GroundControl 1.2m TOUGHSAT XP Technical Parameters

Characteristic	**Ku-band**
Reflector Type & Diameter	Prodelin Model 1123 / 1.2m
Type of Antenna	Offset - Linear with cross pole feed
Peak Power (SSPA)	6 W (standard)
Transmit Bandwidth	3 MHz to 10 MHz
Transmit Gain	43.20 dBi
EIRP	50.98 dBW
Data Rate	6 Mbps (Tx) / 1.2 Mpbs (Rx)
Emission Designators (high/low)	6M00G7D – 10M00G7D
Transmit Polarization	Horizontal
Transmit Max PSD	-17 dBW/4kHz
Transmit Beamwidth	1.18 degrees @ 3dB
Receive G/T	19.5 dB/K
Receive Bandwidth	Up to 5 MHz
Receive Polarization	Vertical
Output Power	6 W
ERP	76.4 kW
Signal Modulation	DVB-S2

TOUGHSAT XP Motion Parameters

Azimuth	410°
Elevation	165°
Position accuracy	0.1°
Tracking capability	Geostationary only

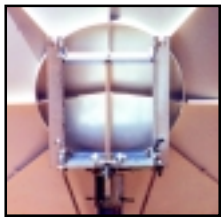
PRODELIN™
A TriPoint Global Company

Receive/Transmit

Series 1123 & 1125

1.2M KU-BAND RX/TX SERIES 1123 & 1125

Prodelin Corporation is the world's largest manufacturer of Rx/Tx VSAT antennas. We have the broadest product line in the industry including Receive Only, Rx/Tx and Rural Telephony antenna systems. Prodelin offers nineteen antenna sizes, 47cm to 4.5M. Prodelin is the leader in obtaining type certifications and approvals for Intelsat, AsiaSat and Eutelsat. Prodelin antennas provide the best quality in the market due to the sophisticated, precision SMC compression molding process technology. Prodelin provides the best value antenna solution to the market with competitive prices, the highest quality products and superb engineering support. Prodelin is ISO registered, KEMA # 70022.01. *Prodelin - The Market Leader in VSAT Antennas.*



Back View
Series 1123

Back View
Series 1125

Option
Feed Horn w/ OMT &
Transmit Reject Filter

Key Features

- Precision Compression Molded Offset Reflector
- Fully Galvanized Steel Mounts
- Optional Non-Penetrating Mast Mount Available
- Reflector/Feed Electrical Anti-Icing Available
- Low Cost Shipping and Easy Local Handling

(828) 464-4141

Receive/Transmit
Series 1123 & 1125

1.2M KU-BAND RX/TX SERIES 1123 & 1125

Electrical		Series 1123 & 1125 Ku-Band	
Antenna Size		1.2 M (48 in.)	
Operating Frequency (GHz)	Receive	10.95 - 12.75	
	Transmit	14.0 - 14.5	
Midband Gain (± .2dB)	Receive	41.7 dBi	
	Transmit	43.2 dBi	
Antenna Noise Temperature			
20° elevation		46 K	
30° elevation		43 K	
Sidelobe Envelope, Co-Pol (dBi)			
$1° \leq \theta \leq 20°$		29-25 Log θ	
$20° < \theta \leq 26.3°$		- 3.5 dBi	
$26.3° < \theta \leq 48°$		32 -25 Log θ	
$48° < \theta$		-10 dBi (averaged)	
Feed Interface		Available in a variety of designs	
Insertion Loss		0.2 dB max.	
Cross -Pol Isolation		>30 dB (on axis)	
VSWR		1.3:1 Max.	
Mechanical			
Reflector Material		Glass Fiber Reinforced Polyester SMC	
Antenna Optics		Prime Focus, Offset Feed	
Mount Type		Elevation over Azimuth	
Mast Pipe Size		2.5" SCH 40 Pipe (2.88" OD) 7.32 cm	
		Series 1123	***Series 1125***
Elevation Adjustment Range		5° to 90° Continuous Fine Adjustment	12° to 90° Continuous Fine Adjustment
Azimuth Adjustment Range		360° Continuous, ± 35° Fine	360° Continuous
Shipping Specifications		83 lbs. (37.6 kg.)	61 lbs. (27.7 kg.)
Environmental Performance			
Wind Loading	Operational	50 mph (80 km/h)	
	Survival	125 mph (201 km/h)	
Temperature	Operational	-40° to 140° F (-40° to 60° C)	
	Survival	-50° to 160° F (-46° to 71° C)	
Rain	Operational	1/2" /hr	
	Survival	2" /hr	
Ice	Operational	--------	
	Survival	1/2" radial	
Atmospheric Conditions		Salt, Pollutants and Contaminants as Encountered in Coastal and Industrial Areas	
Solar Radiation		360 BTU/h/ft^2	

PRODELIN™
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1700 NE Cable Drive • Conover, NC 28613 USA
Tel: (828) 464-4141 • Fax: (828) 466-0860
www.prodelin.com

5002-351 (5-2000)

Annex 1 – Antenna Performance Plots

GENERAL DYNAMICS
C4 Systems

Antenna Test Report
Test No. 1629

Prodelin Series 1123
1.2m Ku-Band RX / TX Antenna System

General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650
828-428-1485 / 828-428-1488 fax

GENERAL DYNAMICS
C4 Systems

General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

TABLE OF CONTENTS

Section I

Gain Analysis

Prodelin Series 1123 1.2M
Ku-Band Rx/Tx Antenna System
Test No. 1629

Frequency In GHz	Polarization	Gain In dBi
10.95	Vertical	41.0
11.95	Vertical	41.7
12.75	Vertical	42.4
14.00	Vertical	43.0
14.25	Vertical	43.2
14.50	Vertical	43.5

Frequency In GHz	Polarization	Gain In dBi
10.95	Horizontal	41.0
11.95	Horizontal	41.7
12.75	Horizontal	42.4
14.00	Horizontal	43.0
14.25	Horizontal	43.2
14.50	Horizontal	43.5

General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

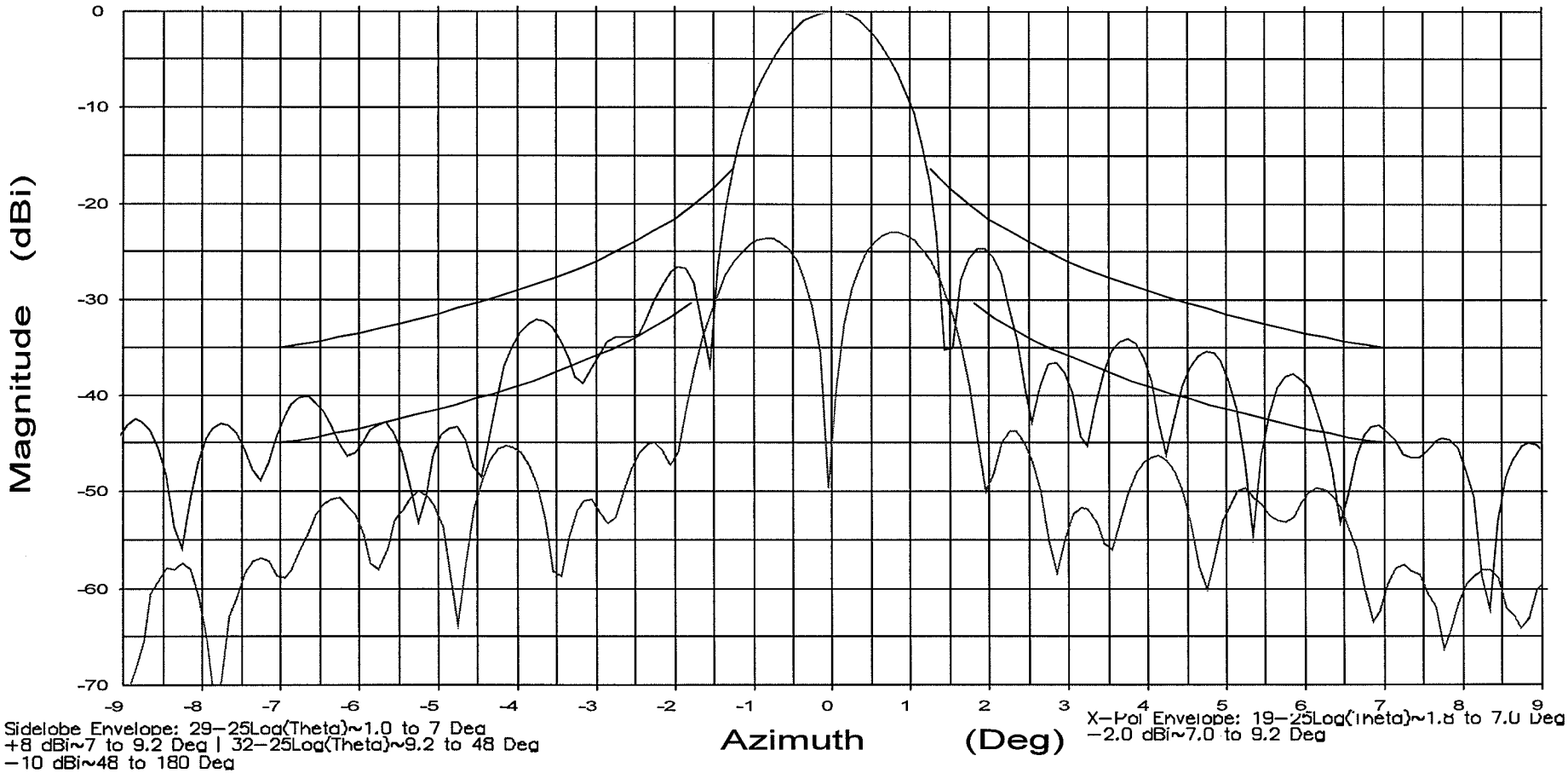
Section II

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 14.000 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Vert. Rx pol: Vert.



Sidelobe Envelope: 29−25Log(Theta)~1.0 to 7 Deg
+8 dBi~7 to 9.2 Deg | 32−25Log(Theta)~9.2 to 48 Deg
−10 dBi~48 to 180 Deg

X-Pol Envelope: 19−25Log(Theta)~1.8 to 7.0 Deg
−2.0 dBi~7.0 to 9.2 Deg

Overlays	Cal. file	table	channel	units
1629-14.dat-ant_under_test——	1629-14.dat	SGH-110	ch1	dBi
1629-20.dat-ant_under_test——	1629-20.dat	SGH-110	ch1	dBi

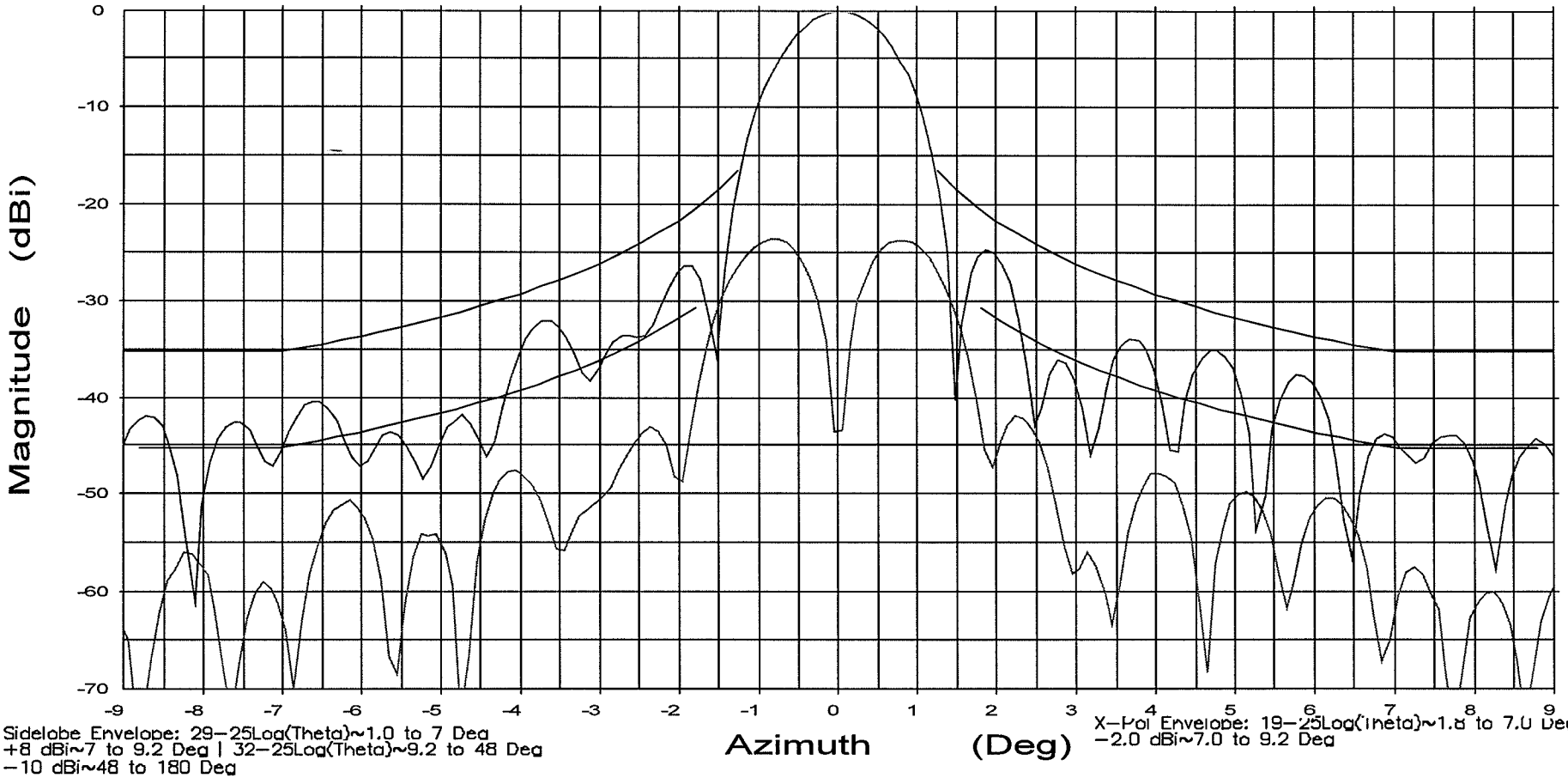
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 14.250 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Vert. Rx pol: Vert.



Sidelobe Envelope: 29−25Log(Theta)~1.0 to 7 Deg
+8 dBi~7 to 9.2 Deg | 32−25Log(Theta)~9.2 to 48 Deg
−10 dBi~48 to 180 Deg

X−Pol Envelope: 19−25Log(Theta)~1.8 to 7.0 Deg
−2.0 dBi~7.0 to 9.2 Deg

Overlays	Cal. file	table	channel	units
1629-14.dat-ant_under_test——	1629-14.dat	SGH-110	ch1	dBi
1629-20.dat-ant_under_test——	1629-20.dat	SGH-110	ch1	dBi

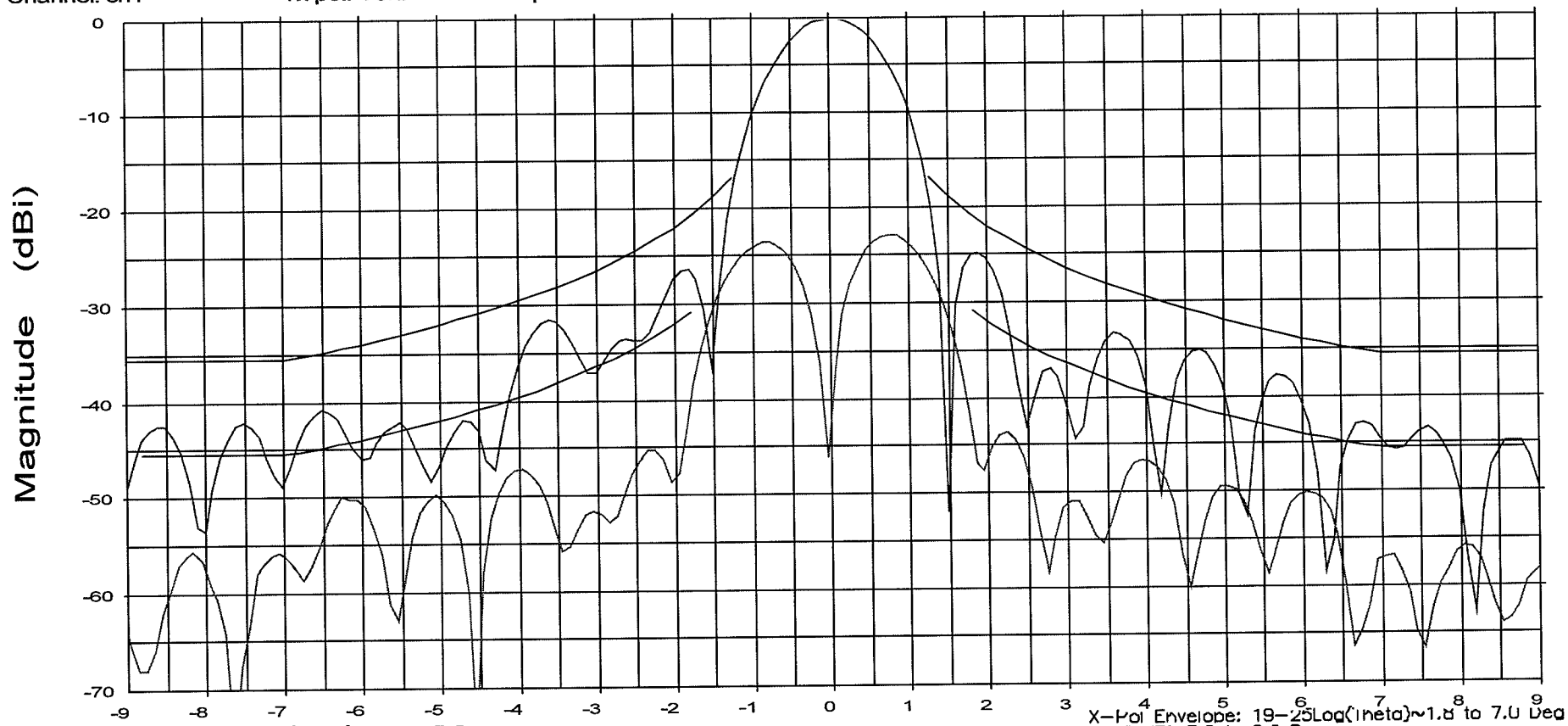
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 14.500 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Vert. Rx pol: Vert.



Sidelobe Envelope: 29−25Log(Theta)~1.0 to 7 Deg
+8 dBi~7 to 9.2 Deg | 32−25Log(Theta)~9.2 to 48 Deg
−10 dBi~48 to 180 Deg

X−Pol Envelope: 19−25Log(Theta)~1.0 to 7.0 Deg
−2.0 dBi~7.0 to 9.2 Deg

Overlays	Cal. file	table	channel	units
1629-14.dat-ant_under_test——	1629-14.dat	SGH-110	ch1	dBi
1629-20.dat-ant_under_test——	1629-20.dat	SGH-110	ch1	dBi

General Dynamics SATCOM Technologies
East Maiden Test Facility
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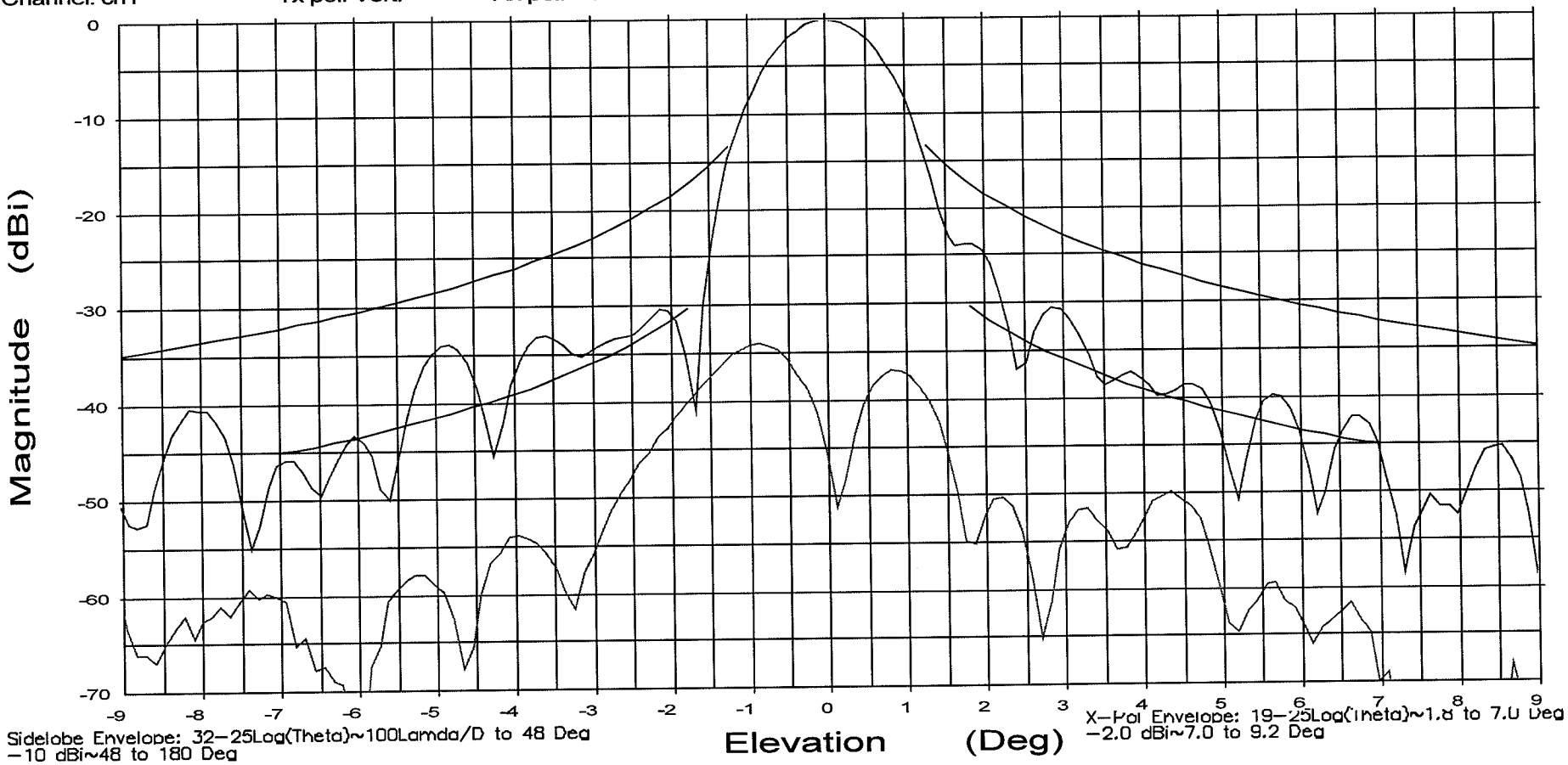
File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 14.000 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Vert. Rx pol: Vert.



Overlays	Cal. file	table	channel	units
1629-19.dat-ant_under_test——	1629-19.dat	SGH-110	ch1	dBi
1629-21.dat-ant_under_test——	1629-21.dat	SGH-110	ch1	dBi

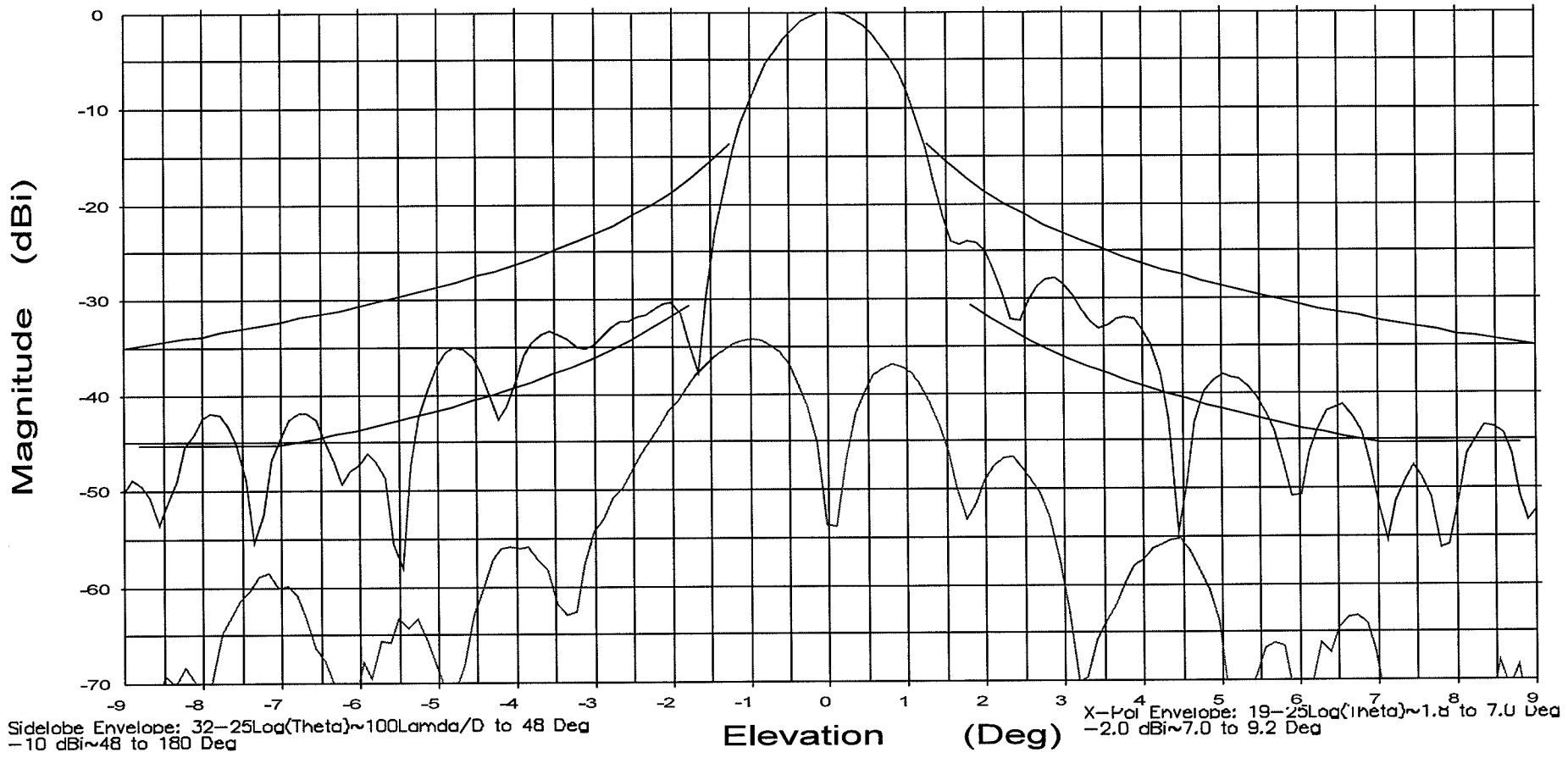
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 14.250 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Vert. Rx pol: Vert.



