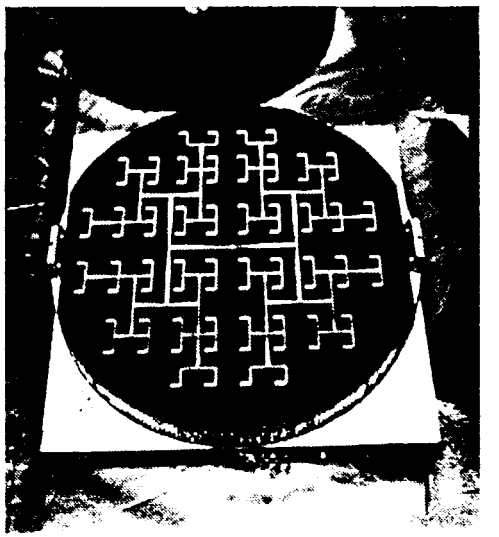
Spacecraft Antenna Accomplishments

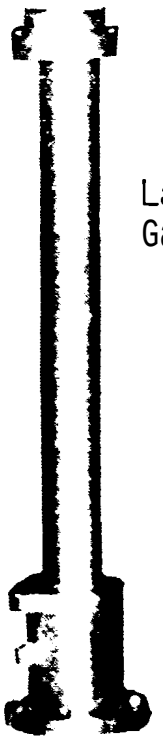
Mars Pathfinder Antennas

Ground Operation Antennas

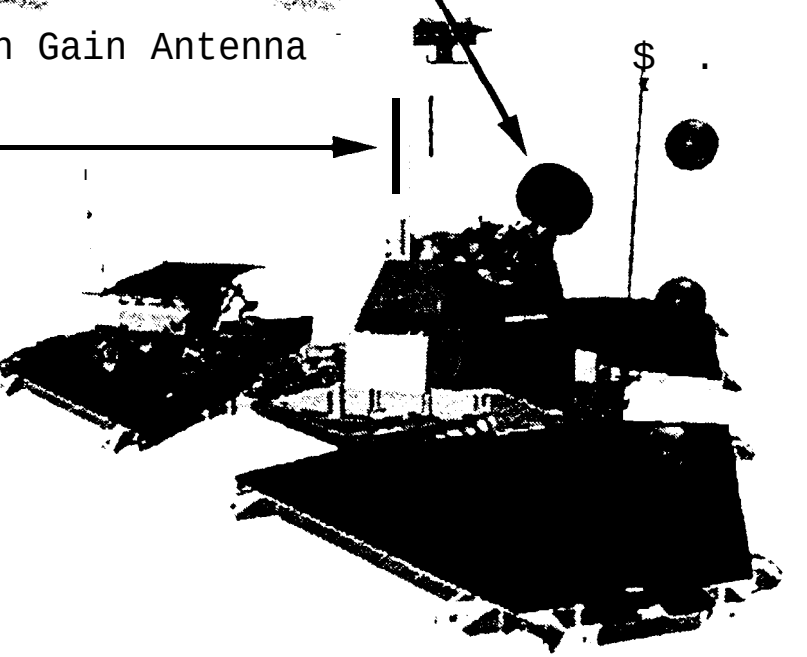
- Gimballed high gain ant for nominal ground operation
- Lander low gain antenna for initial & emergency comm



High Gain Antenna



Lander Low
Gain Antenna



Spacecraft Antenna Accomplishments

Mars Pathfinder Antennas

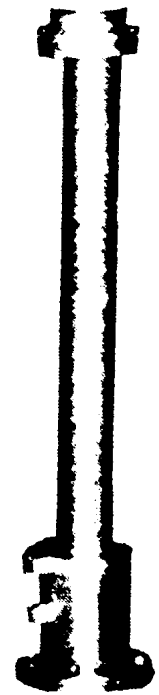
Cruise & Entry Antennas

- Novel "pull away" design allows transference between antennas as spacecraft ejects stages during Mars approach & entry
- Coverage thereby tailored to mission phase
- Lander low gain has piston provision to accommodate mechanical flexibility

Medium Gain Antenna - Used During Cruise

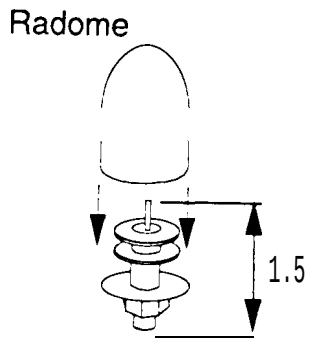
Back Shell Low Gain Ant - Used During Entry

