BVS 2807

DATE 10 February 1995

REV -

ORIGINATOR [signature]
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F17

OLS #21

ACCEPTANCE TEST REPORT
VOLUME I OF IV
SUMMARY AND SPECIFICATION REQUIREMENTS

(CDRL 039A2)

Contract F04701-88-C-0118

Prepared For

UNITED STATES AIR FORCE
Headquarters, Space Division
Los Angeles, California

Prepared By

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1.0 INTRODUCTION

The OLS #21 Acceptance Test Report contains the technical data pertinent to the OLS #21 AVE system. This document is intended to present the Acceptance Test data in terms of the requirements of the Prime Item Development Specification (S-DMSP-886) and Interface Specification (ICD-88802).

Test results and data have been reviewed and verified by Westinghouse Electric Corporation and USAF representatives. System performance data, test histories, data summaries and system analyses are included in this report. In addition, a complete set of system log books are on file at the contractor's facility and are available for review. The Test History is in log book K42588--.

This Acceptance Test Report consists of 4 volumes as follows:

BVS 2807	OLS #21 Summary and Specification Requirements
BVS 2808	OLS #21 Acceptance Vibration Report
BVS 2809	OLS #21 Alignment & Synchronization Curves
BVS 2810	OLS #21 Weight & Center of Gravity

1.1 Summary of OLS 21 System - Specific Parameters

OLS software Program = OLSP03.FS & OLSE03.FS

Gain Constants and Sensor Switch Points

P(0) = 7.750 dB
P(1) = 51.75 dB
P(2) = 0.00 dB
P(3) = 29.75 dB
S(1) = 59.875 dB
S(2) = 22.00 dB
S(3) = 33.75 dB

(These may change during Early Orbit Calibration.)

PMT HV EST (A532) = 3.340 volts ± .250V

Cone Cooler S/N 032 with T detector S/N 4112

T Cold Patch EST (A549) curve - see Table next page.

T Cold Patch EST Voltage = 1.942 ± .200V

TGAIN Left = 7
Right = 7
Both = 7

TLEVEL vs M1 temperature range - see second page following for table

VDGA constant for PMTCAL = $(0440)_8$

Encoder Simulator Bias Constant Prime= -22 Redundant= -21

Encoder Simulator Separation Constant Prime= 6 Redundant= 5

T COLD PATCH TEMP vs. EST VOLTS
CONE COOLER S/N 032
T DETECTOR S/N 4112

T (deg k)	EST (Volts)
98.0	5.056
99.0	4.704
100.0	4.379
101.0	4.078
102.0	3.800
103.0	3.544
104.0	3.307
105.0	3.087
106.0	2.884
107.0	2.696
108.0	2.522
109.0	2.361
110.0	2.212
111.0	2.074
112.0	1.945
113.0	1.826
114.0	1.715
115.0	1.612
116.0	1.516
117.0	1.427
118.0	1.344
119.0	1.267
120.0	1.195
121.0	1.128
122.0	1.065
123.0	1.007
124.0	0.952
125.0	0.901

OLS #21
TLEVEL VS M1 TEMPERATURE RANGE
T DETECTOR S/N 4112

TL	M1 TEMP(°C)		
1111	-27.681°	to	-22.040°
1110	-22.040°		-16.399°
1101	-16.399°		-10.758°
1100	-10.758°		-5.117°
1011	-5.117°		-0.524°
1010	-0.524°		6.165°
1001	6.165°		11.806°
1000	11.806°		17.447°
0111	17.447°		23.088°
0110	23.088°		28.729°
0101	28.729°		34.370°
0100	34.370°		40.011°
0011	40.011°		45.652°
0010	45.652°		51.293°
0001	51.293°		56.934°
0000	56.934°		62.575°

TLEVEL command changes should be uplinked to the OLS as a function of M1 temperature to maximize T Channel output accuracy.

1.2 Specification Pass-Fail Summary

The following sections of this Acceptance Test Report contain the test results as they pertain to the Development Specification requirements. Each Test Report paragraph heading is followed by the corresponding Segment Spec paragraph number in parentheses.

The table on the following page summarizes the OLS #21 pass-fail status vs. Development Spec. paragraph number.

DEVELOPMENT SPEC. PARAGRAPH NUMBER		PASS	FAIL
3.2.1.1.1.1	Infrared Spectrum	x	
3.2.1.1.1.2	Vis-Day Spectrum	x	
3.2.1.1.1.3	Vis-Night Spectrum	x	
3.2.1.1.1.4	Snow Cloud Optics	x	
3.2.1.1.2.1	Fine Geometric Resolution - HRD	x	
3.2.1.1.2.1	Fine Geometric Resolution - T	x	
3.2.1.1.2.2	Smooth Geometric Resolution - HRD	x	
3.2.1.1.2.2	Smooth Geometric Resolution - T	x	
3.2.1.1.2.2	Smooth Geometric Resolution - PMT	x	
3.2.1.1.2.3	Data Sampling	x	
3.2.1.1.3.1	Along Track Geometric Accuracy	x	
3.2.1.1.3.2-4	Along Scan Geometric Accuracy	x	
3.2.1.1.4.1.a	T Channel Radiometric Accuracy Repeatability	x	
3.2.1.1.4.1b	T Channel Radiometric Accuracy - Stability	x	
3.2.1.1.4.1c	T Channel Radiometric Accuracy - Fixed	x	
3.2.1.1.4.2	Daytime Radiometric Accuracy	x	
3.2.1.1.4.3	Nighttime Radiometric Accuracy	x	
3.2.1.1.4.5.1	Terminator Location	x	
3.2.1.1.4.5.3	Maximum Gain Settings	x	
3.2.1.1.4.5.4	Commandable T-Channel Gain	x	

DEVELOPMENT SPEC. PARAGRAPH NUMBER	PASS	FAIL
3.2.1.1.4.5.5 Commandable T-Channel Level	x	
3.2.1.1.4.6.2/3 A/D Conversions & Algorithms	x	
3.2.1.1.5 Radiometric Resolution	x	
3.2.1.1.6.1 T Channel Noise	x	
3.2.1.1.6.2 L Channel Noise (Day)	x	
3.2.1.1.6.3 L Channel Noise (Night)	x	
3.2.1.1.6.4 Dark Current	x	
3.2.1.1.6.5 Stability	x	
3.2.1.1.6.6 Along-Track Noise Integration	x	
3.2.1.1.6.7 Glare Suppression	x	
3.2.1.1.8 Scan Angle	x	
3.2.1.1.9 Data Collection Rate	x	
3.2.1.2 Data Management	x	
3.2.1.3.1 28V Power	x	
3.2.1.3.2 5V Power	x	
3.2.2.1 Total Mass	x	
3.2.2.2 Component Mass	x	
3.2.2.3 Cable Harness Mass	x	
3.2.2.4 Dimensional Limits	x	
3.2.7 Survivability	x	
3.3 Design Features	x	
20.2 Environment	x	
5.1 Shipping & Storage	x	
INTERFACE SPEC PARAGRAPH NUMBER		
3.2.3 Alignment	x	

1.3 <u>Summary of OLS #21 Testing</u>

08/17/94	Start system test
	Short SSS and coax cables
	Short SSS tunnel assy and tape recorders
08/31/94	Installed 1 HRD shim to optimize focus
09/05/94	Completed system adjustment and config tests
09/08/94	3 axis vibration of all units
	PSU vibration problem AM 21-10
	SPS vibration problem AM 21-11
09/13/94	Permanent switch to OLS 20 PSU
09/18/94	Completion post vib electrical tests
09/19/94	Move to thermal vacuum chamber
09/23/94	TV pumpdown, purge and bakeout
09/28/94	T channel adjustment problem
	Beamsplitter in backwards AM 21-14
	Aborted TV test
10/18/94	Completed SSS beamsplitter rework
10/20/94	Completed ambient system retest
10/21/94	SSS 3 axis vibration
10/23/94	Completed post vibration testing
10/24/94	Installed in thermal vacuum chamber
10/28/94	TV pumpdown, purge and bakeout
11/08/94	Completed T channel TV adjustment
11/09/94	Added second HRD shim to optimize focus
	Installed encrypters
	PR complement SN 75, 72, 73, 74
	Flight quality coax cables installed
11/15/94	Hot limit T reference completed
11/17/94	Cold soak #1 completed
11/18/94	Hot soak #1 completed
11/20/94	Cold soak #2 completed
11/22/94	Hot soak #2 completed
11/28/94	Cold limit completed
12/03/94	Hot limit completed
	Chamber warm-up and vent
12/05/94	System acceptance test completed
12/07/94	Weight and center of gravity

1.4 Configuration and Serialized Assemblies

The configuration listing on the following pages includes the current configuration of OLS #21 as of 12-08-94.

DESCRIPTION	ASSEMBLY NO.	REV.	S/N
Key Drawing	536R500G10	AY	5016
SSS Assembly	693R700G04	AK	5016
W/D	693R662G02	D	-
Cable Assy	633R781G01	A	-
Cable Assy	633R782G01	-	-
Cable Assy	633R783G01	-	-
Cable Assy	633R784G01	-	-
Cable Assy	633R785G01	A	-
Cable Assy	432R240G01	-	-
Cable Assy	644R199G01	B	-
Cable	682R189G01	G	-
Cable	693R692G02	J	002
Heat Cont	633R053G21	M	5053
Electronics	633R052G06	M	5053
Heat Cont	633R053G22	M	5054
Electronics	633R052G06	M	5054
Heat Cont	633R053G23	M	5051
Electronics	633R052G06	M	5051
Heat Cont	633R053G24	M	5052
Electronics	633R052G06	M	5052
OSC	623R765G09	V	5016
IMC LEAD	623R909G01	C	-
Spring Assy	522R210G01	A	-
Spring Assy	522R210G01	A	-
Spring Assy	522R210G01	A	-
Spring Assy	522R210G01	A	-
Mot Assy	623R894G01	B	5016

DESCRIPTION	ASSEMBLY NO.	REV.	S/N
IMC/M3	623R858G01	F	5014
Assy	522R222G01	B	1007
Assy	522R223G01	D	1007
Assy	522R222G01	B	1008
Assy	522R223G01	D	1008
Assy	522R302G01	A	-
Rel Assy	640R701G02	G	5016
R/M EST Assy	644R088G02	J	-
ENPA Assy	682R215G08	Y	5016
Cir. Card	682R167G07	Y	5017
Cir. Card	682R112G07	AC	5016
Cir. Card	682R110G07	AD	5018
AUXENCODER	682R300G05	J	5016
Cir. Card	682R149G05	J	5017
Cir. Card	682R151G05	J	5017
SP Assy #1	623R771G01	C	A1019
Flat Spring	522R118H01	B	A1019
SP Assy #2	623R772G01	D	A1020
Flat Spring	522R118H01	B	A1020
SP Assy #3	623R773G01	C	A1008
Flat Spring	522R118H01	B	A1008
SP Assy #4	623R774G01	C	D-20
Flat Spring	522R118H01	B	D-20

DESCRIPTION	ASSEMBLY NO.	REV.	S/N
Z Tunnel	758R836G01	B	5015
H.V. Wire	540R582G06	B	-
Tunnel Frame	758R832G01	A	-
Insulator	758R834G01	-	-
Z Tunnel	758R837G01	B	5015
H.V. Wire	540R582G04	B	-
Tunnel Frame	758R833G01	A	-
Insulator	758R835G01	-	-
Strip	540R593G01	-	-
Strip	540R593G02	-	-
T-Clamp Assy	623R821G02	L	-
AUXENCODER	640R846G06	U	5016
Cir Card	640R825G06	P	5018
Cir Card	640R844G06	U	5018
T-CAL Source	623R920G01	C	5016
HRD Elect	693R663G03	F	5004
FILT Assy	693R661G01	-	-
Cir Card	623R758G04	W	5014
Cir Card	623R506G07	AF	0014
SOL ASSY	758R620G03	N	5009
Cable	758R693G01	D	-
T Channel	765R048G03	K	5008
Cir Card	762R539G03	M	5006
Mod Assy	623R727G01	C	5028
Mod Assy	623R727G01	C	5028
VDGA	644R150G07	P	5016
Cir Card	644R152G05	AB	5016

DESCRIPTION	ASSEMBLY NO.	REV.	S/N
Cir Card	644R153G05	AA	5015
Cir Card	644R127G07	D	5015
Post Amp	644R220G09	T	5016
Cir Card	644R228G07	BA	5016
EST/LMD Assy	644R219G04	E	5016
Cir Card	758R142G03	M	0016
PMT Assy	644R909G07	AC	0018
A1	644R903G04	AC	0018
A2	644R907G02	T	0019
A3	644R807G04	R	5016
A4	644R905G03	L	0018
A5	644R935G06	Y	5014
A7	536R916G01	F	5013
Tube A6	640R920G02	J	0029
Rel Assy	640R381G02	K	5016
R/M EST Assy	640R753G02	J	5015
Z-THERM	758R779G01	B	5015
H.V. Wire	540R582G02	B	-
Blanket	758R807G01	-	-
Frame	758R830G01	A	-
Z-Therm	758R781G01	B	5015
H.V. Wire	540R582G03	B	-
Frame	758R829G01	C	-
Blanket	758R808G01	-	-
RAD Housing	765R158G01	B	-
BLNKT Assy	522R276G02	J	-
Deployable	640R320G01	A	5015

DESCRIPTION	ASSEMBLY NO.	REV.	S/N
Pad Assy	640R332G01	-	-
Mirror Assy	536R188G01	A	5016
Mount DOU	540R565G01	-	-
Plate Assy	540R568G01	A	5015
Strip	540R569G01	B	-
Insulator	758R985G01	-	-
ENC 1A14	688R705H01	E	019
RAD Cooler	9RA5216H02	M	032
TH BLKT Kit	661R660G01	A	5015
GSSB	765R061G01	A	-
GSSA	758R943G01	B	5015
SPS	775R150G04	AH	5016
WD	775R151G01	H	-
BUS BAR	640R714G03	U	5016
BUS BAR	640R714G02	U	5017
MAT PL	712R003G02	W	135485-002
Cable J4	640R941G09	R	-
Cable J5	640R941G04	R	-
Cable J6	640R937G01	H	-
Cable J15	640R941G03	R	-
Cable J19	640R930G04	K	-
Cable J20	640R930G02	K	-
Cable J21	640R941G05	R	-

DESCRIPTION	ASSEMBLY NO.	REV.	S/N
Cable J22	640R941G01	R	-
Cable J23	640R943G03	L	-
Cable J24	640R942G04	N	-
Cable J25	640R930G01	K	-
Cable J26	640R941G06	R	-
Cable J27	644R346G01	H	-
Cable J30	640R944G02	J	-
Cable J31	640R942G06	N	-
COAX J7-14	640R913G01	T	-
R/B Assy	693R864G02	B	5005
MOTH BRD	644R081G04	T	002
Cable P4-34	644R235G01	M	-
Cable J2-3	644R236G01	K	-
Cable J4-P7	765R056G02	E	-
2A1A1	765R626G02	B	5010
2A1A2	785R005G03	C	5012
2A1A3	693R808G02	F	5007
R/B Assy	644R665G07	AR	5029
MOTH BRD	644R081G01	T	001
Cable	644R235G01	M	-
Cable	644R236G01	K	-
Cable	765R056G02	E	-
2A2A1	765R626G02	B	5009
2A2A2	785R005G03	C	5011
2A21A3	765R623G02	E	5005
2A102	775R073G02	L	5009
2A302	775R073G02	L	5010

DESCRIPTION	ASSEMBLY NO.	REV.	S/N
2A104	775R071G02	F	5009
2A304	775R071G02	F	5010
2A106	775R075G03	K	5009
2A306	775R075G03	K	5010
2A107	775R055G03	J	5009
2A307	775R055G03	J	5010
2A108	775R054G02	M	5009
2A308	775R054G02	M	5010
2A122	775R020G02	F	5009
2A322	775R020G02	F	5010
2A123	775R021G02	C	5009
2A323	775R021G02	C	5010
2A124	775R022G02	C	5009
2A324	775R022G02	C	5010
2A125	775R008G03	G	5009
2A325	775R008G03	G	5010
2A127	775R014G05	AC	5009
2A327	775R014G05	AC	5010
2A128	775R023G02	B	5009
3A328	775R023G02	B	5010
2A129	775R024G03	F	5009
2A329	775R024G03	F	5010
2A130	775R025G02	C	5009
2A330	775R025G02	C	5010
2A131	775R026G02	D	5009
2A331	775R026G02	D	5010
2A132	775R015G04	J	5009

DESCRIPTION	ASSEMBLY NO.	REV.	S/N
2A332	775R015G04	J	5010
2A133	775R016G04	K	5009
2A333	775R016G04	K	5010
2A134	775R027G02	C	5009
2A334	775R027G02	C	5010
2A135	775R028G02	C	5011
2A335	775R028G02	C	5010
2A136	775R052G02	G	5009
2A336	775R052G02	G	5010
2A137	775R053G03	J	5009
2A337	775R053G03	J	5010
2A138	775R009G02	B	5009
2A338	775R009G02	B	5010
2A201	775R029G02	B	5009
2A202	775R029G02	B	5010
2A203	775R001G02	N	5004
2A204	775R001G01	N	5010
2A205	775R017G04	K	5009
2A206	775R017G04	K	5010
2A207	775R002G02	L	5009
2A208	775R002G02	L	5010
2A209	775R003G03	K	5009
2A210	775R003G03	K	5010
2A211	775R030G03	C	5009
2A212	775R030G03	C	5010
2A213	775R034G02	F	5004
2A214	775R034G02	F	5009

DESCRIPTION	ASSEMBLY NO.	REV.	S/N
2A215	775R031G03	D	5009
2A216	775R031G03	D	5010
2A217	775R004G02	D	5009
2A218	775R004G02	D	5010
2A219	775R005G02	C	5009
2A220	775R005G02	C	5010
2A221	775R006G02	B	5009
2A222	775R006G02	B	5010
2A223	775R010G03	E	5009
2A224	775R010G03	E	5010
2A227	775R032G02	B	5009
2A232	775R032G02	B	5010
2A228	775R007G02	C	5009
2A233	775R007G02	C	5010
2A229	775R018G02	B	5007
2A234	775R018G02	B	5010
2A230	775R019G02	C	5009
2A235	775R019G02	C	5010
2A231	775R033G02	D	5009
2A236	775R033G02	D	5010
2A237	775R011G04	G	5009
2A240	775R011G04	G	5010
2A238	775R012G03	L	5003
2A241	775R012G03	L	5010
2A239	775R013G03	M	5009
2A242	775R013G03	M	5010
SPU	775R140G04	R	5016

DESCRIPTION	ASSEMBLY NO.	REV.	S/N
W/D	758R605G02	B	-
BUS BAR	640R912G01	N	5016
MOTH BRD	640R927G04	AD	134611-001
Cable J1	640R942G05	N	-
Cable J2	640R942G02	N	-
Cable J3	640R941G07	R	-
Cable J4	640R941G02	R	-
Cable J5	640R942G03	N	-
Cable J6	640R937G01	H	-
Cable J7	640R941G08	R	-
Cable J8	640R943G02	L	-
Cable J9	640R943G01	L	-
3A103	775R042G02	D	5009
3A203	775R042G02	D	5010
3A104	775R043G04	G	5009
3A204	775R043G04	G	5010
3A105	775R040G04	G	5009
3A205	775R040G04	G	5010
3A106	775R041G02	B	5009
3A206	775R041G02	B	5010
3A107	775R035G02	G	5009
3A207	775R035G02	G	5010
3A108	775R044G03	D	5009
3A208	775R044G03	D	5010
3A109	775R036G02	D	5009
3A209	775R036G02	D	5010
3A110	775R037G02	D	5009
3A210	775R037G02	D	5010

DESCRIPTION	ASSEMBLY NO.	REV.	S/N
3A111	775R045G04	D	5009
3A211	775R045G04	D	5010
3A112	775R046G02	C	5009
3A212	775R046G02	C	5010
3A113	775R047G02	C	5009
3A213	775R047G02	C	5010
3A114	775R038G02	F	5009
3A214	775R038G02	F	5010
3A116	775R039G02	B	5009
3A216	775R039G02	B	5010
3A116	775R048G02	E	5009
3A216	775R048G02	E	5010
OSU	693R770G02	K	5016
MOTHER BRD	522R783G04	L	129281-002
Cable	644R134G01	M	-
Cable	644R134G02	M	-
11A1	775R049G02	F	5005
11A2	775R050G02	G	5005
BOT Cover	644R047G04	AB	5017
Top Cover	693R778G02	E	5016
PSU	758R050G09	BG	5015
Wiring Doc	690R898G01	V	-
MOTH BRD	765R397G01	A	134646-001
Matrix Plate	765R396G01	B	128283-002
Cable J1	758R607G01	D	-
Cable J9	644R164G01	M	-
Cable J10	644R165G01	M	-

DESCRIPTION	ASSEMBLY NO.	REV.	S/N
Cable J12	644R166G01	M	-
RFI	690R891G01	B	5014
REG COMP	682R089G03	T	5012
12A3	756R609G02	F	5016
12A101	781R982G02	D	5004
12A102	765R571G05	H	5015
12A103	765R575G05	J	5016
12A104	688R489G04	K	5015
12A105	688R491G05	T	5028
12A106	688R491G05	T	5029
12A107	688R493G05	N	5028
12A108	688R493G05	N	5029
12A109	640R998G05	N	5029
12A110	640R998G05	N	5030
12A112	688R481G05	P	5029
12A113	775R051G02	B	5004
12A114	688R481G05	P	50232
12A115	644R864G04	J	5015
12A117	756R593G02	J	5008
12A201	682R381G04	F	5015
12A202	693R711G02	B	5015
12A203	644R078G04	T	5015
12A204	688R502G04	H	5015
12A205	688R499G04	G	5029
12A206	688R499G04	G	5030
12A207	688R503G04	F	5015
12A208	644R069G04	W	5015

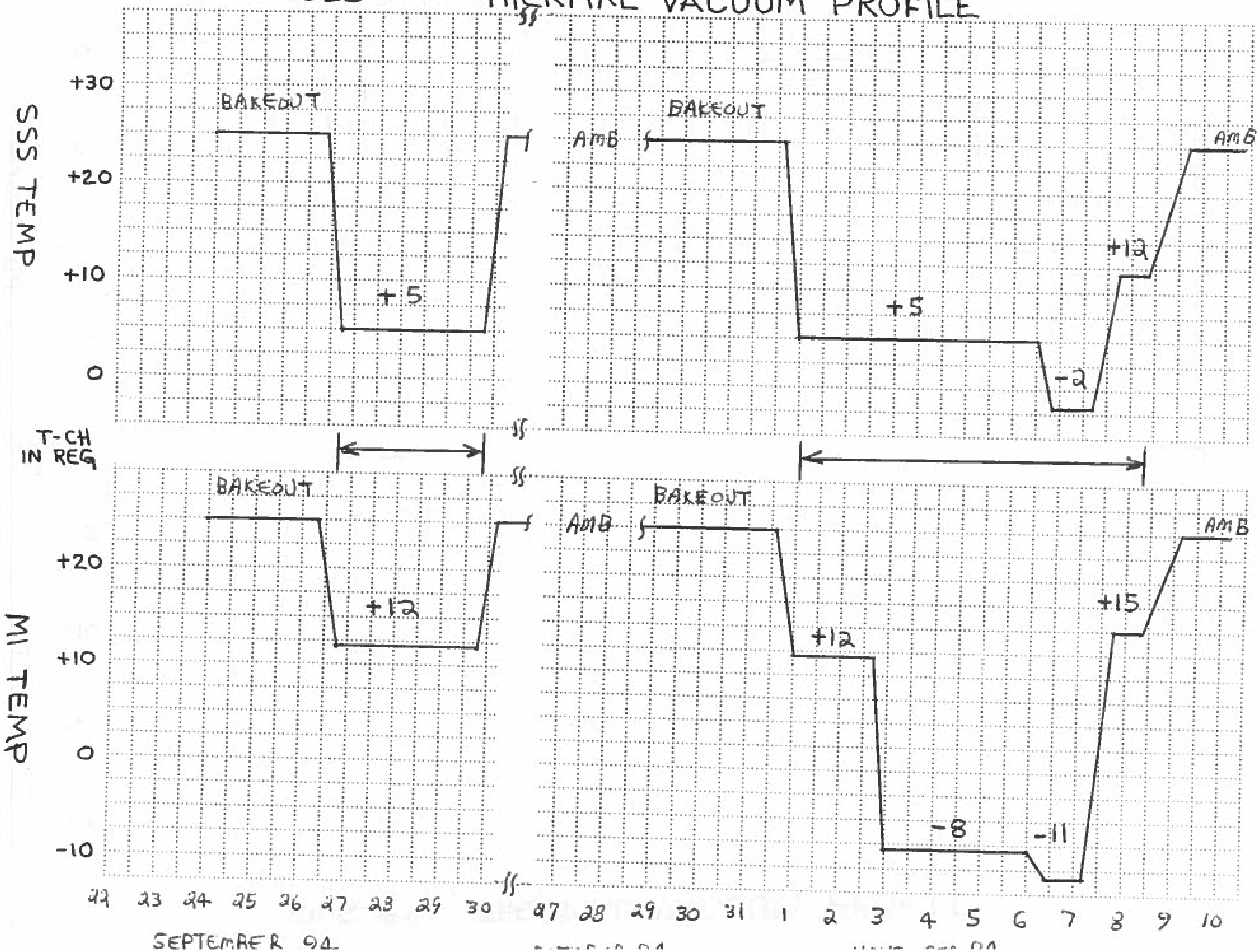
DESCRIPTION	ASSEMBLY NO.	REV.	S/N
12A209	688R505G04	F	5015
12A210	688R504G04	F	5015
12A211	688R500G04	F	5016
12A212	688R495G04	J	5030
12A213	688R495G04	J	5031
12A214	688R497G04	H	5015
Cable	9RA5255H26	J	013
Cable	9RA5255H19	J	006
Cable	9RA5255H20	J	006
Cable	9RA5255H21	J	005
Cable	9RA5255H22	J	001
Cable	9RA5255H27	J	-
Cable	9RA5255H24	J	006
Cable	9RA5255H25	J	006
Cable	9RA8118G01	H	-
Cable Coax	644R327G10	J	813
Cable Coax	644R327G02	J	812R
Cable Coax	644R327G09	J	706R
Cable Coax	644R327G05	J	709
Cable Coax	644R327G06	J	710
Cable Coax	644R328G09	G	711R
Cable Coax	644R328G10	G	712R
Cable Coax	644R328G03	G	709R
Cable Coax	644R328G04	G	710R
Cable Coax	644R328G07	G	707
Cable Coax	644R328G08	G	814R
Cable Coax	644R329G18	M	712R
Cable Coax	644R329G02	M	711

DESCRIPTION	ASSEMBLY NO.	REV.	S/N
Cable Coax	644R329G17	M	710R
Cable Coax	644R329G20	M	715R
Cable Coax	644R329G07	M	714
Cable Coax	644R329G19	M	822R
Cable Coax	644R329G11	M	716
Cable Coax	644R329G12	M	717
Cable Coax	644R329G13	M	718

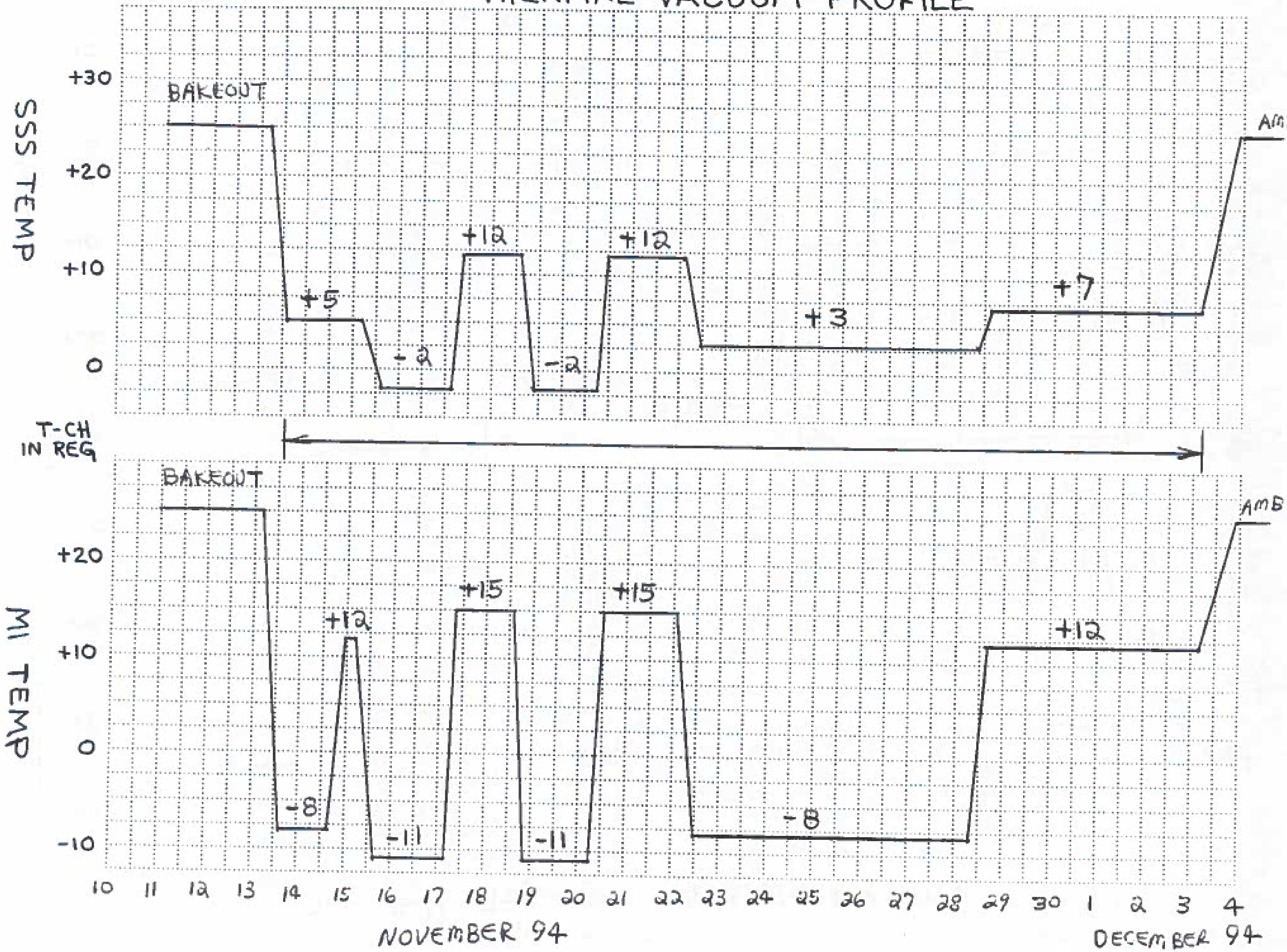
1.5 Thermal Vacuum Profiles

The OLS #21 AVE underwent a series of Thermal Vacuum Tests. The profiles on the next pages represent the history of pumpdowns, SSS temperature and M1 temperatures experienced by the OLS #21 AVE.

OLS #21 THERMAL VACUUM PROFILE



OLS #21 THERMAL VACUUM PROFILE



1.6 Test History Calendar

The test history calendar is a capsule look at the day-to-day progress of the OLS #21 AVE throughout its testing period at WEC.

UNIT OLS #21 TEST HISTORY DATE AUG '94

	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17 Began System Test	18 4x12 4x1x1 4x1x2	19 4x7x1 4x2x1 4x6x1	20 Funct Tests
21 Funct Tests	22 Funct Tests	23 Funct Tests Config Tests 4x1x1 4x1x2	24 Config Tests Funct Tests 4x3x1	25 4x5x1 APC11PT Config Tests 4x4x1	26 4x9x1 4x13 6x6x2 MPA11PT AHC11PT Config Tests 6x2x1 6x3x1	27 Config Tests AHSF3PTI MHC11PT 6x3x3 6x5x1
28 AHSFB11PT 6x2x4 6x8x2 6x9 6x6x3 Funct Tests 6x4x3A 6x3x5 6x6x1 6x3x2	29 Funct Tests Config Tests 6x11x1 6x11x2 6x11x3 6x11x4	30 Funct Tests 6x10 SIMFLT	31 Config Tests Funct Tests 1 shim for HRD installed MHC11PT			

UNIT OLS #21 — TEST HISTORY — DATE SEPT '94

				1 6x7x1 6x11x3 6x7x2 Config Tests Funct Tests	2 6x7x2 6x2x1 Funct Tests Config Tests	3 Config Tests
4 Config Tests	5 Config Tests Prepared for vibration	6 Engineering STS Freq Test	7 No Tests	8 SPS 3 axis vib	9 PSU vib problem	10 SSS 3 axis vib
11 No Tests	12 Special PSU Vib Bad 12A1A2. SPU & OSU 3 axis vib	13 OLS #20 PSU now used in OLS #21 4x1x2 4x1x1 4x2x1 4x6x1	14 6x2x1 6x3x1 MHA7PT MPA7PT	15 6x4x3A 6x6x2 APC7PT 9x1x1 6x7x2 Funct Tests	16 Funct Tests	17 5x1x1C Loop
18 5x1x1C Loop	19 Moved System to TV Chamber	20 Funct Tests	21 Funct Tests	22 Funct Tests 6x3x4 6x6x2 4x11x1 6x3x5 MHA7PT 6x5x1 SIMFLT	23 Funct Tests 6x7x1 6x7x2 AHSF7PT 6x2x2. 6x3x1 Pumpdown @2400	24 Bake-Out
25 Bake-Out	26 t5/t12 @1930 Funct Tests 6x9	27 AHSF7PT AHSFB9PT 4x9x1 6x5x1 6x6x2 6x2x2 7x7 MHC7PT	28 4x8x1. Problem with T-Ch adjust ASU 210, 310 T121T231D	29 MPA7PT ATSF7PT MTC7PT 6x5x2 6x3x3 Chamber Warm-up @2235	30 Removed SSS	

UNIT OLS #21 TEST HISTORY DATE OCT '94

30 Bake-out	31 Bake-out					1 SSS Rework reversed beamsplitter repaired
2 →	3 →	4 →	5 →	6 →	7 →	8 →
9 →	10 →	11 →	12 →	13 →	14 →	15 →
16 →	17 SSS Rework	18 Moved to Blue Rm Adjusted Scanner Readjust PMT Gain Balance AHSF3PTI AHC11PT	19 MPA11PT 6x4x3A MHC11PT APC11PT 6x2x1 6x7x2	20 SIMFLT	21 SSS 3 axis Vib AHSF3PTI AHSF7PT	22 MPA7PT 6x4x3A APC7PT 6x6x2 MHA7PT
23 6x2x1 6x7x2 6x3x1 Funct Tests	24 Installed System in TV Chamber	25 Funct Tests	26 MHA7PT 6x5x1 4x11x1 6x2x2 Backup aux encoder problem 6x9 Funct Tests AHSF7PT	27 6x3x4 6x6x2 6x3x5 6x3x1 Funct Tests broken. SSS extension cable 6x7x1 6x7x2	28 SIMFLT Funct Tests Began Pumpdown @ 1800	29 Bake-out

UNIT OLS #21 TEST HISTORY. DATE Nov '94

		1 +5/+12 Funct Tests 4+8+1 4+8+2 T121T231D	2 ASU 210 310 6+3+3 ATSF7PT Funct Tests 4+9+1 MTC7PT 6+5+2 6+7+3	3 +5/-8 AHSFB9PT 6+5+1 6+6+2 MHC7PT 6+3+5 6+2+5 6+9 6+2+2 MPA7PT APC7PT 6+7+1 6+3+1 6+3+4	4 4+8+3 T121T231A ASU210Q 6+5+1 T121T229A MHC7PT T125T227A 6+2+4 ASU270 AHSF2PT Funct Tests ATSF7PT MTC7PT	5 6+5+2 7+12 Funct Tests
6 To Cold Soak #1 @0001 9+1+3 -2/-11 @0500 T121T231B 6+10 6+2+2 SIMFLT	7 To Hot Soak #1 @0450 9+1+6 +12/+15@1340 T121T231B 6+10 6+2+2	8 SIMFLT Chamber Warm-up @0930	9 Door Open T-Ch Pot Tool Removed Installed BB's Added 1 HRD Shim Funct Tests 6+2+2 6+5+1	10 Funct Tests Chamber Pumpdown @0821	11 Bake-out	12 Bake-out
13 7+7 +5/-8 Funct Tests	14 Funct Tests 6+2+3A TDCRM2G T121T231G T121T221S M1 to +12 @1640	15 M1=+12@0045 6+2+3A TDCRM2G T121T231H To Cold Soak #1 @0440 -2/-11@1330 Funct Tests	16 Funct Tests T121T231B 6+2+2 SIMFLT	17 To Hot Soak #1 @0410 +12/+15@0930 Funct Tests SIMFLT	18 T121T231B Funct Tests 6+2+2 To Cold Soak #2 @1530 7+4A -2/-11@2200	19 Funct Tests T121T231B
20 SIMFLT 9+1+6 To Hot Soak #2 @0710 +12/+15@1200	21 SIMFLT Funct Tests T121T231B SDS Formatter G Problem	22 Funct Tests To Cold Limit @0250 9+1+3 +3/-8 @1138 6+2+3A 6+2+4 6+2+2 6+2+5 6+7+1 6+7+3	23 ATC11PT AHSF3PTI T121T231B ASU 210 310 6+3+5 T123T229B T125T227B ASU 270	24 6+11+1 6+11+2 6+11+3 6+11+4 9+1+6 Funct Tests	25 Funct Tests 6+10 AHC11PT T119T220B	26 TDCRM3B Funct Tests AHSFB9PT MPA11PT MTC11PT MHC11PT 6+3+1
27 9+1+4 Funct Tests SIMFLT 6+3+3 6+6+1 6+6+2 6+6+3 6+4	28 Funct Tests To Hot Limit @1030 7+4B 9+1+2 +7/+12@1430 6+2+3A AHSF3PTI	29 AHSFB9PT Funct Tests 6+2+2 MHC7PT T121T231B ASU 210, 270, 310 6+2+4 6+2+5 APC1PT ATS7PT T123T229B 6+3+1 T125T227B	30 MPA7PT MTC7PT T119T220B TDCRM3B SIMFLT			

UNIT OLS #21 TEST HISTORY DATE DEC '94

				1 6x11x1 6x11x2 6x11x3 6x11x4 Funct Tests 6x3x3 6x3x4	2 6x6x1 6x6x2 6x6x3 9x1x4 Funct Tests 9x1x1	3 6x10 Began Chamber Warm-up @0550
4 Moved system to Blue Room AHSFIIPT	5 6x2x1 AHSFIIPT Uncabled System	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

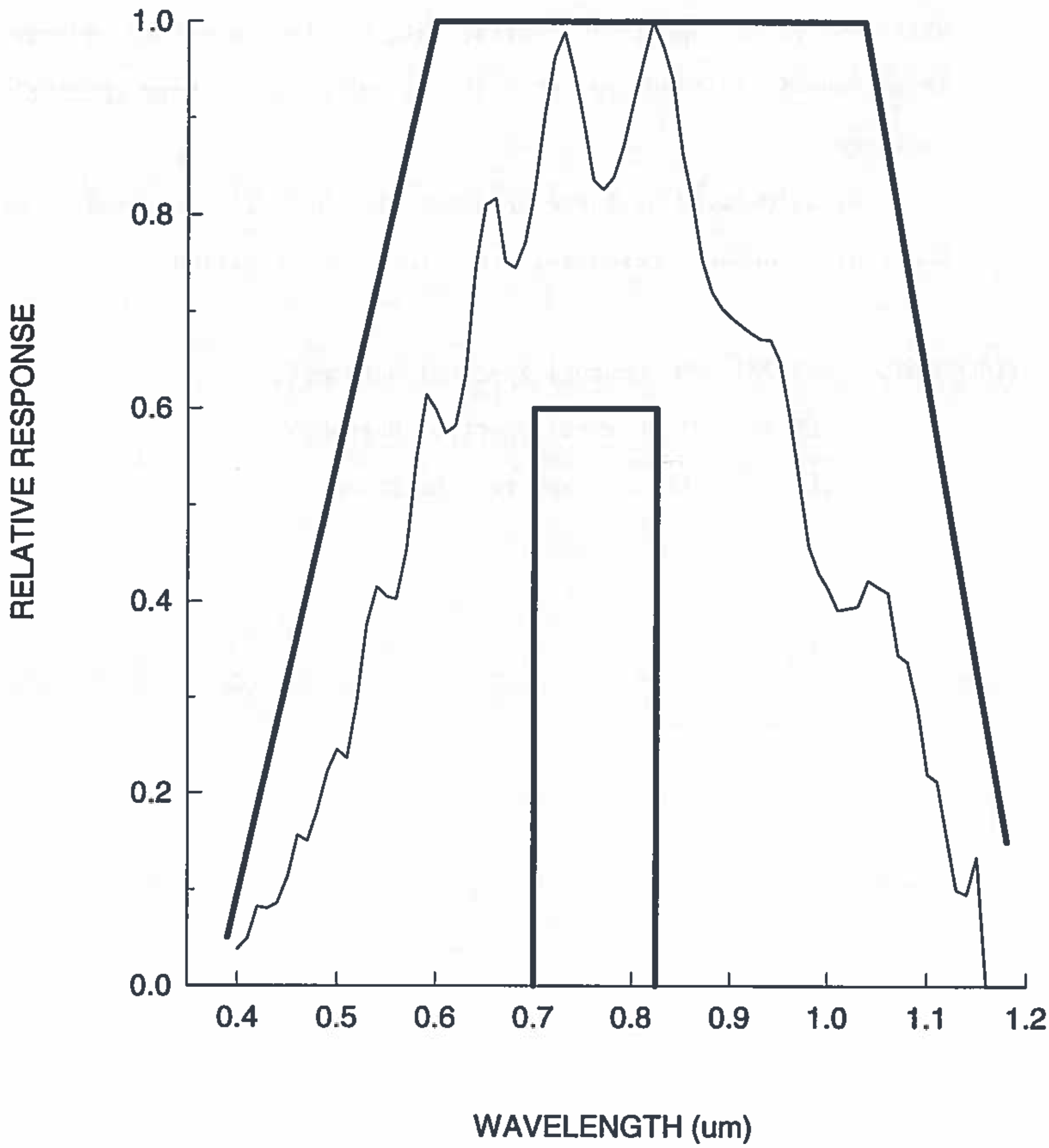
2.0 DEVELOPMENT SPECIFICATION REQUIREMENTS

2.1 Spectra (3.2.1.1.1.1, 3.1.1.1.2, 3.1.1.1.3)

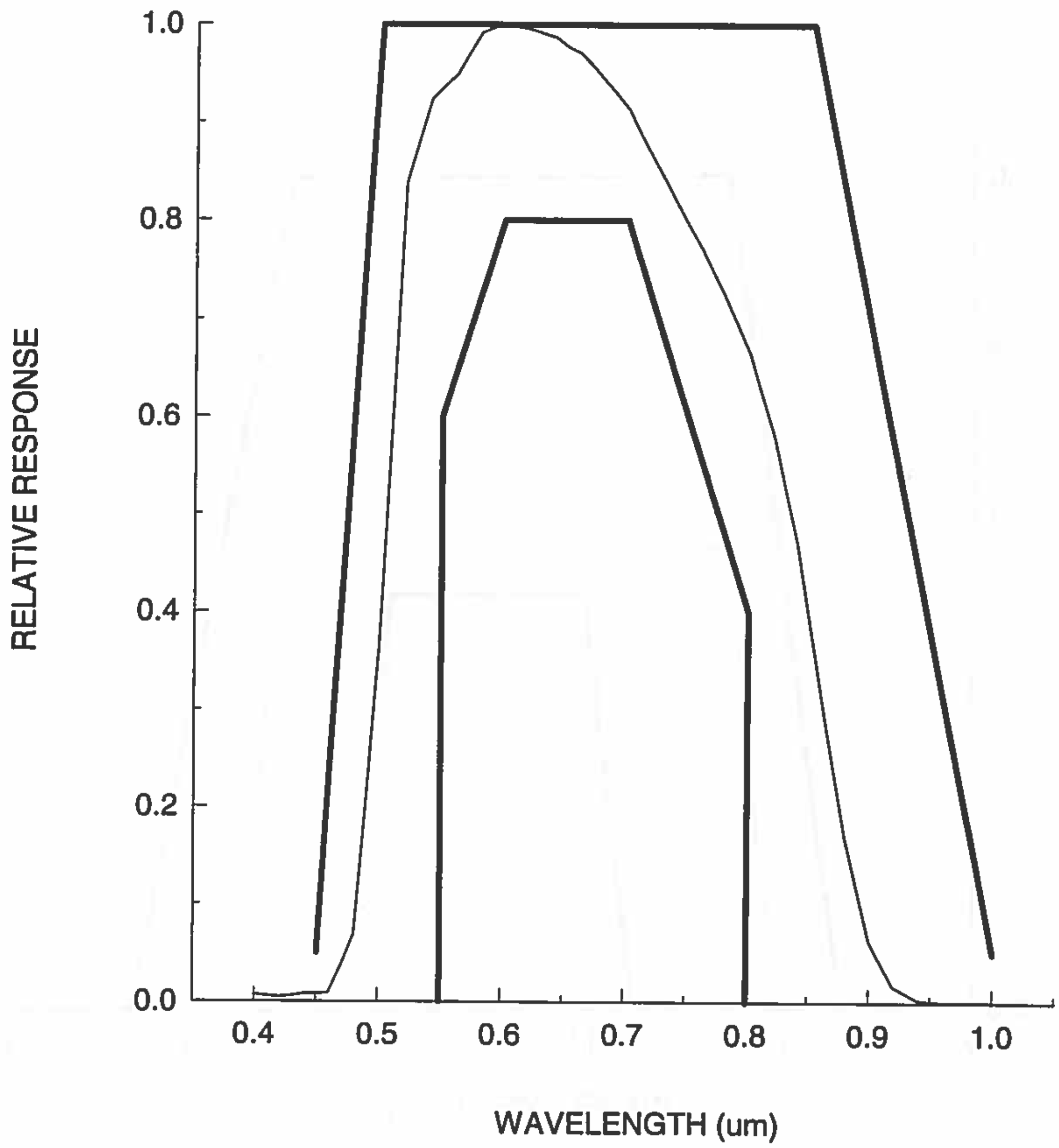
The OLS #21 Channel spectral responses are calculated by computer programs (GAINSET for L Channel and TGAIN for T channel) utilizing vendor spectral response data for the detectors, mirror and lens transmissivities/ reflectivities, and solar & lunar spectral radiance.

