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INFORMATION HANDOUT

FINAL BASELINE HYDROACOUSTIC SURVEY REPORT,
COMMODORE SCHUYLER F. HEIM BRIDGE DEMOLITION AND REPLACEMENT PROJECT
LONG BEACH, CA

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FINAL
BASELINE HYDROACOUSTIC SURVEY REPORT

COMMODORE SCHUYLER F. HEIM BRIDGE DEMOLITION AND REPLACEMENT PROJECT LONG BEACH, CA

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List of Acronyms

ACTA	Alameda Corridor Transportation Authority
AM	Ante Meridian “before midday"
BMPs	Best Management Practices
Heim Bridge	Commodore Schuyler F. Heim Bridge
Caltrans	California Department of Transportation
dB	decibels
dBL	unweighted or linear decibels
EFH	Essential Fish Habitat
ESA	Endangered Species Act
FMPs	Fishery Management Plans
ft	foot
HAPC	Habitat Area of Particular Concern
Hz	hertz
kHz	kilohertz
L_{eq}	equivalent continuous sound pressure level within a given time interval
L_n	statistical sound pressure level
L_{10}	intrusive sound pressure level which is exceeded 10% of the time period
L_{50}	intrusive sound pressure level which is exceeded 50% of the time period
L_{90}	intrusive sound pressure level which is exceeded 90% of the time period
L_p	sound pressure level
m	meter
min	minute
MLLW	mean lower low water
MMMMP	marine mammal monitoring and mitigation plan
MMO	marine mammal observers
MMPA	Marine Mammal Protection Act
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NAD	North American Datum
NMFS	National Marine Fisheries Service
NIST	National Institute of Standard and Technology
PM	Post Meridian “after midday"
re	reference
sec	second
SPL	sound pressure level
RMS	root-mean-square
ROD	Record of Decision
Tetra Tech	Tetra Tech, Inc.
μPa	micro-Pascal

1.0 INTRODUCTION

Tetra Tech, Inc. (Tetra Tech) has been retained by the Alameda Corridor Transportation Authority (ACTA) to conduct baseline hydroacoustic monitoring in support of the environmental studies required during replacement of the Commodore Schuyler F. Heim Bridge, located in the city of Long Beach, California, hereafter referred to as the "Heim Bridge" or the "Site". Figure 1 presents the location of the Heim Bridge and surrounding area.

The proposed project will replace the existing bridge with a fixed-span seismically sound bridge just east of the current alignment. Both the northerly and southerly approaches to the bridge will be replaced as well. Total permanent and temporary disturbance is expected to be approximately 92 acres which includes the 250 foot (ft) buffer along the bridge footprint, used to accommodate temporary structures necessary for bridge construction. The bridge will be 36.6 meters (m) wide and will span 1,463 m over the Cerritos Channel. The bridge will be constructed 14.3 m above mean high water and no changes will be made to the navigational width of the channel. Project implementation is expected to take 2 to 3 years beginning in the winter of 2010.

The proposed project occurs in essential fish habitat (EFH) for various federally managed fish species within the Pacific Groundfish and Coastal Pelagics Fishery Management Plans (FMPs) and within estuarine habitat (a designated habitat area of particular concern [HAPC] for various federally managed fish species within the Pacific Groundfish FMP). HAPC are described in the regulations as subsets of EFH which are "rare, particularly susceptible to human-induced degradation, especially ecologically important, or located in an environmentally stressed area" (Title 50 of Code of Federal Regulations Part 600.815(a)(8)). Designated HAPCs are not afforded any additional regulatory protection under the Magnuson-Stevens Fishery Conservation and Management Act (MSA); however, federal projects with potential adverse impacts to HAPC are more carefully analyzed during the consultation process with the National Marine Fisheries Service (NMFS). NMFS has determined that the proposed action would adversely affect EFH for various federally managed fish species within the Coastal Pelagics and Pacific Groundfish FMPs. However, NMFS concurs that adequate measures are built in to the project to avoid, minimize, mitigate, or otherwise offset the adverse effects to EFH. Additionally, construction activities will adhere to all applicable laws, regulations, and best management practices (BMPs). Therefore, NMFS had no additional EFH Conservation Recommendations for the project.

The proposed project also overlaps with habitat for the following non-Endangered Species Act (ESA) listed but Marine Mammal Protection Act (MMPA) listed marine mammal species: Pacific harbor seal *(Phoca vitulina richardii)* and the California sea lion *(Zalophus californianus).* Since the proposed action may result in effects to these marine mammal species, a Baseline Hydroacoustic Survey Plan (Tetra Tech, 2010) was developed to address the permitting requirements as described in the Project Record of Decision (ROD) and was approved by NMFS.

Sounds introduced into marine habitat by manmade devices could have a deleterious effect on marine mammals by causing stress or injury, interfering with communication and predator/prey detection, and by changing behavior. Acoustic exposure to loud sounds also may result in a temporary or permanent loss of hearing (termed a temporary or permanent threshold shift) depending upon the location of the marine mammal in relation to the source of the sound. During bridge construction in this project, both impact and vibratory pile driving will be required and may result in underwater noise at levels potentially harmful or disturbing to marine mammals. A number of measures have been identified (Section B-2 Protecting Aquatic Communities in the Project ROD that would avoid, minimize, or mitigate project effects to marine mammals. These measures may include using bubble curtains and caps to attenuate noise generated by pile driving as well as establishing safety zones whereby a noise-generating activity is shutdown at the approach of a marine mammal to these safety zones. Subsequently, in order to determine effective safety zones, it was concluded that both the existing ambient noise levels in the absence of pile driving and the maximum noise levels generated by the two pile driving methods (impact and vibratory) during construction need to be evaluated.

This study was undertaken to assess baseline noise levels in the project area. Tetra Tech conducted a field program to measure underwater ambient noise levels at locations within the Cerritos Channel. Measurements were collected east and west of the Heim Bridge. The survey was completed for ACTA in support of the environmental studies and development of a marine mammal monitoring program. Site-specific baseline or ambient noise levels are necessary for quantifying potential harassment take of marine mammals, and for developing mitigation measures, such as safety zones, to avoid or minimize take. A construction hydroacoustic monitoring workplan and the marine mammal monitoring and mitigation plan (MMMMP) will be prepared by the California Department of Transportation (Caltrans) or their contractor using these data to help identify an appropriate marine mammal harassment safety zone during construction activities including pile driving. These workplans will be submitted to NMFS for review and approval.

The results of the baseline hydroacoustic acoustic field program are presented in this report and will be used to assess potential for adverse noise impacts on marine mammals and fish habitat during demolition of the existing bridge and during construction of the new bridge. This initial test report provides preliminary results compiled from short-term spot measurements including frequency, distributions, and statistical parameters. The baseline monitoring was conducted on November 17, 2010 in accordance with the approved workplan.

2.0 TERMINOLOGY

The loudness of underwater sound is dependent on the radiated sound power of the noise source. Received sound pressure levels include the effects of propagation and attenuation that occur between the source and receptor and the propagation and attenuation characteristics of the medium through which the sound passes, with water being a very efficient conductor of sound.

Principal ambient contributors within the Cerritos Channel include shipping traffic, port and intermodal facilities operating along the channel shore, wind and waves, precipitation, biological noise, and flow current and tidal current, which can create turbulence. Shipping traffic typically dominates the ambient environment for frequencies between 10 and 1000 Hertz (Hz). The sum of anthropogenic and natural noise depends on source levels and the propagation conditions including water depth, bottom conditions, and proximity to shore and human activity. Local sea and tidal current conditions that create underwater turbulence can also effect sound propagation and ambient conditions. Unsettled weather conditions can substantially increase low frequency background levels even when the weather conditions occur at a significant distance from the project site. Aside from anthropogenic noise, the principal source of underwater noise is surface agitation, which is dependent on localized conditions of sea state and wind speed and will vary both spatially and temporally.

Sound levels are presented in this report on a logarithmic scale to account for the large range of acoustic pressures that marine life may be exposed to and is expressed in units of decibels (dB). A decibel is defined as the ratio between a measured value and a reference value (abbreviated “re”) of 1 micro-Pascal (μPa). Similar to in-air sound, a logarithmic scale is formed by taking 20 times the logarithm (base 10) of the ratio of two pressures: the measured sound pressure divided by a reference sound pressure. This reference sound for underwater sound pressure is 1 μPa; however in-air sound uses a reference of 20 μPa. Due to the difference in acoustic impedance, a sound wave that has the same intensity in air and in water will in water have a pressure that is 60 times larger than that in air, while the displacement amplitude will be 60 times less. Assuming pressure is maintained as a constant, the displacement amplitude in water will be 3,580 times less than in air. With this relationship, the following table provides corresponding values for air and water having the same intensities at a frequency of 1 kiloHertz (kHz). However, this somewhat simplistic comparison does not account for the frequency dependent hearing capabilities of species of marine life or individual response mechanisms.

Table 1 - Sound Pressure Levels and Comparison to Relative Human Loudness Thresholds

Pressure in Air reference 20 µPa/Hz	Pressure in Water reference 1 µPa/Hz	Relative Loudness (perception of different sound pressure levels in air)
0	62	Threshold of Hearing
58	120	Potentially Audible Depending on the Existing Acoustic Environment
120	182	Uncomfortably Loud
140	202	Threshold of Pain
160	222	Threshold of Direct Damage

Notes:
Hz = Hertz

Sound can be measured, calculated, and presented in various formats. Sound levels change from moment to moment; some are sharp impulses lasting one second or less, while others may rise and fall over much longer periods of time. The L_{eq}, or equivalent continuous sound pressure level (also referred to as the time-averaged level), has been shown to provide both an effective and uniform method for comparing time-varying sound levels. The L_{eq} is calculated by taking the square root of the average of the square of the pressure waveform over the duration of the measurement. Exposure to this sound level over the measurement period would result in the same noise dose as being exposed to the actual (unsteady) sound levels.

Statistical levels provide a percentile time history of the time-varying sound levels. The statistical sound pressure levels (L_n) provide the sound level exceeded for that percentage of time over the given measurement period. An L_{10} level is often referred to as the intrusive sound pressure level and is the sound level that is exceeded for 10 percent of the time during a specified measurement period. Perhaps more useful is the L_{90} level, which is the sound level that is exceeded for 90 percent of the time during the measurement time period. The L_{90} can be thought of as the quietest 10 percent of any time period and is often referred to as the residual sound pressure level. The L_{90} can be an indicator of the potential for acute perceptibility of a new sound source as it will not generally include sound from short term transient events such as vessel traffic.

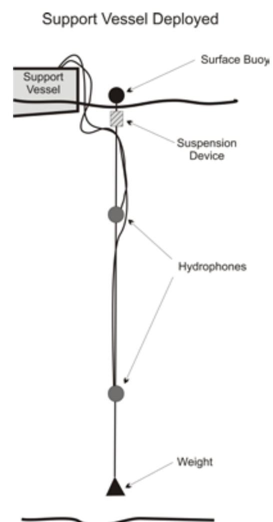
In addition to the reporting of broadband values, which contain sound energy summed across the entire frequency range, a spectral frequency analysis of the sound spectrum was completed. The unit of frequency is Hertz, measuring the cycles per second of the sound pressure waves, and the frequency analysis provided in this report examine 1/3 octave bands from 6.3 Hz to 20,000 Hz. Third octaves are a series of electronic filters used to separate sound into discrete frequency bands, making it possible to know how sound energy is distributed as a function of frequency. Each octave band has a centre frequency that is double the centre frequency of the octave band preceding it. All reported results are presented in linear (unweighted) decibels reference 1 µPa (abbreviated re 1 µPa). The term background noise refers to noise from natural sources (e.g., wind, tides) as well as noise from anthropogenic sources. Sound levels are presented in terms of linear (or unweighted) decibels often referred to as dBL.

Root-mean-square (RMS) is the square root of the mean of the square. This unit reflects the effective sound pressure taking into account both positive and negative pressures in a system. This measurement gives a way of calculating the average of values over a period of time.

NMFS is currently in the process of determining safety criteria (guidelines) for marine species exposed to underwater sound. However, pending adoption of these guidelines, NMFS has preliminarily determined (based on past projects, consultations with experts, and published studies) that a level of 180 dB re 1 μPa_{RMS} (190 dB re 1 μPa_{RMS} for pinnipeds) is the impulse sound pressure level that can be received by marine mammals without injury. Marine mammals have shown behavioral changes when exposed to impulse sound pressure levels of 160 dB re 1 μPa_{RMS} and when exposed to continuous sound levels of 120 dB re 1 μPa_{RMS}.

3.0 FIELD ACTIVITIES

Recordings of underwater ambient noise were performed at twelve locations. Six of these locations were west of the Heim Bridge (E1W through E6W) and six locations were east the Heim Bridge (E1E through E6E). Recordings were made using low noise Reson TC 4040 hydrophones deployed from the side of Tetra Tech's survey vessel in order to determine ambient noise levels in the Cerritos Channel. The twelve locations are presented on Figure 2. Two hydrophones were attached to an anti-heave buoy, the first at a depth of 1/3 of the water column (approximately -18 feet MLLW) and the second hydrophone at a depth of 2/3 of the water column (approximately -36 feet MLLW) to sample the variation in the sound field with depth. The buoy trailed behind the survey vessel. Prior to the field activities, Tetra Tech reviewed the National Oceanic and Atmospheric Administration navigational charts, which indicate that the Channel depth ranges from -50 feet MLLW to -57 feet MLLW east of the Bridge and the Channel depth ranges from -45 to -46 feet MLLW west of the Bridge as well as the tidal cycle on the field sampling day (November 17, 2010) to determine the water column depths. The schematic diagram illustrates the hydrophone setup during noise recording activities.



(**Reference: Draft ANSI Standard S12.64- 200X** Revision 12, May 21, 2009)

Time signals were recorded at both depths for each of the twelve locations. The sensitivity of the measuring hydrophones is traceable to National Institute of Standards and Technology (NIST) international calibration standards. Signals from the hydrophones and signal amplifier were field calibrated using a Bruel and Kjaer, Type 4229 pistonphone calibrator which provides a stated accuracy of 0.6 dB. During sound recordings, the survey vessel's engines and other equipment that might interfere with the measurements were turned off and the vessel was allowed to drift. Each deployment was assigned a unique identifier for reference purposes. Table 2 presents the locations, approximate average distance from the bridge as well as coordinates, start time, and noise sampling duration for each location. Photographs of equipment and field activities including calibration are presented in Appendix A.

Measurements were collected with a RMS detector with a 0.125-second exponential time constant with data-logged in 1-second intervals. Immediately following the completion of short-term measurements, all measurement data were immediately downloaded to a laptop on the vessel to check the data recorded properly and for future analysis.

Table 2 - Description of Monitoring Positions and Measurement Durations

Monitoring Location	Distance from Heim Bridge (feet)	Latitude	Longitude	NAD 83, Zone 5		Start Time	Recording Duration (min:sec)
				Northing	Easting		
E1W	245.6	33°45.96'	118°14.43'	1737127.463	6488549.701	8:52 AM	19:38
E2W	663.6	33°45.95'	118°14.47'	1737007.205	6488115.184	9:20 AM	20:07
E3W	1,209.2	33°45.95'	118°14.56'	1736856.936	6487603.885	9:49 AM	12:35
E4W	2,043.9	33°45.88'	118°14.67'	1736621.871	6486802.744	10:13 AM	15:00
E5W	3,247.3	33°45.85'	118°14.90'	1736181.410	6485681.859	10:41 AM	14:32
E6W	4,320.1	33°45.80'	118°15.20'	1735919.609	6484742.856	11:06 AM	14:38
E1E	261.7	33°45.98'	118°14.33'	1737106.552	6489086.534	12:10 PM	19:12
E2E	1,304.5	33°46.02'	118°14.12'	1737352.297	6490118.706	12:37 PM	14:30
E3E	2,352.7	33°46.10'	118°13.88'	1737659.859	6491109.789	1:00 PM	14:25
E4E	3,420.3	33°46.10'	118°13.63'	1738044.245	6492167.743	1:22 PM	14:30
E5E	5,180.2	33°46.18'	118°13.30'	1738863.083	6493879.640	1:44 PM	14:26
E6E	4,530.4	33°46.14'	118°13.46'	1738722.883	6493237.870	2:07 PM	14:46

Table 3 lists equipment used during the survey and NIST equipment calibration certifications are provided in Appendix B.

Table 3 – Field Equipment

Device	Manufacturer
Hydrophone TC4040 (Qty. 3)	Reson
LD Signal Analyzer 831 w/Sound Recording	Larson Davis
Pistophone Hydrophone Calibrator 4229	Bruel and Kjaer
Preamplifier PRM831 and Signal Conditioning	PCB Piezotronics
Microphone 377B02 (used in the calibration insertion chamber)	PCB Piezotronics

4.0 MONITORING RESULTS

The data provided by this hydroacoustic acoustic field study documents the underwater acoustic environment and characterizes existing sound sources (noise levels) present at the Heim Bridge project site. Levels of background noise in the ocean depend primarily on wind and weather conditions as well as on the intensity and proximity of human activity. The baseline monitoring season was consistent with the same time period that future pile driving is anticipated. The results of this survey will be used during development of the MMMMP and in refinement of the initial safety zone to be monitored during all pile driving activities. Detailed descriptions of measurements and recorded sound levels and any implications related to preliminary methodologies that will be required for the subsequent MMMMP and the construction hydroacoustic workplan are provided in the following sections.

4.1 TIME HISTORIES AND STATISTICAL LEVELS

Time and date stamped time histories for all relevant datasets were compiled in 1-second L_{eq} intervals. These data are presented in Figures 3 through Figure 14 for the twelve monitoring locations the broadband ambient noise levels as a function of time and water depth for each deployment. The ambient noise levels were similar at all locations and were found to be marginally affected by sea state conditions and tidal currents. Sources present of anthropogenic noise included rail movements on the Badger Bridge (directly west of the Heim Bridge), aircraft, and industrial activities including an inactive dredge barge located in the western area of the Channel, near the East Basin. Received sound pressure levels (levels recorded at the monitoring locations) at the two sampling water depths were consistent but periodic deviations on the order of 20 dB were seen for brief periods. Overall, the existing underwater acoustic environment can be categorized as somewhat noisy. Measured background L_{90} values ranged from 120 to 132 dB. Median L_{50} values ranged from 124 to 136 dB. The intrusive L_{10} and L_{50} values ranged from 131 dB during measurement periods with no immediate vessel traffic to values that regularly approached and exceeded 140 dB during periods of ship traffic, most notably during close passbys by tugs, dump scour barges, and at locations in immediate proximity to the Badger Bridge during rail movement.

Table 4 Summary of Baseline Data Statistical Results

Monitoring Position	Broadband Sound Pressure Level dB reference 1 µPa							
	1/3 Water Depth				2/3 Water Depth			
	L_5	L_{10}	L_{50}	L_{90}	L_5	L_{10}	L_{50}	L_{90}
WEST OF THE HEIM BRIDGE								
E1W	138	135	128	125	142	138	132	128
E2W	138	135	127	123	139	137	130	126
E3W	143	134	124	120	143	135	128	124
E4W	134	131	124	120	135	134	128	123
E5W	137	133	125	121	139	135	128	124
E6W	136	133	127	123	139	136	131	127
EAST OF THE HEIM BRIDGE								
E1E	147	142	132	128	144	142	135	131
E2E	135	133	129	127	144	143	135	131
E3E	132	131	128	126	141	139	133	129
E4E	139	133	129	126	142	139	132	128
E5E	141	140	135	130	142	140	134	130
E6E	141	140	136	132	139	138	134	131

4.2 SPECTRAL ANALYSIS

The recorded signals were analyzed to determine statistical and median 1/3-octave band levels using a Fast Fourier Transform from the ambient noise recordings. The resulting time spectra were integrated through the frequency range of each of the 1/3-octave bands between 10 Hz and 20 kHz. Figures 3 through 14 spectrograms provide 1/3-octave band levels and statistical sound levels. Corresponding broadband L-wtd sound levels, shown as the horizontal bar, sum the acoustic energy across all frequencies for that given statistic. These analyses quantitatively describe the frequency (Hz) dependant background sound environment throughout the project area. Overall, residual spectral characteristics of the ambient noise were not found to indicate a strong dependence on vessel traffic except during periodic passby of vessels.

The presence of shipping activity is principally evident in the frequencies of 100 to 1000 Hz and spectra dominated by shipping influences are designated by 'S'. At location E6W, during the passing of a barge, the spectrum showed a slight tonality at 400 Hz designated by 'G'. Rail movements on the Badger Bridge, directly west of the Heim Bridge, contained acoustic energy in the 31 to 300 Hz frequency range and are indicated by 'T', on the sound pressure time histories for locations E2W, E3W, E5W, E3E, E4E, and, E5E. Lower frequency sound energy was likely generated, but was unable to propagate due to the shallow water environment at extended distances and this is shown in the spectral analysis at measurement locations at greater distances. Spectral statisticals that are grouped closer together are an indication that there was an area source present for a majority of the sampling period as compared to spectral lines that are more spread out, which indicates short term temporal events. The spectra for location E2E is indicative of an area source, where as the spectra for location E2W is indicative of a temporal event.

In addition to time histories and spectral analysis, Figure 15 shows the percentage of 1-sec periods per hour for which the average L_{eq}, 1-sec values were ≥120 dB averaged for all measurement periods over the entire monitoring period for each of the twelve deployment locations. This figure shows the percentage of L_{eq}, 1-sec values per hour with noise ≥120 dB, which is greater than 99% of the measured values. The plot also provides temporal variation in the underwater noise levels over the entire survey period for all measurement locations on a cumulative basis.

4.3 SPATIAL VARIATION AND TIDAL INFLUENCE

The Cerritos Channel and the adjacent basins (East Basin to the west and Turning Basin to the east) are well traveled by commercial vessels and recreational boats, but overall sound levels were found to be relatively homogenous acoustically, with similar underwater background sound levels and exposure to noise sources. At increasing distances between the Heim Bridge and Tetra Tech's survey vessel, train movements became less discernable over the ambient noise.

Flow noise is evident in the recordings since an increase in noise below 50 Hz is typically observed in some of the deployments during the times of tidal change, which is expected since water current velocity is typically highest during tide change. In general, higher current velocities are expected to produce increased flow noise on the hydrophone. Tidal height, current data, meteorological conditions, and sea state conditions were obtained. Weather conditions on the day of testing (November 17, 2010) consisted of clear skies and low winds, resulting in low sea state conditions, which would likely conservatively represent the lower end of the expected range of ambient underwater sound levels for this area as compared to inclement weather resulting in rougher surface conditions, and higher channel currents, which could skew ambient underwater sound levels higher. The calm weather and sea state conditions were conducive to accurate underwater sound data collection.

4.4 MMMMP DEVELOPMENT

In marine environments where the background or ambient noise levels are elevated and consistently exceed the 120 dB continuous sound level criterion, the threshold of concern becomes the ambient level. Only areas ensonified by noise louder than ambient need to be actively monitored especially in high energy industrial environments where ambient noise levels may be elevated. Therefore, assessing local ambient or background noise levels in the vicinity of the future pile driving construction activities is important in order to determine the actual areas that need to be monitored for marine mammals.

Among the two mammalian species considered to have potential to be impacted (harbor seal and sea lion), only the sea lion has historically been documented in the project area, albeit in almost negligible numbers. Sea lions have been documented in very low densities within the harbor, and no haul-out sites occur within the vicinity of the project. However, transitory sea lion(s) in the area could be disturbed if they were collocated with noise producing pile driving activities.

