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Acoustic Measurements of a Full-Scale Rotor with Four Tip Shapes Vol. II. Appendix C, Appendix D, Appendix E and Appendix F

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APPENDIX C

TABULATED ACOUSTIC DATA: SELECTED POINTS

This appendix provides a more extensive list of performance and acoustic data for a smaller number of data points than appendix B. Table 5, which lists the order in which the data are presented, is repeated here for convenience. Symbols used in the listing are defined below.

Symbol	Quantity
ALPHA	angle of shaft from vertical, positive aft, deg
CLR/S	rotor lift coefficient, $\frac{L}{\rho S(\Omega R)^2}$
CPO/S	rotor nonideal power coefficient, CP/S - $\frac{\sigma}{2\mu}$ (CLR/S)^2 - $\mu\cdot$CXR/S
CP/S	rotor power coefficient, $\frac{P}{\rho S(\Omega R)^3}$
CXR/S	X-force coefficient, positive forward, $\frac{-D}{\rho S(\Omega R)^2}$
DB	dB value; not corrected for background noise
DBA	dBA value; not corrected for background noise
DBAC	dBA with background noise subtracted
DBC	dB with background noise subtracted
MAT	advancing-tip Mach number
MIC	microphone number
MTIP	rotational-tip Mach number
MTUN	wind-tunnel Mach number
0MEG*R	rotor-tip speed, m/sec
PMIN	minimum acoustic pressure, N/m^2
PMAX	maximum acoustic pressure, N/m^2
PNDB	PNdB, not corrected for background noise
PNDBC	PNdB with background noise subtracted
POINT	test-point number
RPM	rpm of rotor
RUN	test run number
THETA	blade collective pitch, deg
VELOCITY	wind-tunnel velocity, knots
VSOUND	velocity of sound, m/sec
V/OR	advance ratio

TABLE 5.-KEY TO ACOUSTIC DATA TABULATED IN APPENDIX C

Operating condition				Tip planform, page numbers			
μ	M_{tip}	M_{at}	V	Swept-tapered	Swept	Tapered	Rectangular
0.200	0.550	0.660	73	89	--	--	--
.075	.595	.640	30	--	--	--	--
.150	.595	.685	60	91	--	--	--
.200	.600	.720	80	92	118	131	146
.250	.600	.750	100	97	--	--	--
.300	.600	.780	120	100	121	134	150
.375	.600	.825	150	105	124	139	154
.400	.600	.840	160	107	--	--	--
.250	.650	.815	107	110	--	--	--
.375	.650	.895	164	111	127	142	156
.375	.685	.940	170	114	--	142	--
.250	.700	.875	115	115	--	--	--
.375	.700	.965	175	116	--	144	--

Table C1. Acoustic Measurements for the Swept Tapered Tip Rotor.

RUN	POINT	VELOCITY	MTUN	RPM	OMEG*R	MTIP	V/OR	MAT
		ALPHA	CLR/S	THETA	CP/S	CPQ/S	CXR/S	VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
12	26	73.1	0.1094	268.9	188.9	0.5494	0.1994	0.6589
		-5.0	0.06320	8.0	0.00295	0.00133	0.004360	343.7
1	107.4	106.7	100.6	99.5	111.2	108.4	-13.5	13.7
2	109.5	108.8	107.1	106.9	116.7	114.5	-18.7	18.4
3	107.3	106.6	100.3	99.1	111.3	109.0	-15.1	12.0
4	105.5	104.5	101.4	100.6	111.8	108.5	-13.5	10.8
5	109.5	109.0	103.1	102.5	113.9	112.3	-14.6	14.1
6	129.5	129.5	128.1	128.1	141.8	141.8	-136.9	135.9
7	105.3	103.9	99.9	98.3	110.8	106.2	-10.2	10.5
12	27	73.3	0.1097	268.7	188.7	0.5490	0.2001	0.6588
		-5.0	0.08410	10.0	0.00404	0.00156	0.005750	343.7
1	107.5	106.9	101.0	100.0	112.0	109.9	-15.5	11.9
2	110.0	109.4	107.1	106.9	116.9	114.8	-14.2	15.5
3	107.2	106.5	101.3	100.4	112.5	110.6	-12.8	13.7
4	105.9	104.9	100.7	99.7	111.7	109.8	-11.1	12.1
5	111.3	111.0	103.8	103.3	114.8	113.5	-23.1	14.2
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	105.5	103.6	101.1	99.8	112.0	108.2	-17.0	11.7
12	29	73.7	0.1103	269.3	189.1	0.5502	0.2007	0.6606
		-5.0	0.12110	14.0	0.00697	0.00247	0.008810	343.7
1	112.9	112.7	101.7	100.9	113.6	112.3	-23.8	18.4
2	112.9	112.6	106.2	105.9	117.3	115.9	-21.0	22.1
3	112.3	112.1	102.5	101.8	114.2	113.0	-19.3	16.9
4	107.8	107.2	101.3	100.4	112.7	111.2	-15.8	11.3
5	113.5	113.3	105.7	105.3	117.1	116.3	-27.9	25.1
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	113.9	113.7	101.3	99.9	112.8	109.8	-16.6	22.2

Table C1. continued. Acoustic Measurements for the Swept Tapered Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
12	22	73.2 -2.5	0.1095 0.07088	269.1 8.0	189.0 0.00271	0.5498 0.00138	0.1995 0.001910	0.6595 343.7
1	109.5	109.1	102.0	101.3	112.8	111.1	-15.9	16.3
2	110.4	109.8	107.2	106.9	117.6	116.0	-17.8	20.5
3	110.6	110.2	105.6	105.3	116.2	115.0	-21.2	17.7
4	106.6	105.7	99.5	98.0	111.0	108.5	-12.5	10.8
5	111.4	111.0	104.6	104.2	115.7	114.9	-22.5	18.6
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	108.0	107.0	101.0	99.6	112.3	109.5	-11.0	10.5
12	24	73.6 -2.5	0.1102 0.11158	268.5 12.0	188.5 0.00484	0.5486 0.00197	0.2011 0.002750	0.6589 343.7
1	111.2	110.9	103.8	103.3	114.9	114.1	-18.8	17.8
2	112.8	112.5	107.9	107.6	118.7	117.6	-41.7	23.4
3	111.9	111.6	105.3	104.9	116.6	115.8	-24.3	19.9
4	109.4	109.0	103.1	102.5	114.8	113.7	-18.0	20.1
5	114.4	114.2	107.4	107.2	118.9	118.4	-25.0	37.3
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	109.5	108.7	102.7	101.5	113.9	111.6	-15.6	16.3
12	19	73.5 0.0	0.1100 0.07959	268.5 8.0	188.5 0.00223	0.5486 0.00134	0.2007 -0.001470	0.6587 343.7
1	114.0	113.8	104.7	104.3	116.3	115.4	-26.3	30.9
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	114.0	113.8	105.4	105.1	117.1	116.2	-24.8	29.5
4	111.8	111.5	104.7	104.3	116.0	115.1	-26.7	17.9
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table C1. continued. Acoustic Measurements for the Swept Tapered Tip Rotor.

RUN	POINT	VELOCITY	MTUN	RPM	OMEGA*R	MTIP	V/OR	MAT
		ALPHA	CLR/S	THETA	CP/S	CPO/S	CXR/S	VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
12	20	73.7	0.1103	269.7	188.7	0.5490	0.2012	0.6594
		0.0	0.10017	10.0	0.00305	0.00154	-0.001790	343.7
1	114.3	114.2	105.9	105.6	117.8	116.9	-26.8	26.8
2	116.9	116.8	110.5	110.3	121.4	120.4	-68.4	32.5
3	116.5	116.4	108.5	108.3	120.5	119.9	-35.4	35.5
4	113.8	113.6	105.3	105.0	117.9	117.0	-31.1	28.6
5	118.1	118.0	109.1	108.9	121.9	121.6	-44.6	41.6
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	113.5	113.2	106.0	105.5	117.8	116.8	-35.0	33.7
9	6	59.9	0.0903	291.0	204.3	0.5994	0.1509	0.6899
		-5.0	0.07081	10.0	0.00332	0.00137	0.004700	340.9
1	112.7	112.6	104.6	104.5	114.5	113.9	-20.0	21.6
2	112.5	112.3	107.8	107.7	117.8	117.1	-27.2	24.8
3	109.1	108.9	102.7	102.4	113.6	113.0	-17.7	13.1
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	115.2	115.1	103.1	102.8	114.0	113.4	-20.3	27.7
6	114.2	114.1	104.9	104.7	116.6	115.9	-30.7	25.3
7	111.3	111.1	99.1	98.2	110.3	108.2	-16.1	14.0
9	7	59.6	0.0900	290.2	203.8	0.5978	0.1507	0.6879
		-5.0	0.08625	12.0	0.00420	0.00154	0.005410	340.9
1	112.3	112.3	103.6	103.4	114.4	113.9	-19.9	19.4
2	113.8	113.7	107.4	107.3	117.7	117.2	-23.5	24.4
3	108.7	108.5	102.5	102.3	113.8	113.2	-13.6	14.1
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	115.5	115.5	102.3	102.0	113.7	113.1	-24.1	26.4
6	115.6	115.5	106.5	106.4	117.5	117.0	-33.0	24.8
7	115.0	115.0	101.4	100.9	112.4	110.7	-21.5	24.9

Table C1. continued. Acoustic Measurements for the Swept Tapered Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPR/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
8	12	59.6 0.0	0.0895 0.17059	291.0 12.0	204.3 0.00476	0.5965 0.00192	0.1503 -0.005220	0.6862 342.5
1	118.6	118.6	110.0	110.0	122.2	122.0	-36.6	52.0
2	121.6	121.6	113.7	113.7	126.2	126.0	-78.8	43.0
3	116.1	116.0	109.0	109.0	121.1	121.0	-41.3	32.9
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	120.3	120.3	109.6	109.5	122.2	122.1	-42.4	79.6
6	121.6	121.6	113.1	113.0	125.7	125.5	-112.0	51.4
7	118.7	118.6	107.8	107.7	119.5	119.2	-38.2	56.5
8	14	60.3 0.0	0.0905 0.13790	291.0 14.0	204.3 0.00651	0.5966 0.00277	0.1519 -0.006180	0.6972 342.5
1	117.1	117.1	108.6	108.5	121.2	121.1	-37.3	38.6
2	120.4	120.4	112.3	112.3	124.9	124.8	-80.7	42.2
3	115.3	115.3	108.8	108.7	121.4	121.3	-35.5	27.9
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	119.4	119.4	109.7	109.6	122.2	122.1	-41.2	74.9
6	121.1	121.1	112.8	112.8	125.8	125.6	-96.3	47.3
7	120.8	120.8	108.4	108.2	121.1	120.9	-40.5	66.2
11	2	80.4 -7.5	0.1199 0.05378	292.7 8.0	205.5 0.00333	0.5961 0.00141	0.2014 0.006900	0.7161 344.8
1	111.6	111.2	104.3	103.6	114.2	110.6	-15.1	20.5
2	112.5	112.0	109.5	109.3	118.6	116.2	-20.6	23.9
3	111.2	110.8	103.2	102.3	114.1	110.8	-16.4	19.2
4	108.0	107.2	103.2	102.4	113.8	109.5	-10.7	13.7
5	111.7	111.2	102.3	101.1	113.8	109.6	-15.5	20.9
6	111.4	110.7	106.1	105.5	116.6	113.6	-19.8	16.1
7	107.2	105.8	99.8	96.9	111.5	105.2	-12.1	12.6

Table C1. continued. Acoustic Measurements for the Swept Tapered Tip Rotor.

RUN	POINT	VELOCITY	MTUN	RPM	OMEGA*R	MTIP	V/OR	MAT
		ALPHA	CLR/S	THETA	CP/S	CPO/S	CXR/S	VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
11	3	80.3	0.1197	292.5	205.4	0.5951	0.2014	0.7150
		-7.5	0.07513	10.0	0.00457	0.00163	0.009430	345.1
1	110.9	110.5	102.0	100.7	113.0	109.8	-18.7	19.2
2	112.9	112.5	105.7	105.1	116.5	113.8	-21.9	21.9
3	111.0	110.6	103.8	103.0	114.6	111.3	-22.6	14.6
4	108.0	107.1	104.7	104.1	115.0	112.3	-14.7	16.0
5	112.1	111.7	104.0	103.2	115.2	112.6	-16.7	56.6
6	112.7	112.2	106.3	105.8	116.8	114.1	-25.0	117.1
7	111.3	110.8	103.8	102.9	114.7	110.3	-18.3	18.7
11	5	80.2	0.1194	294.3	206.7	0.5982	0.1999	0.7178
		-7.5	0.10432	13.0	0.00675	0.00202	0.013510	345.5
1	107.6	106.6	101.2	99.6	112.6	109.1	-11.8	13.2
2	116.0	115.7	107.4	107.0	117.7	115.4	-27.9	32.5
3	106.1	104.5	102.2	101.0	113.2	110.7	-13.0	14.7
4	107.9	106.9	103.8	103.0	114.8	112.9	-13.5	11.7
5	113.8	113.5	102.2	101.0	113.7	110.9	-18.3	36.3
6	115.0	114.7	106.6	106.1	117.0	114.5	-25.3	29.8
7	119.1	119.0	103.2	102.0	115.3	112.9	-33.0	45.4
11	8	80.3	0.1195	294.9	207.1	0.5993	0.1997	0.7190
		-7.5	0.12642	16.0	0.01010	0.00378	0.016670	345.5
1	120.9	120.9	105.6	105.1	117.8	117.0	-44.4	40.2
2	121.3	121.2	109.5	109.3	120.9	120.1	-48.5	57.7
3	120.2	120.1	106.5	106.0	119.0	118.3	-43.4	44.4
4	115.6	115.4	105.6	105.1	118.0	117.2	-32.5	28.7
5	116.4	116.2	106.2	105.8	118.6	117.9	-37.5	33.8
6	121.1	121.0	109.5	109.2	121.1	120.3	-53.5	42.4
7	123.4	123.4	106.5	105.8	118.7	117.9	-55.9	52.3

Table C1. continued. Acoustic Measurements for the Swept Tapered Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPQ/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
10	5	78.9	0.1199	288.2	202.4	0.5982	0.2007	0.7182
		-5.0	0.08185	10.0	0.00410	0.00159	0.006310	339.3
1	111.6	111.2	101.6	100.4	114.0	112.3	-41.9	33.8
2	113.3	113.0	108.8	109.5	118.9	116.5	-40.2	36.4
3	108.0	107.1	102.9	101.9	114.6	113.2	-44.0	35.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	110.0	109.2	103.8	102.8	116.1	113.5	0.0	13.6
7	110.7	110.1	104.8	104.1	114.6	110.7	-17.6	21.3
10	8	79.0	0.1198	287.8	202.1	0.5962	0.2013	0.7162
		-5.0	0.11115	13.0	0.00627	0.00225	0.008590	339.0
1	109.6	109.0	102.4	101.4	115.1	114.1	-41.9	33.8
2	116.6	116.4	107.8	107.4	119.0	117.6	-40.2	36.4
3	111.7	111.3	103.6	102.8	115.4	114.3	-44.0	35.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	115.2	114.9	106.3	105.8	117.8	116.2	-32.4	29.3
7	120.3	120.2	103.8	102.7	115.4	113.2	-37.5	44.1
10	20	79.3	0.1202	289.6	203.4	0.5993	0.2008	0.7196
		-2.5	0.06940	8.0	0.00277	0.00140	0.002360	339.3
1	114.8	114.6	104.9	104.3	115.9	114.6	-25.0	23.8
2	113.6	113.2	110.1	109.9	120.6	119.3	-35.0	23.8
3	110.9	110.4	103.8	103.1	115.0	113.7	-19.2	19.3
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	114.5	114.1	108.2	107.9	119.5	118.2	-32.7	29.3
7	109.1	108.0	103.5	102.3	114.6	111.8	-16.5	13.4

Table C1. continued. Acoustic Measurements for the Swept Tapered Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
10	22	79.4	0.1202	289.8	203.5	0.5991	0.2009	0.7195
		-2.5	0.10911	12.0	0.00504	0.00205	0.003900	339.7
1	113.0	112.7	105.8	105.3	117.9	117.4	-41.9	33.8
2	116.5	116.3	109.7	109.4	121.2	120.2	-41.9	42.5
3	112.7	112.5	106.7	106.3	118.6	118.1	-44.0	35.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	116.0	115.8	109.6	109.3	121.4	120.4	-44.7	41.0
7	120.5	120.5	105.5	104.7	116.8	115.4	-40.3	42.1
10	23	79.1	0.1198	289.0	202.9	0.5974	0.2008	0.7174
		-2.5	0.11935	13.0	0.00588	0.00239	0.004170	339.7
1	113.6	113.4	107.2	106.8	118.2	117.6	-22.3	25.1
2	118.0	117.8	110.6	110.4	121.9	121.2	-53.4	36.6
3	114.1	113.9	107.5	107.2	118.8	118.2	-23.5	23.5
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	121.5	121.5	107.4	106.9	118.4	117.4	-51.6	52.6
12	5	80.0	0.1198	292.9	205.7	0.5987	0.2003	0.7186
		0.0	0.08111	8.0	0.00226	0.00135	-0.001600	343.5
1	117.2	117.1	107.1	106.8	118.8	117.9	-29.3	39.7
2	119.1	119.0	112.7	112.5	123.5	122.5	-102.7	34.9
3	118.1	118.1	108.6	108.3	121.3	120.6	-49.3	35.0
4	115.0	114.8	106.9	106.5	119.6	118.8	-27.7	29.4
5	120.4	120.4	110.8	110.6	123.2	122.8	-48.0	61.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	114.9	114.6	107.3	106.8	119.8	119.6	-28.2	29.0

Table C1. continued. Acoustic Measurements for the Swept Tapered Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
10	15	79.0	0.1197	289.0	202.9	0.5980	0.2005	0.7179
		0.0	0.09811	10.0	0.00315	0.00159	-0.001160	339.4
1	117.0	116.9	108.6	108.4	120.4	120.0	-41.9	35.6
2	120.8	120.7	114.7	114.7	126.8	126.5	-128.1	115.3
3	116.6	116.5	109.8	109.7	122.4	122.1	-44.0	35.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	120.6	120.5	112.6	112.5	125.2	124.6	-75.2	46.2
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	16	78.9	0.1196	289.0	202.9	0.5980	0.2003	0.7178
		0.0	0.11912	12.0	0.00447	0.00210	-0.001410	339.4
1	118.9	118.9	112.6	112.5	124.1	123.7	-53.8	51.2
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	119.2	119.2	112.6	112.5	124.5	124.1	-55.7	57.7
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	126.4	126.4	118.2	118.2	130.8	130.8	-117.4	70.6
7	121.4	121.4	112.2	112.0	123.9	123.3	-68.7	56.5
11	12	80.3	0.1194	293.7	206.2	0.5959	0.2006	0.7154
		10.0	0.06961	4.0	-0.00063	0.00135	-0.014390	346.1
1	119.2	119.2	101.8	100.5	113.8	111.6	-35.4	36.7
2	116.1	115.9	104.7	103.9	117.1	114.8	-27.5	33.9
3	118.5	118.4	102.6	101.6	114.7	112.5	-29.7	39.2
4	113.5	113.3	101.5	100.1	114.0	111.9	-20.5	22.6
5	117.0	116.9	102.6	101.5	115.4	113.1	-25.4	35.1
6	119.1	119.0	104.4	103.6	116.3	113.9	-34.7	45.0
7	118.5	118.4	102.1	100.2	114.5	111.2	-33.0	30.8

Table C1. continued. Acoustic Measurements for the Swept Tapered Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	BNDB	BNDBC	PMIN	PMAX
11	13	80.6 10.0	0.1198 0.08980	293.3 6.0	206.0 -0.00081	0.5950 0.00144	0.2016 -0.018570	0.7150 346.1
1	120.2	120.2	103.1	102.2	115.0	113.1	-41.6	40.8
2	116.4	116.2	105.8	105.2	118.2	116.3	-36.6	30.3
3	119.4	119.4	104.1	103.3	116.6	115.0	-35.3	50.4
4	114.7	114.5	103.1	102.1	116.0	114.5	-31.0	25.9
5	118.6	118.5	103.9	103.1	116.4	114.7	-50.7	40.4
6	120.1	120.0	106.1	105.5	118.4	116.4	-41.7	51.2
7	118.9	118.6	103.7	102.3	116.3	113.9	-35.4	43.0
11	14	80.9 10.0	0.1202 0.11135	294.1 8.0	206.5 -0.00069	0.5961 0.00165	0.2019 -0.022960	0.7165 346.4
1	120.9	120.9	105.5	105.0	117.9	116.6	-39.2	47.6
2	118.7	118.6	107.1	106.7	119.9	119.4	-33.3	38.5
3	120.7	120.7	106.2	105.7	119.7	118.5	-44.2	49.0
4	116.0	115.8	105.0	104.4	117.6	116.3	-32.2	29.8
5	119.9	119.9	105.4	104.8	118.1	116.9	-40.1	51.6
6	121.6	121.5	107.9	107.5	120.4	119.9	-50.5	53.5
7	120.2	120.1	105.3	104.3	117.1	115.0	-43.5	49.7
11	28	100.9 -5.0	0.1501 0.07811	295.9 10.0	207.8 0.00413	0.6007 0.00175	0.2502 0.005900	0.7510 345.9
1	113.0	112.0	104.6	102.3	116.0	111.2	-27.4	23.1
2	114.3	113.2	109.2	108.2	119.9	116.4	-25.1	26.5
3	113.4	112.5	105.0	102.9	116.5	112.3	-27.1	35.5
4	110.9	109.3	104.3	101.7	116.0	110.1	-22.6	22.6
5	115.8	115.2	107.1	105.7	118.9	116.0	-37.9	31.3
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	113.0	111.7	105.1	102.2	116.4	109.0	-29.4	28.3

Table C1. continued. Acoustic Measurements for the Swept Tapered Tip Rotor.

RUN / MIC	POINT / DB	VELOCITY ALPHA / DBC	MTUN CLR/S / DBA	RPM THETA / DBAC	OMEG*R CP/S / PNDB	MTIP CPO/S / PNDBC	V/OR CXR/S / PMIN	MAT VSOUND / PMAX
12	9	100.4	0.1504	291.8	204.9	0.5968	0.2523	0.7474
		-5.0	0.07848	10.0	0.00407	0.00170	0.005770	343.3
1	113.1	112.2	106.2	104.8	117.2	113.5	-19.8	29.5
2	115.2	114.3	112.1	111.7	121.6	118.4	-30.3	33.9
3	114.1	113.4	107.5	106.5	118.3	115.2	-27.6	36.4
4	111.1	109.6	106.5	105.2	117.5	112.5	-19.5	22.4
5	114.8	111.0	108.7	107.9	119.8	117.5	-26.6	31.2
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	11	100.1	0.1501	293.5	206.1	0.6004	0.2503	0.7507
		-5.0	0.11434	14.0	0.00708	0.00278	0.009360	343.3
1	114.9	114.4	106.5	105.2	118.0	115.7	-31.0	30.6
2	119.8	118.5	108.1	106.9	119.6	116.4	-32.7	47.1
3	114.1	113.3	106.7	105.5	118.2	115.8	-29.9	26.6
4	111.8	110.5	105.9	104.3	117.6	115.2	-22.9	18.6
5	117.6	117.3	109.0	108.2	120.8	119.3	-37.6	48.5
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	122.5	122.4	105.8	103.3	117.2	112.5	-46.2	44.1
12	13	99.9	0.1494	292.5	205.4	0.5979	0.2502	0.7474
		-2.5	0.06861	8.0	0.00267	0.00147	0.001980	343.6
1	115.8	115.3	106.5	105.1	117.8	115.0	-27.7	27.5
2	113.5	112.2	109.9	109.1	120.9	118.6	-29.7	20.5
3	116.2	115.8	107.4	106.3	118.8	116.6	-36.0	26.8
4	112.5	111.4	105.3	103.5	117.5	114.6	-29.7	21.7
5	117.2	116.9	109.3	108.6	120.9	119.3	-32.5	43.5
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	111.9	110.1	107.2	105.6	118.2	114.8	-18.5	23.6

Table C1. continued. Acoustic Measurements for the Swept Tapered Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEGA*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
12	15	100.4	0.1503	293.1	205.8	0.5991	0.2512	0.7496
		-2.5	0.10728	12.0	0.00487	0.00221	0.003780	343.5
1	113.7	113.0	107.8	106.9	118.7	116.7	-29.1	30.3
2	117.7	117.3	111.8	111.3	122.8	120.8	-55.7	41.0
3	115.9	115.5	108.0	107.1	120.1	118.4	-33.7	32.2
4	113.9	113.1	108.2	107.3	120.0	118.4	-32.1	29.8
5	118.9	118.7	111.4	111.0	123.1	122.1	-46.7	53.9
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	120.8	120.6	108.9	107.8	120.1	117.6	-44.9	42.8
11	22	100.7	0.1497	295.1	207.2	0.5992	0.2502	0.7491
		0.0	0.05809	6.0	0.00154	0.00132	-0.001130	345.8
1	117.4	117.1	108.4	107.6	120.2	118.5	-38.0	44.9
2	117.1	116.5	109.7	108.9	122.0	120.2	-35.8	39.7
3	117.3	117.0	108.1	107.2	120.2	118.4	-36.3	43.6
4	115.0	114.4	107.2	106.0	119.6	117.6	-27.0	44.9
5	118.9	118.6	110.2	109.6	122.3	120.7	-40.9	58.9
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	114.4	113.3	106.8	104.9	119.5	116.9	-29.4	30.5
11	23	100.7	0.1498	294.9	207.1	0.5987	0.2505	0.7487
		0.0	0.07790	8.0	0.00212	0.00153	-0.001280	345.9
1	118.4	118.1	109.3	108.6	121.5	120.1	-36.9	41.7
2	118.3	117.9	111.3	110.8	124.2	122.6	-61.1	41.5
3	118.2	118.0	108.9	108.1	121.6	119.9	-46.0	43.2
4	117.3	116.9	109.2	108.5	122.4	120.9	-41.1	48.5
5	120.9	120.8	112.2	111.8	124.8	124.0	-72.5	76.1
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	116.6	115.0	108.8	107.7	121.3	119.3	-36.8	35.3

Table C1. continued. Acoustic Measurements for the Swept Tapered Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
11	24	100.9	0.1501	295.5	207.5	0.6000	0.2505	0.7503
		0.0	0.09931	10.0	0.00290	0.00179	-0.001440	345.8
1	120.4	120.2	112.2	111.8	124.3	123.1	-51.5	55.5
2	120.0	119.7	112.8	112.4	124.7	123.2	-54.5	43.6
3	121.0	120.9	112.5	112.2	125.3	124.2	-63.8	48.2
4	118.9	118.6	111.1	110.7	124.3	123.2	-51.5	41.5
5	123.9	123.8	114.8	114.6	127.3	126.5	-81.0	90.8
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	119.1	118.8	111.2	110.6	124.1	122.7	-33.1	43.9
11	26	100.8	0.1500	294.5	206.8	0.5979	0.2512	0.7481
		0.0	0.12480	13.0	0.00511	0.00304	-0.000990	345.9
1	124.5	124.5	116.0	115.9	129.4	127.7	-99.3	130.2
2	126.5	126.5	117.8	117.7	130.7	130.1	-190.0	98.8
3	124.7	124.6	116.1	116.0	128.9	128.6	-96.3	125.0
4	124.4	124.3	116.1	115.9	129.3	128.8	-88.0	91.4
5	126.5	126.5	119.5	119.4	132.1	131.9	-141.4	130.5
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	128.1	128.1	116.8	116.6	129.4	128.7	-126.7	126.1
14	20	120.3	0.1803	292.9	205.7	0.5993	0.3012	0.7798
		-10.0	0.06831	12.0	0.00603	0.00197	0.011570	343.2
1	114.3	112.6	108.3	105.8	119.5	111.6	-27.4	29.3
2	119.3	118.7	110.3	108.0	122.1	113.1	-48.8	45.1
3	113.6	111.5	108.4	105.0	120.0	112.3	-26.2	21.2
4	111.3	107.6	105.1	99.6	117.1	102.6	-21.5	16.9
5	122.6	122.3	115.4	115.0	126.8	125.8	-57.8	76.2
6	119.1	118.3	110.0	107.4	122.1	112.6	-41.7	39.2
7	121.9	121.6	107.5	104.0	118.7	106.8	-39.4	57.2

Table C1. continued. Acoustic Measurements for the Swept Tapered Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
15	6	119.7	0.1803	291.6	204.8	0.5998	0.3010	0.7804
		-7.5	0.07539	12.0	0.00584	0.00213	0.009980	341.4
1	113.6	111.6	107.6	104.8	119.5	110.8	-24.1	31.1
2	119.1	118.3	111.2	109.3	122.9	115.9	-42.2	43.4
3	113.9	112.0	107.7	104.9	119.8	111.8	-23.5	25.1
4	111.8	108.9	104.9	99.3	117.2	101.7	-17.6	19.0
5	116.0	114.8	107.9	104.8	120.0	112.2	-30.7	34.3
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	120.6	120.2	105.4	97.7	117.8	101.4	-39.9	50.1
15	8	119.6	0.1799	292.7	205.5	0.6011	0.2997	0.7813
		-7.5	0.10231	15.0	0.00856	0.00303	0.014070	341.9
1	117.7	117.0	108.0	105.2	120.8	115.7	-34.6	37.1
2	123.1	122.8	110.2	107.6	123.2	118.5	-50.3	56.5
3	117.9	117.2	108.5	106.0	120.9	115.3	-32.8	35.4
4	114.1	112.4	105.3	99.6	117.9	105.3	-22.7	26.2
5	120.2	119.8	108.6	105.9	120.7	115.4	-41.2	52.6
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	124.2	124.1	105.2	95.1	117.9	99.0	-66.5	64.0
14	12	119.9	0.1802	292.3	205.3	0.5997	0.3009	0.7802
		-5.0	0.07069	10.0	0.00409	0.00183	0.005460	342.2
1	113.6	111.5	107.7	104.8	119.5	113.1	-23.5	22.8
2	116.7	115.2	110.8	109.0	122.0	115.8	-30.3	31.8
3	114.6	112.9	108.8	106.8	120.3	114.4	-32.9	37.0
4	112.2	109.4	105.9	102.1	117.9	107.4	-22.4	19.1
5	123.7	123.5	117.5	117.2	129.1	128.4	-85.6	91.8
6	116.2	114.4	110.4	108.5	121.7	115.6	-33.4	30.2
7	119.8	118.1	106.3	100.0	118.3	105.4	-35.2	33.9

Table C1. continued. Acoustic Measurements for the Swept Tapered Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
14	16	119.9	0.1800	293.3	206.0	0.6012	0.2998	0.7814
		-5.0	0.07376	12.0	0.00586	0.00210	0.010270	342.6
1	114.8	113.3	108.8	106.5	121.2	116.4	-132.0	106.9
2	119.8	119.2	110.2	107.7	122.2	115.1	-126.5	113.9
3	114.7	113.1	109.2	107.3	121.5	116.6	-144.1	114.6
4	111.9	109.3	105.3	100.3	117.2	103.0	-27.5	26.2
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	120.1	119.5	110.3	107.9	121.9	114.2	-39.5	49.9
7	121.7	121.4	106.3	99.5	118.4	104.5	-43.8	52.1
14	14	120.1	0.1803	293.3	206.0	0.6012	0.3003	0.7817
		-5.0	0.10523	14.0	0.00715	0.00302	0.009160	342.6
1	116.5	115.5	108.6	106.2	120.5	114.3	-32.0	50.3
2	122.2	121.8	109.3	106.0	121.8	114.9	-63.5	59.7
3	116.1	115.0	109.7	107.9	121.5	117.1	-35.1	40.9
4	112.9	110.6	105.8	100.7	117.9	105.9	-21.4	25.9
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	121.9	121.5	111.1	109.1	123.9	120.1	-60.7	52.0
7	124.0	123.9	105.8	98.0	118.1	102.4	-52.7	60.5
14	15	119.8	0.1799	293.1	205.8	0.6007	0.2999	0.7809
		-5.0	0.11044	15.0	0.00835	0.00379	0.010150	342.6
1	121.7	121.4	112.2	111.3	126.4	125.7	-132.4	106.9
2	124.6	124.4	113.8	112.8	127.5	126.4	-126.5	113.9
3	121.8	121.5	112.3	111.4	125.7	124.8	-143.3	113.1
4	117.2	116.2	108.2	105.5	121.5	118.0	-41.8	73.1
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	126.6	126.5	114.1	113.2	127.5	126.5	-99.4	76.7
7	127.6	127.5	108.0	103.9	120.7	114.8	-102.8	104.7

Table C1. continued. Acoustic Measurements for the Swept Tapered Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
60	8	120.3	0.1799	292.6	205.5	0.5974	0.3015	0.7775
		-2.5	0.06802	9.9	0.00399	0.00197	0.004780	343.9
1	112.8	110.0	107.4	104.2	119.6	112.0	-22.2	28.9
2	114.7	112.0	108.3	104.0	120.5	110.7	-31.2	36.0
3	113.6	111.4	107.2	103.7	119.8	111.4	-30.2	31.1
4	111.8	108.4	106.6	102.6	119.1	110.5	-22.3	21.6
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	116.4	114.6	109.1	106.0	121.5	114.6	-39.8	35.7
7	118.0	117.1	105.8	97.6	118.7	105.1	-36.8	39.7
22	4	119.5	0.1811	289.2	203.1	0.5984	0.3030	0.7797
		-2.5	0.07327	9.2	0.00323	0.00184	0.002390	339.4
1	115.3	113.8	109.7	108.0	121.6	118.3	-28.0	34.5
2	116.7	115.2	112.6	111.4	124.3	120.7	-46.4	38.8
3	114.8	113.2	109.3	107.4	121.6	118.0	-31.2	34.2
4	113.8	111.6	108.6	106.2	121.0	116.9	-37.4	23.1
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	116.0	114.2	107.9	103.8	121.4	115.4	-27.8	32.6
60	6	120.4	0.1801	291.8	204.9	0.5957	0.3028	0.7761
		-2.5	0.08120	9.9	0.00333	0.00193	0.001930	344.0
1	114.0	111.8	107.8	104.8	120.8	116.3	-24.5	22.6
2	116.3	114.4	110.5	108.4	122.8	118.8	-35.7	32.9
3	114.2	112.1	107.9	104.8	120.8	116.3	-34.6	24.7
4	112.3	108.5	107.2	103.5	120.4	115.3	-27.2	35.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	116.4	114.5	110.7	108.8	122.8	118.6	-43.0	41.4
7	118.0	117.1	107.0	100.6	119.4	109.5	-34.3	39.1

Table C1. continued. Acoustic Measurements for the Swept Tapered Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPQ/S	V/OR CXP/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
60	11	120.6	0.1800	293.8	206.3	0.5987	0.3011	0.7790
		-2.5	0.10797	12.9	0.00548	0.00304	0.003290	344.6
1	118.4	117.7	112.0	111.0	123.8	121.6	-51.6	41.5
2	123.5	123.2	117.7	117.3	129.1	127.7	-134.4	95.7
3	118.3	117.6	111.9	110.9	124.1	122.2	-49.6	46.7
4	117.9	117.2	112.0	111.0	125.0	123.2	-58.6	45.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	124.0	123.8	115.6	115.0	128.0	126.5	-88.7	91.2
7	125.4	125.3	111.6	110.2	123.1	120.1	-71.6	78.4
14	7	119.7	0.1803	291.8	204.9	0.6002	0.3008	0.7807
		0.0	0.07212	8.0	0.00219	0.00163	-0.000300	341.4
1	117.5	116.7	110.2	108.7	122.8	120.4	-37.1	51.5
2	119.3	118.5	112.7	111.5	125.2	122.3	-125.7	113.2
3	117.7	115.9	110.4	109.0	123.1	120.5	-48.8	48.3
4	115.1	113.7	108.2	105.7	120.9	116.3	-26.8	37.3
7	117.2	115.9	109.2	106.5	121.4	117.8	-43.7	39.7
14	8	119.5	0.1801	293.3	206.0	0.6035	0.2989	0.7839
		0.0	0.09133	10.0	0.00291	0.00196	-0.000320	341.3
1	119.7	119.2	112.3	111.4	126.1	125.2	-132.4	106.5
2	121.9	121.4	115.5	114.9	127.9	125.8	-126.4	112.8
3	120.0	119.6	113.0	112.3	126.3	125.4	-144.1	114.6
4	117.2	116.4	109.6	107.9	122.3	118.8	-32.6	42.6
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	121.0	120.4	114.7	114.1	126.9	124.8	-55.1	57.3
7	119.5	118.8	111.4	110.0	124.0	121.5	-54.2	55.3

Table C1. continued. Acoustic Measurements for the Swept Tapered Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
14	9	119.7	0.1803	292.5	205.4	0.6012	0.3003	0.7818
		0.0	0.10800	12.0	0.00418	0.00268	0.000170	341.6
1	119.6	119.1	112.8	112.0	125.2	123.7	-49.6	50.3
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	120.8	120.4	113.5	112.9	126.2	124.8	-59.4	48.8
4	118.4	117.8	111.9	111.0	124.3	121.9	-39.6	49.4
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	124.5	124.2	116.3	115.9	129.1	127.4	-135.6	87.8
7	124.0	123.8	113.2	112.3	125.4	123.6	-67.8	76.1
21	6	149.7	0.2259	291.2	204.5	0.6001	0.3770	0.8264
		-10.0	0.06698	14.0	0.00762	0.00283	0.011510	340.7
1	122.6	121.7	113.5	110.9	127.3	123.7	-72.5	65.9
2	124.6	123.9	114.8	111.5	128.3	123.3	-76.1	65.4
3	121.6	120.6	114.2	112.1	127.4	123.5	-62.2	52.1
4	118.3	115.8	111.4	106.3	124.6	116.1	-49.1	45.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	125.3	124.7	115.5	112.9	129.3	125.4	-78.0	92.8
7	126.7	126.3	115.9	114.3	130.0	127.2	-76.1	79.0
21	10	149.9	0.2254	292.9	205.7	0.6015	0.3753	0.8272
		-10.0	0.07534	15.0	0.00865	0.00312	0.013230	342.0
1	123.0	122.3	113.3	110.5	126.7	122.1	-123.2	99.5
2	125.4	124.8	114.8	111.7	128.5	123.8	-123.3	112.1
3	122.6	121.9	114.4	112.4	127.5	123.6	-125.9	99.4
4	119.5	117.8	111.9	107.4	125.2	117.6	-39.5	50.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	125.9	125.4	116.1	114.0	129.7	126.5	-76.9	77.3
7	127.7	127.4	117.3	116.1	131.2	128.7	-77.7	90.9

Table C1. continued. Acoustic Measurements for the Swept Tapered Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
21	7	149.3 -10.0	0.2254 0.08246	292.2 16.0	205.2 0.00964	0.6021 0.00355	0.3749 0.014440	0.8278 340.8
1	124.1	123.6	114.4	112.4	128.5	126.2	-61.9	87.3
2	126.2	125.7	115.1	112.2	129.0	125.1	-95.7	88.9
3	123.7	123.1	114.8	113.0	128.1	125.7	-68.8	70.8
4	119.6	117.9	112.1	107.9	125.6	119.8	-61.6	54.9
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	127.9	127.6	117.4	116.0	130.9	128.6	-124.7	117.1
7	129.0	128.8	118.5	117.6	132.9	131.5	-110.7	126.5
19	25	151.7 -5.0	0.2245 0.07402	296.3 12.0	208.1 0.00566	0.5988 0.00278	0.3755 0.006220	0.8236 347.5
1	121.5	120.3	113.4	110.4	126.7	122.0	-56.3	70.6
2	123.8	122.8	114.4	110.5	126.6	117.4	-99.6	68.4
3	120.7	119.3	113.5	110.6	126.4	120.3	-60.0	50.9
4	118.0	115.2	111.7	106.4	124.5	114.7	-47.2	38.7
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	125.2	124.7	112.4	107.3	126.5	119.8	-68.0	87.8
55	18	150.2 -5.0	0.2268 0.07171	292.6 14.0	205.5 0.00738	0.6031 0.00305	0.3766 0.010130	0.8302 340.7
1	122.4	121.5	113.4	110.6	127.2	124.0	-59.7	86.3
2	124.8	124.1	115.0	111.9	128.7	123.7	-91.6	66.4
3	121.7	120.6	113.5	110.8	126.3	121.2	-64.9	65.8
4	118.5	116.2	111.3	105.5	124.6	114.7	-45.5	45.6
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	127.0	126.5	116.0	113.7	129.7	126.4	-91.8	100.5
7	125.6	125.3	113.0	109.0	127.0	121.2	-70.5	70.6

Table C1. continued. Acoustic Measurements for the Swept Tapered Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
55	19	150.5	0.2268	292.4	205.3	0.6015	0.3776	0.8286
		-5.0	0.07994	11.0	0.00379	0.00248	0.001810	341.4
1	120.6	119.1	113.5	110.8	126.8	123.1	-55.8	57.3
2	121.4	119.6	114.4	110.9	127.2	121.2	-59.6	59.0
3	119.7	117.8	113.3	110.4	126.0	121.1	-52.8	45.3
4	118.3	115.8	111.6	106.3	124.7	117.5	-40.8	54.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	123.3	122.2	115.3	112.5	129.3	125.3	-59.7	69.6
7	122.7	121.9	112.0	105.5	125.5	117.5	-72.4	60.8
21	3	148.2	0.2254	288.8	202.8	0.5998	0.3764	0.8255
		0.0	0.09654	12.0	0.00474	0.00364	0.000450	338.1
1	122.2	121.3	115.7	114.4	129.9	128.7	-389.4	315.3
2	125.8	125.3	117.5	116.1	131.2	130.0	-390.9	353.9
3	122.1	121.1	116.5	115.5	130.2	129.1	-398.6	317.7
4	122.4	121.5	113.6	111.1	127.5	125.1	-88.1	70.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	128.1	127.8	118.9	117.9	132.9	131.9	-105.1	124.1
7	126.9	126.5	115.3	113.4	129.4	127.6	-80.3	105.1
21	15	160.4	0.2403	295.7	207.6	0.6047	0.3979	0.8453
		-10.0	0.07668	16.0	0.00955	0.00373	0.013240	343.4
1	125.7	125.1	115.6	113.4	129.6	127.1	-81.0	88.6
2	127.8	127.3	116.4	113.1	130.1	126.4	-111.6	94.1
3	124.0	123.1	115.3	112.7	128.6	125.1	-70.4	65.1
4	121.2	119.4	113.1	107.7	126.6	119.3	-58.0	75.6
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	129.8	129.4	117.9	115.9	132.6	130.6	-114.2	111.2
7	128.3	127.9	117.1	115.3	131.1	127.9	-91.1	90.9

Table C1. continued. Acoustic Measurements for the Swept Tapered Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
19	13	161.9 -7.5	0.2408 0.07143	295.9 14.0	207.8 0.00738	0.6006 0.00319	0.4014 0.009260	0.8417 346.0
1	124.0	123.1	114.7	111.4	128.1	124.3	-54.0	89.9
2	126.6	125.9	115.5	110.6	129.0	122.8	-100.9	84.9
3	123.2	122.1	114.6	111.1	128.1	123.3	-69.1	67.6
4	120.2	117.8	113.0	107.1	126.5	118.1	-49.0	50.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	128.9	128.3	117.7	115.4	132.4	129.4	-123.1	119.9
7	127.8	127.3	115.0	111.6	129.3	124.1	-89.3	79.7
17	13	161.2 -5.0	0.2404 0.07192	295.1 12.0	207.2 0.00546	0.6007 0.00284	0.4008 0.005330	0.8415 345.0
1	123.0	121.9	115.2	112.4	129.0	126.3	-71.7	94.8
2	124.0	122.8	115.6	111.1	128.6	120.8	-89.8	76.1
3	122.9	121.7	115.5	112.9	129.0	125.7	-79.0	67.3
4	120.0	117.2	113.6	108.9	127.2	121.0	-61.5	54.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	125.6	124.7	117.4	115.0	132.1	129.1	-104.1	92.9
7	125.9	125.2	115.8	113.0	130.2	126.1	-75.3	75.8
17	14	161.5 -5.0	0.2408 0.07805	294.7 13.0	206.9 0.00614	0.5999 0.00309	0.4020 0.006170	0.8411 344.9
1	124.8	124.1	115.8	113.4	129.3	126.6	-63.9	102.7
2	125.6	124.7	116.0	112.1	129.7	124.8	-95.1	79.2
3	124.1	123.2	116.1	114.0	129.5	127.0	-70.9	89.8
4	121.0	118.8	114.9	111.9	128.0	122.8	-65.6	67.3
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	127.2	126.5	118.1	116.1	132.9	130.3	-95.2	115.5
7	127.1	126.6	115.0	111.2	129.2	124.4	-111.3	106.7

Table C1. continued. Acoustic Measurements for the Swept Tapered Tip Rotor.

RUN	POINT	VELOCITY	MTUN	RPM	OMEG*R	MTIP	V/OR	MAT
		ALPHA	CLR/S	THETA	CP/S	CPO/S	CXR/S	VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
17	15	161.6	0.2407	294.3	206.7	0.5986	0.4027	0.8396
		-5.0	0.08487	14.0	0.00722	0.00362	0.007280	345.3
1	125.4	124.8	116.1	114.0	129.7	126.9	-81.7	97.2
2	126.7	126.1	115.8	111.5	129.5	124.1	-88.4	93.3
3	125.2	124.5	116.2	114.2	129.5	126.7	-64.1	85.5
4	121.2	119.2	114.2	110.4	127.7	122.4	-56.0	52.2
5	128.5	128.1	117.8	116.4	131.8	130.1	-99.5	127.3
6	128.7	128.2	119.0	117.4	133.5	131.5	-109.8	115.7
7	129.7	129.5	113.4	106.1	126.8	116.8	-126.1	122.6
17	16	161.9	0.2410	294.7	206.9	0.5988	0.4031	0.8402
		-5.0	0.09231	15.0	0.00840	0.00440	0.007960	345.6
1	127.6	127.3	117.3	115.8	131.2	129.5	-102.6	119.1
2	129.5	129.1	118.2	116.3	132.2	129.8	-132.9	99.3
3	127.4	127.0	116.6	114.8	130.1	129.0	-101.8	92.9
4	123.1	121.9	114.6	111.2	128.3	124.3	-92.8	85.7
5	130.9	130.6	119.6	118.7	133.5	132.4	-124.0	165.2
6	131.4	131.2	119.2	117.6	133.6	132.1	-145.7	139.9
7	131.5	131.3	113.6	107.4	126.7	117.8	-159.3	143.3
17	9	160.6	0.2408	293.7	206.2	0.6012	0.4011	0.8424
		0.0	0.05056	10.0	0.00294	0.00269	-0.000880	343.0
1	122.2	120.8	115.5	113.2	129.0	126.2	-71.7	78.4
2	122.6	120.7	115.8	112.1	128.8	122.9	-91.2	73.3
3	121.9	120.4	115.5	113.2	128.6	125.2	-63.0	69.2
4	120.7	118.6	114.4	111.2	127.7	123.3	-74.8	69.0
5	123.5	122.4	115.3	112.7	129.0	124.2	-84.5	84.8
6	124.1	123.2	116.8	114.4	130.9	126.9	-68.3	85.3
7	123.4	122.0	114.7	110.8	128.4	124.1	-69.6	73.2

Table C1. continued. Acoustic Measurements for the Swept Tapered Tip Rotor.

RUN	POINT	VELOCITY	MTUN	RPM	OMEG*R	MTIP	V/OR	MAT
		ALPHA	CLR/S	THETA	CP/S	CPO/S	CXR/S	VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
19	9	161.0	0.2405	294.3	206.7	0.6002	0.4012	0.8410
		0.0	0.09744	13.0	0.00561	0.00428	0.001120	344.3
1	124.5	123.7	116.1	114.1	129.6	127.6	-143.2	116.0
2	128.3	127.8	117.6	115.3	131.3	128.7	-139.3	119.0
3	124.1	123.3	115.8	113.6	129.8	127.3	-135.8	108.2
4	122.4	121.1	114.9	112.0	128.0	123.9	-68.8	84.7
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	130.5	130.2	119.5	118.2	134.2	133.1	-141.0	120.9
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
55	13	107.4	0.1623	315.7	221.7	0.6515	0.2495	0.8141
		-5.0	0.07755	10.0	0.00422	0.00177	0.006210	340.3
1	114.1	113.1	107.5	105.8	119.8	117.4	-28.5	28.0
2	113.3	111.9	107.7	105.4	120.1	114.7	-23.6	29.2
3	113.1	111.7	106.9	105.0	118.9	115.6	-23.9	23.5
4	111.1	108.7	105.4	102.4	118.1	113.4	-19.8	24.0
5	122.5	122.4	115.4	115.2	128.2	127.9	-70.8	84.2
6	115.7	114.6	108.8	106.9	121.3	118.0	-35.2	26.9
7	112.7	110.7	105.4	100.5	118.1	109.4	-23.1	20.4
55	14	107.6	0.1627	316.5	222.2	0.6532	0.2494	0.8161
		-5.0	0.09719	12.0	0.00556	0.00220	0.007780	340.2
1	114.9	114.0	108.9	107.7	121.8	120.5	-131.4	106.6
2	115.6	114.5	109.1	107.4	121.9	119.5	-127.4	113.5
3	115.1	114.3	108.8	107.6	121.5	120.3	-131.4	105.0
4	112.5	111.0	106.5	104.2	118.9	115.6	-32.6	19.1
5	125.0	124.9	115.9	115.7	129.2	128.9	-88.7	72.0
6	118.4	117.8	109.6	108.0	122.6	120.2	-35.9	34.0
7	117.4	116.7	106.5	103.2	119.9	116.4	-31.5	34.4

Table C1. continued. Acoustic Measurements for the Swept Tapered Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
55	16	107.7 0.0	0.1626 0.07763	315.9 8.0	221.8 0.00219	0.6513 0.00152	0.2500 -0.000900	0.8141 340.6
1	119.4	119.2	111.9	111.3	124.7	124.1	-131.4	106.6
2	120.5	120.1	113.3	112.7	126.0	125.1	-127.0	115.2
3	118.4	118.0	111.4	110.8	124.7	124.1	-131.1	103.2
4	115.7	115.0	109.5	108.6	121.9	120.8	-32.6	39.4
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	122.3	122.0	114.5	114.1	127.6	126.7	-76.5	74.1
7	116.5	115.6	109.7	108.4	122.1	119.7	-35.2	41.5
55	17	107.6 0.0	0.1625 0.09853	315.7 10.0	221.7 0.00303	0.6509 0.00184	0.2501 -0.001030	0.8137 340.6
1	122.6	122.4	115.2	114.9	127.9	127.6	-86.7	69.6
2	123.9	123.8	116.7	116.5	129.6	129.2	-112.2	78.2
3	120.0	119.8	114.0	113.7	126.6	126.2	-64.8	44.1
4	120.4	120.2	114.0	113.6	127.0	126.6	-51.3	67.7
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	125.3	125.2	117.9	117.7	131.4	131.1	-117.0	78.5
7	121.1	120.9	113.4	112.9	126.3	125.4	-53.6	56.9
21	36	165.1 -10.0	0.2444 0.08127	322.2 15.5	226.3 0.00919	0.6511 0.00365	0.3759 0.012980	0.8958 347.5
1	127.4	126.9	115.3	112.1	129.9	127.2	-176.9	90.5
2	127.8	127.2	115.9	110.9	129.9	123.6	-148.2	86.0
3	125.1	124.3	115.9	113.3	130.2	127.7	-126.4	103.3
4	124.7	123.8	115.2	112.0	129.1	125.2	-79.6	78.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	126.0	125.2	116.2	113.4	130.7	127.9	-90.9	80.5

Table C1. continued. Acoustic Measurements for the Swept Tapered Tip Rotor.

RUN	POINT	VELOCITY	MTUN	RPM	OMEG*R	MTIP	V/OR	MAT
		ALPHA	CLR/S	THETA	CP/S	CPO/S	CXR/S	VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
55	26	162.7	0.2449	317.9	223.2	0.6533	0.3754	0.8985
		-5.0	0.07344	10.0	0.00350	0.00258	0.001010	341.7
1	125.9	125.3	117.1	115.5	130.9	128.6	-100.1	124.0
2	123.8	122.3	117.1	114.4	130.3	125.8	-83.7	105.2
3	123.6	122.5	116.6	114.7	130.0	127.1	-81.3	67.6
4	122.8	121.5	115.8	113.4	129.1	125.7	-79.7	83.9
5	132.4	132.2	123.5	123.1	137.3	136.9	-261.0	234.1
6	126.2	125.3	118.5	116.5	132.9	130.9	-96.9	115.4
7	122.8	121.1	114.4	109.5	127.9	121.7	-72.9	68.4
55	23	162.1	0.2449	316.3	222.1	0.6524	0.3759	0.8976
		-5.0	0.07459	12.0	0.00577	0.00305	0.005780	340.5
1	126.2	125.7	115.8	113.5	130.0	127.7	-132.4	114.5
2	124.0	122.6	115.2	109.6	129.0	121.8	-97.2	78.0
3	123.5	122.5	115.4	112.7	128.8	125.9	-114.4	80.9
4	124.2	123.2	114.7	111.3	128.4	124.6	-91.7	78.0
5	133.7	133.6	123.2	122.8	137.2	136.8	-249.2	227.5
6	127.4	126.8	117.5	114.9	132.3	130.0	-109.5	102.0
7	124.5	123.4	113.9	108.3	127.8	122.1	-112.9	76.3
55	25	161.9	0.2440	317.3	222.8	0.6526	0.3744	0.8970
		-5.0	0.08152	13.0	0.00660	0.00339	0.006800	341.4
1	127.1	126.6	116.1	113.9	130.2	128.2	-123.2	124.6
2	126.8	126.1	115.6	110.7	129.8	125.1	-110.6	88.4
3	123.4	122.3	115.1	112.2	128.7	125.0	-88.5	89.9
4	125.4	124.8	114.5	110.9	128.7	125.5	-84.8	80.0
5	135.0	134.9	123.5	123.2	137.8	137.5	-261.6	208.8
6	128.0	127.5	117.7	115.3	132.2	129.8	-111.2	140.7
7	125.7	124.9	114.3	109.7	128.4	123.1	-88.1	83.6

Table C1. continued. Acoustic Measurements for the Swept Tapered Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
21	29	164.5	0.2445	320.6	225.1	0.6503	0.3765	0.8951
		-5.0	0.09348	14.5	0.00844	0.00466	0.007740	346.2
1	128.0	127.6	117.3	115.6	131.8	130.4	-124.8	99.5
2	129.0	128.6	117.7	115.1	131.4	128.9	-131.5	112.9
3	125.6	124.9	116.6	114.5	130.6	128.6	-125.6	101.0
4	128.1	127.7	116.9	115.0	131.4	129.9	-125.8	104.4
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	129.0	128.6	118.1	116.5	132.6	131.2	-91.1	90.4
21	21	164.1	0.2442	319.6	224.4	0.6494	0.3766	0.8940
		0.0	0.08356	8.0	0.00332	0.00293	-0.000810	345.6
1	126.3	125.8	116.3	114.1	130.6	128.8	-123.2	110.4
2	125.6	124.6	117.0	113.9	130.5	125.5	-124.3	116.1
3	123.7	122.6	116.5	114.4	130.6	128.2	-127.0	100.0
4	124.7	123.9	115.7	113.0	129.7	127.1	-88.8	95.2
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	127.7	127.1	118.7	116.8	133.5	131.8	-128.0	96.7
7	125.8	124.9	116.0	113.0	130.2	127.5	-82.1	90.9
21	23	164.2	0.2444	319.8	224.6	0.6499	0.3766	0.8946
		0.0	0.09473	11.5	0.00459	0.00370	0.000010	345.6
1	127.1	126.6	116.8	114.8	131.2	129.3	-126.4	107.6
2	126.9	126.1	117.2	114.2	130.9	127.4	-132.1	121.7
3	124.5	123.6	116.8	114.9	130.8	128.7	-126.6	100.0
4	126.9	126.4	116.6	114.6	130.7	128.8	-124.3	88.8
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	128.7	128.2	119.5	117.9	134.3	133.0	-118.9	136.1
7	127.5	126.9	115.9	112.7	130.3	127.7	-90.9	90.9

Table C1. continued. Acoustic Measurements for the Swept Tapered Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
55	35	170.5	0.2563	333.3	234.0	0.6841	0.3752	0.9408
		-7.5	0.06861	13.0	0.00709	0.00405	0.006870	342.1
1	133.8	133.7	124.2	123.9	137.9	137.6	-414.5	387.3
2	131.9	131.6	119.8	117.9	134.1	132.8	-398.6	362.4
3	133.3	133.2	125.7	125.4	139.2	138.9	-414.5	371.2
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	131.4	131.1	120.4	118.8	135.0	133.8	-183.0	210.1
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
55	31	170.7	0.2560	332.5	233.5	0.6905	0.3767	0.9369
		-5.0	0.07311	12.0	0.00595	0.00361	0.004820	343.1
1	133.3	133.2	122.0	121.4	136.6	136.1	-194.7	272.7
2	131.6	131.3	119.1	116.8	133.2	131.6	-183.4	154.4
3	132.4	132.2	122.9	122.4	136.7	136.2	-172.7	336.3
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	130.4	130.0	120.1	118.3	134.7	133.2	-169.8	200.2
7	130.1	129.8	122.3	121.6	135.0	134.0	-214.2	183.3
55	40	171.1	0.2560	336.3	236.2	0.6870	0.3732	0.9434
		-2.5	0.07759	11.0	0.00470	0.00349	0.001640	343.7
1	133.0	132.8	122.5	121.9	136.6	136.1	-225.2	318.8
2	131.2	130.9	121.3	120.1	134.1	132.4	-183.3	171.5
3	132.2	132.0	123.3	122.9	137.1	136.5	-211.6	313.9
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	130.7	130.3	122.1	121.2	135.8	134.2	-140.6	206.6
7	131.4	131.2	123.2	122.6	136.2	135.3	-243.7	205.4

Table C1. continued. Acoustic Measurements for the Swept Tapered Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
55	41	171.2	0.2560	334.9	235.2	0.6835	0.3751	0.9399
		-2.5	0.08180	11.5	0.00514	0.00369	0.002090	344.1
1	132.8	132.6	121.8	121.1	135.9	135.2	-199.1	279.5
2	130.9	130.5	120.3	118.7	133.6	131.2	-156.7	194.6
3	132.5	132.3	122.9	122.4	136.9	136.4	-160.3	304.1
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	129.8	129.3	120.9	119.5	135.0	133.3	-139.4	206.8
7	130.2	129.9	122.6	122.0	135.5	134.4	-219.3	171.8
55	4	115.2	0.1747	338.7	237.8	0.7008	0.2496	0.8757
		-5.0	0.07701	10.0	0.00434	0.00192	0.006120	339.4
1	123.3	123.2	110.7	109.7	124.6	123.9	-65.6	82.5
2	117.2	116.0	109.6	107.3	122.6	118.8	-44.1	36.4
3	122.0	121.8	110.3	109.2	124.0	122.9	-57.9	56.6
4	119.0	118.5	108.8	107.1	122.5	120.9	-44.3	37.5
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	118.2	117.3	110.8	109.2	123.5	120.2	-47.2	48.0
7	117.5	116.6	108.1	104.9	121.9	118.9	-34.0	45.7
55	5	115.3	0.1746	339.1	238.1	0.7009	0.2494	0.8757
		-5.0	0.09858	12.0	0.00610	0.00272	0.007700	339.7
1	125.4	125.3	113.3	112.8	127.3	126.9	-130.6	106.1
2	120.3	119.7	111.4	110.0	124.9	123.2	-127.0	115.2
3	124.2	124.1	112.9	112.3	126.3	125.7	-130.7	103.2
4	121.1	120.8	110.7	109.6	124.0	122.8	-54.4	49.7
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	121.6	121.2	112.4	111.4	125.0	123.0	-51.5	72.0
7	120.4	120.0	109.0	106.7	123.0	121.0	-48.0	54.2

Table C1. continued. Acoustic Measurements for the Swept Tapered Tip Rotor.

RUN	POINT	VELOCITY	MTUN	RPM	OMEG*R	MTIP	V/OR	MAT
		ALPHA	CLR/S	THETA	CP/S	CPO/S	CXR/S	VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
55	7	115.7	0.1749	339.8	238.6	0.7014	0.2497	0.8766
		0.0	0.07947	8.0	0.00237	0.00167	-0.000960	340.2
1	123.4	123.2	115.6	115.2	128.2	127.4	-68.9	104.5
2	123.1	122.8	116.4	116.0	129.1	127.8	-76.5	71.3
3	123.7	123.6	115.0	114.6	128.7	128.2	-64.9	96.0
4	121.9	121.7	114.2	113.7	126.9	125.9	-61.3	74.9
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	124.5	124.3	117.7	117.4	130.4	129.4	-109.1	91.8
7	121.8	121.4	113.6	112.9	127.2	126.5	-53.6	68.8
55	8	115.8	0.1749	339.8	238.6	0.7008	0.2499	0.8759
		0.0	0.10004	10.0	0.00345	0.00218	-0.000900	340.5
1	126.9	126.8	120.0	119.9	133.2	133.1	-412.9	334.8
2	124.6	124.4	117.5	117.2	130.9	130.5	-399.4	361.6
3	126.0	125.9	118.5	118.3	132.0	131.8	-412.9	329.7
4	124.2	124.1	116.9	116.6	129.9	129.4	-79.3	107.0
5	134.7	134.6	126.8	126.7	139.4	139.3	-367.9	231.8
6	127.1	127.0	119.7	119.5	132.8	132.2	-156.0	108.8
7	124.5	124.3	116.9	116.5	129.6	129.2	-72.9	70.4
56	4	175.4	0.2640	341.4	239.7	0.7015	0.3768	0.9658
		-5.0	0.07067	12.0	0.00629	0.00481	0.002600	341.8
1	135.6	135.5	129.6	129.5	142.8	142.7	-1312.0	1060.0
2	130.1	129.7	121.9	120.7	136.4	135.4	-1265.0	1137.5
3	137.1	137.1	130.3	130.2	143.9	143.9	-1295.5	1030.4
4	137.7	137.6	130.9	130.8	143.9	143.7	-496.7	655.8
5	135.9	135.8	128.2	128.0	141.4	141.2	-345.9	442.6
6	130.8	130.4	121.7	120.4	135.6	133.8	-177.5	153.4
7	134.9	134.8	128.3	128.1	141.2	141.0	-461.6	354.7

Table C1. continued. Acoustic Measurements for the Swept Tapered Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
56	5	175.1	0.2633	343.6	241.3	0.7053	0.3738	0.9690
		-5.0	0.07826	13.0	0.00713	0.00520	0.003510	342.1
1	136.3	136.3	128.7	128.6	141.5	141.3	-399.7	503.6
2	131.3	131.0	120.6	118.9	134.8	132.8	-200.1	204.2
3	136.6	136.5	130.2	130.1	143.4	143.3	-449.2	527.7
4	137.6	137.6	130.9	130.8	143.9	143.7	-649.5	578.4
5	135.3	135.1	127.8	127.6	140.8	140.5	-406.9	425.8
6	130.7	130.3	121.9	120.7	136.1	134.7	-242.3	183.4
7	135.5	135.4	128.6	128.4	141.6	141.4	-532.4	302.9
56	6	175.6	0.2636	344.0	241.6	0.7049	0.3745	0.9689
		-5.0	0.08309	13.5	0.00756	0.00547	0.003720	342.7
1	137.7	137.6	129.5	129.4	142.7	142.5	-364.0	632.7
2	132.4	132.1	121.4	120.0	136.0	134.4	-200.8	196.7
3	136.8	136.7	130.5	130.4	143.5	143.3	-539.1	575.3
4	137.9	137.9	131.2	131.2	143.9	143.8	-567.8	630.2
5	135.5	135.3	128.5	128.4	141.2	141.0	-364.4	447.4
6	130.7	130.3	122.1	121.0	135.9	134.2	-201.6	185.9
7	134.7	134.5	128.1	127.9	141.0	140.8	-496.6	344.1
56	10	176.5	0.2632	345.2	242.4	0.7027	0.3751	0.9663
		-2.5	0.08322	12.0	0.00573	0.00481	0.000610	345.0
1	137.1	137.0	128.0	127.8	141.6	141.2	-452.5	509.8
2	131.6	131.3	122.3	121.1	135.3	133.3	-222.9	185.9
3	135.8	135.7	129.1	129.0	142.1	141.8	-389.2	475.6
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	134.4	134.3	126.5	126.2	139.7	139.3	-305.4	411.4
6	131.4	131.1	123.4	122.5	136.8	135.1	-209.3	172.0
7	134.8	134.7	127.8	127.6	140.8	140.5	-457.3	275.5

Table C2. Acoustic Measurements for the Swept Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
48	4	81.2 -5.0	0.1205 0.06421	295.0 8.0	207.2 0.00225	0.5973 0.00060	0.2020 0.004360	0.7180 346.8
1	114.0	113.8	100.5	98.6	112.2	107.7	-20.4	19.9
2	114.0	113.6	106.0	105.3	117.1	114.5	-26.0	28.4
3	113.6	113.5	101.4	99.9	113.0	109.8	-18.4	17.8
4	110.1	109.5	102.0	100.7	113.9	111.2	-12.8	18.7
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	118.2	118.0	106.1	105.5	117.2	114.7	-39.8	33.2
7	113.0	112.6	102.5	101.1	113.5	108.1	-19.3	19.3
48	5	80.7 -5.0	0.1198 0.08648	296.0 10.0	207.9 0.00432	0.5994 0.00175	0.2001 0.005900	0.7193 346.8
1	109.9	109.3	101.5	100.1	113.3	110.2	-14.5	15.9
2	115.9	115.6	108.8	108.5	119.5	117.7	-33.8	32.9
3	110.2	109.6	102.6	101.5	114.5	112.4	-15.2	16.8
4	109.8	109.1	101.8	100.4	114.4	112.4	-13.9	16.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	118.0	117.9	108.3	107.9	119.1	117.3	-46.2	39.4
7	114.5	114.2	100.4	97.9	112.3	107.2	-21.0	21.3
48	6	80.7 -5.0	0.1198 0.10845	295.4 12.0	207.4 0.00598	0.5982 0.00229	0.2005 0.007470	0.7181 346.8
1	107.5	106.4	103.5	102.6	114.9	112.8	-13.8	14.0
2	117.7	117.5	107.8	107.4	119.2	117.7	-33.6	29.1
3	108.8	107.9	103.3	102.3	115.0	113.4	-16.5	12.9
4	111.5	111.1	105.2	104.6	117.0	115.7	-24.7	19.7
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	119.0	118.8	108.6	108.3	119.7	118.3	-33.9	48.8
7	119.0	118.9	102.1	100.3	113.9	110.2	-35.5	29.9

Table C2. continued. Acoustic Measurements for the Swept Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
48	7	80.6	0.1196	296.4	208.1	0.6002	0.1995	0.7199
		-5.0	0.11791	13.0	0.00694	0.00271	0.008140	346.8
1	109.8	109.1	103.4	102.5	115.4	113.9	-15.3	22.6
2	118.4	118.3	110.6	110.4	121.7	120.8	-48.4	41.1
3	111.3	110.8	104.6	103.9	116.5	115.3	-19.1	22.9
4	111.7	111.2	104.3	103.5	117.0	115.9	-21.2	22.4
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	119.1	118.9	109.3	109.0	120.8	119.7	-39.2	54.0
7	121.4	121.4	103.6	102.4	115.1	112.4	-41.5	40.4
48	10	80.6	0.1196	295.2	207.3	0.5977	0.2004	0.7175
		-2.5	0.07249	8.0	0.00282	0.00145	0.001930	346.8
1	114.7	114.5	102.2	100.9	113.9	111.5	-21.4	24.5
2	114.4	114.1	106.8	106.2	117.9	115.6	-36.6	31.2
3	114.6	114.4	104.9	104.3	116.2	114.5	-26.3	24.5
4	111.0	110.5	102.9	101.8	114.9	113.2	-18.5	23.4
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	119.6	118.5	105.9	105.2	117.5	115.4	-41.8	35.3
7	114.7	114.4	101.4	99.3	113.8	110.1	-23.3	19.5
48	11	80.6	0.1195	295.8	207.7	0.5989	0.1998	0.7186
		-2.5	0.09549	10.0	0.00400	0.00178	0.002560	346.8
1	112.8	112.5	103.5	102.6	115.3	113.6	-20.4	21.7
2	115.7	115.5	110.0	109.8	121.1	119.8	-51.6	41.0
3	113.1	112.8	105.1	104.5	116.8	115.6	-23.3	30.7
4	112.0	111.6	104.9	104.3	117.2	116.1	-21.0	22.1
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	118.4	118.3	109.0	108.7	120.7	119.4	-50.4	37.4
7	114.5	114.2	102.8	101.2	115.1	112.4	-22.2	26.5

Table C2. continued. Acoustic Measurements for the Swept Tip Rotor.

RUN	POINT	VELOCITY	MTUN	RPM	OMEG*R	MTIP	V/OR	MAT
		ALPHA	CLR/S	THETA	CP/S	CPO/S	CXR/S	VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
48	21	80.8	0.1199	295.8	207.7	0.5990	0.2005	0.7191
		0.0	0.06110	6.0	0.00174	0.00128	-0.001140	346.8
1	116.5	116.4	105.5	105.0	119.2	118.7	-31.8	38.7
2	116.0	115.7	108.3	107.9	121.1	120.6	-46.0	32.1
3	116.8	116.7	105.5	104.9	119.1	118.6	-34.4	31.9
4	112.7	112.4	104.4	103.7	117.7	117.1	-19.3	26.9
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	119.2	119.1	109.1	108.7	122.1	121.6	-37.8	40.2
7	115.1	114.8	103.0	101.3	114.7	111.5	-26.6	31.1
48	22	80.7	0.1197	295.6	207.6	0.5986	0.2002	0.7184
		0.0	0.08439	8.0	0.00255	0.00149	-0.001340	346.8
1	116.6	116.5	107.4	107.1	120.1	119.8	-37.4	34.7
2	119.3	119.2	111.1	110.9	124.1	123.8	-88.1	35.6
3	116.9	116.8	107.8	107.4	121.0	120.7	-47.4	39.0
4	115.0	114.8	106.8	106.4	120.0	119.6	-30.2	31.1
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	121.5	121.4	110.7	110.5	124.6	124.3	-70.2	44.5
7	117.8	117.6	106.7	106.0	118.7	117.0	-38.4	35.2
48	24	80.6	0.1197	295.4	207.4	0.5987	0.2002	0.7185
		0.0	0.11732	11.0	0.00413	0.00207	-0.002580	346.5
1	120.5	120.5	114.9	114.8	127.4	127.3	-120.1	97.4
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	121.2	121.2	114.7	114.6	127.3	127.3	-128.0	101.8
4	122.1	122.1	116.1	116.1	129.4	129.3	-73.6	78.3
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	121.2	121.1	113.8	113.7	125.2	124.7	-73.7	59.4

Table C2. continued. Acoustic Measurements for the Swept Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
49	11	120.0	0.1796	293.8	206.3	0.6005	0.2995	0.7803
		-10.0	0.07207	12.0	0.00643	0.00218	0.012020	343.6
1	114.6	113.3	106.4	102.6	118.7	110.8	-32.5	31.0
2	119.1	118.4	109.4	106.7	120.7	111.6	-39.8	39.3
3	114.6	113.2	107.6	104.8	119.0	110.2	-35.6	31.1
4	112.2	109.7	105.5	100.1	118.1	106.5	-26.6	21.6
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	119.9	119.2	109.2	106.6	120.5	111.4	-40.8	45.7
7	120.8	120.5	106.3	102.2	117.7	103.2	-38.3	44.2
49	13	120.3	0.1801	293.0	205.7	0.5988	0.3012	0.7791
		-10.0	0.08068	13.0	0.00738	0.00241	0.013830	343.6
1	115.4	114.1	106.8	102.8	119.4	112.2	-26.0	29.4
2	119.6	118.9	109.0	105.5	121.2	114.4	-43.0	33.3
3	115.7	114.5	108.1	105.5	119.9	112.9	-35.2	27.9
4	113.2	111.1	105.9	101.1	118.6	107.8	-19.4	26.9
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	120.8	120.3	109.5	106.9	121.4	114.5	-41.8	51.9
7	122.3	122.1	106.3	101.4	117.9	104.7	-45.9	60.5
49	12	120.2	0.1799	293.8	206.3	0.6004	0.3001	0.7806
		-10.0	0.09024	14.0	0.00850	0.00272	0.015980	343.6
1	116.7	115.7	108.6	106.1	121.7	118.3	-120.5	97.4
2	121.2	120.6	110.1	107.5	122.9	117.6	-119.0	108.0
3	117.1	116.2	109.3	107.2	121.6	118.0	-128.0	100.8
4	113.9	112.2	105.8	100.7	118.6	108.3	-26.7	26.7
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	122.7	122.3	109.6	106.9	121.9	116.9	-53.7	65.2
7	124.0	123.8	105.8	98.4	117.4	99.6	-53.9	59.8

Table C2. continued. Acoustic Measurements for the Swept Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
49	5	120.0 -5.0	0.1800 0.07459	293.6 10.0	206.2 0.00435	0.6011 0.00200	0.2999 0.005530	0.7814 343.0
1	112.9	110.5	107.9	105.3	119.1	111.3	-25.2	34.2
2	114.8	112.2	108.6	105.1	120.7	112.5	-31.7	32.0
3	114.4	112.7	108.0	105.5	119.6	113.0	-25.5	31.8
4	112.7	109.7	106.8	103.3	119.1	111.6	-27.4	33.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	114.9	112.4	109.4	106.7	121.2	113.5	-35.6	38.6
7	116.6	115.5	105.4	96.4	117.6	99.4	-29.6	35.7
49	6	119.9 -5.0	0.1798 0.09458	294.6 12.0	206.9 0.00586	0.6032 0.00250	0.2985 0.007500	0.7832 343.0
1	113.1	111.1	107.2	103.9	119.1	110.7	-20.4	27.2
2	119.5	118.7	109.8	107.0	122.2	116.0	-41.8	43.9
3	114.5	112.7	108.1	105.5	119.6	112.8	-23.2	25.7
4	111.7	108.6	106.4	102.4	118.7	108.8	-30.4	28.1
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	120.8	120.2	109.7	107.2	121.4	115.0	-39.0	42.6
7	119.5	119.0	106.4	101.5	118.0	104.4	-52.2	47.8
49	7	119.9 -5.0	0.1796 0.10429	293.4 13.0	206.0 0.00681	0.6001 0.00302	0.2997 0.008100	0.7800 343.3
1	114.6	112.9	107.3	104.0	119.7	112.5	-34.9	35.1
2	119.8	119.1	109.6	106.8	122.2	116.9	-63.1	50.0
3	114.8	113.1	108.1	105.4	119.9	113.5	-39.4	35.9
4	112.4	109.4	106.2	101.6	119.4	112.0	-21.8	27.8
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	121.8	121.3	109.9	107.3	122.4	117.4	-51.3	59.9
7	122.5	122.2	105.8	97.3	118.4	103.3	-55.7	55.9

Table C2. continued. Acoustic Measurements for the Swept Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
49	8	120.1	0.1799	293.0	205.7	0.5988	0.3008	0.7789
		-5.0	0.10946	14.0	0.00790	0.00363	0.009240	343.6
1	119.8	119.4	109.4	107.4	122.8	120.6	-119.9	96.8
2	122.6	122.2	111.4	109.7	123.6	120.3	-120.0	108.0
3	119.8	119.3	109.9	108.3	122.6	120.5	-128.0	101.8
4	116.0	114.8	107.4	103.9	120.5	115.1	-39.2	32.2
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	126.1	125.9	112.0	110.5	124.8	122.1	-94.3	82.0
7	127.0	126.9	106.4	99.0	119.0	106.0	-73.7	73.9
49	18	120.5	0.1799	293.0	205.7	0.5971	0.3017	0.7773
		0.0	0.07850	8.0	0.00214	0.00174	-0.001200	344.6
1	117.2	116.3	108.6	106.2	120.8	117.0	-46.9	50.9
2	119.0	118.1	111.4	109.8	124.2	121.3	-54.3	38.3
3	118.1	117.3	109.4	107.6	121.9	118.4	-42.1	39.9
4	115.3	113.8	107.9	104.9	120.6	116.1	-37.4	35.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	119.4	118.6	111.6	110.0	123.8	120.7	-50.3	41.2
7	115.6	113.6	107.4	102.6	119.8	113.0	-32.6	28.6
49	19	120.4	0.1798	292.6	205.5	0.5963	0.3019	0.7763
		0.0	0.09740	10.0	0.00307	0.00214	-0.000820	344.6
1	117.4	116.5	110.7	109.4	123.7	122.1	-119.9	96.8
2	120.7	120.1	113.6	112.7	126.7	124.3	-119.0	108.1
3	118.8	118.1	111.5	110.3	124.3	123.0	-128.0	101.8
4	116.4	115.3	109.8	108.2	122.4	119.6	-37.3	31.2
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	120.1	119.5	113.6	112.7	125.8	123.5	-57.8	63.4
7	118.8	117.9	110.5	108.7	123.0	119.3	-44.6	53.1

Table C2. continued. Acoustic Measurements for the Swept Tip Rotor.

RUN	POINT	VELOCITY	MTUN	RPM	OMEGA*R	MTIP	V/OR	MAT
		ALPHA	CLR/S	THETA	CP/S	CPO/S	CXR/S	VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
49	20	120.4	0.1798	295.2	207.3	0.6016	0.2993	0.7817
		0.0	0.10771	11.0	0.00359	0.00244	-0.001010	344.5
1	117.4	116.5	111.5	110.5	123.6	121.4	-48.8	41.6
2	122.0	121.5	114.5	113.8	127.5	125.6	-86.0	71.6
3	117.5	116.6	111.3	110.2	123.5	121.2	-47.4	37.8
4	116.2	115.0	109.9	108.3	122.5	119.8	-42.0	36.9
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	120.8	120.2	114.1	113.3	126.1	124.0	-56.6	83.2
7	119.8	119.1	110.1	108.1	122.9	119.2	-44.5	48.9
49	21	120.4	0.1796	293.6	206.2	0.5978	0.3009	0.7777
		0.0	0.11589	12.0	0.00466	0.00302	-0.000100	344.9
1	120.2	119.8	113.7	113.0	126.0	124.5	-69.3	70.5
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	120.5	120.1	114.0	113.4	126.4	125.0	-78.9	55.3
4	119.3	118.7	113.2	112.5	125.6	124.0	-58.9	51.4
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	125.0	124.8	117.3	116.9	129.7	128.3	-74.4	101.4
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
49	31	149.9	0.2254	292.4	205.3	0.6002	0.3761	0.8260
		-10.0	0.06048	13.0	0.00678	0.00276	0.009720	342.1
1	121.3	120.3	111.8	107.6	124.2	115.9	-65.4	61.0
2	123.7	122.9	112.2	105.4	125.2	112.9	-63.6	75.7
3	121.8	120.9	113.2	110.6	125.3	117.9	-65.2	64.9
4	118.8	116.7	110.6	104.0	123.5	112.4	-63.4	39.6
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	126.8	126.4	113.8	110.4	126.9	119.7	-75.4	95.5
7	125.5	125.1	114.4	112.0	128.7	124.3	-74.4	74.3

Table C2. continued. Acoustic Measurements for the Swept Tip Rotor.

RUN	POINT	VELOCITY	MTUN	RPM	OMEG*R	MTIP	V/OR	MAT
		ALPHA	CLR/S	THETA	CP/S	CPO/S	CXR/S	VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
49	32	151.3	0.2254	295.2	207.3	0.6004	0.3759	0.8261
		-10.0	0.07127	14.0	0.00805	0.00304	0.011970	345.3
1	121.2	120.1	111.7	107.6	124.4	116.1	-62.1	48.4
2	123.3	122.3	112.7	107.1	125.2	112.8	-119.0	108.0
3	122.0	120.9	113.2	110.2	126.2	119.4	-128.0	101.8
4	118.8	116.4	110.7	103.6	123.8	111.8	-53.9	79.2
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	126.5	126.0	114.3	111.2	128.1	121.1	-83.5	130.0
7	125.3	124.8	114.3	111.6	128.6	123.9	-74.4	72.1
49	26	150.7	0.2255	295.6	207.6	0.6035	0.3741	0.8293
		-5.0	0.08085	12.0	0.00590	0.00298	0.006070	343.9
1	120.6	119.0	112.8	109.4	126.1	122.0	-119.5	96.8
2	122.4	121.0	114.2	110.6	126.8	120.3	-119.7	108.6
3	121.0	119.7	113.5	110.8	126.3	121.6	-128.0	100.3
4	118.4	115.8	111.3	105.6	124.1	115.0	-54.4	39.2
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	125.9	125.3	114.8	112.0	128.4	123.9	-88.5	125.5
7	124.7	124.3	114.3	111.6	128.5	124.0	-66.2	66.5
49	27	150.9	0.2257	294.2	206.6	0.6007	0.3763	0.8267
		-5.0	0.08948	13.0	0.00686	0.00342	0.007040	343.9
1	121.6	120.5	113.1	110.0	126.1	122.1	-65.2	56.0
2	123.3	122.2	114.1	110.4	126.8	120.6	-64.4	65.5
3	121.8	120.7	113.1	110.1	125.8	120.7	-57.5	57.8
4	119.4	117.4	111.0	104.4	123.9	113.2	-53.5	42.9
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	127.5	127.1	115.3	112.7	129.9	124.9	-96.1	103.8
7	125.8	125.3	115.0	112.6	129.3	125.2	-74.4	74.1

Table C2. continued. Acoustic Measurements for the Swept Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
49	37	150.9	0.2247	295.8	207.7	0.6011	0.3743	0.8261
		0.0	0.06939	8.0	0.00212	0.00220	-0.001520	345.6
1	121.8	120.7	113.1	110.0	126.8	123.4	-119.9	96.8
2	120.3	117.8	113.9	110.1	126.7	121.0	-119.8	108.6
3	121.6	120.4	114.0	111.6	127.0	122.9	-128.0	101.8
4	119.9	118.1	112.1	107.9	125.1	119.9	-49.9	55.6
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	123.5	122.5	116.0	114.0	129.5	125.6	-80.9	84.9
7	122.0	120.8	112.4	107.2	126.5	121.6	-70.5	52.4
49	38	151.8	0.2256	295.4	207.4	0.5992	0.3770	0.8251
		0.0	0.08713	10.0	0.00314	0.00272	-0.000900	346.2
1	121.2	119.8	113.0	109.5	126.5	122.6	-119.9	96.8
2	121.5	119.7	113.4	108.4	126.6	119.1	-119.7	108.6
3	121.1	119.7	114.1	111.7	127.3	123.7	-128.7	102.4
4	120.4	118.8	112.0	107.4	125.6	119.8	-50.1	47.8
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	124.5	123.7	114.7	111.7	128.4	123.8	-97.2	72.4
7	124.4	123.7	113.3	109.3	127.8	123.4	-74.4	62.5
49	39	151.8	0.2255	294.6	206.9	0.5976	0.3779	0.8234
		0.0	0.09504	11.0	0.00390	0.00317	-0.000440	346.2
1	121.3	120.0	113.4	110.5	126.3	122.7	-54.6	66.5
2	123.8	122.8	114.6	111.5	128.0	123.4	-84.8	81.3
3	121.6	120.4	113.8	111.4	126.8	122.8	-62.5	57.0
4	120.2	118.6	111.9	107.1	125.2	119.9	-47.5	54.1
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	126.0	125.4	115.9	113.9	129.7	126.2	-97.2	96.6
7	125.9	125.4	114.5	111.6	129.2	126.7	-74.0	73.7

Table C2. continued. Acoustic Measurements for the Swept Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
49	40	151.9	0.2257	295.8	207.7	0.6000	0.3766	0.8260
		0.0	0.10284	12.0	0.00502	0.00394	0.000090	346.2
1	121.2	119.9	113.4	110.7	126.3	122.6	-56.8	66.8
2	124.9	124.1	115.2	112.5	128.5	124.6	-90.0	87.3
3	121.6	120.5	114.5	112.4	126.9	123.2	-73.5	56.9
4	122.3	121.3	112.4	108.3	125.9	122.0	-78.6	71.3
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	127.6	127.2	116.2	114.3	129.7	126.3	-105.9	97.0
7	126.6	126.2	115.0	112.6	129.6	127.1	-74.4	74.3
51	32	155.1	0.2305	292.8	205.6	0.5941	0.3886	0.8249
		-2.6	0.08789	12.7	0.00608	0.00334	0.005140	346.1
1	125.0	124.4	115.1	113.0	128.9	126.3	-407.6	329.7
2	124.5	123.6	114.9	111.5	127.0	120.8	-71.6	99.6
3	124.2	123.6	113.4	110.1	126.2	120.8	-73.7	61.8
4	119.7	117.8	111.3	103.5	124.4	111.9	-43.8	47.7
5	126.9	126.5	115.5	113.5	128.5	124.6	-95.5	87.5
6	127.9	127.5	115.7	113.0	128.9	123.9	-93.5	148.1
7	129.8	129.6	115.1	112.4	129.3	125.9	-111.0	117.1
51	13	164.4	0.2449	320.9	225.3	0.6527	0.3758	0.8980
		-10.0	0.06707	13.5	0.00783	0.00341	0.010580	345.2
1	127.4	127.0	117.0	115.2	131.7	129.9	-407.6	329.3
2	124.5	123.3	114.8	107.1	128.8	119.3	-371.6	334.4
3	125.9	125.2	116.9	115.0	131.1	129.4	-403.9	318.7
4	123.2	122.0	113.9	109.6	128.2	121.7	-71.3	121.3
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	129.0	128.6	117.5	114.7	132.4	129.7	-116.1	144.6
7	126.8	126.1	114.7	110.4	129.3	125.2	-117.0	97.2

Table C2. continued. Acoustic Measurements for the Swept Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
49	44	163.6	0.2440	321.3	225.6	0.6541	0.3735	0.8984
		-5.0	0.06256	10.0	0.00453	0.00286	0.003440	344.9
1	127.1	126.7	116.0	113.9	129.8	127.1	-88.2	173.8
2	125.8	124.8	118.0	116.0	129.9	125.8	-78.2	145.1
3	126.4	125.9	116.4	114.4	129.7	126.9	-109.0	144.2
4	124.3	123.4	115.5	112.9	128.8	125.6	-69.7	107.1
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	130.0	129.6	118.3	116.5	131.9	128.7	-151.8	127.9
7	126.2	125.5	115.2	111.6	129.5	126.0	-76.5	108.0
49	45	164.2	0.2444	320.7	225.2	0.6516	0.3756	0.8964
		-5.0	0.07036	11.0	0.00524	0.00303	0.004570	345.6
1	127.1	126.6	116.2	114.0	130.0	127.4	-88.8	137.1
2	125.5	124.4	117.2	114.5	129.7	125.1	-109.3	198.2
3	125.9	125.2	116.3	114.3	129.8	126.8	-105.4	148.5
4	125.5	124.9	116.2	114.1	130.1	127.4	-92.8	145.1
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	129.5	129.1	118.2	116.4	132.1	128.9	-136.2	194.0
7	126.7	126.0	115.6	112.2	129.9	126.8	-86.6	96.8
59	6	163.5	0.2447	319.5	224.4	0.6528	0.3754	0.8979
		-5.0	0.07482	12.0	0.00593	0.00340	0.005250	343.7
1	128.3	127.9	117.1	115.4	131.5	130.0	-113.6	188.6
2	126.5	125.7	118.2	116.0	131.0	127.3	-139.6	149.5
3	126.1	125.5	116.5	114.4	130.4	128.9	-93.2	133.0
4	125.6	125.0	115.4	112.6	129.6	126.5	-102.8	117.6
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	130.7	130.4	119.8	118.5	134.1	133.0	-151.0	170.5
7	126.0	125.2	115.2	111.4	129.3	125.8	-88.1	88.2

Table C2. continued. Acoustic Measurements for the Swept Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
51	6	163.1	0.2442	316.9	222.5	0.6475	0.3776	0.8920
		-5.0	0.07780	12.0	0.00594	0.00335	0.005260	343.7
1	127.7	127.3	119.2	118.2	133.8	132.9	-411.0	414.0
2	125.6	124.5	117.7	115.1	131.1	128.3	-368.0	334.4
3	125.8	125.1	119.0	118.0	133.1	132.2	-403.9	404.7
4	124.4	123.5	115.2	112.1	128.9	126.2	-77.7	64.3
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	130.0	129.6	120.1	118.9	134.3	133.2	-130.1	134.5
7	127.2	126.6	115.8	112.6	130.1	127.5	-103.6	122.6
51	8	163.4	0.2443	319.5	224.4	0.6522	0.3751	0.8969
		-5.0	0.09065	13.5	0.00768	0.00426	0.006930	344.0
1	128.8	128.5	117.4	115.9	132.0	130.7	-126.6	161.6
2	126.9	126.2	117.7	115.2	130.8	127.4	-101.5	137.0
3	126.1	125.5	116.9	115.1	130.8	129.4	-107.9	141.7
4	126.0	125.4	116.4	114.3	130.3	128.7	-100.5	87.4
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	130.7	130.4	120.0	118.7	134.2	133.2	-136.1	164.3
7	128.5	129.1	115.9	112.8	130.2	127.4	-127.4	103.7
51	20	164.9	0.2447	321.9	226.0	0.6523	0.3757	0.8974
		0.0	0.07813	9.0	0.00273	0.00280	-0.001800	346.5
1	127.6	127.2	117.2	115.5	131.3	129.2	-100.5	183.7
2	125.4	124.3	116.7	113.6	129.9	125.0	-95.6	102.6
3	126.6	126.0	117.0	115.2	130.3	127.4	-98.8	154.0
4	123.4	122.1	115.2	112.2	128.2	123.5	-94.8	93.3
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	129.3	129.5	118.1	115.9	132.4	128.5	-143.3	137.6
7	125.7	124.9	115.5	112.1	129.1	125.4	-115.2	132.3

Table C2. continued. Acoustic Measurements for the Swept Tip Rotor.

RUN	POINT	VELOCITY ALPHA	VTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPC/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
51	22	165.0	0.2445	322.5	226.5	0.6524	0.3753	0.8972
		0.0	0.09391	11.0	0.00429	0.00369	-0.000740	347.1
1	129.2	128.9	118.9	117.8	133.2	132.1	-407.6	329.7
2	125.9	124.9	117.5	114.8	131.4	127.1	-371.5	334.4
3	126.6	126.0	117.6	116.0	131.6	130.1	-404.7	321.9
4	125.1	124.3	115.3	112.3	128.6	124.6	-89.2	87.5
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	130.0	129.7	118.3	116.3	132.9	122.5	-155.5	141.5
7	126.5	125.7	115.5	111.9	129.5	126.2	-100.0	81.3

Table C3. Acoustic Measurements for the Tapered Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPQ/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
23	23	79.3 -5.0	0.1195 0.06471	290.8 8.0	204.2 0.00305	0.5982 0.00139	0.2001 0.004430	0.7179 341.4
1	115.6	115.5	105.4	104.9	117.8	117.0	-26.8	27.4
2	113.9	113.5	107.7	107.3	119.5	118.7	-31.5	26.7
3	113.9	113.7	104.3	103.7	116.9	116.0	-20.9	28.7
4	110.6	110.1	103.0	102.1	115.5	114.1	-15.8	18.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	118.0	117.9	108.6	108.2	121.0	120.4	-44.6	25.4
7	111.6	111.1	105.7	105.1	117.1	115.3	-17.0	14.5
23	24	79.7 -5.0	0.1201 0.08784	291.2 10.0	204.5 0.00425	0.5991 0.00165	0.2007 0.005830	0.7193 341.3
1	111.9	111.6	104.3	103.6	116.6	115.7	-20.5	22.6
2	115.0	114.7	107.7	107.3	120.0	119.3	-32.0	36.2
3	110.4	109.8	103.3	102.5	115.4	114.4	-18.2	16.1
4	111.8	111.4	107.2	106.9	118.7	118.0	-24.0	18.9
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	116.5	116.3	109.1	108.8	121.1	120.5	-36.2	34.5
7	115.1	114.9	107.8	107.4	119.4	118.1	-26.6	28.6
23	26	79.4 -5.0	0.1196 0.11816	292.3 13.0	205.3 0.00698	0.6009 0.00270	0.1993 0.008320	0.7207 341.6
1	112.6	112.3	106.9	106.6	118.9	118.5	-28.5	25.6
2	119.8	119.7	112.1	112.0	124.4	124.2	-40.0	47.6
3	112.8	112.5	106.1	105.7	118.6	118.1	-27.2	19.6
4	112.5	112.2	105.4	104.9	118.6	118.1	-26.6	21.2
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	119.8	119.8	110.8	110.6	124.2	123.9	-39.9	41.1
7	122.8	122.7	110.1	109.8	124.1	123.6	-47.2	53.1

Table C3. continued. Acoustic Measurements for the Tapered Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
23	15	79.2	0.1198	290.0	203.6	0.5984	0.2004	0.7183
		-2.5	0.07313	8.0	0.00278	0.00143	0.001770	340.3
1	116.8	116.7	105.6	105.1	119.1	118.6	-28.9	28.0
2	115.4	115.1	111.4	111.3	122.7	122.3	-33.9	32.0
3	114.2	114.0	106.3	105.9	118.7	118.2	-25.6	21.7
4	111.3	110.9	104.5	103.8	117.2	116.6	-18.5	23.7
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	117.2	117.0	108.4	108.1	121.2	120.7	-39.8	28.3
7	112.8	112.4	104.3	103.3	117.1	115.5	-20.2	20.3
23	16	79.2	0.1197	289.8	203.5	0.5979	0.2005	0.7178
		-2.5	0.09650	10.0	0.00391	0.00171	0.002310	340.3
1	114.9	114.7	108.4	108.1	121.7	121.4	-142.4	115.1
2	117.3	117.1	112.0	111.8	124.1	123.9	-128.2	115.3
3	113.6	113.4	107.3	107.0	120.7	120.4	-134.9	107.5
4	113.2	113.0	107.8	107.5	119.9	119.6	-29.0	28.5
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	119.0	117.9	110.4	110.1	122.7	122.4	-42.2	39.5
7	116.2	116.0	107.2	106.7	120.3	119.6	-27.0	30.2
23	17	79.2	0.1197	289.8	203.5	0.5979	0.2004	0.7177
		-2.5	0.11718	12.0	0.00549	0.00234	0.002930	340.4
1	113.6	113.4	107.7	107.4	119.7	119.4	-31.4	29.4
2	119.8	119.7	113.2	113.1	125.5	125.4	-60.5	49.7
3	114.1	113.9	107.9	107.6	120.2	119.9	-30.6	25.6
4	115.3	115.2	108.9	108.7	121.7	121.6	-33.2	30.5
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	120.2	120.1	111.7	111.5	124.7	124.5	-62.4	55.2
7	121.5	121.5	111.4	111.2	125.4	125.2	-45.6	56.3

Table C3. continued. Acoustic Measurements for the Tapered Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
23	7	79.0	0.1199	288.2	202.4	0.5970	0.2012	0.7171
		0.0	0.08079	8.0	0.00234	0.00143	-0.001520	339.0
1	118.7	118.6	108.8	108.6	122.4	122.3	-38.6	47.5
2	118.5	118.4	112.0	111.9	124.3	124.0	-82.4	39.0
3	117.6	117.5	108.9	108.7	122.3	122.1	-41.2	41.2
4	116.0	115.8	107.8	107.5	121.3	121.0	-29.0	30.9
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	120.3	120.2	112.0	111.8	125.3	125.1	-69.9	64.4
7	116.4	116.2	107.6	107.1	120.9	120.5	-36.4	30.8
23	8	78.9	0.1197	288.8	202.8	0.5982	0.2003	0.7180
		0.0	0.10375	10.0	0.00331	0.00171	-0.002070	339.0
1	119.3	119.2	111.3	111.2	124.3	124.2	-143.2	115.9
2	122.8	122.8	116.8	116.7	128.8	128.7	-134.4	115.6
3	118.7	118.6	111.2	111.1	124.3	124.2	-134.9	107.3
4	119.6	119.5	112.1	112.0	125.3	125.2	-42.8	52.2
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	123.2	123.2	114.6	114.5	127.8	127.7	-99.2	59.3
7	119.9	119.8	112.1	111.9	125.1	124.9	-60.6	54.4
23	10	79.1	0.1200	289.8	203.5	0.5997	0.2003	0.7198
		0.0	0.12534	11.0	0.00489	0.00249	-0.002650	339.3
1	123.1	123.1	117.0	117.0	129.8	129.7	-64.0	75.7
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	123.9	123.9	117.0	116.9	129.5	129.5	-67.1	104.3
4	123.8	123.8	117.1	117.1	130.6	130.5	-68.1	81.1
5	123.5	123.5	117.1	117.1	130.0	130.0	-64.9	104.4
6	126.5	126.4	119.5	119.5	132.8	132.7	-144.2	97.4
7	124.5	124.5	116.8	116.7	129.6	129.6	-86.8	82.0

Table C3. continued. Acoustic Measurements for the Tapered Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
23	30	79.5	0.1195	290.6	204.1	0.5967	0.2006	0.7164
		10.0	0.06834	4.0	-0.00065	0.00130	-0.014090	342.0
1	120.2	120.1	109.1	108.8	123.3	123.0	-143.2	115.5
2	116.5	116.2	107.2	106.8	120.7	120.1	-128.4	114.5
3	118.9	118.8	108.8	108.6	123.2	123.0	-134.5	107.5
4	114.2	114.0	105.0	104.4	118.4	118.0	-22.5	27.6
5	122.2	122.1	114.0	113.9	128.1	128.0	-67.3	131.4
6	121.2	121.2	109.3	109.1	123.5	123.2	-42.4	54.8
7	120.4	120.3	109.0	108.6	123.2	122.9	-32.0	36.2
23	32	79.3	0.1199	290.9	204.2	0.5965	0.2013	0.7166
		10.0	0.11412	8.0	-0.00065	0.00167	-0.023490	342.3
1	122.3	122.2	109.3	109.1	123.5	123.3	-43.0	58.3
2	118.9	118.7	109.6	109.4	123.1	122.8	-47.0	42.8
3	120.8	120.7	109.1	108.9	123.5	123.3	-44.2	54.9
4	116.7	116.6	107.0	106.7	120.5	120.2	-33.0	42.3
5	125.2	125.2	114.0	113.9	128.1	128.0	-74.9	68.8
6	124.0	124.0	112.6	112.5	126.9	126.8	-71.2	70.2
7	122.7	122.6	110.2	109.9	124.5	124.3	-53.3	60.1
25	9	119.9	0.1800	292.7	205.5	0.5999	0.3005	0.7802
		-10.0	0.06109	11.0	0.00539	0.00192	0.010000	342.6
1	112.7	110.2	107.3	104.1	119.5	110.6	-27.0	21.5
2	118.2	117.3	110.8	108.7	122.9	118.3	-38.1	45.7
3	113.2	110.8	108.2	105.7	119.9	112.4	-35.6	18.4
4	111.3	107.3	106.3	102.3	118.1	105.0	-20.6	18.1
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	118.1	117.1	110.4	108.1	122.4	116.8	-45.3	50.8
7	120.4	119.9	109.5	107.1	123.3	118.6	-44.0	40.2

Table C3. continued. Acoustic Measurements for the Tapered Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
25	10	120.0	0.1802	293.1	205.8	0.6007	0.3004	0.7812
		-10.0	0.07103	12.0	0.00636	0.00211	0.012070	342.6
1	114.1	112.2	107.6	104.5	120.0	113.2	-31.3	32.3
2	120.1	119.4	112.2	110.7	124.3	121.2	-49.0	48.2
3	114.4	112.7	108.3	105.8	120.6	113.9	-28.9	25.3
4	111.8	108.5	105.7	100.1	118.2	105.4	-24.3	25.1
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	119.9	119.2	110.7	108.4	123.3	118.4	-45.2	51.0
7	121.6	121.2	110.5	108.7	124.1	119.9	-48.4	52.1
25	11	120.2	0.1802	293.9	206.4	0.6018	0.2999	0.7823
		-10.0	0.08123	13.0	0.00734	0.00241	0.013730	342.9
1	115.3	113.9	108.5	106.0	121.3	116.8	-29.6	29.1
2	121.0	120.5	112.3	110.3	124.3	120.6	-49.0	42.3
3	114.7	113.2	108.3	105.7	120.3	113.0	-27.5	23.0
4	112.9	110.6	106.1	101.2	118.4	107.1	-20.6	23.7
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	121.9	121.5	111.2	109.3	124.2	120.5	-45.1	42.0
7	123.2	122.9	110.0	107.8	123.8	119.6	-44.3	52.8
26	5	119.3	0.1803	292.2	205.2	0.6027	0.2996	0.7833
		-7.5	0.06105	10.0	0.00442	0.00192	0.006810	340.4
1	115.4	114.1	107.7	104.7	120.6	113.6	-34.9	30.4
2	115.8	113.8	112.0	110.6	123.1	115.7	-40.6	33.2
3	115.5	114.3	108.8	106.6	120.3	114.2	-36.0	29.1
4	114.7	113.3	106.3	102.4	118.8	108.3	-28.9	25.4
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	116.2	114.6	109.1	105.9	121.5	112.8	-30.9	34.7
7	117.4	116.4	107.6	103.6	121.0	113.8	-35.1	32.4

Table C3. continued. Acoustic Measurements for the Tapered Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
26	6	119.8	0.1810	290.4	203.9	0.5991	0.3026	0.7804
		-7.5	0.08160	12.0	0.00613	0.00237	0.009720	340.4
1	115.9	114.8	108.7	106.6	120.5	113.7	-37.5	28.8
2	119.4	118.6	109.7	106.8	122.8	117.2	-42.4	33.9
3	116.2	115.1	108.7	106.5	120.8	114.2	-37.8	29.3
4	114.2	112.5	107.1	103.7	119.4	111.0	-29.2	22.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	120.4	119.8	110.7	108.5	123.2	118.1	-41.6	46.5
7	121.5	121.2	109.7	107.4	123.4	118.9	-43.4	52.9
26	8	118.9	0.1795	291.8	204.9	0.6014	0.2989	0.7811
		-7.5	0.09971	14.0	0.00813	0.00321	0.012300	340.7
1	116.1	115.0	108.0	105.3	121.1	116.5	-29.3	29.7
2	121.9	121.5	110.7	108.6	123.3	118.7	-58.4	46.5
3	116.7	115.8	109.2	107.3	121.9	118.5	-36.4	25.1
4	114.2	112.5	107.9	105.2	119.7	112.3	-30.4	23.8
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	123.2	122.9	112.2	110.8	125.5	123.0	-59.6	59.1
7	125.7	125.5	113.5	112.7	127.5	125.9	-64.1	68.1
26	9	119.4	0.1801	291.4	204.6	0.6000	0.3005	0.7803
		-7.5	0.10456	15.0	0.00965	0.00427	0.013380	341.0
1	121.2	120.9	110.1	108.6	124.1	122.6	-60.1	43.8
2	125.1	124.9	114.4	113.6	127.9	126.9	-71.0	80.3
3	120.4	120.0	111.1	110.0	124.1	122.7	-63.2	43.6
4	118.0	117.3	108.6	106.1	121.8	118.9	-47.8	41.9
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	128.2	128.1	115.1	114.4	129.3	128.6	-98.2	97.2
7	129.7	129.6	116.9	116.5	130.9	130.3	-104.7	90.6

Table C3. continued. Acoustic Measurements for the Tapered Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEGA*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
25	4	119.1 -5.0	0.1794 0.07295	292.5 10.0	205.4 0.00418	0.6012 0.00186	0.2989 0.005540	0.7809 341.6
1	113.6	111.4	107.6	104.7	120.2	113.2	-24.3	25.1
2	114.5	111.6	108.8	105.4	121.1	112.7	-28.4	25.7
3	114.8	113.3	109.4	107.6	121.0	115.5	-30.5	41.4
4	113.1	110.8	107.2	104.1	119.3	110.7	-32.8	35.5
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	116.3	114.6	111.6	110.1	122.9	116.4	-34.6	33.7
7	116.0	114.6	107.1	102.5	120.8	113.6	-28.8	27.2
26	3	119.4 -5.0	0.1801 0.08356	292.0 11.0	205.0 0.00491	0.6012 0.00205	0.3000 0.006630	0.7815 341.1
1	114.5	112.9	108.4	106.0	120.4	113.1	-27.2	25.3
2	117.6	116.4	110.4	108.1	122.4	115.6	-39.6	25.4
3	115.4	114.1	108.6	106.4	120.6	114.1	-27.8	33.0
4	113.5	111.5	106.1	101.4	118.4	108.9	-32.8	19.1
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	119.2	118.4	110.1	107.4	122.6	118.5	-39.2	52.9
7	119.6	119.0	108.7	105.8	122.3	116.8	-39.8	40.3
25	7	120.1 -5.0	0.1805 0.10501	293.1 13.5	205.8 0.00742	0.6014 0.00330	0.3005 0.009130	0.7821 342.2
1	116.6	115.5	109.2	107.2	122.1	119.1	-35.6	32.1
2	122.6	122.2	111.9	110.3	125.5	123.4	-60.9	60.8
3	117.3	116.5	110.4	108.9	122.4	119.5	-39.6	30.8
4	115.8	114.5	108.2	105.3	120.6	116.0	-32.8	33.6
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	125.1	124.8	114.3	113.5	127.7	126.1	-63.6	76.3
7	126.4	126.3	113.6	112.8	127.7	126.0	-77.8	65.5

Table C3. continued. Acoustic Measurements for the Tapered Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
28	8	120.3 -2.5	0.1784 0.06799	293.0 9.7	205.7 0.00389	0.5932 0.00181	0.3012 0.004980	0.7719 346.8
1	115.3	114.1	108.2	105.6	120.7	114.9	-35.3	31.2
2	114.2	111.2	109.8	107.3	121.4	112.3	-32.4	36.1
3	116.0	114.9	108.2	105.6	120.6	113.4	-33.2	27.1
4	113.1	110.7	106.7	102.6	119.6	111.1	-25.2	29.8
6	119.0	118.2	111.0	109.0	122.9	116.9	-41.6	57.2
7	121.1	120.7	109.6	107.3	123.2	118.8	-48.6	36.3
28	6	119.7 -2.5	0.1779 0.08057	293.6 9.7	206.2 0.00339	0.5955 0.00182	0.2991 0.002530	0.7736 346.2
1	115.7	114.4	108.7	106.4	121.1	116.3	-36.7	37.4
2	115.3	112.8	110.2	107.9	122.1	117.3	-36.1	36.0
3	116.6	115.5	108.7	106.3	121.2	117.0	-38.6	33.2
4	113.8	111.6	107.3	103.9	120.0	113.7	-24.5	24.7
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	116.8	115.4	110.6	108.6	122.3	117.1	-33.3	29.8
7	119.2	118.5	109.8	107.4	123.3	120.3	-37.2	47.5
24	7	120.4 0.0	0.1798 0.07513	295.1 8.0	207.2 0.00206	0.6014 0.00167	0.2993 -0.001030	0.7814 344.6
1	118.3	117.6	109.9	108.2	122.6	119.9	-60.3	46.4
2	118.4	117.3	111.6	110.0	124.1	120.7	-64.9	42.7
3	118.5	117.8	110.5	109.0	123.0	120.7	-41.8	54.1
4	116.7	115.7	109.5	107.5	122.5	119.7	-48.2	39.7
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	119.5	118.7	112.1	110.8	124.4	121.1	-53.8	54.9
7	115.8	113.8	108.8	105.4	121.3	116.0	-33.0	36.5

Table C3. continued. Acoustic Measurements for the Tapered Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
24	8	120.6	0.1800	293.9	206.4	0.5985	0.3011	0.7787
		0.0	0.09693	10.0	0.00302	0.00208	-0.000750	344.8
1	118.0	117.2	111.1	109.8	123.8	122.4	-45.5	43.2
2	120.9	120.4	113.0	111.8	125.8	123.2	-78.5	68.4
3	118.5	117.9	111.2	109.9	124.2	122.9	-41.8	63.2
4	116.5	115.4	110.1	108.5	123.0	120.4	-39.2	39.2
6	120.5	119.9	113.9	112.9	126.2	123.6	-71.2	53.1
7	118.9	118.1	111.0	109.3	124.3	122.2	-43.4	49.9
24	10	120.9	0.1801	295.1	207.2	0.6003	0.3005	0.7807
		0.0	0.11481	12.0	0.00474	0.00304	0.000190	345.2
1	120.7	120.3	114.9	114.4	127.6	126.8	-89.6	57.7
2	126.3	126.2	118.0	117.6	131.7	131.2	-96.4	131.6
3	122.1	121.8	115.5	115.1	128.3	127.5	-86.8	64.1
4	122.1	121.8	115.1	114.6	128.4	127.8	-65.3	76.5
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	125.6	125.4	117.6	117.2	130.7	130.2	-94.3	133.9
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	17	150.2	0.2251	293.3	206.0	0.6001	0.3757	0.8255
		-10.0	0.07073	14.0	0.00808	0.00306	0.012050	343.2
1	124.3	123.7	115.3	113.7	129.0	126.4	-77.8	76.8
2	125.5	125.0	115.1	112.1	128.7	123.8	-102.5	66.3
3	124.0	123.4	115.4	113.9	128.3	125.4	-80.9	71.7
4	120.6	119.2	112.3	108.3	125.8	120.8	-71.6	43.6
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	128.8	128.5	117.5	116.0	131.1	128.8	-91.0	129.2
7	129.0	128.8	116.5	115.1	130.7	127.9	-114.5	98.3

Table C3. continued. Acoustic Measurements for the Tapered Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
26	19	149.7	0.2255	292.9	205.7	0.6020	0.3750	0.8278
		-10.0	0.07568	14.5	0.00901	0.00358	0.012970	341.6
1	123.5	122.8	114.1	111.8	127.7	124.4	-66.1	62.9
2	126.5	126.0	114.6	111.1	128.3	123.4	-100.7	98.1
3	122.8	122.1	114.9	113.2	127.8	124.0	-76.5	58.5
4	120.5	119.1	111.3	105.2	124.7	115.9	-61.4	39.5
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	129.3	129.1	117.1	115.5	130.8	128.2	-116.8	135.1
7	128.4	128.1	115.1	113.1	129.4	126.2	-124.8	94.8
26	12	150.1	0.2257	292.0	205.0	0.5994	0.3770	0.8254
		-5.0	0.07736	12.0	0.00568	0.00286	0.005910	342.1
1	121.4	120.2	114.4	112.3	127.7	125.4	-132.8	107.3
2	132.9	132.8	124.9	124.7	137.6	137.3	-391.7	352.0
3	121.6	120.5	114.9	113.1	127.5	124.6	-128.9	102.8
4	118.8	116.7	111.8	107.2	124.6	116.4	-51.9	43.4
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	127.0	126.6	117.2	115.7	131.1	129.3	-78.6	130.0
7	127.9	127.6	114.1	111.2	128.3	124.4	-96.9	90.1
26	13	150.3	0.2258	292.0	205.0	0.5989	0.3775	0.8250
		-5.0	0.08713	13.0	0.00673	0.00329	0.007120	342.4
1	122.6	121.8	114.5	112.5	127.9	125.7	-132.1	106.7
2	124.8	124.0	116.5	114.5	129.5	127.1	-391.7	355.2
3	123.0	122.3	114.8	113.0	127.9	125.6	-129.6	103.4
4	119.6	117.7	112.3	108.3	125.4	119.8	-63.0	58.4
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	128.4	128.1	117.4	115.9	131.2	129.8	-99.7	127.1
7	128.8	128.6	117.3	116.2	131.6	129.7	-106.5	92.4

Table C3. continued. Acoustic Measurements for the Tapered Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPQ/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
25	16	150.9	0.2257	294.9	207.1	0.6022	0.3754	0.8282
		0.0	0.06748	8.0	0.00205	0.00211	-0.001380	343.9
1	122.7	121.8	114.8	112.9	128.0	125.2	-77.3	70.4
2	122.3	121.0	114.3	110.6	127.7	122.1	-76.1	81.7
3	122.9	122.0	115.2	113.4	128.1	125.9	-76.7	69.5
4	121.7	120.6	113.2	110.0	126.4	121.8	-78.1	64.6
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	125.9	125.2	116.6	114.6	130.7	128.7	-95.3	342.7
7	124.9	124.4	114.4	111.7	128.6	125.7	-91.2	71.7
25	17	150.9	0.2257	295.1	207.2	0.6025	0.3751	0.8285
		0.0	0.08489	10.0	0.00297	0.00256	-0.000820	343.9
1	121.8	120.7	114.4	112.3	127.9	125.3	-70.0	69.9
2	121.8	120.1	114.5	111.0	127.7	122.5	-94.8	73.7
3	121.7	120.6	115.0	113.1	127.9	124.5	-62.0	64.8
4	121.4	120.3	112.9	109.6	125.8	120.4	-83.2	70.3
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	125.3	124.6	116.3	114.1	130.4	128.3	-111.5	115.7
7	124.8	124.3	113.7	110.3	127.9	124.3	-72.8	66.9
25	19	150.9	0.2253	295.1	207.2	0.6014	0.3751	0.8270
		0.0	0.10092	12.0	0.00504	0.00384	0.000490	344.6
1	123.0	122.2	114.9	113.0	128.4	126.4	-85.7	75.4
2	125.0	124.2	115.2	112.3	128.6	124.4	-102.4	93.5
3	123.5	122.8	115.5	113.9	128.6	126.6	-110.8	59.5
4	124.0	123.4	113.7	111.0	127.5	125.4	-90.4	73.2
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	129.1	128.9	118.3	117.1	132.6	131.5	-149.0	121.9
7	127.7	127.4	115.9	114.1	130.2	128.2	-85.3	84.7

Table C3. continued. Acoustic Measurements for the Tapered Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPC/S	V/OR CXP/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
57	6	164.3	0.2445	321.1	225.5	0.6525	0.3753	0.8974
		-5.0	0.07535	12.0	0.00595	0.00341	0.005270	345.6
1	128.0	127.7	116.4	114.3	130.0	127.2	-116.3	180.3
2	126.0	125.1	117.5	115.0	130.0	125.1	-107.9	145.3
3	124.9	124.1	115.7	113.2	129.1	125.6	-100.2	114.2
4	125.8	125.2	115.3	112.4	129.4	125.9	-113.9	87.1
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	130.1	129.8	118.8	117.1	132.6	129.1	-115.5	160.0
7	126.9	126.2	115.5	112.0	129.5	125.6	-94.6	97.6
57	7	164.1	0.2441	320.5	225.1	0.6507	0.3757	0.8951
		-5.0	0.08628	13.0	0.00720	0.00405	0.006390	345.9
1	128.9	128.6	116.7	114.8	130.9	128.8	-141.5	137.4
2	126.9	126.2	117.6	115.2	130.0	125.7	-119.4	138.7
3	125.8	125.2	116.2	114.1	129.9	127.0	-109.2	94.8
4	126.5	126.0	115.3	112.5	129.5	126.6	-128.9	99.2
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	130.3	130.0	118.9	117.3	132.8	129.8	-129.3	192.6
7	127.2	126.6	115.3	111.6	129.7	126.3	-120.3	99.2
58	16	170.4	0.2557	335.1	235.3	0.6865	0.3730	0.9425
		-7.5	0.06912	12.5	0.00741	0.00416	0.007430	342.8
1	133.6	133.4	124.1	123.7	137.0	136.0	-210.9	504.9
2	132.7	132.5	118.0	115.1	132.8	129.5	-181.0	239.2
3	134.0	133.9	126.0	125.8	139.2	138.8	-247.4	465.2
4	133.7	133.6	126.1	125.8	138.8	138.2	-279.4	472.6
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	131.5	131.3	118.9	116.8	133.4	130.3	-198.9	215.1
7	133.3	133.1	124.1	123.7	137.9	137.4	-320.7	191.9

Table C3. continued. Acoustic Measurements for the Tapered Tip Rotor.

RUN	POINT	VELOCITY	MTUN	RPM	OMEG*R	MTIP	V/OR	MAT
		ALPHA	CLR/S	THETA	CP/S	CPO/S	CXR/S	VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
58	6	171.0	0.2561	333.1	233.9	0.6811	0.3765	0.9376
		-5.0	0.07781	12.0	0.00657	0.00423	0.004610	343.4
1	134.0	133.9	122.0	121.4	136.3	134.8	-223.2	331.6
2	131.8	131.5	118.2	115.5	132.5	129.2	-168.6	141.8
3	133.1	132.9	123.7	123.2	137.0	136.3	-174.6	344.1
4	133.3	133.2	125.0	124.7	138.2	137.5	-165.4	416.1
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	131.3	131.0	119.4	117.5	133.4	130.3	-157.7	173.6
7	131.2	130.9	123.1	122.5	136.6	136.0	-210.9	237.5
58	7	170.6	0.2553	333.9	234.5	0.6821	0.3748	0.9378
		-5.0	0.08171	12.5	0.00707	0.00448	0.005120	343.7
1	134.8	134.7	122.8	122.3	136.9	135.6	-229.7	433.5
2	132.0	131.8	118.2	115.6	132.4	129.2	-193.7	165.4
3	133.5	133.4	124.1	123.7	137.3	136.4	-186.7	373.4
4	133.7	133.6	125.5	125.2	138.6	137.9	-233.5	426.7
5	141.7	141.7	132.9	132.9	145.8	145.7	-936.8	856.9
6	131.1	130.8	119.0	116.9	133.1	129.5	-149.7	224.2
7	130.9	130.6	122.7	122.1	135.9	135.2	-223.3	214.5
58	11	171.9	0.2558	332.1	233.2	0.6747	0.3796	0.9308
		-2.5	0.07056	10.0	0.00414	0.00326	0.001020	345.6
1	131.5	131.3	120.2	119.3	134.7	132.9	-147.9	298.5
2	128.1	127.4	119.6	117.7	132.4	129.3	-183.0	145.2
3	129.8	129.5	120.6	119.7	134.6	132.8	-134.4	251.2
4	131.8	131.7	122.8	122.2	136.4	135.3	-161.8	376.0
5	140.0	140.0	131.2	131.1	143.8	143.6	-732.3	764.9
6	128.8	128.3	119.9	118.3	133.6	130.7	-119.2	197.1
7	131.0	130.7	120.9	119.9	135.1	134.3	-135.4	234.3

Table C3. continued. Acoustic Measurements for the Tapered Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
58	12	172.1	0.2561	336.1	236.0	0.6828	0.3756	0.9393
		-2.5	0.07800	11.0	0.00506	0.00377	0.001830	345.6
1	133.1	132.9	121.1	120.3	136.0	134.4	-192.1	331.6
2	130.6	130.2	119.4	117.4	132.5	129.3	-141.2	144.2
3	132.2	132.0	121.9	121.3	135.5	133.9	-186.0	321.5
4	132.8	132.6	124.6	124.3	137.8	136.8	-199.4	375.1
5	141.6	141.6	132.6	132.5	145.8	145.6	-786.4	816.0
6	129.9	129.5	119.8	118.1	133.6	130.6	-146.4	176.5
7	129.8	129.4	122.1	121.3	135.4	134.4	-182.7	199.4
58	18	175.8	0.2629	344.6	242.0	0.7034	0.3743	0.9667
		-7.5	0.07001	12.8	0.00822	0.00514	0.006930	344.0
1	137.7	137.6	130.0	129.9	142.9	142.6	-347.2	734.6
2	130.8	130.4	119.3	116.9	133.9	130.7	-157.6	185.0
3	137.0	136.9	130.7	130.6	143.5	143.2	-567.7	622.8
4	137.9	137.8	130.2	130.1	143.6	143.4	-607.4	615.4
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	132.5	132.2	121.3	119.9	135.7	133.5	-198.3	236.5
7	136.6	136.5	129.9	129.8	143.2	143.1	-432.4	519.3
58	21	176.2	0.2630	346.4	243.2	0.7058	0.3732	0.9692
		-5.0	0.07624	12.0	0.00691	0.00457	0.004720	344.6
1	138.8	138.7	130.6	130.5	144.0	143.8	-384.8	817.0
2	132.7	132.4	122.2	121.0	136.3	134.4	-189.5	277.5
3	137.8	137.7	131.1	131.0	144.3	144.2	-620.4	645.2
4	138.7	138.7	131.4	131.3	144.3	144.1	-605.2	659.6
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	133.3	133.1	123.7	122.9	137.6	136.2	-244.4	185.9
7	135.6	135.4	129.1	128.9	142.1	141.9	-468.5	378.4

Table C3. continued. Acoustic Measurements for the Tapered Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
58	26	176.9	0.2631	345.8	242.8	0.7020	0.3753	0.9655
		-2.5	0.07830	11.0	0.00557	0.00458	0.001000	345.9
1	136.5	136.4	127.9	127.7	141.2	140.6	-262.1	610.7
2	131.8	131.5	122.7	121.8	135.7	133.7	-251.3	225.5
3	136.3	136.2	129.0	128.9	142.2	142.0	-366.4	648.3
4	137.7	137.7	130.6	130.5	143.0	142.7	-503.4	610.2
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	131.8	131.5	123.1	122.2	136.3	134.4	-202.1	185.9
7	135.4	135.2	128.0	127.8	141.1	140.8	-463.9	368.4

Table C4. Acoustic Measurements for the Rectangular Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEGA*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
39	10	79.6	0.1202	290.0	203.6	0.5979	0.2013	0.7182
		-5.0	0.06340	8.0	0.00312	0.00147	0.004470	340.6
1	114.5	114.3	101.3	99.9	113.3	111.7	-20.1	22.8
2	114.2	113.8	108.4	108.0	119.2	117.6	-29.4	27.7
3	113.0	112.7	102.7	101.7	114.7	113.0	-15.7	19.4
4	111.3	110.9	104.8	104.2	116.1	114.4	-16.5	20.6
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	117.8	117.6	105.8	105.2	118.0	117.1	-46.6	30.3
7	112.8	112.5	100.7	98.6	113.2	109.6	-20.7	20.2
39	11	79.5	0.1202	289.4	203.2	0.5972	0.2015	0.7175
		-5.0	0.08908	10.0	0.00458	0.00182	0.006390	340.3
1	112.5	112.2	103.9	103.1	115.7	114.0	-19.4	22.1
2	115.2	114.9	105.8	105.1	117.9	116.7	-37.1	25.4
3	110.4	109.9	102.4	101.3	114.1	112.6	-19.7	20.2
4	111.0	110.5	103.9	103.2	116.2	114.9	-28.6	24.8
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	118.7	118.5	107.1	106.7	119.3	118.5	-46.4	27.7
7	116.5	116.3	104.9	104.0	116.6	114.7	-29.0	26.6
39	13	79.5	0.1201	290.6	204.1	0.5996	0.2006	0.7199
		-5.0	0.11756	13.0	0.00701	0.00274	0.008470	340.3
1	110.9	110.4	104.1	103.4	116.3	115.4	-17.7	22.4
2	118.8	118.7	110.9	110.7	122.6	122.2	-43.8	39.0
3	112.0	111.7	105.1	104.5	117.3	116.7	-17.9	25.1
4	112.5	112.2	105.1	104.5	117.9	117.3	-23.2	24.3
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	119.6	119.5	109.7	109.5	121.9	121.5	-36.4	40.9
7	121.7	121.7	107.2	106.6	120.0	119.1	-46.4	59.7

Table C4. continued. Acoustic Measurements for the Rectangular Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
39	5	79.3	0.1201	288.8	202.8	0.5976	0.2013	0.7179
		-2.5	0.07375	8.0	0.00287	0.00149	0.001820	339.4
1	115.1	114.9	104.5	103.9	117.9	117.1	-119.8	96.8
2	114.3	113.9	109.2	108.9	120.6	120.0	-126.2	113.7
3	113.8	113.6	104.9	104.3	118.4	117.7	-128.4	102.1
4	112.0	111.6	104.1	103.4	116.4	115.5	-23.5	16.7
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	117.8	117.7	107.5	107.0	119.4	118.7	-42.0	35.0
7	114.6	114.3	102.9	101.6	115.8	113.9	-20.7	20.2
39	7	79.3	0.1201	288.8	202.8	0.5971	0.2014	0.7173
		-2.5	0.10751	11.0	0.00480	0.00210	0.002740	339.7
1	112.1	111.8	104.5	103.8	116.3	115.2	-18.2	21.2
2	117.5	117.3	111.3	111.1	122.7	121.9	-49.4	38.3
3	112.7	112.4	105.8	105.3	117.8	117.0	-23.4	24.1
4	114.1	113.9	106.7	106.4	119.0	118.4	-29.7	22.6
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	118.0	117.9	109.6	109.3	121.4	120.4	-43.2	38.5
7	119.2	119.1	106.0	105.3	119.1	118.4	-41.6	44.4
39	8	79.3	0.1197	288.8	202.8	0.5953	0.2014	0.7152
		-2.5	0.11741	12.0	0.00565	0.00247	0.003060	340.7
1	111.3	110.9	105.8	105.3	117.5	116.6	-23.1	25.6
2	118.6	118.5	111.8	111.6	123.6	122.8	-49.2	38.9
3	113.4	113.1	106.6	106.2	118.8	118.3	-27.7	22.7
4	113.9	113.7	107.2	106.9	120.0	119.6	-31.5	24.4
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	118.7	118.6	110.4	110.2	123.4	123.0	-48.6	43.7
7	121.8	121.8	107.2	106.7	120.6	120.1	-52.1	56.5

Table C4. continued. Acoustic Measurements for the Rectangular Tip Rotor.

RUN	POINT	VELOCITY	MTUN	RPM	OMEG*R	MTIP	V/OR	MAT
		ALPHA	CLR/S	THETA	CP/S	CPO/S	CXR/S	VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
39	18	79.6	0.1203	288.6	202.7	0.5950	0.2024	0.7154
		0.0	0.05856	6.0	0.00171	0.00129	-0.001070	340.6
1	116.7	116.6	104.4	103.7	118.5	118.0	-34.0	41.7
2	115.2	114.9	108.1	107.8	119.9	118.4	-32.6	30.0
3	116.0	115.9	104.7	104.0	118.4	118.0	-34.6	29.8
4	113.4	113.1	104.8	104.2	117.3	116.6	-28.0	24.4
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	117.9	117.8	108.1	107.7	121.2	120.6	-41.6	42.5
7	115.7	115.4	103.7	102.4	116.7	115.2	-27.3	26.3
39	19	79.5	0.1200	289.8	203.5	0.5974	0.2012	0.7176
		0.0	0.07983	8.0	0.00234	0.00142	-0.001320	340.6
1	116.8	116.7	107.5	107.2	120.8	120.5	-35.6	35.8
2	118.4	118.2	112.5	112.4	124.4	124.1	-63.9	41.4
3	116.5	116.4	108.4	108.2	121.4	121.2	-33.0	40.9
4	115.5	115.4	108.0	107.7	120.8	120.5	-37.2	31.9
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	120.3	120.2	111.7	111.5	125.0	124.8	-50.2	86.5
7	116.8	116.6	105.9	105.2	118.5	117.8	-37.6	31.3
39	20	79.6	0.1202	289.8	203.5	0.5974	0.2015	0.7178
		0.0	0.10598	10.0	0.00344	0.00182	-0.002270	340.6
1	118.3	118.2	111.3	111.1	123.5	123.3	-43.5	49.6
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	120.1	120.0	112.4	112.3	125.4	125.2	-49.3	47.1
4	120.3	120.3	112.9	112.8	126.0	125.9	-61.7	49.2
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	123.9	123.8	116.7	116.7	129.7	129.6	-102.7	78.3
7	120.5	120.4	111.8	111.6	123.7	123.2	-53.7	60.3

Table C4. continued. Acoustic Measurements for the Rectangular Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
39	22	79.7	0.1203	289.2	203.1	0.5956	0.2022	0.7160
		0.0	0.12485	12.0	0.00492	0.00249	-0.002280	341.0
1	120.9	120.9	115.8	115.7	127.7	127.6	-64.7	72.8
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	123.3	123.2	116.7	116.7	129.0	129.0	-77.4	84.8
4	122.6	122.6	116.4	116.4	129.1	129.0	-77.4	66.7
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	124.0	124.0	114.8	114.7	126.6	126.3	-78.2	77.8
39	24	79.5	0.1199	288.8	202.8	0.5948	0.2019	0.7149
		10.0	0.06885	4.0	-0.00057	0.00142	-0.014180	340.9
1	119.0	118.9	105.9	105.4	120.2	119.8	-34.0	37.7
2	115.3	115.0	105.7	105.1	118.9	118.2	-24.6	36.2
3	118.3	118.2	106.0	105.5	119.9	119.5	-33.0	43.6
4	114.5	114.3	104.0	103.3	117.8	117.2	-27.4	28.8
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	121.3	121.2	107.9	107.5	121.9	121.4	-41.8	47.6
7	121.0	120.9	102.5	100.8	114.9	111.6	-33.4	38.9
39	26	79.4	0.1198	290.0	203.6	0.5972	0.2009	0.7172
		10.0	0.11314	8.0	-0.00044	0.00179	-0.022970	341.0
1	121.2	121.1	108.2	108.0	122.2	122.0	-35.3	47.8
2	119.9	119.8	109.4	109.1	123.0	122.8	-53.6	61.5
3	120.2	120.2	108.3	108.1	122.7	122.5	-41.2	45.7
4	117.0	116.9	106.9	106.5	120.4	120.1	-27.6	33.7
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	124.5	124.5	112.0	111.8	126.3	126.2	-60.8	60.2
7	122.3	122.3	104.9	104.0	117.7	116.0	-45.0	63.4

Table C4. continued. Acoustic Measurements for the Rectangular Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
40	11	119.9 -10.0	0.1799 0.06949	292.4 12.0	205.3 0.00633	0.5987 0.00214	0.3009 0.011940	0.7789 342.9
1	113.0	110.6	106.7	103.0	118.7	109.2	-27.8	28.0
2	118.6	117.7	110.2	107.6	122.3	116.3	-44.0	41.4
3	114.6	112.9	107.9	105.3	119.8	111.7	-31.4	27.0
4	112.8	110.7	105.9	101.0	119.0	109.7	-26.4	23.7
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	119.8	119.1	110.1	107.4	122.2	116.5	-43.6	81.5
7	120.5	120.1	106.3	100.7	118.5	104.0	-38.4	42.8
40	12	120.0 -10.0	0.1799 0.08871	295.4 14.0	207.4 0.00845	0.6043 0.00275	0.2981 0.015310	0.7844 343.3
1	116.3	115.3	107.7	104.6	120.2	113.7	-31.8	36.9
2	122.1	121.7	110.7	108.5	122.9	117.7	-58.4	48.7
3	115.8	114.6	107.9	105.1	120.5	113.4	-30.3	41.5
4	113.2	111.1	106.7	102.6	119.3	110.6	-31.2	28.6
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	123.5	123.2	110.9	108.8	123.6	119.5	-56.5	56.6
7	125.0	124.9	107.1	101.7	120.1	110.5	-68.8	64.8
40	13	120.0 -10.0	0.1797 0.09842	294.0 15.0	206.4 0.00981	0.6008 0.00327	0.2995 0.017780	0.7808 343.6
1	119.3	118.8	107.5	104.3	120.3	113.4	-31.5	34.7
2	123.8	123.5	111.4	109.5	124.5	120.9	-66.0	62.7
3	118.8	118.2	109.1	107.0	121.6	117.1	-37.3	37.0
4	115.5	114.2	107.4	103.7	120.1	112.9	-26.5	28.9
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	125.7	125.6	111.8	110.1	125.3	122.9	-66.9	86.0
7	126.9	126.8	106.2	98.5	119.1	106.5	-74.9	78.5

Table C4. continued. Acoustic Measurements for the Rectangular Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
40	5	119.4	0.1799	292.2	205.2	0.6011	0.2997	0.7813
		-5.0	0.07167	10.0	0.00416	0.00192	0.005340	341.3
1	114.4	112.7	107.1	103.9	119.7	111.6	-24.0	28.0
2	115.5	113.3	110.0	107.7	121.9	116.1	-43.4	28.2
3	115.6	114.5	108.5	106.2	120.4	113.3	-31.1	29.7
4	113.6	111.5	106.8	103.0	120.0	112.3	-25.0	28.6
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	118.5	117.6	110.4	108.2	122.5	116.2	-33.4	37.1
7	116.6	115.5	105.8	98.1	118.4	102.8	-41.9	33.7
40	6	119.3	0.1795	292.0	205.0	0.6001	0.2996	0.7799
		-5.0	0.09101	12.0	0.00571	0.00245	0.007430	341.7
1	114.3	112.5	107.3	104.1	119.6	111.9	-25.8	24.3
2	117.6	116.4	112.0	110.6	123.4	117.4	-43.4	38.5
3	115.5	114.3	108.4	106.2	120.0	113.3	-37.5	26.7
4	113.2	111.2	106.8	103.6	119.2	110.6	-25.5	27.1
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	118.6	117.6	110.5	108.2	122.6	116.3	-36.2	49.4
7	121.9	121.6	106.4	100.8	118.9	107.0	-55.3	52.8
40	8	119.8	0.1802	292.4	205.3	0.6004	0.3005	0.7808
		-5.0	0.10739	14.0	0.00808	0.00367	0.009880	342.0
1	118.7	118.1	108.9	106.7	122.4	119.4	-56.1	38.6
2	122.7	122.3	112.5	111.2	124.7	122.5	-62.9	55.1
3	119.6	119.1	109.9	108.2	123.2	120.8	-53.0	49.9
4	116.2	115.1	108.7	106.3	122.2	119.4	-34.5	35.9
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	125.2	124.9	112.6	111.3	125.8	124.1	-98.5	73.4
7	127.9	127.9	109.2	106.5	122.6	118.3	-93.3	98.2

Table C4. continued. Acoustic Measurements for the Rectangular Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
42	7	120.4	0.1821	292.2	205.2	0.6034	0.3022	0.7858
		-2.5	0.07023	9.5	0.00391	0.00201	0.004290	340.0
1	114.0	111.9	107.8	104.8	119.8	112.0	-26.0	27.3
2	116.3	114.5	110.1	107.7	122.1	116.3	-29.6	37.2
3	115.2	113.6	108.3	105.7	120.4	113.7	-26.2	29.7
4	113.4	110.9	107.1	103.3	120.0	112.3	-25.4	22.7
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	119.5	118.7	110.9	108.8	123.3	118.7	-44.0	54.5
7	118.2	117.3	108.1	104.4	119.9	109.8	-41.8	43.1
42	6	120.2	0.1818	292.8	205.6	0.6047	0.3011	0.7868
		-2.5	0.08486	9.5	0.00335	0.00194	0.001720	340.0
1	115.7	114.4	108.8	106.5	121.3	117.5	-35.4	32.1
2	116.9	115.4	111.5	109.9	123.3	120.1	-53.7	42.4
3	116.7	115.6	109.1	107.0	121.8	118.3	-36.0	37.7
4	114.5	112.6	107.9	104.9	120.9	116.9	-33.5	29.7
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	118.3	117.2	111.2	109.5	123.5	120.4	-46.8	44.4
7	116.1	114.5	108.4	104.7	120.7	115.5	-37.6	35.9
42	10	120.1	0.1815	293.2	205.9	0.6049	0.3004	0.7866
		-2.5	0.10030	11.5	0.00492	0.00253	0.003790	340.4
1	115.1	113.6	109.6	107.9	121.4	117.8	-31.8	30.3
2	119.7	119.0	113.2	112.1	125.5	122.7	-83.7	80.5
3	115.7	114.4	110.7	109.4	122.3	119.7	-42.3	32.6
4	115.2	113.6	110.0	108.4	122.3	119.6	-37.6	40.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	120.7	120.1	113.1	111.9	124.9	121.9	-60.5	74.0
7	119.8	119.2	108.4	104.5	120.7	114.8	-43.9	54.7

Table C4. continued. Acoustic Measurements for the Rectangular Tip Rotor.

RUN / MIC	POINT / DB	VELOCITY ALPHA / DBC	MTUN CLR/S / DBA	RPM THETA / DBAC	OMEG*R CP/S / PNDB	MTIP CPO/S / PNDBC	V/OR CXR/S / PMIN	MAT VSOUND / PMAX
40	18	120.4	0.1798	293.6	206.2	0.5989	0.3007	0.7790
		0.0	0.07640	8.0	0.00218	0.00173	-0.000910	344.2
1	117.7	116.9	109.5	107.6	122.4	119.7	-41.9	44.3
2	119.1	118.3	112.1	110.8	125.0	122.3	-55.7	68.1
3	118.1	117.3	109.8	108.0	122.7	119.8	-48.3	46.8
4	116.6	115.5	109.1	107.0	122.1	118.9	-31.1	35.7
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	119.4	118.6	112.2	110.9	124.4	121.4	-77.1	56.0
7	117.5	116.3	108.8	105.6	121.4	116.4	-35.8	35.3
40	19	120.3	0.1798	295.0	207.2	0.6018	0.2992	0.7818
		0.0	0.09507	10.0	0.00304	0.00209	-0.000620	344.2
1	118.5	117.9	111.3	110.2	124.5	122.2	-40.0	46.5
2	120.8	120.2	113.7	112.8	126.4	124.2	-57.9	47.9
3	118.4	117.8	111.3	110.1	124.0	121.5	-52.2	46.4
4	116.7	115.6	110.2	108.7	122.5	119.7	-42.3	35.6
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	120.9	120.4	114.8	114.1	127.2	125.2	-52.5	60.2
7	117.4	116.2	109.3	107.5	122.0	117.6	-40.6	50.6
40	20	120.7	0.1803	295.4	207.4	0.6026	0.2997	0.7832
		0.0	0.11427	12.0	0.00465	0.00299	0.000090	344.2
1	120.6	120.2	114.1	113.5	126.2	124.2	-58.1	57.6
2	124.4	124.1	116.3	115.8	129.2	127.5	-93.0	108.1
3	121.7	121.4	114.5	113.9	127.4	125.8	-79.3	70.4
4	121.1	120.8	114.3	113.8	127.4	126.1	-52.8	64.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	125.0	124.8	116.2	115.7	129.4	128.3	-117.9	79.6
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table C4. continued. Acoustic Measurements for the Rectangular Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
41	18	150.9	0.2259	293.4	206.0	0.5996	0.3773	0.8258
		-10.0	0.07196	14.0	0.00852	0.00342	0.012150	343.6
1	124.3	123.8	112.9	109.6	126.3	121.3	-72.8	59.8
2	125.2	124.6	112.9	106.2	126.1	115.0	-93.1	78.0
3	124.6	124.1	113.5	110.7	126.4	120.4	-75.1	66.6
4	120.4	119.0	111.2	105.0	124.5	115.2	-70.2	59.8
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	129.4	129.2	115.3	112.4	128.9	124.1	-111.5	166.9
7	129.7	129.5	110.5	100.2	124.1	109.7	-111.5	88.4
41	12	150.4	0.2255	292.8	205.6	0.5995	0.3767	0.8253
		-5.0	0.06204	10.0	0.00443	0.00256	0.003970	343.0
1	121.8	120.7	112.6	109.0	125.8	120.7	-72.6	66.3
2	122.8	121.6	114.9	112.1	126.9	121.2	-70.8	93.2
3	122.5	121.7	113.8	111.4	126.7	122.4	-52.3	77.0
4	119.9	118.3	111.6	106.7	124.6	117.3	-58.4	62.9
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	128.0	127.6	115.8	113.5	129.4	124.9	-95.2	100.4
7	126.1	125.8	110.6	98.0	123.7	105.9	-78.0	75.8
41	13	150.6	0.2259	292.4	205.3	0.5987	0.3777	0.8248
		-5.0	0.08014	12.0	0.00610	0.00318	0.006050	343.0
1	122.2	121.3	112.3	108.5	125.7	120.8	-79.3	68.6
2	123.8	122.8	114.5	111.2	126.8	120.7	-76.8	70.0
3	123.0	122.2	113.9	111.5	126.6	122.3	-94.1	68.6
4	120.2	118.6	112.1	107.8	125.2	119.4	-60.5	54.8
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	128.6	128.3	115.7	113.2	129.7	125.4	-82.0	135.4
7	128.3	128.1	110.9	101.2	123.3	109.7	-78.2	78.5

Table C4. continued. Acoustic Measurements for the Rectangular Tip Rotor.

RUN	POINT	VELOCITY	MTUN	RPM	OMEG*R	MTIP	V/OR	MAT
		ALPHA	CLR/S	THETA	CP/S	CPO/S	CXR/S	VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
41	14	150.7	0.2258	294.4	206.7	0.6022	0.3754	0.8283
		-5.0	0.08775	13.0	0.00706	0.00362	0.007130	343.3
1	123.0	122.2	113.2	110.1	126.8	122.5	-119.8	96.8
2	125.1	124.5	115.5	112.9	127.8	122.0	-125.9	114.6
3	123.4	122.8	114.3	112.1	127.1	123.7	-128.4	102.1
4	119.9	118.2	112.0	107.6	124.9	119.0	-63.3	46.9
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	129.2	128.9	116.4	114.4	130.2	127.8	-109.2	135.4
7	127.9	127.7	111.2	102.8	123.6	110.6	-78.2	78.5
41	15	150.7	0.2259	295.0	207.2	0.6034	0.3748	0.8296
		-5.0	0.09456	14.0	0.00842	0.00437	0.008430	343.3
1	123.8	123.1	113.2	110.2	126.3	121.7	-63.6	60.4
2	126.9	126.4	114.5	111.0	127.6	121.7	-94.0	109.5
3	124.3	123.8	114.8	112.9	127.6	124.3	-80.9	71.0
4	120.4	118.9	112.5	108.7	125.5	119.7	-69.2	42.9
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	131.3	131.1	117.3	115.6	131.3	129.7	-144.9	213.1
7	130.3	130.1	112.0	105.7	124.9	115.7	-134.8	112.1
45	8	156.5	0.2322	292.2	205.2	0.5918	0.3929	0.8243
		-2.6	0.08696	12.5	0.00631	0.00348	0.005380	346.7
1	125.8	125.3	114.6	112.2	127.5	123.4	-121.7	96.7
2	125.8	125.1	117.2	115.3	128.9	124.3	-84.4	150.6
3	125.6	125.1	114.6	112.1	127.2	122.7	-126.3	79.5
4	121.3	119.8	112.4	107.1	125.4	118.3	-61.9	60.5
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	129.4	129.0	116.5	114.2	130.2	125.9	-111.4	159.0
7	129.5	129.3	111.5	100.9	124.2	108.6	-116.1	96.7

Table C4. continued. Acoustic Measurements for the Rectangular Tip Rotor.

RUN	POINT	VELOCITY ALPHA	MTUN CLR/S	RPM THETA	OMEG*R CP/S	MTIP CPO/S	V/OR CXR/S	MAT VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
46	12	163.7	0.2446	319.7	224.5	0.6521	0.3756	0.8970
		-10.0	0.07321	14.0	0.00895	0.00400	0.011750	344.3
1	128.9	128.6	116.3	114.9	131.6	129.8	-421.0	340.1
2	127.3	126.7	115.0	108.0	128.8	119.7	-352.5	319.9
3	126.6	126.1	116.5	114.5	130.7	128.7	-410.3	326.7
4	125.2	124.5	114.5	111.0	128.8	125.0	-85.5	96.4
5	132.8	132.7	118.7	117.5	132.5	130.6	-261.7	170.3
6	130.4	130.1	116.4	113.1	130.8	126.5	-151.2	172.5
7	128.0	127.5	112.5	104.6	126.3	116.9	-97.6	115.5
46	13	163.9	0.2446	320.3	224.9	0.6527	0.3753	0.8977
		-10.0	0.08205	15.0	0.01037	0.00464	0.013470	344.6
1	129.6	129.3	117.3	115.6	131.9	130.5	-421.0	340.1
2	127.7	127.1	115.5	110.2	129.3	121.2	-355.4	319.9
3	126.5	125.9	116.8	114.9	130.8	129.0	-410.3	323.1
4	126.5	126.0	114.7	111.2	128.9	125.3	-127.7	89.8
5	133.1	133.0	118.8	117.7	132.3	130.6	-262.1	182.9
6	130.9	130.6	116.9	114.1	131.3	127.4	-154.1	153.1
7	128.6	128.2	113.5	107.4	127.3	119.7	-104.9	105.9
46	5	162.6	0.2447	317.9	223.2	0.6533	0.3751	0.8983
		-5.0	0.07030	11.0	0.00556	0.00334	0.004610	341.7
1	128.9	128.6	116.7	115.0	130.6	128.2	-147.7	178.8
2	126.9	126.2	118.5	116.8	130.2	126.6	-169.4	164.8
3	126.6	126.1	116.5	114.7	129.7	127.2	-106.6	147.3
4	125.8	125.1	116.0	113.9	129.6	127.1	-101.5	113.5
5	132.0	131.8	120.8	120.2	134.0	132.5	-222.7	180.5
6	131.0	130.7	119.2	117.9	132.6	129.7	-141.0	193.1
7	126.4	125.7	113.9	108.7	127.2	120.2	-83.7	80.4

Table C4. continued. Acoustic Measurements for the Rectangular Tip Rotor.

RUN	POINT	VELOCITY	MTUN	RPM	OMEG*R	MTIP	V/OR	MAT
		ALPHA	CLR/S	THETA	CP/S	CPO/S	CXR/S	VSOUND
MIC	DB	DBC	DBA	DBAC	PNDB	PNDBC	PMIN	PMAX
46	7	162.9	0.2446	318.5	223.7	0.6527	0.3753	0.8976
		-5.0	0.08897	13.0	0.00769	0.00434	0.006930	342.7
1	129.3	129.0	116.8	115.1	130.6	128.7	-137.8	189.2
2	127.7	127.1	118.3	116.5	130.4	126.5	-116.9	123.9
3	125.8	125.2	116.4	114.5	129.5	126.9	-123.0	111.8
4	126.3	125.8	115.6	113.1	129.3	126.7	-100.1	101.7
5	132.4	132.3	120.4	119.6	133.4	132.0	-269.5	172.1
6	130.3	130.1	118.8	117.3	132.6	129.6	-144.9	169.1
7	127.8	127.3	114.4	109.8	127.8	122.5	-133.0	93.5
46	18	164.6	0.2447	320.1	224.8	0.6498	0.3771	0.8949
		0.0	0.05304	7.0	0.00225	0.00250	-0.001380	345.9
1	128.3	128.0	118.1	116.8	132.6	131.4	-421.0	340.1
2	125.8	124.9	117.3	114.5	130.4	125.3	-352.5	319.9
3	126.7	126.2	117.9	116.5	131.5	130.1	-410.3	326.3
4	125.8	125.1	116.6	114.7	130.2	127.5	-82.7	110.0
5	131.0	130.8	121.6	121.0	134.5	132.8	-176.3	272.6
6	129.8	129.4	118.3	116.4	132.1	129.0	-137.6	126.2
7	126.1	125.3	114.4	110.0	127.4	121.4	-101.4	108.2
46	20	164.8	0.2448	321.7	225.9	0.6525	0.3757	0.8977
		0.0	0.07212	9.0	0.00319	0.00282	-0.000390	346.2
1	128.8	128.5	117.5	116.0	131.1	129.1	-108.2	183.6
2	125.5	124.5	116.1	112.5	128.5	122.5	-93.6	130.6
3	126.6	126.1	116.4	114.3	129.4	126.1	-93.8	136.6
4	125.9	125.2	116.1	113.8	130.0	127.3	-95.8	102.5
5	131.8	131.6	121.5	120.9	134.4	132.8	-329.4	192.9
6	130.1	129.7	118.3	116.4	132.3	129.0	-157.9	132.6
7	126.8	126.2	114.9	111.3	128.3	122.9	-98.4	119.4

APPENDIX D

PLOTS OF 1/3-OCTAVE SPECTRA

This appendix provides 1/3-octave plots for microphpone 3, which was located three rotor radii in front of the rotor, and for microphone 2, under the rotor. Each 1/3-octave plot shows three curves: an uncorrected raw-data spectrum, a background-noise spectrum, and a data spectrum corrected for the background noise. By displaying both raw data and data corrected for background noise, the extent to which the background noise contaminates the data can be observed. Table 6, which lists the order in which the data are presented, is repeated here for convenience. Symbols used in the plots are defined below.