As calculated by these programs, the OLS #21 T channel, L Day and L Nite spectral responses are within specification.

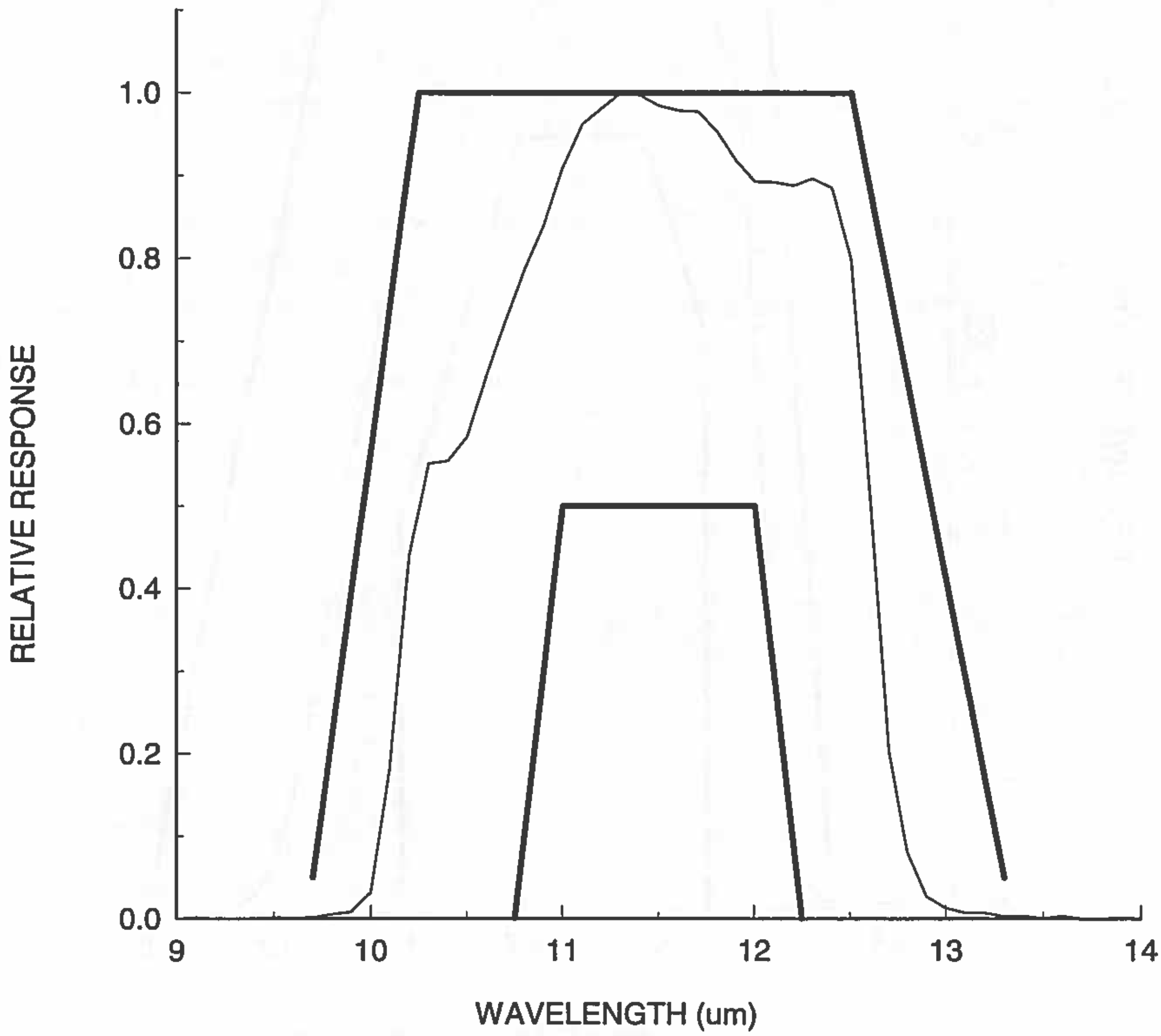
ATTACHMENTS: OLS #21 HRD Channel Spectral Response.
OLS #21 PMT Channel Spectral Response.
OLS #21 T Channel Spectral Response.



OLS21 VISIBLE DAY SPECTRUM



OLS21 VISIBLE NIGHTTIME SPECTRUM



OLS21 T CHANNEL SPECTRUM

2.2 GEOMETRIC RESOLUTION

2.2.1 Fine Geometric Resolution - Infrared (3.2.1.1.2.1)

The TF Surface Resolution Parameter (SRP) is within the development specification limits.

The STS Computer programs calculate and plot the Fine Primary SRP, and the T Right & Left Fallback modes. In addition, all Specification required modes are tabulated and presented. The designations on the graphs are defined as follows:

TF	T Fine Electronics
TS	T Smooth Electronics

2.2.1.1 Baseline (Orbit Nominal)

Effective with OLS18 the nominal environment is no longer part of OLS testing.

2.2 Geometric Resolution (Cont'd)

2.2.1 Fine Geometric Resolution, Infrared (Cont'd.) (3.2.1.1.2.1)

2.2.1.2 Acceptance - Vibration

Effective with OLS 18 previbration testing is no longer done on the T channel. The T channel is accepted by similarity to OLS's 12 thru 17 contingent on all other alignment/synchronization and MTF data being in spec and typical of the performance of prior OLS units.

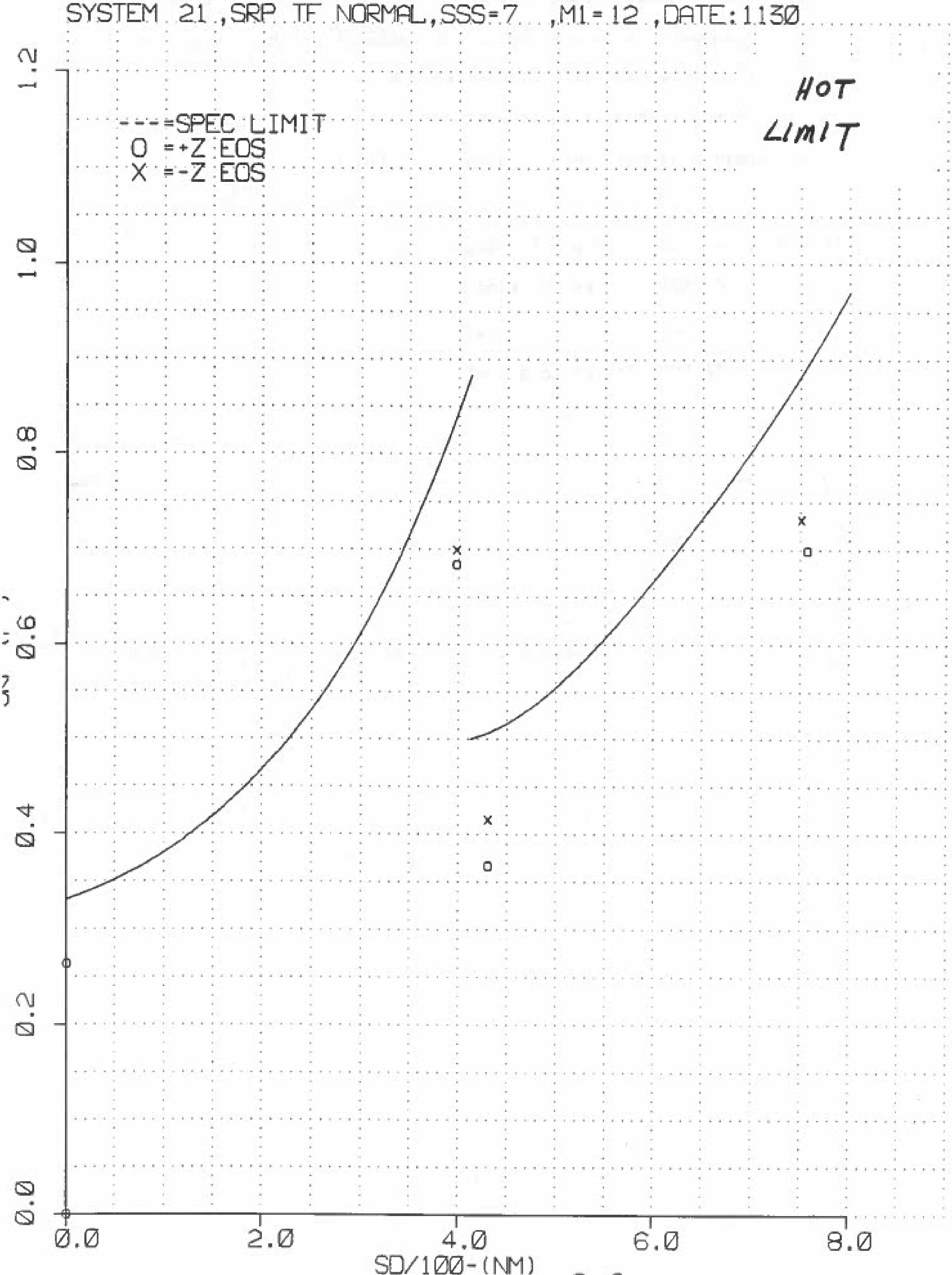
2.2 Geometric Resolution (Cont'd)

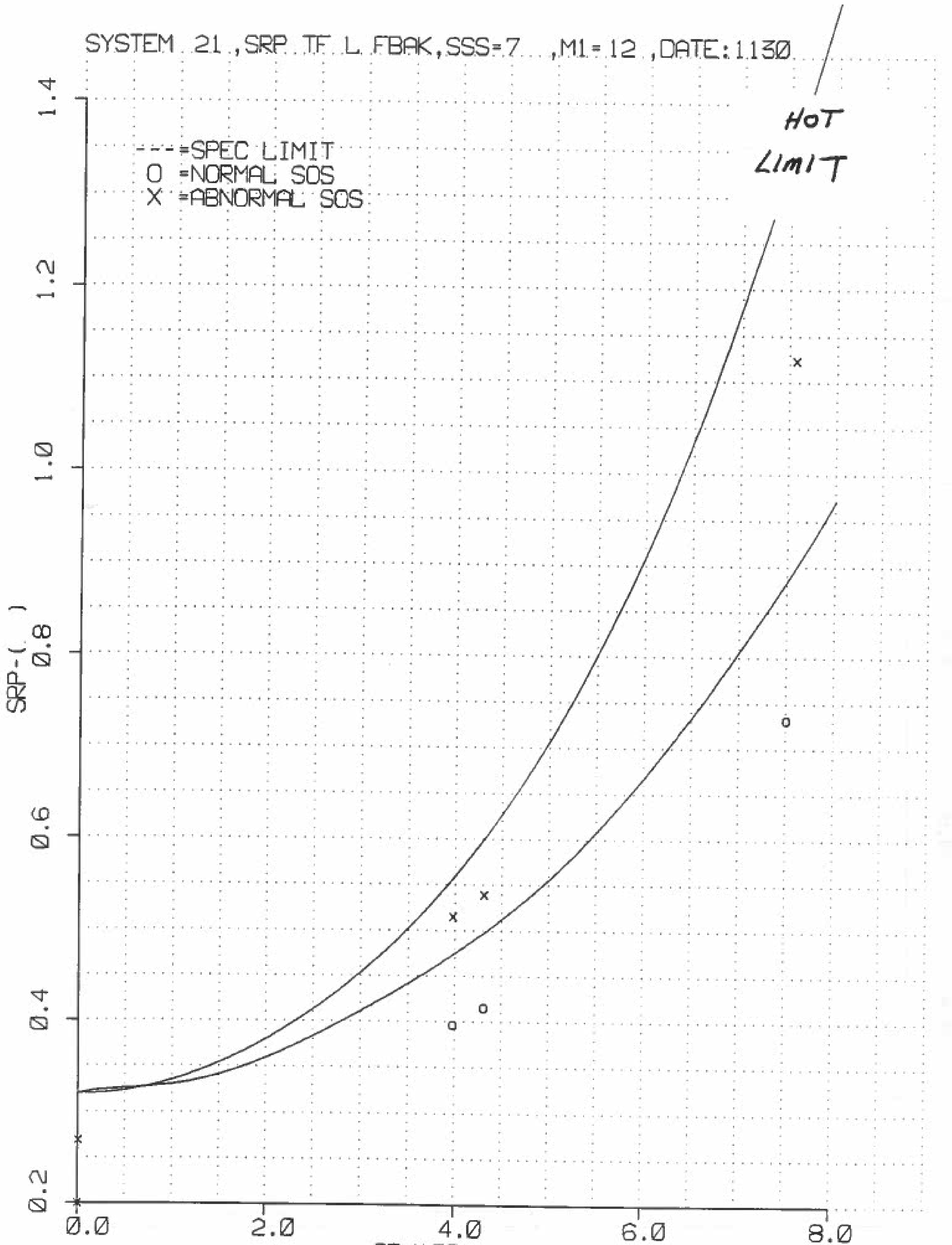
2.2.1 Fine Geometric Resolution, Infrared (Cont'd) (3.2.1.1.2.1)

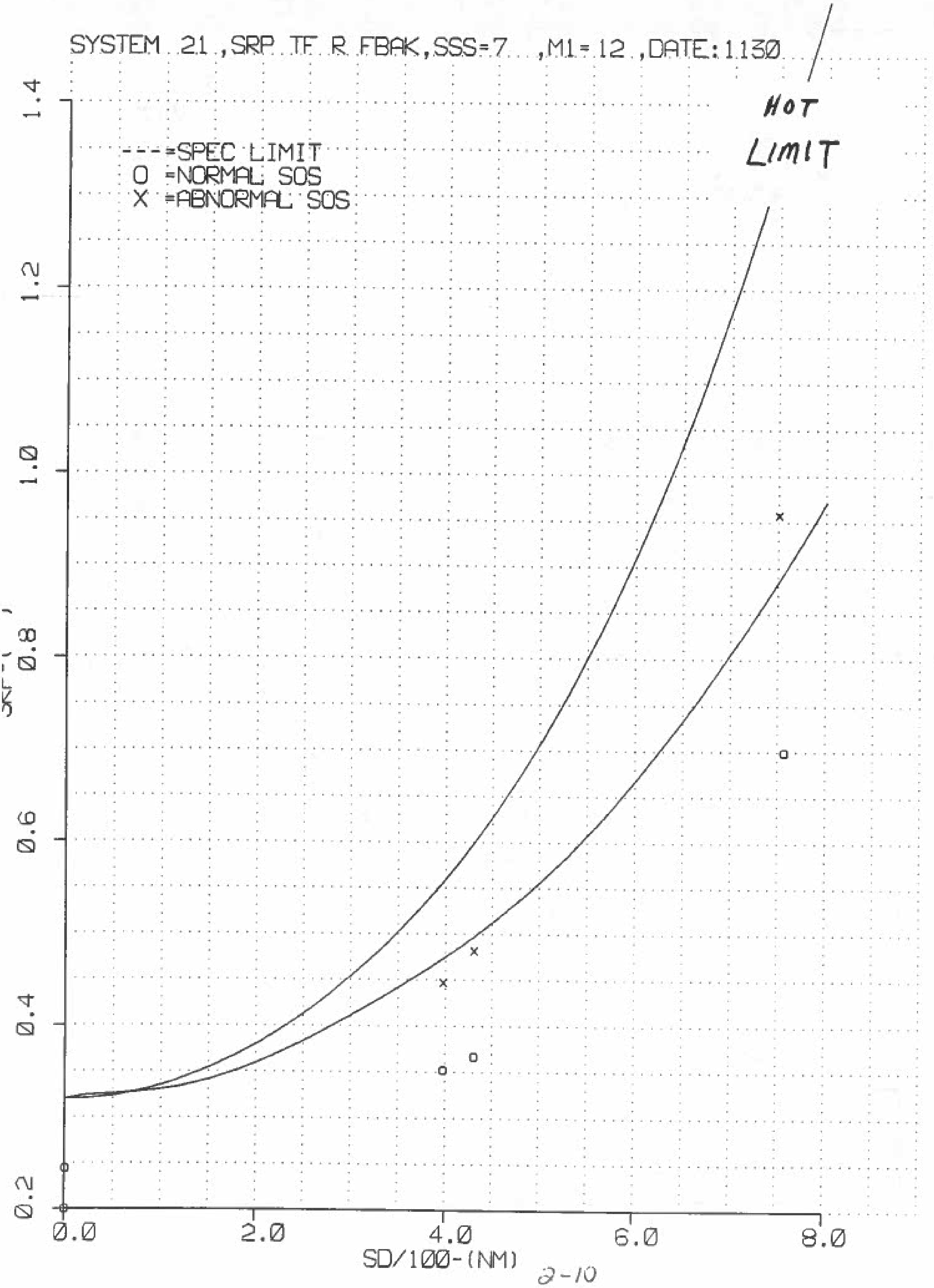
2.2.1.3 Acceptance - Thermal Vacuum

The attached TF SRP curves and tables demonstrate in-spec performance at the thermal vacuum test limits.

ATTACHMENTS: TF SRP Curves Hot Limits
TF SRP Tables Hot Limits
TF SRP Curves Cold Limits
TF SRP Tables Cold Limits


SYSTEM 21 ,SRP TF NORMAL,SSS=7 ,M1=12 ,DATE:1130
HOT LIMIT
----=SPEC LIMIT
O =+Z EOS
X =-Z EOS
0.0
0.2
0.4
0.6
0.8
1.0
1.2
0.0
2.0
4.0
6.0
8.0
SD/100-(NM)


SYSTEM 21 ,SRP TF L FBAK,SSS=7 ,M1=12 ,DATE:1130
HOT LIMIT
---=SPEC LIMIT
O =NORMAL SOS
X =ABNORMAL SOS
SRP-( )
0.2
0.4
0.6
0.8
1.0
1.2
1.4
0.0
2.0
4.0
6.0
8.0
SD/100-(NM)


SYSTEM 21 ,SRP TF R FBAK,SSS=7 ,M1=12 ,DATE:1130
HOT LIMIT
---=SPEC LIMIT
O =NORMAL SOS
X =ABNORMAL SOS
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
2.0
4.0
6.0
8.0
SD/100-(NM)

2-10

T, COMPLETE, SRP (NM)

FLT. NO. = 21 ENV. = 4 SSS= 7DEGC M1= 12DEGC DATE: 1130

SEG	SUR. DIST. (NM)	TFP	TFB	TSP	TSB
LFT	-750.	0.731	0.732	1.747	1.747
MID	-750.	1.273	0.000	1.837	1.837
RGT	-750.	0.957	0.952	1.763	1.763
LFT	0.	0.000	0.000	0.000	0.000
MID	0.	0.000	0.000	0.000	0.000
RGT	0.	0.000	0.000	0.000	0.000
LFT	-431.	0.415	0.412	1.470	1.470
MID	-431.	0.718	0.000	1.507	1.506
RGT	-431.	0.481	0.485	1.479	1.478
LFT	-398.	0.396	0.392	1.414	1.414
MID	-398.	0.699	0.696	1.445	1.445
RGT	-398.	0.447	0.449	1.417	1.417
LFT	0.	0.000	0.000	0.000	0.000
MID	0.	0.000	0.000	0.000	0.000
RGT	0.	0.000	0.000	0.000	0.000
LFT	0.	0.269	0.266	0.980	0.979
MID	0.	0.263	0.260	0.979	0.978
RGT	0.	0.244	0.243	0.979	0.979
LFT	0.	0.000	0.000	0.000	0.000
MID	0.	0.000	0.000	0.000	0.000
RGT	0.	0.000	0.000	0.000	0.000
LFT	398.	0.515	0.519	1.423	1.422
MID	398.	0.684	0.681	1.443	1.442
RGT	398.	0.352	0.350	1.412	1.411
LFT	431.	0.539	0.543	1.481	1.480
MID	431.	0.702	0.000	1.505	1.505
RGT	431.	0.367	0.365	1.467	1.466
LFT	0.	0.000	0.000	0.000	0.000
MID	0.	0.000	0.000	0.000	0.000
RGT	0.	0.000	0.000	0.000	0.000
LFT	757.	1.123	1.115	1.812	1.811
MID	757.	1.827	0.000	2.078	2.071
RGT	757.	0.699	0.701	1.725	1.724

T, COMPLETE, SRP RATIO

SEG	SUR. DIST. (NM)	TFP	TFB	TSP	TSB
LFT	-750.	0. 827	0. 827	0. 777	0. 777
MID	-750.	0. 000	0. 000	0. 817	0. 817
RGT	-750.	0. 714	0. 710	0. 784	0. 784
LFT	0.	0. 000	0. 000	0. 000	0. 000
MID	0.	0. 000	0. 000	0. 000	0. 000
RGT	0.	0. 000	0. 000	0. 000	0. 000
LFT	-431.	0. 835	0. 828	0. 918	0. 918
MID	-431.	0. 000	0. 000	0. 941	0. 941
RGT	-431.	0. 803	0. 809	0. 924	0. 923
LFT	-398.	0. 837	0. 828	0. 922	0. 922
MID	-398.	0. 833	0. 829	0. 942	0. 942
RGT	-398.	0. 802	0. 805	0. 924	0. 923
LFT	0.	0. 000	0. 000	0. 000	0. 000
MID	0.	0. 000	0. 000	0. 000	0. 000
RGT	0.	0. 000	0. 000	0. 000	0. 000
LFT	0.	0. 840	0. 831	0. 933	0. 933
MID	0.	0. 795	0. 786	0. 932	0. 932
RGT	0.	0. 763	0. 758	0. 933	0. 932
LFT	0.	0. 000	0. 000	0. 000	0. 000
MID	0.	0. 000	0. 000	0. 000	0. 000
RGT	0.	0. 000	0. 000	0. 000	0. 000
LFT	398.	0. 925	0. 932	0. 929	0. 928
MID	398.	0. 815	0. 812	0. 941	0. 941
RGT	398.	0. 744	0. 740	0. 920	0. 920
LFT	431.	0. 898	0. 905	0. 924	0. 924
MID	431.	0. 000	0. 000	0. 940	0. 940
RGT	431.	0. 738	0. 733	0. 916	0. 916
LFT	0.	0. 000	0. 000	0. 000	0. 000
MID	0.	0. 000	0. 000	0. 000	0. 000
RGT	0.	0. 000	0. 000	0. 000	0. 000
LFT	757.	0. 825	0. 819	0. 802	0. 801
MID	757.	0. 000	0. 000	0. 919	0. 916
RGT	757.	0. 781	0. 783	0. 763	0. 763

TF, LEFT, PRIMARY

FLT. NO. = 21 ENV. = 4 SSS= 7DEGC M1= 12DEGC DATE: 1130

SUR. DIST. (NM)	SRP ACTUAL (NM)	SRP RATIO
-750.	0.731	0.827
0.	0.000	0.000
-431.	0.415	0.835
-398.	0.396	0.837
0.	0.000	0.000
0.	0.269	0.840
0.	0.000	0.000
398.	0.515	0.925
431.	0.539	0.898
0.	0.000	0.000
757.	1.123	0.825

TF, LEFT, BACKUP

FLT. NO. = 21 ENV. = 4 SSS= 7DEGC M1= 12DEGC DATE: 1130

SUR. DIST. (NM)	SRP ACTUAL (NM)	SRP RATIO
-750.	0.732	0.827
0.	0.000	0.000
-431.	0.412	0.828
-398.	0.392	0.828
0.	0.000	0.000
0.	0.266	0.831
0.	0.000	0.000
398.	0.519	0.932
431.	0.543	0.905
0.	0.000	0.000
757.	1.115	0.819

TF, RIGHT, PRIMARY

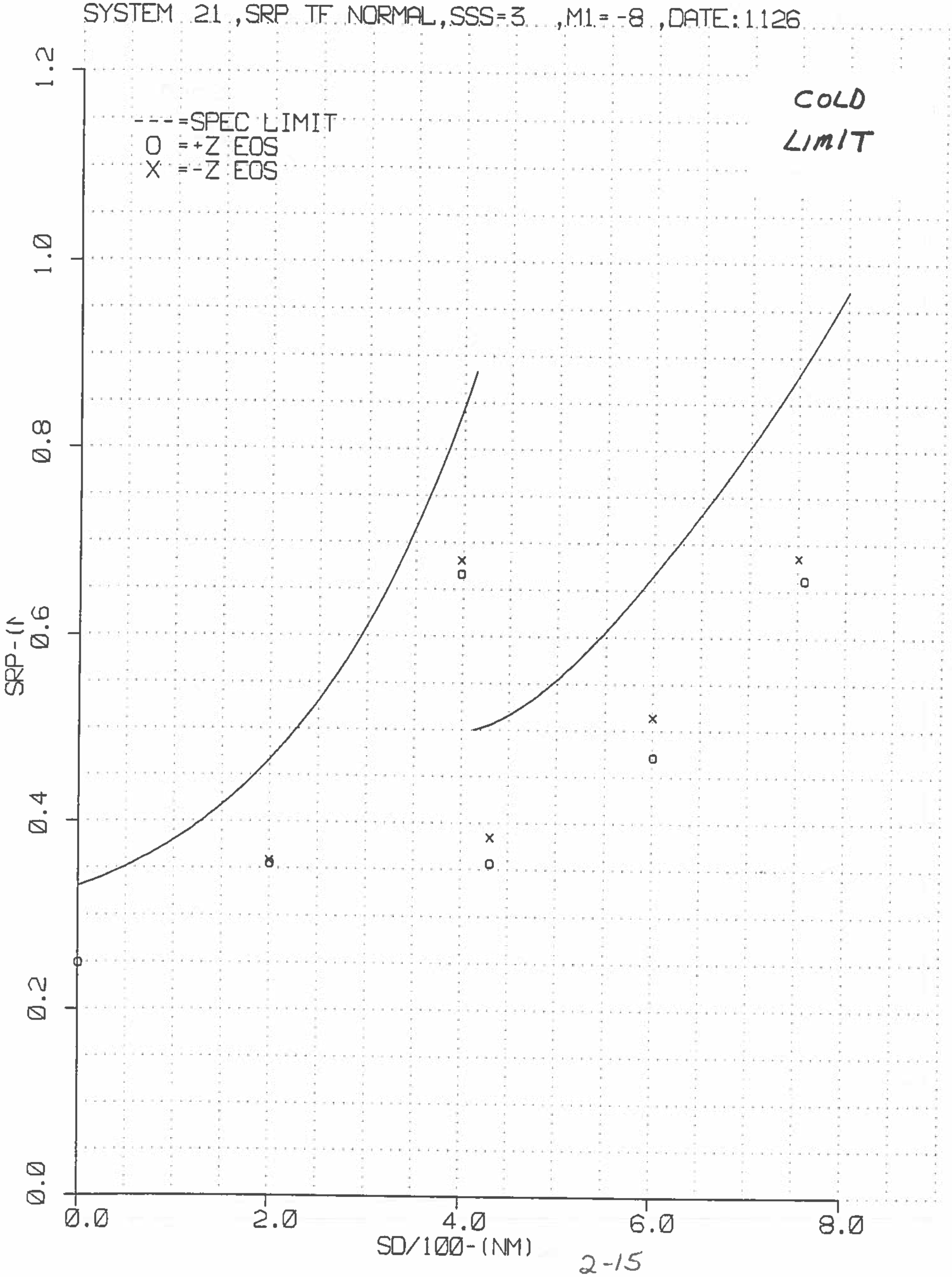
FLT. NO. = 21 ENV. = 4 SSS= 7DEGC M1= 12DEGC DATE: 1130

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-750.	0.957	0.714
0.	0.000	0.000
-431.	0.481	0.803
-398.	0.447	0.802
0.	0.000	0.000
0.	0.244	0.763
0.	0.000	0.000
398.	0.352	0.744
431.	0.367	0.738
0.	0.000	0.000
757.	0.699	0.781

TF RIGHT, BACKUP

FLT. NO. = 21 ENV. = 4 SSS= 7DEGC M1= 12DEGC DATE: 1130

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-750.	0.952	0.710
0.	0.000	0.000
-431.	0.485	0.809
-398.	0.449	0.805
0.	0.000	0.000
0.	0.243	0.758
0.	0.000	0.000
398.	0.350	0.740
431.	0.365	0.733
0.	0.000	0.000
757.	0.701	0.783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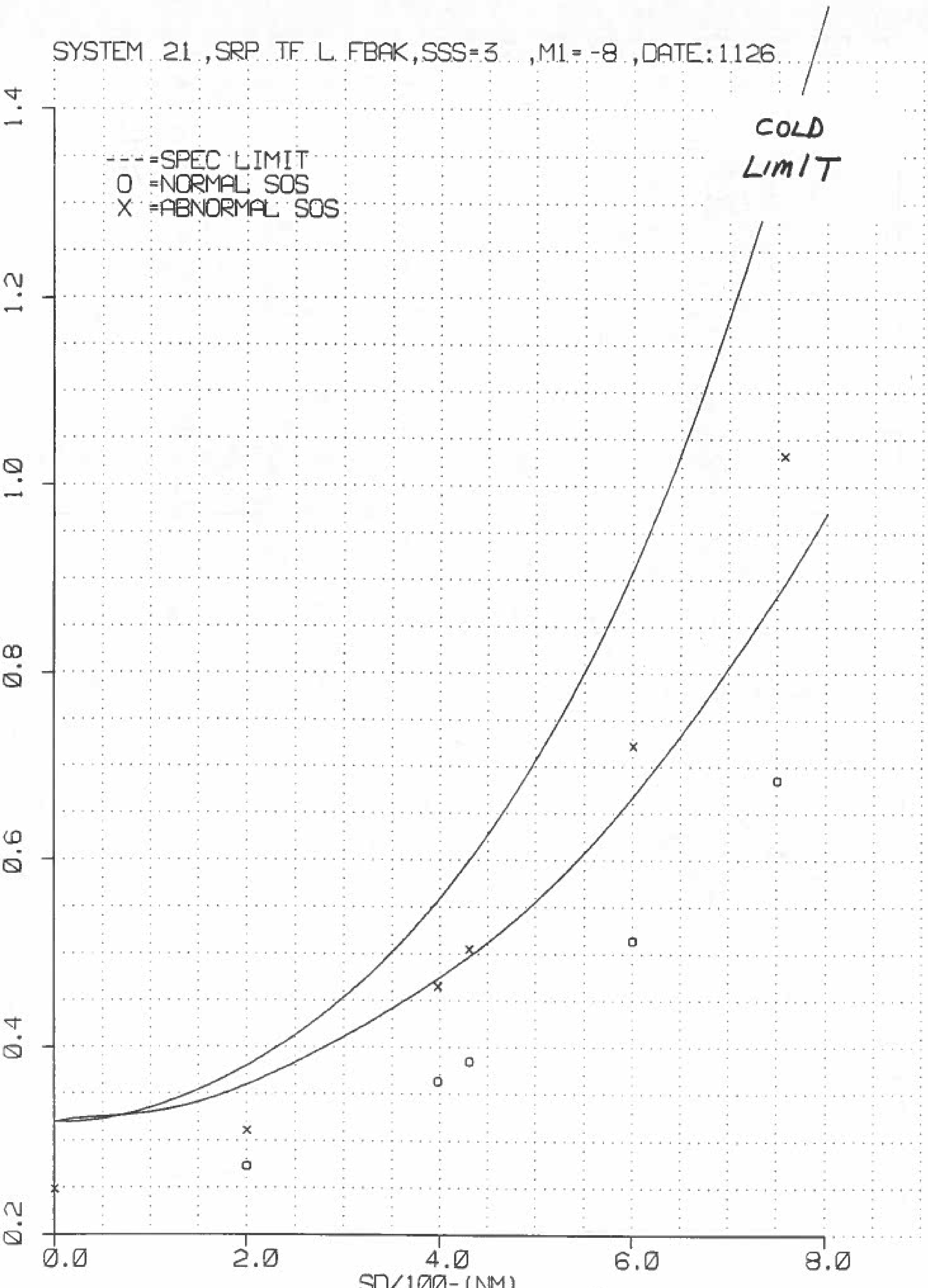
----=SPEC LIMIT
O =+Z EOS
X =-Z EOS
COLD LIMIT
SRP-(I)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
0.0
2.0
4.0
6.0
8.0
SD/100-(NM)

2-15



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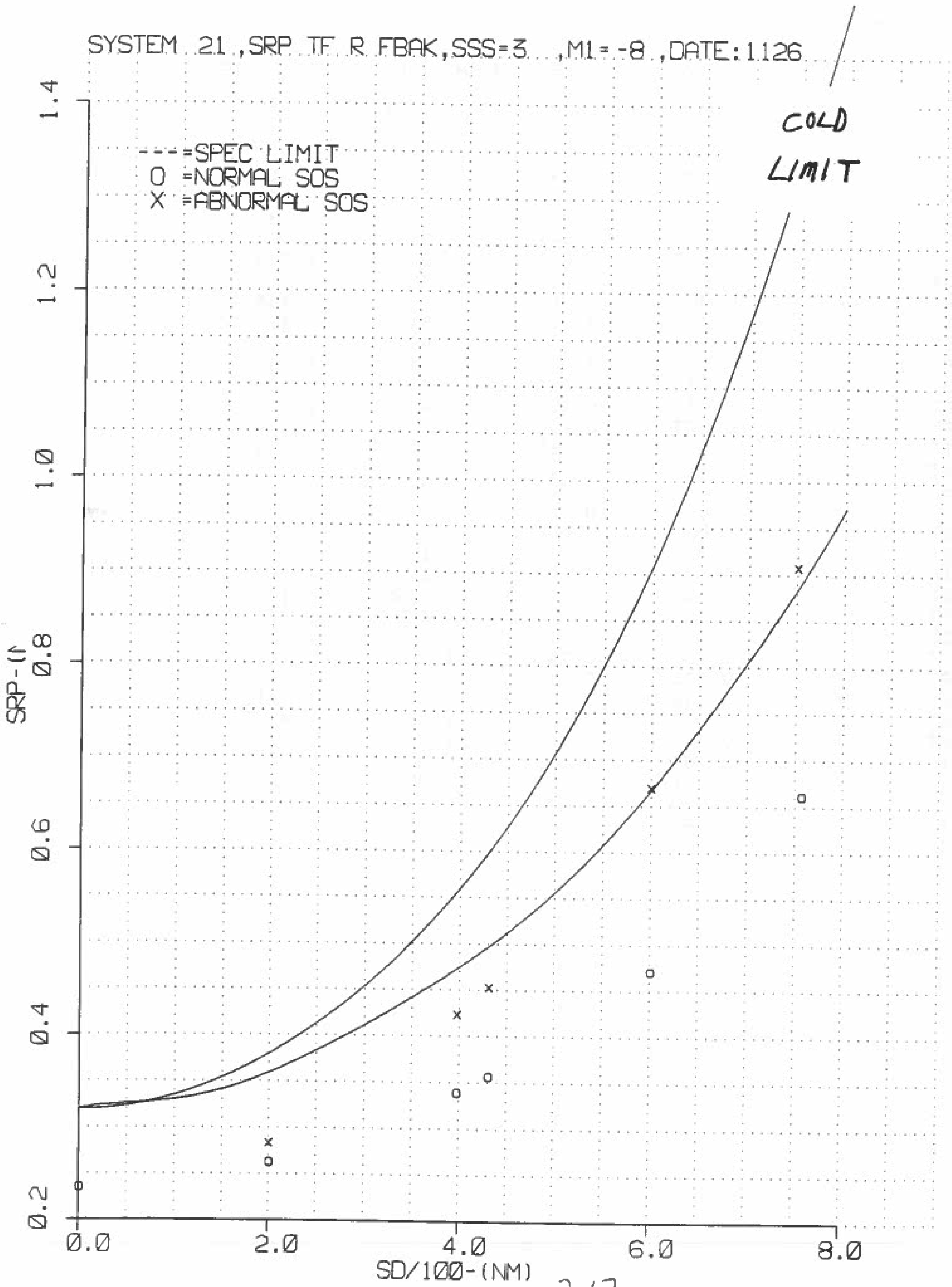
COLD LIMIT
----=SPEC LIMIT
O =NORMAL SOS
X =ABNORMAL SOS
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
2.0
4.0
6.0
8.0
SD/100-(NM)


SYSTEM 21 ,SRP TF R FBAK,SSS=3 ,M1=-8 ,DATE:1126
COLD LIMIT
----=SPEC LIMIT
O =NORMAL SOS
X =ABNORMAL SOS
SRP-(I
0.2
0.4
0.6
0.8
1.0
1.2
1.4
0.0
2.0
4.0
6.0
8.0
SD/100-(NM)

T, COMPLETE, SRP (NM)

FLT. NO. = 21 ENV. = 4 SSS= 3DEGC M1= -8DEGC DATE: 1126

SEG	SUR. DIST. (NM)	TFP	TFB	TSP	TSB
LFT	-750.	0.685	0.692	1.732	1.715
MID	-750.	1.347	0.000	1.867	1.846
RGT	-750.	0.908	0.916	1.749	1.731
LFT	-600.	0.514	0.524	1.721	1.704
MID	-600.	1.147	0.000	1.824	1.804
RGT	-600.	0.670	0.677	1.730	1.713
LFT	-431.	0.385	0.392	1.470	1.455
MID	-431.	0.705	0.000	1.510	1.495
RGT	-431.	0.453	0.461	1.477	1.463
LFT	-398.	0.363	0.371	1.415	1.400
MID	-398.	0.681	0.688	1.446	1.432
RGT	-398.	0.423	0.431	1.418	1.403
LFT	-200.	0.273	0.278	1.107	1.096
MID	-200.	0.358	0.365	1.114	1.103
RGT	-200.	0.283	0.290	1.112	1.100
LFT	0.	0.249	0.253	0.981	0.971
MID	0.	0.249	0.254	0.981	0.971
RGT	0.	0.235	0.240	0.980	0.970
LFT	200.	0.311	0.318	1.116	1.104
MID	200.	0.355	0.363	1.119	1.108
RGT	200.	0.263	0.269	1.112	1.100
LFT	398.	0.465	0.473	1.422	1.407
MID	398.	0.666	0.674	1.445	1.430
RGT	398.	0.339	0.346	1.415	1.401
LFT	431.	0.505	0.513	1.477	1.462
MID	431.	0.682	0.000	1.510	1.495
RGT	431.	0.357	0.363	1.466	1.451
LFT	601.	0.722	0.729	1.729	1.712
MID	601.	1.084	0.000	1.807	1.788
RGT	601.	0.471	0.478	1.707	1.689
LFT	757.	1.032	1.043	1.794	1.775
MID	757.	1.789	0.000	2.064	2.035
RGT	757.	0.661	0.668	1.711	1.694

T, COMPLETE, SRP RATIO

SEG	SUR. DIST. (NM)	TFP	TFB	TSP	TSB
LFT	-750.	0.775	0.783	0.770	0.762
MID	-750.	0.000	0.000	0.830	0.821
RGT	-750.	0.677	0.684	0.778	0.770
LFT	-600.	0.771	0.785	0.874	0.865
MID	-600.	0.000	0.000	0.926	0.916
RGT	-600.	0.736	0.745	0.879	0.870
LFT	-431.	0.774	0.789	0.918	0.907
MID	-431.	0.000	0.000	0.943	0.934
RGT	-431.	0.755	0.768	0.923	0.913
LFT	-398.	0.767	0.784	0.922	0.913
MID	-398.	0.811	0.820	0.943	0.933
RGT	-398.	0.759	0.773	0.924	0.915
LFT	-200.	0.759	0.775	0.923	0.914
MID	-200.	0.767	0.782	0.929	0.920
RGT	-200.	0.746	0.763	0.927	0.918
LFT	0.	0.777	0.791	0.934	0.925
MID	0.	0.753	0.768	0.935	0.925
RGT	0.	0.734	0.750	0.934	0.924
LFT	200.	0.818	0.836	0.930	0.921
MID	200.	0.760	0.776	0.933	0.924
RGT	200.	0.730	0.749	0.927	0.917
LFT	398.	0.835	0.849	0.927	0.918
MID	398.	0.794	0.803	0.942	0.933
RGT	398.	0.716	0.731	0.923	0.914
LFT	431.	0.841	0.855	0.922	0.913
MID	431.	0.000	0.000	0.943	0.933
RGT	431.	0.717	0.731	0.915	0.906
LFT	601.	0.792	0.800	0.878	0.869
MID	601.	0.000	0.000	0.917	0.907
RGT	601.	0.705	0.716	0.866	0.857
LFT	757.	0.758	0.766	0.794	0.785
MID	757.	0.000	0.000	0.913	0.900
RGT	757.	0.739	0.746	0.757	0.750

TF, LEFT, PRIMARY

FLT. NO. = 21 ENV. = 4 SSS= 3DEGC M1= -8DEGC DATE: 1126

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-750.	0.685	0.775
-600.	0.514	0.771
-431.	0.385	0.774
-398.	0.363	0.767
-200.	0.273	0.759
0.	0.249	0.777
200.	0.311	0.818
398.	0.465	0.835
431.	0.505	0.841
601.	0.722	0.792
757.	1.032	0.758

TF, LEFT, BACKUP

FLT. NO. = 21 ENV. = 4 SSS= 3DEGC M1= -8DEGC DATE: 1126

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-750.	0.692	0.783
-600.	0.524	0.785
-431.	0.392	0.789
-398.	0.371	0.784
-200.	0.278	0.775
0.	0.253	0.791
200.	0.318	0.836
398.	0.473	0.849
431.	0.513	0.855
601.	0.729	0.800
757.	1.043	0.766

TF, RIGHT, PRIMARY

FLT. NO. = 21 ENV. = 4 SSS= 3DEGC M1= -8DEGC DATE: 1126

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-750.	0.908	0.677
-600.	0.670	0.736
-431.	0.453	0.755
-398.	0.423	0.759
-200.	0.283	0.746
0.	0.235	0.734
200.	0.263	0.730
398.	0.339	0.716
431.	0.357	0.717
601.	0.471	0.705
757.	0.661	0.739

TF RIGHT, BACKUP

FLT. NO. = 21 ENV. = 4 SSS= 3DEGC M1= -8DEGC DATE: 1126

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-750.	0.916	0.684
-600.	0.677	0.745
-431.	0.461	0.768
-398.	0.431	0.773
-200.	0.290	0.763
0.	0.240	0.750
200.	0.269	0.749
398.	0.346	0.731
431.	0.363	0.731
601.	0.478	0.716
757.	0.668	0.746

2.2 Geometric Resolution (Cont'd)

2.2.2 Fine Geometric Resolution - Daytime Visual (3.2.1.1.2.1)

2.2.2.1 Baseline (Orbit Nominal)

Effective with OLS 18 the nominal environment is no longer part of OLS testing.