The principal mechanism of potential effects to marine mammals from the proposed project is exposure to underwater sound generated by pile driving and by vessel traffic. In addition, because vessel traffic coming in and going out of the area (e.g., barges, tugs, work vessels) related to the proposed construction of the project would be transiting to and from offshore waters where the sea lion, harbor seal, and other marine mammals occur, these work vessels could potentially collide with marine mammals.

Caltrans will incorporate minimization measures to avoid impacts to marine animals during demolition and reconstruction, including both active acoustic and visual monitoring components. An active acoustic monitoring system will be in effect during initial pile driving for both impact and vibrational methods. This system will include an impact area to cover the expected area of insonification which is dependent on pile diameters and hammer impact forces. The hydroacoustic testing during pile driving will be conducted to ascertain whether sound energy generated is and remains within the levels predicted. Once pile diameters, impact forces, penetration depths, and methods (vibration/impact) have been established, an acoustic modeling and a hydroacoustic monitoring plan for measurements during piling and demolition/reconstruction will be developed by Caltrans or their contractor.

The Baseline Hydroacoustic Survey Plan (Tetra Tech, 2010) included a conceptual MMMMP which outlined the safety zone establishment procedures. The size of the 180 and 190 dB re 1 μPa_{RMS} safety radii will be determined utilizing the baseline data collected as well as specific construction activities. These radii will be incorporated into Caltrans mitigation monitoring during initial survey activities at which time actual underwater sound propagation will be measured.

Mitigation measures in the MMMMP would include the development and delineation of a marine mammal safety zone based on the hydroacoustic threshold values established by NMFS. The use of trained marine mammal experts (known as marine mammal observers, MMOs) during construction activities and implementation of mitigation measures will minimize or remove the potential impacts of the project on marine mammals and will address NMFS's concerns and requests. If marine mammals are observed within or are about to enter specific safety radii around the proposed survey activities, mitigation will be initiated by these vessel-based MMOs such as a temporary stoppage of pile driving activities when a sea lion or any other marine mammal is observed within or approaching the safety. Once the MMMMP is implemented, the likelihood of any harassment of marine mammals is considered very unlikely.

5.0 CONCLUSION

The Cerritos Channel background noise levels are at significant levels in comparison to the open ocean. The existing ambient acoustic environment is consistently above the "biologically significant" level of 120 dBL broadband threshold. In addition, the data shows that this shallow water environment is not a good transmitter of low frequency noise due to water depth and channel geometries and therefore noise generated from pile driving activities is not expected to propagate as effectively as compared to an a unbounded open waterway or open ocean.

Caltrans or their contractor will develop a MMMMP which will revise the proposed mitigation and minimization strategies outlined in the conceptual MMMMP utilizing the baseline measurement data and the MMMMP will clearly identify the safety zones to be monitored. The MMMMP will be submitted for approval to NMFS.

6.0 REFERENCES

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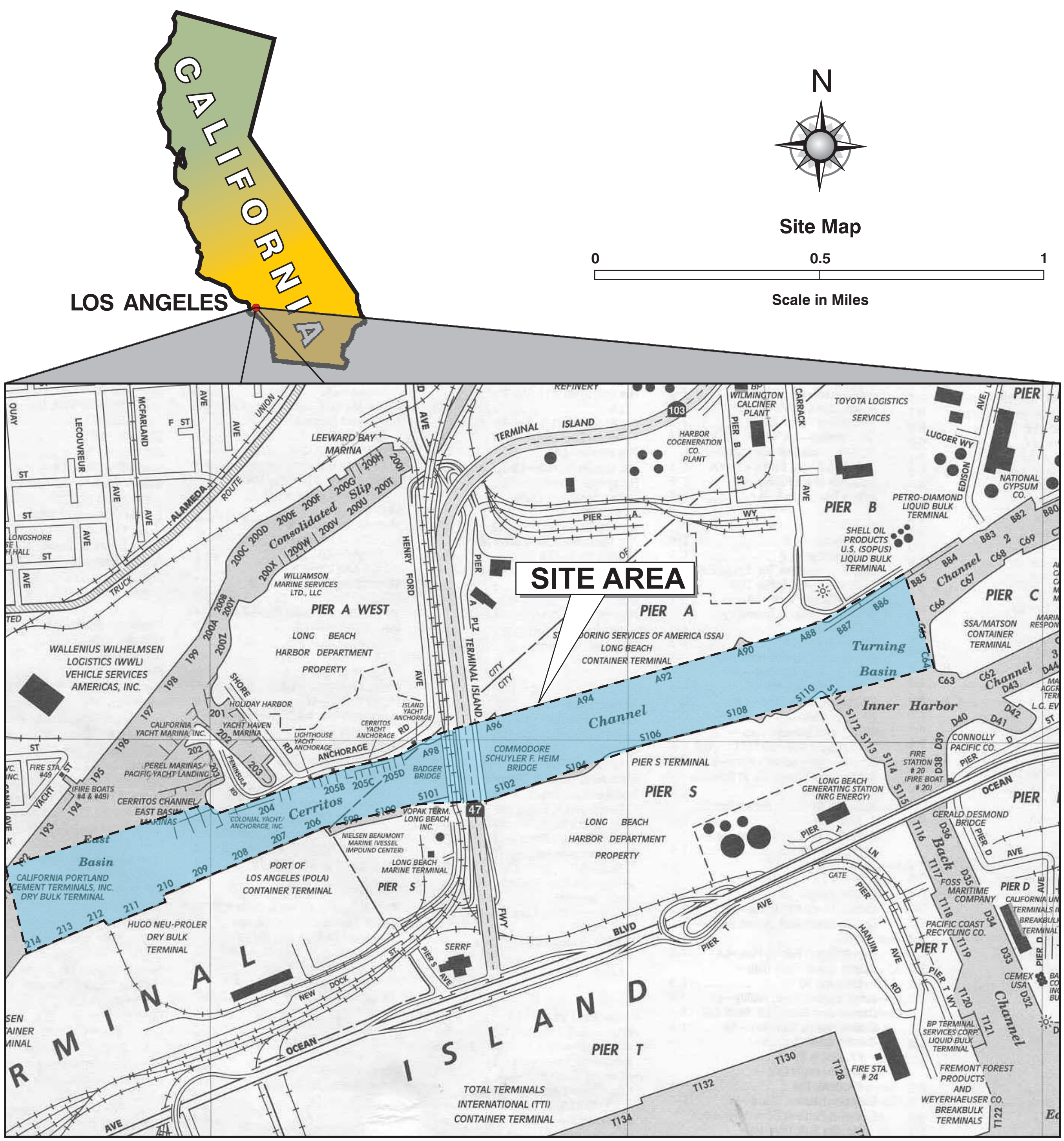
FIGURES

FIGURE 1
SITE LOCATION MAP



Source: Los Angeles & Long Beach Harbors 2003-2008, Automobile Club of Southern California

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FIGURE 2

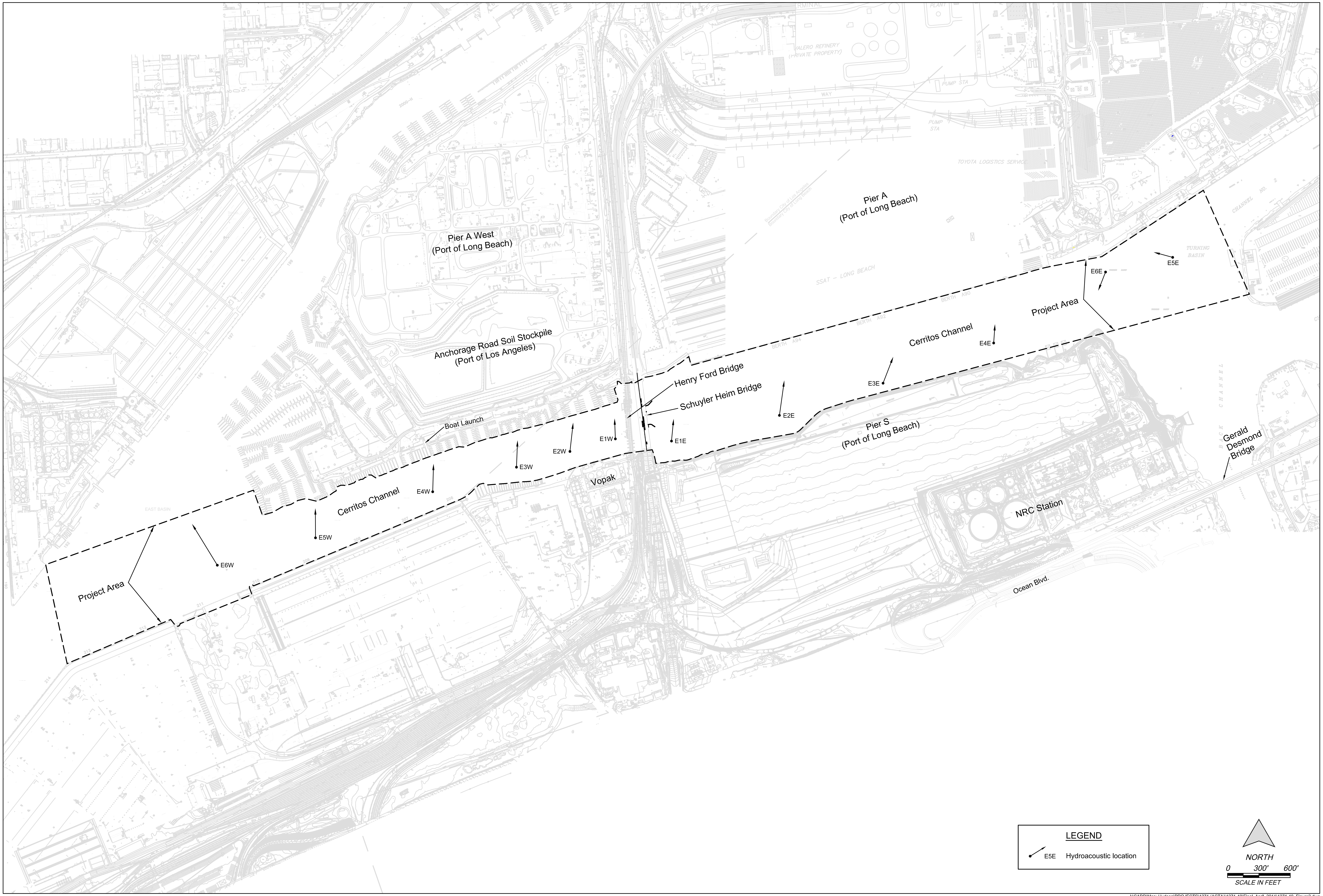

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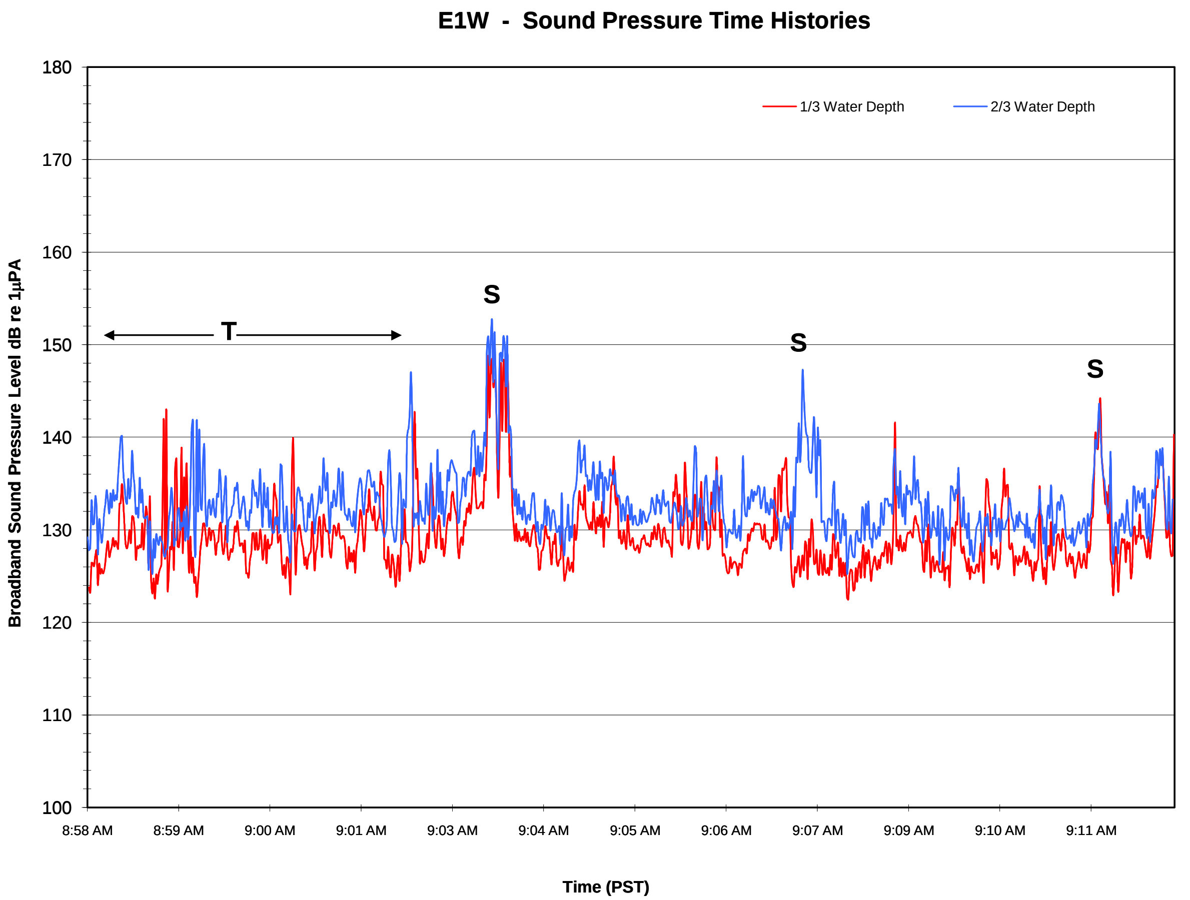
Figure 3 - Location E1W



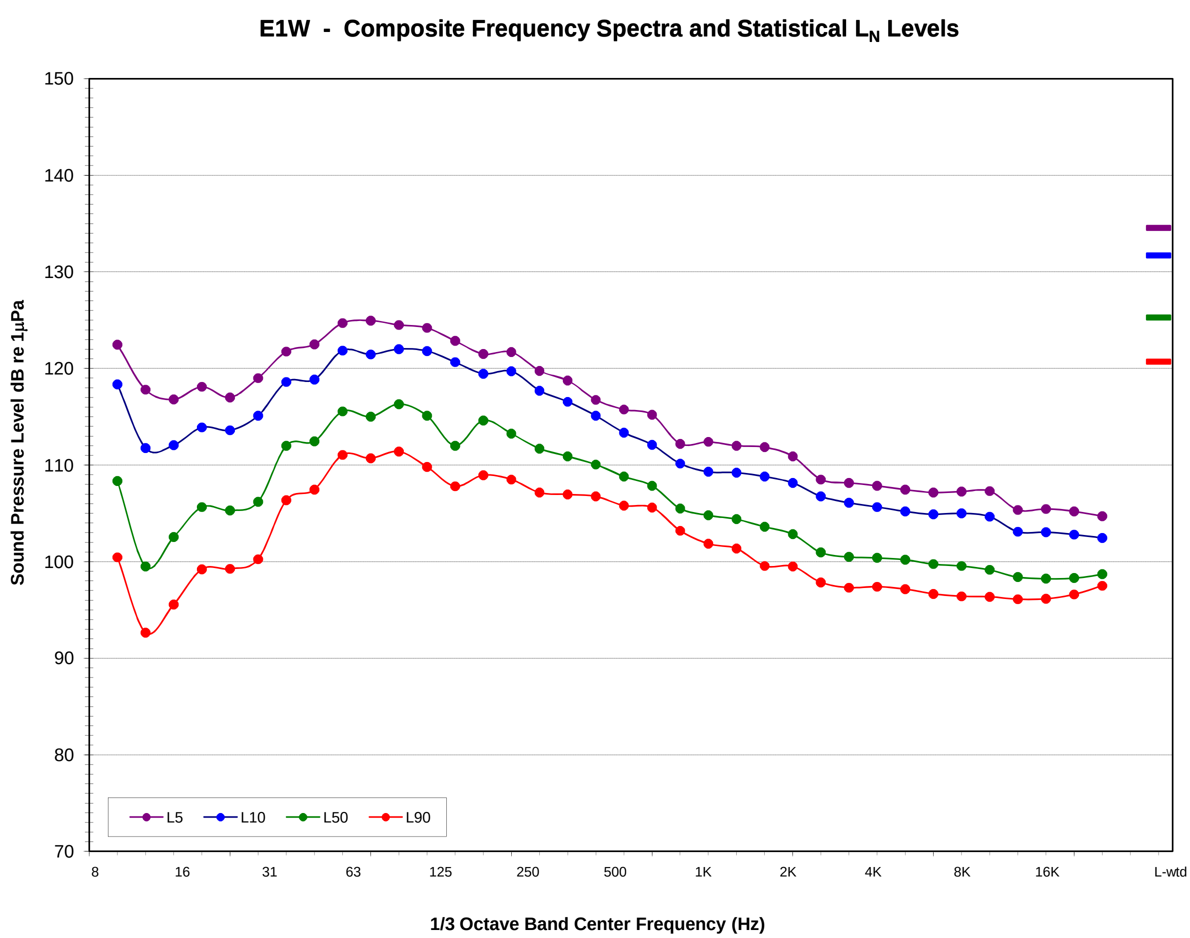
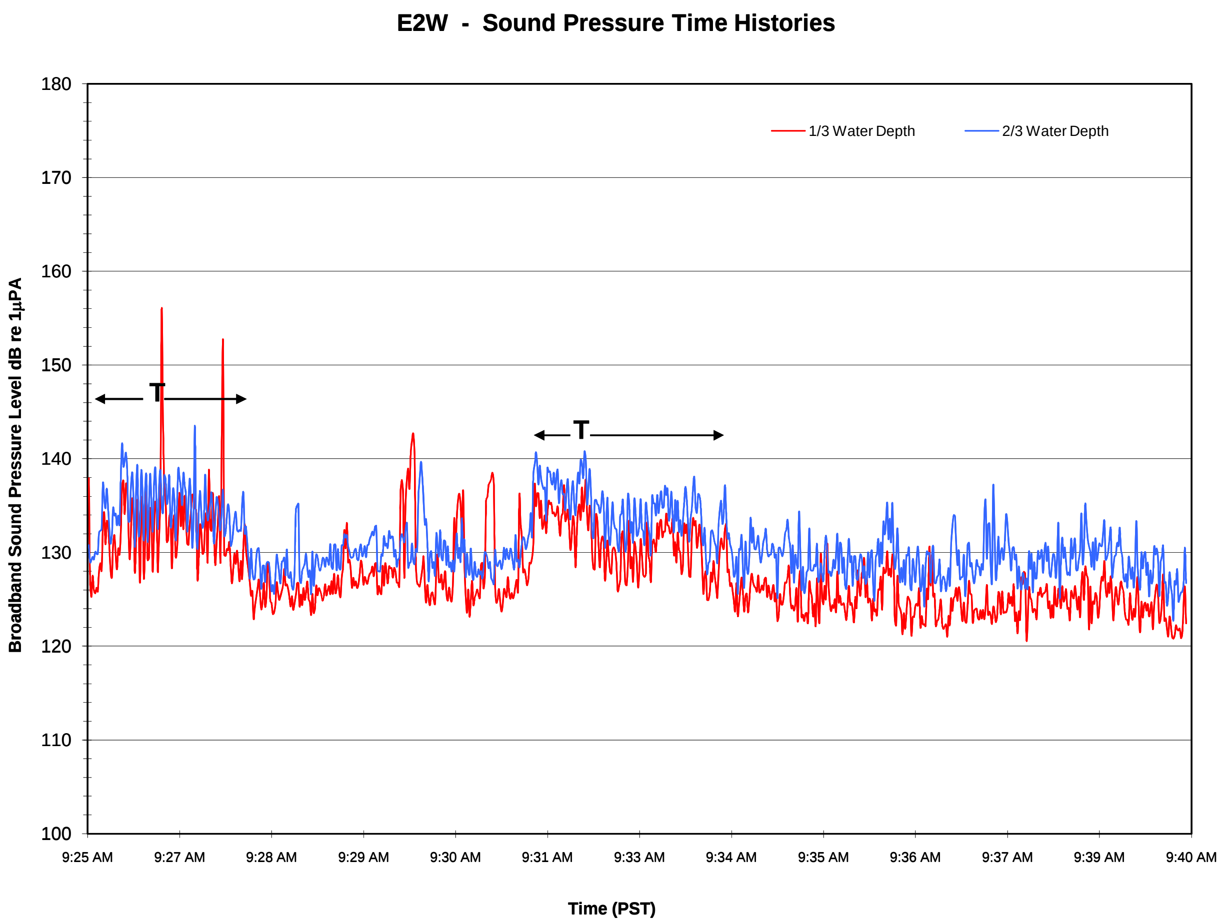


