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NYPP Stability Analysis

With PA301 and PA302 Out of Service

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NYPP Stability Analysis
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1.0 - Executive Summary

1.1) Introduction

In the spring of 1995 NYPA will be performing maintenance on one of the two 345KV ties between New York and Ontario Hydro at Niagara(PA301 & PA302). The NY-OH interconnection at Niagara consists of these two 345 circuits and two 230 KV circuits (BP76 & PA27). Previous analysis conducted by NYPP, NY-OH and NPCC have indicated a potential for severe NYPP system response if all of the ties at Niagara are lost. This study examined the situation where both PA301 and PA302 are out of service (one planned, one forced) and the subsequent loss of both remaining 230KV ties.

1.2) Recommendations

It is the conclusion of this study that the oscillatory response of the NYPP system when separated from Ontario Hydro is a function of the net export from western New York and independent of both Central East and OH-NY interface flows. It is therefore recommended that:

1) A new interface be defined to monitor the net export from western New York (WNY Export). This interface would consist of the flows out of the west across Dysinger East, the NYPP-OH ties at Niagara and the three westernmost ties to PJM (#69, #171 & #37).

2) In the event that both PA301 and PA302 are out of service, it is required that the WNY Export be limited to:

   1100 MW when the generation rejection at Niagara is not armed.
   2300 MW when the four unit generation rejection system at Niagara is armed.

3) A special protection system should be considered at Niagara to reject four units in the event of loss of all the western NYPP ties to OH, under a wide range of network configurations. The present system, when it is armed, implements rejection solely for the loss of PA27.

4) In the event that both PA301 and PA302 are both out of service, it is recommended the stability limits on the NY-OH interface be revised to :

   800 MW from OH to NYPP.
   500 MW from NYPP to OH

2.) Discussion of Results

Analysis was conducted on system representations with both PA301 and PA302 out of service. The key contingency tested was a LLG fault on BP76 and PA27, which is referred to in this study as WC15. The study examined both peak load and off peak load levels in detail and examined a few scenarios under light load conditions. The NYPP peak load was approximately 27,000 MW, the off peak load was approximately 20,000 MW, and the light load was approximately 10,000 MW. The Lewiston pumped storage hydro plant adjacent to Niagara was modeled as a generator in the peak load case, it was out of service in the off peak analysis, and it was modeled as pumping in the light load case.

In the course of this study it was noted that NYPP system response was essentially independent of OH-NYPP and Central East flows, yet closely related to the export levels from western New York. A new closed interface consisting of the summation of the line flows across Dysinger East, the NY-OH flows west at Niagara, and the flows south on the three westernmost ties to PJM. For the purposes of this study, the quantity western New York export (WNY Export) is defined to be the net export from this generation pocket.

Without generation rejection triggered for the loss of all the NY-OH ties at Niagara, it is necessary to maintain WNY Export at or below 1100 MW. This value represents a 200 MW margin applied to the highest export level which exhibited damping.

Generation rejection at Niagara triggered by the loss of the NY-OH ties at Niagara is more effective in producing a damped system response then the equivilent precontingency reduction in WNY Export. NYPA has the capability to reject up to four units with a combined output of 700 MW for the loss of PA27. For all conditions evaluated in this study, four unit rejection is sufficient to support WNY export level of 2300 MW. Generation rejection is not available for all potentail combinations of NY-OH tie line configuations at Niagara. As presently configured, the generation rejection is only triggered by the loss of PA27. If PA27 is out of service, the capability for generation rejection is unavailable.

2.1 Interface Definitions

The lines comprising the Central East, Dysinger East, NY-OH and Western Export interfaces are shown in the tables below. The definitions below are the operating definitions and reflect the on line metering. All discussions and recommendations in this report employ the operating definitions, and reflect actual monitored quantities.

Table 2
Central East Definition

Name	Line ID	Voltage (KV)
*Plattsburgh - Sandbar	PV-20	115
Edic - *New Scotland	14	345
Marcy - * New Scotland	18	345
Porter - *Rotterdam (2 ckts)	30 & 31	230
Inghams Bus Tie		115
E. Springfld - * Inghams	7	115

Table 3
NY-OH Definition

Name	Line ID	Voltage (KV)
*Niagara - Beck A	PA301	345
*Niagara - Beck B	PA302	345
*Niagara - Beck	PA27	230
*Packard - Beck	BP76	230
*Moses - St Lawrence	L33	230
*Moses - St Lawrence	L34	230

Table 4
Dysinger East Definition

Name	Line ID	Voltage (KV)
*Kintegh - Sta. 80	SR1	345
Niagara - *Sta. 80	NR2	345
*Stolle - Meyer	67	230
*Andover - Palmitier (n-o)	932	115
*Lockport - Sweden	111	115
*Lockport - Sweden	113	115
*Lockport - Telegraph	114	115
*Lockport - Arkron 1	107	115
*Lockport - Arkron 2	108	115
*Lockport - Oakfield	112	115

Table 5
Western NY Export Definition

Name			Line ID	Voltage (KV)
*Niagara	-	Beck A	PA301	345
*Niagara	-	Beck B	PA302	345
*Niagara	-	Beck	PA27	230
*Packard	-	Beck	BP76	230
*Kintegh	-	Sta. 80	SR1	345
Niagara	-	*Sta. 80	NR2	345
*Stolle	-	Meyer	67	230
*Andover	-	Palmitier (n-o)	932	115
*Lockport	-	Sweden	111	115
*Lockport	-	Sweden	113	115
*Lockport	-	Telegraph	114	115
*Lockport	-	Arkron 1	107	115
*Lockport	-	Arkron 2	108	115
*Lockport	-	Oakfield	112	115
*S.Ripley	-	Erie S.	69	230
Falconer	-	*Warren	171	115
Stolle	-	Homer City	37	345

2.2 Study Case Development

Three base cases were employed in this analysis representing peak load, off peak load and light load conditions.

The peak load model utilized the 1994/995 NYPP Operations dynamic model which has been most recently used in NYPP Central East and Total East stability analysis. The NYPP representation was developed from the 1994 NYPP Summer Operating Study base case. The system representation outside of NYPP was obtained from the 1993 Summer peak base case developed by NPCC SS-37. Updates to the areas outside of New York were made consistent with the ongoing NY/OH/HQ Beau Tie study. Updates within NYPP were supplied by NMPC and NYSEG. NMPC updates were confined to underlying system adjustments in western New York and dynamic modeling adjustments on some small hydro and NUG units. NYSEG adjustments involved finalized data for the Saranac Energy NUG. The NYPP system load in this case is approximately 27,000 MW.

The off peak representation was developed from the 1992 MEN Off Peak Dynamics base case. This represents the only off-peak dynamics base case available which has been employed and reviewed by the represented utilities outside of NPCC. The base 1992 representation has been upgraded in Ontario, NYPP and the Chateauguay/Beauharnois areas. The NYPP representation is a renumbered version of the peak system with loads scaled to 75% peak, and generation redispatched accordingly. The NYPP system load in this case is approximately 20,000 MW.

The light load case was developed out of NPCC COSS-2. It is the result of an interregional effort to develop a dynamics case for an extreme light load condition. It was developed from actual system conditions at 6AM on the Sunday of Memorial Day weekend 1993. The case was constructed on the basis of the 1992 MEN/DSG system model with representations supplied by the participating utilities. The NYPP system load in this case is approximately 10,000 MW.

The three cases were developed from different sources at different times. Each has its own company and bus numbering convention. There is a one-to-one correlation in the NYPP system between the peak and off peak system. Aside from that, the system representations can be categorized as similar and equivalent.

Transfer cases were developed the detailed base case representation by exchanging Ontario and Michigan generation against Cleveland and PJM. In this manner it was possible to adjust both OH-NY flows and WNY Export export while maintaining constant Central East and Moses South conditions. Transcriptions, and summaries can be found in Appendices C, D and E.

2.3 Static Load Models for Dynamic Simulations.

The load models employed in this study are shown in Table 3.

Table 3
Static Load Models for Dynamic Simulation

Load model		Real Power		Reactive Power	
		Constant Current	Constant Impedance	Constant Current	Constant Impedance
REGION	AREA	(%)	(%)	(%)	(%)
NPCC	NEPOOL	0	100	0	100
	NYPP	0	100	0	100
	ONTARIO	50	50	0	100
	QUEBEC	100	0	0	100
	N BRUNS.	100	0	0	100
	N.Scotia	50	50	0	100
MAAC		100	0	0	100
ECAR		100	0	0	100

Constant Current - Power varies directly with voltage.
Constant Impedance - Power varies directly with the square of the voltage magnitude

2.4) Sensitivity Testing

It has been noted in previous testing conducted by NYPP, NYPA, NY-OH and NPCC studies that the NYPP system exhibits a undamped system response under a wide range of load levels and dispatch conditions, when all the ties between NYPP and OH at Niagara are opened. Combinations of restrictions on Central East and NY-OH interface flows in conjunction with assorted levels of generation rejection at Niagara have been shown to improve the level of damping exhibited by the NYPP system for the loss of all of the Niagara ties. The purpose of this study was to identify the most effective measures to attain sufficient system damping for this contingency.

2.4a Central East

Central East is the prime stability limited interface on the NYPP system. The dynamic performance of Central East has been shown to be closely tied to the number of units in service in the Oswego Complex, the status of the HVDC interconnection to Hydro Quebec at Chateauguay, the status of non-utility generators at Sithe, the status of the SVC installations at Fraser and Leeds, as well as the status of lines in Central New York. For the purposes of this study all cases assumed:

a) Three utility units in service in the Oswego Complex
b) Both Fraser and Leeds SVCs in service
c) 1200 MW all AC imports from HQ (HVDC O/S)
e) Six Sithe units in service

Central East flows were varied from 1850 to 3100 MW in an assortment of cases to determine the impact of CE flow on system damping. Sensitivities to the dispatch the Sithe were briefly examined and are discussed in section 2.4e below.

2.4b NY-OH

New York is interconnected with Ontario Hydro with four ties at Niagara (2-230 KV, 2-345 KV), and two 230 KV ties in northern New York at Moses. Since the critical contingency is loss of all the ties at Niagara, it is was prudent to examine the effect of the precontingency flow condition on NYPP system response. Flows were examined for the range of OH-NY flows from 1000 MW into New York to 700 MW into Ontario.

2.4c WNY Export

In the course of this study it became apparent that the system response could be dramatically improved by restricting the level of generation in western New York. A new interface was defined to quantify the level of net export from western New York. This closed interface consists of Dysinger East, the NY-OH ties at Niagara, and the three western

most ties to Pennsylvania. This pocket also includes the generating plants at Niagara/Lewiston, Huntley, Dunkirk and Kintegh, as well as distributed NMPC small hydro stations, approximately 550 MW of NUGs contracted to NMPC, and approximately 150 MW of NUGs contracted to NYSEG.

The system response was examined under various levels of export from this generation pocket from 1200 MW to 2800 MW. Since the generation area is closed, the quantity WNY Export is independent of NY-OH transfers.

2.4c Impact of Niagara Generation Rejection

Previous analysis examined the potential for rejection of generation at both the Niagara hydro project and the adjacent Lewiston pumped storage facility. In this analysis, NYPA has indicated that only Niagara generation rejection (up to four 175MW units) is feasible.

This study examined both three and four unit rejection.

2.4e Sithe

The installation and operation of the Sithe NUG (1080 MW) in the Oswego Complex has been shown to have an impact on the stability performance of Central East . System performance was examined briefly both with and without Sithe in service.

3.0 - Results of Stability Testing

A list of all the conditions studied can be found in Section 6.0. A quick view summary of all simulations conducted can be found in Appendix A&B. Appendix A&B contain only Edic voltage, Nine Mile 2 angle and Fraser SVC output response plots. A summary of the load flows examined can be found in Appendix C&D. The complete dynamics plots are contained in Appendix F supplied on request.

This study commenced with the intent to identify levels of NY-OH and/or Central East transfers which could withstand the loss of all the NY-OH ties at Niagara for a system condition with PA301 and PA302 out of service(WC15). In the course of the study it was observed that NYPP dynamic response is completely independent of NY-OH flows and primarily independent of Central East. It was possible to generate damped system responses over a wide range of operating conditions by restricting generation in western NYPP to test levels of WNY Export of 1300MW, and/or employing generation rejection at Niagara.

3.1 Central East

Initial simulations attempted to determine a level of CE which could sustain the loss of the NY-OH ties at Niagara without employing generation rejection. It was expected that such a level could be found since the oscillatory response of the NYPP system was assumed to be directly related to CE flow. Beginning with the off peak case, CE flows were reduced from 3100 to 1850MW before significant damping was observed. In the peak case it was necessary to reduce CE from 3100 to 2400 MW before any damping was observed. While these results were initially assumed to indicate a strong correlation between damping for the WC15 contingency and CE flow, this assumption was later found to be incorrect.

The increase in damping observed as Central East was reduced is not directly related to Central East flow. It is directly related to the means employed to reduce Central East, that is, reduction in WNY Export. The case which appeared to be damped at low levels of CE flow can be made undamped for the same level of Central East by increasing western New York generation. Exhibit 1 indicates the difference in system response for low CE/high WNY Export, low CE/low WNY Export and high CE/low WNY Export.

As long as WNY Export is held below 1300 MW, varying Central East flow range from 1850 to 3100 MW resulted in no significant change in the damping of the NYPP system response to WC15. Exhibit 2 shows the result of varying CE between 2600 and 2200 MW while maintaining a constant 1770 MW western generation export, with OH-NY held constant at -650 MW. Stressing the NYPP system, as reflected in stressing Central East, results in increasing the magnitude of observed parameter swings but does not significantly effect system damping.

3.2 OH-NY

Similar to the Central East analysis, initial simulations attempted to determine a level of OH-NY tie flow which could sustain loss of the NY-OH ties at Niagara without employing generation rejection. It was expected that such a level could be found since the oscillatory response of the NYPP system was assumed to be directly related to OH-NY flow. Beginning with the off peak case, OH-NY flows were varied from 1000 MW into New York to 800 MW into Ontario with no significant change in damping. These tests were then repeated on the peak case. Examples of NYPP response over a range of OH-NY flows can be found in Exhibit 3.