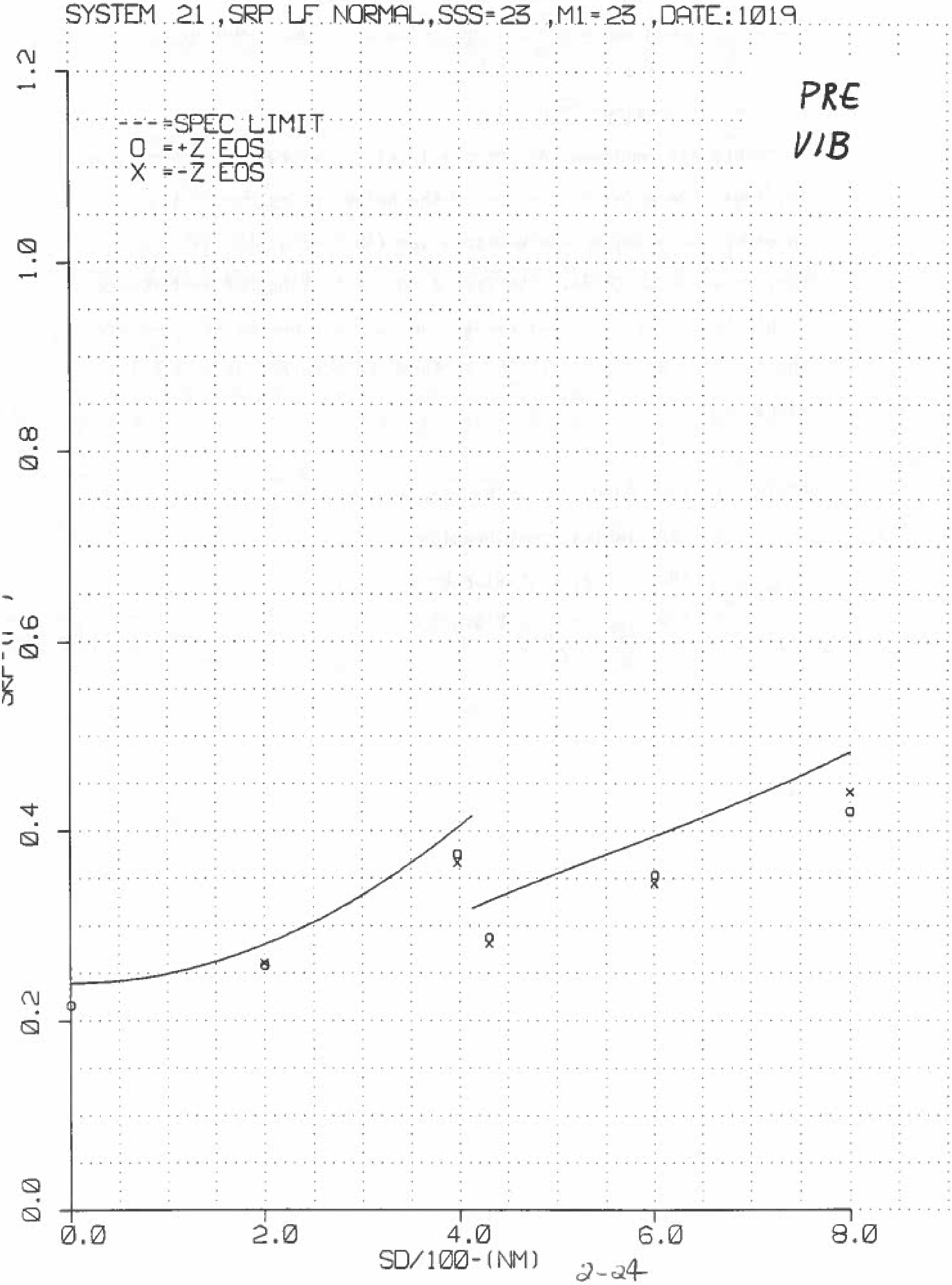
2.2 Geometric Resolution (Cont'd)

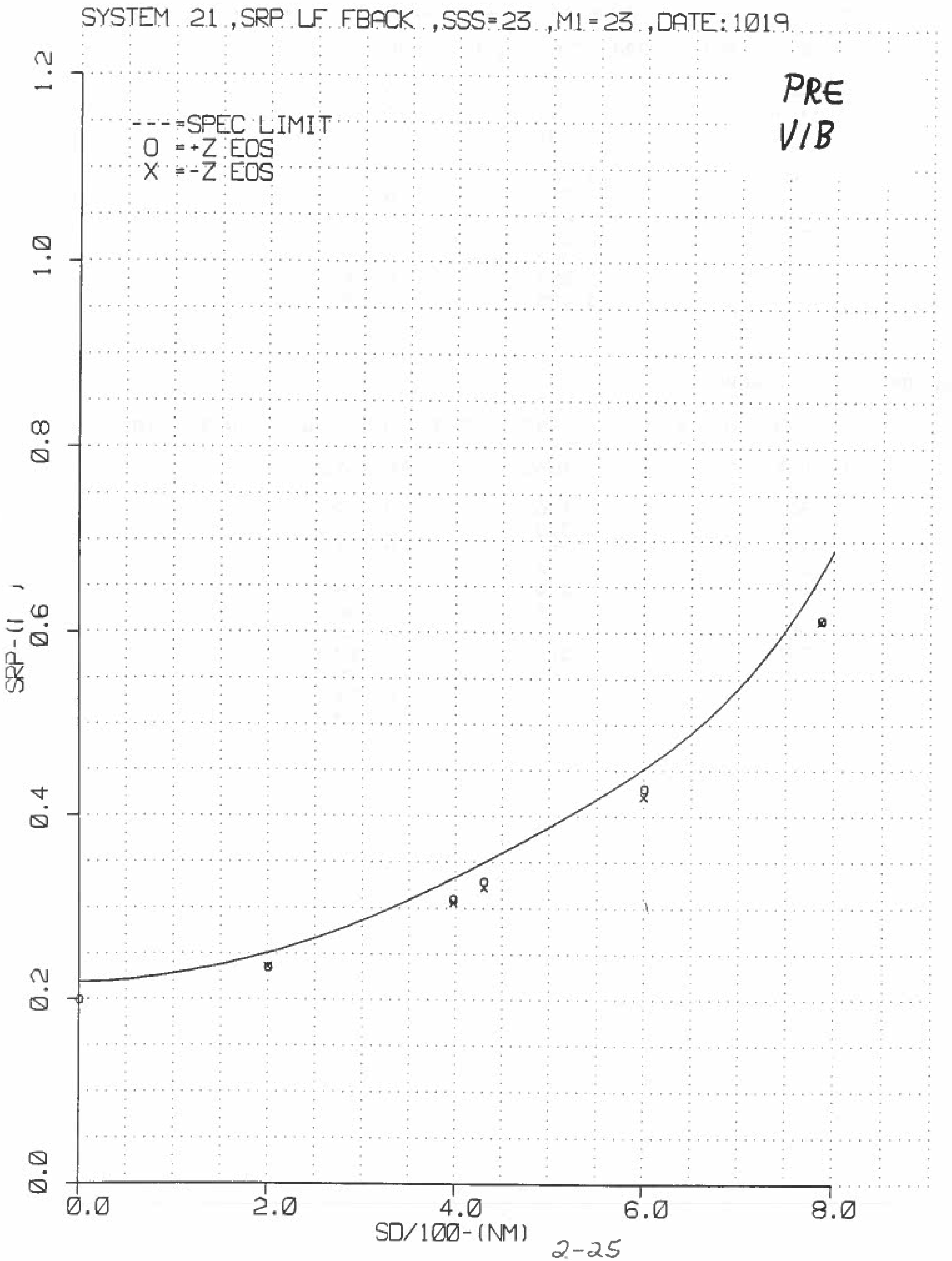
2.2.2 Fine Geometric Resolution - Daytime Visual (Cont'd) (3.2.1.1.2.1)

2.2.2.2 Acceptance - Vibration

OLS #21 underwent Acceptance-level SSS vibration on September 10, 1994. Because of a rework of the Relay Optics due to the incorrect mounting of the beamsplitter (AM 21-14), the SSS was revibrated on 10/20/94. The Pre-to-Post Vibration SRP performance is within Specification requirements and is shown on the attached curves and tables. No changes in SRP performance occurred as a result of vibration.

ATTACHMENTS: LF SRP Curves Pre-Vibration
LF SRP Tables Pre-Vibration
LF SRP Curves Post-Vibration
LF SRP Tables Post-Vibration


SYSTEM 21 ,SRP LF NORMAL,SSS=23 ,M1=23 ,DATE:1019
PRE
VIB
----=SPEC LIMIT
O =+Z EOS
X =-Z EOS
0.0
0.2
0.4
0.6
0.8
1.0
1.2
0.0
2.0
4.0
6.0
8.0
SD/100-(NM)


SYSTEM 21 ,SRP LF FBACK ,SSS=23 ,M1=23 ,DATE:1019
PRE
V/B
----=SPEC LIMIT
O =+Z EOS
X =-Z EOS
1.2
1.0
0.8
0.6
0.4
0.2
0.0
SRP-(I)
0.0
2.0
4.0
6.0
8.0
SD/100-(NM)

2-25

LF, DAY, NORMAL, PRIMARY

FLT. NO. = 21 ENV. = 2 SSS= 23DEGC M1= 23DEGC DATE: 1019

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-800.	0.441	0.913
-600.	0.345	0.874
-431.	0.281	0.863
-398.	0.366	0.908
-200.	0.261	0.930
0.	0.216	0.901
200.	0.258	0.921
398.	0.375	0.931
431.	0.287	0.880
601.	0.353	0.895
800.	0.420	0.870

LF, DAY, NORMAL, BACKUP

FLT. NO. = 21 ENV. = 2 SSS= 23DEGC M1= 23DEGC DATE: 1019

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-800.	0.440	0.912
-600.	0.343	0.871
-431.	0.281	0.861
-398.	0.366	0.906
-200.	0.259	0.925
0.	0.215	0.896
200.	0.257	0.916
398.	0.375	0.929
431.	0.286	0.878
601.	0.352	0.891
800.	0.419	0.868

LF, DAY, FALLBACK, PRIMARY

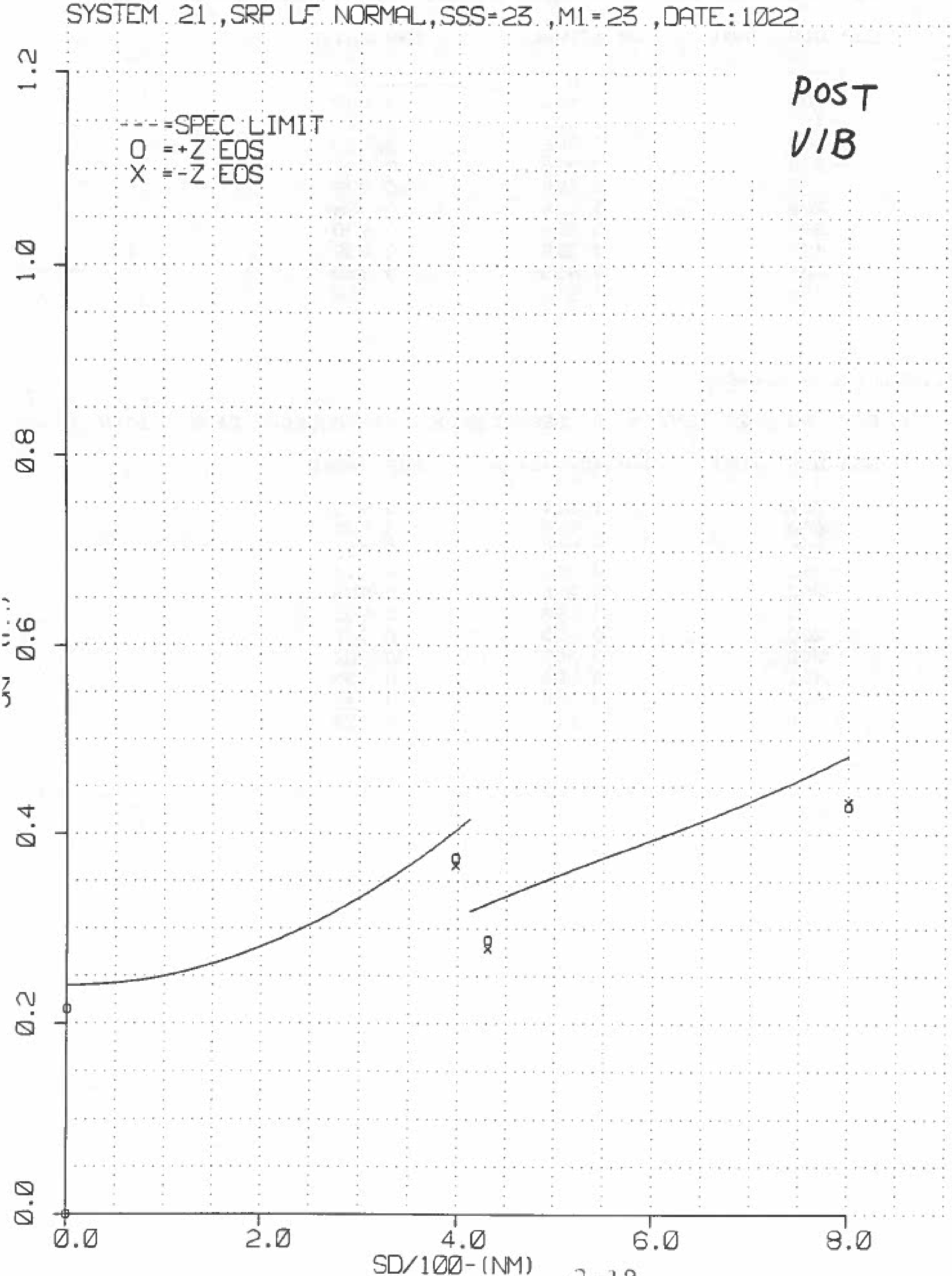
FLT. NO. = 21 ENV. = 2 SSS= 23DEGC M1= 23DEGC DATE: 1019

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-787.	0.612	0.922
-600.	0.421	0.932
-431.	0.322	0.921
-398.	0.306	0.920
-200.	0.236	0.941
0.	0.199	0.909
200.	0.235	0.936
398.	0.309	0.930
431.	0.328	0.939
601.	0.430	0.950
788.	0.614	0.922

LF, DAY, FALLBACK, BACKUP

FLT. NO. = 21 ENV. = 2 SSS= 23DEGC M1= 23DEGC DATE: 1019

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-787.	0.611	0.921
-600.	0.419	0.928
-431.	0.320	0.916
-398.	0.304	0.915
-200.	0.235	0.936
0.	0.198	0.905
200.	0.233	0.931
398.	0.307	0.924
431.	0.326	0.933
601.	0.428	0.947
788.	0.612	0.920



SYSTEM 21 ,SRP LF NORMAL,SSS=23 ,M1=23 ,DATE:1022
POST
V/B
----=SPEC LIMIT
O =+Z EOS
X =-Z EOS
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.0
2.0
4.0
6.0
8.0
SD/100-(NM)

2-28

LF, DAY, NORMAL, PRIMARY

FLT. NO. = 21 ENV. = 2 SSS= 23DEGC M1= 23DEGC DATE: 1022

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-800.	0.434	0.899
0.	0.000	0.000
-431.	0.278	0.853
-398.	0.367	0.908
0.	0.000	0.000
0.	0.215	0.896
0.	0.000	0.000
398.	0.375	0.928
431.	0.287	0.881
0.	0.000	0.000
800.	0.429	0.888

LF, DAY, NORMAL, BACKUP

FLT. NO. = 21 ENV. = 2 SSS= 23DEGC M1= 23DEGC DATE: 1022

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-800.	0.433	0.897
0.	0.000	0.000
-431.	0.278	0.852
-398.	0.365	0.906
0.	0.000	0.000
0.	0.214	0.891
0.	0.000	0.000
398.	0.374	0.926
431.	0.287	0.878
0.	0.000	0.000
800.	0.428	0.886

2.2 Geometric Resolution (Cont'd)

2.2.2 Fine Geometric Resolution - Daytime Visual (Cont'd) (3.2.1.1.2.1)

2.2.2.3 Acceptance - Thermal Vacuum

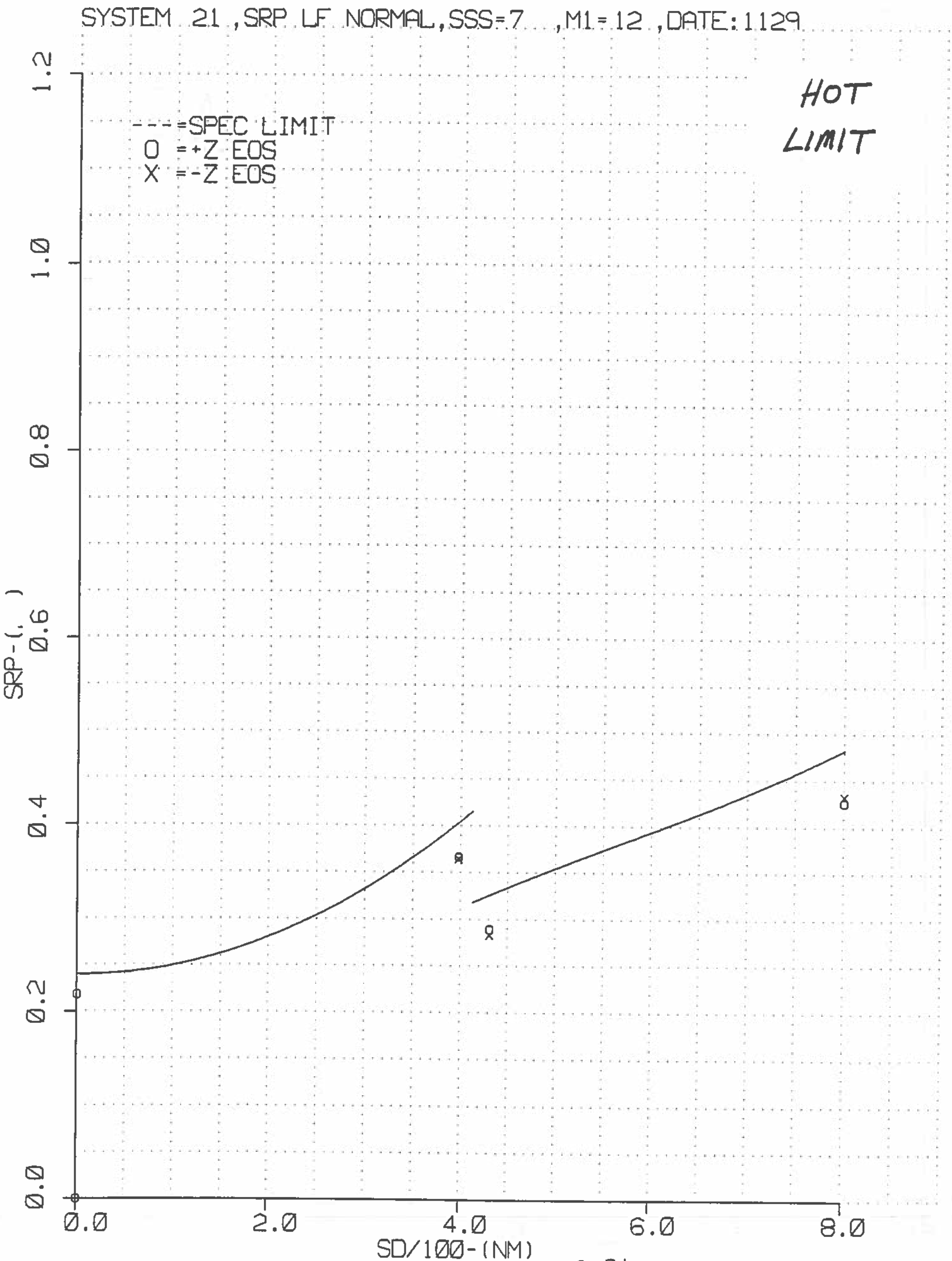
OLS #21 LF SRP is within the specification limits in both Primary and Redundant configurations.

ATTACHMENTS: LF SRP Curve Hot Limit

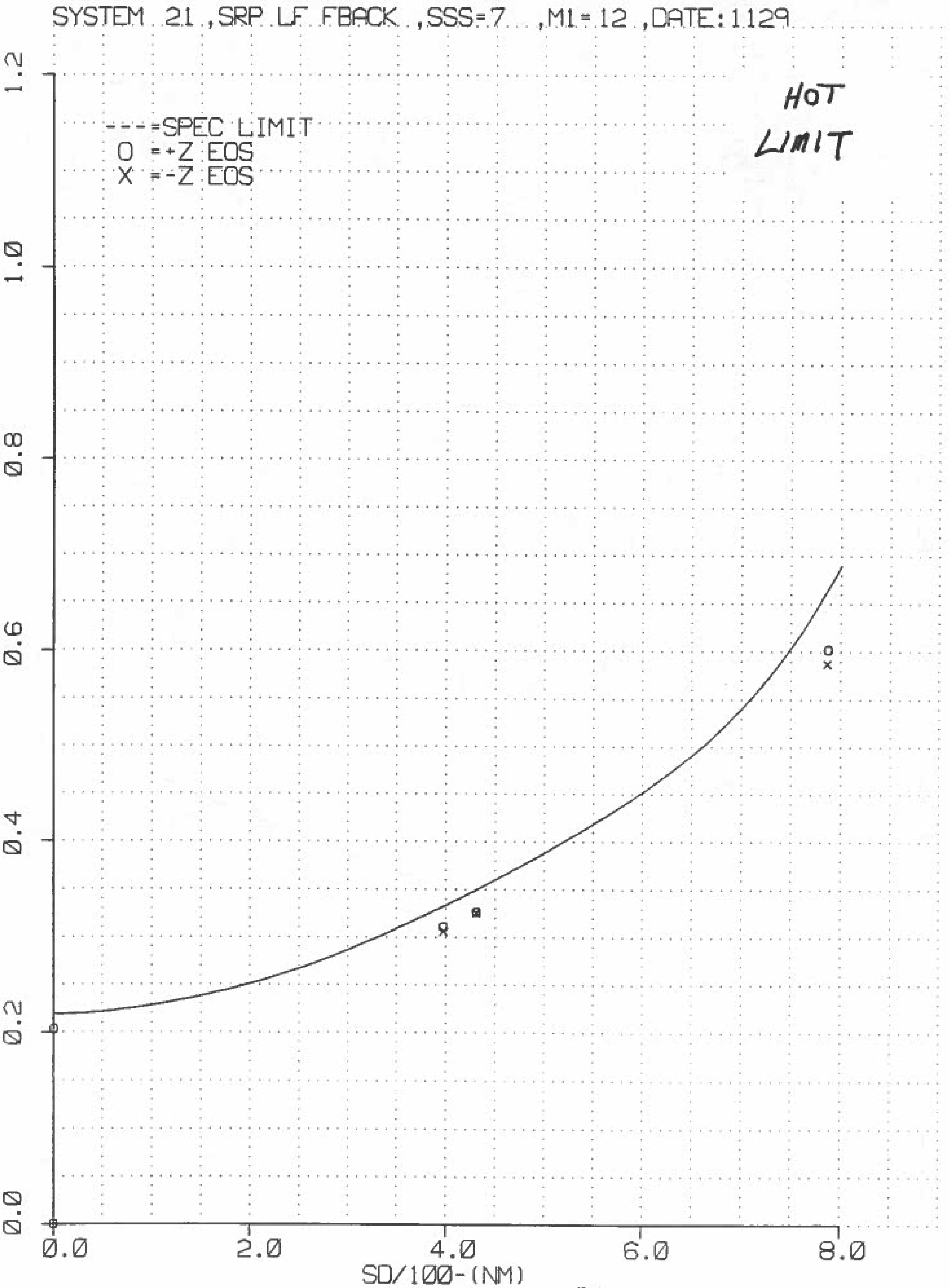
LF SRP Tables Hot Limit

LF SRP Curves Cold Limit

LF SRP Tables Cold Limit



SYSTEM 21 ,SRP LF NORMAL,SSS=7 ,M1=12 ,DATE:1129
HOT LIMIT
----=SPEC LIMIT
O =+Z EOS
X =-Z EOS
SRP-(,)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.0
2.0
4.0
6.0
8.0
SD/100-(NM)


SYSTEM 21 ,SRP LF FBACK ,SSS=7 ,M1=12 ,DATE:1129
HOT LIMIT
----=SPEC LIMIT
O =+Z EOS
X =-Z EOS
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.0
2.0
4.0
6.0
8.0
SD/100-(NM)

LF, DAY, NORMAL, PRIMARY

FLT. NO. = 21   ENV. = 4   SSS= 7DEGC   M1= 12DEGC   DATE: 1129

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-800.	0.433	0.897
0.	0.000	0.000
-431.	0.283	0.868
-398.	0.365	0.903
0.	0.000	0.000
0.	0.218	0.909
0.	0.000	0.000
398.	0.367	0.909
431.	0.289	0.885
0.	0.000	0.000
800.	0.426	0.883

LF, DAY, NORMAL, BACKUP

FLT. NO. = 21   ENV. = 4   SSS= 7DEGC   M1= 12DEGC   DATE: 1129

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-800.	0.424	0.879
0.	0.000	0.000
-431.	0.279	0.856
-398.	0.357	0.886
0.	0.000	0.000
0.	0.214	0.892
0.	0.000	0.000
398.	0.360	0.892
431.	0.285	0.873
0.	0.000	0.000
800.	0.417	0.864

LF, DAY, FALLBACK, PRIMARY

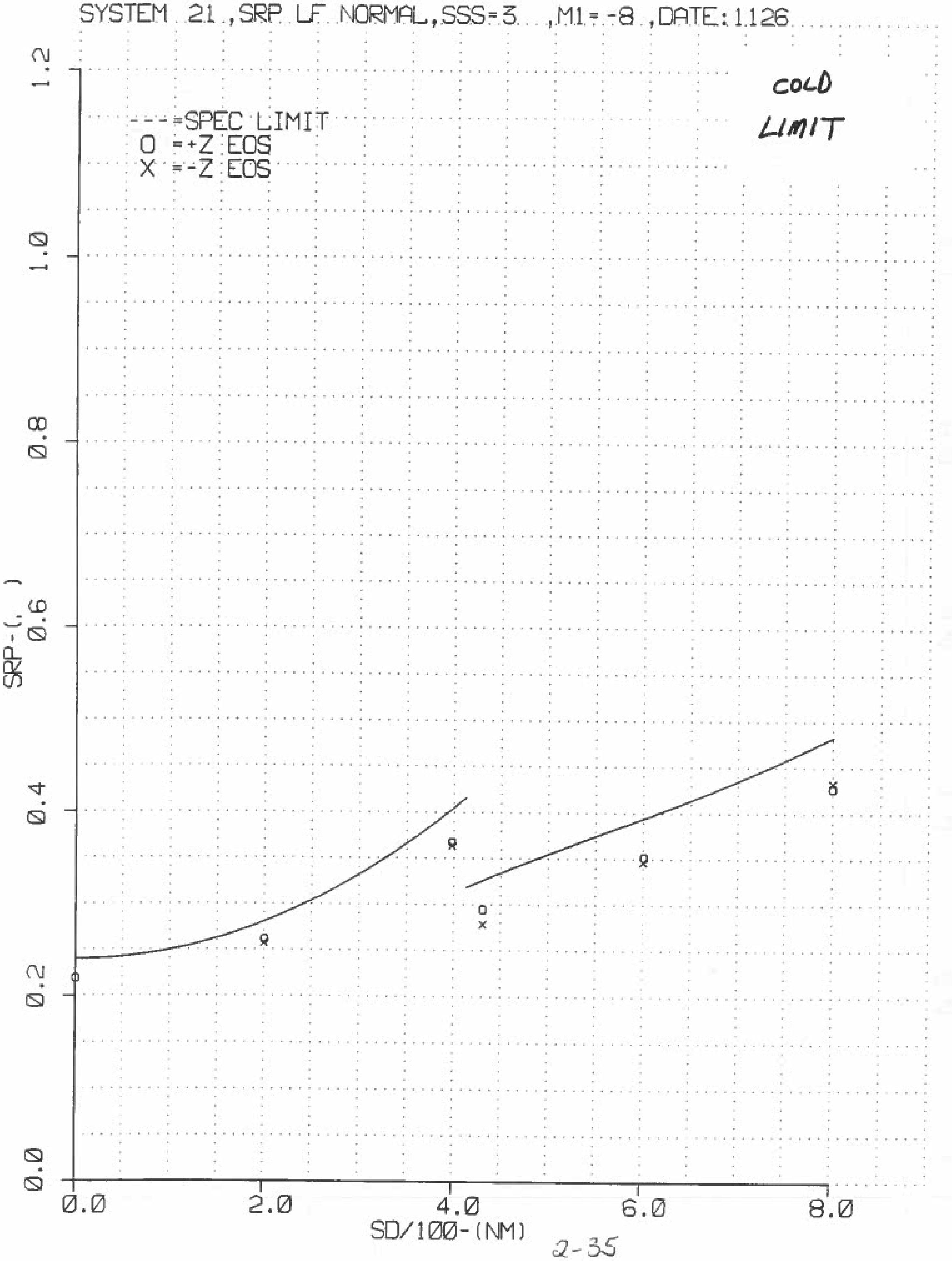
FLT. NO. = 21 ENV. = 4 SSS= 7DEGC M1= 12DEGC DATE: 1129

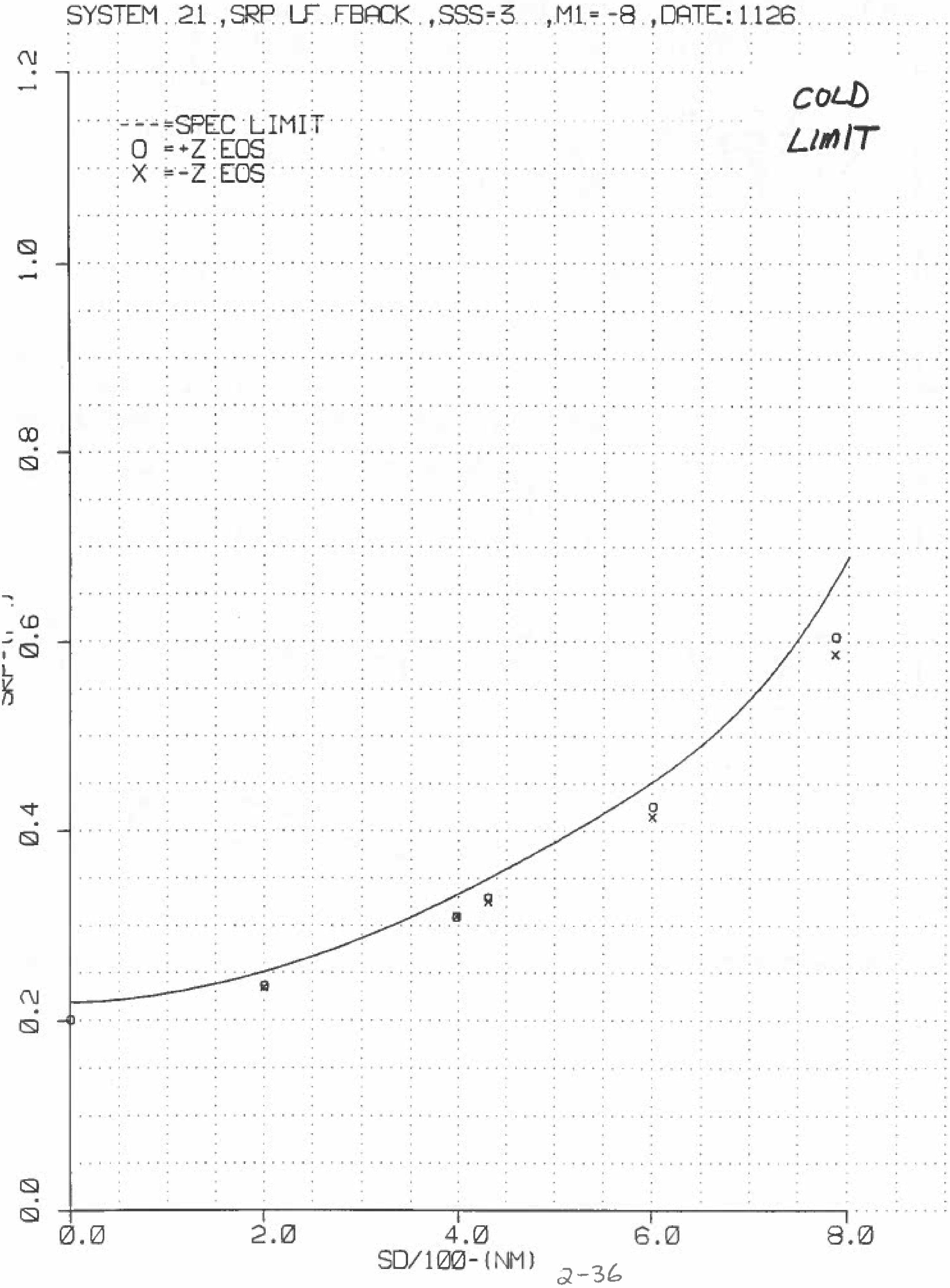
SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-787.	0.587	0.884
0.	0.000	0.000
-431.	0.325	0.931
-398.	0.306	0.920
0.	0.000	0.000
0.	0.203	0.928
0.	0.000	0.000
398.	0.311	0.935
431.	0.327	0.934
0.	0.000	0.000
788.	0.602	0.905

LF, DAY, FALLBACK, BACKUP

FLT. NO. = 21 ENV. = 4 SSS= 7DEGC M1= 12DEGC DATE: 1129

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-787.	0.579	0.872
0.	0.000	0.000
-431.	0.319	0.912
-398.	0.300	0.902
0.	0.000	0.000
0.	0.200	0.912
0.	0.000	0.000
398.	0.305	0.917
431.	0.320	0.915
0.	0.000	0.000
788.	0.594	0.892


SYSTEM 21 ,SRP LF NORMAL,SSS=3 ,M1=-8 ,DATE:1126
COLD LIMIT
---=SPEC LIMIT
O =+Z EOS
X =-Z EOS
SRP-(,)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
0.0
2.0
4.0
6.0
8.0
SD/100-(NM)



SYSTEM 21 ,SRP LF FBACK ,SSS=3 ,M1=-8 ,DATE:1126
COLD LIMIT
----=SPEC LIMIT
O =+Z EOS
X =-Z EOS
0.0
0.2
0.4
0.6
0.8
1.0
1.2
0.0
2.0
4.0
6.0
8.0
SD/100-(NM)

LF, DAY, NORMAL, PRIMARY

FLT. NO. = 21 ENV. = 4 SSS= 3DEGC M1= -8DEGC DATE: 1126

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-800.	0.432	0.895
-600.	0.347	0.879
-431.	0.278	0.852
-398.	0.364	0.902
-200.	0.257	0.917
0.	0.219	0.912
200.	0.261	0.931
398.	0.368	0.911
431.	0.294	0.902
601.	0.352	0.891
800.	0.427	0.885

LF, DAY, NORMAL, BACKUP

FLT. NO. = 21 ENV. = 4 SSS= 3DEGC M1= -8DEGC DATE: 1126

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-800.	0.425	0.881
-600.	0.342	0.866
-431.	0.274	0.841
-398.	0.358	0.886
-200.	0.252	0.900
0.	0.215	0.897
200.	0.256	0.914
398.	0.362	0.896
431.	0.290	0.888
601.	0.346	0.876
800.	0.419	0.869

LF, DAY, FALLBACK, PRIMARY

FLT. NO. = 21 ENV. = 4 SSS= 3DEGC M1= -8DEGC DATE: 1126

SUR. DIST. (NM)	SRP ACTUAL (NM)	SRP RATIO
-787.	0.587	0.884
-600.	0.415	0.919
-431.	0.326	0.931
-398.	0.309	0.930
-200.	0.234	0.933
0.	0.200	0.915
200.	0.236	0.941
398.	0.309	0.929
431.	0.329	0.941
601.	0.426	0.942
788.	0.605	0.909

LF, DAY, FALLBACK, BACKUP

FLT. NO. = 21 ENV. = 4 SSS= 3DEGC M1= -8DEGC DATE: 1126

SUR. DIST. (NM)	SRP ACTUAL (NM)	SRP RATIO
-787.	0.580	0.874
-600.	0.407	0.901
-431.	0.319	0.914
-398.	0.303	0.913
-200.	0.230	0.917
0.	0.197	0.899
200.	0.232	0.924
398.	0.303	0.912
431.	0.323	0.923
601.	0.418	0.924
788.	0.598	0.899

2.2 Geometric Resolution (Cont'd)

2.2.3 Smoothed Geometric Resolution - Infrared (3.2.1.1.2.2)

2.2.3.1 Baseline (Orbit Nominal)

Effective with OLS 18 the nominal environment is no longer part of OLS testing.

2.2 Geometric Resolution (Cont'd)

2.2.3 Smoothed Geometric Resolution - Infrared (Cont'd) (3.2.1.1.2.2)

2.2.3.2 Acceptance - Vibration

Effective with OLS 18 previbration testing is no longer done on the T channel. The T channel is accepted by similarity to OLS's 12 thru 17 contingent on all other alignment/synchronization and MTF data being in spec and typical of the performance of prior OLS units.

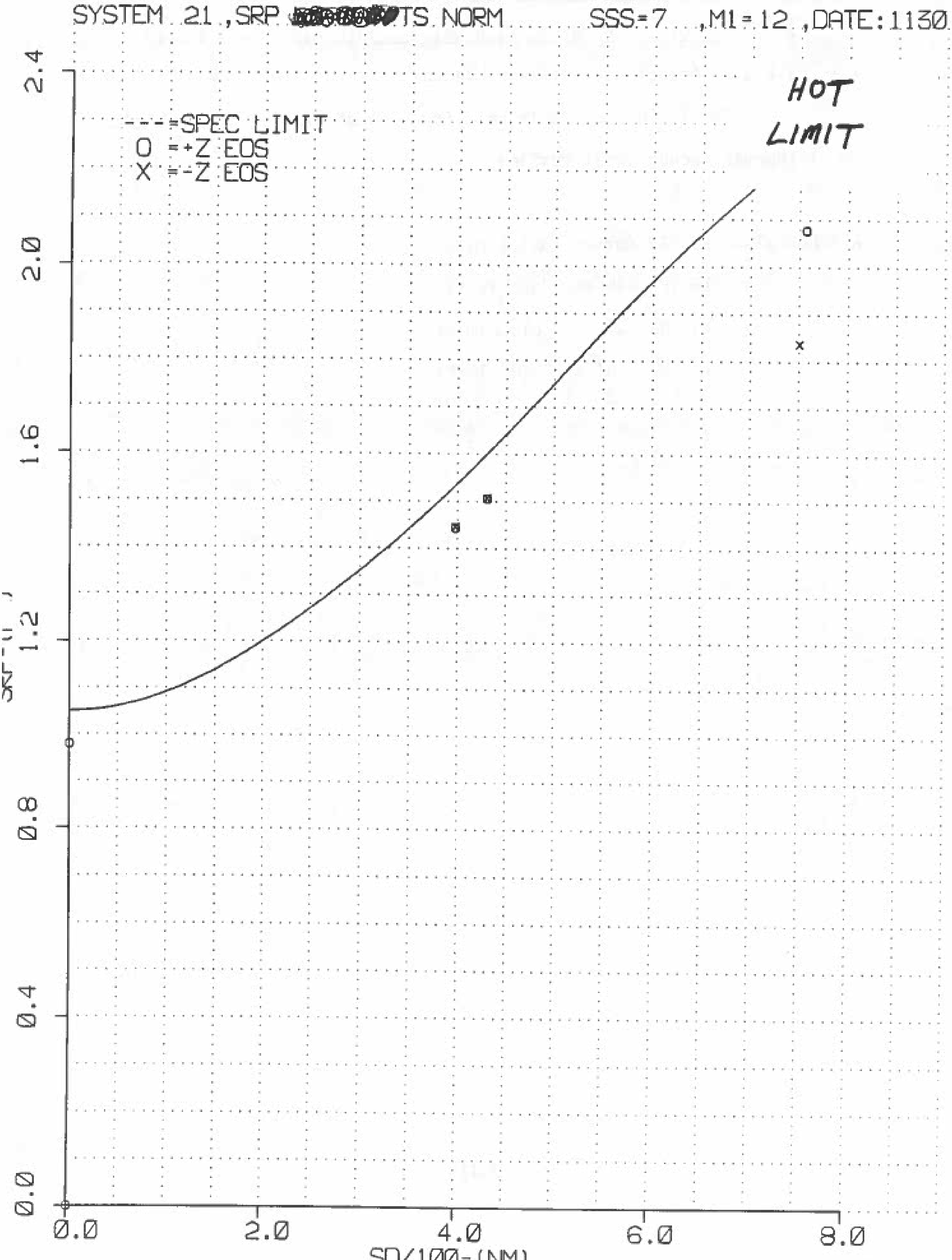
2.2 Geometric Resolution (Cont'd)

2.2.3 Smoothed Geometric Resolution - Infrared (3.2.1.1.2.2)

2.2.3.3 Acceptance - Thermal Vacuum

The TS SRP is within spec for the extremes of hot and cold Thermal Vacuum limit testing.