Figure 4 - Location E2W



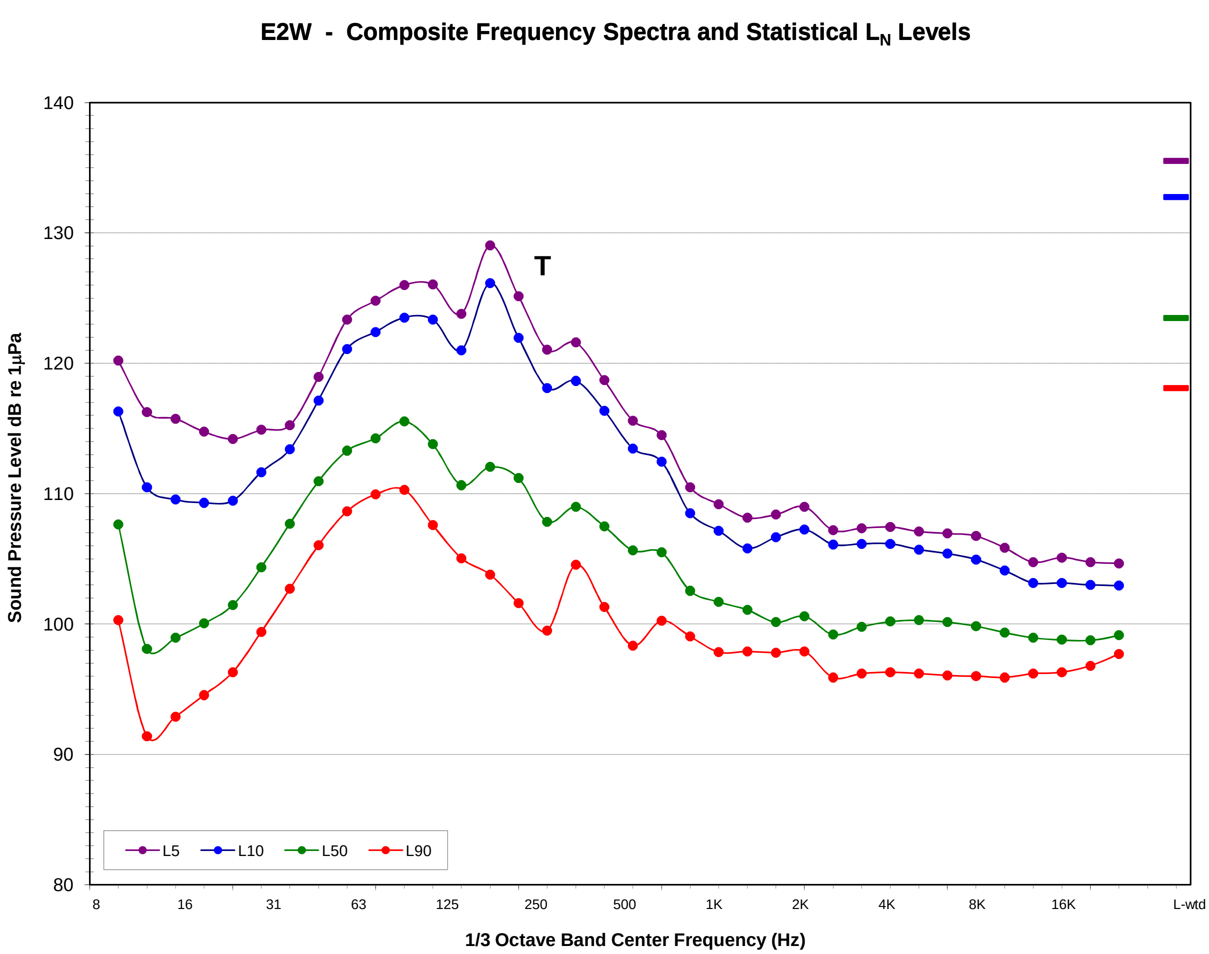
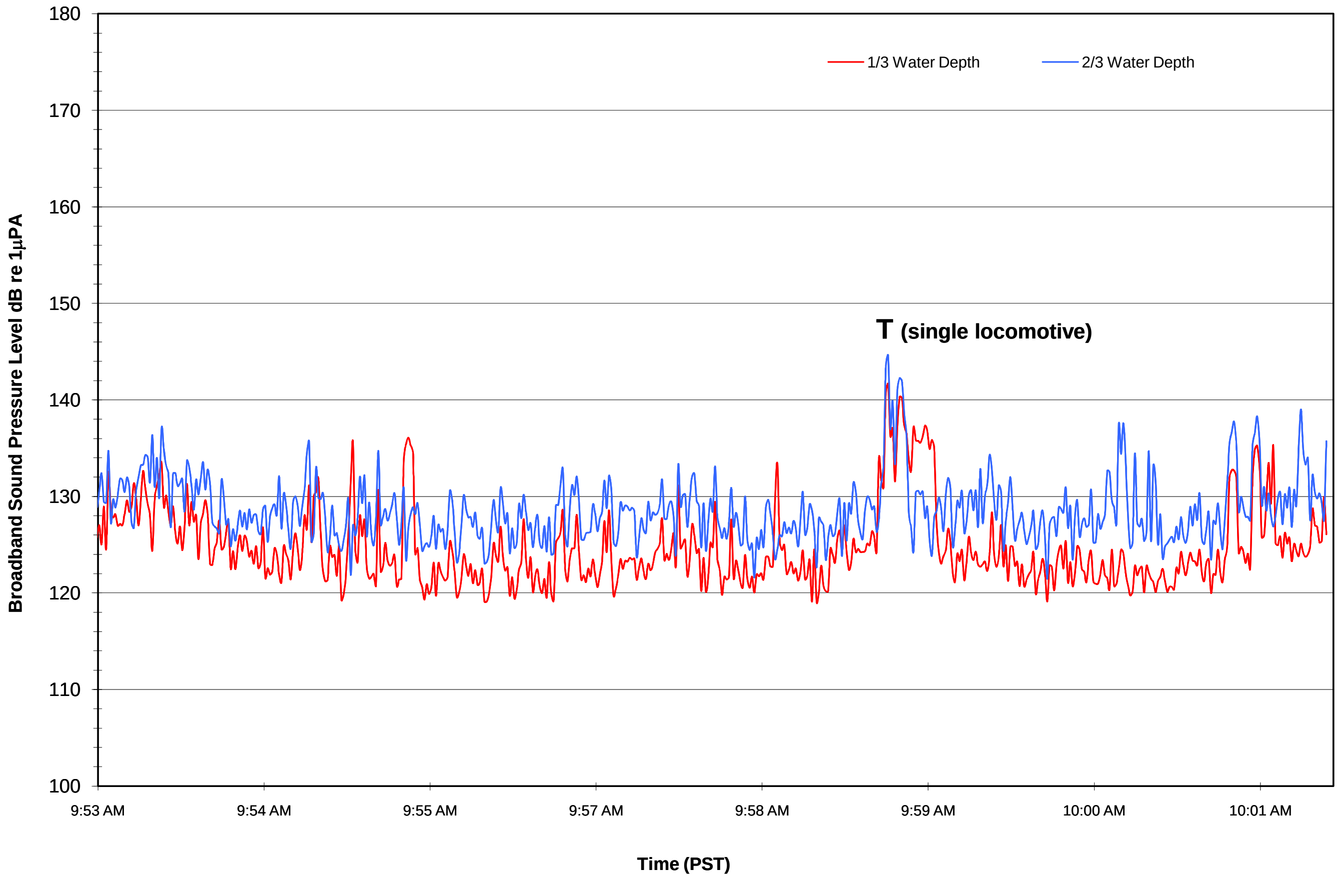


Figure 5 - Location E3W

E3W - Sound Pressure Time Histories



E3W - Composite Frequency Spectra and Statistical L_N Levels

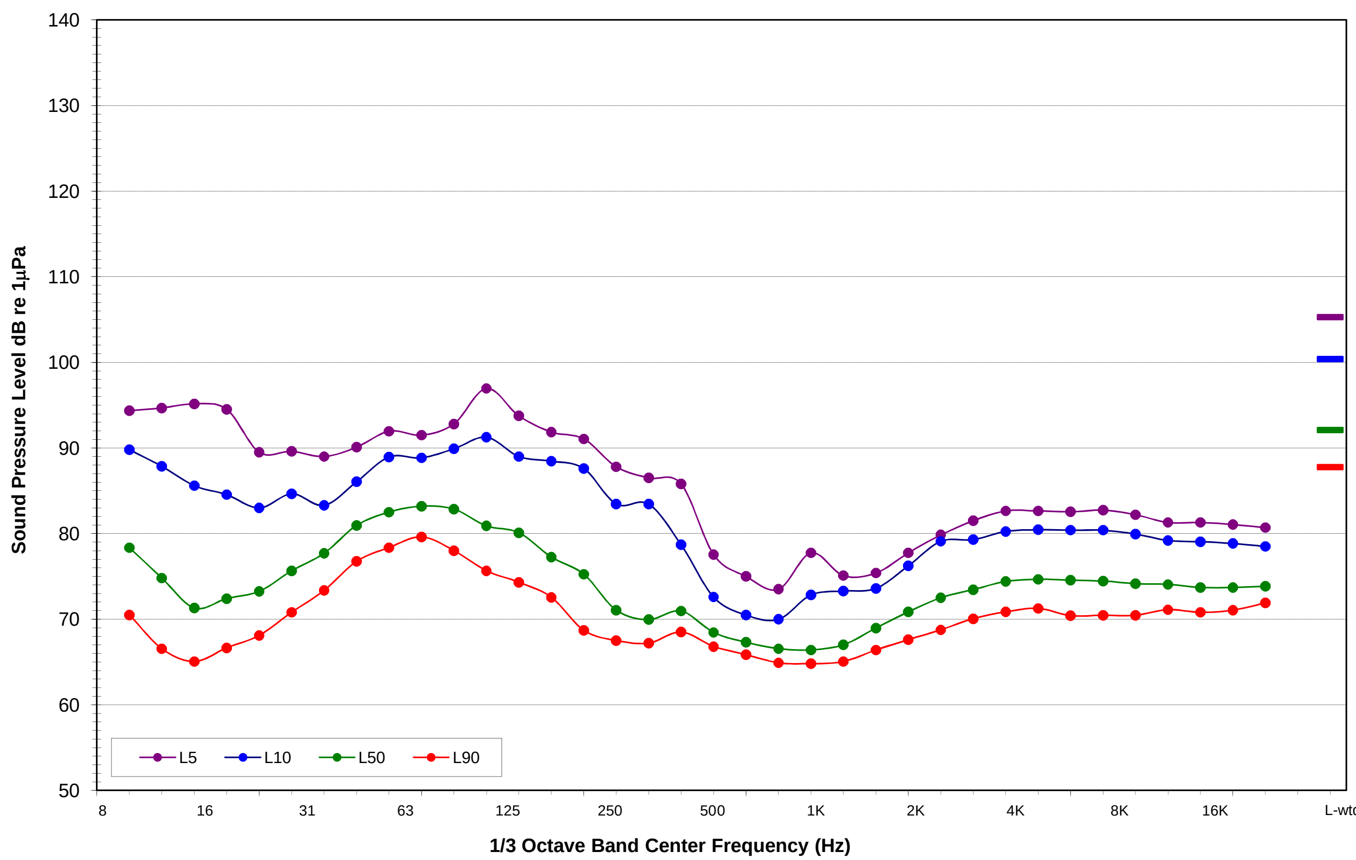
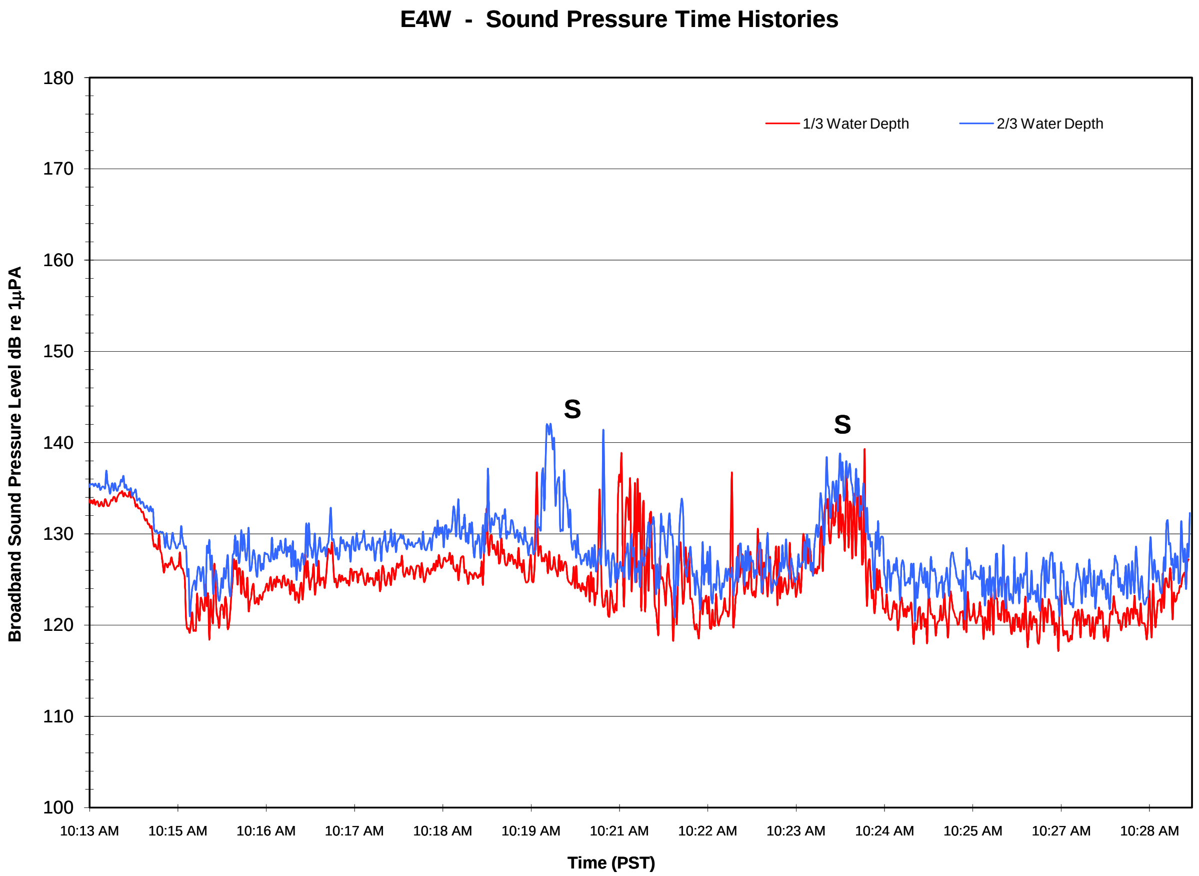


Figure 6 - Location E4W



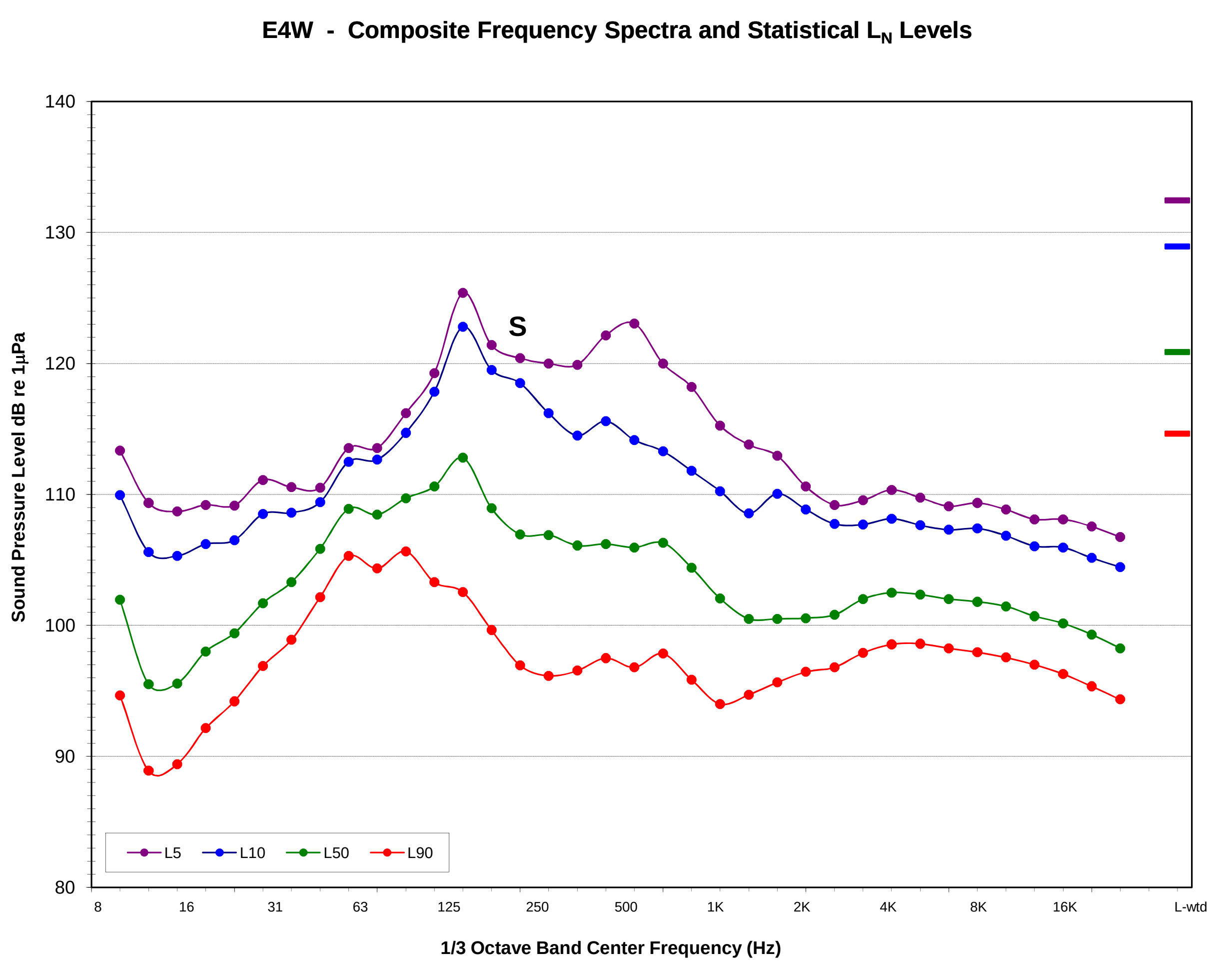
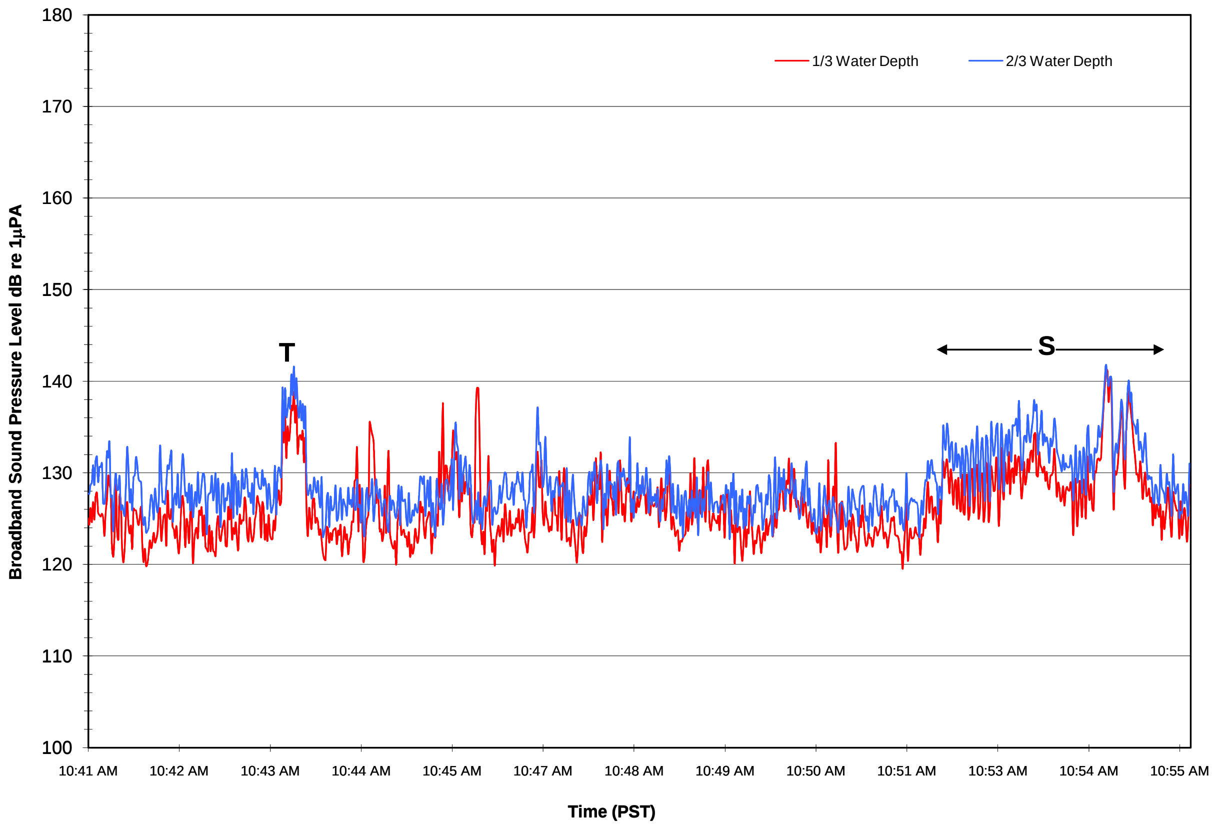


Figure 7 - Location E5W

E5W - Sound Pressure Time Histories



E5W - Composite Frequency Spectra and Statistical L_N Levels

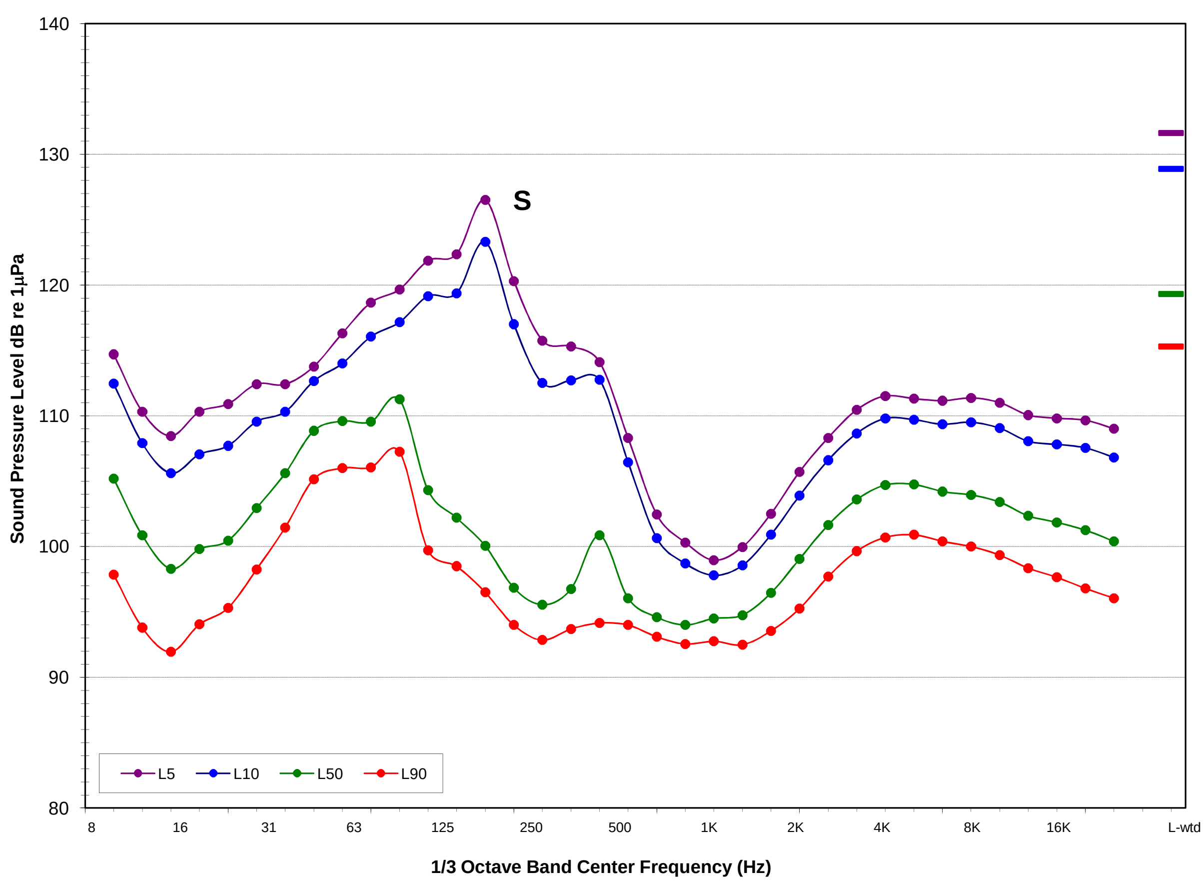
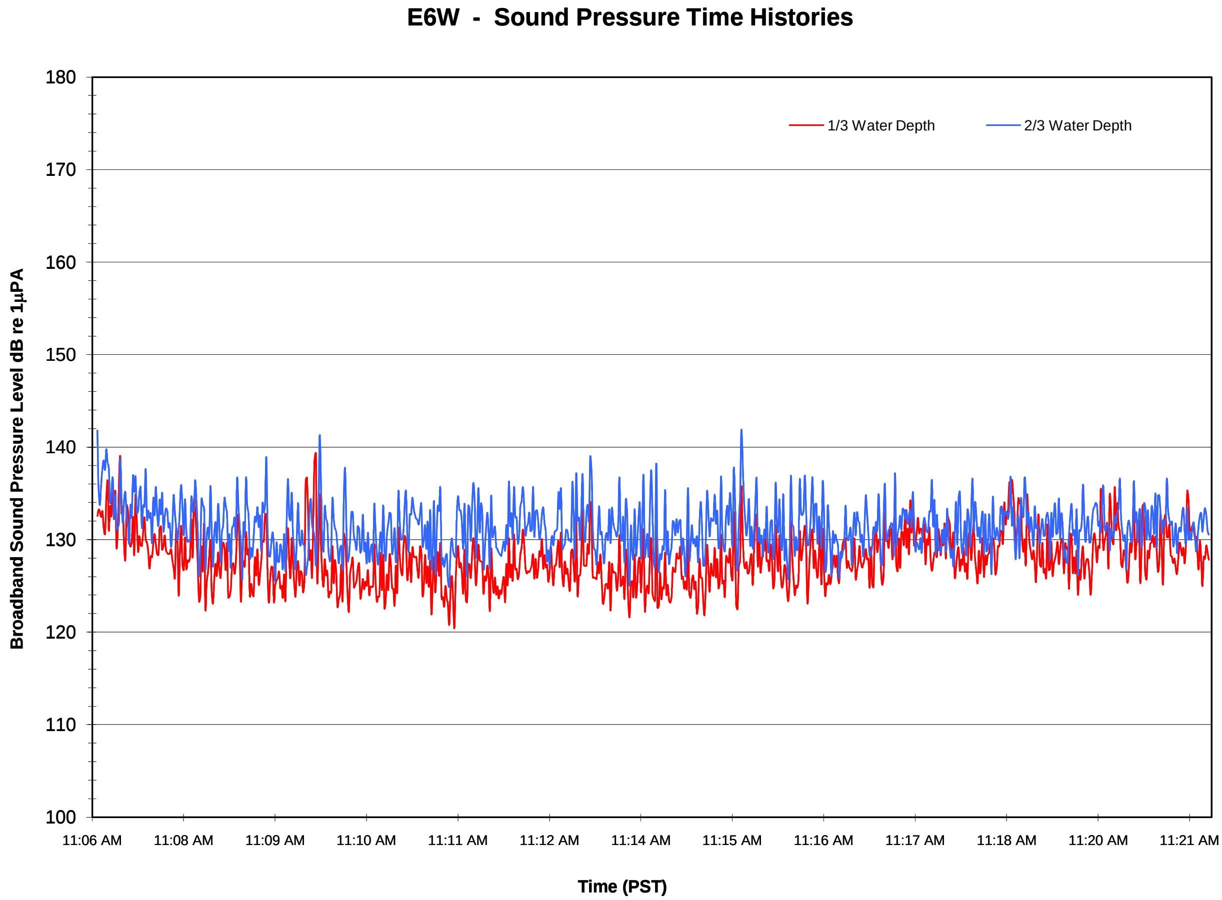