Transfers between OH and NYPP primarily modeled across the Niagara ties. The phase shifers at St. Lawrence (L33 &L34) were maintained at zero for all cases except for transfers toward New York at 800 MW or above. Previous studies have indicated that flows on the St. Lawrence ties have no effect on the oscillatory NYPP system response to loss ot the Niagara ties.

OH-NY flow is not directly related to the NYPP system response to loss of the OH- NY ties at Niagara.

3.3 Western Export

In the course of this study it was observed that a if WNY Export is allowed to operate at maximum, the system response to WC15 was undamped under all flow conditions. Examples of this can be found in Exhibit 1. Undamped or lightly damped cases were observed under stressed system conditions when western generation export was above 1300 MW. Examples of this observation can be found in Exhibit 4.

From these results it can be concluded that without generation rejection it would be necessary to substantially restrict the western generation export to insure system stability.

3.4 Impact of Generation Rejection

A low WNY Export level is required to sustain system stability in the event of contingency loss of the all the NY-OH ties at Niagara. This study has shown that the necessary reduction can be achieved by precontingency dispatch. Previous analysis has indicated that the stable results can be attained with generation rejection at Niagara. In this study three and four unit rejection was examined over a wide range of system conditions.

In all cases it was observed that increaseing the precontingency WNY Export by the amount of generation rejection, resulted in well damped system response. For example, if the test level of WNY Export of 1300 MW was stable without generation rejection, then four unit rejection (700 MW) would yield a stable result, for a pre-contingency western NY export of 2000 MW. Examples of this observation can be found in Exhibit 5.

A comparison of the the results in Exhibit 4 where WNY Export was limited, to the results in Exhibit 5 where generation rejection was employed, indicates that generation rejection is more effective than precontingency WNY Export limits. The Exhibit 5 cases employ a 2400 MW precontingency western export, which when acted upon by 700 MW of generation rejection results in an effective post contingency western NY export of 1700 MW. The cases with rejection and an effective post contingency export of 1700 MW are better damped than the cases without rejection where the post contingency western NY export was 1300 MW.

The observation that Niagara generation rejection is so effective lead to an investigation of precontingency dispatch with four Niagara units out of service. The results of comparing Niagara precontingency dispatch to generation rejection can be found in Exhibit 6. Precontingency reduction in Niagara generation is no more effective than precontingency reduction of other units in western New York.

While four unit rejection is more effective than pre contingency western generation reduction, restrictions on WNY Export will be required at times. From Appendicies C, D, and E it can be observed that four unit rejection is sufficient to sustain of test export levels to 2600 MW, which would equate to an operating limit of 2300 MW. Exhibit 7 indicates the system response to maximum WNY Export both with and without four unit generation rejection. At export test levels of 2800 MW four unit rejection is insufficient to produce a damped system response. Therefore, even with four unit rejection armed at Niagara, WNY Export monitoring is required and restrictions on WNY Export may be necessary.

Generation rejection is not available for all potentail combinations of NY-OH tie line configuations at Niagara. As presently configured, the generation rejection is only triggered by the loss of PA27. If PA27 is out of service, the capability for generation rejection is unavailable.

3.5 Sithe

The effect of Sithe generation is presented in Exhibit 8. The presence or absence of Sithe had no substanial effect on the results discussed above. If Sithe were unavailable, and the generation were replaced by maximizing net western generation, the NYPP response to WC15 would be undamped. If Sithe were unavailable and the generation were replaced by a variety of sources, maintaining net western generation below 1300 MW, would result in the NYPP system response being undamped. There was no significant difference in system response between a case with three utility units on in the Oswego Complex versus the case with only two utility units in service.

4.0 Conclusions

From this study it is concluded that Niagara generation rejection is the most effective means to stabilize the NYPP system for the contingency loss of all the NY-OH ties at Niagara. This observation is supported by previous NYPP and NYPA analysis which included four Niagara unit generation rejection in previous recommendations addressing this contingency.

The acceptable test level for WNY Export without generation rejection was 1300 MW. A 200 MW safety margin is applied to arrive at the recommended limit of 1100 MW without generation rejection. The acceptable test level for western generation export with generation was 2600 MW. A 10% safety margin is applied to arrive at the recommended limit of 2300 MW with generation rejection.

5.0 - Tables of evaluation tests

Response to WC15 with PA301/PA302 O/S - **Flows Toward OH**

key
() - load flow identifier
go - growing oscillations
nd - no damping, sustained oscillations of constant magnitude
OK - well damped

Western Export: Dysinger East +
Flows toward OH on PA27 & BP76 +
Flows toward PJM on 69, 177 and 37

	OHNY -700		OHNY -500		OHNY -200		OHNY 0	
	peak	off	peak	off	peak	off		
CE 3100 Reject 0	go(16)	..	go(15)	go(15)	..	..	go(7)	go(7)
Reject 3	nd	..	nd	nd	..	..	nd	OK
Reject 4	OK	..	OK	nd	..	..	ld	OK
Western Export	2659		2655	2872			2676	2845
CE 2800 Reject 0	go(18)	go(18)	go(17)	go(17)	..(9)	go(9)	go(8)	go(8)
Reject 3	OK	nd	nd	..	..	..	OK	..
Reject 4	OK	OK	OK	OK	OK	..	OK	OK
Western Export	2295	2470	2480	2396	2409	2379	2402	2389
************								
CE 2800 Reject 0	..(90)	..	OK(91)	OK(91)	OK(92)	OK(92)	OK(93)	OK(93)
Western Export	1304		1306	1312	1301	1315	1300	1309
************								
CE 2700 Reject 0	nd(c)	go(c)	..	..	..	go(1)	..	..
Reject 4	OK	OK	..	..	..	OK	..	..
Western Export	2191	2101				2039		
CE 2600 Reject 0	nd(e)	nd(e)	..	..	..	go(q)	..	..
Reject 4	OK	OK	..	..	..	OK	..	..
Western Export	2002	1912				1984		
CE 2500 Reject 0	ld(g)	..	ld(u)	..	ld(r)	nd(r)	..	..
Reject 4	OK	..	OK	..	OK	OK	..	..
Western Export	2002		1998		1717	1887		
CE 2400 Reject 0	nd(h)	nd(h)	..	..	..	..	..	..
Reject 4	OK		..	..	..	..	..	..
Western Export	2003	1912						
CE 2200 Reject 0	OK(40)	OK(40)	OK(41)	OK(41)	OK(42)	OK(42)	OK(43)	
Reject 4	OK	..	..	..	..	..	..	
Western Export	2003	1912	1998	1907	1678	1897	1671	
CE 2000 Reject 0	..	..	..	OK(t)	..	..		
Western Export				1511				
CE 1850 Reject 0	..	..	..	OK(s)	..	..		
Western Export				1513				

Sithe replaced with Hunt/Dunk & PJM (Maximum Western Generation)

CE 2500 Reject 0	go(30)	..	go(31)	..	go(32)	..	go(33)	..
Reject 4	nd	..	nd	..	nd	..	nd	..
Western Export	2673		2669		2657		2639	

Alternate cases

Peak	42a	-	CE2200:NYOH-200:WGEN2635 Max.western export
Peak	90a	-	CE2803:NYOH-662:WGEN1310 4 Nia. units O/S
Peak	17a	-	CE2816:NYOH-523:WGEN1828
Peak	14	-	CE3105:NYOH-514:WGEN2446
Peak	30a	-	CE2800:NYOH-695:WGEN2669 Max western export, Sithe O/S
Off Peak	SA	-	CE1850:NYOH-500:WGEN2833 Max western export
Off peak	14	-	CE3100:NYOH-502:WGEN2446

5.0 - Tables of evaluation tests (cont.)

Response to WC15 with PA301/PA302 O/S - Flows Toward NY

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key
() - load flow identifier
go - growing oscillations
nd - no damping, sustained oscillations of constant magnitude
OK - well damped

Western Export: Dysinger East +
Flows toward OH on PA27 & BP76 +
Flows toward PJM on 69, 131 and 37

		OHNY 200 peak	OHNY 200 off	OHNY 500 peak	OHNY 500 off	OHNY 800 peak	OHNY 800 off	OHNY 1000 peak	OHNY 1000 off
CE 3100	R0	..	..	..	..	go(07)	go(07)	nd(06)	nd(12)
	R3	..	..	..	..	nd	OK	OK	..
	R4	..	..	..	..	OK	OK	OK	OK
Western Export						2225	1591	1784	1591
CE 2800	R0	go(10)	..	go(25)	..	nd(19)	..	..	..
	R3	..	..	..	..	OK	..	..	..
	R4	OK	..	OK	..	OK	..	..	..
Western Export		2387		2350		1935			

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		OHNY 200 peak	OHNY 200 off	OHNY 500 peak	OHNY 500 off	OHNY 800 peak	OHNY 800 off	OHNY 1000 peak	OHNY 1000 off
CE 2800	R0	OK(94)	OK(94)	OK(95)	..	OK(96)	..	ld(97)	..
Western Export		1303	1300	1330	..	1317	..	1316	..

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		OHNY 200 peak	OHNY 200 off	OHNY 500 peak	OHNY 500 off	OHNY 800 peak	OHNY 800 off	OHNY 1000 peak	OHNY 1000 off
CE 2700	R0	..	..	..	..	..	..	..	..
	R4	..	..	..	..	..	..	..	..
Western Export									
CE 2600	R0	..	..	..	..	..	..	..	..
	R4	..	..	..	..				
Western Export									
CE 2500	R0	ND(23)	nd(23)	nd(22)	nd(22)	go(21)	OK(21)	..	..
	R4	OK	OK	OK	OK	OK	OK	..	..
Western Export		2013	1904	1989	1889	1705	1238		
CE 2400	R0	..	..	..	..	..	..	..	..
	R4	..	..	..	..	..	..	..	..
Western Export									
CE 2200	R0	ld(44)	..	ld(45)	..	go(46)	..	..	..
	R4	..	..	..	..	OK	..	..	..
Western Export		1653		1638		1619			
CE 2000	R0	..	..	..	..	..	..	..	..
Western Export									
CE 1850	R0	..	..	..	..	..	..	..	..
Western Export									

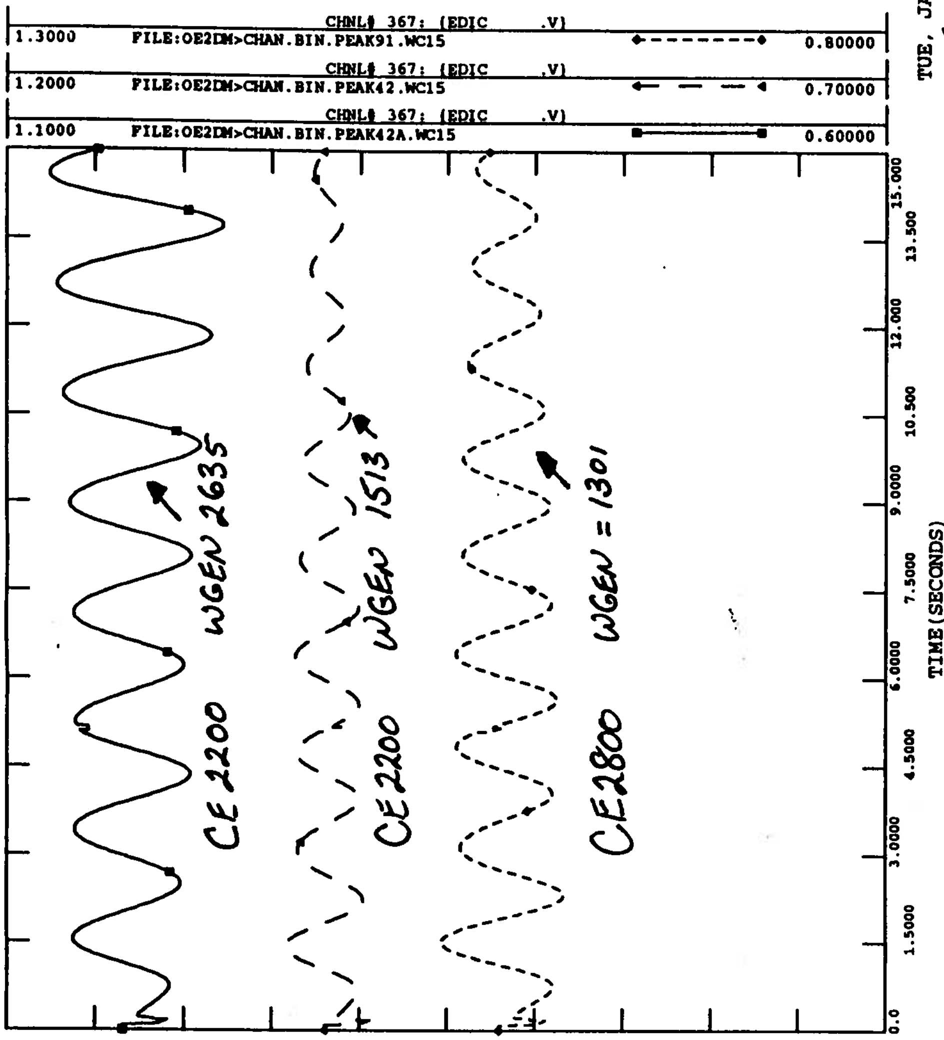
Sithe replaced with Hunt/Dunk & PJM (Maximum Western Generation)

		OHNY 200 peak	OHNY 200 off	OHNY 500 peak	OHNY 500 off	OHNY 800 peak	OHNY 800 off	OHNY 1000 peak	OHNY 1000 off
CE 2500	R0	go(34)	..	go(35)	..	go(36)	..	..	..
	R4	nd	..	nd	..	nd	..	..	..
Western Export		2621		2614		2619			