Symbol	Quantity
$C_{LR/\sigma}$	rotor-lift coefficient, $\frac{L}{\rho S(\Omega R)^2}$
DBAC	dBA with background noise subtracted
DBAU	raw dBA value
DBC	dB with background noise subtracted
DBU	raw dB value
M_{at}	advancing-tip Mach number
MAXAMP	maximum acoustic pressure, N/m^2
MIC	microphone number
MINAMP	minimum acoustic pressure, N/m^2
M_{tip}	rotational tip Mach number
PNDBC	PNdB with background noise subtracted
PNDBU	raw PNdB
PT	test-point number
RUN	test-run number
V	wind-tunnel velocity, knots
α	angle of shaft from vertical, positive aft, deg
μ	advance ratio

TABLE 6.-KEY TO 1/3-OCTAVE SPECTRA IN APPENDIX D

Operating condition				Tip planform, page numbers			
μ	M_{tip}	M_{at}	V	Swept-tapered	Swept	Tapered	Rectangular
0.200	0.550	0.660	73	--	--	--	--
.075	.595	.640	30	--	--	--	--
.150	.595	.685	60	--	--	--	--
.200	.600	.720	80	160	202	230	260
.250	.600	.750	100	--	--	--	--
.300	.600	.780	120	170	206	238	268
.375	.600	.825	150	178	214	246	274
.400	.600	.840	160	--	--	--	--
.250	.650	.815	107	--	--	--	--
.375	.650	.895	164	186	220	--	278
.375	.685	.940	170	192	226	252	--
.250	.700	.875	115	--	--	--	--
.375	.700	.965	175	198	--	256	--

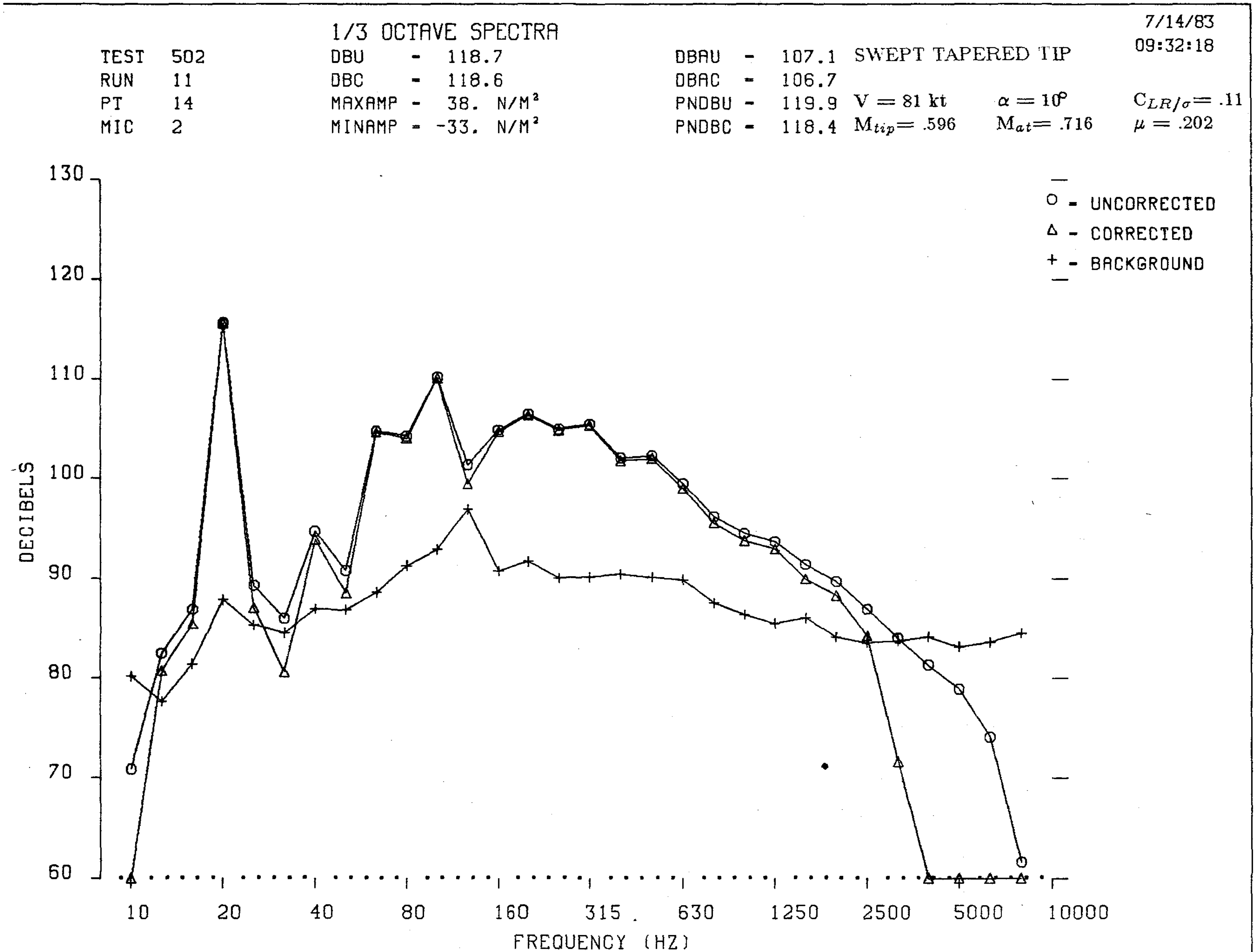

Figure D1(a). One-Third Octave Specta for The Swept Tapered Tip Rotor.

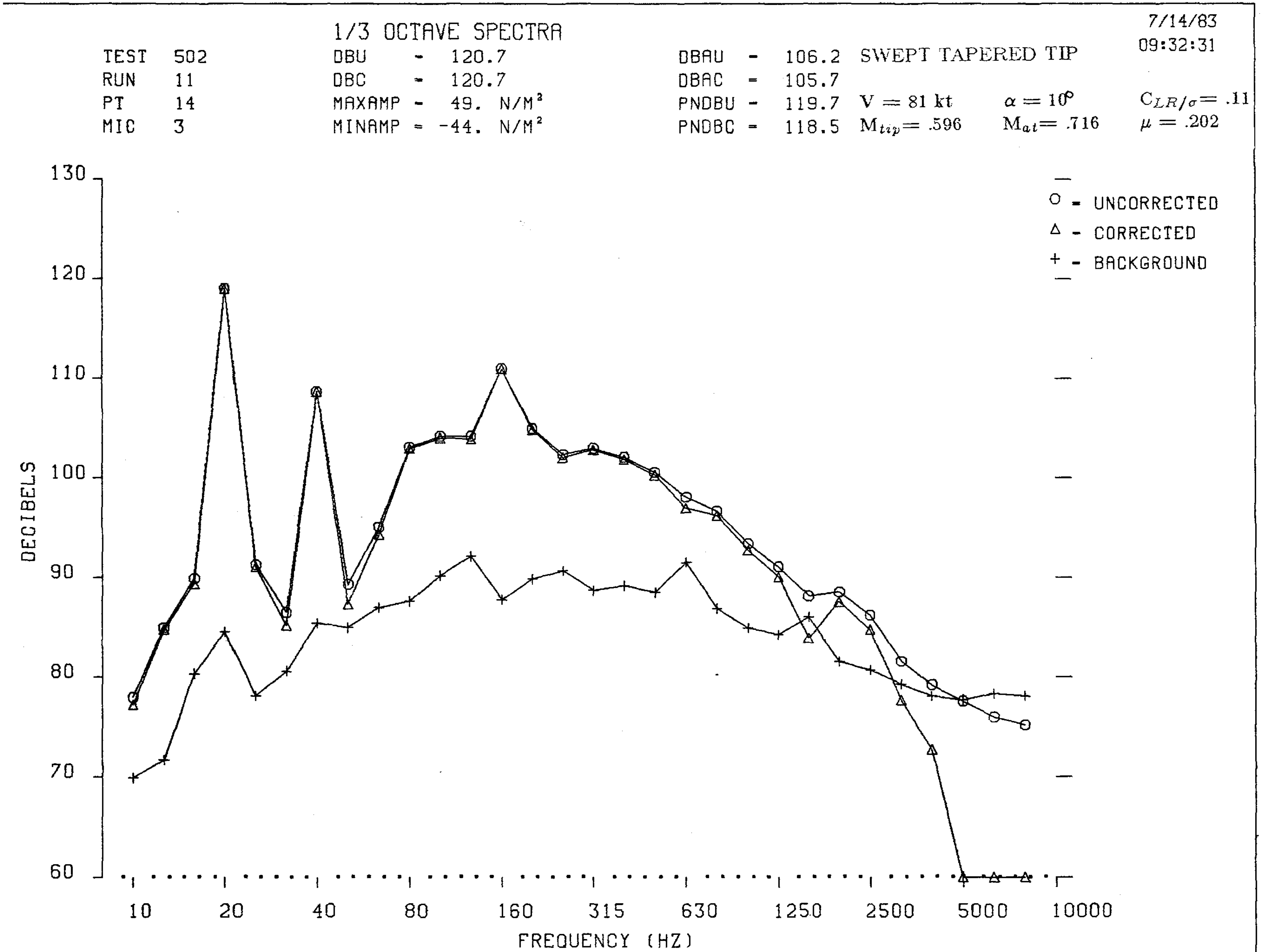

Figure D1(b). One-Third Octave Specta for The Swept Tapered Tip Rotor.

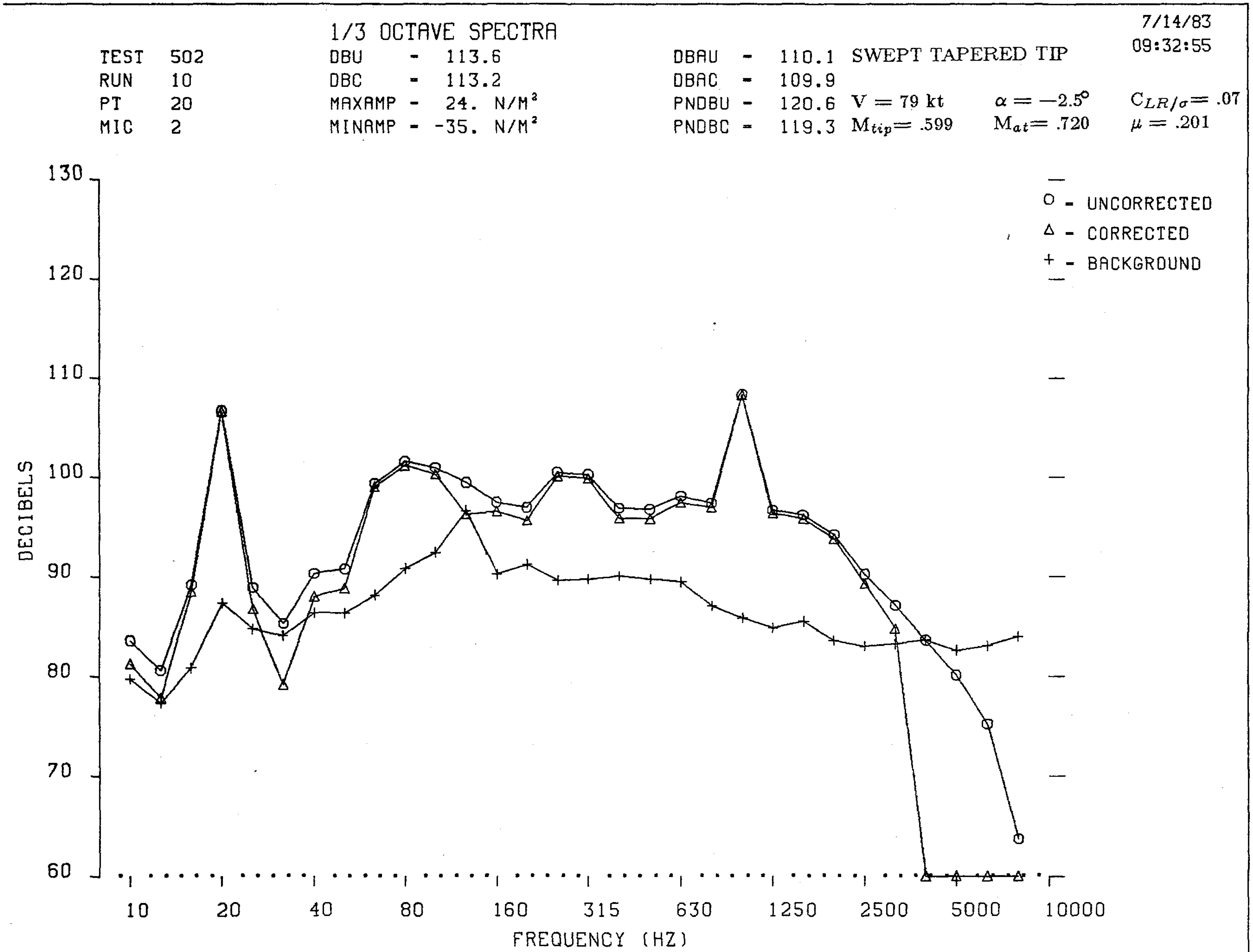

Figure D1(c). One-Third Octave Specta for The Swept Tapered Tip Rotor.

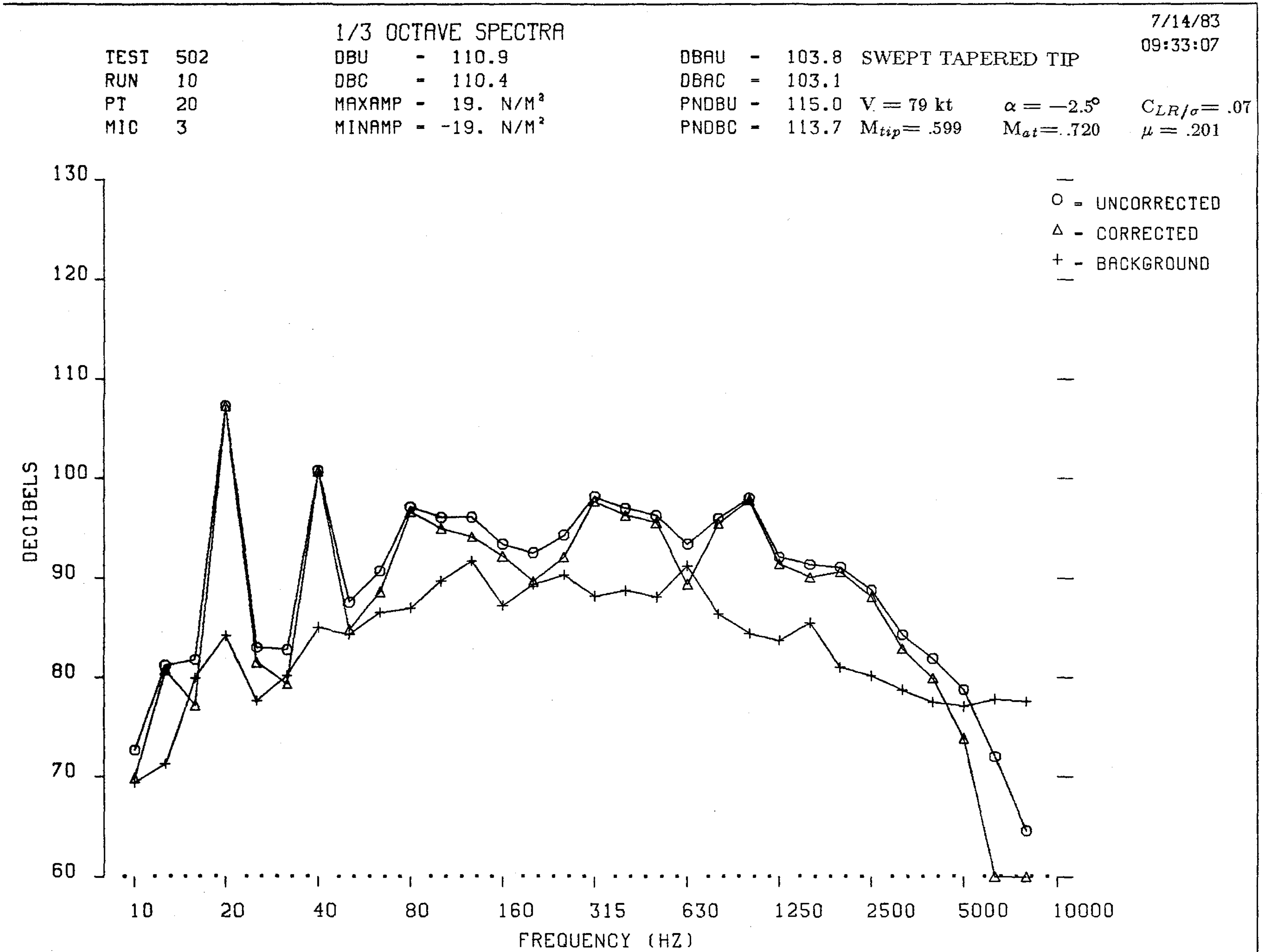

Figure D1(d). One-Third Octave Specta for The Swept Tapered Tip Rotor.

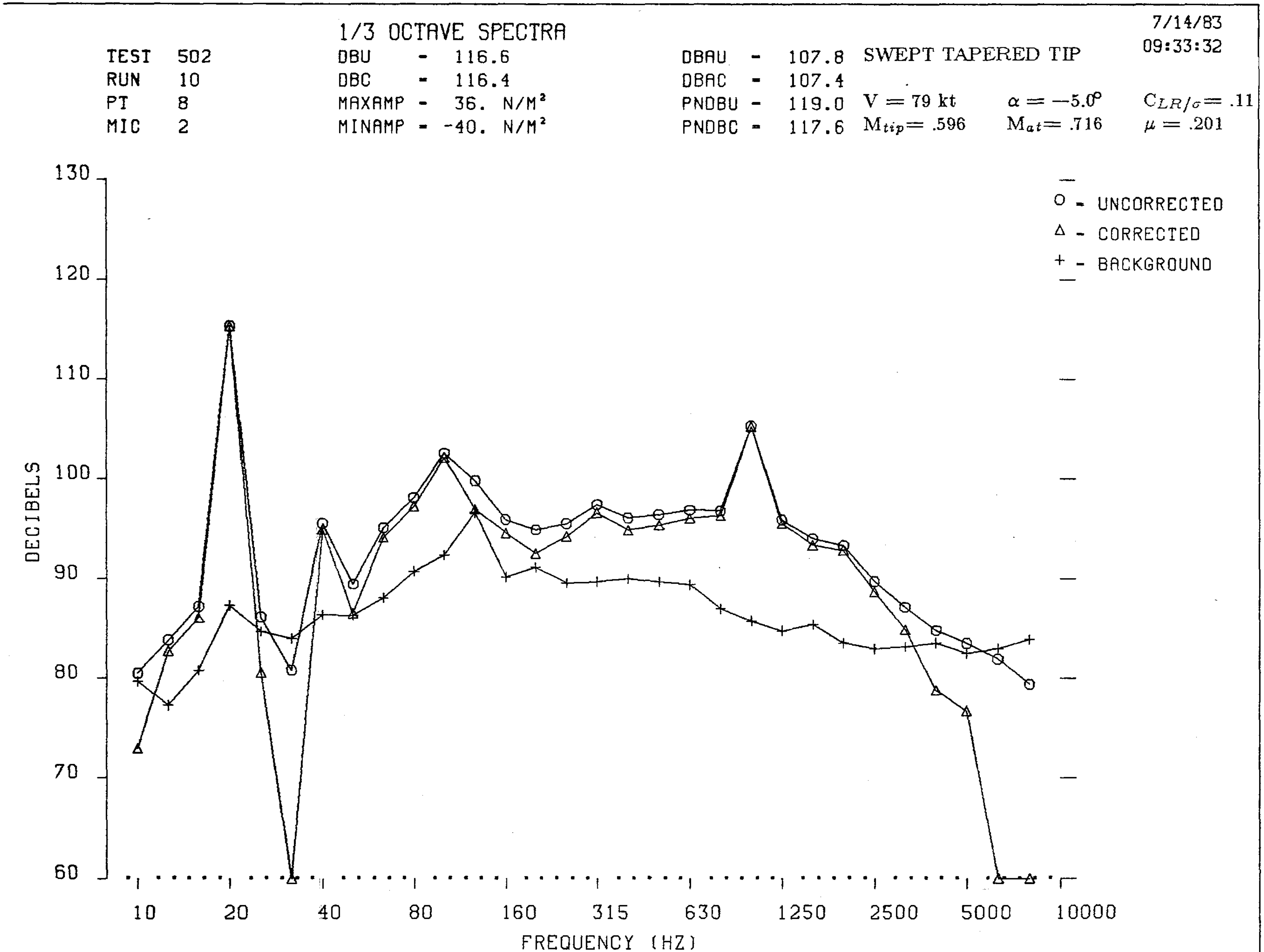

Figure D1(e). One-Third Octave Specta for The Swept Tapered Tip Rotor.

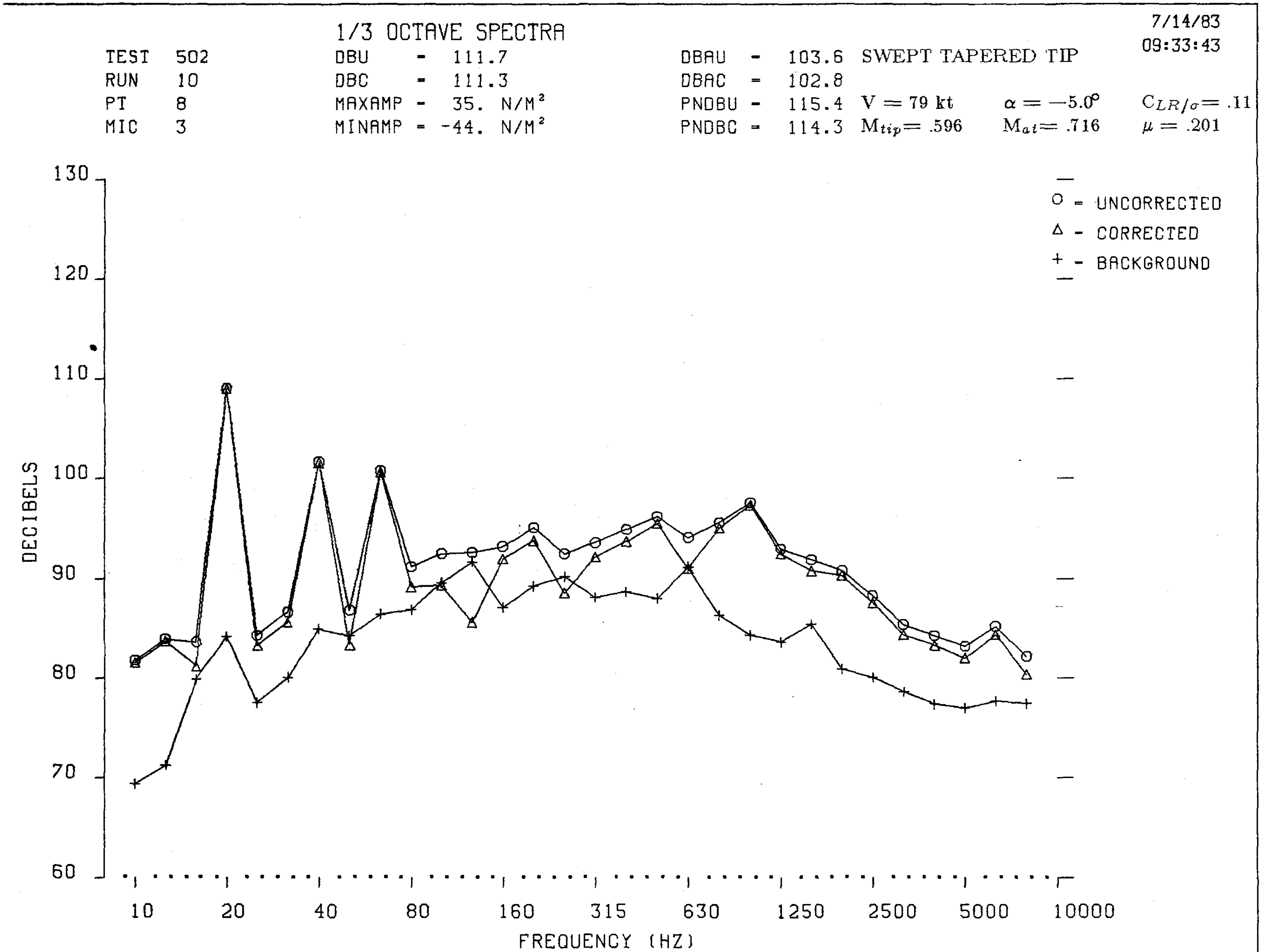

Figure D1(f). One-Third Octave Specta for The Swept Tapered Tip Rotor.

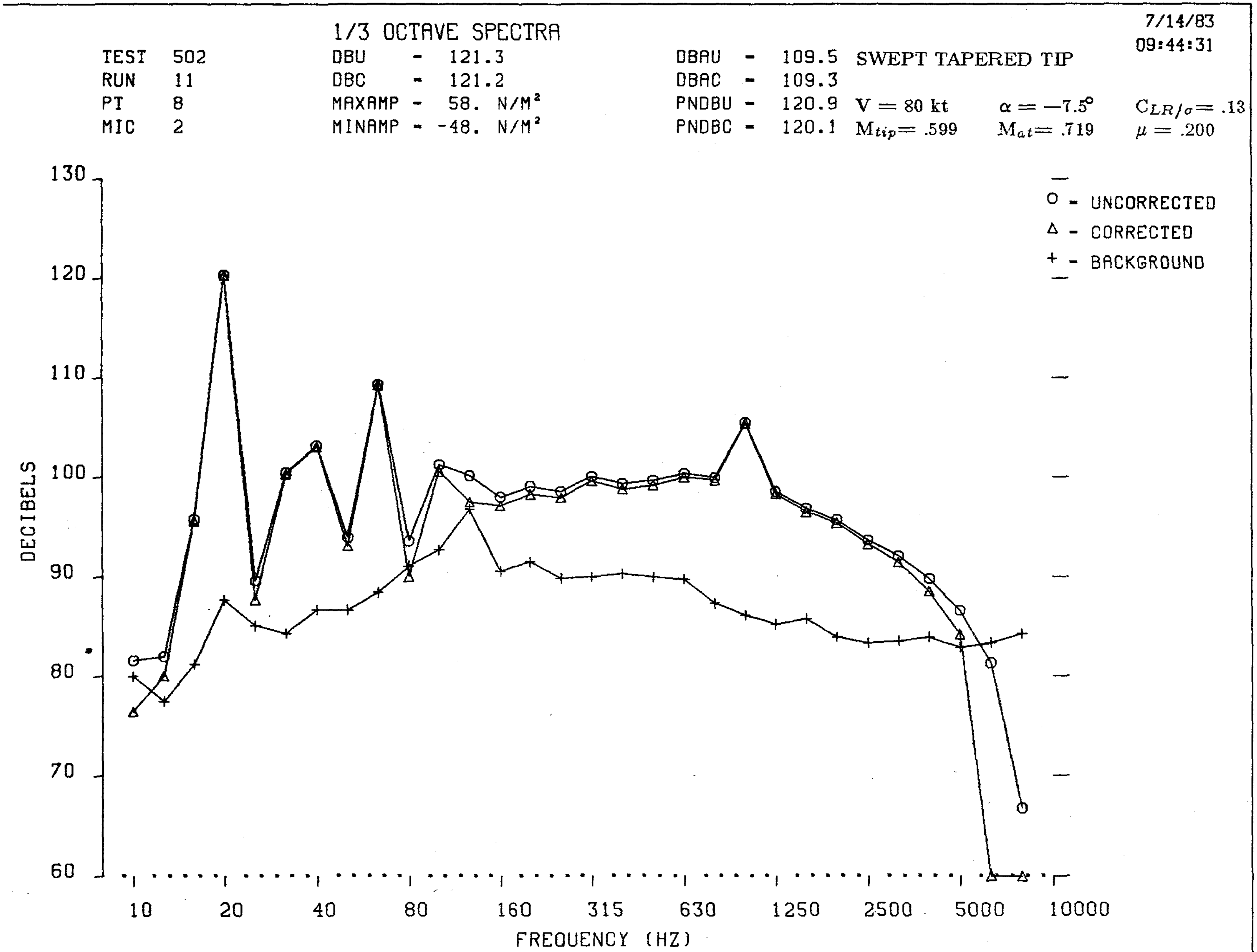

Figure D1(g). One-Third Octave Specta for The Swept Tapered Tip Rotor.

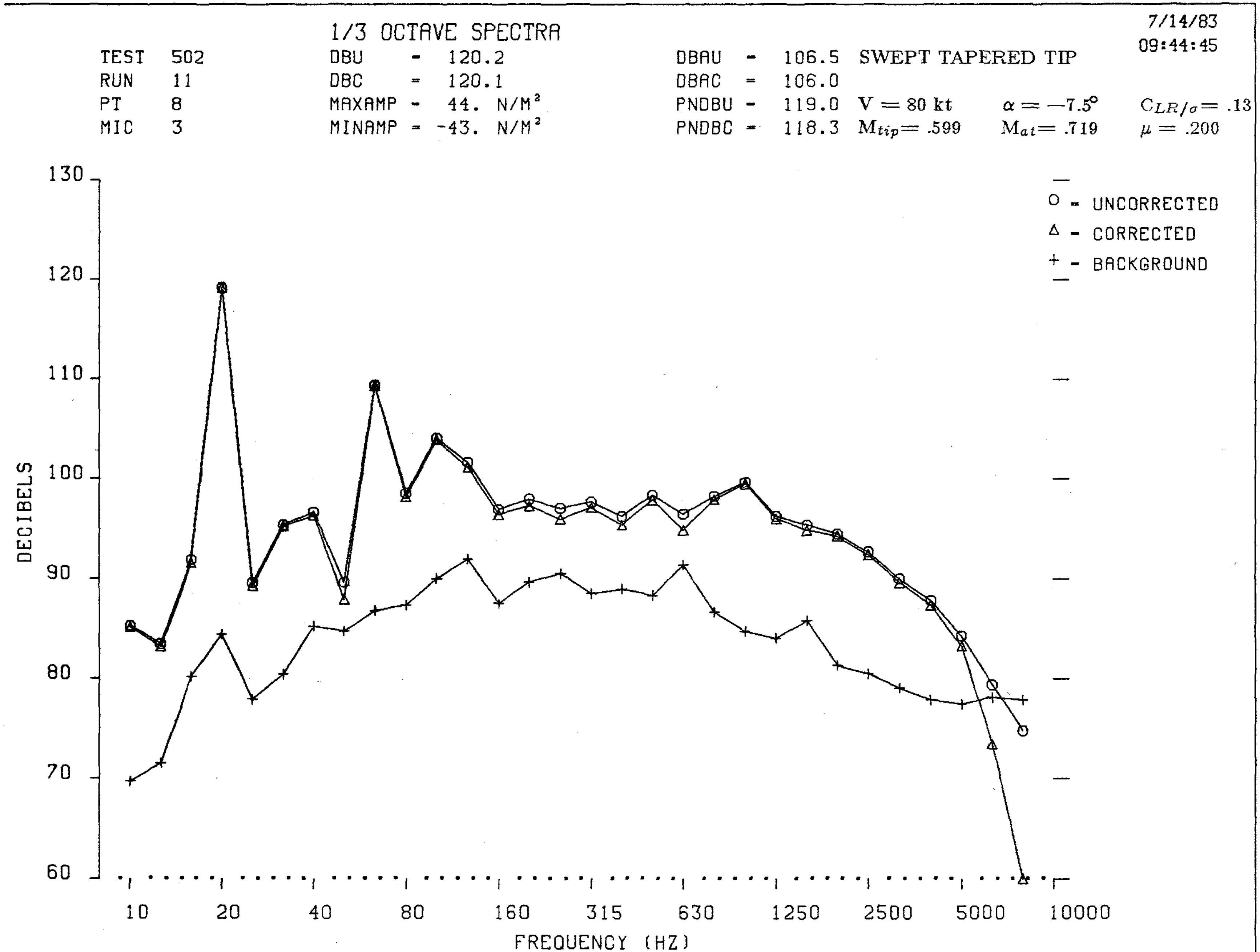

Figure D1(h). One-Third Octave Specta for The Swept Tapered Tip Rotor.

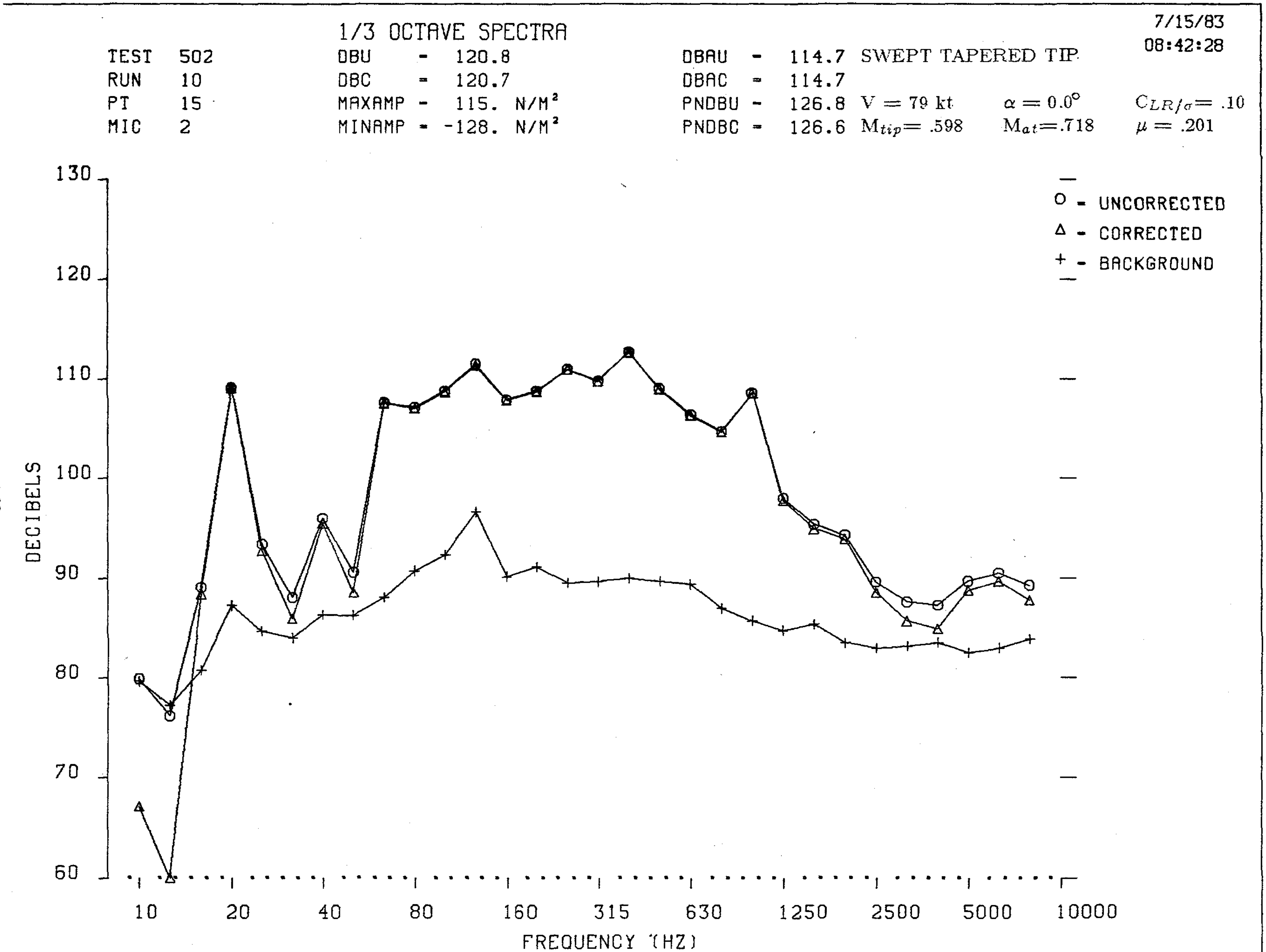

Figure D1(i). One-Third Octave Specta for The Swept Tapered Tip Rotor.

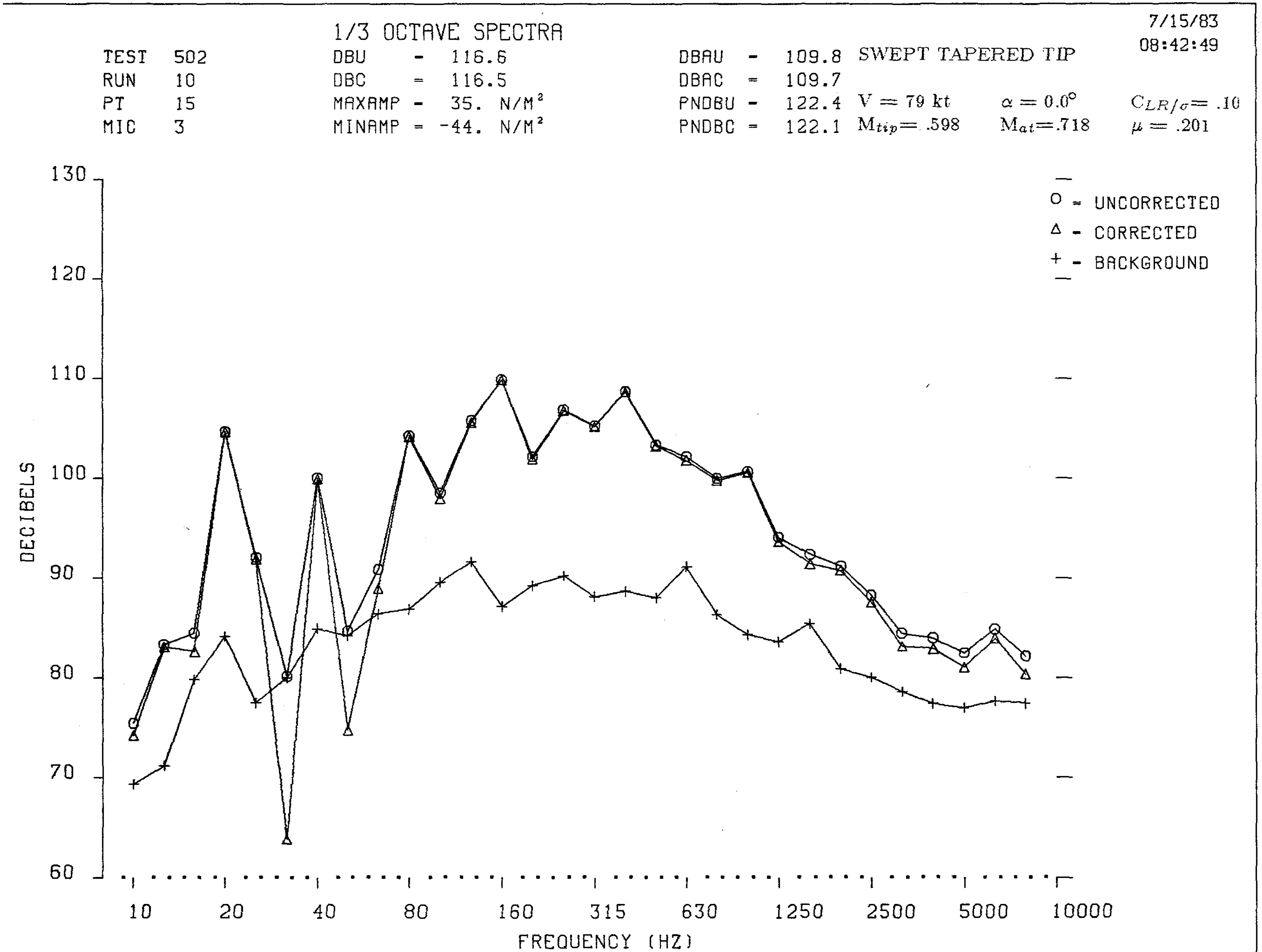

Figure D1(j). One-Third Octave Specta for The Swept Tapered Tip Rotor.

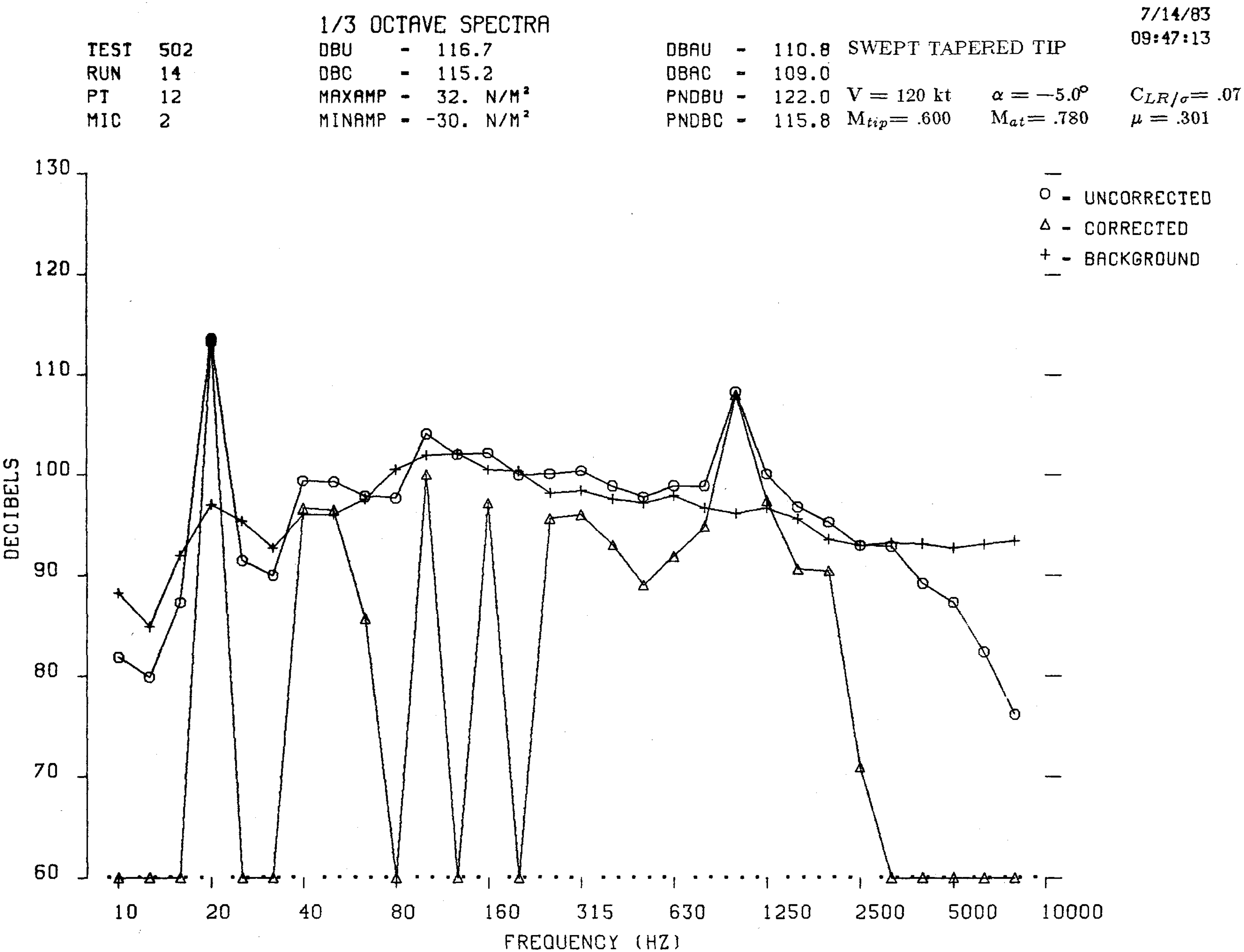

Figure D1(k). One-Third Octave Specta for The Swept Tapered Tip Rotor.

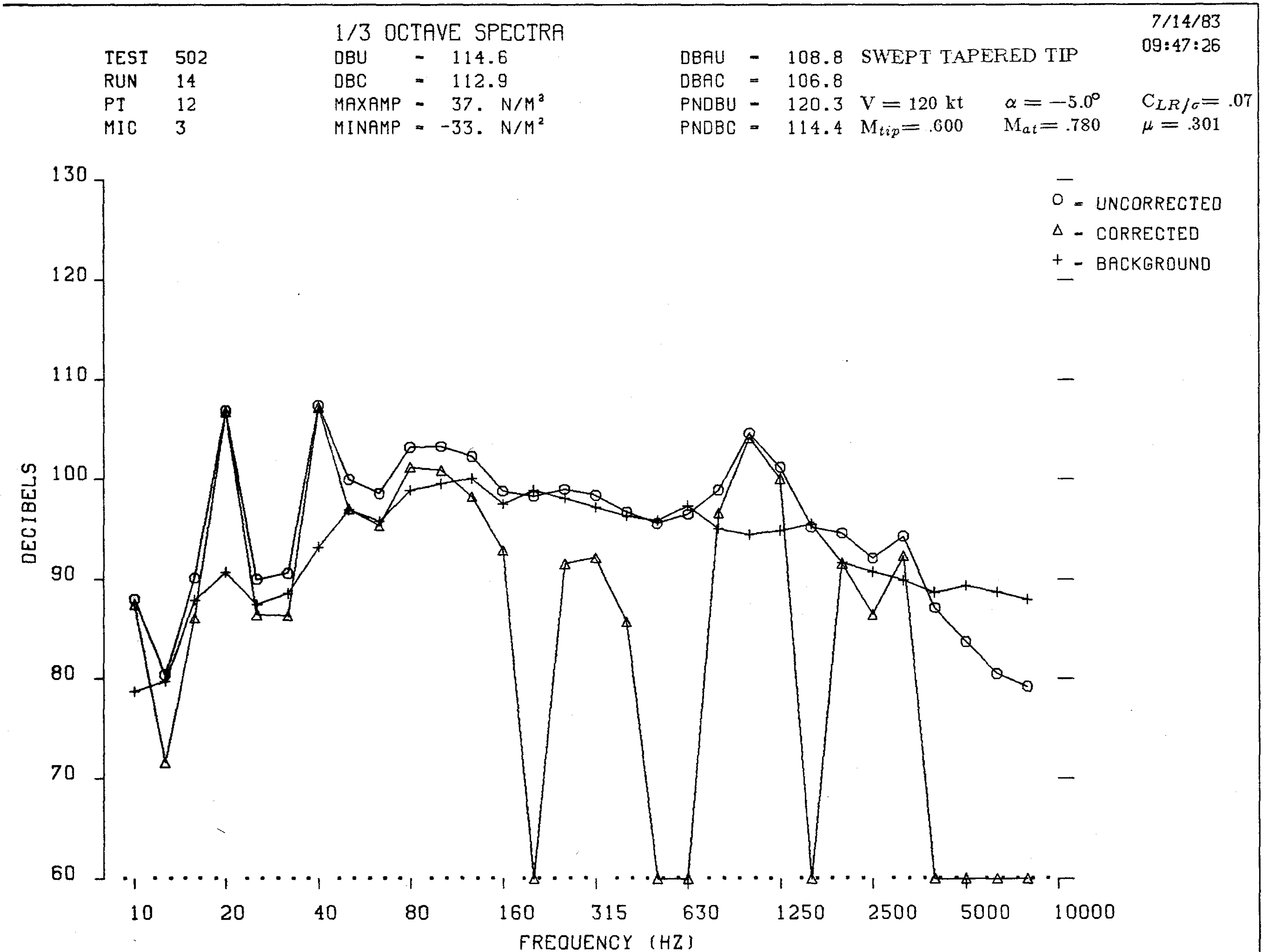

Figure D1(l). One-Third Octave Specta for The Swept Tapered Tip Rotor.

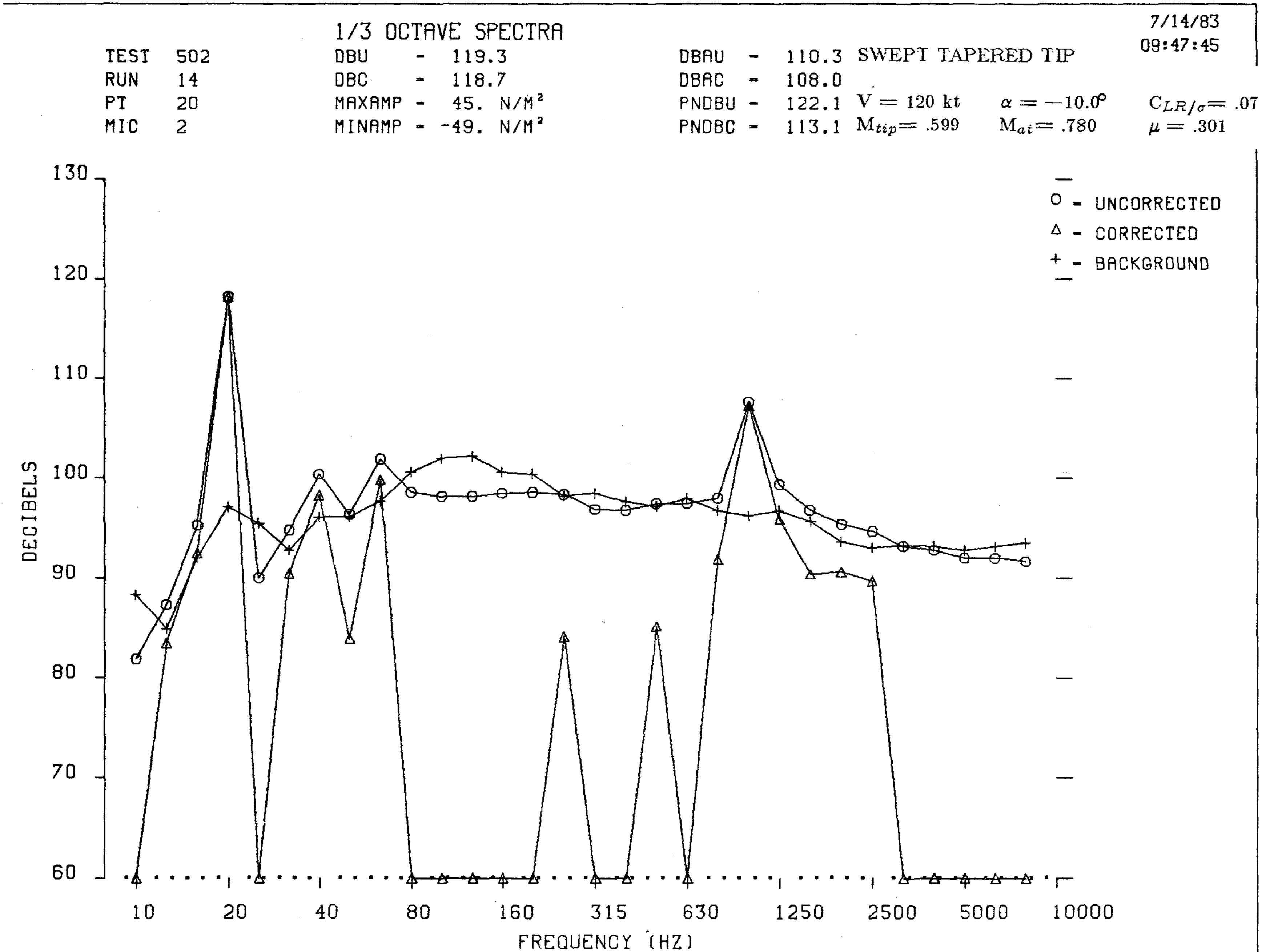

Figure D1(m). One-Third Octave Specta for The Swept Tapered Tip Rotor.

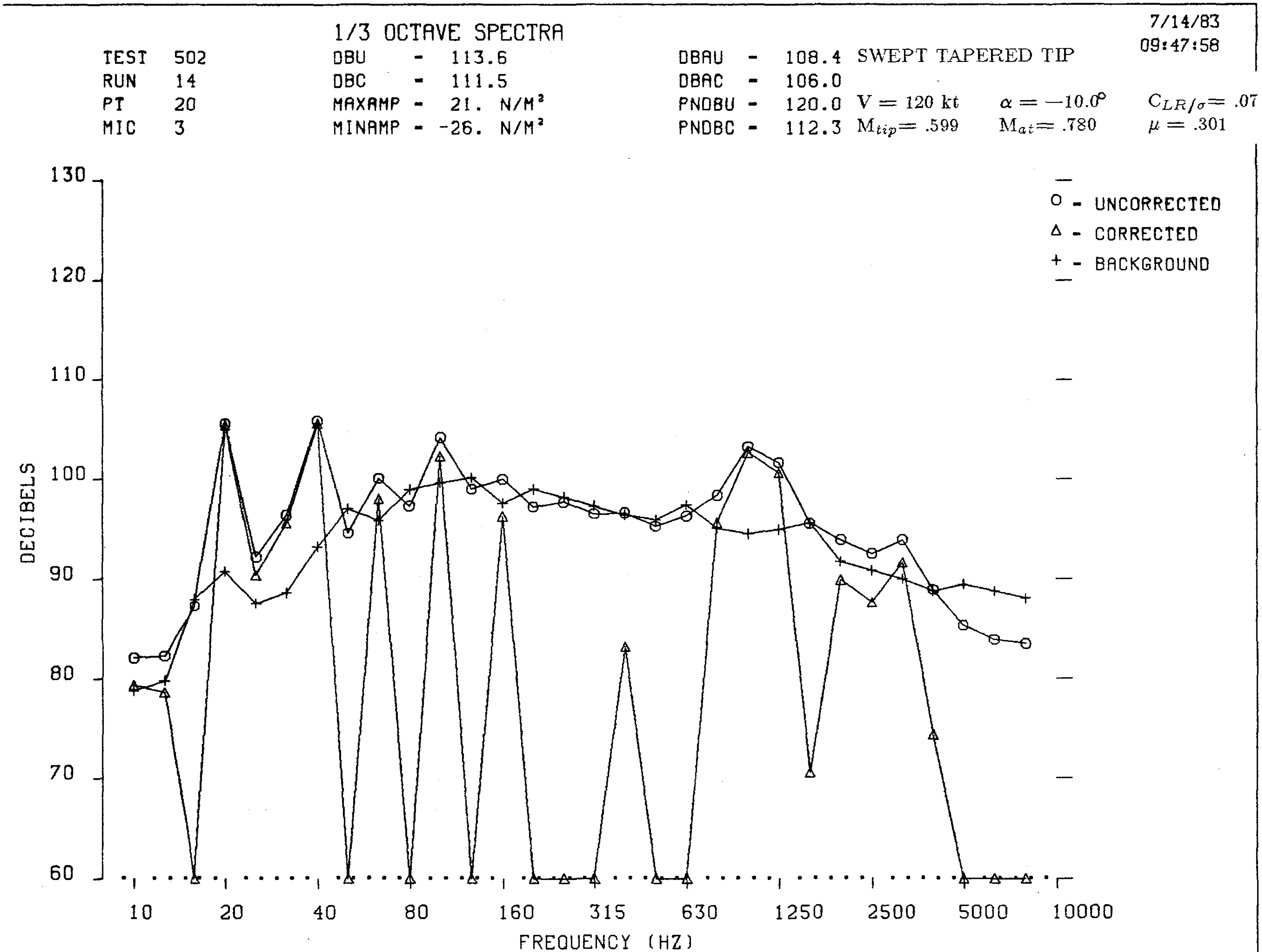

Figure D1(n). One-Third Octave Specta for The Swept Tapered Tip Rotor.

1/3 OCTAVE SPECTRA

7/15/83
08:43:06

TEST 502
RUN 14
PT 8
MIC 2

DBU - 121.9
DBC - 121.4
MAXAMP - 113. N/M^2
MINAMP - -126. N/M^2

DBAU - 115.5
DBAC - 114.9
PNDBU - 127.9
PNDBC - 125.8

SWEPT TAPERED TIP

$V = 120$ kt $\quad \alpha = 0.0^\circ \quad C_{LR/\sigma} = .09$

$M_{tip} = .604 \quad M_{at} = .784 \quad \mu = .300$

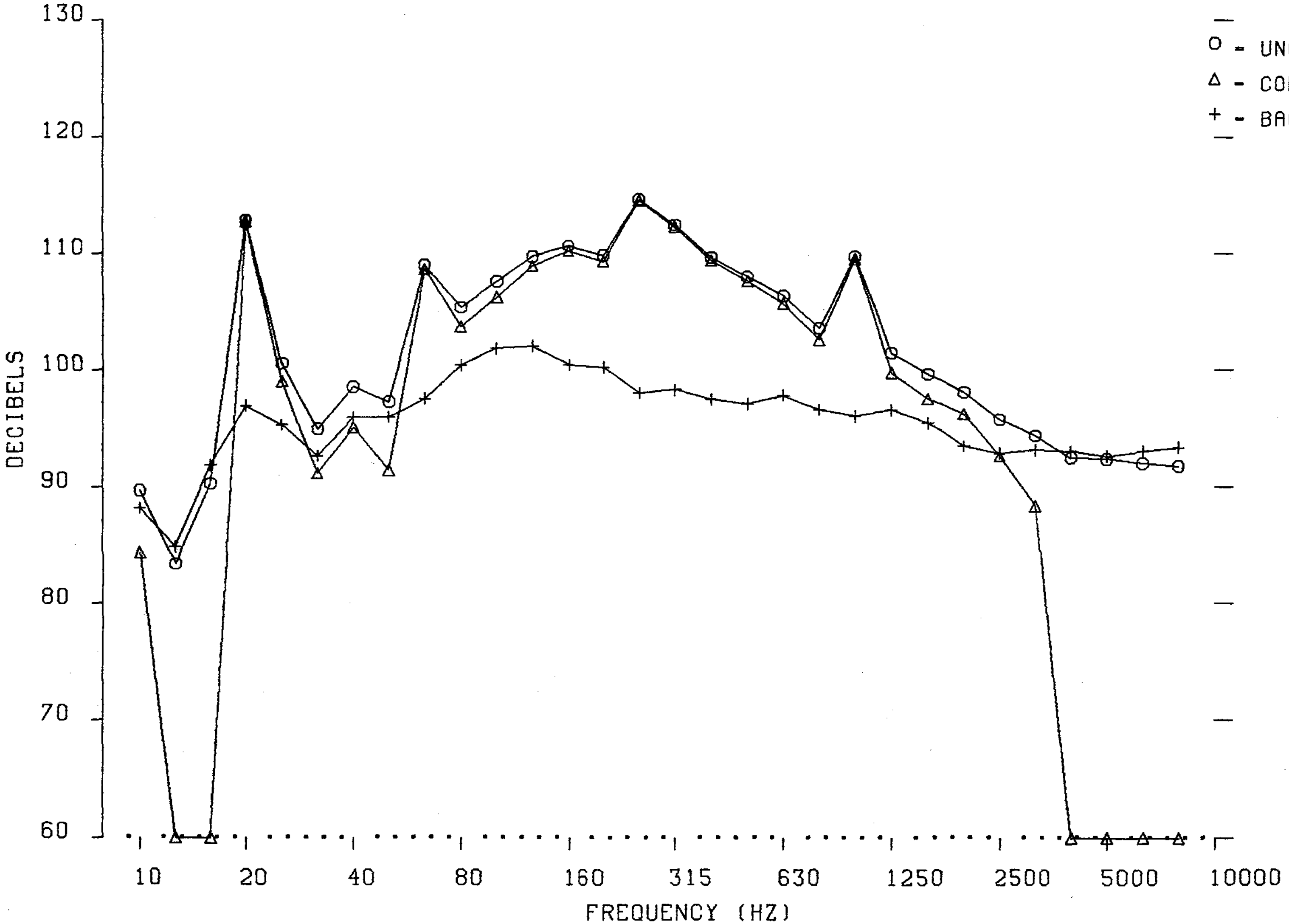

Figure D1(o). One-Third Octave Specta for The Swept Tapered Tip Rotor.

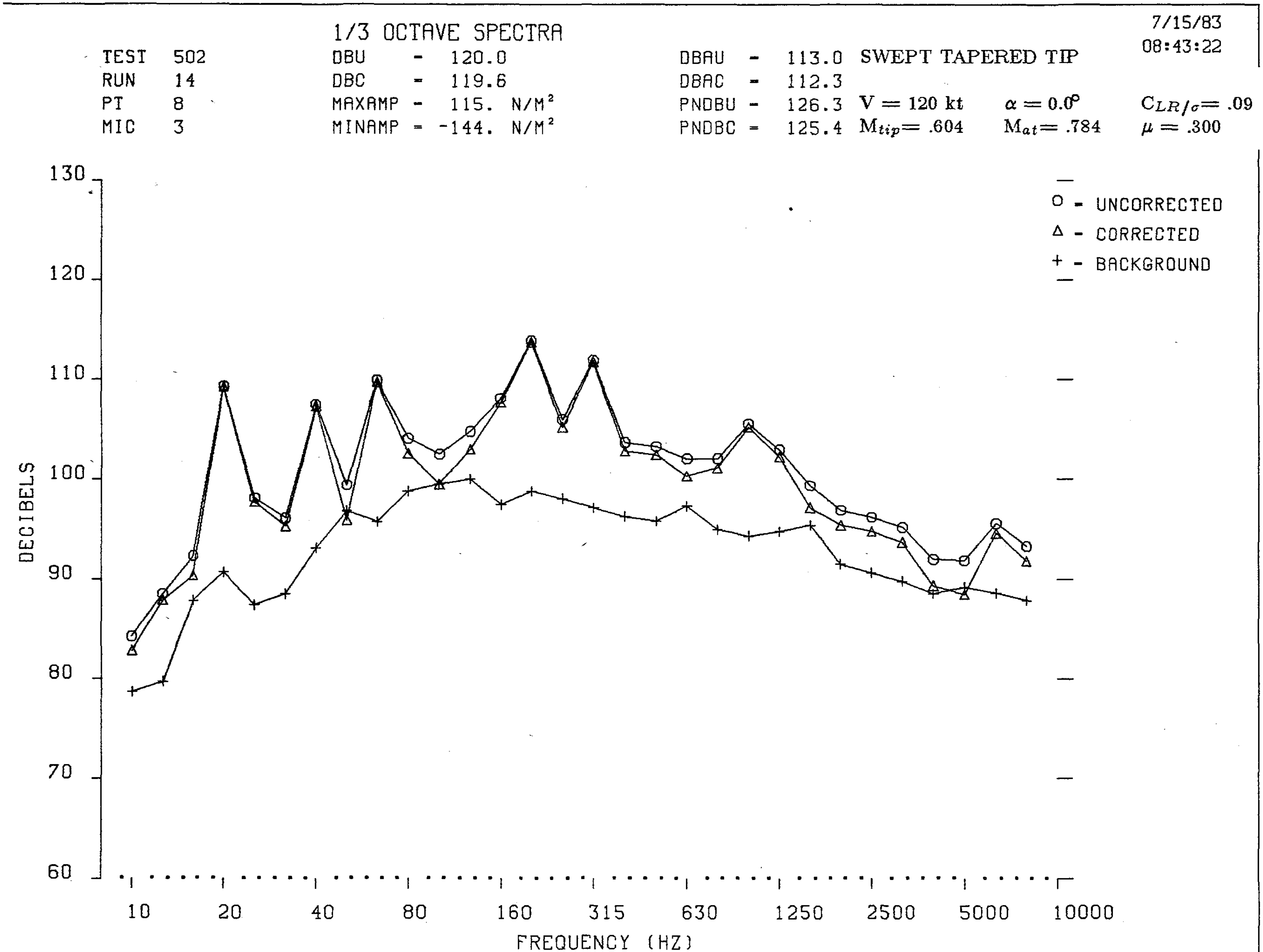

Figure D1(p). One-Third Octave Specta for The Swept Tapered Tip Rotor.

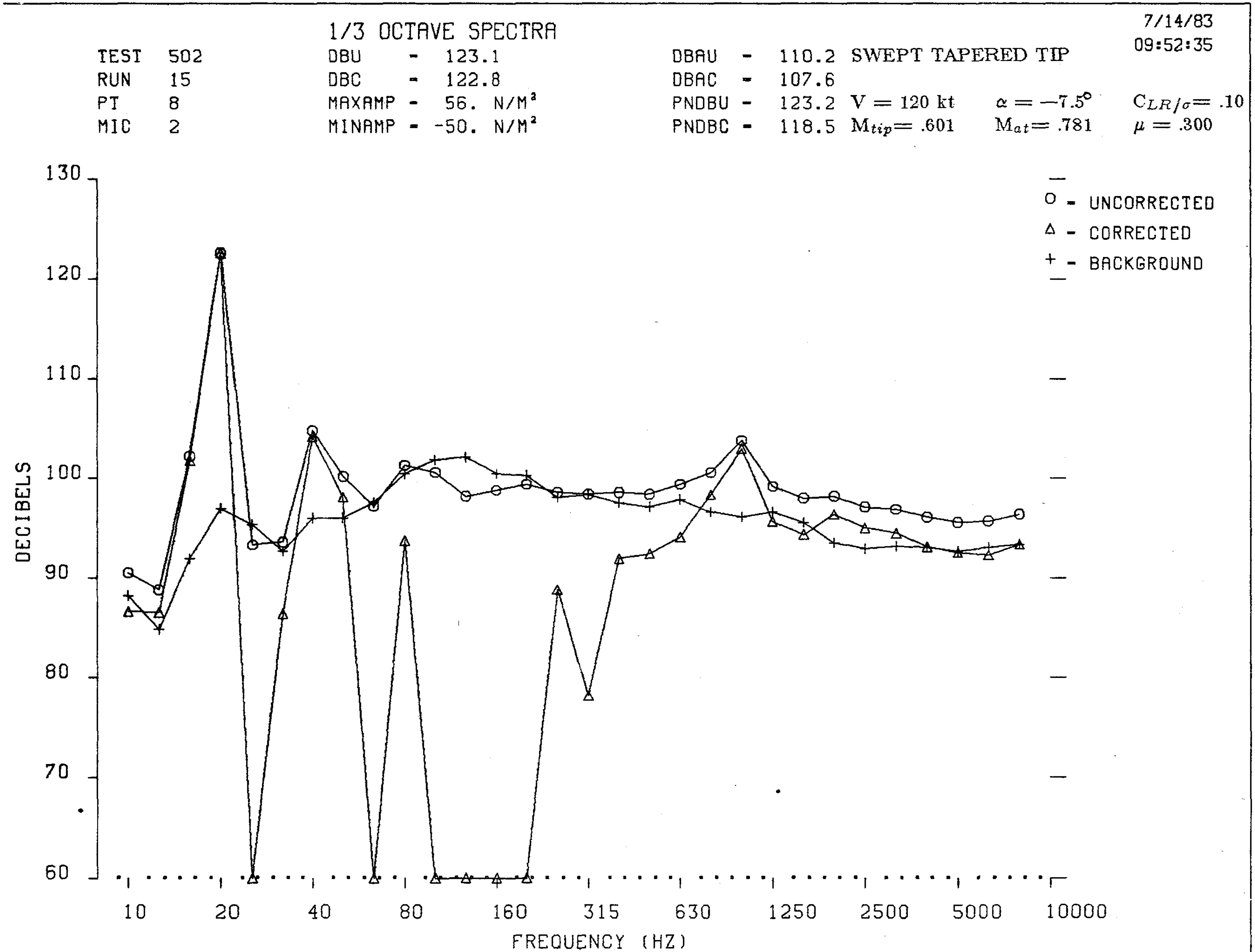

Figure D1(q). One-Third Octave Specta for The Swept Tapered Tip Rotor.

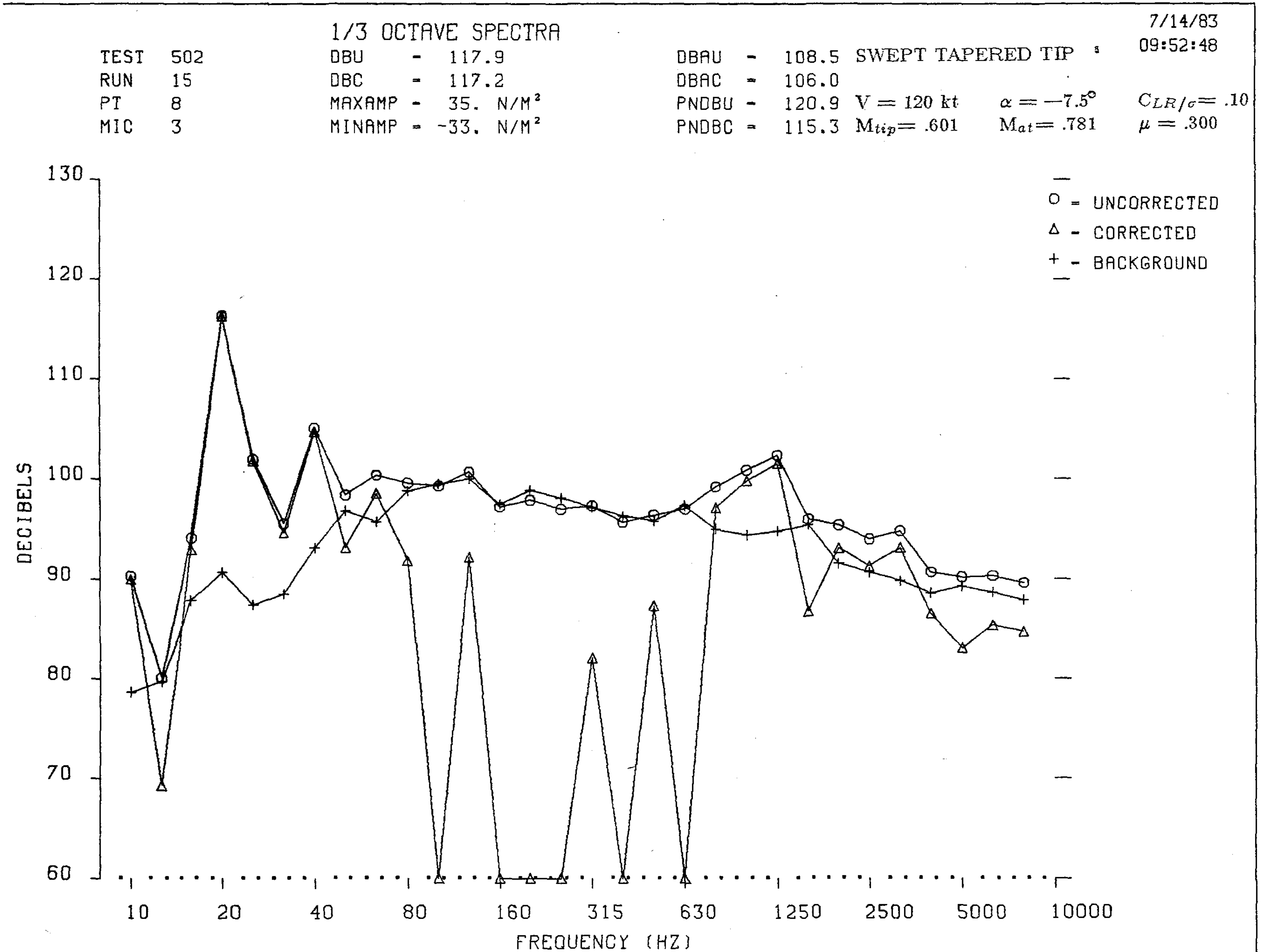

Figure D1(r). One-Third Octave Specta for The Swept Tapered Tip Rotor.

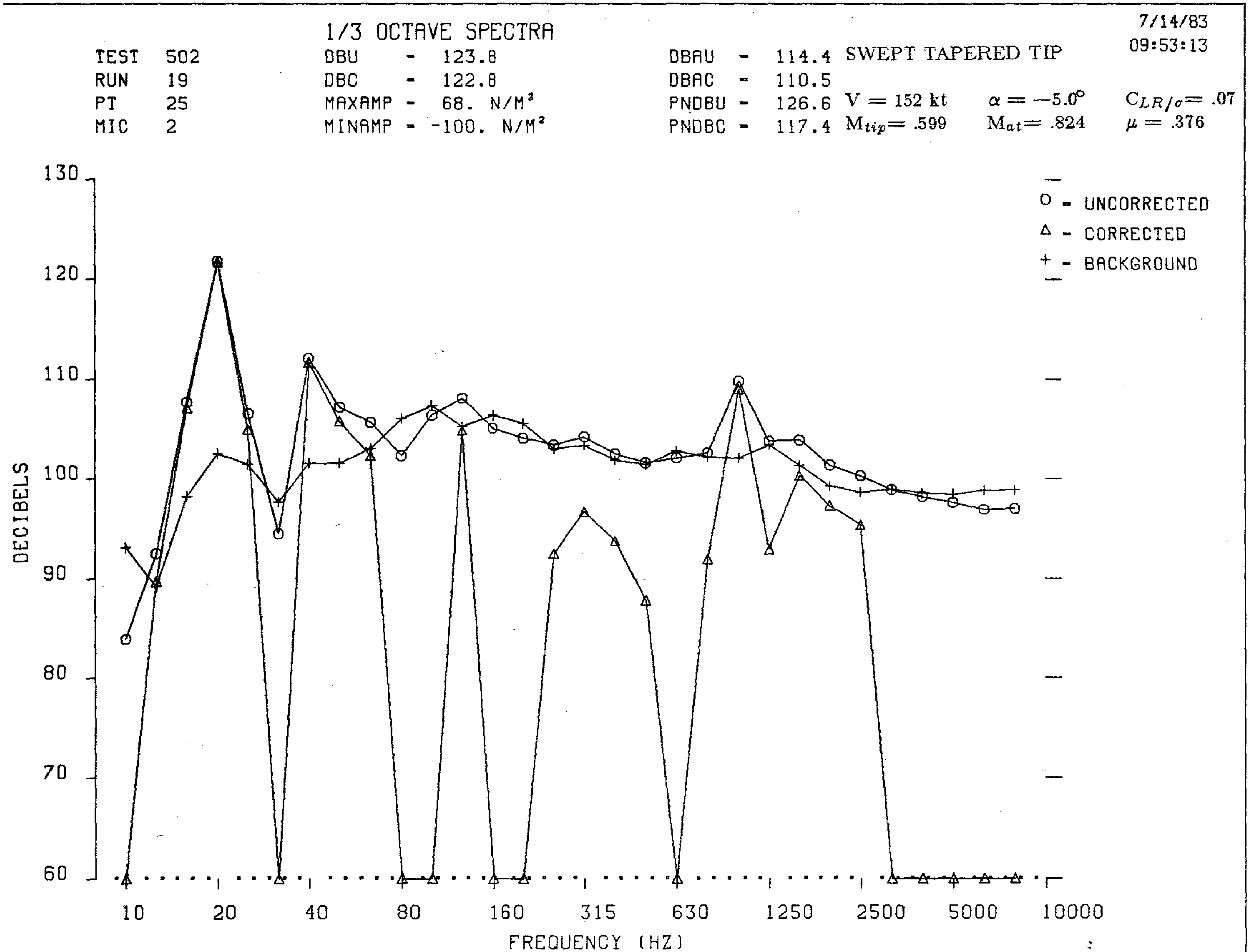

Figure D1(s). One-Third Octave Specta for The Swept Tapered Tip Rotor.

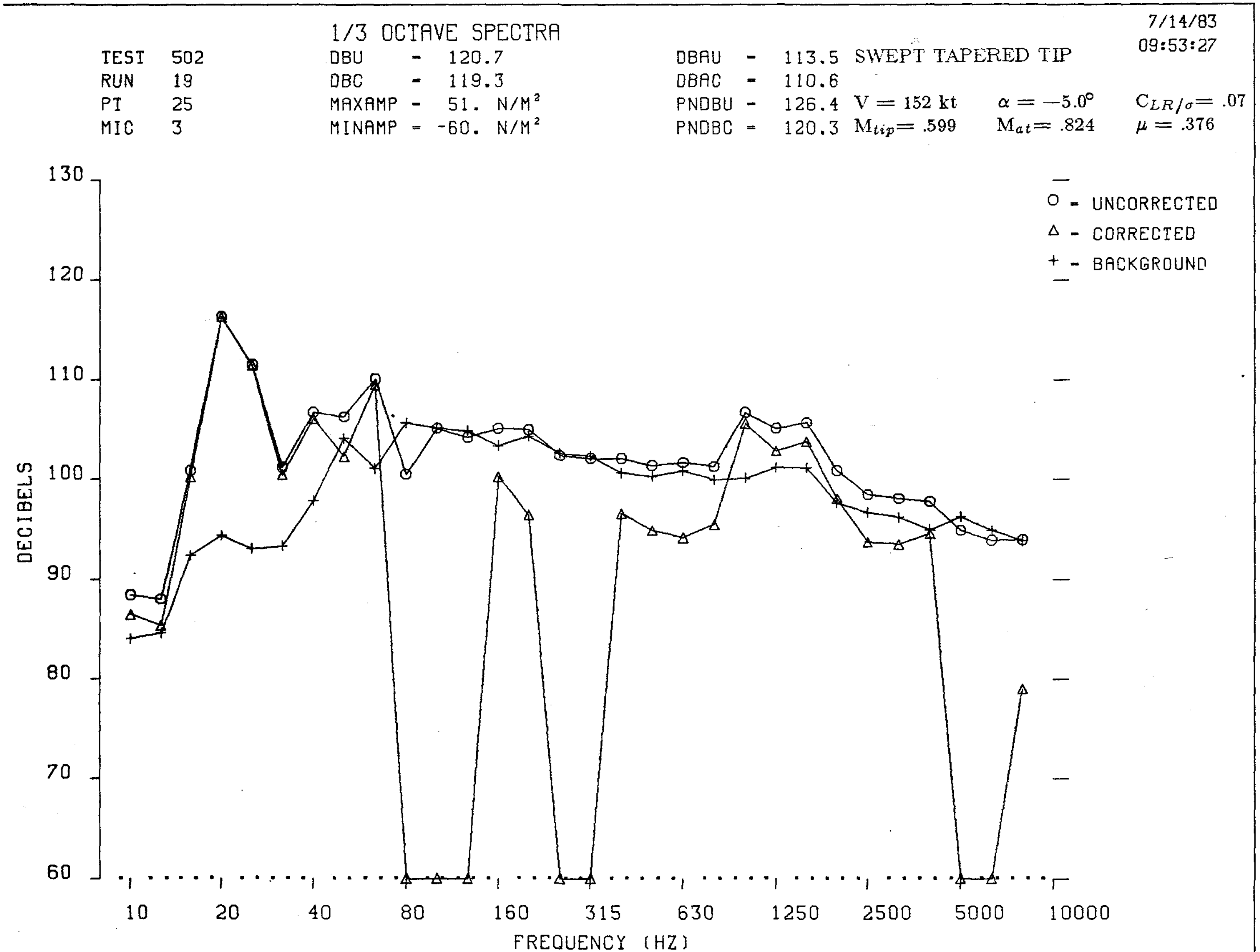

Figure D1(t). One-Third Octave Specta for The Swept Tapered Tip Rotor.

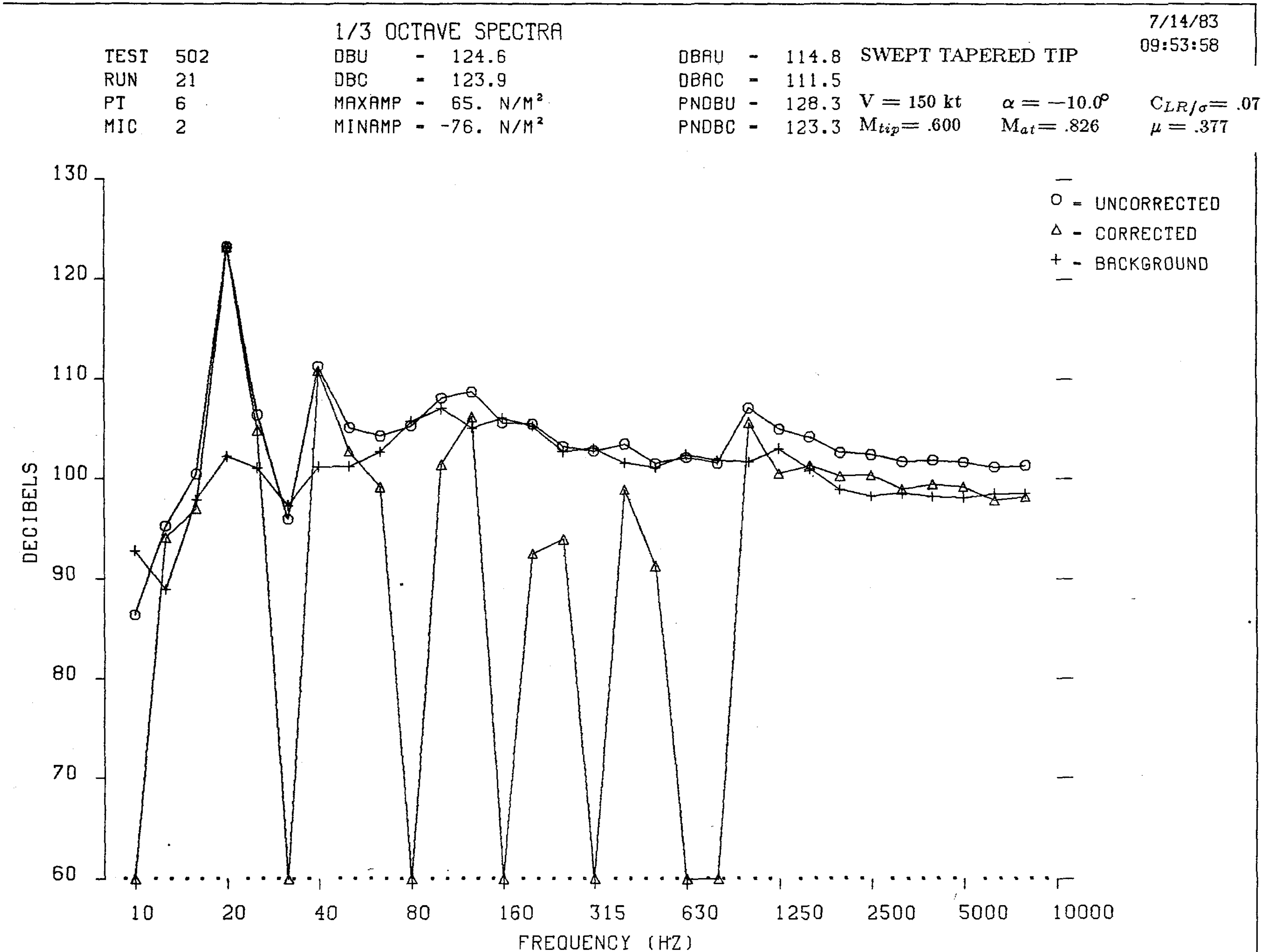

Figure D1(u). One-Third Octave Specta for The Swept Tapered Tip Rotor.

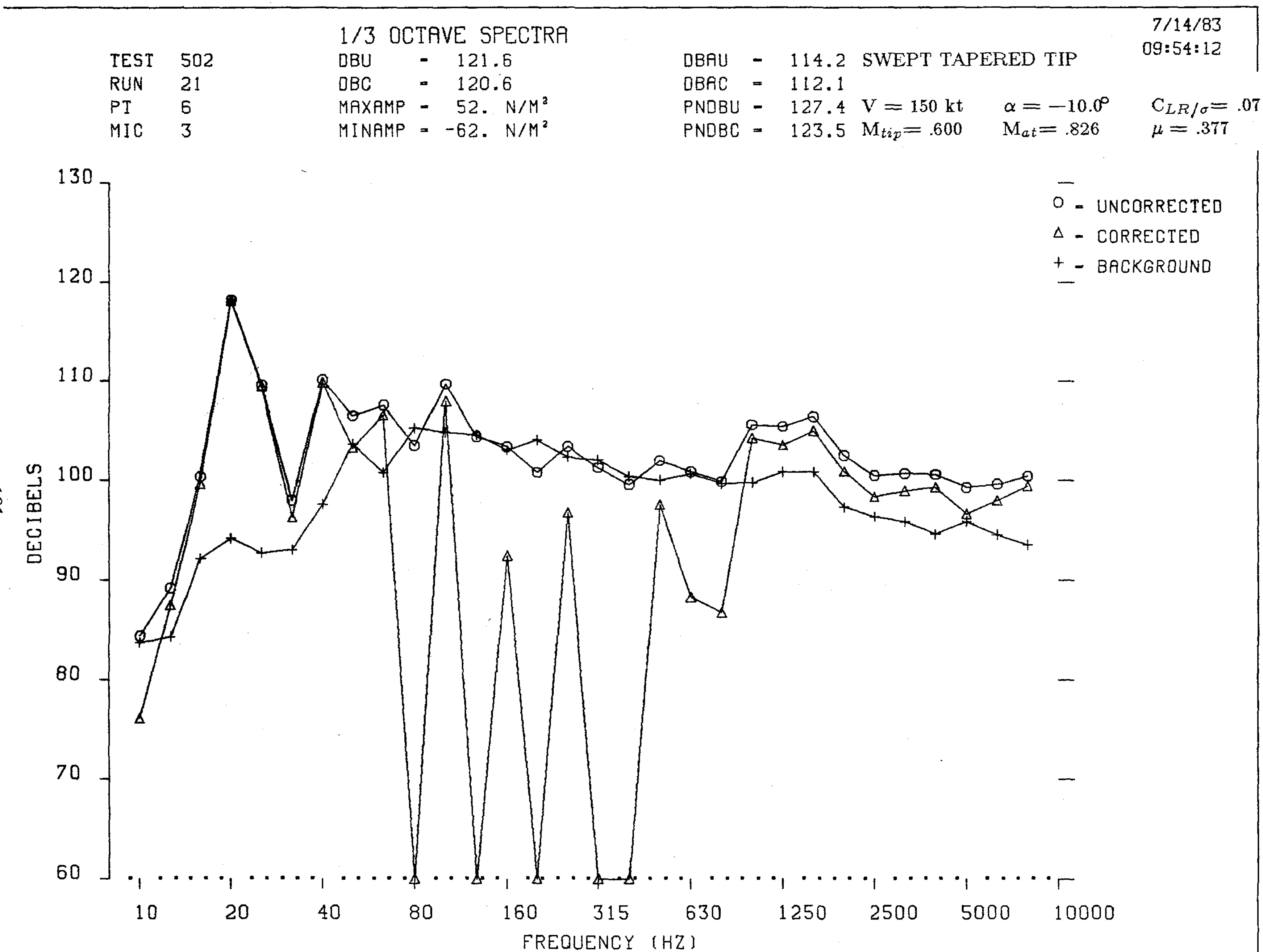

Figure D1(v). One-Third Octave Specta for The Swept Tapered Tip Rotor.

1/3 OCTAVE SPECTRA

7/14/83
10:02:42

TEST	502	DBU	- 125.8	DBAU	- 117.5	SWEPT TAPERED TIP	
RUN	21	DBC	- 125.3	DBAC	- 116.1		
PT	3	MAXAMP	- 354. N/M²	PNDBU	- 131.2	$V = 148$ kt, $\alpha = 0.0°$	$C_{LR/\sigma} = .10$
MIC	2	MINAMP	- -391. N/M²	PNDBC	- 130.0	$M_{tip} = .600$, $M_{at} = .826$	$\mu = .376$

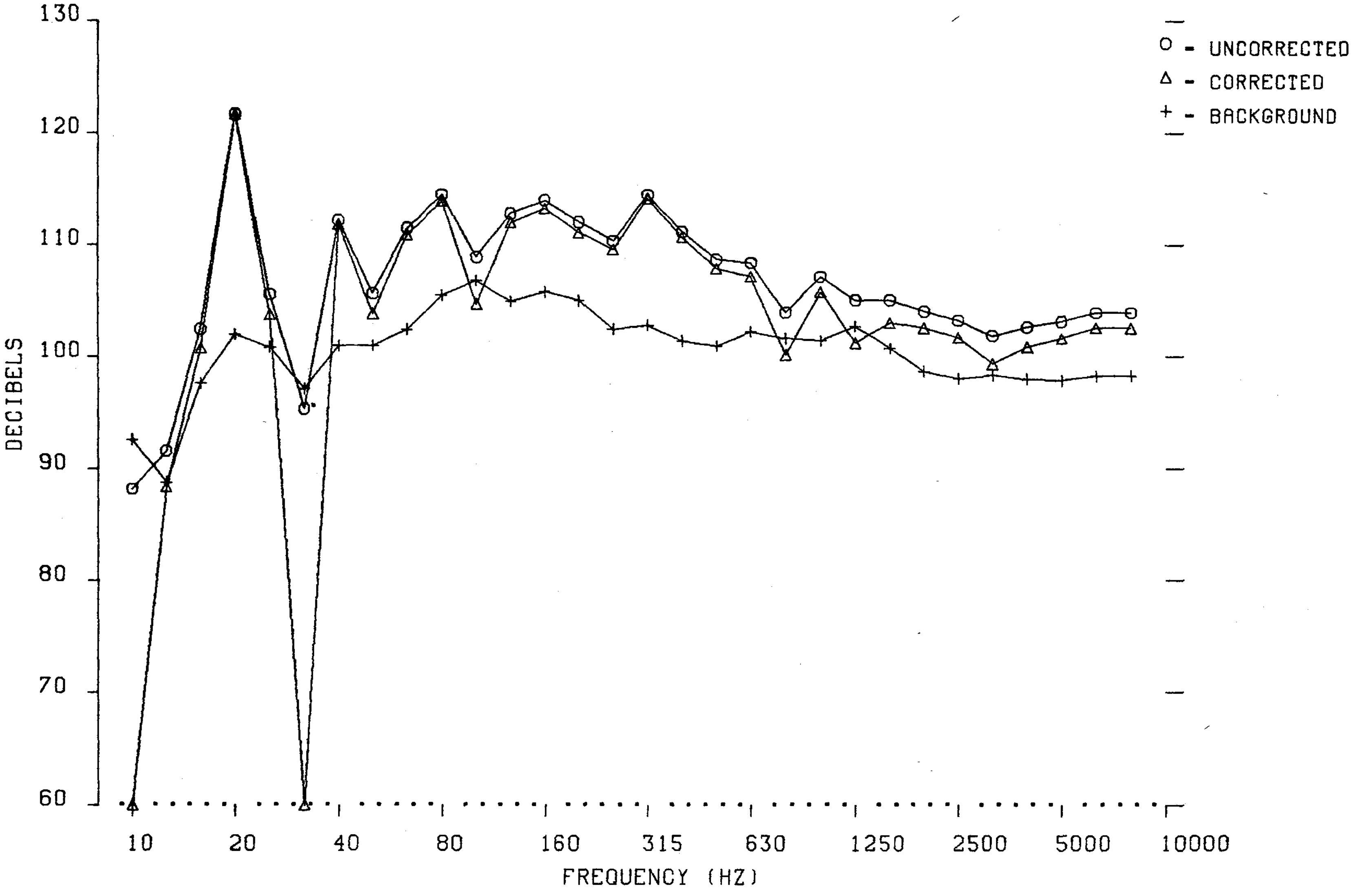

Figure D1(w). One-Third Octave Specta for The Swept Tapered Tip Rotor.

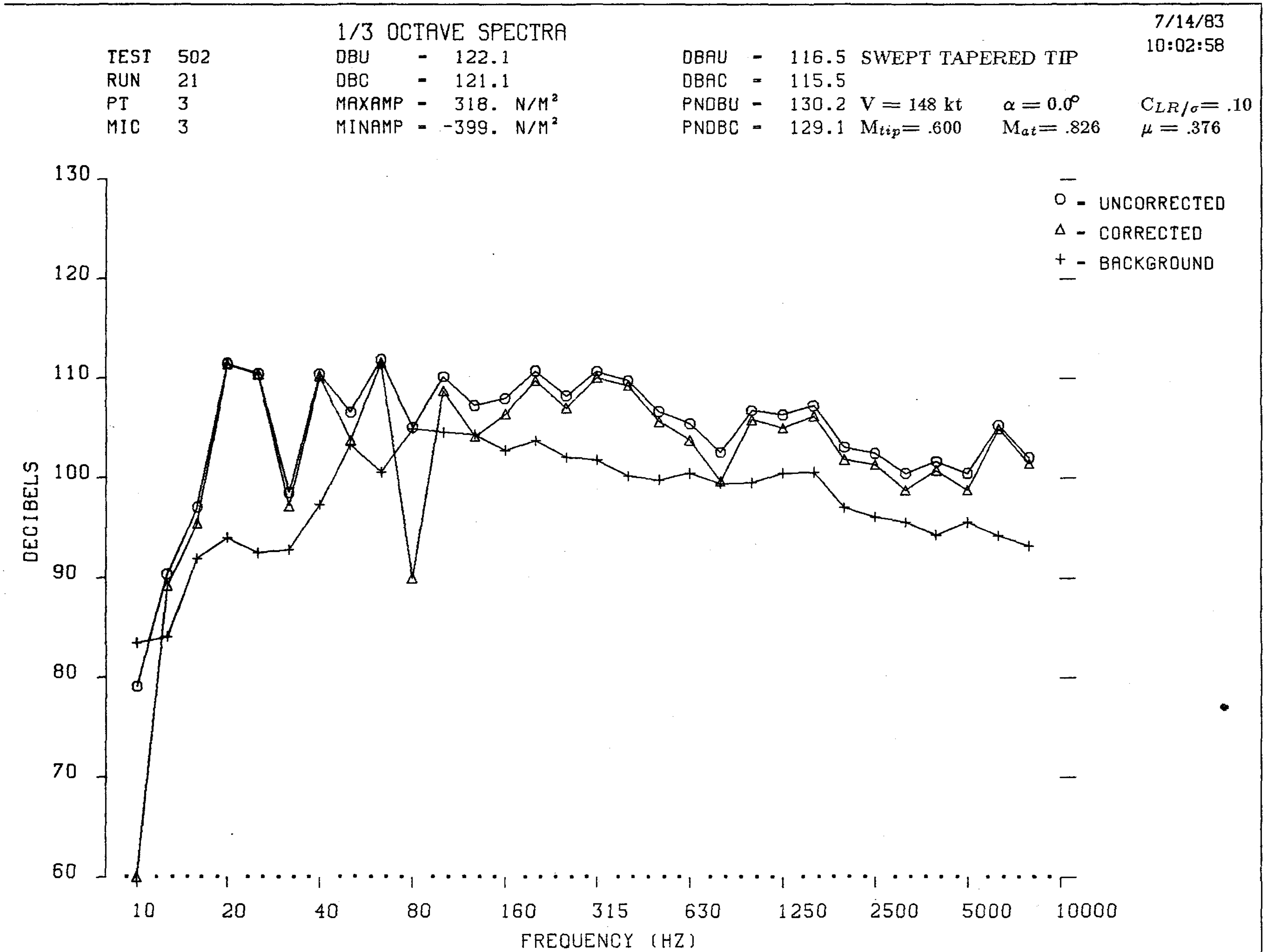

Figure D1(x). One-Third Octave Specta for The Swept Tapered Tip Rotor.

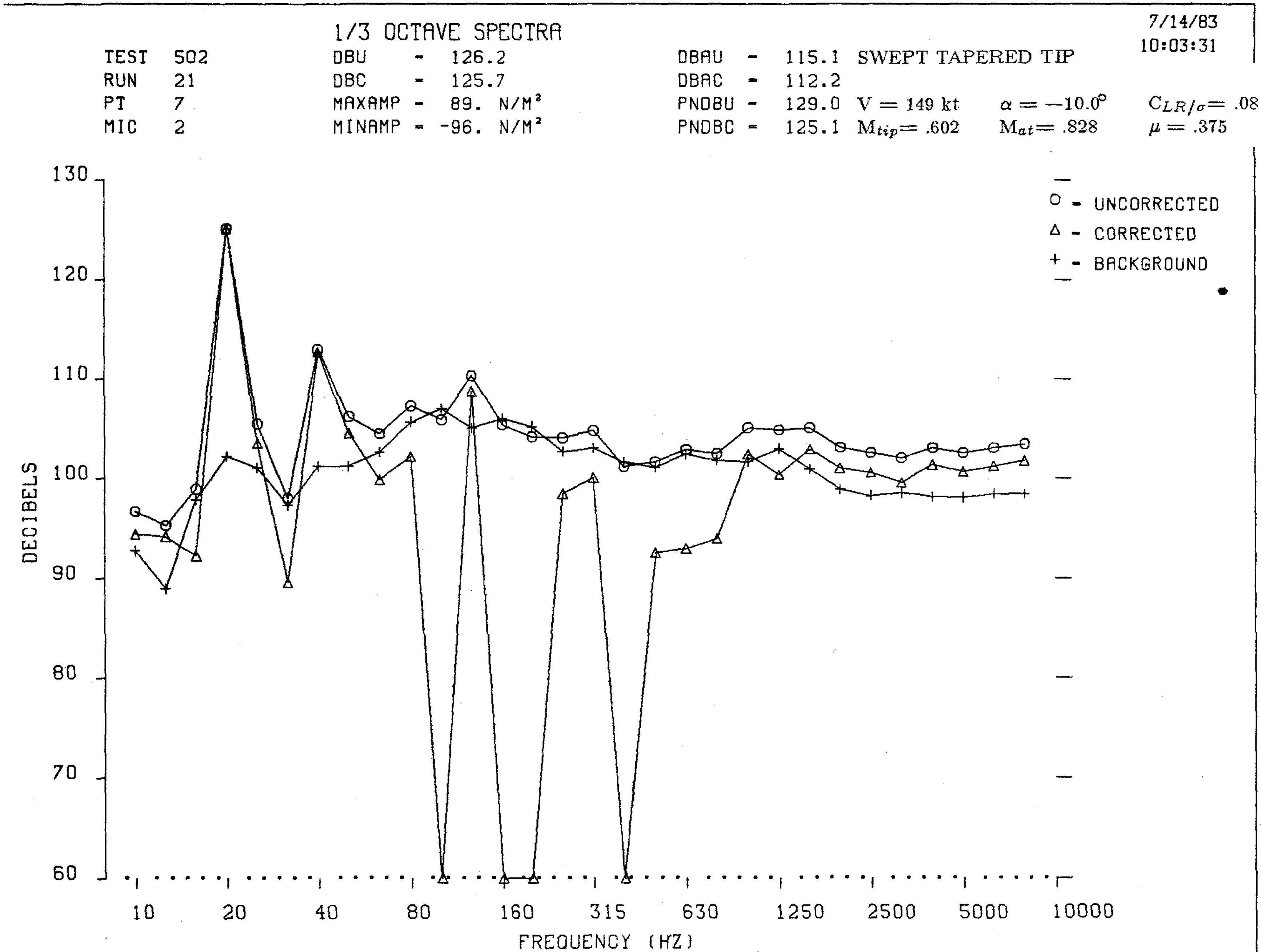

Figure D1(y). One-Third Octave Specta for The Swept Tapered Tip Rotor.

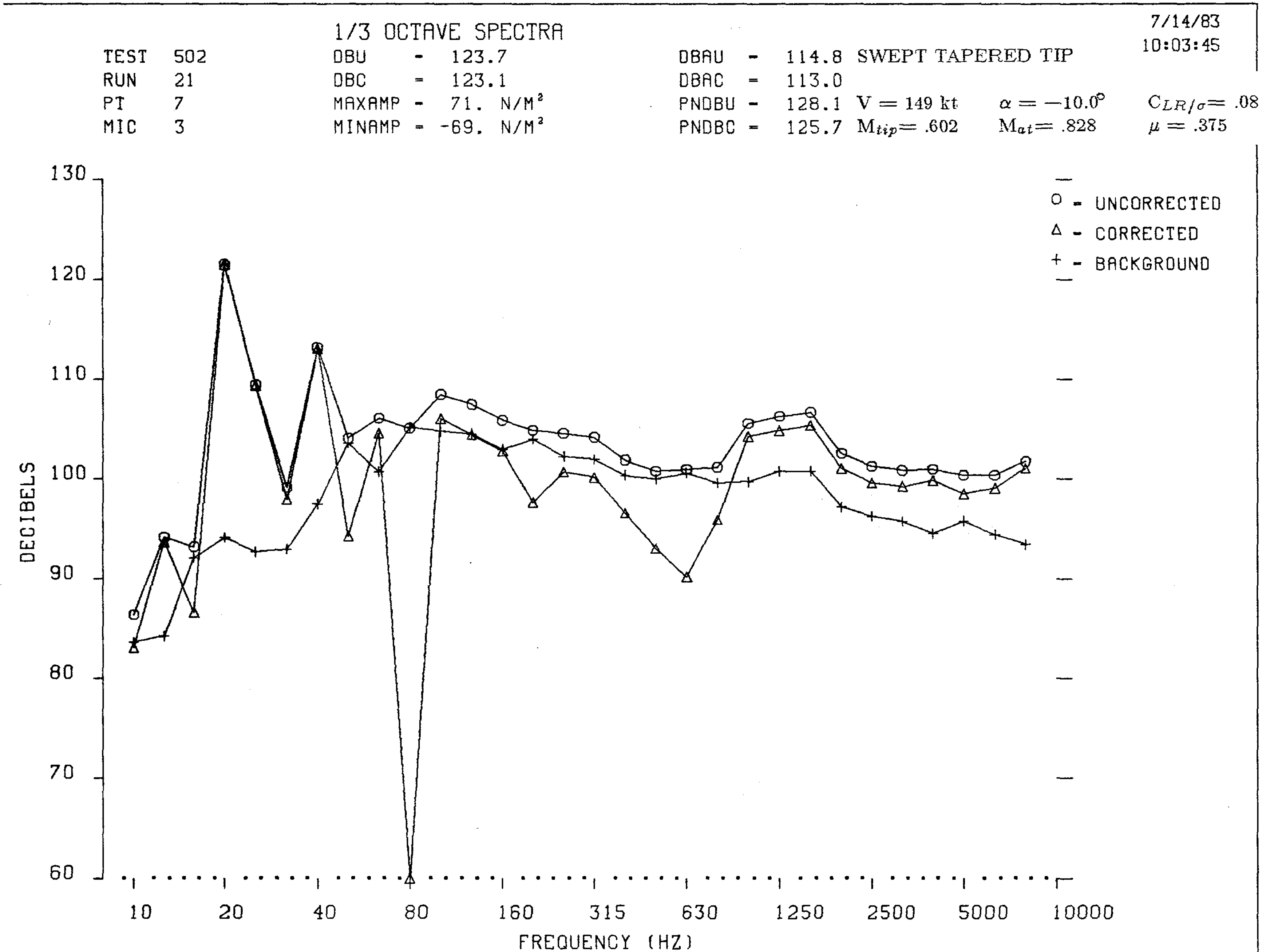

Figure D1(z). One-Third Octave Specta for The Swept Tapered Tip Rotor.

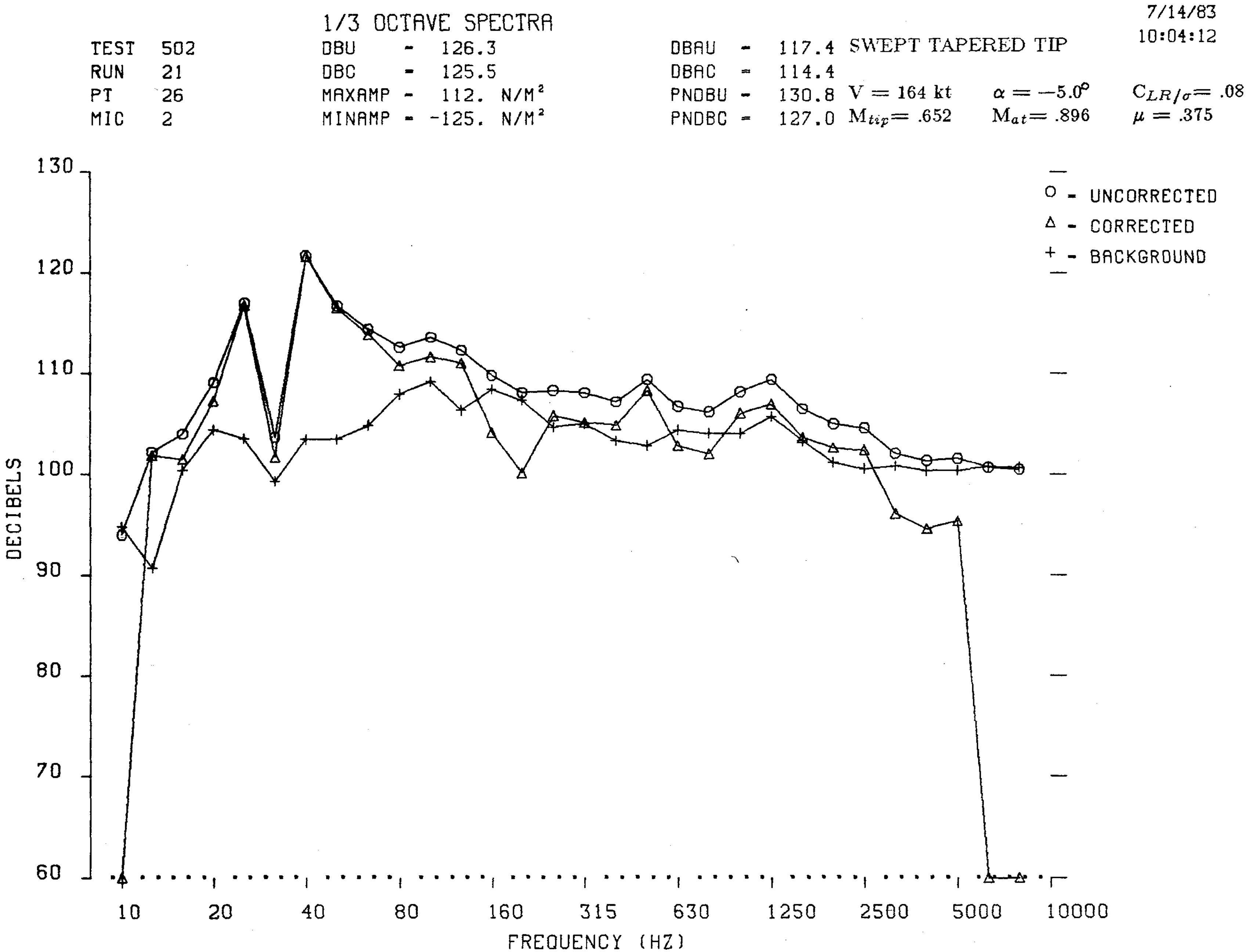

Figure D1(aa). One-Third Octave Specta for The Swept Tapered Tip Rotor.

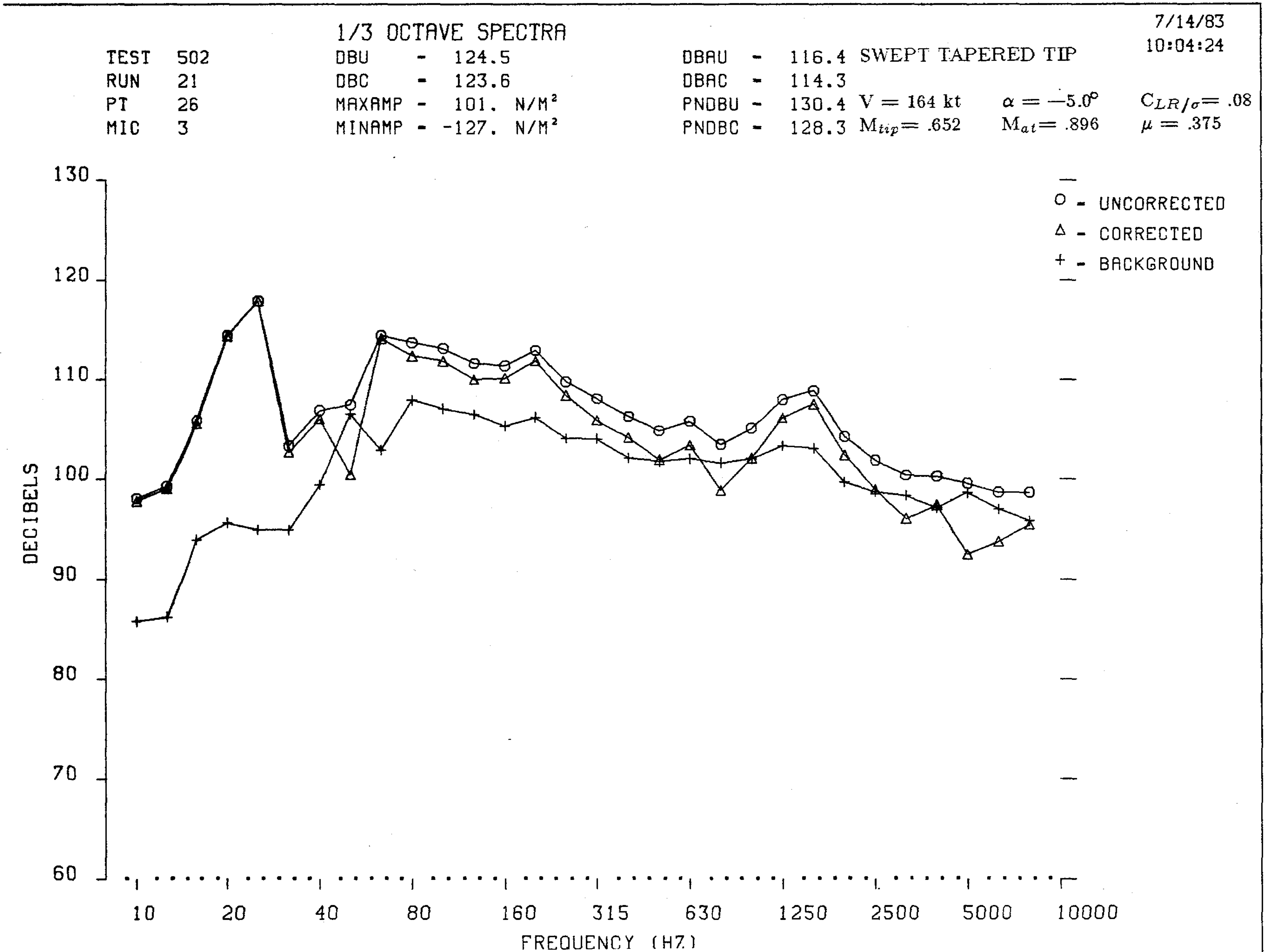

Figure D1(bb). One-Third Octave Specta for The Swept Tapered Tip Rotor.

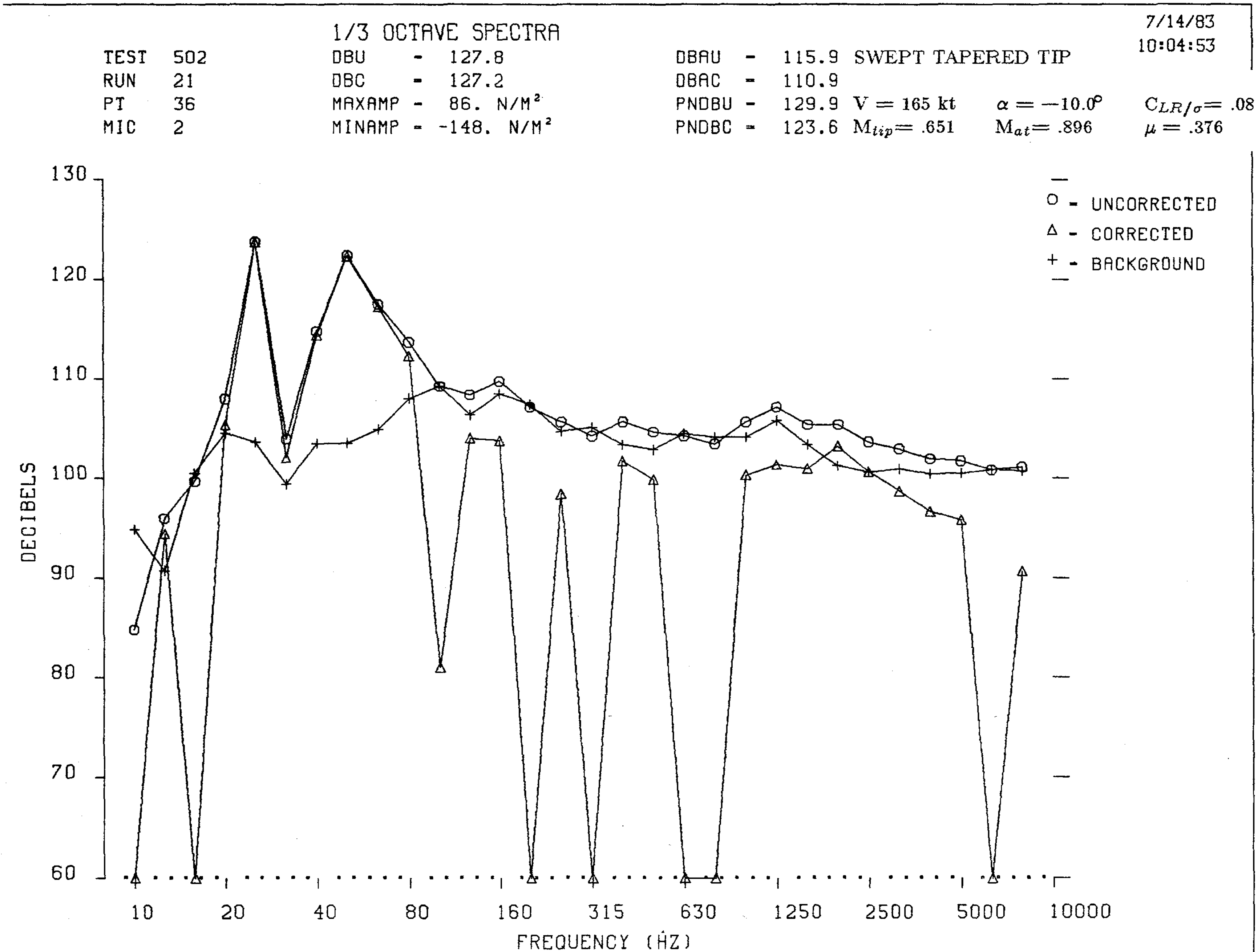

Figure D1(cc). One-Third Octave Specta for The Swept Tapered Tip Rotor.

1/3 OCTAVE SPECTRA

7/14/83
10:05:03

TEST 502
RUN 21
PT 36
MIC 3

DBU - 125.1
DBC - 124.3
MAXAMP - 103. N/M²
MINAMP - -126. N/M²

DBAU - 115.9
DBAC - 113.3
PNDBU - 130.2
PNDBC - 127.7

SWEPT TAPERED TIP

$V = 165$ kt $\alpha = -10.0^{\circ}$ $C_{LR/\sigma} = .08$

$M_{tip} = .651$ $M_{at} = .896$ $\mu = .376$

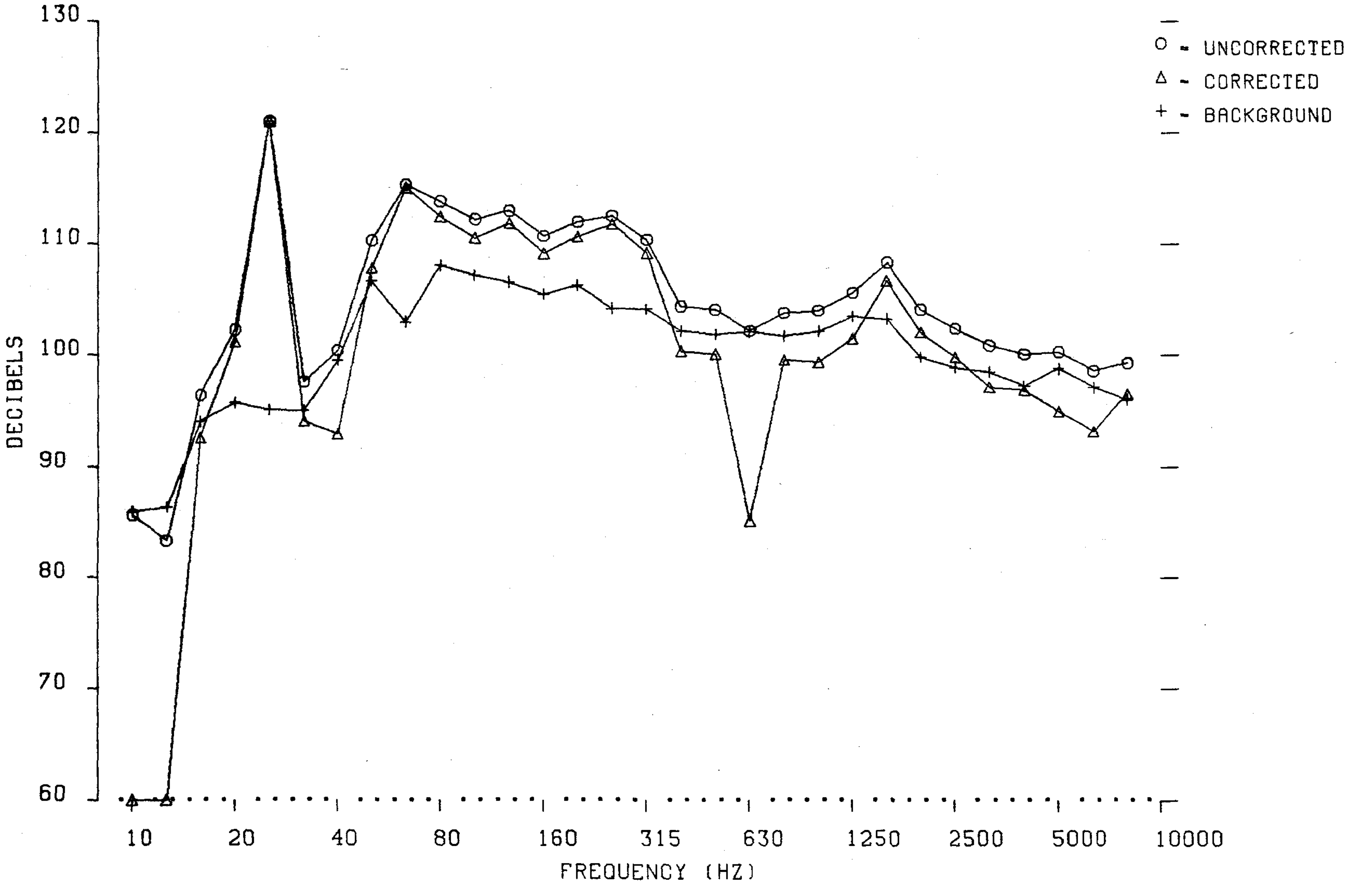

Figure D1(dd). One-Third Octave Specta for The Swept Tapered Tip Rotor.

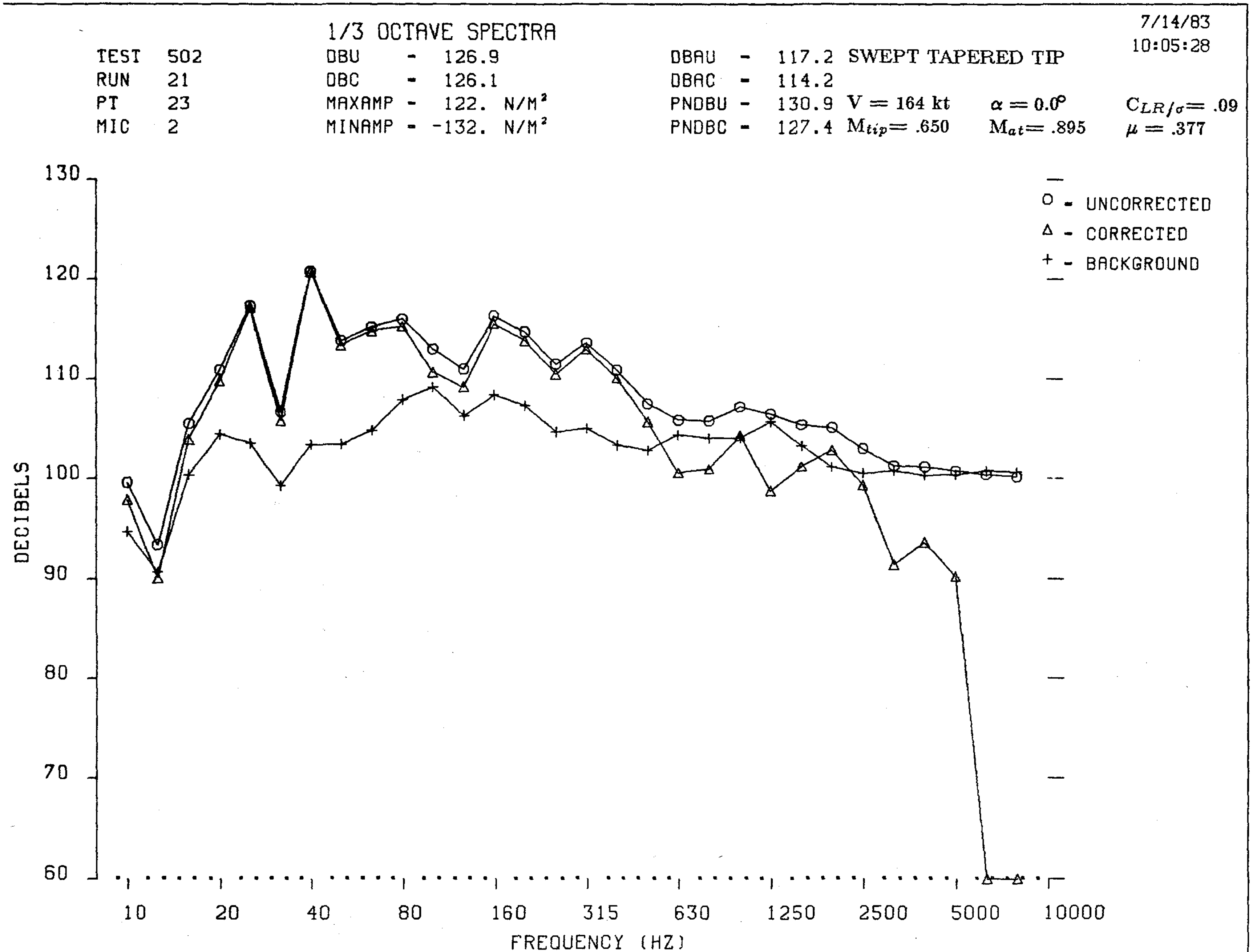

Figure D1(ee). One-Third Octave Specta for The Swept Tapered Tip Rotor.

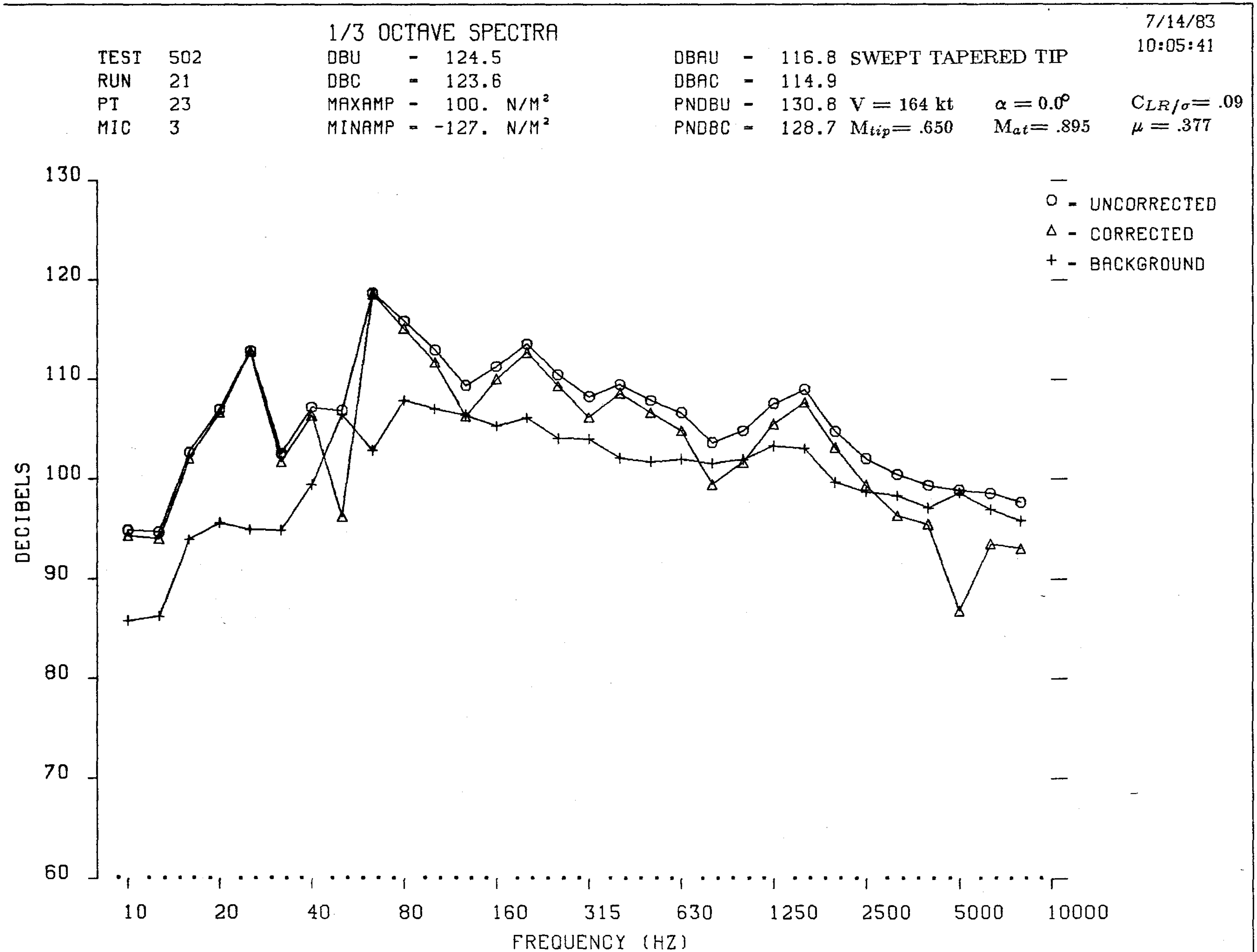

Figure D1(ff). One-Third Octave Specta for The Swept Tapered Tip Rotor.

1/3 OCTAVE SPECTRA

7/14/83
10:18:22

TEST	502	DBU	- 130.9	DBAU	- 120.3	SWEPT TAPERED TIP	
RUN	55	DBC	- 130.5	DBAC	- 118.7		
PT	41	MAXAMP	- 195. N/M²	PNDBU	- 133.6	$V = 171$ kt	$\alpha = -2.5^{\circ}$	$C_{LR/\sigma} = .08$
MIC	2	MINAMP	- -157. N/M²	PNDBC	- 131.2	$M_{tip} = .684$	$M_{at} = .940$	$\mu = .375$

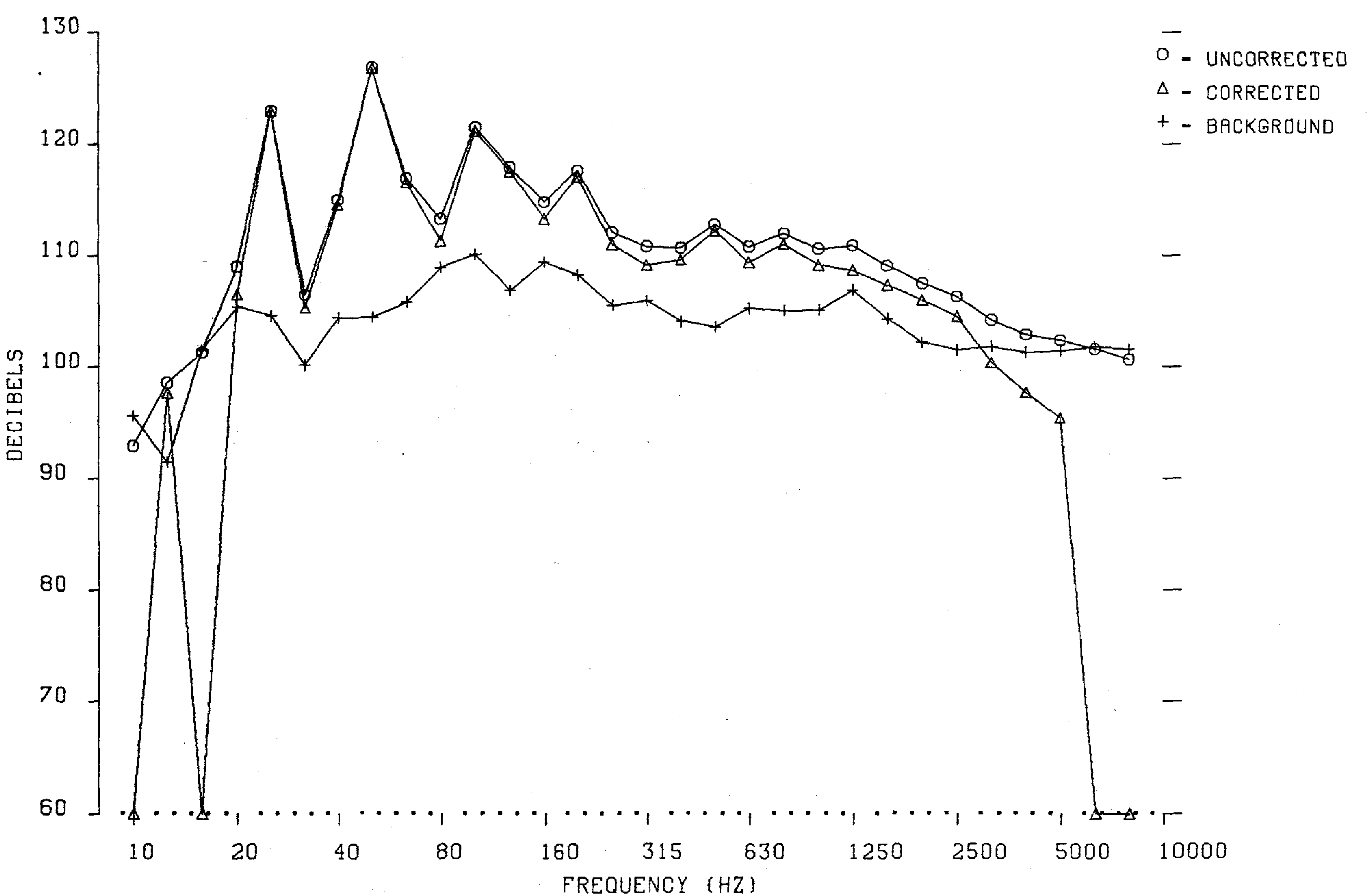

Figure D1(gg). One-Third Octave Specta for The Swept Tapered Tip Rotor.

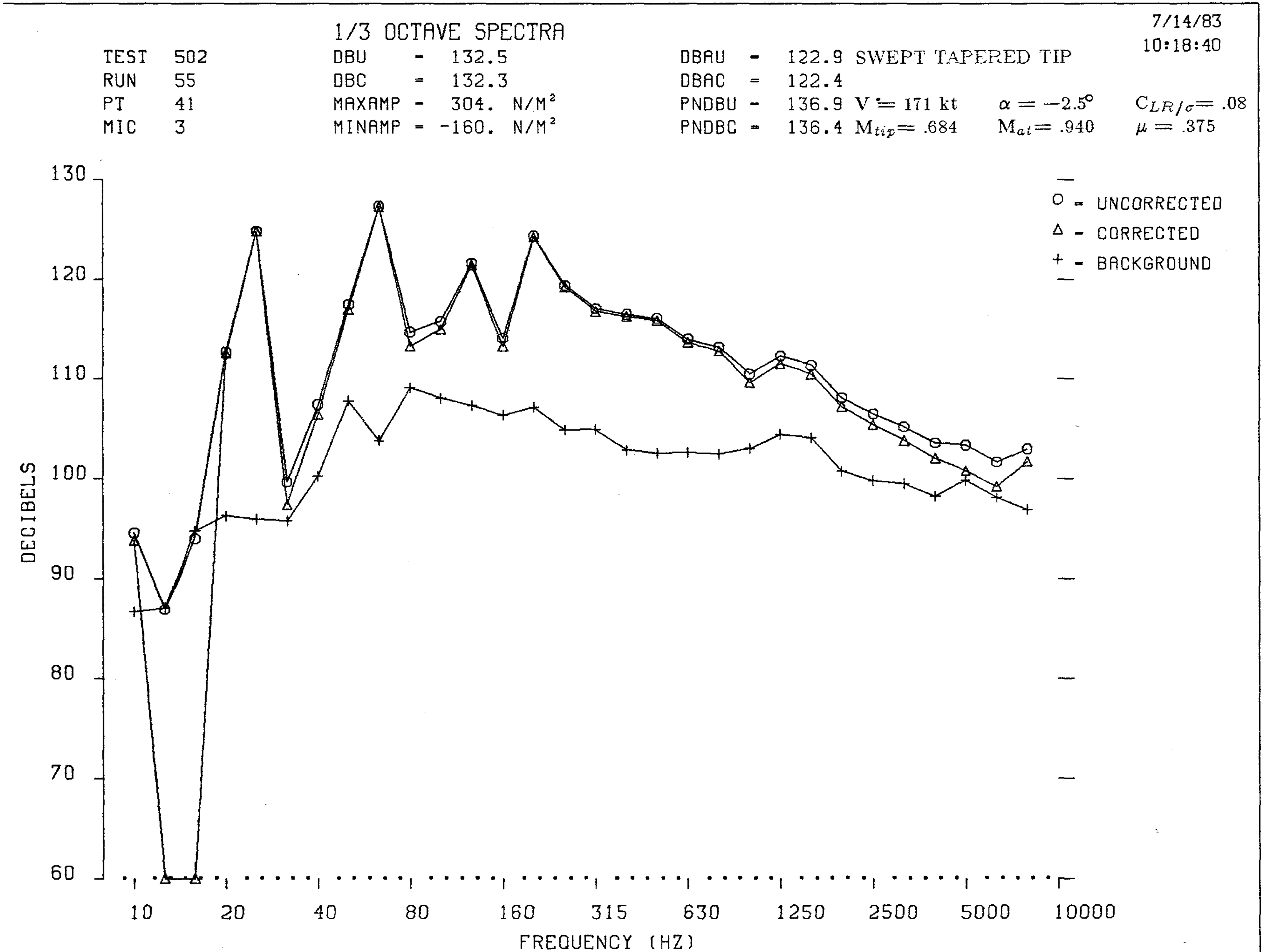

Figure D1(hh). One-Third Octave Specta for The Swept Tapered Tip Rotor.

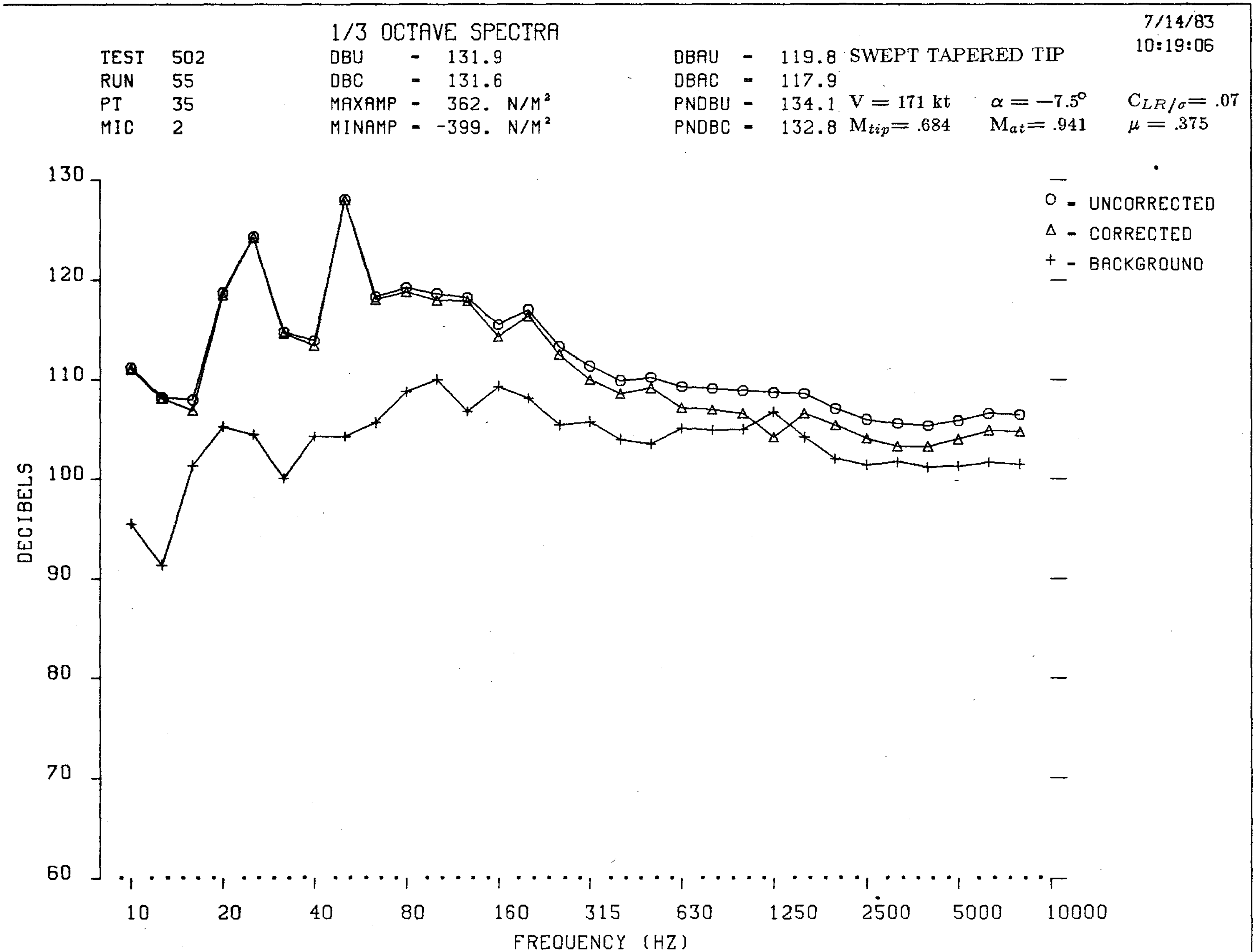

Figure D1(ii). One-Third Octave Specta for The Swept Tapered Tip Rotor.

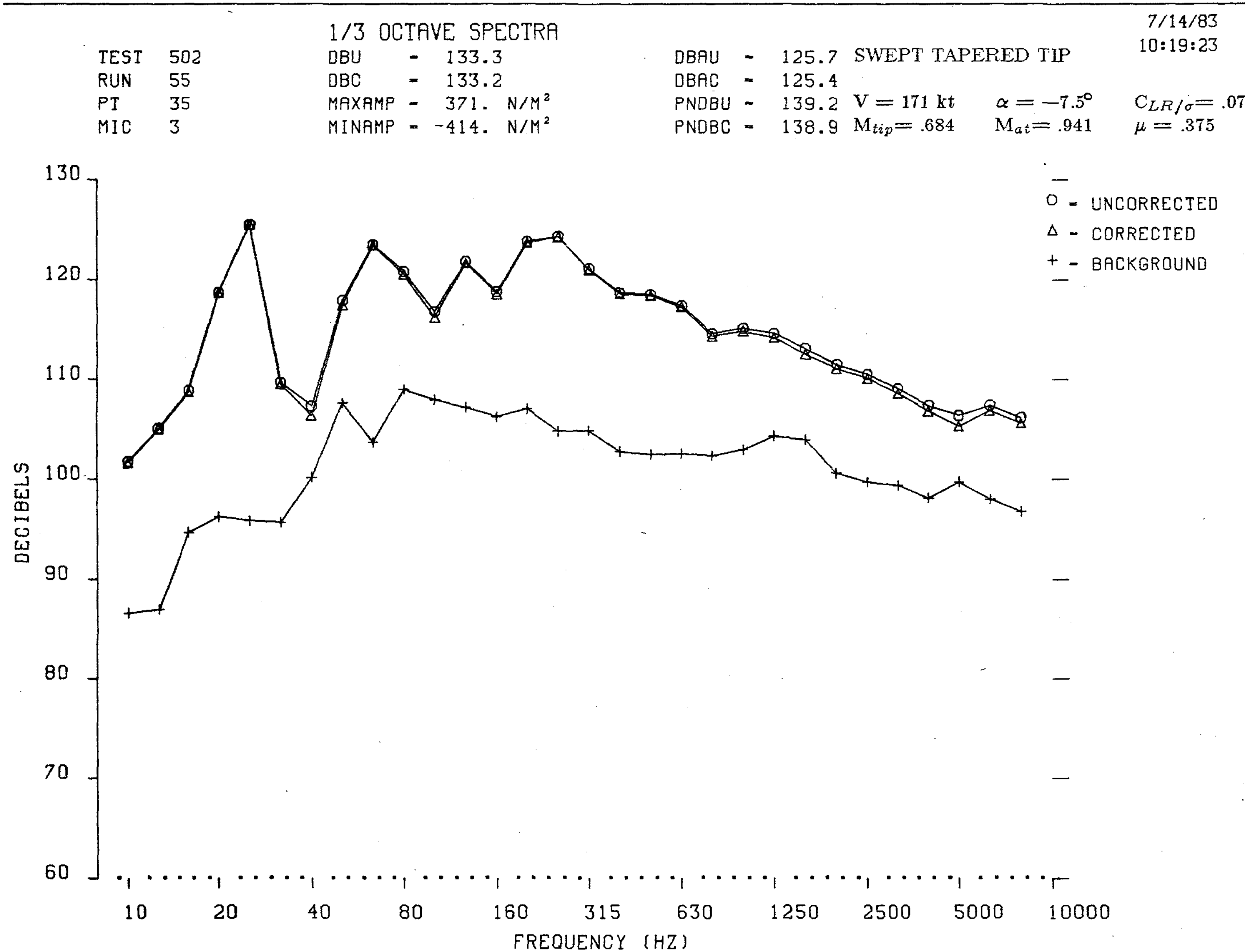

Figure D1(jj). One-Third Octave Specta for The Swept Tapered Tip Rotor.

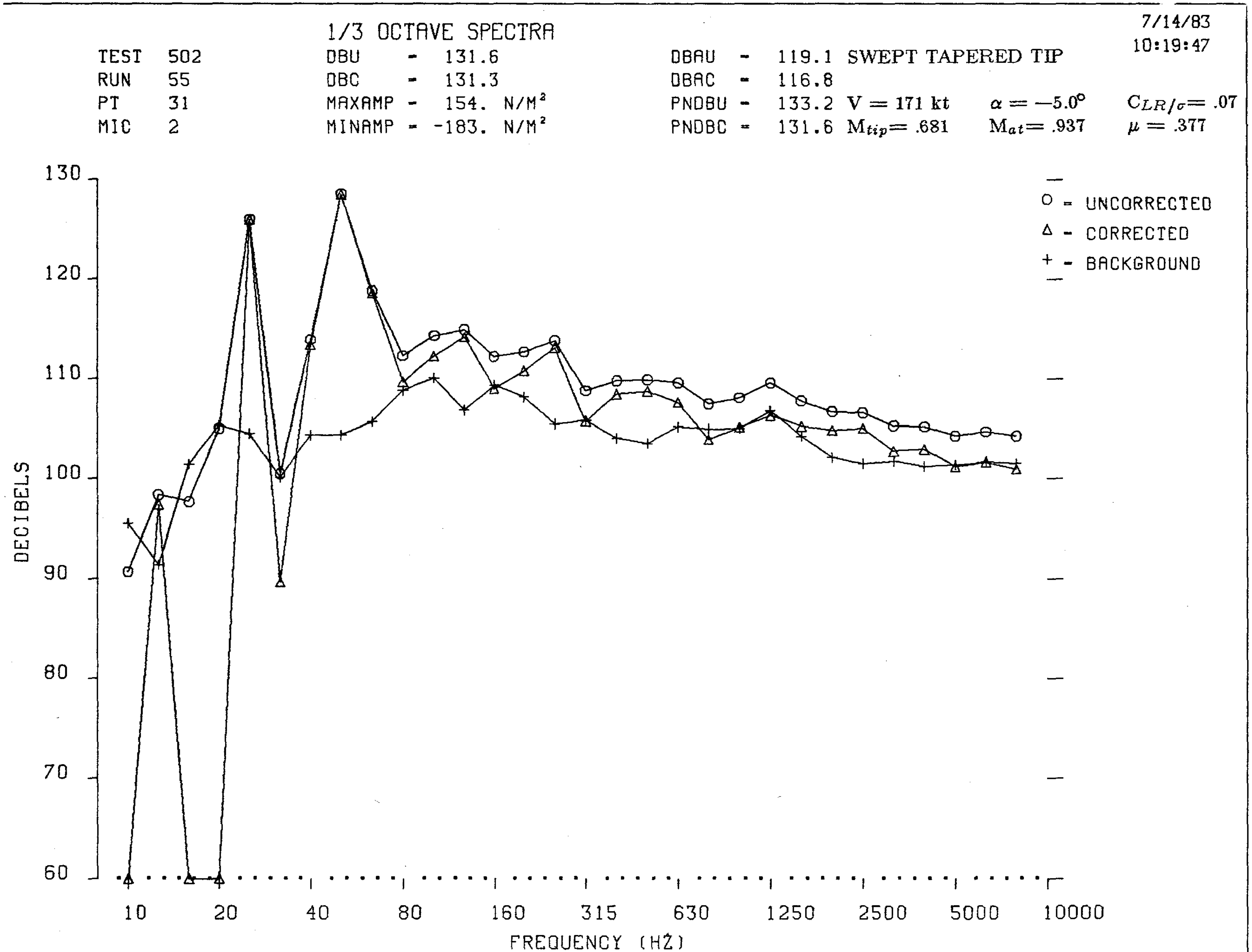

Figure D1(kk). One-Third Octave Specta for The Swept Tapered Tip Rotor.

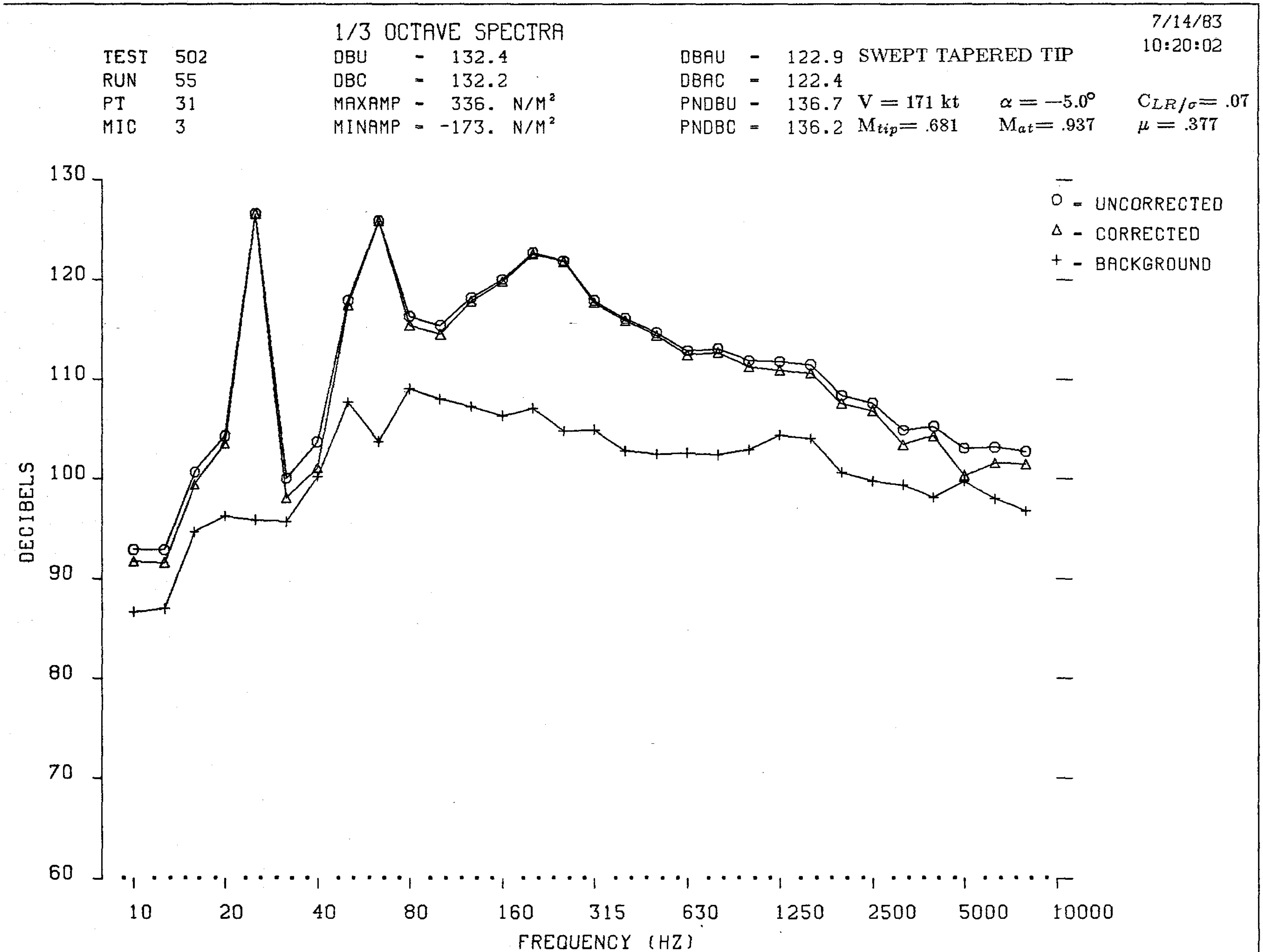

Figure D1(ll). One-Third Octave Specta for The Swept Tapered Tip Rotor.

