AD-A123 919 THE OHIO STATE UNIVERSITY NCTR DATA BASE FILE STRUCTURE 1/1
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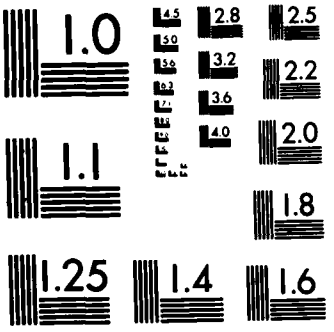
J S CHEN ET AL. OCT 82 ESL-714190-1 N00014-82-K-0037
UNCLASSIFIED F/G 9/2 NL



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

OSU

The Ohio State University

THE OHIO STATE UNIVERSITY NCTR DATA BASE FILE STRUCTURE

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The Ohio State University

ElectroScience Laboratory

Department of Electrical Engineering
Columbus, Ohio 43212

Technical Report 714190-1

Contract N00014-82-K-0037

October 1982

Department of the Navy
Office of Naval Research
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Arlington, Virginia 22217

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16. Abstract (Limit: 200 words)

The ElectroScience Laboratory of the Ohio State University is developing an advanced radar target backscatter measurement facility. The data from this facility is stored in a standard format on computer compatible media (such as floppy disks). This report gives the details of the data file format which is used.

17. Document Analysis a. Descriptors

b. Identifiers/Open-Ended Terms

Radar
Target Classification
Backscatter
Data Base
identification

c. COSATI Field/Group

18. Availability Statement

19. Security Class (This Report) Unclassified

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22. Price

(See ANSI-Z39.18) *See Instructions on Reverse*

OPTIONAL FORM 272 (4-77)
(Formerly NTIS-35)
Department of Commerce

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

I. INTRODUCTION

The ElectroScience Laboratory of The Ohio State University is developing an advanced radar backscatter measurement facility. This facility is being developed so that Non-Cooperative Target Recognition (NCTR) techniques can be developed by a data base user community. The NCTR data base contains files in a standardized format. The format allows for a named file to contain header information in plain English text (ASCII) followed by a variable amount of amplitude (dB) and phase (degrees) data. Any file may contain raw measured data, calibrated data, or filtered/edited calibrated data. The format uses a fixed word length (16 bit) packed in 512-word blocks. The result is flexible yet efficient storage of data.

II. DETAILED FORMAT

An NCTR data file contains a file header and a set of data points (see Table 1). There are three lines of English language text in the file header, each containing 60 ASCII characters. The number of data points may vary up to a maximum of 801. Numerical information on the number of data points, the frequency of the first data point, and the frequency increment can be retrieved directly from the 3rd line of the file header, as shown in Table 2. The data files are originally created on Digital Equipment Corporation (DEC) PDP 11/23 floppy disks in RT11 format. They are then transferred to disks on a DEC VAX system.

Files on the VAX disks are formatted in blocks of 512 8 bit bytes as shown in Table 3. Block 1 contains both characters and real numbers. Characters are stored in every other 8 bit byte from byte 1 to byte 360. (This permits data transfer of 16 bit words.) From byte 361 to byte 476 are 4-byte real numbers stored in groups of four consecutive bytes in the standard "exponent, mantissa, mantissa, mantissa" format. Bytes 477 to 512 are not used. From block 2 on, only 4 byte real numbers are stored and there are unused bytes from byte 409 to 512. In Appendix 1 there is a Hexadecimal/ASCII dump of a typical VAX disk file called C5203. In reading four consecutive bytes for a real number, the first byte read should be placed in the first byte of a REAL *4 FORTRAN variable, the 2nd byte in the 2nd byte and so forth. There is no need to swap bytes on a VAX computer. A flow chart for reading the file is shown in Figure 1. Appendix 2 is the header and data printout of the same file (C5203). In Appendix 3 there is a listing of a FORTRAN program which can read files from VAX disks and plot the data. A plot of file C5203 is also included in Appendix 3.

TABLE 1

DATA FILE OUTLINE

FILE HEADER	LINE 1 (60 characters) LINE 2 (60 characters) LINE 3 (60 characters
DATA POINT 1	Amplitude in dB, phase in degrees
DATA POINT 2	Amplitude in dB, phase in degrees
	.
	.
	.
	.
	.
	.
DATA POINT 801	

TABLE 2

LINE 3 OF THE FILE HEADER

CHARACTER NO:	1	4 5 6		11 15		20 24	60
VALUE:		# OF DATA PTS		STARTING FREQ. IN MHz		FREQ. INCREMENT IN MHz	. . . . .

NOTE: The starting frequency is the frequency of the first data point.

Frequency of the n^{th} data = *starting frequency*

+ (n-1) x Frequency Increment.

TABLE 3

DETAILED BLOCK AND BYTE ASSIGNMENT FOR
THE DATA FILES

NOTE: Line 1 ≡ 1st character ~ 60th character
Line 2 ≡ 61st character ~ 120th character
Line 3 ≡ 121st character ~ 180th character

BLOCK 1 BYTE #	(8 BIT BYTES)
1	1st Character
2	NOT USED
3	2nd Character
4	NOT USED
	•
	•
	•
	•
	•
2n-1	nth Character
	•
	•
	•
	•
359	180th Character
360	NOT USED
361	Amplitude of 1st
362	Data Point
363	(Four-Byte Real
364	Number)
365	Phase of 1st
366	data point
367	(Four-Byte Real
368	Number)
	•
	•
	•

TABLE 3 (Cont.)

BLOCK 1 (Cont.)

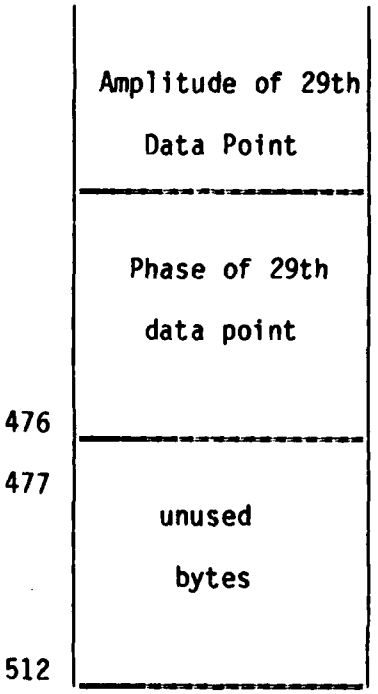

TABLE 3 (Cont.d)

BLOCKS 2, 3, 4, . . .