EXHIBIT 1

Peak

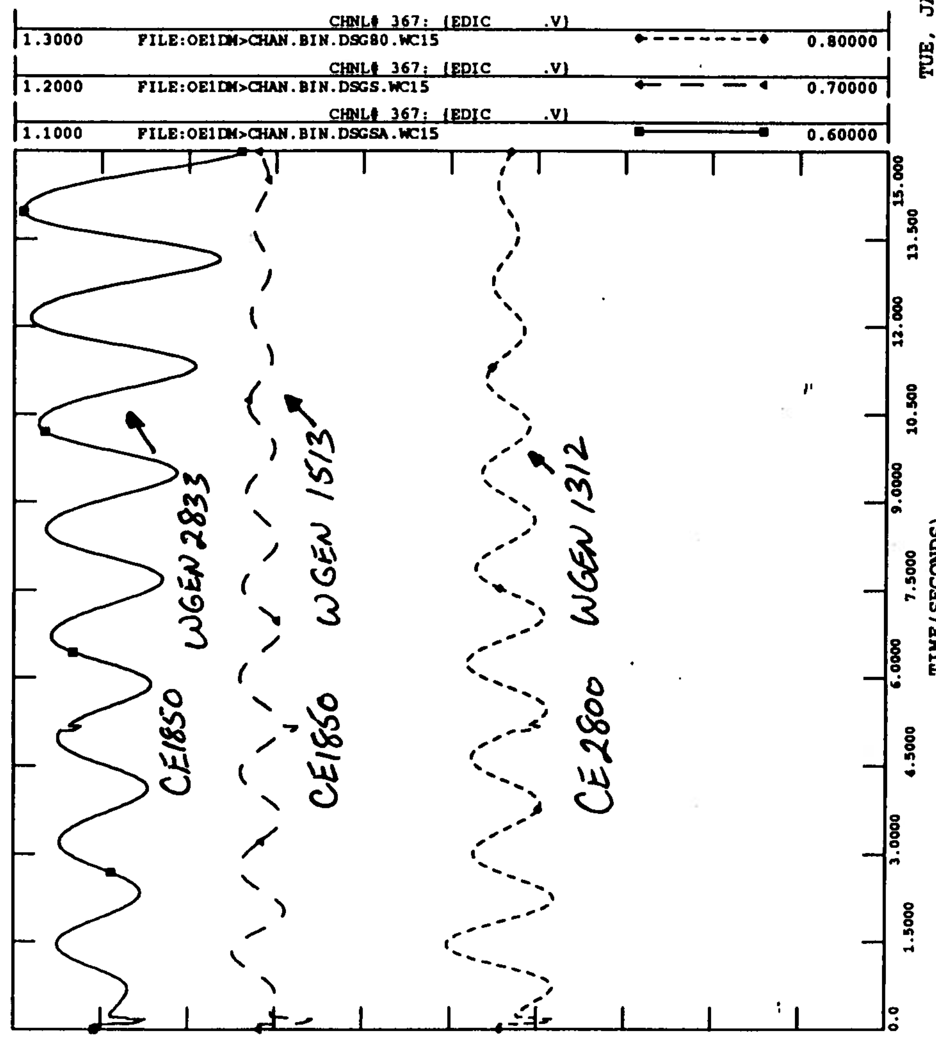
WC15 LLG-NC@BECK/NIAGARA-PACKARD BP76/PA27
PEAK42A :CE2265 TE3556 MS1224 BLIP3949 OHNY -257
NYPP STABILITY ANALYSIS WITH PA301 & PA302 OUT OF SERVICE
OH-NY HELD CONSTANT - VARY CE AND/OR WEST NET GEN - PEAK



TUE, JAN 24 1995 11:14
1.1) OHNY -200

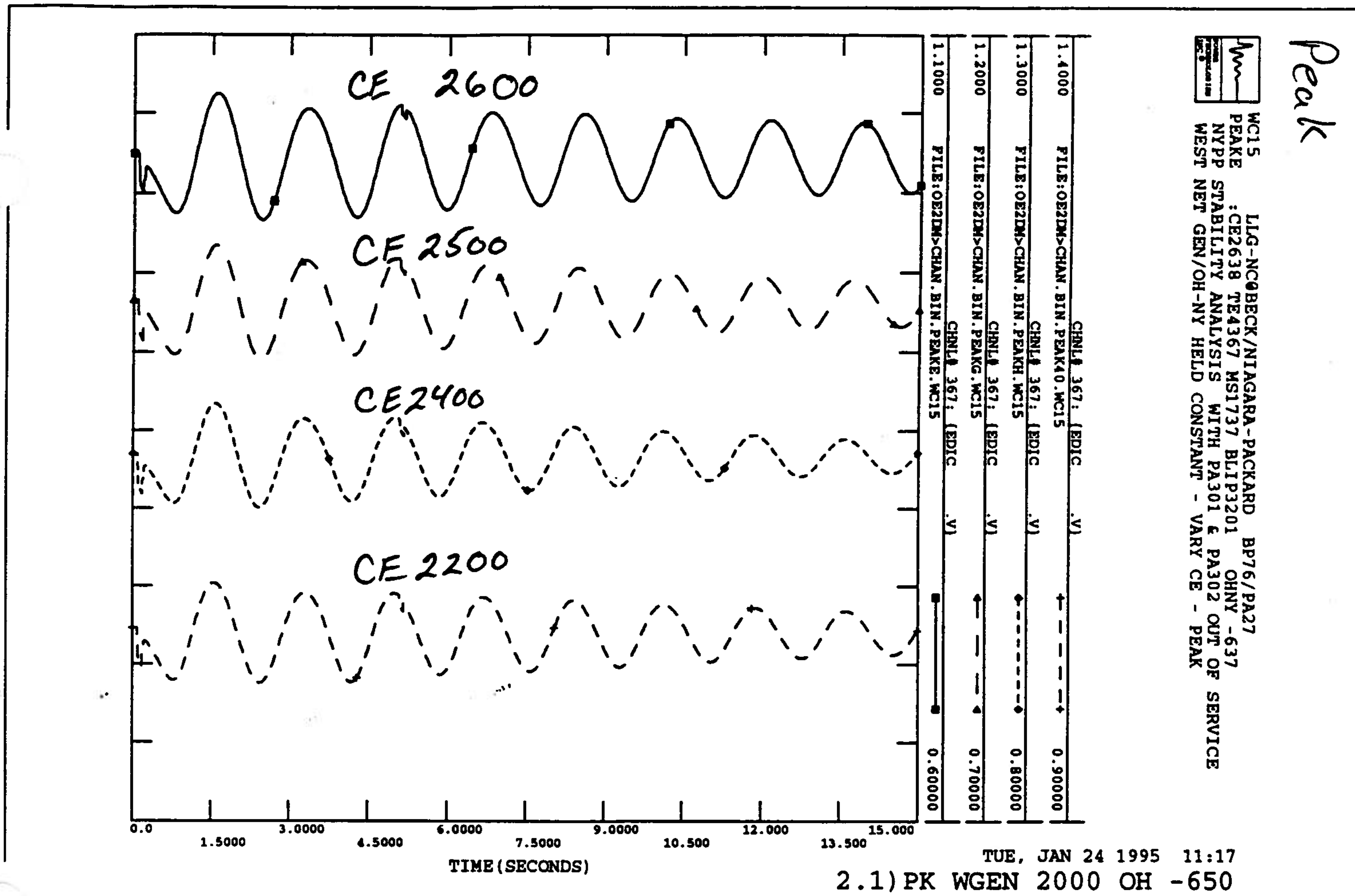
Off Peak

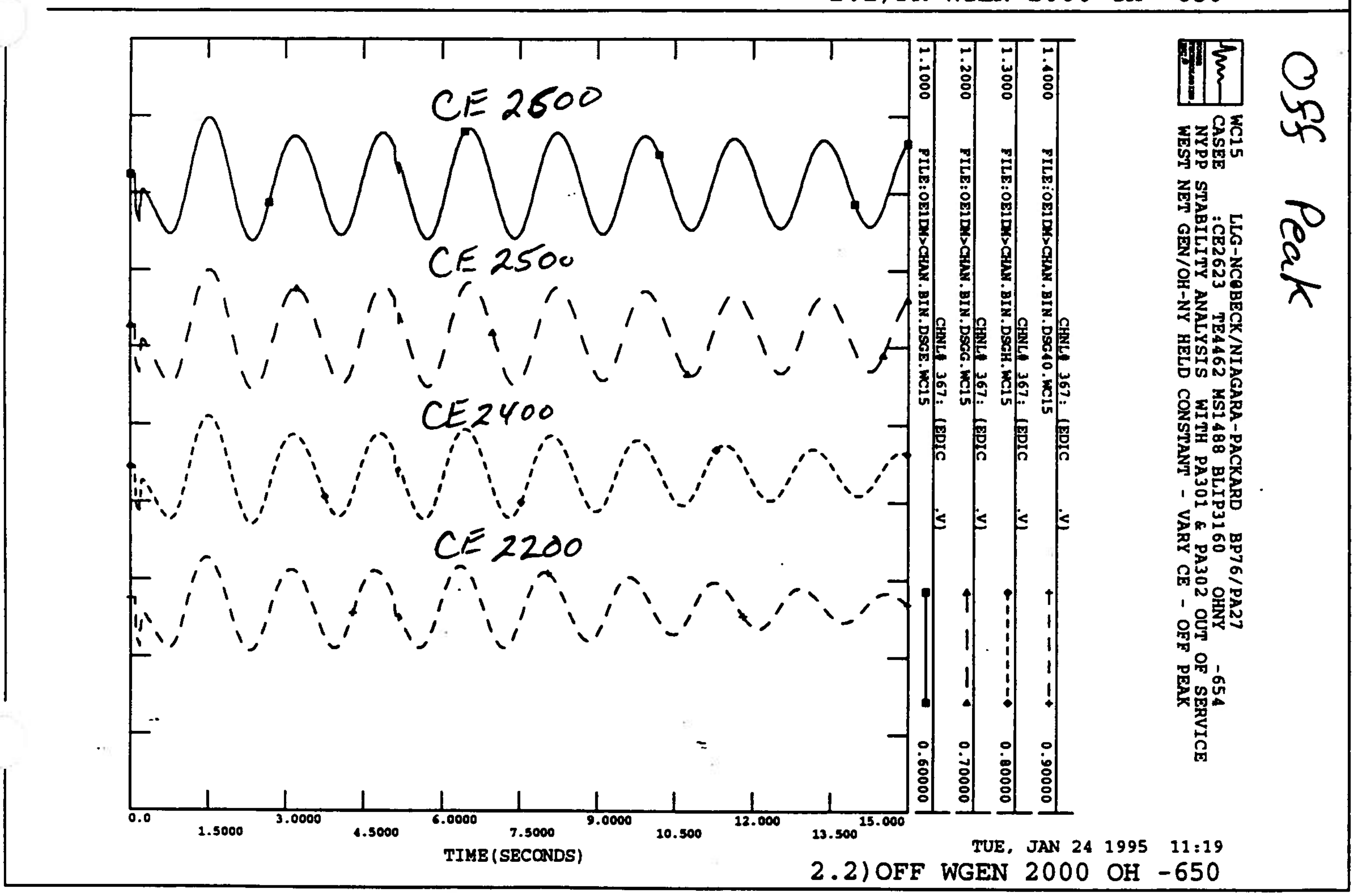
WC15 LLG-NC@BECK/NIAGARA-PACKARD BP76/PA27
CASESA :CE1881 TE2952 MS990 BLIP3410 NYOH -540
NYPP STABILITY ANALYSIS WITH PA301 & PA302 OUT OF SERVICE
OH-NY HELD CONSTANT - VARY CE AND/OR WEST NET GEN - PEAK



TUE, JAN 24 1995 11:16
1.2) OHNY -500

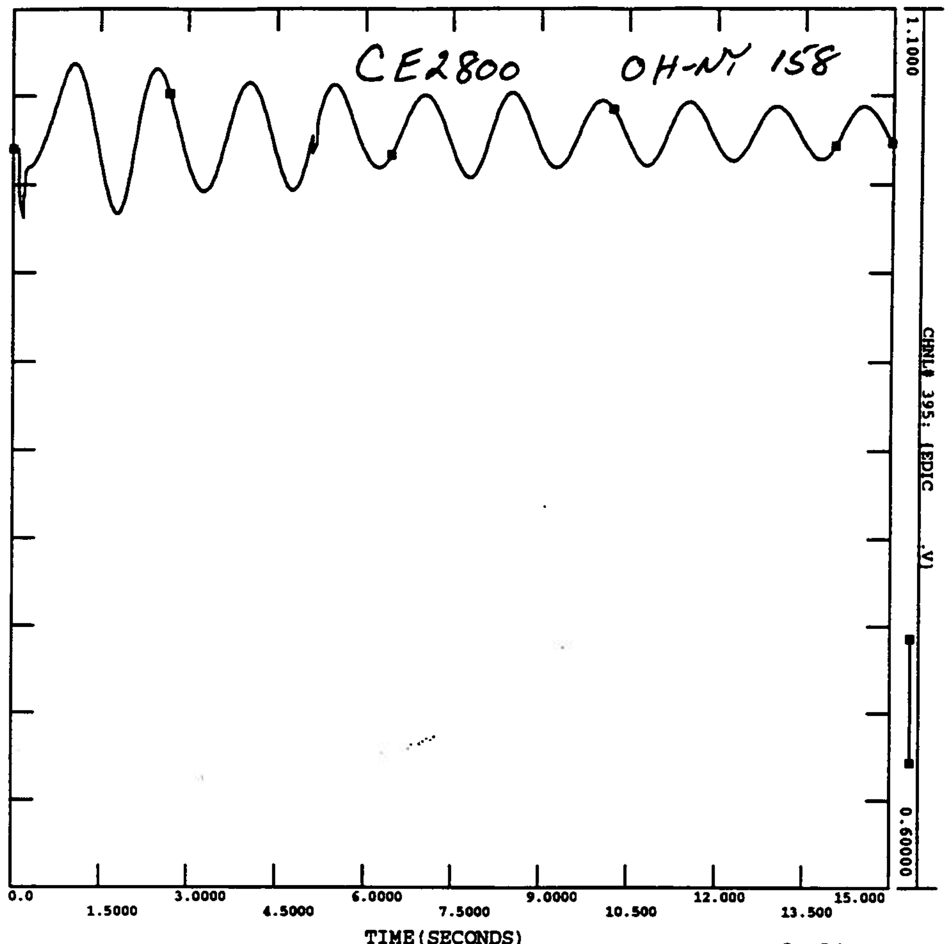
EXHIBIT 2


Peak
WC15 LLG-NC@BECK/NIAGARA-PACKARD BP76/PA27
PEAKE :CE2638 TE4367 MS1737 BLIP3201 OHNY -637
NYPP STABILITY ANALYSIS WITH PA301 & PA302 OUT OF SERVICE
WEST NET GEN/OH-NY HELD CONSTANT - VARY CE - PEAK
CE 2600
CE 2500
CE2400
CE 2200
1.4000 FILE:OE2DM>CHAN.BIN.PEAK40.WC15 CHNL# 367: (EDIC .V) 0.90000
1.3000 FILE:OE2DM>CHAN.BIN.PEAKH.WC15 CHNL# 367: (EDIC .V) 0.80000
1.2000 FILE:OE2DM>CHAN.BIN.PEAKG.WC15 CHNL# 367: (EDIC .V) 0.70000
1.1000 FILE:OE2DM>CHAN.BIN.PEAKE.WC15 CHNL# 367: (EDIC .V) 0.60000
0.0 1.5000 3.0000 4.5000 6.0000 7.5000 9.0000 10.500 12.000 13.500 15.000
TIME(SECONDS)
TUE, JAN 24 1995 11:17
2.1) PK WGEN 2000 OH -650


