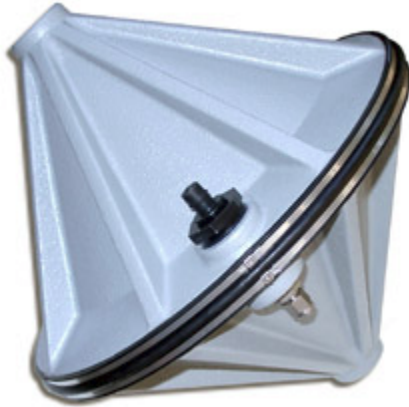




Comes installed in cage - click pic for view

SPECIFICATIONS

- **PRICE:** USD \$10,203
- **Frequency Range:** 200Hz - 9kHz
- **SPL:** 197dB/uPa/m @ 600Hz
- **Maximum Voltage:** 80 Vrms
- **Duty Cycle:** 100%/10A, 50%/14A
- **Impedance:** 8 ohms nominal (including AC1424HP xfmr box)
- **Depth Rating:** 6' - 40'
- **Dimensions:** 16.5" x 16.5" x 16.5"
- **Ducer/Cage Wt:** 61 lbs/air, 33 lbs/water
- **Finish:** 10-mil PPG Amerlock II (Safety Yellow) over MIL-C-5541 Class 1-A; 316 SS cage (natural electropolished)
- **Connector:** Subconn [MCBH3MSS](#)
- **Cable:** Subconn [MCIL3F/MCDLS-F](#) on 50 foot SOOW terminated with Speakon NL4FX
- **Data:** [Guide](#), [TVR](#), [SPL](#), [Z](#), [tabular](#)
- **Included:** Protective cage, [AC1424HP](#) bridging xfmr box, 50 foot terminated cable
- **Option:** Add Swagelok SS-400-1-OR (\$120)
- **Warranty:** 2 year limited
- **Amplifier:** [CDi2000](#) (USA) \$1870.14

[Printable PDF brochure \(47KB\)](#)
[Complete instructions and test data \(12.6MB\)](#)

Lubell LL-1424HP Underwater Acoustic Transducer or Underwater Speaker

High-Power Broadband Piezoelectric Underwater speaker for Military, scientific, and marine biology

DESCRIPTION

The LL-1424HP is a piezoelectric underwater acoustic transducer designed for use in applications including marine biology, sub-bottom profiling, as well as for general military and scientific applications. The LL-1424HP may also be used as an underwater speaker when high power is required.

The LL-1424HP has a useful frequency range of 200Hz-9kHz, a maximum SPL of 197dB/uPa/m @ 600Hz w/80V rms applied, and a nominal impedance of 8 ohms. Because of variation between cast parts, the uniformity of response cannot be guaranteed but is typically +/- 1.5dB from published values. The LL1424HP is provided with an AC1424HP bridging transformer box allowing connection to amplifiers up to 2500 watts at 4 ohms bridged mono.

The LL-1424HP is built to withstand ocean environments by virtue of its 10 mil epoxy finish and cage mounting system. The LL-1424HP is fitted with a Subconn bulkhead connector and includes a mating 50 foot Subconn cable.

Lubell Labs Inc.
712 S Yearling Rd.
Columbus, Ohio 43213 USA
Tel: (614) 725-2701 Fax: (614) 725-2702
email: sales@lubell.com



Lubell Labs LL-1424HP Underwater Acoustic Transducer



Lubell Labs AC-1424HP Bridging Transformer Box





LL1424HP Underwater Acoustic Transducer Instructions

1. If the LL1424HP was ordered with optional installed Swagelok SS-400-1-OR pressure fitting, this fitting must either be plugged (Swagelok SS-400-P), or connected to line and bladder before transducer is used. Use Swagelok tubing and fittings only, and follow Swagelok tightening instructions carefully.
2. Connect provided 50 foot Subconn MCIL3F/MCDLS-F cable to mating Subconn MCBH3MSS bulkhead connector on the Lubell LL1424HP transducer. Connect the Speakon NL4FX connector on the other end of the cable to the mating NLT4MP connector on the Lubell AC1424HP transformer box. Now connect the AC1424HP bridging transformer box input (++) to the bridged output of a Crown CDi2000 amplifier (or equivalent) making sure that the amplifier has been placed in BRIDGE MODE. Connect the AC1424HP GROUND terminal to an approved ship or service ground.
3. Refer to the tabular data included with the LL1424HP before using the transducer. Voltage, current, and duty-cycle must be monitored during use to prevent damage to the transducer. Damage to transducer, cable, transformer box or amplifier as a result of excess voltage or current will not be covered under the warranty. Use extreme caution when reproducing white noise or swept sine waves, as current increases as frequency increases. For example 80V @ 600 Hz = 8.5A, but 80V @ 3.8kHz = 25.6A!. The LL1424HP's 80 volt rating proves useful for operation in the 600Hz region.
4. Maximum Voltage: 80 Vrms
5. Maximum Current: 10 amperes continuous; 14 amperes @ 50% D.C. Monitor current, and use 10A fuse for additional protection.
6. Minimum Depth: 6 feet (1.83 meters)
7. Maximum uncompensated depth: 40 feet (12.19 meters) *
8. Maximum External Housing Pressure: 17.76 psi (1.249 Kg/cm, 1.225 Bar)
9. Do not pressurize the LL1424HP using compressed air. Instead use a self-compensating bladder of sufficient volume *
10. DO NOT allow internal pressure to exceed external pressure or seals will fail.
11. Do not remove the LL1424HP from it's cage, or operate the transducer out of the water.
12. Do not lift the LL1424HP by it's power cable
13. Do not tow the LL1424HP unless mounted in an approved towed body.
14. Do not exceed 180dB if divers are in the vicinity of the LL1424HP. The LL1424HP's sound levels can be harmful to human hearing.

* Note: Users wishing to operate unit at depth greater than 40' may wish to order the LL1424HP with the optional Swagelok SS-400-1-OR pressure fitting with plug (\$120) allowing connection to an aftermarket bladder. When operating at 100' depth, the pressure exerted on the LL1424HP would be 44.4 psi (.444 psi/ft seawater x 100'). At this depth, the bladder volume to LL1424HP volume ratio would be 3.02:1 (.444 psi/ft seawater x 100' depth / 14.7 atmospheric pressure at sea level). Since the internal volume of the LL1424HP is 5619cc, the required bladder volume would be 16,969cc (5619cc x 3.02). Use bladder type compensation only as pressure compensation is safe and automatic. Bladder may be located in any convenient position within 5' of the transducer.

Swagelok Tube Fitting Instructions for 1 in. / 25 mm and Smaller Fittings

Fig. 1



Fig. 2



Fig. 3

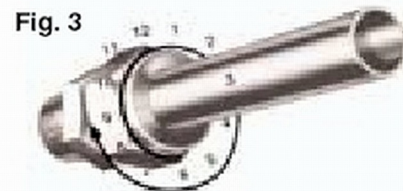


Fig. 6



Fig. 7

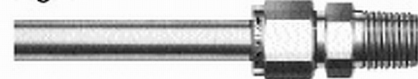


Fig. 8



Female pipe port
on existing equipment

Fig. 9



Swagelok

Installation Instructions

Note: These instructions apply to traditional fittings and fittings with the advanced back-ferrule geometry.

1. Insert tubing into the Swagelok tube fitting (Fig. 1).
2. Make sure that the tubing rests firmly on the shoulder of the tube fitting body and that the nut is finger-tight.
3. Scribe the nut at the 6 o'clock position (Fig. 2).
4. While holding fitting body steady, tighten the nut 1 1/4 turns to the 9 o'clock position. (Fig. 3)

Note: For 1/16, 1/8, and 3/16 in.; 2, 3, and 4 mm tube fittings, tighten the nut 3/4 turn to the 3 o'clock position.

Installation in High-Pressure Applications and High Safety-Factor Systems

1. Insert tubing into the Swagelok tube fitting.
2. Make sure that the tubing rests firmly on the shoulder of the tube fitting body.
3. Due to the variations of tubing diameters, a common starting point is desirable. Therefore, tighten the nut until the tubing will not turn by hand or move axially in the fitting.
4. Scribe the nut at the 6 o'clock position.
5. While holding fitting body steady, tighten the nut 1 1/4 turns to the 9 o'clock position.

Note: For 1/16, 1/8, and 3/16 in.; 2, 3, and 4 mm tube fittings, tighten the nut 3/4 turn to the 3 o'clock position.

Gaugeability

On initial installation, the Swagelok gap inspection gauge assures the installer or inspector that a fitting has been sufficiently tightened.

Position the Swagelok gap inspection gauge next to the gap between the nut and body.

- If the gauge will not enter the gap, the fitting is sufficiently tightened (Fig. 4).
- If the gauge will enter the gap, additional tightening is required (Fig. 5).

Fig. 4



Fig. 5



Reassembly Instructions

You may disassemble and reassemble a Swagelok tube fitting, port connector, cap, and plug many times.

1. Insert tubing with preswaged ferrules into the fitting body until the front ferrule seats (Fig. 6).
2. Rotate the nut with a wrench to the previously pulled-up position; at this point a significant increase in resistance will be encountered.
3. Tighten slightly with a wrench (Fig. 7).

Note: Do not use the gap inspection gauge with reassembled fittings.

