NAVAL SURFACE WARFARE CENTER
Carderock Division, 9500 MacArthur Blvd.
West Bethesda, MD 20817-5700

NSWCCD-71-TR--2007/531 June 2007

Signatures Directorate
Evaluation Report

FINAL ACOUSTIC TRIAL RESULTS FOR R/V HENRY B BIGELOW (R-225) (ACTRL 04/07)

By
James R. Otis
Edward L. Bradley

NSWCCD-71-TR--2007/531 June 2007 FINAL ACOUSTIC TRIAL
RESULTS FOR HENRY B BIGLOW (R-225) ACTRL (04/07)

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ABSTRACT

The National Oceanic and Atmospheric Administration (NOAA) ship *Henry B. Bigelow* (R 225) underwater radiated noise was measured 10 and 11 April 2007 at the Atlantic Undersea Test and Evaluation Center (AUTEC) on Andros Island in The Bahamas using a Naval Surface Warfare Center radiated noise acquisition and analysis system. One-third octave band and narrow bandwidth sound pressure levels were measured at selected speeds and machinery configurations.

Radiated noise comparisons were made to the International Council for the Exploration of the Sea (ICES) recommended noise limits for vessels used in fisheries research. At 5, 10, 11, and 12 knots, the radiated one-third octave band noise level of the *Henry B. Bigelow* were lower than the ICES limit in accordance with the "NOAA Fisheries Research Vessel Statement of Requirements (SOR) Revision C," dated 13 June 2005.

ADMINISTRATIVE INFORMATION

The Signatures Characterization and Analysis Division of the Naval Surface Warfare Center, Carderock Division (NSWCCD) prepared this report for NOAA, Marine and Aviation Operations . Questions or comments should be directed to Edward Bradley (301)-227-0566, email: edward.bradley@navy.mil.

INTRODUCTION

The Naval Surface Warfare Center was tasked to measure the underwater radiated noise of *Henry B. Bigelow* (R 225). The measurements took place 10 and 11 April 2007 at the Atlantic Undersea Test and Evaluation Center (AUTEC) on Andros Island in The Bahamas using a NSWCCD radiated noise acquisition and analysis system on the support vessel USNS *Hayes* (T-AG 195). The support vessel was moored to a buoy approximately 70 miles south of the main site. Water depth at this location was over 4400 feet.

The measurements were acquired using a vertical hydrophone array suspended from neutrally buoyant subsurface floats. Hydrophones depths were 100, 200, 300, 400, 500, 600, 700, and 800 feet. Signals were cabled to the lab on *Hayes* for recording and analysis. *Henry B. Bigelow* made multiple runs past the hydrophone array at a distance of approximately 200 yards for each speed and machinery condition evaluated. Six runs, three starboard aspect and three port aspect, were averaged to make the radiated noise signature at the critical 11 knot speed. At other speeds, typically four runs were made. A 50 kHz acoustic pinger system was used to calculate the range to *Henry B. Bigelow* for normalizing the acoustic measurements to a reference distance of 1 meter. Spherical spreading was assumed and no adjustments for sea surface reflected noise or absorption were made. The signatures presented represent a power average of 16 one second samples centered at the closest point of approach (CPA) *Henry B.*

Bigelow made to the hydrophone array. Background noise levels were acquired before each 11 knot run and before each series at other speeds and compared to the ship measurements. One-third octave band and narrow bandwidth noise levels at each hydrophone that were less than 3 dB above the background were discarded. One-third octave band and narrow bandwidth noise levels between 3 and 19 dB above the background were adjusted by a power subtraction algorithm that removed the contribution of background noise. For each speed evaluated, data that fell within a 15 to 45 degree down angle from the ship was averaged. Hydrophones at depths of 200, 300, and 500 feet were used in the data average for all runs except for the test where the trawl was deployed. The CPA for that evaluation was over 300 yards and therefore hydrophones at depths of 300, 500, and 800 feet were used to meet the down angle criteria.

The weather conditions were good for most of the radiated noise survey with ambient noise measurements in the 1 kHz one-third octave band of 80 to 85 dB. Near the end of the trial, weather conditions began to deteriorate and noise levels in the 1 kHz band varied between 87 and 89 dB. Additionally, there was a period during the night when biologics controlled the region around 630 Hz and noise levels approached 100 dB in the 630 Hz band.

Ship characteristics are listed below.

Builder: VT Halter Marine, Inc., Moss Point, Mississippi
Launched: 8 July 2005
Hull Number: R 225 (Second ship in the class)
Home Port: New England
Length Overall: 63.6 m (208.6 ft)
Beam: 15.0 m (49.2 ft)
Draft: (Centerboard retracted) 5.90 m (19.4 ft)
Draft: (Centerboard extended) 9.05 m (29.7 ft)
Full Load Displacement: 2,479 metric tons
Light Ship Displacement: 1,840 metric tons
Speed Sustained: 14.0 knots
Speed, Hydro-acoustic Survey: 0 to 11 knots
Endurance: 40 days/12,000 nautical miles @ 12 knots
Machinery Plant:
- Integrated Diesel Electric, 24-Pulse DC SCR Drive System
- Two 1,150 kW (1,542 hp) Propulsion Motors on a Common Shaft
- Two 1,360 kW Diesel Generators on compound resilient mounts
- Two 910 kW Diesel Generators on compound resilient mounts

Propeller: 5 blades, fixed pitch, 4.3 m (14.1 ft) diameter
Azimuthing Bow Thruster: 720 kW (966 hp) AC Induction

Ship speed was set by propeller shaft rpm using the values shown below.

5 knots	50 srpm
10 knots	86 srpm
11 knots	91 srpm
12 knots	100 srpm
13.5 knots	116 srpm
14 knots	121 srpm

The *Henry B. Bigelow* one-third octave band signatures are presented in Appendix A Figures A-1 through A-25. Port and starboard aspect averages at each generator combination for each speed are shown. In addition, an overall port and starboard average is shown for each speed along with an overall beam aspect average that averaged all the runs at a particular speed. Figures A-1 through A-25 also show a recommended noise limit derived from that presented in the "International Council for the Exploration of the Sea (ICES)" report No. 209 of May 1995. The ICES report provided the noise limit in a 1 Hz bandwidth by the following formulas: 1 Hz to 1 kHz = 135 - 1.66*LOG(freq in Hz); 1 kHz to 100 kHz = 130 - 22*LOG(freq in kHz); the noise limit in the figures has been adjusted to a one-third octave bandwidth. As stated in the ICES report, this noise limit should prevent avoidance of vessels by cod, herring, and similar species at a range greater than approximately 20 meters. It would also allow echo-sounder fish surveys.

Figure A-1 compares the beam aspect one-third octave band signatures as ship speed increased. A light swish at propeller shaft rpm was aurally detected at speeds of 10 knots and faster. At 13.5 knots and faster speeds, noise at the frequency of propeller blade rate contributed to the low frequency peak in the 10 Hz band.

Figures A-2 and A-3 present *Henry B. Bigelow* one-third octave band noise levels at 5 knots with the different generator combinations indicated on the plots. Overall port, starboard, and beam aspect averages are shown in Figures A-4 and A-5. A region around 630 Hz was controlled by biologic noise that was not removed by background noise correction during part of this evaluation.

Figures A-6 and A-7 present *Henry B. Bigelow* one-third octave band noise levels at 10 knots with the different generator combinations indicated on the plots. Overall port, starboard, and beam aspect averages are shown in Figures A-8 and A-9. Frequency points not displayed on the plots were controlled by background noise.

Figures A-10 and A-11 present *Henry B. Bigelow* one-third octave band noise levels at 11 knots with the different generator combinations indicated on the plots. Overall port, starboard, and beam aspect averages are shown in Figures A-12 and A-13.

Figures A-14 and A-15 present *Henry B. Bigelow* one-third octave band noise levels at 12 knots with the different generator combinations indicated on the plots. Overall port, starboard, and beam aspect averages are shown in Figures A-16 and A-17. This speed was the fastest that fell below the ICES limit in accordance with the “NOAA Fisheries Research Vessel Statement of Requirements (SOR) Revision C,” dated 13 June 2005.

Figures A-18 and A-19 present *Henry B. Bigelow* one-third octave band noise levels at 13.5 knots with the different generator combinations indicated on the plots. Overall port, starboard, and beam aspect averages are shown in Figures A-20 and A-21. Noise at the frequency of propeller blade rate contributed to the low frequency peak in the 10 Hz band.

Figures A-22 and A-23 present *Henry B. Bigelow* one-third octave band noise levels at 14 knots with the different generator combinations indicated on the plots. Overall port, starboard, and beam aspect averages are shown in Figures A-24 and A-25. As was the case at 13.5 knots noise at the frequency of propeller blade rate contributed to the low frequency peak in the 10 Hz band.

Narrow bandwidth signatures (0.75 Hz bandwidth) are shown in Figures A-26 through A-49 for the speeds evaluated. Also shown on the figures is the spectrum level ICES limit. Again, port and starboard aspect averages for each generator combination at each speed are shown. In addition, the overall port and starboard aspect averages at each speed are shown along with a beam aspect average of all runs at a particular speed. Appendix B lists the overall port and starboard averaged narrow bandwidth levels above the ICES limit.

One run was acquired with the trawl deployed 100 meters aft of the ship. Figure A-50 compares the ship noise levels while pulling the trawl to the 10 knot signature without the trawl.

Five diagnostic runs were acquired to investigate the contribution of the marine sanitation device (MSD) and the seawater ejector pumps to the ship noise levels. Figures A-51 to A-55 compare these evaluations to the same aspect, same speed base line runs using a zoomed narrow bandwidth plot covering 50 to 100 Hz. The noise level at 58 Hz was the focus of this exercise. The first two figures show the results when the MSD was secured at a ship speed of 11 knots. As shown, the 58 Hz levels did not change significantly. In the next figure the seawater ejector pumps were secured at a ship speed of 5 knots. The 58 Hz level dropped 5 dB. The last two figures show the results when the seawater ejector pumps and MSD were secured at a ship speed of 5 knots. In this case, the 58 Hz level dropped 13 dB on the port aspect and 7 dB on the starboard aspect. The seawater ejector pumps were located on the port side of the ship and were probably the major source of noise at 58 Hz as securing the MSD pumps alone at 11 knots did not change this frequency level.

DATA ACQUISITION

CSI Model 2120 portable analyzers were used for main machinery, auxiliary machinery, hull frame data, and diagnostic probing measurements. The system uses Wilcoxon model 728A accelerometers. The data collector is capable of acquiring narrowband spectra with up to 3200 lines of resolution as well as one-third octave band data.

Main and auxiliary machinery data was collected from 0 to 500 Hz (1.25 Hz resolution) and from 0 to 5000 Hz (12.5 Hz resolution) using the CSI portable data acquisition and analysis system. Larger units were measured both above and below mounts at several corners. Hard mounted units were measured on their foundations. Measurements were acquired during the acoustic trial and during the transit after the trial.

SHORTED SYSTEMS

Structureborne noise personnel performed vibration measurements on the hull, main machinery items, and on auxiliary machinery items. A sound short investigation was performed by NSWCCD personnel. Identified sound shorts included: decking screws contacting intermediate masses, start air piping mounted directly to hull, fuel oil piping mounted directly to hull, ineffective mounting of start air storage tanks, electrical cabling leaving the diesel generators pulled taught, shorted mounts on the Ejector Pump skid, Marine Sanitation Unit, Port and Starboard Propulsion Transformers, and the Diesel Generator Units 1, 2, and 3.

Appendix C lists both the frequency (Hz) and the acceleration level (dB) for main and auxiliary machinery.

DIESEL GENERATOR SETS

The dominant transmission paths for Diesel Generator (GENSET) related tones are via the resilient mounts, the electrical power cable bundles, airborne noise coupling, and other flanking paths. The GENSETS are the main source of radiated noise observed during the acoustic trial.

Table 1. Vibration Levels for GENSET-Related Frequencies

Location			Levels in AdB: re 1µg				
			15 Hz	30 Hz	60 Hz	120 Hz	210 Hz
PORT 3512 GENSET #1	FPC	VAM	88	92	94	115	100
		VBM	46	46	41	45	74
		TL	42	46	53	70	36
	ASC	VAM	66	87	92	92	105
		VBM	45	51	44	46	69
		TL	21	36	48	46	36
STBD 3512 GENSET #2	FPC	VAM	66	81	83	115	101
		VBM	47	56	36	57	63
		TL	19	25	47	58	38
	ASC	VAM	63	88	95	93	103
		VBM	40	55	44	38	63
		TL	23	33	51	55	40
PORT 3508 GENSET #3	FPC	VAM	90	93	89	116	101
		VBM	53	57	46	53	67
		TL	37	36	43	63	34
	ASC	VAM	72	82	89	102	98
		VBM	49	66	47	57	65
		TL	23	16	42	45	33
STBD 3508 GENSET #4	FPC	VAM	72	87	86	119	101
		VBM	43	54	36	52	69
		TL	29	33	50	67	32
	ASC	VAM	68	81	87	111	103
		VBM	46	60	42	50	55
		TL	22	21	45	61	48

( ) = Mount attenuation
VAM = Vertical Above Mount
VBM = Vertical Below Mount
FPC = Forward Port Corner
ASC = Aft Starboard Corner
TL = Transmission Loss

Transmission loss is the amount of mechanical energy dissipated from the above mount or on the unit to the below mount or the foundation. Table 1 shows the transmission loss on opposing corners for diesel generators 1 through 4. The transmission loss varies from 19 dB to 70 dB this was good attenuation across the mounting system.

STEERING GEAR HYDRAULIC POWER UNITS

Steering gear hydraulic piston frequency levels increase greatly when rudder is applied, placing a hydraulic load on the units. It should also be noted that the measurements are not taken simultaneously, but one channel at a time. As such, there is a significant variation in loading and therefore levels will vary accordingly. The Starboard Hydraulic Pump was the only steering gear pump operated during the acoustic trial.

Table 2. Vibration Levels for Steering Gear Hydraulic Power Units

Location		Levels in AdB re: 1 µg			
		30 Hz	60 Hz	300 Hz	360 Hz
HPU Port	VAM	NA	NA	NA	NA
	VBM	NA	NA	NA	NA
HPU Stbd	VAM	72	66	80	81
	VBM	52	43	64	66
VAM = Vertical Above Mount VBM = Vertical Below Mount					

SALT WATER EJECTOR PUMPS

A high 58 Hz rotational tone was observed on Salt Water Ejector Pumps 1 and 2. The below mount 58 Hz levels are higher than expected. The pumps are resting on a skid that has shorted resilient mounts. Table 3 shows the vertical above and vertical below mount data observed on the ejector pump skid. Previous data from the June 2006 BIGELOW acoustic trial shows similar high below mount levels.

Table 3. Vibration Levels for Ejector Pumps 1 and 2

Location		Levels in AdB re: 1 µg		
		58 Hz	201 Hz	298 Hz
Ejector Pump #1	VAM	95	86	95
	VBM	67	78	84
Ejector Pump #2	VAM	91	76	80
	VBM	65	73	60
VAM = Vertical Above Mount VBM = Vertical Below Mount				

MARINE SANITATION UNIT

The Marine Sanitation Unit has two vacuum pumps that run intermittently. The structureborne vibration data collected on this unit shows 29 Hz rotational harmonics. These harmonics are typical of rotating machinery. The 89 Hz vertical above and vertical below mount levels are higher than expected. This unit has shorted resilient mounts and possible structural support issues.

Table 4. Vibration Levels for the Marine Sanitation Unit

Location		Levels in AdB re: 1 µg		
		29 Hz	59 Hz	89 Hz
Marine Sanitation Unit	VAM	99	88	111
	VBM	57	51	69
VAM = Vertical Above Mount VBM = Vertical Below Mount				

CONCLUSIONS

RADIATED NOISE

At 5, 10, 11, and 12 knots, the radiated one-third octave band noise level of the *Henry B. Bigelow* were lower than the ICES limit in accordance with the "NOAA Fisheries Research Vessel Statement of Requirements (SOR) Revision C," dated 13 June 2005.

The seawater ejector pumps are the likely source of noise at 58 Hz.

Ship one-third octave band noise levels at 3.5 knots with the trawl deployed were generally less than the 10 knot noise levels without the trawl deployed.

STRUCTUREBORNE NOISE

Periodically inspect beneath the engine room decking to ensure that decking screws are not shorted against the intermediate mass. If they are shorted, use appropriate sized screws in order to prevent this short.

The start air system is connected directly to all four diesel generators. This system will transmit acoustic energy to hull if the system is not resiliently mounted. Ensure that all piping and storage tanks are resiliently mounted. Start air piping is currently welded to the hull in one spot and resiliently mounted in another spot. This is inconsistent and ineffective. The start air storage tanks are not properly mounted.

The fuel oil system transmits acoustic energy to water in two different ways. One transmission path is through the steel piping that is connected to each of the four diesel generators, and the other transmission path is through pressure pulsations within the fuel. Unless a pulsation dampener is used, these pulsations will travel throughout the fuel oil piping system. Since a pulsation dampener is not in use, it is crucial that the entire system be resilient mounted. This will separate the fuel oil system from the hull and reduce the impact of the pressure pulsations.

Currently, the electrical cabling connected to the diesel generators is pulled taught and routed to a resilient mount. While this cabling is resiliently mounted, it is an ineffective method of resilient mounting. The most effective means of attenuating acoustic energy in cabling is to allow the cabling to make a loop before being routed throughout the vessel. The current method of cable routing is not an effective form of resilient mounting.

The resilient mounts on many systems are shorted. These resilient should be replaced with either higher capacity mounts or higher quality mounts. Failing resilient mounts will degrade the acoustic signature of the *Henry B. Bigelow*. Mounts are failing on: Chilled Storeroom Reefer Unit #2, Ejector Pump Skid, Marine Sanitation Unit, Diesel Generator 1, 2, and 3, Port and Starboard Propulsion Transformers.

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APPENDIA A:

RADIATED NOISE FIGURES (U)

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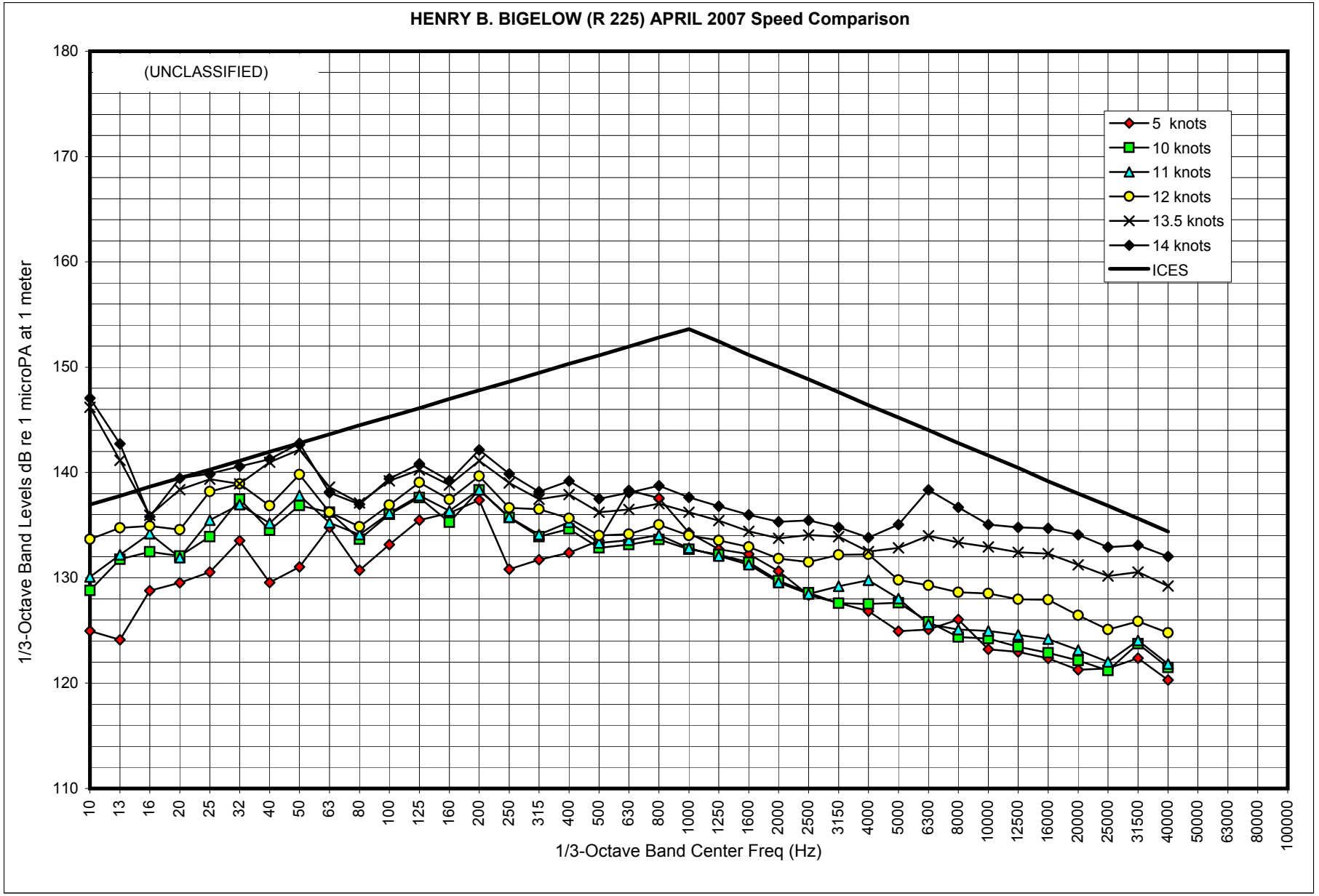

Figure A-1 One-third octave band signatures at 5, 10, 11, 12, 13.5, 14 knots and ICES limit.

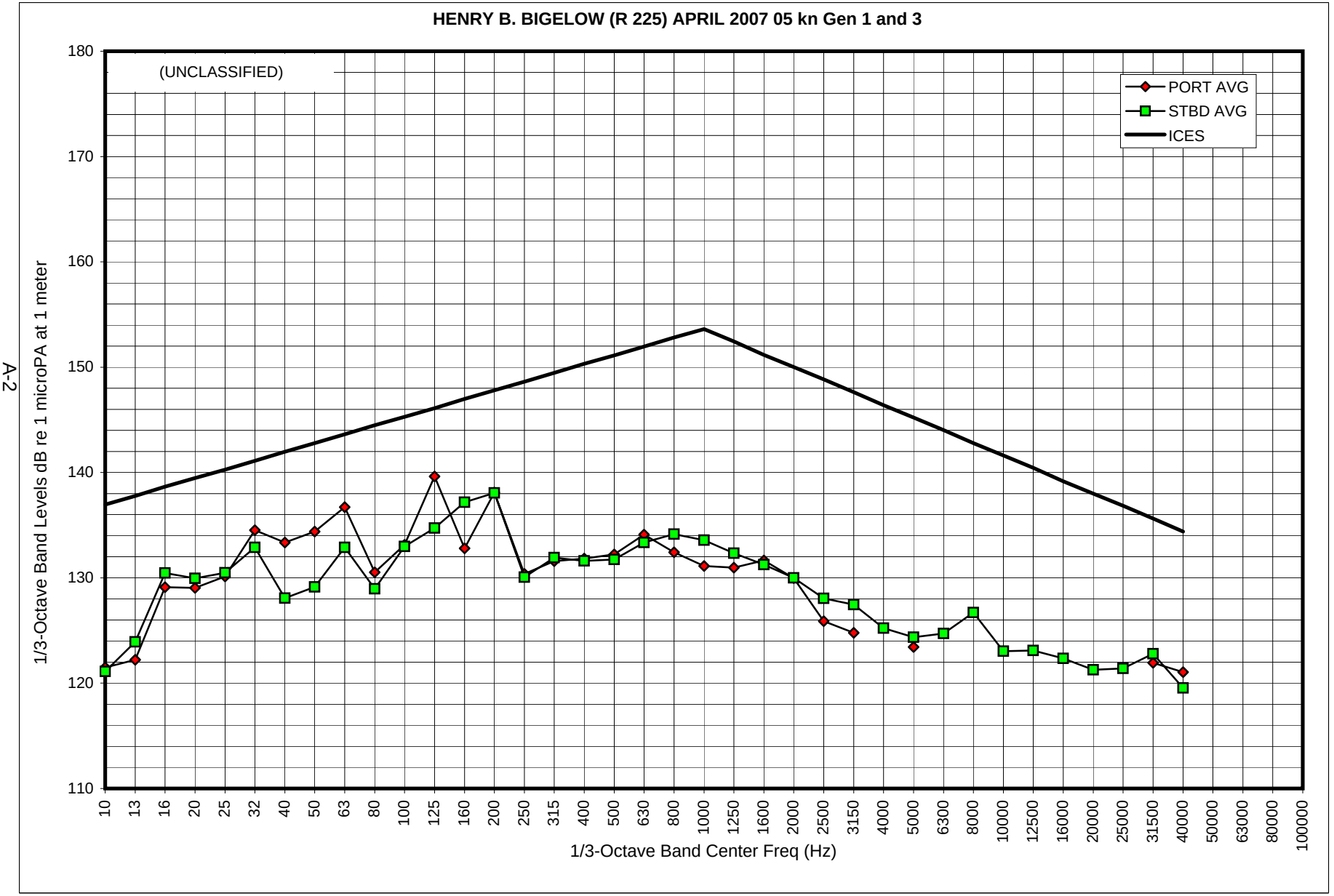

Figure A-2. One-third octave band port and starboard signatures at 5 knots with generators 1 and 3.

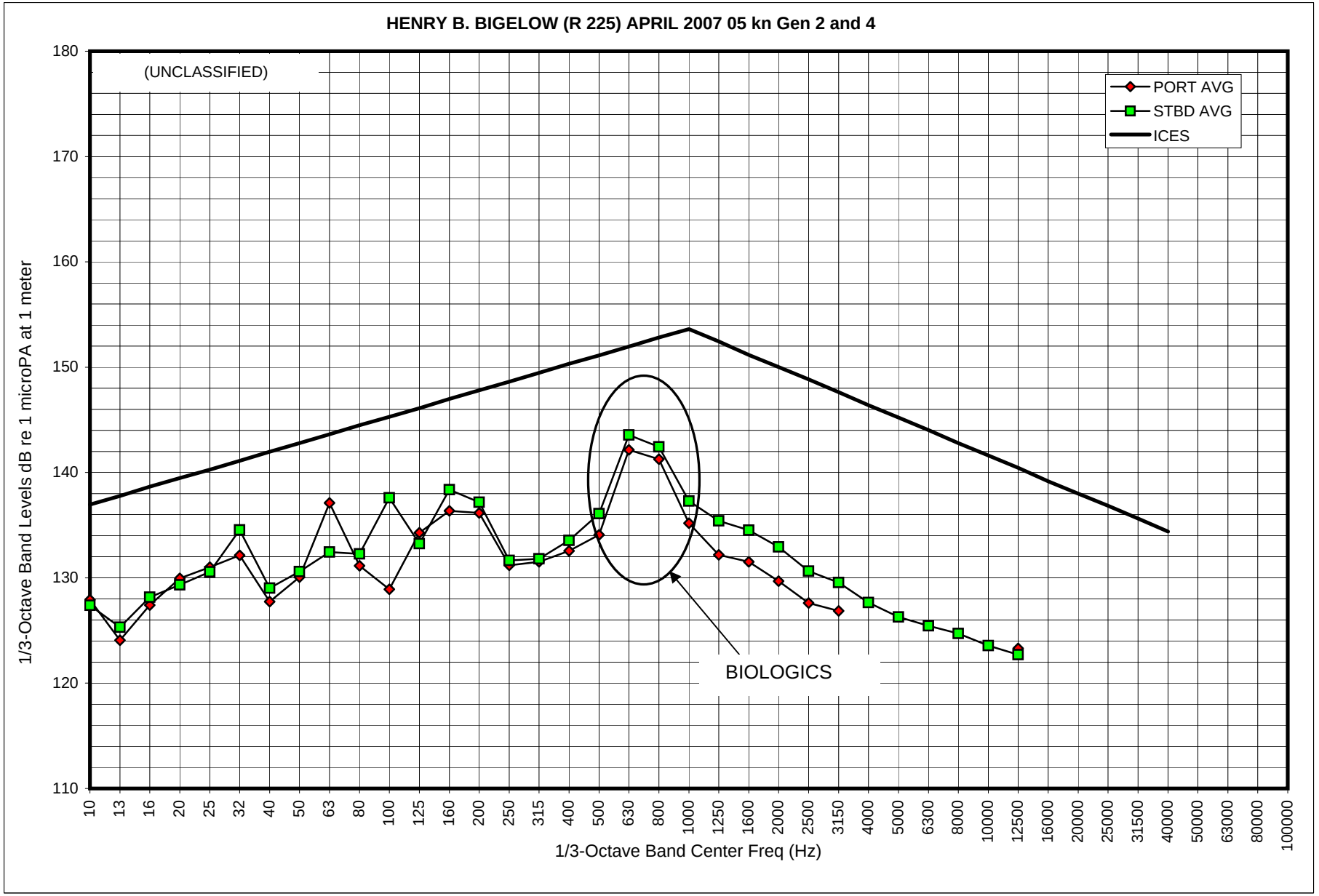

Figure A-3. One-third octave band port and starboard signatures at 5 knots with generators 2 and 4.

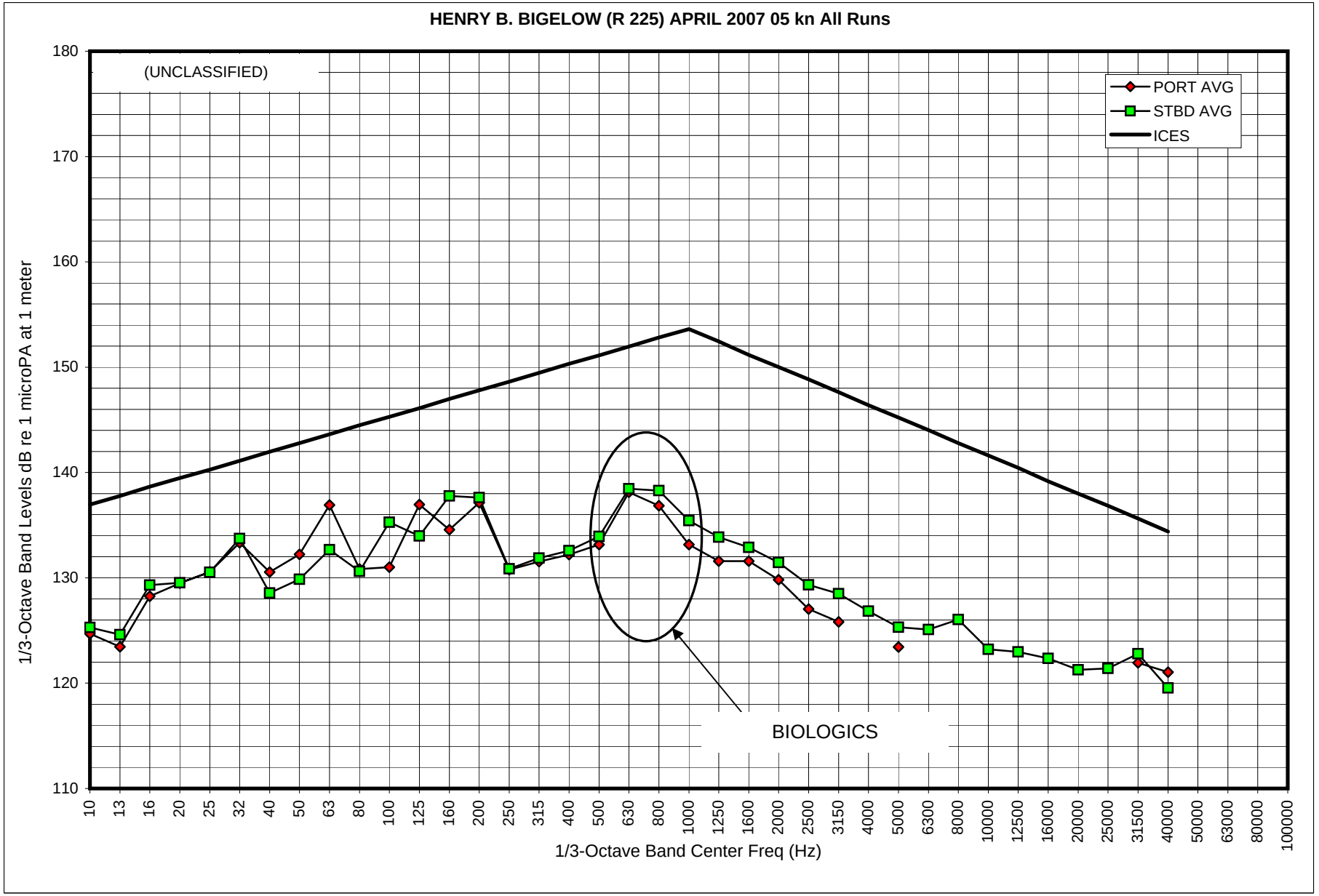

Figure A-4. One-third octave band port and starboard signatures at 5 knots, all runs averaged.

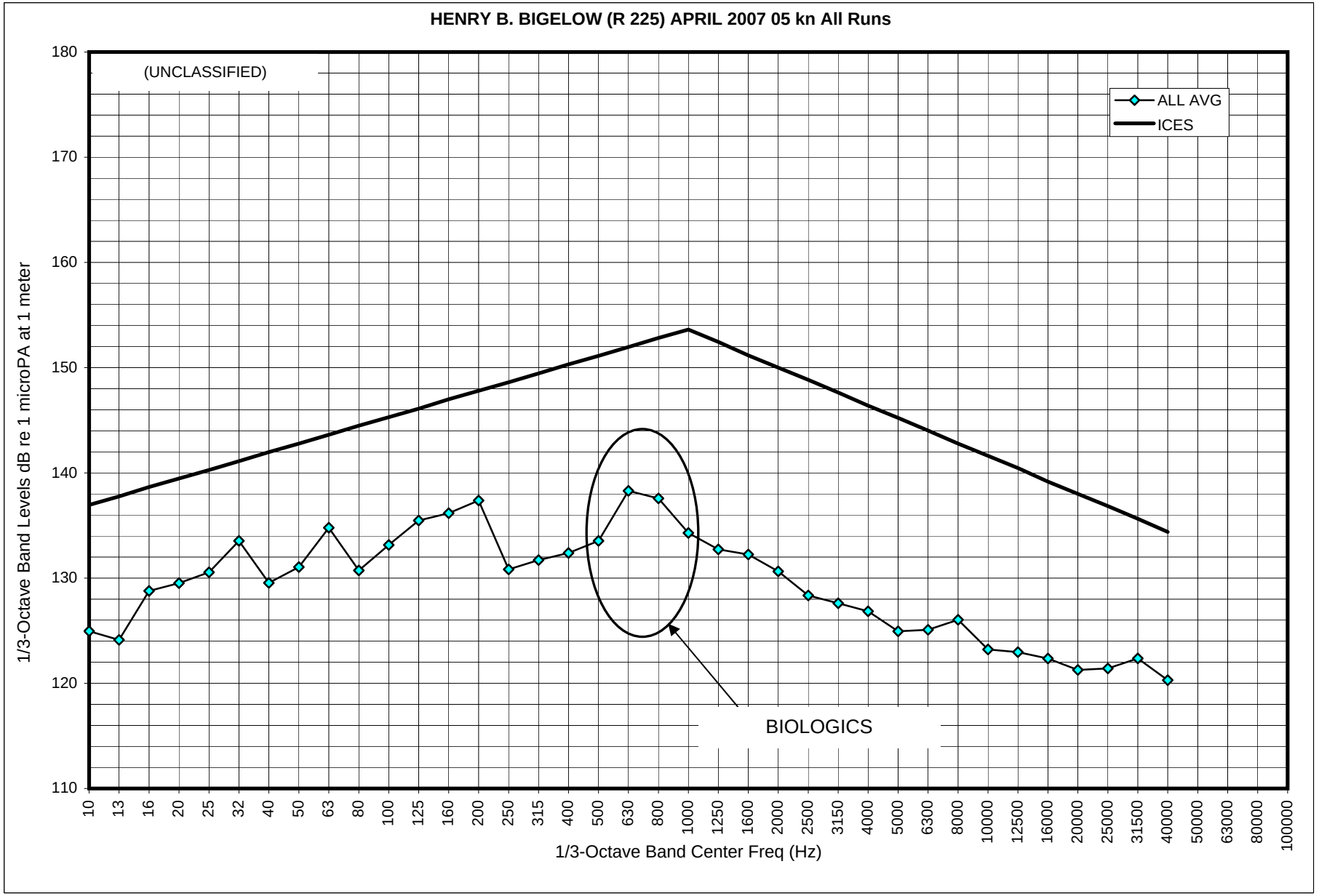

Figure A-5. One-third octave band beam aspect signature at 5 knots, all runs averaged.

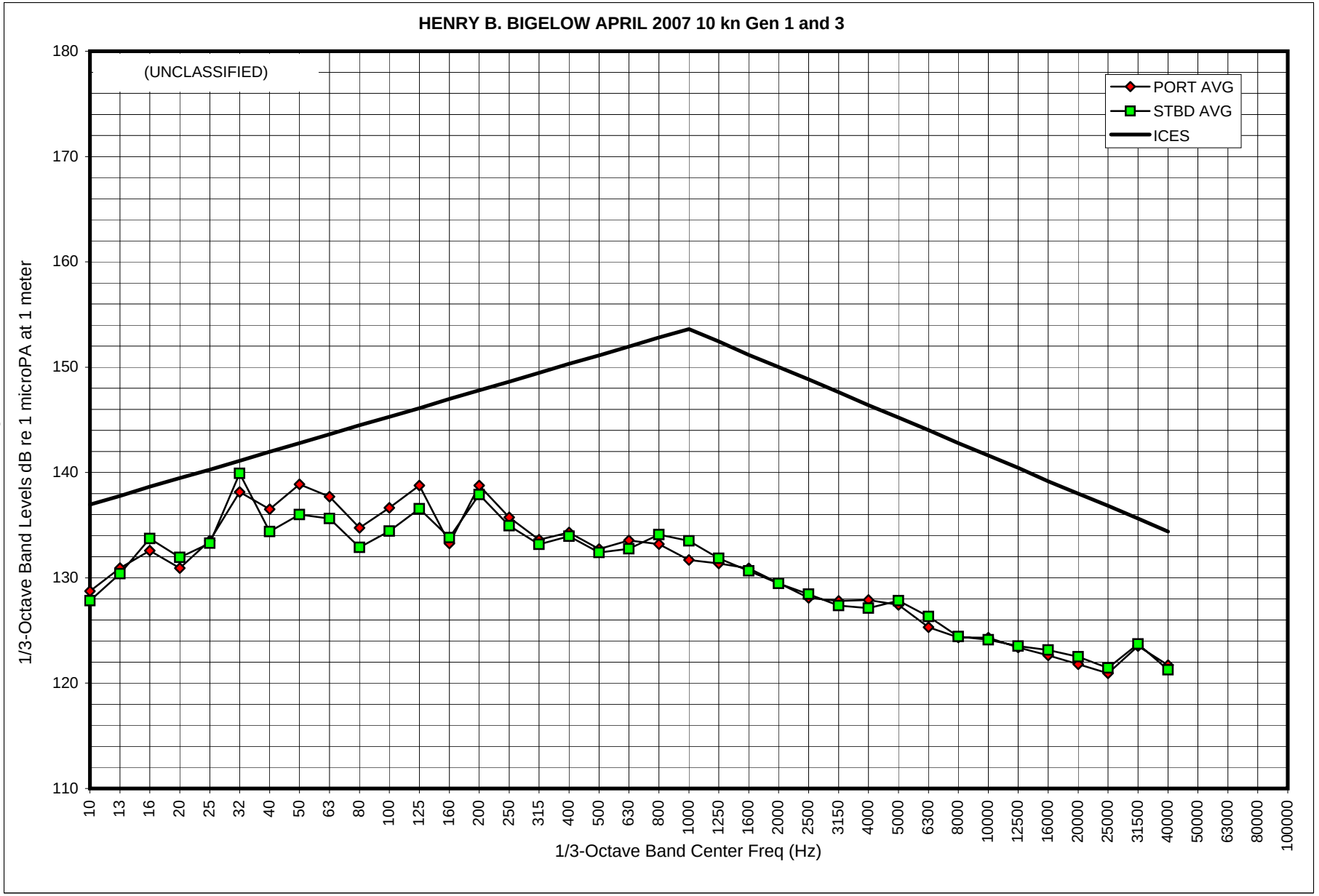

Figure A-6. One-third octave band port and starboard signatures at 10 knots with generators 1 and 3.