1	Amplitude
2	(4 byte real) of
3	30th data point
4	
5	phase
6	of 30th
7	data point
8	
9	.
	.
	.
	.
	.
	.
408	.
409	
	unused
	bytes
512	

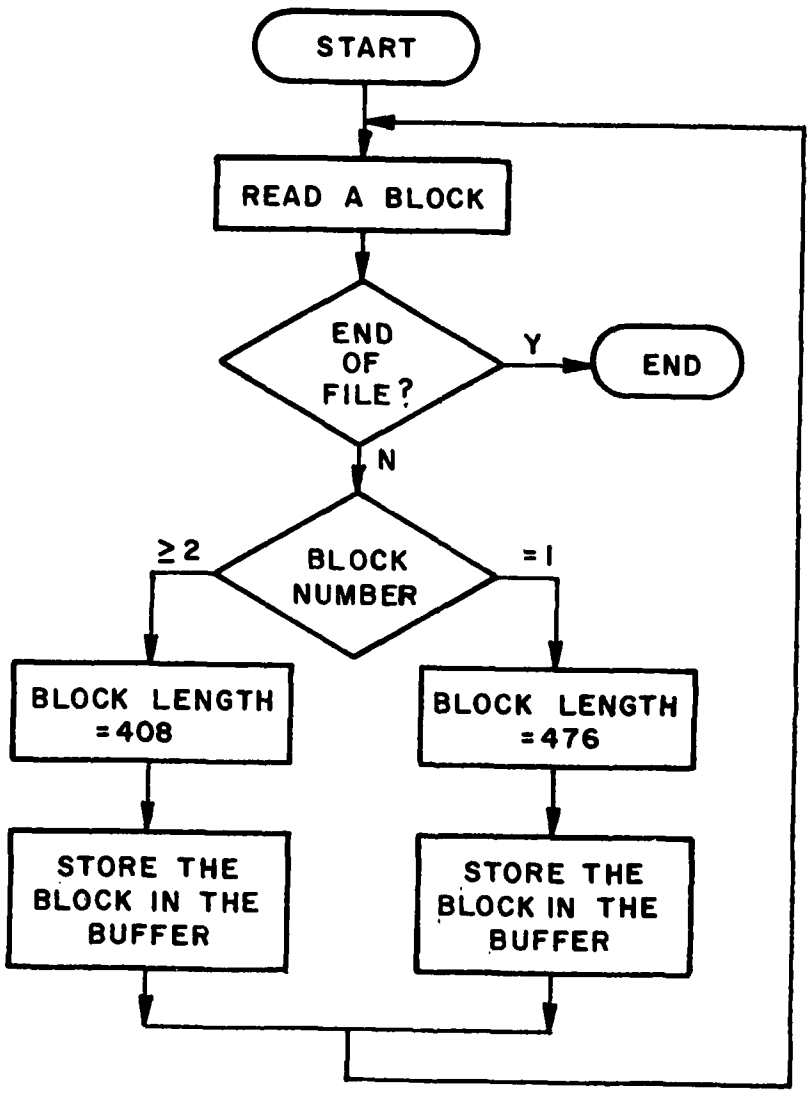

Figure 1. Flowchart for reading files.

APPENDIX I

HEXADECIMAL/ASCII DUMP OF VAX FILE C5203

This printout was produced by the VAX utility called "DUMP". It is printed in the standard output format. Hexadecimal data is printed from right to left in this dump while ASCII equivalent values are printed from left to right. Thus, Hex "43" corresponds to ASCII "C" and Hex "10" corresponds to an ASCII "non printing" character (shown as "." and not used by the file system).