Tube Adapters

Installation Instructions

1. Install the end opposite the tube adapter end (Fig. 8).
 2. Insert the tube adapter into the Swagelok tube fitting. Make sure that the tube adapter rests firmly on the shoulder of the tube fitting body and that the nut is finger-tight (Fig. 9).
 3. Scribe the nut at the 6 o'clock position.
 4. While holding fitting body steady, tighten the nut 1 1/4 turns to the 9 o'clock position.
- Note: For 1/8 and 3/16 in. tube fittings, tighten the nut 3/4 turn to the 3 o'clock position.

Fig. 10



Fig. 11

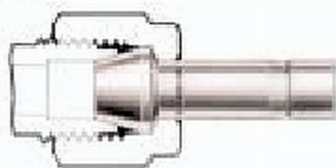
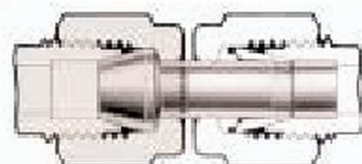


Fig. 12



Port Connector

Installation Instructions—machined ferrule end

1. Remove the nut and ferrules from one Swagelok tube fitting end.
 2. Place the nut over the machined ferrule end of the port connector (Fig. 10).
 3. Turn the nut onto the fitting so that it is finger-tight (Fig. 11).
 4. Scribe the nut at the 6 o'clock position.
 5. While holding fitting body steady, tighten the nut 1/4 turn to the 9 o'clock position.
- Note: For 1/16 and 1/8 in. and 3 mm tube fittings, tighten the nut 1/8 turn.

Installation Instructions—tube adapter end

1. Insert the tube adapter into the Swagelok tube fitting. Make sure that the tube adapter rests firmly on the shoulder of the tube fitting body and that the nut is finger-tight (Fig. 12).
 2. Scribe the nut at the 6 o'clock position.
 3. While holding fitting body steady, tighten the nut 1 1/4 turns to the 9 o'clock position.
- Note: For 1/16 and 1/8 in. and 3 mm tube fittings, tighten the nut 3/4 turn to the 3 o'clock position.

Cap

Installation Instructions

See tube fitting installation instructions.

Plug

Installation Instructions

While holding fitting body steady, tighten the plug 1/4 turn from the finger-tight position.

Note: For 1/16, 1/8, and 3/16 in.; 2, 3, and 4 mm tube fittings, tighten the plug 1/8 turn. For over 1 in. and over 25 mm tube fittings, tighten the plug 1/4 turn.

Preswaging Tool

Installation Instructions

1. Install the Swagelok nut and ferrules onto the preswaging tool.
2. Insert tubing into the preswaging tool.
3. Make sure that the tubing rests firmly on the shoulder of the preswaging tool body and that the nut is finger-tight.
4. Scribe the nut at the 6 o'clock position.
5. While holding the preswaging tool steady, tighten the nut 1 1/4 turns to the 9 o'clock position.

Note: For 1/16, 1/8, and 3/16 in.; 2, 3, and 4 mm tube fittings, tighten the nut 3/4 turn to the 3 o'clock position (Fig. 13).

6. Loosen the nut.

7. Remove the tubing with preswaged ferrules from the preswaging tool.

Note: If the tubing sticks in the preswaging tool, remove the tubing by gently rocking it back and forth. Do not turn the tubing (Fig. 14).

8. Insert tubing with preswaged ferrules into the fitting body until the front ferrule seats.
9. Rotate the nut with a wrench to the previously pulled-up position; at this point, a significant increase in resistance will be encountered.
10. Tighten slightly with a wrench

Note: Do not use the gap inspection gauge with fittings that were assembled using the preswaging tool (Fig. 15).

Fig. 13

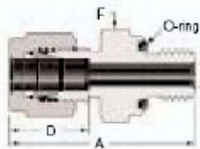


Fig. 14



Fig. 15





① The E dimension is the minimum nominal opening. These fittings may have a larger opening at the pipe/straight thread end.

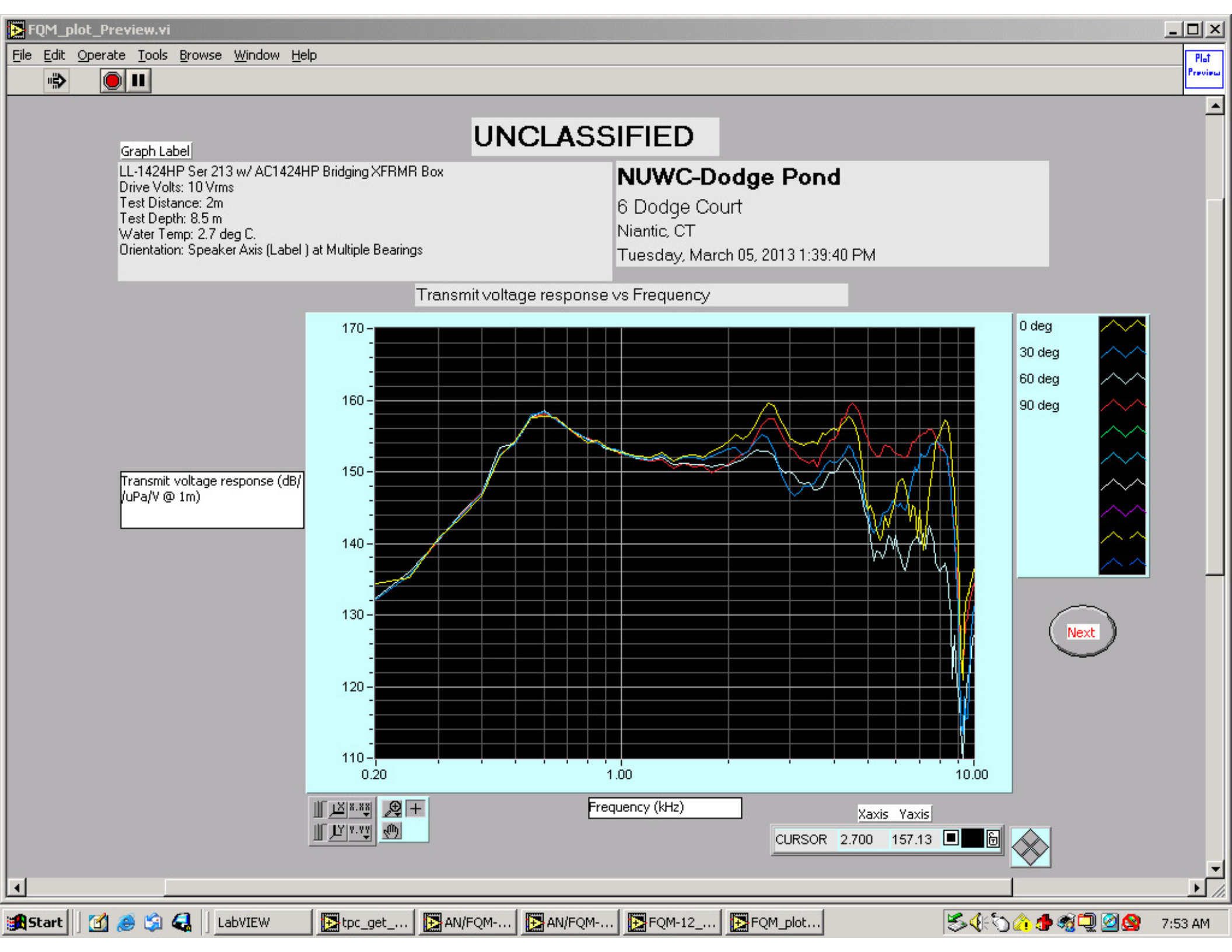
O-seal Fitting (Male SAE/MS Straight Thread)