ATTACHMENTS:	TS SRP Curve	Hot Limits
	TS SRP Tables	Hot Limits
	TS SRP Curve	Cold Limits
	TS SRP Tables	Cold Limits



SYSTEM 21 ,SRP [redacted]TS NORM SSS=7 ,M1=12 ,DATE:1130
----=SPEC LIMIT
O =+Z EOS
X =-Z EOS
HOT LIMIT
2.4
2.0
1.6
1.2
0.8
0.4
0.0
0.0
2.0
4.0
6.0
8.0
SD/100-(NM)

TS, MID, PRIMARY

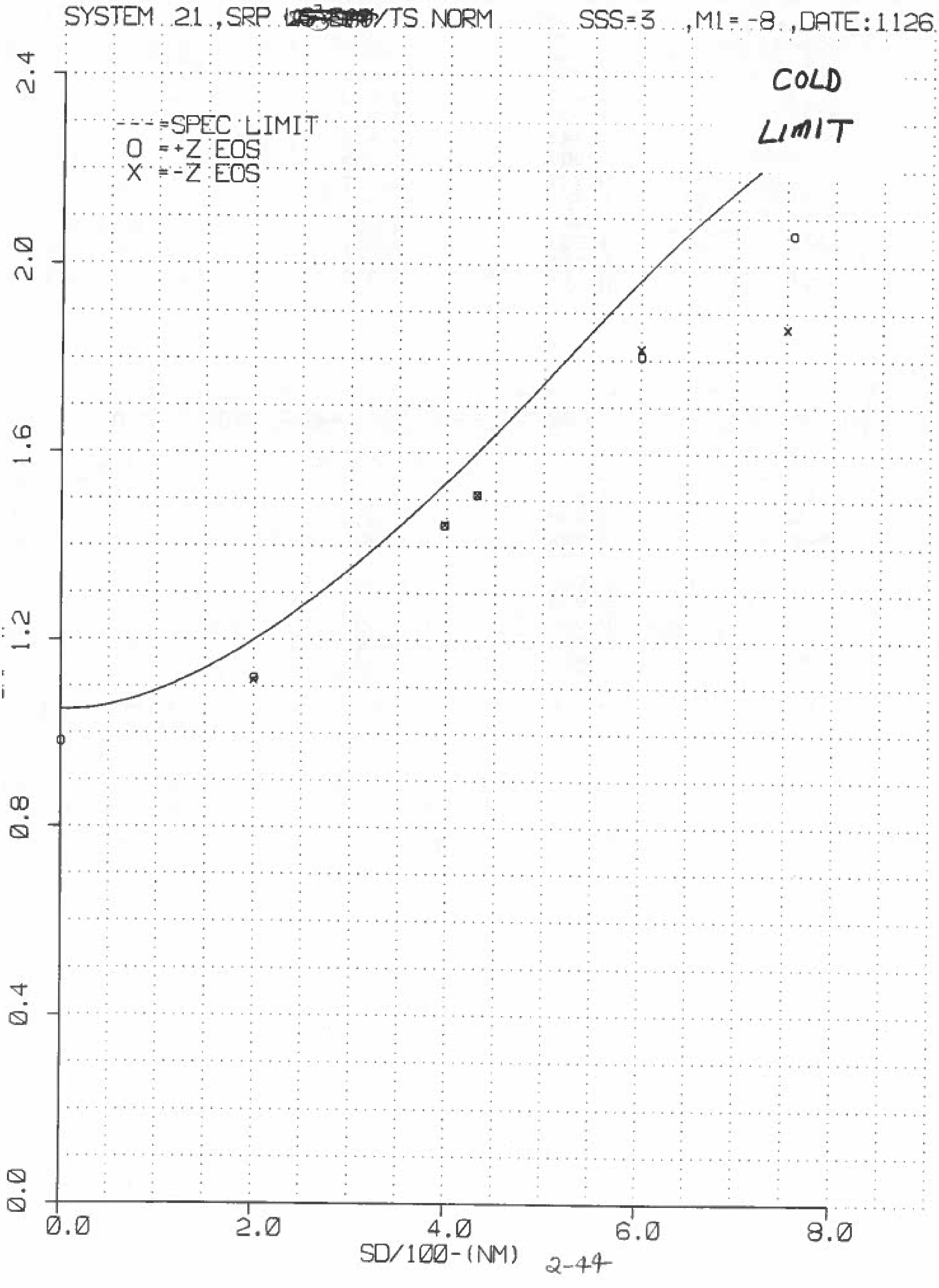
FLT. NO. = 21 ENV. = 4 SSS= 7DEGC M1= 12DEGC DATE: 1130

SUR. DIST. (NM)	SRP ACTUAL (NM)	SRP RATIO
-750.	1.837	0.817
0.	0.000	0.000
-431.	1.507	0.941
-398.	1.445	0.942
0.	0.000	0.000
0.	0.979	0.932
0.	0.000	0.000
398.	1.443	0.941
431.	1.505	0.940
0.	0.000	0.000
757.	2.078	0.919

TS, MID, BACKUP

FLT. NO. = 21 ENV. = 4 SSS= 7DEGC M1= 12DEGC DATE: 1130

SUR. DIST. (NM)	SRP ACTUAL (NM)	SRP RATIO
-750.	1.837	0.817
0.	0.000	0.000
-431.	1.506	0.941
-398.	1.445	0.942
0.	0.000	0.000
0.	0.978	0.932
0.	0.000	0.000
398.	1.442	0.941
431.	1.505	0.940
0.	0.000	0.000
757.	2.071	0.916



SYSTEM 21 ,SRP /TS NORM SSS=3 ,M1=-8 ,DATE:1126
COLD LIMIT
----=SPEC LIMIT
O =+Z EOS
X =-Z EOS
0.0
0.4
0.8
1.2
1.6
2.0
2.4
0.0
2.0
4.0
6.0
8.0
SD/100-(NM)

2-44

TS, MID, PRIMARY

FLT. NO. = 21 ENV. = 4 SSS= 3DEGC M1= -8DEGC DATE: 1126

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-750.	1.867	0.830
-600.	1.824	0.926
-431.	1.510	0.943
-398.	1.446	0.943
-200.	1.114	0.929
0.	0.981	0.935
200.	1.119	0.933
398.	1.445	0.942
431.	1.510	0.943
601.	1.807	0.917
757.	2.064	0.913

TS, MID, BACKUP

FLT. NO. = 21 ENV. = 4 SSS= 3DEGC M1= -8DEGC DATE: 1126

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-750.	1.846	0.821
-600.	1.804	0.916
-431.	1.495	0.934
-398.	1.432	0.933
-200.	1.103	0.920
0.	0.971	0.925
200.	1.108	0.924
398.	1.430	0.933
431.	1.495	0.933
601.	1.788	0.907
757.	2.035	0.900

2.2 <u>Geometric Resolution</u> (Cont'd)

2.2.4 Smoothed Geometric Resolution - Daytime Visual (3.2.1.1.2.2)

2.2.4.1 Baseline (Orbit Nominal)

Effective with OLS 18 the nominal environment is no longer part of OLS testing.

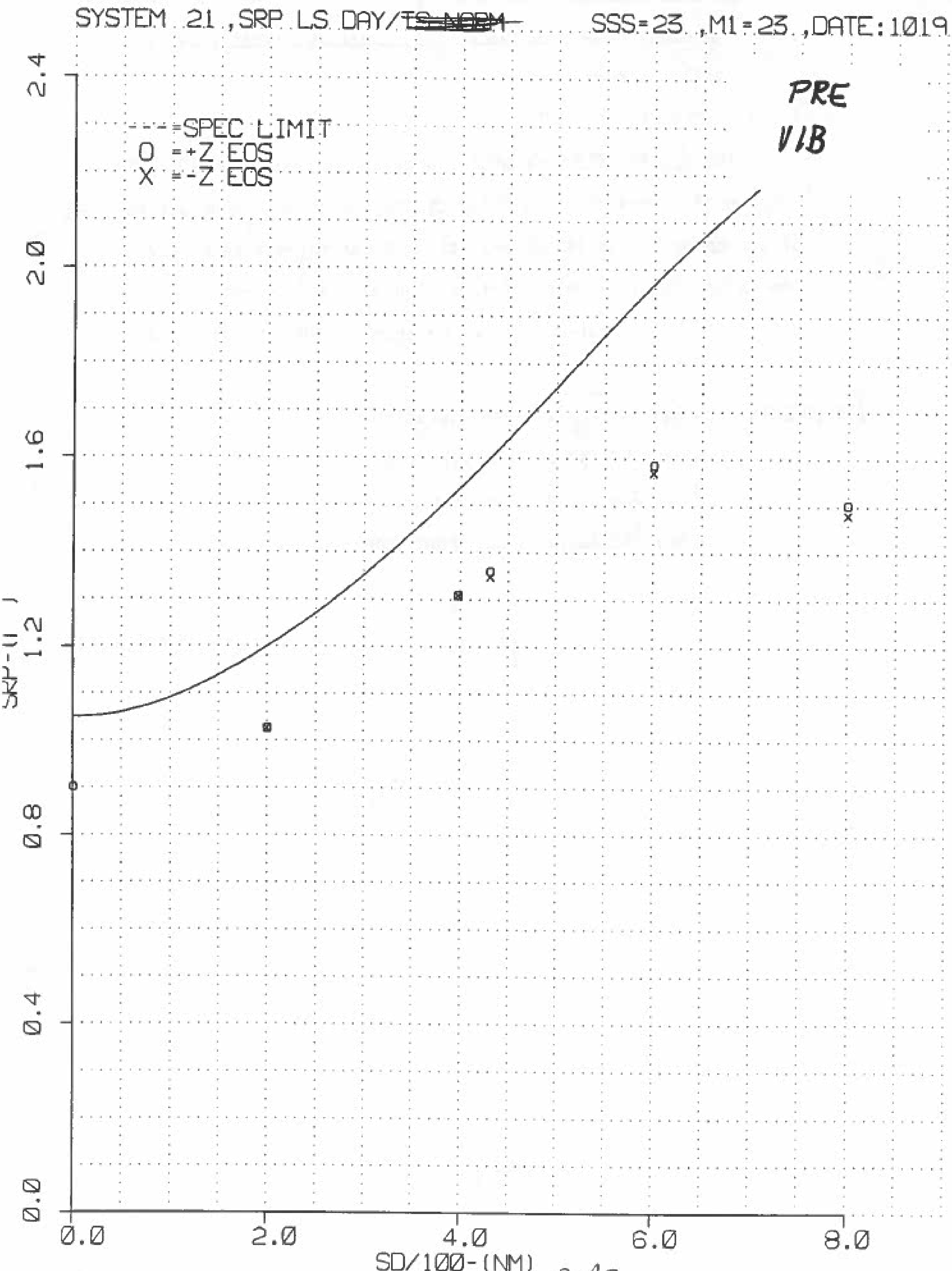
2.2 Geometric Resolution (Cont'd)

2.2.4 Smoothed Geometric Resolution - Daytime Visual (Cont'd) (3.2.1.1.2.2)

2.2.4.2 Acceptance - Vibration

The OLS #21 SSS underwent vibrations on September 10, 1994. Because of a rework of the Relay Optics due to the incorrect mounting of the beamsplitter (AM 21-14), the SSS was revibrated on 10/20/94. The LS Day SRP is within specification both before and after SSS vibration. No vibration-related changes in SRP were observed.

ATTACHMENTS:	LS Day SRP Curve	Pre-Vibration
	LS Day SRP Tables	Pre-Vibration
	LS Day SRP Curve	Post-Vibration
	LS Day SRP Table	Post-Vibration


SYSTEM 21 ,SRP LS DAY/~~TS NORM~~ SSS=23 ,M1=23 ,DATE:1019
PRE
VIB
---=SPEC LIMIT
O =+Z EOS
X =-Z EOS
2.4
2.0
1.6
1.2
0.8
0.4
0.0
0.0
2.0
4.0
6.0
8.0
SD/100-(NM)

LS, DAY, NORMAL, PRIMARY

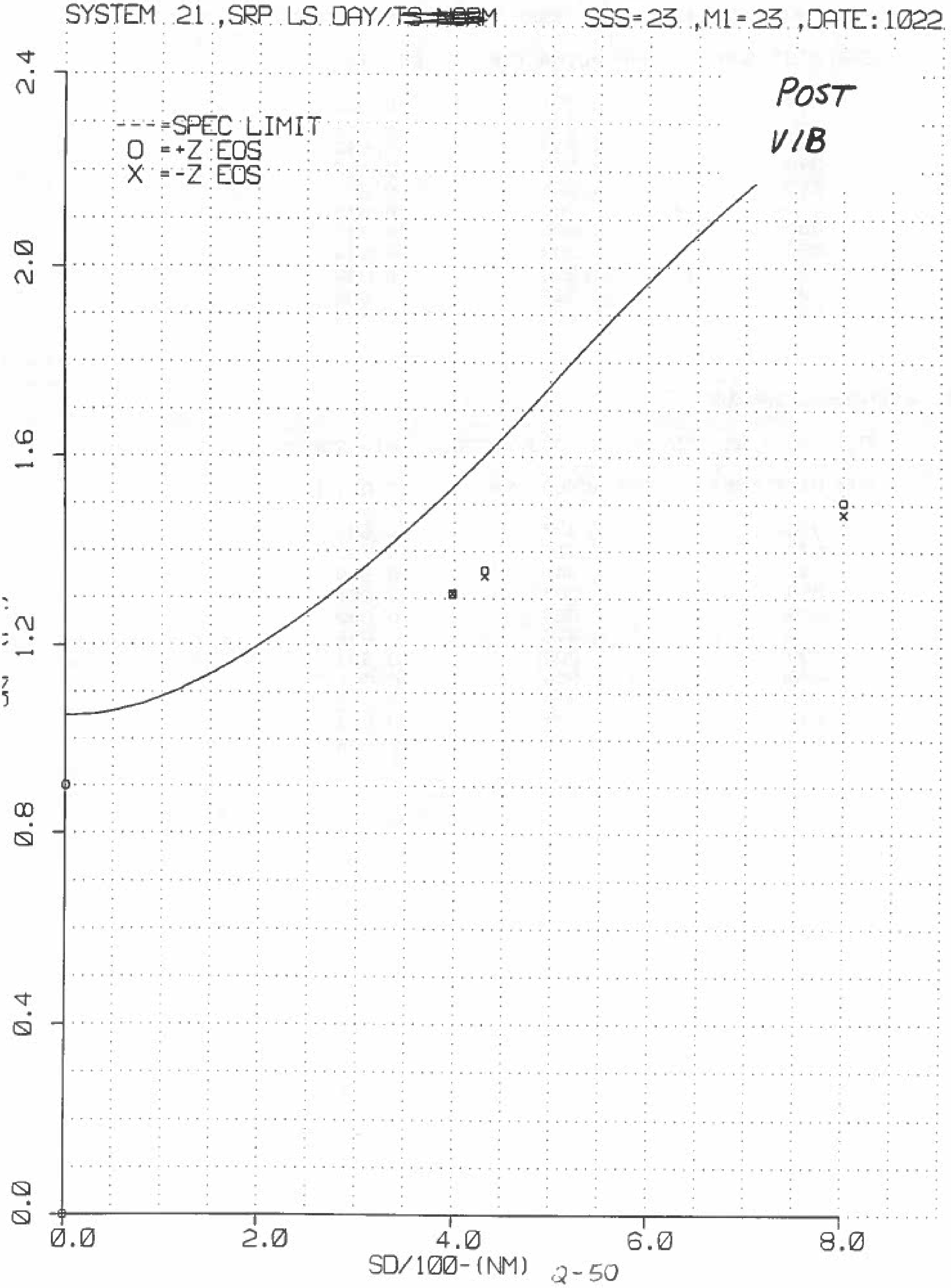
FLT. NO. = 21 ENV. = 2 SSS= 23DEGC M1= 23DEGC DATE: 1019

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-800.	1.481	0.630
-600.	1.570	0.797
-431.	1.349	0.842
-398.	1.309	0.853
-200.	1.026	0.855
0.	0.901	0.858
200.	1.025	0.855
398.	1.309	0.854
431.	1.360	0.849
601.	1.587	0.805
800.	1.503	0.639

LS, DAY, NORMAL, BACKUP

FLT. NO. = 21 ENV. = 2 SSS= 23DEGC M1= 23DEGC DATE: 1019

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-800.	1.477	0.629
-600.	1.566	0.795
-431.	1.345	0.840
-398.	1.305	0.851
-200.	1.023	0.853
0.	0.899	0.856
200.	1.022	0.852
398.	1.306	0.852
431.	1.356	0.847
601.	1.582	0.803
800.	1.499	0.638


SYSTEM 21 ,SRP LS DAY/TS NORM SSS=23 ,M1=23 ,DATE:1022
----=SPEC LIMIT
O =+Z EOS
X =-Z EOS
POST
V/B
2.4
2.0
1.6
1.2
0.8
0.4
0.0
0.0
2.0
4.0
6.0
8.0
SD/100-(NM)
2-50

LS, DAY, NORMAL, PRIMARY

FLT. NO. = 21 ENV. = 2 SSS= 23DEGC M1= 23DEGC DATE: 1022

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-800.	1.479	0.630
0.	0.000	0.000
-431.	1.347	0.841
-398.	1.309	0.854
0.	0.000	0.000
0.	0.900	0.858
0.	0.000	0.000
398.	1.309	0.854
431.	1.358	0.848
0.	0.000	0.000
800.	1.504	0.640

LS, DAY, NORMAL, BACKUP

FLT. NO. = 21 ENV. = 2 SSS= 23DEGC M1= 23DEGC DATE: 1022

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-800.	1.476	0.628
0.	0.000	0.000
-431.	1.344	0.839
-398.	1.306	0.852
0.	0.000	0.000
0.	0.898	0.856
0.	0.000	0.000
398.	1.306	0.852
431.	1.355	0.846
0.	0.000	0.000
800.	1.501	0.638

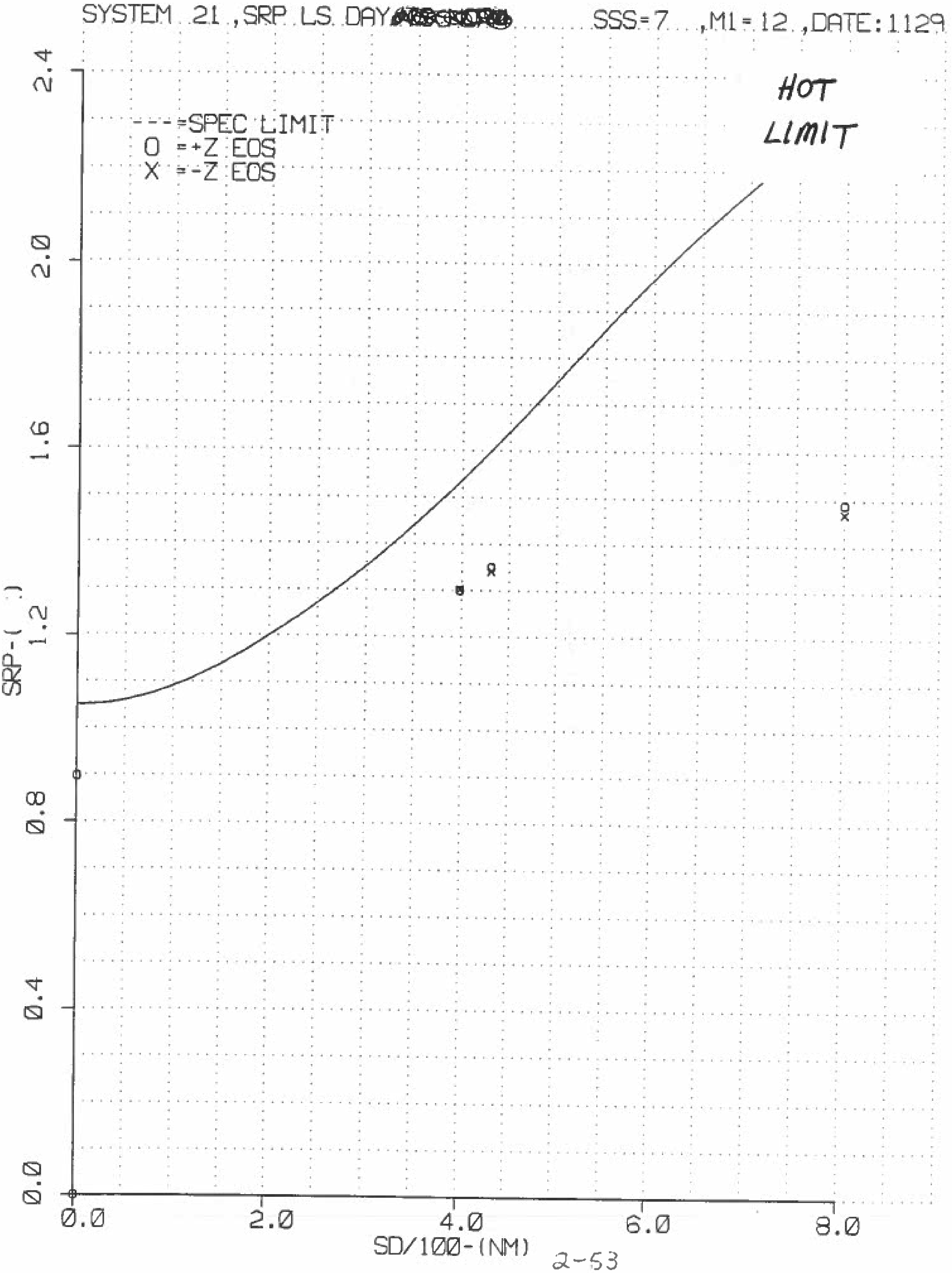
2.2 Geometric Resolution (Cont'd)

2.2.4 Smoothed Geometric Resolution - Daytime Visual (Cont'd) (3.2.1.1.2.2)

2.2.4.3 Acceptance - Thermal Vacuum

The LS Day SRP is within specification allowance over the entire range of temperatures.

ATTACHMENTS:	LS Day SRP Curve	Hot Limits
	LS Day SRP Tables	Hot Limits
	LS Day SRP Curve	Cold Limits
	LS Day SRP Tables	Cold Limits



SYSTEM 21 ,SRP LS DAY [redacted]
SSS=7 ,M1=12 ,DATE:1129
HOT LIMIT
----=SPEC LIMIT
O =+Z EOS
X =-Z EOS
SRP-( )
SD/100-(NM)

LS, DAY, NORMAL, PRIMARY

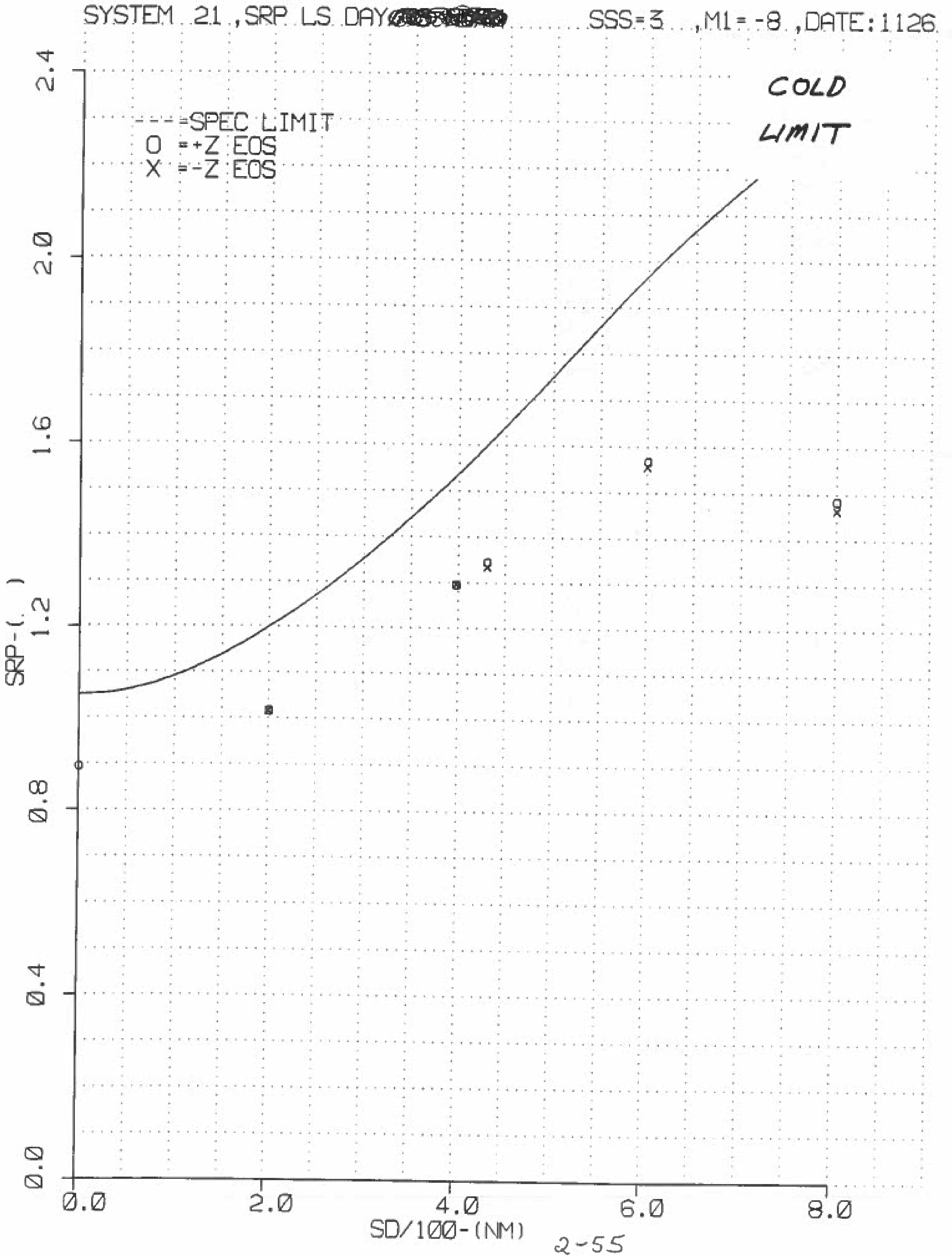
FLT. NO. = 21 ENV = 4 SSS= 7DEGC M1= 12DEGC DATE: 1129

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-800.	1.470	0.626
0.	0.000	0.000
-431.	1.341	0.838
-398.	1.302	0.849
0.	0.000	0.000
0.	0.897	0.854
0.	0.000	0.000
398.	1.300	0.847
431.	1.350	0.843
0.	0.000	0.000
800.	1.490	0.634

LS, DAY, NORMAL, BACKUP

FLT. NO. = 21 ENV = 4 SSS= 7DEGC M1= 12DEGC DATE: 1129

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-800.	1.463	0.623
0.	0.000	0.000
-431.	1.335	0.834
-398.	1.296	0.845
0.	0.000	0.000
0.	0.893	0.850
0.	0.000	0.000
398.	1.293	0.844
431.	1.343	0.839
0.	0.000	0.000
800.	1.482	0.631


SYSTEM 21 ,SRP LS DAY[redacted] SSS=3 ,M1=-8 ,DATE:1126
COLD LIMIT
----=SPEC LIMIT
O =+Z EOS
X =-Z EOS
SRP-( )
0.0
0.4
0.8
1.2
1.6
2.0
2.4
0.0
2.0
4.0
6.0
8.0
SD/100-(NM)

LS, DAY, NORMAL, PRIMARY

FLT. NO. = 21   ENV = 4   SSS= 3DEGC   M1= -8DEGC   DATE: 1126

SUR. DIST. (NM)	SRP ACTUAL (NM)	SRP RATIO
-800.	1.464	0.623
-600.	1.556	0.790
-431.	1.335	0.834
-398.	1.296	0.845
-200.	1.015	0.846
0.	0.894	0.851
200.	1.015	0.846
398.	1.295	0.845
431.	1.345	0.840
601.	1.567	0.795
800.	1.483	0.631

LS, DAY, NORMAL, BACKUP

FLT. NO. = 21   ENV = 4   SSS= 3DEGC   M1= -8DEGC   DATE: 1126

SUR. DIST. (NM)	SRP ACTUAL (NM)	SRP RATIO
-800.	1.457	0.620
-600.	1.548	0.786
-431.	1.327	0.829
-398.	1.290	0.841
-200.	1.010	0.843
0.	0.890	0.847
200.	1.011	0.843
398.	1.290	0.841
431.	1.339	0.836
601.	1.560	0.792
800.	1.476	0.628

2.2 Geometric Resolution (Cont'd)

2.2.5 Smoothed Geometric Resolution - Nighttime Visual (3.2.1.1.2.2)

LS Night SRP routinely is deliberately adjusted to be close to spec limit during system integration in order to optimize PMT signal-to-noise ratio, at the expense of SRP margin.

2.2.5.1 Baseline (Orbit Nominal)

Effective with OLS 18 the nominal environment is no longer part of OLS testing.

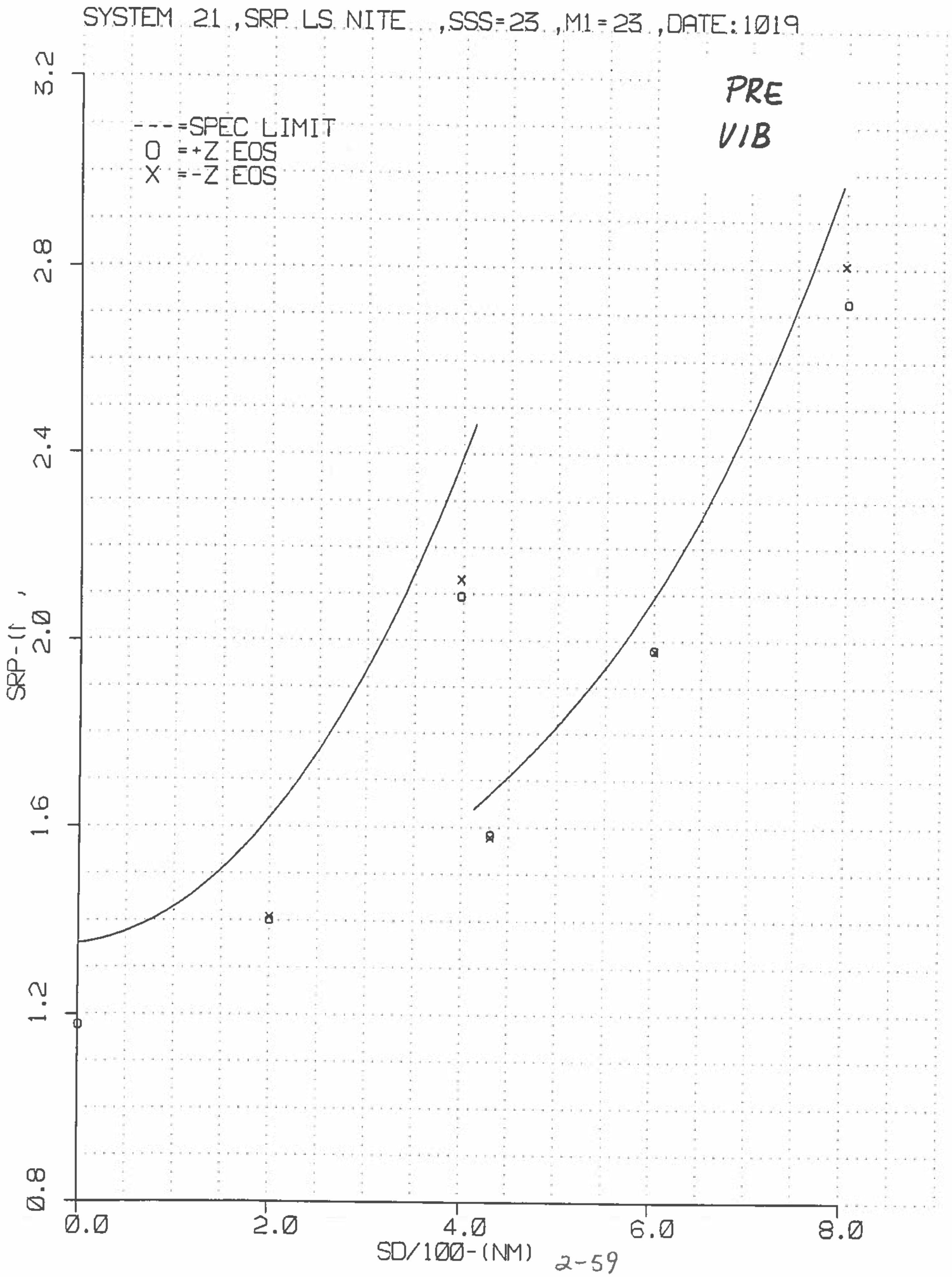
2.2 Geometric Resolution (Cont'd)

2.2.5 Smoothed Geometric Resolution - Nighttime Visual (Cont'd) (3.1.2.2)

2.2.5.2 Acceptance - Vibration

The LS Night SRP is within specification before and after SSS vibration. No vibration-induced changes in SRP were observed.

ATTACHMENTS:	LS Night SRP Curve	Pre-Vibration
	LS Night SRP Tables	Pre-Vibration
	LS Night SRP Curve	Post-Vibration
	LS Night SRP Tables	Post-Vibration



SYSTEM 21 ,SRP LS NITE ,SSS=23 ,M1=23 ,DATE:1019
PRE VIB
---=SPEC LIMIT
O =+Z EOS
X =-Z EOS
3.2
2.8
2.4
2.0
1.6
1.2
0.8
SRP-((
0.0
2.0
4.0
6.0
8.0
SD/100-(NM)

LS, NITE, NORMAL, PRIMARY

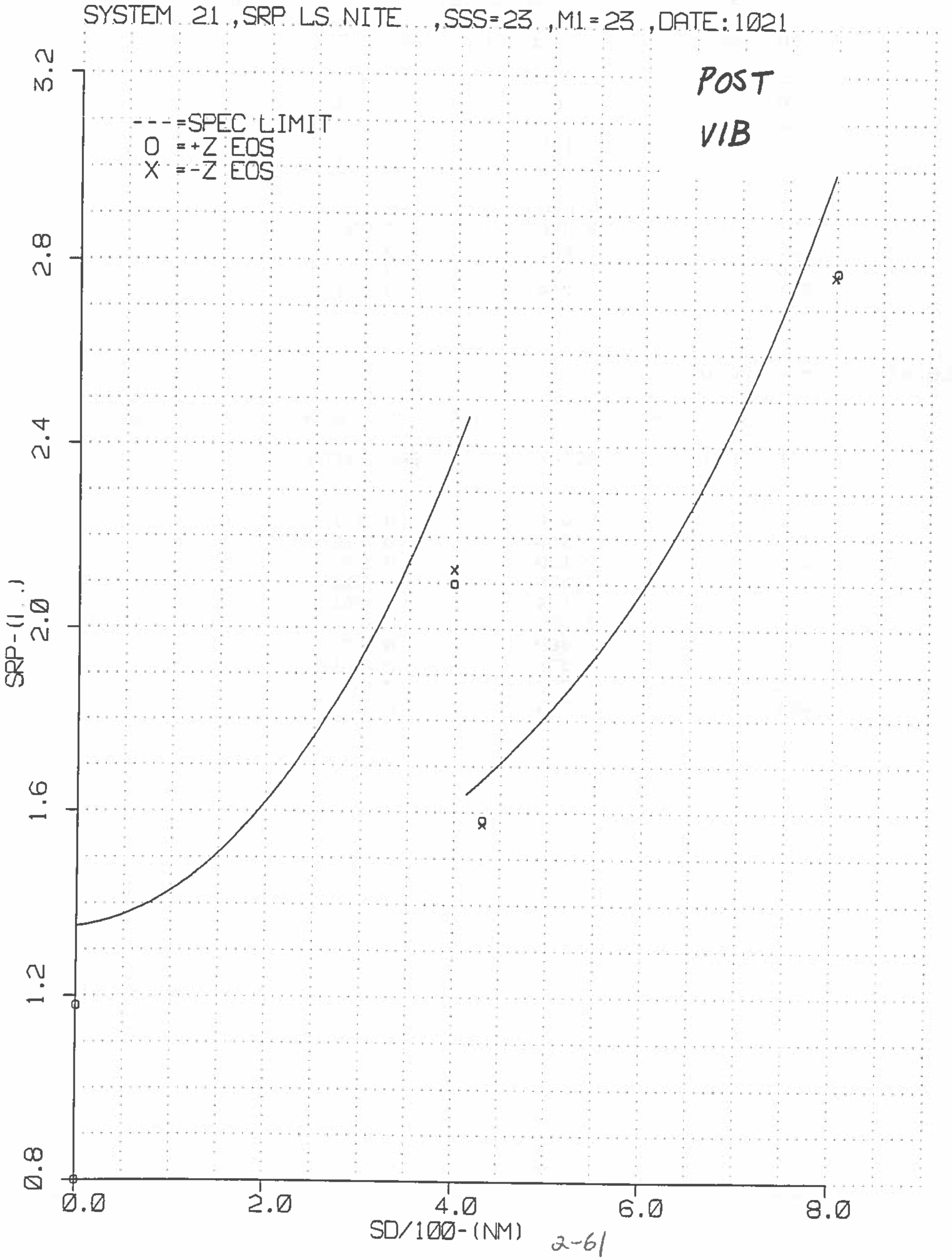
FLT. NO. = 21 ENV. = 2 SSS= 23DEGC M1= 23DEGC DATE: 1019

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-799.	2.807	0.937
-601.	1.978	0.943
-430.	1.579	0.945
-397.	2.131	0.895
-200.	1.407	0.868
0.	1.177	0.872
200.	1.401	0.864
397.	2.094	0.879
430.	1.584	0.948
600.	1.980	0.945
801.	2.725	0.906

LS, NITE, NORMAL, BACKUP

FLT. NO. = 21 ENV. = 2 SSS= 23DEGC M1= 23DEGC DATE: 1019

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-799.	2.793	0.933
-601.	1.969	0.940
-430.	1.573	0.941
-397.	2.121	0.890
-200.	1.401	0.864
0.	1.173	0.868
200.	1.394	0.860
397.	2.085	0.875
430.	1.578	0.944
600.	1.971	0.941
801.	2.711	0.902



SYSTEM 21 ,SRP LS NITE ,SSS=23 ,M1=23 ,DATE:1021
POST VIB
---=SPEC LIMIT
O =+Z EOS
X =-Z EOS
SRP-(I .)
0.8
1.2
1.6
2.0
2.4
2.8
3.2
0.0
2.0
4.0
6.0
8.0
SD/100-(NM)

LS, NITE, NORMAL, PRIMARY

FLT. NO. = 21 ENV. = 2 SSS= 23DEGC M1= 23DEGC DATE: 1021

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-799.	2.770	0.925
0.	0.000	0.000
-430.	1.574	0.942
-397.	2.129	0.894
0.	0.000	0.000
0.	1.179	0.873
0.	0.000	0.000
397.	2.098	0.881
430.	1.582	0.947
0.	0.000	0.000
801.	2.779	0.924

LS, NITE, NORMAL, BACKUP

FLT. NO. = 21 ENV. = 2 SSS= 23DEGC M1= 23DEGC DATE: 1021

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-799.	2.755	0.920
0.	0.000	0.000
-430.	1.568	0.938
-397.	2.118	0.889
0.	0.000	0.000
0.	1.174	0.870
0.	0.000	0.000
397.	2.088	0.877
430.	1.576	0.943
0.	0.000	0.000
801.	2.764	0.919

2.2 Geometric Resolution (Cont'd)

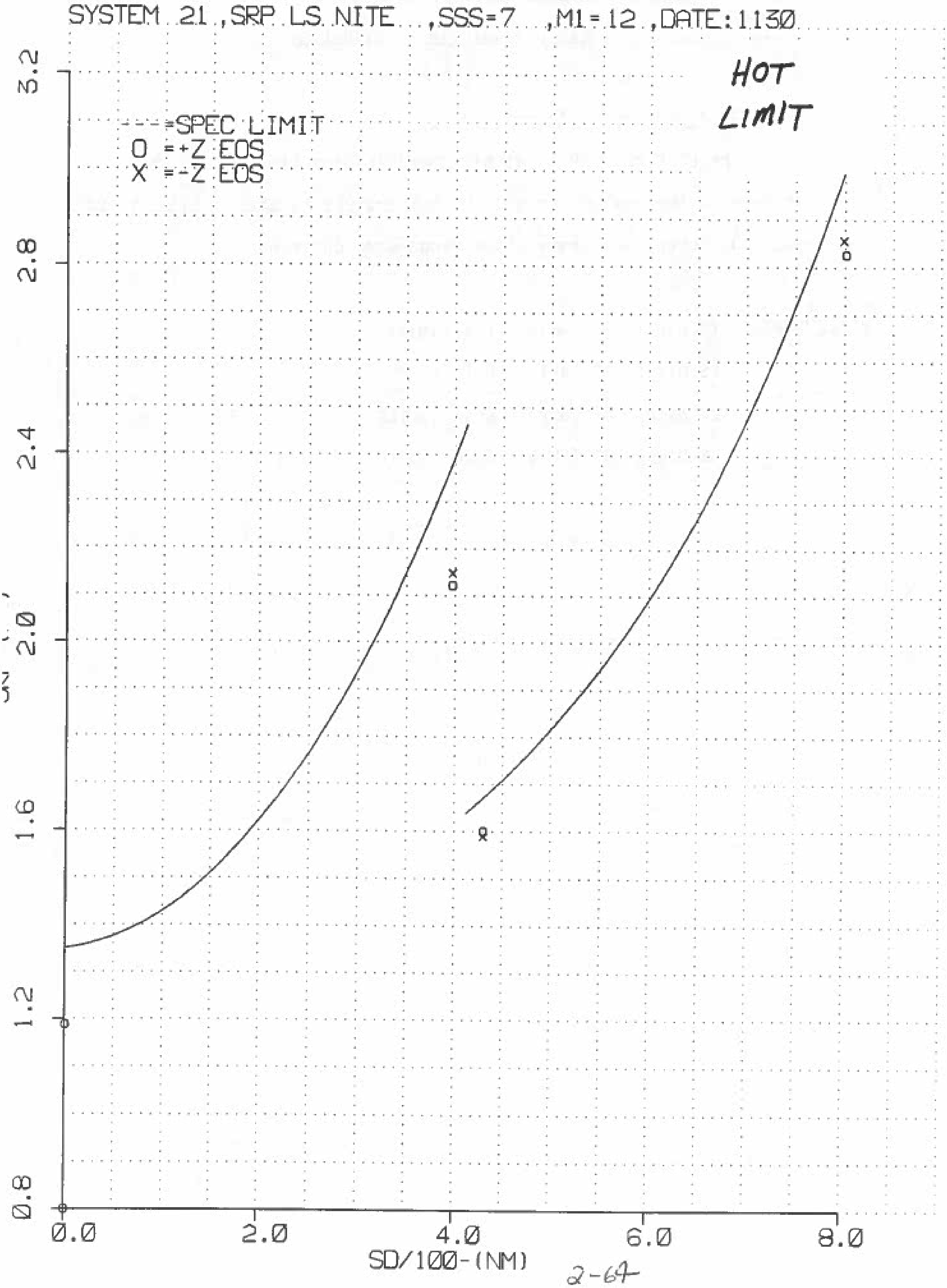
2.2.5 Smoothed Geometric Resolution - Nighttime Visual (Cont'd) (3.1.2.2)

2.2.5.3 Acceptance - Thermal Vacuum

The LS Night SRP is within specification limits over the Acceptance temperature range. No temperature-related changes in SRP over the Acceptance temperature range were observed.