Lander Low Gain Ant - Used during initial ground operations & emergencies

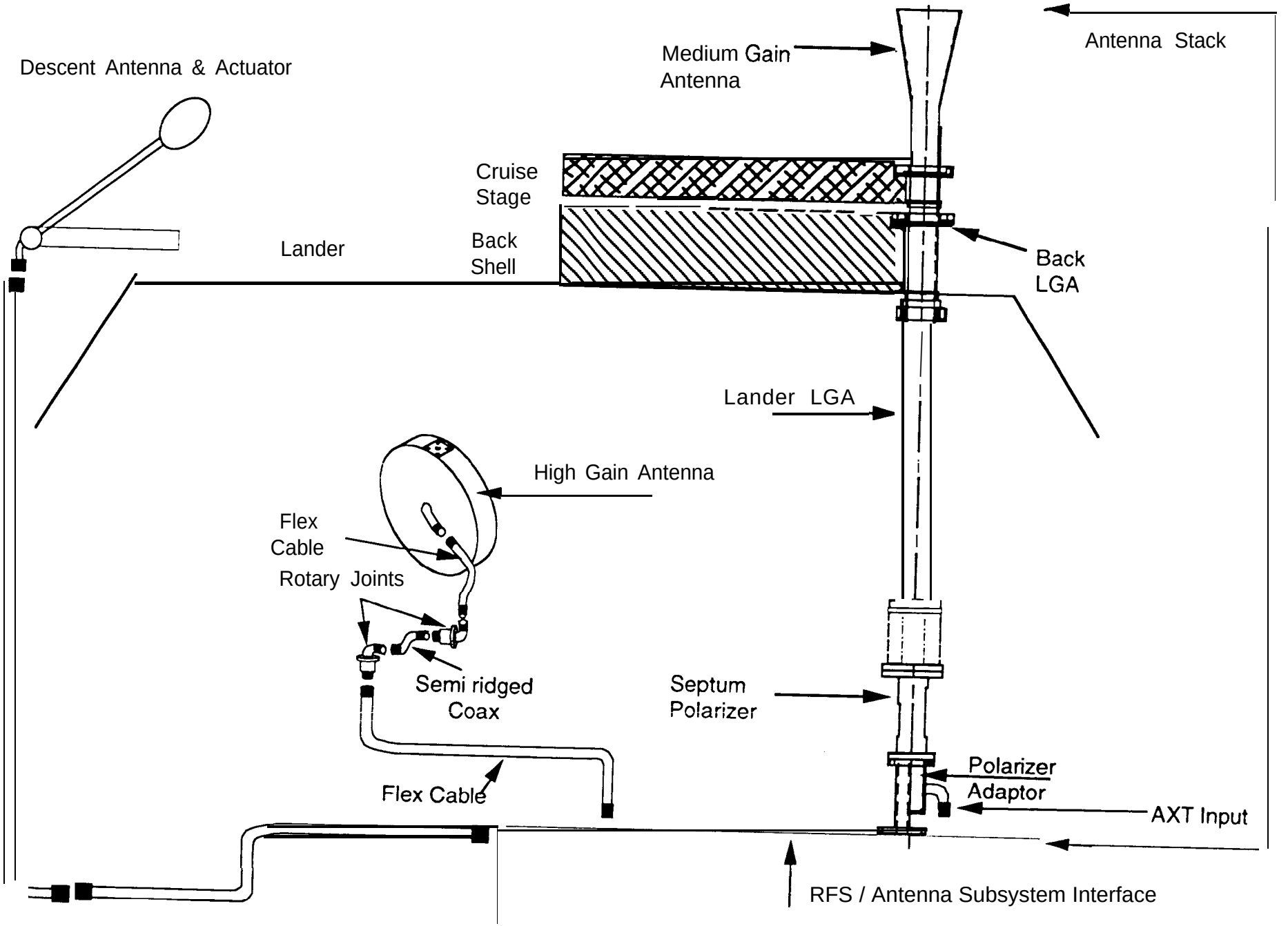


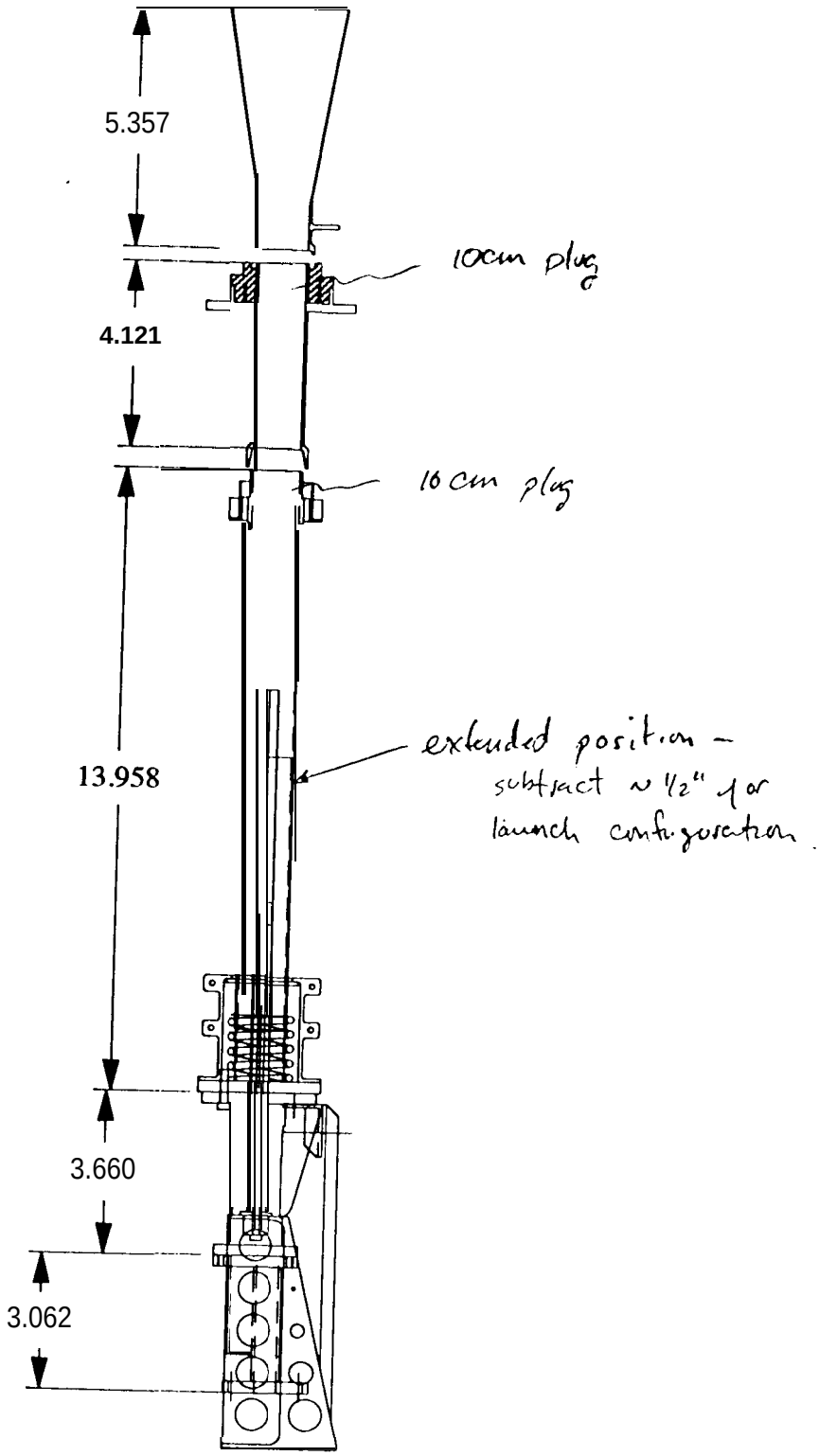
Descent Antenna

- Uses mono-pole over choked ground plane to provide open-loop telemetry during descent
- Deployable



Mars Pathfinder Antenna Subsystem




5.357
10cm plug
4.121
10 cm plug
13.958
extended position –
subtract ~ 1/2" for
launch configuration.
3.660
3.062

Mars pathfinder
TEL Subsystem
Antenna Stack Hardware Summary

Nomenclature	Ref. Des.	H/W Class	Part No.	Rev	Serial No.	Final Inspect Report No.	Weight (kg)	Cog. Eng
Medium Gain Antenna (MGA)	2002MGA	C	10158969-1	A	001	056451	0.07	Burke / Vacchione
Back Shell Low Gain Antenna (BLGA)	2002BLGA	C	10158875-1	A	001	056477	0.27	Burke / Vacchione
Lander Low Gain Antenna Assembly (LLGA)	2002LGA	C	10167333-1	A		056478	0.77	Burke / Vacchione
Base			10158876-1		001			
Sprung Section			10158871-1		001			
Spring Retainer Side 1			10165197-1		001			
Spring Retainer Side 2			10165197-2		001			
Compression Spring			C1460-135-3000-s		001			
Polarizer			10140204-1		006			
Polarizer Adapter			10158877-1		001			
Antenna Bracket			10158878-101		001			
SubBracket 1			10158878-102		001			
SubBracket 2			10158878-103		001			

Mars Pathfinder TEL Subsystem
Antenna Stack Test Summary: RF Characterization

*All measurement data accurate to within ±0.2 dB

Frequency	7.175 GHz	8.425 GHz
Cruise Configuration (MGA)		
Boresite Gain		
Pre Environmental Test	11.6 dBic	14.0 dBic
Post Environmental Test	11.7 dBic	14.0 dBic
± 10 deg EOC Gain		
Pre Environmental Test	10.8 dBic	13.1 dBic
Post Environmental Test	10.9 dBic	13.5 dBic
Requirement	**10.7 dBic**	**9.5** dBic
± 60 deg EOC Gain		
Pre Environmental Test	Not Measured	-14.2 dBic
Post Environmental Test	-11.4 dBic	-12.8 dBic
Desired	**-23.4 dBic**	**-7.6 dBic**
Entry Configuration (Back Shell LGA)		
Boresite Gain		
Pre Environmental Test	4.5 dBic	6.5 dBic
Post Environmental Test	4.3 dBic	6.5 dBic
± 6 deg EOC Gain		
Pre Environmental Test	Not Measured	6.3 dBic
Post Environmental Test	4.2 dBic	6.4 dBic
Requirement	Not Used	2.2 dBic
Landed Configuration (Lander LGA)		
Boresite Gain		
Pre Environmental Test	7.8 dBic	8.5 dBic
Post Environmental Test	7.8 dBic	8.3 dBic
± 30 deg EOC Gain		
Pre Environmental Test	Not Measured	6.2 dBic
Post Environmental Test	5.5 dBic	6.2 dBic
Requirement		**6.3 dBic**