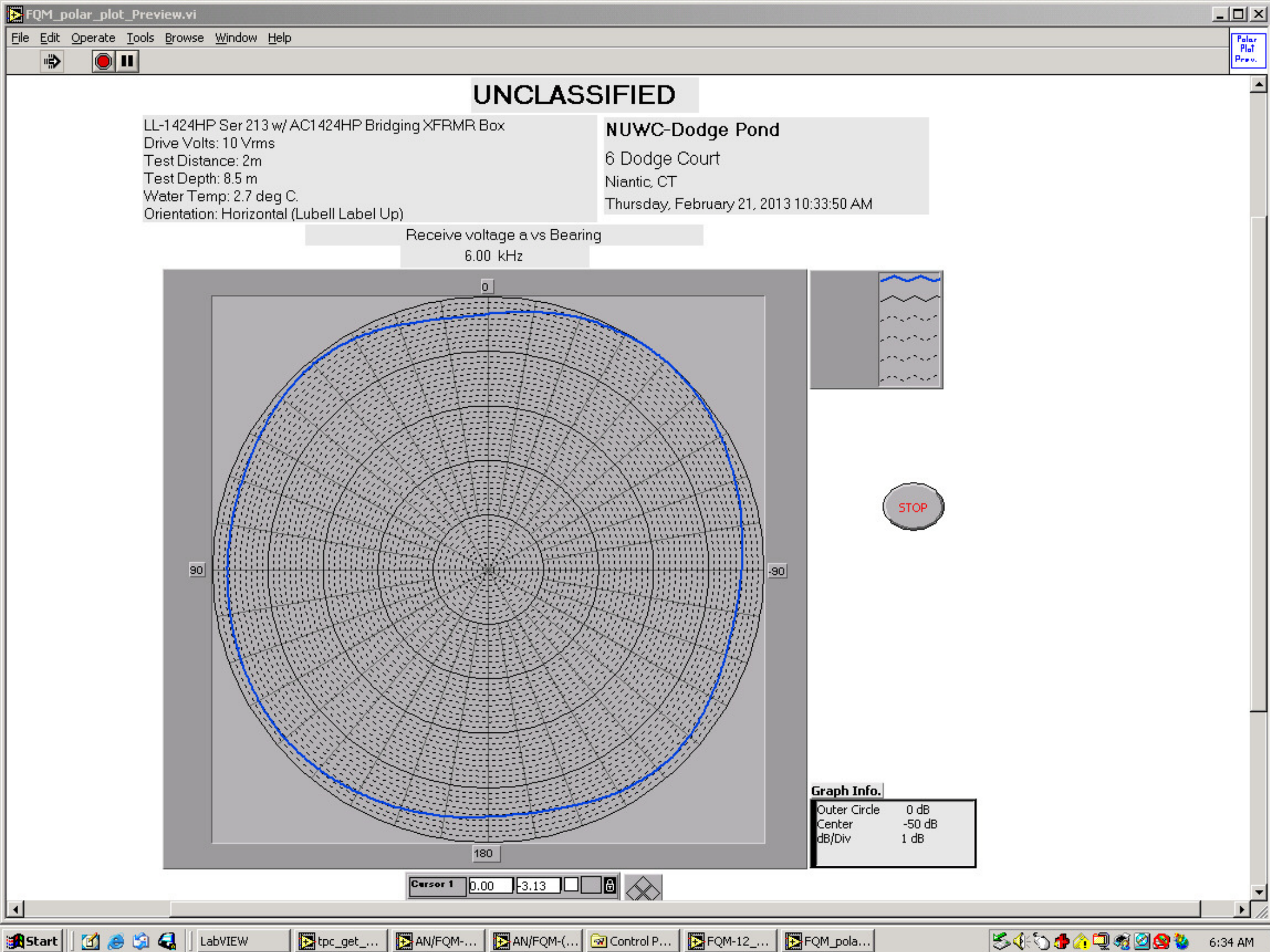
Tube OD	SAE/MS Male Thread Size	Basic Ordering Number	Dimensions			
			A	D	E ^①	F Flat
Dimensions, in.						
1/16	5/16-24	-100-1-OR	1.05	0.34	0.05	9/16
1/8	5/16-24	-200-1-OR	1.29	0.50	0.09	9/16
3/16	3/8-24	-300-1-OR	1.35	0.54	0.12	5/8
1/4	7/16-20	-400-1-OR	1.51	0.60	0.19	3/4
5/16	1/2-20	-500-1-OR	1.60	0.64	0.25	7/8
3/8	9/16-18	-600-1-OR	1.67	0.66	0.28	15/16
1/2	3/4-16	-810-1-OR	1.81	0.90	0.41	1 1/8
3/4	1 1/16-12	-1210-1-OR	2.06	0.96	0.62	1 1/2
1	1 5/16-12	-1610-1-OR	2.29	1.23	0.88	1 3/4