NOTE: As mentioned in the text, ASCII characters are packed 1 per 16 bit word. This printout, however, produces an ASCII character from each 8 bit byte (if legal ASCII, otherwise a "." is inserted in the ASCII character string). Thus to read the header data from the ASCII string in this dump, only every other character is used.

```
Dump of file DRA1:[CHEN]C52Ø3.;1 on 3Ø-SEP-1982 1Ø:53:Ø8.37
File ID (14693,28,Ø)   End of file block 5 / Allocated 6

Virtual block number 1 (ØØØØØØØ1), 512 (Ø2ØØ) bytes

 D72ØC236 3Ø2Ø442E F542C249 994C4441 8F43C12Ø B32Ø4433 5C3ØC132 8Ø351Ø43 C.5.2.Ø\3D . .C.ADL.I.B..D .6. . ØØØØØØ
 2847C22Ø 5634442D F55ØC256 992Ø4445 F552C245 CC48445Ø ØØ53C22Ø 4C4E4449 IDNL .S.PDH.E.R.ED .V.P.-D4f .G( ØØØØ2Ø
 3344C245 9958Ø442Ø ØØ34AC14F 992Ø4453 EB54C25Ø 192Ø4431 663ØC232 E62Ø4443 CD .2.Øf1D .P.T.SD .O.J. DP.E.D3 ØØØØ4Ø
 3332C231 4C2D4431 B52ØC22Ø E62Ø442Ø 285ØC241 99434420 4753C242 CC414420  DA.B.SG DC.A.P( D . . .1D-L1.23 ØØØØ6Ø
 8552C245 E6584449 1E4DC22Ø E6534445 3349C252 CC454453 7A2ØC243 66474420  DGfC. zSDE.R.I3EDS. .M.IDX.E.R. ØØØØ8Ø
 ÉA2ØC254 334E4441 652ØC245 E64F442Ø 9944C24E ØØ454420 1E54C241 992Ø4453 SD .A.T. DE.N.D. DO.F. fADN.T. . ØØØØAØ
 5132C236 CC2Ø4456 2345C253 662D4437 A332C22Ø ØØ534445 514CC242 8Ø414443 CDA.B.LQEDS. .2.7D-fS.E(PD .8.2Q ØØØØCØ
 CC4EC22Ø 3Ø314433 CC32C23D 194C444E 3D2ØC22Ø 332Ø4445 D754C245 3352442Ø  DP3E.T.ED 3 . =NDL.=.2.ØD1. .F. ØØØØEØ
 :43ØC131 562Ø4420 7A2ØC23D 664E4449 992ØC231 193Ø443Ø D732C22Ø 8Ø3D4446 FD=. .2.ØDØ.1. .IDNf=. z D f1.Ø. ØØØ1ØØ
 CC4EC223 5633Ø431 283DC242 332Ø443Ø F533C23D E642442F A341C13D 33414420  DA3=.A./DB.=.3.ØD 3B.=(1DØf .N. ØØØ12Ø
 ØA42C22Ø 99344430 3056C241 CC2Ø4453 2854C145 8Ø534445 8F52C25Ø 8Ø2Ø444F OD .P.R.EDS.E.T(SD .A.V==D4. .B. ØØØ14Ø
 D578C36E 289742AA 8313C38Ø C51E42AA 3875C391 D65842C2 D72ØC234 663D4457 WD=f4. ..BX...u8.B.......B.+n.x. ØØ316Ø
 89CØC36A 51B842AC 95DDC34F 4C3842AC 6276C385 8EB142B2 DDCEC354 6E8F42B2 .B.nT....B....vb.B8LO....B.±j... ØØØ18Ø
 7E9FC35C 382842A2 D452C347 FBØ542A8 AD2FC34A ØA6842A6 196AC35D 552342A3 .B#UJ.j..Bh.J./..3..G.R..B(.\..~ ØØØ1AØ
 Ø1DØØ1D8 31F74297 FØC3C34C DC57429B E115C329 743142A2 7DFFC333 B36E429B .Bn.3..).B1t)....3W.H....B.1.... ØØØ1CØ
 ØØ11ØØ78 ØØFØØ168 Ø17ØØ178 Ø13ØØ188 Ø19ØØ198 Ø1AØØ1A8 Ø1BØØ1B8 Ø1CØØ1C8 .....................x.p.h...x... ØØØ1EØ
```

```
Dump of file DRA1:[CHEN]C52Ø3.;1 on 3Ø-SEP-1982 1Ø:53:ØØ.37
File ID (14693,28,Ø)   End of file block 5 / Allocated 6

Virtual block number 2 (ØØØØØØØ2), 512 (Ø2ØØ) bytes

 EEF8429Ø ØØ9A3C315 34D5429Ø C976C315 BDFØ429A E174C3Ø8 3FF8429F 516BC321 l.kQ.B.?..t..B....v..B.4.....B.. ØØØØØØ
 ØØ9214292 2926C296 39934291 E6DFC2B4 3E4E4296 837CC2DD 36AE4296 ØØ9C1C2E6 .....B.6..l..BN>.....B.9..&).Bl. ØØØØ2Ø
 ØE174293 C3AFC23F 98424292 6ØBBC26E 5DB5429C 3C1BC26B D6F54291 261AC287 ...&.B..k..<.B.ln..'.BB.?....B.. ØØØØ4Ø
 1DCB4296 EBBD4125 9C214294 C7A1C183 24994294 8BD7C1Ø9 E2524293 F23DC148 H.=..BR.......B.$.....Bl.XA...B.. ØØØØ6Ø
 877Ø429B 816Ø425B 9E774296 9CF842Ø9 5ØBD4295 CAØD422B 5ØDØ429A 3DB542Ø1 .B.=.B.P+B...B.P.B...Bw.[B'..Bp. ØØØØ8Ø
 BØEB42A8 9C5B42DØ FD7A429E 82B54299 E86A429A DC92428C 496842A2 16CF4299 .B...BhI.B...Bj..B...Bz..B[..B.. ØØØØAØ
 2ECE42A8 A9D442FA B12A42A8 A4C342E1 ØCCE42A1 7DA7429F CØF142A2 9Ø6A42B7 .Bj..B...B.).B...B...B*..B...B.. ØØØØCØ
 EFC142A5 DDA842EA 5FCB42AB BF8942F7 78D442AB 186Ø42E3 913F42A7 BD9Ø42DF .B...B?..B'..B.x.B...B._.B...B.. ØØØØEØ