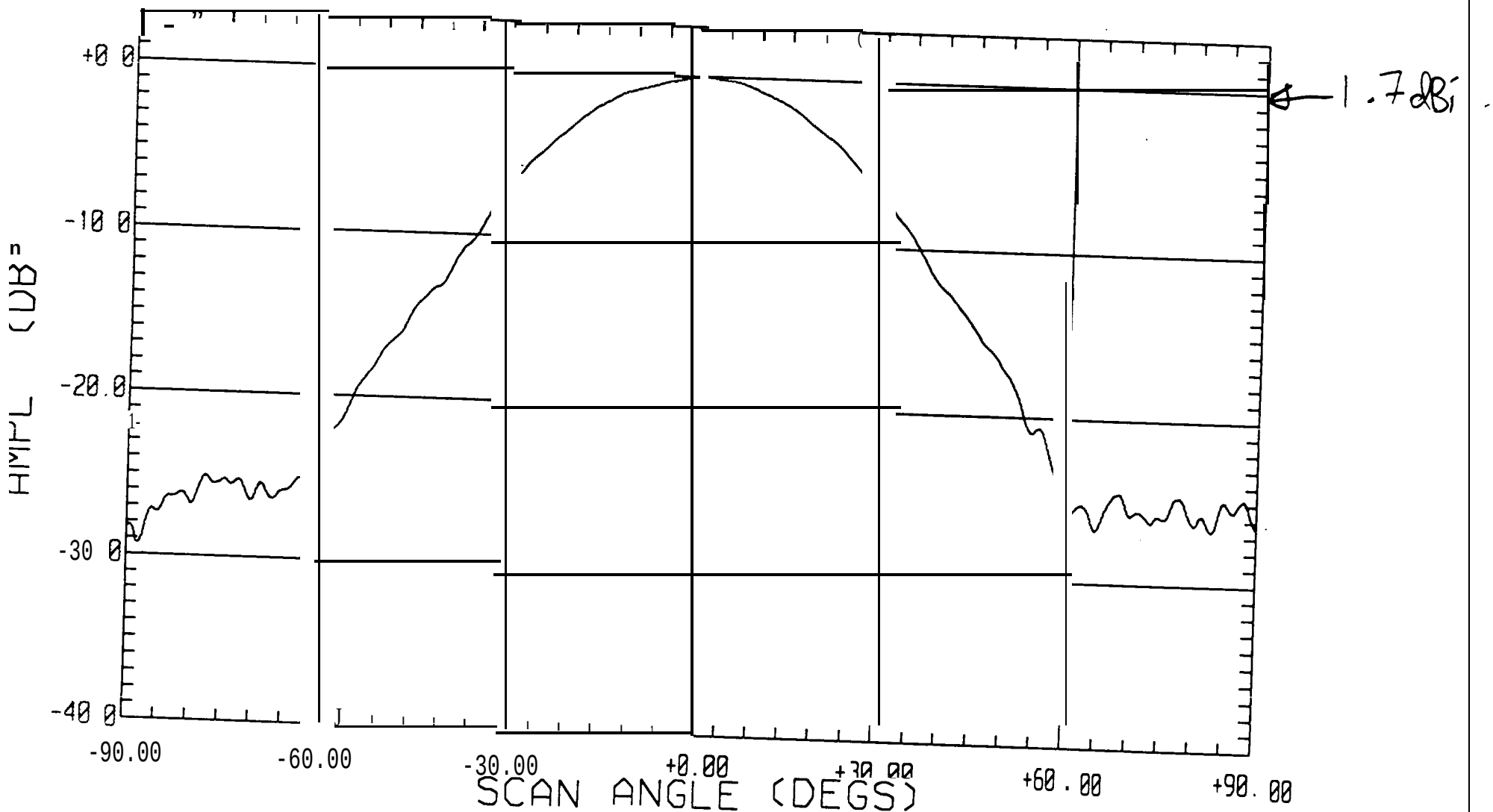
Mars Pathfinder
TEL Subsystem
Antenna Stack Test Summary
Environmental Tests

Hardware	Environment
Polarizer Adapter, SN 001	Thermal: +125 deg C, 5 hours dwell Odeg C/-l IOdeg C, 36 cycles, 15 deg C/rein
HTP-6 Radome bounded with RTV560 in Lap shear tube	Thermal: +125 deg C, 5 hours dwell OdegC/-110 deg C, 36 cycles, 15 deg C/min
	Lap Shear Test (2) Ambient cure, no thermal cycle, failed at 47.2 & 52.8 lbs (2) Ambient cure, with thermal cycle, failed at 33.5 &61.6 lbs
Entry Configuration Antenna Stack, SN 001 (Lander LGA & Back Shell LGA) & MGA , SN001	Random Vibration Protoflight level, 8.6 grins, 1 min/axis
	Sine Survey 0.25 g, 5-2000 Hz each axis
Cruise Configuration Antenna Stack, SN001	High Power Vacuum 52 W CW, Hard Vacuum, 30 rnin No Breakdown Detected
Entry Configuration Antenna Stack, SN001	High Power Vacuum 52 W CW, Hard Vacuum, 30 min 52 W CW, 10 Torr C02, 30 min No Breakdown Detected
Landed Configuration Antenna Stack, SN001	High Power Vacuum 52 W CW, Hard Vacuum, 30 min 52 W CW, 10 Torr C02, 30 min No Breakdown Detected