ATTACHMENTS:

LS Night SRP Curve	Hot Limits
LS Night SRP Tables	Hot Limits
LS Night SRP Curve	Cold Limits
LS Night SRP Tables	Cold Limits


SYSTEM 21 ,SRP LS NITE ,SSS=7 ,M1=12 ,DATE:1130
HOT LIMIT
----=SPEC LIMIT
O =+Z EOS
X =-Z EOS
3.2
2.8
2.4
2.0
1.6
1.2
0.8
0.0
2.0
4.0
6.0
8.0
SD/100-(NM)

2-64

LS, NITE, NORMAL, PRIMARY

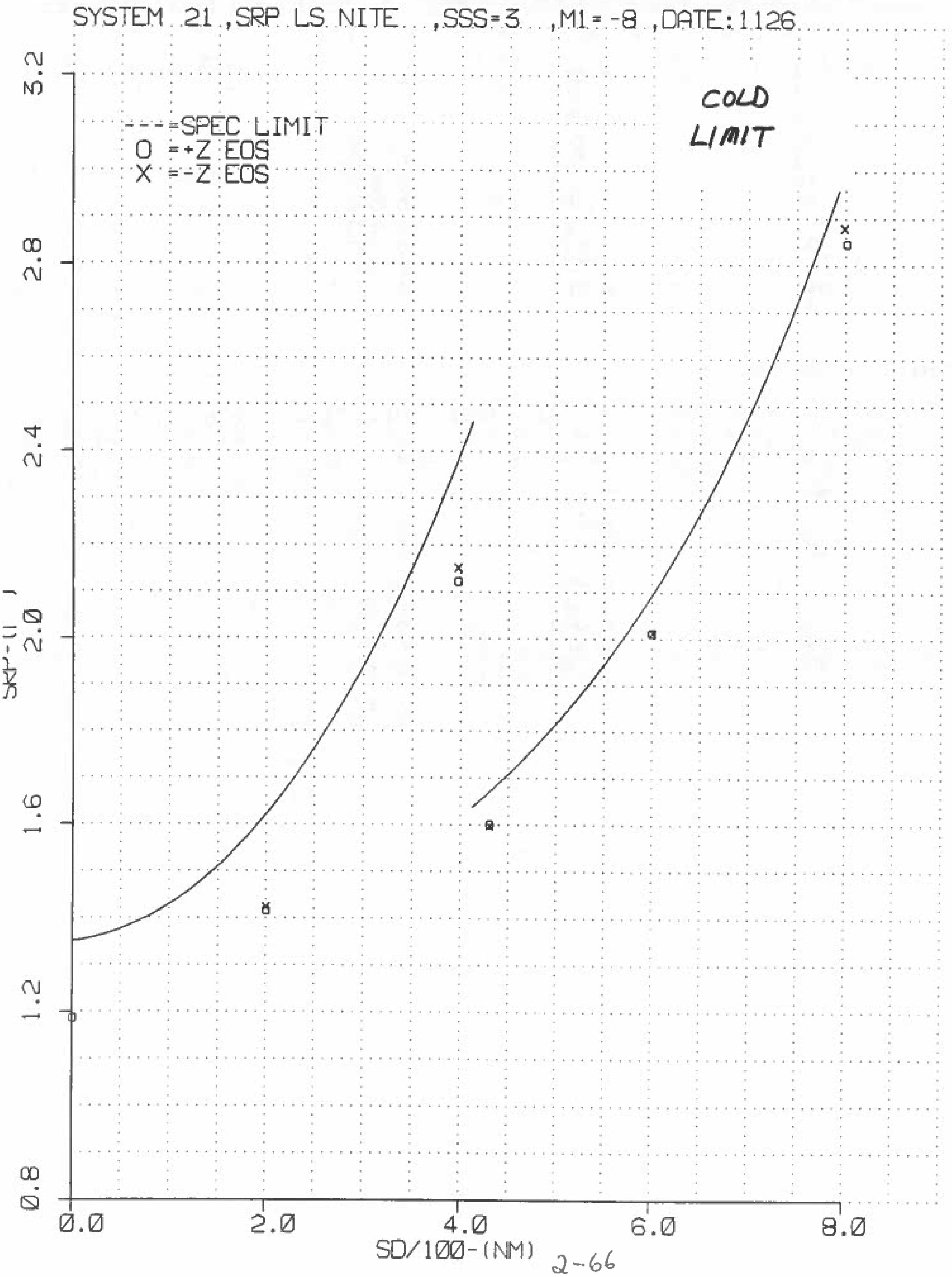
FLT. NO. = 21 ENV. = 4 SSS= 7DEGC M1= 12DEGC DATE: 1130

SUR. DIST. (NM)	SRP ACTUAL (NM)	SRP RATIO
-799.	2.857	0.954
0.	0.000	0.000
-430.	1.590	0.952
-397.	2.148	0.902
0.	0.000	0.000
0.	1.188	0.879
0.	0.000	0.000
397.	2.122	0.891
430.	1.600	0.957
0.	0.000	0.000
801.	2.827	0.940

LS, NITE, NORMAL, BACKUP

FLT. NO. = 21 ENV. = 4 SSS= 7DEGC M1= 12DEGC DATE: 1130

SUR. DIST. (NM)	SRP ACTUAL (NM)	SRP RATIO
-799.	2.846	0.950
0.	0.000	0.000
-430.	1.585	0.948
-397.	2.138	0.898
0.	0.000	0.000
0.	1.182	0.876
0.	0.000	0.000
397.	2.112	0.887
430.	1.594	0.954
0.	0.000	0.000
801.	2.816	0.936



SYSTEM 21 ,SRP LS NITE ,SSS=3 ,M1=-8 ,DATE:1126
COLD LIMIT
----=SPEC LIMIT
O =+Z EOS
X =-Z EOS
SRP-(I J
3.2
2.8
2.4
2.0
1.6
1.2
0.8
0.0
2.0
4.0
6.0
8.0
SD/100-(NM)

2-66

LS, NITE, NORMAL, PRIMARY

FLT. NO. = 21 ENV. = 4 SSS= 3DEGC M1= -8DEGC DATE: 1126

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-799.	2.879	0.962
-601.	2.013	0.960
-430.	1.598	0.956
-397.	2.152	0.903
-200.	1.423	0.878
0.	1.187	0.879
200.	1.416	0.873
397.	2.122	0.891
430.	1.601	0.958
600.	2.012	0.961
801.	2.846	0.946

LS, NITE, NORMAL, BACKUP

FLT. NO. = 21 ENV. = 4 SSS= 3DEGC M1= -8DEGC DATE: 1126

SUR. DIST. (NM)	SRP ACTUAL(NM)	SRP RATIO
-799.	2.866	0.957
-601.	2.004	0.956
-430.	1.592	0.953
-397.	2.141	0.899
-200.	1.417	0.874
0.	1.182	0.875
200.	1.409	0.869
397.	2.112	0.887
430.	1.595	0.954
600.	2.004	0.957
801.	2.832	0.942

2.2 Geometric Resolution (Cont'd)

2.2.6 Data Sampling (3.2.1.1.2.3)

The sampling frequency ratios for all modes of the 5D-3 OLS satisfy the specification requirements. The calculations are contained in the 5D-3 OLS System Summary Report. The results are summarized below. The worst-case sampling frequency ratio for each mode is given.

MODE	SAMPLING FREQ. RATIO (Spec: > 2.4)
LF Day - Normal	2.58
LF Day - Fallback	2.61
LS & TS Day - Normal	2.50
LS Night - Normal	2.66
TF - Normal	3.44
TF Fallback - Normal Side of scan	3.28
TF Fallback - Abnormal Side of Scan	3.28

2.3 Geometric Accuracy (3.2.1.1.3.1 thru 3.2.1.1.3.4)

The alignment and synchronization of the SSS determine the Geometric Accuracy. Geometric accuracy is specified in 3 categories (Repeatability, Stability & Fixed Errors). Within these categories, accuracy is further specified for Along Track, Along Scan (Stored Data), Along Scan (Direct Data), and Along Scan (with digital delphi generation, i.e., the Encoder Simulator locked mode).

There was an observed shift in alignment between the extremes of M1 temperature of -8°C and +12°C on the order of 0.15 milliradians or less for all channels. There was also an observed shift in synchronization in all modes in OLS #21 of approximately 0.2 milliradians or less between M1 temperature extremes of -8°C and +12°.

The Repeatability error is calculated using the rms difference of the measured alignment/synchronization (as a function of the variation of M1 temperature on orbit) from the hot-to-cold average values of alignment/ synchronization. The total Repeatability contribution for synchronization is determined by rss'ing the wow-flutter error (as measured in test 6x11.ST) and the jitter error (which was negligible on OLS #21) with the repeatability shift between the Hot and Cold Limits.

The Primary Alignment Reference Axes (REFPLN) are calculated in a computer program using HRD & T channel Alignment and Sync data from several tests. The data determine a best-fit alignment with respect to the Interface Mounting Axes. The REFPLN Alignment and REFPLN Synchronization curves are included here. The remainder of the Alignment and Synchronization data for the OLS #21 SSS are in BVS 2809, Vol. III of this Acceptance Test Report.

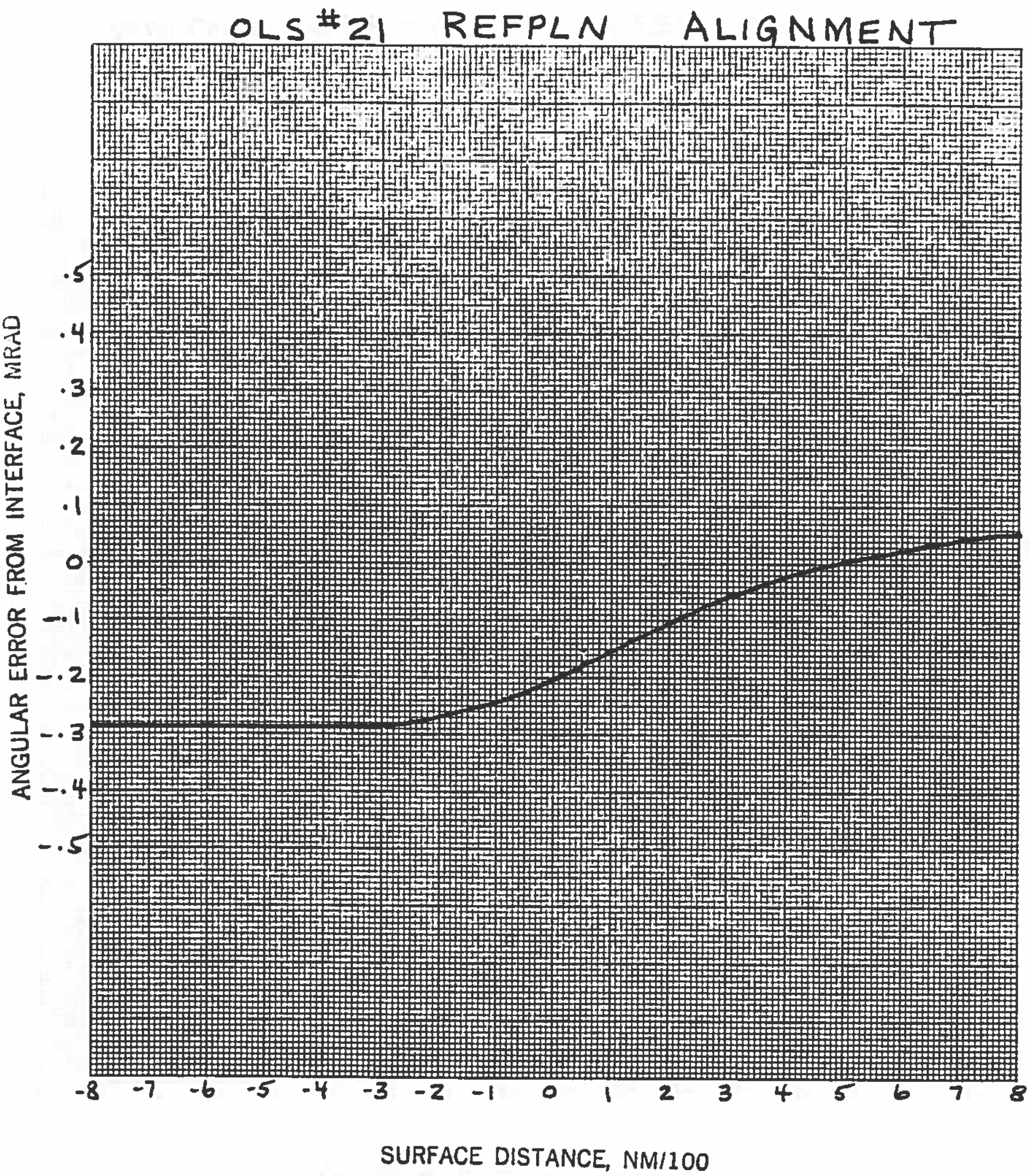
The 5D-3 System has a Fallback mode utilizing an encoder control track and Encoder Simulator. The spec limits and measured results are shown in Table 2.3-2.

ATTACHMENTS: OLS #21 REFPLN ALIGNMENT

OLS #21 REFPLN SYNCHRONIZATION

OLS #21 ALIGN/SYNC vs SPEC, Table 2.3-1

OLS #21 Encoder Simulator Sync, Table 2.3-2


OLS #21 REFPLN ALIGNMENT
ANGULAR ERROR FROM INTERFACE, MRAD
.5
.4
.3
.2
.1
0
-.1
-.2
-.3
-.4
-.5
-8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8
SURFACE DISTANCE, NM/100

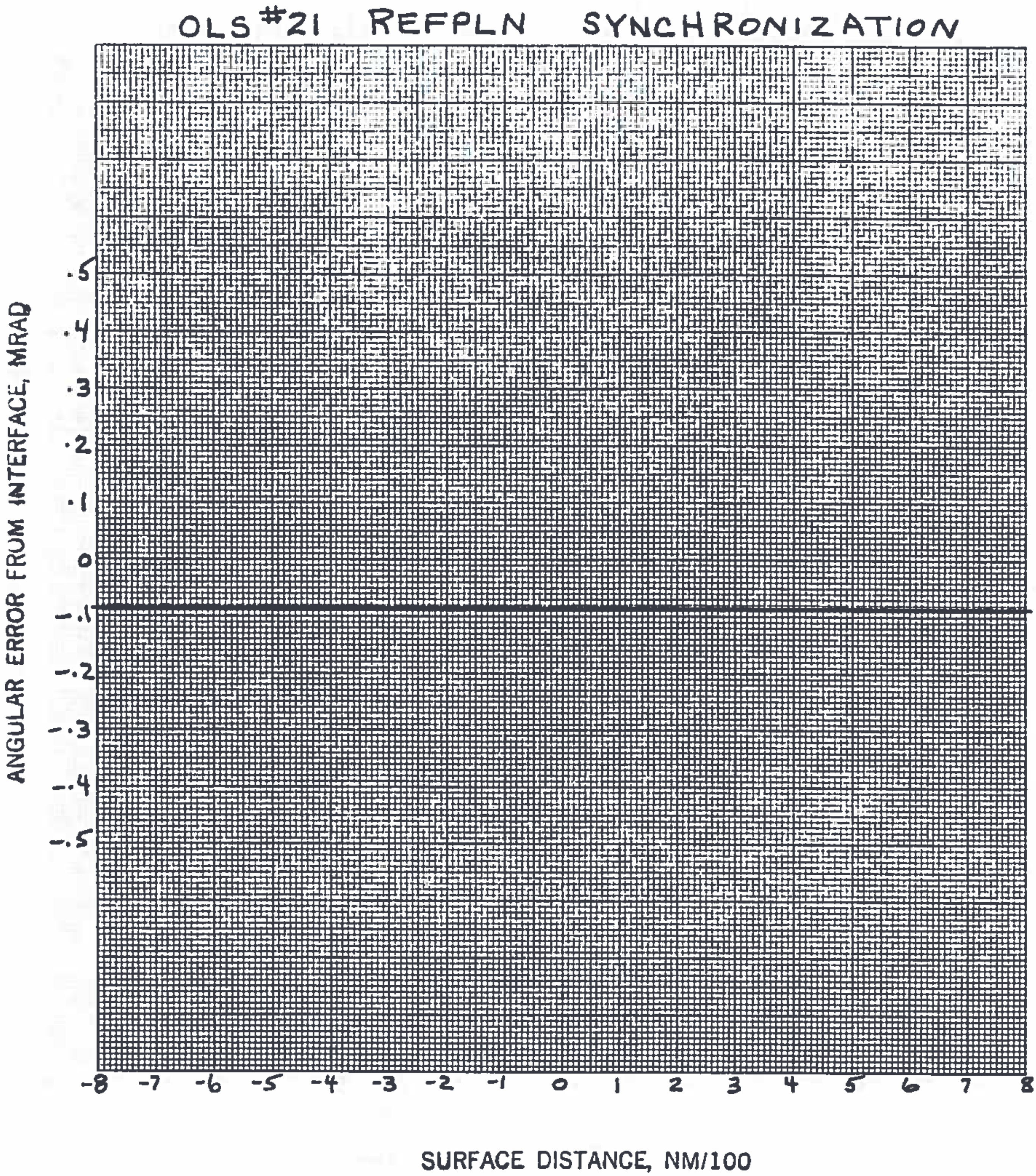

OLS #21 REFPLN SYNCHRONIZATION
ANGULAR ERROR FROM INTERFACE, MRAD
.5
.4
.3
.2
.1
0
-.1
-.2
-.3
-.4
-.5
-8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8
SURFACE DISTANCE, NM/100

Table 2.3-1

OLS #21 ALIGN/SYNC vs. SPEC
all numbers in milliradians

	HRD	T	PMT
FIXED - Delta between "REFPLN" & Optic Hot - Cold Average			
AT SPEC	0.45	0.70	0.60
Measured (worst-case)	0.27	0.33	0.43
AS STORED SPEC	0.80	0.80	1.90
Measured (worst-case)	0.29	0.48	1.14
AS DIRECT FINE SPEC	0.80	0.80	1.90
Measured (worst-case)	0.29*	0.48*	N/A
AS DIRECT SMOOTH SPEC	0.80	0.80	1.90
Measured (worst-case)	0.29*	0.48*	0.88
STABILITY - Delta Between Pre & Post - Vibration			
AT SPEC	0.50	0.55	0.55
Measured (worst-case)	0.08	0.09**	0.13
AS STORED SPEC	0.20	0.25	0.25
Measured (worst-case)	0.06	0.12**	0.12
AS DIRECT FINE SPEC	0.20	0.25	0.25
Measured (worst-case)	0.06*	0.12**	N/A
AS DIRECT SMOOTH SPEC	0.20	0.25	0.25
Measured (worst-case)	0.06*	0.12**	0.10
REPEATABILITY - Delta between TV Hot & Cold Limits			
AT SPEC	0.20	0.22	0.20
Measured (rms)	0.04	0.03	0.07
AS STORED SPEC	0.30	0.30	0.30
Measured (rms)	0.07	0.08	0.16
AS DIRECT FINE SPEC	0.50	0.50	0.50
Measured (rms)	0.06	0.08*	N/A
AS DIRECT SMOOTH SPEC	2.00	2.00	2.00
Measured (rms)	0.09	0.08*	0.09
TOTAL -			
AT SPEC	1.00	1.30	1.20
Calculated	0.36	0.43	0.58
AS STORED SPEC	1.16	1.19	2.29
Calculated	0.38	0.62	1.34
AS DIRECT FINE SPEC	1.34	1.36	2.46
Calculated	0.38	0.62	N/A
AS DIRECT SMOOTH SPEC	2.81	2.82	3.92
Calculated	0.40	0.62	1.02

N/A = not applicable   * = Inferred from AS Stored number.
** Average of OLS #12 thru OLS #17

Table 2.3-2
OLS #21 ALONG-SCAN GEOMETRIC ACCURACY WITH ENCODER SIMULATOR

	Stored	Direct Fine	Direct Smooth
Repeatability-Spec, mrad	1.0	1.1	2.2
Measured	0.08	0.07	0.09
Stability - Spec, mrad	0.80	0.80	0.80
Measured	0.20	0.20*	0.20*
Fixed - Spec, mrad	9.8	9.8	9.8
Measured	0.68	0.68*	0.68*
Total - Spec, mrad	11.1	11.2	12.3
Calculated	0.90	0.89	0.90

*Inferred from stored number

2.4 RADIOMETRIC ACCURACY

2.4.1 T Channel Radiometric Accuracy (3.2.1.1.4.1 a,b,c)

The overall one sigma accuracy of the OLS #21 T Channel DC response is 0.73°K compared to a 1.1°K spec and therefore OLS #21 does meet this specification requirement.

Table 2.4.1-1 presents the overall summary of performance, which is discussed more fully in sections 2.4.1.1, 2.4.1.2 and 2.4.1.3.

ATTACHMENTS:

Table 2.4.1-1	Overall Contributors
Table 2.4.1-2	210° to 310°K Best Straight Line Calibrations
Table 2.4.1-3	T DC Response Compilation of Test Runs
Table 2.4.1-4	BSL Equation T Right, Run #9
Table 2.4.1-5	BSL Equation T Mid, Run #9
Table 2.4.1-6	BSL Equation T Left, Run #9
Figure 2.4.1-1	T DC Response Plots, Run #1 - Primary
Figure 2.4.1-2	T DC Response Plots, Run #1 - Redundant
Figure 2.4.1-3	T DC Response Plots, Run #8 - Primary
Figure 2.4.1-4	T DC Response Plots, Run #8 - Redundant
Figure 2.4.1-5	T DC Response Plots, Run #9 - Primary
Figure 2.4.1-6	T DC Response Plots, Run #9 - Redundant

TABLE 2.4.1-1

OLS #21

OVERALL CONTRIBUTORS TO T-CHANNEL RADIOMETRIC ACCURACY

SPECIFICATION PARA. 3.1.4.1	RMS DEVIATION (°K)	SPECIFICATION MAX ONE SIGMA ERROR (°K)
a) Repeatability (<1 day)	0.23	0.42
b) Stability (>1 day)	0.61	0.80
c) Fixed Deviations	0.32	0.60
TOTAL (RSS) ACCURACY	0.73	1.10

Discussion of T DC Response Test and Overview

The measurement of T DC Response is accomplished in the thermal vacuum chamber because the T detector must be cooled to its operating temperature of near 110°K. Two controlled blackbody targets variable in temperature over the dynamic range of 190°K to 310°K provide the absolute infrared radiance reference. The temperature of each target is measured by five thermocouples which have been calibrated against a precision platinum resistance temperature standard. The five thermocouples provide target temperature gradient information to indicate target stability as well as the capability to average the five for the reference target temperature. T Channel DC Response consists of comparing the average target temperature to the channel output voltage at the input to the A/D converters for several target temperatures.

Nine vacuum runs were made on OLS #21. The T DC Response data from vacuum runs (1 through 9) is compiled in Table 2.4.1-2 and -3, which show the equipment temperature environments and characteristics of each run. The column headed "Data Points" indicates how many target temperatures were in that run. The characteristics of the response itself are indicated in three columns each for T LFT, T MID and T RGT. The compared channel response to target temperature results in a difference for each data point. This difference is corrected for M1 Temperature so that all data for a given run reflect the same M1 temperature and the expected shaper circuit difference is subtracted. In this form the difference data for a given run should ideally be a linear function vs. target temperature. A linear least-squares fit to the corrected data is used to determine the equation of the best straight line (BSL). In Table 2.4.1-2 the slope error, the 210°K ordinate and the RMS data fit values for these different BSL's are listed in the columns headed Slope, Ordinate at 210°K, and RMS Dev.

In order to distinguish between gain and bias type effects caused by environment, the 310°K value that results when the 210°K BSL value is forced to zero difference is also calculated. Table 2.4.1-3 shows the pre-shaper % gain Difference from Nominal, the Bias Diff. from Nominal (at 190°K) where the pre-shaper Gain is forced to nominal, and the M1 temperature coefficient (K factor); in three columns each for TRGT, TMID and TLEFT.

Tables 2.4.1-4, -5 and -6 show the STS computer processed and gain compensated T DC Response Data of the final "Hot Limit" Run (Run #9) for TRGT, TMID, and TLEFT respectively. The fourth line down in the body of the Best Straight Line Equation, "RMS Deviation", is the RMS error (for 210°K to 310°K) of the data points fitted to the best straight line. "FP" is T Fine Primary; "FB" is T Fine, Backup (Redundant); "SP" is T Smoothed, Primary; "SB" is T Smoothed, Backup (redundant). The SP and SB are not used for T Right Only or for T Left Only in the Primary or Redundant normal modes; these are utilized only in the Fallback (slightly degraded) modes of operation. SP and SB are applicable to T Mid in normal Primary or Redundant modes.

Runs 8 and 9 together indicate the changes which accompany operation over the foreoptics cold-to-warm temperature range as indicated by M1 temperature.

Runs 4 and 5 or 6 and 7 together indicate the magnitude of the variation over the extremes of SSS temperature, (+12° to -2°C); when compared to the +7°C SSS run pairs with the corresponding M1 temperatures, (Runs 8 and 9, respectively). However, changes between these runs are not only due to SSS temperature differences. The PSU, which contains the shaper networks was varied in temperature along with the SSS, from a low of -1.2°C to a high of +36.9°C.

Figures 2.4.1-1 through 2.4.1-6 inclusive show, for Run No. 1 along with No. 8 and No. 9, (respectively), the test data points for Targets 1 and 2 and the BSL plots for Right, Mid, and Left. (No BSL data plot was obtained for Runs 2 through 7).

The OLS #21 average M1 coefficient (coupling factor) measured for the Hot Limit run (#9) was 0.181°K at 210°K scene per 1°C temperature change of M1. The lower the M1 coefficient value, the better the performance. The T Clamp leakage was +0.091% T LEFT and +0.092% RIGHT.

The BSL differences (from Table 2.4.1-4,5 and 6) between Fine Primary and Fine Backup are small, the largest being 0.22°K for T Lft, at the 310°K end. In the Smooth Primary and Backup modes, T Lft differs by 0.20°K (at 190°K).

The difference between T LEFT and T RIGHT segments calibration (from Tables 2.4.1.3-3 and 4) is 0.44°K worst-case, vs. a spec limit of 1.0°K.

TABLE 2.4.1-2
OLS #21
210# TO 310#K BEST STRAIGHT LINE CALCULATIONS

DATE	RUN#	R/L TG	TL	# OF DATA POINTS	TEMPERATURE #C			T RIGHT			T MID			T LEFT			COMMENTS
					SSS	M1	PSU	SLOPE	ORD. @ 210#	RMS DEV	SLOPE	ORD. @ 210°	RMS DEV	SLOPE	ORD. @ 210°	RMS DEV	
TDCRM3A 11/04/94	1	6/6	13	6	5.6	-8.1	27.2	-0.0034	0.51	0.12	-0.0077	0.54	0.25	-0.0050	0.62	0.12	TVac Adjust Nominal
VACUUM BREAK																	
T121T231H 11/14/94	2	5/6	13	2	7.3	-7.5	31.9	-0.0102	0.67	0.00	-0.0063	0.50	0.00	-0.0006	0.40	0.00	COLD OPTICS LIMIT
T121T231H 11/15/94	3	5/6	9	2	6.3	11.9	31.8	-0.0140	0.66	0.00	-0.0094	0.42	0.00	-0.0042	0.33	0.00	HOT OPTICS LIMIT
T121T231B 11/16/94	4	6/6	13	2	-2.0	-10.9	-1.2	0.0029	0.67	0.00	0.0029	0.55	0.00	0.0019	0.85	0.00	COLD SOAK #1
T121T231B 11/18/94	5	6/6	9	2	11.7	15.2	36.5	-0.0017	0.10	0.00	-0.0053	0.18	0.00	-0.0086	0.47	0.00	HOT SOAK #1
T121T231B 11/19/94	6	6/6	13	2	-1.8	-11.6	-1.2	0.0004	0.88	0.00	-0.0002	0.73	0.00	-0.0018	1.04	0.00	COLD SOAK #2
T121T231B 11/21/94	7	6/6	9	2	11.5	15.1	36.9	-0.0071	0.41	0.00	-0.0105	0.42	0.00	-0.0145	0.70	0.00	HOT SOAK #2
TDCRM3B 11/23/94	8	6/6	12	8	3.3	-7.9	2.2	-0.0029	0.33	0.19	-0.0038	0.25	0.22	-0.0069	0.54	0.19	COLD LIMIT
TDCRM3B 11/30/94	9	7/7	9	8	6.2	12.1	31.8	-0.0028	0.41	0.14	-0.0065	0.49	0.11	-0.0095	0.74	0.10	HOT LIMIT

TABLE 2.4.1-3
OLS #21
T DC RESPONSE COMPILATION OF TEST RUNS

DATE	RUN #	R/L TG	TL	# OF DATA POINTS	TEMPERATURE °C			T RIGHT			T MID			T LEFT			COMMENTS
					SSS	M1	PSU	% GAIN DIFF. FROM NOM.	BIAS DIFF. FROM NOM.	K FACTOR	% GAIN DIFF. FROM NOM.	BIAS DIFF. FROM NOM.	K FACTOR	% GAIN DIFF. FROM NOM.	BIAS DIFF. FROM NOM.	K FACTOR	
TDCRM3A 11/04/94	1	6/6	13	6	5.6	-8.1	27.2	-0.01	0.75	0.171	-0.61	0.51	0.168	-0.14	0.86	0.174	TVAC ADJUST NOMINAL
VACUUM BREAK																	
T121T231H 11/14/94	2	5/6	13	2	7.3	-7.5	31.9	-0.87	0.57	0.183	-0.44	0.53	0.180	0.30	0.74	0.181	COLD OPTICS LIMIT
T121T231H 11/15/94	3	5/6	9	2	6.3	11.9	31.8	-1.44	0.27	0.183	-0.99	0.13	0.180	-0.31	0.35	0.181	HOT OPTICS LIMIT
T121T231B 11/16/94	4	6/6	13	2	-2.0	-10.9	-1.2	1.09	1.42	0.183	0.95	1.17	0.180	1.11	1.68	0.181	COLD SOAK #1
T121T231B 11/18/94	5	6/6	9	2	11.7	15.2	36.5	-0.16	0.06	0.183	-0.61	-0.06	0.180	-0.83	0.25	0.181	HOT SOAK #1
T121T231B 11/19/94	6	6/6	13	2	-1.8	-11.6	-1.2	0.91	1.65	0.183	0.67	1.34	0.180	0.74	1.83	0.181	COLD SOAK #2
T1215231B 11/21/93	7	6/6	9	2	11.5	15.1	36.9	-0.66	0.25	0.183	-1.15	0.00	0.180	-1.47	0.24	0.181	HOT SOAK #2
TDCRM3B 11/23/94	8	6/6	12	8	3.3	-7.9	2.2	-0.10	0.45	0.183	-0.32	0.22	0.180	-0.50	0.58	0.181	COLD LIMIT
TDCRM3B 11/30/94	9	7/7	9	8	6.2	12.1	31.8	-0.02	0.61	0.183	-0.49	0.50	0.180	-0.69	0.77	0.181	HOT LIMIT

TABLE 2.4.1-4

LS NUMBER 21

T RGT DATA OF 11/29/94

SSS AT 6.2°C

M1 AT 12.1°C

PSU TEMP = 31.8°C

M1 Coefficient =0.183 K/oC

T GAIN = 7

T LEVEL = 9

V2 <T Clamp> = 1.97754

K9 <TL Step Size> = 0.919172

BEST STRAIGHT LINE EQUATION

	FP	(Δ)	FB	SP	(Δ)	SB
SL SLOPE	-0.0028	-	-0.0038	-0.0030	-	-0.0040
SL AT 190K<K>	0.47	(.01)	0.48	0.49	(.06)	0.54
SL AT 210K<K>	0.41	(.01)	0.40	0.43	(.03)	0.46
SL AT 310K<K>	0.13	(.11)	0.02	0.13	(.07)	0.06
MS DEVIATION<K>	0.14	-	0.15	0.17	-	0.13
SL AT 310K;						
190 AT OV<K>	-0.01	-	-0.13	-0.02	-	-0.11
CHANGE FROM						
NOM GAIN	-0.02.	-	-0.18	-0.02	-	-0.15
IAS DIFF FROM						
NORMAL 190K<K>	0.61	-	0.51	0.63	-	0.61

TABLE 2.4.1-5

OLS NUMBER 21

T MID DATA OF 11/29/94

SSS AT 6.2°C

M1 AT 12.0°C

PSU TEMP = 31.9°C

M1 Coefficient =0.180 K/oC

T GAIN = 0

T LEVEL = 9

V2 <T Clamp> = 1.98242

K9 <TL Step Size> = .919172

BEST STRAIGHT LINE EQUATION

	FP	(Δ)	FB	SP	(Δ)	SB
BSL SLOPE	-0.0065	-	-0.0069	-0.0067	-	-0.0073
BSL AT 190K<K>	0.62	(.07)	0.55	0.67	(.06)	0.61
BSL AT 210K<K>	0.49	(.08)	0.41	0.54	(.08)	0.46
BSL AT 310K<K>	-0.16	(.05)	-0.21	-0.13	(.14)	-0.27
RMS DEVIATION<K>	0.11	-	0.10	0.10	-	0.09
BSL AT 310K; 190 AT 0V<K>	-0.35	-	-0.46	-0.34	-	-0.46
% CHANGE FROM NOM GAIN	-0.49	-	-0.63	-0.47	-	-0.64
BIAS DIFF FROM NORMAL 190K<K>	0.50	-	0.31	0.58	-	0.39

TABLE 2.4.1-6

LS NUMBER 21

T LFT DATA OF 11/29/94

SSS AT 6.2°C

M1 AT 12.0°C

PSU TEMP = 31.9°C

M1 Coefficient =.181°K/C

T GAIN = 7

T LEVEL =9

V2 <T Clamp> = 1.99219

K9 <TL Step Size> = .919172

BEST STRAIGHT LINE EQUATION

	FP	(Δ)	FB	SP	(Δ)	SB
SL SLOPE	-0.0095	-	-0.0101	-0.0101	-	-0.0098
SL AT 190K<K>	0.93	(.14)	0.79	1.01	(.20)	0.81
SL AT 210K<K>	0.74	(.15)	0.59	0.81	(.20)	0.61
SL AT 310K<K>	-0.21	(.22)	-0.43	-0.20	(.17)	-0.37
MS DEVIATION<K>	0.10	-	0.08	0.09	-	0.09
SL AT 310K; 190 AT OV<K>	-0.50	-	-0.68	-0.52	-	-0.63
CHANGE FROM NOM GAIN	-0.69	-	-0.94	-0.72	-	-0.87
IAS DIFF FROM NORMAL 190K<K>	0.77	-	0.42	0.86	-	0.49

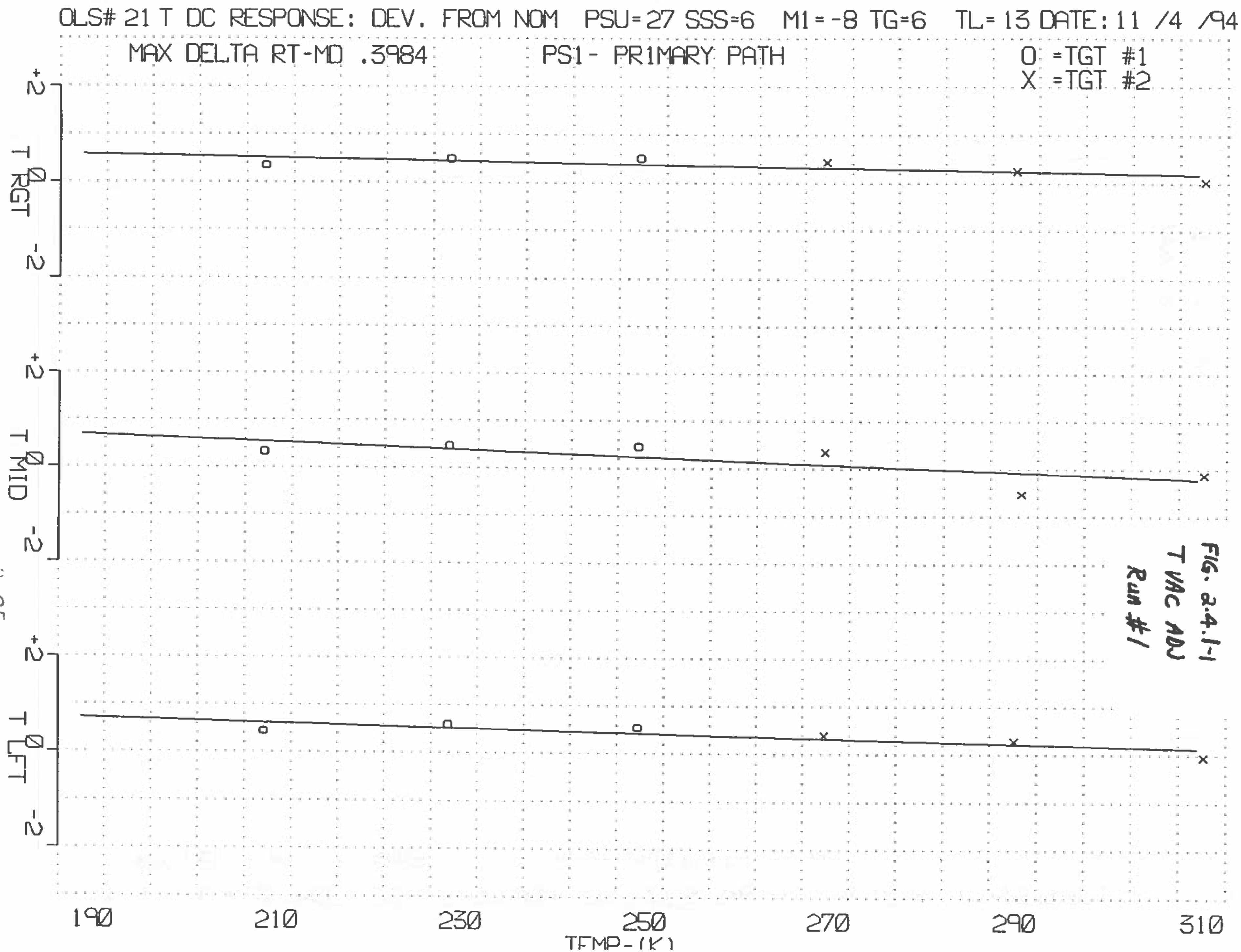
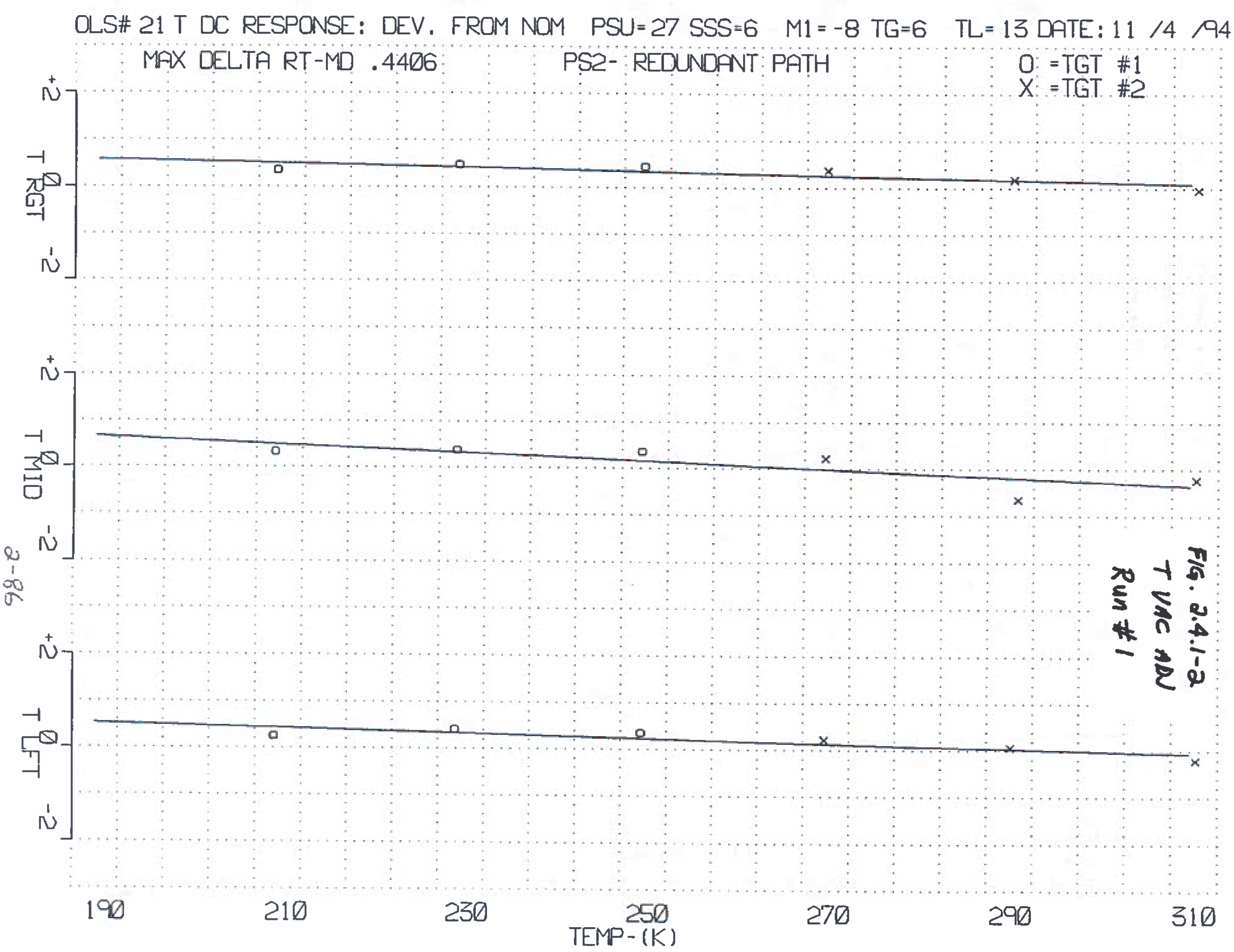
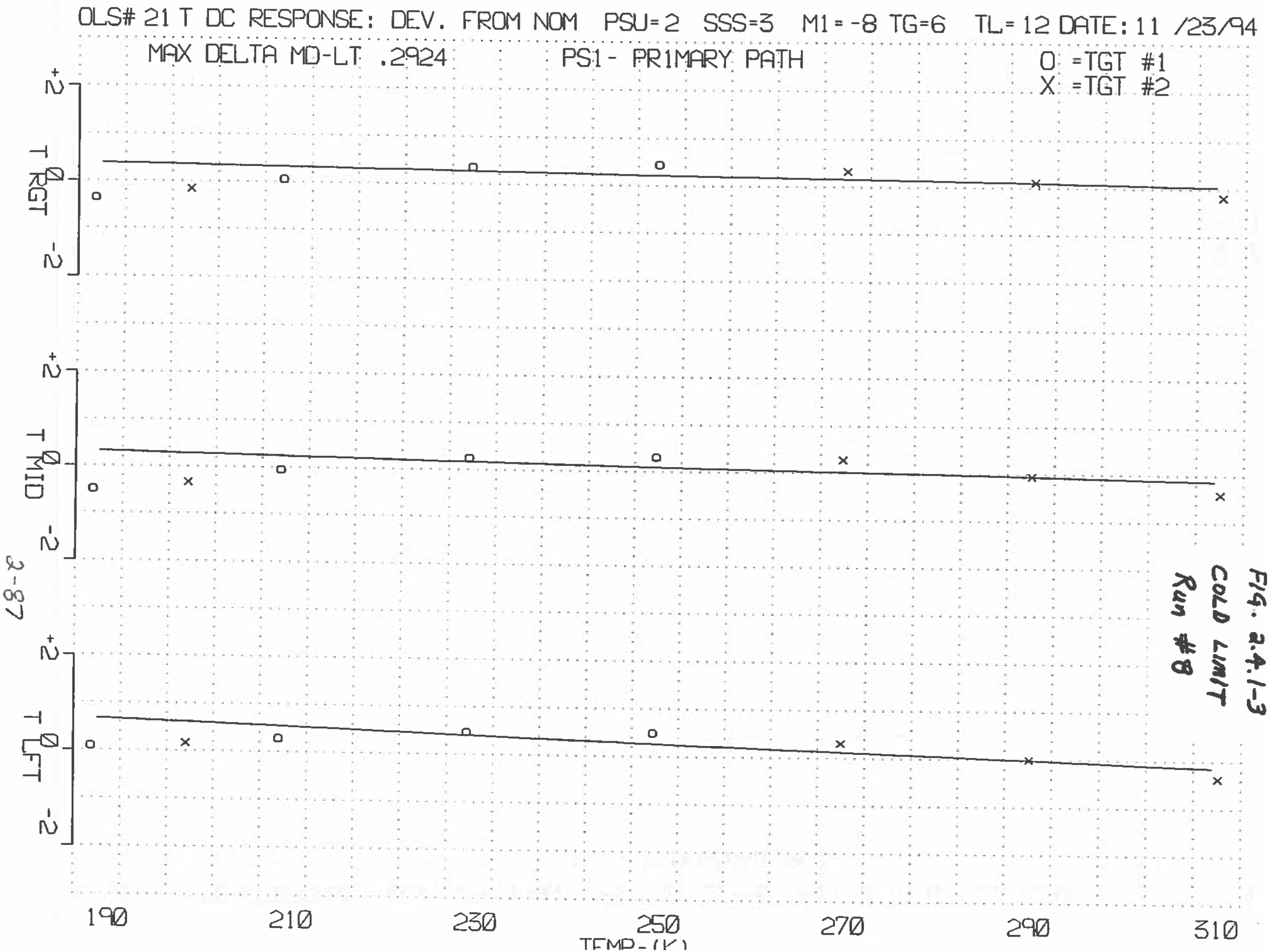


