceeding 2 db below the Conducted AVERAGE Limit are retaken using AVERAGE (CISPR) Detection. Each EUT is powered from a 50Hz AC source.

Appendix D Measurement Facilities Information

MEASUREMENT FACILITIES INFORMATION

DESCRIPTION of MEASUREMENT FACILITIES

The Open Area Test Site (OATS) is composed of a building and associated ground screen with a control room underneath.

The building is a TUFF-SPAN enclosure constructed of fiberglass reinforced plastic materials which provide above-ground weather protection. These materials are non conductive, non magnetic and RF transparent. They do not impact the surrounding electromagnetic environment and are corrosion resistant. The enclosure size permits Ten Meter Radiated Measurements within its confines and utilizes a remote controlled Macton Turntable Assembly. The conductive turntable is 16 feet in diameter and capable of moving a 10,000 pound load a full 360 degrees of rotation. It is flush-mounted to the ground screen and edge bonded circumferentially to the ground screen with beryllium copper "fingers". The ground screen is constructed of welded wire mesh lying directly on top of a concrete-over-steel foundation. The screen is extended beyond the building itself to provide 30 meter measurement capability when needed. There are no reflecting objects within the required obstruction free oval area.

The control room is located beneath the ground screen level with stairwell access to the ground plane area. An elevator is located beyond the ground screen and provides access to the control room, shipping dock and ground screen areas for large sized EUT's. Primary power cabling to the EUT is fed through a hole in the center of the table along with necessary EUT/Support Equipment interface cabling. A remote controlled EMCO Antenna Mast Assembly is located on the ground screen. It provides the operator with adjustable antenna height over the 1 meter through 4 meter range as well as allowing both horizontal and vertical polarizations at any height.

A conducted emissions measurement area is located in a shielded room and consists of a conductive (galvanized sheet metal) wall 20' wide x 8' high with a metal floor bonded to the wall. AC Power is supplied through receptacles located on the vertical wall. Each receptacle is adequately filtered using Shielded Room EMI Power Line Filters (Rayproof 1B42 Units) which provide 100 db attenuation over the 14KHz to 10GHz frequency range. The shielded room itself is bonded directly to earth ground.

Additionally, both the control room/shielded rooms and ground plane area have heating, air conditioning and relative humidity controlled environments.

Capability

Test Site Service's open area Test Sites have been evaluated in accordance with ANSI C63.4 procedures and found to be in compliance with ANSI C63.4-(1992) Site Attenuation and LISN requirements.

In addition, Test Site Services is Assessed and Approved annually by a European Competent Body to assure competence in testing products for CE Mark Compliance (Emissions and Immunity).

All of Test Site Service's measurement facilities meet the technical requirements for qualification testing of products to FCC, CISPR, IEC, VCCI, BSMI and other International Standards.

Accreditation / Approval

- FCC Registered (Registration # 91007 & #91008)
- Industry Canada RSS-212 (File # IC4276)
- VCCI Registered (Registration # R-1145, C-1205)
- BSMI Accreditation (Reference # SL2-IN-E-1018)
- NVLAP Accredited (Radiated and Conducted Emissions Tests Only) (Lab Code # 100419-0)
- Australia (ACA), MRA / NVLAP
- New Zealand (Ministry of Commerce), MRA / NVLAP
- U.S. Conformity Assessment Body (CAB), EMC Directive 89/336/EEC
- Competent Body Assessment / Approval (Technology International, UK) (File# TSS-031899)
- Competent Body Assessment / Approval (Nemko AS, Norway) (Aut. # ELA174)
- Competent Body Assessment / Approval (TUV Rheinland)
- NCC-OCD / Anatel (Brazil / Latin America)
- NARTE certified EMC Technicians & Engineers (ATL-0122T, ATL-0025T, EMC-001677NE, EMC-000142NE)

NOTE: Certificates upon request.

TEST SITE SERVICES, INC.

PO BOX 766

MARLBORO, MA 01752

(508)634-3444

EMC Facility Client Satisfaction Questionnaire

Thank you for choosing to use the Test Site Services EMC test facilities to test your product. Client satisfaction is very important to Test Site Services. To help serve you fully and continue to make improvements in our service, we need your feedback and comments on the service we performed for you today. We would appreciate your taking a few moments to complete this questionnaire.

1. Did scheduling meet your needs _____
2. Test operator support _____
3. Personnel attitude _____
4. Efficiency of test process _____
5. Work completed in a timely manner _____
6. Report received in a timely manner _____
7. Report content and clarity _____
8. Overall rating _____
9. Additional Comments: _____

Test Date: / /

Completed By: _____

*Please return to: Lab Manager or
(At Test Site)*

*Richard L. Wiedeman
President
Test Site Services, Inc.
PO Box 766
Marlboro, MA 01752*