(-',

FILE NAME: MGAaah NO. SAMPLES: 361

MGA S/N 001 POST ENV.BASE LINE COPOL F r_eq = 7,18 GHz



FILE MGAaah . DAT MAX VALUE OF -.03 Db at 1. 00 DEGS

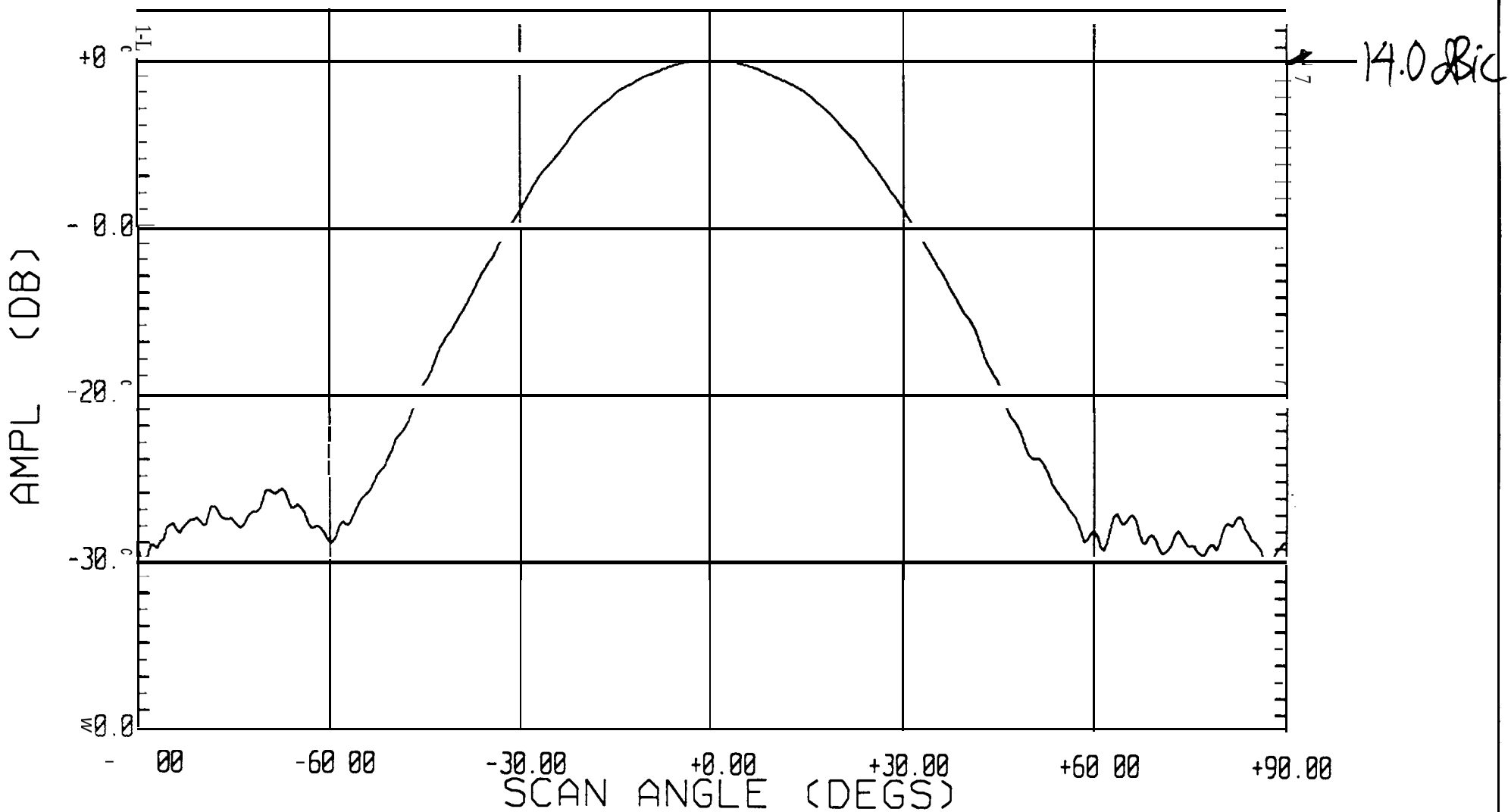
MIN VALUE OF -29.28 Db at -88. 00 DEGS

3 Ott 1995 14:46:33

POL ANGLE .8284

FILE NAME: MGAaaa No SAMPLES: 36 Freq = 8 43 GHz

MGA S/N 001 POST ENV. BASE LINE COPOL

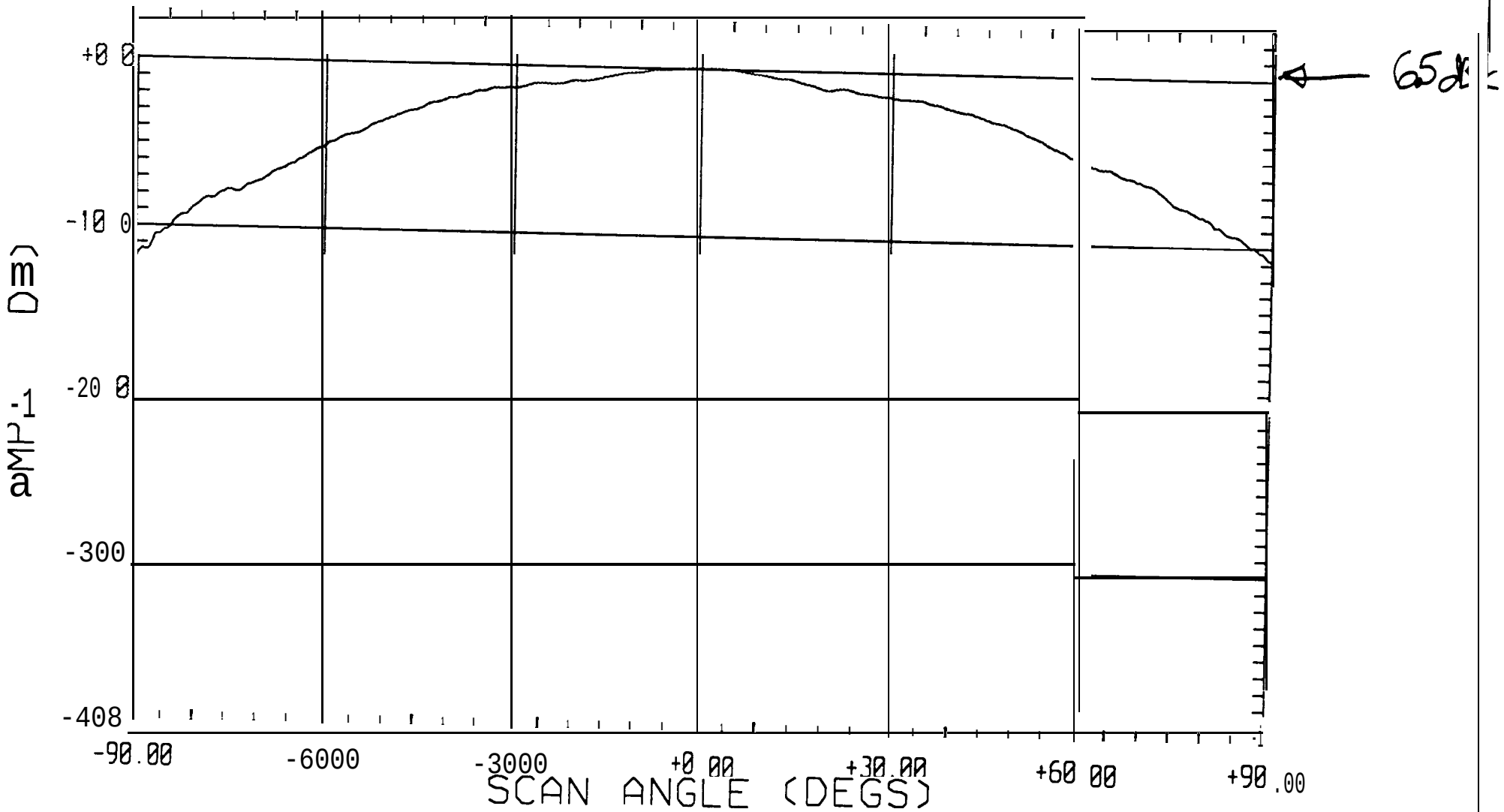


FILE MGAaaa DAT MAX VALUE OF -.01 Db at 1.00 DEGS 3 Oct 1995 14:22:09