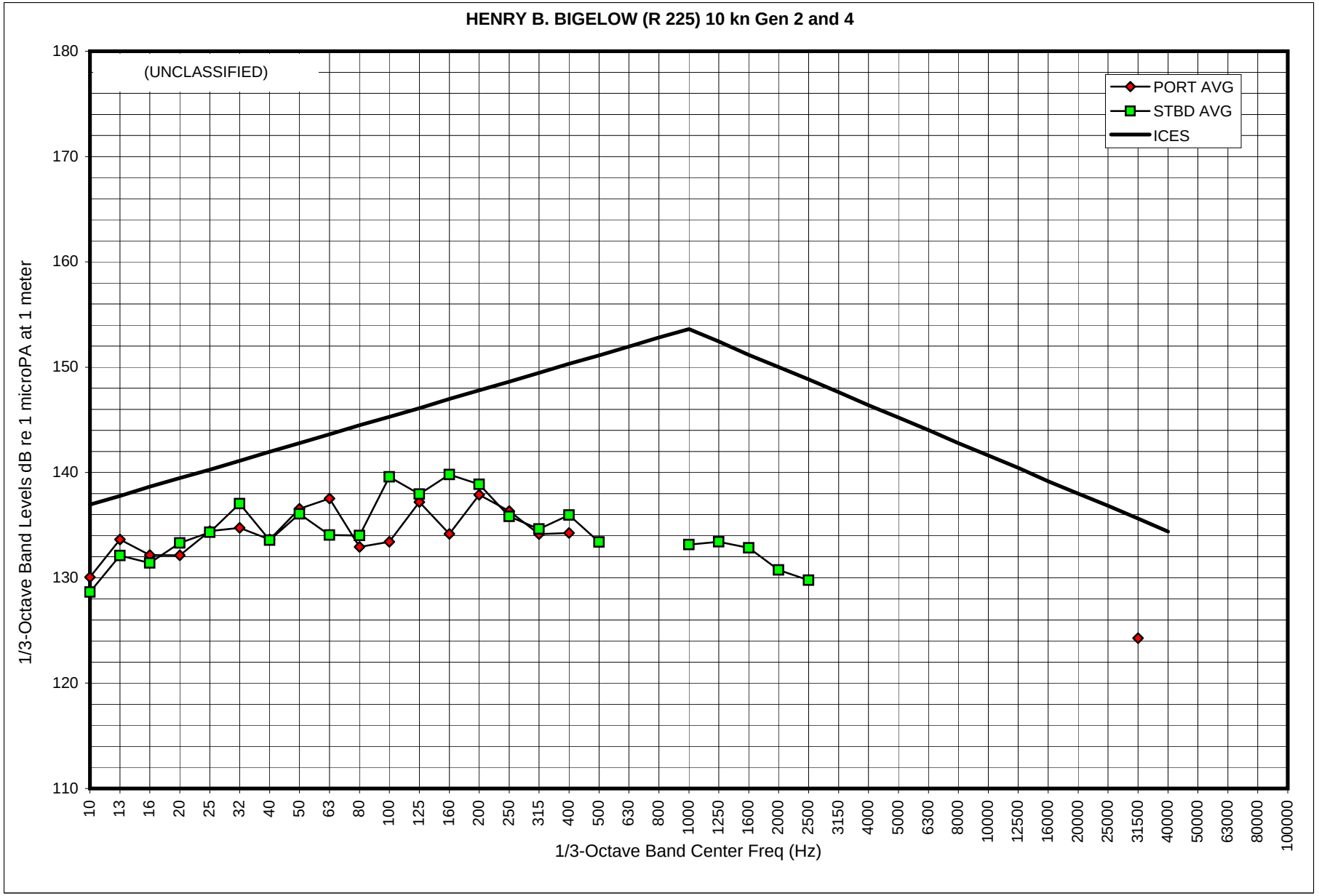

Figure A-7. One-third octave band port and starboard signatures at 10 knots with generators 2 and 4.

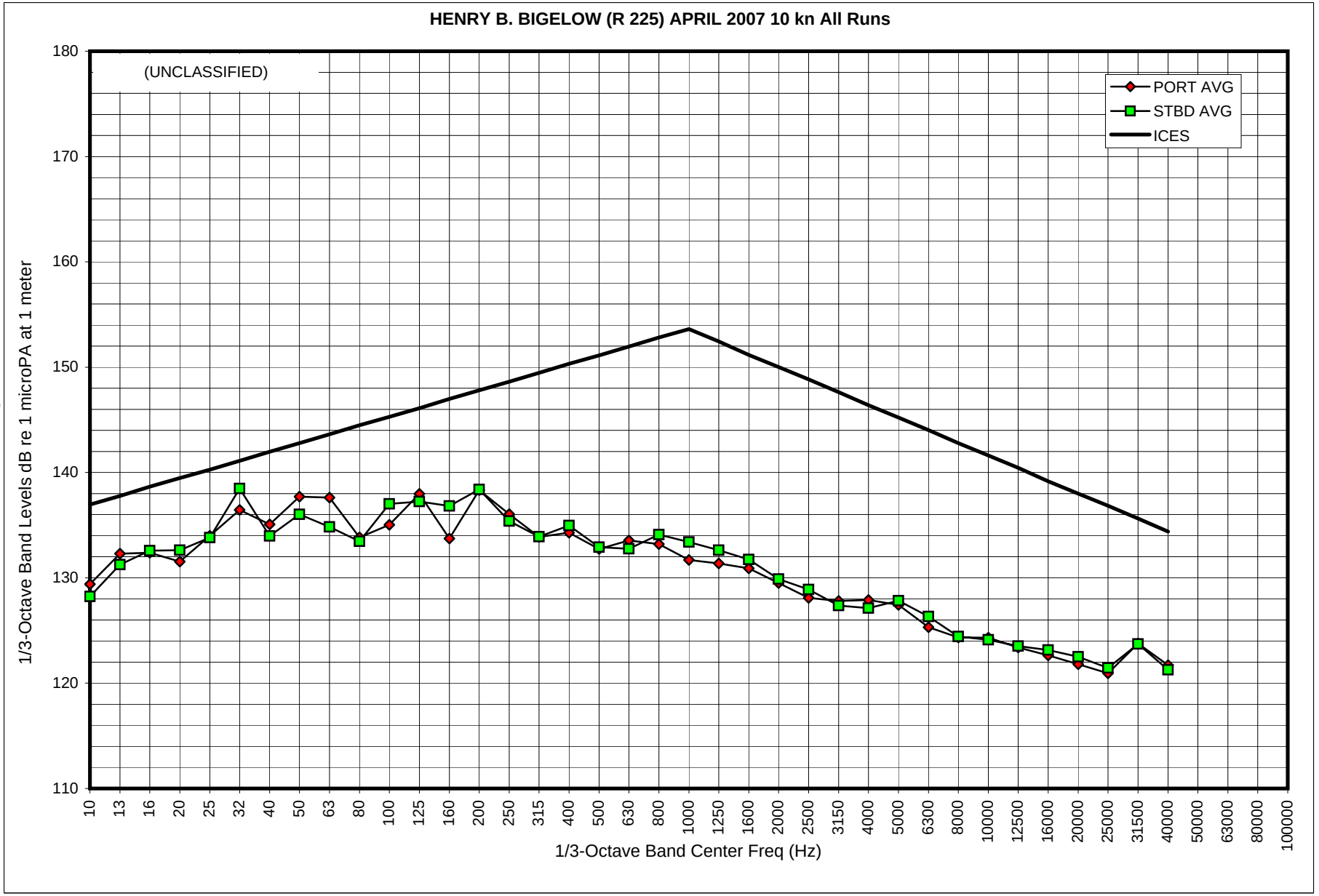

Figure A-8. One-third octave band port and starboard signatures at 10 knots, all runs averaged.

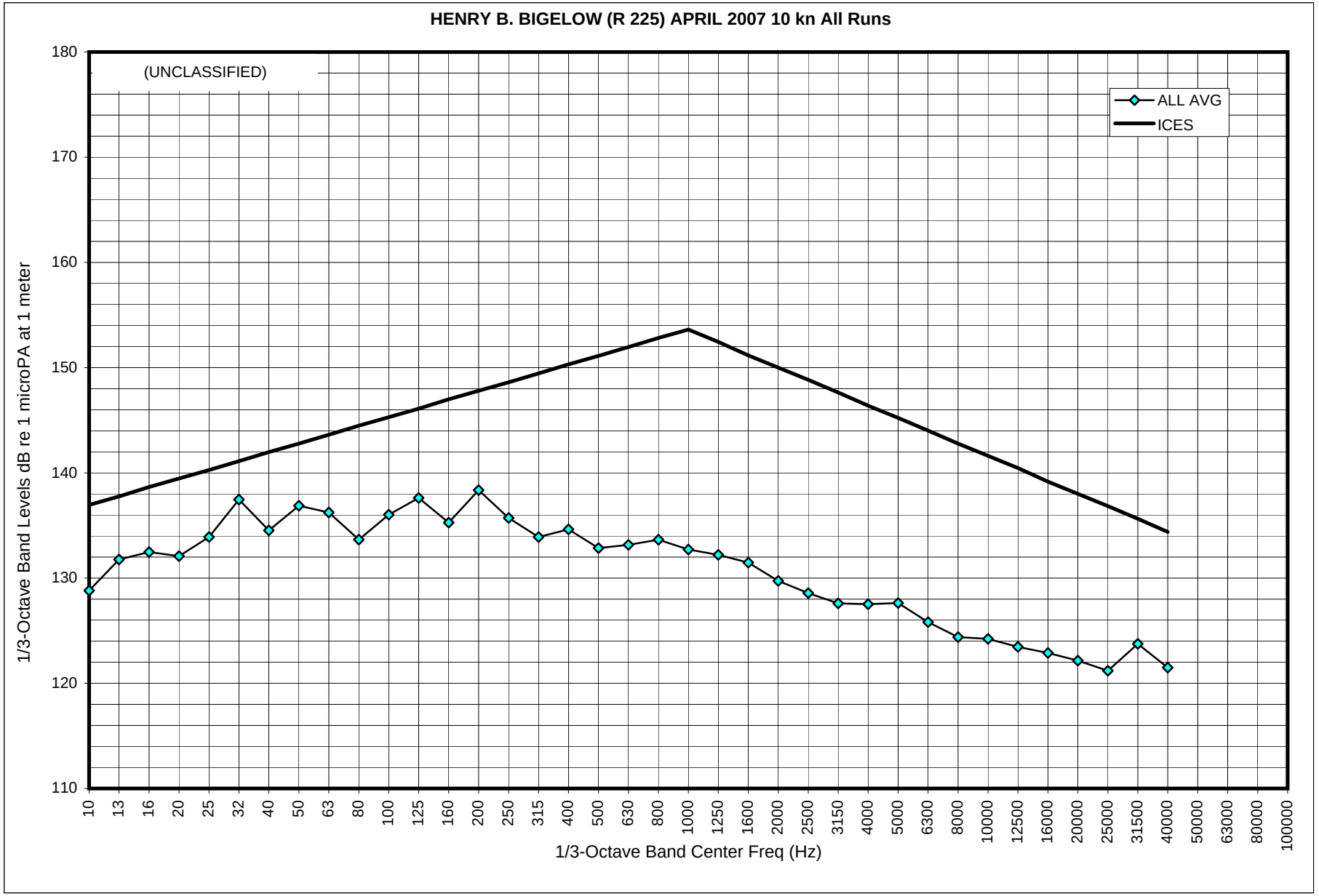

Figure A-9. One-third octave band beam aspect signature at 10 knots, all runs averaged.

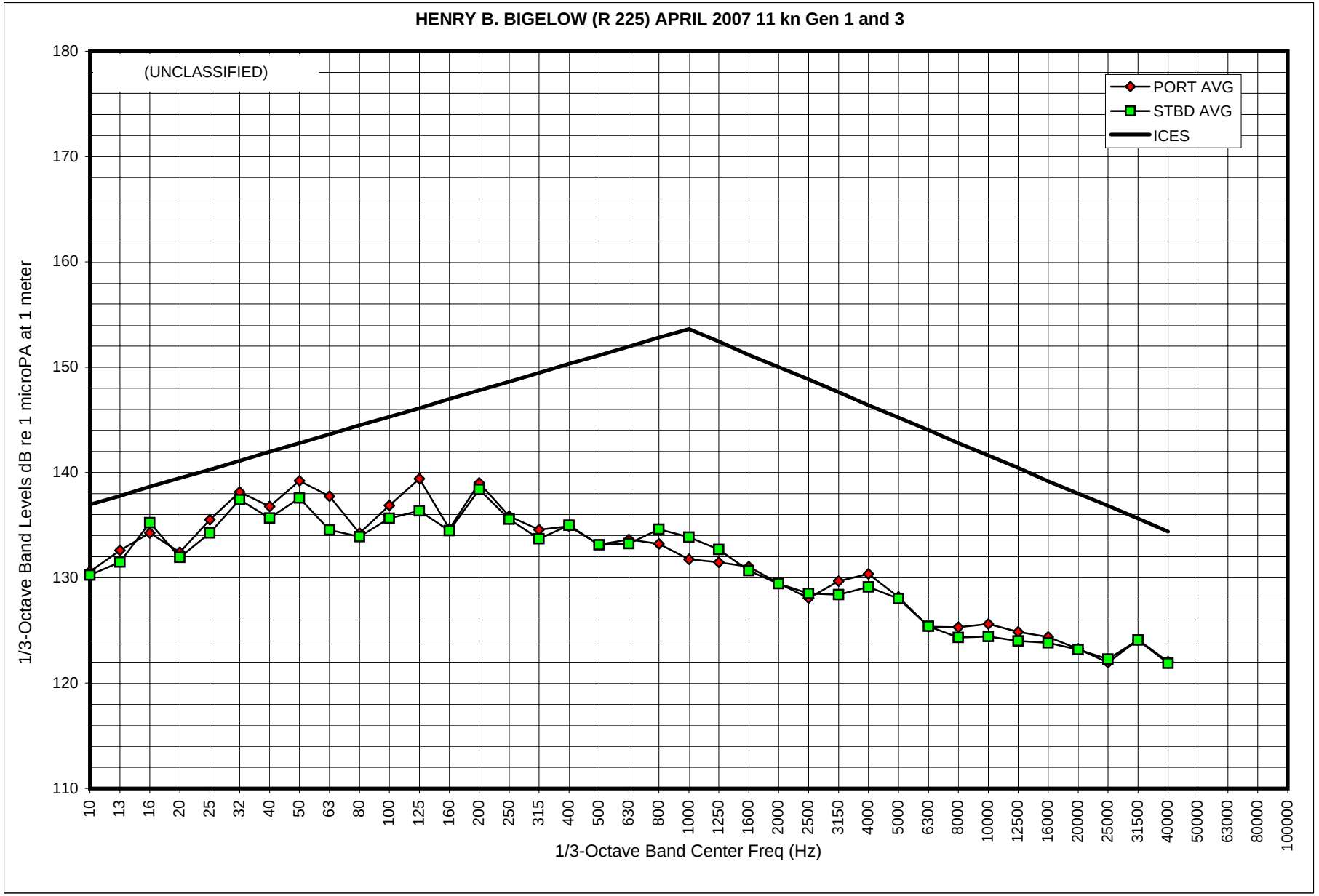

Figure A-10. One-third octave band port and starboard signatures at 11 knots with generators 1 and 3.

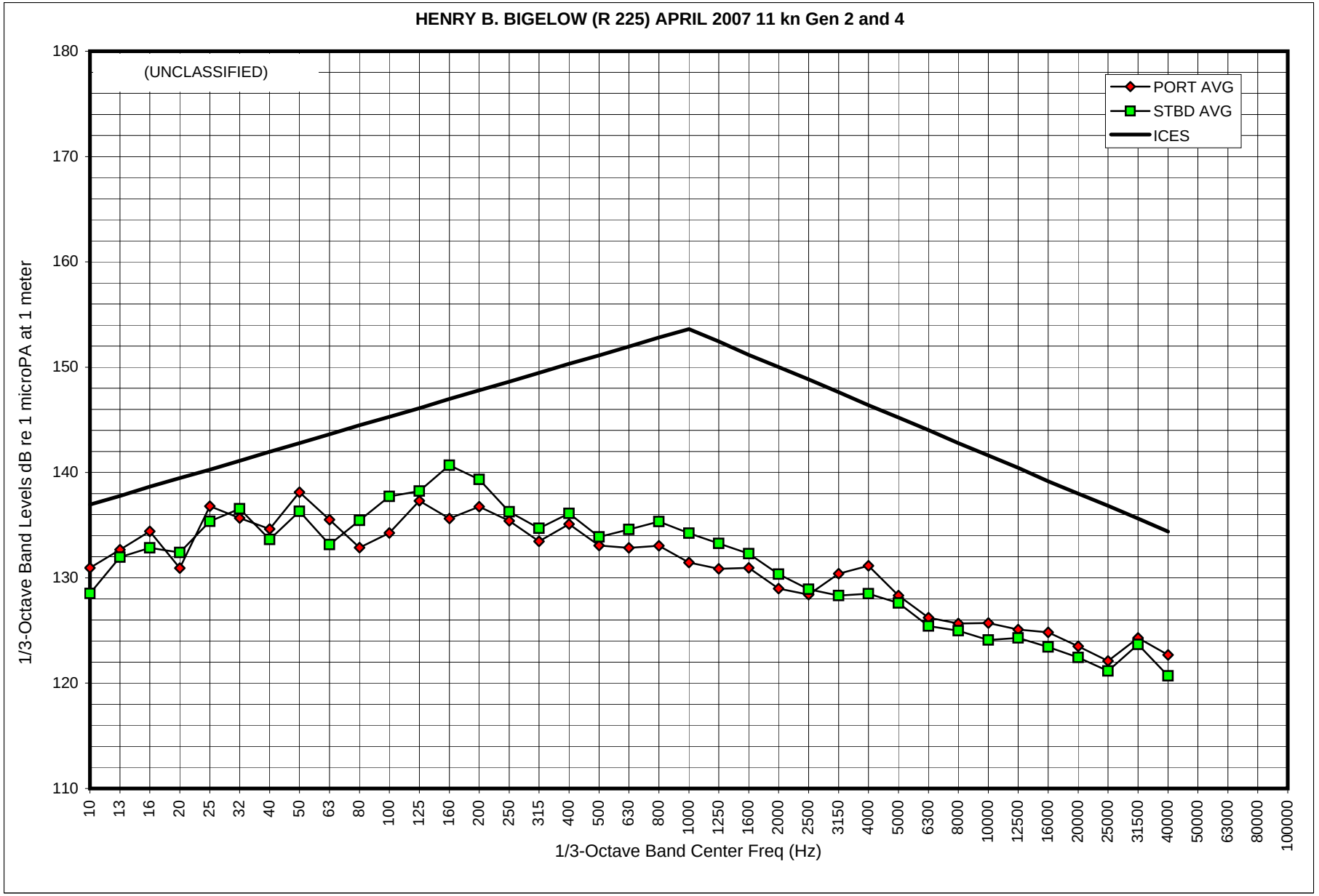

Figure A-11. One-third octave band port and starboard signatures at 11 knots with generators 2 and 4.

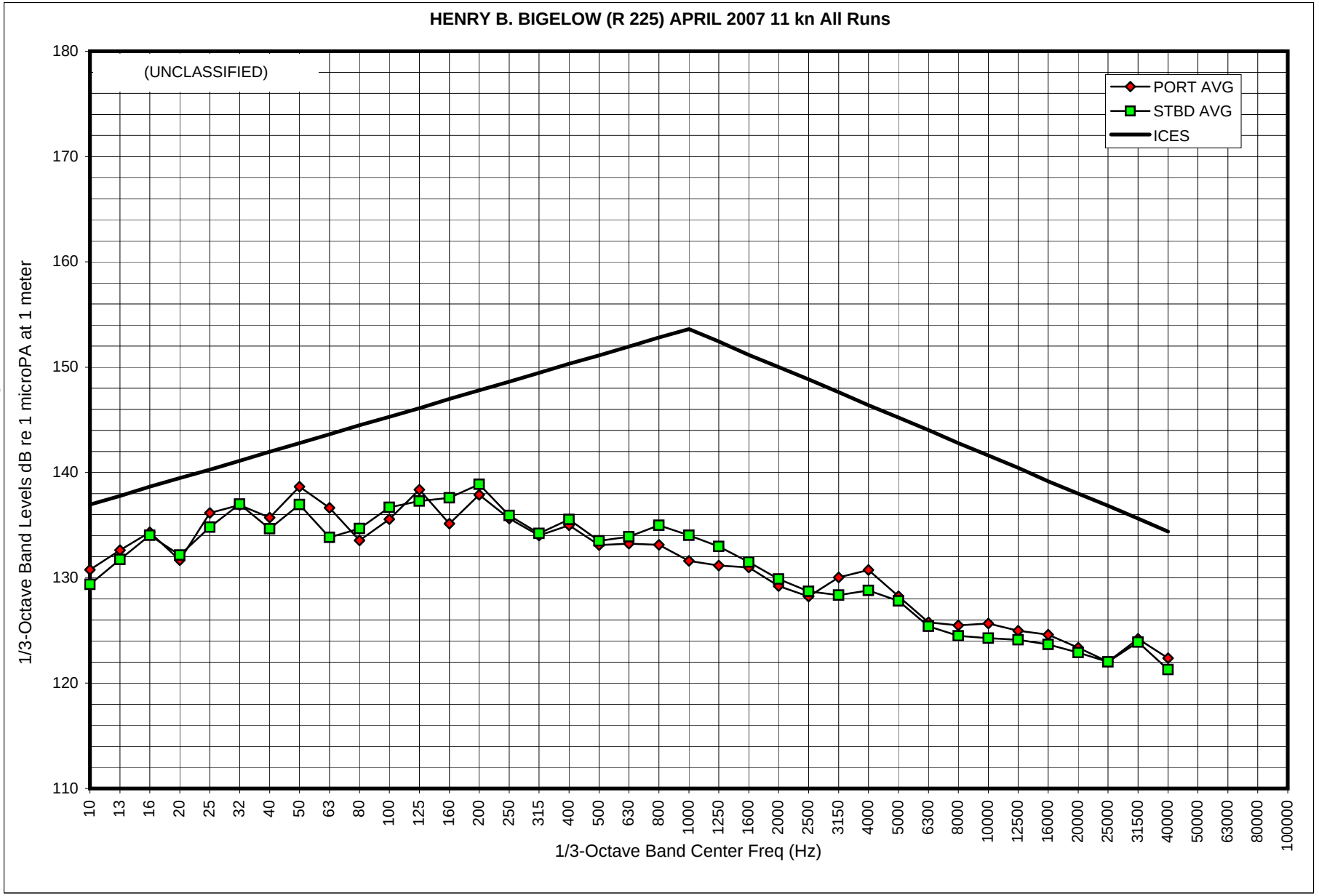

Figure A-12. One-third octave band port and starboard signatures at 11 knots, all runs averaged.

Figure A-13. One-third octave band beam aspect signature at 11 knots, all runs averaged.

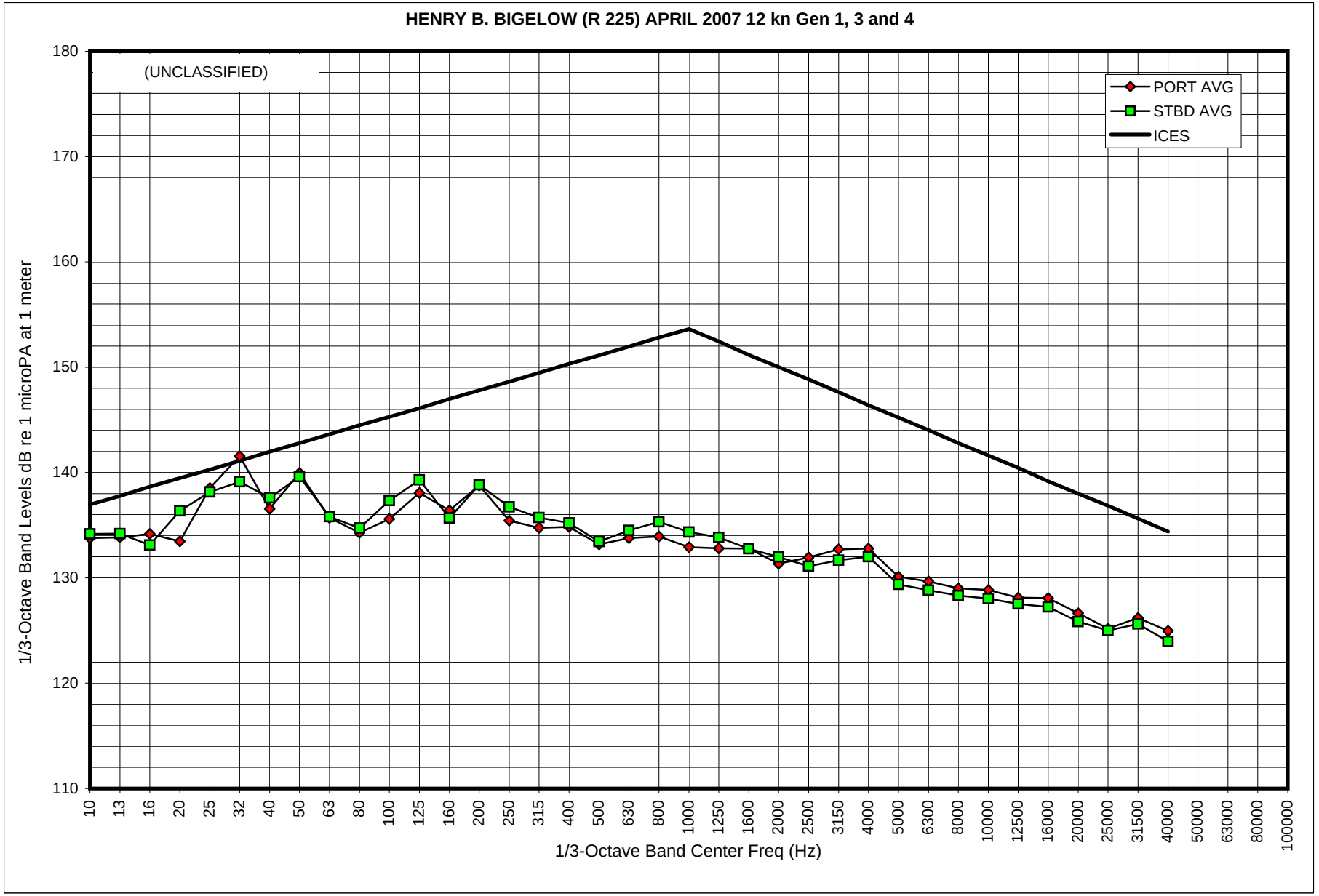

Figure A-14. One-third octave band port and starboard signatures at 12 knots with generators 1, 3 and 4.

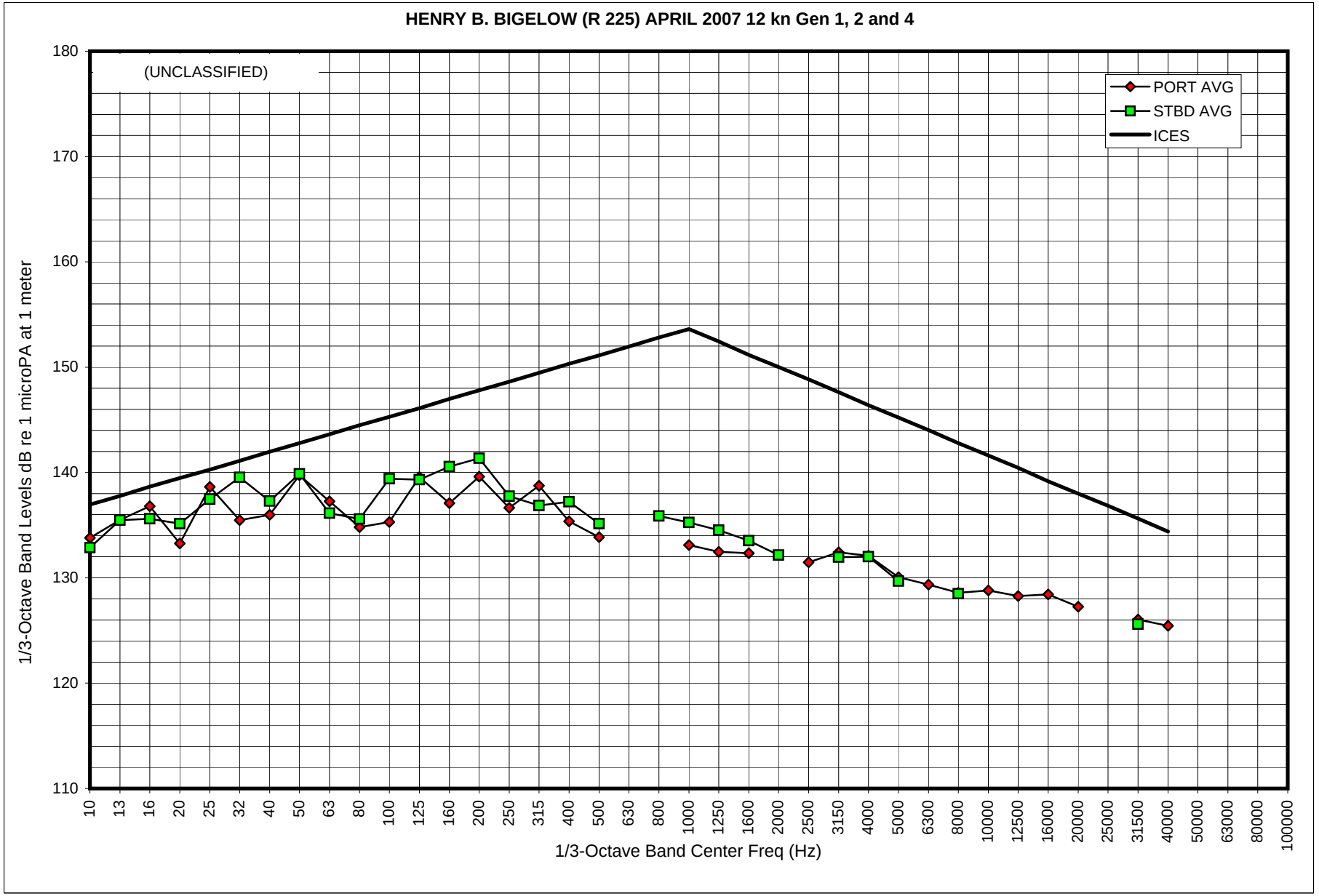

Figure A-15. One-third octave band port and starboard signatures at 12 knots with generators 1, 2 and 4.

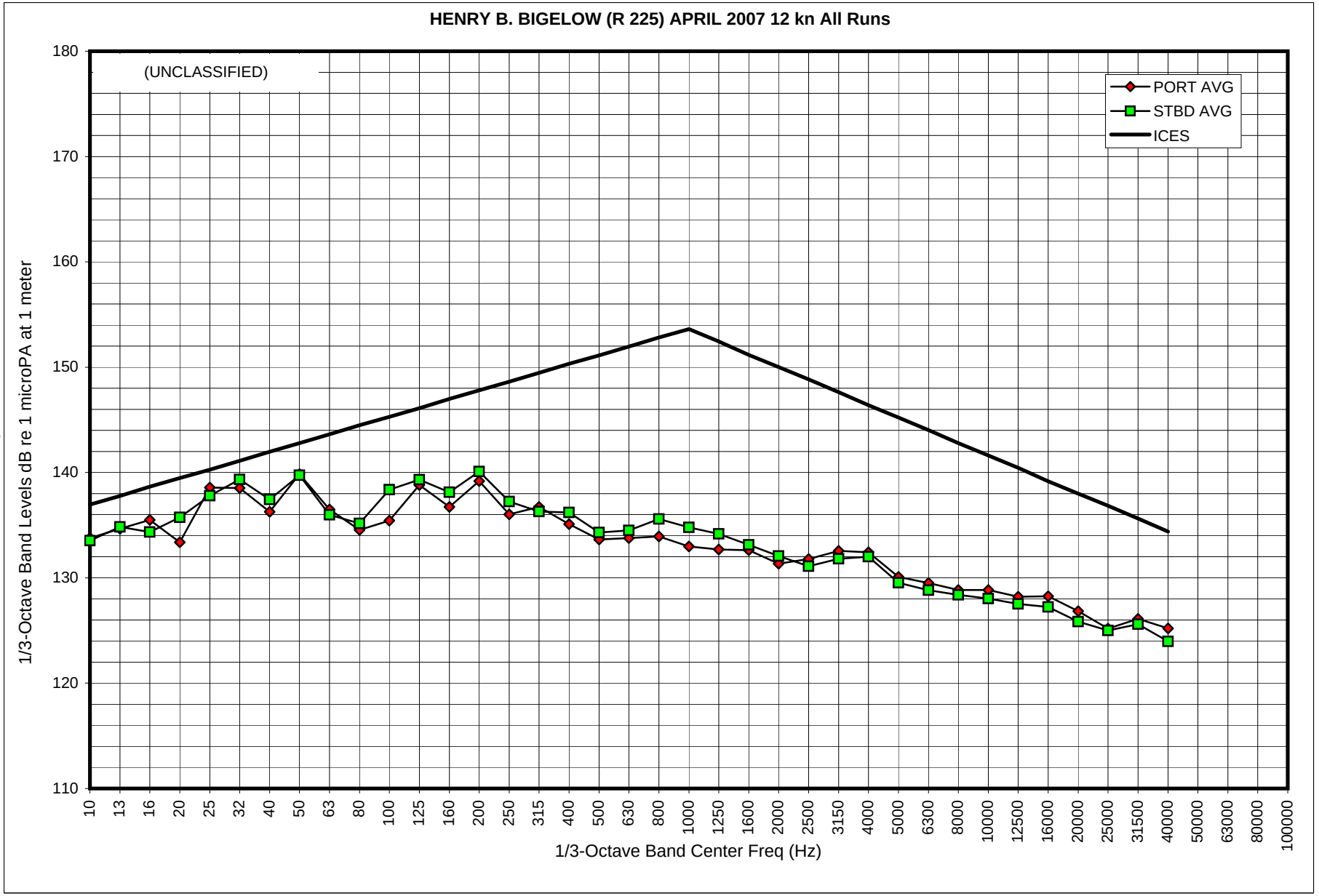

Figure A-16. One-third octave band port and starboard signatures at 12 knots, all runs averaged.

Figure A-17. One-third octave band beam aspect signature at 12 knots, all runs averaged.

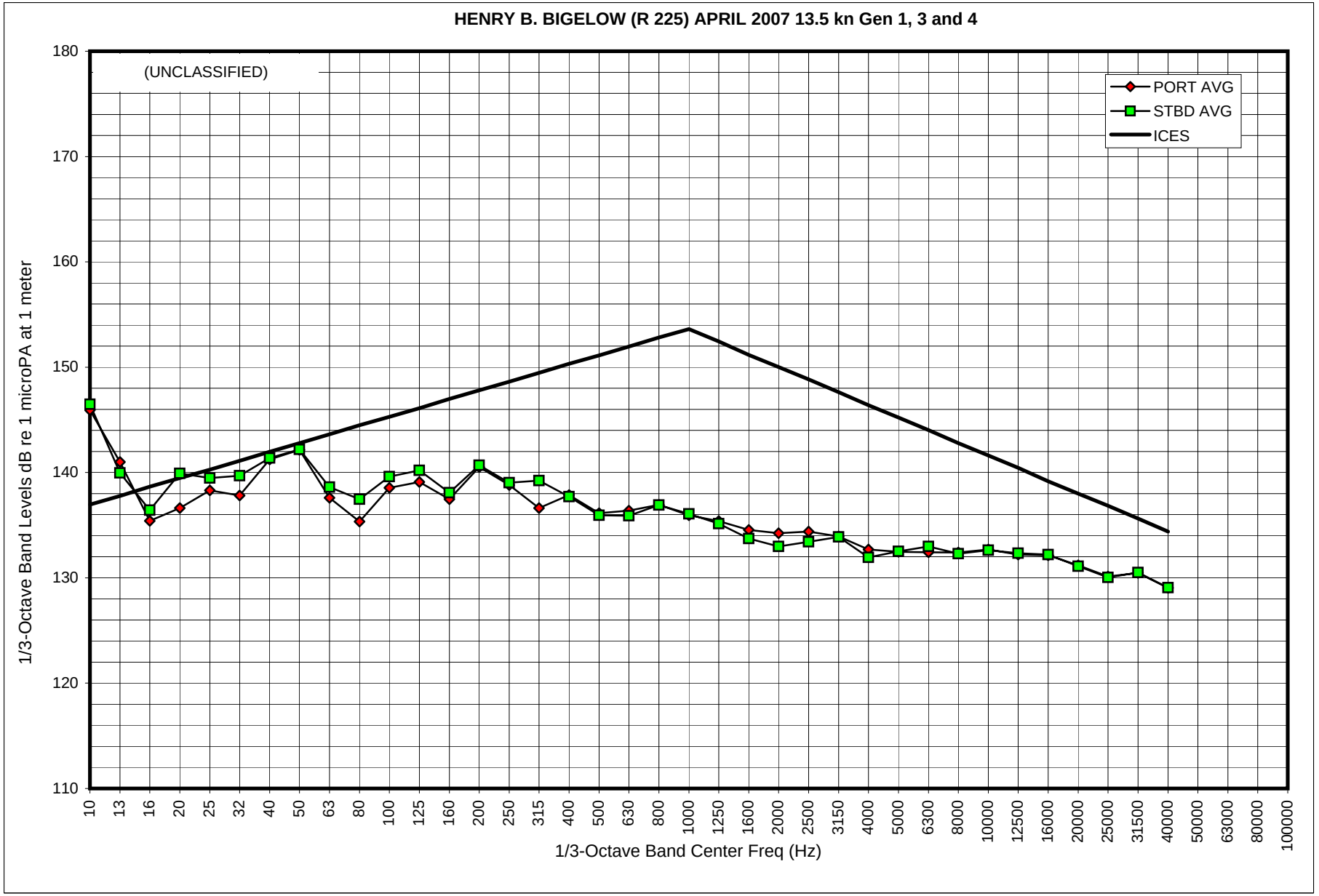

Figure A-18. One-third octave band port and starboard signatures at 13.5 knots with generators 1, 3 and 4.