Overlays	Cal. file	table	channel	units
1629-19.dat-ant_under_test——	1629-19.dat	SGH-110	ch1	dBi
1629-21.dat-ant_under_test——	1629-21.dat	SGH-110	ch1	dBi

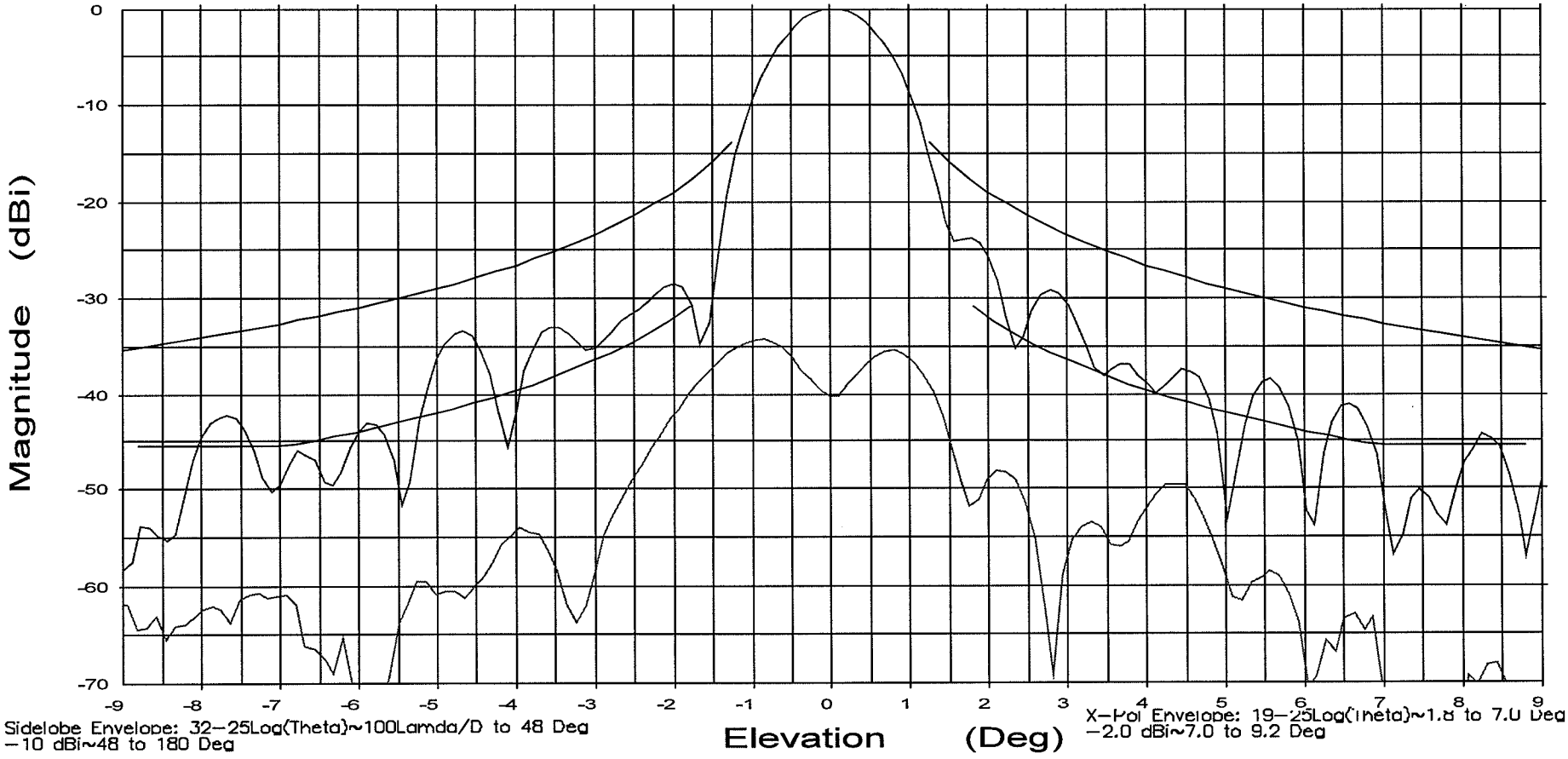
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 14.500 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Vert. Rx pol: Vert.



Overlays	Cal. file	table	channel	units
1629-19.dat-ant_under_test——	1629-19.dat	SGH-110	ch1	dBi
1629-21.dat-ant_under_test——	1629-21.dat	SGH-110	ch1	dBi

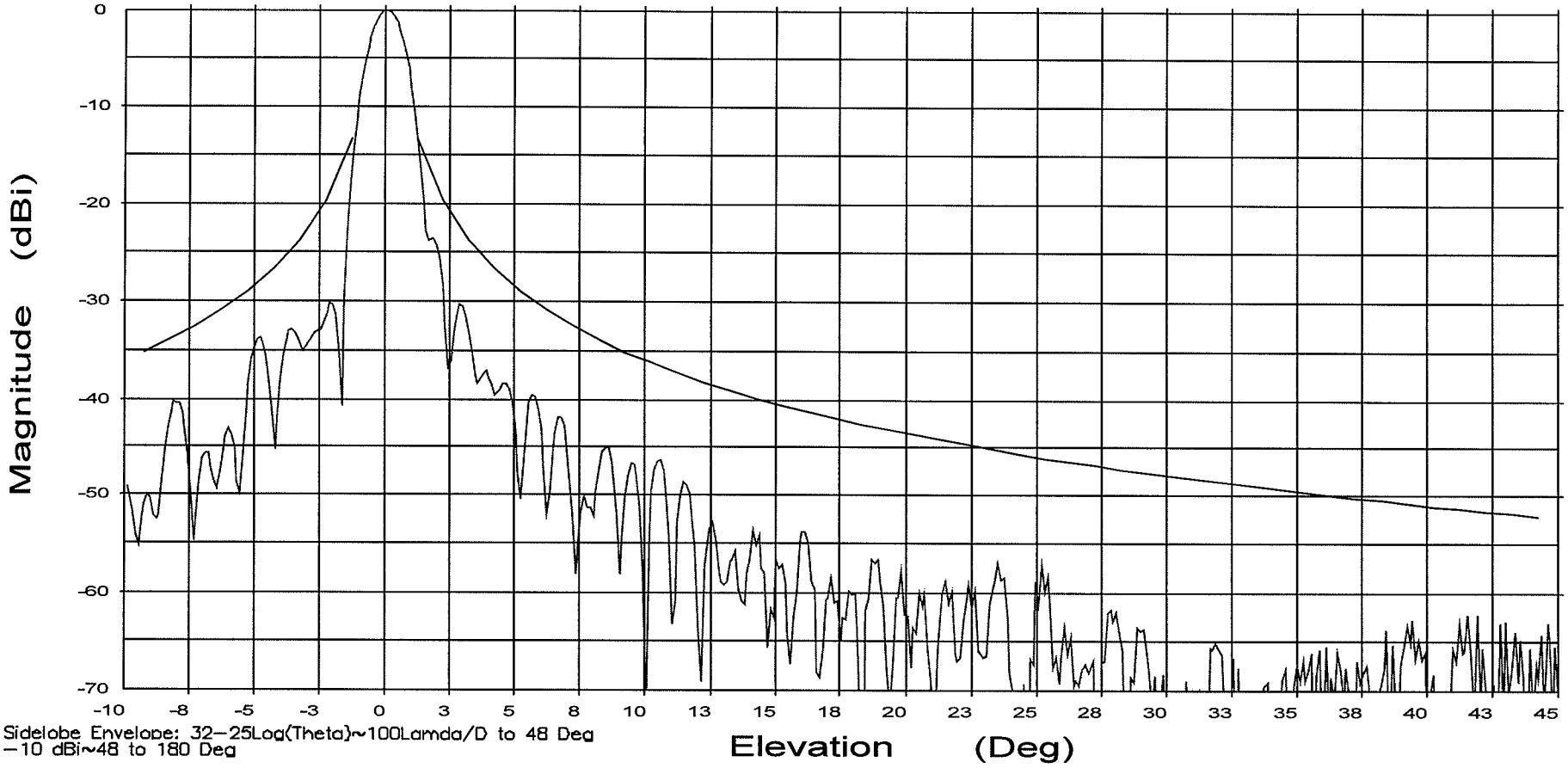
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 14.000 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Vert. Rx pol: Vert.



Sidelobe Envelope: 32−25Log(Theta)~100Lamda/D to 48 Deg
−10 dBi~48 to 180 Deg

Overlays	Cal. file	table	channel	units
1629-19.dat-ant_under_test——	1629-19.dat	SGH-110	ch1	dBi

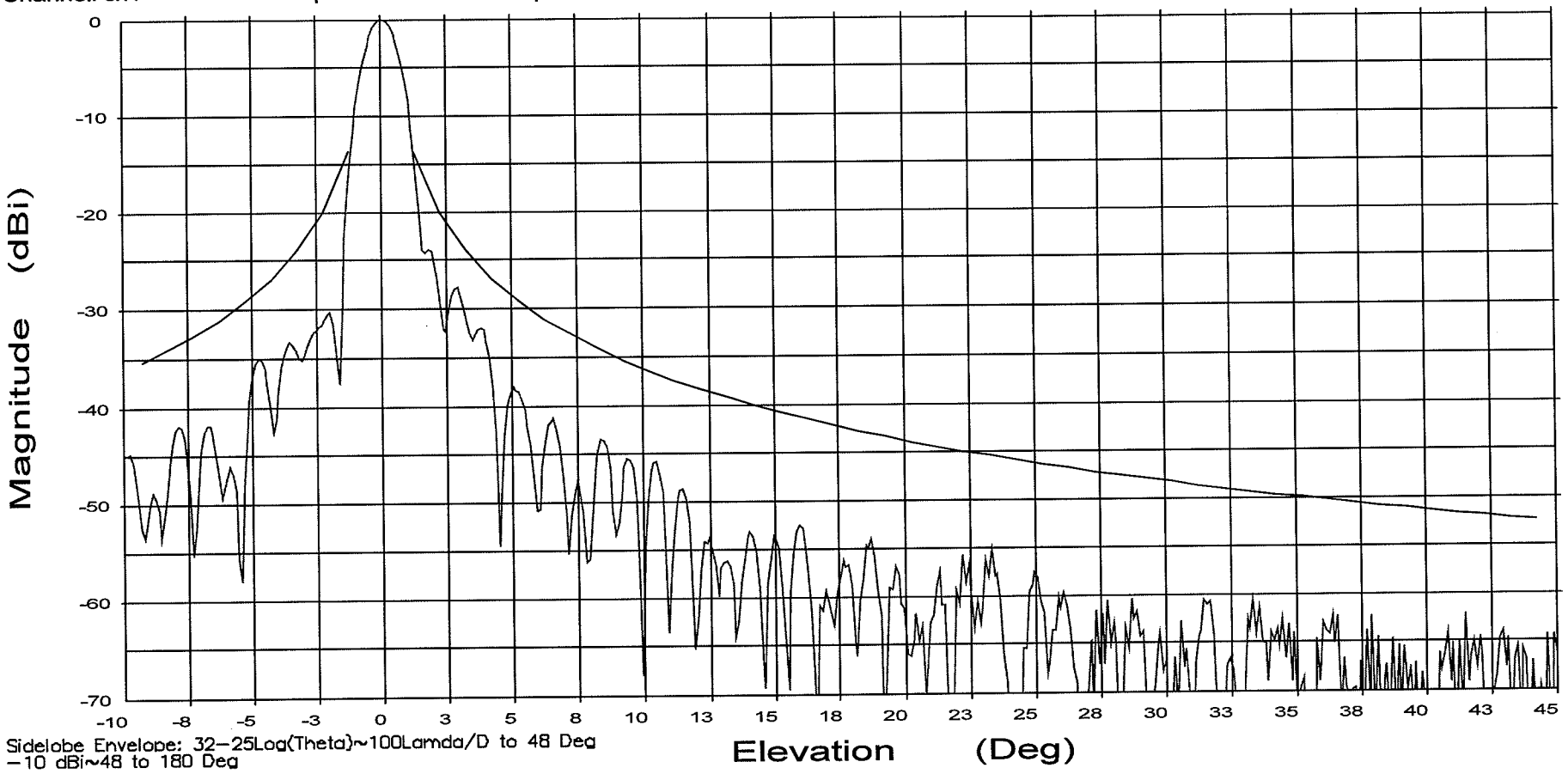
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 14.250 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Vert. Rx pol: Vert.



Sidelobe Envelope: 32-25Log(Theta)~100Lamda/D to 48 Deg
-10 dBi~48 to 180 Deg

Overlays	Cal. file	table	channel	units
1629-19.dat-ant_under_test——	1629-19.dat	SGH-110	ch1	dBi

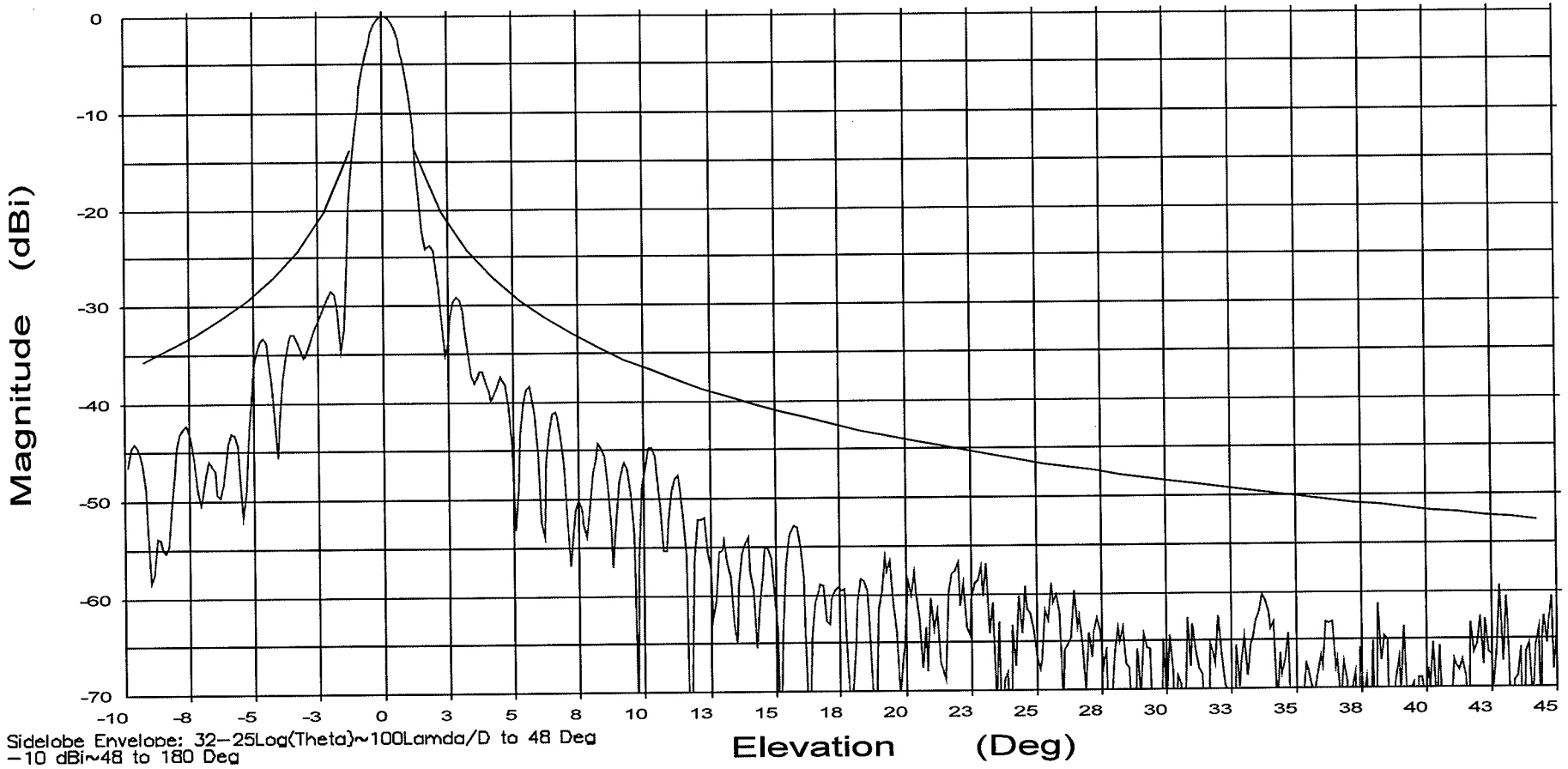
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 14.500 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Vert. Rx pol: Vert.



Sidelobe Envelope: 32-25Log(Theta)~100Lamda/D to 48 Deg
-10 dBi~48 to 180 Deg

Overlays	Cal. file	table	channel	units
1629-19.dat-ant_under_test——	1629-19.dat	SGH-110	ch1	dBi

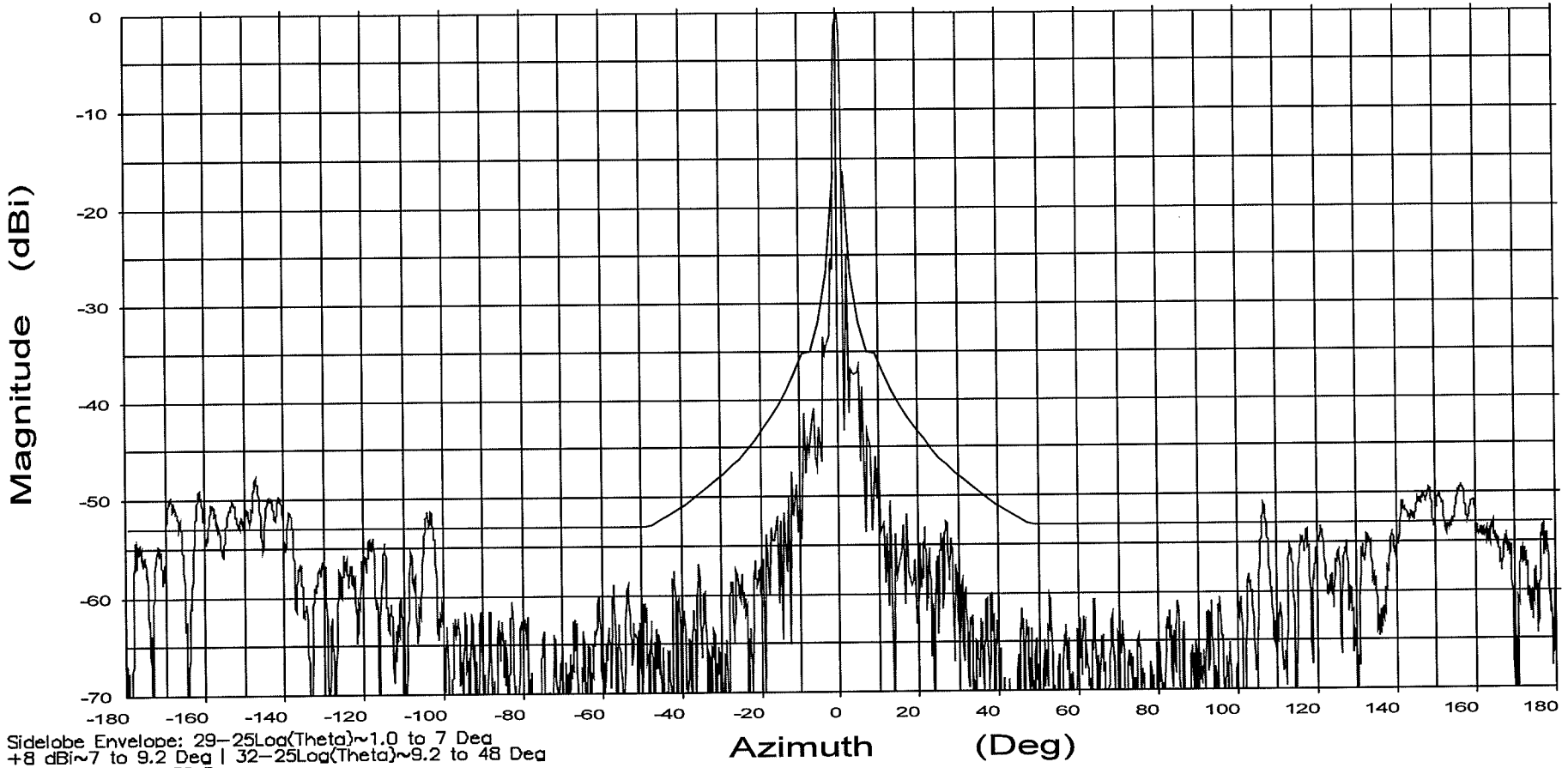
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 14.000 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Vert. Rx pol: Vert.



Sidelobe Envelope: 29−25Log(Theta)~1.0 to 7 Deg
+8 dBi~7 to 9.2 Deg | 32−25Log(Theta)~9.2 to 48 Deg
−10 dBi~48 to 180 Deg

Overlays	Cal. file	table	channel	units
1629-14.dat-ant_under_test——	1629-08.dat	SGH-110	ch1	dBi

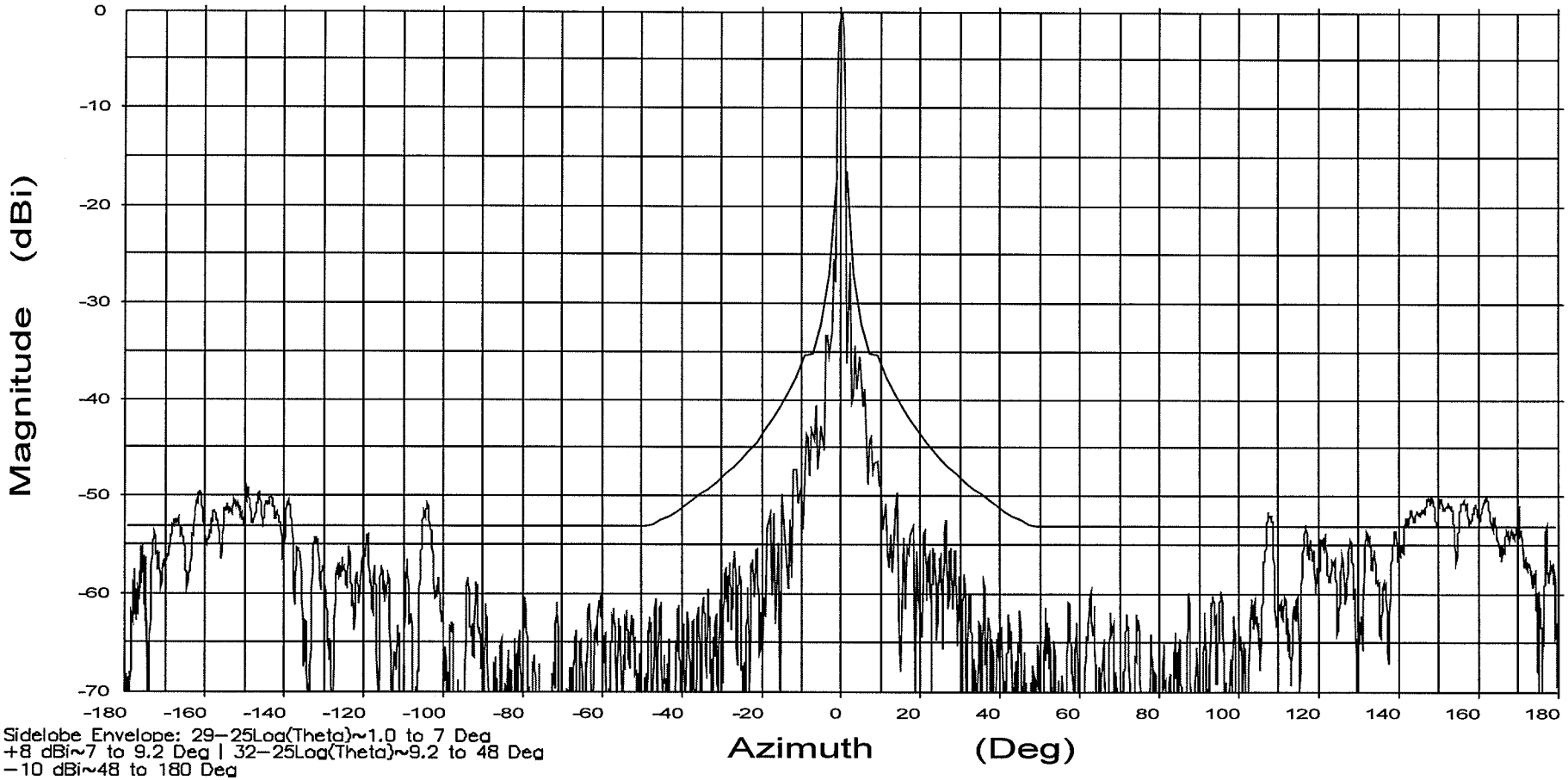
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 14.250 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Vert. Rx pol: Vert.



Sidelobe Envelope: 29−25Log(Theta)~1.0 to 7 Deg
+8 dBi~7 to 9.2 Deg | 32−25Log(Theta)~9.2 to 48 Deg
−10 dBi~48 to 180 Deg

Overlays	Cal. file	table	channel	units
1629-14.dat-ant_under_test——	1629-08.dat	SGH-110	ch1	dBi

General Dynamics SATCOM Technologies
East Maiden Test Facility
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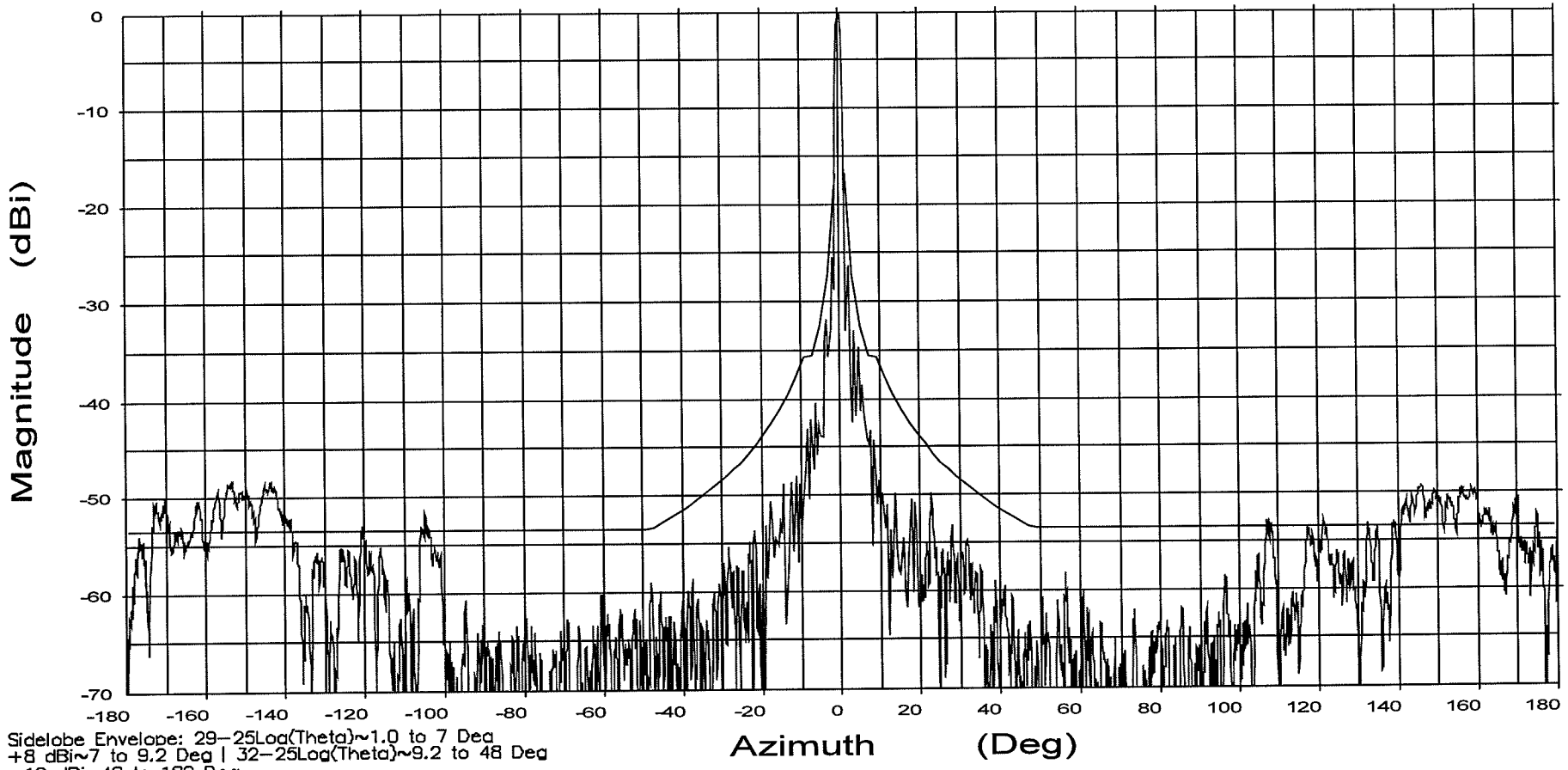
File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 14.500 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Vert. Rx pol: Vert.