FIG. 2.4.1-1
T VAC ADJ
Run #1


OLS# 21 T DC RESPONSE: DEV. FROM NOM PSU=27 SSS=6 M1=-8 TG=6 TL=13 DATE: 11 /4 /94
MAX DELTA RT-MD .4406
PS2- REDUNDANT PATH
O =TGT #1
X =TGT #2
FIG. 2.4.1-2
T VAC ADJ
Run #1
T RGT
T MID
T LFT
+2
0
-2
190
210
230
250
270
290
310
TEMP-(K)


OLS# 21 T DC RESPONSE: DEV. FROM NOM PSU=2 SSS=3 M1=-8 TG=6 TL=12 DATE:11 /23/94
MAX DELTA MD-LT .2924
PS1- PRIMARY PATH
O =TGT #1
X =TGT #2
+2
0
-2
T RGT
T MID
T LFT
190
210
230
250
270
290
310
TEMP-(K)
FIG. 2.4.1-3
COLD LIMIT
Run #8

OLS# 21 T DC RESPONSE: DEV. FROM NOM PSU=2 SSS=3 M1=-8 TG=6 TL=12 DATE: 11 /23/94

MAX DELTA LT-RT .2976 PS2- REDUNDANT PATH

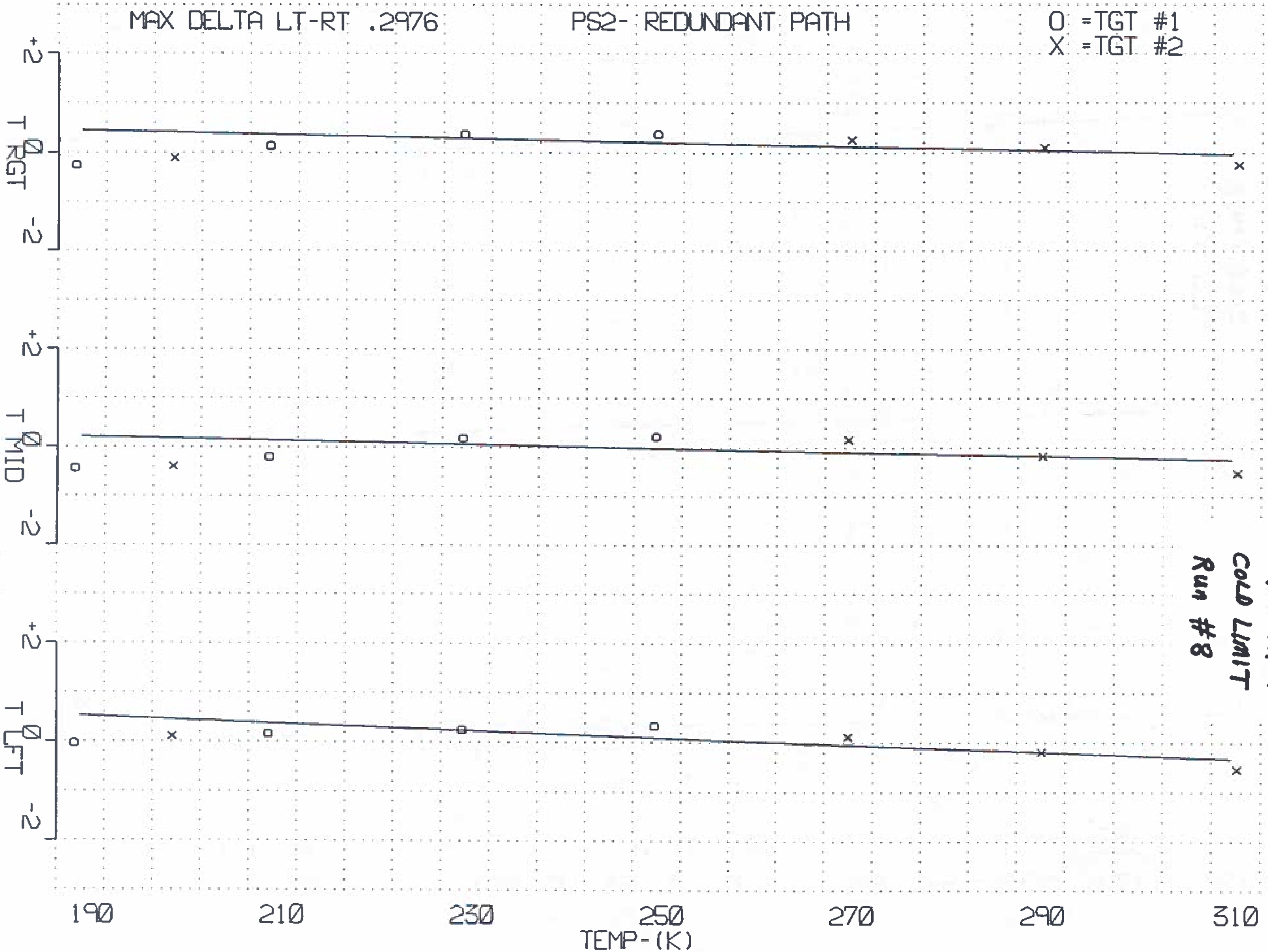


FIG. 2.4.1-4
COLD LIMIT
Run #8

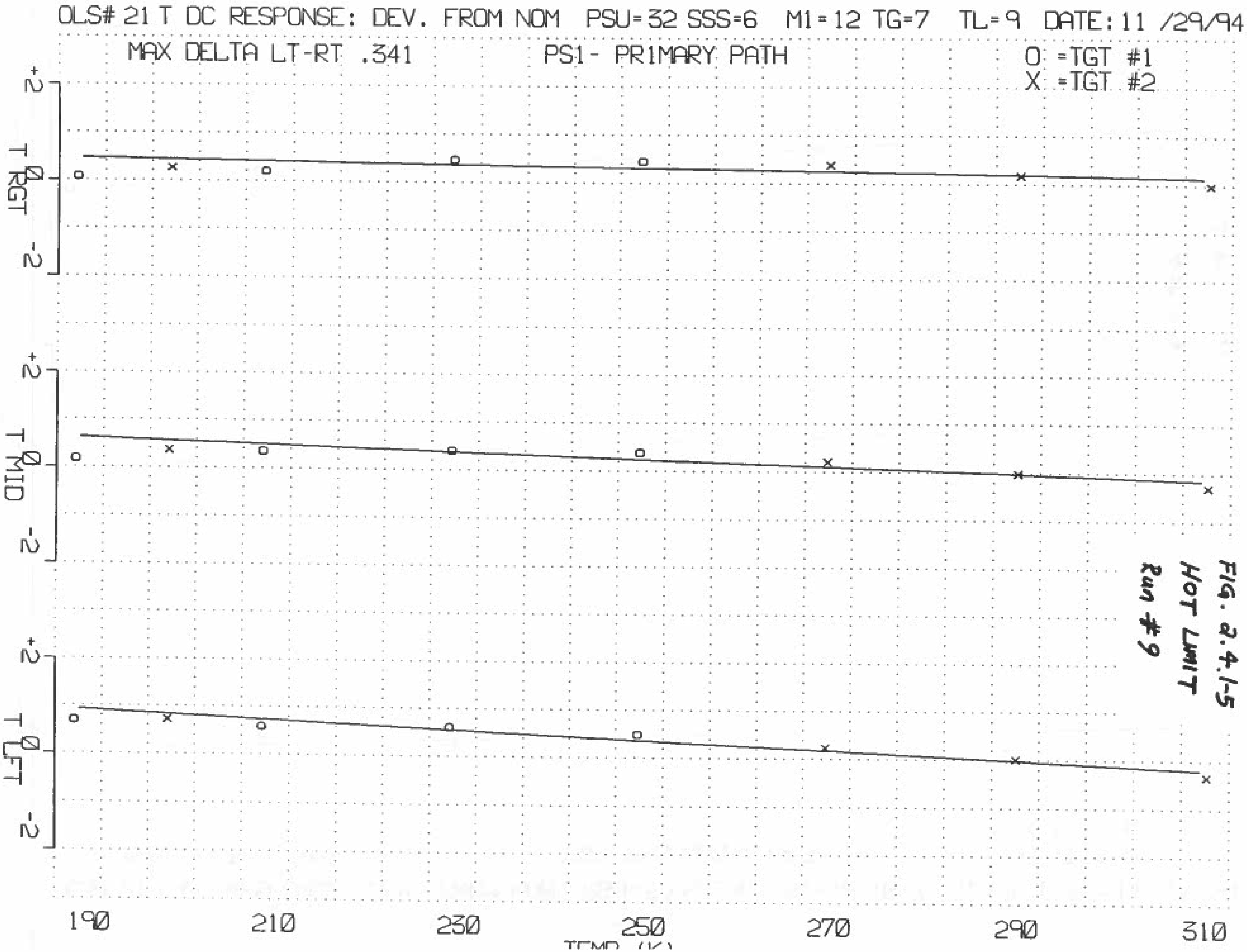
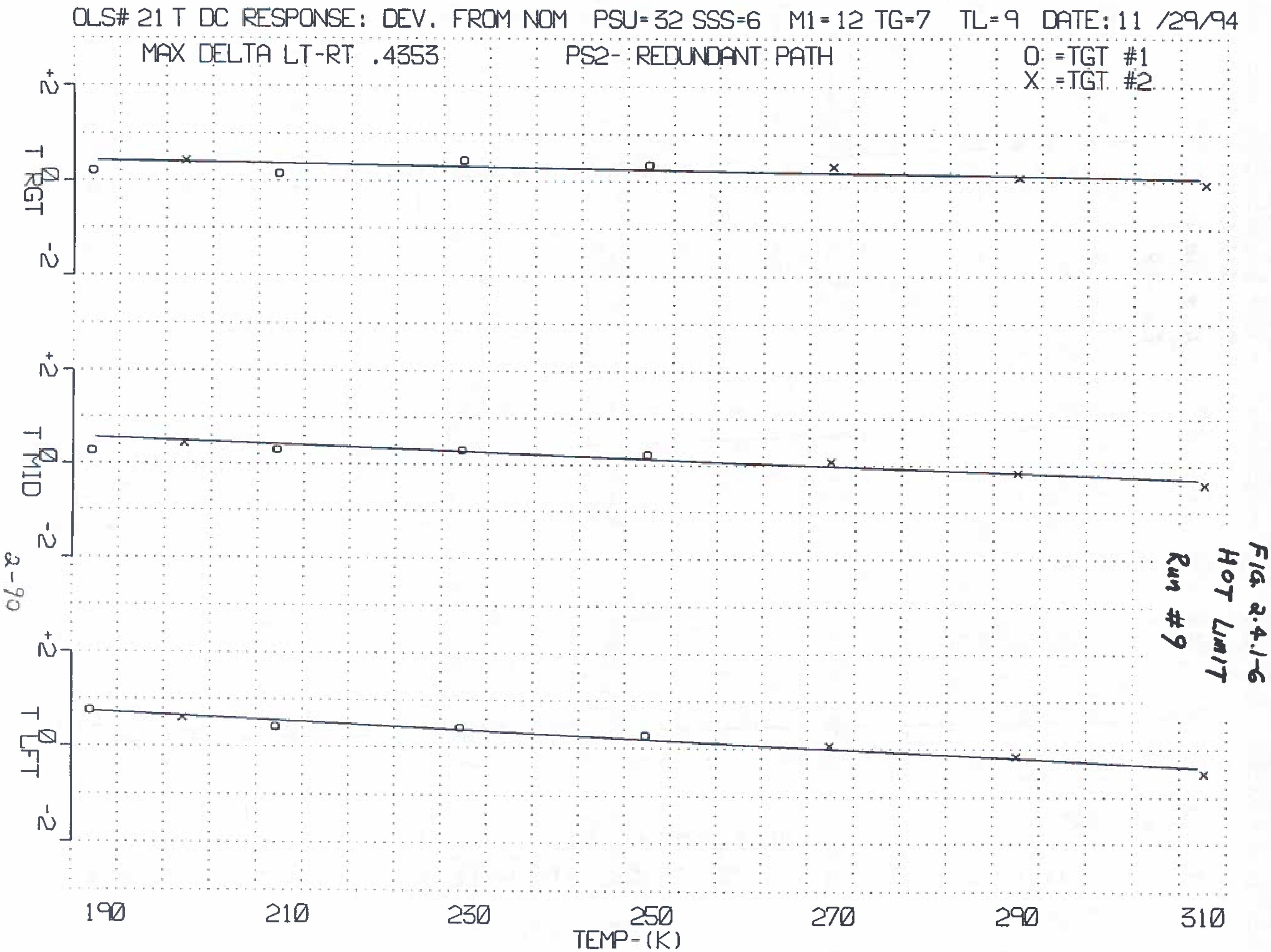


FIG. 2.4.1-5
HOT LIMIT
Run #9


OLS# 21 T DC RESPONSE: DEV. FROM NOM PSU=32 SSS=6 M1=12 TG=7 TL=9 DATE: 11 /29/94
MAX DELTA LT-RT .4353
PS2- REDUNDANT PATH
O =TGT #1
X =TGT #2
T RGT
T MID
T LFT
+2
Ø
-2
190
210
230
250
270
290
310
TEMP-(K)
FIG. 2.4.1-6
HOT LIMIT
Run #9

2.4 RADIOMETRIC ACCURACY

2.4.1 T Channel Radiometric Accuracy (Cont'd)

2.4.1.1 Repeatability (3.2.1.1.4.1a)

The 1 sigma Repeatability of T Channel DC Response is 0.23°K compared to a 0.42°K one sigma specification maximum and therefore OLS #21 does meet this specification requirements.

ATTACHMENTS

Table 2.4.1.1-1 Repeatability Contributors

Table 2.4.1.1-2 Gain and Bias Variations with Temperature Change

Table 2.4.1.1-3 Target Crosstalk, T Clamp Leakage Data

TABLE 2.4.1.1-1

OLS #21

REPEATABILITY CONTRIBUTORS SUMMARY

ERROR SOURCE	ONE SIGMA ERROR (K°)
1. Diurnal M1 Temperature Change (4°C)	
A. Quantization of T Level Command	0.17
B. Inability to Compensate Actual Effect Exactly	0.06*
2. Temperature Change PSU ± 4.5°C, SSS ± 1°C	
A. Effect due to Gain Change	0.06*
B. Effect due to Bias Change	0.05*
3. T Clamp Shaper Compensation	0.08
4. T Clamp Leakage	0.08*
TOTAL RSS REPEATABILITY ERROR (°K)	0.23
SPECIFICATION LIMIT, °K, ONE SIGMA	0.42 MAXIMUM

*FROM TEST DATA (REDUCED)

Discussion of Repeatability Calculations

1. Diurnal M1 Temperature Change

A. The effects of M1 temperature (more properly the foreoptics temperature) are a Repeatability error source. The foreoptics thermal time constant is short enough to permit significant diurnal temperature variations. The ability to compensate for foreoptics temperature using the T Level command greatly reduces this error but does not eliminate it. Although calculations enabling ground compensation smaller than the quantization of the T Level command are possible, it is herein assumed that they will not generally be made. Therefore an error is ascribed due to the T Level quantization as follows:

	0.294°K	RMS T Level Cmd. Quantization Error at 210°K (1.02° x $1/\sqrt{12}$)
x	0.564	RMS Temperature Linearity Effects over 210-310°K dynamic range
=	0.17°K	RMS error

B. The fact that foreoptics temperature effect cannot be accurately predicted by the single monitor of M1 temperature means that in times of sharp transition the ability to compensate is impaired. It has been assumed that this error may be represented by a 1°C lag in M1 temperature during the 1/3 of the orbit that sharp transistions occur. Therefore the inability to compensate the actual effect is ascribed the following error:

	1°C	Lag in M1 Temperature
x	$1/\sqrt{3}$	RMS Over total orbit
x	0.181	T Left T Mid T Right average sensitivity coefficient of video at 210K to M1 temperature change for OLS #21 (K factor)
x	0.564	Temperature Linearity Effects over dynamic range.
=	0.059°K	RMS error

Discussion of Repeatability Calculations

Total T channel gain change with temperature may be broken down into two components as follows:

$$\text{Total Gain } \Delta = [(\text{PSU } \Delta T) \times P_G] + [\text{SSS } \Delta T) \times S_G]$$

where: P_G = PSU coefficient of gain, % per °C.
S_G = SSS coefficient of gain, % per °C.

Similarly for bias changes with temperature:

$$\text{Total Bias } \Delta = [(\text{PSU } \Delta T) \times P_B] + [(\text{SSS } \Delta T) \times S_B]$$

where: P_B = PSU coefficient of bias, °K per °C.
S_B = SSS coefficient of bias, °K per °C.

Data from two pairs of runs designated A and B, were used to solve these equations simultaneously:

$$\text{Gain } \Delta, \text{ Run A} = G_A = (T_{PA})(P_G) + (T_{SA})(S_G)$$
$$\text{Gain } \Delta, \text{ Run B} = G_B = (T_{PB})(P_G) + (T_{SB})(S_G)$$
$$\text{Bias } \Delta, \text{ Run A} = B_A = (T_{PA})(P_B) + (T_{SA})(G_B)$$
$$\text{Bias } \Delta, \text{ Run B} = B_B = (T_{PB})(P_B) + (T_{SB})(S_B)$$

where: G = Total Gain change over temperature
B = Total Bias change over temperature
T_P = PSU Temperature change
T_S = SSS Temperature change

Solved simultaneously for the temperature sensitivity factors, these equations can be reduced to the following:

$$S_G = \frac{(T_{PA})(G_B) - (T_{PB})(G_A)}{(T_{PA})(T_{SB}) - (T_{PB})(T_{SA})}$$

$$P_G = \frac{G_A - (T_{SA})(S_G)}{T_{PA}}$$

$$S_B = \frac{(T_{PA})(B_B) - (T_{PB})(B_A)}{(T_{PA})(T_{SB}) - (T_{PB})(T_{SA})}$$

$$P_B = \frac{B_A - (T_{SA})(S_B)}{T_{PA}}$$

2. SSS and PSU Temperature Change: Effect On Gain Change

The effects of SSS and PSU temperature change on gains were determined from parametric analysis of the four runs in Table 2.4.1.1-2. Solving simultaneous equations yielded sensitivity coefficients of gain change for both SSS and PSU temperature change. Temperature data from 5D-2 systems indicates that the worst case SSS temperature variations are 1°C while worst case PSU temperature variations are 4.5°C. Using the worst-case factors yields:

S_G = -0.202 Gain change per degree SSS change
x 1°C temperature change
x .31°K RMS over 210K to 310K range

x $1/\sqrt{3}$ for uniform temperature distribution
= -0.036

P_G = 0.056 Gain change per degree PSU change
x 4.5° temperature change
x .31°K RMS over 210K to 310K range

x $1/\sqrt{3}$ for uniform temperature distribution
= 0.045

RSS'ing these two contributors yields 0.058 degree total.

3. SSS and PSU Temperature Change, Effect On Bias Change

From Table 2.4.1.1-2:

S_B =-0.077 deg Bias change per degree SSS change
x 1° temperature change
x 0.564 RMS Temperature Linearization Effects, 210K to 310K

x $1/\sqrt{3}$ for uniform temperature distribution
= -0.025

P_B = -0.027 deg Bias change per degree PSU change
x 4.5° temperature change
x 0.564 RMS Temperature Linearization Effects, 210K to 310K

x $1/\sqrt{3}$ for uniform temperature distribution
= -0.040

RSS'ing these two contributors yields 0.047 degree total.

4. T Clamp Shaper Compensation

The SSS temperature changes throughout each orbit are expected to cause a one sigma error of 0.146°K at 210K due to the compensation for T clamp temperature variation from 228K to 253K. This times the 0.564 RMS Temperature Linearitation Effect over the dynamic range equals 0.08°K RMS error.

5. T Clamp Leakage

An along scan variation (ASV) effect may be caused by some of the scene radiance being viewed at the time of T clamp during the overscan period getting into the reference T Clamp value. This can happen if the T detector sensitivity extends slightly beyond the boundaries of M4′ during the clamp time. The test performed for leakage is to view one target at 210°K during active scan while the other target (which is at the T Clamp angle) is varied over the 210° to 310°K dynamic range. This data is presented in Table 2.4.1.1-3. The effect on the response to the active scan target is attributed to the T clamp optical leakage.

Using the OLS #21 T data from Table 2.4.1.1-3, the T clamp leakage contribution can be calculated as follows:

$$\text{T clamp leakage ratio (LR)} = 100\% \times \Delta T \times \frac{\frac{\partial P}{\Delta T}\ 215}{\Delta P}$$
$$= \Delta T \times .50552\%$$

This calculation is performed in the MODE 4 data reduction of T121T221S. The ratio calculated is:

0.091% T LEFT

0.092% T RIGHT

The peak error from T clamp leakage (due to the 310° background) can be calculated as follows:

$$\text{peak error} = LR \times \Delta N \times \left(\frac{\partial P}{\Delta T_{210}}^{-1}\right) -1$$

$$= \Delta T \times \frac{\Delta N}{\Delta P} \times \frac{\frac{\partial P}{\Delta T}_{215}}{\frac{\partial P}{\Delta T}_{210}}$$

$$= \Delta T \times 0.8156 \times 1.0788$$
$$= \Delta T \times 0.880$$

where:

ΔP = Difference in radiance between 210° and 310°K

= 16.742 E-4 w cm^{-2} sr^{-1} @ 310°K
- 2.3468E-4 w cm^{-2} sr^{-1} @ 210°K

= 14.395E-4 w cm^{-2} sr^{-1}

and: ΔN = Difference in radiance between 240° and 310°K

= 16.742 E-4 w cm^{-2} sr^{-1} @ 310°K
- 5.001 E-4 w cm^{-2} sr^{-1} @ 240°K

11.741 E-4 w cm^{-2} sr^{-1}

$\frac{\partial P}{\Delta T_{210}}$ = slope of radiance curve at 210°K = 6.7452 E-6

$\frac{\partial P}{\Delta T_{215}}$ = slope of radiance curve at 215°K = 7.415 E-6

ΔT = measured change in response to 210° target as the background is varied from 210° to 310°K.

RMS ERROR = PEAK ERROR
x 0.7605 for RMS distribution of leakage radiance over dynamic range.
x 0.564 RMS Temperature Linearization Effect

FROM MODE 4 Data reduction:

Calculated RMS leakage error = 0.077°K T LEFT
= 0.078°K T RIGHT

The worst-case contribution to repeatability error by T-clamp leakage is therefore
0.078°K RMS.

TABLE 2.4.1.1-2

OLS #21

GAIN AND BIAS VARIATIONS WITH TEMPERATURE CHANGE
(M1 TEMP CORRECTED TO +12·C OR -8·C)
(FROM UNCORRECTED DATA TABLE)

		SSS TEMP	PSU TEMP	T RGT % GAIN DELTA (%)	T RGT BIAS CHG. @ 190·K (·K)	T MID % GAIN DELTA (%)	T MID BIAS CHG. @ 190·K (·K)	T LFT % GAIN DELTA (%)	T LFT BIAS CHG. @ 190·K (·K)
M1 = -8·C (Run A)	RUN 2 COLD OPTICS LIMIT	7.3	31.9	-0.87	0.57	-0.44	0.53	0.30	0.74
	** RUN 8 COLD LIMIT	3.3	2.2	-1.83	1.54	-1.21	1.37	-0.57	1.77
	RUN 2- RUN 8	4.0 T_{SA}	29.7 T_{PA}	0.96 G_A	-0.97 B_A	0.77 G_A	-0.84 B_A	0.87 G_A	-1.03 B_A
M1=+12·C (Run B)	RUN 7 HOT SOAK #2	11.5	36.9	-0.66	0.25	-0.15	0.00	-1.47	0.24
	RUN 9 HOT LIMIT	6.2	31.8	-0.02	0.61	-0.49	0.50	-0.69	0.77
	RUN 7- RUN 9	5.3 T_{SB}	5.1 T_{PB}	-0.64 G_B	-0.36 B_B	-0.66 G_B	-0.50 B_B	-0.78 G_B	-0.53 B_B
Calculated Sensitivity Factors	SSS:	S_G (%/C)		-0.1745		-0.1717		-0.2015*	
		S_B (K/C)			-0.0419		-0.0771*		-0.0765
	PSU:	P_G (%/C)		0.0558		0.0491		0.0564*	
		P_B (K/C)			-0.0270*		-0.0179		-0.0244

*WORST CASE VALUES

**MODIFIED FOR TRGT GAIN = 5, TLVL =13

TABLE 2.4.1.1-3
OLS #21
TARGET CROSSTALK, T CLAMP LEAKAGE DATA*

SSS = +7°
M1 = -8°

	T RIGHT	T MID	T CPL	T CPR	T LEFT	
T1 210° [T2 @ 310°] (T121T231G)	0.68	0.51	0.65	0.30	0.40	11/14/94
Difference, ΔT	0.12	0.05	0.00	0.00	0.13	
T1 210° [T2 @ 210°]	0.80	0.56	0.65	0.30	0.53	11/14/94
Worst Case Data From T121T221S.ST Mode 4 Data Reduction: T clamp leakage ratio is Peak leakage error at 210°K is RMS leakage error at 210°K is			0.091% 0.158°K 0.077°K	0.092% 0.160°K 0.078°K		

*Data is FP Deviation in °K

2.4 Radiometric Accuracy

2.4.1 T Channel Radiometric Accuracy (Cont'd)

2.4.1.2 Stability (3.2.1.1.4.1b)

The T Channel Radiometric Accuracy (Stability) analysis in the OLS 5D-3 System Summary Report Paragraph 3.5.1.2, predicts 0.61°K 1 sigma error in stability compared to the 0.8°K maximum specification requirement. This calculation is applicable to all 5D-3 systems with 190-310°K total range.

ATTACHMENTS

Table 2.4.1.2-1 Stability Contributors Summary

Table 2.4.1.2-2 Change in BSL 210°, 310°K Points Between Runs

Table 2.4.1.2-3 Change in 210°, 310° Output Deviation From Nominal (°K) between Power Supply 1 and Power Supply 2

TABLE 2.4.1.2-1

STABILITY CONTRIBUTORS SUMMARY

			ONE SIGMA ERROR (°K)
1. Shaped Bias			
a) Open Loop Mirror Emissivity		0.1	
b) T Clamp Shaper Compensation	- Temperature	0.23	
	- Age	0.17	
RSS Total		0.30°K	
X RMS Temperature Linearization Effect		0.564	
= RMS Shaped Bias Errors			0.17°K
2. Bias			
a) Preshaper Gain	- Inner Stage Temperature	0.28	
	- Bias Current	0.24	
	- Amplifiers	0.22	
b) Post Shaper DC Drift		0.12	
RSS Total = RMS Bias Error			0.45°K
3. Gain			
Postshaper Gain Changes	- Amplifier		
over the 210-310K range, °K RMS Error			0.38
TOTAL RSS Stability Error (Total Dynamic Range)			0.61
Stability Error Specification (°K, 1 Sigma)			0.80 Maximum

Discussion of Stability Errors

The experimentally derived RMS change of the BSL(s) between runs was calculated to be 0.10°K, 0.16°K and 0.19°K for TRGT, TMID and TLEFT respectively. The two runs used were Run #4 and run #6. The results verify the analytical estimate of the stability over time intervals greater than one day. This data is tabulated in Table 2.4.1.2-2.

As an additional check of stability, the Fine-Primary outputs of the three segments as a deviation from nominal (°K) at 210° and 310° were compared using power supply 1 data of TDCRM3B.ST and power supply 2 data of 6X2X3A.ST. (Both from Run #8). This data is tabulated in Table 2.4.1.2-3. The deltas were calculated and RMS'd over the temperature range. The results are comparable to the "Change Between Runs" data.

TABLE 2.4.1.2-2

OLS #21

CHANGE IN BSL 210, 310K POINTS BETWEEN RUNS

SSS = 2°C, M1 = 11°C

	TG R/L	TL	T RGT 210	T RGT 310	T MID 210	T MID 310	T LFT 210	T LFT 310
T121T231B 11/16/94	6/6	13	0.67	0.97	0.54	0.83	0.85	1.04
T121T231B 11/19/94	6/6	13	0.80	0.92	0.73	0.70	1.04	0.86
Change Between Runs			0.13	0.05	0.19	0.13	0.19	0.18
RMS Change			0.10°K		0.16°K		0.19°K	

TABLE 2.4.1.2-3

OLS #21

T CHANNEL DC RESPONSE

DIFFERENCE BETWEEN POWER SUPPLIES 1 and 2

From Cold Limit (Run #8), SSS = +3°C, M1 = -8°C

	RIGHT		MID		LEFT	
	TGT-1 210°K	TGT-2 310°K	TGT-1 210°	TGT-2 310°	TGT-1 210°	TGT-2 310°
FP DEV [K] Power Supply 1 TDCRM3B*	0.98	0.15	0.87	-0.08	1.20	-0.05
FP DEV [K] Power Supply 2 6X2X3A	0.92	0.39	0.92	0.12	1.29	0.15
Change °K	0.06	0.24	0.05	0.20	0.09	0.20
RMS °K	0.17		0.15		0.16	

* MODIFIED FOR TLVL = 13

2.4 RADIOMETRIC ACCURACY

2.4.1 T Channel Radiometric Accuracy (Cont'd)

2.4.1.3 Fixed Deviations (3.2.1.1.4.1c)

The Fixed deviations for OLS #21 are 0.32°K, 1 sigma, compared to the 0.6°K specification maximum. The calibrateable portion of the fixed deviations is 0.21°K RMS compared to the 0.4°K RMS specification maximum. The Fixed deviation calibration for separate detector segments is 0.44°K (worst case) compared to the 1°K spec. maximum. The maximum along scan variation was 0.11°K RMS for TF (Left) and 0.08°K RMS for TS compared to the 0.2°K RMS specification maximum.

ATTACHMENTS

TABLE 2.4.1.3-1

OLS #21

FIXED DEVIATION CONTRIBUTORS

DEVIATION SOURCE	ONE SIGMA ERROR (°K)
1. Foreoptics Mirror Emissivity	0.10*
2. T Clamp Shaper Compensation	0.09
3. Transfer Function	
A. Non-Linearity	0.21* 0.4°K Spec Max
B. Shaper Components Variation	0.10
C. Detector Spectrum Variation (included in 3A)	-
4. Test Targets	
A. Temperature	0.10
B. Emissivity	0.10
C. Repeatability	0.03*
TOTAL (RSS) FIXED DEVIATION	0.32
FIXED DEV. SPECIFICATION LIMIT, °K ONE SIGMA	0.60 Maximum

* FROM TEST DATA ANALYSIS

	DATA	SPEC MAX
5. Fixed Deviation BSL Calibrations Match for Separate Segments (Worst Case)	0.44	1.0°K
6. Along Scan Varations within a segment (265° to 310°K) Worst Case	0.11°K RMS	0.2°K RMS

Discussion of Fixed Deviation Tests and Calculations

1. Foreoptics Mirror Emissivity

The foreoptics mirror emissivity is a source of Fixed deviations as well as of Repeatability and Stability deviations. The correction in operation is made on M1 temperature only; whereas the entire foreoptics causes the offset phenomena. The ground calibration is made in the thermal vacuum chamber, where M1 is cooled radiatively via a cold tunnel, which fills the M1 view beyond the optical field of view of the system. Thus the foreoptics temperature distribution in the chamber differs somewhat from operation in space, especially in that M2 is colder in the chamber. It is not possible to determine accurately this effect based upon present knowledge. It is therefore assumed that it is equivalent to a 1°C difference in M1 temperature, or about 0.181°K at 210° using the actual OLS #21 M1 coefficient (K factor). The RMS Temperature Linearization Effect, 0.564, transforms this to a 0.10°K RMS contribution to fixed deviation.

2. T Clamp Shaper Compensation

The T Clamp shaper compensation contribution arises as follows. If the T Clamp emissivity were initially only 0.98 rather than the 0.995 used to calculate the compensation for T Clamp temperature, the error at 242°K would be 0.70°K. Although this error would be compensated for when the T channel adjustments were made, a change in T Clamp temperature to 256°K or 230°K would result in an error of 0.78°K, producing an uncompensated error of 0.08°K. Over the dynamic range this is equivalent to 0.09°K RMS.

3. Transfer Function

A. The departure of the T channel radiometric transfer function from a linear relationship is not an error as such because it is known and compensation can be made for it. However, this type of deviation is included within the constraints of the Fixed deviation portion of the T channel radiometric accuracy spec. The nominal T Channel non-linear transfer function (shaper) error is tabulated in Table 2.4.1.3-2 and plotted in Figure 2.4.1.3-1. The nominal shaper error is 0.13°K RMS. This calculation is made with the 5D-3 shaper, which is also used on OLS #21. The worst-case reduced test data (from Tables 2.4.1-4,5 & 6) RMS Deviations of the points from the BSL for OLS #21, are 0.17°K for T Right (Smooth Primary), 0.11°K for T MID (Fine Primary) and 0.10°K for T Left (Fine Primary). The analytic value, (0.13°K RMS) and the worst-case test value of 0.17°K are RSS'ed to become 0.21°K RMS for this Fixed deviation source versus the 0.4°K maximum spec allowance for the calibrateable portion of the Fixed deviations.

B. Departure of shaper components from design nominal values may cause additional peak errors of 0.25°K and are assigned a one sigma error of 0.1°K. These deviations would not be included in the measured deviation, because the data points are not close enough together to adequately detect them.

C. The T detector spectrum difference from unit to unit is included in the calibration data and is therefore included in 3A, the non-linearity of transfer function.

4. Test Targets

The deviation of the reference test target indicated blackbody temperature from absolute is the result of contributions from three Fixed deviation sources.

A. The measurement of the averaged target temperature using the 5 thermocouples immersed in the target baseplate is subject to the accuracy of the PQL/Block V Thermocouple Aquisition and Control System calibrated per procedure MCS0116801B. A review of the calibration procedure and the equipment used has led to ascribing 0.1°K RMS to these sources.

B. The actual effective blackbody temperature of the target also deviates from that measured because of differing emissivity from that assumed and because the "true" radient temperature differs from the measured temperature using the thermocouples. The effective emissivity is a combination of true emissivity (which is better than 0.996 according to Eppley) and reflectance of up to 0.004. An average emissivity of 0.998 is corrected for along with the thermocouple calibration. This source of deviation has been assigned 0.1°K RMS.

C. Actual measurements using OLS systems 12 thru 17 of the two Eppley IR Reference test targets over the 210° to 310°K range reveal small differences between the targets. Effective with OLS 18 and up these differences are no longer measured. The values measured for OLS 12 thru OLS 17 are averaged to obtain a value of 0.03°K RMS for this error source.

Fixed Deviation Calibrations for Separate Segments

The calibrations are represented by the best straight line (BSL) equations for the separate segments. The BSL deviation expressions (from ideal), in y = mx + b form for the segments are tabulated in Table 2.4.1.3-3. In T Smooth the Right and Left detector segments are averaged and used across the entire scan line.

In order to determine the differences in calibrations for separate segments, (for comparison to the specification) the T Fine BSL deviation equations of Table 2.4.1.3-3 were evaluated at 210°K and 310°K. The 3 possible segment differences were then calculated. Also, the worst-case deviations between segments were taken from the Best Straight Line Plots (Figures 2.4.1-1 thru 2.4.1-6). These results are tabulated in Table 2.4.1.3-4. The calibration differences for separate segments are within the 1°K maximum spec throughout the dynamic range of 210 to 310K for OLS #21.

Along Scan Variation (265°K to 310°K) Within a Segment

The Along Scan Variation (ASV) in T DC Response is considered to be a Fixed deviation, since as a function of scan angle it does not vary as a function of time per se. Figures 2.4.1.3-2, 3, 4, 5, 6, 7, 8 and 9 show the deviations along-scan vs. surface distance (nmi/100) for T RGT, T MID, TLFT, and T AUTO. The vertical scale factor is 1.0°K per cm. Four figures are for M1 = -8°c and four are for M1 = +12°C. The computer printed number to the right of each curve is the computed RMS deviation in millidegrees K for the associated ASV plot. the RMS ASV values are only printed for the target temperatures above 265°K, i.e., the 270° and 310°K plots.

The T DC response BSL calibrations are taken using test scan angles of -50° (-600nmi) for T LFT, +50° (+600nmi) for T RGT, and +0° (0 nmi) for T MID.

OLS #21 has some ASV, but is within spec. The worst case (max) ASV RMS value within a segment for OLS #21 was 0.11°K and is entered in Table 2.4.1.3-5 to compare with the specification limit.

TABLE 2.4.1.3-2

T SHAPER ERROR LIST

The 190 to 310°K 5D3 T Shaper used for OLS #13 and up has 6 straight line segments of decreasing slope and 5 (inflections) diode break points. The significant features in the shaper curve are tabulated below:

T (°K)	ERROR (°K)	REMARKS
190	0	End point adjusted to be an Ideal Curve
195	-0.38	1st slope is parallel to Radiance (Smooth) Curve
201.5	0	
205	+0.26	1st diode cut-in
210	0	
215	-0.18	2nd slope is parallel to Radiance (Smooth) Curve
220.5	0	
224	+0.20	2nd diode cut-in
228.5	0	
235	-0.20	3rd slope is parallel to Radiance Curve
240.5	0	
245	+0.19	3rd diode cut-in
251.5	0	
257	-0.21	4th slope is parallel to Radiance Curve
263	0	
267	+0.165	4th diode cut-in
272	0	
279	-0.195	5th slope is parallel to Radiance Curve
284.5	0	
291	+0.16	5th diode cut-in
296	0	
303	-0.13	6th slope is parallel to Radiance Curve
310	+0.023	

The largest plus and minus errors in the 210K-310°K range are +0.20° and -0.21°K respectively.

The standard deviation = 0.13°K RMS over the 210° to 310°K dynamic range.