MIN VALUE OF -30 26 Db at 87 00 DEGS POL ANGLE 0357

FILE NAME: BSLGAc NO. SAMPLES: 361 Freq = 8.43 GHz

BACK SHELL LGA S/N 001 POST ENU. BASE LINE COPOL



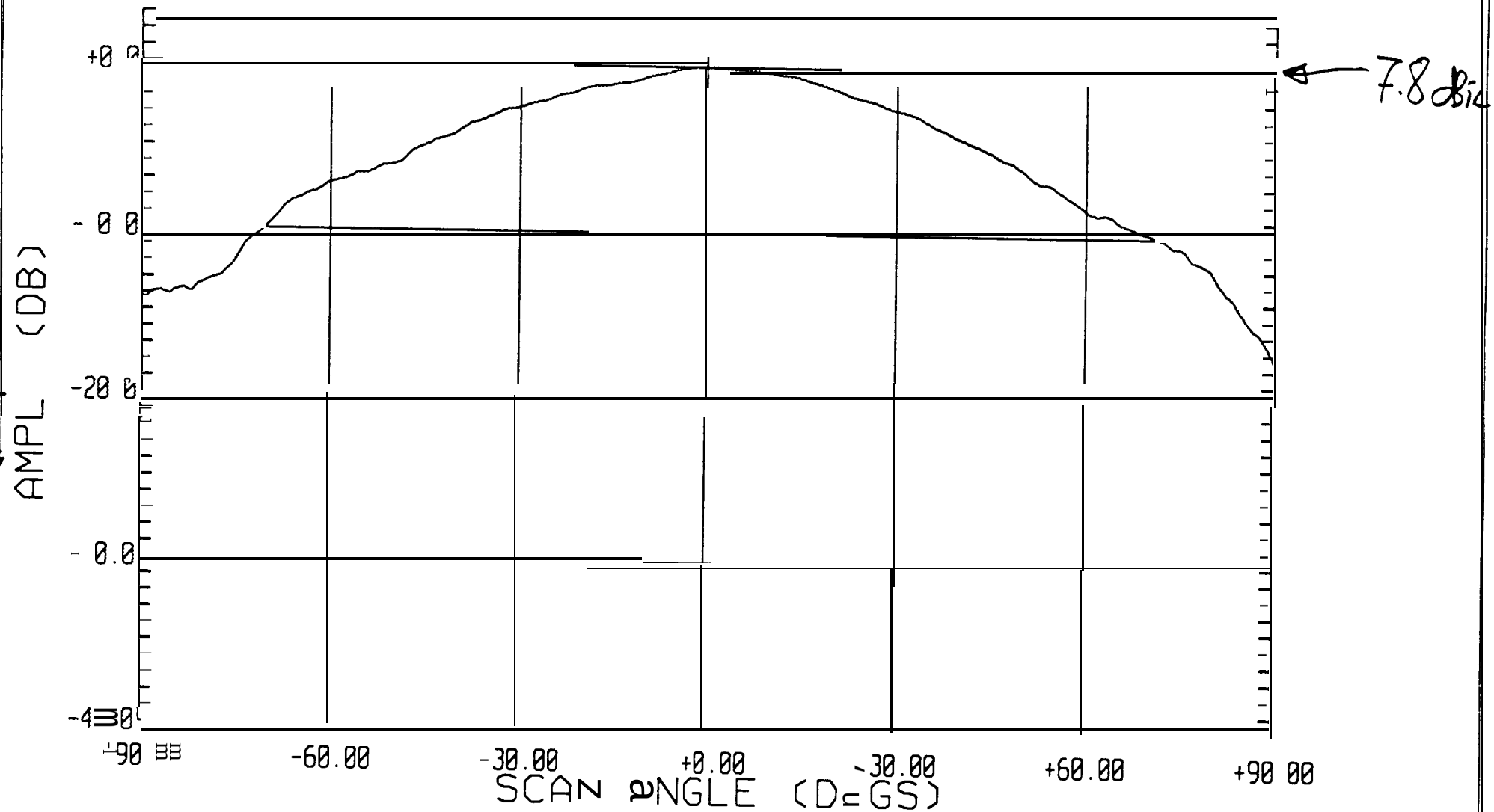
FILE BSLGAc. DAT MAX VALUE OF .06 Db at -1. 00 DEGS

MIN VALUE OF -11.87 Db at -90. 00 DEGS

3 Ott 1995 13:44:04

POL ANGLE ,8814

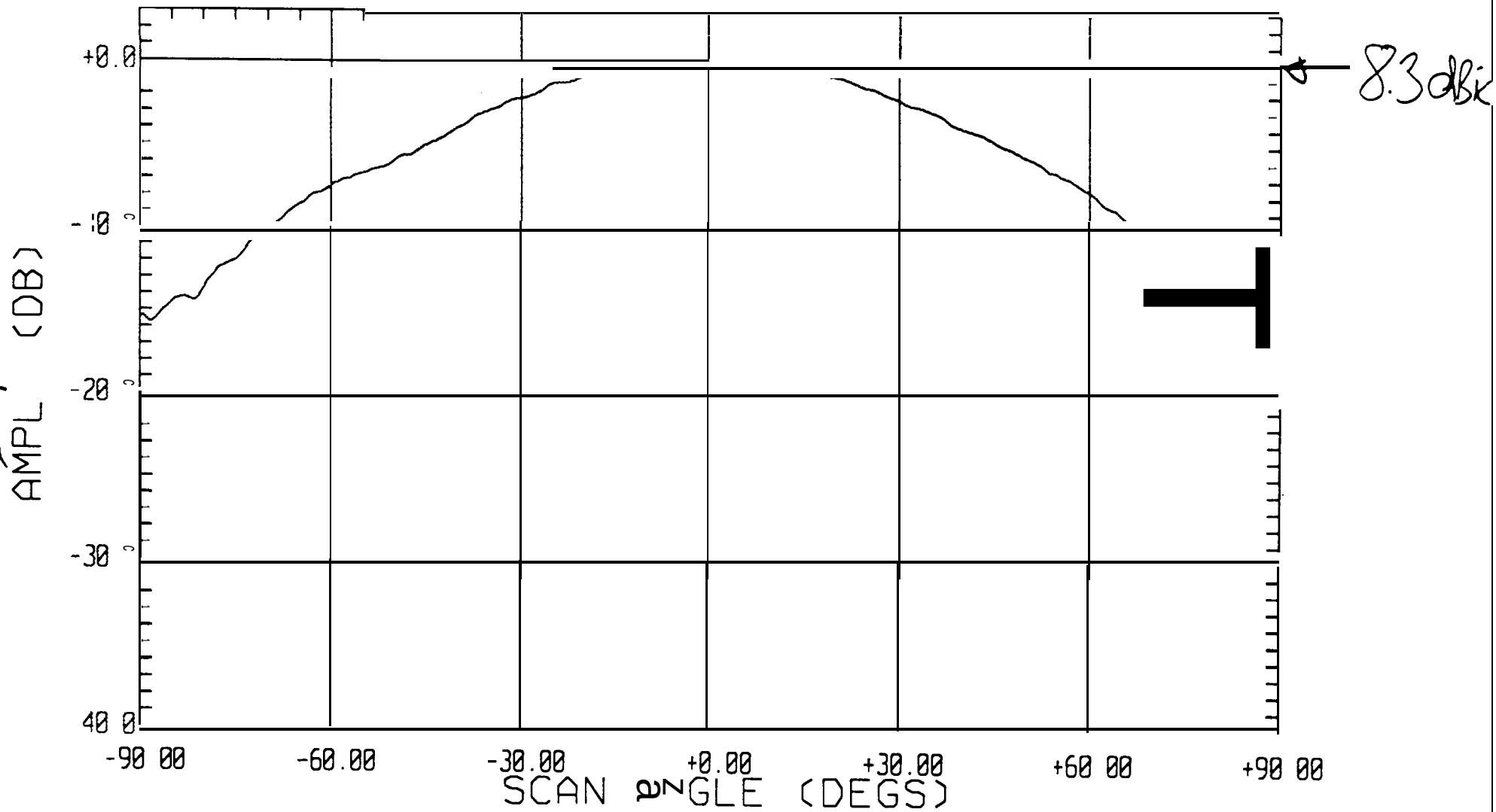
FILE NAME: LGAaaa NO SAMPLES: 361 Freq = 7. 8 GHz
LGA S/N 00 POST ENV. BASE LINE COPOL