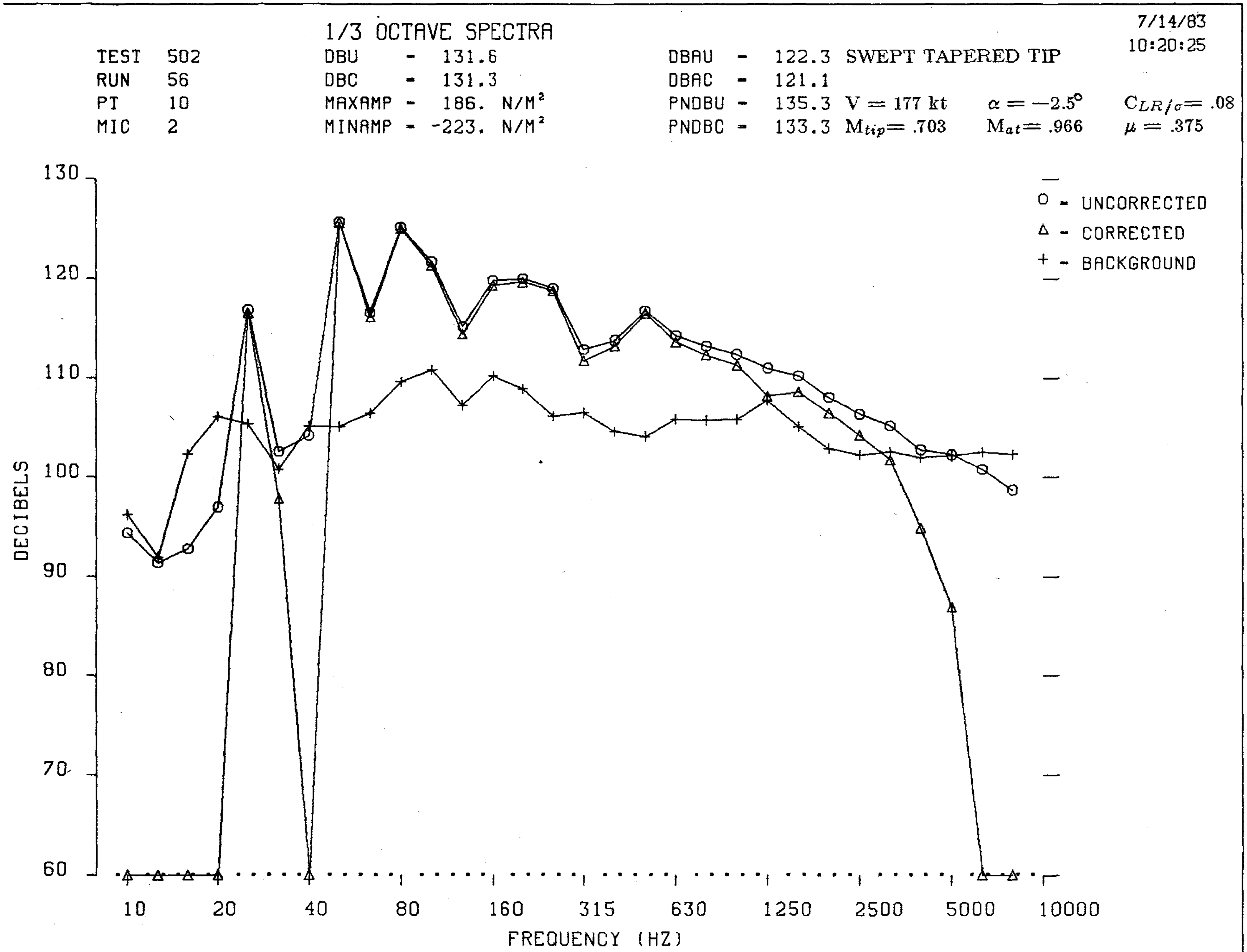

Figure D1(mm). One-Third Octave Specta for The Swept Tapered Tip Rotor.

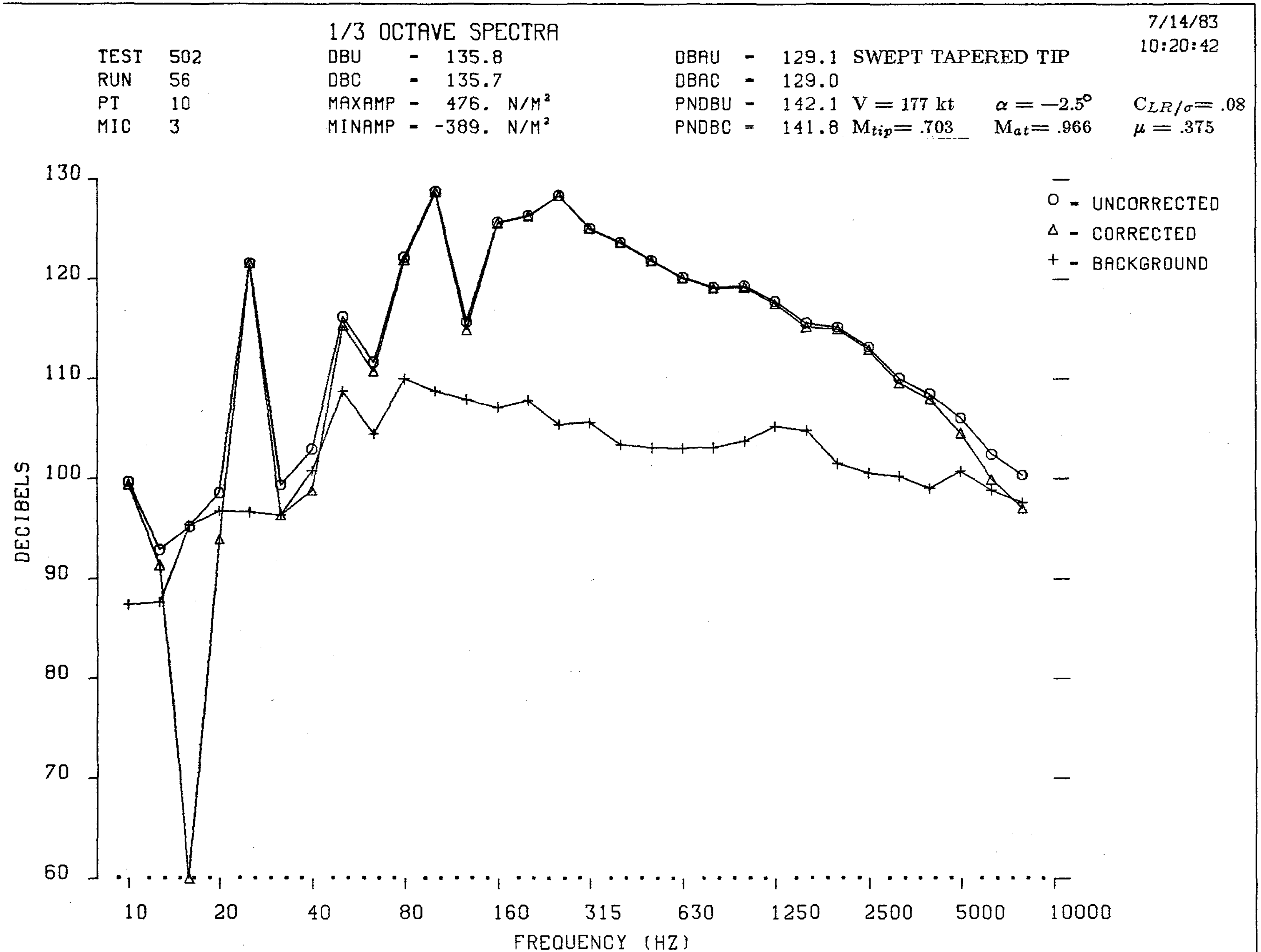

Figure D1(nn). One-Third Octave Specta for The Swept Tapered Tip Rotor.

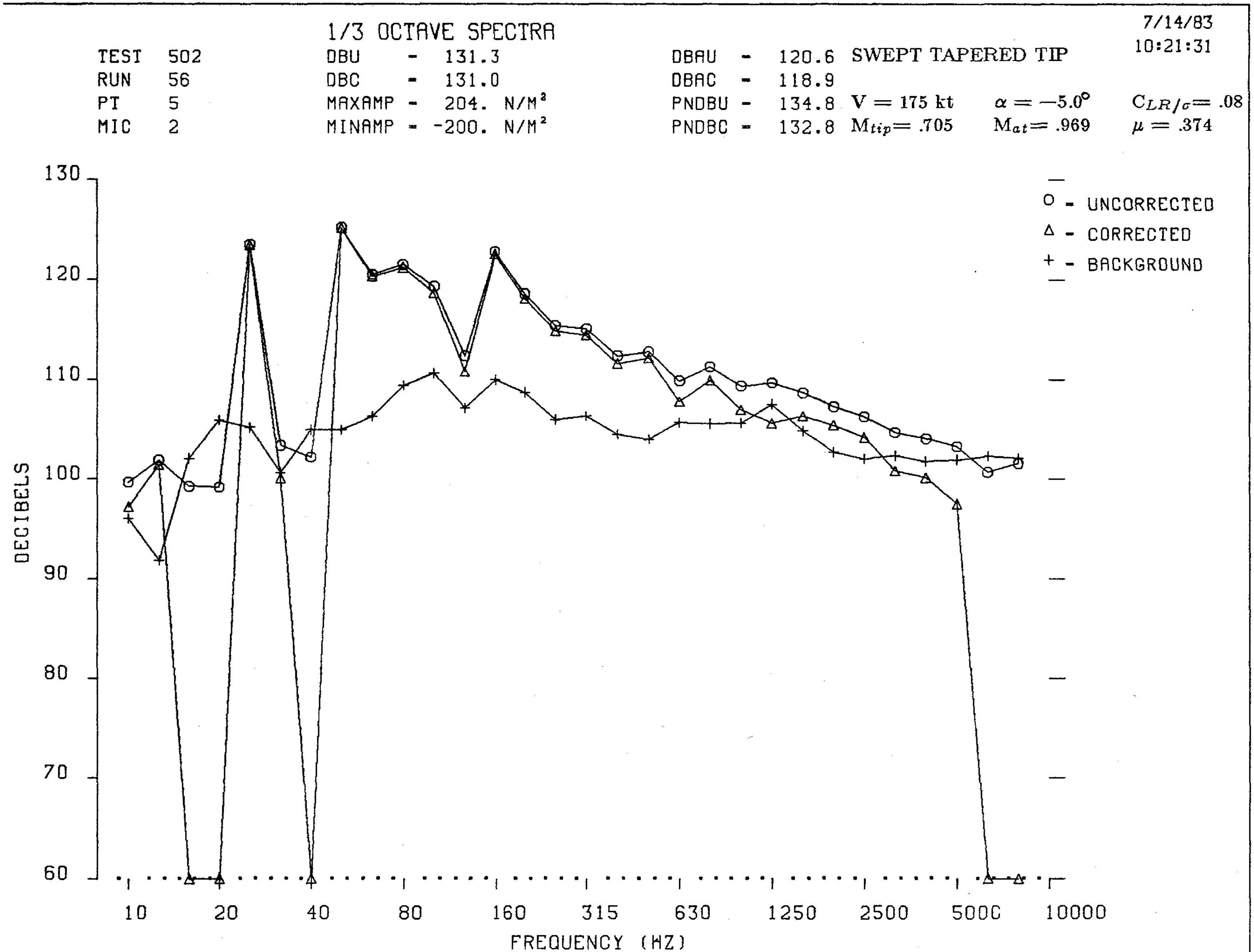

Figure D1(oo). One-Third Octave Specta for The Swept Tapered Tip Rotor.

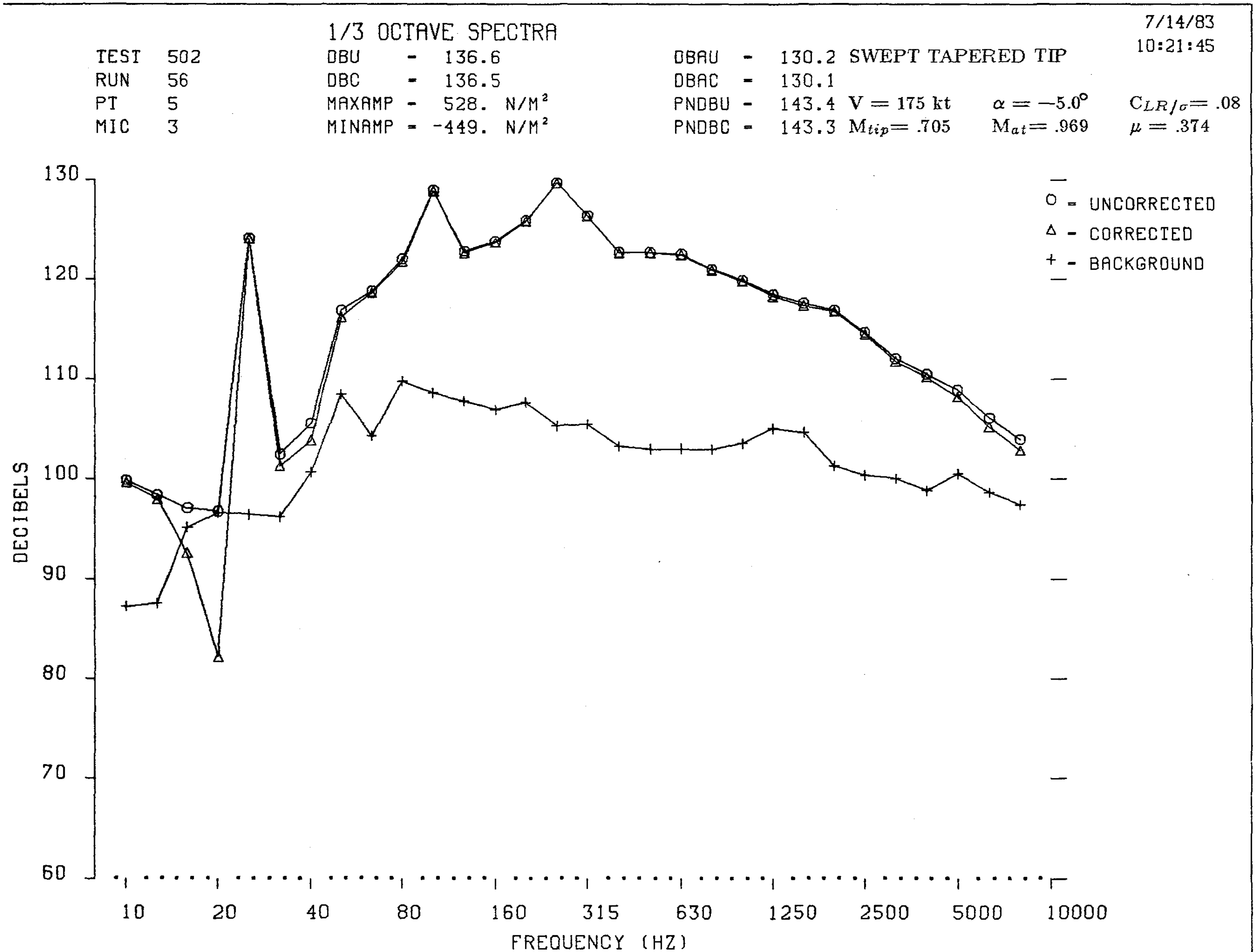

Figure D1(pp). One-Third Octave Specta for The Swept Tapered Tip Rotor.

1/3 OCTAVE SPECTRA

7/14/83
09:07:40

TEST 502	DBU - 114.4	DBAU - 106.8	SWEPT TIP		
RUN 48	DBC - 114.1	DBAC - 106.2			
PT 10	MAXAMP - 31. N/M²	PNDBU - 117.9	$V = 81$ kt	$\alpha = -2.5°$	$C_{LR/\sigma} = .07$
MIC 2	MINAMP - -37. N/M²	PNDBC - 115.6	$M_{tip} = .598$	$M_{at} = .718$	$\mu = .200$

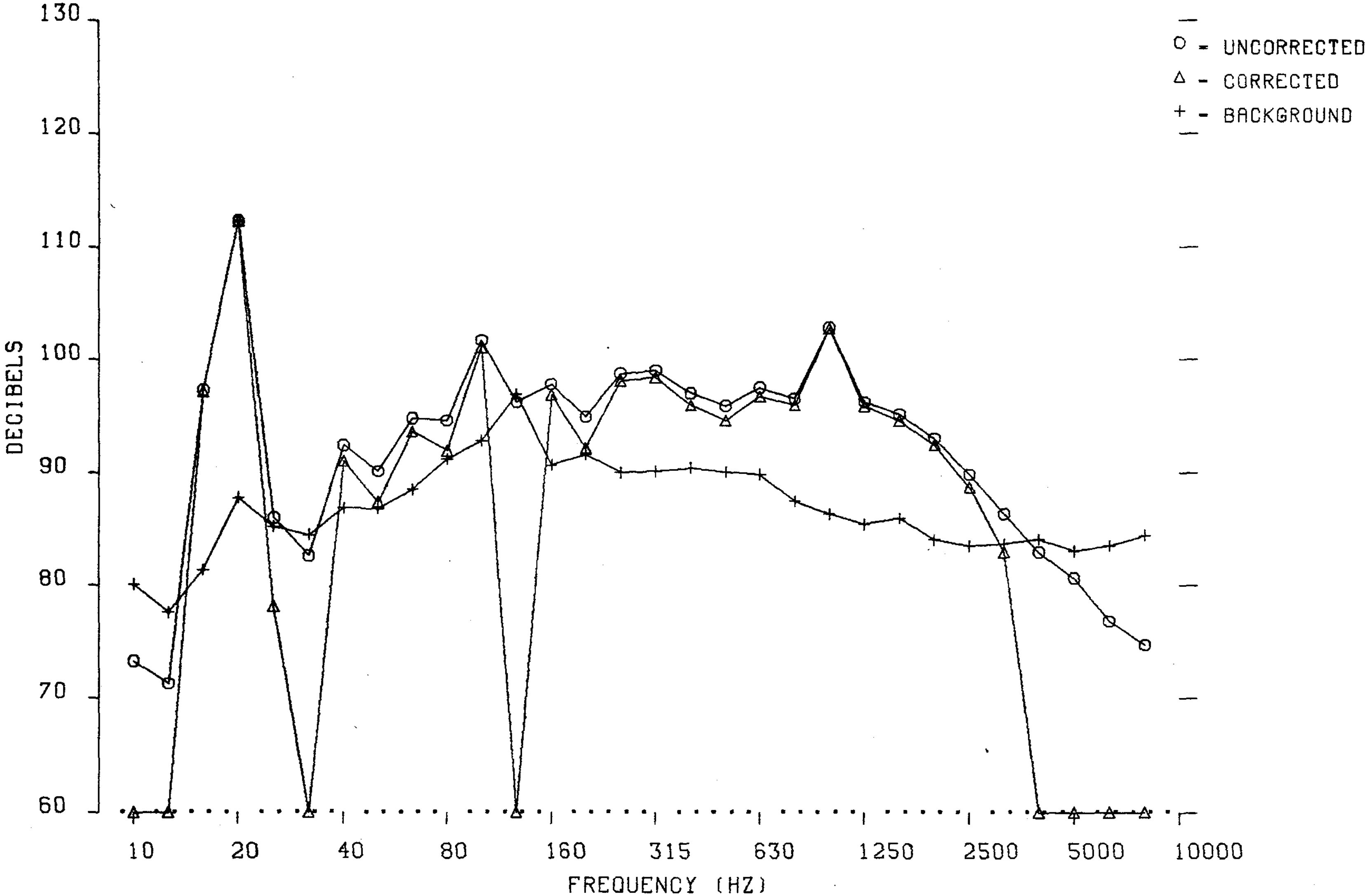

Figure D2(a). One-Third Octave Specta for The Swept Tip Rotor.

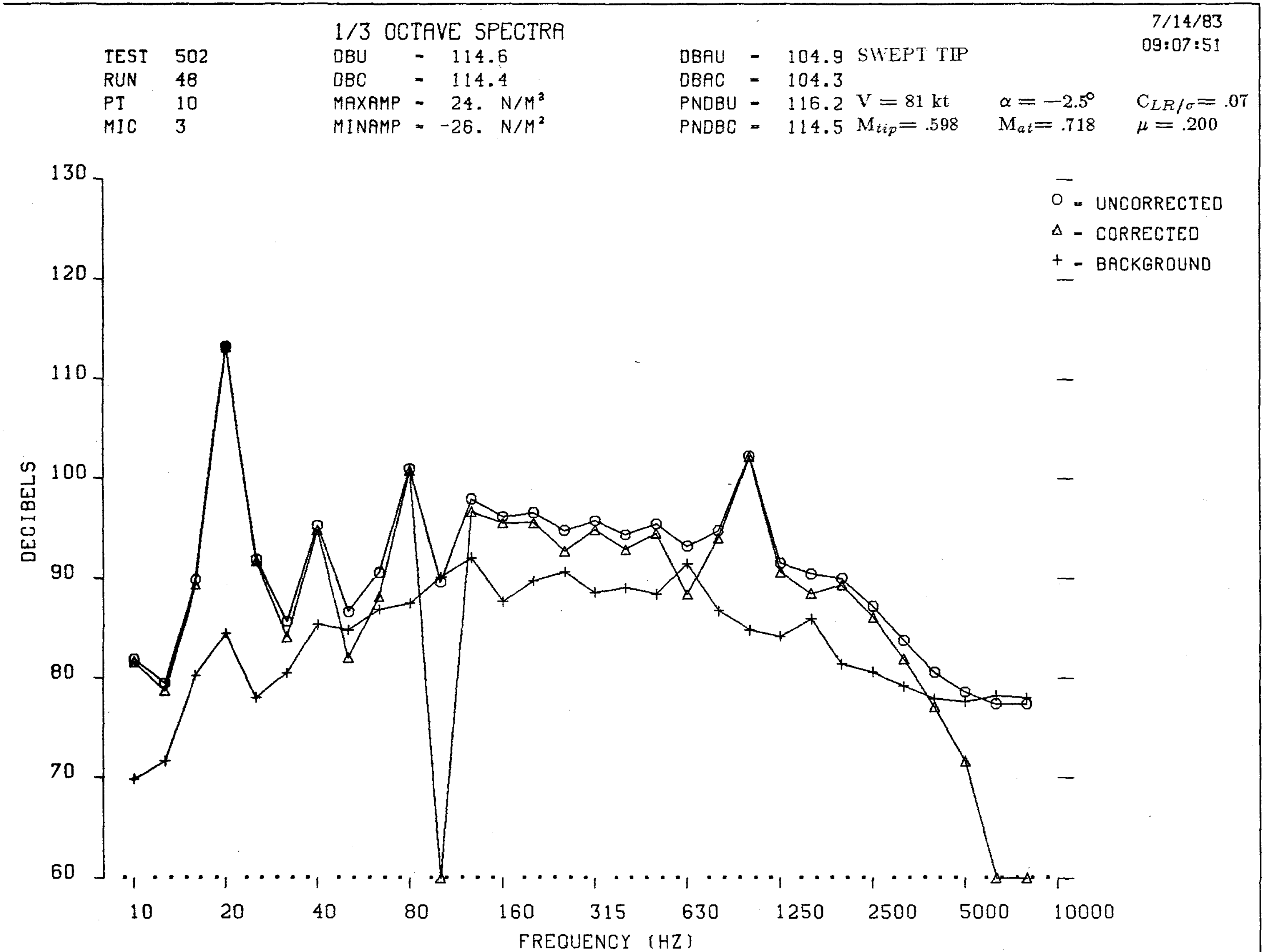

Figure D2(b). One-Third Octave Specta for The Swept Tip Rotor.

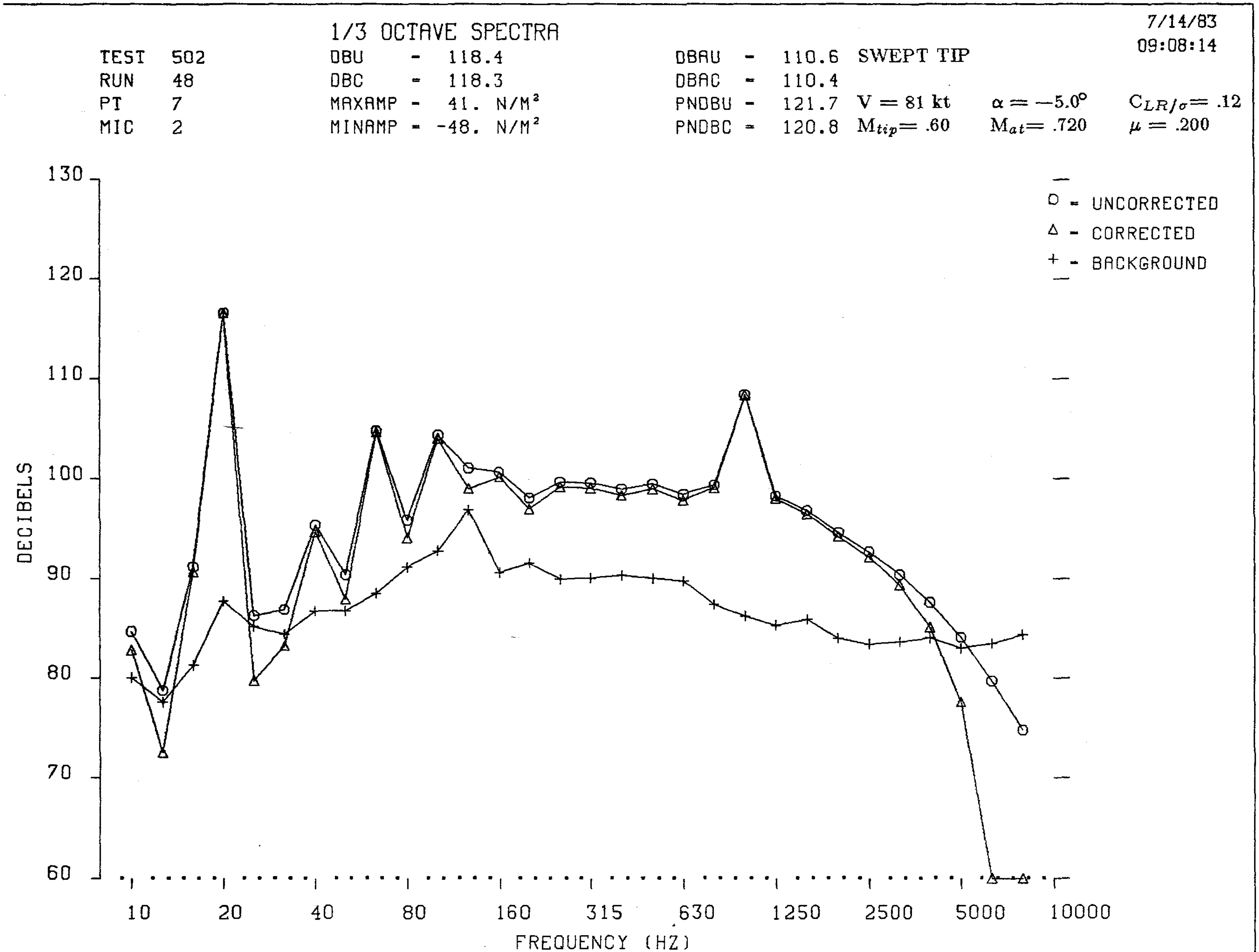

Figure D2(c). One-Third Octave Specta for The Swept Tip Rotor.

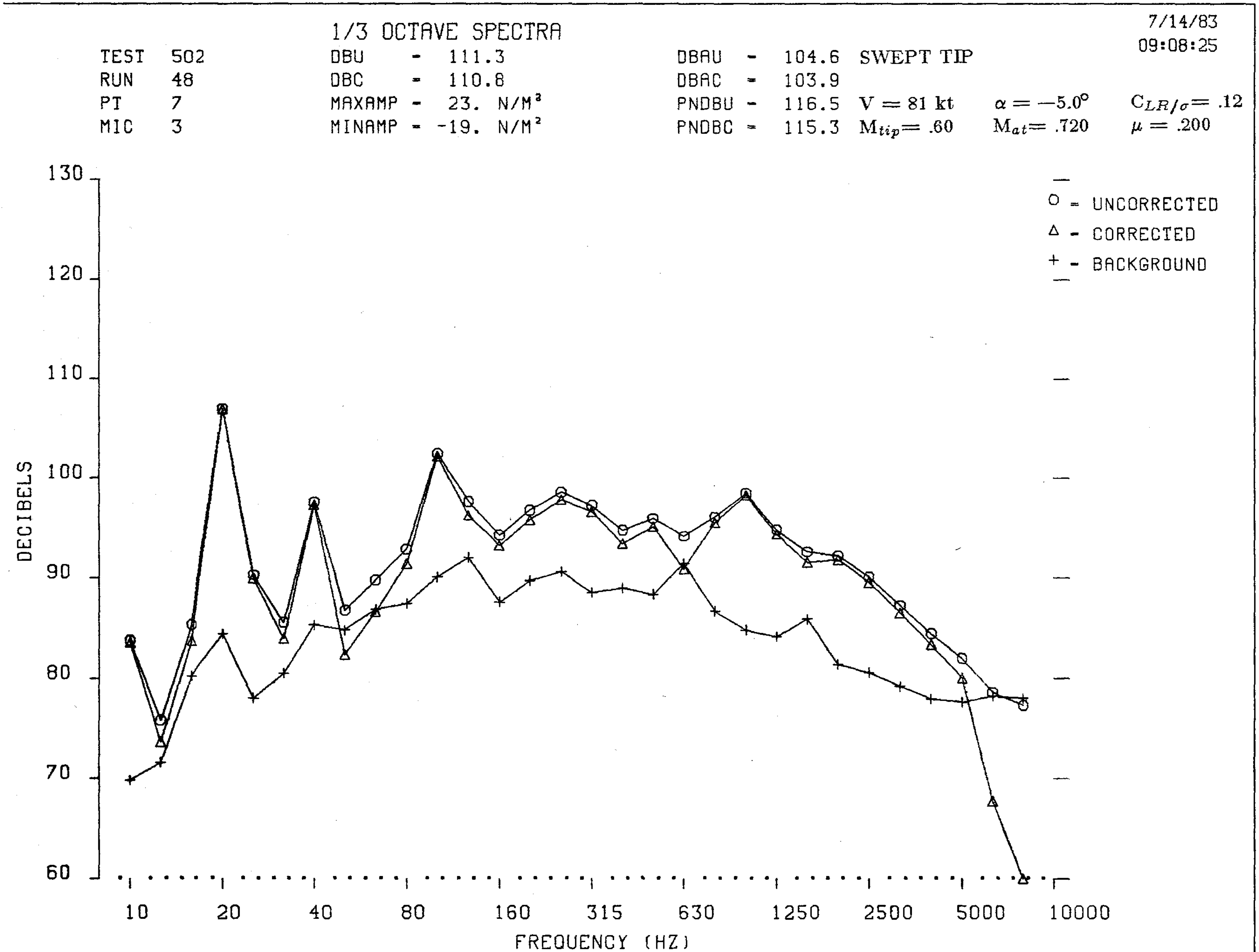

Figure D2(d). One-Third Octave Specta for The Swept Tip Rotor.

1/3 OCTAVE SPECTRA

7/14/83
09:08:46

TEST 502	DBU - 114.8	DBAU - 108.6	SWEPT TIP		
RUN 49	DBC - 112.2	DBAC - 105.1			
PT 5	MAXAMP - 32. N/M²	PNDBU - 120.7	V = 120 kt	$\alpha = -5.0^{\circ}$	$C_{LR/\sigma} = .07$
MIC 2	MINAMP - -32. N/M²	PNDBC - 112.5	$M_{tip} = .600$	$M_{at} = .781$	$\mu = .300$

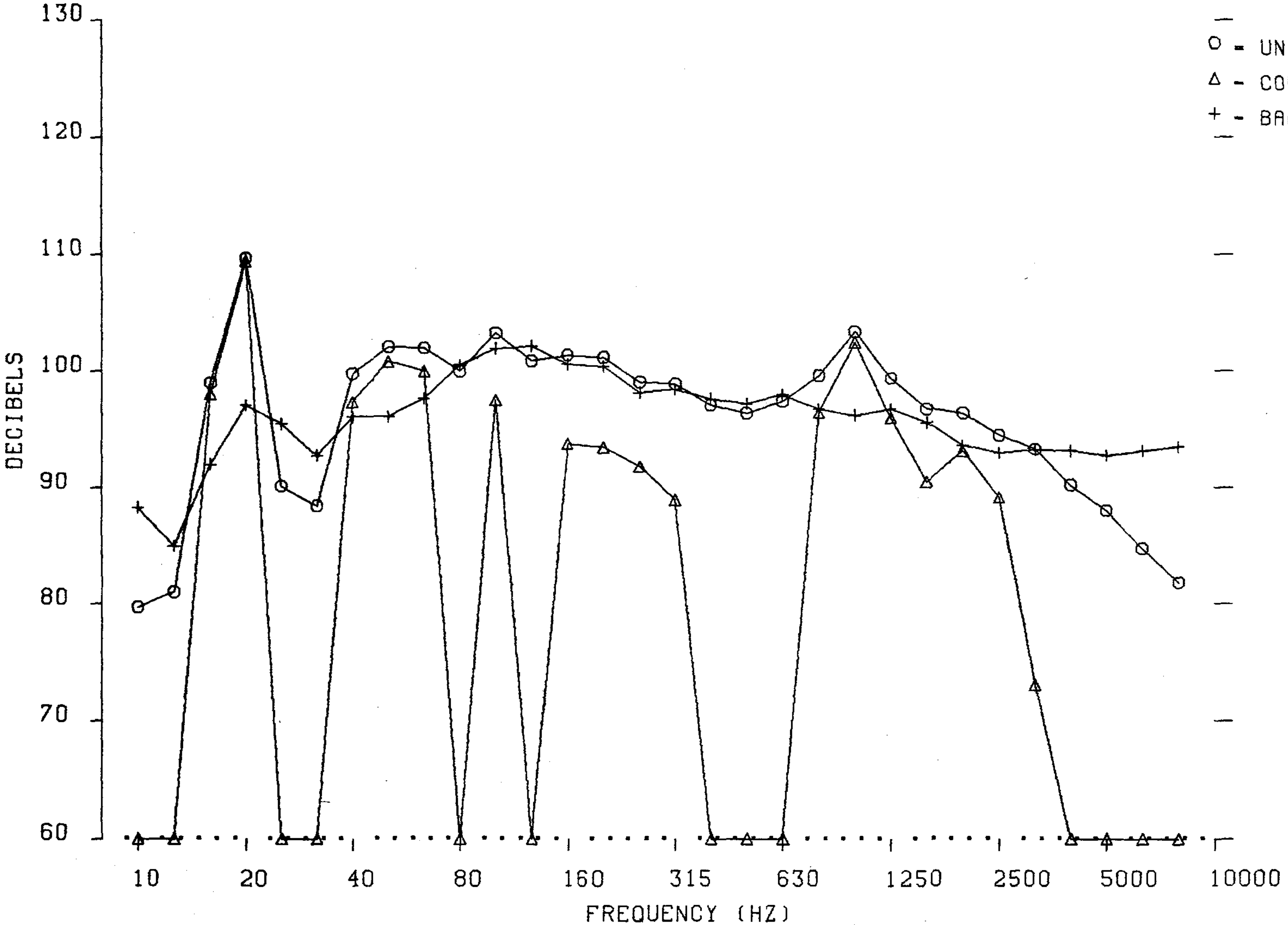

Figure D2(e). One-Third Octave Specta for The Swept Tip Rotor.

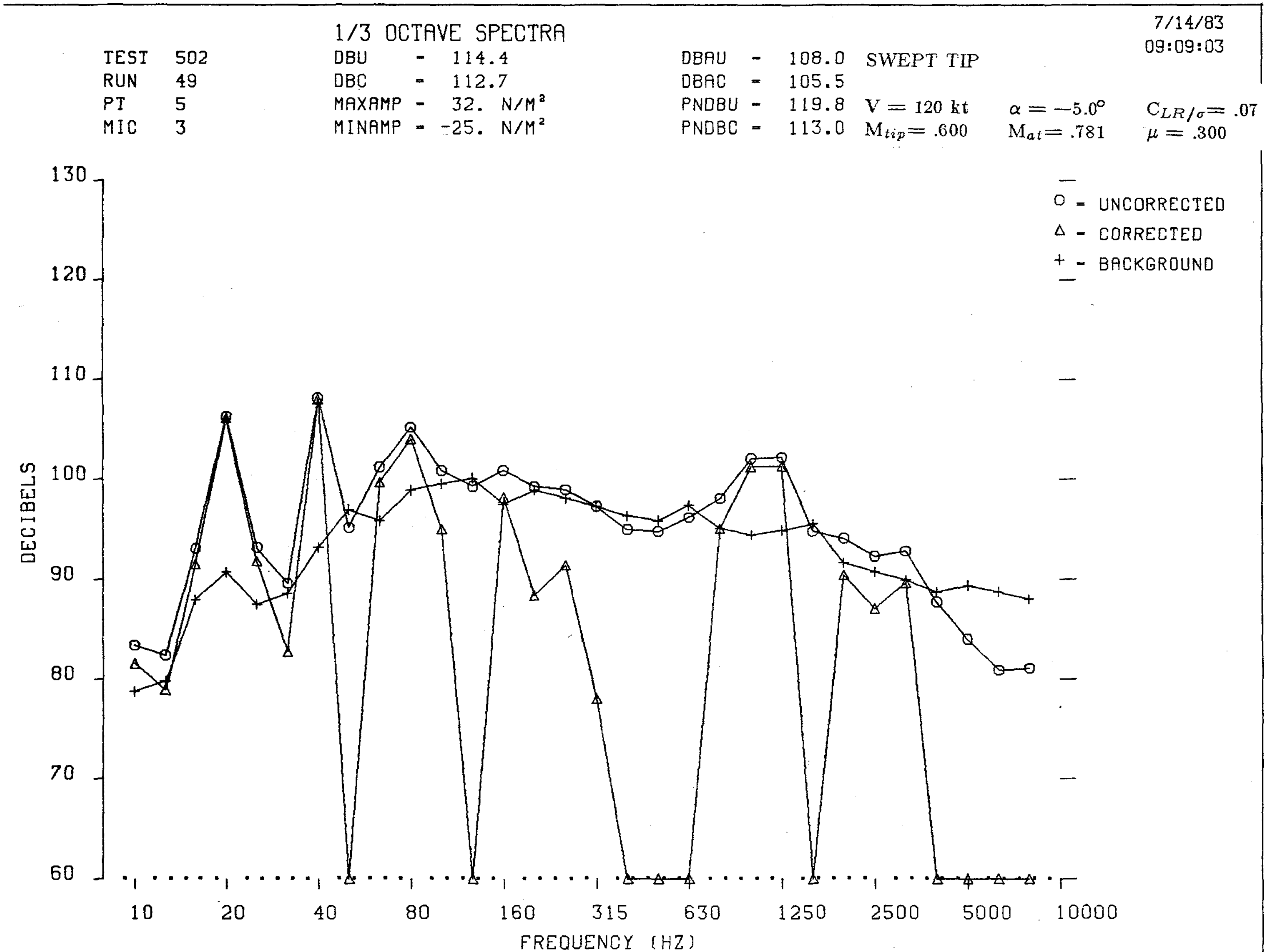

Figure D2(f). One-Third Octave Specta for The Swept Tip Rotor.

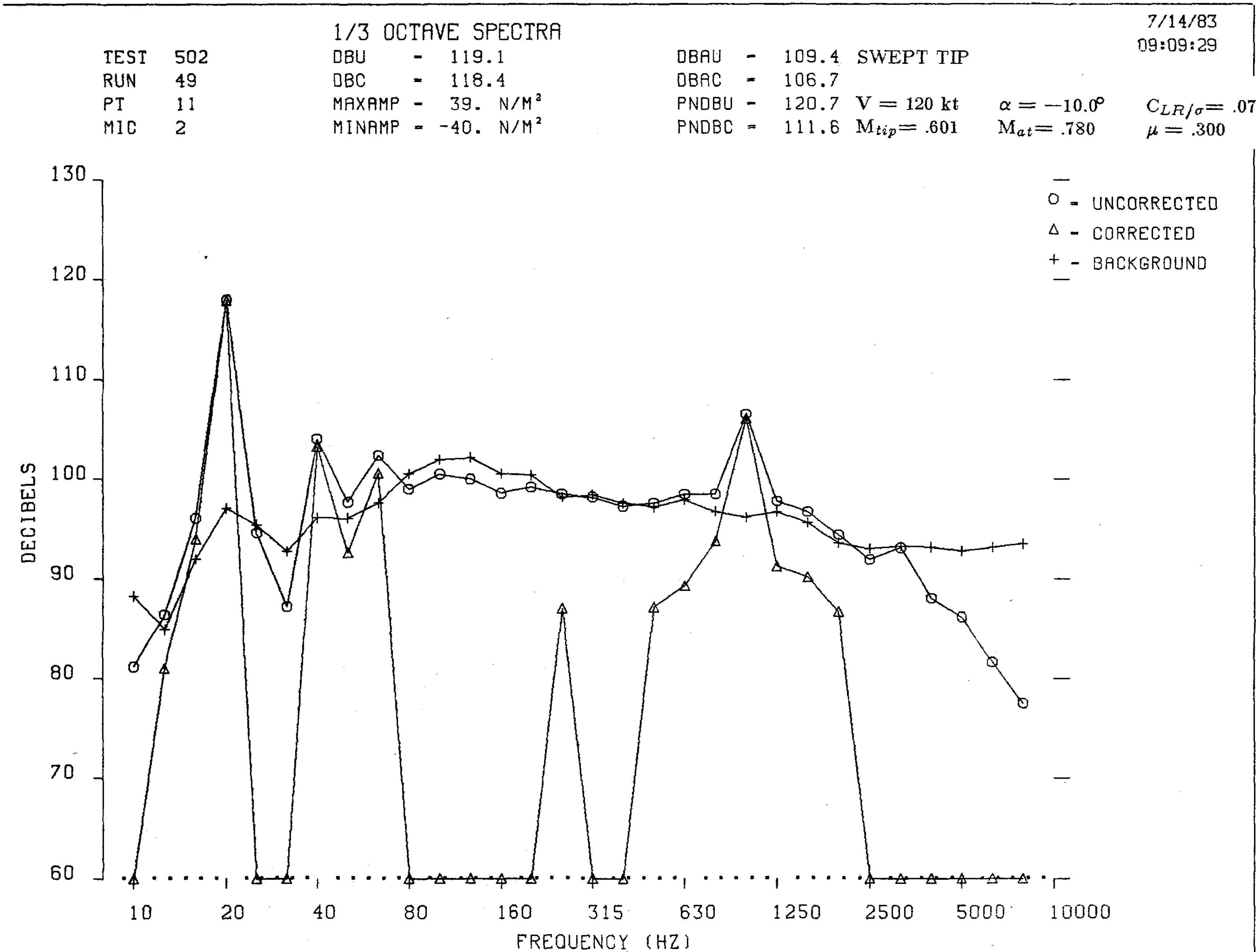

Figure D2(g). One-Third Octave Specta for The Swept Tip Rotor.

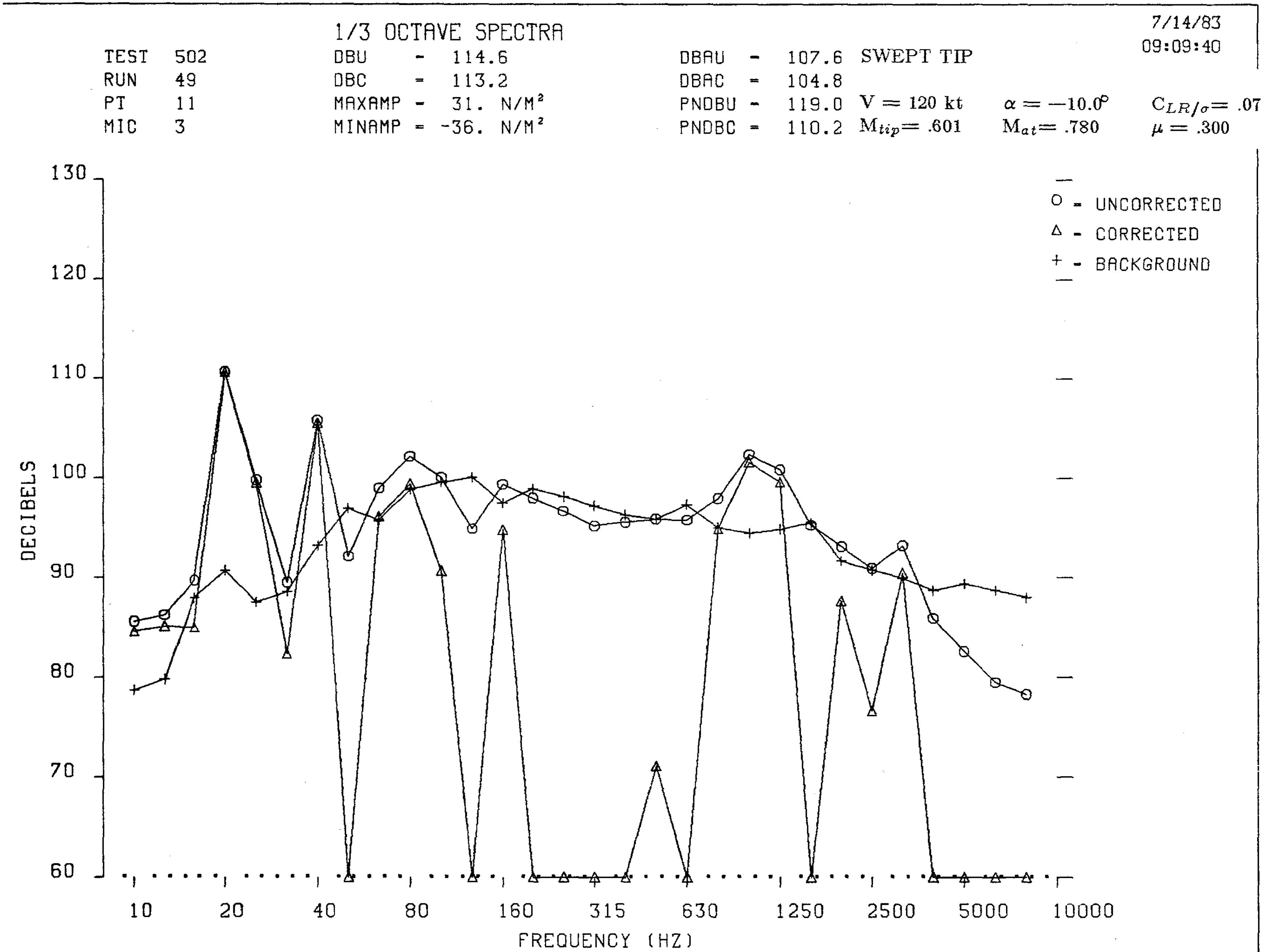

Figure D2(h). One-Third Octave Specta for The Swept Tip Rotor.

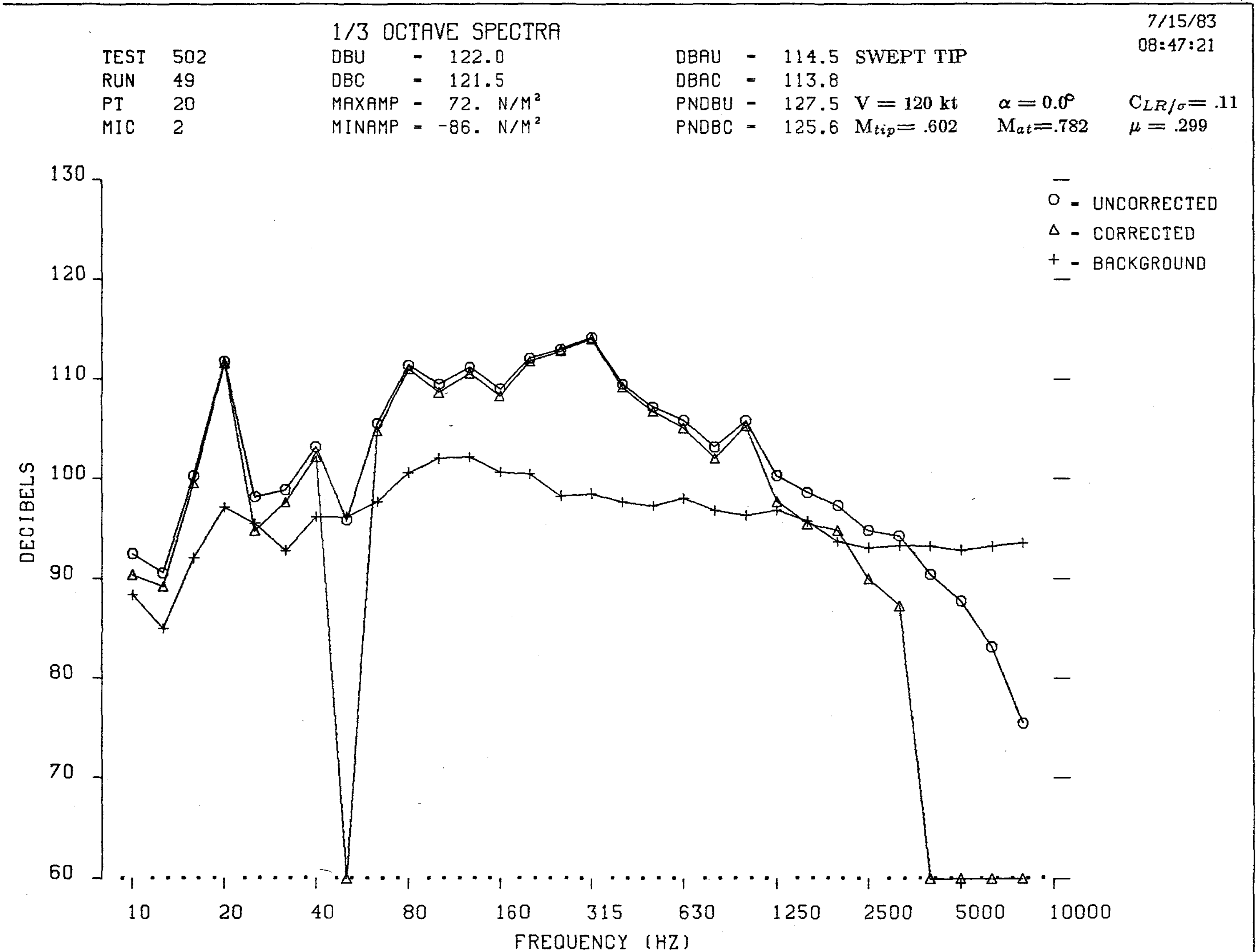

Figure D2(i). One-Third Octave Specta for The Swept Tip Rotor.

1/3 OCTAVE SPECTRA

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08:47:32

TEST 502	DBU - 117.5	DBAU - 111.3	SWEPT TIP		
RUN 49	DBC = 116.6	DBAC = 110.2			
PT 20	MAXAMP - 38. N/M²	PNDBU - 123.5	V = 120 kt	$\alpha = 0.0^{o}$	$C_{LR/\sigma} = .11$
MIC 3	MINAMP = -47. N/M²	PNDBC = 121.2	$M_{tip} = .602$	$M_{at} = .782$	$\mu = .299$

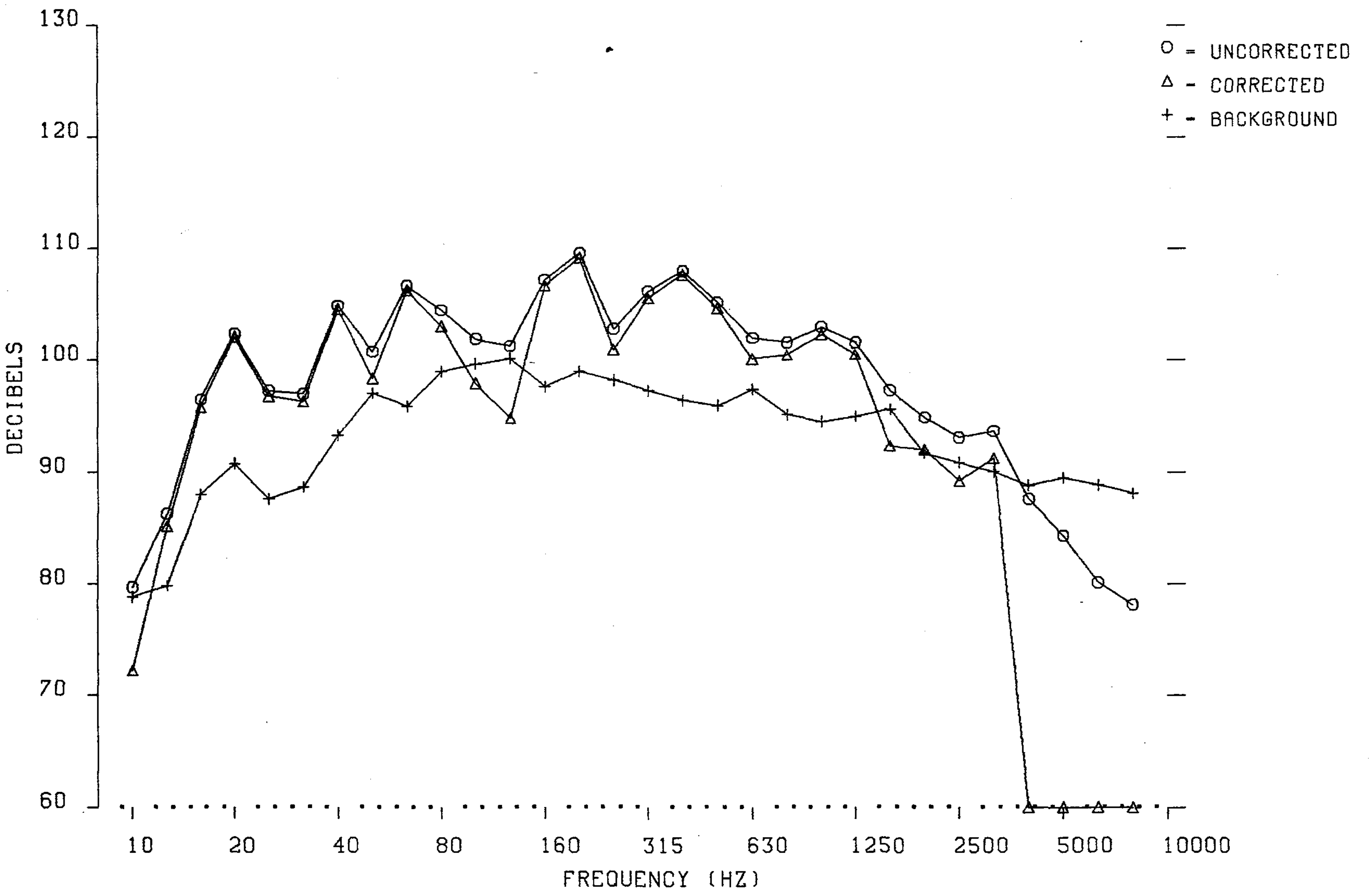

Figure D2(j). One-Third Octave Specta for The Swept Tip Rotor.

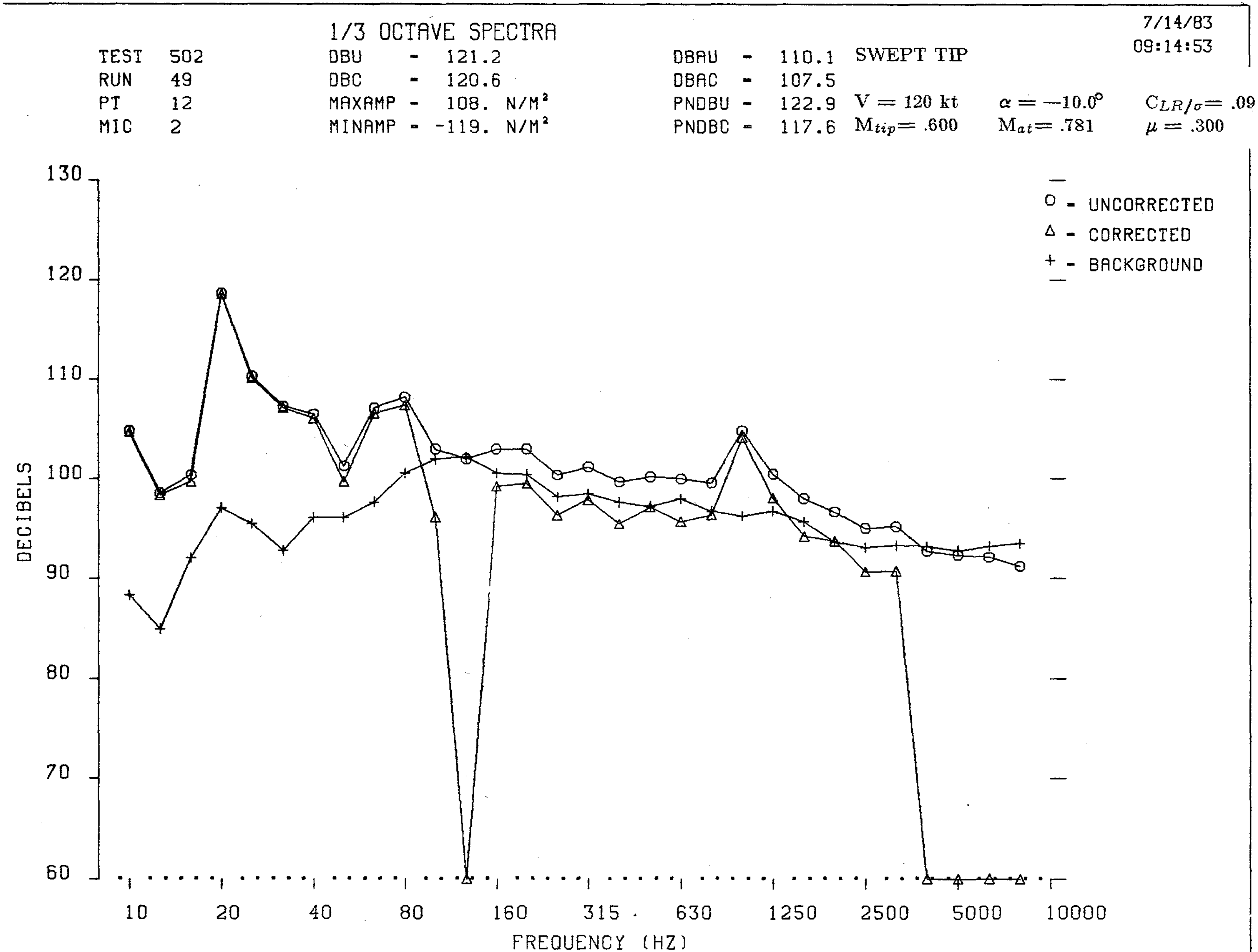

Figure D2(k). One-Third Octave Specta for The Swept Tip Rotor.

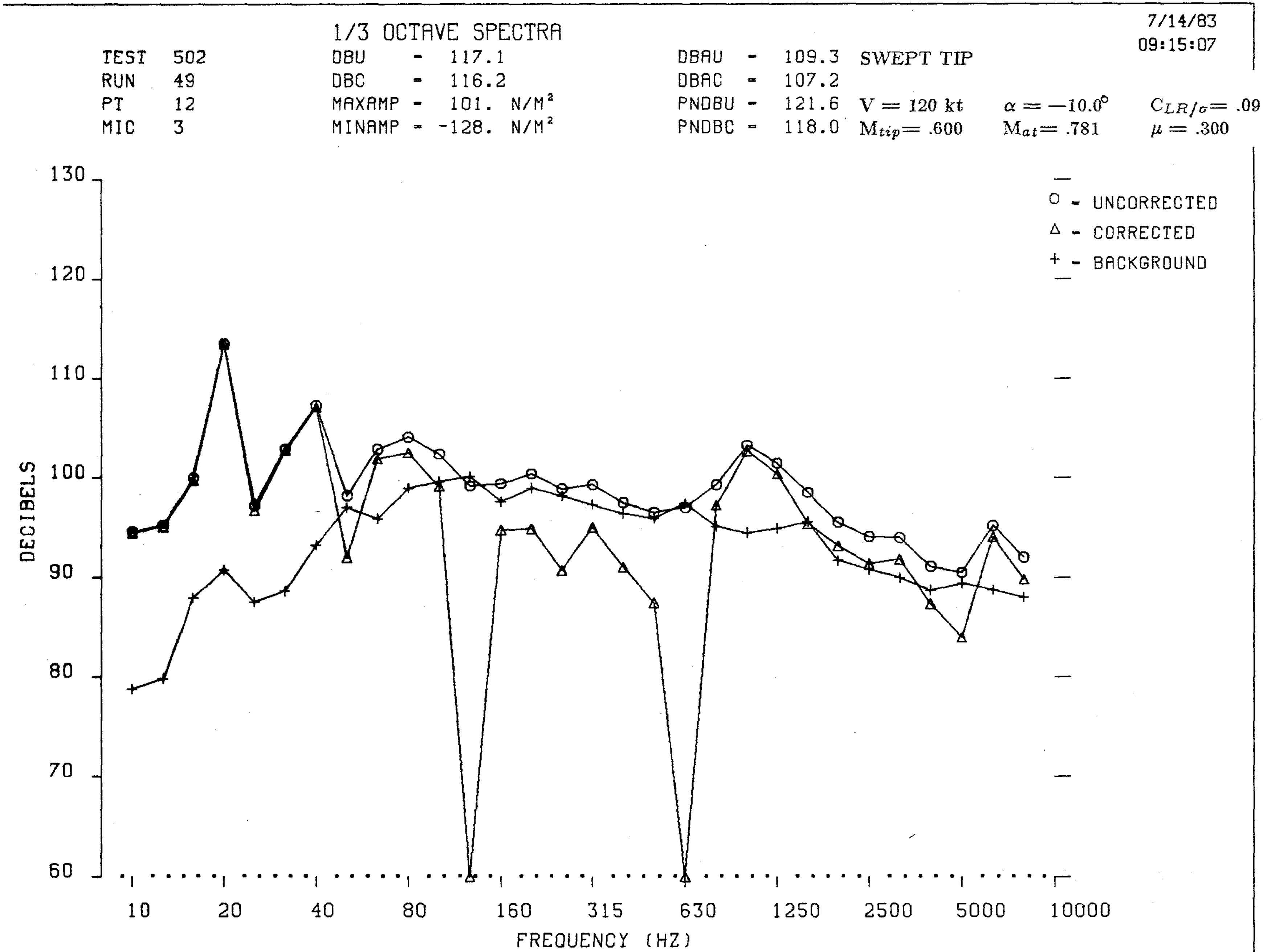

Figure D2(l). One-Third Octave Specta for The Swept Tip Rotor.

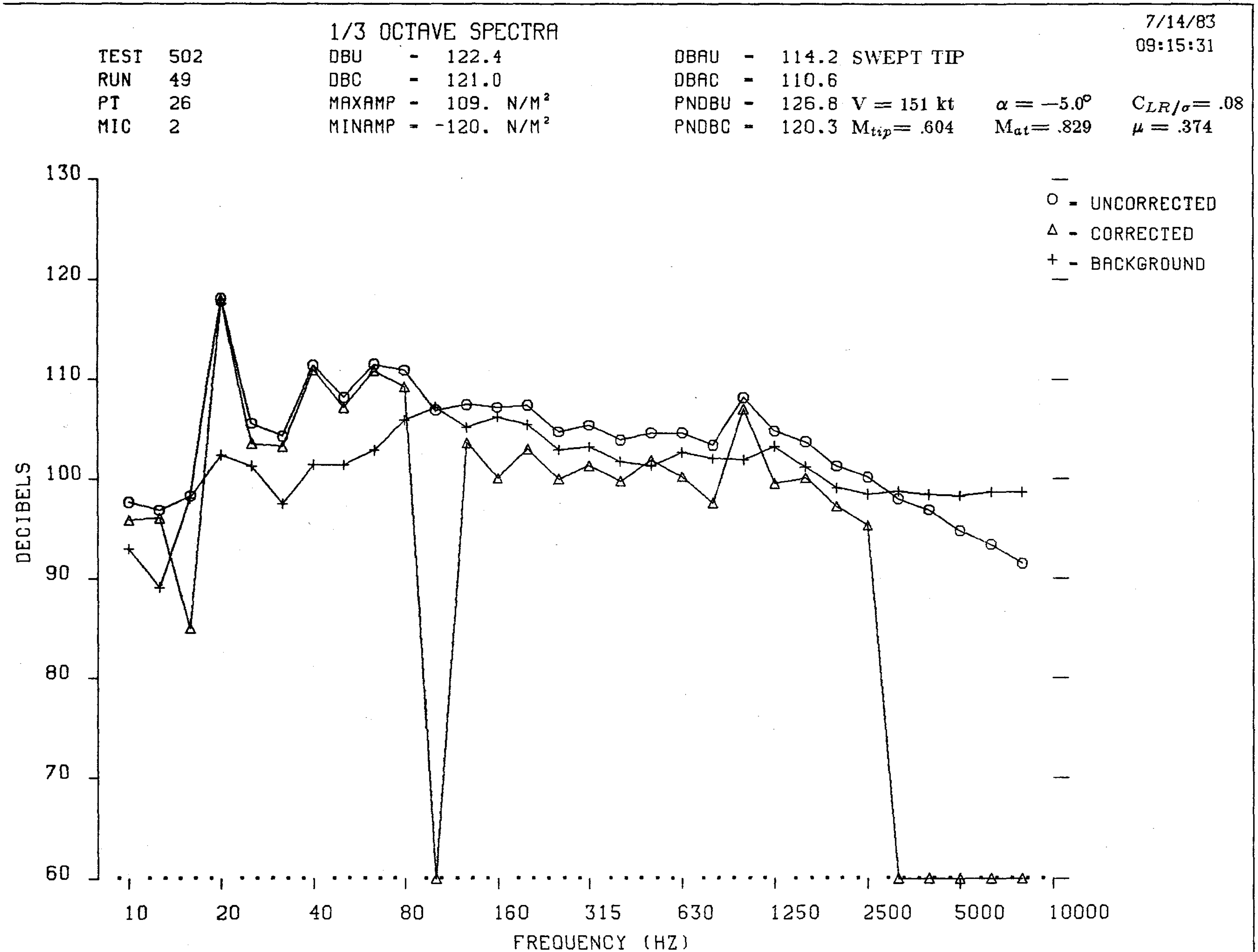

Figure D2(m). One-Third Octave Specta for The Swept Tip Rotor.

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09:15:42

1/3 OCTAVE SPECTRA

TEST	502	DBU	-	121.0	DBAU	-	113.5	SWEPT TIP
RUN	49	DBC	=	119.7	DBAC	=	110.8	
PT	26	MAXAMP	-	101. N/M²	PNDBU	-	126.3	$V = 151$ kt, $\alpha = -5.0°$, $C_{LR/\sigma} = .08$
MIC	3	MINAMP	=	-128. N/M²	PNDBC	=	121.6	$M_{tip} = .604$, $M_{at} = .829$, $\mu = .374$

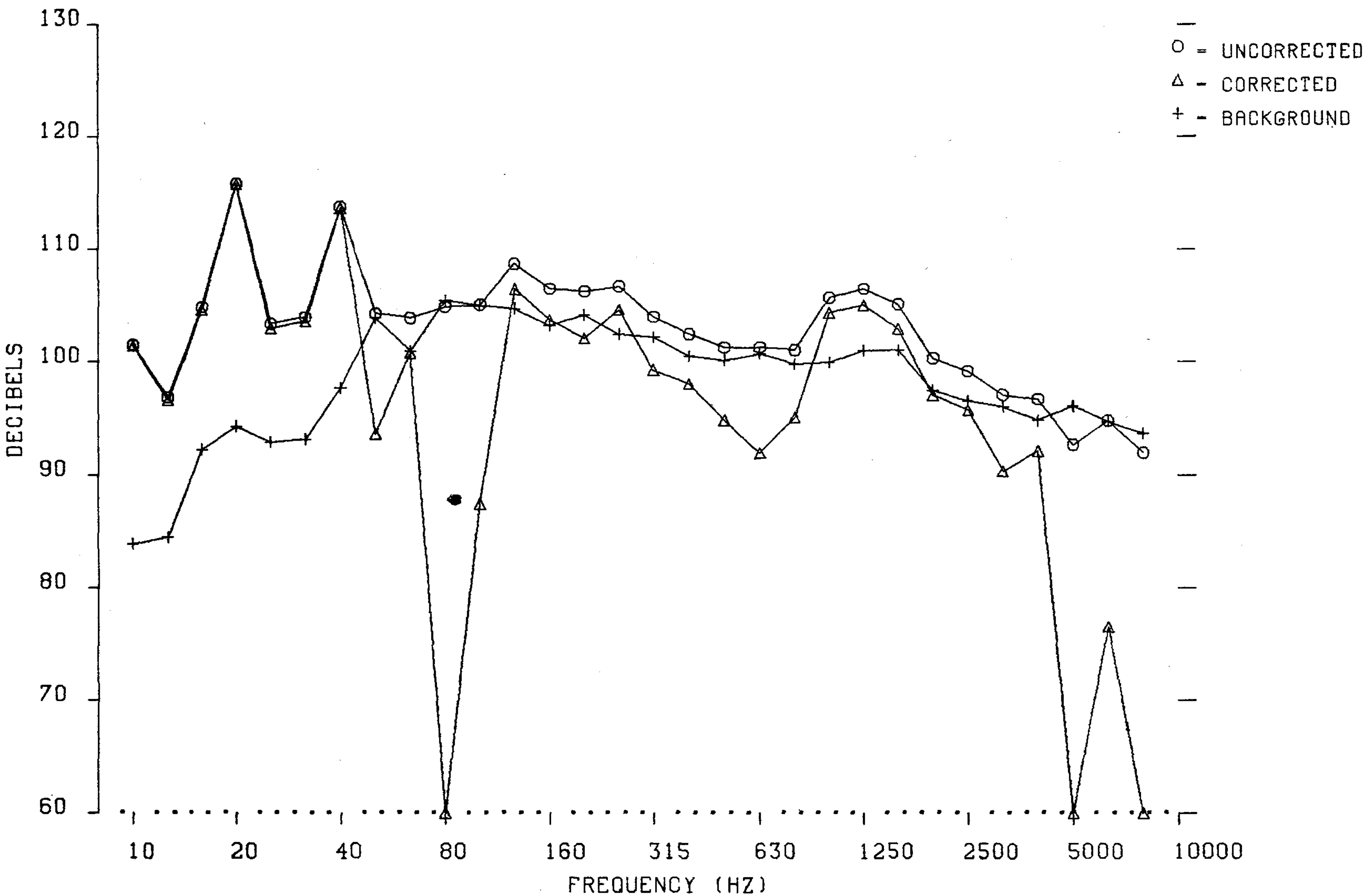

Figure D2(n). One-Third Octave Specta for The Swept Tip Rotor.

		1/3 OCTAVE SPECTRA			7/14/83 09:16:03
TEST 502	DBU - 123.3	DBAU - 112.7	SWEPT TIP		
RUN 49	DBC - 122.3	DBAC - 107.1			
PT 32	MAXAMP - 108. N/M²	PNDBU - 125.2	V = 151 kt	$\alpha = -10.0^{\circ}$	$C_{LR/\sigma} = .07$
MIC 2	MINAMP - -119. N/M²	PNDBC - 112.8	$M_{tip} = .600$	$M_{at} = .826$	$\mu = .376$

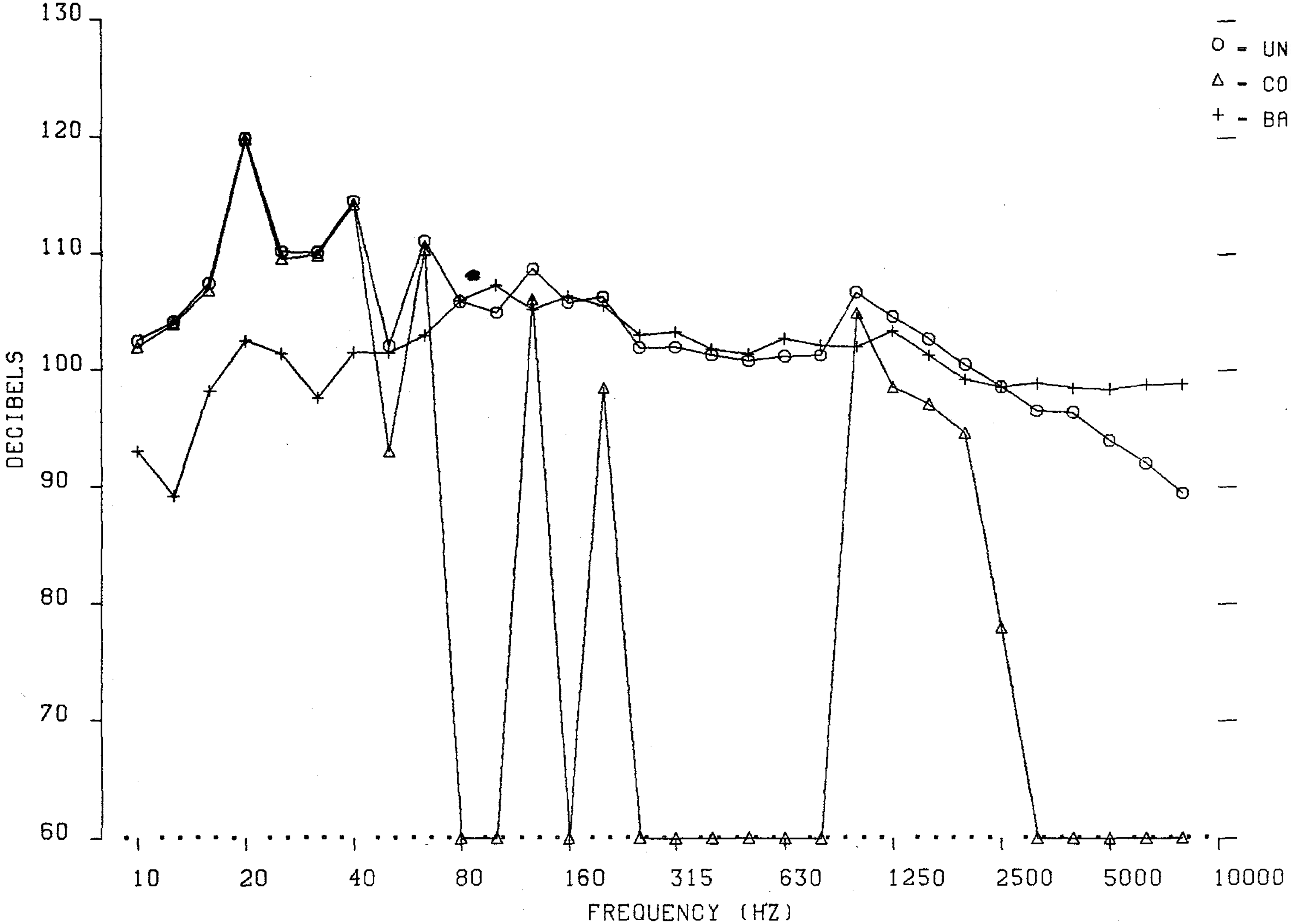

Figure D2(o). One-Third Octave Specta for The Swept Tip Rotor.

7/14/83
09:16:16

1/3 OCTAVE SPECTRA

TEST	502	DBU	-	122.0		DBAU	-	113.2	SWEPT TIP		
RUN	49	DBC	=	120.9		DBAC	=	110.2			
PT	32	MAXAMP	-	102.	N/M^2	PNDBU	-	126.2	$V = 151$ kt	$\alpha = -10.0^\circ$	$C_{LR/\sigma} = .07$
MIC	3	MINAMP	=	-128.	N/M^2	PNDBC	=	119.4	$M_{tip} = .600$	$M_{at} = .826$	$\mu = .376$

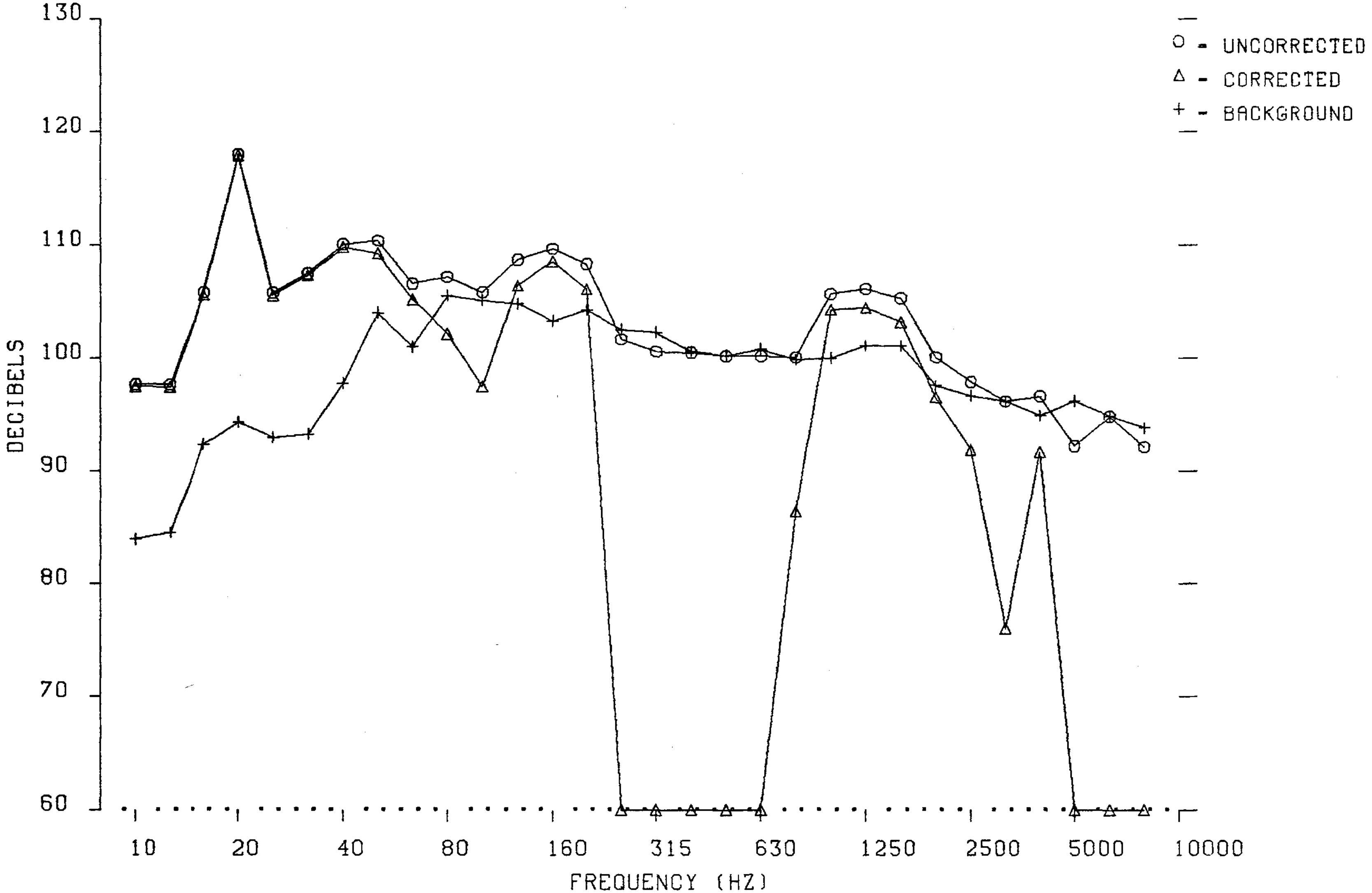

Figure D2(p). One-Third Octave Specta for The Swept Tip Rotor.

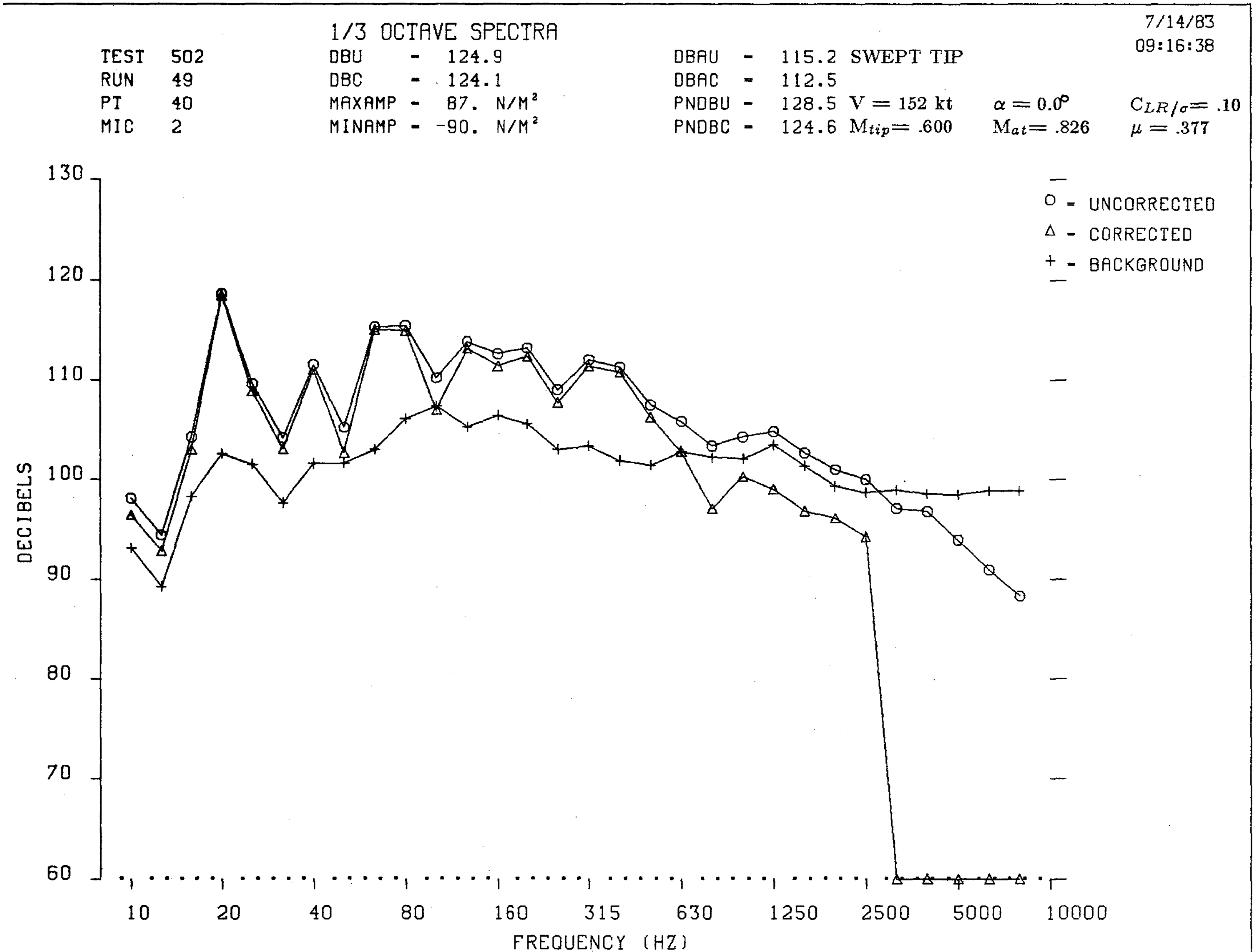

Figure D2(q). One-Third Octave Specta for The Swept Tip Rotor.

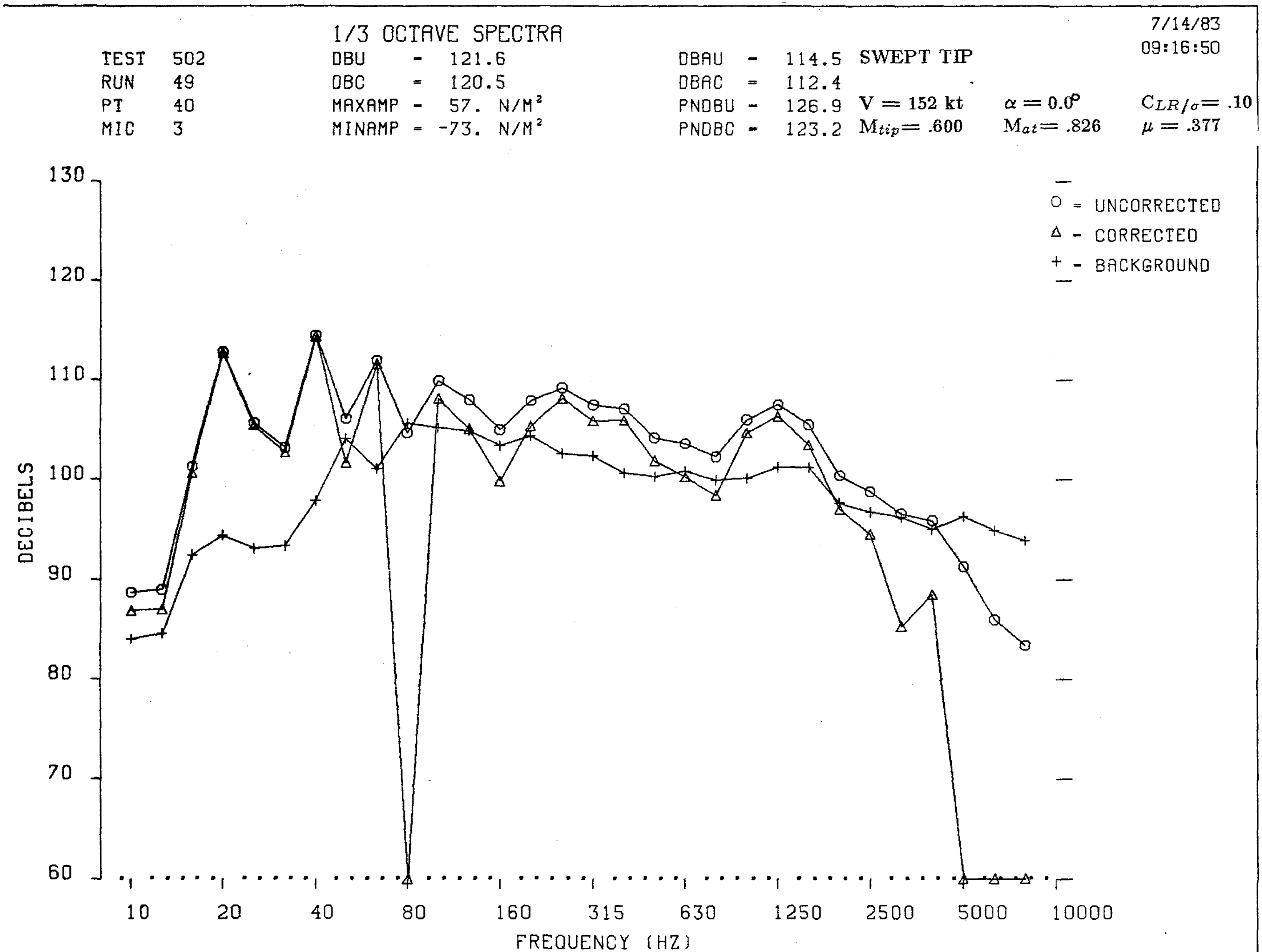

Figure D2(r). One-Third Octave Specta for The Swept Tip Rotor.

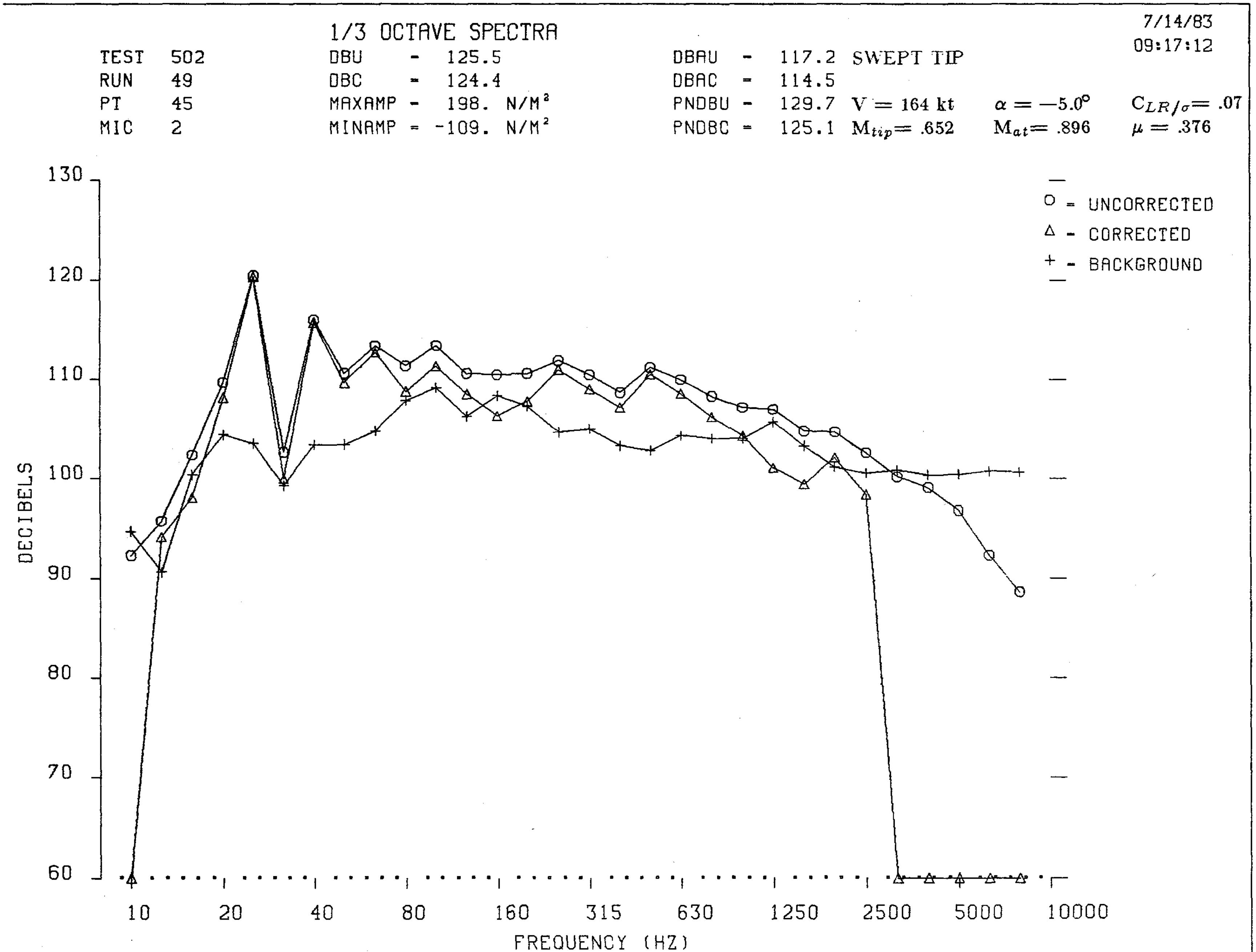

Figure D2(s). One-Third Octave Specta for The Swept Tip Rotor.

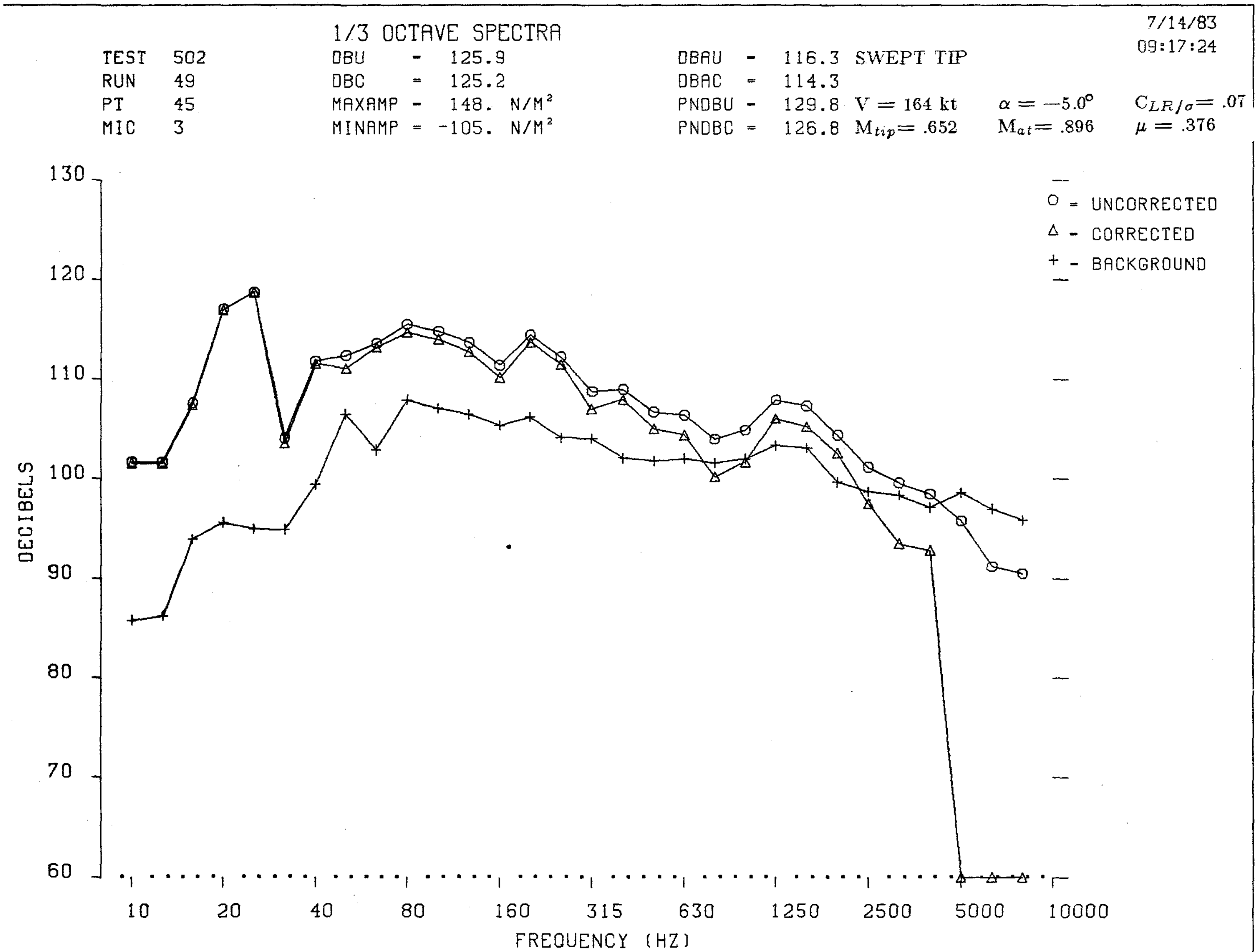

Figure D2(t). One-Third Octave Specta for The Swept Tip Rotor.

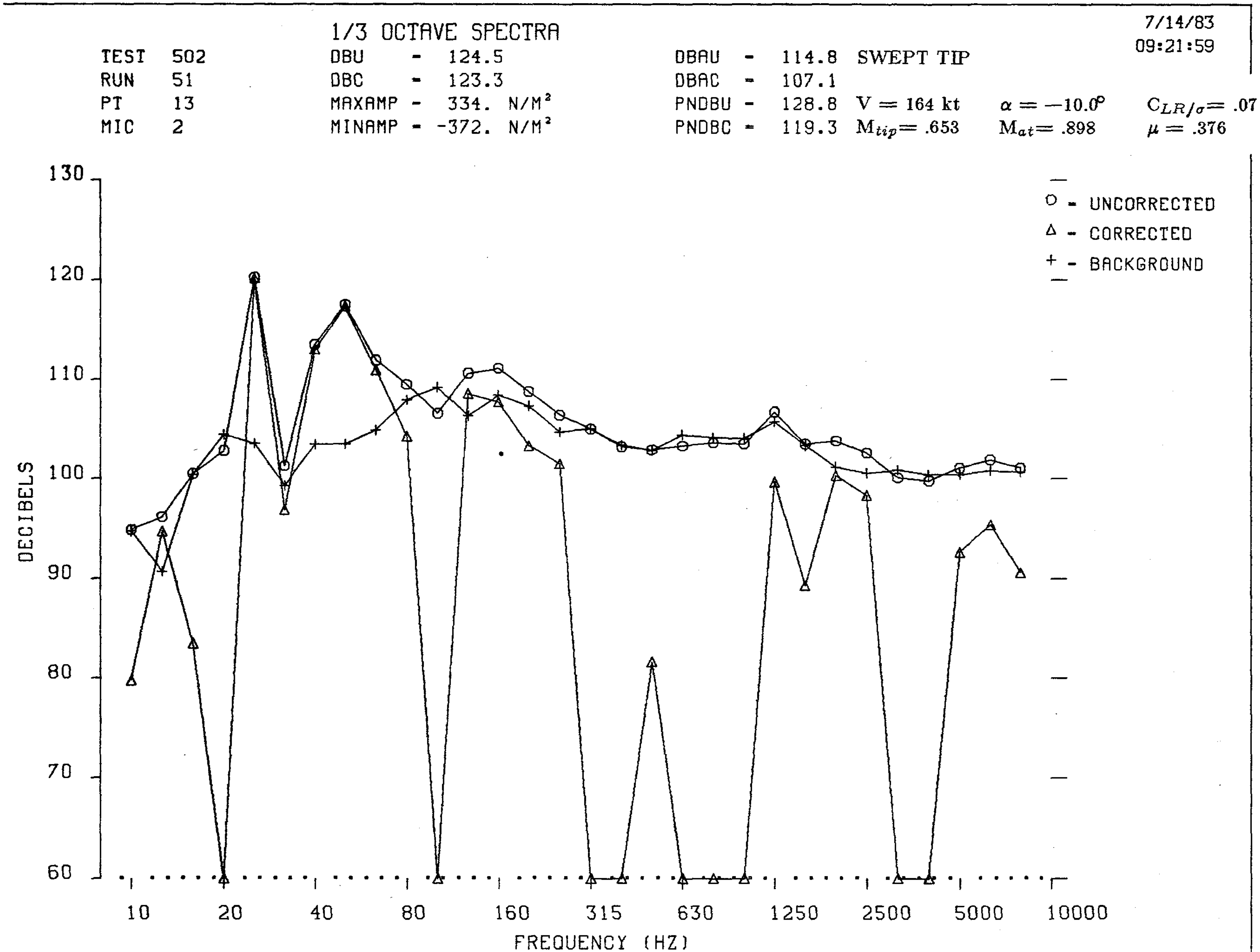

Figure D2(u). One-Third Octave Specta for The Swept Tip Rotor.

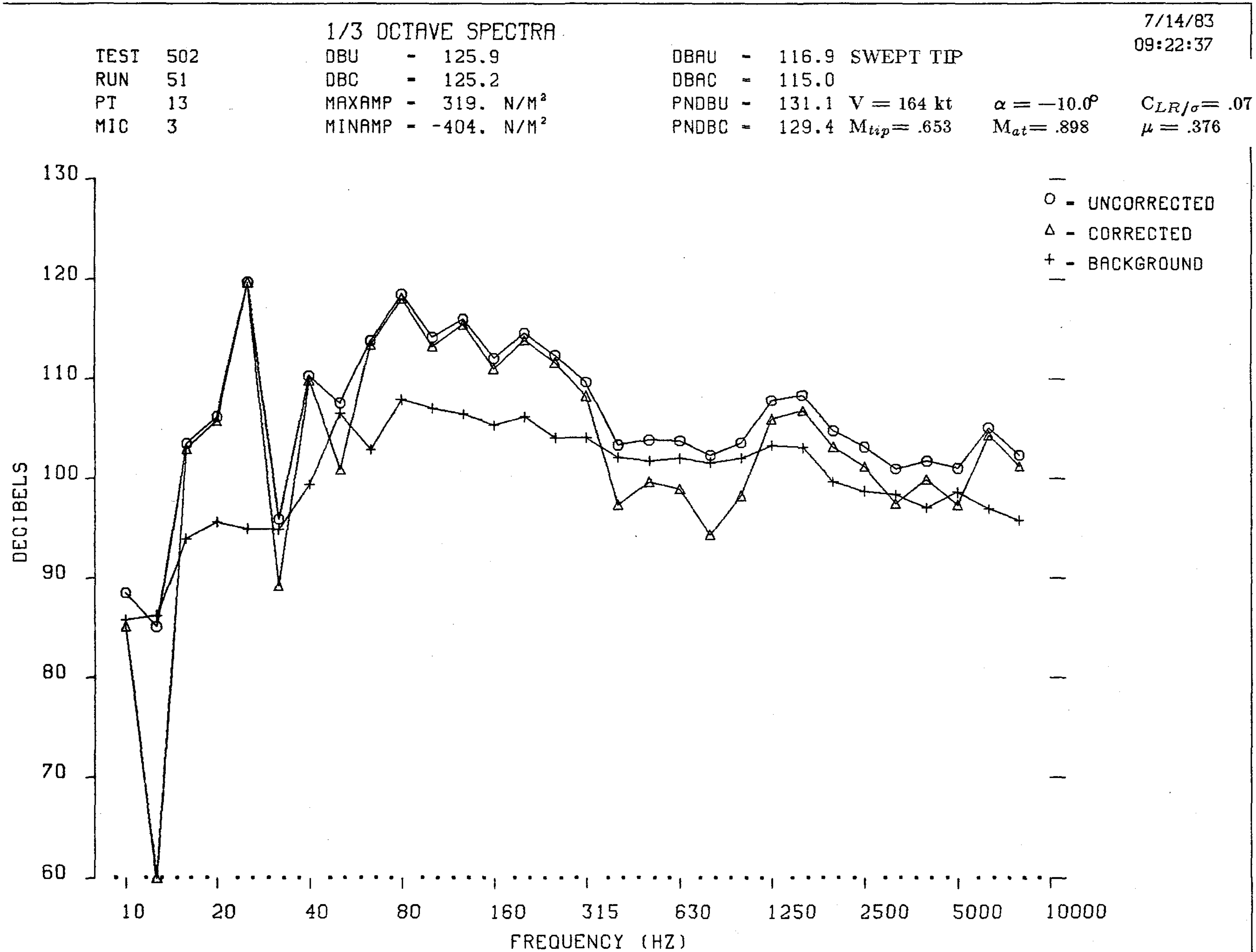

Figure D2(v). One-Third Octave Specta for The Swept Tip Rotor.

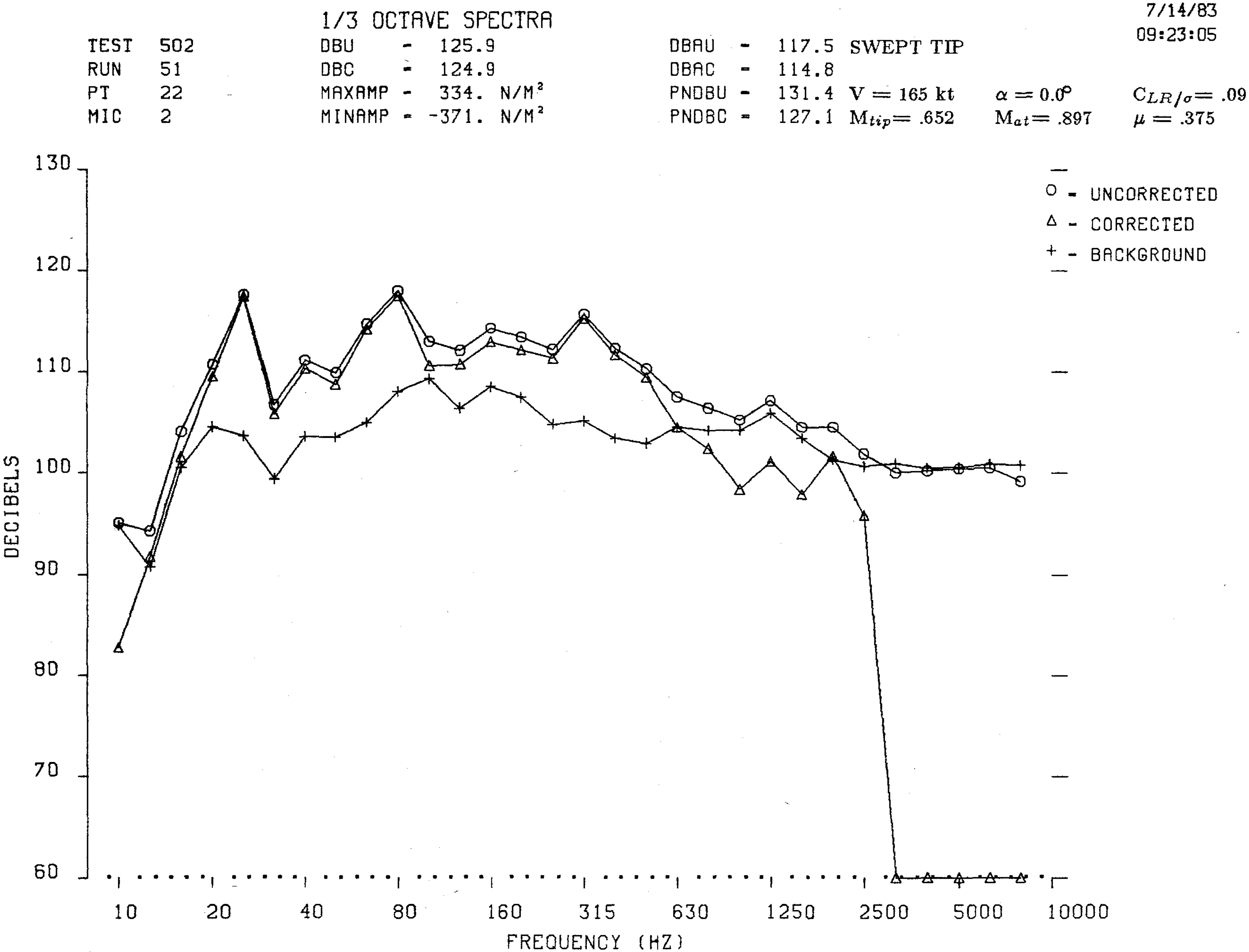

Figure D2(w). One-Third Octave Specta for The Swept Tip Rotor.

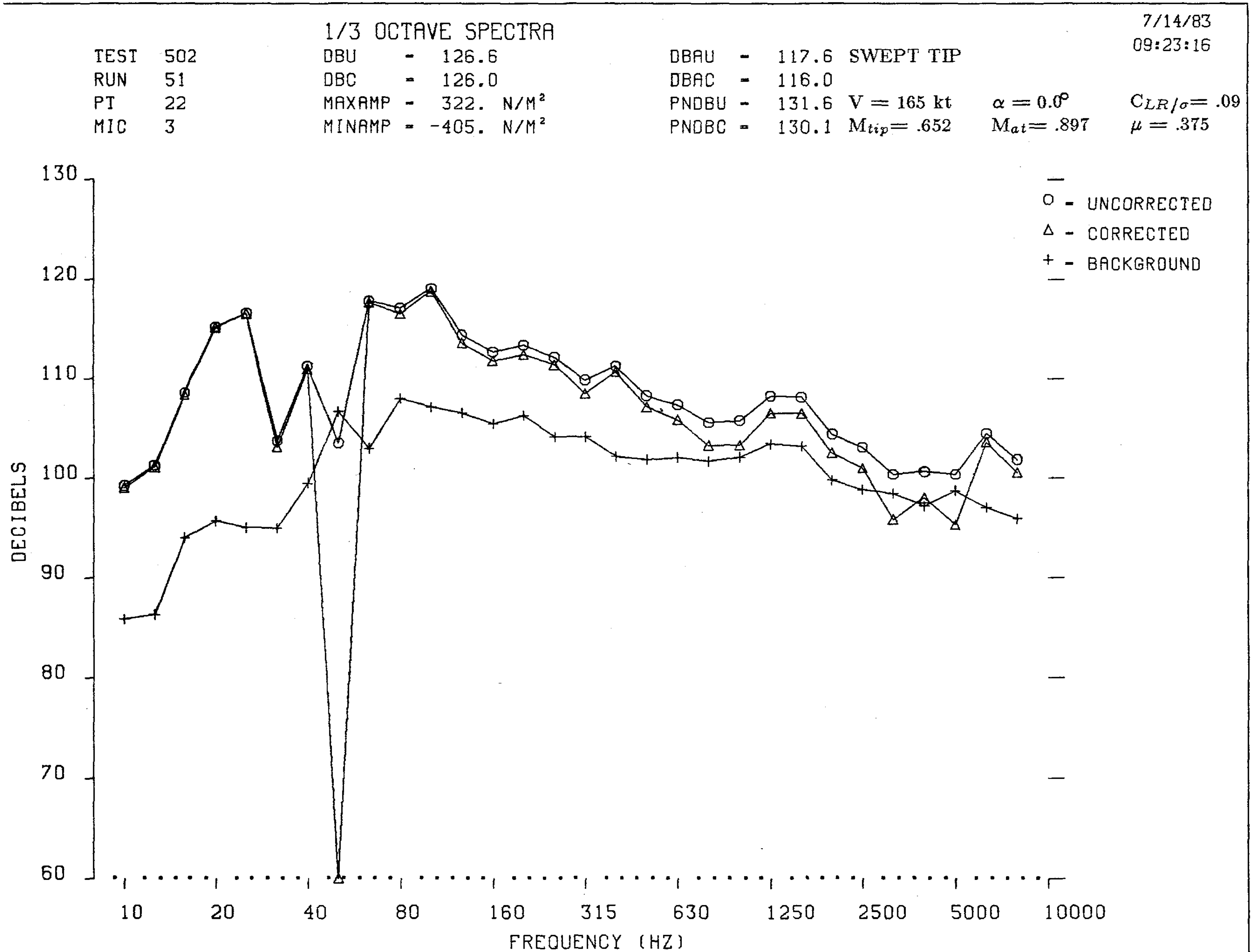

Figure D2(x). One-Third Octave Specta for The Swept Tip Rotor.

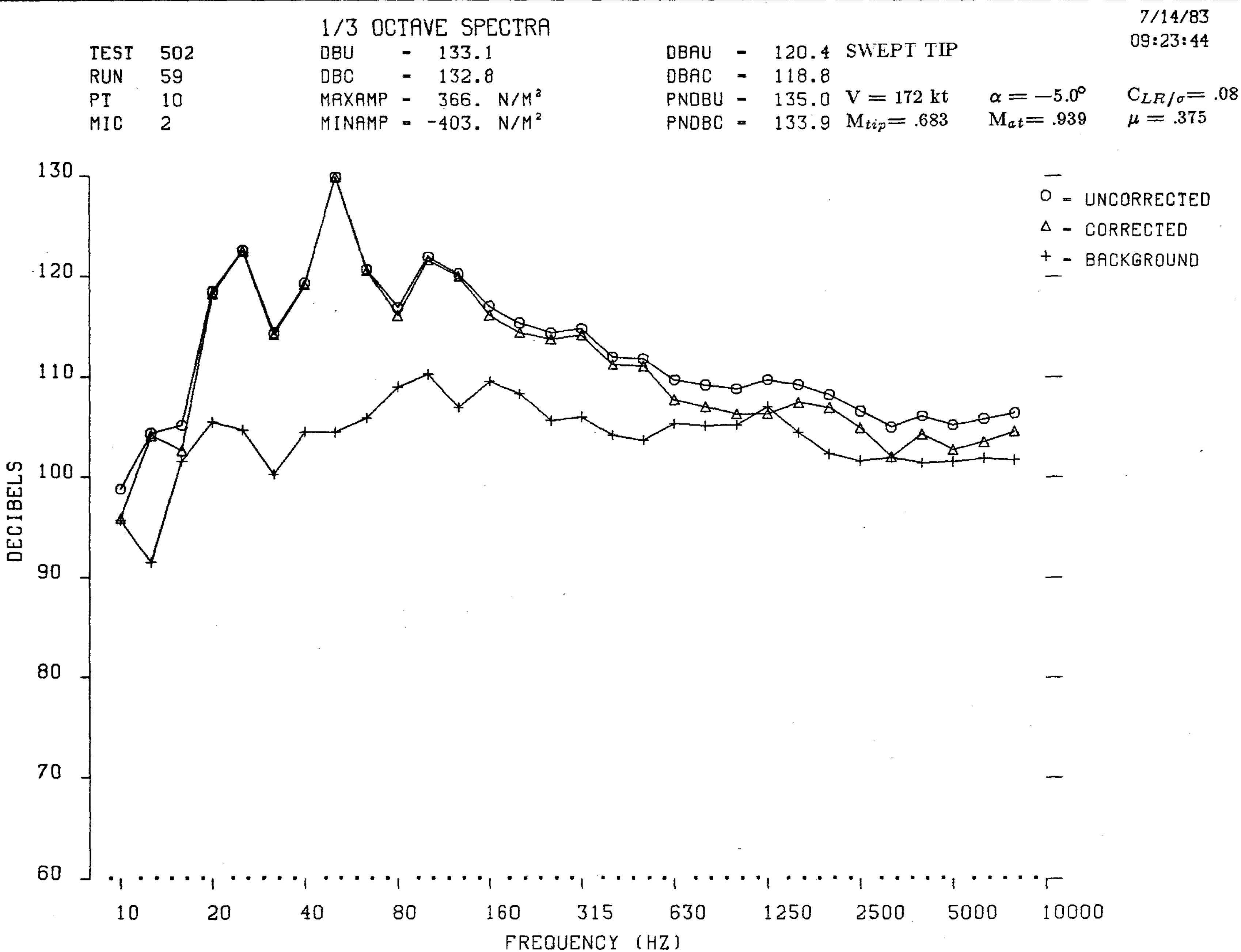

Figure D2(y). One-Third Octave Specta for The Swept Tip Rotor.

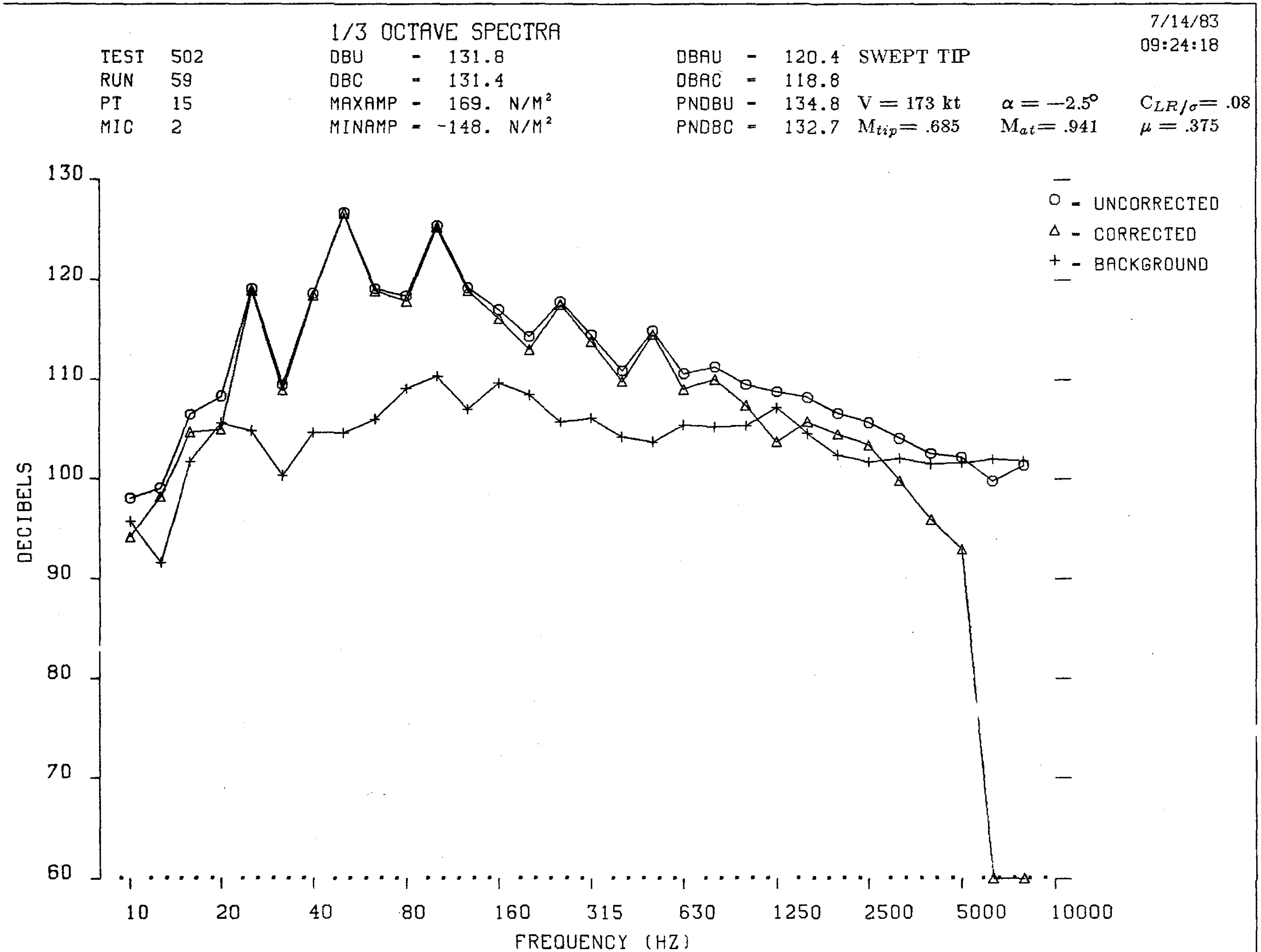

Figure D2(z). One-Third Octave Specta for The Swept Tip Rotor.

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09:24:29

1/3 OCTAVE SPECTRA

TEST 502	DBU - 132.8	DBAU - 123.8	SWEPT TIP		
RUN 59	DBC - 132.6	DBAC - 123.3			
PT 15	MAXAMP - 308. N/M^2	PNDBU - 137.6	$V = 173$ kt	$\alpha = -2.5^\circ$	$C_{LR/\sigma} = .08$
MIC 3	MINAMP - -211. N/M^2	PNDBC - 137.0	$M_{tip} = .685$	$M_{at} = .941$	$\mu = .375$

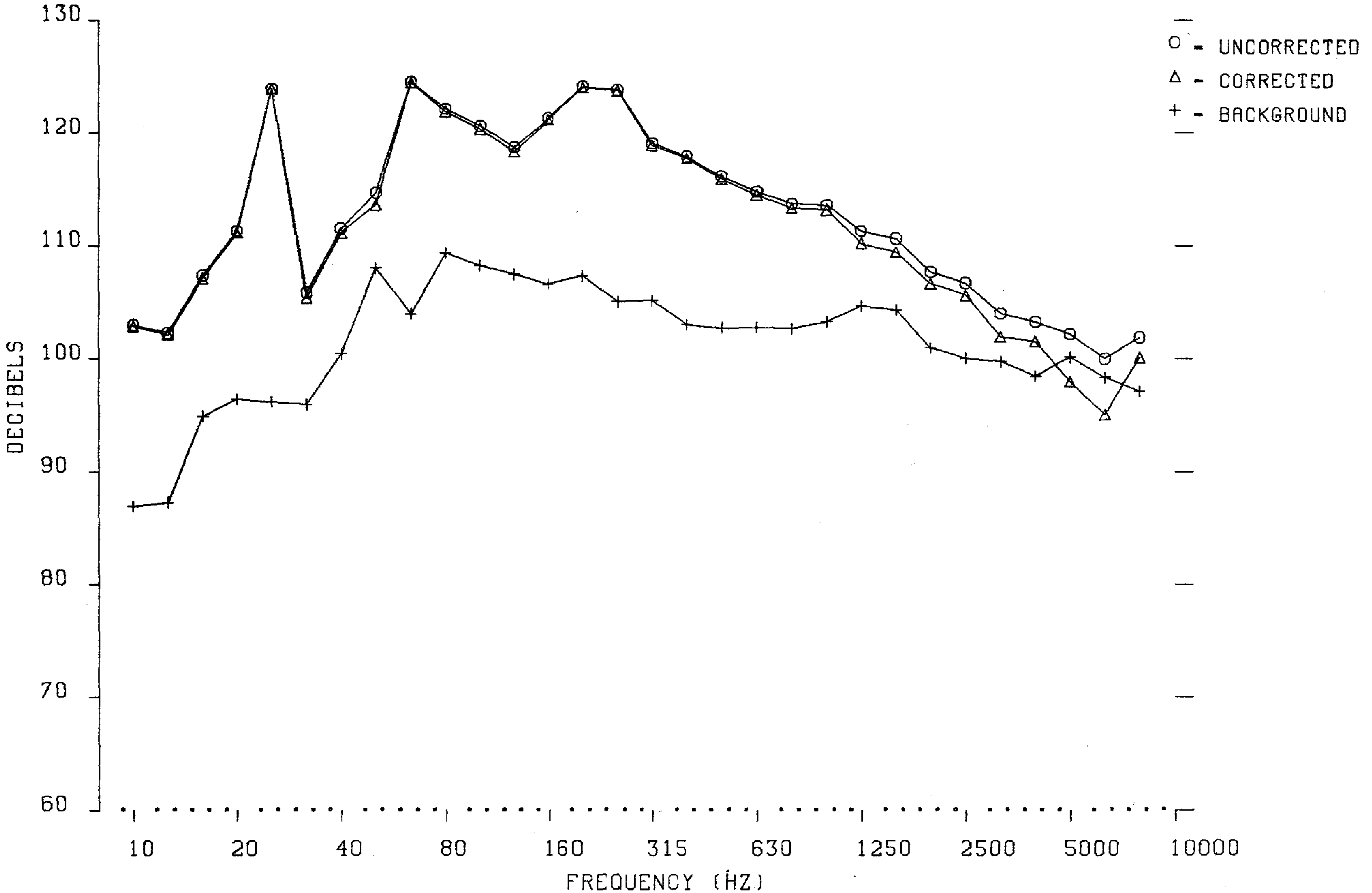

Figure D2(aa). One-Third Octave Specta for The Swept Tip Rotor.

1/3 OCTAVE SPECTRA

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09:24:53

TEST 502	DBU - 132.7	DBAU - 119.6	SWEPT TIP		
RUN 59	DBC - 132.5	DBAC - 117.4			
PT 17	MAXAMP - 183. N/M²	PNDBU - 134.2	$V = 173$ kt	$\alpha = -7.5^\circ$	$C_{LR/\sigma} = .07$
MIC 2	MINAMP - -204. N/M²	PNDBC - 132.7	$M_{tip} = .686$	$M_{at} = .924$	$\mu = .374$

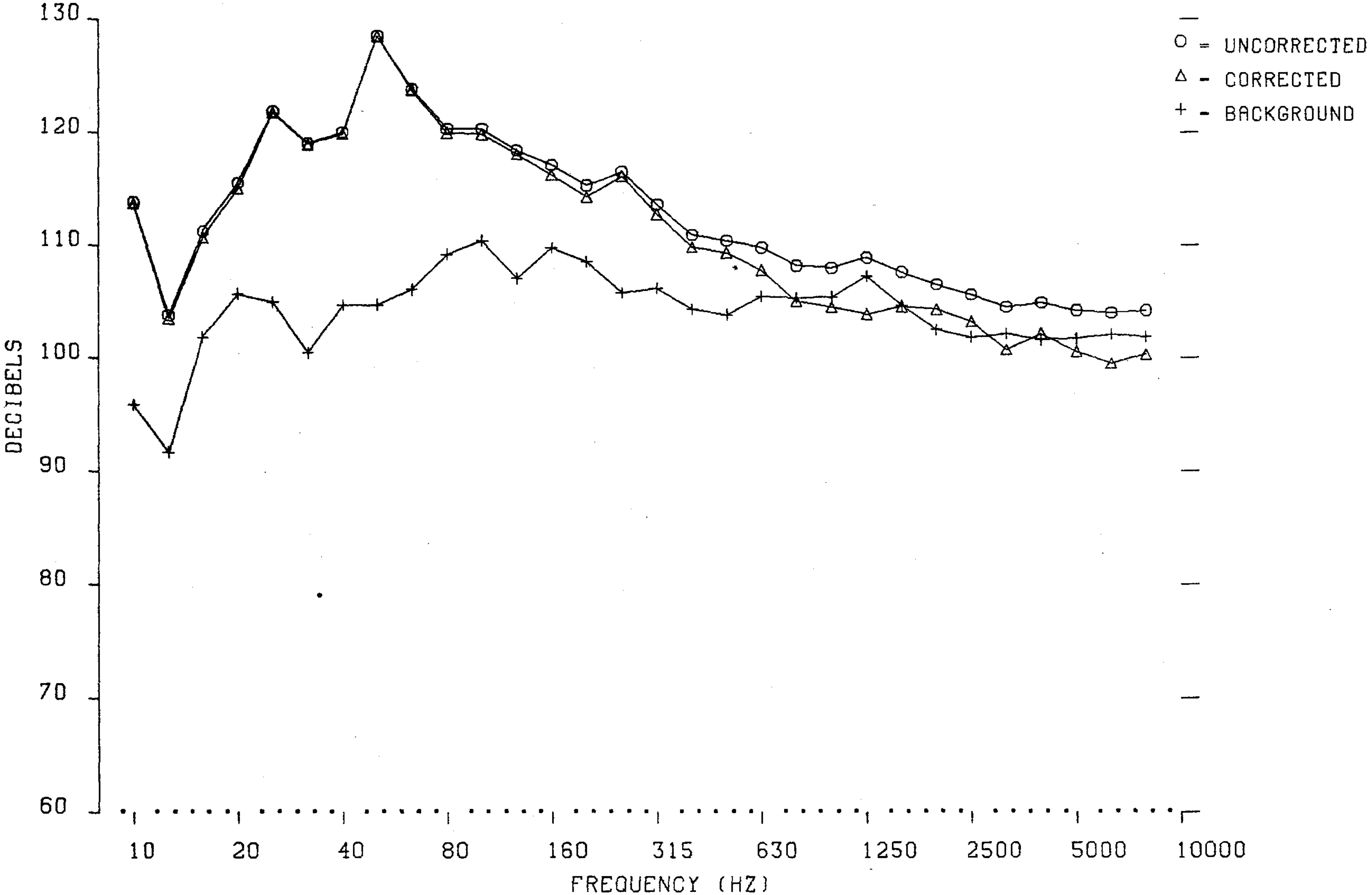


Figure D2(bb). One-Third Octave Specta for The Swept Tip Rotor.

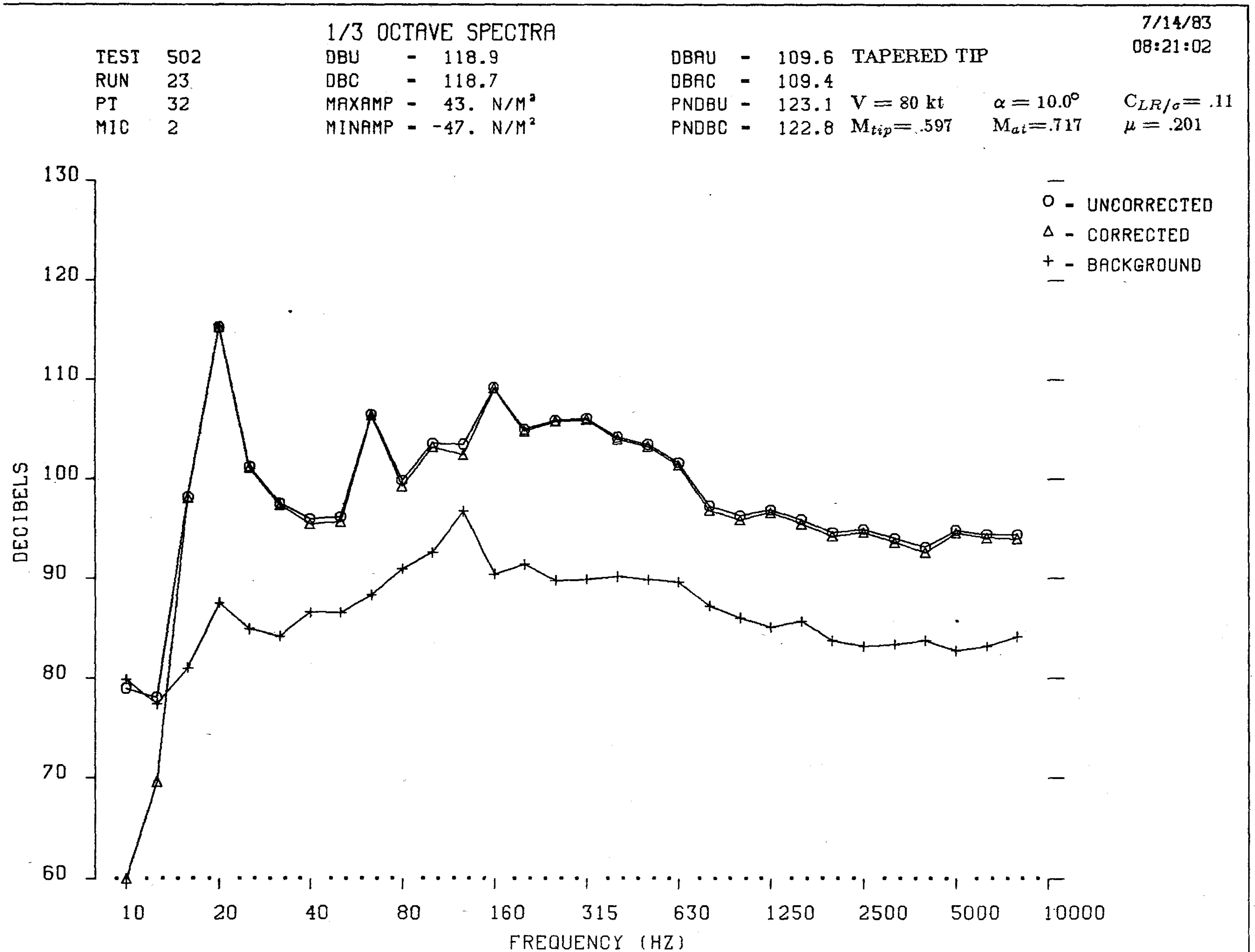


Figure D3(a). One-Third Octave Specta for The Tapered Tip Rotor.

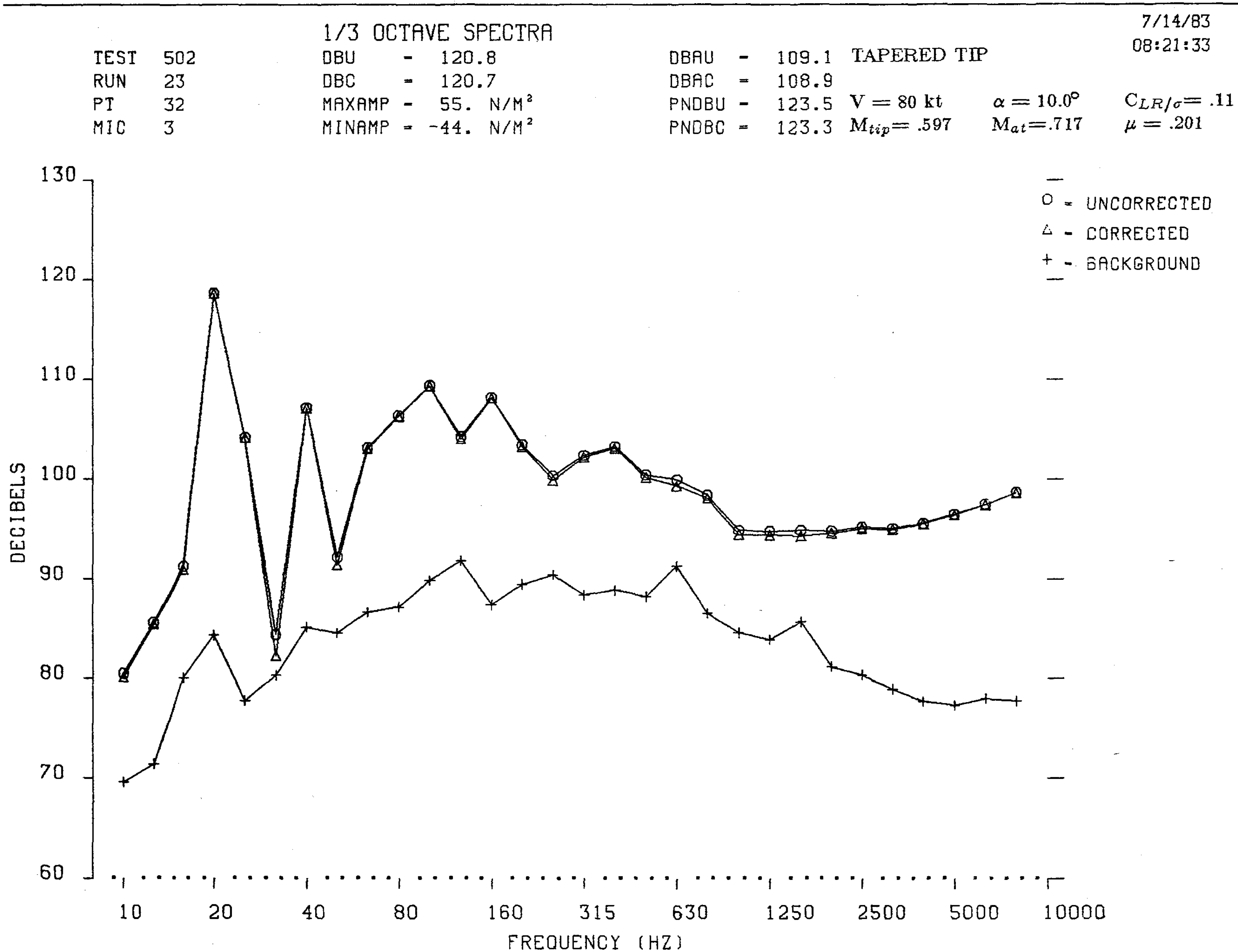


Figure D3(b). One-Third Octave Specta for The Tapered Tip Rotor.

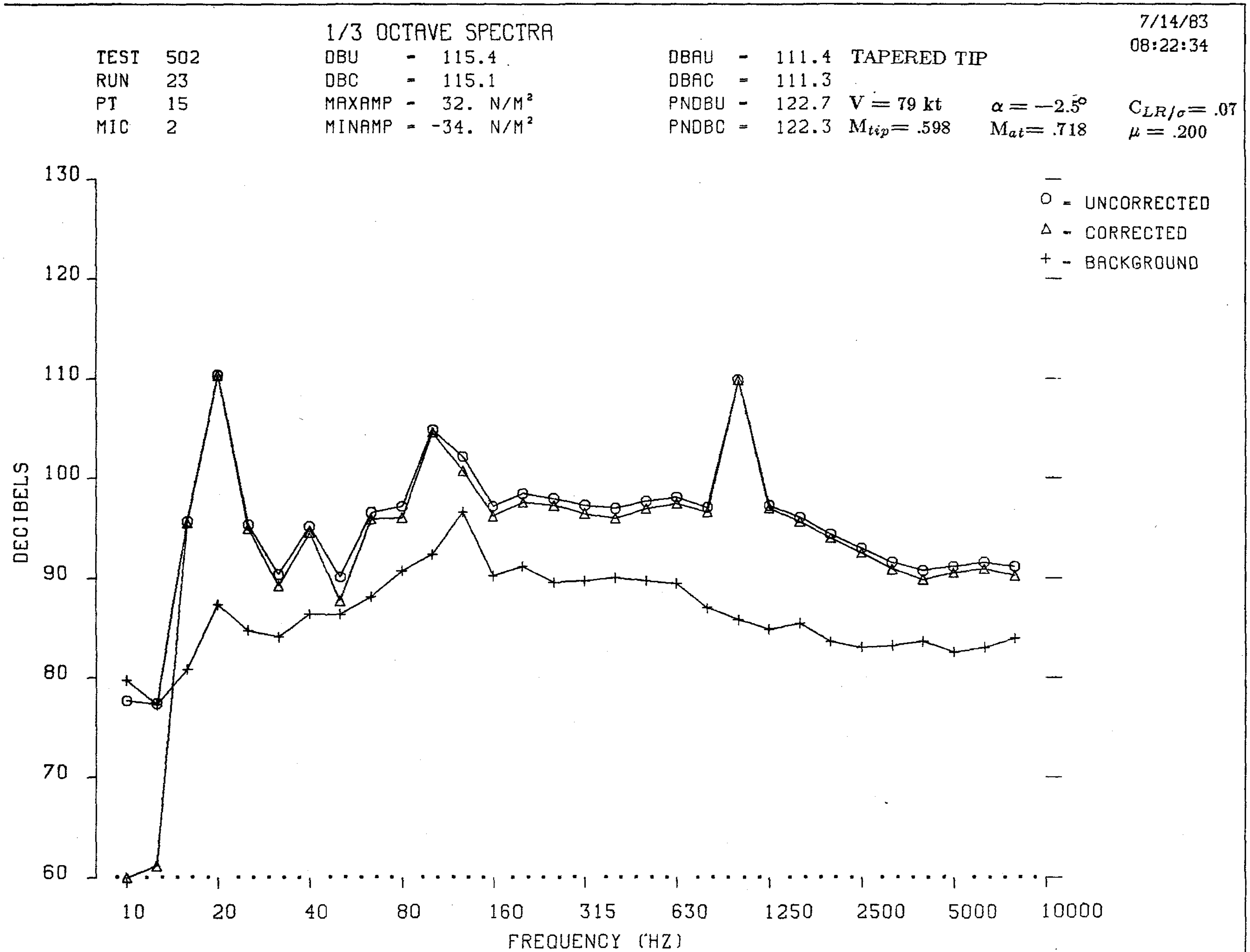


Figure D3(c). One-Third Octave Specta for The Tapered Tip Rotor.

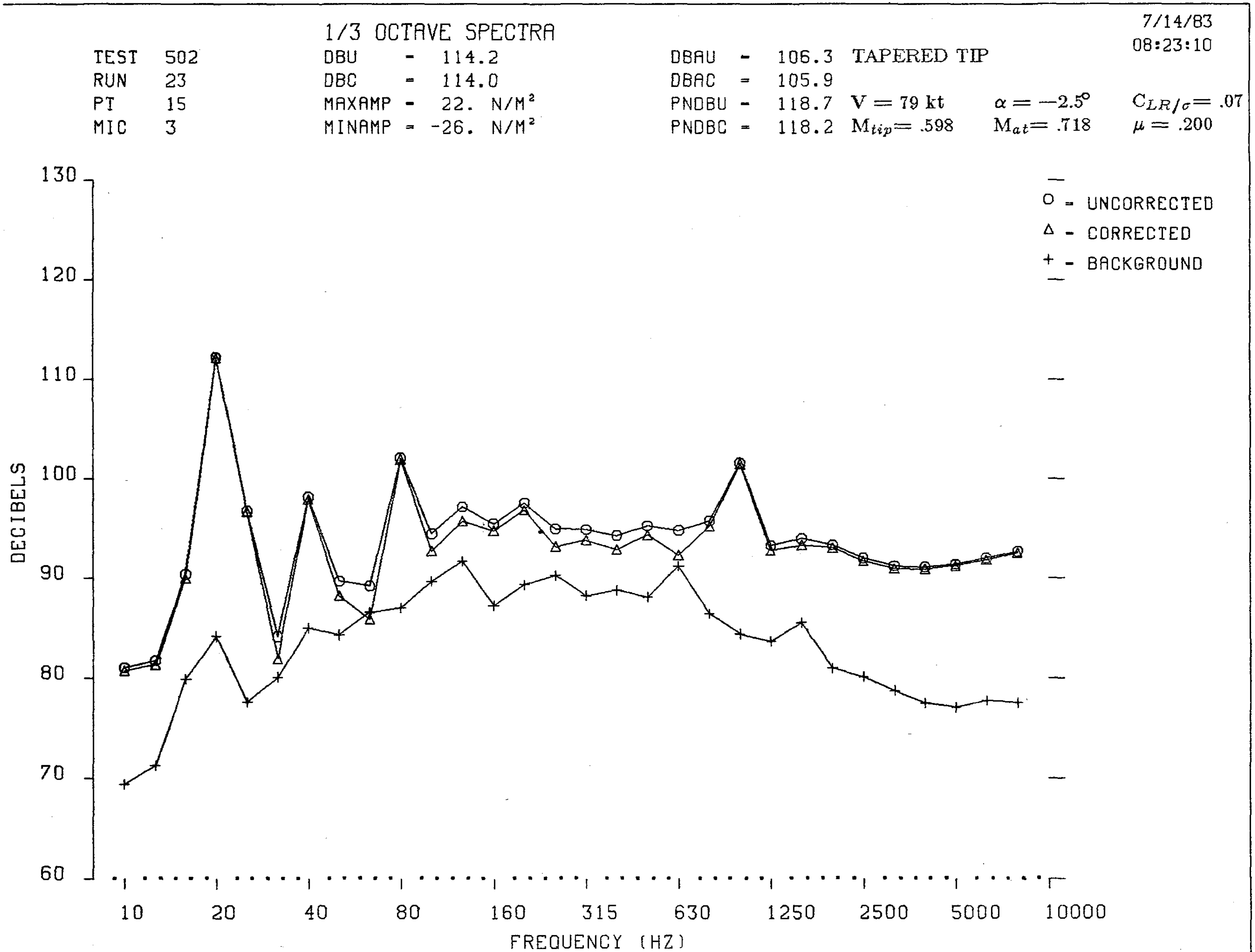


Figure D3(d). One-Third Octave Specta for The Tapered Tip Rotor.

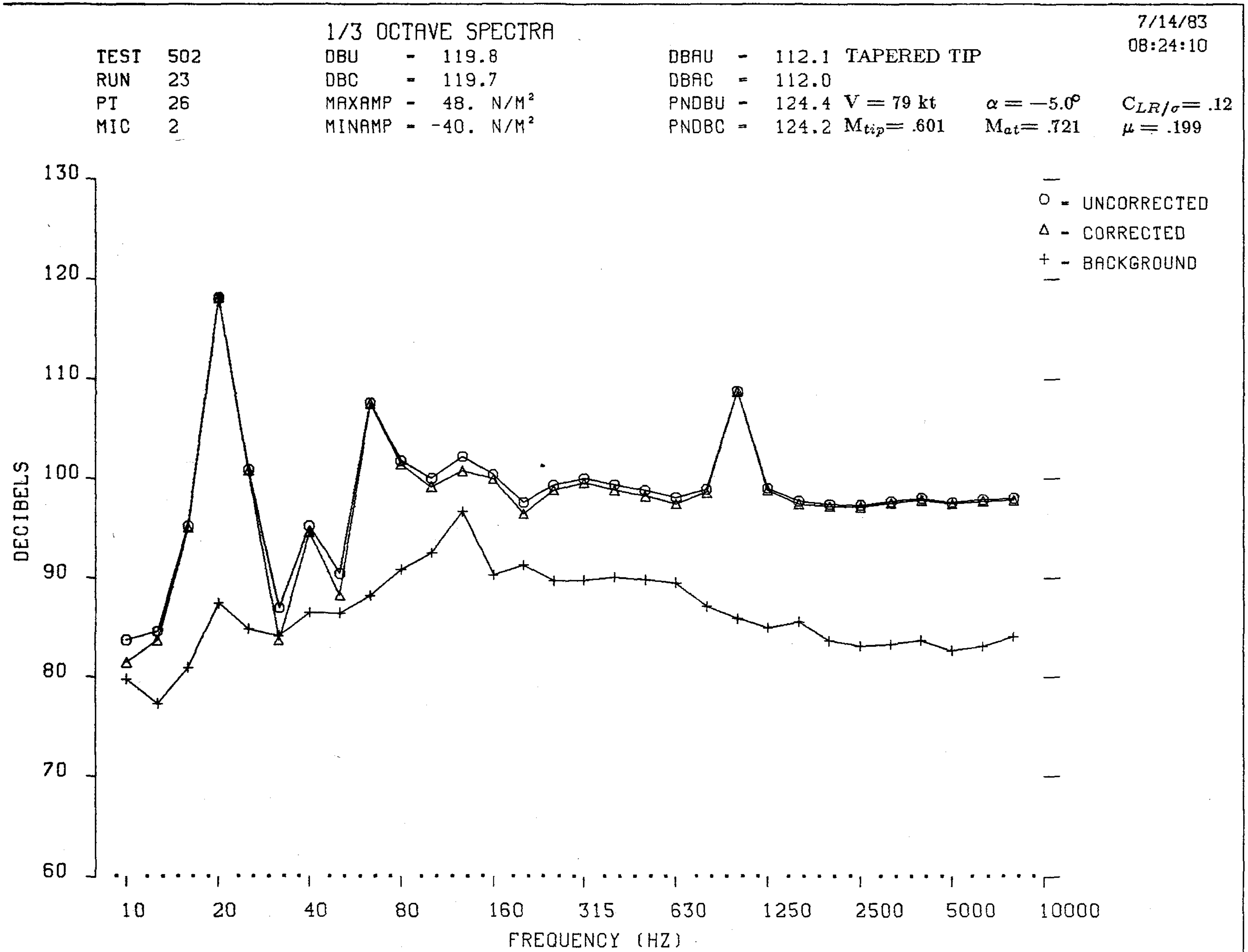


Figure D3(e). One-Third Octave Specta for The Tapered Tip Rotor.

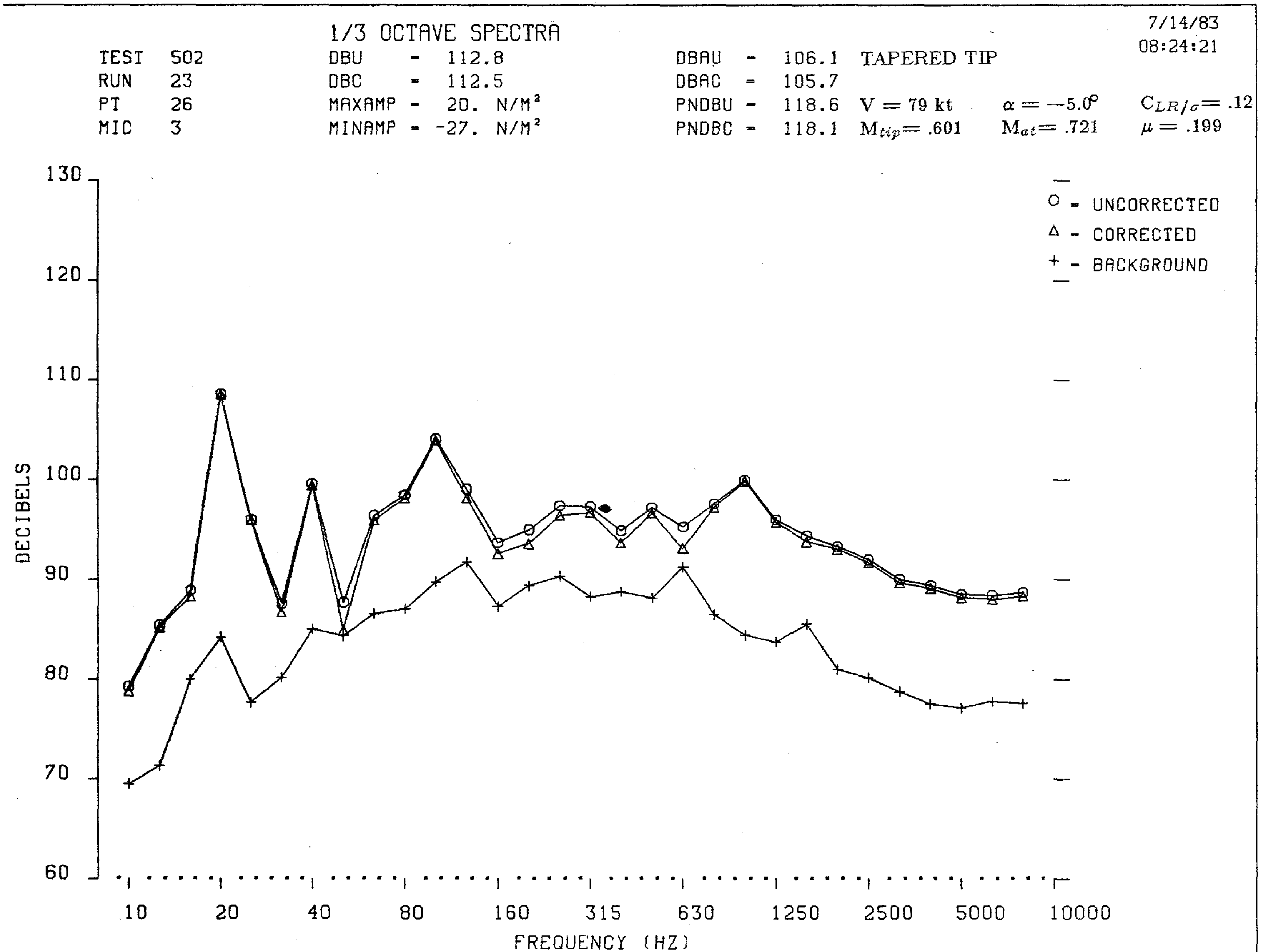


Figure D3(f). One-Third Octave Specta for The Tapered Tip Rotor.

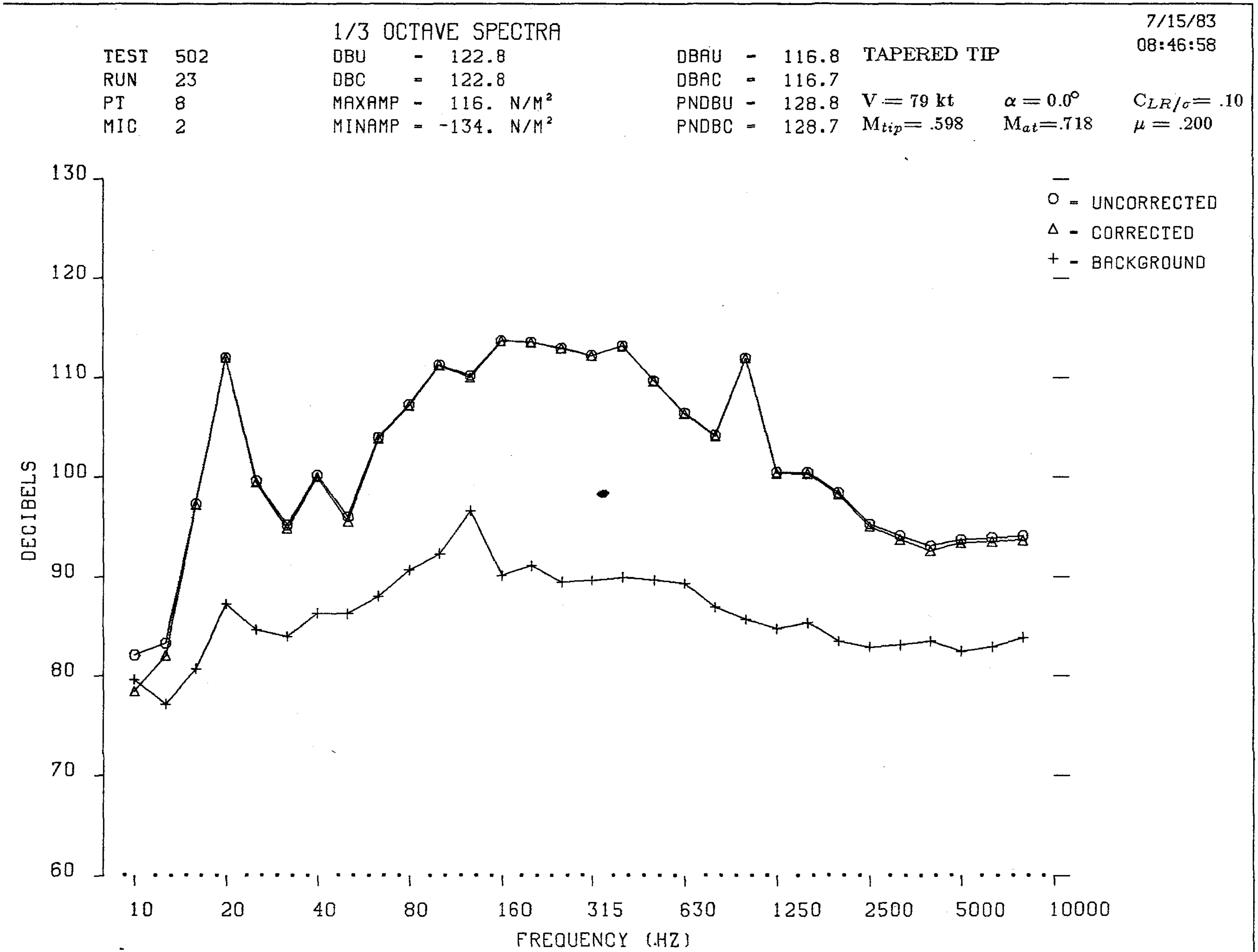


Figure D3(g). One-Third Octave Specta for The Tapered Tip Rotor.