Off Peak
WC15 LLG-NC@BECK/NIAGARA-PACKARD BP76/PA27
CASEE :CE2623 TE4462 MS1488 BLIP3160 OHNY -654
NYPP STABILITY ANALYSIS WITH PA301 & PA302 OUT OF SERVICE
WEST NET GEN/OH-NY HELD CONSTANT - VARY CE - OFF PEAK
CE 2600
CE 2500
CE2400
CE 2200
1.4000 FILE:OE1DM>CHAN.BIN.DSG40.WC15 CHNL# 367: (EDIC .V) 0.90000
1.3000 FILE:OE1DM>CHAN.BIN.DSGH.WC15 CHNL# 367: (EDIC .V) 0.80000
1.2000 FILE:OE1DM>CHAN.BIN.DSGG.WC15 CHNL# 367: (EDIC .V) 0.70000
1.1000 FILE:OE1DM>CHAN.BIN.DSGE.WC15 CHNL# 367: (EDIC .V) 0.60000
0.0 1.5000 3.0000 4.5000 6.0000 7.5000 9.0000 10.500 12.000 13.500 15.000
TIME(SECONDS)
TUE, JAN 24 1995 11:19
2.2) OFF WGEN 2000 OH -650

Lite

WC15 LLG-NCOBECK/NIAGARA-PACKARD BP76/PA27
MINIMUM LOAD CASE
NYPP STABILITY ANALYSIS WITH PA301 & PA302 OUT OF SERVICE
WEST NET GEN/CE HELD CONSTANT - VARY OHNY - LIGHT LD
FILE: OSRRT>CHAN.BIN.FLT40



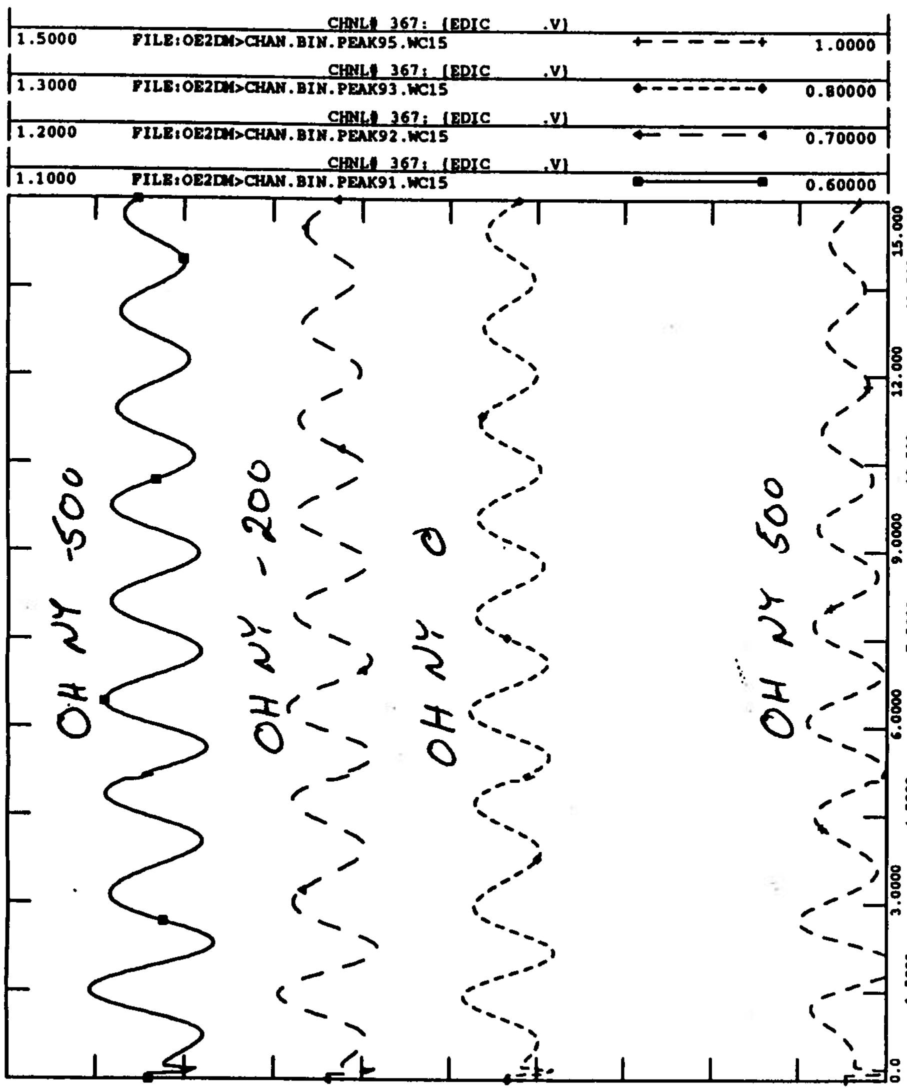
TUE, JAN 24 1995 11:19

2.3) OFF CE2800 WGEN 1230

EXHIBIT 3

Peak

WC15 LLG-NC@BECK/NIAGARA-PACKARD BP76/PA27
PEAK91 :CE2813 TE5542 MS1715 BLIP2495 NYOH -522 WGEN1305
NYPP STABILITY ANALYSIS WITH PA301 & PA302 OUT OF SERVICE
WEST NET GEN/CE HELD CONSTANT - VARY OHNY - PEAK

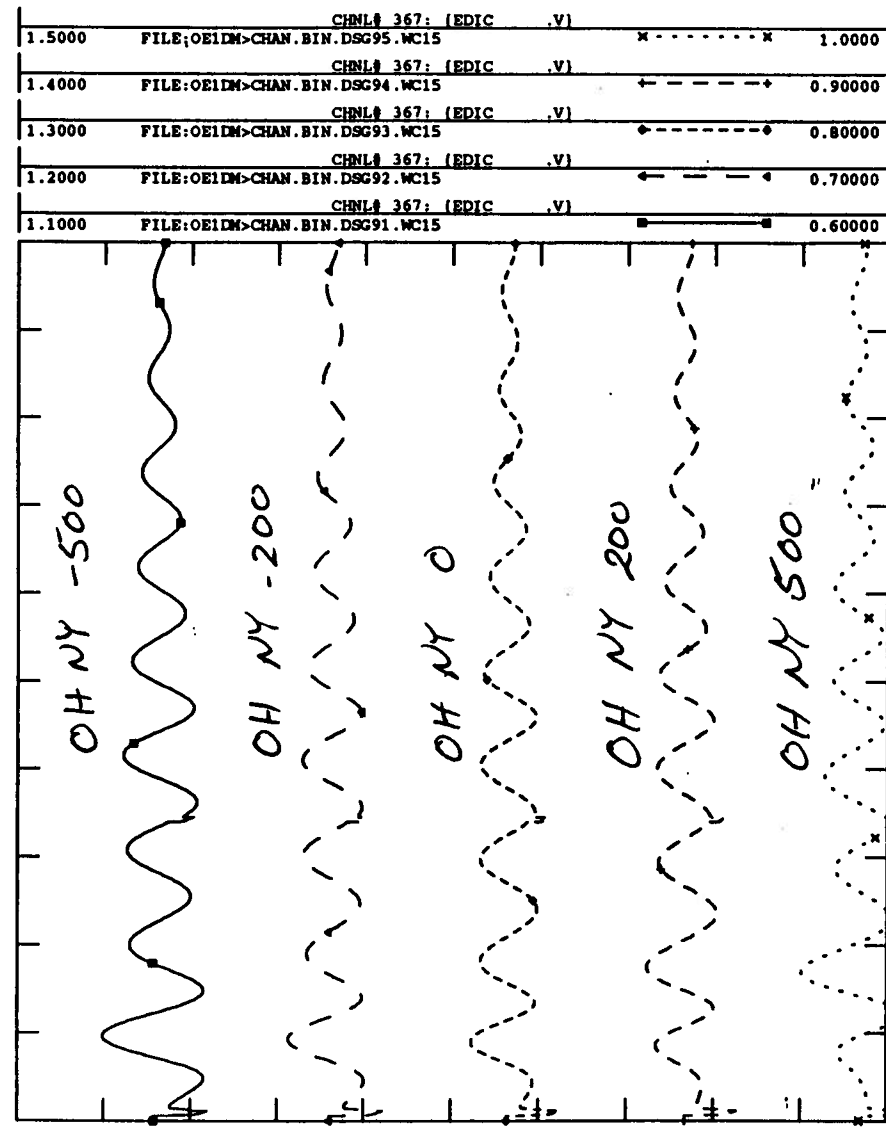


TUE, JAN 24 1995 11:21

3.1) PEAK CE2800 WGEN 1300

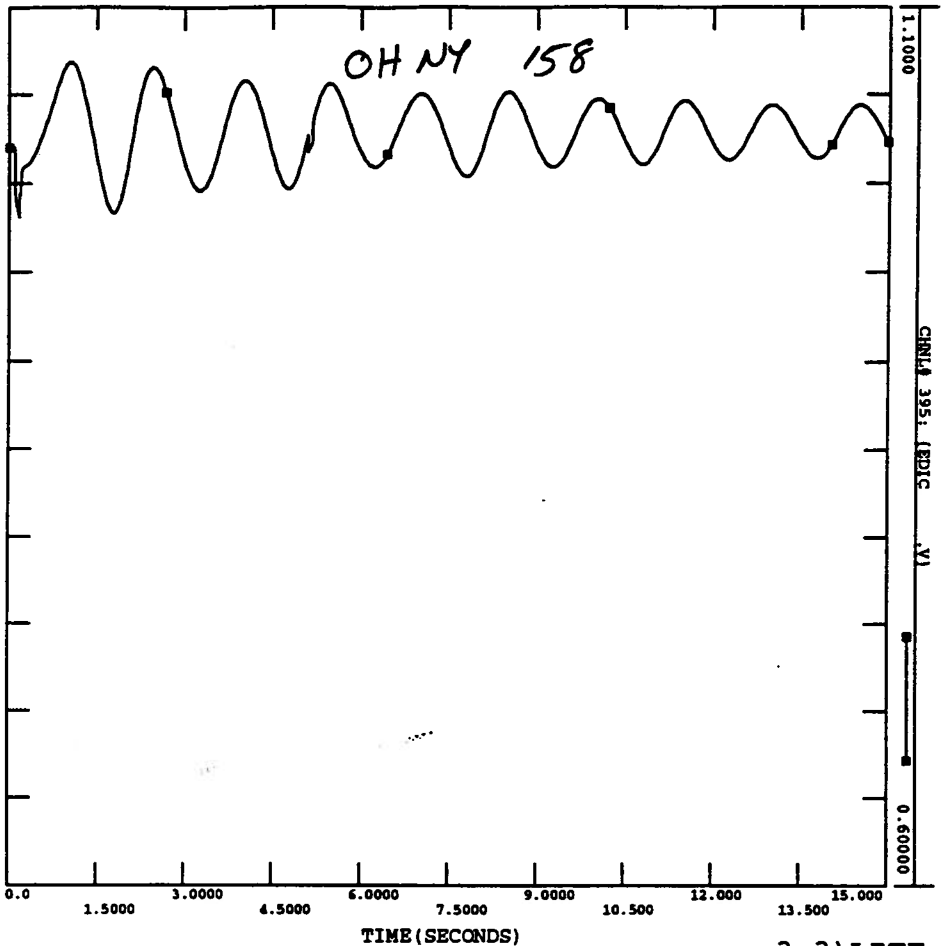
Off Peak

WC15 LLG-NC@BECK/NIAGARA-PACKARD BP76/PA27
CASE91 :CE2812 TE4794 MS1486 BLIP2837 OHNY -513 WGEN1321
NYPP STABILITY ANALYSIS WITH PA301 & PA302 OUT OF SERVICE
WEST NET GEN/CE HELD CONSTANT - VARY OHNY - OFF PEAK



TUE, JAN 24 1995 11:24

3.2) OFF CE2800 WGEN 1300



WC15 LLG-NC@BECK/NIAGARA-PACKARD BP76/PA27
MINIMUM LOAD CASE
NYPP STABILITY ANALYSIS WITH PA301 & PA302 OUT OF SERVICE
WEST NET GEN/CE HELD CONSTANT - VARY OHNY - LIGHT LD
FILE: OSRRT>CHAN.BIN.FLT40