FILE LGAaaa DAT MAX VALUE OF - 02 Db at -1.50 DEGS 3 Oct 995 5:26:07
MIN VALUE OF -17 47 Db at 90.00 DEGS POL ANGLE -.0036000000000

FILE NAME: LGach NO SAMPLES: 36 Freq = 8 43 GHz

LGa S/N 001 POST ENV COPOL



FILE GAach DAT MAX VALUE OF 0.00 Db at 3.00 DEGS 3 Oct 1995 16:00:41

MIN VALUE OF -15.72 Db at -88 50 DEGS POL ANGLE 0262

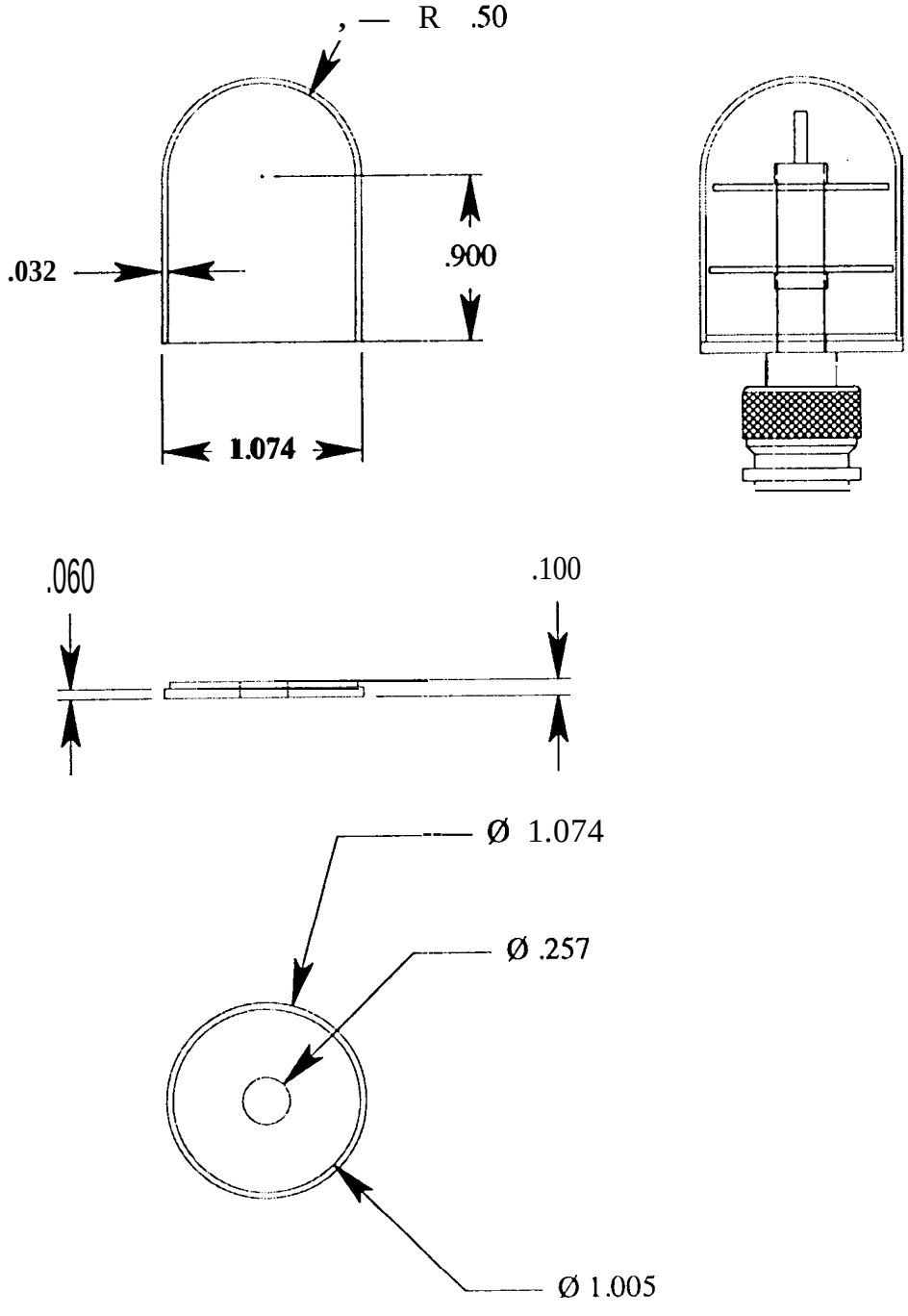
Mars Pathfinder
Telecom Subsystem
DEA & Transmission Line Hardware Summary

Nomenclature	Ref. Des.	H/W Class	Part No.	Rev	Serial No.	Final Inspect Report No.	Weight (kg)	Cog. Eng
Descent Antenna Assembly (DEA)	2002DEA							Vacchione / Burke
Descent Antenna		C	10162821-1	A	005	055269	0.024	Vacchione
Descent Antenna Actuator Assembly		C	10162810-1	A	001	055269	0.123 act cable included	Burke
Housing			10162811-1	A	001			
Armature			10162812-1	A	001			
Sleeve, bearing			10162813-[illegible]	[illegible]	00			
Fitting, end			10162813-1	A	00			
an					00 00			
Cap, End			10162816-1	A	001 / 002			
Plug, Threaded			10162817-1	A	00. / 002			
Axle			10162818-1	A	001			
Plate, Stop			10162828-1	A	001			
Springs								
De An nn an mi m								hi
			G R R					
			G R R					
Actuator Cable			10162820-1 / G1R42R420 118	a				

Mars Pathfinder
Telecom Subsystem
DEA & Transmission Line Test Summary: RF Characterization