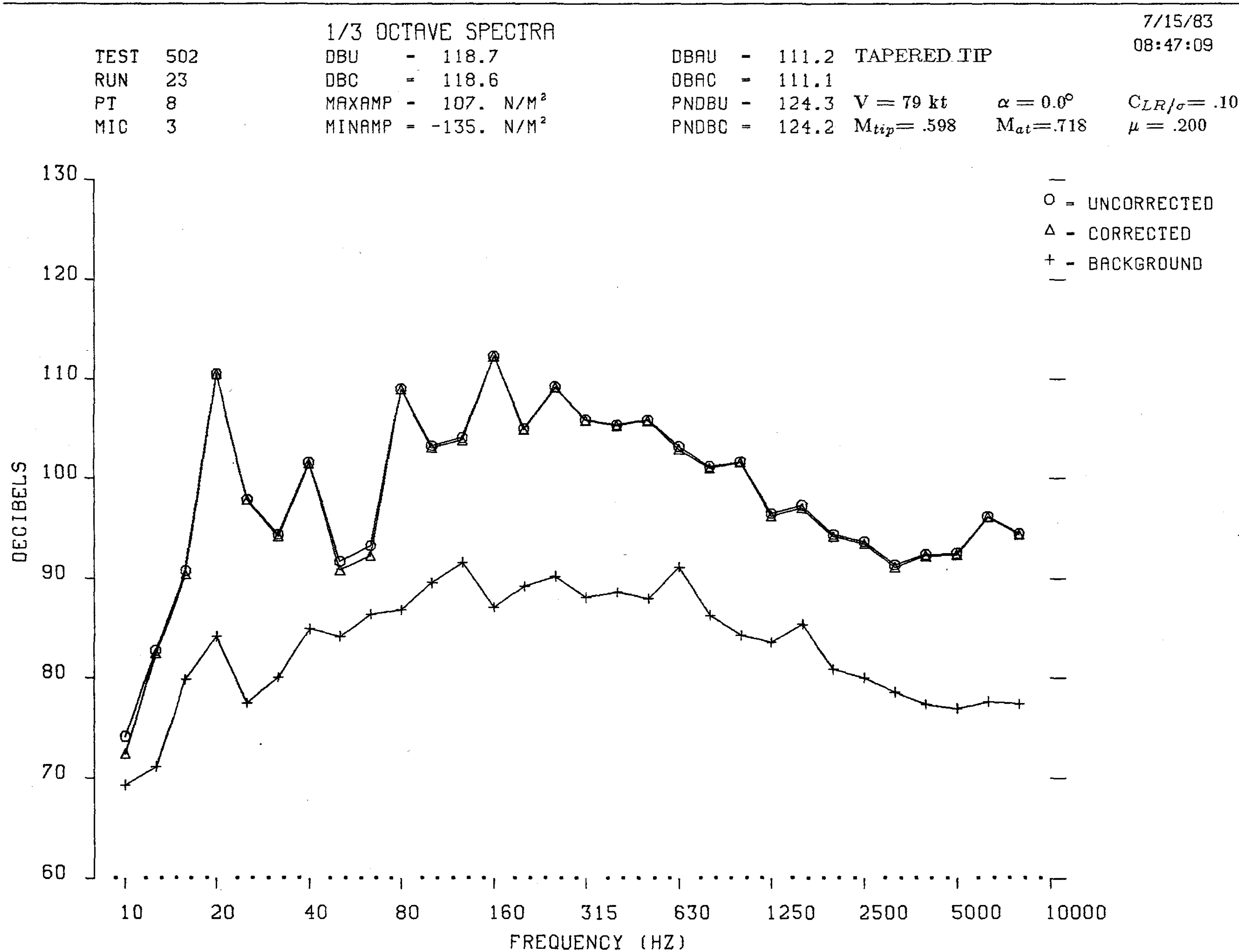


Figure D3(h). One-Third Octave Specta for The Tapered Tip Rotor.

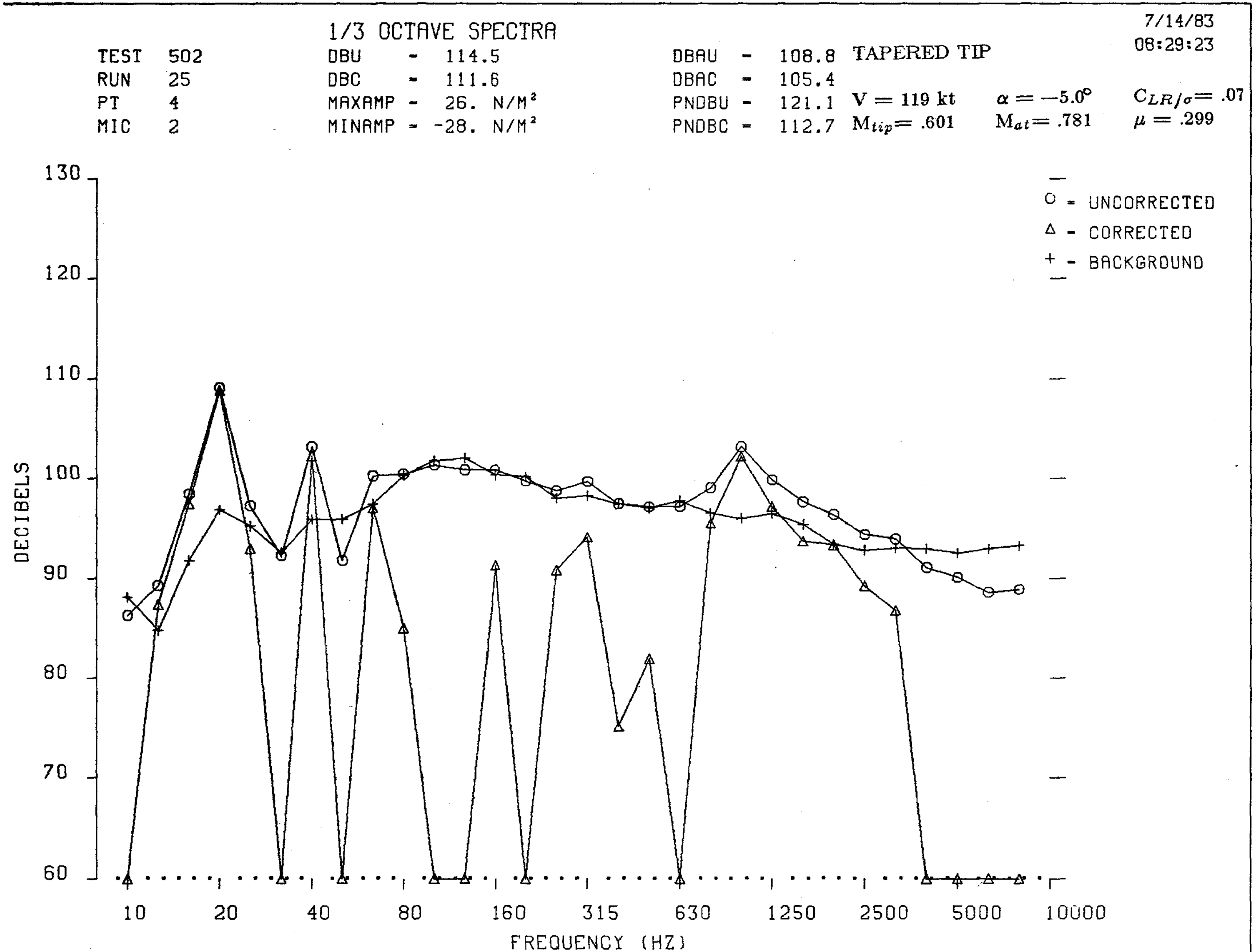


Figure D3(i). One-Third Octave Specta for The Tapered Tip Rotor.

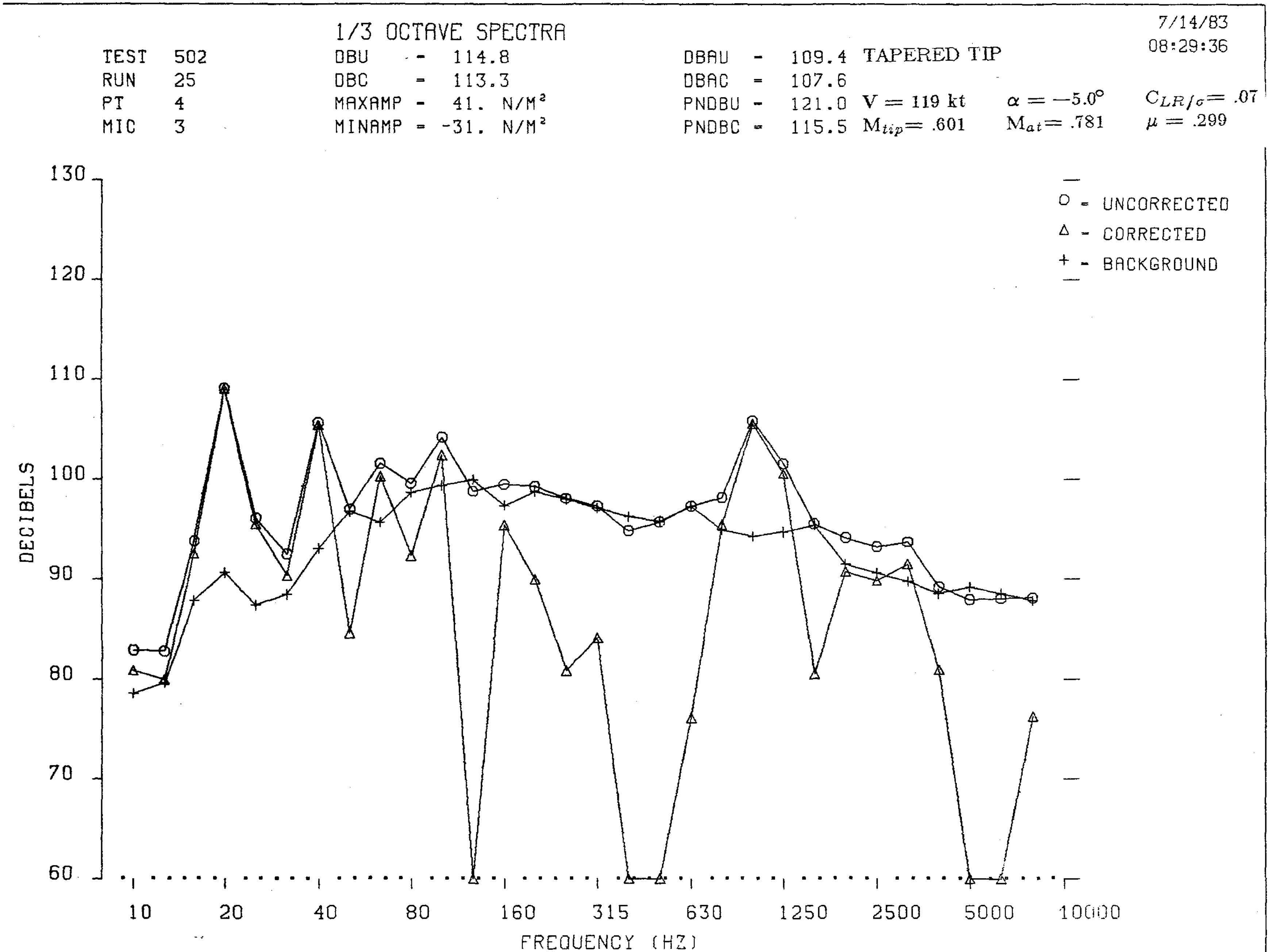


Figure D3(j). One-Third Octave Specta for The Tapered Tip Rotor.

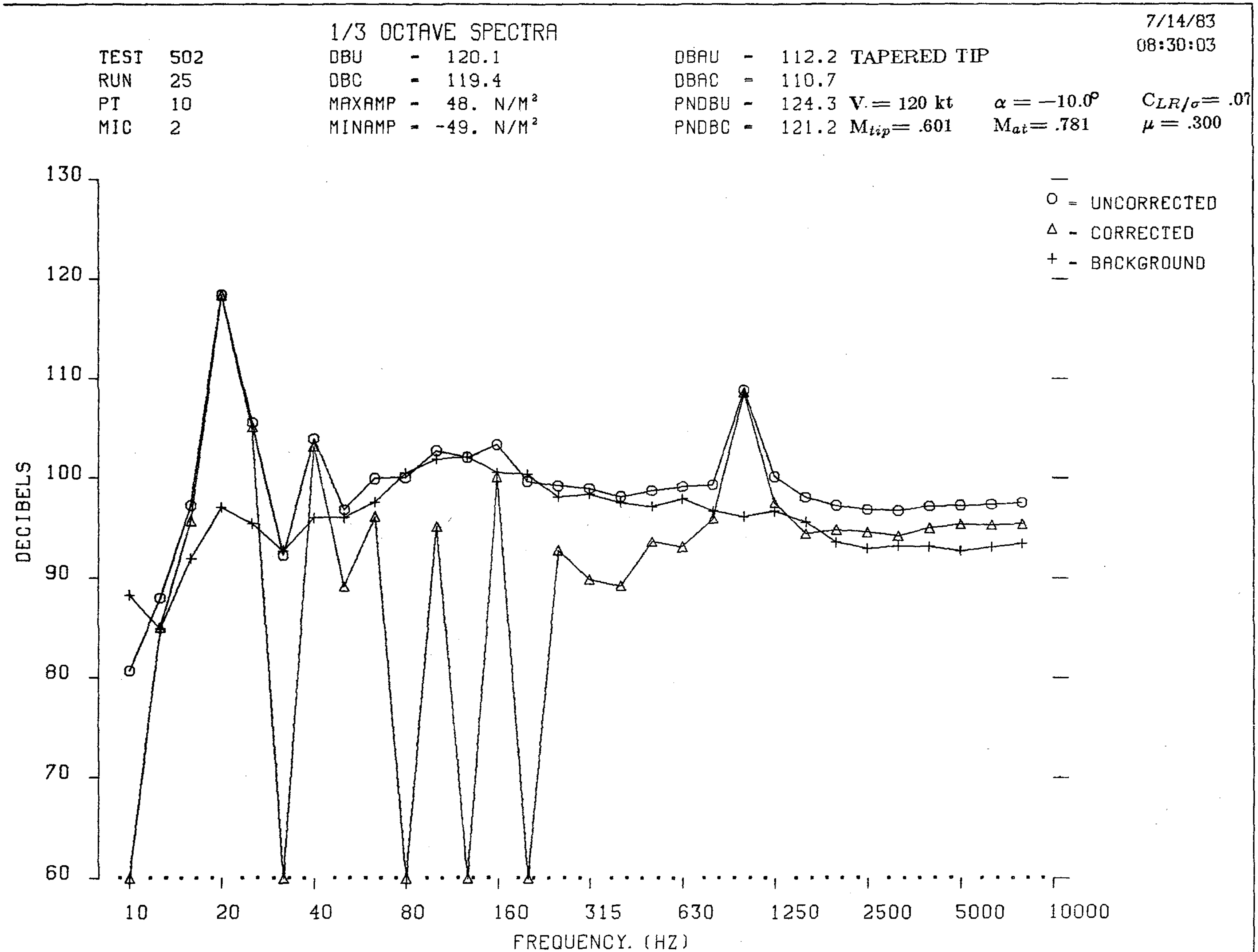


Figure D3(k). One-Third Octave Specta for The Tapered Tip Rotor.

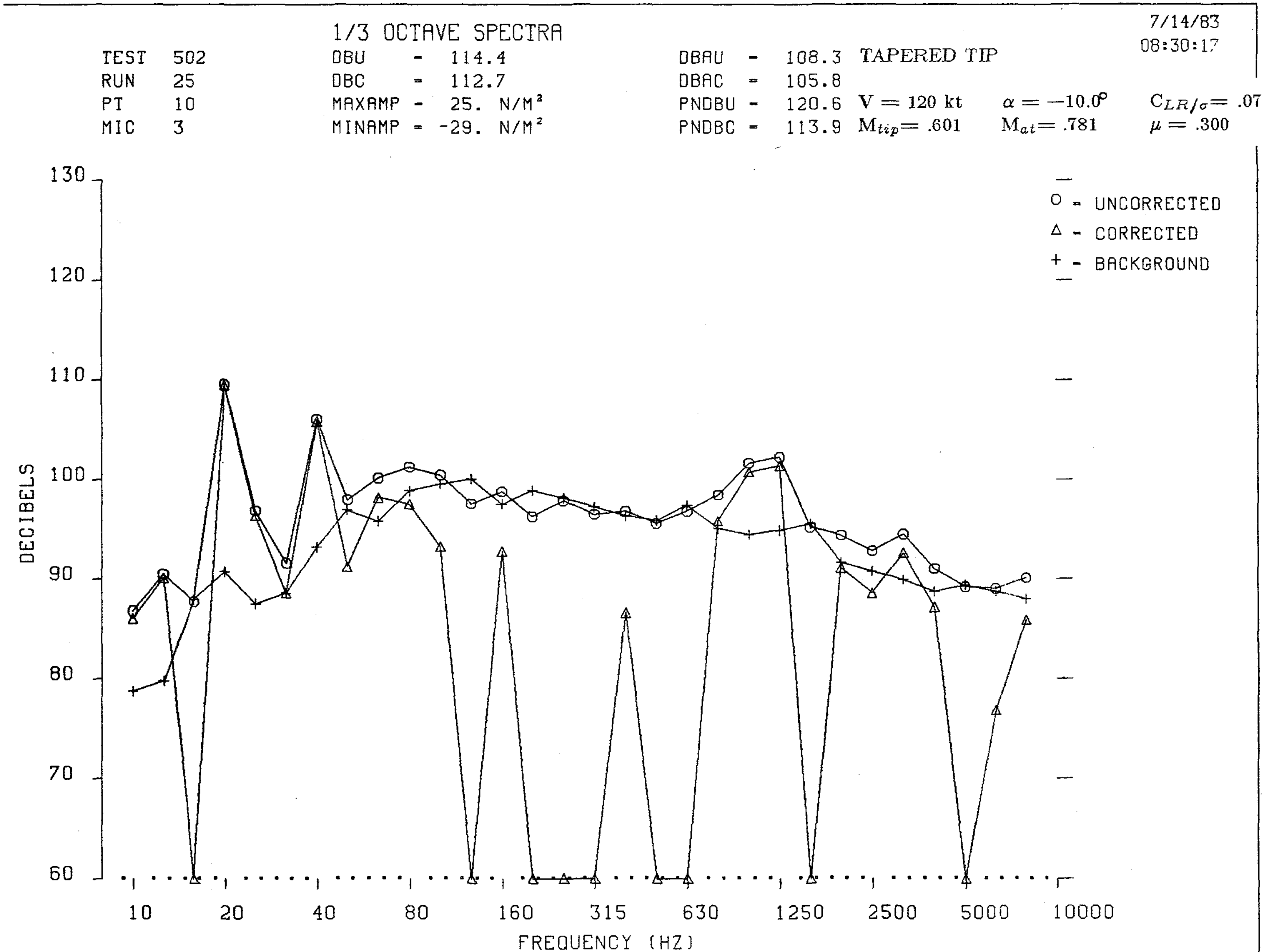


Figure D3(l). One-Third Octave Specta for The Tapered Tip Rotor.

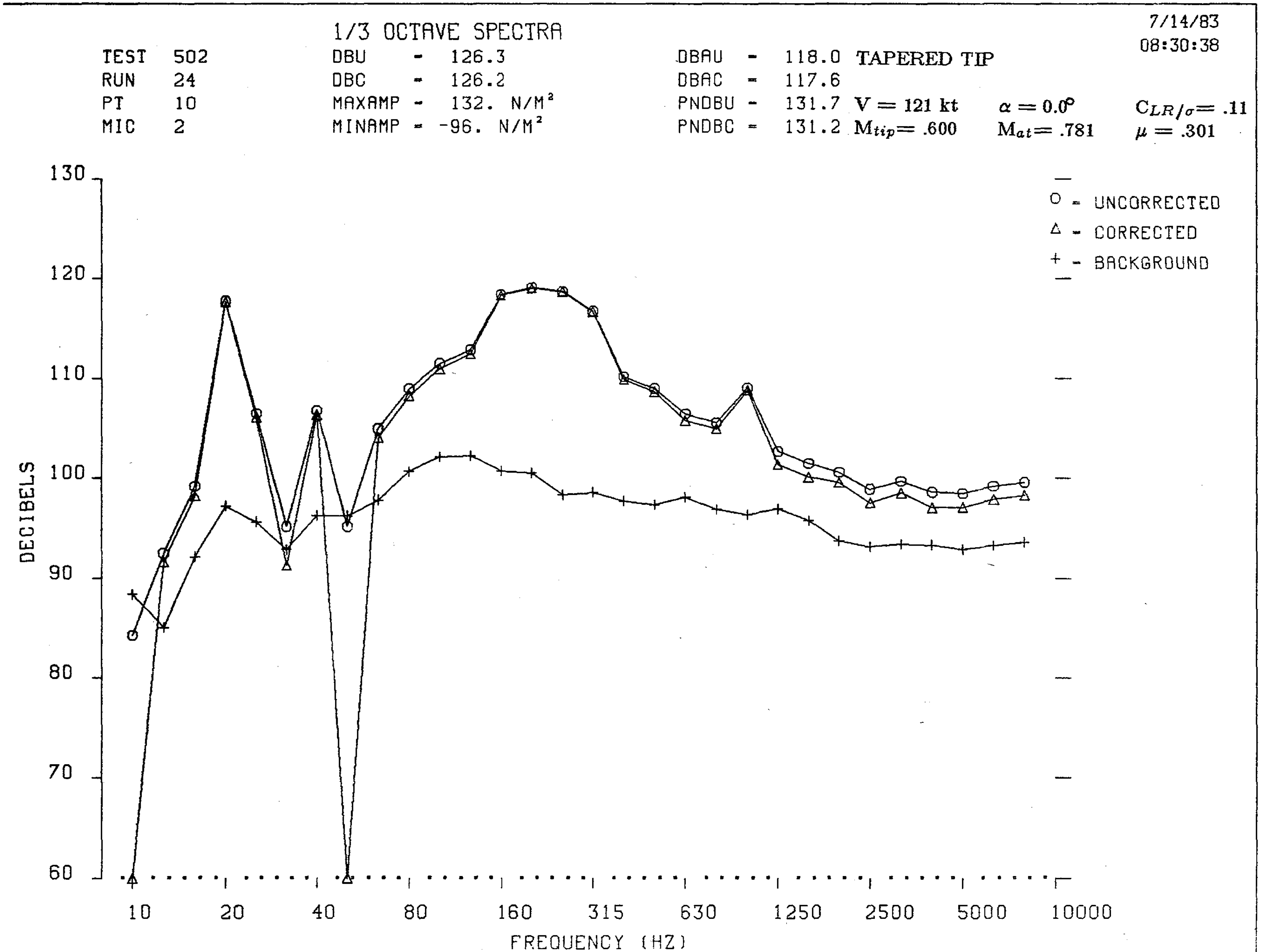


Figure D3(m). One-Third Octave Specta for The Tapered Tip Rotor.

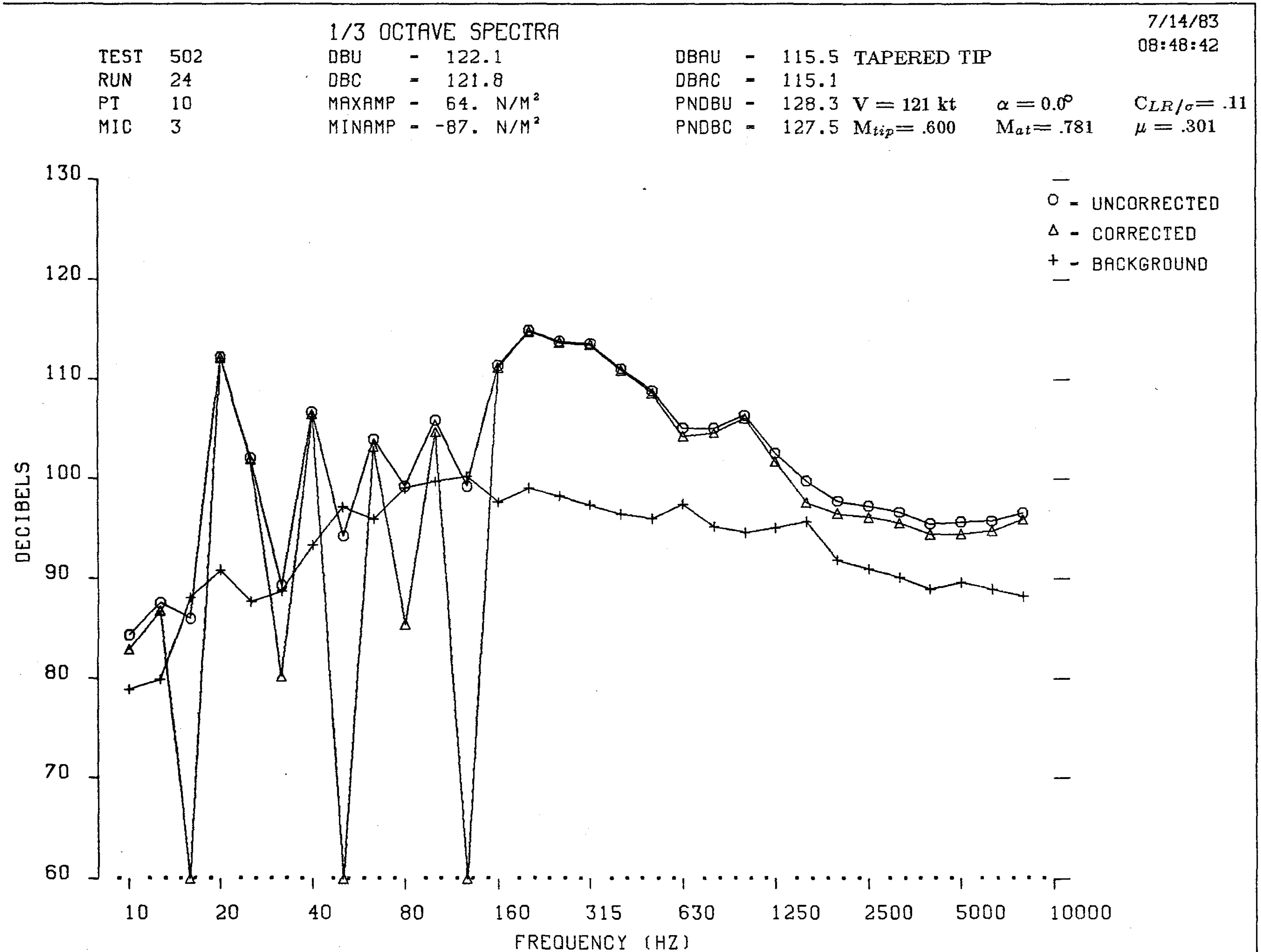


Figure D3(n). One-Third Octave Specta for The Tapered Tip Rotor.

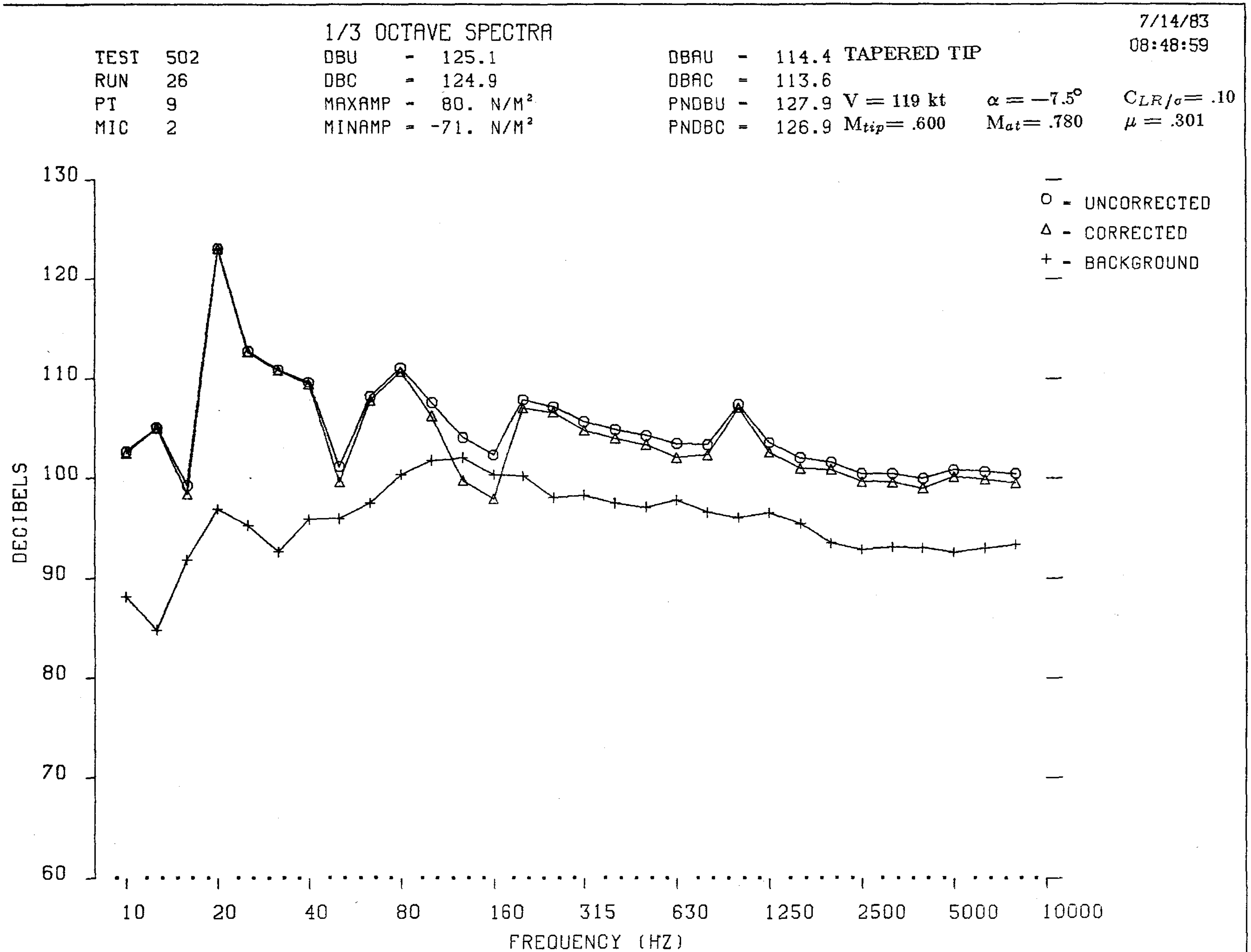


Figure D3(o). One-Third Octave Specta for The Tapered Tip Rotor.

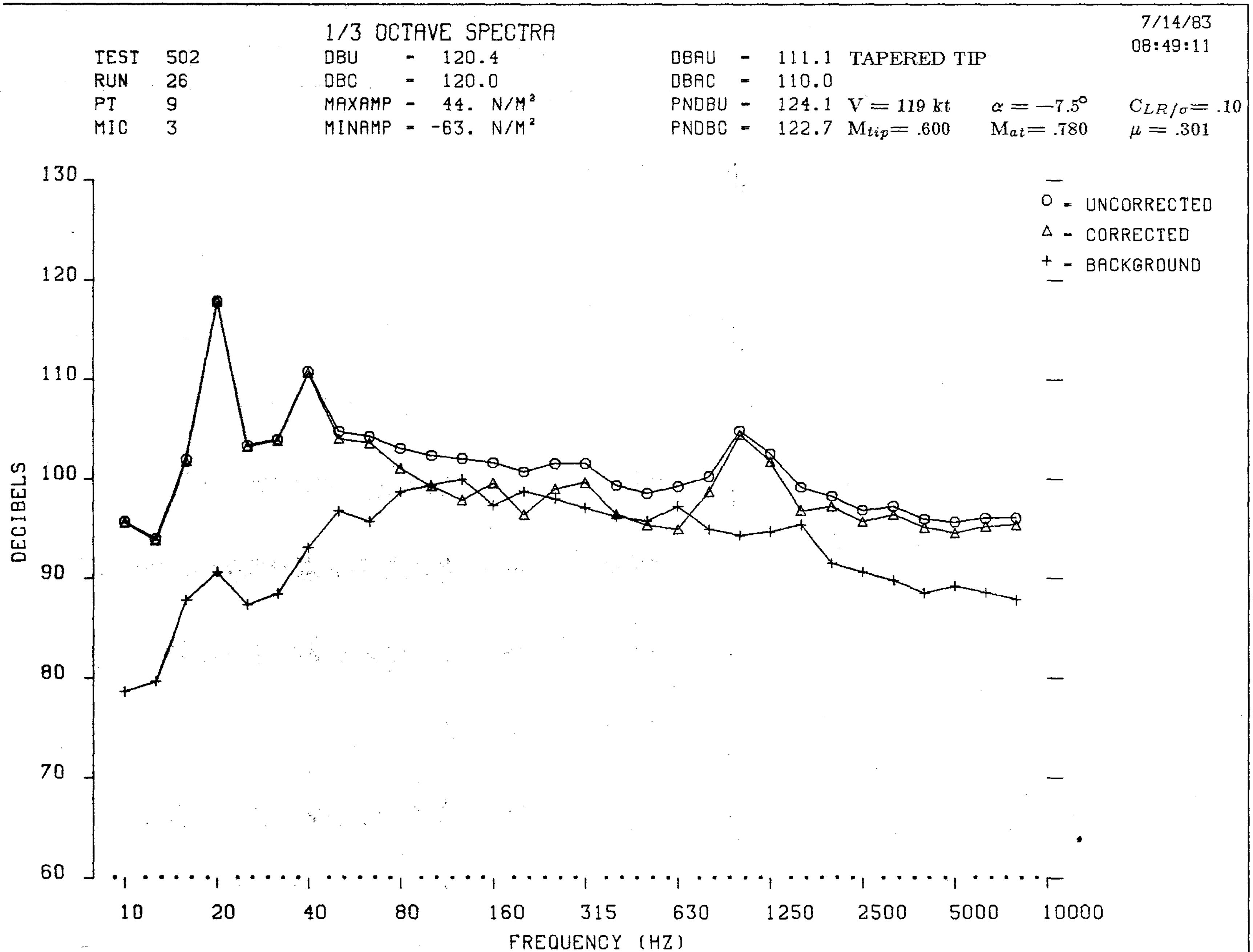


Figure D3(p). One-Third Octave Specta for The Tapered Tip Rotor.

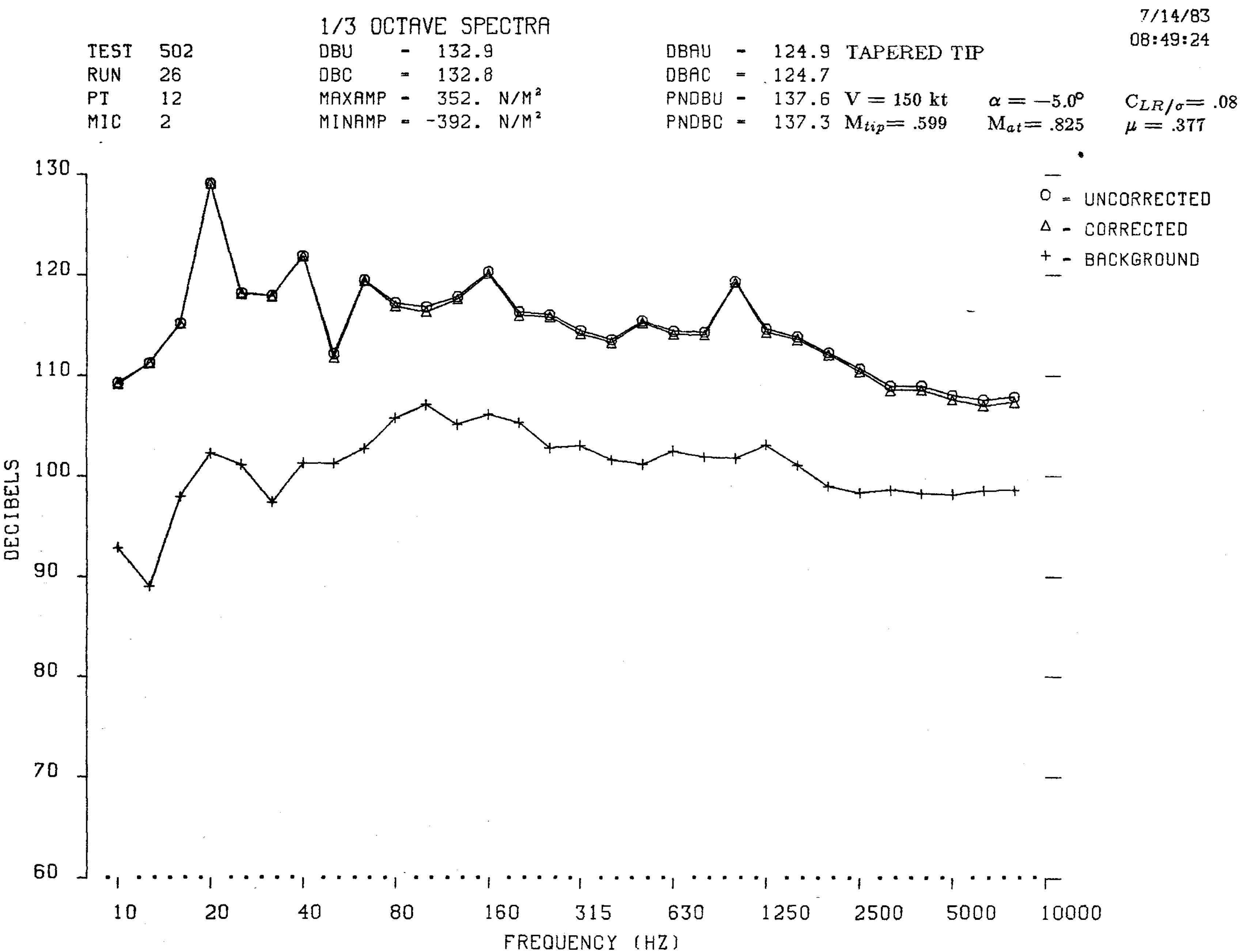


Figure D3(q). One-Third Octave Specta for The Tapered Tip Rotor.

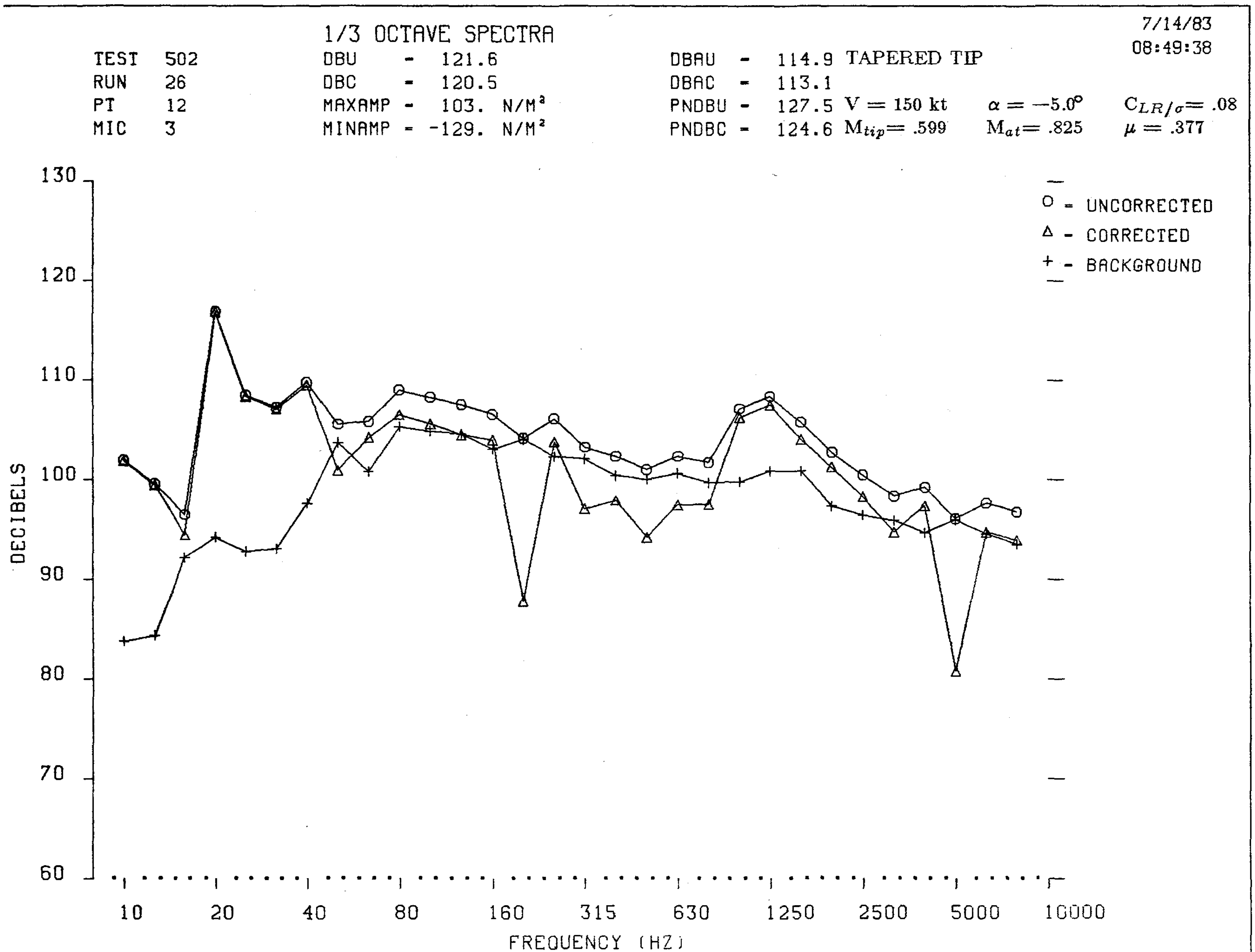


Figure D3(r). One-Third Octave Specta for The Tapered Tip Rotor.

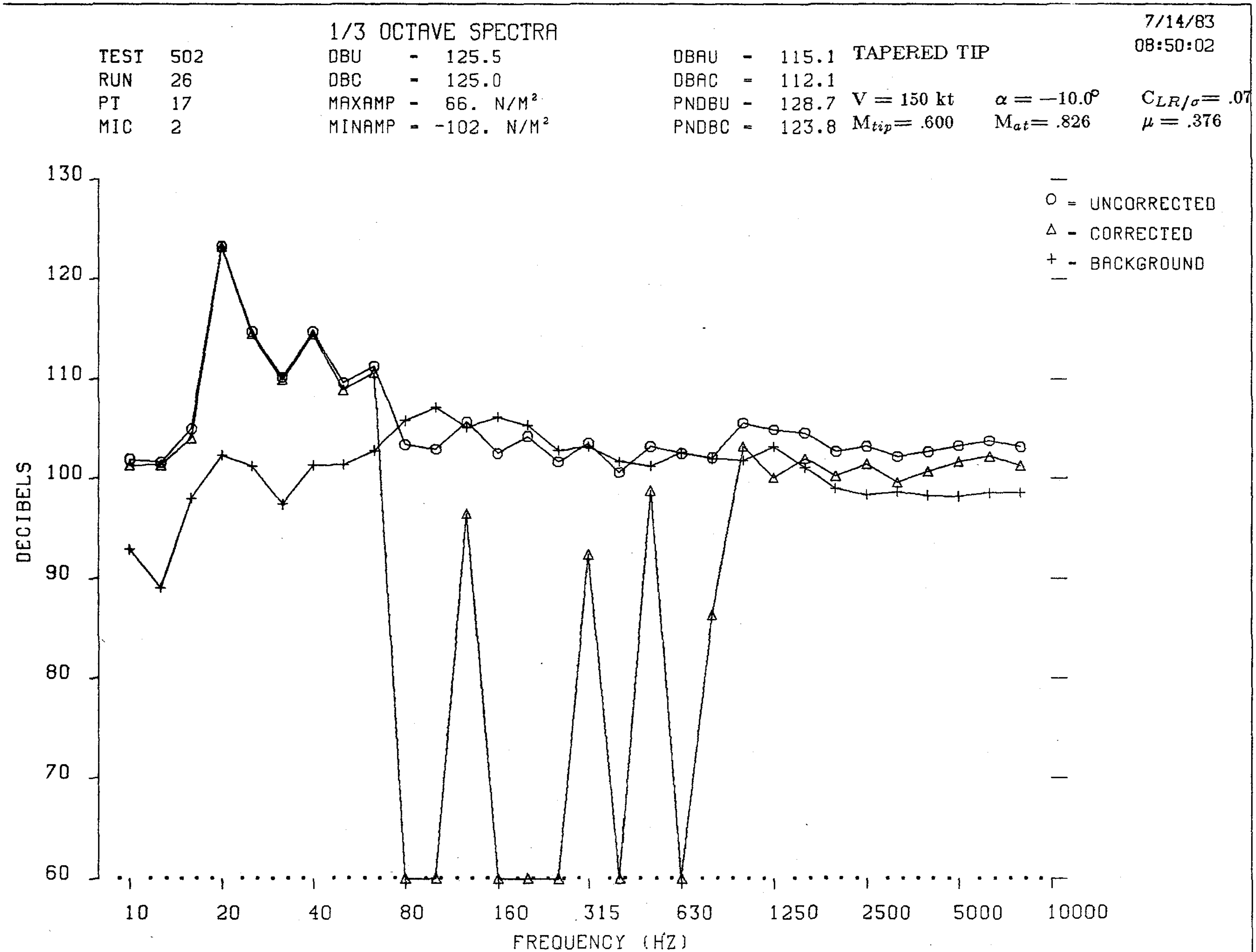


Figure D3(s). One-Third Octave Specta for The Tapered Tip Rotor.

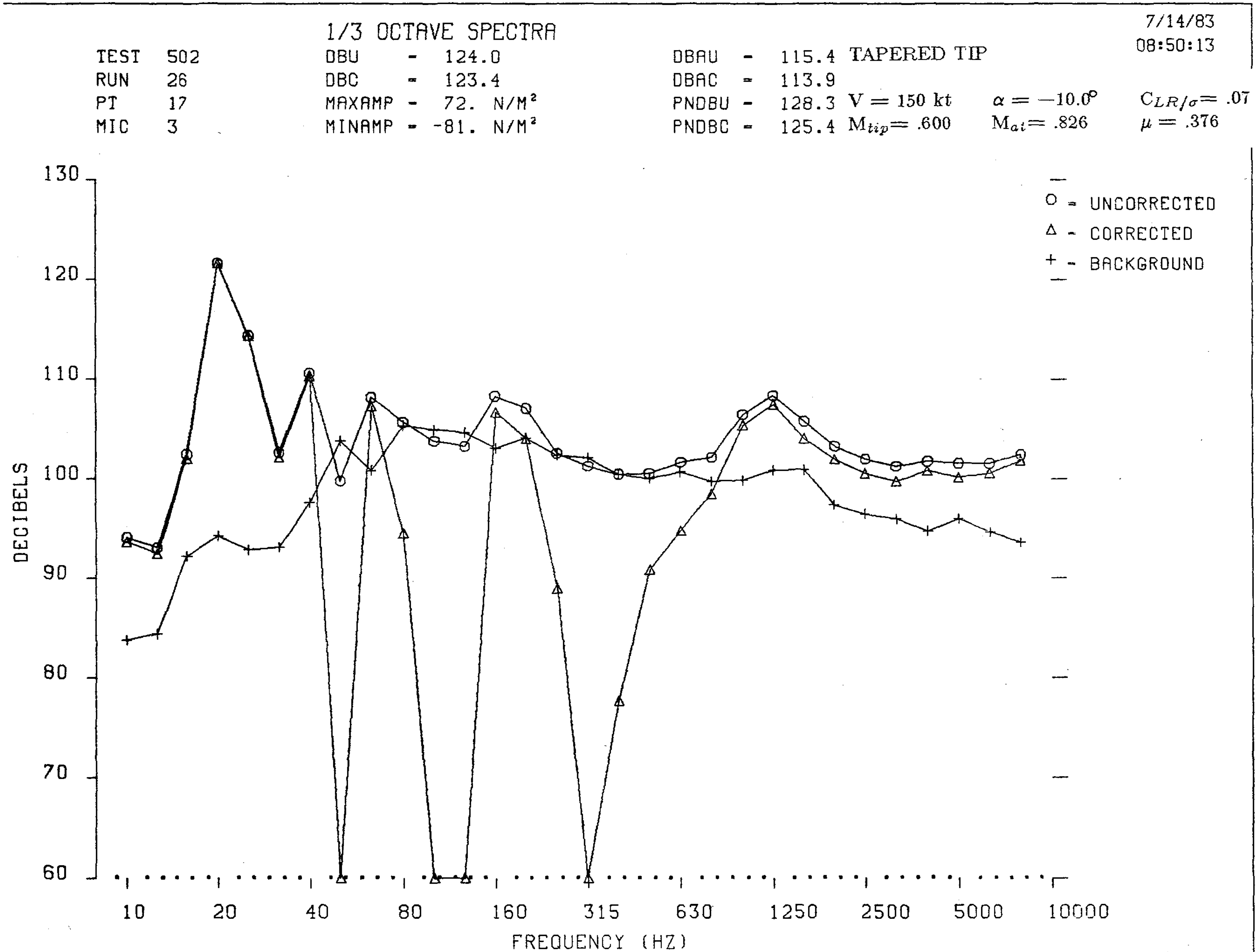


Figure D3(t). One-Third Octave Specta for The Tapered Tip Rotor.

1/3 OCTAVE SPECTRA

7/14/83
08:50:44

TEST 502
RUN 25
PT 19
MIC 2

DBU - 125.0
DBC - 124.2
MAXAMP - 93. N/M²
MINAMP = -102. N/M²

DBAU - 115.2
DBAC = 112.3
PNDBU - 128.6
PNDBC = 124.4

TAPERED TIP

$V = 151$ kt $\alpha = 0.0^{\circ}$ $C_{LR/\sigma} = .10$

$M_{tip} = .601$ $M_{at} = .827$ $\mu = .375$

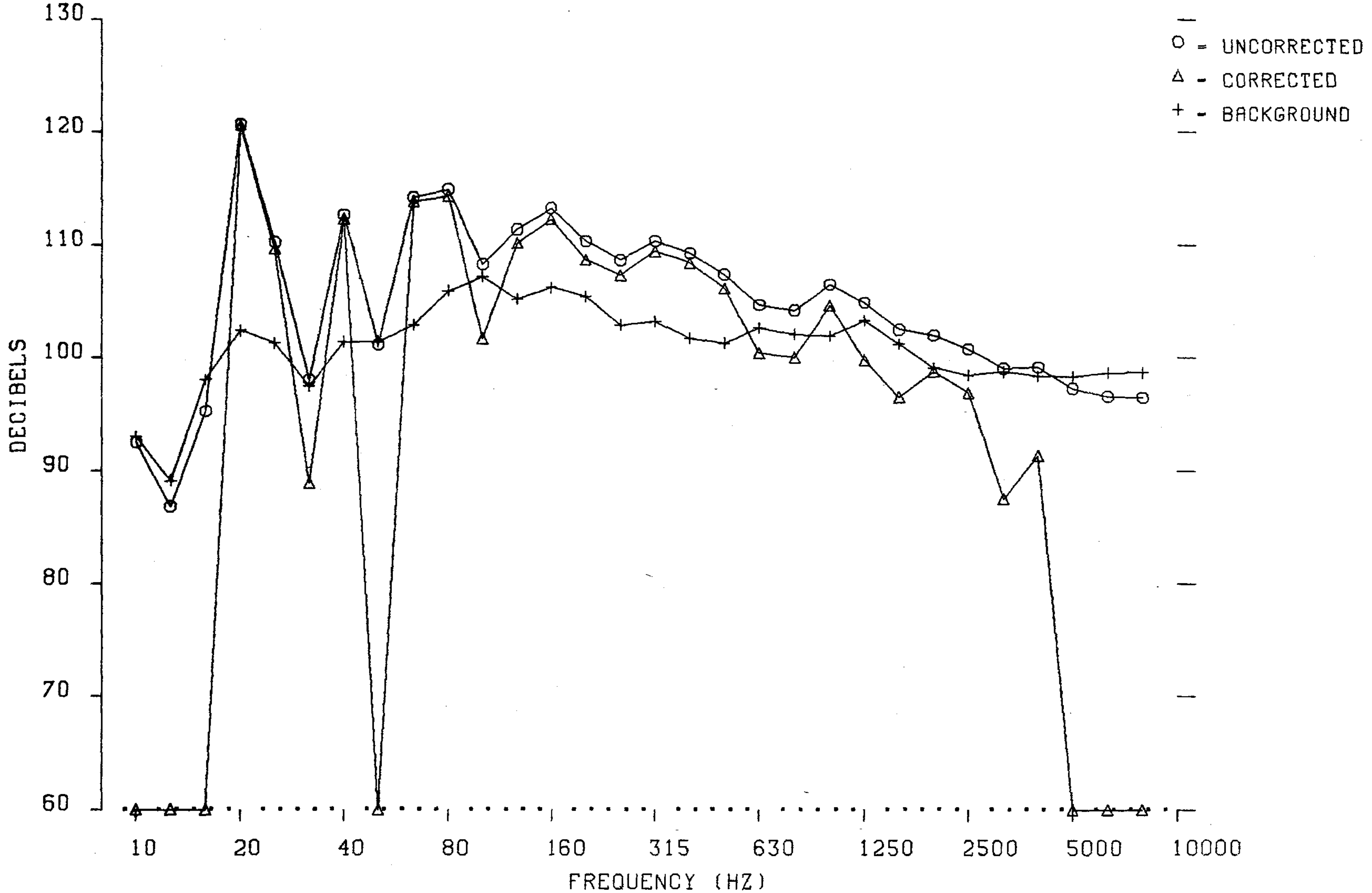


Figure D3(u). One-Third Octave Specta for The Tapered Tip Rotor.

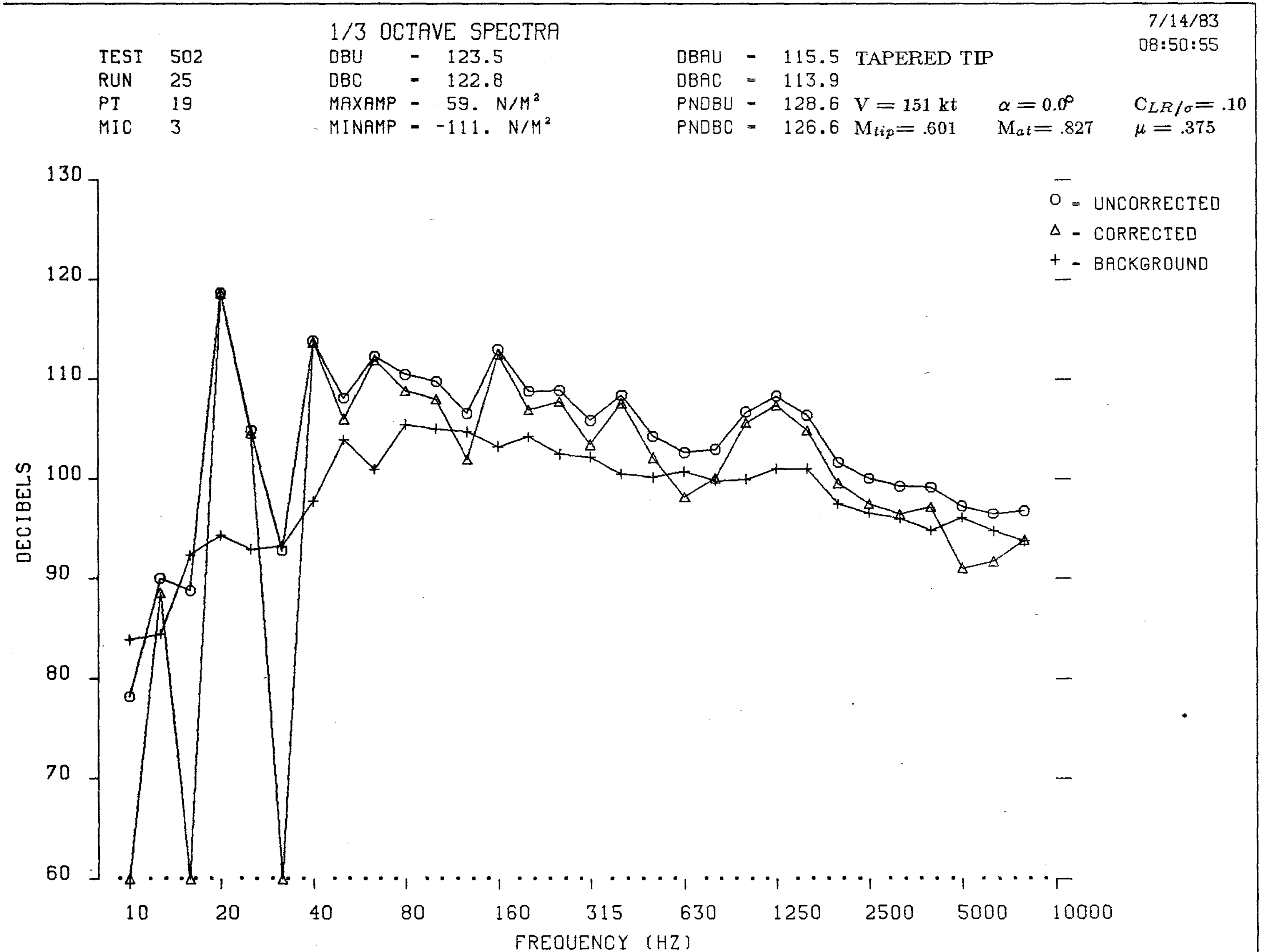


Figure D3(v). One-Third Octave Specta for The Tapered Tip Rotor.

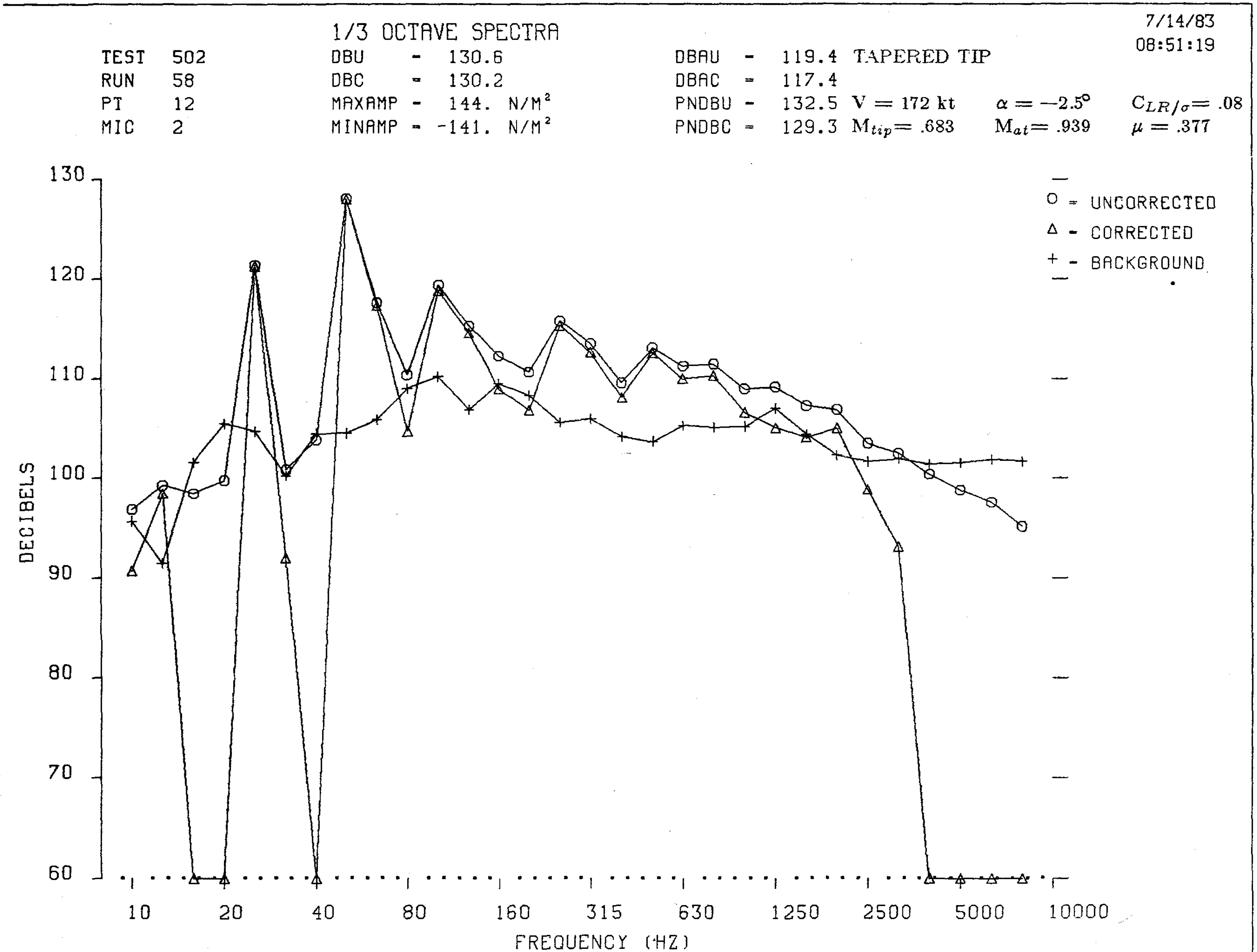


Figure D3(w). One-Third Octave Specta for The Tapered Tip Rotor.

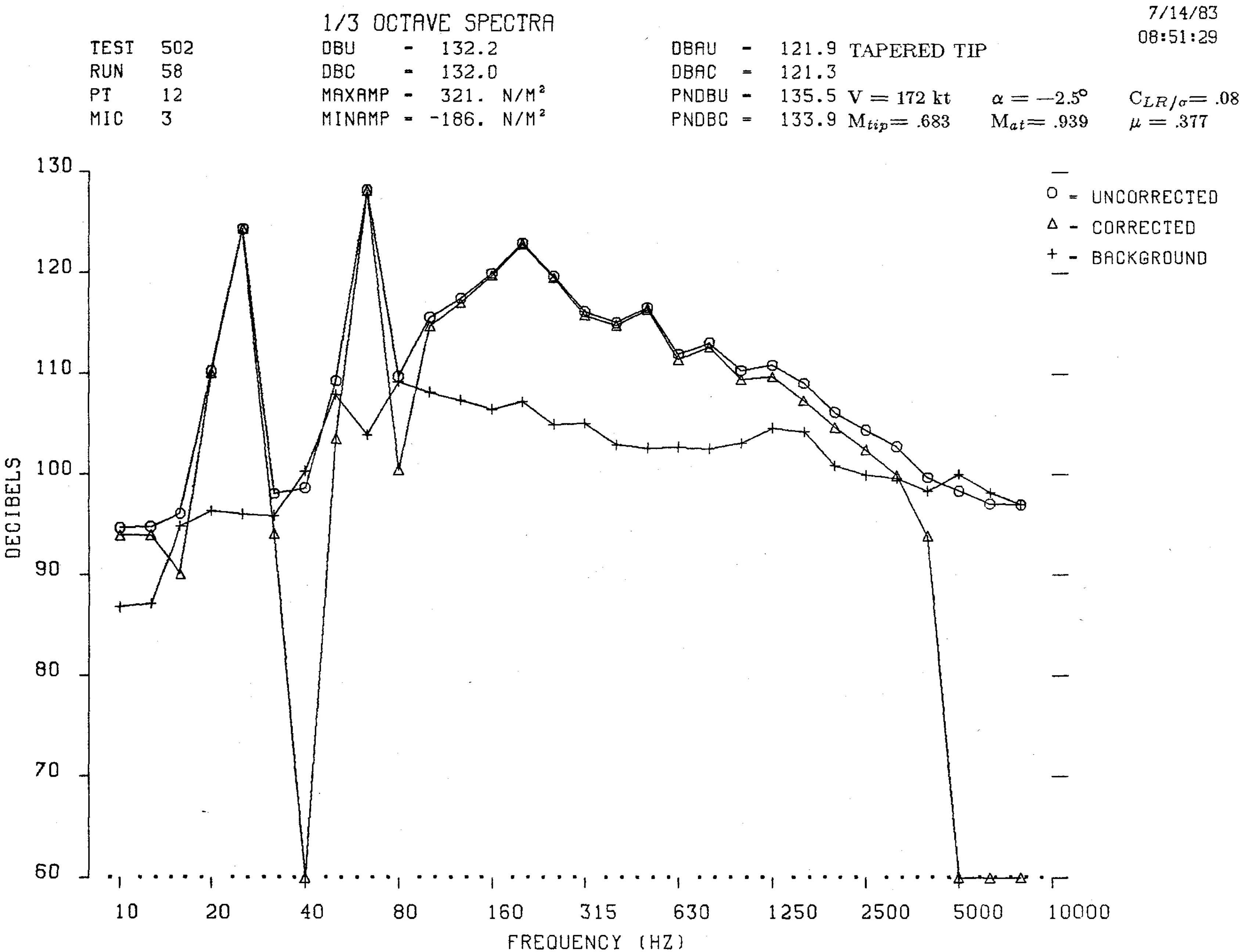


Figure D3(x). One-Third Octave Specta for The Tapered Tip Rotor.

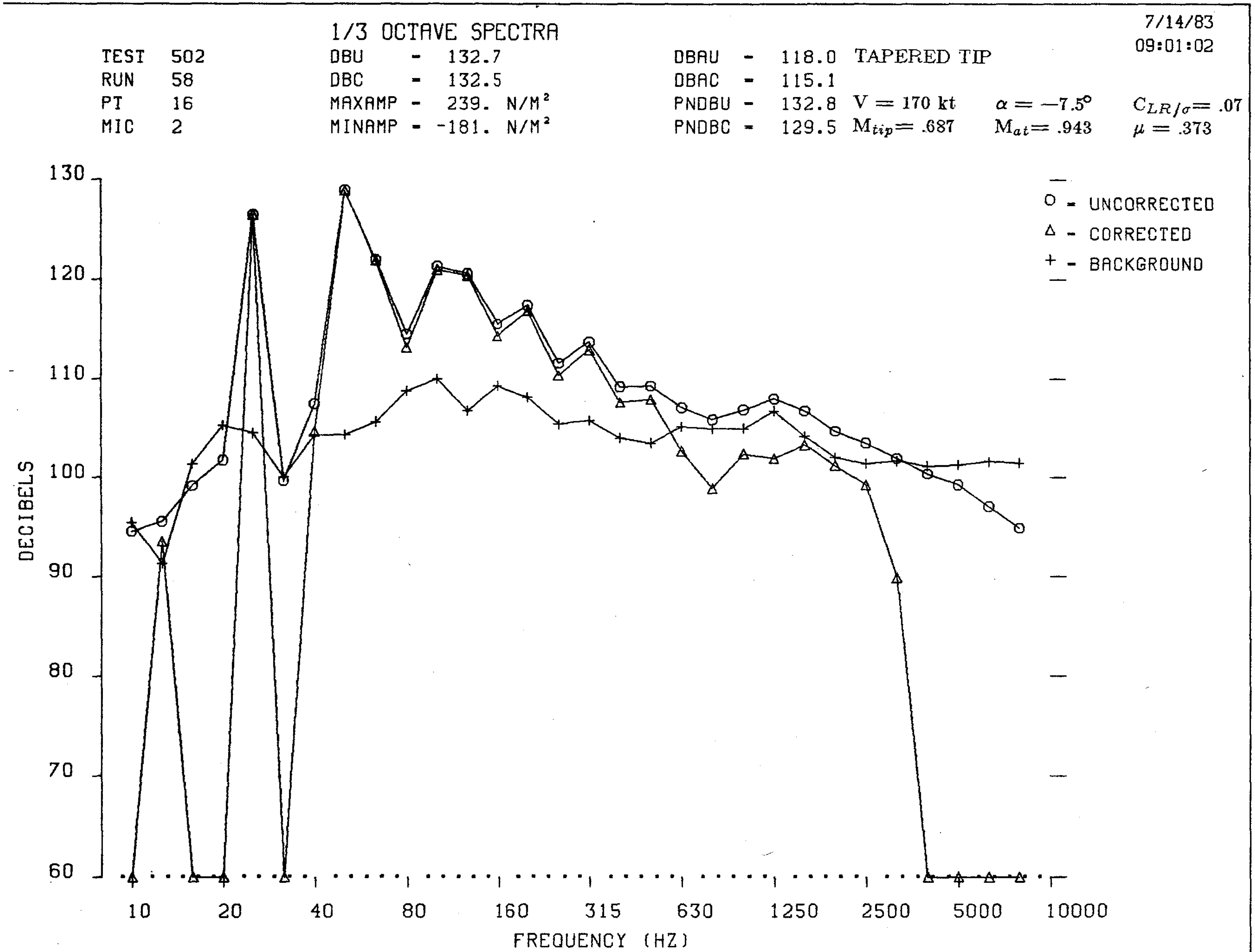


Figure D3(y). One-Third Octave Specta for The Tapered Tip Rotor.

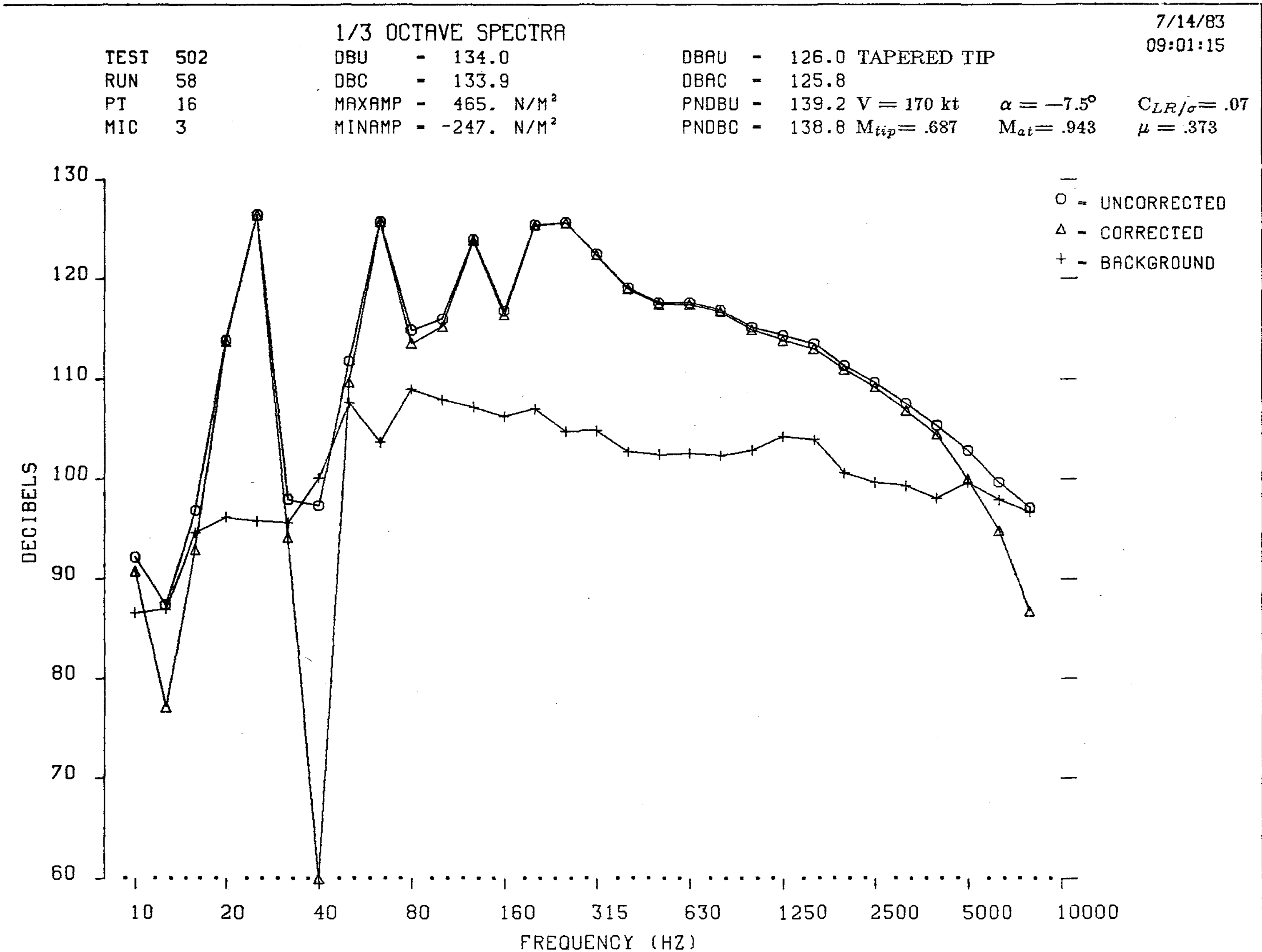


Figure D3(z). One-Third Octave Specta for The Tapered Tip Rotor.

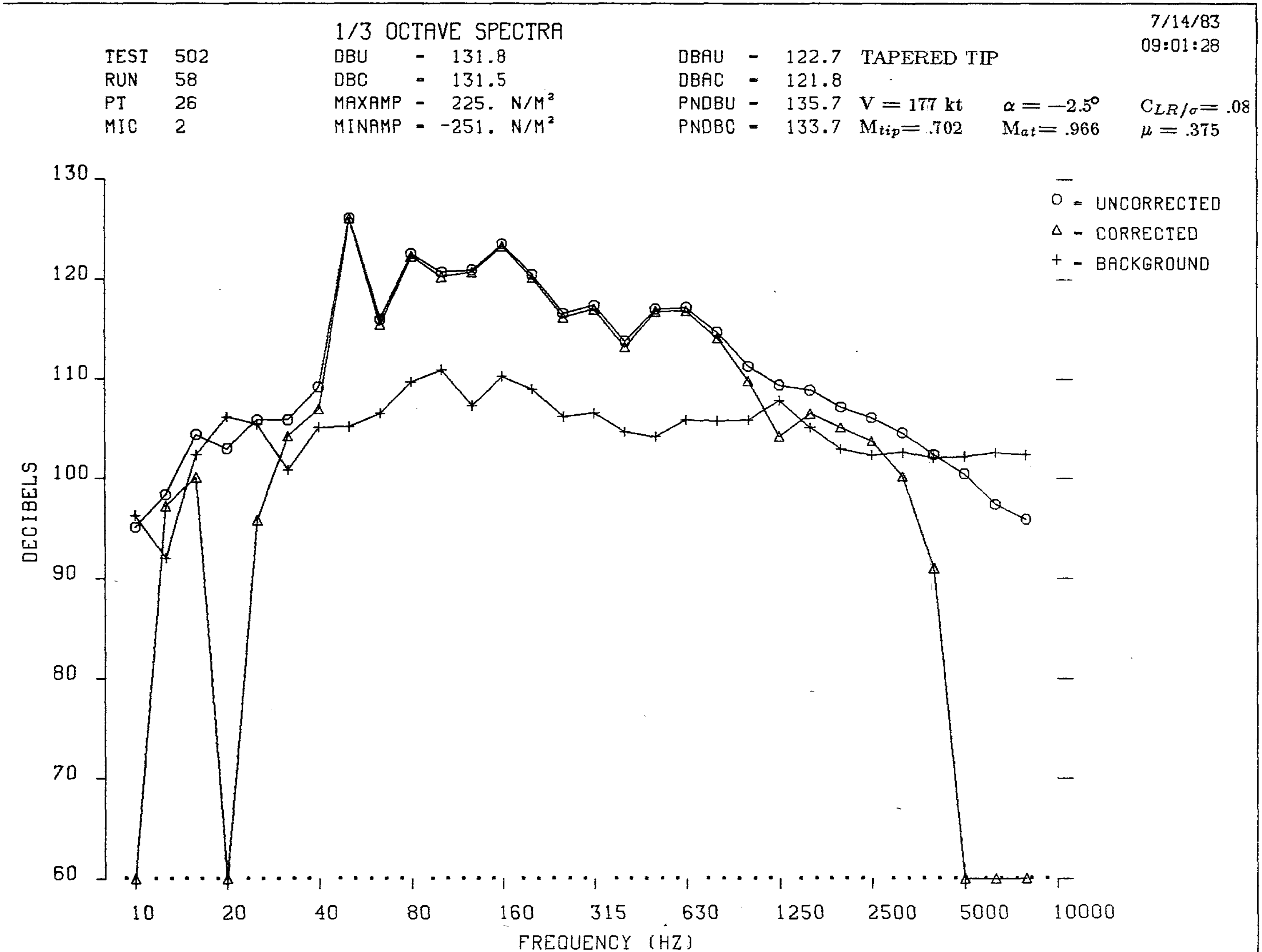


Figure D3(aa). One-Third Octave Specta for The Tapered Tip Rotor.

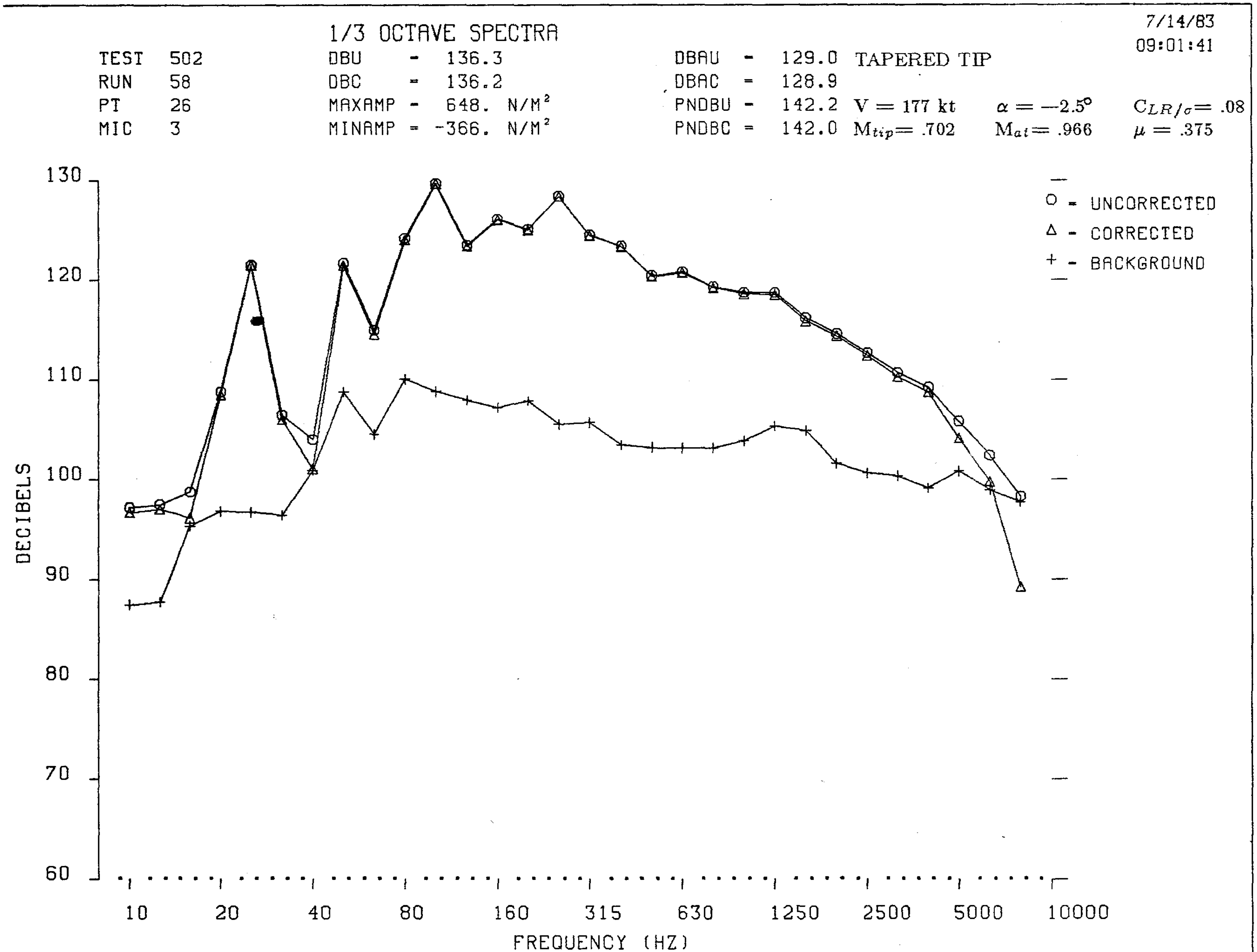


Figure D3(bb). One-Third Octave Specta for The Tapered Tip Rotor.

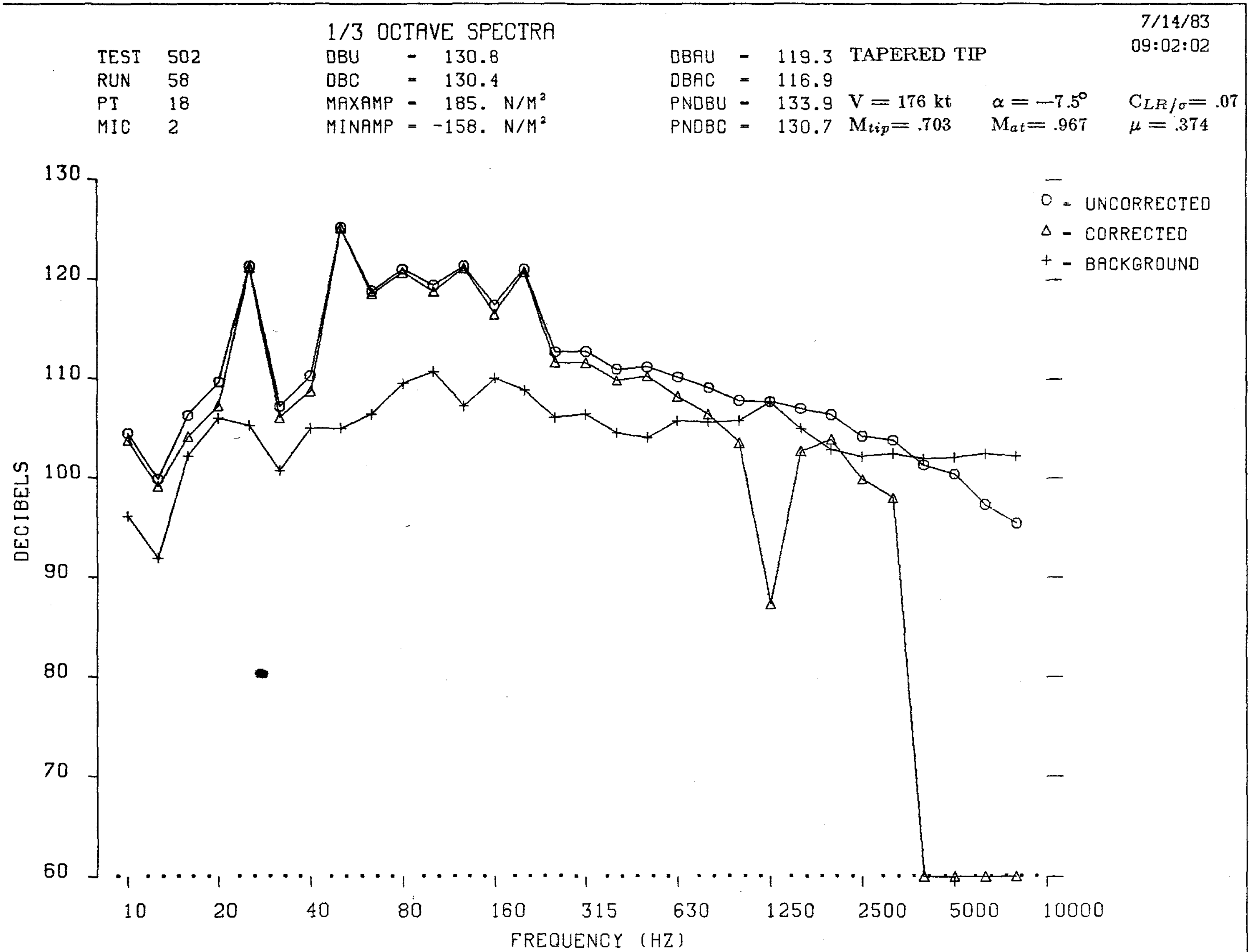


Figure D3(cc). One-Third Octave Specta for The Tapered Tip Rotor.

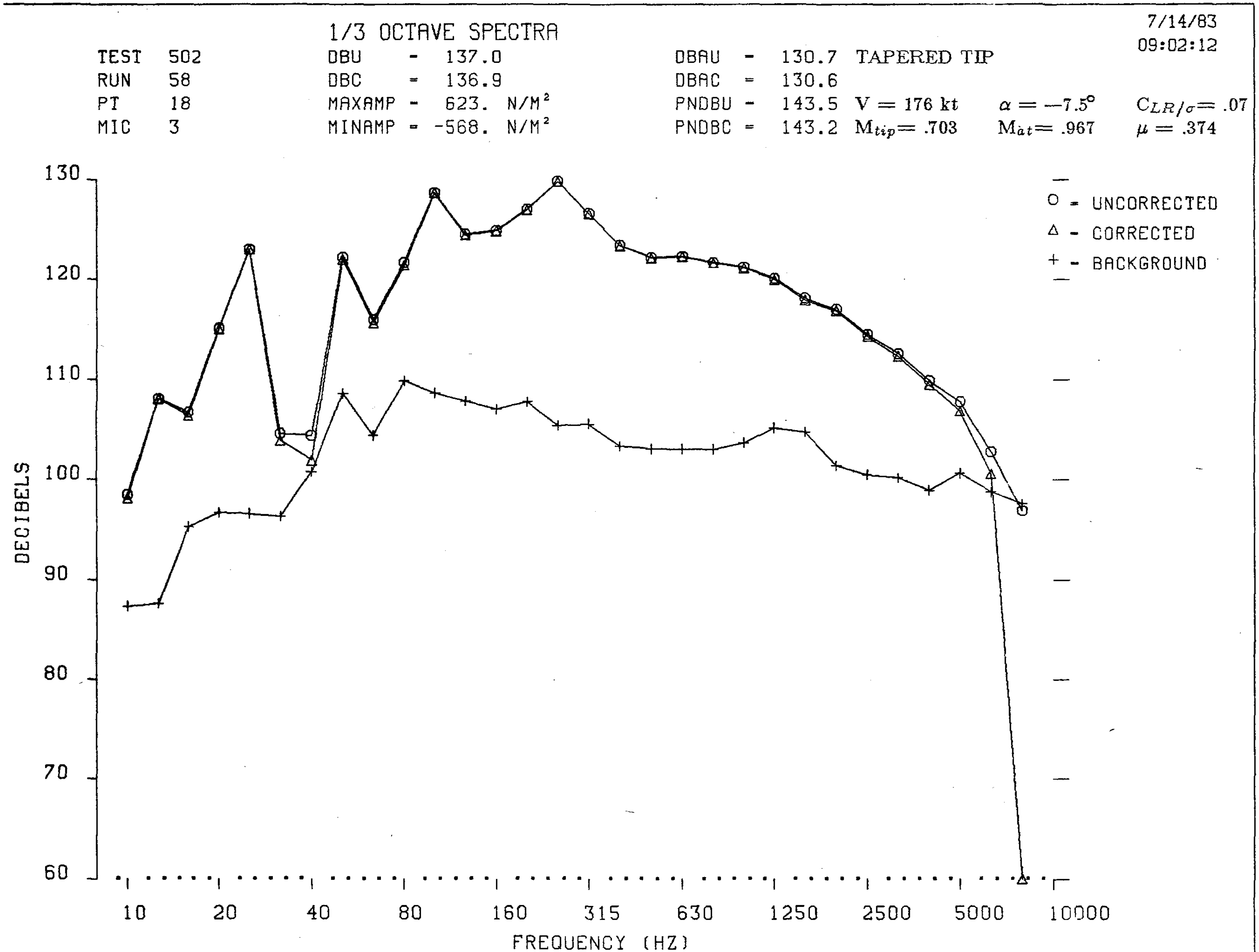


Figure D3(dd). One-Third Octave Specta for The Tapered Tip Rotor.

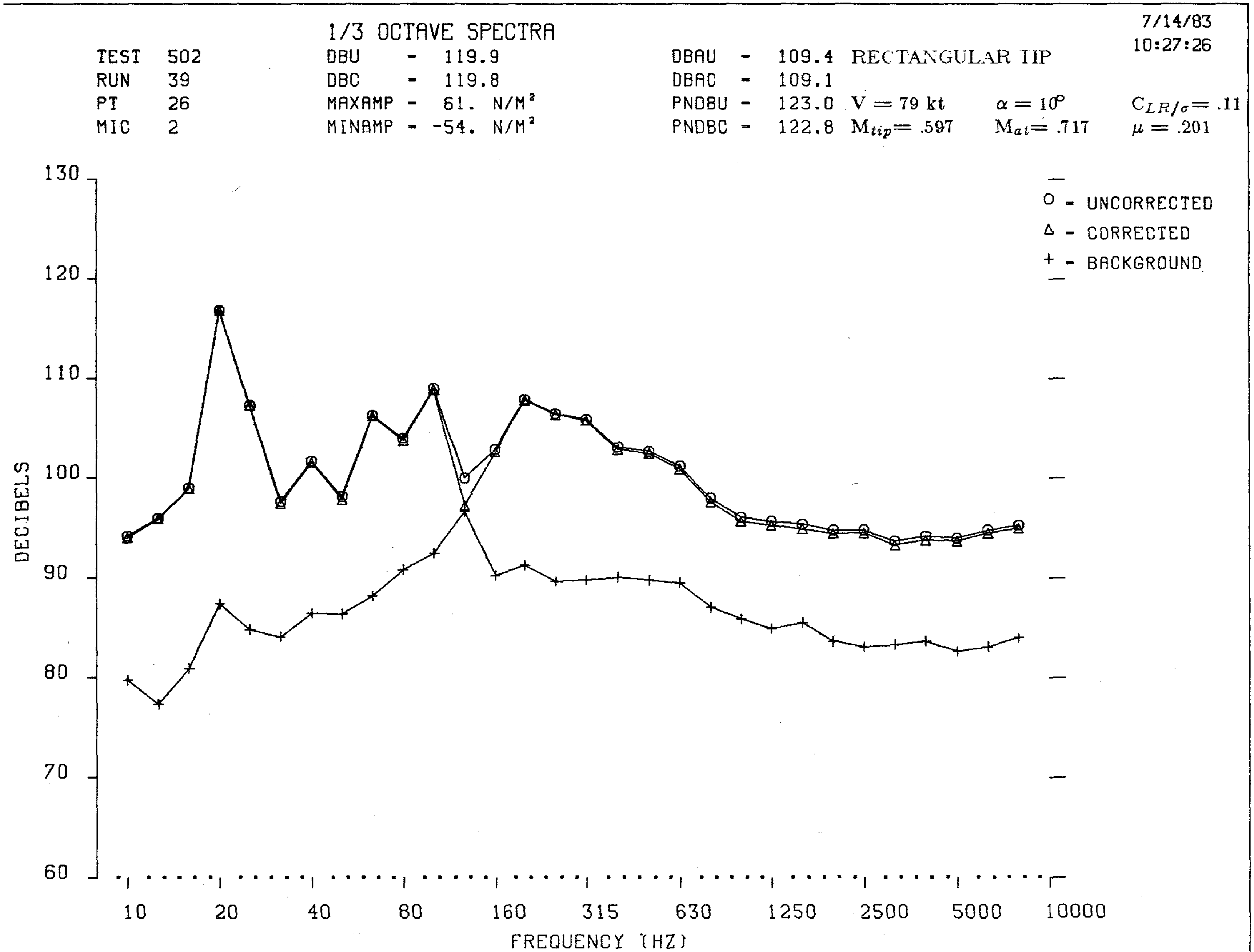


Figure D4(a). One-Third Octave Specta for The Rectangular Tip Rotor.

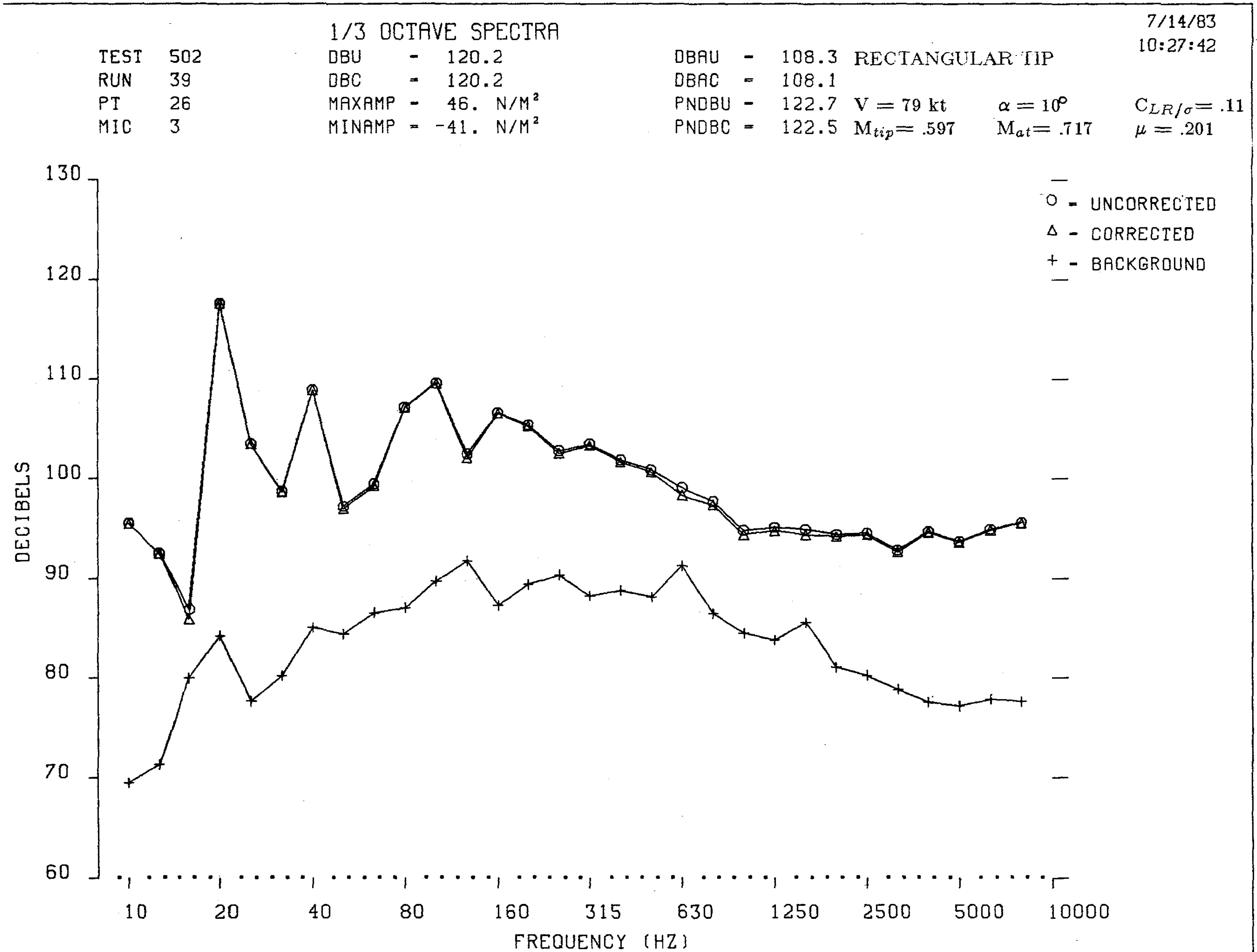


Figure D4(b). One-Third Octave Specta for The Rectangular Tip Rotor.

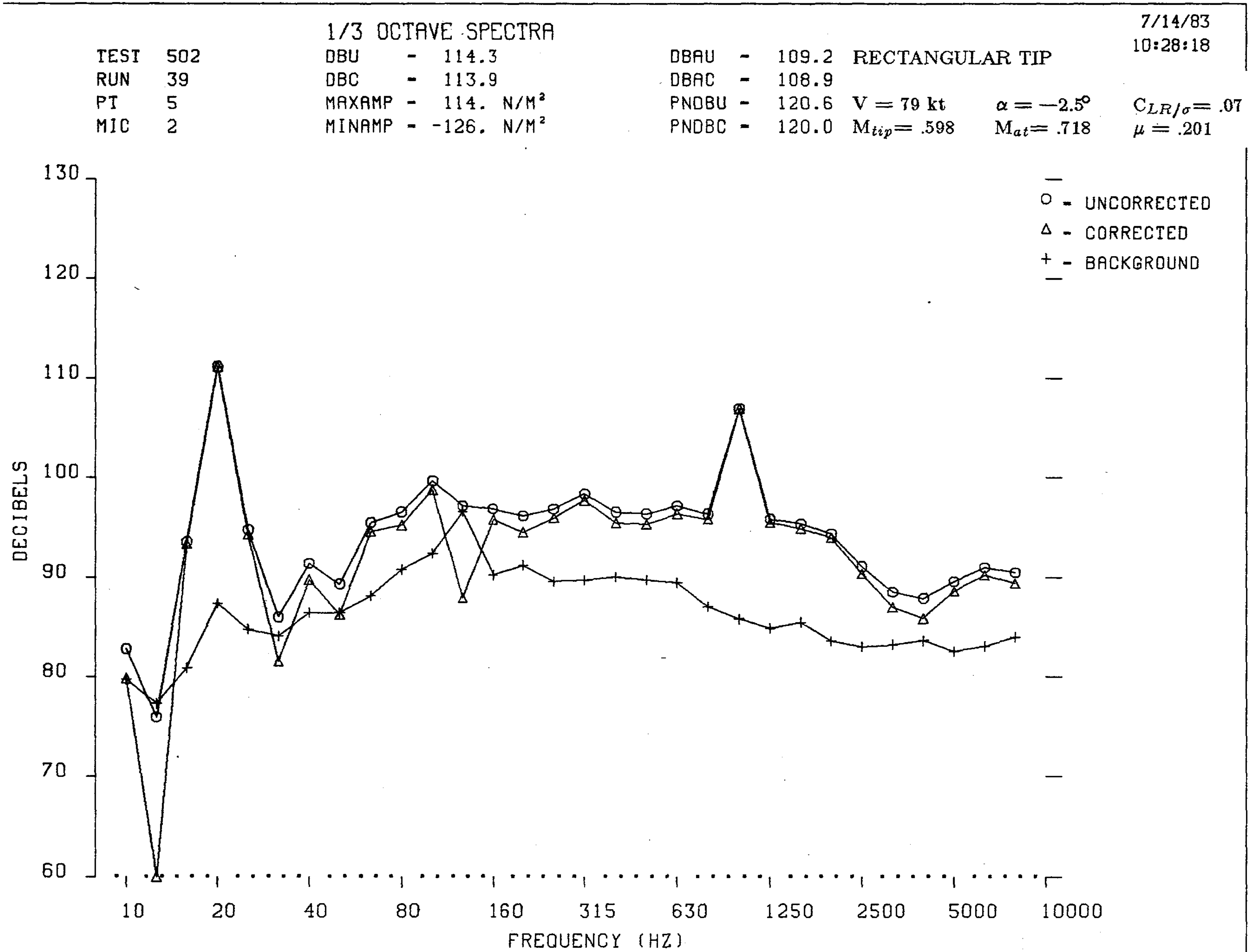


Figure D4(c). One-Third Octave Specta for The Rectangular Tip Rotor.

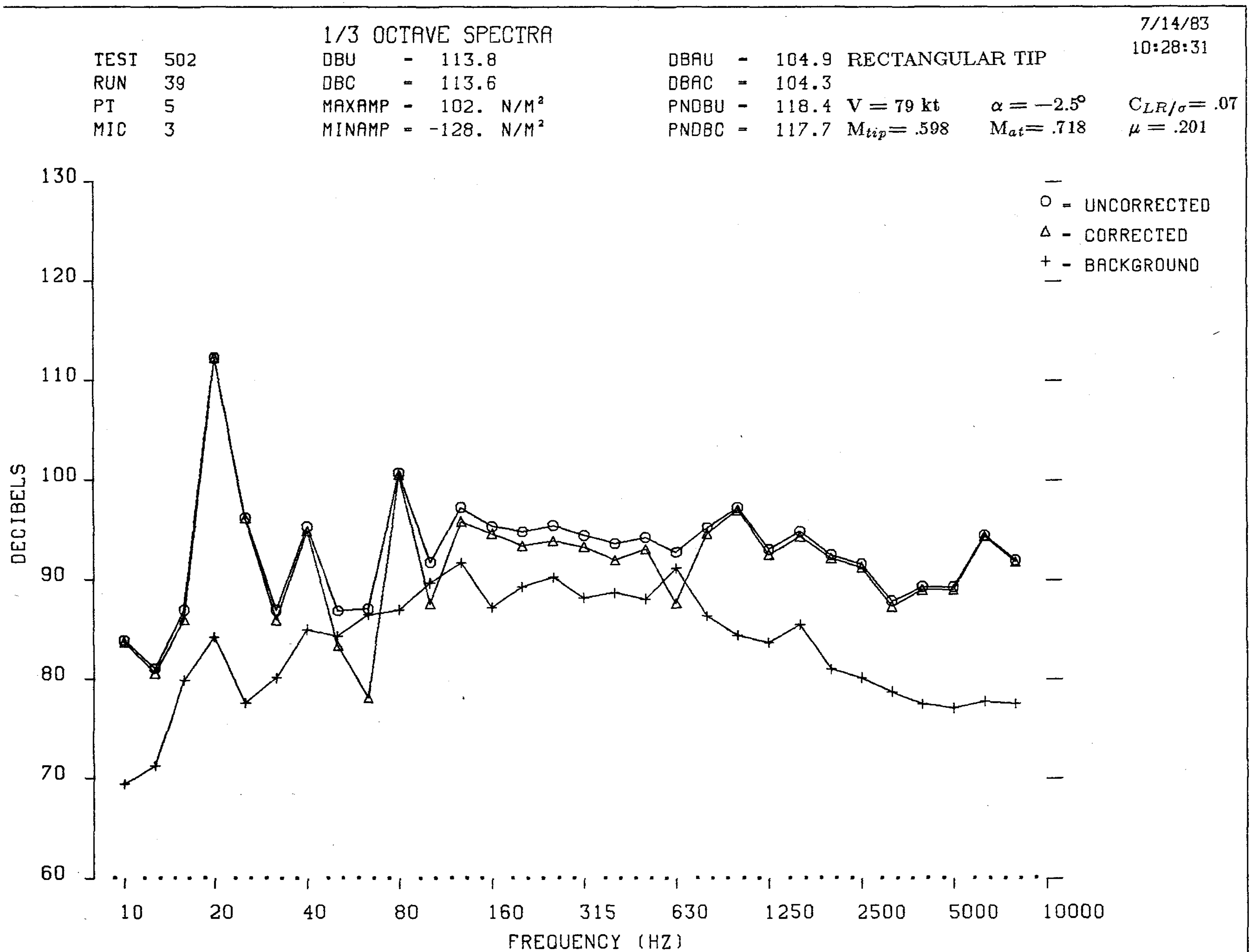


Figure D4(d). One-Third Octave Specta for The Rectangular Tip Rotor.

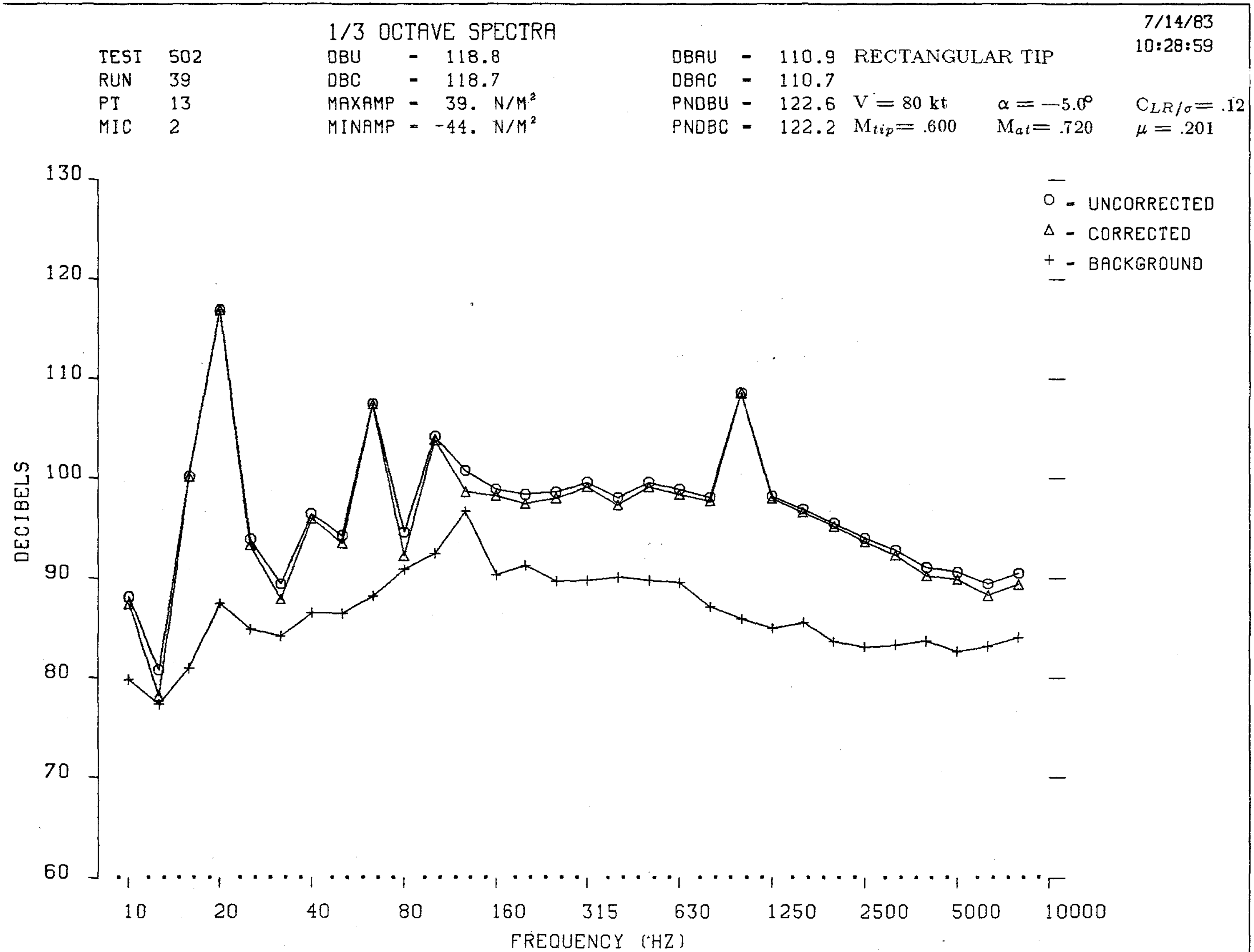


Figure D4(e). One-Third Octave Specta for The Rectangular Tip Rotor.

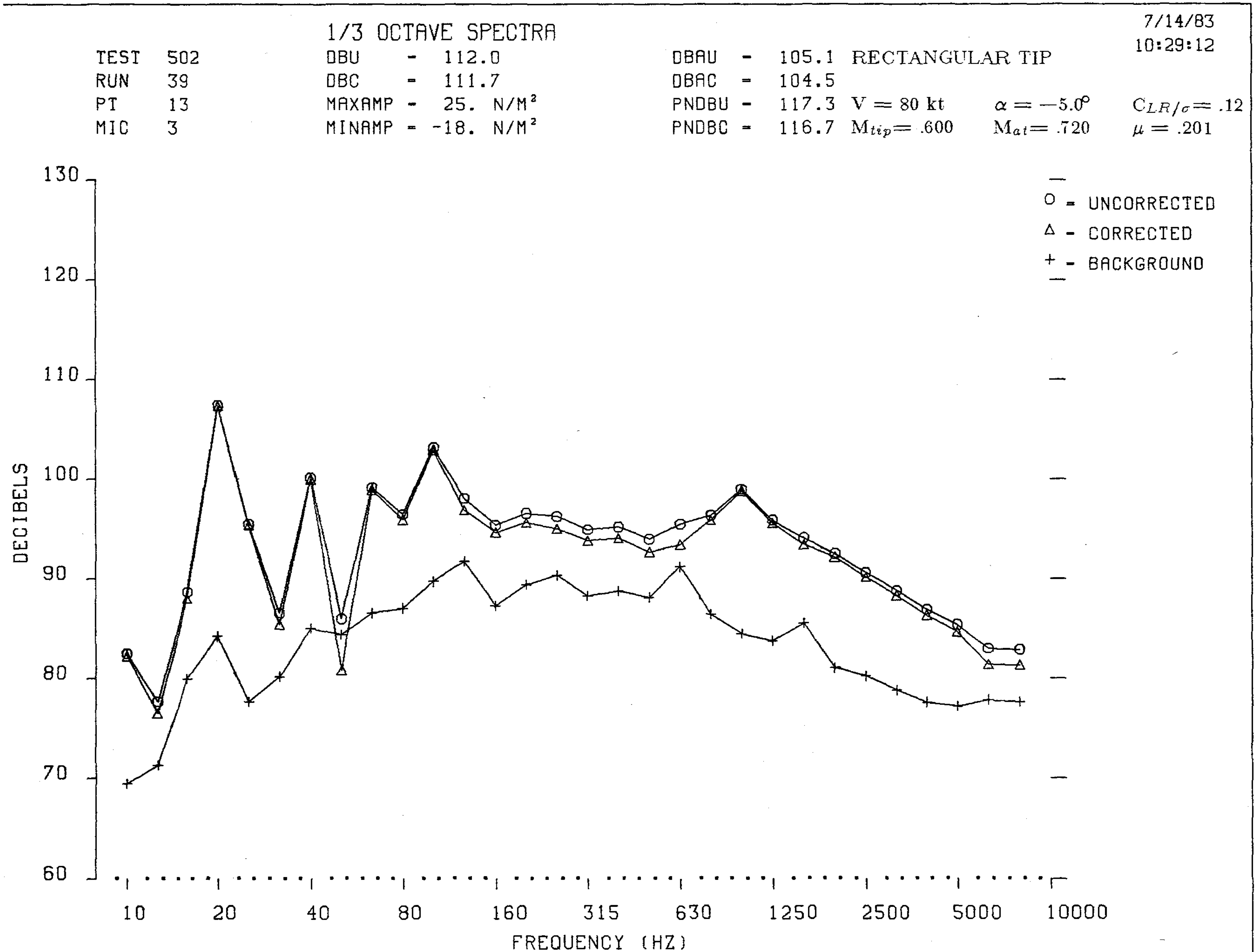


Figure D4(f). One-Third Octave Specta for The Rectangular Tip Rotor.

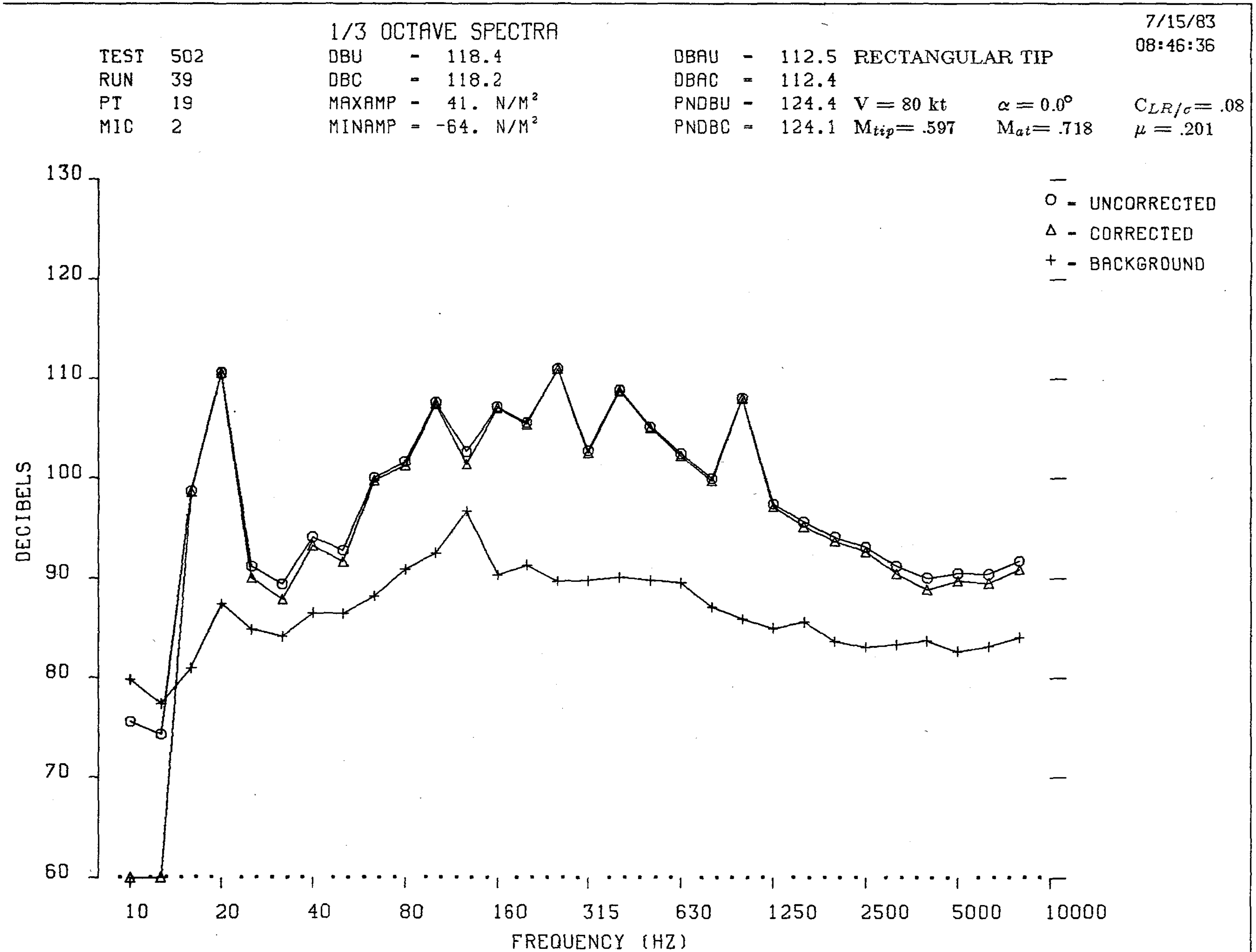


Figure D4(g). One-Third Octave Specta for The Rectangular Tip Rotor.

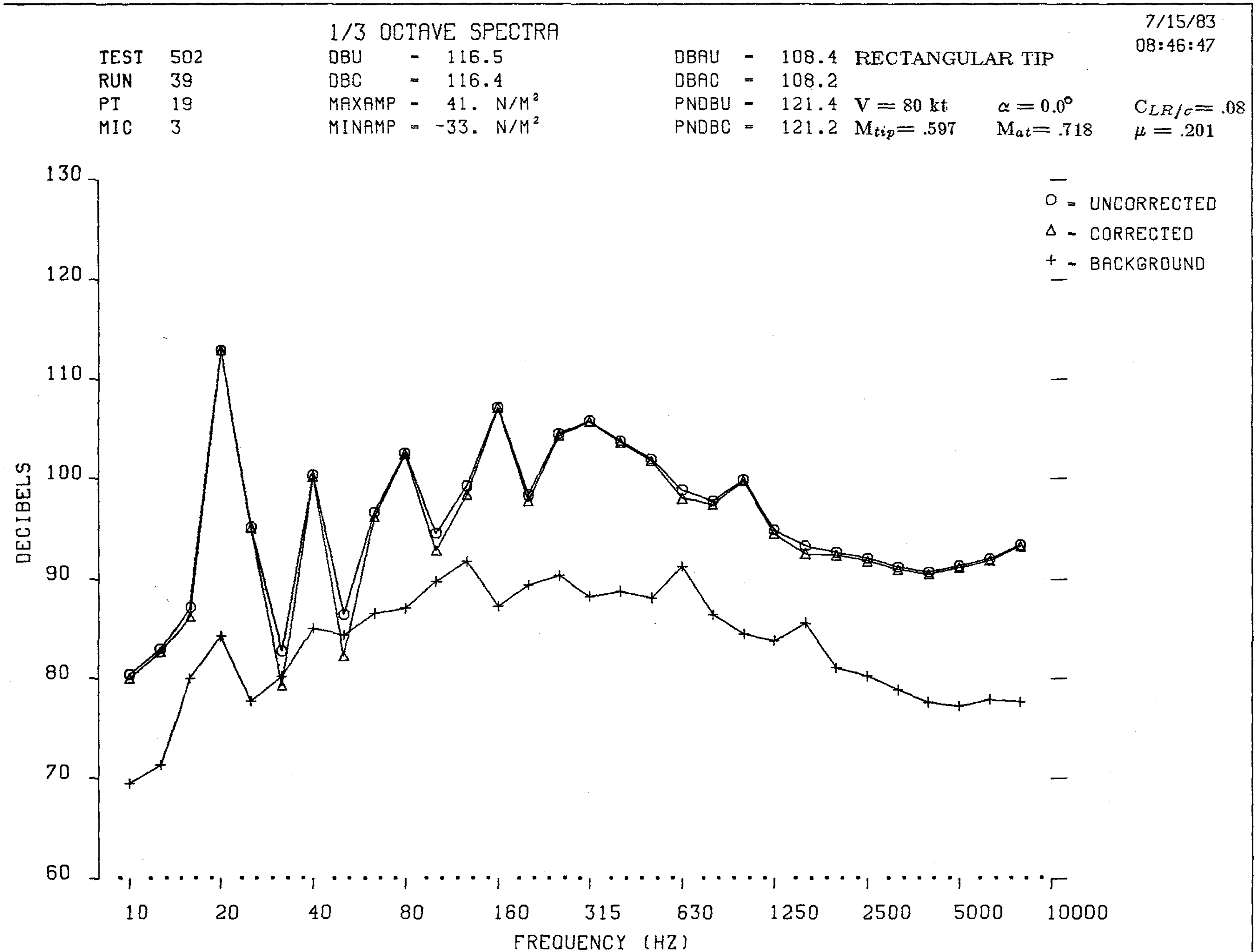


Figure D4(h). One-Third Octave Specta for The Rectangular Tip Rotor.

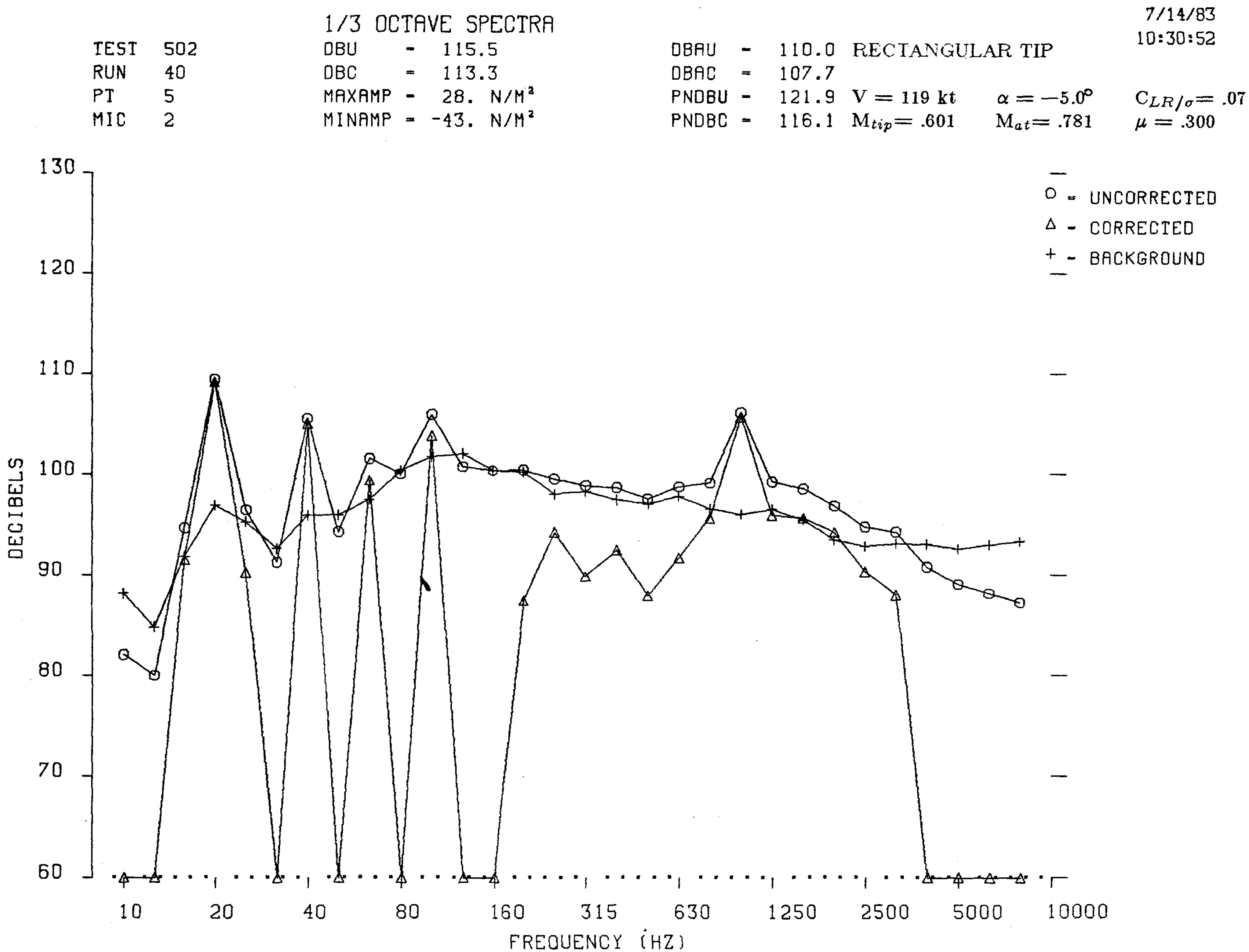


Figure D4(i). One-Third Octave Specta for The Rectangular Tip Rotor.

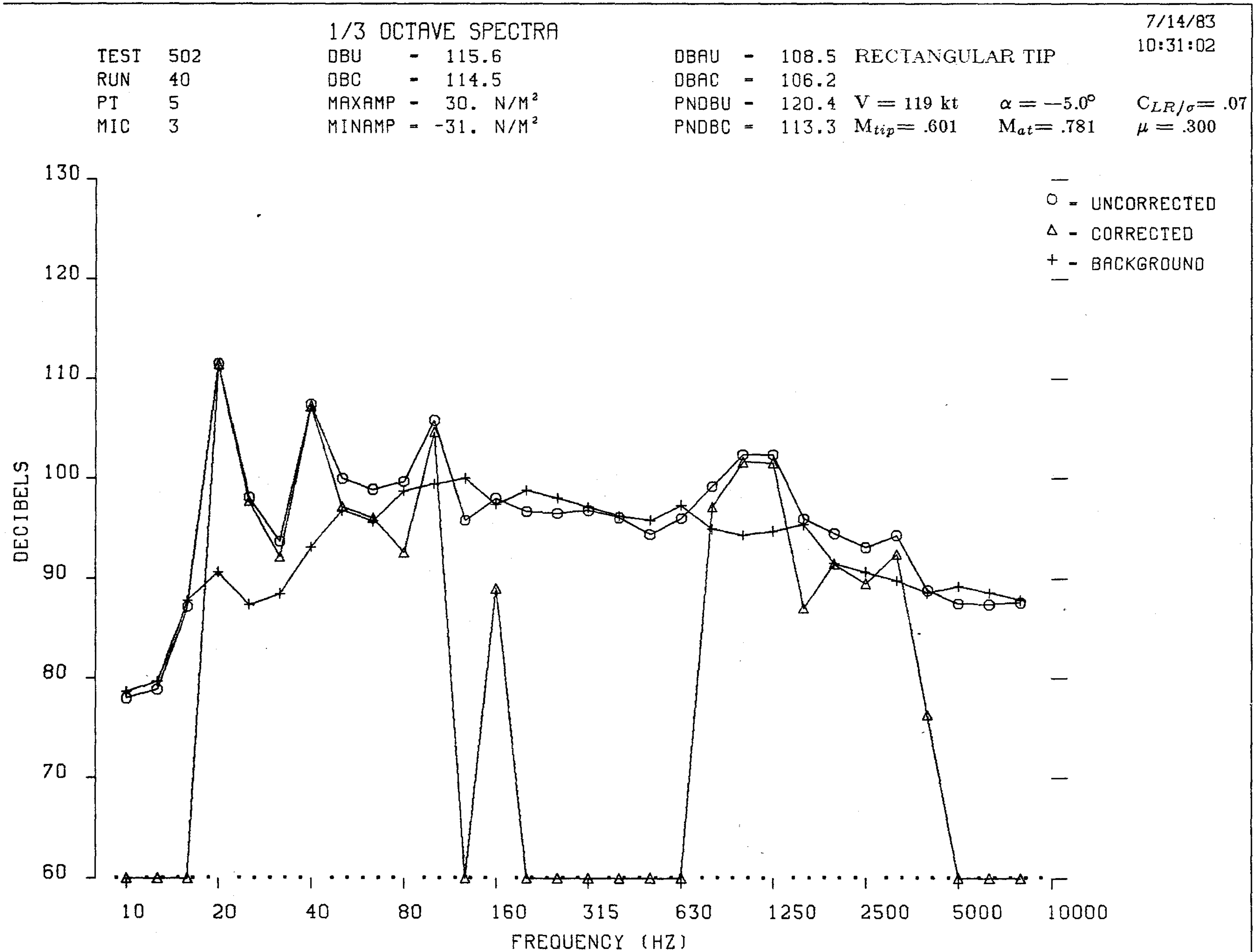


Figure D4(j). One-Third Octave Specta for The Rectangular Tip Rotor.

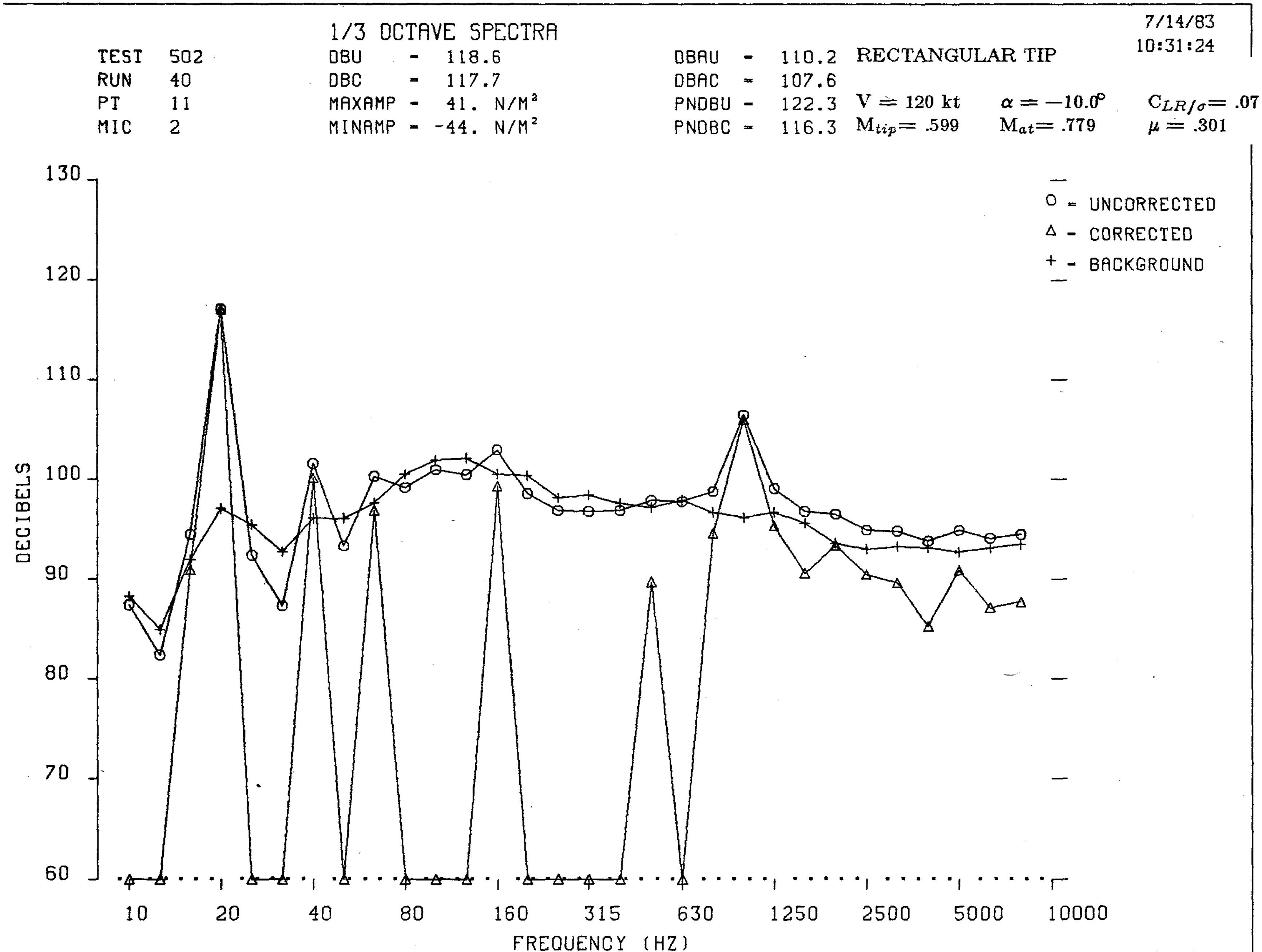


Figure D4(k). One-Third Octave Specta for The Rectangular Tip Rotor.

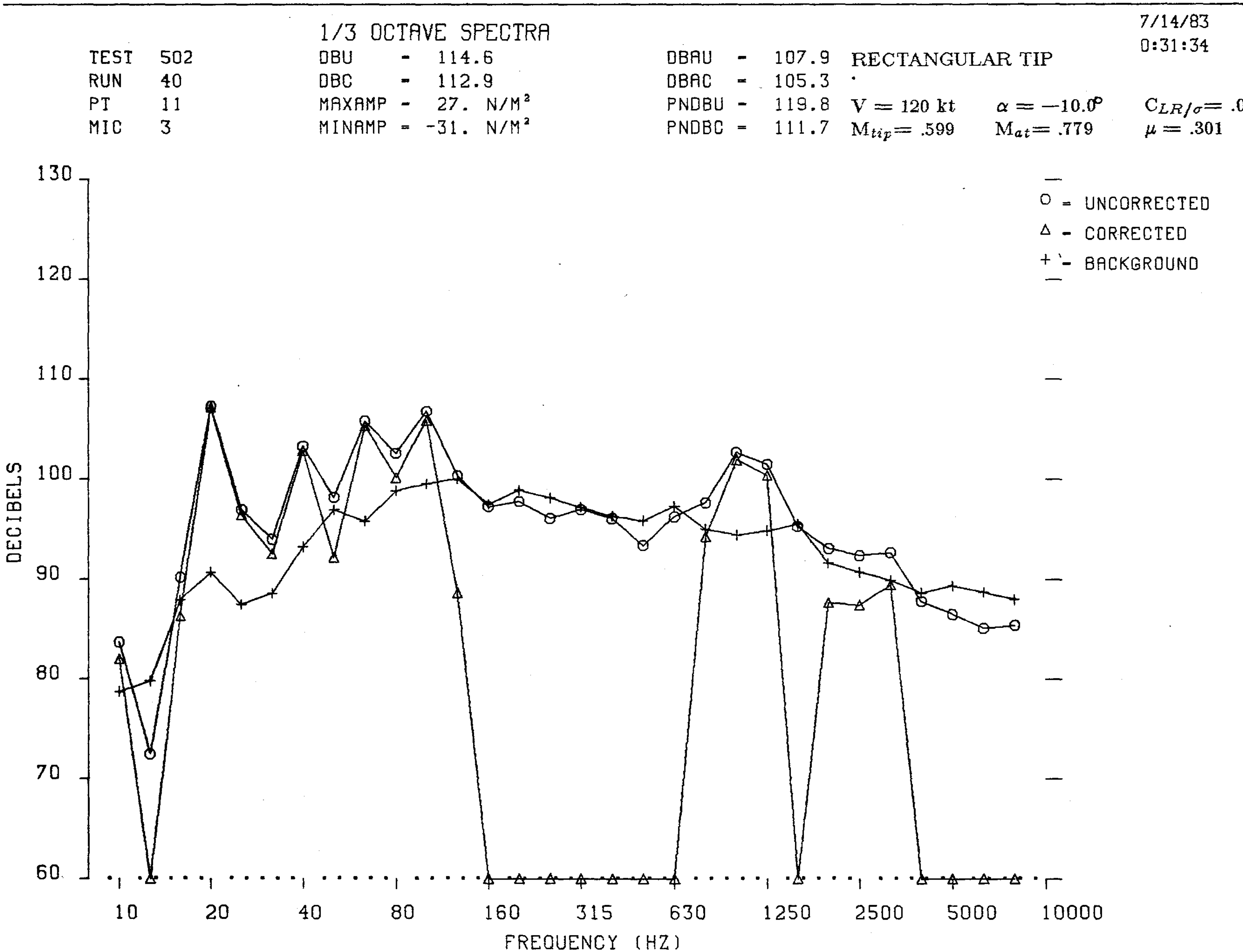


Figure D4(l). One-Third Octave Specta for The Rectangular Tip Rotor.

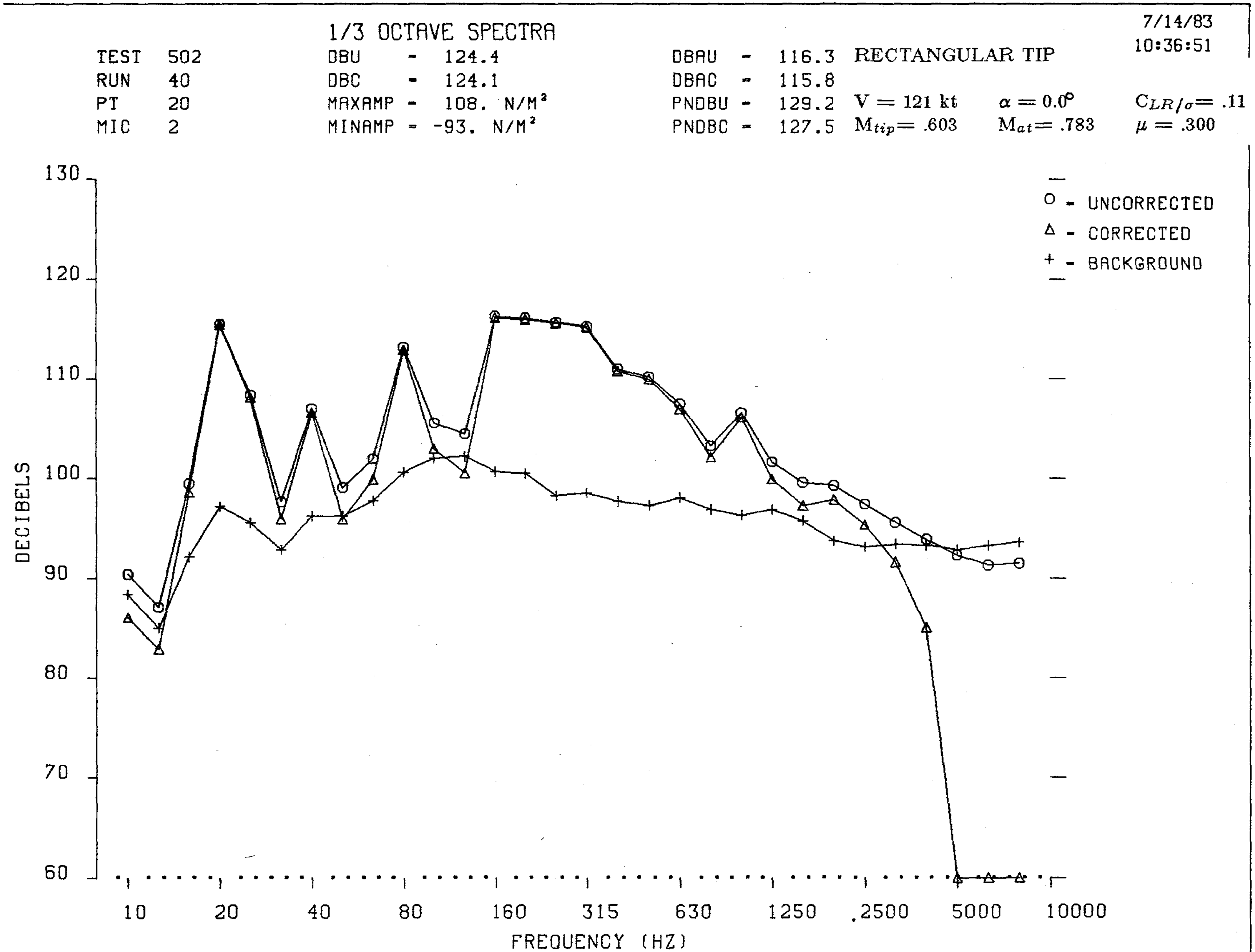


Figure D4(m). One-Third Octave Specta for The Rectangular Tip Rotor.

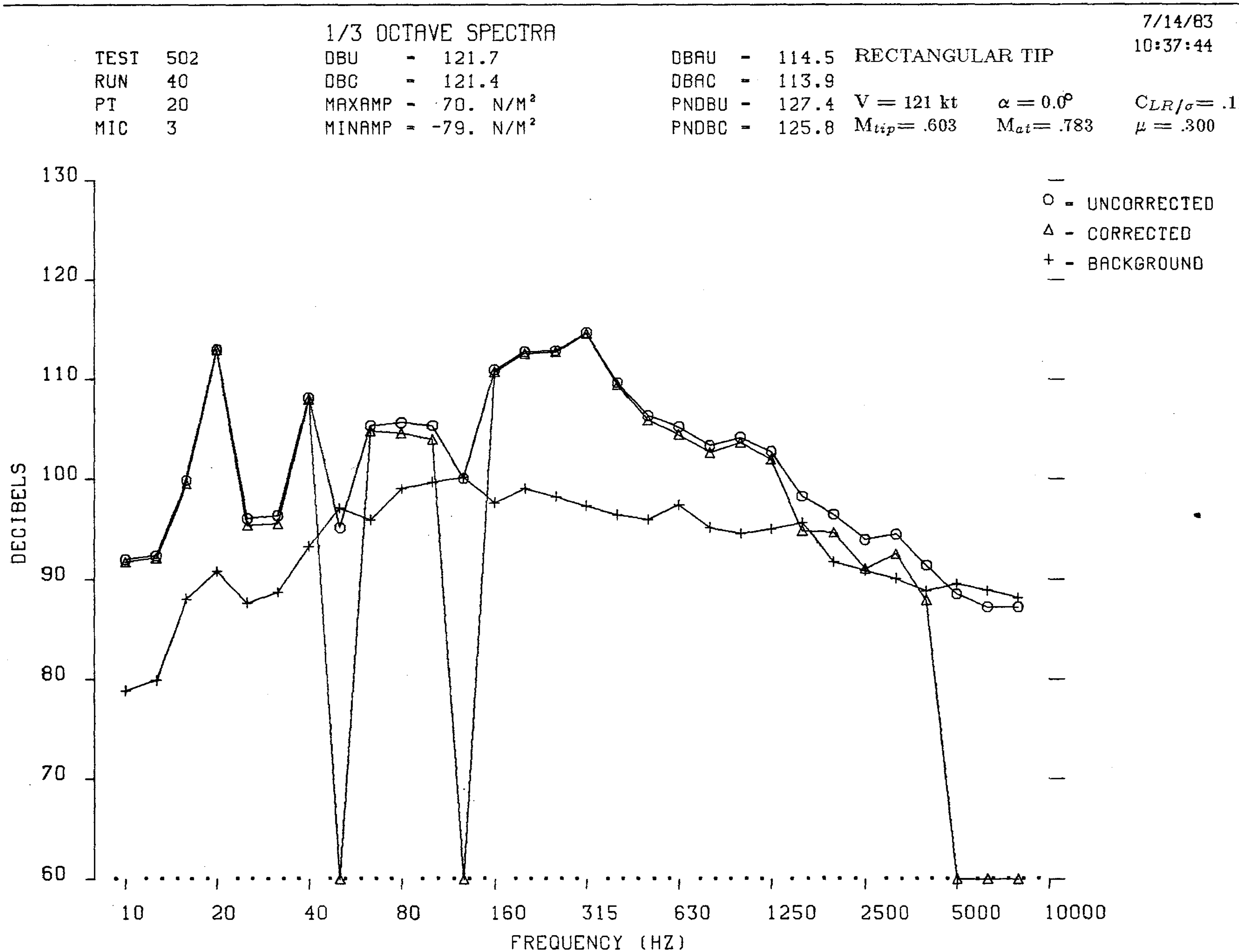


Figure D4(n). One-Third Octave Specta for The Rectangular Tip Rotor.

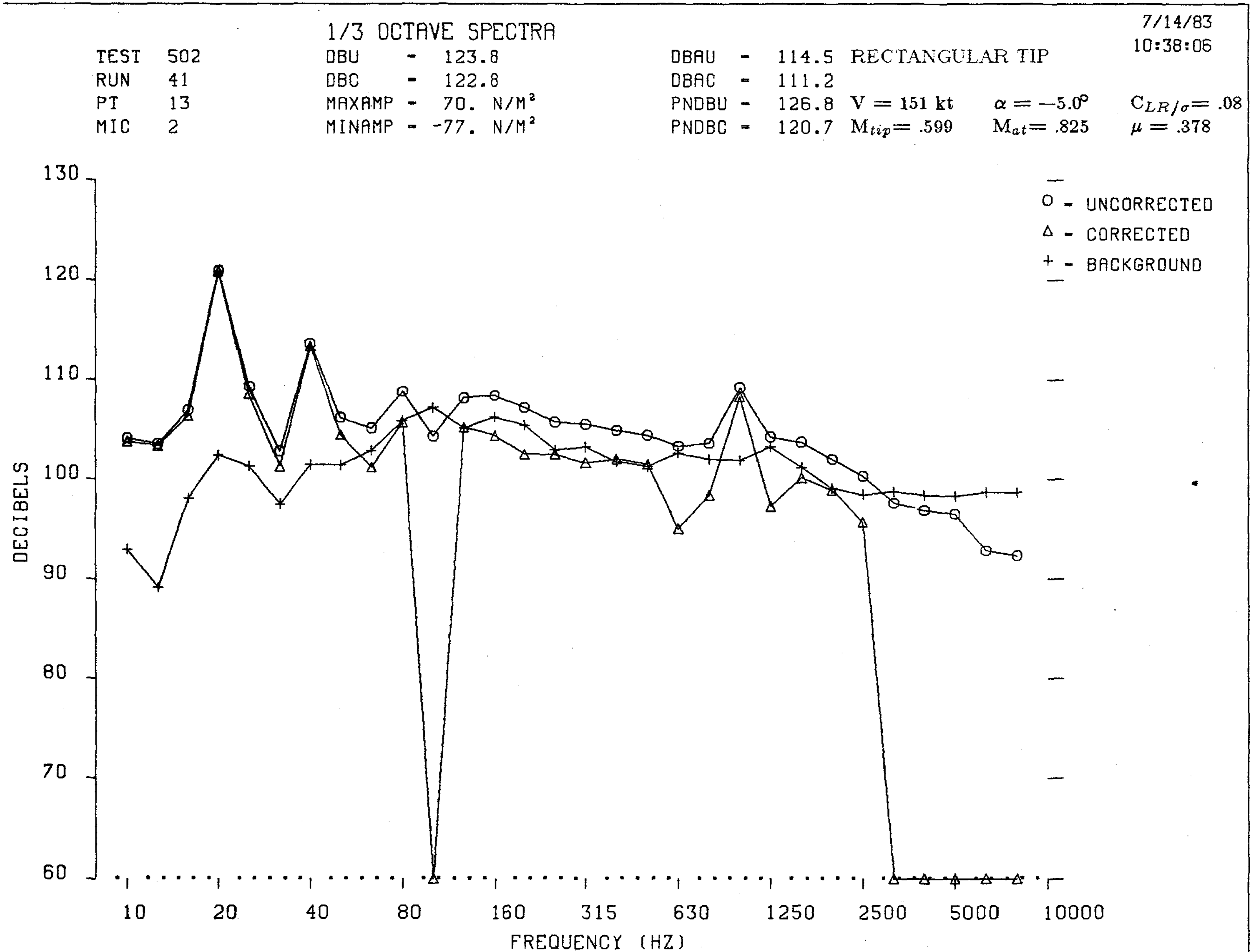


Figure D4(o). One-Third Octave Specta for The Rectangular Tip Rotor.

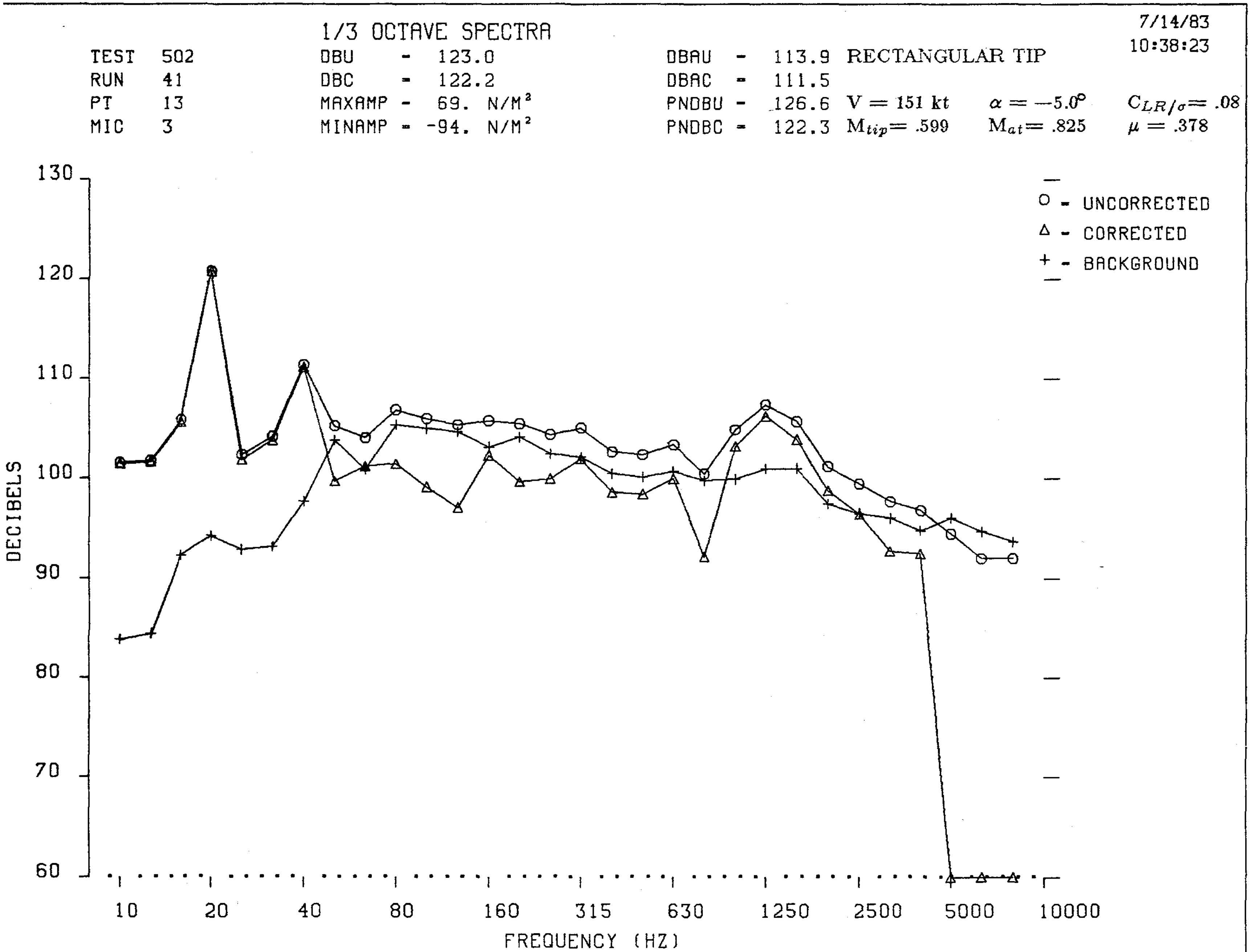


Figure D4(p). One-Third Octave Specta for The Rectangular Tip Rotor.