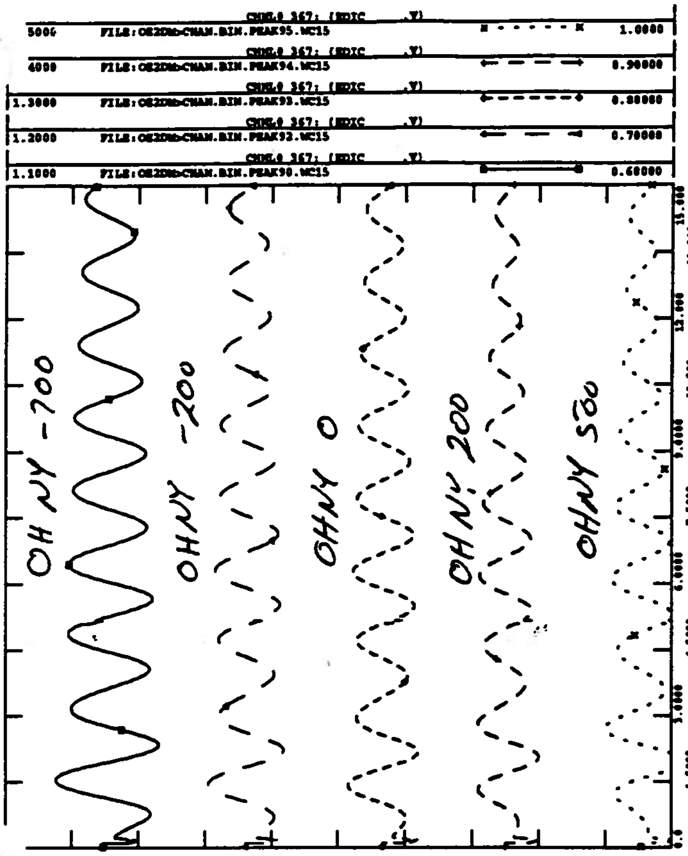
TUE, JAN 24 1995 11:24

3.3)LITE CE2800 WGEN 1300

EXHIBIT 4

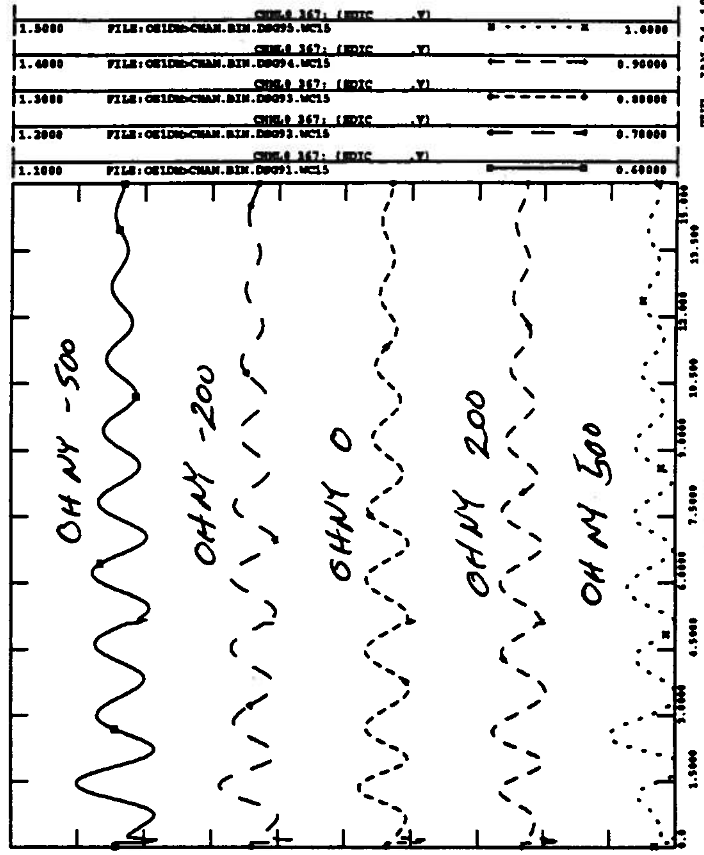
WC15 LLG-NC0BECK/NIAGARA-PACKARD BP76/PA27
PEAK90 :CE2785 TE5540 MS1732 BLIP2262 NYOH -702 WGEN1304 C
NYPP STABILITY ANALYSIS WITH PA301 & PA302 OUT OF SERVICE
CE HELD CONSTANT - VARY OHNY - W/ AND W/O WGEN LIMIT PEAK

TUE, JAN 24 1995 13:56
4.2)OFF CE2800 WGEN 1300



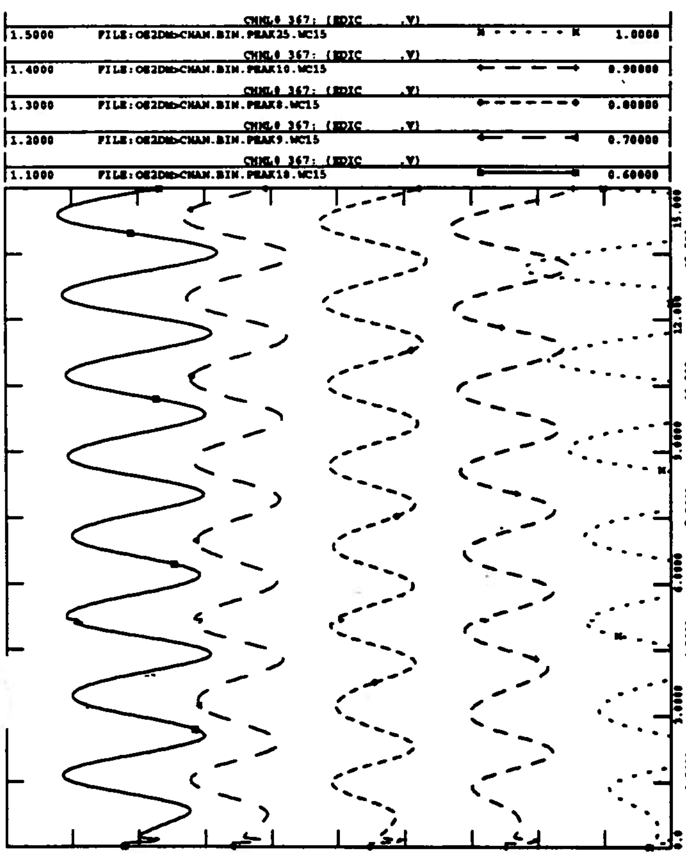
WC15 LLG-NC0BECK/NIAGARA-PACKARD BP76/PA27
CASE91 :CE2812 TE4794 MS1486 BLIP2837 OHNY -513 WGEN1321
NYPP STABILITY ANALYSIS WITH PA301 & PA302 OUT OF SERVICE
CE HELD CONSTANT - VARY OHNY - W/ AND W/O WGEN LIMIT PEAK

TUE, JAN 24 1995 14:05
4.4)OFF CE2800 WGEN 1300



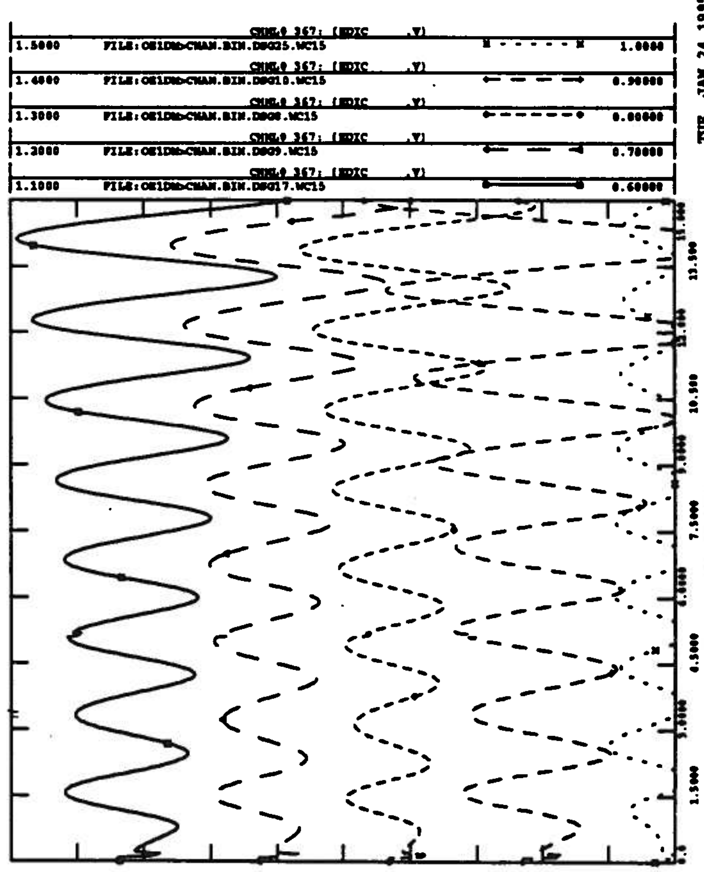
WC15 LLG-NC0BECK/NIAGARA-PACKARD BP76/PA27
PEAK18 :CE2831 TE4756 MS1726 BLIP3125 OHNY -667
NYPP STABILITY ANALYSIS WITH PA301 & PA302 OUT OF SERVICE
CE HELD CONSTANT - VARY OHNY - W/ AND W/O WGEN LIMIT PEAK

TUE, JAN 24 1995 13:53
4.1)PEAK CE2800 VARY WGEN



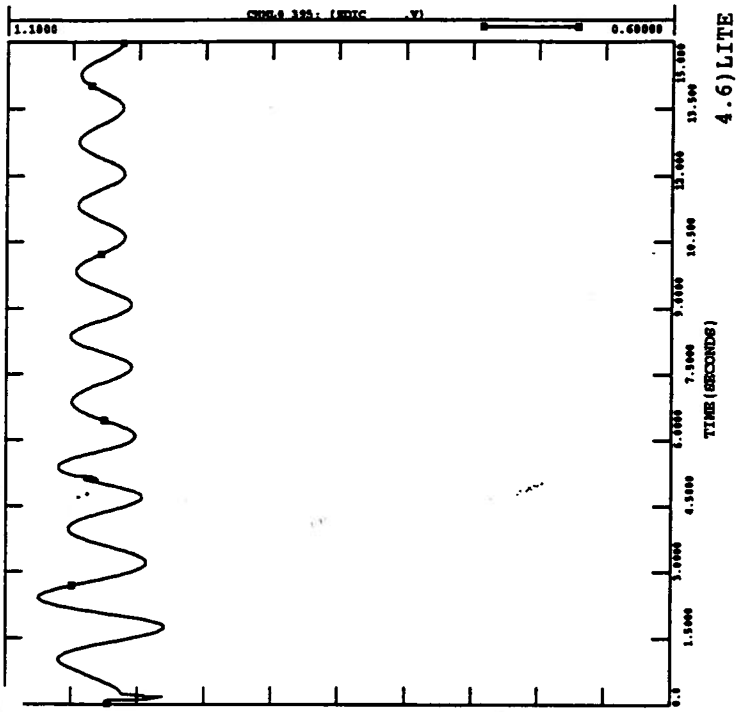
WC15 LLG-NC0BECK/NIAGARA-PACKARD BP76/PA27
CASE17 :CE2816 TE4784 MS1495 BLIP3467 OHNY -525 WGEN2396
NYPP STABILITY ANALYSIS WITH PA301 & PA302 OUT OF SERVICE
CE HELD CONSTANT - VARY OHNY - W/ AND W/O WGEN LIMIT PEAK

TUE, JAN 24 1995 14:02
4.3)OFF CE2800 VARY WGEN



MC15 LLG-NC0BECK/NIAGARA-PACKARD BF76/PA27
MINIMUM LOAD CASE
NYPP STABILITY ANALYSIS WITH PA301 & PA302 OUT OF SERVICE
CE HELD CONSTANT - VARY OHNY - W/ AND W/O WGEN LIMIT PEAK
FILE: OSRRT>CHAN.BIN.PLT47

TUE, JAN 24 1995 14:07
4.6)LITE CE2800 WGEN 1230



MC15 LLG-NC0BECK/NIAGARA-PACKARD BF76/PA27
MINIMUM LOAD CASE
NYPP STABILITY ANALYSIS WITH PA301 & PA302 OUT OF SERVICE
CE HELD CONSTANT - VARY OHNY - W/ AND W/O WGEN LIMIT PEAK
FILE: OSRRT>CHAN.BIN.PLT39