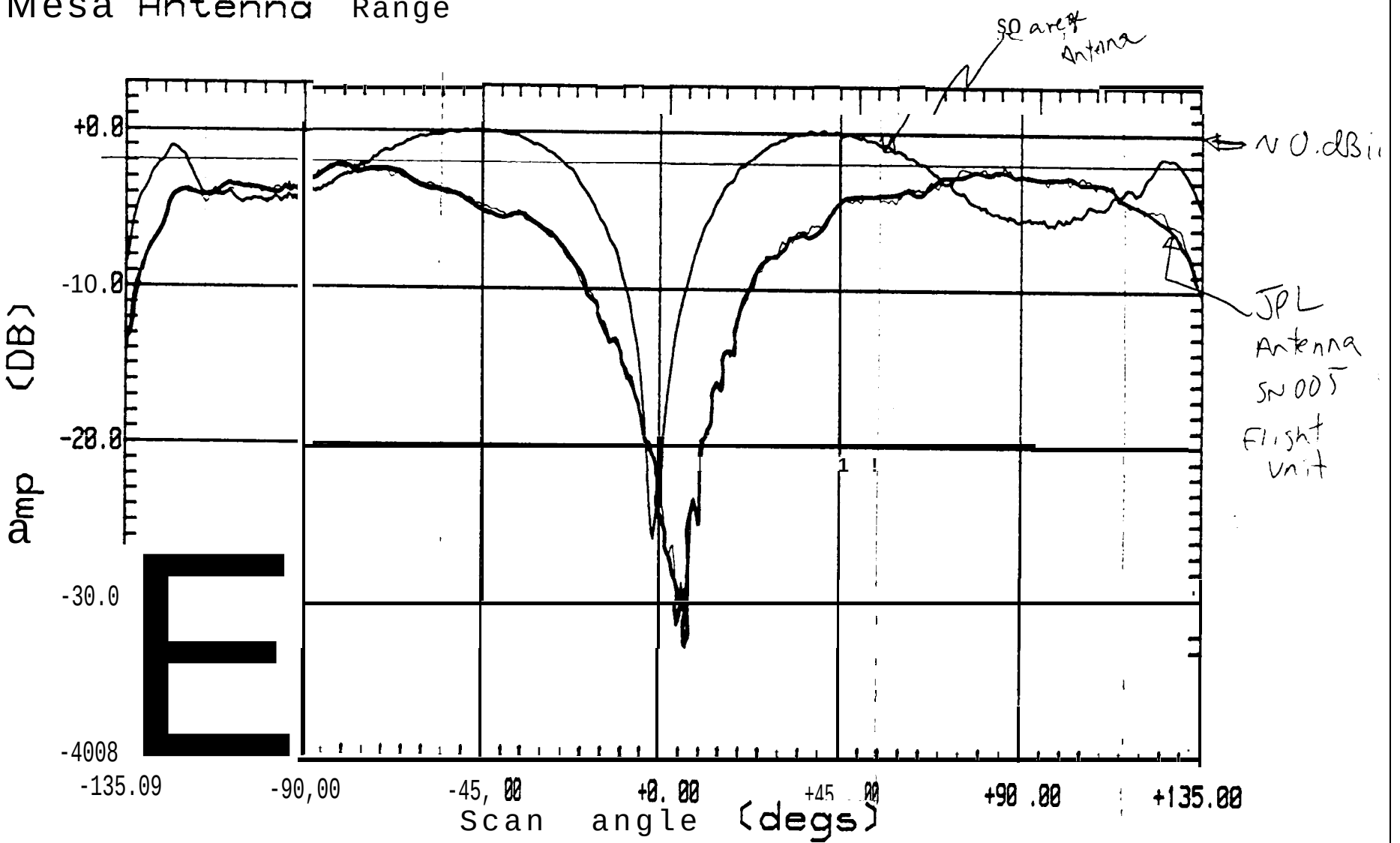
*All measurement data accurate to within ±0.2 dB.
Note DEA performance in presence of spacecraft will be highly perturbed;
Ail information summarized here is for isolated antenna.

Frequency	8.425 GHz
Descent Antenna	
Peak Gain (85 deg From ant axis)	
Pre Environmental Test	-2.2 dBic
Post Environmental Test	-2.4 dBic
± 30 (about pattern peak) deg EOC Gain	
Pre Environmental Test	-4.2 dBic
Post Environmental Test	-4.4 dBic
Requirement	Not yet determined
Transrn.ission Line Assembly	
Insertion Loss Post Environmental Test	-2.0 dB
Return Loss Post Environmental Test	-27.2 dB


R .50
.032
.900
1.074
.060
.100
Ø 1.074
Ø .257
Ø 1.005

File name: MesaAA No. samples: 5441 Freq = 8,4225 GHz

Mesa Antenna Range



Max value of -2.28 Db at 80.50 degs

Min value of -25,92 Db at -5.50 degs

11 Dec 1995 10:29:09

Pot angle 45.1022

Mars Pathfinder
HGAA Subsystem
HGA & Transmission Line Hardware Summary

Nomenclature	Ref. Des.	H/W Class	Part No.	Rev	Serial No.	Final Inspect Report No.	Weight (kg)	Cog. Eng
High Gain Antenna	2002HGA	c	303901-500	A	001	048171	1.1	Vacchione
HGAA Transmission Line Assembly	2002CX 10							Vacchione
HGA Cable		c	G6COICO1O 08.6	A	995661	049191		
Rotary Joint 1		c	21186	A	003	045811	0.08	
Internal HGAA Cable		c	1OI6743-1A	A	002			
Rotary Joint 2		c	21186	A	006	045811	0.08	
External HGAA Cable		c	G6R11T21O 14.7	A	1022260	055102	0.115	

Mars Pathfinder HGAA Subsystem
HGA & Transmission Line Test Summary: RF Characterization

*All measurement data accurate to within ±0.2 dB

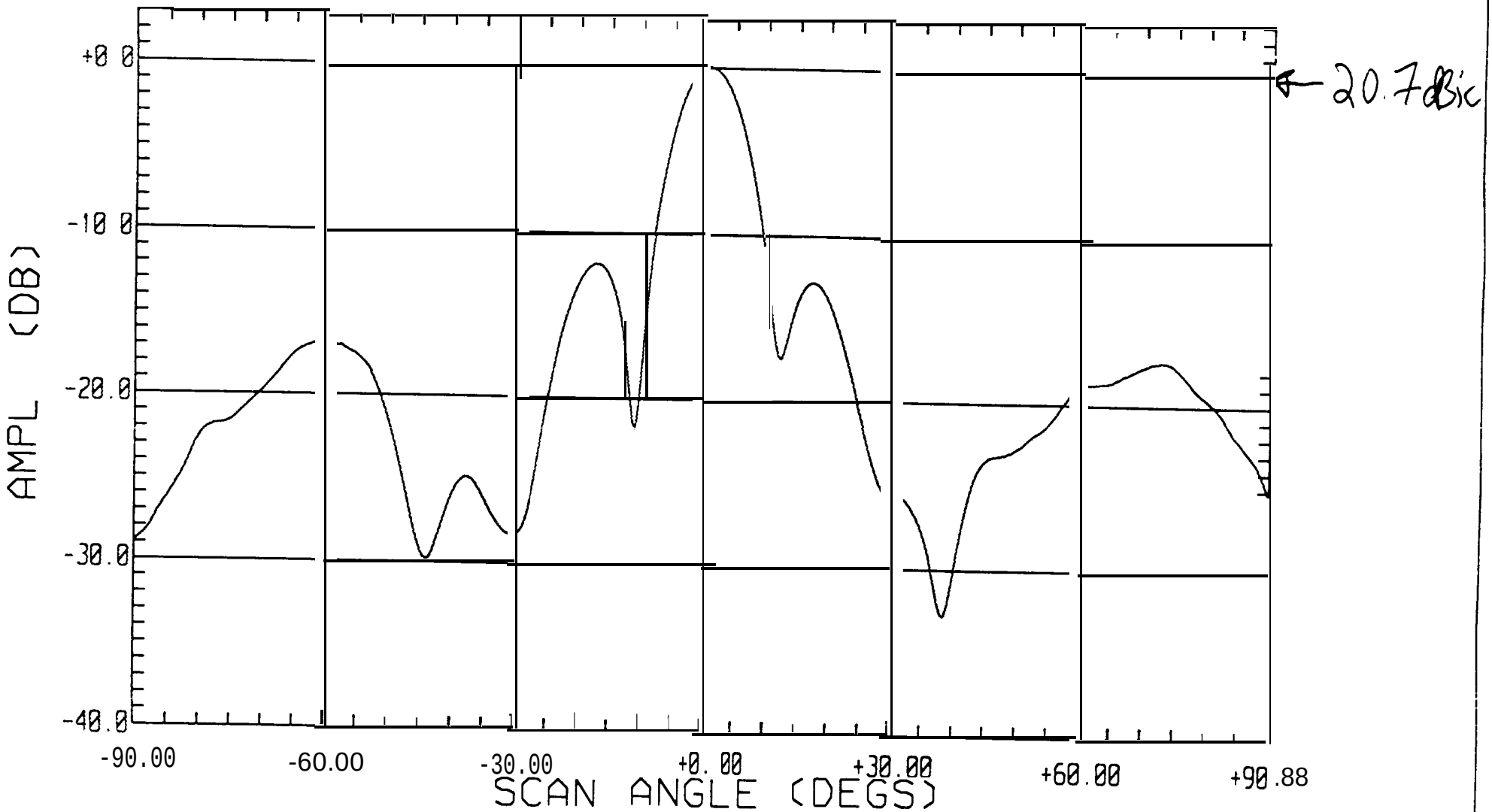
Frequency	7.175 GHz	8.425 GHz
High Gain Antenna		
Boresite Gain		
Pre Environmental Test	21.0 dBic	25.2 dBic
Post Environmental Test	20,7 dBic	24.9 dBic
± 2 deg EOC Gain		
Pre Environmental Test	20.5 dBic	24.5 dBic
Post Environmental Test	20.1 dBic	24.3 dBic
Requirement	> 15 dBic	> 23.3 dBic
Transmission Line Assembly		
Insertion Loss Post Environmental Test	1.1 dB	1.2 dB
Return Loss Post Environment Test	-18.1 dB	-22.1 dB
HGAA Assembly		
Return Loss Post Environmental Test	-12 dB	-18 dB