Sidelobe Envelope: 29−25Log(Theta)~1.0 to 7 Deg
+8 dBi~7 to 9.2 Deg | 32−25Log(Theta)~9.2 to 48 Deg
−10 dBi~48 to 180 Deg

Overlays	Cal. file	table	channel	units
1629-14.dat-ant_under_test——	1629-08.dat	SGH-110	ch1	dBi

General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

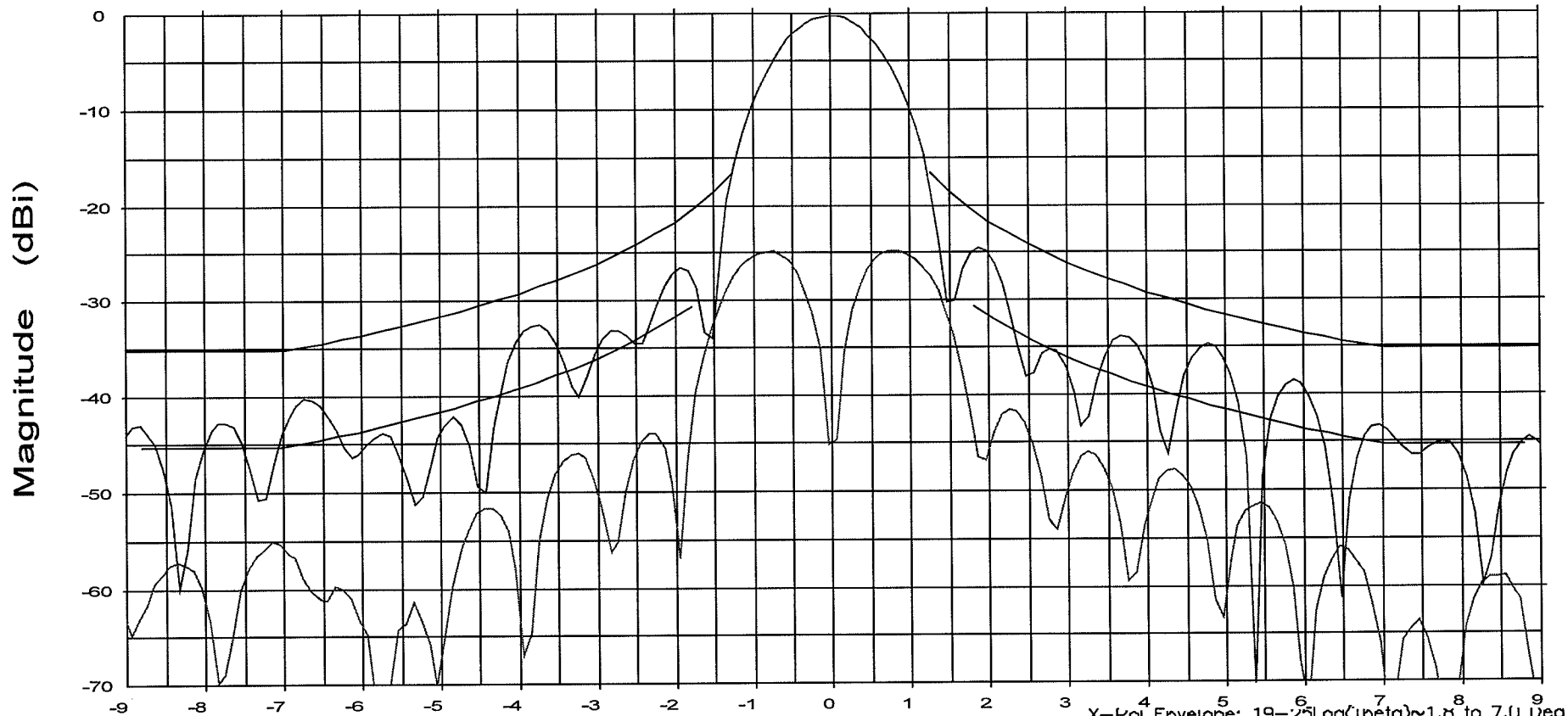
Section III

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 14.000 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Horiz. Rx pol: Horiz.



Sidelobe Envelope: 29−25Log(Theta)~1.0 to 7 Deg
+8 dBi~7 to 9.2 Deg | 32−25Log(Theta)~9.2 to 48 Deg
−10 dBi~48 to 180 Deg

X-Pol Envelope: 19−25Log(Theta)~1.8 to 7.0 Deg
−2.0 dBi~7.0 to 9.2 Deg

Overlays	Cal. file	table	channel	units
1629-29.dat-ant_under_test——	1629-29.dat	SGH-110	ch1	dBi
1629-32.dat-ant_under_test——	1629-32.dat	SGH-110	ch1	dBi

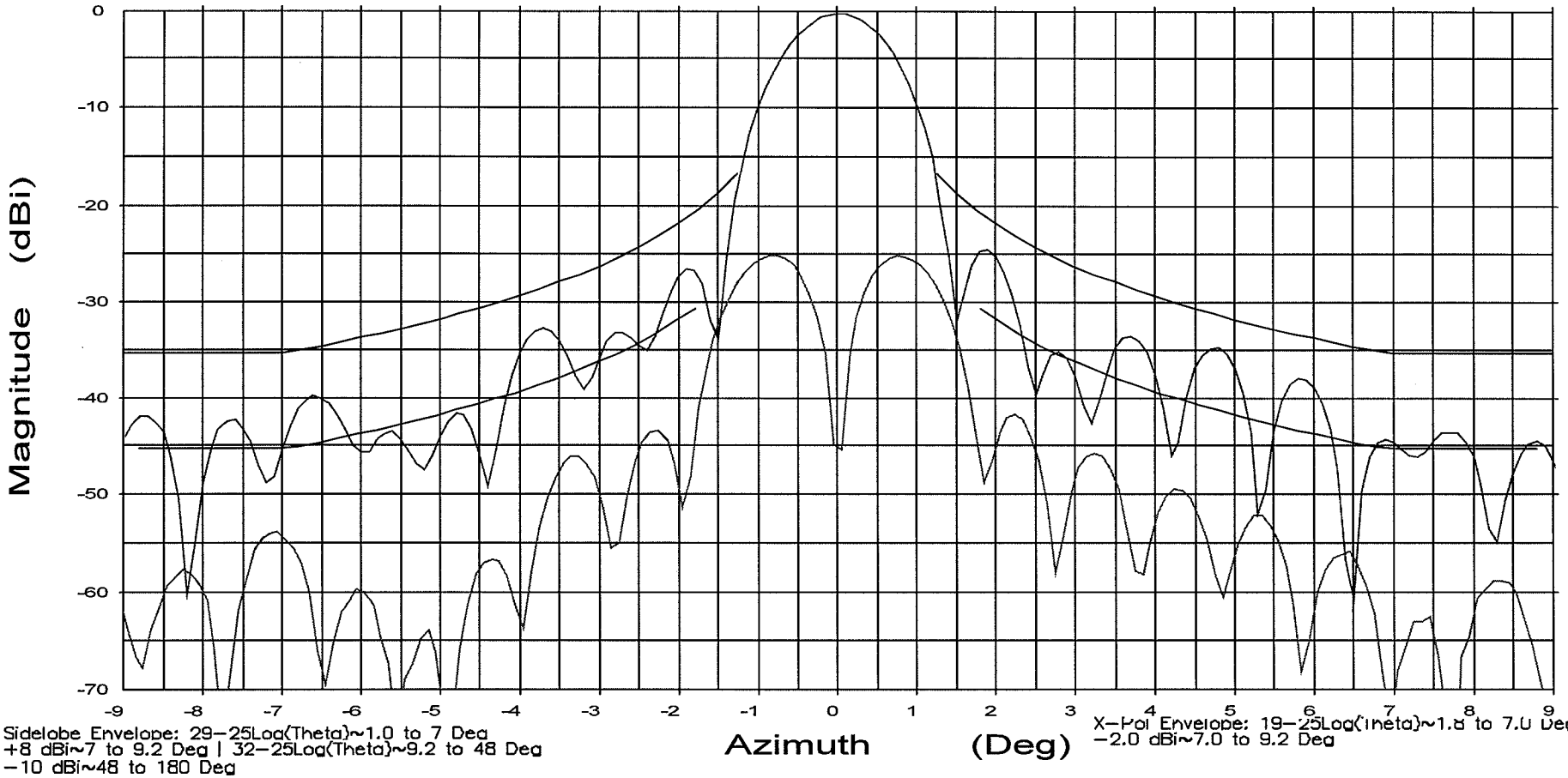
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 14.250 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Horiz. Rx pol: Horiz.



Sidelobe Envelope: 29−25Log(Theta)~1.0 to 7 Deg
+8 dBi~7 to 9.2 Deg | 32−25Log(Theta)~9.2 to 48 Deg
−10 dBi~48 to 180 Deg

X-Pol Envelope: 19−25Log(Theta)~1.8 to 7.0 Deg
−2.0 dBi~7.0 to 9.2 Deg

Overlays	Cal. file	table	channel	units
1629-29.dat-ant_under_test——	1629-29.dat	SGH-110	ch1	dBi
1629-32.dat-ant_under_test——	1629-32.dat	SGH-110	ch1	dBi

General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

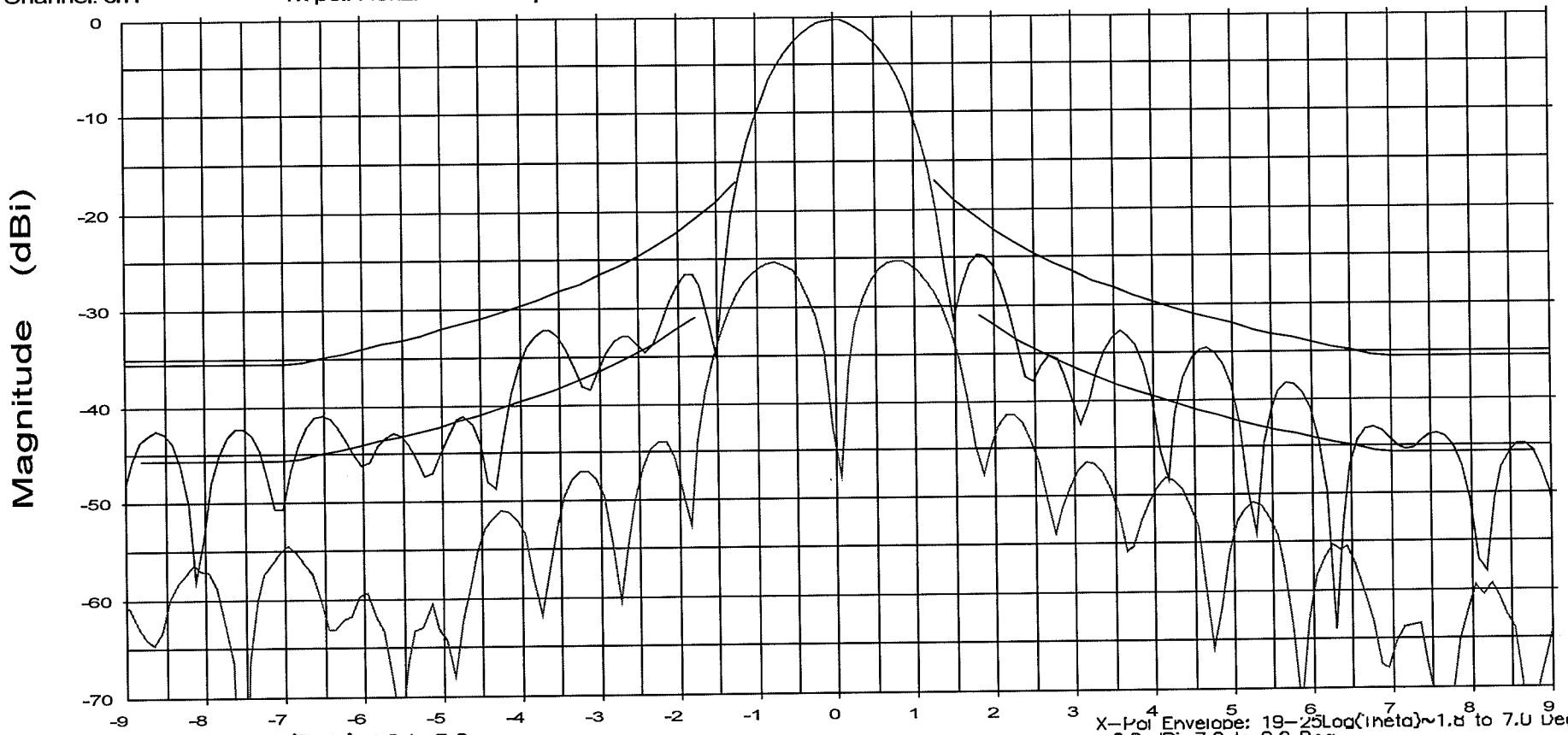
Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 14.500 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1

Tx pol: Horiz.

Rx pol: Horiz.



Sidelobe Envelope: 29−25Log(Theta)~1.0 to 7 Deg
+8 dBi~7 to 9.2 Deg | 32−25Log(Theta)~9.2 to 48 Deg
−10 dBi~48 to 180 Deg

X−Pol Envelope: 19−25Log(Theta)~1.8 to 7.0 Deg
−2.0 dBi~7.0 to 9.2 Deg

Overlays	Cal. file	table	channel	units
1629-29.dat-ant_under_test——	1629-29.dat	SGH-110	ch1	dBi
1629-32.dat-ant_under_test——	1629-32.dat	SGH-110	ch1	dBi

General Dynamics SATCOM Technologies
East Maiden Test Facility
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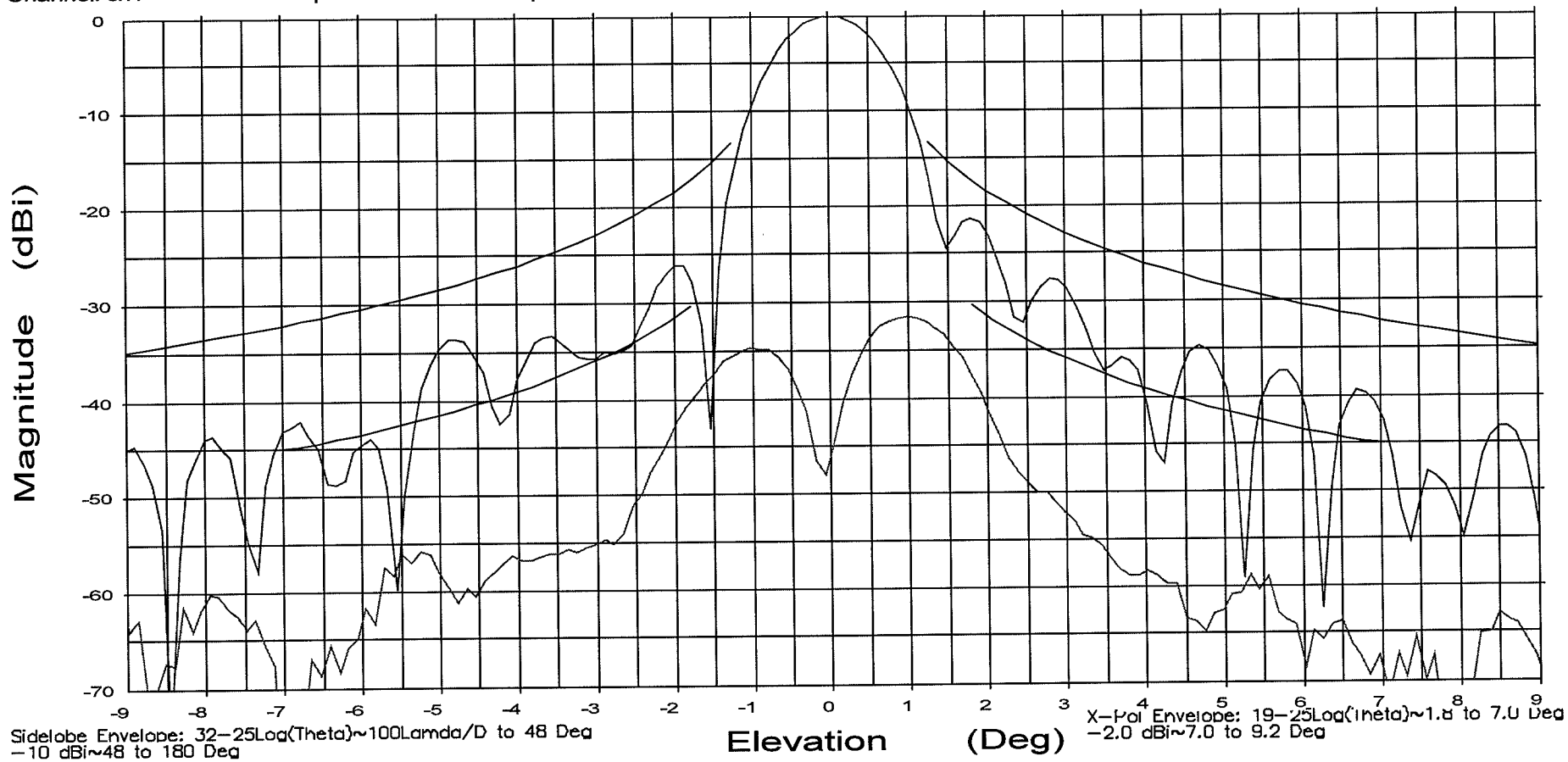
File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 14.000 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Horiz. Rx pol: Horiz.



Overlays	Cal. file	table	channel	units
1629-28.dat-ant_under_test——	1629-28.dat	SGH-110	ch1	dBi
1629-35.dat-ant_under_test——	1629-35.dat	SGH-110	ch1	dBi

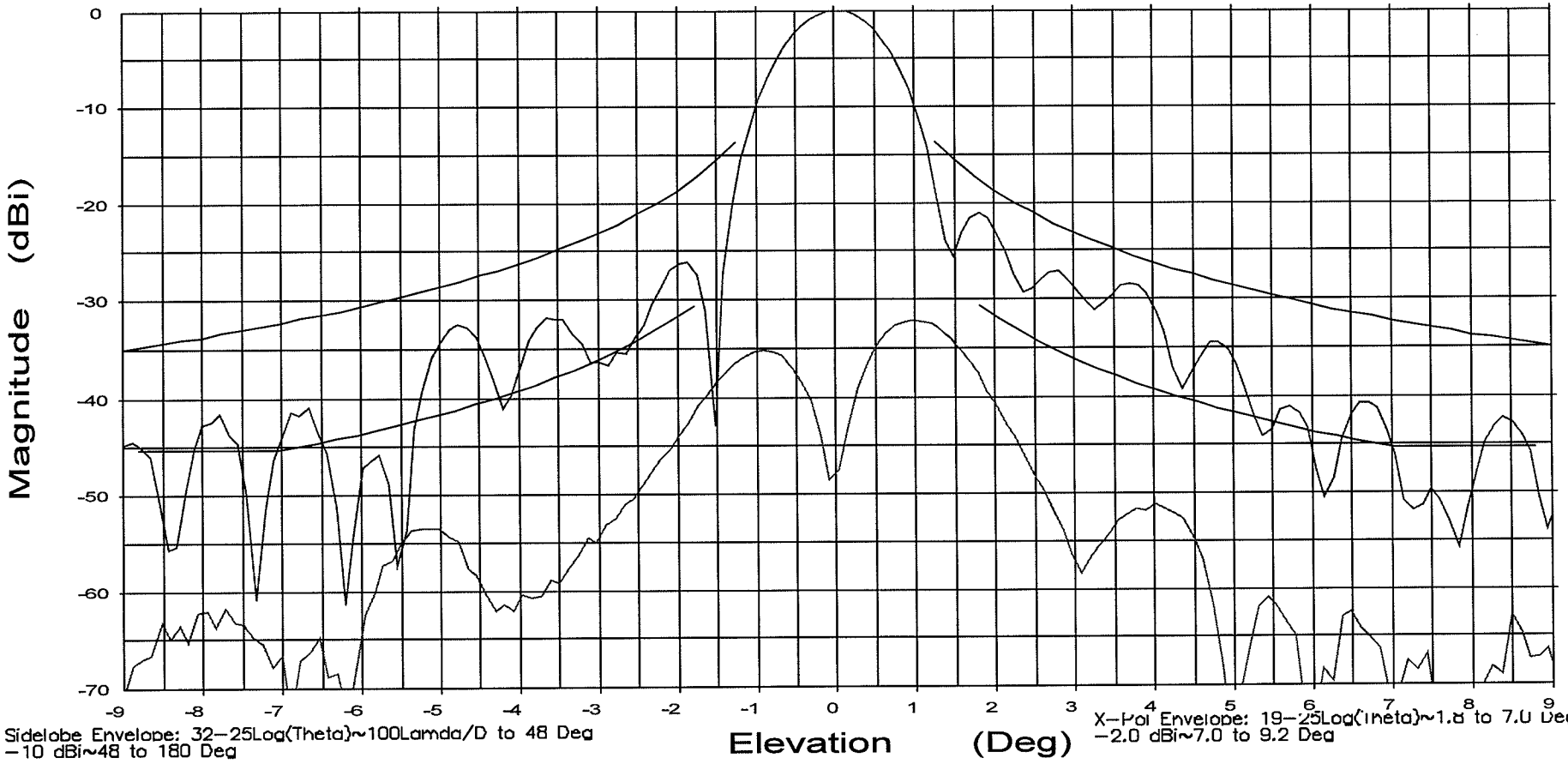
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 14.250 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Horiz. Rx pol: Horiz.



Overlays	Cal. file	table	channel	units
1629-28.dat-ant_under_test——	1629-28.dat	SGH-110	ch1	dBi
1629-35.dat-ant_under_test——	1629-35.dat	SGH-110	ch1	dBi

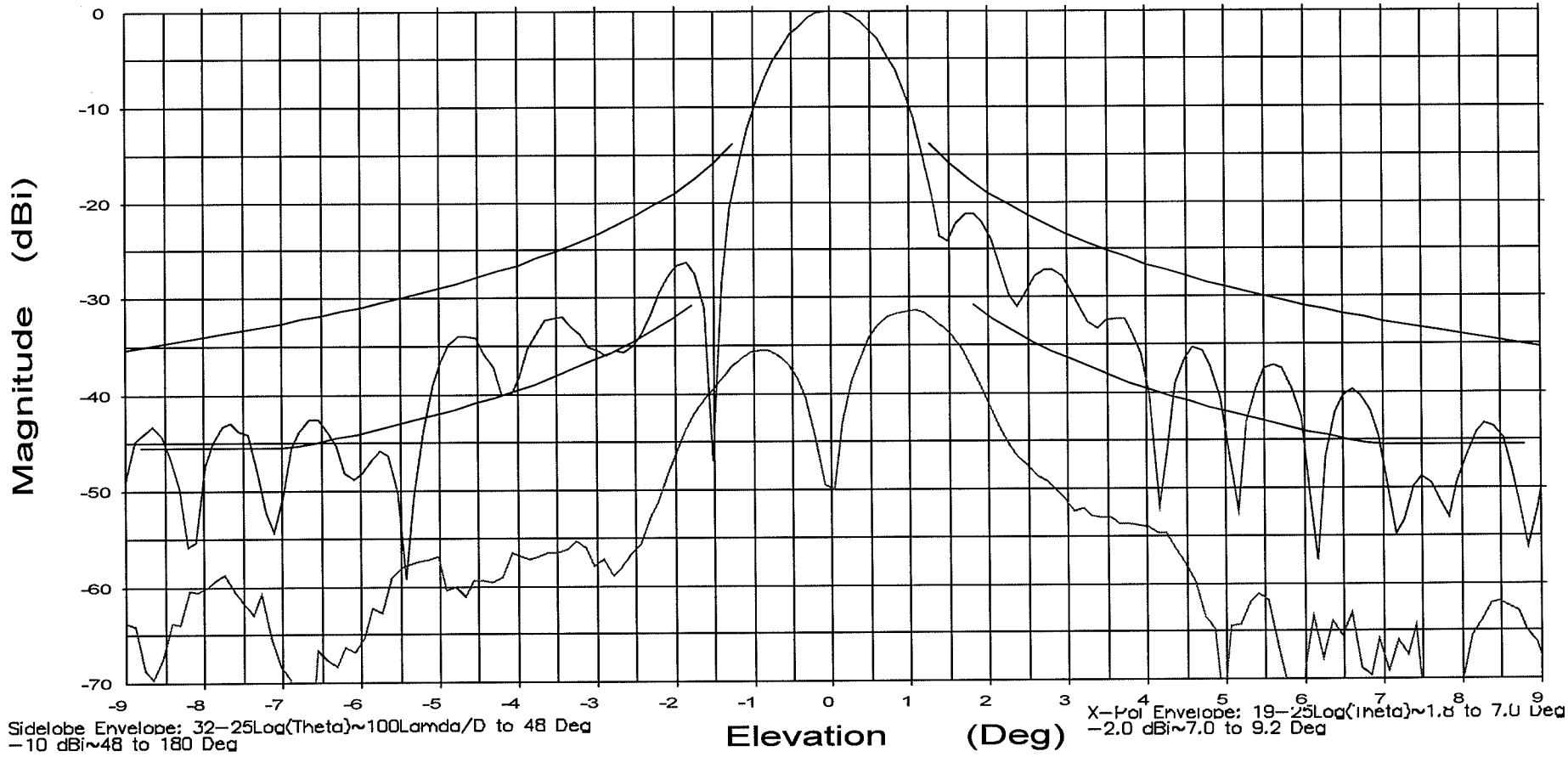
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 14.500 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Horiz. Rx pol: Horiz.