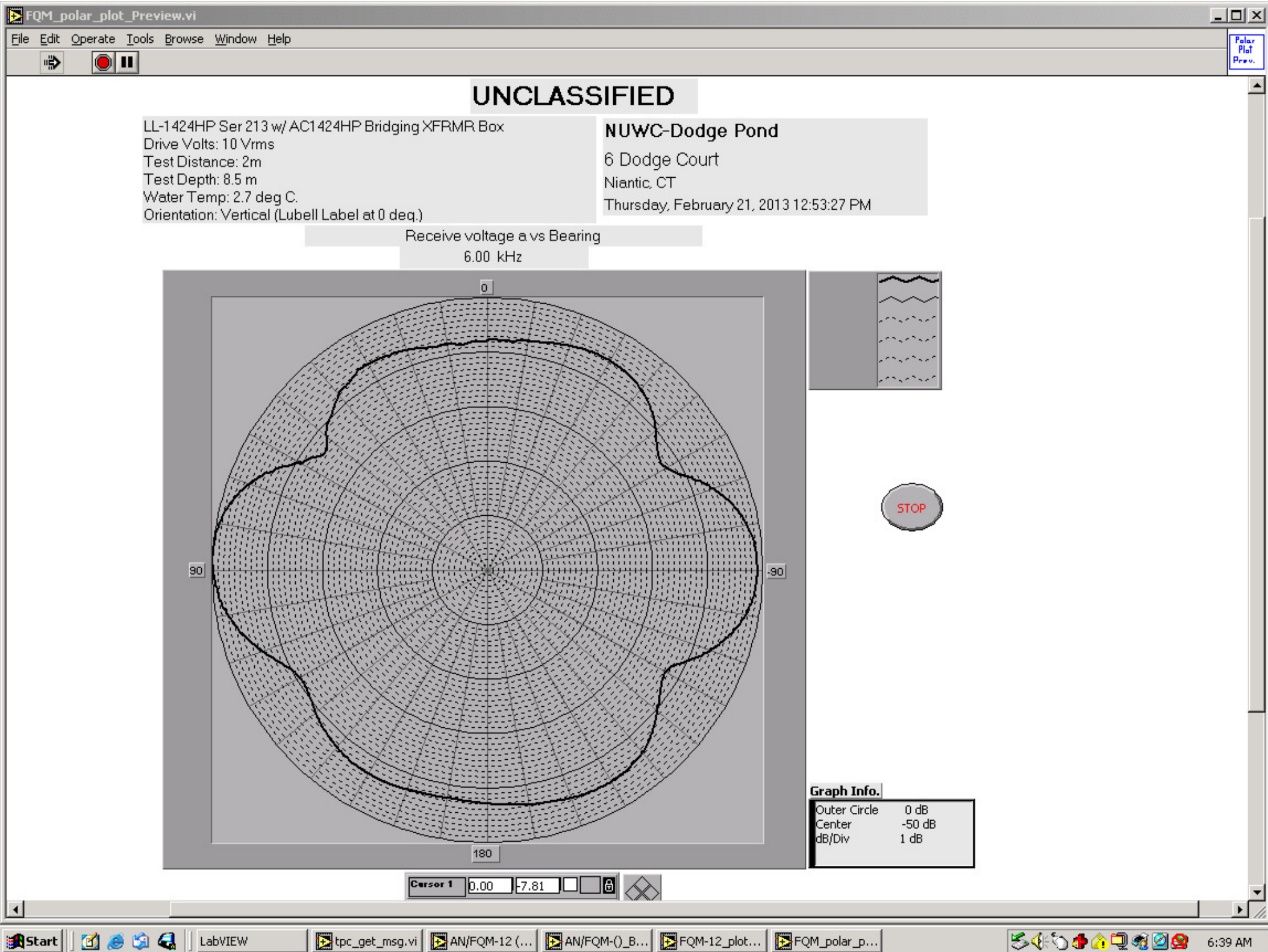
Plug

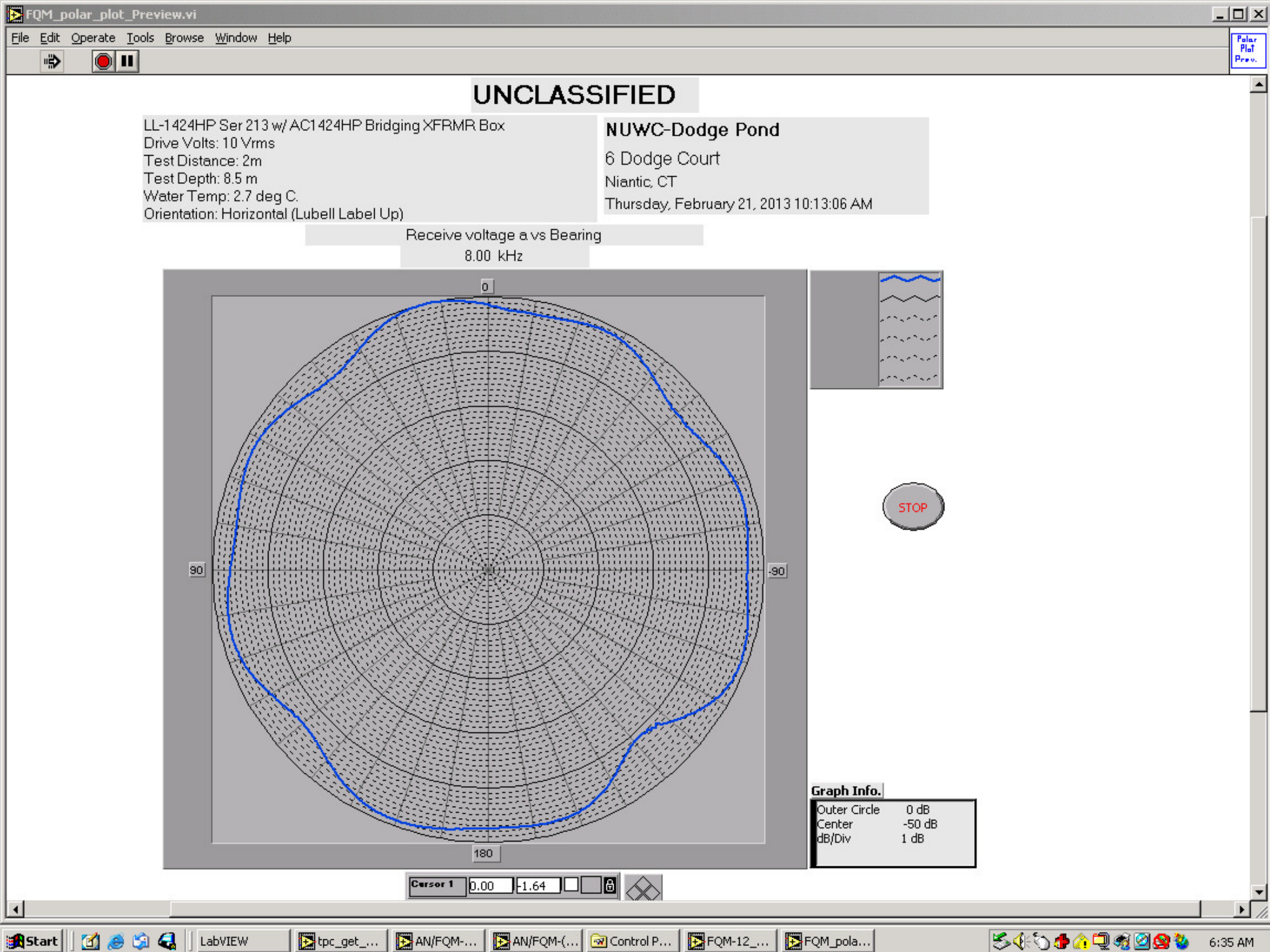


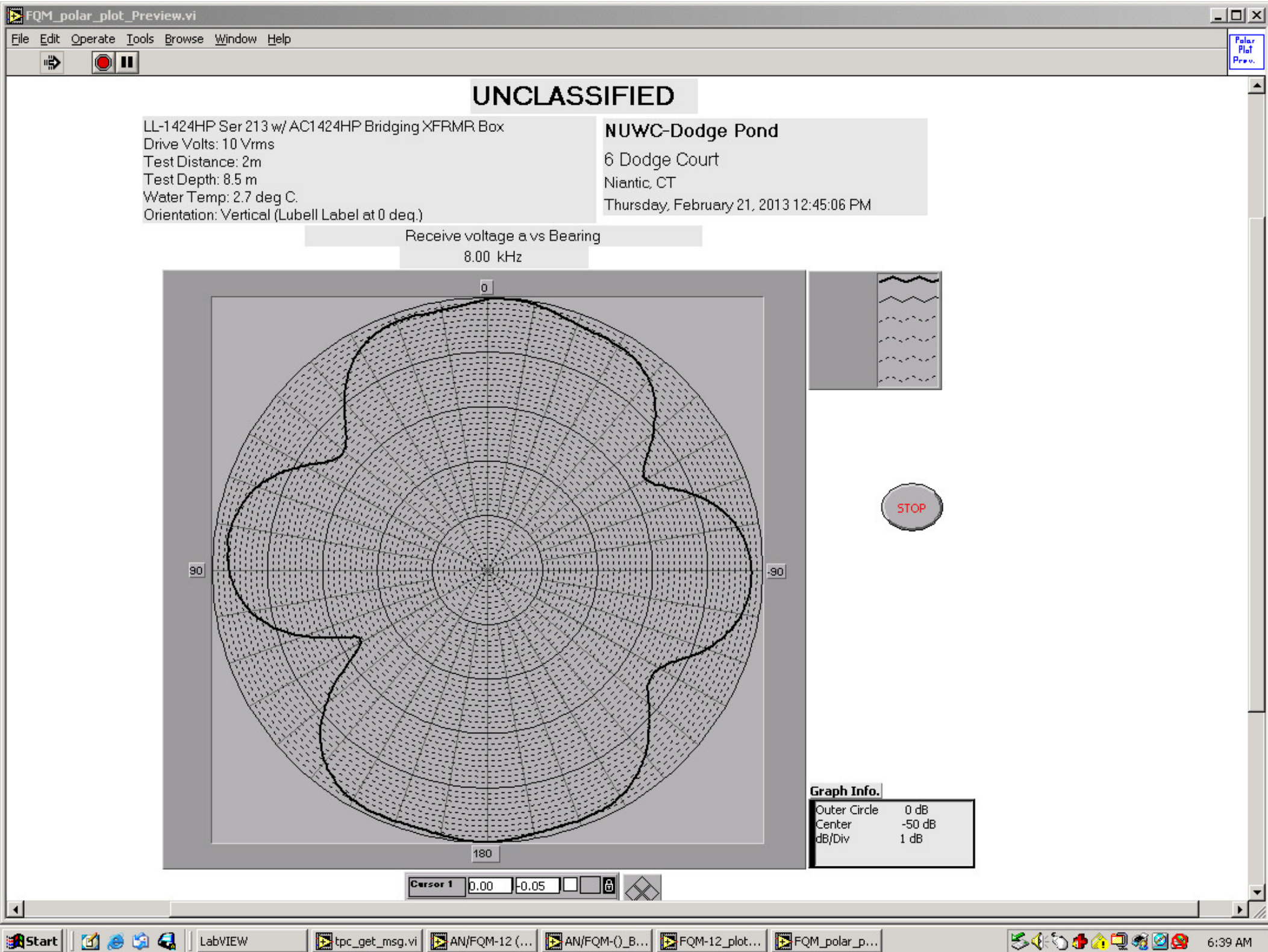
Tube OD	Basic Ordering Number
Dimensions, in.	
1/16	-100-P
1/8	-200-P
3/16	-300-P
1/4	-400-P
5/16	-500-P
3/8	-600-P
1/2	-810-P
5/8	-1010-P
3/4	-1210-P
7/8	-1410-P
1	-1610-P
1 1/4	-2000-P
1 1/2	-2400-P
2	-3200-P