1/3 OCTAVE SPECTRA

7/14/83
10:38:51

TEST 502
RUN 41
PT 18
MIC 2

DBU - 125.2
DBC - 124.6
MAXAMP - 78. N/M^2
MINAMP - -93. N/M^2

DBAU - 112.9
DBAC - 106.2
PNDBU - 126.1
PNDBC - 115.0

RECTANGULAR TIP

$V = 151$ kt $\quad \alpha = -10.0^\circ \quad C_{LR/\sigma} = .07$

$M_{tip} = .60 \quad M_{at} = .826 \quad \mu = .377$

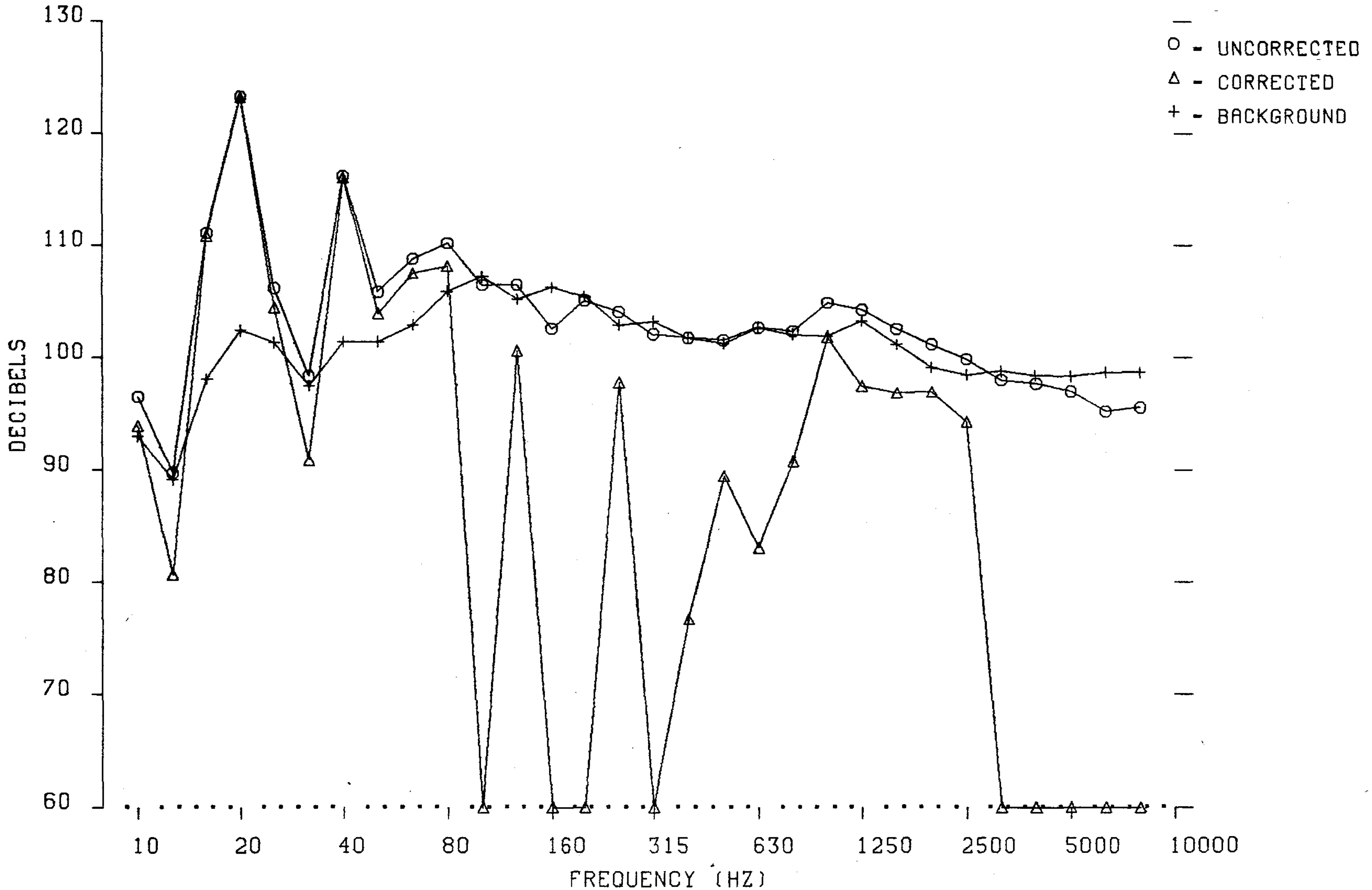


Figure D4(q). One-Third Octave Specta for The Rectangular Tip Rotor.

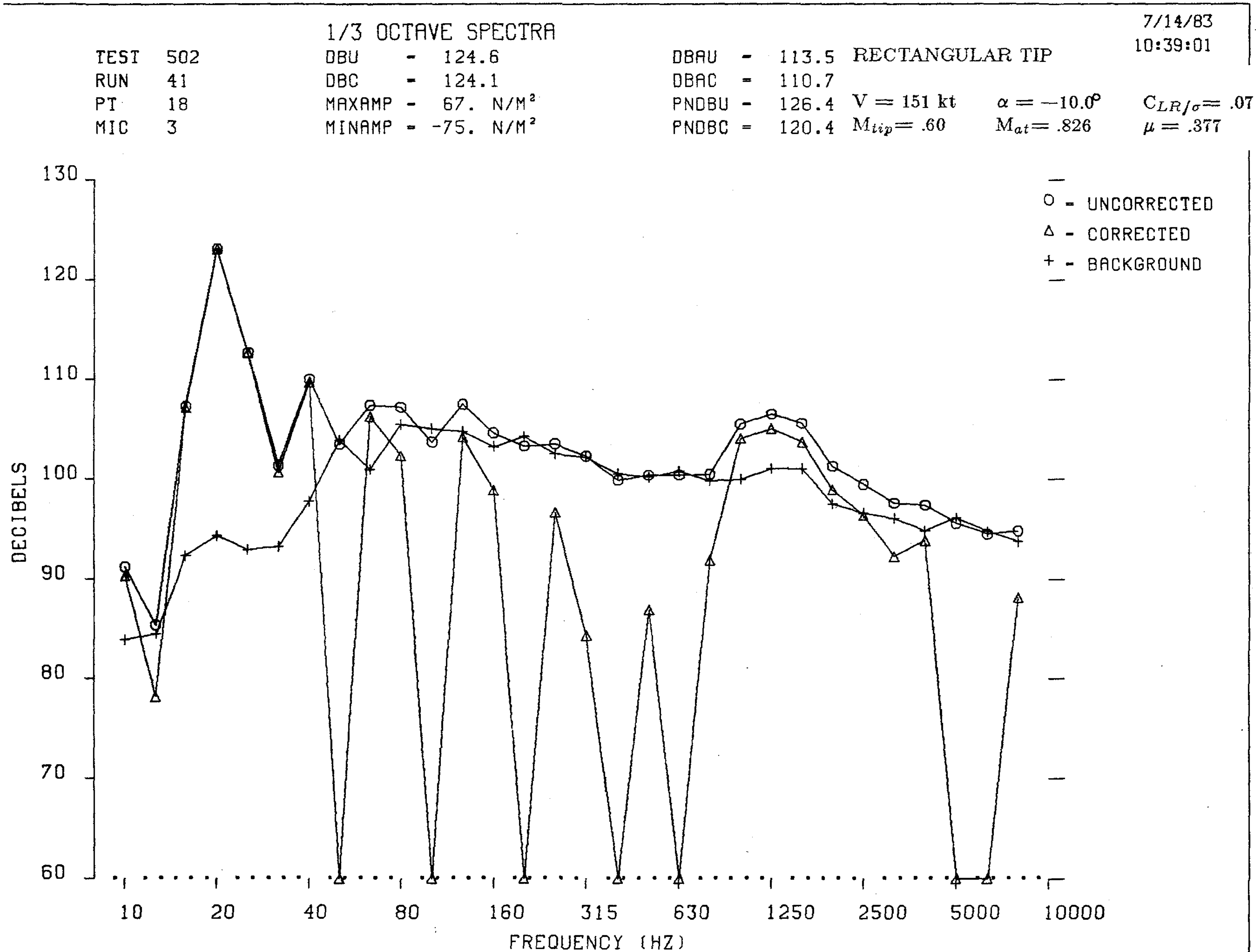


Figure D4(r). One-Third Octave Specta for The Rectangular Tip Rotor.

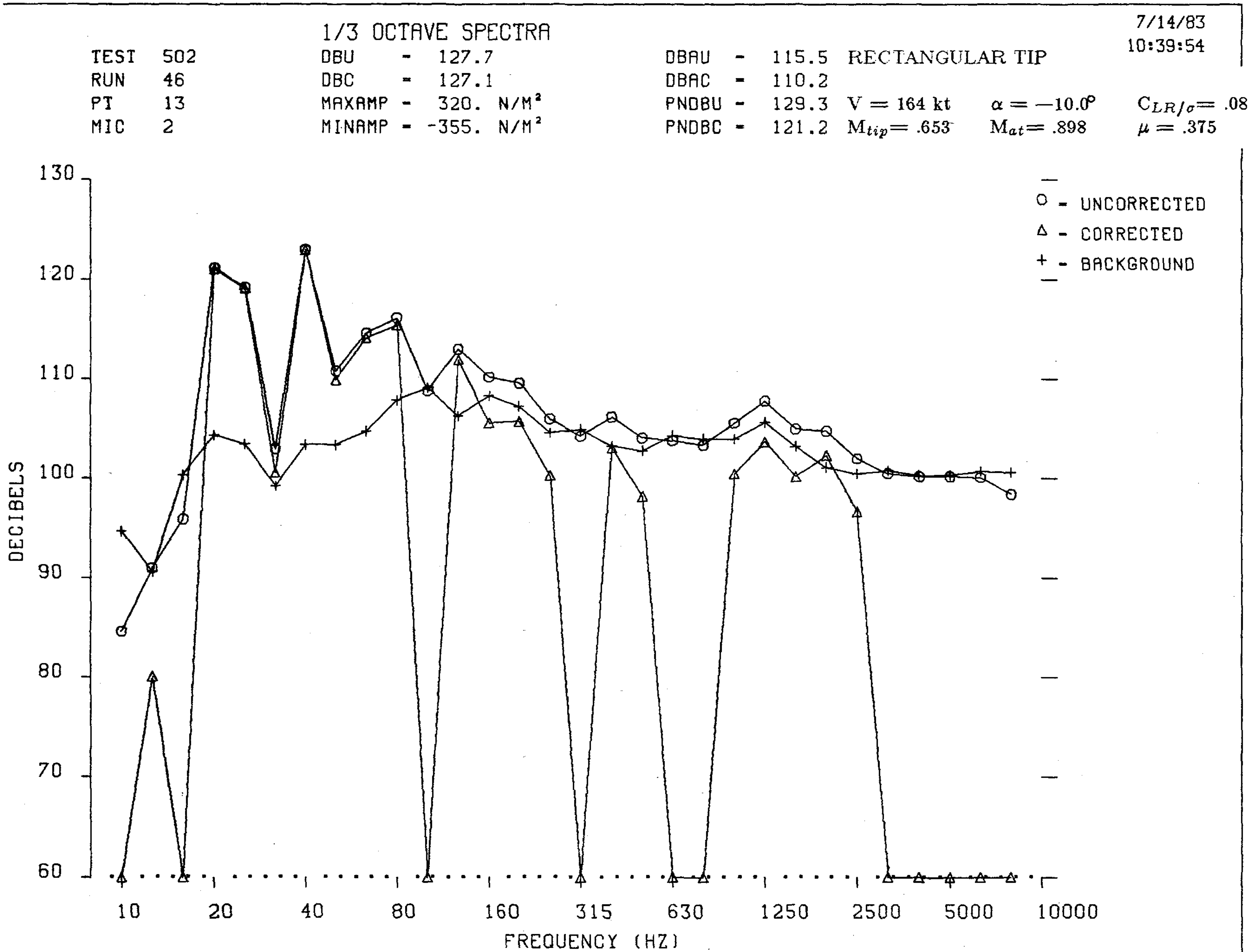


Figure D4(s). One-Third Octave Specta for The Rectangular Tip Rotor.

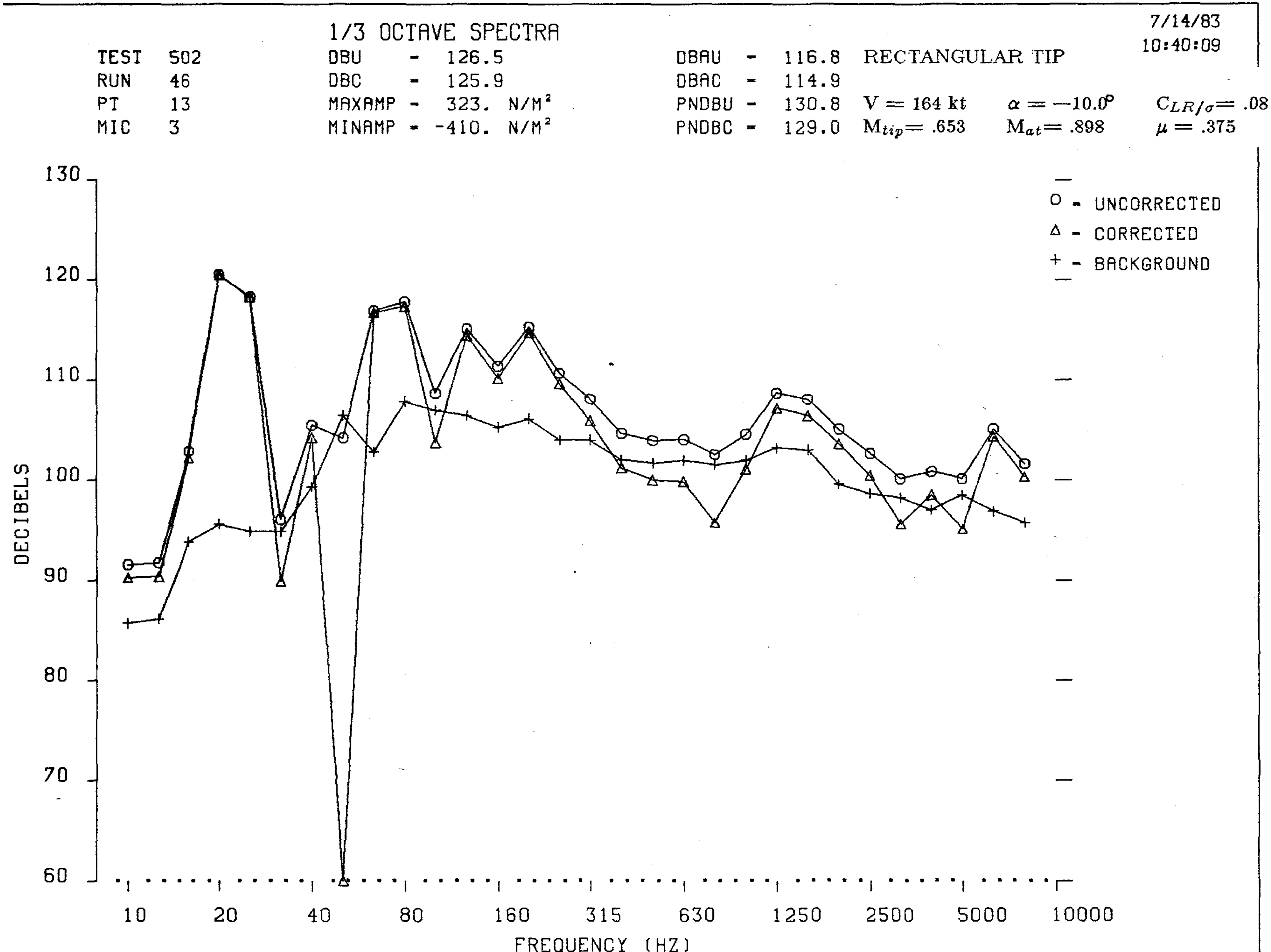


Figure D4(t). One-Third Octave Specta for The Rectangular Tip Rotor.

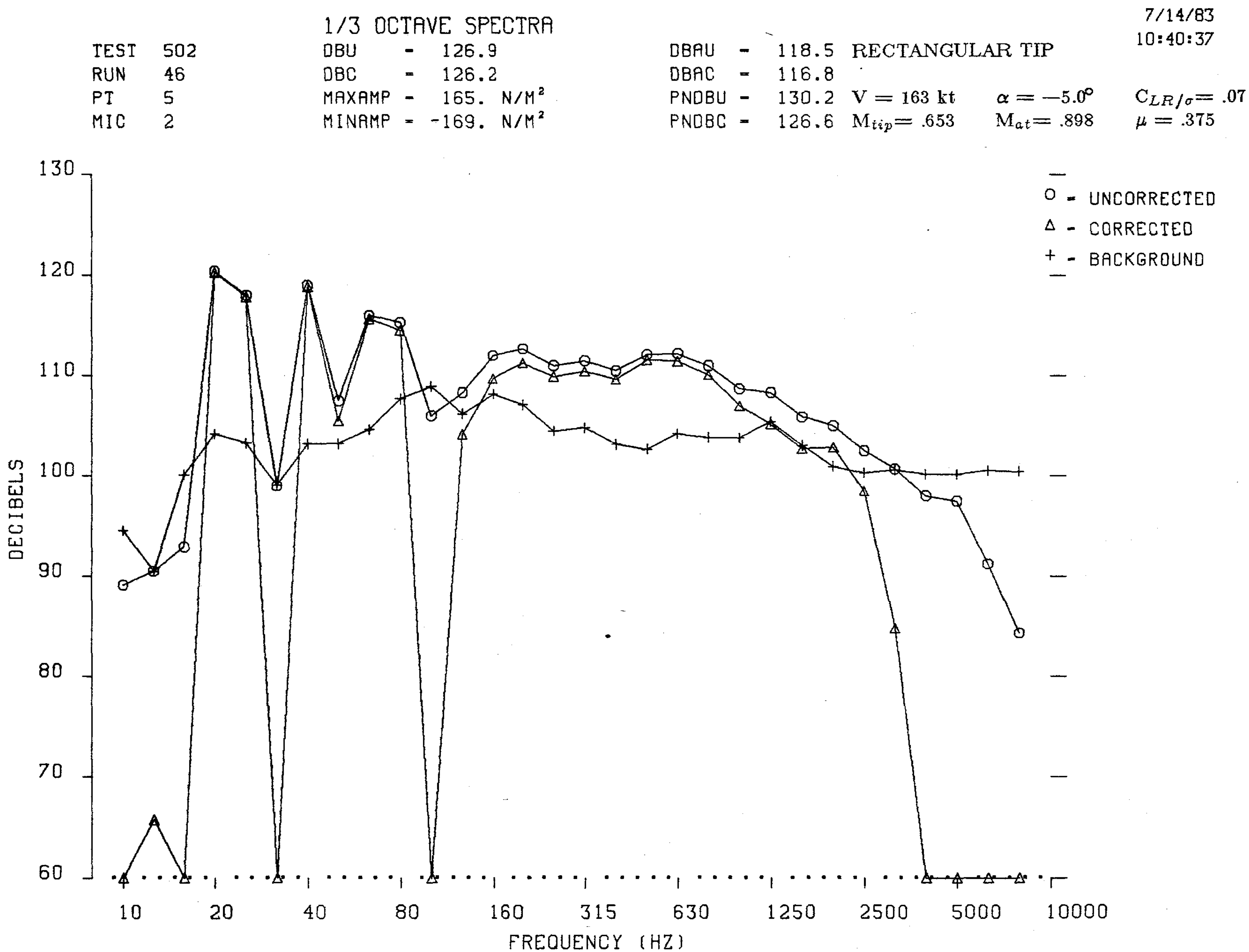


Figure D4(u). One-Third Octave Specta for The Rectangular Tip Rotor.

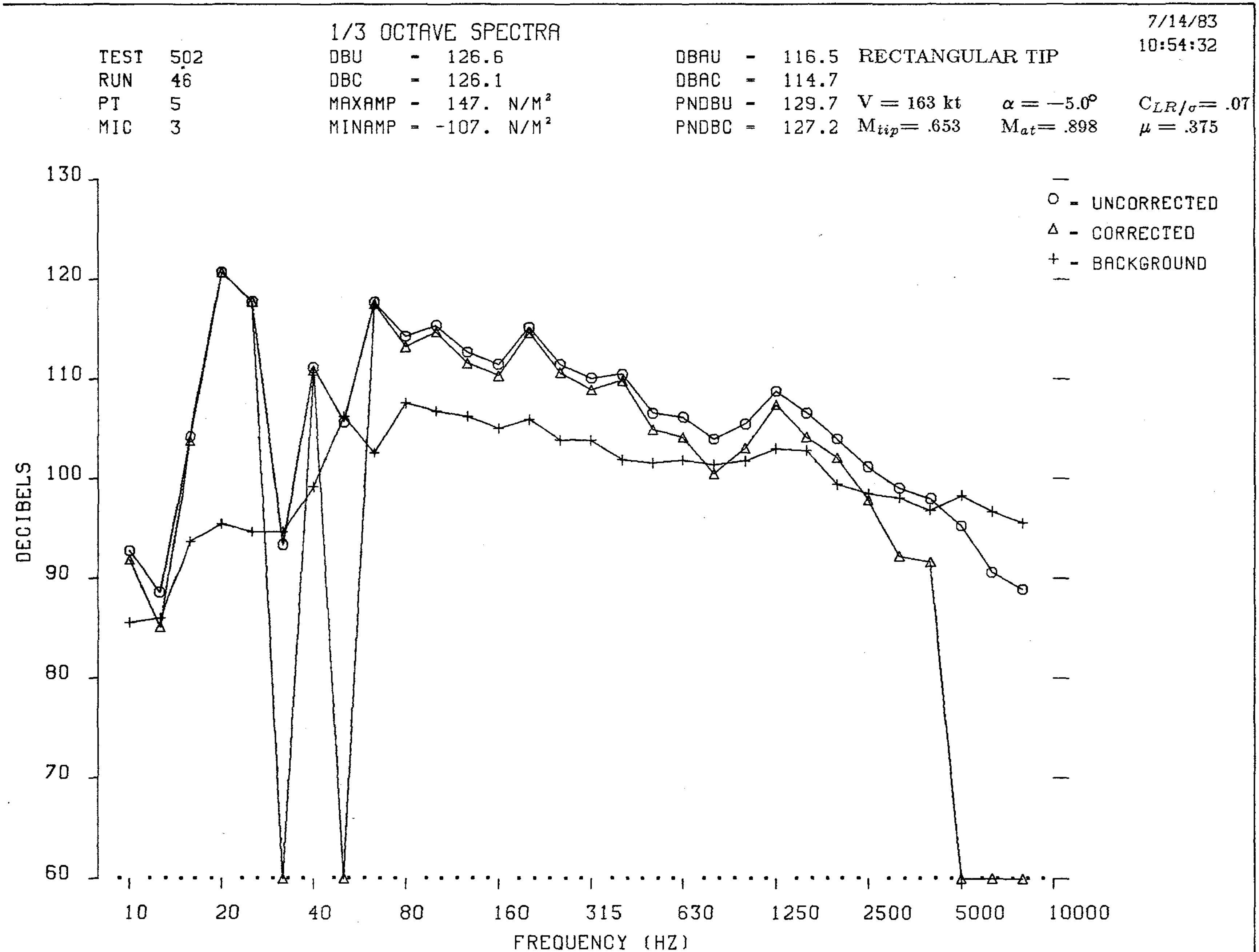


Figure D4(v). One-Third Octave Specta for The Rectangular Tip Rotor.

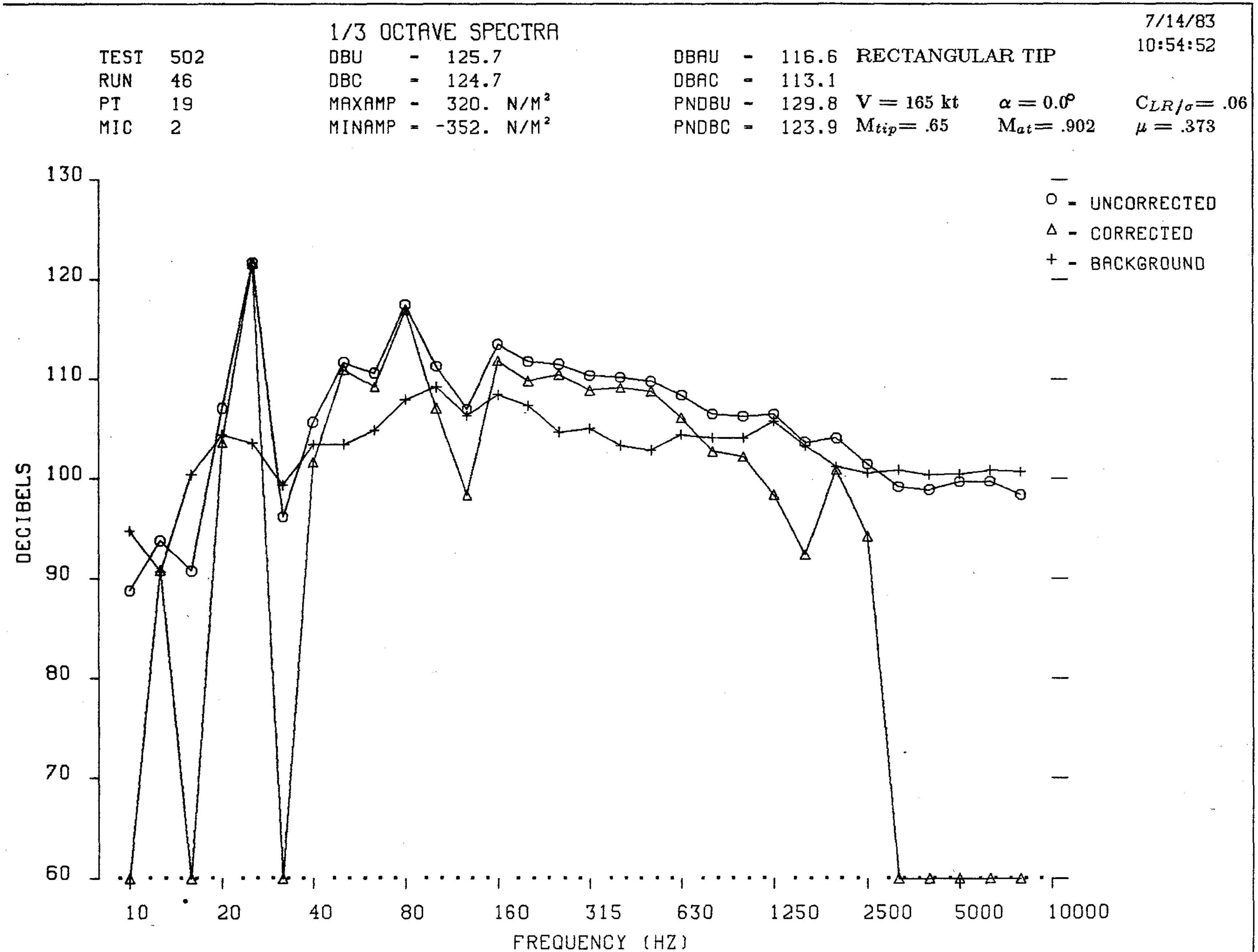


Figure D4(w). One-Third Octave Specta for The Rectangular Tip Rotor.

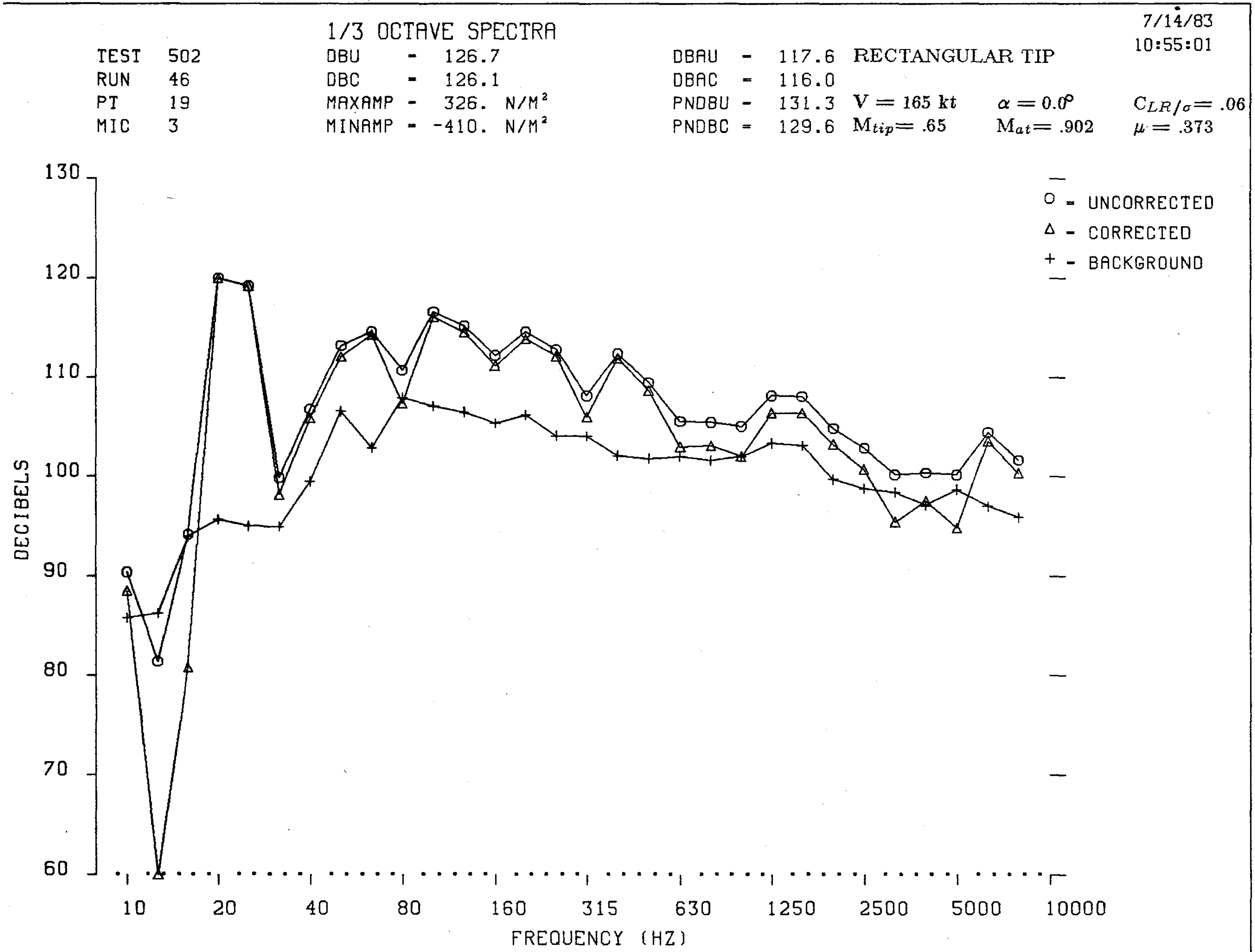


Figure D4(x). **One-Third Octave Specta for The Rectangular Tip Rotor.**

APPENDIX E

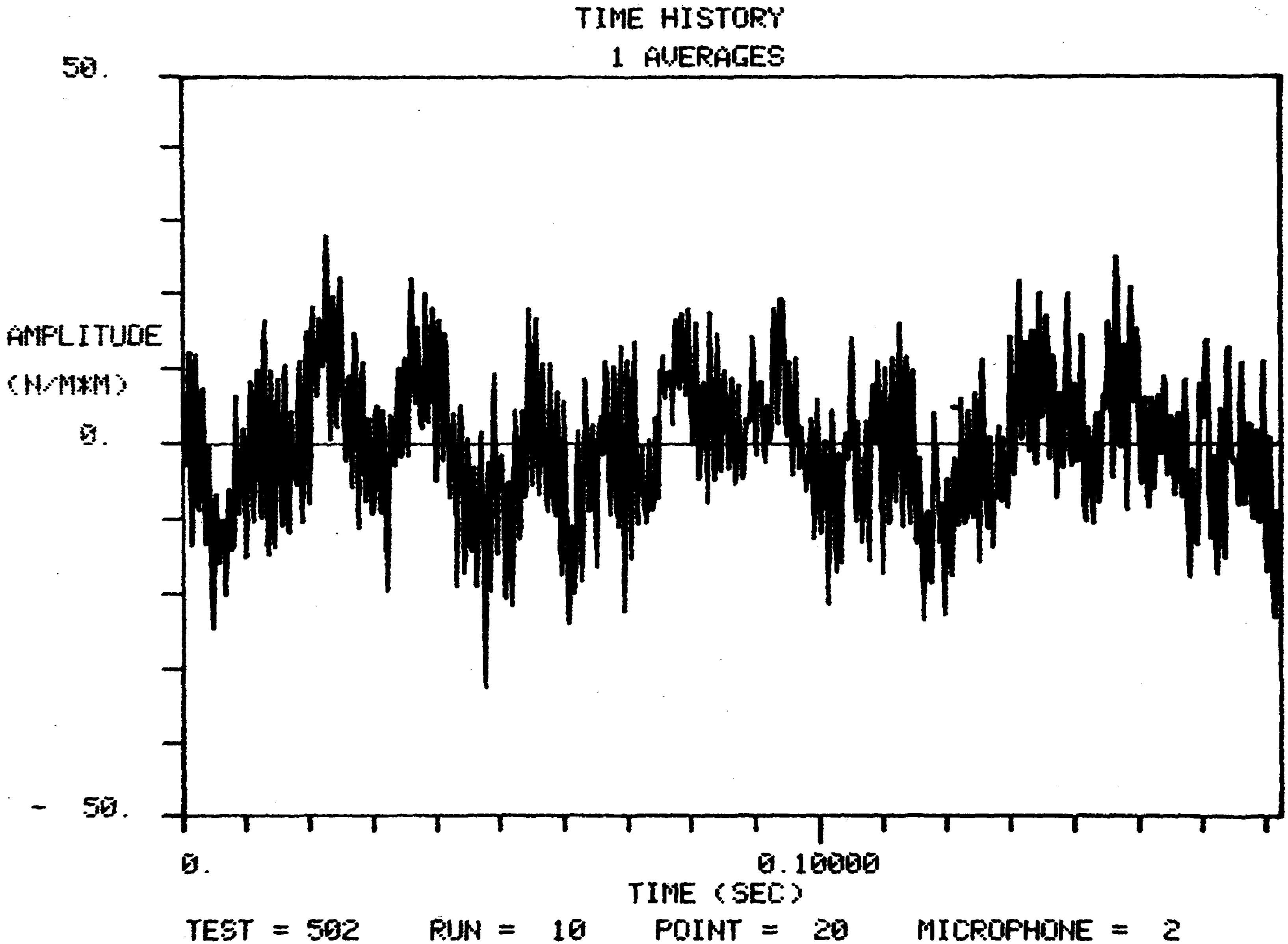
TIME HISTORIES

This appendix provides representative pressure time-histories for two microphones, microphone 2, under the rotor, and microphone 3, located three radii in front of the rotor. The time-histories show a raw waveform for each data point and a waveform from 50 synchronous signals for some of the data. Only some averaged data are shown due to data-acquisition or data-reduction problems. Table 7, which lists the order in which the data are presented, is repeated here for convenience. The symbols used in the time-histories are defined below.

Symbol	Quantity
C_{LR}/σ	rotor-lift coefficient, $\frac{L}{\rho S(\Omega R)^2}$
M_{at}	advancing-tip Mach number
MICROPHONE	microphone number
M_{tip}	rotational tip Mach number
PT	test-point number
RUN	test-run number
V	wind-tunnel velocity, knots
α	angle of shaft from vertical, positive aft, deg
μ	advance ratio

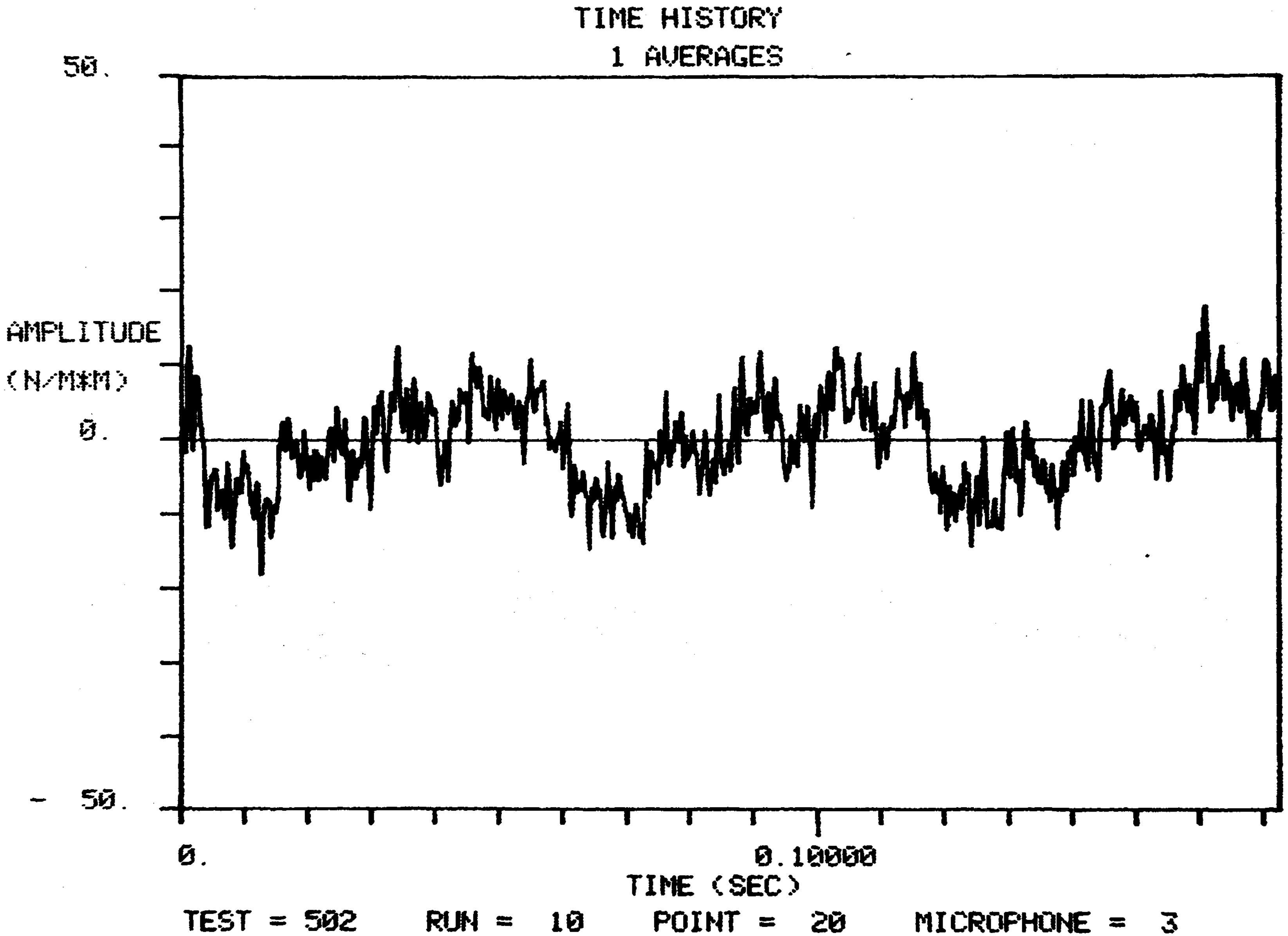
TABLE 7.-KEY TO TIME-HISTORIES IN APPENDIX E

Operating condition				Tip planform, page numbers			
μ	M_{tip}	M_{at}	V	Swept-tapered	Swept	Tapered	Rectangular
0.200	0.550	0.660	73	--	--	--	--
.075	.595	.640	30	--	--	--	--
.150	.595	.685	60	--	--	--	--
.200	.600	.720	80	286	304	324	344
.250	.600	.750	100	--	--	--	--
.300	.600	.780	120	--	--	--	--
.375	.600	.825	150	290	308	332	352
.400	.600	.840	160	--	--	--	--
.250	.650	.815	107	--	--	--	--
.375	.650	.895	164	296	316	--	354
.375	.685	.940	170	--	--	--	--
.250	.700	.875	115	--	--	--	--
.375	.700	.965	175	300	--	340	--



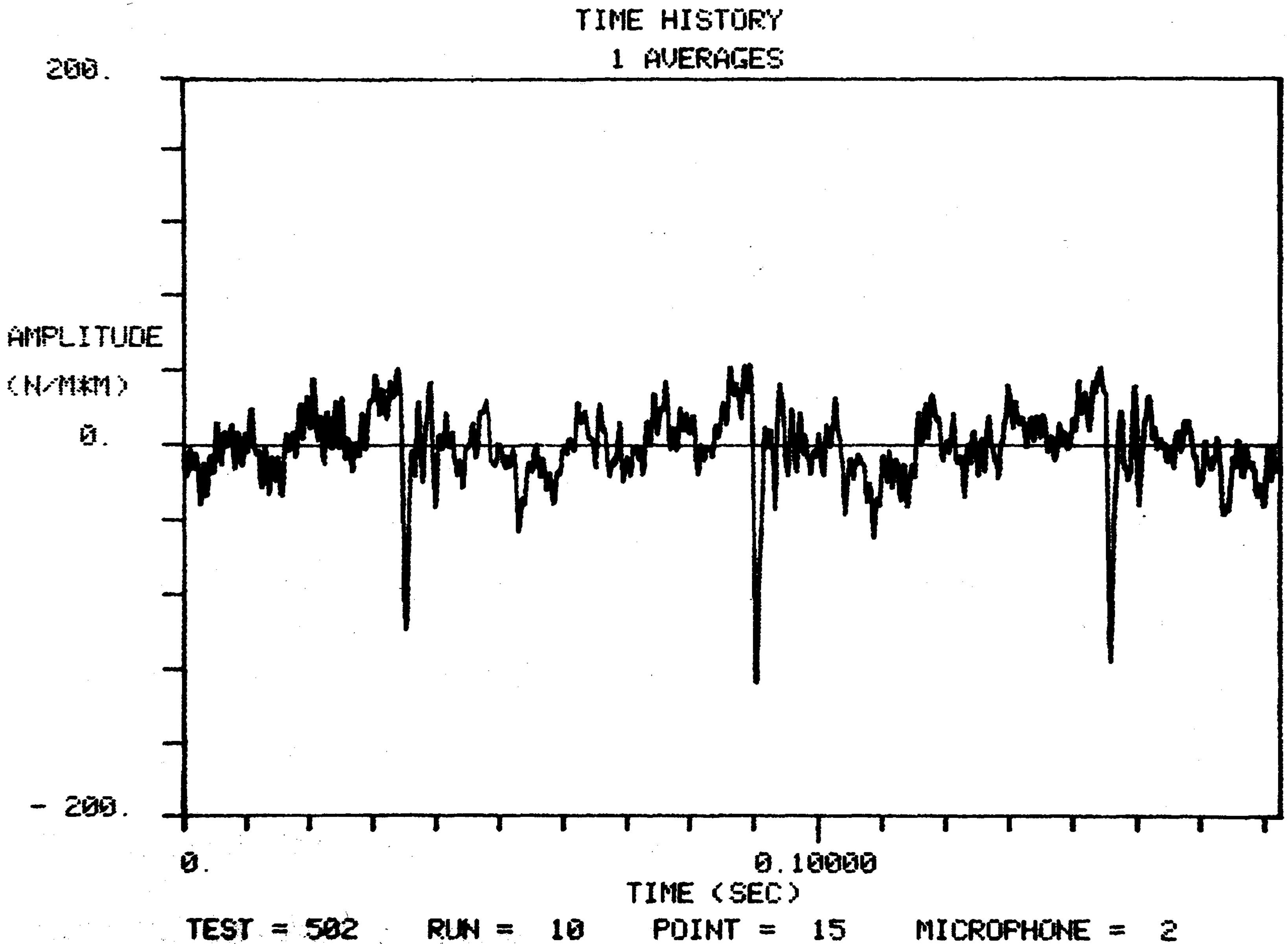
SWEPT TAPERED TIP $V = 79$ kt $\alpha = -2.5^\circ$ $C_{LR/\sigma} = .07$
$M_{tip} = .599$ $M_{at} = .720$ $\mu = .201$

Figure E1(a). Acoustic Time History for Swept Tapered Tip Rotor.



SWEPT TAPERED TIP $V = 79$ kt $\alpha = -2.5^\circ$ $C_{LR/\sigma} = .07$
$M_{tip} = .599$ $M_{at} = .720$ $\mu = .201$

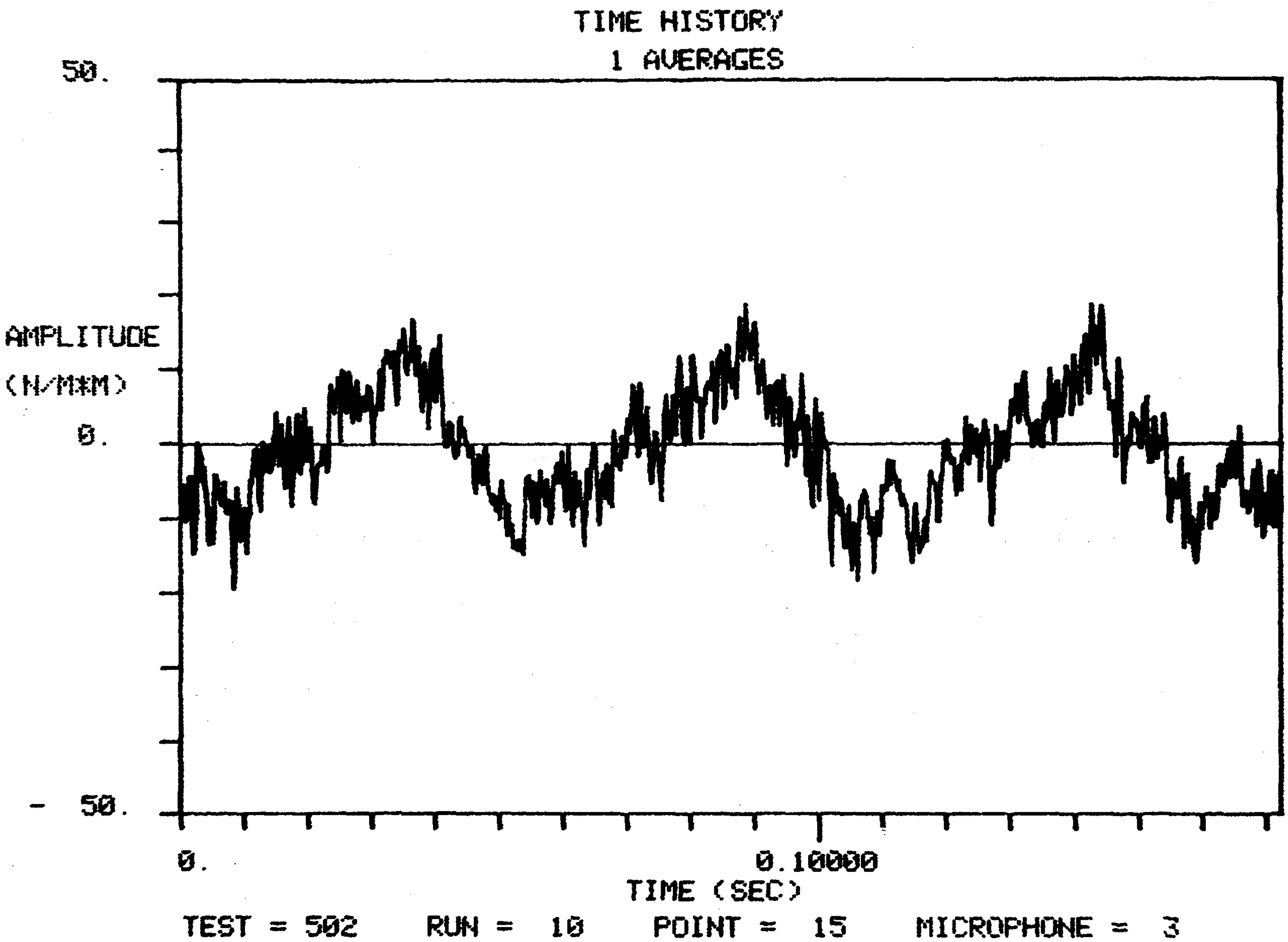
Figure E1(b). Acoustic Time History for Swept Tapered Tip Rotor.



SWEPT TAPERED TIP $V = 79$ kt $\alpha = 0.0^{\circ}$ $C_{LR/\sigma} = .10$

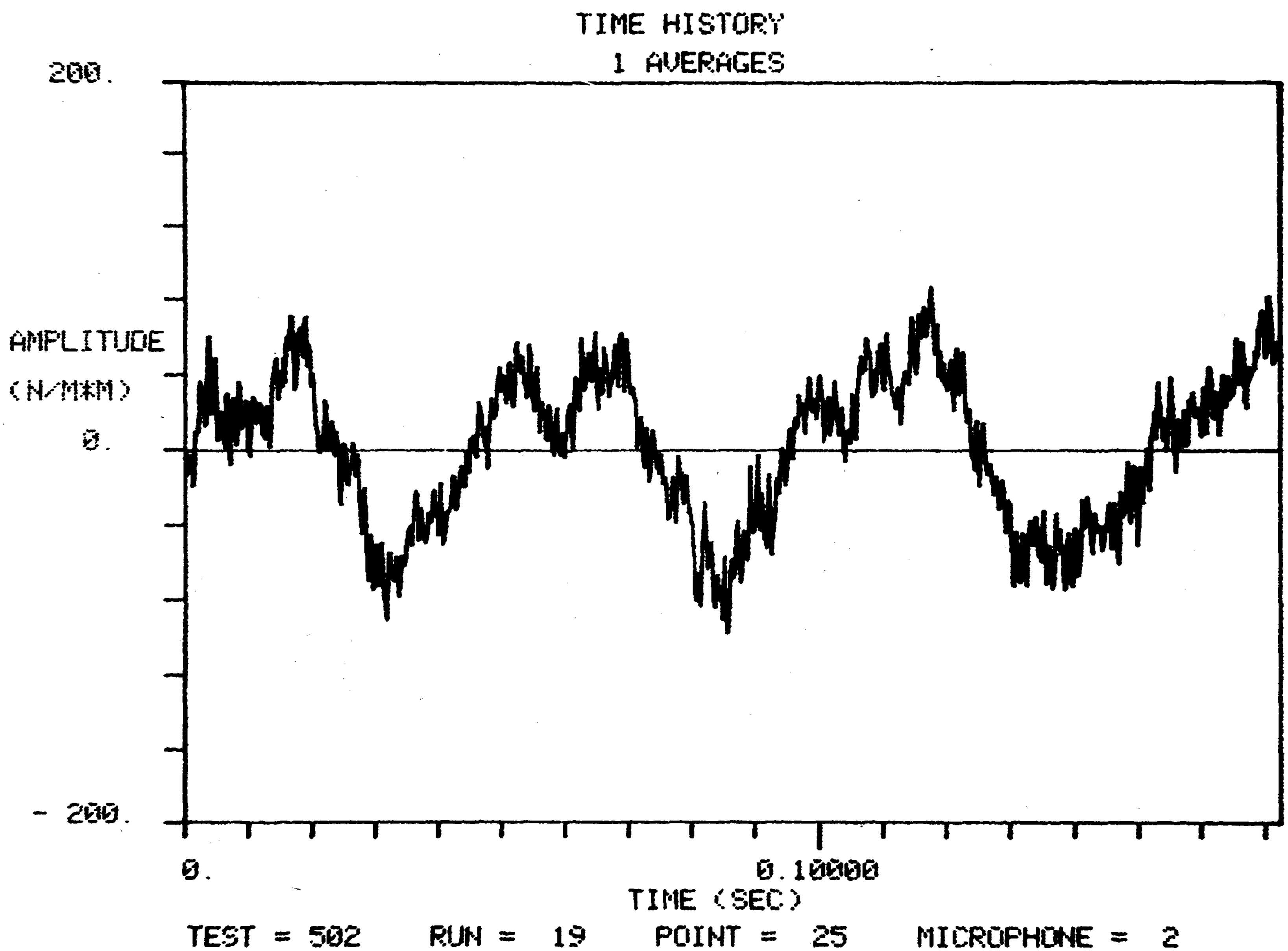
$M_{tip} = .598$ $M_{at} = .720$ $\mu = .201$

Figure E1(c). Acoustic Time History for Swept Tapered Tip Rotor.



SWEPT TAPERED TIP $V = 79$ kt $\alpha = 0.0^{\circ}$ $C_{LR/\sigma} = .10$
$M_{tip} = .598$ $M_{at} = .720$ $\mu = .201$

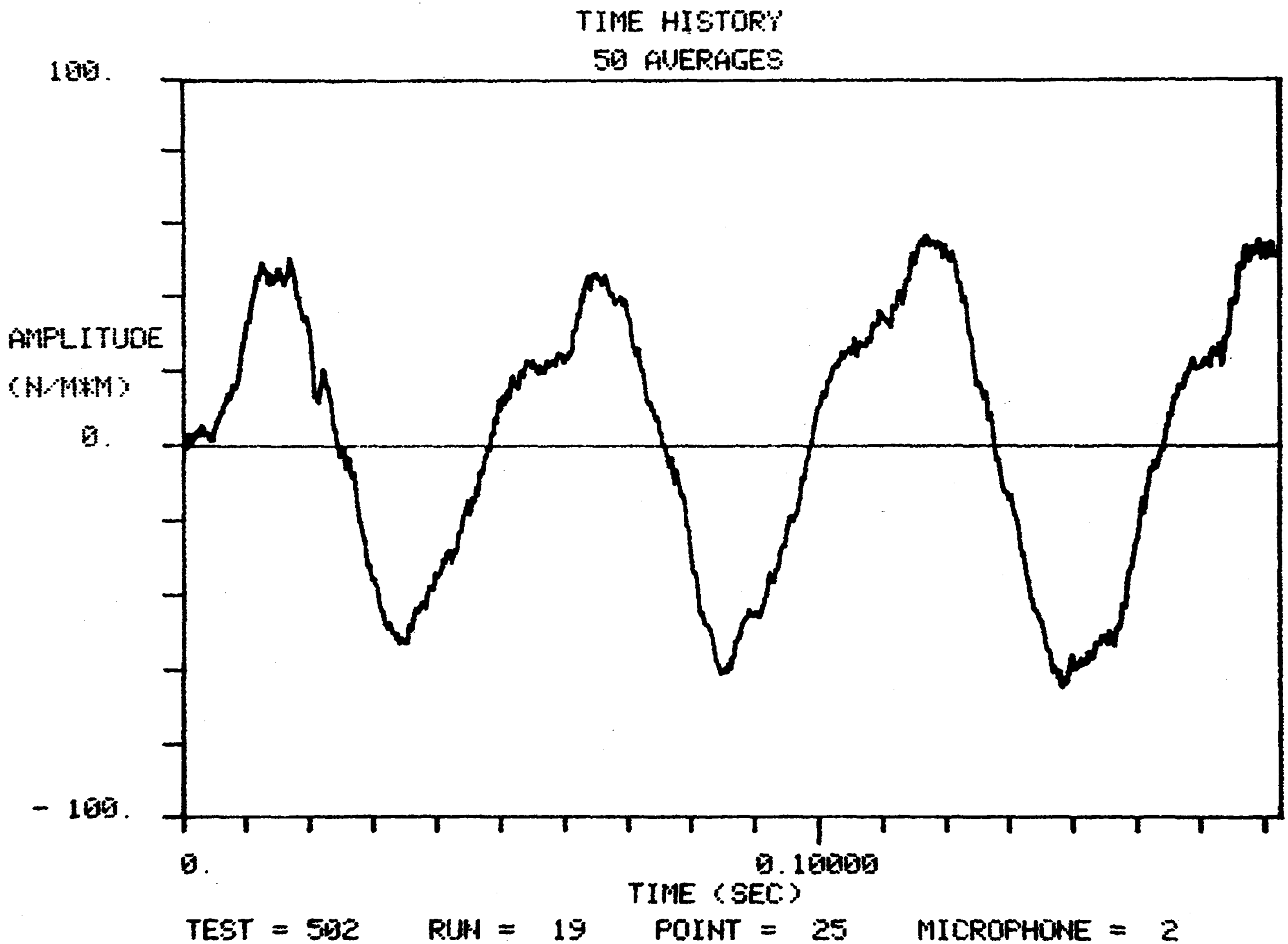
Figure E1(d). Acoustic Time History for Swept Tapered Tip Rotor.



SWEPT TAPERED TIP $V = 152$ kt $\alpha = -5.0°$ $C_{LR/\sigma} = .07$

$M_{tip} = .599$ $M_{at} = .824$ $\mu = .376$

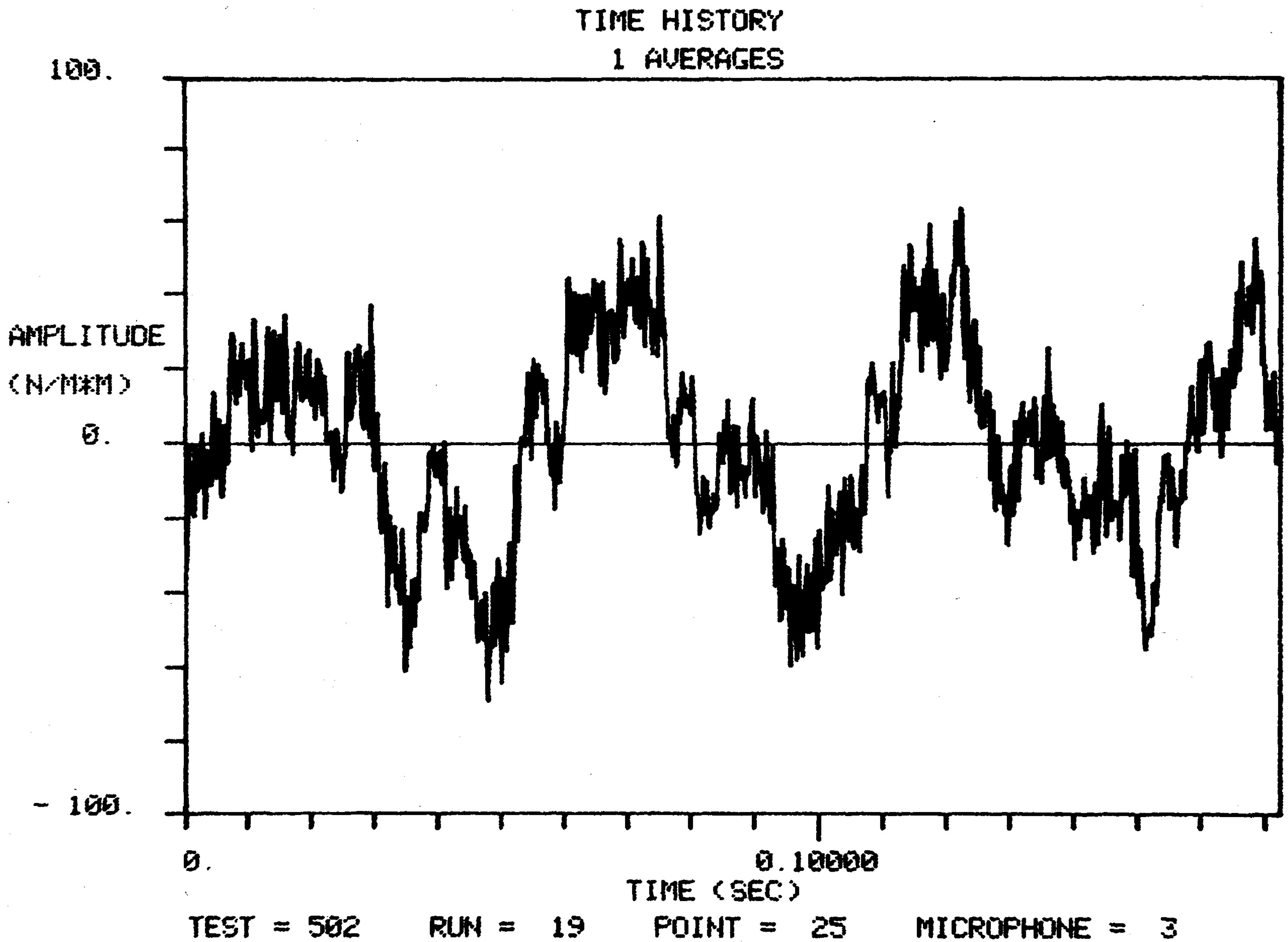
Figure E1(e). Acoustic Time History for Swept Tapered Tip Rotor.



SWEPT TAPERED TIP $V = 152$ kt $\alpha = -5.0^{\circ}$ $C_{LR/\sigma} = .07$

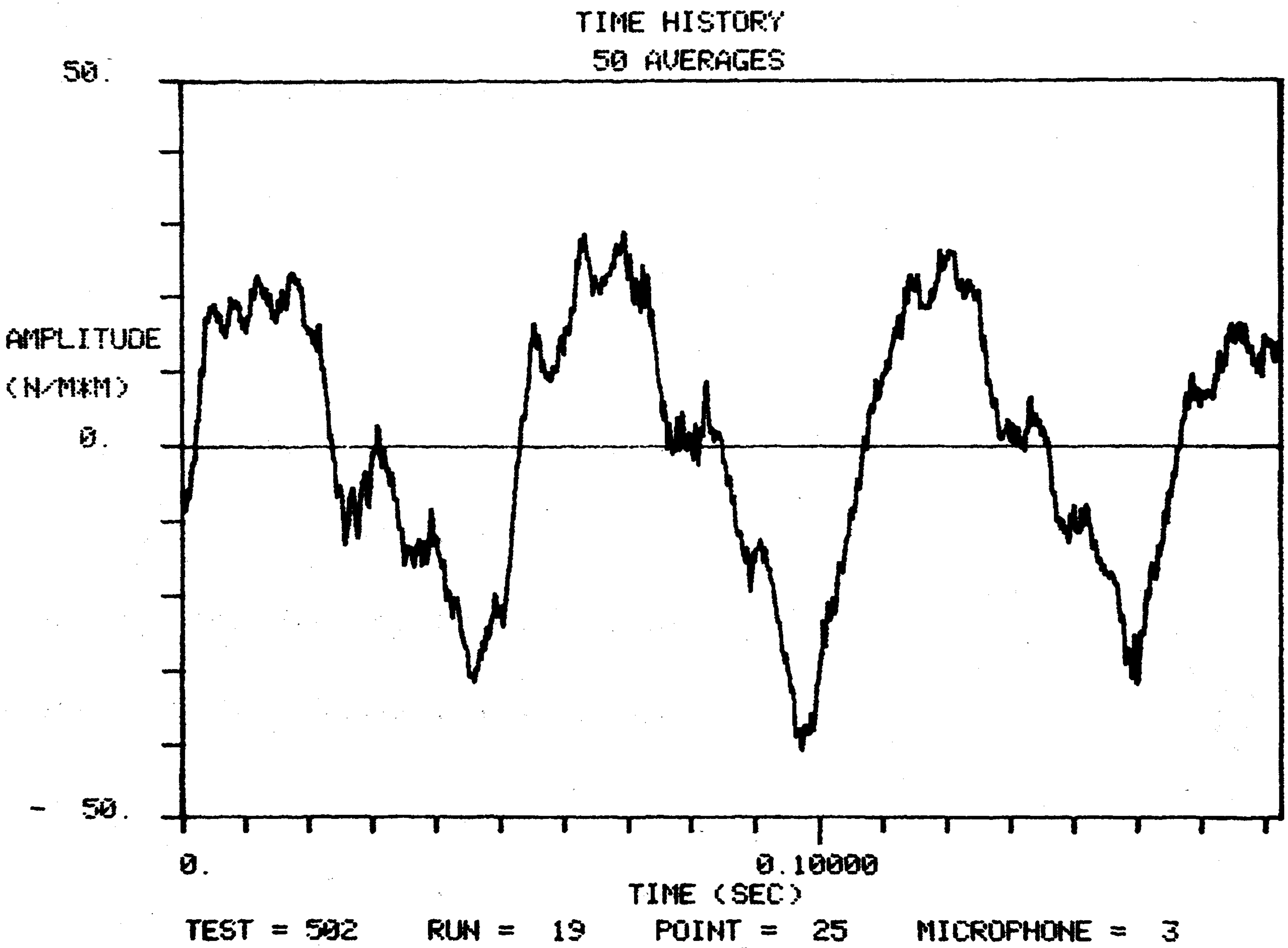
$M_{tip} = .599$ $M_{at} = .824$ $\mu = .376$

Figure E1(f). Acoustic Time History for Swept Tapered Tip Rotor.



SWEPT TAPERED TIP $V = 152$ kt $\alpha = -5.0^\circ$ $C_{LR/\sigma} = .07$
$M_{tip} = .599$ $M_{at} = .824$ $\mu = .376$

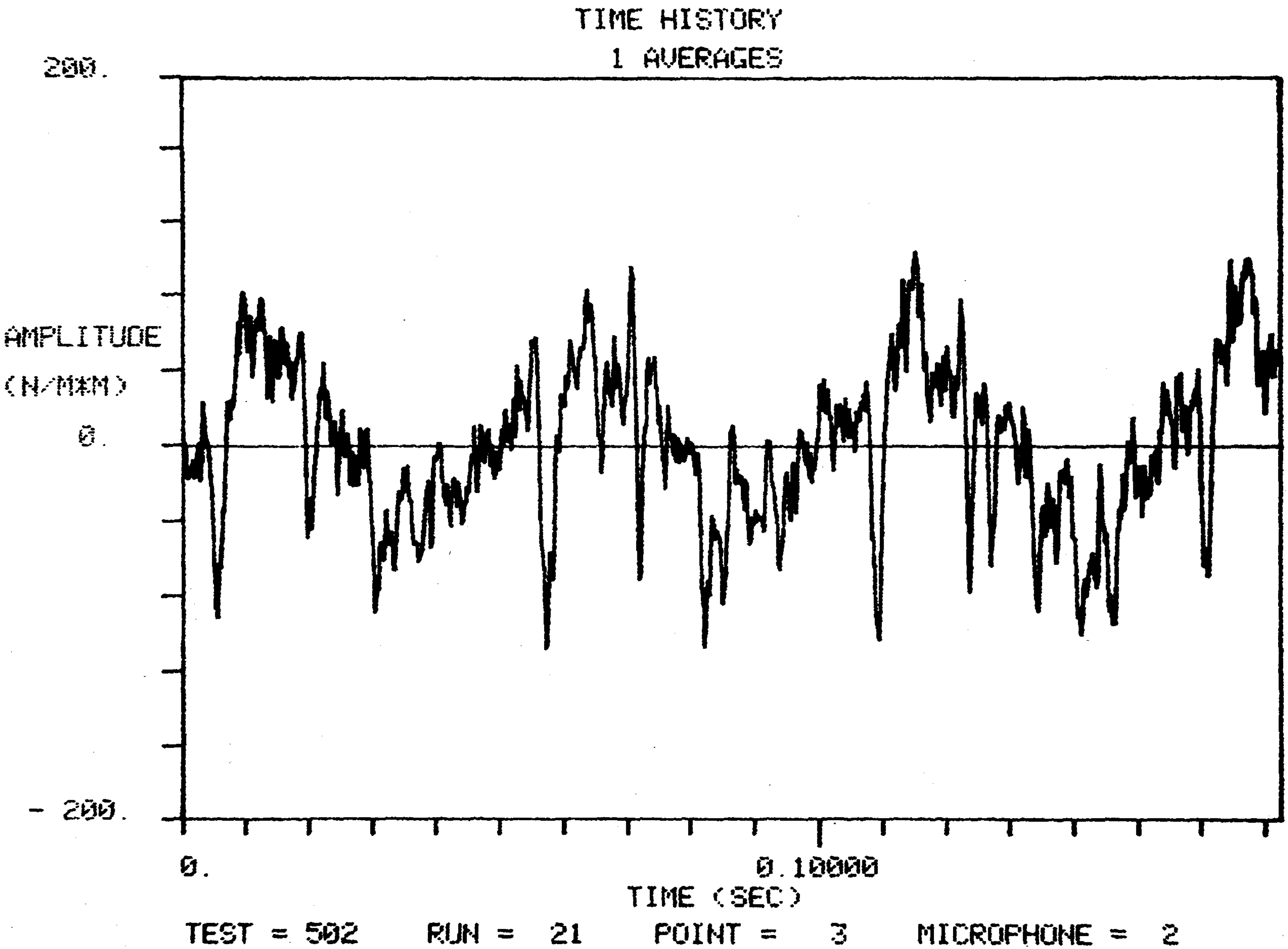
Figure E1(g). Acoustic Time History for Swept Tapered Tip Rotor.



SWEPT TAPERED TIP $V = 152$ kt $\alpha = -5.0^{\circ}$ $C_{LR/\sigma} = .07$

$M_{tip} = .599$ $M_{at} = .824$ $\mu = .376$

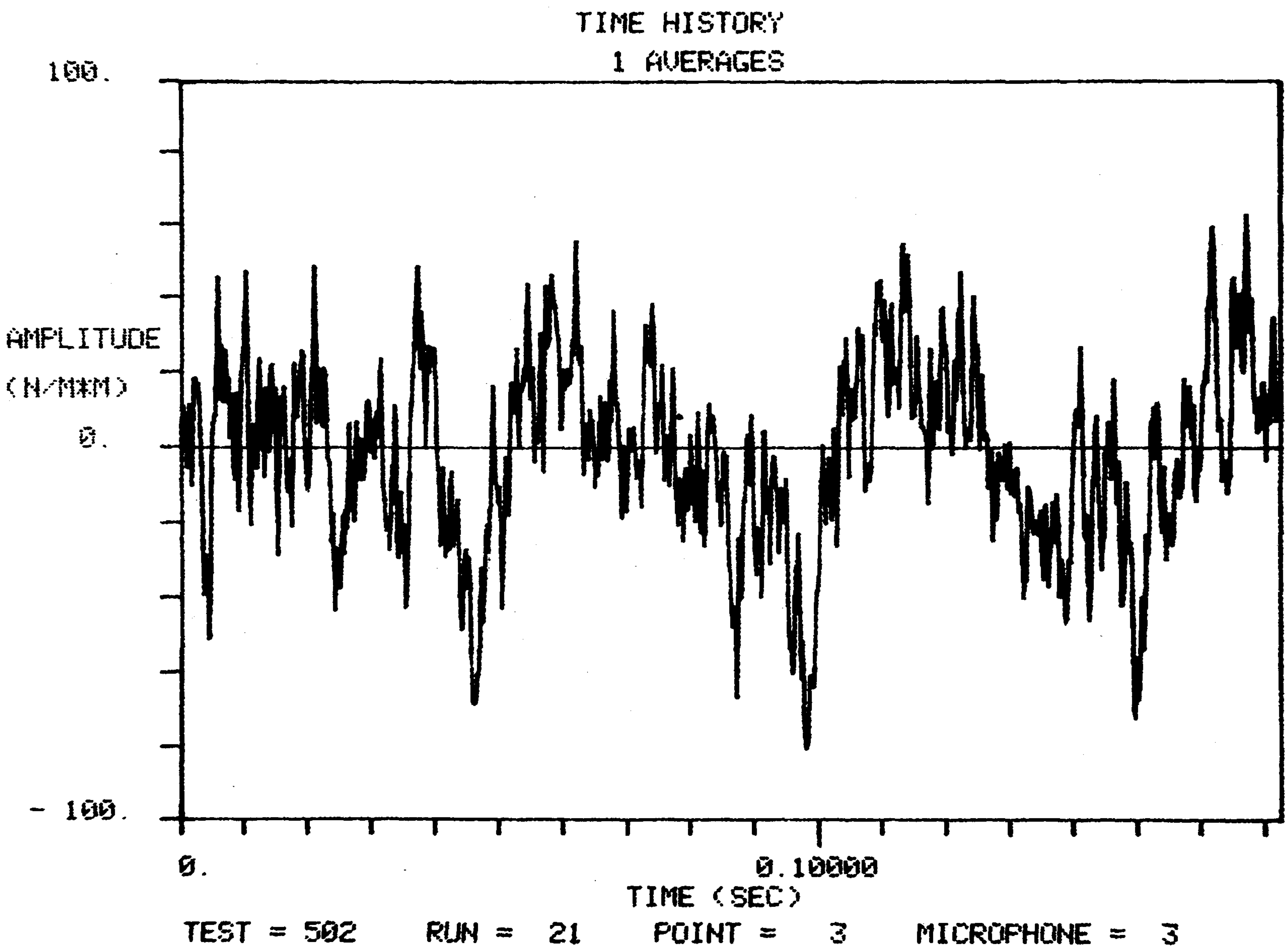
Figure E1(h). Acoustic Time History for Swept Tapered Tip Rotor.



SWEPT TAPERED TIP $V = 148$ kt $\alpha = 0.0°$ $C_{LR/\sigma} = .10$

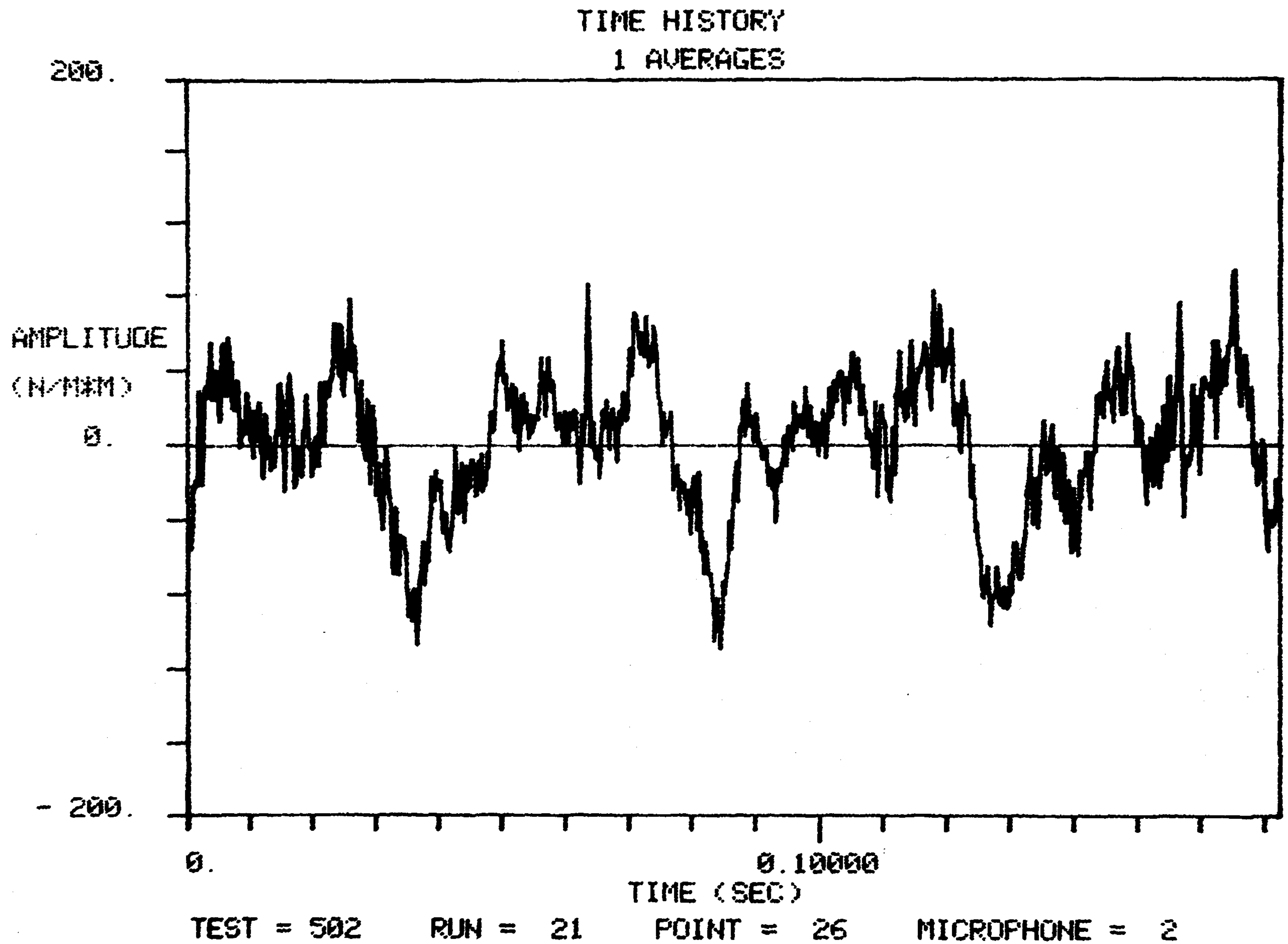
$M_{tip} = .600$ $M_{at} = .826$ $\mu = .376$

Figure E1(i). Acoustic Time History for Swept Tapered Tip Rotor.



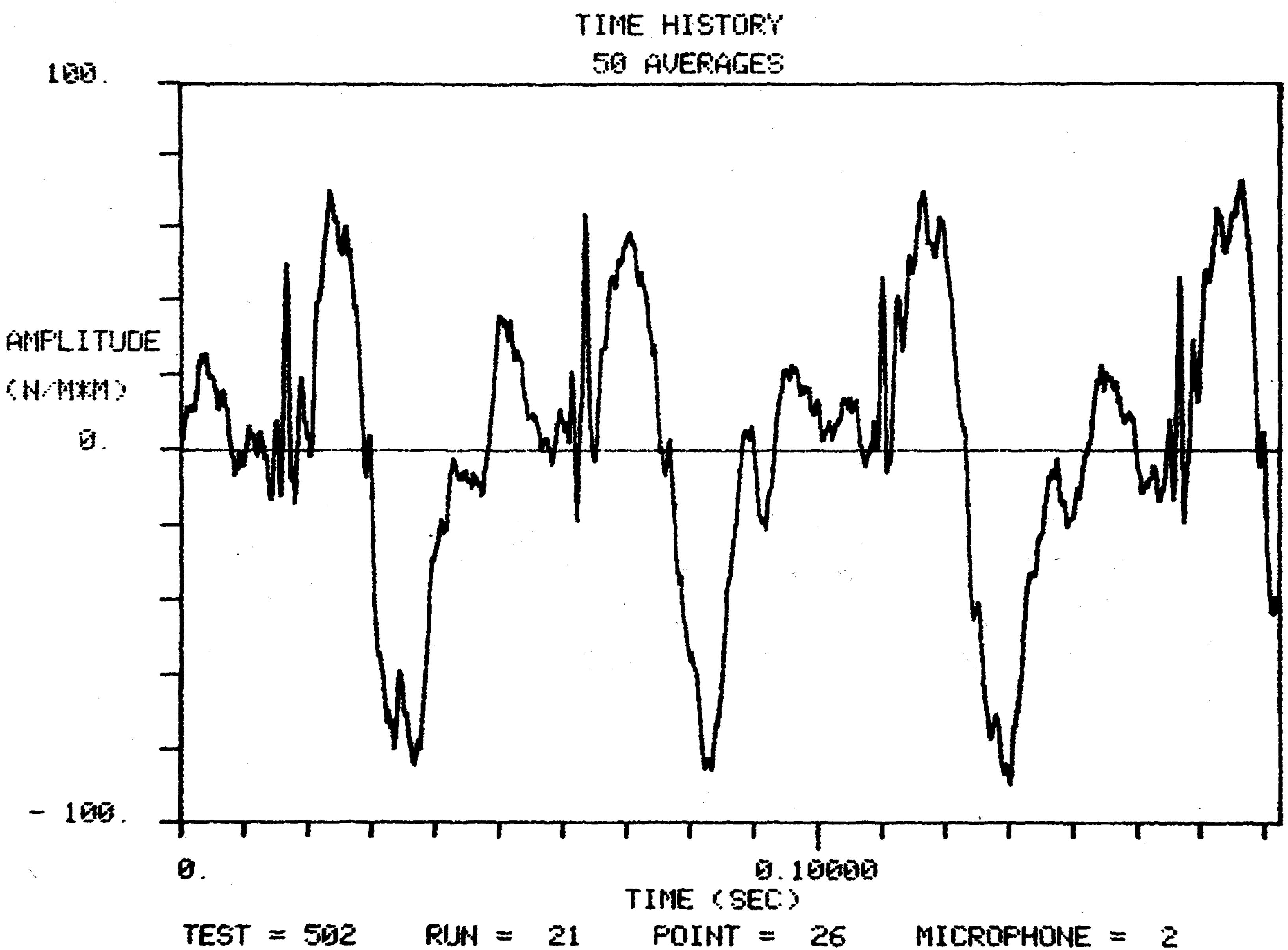
SWEPT TAPERED TIP $V = 148$ kt $\alpha = 0.0°$ $C_{LR/\sigma} = .10$
$M_{tip} = .600$ $M_{at} = .826$ $\mu = .376$

Figure E1(j). Acoustic Time History for Swept Tapered Tip Rotor.



SWEPT TAPERED TIP $V = 164$ kt $\alpha = -5.0^\circ$ $C_{LR/\sigma} = .08$
$M_{tip} = .652$ $M_{at} = .896$ $\mu = .375$

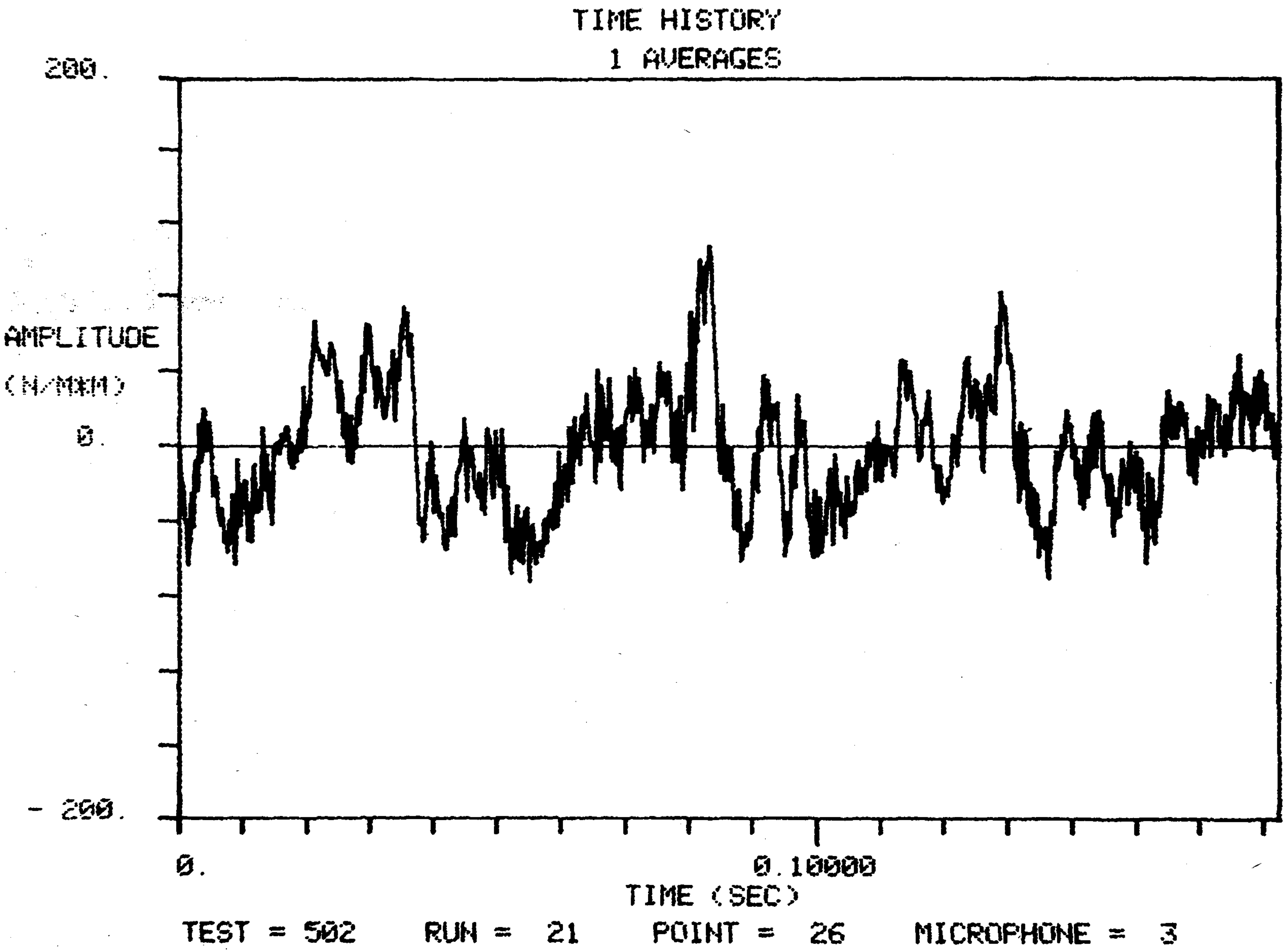
Figure E1(k). Acoustic Time History for Swept Tapered Tip Rotor.



SWEPT TAPERED TIP $V = 164$ kt $\alpha = -5.0^\circ$ $C_{LR/\sigma} = .08$

$M_{tip} = .652$ $M_{at} = .896$ $\mu = .375$

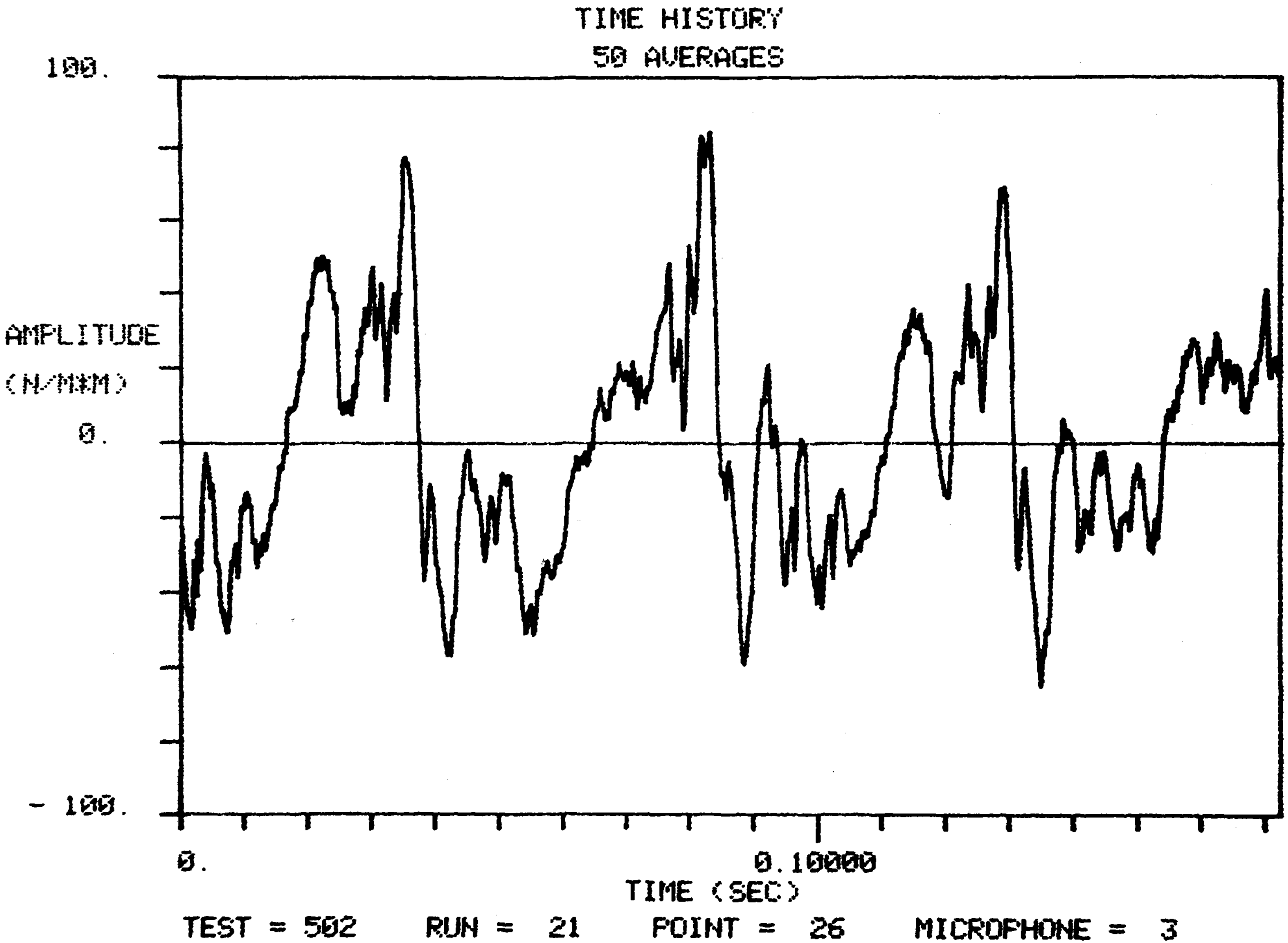
Figure E1(l). Acoustic Time History for Swept Tapered Tip Rotor.



SWEPT TAPERED TIP $V = 164$ kt $\alpha = -5.0°$ $C_{LR/\sigma} = .08$

$M_{tip} = .652$ $M_{at} = .896$ $\mu = .375$

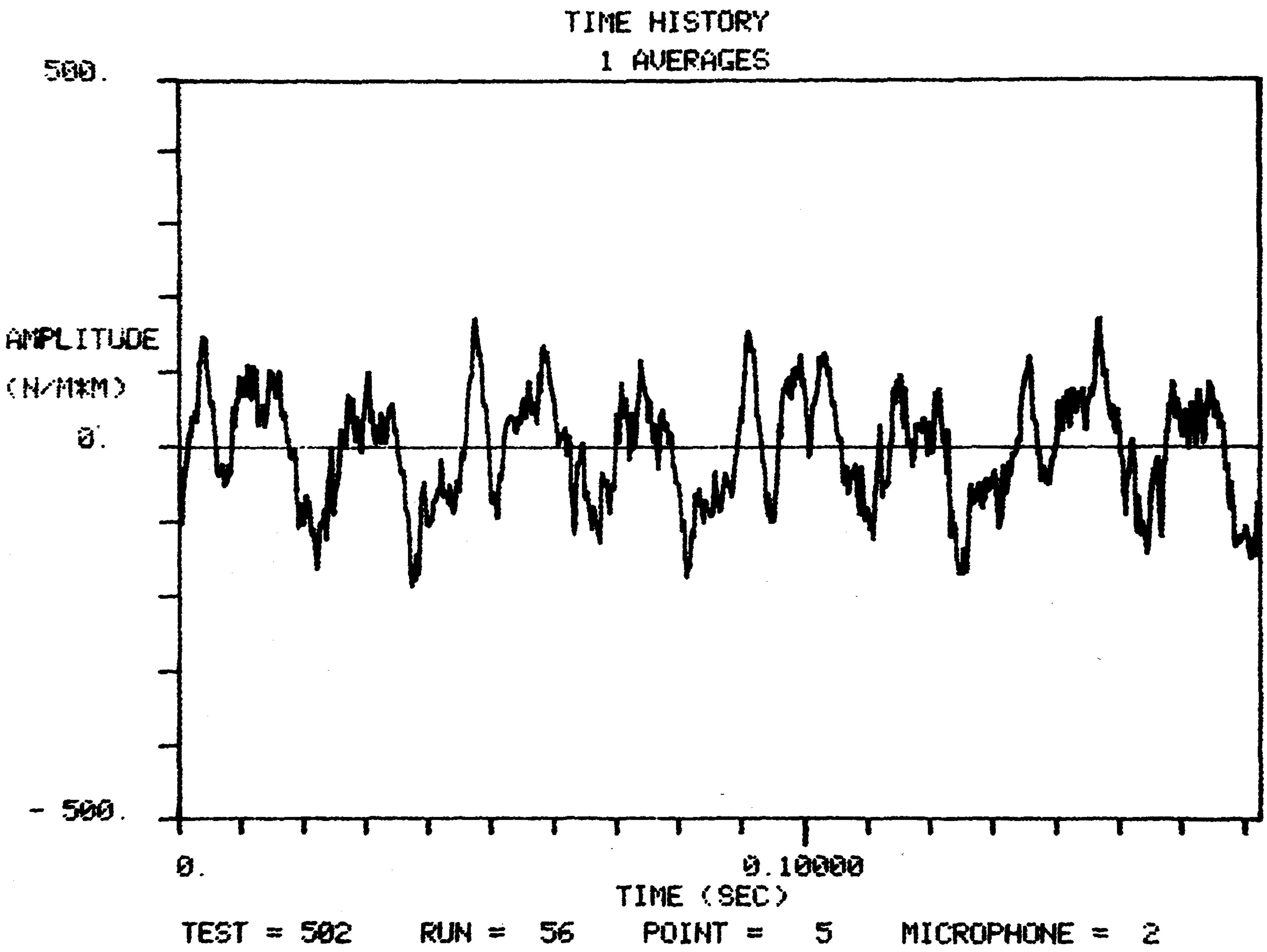
Figure E1(m). Acoustic Time History for Swept Tapered Tip Rotor.



SWEPT TAPERED TIP $V = 164$ kt $\alpha = -5.0^{\circ}$ $C_{LR/\sigma} = .08$

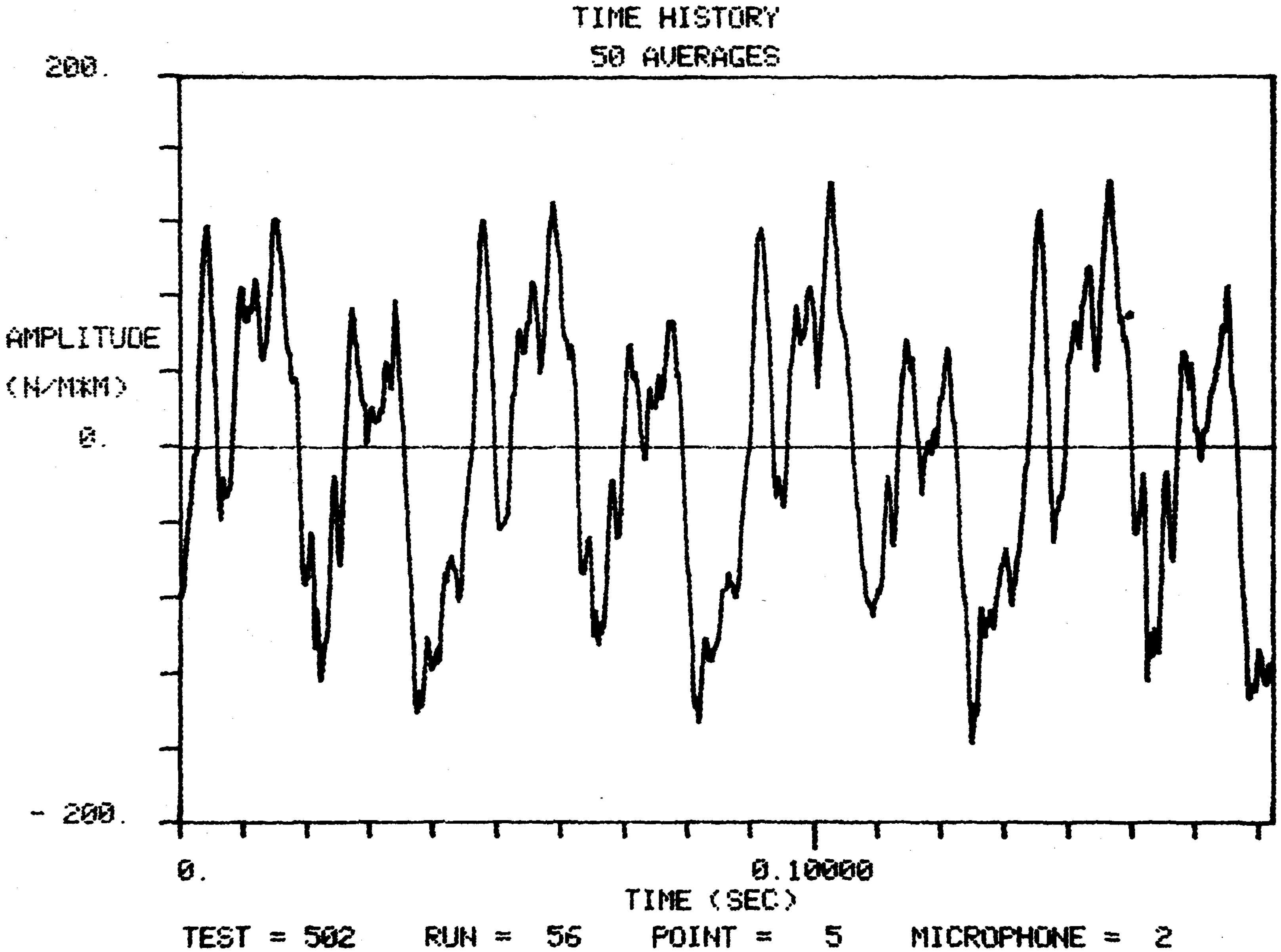
$M_{tip} = .652$ $M_{at} = .896$ $\mu = .375$

Figure E1(n). Acoustic Time History for Swept Tapered Tip Rotor.



SWEPT TAPERED TIP $V = 175$ kt $\alpha = -5.0^{\circ}$ $C_{LR/\sigma} = .08$
$M_{tip} = .705$ $M_{at} = .969$ $\mu = .374$

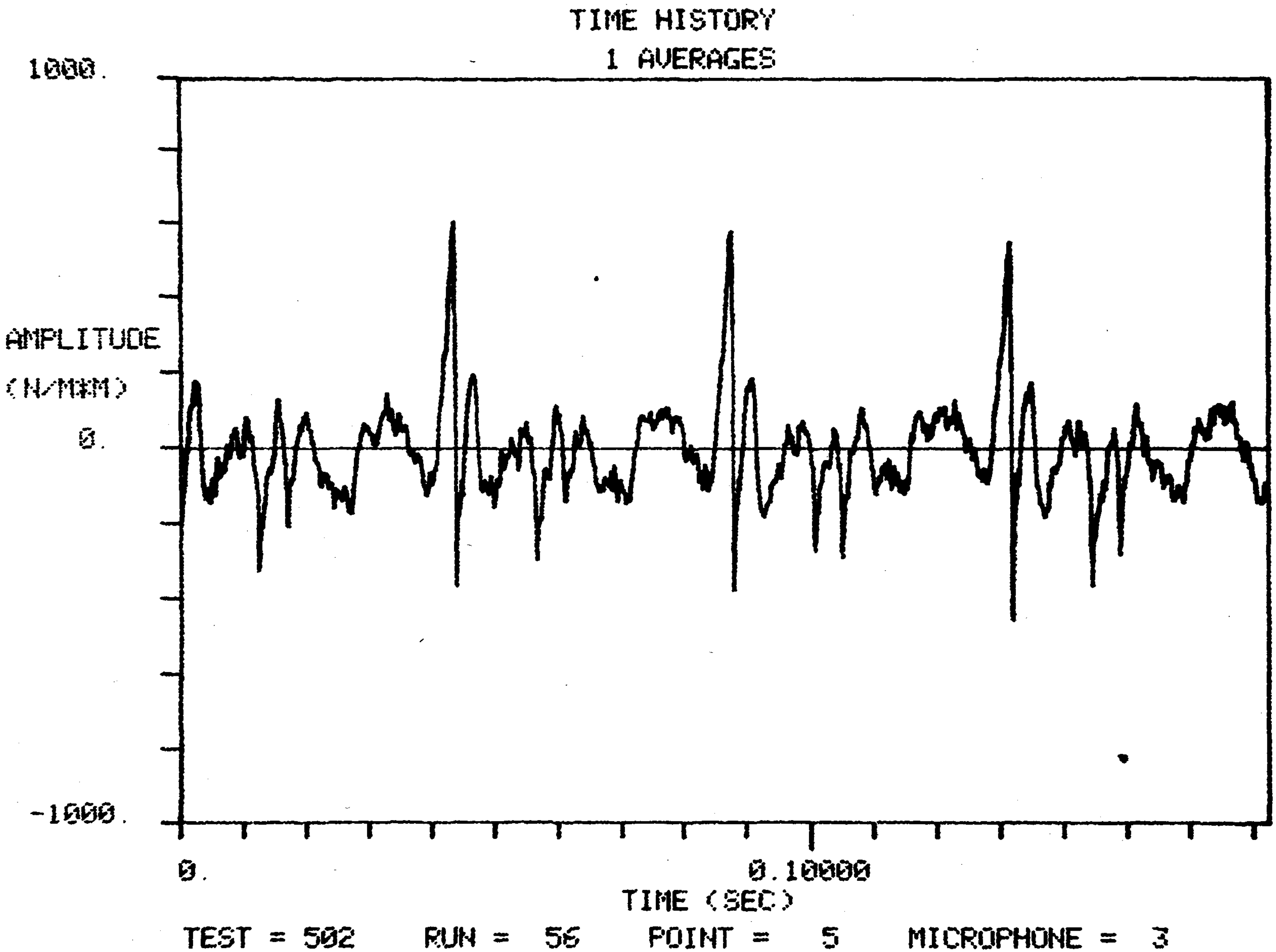
Figure E1(o). Acoustic Time History for Swept Tapered Tip Rotor.



SWEPT TAPERED TIP $V = 175$ kt $\alpha = -5.0^\circ$ $C_{LR/\sigma} = .08$

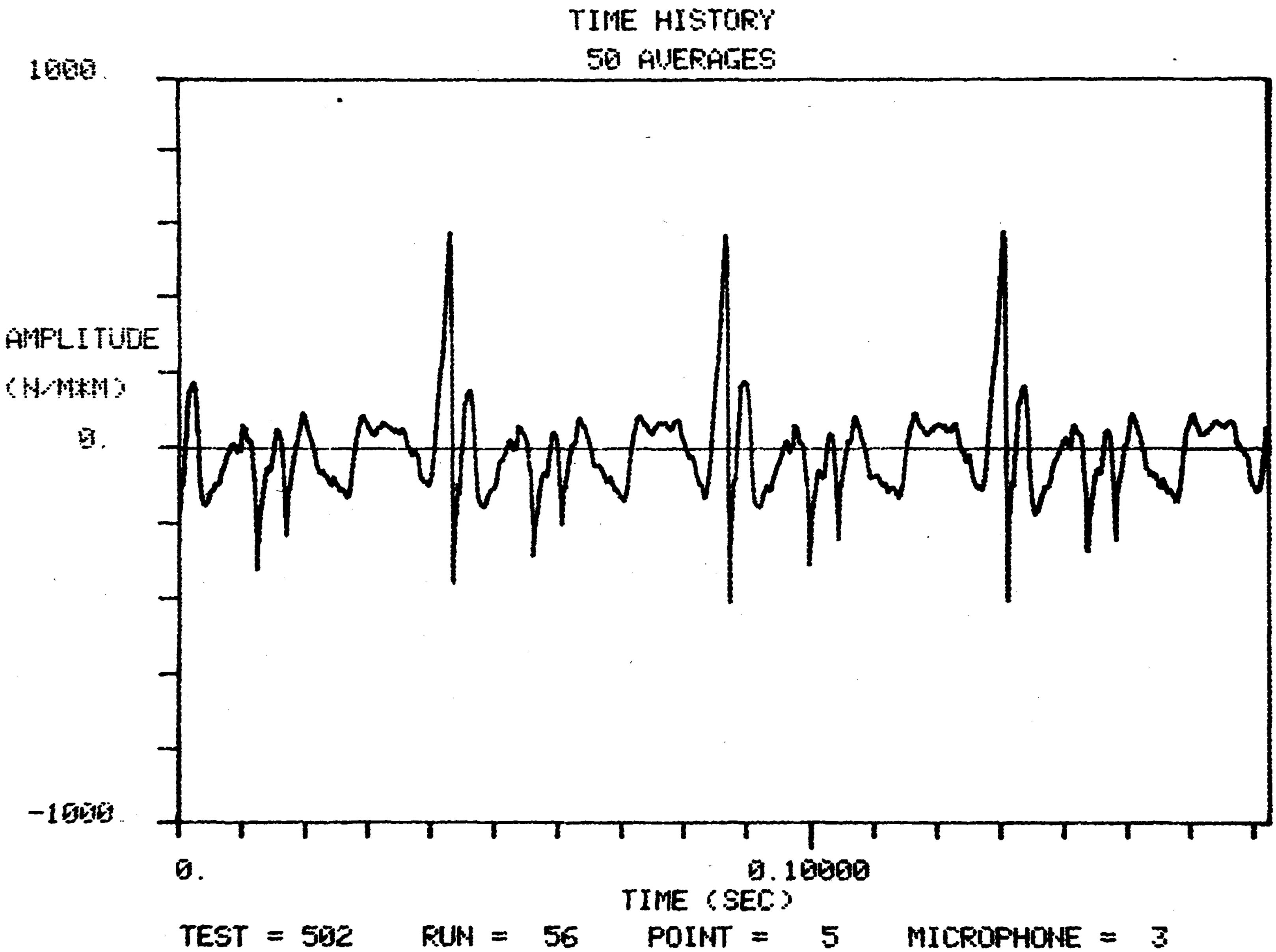
$M_{tip} = .705$ $M_{at} = .969$ $\mu = .374$

Figure E1(p). Acoustic Time History for Swept Tapered Tip Rotor.



SWEPT TAPERED TIP $V = 175$ kt $\alpha = -5.0^\circ$ $C_{LR/\sigma} = .08$
$M_{tip} = .705$ $M_{at} = .969$ $\mu = .374$

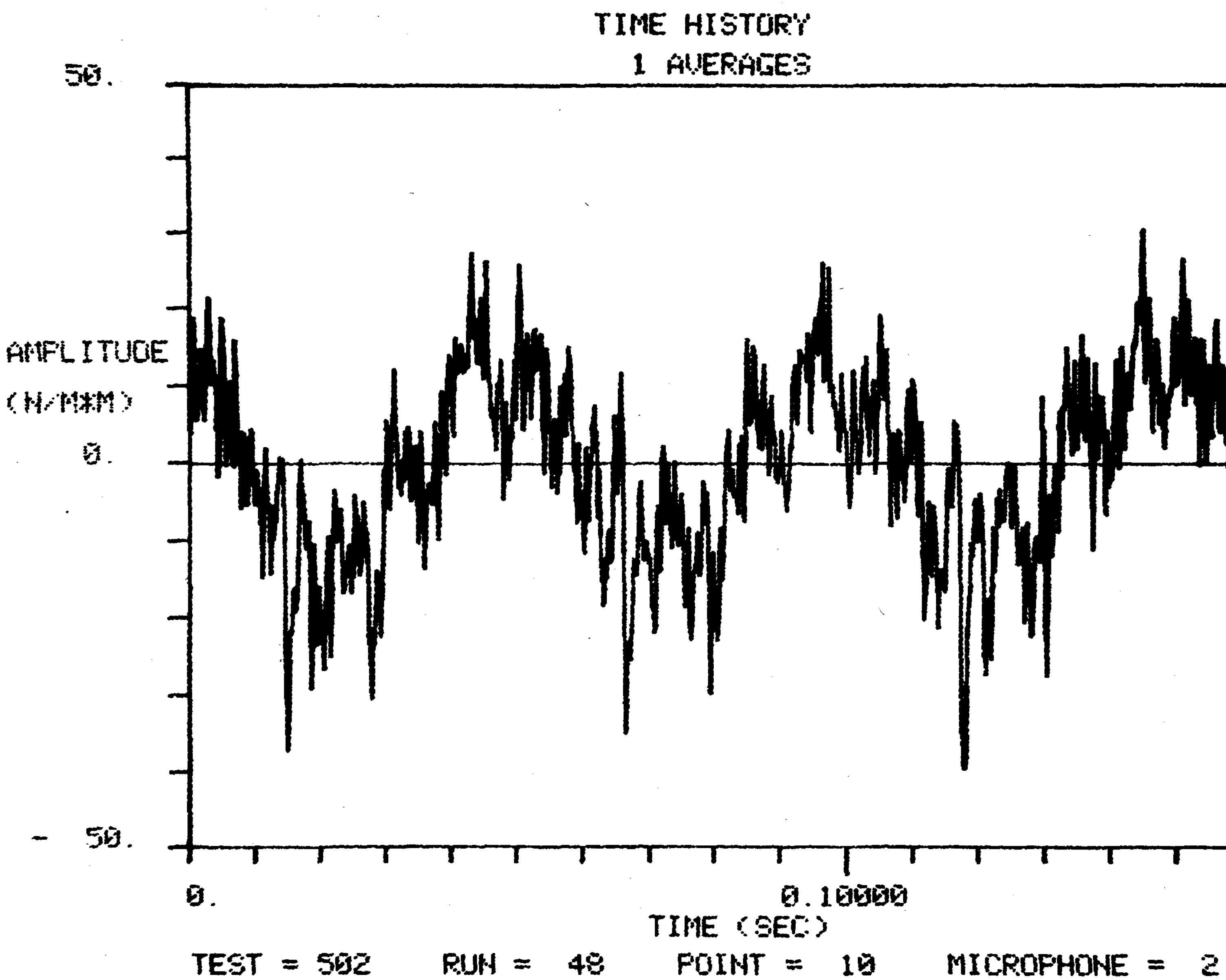
Figure E1(q). Acoustic Time History for Swept Tapered Tip Rotor.



SWEPT TAPERED TIP $V = 175$ kt $\alpha = -5.0°$ $C_{LR/\sigma} = .08$

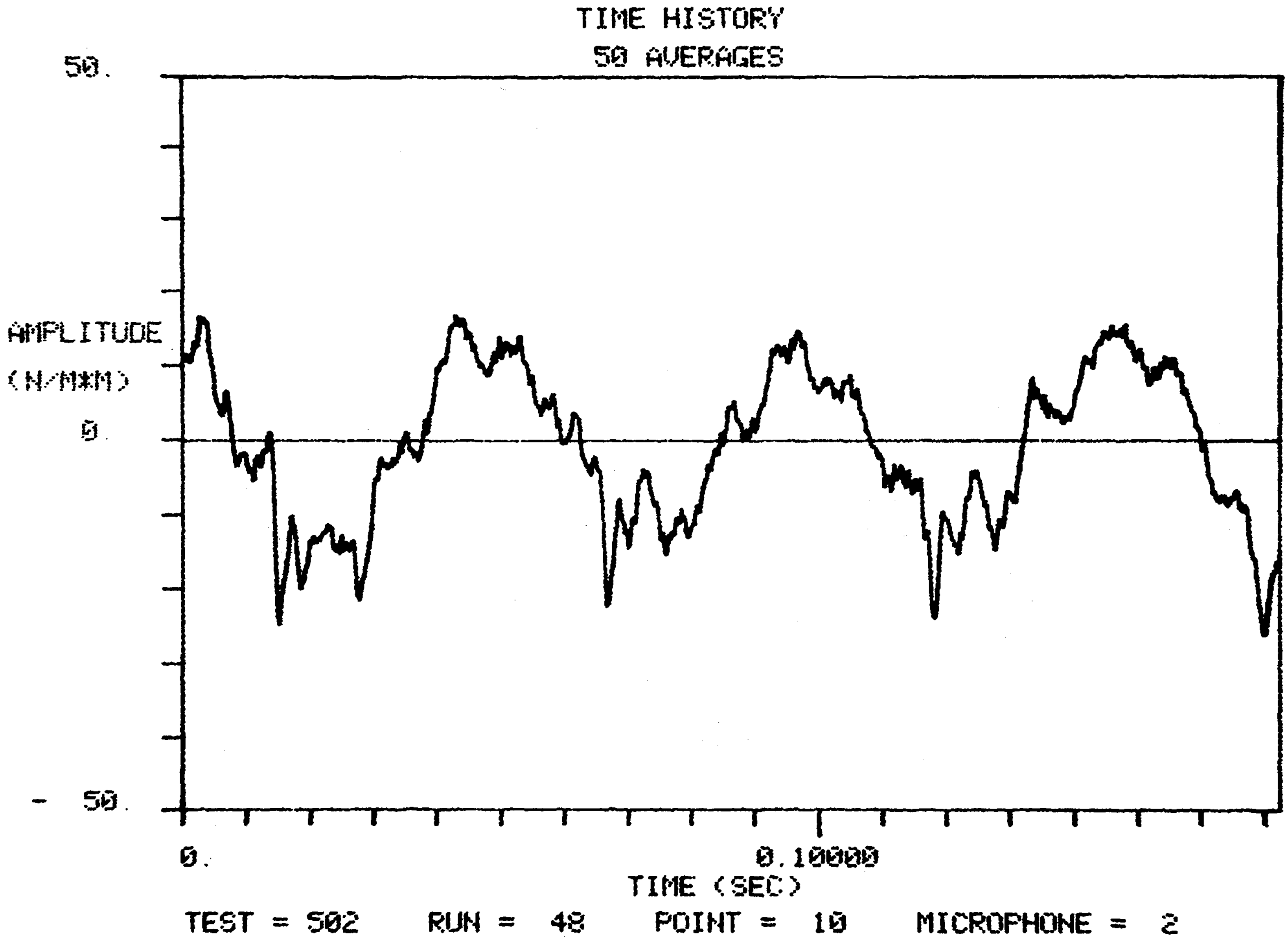
$M_{tip} = .705$ $M_{at} = .969$ $\mu = .374$

Figure E1(r). Acoustic Time History for Swept Tapered Tip Rotor.



SWEPT TIP $V = 81$ kt $\alpha = -2.5^\circ$ $C_{LR/\sigma} = .07$
$M_{tip} = .598$ $M_{at} = .718$ $\mu = .200$

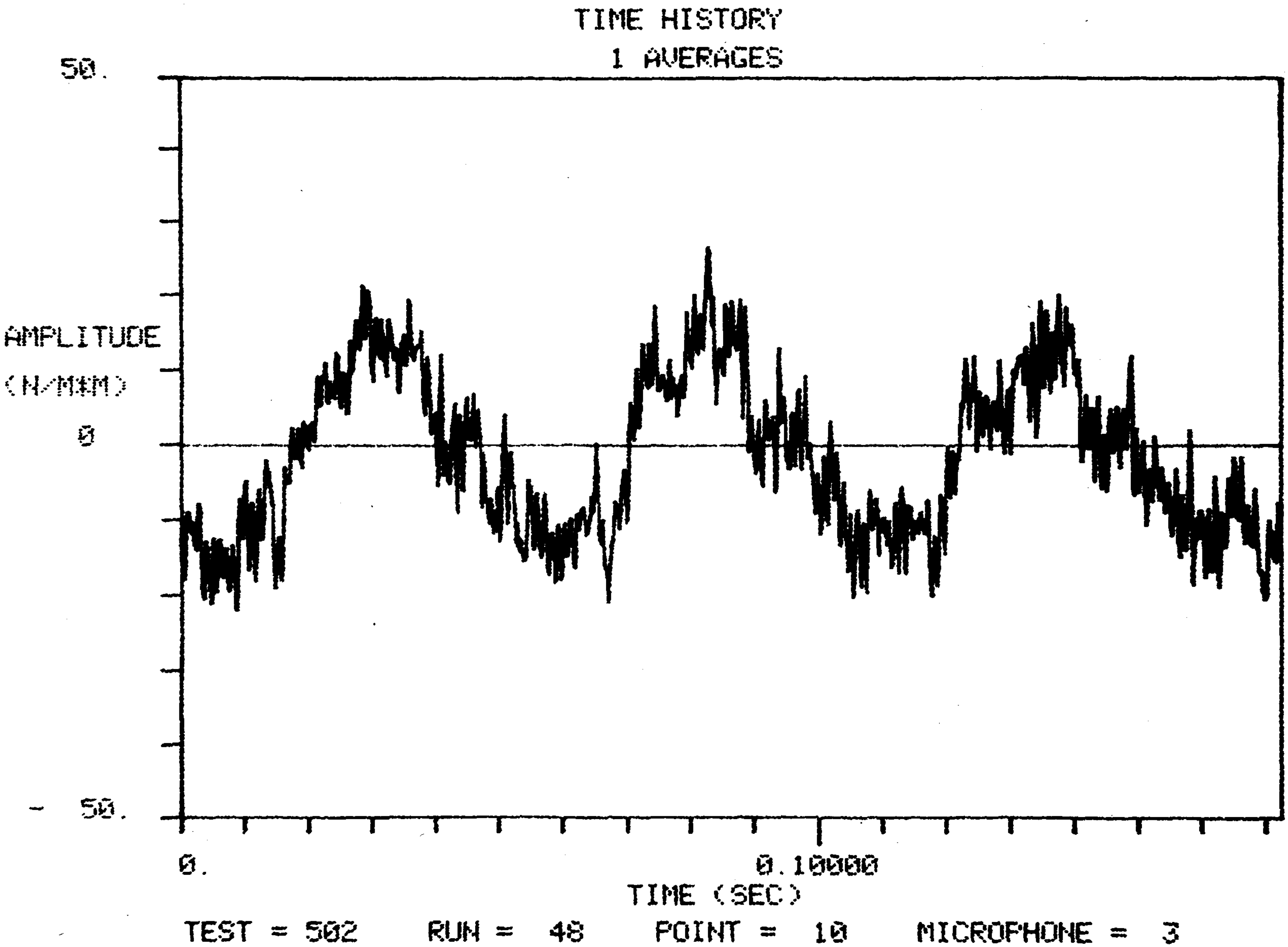
Figure E2(a). Acoustic Time History for Swept Tip Rotor.



SWEPT TIP $V = 81$ kt $\alpha = -2.5^{\circ}$ $C_{LR/\sigma} = .07$

$M_{tip} = .598$ $M_{at} = .718$ $\mu = .200$

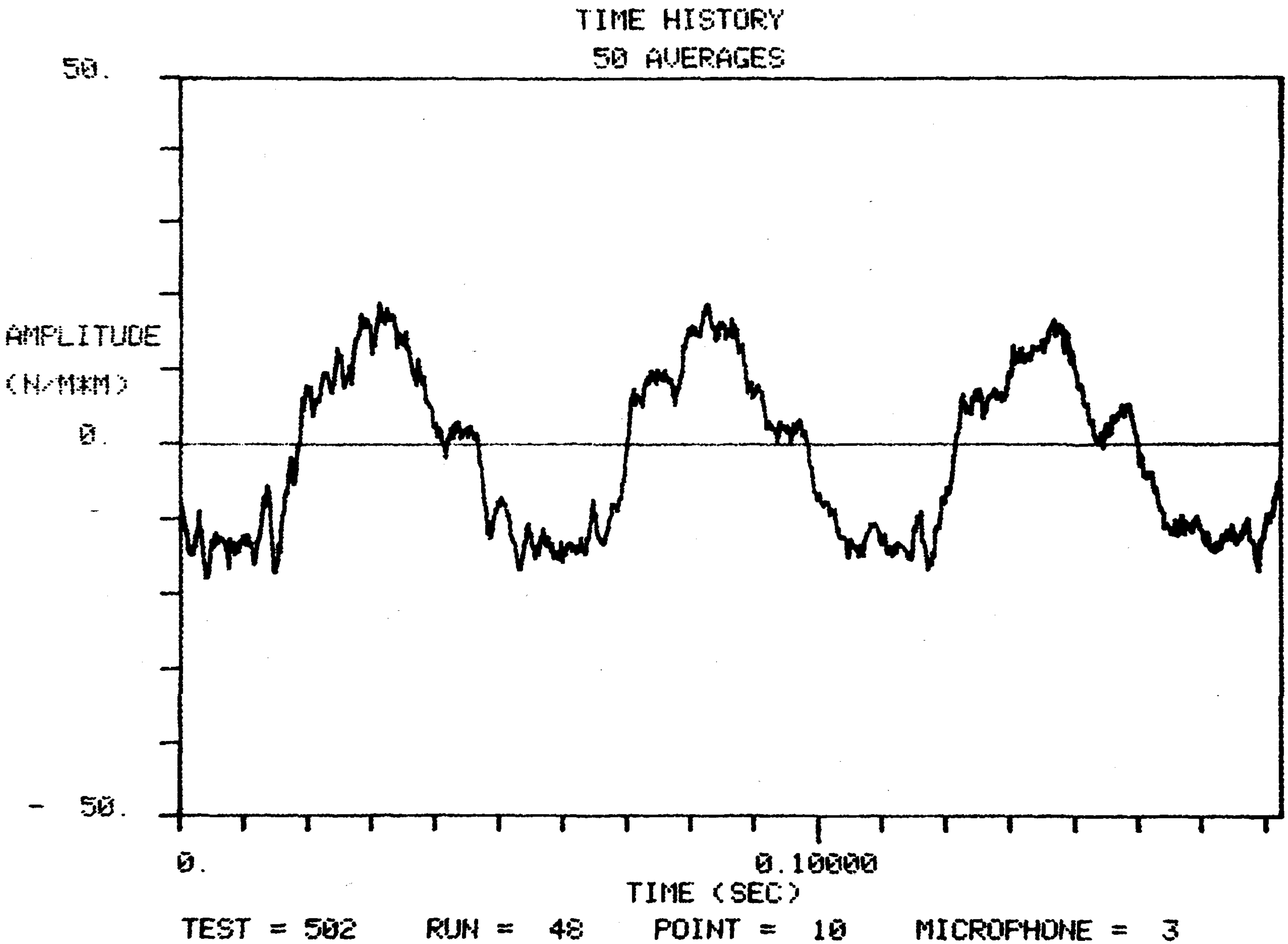
Figure E2(b). Acoustic Time History for Swept Tip Rotor.



SWEPT TIP $V = 81$ kt $\alpha = -2.5^{\circ}$ $C_{LR/\sigma} = .07$

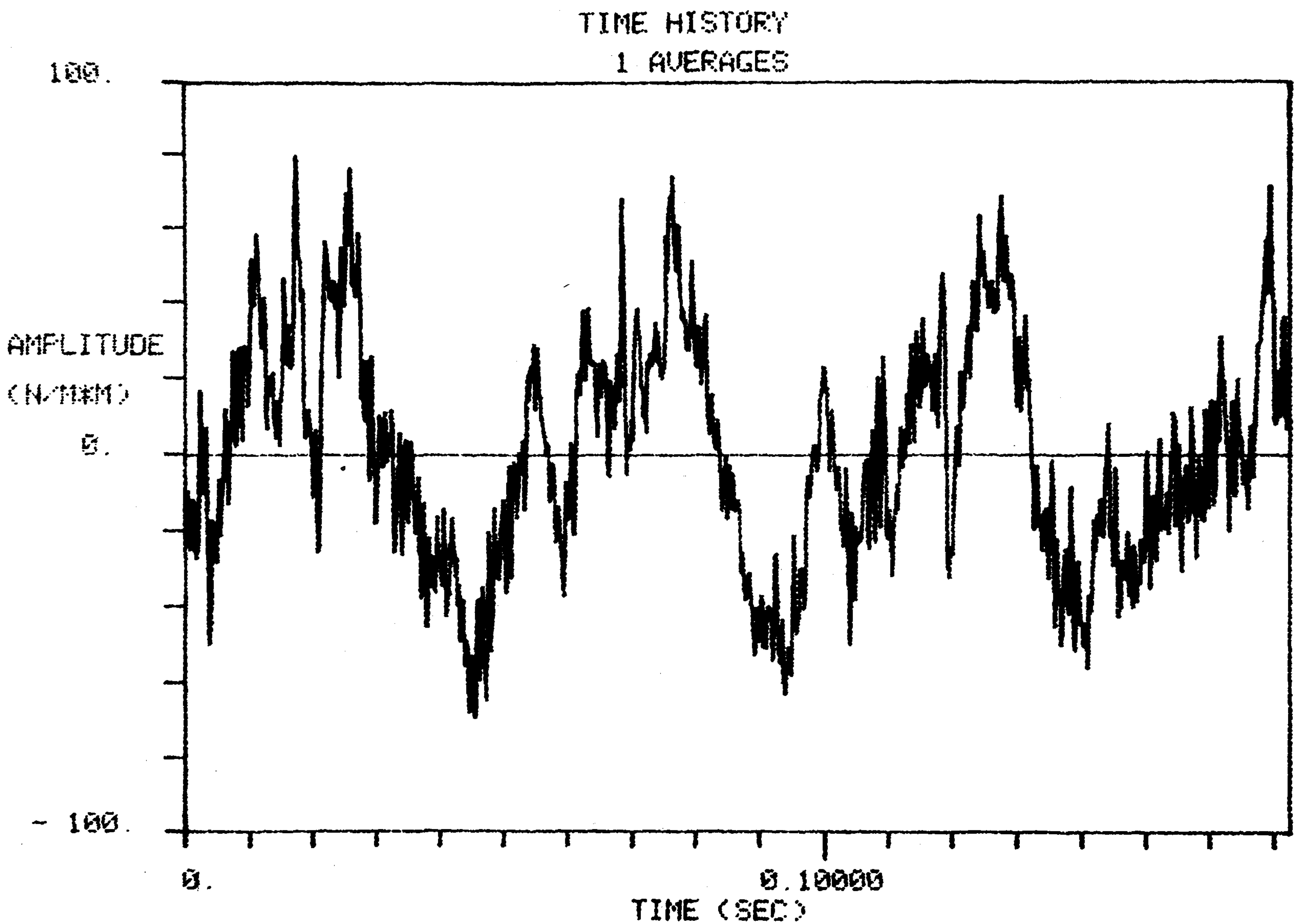
$M_{tip} = .598$ $M_{at} = .718$ $\mu = .200$

Figure E2(c). Acoustic Time History for Swept Tip Rotor.



SWEPT TIP $V = 81$ kt $\alpha = -2.5^\circ$ $C_{LR/\sigma} = .07$
$M_{tip} = .598$ $M_{at} = .718$ $\mu = .200$

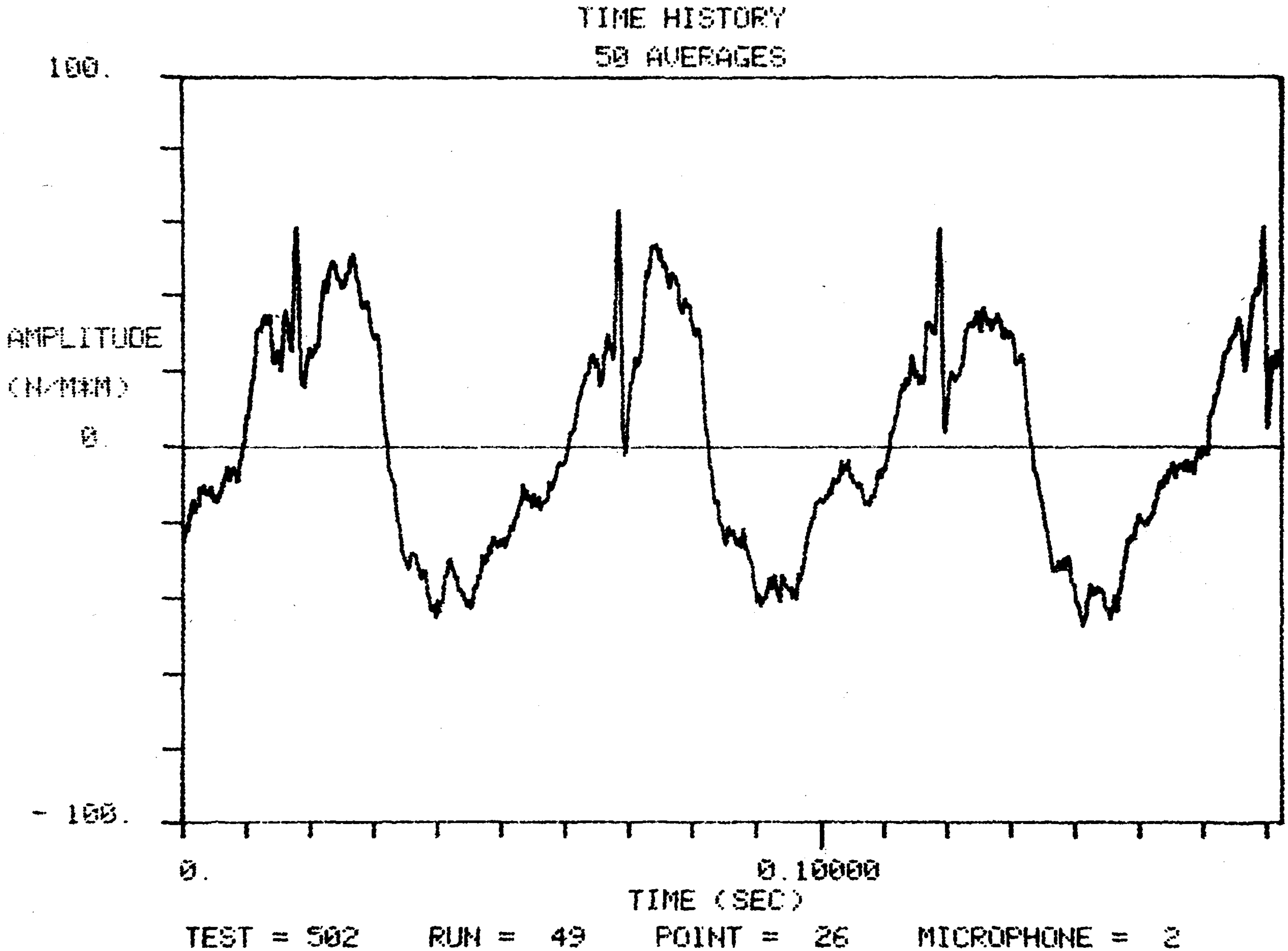
Figure E2(d). Acoustic Time History for Swept Tip Rotor.



TEST = 502 RUN = 49 POINT = 26 MICROPHONE = 2

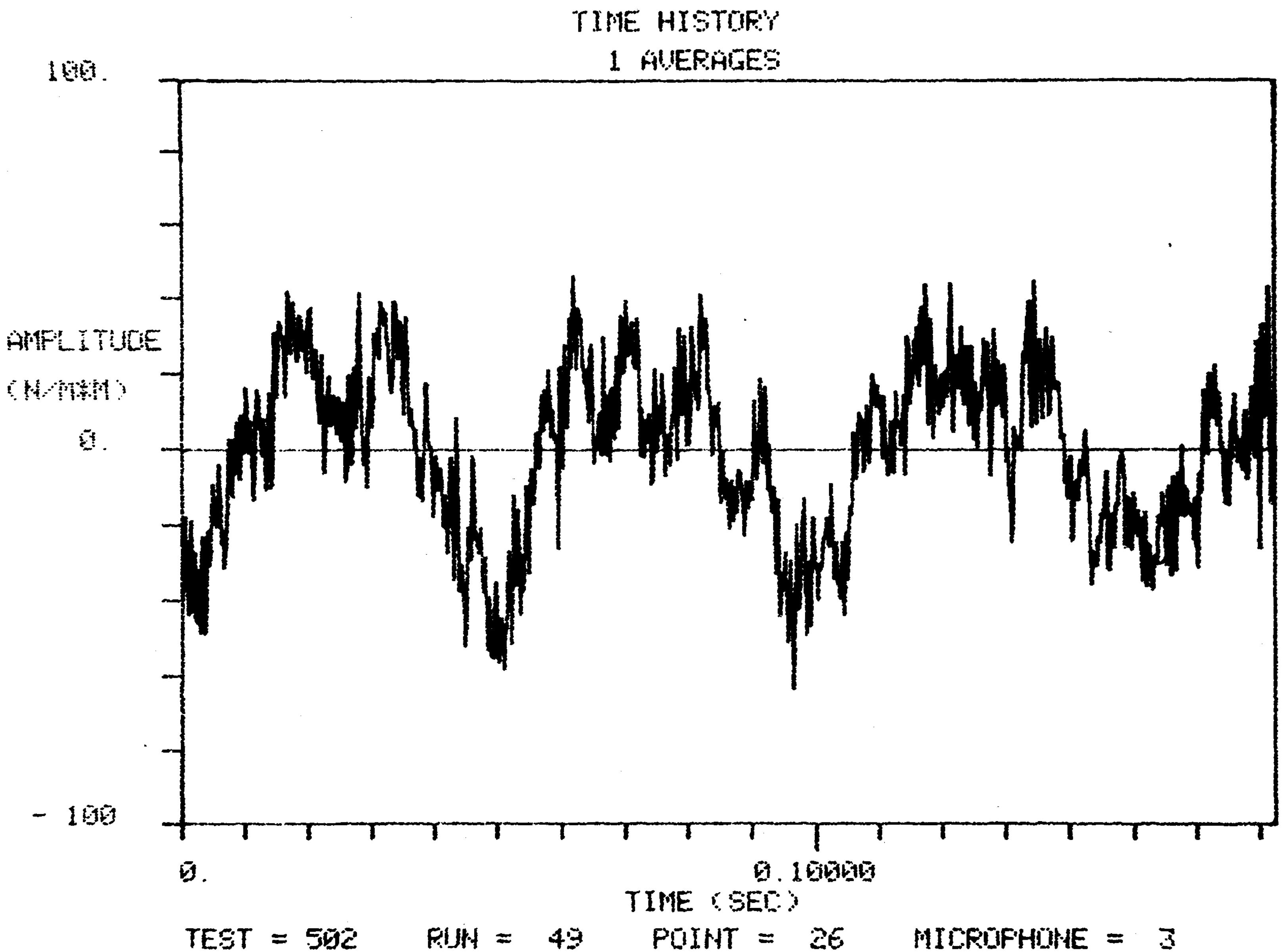
SWEPT TIP $V = 151$ kt $\alpha = -5.0^{\circ}$ $C_{LR/\sigma} = .08$
$M_{tip} = .604$ $M_{at} = .829$ $\mu = .374$

Figure E2(e). Acoustic Time History for Swept Tip Rotor.



SWEPT TIP $V = 151$ kt $\alpha = -5.0°$ $C_{LR/\sigma} = .08$
$M_{tip} = .604$ $M_{at} = .829$ $\mu = .374$

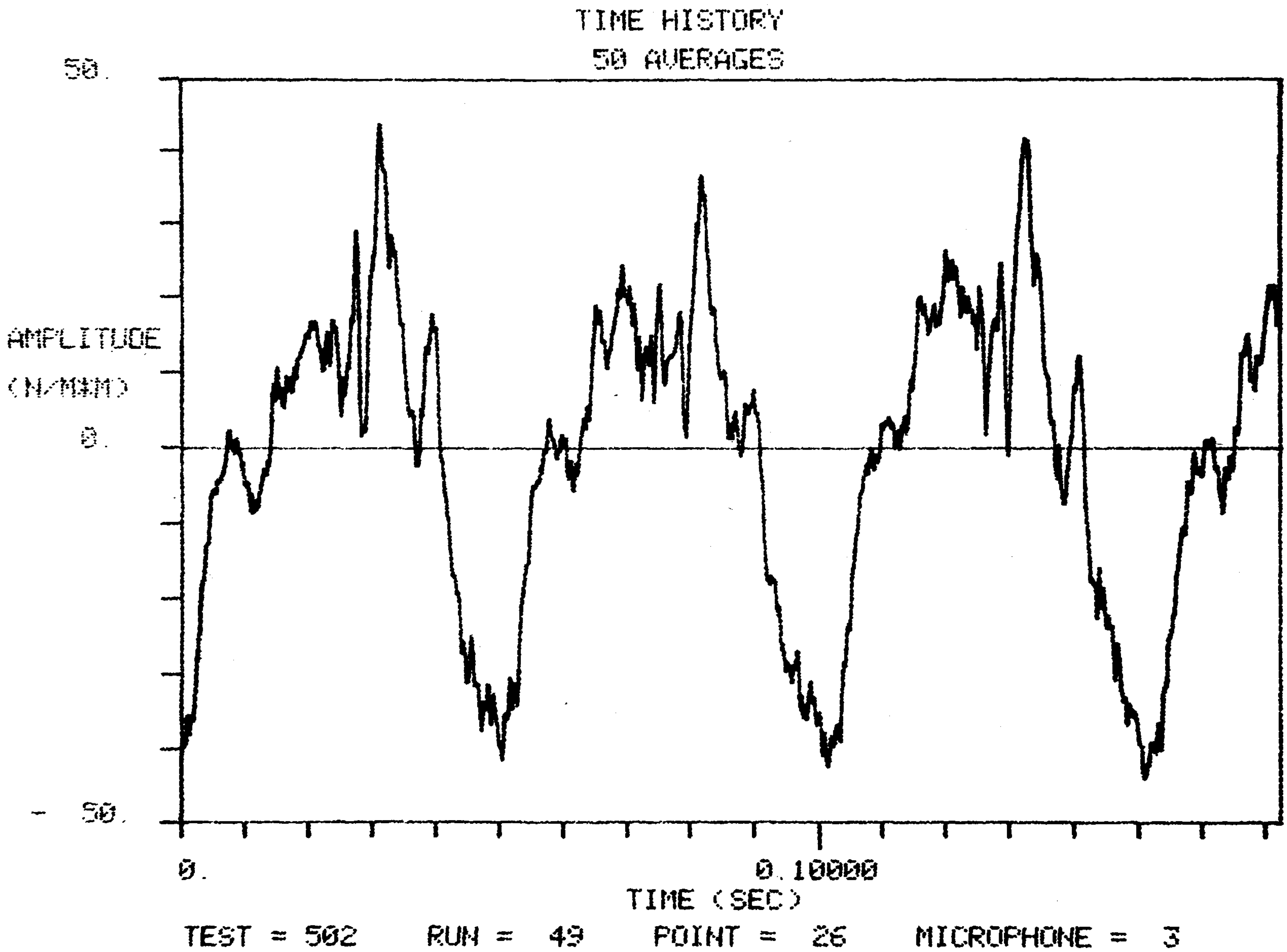
Figure E2(f). Acoustic Time History for Swept Tip Rotor.



SWEPT TIP V = 151 kt $\alpha = -5.0^{\circ}$ $C_{LR/\sigma} = .08$

$M_{tip} = .604$ $M_{at} = .829$ $\mu = .374$

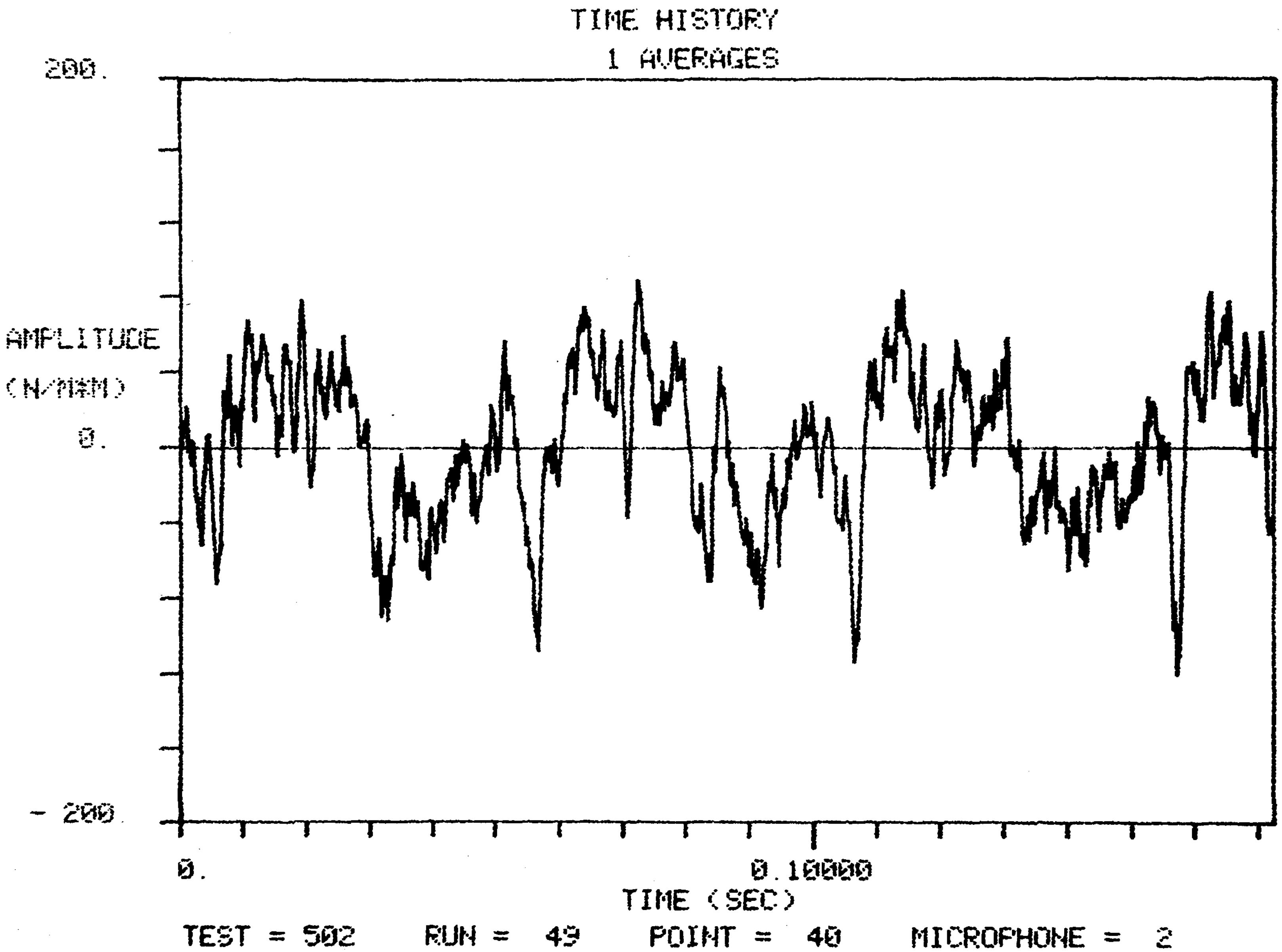
Figure E2(g). Acoustic Time History for Swept Tip Rotor.



SWEPT TIP $V = 151$ kt $\alpha = -5.0^{\circ}$ $C_{LR/\sigma} = .08$

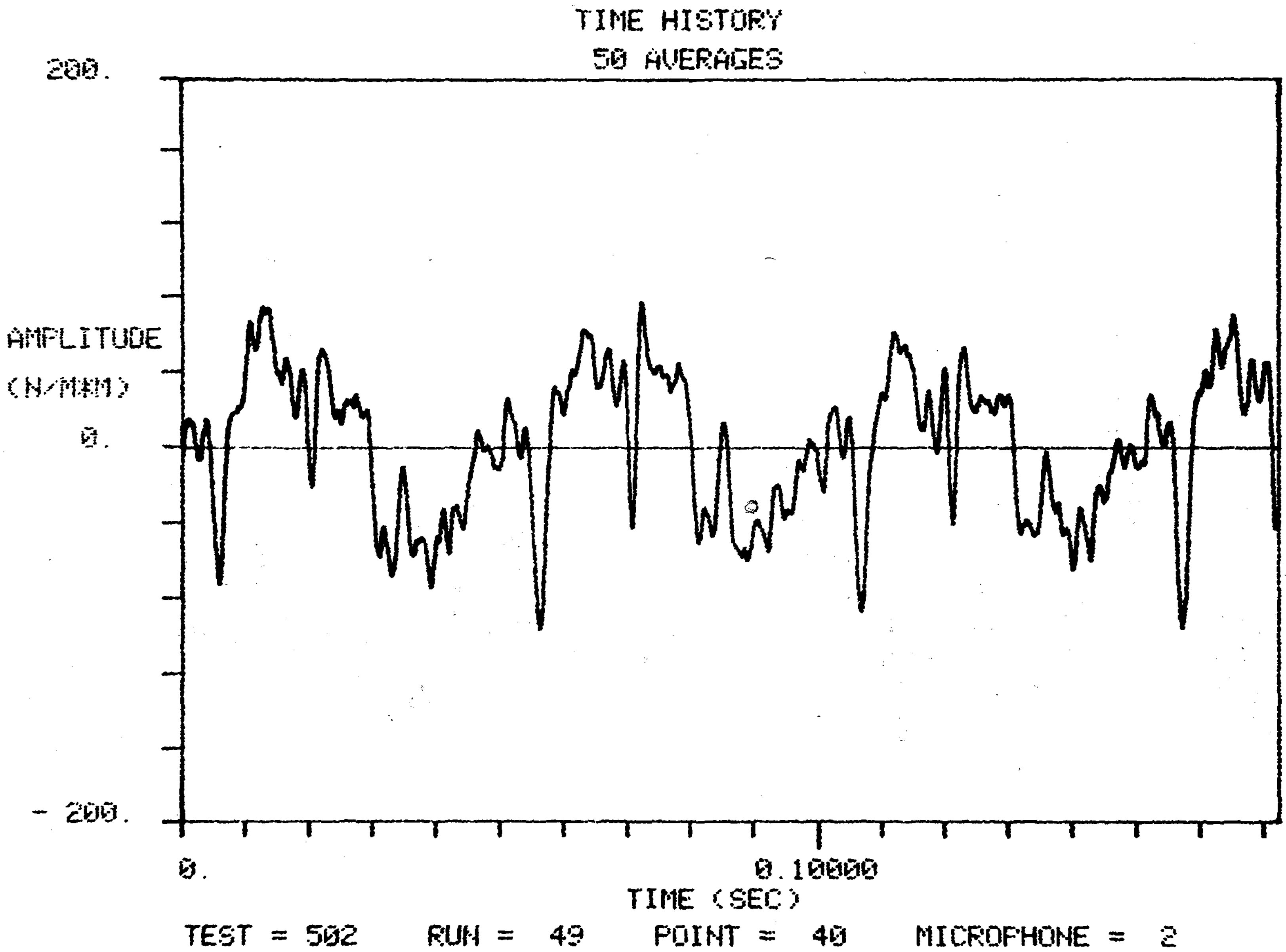
$M_{tip} = .604$ $M_{at} = .829$ $\mu = .374$

Figure E2(h). Acoustic Time History for Swept Tip Rotor.



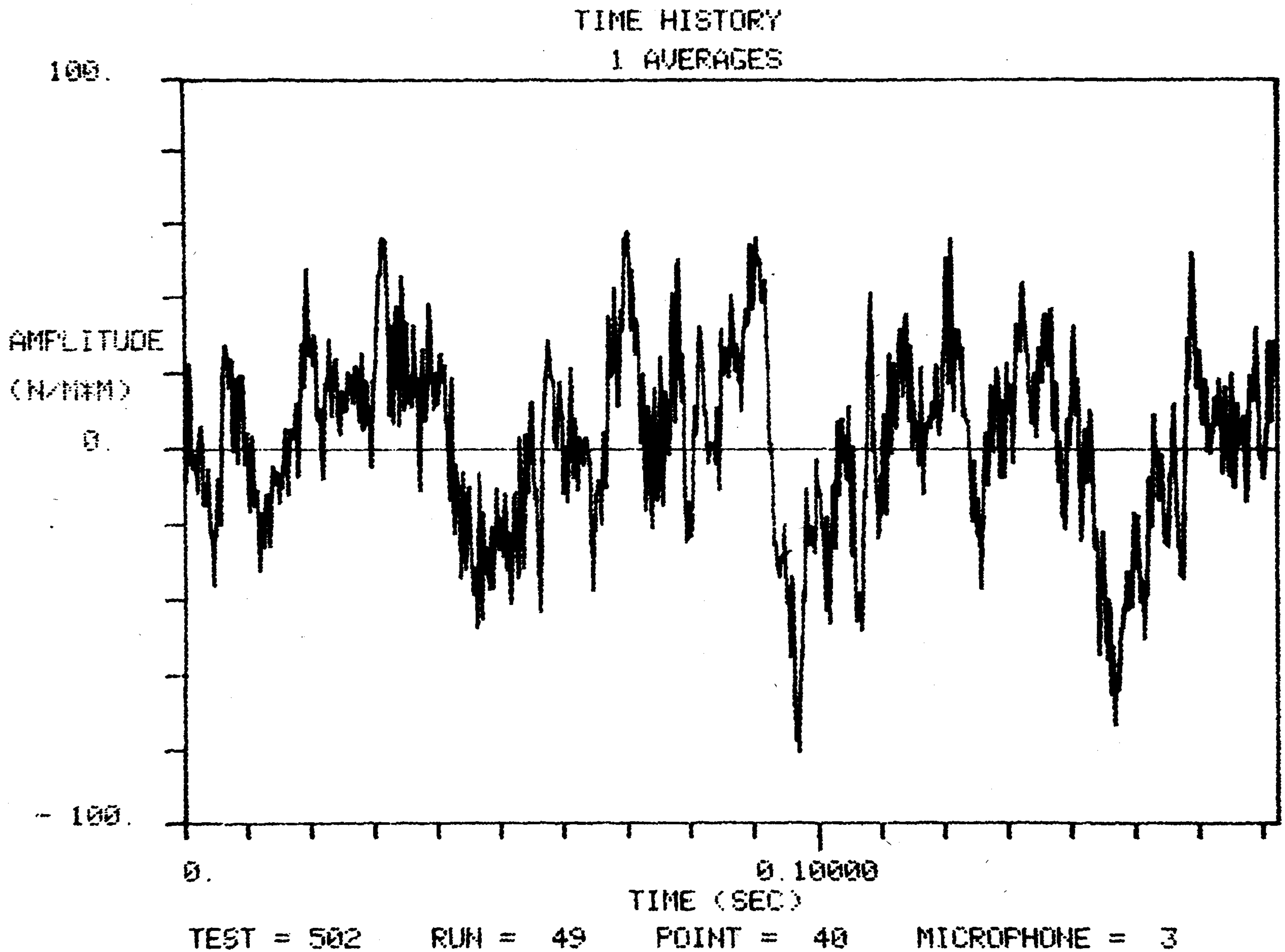
SWEPT TIP $V = 152$ kt $\alpha = 0.0^{\circ}$ $C_{LR/\sigma} = .10$
$M_{tip} = .600$ $M_{at} = .826$ $\mu = .377$

Figure E2(i). Acoustic Time History for Swept Tip Rotor.