Overlays	Cal. file	table	channel	units
1629-28.dat-ant_under_test——	1629-28.dat	SGH-110	ch1	dBi
1629-35.dat-ant_under_test——	1629-35.dat	SGH-110	ch1	dBi

General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

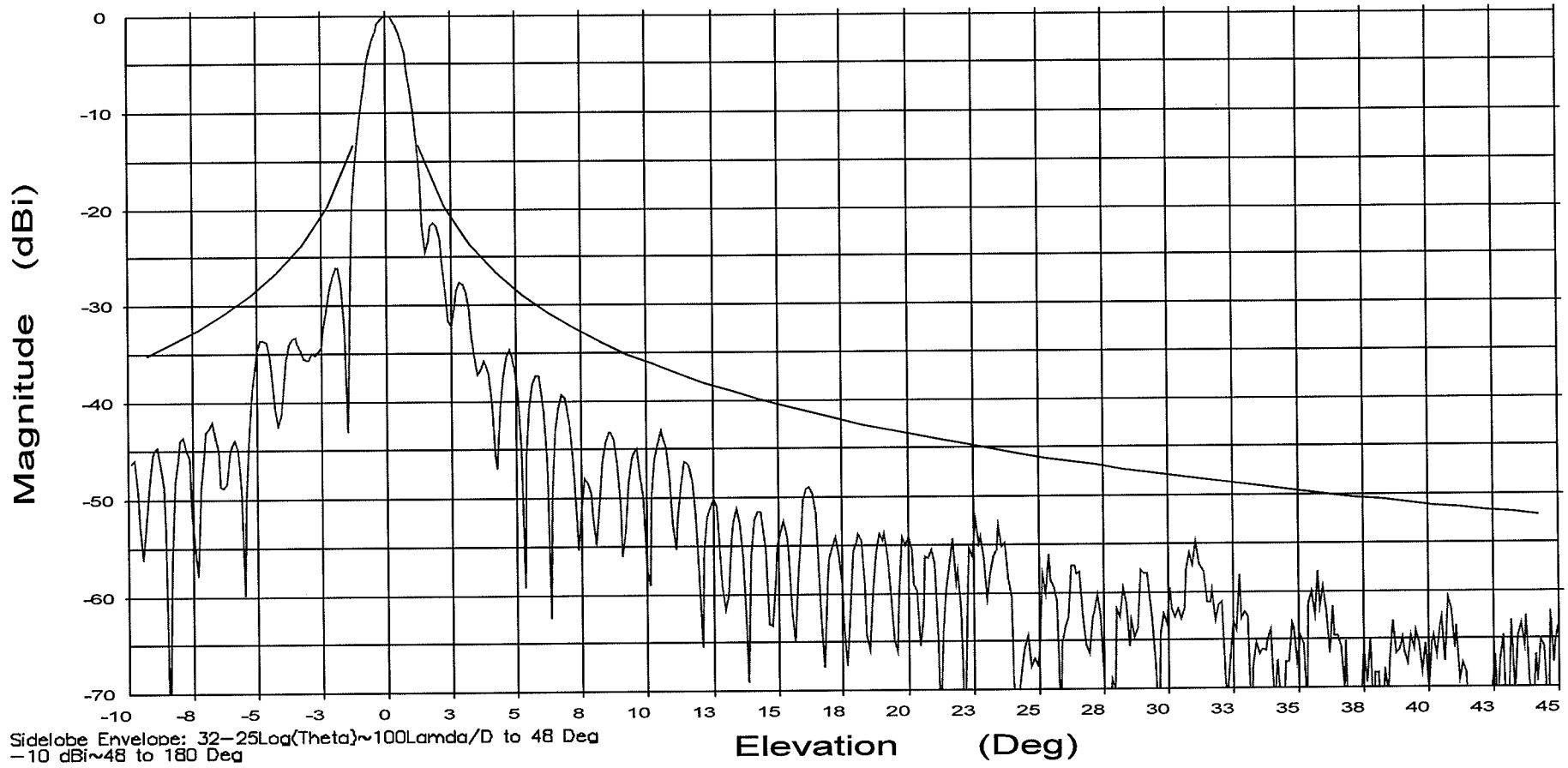
Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 14.000 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1

Tx pol: Horiz.

Rx pol: Horiz.



Sidelobe Envelope: 32-25Log(Theta)~100Lamda/D to 48 Deg
-10 dBi~48 to 180 Deg

Overlays	Cal. file	table	channel	units
1629-28.dat-ant_under_test——	1629-28.dat	SGH-110	ch1	dBi

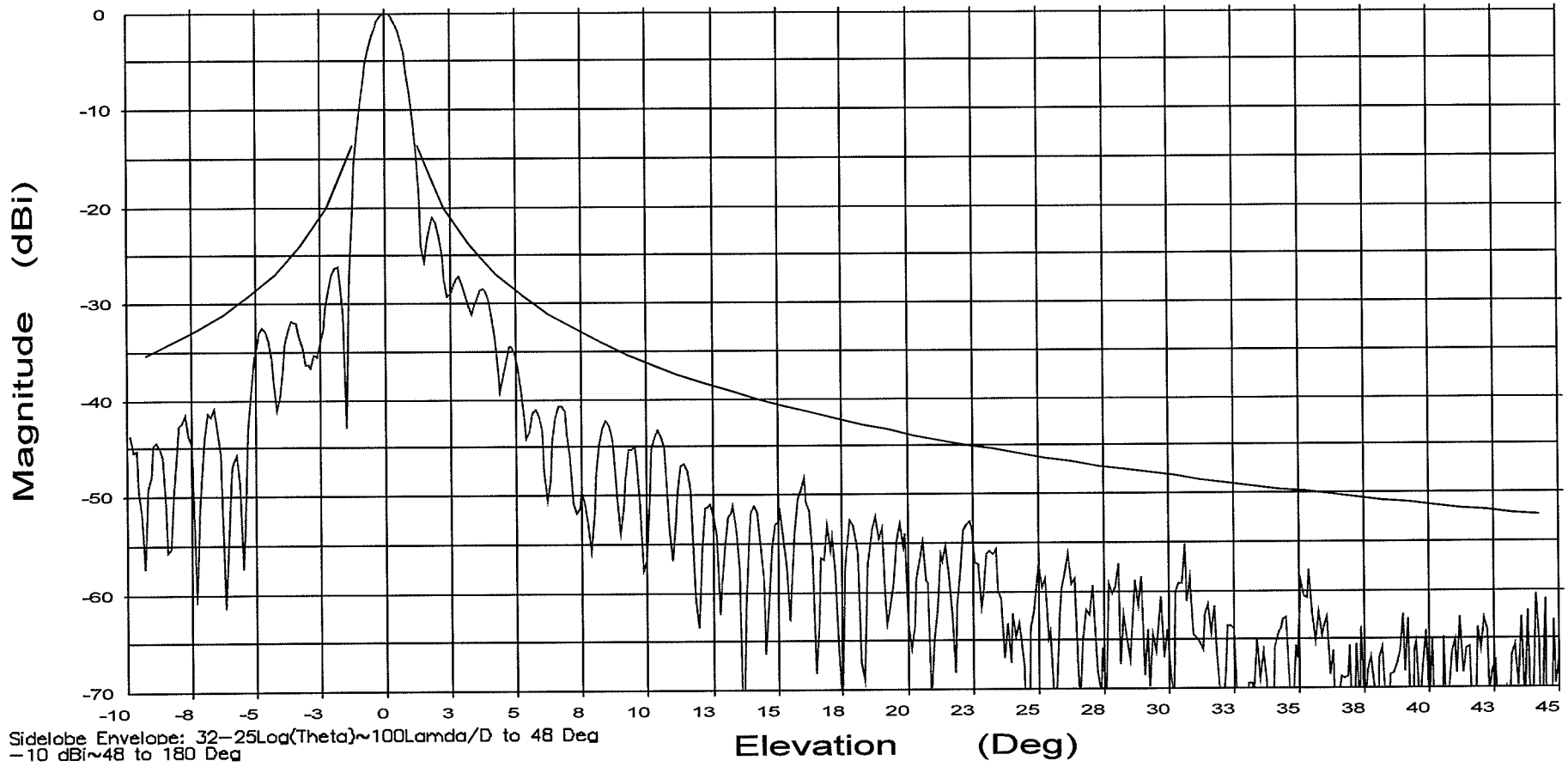
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 14.250 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Horiz. Rx pol: Horiz.



Sidelobe Envelope: 32−25Log(Theta)~100Lamda/D to 48 Deg
−10 dBi~48 to 180 Deg

Overlays	Cal. file	table	channel	units
1629-28.dat-ant_under_test——	1629-28.dat	SGH-110	ch1	dBi

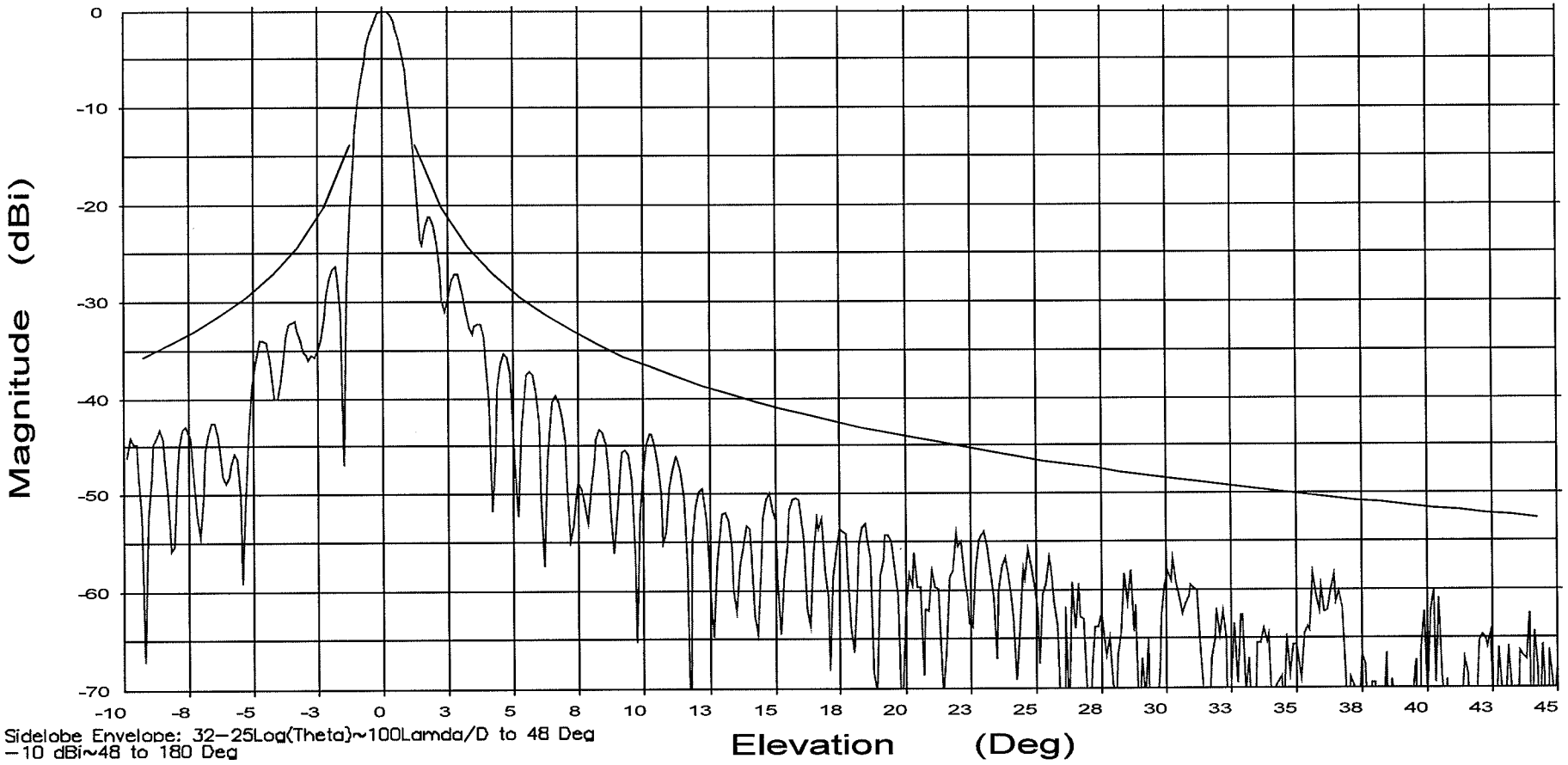
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 14.500 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Horiz. Rx pol: Horiz.



Sidelobe Envelope: 32-25Log(Theta)~100Lamda/D to 48 Deg
-10 dBi~48 to 180 Deg

Overlays	Cal. file	table	channel	units
1629-28.dat-ant_under_test——	1629-28.dat	SGH-110	ch1	dBi

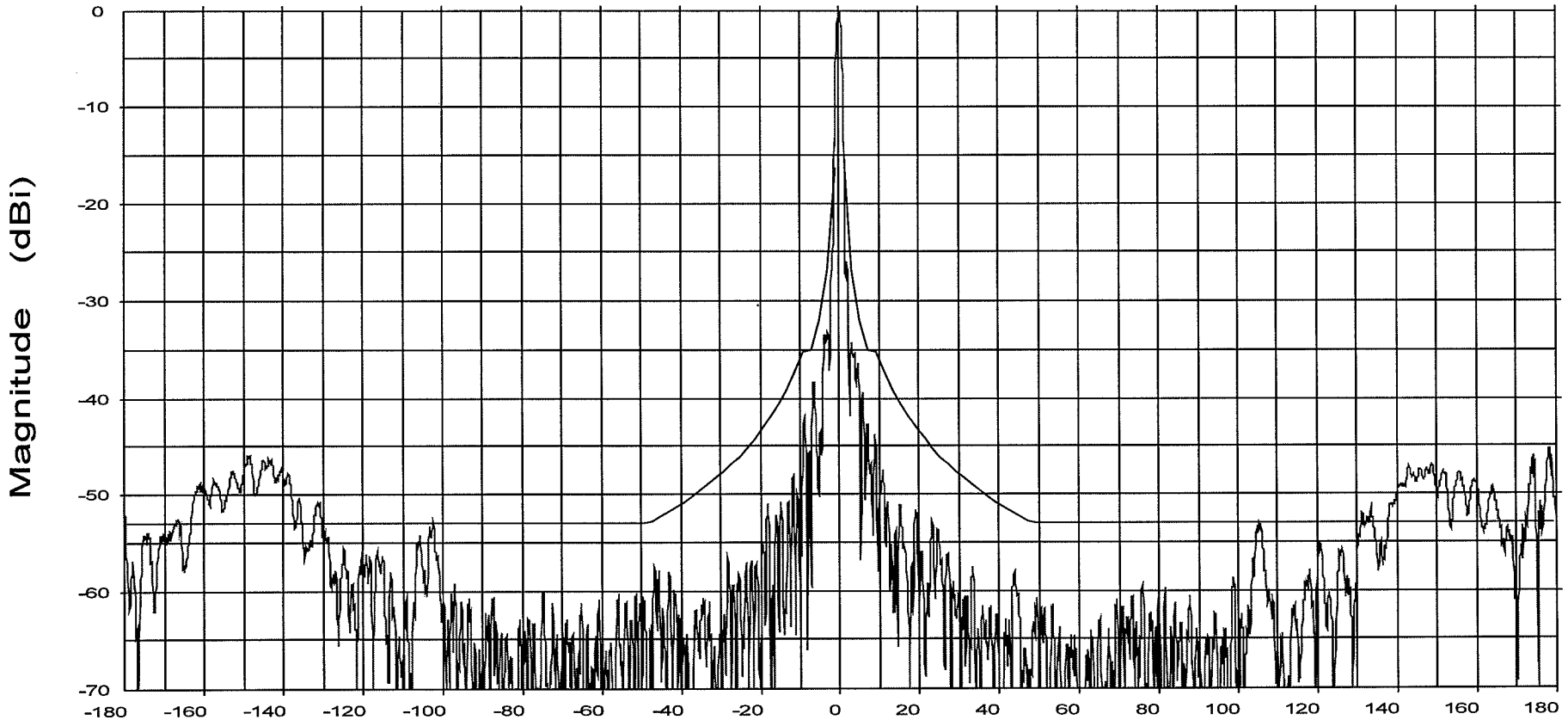
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 14.000 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Horiz. Rx pol: Horiz.



Sidelobe Envelope: 29−25Log(Theta)~1.0 to 7 Deg
+8 dBi~7 to 9.2 Deg | 32−25Log(Theta)~9.2 to 48 Deg
−10 dBi~48 to 180 Deg

Overlays	Cal. file	table	channel	units
1629-29.dat-ant_under_test——	1629-24.dat	SGH-110	ch1	dBi

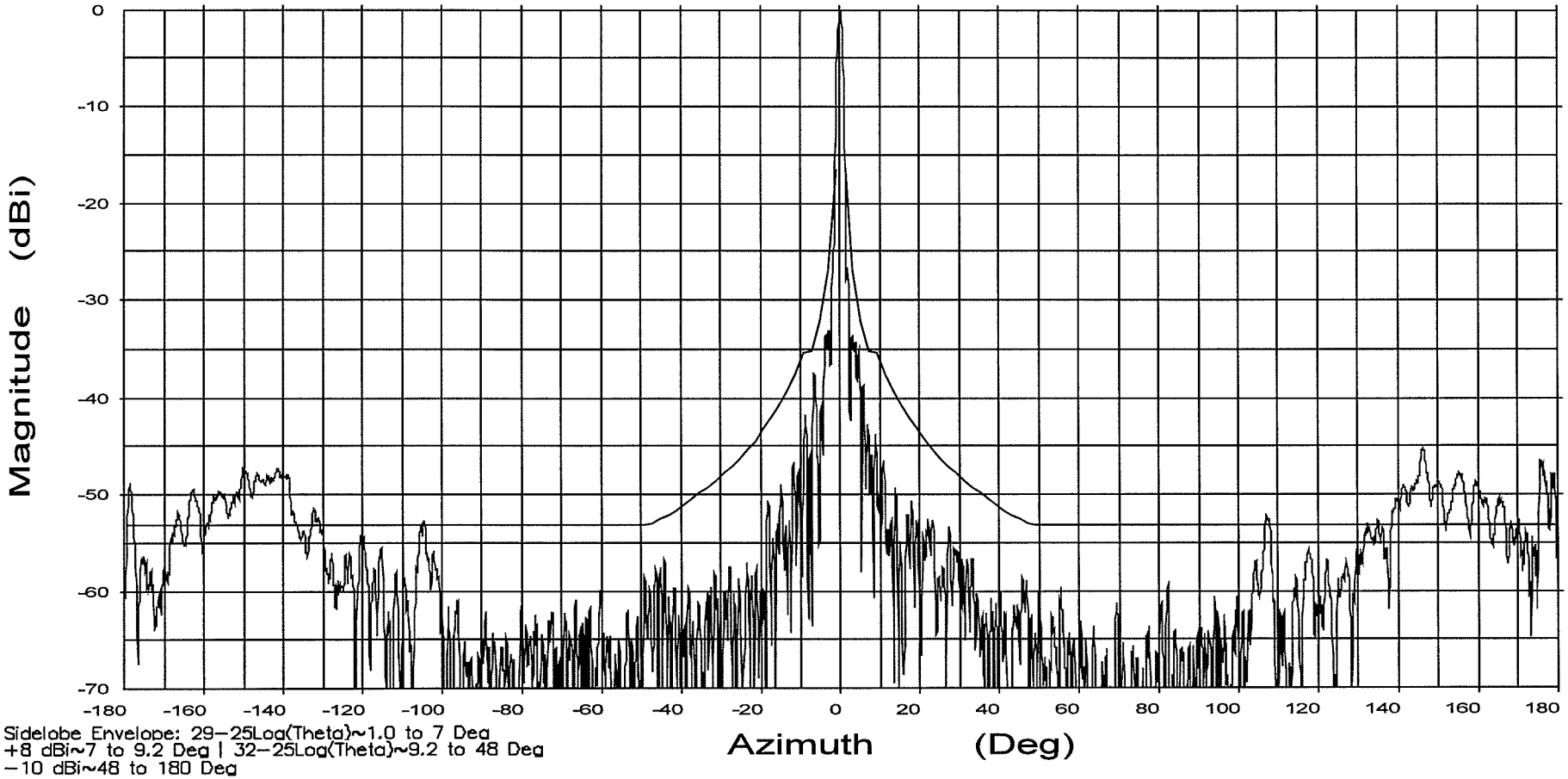
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 14.250 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Horiz. Rx pol: Horiz.



Sidelobe Envelope: 29−25Log(Theta)~1.0 to 7 Deg
+8 dBi~7 to 9.2 Deg | 32−25Log(Theta)~9.2 to 48 Deg
−10 dBi~48 to 180 Deg

Overlays	Cal. file	table	channel	units
1629-29.dat-ant_under_test——	1629-24.dat	SGH-110	ch1	dBi

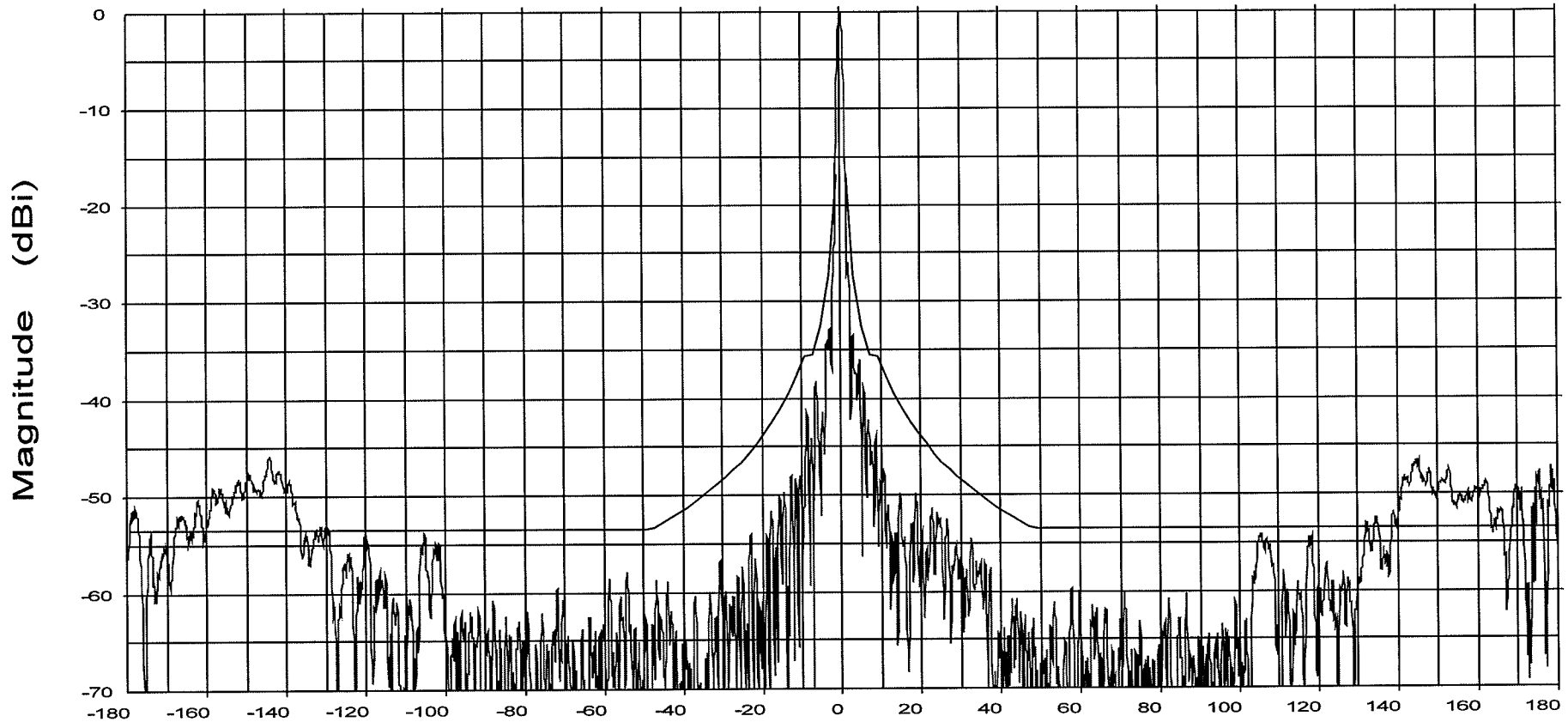
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 14.500 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Horiz. Rx pol: Horiz.



Sidelobe Envelope: 29−25Log(Theta)~1.0 to 7 Deg
+8 dBi~7 to 9.2 Deg | 32−25Log(Theta)~9.2 to 48 Deg
−10 dBi~48 to 180 Deg

Overlays	Cal. file	table	channel	units
1629-29.dat-ant_under_test——	1629-24.dat	SGH-110	ch1	dBi

General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

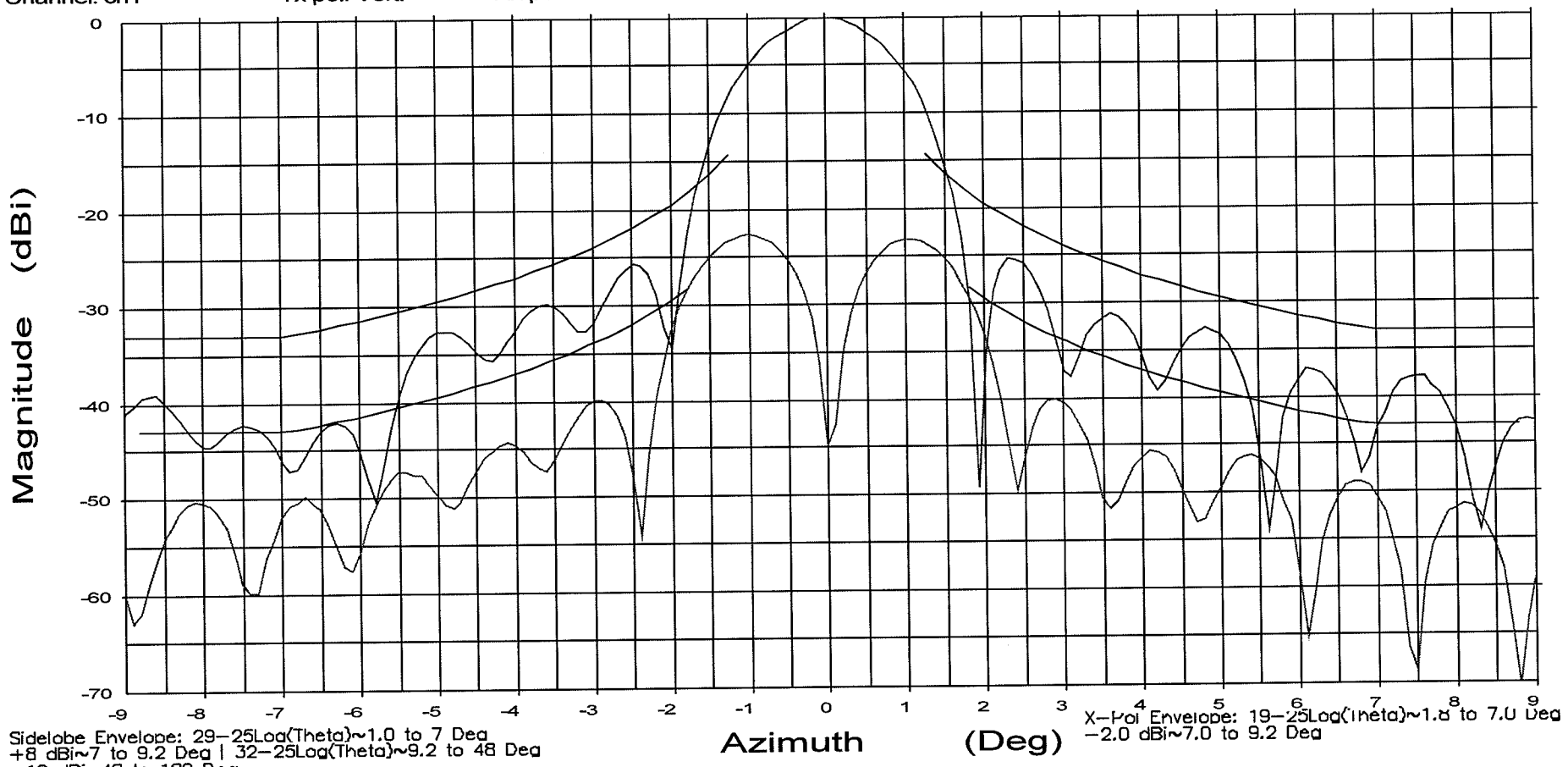
Section IV

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 10.950 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Vert. Rx pol: Vert.