 347F42BØ 41D3431C 176D42AB CAC942FD A2BE42AB 36AE431F 245D42AE 367D43ØC .C)6.B)$.C.6.B...B...Bm..C.A.B.4 ØØØ1ØØ
 62Ø142AF ØØB5432Ø F6B242AF D4Ø24326 6ØDC42AF 9ØD14323 B45642AF 1E6E431F .Cn..BV.#C...B.'&C...B.. C...B.b ØØØ12Ø
 ØØ5A42AE 3E4C4324 596242B3 9AB7433F 3BD942B8 56BØ4337 8ØB242B3 A9Ø64328 (C...B..7C.V.B.;?C...BbY$CL..BZ. ØØØ14Ø
 C8A342B1 37ED4348 BJ9Ø42B2 5A4F4332 93A142B4 DEDD4337 24DA42B7 85CC4335 5C...B.$7C...B..2COZ.B..HC.7.B.. ØØØ16Ø
 Ø17CØ184 Ø18CØ194 64A942B6 3274434A 4A6642B4 3236434A ED6F42B4 7CØ44353 SC.l.Bo.JC62.BfJJCt2.B.d.....l. ØØØ18Ø
 ØØFCØ1Ø4 Ø1ØCØ114 Ø11CØ124 Ø12CØ134 Ø13CØ144 Ø14CØ154 Ø15CØ164 Ø16CØ174 t.l.d.\.T.L.D.<.4..,S.......... ØØØ1AØ
 ØØ7CØØ94 ØØ8CØØ94 ØØ9CØØA4 ØØACØØB4 ØØBCØØC4 ØØCCØØD4 ØØDCØØE4 ØØECØØF4 ..............................l. ØØØ1CØ
 ØØ33ØØØ4 3ØØCØØ14 ØØ1CØØ24 ØØ2CØØ34 ØØ3CØØ44 ØØ4CØØ54 ØØ5CØØ64 ØØ6CØØ74 t.l.d.\.T.L.D.<.4..,S.........3. ØØØ1EØ
```

```
Dump of file DRA1:[CHEN]C52Ø3.;1 on 3Ø-SEP-1982 1Ø:53:Ø8.37
File ID (14693,28,Ø)    End of file block 5 / Allocated 6

Virtual block number 3 (ØØØØØØØ3), 512 (Ø2ØØ) bytes

 EØ3Ø42B9 422D4358 371542B8 12Ø6436A 3CØD42B4 6EC64358 54894287 2DFA435E ^C.-.B.TXC.n.B.<jC...B.7XC-B.BØ. ØØØØØØ
 45F742B3 332F435F 384B42BA 71A14380 27D242BB 7BE54368 CAD142B6 F7184354 TC...B..hC.{.B.'.C.q.BK;_C/3.B ! ØØØØ2Ø
 DF4442BA 32874362 131242B8 A92F4370 26C442BB 99144367 A2EE42B6 D4Ø8435A ZC...B..gC...B.&pC/..B...C...BD. ØØØØ4Ø
 64FC42B6 289A4377 C31A42B5 5ØBØ4370 489542B7 2CA84367 862242B1 CØØ9437D }C...B".gC.,.B.HpC.P.B..wC.(.B.d ØØØØ6Ø
 ØAB24285 E4FC437A 774C42B4 A4ØØ438Ø 51AC42B5 A17E438A 8EBA42B2 574D4384 .CMW.B...C~..B.Q.C...BLwzC...B.. ØØØØ8Ø
 4B8C42AF 99424388 ADØA42AA F49A4388 454842AE ØØCE438E 18Ø242B2 B37B437D }C{..B...C...BKE.C...B...CB..B.\ ØØØØAØ
 ECAC429F 2Ø224398 C2AE42A7 29D84396 9E8B42AC DD5F4387 8EC942A9 9CC84387 .C...B...C_..B...C.).B...C" .B.. ØØØØCØ
 CCFB429E 5459439D B35542A3 982743A5 159D42A9 C98743A2 3ABA429E 8B44433F .CD..B.:.C...B...C'..BU..CYT.B.. ØØØØEØ
 DB9D429F 5E8D43B3 199342A2 339843B8 EØ8Ø42A3 F35843BØ ØB5D4299 55A743A8 .C.U.B]..CX..B...C.3.B...C.].B.. ØØØ1ØØ
 6E574295 EC5843C6 B71D429E 427C43C1 BFØ74296 972443BE 8ØE3429B FE9B438Ø .C...B...CX..B...CIB.B...CP..BW.. ØØØ12Ø
 1DAF4251 C36A43DC EC574295 B6BC43E3 2F754296 389243CB 63ØB4294 517643C5 .CvQ.B.c.C.B.Bv/.C...BW..Cj..B.. ØØØ14Ø
 2AC54283 FD3D43FE ØØ324295 F8DF43F7 4A234298 2F4943FØ DE534292 7D6C43D9 .C1}.BS..CI/.B{J.C...BZ..C=..B.^ ØØØ15Ø
 Ø17CØ184 Ø18CØ194 3C3342AØ 3B1A44ØØ 59794296 Ø12543F4 7AE5429A 88B443FA .C...B.z.C%..ByY.}...B3<.....I. ØØØ18Ø
 ØØFCØ1Ø4 Ø1ØCØ114 Ø11CØ124 Ø12CØ134 Ø13CØ144 Ø14CØ154 Ø15CØ164 Ø16CØ174 t.l.d.\.T.L.D.<.4...S..........  ØØØ1AØ
 ØØ7CØØ84 ØØ8CØØ94 ØØ9CØØA4 ØØACØØB4 ØØBCØØC4 ØØCCØØD4 ØØDCØØE4 ØØECØØF4 ..........................I.  ØØØ1CØ
 ØØ33ØØØ4 ØØ2CØØ14 ØØ1CØØ24 ØØ2CØØ34 ØØ3CØØ44 ØØ4CØØ54 ØØ5CØØ64 ØØ6CØØ74 t.l.d.\.T.L.D.<.4...S.....3.  ØØ1EØ
```

```
Dump of file DRA1:[CHEN]C52Ø3.;1 on 3Ø-SEP-1982 1Ø:53:Ø8.37
File ID (14693,28,Ø)   End of file block 5 / Allocated 6

Virtual block number 4 (ØØØØØØØ4), 512 (Ø2ØØ) bytes

 8BEC4295 AF3E44Ø7 59834294 CC5643FF 86374299 614D44Ø2 7BØF42A7 ACF944Ø7 .D...B.{.DMa.B7..CV..B.Y.D>..B.. ØØØØØØ
 C8FF42A5 D2D24415 7D1D42A1 FEF444ØF 6B3542A4 417D4412 3BF742A6 882D44ØF .D-..B.;.D}A.B5k.D...B.}.D...B.. ØØØØ2Ø
 C33442A2 328E4415 758B42BØ C5Ø84416 131E42A8 58914413 A67842A1 8AØE4412 .D...Bx..D.X.B...D...B.u.D...B4. ØØØØ4Ø