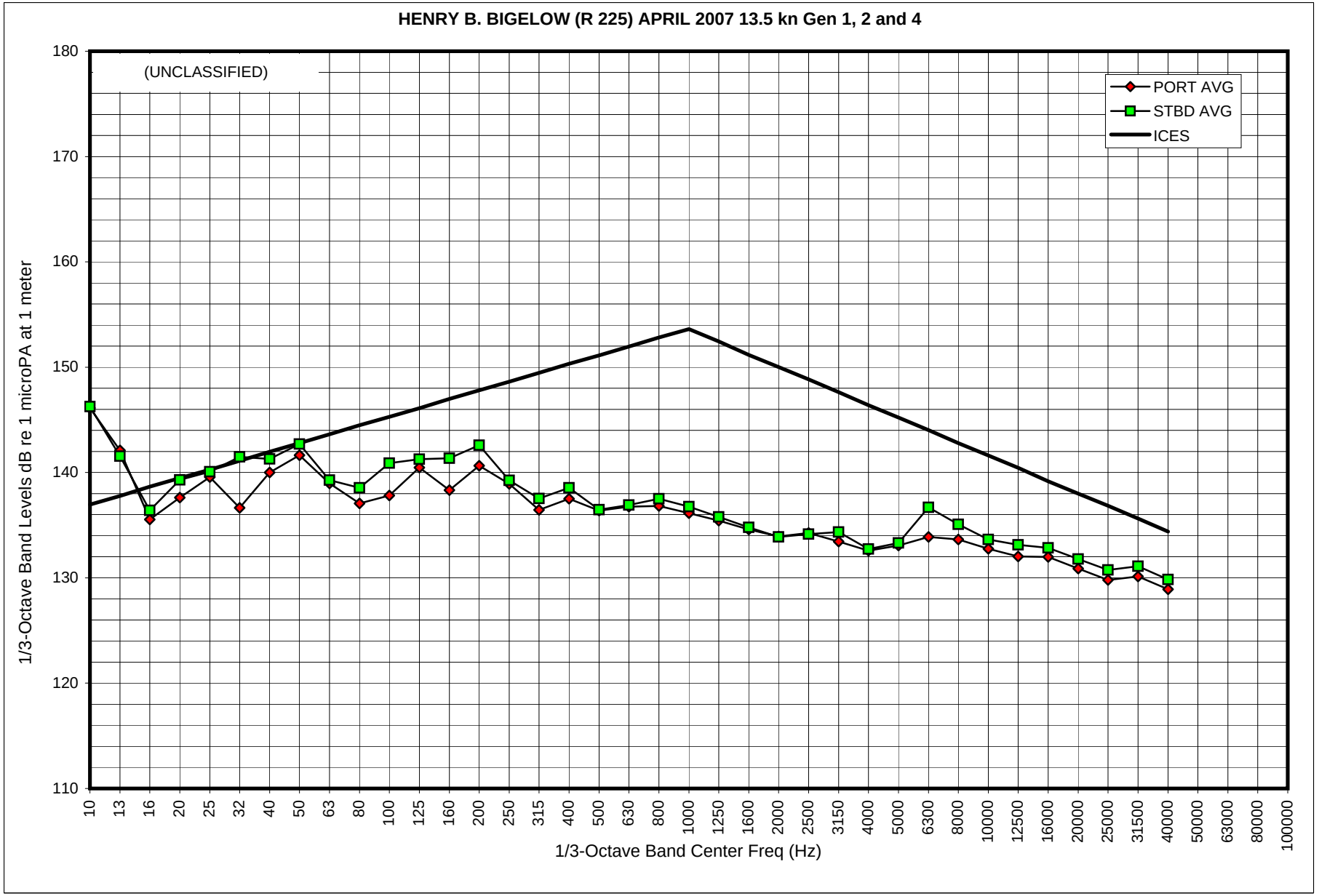

Figure A-19. One-third octave band port and starboard signatures at 13.5 knots with generators 1, 2 and 4.

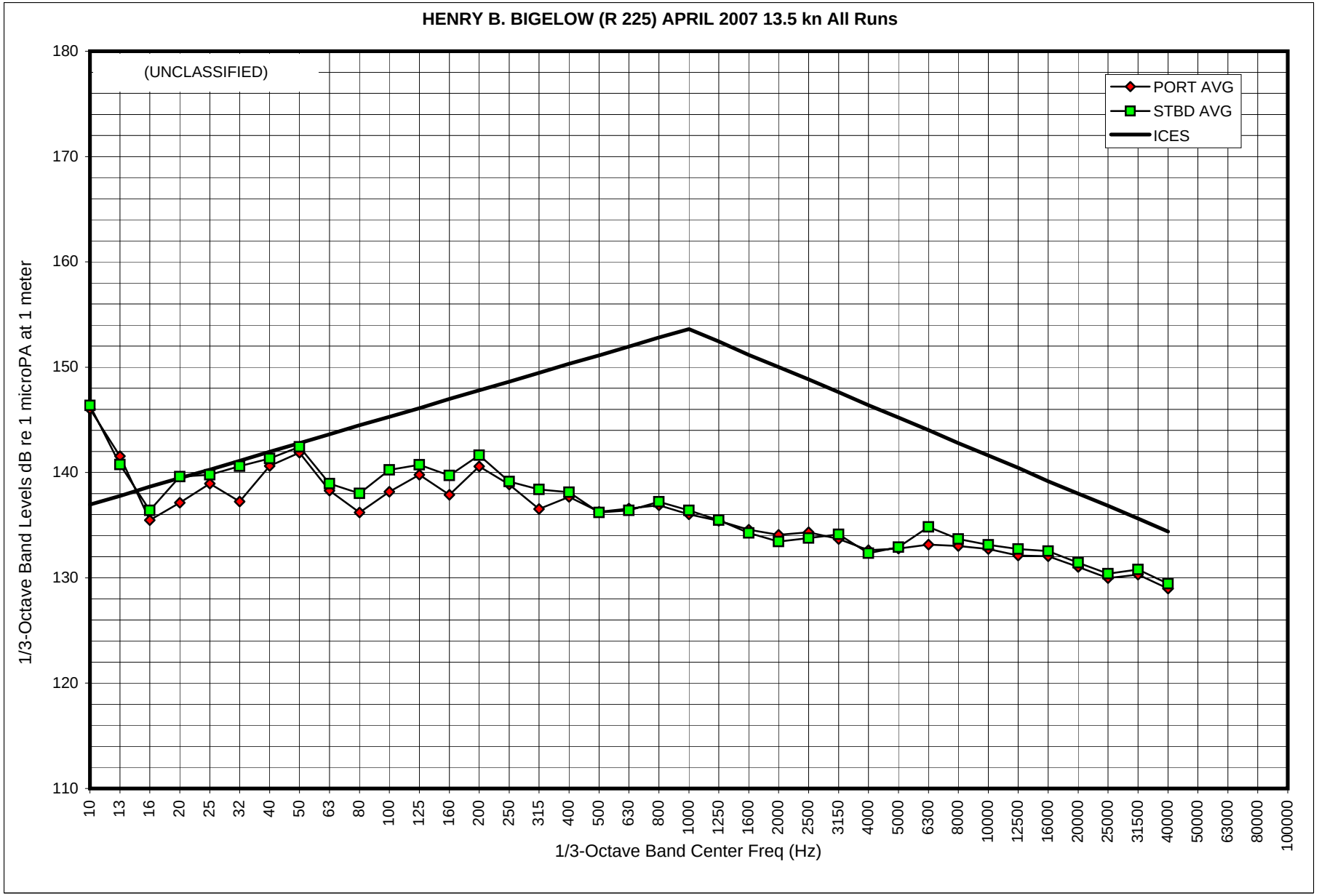

Figure A-20. One-third octave band port and starboard signatures at 13.5 knots, all runs averaged.

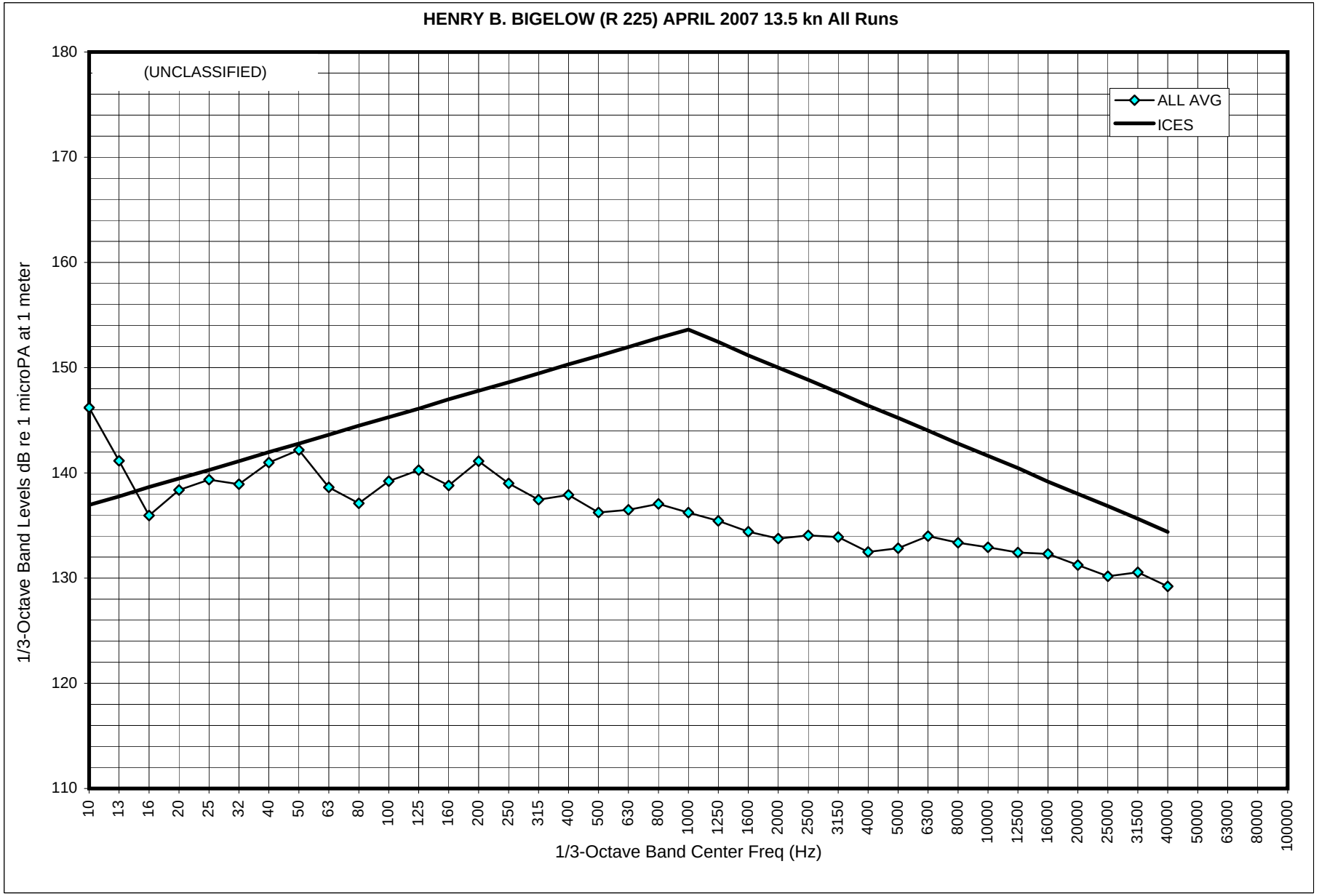

Figure A-21. One-third octave band beam aspect signature at 13.5 knots, all runs averaged.

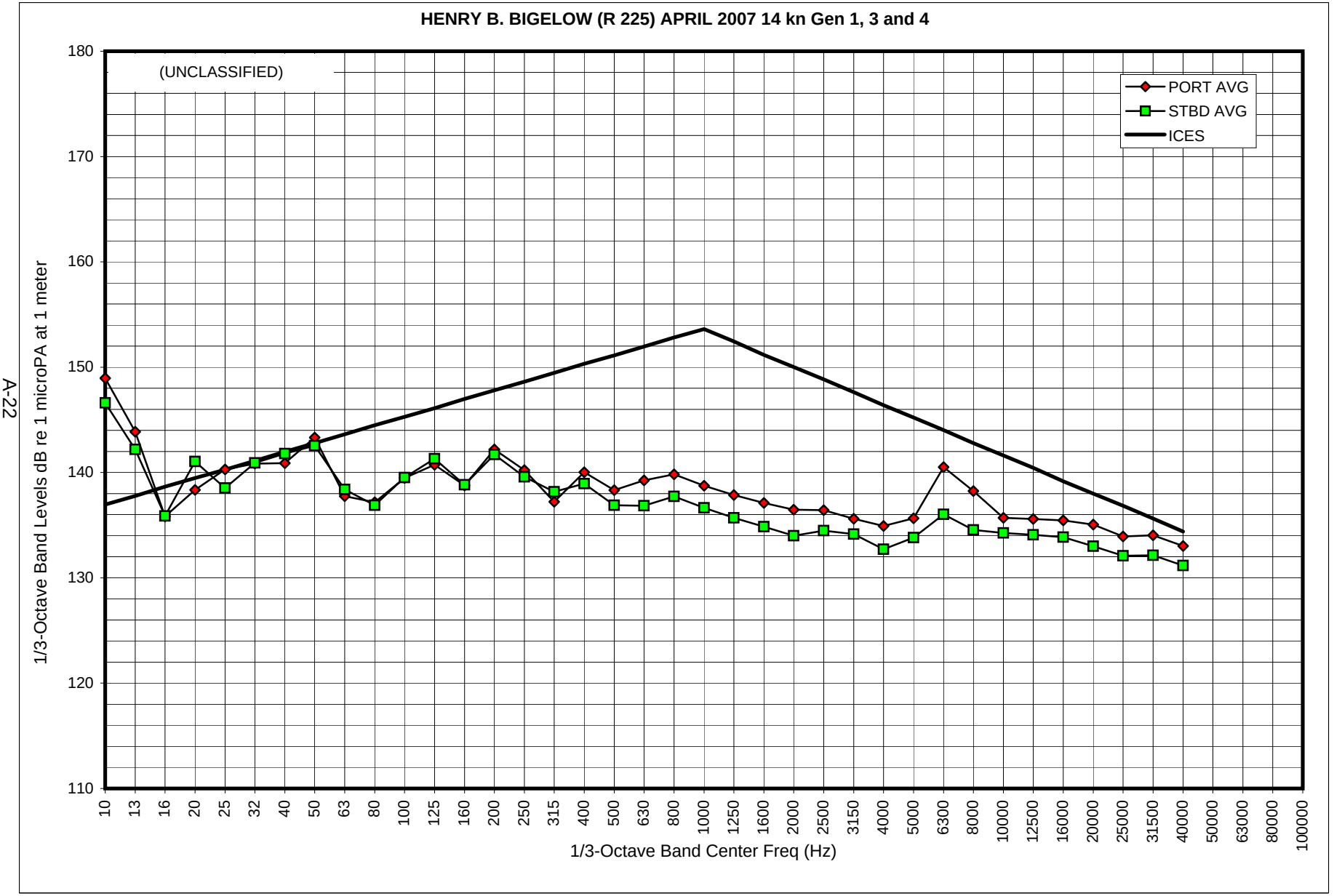

Figure A-22. One-third octave band port and starboard signatures at 14 knots with generators 1, 3 and 4.

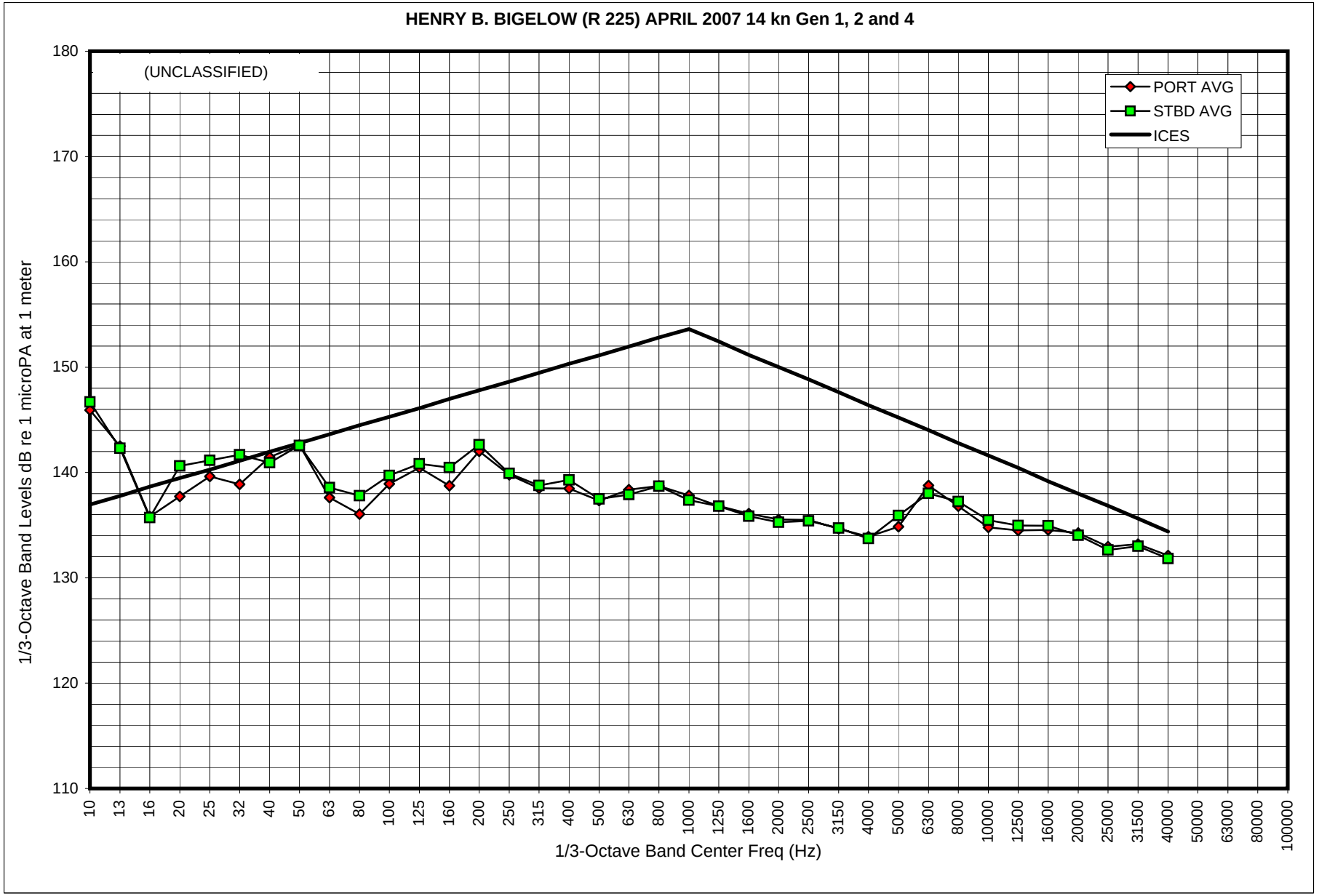

Figure A-23. One-third octave band port and starboard signatures at 14 knots with generators 1, 2 and 4.

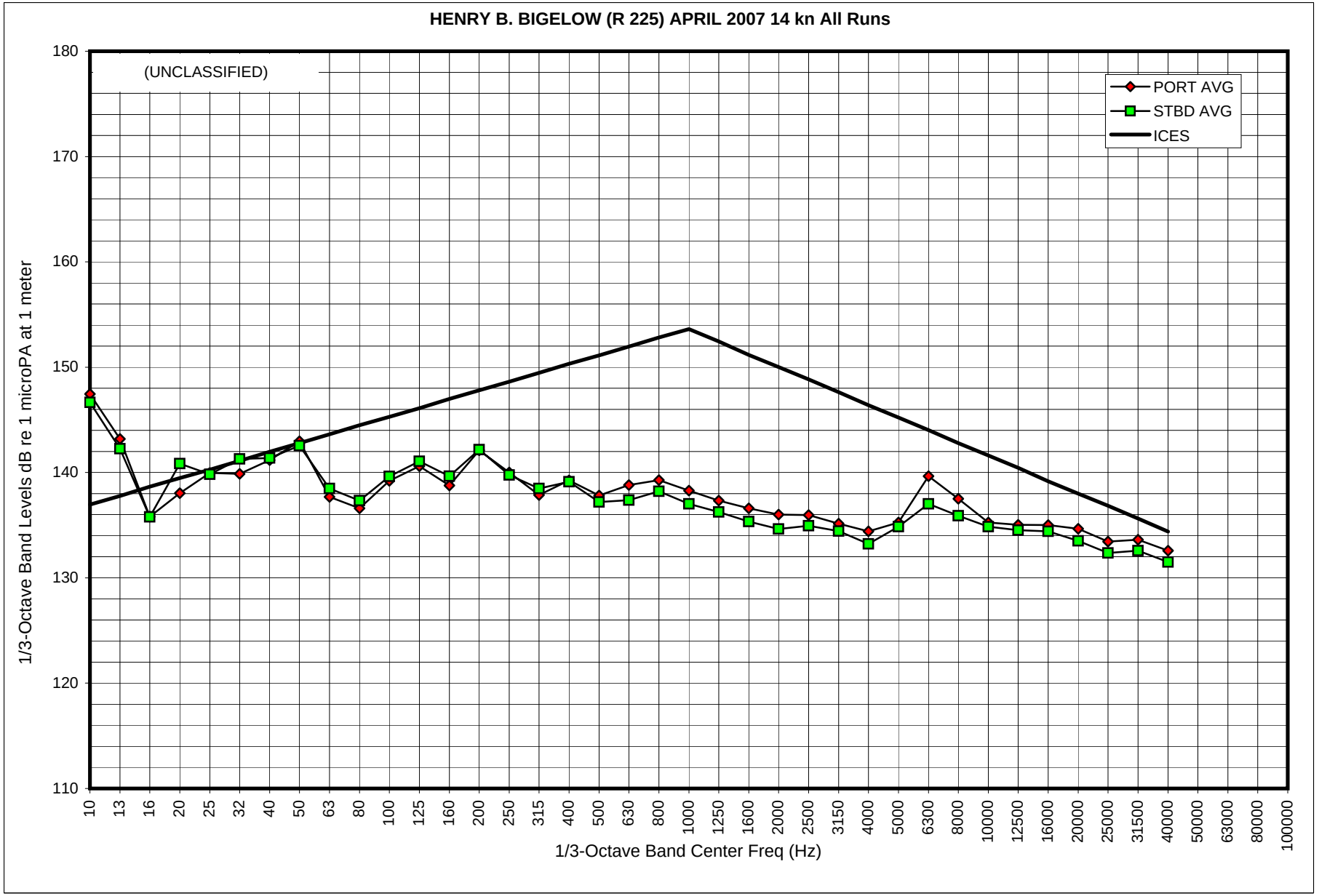

Figure A-24. One-third octave band port and starboard signatures at 14 knots, all runs averaged.

Figure A-25. One-third octave band beam aspect signature at 14 knots, all runs averaged.

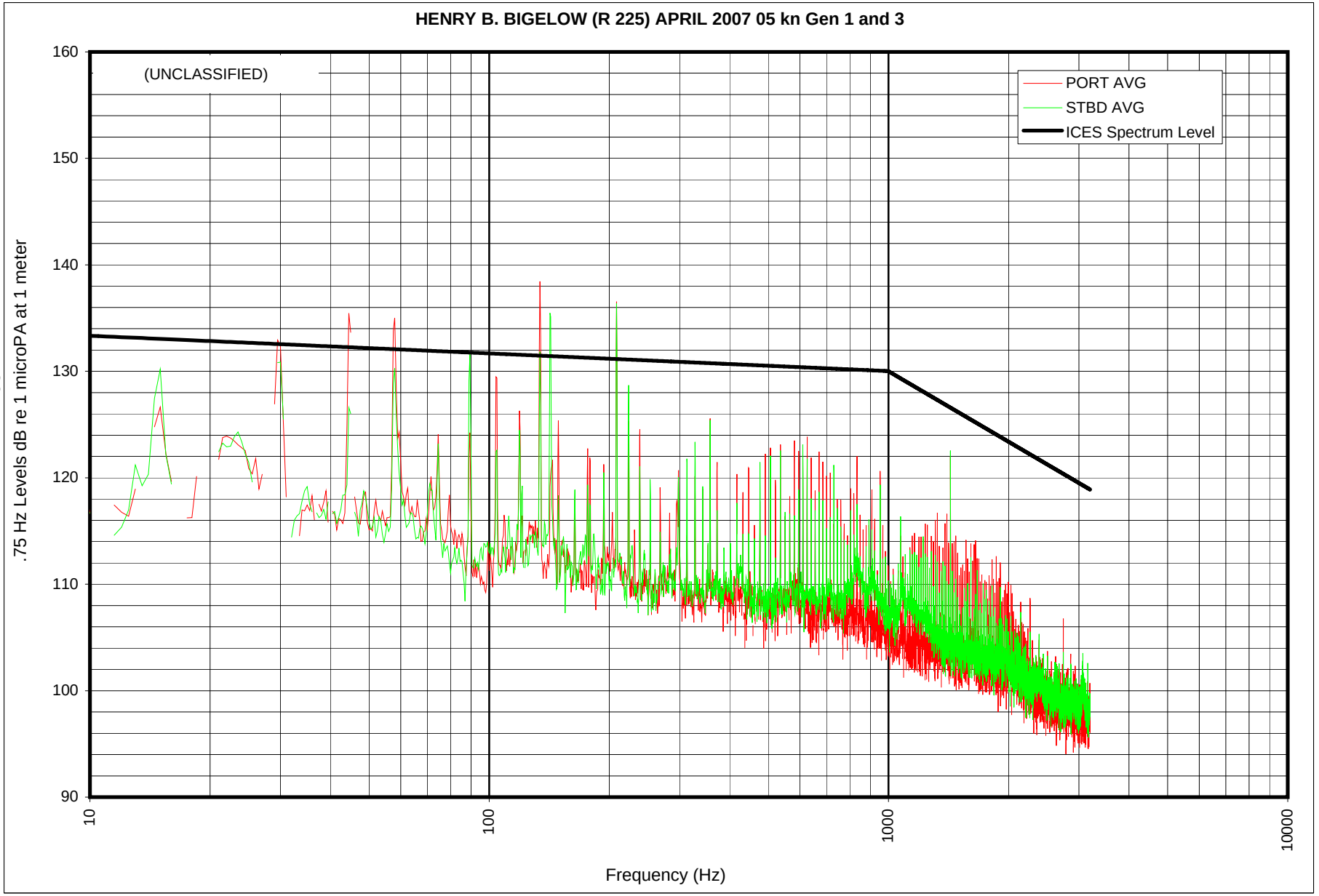

Figure A-26. Narrow bandwidth port and starboard signatures at 5 knots with generators 1 and 3.

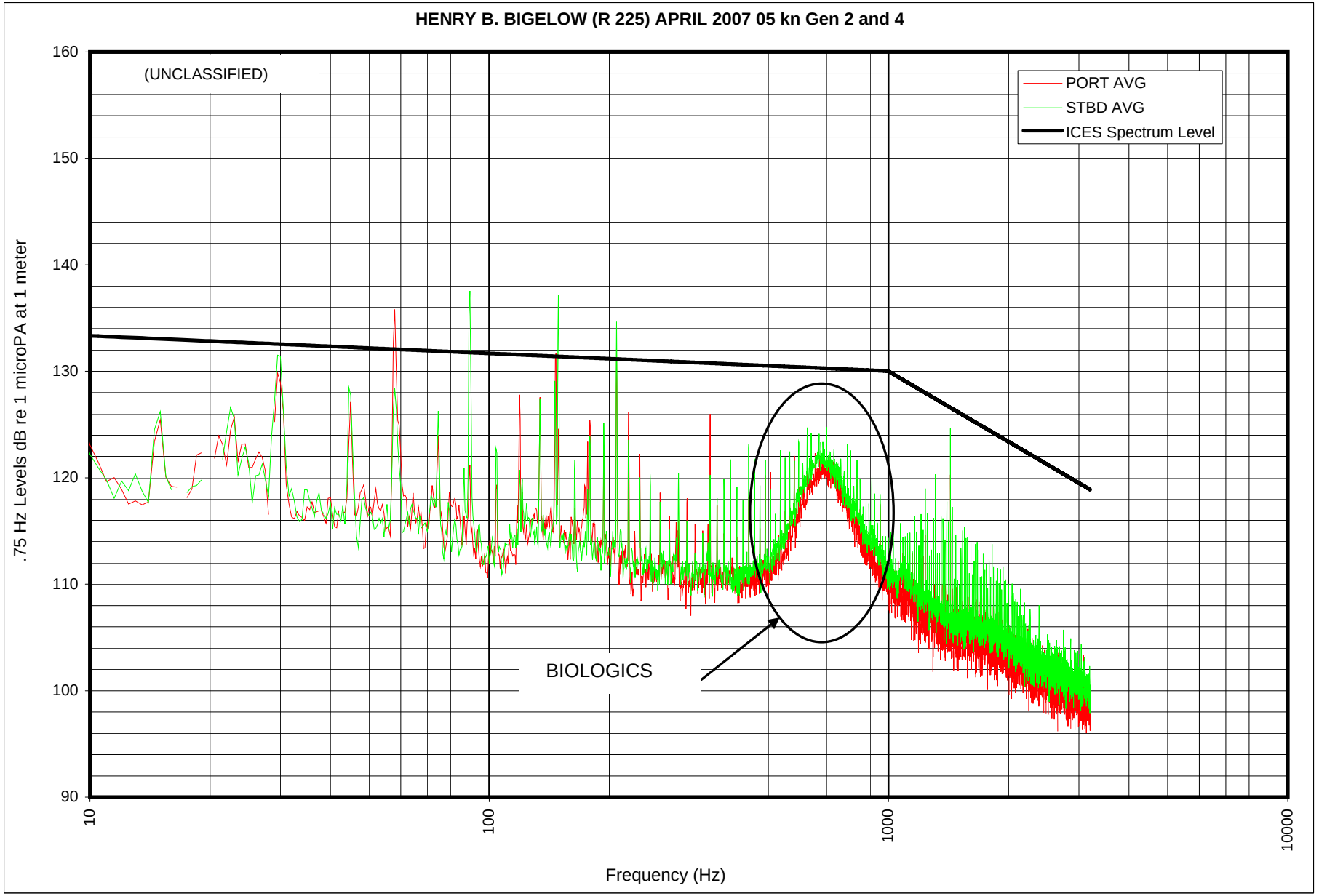

Figure A-27. Narrow bandwidth port and starboard signatures at 5 knots with generators 2 and 4.

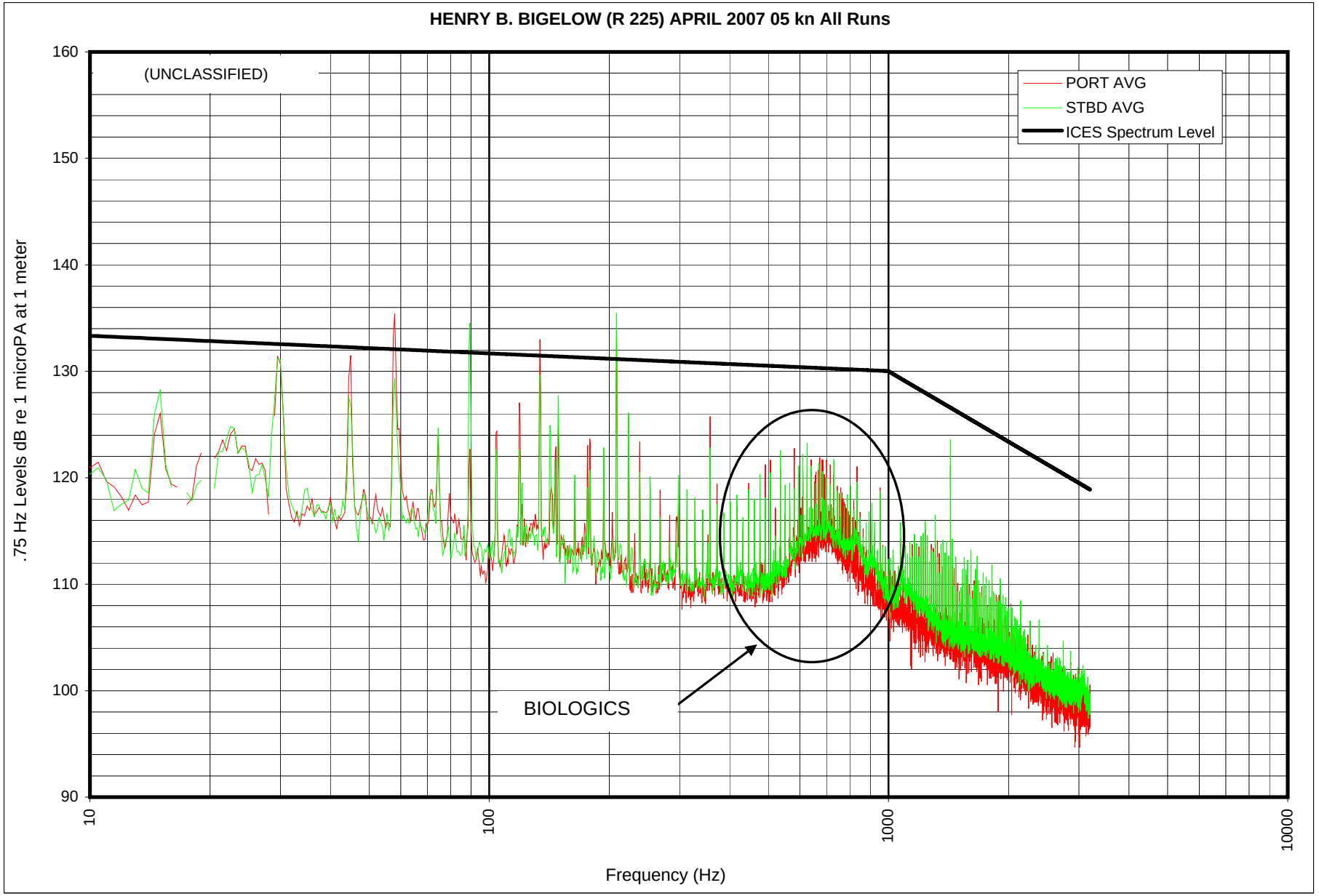

Figure A-28. Narrow bandwidth port and starboard signatures at 5 knots, all runs averaged.

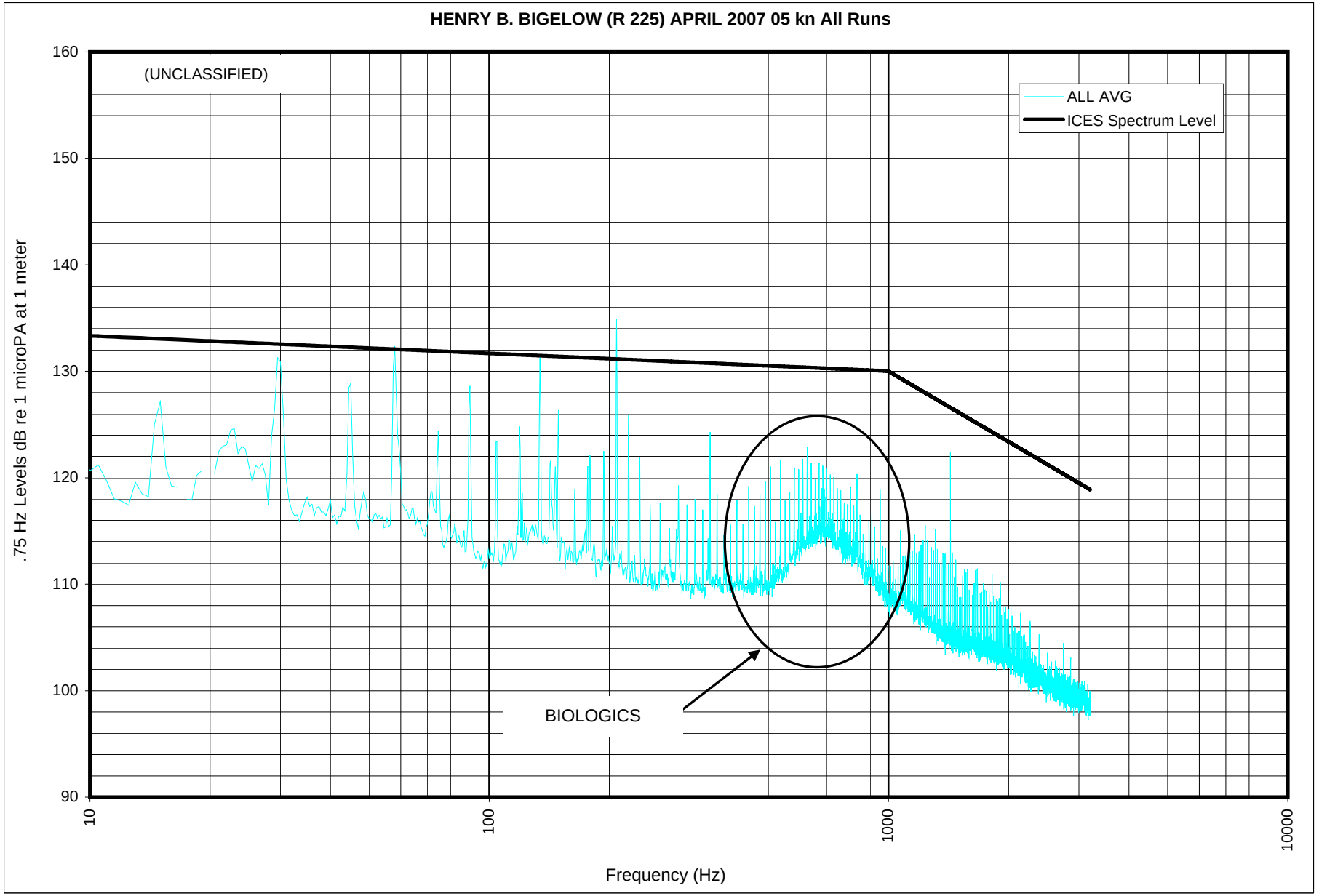

Figure A-29. Narrow bandwidth beam aspect signature at 5 knots, all runs averaged.