Sidelobe Envelope: 29−25Log(Theta)~1.0 to 7 Deg
+8 dBi~7 to 9.2 Deg | 32−25Log(Theta)~9.2 to 48 Deg
−10 dBi~48 to 180 Deg

X-Pol Envelope: 19−25Log(Theta)~1.8 to 7.0 Deg
−2.0 dBi~7.0 to 9.2 Deg

Overlays	Cal. file	table	channel	units
1629-15.dat-ant_under_test——	1629-15.dat	SGH-110	ch1	dBi
1629-20.dat-ant_under_test——	1629-20.dat	SGH-110	ch1	dBi

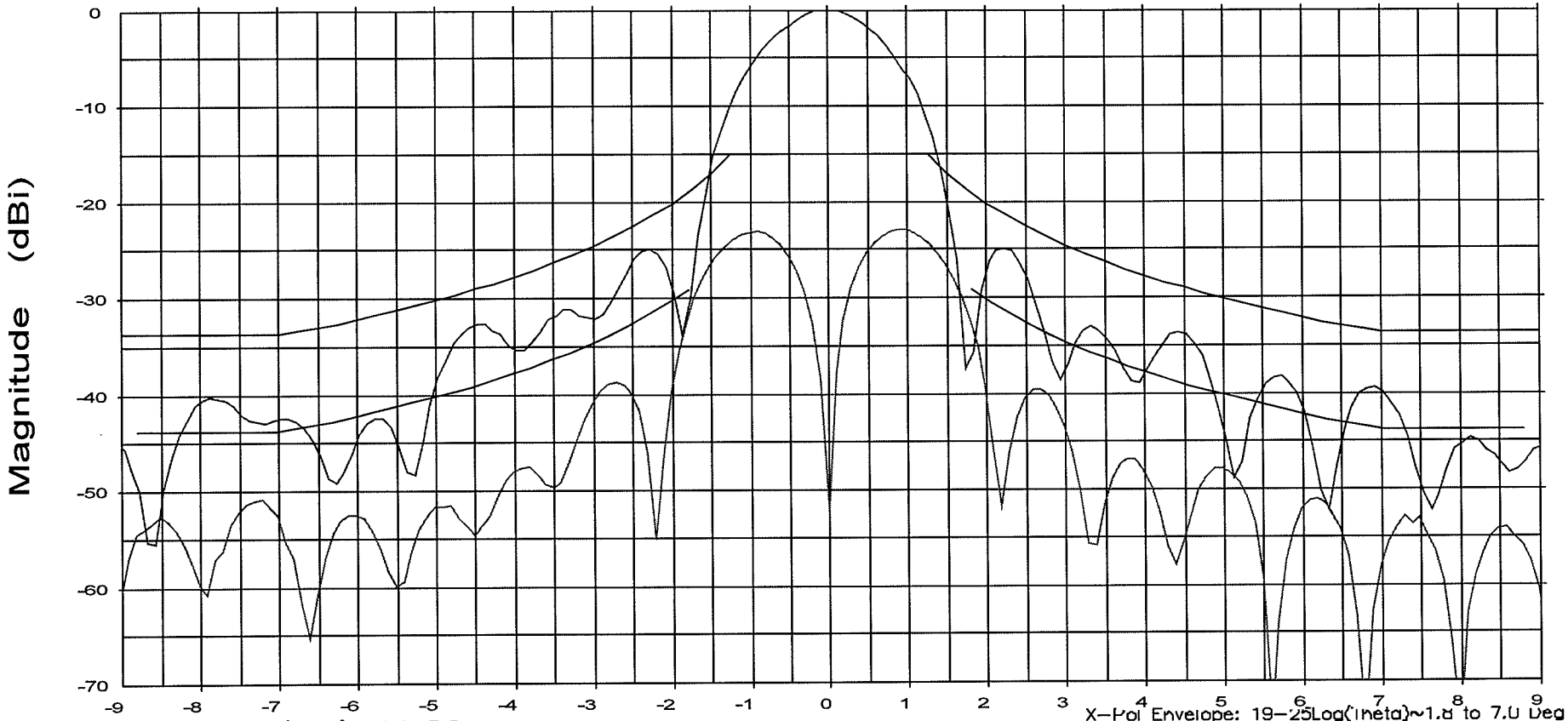
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 11.950 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Vert. Rx pol: Vert.



Overlays	Cal. file	table	channel	units
1629-15.dat-ant_under_test——	1629-15.dat	SGH-110	ch1	dBi
1629-20.dat-ant_under_test——	1629-20.dat	SGH-110	ch1	dBi

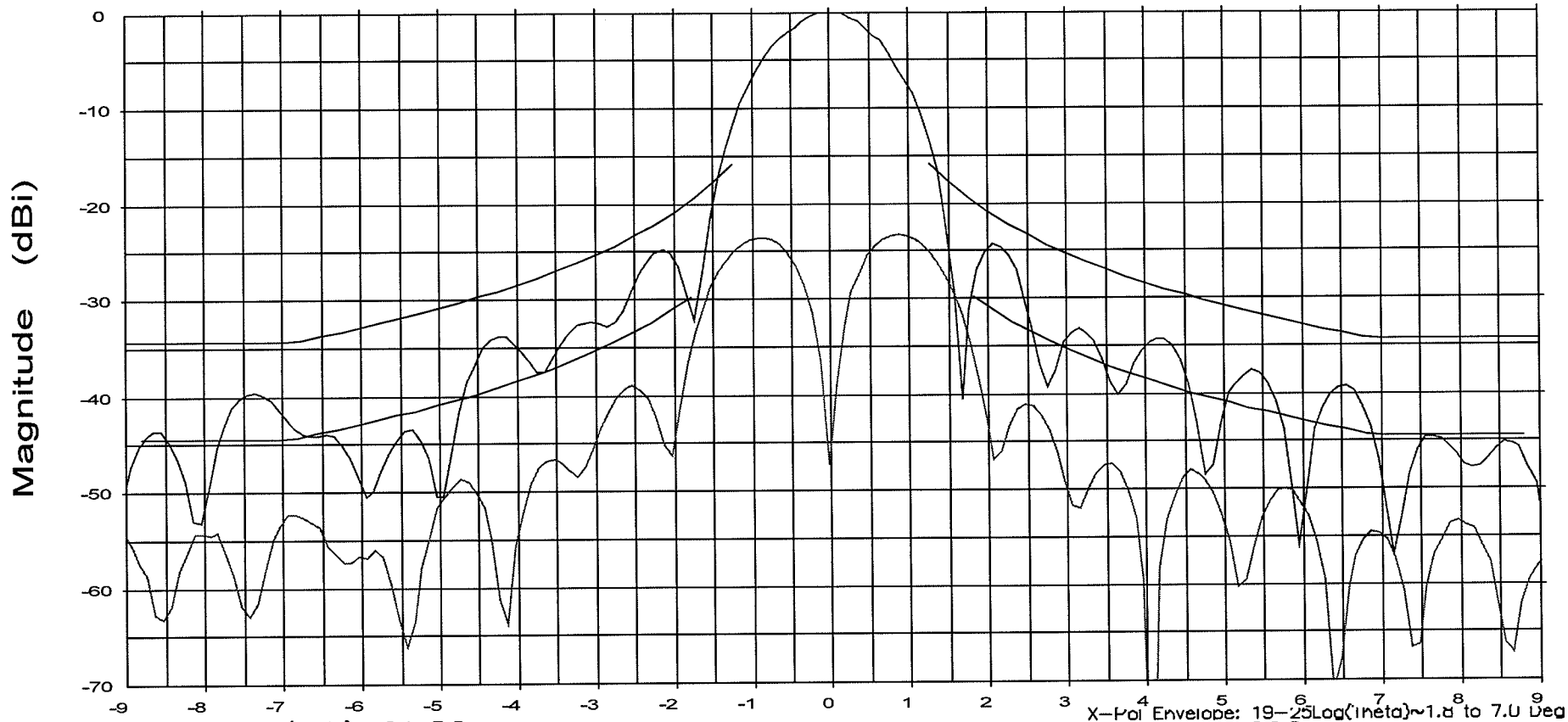
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 12.750 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Vert. Rx pol: Vert.



Sidelobe Envelope: 29−25Log(Theta)~1.0 to 7 Deg
+8 dBi~7 to 9.2 Deg | 32−25Log(Theta)~9.2 to 48 Deg
−10 dBi~48 to 180 Deg

X-Pol Envelope: 19−25Log(Theta)~1.0 to 7.0 Deg
−2.0 dBi~7.0 to 9.2 Deg

Overlays	Cal. file	table	channel	units
1629-15.dat-ant_under_test——	1629-15.dat	SGH-110	ch1	dBi
1629-20.dat-ant_under_test——	1629-20.dat	SGH-110	ch1	dBi

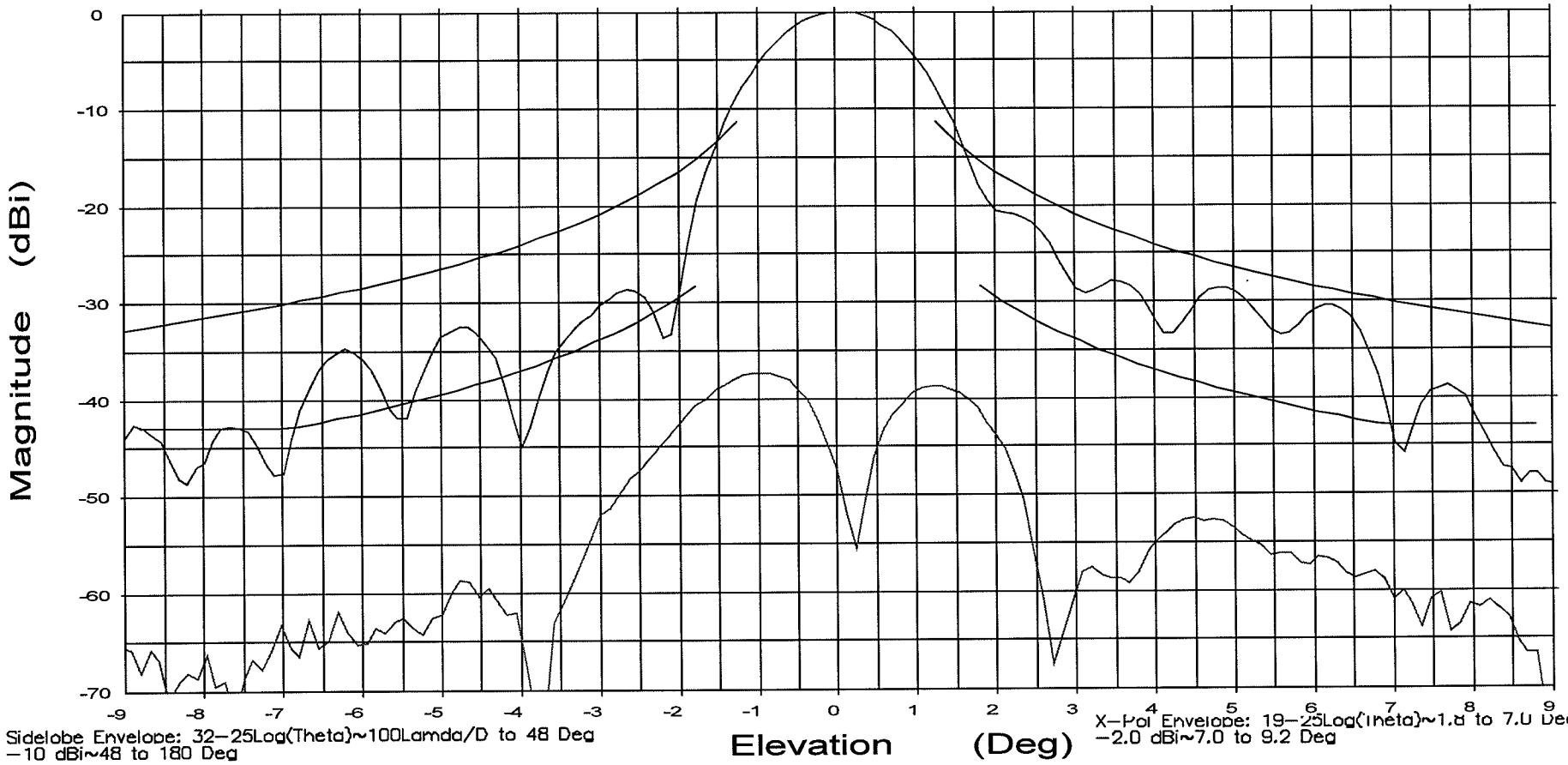
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 10.950 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Vert. Rx pol: Vert.



Overlays	Cal. file	table	channel	units
1629-19.dat-ant_under_test——	1629-19.dat	SGH-110	ch1	dBi
1629-21.dat-ant_under_test——	1629-21.dat	SGH-110	ch1	dBi

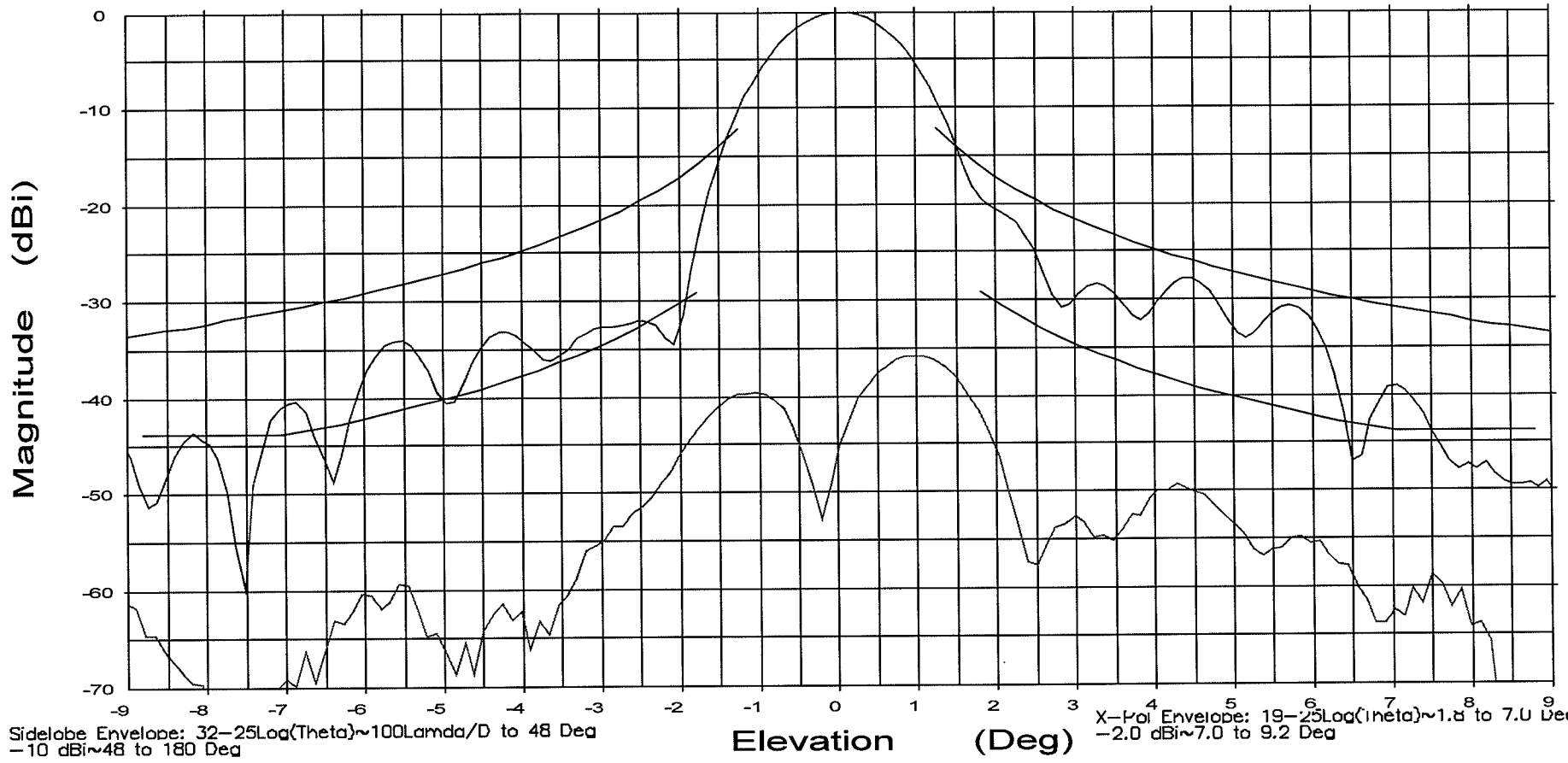
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 11.950 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Vert. Rx pol: Vert.



Overlays	Cal. file	table	channel	units
1629-19.dat-ant_under_test——	1629-19.dat	SGH-110	ch1	dBi
1629-21.dat-ant_under_test——	1629-21.dat	SGH-110	ch1	dBi

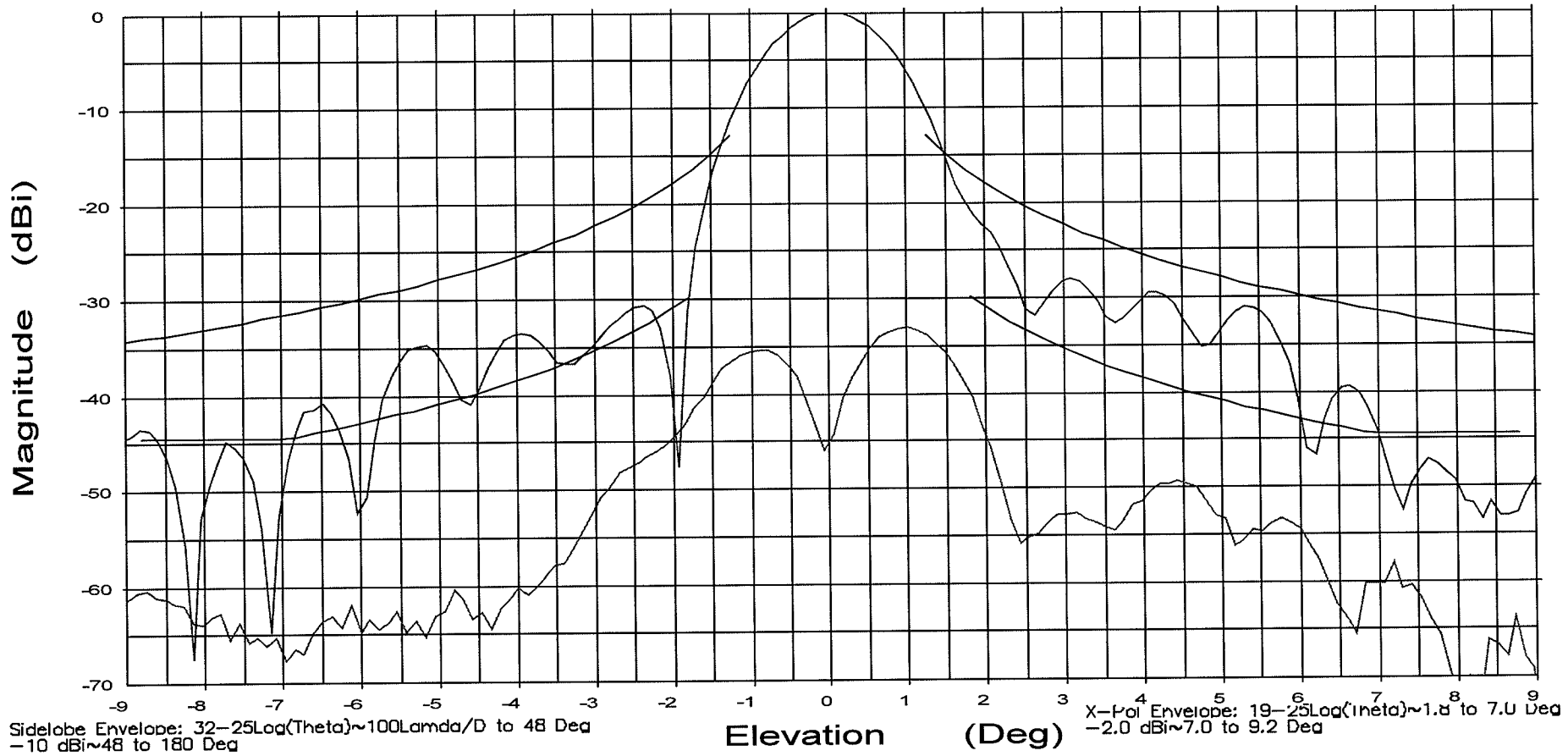
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 12.750 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Vert. Rx pol: Vert.



Overlays	Cal. file	table	channel	units
1629-19.dat-ant_under_test——	1629-19.dat	SGH-110	ch1	dBi
1629-21.dat-ant_under_test——	1629-21.dat	SGH-110	ch1	dBi

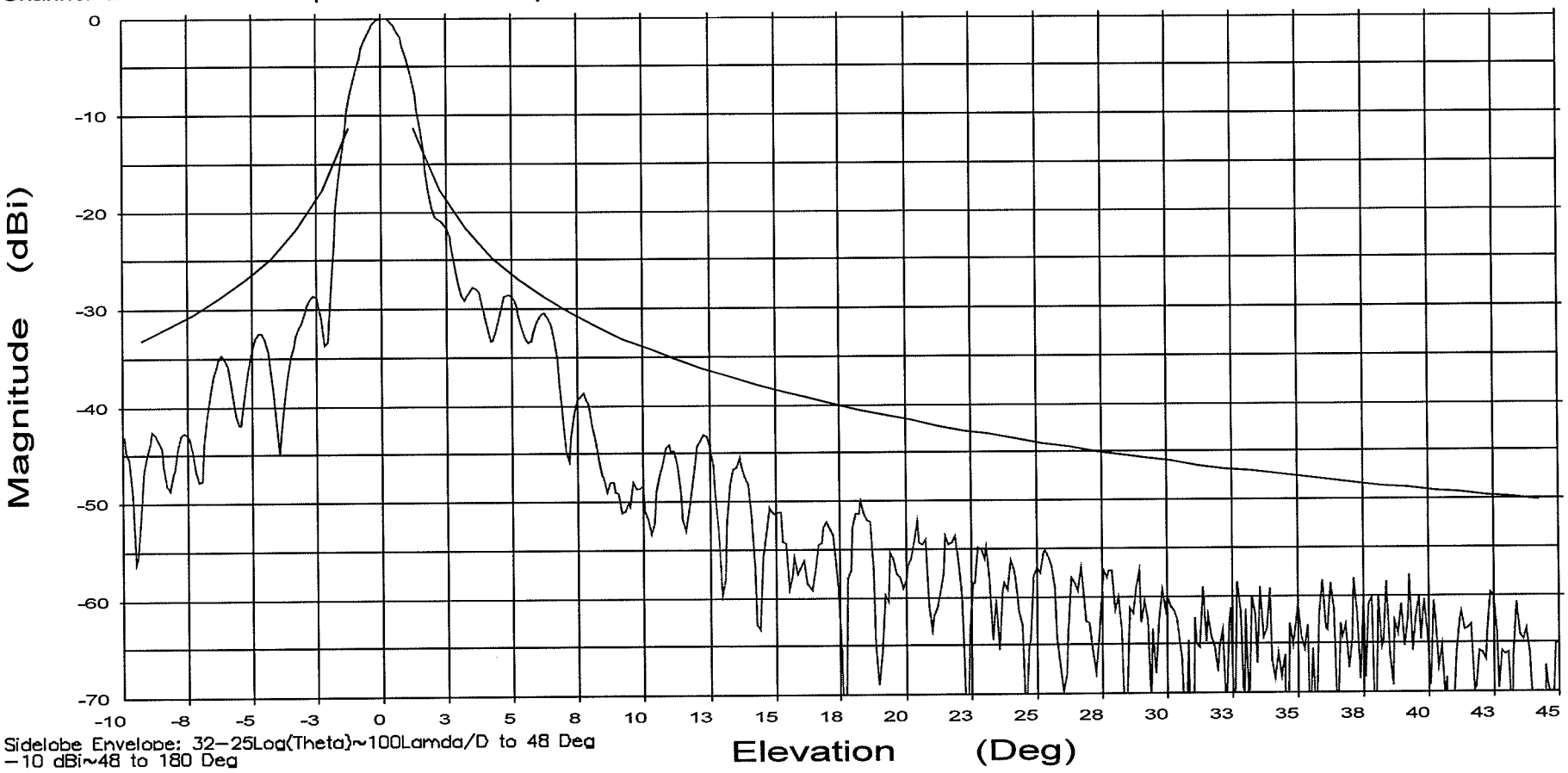
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 10.950 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Vert. Rx pol: Vert.



Sidelobe Envelope: 32-25Log(Theta)~100Lamda/D to 48 Deg
-10 dBi~48 to 180 Deg

Overlays	Cal. file	table	channel	units
1629-19.dat-ant_under_test——	1629-19.dat	SGH-110	ch1	dBi

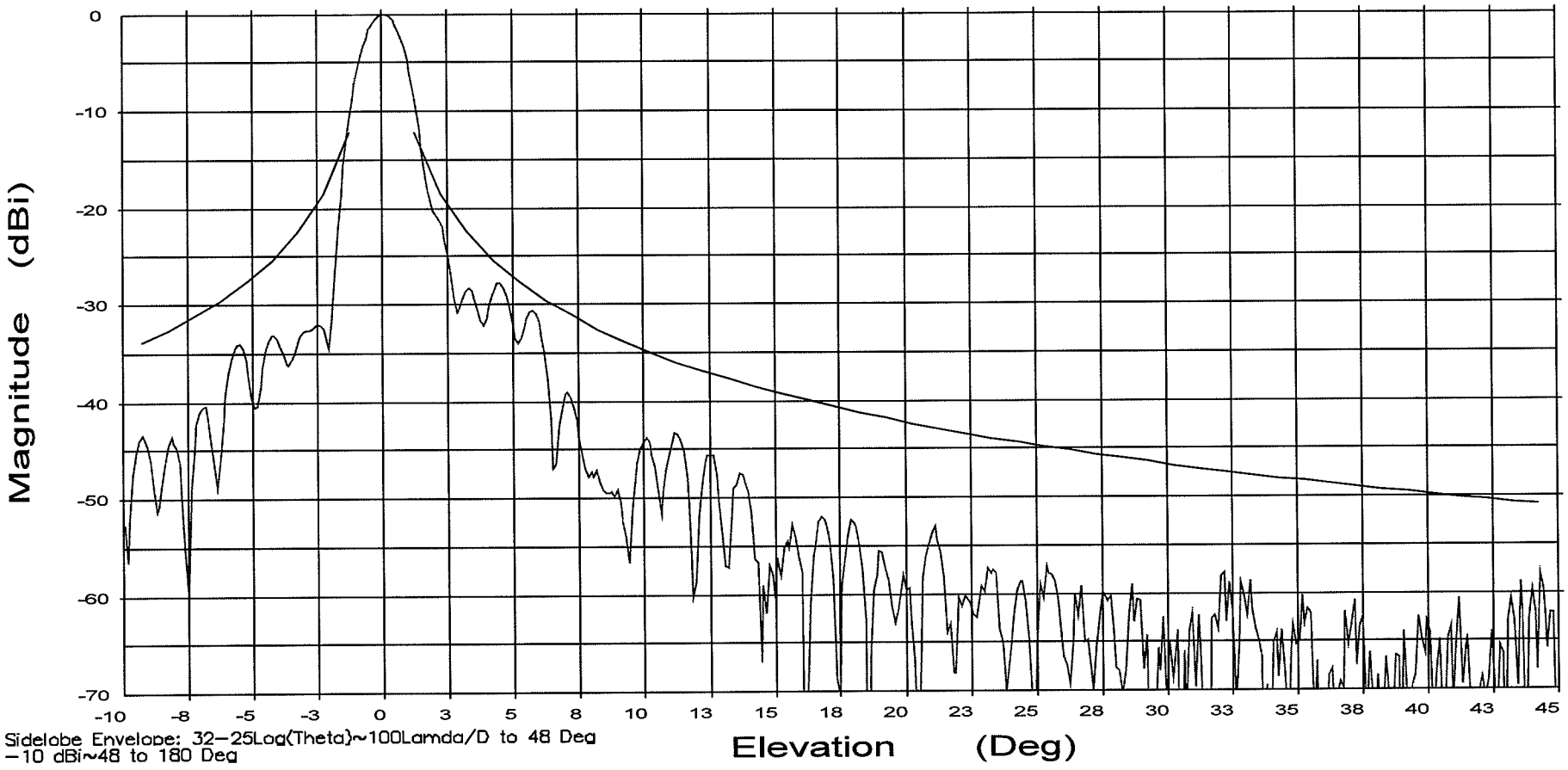
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 11.950 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Vert. Rx pol: Vert.