TUE, JAN 24 1995 14:06
4.5)LITE CE2800 WGEN 2209

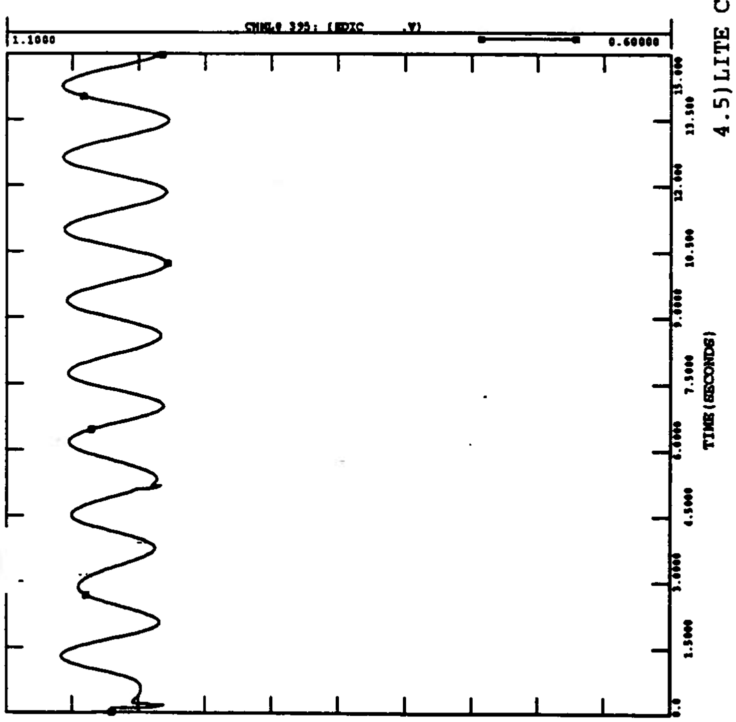
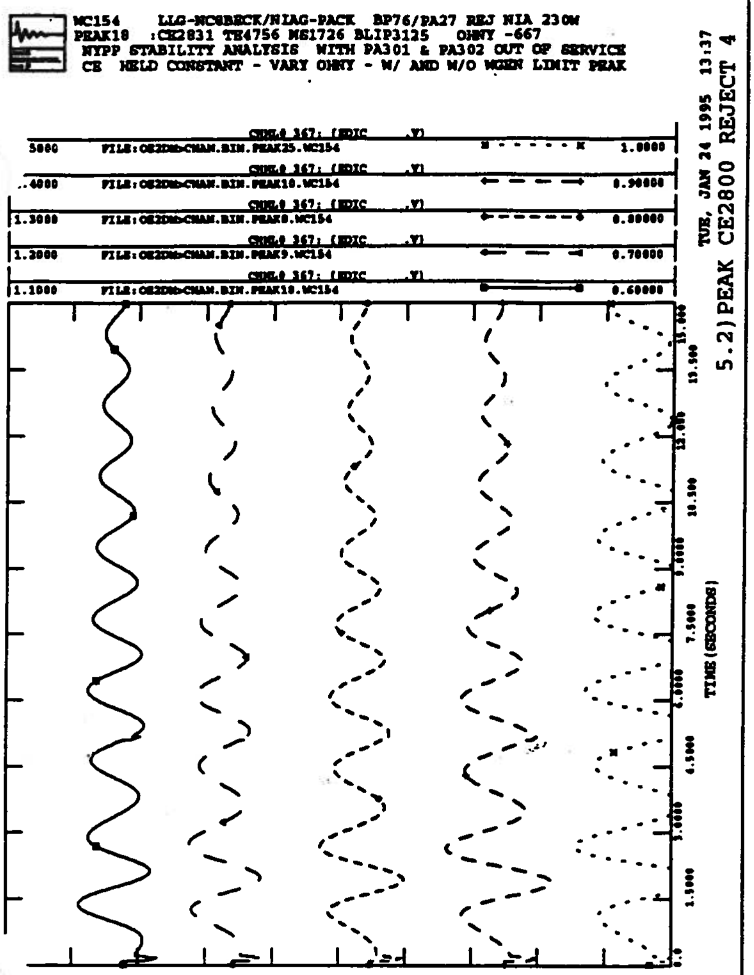
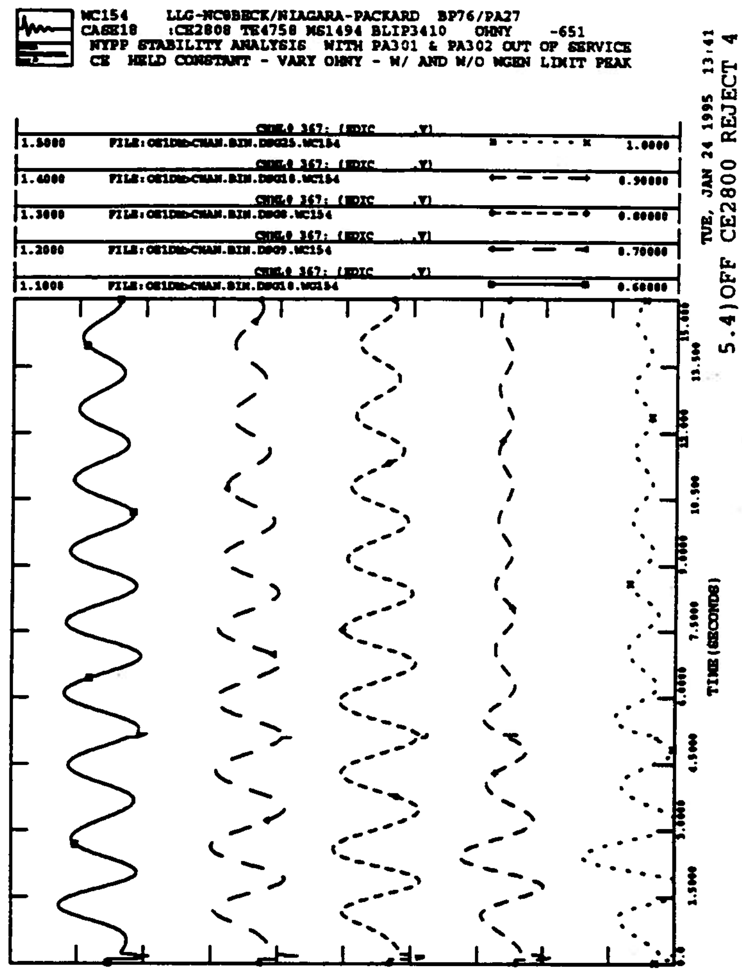
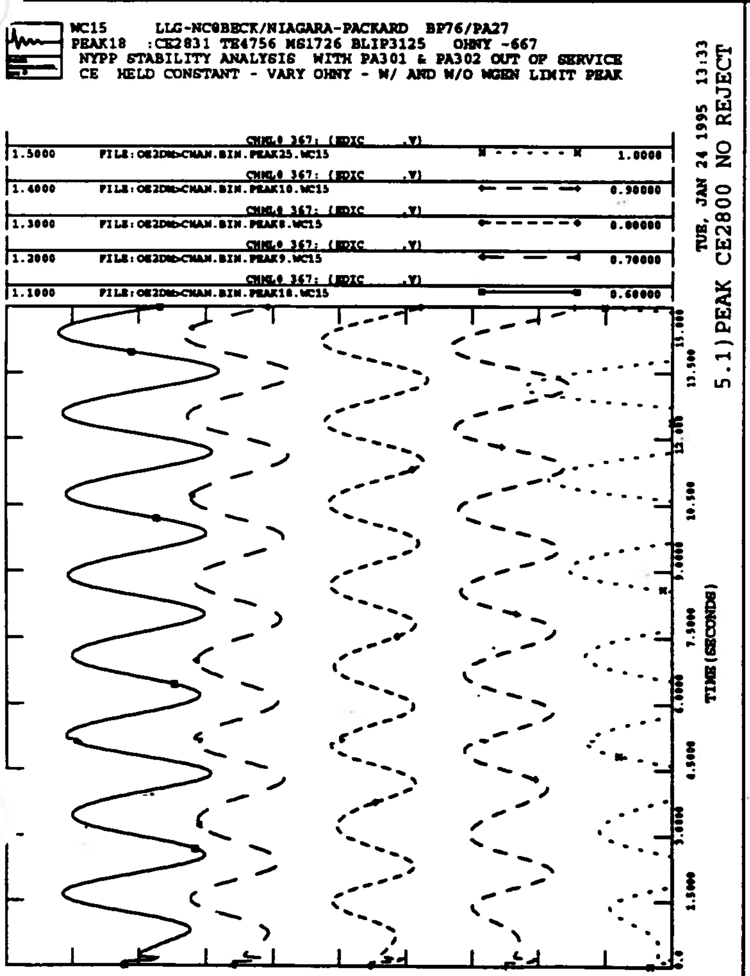
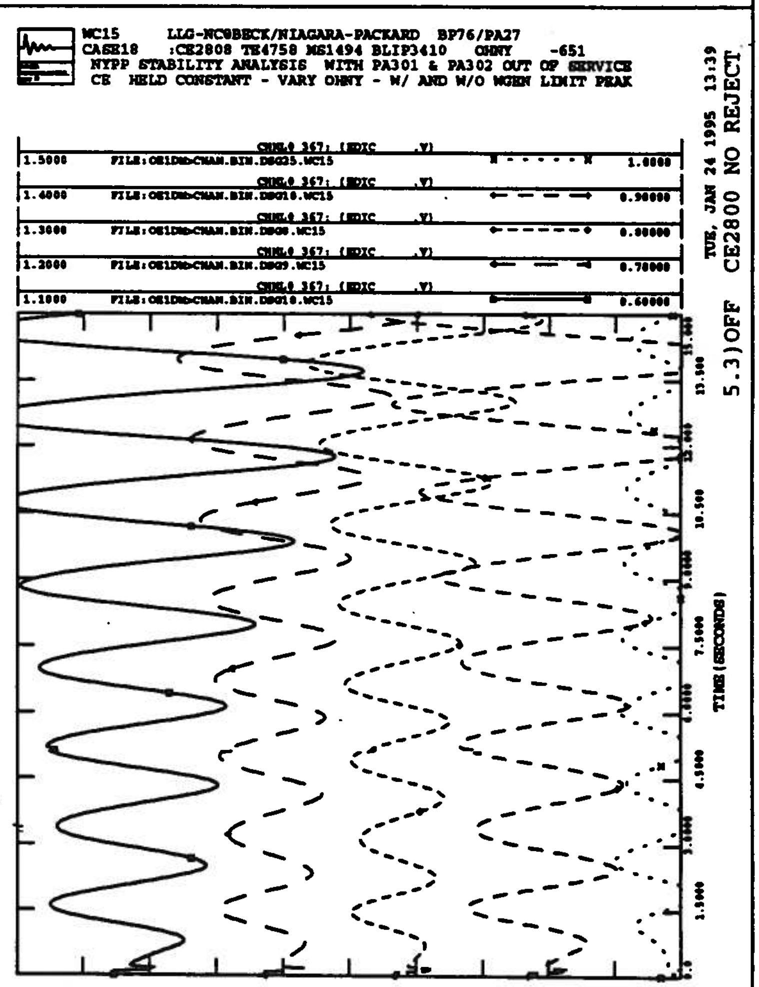


EXHIBIT 5


MC154 LLG-NC0BECK/NIAG-PACK BP76/PA27 REJ NIA 230W
PEAK18 :CE2831 TE4756 MS1726 BLIP3125 OHNY -667
NYPP STABILITY ANALYSIS WITH PA301 & PA302 OUT OF SERVICE
CE HELD CONSTANT - VARY OHNY - W/ AND W/O WGEN LIMIT PEAK
TUE, JAN 24 1995 13:37
5.2) PEAK CE2800 REJECT 4
TIME (SECONDS)


MC154 LLG-NC0BECK/NIAGARA-PACKARD BP76/PA27
CASE18 :CE2808 TE4758 MS1494 BLIP3410 OHNY -651
NYPP STABILITY ANALYSIS WITH PA301 & PA302 OUT OF SERVICE
CE HELD CONSTANT - VARY OHNY - W/ AND W/O WGEN LIMIT PEAK
TUE, JAN 24 1995 13:41
5.4) OFF CE2800 REJECT 4
TIME (SECONDS)

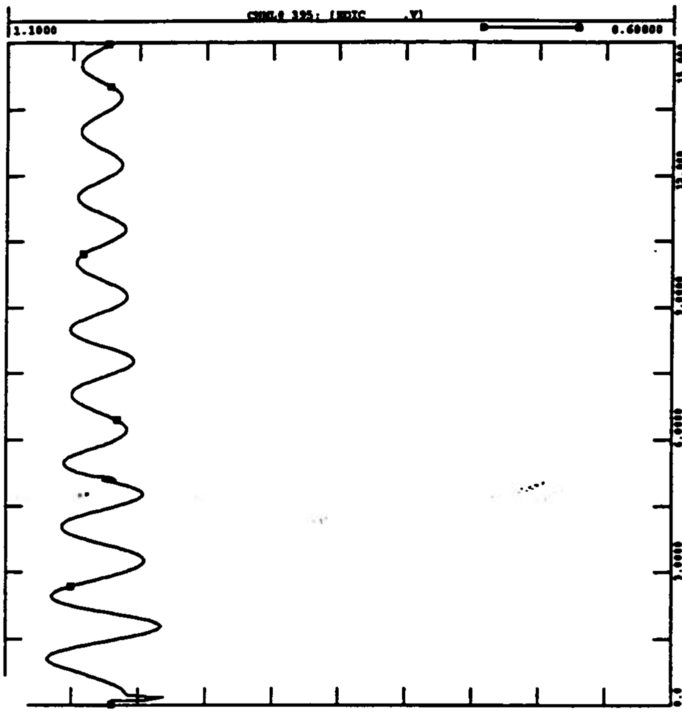

MC15 LLG-NC0BECK/NIAGARA-PACKARD BP76/PA27
PEAK18 :CE2831 TE4756 MS1726 BLIP3125 OHNY -667
NYPP STABILITY ANALYSIS WITH PA301 & PA302 OUT OF SERVICE
CE HELD CONSTANT - VARY OHNY - W/ AND W/O WGEN LIMIT PEAK
TUE, JAN 24 1995 13:33
5.1) PEAK CE2800 NO REJECT
TIME (SECONDS)


MC15 LLG-NC0BECK/NIAGARA-PACKARD BP76/PA27
CASE18 :CE2808 TE4758 MS1494 BLIP3410 OHNY -651
NYPP STABILITY ANALYSIS WITH PA301 & PA302 OUT OF SERVICE
CE HELD CONSTANT - VARY OHNY - W/ AND W/O WGEN LIMIT PEAK
TUE, JAN 24 1995 13:39
5.3) OFF CE2800 NO REJECT
TIME (SECONDS)

WC15 LLG-NC0BECK/NIAGARA-PACKARD BP76/PA27
MINIMUM LOAD CASE
NYPP STABILITY ANALYSIS WITH PA301 & PA302 OUT OF SERVICE
CE HELD CONSTANT - VARY OHNY - W/ AND W/O WGEN LIMIT PEAK
FILE: OSRRT>CHAN.BIN.FLT40

TUE, JAN 24 1995 13:42

5.6) LITE CE2800 REJECT 4



WC15 LLG-NC0BECK/NIAGARA-PACKARD BP76/PA27
MINIMUM LOAD CASE
NYPP STABILITY ANALYSIS WITH PA301 & PA302 OUT OF SERVICE
CE HELD CONSTANT - VARY OHNY - W/ AND W/O WGEN LIMIT PEAK
FILE: OSRRT>CHAN.BIN.FLT39