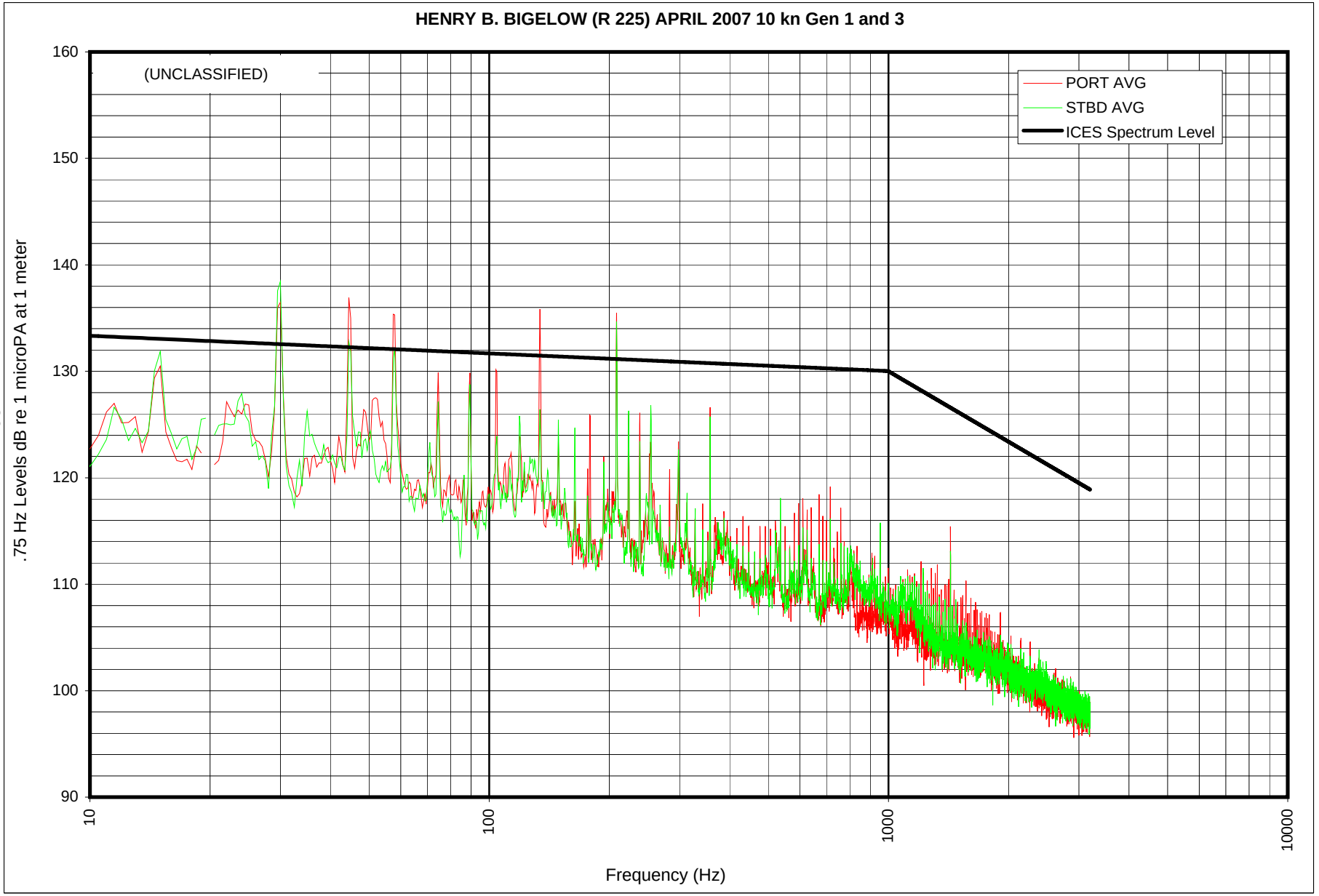

Figure A-30. Narrow bandwidth port and starboard signatures at 10 knots with generators 1 and 3.

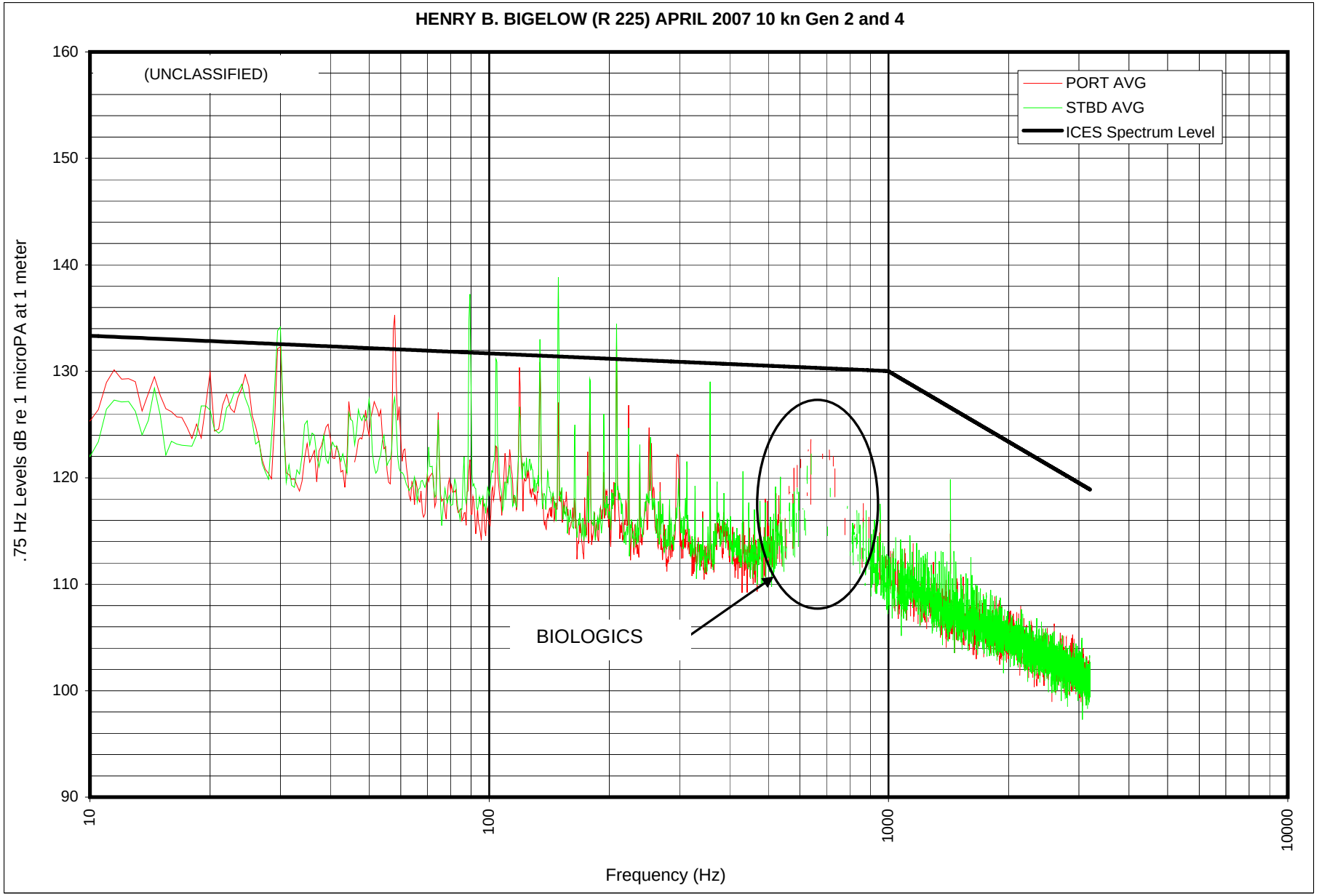

Figure A-31. Narrow bandwidth port and starboard signatures at 10 knots with generators 2 and 4.

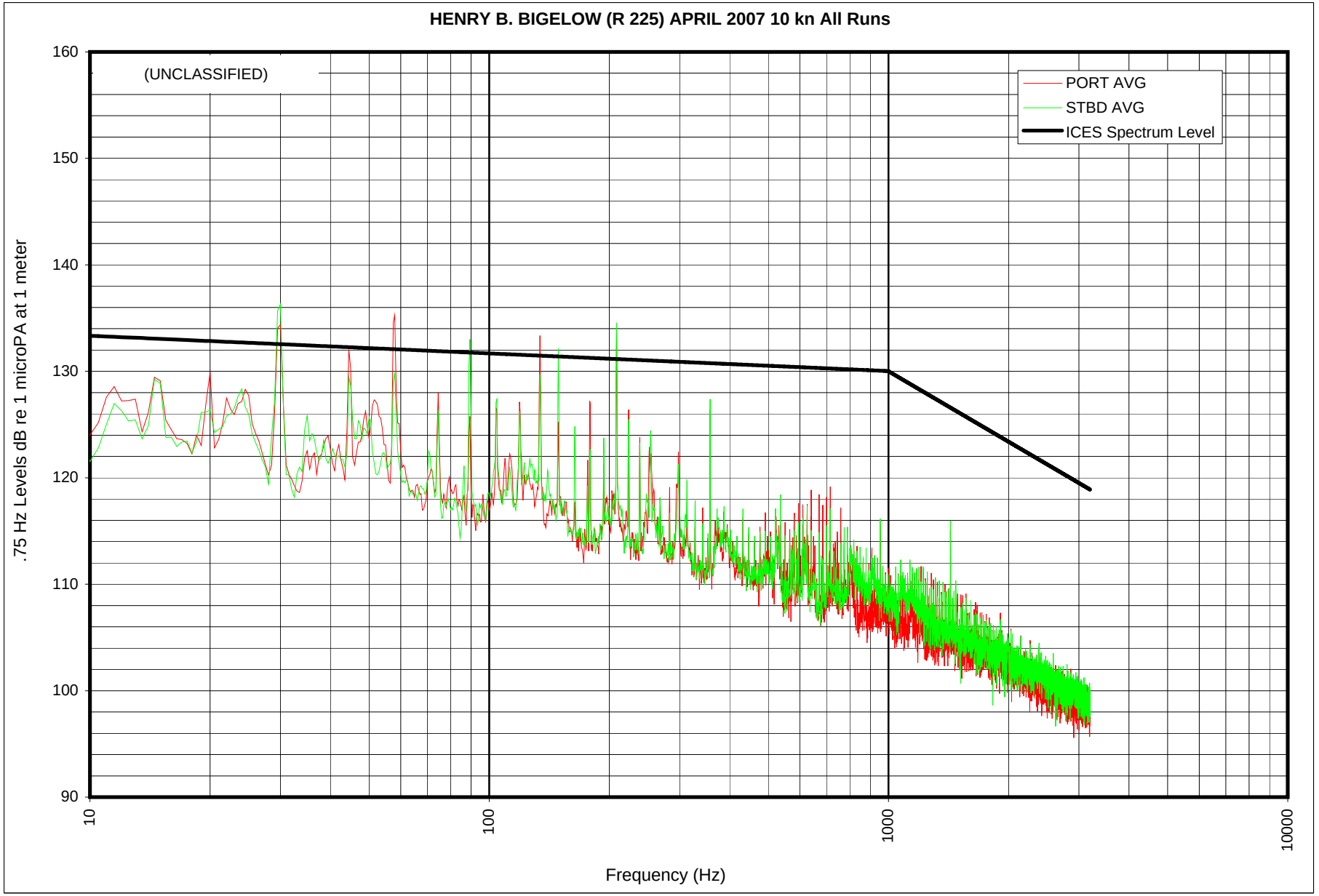

Figure A-32. Narrow bandwidth port and starboard signatures at 10 knots, all runs averaged.

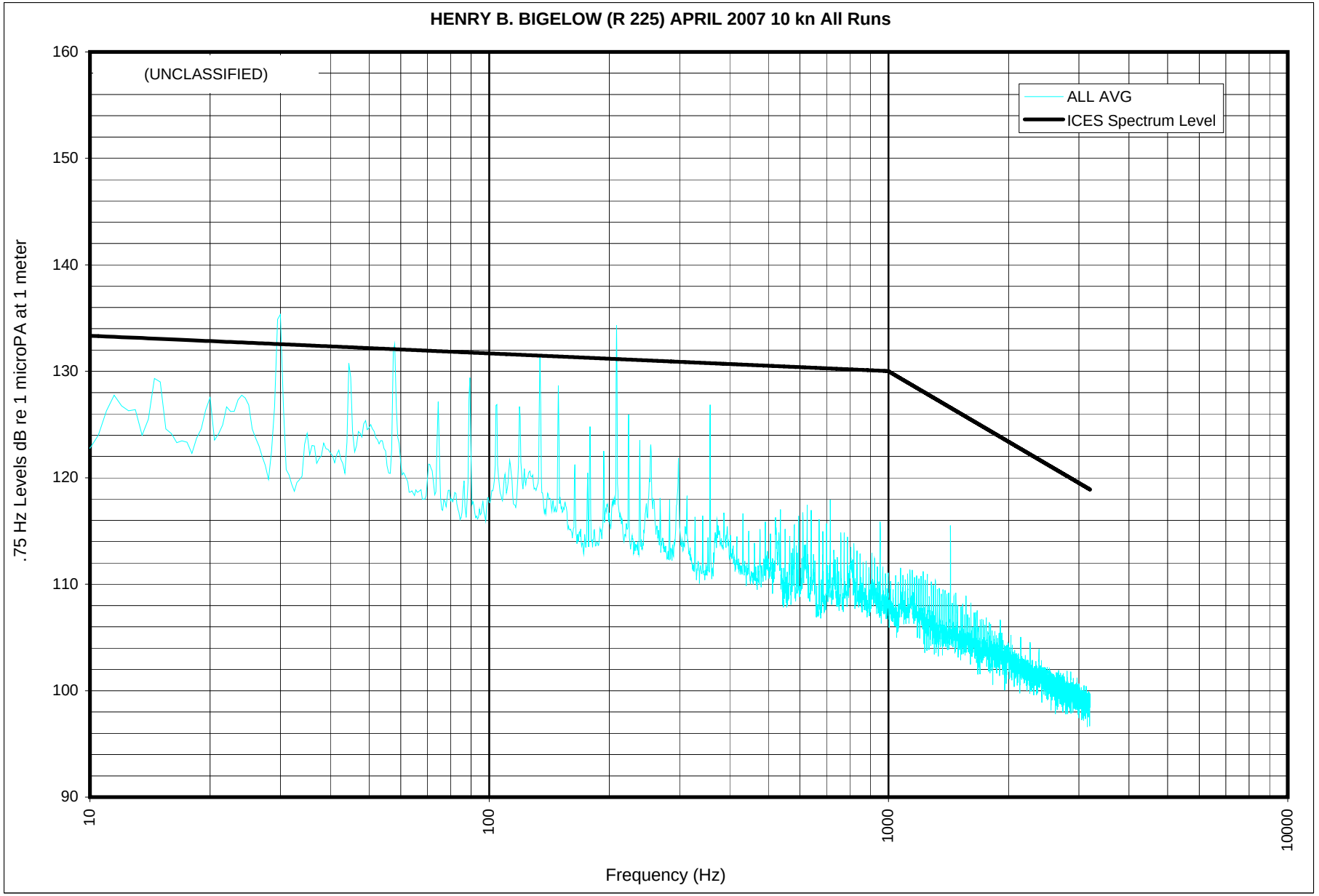

Figure A-33. Narrow bandwidth beam aspect signature at 10 knots, all runs averaged.

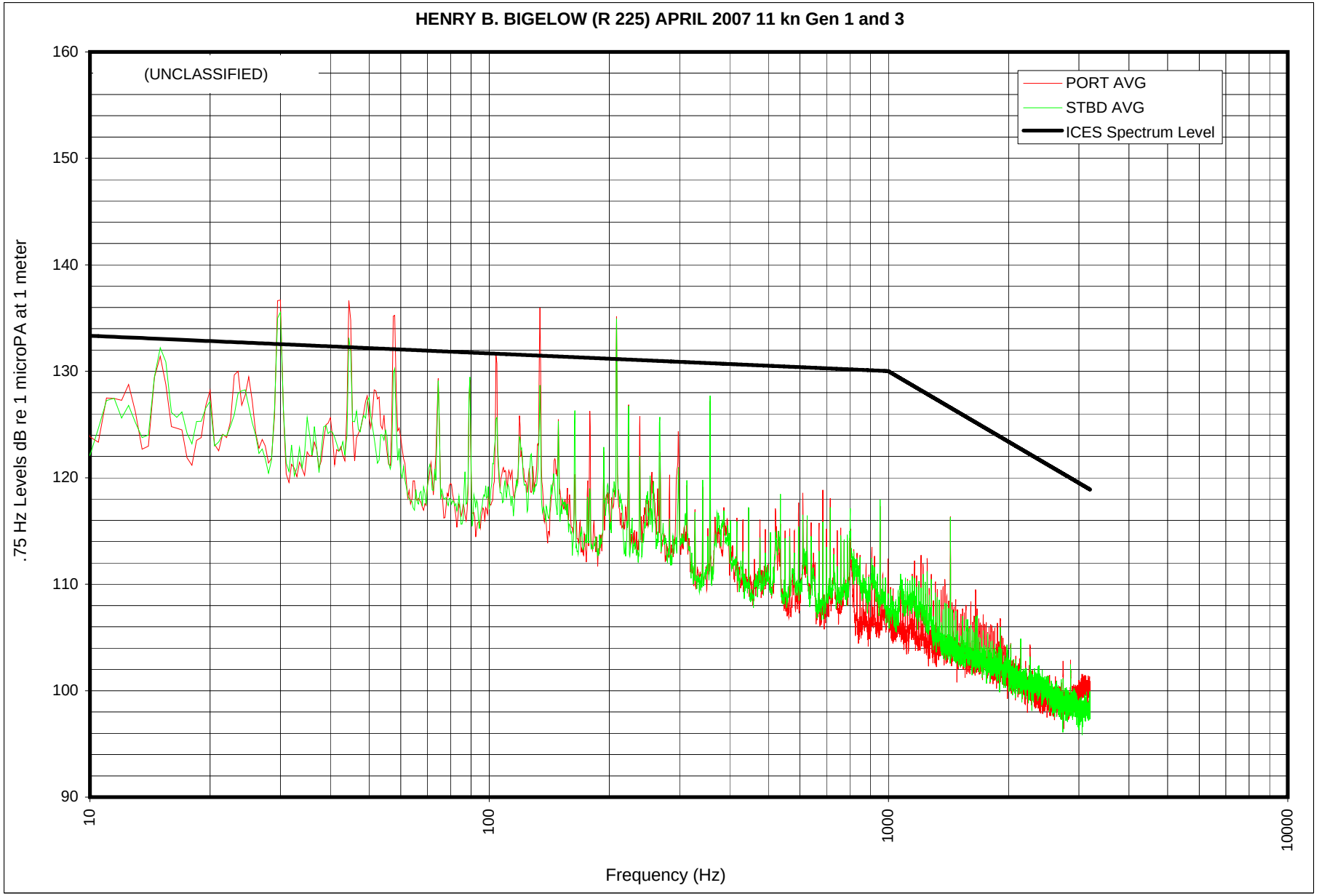

Figure A-34. Narrow bandwidth port and starboard signatures at 11 knots with generators 1 and 3.

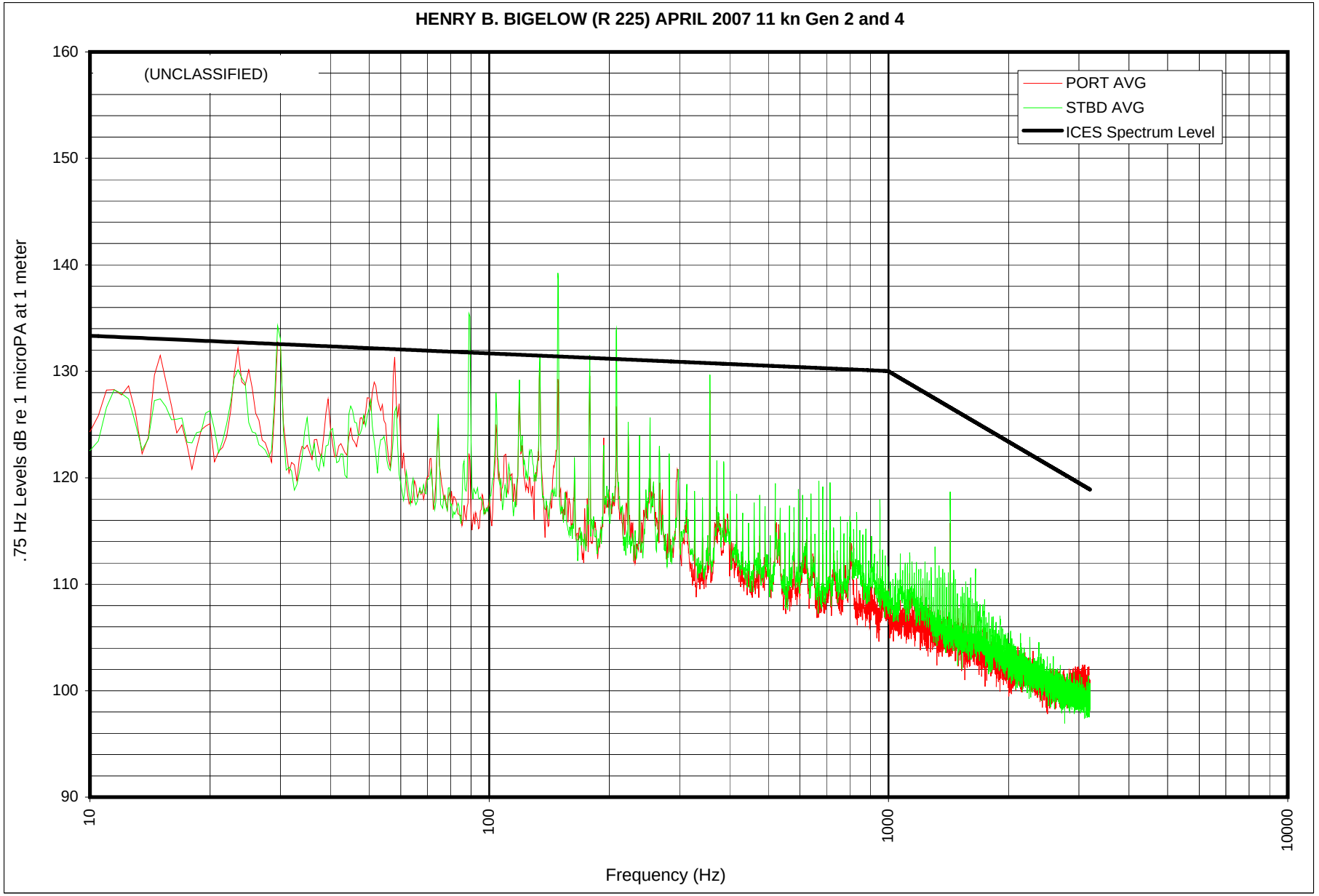

Figure A-35. Narrow bandwidth port and starboard signatures at 11 knots with generators 2 and 4.

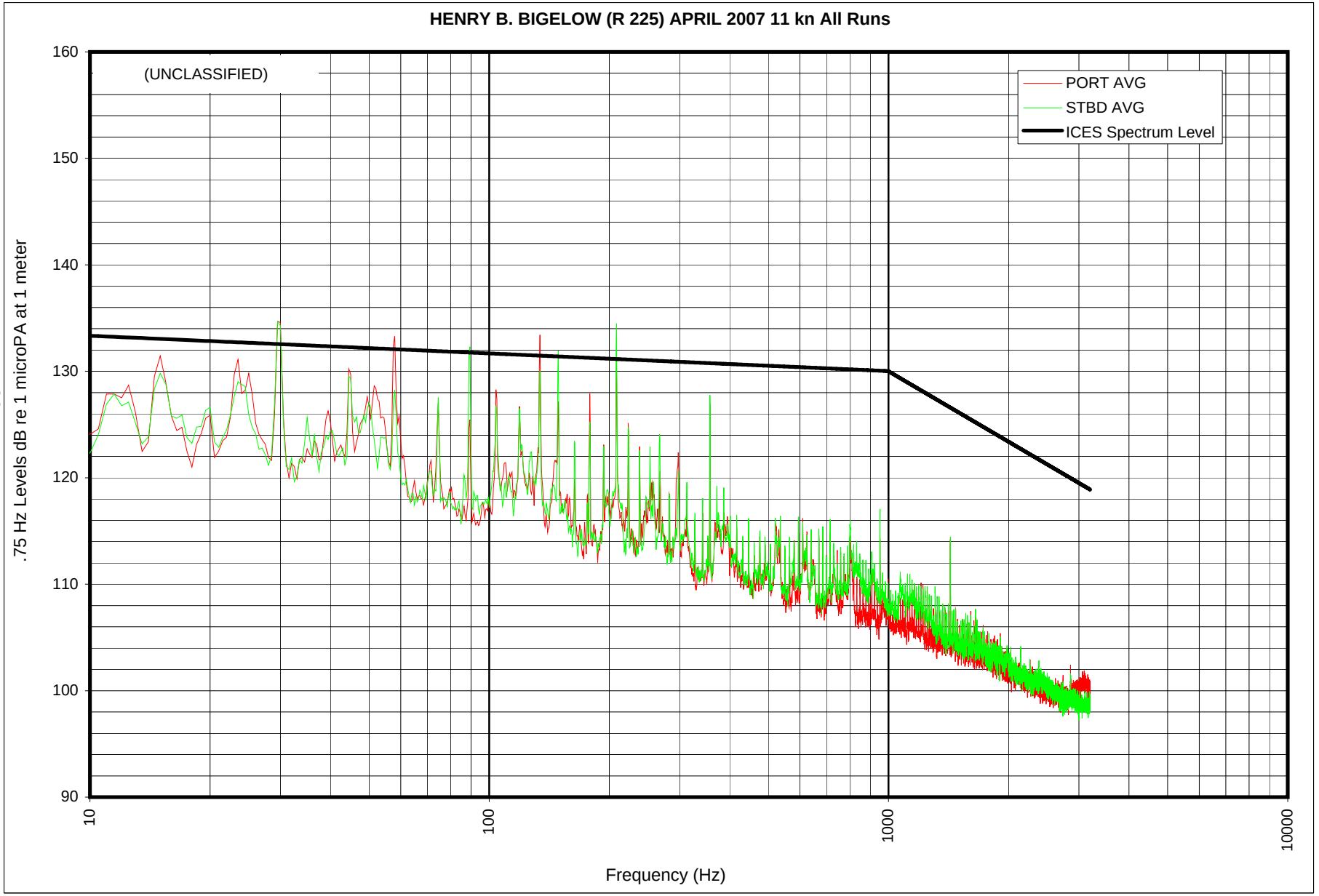

Figure A-36. Narrow bandwidth port and starboard signatures at 11 knots, all runs averaged.

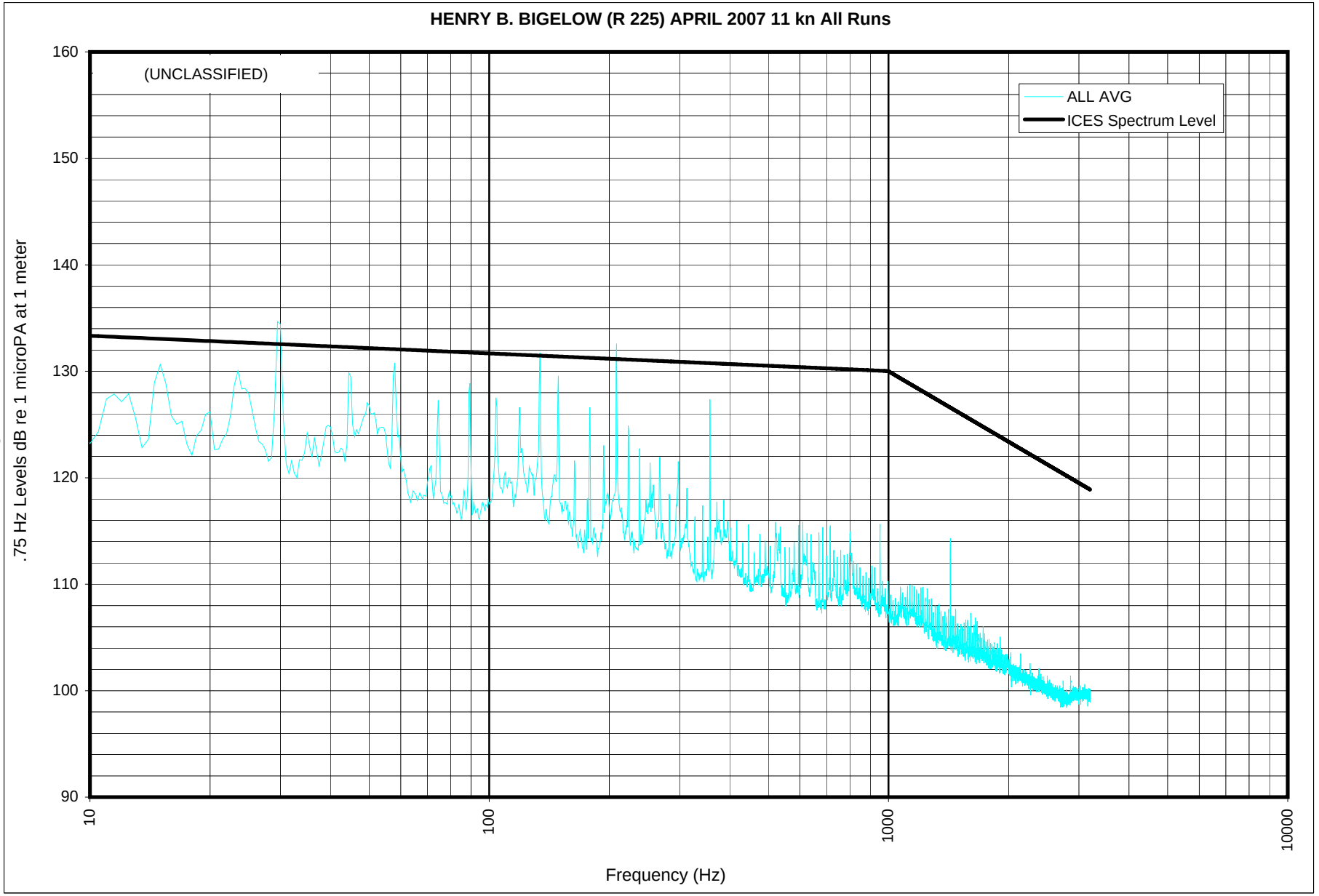

Figure A-37. Narrow bandwidth beam aspect signature at 11 knots, all runs averaged.

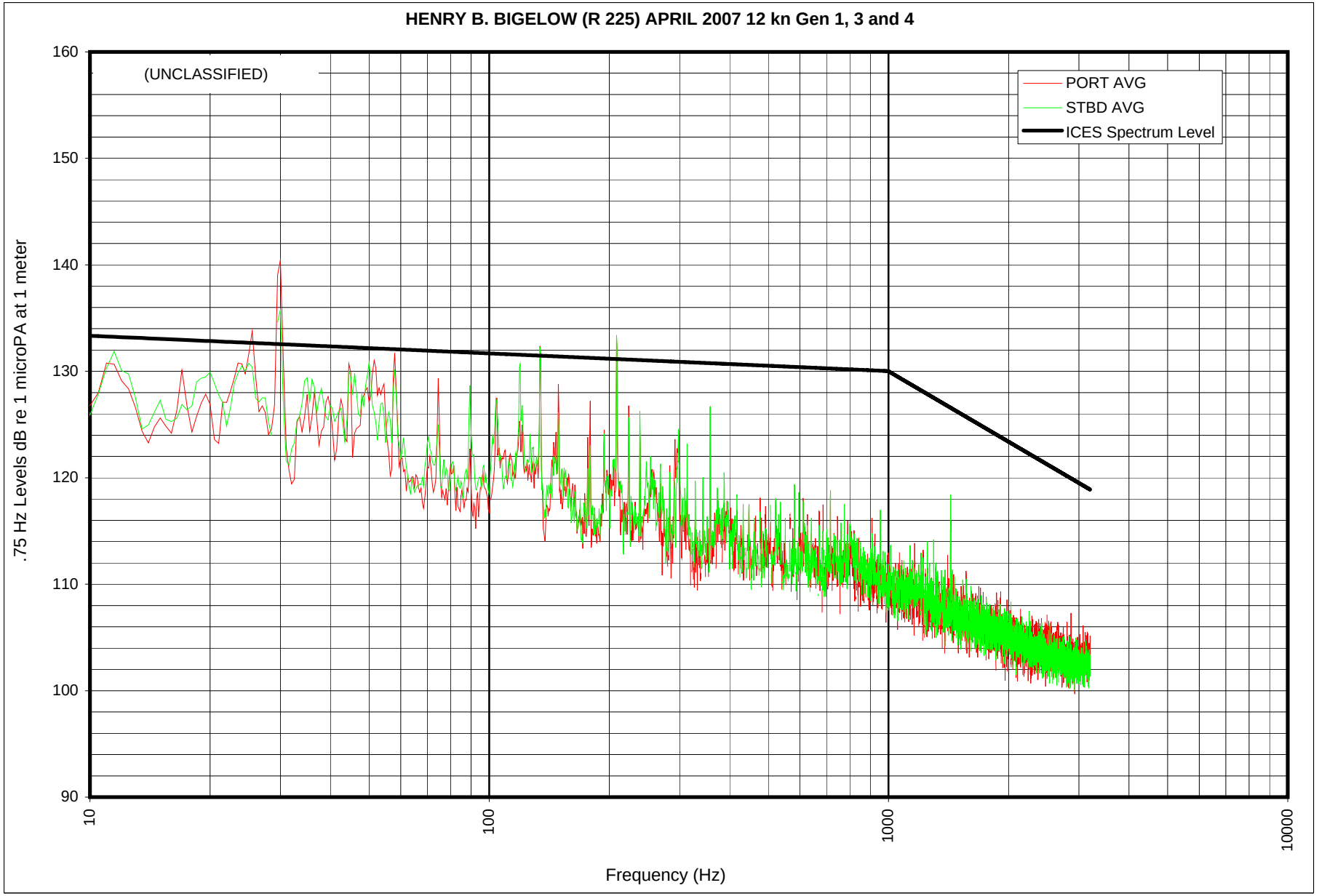

Figure A-38. Narrow bandwidth port and starboard signatures at 12 knots with generators 1, 3 and 4.

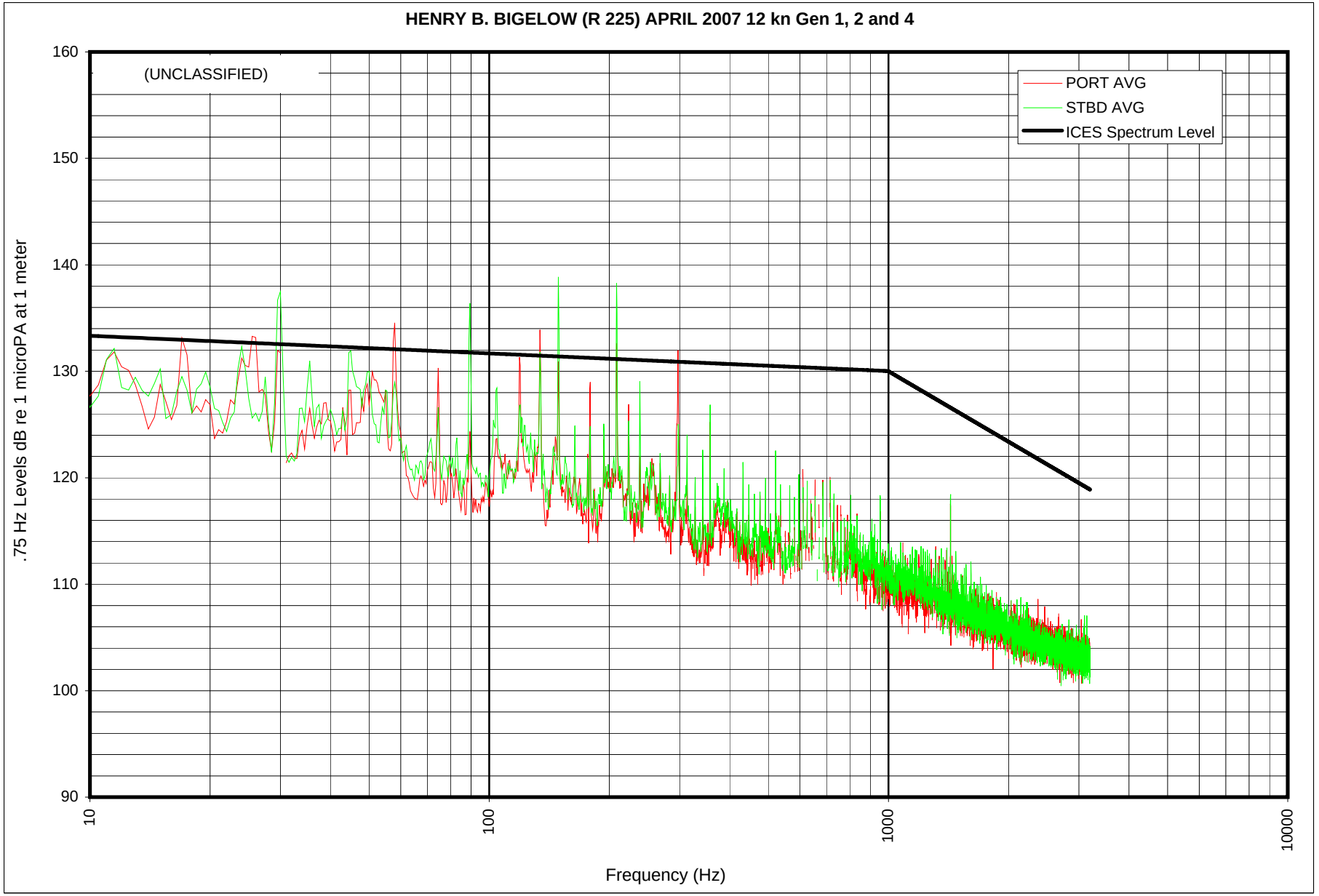

Figure A-39. Narrow bandwidth port and starboard signatures at 12 knots with generators 1, 2 and 4.