TABLE 2.4.1.3-3

OLS #21

BSL CALIBRATION EQUATIONS

(From Tables 2.4.1-4,5,6)

			EVALUATED @ 210°	EVALUATED @ 310°
T FINE (Primary)				
T-Right:	Error = 0.0028 (T-190) + 0.47	(°K)	0.414	0.134
T-Mid:	Error = 0.0065 (T-190) + 0.62	(°K)	0.617	-0.160
T-Left:	Error = 0.0095 (T-190) + 0.93	(°K)	0.740	-0.210
T FINE (Redundant)				
T-Right:	Error =-0.0038 (T-190) + 0.48	(°K)	0.404	0.024
T-Mid:	Error =-0.0069 (T-190) + 0.55	(°K)	0.412	0.182
T-Left:	Error =-0.0101 (T-190) + 1.01	(°K)	0.808	-0.202
T SMOOTH (Primary - SP MID)	Error =-0.0067 (T-190) + 0.67	(°K)	0.536	-0.134
T SMOOTH (Redundant - SB MID)	Error =-0.0073 (T-190) + 0.61	(°K)	-0.146	-0.876

TABLE 2.4.1.3-4

OLS #21

FIXED DEVIATION CALIBRATION DIFFERENCES FOR SEPARATE SEGMENTS

Calculated from BSL Equations in Table 2.4.1.3-3:

	DIFFERENCE AT 210°K (°K)	DIFFERENCE AT 310K (°K)	SPECIFICATION (MAX)
PRIMARY			
T Mid to T Right	0.20	0.29	1°K
T Mid to T Left	0.12	0.05	1°K
T Right to T Left	0.33	0.34	1°K
REDUNDANT			
T Mid to T Right	0.01	0.16	1°K
T Mid to T Left	0.40	0.38	1°K
T Right to T Left	0.40	0.23	1°K

Worst Case Differences from Best Straight Line
Plots (Figures 2.4.1-1 thru 2.4.1-6):

RUN #	PRIMARY PATH	REDUNDANT PATH	SPEC. MAX.
1	0.40 MID-RGT	*0.44 MID-RGT	1°K
8	0.29 MID-LFT	0.30 LFT-RGT	1°K
9	0.34 LFT-RGT	*0.44 LFT-RGT	1°K

*WORST-CASE DATA

TABLE 2.4.1.3-5

OLS #21

ALONG SCAN VARIATION (265°K to 310°K) WITHIN A SEGMENT

(From ASV Graphs)

	ONE SIGMA ERROR (°K RMS)	SPEC LIMIT (°K RMS)
T-FINE		
T-Left Segment	0.11	0.2
T-Mid (Sum) Segment	0.08	0.2
T-Right Segment	0.10	0.2
T-SMOOTH		
T-Sum	0.08	0.2

TABLE 2.4.1.3-6

CONE COOLER S/N 032

THERMISTOR S/N KC-59

OLS-21

CONE (INNER STAGE) PATCH TEMP. EST

TEMPERATURE °K	PATCH EST. VOLTS
98	5.056
99	4.704
100	4.379
101	4.078
102	3.800
103	3.544
104	3.307
105	3.087
106	2.884
107	2.696
108	2.522
109	2.361
110	2.212
111	2.074
112	1.945
113	1.826
114	1.715
115	1.612
116	1.516
117	1.427
118	1.344
119	1.267
120	1.195
121	1.128
122	1.065
123	1.007
124	0.952
125	0.901

TABLE 2.4.1.3-7

CONE COOLER OUTER STAGE TEMP EST

OLS #21

T CONE TEMP EST (EST #33)

T (DEG K)	EST VOLTS	T (DEG K)	EST VOLTS
158	4.8221	194	4.1282
159	4.8181	196	4.0328
160	4.8136	198	3.93
161	4.8088	200	3.8195
162	4.8035	202	3.7016
163	4.7978	204	3.5769
164	4.7915	206	3.4468
165	4.7848	208	3.3115
166	4.7775	210	3.1719
167	4.7695	212	3.0292
168	4.7609	214	2.8844
169	4.7515	216	2.7386
170	4.7414	218	2.5924
171	4.7306	220	2.4475
172	4.7188	222	2.305
173	4.7063	224	2.1659
174	4.6926	226	2.0302
175	4.678	228	1.8995
176	4.6622	230	1.7735
177	4.6454	235	1.4832
178	4.6273	240	1.2308
179	4.608	245	1.0159
180	4.5874	250	0.8359
181	4.5654	255	0.6873
182	4.5418	260	0.5650
183	4.517	265	0.4653
184	4.4904	270	0.3842
185	4.4622	275	0.3182
186	4.4323	280	0.2646
187	4.4008	285	0.2207
188	4.3673	290	0.1852
189	4.3322	295	0.1560
190	4.2951	300	0.1320
192	4.2156	305	0.1123

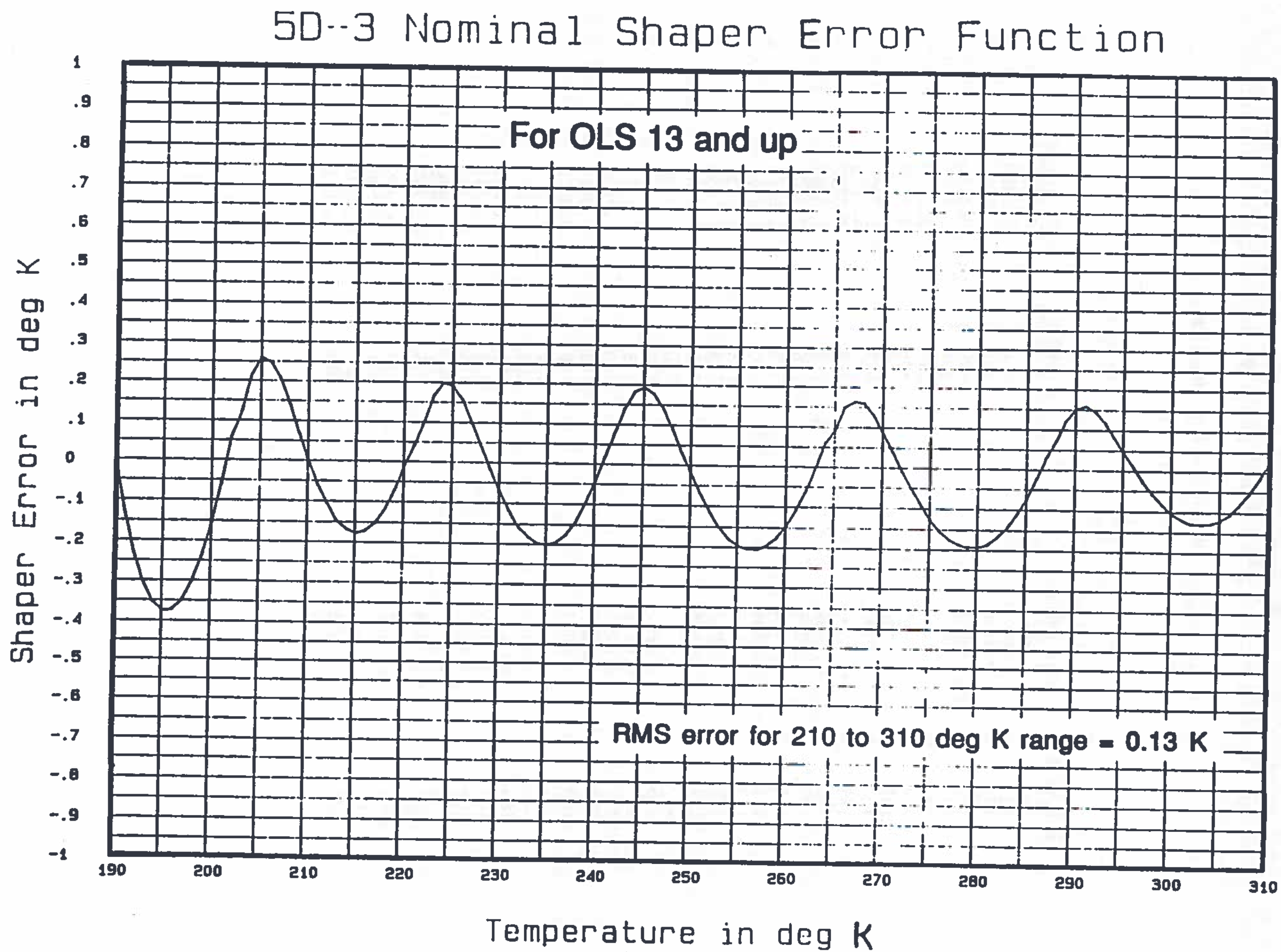


FIGURE 2.4.1.3-1

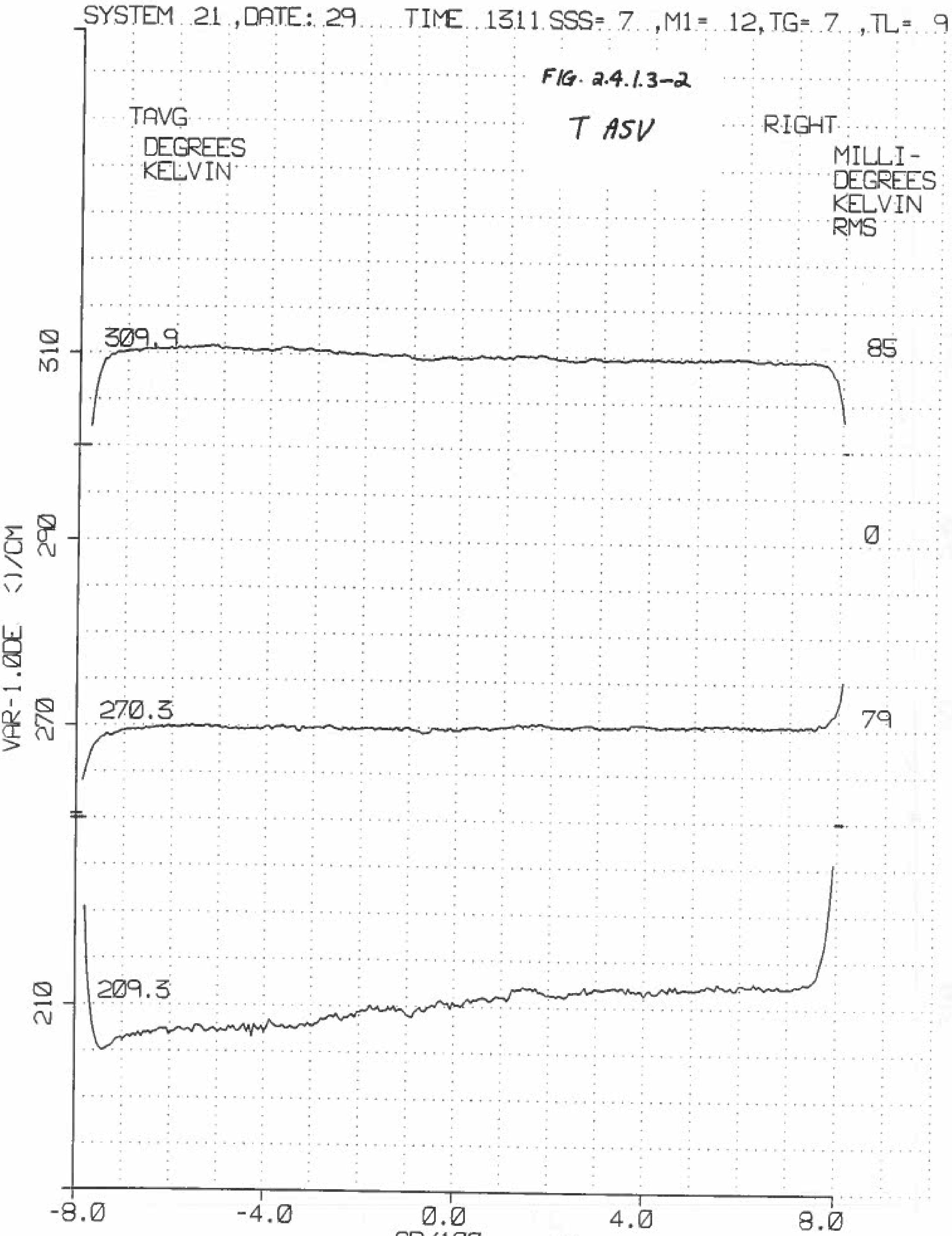
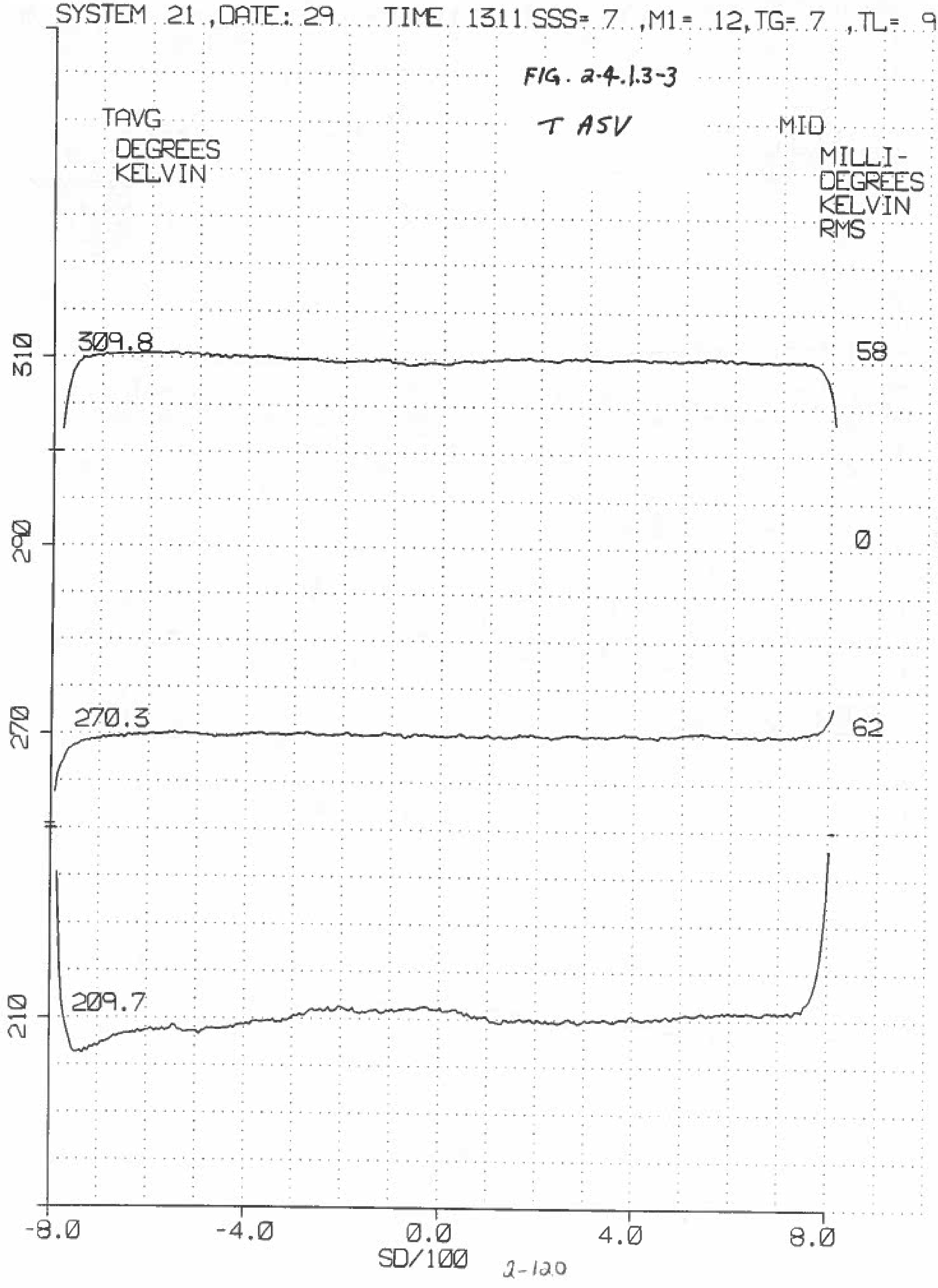
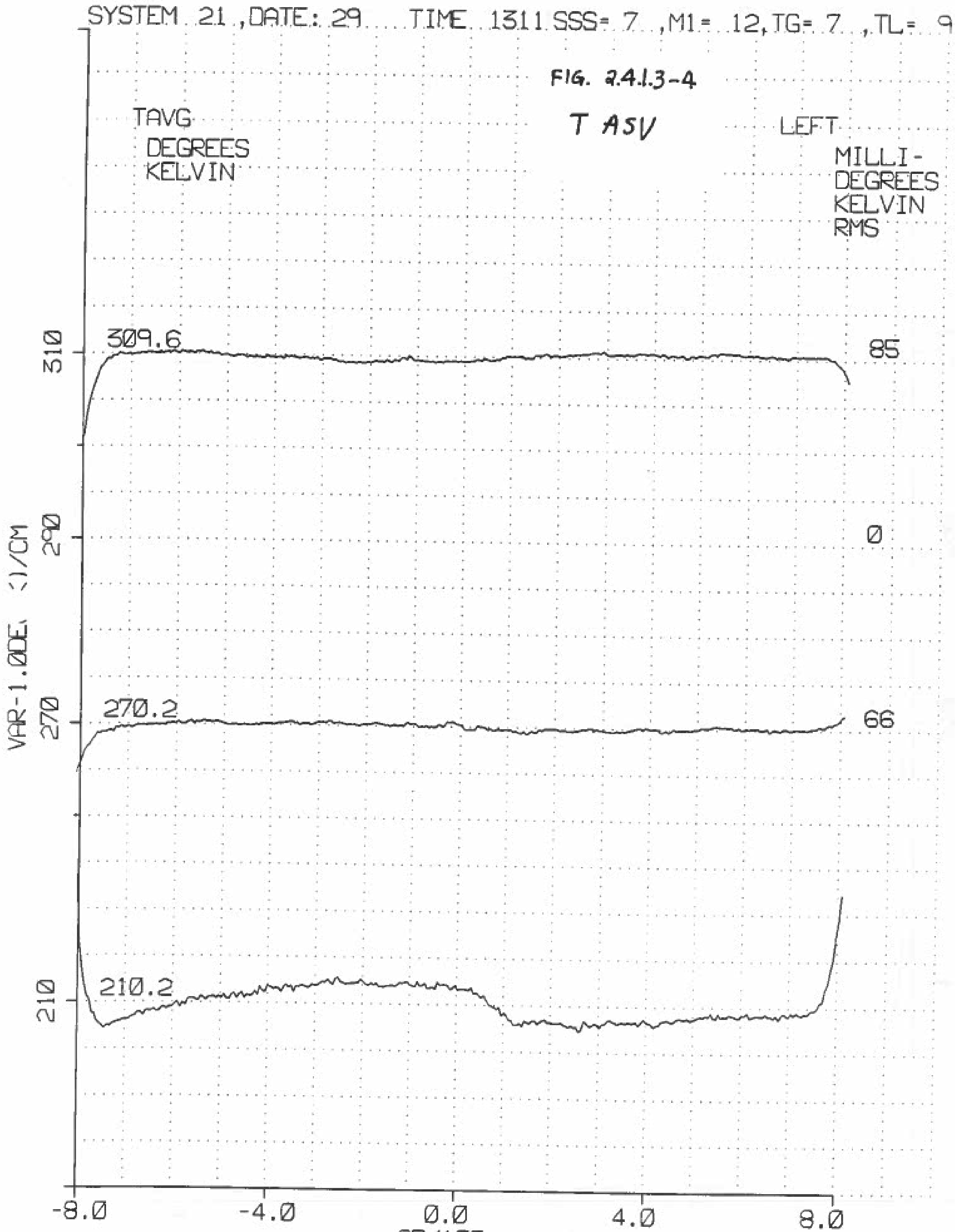
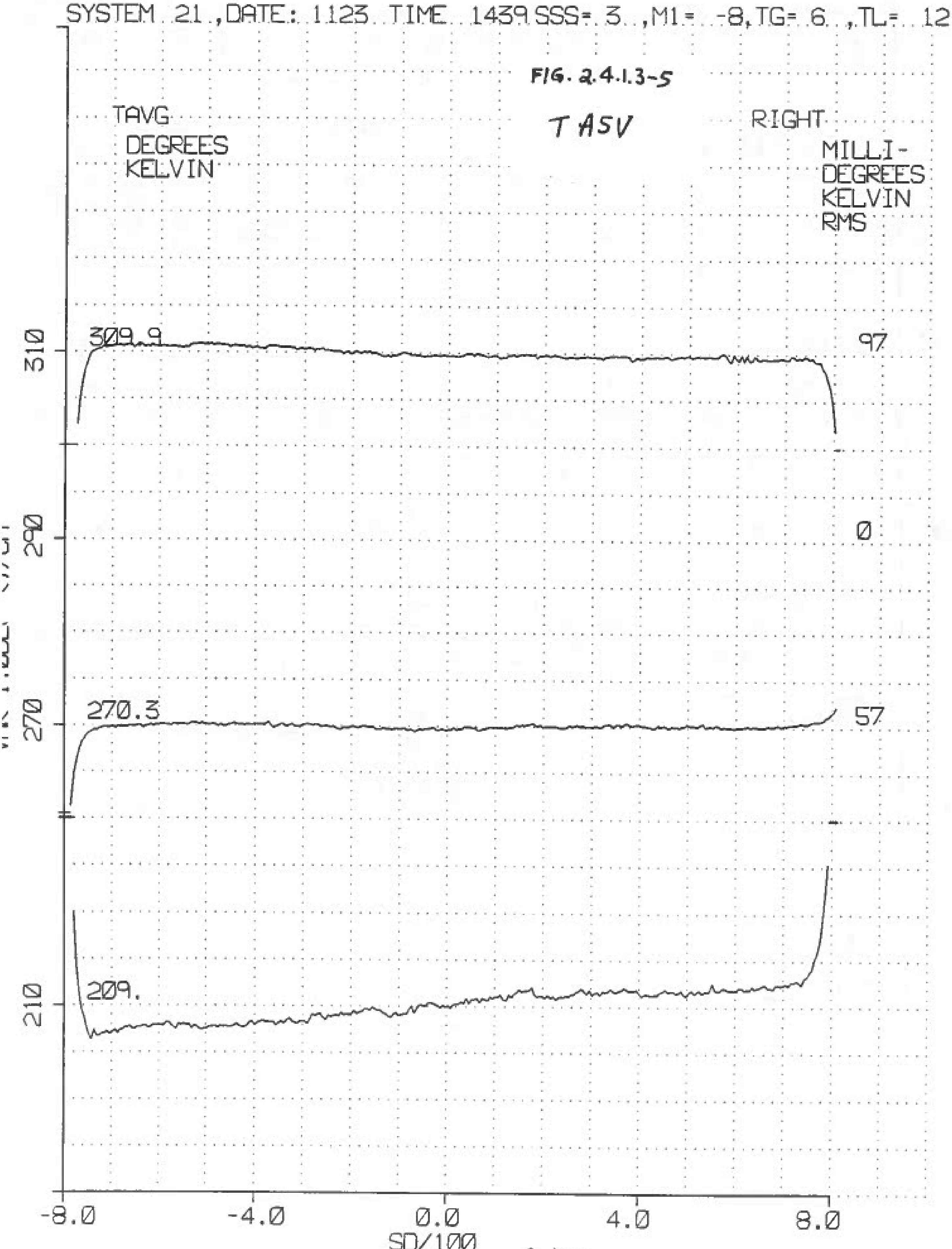
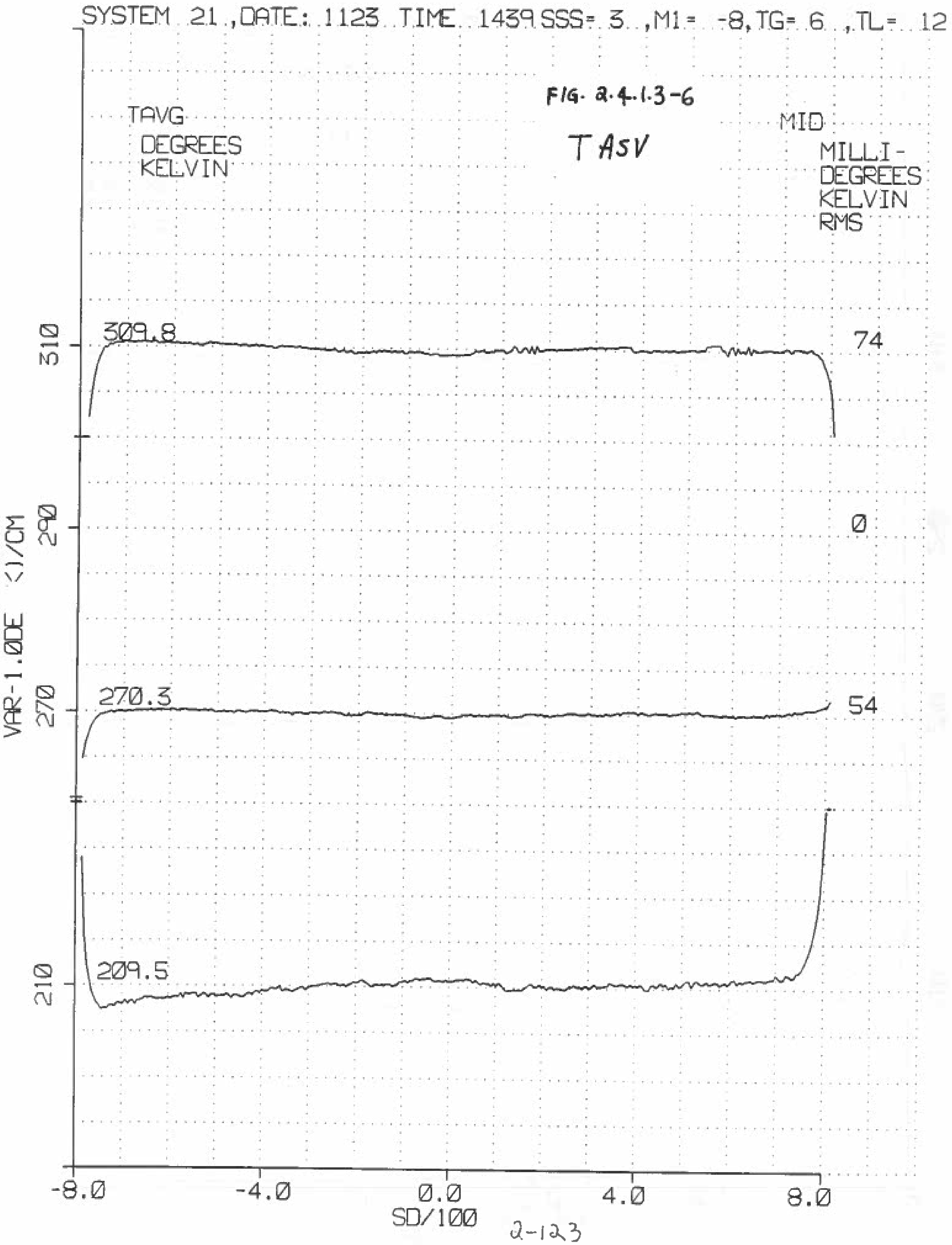

SYSTEM 21 ,DATE: 29 TIME 1311 SSS= 7 ,M1= 12,TG= 7 ,TL= 9
FIG. 2.4.1.3-2
TAVG
DEGREES
KELVIN
T ASV
RIGHT
MILLI-
DEGREES
KELVIN
RMS
309.9
310
85
290
0
270.3
270
79
209.3
210
VAR-1.0DE ()/CM
-8.0
-4.0
0.0
4.0
8.0
SD/100

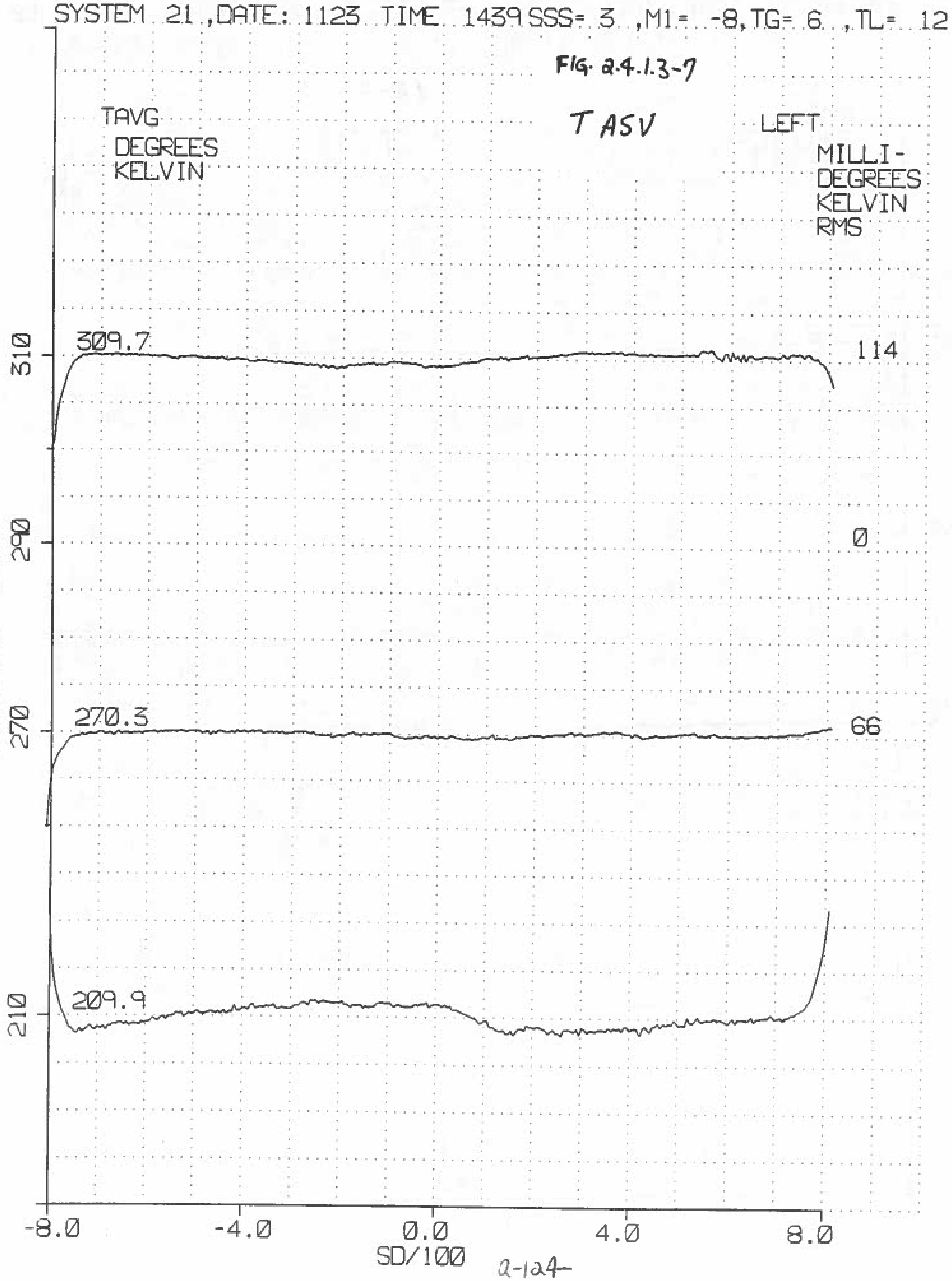
FIG. 2-4.1.3-3

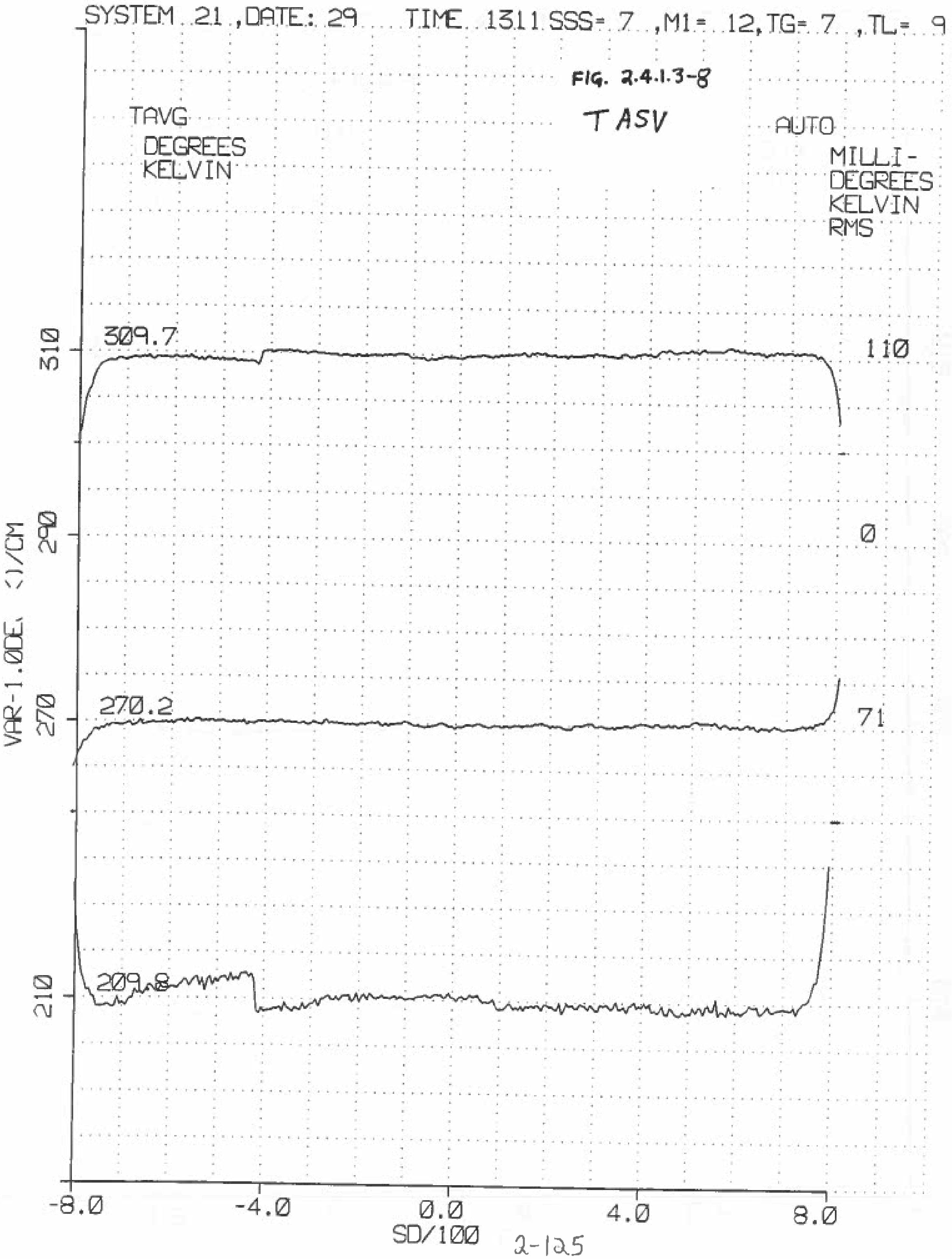

SYSTEM 21 ,DATE: 29 TIME 1311 SSS= 7 ,M1= 12,TG= 7 ,TL= 9
T ASV
TAVG
DEGREES
KELVIN
MID
MILLI-
DEGREES
KELVIN
RMS
310
309.8
58
290
0
270
270.3
62
210
209.7
-8.0
-4.0
0.0
4.0
8.0
SD/100

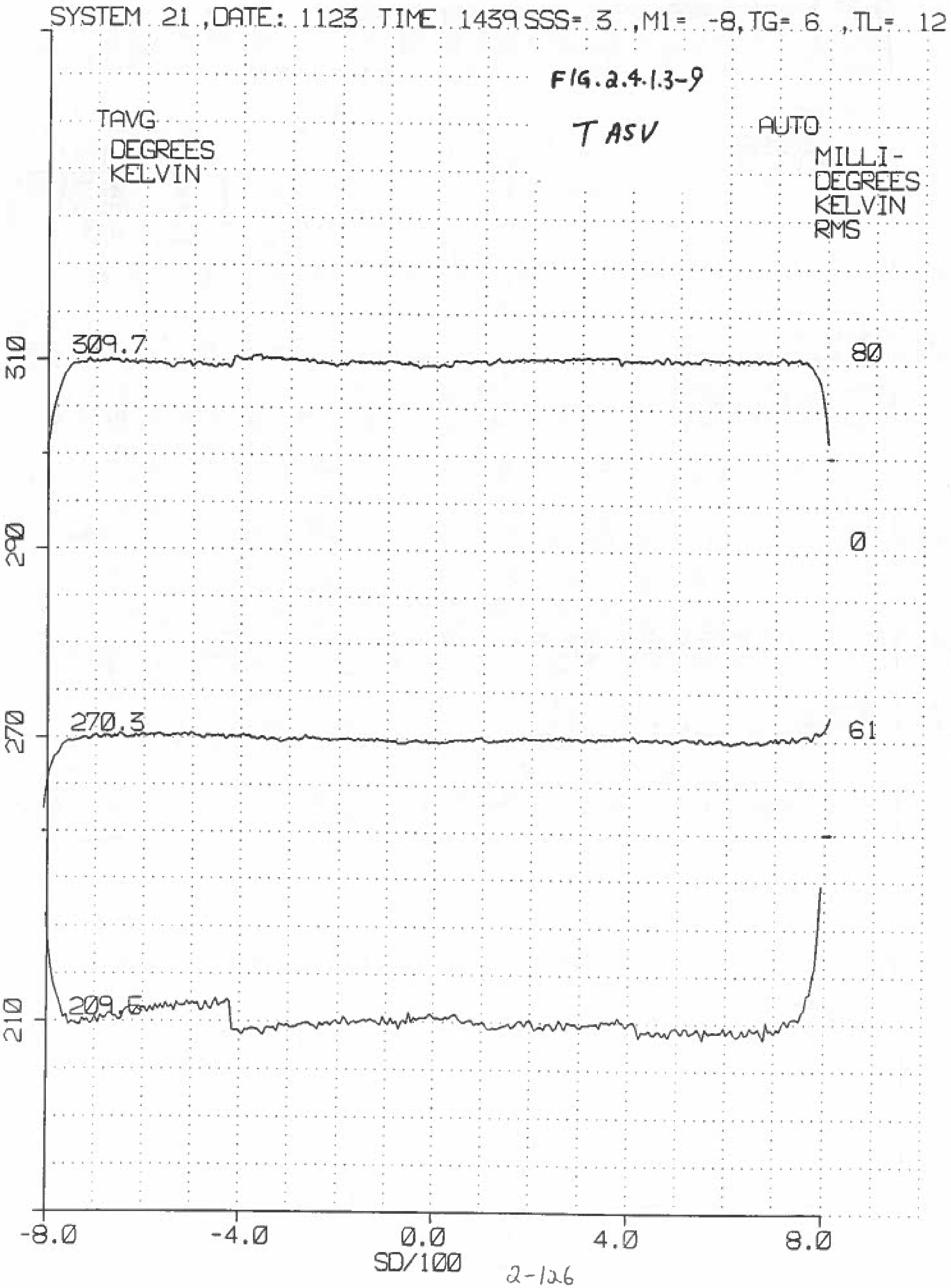

SYSTEM 21 ,DATE: 29 TIME 1311 SSS= 7 ,M1= 12,TG= 7 ,TL= 9
FIG. 2.4.1.3-4
T ASV
TAVG
DEGREES
KELVIN
LEFT
MILLI-
DEGREES
KELVIN
RMS
309.6
85
0
270.2
66
210.2
310
290
270
210
VAR-1.0DE( )/CM
-8.0
-4.0
0.0
4.0
8.0
SD/100


SYSTEM 21 ,DATE: 1123 TIME 1439 SSS= 3 ,M1= -8,TG= 6 ,TL= 12
FIG. 2.4.1.3-5
TAVG
DEGREES
KELVIN
TASV
RIGHT
MILLI-
DEGREES
KELVIN
RMS
309.9
97
0
270.3
57
209.
310
290
270
210
-8.0
-4.0
0.0
4.0
8.0
SD/100


SYSTEM 21 ,DATE: 1123 TIME 1439 SSS= 3 ,M1= -8,TG= 6 ,TL= 12
FIG. 2.4.1.3-6
TASV
TAVG
DEGREES
KELVIN
MID
MILLI-
DEGREES
KELVIN
RMS
309.8
74
0
270.3
54
209.5
310
290
270
210
VAR-1.0DE ()/CM
-8.0
-4.0
0.0
4.0
8.0
SD/100


SYSTEM 21 ,DATE: 1123 TIME 1439 SSS= 3 ,M1= -8,TG= 6 ,TL= 12
FIG. 2.4.1.3-7
TAVG
DEGREES
KELVIN
T ASV
LEFT
MILLI-
DEGREES
KELVIN
RMS
309.7
270.3
209.9
114
0
66
310
290
270
210
-8.0
-4.0
0.0
4.0
8.0
SD/100


SYSTEM 21 ,DATE: 29 TIME 1311 SSS= 7 ,M1= 12,TG= 7 ,TL= 9
FIG. 2.4.1.3-8
T ASV
TAVG
DEGREES
KELVIN
AUTO
MILLI-
DEGREES
KELVIN
RMS
309.7
270.2
209.8
310
290
270
210
110
Ø
71
VAR-1.ØDE( )/CM
-8.Ø
-4.Ø
Ø.Ø
4.Ø
8.Ø
SD/1ØØ


SYSTEM 21 ,DATE: 1123 TIME 1439 SSS= 3 ,M1= -8,TG= 6 ,TL= 12
FIG. 2.4.1.3-9
T ASV
TAVG
DEGREES
KELVIN
AUTO
MILLI-
DEGREES
KELVIN
RMS
309.7
310
80
290
0
270.3
270
61
209.5
210
-8.0
-4.0
0.0
4.0
8.0
SD/100

2.4 Radiometric Accuracy (Cont'd)

2.4.2 Daytime Radiometric Accuracy (3.2.1.1.4.2)

OLS #21 achieved the 7% absolute radiance requirement by setting the HRD channel gain as shown on the L channel DC Response plot, using the calibrated light source (VULS).

The analysis of the calibration accuracy and the L-Day channel stability show within-specification performance. The gain ratios (PMH/PML, PML/HRD, and PMH/HRD) were measured using the VULS during Acceptance Test in test 6x2x1.ST, and vary less than 0.56% from the average of the ratios. The gain ratios measured in test 6x2x2.ST using a less accurate test method show greater variation.

The plot of L DC Response contains the calculated sensor switch points, S(x), and relative gains P(X), which are stored in the OLS Constants Memory page zero, locations 39H through 3FH. P(2) and S(2) represent the bypass of the PMT 1/9 mode, which is not usually implemented on orbit.

Two factors must be taken into account in modifying the nominal value of P0 for OLS 21. The addition of 1 shim to the HRD/Preamp interface caused an additional 0.523 dB loss in signal output.

OLS #21 exhibited a 1.193dB drop in transmission from room temperature to +5°C. Thus P(0) must be reset to 6.0 (nom) + 1.193 + 0.523 = 7.716 dB. Rounding off to the nearest 1/8 dB gives 7.750 dB as the new setting for P(0).

P1 is derived using the PMT LO/HRD average gain value of 50.13 dB with a compensation for the HRD Loss and PMT Gain Ratios with temperature from the test data as plotted in figure 2.4.2-2 and converted to dB of 1.193 dB and 0.431 dB, respectively. The P1 value is 50.13 + 1.193 + 0.431 = 51.75 db (rounded to nearest 1/8th dB = 51.75).

Since the PMT 1/9 mode is currently unused, P2=0dB. P3 is given the PMT HI/LO average gain ratio of 29.69 dB or 29.75 dB after rounding.

ATTACHMENT: OLS #21 L Channel DC Response Plot

Table 2.4.2-1 OLS #21 DC Response Stability

Table 2.4.2-2 OLS #21 PMT/HRD DC Response vs. SSS Temp.