 215442A6 1BF84418 CCAB42AC A255441F AB1142AC A88B4418 CEC7429D A28A4417 .D...B...D...B...DU..B...D...BTI ØØØØ6Ø
 582D42AD ZØD6441D E11B42B2 D51B4426 9E1142BØ 45C54429 1B9942A4 CØØC441D .D...B..)D.E.B..&D...B...D...B-X ØØØØ8Ø
 3D7C42AC 71F54422 26C642BØ 5D1C443Ø 95DF42B3 53144426 2ØCC42A8 5DAD441D .D.}.B. &D.S.B..ØD.}.5.&"D.q.BI= ØØØØAØ
 9A7242BØ 35ØA442D 128A42AD ØF464428 F87C42B4 ØCD84429 D93B42B3 FA984424 $D...B¦.)D...BI.(DF..B..-D...Br. ØØØØCØ
 DB1F42AF 39EB442F 705F42B3 ØD3A442C CD4Ø42AF BA674427 A16942B2 DCB1442C ,D...BI.'Dg..B@..D:..B_}/D.i.B.. ØØØØEØ
 FC724234 33F54431 96C642BØ BBØ14433 1A8F42B4 684ØC433 3EAØ42A8 C7B5443Ø ØD...B.>3.@h.B..3D...B..1D.c.Br. ØØØ1ØØ
 8C8742B4 DB51C431 374942AB 9688C432 9E2C42B1 79DBC43Ø C94B42B5 B91DC42F /....BK.Ø..y.B,.2....BI71.Q..B.. ØØØ12Ø
 F1F442B2 Ø17EC429 D51442B3 7CDØC42A 52A942B3 7B11C42E BA1Ø42B3 ØBBEC42D -....B.....{.B.R*..I.B..).~..B.. ØØØ14Ø
 ED8742AA 5ØEØC42E 3D1C42B5 5D35C427 EBD542BA ØA49C42B 24CE42AF 59Ø2C43Ø Ø..Y.B.$+.I..B..'.UJ.B.=...P.B.. ØØØ16Ø
 Ø17CØ184 Ø18CØ194 AB5642B2 235ØC427 D77B42B4 9ABEC423 F65642AF A9CDC426 &....BV.#....B{.'.P#.BV.....I. ØØØ18Ø
 ØØFCØ1Ø4 Ø1ØCØ114 Ø11CØ124 Ø12CØ134 Ø13CØ144 Ø14CØ154 Ø15CØ164 Ø16CØ174 t.l.d.\.T.L.D.<.4...$..... ØØØ1AØ
 ØØ7CØØ94 ØØ8CØØ94 ØØ9CØØA4 ØØACØØB4 ØØBCØØC4 ØØCCØØD4 ØØDCØØE4 ØØECØØF4 .....I. ØØØ1CØ
 ØØ33ØØØ4 ØØØCØØ14 ØØ1CØØ24 ØØ2CØØ34 ØØ3CØØ44 ØØ4CØØ54 ØØ5CØØ64 ØØ6CØØ74 t.l.d.\.T.L.D.<.4.,.$.....3. ØØØ1EØ
```

```
Dump of file DRA1:[CHEN]C52Ø3.;1 on 3Ø-SEP-1982 1Ø:53:Ø8.37
File ID (14693,28,Ø)   End of file block 5 / Allocated 6

Virtual block number 5 (ØØØØØØØ5), 512 (Ø2ØØ) bytes

 386742AE 7176C421 3A9442AB D9A8C42Ø 134B42AC CC4DC41E 1B3A42BØ 49ØFC426 &..I.B:...M..BK. ....B.:I.vq.Bg8 ØØØØØØ
 E5Ø942A6 E233C416 435142AC A715C41B 54Ø142AD 6E89C421 EA6C42AE CØ49C421 I.I..B1.I..n.B.T.....BQK..3..B.. ØØØØ2Ø
 4AØ242A5 3Ø35C414 31ØF42AF 7Ø95C413 B59342AB 327BC419 891442A4 4464C41E ..dD.B....(2.B.....p.B.1..5..B.J ØØØØ4Ø
 9C3542AE 35DØC43D 7B3D42A5 3A18C413 7D7542A5 DC11C41Ø 5CB142A8 F437C41Ø ..7..B.\.....Bu)...:.B=(.....B5. ØØØØ6Ø
 BE7942A8 3341C497 7E9Ø42A3 FC5DC4Ø7 E5C142AØ 8BF1C4ØC E1AD42A5 9EE8C4Ø9 .....B.......B....]..B.~..A3.By. ØØØØ8Ø
 47AØ42A4 35DBC4ØØ Ø34642AØ 991DC4Ø1 85C342A4 DBBFC4ØØ 4D5342A8 91F3C4Ø5 .....BcM.....B.......BF....S.B.G ØØØØAØ
 86AC42A5 ØD69C3EB EB7D42AØ 2D74C3F7 DD6D42A3 959BC3FF Ø4ØF42AB ØA1CC3FA .....B.......Bm...t-.B).....B.. ØØØØCØ
 94DF42A7 ØABEC3D7 35Ø642A5 3D5BC3E3 5E86429E 6D7ØC3F7 936242AØ 9496C3F1 .....Bb...pm.B.^..[=.B.5.....B.. ØØØØEØ
 FC7242B4 53F54431 95C642BØ BBØ14433 1A8F42B4 B568C3E3 2933429D 83F3C3DC .....B3)..h..B..3D...B..1D.c.Br. ØØØ1ØØ
 8D8742B4 DB51C431 374942A8 96B8C432 9E2C42B1 79DBC43Ø C94B42B5 B91DC42F /....BK.Ø..y.B..2....BI71.Q..B.. ØØØ12Ø
 F1F442B2 Ø17EC429 D51442B3 7CDØC42A 52A942B3 7B11C42E BA1Ø42B3 ØBBEC42D -....B.....(.B.R*..|.B..).~..B.. ØØØ14Ø
 ED8742AA 5ØEØC42E 3D1C42B5 5D55C427 EBD542BA ØA49C42B 24CE42AF 59Ø2C43Ø Ø..Y.B.5+.I..B..'.U].B.=...P.B.. ØØØ16Ø
 Ø17CØ184 Ø18CØ194 A3564282 2350C427 D77B42B4 9ABEC423 F65642AF A9CDC426 &....BV.#....B(.'.P#.BV.......|. ØØØ18Ø
 ØØFCØ1Ø4 Ø1ØCØ114 Ø11CØ124 Ø12CØ134 Ø13CØ144 Ø14CØ154 Ø15CØ164 Ø16CØ174 t.l.d.\.T.L.D.<.4...$..... ØØØ1AØ
 ØØ7CØØ84 Ø28CØØ94 ØØ9CØØA4 ØØACØØB4 ØØBCØØC4 ØØCCØØD4 ØØDCØØE4 ØØECØØF4 .....|. ØØØ1CØ
 ØØ22ØØØ4 ØØØCØØ14 ØØ1CØØ24 ØØ2CØØ34 ØØ3CØØ44 ØØ4CØØ54 ØØ5CØØ64 ØØ6CØØ74 t.l.d.\.T.L.D.<.4...$.....". ØØØ1EØ
```