Figure 8 - Location E6W



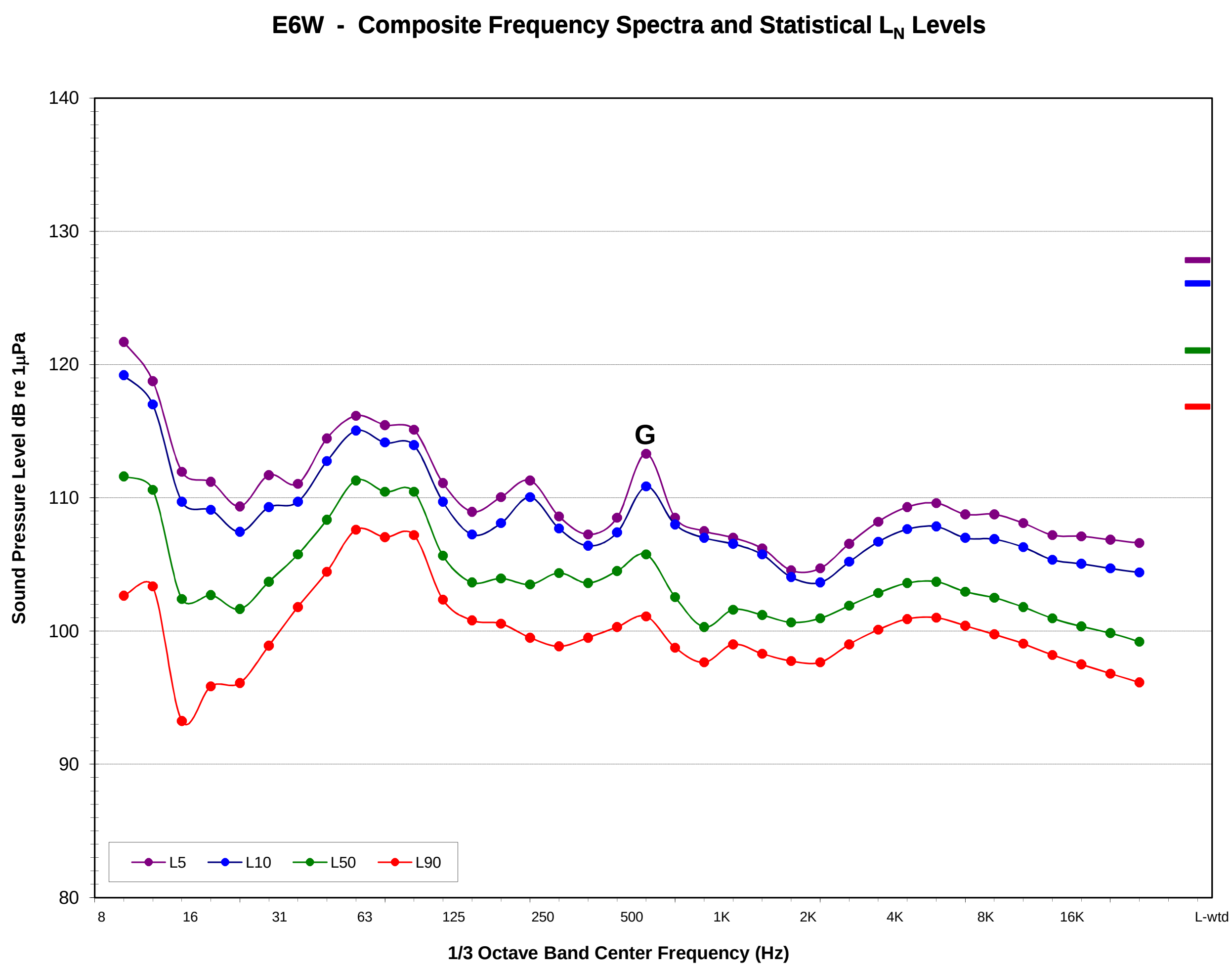
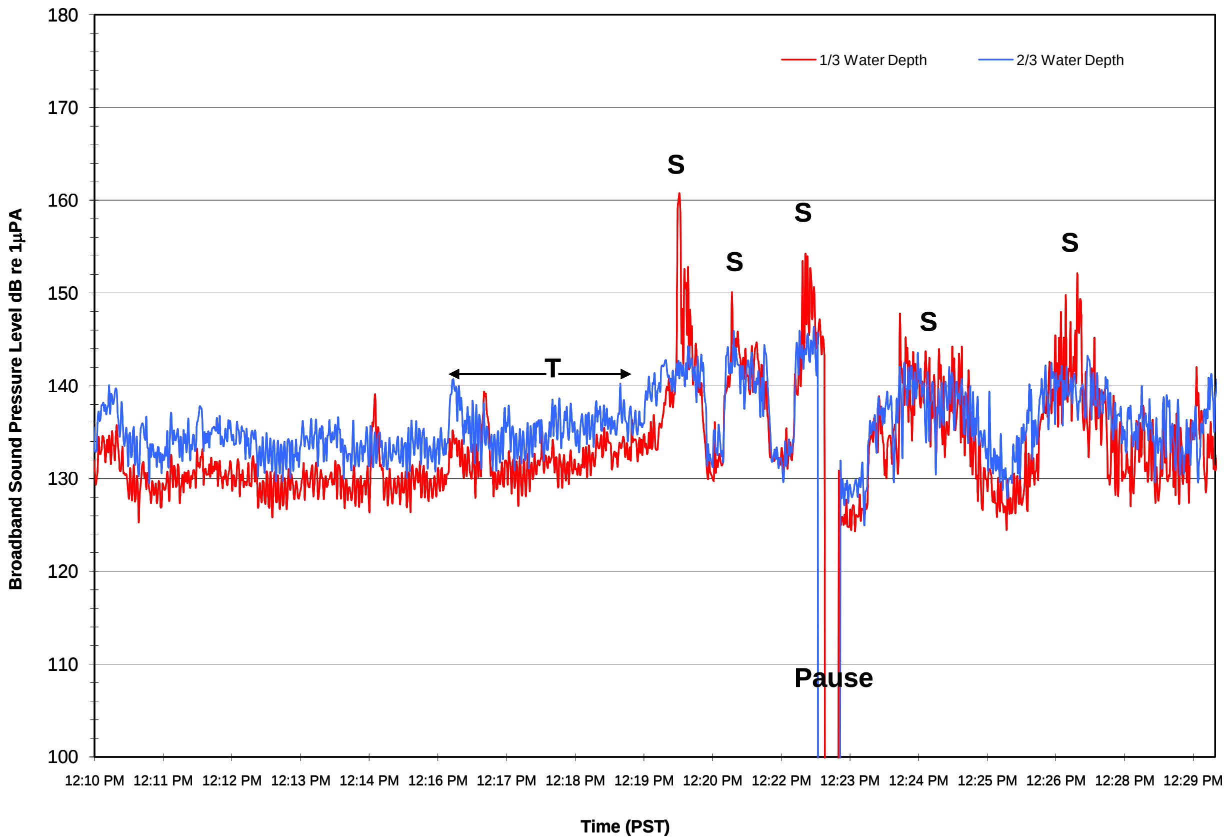


Figure 9 - Location E1E

E1E - Sound Pressure Time Histories



E1E - Composite Frequency Spectra and Statistical L_N Levels

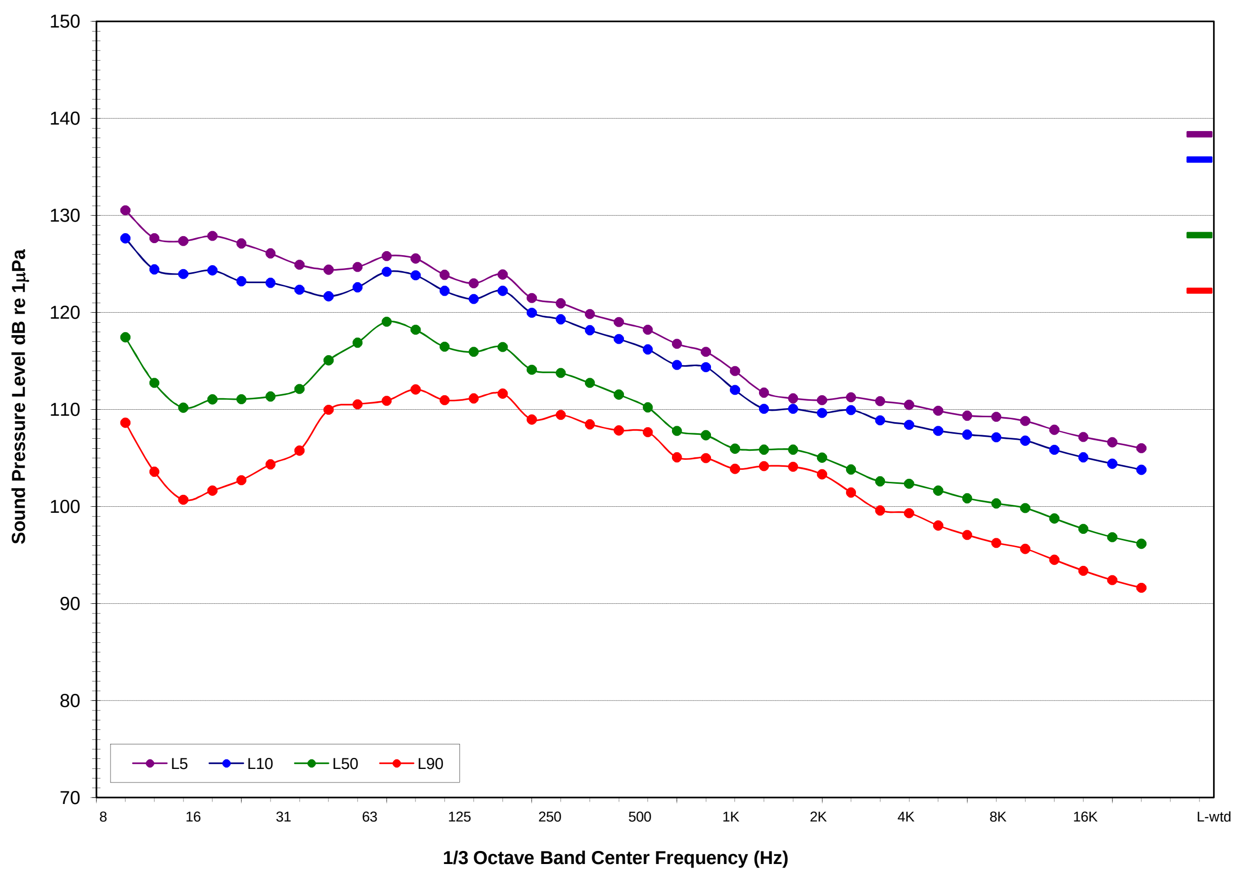
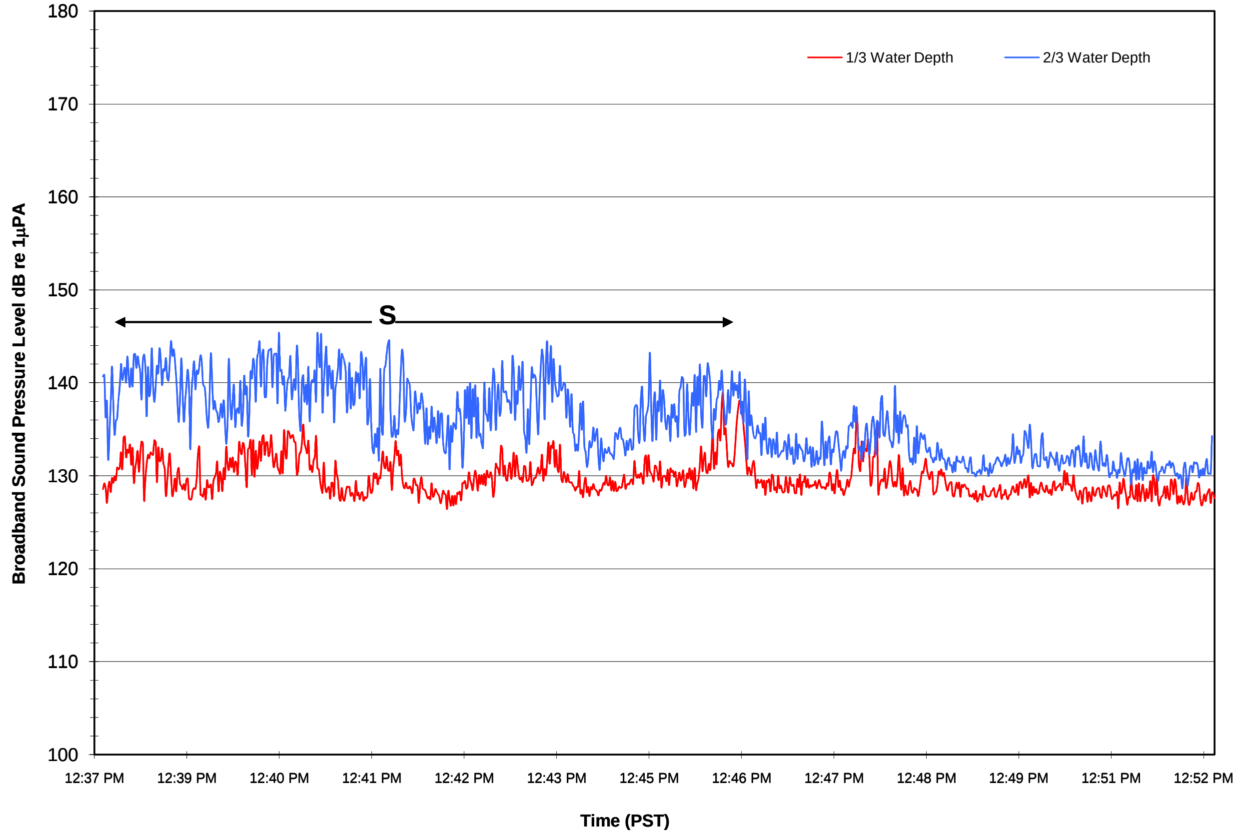


Figure 10 - Location E2E

E2E - Sound Pressure Time Histories



E2E - Composite Frequency Spectra and Statistical L_N Levels

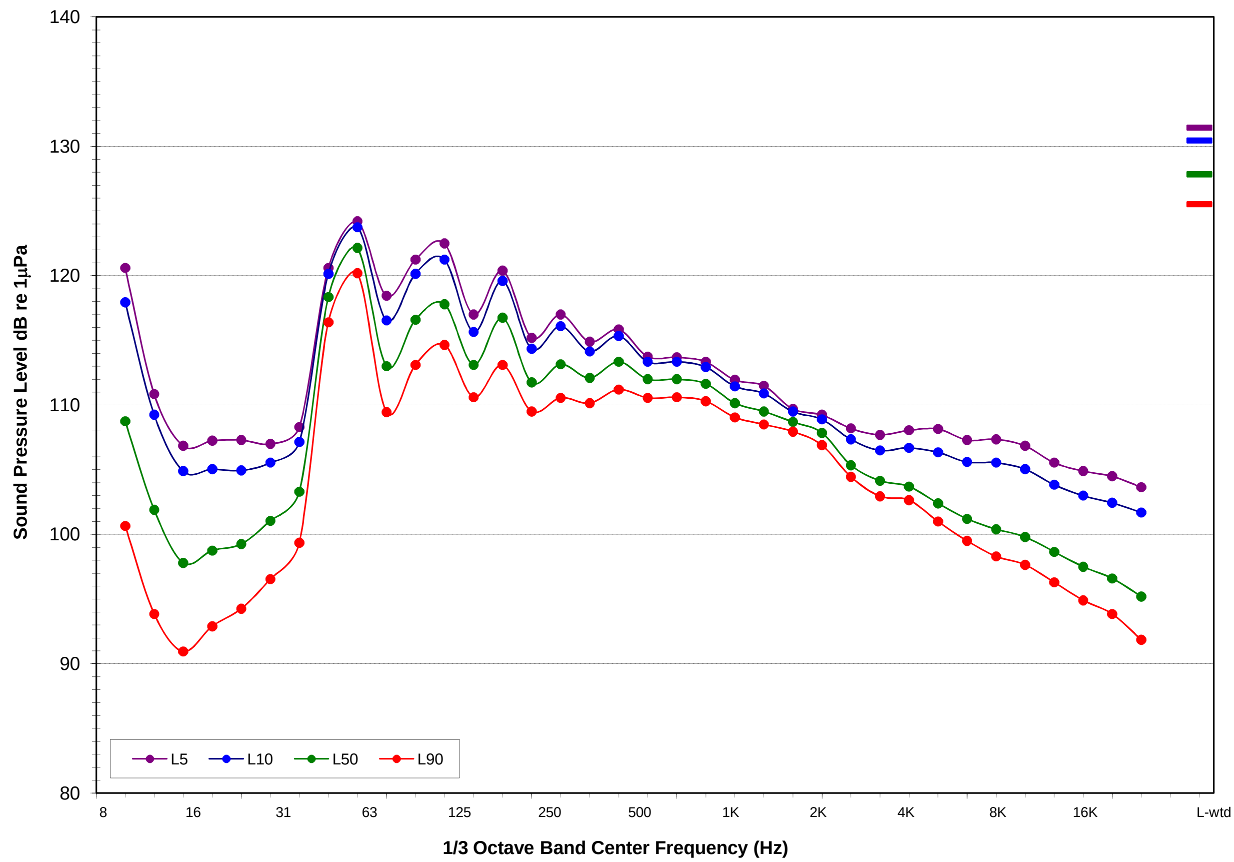
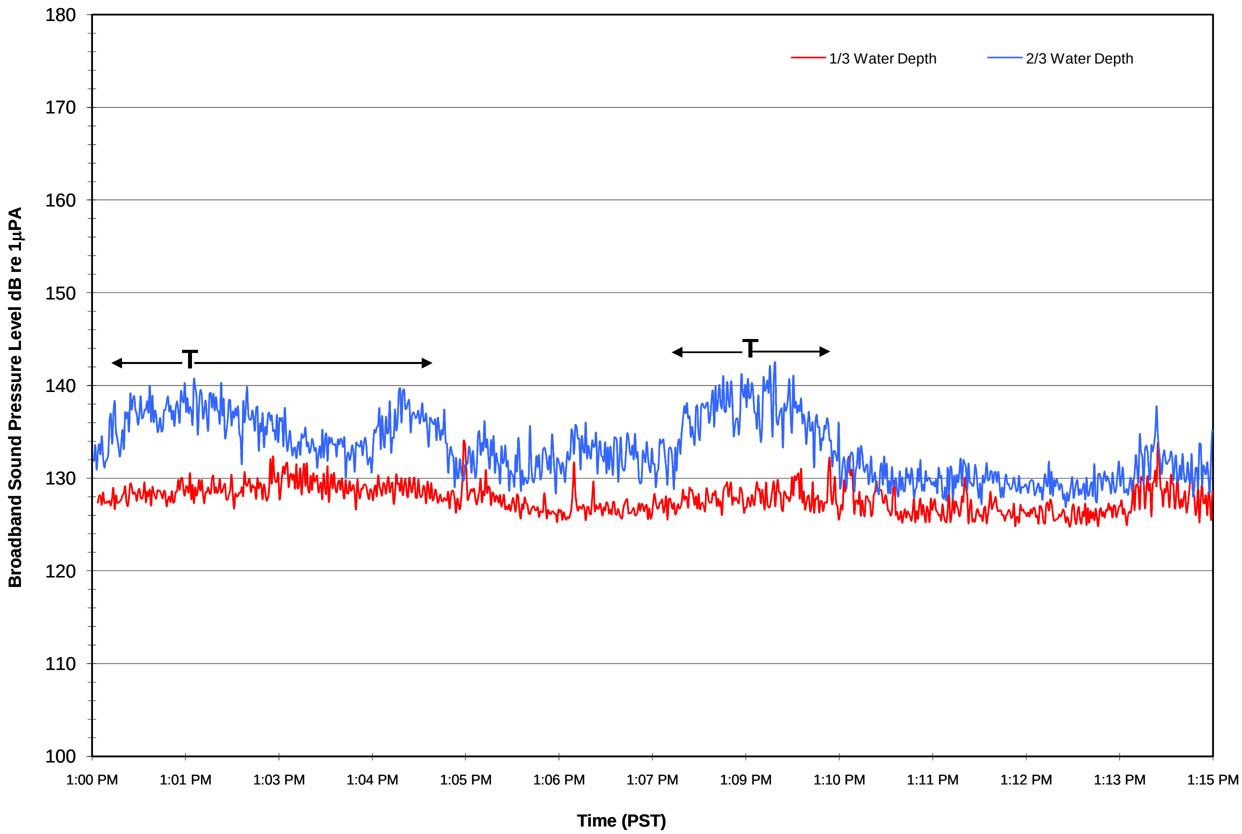