OLS21 L CHANNEL DC RESPONSE

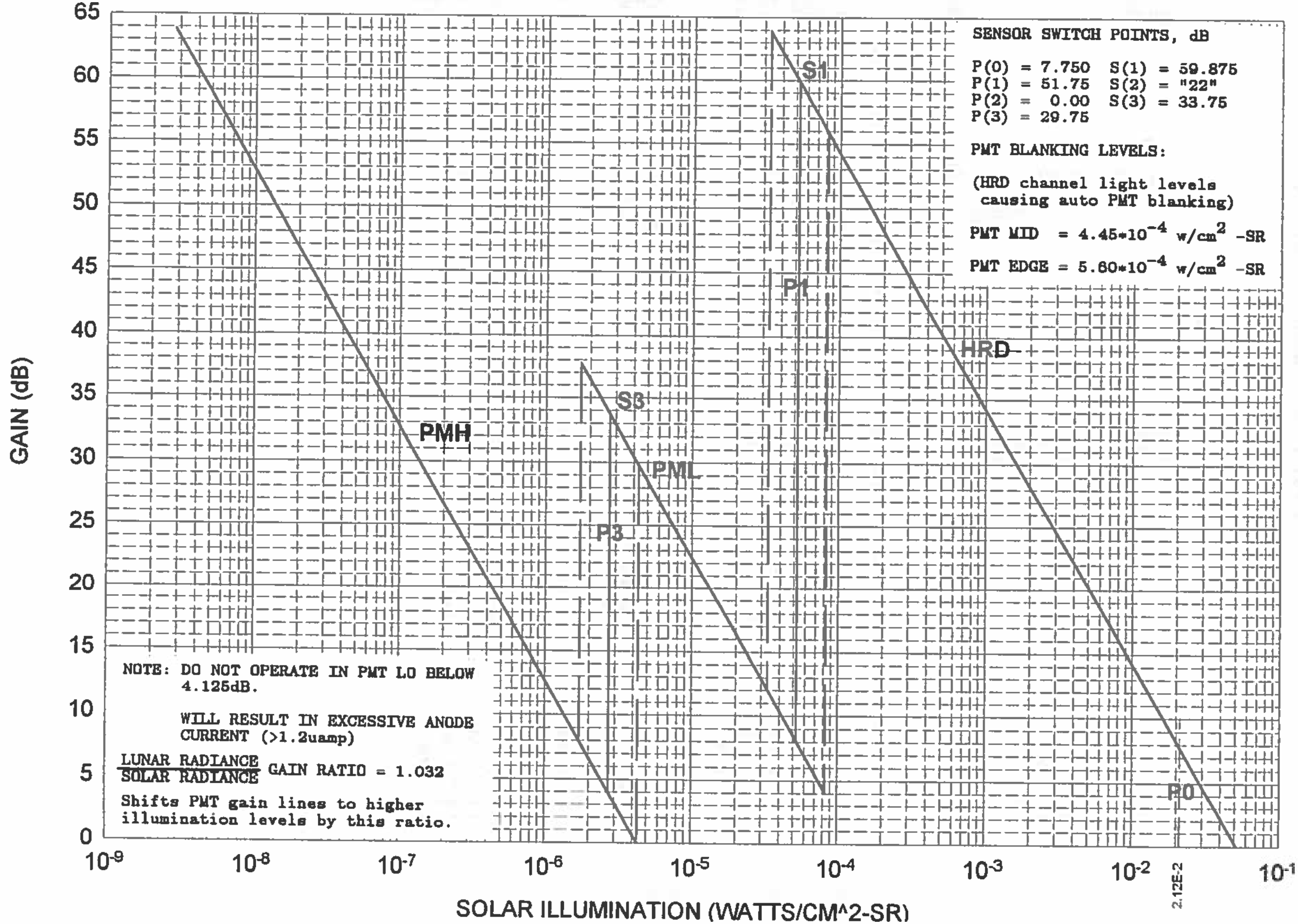


Table 2.4.2-1

OLS #21 L DC Response Stability

Stability vs. Time (6x2x1.ST data using VULS)

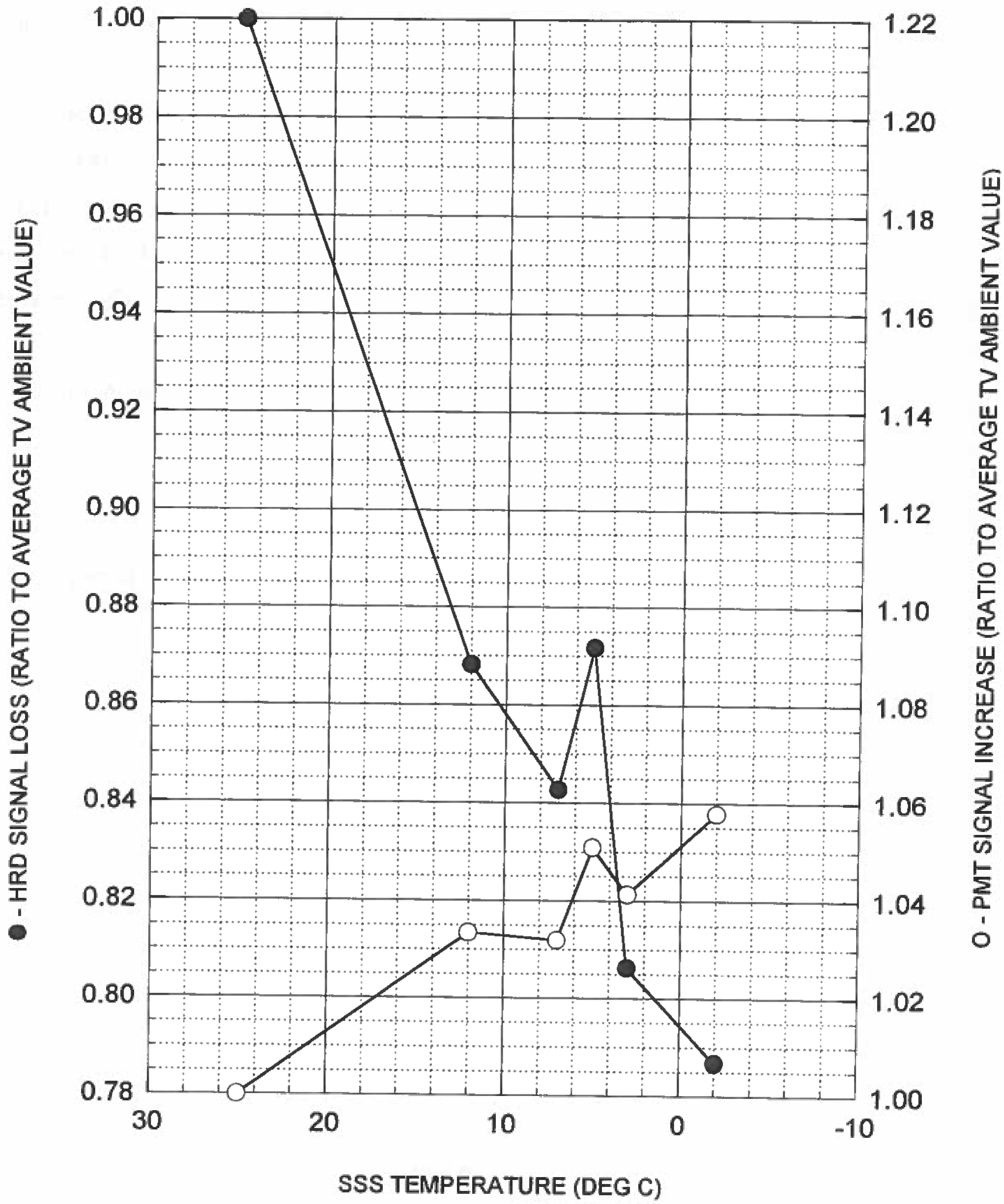
DATE	PMT HI / PMT LO dB	PMT LO / HRD dB	PMT HI / HRD dB
08/26/94	29.69	49.85	79.54
09/02/94	29.69	50.17	79.86
09/14/94	29.69	50.31	80.00
10/19/94	29.70	50.03	79.73
10/23/94	29.68	50.06	79.74
12/05/94	29.71	50.37	80.08
Average	29.69	50.13	79.83
(Direct Multiple)	(30.53)	(321.06)	(9800.54)

Stability vs. Temperature (6x2x2.ST data using half sphere source)

DATE	ENVIRONMENT	PMT HI / PMT LO dB	PMT LO / HRD dB	PMT HI / HRD dB
9/23/94	TVAC Amb	29.71	40.16	69.87
10/26/93	TVAC Amb	29.71	39.55	69.26
11/09/94	TVAC Amb	29.56	40.11	69.67
Average		29.66	39.94	69.60

DATE	ENVIRONMENT	PMT HI / PMT LO dB	PMT LO / HRD dB	PMT HI / HRD dB
09/29/94	+5/+12	29.71	41.93	71.32
11/03/94	+5/+12	29.69	41.45	71.14
11/06/94	-2/-11	29.67	42.01	71.68
11/07/94	+12/+15	29.65	40.90	70.55
11/16/94	-2/-11	29.68	42.38	72.06
11/18/94	+12/+15	29.63	41.27	70.90
11/22/94	-3/-8	29.63	42.09	71.72
11/29/94	+7/+12	29.68	41.51	71.19
Average		29.67	41.65	71.32

TABLE 2.4.2-2 - PMT / HRD DC RESPONSE vs SSS TEMPERATURE - OLS 21



2.4 Radiometric Accuracy, (Cont'd)

2.4.3 Nighttime Radiometric Accuracy (3.2.1.1.4.3)

The PMT accuracy is required to degrade by no more than 60% from its initial accuracy at time of Acceptance testing to end of 3 year orbital life.

The 5D-3 OLS System Summary Report indicates PMT channel stability to be within 25.7% over the mission life so that the PMT meets this specification requirement. The above figures do not include corrections utilizing on-board LED calibration. The PMT CAL LED is extremely stable, and has an essentially constant output over the mission life.

The DC response curve of the OLS #21 PMT is shown in the L Channel DC Response curve in paragraph 2.4.2.

ATTACHMENT: Table 2.4.3-1 PMT CAL Baseline data

(See para 2.4.2 attachment for L. Chan. DC Response curve)

TABLE 2.4.3-1

PMT CAL BASELINE DATA

The PMT Cal voltage EST is a monitor of PMT sensitivity and stability characteristics. In order to relate on-orbit measurement of PMT CAL to measurement during Acceptance Test, the following data are provided. PMT CAL Voltage (EST #40) and PMT BU (Back-up) CAL V (EST #41) are sampled 500 times in test 6x6x2.ST. The PMT Cal voltage EST output is tabulated below.

TABLE 2.4.3-1

PMT CAL BASELINE DATA

DATE	SSS TEMP	OUTPUT VOLTAGE (mV)	
		PMT CAL V (EST #40)	PMT BU CAL V (EST #41)
08-19-94	+25	2505	2517
08-26-94	+25	2484	2506
09-14-94	+25	2505	2514
09-22-93	+25	2503	2509
09-27-93	+5	2535	2547
10-22-94	+25	2524	2521
10-27-94	+25	2496	2492
11-03-94	+5	2566	2580
11-27-94	+3	2520	2526
12-02-94	+7	2481	2492
	AVERAGE	2512	2520
Max change from AVERAGE		2.15%	2.36%

2.4 RADIOMETRIC ACCURACY, (Cont'd)

2.4.4 Gain Control Accuracy (3.1.4.4)

Along-Scan Gain Control (ASGC) accuracy is within the specification limit of 4dB of the smooth monotonic curve drawn through the nominal values of Gain Value versus Scense Solar Elevation (GVVSSE), tabulated in para 3.2.1.1.1.4 of S-DMSP-886.

System Tests 5x6x3.ST and 5x6x6.ST exercise the ASGC function through various combinations of extremes of slope and bias adjustment; and measure channel output for a wide range of values. These are automatically compared against stored test limits which ensure spec compliance.

An analysis using the ASGC software algorithm showing 3.25dB maximum error is summarized in the System Summary Report paragraph 3.5.4.

ATTACHMENTS: None.

2.4 RADIOMETRIC ACCURACY, (Cont'd)

2.4.5 Gain Control Adjustability (3.2.1.1.4.4 et al)

The OLS #21 Gain Control Adjustability is similar to the 5D-1 systems. The OLS 5D-3 System Summary Report paragraph 3.5.5 contains the analysis required to demonstrate conformance with the specifications, with additional information below.

TERMINATOR LOCATION (3.1.4.5.1)

The GNC Command (an uplink command) has a sub mode (GNC 10 θ X) which allows the GVVSSE bias (terminator location) to be adjusted by X degrees, where X is a 6-bit 2's complement word with an LSB of 0.5°. This results in the required range of + 15.5 degrees.

MAXIMUM GAIN SETTING (3.2.1.1.4.5.3)

The maximum ASGC gain is commandable. An operational value is determined in Early Orbit Calibrations. The value is stored in the Operational Constants Memory location page θ Address 44H (BCMAX). The ASGC function & performance are exercised in tests 5x6x3.ST & 5x6x6.ST

COMMANDABLE T-CHANNEL GAIN (3.2.1.1.4.5.4)

The T-Channel Commandable Gain is exercised in test 6x8x2.ST. The channel output is measured for the entire range of commandable gains. The T Channel Gain is required to have the capability of being varied by command to be between 164% and 174% of the established minimum gain value (0 dB).

The actual percentage of TGAIN change for OLS #21 was measured as 68.9% for T Right and 69.0% for T Left.

Each step of TGAIN is required to be between 0.9% and 2.5% above the preceeding lower gain value. Measured gain steps on OLS #21 ranged from 1.61% to 1.90%, within specification.

COMMANDABLE T CHANNEL LEVEL (3.2.1.1.4.5.5)

The T Channel Commandable Level is also exercised in test 6x8x2.ST. The specification requires that TLEVEL be variable over at least a 14° range in steps of 1.1°K or less. Measured results for OLS 21 testing were 15.3° range with an average step size of 1.018°K; both within specification.

2.4 RADIOMETRIC ACCURACY, Cont'd

2.4.6 A/D Conversions & Algorithms (3.2.1.1.4.6.2 & 3.2.1.1.4.6.3)

S-DMSP-886 specifies that the Stored Smooth Algorithm accuracy with an ideal A/D shall be verified by analysis. OLS 5D-3 System Summary Report contains the analysis which shows that the LS % Full Scale Deviation does meet the specification. The results are summarized below:

Mode	% Full Scale Deviation	Analysis
LS	≤ ± 2.2%	-1.70%, +2.09%
TS	≤ ± 0.4%	± 0.39%

The Actual A/D Conversion Radiometric Accuracy was measured in system test 6x10.ST. The worst-case results from the OLS #21 Thermal Vacuum runs are summarized below:

A/D	BSL SLOPE (% DEV FROM IDEAL)	BSL OFFSET (% OF FULL SCALE)	RMS DEV FROM BSL (% OF FULL SCALE)
SDF-L PRIM	+0.04	-0.04	0.05
RED	+0.22	-0.04	0.04
SDF-T PRIM	-0.27	+0.10	0.15
RED	+0.11	-0.12	0.17
RTD-FL PRIM	+0.17	-0.06	0.03
RED	-0.04	-0.10	0.04
RTD-FT PRIM	-0.32	0.00	0.12
RED	-0.14	-0.14	0.09
SPEC	±1.0	±1.0	0.50
RTD-SL PRIM	-0.10	-0.04	0.03
RED	-0.12	-0.06	0.03
RTD-ST PRIM	-0.22	-0.06	0.08
RED	-0.43	+0.16	0.11
SDS-L PRIM	-0.05	+0.04	0.04
RED	-0.15	+0.10	0.03
SDS-T PRIM	+0.12	-0.36	0.05
RED	+0.13	-0.32	0.07
SPEC	±0.5	±0.5	0.25

2.5 RADIOMETRIC RESOLUTION (3.2.1.1.5 et al.)

S-DMSP-886 apportions the Radiometric Resolution verification between Test and Analysis.

The Fine and Direct Smoothed Radiometric Resolution (para. 3.2.1.1.5.1), as well as the Stored Smoothed A/D Converter Error (para. 3.2.1.1.5.2), were measured in System Test 6x10.ST during the OLS #21 vacuum runs and are tabulated below:

A/D		PEAK DEV FROM BSL (% OF FULL SCALE)	SPEC
SDF-L	PRIM	+0.08	±0.8%
	RED	-0.09	
SDF-T	PRIM	+0.30	±0.8%
	RED	+0.34	
RTD-FL	PRIM	-0.06	±0.8%
	RED	-0.08	
RTD-FT	PRIM	+0.30	±0.8%
	RED	-0.18	
RTD-SL	PRIM	+0.06	±0.25%
	RED	+0.06	
RTD-ST	PRIM	+0.16	±0.25%
	RED	+0.245	
SDS-L	PRIM	-0.09	±0.5%
	RED	+0.06	
SDS-T	PRIM	-0.11	±0.5%
	RED	+0.16	

The Stored Smoothed Algorithms Resolution with Ideal A/D (para. 3.2.1.1.5.2.1) are verified by Analysis in OLS 5D-3 System Summary Report, and are summarized in Table 2.5.1.

TABLE 2.5-1

Stored Smoothed Algorithms
Resolution With Ideal A/D

ITEM	SPEC	ACTUAL
Accuracy		
LS Algorithm	<±2.2%	-1.70% +2.09%
TS Algorithm	<±0.4%	±0.39%
Resolution		
LS Algorithm	<1.6%	1.57%
TS Algorithm		
Population 1 Density	25%	25%
Population 1 Quantization	<0.8%	0.78%
Population 2 Density	75%	75%
Population 2 Quantization	<0.4%	0.39%
Population Distribtution	Uniform	Uniform
Quantization Capability	0.4%	0.4%

2.6 NOISE

2.6.1 T Channel Noise (3.2.1.1.6.1)

The T Channel noise equivalent temperature difference (NETD) is specified between 210K and 310K, although the T channel responsivity extends down to 190K.

The NETD is measured during T Channel DC response tests in the Thermal Vacuum Chamber.

The Channel views a stable blackbody target at 210K (worst-case noise). The channel output is sampled & the noise (std. deviation) of 2000 samples is converted to NETD using the following formula:

NETD = [Avg Noise in Volts * 24 °/Volt] * 1.074 (the shaper slope correction)

The OLS #21 NETD is in-spec. The average noise in the T Right segment is 9.4% larger than in the T Left segment.

	TF	TS	TS Fallback
SPEC	2.2°K	0.90°K	1.3°K
Worst-Case Measured NETD	0.897°K	0.359°K	0.511°K
Worst-Case Average NETD	0.840°K	0.336°K	0.470°K

ATTACHMENT: Table 2.6.1-1 OLS #21 NETD

Table 2.6.1-1

OLS #21 PRIMARY SIDE NETD										
DATE	TG				Noise mV					
	SSS	M1	R/L	TL	FINE RGT	SMOOTH RGT	FINE MID	SMOOTH MID	FINE LFT	SMOOTH LFT
11/01/94	5	12	6/6	3	34.57	19.39	25.07*	13.91*	30.61	17.24*
11/04/94	5	-8	6/6	13	33.41	19.03	23.40	13.19	29.04	15.78
11/06/94	-2	-11	6/6	13	33.48	19.26	24.64	13.46	29.99	16.61
11/07/94	12	15	6/6	9	31.22	17.07	21.97	12.33	28.27	15.79
11/14/94	7	-8	5/6	13	30.74	17.23	21.18	12.19	28.95	15.93
11/15/94	7	12	5/6	9	30.82	17.35	21.99	12.22	28.84	15.89
11/16/94	-2	-11	6/6	13	33.61	19.61	24.03	13.61	30.14	16.70
11/18/94	12	15	6/6	9	31.20	17.99	21.80	12.13	28.46	14.83
11/19/94	-2	-11	6/6	13	33.14	19.22	24.20	13.34	29.69	16.20
11/21/94	12	15	6/6	9	31.49	17.66	21.96	12.66	28.34	15.32
11/23/94	3	-8	6/6	12	32.78	19.82*	23.69	13.62	30.51	16.57
11/29/94	7	12	7/7	9	32.70	19.69	23.31	13.86	29.67	16.75
			AVERAGE		32.43	18.61	23.10	13.04	29.38	16.13
			NETD		0.778	0.447	0.554	0.313	0.705	0.387
NETD Correction for Shaper Slope**					0.836	0.480	0.596	0.336	0.757	0.416

* Worst Case Measured
** Shaper Slope Correction Factor = 1.074

Table 2.6.1-1

OLS #21 REDUNDANT SIDE NETD										
DATE	TG				Noise mV					
	SSS	M1	R/L	TL	FINE RGT	SMOOTH RGT	FINE MID	SMOOTH MID	FINE LFT	SMOOTH LFT
11/14/94	7	-8	6/6	13	34.80*	19.48	24.76	13.63	31.13*	16.24
11/15/94	7	12	5/6	9	31.70	17.46	22.81	13.13	29.10	16.38
11/22/94	3	-8	6/6	13	31.08	17.85	23.07	12.71	29.17	14.84
11/28/94	7	12	6/6	9	32.85	18.18	23.42	12.52	28.98	15.30
AVERAGE					32.61	18.24	23.52	13.00	29.60	15.69
NETD					0.783	0.438	0.564	0.312	0.710	0.377
NETD Correction for Shaper Slope**					0.840	0.470	0.606	0.335	0.763	0.404
Worst Case Corrected NETD					0.897	0.511	0.646	0.359	0.802	0.444

* Worst Case Measured
**Shaper Slope Correction Factor = 1.074

2.6 NOISE (Cont'd)

2.6.2 L-Channel Noise (Day) (3.2.1.1.6.2)

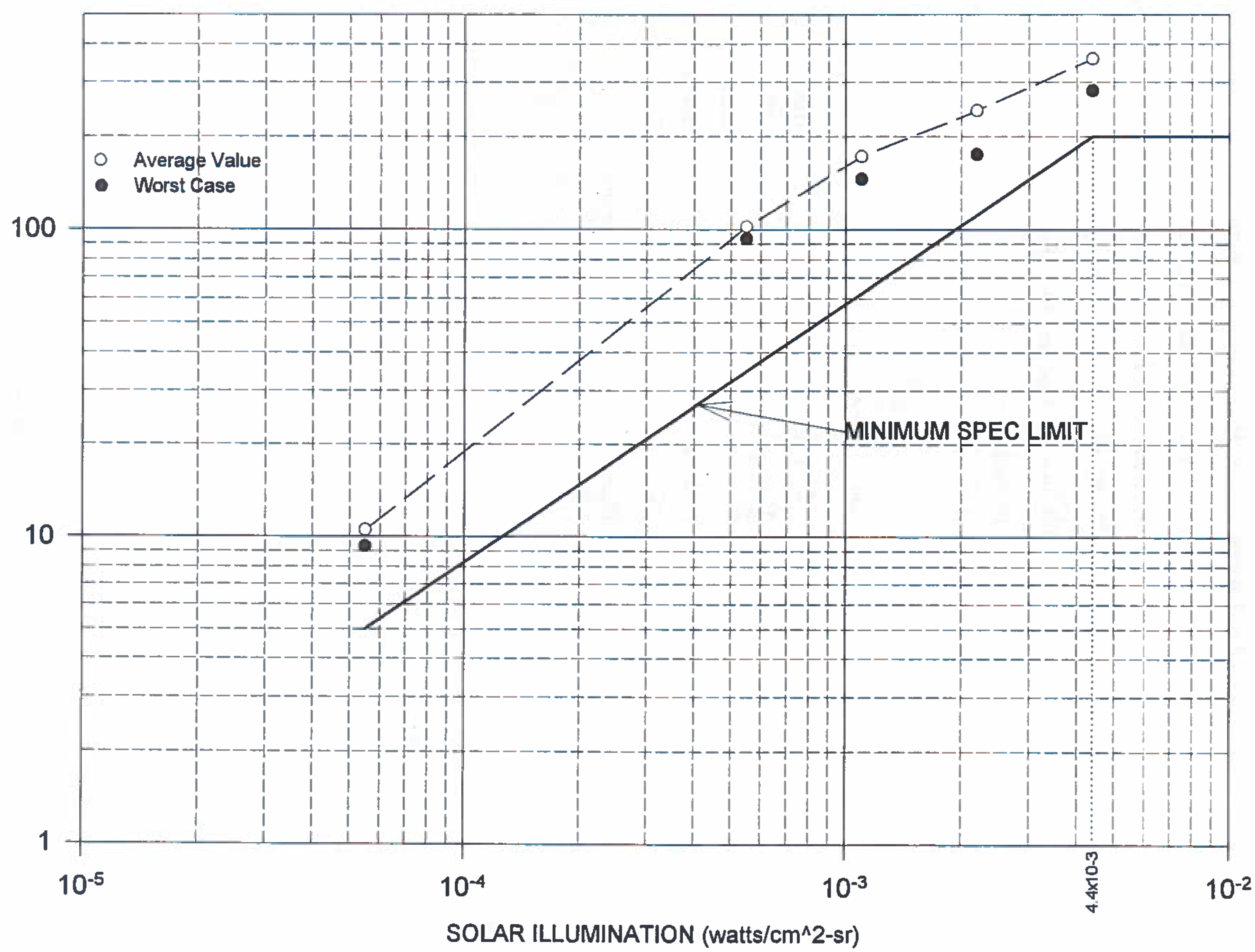
The L Channel Noise is measured using the calibrated Variable Uniform Light Source (VULS). Dark noise is measured in test 6x3x1.ST and shot noise is measured in 6x3x5.ST.

The OLS #21 HRD is in-spec for the entire range of illumination. In summary:

	SNR		
LIGHT LEVEL	SPEC	WORST CASE MEASURED	AVERAGE
5.5×10^{-5}	5	9.3	10.5
5.5×10^{-4}	34.8	93.5	102.2
1.1×10^{-3}	62.3	145.7	172.4
2.2×10^{-3}	112	175.3	241.8
4.4×10^{-3}	200	281.3	356.8

ATTACHMENT: OLS #21 HRD Channel SNR Graph

OLS 21 HRD CHANNEL SNR



2.6 NOISE (Cont'd)

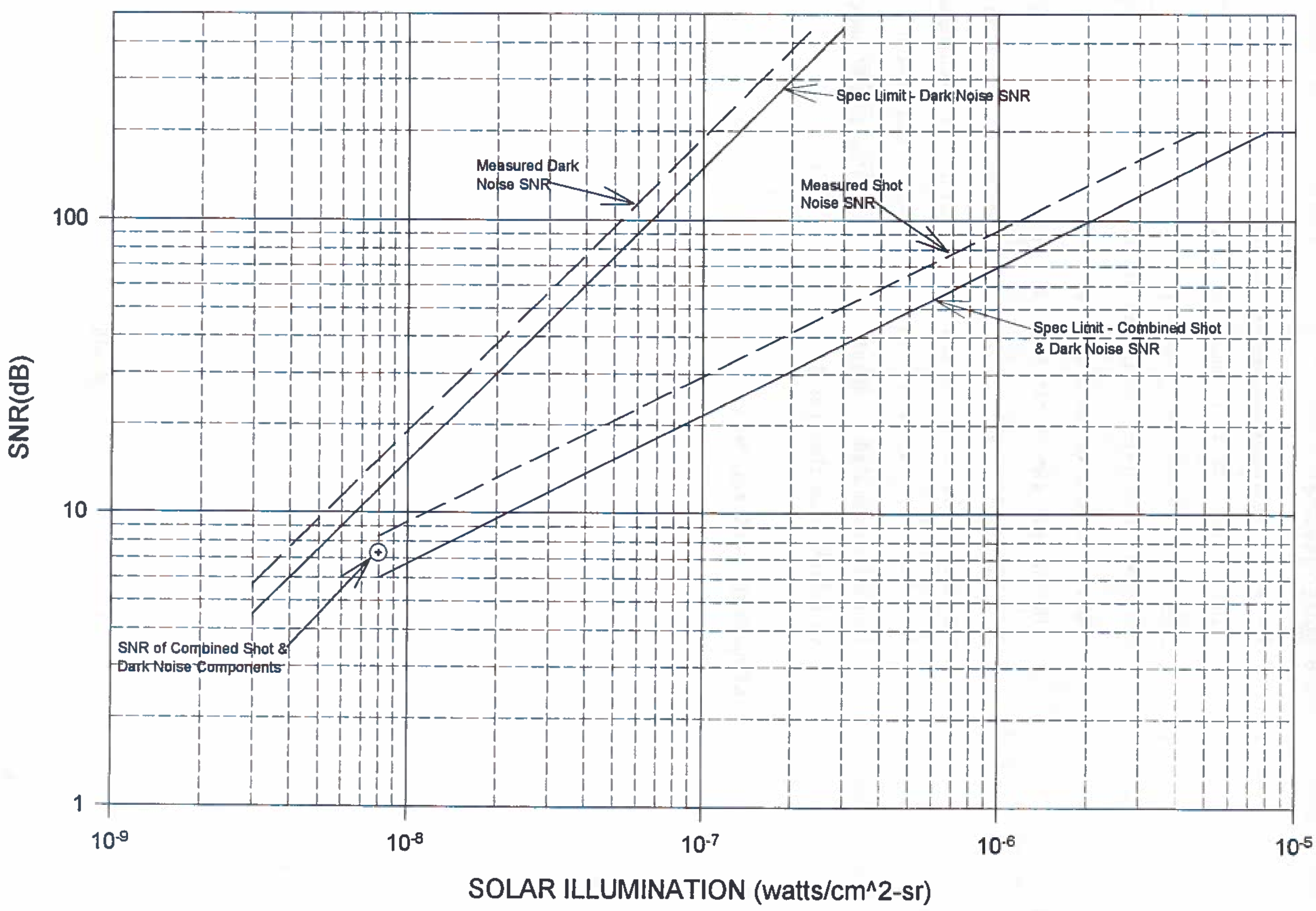
2.6.3 L Channel Noise (Night) 3.2.1.1.6.3)

The PMT dark noise is measured in all environments in Tests 6x3x1.ST, 6x3x2.ST and 6x3x4.ST. The SNR is calculated from the measured noise (std. deviation of multiple voltage samples) vs. light level and compared against spec values.

The minimum (worst case) OLS #21 PMT Shot Noise SNR was 8.3 at 8.0×10^{-9} watts/cm^2-sr. The worst case measured Dark Noise SNR was 15.2 which is better than the specification requirement of 12. The worst case combined PMT shot noise and dark noise SNR is 7.28 calculated as $SNR=1/\sqrt{1/(SNR\ dark)^2 + 1/(SNR\ shot)^2}$ which is better than the spec limit of 6.0..

ATTACHMENT: OLS #21 PMT channel SNR graph.

OLS21 PMT CHANNEL SNR



2.6 NOISE (Cont'd)

2.6.4 Dark Current (3.2.1.1.6.4)

The Dark Current (the PMT noise with no signal input) is determined from the graph of PMT SNR in paragraph 2.6.3. The Dark Noise SNR is calculated from data gathered during PMT Smoothed Noise measurements. These measurements are made in Test 6x3x1.ST during Thermal Vacuum testing. For OLS #21 the average Dark Noise SNR at 8 x 10^{-9} watts/cm^2-SR is 19.3, or 31.1% of the noise corresponding to an SNR of 6. The MINIMUM Dark Noise SNR measured at 8 x 10^{-9} watts/cm^2-SR was 15.2, or 9.5% of the noise corresponding to a SNR of 6. This is well within the spec requirement for the dark current to be 50% or less of the noise corresponding to an SNR of 6.00.

2.6 NOISE. (Cont'd)

2.6.5 Stability (3.2.1.1.6.5) (L - Channel (night)

The OLS 5D-3 System Summary Report contains the analysis for this spec requirement.

The loss in sensitivity after 3 years on orbit of the PMT channel will be < 23%. This would require 2.27dB change in VDGA gain to compensate and over 6dB of VDGA gain is available.

ATTACHMENT: None.

2.6 NOISE (Cont'd)

2.6.6 Along-Track Noise Integration (3.2..1.1.6.6)

OLS 5D-3 System Summary Report contains the analysis which concludes that the OLS 5D-3 algorithm is consistently above 0.6 times the SNR resulting from perfect integration with 8 bit A/D for T Channel; and above $1/\sqrt{2}$ times the SNR resulting from perfect integration with 6-bit A/D for L channel. Therefore, the Along-Track Noise Integration is in-spec.

ATTACHMENT: None.

2.6 NOISE. (Cont'd)

2.6.7 Glare Suppression (3.2.1.1.6.7)

OLS 5D-3 System Summary Report contains the analysis which verifies that the OLS does provide effective protection against solar glare for sun angles between 75° and 95°.

ATTACHMENTS: None.

2.7 SURVIVABILITY (3.2.7)

The OLS 5D-3 System Summary Report contains calculations of survivability. OLS testing has provided values of A=41.6 and B=0.50 for A and B as defined in BVS 2740. This BVS - Verification of Survivability Requirements - provides an unclassified reference for verification of the survivability requirements for OLS's 17 thru 21. Unitless OLS system test values will be provided in the System test and Verification Plan Volume IV - Verification Matrix and the Acceptance Test Report. These values will be referenced to classified reports published for OLS 12 thru 16 as an aid in the interpretation of the test results.

The survivability specification, paragraph 3.2.7 of S-DMSP-886, references classified requirements for OLS 17 thru 21 as identified in BVS 2104, Rev. A. Unitless test values "A" and "B" published in each System Test and Verification Plan Volume IV-Verification Matrix and in the Acceptance Test Report for OLS's 17 thru 21 support this requirement. Classified BVS 2353 published for OLS 12 thru 16 under contract F04701-83-C-0048 is used for reference to interpret the measured values for "A" and "B". Value "A" is to be interpreted as that requirement specified in paragraph 3.2.1 of BVS 2353. Value "B" is to be interpreted as that requirement specified in paragraph 3.3.1 of BVS 2353.

ATTACHMENTS: None.

2.8 SCAN ANGLE (3.2.1.1.8)

Tests 6x7x1.ST and 6x7x3.ST (End of Scan Vignette for HRD & T channels respectively) measure the delphi number at which 1% vignetting of scene begins to occur. The measured delphis enable calculation of the altitude needed to obtain contiguous coverage at the equator. The contiguous coverage requirement is based on the average of +Z and -Z scan angles.

For OLS #21, the following results were obtained:

CHANNEL	DELPHI	SCAN ANGLE	CONTIGUOUS COVERAGE ABOVE:	
+Z HRD	+990.5	+55.93°	427.88 n. mi.	428.97 avg.
-Z HRD	-988.5	-55.82°	430.06 n. mi.	
+Z T	+981.0	+55.39°	438.28 n. mi.	435.54 avg.
-Z T	-986.0	-55.68°	432.79 n. mi.	

Thus, both the HRD channel and the T channel meet the requirements for contiguous coverage above 440 naut. mi, since both channels will provide contiguous coverage for all altitudes above 435.54 naut. mi.

ATTACHMENTS: None.

2.9 DATA COLLECTION RATE (3.2.1.1.9)

OLS #21 does scan the field of view at the prescribed 11.88 +/- .12 Hz rate. This parameter is measured in Scanner Functional tests 5x12x1.ST (Primary Side) and 5x12x2.ST (Redundant Side).

The test results are summarized below for all TV tests:

Date	Frequency, Hz Primary	Redundant
11-01-94 Optic Limit	11.90	11.90
11-14-94 Optic Limit	11.92	11.91
11-28-94 Cold Limit	11.92	11.92
12-02-94 Hot Limit	11.90	11.90

ATTACHMENTS: None.

2.10 POWER (3.2.1.3.1 and 3.2.1.3.2)

Both +28V and +5V power is measured and monitored continuously throughout all of the test sequence.

The power required in the eight Development-Spec-defined modes is tabulated below. The Development Spec Power Profile is measured in test 5x2x11.ST for modes 1 through 8 and 5x2x2.ST for mode 0.

10V power consumption is not tested. The current system test equipment is not capable of monitoring 10V power. Analysis of the components using S/C supplied 10V power indicates that 5D-3 10V power consumption is in spec.

S-DMSP-886 limits 28V power consumed for SSS thermal control to 23 watts maximum. SSS heater power consumption was not measured. Analysis of the heater resistances and tolerances indicates that 5D-3 SSS heater power consumption is in spec.

OLS #21 28V power consumption is in spec for all modes in the primary and redundant configurations. Fallback (dual power) configuration power consumption is also in spec. See the attached table for further details.

ATTACHMENTS: OLS #21 Power Profile

OLS #21 POWER PROFILE

SINGLE POWER			DUAL POWER	
28V MODE/LIMIT	TV COLD LIMIT 11-27-94	TV HOT LIMIT 12-02-94	28V LIMIT	**WORST CASE (CALCULATED)
0 88W	41	42	131W	62
1 105W	69	71	148W	91
2 116W	78	80	159W	100
3 125W	86	87	168W	107
4 157W	119	121	200W	141
5 167W	128	130	210W	150
6 198W	152	155	241W	175
7 207W	167	170	250W	190
8 218W	177	180	261W	200
5V MODE/LIMIT				
0 6.0W	3	4		
1 6.0W	3	4		
2 6.0W	3	4		
3 6.0W	3	4		
4 6.0W	3	4		
5 6.0W	3	4		
6 6.0W	3	4		
7 6.0W	3	4		
8 6.0W	4	5		

2.11 MASS

2.11.1 Total Mass (3.2.2-1)

The total weight of OLS #21 is 286.9 lbs. excluding the 9RA5255H27 cable which has not yet shipped as shown in Table 2.11.1. The tape recorders to be delivered with OLS 21 are currently unspecified. The max spec limit of 91 lbs. for total tape recorder weight was used to calculate the total weight. Since the weight of the 9RA5255H27 cable is typically between eight and nine lbs., the maximum weight specification of 300 lbs. will not be exceeded.

2.11.2 Component Mass (3.2.2.2)

All Westinghouse furnished parts meet their center of gravity specification limits and their maximum specified weight allocation as shown in Table 2.11.1.

ATTACHMENT: Table 2.11.1 - OLS #21 Weight and Center-of-Gravity Table

REVISED TABLE - RELEASED
PER 01C41 1330 6/14/00

TABLE 2.11.1

WESTINGHOUSE FURNISHED PARTS SUPPLIED WTH OLS 21 SYSTEM

SUMMARY OF WEIGHT AND CENTER OF GRAVITY

UNIT	UNIT SER.NO.	x(in)		y(in)		z(in)		WEIGHT (lbs.)	
		SPEC	ACT	SPEC	ACT	SPEC	ACT	MAX SPEC(1)	ACT
SSS	5016	1.8±0.5	1.67	6.2±0.5	6.18	0.7±0.5	0.60	59.0	58.21
SPS	5016	3.0±0.5	3.03	13.0±0.5	12.67	8.6±0.8	8.53	65.0	59.18
SPU	5016	3.0±0.5	2.91	6.6±0.5	6.67	6.0±0.5	5.81	20.5	18.81
PSU	5015	2.8±0.5	2.73	7.0±0.5	6.68	7.2±0.5	7.03	29.0	26.19
OSU	5016	1.2±0.25	1.30	4.0±0.5	4.20	2.5±0.5	2.68	4.5	3.56
GSSA/DOC	5016	4.2±0.5	4.44	0.1±0.3	0.02	3.0±0.5	2.70	9.0	7.20
PR1	TBD								
PR2	TBD								
PR3	TBD								
PR4	TBD								
CABLES	(5)							40.0	22.72(3)
BB4	7	1.25±1/8	1.14	2.62±1/8	2.72	2.25±1/8	2.37	4.0(6)	2.9(6)
								300(4)	286.9(2)

(1) S-DMSP-886 11 Feb. 1993
(2) Assumes MAX Spec Limit of 91 lbs. For PR's
(3) Excludes 9RA5255H27
(4) This is the max spec weight for the OLS AVE and is independent of the max spec weights imposed on individual units
(5) Serial Numbers are as recorded on data sheet
(6) The weight of BB4 is not included in the 300 lb requirement and is excluded from the weight calculation.

2.12 COOLER TRANSIENT MARGIN (3.2.2.5)

The T channel cone cooler transient cooldown cooling capacity margin is tested by the file 7x7.ST. An external power supply provides 1/2 Watt of heating to the outer stage of the cooler during a normal cooldown. On OLS #21 cone cooler S/N 032 successfully reached its operating set-point with 1/2 watt of external power applied, demonstrating the required margin.

ATTACHMENTS: None

2.13 DESIGN FEATURES

The following design features of the 5D-3 OLS are addressed in the analyses. The analyses are contained in the OLS 5D-3 System Summary Report. The requirements of the Design Features are met or exceeded in each category.

SUBJECT	SPEC. PARA.
DESIGN INTERFACES	(3.1.2)
RELIABILITY	(3.2.3)
WEAROUT/CONSUMPTION	(3.2.3.3)
STORAGE	(3.2.3.4)
CONTAMINATION CONTROL	(3.2.3.5)
CORROSION OF METAL PARTS	(3.2.3.6)
MAINTAINABILITY	(3.2.4)
INTERCHANGEABILITY	(3.3.5)

ATTACHMENTS: None.

2.14 REDUNDANT AND FALLBACK SUBSYSTEMS (3.2.3.1 & 3.2.3.2)

Paragraph 3.2.3.1 of the development spec requires the OLS to incorporate the following redundant subsystems:

(1) Along-Scan Gain Control

(2) Main Bus Power Supplies

(3) Data Processors

(4) Memories

(5) I/O Interfaces

- a. Bus Controls
- b. I/O Controls
- c. S/C Interfaces
- d. WOW/Flutter Signals/Clock Drivers
- e. Drive Motor Controls
- f. Sensor Controls
- g. Gain Controls
- h. Encoder Processors

(6) Data Channels

- a. Smooth Video Filters
- b. Fine Video Filters
- c. T-Channel Post Amplifiers
- d. SDS Channel
- e. SDF Channel
- f. RTD Channel
- g. Special Sensor Processors
- h. Output Data Multiplexers
- i. RDS Channel

(7) Output Switching Unit Oscillator and Clock Circuits

(8) Digital Tape Recorders - (Three of Four Required)

(9) Output Data Channels - (Three of Four Required)

Paragraph 3.2.3.2 requires the OLS to incorporate the following fallback subsystems:

(1) IMC Shut-Off Mode.

(2) HRD - Detector Single Segment Select, with associated electronics.

(3) T-Detector Single Segment Select, with associated electronics.

(4) Digital Generation of Delphi Scanner Clock.

(5) PMT Shut-Off Mode

Redundant and fallback subsystems are verified by test during the normal test flow either by repetition of the relevant test on the alternate subsystem (in the case of a redundant subsystem) or by tests designed to verify the specific subsystem (in the case of a fallback subsystem). In each case, any out-of-specs or anomalies are reported as part of the relevant Test Report paragraph.

2.15 ENVIRONMENT

The following enviromental requirements are addressed in analyses and are contained in the OLS 5D-3 System Summary Report. The Thermal Vacuum (except CHA), Random Vibration, and shock requirements are verified by the sucessful completion of the approved Test Procedure.

The 5D-3 Environmental requirements of the Development Specification are met or exceeded by the OLS #21 AVE.

SUBJECT	SPEC. PARA
GROUND ENVIRONMENT	20.2.1
LAUNCH ENVIRONMENT	20.2.2
THERMAL VACUUM (CHA)	20.2.2.1
ACCELERATION	20.2.2.5
CHARGED PARTICLE ENVIRONMENT	20.2.2.6
LAUNCH PRESSURE PROFILE	20.2.2.8
ACCOUSTIC FIELD	20.2.2.9
TRANSPORATION & HANDLING ENVIRONMENT	20.2.3

ATTACHMENTS: None.

3.0 INTERFACE SPECIFICATION REQUIREMENTS

Electrical Interface parameters are measured in the OLS Detailed Electrical Test (T927989) and the OLS Special Sensor Detailed Electrical Test (T927992). These tests demonstrated conformance with all applicable Interface Specification requirements. The only Interface related system measurements that vary significantly from system to system are the SSS Alignment axes which are included here.

3.1 SSS ALIGNMENT AXES

The OLS #21 SSS Reference Plane axes are within the specification allowances. The results of system test and calculation are given below. The designations are those in Interface Spec ICD-88802, para. 3.2.3.2.

SECONDARY REFERENCE AXES TO PRIMARY AXES	SECONDARY REFERENCES AXES TO MOUNTING (INTERFACE) AXES
X_{R-P} = 0.422 mrad = 87 arc sec	X_{R-M} = 0.209 mrad = 43 arc sec
Y_{R-P} = 0.441 mrad = 91 arc sec	Y_{R-M} = 0.291 mrad = 60 arc sec
Z_{R-P} = 0.116 mrad = 24 arc sec	Z_{R-M} = 0.150 mrad = 31 arc sec

These are within the specification limits of 600 arc seconds. The Mounting (Interface) Axes to Primary axes are also calculated, using the computer program REFPLN and are given below:

X_{M-P} = 0.218 mrad = 45 arc sec

Y_{M-P} = 0.286 mrad = 59 arc sec

Z_{M-P} = 0.223 mrad = 46 arc sec

These are within the specification limits of 120 arc seconds.