TUE, JAN 24 1995 13:41

5.5) LITE CE2800 NO REJECT

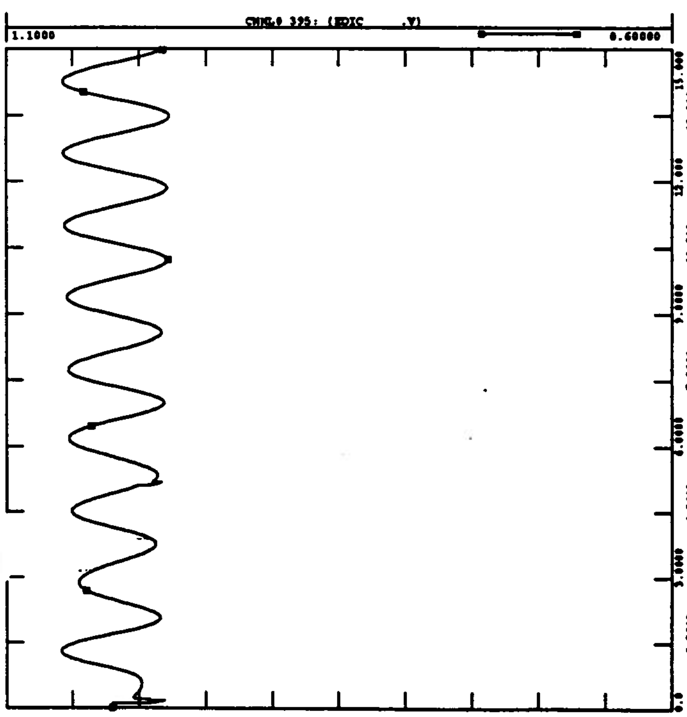
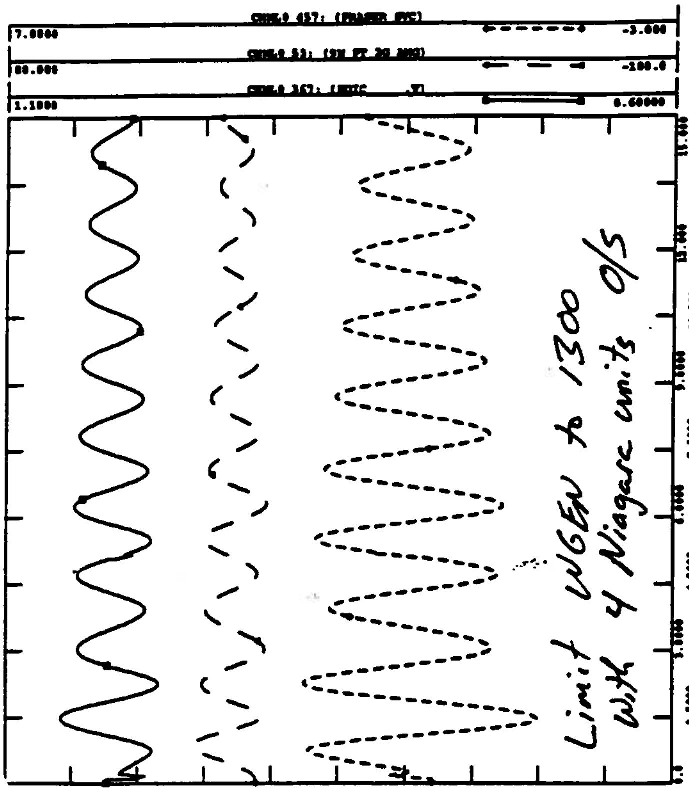


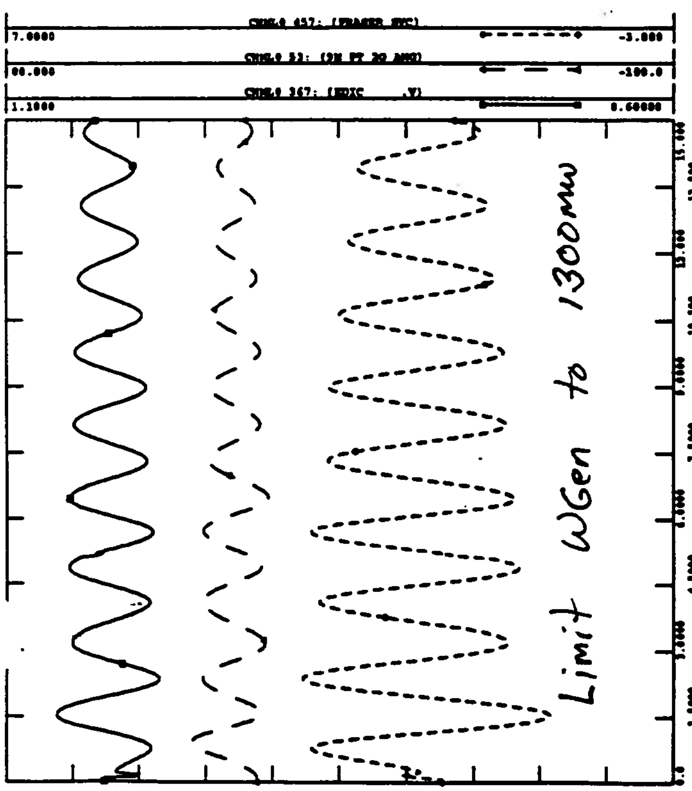
EXHIBIT 6

MC15 LLG-NC0BECK/NIAGARA-PACKARD BP76/PA27
PEAK90A :CE2803 TE5606 MS1734 BLIP2219 NYOH -662 WGEN1310
NYPP STABILITY ANALYSIS WITH PA301 & PA302 OUT OF SERVICE
PEAK CENTRAL EAST = 2800 VARIOUS OH AND WESTERN GEN
FILE: OE2DM>CHAN.BIN.PEAK90A.MC15



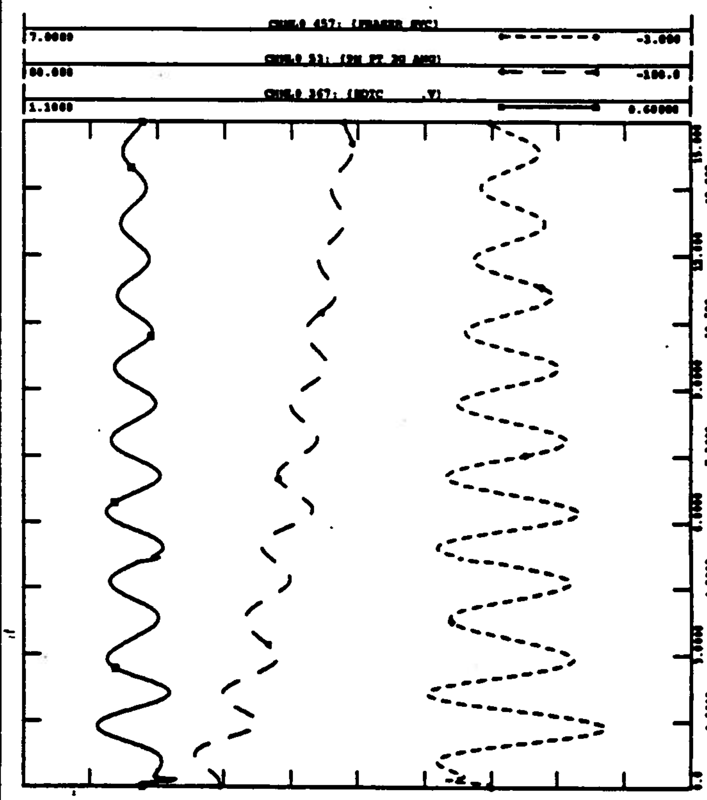
FRI, JAN 20 1995 12:17
6.1) PK WGEN 1300 NIA1700

MC15 LLG-NC0BECK/NIAGARA-PACKARD BP76/PA27
PEAK90 :CE2785 TE5540 MS1732 BLIP2262 NYOH -702 WGEN1304 C
NYPP STABILITY ANALYSIS WITH PA301 & PA302 OUT OF SERVICE
PEAK CENTRAL EAST = 2800 VARIOUS OH AND WESTERN GEN
FILE: OE2DM>CHAN.BIN.PEAK90.MC15



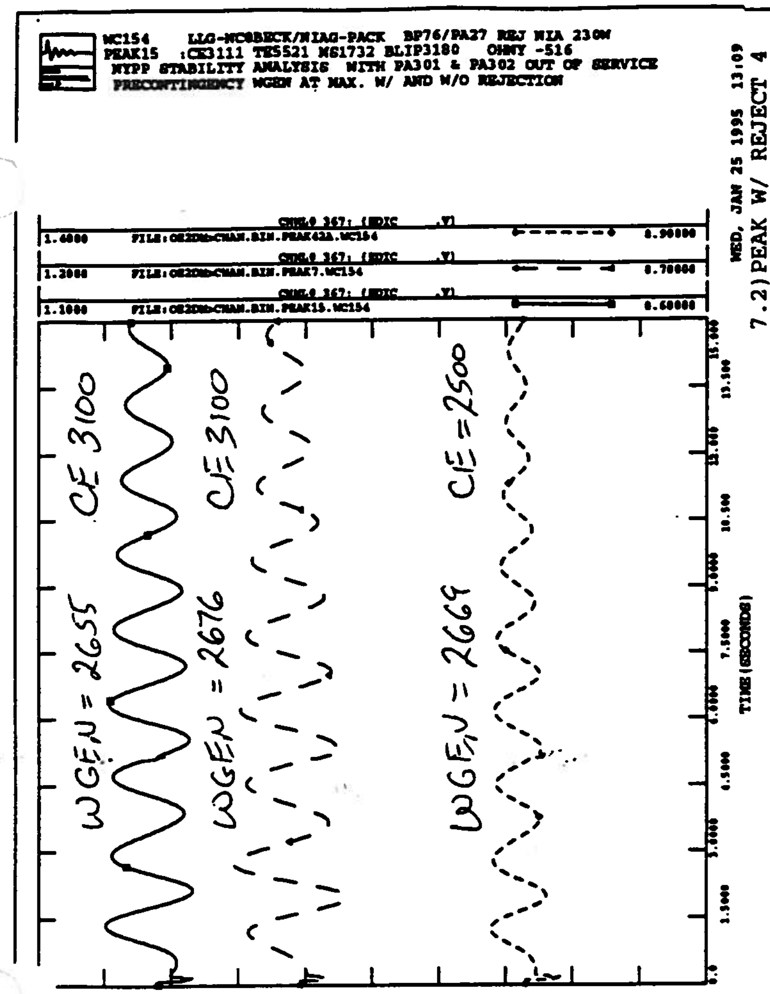
FRI, JAN 20 1995 12:16
6.1) PK WGEN 1300 NIA2400

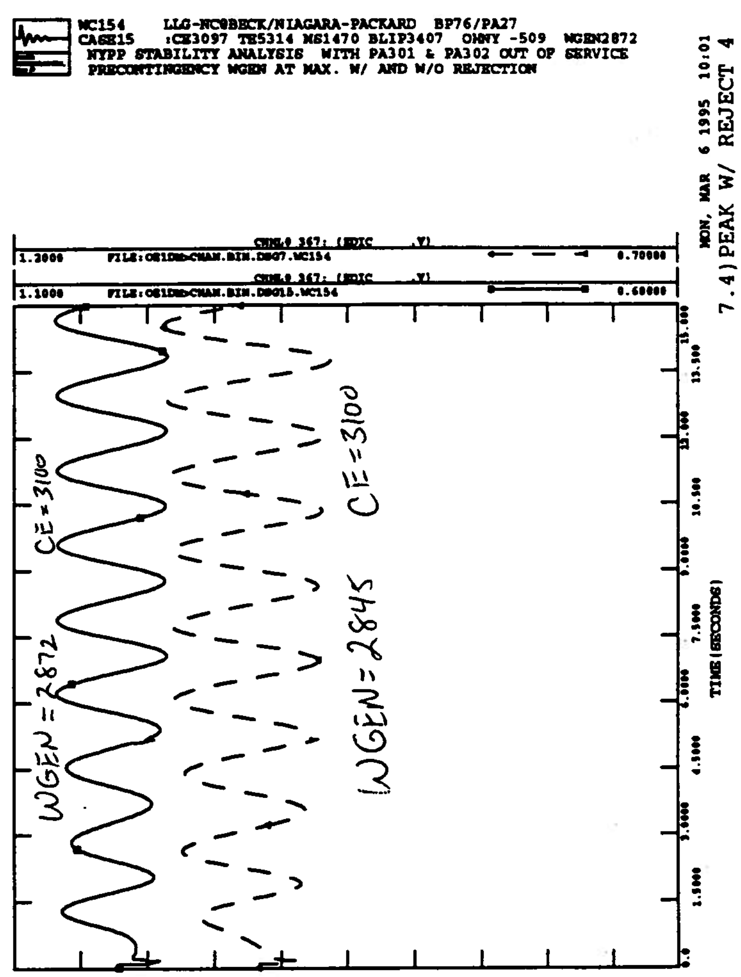
MC154 LLG-NC0BECK/NIAG-PACK BP76/PA27 REJ NIA 230W
PEAK18 :CE2831 TE4756 MS1726 BLIP3125 OHNY -667
NYPP STABILITY ANALYSIS WITH PA301 & PA302 OUT OF SERVICE
PEAK CENTRAL EAST = 2800 VARIOUS OH AND WESTERN GEN
FILE: OE2DM>CHAN.BIN.PEAK18.MC154