Figure 11 - Location E3E

E3E - Sound Pressure Time Histories



E3E - Composite Frequency Spectra and Statistical L_N Levels

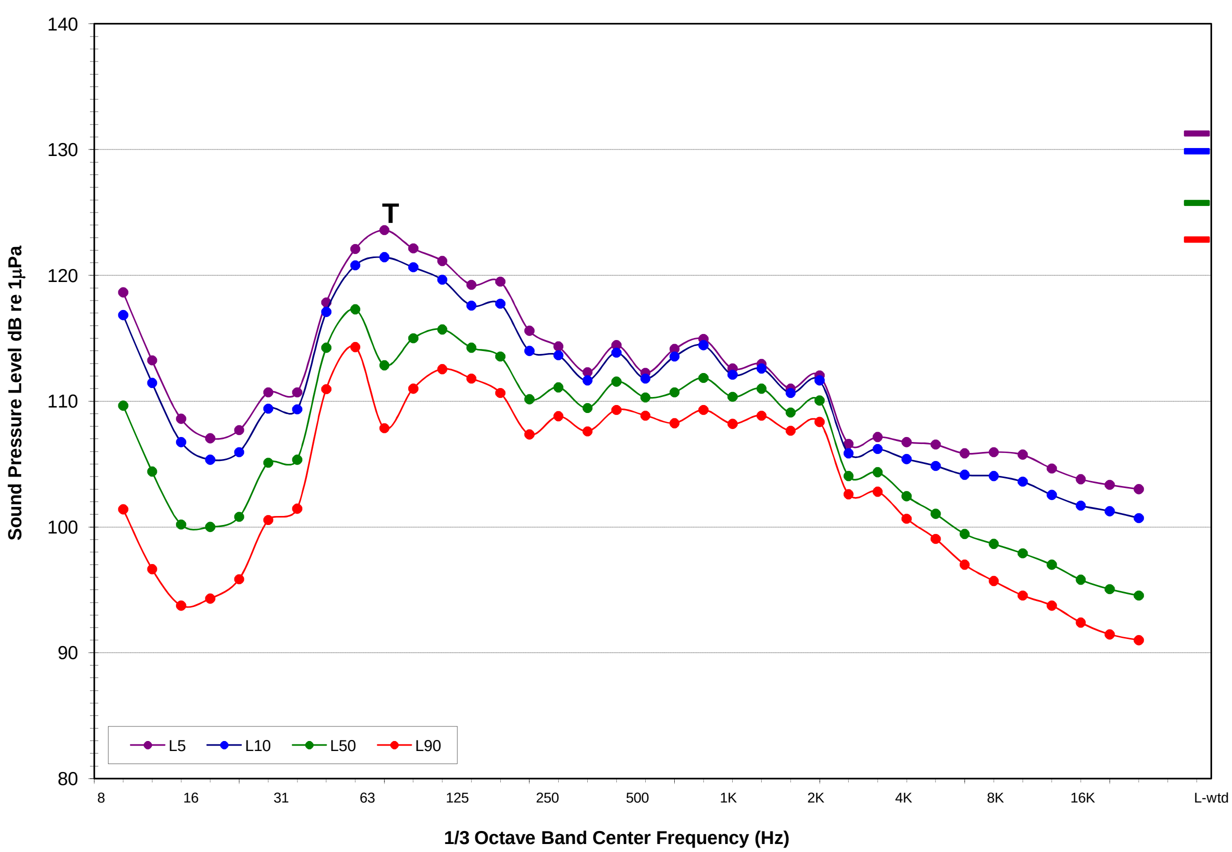
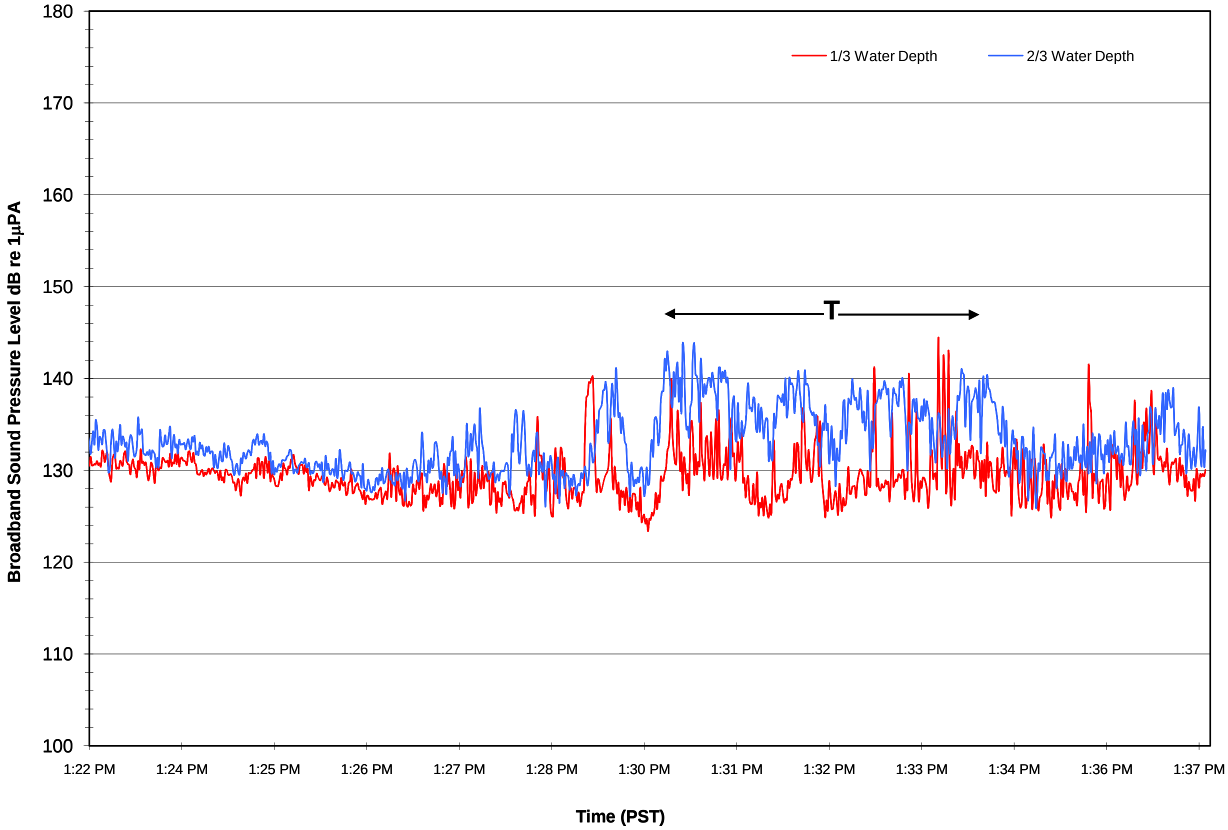


Figure 12 - Location E4E

E4E - Sound Pressure Time Histories



E4E - Composite Frequency Spectra and Statistical L_N Levels

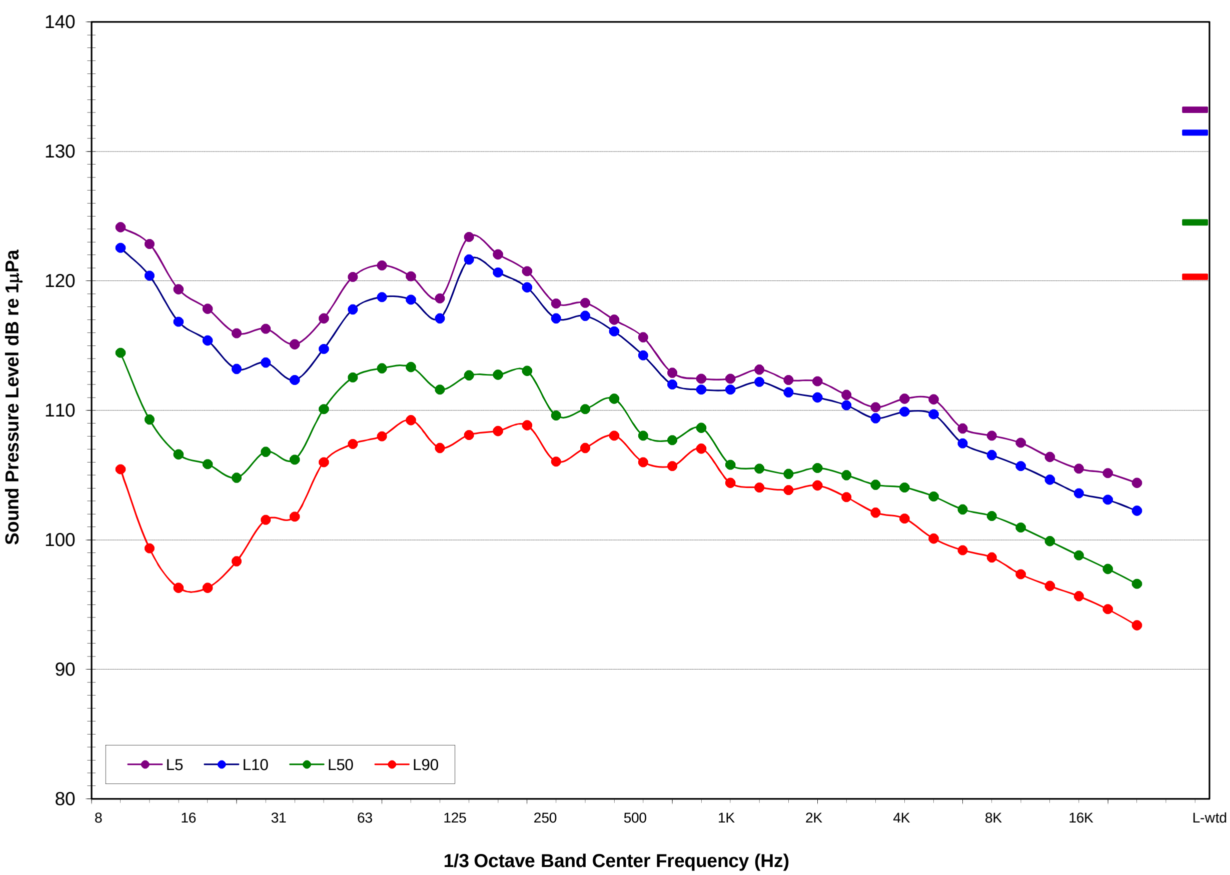
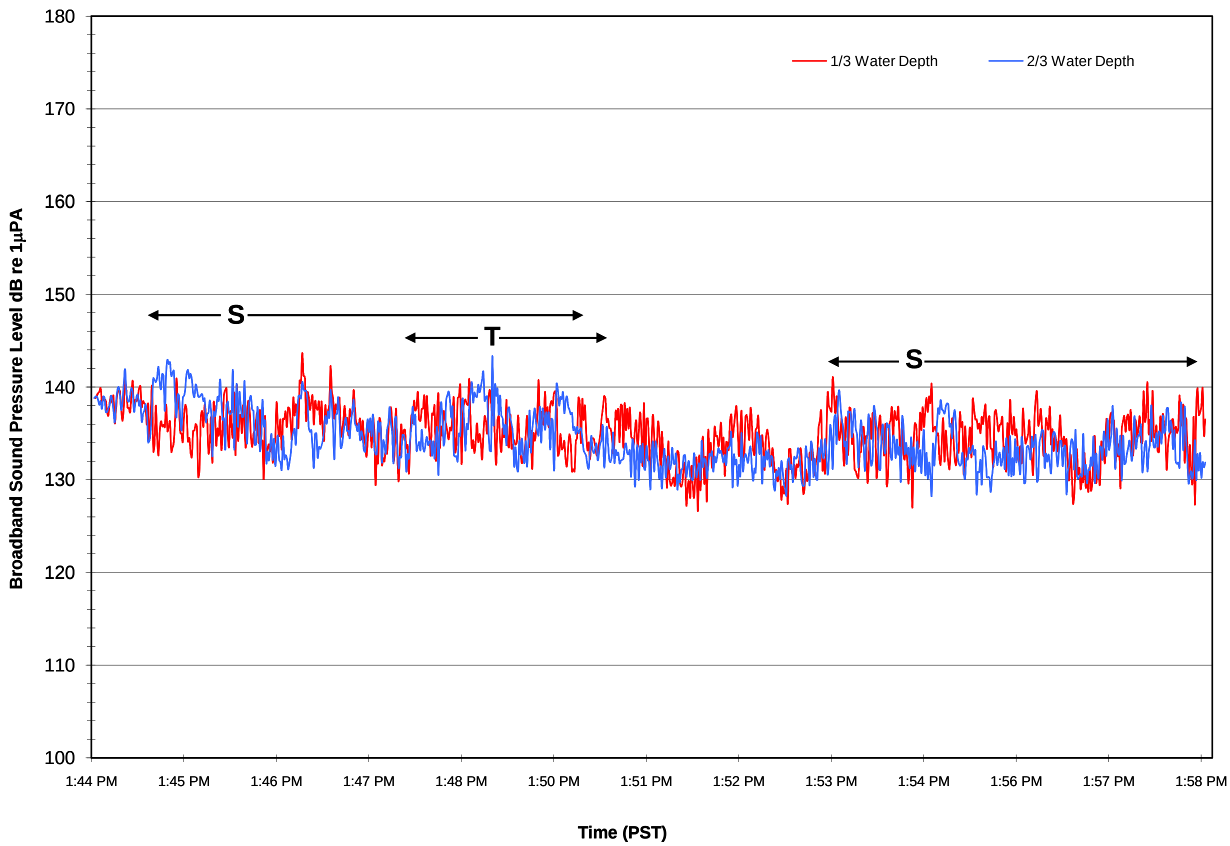


Figure 13 - Location E5E

E5E - Sound Pressure Time Histories



E5E - Composite Frequency Spectra and Statistical L_N Levels

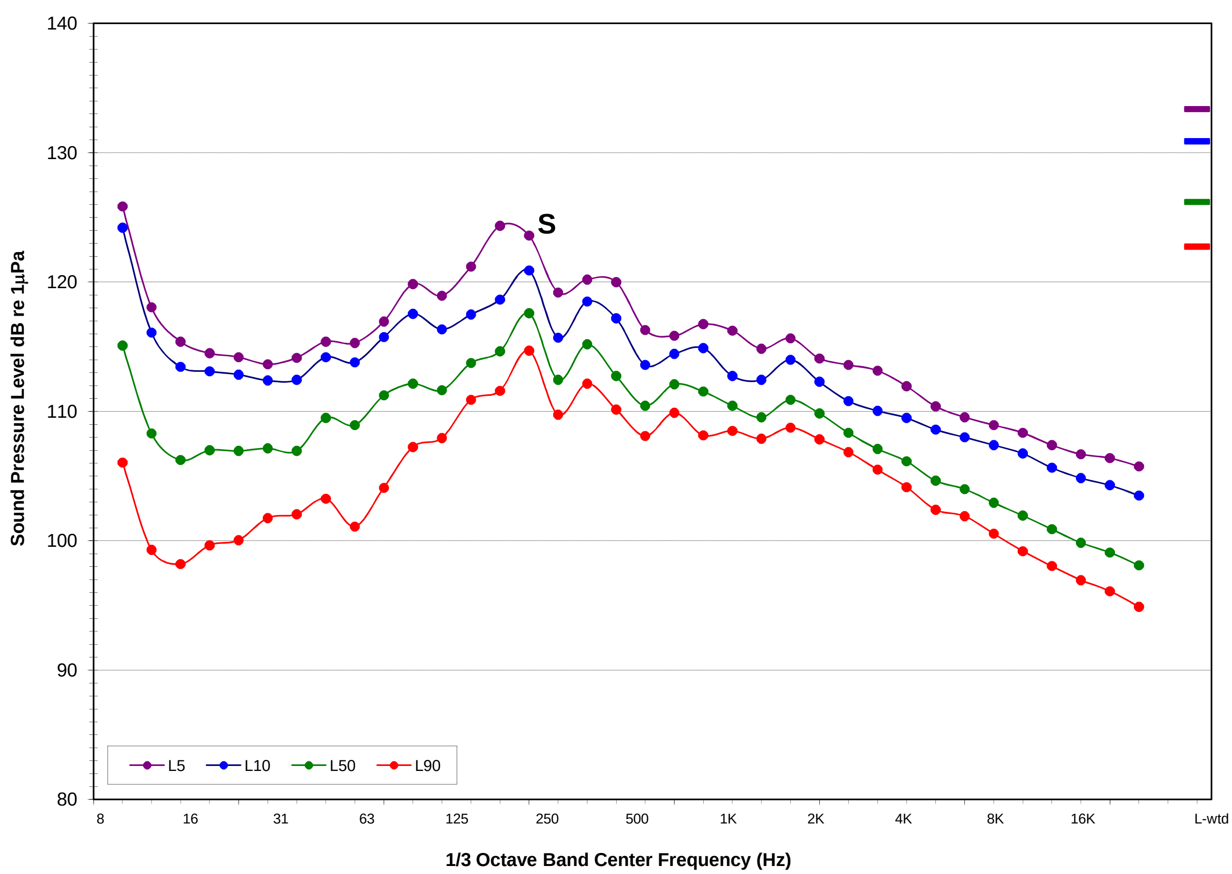
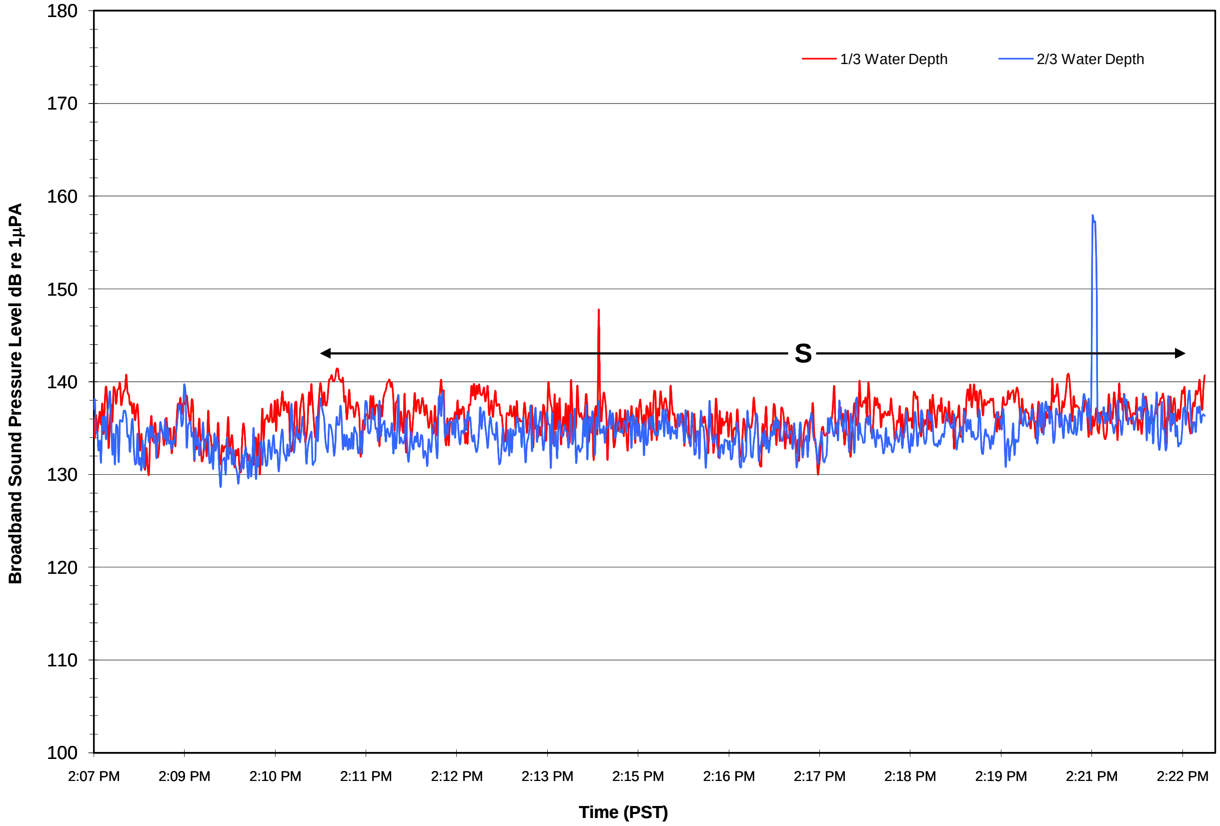