SWEPT TIP $V = 152$ kt $\alpha = 0.0^\circ$ $C_{LR/\sigma} = .10$
$M_{tip} = .600$ $M_{at} = .826$ $\mu = .377$

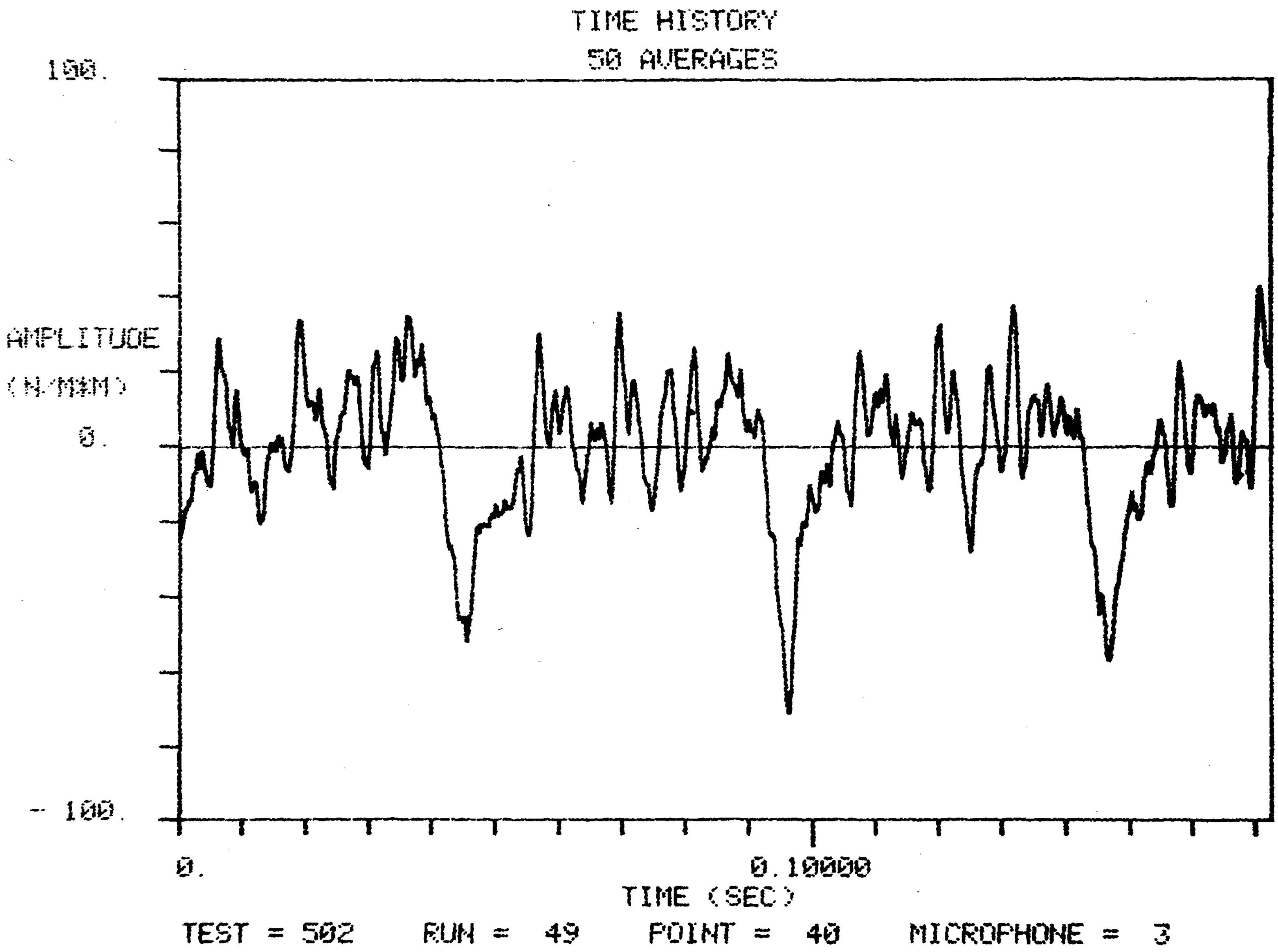
Figure E2(j). Acoustic Time History for Swept Tip Rotor.



SWEPT TIP $V = 152$ kt $\alpha = 0.0^{\circ}$ $C_{LR/\sigma} = .10$

$M_{tip} = .600$ $M_{at} = .826$ $\mu = .377$

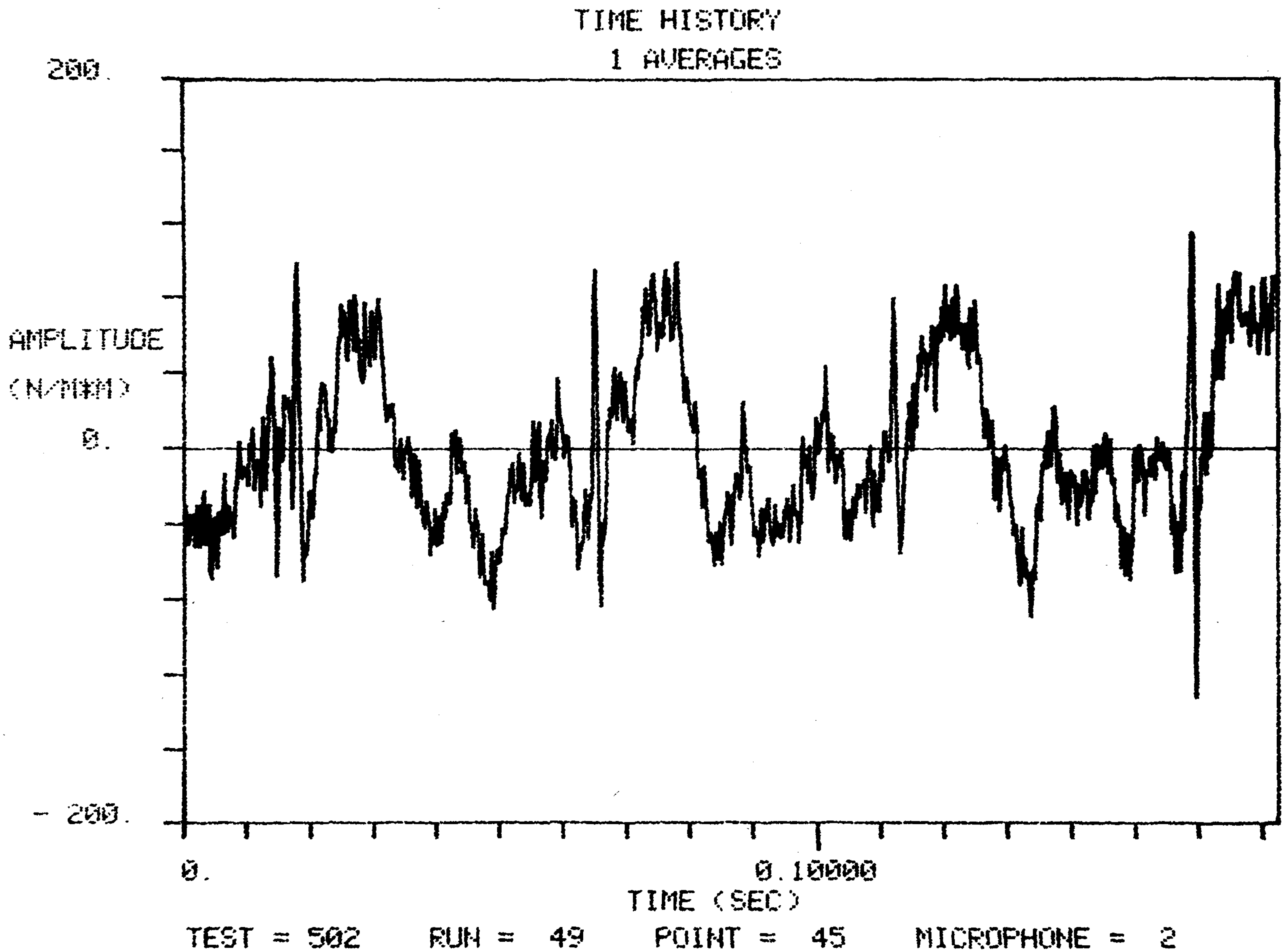
Figure E2(k). Acoustic Time History for Swept Tip Rotor.



SWEPT TIP $V = 152$ kt $\alpha = 0.0^\circ$ $C_{LR/\sigma} = .10$

$M_{tip} = .600$ $M_{at} = .826$ $\mu = .377$

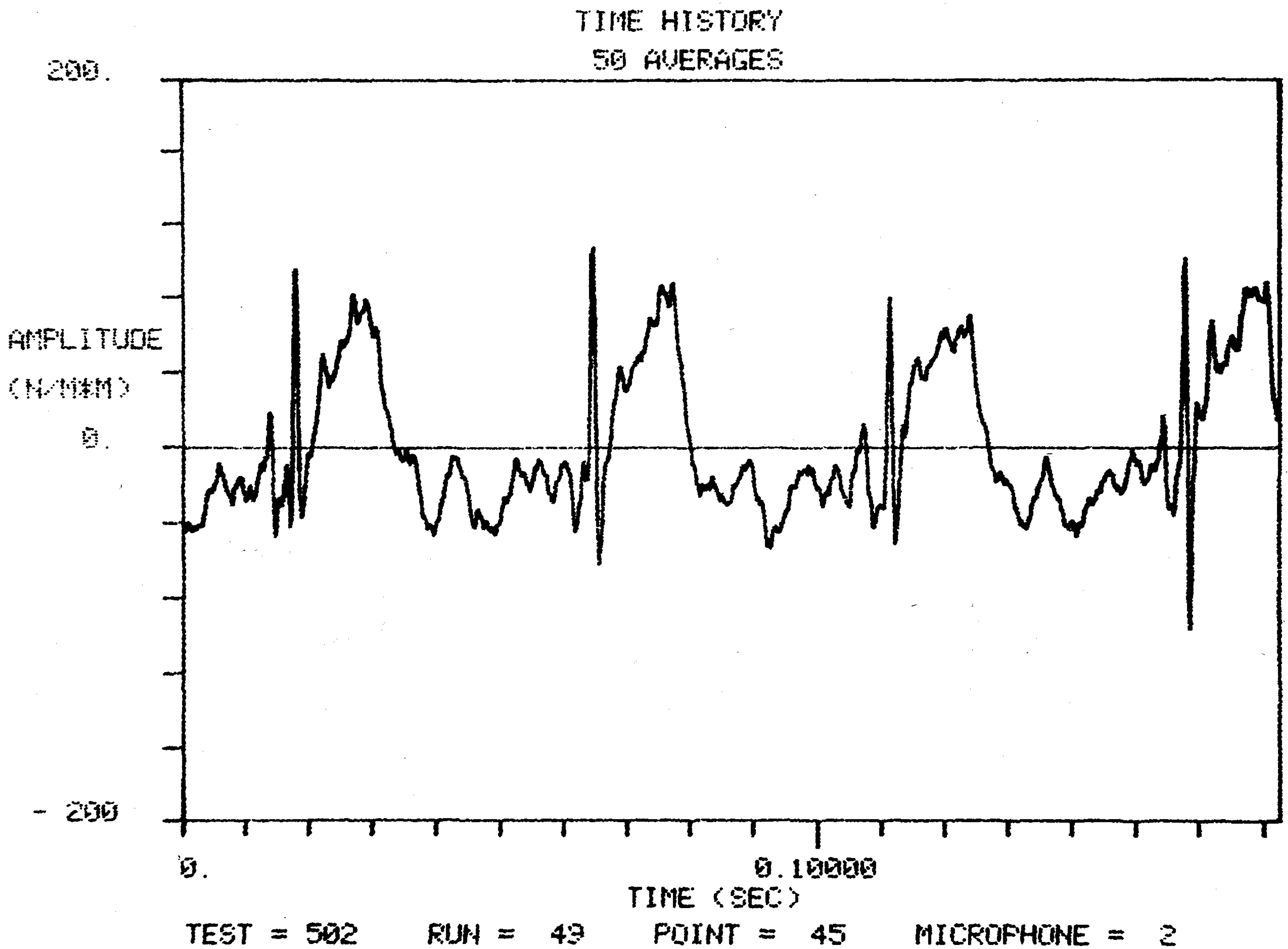
Figure E2(l). Acoustic Time History for Swept Tip Rotor.



SWEPT TIP $V = 164$ kt $\alpha = -5.0^{\circ}$ $C_{LR/\sigma} = .07$

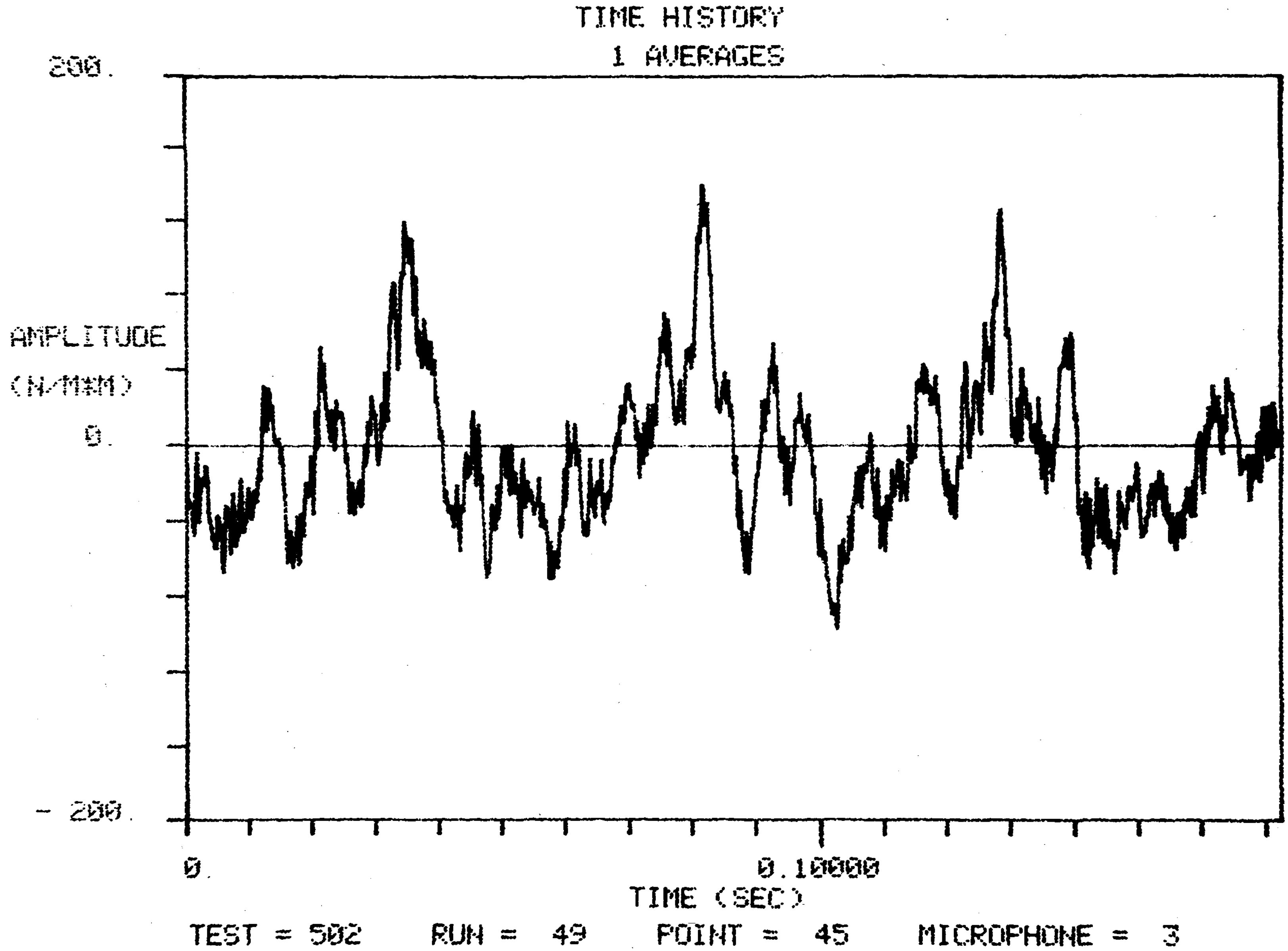
$M_{tip} = .652$ $M_{at} = .896$ $\mu = .376$

Figure E2(m). Acoustic Time History for Swept Tip Rotor.



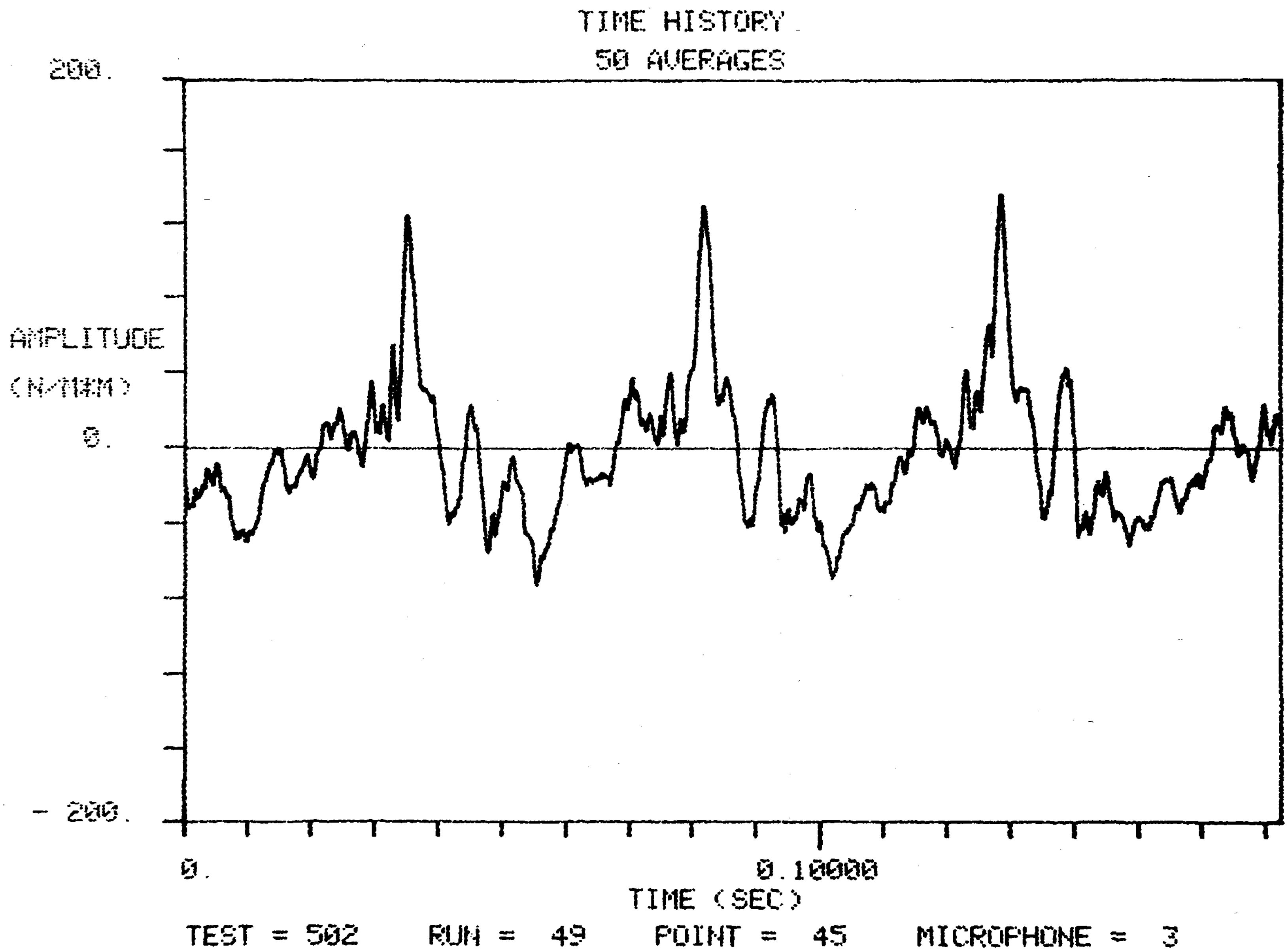
SWEPT TIP V = 164 kt $\alpha = -5.0^{\circ}$ $C_{LR/\sigma} = .07$
$M_{tip} = .652$ $M_{at} = .896$ $\mu = .376$

Figure E2(n). Acoustic Time History for Swept Tip Rotor.



SWEPT TIP $V = 164$ kt $\alpha = -5.0°$ $C_{LR/\sigma} = .07$
$M_{tip} = .652$ $M_{at} = .896$ $\mu = .376$

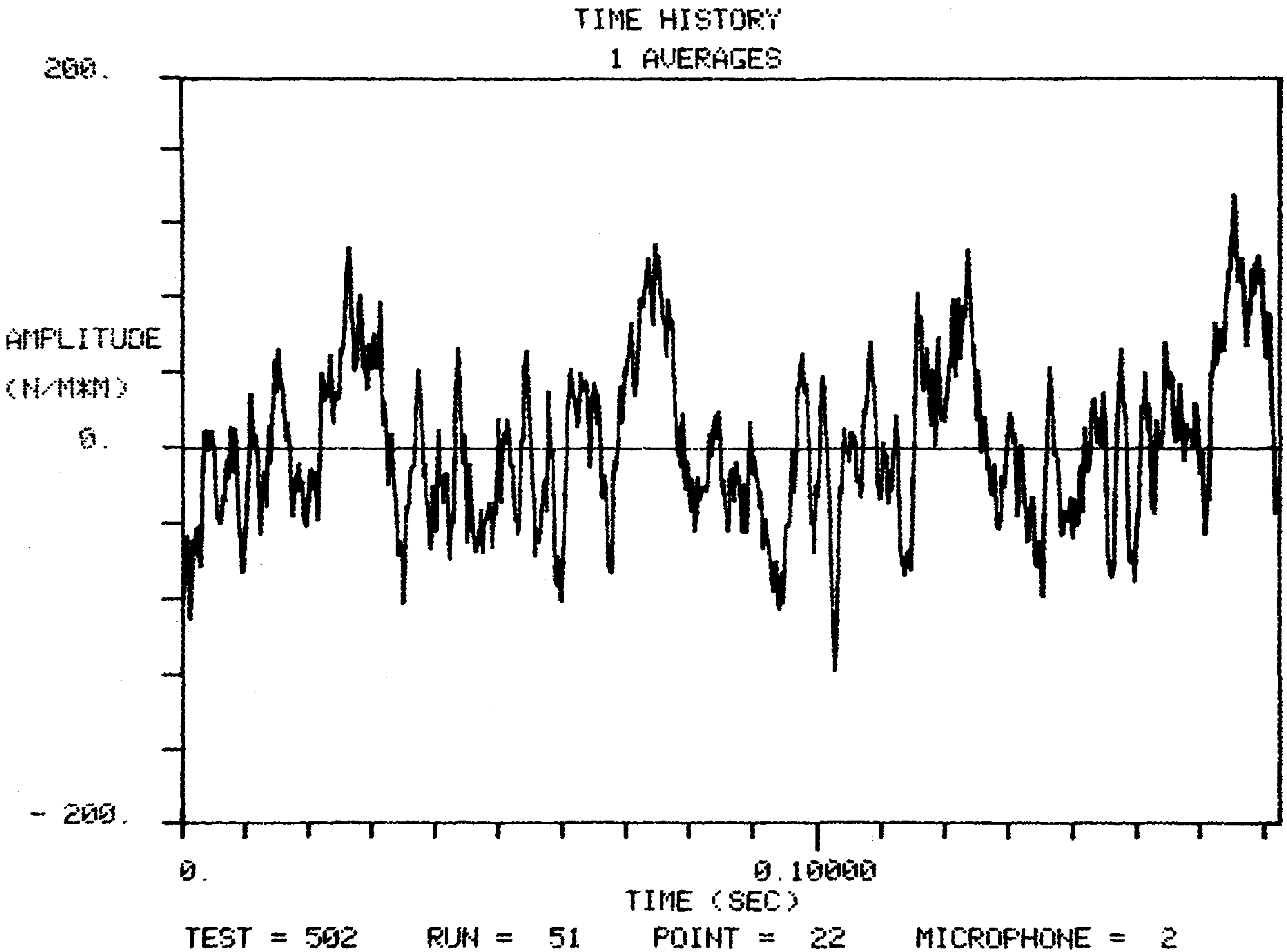
Figure E2(o). Acoustic Time History for Swept Tip Rotor.



SWEPT TIP V = 164 kt $\alpha = -5.0°$ $C_{LR/\sigma} = .07$

$M_{tip} = .652$ $M_{at} = .896$ $\mu = .376$

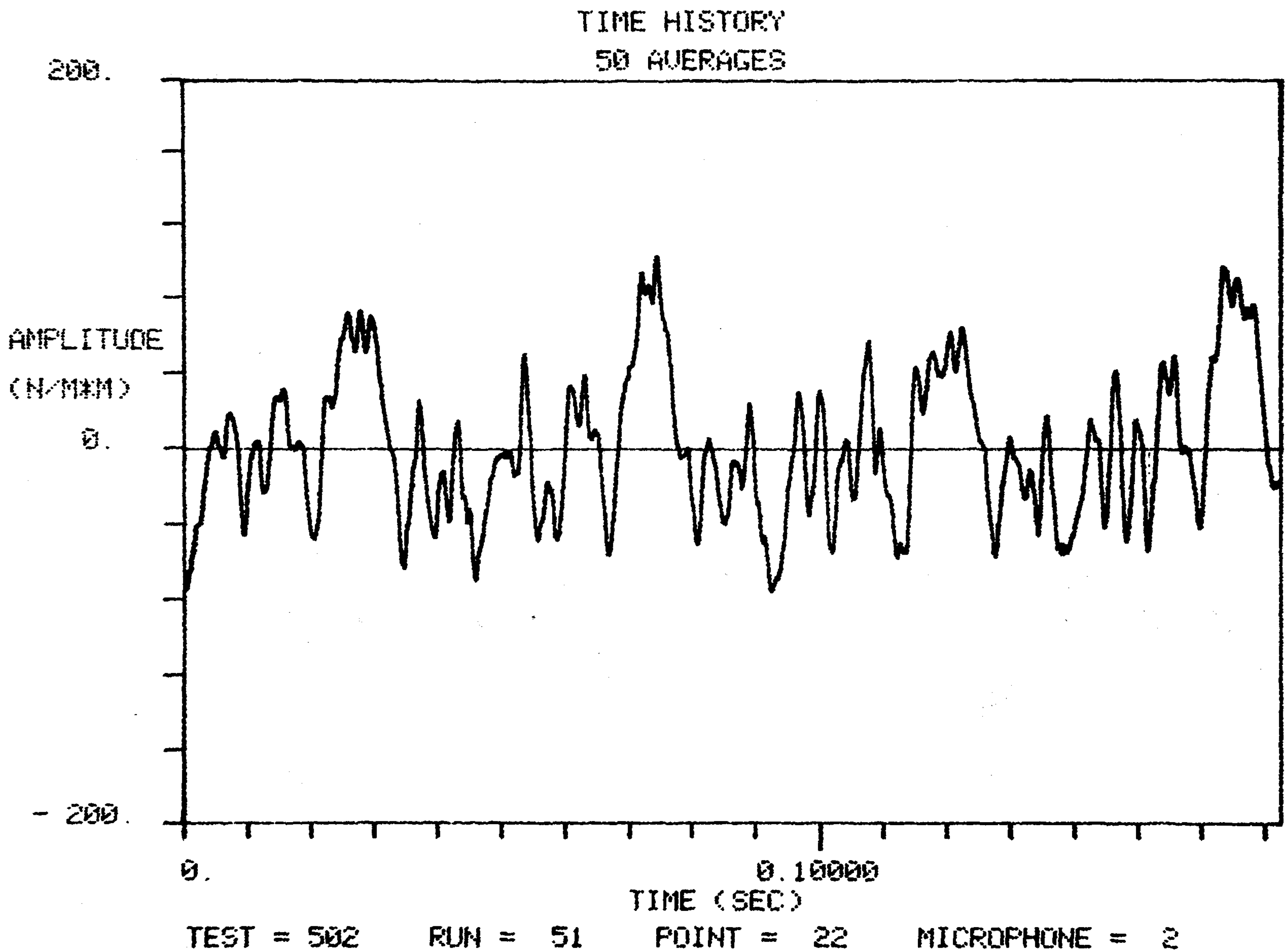
Figure E2(p). Acoustic Time History for Swept Tip Rotor.



SWEPT TIP $V = 165$ kt $\alpha = 0.0°$ $C_{LR/\sigma} = .09$

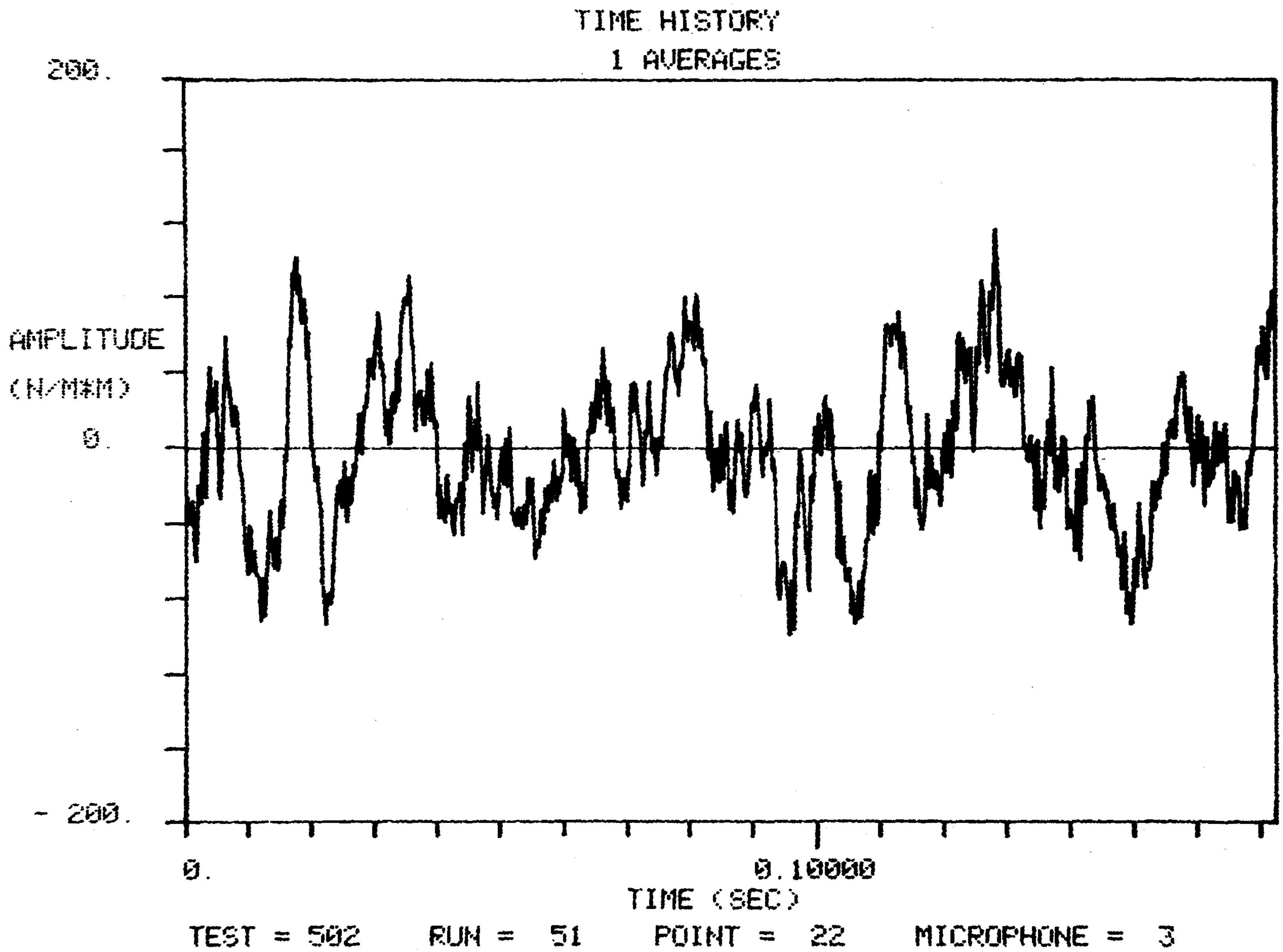
$M_{tip} = .652$ $M_{at} = .897$ $\mu = .375$

Figure E2(q). Acoustic Time History for Swept Tip Rotor.



SWEPT TIP V = 165 kt $\alpha = 0.0°$ $C_{LR/\sigma} = .09$
$M_{tip} = .652$ $M_{at} = .897$ $\mu = .375$

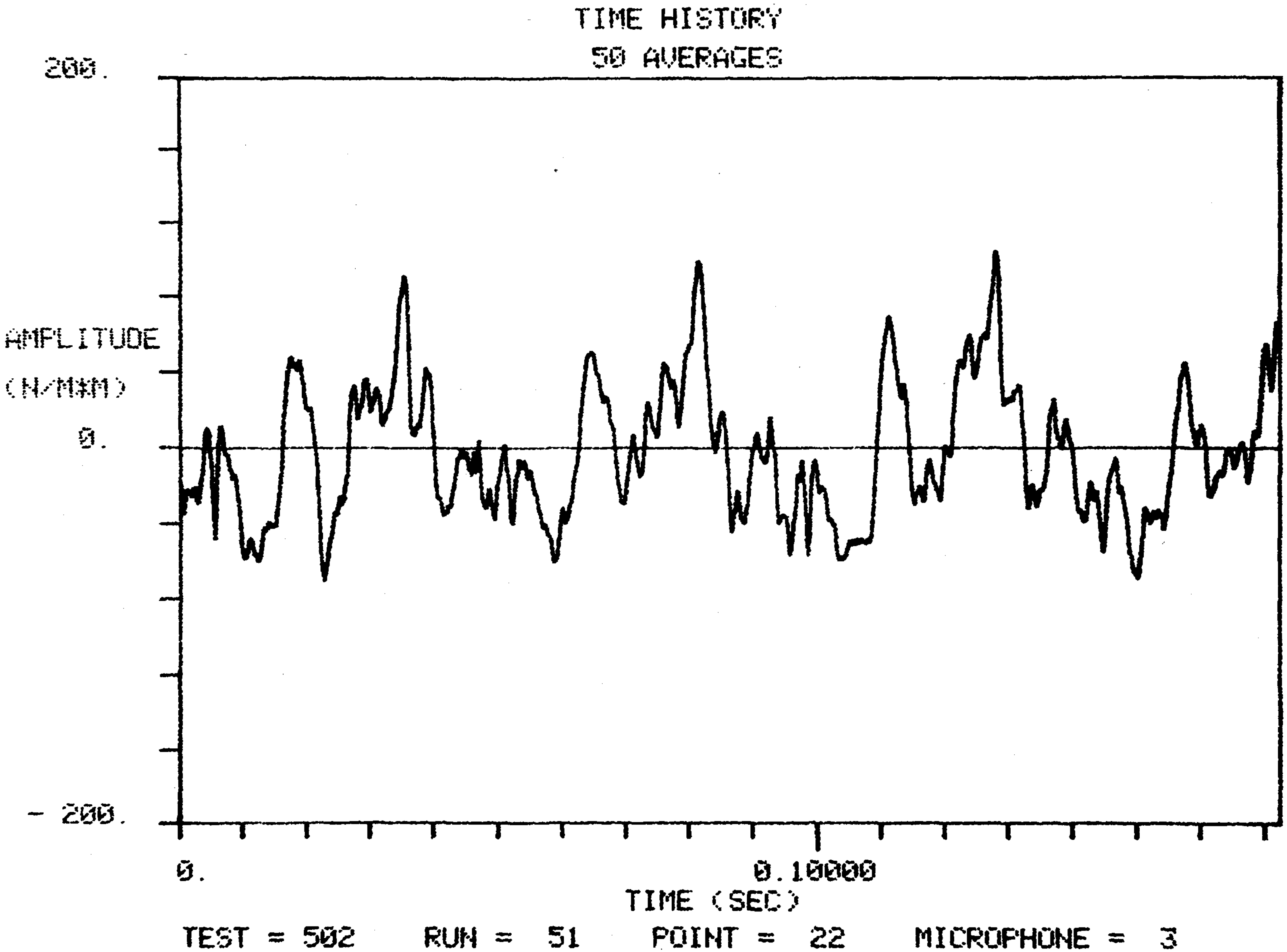
Figure E2(r). Acoustic Time History for Swept Tip Rotor.



SWEPT TIP $V = 165$ kt $\alpha = 0.0^\circ$ $C_{LR/\sigma} = .09$

$M_{tip} = .652$ $M_{at} = .897$ $\mu = .375$

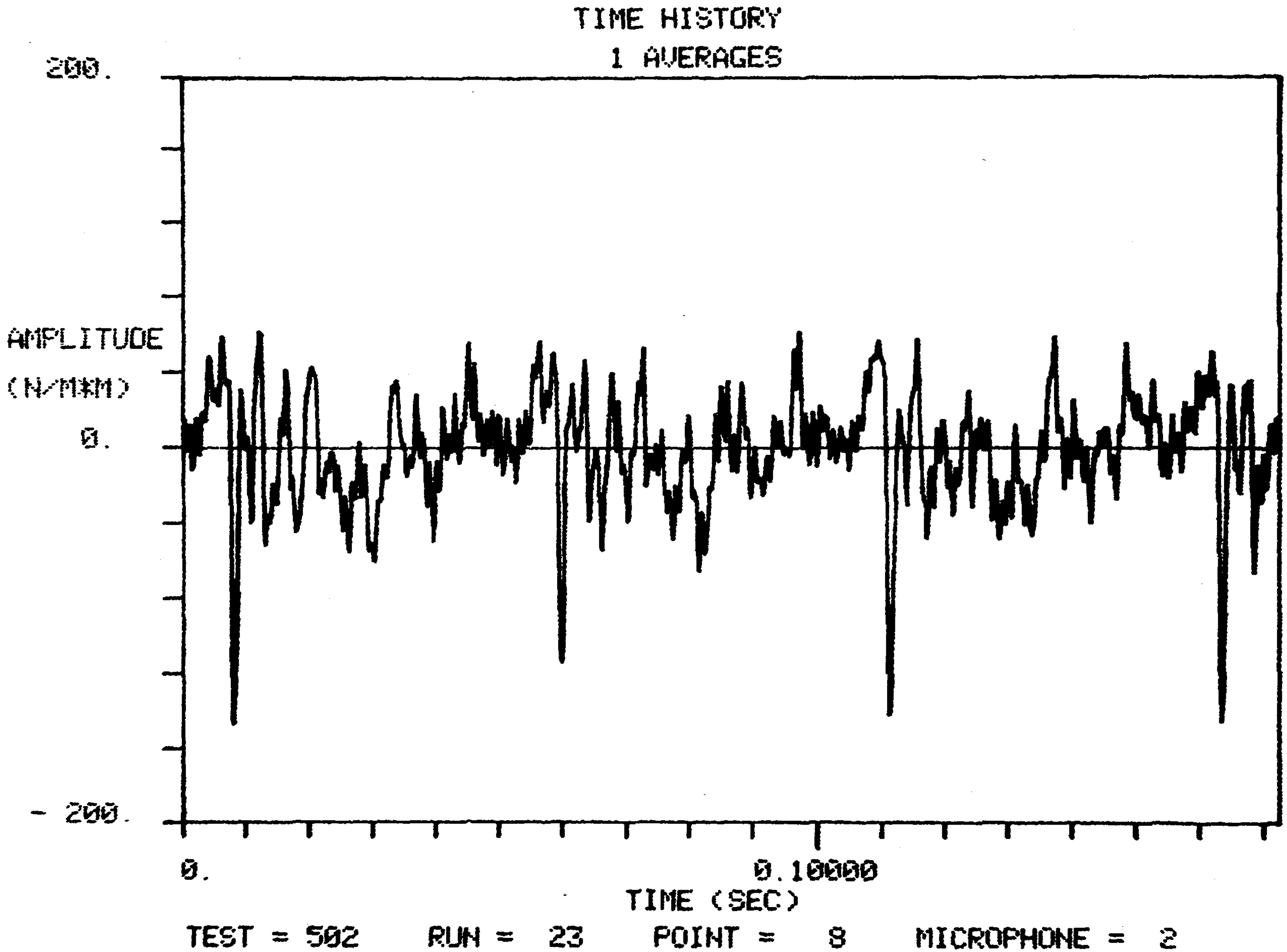
Figure E2(s). Acoustic Time History for Swept Tip Rotor.



SWEPT TIP $V = 165$ kt $\alpha = 0.0^{\circ}$ $C_{LR/\sigma} = .09$

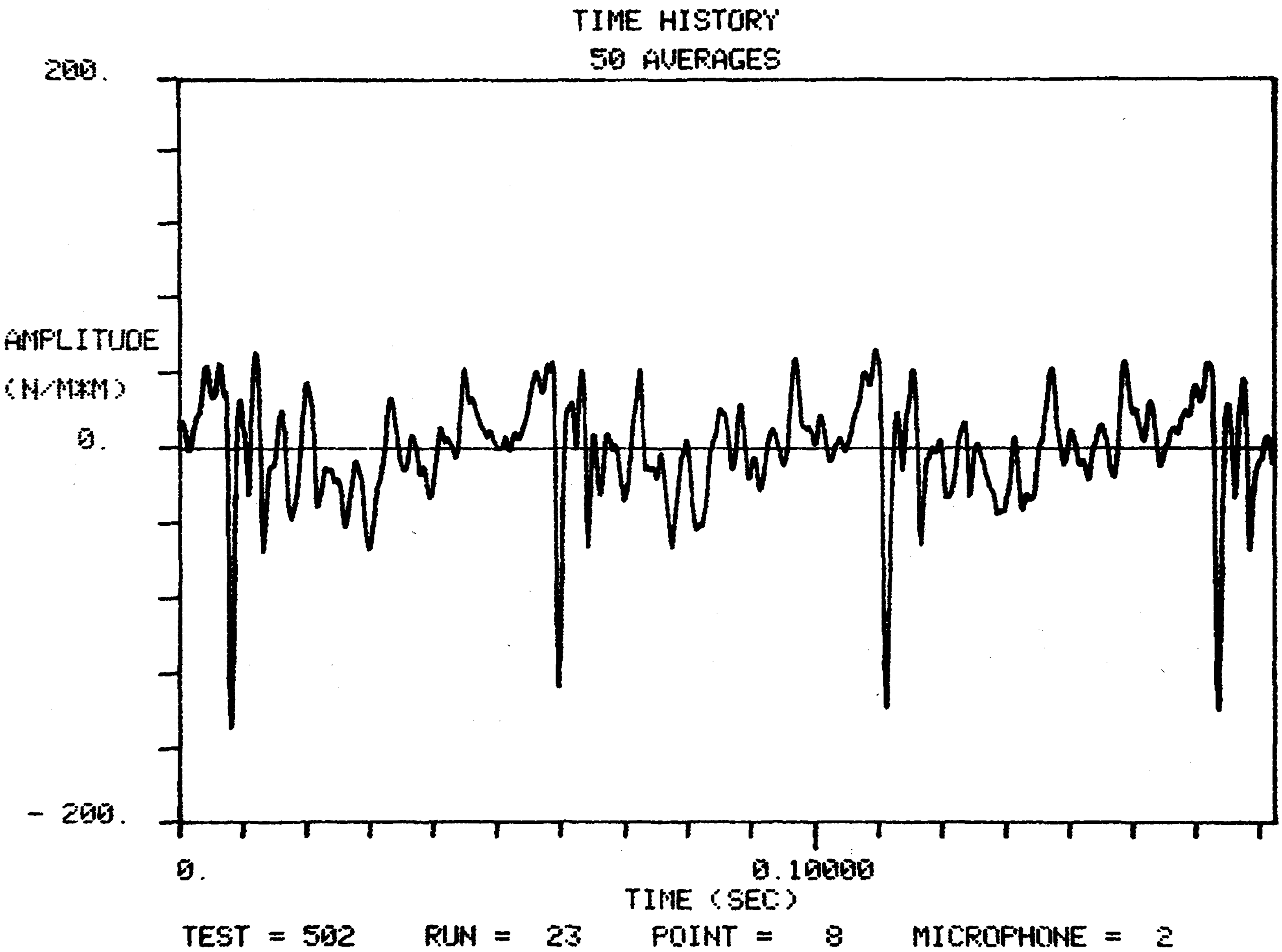
$M_{tip} = .652$ $M_{at} = .897$ $\mu = .375$

Figure E2(t). Acoustic Time History for Swept Tip Rotor.



TAPERED TIP $V = 79$ kt $\alpha = 0.0^{\circ}$ $C_{LR/\sigma} = .10$
$M_{tip} = .598$ $M_{at} = .718$ $\mu = .200$

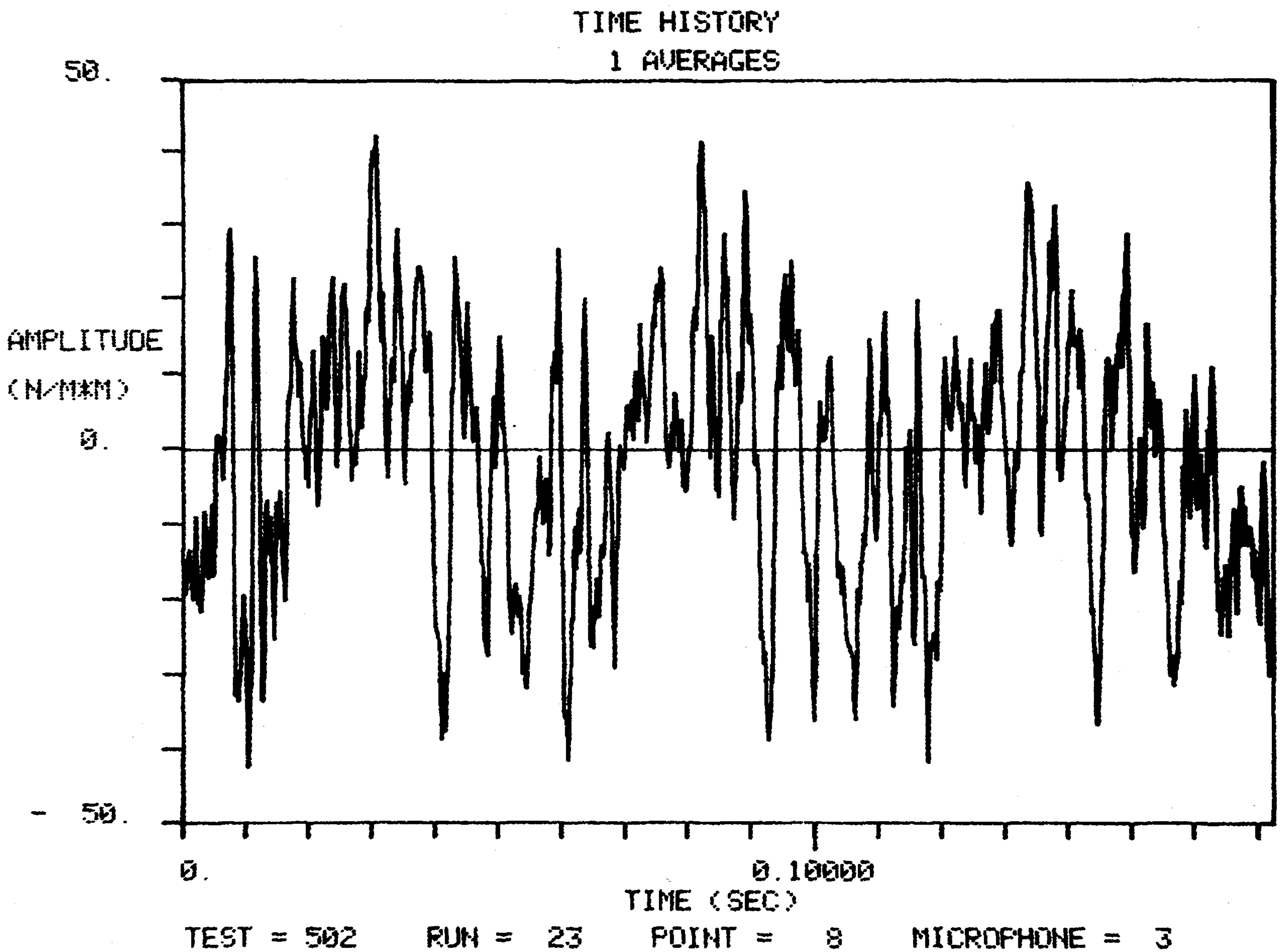
Figure E3(a). Acoustic Time History for Tapered Tip Rotor.



TAPERED TIP $V = 79$ kt $\alpha = 0.0^{\circ}$ $C_{LR}/\sigma = .10$

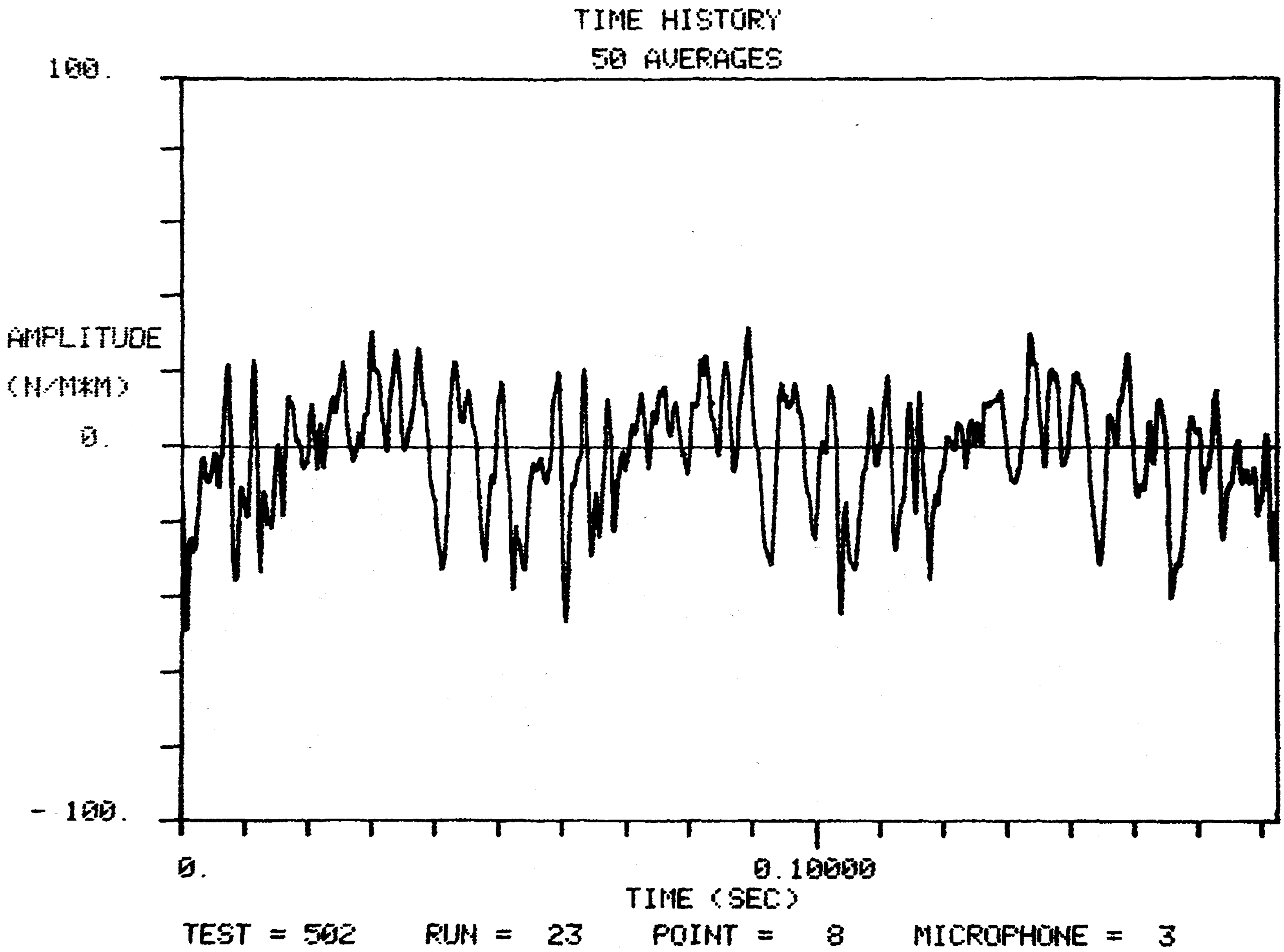
$M_{tip} = .598$ $M_{at} = .718$ $\mu = .200$

Figure E3(b). Acoustic Time History for Tapered Tip Rotor.



TAPERED TIP V = 79 kt $\alpha = 0.0°$ $C_{LR/\sigma}$ = .10
M_{tip} = .598 M_{at} =.718 μ = .200

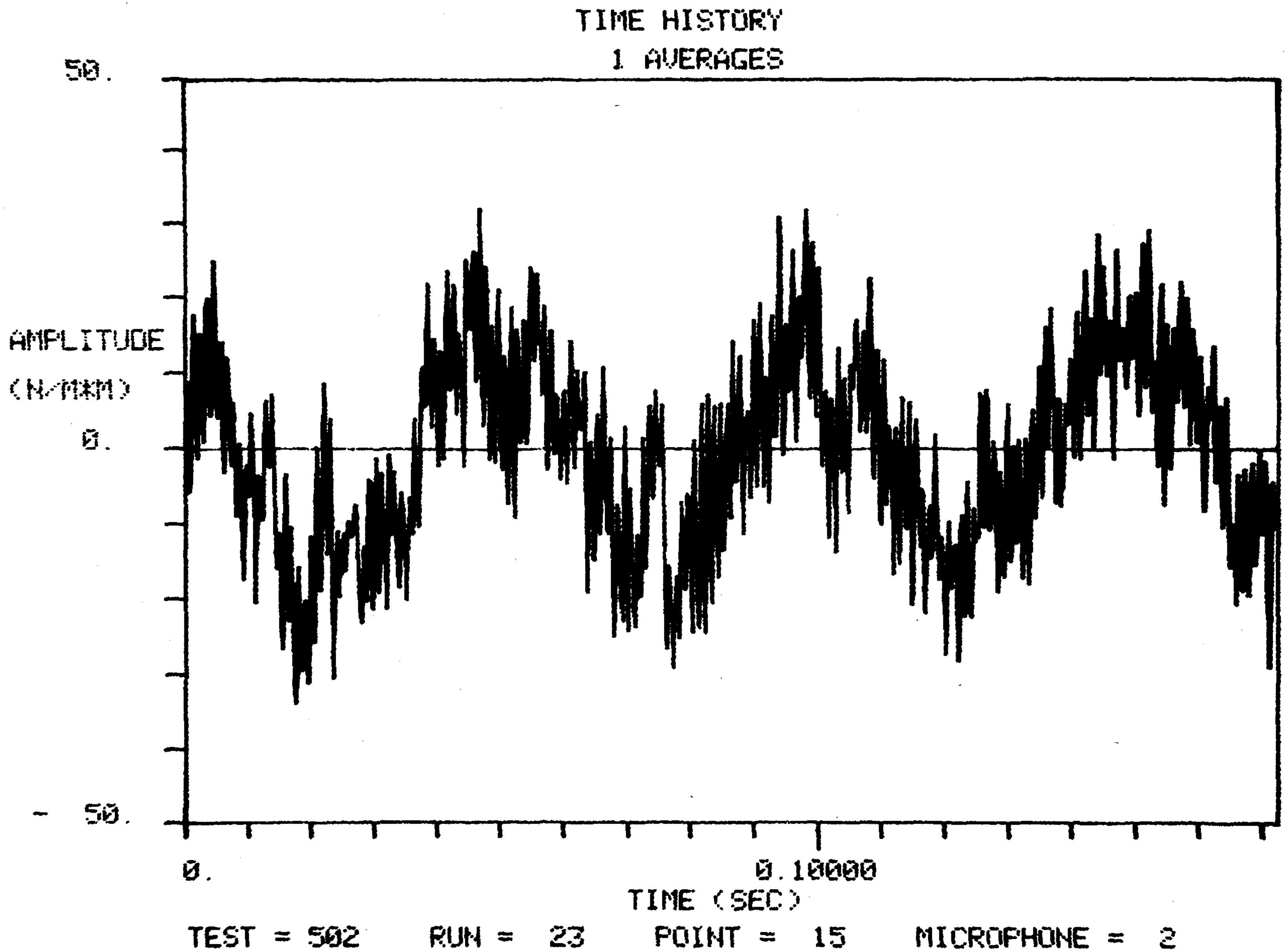
Figure E3(c). Acoustic Time History for Tapered Tip Rotor.



TAPERED TIP V = 79 kt $\alpha = 0.0^{\circ}$ $C_{LR/\sigma} = .10$

$M_{tip} = .598$ $M_{at} = .718$ $\mu = .200$

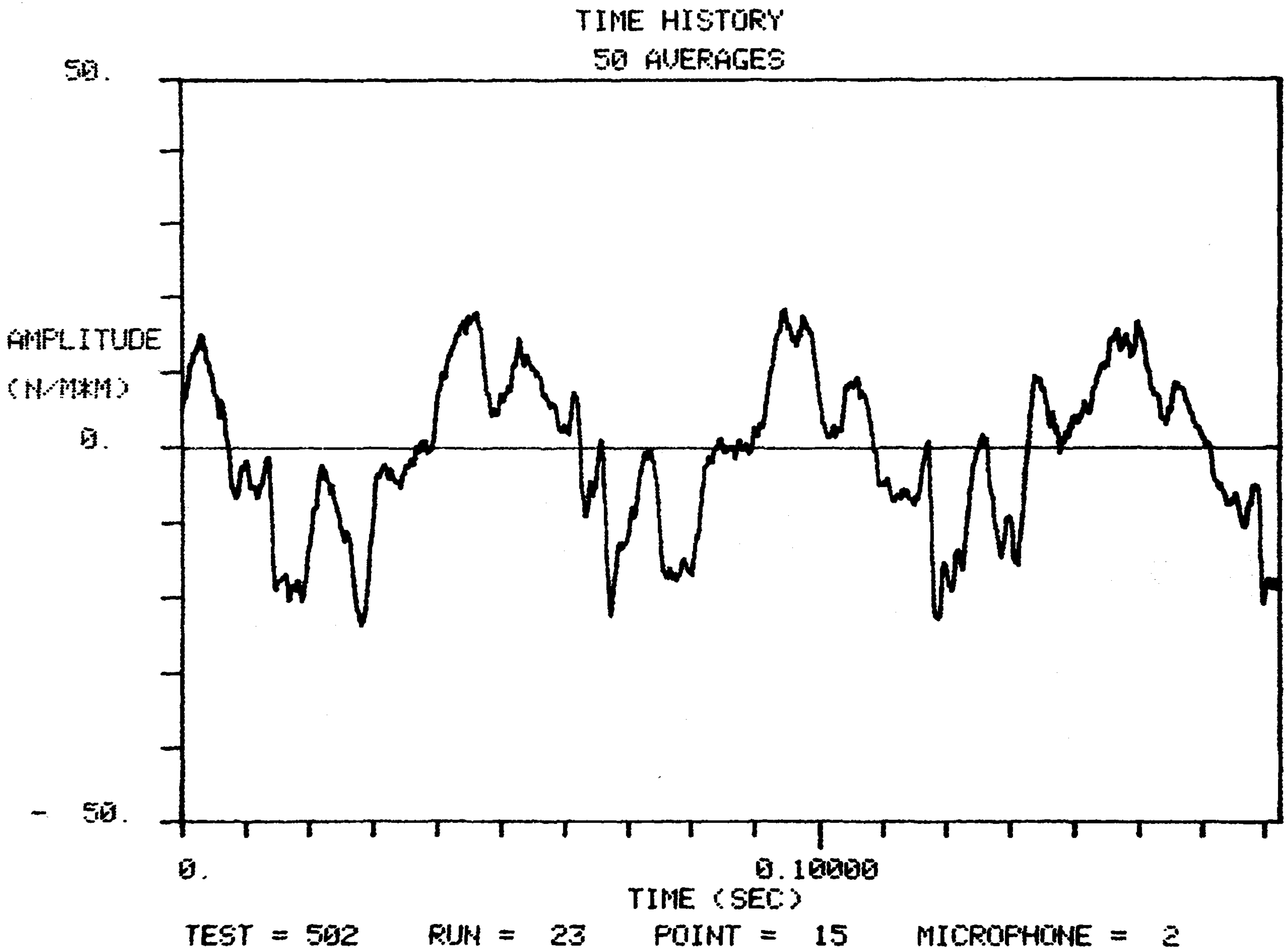
Figure E3(d). Acoustic Time History for Tapered Tip Rotor.



TAPERED TIP $V = 79$ kt $\alpha = -2.5^\circ$ $C_{LR/\sigma} = .07$

$M_{tip} = .598$ $M_{at} = .718$ $\mu = .200$

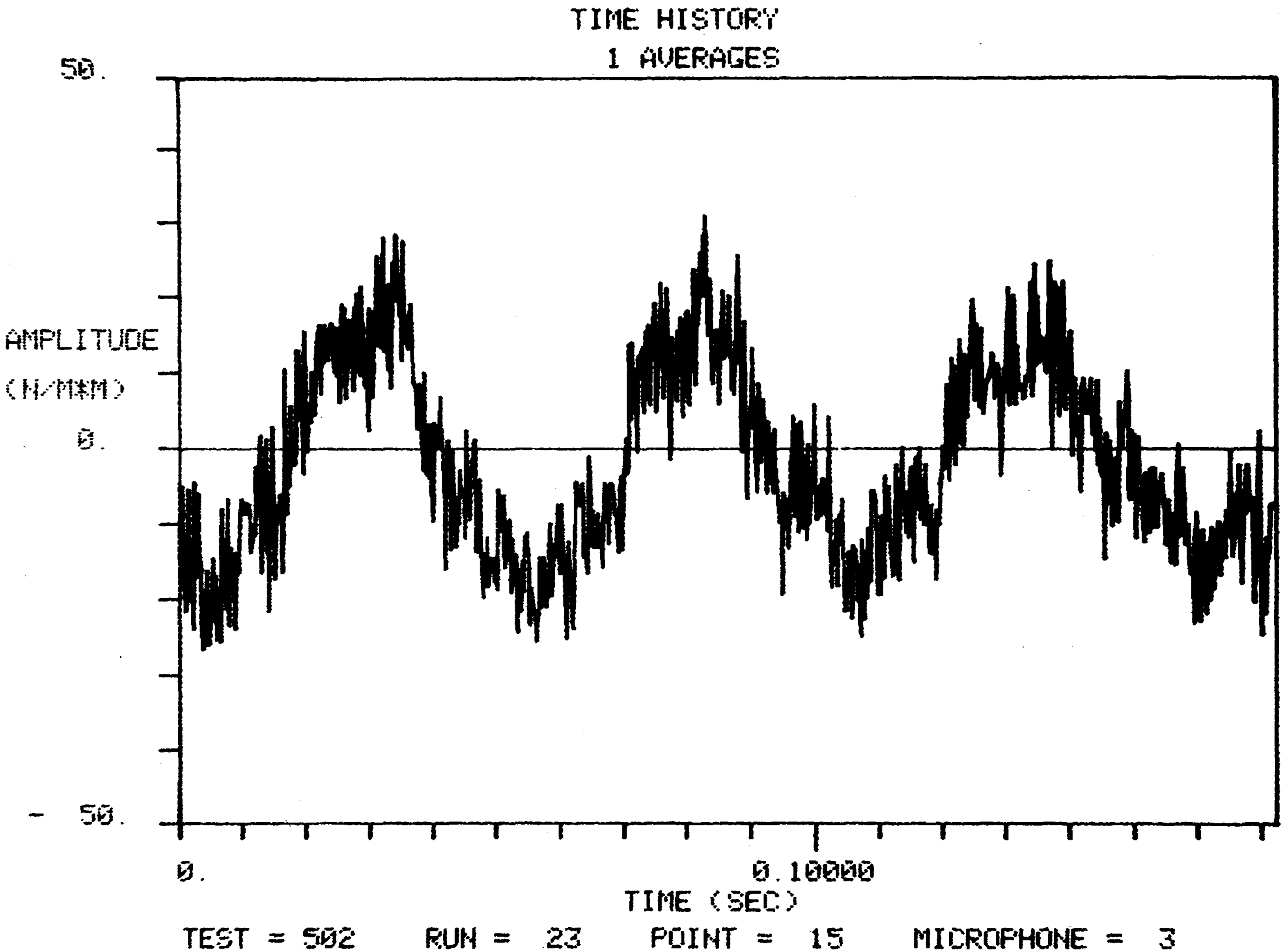
Figure E3(e). Acoustic Time History for Tapered Tip Rotor.



TAPERED TIP $V = 79$ kt $\alpha = -2.5^{\circ}$ $C_{LR/\sigma} = .07$

$M_{tip} = .598$ $M_{at} = .718$ $\mu = .200$

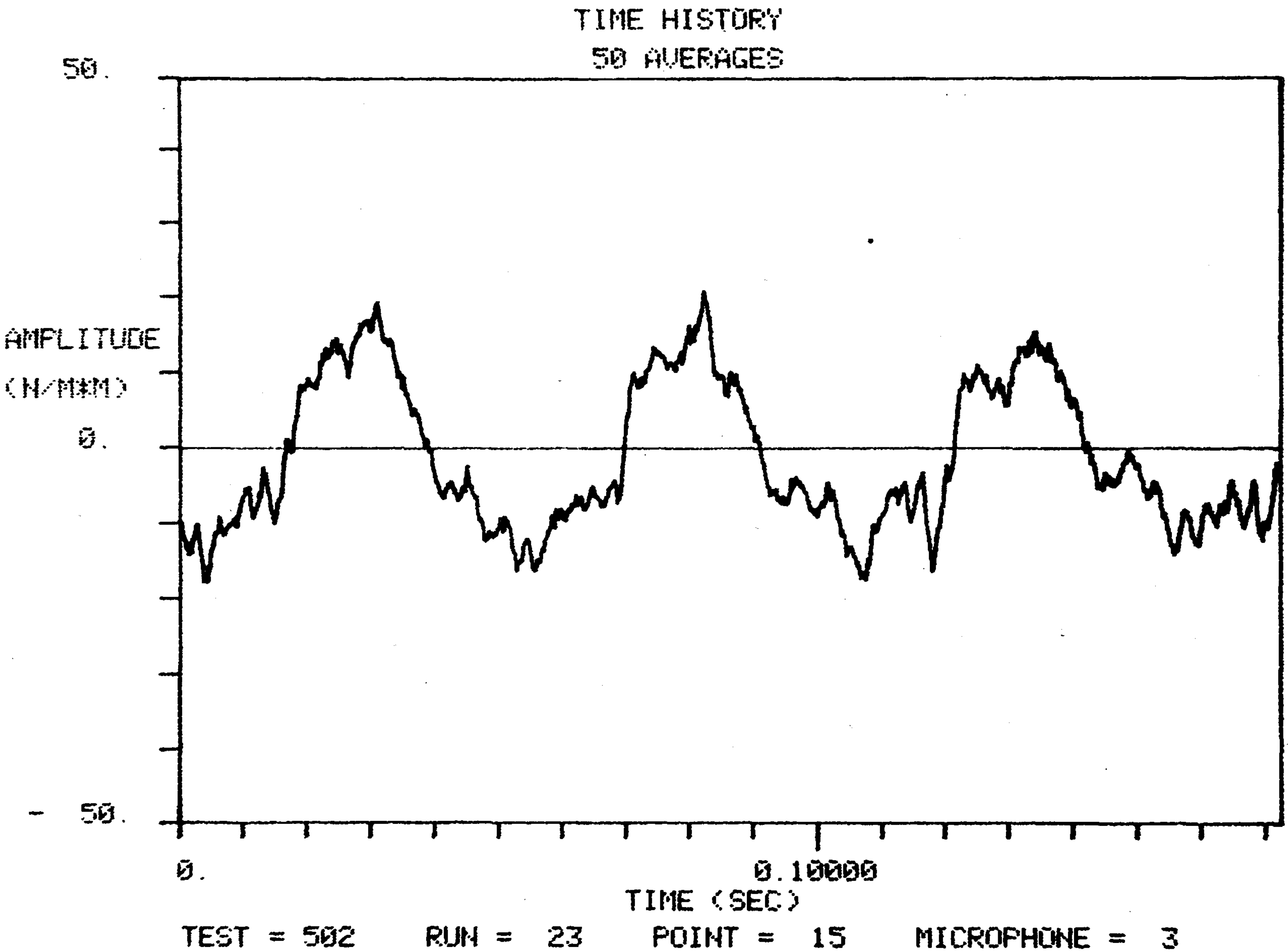
Figure E3(f). Acoustic Time History for Tapered Tip Rotor.



TAPERED TIP $V = 79$ kt $\alpha = -2.5°$ $C_{LR/\sigma} = .07$

$M_{tip} = .598$ $M_{at} = .718$ $\mu = .200$

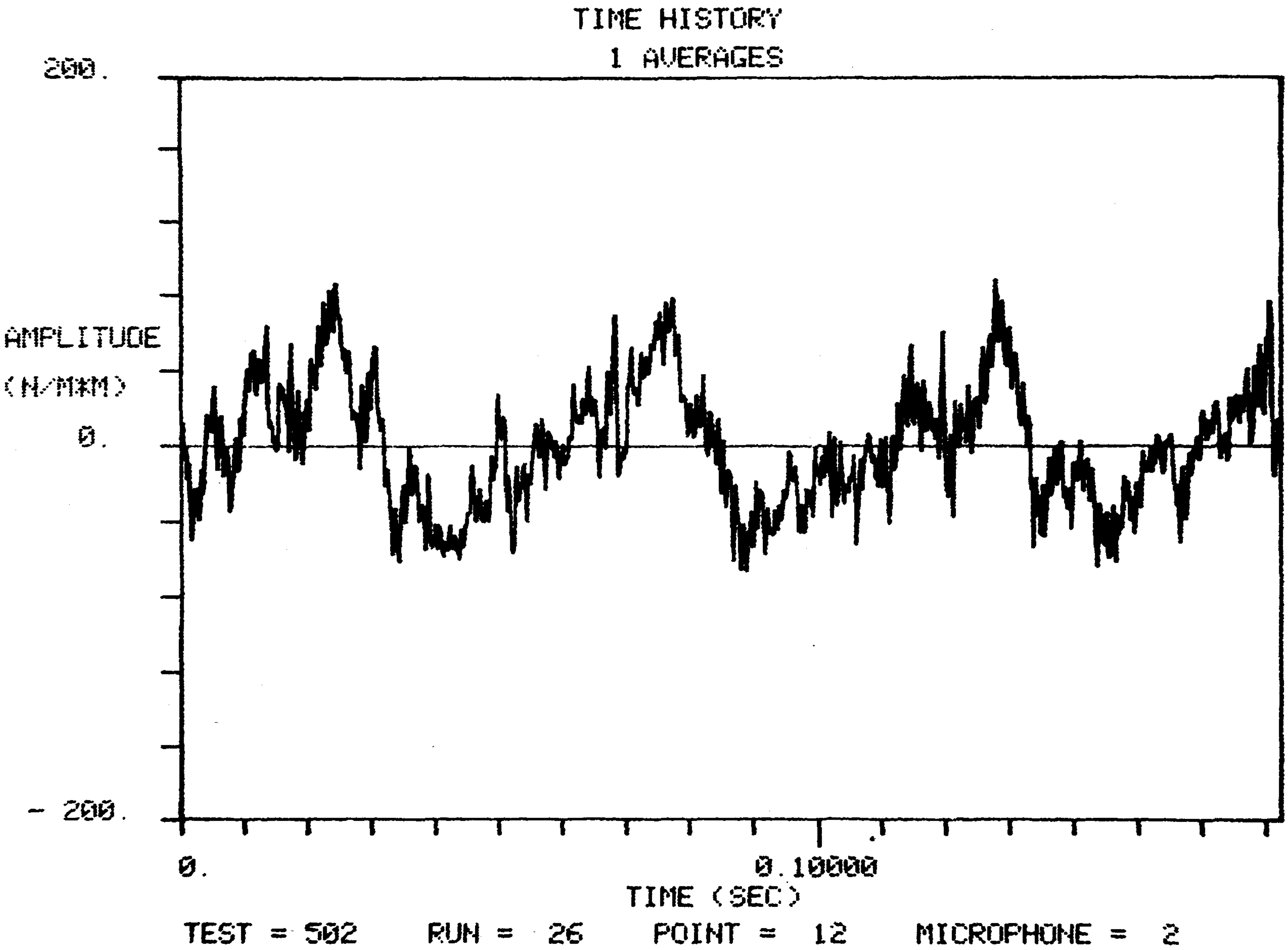
Figure E3(g). Acoustic Time History for Tapered Tip Rotor.



TAPERED TIP $V = 79$ kt $\alpha = -2.5°$ $C_{LR/\sigma} = .07$

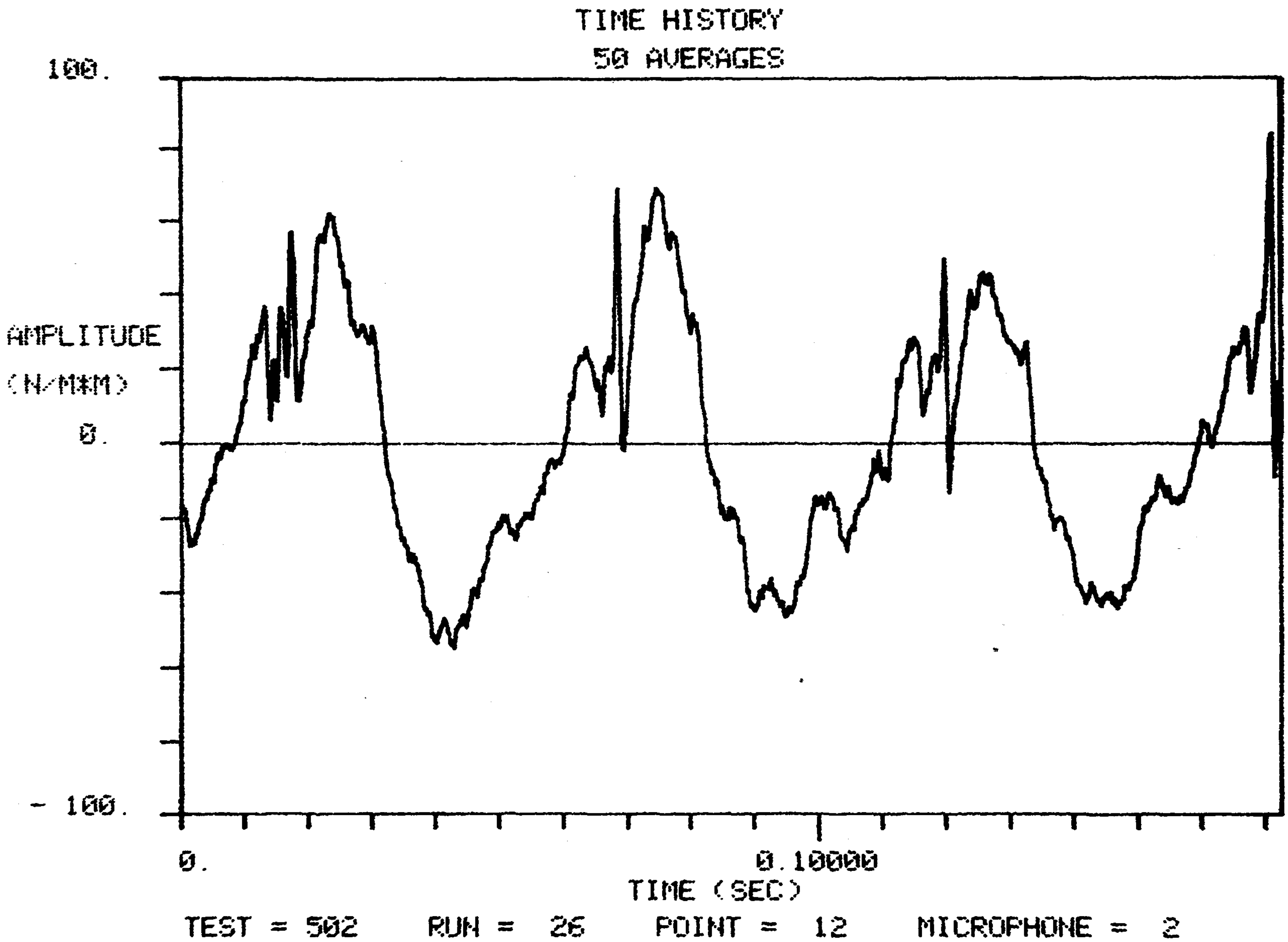
$M_{tip} = .598$ $M_{at} = .718$ $\mu = .200$

Figure E3(h). Acoustic Time History for Tapered Tip Rotor.



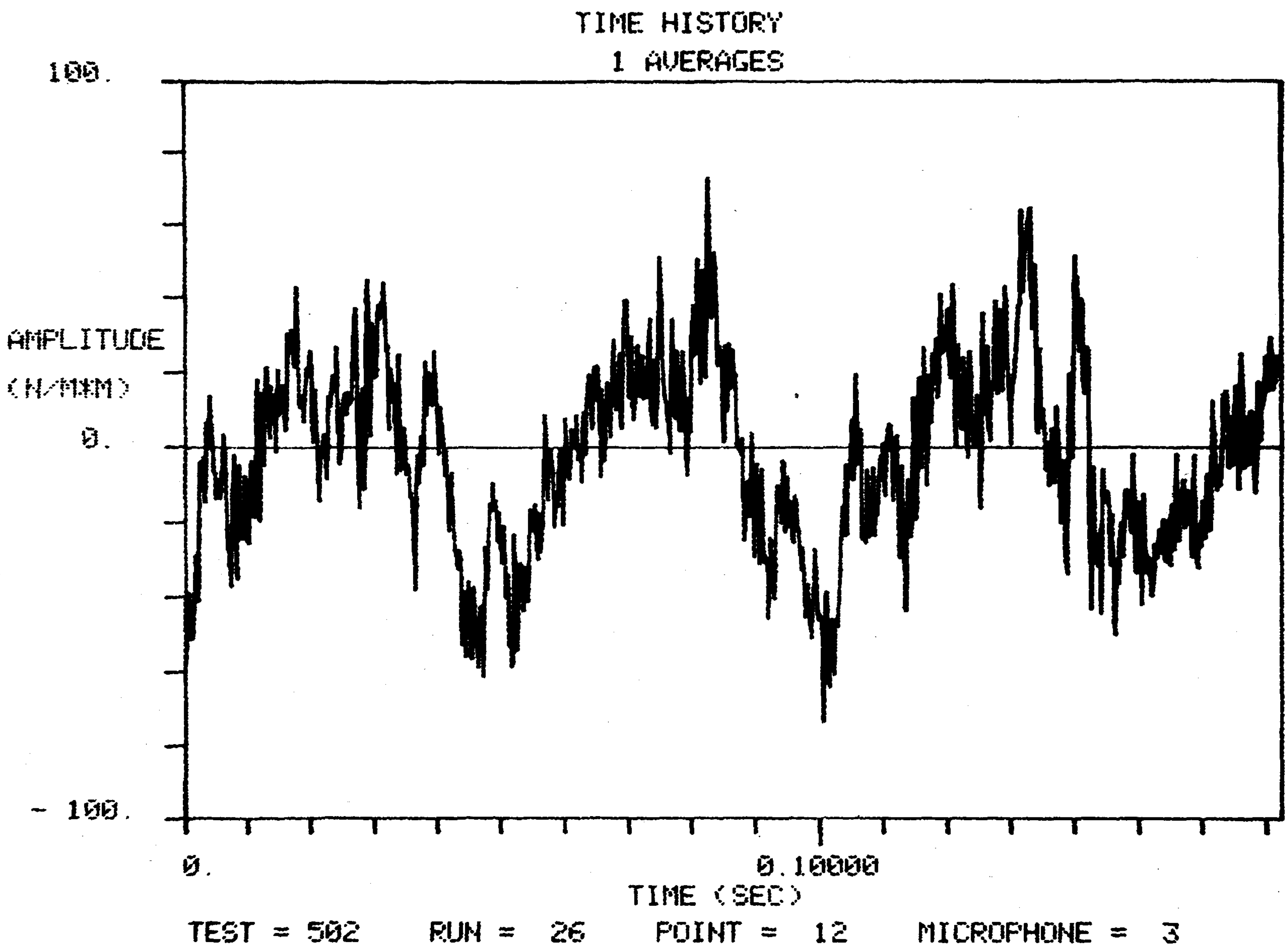
TAPERED TIP $V = 150$ kt $\alpha = -5.0°$ $C_{LR/\sigma} = .08$
$M_{tip} = .599$ $M_{at} = .825$ $\mu = .377$

Figure E3(i). Acoustic Time History for Tapered Tip Rotor.



TAPERED TIP $V = 150$ kt $\alpha = -5.0^{\circ}$ $C_{LR/\sigma} = .08$
$M_{tip} = .599$ $M_{at} = .825$ $\mu = .377$

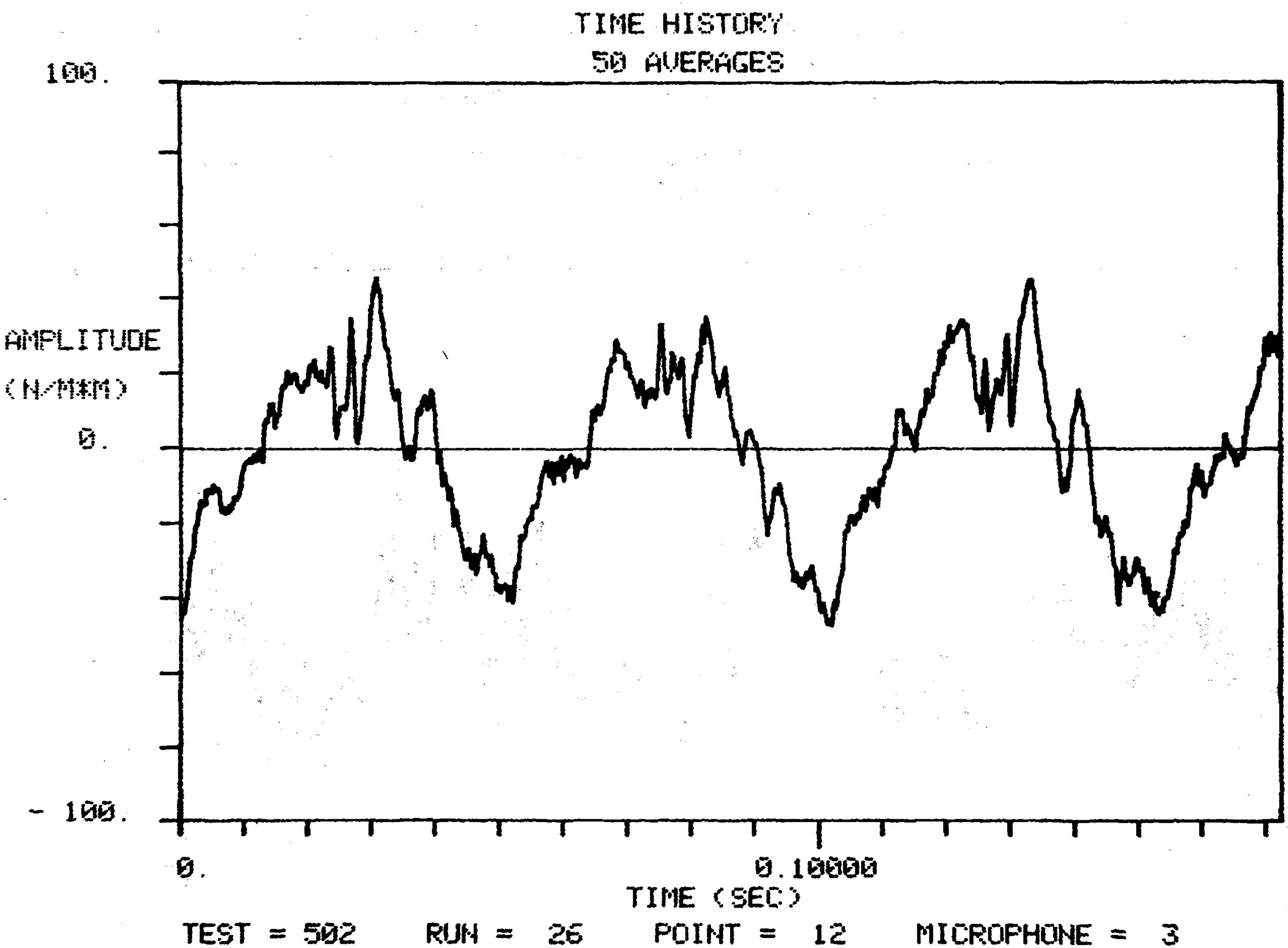
Figure E3(j). Acoustic Time History for Tapered Tip Rotor.



TAPERED TIP V = 150 kt $\alpha = -5.0^{\circ}$ $C_{LR/\sigma} = .08$

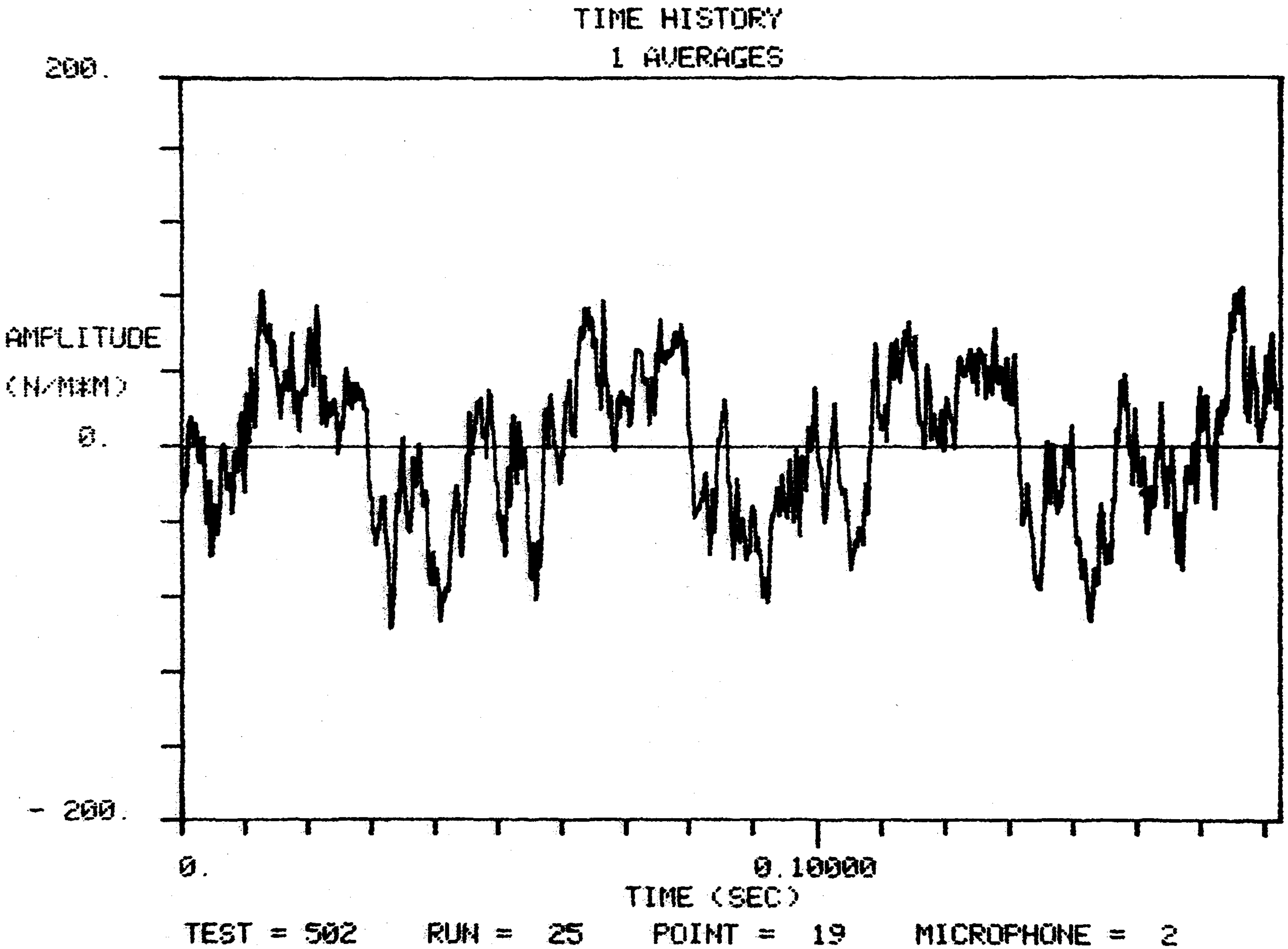
$M_{tip} = .599$ $M_{at} = .825$ $\mu = .377$

Figure E3(k). Acoustic Time History for Tapered Tip Rotor.



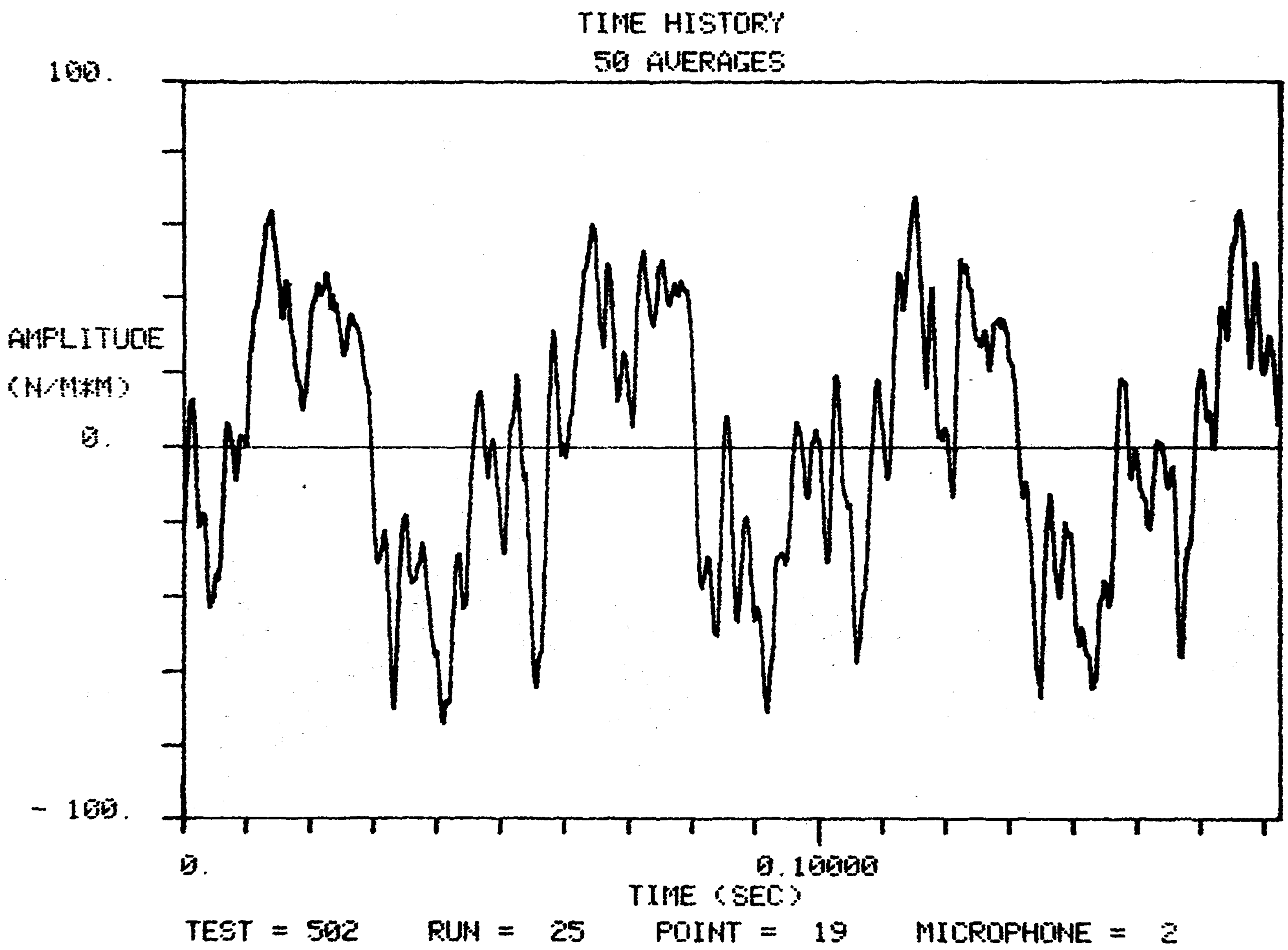
TAPERED TIP $V = 150$ kt $\alpha = -5.0^{\circ}$ $C_{LR/\sigma} = .08$
$M_{tip} = .599$ $M_{at} = .825$ $\mu = .377$

Figure E3(l). Acoustic Time History for Tapered Tip Rotor.



TAPERED TIP V = 151 kt $\alpha = 0.0^{\circ}$ $C_{LR/\sigma} = .10$
$M_{tip} = .601$ $M_{at} = .827$ $\mu = .375$

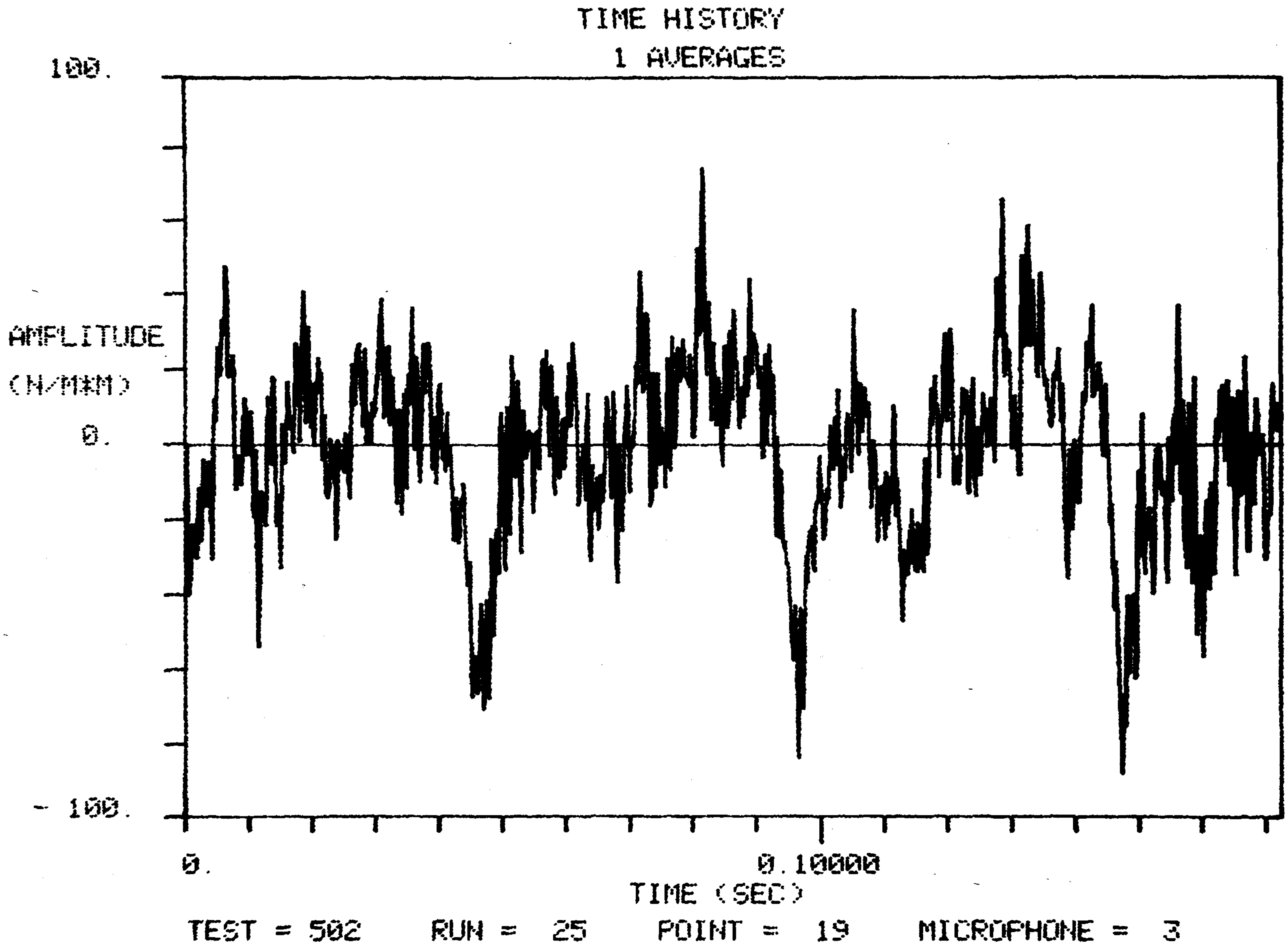
Figure E3(m). Acoustic Time History for Tapered Tip Rotor.



TAPERED TIP V = 151 kt $\alpha = 0.0°$ $C_{LR/\sigma} = .10$

$M_{tip} = .601$ $M_{at} = .827$ $\mu = .375$

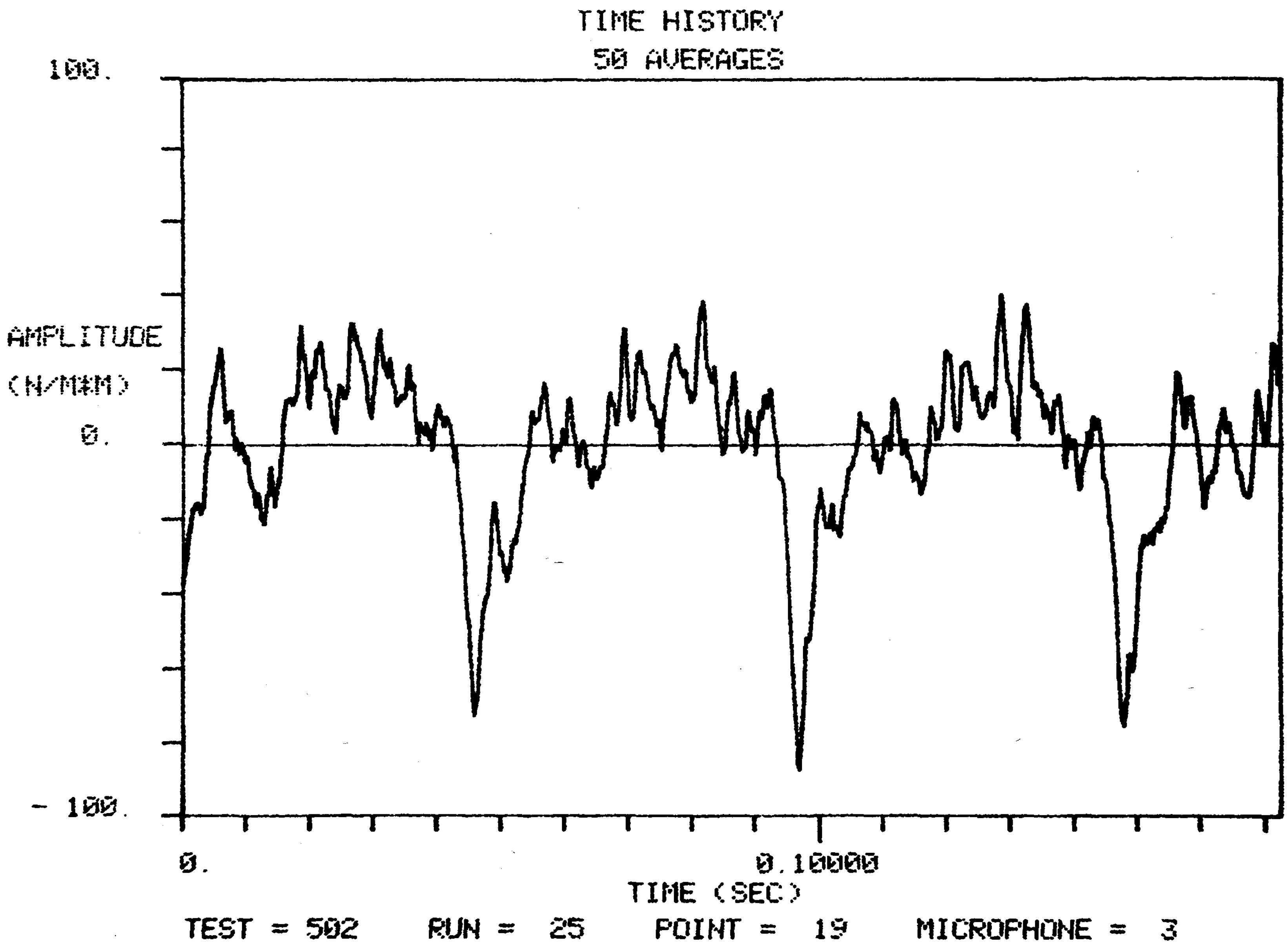
Figure E3(n). Acoustic Time History for Tapered Tip Rotor.



TAPERED TIP $V = 151$ kt $\alpha = 0.0^{\circ}$ $C_{LR/\sigma} = .10$

$M_{tip} = .601$ $M_{at} = .827$ $\mu = .375$

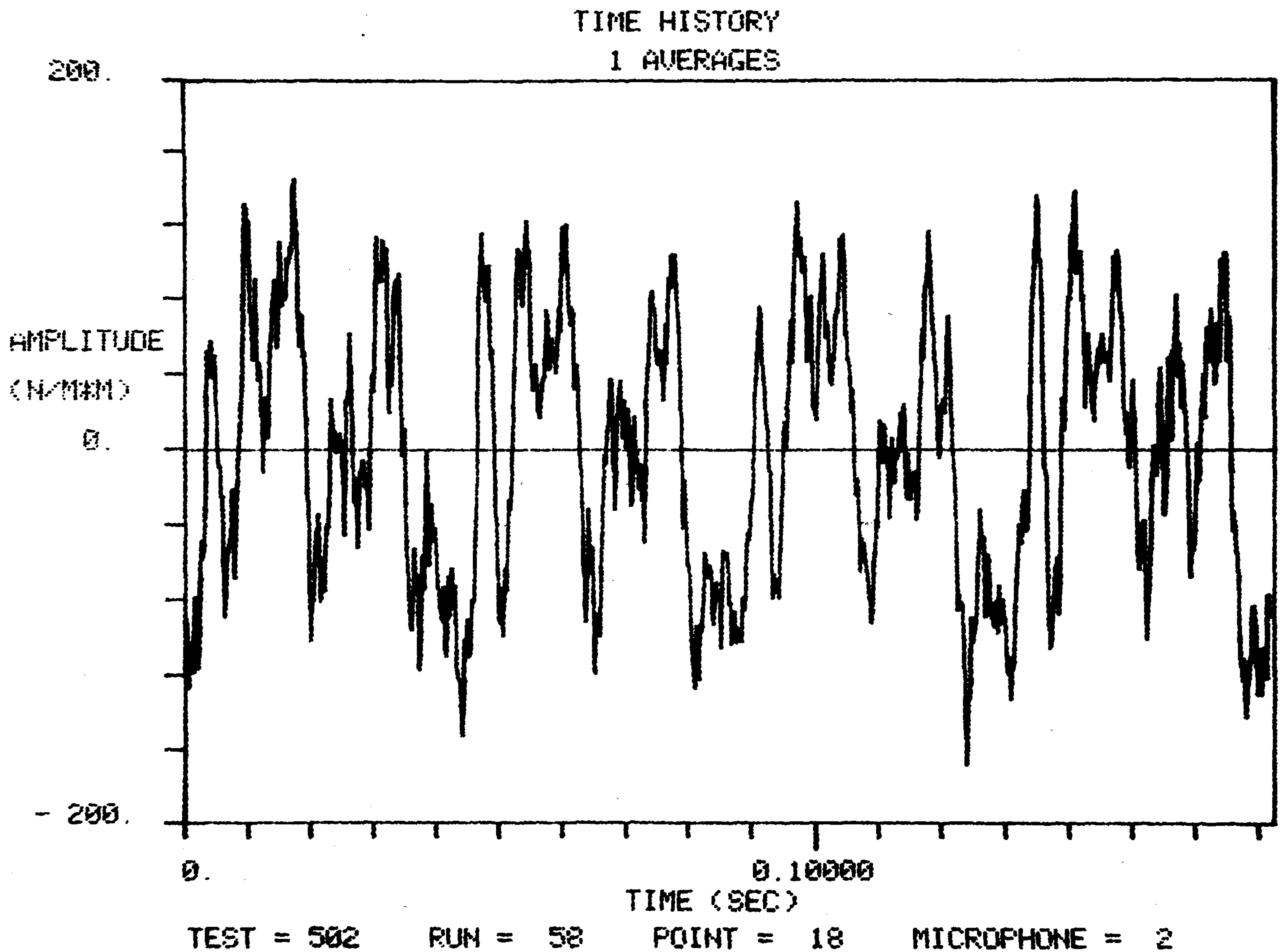
Figure E3(o). Acoustic Time History for Tapered Tip Rotor.



TAPERED TIP $V = 151$ kt $\alpha = 0.0^{\circ}$ $C_{LR/\sigma} = .10$

$M_{tip} = .601$ $M_{at} = .827$ $\mu = .375$

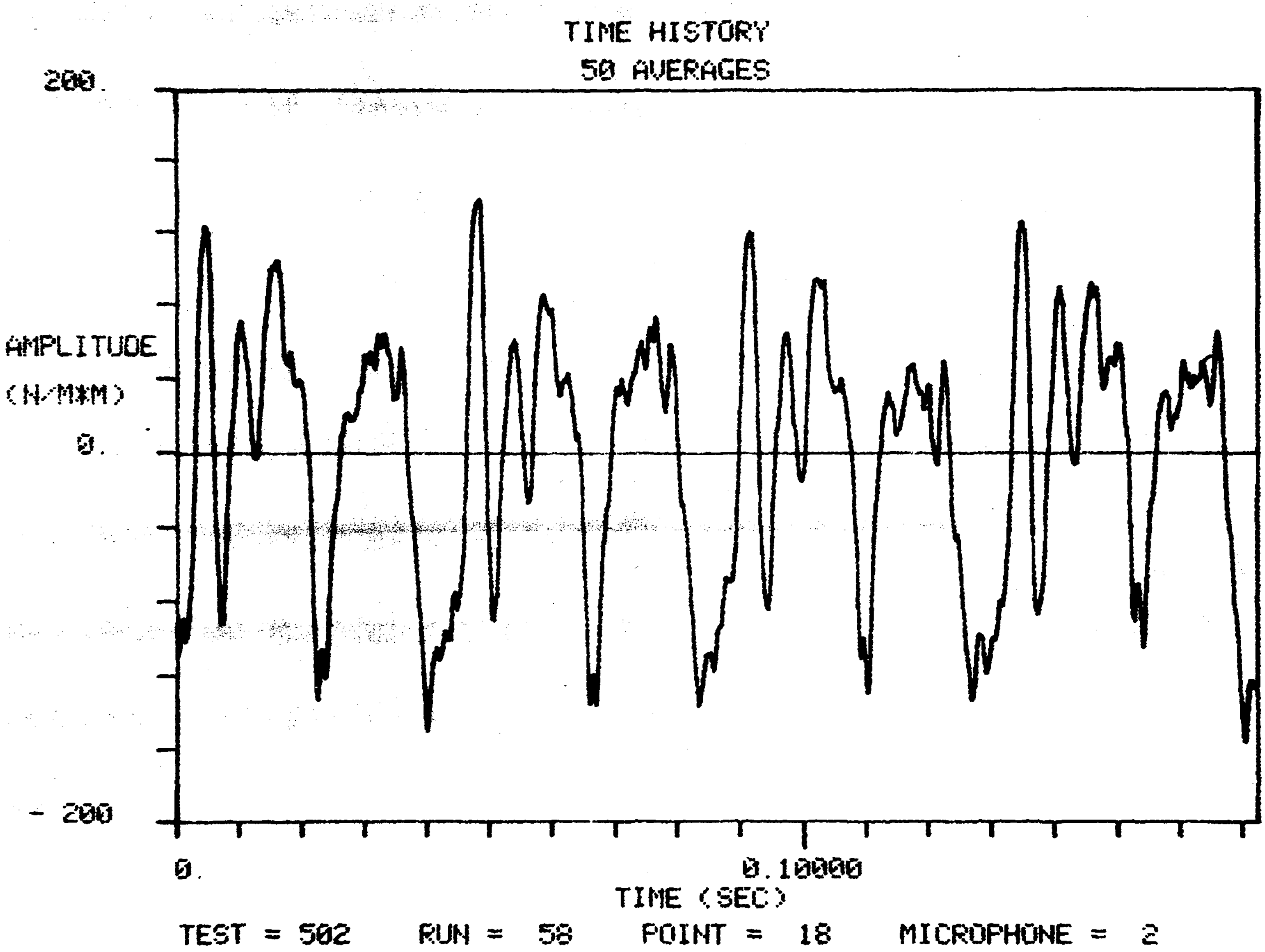
Figure E3(p). Acoustic Time History for Tapered Tip Rotor.



TAPERED TIP V = 176 kt $\alpha = -7.5^{\circ}$ $C_{LR/\sigma} = .07$

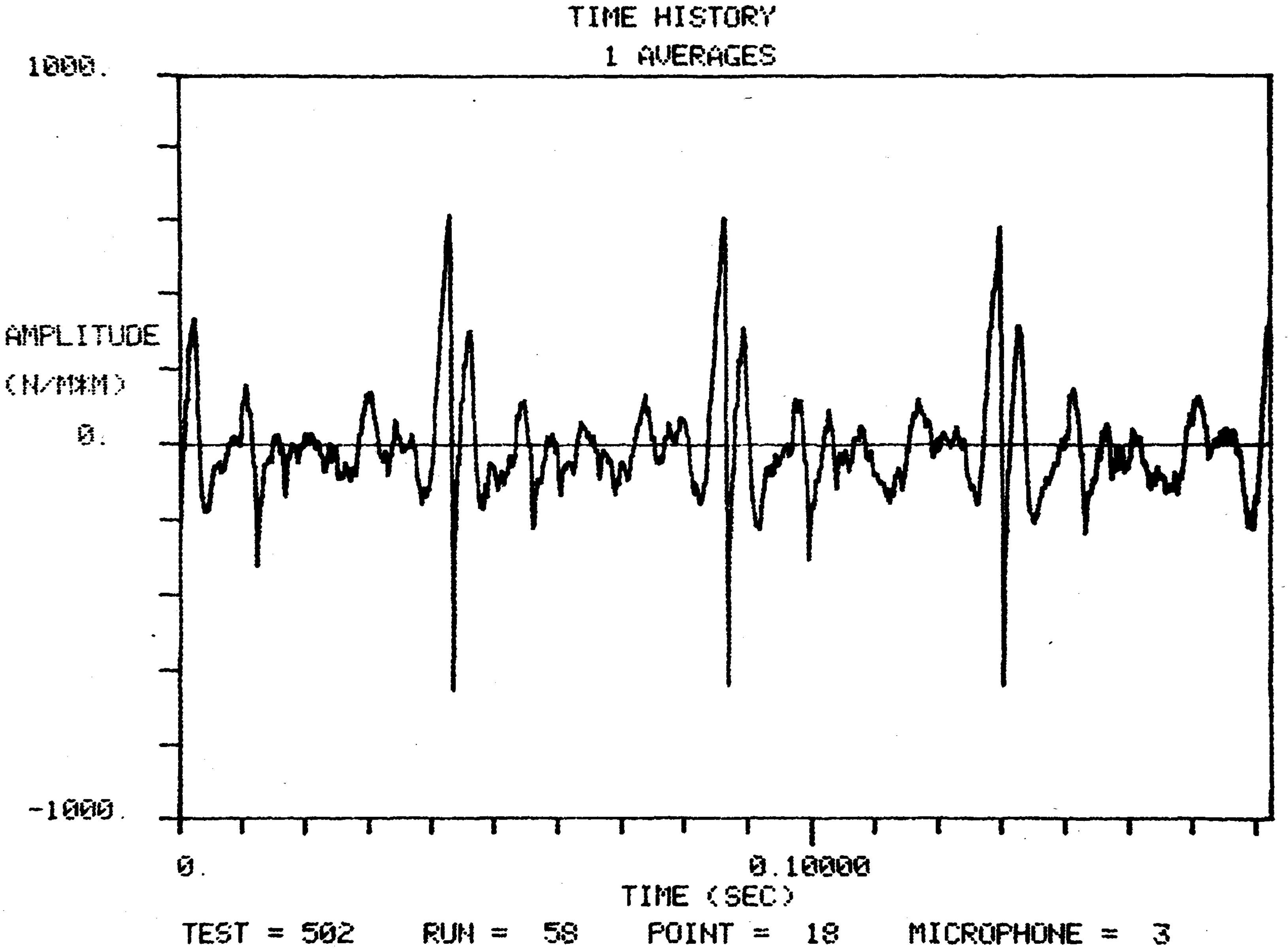
$M_{tip} = .703$ $M_{at} = .967$ $\mu = .374$

Figure E3(q). Acoustic Time History for Tapered Tip Rotor.



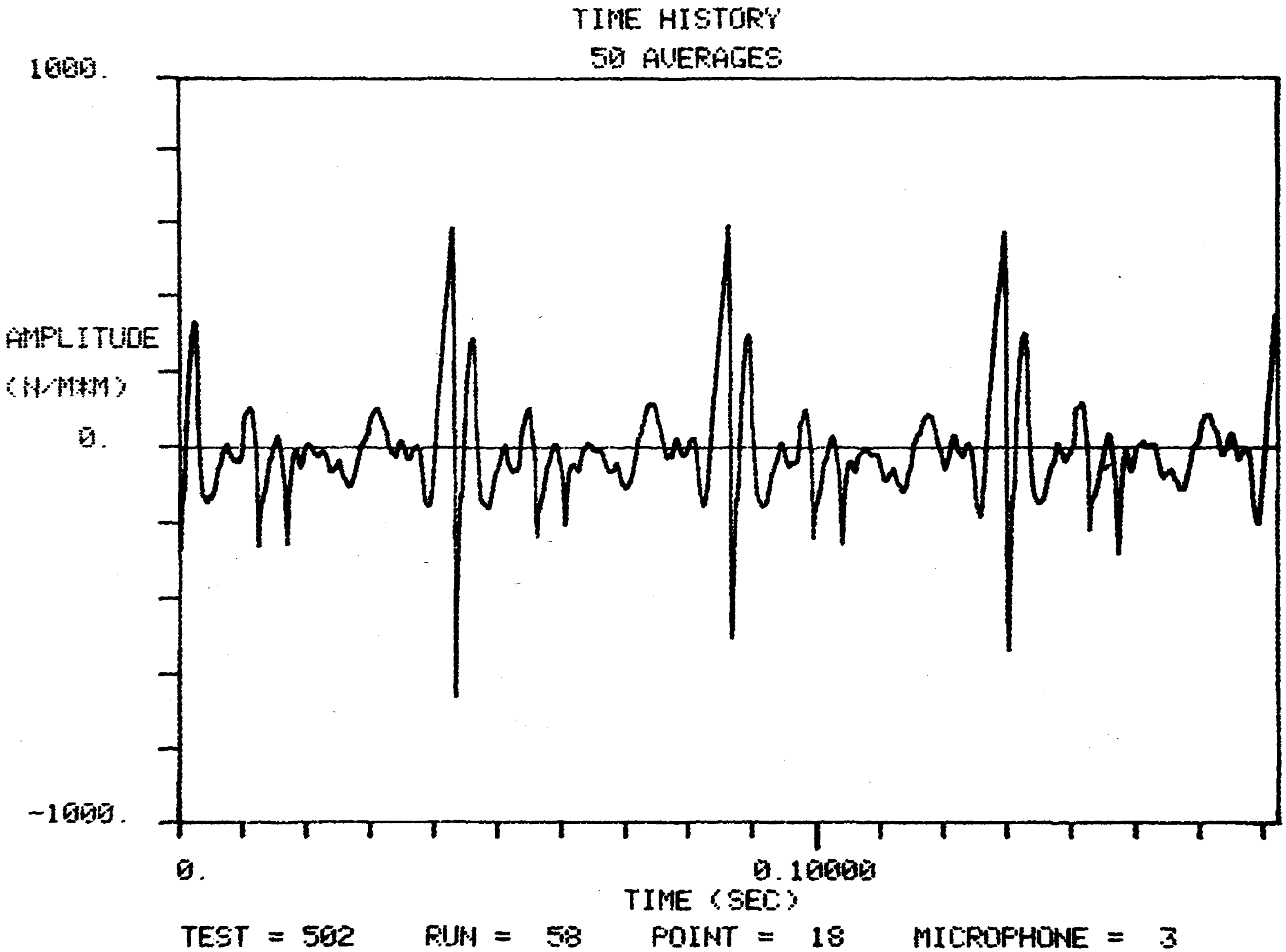
TAPERED TIP $V = 176$ kt $\alpha = -7.5^\circ$ $C_{LR/\sigma} = .07$
$M_{tip} = .703$ $M_{at} = .967$ $\mu = .374$

Figure E3(r). Acoustic Time History for Tapered Tip Rotor.



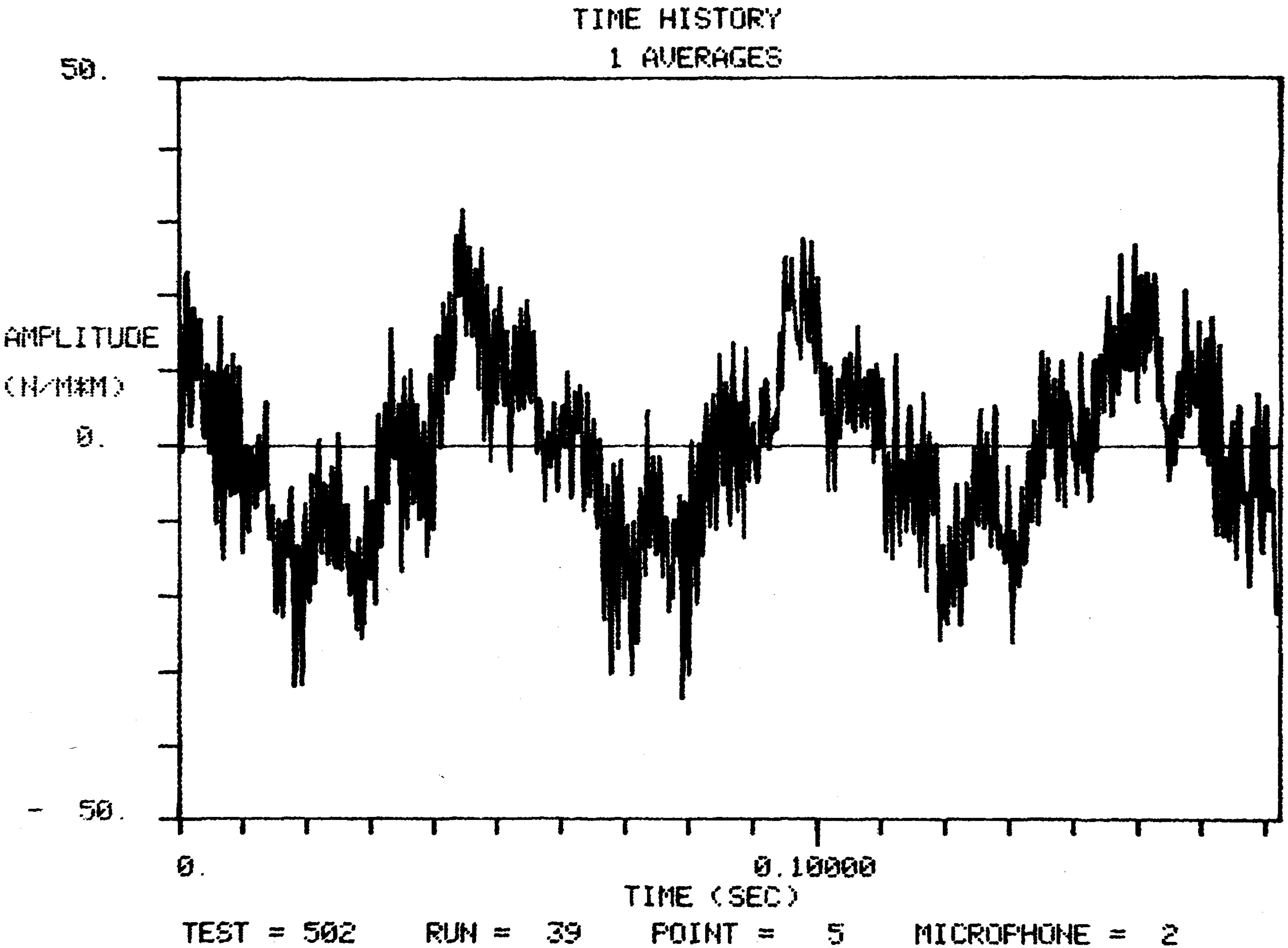
TAPERED TIP $V = 176$ kt $\alpha = -7.5°$ $C_{LR/\sigma} = .07$
$M_{tip} = .703$ $M_{at} = .967$ $\mu = .374$

Figure E3(s). Acoustic Time History for Tapered Tip Rotor.



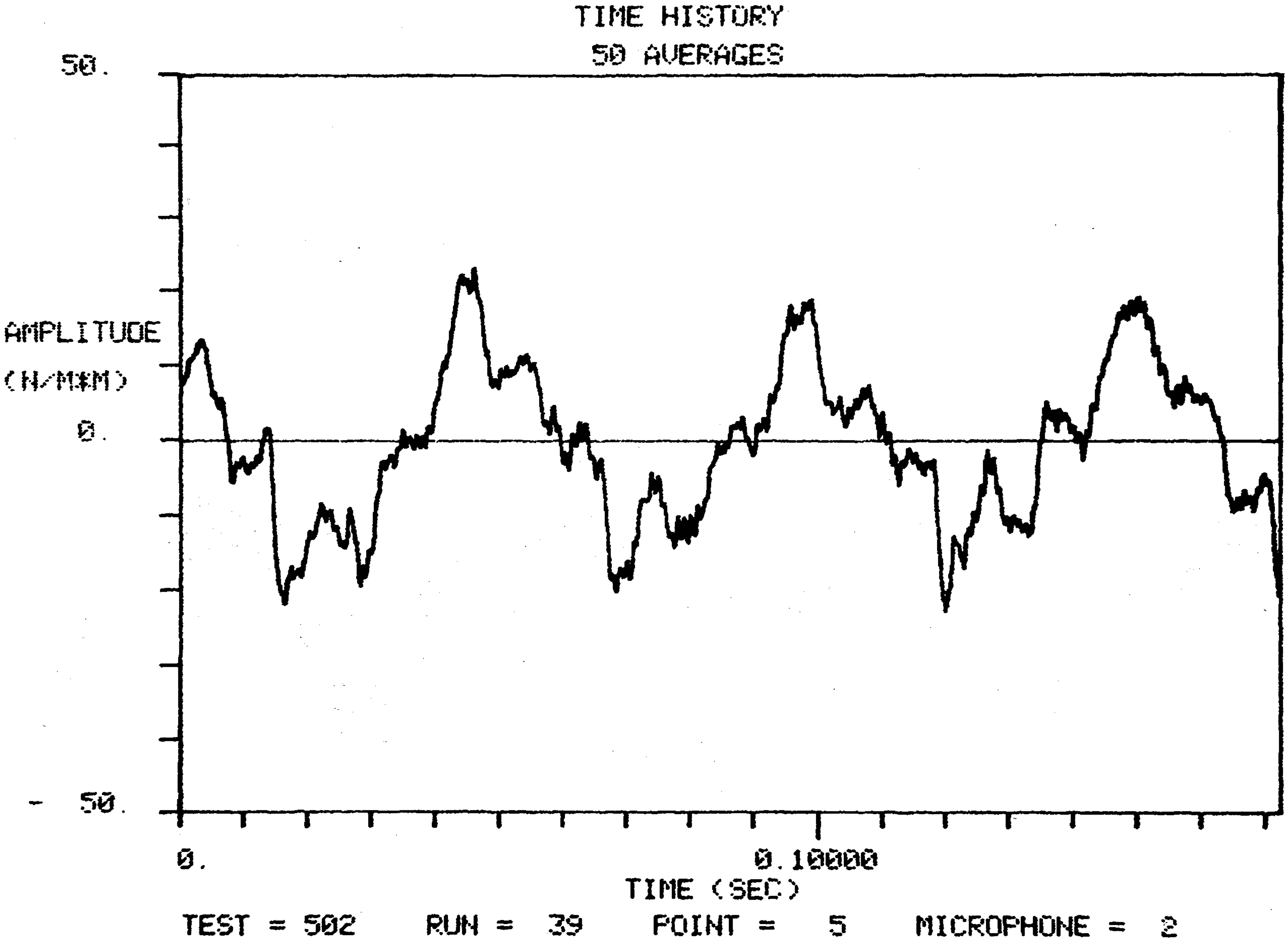
TAPERED TIP $V = 176$ kt $\alpha = -7.5^\circ$ $C_{LR/\sigma} = .07$
$M_{tip} = .703$ $M_{at} = .967$ $\mu = .374$

Figure E3(t). Acoustic Time History for Tapered Tip Rotor.



RECTANGULAR TIP $V = 79$ kt $\alpha = -2.5^\circ$ $C_{LR/\sigma} = .07$
$M_{tip} = .598$ $M_{at} = .718$ $\mu = .201$

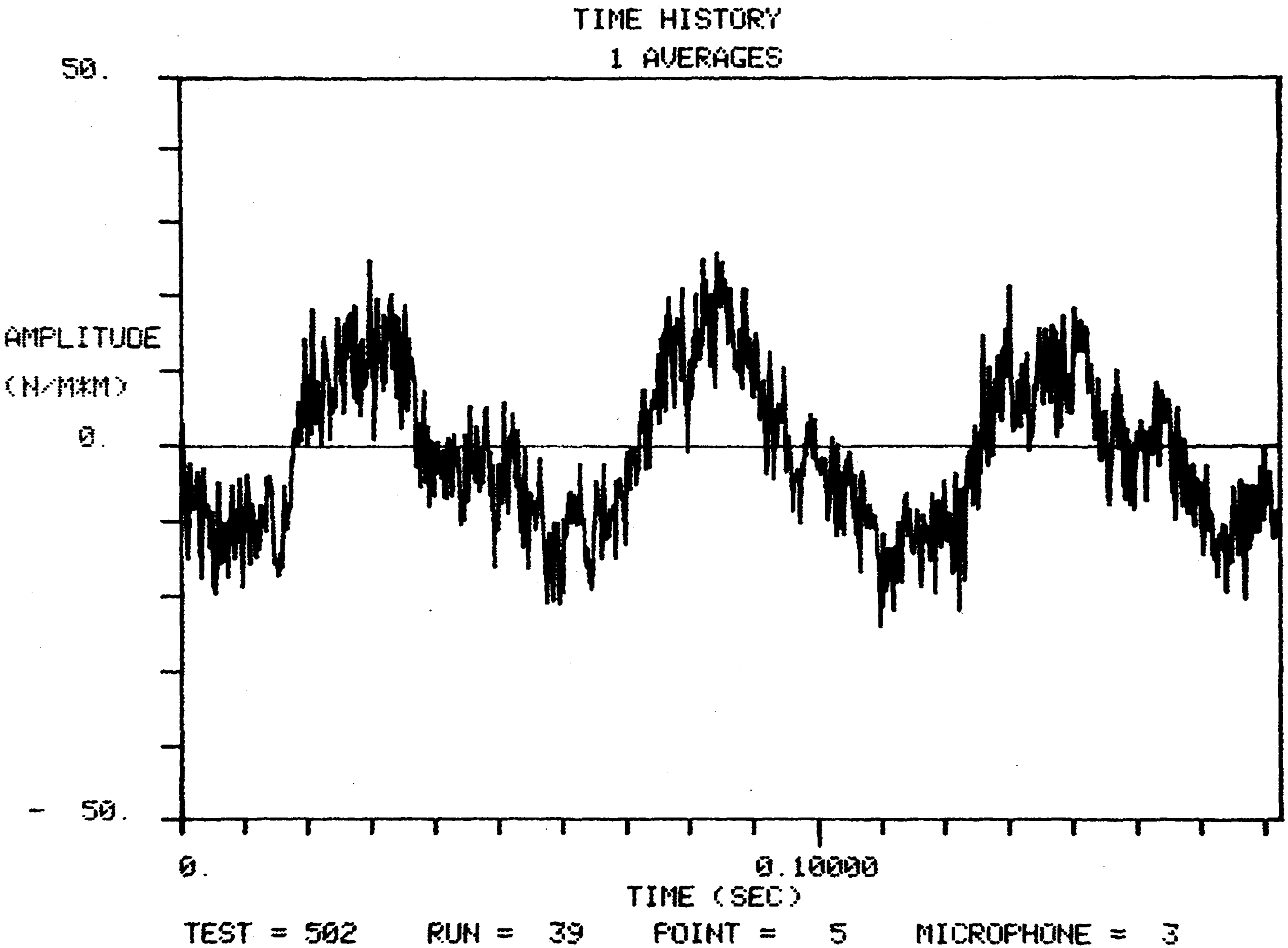
Figure E4(a). Acoustic Time History for Rectangular Tip Rotor.



RECTANGULAR TIP $V = 79$ kt $\alpha = -2.5^\circ$ $C_{LR/\sigma} = .07$

$M_{tip} = .598$ $M_{at} = .718$ $\mu = .201$

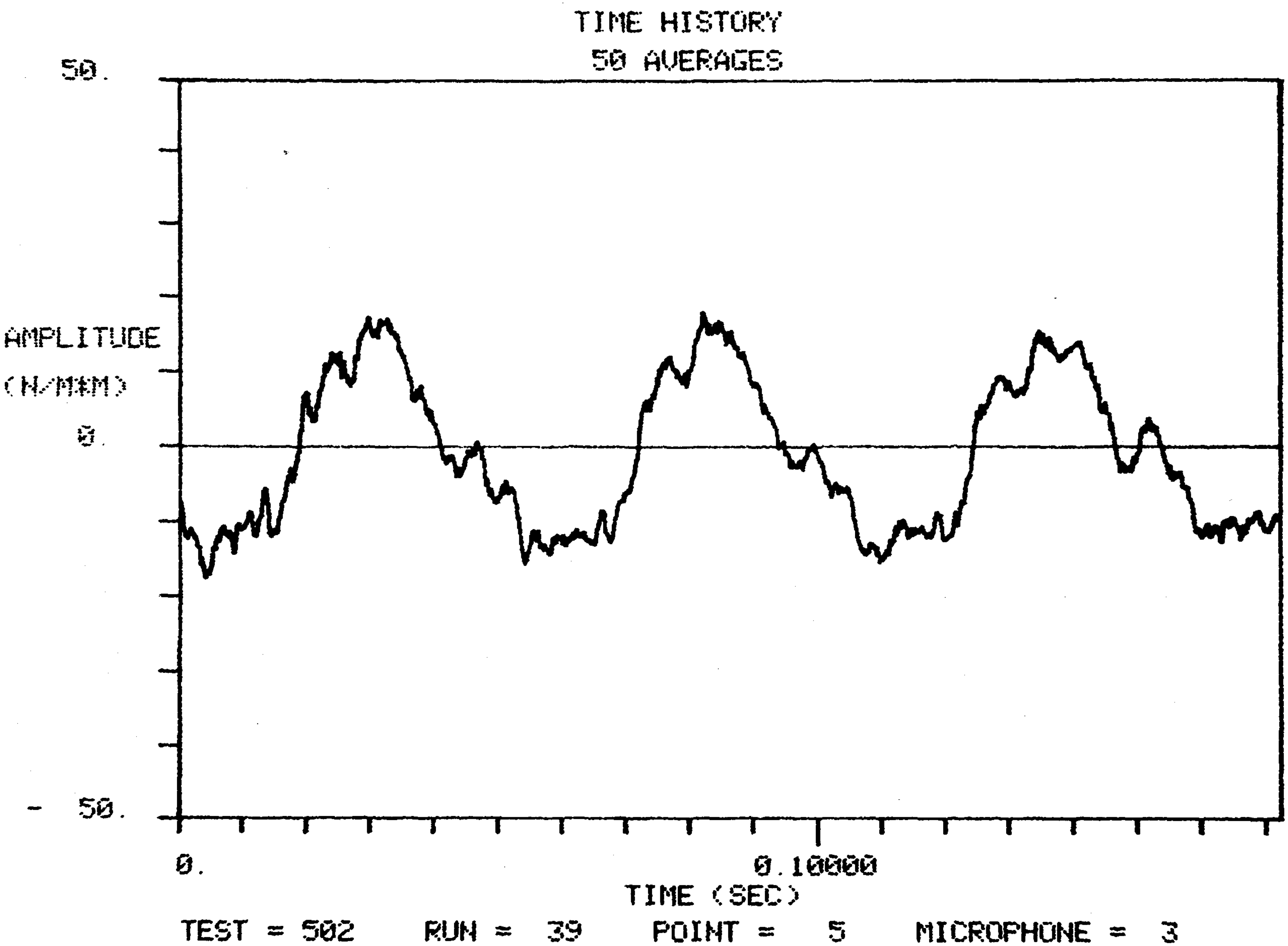
Figure E4(b). Acoustic Time History for Rectangular Tip Rotor.



RECTANGULAR TIP $V = 79$ kt $\alpha = -2.5^\circ$ $C_{LR/\sigma} = .07$

$M_{tip} = .598$ $M_{at} = .718$ $\mu = .201$

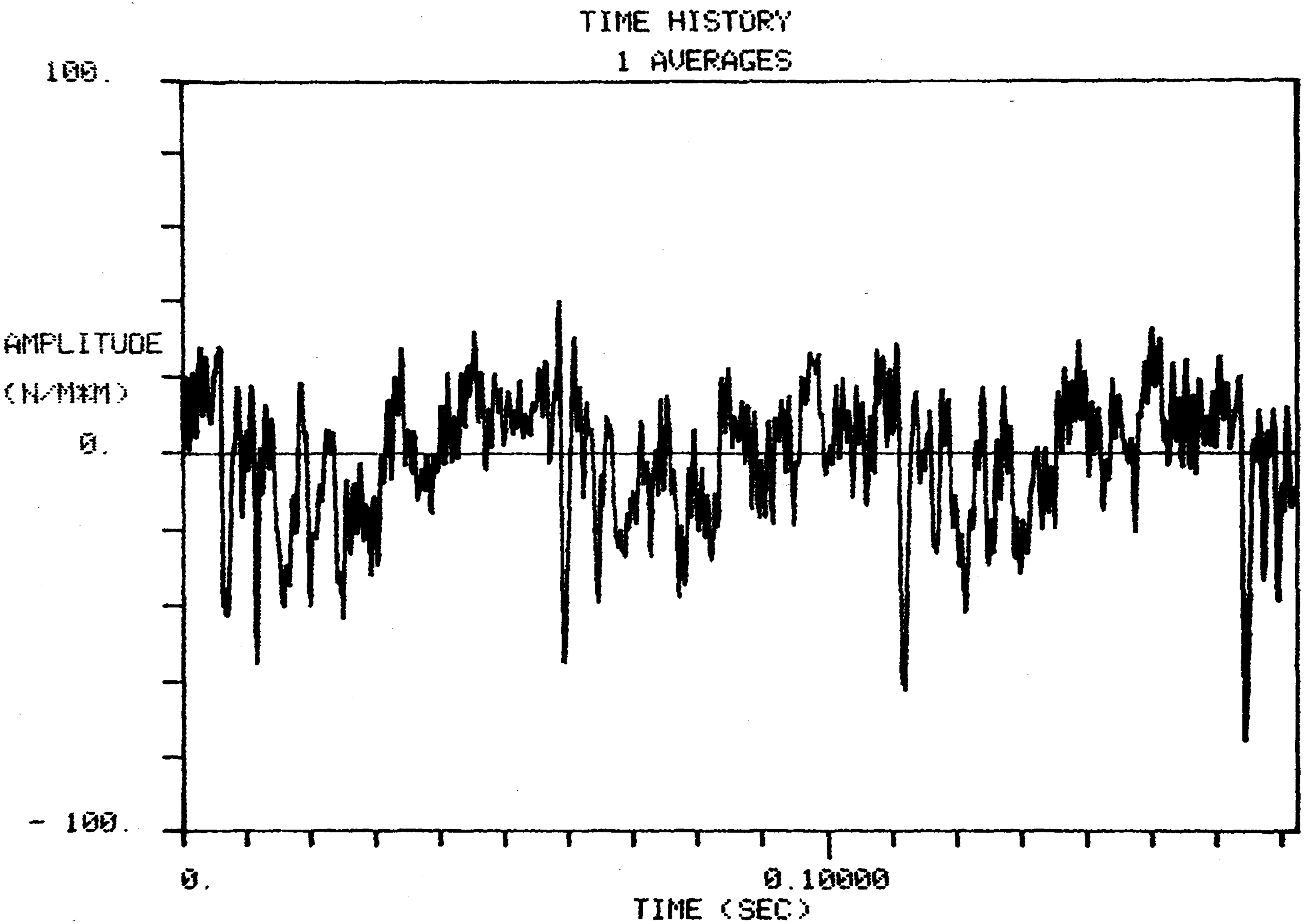
Figure E4(c). Acoustic Time History for Rectangular Tip Rotor.



RECTANGULAR TIP $V = 79$ kt $\alpha = -2.5°$ $C_{LR/\sigma} = .07$

$M_{tip} = .598$ $M_{at} = .718$ $\mu = .201$

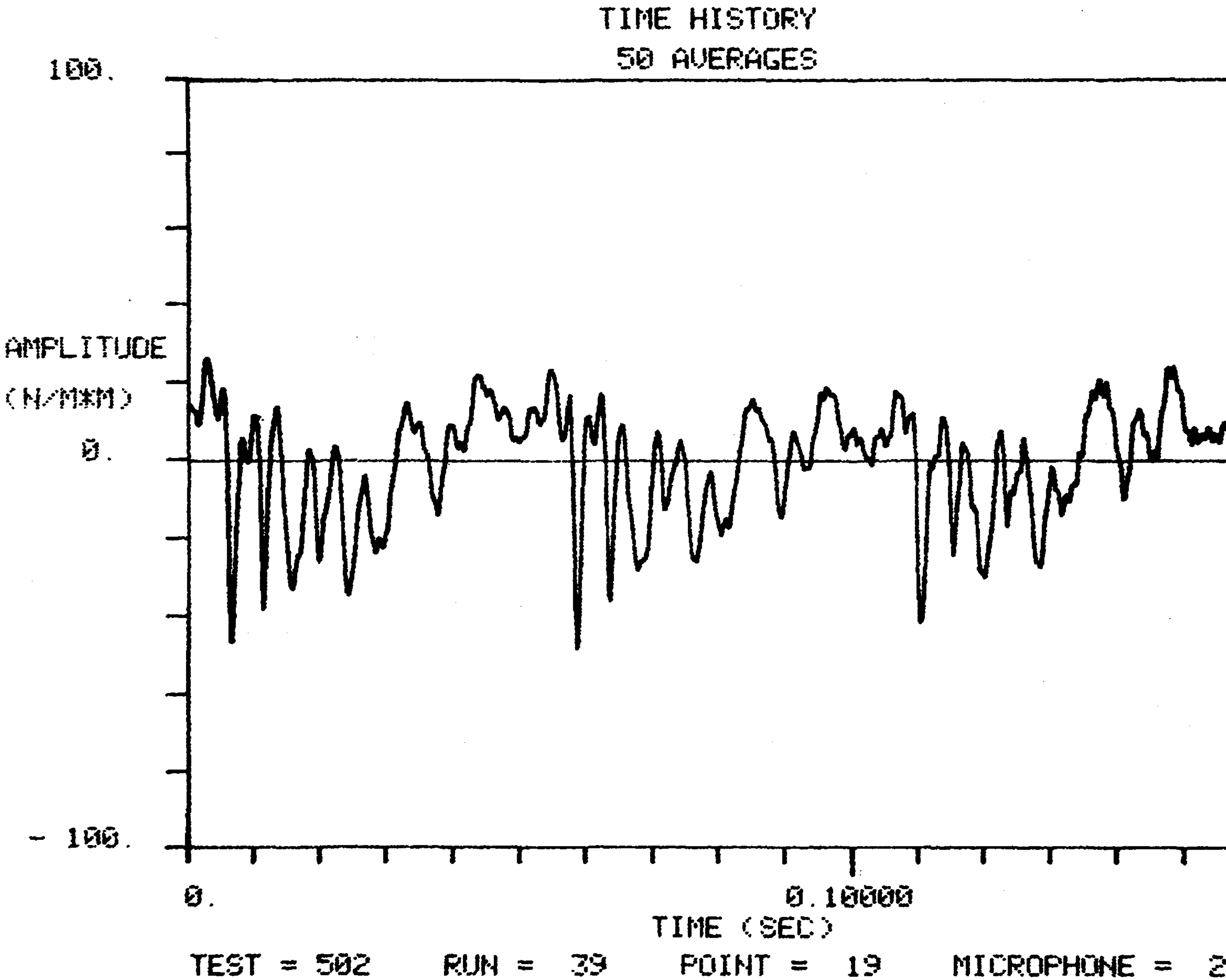
Figure E4(d). Acoustic Time History for Rectangular Tip Rotor.



TEST = 502 RUN = 39 POINT = 19 MICROPHONE = 2

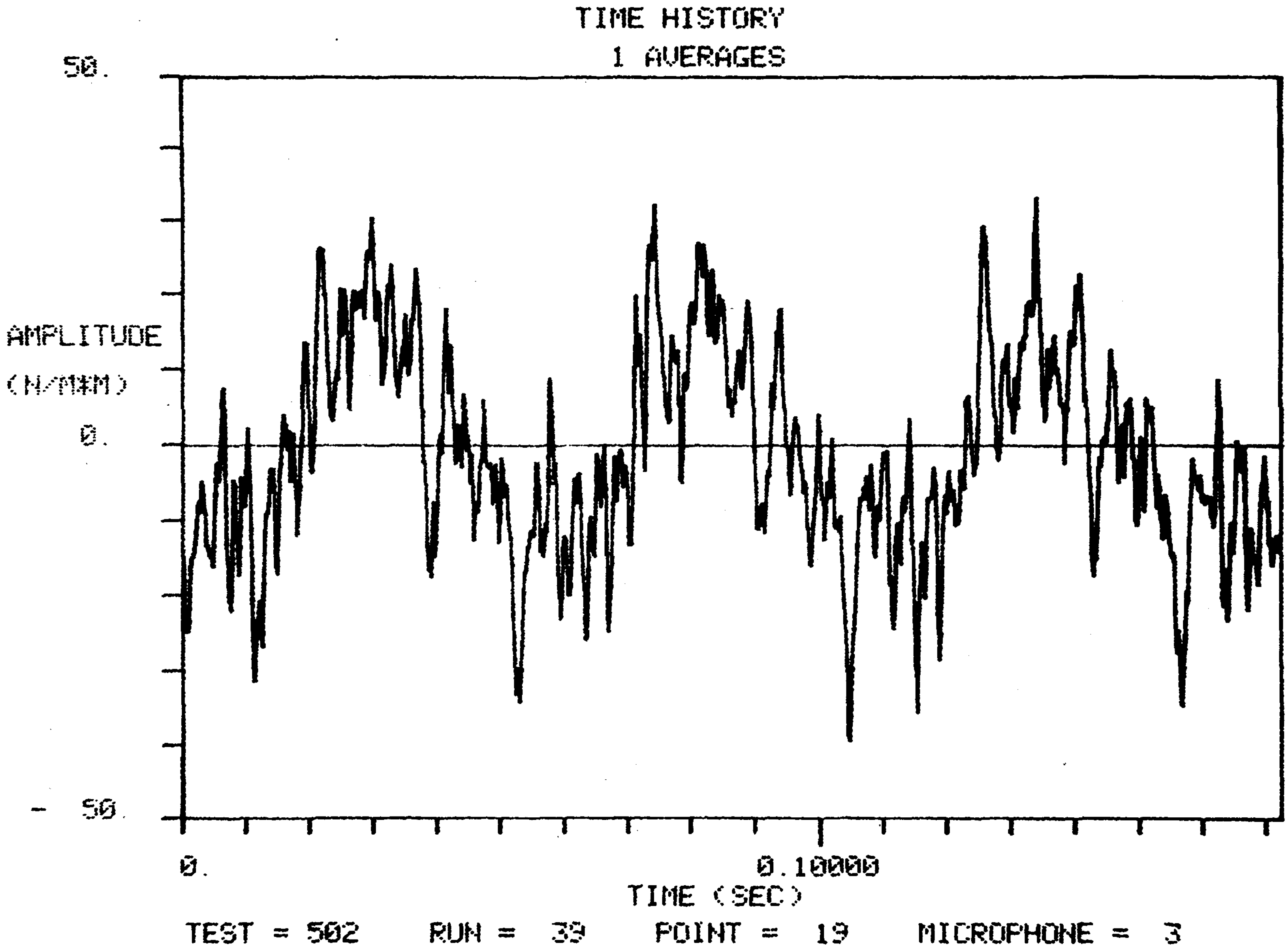
RECTANGULAR TIP $V = 80$ kt $\alpha = 0.0^\circ$ $C_{LR/\sigma} = .08$
$M_{tip} = .597$ $M_{at} = .718$ $\mu = .201$

Figure E4(e). Acoustic Time History for Rectangular Tip Rotor.



RECTANGULAR TIP $V = 80$ kt $\alpha = 0.0°$ $C_{LR/\sigma} = .08$
$M_{tip} = .597$ $M_{at} = .718$ $\mu = .201$

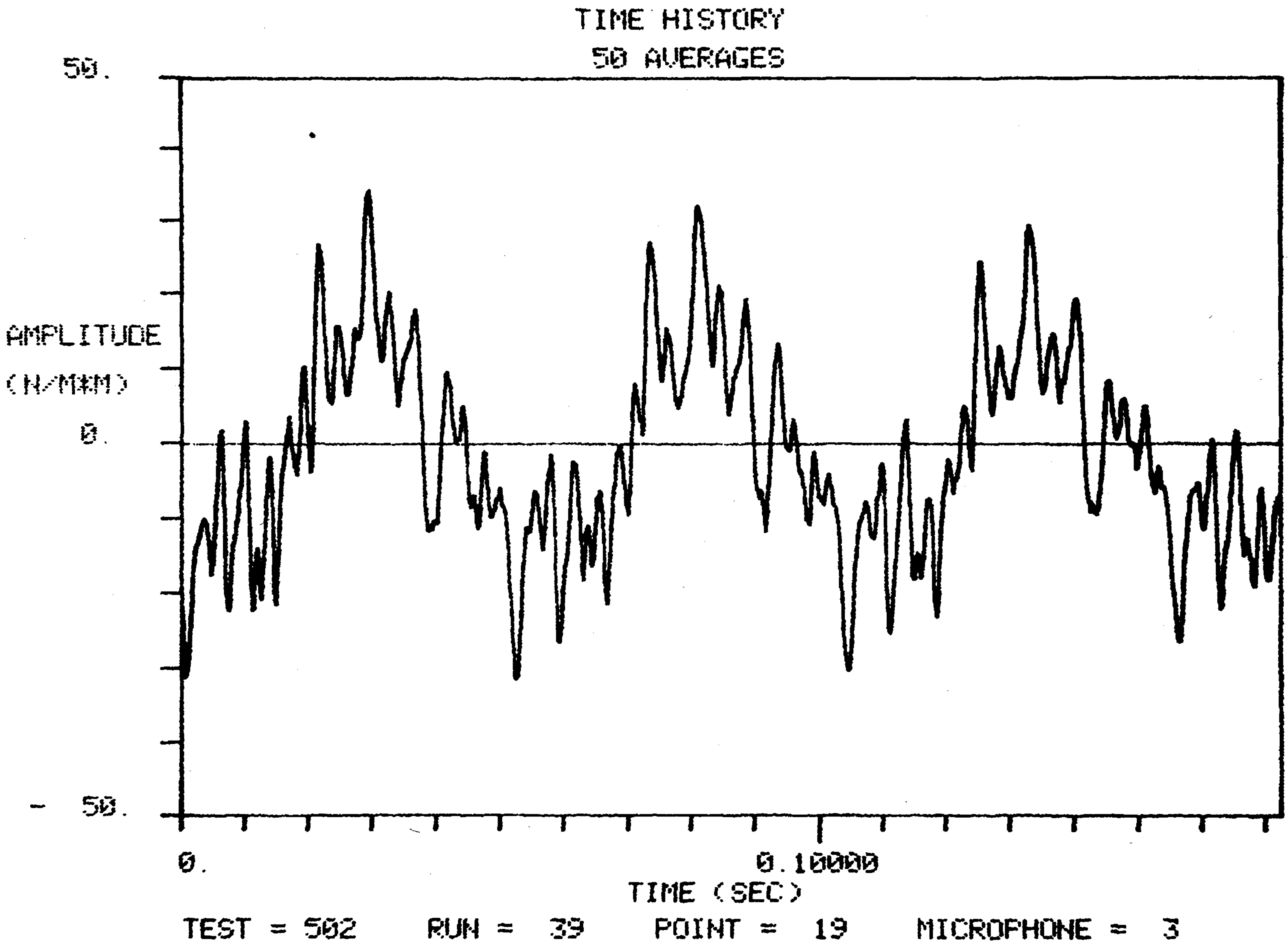
Figure E4(f). Acoustic Time History for Rectangular Tip Rotor.



RECTANGULAR TIP $V = 80$ kt $\alpha = 0.0^{\circ}$ $C_{LR/\sigma} = .08$

$M_{tip} = .597$ $M_{at} = .718$ $\mu = .201$

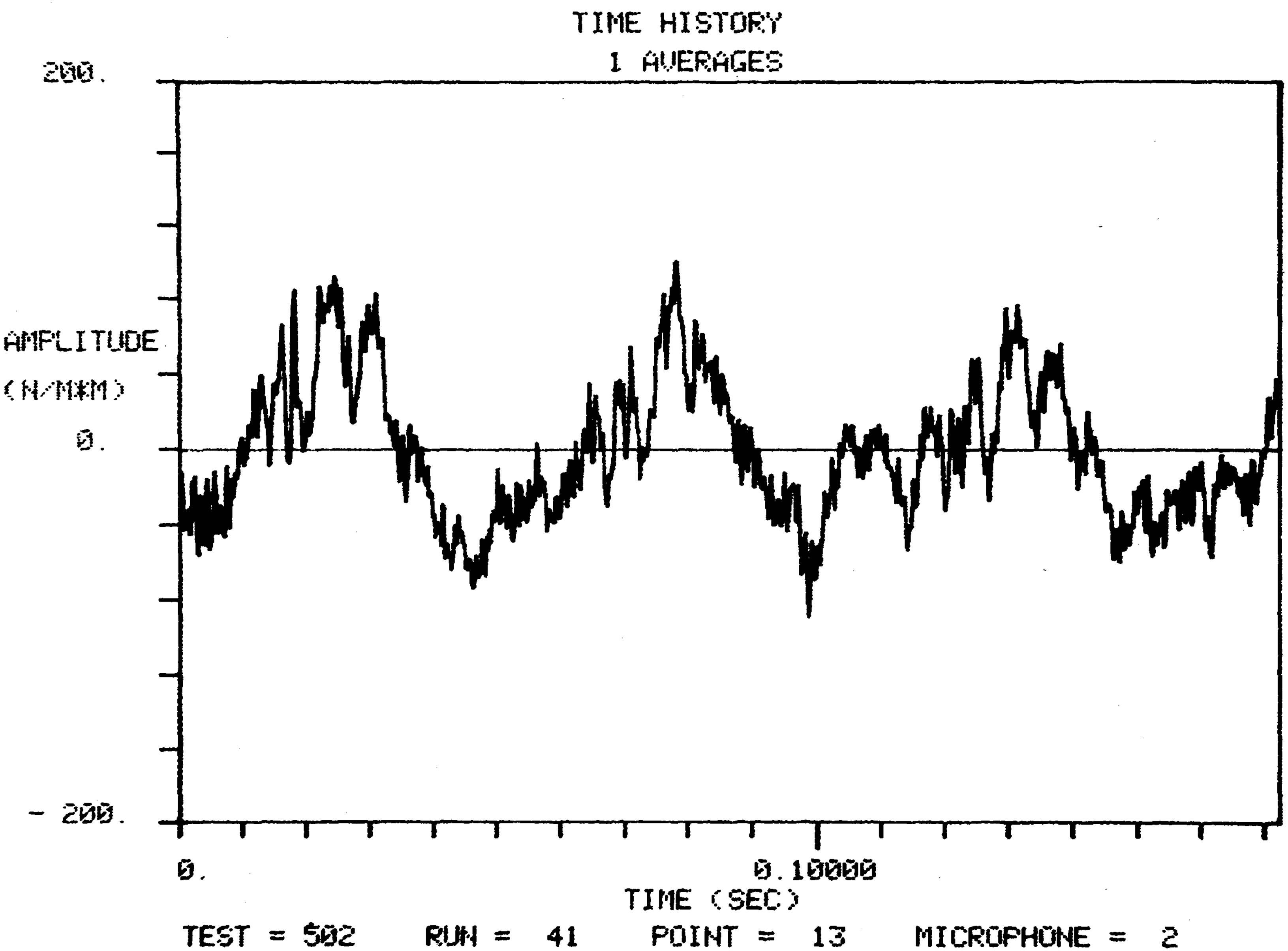
Figure E4(g). Acoustic Time History for Rectangular Tip Rotor.



RECTANGULAR TIP $V = 80$ kt $\alpha = 0.0^{\circ}$ $C_{LR}/\sigma = .08$

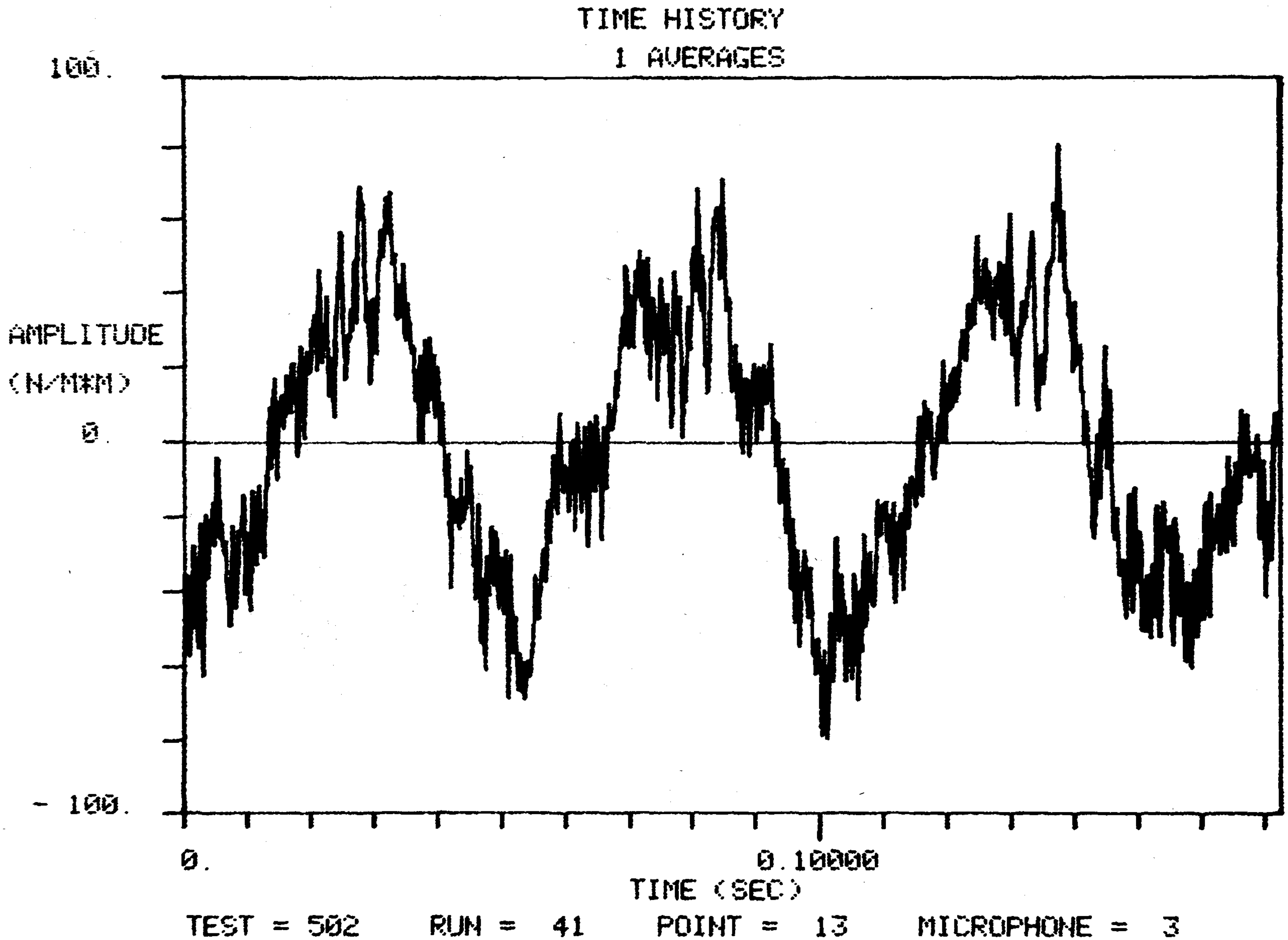
$M_{tip} = .597$ $M_{at} = .718$ $\mu = .201$

Figure E4(h). Acoustic Time History for Rectangular Tip Rotor.



RECTANGULAR TIP $V = 151$ kt $\alpha = -5.0^{\circ}$ $C_{LR/\sigma} = .08$
$M_{tip} = .599$ $M_{at} = .825$ $\mu = .378$

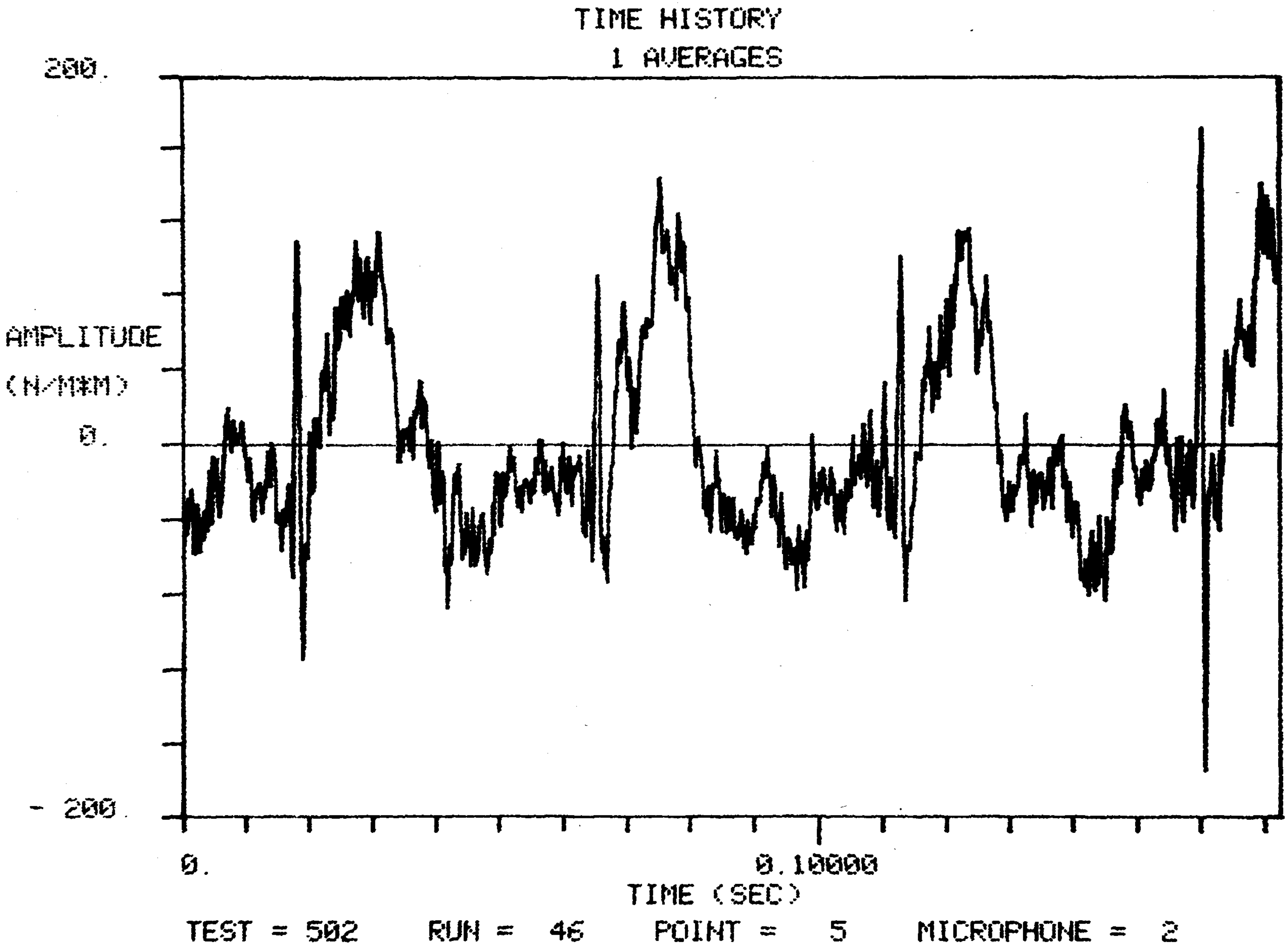
Figure E4(i). Acoustic Time History for Rectangular Tip Rotor.



RECTANGULAR TIP $V = 151$ kt $\alpha = -5.0°$ $C_{LR/\sigma} = .08$

$M_{tip} = .599$ $M_{at} = .825$ $\mu = .378$

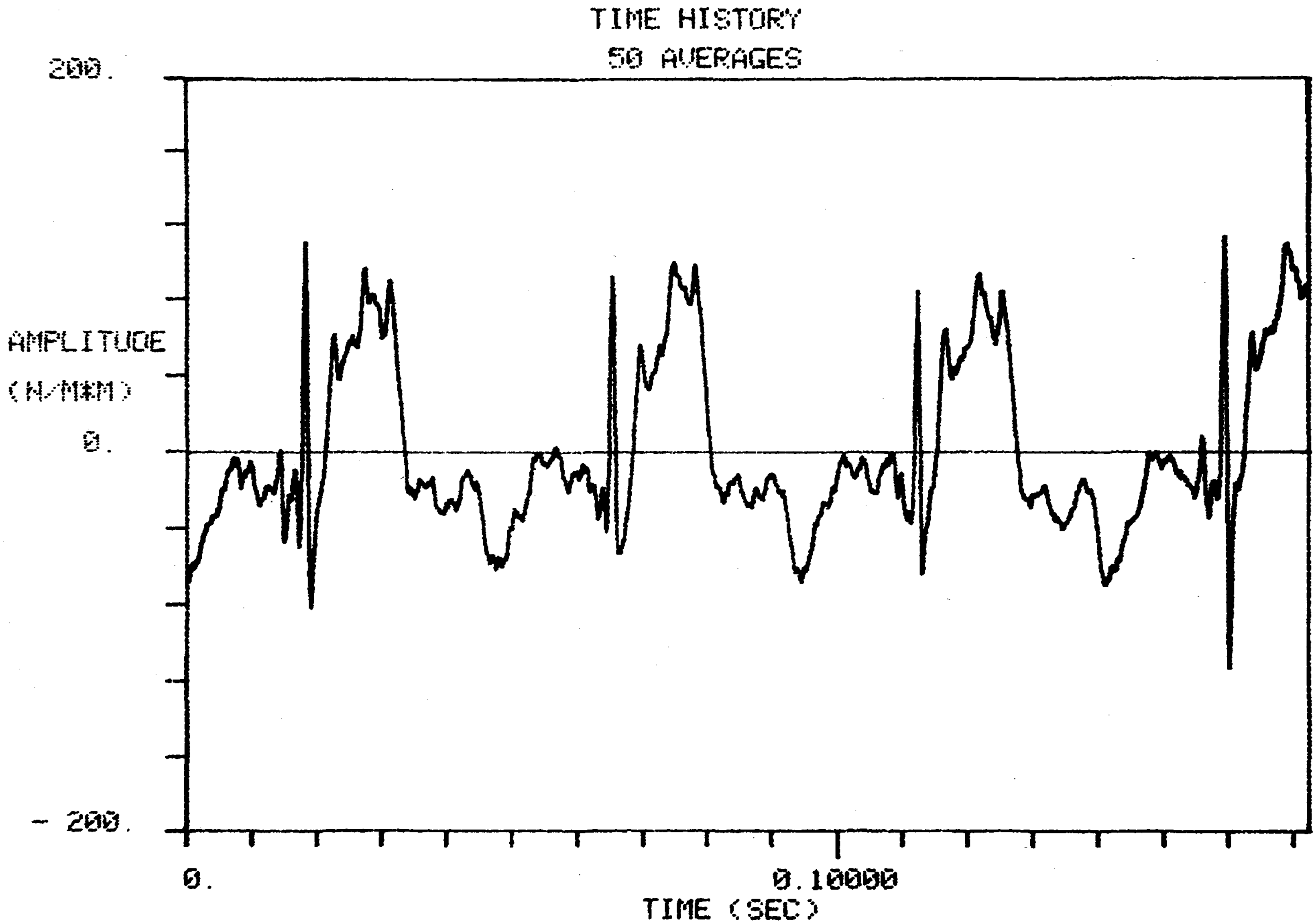
Figure E4(j). Acoustic Time History for Rectangular Tip Rotor.



RECTANGULAR TIP $V = 163$ kt $\alpha = -5.0^{\circ}$ $C_{LR/\sigma} = .07$

$M_{tip} = .653$ $M_{at} = .898$ $\mu = .375$

Figure E4(k). Acoustic Time History for Rectangular Tip Rotor.

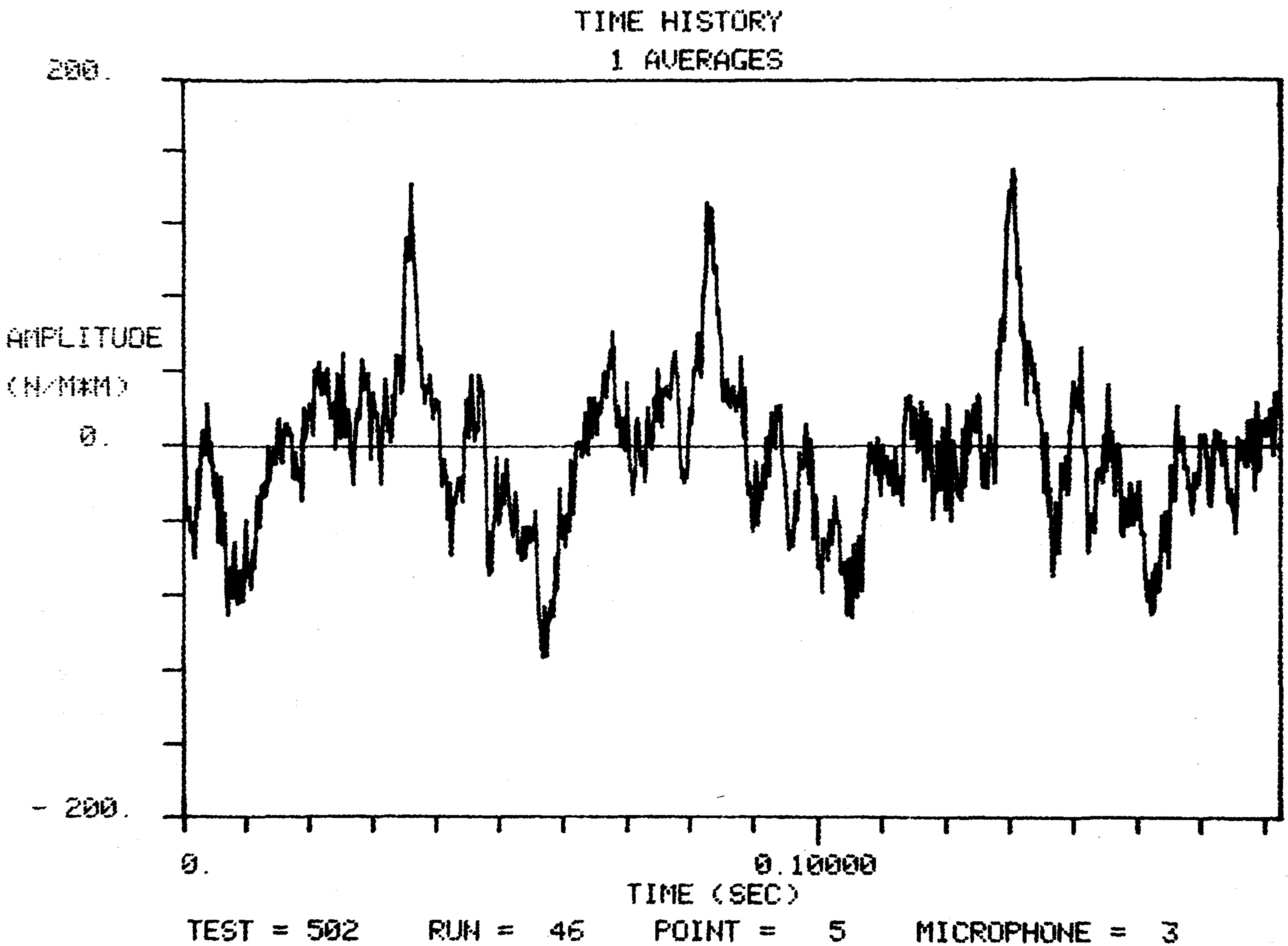


TEST = 502 RUN = 46 POINT = 5 MICROPHONE = 2

RECTANGULAR TIP $V = 163$ kt $\alpha = -5.0^{\circ}$ $C_{LR/\sigma} = .07$

$M_{tip} = .653$ $M_{at} = .898$ $\mu = .375$

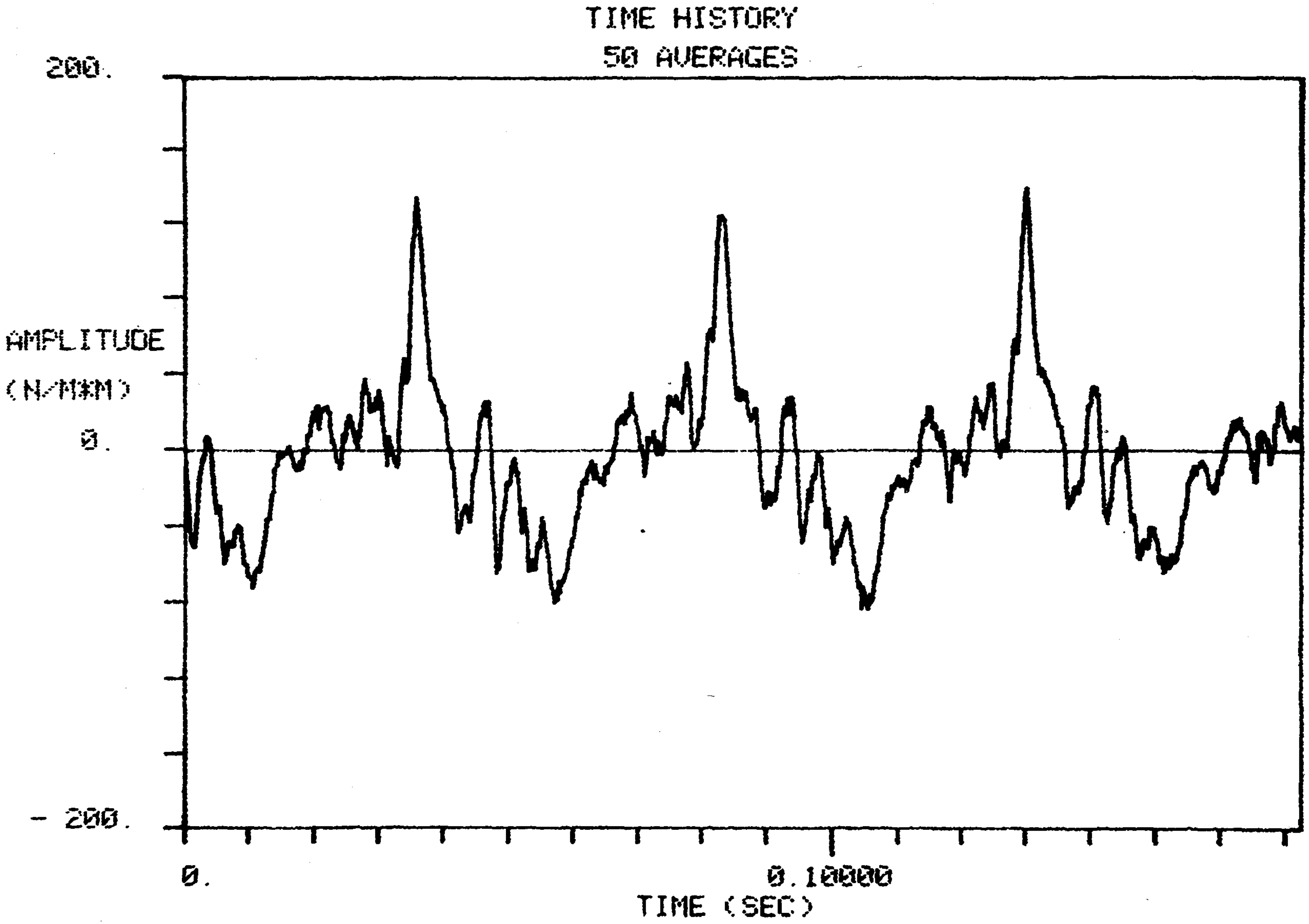
Figure E4(1). Acoustic Time History for Rectangular Tip Rotor.



RECTANGULAR TIP $V = 163$ kt $\alpha = -5.0^{\circ}$ $C_{LR/\sigma} = .07$

$M_{tip} = .653$ $M_{at} = .898$ $\mu = .375$

Figure E4(m). Acoustic Time History for Rectangular Tip Rotor.



TEST = 502 RUN = 46 POINT = 5 MICROPHONE = 3

RECTANGULAR TIP $V = 163$ kt $\alpha = -5.0^{\circ}$ $C_{LR/\sigma} = .07$
$M_{tip} = .653$ $M_{at} = .898$ $\mu = .375$

Figure E4(n). Acoustic Time History for Rectangular Tip Rotor.

APPENDIX F

ACOUSTIC TRENDS AS A FUNCTION OF ROTOR-LIFT COEFFICIENT

This appendix shows noise trends with variations in rotor operating condition for a few microphones — microphones 2 and 6 under the rotor and microphone 3, located three radii in front of the rotor. The dBA measurements are shown as a function of rotor-lift coefficient. Table 8, which lists the order in which the data are presented, is repeated here for convenience. Symbols used in the plots are defined below.

Symbol	Quantity
ALPHA	rotor-shaft angle, positive aft, deg
CLR/S	rotor lift coefficient, $\frac{L}{\rho S(\Omega R)^2}$
DBAU MIC2	raw dBA value measured at microphone 2
DBAC MIC2	dBA with background noise subtracted, measured at microphone 2
DBAU MIC3	raw dBA value measured at microphone 3
DBAC MIC3	dBA with background noise subtracted, measured at microphone 3
DBAU MIC6	raw dBA value measured at microphone 6
DBAC MIC6	dBA with background noise subtracted, measured at microphone 6
0MEG*R	rotor-tip speed, ft/sec
VKTS	wind-tunnel velocity, knots
α	angle of shaft from vertical, positive aft, deg

TABLE 8.-KEY TO GRAPHS OF ACOUSTIC TRENDS IN APPENDIX F

Operating condition				Tip planform, page numbers			
μ	M_{tip}	M_{at}	V	Swept-tapered	Swept	Tapered	Rectangular
0.200	0.550	0.660	73	--	--	--	--
.075	.595	.640	30	--	--	--	--
.150	.595	.685	60	--	--	--	--
.200	.600	.720	80	360	378	396	414
.250	.600	.750	100	--	--	--	--
.300	.600	.780	120	366	384	402	420
.375	.600	.825	150	372	390	408	426
.400	.600	.840	160	--	--	--	--
.250	.650	.815	107	--	--	--	--
.375	.650	.895	164	--	--	--	--
.375	.685	.940	170	--	--	--	--
.250	.700	.875	115	--	--	--	--
.375	.700	.965	175	--	--	--	--

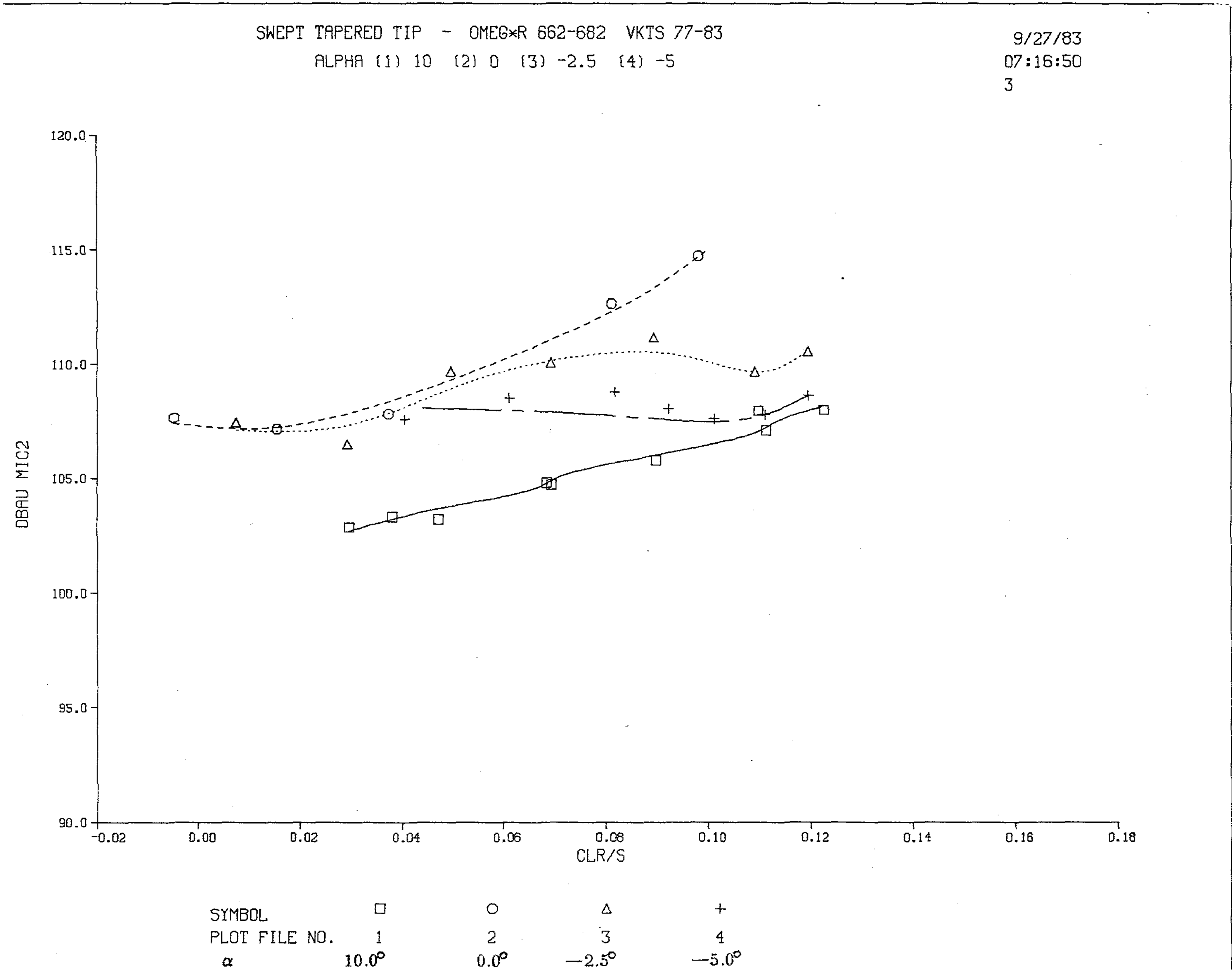


Figure F1(a). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Swept Tapered Tip Rotor.

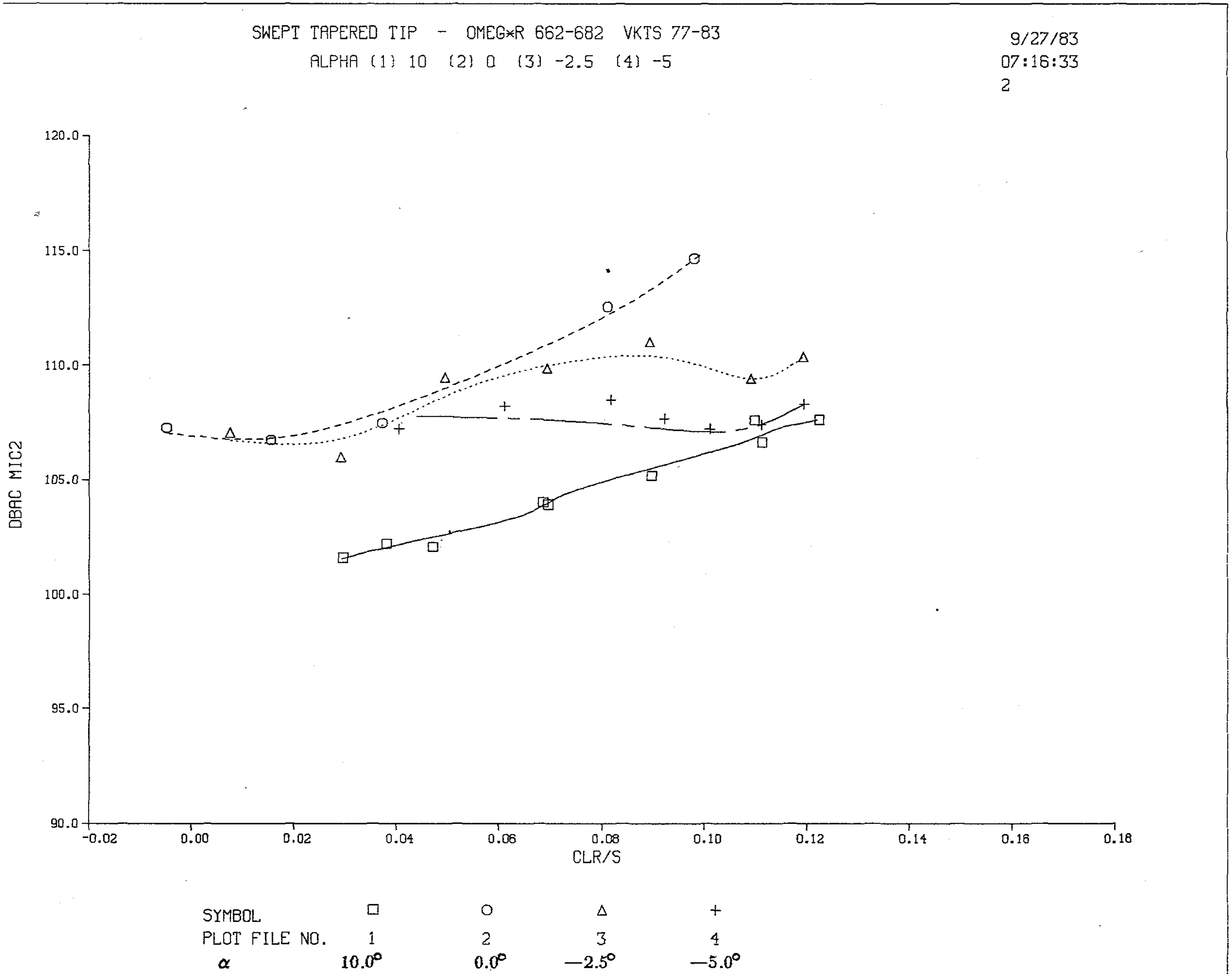


Figure F1(b). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Swept Tapered Tip Rotor.

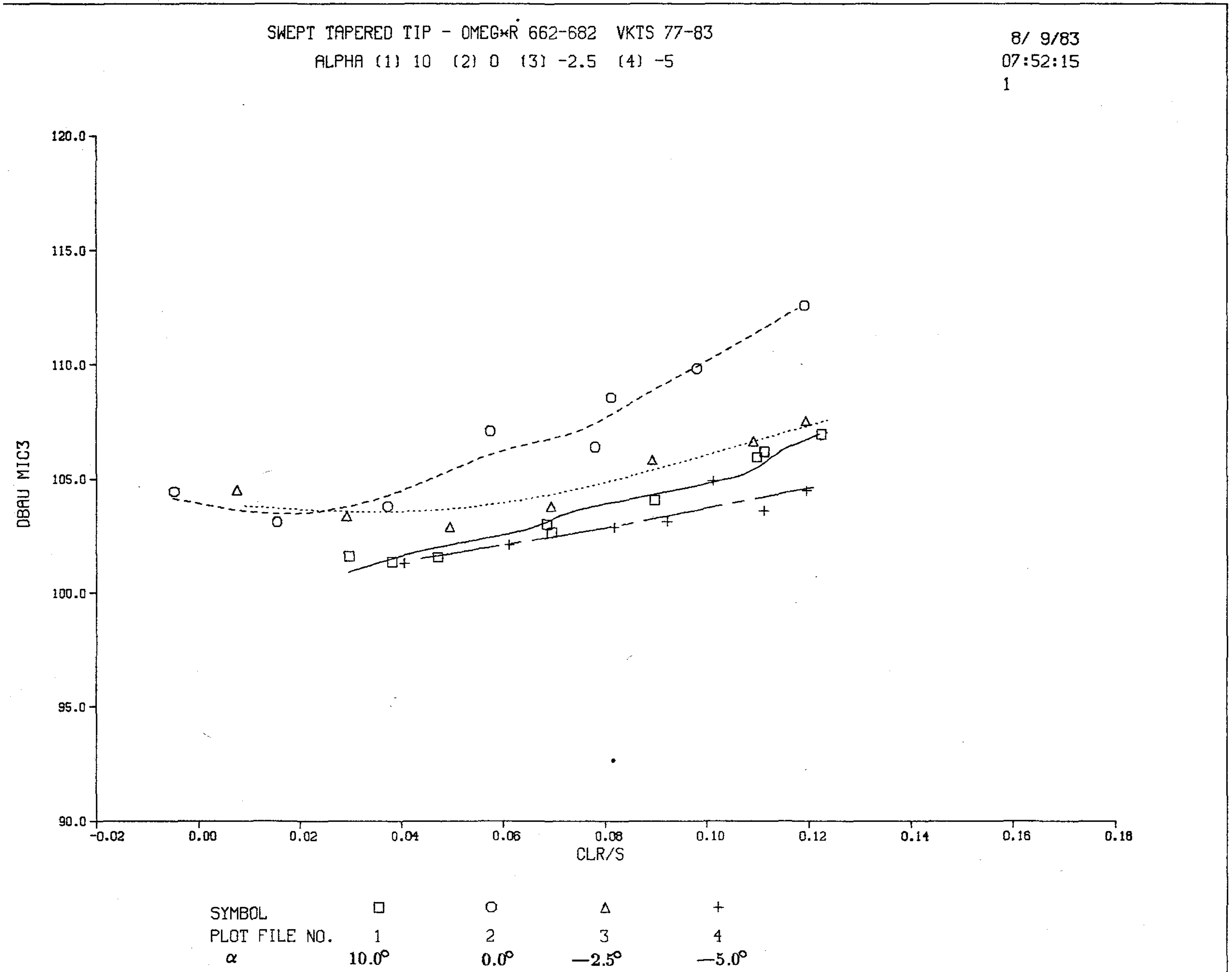


Figure F1(c). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Swept Tapered Tip Rotor.

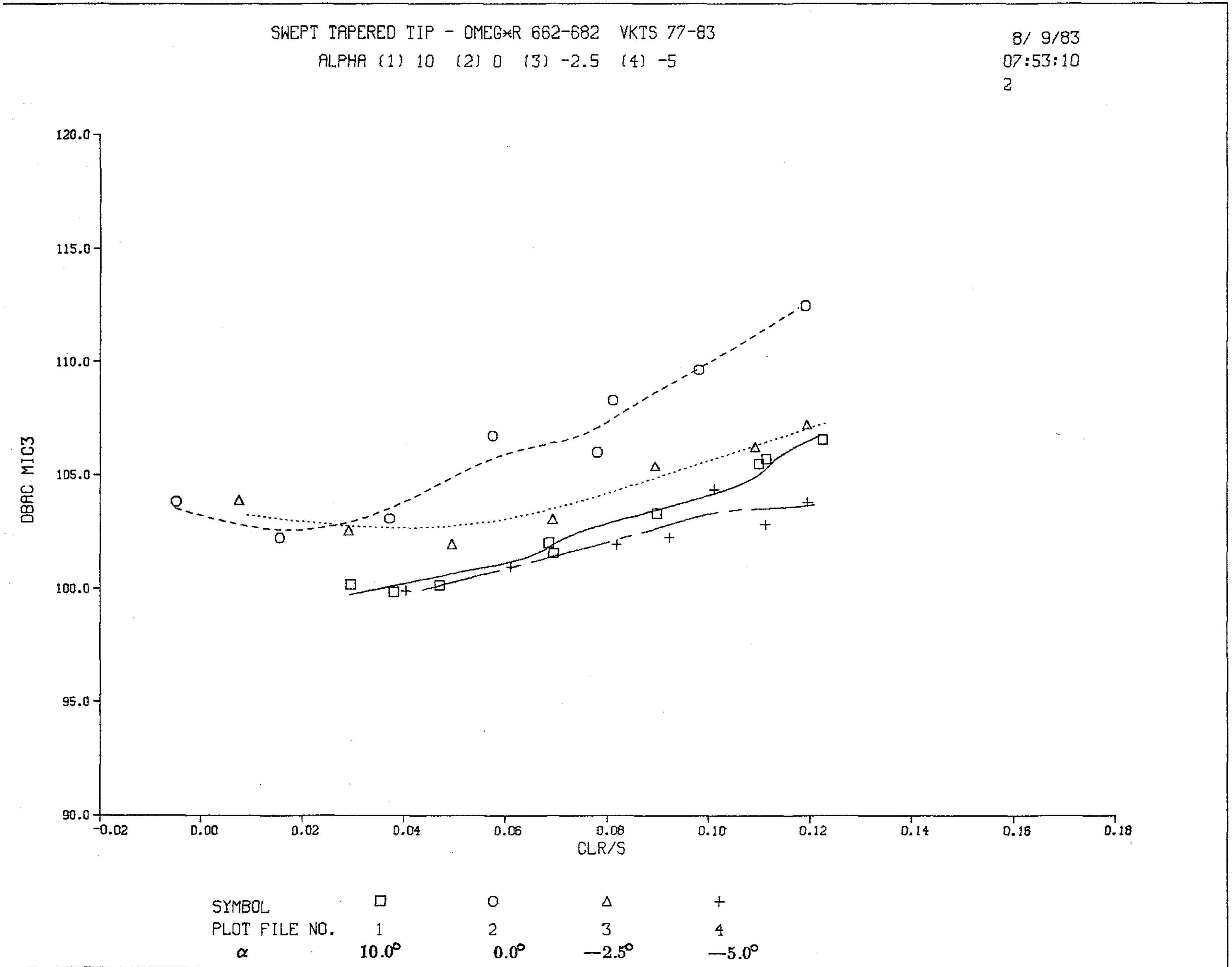


Figure F1(d). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Swept Tapered Tip Rotor.

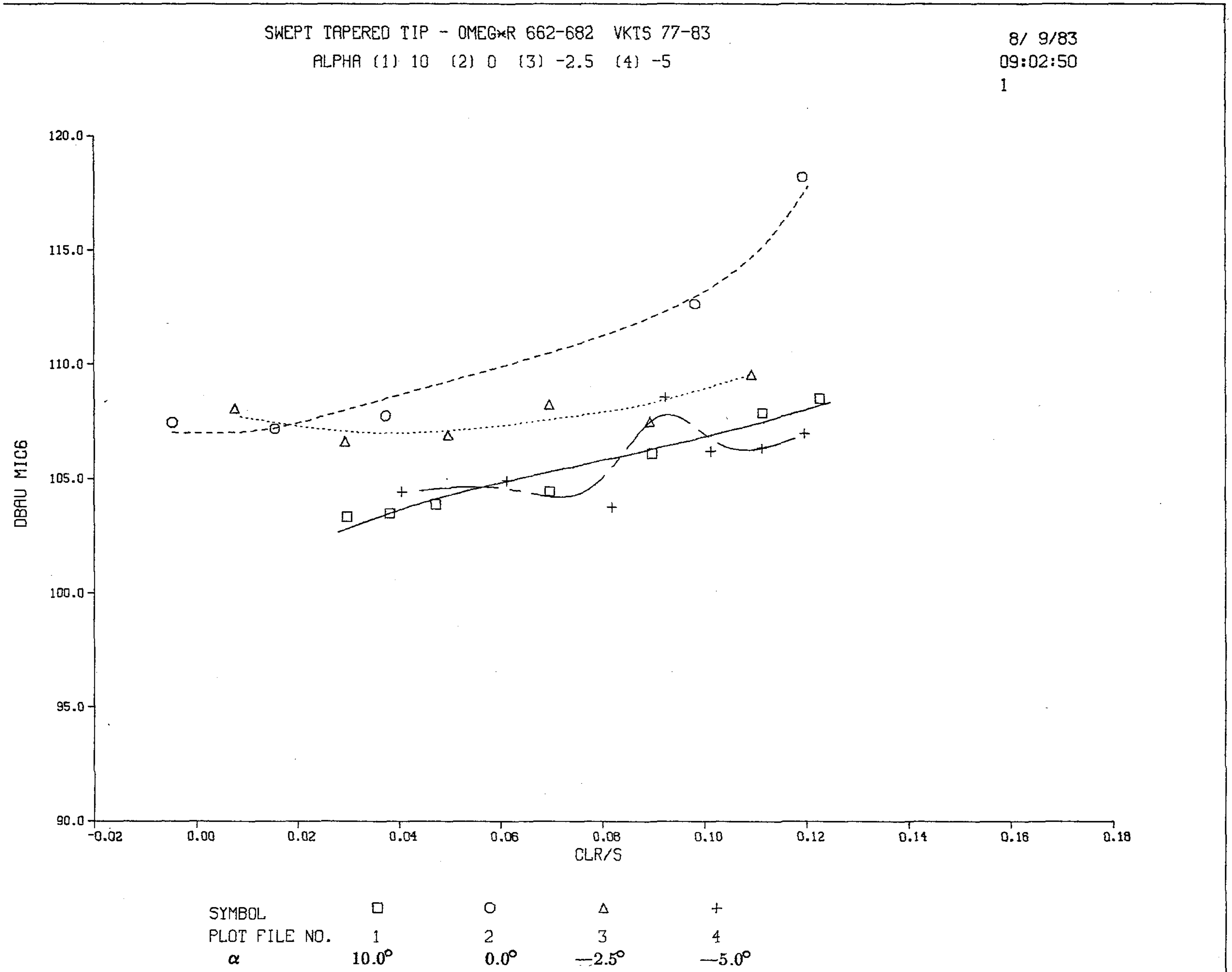


Figure F1(e). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Swept Tapered Tip Rotor.

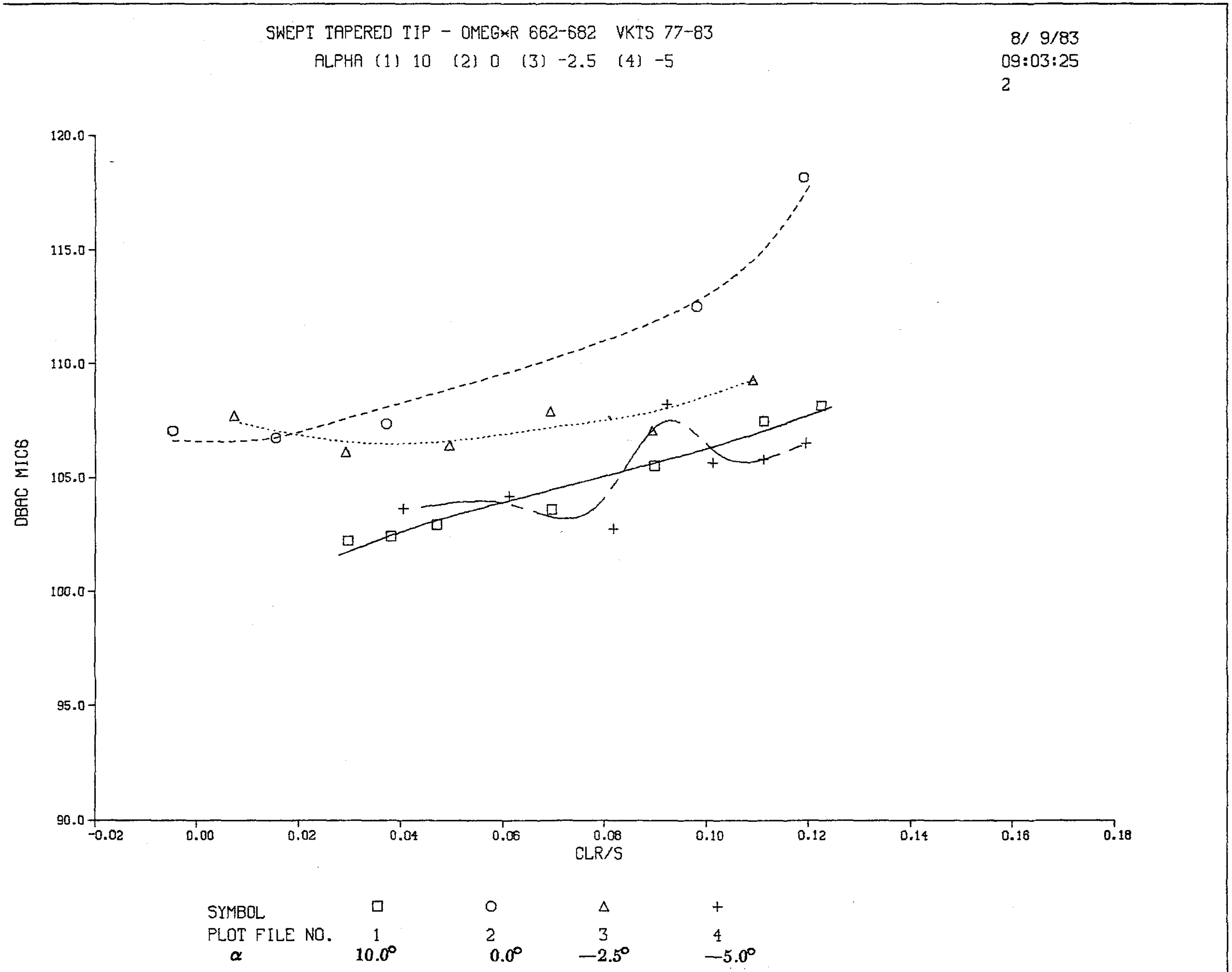


Figure F1(f). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Swept Tapered Tip Rotor.

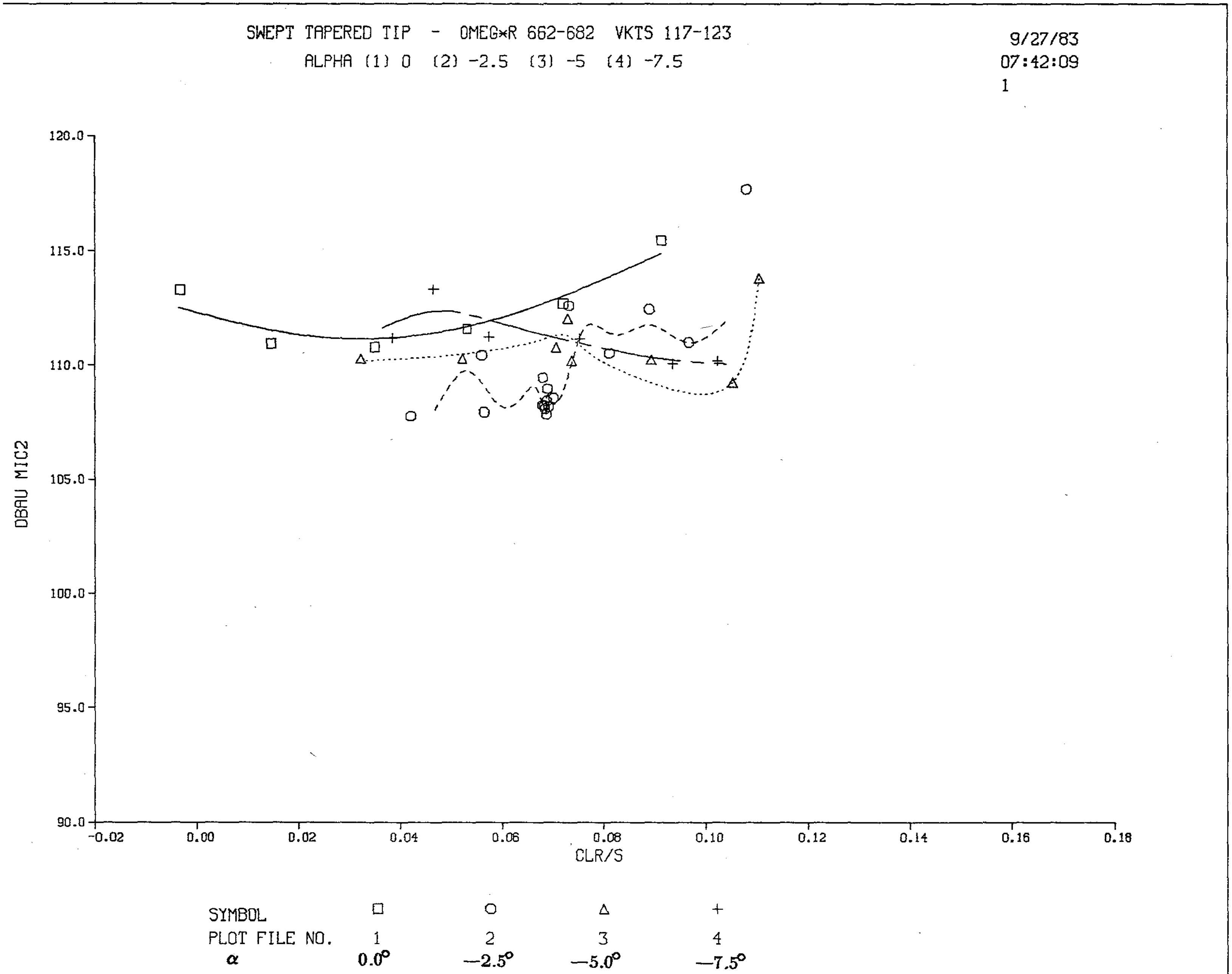
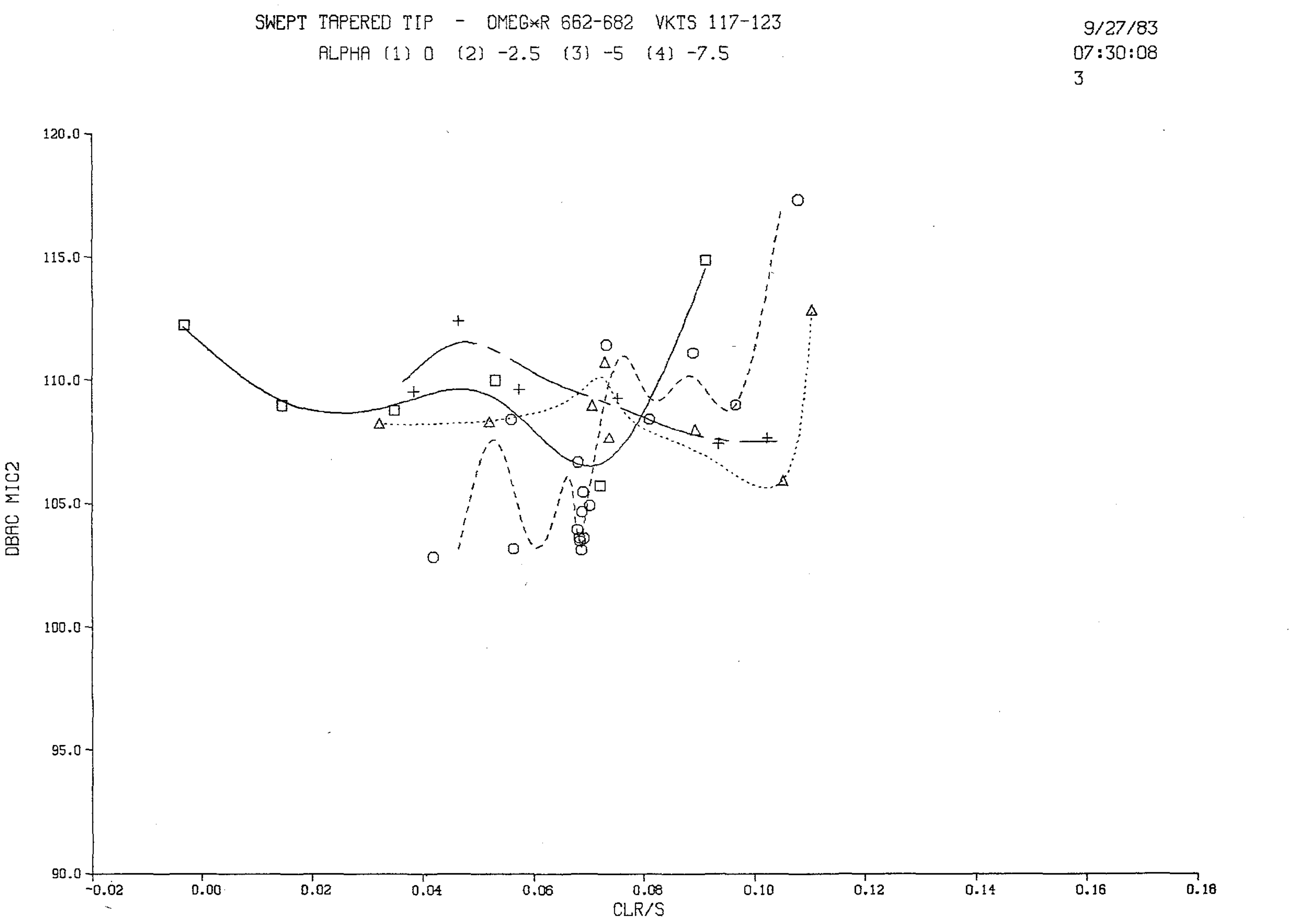


Figure F1(g). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Swept Tapered Tip Rotor.



SYMBOL	□	○	△	+
PLOT FILE NO.	1	2	3	4
α	0.0°	—2.5°	—5.0°	—7.5°

Figure F1(h). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Swept Tapered Tip Rotor.

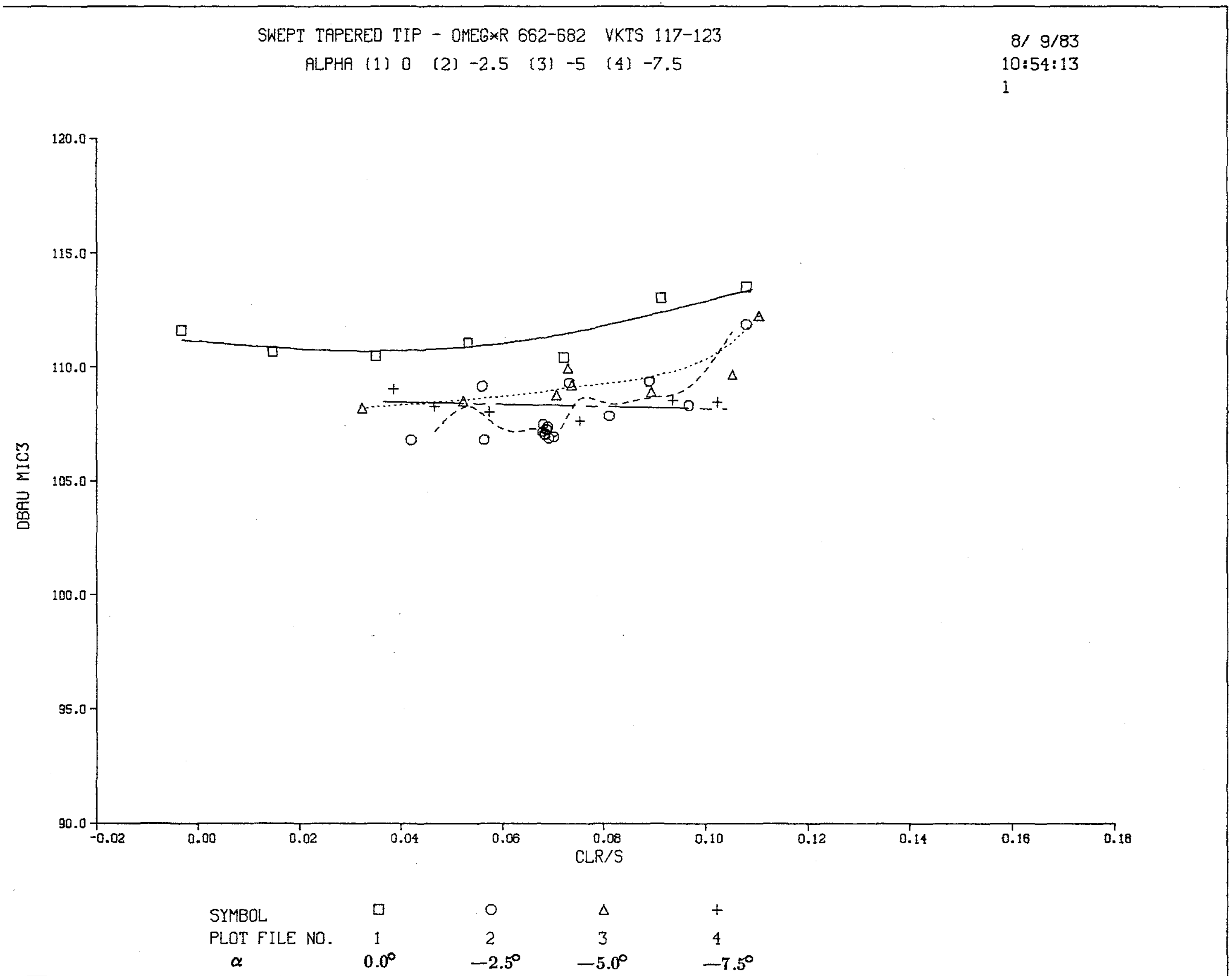


Figure F1(i). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Swept Tapered Tip Rotor.

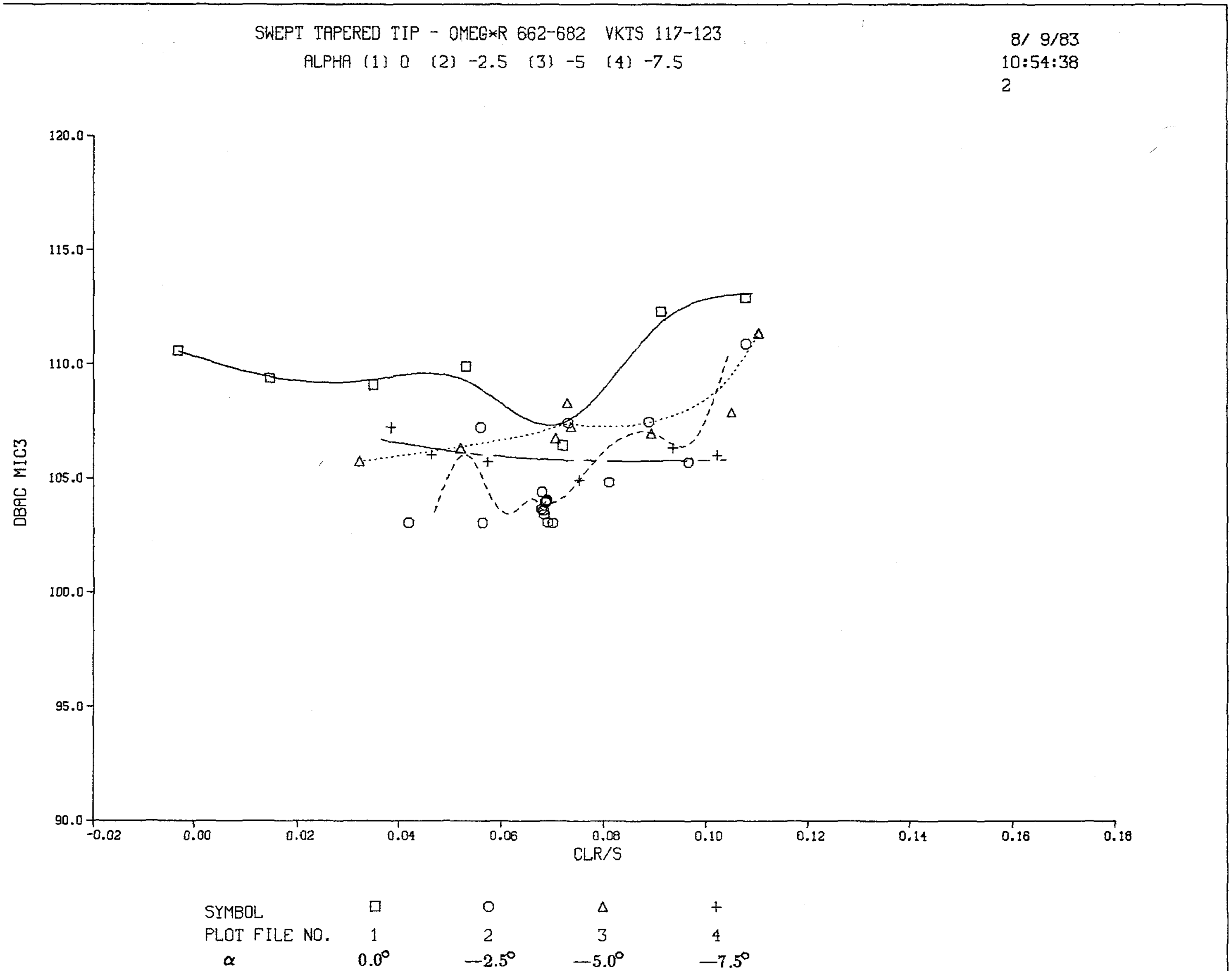


Figure F1(j). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Swept Tapered Tip Rotor.

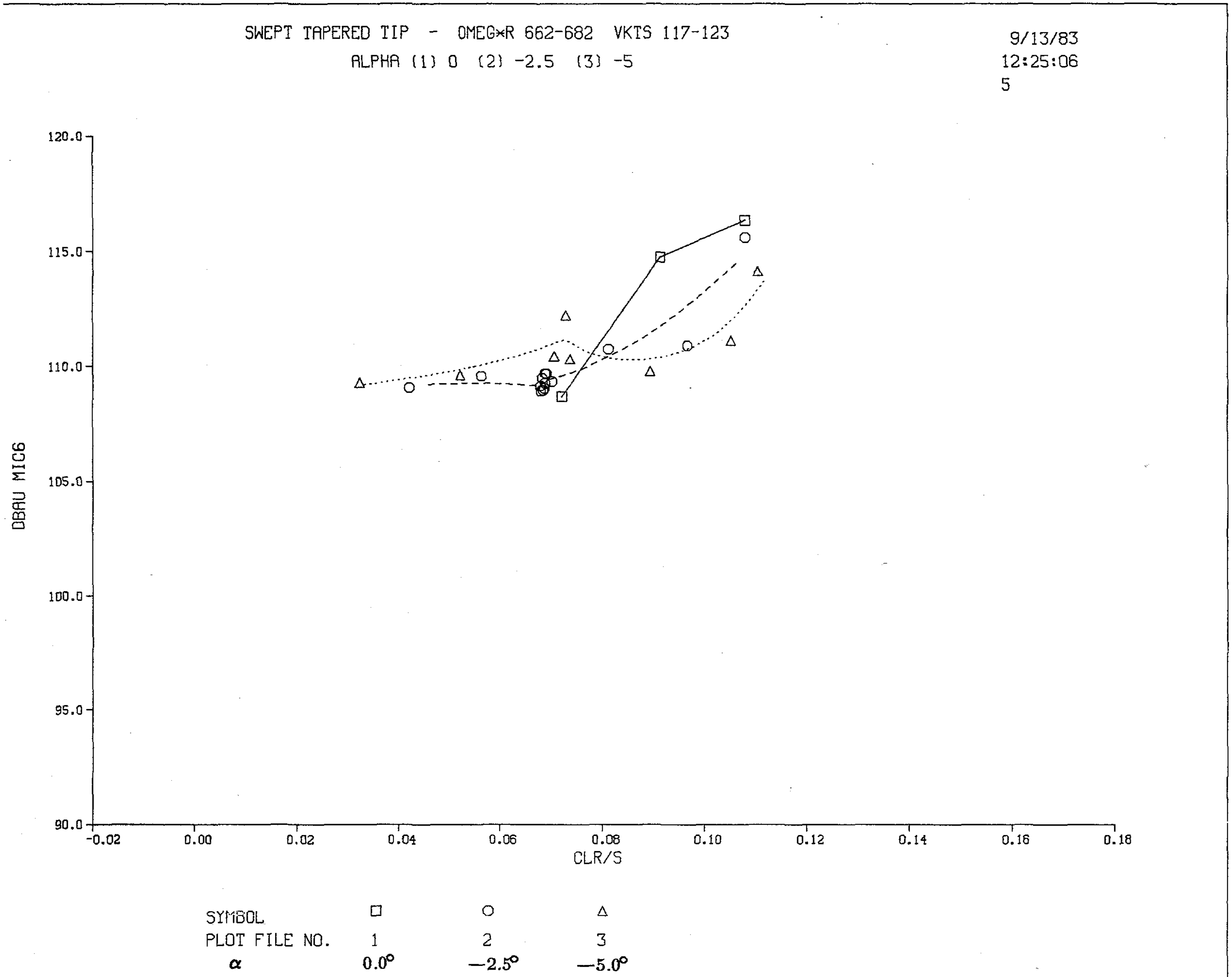


Figure F1(k). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Swept Tapered Tip Rotor.

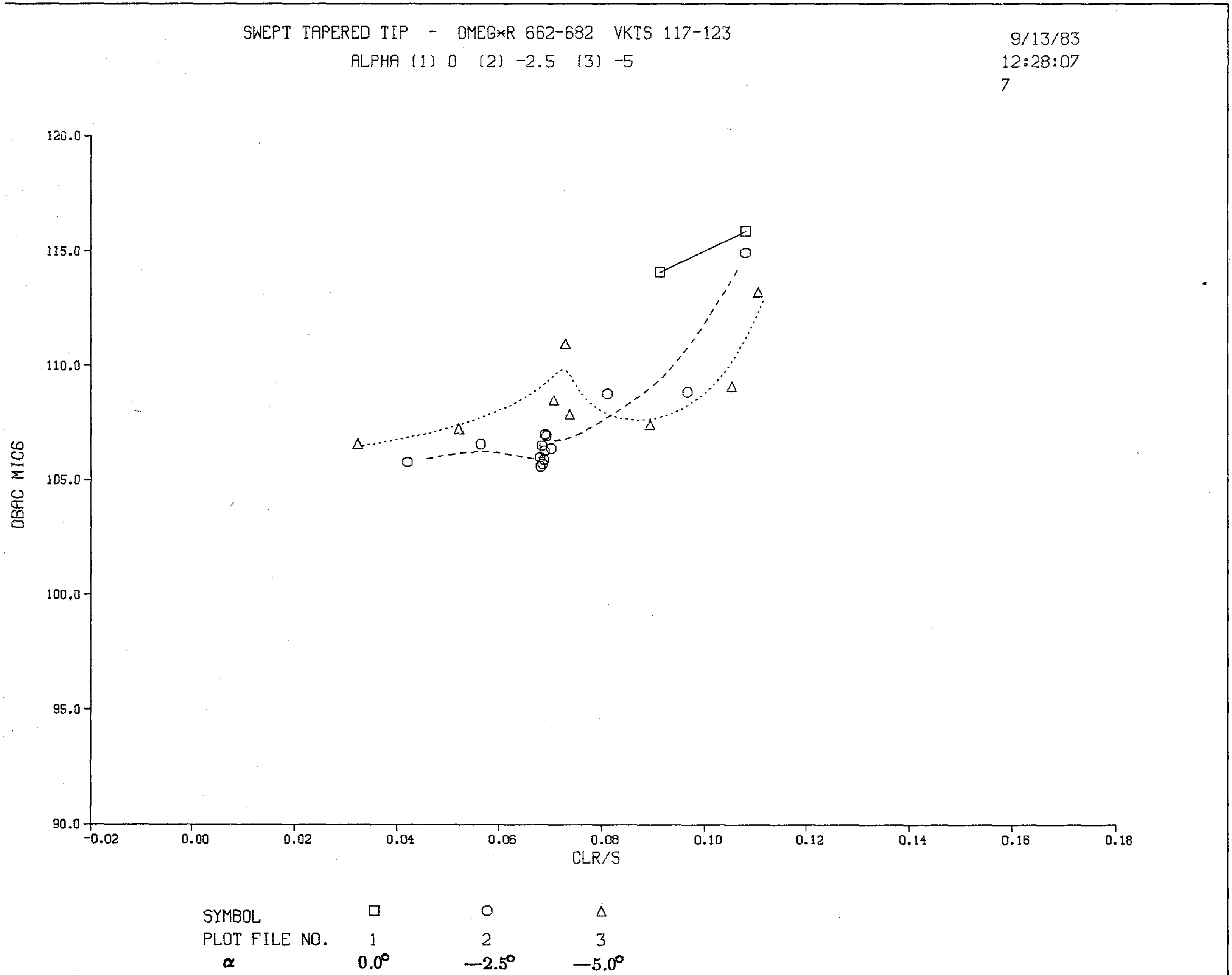


Figure F1(l). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Swept Tapered Tip Rotor.

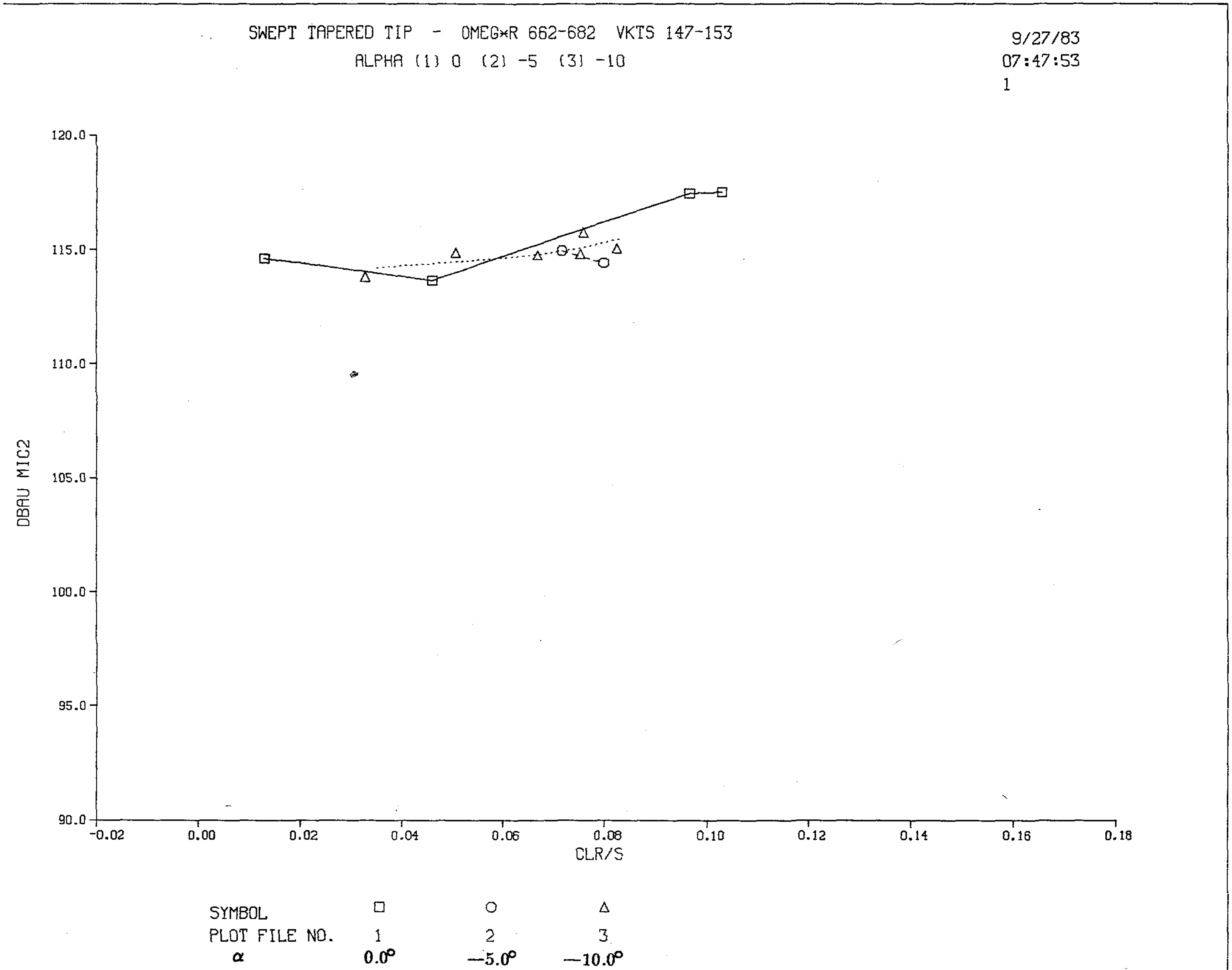


Figure F1(m). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Swept Tapered Tip Rotor.

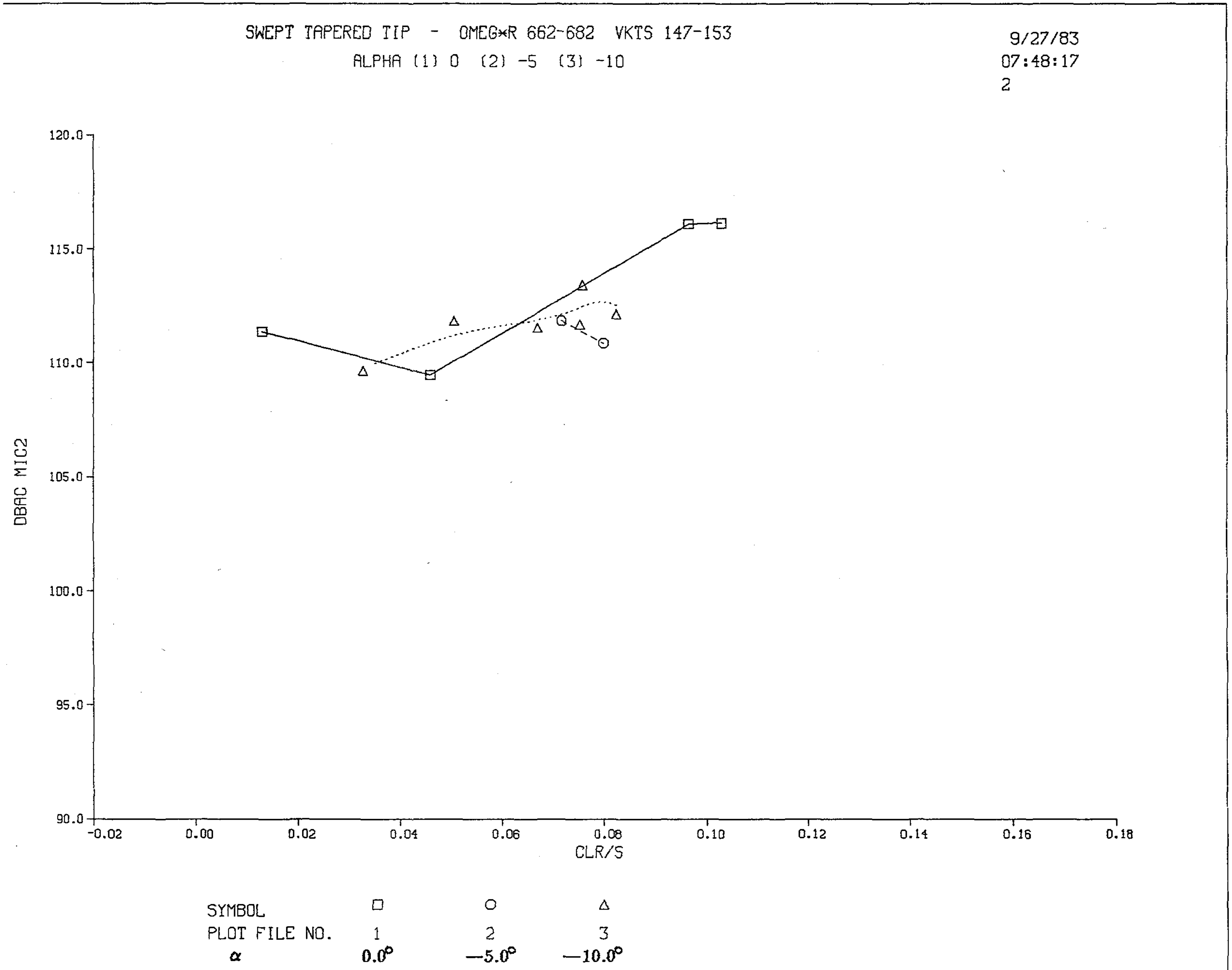
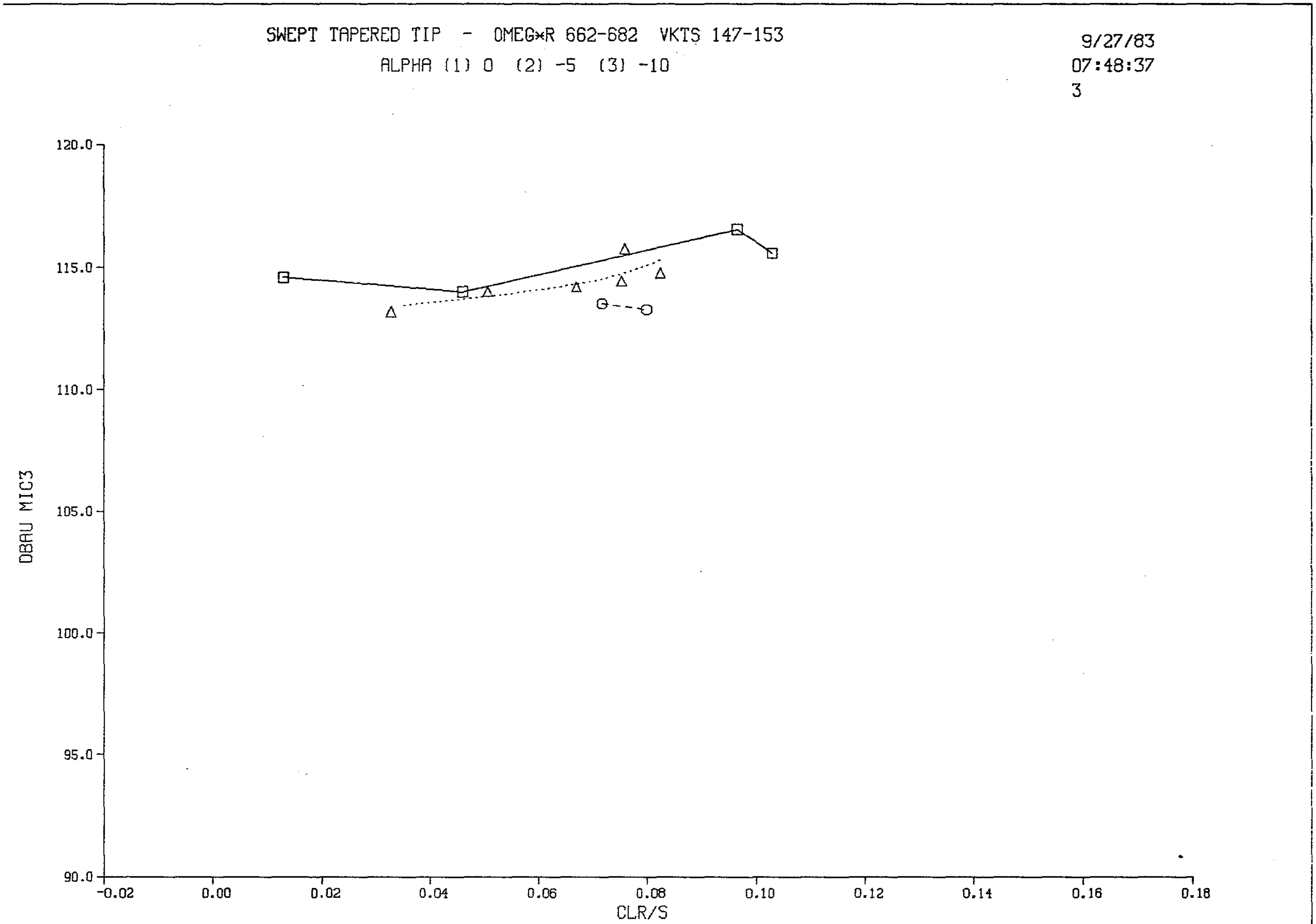
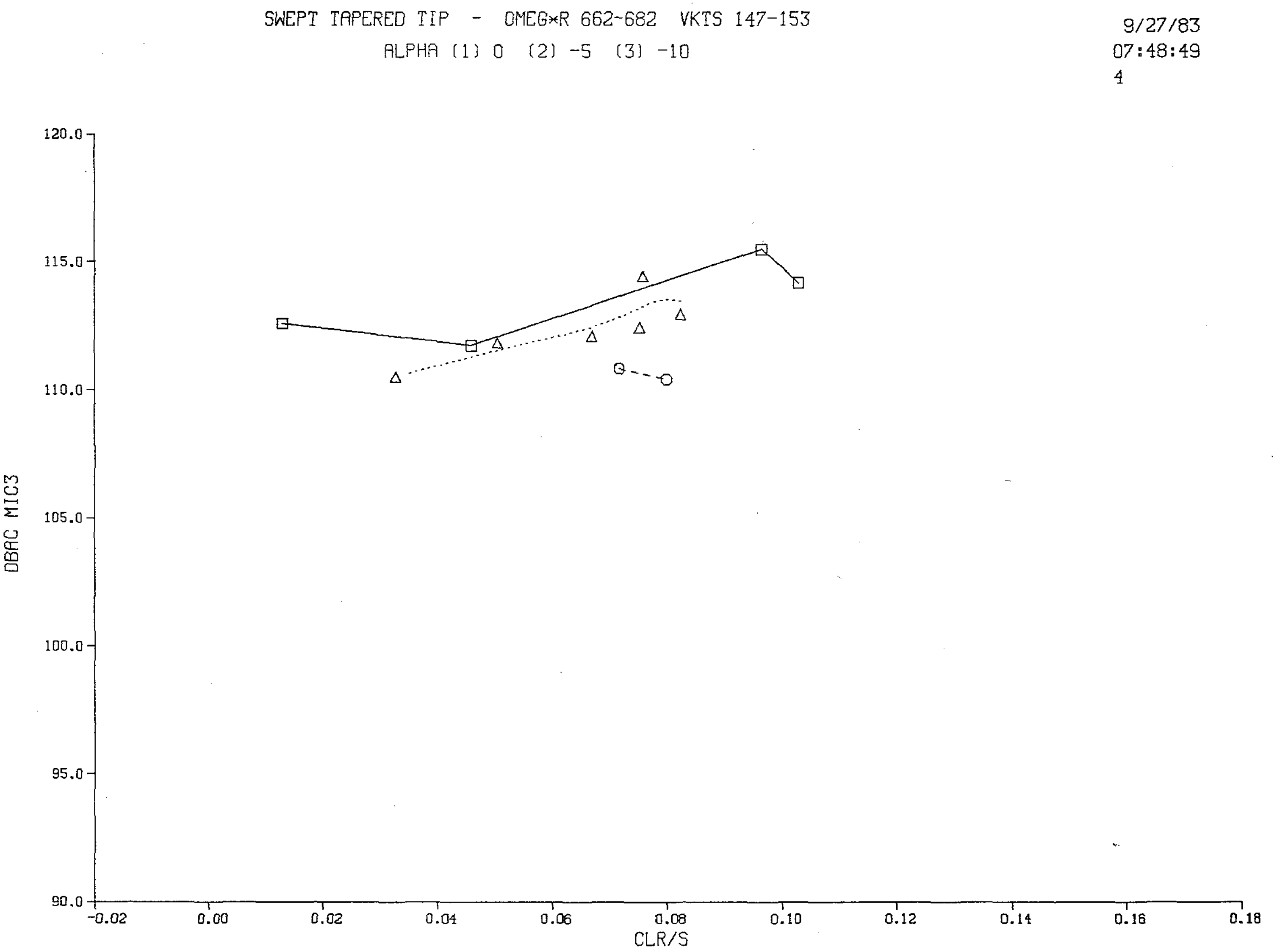


Figure F1(n). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Swept Tapered Tip Rotor.



SYMBOL	□	○	△
PLOT FILE NO.	1	2	3
α	0.0°	−5.0°	−10.0°

Figure F1(o). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Swept Tapered Tip Rotor.



SYMBOL	□	○	△
PLOT FILE NO.	1	2	3
α	0.0°	-5.0°	-10.0°

Figure F1(p). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Swept Tapered Tip Rotor.

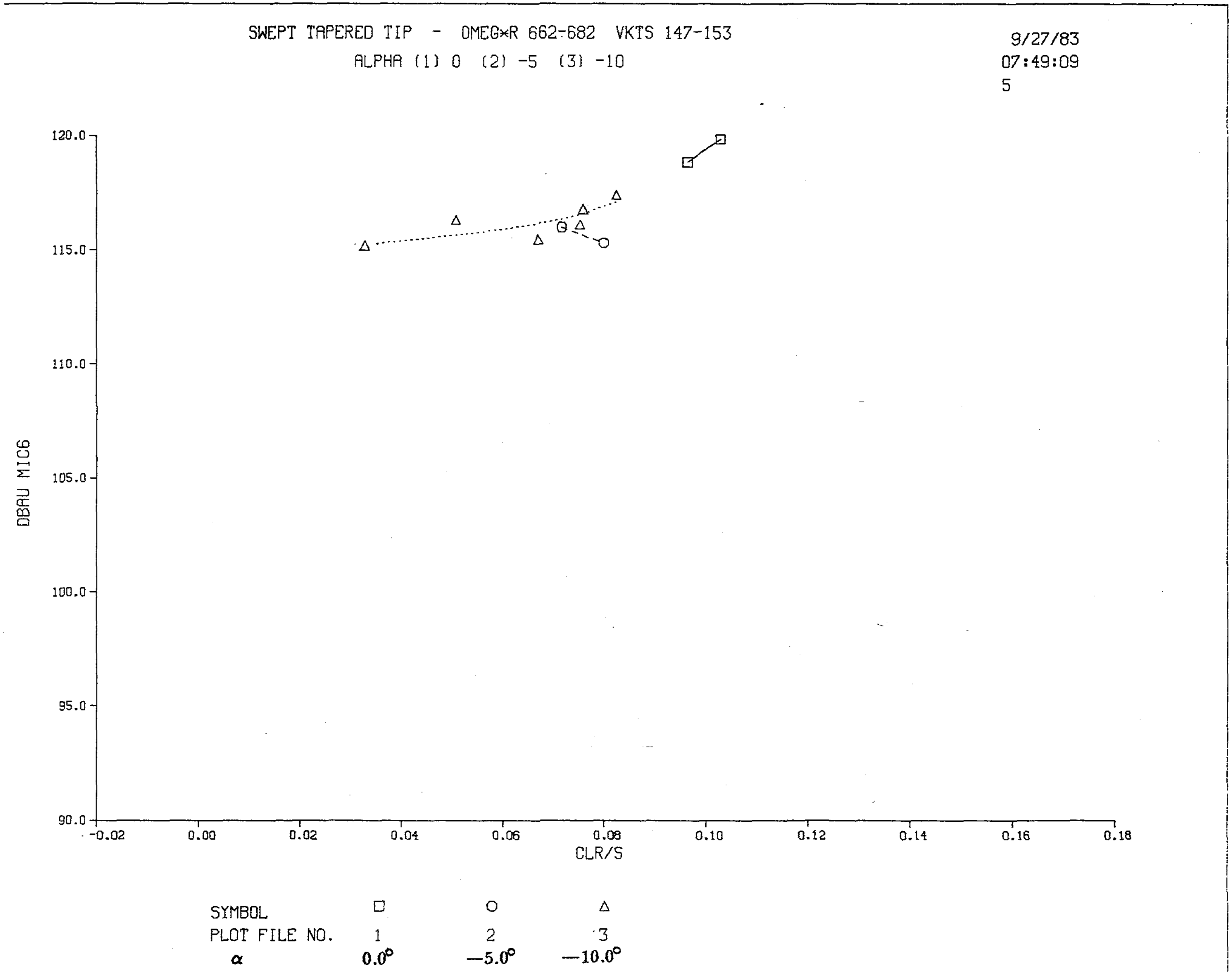


Figure F1(q). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Swept Tapered Tip Rotor.

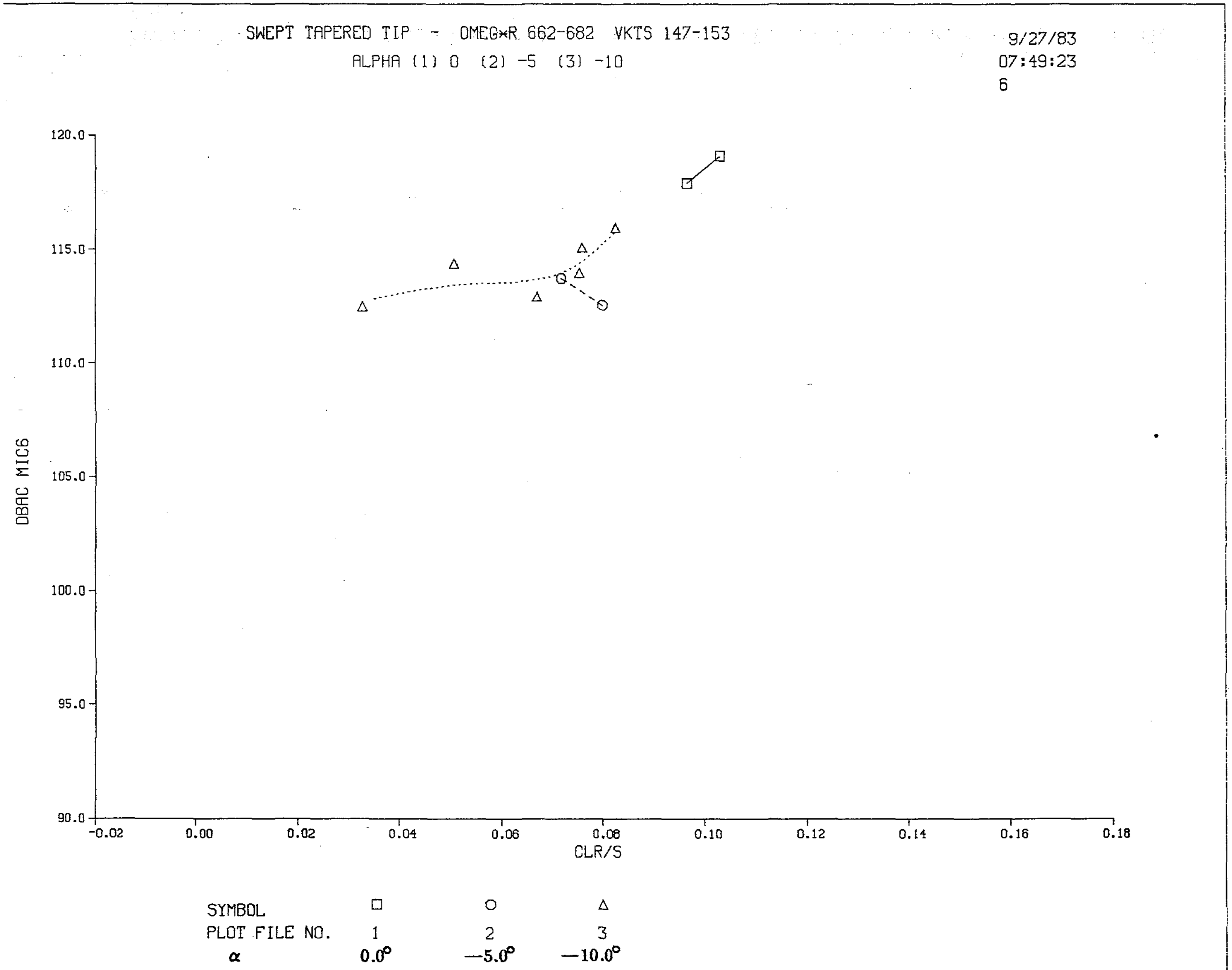


Figure F1(r). **A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Swept Tapered Tip Rotor.**

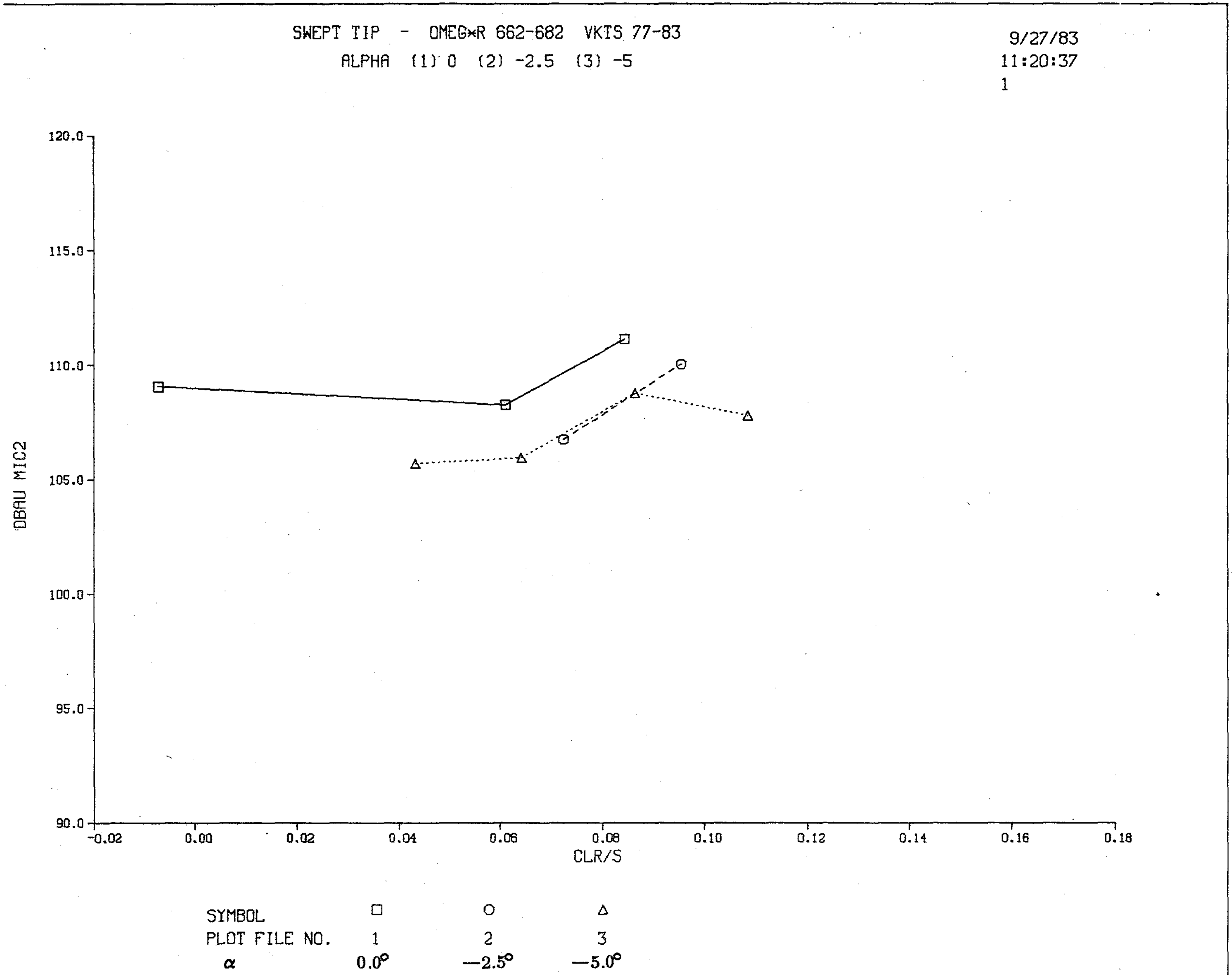


Figure F2(a). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Swept Tip Rotor.

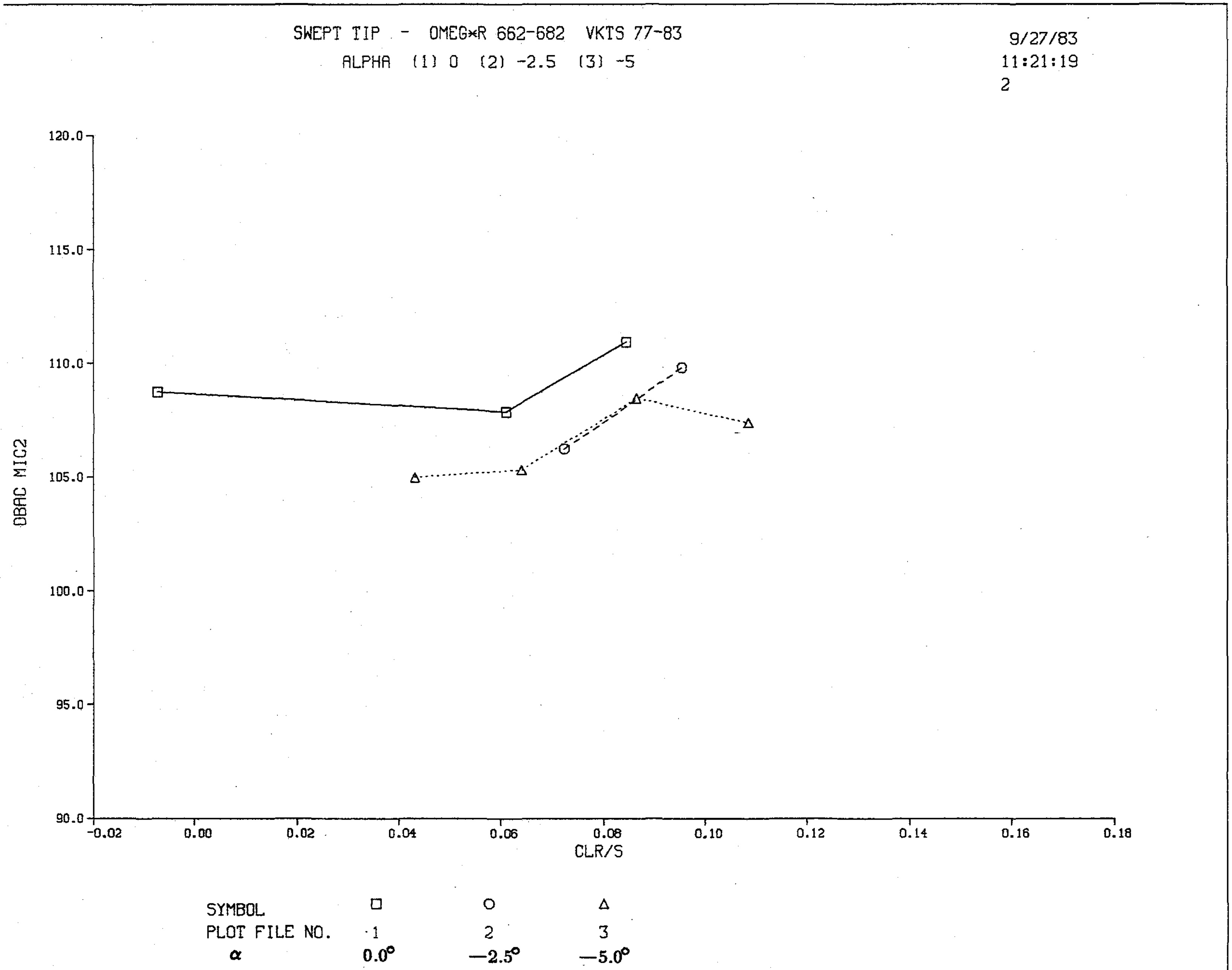


Figure F2(b). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Swept Tip Rotor.

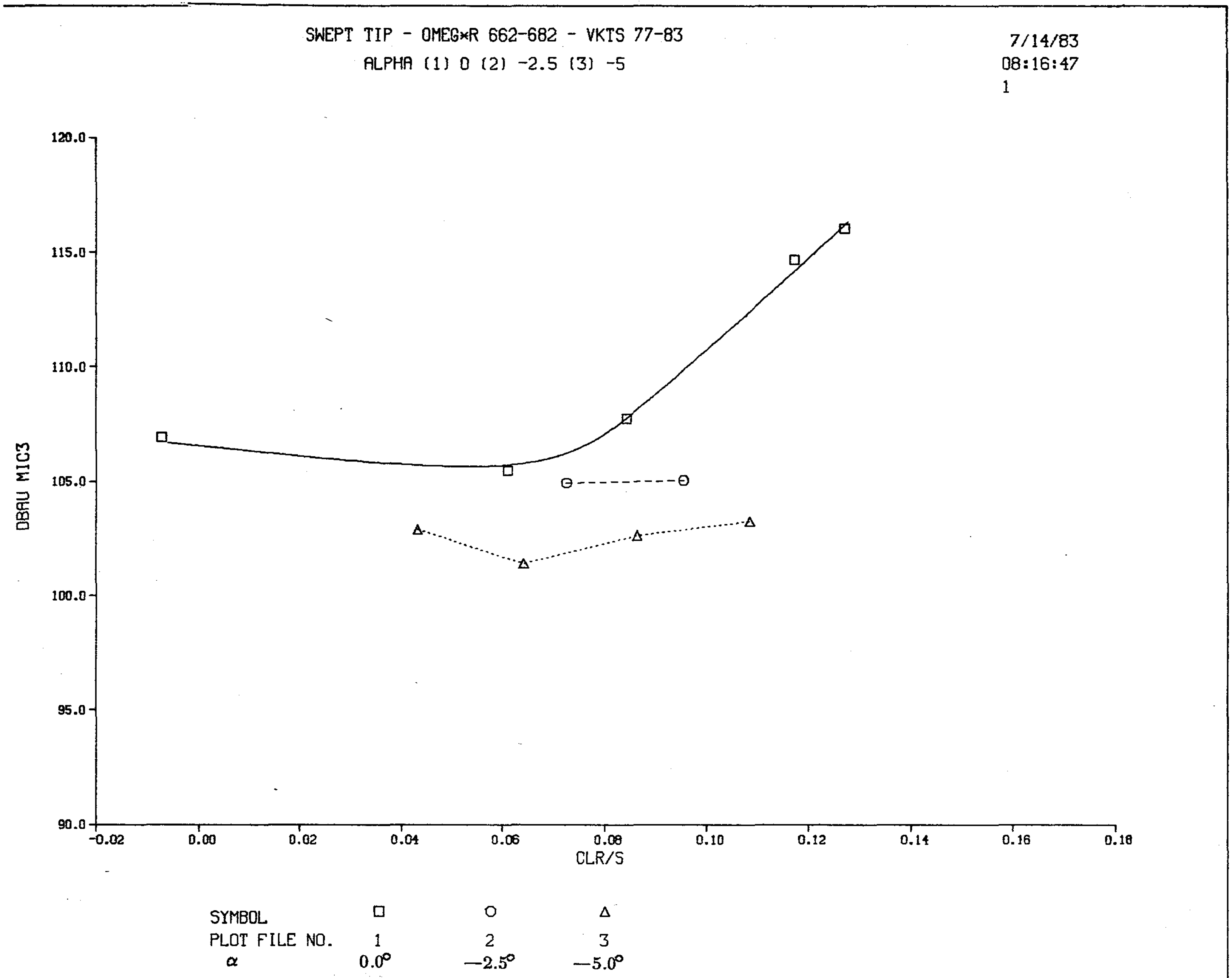


Figure F2(c). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Swept Tip Rotor.

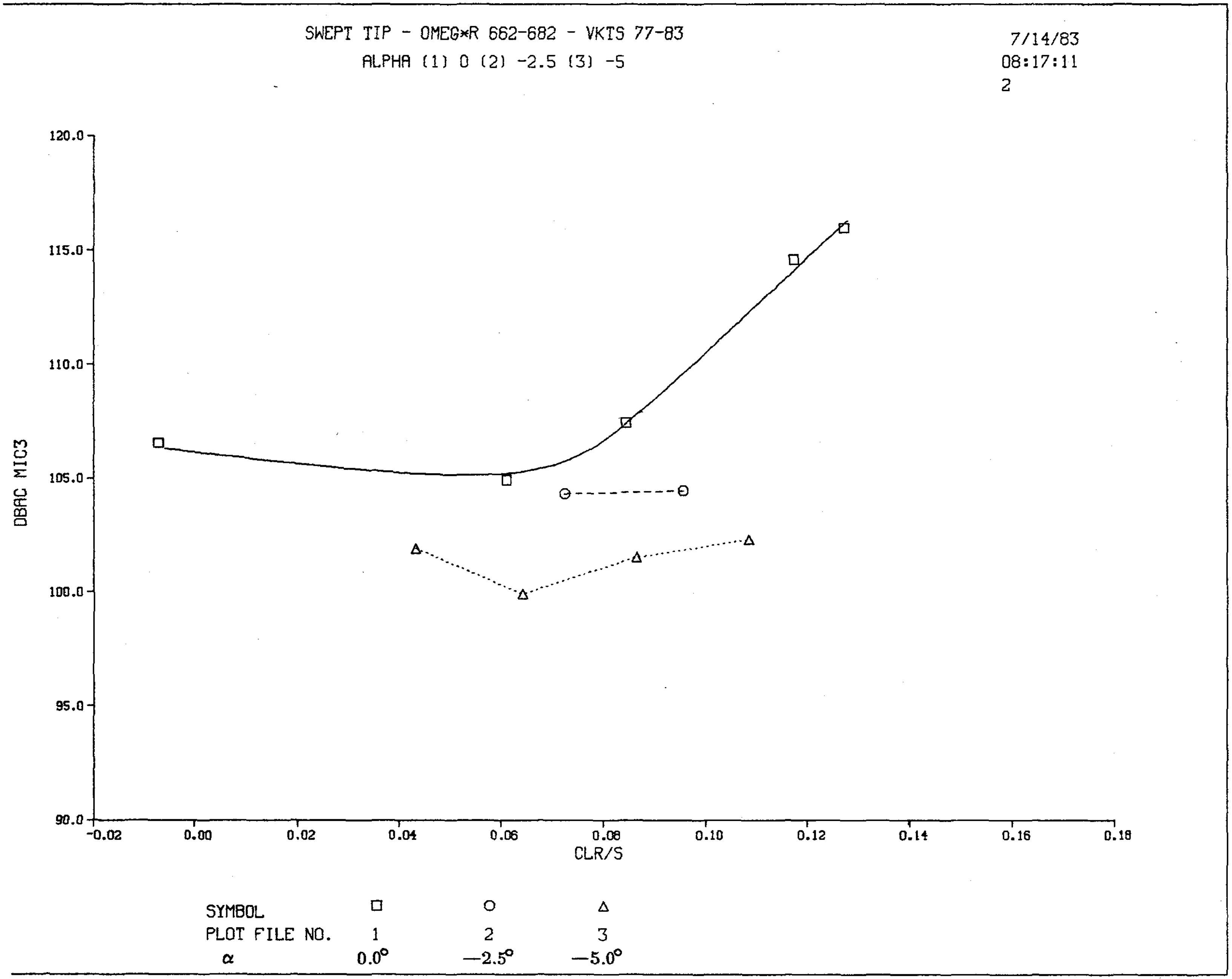


Figure F2(d). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Swept Tip Rotor.

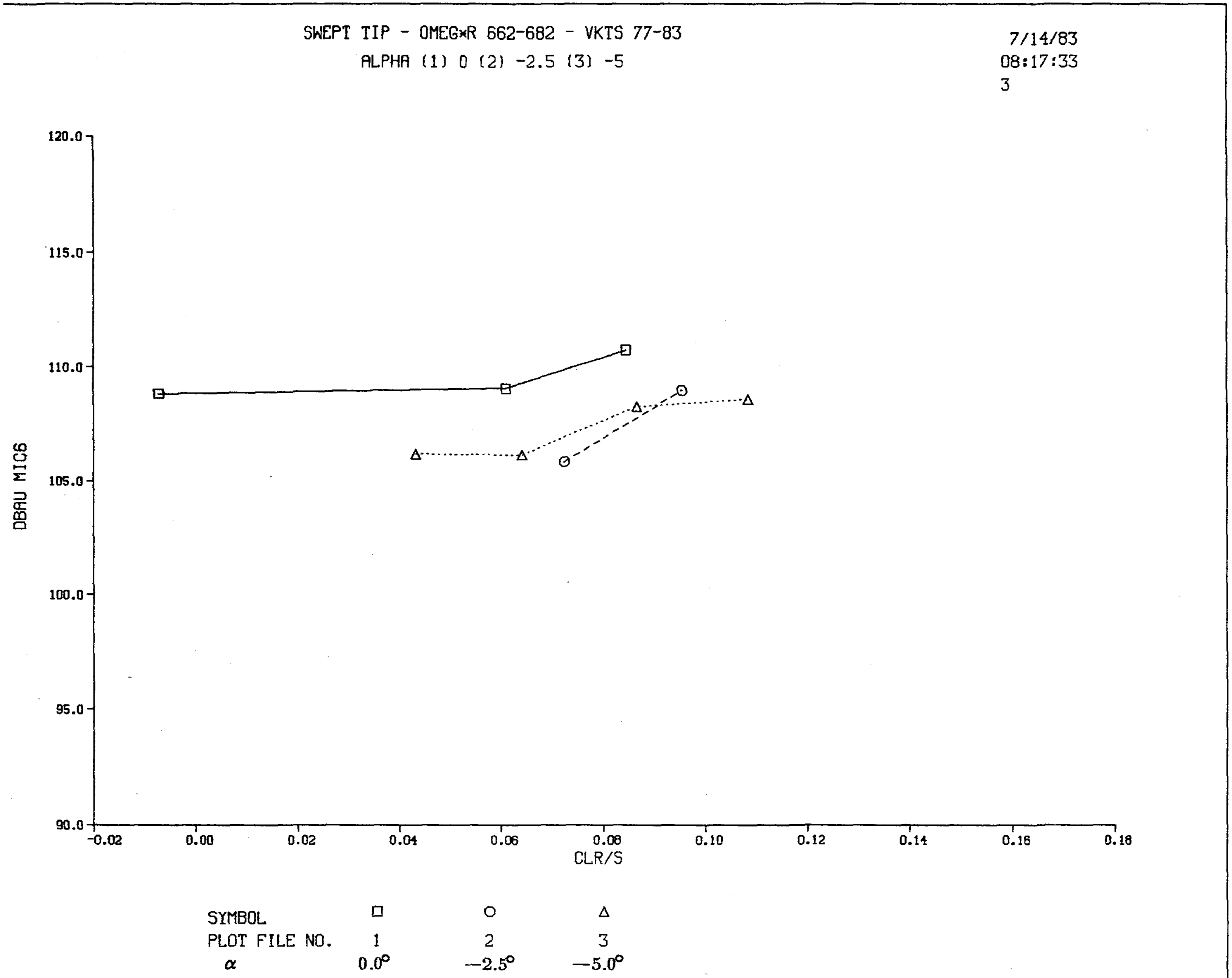


Figure F2(e). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Swept Tip Rotor.

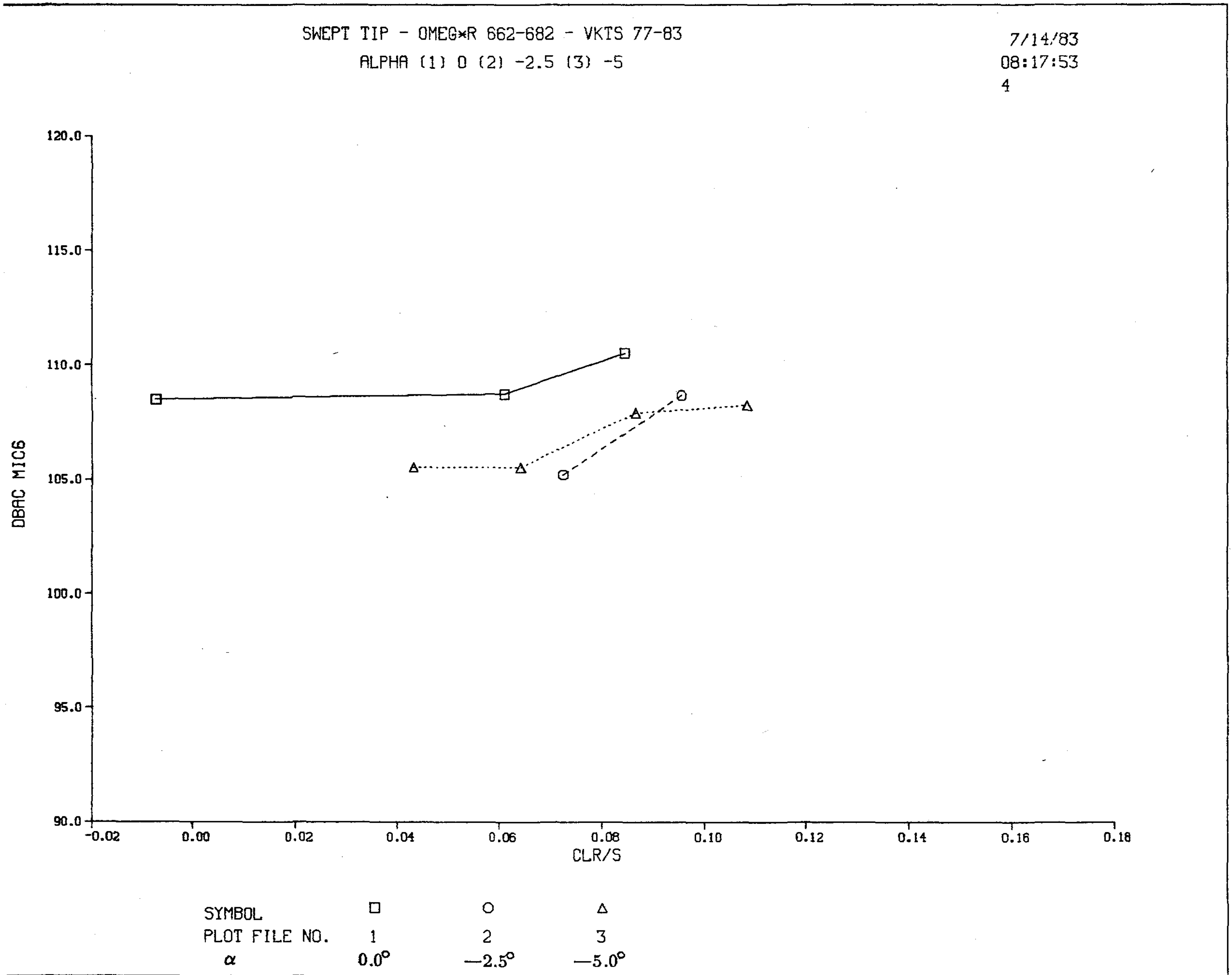


Figure F2(f). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Swept Tip Rotor.

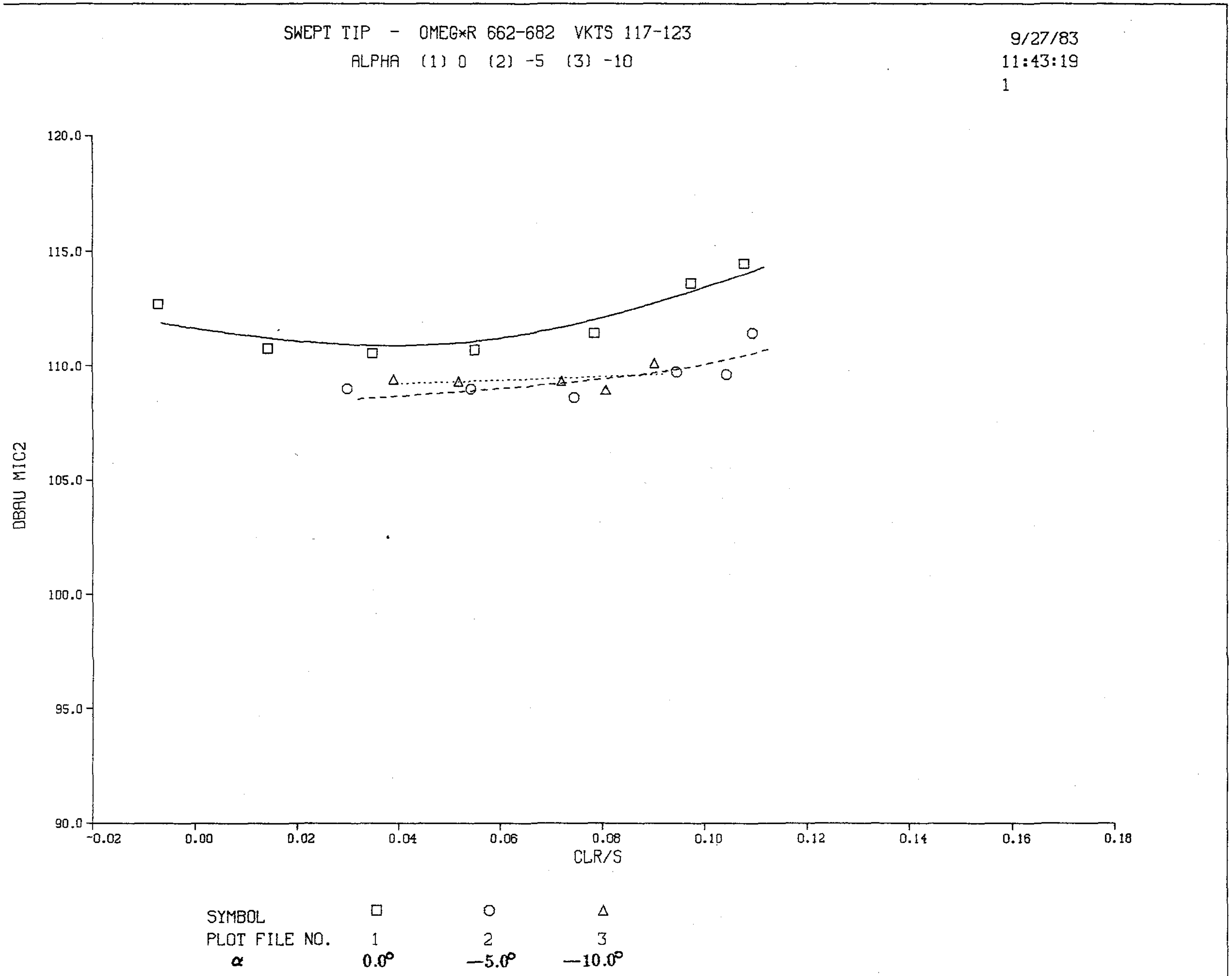


Figure F2(g). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Swept Tip Rotor.

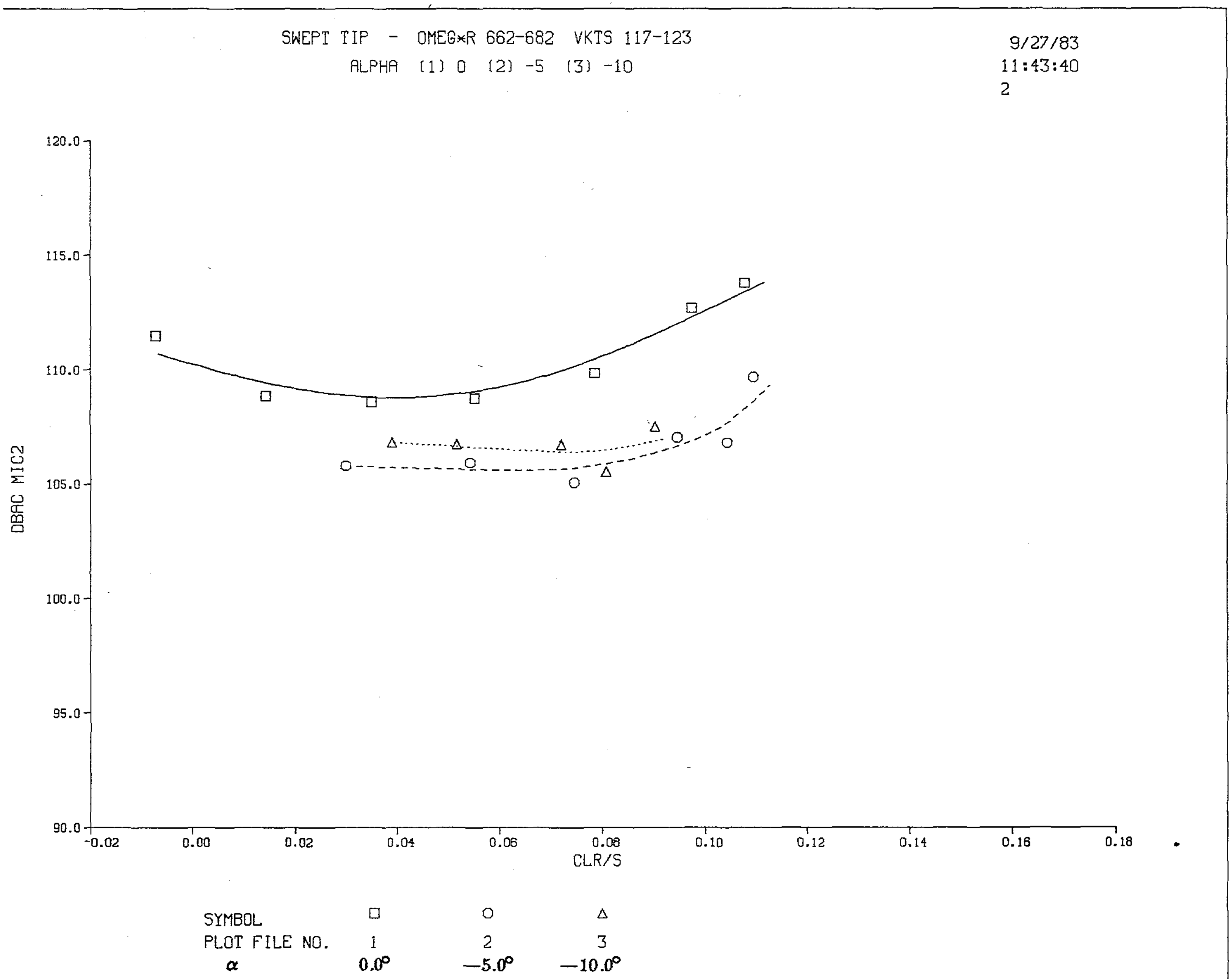


Figure F2(h). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Swept Tip Rotor.

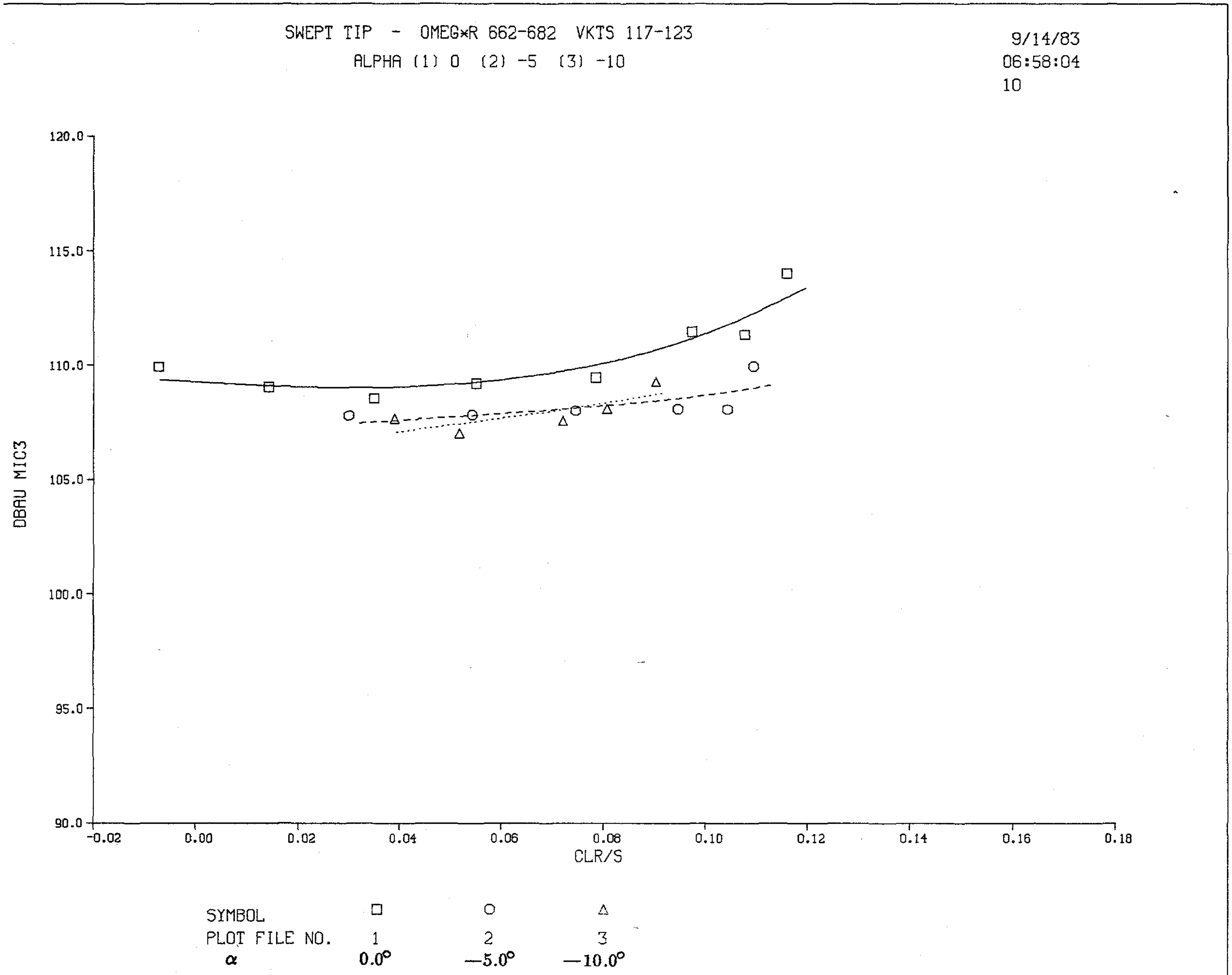
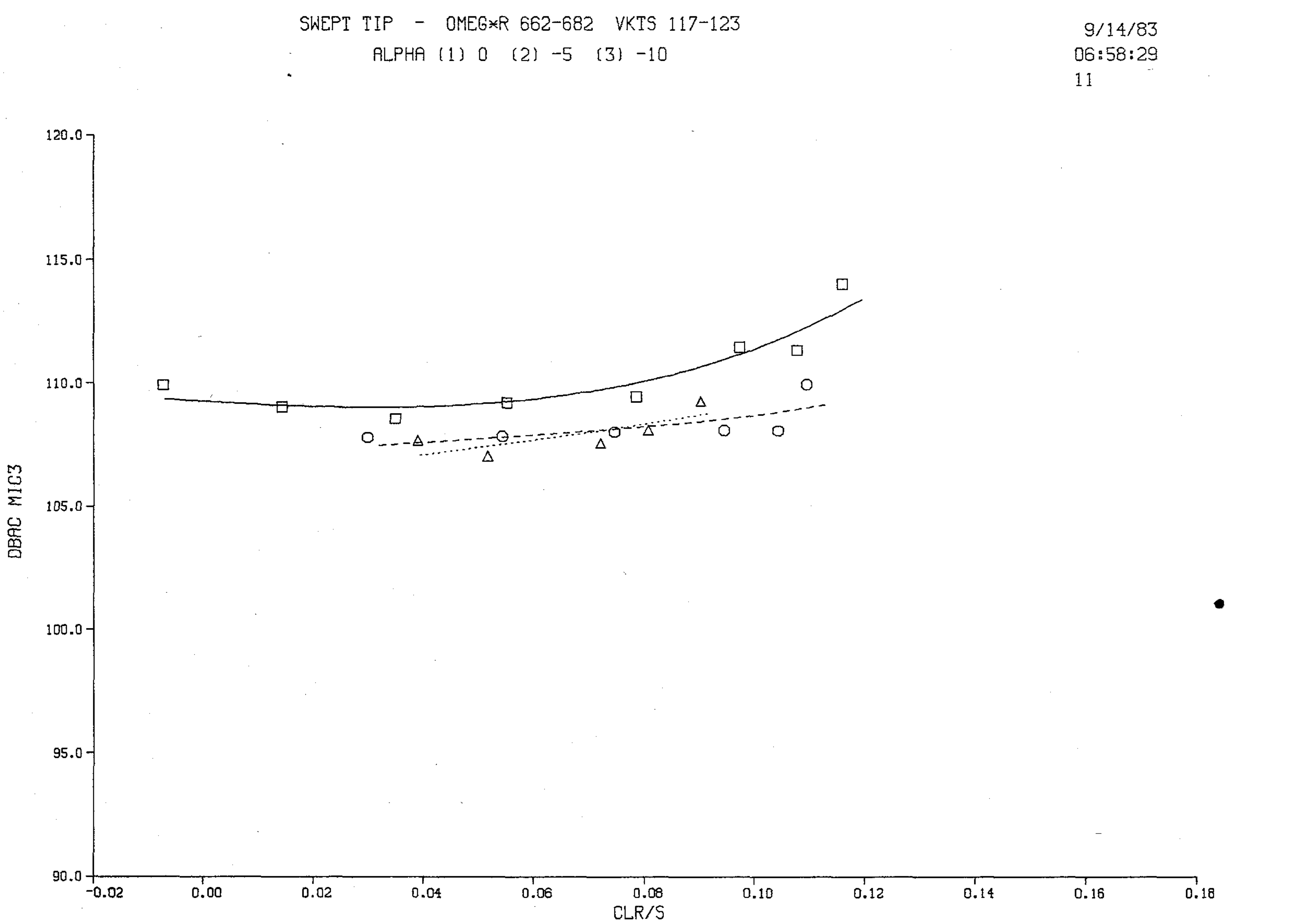


Figure F2(i). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Swept Tip Rotor.



SYMBOL	□	○	△
PLOT FILE NO.	1	2	3
α	$0.0°$	$-5.0°$	$-10.0°$

Figure F2(j). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Swept Tip Rotor.

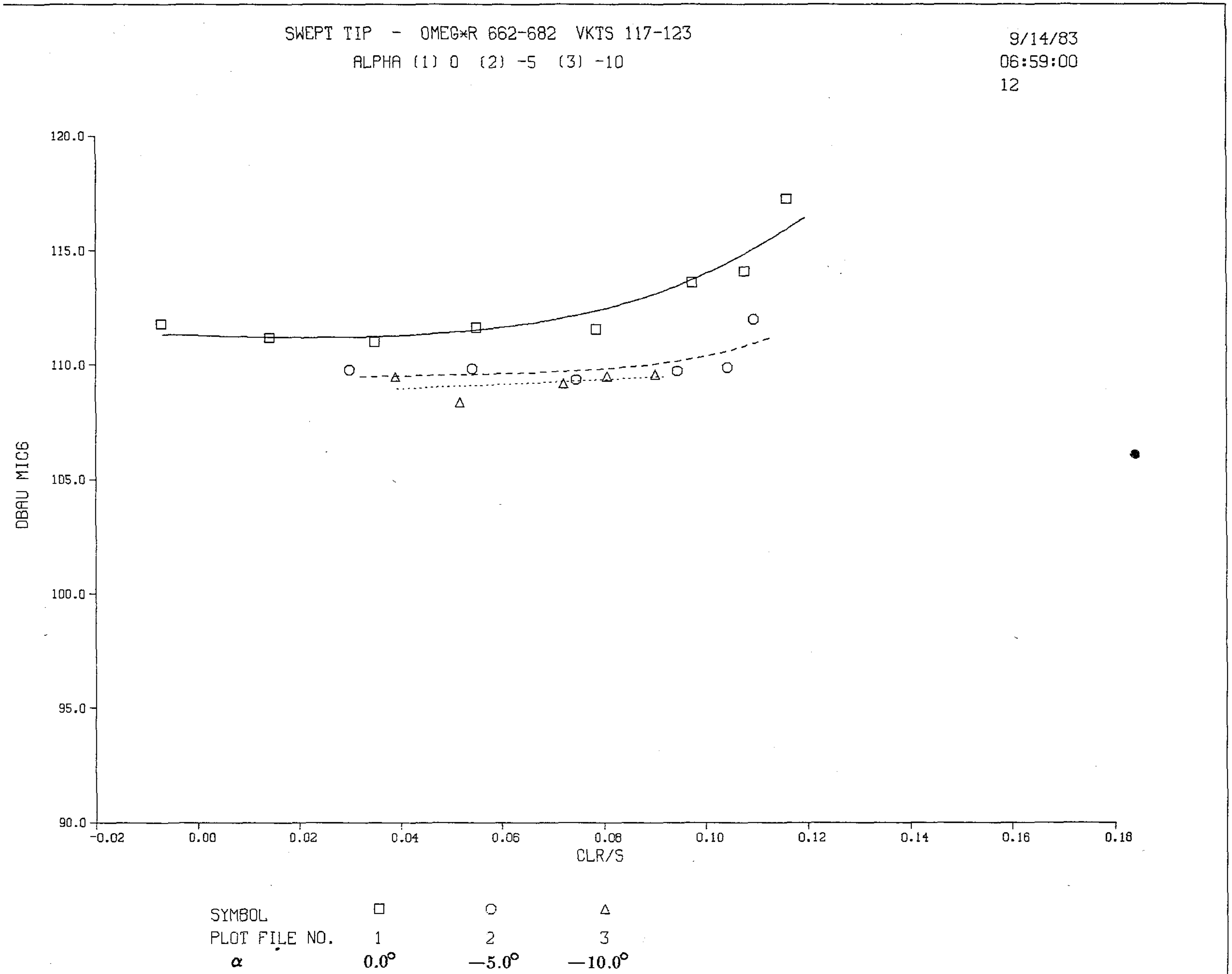


Figure F2(k). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Swept Tip Rotor.

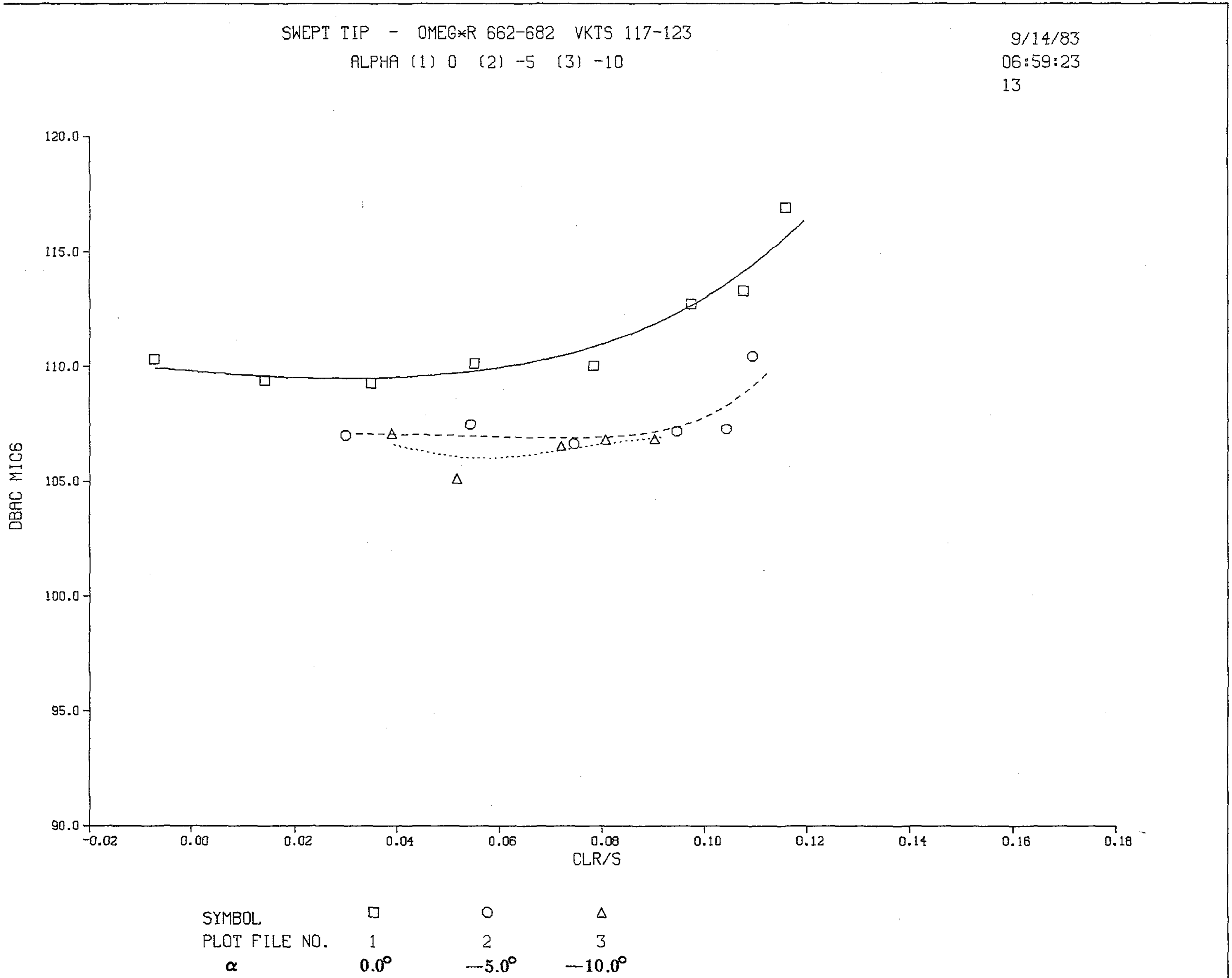


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Figure F2(l). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Swept Tip Rotor.

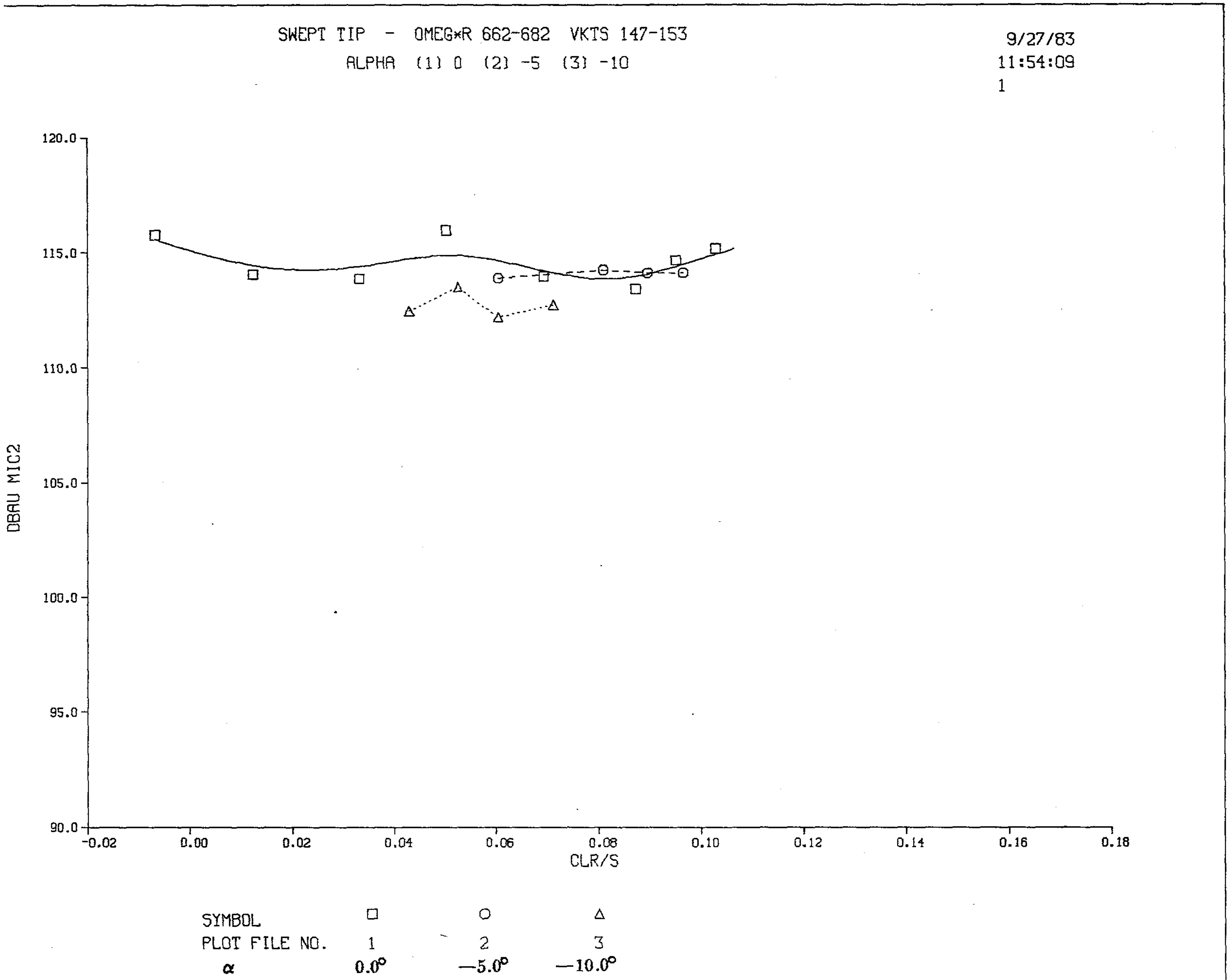


Figure F2(m). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Swept Tip Rotor.

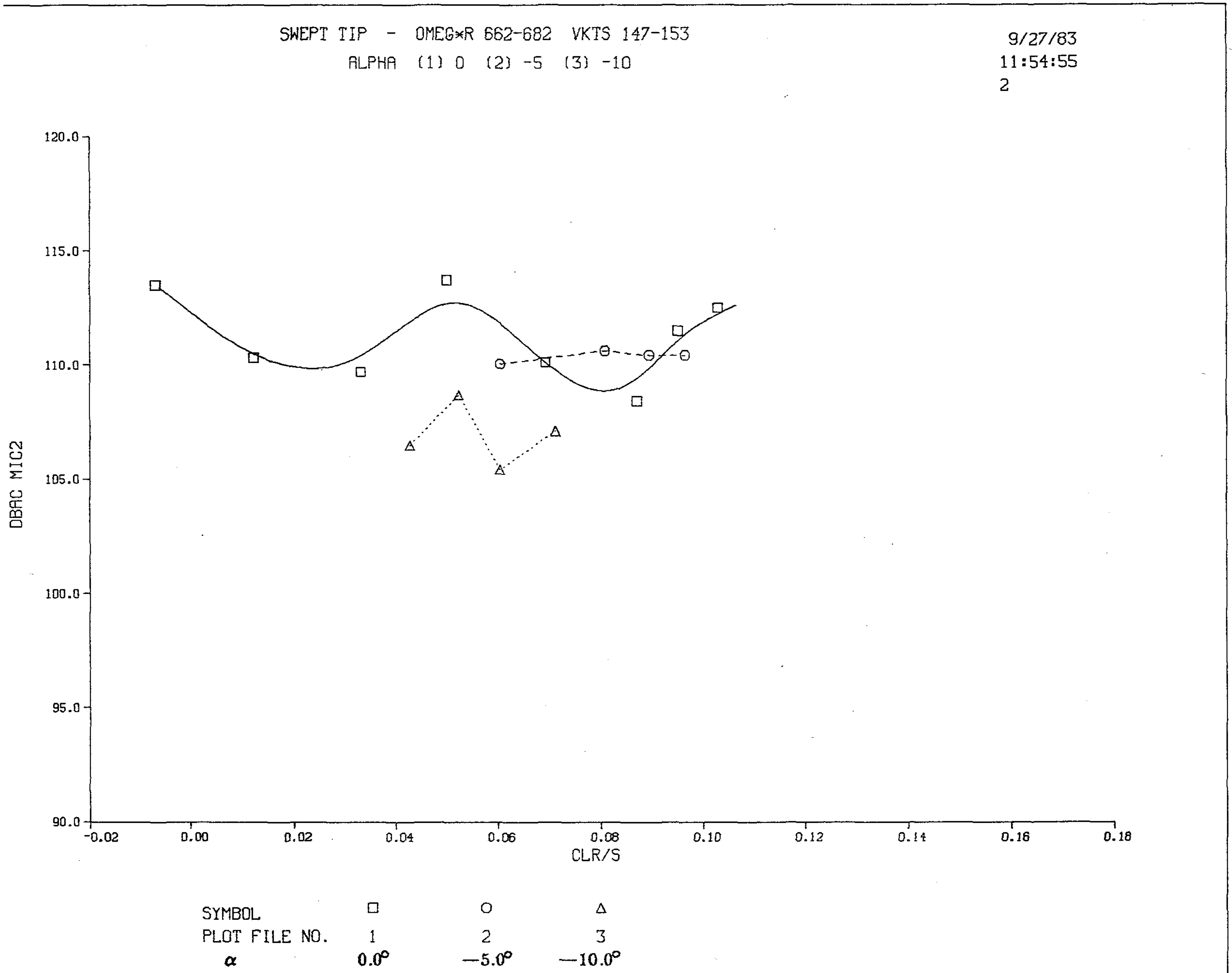


Figure F2(n). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Swept Tip Rotor.

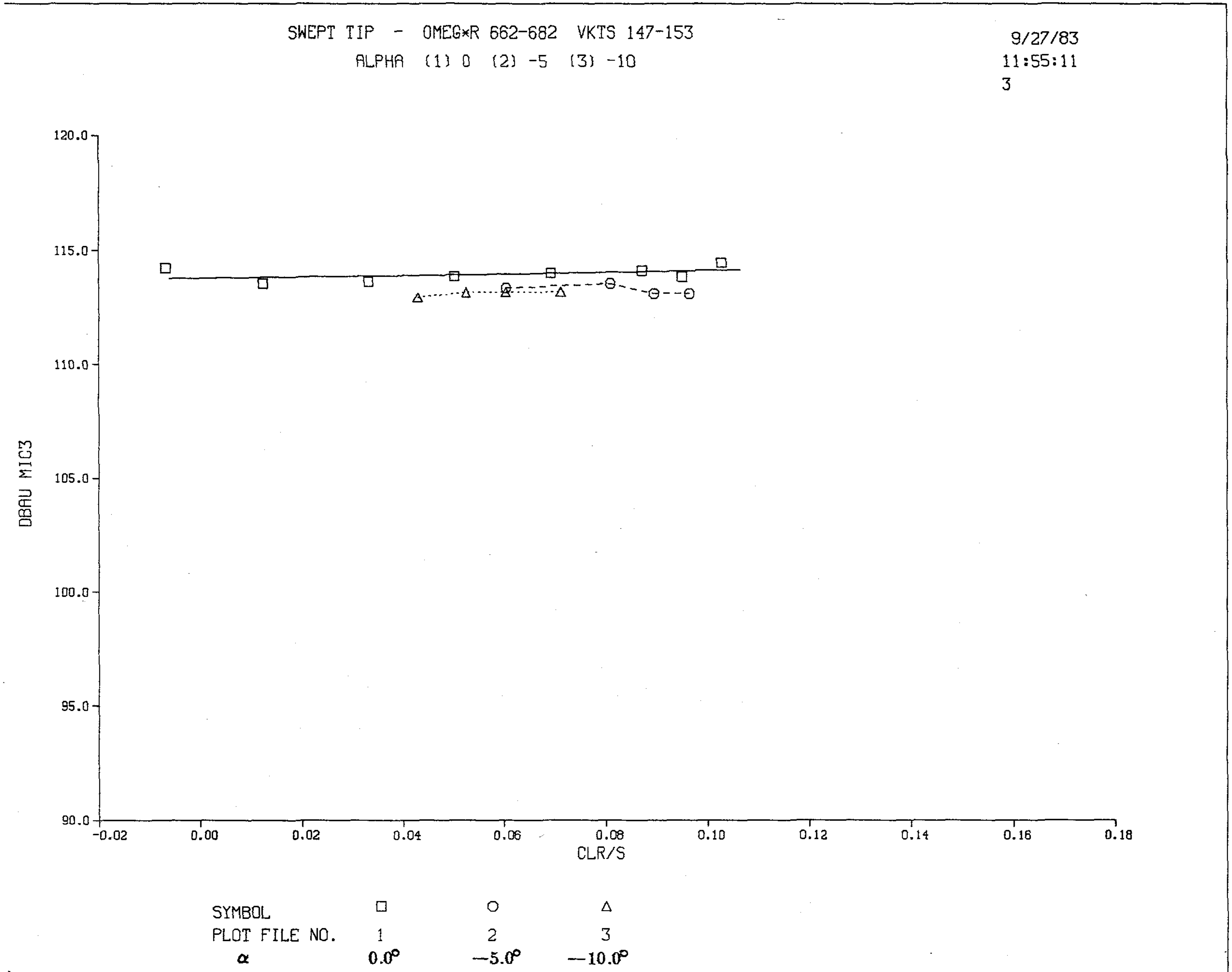


Figure F2(o). **A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Swept Tip Rotor.**

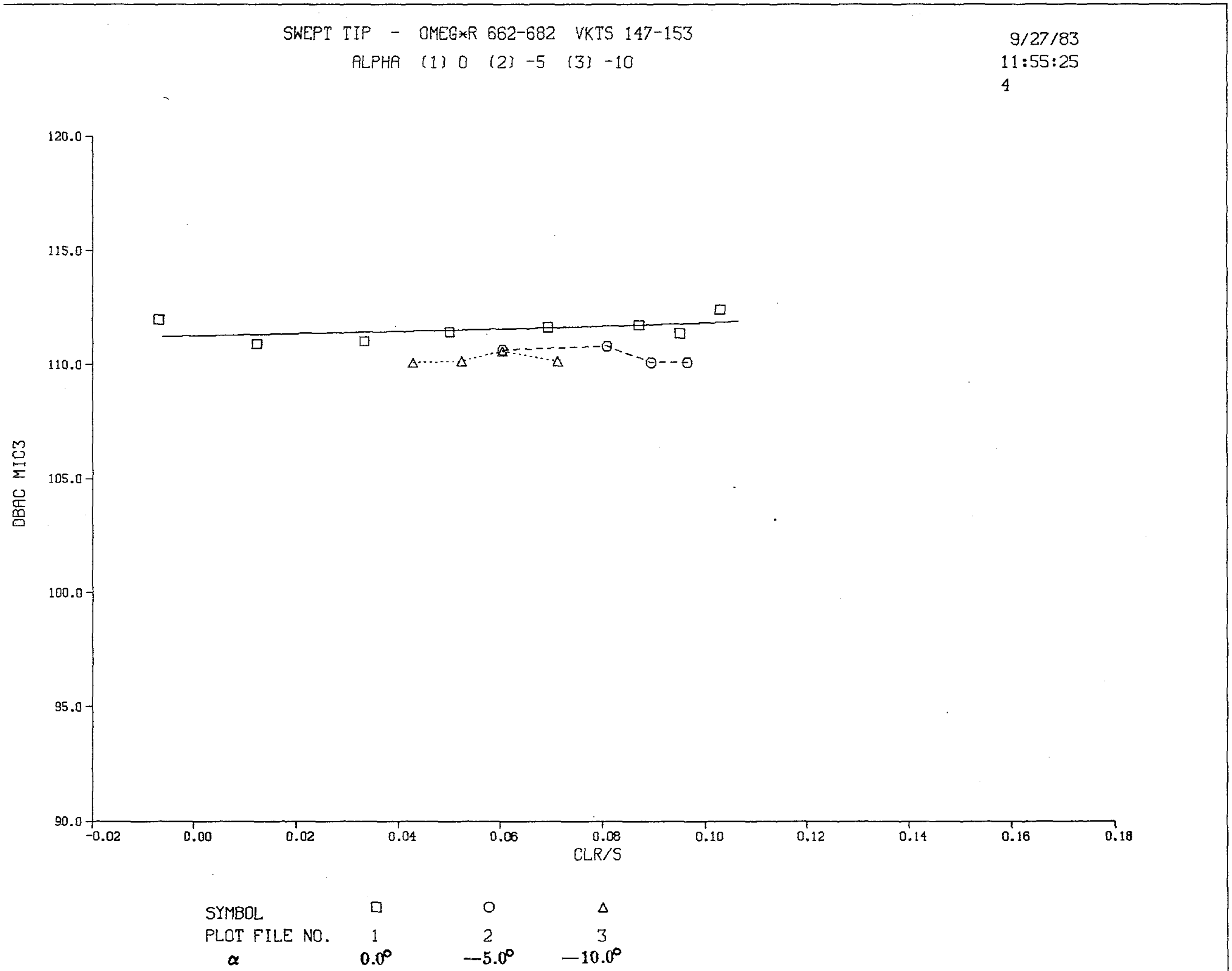


Figure F2(p). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Swept Tip Rotor.

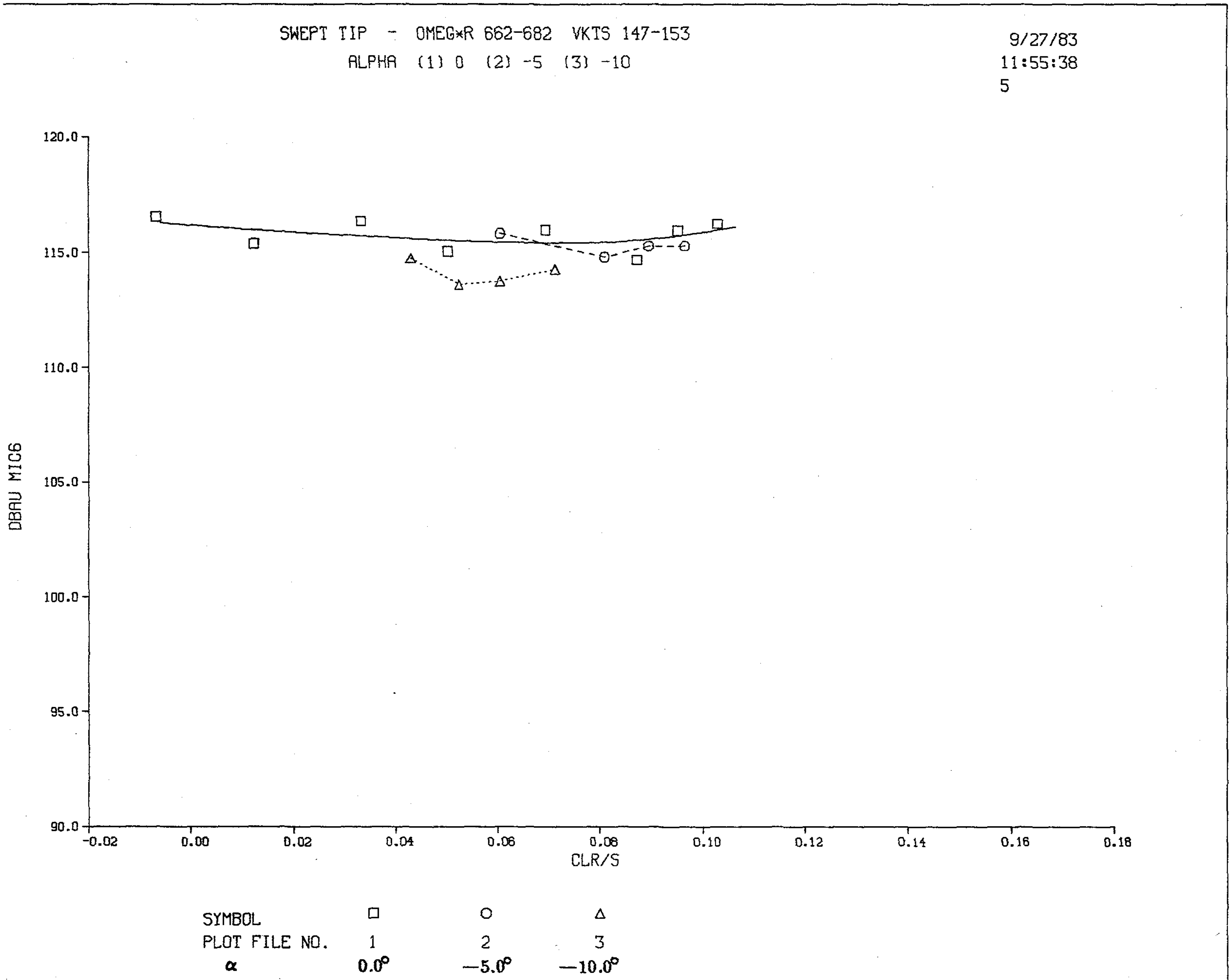


Figure F2(q). **A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Swept Tip Rotor.**

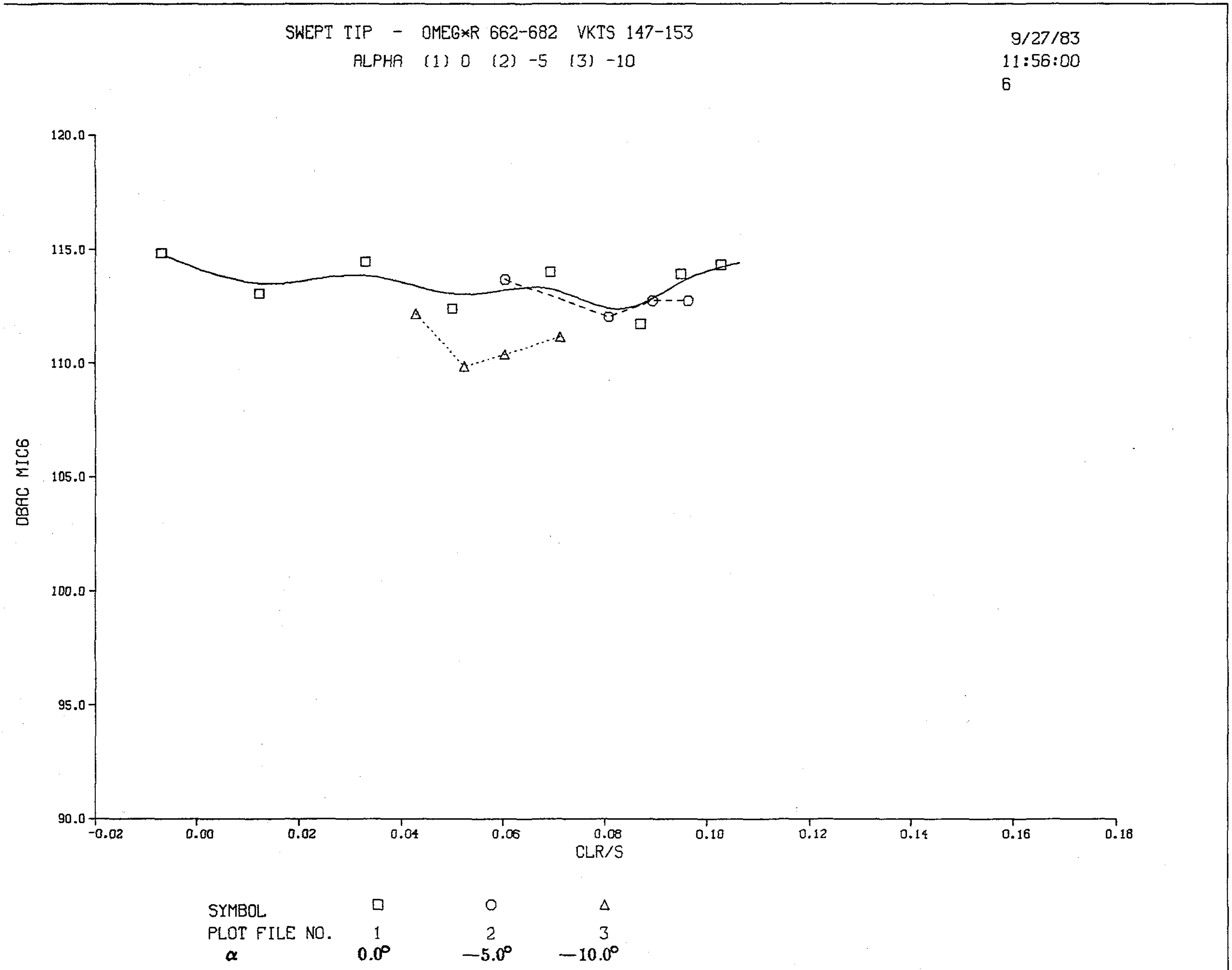


Figure F2(r). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Swept Tip Rotor.

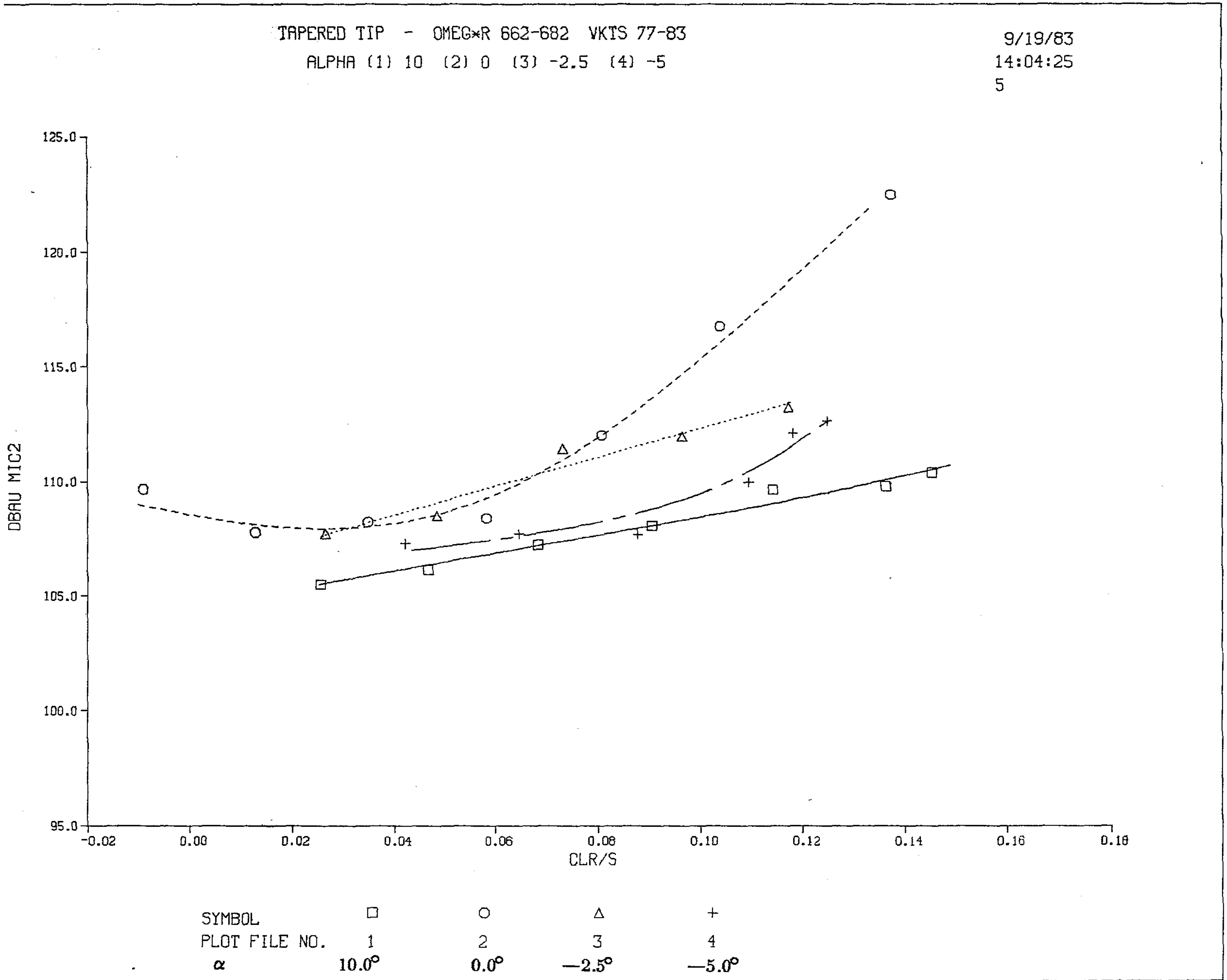


Figure F3(a). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Tapered Tip Rotor.

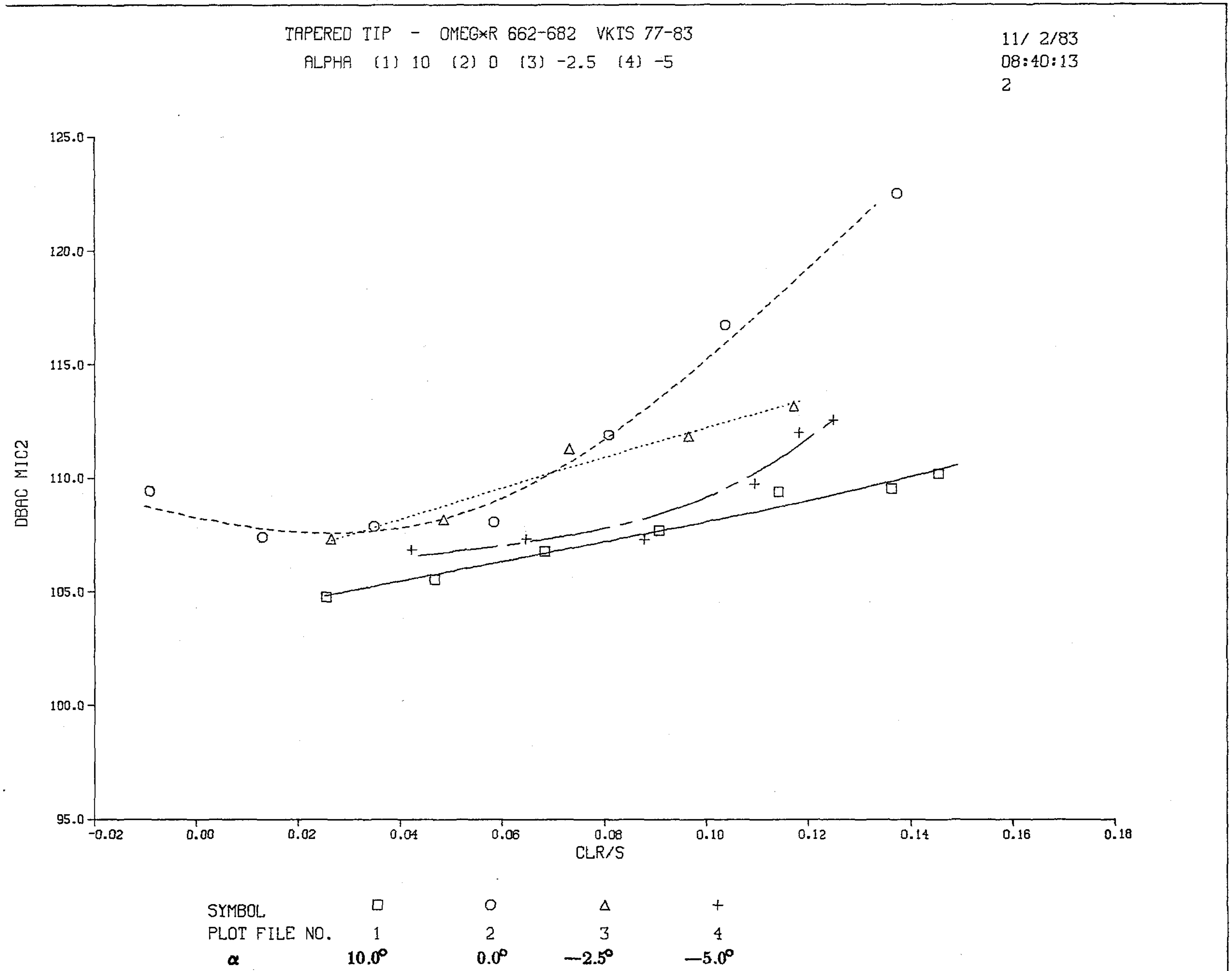


Figure F3(b). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Tapered Tip Rotor.

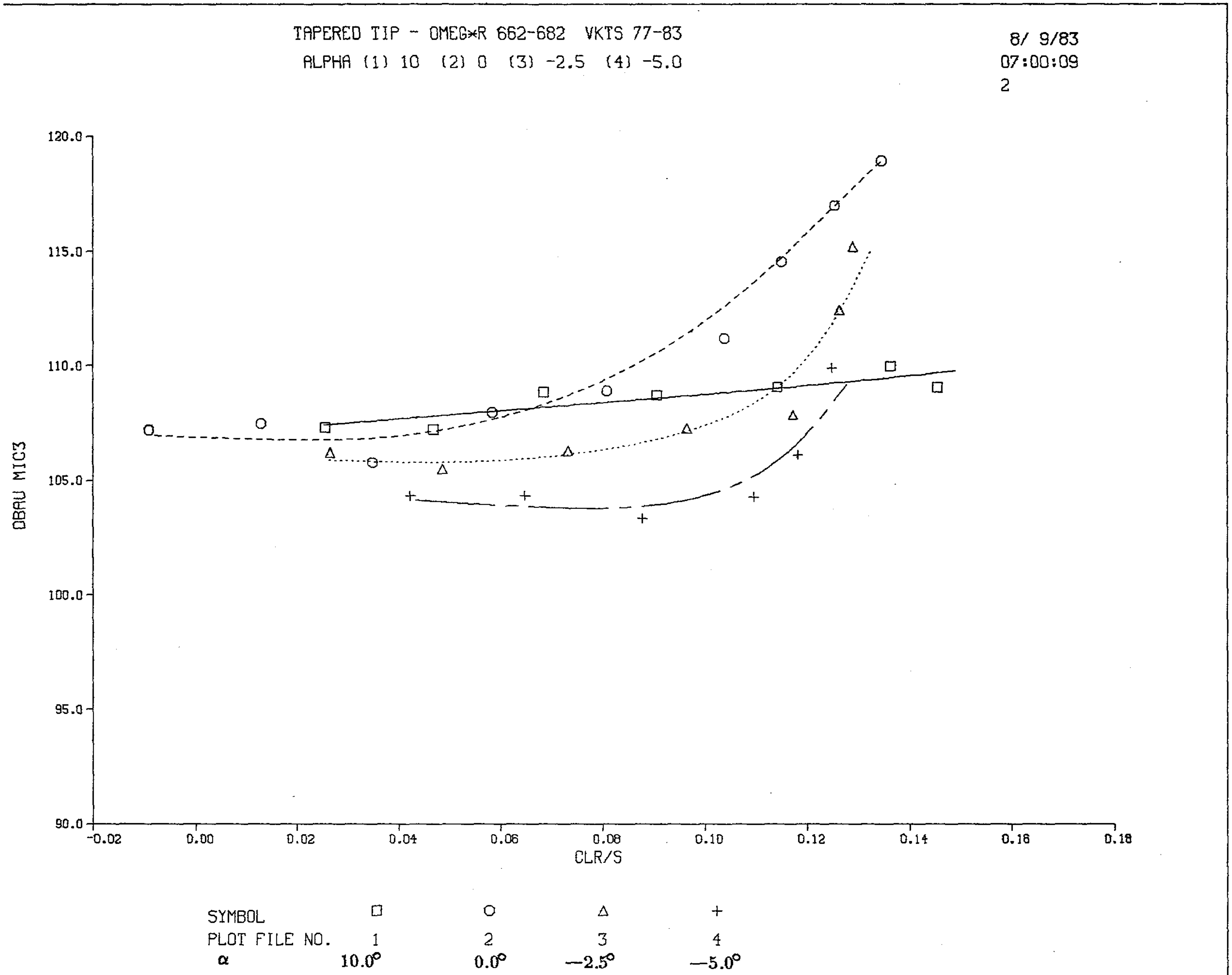


Figure F3(c). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Tapered Tip Rotor.

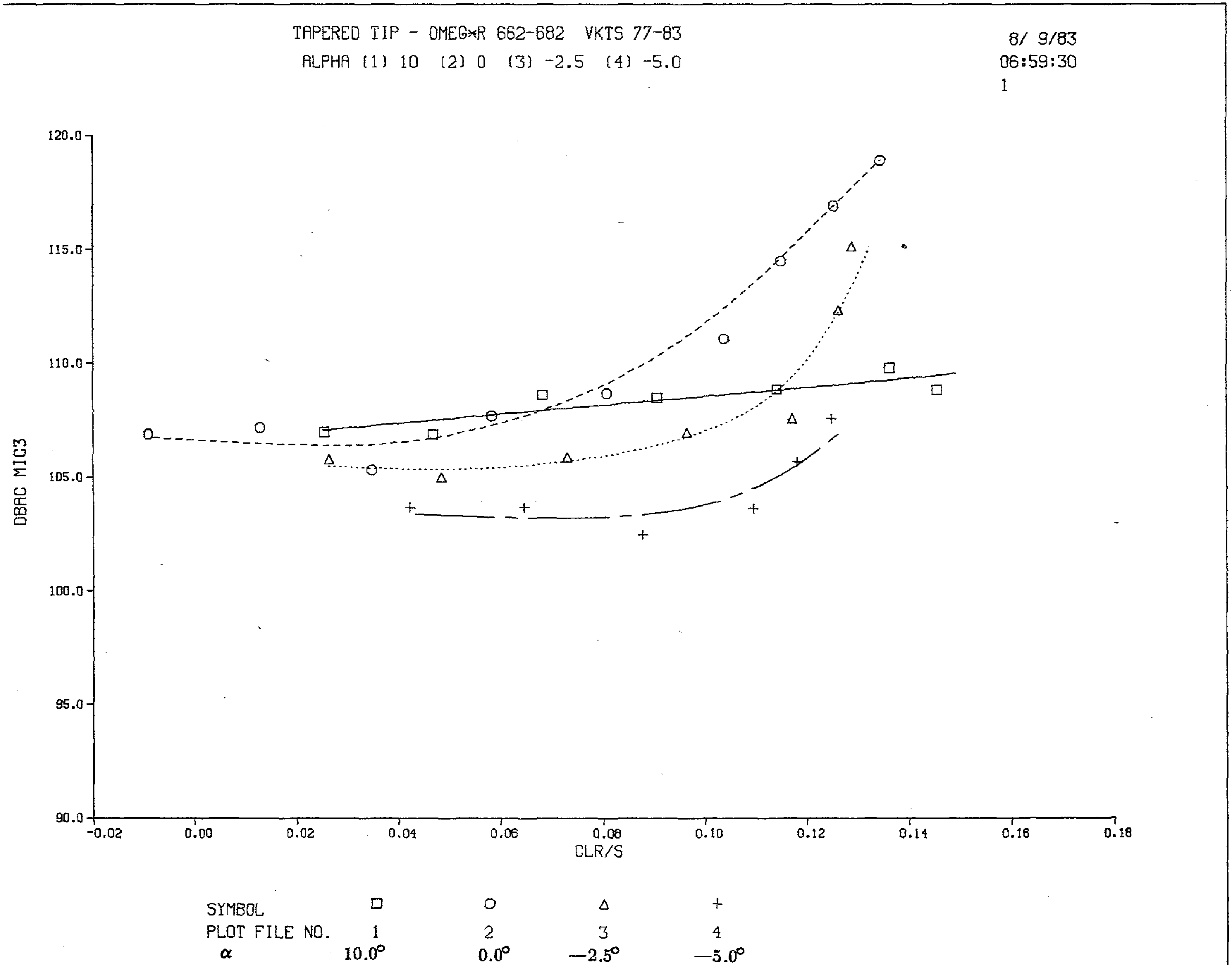


Figure F3(d). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Tapered Tip Rotor.

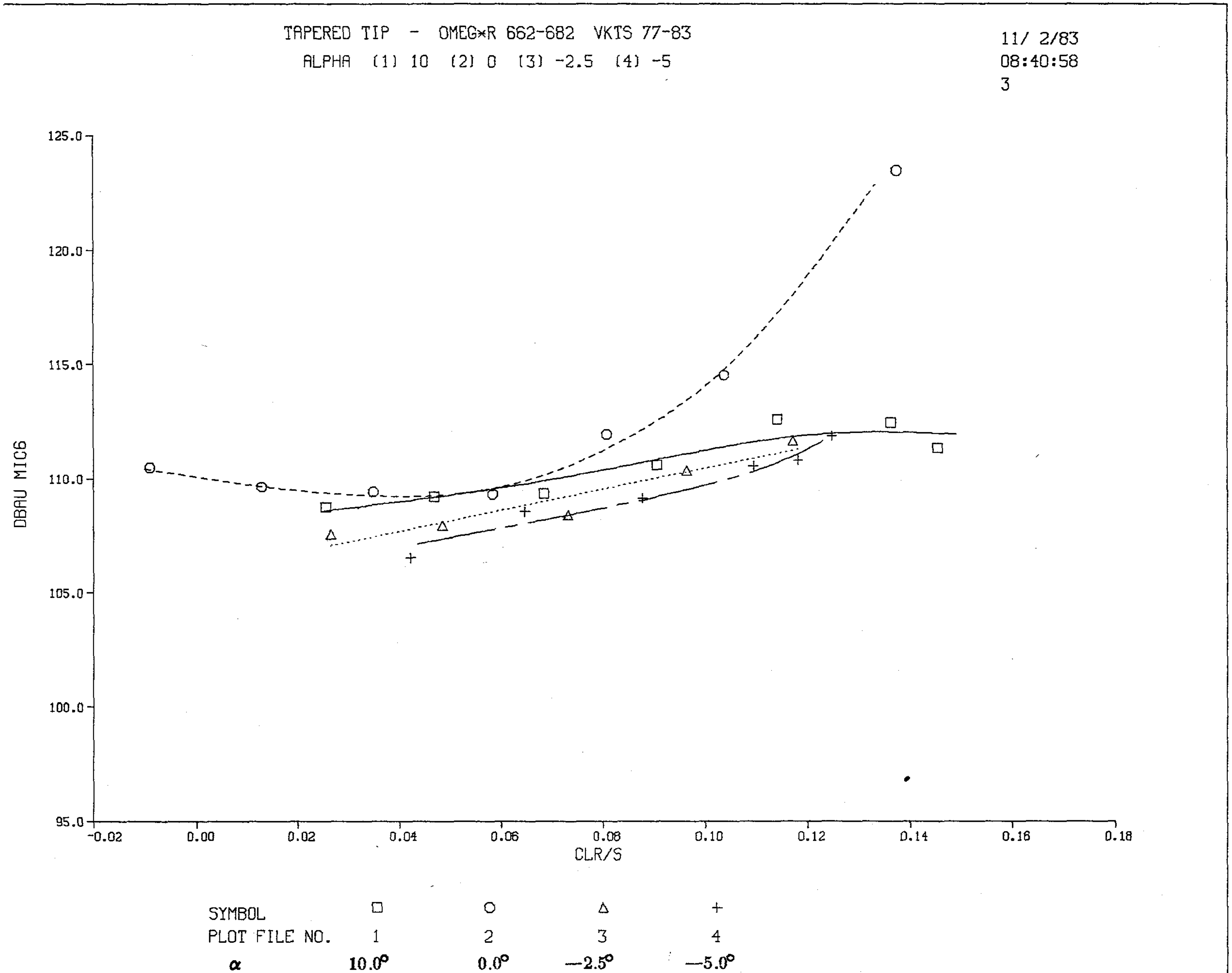


Figure F3(e). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Tapered Tip Rotor.

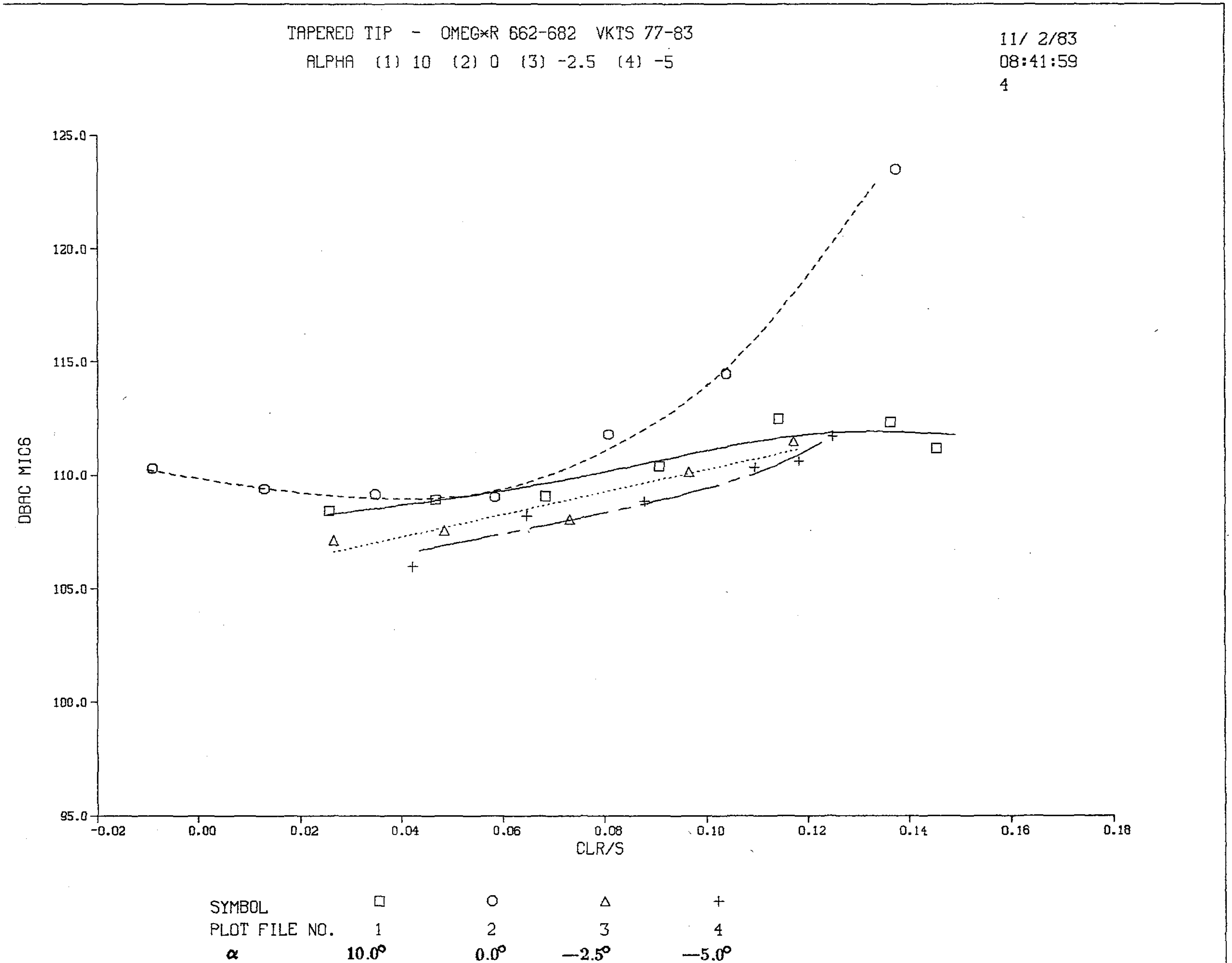


Figure F3(f). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Tapered Tip Rotor.

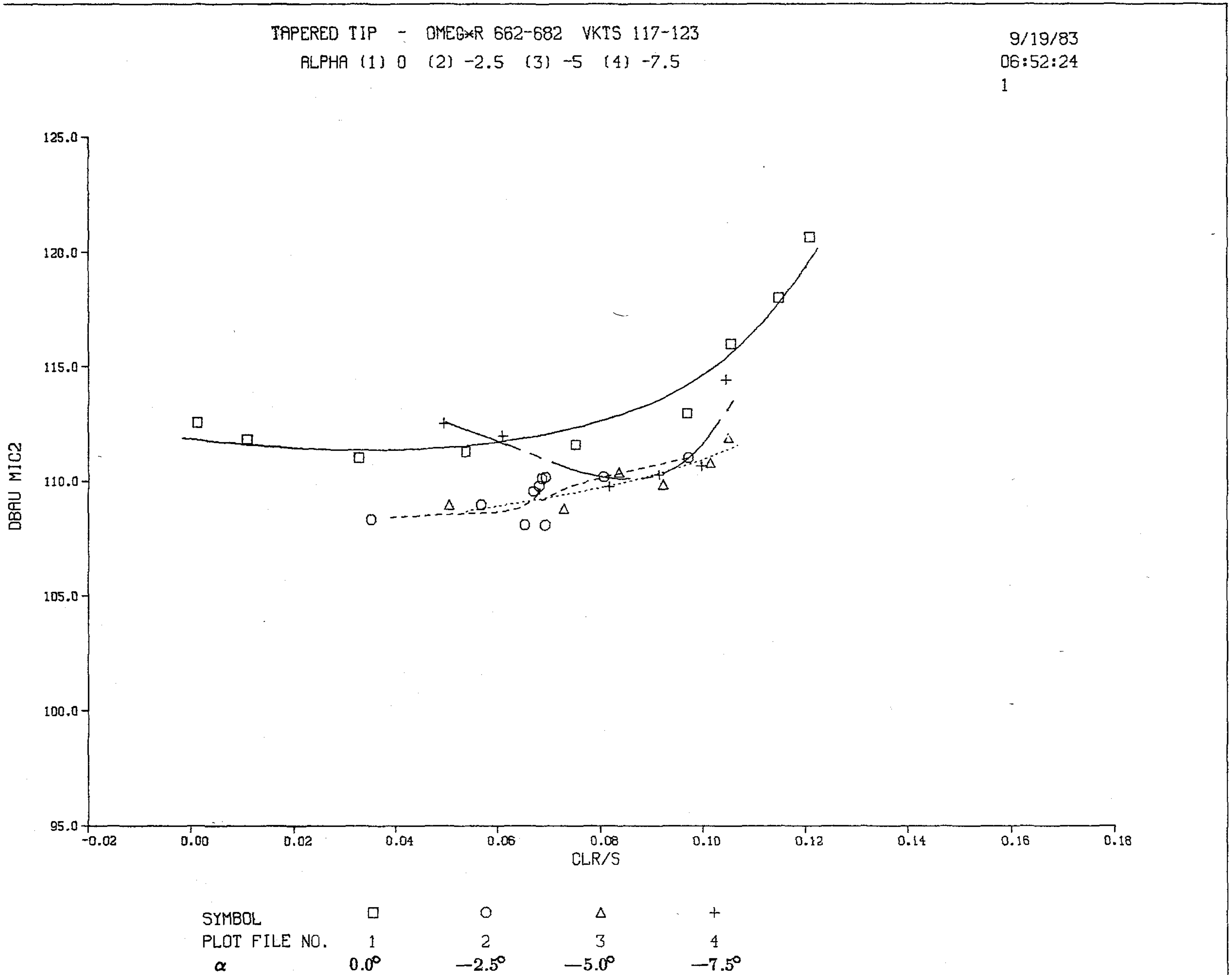


Figure F3(g). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Tapered Tip Rotor.

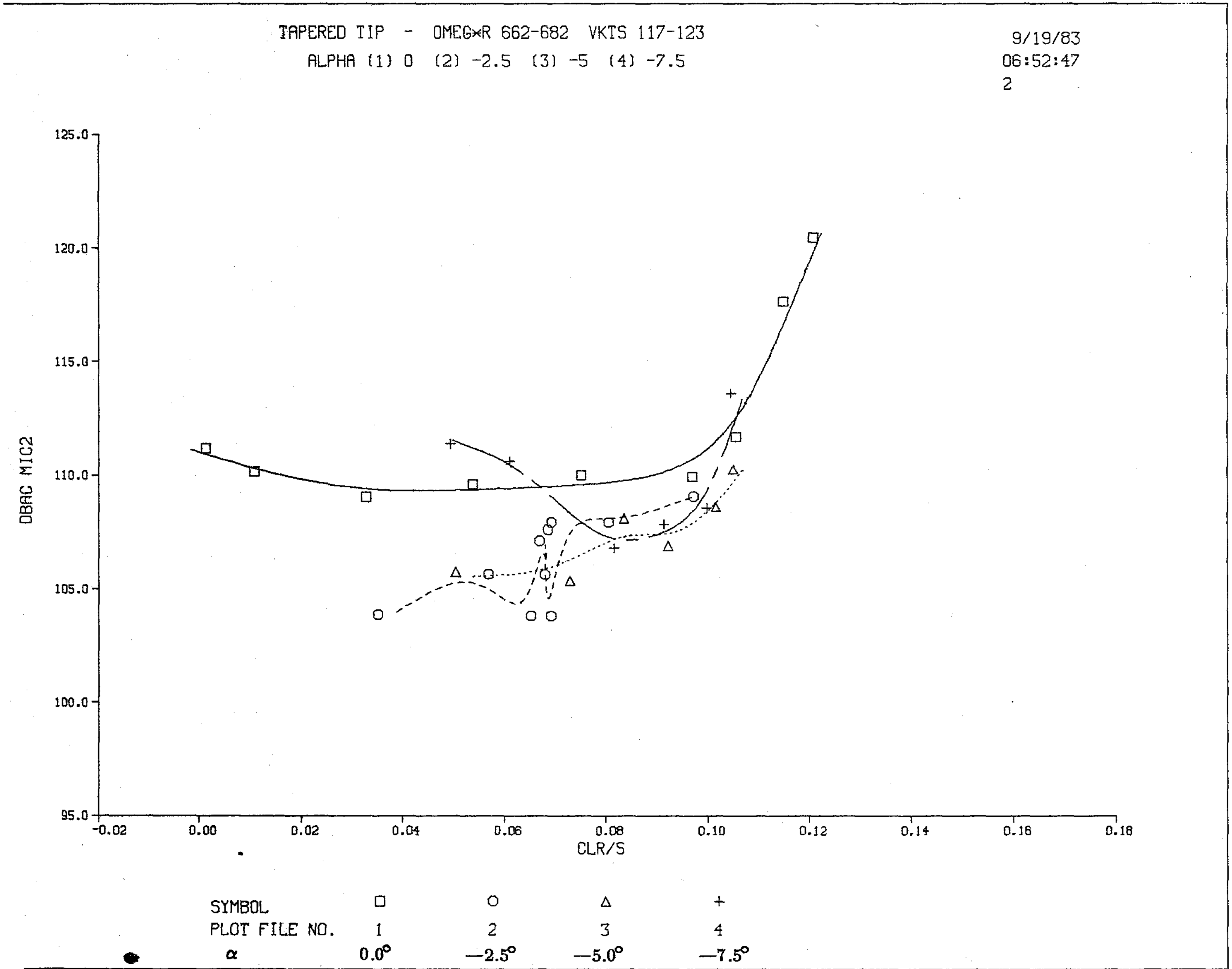


Figure F3(h). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Tapered Tip Rotor.

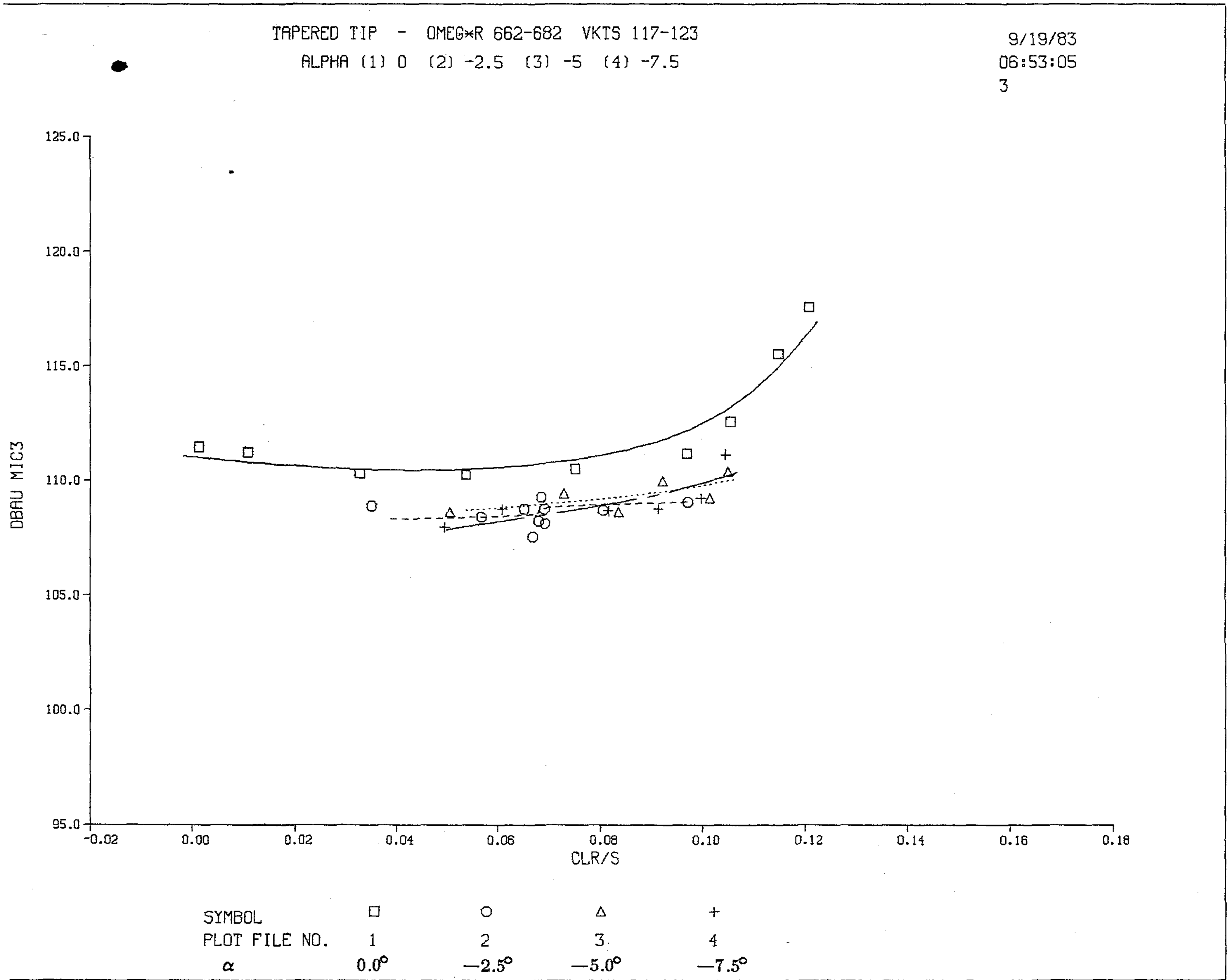


Figure F3(i). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Tapered Tip Rotor.

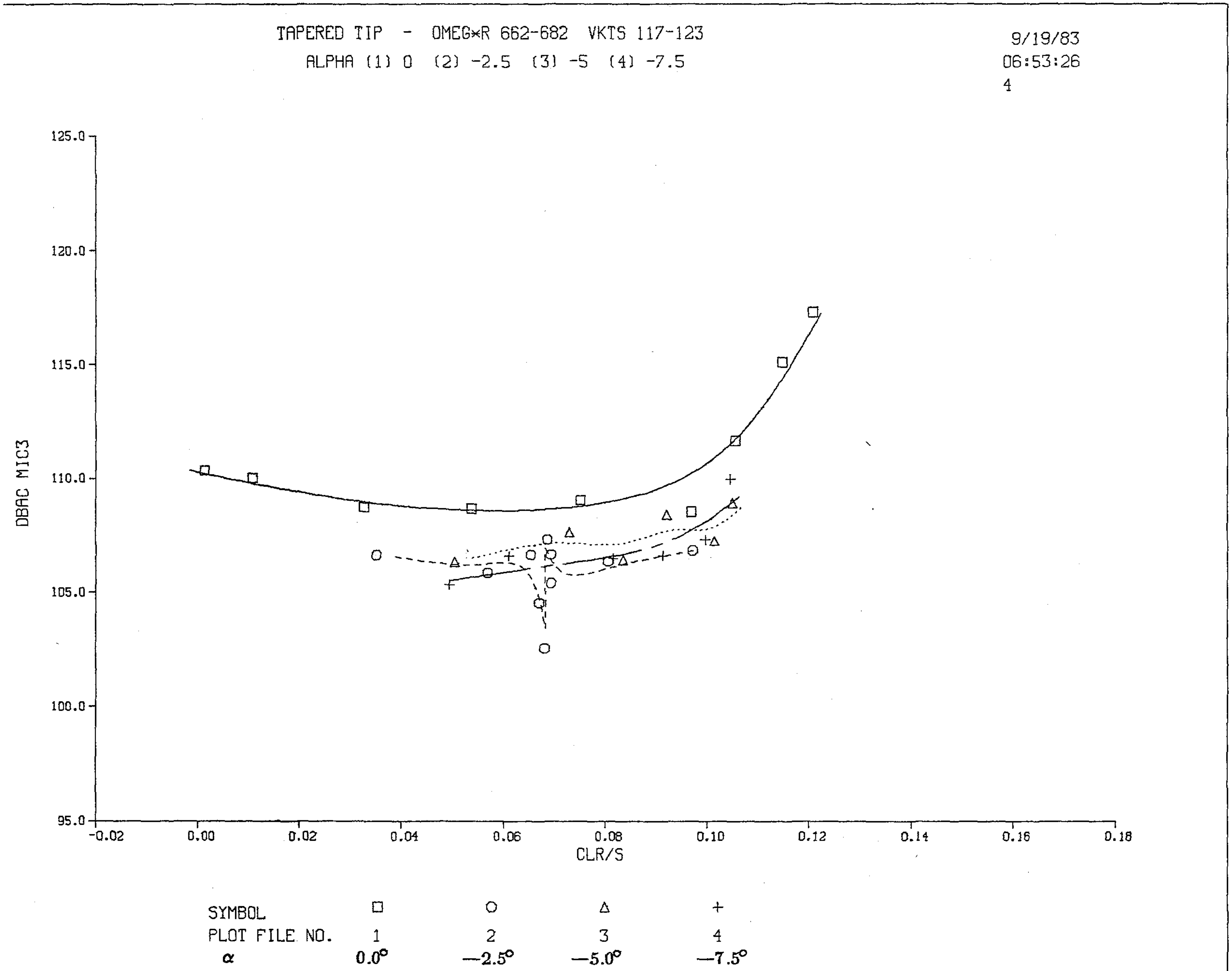


Figure F3(j). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Tapered Tip Rotor.

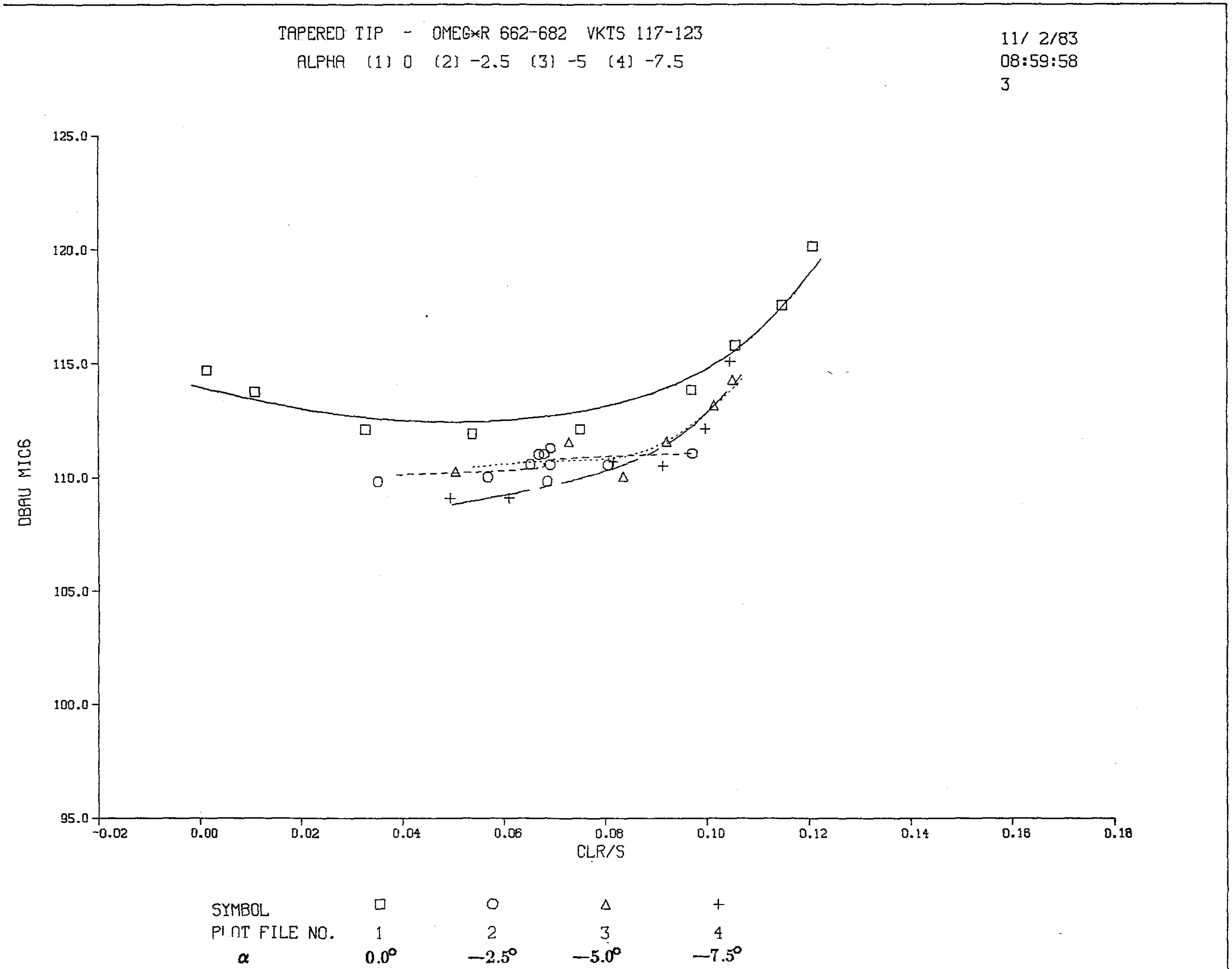


Figure F3(k). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Tapered Tip Rotor.

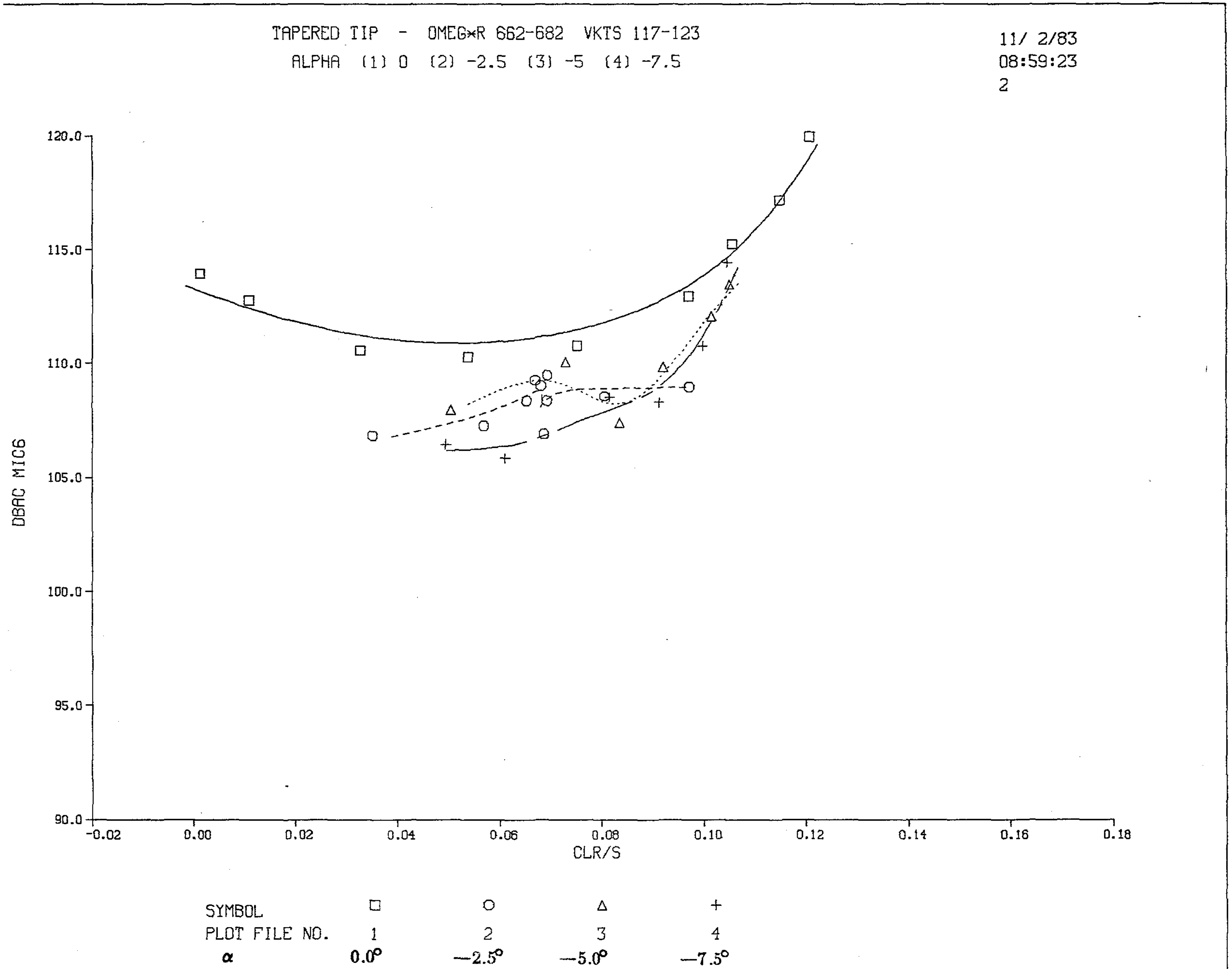


Figure F3(l). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Tapered Tip Rotor.

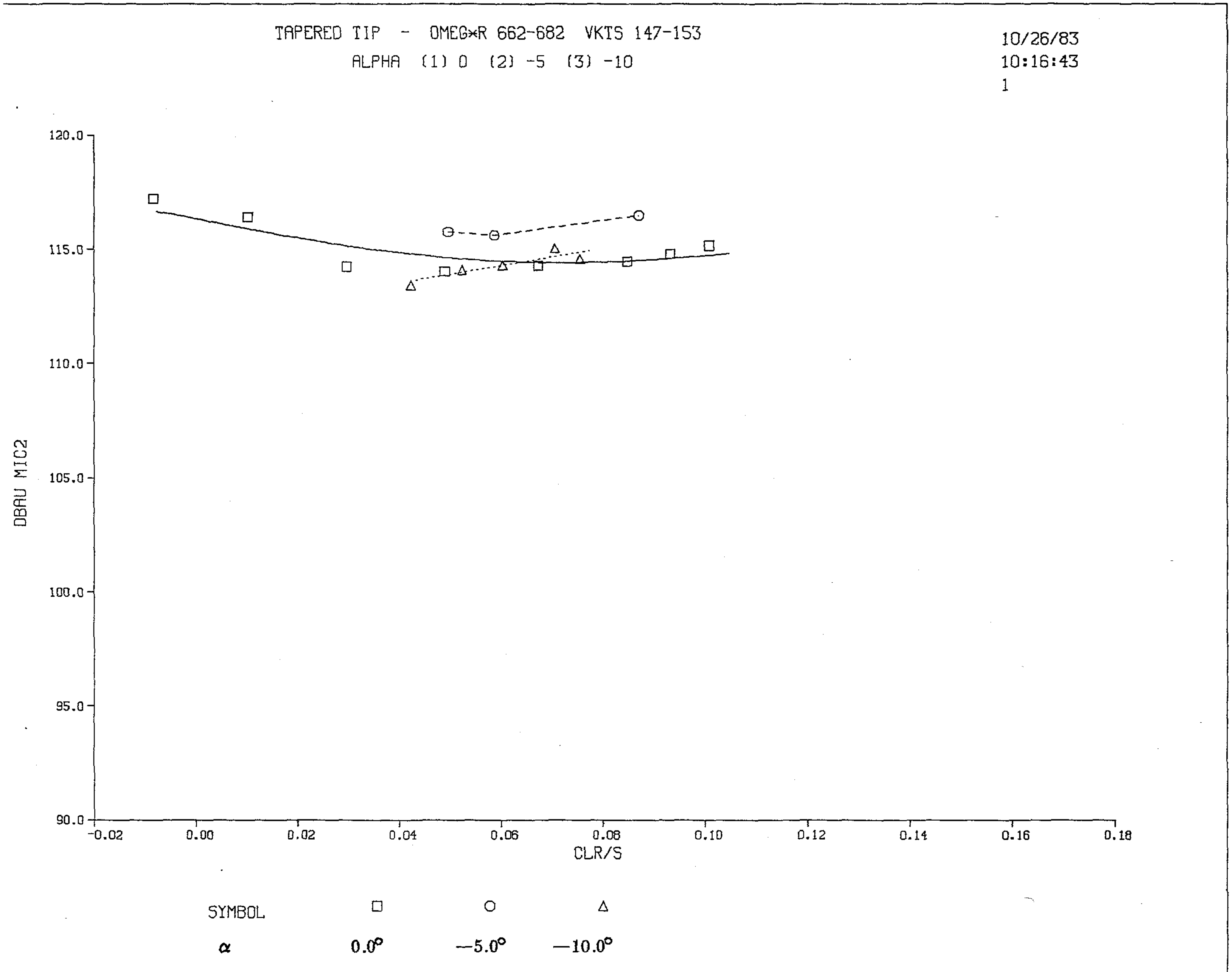


Figure F3(m). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Tapered Tip Rotor.

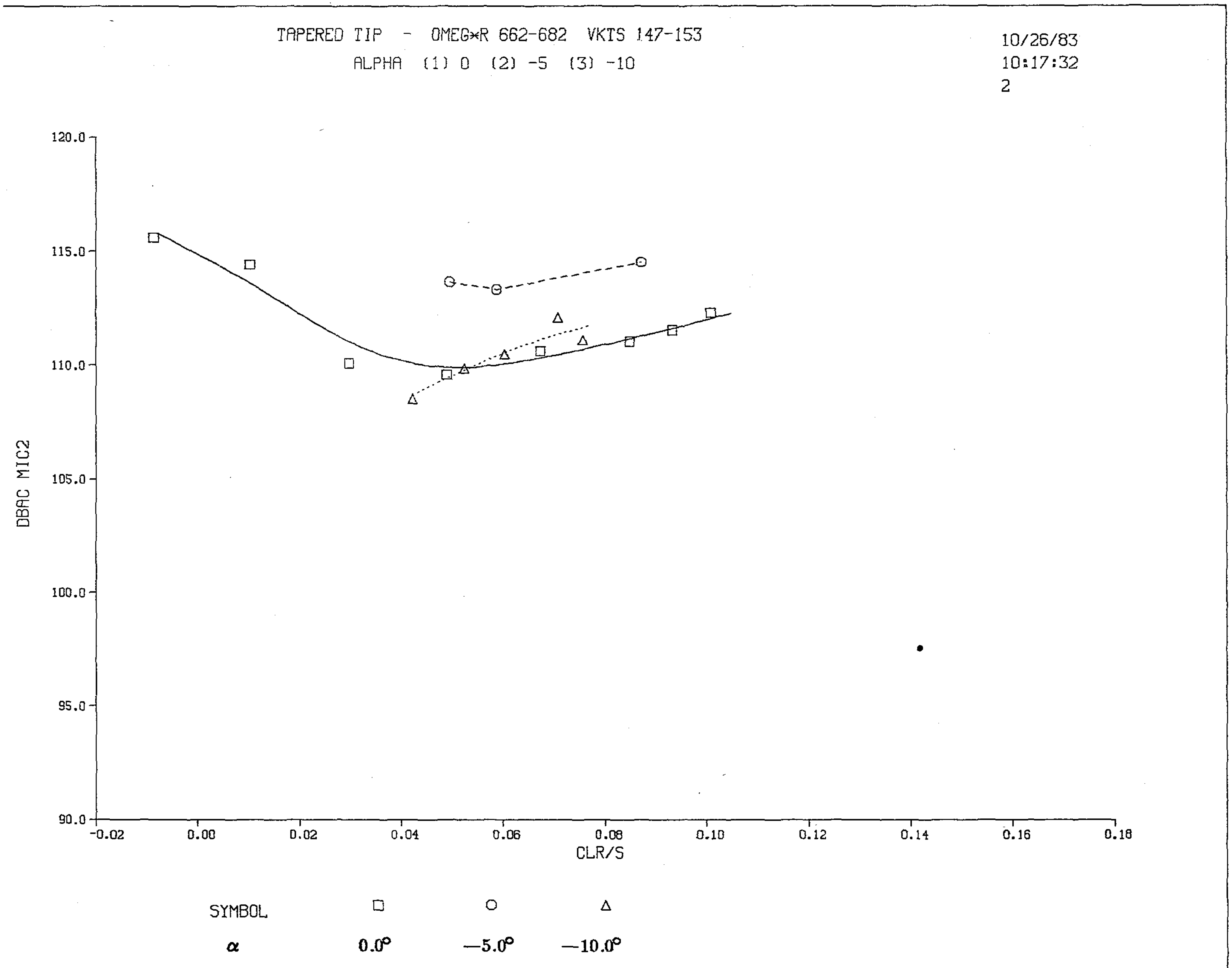


Figure F3(n). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Tapered Tip Rotor.

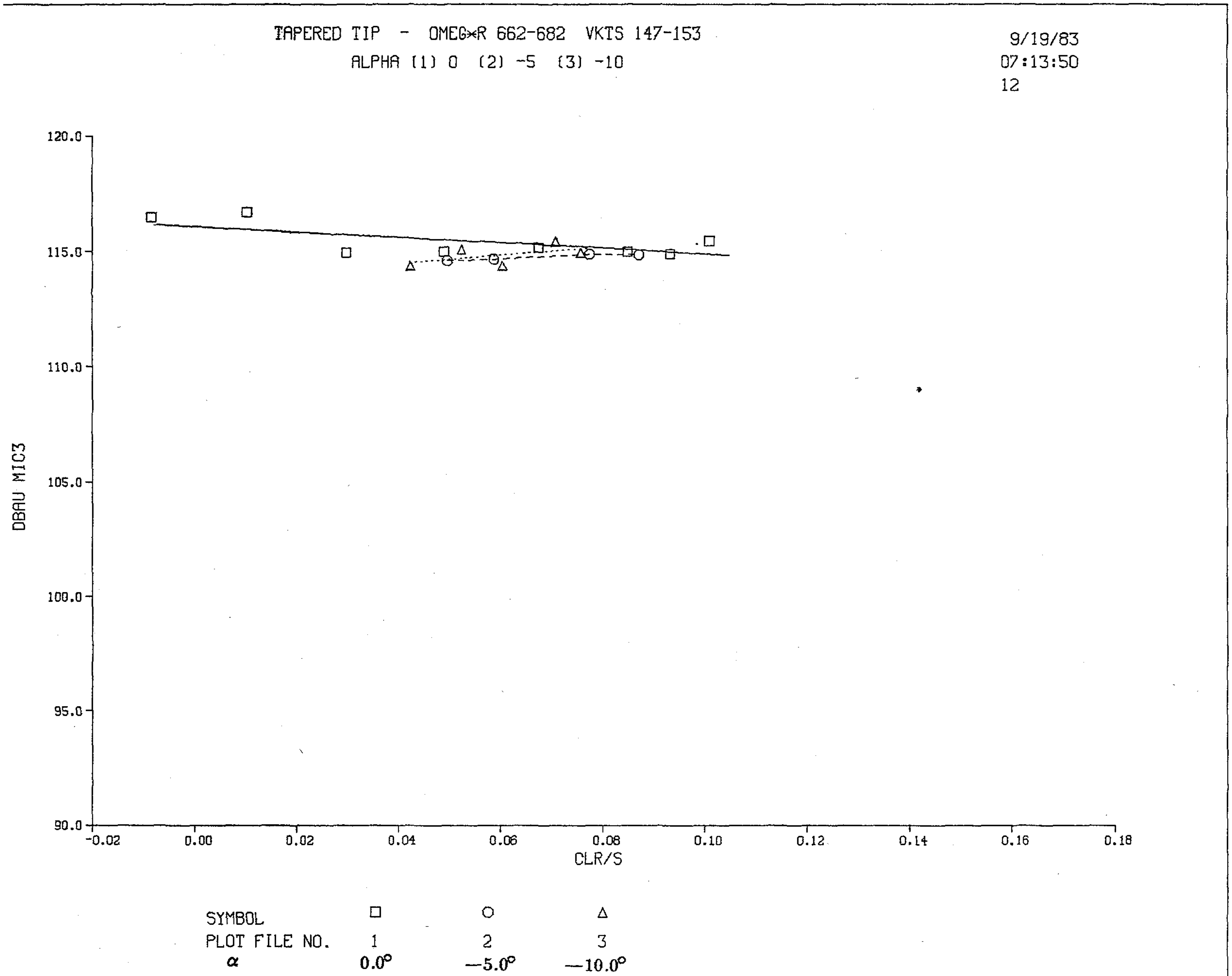


Figure F3(o). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Tapered Tip Rotor.

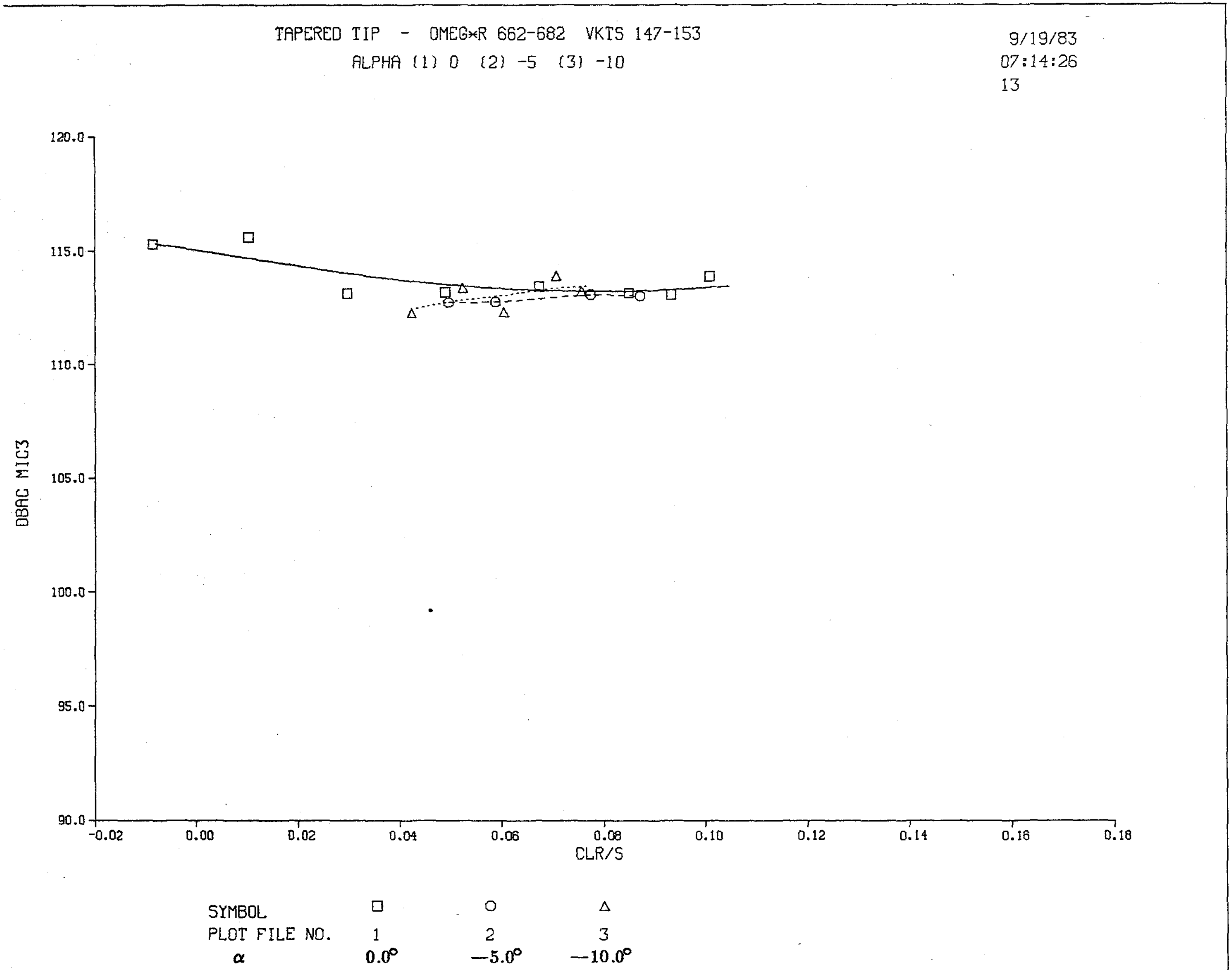
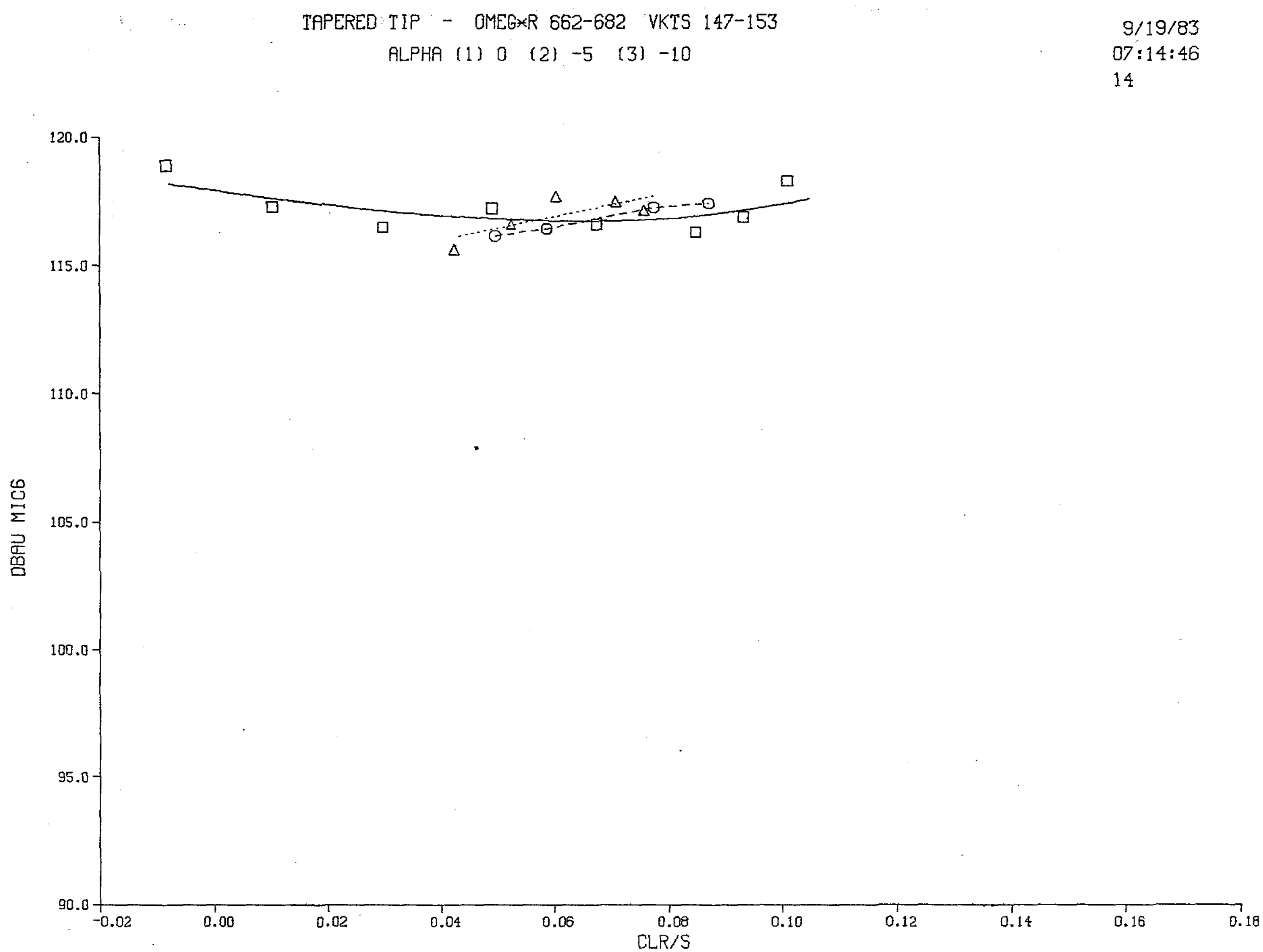


Figure F3(p). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Tapered Tip Rotor.



SYMBOL	□	○	△
PLOT FILE NO.	1	2	3
α	0.0°	—5.0°	—10.0°

Figure F3(q). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Tapered Tip Rotor.

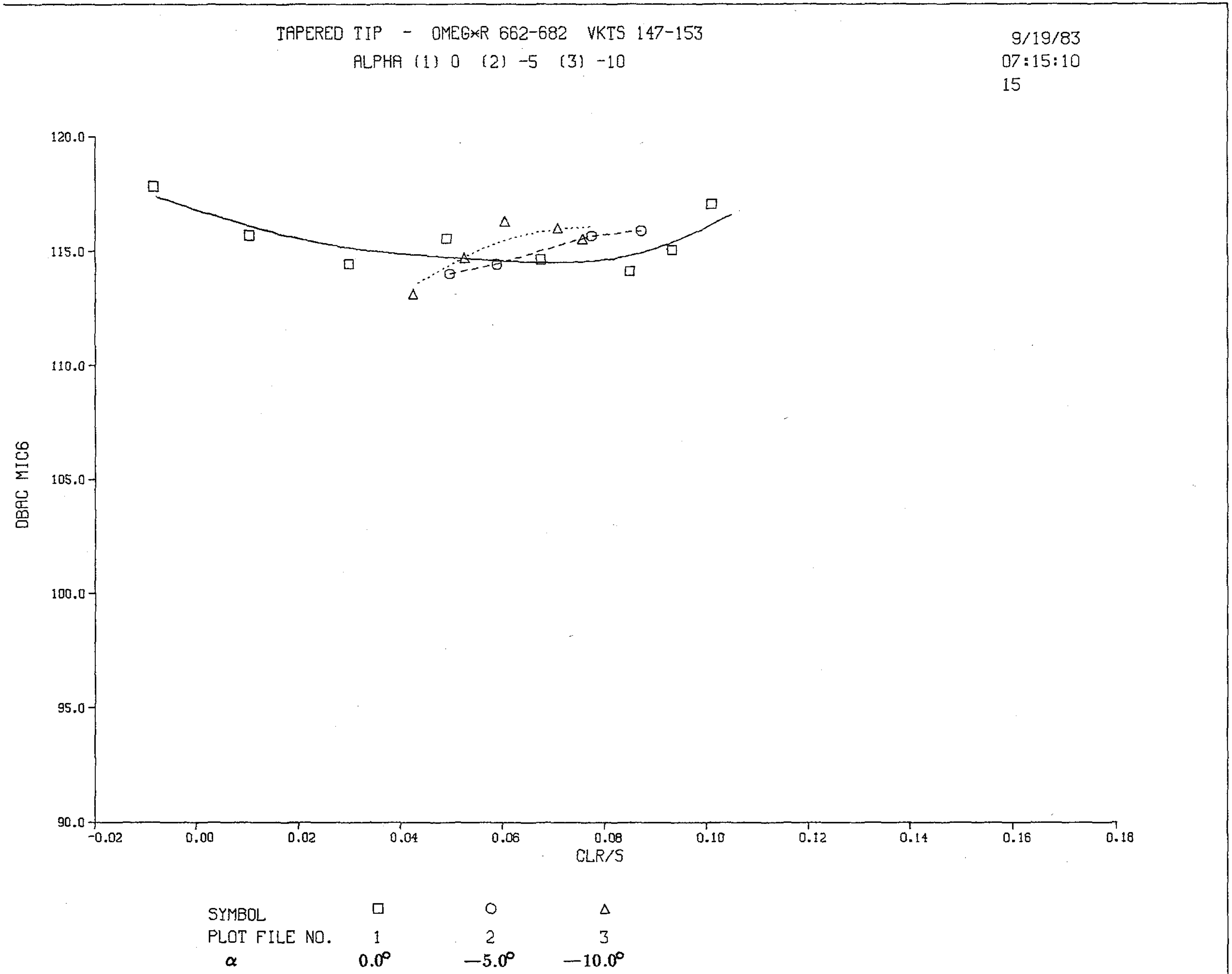


Figure F3(r). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Tapered Tip Rotor.

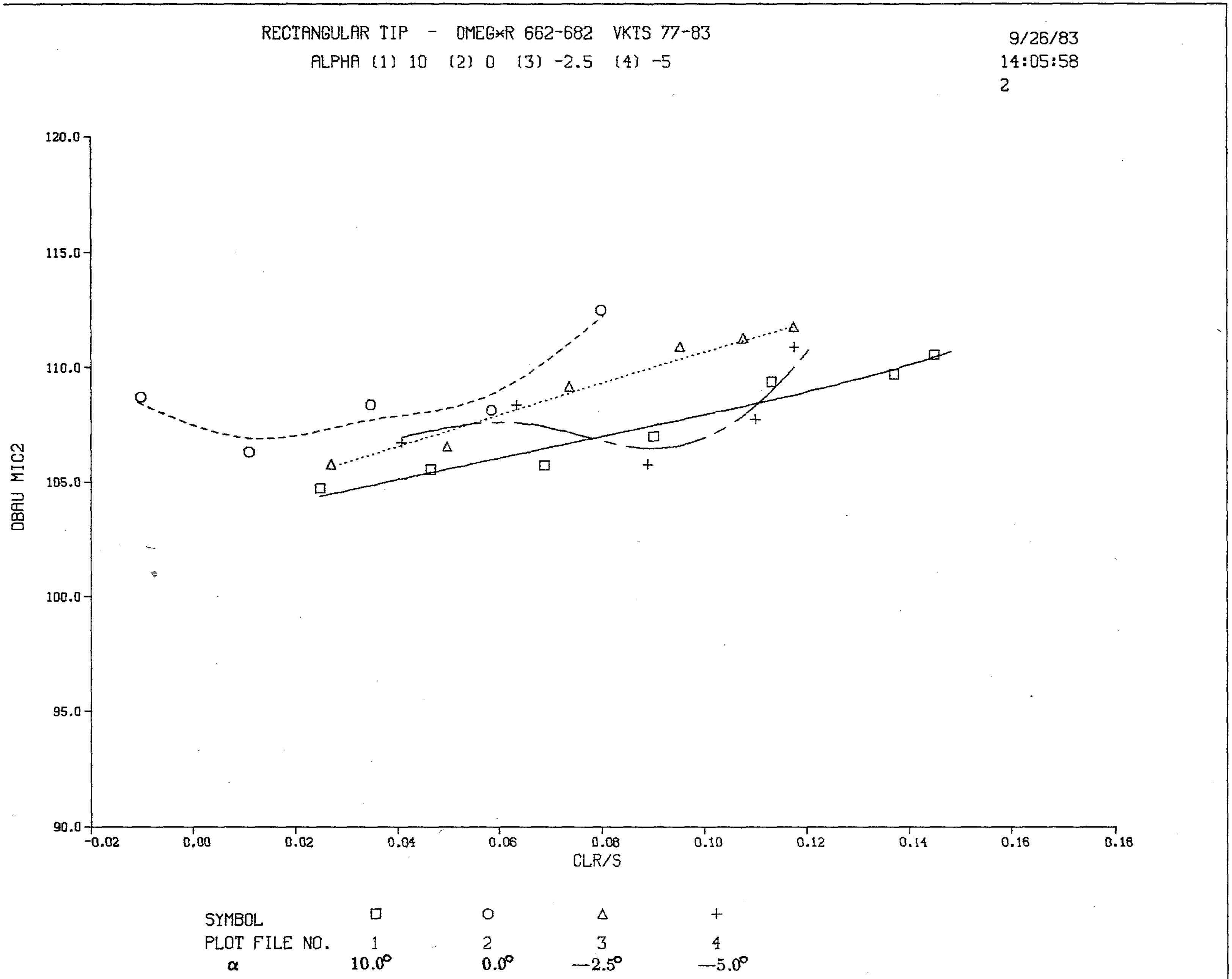


Figure F4(a). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Rectangular Tip Rotor.

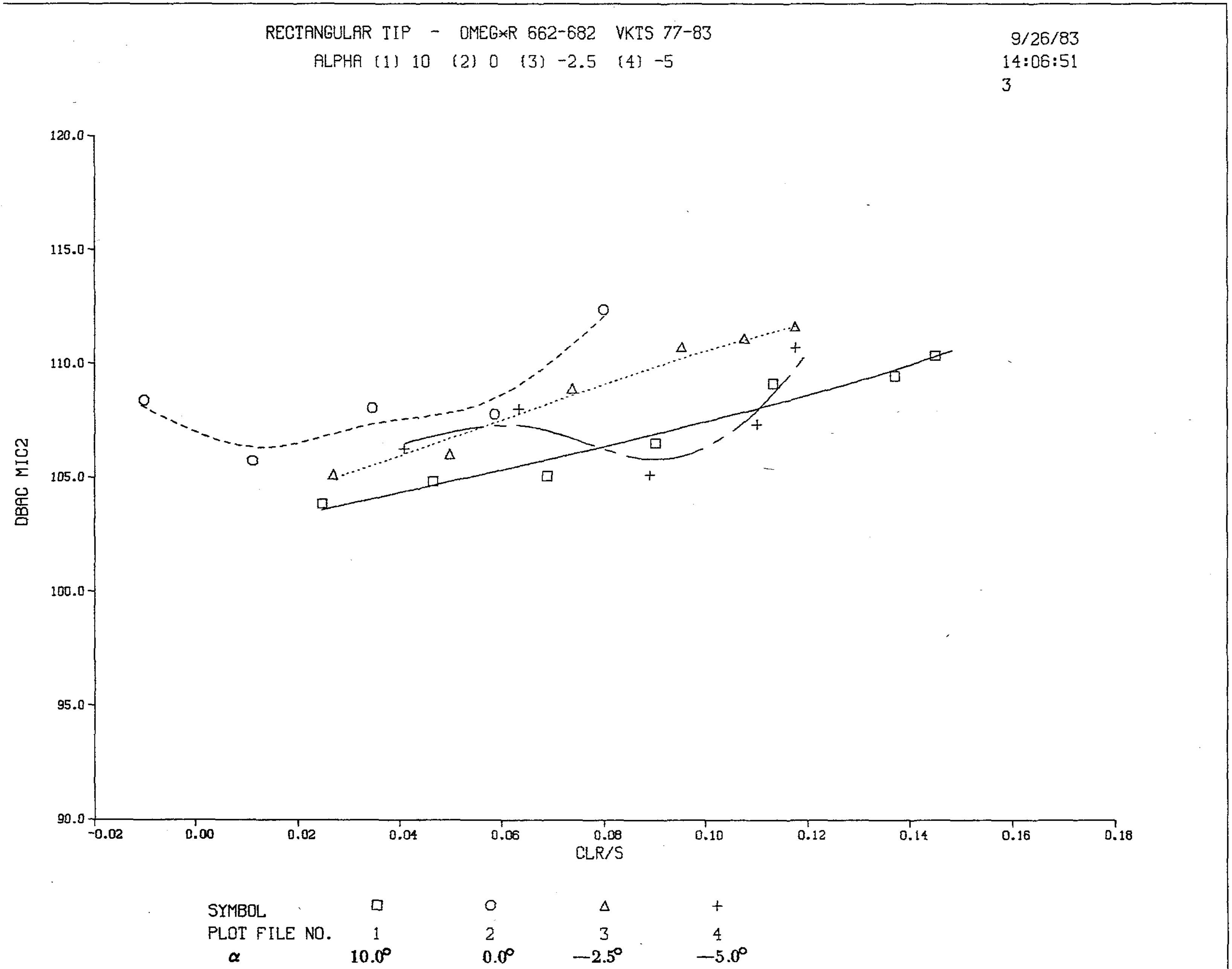


Figure F4(b). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Rectangular Tip Rotor.

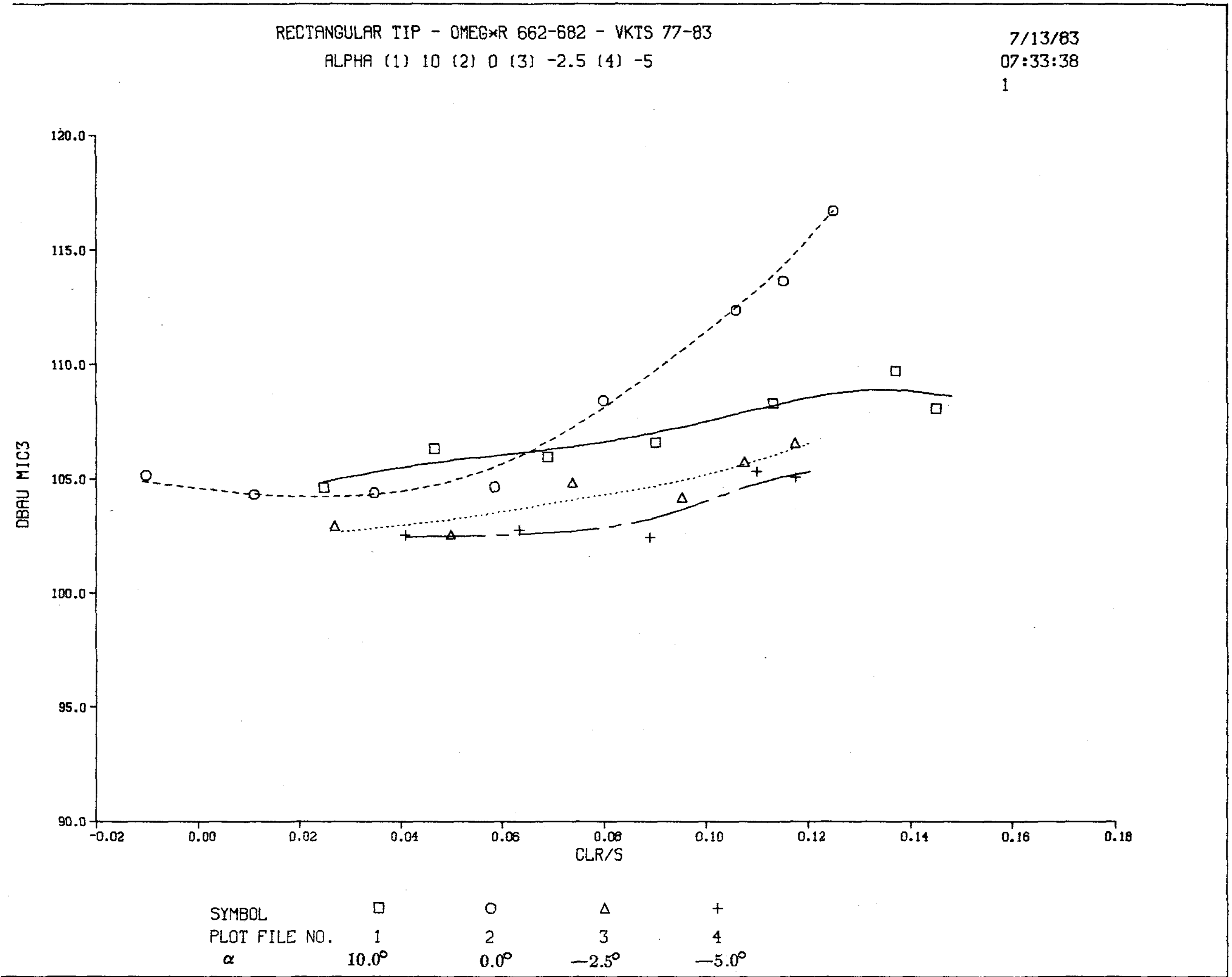


Figure F4(c). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Rectangular Tip Rotor.

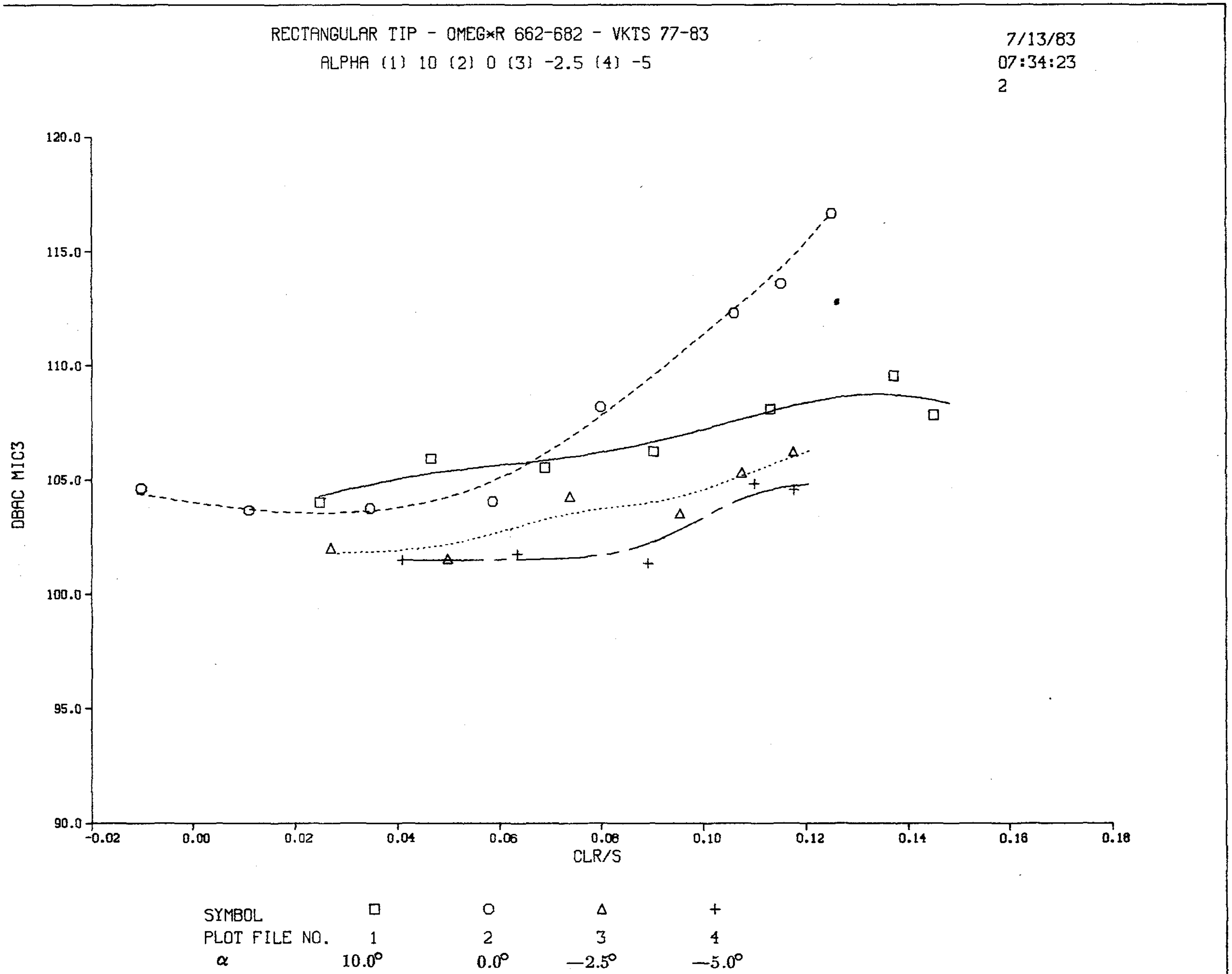


Figure F4(d). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Rectangular Tip Rotor.

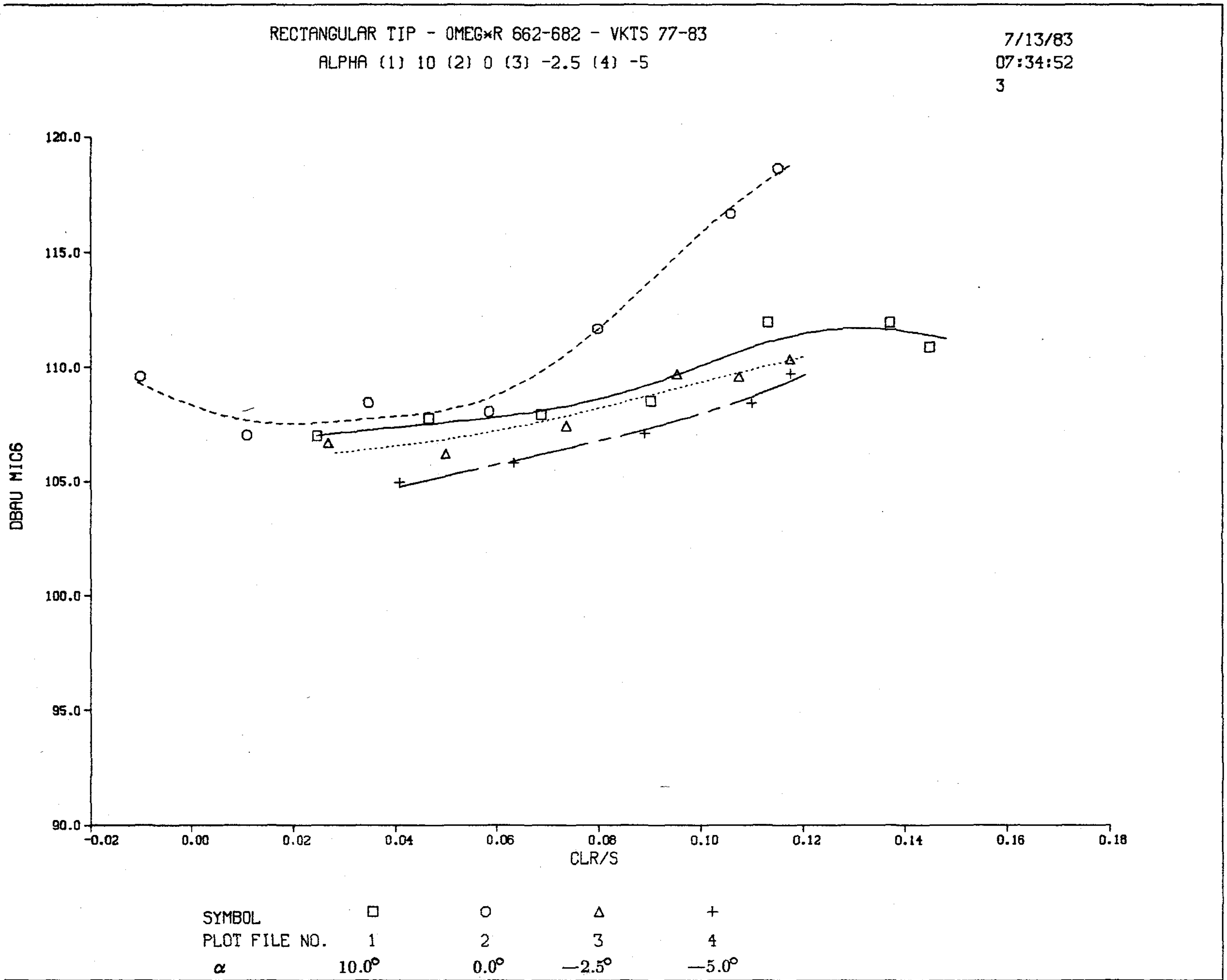


Figure F4(e). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Rectangular Tip Rotor.

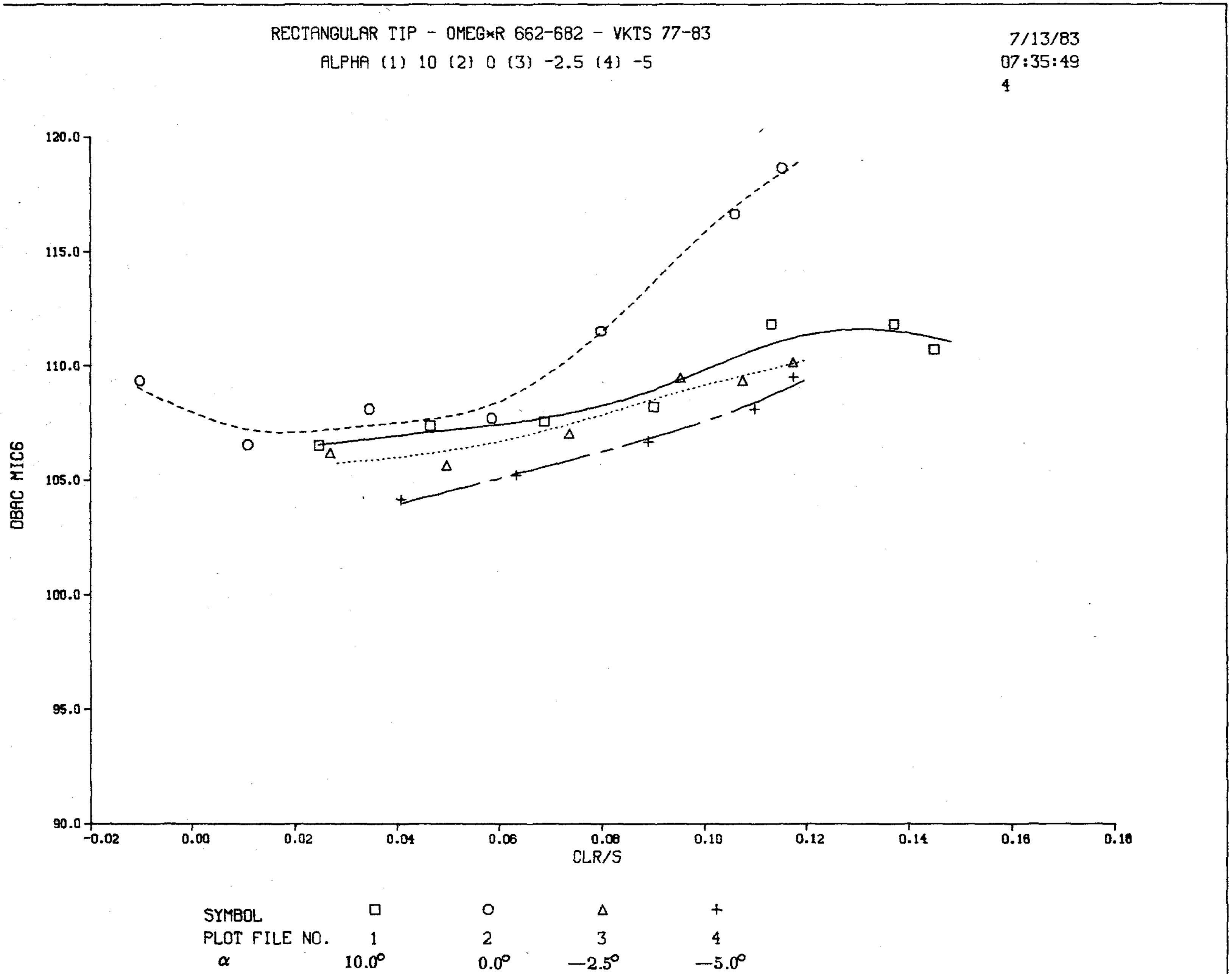


Figure F4(f). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Rectangular Tip Rotor.

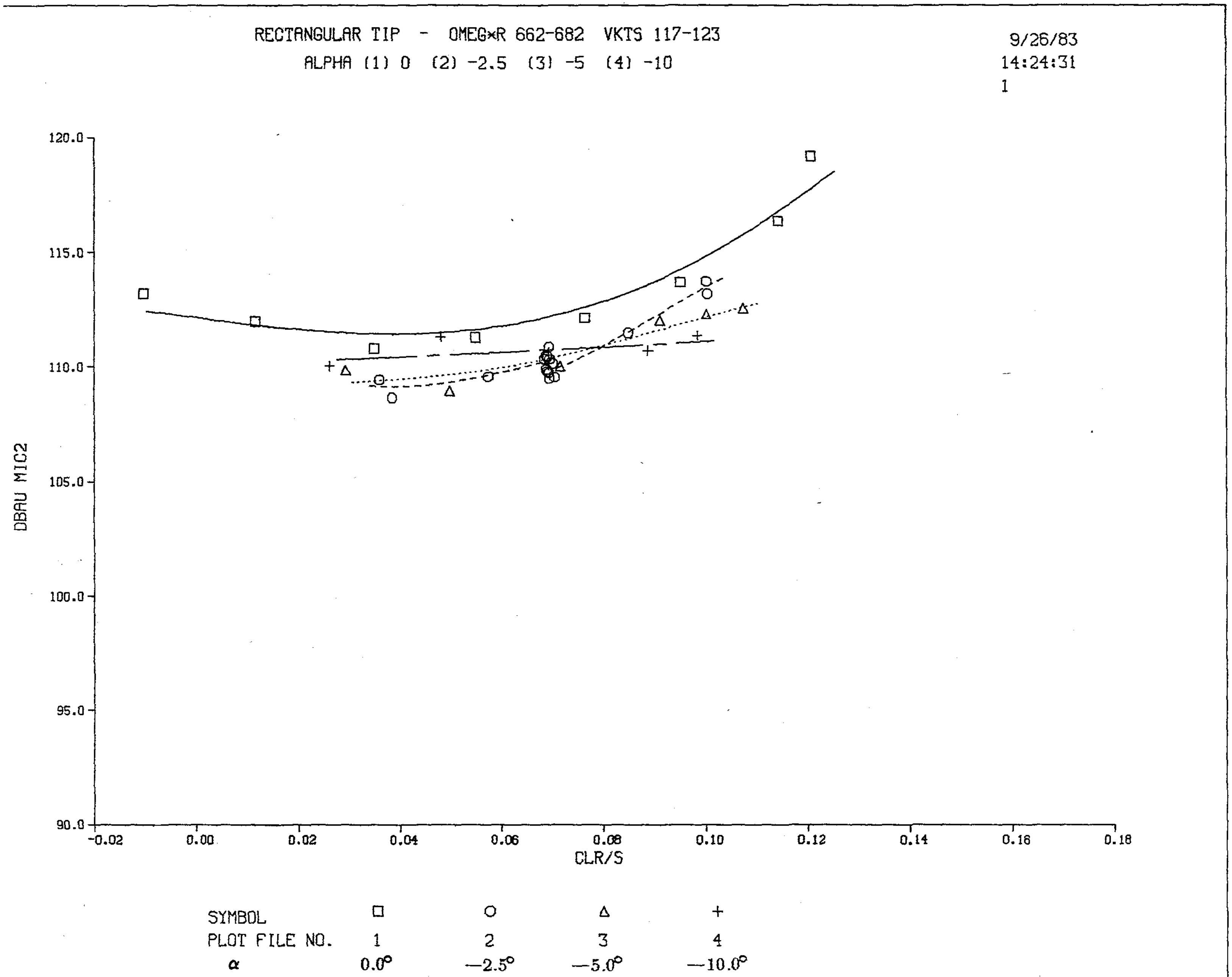


Figure F4(g). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Rectangular Tip Rotor.

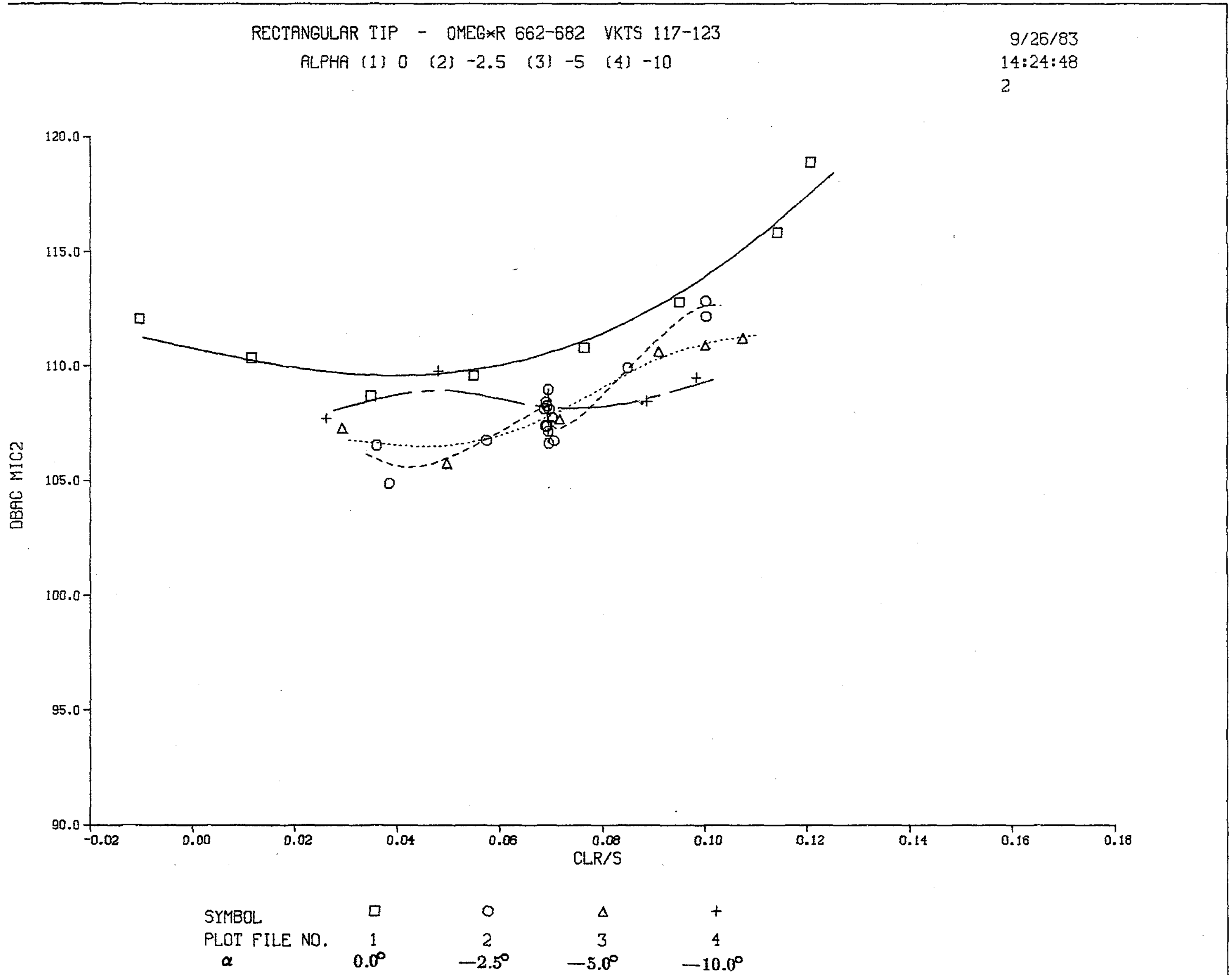


Figure F4(h). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Rectangular Tip Rotor.

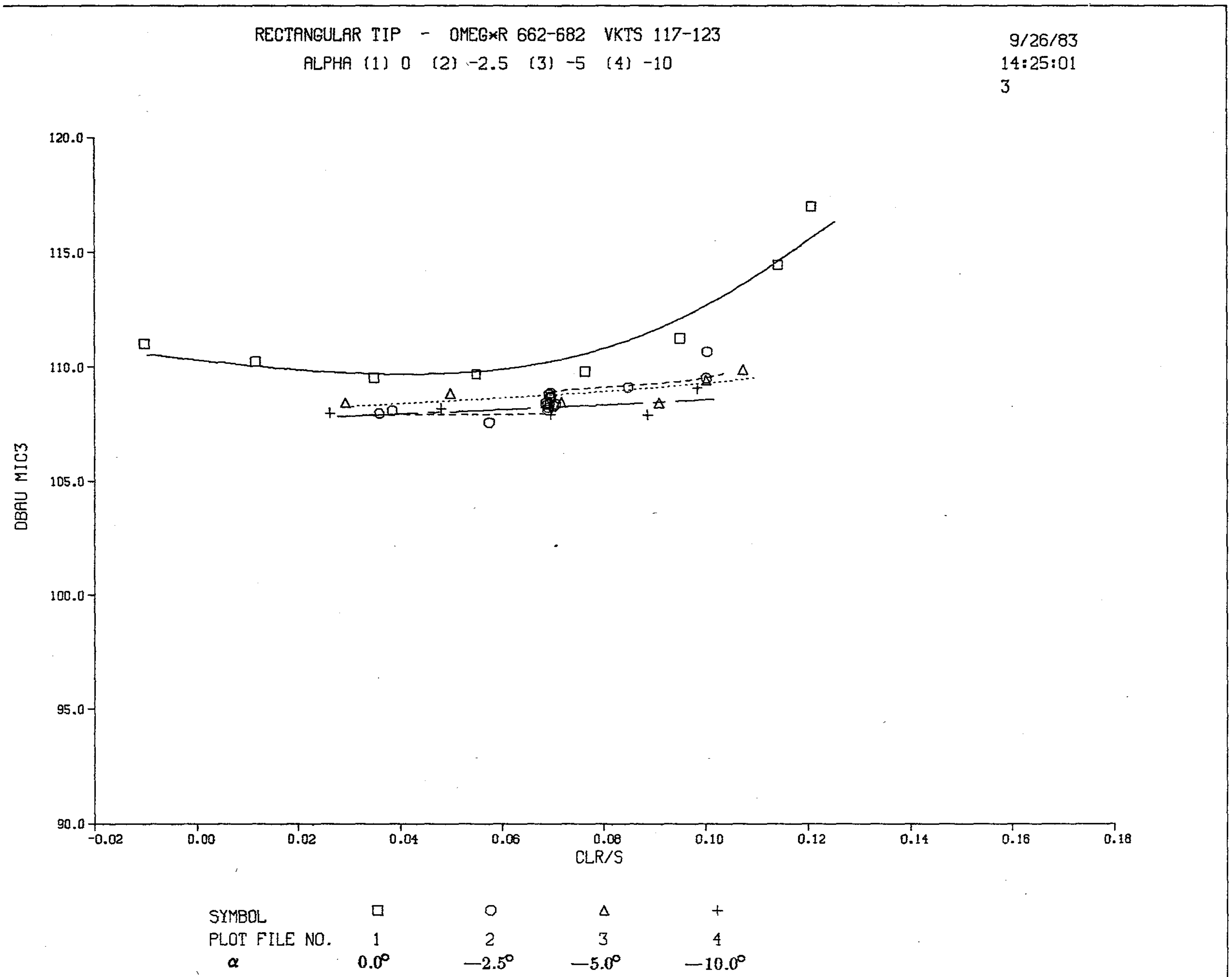


Figure F4(i). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Rectangular Tip Rotor.

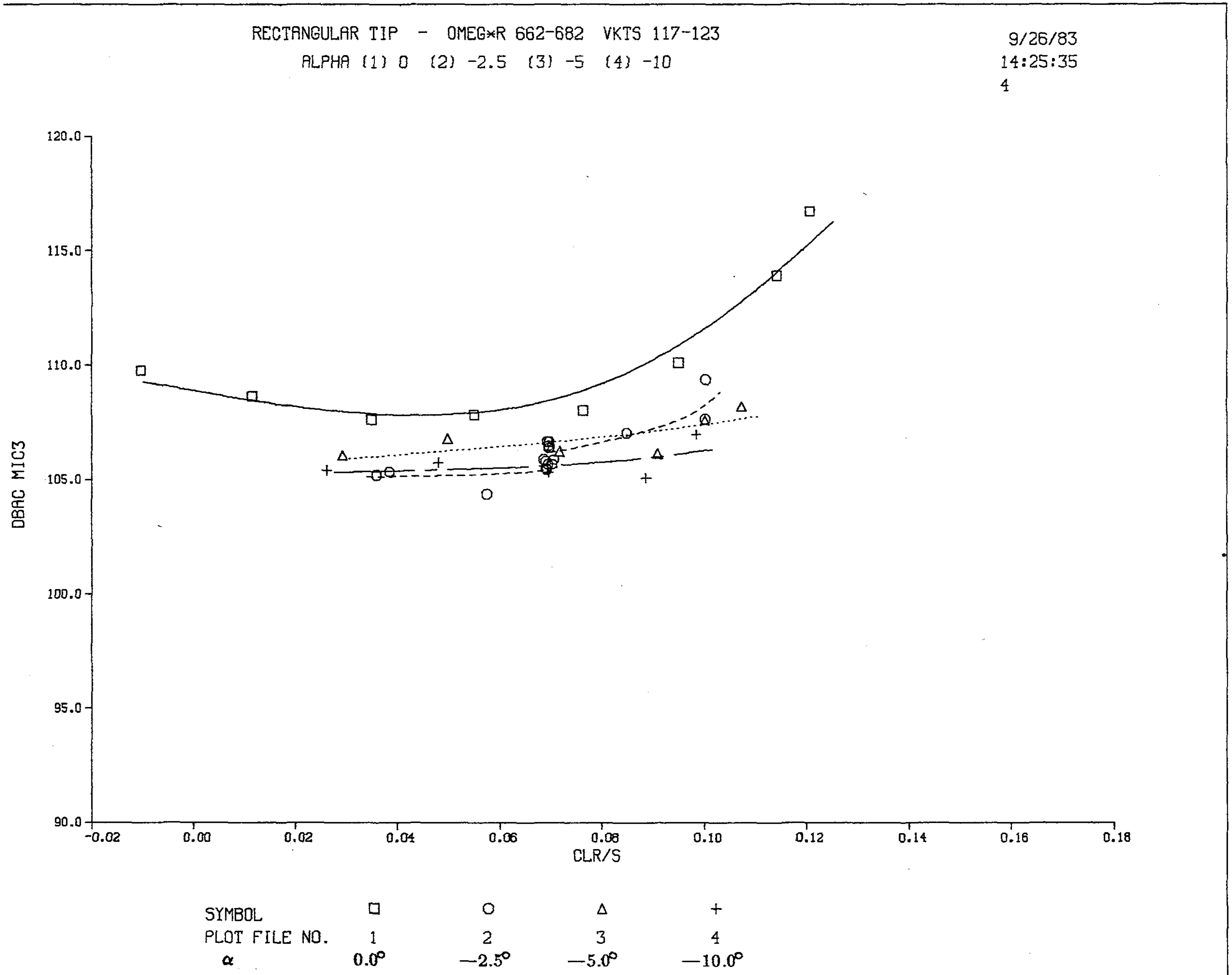


Figure F4(j). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Rectangular Tip Rotor.

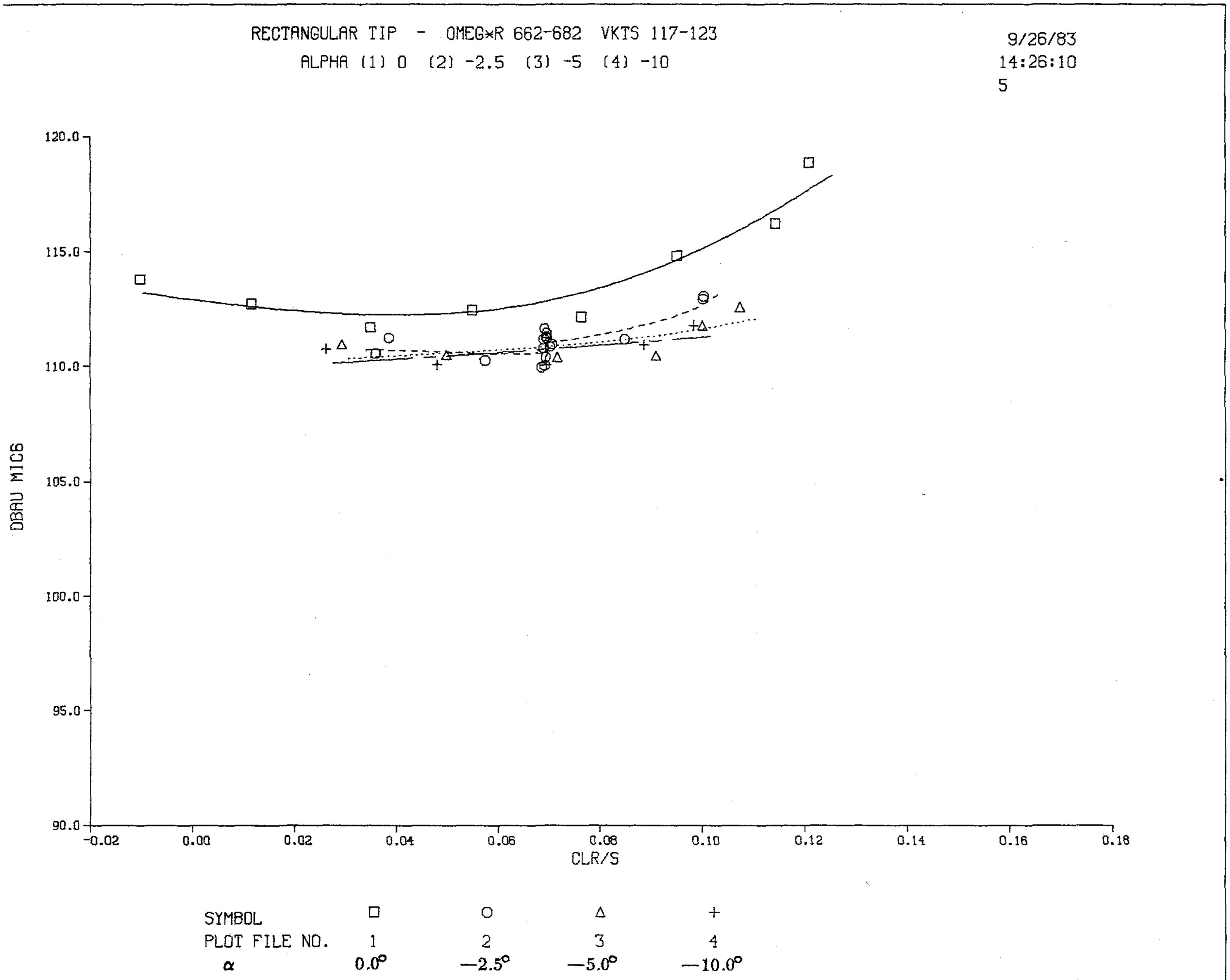


Figure F4(k). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Rectangular Tip Rotor.

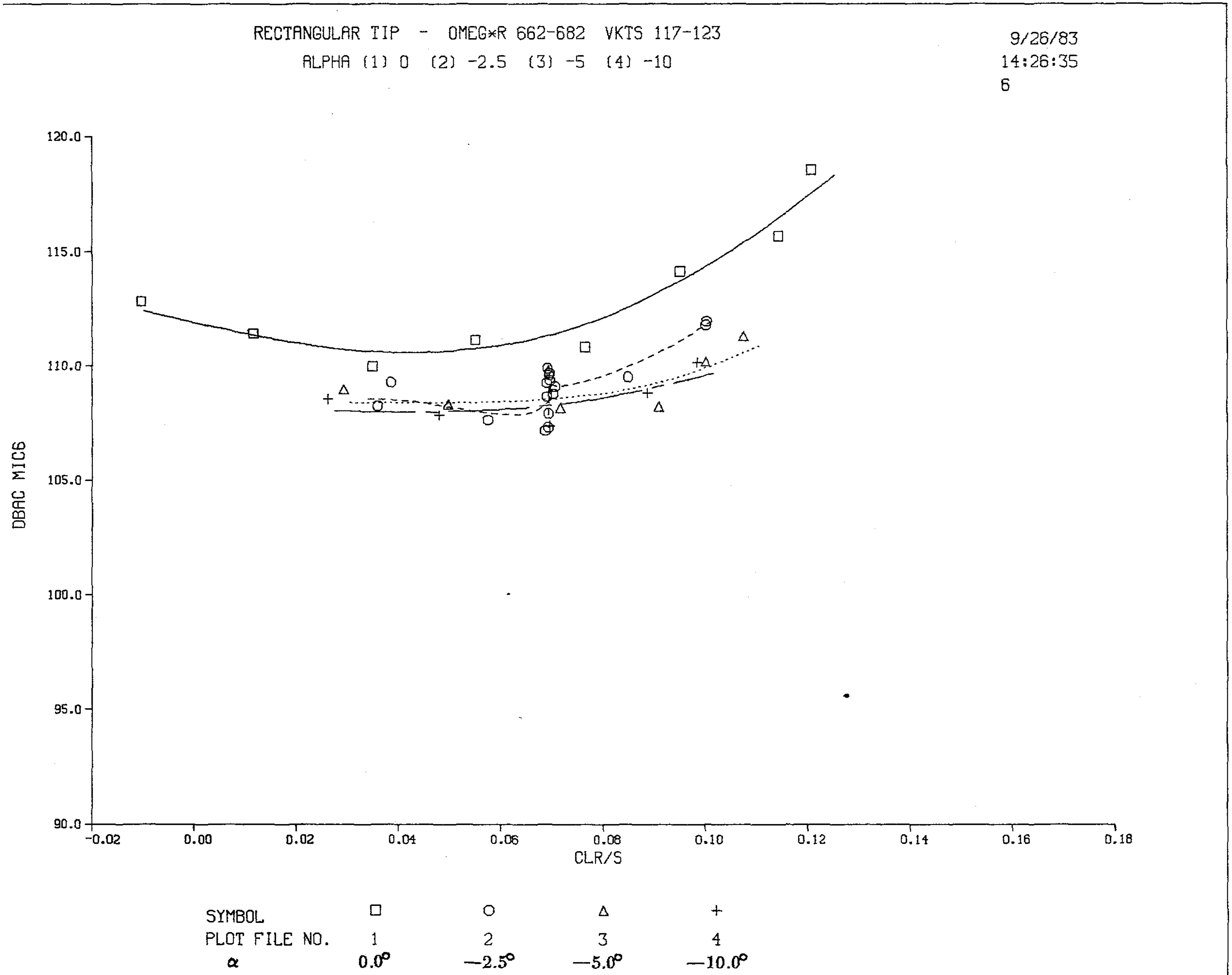


Figure F4(1). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Rectangular Tip Rotor.

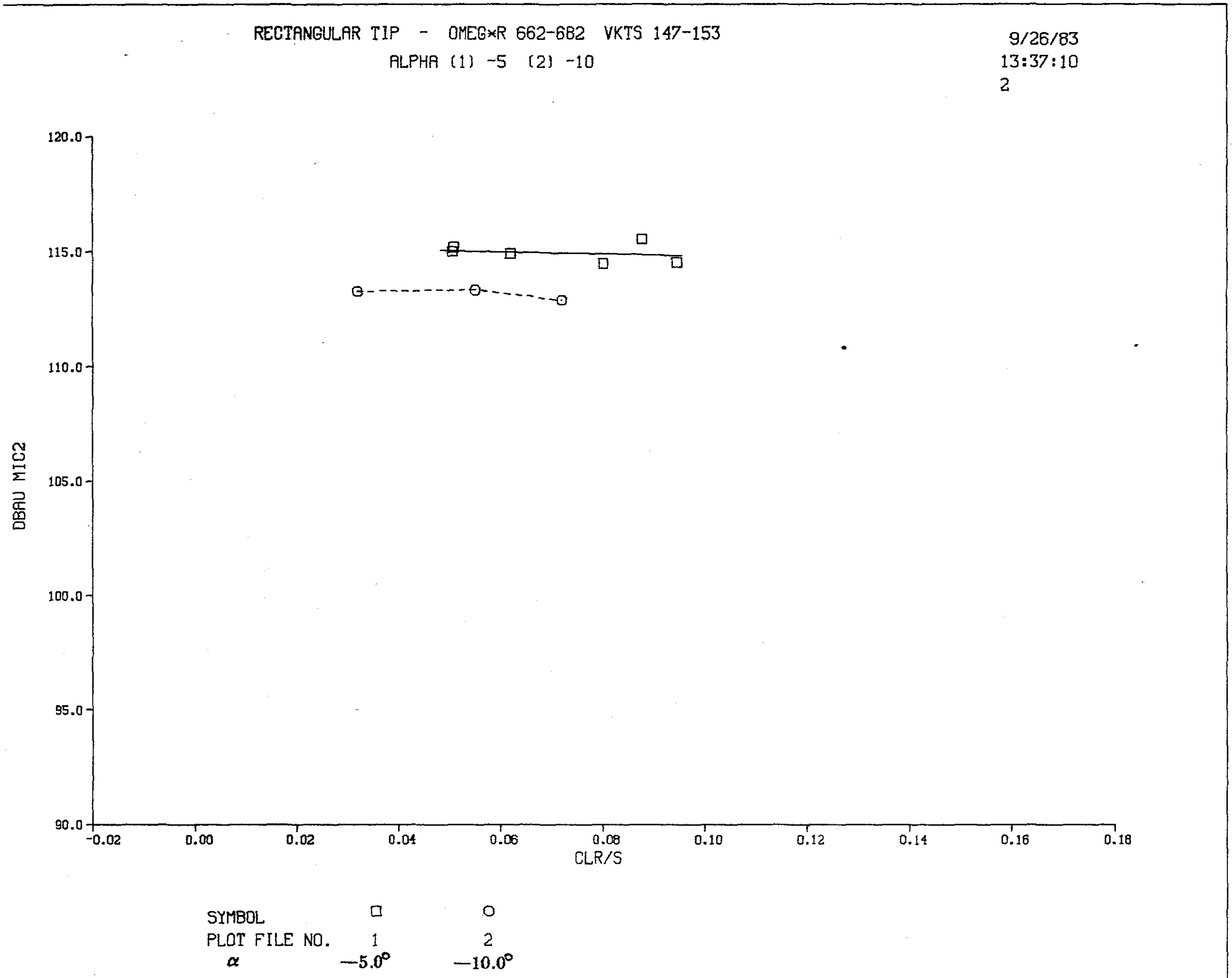


Figure F4(m). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Rectangular Tip Rotor.

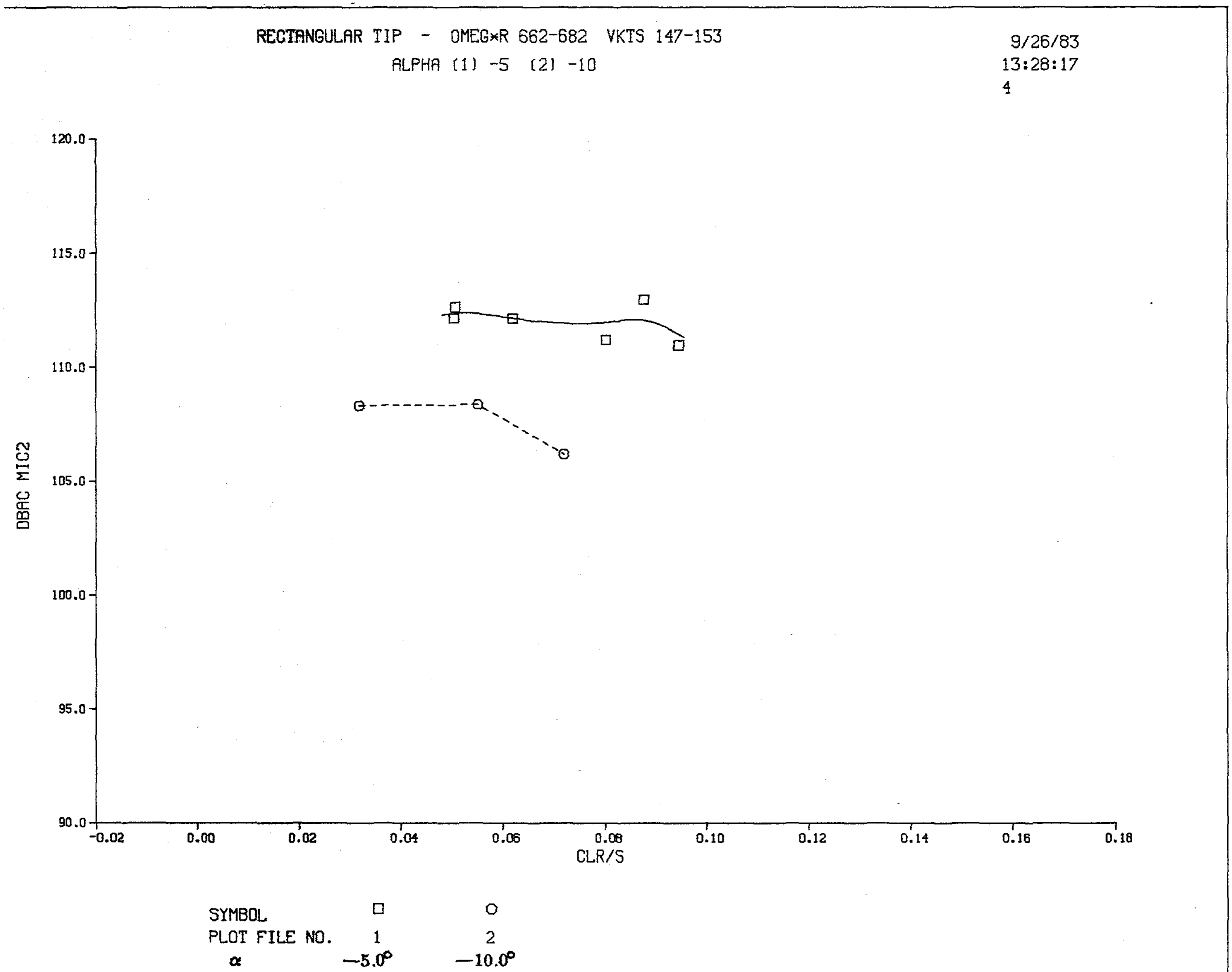


Figure F4(n). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Rectangular Tip Rotor.

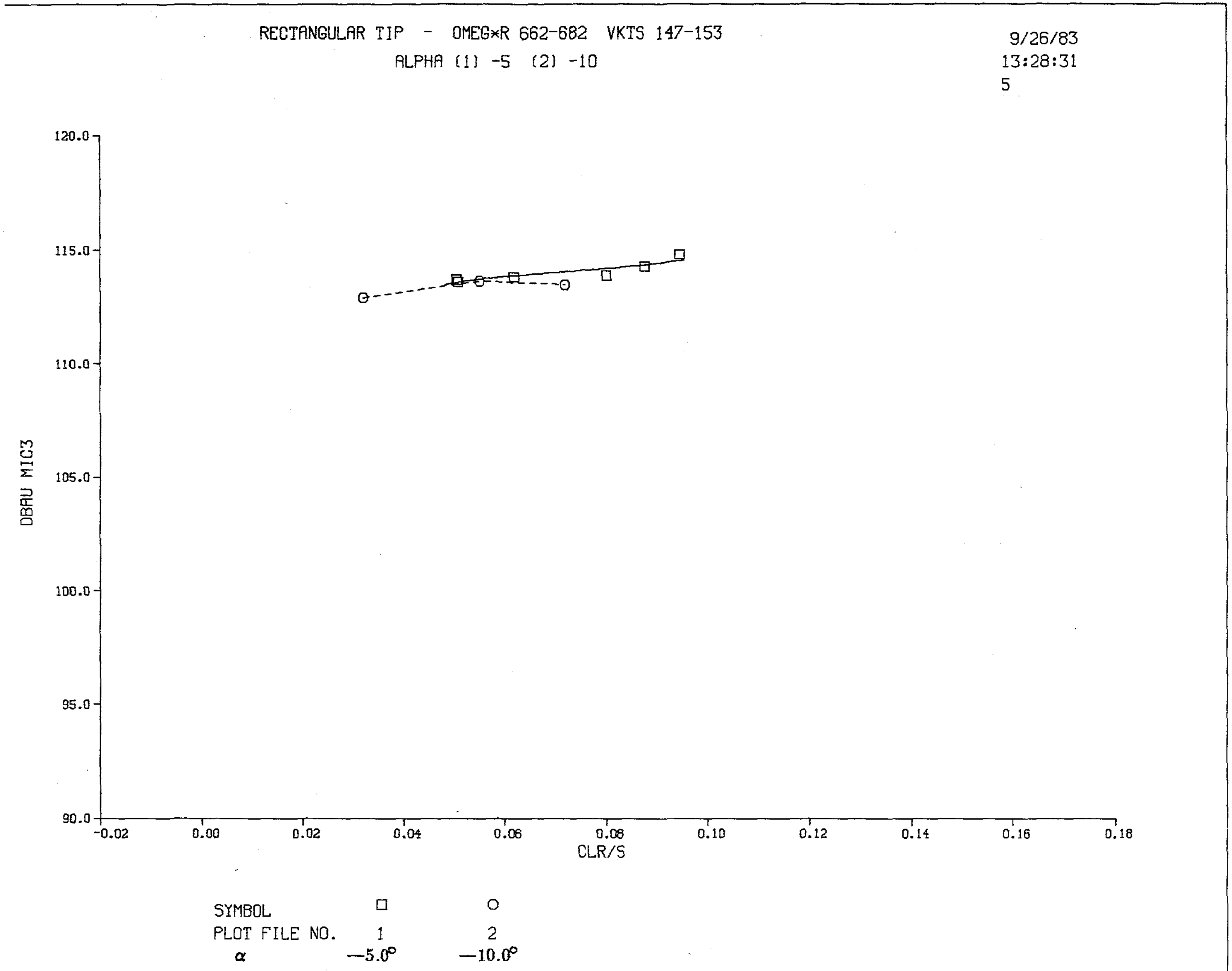


Figure F4(o). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Rectangular Tip Rotor.

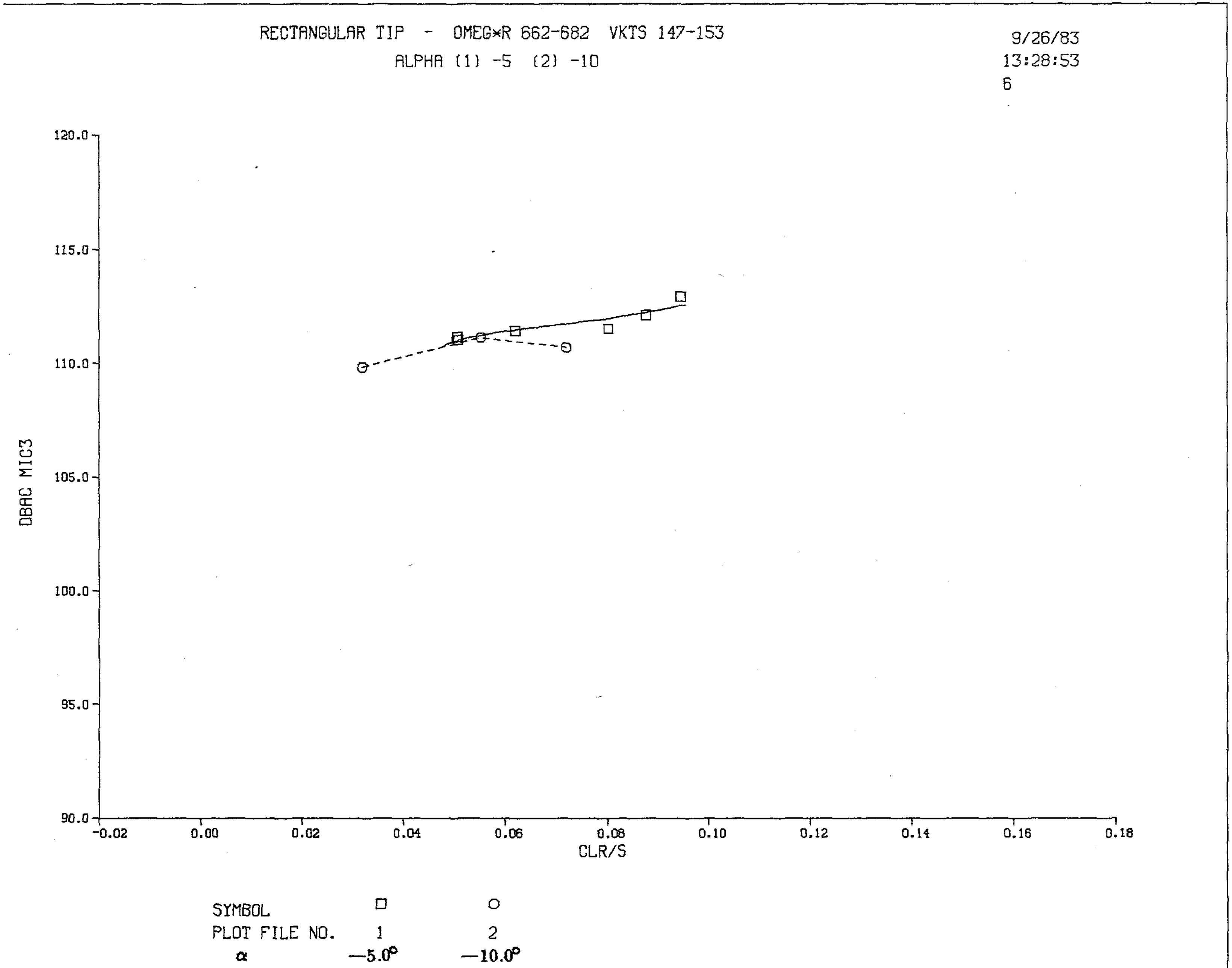


Figure F4(p). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Rectangular Tip Rotor.

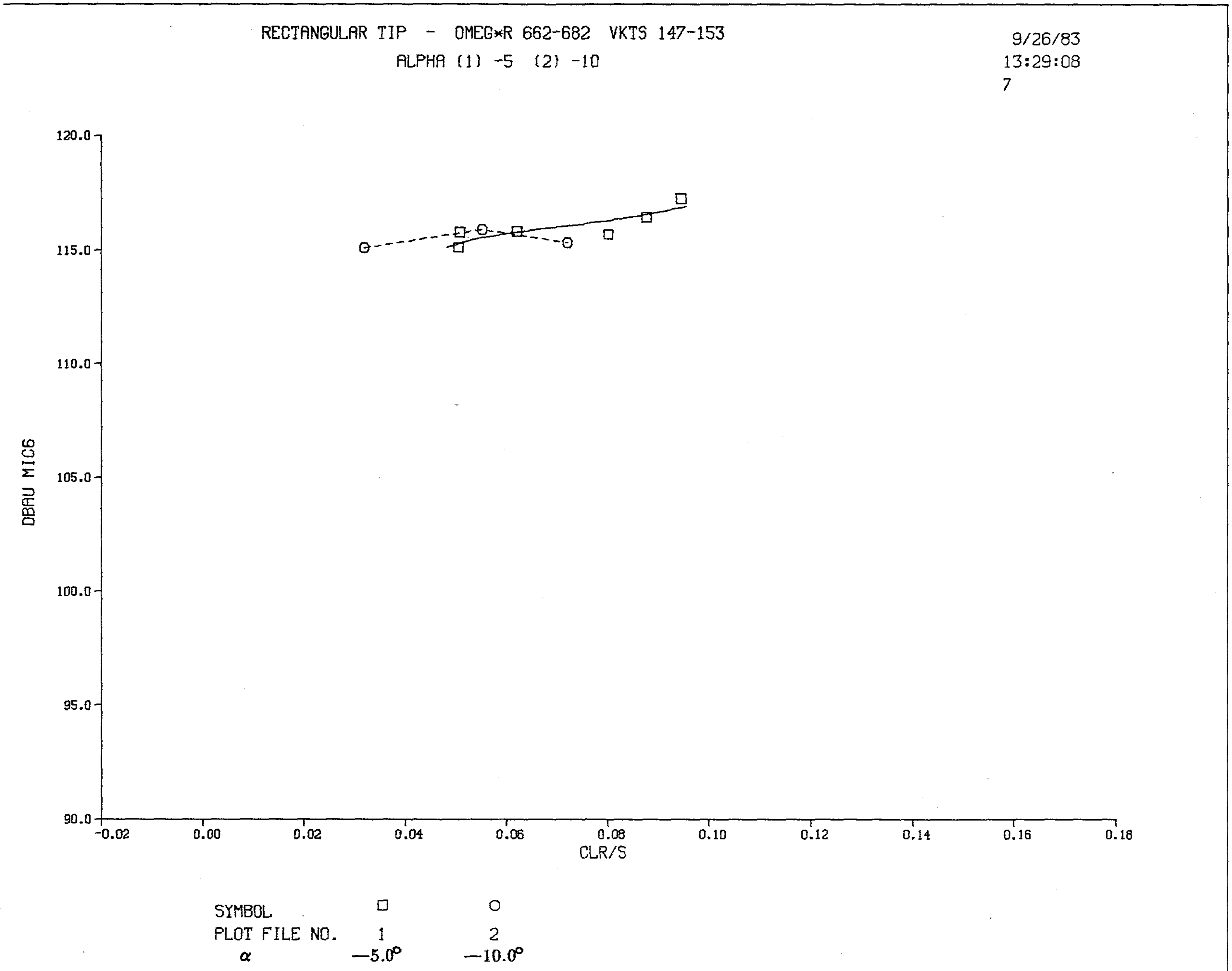


Figure F4(q). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Rectangular Tip Rotor.

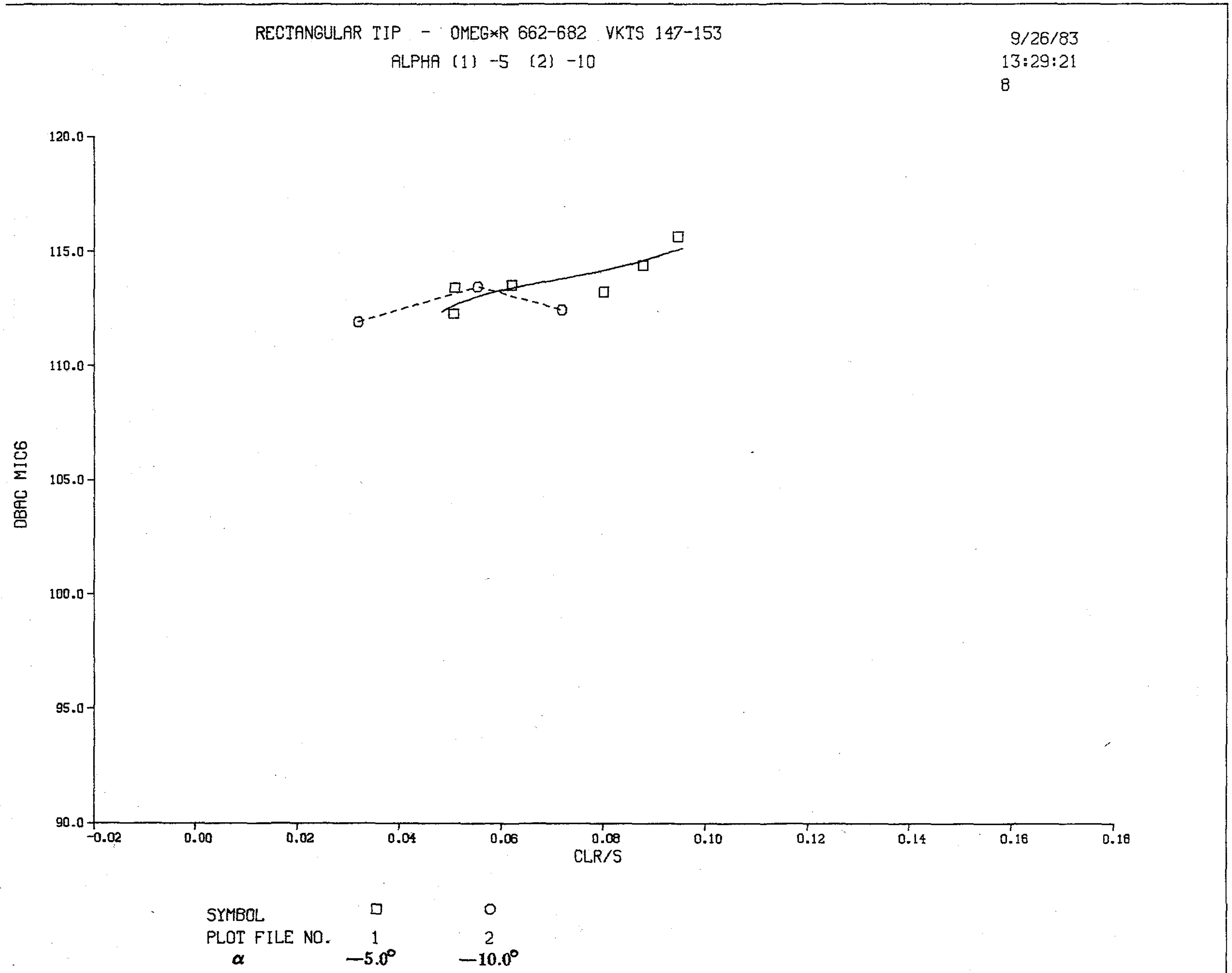


Figure F4(r). A-weighed Sound Pressure Level as a Function of Rotor Lift Coefficient for the Rectangular Tip Rotor.

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15. Supplementary Notes

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16. Abstract

A full-scale helicopter with four different blade-tip geometries was tested in the 40- by 80-Foot Wind Tunnel at Ames Research Center. Performance, loads, and noise were measured. The four tip shapes tested were rectangular, tapered, swept, and swept-tapered. This report presents noise measurements from that test in the form of tables and plots. The noise data include measurements of the sound pressure levels in dB, dBA, and tone-corrected PNdB, for all of the conditions tested. Also included are the detailed measurements, 1/3-octave spectra and time-histories for some selected data, and plots of dBA as function of test condition. Some performance measurements are included to aid interpretation of the noise data.

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