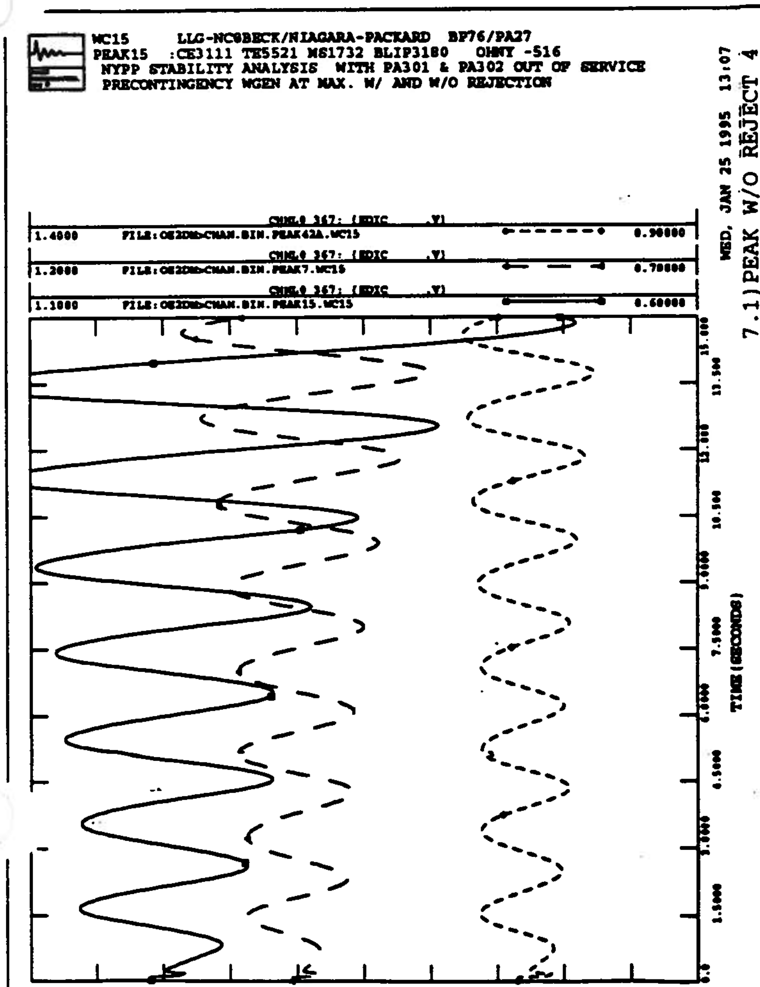


FRI, JAN 20 1995 12:18
6.3) PK WGEN 2295 NIA2575

EXHIBIT 7


WC154 LLG-NC0BECK/NIAG-PACK BP76/PA27 REJ NIA 230W
PEAK15 :CE3111 TE5521 MS1732 BLIP3180 OHNY -516
NYPP STABILITY ANALYSIS WITH PA301 & PA302 OUT OF SERVICE
PRECONTINGENCY WGEN AT MAX. W/ AND W/O REJECTION
WED, JAN 25 1995 13:09
7.2) PEAK W/ REJECT 4
TIME (SECONDS)
WGEN = 2655 CE 3100
WGEN = 2676 CE 3100
WGEN = 2669 CE = 2500


WC154 LLG-NC0BECK/NIAGARA-PACKARD BP76/PA27
CASE15 :CE3097 TE5314 MS1470 BLIP3407 OHNY -509 WGEN2872
NYPP STABILITY ANALYSIS WITH PA301 & PA302 OUT OF SERVICE
PRECONTINGENCY WGEN AT MAX. W/ AND W/O REJECTION
MON, MAR 6 1995 10:01
7.4) PEAK W/ REJECT 4
TIME (SECONDS)
WGEN = 2872 CE = 3100
WGEN = 2845 CE = 3100


WC15 LLG-NC0BECK/NIAGARA-PACKARD BP76/PA27
PEAK15 :CE3111 TE5521 MS1732 BLIP3180 OHNY -516
NYPP STABILITY ANALYSIS WITH PA301 & PA302 OUT OF SERVICE
PRECONTINGENCY WGEN AT MAX. W/ AND W/O REJECTION
WED, JAN 25 1995 13:07
7.1) PEAK W/O REJECT 4
TIME (SECONDS)

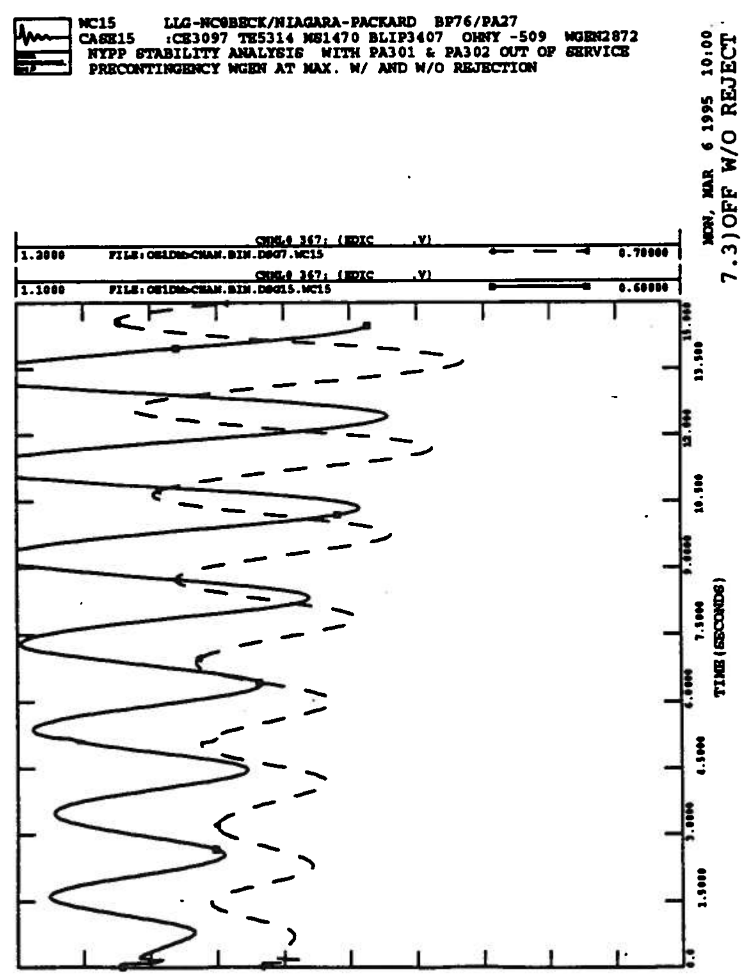
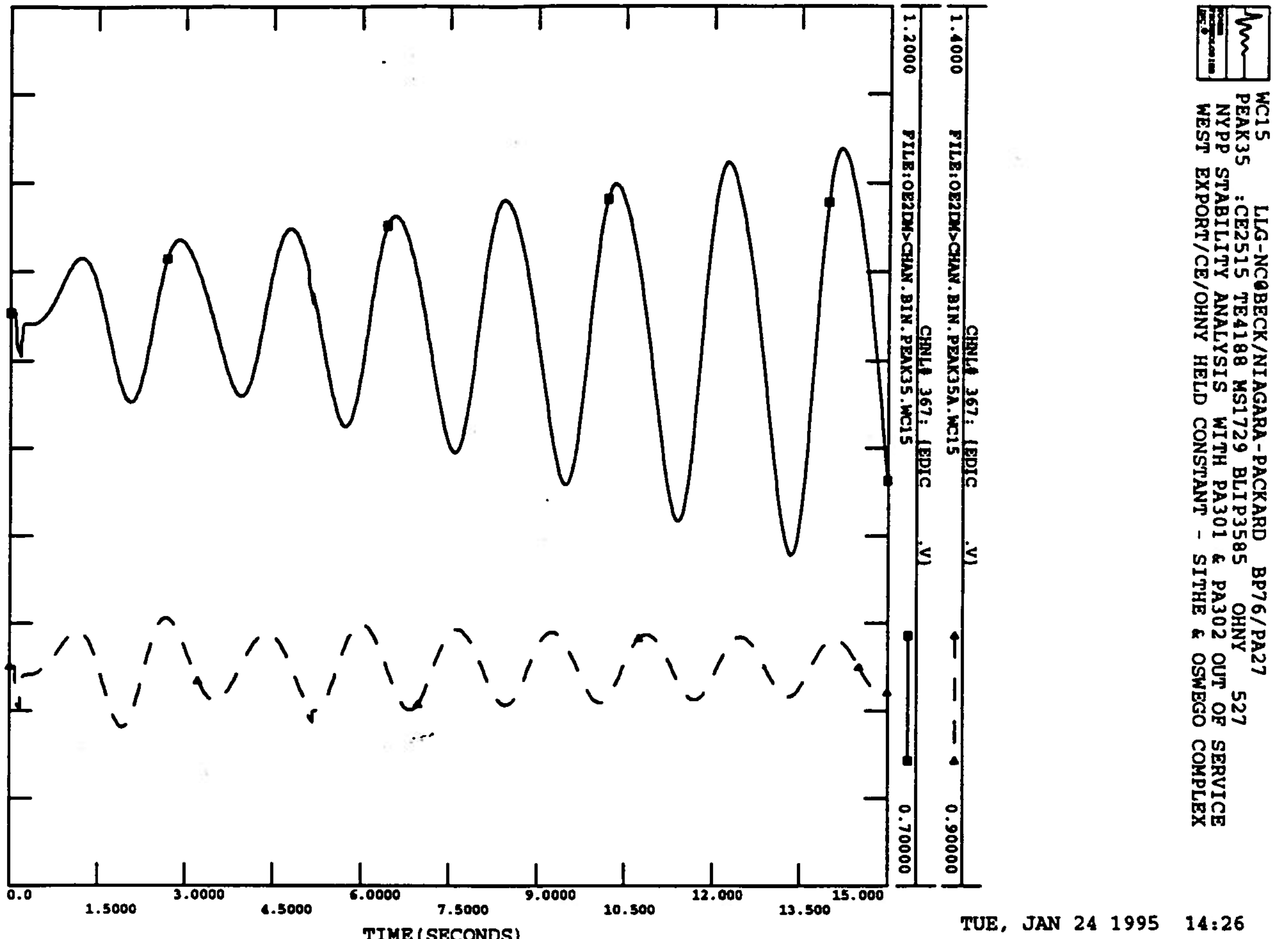
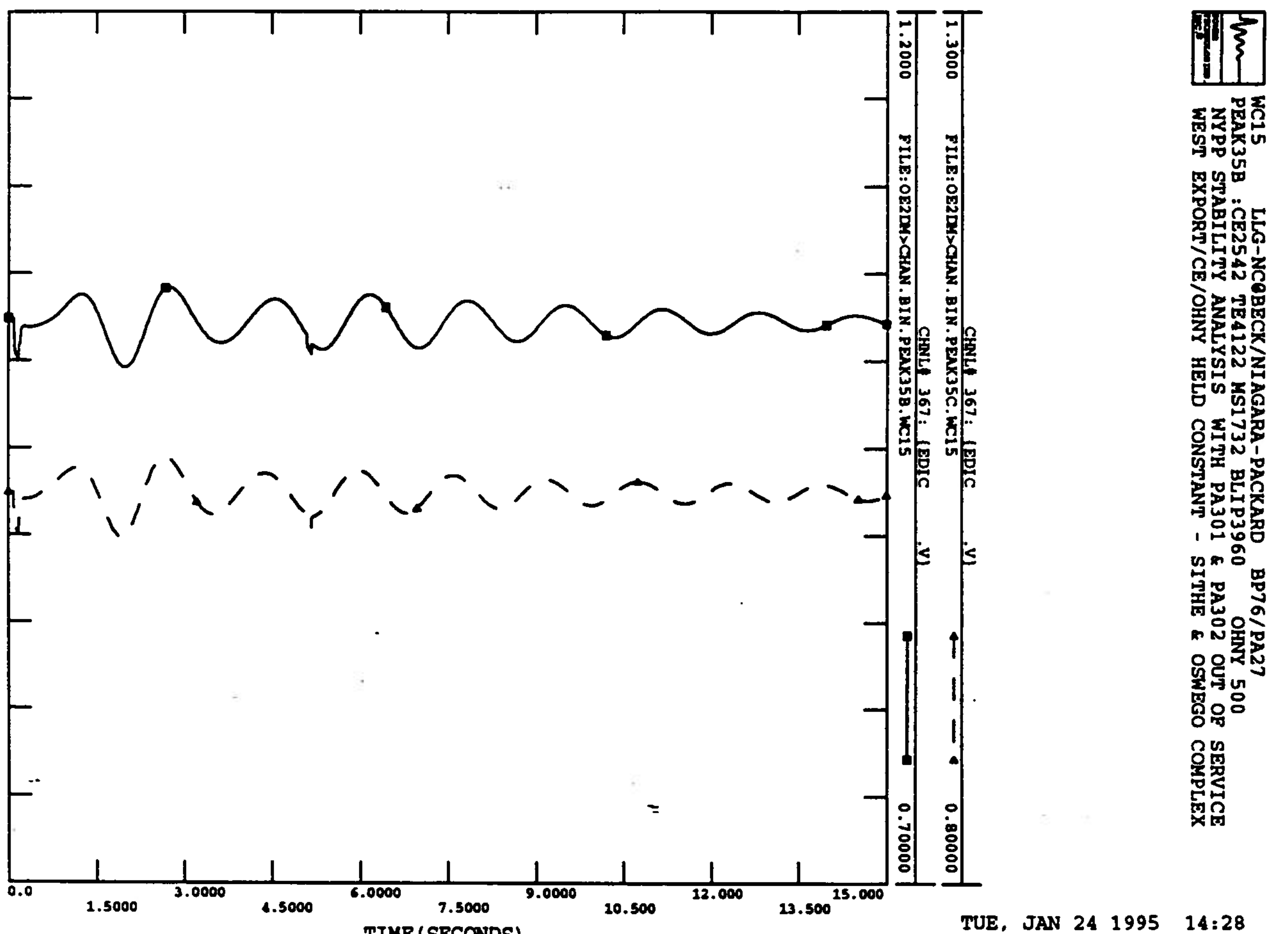

WC15 LLG-NC0BECK/NIAGARA-PACKARD BP76/PA27
CASE15 :CE3097 TE5314 MS1470 BLIP3407 OHNY -509 WGEN2872
NYPP STABILITY ANALYSIS WITH PA301 & PA302 OUT OF SERVICE
PRECONTINGENCY WGEN AT MAX. W/ AND W/O REJECTION
MON, MAR 6 1995 10:00
7.3) OFF W/O REJECT
TIME (SECONDS)

EXHIBIT 8



TUE, JAN 24 1995 14:26

8.1) PK CE2500 W/O SITHE



TUE, JAN 24 1995 14:28

8.2) PK CE2500 SITHE/OSW