Mars Pathfinder
HGAA Subsystem
High Gain Antenna & Transmission Lines Test Summary
Environmental Tests

Hardware	Environment
High Gain Antenna, SN 001	Thermal: +45 deg C / -105 deg C, 25 cycles, 4 deg C / min
HGAA Transmission Line Assembly	Thermal: +125 deg C, 5 hours dwell +0 deg C / -100 deg C, 6 cycles, 120 deg C/hour
High Gain Antenna, SN 001	Random Vibration Protoflight level, 15.7 grins, 1 rein/for X-Axis Sine Input X-axis, one sweep up& down
	5 - 20 Hz 1.27 cm DA
	20-100 Hz 10.0 gpk
	Sine Survey Low Level, 5-2000 Hz X- axis Lowest Resonant Frequency: 773 Hz
High Gain Antenna, SN001	High Power Vacuum Space Vacuum & 10 Torr C02 1 hour each Pulsed Operation, 52 W Pk, 13 W Ave No Breakdown Detected
HGAA Transmission Line Assembly	High Power Vacuum 52 W CW, Hard Vacuum, 30 min 52 W CW, 10 Torr C02, 30 min No Breakdown Detected
Landed Configuration Antenna Stack, SNOO1	High Power Vacuum 52 W CW, Hard Vacuum, 30 min 52 W CW, 10 Torr C02, 30 min No Breakdown Detected

FILE NAME: HUGHAQ NO. SAMPLES: 361 Freq = 7,18 GHz

HIGH GAINANTENNA S/N 002 COPOL

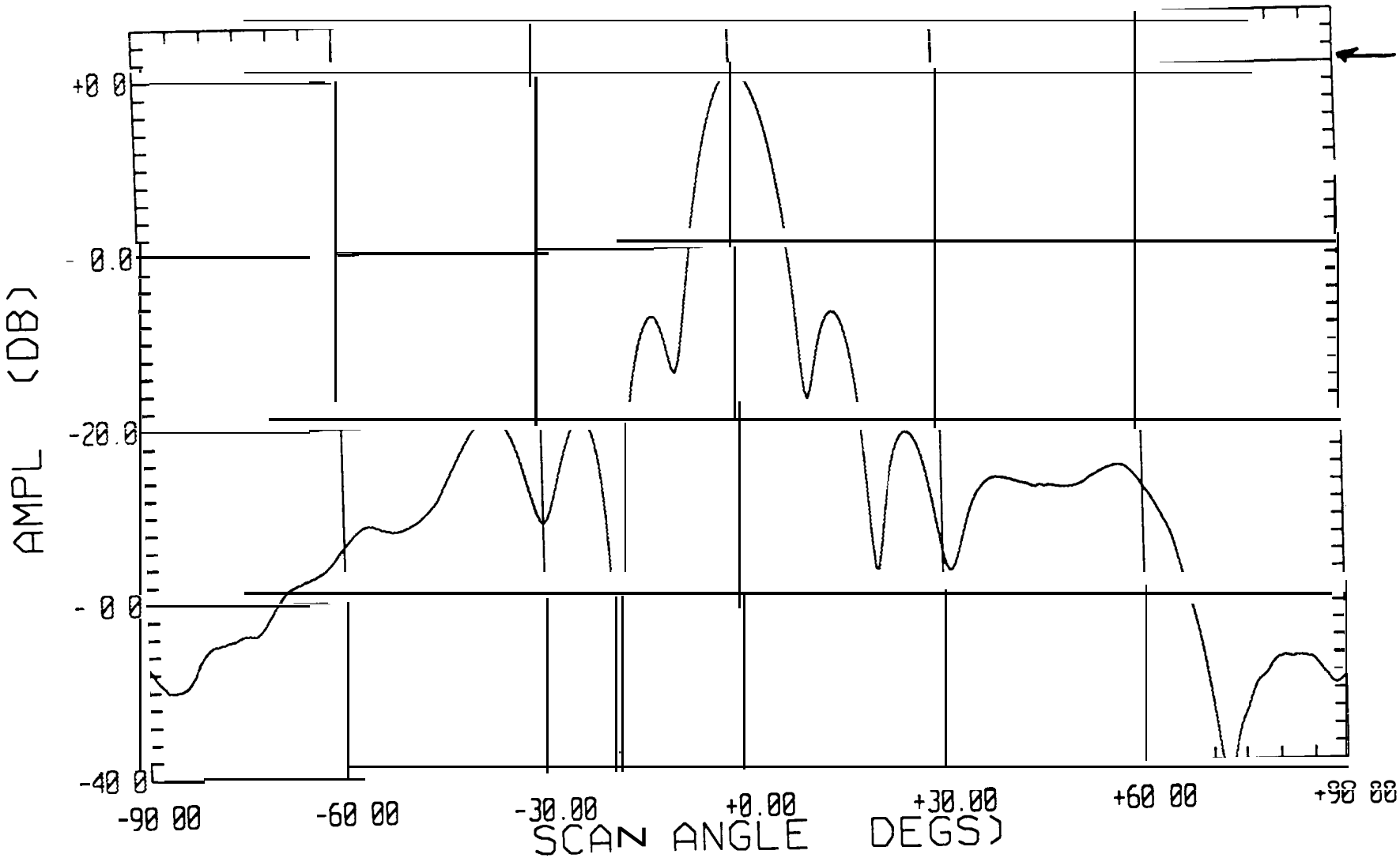


FILE HUGHAQ . DAT MAX VALUE OF .05 Db at .50 DEGS 2 Jun 1995 11:13:59

MIN VALUE OF -32.80 Db at 38. 50 DEGS POL ANGLE . 0043

FILE NAME: HUGHAA NU. SAMPLES: 361 Freq = 8 43 GHz

HIGH GAIN ANTENNA S/N 302 COPOL



FILE HUGHAA DAT MAX VALUE OF .02 Db at 50 DEGS 2 Jun 1995 10:31:12

MIN VALUE OF -44 65 Db at -19.00 D GS POL ANGLE 0066