Sidelobe Envelope: 32−25Log(Theta)~100Lamda/D to 48 Deg
−10 dBi~48 to 180 Deg

Overlays	Cal. file	table	channel	units
1629-19.dat-ant_under_test——	1629-19.dat	SGH-110	ch1	dBi

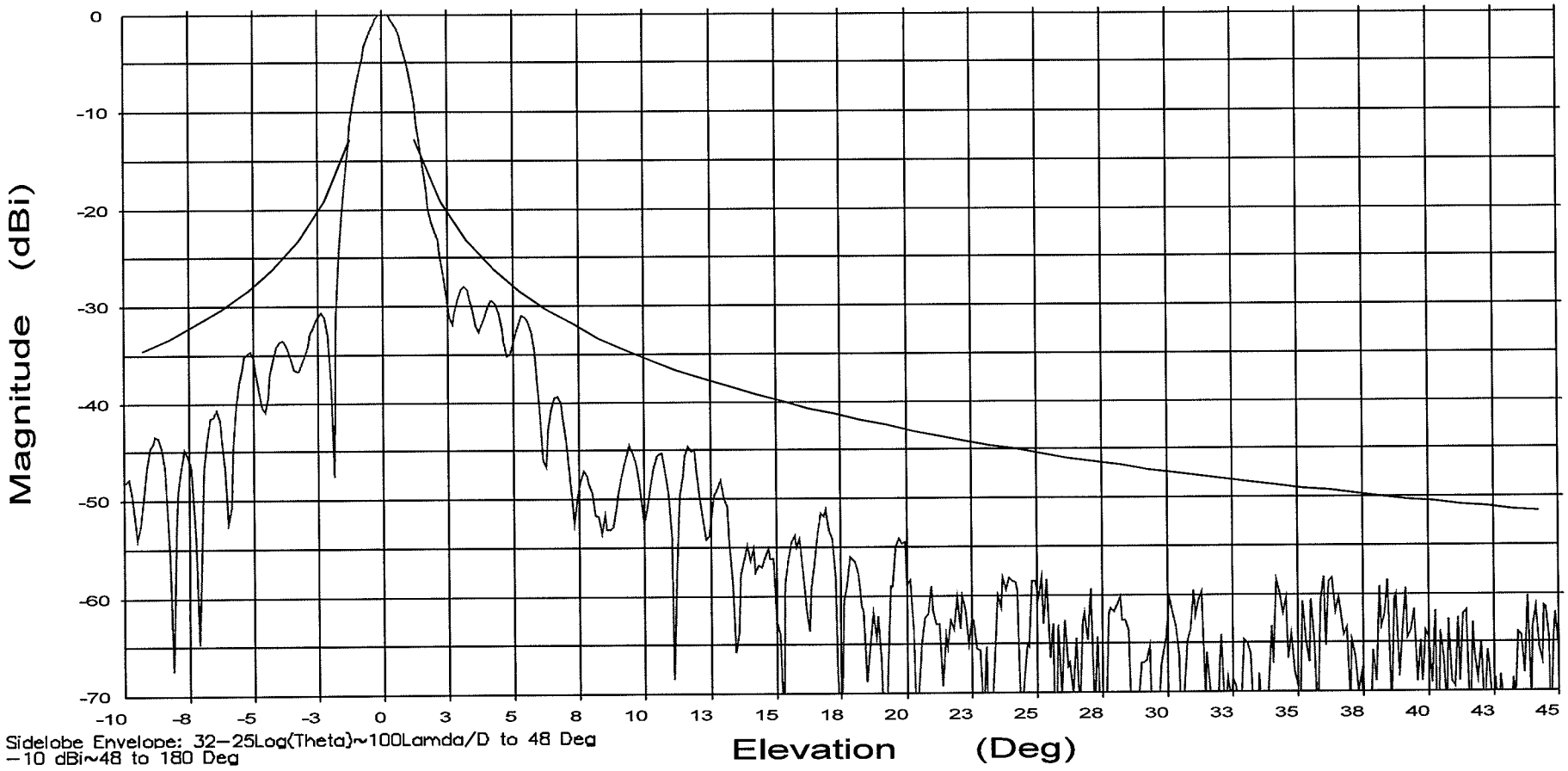
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 12.750 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Vert. Rx pol: Vert.



Sidelobe Envelope: 32−25Log(Theta)~100Lamda/D to 48 Deg
−10 dBi~48 to 180 Deg

Overlays	Cal. file	table	channel	units
1629-19.dat-ant_under_test——	1629-19.dat	SGH-110	ch1	dBi

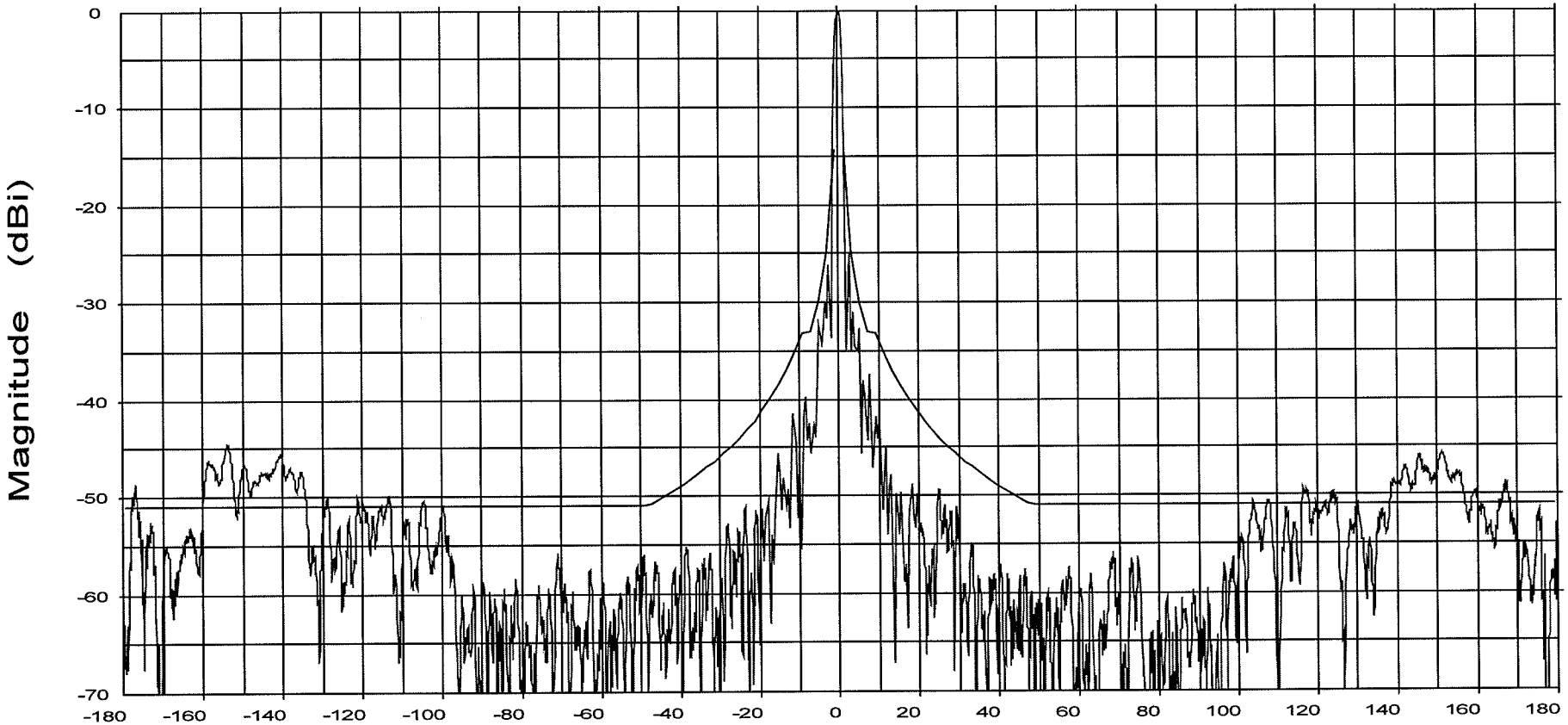
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 10.950 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Vert. Rx pol: Vert.



Sidelobe Envelope: 29−25Log(Theta)~1.0 to 7 Deg
+8 dBi~7 to 9.2 Deg | 32−25Log(Theta)~9.2 to 48 Deg
−10 dBi~48 to 180 Deg

Overlays	Cal. file	table	channel	units
1629-15.dat-ant_under_test——	1629-08.dat	SGH-110	ch1	dBi

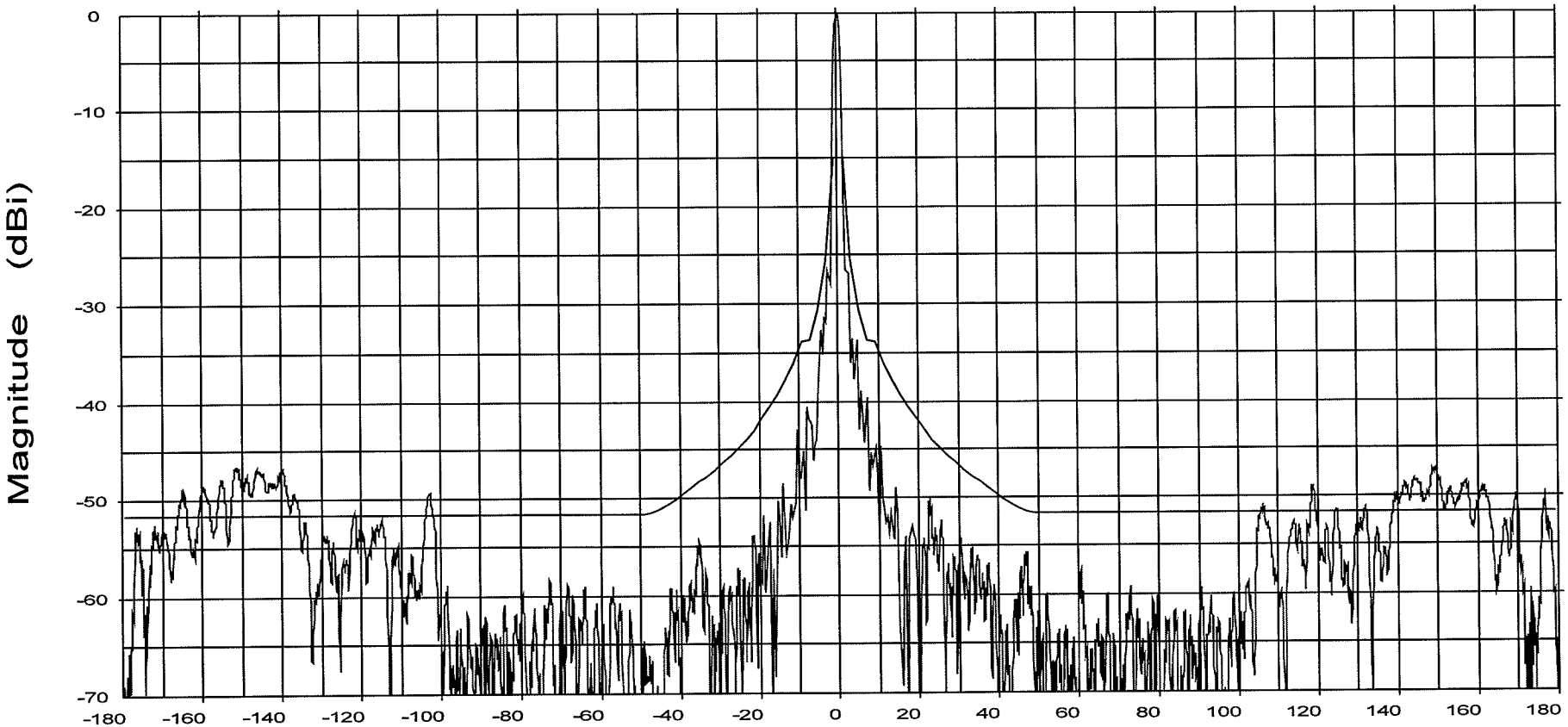
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 11.950 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Vert. Rx pol: Vert.



Sidelobe Envelope: 29−25Log(Theta)~1.0 to 7 Deg
+8 dBi~7 to 9.2 Deg | 32−25Log(Theta)~9.2 to 48 Deg
−10 dBi~48 to 180 Deg

Overlays	Cal. file	table	channel	units
1629-15.dat-ant_under_test——	1629-08.dat	SGH-110	ch1	dBi

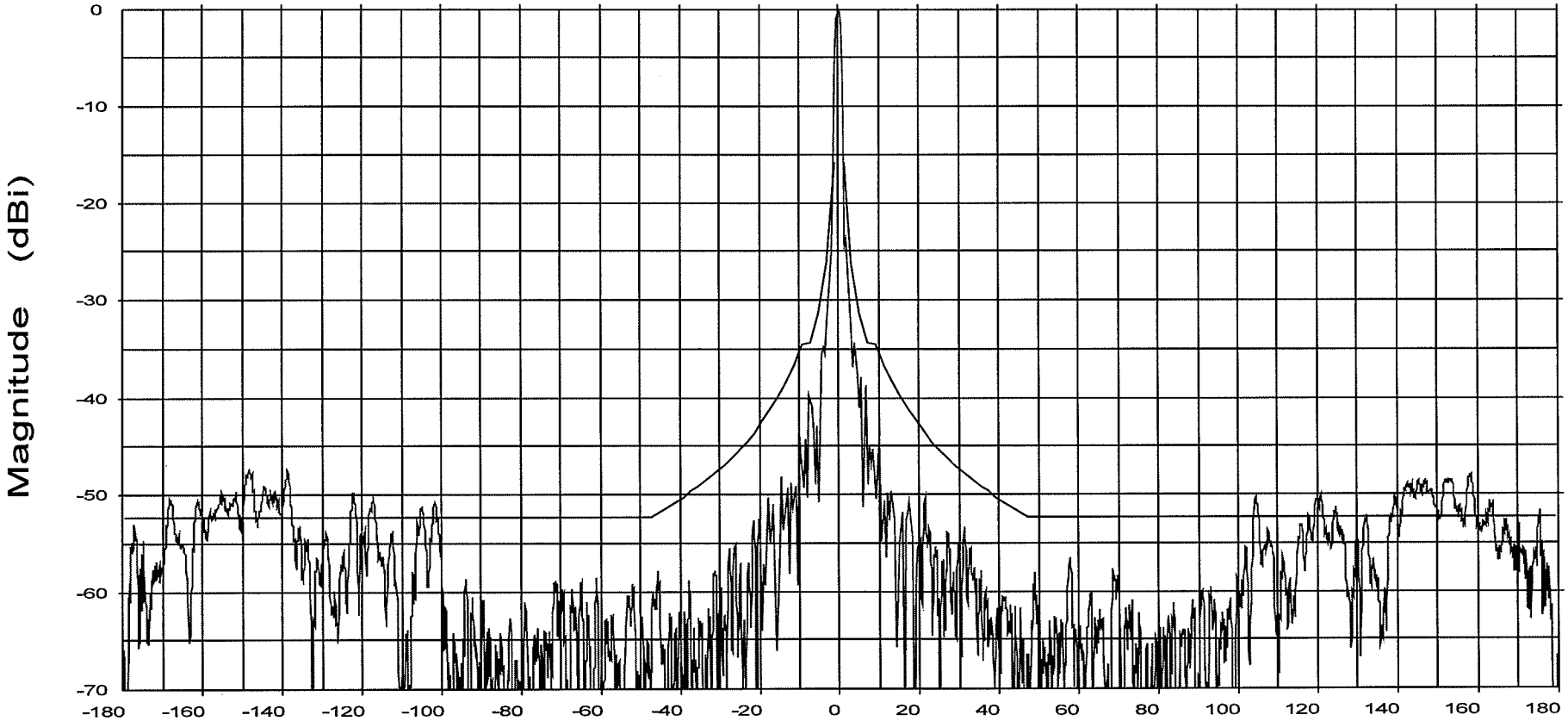
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 12.750 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Vert. Rx pol: Vert.



Sidelobe Envelope: 29−25Log(Theta)~1.0 to 7 Deg
+8 dBi~7 to 9.2 Deg | 32−25Log(Theta)~9.2 to 48 Deg
−10 dBi~48 to 180 Deg

Overlays	Cal. file	table	channel	units
1629-15.dat-ant_under_test——	1629-08.dat	SGH-110	ch1	dBi

General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

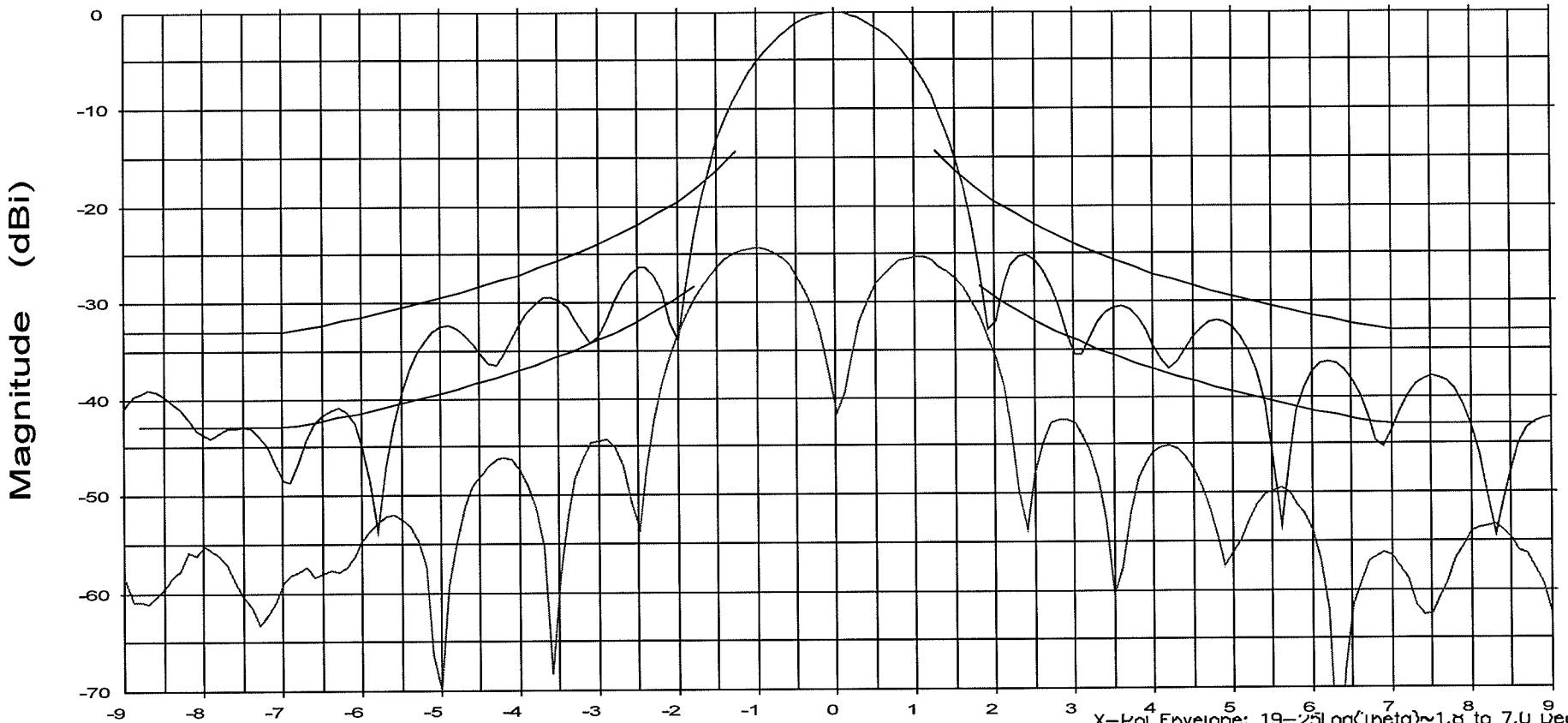
Section V

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 10.950 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Horiz. Rx pol: Horiz.



Sidelobe Envelope: 29-25Log(Theta)~1.0 to 7 Deg
+8 dBi~7 to 9.2 Deg | 32-25Log(Theta)~9.2 to 48 Deg
-10 dBi~48 to 180 Deg

X-Pol Envelope: 19-25Log(Theta)~1.8 to 7.0 Deg
-2.0 dBi~7.0 to 9.2 Deg

Overlays	Cal. file	table	channel	units
1629-29.dat-ant_under_test——	1629-29.dat	SGH-110	ch1	dBi
1629-33.dat-ant_under_test——	1629-33.dat	SGH-110	ch1	dBi

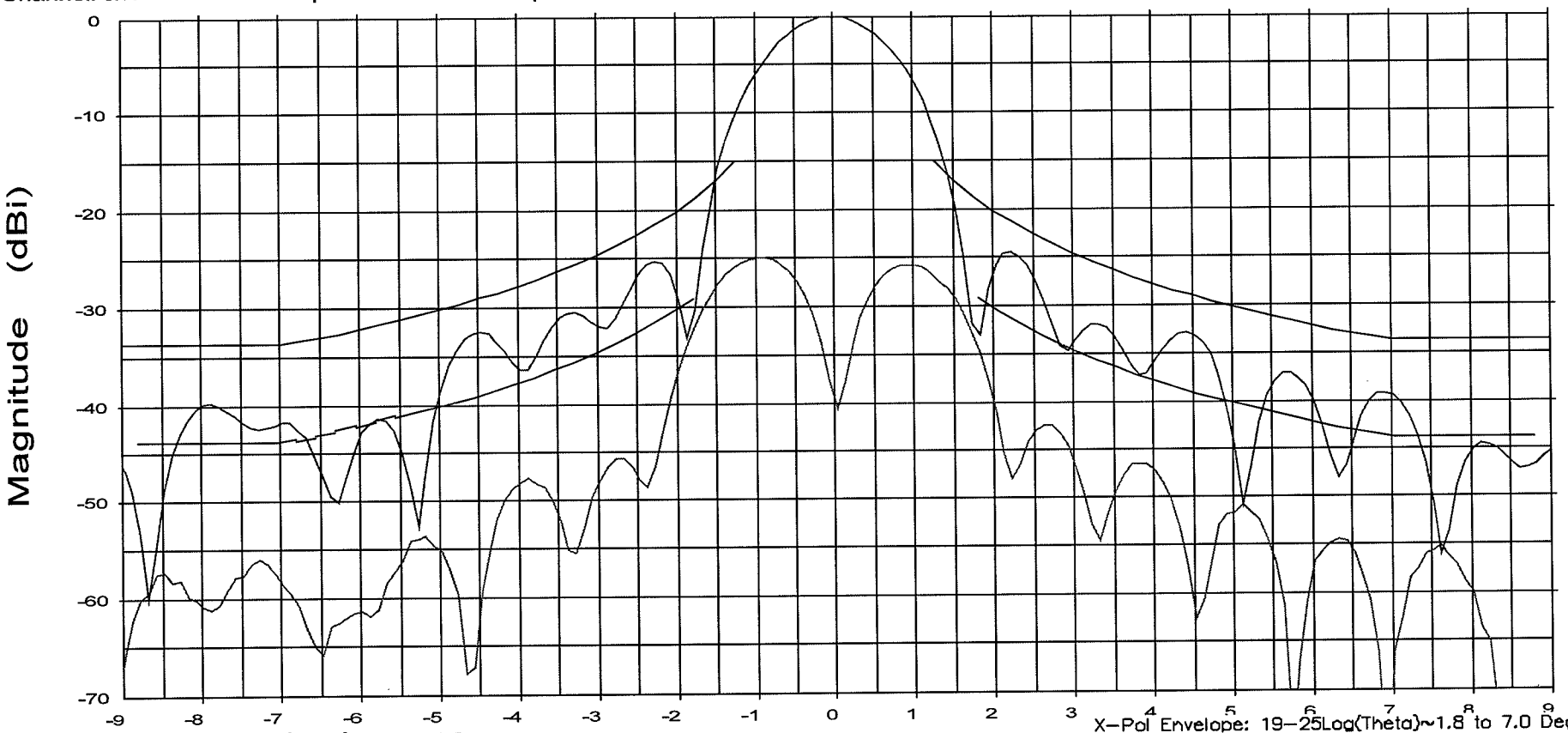
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 11.950 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Horiz. Rx pol: Horiz.



Sidelobe Envelope: 29−25Log(Theta)~1.0 to 7 Deg
+8 dBi~7 to 9.2 Deg | 32−25Log(Theta)~9.2 to 48 Deg
−10 dBi~48 to 180 Deg

X−Pol Envelope: 19−25Log(Theta)~1.8 to 7.0 Deg
−2.0 dBi~7.0 to 9.2 Deg

Overlays	Cal. file	table	channel	units
1629-29.dat-ant_under_test——	1629-29.dat	SGH-110	ch1	dBi
1629-33.dat-ant_under_test——	1629-33.dat	SGH-110	ch1	dBi

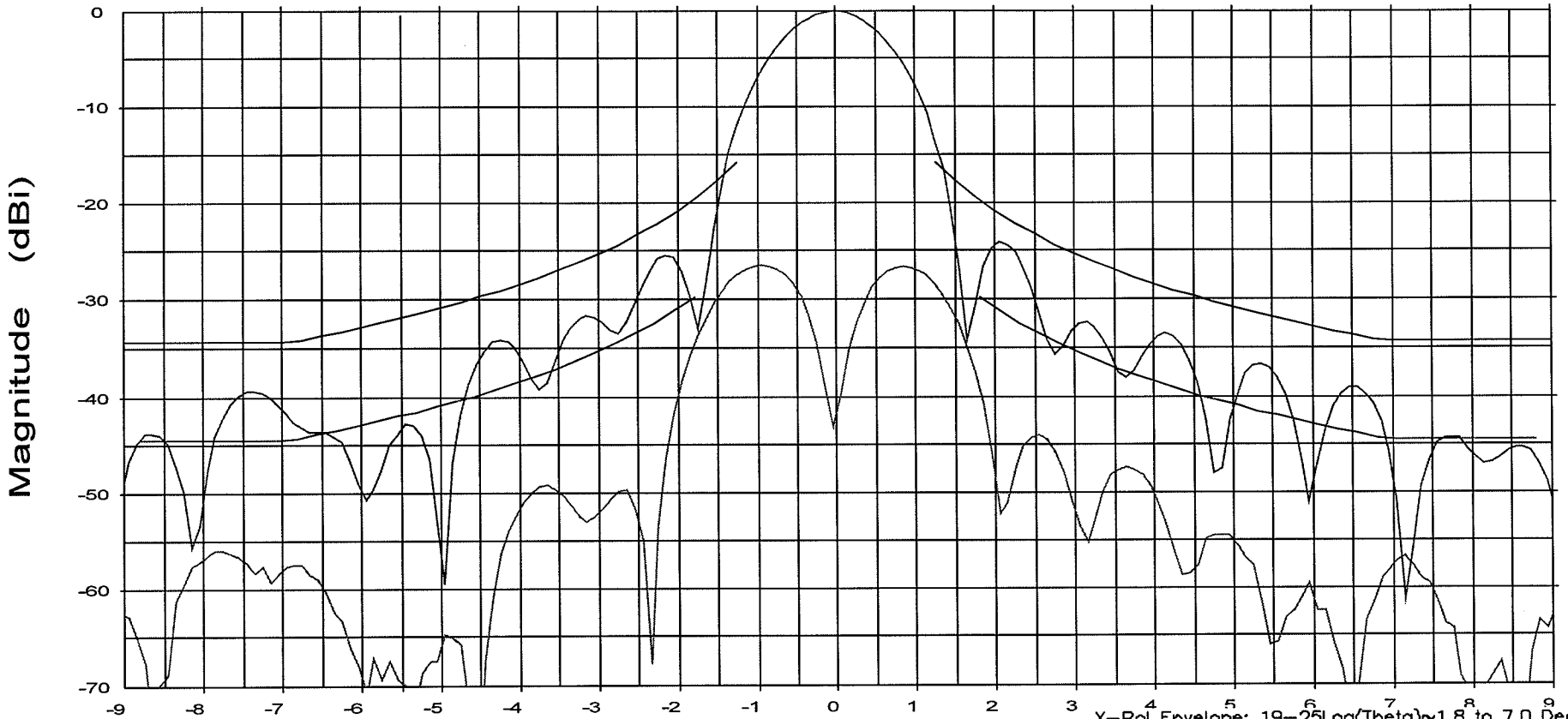
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 12.750 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Horiz. Rx pol: Horiz.