APPENDIX II

PRINTOUT OF ALL INFORMATION

IN FILE C5203

C5203 CALIB. 6 IN SPHERE VP-4 GC 201 PTS OJ PED ABS CAP
1-12 GC SERIES MIXERS AT END OF ANT CABLES 27-SEP 82 PETE
NL=201 FF= 2001 IN= 10 A=A/B=30 B=10 NO PRESETS AV=4 BW=4

24.355	287.393;	21.346	295.728;	21.271	300.292;	22.304	306.703;	22.320	293.308;
21.537	308.104;	21.548	301.365;	20.417	304.725;	20.755	309.331;	21.123	310.243;
20.254	304.876;	19.463	315.127;	20.307	317.530;	19.483	309.765;	18.899	319.671;
19.906	325.780;	19.343	322.553;	18.026	322.741;	18.117	331.245;	18.777	332.311;
18.703	337.387;	18.153	341.230;	18.254	343.106;	18.230	345.298;	19.546	345.101;
18.324	348.915;	18.382	356.860;	18.485	357.851;	18.518	355.802;	18.076	362.592;
18.765	368.270;	19.289	370.737;	18.664	368.601;	18.827	373.719;	19.441	379.156;
20.285	377.588;	19.363	379.189;	19.874	386.076;	21.086	382.946;	20.304	379.936;
20.131	389.225;	21.087	31.333;	21.023	27.968;	20.946	28.387;	21.434	30.959;
21.422	29.358;	20.742	35.053;	21.768	39.803;	21.454	31.724;	21.386	39.264;
22.025	39.780;	21.963	40.891;	21.922	41.708;	21.995	40.001;	21.923	42.165;
22.433	45.335;	23.029	47.501;	22.419	41.139;	21.813	45.381;	22.893	45.960;
22.572	44.508;	22.336	50.055;	22.223	52.871;	22.616	50.549;	22.526	50.549;
22.793	55.545;	22.916	54.108;	22.523	58.518;	23.027	54.065;	23.234	53.241;
22.843	58.121;	23.394	64.222;	23.279	55.800;	22.409	54.707;	22.803	57.859;
23.394	60.165;	23.009	65.349;	23.359	63.438;	22.190	57.794;	22.913	60.079;
22.723	61.790;	22.799	66.171;	22.320	69.315;	22.665	64.320;	22.558	62.724;
22.637	63.425;	22.263	71.002;	21.784	68.478;	21.334	68.299;	21.912	67.806;
21.195	67.932;	21.577	75.982;	20.970	76.263;	19.991	71.772;	19.779	81.394;
21.135	82.797;	20.463	78.665;	19.852	84.167;	19.131	88.475;	20.465	92.101;
20.262	89.716;	19.982	88.497;	19.438	95.295;	18.843	96.630;	19.039	99.462;
18.673	98.659;	18.548	101.610;	18.773	113.857;	18.748	110.382;	18.139	108.745;
18.359	120.392;	19.036	123.986;	19.754	127.495;	19.396	125.267;	19.310	122.202;
18.794	128.543;	20.029	135.676;	20.935	130.380;	19.191	127.859;	18.544	135.585;
18.593	143.532;	20.779	146.256;	20.552	143.996;	20.186	149.824;	20.723	146.539;
20.235	147.346;	21.009	150.770;	22.057	149.510;	20.345	151.635;	19.726	155.658;
21.584	159.634;	21.600	152.109;	20.763	157.750;	20.513	169.273;	22.077	166.332;
22.368	157.303;	21.668	157.366;	21.816	166.325;	22.448	176.364;	22.819	162.445;
21.533	164.979;	22.481	169.850;	22.621	168.760;	21.634	173.707;	22.875	172.662;
22.323	167.728;	21.975	172.852;	22.435	175.414;	21.982	176.780;	21.031	180.593;
22.513	179.730;	22.874	177.390;	22.623	184.277;	22.723	183.524;	22.202	181.411;
21.402	182.143;	22.569	186.954;	22.466	185.519;	22.415	189.512;	22.479	198.994;
22.363	183.652;	21.893	188.968;	23.365	192.535;	22.655	165.604;	21.366	193.337;
21.995	196.396;	22.685	192.862;	22.334	193.715;	22.813	201.202;	21.589	199.158;
21.404	198.557;	21.778	198.249;	21.864	198.568;	21.666	204.347;	21.537	209.116;
20.851	201.733;	20.567	206.803;	21.464	212.568;	21.899	211.499;	20.661	215.346;
21.843	215.140;	20.686	212.773;	20.685	218.286;	21.826	222.379;	20.735	219.453;
20.112	224.314;	20.437	224.808;	21.093	226.430;	21.838	231.142;	20.565	230.402;
20.832	231.798;	20.535	234.908;	21.377	232.208;	20.483	236.411;	20.115	242.475;
20.691	239.210;	20.872	236.286;	19.796	246.388;	20.651	252.479;	20.948	249.742;
19.645	246.146;								

APPENDIX III

LISTING OF FORTRAN PROGRAM

PLOT20 FOR Contains subroutine TR which reads NCTR file data, and subroutine DCDE which decodes data found in file header.

```
C
C
C       PROGRAM NAME : PLOT2Ø.FOR
C       THIS PROGRAM READS BACKSCATTER DATA FILES STORED
C       ON VAX DISKS AND PLOTS THE FILES.
C
C
        CHARACTER*1 YN
        COMMON BUFF
        BYTE BUFF(6656)
        INTEGER*2 LINE1(3Ø),LINE2(3Ø),PARAM(3Ø),INFILE(15)
        REAL*4 AP(16Ø2),A(8Ø1),P(8Ø1)
C
C       DEFINE BUFFER STRUCTURE
C
        EQUIVALENCE(LINE1(1),BUFF(1)),(LINE2(1),BUFF(61))
     1,(PARAM(1),BUFF(121)),(AP(1),BUFF(361))
        CALL PLOTS(Ø,Ø,Ø)
        TYPE *,'INPUT NO OF PLOTS'
        ACCEPT *, NOP
C
C       SET PHASE AXIS MAX AND MIN IN THE PLOTS
C
        TYPE *,'INPUT THE PHASE MIN AND THE PHASE MAX'
        ACCEPT *,PMIN,PMAX
        DO 198 III=1,NOP
C
C       READ A FILE
C
        CALL TR(INFILE)
        TYPE 1Ø5,LINE1
        TYPE 1Ø5,LINE2
        TYPE 1Ø5,PARAM
        TYPE 1Ø7,(AP(K),K=1,2Ø)
1Ø5     FORMAT(X,3ØA2)
1Ø7     FORMAT(1X,5(2F12.3,1H;))
C
C       GET NUMERICAL INFORMATION FROM THE THIRD LINE
C       OF THE HEADER
C
        CALL DCDE(NP,FMIN,FINC)
C
C       DIVIDE AN AMP-PHASE ARRAY INTO
C       AN AMP ARRAY AND A PHASE ARRAY
C
        DO 199 NN=1,NP
        A(NN)=AP(2*NN-1)
199     P(NN)=AP(2*NN)
688     FORMAT(A1)
689     FORMAT(1X,5(2F12.3,1H;))
C
C       CALCULATE THE AVERAGE OF AMPLITUDE TO
C       BE USED IN PLOTTING
C
667     CALL AVMM(A,AVM,NP)
        FMAX=FMIN+(NP-1)*FINC
        JAVM=AVM
        JAVM=JAVM/5
        AVM=JAVM*5.
        AMIN=AVM-2Ø.
        AMAX=AVM+2Ø.
C
C       SMOOTH A DATA FILE
```

```
C
      TYPE *,'INPUT NO. OF PTS FOR SMOOTHING'
      ACCEPT *,NS
      IF(NS.GT.Ø)CALL HAMM(A,P,NP,NS)
C
C     ELIMINATE BRANCH CUTS IN PHASE DATA
C
C
      CALL LPV(P,185.,3Ø.,PMAX,PMIN,NP)
      TYPE *,'DO YOU WANT TO PRINT THE DATA ? Y OR N'
      ACCEPT 688,YN
      IF(YN.EQ.'N')GO TO 196
      PRINT 1Ø5,LINE1
      PRINT 1Ø5,LINE2
      PRINT 1Ø5,PARAM
      PRINT 689,(A(JP),P(JP),JP=1,NP)
C
C     PLOT A DATA FILE
C
196   CALL EPLOT(A,P,INFILE,PMAX,PMIN,AMAX,AMIN,FINC,FMAX,FMIN,NP,NS)
198   CONTINUE
      CALL PLOT(Ø,Ø,999)
      CALL EXIT
      END
      SUBROUTINE TR(INFILE)
      INTEGER*2 INFILE(15),IBUFF(3328)
      COMMON BUFF
      BYTE BUFF(6656),TBUFF(512)
      EQUIVALENCE (BUFF(1),IBUFF(1))
      WRITE(6,5)
5     FORMAT(1X,'TYPE DATA FILE NAME')
      ACCEPT 1Ø,INFILE
1Ø    FORMAT(15A2)
      INFILE(15)=Ø
      IB=1
      ICNT=Ø
      OPEN(UNIT=8,NAME=INFILE,TYPE='OLD')
C
C     SET BLOCK LENGTH IN BYTES
C
82    IF(IB.EQ.1)LEN=512-9*4
      IF(IB.GT.1)LEN=512-26*4
C
C     READ A BLOCK OF 512 BYTES
C
      READ(8,8Ø,END=9Ø)(TBUFF(I),I=1,512)
8Ø    FORMAT(512A1)
C
C     STORE A BLOCK INTO THE BUFFER ACCORDING TO ITS LENGTH
C
      DO 85 I=1,LEN
85    BUFF(ICNT+I)=TBUFF(I)
      IB=IB+1
      ICNT=ICNT+LEN
      GO TO 82
9Ø    DO 86 I=1,LEN
86    BUFF(ICNT+I)=TBUFF(I)
C
C     ELIMINATE BLANK SPACES IN BETWEEN EACH CHARACTER
C     IN A FILE HEADER
C
      DO 4Ø I=1,18Ø
4Ø    BUFF(I)=BUFF(2*I-1)
331   CLOSE(UNIT=8,DISP='SAVE')
```

```
      RETURN
      END
      SUBROUTINE DCDE(NP,FMIN,FINC)
      COMMON BUFF
      BYTE BUFF(6656)
      INTEGER*4 IMIN,IINC,NP
C
C     NO OF DATA POINTS IS STORED IN THREE CHARACTERS, AND
C     STARTING FREQ AND FREQ INC. IN 5 CHARACTERS
C
      CHARACTER*3 CNL
      CHARACTER*5 CFF,CINC
      EQUIVALENCE (BUFF(124),CNL),(BUFF(131),CFF),(BUFF(140),CINC)
C
C
C     CONVERT CHARACTERS INTO THEIR NUMERICAL EQUIVALENTS
C
      DECODE(3,100,CNL)NP
100   FORMAT(I5)
      DECODE(5,100,CFF)IMIN
      DECODE(5,100,CINC)IINC
      FMIN=FLOAT(IMIN)/1000.
      FINC=FLOAT(IINC)/1000.
      TYPE 200,NP,FMIN,FINC
200   FORMAT(' NP=',I8,' FMIN=',F10.4,' FINC=',F10.4)
      RETURN
      END

      SUBROUTINE AVMM(A,AVM,NP)
      REAL A(801)
      AVM=0.
      DO 10 I=1,NP
10    AVM=AVM+A(I)
      AVM=AVM/NP
      RETURN
      END
```

```
      SUBROUTINE LPV(P,VR,DV,PMAX,PMIN,NP)
      REAL*4 P(801)
      DO 100 I=1,NP
      IF(P(I).GT.PMAX)P(I)=P(I)-360.
100   IF(P(I).LT.PMIN)P(I)=P(I)+360.
      PMED=(PMAX+PMIN)/2.
      DO 10 I=1,NP-1
      IF(ABS(P(I+1)-P(I)).LT.VR)GO TO 10
      IF(P(I).LT.PMED)P(I+1)=P(I+1)-360.
      IF(P(I).GT.PMED)P(I+1)=P(I+1)+360.
      IF(P(I+1).GT.PMAX+DV)P(I+1)=P(I+1)-360.
      IF(P(I+1).LT.PMIN-DV)P(I+1)=P(I+1)+360.
10    CONTINUE
      RETURN
      END
      SUBROUTINE HAMM(A,PH,K,N)
      DIMENSION A(301), PH(801), AA(801),PPH(801)
      DTR=57.29577958
      TPI=6.2831853
      DO 4 KL=1,K
4     A(KL)= 10.0**(A(KL)/20.)
      N2=(N-1)/2
      DO 3 KM=1,K
      REAL=0.0
      XIMAG=0.0
      KOUNT=1
2     KW=KM-N2+KOUNT-1
      OFF=FLOAT(KM-KW)*TPI/FLOAT(N)
      IF(KW.LT.1) KW=2-KW
      IF(KW.GT.K) KW=2 * K - KW
      W=COS(OFF)+1.
      FACT=W*A(KW)
      REAL=REAL+FACT*COS(PH(KW)/DTR)
      XIMAG=XIMAG+FACT*SIN(PH(KW)/DTR)
      IF(KOUNT.EQ.N) GO TO 1
      KOUNT=KOUNT+1
      GO TO 2
1     CONTINUE
      REAL=REAL/FLOAT(N)
      XIMAG=XIMAG/FLOAT(N)
      AA(KM)=SQRT(REAL*REAL+XIMAG*XIMAG)
      PPH(KM)=ATAN2(XIMAG,REAL)*DTR
3     CONTINUE
      DO 5 KKK=1,K
      A(KKK)=20.0 * ALOG10(AA(KKK))
      PH(KKK)=PPH(KKK)
5     CONTINUE
      RETURN
      END
      SUBROUTINE EPLOT(A,P,INFILE,
     1  PMAX,PMIN,AMAX,AMIN,FINC,FMAX,FMIN,NP,NS)
      INTEGER*2 INFILE(15),LINE1(30),LINE2(30),PARAM(30)
      DIMENSION F(801),A(801),P(801)
      COMMON BUFF
      BYTE BUFF(6656)
      EQUIVALENCE(LINE1(1),BUFF(1)),(LINE2(1),BUFF(61))
     1,(PARAM(1),BUFF(121))
      DO 7 K=1,NP
7     F(K)=FMIN+(K-1)*FINC
6     CONTINUE
      NCA=23
      NCP=12
```

```
NCF=15
DSF=(FMAX-FMIN)/6.Ø
DSA=(AMAX-AMIN)/4.Ø
DSP=(PMAX-PMIN)/4.Ø
CALL PLOT(1.,1.,-3)
CALL AXIS(Ø.,Ø.,'FREQUENCY (GHZ)',-NCF,6.,Ø.,FMIN,DSF,1.5 ,2)
CALL AXIS(Ø.,Ø.,'1Ø*LOG(SIGMA) (SQ. CM.)',NCA,4.,9Ø.,AMIN,DSA,1.,1)
CALL LINE(F,FMIN,DSF,A,AMIN,DSA,NP,Ø,1)
CALL PLOT(Ø.,5.,-3)
CALL AXIS(Ø.,Ø.,'FREQUENCY (GHZ)',-NCF,6.,Ø.,FMIN,DSF,1.5 ,2)
CALL AXIS(Ø.,Ø.,'PHASE (DEG.)',NCP,4.,9Ø.,PMIN,DSP,1.,1)
CALL LINE(F,FMIN,DSF,P,PMIN,DSP,NP,Ø,1)
CALL SYMBOL(.2, -.8, .1,LINE1, Ø.Ø,6Ø)
CALL SYMBOL(.2, -1., .1,LINE2, Ø.Ø,6Ø)
CALL SYMBOL(.2,-1.2,.1,PARAM,Ø.,6Ø)
CALL SYMBOL(.2,-1.4,.1,INFILE,Ø.,12)
RN=NS
CALL SYMBOL(2.,-1.4,.1,'PT OF SMOOTHING',Ø.,15)
CALL NUMBER(4.,-1.4,.1,RN,Ø.,-1)
CALL PLOT(Ø.,Ø.,-999)
RETURN
END
```

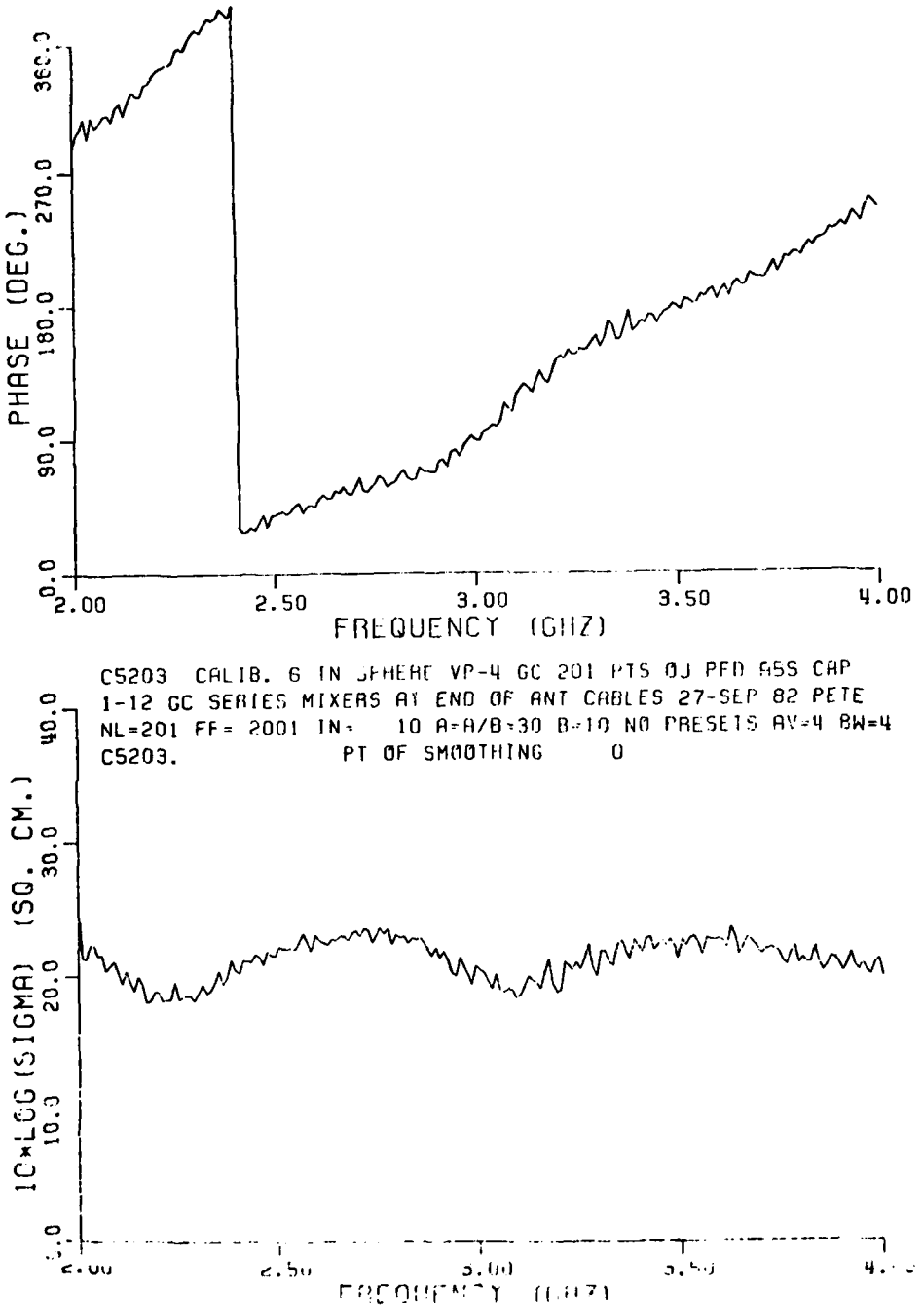

Figure A III-1. Plot of file C5203 (output of PLOT 20.FOR).