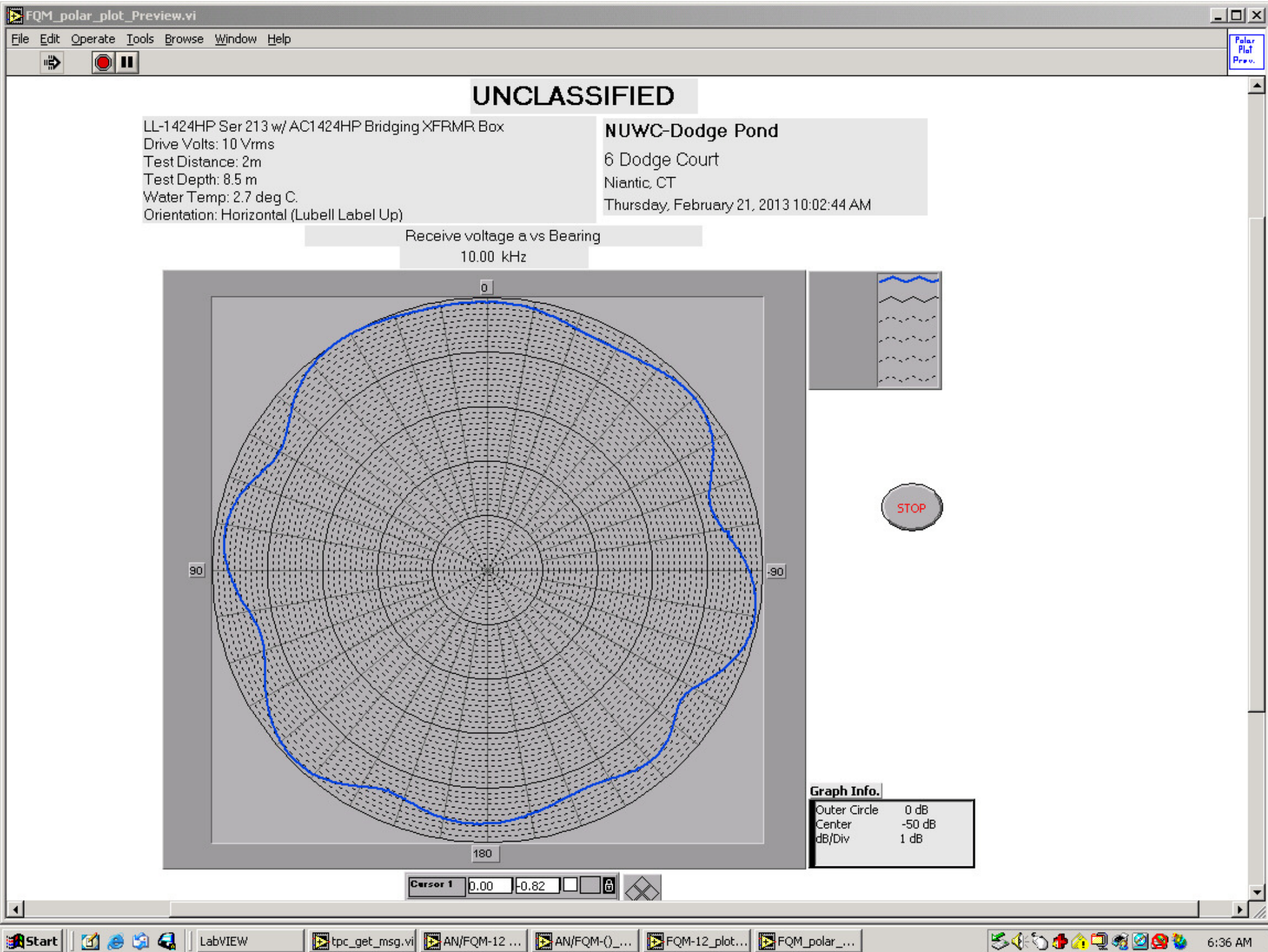


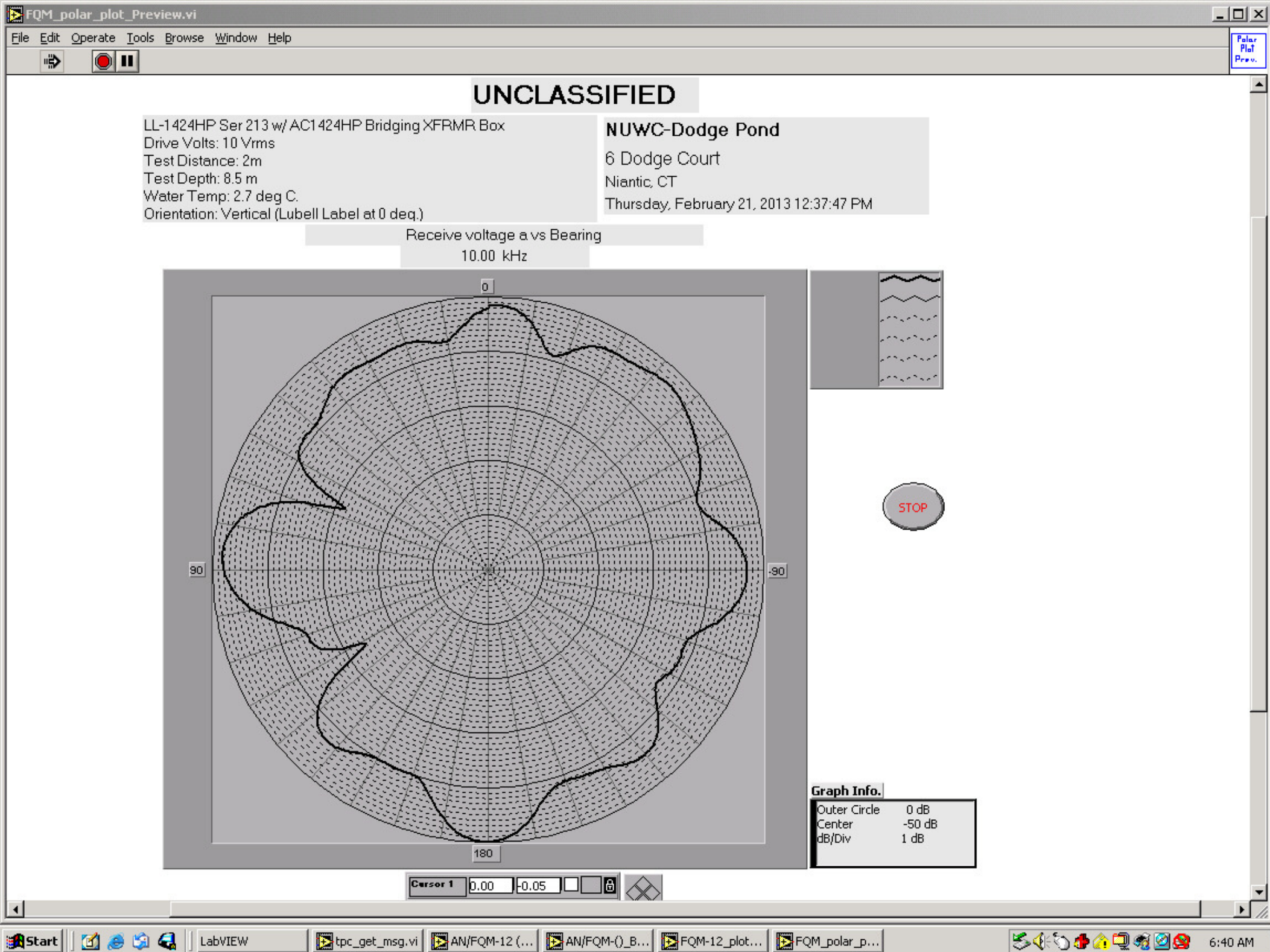


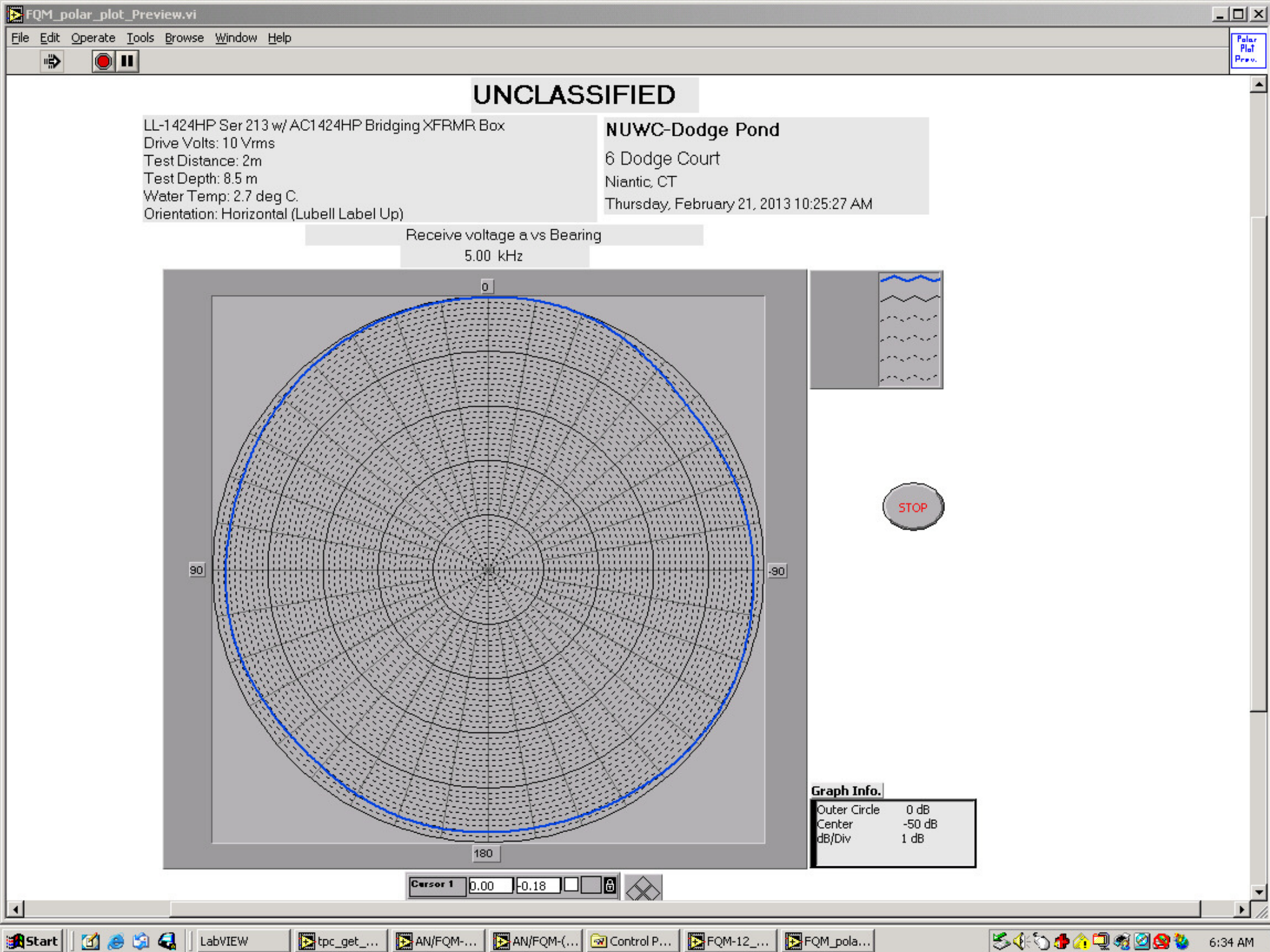


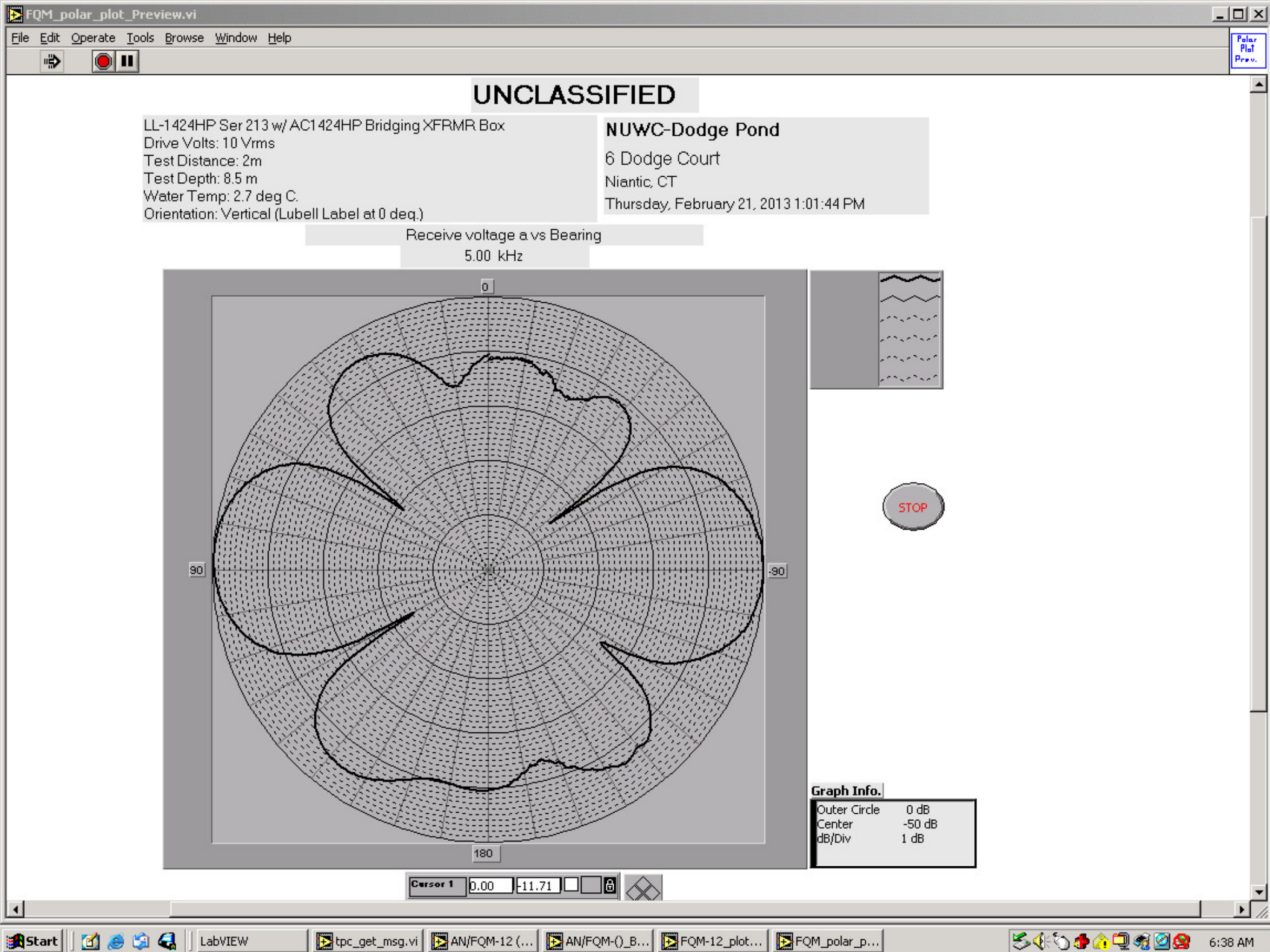












Graph Label

LL1424HP - A, with 1 and 2 Ohm Resistor

DRIVE VOLTS: 80 Vrms

TEST DISTANCE: 2 meters

TEST DEPTH: 8.5 meters

WATER TEMP: 6.0 DEG C.

ORIENTATION: Horizontal

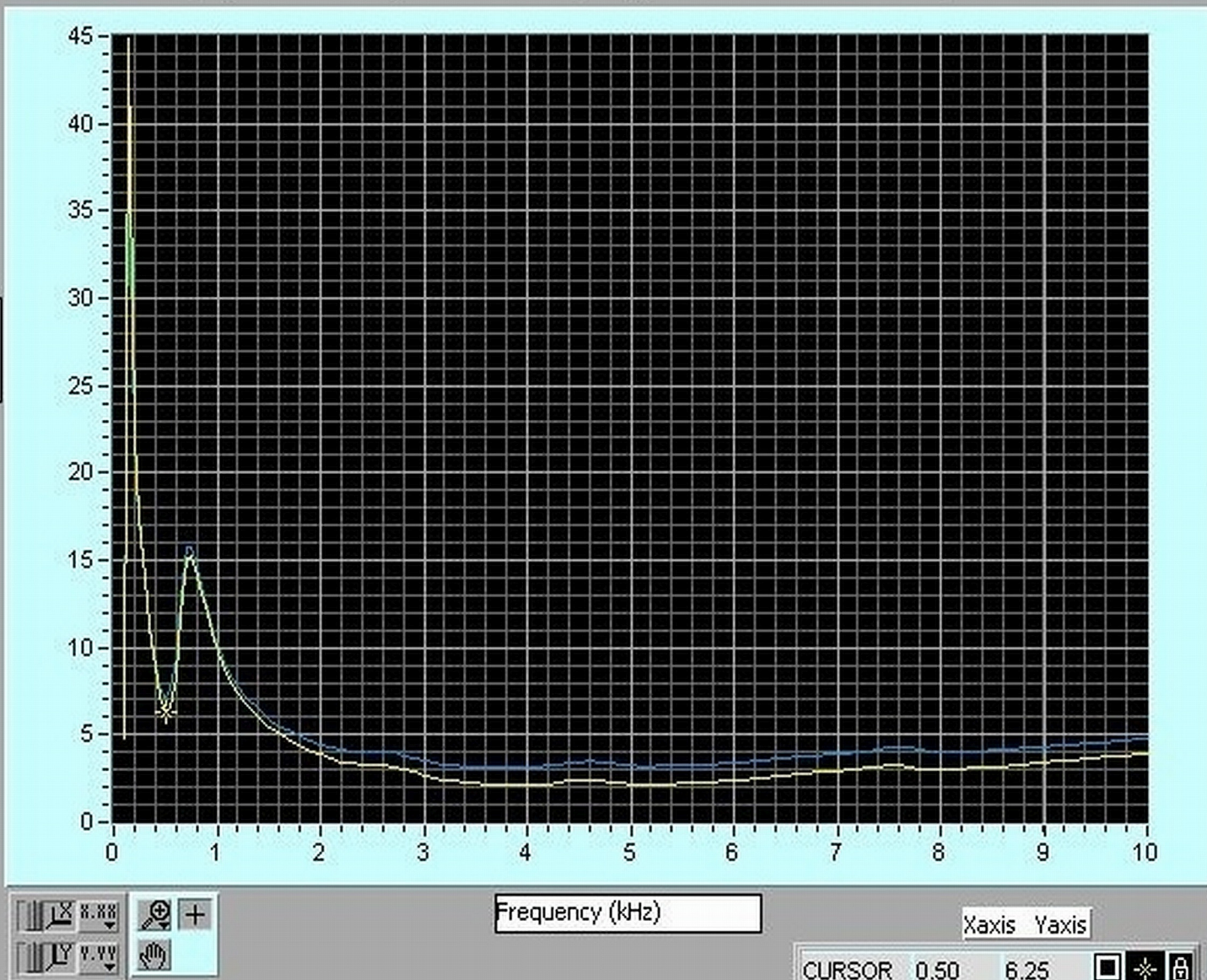
NUWC-Dodge Pond

6 Dodge Court

Niantic, CT

Thursday, August 14, 2003 3:35:50 PM

Impedance magnitude vs Frequency



Frequency Khz	Transmit Voltage Volts	Transmit Current amps	Real Power watts	Z Magnitude ohms	Phase (Z) deg	SPL dB// dB//uPa	TVR dB// uPa/volt	TCR uPa/amp
Se 100 Hz to 10KHz at 10v with 2 ohm resistor.dat								
0.10	10.00	0.15	0.86	64.75	-55.95	137.53	117.53	153.75
0.15	10.09	0.25	0.95	39.63	-68.19	146.94	126.86	158.82
0.20	9.96	0.34	1.12	28.88	-70.93	151.22	131.25	160.47
0.25	9.97	0.46	1.45	21.87	-71.44	156.49	136.51	163.31
0.30	9.97	0.58	1.95	17.24	-70.21	160.06	140.08	164.82
0.35	10.04	0.70	2.53	14.33	-68.91	163.99	143.96	167.08
0.40	10.04	0.85	3.48	11.81	-65.94	167.00	146.97	168.41
0.45	9.98	1.03	5.20	9.73	-59.51	171.63	151.64	171.41
0.50	9.91	1.19	7.77	8.31	-48.91	174.29	154.37	172.76
0.55	10.05	1.28	10.65	7.88	-33.77	177.18	157.14	175.07
0.60	10.06	1.13	10.69	8.90	-19.69	178.20	158.15	177.15
0.65	10.04	0.87	8.50	11.55	-12.88	177.65	157.62	178.88
0.70	10.02	0.65	6.17	15.32	-19.52	176.48	156.47	180.17
0.75	10.05	0.60	5.04	16.64	-33.99	175.49	155.45	179.87
0.80	10.00	0.64	4.59	15.66	-44.08	174.53	154.53	178.43
0.85	10.00	0.69	4.42	14.48	-50.19	173.75	153.76	176.97
0.90	10.01	0.75	4.34	13.27	-54.97	173.29	153.27	175.73
0.95	10.04	0.84	4.47	12.02	-57.81	172.93	152.90	174.50
1.00	10.06	0.92	4.77	10.95	-58.94	172.55	152.50	173.28
1.00	10.06	0.92	4.77	10.94	-58.98	172.56	152.51	173.29
1.10	10.06	1.06	5.42	9.50	-59.42	171.92	151.87	171.43
1.20	10.06	1.19	6.16	8.44	-59.08	171.41	151.36	169.88
1.30	10.03	1.32	7.03	7.61	-57.89	170.87	150.84	168.47
1.40	10.06	1.45	7.89	6.96	-57.13	170.58	150.53	167.37
1.50	10.00	1.57	8.92	6.36	-55.44	170.36	150.36	166.43
1.60	9.93	1.71	10.15	5.81	-53.21	170.18	150.25	165.53
1.70	9.92	1.82	11.35	5.45	-51.03	170.25	150.32	165.05
1.80	9.96	1.92	12.52	5.17	-49.21	170.53	150.57	164.85
1.90	9.97	2.06	14.02	4.85	-46.85	170.58	150.60	164.31
2.00	9.92	2.15	15.29	4.61	-44.21	170.47	150.54	163.82
2.10	9.95	2.26	16.77	4.40	-41.82	171.38	151.42	164.29
2.20	10.04	2.38	18.71	4.22	-38.50	172.22	152.18	164.69
2.30	9.98	2.41	19.67	4.14	-35.16	173.75	153.77	166.11

2.40	9.95	2.42	20.33	4.11	-32.47	174.58	154.62	166.90
2.50	9.92	2.41	20.61	4.12	-30.23	175.16	155.23	167.54
2.60	9.92	2.36	20.33	4.20	-29.72	176.03	156.10	168.58
2.70	9.95	2.39	20.32	4.16	-31.23	175.84	155.88	168.27
2.80	9.94	2.53	21.41	3.93	-31.76	175.53	155.58	167.46
2.90	10.04	2.71	23.51	3.70	-30.21	174.13	154.10	165.47
3.00	9.96	2.82	24.80	3.53	-28.04	172.85	152.88	163.84
3.10	10.03	2.95	26.66	3.41	-25.54	171.55	151.52	162.17
3.20	9.94	3.01	27.57	3.30	-23.00	171.34	151.39	161.77
3.30	10.02	3.10	29.09	3.23	-20.45	170.48	150.47	160.65
3.40	9.94	3.13	29.64	3.17	-17.89	170.29	150.34	160.37
3.50	9.93	3.18	30.41	3.13	-15.33	170.16	150.23	160.12
3.60	10.00	3.23	31.45	3.10	-12.69	170.66	150.66	160.49
3.70	9.92	3.23	31.52	3.07	-10.40	171.06	151.12	160.88
3.80	10.00	3.28	32.46	3.05	-7.85	169.88	149.87	159.57
3.90	9.92	3.25	32.15	3.05	-5.25	170.83	150.90	160.58
4.00	10.00	3.26	32.62	3.06	-2.85	172.55	152.55	162.27
4.10	9.96	3.23	32.19	3.08	-0.71	172.84	152.88	162.65
4.20	9.91	3.17	31.44	3.12	1.66	173.66	153.73	163.63
4.30	10.03	3.13	31.32	3.20	3.48	174.75	154.73	164.84
4.40	10.03	3.05	30.50	3.29	4.62	176.01	155.98	166.32
4.50	10.06	2.99	29.93	3.37	4.82	176.57	156.51	167.07
4.60	10.09	2.96	29.83	3.40	4.07	176.78	156.70	167.34
4.70	10.06	3.01	30.19	3.35	3.60	176.62	156.57	167.06
4.80	9.99	3.07	30.61	3.25	4.25	176.29	156.30	166.54
4.90	9.91	3.11	30.65	3.19	5.85	175.45	155.53	165.60
5.00	9.98	3.17	31.33	3.15	7.44	174.93	154.95	164.93
5.10	9.91	3.17	31.02	3.12	9.41	174.43	154.51	164.40
5.20	9.99	3.21	31.38	3.12	11.43	173.88	153.89	163.76
5.30	9.93	3.18	30.77	3.12	13.32	173.41	153.47	163.35
5.40	10.02	3.20	30.90	3.13	15.18	173.39	153.38	163.30
5.50	9.98	3.16	30.16	3.16	16.89	172.77	152.79	162.78
5.60	9.94	3.12	29.40	3.19	18.38	172.69	152.74	162.81
5.70	9.91	3.09	28.75	3.21	19.96	173.13	153.21	163.34
5.80	10.02	3.10	28.86	3.24	21.45	172.51	152.49	162.69
5.90	9.95	3.05	27.98	3.26	23.01	172.14	152.19	162.44
6.00	9.93	3.01	27.26	3.30	24.27	172.51	152.57	162.94
6.10	9.91	2.97	26.55	3.34	25.47	172.99	153.07	163.55
6.20	9.93	2.92	25.92	3.40	26.72	173.44	153.50	164.13

6.30	9.92	2.88	25.25	3.45	27.77	173.72	153.79	164.54
6.40	9.91	2.84	24.62	3.50	28.88	174.15	154.22	165.09
6.50	9.92	2.79	24.05	3.56	29.69	173.97	154.04	165.06
6.60	10.02	2.79	24.11	3.59	30.35	174.01	154.00	165.10
6.70	10.01	2.75	23.63	3.64	30.87	174.40	154.39	165.61
6.80	10.01	2.71	23.12	3.69	31.51	173.90	153.90	165.24
6.90	10.02	2.68	22.76	3.73	32.14	173.45	153.44	164.88
7.00	10.01	2.66	22.42	3.76	32.70	174.15	154.14	165.64
7.10	10.00	2.63	21.96	3.80	33.52	173.42	153.42	165.01
7.20	10.00	2.60	21.52	3.84	34.19	173.06	153.06	164.76
7.30	10.00	2.57	21.03	3.89	35.02	173.12	153.12	164.92
7.40	10.02	2.53	20.49	3.96	35.93	172.82	152.80	164.77
7.50	10.04	2.47	20.00	4.06	36.38	173.59	153.56	165.72
7.60	10.02	2.42	19.70	4.14	35.78	174.33	154.31	166.64
7.70	9.98	2.36	19.41	4.22	34.64	173.88	153.90	166.41
7.80	9.93	2.39	19.70	4.16	33.78	173.75	153.81	166.19
7.90	10.07	2.48	20.72	4.07	33.77	172.87	152.81	165.00
8.00	10.00	2.50	20.49	4.00	34.87	172.22	152.22	164.27
8.10	9.98	2.50	20.12	4.00	36.15	172.50	152.52	164.56
8.20	9.94	2.48	19.65	4.02	37.05	173.22	153.27	165.35
8.30	9.92	2.47	19.40	4.02	37.67	173.26	153.33	165.41
8.40	9.96	2.48	19.37	4.01	38.40	171.83	151.87	163.94
8.50	9.92	2.48	18.92	4.01	39.66	169.66	149.72	161.78
8.60	10.01	2.50	18.84	4.01	41.07	167.14	147.13	159.19
8.70	9.96	2.46	18.16	4.05	42.07	164.22	144.26	156.42
8.80	9.95	2.43	17.61	4.10	43.20	160.98	141.02	153.28
8.90	9.95	2.39	17.09	4.16	44.07	156.10	136.15	148.53
9.00	9.97	2.37	16.75	4.21	44.79	151.18	131.21	143.70
9.10	9.98	2.34	16.35	4.26	45.59	144.39	124.41	137.00
9.20	9.97	2.31	15.92	4.32	46.26	135.29	115.31	128.02
9.30	9.92	2.29	15.48	4.33	47.06	141.84	121.91	134.65
9.40	9.93	2.26	15.14	4.39	47.63	146.31	126.38	139.22
9.50	9.93	2.24	14.83	4.44	48.17	148.96	129.02	141.96
9.60	9.97	2.22	14.60	4.50	48.66	150.29	130.32	143.38
9.70	10.00	2.19	14.34	4.57	49.00	149.33	129.33	142.53
9.80	10.00	2.17	14.08	4.62	49.49	148.73	128.73	142.01
9.90	9.99	2.15	13.81	4.66	49.89	146.40	126.41	139.77
10.00	10.01	2.13	13.53	4.70	50.59	134.56	114.55	127.99

Frequency Khz	Transmit Voltage Volts	Transmit Current amps	Real Power watts	Z Magnitude ohms	Phase (Z) deg	SPL dB// dB//uPa	TVR dB// uPa/volt	TCR uPa/amp
Se 100 Hz to 10KHz at 80v with 2 ohm resistor.dat								
0.10	80.07	10.50	630.03	7.63	41.44	155.29	117.23	134.87
0.15	80.04	2.09	81.98	38.35	-60.62	166.66	128.59	160.27
0.20	80.01	3.67	104.09	21.82	-69.22	171.25	133.19	159.97
0.25	80.06	4.64	134.78	17.27	-68.70	176.49	138.42	163.16
0.30	80.03	5.74	186.63	13.95	-66.02	180.18	142.12	165.00
0.35	79.97	7.09	255.74	11.28	-63.20	184.09	146.03	167.07
0.40	79.95	8.65	372.84	9.24	-57.37	187.28	149.22	168.54
0.45	79.95	10.38	562.65	7.70	-47.32	191.78	153.73	171.46
0.50	80.02	11.36	761.92	7.05	-33.02	194.27	156.20	173.16
0.55	80.05	10.65	811.55	7.51	-17.90	196.00	157.93	175.45
0.60	80.02	8.48	672.19	9.43	-8.00	196.14	158.07	177.57
0.65	79.96	6.26	494.34	12.77	-9.02	195.25	157.19	179.32
0.70	79.99	5.08	378.06	15.73	-21.62	194.28	156.22	180.16
0.75	80.03	5.09	332.31	15.73	-35.32	193.52	155.46	179.39
0.80	80.00	5.45	315.41	14.67	-43.71	192.63	154.57	177.89
0.85	79.92	5.91	306.21	13.51	-49.62	191.88	153.83	176.44
0.90	80.06	6.54	308.19	12.24	-53.94	191.56	153.49	175.25
0.95	80.04	7.23	323.78	11.08	-55.95	191.25	153.18	174.07
1.00	80.09	7.92	349.50	10.11	-56.59	190.90	152.82	172.92
1.00	80.04	7.92	348.57	10.11	-56.65	190.94	152.87	172.96
1.10	80.00	9.04	394.42	8.85	-56.96	190.23	152.17	171.10
1.20	79.93	10.25	455.77	7.80	-56.19	189.67	151.62	169.46
1.30	80.04	11.29	521.67	7.09	-54.74	189.23	151.16	168.17
1.40	79.98	12.30	581.32	6.50	-53.79	189.02	150.96	167.22
1.50	79.94	13.51	665.64	5.92	-51.94	188.85	150.79	166.24
1.60	79.97	14.64	758.31	5.46	-49.62	188.78	150.72	165.47
1.70	79.95	15.25	833.78	5.24	-46.83	188.44	150.39	164.78
1.80	80.02	16.15	916.64	4.95	-44.83	189.00	150.94	164.84
1.90	79.96	17.13	1010.77	4.67	-42.43	188.83	150.77	164.16
2.00	79.95	17.91	1101.27	4.46	-39.74	188.68	150.63	163.62
2.10	79.92	18.64	1185.19	4.29	-37.27	189.33	151.28	163.93
2.20	80.01	19.34	1281.86	4.14	-34.07	190.12	152.05	164.39
2.30	80.01	19.57	1341.75	4.09	-31.03	191.77	153.71	165.94

2.40	79.96	19.67	1377.88	4.07	-28.81	192.37	154.31	166.49
2.50	80.00	19.64	1395.20	4.07	-27.39	192.98	154.92	167.12
2.60	80.09	19.66	1405.85	4.07	-26.78	193.28	155.21	167.41
2.70	80.05	20.01	1427.77	4.00	-26.95	193.07	155.00	167.05
2.80	79.97	20.83	1486.15	3.84	-26.85	193.16	155.11	166.79
2.90	79.97	21.92	1584.75	3.65	-25.31	191.72	153.67	164.91
3.00	79.95	22.76	1669.85	3.51	-23.42	190.56	152.51	163.42
3.10	79.93	23.47	1751.44	3.41	-20.98	189.16	151.10	161.75
3.20	79.93	24.06	1822.85	3.32	-18.62	189.31	151.26	161.69
3.30	79.95	24.52	1882.84	3.26	-16.15	188.65	150.60	160.86
3.40	79.93	24.91	1933.78	3.21	-13.76	188.60	150.55	160.67
3.50	79.69	25.11	1961.84	3.17	-11.37	188.32	150.30	160.33
3.60	79.97	25.35	2002.56	3.15	-8.89	188.43	150.38	160.36
3.70	79.96	25.54	2027.85	3.13	-6.74	188.74	150.68	160.60
3.80	80.04	25.65	2046.77	3.12	-4.31	188.00	149.93	159.82
3.90	79.93	25.54	2040.49	3.13	-2.00	188.97	150.92	160.83
4.00	80.05	25.43	2035.75	3.15	0.28	190.58	152.52	162.48
4.10	79.97	25.25	2018.03	3.17	2.30	190.42	152.36	162.37
4.20	79.94	24.77	1975.08	3.23	4.25	191.42	153.36	163.54
4.30	80.00	24.28	1931.90	3.30	5.90	192.37	154.31	164.67
4.40	80.00	23.72	1884.14	3.37	6.84	193.40	155.34	165.89
4.50	80.01	23.16	1838.63	3.45	7.17	194.40	156.34	167.11
4.60	79.95	22.93	1822.22	3.49	6.37	194.73	156.67	167.52
4.70	79.92	23.22	1845.29	3.44	6.12	194.72	156.67	167.41
4.80	79.95	23.89	1896.98	3.35	6.70	194.32	156.26	166.76
4.90	79.97	24.38	1930.52	3.28	7.99	193.64	155.58	165.90
5.00	79.97	24.73	1947.90	3.23	9.93	192.96	154.90	165.10
5.10	80.00	24.92	1953.37	3.21	11.57	192.29	154.23	164.36
5.20	79.95	24.92	1936.57	3.21	13.58	191.49	153.43	163.56
5.30	79.95	24.83	1914.67	3.22	15.36	190.85	152.79	162.95
5.40	80.00	24.74	1891.22	3.23	17.17	191.09	153.03	163.22
5.50	79.95	24.55	1859.16	3.26	18.71	190.34	152.29	162.54
5.60	79.96	24.35	1826.11	3.28	20.29	190.02	151.96	162.29
5.70	80.04	24.16	1795.94	3.31	21.75	190.50	152.43	162.84
5.80	80.02	24.06	1770.15	3.33	23.14	189.87	151.80	162.24
5.90	80.02	23.78	1731.05	3.36	24.55	189.42	151.35	161.89
6.00	80.04	23.50	1692.92	3.41	25.84	189.85	151.79	162.43
6.10	79.98	23.10	1648.20	3.46	26.84	190.64	152.58	163.37
6.20	79.95	22.78	1606.41	3.51	28.13	191.08	153.02	163.93

6.30	79.92	22.44	1567.26	3.56	29.09	191.17	153.12	164.15
6.40	79.95	22.10	1527.13	3.62	30.19	191.80	153.74	164.91
6.50	80.05	21.87	1503.94	3.66	30.80	191.58	153.52	164.79
6.60	80.07	21.43	1465.15	3.74	31.36	191.48	153.41	164.86
6.70	80.09	21.23	1440.56	3.77	32.06	191.83	153.76	165.30
6.80	80.02	20.99	1415.99	3.81	32.52	191.19	153.12	164.75
6.90	79.99	20.68	1386.80	3.87	33.04	190.91	152.85	164.60
7.00	79.93	20.47	1363.15	3.90	33.58	191.61	153.56	165.39
7.10	79.92	20.35	1345.10	3.93	34.18	190.96	152.90	164.79
7.20	80.03	20.12	1319.98	3.98	34.96	190.73	152.66	164.66
7.30	80.01	19.75	1279.57	4.05	35.95	190.90	152.84	164.99
7.40	80.03	19.36	1250.95	4.13	36.17	191.59	153.53	165.86
7.50	79.98	18.82	1220.84	4.25	35.79	192.62	154.56	167.13
7.60	79.94	18.57	1220.66	4.30	34.70	192.21	154.16	166.84
7.70	80.03	18.87	1260.13	4.24	33.46	191.52	153.45	166.00
7.80	79.99	19.45	1293.40	4.11	33.77	190.53	152.47	164.75
7.90	79.99	19.83	1299.41	4.03	34.99	189.39	151.33	163.44
8.00	80.08	19.97	1289.75	4.01	36.24	188.69	150.62	162.68
8.10	79.92	19.78	1254.43	4.04	37.50	188.54	150.49	162.61
8.20	79.97	19.74	1233.16	4.05	38.63	188.66	150.60	162.75
8.30	80.06	19.68	1216.46	4.07	39.44	187.57	149.50	161.69
8.40	79.92	19.51	1185.81	4.10	40.49	185.53	147.48	159.72
8.50	80.01	19.49	1167.66	4.10	41.52	183.81	145.75	158.01
8.60	80.05	19.30	1134.89	4.15	42.72	181.35	143.28	155.64
8.70	79.98	19.09	1107.81	4.19	43.49	178.06	140.00	152.44
8.80	79.96	18.90	1082.25	4.23	44.27	174.16	136.10	148.63
8.90	79.95	18.70	1058.39	4.27	44.94	168.34	130.29	142.91
9.00	79.97	18.48	1032.77	4.33	45.67	163.63	125.57	138.30
9.10	80.06	18.30	1011.53	4.38	46.34	157.35	119.28	132.10
9.20	80.02	18.14	990.27	4.41	46.97	161.61	123.55	136.44
9.30	79.94	18.02	970.84	4.44	47.63	164.59	126.53	139.47
9.40	80.05	17.85	955.81	4.48	48.03	167.14	129.07	142.10
9.50	79.98	17.68	932.32	4.52	48.74	169.17	131.11	144.23
9.60	79.96	17.41	911.14	4.59	49.13	169.94	131.88	145.12
9.70	80.00	17.23	894.45	4.64	49.53	169.00	130.93	144.27
9.80	79.97	17.03	871.54	4.70	50.21	167.23	129.17	142.60
9.90	80.06	16.90	858.33	4.74	50.61	163.74	125.67	139.19
10.00	79.99	16.67	831.99	4.80	51.41	149.24	111.18	124.80