Sidelobe Envelope: 29−25Log(Theta)~1.0 to 7 Deg
+8 dBi~7 to 9.2 Deg | 32−25Log(Theta)~9.2 to 48 Deg
−10 dBi~48 to 180 Deg

X−Pol Envelope: 19−25Log(Theta)~1.8 to 7.0 Deg
−2.0 dBi~7.0 to 9.2 Deg

Overlays	Cal. file	table	channel	units
1629-29.dat-ant_under_test——	1629-29.dat	SGH-110	ch1	dBi
1629-33.dat-ant_under_test——	1629-33.dat	SGH-110	ch1	dBi

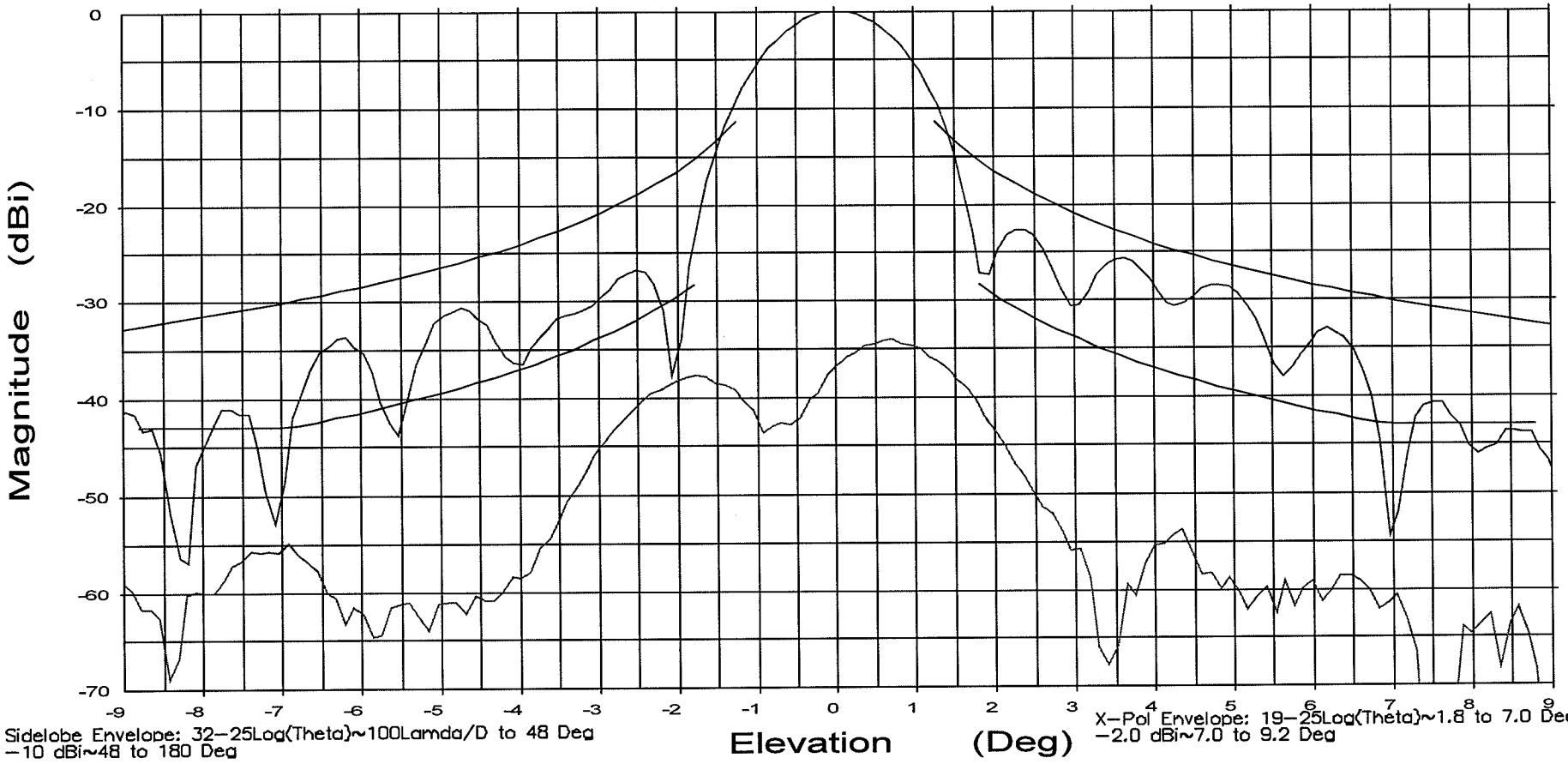
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 10.950 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Horiz. Rx pol: Horiz.



Overlays	Cal. file	table	channel	units
1629-28.dat-ant_under_test——	1629-28.dat	SGH-110	ch1	dBi
1629-35.dat-ant_under_test——	1629-35.dat	SGH-110	ch1	dBi

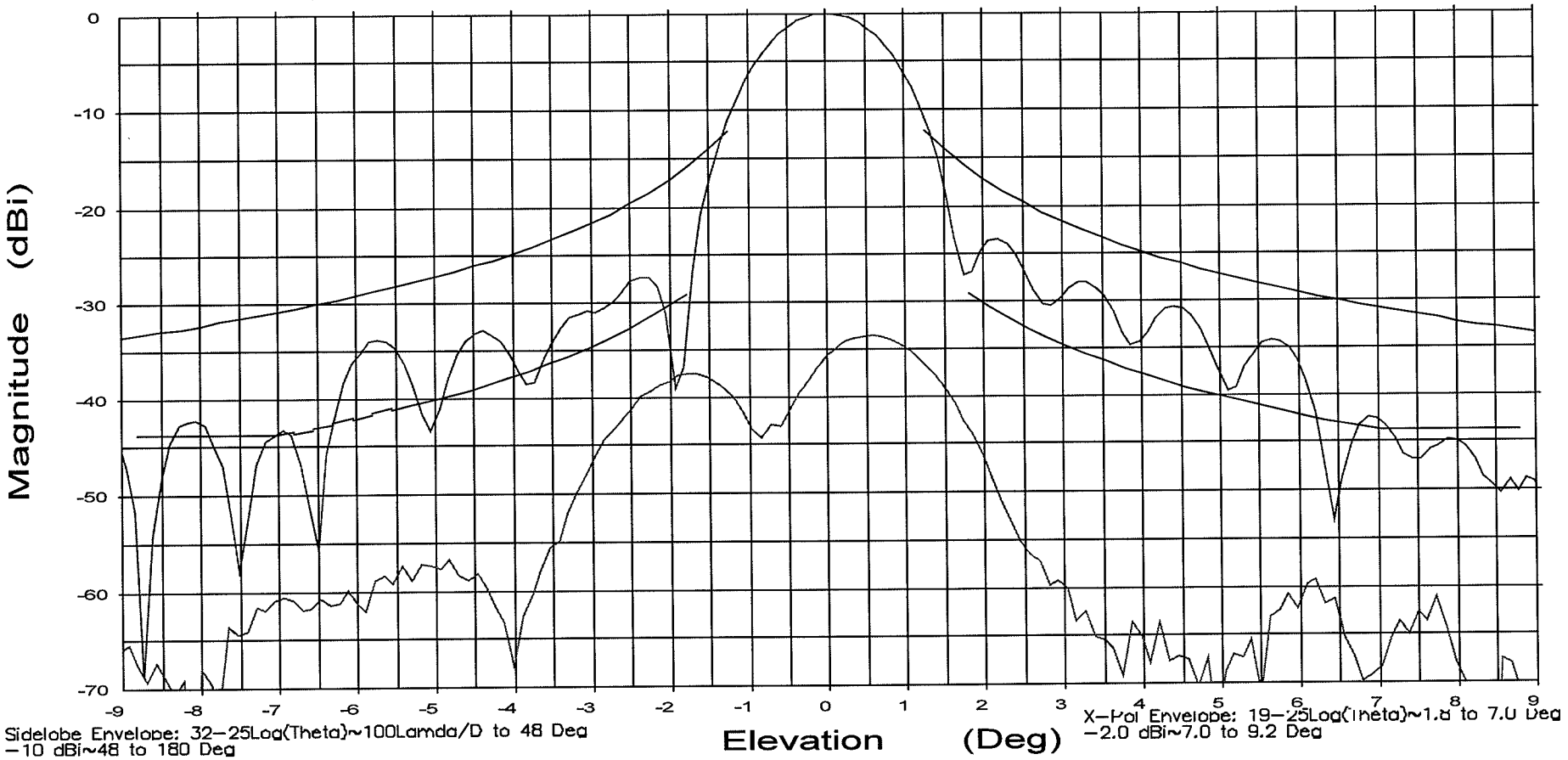
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 11.950 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Horiz. Rx pol: Horiz.



Overlays	Cal. file	table	channel	units
1629-28.dat-ant_under_test——	1629-28.dat	SGH-110	ch1	dBi
1629-35.dat-ant_under_test——	1629-35.dat	SGH-110	ch1	dBi

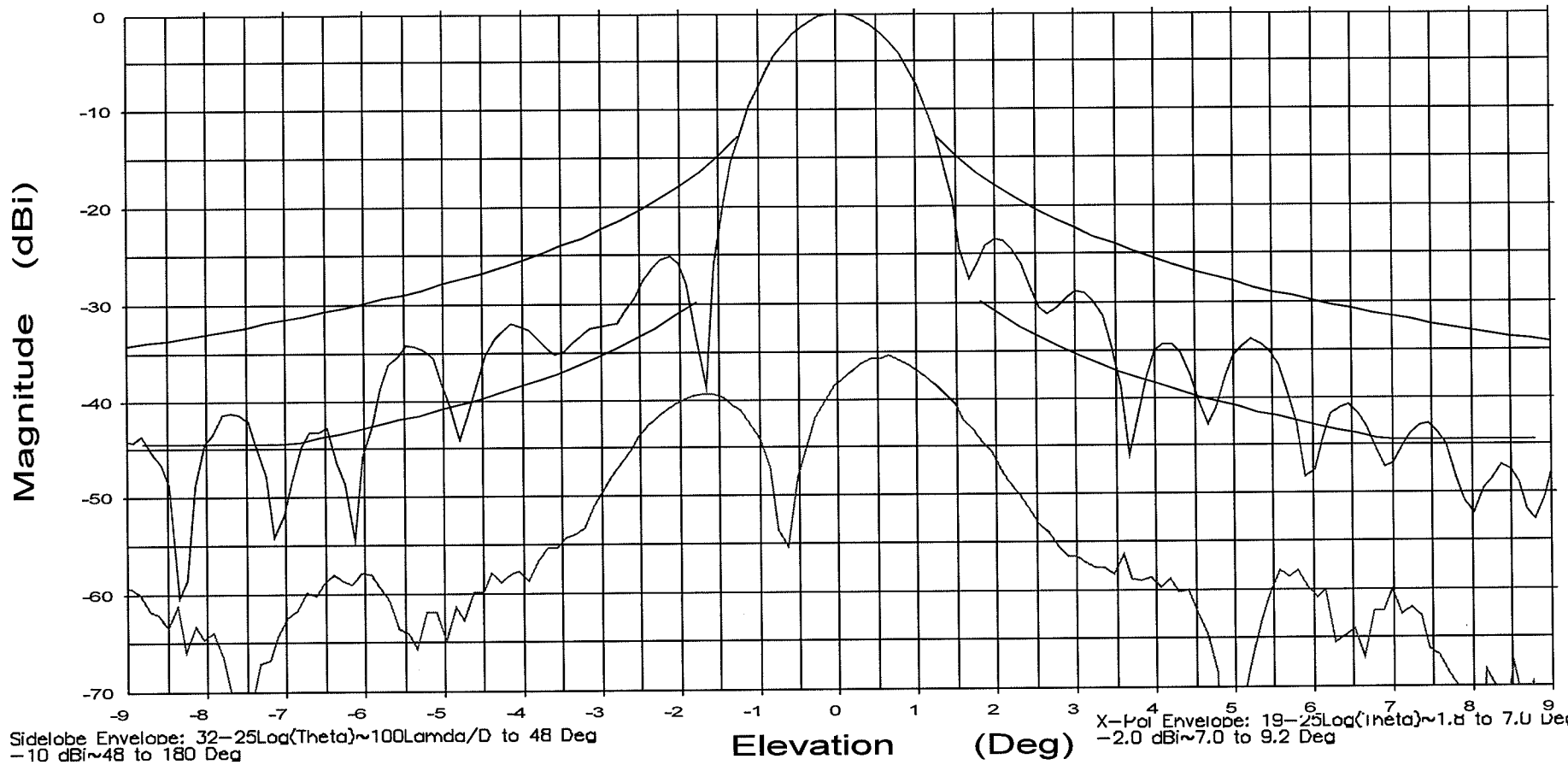
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 12.750 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Horiz. Rx pol: Horiz.



Overlays	Cal. file	table	channel	units
1629-28.dat-ant_under_test——	1629-28.dat	SGH-110	ch1	dBi
1629-35.dat-ant_under_test——	1629-35.dat	SGH-110	ch1	dBi

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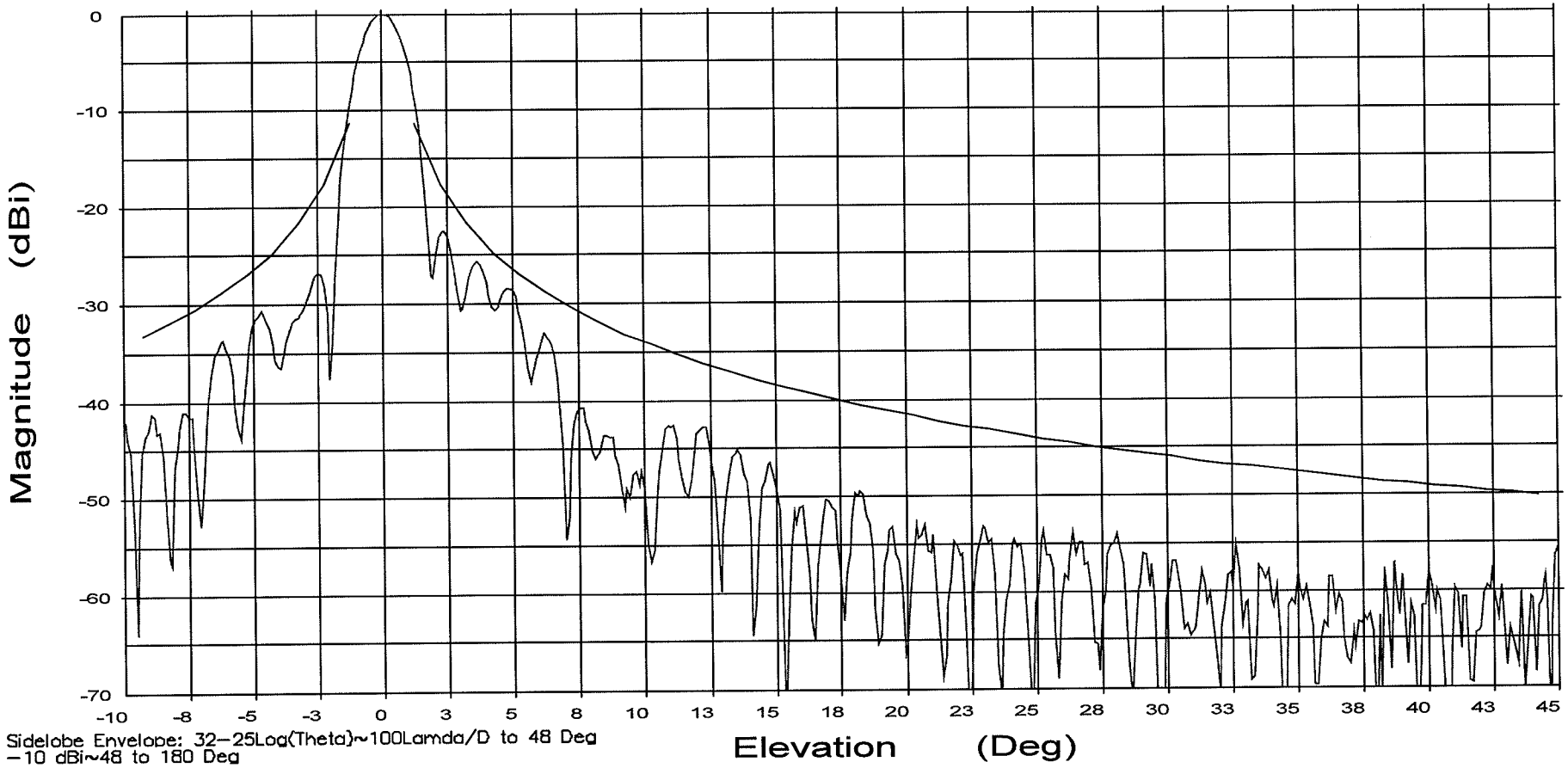
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 10.950 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Horiz. Rx pol: Horiz.



Sidelobe Envelope: 32-25Log(Theta)~100Lamda/D to 48 Deg
-10 dBi~48 to 180 Deg

Overlays	Cal. file	table	channel	units
1629-28.dat-ant_under_test——	1629-28.dat	SGH-110	ch1	dBi

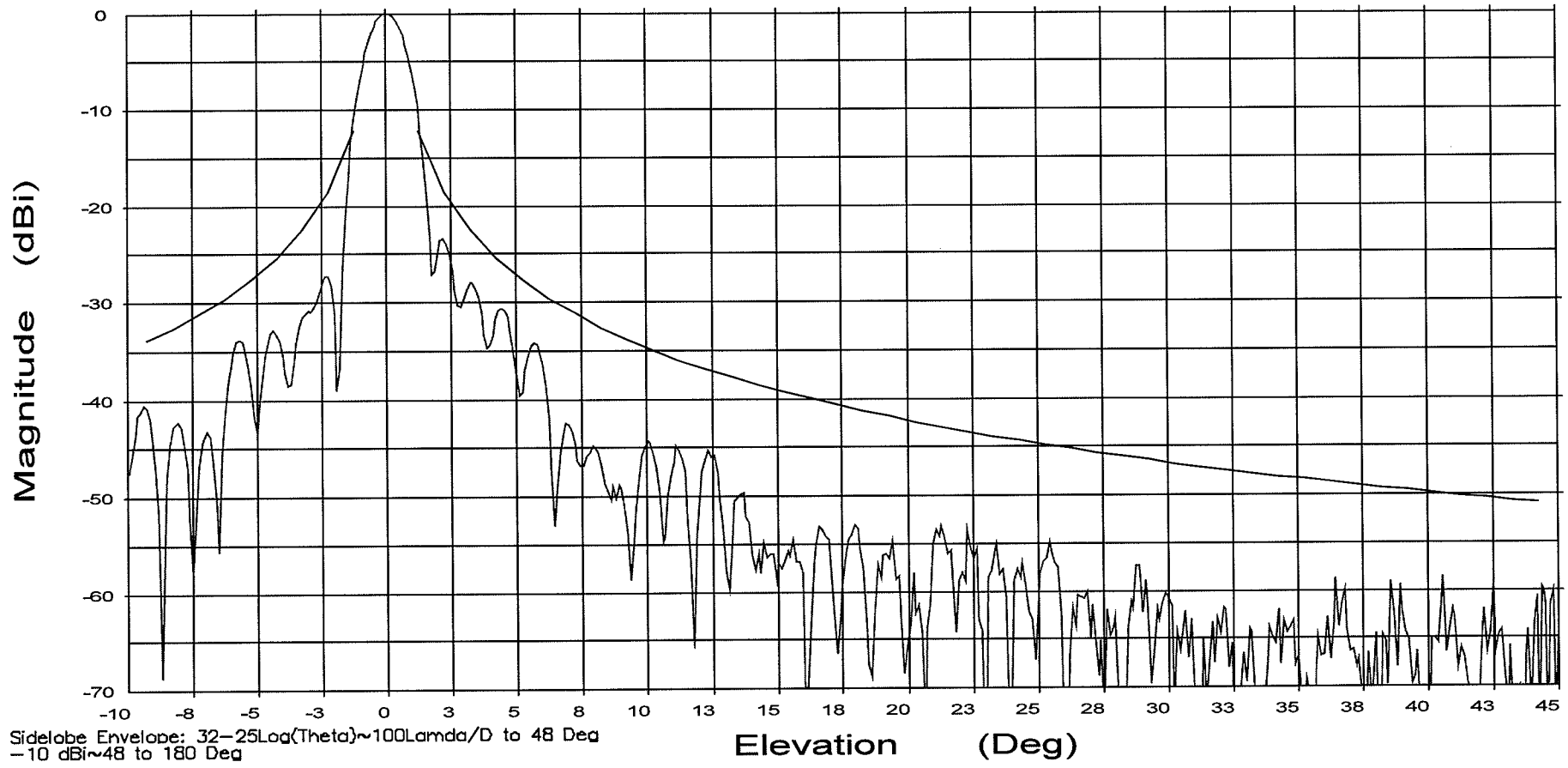
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 11.950 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Horiz. Rx pol: Horiz.



Sidelobe Envelope: 32−25Log(Theta)~100Lamda/D to 48 Deg
−10 dBi~48 to 180 Deg

Overlays	Cal. file	table	channel	units
1629-28.dat-ant_under_test——	1629-28.dat	SGH-110	ch1	dBi

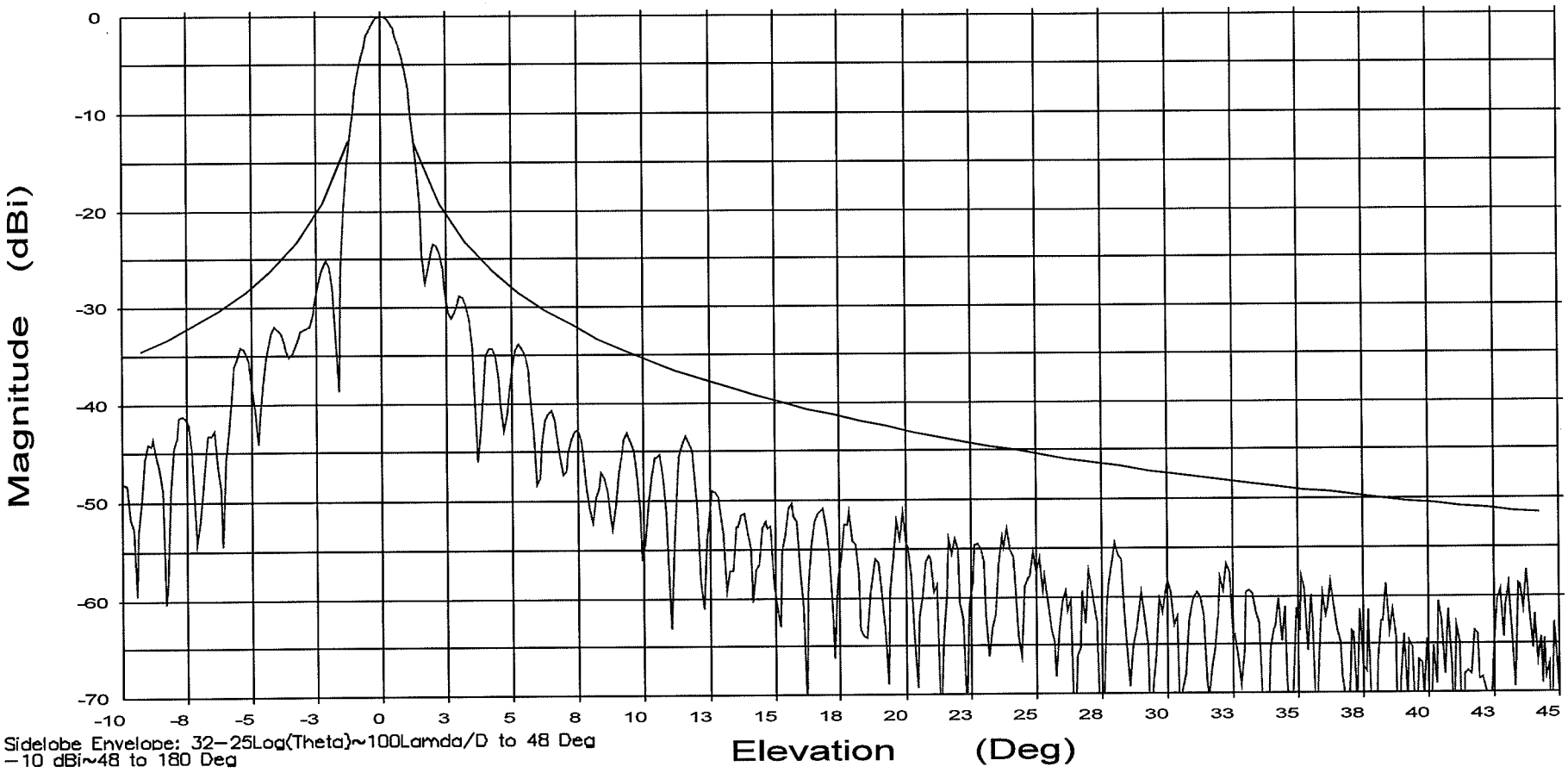
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 12.750 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Horiz. Rx pol: Horiz.



Sidelobe Envelope: 32-25Log(Theta)~100Lamda/D to 48 Deg
-10 dBi~48 to 180 Deg

Overlays	Cal. file	table	channel	units
1629-28.dat-ant_under_test——	1629-28.dat	SGH-110	ch1	dBi

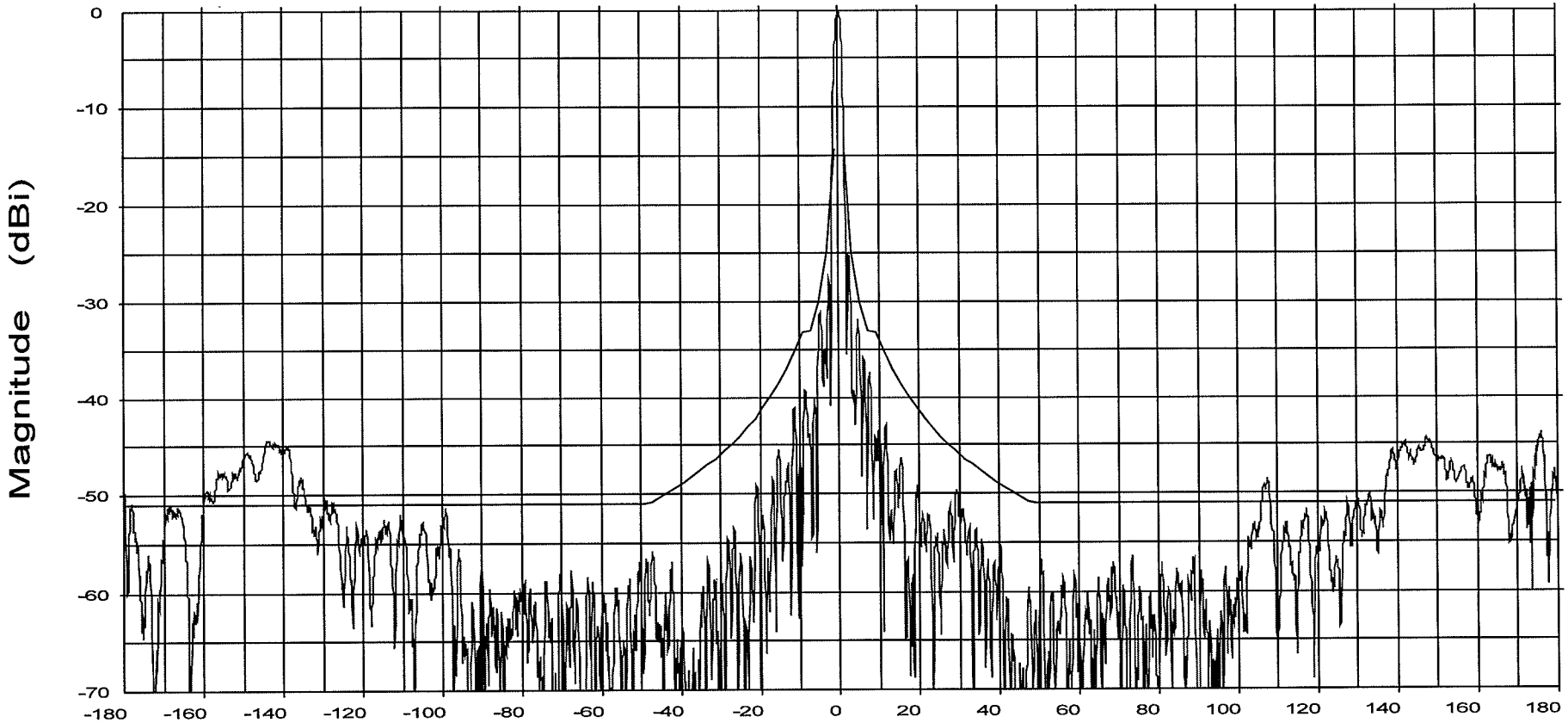
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 10.950 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Horiz. Rx pol: Horiz.