Figure 14 - Location E6E

E6E - Sound Pressure Time Histories



E6E - Composite Frequency Spectra and Statistical L_N Levels

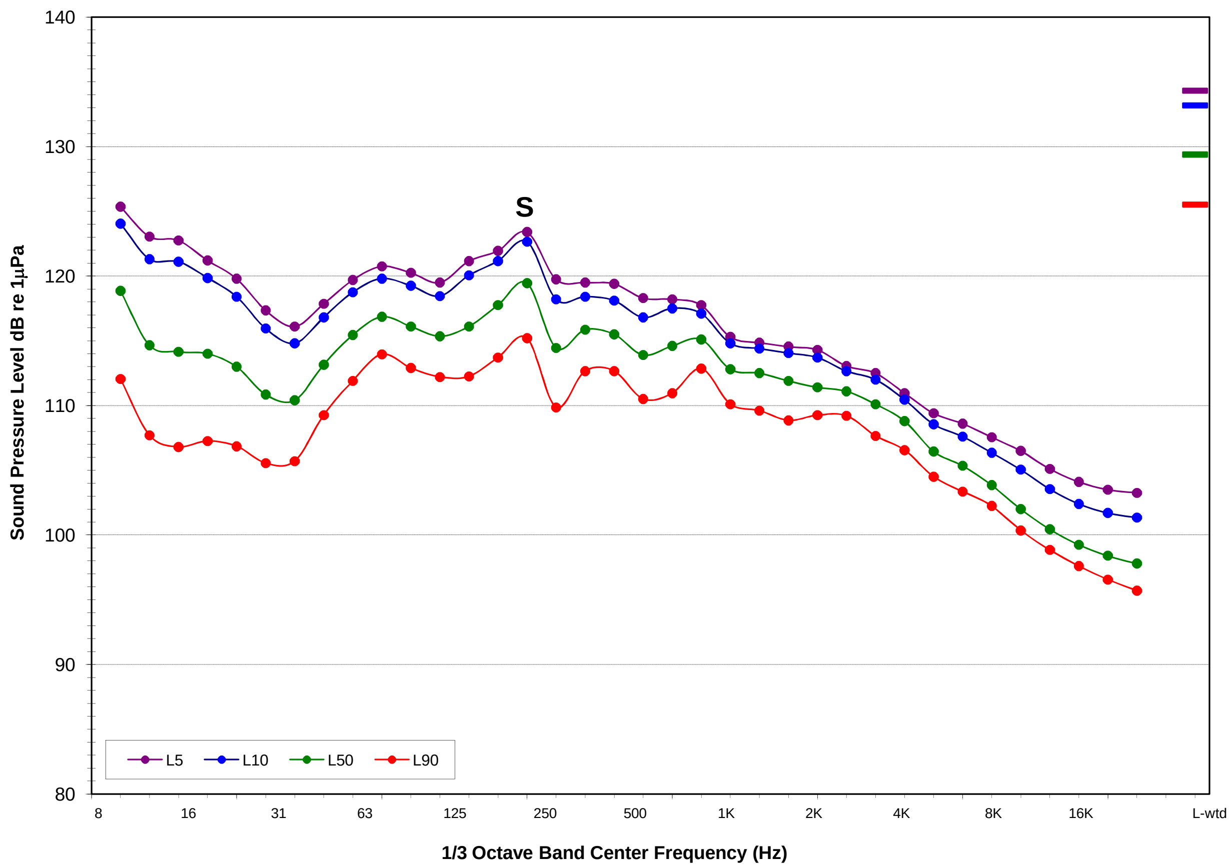
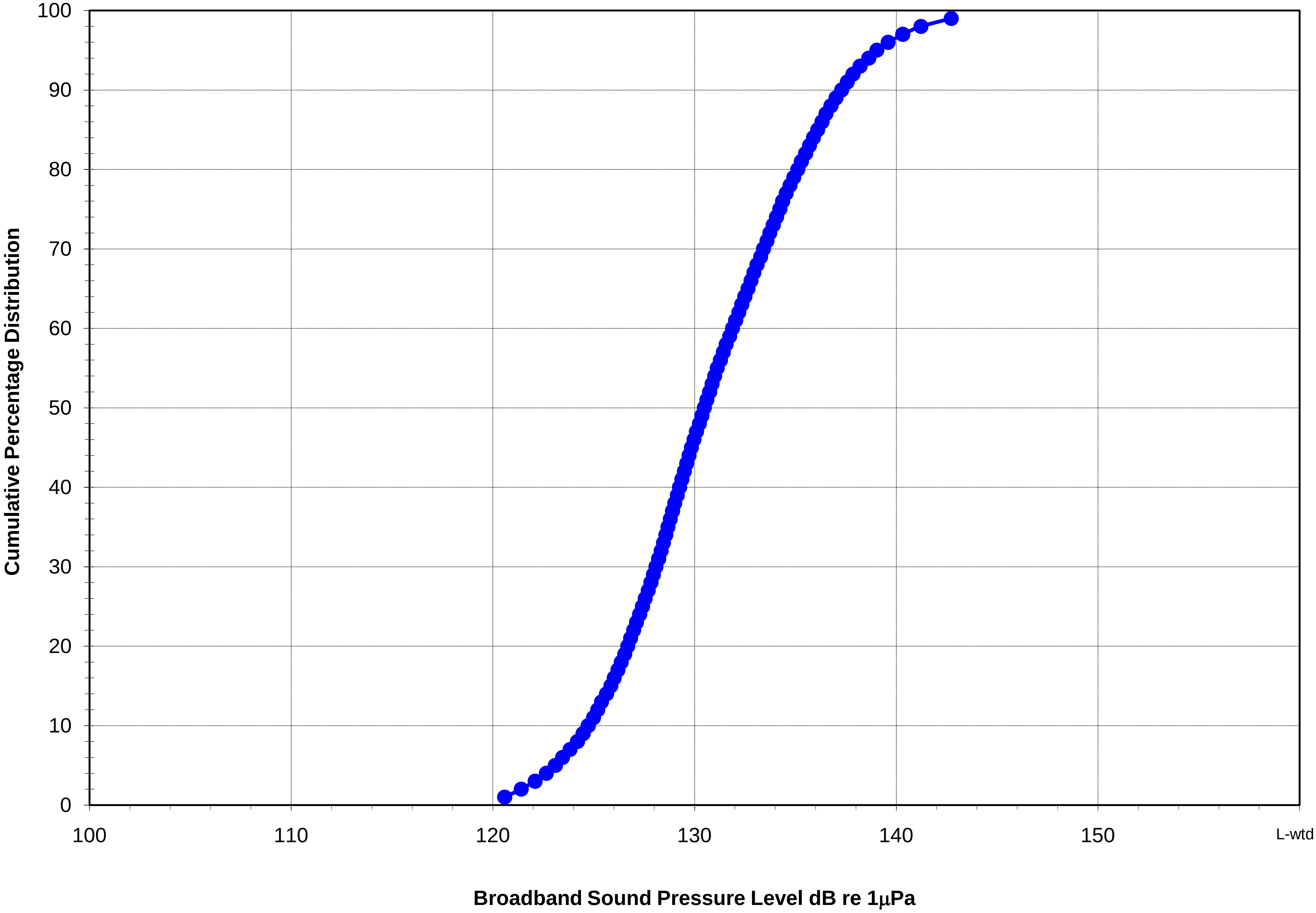


Figure 15 Cumulative Percentage Distribution of 1-sec L_{eqs}



APPENDIX A

PHOTOGRAPHS

1.
Measuring hydrophone cable.JPG
11/17/2010, 8:05 AM

2.
Larson Meters.JPG
11/17/2010, 8:07 AM

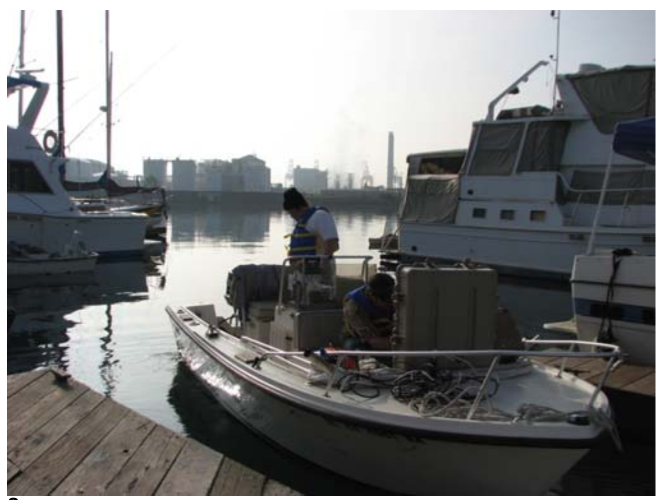
3.
Hydroacoustic gear setup.JPG
11/17/2010, 8:14 AM

4.
Calibrator.JPG
11/17/2010, 8:23 AM

5.
Calibration - Probe in water.JPG
11/17/2010, 8:25 AM

6.
Calibrating.JPG
11/17/2010, 8:27 AM

7.
Calibrating (2).JPG
11/17/2010, 8:27 AM



8.
Preparing equipment.JPG
11/17/2010, 8:44 AM

9.
Cerritos Channel_Lkg W.JPG
11/17/2010, 8:48 AM

10.
Monitoring Sound Equipment.JPG
11/17/2010, 8:50 AM

11.
Preparing Sound Equipment.JPG
11/17/2010, 8:50 AM

12.
Cerritos Channel beneath Henry Ford bridge_Lkg E.JP
11/17/2010, 9:08 AM

13.
West of Henry Ford Bridge_Lkg E.JPG
11/17/2010, 10:07 AM

14.
Cerritos Channel, West of Bridge.JPG
11/17/2010, 10:07 AM

15.
Sound Monitoring_1100 AM.JPG
11/17/2010, 10:48 AM

16.
Monitoring Sound Readings.JPG
11/17/2010, 11:07 AM

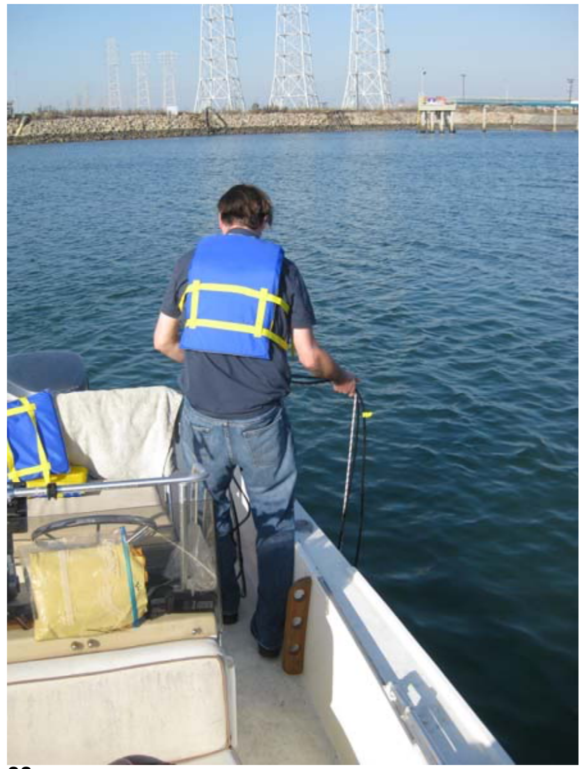
17.
CH Bridge_3.JPG
11/17/2010, 12:11 PM

18.
CH Bridge Up position_Lkg W.JPG
11/17/2010, 12:37 PM

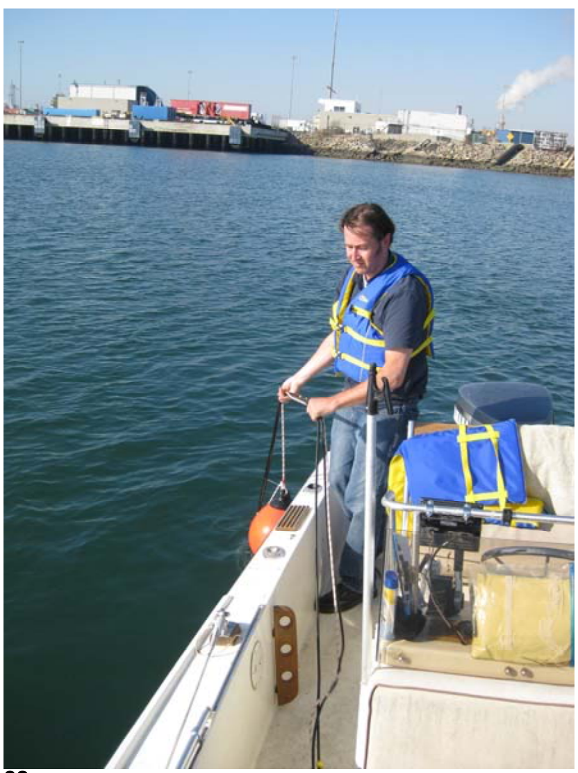
19.
SH Bridge Up position_2_Lkg W.JPG
11/17/2010, 12:37 PM

20.
SH Bridge Up postion_3_Lkg W.JPG
11/17/2010, 12:37 PM

21.
Deployment of Sound Meter.JPG
11/17/2010, 1:14 PM



22.
Deployment of Sound Meter_2.JPG
11/17/2010, 2:05 PM



23.
Deployment of Sound Meter 3.JPG
11/17/2010, 2:05 PM

APPENDIX B

HYDROPHONE CERTIFICATES OF LABORATORY CALIBRATION

HYDROPHONE DIRECTIVITY

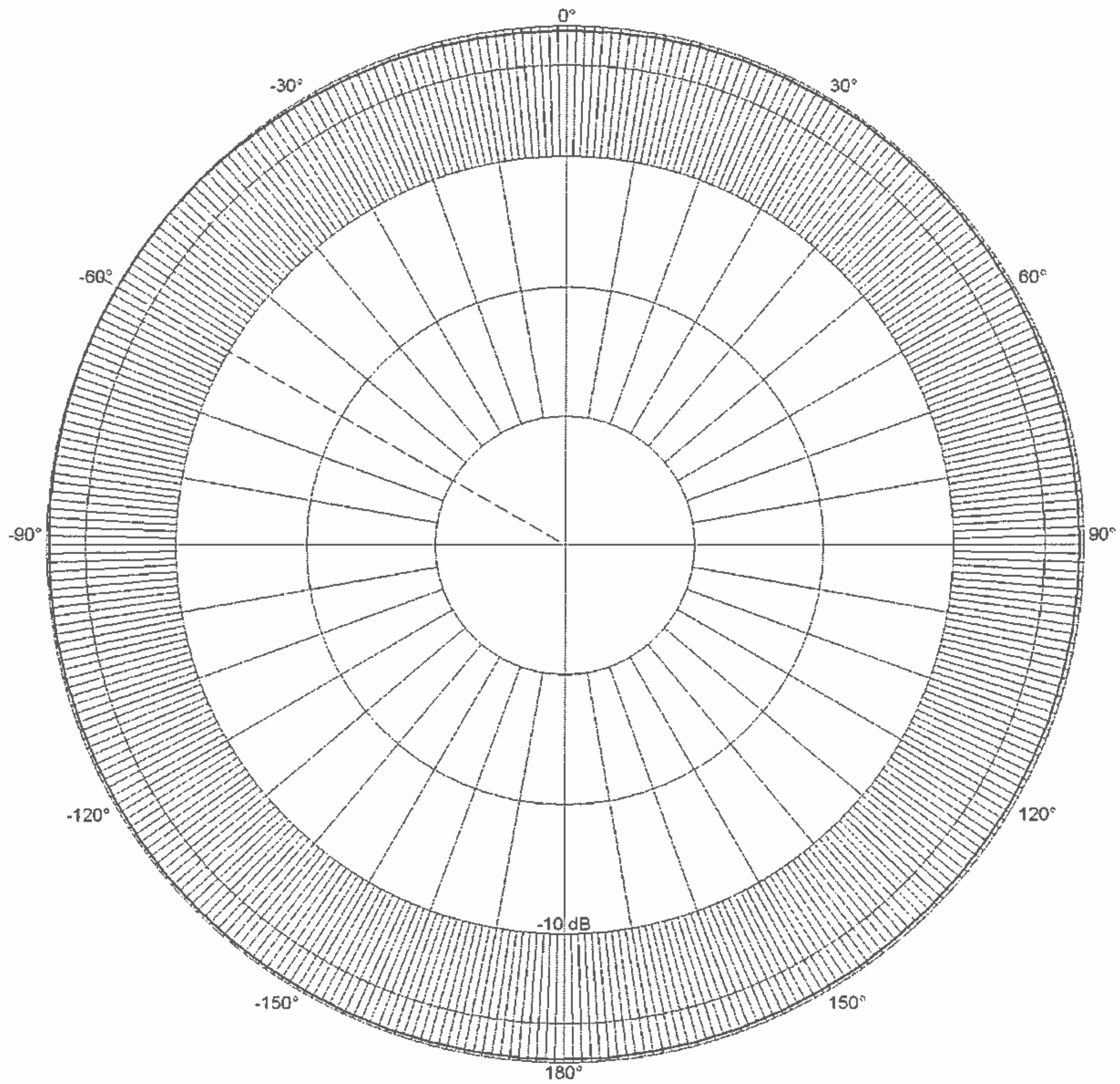
RESON

Under Test:	TC4040-6	Amplitude:	10.0 Vrms	Temperature:	23.46°C
S/N:	1510024	Pulse Width:	150.0 µs	Depth:	1.2 m
Reference:	TC4033	Angle:	-180.0° to 180.0°	Distance:	0.60 m
Date:	2010-08-17	Frequency:	100.00 kHz	Tested by:	PRA
Session, Run:	8014, 7				
Max RR:	-213.3 dB re 1µPa/V at 1m				
SL Right:	-60.0°, 0.0dB dB re 1µPa/V at 1m				
Comment:	Horizontal.				

For all five pages

2010 -08- 18 3

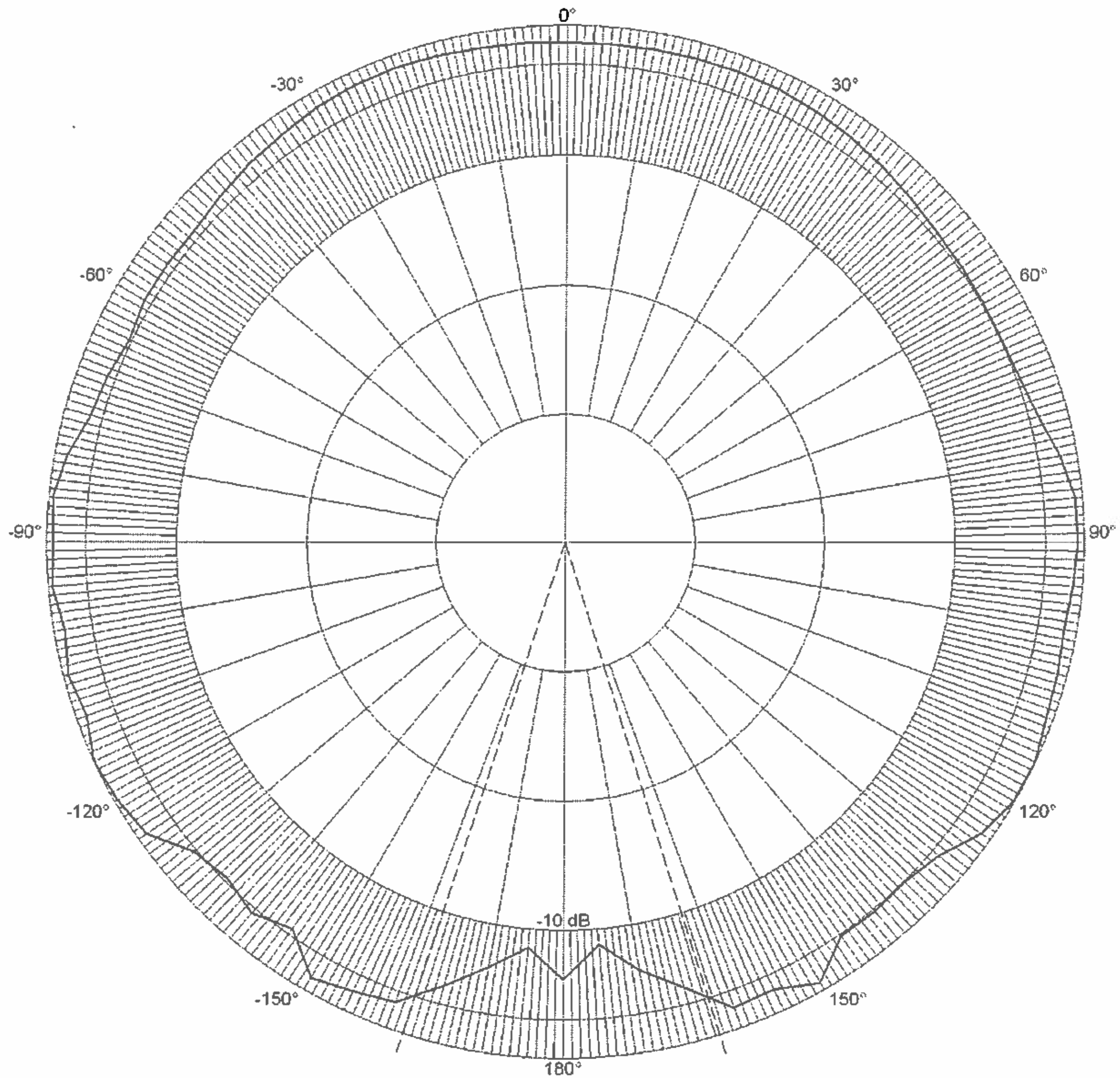
For all plots!
2010-08-17 PRA



HYDROPHONE DIRECTIVITY

RESON

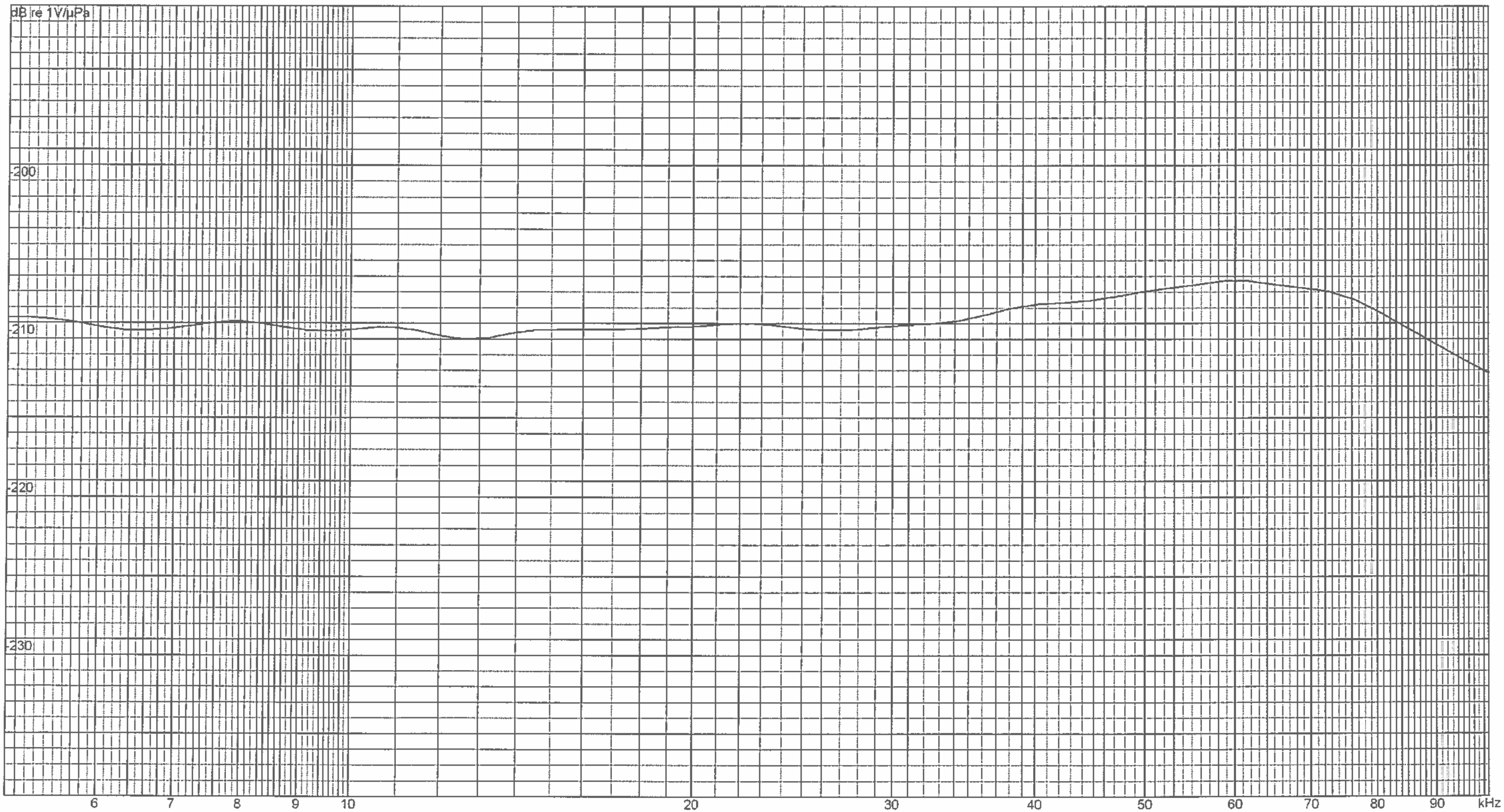
Under Test:	TC4040-6	Amplitude:	25.0 Vrms	Temperature:	23.46°C
S/N:	1510024	Pulse Width:	300.0 µs	Depth:	1.2 m
Reference:	TC4033	Angle:	-180.0° to 180.0°	Distance:	0.60 m
Date:	2010-08-17	Frequency:	50.00 kHz	Tested by:	PRA
Session, Run:	8014, 21				
Max RR:	-206.9 dB re 1µPa/V at 1m				
W:	324.4°				
Comment:	Vertical.				