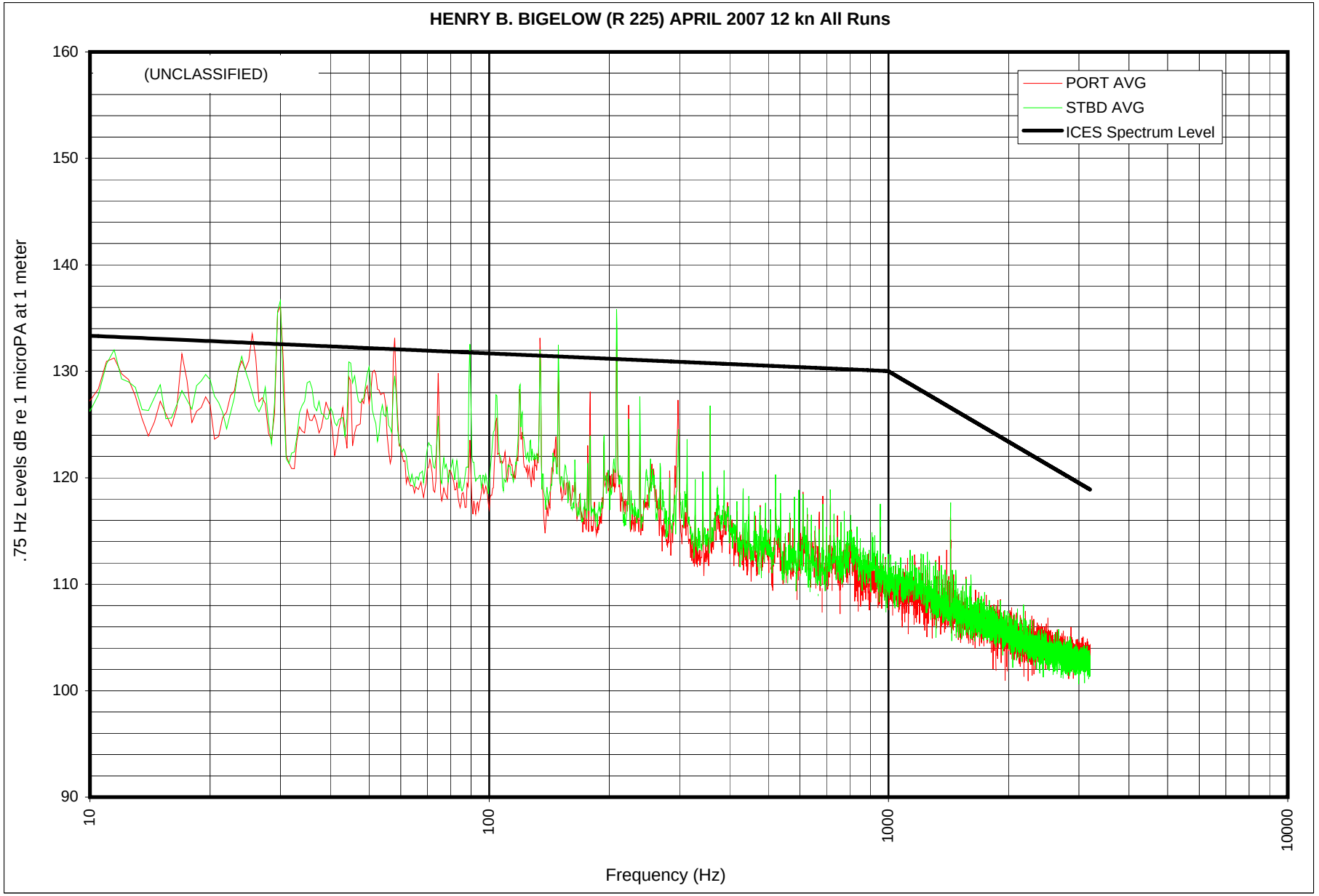

Figure A-40. Narrow bandwidth port and starboard signatures at 12 knots, all runs averaged.

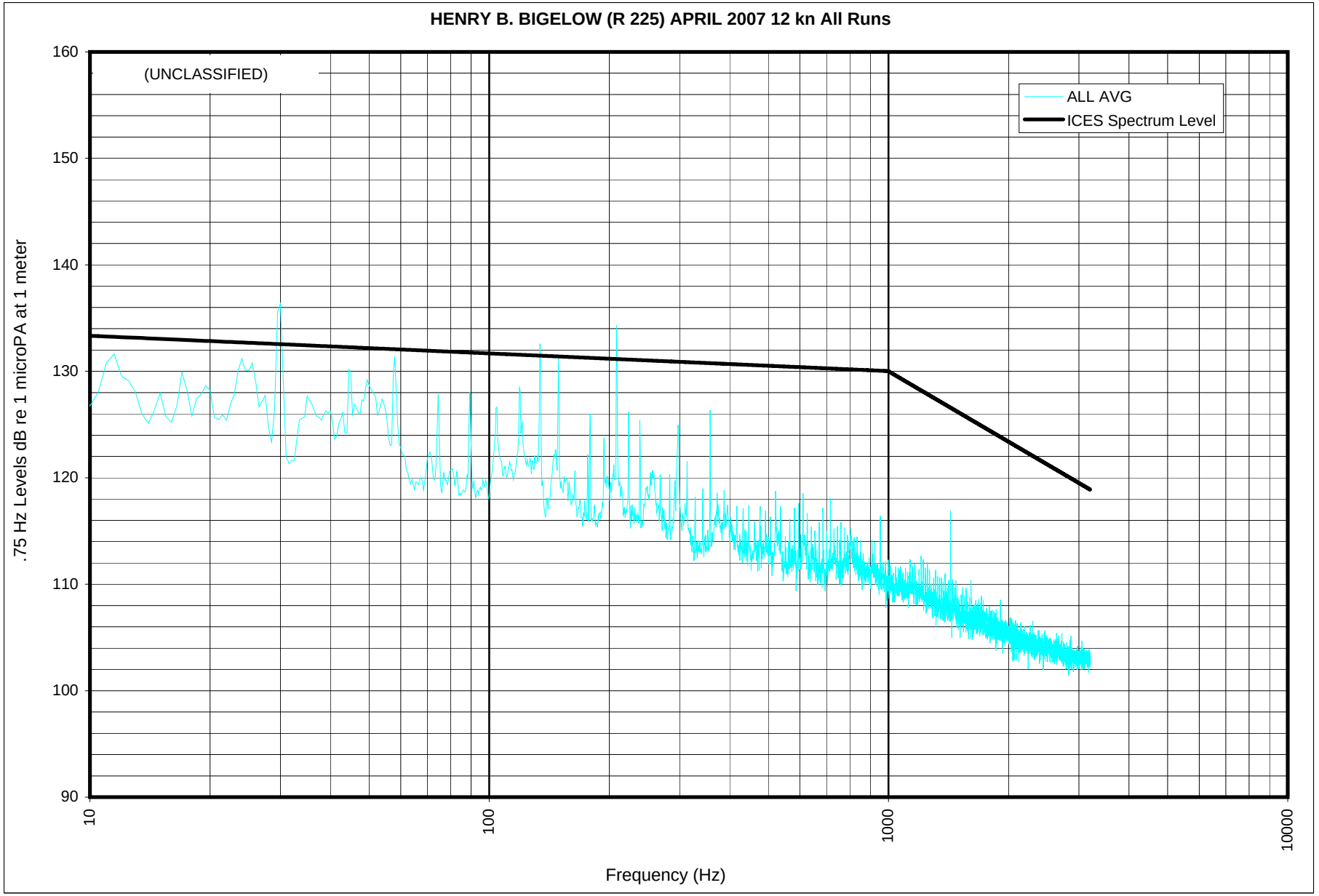

Figure A-41. Narrow bandwidth beam aspect signature at 12 knots, all runs averaged.

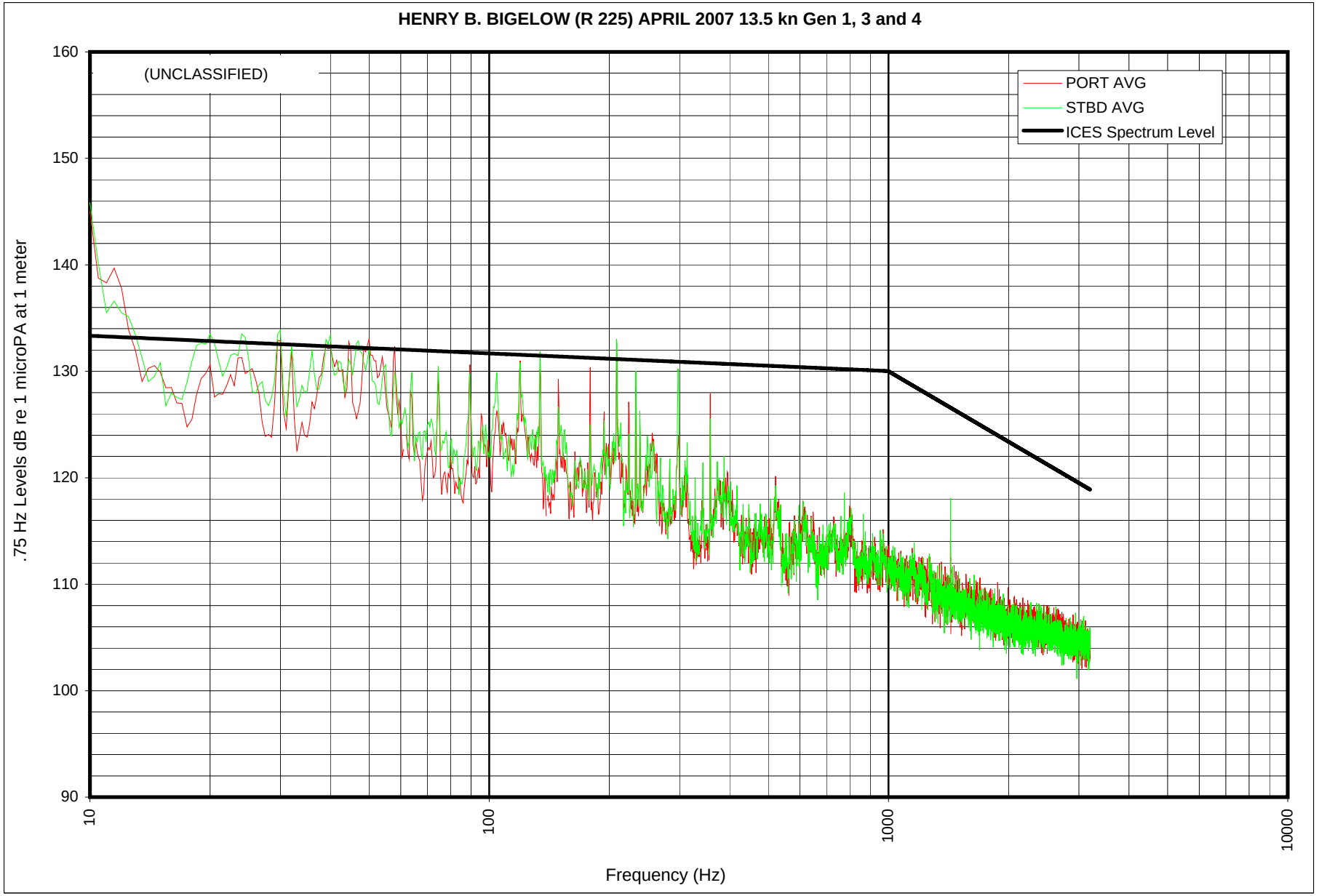

Figure A-42. Narrow bandwidth port and starboard signatures at 13.5 knots with generators 1, 3 and 4.

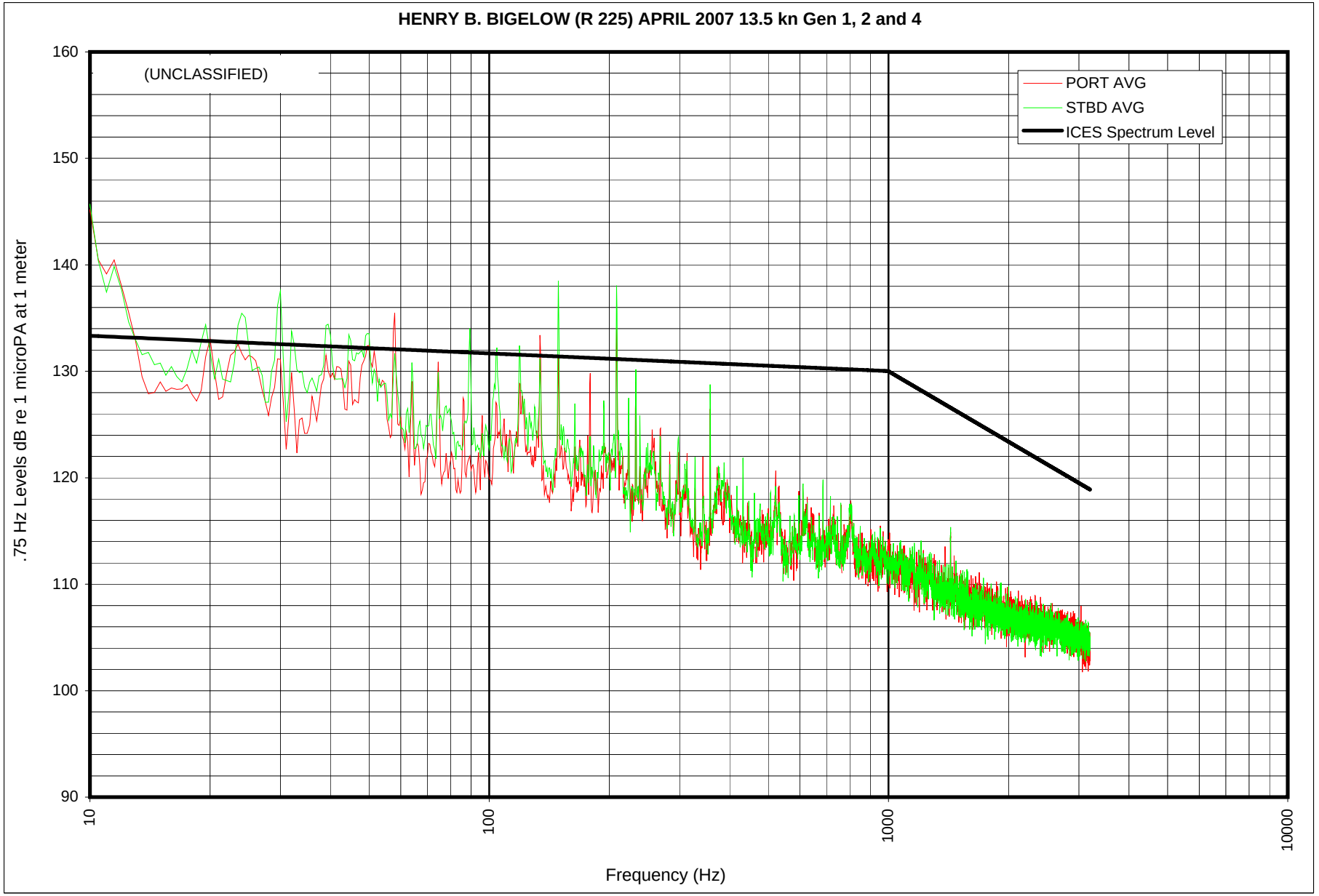

Figure A-43. Narrow bandwidth port and starboard signatures at 13.5 knots with generators 1, 2 and 4.

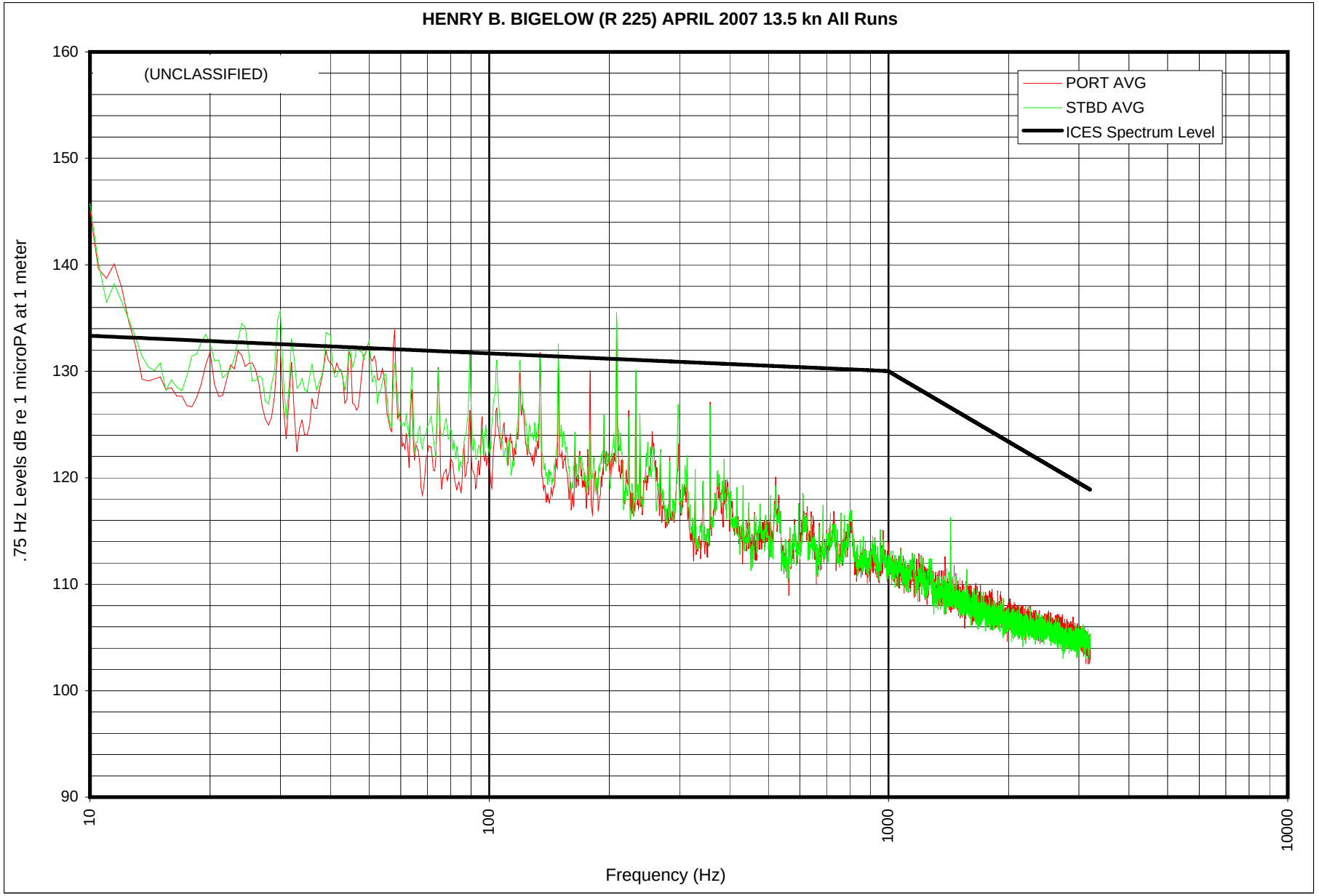

Figure A-44. Narrow bandwidth port and starboard signatures at 13.5 knots, all runs averaged.

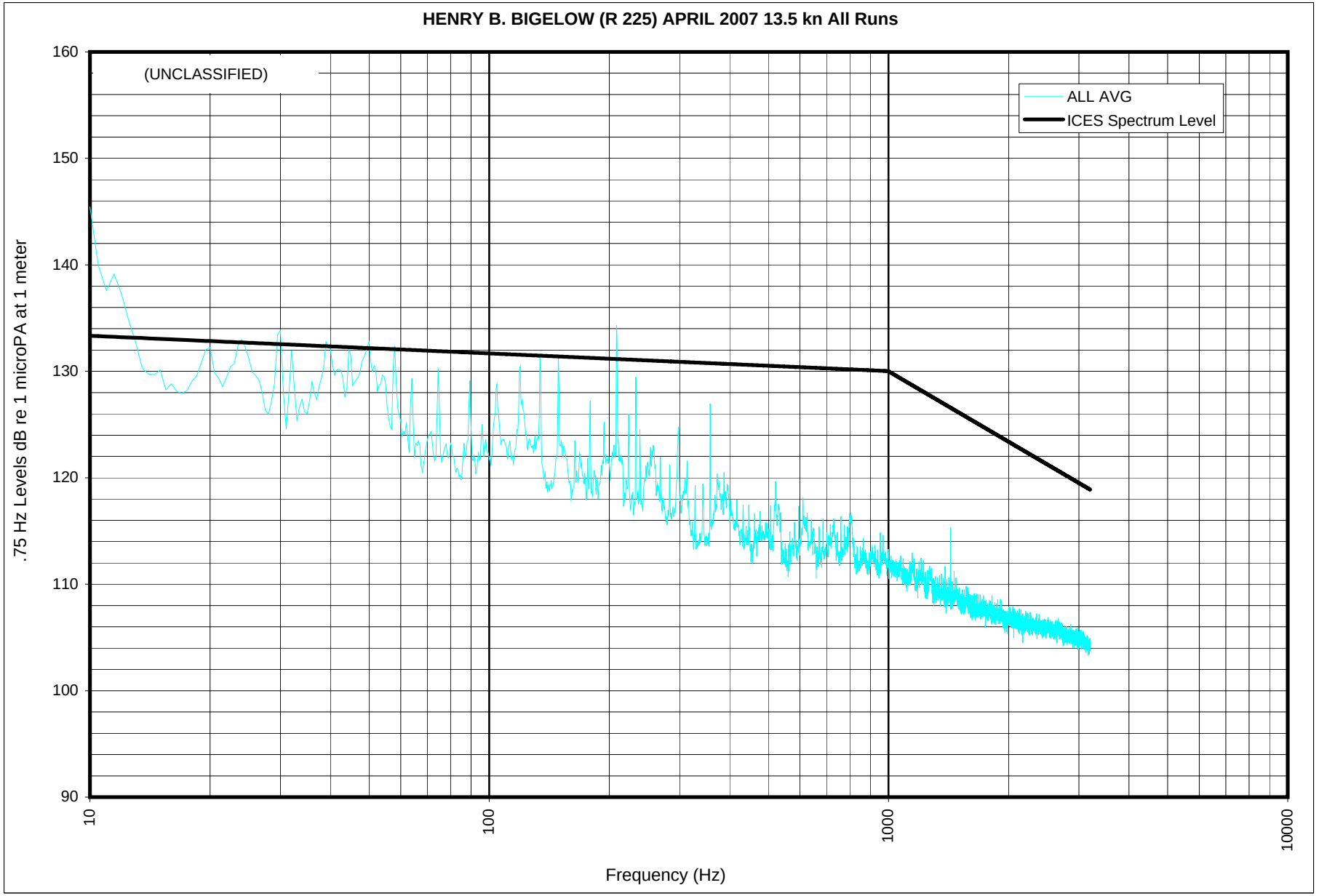

Figure A-45. Narrow bandwidth beam aspect signature at 13.5 knots, all runs averaged.

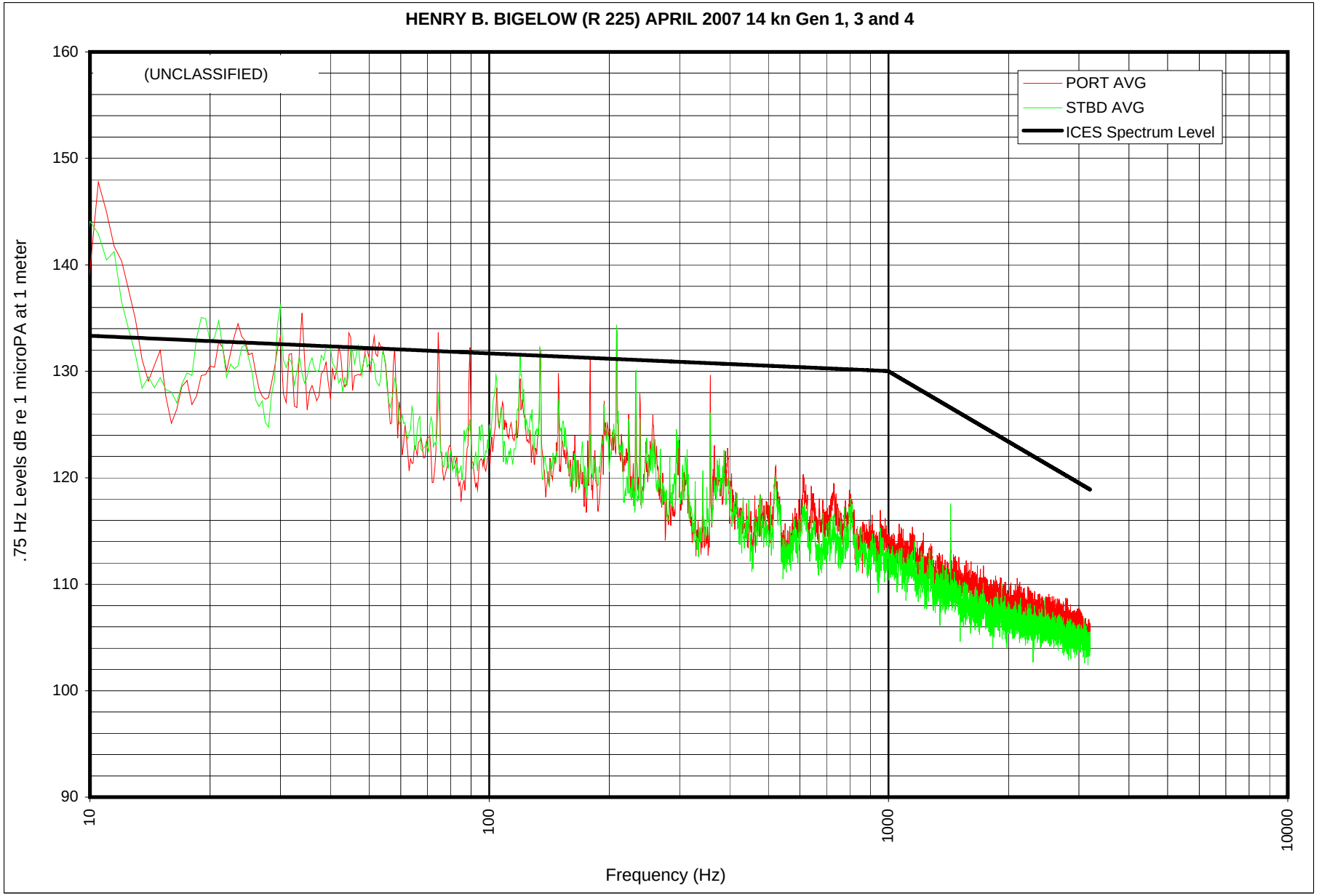

Figure A-46. Narrow bandwidth port and starboard signatures at 14 knots with generators 1, 3 and 4.

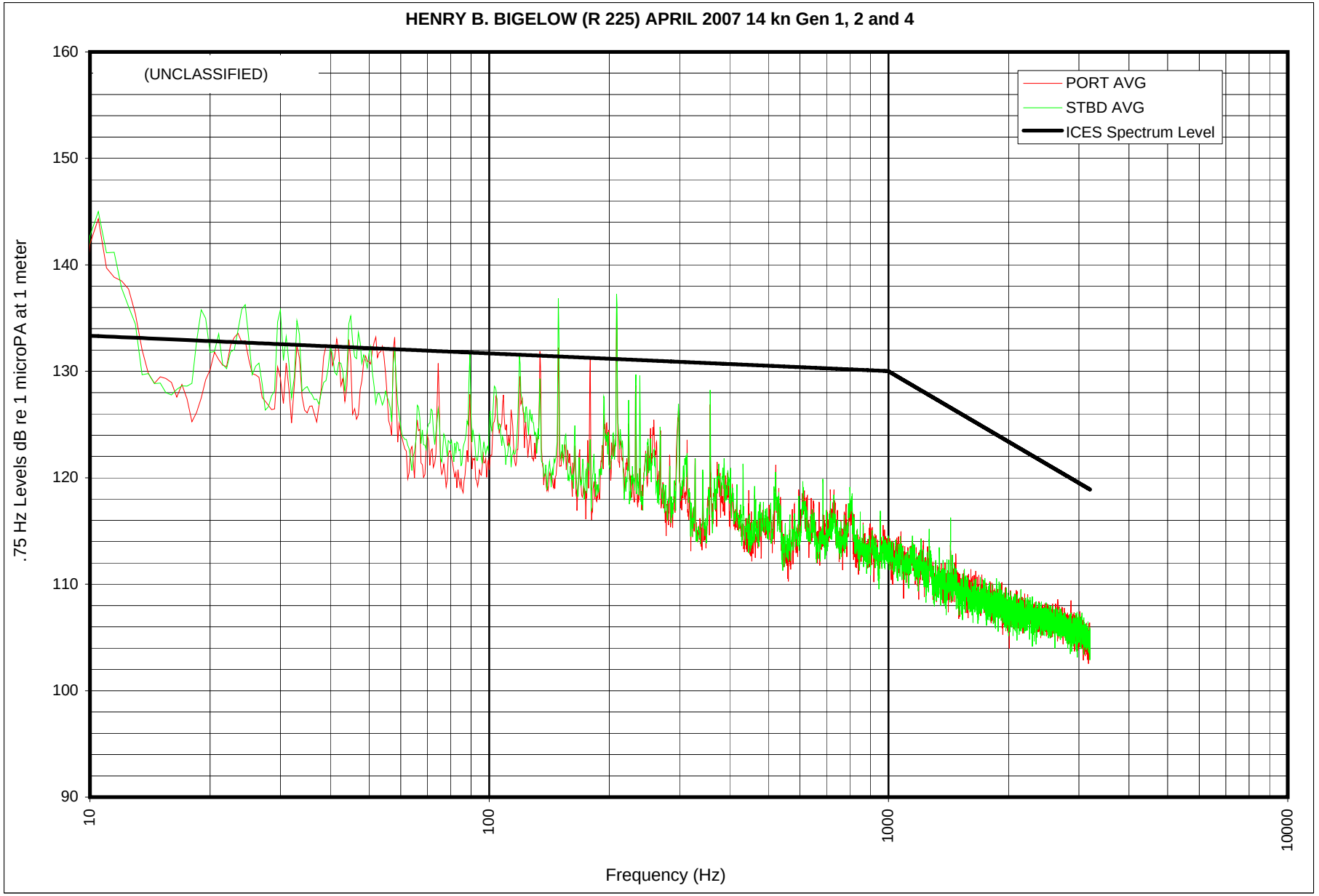

Figure A-47. Narrow bandwidth port and starboard signatures at 14 knots with generators 1, 2 and 4.

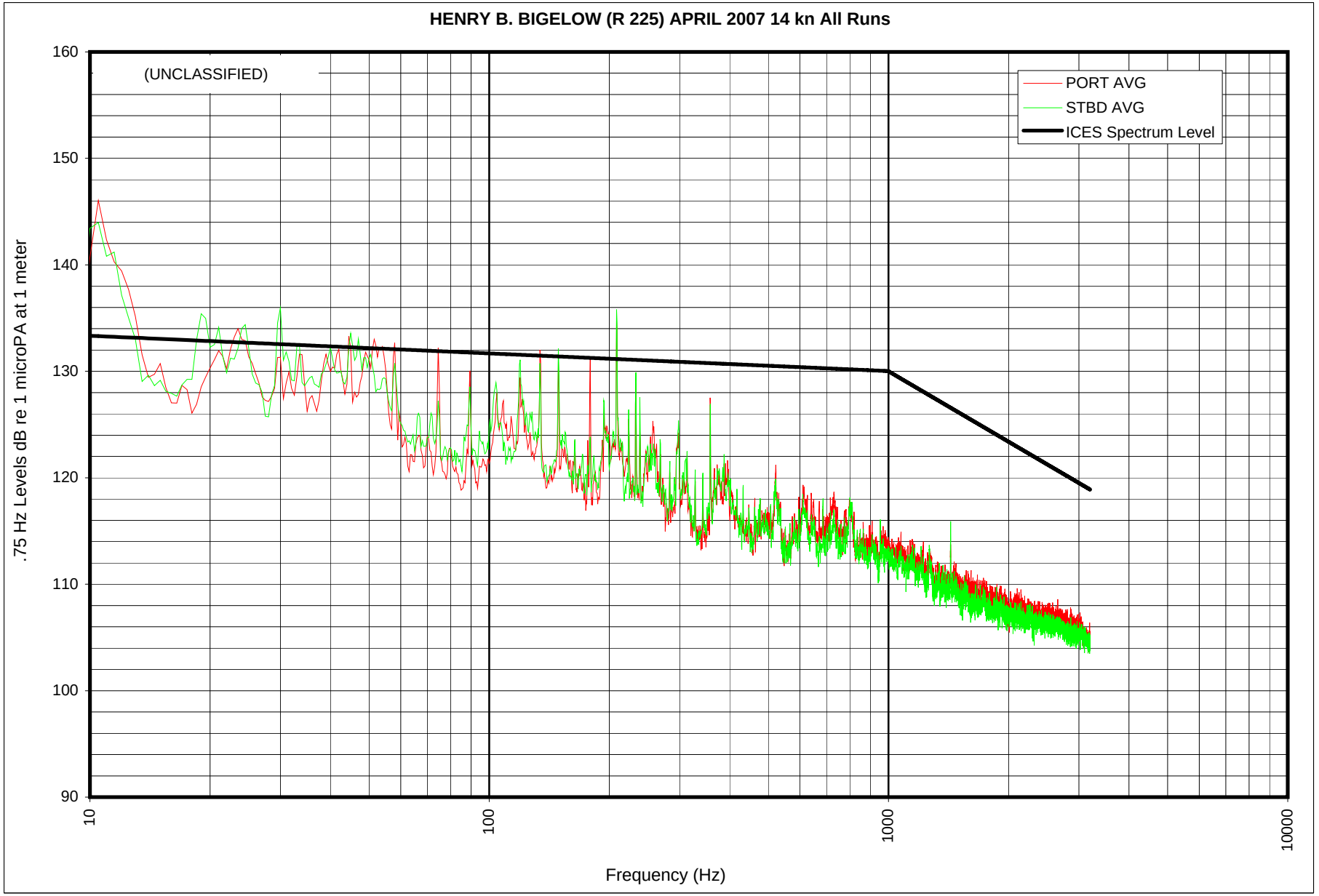

Figure A-48. Narrow bandwidth port and starboard signatures at 14 knots, all runs averaged.

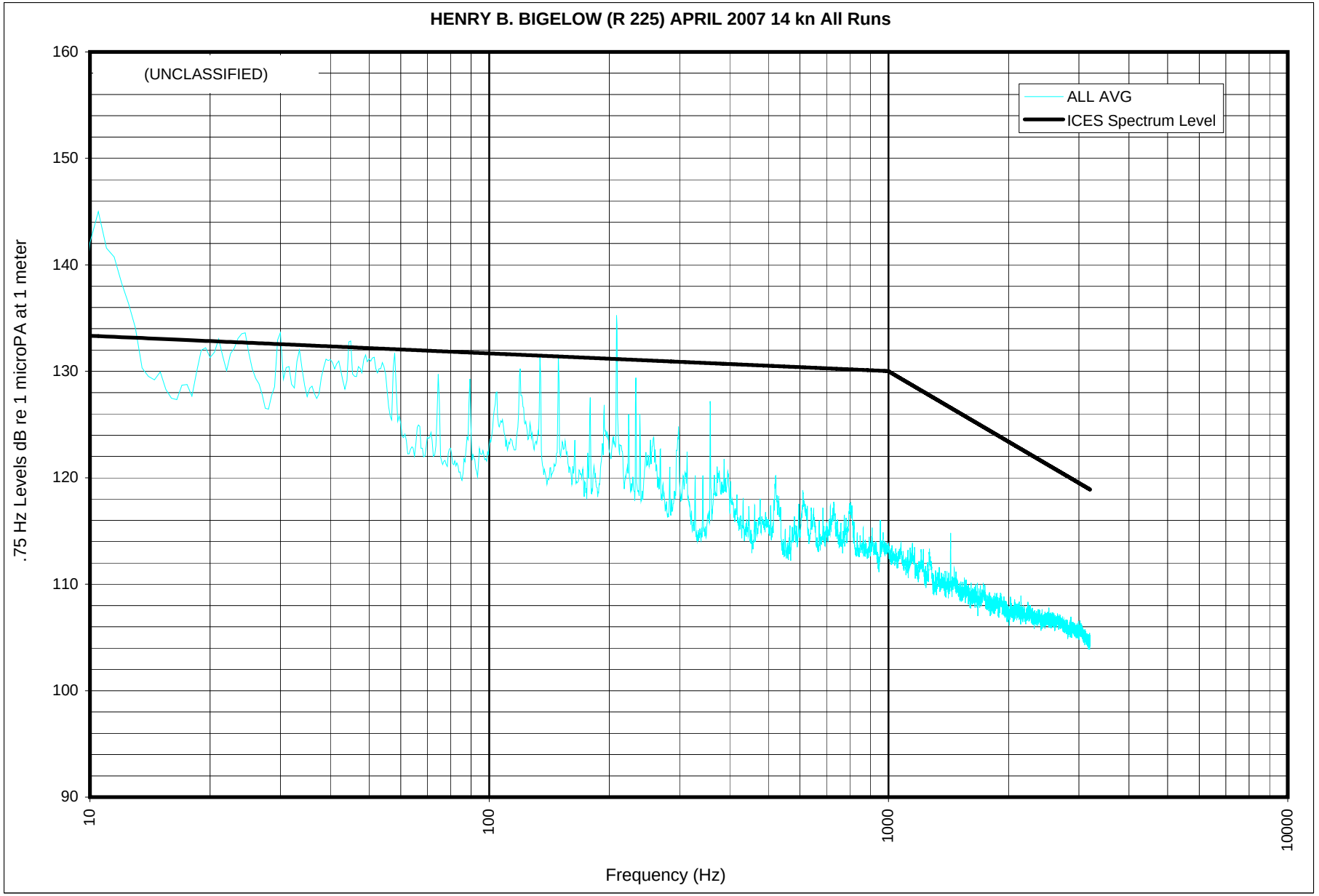

Figure A-49. Narrow bandwidth beam aspect signature at 14 knots, all runs averaged.

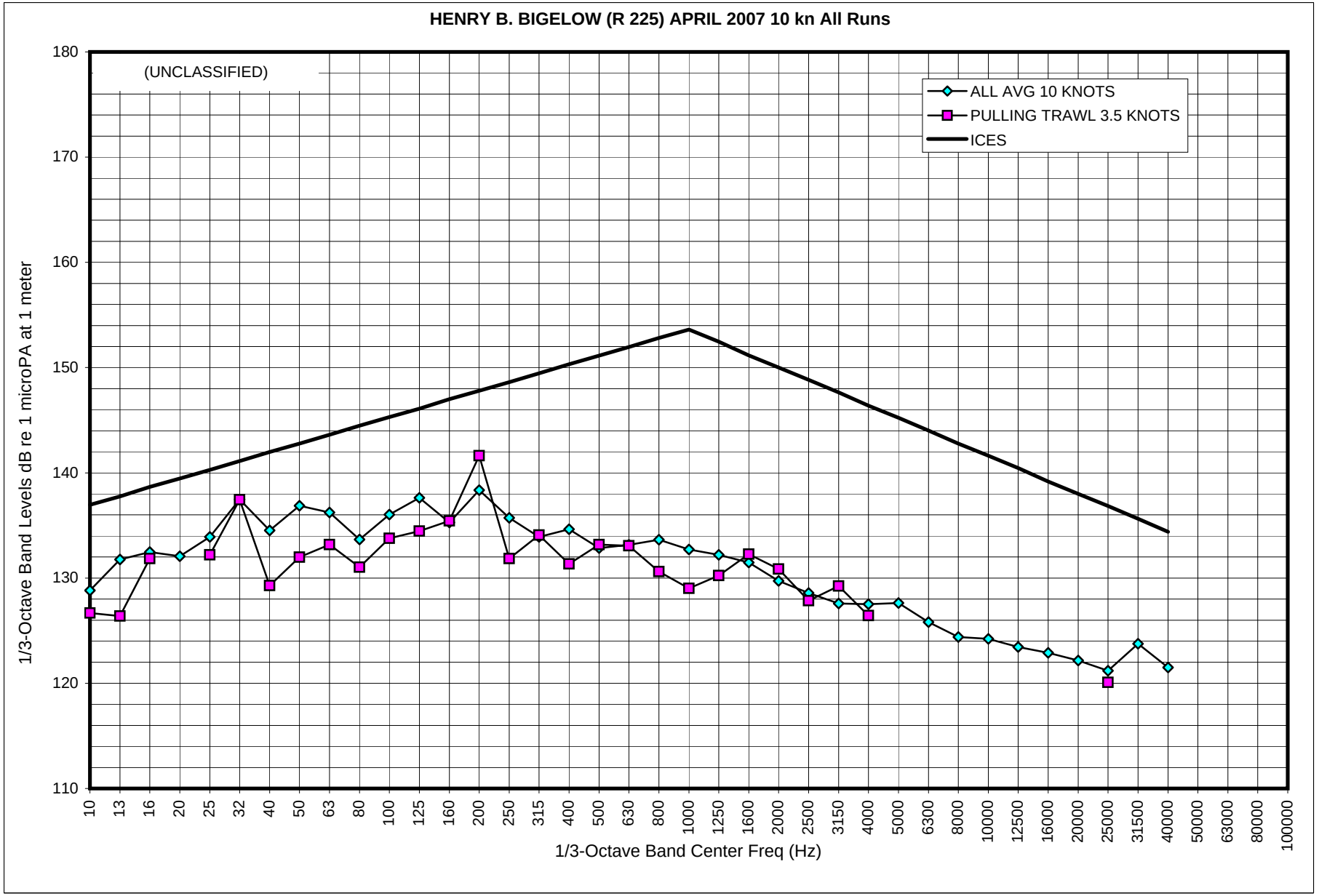

Figure A-50. One-third octave band beam aspect signature at 10 knots, all runs averaged and pulling trawl 3.5 knots.

STARBOARD 11 KN RUN 12010 WITH MARINE SANITATION DEVICE SECURED COMPARED TO BASELINE

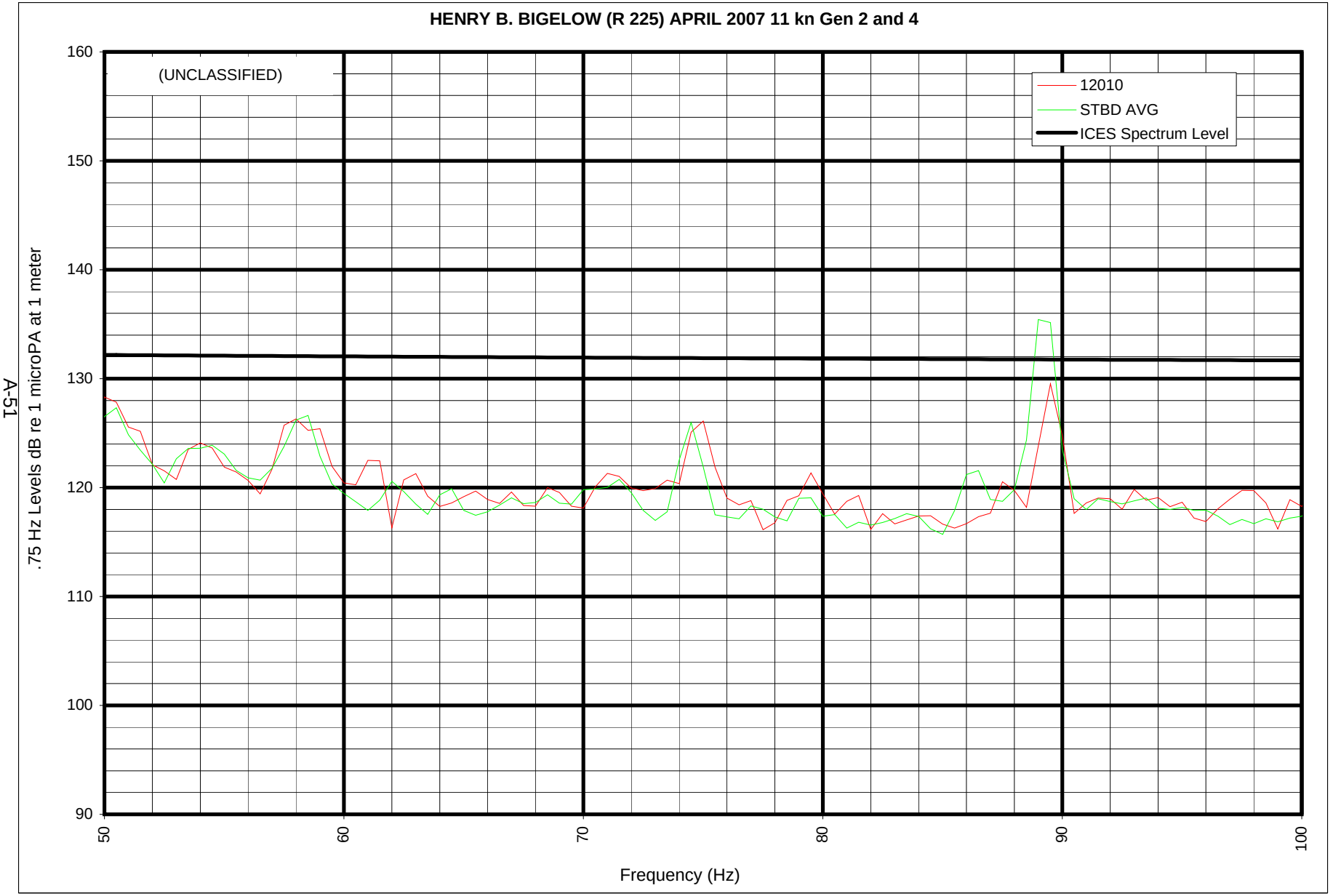

Figure A-51. Narrow bandwidth starboard signature at 11 knots, compared to diagnostic run with MSD secured.

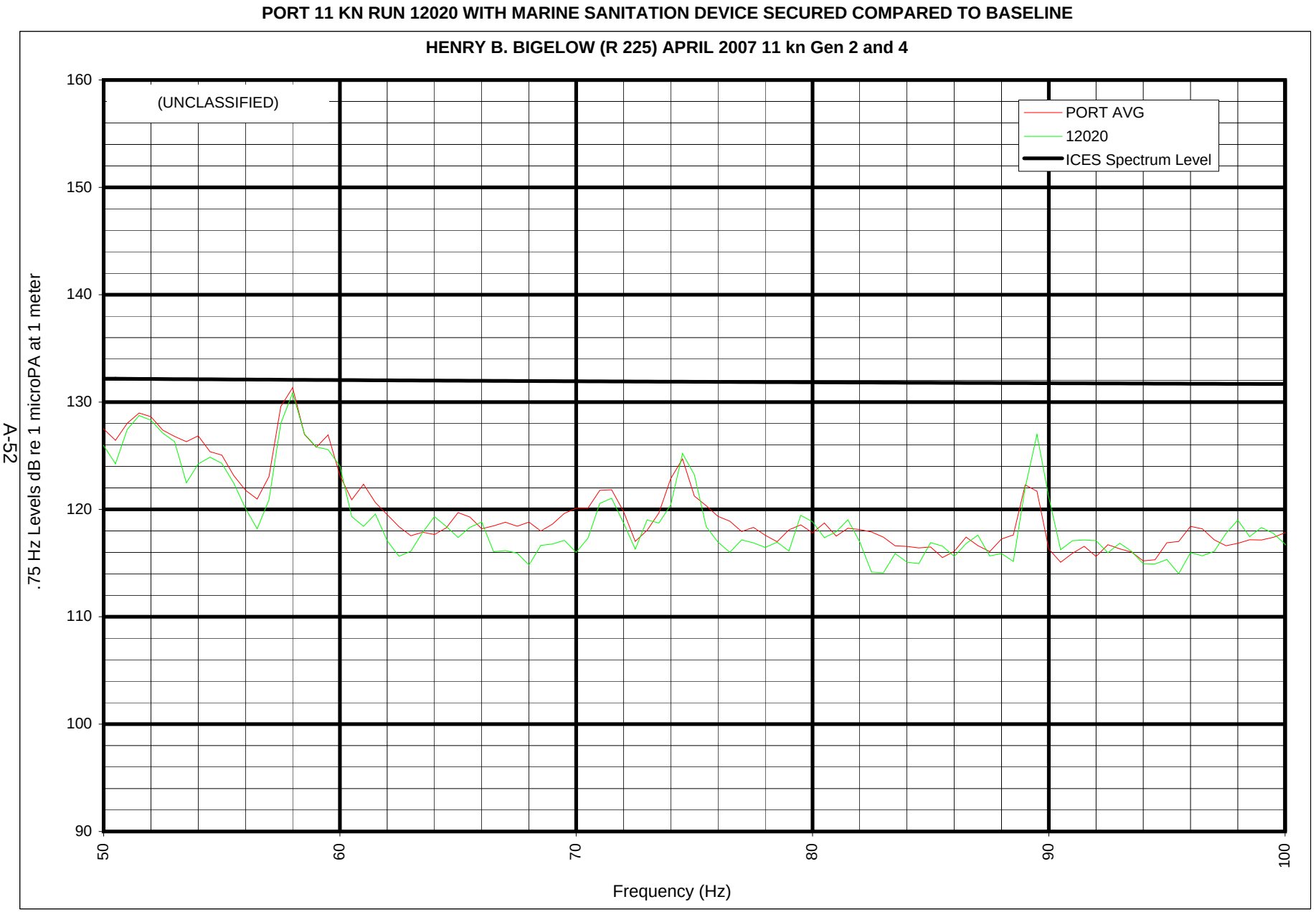

Figure A-52. Narrow bandwidth port signature at 11 knots, compared to diagnostic run with MSD secured.

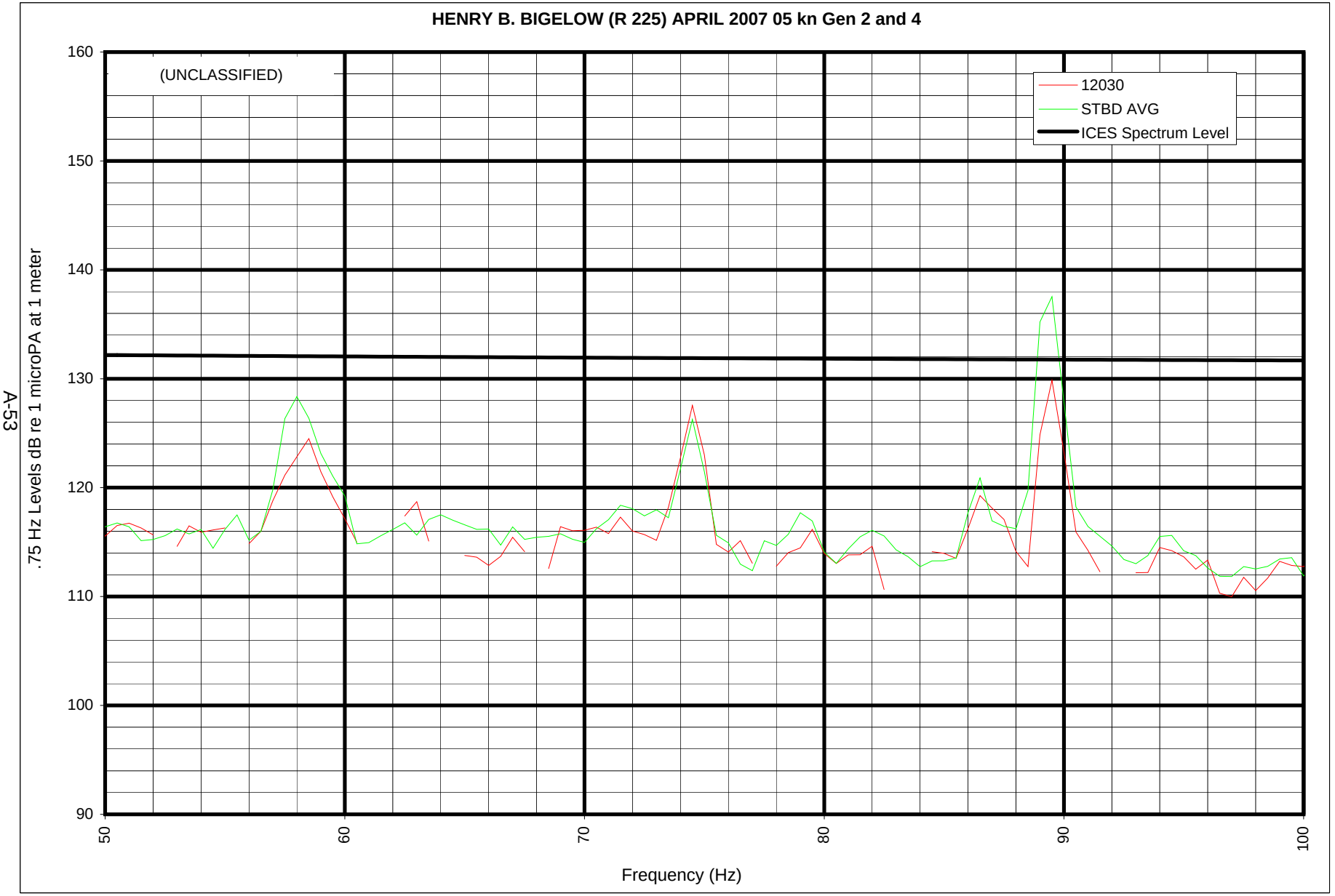

Figure A-53. Narrow bandwidth starboard signature at 5 knots, compared to diagnostic run with seawater ejector pumps secured.

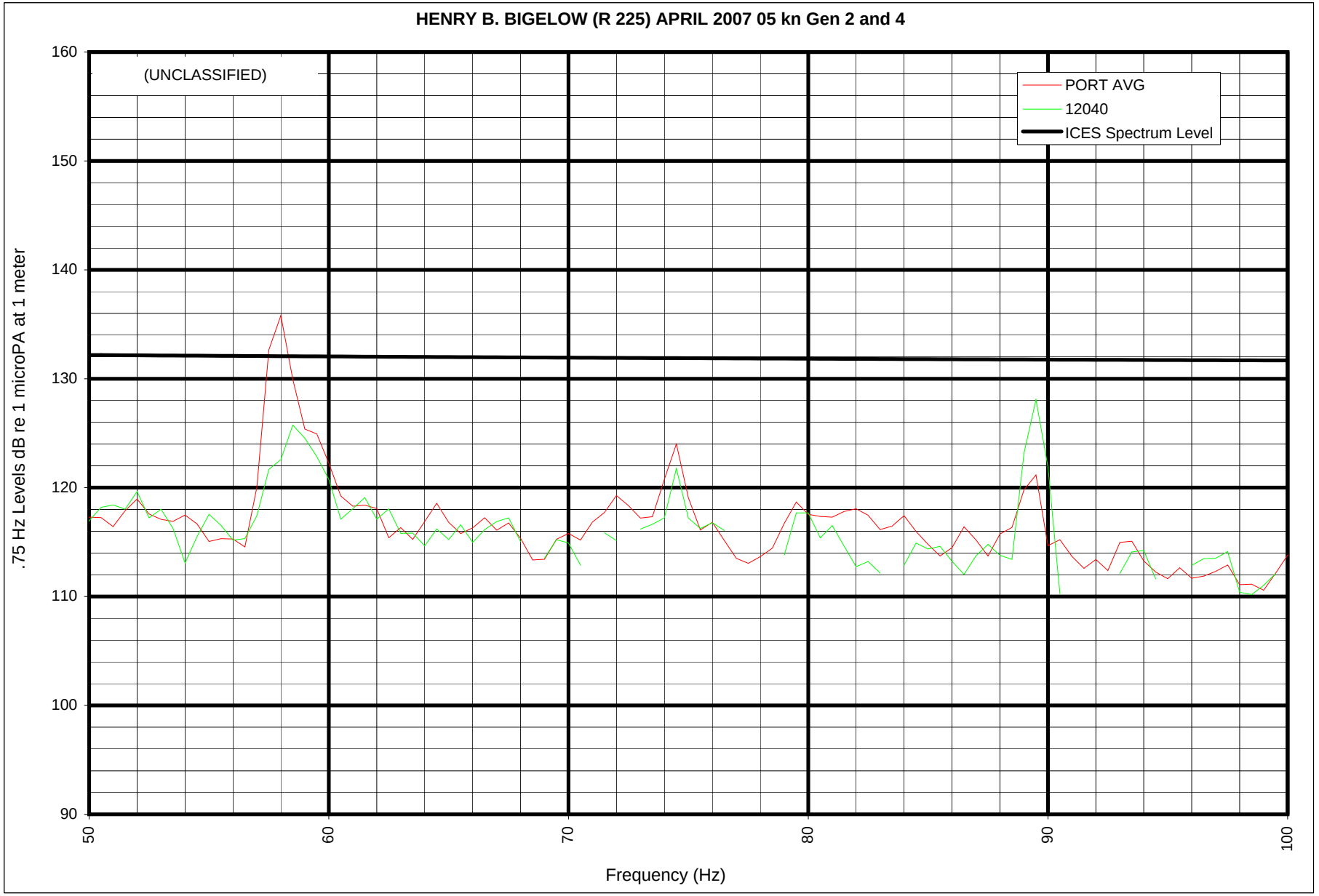

Figure A-54. Narrow bandwidth port signature at 5 knots, compared to diagnostic run with seawater ejector pumps and MSD secured.

STARBOARD 5 KN RUN 12050 WITH SEAWATER EJECTOR PUMPS AND MARINE SANITATION DEVICE SECURED COMPARED TO BASELINE

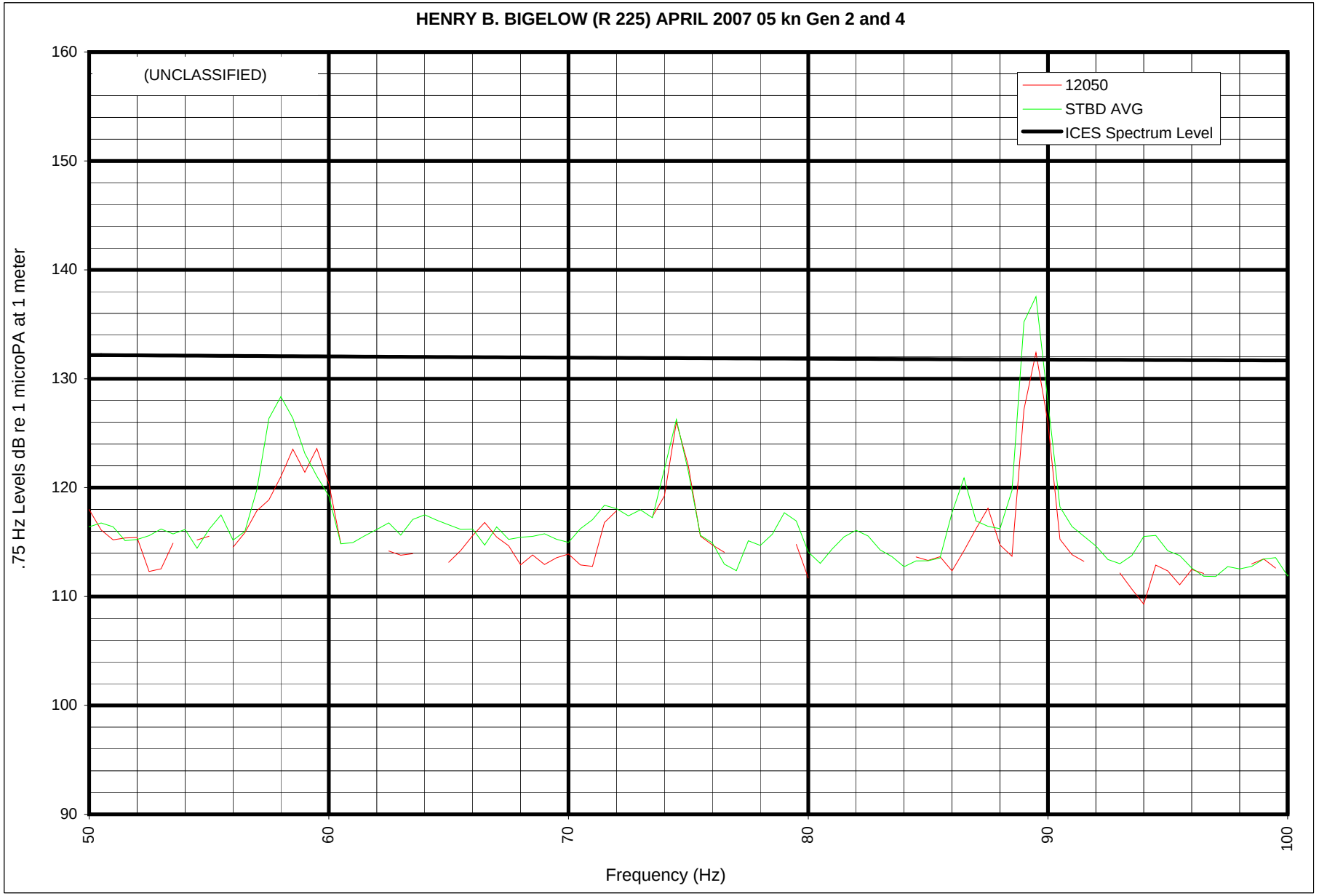

Figure A-55. Narrow bandwidth starboard signature at 5 knots, compared to diagnostic run with seawater ejector pumps and MSD secured.

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APPENDIX B:

NARROWBAND WIDTH LEVES vs. ICES

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HENRY B. BIGELOW April 2007 trial.

.75 Hz bandwidth levels dB relative to 1 microPA at 1 meter compared to ICES spectrum level limit

11 knots Generators 2 and 4			
Freq. (Hz)	Port aspect dB over ICES spectrum level limit	Starboard aspect dB over ICES spectrum level limit	Beam average dB over ICES spectrum level limit
29.5	0.4	1.4	1.4
30		0.5	0.5
89		3.2	
89.5		3.2	
148.5		7.6	2.6
149		7.6	2.6
178.5		0.7	
208		2.8	
208.5		2.8	

11 knots generators 1 and 3			
Freq. (Hz)	Port aspect dB over ICES spectrum level limit	Starboard aspect dB over ICES spectrum level limit	Beam average dB over ICES spectrum level limit
29.5	4.4	2.4	3.4
30	4.5	3.5	3.5
44.5	4.7	0.7	2.7
45	2.7		0.7
57.5	2.9		0.9
58	2.9		0.9
104	0.3		
134	4.5		0.5
208.5	3.8	3.8	3.8

11 knots all runs averaged			
Freq. (Hz)	Port aspect dB over ICES spectrum level limit	Starboard aspect dB over ICES spectrum level limit	Beam average dB over ICES spectrum level limit
29.5	2.4	2.4	2.4
30	2.5	1.5	1.5
58	0.9		
89.5		0.2	
134	1.5		0.5
149		0.6	
208		0.8	
208.5		2.8	1.8

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APPENDIX C:

STRUCTUREBORNE NOISE MAIN AND AUXILIARY MACHINERY TONES

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HENERY B. BIGELOW (R 225)
Post-Construction Acoustic Trial
April 2007

Auxiliary Machinery Tones >55 AdB with > 10 dB SNR
Frequency Resolution 1.25 Hz <1600 Hz 12.5 Hz >1600 Hz

SORTED BY FREQUENCY

UNCLASSIFIED

MACHINE	FREQ (Hz)	LEVEL	MACHINE	FREQ (Hz)	LEVEL
DIES GEN 2	1.25	101.9	MID MMR PORT	7.5	64.4
DIES GEN 2	1.25	95.2	TA04-DES/GEN STORS	7.5	63.5
DIES GEN 3	1.25	92.5	FWD MMR PORT	7.5	62.6
DIES GEN 3	1.25	91.3	AC02-EOS	7.5	62.1
DIES GEN 4	1.25	91.2	BOW THRUSTER RM PORT	7.5	62.1
STRG AFT STBD	1.25	88.2	TA04-DES/GEN STORS	7.5	61.8
DIES GEN 4	1.25	87.8	BOW THRUSTER RM STBD	7.5	61.4
DIES GEN 4	1.25	81.6	SEWAGE RM STBD	7.5	61.1
FO PURIFIER 2	1.25	80.7	AFT MMR STBD	7.5	60.4
DIES GEN 2	1.25	80.3	HOT WATER CIRC#1	7.5	59.3
SS XFRMR T2	1.25	79.5	AFT MMR PORT	7.5	58.3
E06-MAIN DECK EX	1.25	79.5	MID MMR STBD	7.5	57.2
DIES GEN 1	1.25	78.9	SEWAGE RM PORT	7.5	55.1
CHILL WTR PMP 3	1.25	78.8	STBD STRG HPU	8.75	82.0
FWD MMR STBD	1.25	78.7	PROPUL MTR AFT	8.75	77.3
DIES GEN 4	1.25	77.3	S03-MMR	8.75	77.2
DIES GEN 3	1.25	77.0	PROPUL MTR FWD	8.75	74.2
AFT MMR STBD	1.25	73.1	DIES GEN 2	8.75	73.0
CHILL WTR PMP 3	1.25	71.8	PROPUL MTR XFRMR (STBD)	8.75	70.7
DIES GEN 3	1.25	70.9	S05-OCEANWINCH RM	8.75	69.8
DIES GEN 4	1.25	70.3	PROPUL MTR XFRMR (PORT)	8.75	69.5
AC02-EOS	1.25	69.7	STBD STRG HPU	8.75	66.2
AC01-OA SUP A/C	1.25	66.6	PROPUL MTR AFT	8.75	61.2
TRANSDUCER RM PORT	1.25	63.2	SS XFRMR T2	8.75	60.9
DIES GEN 4	1.25	58.8	DIES GEN 2	8.75	60.1
TRAWLING HPU SYSTEM	1.25	58.1	PROPUL MTR XFRMR (STBD)	8.75	59.9
TRANSDUCER RM STBD	1.25	56.9	AC01-OA SUP A/C	8.75	58.5
DIES GEN 2	1.25	56.4	DIES GEN 2	8.75	58.1
DIES GEN 2	1.25	56.1	DIES GEN 1	8.75	57.4
BOW THRUSTER RM PORT	1.25	55.9	DIES GEN 2	8.75	56.7
TA04-DES/GEN STORS	1.25	55.5	PROPUL MTR FWD	8.75	56.6
S01-EMG GEN RM	2.5	59.4	DIES GEN 1	8.75	56.2
DIES GEN 3	6.25	59.4	AC PLANT 2	10	66.9
HOT WATER CIRC#1	7.5	73.0	THRUST BEARING	10	66.8
S06-TRWL WINCH RM	7.5	71.6	AC PLANT 1	10	65.8
STRG AFT PORT	7.5	71.0	MN SW COOL PMP 2	11.25	72.2
S06-TRWL WINCH RM	7.5	69.7	AUX SW COOL PMP 2	11.25	71.8
STRG AFT STBD	7.5	69.1	STBD STRG HPU	12.5	80.0
STRG FWD STBD	7.5	66.5	FO PURIFIER 2	12.5	76.4
SS XFRMR T1	7.5	66.1	PROPUL MTR AFT	12.5	75.4
SS XFRMR T2	7.5	64.8	PROPUL MTR FWD	12.5	73.5

UNCLASSIFIED

MACHINE	FREQ (Hz)	LEVEL	MACHINE	FREQ (Hz)	LEVEL
STRG FWD PORT	12.5	71.7	DIES GEN 2	25	87.5
THRUST BEARING	12.5	70.2	DIES GEN 1	25	86.6
AC PLANT 1	12.5	68.7	TA04-DES/GEN STORS	25	86.0
STBD STRG HPU	12.5	65.6	DIES GEN 4	25	85.3
TRANSDUCER RM PORT	12.5	64.7	DIES GEN 2	25	84.9
SS XFRMR T2	12.5	64.4	DIES GEN 2	25	84.7
MID MMR PORT	12.5	61.3	DIES GEN 4	25	84.6
STRG FWD STBD	12.5	61.1	DIES GEN 4	25	84.1
SS XFRMR T2	12.5	60.8	DIES GEN 3	25	82.2
SEWAGE RM STBD	12.5	60.4	DIES GEN 1	25	80.8
BOW THRUSTER RM PORT	12.5	58.3	DIES GEN 3	25	80.2
BOW THRUSTER RM STBD	12.5	57.9	DIES GEN 4	25	79.3
S06-TRWL WINCH RM	15	71.0	DIES GEN 3	25	77.3
PROPUL MTR FWD	15	68.7	DIES GEN 3	25	77.3
DIES GEN 1	15	66.1	DIES GEN 3	25	75.1
THRUST BEARING	15	60.7	S01-EMG GEN RM	25	60.8
STBD STRG HPU	16.25	75.5	SS XFRMR T1	25	58.8
PROPUL MTR XFRMR (PORT)	17.5	56.3	AC PLANT 2	27.5	63.0
E02-REEFR MACH RM	20	77.9	MARINE SAN UNIT	28.75	98.7
S02-MMR	20	76.5	EXTRA CUT 22	28.75	90.8
TRAWLING HPU SYSTEM	20	75.4	EXTRA CUT 24	28.75	85.1
E03-01 LOCKER	20	58.3	EXTRA CUT 26	28.75	82.7
TRAWLING HPU SYSTEM	20	55.9	EXTRA CUT 19	28.75	74.9
EXTRA CUT 21	21.25	74.2	EXTRA CUT 23	28.75	72.5
DIES GEN 2	21.25	73.6	EXTRA CUT 27	28.75	62.1
S05-OCEANWINCH RM	21.25	69.1	MARINE SAN UNIT	28.75	56.9
AC PLANT 1	21.25	62.3	S01-EMG GEN RM	30	97.6
EXTRA CUT 20	22.5	78.6	S02-MMR	30	96.4
DIES GEN 1	22.5	78.1	E03-01 LOCKER	30	96.0
DIES GEN 2	22.5	75.8	DIES GEN 1	30	93.9
DIES GEN 1	22.5	75.5	S03-MMR	30	93.7
DIES GEN 4	22.5	73.5	TA01-REFER MACH RM	30	90.6
DIES GEN 1	22.5	73.3	DIES GEN 3	30	90.6
DIES GEN 3	22.5	72.1	DIES GEN 2	30	90.3
DIES GEN 3	22.5	70.6	DIES GEN 1	30	90.3
DIES GEN 4	22.5	69.5	DIES GEN 2	30	89.7
DIES GEN 2	23.75	75.8	DIES GEN 4	30	89.2
S06-TRWL WINCH RM	23.75	70.8	DIES GEN 2	30	88.0
DIES GEN 1	23.75	70.5	DIES GEN 2	30	87.6
S06-TRWL WINCH RM	23.75	67.6	DIES GEN 4	30	87.6
DIES GEN 3	23.75	60.9	DIES GEN 1	30	87.1
REEFER #2	23.75	59.1	DIES GEN 1	30	86.7
S01-EMG GEN RM	25	96.8	TA04-DES/GEN STORS	30	86.4
S02-MMR	25	95.6	DIES GEN 4	30	85.7
E03-01 LOCKER	25	95.2	DIES GEN 1	30	84.9
DIES GEN 1	25	93.0	DIES GEN 3	30	84.9
TA01-REFER MACH RM	25	90.0	DIES GEN 2	30	84.7
DIES GEN 1	25	89.7	DIES GEN 4	30	84.5
DIES GEN 2	25	89.2	TA01-REFER MACH RM	30	84.4

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MACHINE	FREQ (Hz)	LEVEL	MACHINE	FREQ (Hz)	LEVEL
DIES GEN 2	30	84.3	DIES GEN 4	45	83.4
DIES GEN 4	30	83.5	DIES GEN 4	45	83.0
DIES GEN 3	30	82.0	S06-TRWL WINCH RM	45	74.8
DIES GEN 3	30	81.0	DIES GEN 1	45	69.1
DIES GEN 4	30	80.8	DIES GEN 2	45	67.3
DIES GEN 2	30	80.6	DIES GEN 4	45	67.2
DIES GEN 4	30	80.5	DIES GEN 1	45	66.5
DIES GEN 3	30	80.2	DIES GEN 2	45	66.3
DIES GEN 4	30	79.5	DIES GEN 3	45	65.2
DIES GEN 1	30	78.4	DIES GEN 4	45	65.1
S06-TRWL WINCH RM	30	77.6	DIES GEN 1	45	64.6
S02-MMR	30	75.9	S01-EMG GEN RM	45	62.5
EXTRA CUT 13	30	75.4	E04-GALLEY	46.25	62.1
TA04-DES/GEN STORS	30	75.4	TRAWLING HPU SYSTEM	47.5	59.7
DIES GEN 3	30	75.3	CHILL WTR PMP 3	51.25	68.4
REEFER #2	30	75.3	EXTRA CUT 11	57.5	99.1
S05-OCEANWINCH RM	30	73.8	EXTRA CUT 17	57.5	98.1
EXTRA CUT 17	30	72.6	EXTRA CUT 22	57.5	92.4
S03-MMR	30	72.1	FW DIS EJECT PMP 2	57.5	90.8
E02-REEFR MACH RM	30	71.8	EXTRA CUT 13	57.5	89.5
STBD STRG HPU	30	71.8	AC02-EOS	57.5	87.8
DIES GEN 3	30	71.2	MARINE SAN UNIT	57.5	87.6
EXTRA CUT 11	30	71.1	EXTRA CUT 15	57.5	83.6
S06-TRWL WINCH RM	30	71.0	EXTRA CUT 19	57.5	82.8
FW DISTILLER 2	30	70.7	EXTRA CUT 14	57.5	82.4
DIES GEN 3	30	66.0	EXTRA CUT 24	57.5	82.0
S01-EMG GEN RM	30	65.5	EXTRA CUT 18	57.5	80.9
AC PLANT 2	30	64.7	AC02-EOS	57.5	79.7
S05-OCEANWINCH RM	30	63.9	EXTRA CUT 26	57.5	74.5
DIES GEN 1	30	62.3	EXTRA CUT 12	57.5	73.4
DIES GEN 3	30	62.3	EXTRA CUT 16	57.5	72.8
REEFER #2	30	61.8	EXTRA CUT 23	57.5	68.1
E02-REEFR MACH RM	30	61.2	FW DIS EJECT PMP 2	57.5	64.1
DIES GEN 4	30	59.6	FWD MMR PORT	57.5	62.1
E03-01 LOCKER	30	59.5	E02-REEFR MACH RM	58.75	95.2
DIES GEN 4	30	58.6	E06-MAIN DECK EX	58.75	92.2
DIES GEN 3	30	58.1	AC01-OA SUP A/C	58.75	90.7
DIES GEN 2	30	57.8	AC01-OA SUP A/C	58.75	85.6
PROPUL MTR XFRMR (PORT)	30	57.6	FO PURIFIER 2	58.75	84.3
SS XFRMR T1	30	57.6	E02-REEFR MACH RM	58.75	83.2
FW DISTILLER 2	40	67.8	TA04-DES/GEN STORS	58.75	79.2
AC02-EOS	41.25	69.2	E04-GALLEY	58.75	78.8
DIES GEN 2	45	98.2	E03-01 LOCKER	58.75	75.5
DIES GEN 2	45	97.5	HOT WATER CIRC#1	58.75	71.2
DIES GEN 1	45	96.7	TA04-DES/GEN STORS	58.75	67.7
DIES GEN 1	45	96.4	AC PLANT 2	58.75	67.4
DIES GEN 4	45	90.2	REEFER #2	58.75	66.2
DIES GEN 3	45	88.8	E03-01 LOCKER	58.75	66.2
DIES GEN 2	45	86.5	DIES GEN 4	60	97.7

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MACHINE	FREQ (Hz)	LEVEL	MACHINE	FREQ (Hz)	LEVEL
DIES GEN 2	60	94.8	DIES GEN 4	75	109.0
DIES GEN 3	60	94.5	DIES GEN 4	75	107.2
S02-MMR	60	93.5	DIES GEN 3	75	105.3
DIES GEN 2	60	93.0	DIES GEN 2	75	103.6
DIES GEN 1	60	92.4	DIES GEN 1	75	101.3
DIES GEN 1	60	89.9	DIES GEN 2	75	100.1
S03-MMR	60	89.2	DIES GEN 4	75	99.8
DIES GEN 3	60	89.0	DIES GEN 1	75	99.7
DIES GEN 4	60	86.7	DIES GEN 3	75	99.1
DIES GEN 4	60	86.2	DIES GEN 1	75	96.9
DIES GEN 1	60	86.0	DIES GEN 2	75	96.3
DIES GEN 2	60	82.7	DIES GEN 4	75	95.9
S01-EMG GEN RM	60	77.8	DIES GEN 1	75	94.0
S02-MMR	60	75.5	DIES GEN 3	75	93.9
TA01-REFER MACH RM	60	72.2	DIES GEN 2	75	92.6
REEFER #2	60	71.4	FW DISTILLER 2	75	77.2
TA01-REFER MACH RM	60	66.2	DIES GEN 4	75	70.9
STBD STRG HPU	60	65.7	DIES GEN 1	75	68.4
DIES GEN 4	60	65.2	DIES GEN 3	75	68.4
DIES GEN 3	60	64.5	DIES GEN 4	75	67.2
DIES GEN 4	60	64.5	DIES GEN 2	75	66.9
DIES GEN 2	60	62.5	DIES GEN 4	75	65.8
DIES GEN 1	60	62.2	DIES GEN 1	75	65.5
DIES GEN 1	60	61.7	DIES GEN 2	75	65.1
DIES GEN 2	60	61.1	DIES GEN 2	75	65.1
DIES GEN 1	60	61.1	DIES GEN 3	75	64.8
DIES GEN 3	60	60.0	DIES GEN 1	75	64.5
DIES GEN 2	60	59.7	DIES GEN 4	75	63.8
DIES GEN 4	60	59.6	DIES GEN 2	75	58.3
FWD MMR STBD	60	58.3	DIES GEN 1	75	58.3
DIES GEN 3	60	58.1	DIES GEN 3	75	57.8
MID MMR STBD	60	57.0	SS XFRMR T2	75	56.9
PROPUL MTR XFRMR (STBD)	60	55.9	S01-EMG GEN RM	75	56.9
DIES GEN 1	60	55.9	TRAWLING HPU SYSTEM	78.75	76.9
PROPUL MTR XFRMR (PORT)	60	55.5	EXTRA CUT 22	86.25	104.2
FW DIS EJECT PMP 2	62.5	96.7	EXTRA CUT 25	86.25	82.8
E02-REEFR MACH RM	62.5	95.8	EXTRA CUT 27	86.25	75.7
S03-MMR	62.5	93.2	EXTRA CUT 23	86.25	75.6
E06-MAIN DECK EX	62.5	91.9	EXTRA CUT 24	86.25	71.5
AC01-OA SUP A/C	62.5	90.1	EXTRA CUT 26	86.25	67.7
AC02-EOS	62.5	87.9	AC PLANT 2	86.25	66.8
E02-REEFR MACH RM	62.5	83.7	DIES GEN 3	87.5	122.7
AC02-EOS	62.5	77.3	DIES GEN 4	87.5	121.9
E03-01 LOCKER	62.5	76.4	DIES GEN 1	87.5	113.0
REEFER #2	62.5	67.3	MARINE SAN UNIT	87.5	111.5
EXTRA CUT 15	66.25	67.9	MARINE SAN UNIT	87.5	104.4
E02-REEFR MACH RM	66.25	56.7	DIES GEN 3	87.5	86.4
AC PLANT 2	71.25	74.6	DIES GEN 4	87.5	80.8
PROPUL MTR AFT	72.5	69.9	HOT WATER CIRC#1	87.5	76.1

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MACHINE	FREQ (Hz)	LEVEL
DIES GEN 3	87.5	75.9
DIES GEN 4	87.5	72.0
DIES GEN 1	87.5	70.4
DIES GEN 2	87.5	69.5
MARINE SAN UNIT	87.5	69.2
MARINE SAN UNIT	87.5	68.5
DIES GEN 3	87.5	66.7
PROPUL MTR FWD	87.5	61.4
DIES GEN 3	88.75	123.1
DIES GEN 3	88.75	108.9
DIES GEN 3	88.75	103.8
DIES GEN 3	88.75	101.3
DIES GEN 3	88.75	84.8
DIES GEN 3	88.75	75.0
TA04-DES/GEN STORS	88.75	73.8
DIES GEN 3	88.75	71.7
TA04-DES/GEN STORS	88.75	67.3
FWD MMR STBD	88.75	66.1
DIES GEN 3	88.75	64.2
S05-OCEANWINCH RM	88.75	58.0
DIES GEN 4	90	122.2
DIES GEN 1	90	113.2
DIES GEN 2	90	112.7
DIES GEN 2	90	110.0
DIES GEN 4	90	106.1
DIES GEN 4	90	104.4
DIES GEN 4	90	103.4
DIES GEN 1	90	99.8
DIES GEN 2	90	96.4
DIES GEN 1	90	95.7
DIES GEN 1	90	93.0
DIES GEN 2	90	90.4
DIES GEN 4	90	80.8
DIES GEN 1	90	76.8
DIES GEN 2	90	75.5
DIES GEN 4	90	72.0
DIES GEN 1	90	70.6
S01-EMG GEN RM	90	69.7
DIES GEN 2	90	69.5
DIES GEN 4	90	67.7
DIES GEN 4	90	67.5
DIES GEN 2	90	66.7
FW DISTILLER 2	90	64.9
CHILL WTR PMP 3	90	64.8
DIES GEN 2	90	64.8
DIES GEN 1	90	63.4
DIES GEN 1	90	58.1
PROPUL MTR XFRMR (PORT)	90	57.3
REEFER #2	90	55.2
PROPUL MTR FWD	91.25	64.3
DIES GEN 3	100	117.8
DIES GEN 4	100	116.5
DIES GEN 3	103.8	117.1
DIES GEN 3	103.8	104.2
DIES GEN 3	103.8	97.2
DIES GEN 3	103.8	93.6
FWD MMR STBD	103.8	75.7
DIES GEN 3	103.8	75.6
MID MMR STBD	103.8	66.5
AFT MMR STBD	103.8	61.8
EXTRA CUT 14	103.8	60.7
DIES GEN 3	103.8	59.6
EXTRA CUT 12	103.8	56.3
DIES GEN 4	105	117.2
DIES GEN 2	105	110.4
DIES GEN 1	105	110.3
DIES GEN 2	105	108.6
DIES GEN 4	105	106.9
DIES GEN 1	105	105.4
DIES GEN 2	105	100.2
DIES GEN 4	105	98.4
DIES GEN 1	105	96.6
DIES GEN 2	105	93.2
DIES GEN 1	105	92.1
DIES GEN 4	105	91.9
DIES GEN 4	105	76.6
DIES GEN 2	105	75.6
DIES GEN 1	105	74.7
DIES GEN 2	105	74.2
DIES GEN 4	105	71.0
DIES GEN 1	105	69.3
DIES GEN 1	105	68.3
FW DISTILLER 2	105	66.3
DIES GEN 2	105	65.6
DIES GEN 4	105	65.4
DIES GEN 2	105	64.8
DIES GEN 1	105	62.9
S01-EMG GEN RM	105	55.1
AC01-OA SUP A/C	106.3	68.5
S03-MMR	107.5	81.4
E03-01 LOCKER	107.5	66.6
E03-01 LOCKER	107.5	63.3
S02-MMR	108.8	81.8
STBD STRG HPU	108.8	56.6
S05-OCEANWINCH RM	111.3	67.6
DIES GEN 2	112.5	114.3
THRUST BEARING	112.5	64.6
EXTRA CUT 22	115	79.0

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MACHINE	FREQ (Hz)	LEVEL	MACHINE	FREQ (Hz)	LEVEL
EXTRA CUT 25	115	57.4	AC01-OA SUP A/C	120	76.5
EXTRA CUT 24	116.3	66.8	SS XFRMR T1	120	76.3
EXTRA CUT 26	116.3	63.9	AC PLANT 2	120	75.4
AC01-OA SUP A/C	117.5	75.0	SS XFRMR T2	120	74.3
DIES GEN 3	118.8	118.6	E02-REEFR MACH RM	120	70.4
DIES GEN 3	118.8	111.3	S05-OCEANWINCH RM	120	69.2
DIES GEN 3	118.8	110.7	PROPUL MTR XFRMR (STBD)	120	67.7
DIES GEN 3	118.8	104.5	DIES GEN 1	120	67.3
AC02-EOS	118.8	96.5	DIES GEN 2	120	66.2
AC02-EOS	118.8	90.6	FW DISTILLER 2	120	65.6
TA04-DES/GEN STORS	118.8	81.0	DIES GEN 4	120	64.9
TRAWLING HPU SYSTEM	118.8	79.5	TA04-DES/GEN STORS	120	64.9
REEFER #2	118.8	79.4	S01-EMG GEN RM	120	63.0
DIES GEN 3	118.8	78.5	DIES GEN 2	120	61.2
FO PURIFIER 2	118.8	76.3	AC PLANT 2	120	60.6
DIES GEN 3	118.8	75.1	TA01-REFER MACH RM	120	60.5
FWD MMR STBD	118.8	70.8	DIES GEN 1	120	59.9
HOT WATER CIRC#1	118.8	69.0	STBD STRG HPU	120	59.9
MID MMR STBD	118.8	68.8	AC PLANT 1	120	59.4
DIES GEN 3	118.8	64.7	AUX SW COOL PMP 1	120	57.5
AFT MMR STBD	118.8	61.5	AUX SW COOL PMP 2	120	57.3
DIES GEN 3	118.8	59.1	PROPUL MTR XFRMR (PORT)	120	57.3
DIES GEN 3	118.8	57.2	DIES GEN 4	125	115.1
HOT WATER CIRC#1	118.8	56.6	DIES GEN 1	125	113.9
DIES GEN 3	118.8	55.4	DIES GEN 4	125	110.6
DIES GEN 4	120	119.0	DIES GEN 3	125	110.4
DIES GEN 4	120	115.9	AC02-EOS	125	95.9
DIES GEN 2	120	115.2	E06-MAIN DECK EX	125	93.3
DIES GEN 1	120	114.8	AC02-EOS	125	86.7
DIES GEN 4	120	112.4	DIES GEN 2	125	82.2
DIES GEN 4	120	111.3	DIES GEN 2	125	81.6
DIES GEN 2	120	109.6	DIES GEN 1	125	80.3
DIES GEN 1	120	108.0	DIES GEN 1	125	76.9
DIES GEN 2	120	97.9	SS XFRMR T1	125	75.3
DIES GEN 2	120	95.9	SS XFRMR T2	125	73.4
E06-MAIN DECK EX	120	93.8	TA01-REFER MACH RM	125	68.3
DIES GEN 1	120	91.7	TA01-REFER MACH RM	125	64.8
DIES GEN 1	120	90.4	S06-TRWL WINCH RM	130	93.2
DIES GEN 2	120	83.0	EXTRA CUT 15	131.3	77.9
DIES GEN 2	120	82.5	S06-TRWL WINCH RM	132.5	81.1
E02-REEFR MACH RM	120	82.0	DIES GEN 3	133.8	96.0
DIES GEN 1	120	81.0	DIES GEN 3	133.8	93.1
DIES GEN 4	120	80.5	DIES GEN 3	133.8	92.8
AUX SW COOL PMP 1	120	79.3	FWD MMR STBD	133.8	72.8
DIES GEN 4	120	79.2	MID MMR STBD	133.8	71.1
MN SW COOL PMP 2	120	79.1	DIES GEN 3	133.8	61.8
S05-OCEANWINCH RM	120	78.7	AFT MMR STBD	133.8	60.0
CHILL WTR PMP 3	120	77.9	STRG AFT PORT	133.8	59.1
DIES GEN 1	120	77.5	DIES GEN 3	133.8	58.1

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MACHINE	FREQ (Hz)	LEVEL	MACHINE	FREQ (Hz)	LEVEL
DIES GEN 3	133.8	56.7	EXTRA CUT 22	143.8	88.2
DIES GEN 3	133.8	55.9	TA01-REFER MACH RM	143.8	70.7
DIES GEN 1	135	105.2	EXTRA CUT 23	143.8	66.1
DIES GEN 1	135	104.5	EXTRA CUT 27	143.8	64.1
DIES GEN 2	135	99.9	EXTRA CUT 26	143.8	61.0
DIES GEN 4	135	98.2	EXTRA CUT 25	143.8	56.2
DIES GEN 2	135	97.3	MARINE SAN UNIT	145	92.2
DIES GEN 4	135	94.2	MARINE SAN UNIT	145	59.4
DIES GEN 1	135	93.9	S05-OCEANWINCH RM	147.5	75.4
DIES GEN 4	135	93.3	S02-MMR	147.5	66.6
DIES GEN 1	135	92.9	DIES GEN 3	148.8	98.1
DIES GEN 2	135	88.4	FO PURIFIER 2	148.8	89.6
DIES GEN 1	135	74.4	DIES GEN 3	148.8	85.6
S01-EMG GEN RM	135	74.1	FWD MMR STBD	148.8	83.9
DIES GEN 2	135	72.6	TA04-DES/GEN STORS	148.8	79.8
DIES GEN 1	135	72.3	TA04-DES/GEN STORS	148.8	70.1
DIES GEN 1	135	71.3	REEFER #2	148.8	64.2
DIES GEN 2	135	69.7	AFT MMR STBD	148.8	62.6
DIES GEN 2	135	68.7	DIES GEN 3	148.8	60.9
DIES GEN 1	135	68.3	TRAWLING HPU SYSTEM	148.8	57.7
FW DISTILLER 2	135	66.6	DIES GEN 3	148.8	55.9
DIES GEN 2	135	65.8	DIES GEN 3	148.8	55.2
DIES GEN 1	135	65.7	DIES GEN 2	150	101.0
AC PLANT 2	135	64.4	DIES GEN 1	150	98.0
DIES GEN 1	135	64.0	DIES GEN 2	150	95.1
DIES GEN 2	135	62.8	DIES GEN 1	150	94.1
DIES GEN 1	135	62.5	DIES GEN 1	150	92.3
PROPUL MTR FWD	135	60.8	DIES GEN 1	150	91.9
PROPUL MTR XFRMR (PORT)	135	59.7	DIES GEN 4	150	91.2
PROPUL MTR AFT	135	59.7	DIES GEN 4	150	90.4
DIES GEN 4	135	59.7	FO PURIFIER 2	150	89.9
DIES GEN 1	135	58.6	DIES GEN 4	150	89.2
DIES GEN 4	135	57.8	DIES GEN 2	150	89.2
DIES GEN 2	135	57.5	MARINE SAN UNIT	150	87.9
DIES GEN 4	135	56.7	FWD MMR STBD	150	84.1
DIES GEN 2	135	55.3	DIES GEN 2	150	70.6
DIES GEN 2	135	55.1	DIES GEN 2	150	69.2
S06-TRWL WINCH RM	137.5	94.3	FW DISTILLER 2	150	68.3
S06-TRWL WINCH RM	137.5	85.4	DIES GEN 1	150	66.7
S01-EMG GEN RM	137.5	75.4	DIES GEN 2	150	64.6
CHILL WTR PMP 3	137.5	75.3	DIES GEN 1	150	63.5
DIES GEN 1	137.5	72.2	DIES GEN 1	150	63.3
DIES GEN 2	137.5	69.7	AC PLANT 2	150	62.3
DIES GEN 2	137.5	68.9	DIES GEN 2	150	62.1
EXTRA CUT 17	138.8	86.8	DIES GEN 1	150	61.5
TRAWLING HPU SYSTEM	138.8	71.5	E03-01 LOCKER	150	61.1
S01-EMG GEN RM	140	66.7	PROPUL MTR XFRMR (PORT)	150	60.5
E02-REEFR MACH RM	140	65.4	DIES GEN 2	150	60.2
E04-GALLEY	141.3	79.2	DIES GEN 4	150	58.3

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MACHINE	FREQ (Hz)	LEVEL	MACHINE	FREQ (Hz)	LEVEL
DIES GEN 2	150	56.2	EXTRA CUT 16	173.8	91.8
DIES GEN 4	150	55.3	FW DIS EJECT PMP 2	173.8	76.7
S05-OCEANWINCH RM	158.8	81.2	MARINE SAN UNIT	173.8	65.8
TRAWLING HPU SYSTEM	158.8	73.6	EXTRA CUT 24	173.8	65.0
STBD STRG HPU	161.3	64.3	DIES GEN 1	175	113.2
S05-OCEANWINCH RM	162.5	83.9	TRAWLING HPU SYSTEM	175	82.3
DIES GEN 3	163.8	97.9	DIES GEN 2	175	77.2
DIES GEN 3	163.8	90.0	AC02-EOS	175	76.9
DIES GEN 3	163.8	85.8	DIES GEN 1	175	76.7
FWD MMR STBD	163.8	73.2	CHILL WTR PMP 3	175	76.5
MID MMR STBD	163.8	62.7	DIES GEN 2	175	74.2
DIES GEN 3	163.8	59.9	AC01-OA SUP A/C	176.3	79.9
DIES GEN 3	163.8	59.5	EXTRA CUT 19	176.3	62.3
DIES GEN 3	163.8	59.1	E03-01 LOCKER	176.3	60.6
DIES GEN 3	163.8	58.9	MN SW COOL PMP 2	177.5	88.8
DIES GEN 4	165	100.3	AUX SW COOL PMP 1	177.5	84.7
DIES GEN 1	165	98.3	AUX SW COOL PMP 2	177.5	82.0
DIES GEN 4	165	97.3	TA04-DES/GEN STORS	177.5	80.2
DIES GEN 1	165	97.1	E04-GALLEY	177.5	79.9
DIES GEN 1	165	96.8	CHILL WTR PMP 3	177.5	76.0
DIES GEN 4	165	96.8	TA04-DES/GEN STORS	177.5	74.0
DIES GEN 2	165	94.3	EXTRA CUT 26	177.5	73.5
DIES GEN 2	165	93.3	HOT WATER CIRC#1	177.5	67.0
DIES GEN 2	165	93.1	MN SW COOL PMP 2	177.5	65.5
DIES GEN 1	165	91.7	PROPUL MTR FWD	177.5	63.5
DIES GEN 4	165	88.2	AUX SW COOL PMP 2	177.5	61.7
DIES GEN 1	165	70.6	AC PLANT 2	177.5	61.4
DIES GEN 1	165	69.1	PROPUL MTR AFT	177.5	59.6
DIES GEN 2	165	69.1	AUX SW COOL PMP 1	177.5	58.1
DIES GEN 1	165	66.0	TRAWLING HPU SYSTEM	178.8	95.5
DIES GEN 1	165	65.0	DIES GEN 3	178.8	93.3
DIES GEN 2	165	64.9	DIES GEN 3	178.8	91.3
DIES GEN 2	165	63.3	TRAWLING HPU SYSTEM	178.8	82.2
DIES GEN 2	165	61.5	CHILL WTR PMP 3	178.8	77.0
DIES GEN 2	165	60.7	TA01-REFER MACH RM	178.8	75.3
AC PLANT 2	165	60.6	TA01-REFER MACH RM	178.8	73.8
PROPUL MTR XFRMR (PORT)	165	60.6	REEFER #2	178.8	70.3
DIES GEN 4	165	58.5	FWD MMR STBD	178.8	66.9
DIES GEN 4	165	57.9	MID MMR STBD	178.8	65.8
DIES GEN 4	165	55.6	AC01-OA SUP A/C	178.8	64.5
TA01-REFER MACH RM	170	73.3	AFT MMR STBD	178.8	63.8
E02-REEFR MACH RM	171.3	74.6	DIES GEN 3	178.8	62.9
TA01-REFER MACH RM	171.3	73.7	DIES GEN 3	178.8	60.7
AC PLANT 2	171.3	62.1	DIES GEN 3	178.8	58.5
EXTRA CUT 22	172.5	77.0	DIES GEN 1	180	113.9
S01-EMG GEN RM	172.5	62.9	DIES GEN 2	180	113.3
EXTRA CUT 18	173.8	96.5	DIES GEN 2	180	111.3
EXTRA CUT 15	173.8	94.4	DIES GEN 1	180	99.7
EXTRA CUT 17	173.8	93.4	DIES GEN 4	180	95.0

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MACHINE	FREQ (Hz)	LEVEL	MACHINE	FREQ (Hz)	LEVEL
DIES GEN 2	180	93.3	TRAWLING HPU SYSTEM	195	91.9
DIES GEN 4	180	90.2	DIES GEN 4	195	91.5
DIES GEN 4	180	90.0	DIES GEN 1	195	84.7
DIES GEN 2	180	88.5	DIES GEN 1	195	82.1
DIES GEN 1	180	88.0	FW DISTILLER 2	195	65.5
DIES GEN 4	180	87.4	DIES GEN 1	195	63.7
DIES GEN 1	180	85.1	TRAWLING HPU SYSTEM	195	63.0
DIES GEN 2	180	77.7	DIES GEN 4	195	61.3
DIES GEN 1	180	77.5	DIES GEN 4	195	61.1
AC02-EOS	180	77.1	DIES GEN 2	195	60.2
PROPUL MTR XFRMR (STBD)	180	75.3	DIES GEN 4	195	59.8
DIES GEN 2	180	75.0	DIES GEN 1	195	59.8
DIES GEN 1	180	70.2	DIES GEN 2	195	58.3
FW DISTILLER 2	180	67.9	DIES GEN 1	195	58.1
DIES GEN 1	180	67.3	DIES GEN 4	195	57.8
DIES GEN 1	180	67.3	DIES GEN 2	195	57.1
DIES GEN 2	180	63.5	DIES GEN 1	195	56.9
STBD STRG HPU	180	62.4	AUX SW COOL PMP 2	195	56.7
DIES GEN 2	180	62.0	DIES GEN 2	195	56.6
DIES GEN 1	180	60.6	DIES GEN 1	195	56.4
PROPUL MTR AFT	180	58.8	S06-TRWL WINCH RM	196.3	83.5
DIES GEN 2	180	57.2	TRAWLING HPU SYSTEM	198.8	72.4
DIES GEN 4	180	57.2	FW DIS EJECT PMP 2	200	81.1
PROPUL MTR FWD	180	56.7	TA04-DES/GEN STORS	200	79.3
SS XFRMR T1	180	55.9	EXTRA CUT 14	201.3	86.3
PROPUL MTR XFRMR (PORT)	180	55.2	TA01-REFER MACH RM	205	69.9
TRAWLING HPU SYSTEM	187.5	95.2	S05-OCEANWINCH RM	206.3	77.4
S06-TRWL WINCH RM	187.5	81.4	S05-OCEANWINCH RM	206.3	74.3
THRUST BEARING	187.5	61.4	DIES GEN 3	208.8	100.7
S06-TRWL WINCH RM	188.8	87.4	DIES GEN 3	208.8	100.3
S06-TRWL WINCH RM	188.8	81.3	DIES GEN 3	208.8	98.5
E03-01 LOCKER	191.3	74.2	DIES GEN 3	208.8	97.4
E03-01 LOCKER	191.3	59.5	DIES GEN 3	208.8	87.5
DIES GEN 3	193.8	106.2	DIES GEN 3	208.8	79.3
DIES GEN 3	193.8	99.9	AC01-OA SUP A/C	208.8	71.6
DIES GEN 3	193.8	99.1	MID MMR STBD	208.8	68.3
DIES GEN 3	193.8	94.3	DIES GEN 3	208.8	59.6
DIES GEN 3	193.8	61.2	DIES GEN 3	208.8	57.5
MID MMR STBD	193.8	61.2	SHAFT SEAL	208.8	55.0
DIES GEN 3	193.8	60.8	DIES GEN 1	210	109.9
DIES GEN 3	193.8	59.5	DIES GEN 1	210	105.3
DIES GEN 3	193.8	57.3	DIES GEN 2	210	103.5
DIES GEN 3	193.8	56.1	DIES GEN 2	210	103.5
DIES GEN 4	195	109.5	DIES GEN 4	210	103.0
DIES GEN 4	195	105.8	DIES GEN 4	210	102.1
DIES GEN 4	195	103.2	DIES GEN 2	210	101.5
DIES GEN 2	195	101.4	DIES GEN 4	210	101.2
DIES GEN 1	195	101.0	DIES GEN 1	210	100.2
DIES GEN 2	195	96.1	DIES GEN 4	210	94.2

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MACHINE	FREQ (Hz)	LEVEL	MACHINE	FREQ (Hz)	LEVEL
DIES GEN 1	210	89.5	S01-EMG GEN RM	215	66.5
DIES GEN 2	210	85.3	E03-01 LOCKER	216.3	74.4
FW DISTILLER 2	210	80.4	S06-TRWL WINCH RM	218.8	80.5
DIES GEN 1	210	76.7	E02-REEFR MACH RM	221.3	90.7
DIES GEN 1	210	74.1	FWD MMR STBD	222.5	69.9
DIES GEN 1	210	74.1	AFT MMR PORT	222.5	59.8
PROPUL MTR XFRMR (STBD)	210	70.0	DIES GEN 3	223.8	113.4
PROPUL MTR XFRMR (PORT)	210	69.5	DIES GEN 3	223.8	112.5
DIES GEN 1	210	69.5	DIES GEN 3	223.8	102.0
DIES GEN 2	210	69.2	DIES GEN 3	223.8	96.4
DIES GEN 4	210	68.8	DIES GEN 3	223.8	81.7
MN SW COOL PMP 2	210	68.4	DIES GEN 3	223.8	76.3
PROPUL MTR AFT	210	68.1	DIES GEN 3	223.8	62.2
DIES GEN 1	210	68.1	DIES GEN 3	223.8	59.5
DIES GEN 1	210	68.0	DIES GEN 3	223.8	57.5
DIES GEN 2	210	68.0	DIES GEN 4	225	114.4
DIES GEN 1	210	67.2	DIES GEN 3	225	114.1
CHILL WTR PMP 3	210	67.1	DIES GEN 4	225	114.1
DIES GEN 4	210	66.7	DIES GEN 3	225	113.3
DIES GEN 1	210	65.3	DIES GEN 2	225	102.4
DIES GEN 2	210	63.5	DIES GEN 2	225	102.4
DIES GEN 2	210	63.0	DIES GEN 4	225	100.1
DIES GEN 2	210	62.7	DIES GEN 2	225	99.6
PROPUL MTR FWD	210	62.6	DIES GEN 4	225	96.6
AUX SW COOL PMP 2	210	61.8	DIES GEN 4	225	96.4
DIES GEN 2	210	61.6	DIES GEN 1	225	96.2
AC PLANT 2	210	60.5	E02-REEFR MACH RM	225	94.7
SS XFRMR T1	210	60.2	DIES GEN 1	225	92.4
PROPUL MTR FWD	210	60.0	DIES GEN 2	225	89.8
PROPUL MTR AFT	210	58.7	DIES GEN 1	225	89.5
PROPUL MTR XFRMR (PORT)	210	58.7	DIES GEN 1	225	88.4
DIES GEN 4	210	58.4	DIES GEN 3	225	82.5
SS XFRMR T1	210	57.6	DIES GEN 3	225	78.2
DIES GEN 2	210	57.3	DIES GEN 1	225	68.6
DIES GEN 4	210	57.2	PROPUL MTR XFRMR (STBD)	225	67.7
FO PURIFIER 2	210	55.9	AC PLANT 2	225	66.4
DIES GEN 4	210	55.7	AUX SW COOL PMP 1	225	66.2
AUX SW COOL PMP 1	210	55.1	DIES GEN 1	225	65.9
FW DIS EJECT PMP 2	212.5	95.7	DIES GEN 4	225	65.8
DIES GEN 3	212.5	87.2	DIES GEN 2	225	65.8
FW DISTILLER 2	212.5	80.3	FO PURIFIER 2	225	64.9
DIES GEN 1	212.5	76.9	AUX SW COOL PMP 2	225	64.2
E03-01 LOCKER	212.5	76.7	DIES GEN 1	225	64.1
DIES GEN 1	212.5	74.2	DIES GEN 1	225	63.9
DIES GEN 4	212.5	68.5	DIES GEN 2	225	63.4
SS XFRMR T1	212.5	59.9	DIES GEN 1	225	63.2
S03-MMR	213.8	80.6	DIES GEN 4	225	62.6
E02-REEFR MACH RM	213.8	59.4	DIES GEN 2	225	62.0
AC PLANT 2	215	79.3	MN SW COOL PMP 2	225	61.3

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MACHINE	FREQ (Hz)	LEVEL	MACHINE	FREQ (Hz)	LEVEL
DIES GEN 4	225	61.0	PROPUL MTR XFRMR (STBD)	240	90.2
DIES GEN 2	225	60.6	SS XFRMR T2	240	83.2
AC PLANT 1	225	59.7	SS XFRMR T1	240	80.9
PROPUL MTR FWD	225	58.9	PROPUL MTR XFRMR (PORT)	240	76.9
DIES GEN 1	225	58.2	DIES GEN 2	240	75.5
DIES GEN 2	225	57.8	DIES GEN 1	240	74.0
DIES GEN 2	225	57.4	S06-TRWL WINCH RM	240	68.7
DIES GEN 1	225	56.8	PROPUL MTR FWD	240	64.9
DIES GEN 1	225	56.6	DIES GEN 1	240	64.9
DIES GEN 2	225	56.1	FW DISTILLER 2	240	64.5
PROPUL MTR AFT	225	55.5	DIES GEN 2	240	64.3
EXTRA CUT 23	231.3	59.9	DIES GEN 4	240	64.3
TA01-REFER MACH RM	233.8	74.6	AC PLANT 2	240	64.1
TA01-REFER MACH RM	235	72.2	DIES GEN 1	240	63.9
DIES GEN 1	237.5	107.9	DIES GEN 4	240	62.8
DIES GEN 2	237.5	105.6	DIES GEN 1	240	62.6
TRAWLING HPU SYSTEM	237.5	91.6	DIES GEN 1	240	61.6
PROPUL MTR XFRMR (STBD)	237.5	90.0	PROPUL MTR AFT	240	61.6
SS XFRMR T2	237.5	82.9	DIES GEN 2	240	61.2
REEFER #2	237.5	81.1	AUX SW COOL PMP 1	240	61.1
SS XFRMR T1	237.5	80.6	CHILL WTR PMP 3	240	61.1
DIES GEN 3	237.5	79.8	DIES GEN 4	240	60.2
FWD MMR STBD	237.5	72.9	CHILL WTR PMP 3	240	59.8
TRAWLING HPU SYSTEM	237.5	70.7	DIES GEN 1	240	58.3
MID MMR STBD	237.5	68.8	DIES GEN 1	240	58.2
TRAWLING HPU SYSTEM	237.5	66.5	AUX SW COOL PMP 2	240	57.8
REEFER #2	237.5	60.6	DIES GEN 2	240	57.7
DIES GEN 3	238.8	104.3	FO PURIFIER 2	240	57.4
DIES GEN 3	238.8	98.0	DIES GEN 2	240	56.4
DIES GEN 3	238.8	96.0	DIES GEN 4	240	55.2
DIES GEN 3	238.8	95.7	DIES GEN 2	250	64.2
REEFER #2	238.8	81.2	AC PLANT 1	250	63.3
DIES GEN 3	238.8	79.7	DIES GEN 3	252.5	101.7
DIES GEN 3	238.8	73.5	DIES GEN 3	253.8	107.7
DIES GEN 3	238.8	73.1	DIES GEN 3	253.8	94.3
DIES GEN 3	238.8	71.4	DIES GEN 3	253.8	93.9
REEFER #2	238.8	59.8	DIES GEN 3	253.8	64.6
DIES GEN 1	240	111.4	DIES GEN 3	253.8	63.9
DIES GEN 2	240	109.7	DIES GEN 4	255	105.2
DIES GEN 1	240	108.1	DIES GEN 4	255	102.3
DIES GEN 4	240	106.2	DIES GEN 1	255	100.8
DIES GEN 2	240	105.6	DIES GEN 2	255	100.0
DIES GEN 4	240	103.9	DIES GEN 1	255	99.9
DIES GEN 2	240	103.2	DIES GEN 2	255	99.8
DIES GEN 1	240	101.5	DIES GEN 1	255	99.7
DIES GEN 1	240	98.1	DIES GEN 2	255	99.2
DIES GEN 2	240	97.9	DIES GEN 2	255	97.7
DIES GEN 4	240	96.0	DIES GEN 1	255	95.8
DIES GEN 4	240	95.1	DIES GEN 4	255	95.8

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MACHINE	FREQ (Hz)	LEVEL	MACHINE	FREQ (Hz)	LEVEL
DIES GEN 4	255	95.7	PROPUL MTR XFRMR (PORT)	270	68.3
FW DISTILLER 2	255	71.7	DIES GEN 1	270	67.9
AC PLANT 2	255	71.0	DIES GEN 1	270	67.2
AC PLANT 2	255	69.1	CHILL WTR PMP 3	270	62.9
PROPUL MTR XFRMR (STBD)	255	66.5	DIES GEN 1	270	62.5
DIES GEN 2	255	66.1	PROPUL MTR AFT	270	62.3
DIES GEN 2	255	65.5	STBD STRG HPU	270	61.6
DIES GEN 1	255	63.2	DIES GEN 2	270	59.2
AC PLANT 1	255	63.1	AC01-OA SUP A/C	272.5	84.2
PROPUL MTR XFRMR (PORT)	255	62.7	AC01-OA SUP A/C	272.5	75.1
DIES GEN 1	255	62.5	S03-MMR	275	101.5
DIES GEN 1	255	61.1	E04-GALLEY	275	90.0
PROPUL MTR FWD	255	61.0	TA01-REFER MACH RM	275	88.7
CHILL WTR PMP 3	255	59.1	S05-OCEANWINCH RM	275	79.6
PROPUL MTR XFRMR (PORT)	255	59.1	S05-OCEANWINCH RM	276.3	74.5
DIES GEN 4	255	55.6	S03-MMR	278.8	97.4
TRAWLING HPU SYSTEM	257.5	84.1	EXTRA CUT 21	278.8	57.3
E06-MAIN DECK EX	258.8	82.1	TA01-REFER MACH RM	281.3	82.9
AC02-EOS	258.8	79.7	TA01-REFER MACH RM	281.3	76.9
S01-EMG GEN RM	258.8	63.0	DIES GEN 3	282.5	102.7
EXTRA CUT 23	260	66.3	DIES GEN 3	282.5	99.2
MARINE SAN UNIT	261.3	67.8	DIES GEN 3	282.5	96.6
AC01-OA SUP A/C	262.5	88.4	DIES GEN 3	282.5	94.5
TA04-DES/GEN STORS	266.3	75.3	E03-01 LOCKER	282.5	74.2
DIES GEN 3	267.5	98.6	S01-EMG GEN RM	282.5	72.4
S03-MMR	267.5	93.3	FWD MMR STBD	282.5	71.3
S02-MMR	267.5	88.7	DIES GEN 3	282.5	68.2
DIES GEN 3	267.5	88.3	MID MMR STBD	282.5	64.9
DIES GEN 3	267.5	87.2	DIES GEN 3	282.5	57.7
S03-MMR	267.5	81.9	DIES GEN 1	285	100.9
S02-MMR	267.5	79.8	DIES GEN 4	285	99.6
FWD MMR STBD	267.5	71.1	DIES GEN 4	285	99.3
S01-EMG GEN RM	267.5	70.3	DIES GEN 1	285	98.5
DIES GEN 3	267.5	60.0	DIES GEN 2	285	98.5
EXTRA CUT 25	268.8	72.0	DIES GEN 2	285	97.1
REEFER #2	268.8	60.2	DIES GEN 2	285	96.9
DIES GEN 2	270	102.8	DIES GEN 1	285	96.6
DIES GEN 1	270	100.3	DIES GEN 2	285	96.2
DIES GEN 2	270	100.1	DIES GEN 4	285	95.5
DIES GEN 4	270	99.0	DIES GEN 4	285	95.2
DIES GEN 4	270	95.3	DIES GEN 1	285	95.0
DIES GEN 4	270	93.8	DIES GEN 1	285	71.1
DIES GEN 4	270	92.0	DIES GEN 1	285	67.4
DIES GEN 2	270	87.0	PROPUL MTR XFRMR (PORT)	285	67.1
TA01-REFER MACH RM	270	87.0	FW DISTILLER 2	285	66.8
DIES GEN 1	270	87.0	DIES GEN 1	285	66.3
TA01-REFER MACH RM	270	77.0	DIES GEN 2	285	64.8
EXTRA CUT 12	270	72.7	PROPUL MTR FWD	285	59.5
EXTRA CUT 18	270	72.0	DIES GEN 1	285	56.7

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MACHINE	FREQ (Hz)	LEVEL	MACHINE	FREQ (Hz)	LEVEL
AUX SW COOL PMP 2	285	55.7	PROPUL MTR XFRMR (PORT)	300	81.9
S02-MMR	286.3	90.4	STBD STRG HPU	300	80.1
S02-MMR	287.5	92.8	STBD STRG HPU	300	79.7
TA01-REFER MACH RM	287.5	87.3	DIES GEN 2	300	79.4
E03-01 LOCKER	287.5	75.1	HOT WATER CIRC#1	300	79.4
DIES GEN 1	287.5	71.3	DIES GEN 2	300	78.9
BOW THRUSTER RM PORT	287.5	58.2	DIES GEN 1	300	76.8
EXTRA CUT 17	288.8	102.1	DIES GEN 1	300	76.8
EXTRA CUT 15	288.8	89.6	PROPUL MTR XFRMR (STBD)	300	74.6
EXTRA CUT 16	288.8	75.3	DIES GEN 2	300	70.8
EXTRA CUT 22	288.8	68.4	FW DISTILLER 2	300	70.4
AC02-EOS	290	75.2	DIES GEN 1	300	69.6
MARINE SAN UNIT	290	70.6	STRG AFT STBD	300	69.2
MARINE SAN UNIT	290	67.1	STBD STRG HPU	300	66.0
AC PLANT 2	292.5	68.6	STBD STRG HPU	300	63.7
MN SW COOL PMP 2	292.5	65.6	DIES GEN 1	300	62.9
PROPUL MTR AFT	292.5	58.5	AUX SW COOL PMP 2	300	60.5
PROPUL MTR FWD	292.5	55.7	CHILL WTR PMP 3	300	60.4
TA01-REFER MACH RM	293.8	80.8	DIES GEN 4	300	58.8
TA01-REFER MACH RM	293.8	79.6	AUX SW COOL PMP 1	300	58.2
E06-MAIN DECK EX	295	80.5	DIES GEN 2	300	57.4
MN SW COOL PMP 2	295	67.8	WINCH RM STBD	300	56.6
EXTRA CUT 27	295	61.0	DIES GEN 4	300	55.8
HOT WATER CIRC#1	296.3	76.7	DIES GEN 4	300	55.0
STRG AFT STBD	296.3	68.3	DIES GEN 3	305	73.5
E03-01 LOCKER	296.3	59.5	DIES GEN 3	312.5	101.4
WINCH RM PORT	296.3	56.0	DIES GEN 3	312.5	98.2
DIES GEN 3	297.5	100.5	DIES GEN 3	312.5	94.0
DIES GEN 3	297.5	97.4	DIES GEN 3	312.5	91.7
DIES GEN 3	297.5	96.0	DIES GEN 3	312.5	87.9
DIES GEN 3	297.5	89.1	DIES GEN 3	312.5	87.5
FWD MMR STBD	297.5	74.3	DIES GEN 3	312.5	86.5
DIES GEN 3	297.5	69.1	DIES GEN 3	312.5	85.9
REEFER #2	298.8	77.9	AC02-EOS	312.5	82.7
FO PURIFIER 2	298.8	72.9	DIES GEN 3	312.5	82.0
MN SW COOL PMP 2	298.8	66.5	DIES GEN 3	312.5	81.3
EXTRA CUT 25	298.8	60.0	FWD MMR STBD	312.5	81.3
DIES GEN 1	300	104.6	DIES GEN 2	312.5	71.1
DIES GEN 2	300	101.0	MID MMR STBD	312.5	70.9
DIES GEN 2	300	98.9	AC PLANT 2	312.5	70.2
DIES GEN 4	300	98.1	DIES GEN 3	312.5	68.7
DIES GEN 4	300	96.2	AC02-EOS	312.5	65.8
DIES GEN 4	300	95.5	DIES GEN 1	315	105.9
DIES GEN 4	300	95.0	DIES GEN 2	315	105.6
FW DIS EJECT PMP 2	300	94.9	DIES GEN 4	315	101.7
DIES GEN 2	300	91.3	DIES GEN 4	315	98.5
DIES GEN 1	300	86.0	DIES GEN 2	315	98.3
FW DIS EJECT PMP 2	300	84.4	DIES GEN 2	315	93.5
PROPUL MTR XFRMR (PORT)	300	83.1	DIES GEN 4	315	92.1

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MACHINE	FREQ (Hz)	LEVEL	MACHINE	FREQ (Hz)	LEVEL
DIES GEN 1	315	90.1	DIES GEN 2	330	70.9
DIES GEN 4	315	87.7	DIES GEN 2	330	70.6
DIES GEN 2	315	87.1	DIES GEN 2	330	68.5
DIES GEN 2	315	70.4	DIES GEN 2	330	67.1
DIES GEN 1	315	69.5	DIES GEN 2	330	66.5
DIES GEN 1	315	68.7	PROPUL MTR XFRMR (STBD)	330	65.1
DIES GEN 1	315	67.2	FW DISTILLER 2	330	63.5
DIES GEN 1	315	65.4	DIES GEN 2	330	63.2
DIES GEN 2	315	63.5	DIES GEN 4	330	62.9
MARINE SAN UNIT	315	63.4	DIES GEN 1	330	61.9
AUX SW COOL PMP 1	315	62.5	DIES GEN 2	330	60.8
FW DISTILLER 2	315	60.4	DIES GEN 2	330	60.7
DIES GEN 2	315	57.5	DIES GEN 4	330	59.7
AC01-OA SUP A/C	317.5	81.2	AC PLANT 2	330	59.1
EXTRA CUT 22	317.5	77.3	DIES GEN 1	330	57.1
TRAWLING HPU SYSTEM	317.5	75.6	EXTRA CUT 20	335	73.1
E06-MAIN DECK EX	317.5	74.5	DIES GEN 2	335	60.4
AC01-OA SUP A/C	317.5	65.0	DIES GEN 1	336.3	58.4
EXTRA CUT 23	317.5	62.5	TRAWLING HPU SYSTEM	337.5	81.5
MARINE SAN UNIT	318.8	78.6	DIES GEN 2	337.5	69.8
MARINE SAN UNIT	318.8	58.8	DIES GEN 1	337.5	66.5
E02-REEFR MACH RM	320	80.6	DIES GEN 1	337.5	66.3
E02-REEFR MACH RM	320	73.1	DIES GEN 1	337.5	61.1
TA01-REFER MACH RM	321.3	74.9	DIES GEN 1	337.5	57.8
TA01-REFER MACH RM	321.3	70.2	DIES GEN 3	342.5	104.5
S01-EMG GEN RM	322.5	72.5	DIES GEN 3	342.5	101.9
E03-01 LOCKER	323.8	58.6	DIES GEN 3	342.5	96.6
REEFER #2	325	78.5	DIES GEN 3	342.5	80.0
MARINE SAN UNIT	325	78.5	DIES GEN 3	342.5	79.8
DIES GEN 2	325	76.3	FWD MMR STBD	342.5	78.1
DIES GEN 1	325	74.6	DIES GEN 3	342.5	73.6
DIES GEN 2	325	70.9	MID MMR STBD	342.5	73.0
DIES GEN 3	327.5	97.3	S02-MMR	342.5	69.0
DIES GEN 3	327.5	89.9	EXTRA CUT 14	342.5	64.4
FWD MMR STBD	327.5	72.2	DIES GEN 3	342.5	62.1
DIES GEN 3	327.5	61.3	EXTRA CUT 12	342.5	59.5
REEFER #2	328.8	77.3	SHAFT SEAL	342.5	58.6
DIES GEN 4	330	98.3	FWD MMR PORT	342.5	56.6
DIES GEN 2	330	98.0	DIES GEN 2	345	112.8
DIES GEN 2	330	97.1	DIES GEN 2	345	109.9
DIES GEN 4	330	92.7	DIES GEN 4	345	109.5
DIES GEN 1	330	92.5	DIES GEN 4	345	109.1
DIES GEN 2	330	91.7	DIES GEN 1	345	107.3
DIES GEN 4	330	90.1	DIES GEN 4	345	104.7
DIES GEN 1	330	88.4	DIES GEN 1	345	104.5
DIES GEN 4	330	88.1	DIES GEN 2	345	103.8
DIES GEN 1	330	85.0	DIES GEN 1	345	102.4
DIES GEN 1	330	74.7	DIES GEN 4	345	100.9
STBD STRG HPU	330	72.6	DIES GEN 2	345	97.3

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MACHINE	FREQ (Hz)	LEVEL	MACHINE	FREQ (Hz)	LEVEL
DIES GEN 1	345	91.5	DIES GEN 3	357.5	96.1
DIES GEN 4	345	76.4	DIES GEN 3	357.5	94.6
DIES GEN 4	345	75.4	REEFER #2	357.5	93.7
DIES GEN 2	345	72.9	AC PLANT 2	357.5	78.3
DIES GEN 2	345	72.2	MID MMR STBD	357.5	76.0
DIES GEN 1	345	71.8	DIES GEN 3	357.5	73.1
FW DISTILLER 2	345	71.3	FWD MMR STBD	357.5	72.0
DIES GEN 1	345	70.8	DIES GEN 3	357.5	71.9
DIES GEN 2	345	69.8	EXTRA CUT 22	357.5	71.0
DIES GEN 2	345	69.4	EXTRA CUT 14	357.5	69.2
DIES GEN 1	345	69.2	DIES GEN 3	357.5	68.8
DIES GEN 2	345	69.0	DIES GEN 3	357.5	67.4
DIES GEN 4	345	68.5	CHILL WTR PMP 3	357.5	66.1
DIES GEN 1	345	66.3	TRAWLING HPU SYSTEM	357.5	61.2
DIES GEN 1	345	64.9	FWD MMR PORT	357.5	58.6
DIES GEN 1	345	64.8	AC PLANT 1	357.5	56.6
PROPUL MTR XFRMR (STBD)	345	63.5	DIES GEN 4	360	107.9
DIES GEN 2	345	62.6	DIES GEN 2	360	104.4
DIES GEN 1	345	61.1	DIES GEN 4	360	102.6
CHILL WTR PMP 3	345	60.8	DIES GEN 2	360	102.5
PROPUL MTR AFT	345	57.8	DIES GEN 4	360	100.2
PROPUL MTR FWD	345	56.6	DIES GEN 1	360	100.1
DIES GEN 4	345	56.6	DIES GEN 4	360	98.1
DIES GEN 4	345	56.1	DIES GEN 1	360	97.7
SS XFRMR T1	345	55.5	DIES GEN 1	360	90.6
PROPUL MTR FWD	345	55.3	DIES GEN 2	360	87.7
EXTRA CUT 22	346.3	73.4	PROPUL MTR XFRMR (STBD)	360	87.5
AC02-EOS	347.5	82.6	MN SW COOL PMP 2	360	83.9
AC02-EOS	347.5	71.9	DIES GEN 1	360	83.2
AC02-EOS	350	83.3	STBD STRG HPU	360	81.1
DIES GEN 4	350	74.6	PROPUL MTR XFRMR (PORT)	360	78.9
DIES GEN 1	350	71.3	AUX SW COOL PMP 2	360	78.3
DIES GEN 2	350	69.6	DIES GEN 4	360	78.2
DIES GEN 2	351.3	58.6	CHILL WTR PMP 3	360	77.6
TRAWLING HPU SYSTEM	352.5	89.6	DIES GEN 4	360	77.3
AC01-OA SUP A/C	353.8	82.3	DIES GEN 2	360	77.3
E02-REEFR MACH RM	353.8	72.9	DIES GEN 1	360	76.0
AC01-OA SUP A/C	353.8	58.7	DIES GEN 1	360	75.6
PROPUL MTR FWD	355	64.2	SS XFRMR T1	360	71.6
PROPUL MTR AFT	355	61.2	MN SW COOL PMP 2	360	71.1
PROPUL MTR FWD	355	57.3	S01-EMG GEN RM	360	70.4
EXTRA CUT 25	356.3	68.9	SS XFRMR T2	360	69.3
EXTRA CUT 24	356.3	66.3	S06-TRWL WINCH RM	360	68.9
HOT WATER CIRC#1	356.3	60.4	DIES GEN 2	360	68.7
EXTRA CUT 26	356.3	59.6	PROPUL MTR FWD	360	68.4
DIES GEN 3	357.5	102.8	DIES GEN 2	360	67.3
AC PLANT 2	357.5	98.3	PROPUL MTR FWD	360	67.3
DIES GEN 3	357.5	98.3	S03-MMR	360	67.2
TRAWLING HPU SYSTEM	357.5	96.8	STBD STRG HPU	360	66.6

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MACHINE	FREQ (Hz)	LEVEL	MACHINE	FREQ (Hz)	LEVEL
PROPUL MTR XFRMR (STBD)	360	65.9	DIES GEN 2	375	89.6
MARINE SAN UNIT	360	64.9	DIES GEN 1	375	87.4
FW DISTILLER 2	360	64.3	TA01-REFER MACH RM	375	85.8
PROPUL MTR AFT	360	63.6	TA01-REFER MACH RM	375	84.2
DIES GEN 1	360	63.2	TA01-REFER MACH RM	375	76.9
PROPUL MTR XFRMR (PORT)	360	60.8	DIES GEN 4	375	75.0
AUX SW COOL PMP 2	360	60.0	DIES GEN 4	375	74.7
AUX SW COOL PMP 1	360	59.5	PROPUL MTR XFRMR (STBD)	375	73.0
DIES GEN 1	360	59.3	DIES GEN 4	375	73.0
DIES GEN 1	360	58.9	DIES GEN 1	375	72.7
SS XFRMR T1	360	58.3	DIES GEN 4	375	70.5
PROPUL MTR AFT	360	58.2	DIES GEN 2	375	69.7
DIES GEN 2	360	57.7	DIES GEN 2	375	67.7
DIES GEN 1	360	56.7	DIES GEN 4	375	61.4
DIES GEN 1	360	56.3	DIES GEN 2	375	60.2
DIES GEN 4	360	56.1	DIES GEN 4	375	60.0
AC PLANT 2	362.5	98.6	DIES GEN 4	375	59.1
REEFER #2	362.5	94.0	DIES GEN 1	375	58.1
S05-OCEANWINCH RM	362.5	93.8	DIES GEN 1	375	55.1
PROPUL MTR XFRMR (STBD)	362.5	87.0	AC01-OA SUP A/C	376.3	59.0
DIES GEN 4	362.5	80.0	MARINE SAN UNIT	377.5	62.7
DIES GEN 4	362.5	79.0	FO PURIFIER 2	383.8	82.8
CHILL WTR PMP 3	362.5	78.8	FWD MMR STBD	386.3	72.9
AC PLANT 2	362.5	78.5	EXTRA CUT 22	386.3	70.4
SS XFRMR T1	362.5	71.2	MID MMR STBD	386.3	66.6
SS XFRMR T2	362.5	69.0	EXTRA CUT 23	386.3	60.7
PROPUL MTR FWD	362.5	68.5	DIES GEN 3	387.5	101.1
PROPUL MTR XFRMR (STBD)	362.5	67.2	DIES GEN 3	387.5	95.3
PROPUL MTR AFT	362.5	63.9	DIES GEN 3	387.5	94.9
SS XFRMR T1	362.5	57.8	AUX SW COOL PMP 2	387.5	86.7
EXTRA CUT 20	363.8	87.7	REEFER #2	387.5	71.8
TA01-REFER MACH RM	363.8	68.3	DIES GEN 3	387.5	67.8
DIES GEN 3	372.5	103.2	DIES GEN 4	387.5	61.8
DIES GEN 3	372.5	90.1	DIES GEN 3	387.5	61.6
DIES GEN 3	372.5	67.7	DIES GEN 3	387.5	61.2
AC PLANT 2	372.5	62.2	DIES GEN 3	387.5	59.8
DIES GEN 3	372.5	58.3	DIES GEN 3	387.5	59.7
AC PLANT 2	373.8	83.0	DIES GEN 3	387.5	58.7
E03-01 LOCKER	373.8	61.1	TRAWLING HPU SYSTEM	388.8	85.1
DIES GEN 4	375	107.6	AUX SW COOL PMP 2	388.8	85.0
DIES GEN 2	375	102.3	MARINE SAN UNIT	388.8	65.8
DIES GEN 4	375	102.3	MARINE SAN UNIT	388.8	57.8
DIES GEN 4	375	100.4	DIES GEN 4	390	102.1
DIES GEN 2	375	98.6	DIES GEN 1	390	100.0
DIES GEN 4	375	97.9	DIES GEN 2	390	99.1
DIES GEN 1	375	97.8	DIES GEN 4	390	93.0
DIES GEN 1	375	97.7	DIES GEN 1	390	87.4
DIES GEN 1	375	95.4	DIES GEN 2	390	87.0
DIES GEN 2	375	94.2	DIES GEN 1	390	85.6

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MACHINE	FREQ (Hz)	LEVEL	MACHINE	FREQ (Hz)	LEVEL
STBD STRG HPU	390	83.0	FW DISTILLER 2	405	62.3
PROPUL MTR XFRMR (PORT)	390	79.7	PROPUL MTR AFT	405	62.0
DIES GEN 1	390	73.9	DIES GEN 4	405	61.9
DIES GEN 1	390	73.5	DIES GEN 4	405	61.6
DIES GEN 1	390	73.1	DIES GEN 4	405	55.6
S06-TRWL WINCH RM	390	72.2	AC02-EOS	406.3	75.5
DIES GEN 2	390	67.2	S06-TRWL WINCH RM	407.5	77.6
DIES GEN 4	390	65.7	S06-TRWL WINCH RM	407.5	69.5
FW DISTILLER 2	390	61.0	TRAWLING HPU SYSTEM	408.8	88.4
S01-EMG GEN RM	390	61.0	TA01-REFER MACH RM	410	85.1
DIES GEN 4	390	60.2	TA01-REFER MACH RM	410	81.6
DIES GEN 2	390	59.2	PROPUL MTR XFRMR (PORT)	412.5	86.6
CHILL WTR PMP 3	390	56.8	REEFER #2	412.5	83.0
PROPUL MTR FWD	390	56.3	S06-TRWL WINCH RM	412.5	81.2
EXTRA CUT 18	391.3	73.1	S02-MMR	413.8	64.1
EXTRA CUT 16	391.3	69.2	EXTRA CUT 13	416.3	102.2
EXTRA CUT 14	393.8	67.1	MID MMR STBD	416.3	64.8
TRAWLING HPU SYSTEM	396.3	90.6	DIES GEN 3	417.5	102.7
TRAWLING HPU SYSTEM	397.5	64.3	EXTRA CUT 17	417.5	102.3
DIES GEN 2	400	79.1	DIES GEN 3	417.5	98.5
AC02-EOS	400	72.5	REEFER #2	417.5	83.9
MID MMR STBD	401.3	70.6	DIES GEN 3	417.5	77.3
DIES GEN 3	402.5	106.1	EXTRA CUT 16	417.5	73.4
DIES GEN 3	402.5	99.0	DIES GEN 3	417.5	68.0
DIES GEN 3	402.5	98.2	DIES GEN 3	417.5	64.1
DIES GEN 3	402.5	98.1	EXTRA CUT 11	418.8	102.3
DIES GEN 3	402.5	72.0	DIES GEN 4	420	108.6
DIES GEN 3	402.5	67.3	DIES GEN 2	420	103.4
DIES GEN 3	402.5	67.2	DIES GEN 1	420	101.6
TA04-DES/GEN STORS	402.5	67.1	DIES GEN 1	420	100.5
DIES GEN 4	405	107.8	DIES GEN 4	420	100.4
DIES GEN 2	405	106.7	DIES GEN 1	420	98.2
DIES GEN 1	405	104.9	DIES GEN 4	420	97.6
DIES GEN 4	405	102.5	DIES GEN 2	420	96.4
DIES GEN 4	405	102.0	DIES GEN 2	420	93.4
DIES GEN 1	405	101.3	DIES GEN 1	420	90.6
DIES GEN 4	405	100.4	PROPUL MTR XFRMR (STBD)	420	88.3
DIES GEN 1	405	96.6	PROPUL MTR XFRMR (PORT)	420	85.1
DIES GEN 1	405	95.0	DIES GEN 1	420	78.7
DIES GEN 2	405	90.3	STBD STRG HPU	420	77.3
DIES GEN 2	405	89.9	EXTRA CUT 18	420	75.2
PROPUL MTR XFRMR (PORT)	405	84.7	DIES GEN 2	420	74.6
PROPUL MTR XFRMR (STBD)	405	81.6	S06-TRWL WINCH RM	420	72.9
DIES GEN 2	405	78.3	DIES GEN 1	420	72.1
DIES GEN 1	405	77.4	DIES GEN 4	420	68.5
DIES GEN 1	405	77.3	DIES GEN 2	420	68.3
DIES GEN 1	405	74.8	EXTRA CUT 12	420	68.2
DIES GEN 2	405	72.2	DIES GEN 4	420	65.1
FWD MMR PORT	405	64.2	AC PLANT 2	420	64.7

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MACHINE	FREQ (Hz)	LEVEL	MACHINE	FREQ (Hz)	LEVEL
PROPUL MTR XFRMR (STBD)	420	59.2	TA01-REFER MACH RM	437.5	82.4
DIES GEN 4	420	56.1	DIES GEN 2	437.5	81.7
AC01-OA SUP A/C	421.3	65.6	E02-REEFR MACH RM	437.5	81.6
TA01-REFER MACH RM	422.5	79.2	DIES GEN 2	437.5	81.3
E03-01 LOCKER	423.8	65.5	DIES GEN 3	446.3	105.7
S01-EMG GEN RM	423.8	64.5	DIES GEN 3	446.3	105.6
DIES GEN 3	425	109.6	DIES GEN 3	446.3	96.4
AC PLANT 2	425	92.7	DIES GEN 3	446.3	94.9
DIES GEN 3	425	84.8	TA01-REFER MACH RM	446.3	74.1
DIES GEN 1	425	80.5	FWD MMR STBD	446.3	72.6
E03-01 LOCKER	425	73.5	DIES GEN 3	446.3	69.2
TRAWLING HPU SYSTEM	427.5	82.8	TA01-REFER MACH RM	446.3	68.3
AC PLANT 2	427.5	75.3	DIES GEN 3	446.3	65.5
AC PLANT 2	428.8	93.2	MID MMR STBD	446.3	63.3
DIES GEN 3	431.3	109.9	FO PURIFIER 2	447.5	79.1
DIES GEN 3	431.3	104.7	REEFER #2	447.5	66.6
DIES GEN 3	431.3	102.2	DIES GEN 2	450	107.4
DIES GEN 3	431.3	88.5	DIES GEN 4	450	105.1
S01-EMG GEN RM	431.3	76.8	DIES GEN 1	450	103.6
E03-01 LOCKER	431.3	73.4	DIES GEN 2	450	103.0
DIES GEN 3	431.3	72.9	DIES GEN 2	450	99.5
E03-01 LOCKER	431.3	72.5	DIES GEN 1	450	96.1
DIES GEN 3	431.3	67.7	DIES GEN 1	450	96.0
DIES GEN 3	431.3	60.9	DIES GEN 2	450	96.0
DIES GEN 3	432.5	84.6	DIES GEN 4	450	94.5
TA01-REFER MACH RM	433.8	88.4	DIES GEN 4	450	84.2
TA01-REFER MACH RM	433.8	81.9	STBD STRG HPU	450	84.0
DIES GEN 4	435	109.0	DIES GEN 4	450	82.6
DIES GEN 4	435	101.7	DIES GEN 4	450	82.5
DIES GEN 2	435	101.6	DIES GEN 2	450	78.9
DIES GEN 1	435	97.2	DIES GEN 2	450	75.4
DIES GEN 2	435	96.1	DIES GEN 2	450	75.4
DIES GEN 1	435	95.7	DIES GEN 2	450	75.3
DIES GEN 2	435	94.3	PROPUL MTR XFRMR (STBD)	450	74.6
DIES GEN 4	435	91.5	DIES GEN 4	450	74.5
DIES GEN 2	435	81.4	AC PLANT 2	450	69.1
DIES GEN 2	435	80.9	AUX SW COOL PMP 2	450	66.5
DIES GEN 4	435	78.8	CHILL WTR PMP 3	450	61.5
PROPUL MTR XFRMR (STBD)	435	78.6	STBD STRG HPU	450	59.7
AC01-OA SUP A/C	435	72.7	FW DISTILLER 2	450	56.9
DIES GEN 4	435	70.6	DIES GEN 3	461.3	103.1
DIES GEN 2	435	69.1	DIES GEN 3	461.3	99.5
DIES GEN 1	435	66.5	DIES GEN 3	461.3	94.3
FW DISTILLER 2	435	65.7	DIES GEN 3	461.3	88.3
DIES GEN 4	435	63.5	EXTRA CUT 18	461.3	69.8
MARINE SAN UNIT	435	62.2	EXTRA CUT 12	461.3	67.3
CHILL WTR PMP 3	435	60.5	MID MMR STBD	461.3	65.4
DIES GEN 4	437.5	110.4	FWD MMR PORT	461.3	64.0
TA01-REFER MACH RM	437.5	87.2	DIES GEN 3	461.3	61.1

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MACHINE	FREQ (Hz)	LEVEL
DIES GEN 3	461.3	60.8
EXTRA CUT 16	461.3	59.1
MN SW COOL PMP 2	462.5	87.6
AUX SW COOL PMP 1	462.5	72.6
MN SW COOL PMP 2	463.8	84.7
DIES GEN 1	465	107.8
DIES GEN 2	465	106.6
DIES GEN 1	465	105.7
DIES GEN 2	465	101.1
DIES GEN 4	465	98.1
DIES GEN 1	465	97.7
DIES GEN 4	465	97.6
DIES GEN 4	465	85.8
DIES GEN 4	465	84.2
DIES GEN 2	465	76.7
DIES GEN 1	465	75.5
DIES GEN 1	465	73.6
DIES GEN 4	465	72.3
AC PLANT 2	465	71.7
DIES GEN 4	465	70.7
AUX SW COOL PMP 2	465	67.1
DIES GEN 2	465	64.2
DIES GEN 4	465	56.9
DIES GEN 3	475	112.3
DIES GEN 1	475	109.3
DIES GEN 1	475	108.3
DIES GEN 2	475	107.5
PROPUL MTR XFRMR (STBD)	475	90.0
DIES GEN 4	475	75.3
SS XFRMR T1	475	70.6
DIES GEN 3	476.3	111.7
DIES GEN 3	476.3	96.0
TRAWLING HPU SYSTEM	476.3	96.0
DIES GEN 3	476.3	93.4
FWD MMR STBD	476.3	71.4
DIES GEN 3	476.3	67.3
MID MMR STBD	476.3	66.9
MARINE SAN UNIT	476.3	64.5
TRAWLING HPU SYSTEM	476.3	63.5
DIES GEN 3	476.3	63.3
REEFER #2	477.5	65.2
DIES GEN 1	480	108.6
DIES GEN 1	480	107.0
DIES GEN 2	480	106.8
DIES GEN 4	480	103.8
DIES GEN 2	480	103.7
DIES GEN 4	480	103.4
DIES GEN 4	480	94.8
PROPUL MTR XFRMR (STBD)	480	89.9
PROPUL MTR XFRMR (PORT)	480	79.4
STBD STRG HPU	480	78.3
S03-MMR	480	75.9
DIES GEN 4	480	75.7
AC01-OA SUP A/C	480	71.4
DIES GEN 4	480	71.2
SS XFRMR T1	480	71.0
AC PLANT 2	480	69.5
PROPUL MTR FWD	480	68.4
DIES GEN 1	480	65.3
DIES GEN 2	480	62.5
FW DISTILLER 2	480	59.8
STBD STRG HPU	480	59.3
DIES GEN 4	480	58.8
SS XFRMR T2	480	56.4
S01-EMG GEN RM	483.8	78.1
S03-MMR	488.8	78.4
DIES GEN 3	491.3	103.8
DIES GEN 3	491.3	103.1
DIES GEN 3	491.3	101.4
DIES GEN 3	491.3	96.4
DIES GEN 3	491.3	76.5
MID MMR STBD	491.3	68.7
DIES GEN 3	491.3	65.0
DIES GEN 3	491.3	64.5
DIES GEN 2	495	106.8
DIES GEN 1	495	102.8
DIES GEN 4	495	102.6
DIES GEN 1	495	99.5
DIES GEN 2	495	98.6
DIES GEN 1	495	97.2
DIES GEN 4	495	96.7
PROPUL MTR XFRMR (STBD)	495	75.4
DIES GEN 2	495	74.1
DIES GEN 1	495	71.2
CHILL WTR PMP 3	495	70.8
PROPUL MTR XFRMR (PORT)	495	69.3
DIES GEN 4	495	69.1
DIES GEN 1	495	67.5
DIES GEN 1	495	66.4
PROPUL MTR FWD	495	65.8
AUX SW COOL PMP 2	495	64.5
DIES GEN 2	495	63.5
FW DISTILLER 2	495	62.2
PROPUL MTR AFT	495	59.9
TRAWLING HPU SYSTEM	496.3	80.3
E03-01 LOCKER	496.3	64.2
DIES GEN 4	512.5	78.0
STBD STRG HPU	512.5	71.7

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MACHINE	FREQ (Hz)	LEVEL	MACHINE	FREQ (Hz)	LEVEL
MARINE SAN UNIT	512.5	66.6	SS XFRMR T2	837.5	65.9
DIES GEN 4	525	61.2	STRG AFT STBD	850	76.3
TRAWLING HPU SYSTEM	537.5	98.8	DIES GEN 1	850	68.0
CHILL WTR PMP 3	537.5	78.1	DIES GEN 2	850	65.6
DIES GEN 3	537.5	67.8	AC PLANT 2	862.5	107.7
DIES GEN 4	537.5	60.0	TA01-REFER MACH RM	862.5	87.9
S05-OCEANWINCH RM	550	92.9	AC PLANT 2	862.5	85.6
DIES GEN 3	550	67.7	TA01-REFER MACH RM	862.5	79.0
TRAWLING HPU SYSTEM	587.5	96.7	DIES GEN 1	875	72.7
PROPUL MTR AFT	587.5	61.2	PROPUL MTR AFT	875	69.9
FW DIS EJECT PMP 2	600	103.4	DIES GEN 1	875	67.4
STBD STRG HPU	600	96.6	FW DIS EJECT PMP 2	887.5	108.2
S05-OCEANWINCH RM	600	89.4	TRAWLING HPU SYSTEM	887.5	92.5
PROPUL MTR XFRMR (STBD)	600	87.5	HOT WATER CIRC#1	887.5	67.5
STBD STRG HPU	600	79.2	STBD STRG HPU	900	107.2
SS XFRMR T1	600	67.6	STBD STRG HPU	900	82.1
SS XFRMR T2	600	66.1	DIES GEN 1	900	65.1
S03-MMR	612.5	88.9	AC01-OA SUP A/C	925	96.0
AC01-OA SUP A/C	625	91.0	REEFER #2	925	94.7
S06-TRWL WINCH RM	637.5	72.9	TRAWLING HPU SYSTEM	950	92.3
AC PLANT 2	650	84.2	AC PLANT 1	950	76.4
DIES GEN 3	650	83.2	DIES GEN 1	962.5	88.3
AC PLANT 2	687.5	94.3	FW DIS EJECT PMP 2	962.5	83.2
MARINE SAN UNIT	687.5	78.8	SS XFRMR T1	962.5	71.1
DIES GEN 1	687.5	78.3	PROPUL MTR XFRMR (PORT)	962.5	68.4
DIES GEN 1	687.5	71.2	DIES GEN 2	962.5	68.1
DIES GEN 2	687.5	61.1	TA01-REFER MACH RM	1000	68.1
DIES GEN 2	687.5	58.9	CHILL WTR PMP 3	1025	84.9
AC02-EOS	700	77.8	DIES GEN 4	1025	77.3
DIES GEN 4	700	64.6	E06-MAIN DECK EX	1050	86.2
E03-01 LOCKER	712.5	111.8	AC02-EOS	1050	70.4
TRAWLING HPU SYSTEM	712.5	95.1	TRAWLING HPU SYSTEM	1075	98.5
S06-TRWL WINCH RM	712.5	68.4	AC PLANT 2	1075	97.7
DIES GEN 3	725	65.6	SS XFRMR T1	1075	75.7
SS XFRMR T1	725	64.7	SS XFRMR T2	1075	69.7
DIES GEN 3	725	63.9	AUX SW COOL PMP 2	1100	95.8
TA01-REFER MACH RM	750	101.9	TA01-REFER MACH RM	1113	61.8
TA01-REFER MACH RM	750	77.6	MARINE SAN UNIT	1138	59.0
AUX SW COOL PMP 2	750	76.2	FW DIS EJECT PMP 2	1163	83.0
MARINE SAN UNIT	750	76.0	FW DIS EJECT PMP 2	1188	103.1
DIES GEN 2	750	62.9	STBD STRG HPU	1200	101.9
S01-EMG GEN RM	775	93.2	AUX SW COOL PMP 2	1200	84.2
MN SW COOL PMP 2	775	84.3	DIES GEN 1	1200	69.6
E03-01 LOCKER	775	73.2	DIES GEN 1	1213	72.2
MARINE SAN UNIT	787.5	61.1	DIES GEN 4	1213	67.2
S03-MMR	800	88.8	REEFER #2	1225	75.8
AUX SW COOL PMP 2	825	74.8	DIES GEN 4	1225	75.4
S01-EMG GEN RM	837.5	88.4	DIES GEN 4	1225	72.6
REEFER #2	837.5	81.8	DIES GEN 3	1250	70.1

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MACHINE	FREQ (Hz)	LEVEL	MACHINE	FREQ (Hz)	LEVEL
DIES GEN 3	1250	69.3	S01-EMG GEN RM	1725	66.5
DIES GEN 2	1263	67.5	E03-01 LOCKER	1725	61.2
TA01-REFER MACH RM	1275	78.6	PROPUL MTR XFRMR (STBD)	1738	74.2
AC PLANT 2	1288	95.5	PROPUL MTR AFT	1750	69.8
DIES GEN 4	1288	70.4	MN SW COOL PMP 2	1775	106.1
E02-REEFR MACH RM	1300	88.7	AC PLANT 2	1788	102.6
DIES GEN 4	1325	76.5	CHILL WTR PMP 3	1788	82.7
S03-MMR	1338	93.1	PROPUL MTR XFRMR (STBD)	1800	71.3
S02-MMR	1338	88.8	DIES GEN 3	1813	59.4
DIES GEN 4	1338	67.2	TRAWLING HPU SYSTEM	1825	85.1
DIES GEN 3	1338	67.2	DIES GEN 4	1838	66.9
DIES GEN 3	1338	64.4	DIES GEN 4	1863	65.9
DIES GEN 3	1350	74.1	DIES GEN 3	1875	69.0
DIES GEN 4	1363	63.9	DIES GEN 4	1888	61.3
TRAWLING HPU SYSTEM	1375	93.2	DIES GEN 4	1900	88.2
DIES GEN 1	1388	81.2	DIES GEN 3	1900	66.3
AC02-EOS	1388	80.2	DIES GEN 3	1900	63.3
TRAWLING HPU SYSTEM	1425	90.3	E06-MAIN DECK EX	1925	88.7
AC PLANT 2	1438	98.7	S01-EMG GEN RM	1963	73.1
PROPUL MTR FWD	1438	77.0	AC PLANT 2	1975	95.1
DIES GEN 1	1438	74.2	AC02-EOS	1975	83.7
DIES GEN 1	1438	72.3	AC PLANT 2	2000	96.3
PROPUL MTR AFT	1438	69.5	REEFER #2	2000	75.5
SS XFRMR T2	1438	66.5	MN SW COOL PMP 2	2013	104.3
DIES GEN 2	1450	67.2	CHILL WTR PMP 3	2025	88.8
REEFER #2	1463	79.4	TA01-REFER MACH RM	2038	79.4
DIES GEN 4	1488	68.5	AC PLANT 1	2063	81.6
DIES GEN 4	1500	73.6	DIES GEN 3	2088	61.8
STBD STRG HPU	1500	68.6	TA01-REFER MACH RM	2100	75.0
DIES GEN 4	1525	82.2	STBD STRG HPU	2100	58.9
REEFER #2	1525	79.2	AC PLANT 2	2138	90.2
MN SW COOL PMP 2	1538	105.2	REEFER #2	2150	82.3
AUX SW COOL PMP 2	1538	94.1	DIES GEN 2	2163	106.4
AC PLANT 1	1538	76.5	DIES GEN 1	2163	85.8
CHILL WTR PMP 3	1550	95.9	DIES GEN 1	2163	84.2
DIES GEN 3	1563	66.5	SS XFRMR T2	2163	70.4
TA01-REFER MACH RM	1563	65.2	DIES GEN 2	2163	70.0
MARINE SAN UNIT	1563	55.1	DIES GEN 1	2175	68.7
HOT WATER CIRC#1	1575	76.7	TA04-DES/GEN STORS	2250	69.8
AC02-EOS	1625	83.2	TA01-REFER MACH RM	2263	55.3
AC02-EOS	1625	62.0	MN SW COOL PMP 2	2375	100.8
TA01-REFER MACH RM	1638	70.9	S03-MMR	2375	86.8
MN SW COOL PMP 2	1650	100.5	S02-MMR	2388	88.3
FW DIS EJECT PMP 2	1663	86.1	CHILL WTR PMP 3	2388	75.5
DIES GEN 2	1663	68.4	REEFER #2	2388	55.0
TA01-REFER MACH RM	1675	86.4	DIES GEN 2	2400	76.6
PROPUL MTR XFRMR (PORT)	1675	83.7	AC02-EOS	2438	82.5
TA01-REFER MACH RM	1675	67.9	DIES GEN 2	2450	76.5
PROPUL MTR XFRMR (STBD)	1700	72.7	REEFER #2	2475	90.7

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MACHINE	FREQ (Hz)	LEVEL	MACHINE	FREQ (Hz)	LEVEL
AC PLANT 2	2500	88.5	MN SW COOL PMP 2	3188	96.8
SS XFRMR T2	2513	75.5	E03-01 LOCKER	3188	67.4
TA01-REFER MACH RM	2538	61.9	CHILL WTR PMP 3	3225	93.0
STBD STRG HPU	2550	102.3	E06-MAIN DECK EX	3238	87.2
AC PLANT 2	2575	92.7	PROPUL MTR XFRMR (PORT)	3238	70.4
TA01-REFER MACH RM	2600	79.4	S01-EMG GEN RM	3250	76.8
S06-TRWL WINCH RM	2600	67.2	FO PURIFIER 2	3263	96.5
TA01-REFER MACH RM	2600	59.6	MN SW COOL PMP 2	3313	105.0
DIES GEN 4	2638	75.4	AUX SW COOL PMP 1	3313	95.7
DIES GEN 4	2638	64.9	AUX SW COOL PMP 2	3313	95.2
DIES GEN 1	2650	83.4	E06-MAIN DECK EX	3313	88.5
DIES GEN 3	2663	71.1	CHILL WTR PMP 3	3338	93.8
DIES GEN 3	2688	76.5	S06-TRWL WINCH RM	3350	60.3
DIES GEN 3	2700	76.2	DIES GEN 1	3363	109.6
MN SW COOL PMP 2	2713	99.8	TA04-DES/GEN STORS	3375	57.2
DIES GEN 3	2738	108.3	E06-MAIN DECK EX	3388	88.3
CHILL WTR PMP 3	2738	83.1	TA04-DES/GEN STORS	3413	57.7
DIES GEN 3	2738	75.6	AC PLANT 2	3425	90.0
DIES GEN 4	2750	72.8	CHILL WTR PMP 3	3463	100.4
DIES GEN 4	2763	105.7	AC02-EOS	3475	81.9
E06-MAIN DECK EX	2763	84.4	AC02-EOS	3475	71.5
STBD STRG HPU	2763	80.9	PROPUL MTR AFT	3500	67.3
SS XFRMR T2	2763	79.7	MN SW COOL PMP 2	3550	109.0
SS XFRMR T1	2763	72.4	AUX SW COOL PMP 1	3550	94.3
DIES GEN 2	2763	62.9	S03-MMR	3575	76.8
PROPUL MTR XFRMR (STBD)	2763	62.5	S01-EMG GEN RM	3575	72.8
AC02-EOS	2788	81.0	SS XFRMR T1	3600	71.2
AC02-EOS	2788	65.1	E02-REEFR MACH RM	3625	75.4
HOT WATER CIRC#1	2800	64.9	HOT WATER CIRC#1	3663	63.2
DIES GEN 1	2813	73.3	DIES GEN 2	3688	56.0
DIES GEN 3	2863	101.9	CHILL WTR PMP 3	3700	81.2
SS XFRMR T1	2875	73.9	S01-EMG GEN RM	3775	69.9
DIES GEN 1	2875	73.7	DIES GEN 3	3813	100.2
PROPUL MTR FWD	2875	68.5	STBD STRG HPU	3888	76.0
PROPUL MTR AFT	2875	60.5	FO PURIFIER 2	3950	109.5
E06-MAIN DECK EX	2925	86.5	AUX SW COOL PMP 1	4138	91.6
S01-EMG GEN RM	2925	66.6	AUX SW COOL PMP 2	4138	85.5
E06-MAIN DECK EX	2963	84.9	AC PLANT 2	4288	79.2
AC PLANT 2	3000	98.4	DIES GEN 3	4288	77.3
SS XFRMR T2	3000	84.9	TRAWLING HPU SYSTEM	4288	76.9
SS XFRMR T1	3000	68.9	PROPUL MTR FWD	4313	75.0
S01-EMG GEN RM	3025	71.5	PROPUL MTR AFT	4313	74.9
DIES GEN 1	3038	78.1	PROPUL MTR AFT	4313	68.9
TRAWLING HPU SYSTEM	3063	73.1	DIES GEN 1	4313	63.8
MN SW COOL PMP 2	3075	100.3	AC PLANT 1	4325	74.2
AUX SW COOL PMP 1	3075	100.0	HOT WATER CIRC#1	4513	73.0
CHILL WTR PMP 3	3100	82.9	S03-MMR	4638	90.5
AC02-EOS	3138	79.2	PROPUL MTR XFRMR (PORT)	4738	71.3
TA01-REFER MACH RM	3163	76.3			

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MACHINE	FREQ (Hz)	LEVEL
S02-MMR	4763	98.6
TRAWLING HPU SYSTEM	4825	82.2
AUX SW COOL PMP 2	4850	92.8
MN SW COOL PMP 2	4850	91.2
S03-MMR	4875	91.7
CHILL WTR PMP 3	4888	110.3
FO PURIFIER 2	4938	118.1
MN SW COOL PMP 2	4963	100.1
AUX SW COOL PMP 2	4963	97.5
AUX SW COOL PMP 1	4963	96.4
MN SW COOL PMP 2	4963	69.4

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