Sidelobe Envelope: 29−25Log(Theta)~1.0 to 7 Deg
+8 dBi~7 to 9.2 Deg | 32−25Log(Theta)~9.2 to 48 Deg
−10 dBi~48 to 180 Deg

Overlays	Cal. file	table	channel	units
1629-29.dat-ant_under_test——	1629-24.dat	SGH-110	ch1	dBi

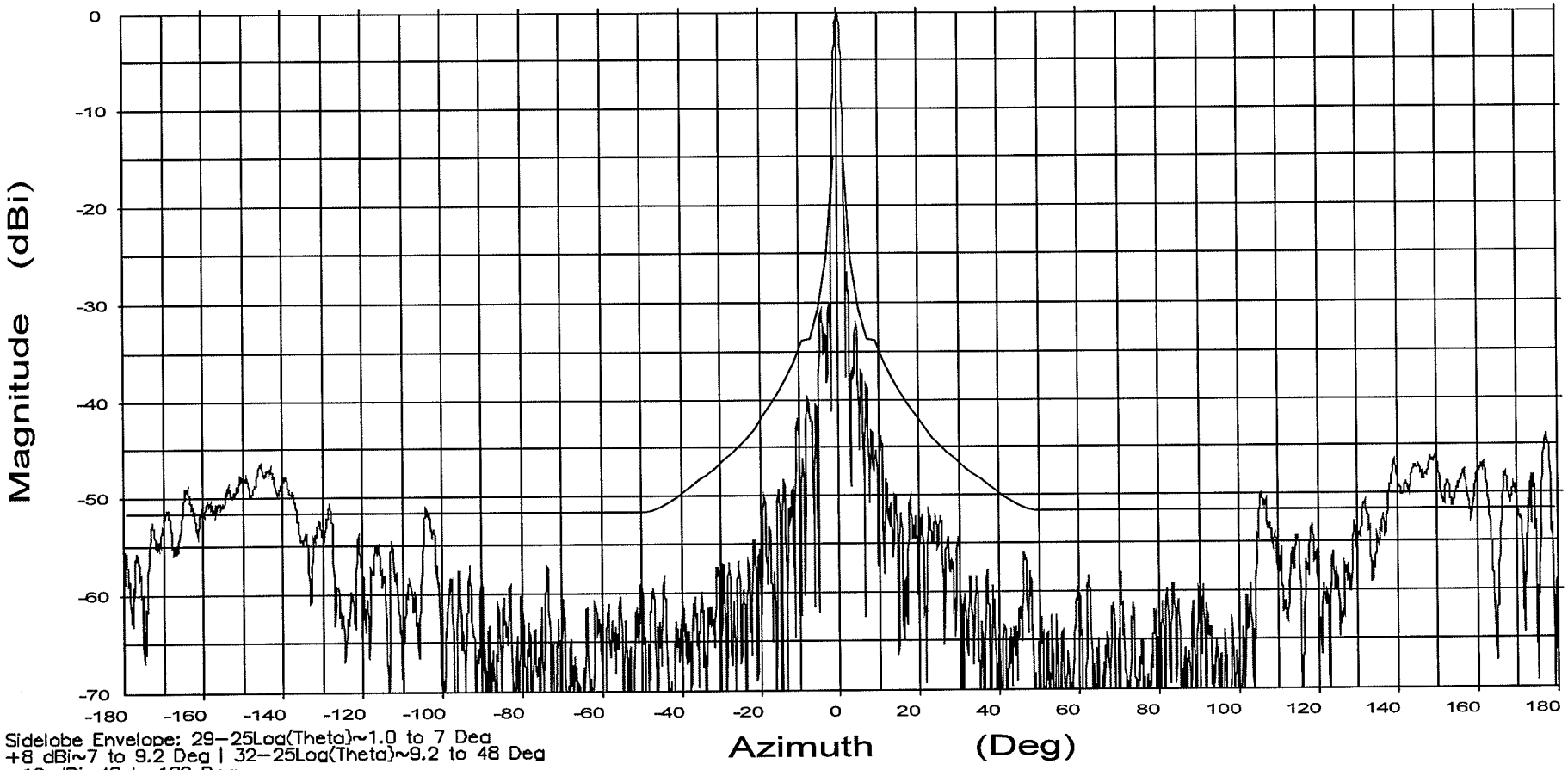
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 11.950 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Horiz. Rx pol: Horiz.



Sidelobe Envelope: 29−25Log(Theta)~1.0 to 7 Deg
+8 dBi~7 to 9.2 Deg | 32−25Log(Theta)~9.2 to 48 Deg
−10 dBi~48 to 180 Deg

Overlays	Cal. file	table	channel	units
1629-29.dat-ant_under_test——	1629-24.dat	SGH-110	ch1	dBi

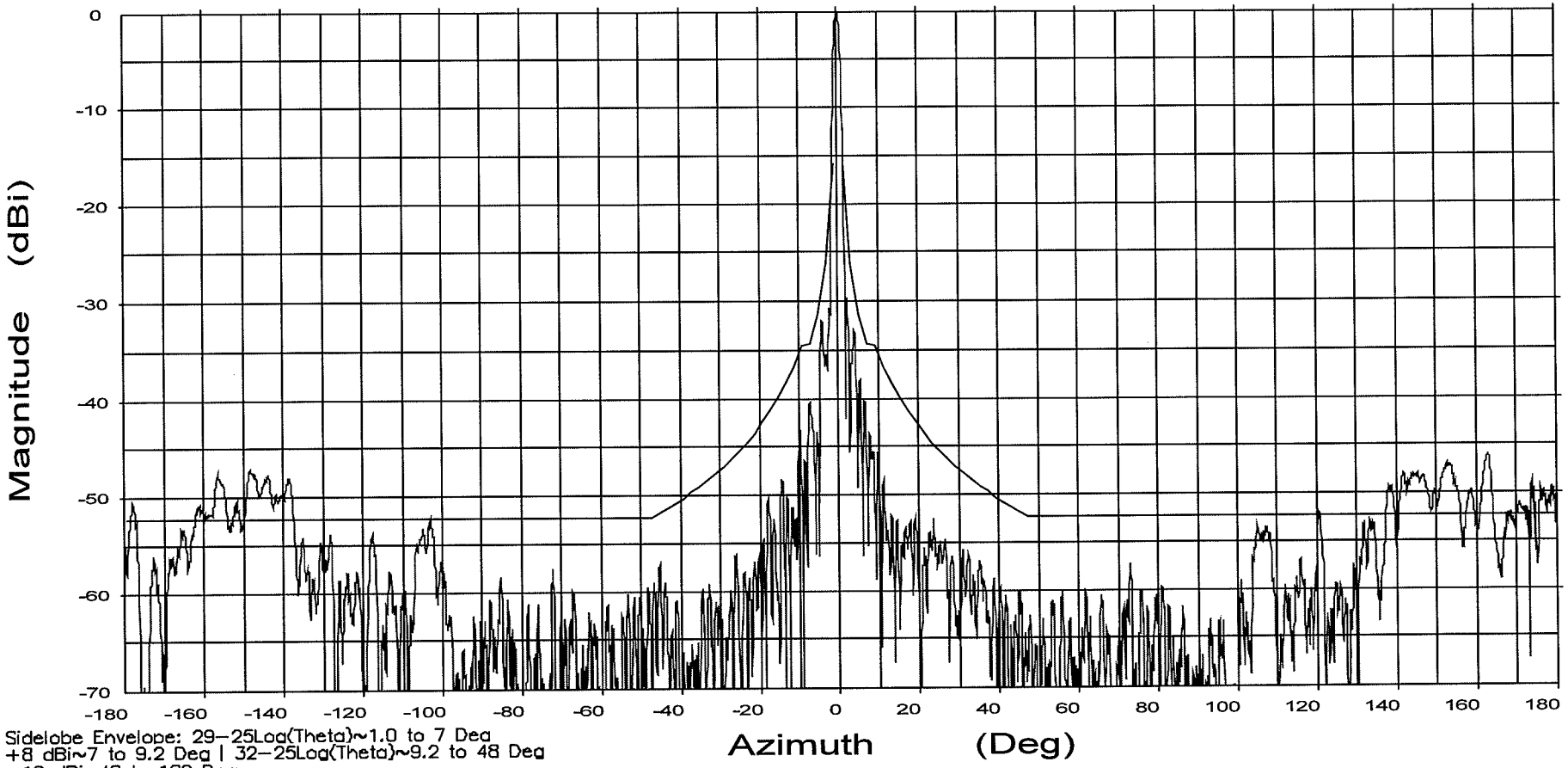
General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

File: See Legend

Prodelin Series 1123
1.2m Ku Band Antenna System

Frequency : 12.750 GHz

Operator: Keny Poovey
Ser. no.:
Channel: ch1 Tx pol: Horiz. Rx pol: Horiz.



Sidelobe Envelope: 29−25Log(Theta)~1.0 to 7 Deg
+8 dBi~7 to 9.2 Deg | 32−25Log(Theta)~9.2 to 48 Deg
−10 dBi~48 to 180 Deg

Overlays	Cal. file	table	channel	units
1629-29.dat-ant_under_test——	1629-24.dat	SGH-110	ch1	dBi

General Dynamics SATCOM Technologies
East Maiden Test Facility
4488 Lawing Chapel Church Road
Maiden, North Carolina 28650

Annex 2 – Link Budget

Link Budget

Produced using Satmaster Pro

Friday 20 March 2015

Service Name	Return TDMA / iDirect / 0.5Mbit
Coverage	SATMEX 6 Ku-Band
Uplink earth station	Houston, USA-TX-E
Downlink earth station	Mount Jackson, USA-VA
Satellite name	SATMEX 6
Modcod	Manual

Link Input Parameters	*Up*	*Down*	*Units*
Site latitude	29.77N	38.72N	degrees
Site longitude	95.37W	78.66W	degrees
Site altitude	0.500	0.500	km
Frequency	14.32	12.020	GHz
Polarization	Horizontal	Vertical	
Rain model	ITU-R	ITU-R	
Rain zone or mm/h	67.2	48.8	
Availability (average year)	99.65	99.9	%
Antenna aperture	1.2	3.8	metres
Antenna efficiency or gain (+ or - prefix)	65	65	% or dBi
Coupling loss	0.0	0.2	dB
Antenna mispoint loss	0.0	0.2	dB
Other path losses	0	0	dB
LNB noise figure or temp (+ prefix)		0.6	dB or K
Antenna Noise		22.00	K
Csat/ACIo	120	120	dB.Hz
Csat/ASIo	120.00	120.00	dB.Hz
Csat/XPIo	120	120	dB.Hz
Uplink station HPA output back-off	0		dB
Uplink power control	0		dB
Number of carriers / HPA	1		
HPA C/IMo	140		dB.Hz
Required HPA power	MIN		W

Satellite Input Parameters	*Value*	*Units*
Satellite longitude	113.00W	degrees
Transponder type	LTWTA	
G/T Reference	0.5	dB/K

SFD Reference	-89.8	dBW/m2
Receive G/T	-1	dB/K
Attenuator pad (gain step)	0	dB
Effective SFD	-88.30	dBW/m2
Satellite ALC	0	dB
EIRP (saturation)	47	dBW
Transponder bandwidth	36	MHz
Input back off total	6	dB
Output back off total	3.00	dB
C/IM	21.27	dB
Number of transponder carriers	AUTO	

Carrier/Link Input Parameters	***Value***	***Units***
Modulation	8-PSK	
Required Es/No	9.3	dB
Information rate	0.8	Mbps
Information rate overhead	0	%
FEC code rate	0.667	
Spreading gain	0	dB
(1 + Roll off factor)	1.25	
Carrier spacing factor	1.25	
Bandwidth allocation step size	0.01	MHz
Implementation loss	0	dB
System margin	0	dB

Calculations at Saturation	***Value***	***Units***
Gain 1m^2	44.57	dB/m2
Uplink C/No	94.72	dB.Hz
Downlink C/No	102.23	dB.Hz
Total C/No	94.01	dB.Hz
Uplink EIRP for saturation	74.21	dBW

General Calculations	***Up***	***Down***	***Units***
Elevation	50.28	32.82	degrees
True azimuth	212.62	227.52	degrees
Compass bearing	209.88	237.33	degrees
Path distance to satellite	37059.44	38364.60	km
Propagation time delay	0.123617	0.127970	seconds
Antenna efficiency	65.00	65.00	%
Antenna gain	43.24	51.73	dBi

Availability (average year)	99.65	99.9	%
Link downtime (average year)	30.681	8.766	hours
Availability (worst month)	98.856	99.615	%
Link downtime (worst month)	8.353	2.809	hours

Uplink Calculation	***Clear***	***Rain Up***	***Rain Dn***	***Units***
Uplink transmit EIRP	48.62	48.62	48.62	dBW
Transponder input back-off (total)	6.00	6.00	6.00	dB
Input back-off per carrier	25.59	28.65	25.59	dB
Antenna mispoint	0.00	0.00	0.00	dB
Free space loss	206.94	206.94	206.94	dB
Atmospheric absorption	0.14	0.20	0.14	dB
Tropospheric scintillation fading	0.00	0.39	0.00	dB
Cloud attenuation	0.00	0.50	0.00	dB
Rain attenuation	0.00	2.47	0.00	dB
Total attenuation (gas-rain-cloud-scintillation)	0.14	3.20	0.14	dB
Other path losses	0.00	0.00	0.00	dB
Uplink power control	0.00	0.00	0.00	dB
Uncompensated fade	0.00	3.06	0.00	dB
C/No (thermal)	69.14	66.07	69.14	dB.Hz
C/N (thermal)	13.12	10.05	13.12	dB
C/ACI	38.39	35.33	38.39	dB
C/ASI	38.39	35.33	38.39	dB
C/XPI	38.39	28.50	38.39	dB
C/IM	58.39	58.39	58.39	dB
C/(N+I) [= Es/(No+Io)]	13.08	9.97	13.08	dB
Eb/(No+Io)	10.07	6.95	10.07	dB

Downlink Calculation	***Clear***	***Rain Up***	***Rain Dn***	***Units***
Satellite EIRP total	47.00	47.00	47.00	dBW
Transponder output back-off (total)	3.00	3.00	3.00	dB
Output back-off per carrier	22.59	25.65	22.59	dB
Satellite EIRP per carrier	24.41	21.35	24.41	dBW
Antenna mispoint	0.20	0.20	0.20	dB
Free space loss	205.72	205.72	205.72	dB
Atmospheric absorption	0.11	0.11	0.19	dB
Tropospheric scintillation fading	0.00	0.00	0.53	dB
Cloud attenuation	0.00	0.00	0.49	dB
Rain attenuation	0.00	0.00	2.81	dB
Total attenuation (gas-rain-cloud-scintillation)	0.11	0.11	3.53	dB
Other path losses	0.00	0.00	0.00	dB

Noise increase due to precipitation	0.00	0.00	4.40	dB
Downlink degradation (DND)	0.00	0.00	7.81	dB
Total system noise	77.03	77.03	212.19	K
Figure of merit (G/T)	32.66	32.66	28.26	dB/K
C/No (thermal)	79.64	76.57	71.82	dB.Hz
C/N (thermal)	23.62	20.55	15.80	dB
C/ACI	41.39	38.33	41.39	dB
C/ASI	41.39	38.33	41.39	dB
C/XPI	41.39	38.33	23.90	dB
C/IM	21.27	21.27	21.27	dB
C/(N+I) [= Es/(No+Io)]	19.20	17.77	14.21	dB
Eb/(No+Io)	16.19	14.76	11.19	dB

Totals per Carrier (End-to-End)	***Clear***	***Rain Up***	***Rain Dn***	***Units***
C/No (thermal)	68.76	65.70	67.26	dB.Hz
C/N (thermal)	12.75	9.68	11.25	dB
C/ACI	36.63	33.56	36.63	dB
C/ASI	36.63	33.56	36.63	dB
C/XPI	36.63	28.07	23.74	dB
C/IM	21.27	21.27	21.27	dB
C/I (total)	20.91	20.04	19.16	dB
C/(No+Io)	68.15	65.32	66.61	dB.Hz
C/(N+I) [= Es/(No+Io)]	12.13	9.30	10.60	dB
Eb/(No+Io)	9.12	6.29	7.58	dB
Implementation loss	0.00	0.00	0.00	dB
System margin	0.00	0.00	0.00	dB
Net Es/(No+Io)	12.13	9.30	10.60	dB
Required Es/(No+Io)	9.30	9.30	9.30	dB
Excess margin	2.83	0.00	1.30	dB

Earth Station Power Requirements	***Value***	***Units***
EIRP per carrier	48.62	dBW
Antenna gain	43.24	dBi
Antenna feed flange power per carrier	5.38	dBW
Uplink power control	0.00	dB
HPA output back off	0.00	dB
Waveguide loss	0.0	dB
Number of HPA carriers	1	
Total HPA power required	5.3810	dBW
Required HPA power	3.4522	W

Power Density Calculations	Up	Down	Units
Power density (flange)	-50.64	20.12	dBW/Hz
EIRP density	-7.40	-31.61	dBW/Hz

Space Segment Utilization	Value	Units
Overall availability	99.550	%
Information rate	0.8000	Mbps
Information rate (inc overhead)	0.8000	Mbps
Transmit rate	1.1994	Mbps
Symbol rate	0.3998	Mbaud
Noise Bandwidth	56.02	dB.Hz
Occupied bandwidth	0.4998	MHz
Minimum allocated bandwidth required	0.4998	MHz
Allocated transponder bandwidth	0.5000	MHz
Percentage transponder bandwidth used	1.39	%
Used transponder power	24.41	dBW
Percentage transponder power used	1.10	%
Max carriers by transponder bandwidth	72.00	
Max carriers by transponder power	90.99	
Max transponder carriers limited by:-	Bandwidth	[72.00]
Power equivalent bandwidth usage	0.3957	MHz

Annex 3 – Radiation Hazard Study

Radiation Hazard Study

Prodelin 1.2m Ku (Type 1123)

This study analyzes the potential Radio Frequency (RF) human exposure levels caused by the Electro Magnetic (EM) fields of the above-captioned antenna. The mathematical analysis performed below complies with the methods described in the Federal Communications Commission Office of Engineering and Technology Bulletin No. 65 (1985 rev. 1997) R&O 96-326.

Maximum Permisible Exposure

There are two separate levels of exposure limits. The first applies to persons in the general population who are in an uncontrolled environment. The second applies to trained personnel in a controlled environment. According to 47 C.F.R. § 1.1310, the Maximum Permissible Exposure (MPE) limits for frequencies above 1.5 GHz are as follows:

- General Population / Uncontrolled Exposure 1.0 mW/cm2
- Occupational / Controlled Exposure 5.0 mW/cm2

The purpose of this study is to determine the power flux density levels for the earth station under study as compared with the MPE limits. This comparison is done in each of the following regions:

1. Far-field region
2. Near-field region
3. Transition region
4. The region between the feed and the antenna surface
5. The main reflector region
6. The region between the antenna edge and the ground

Input Parameters

The following input parameters were used in the calculations:

Parameter	Value	Unit	Symbol
Atenna Diameter:	1.2	m	D
Antenna Transmit Gain:	43.20	dBi	G
Trasmit Frequency:	14250	MHz	f
Feed Flange Diameter:	19.00	cm	d
Power Input to the Antenna:	20.00	W	P

Calculated Parameters

The following values were calculated using the above input parameters and the corresponding formulas.

Parameter	Value	Unit	Symbol	Formula
Anenna Surface Area:	1.13	m^2	A	$\pi D^2/4$
Area of Feed Flange:	283.53	cm^2	a	$\pi d^2/4$
Antenna Efficiency:	0.65		η	$G\lambda^2/(\pi^2 D^2)$
Gain Factor:	20892.96		g	$10^{G/10}$
Wavelength:	0.0211	m	λ	$300/f$

Behavior of EM Fields as a Function of Distance

The behavior of the characteristics of EM fields varies depending on the distance from the radiating antenna. These characteristics are analyzed in three primary regions: the near-field region, the far-field region and the transition region. Of interest also are the region between the antenna main reflector and the subreflector, the region of the main reflector area and the region between the main reflector and ground.

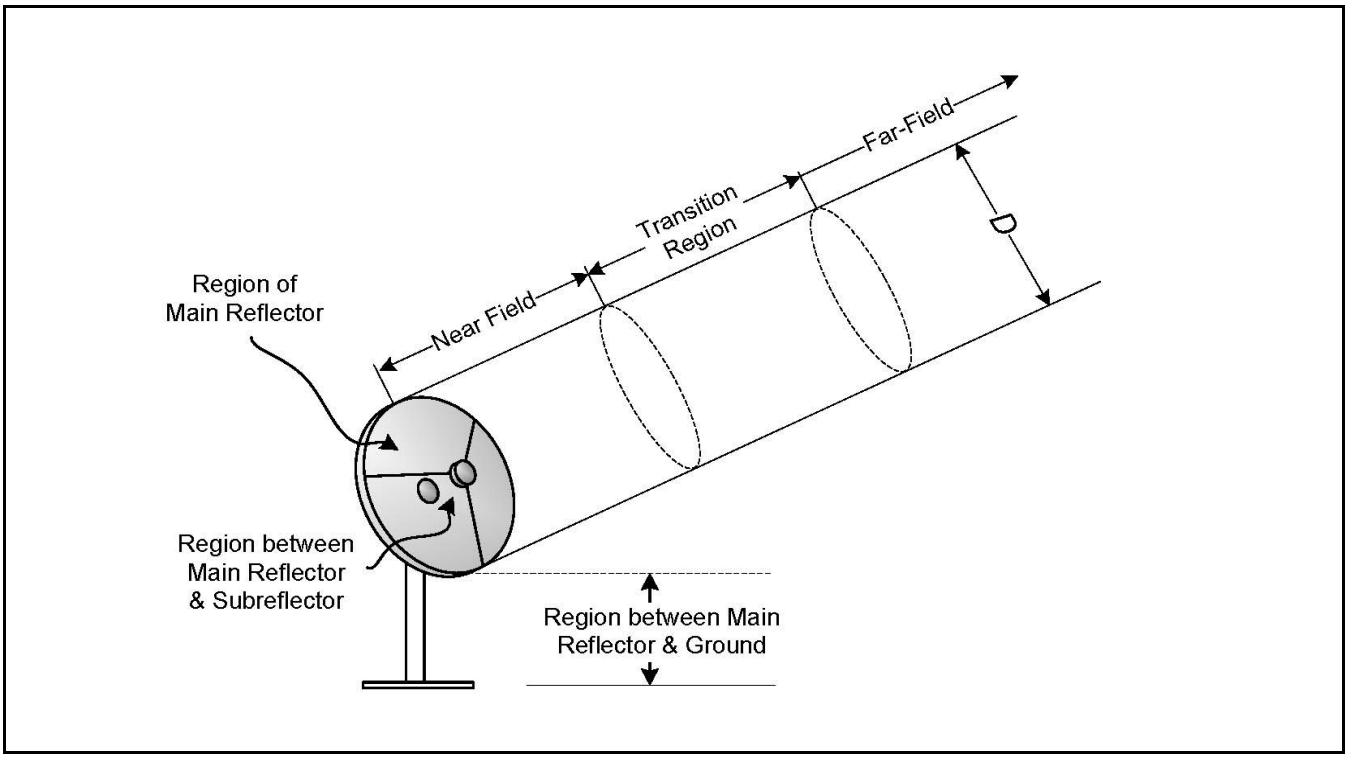


Figure 1. EM Fields as a Function of Distance

For parabolic aperture antennas with circular cross sections, such as the antenna under study, the near-field, far-field and transition region distances are calculated as follows:

Parameter	Value	Unit	Formula
Near Field Distance:	17.100	m	$R_{nf} = D^2/(4\lambda)$
Distance to Far Field:	41.040	m	Rff = 0.60D2/(λ)
Distance of Trasition Region	17.100	m	Rt = Rnf

The distance in the transition region is between the near and far fields. Thus, Rnf ≤ Rt ≤ Rff . However, the power density in the transition region will not exceed the power density in the near-field. Therefore, for purposes of the present analysis, the distance of the transition region can equate the distance to the near-field.

Power Flux Density Calculations

The power flux density is considered to be at a maximum through the entire length of the near-field. This region is contained within a cylindrical volume with a diameter, D, equal to the diameter of the antenna. In the transition region and the far-field, the power density decreases inversely with the square of the distance. The following equations are used to calculate power density in these regions.

Parameter	Value	Unit	Symbol	Formula
Power Density in the Near-Field	4.609	mW/cm^2	S_{nf}	$16.0\ \eta\ P/(\pi D^2)$
Power Density in the Far-Field	1.974	mW/cm^2	S_{ff}	$GP/(4\pi R_{ff}^2)$
Power Density in the Trans. Region	4.609	mW/cm^2	S_t	$S_{nf} R_{nf} /(R_t)$

The region between the main reflector and the subreflector is confined within a conical shape defined by the feed assembly. The most common feed assemblies are waveguide flanges. This energy is determined as follows:

Parameter	Value	Unit	Symbol	Formula
Power Density at the Feed Flange	282.2	mW/cm^2	S_{fa}	$4P / a$

The power density in the main reflector is determined similarly to the power density at the feed flange; except that the area of the reflector is used.

Parameter	Value	Unit	Symbol	Formula
Power Density at Main Reflector	7.074	mW/cm^2	$S_{surface}$	$4P / A$

The power density between the reflector and ground, assuming uniform illumination of the reflector surface, is calculated as follows:

Parameter	Value	Unit	Symbol	Formula
Power Density between Reflector and Ground	1.768	mW/cm^2	S_g	P / A

Table 1 summarizes the calculated power flux density values for each region. In a controlled environment, the only regions that exceed FCC limitations are shown below. These regions are only accessible by trained technicians who, as a matter of procedure, turn off transmit power before performing any work in these areas.

Power Densities	**mW/cm2**	**Controlled Environment (5 mW/cm2)**
Far Field Calculation	1.974	Satisfies FCC Requirements
Near Field Calculation	4.609	Satisfies FCC Requirements
Transition Region	4.609	Satisfies FCC Requirements
Region between Main and Subreflector	282.2	Exceeds Limitations
Main Reflector Region	7.074	Exceeds Limitations
Region between Main Reflector and Ground	1.768	Satisfies FCC Requirements

Table 1. Power Flux Density for Each Region

In conclusion, the results show that the antenna, in a controlled environment, and under the proper mitigation procedures, meets the guidelines specified in 47 C.F.R. § 1.1310.