HYDROPHONE SENSITIVITY

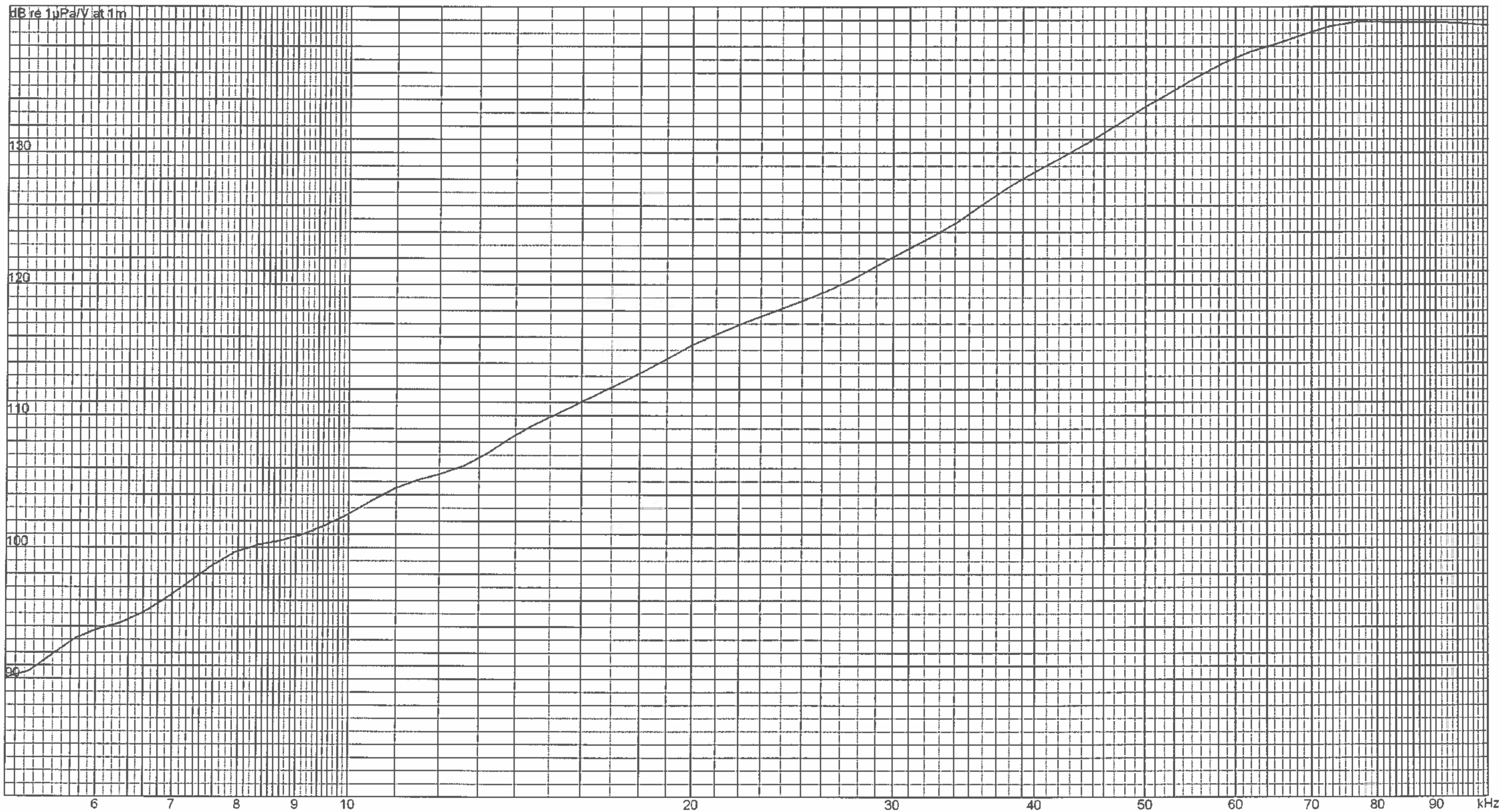
RESON

Under Test:	TC4040-6	Amplitude:	20.0 Vrms	Temperature:	°C
S/N:	1510024	Pulse Width:	600.0 µs	Depth:	0.0 m
Reference:		Rep Rate:	50.0 ms	Distance:	0.00 m
Date:	2010-08-17	Averages:	8	Tested by:	PRA
Session, Run:	8014, 8				
Comment:	PHO @ 250 Hz: -208.8 dB				



PROJECTOR SENSITIVITY

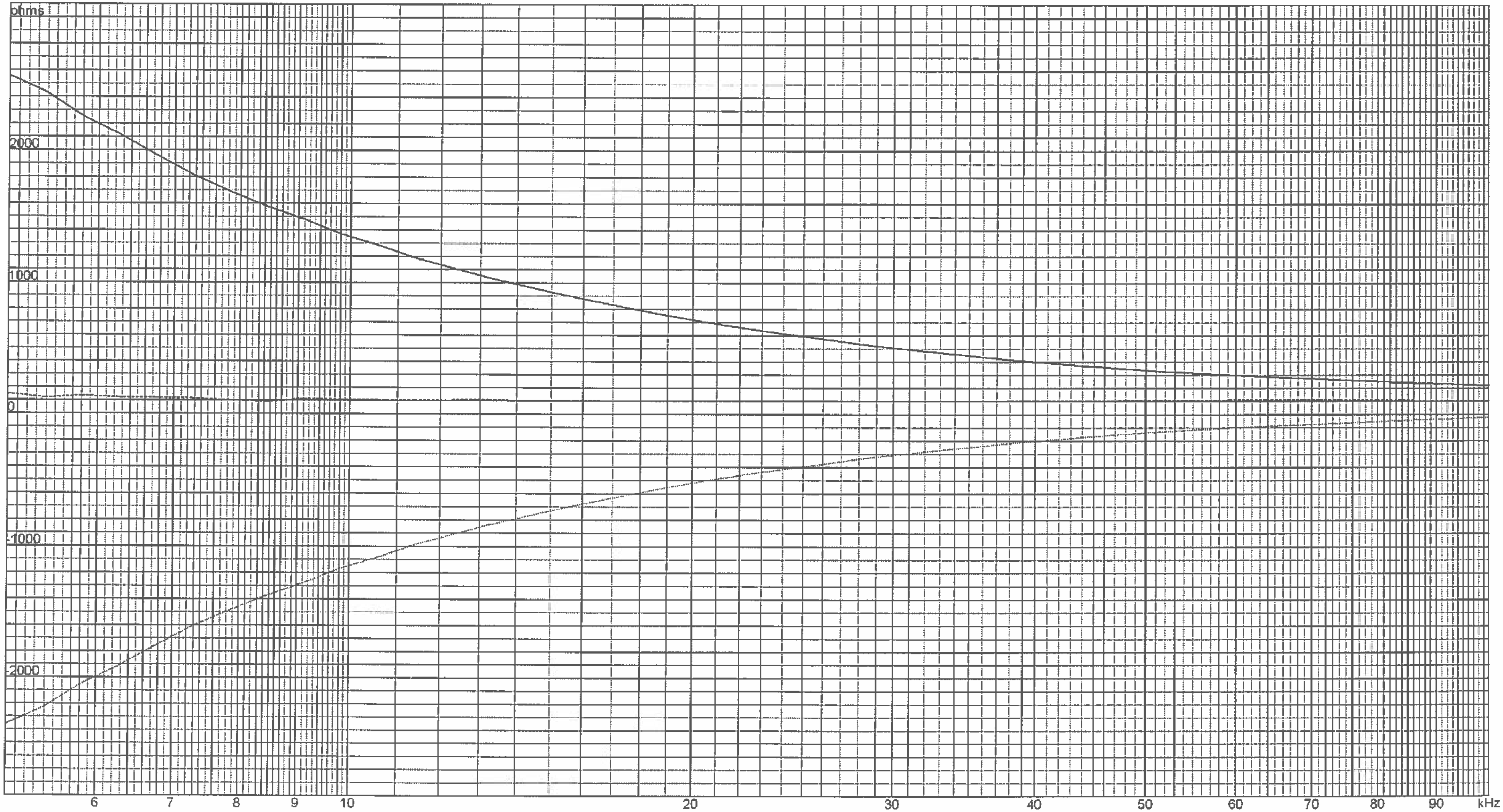
Under Test:	TC4040-6	Amplitude:	10.0 Vrms	Temperature:	°C
S/N:	1510024	Pulse Width:	820.0 µs	Depth:	0.0 m
Reference:		Rep Rate:	109.9 ms	Distance:	0.00 m
Date:	2010-08-17	Averages:	8	Tested by:	PRA
Session, Run:	8014, 10				
50.00 kHz:	132.48 dB re 1µPa/V at 1m				
Comment:					



IMPEDANCE SUMARY

RESON

Under Test:	TC4040-6	Amplitude:	10.0 Vrms	Temperature:	23.46°C
S/N:	1510024	Pulse Width:	2400.0 µs	Depth:	1.2 m
		Rep Rate:	50.0 ms	Cal Resistor:	0.0 ohms
Date:	2010-08-17	Averages:	4	Tested by:	PRA
Session, Run:	8014, 12				
Comment:					



HYDROPHONE DIRECTIVITY

RESON

Under Test:	TC4040-6	Amplitude:	10.0 Vrms	Temperature:	23.46°C
S/N:	1510023	Pulse Width:	150.0 µs	Depth:	1.2 m
Reference:	TC4033	Angle:	-180.0° to 180.0°	Distance:	0.60 m
Date:	2010-08-17	Frequency:	100.00 kHz	Tested by:	PRA
Session, Run:	8014, 1				
Max RR:	-213.1 dB re 1µPa/V at 1m				
SL Right:	-45.0°, 0.0dB dB re 1µPa/V at 1m				
Comment:	Horizontal.				

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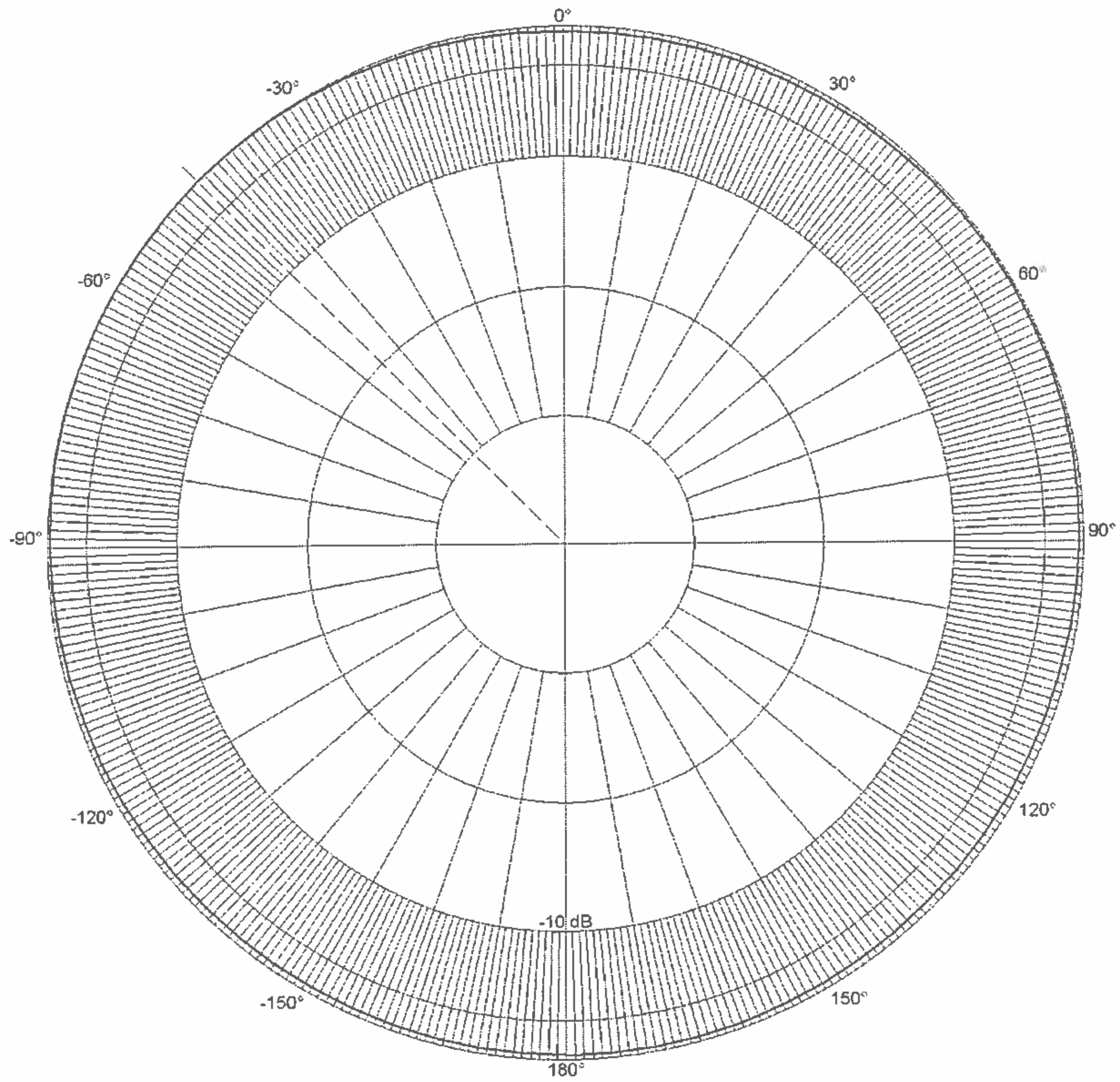
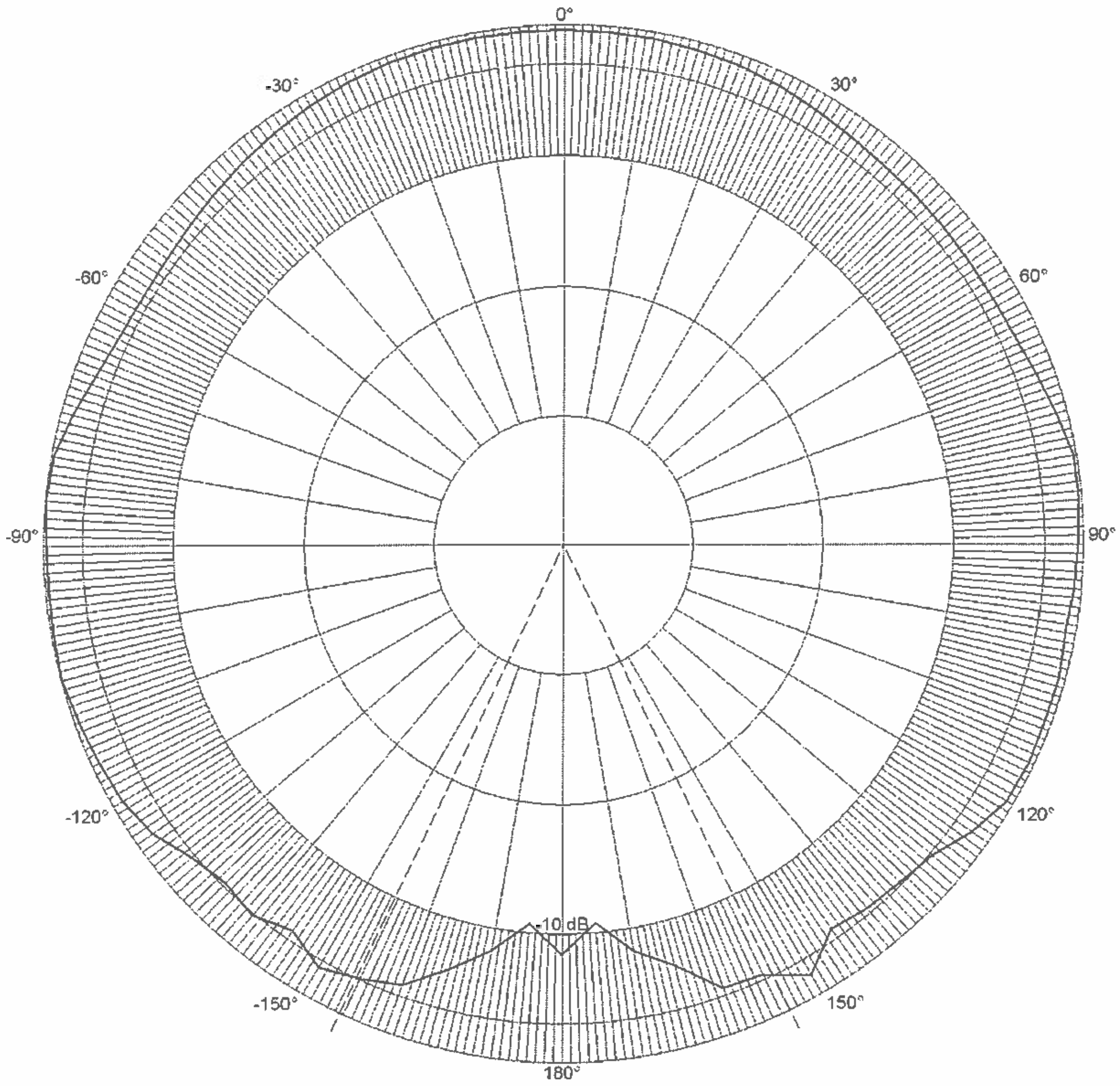
For all sheets!
2010-08-17 PRA



HYDROPHONE DIRECTIVITY

RESON

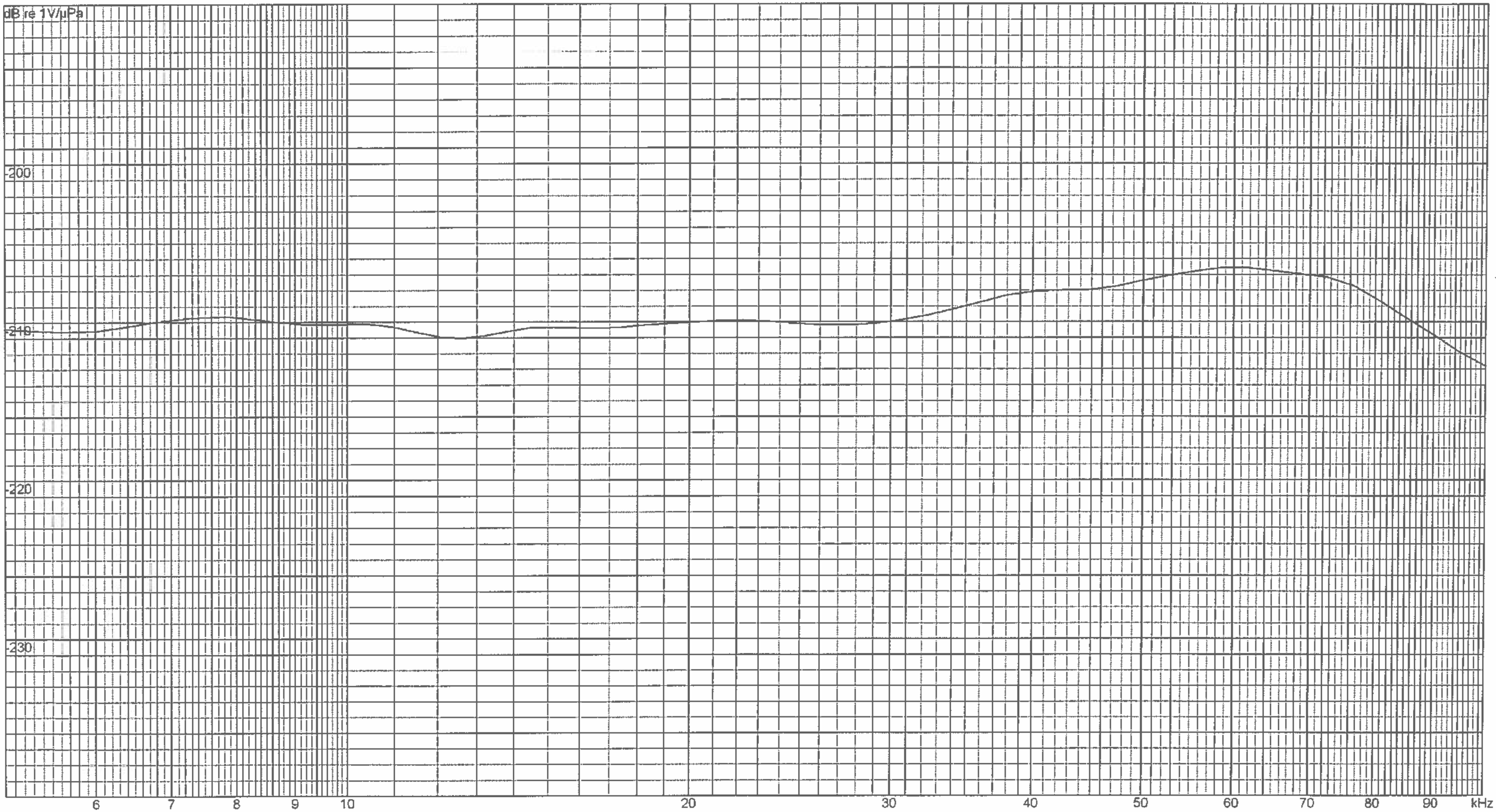
Under Test:	TC4040-6	Amplitude:	25.0 Vrms	Temperature:	23.46°C
S/N:	1510023	Pulse Width:	300.0 µs	Depth:	1.2 m
Reference:	TC4033	Angle:	-180.0° to 180.0°	Distance:	0.60 m
Date:	2010-08-17	Frequency:	50.00 kHz	Tested by:	PRA
Session, Run:	8014, 22				
Max RR:	-206.6 dB re 1µPa/V at 1m				
W:	308.4°				
Comment:	Vertical.				



HYDROPHONE SENSITIVITY

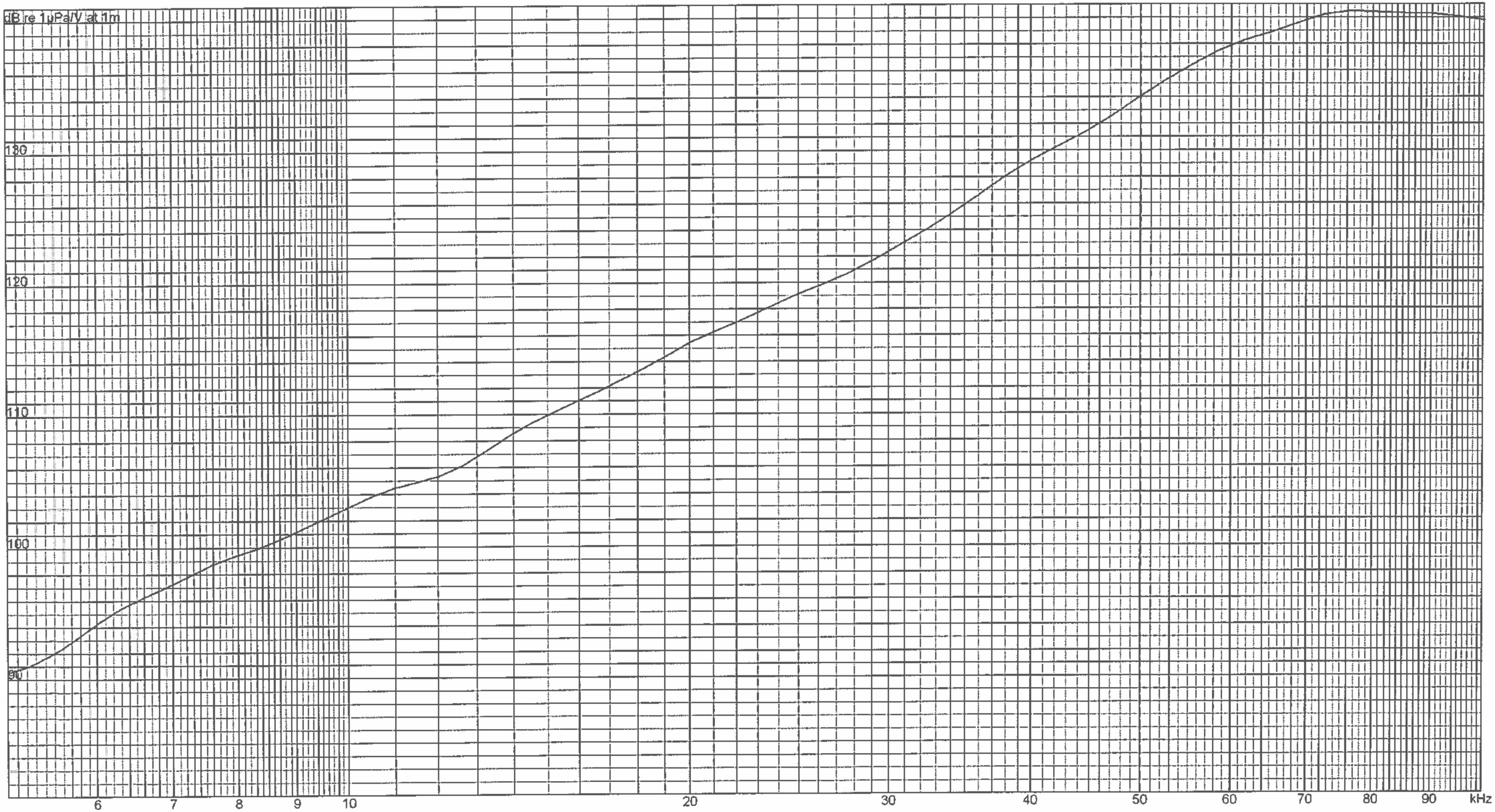
RESON

Under Test:	TC4040-6	Amplitude:	20.0 Vrms	Temperature:	°C
S/N:	1510023	Pulse Width:	600.0 µs	Depth:	0.0 m
Reference:		Rep Rate:	50.0 ms	Distance:	0.00 m
Date:	2010-08-17	Averages:	8	Tested by:	PRA
Session, Run:	8014, 2				
Comment:	PHO @ 250 Hz: -208.9 dB				



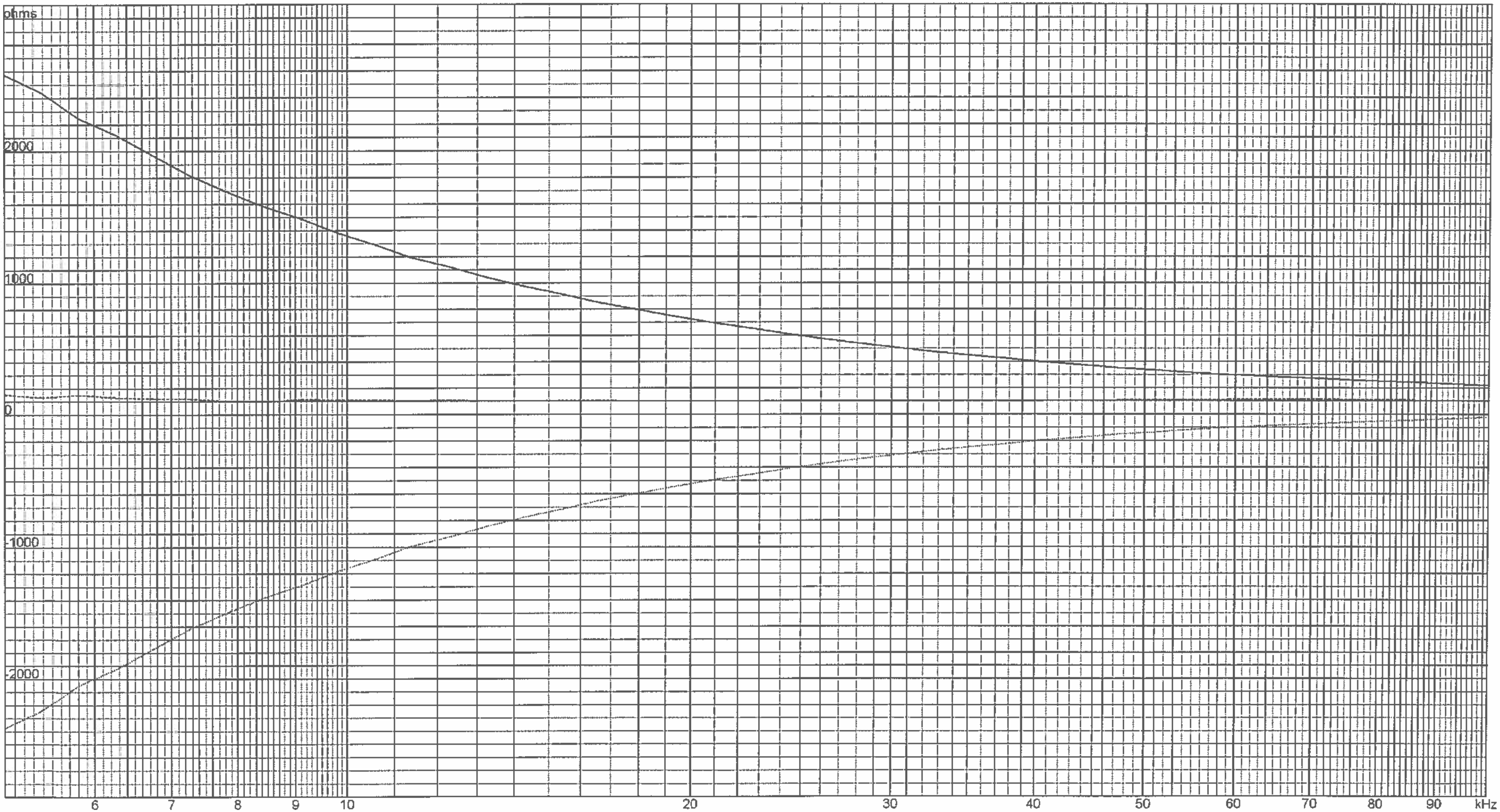
PROJECTOR SENSITIVITY

Under Test:	TC4040-6	Amplitude:	10.0 Vrms	Temperature:	°C
S/N:	1510023	Pulse Width:	820.0 µs	Depth:	0.0 m
Reference:		Rep Rate:	109.9 ms	Distance:	0.00 m
Date:	2010-08-17	Averages:	8	Tested by:	PRA
Session, Run:	8014, 4				
50.00 kHz:	133.06 dB re 1µPa/V at 1m				
Comment:					



IMPEDANCE SUMARY

Under Test:	TC4040-6	Amplitude:	10.0 Vrms	Temperature:	23.46°C
S/N:	1510023	Pulse Width:	2400.0 µs	Depth:	1.2 m
		Rep Rate:	50.0 ms	Cal Resistor:	0.0 ohms
Date:	2010-08-17	Averages:	4	Tested by:	PRA
Session, Run:	8014, 6				
Comment:					



HYDROPHONE DIRECTIVITY

RESON

Under Test:	TC4040-6	Amplitude:	10.0 Vrms	Temperature:	23.46°C
S/N:	1510025	Pulse Width:	150.0 µs	Depth:	1.2 m
Reference:	TC4033	Angle:	-180.0° to 180.0°	Distance:	0.60 m
Date:	2010-08-17	Frequency:	100.00 kHz	Tested by:	PRA
Session, Run:	8014, 13				
Max RR:	-213.5 dB re 1µPa/V at 1m				
SL Right:	80.0°, 0.0dB dB re 1µPa/V at 1m				
Comment:	Horizontal.				

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2010-08-17 PRA

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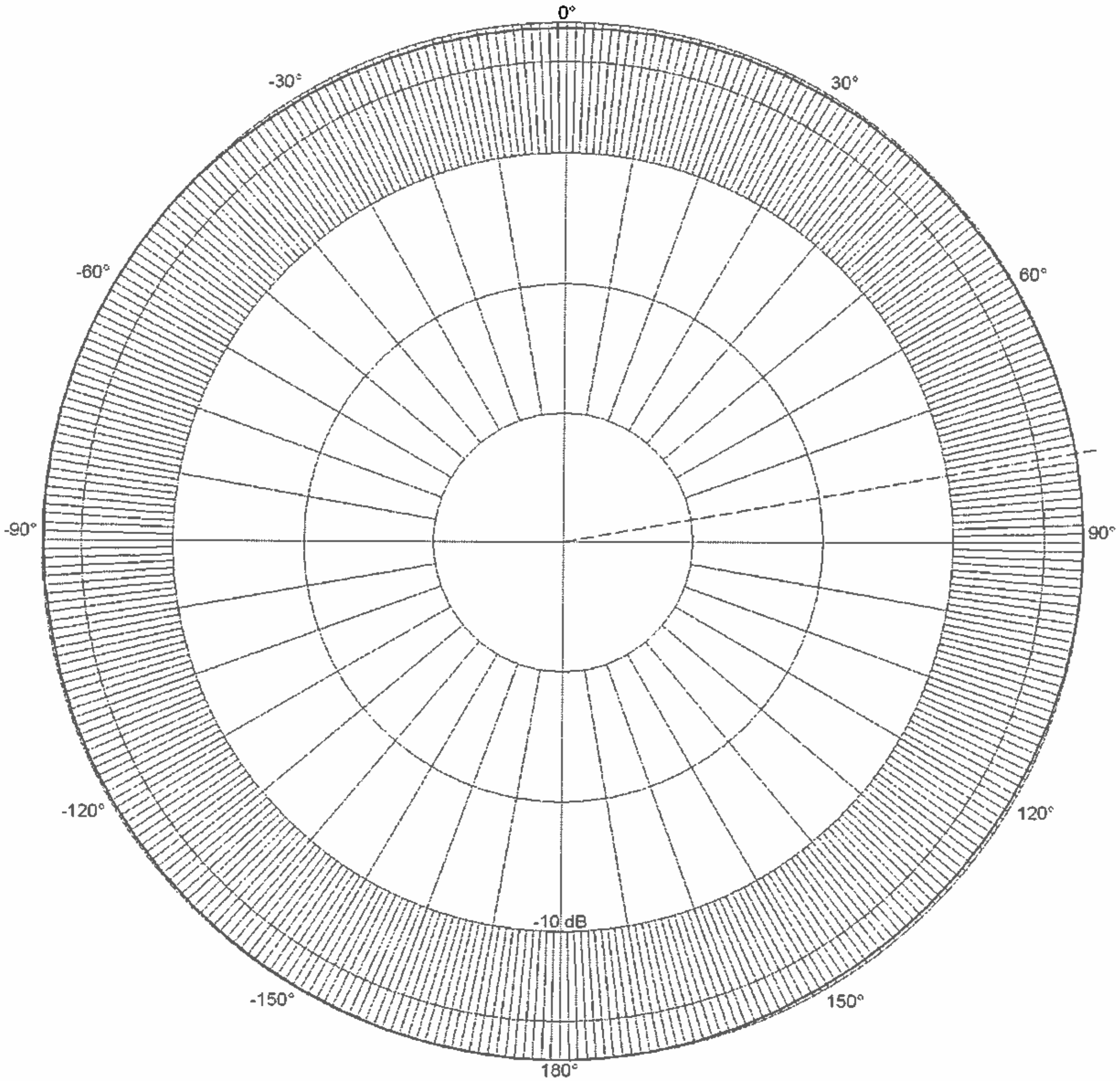
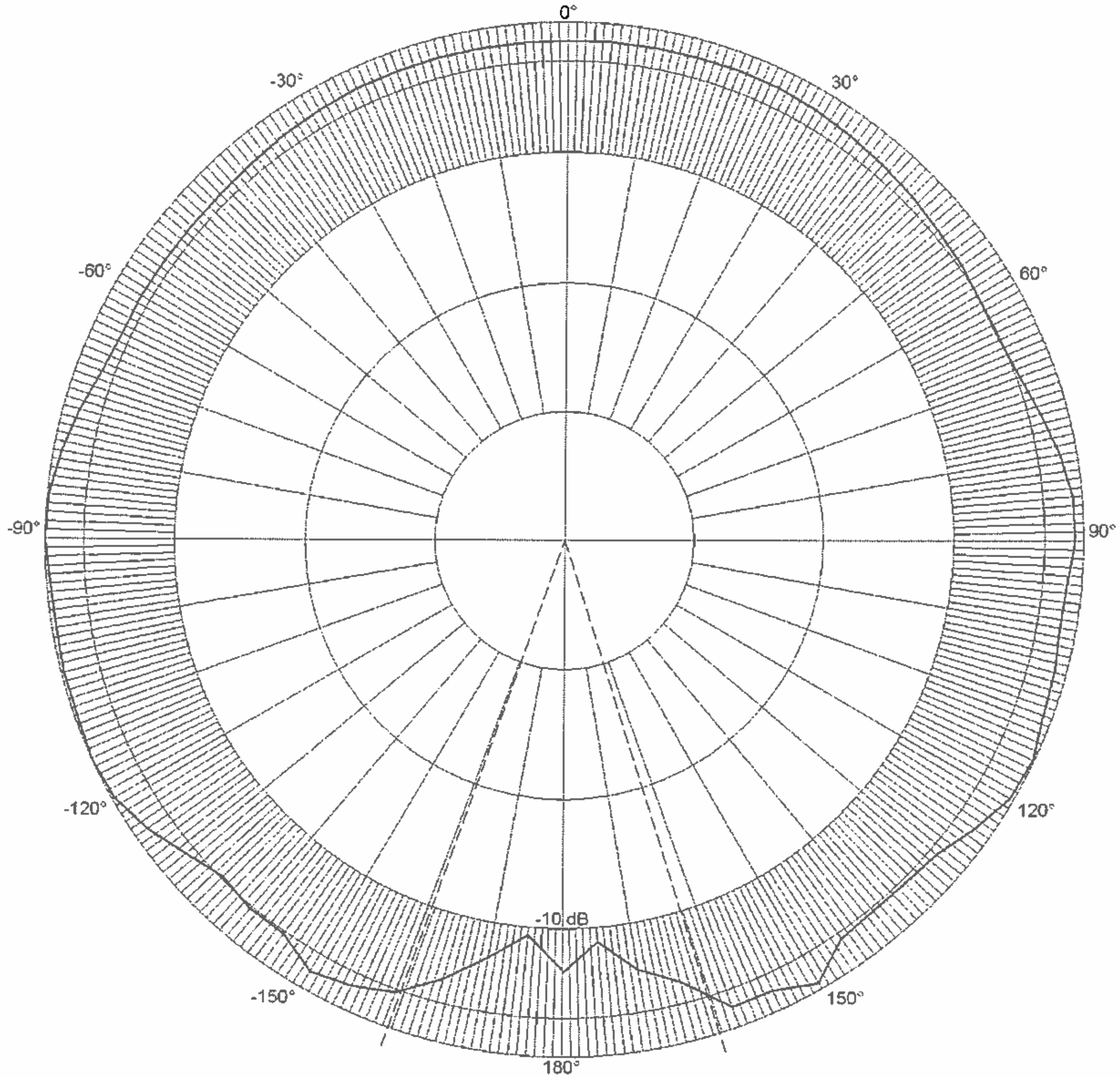


HYDROPHONE DIRECTIVITY

RESON

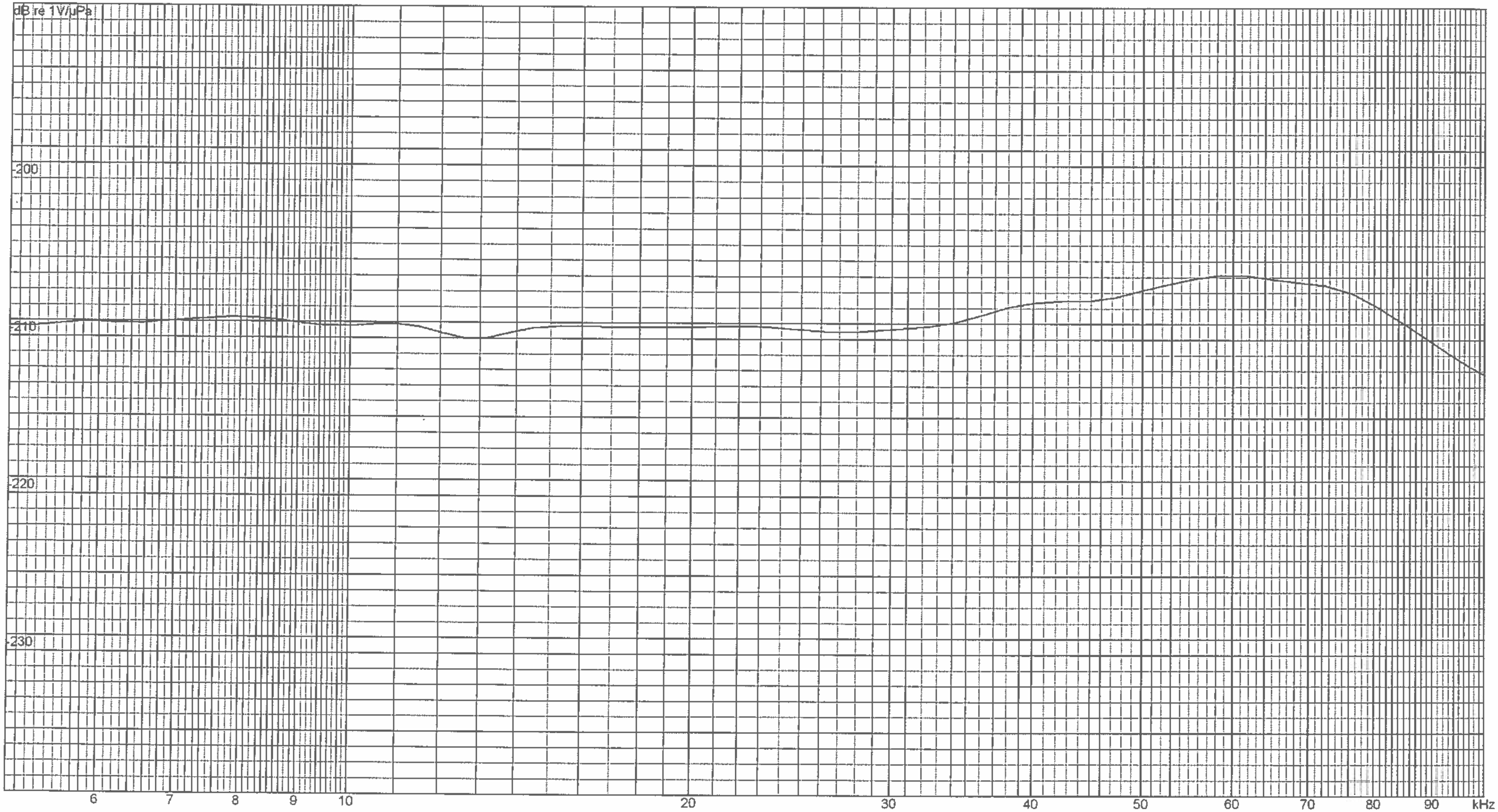
Under Test:	TC4040-6	Amplitude:	25.0 Vrms	Temperature:	23.46°C
S/N:	1510025	Pulse Width:	300.0 µs	Depth:	1.2 m
Reference:	TC4033	Angle:	-180.0° to 180.0°	Distance:	0.60 m
Date:	2010-08-17	Frequency:	50.00 kHz	Tested by:	PRA
Session, Run:	8014, 19				
Max RR:	-206.9 dB re 1µPa/V at 1m				
W:	322.9°				
Comment:	Vertical.				



HYDROPHONE SENSITIVITY

RESON

Under Test:	TC4040-6	Amplitude:	20.0 Vrms	Temperature:	°C
S/N:	1510025	Pulse Width:	600.0 µs	Depth:	0.0 m
Reference:		Rep Rate:	50.0 ms	Distance:	0.00 m
Date:	2010-08-17	Averages:	8	Tested by:	PRA
Session, Run:	8014, 14				
Comment:	PHO @ 250 Hz: -208.8 dB				



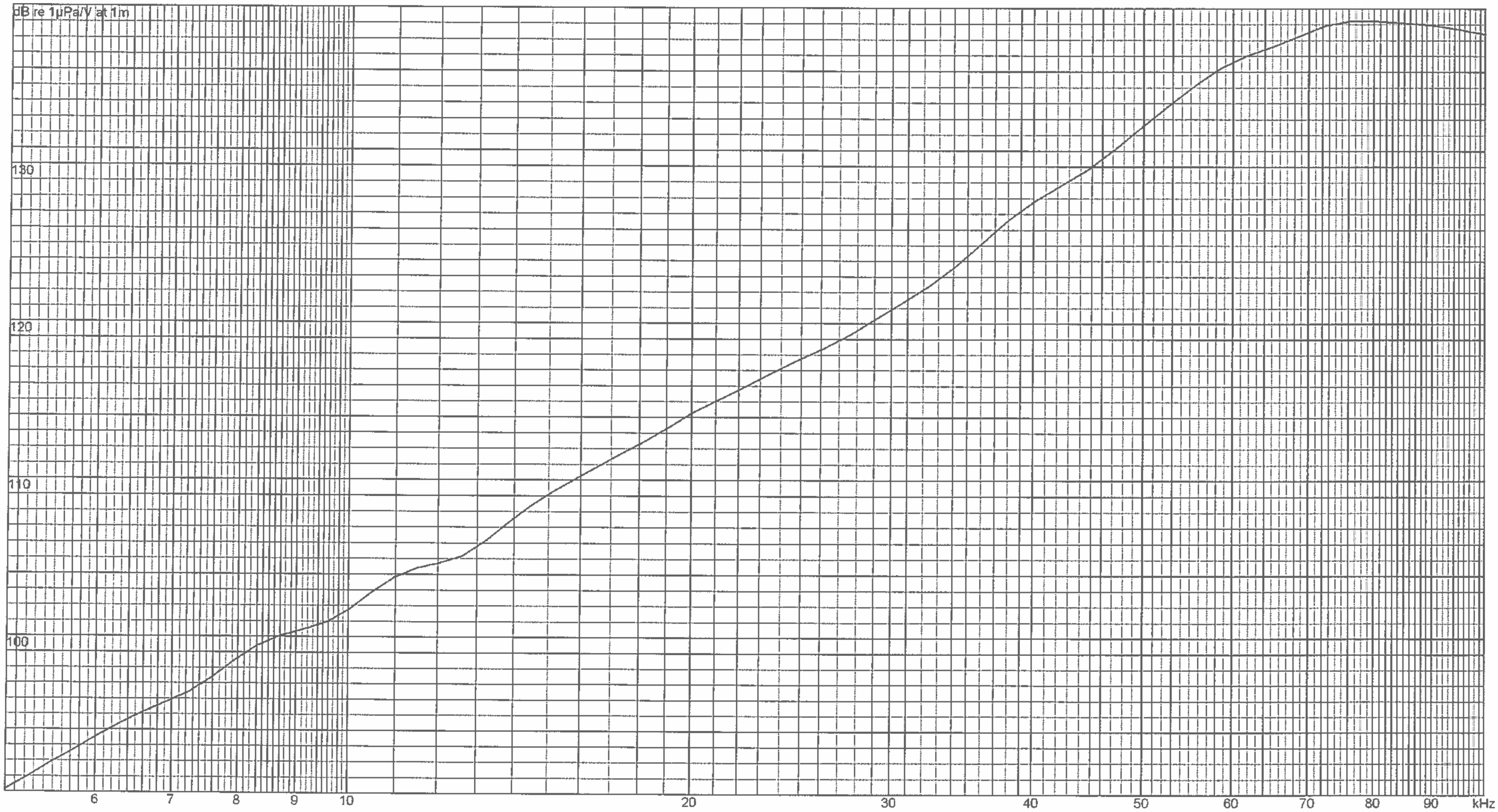
PROJECTOR SENSITIVITY

RESON

Under Test:	TC4040-6
S/N:	1510025
Reference:	
Date:	2010-08-17
Session, Run:	8014, 16
Comment:	

Amplitude:	10.0 Vrms
Pulse Width:	820.0 µs
Rep Rate:	109.9 ms
Averages:	8

Temperature:	°C
Depth:	0.0 m
Distance:	0.00 m
Tested by:	PRA



IMPEDANCE SUMARY

RESON

Under Test:	TC4040-6	Amplitude:	10.0 Vrms	Temperature:	23.46°C
S/N:	1510025	Pulse Width:	2400.0 µs	Depth:	1.2 m
		Rep Rate:	50.0 ms	Cal Resistor:	0.0 ohms
Date:	2010-08-17	Averages:	4	Tested by:	PRA
Session, Run:	8014, 18				
Comment: