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Project Report

PA-229-14
(RSP)

Data Reduction Program Documentation ALC102

(Effective: August 1971)

C. R. Berndtson
R. H. French
D. E. Nessman

19770

30 August 1971

Prepared for the Advanced Research Projects Agency,
the Department of the Army, and the Department of the Air Force
under Electronic Systems Division Contract F19628-70-C-0230 by

Lincoln Laboratory
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Lexington, Massachusetts

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MASSACHUSETTS INSTITUTE OF TECHNOLOGY

LINCOLN LABORATORY

(6)

DATA REDUCTION PROGRAM DOCUMENTATION ALC1φ2 (EFFECTIVE: AUGUST 1971).

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(12) 6φp.

(15) F19628-7φ-C-φ23φ,
ARPA Order-6φφ

(9) PROJECT REP[redacted]T, PA-229-14
(Re-entry Systems Program)
(14)

(11) 3φ AUG[redacted]1971

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Bedford, Mass 01730

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The work reported in this document was performed at Lincoln Laboratory, a center for research operated by Massachusetts Institute of Technology. This work was sponsored by the Advanced Research Projects Agency of the Department of Defense (ARPA Order 600), the Department of the Army, and the Department of the Air Force under Air Force Contract F19628-70-C-0230.

FOREWORD

This is the fourteenth report in the Data Reduction Program Documentation series. It is dated accor ng to the date of completion of the documentation. No implication is made that this program will not subsequently be modified, amended, or superseded; on the contrary, the history of radar data processing is one of continuous evolution of techniques, and it is unrealistic to assume that steady-state has been reached.

The preparation of reports in this series is under the Editorship of Charles R. Berndtson of Lincoln, and of D. Nessman and R. French of Philco-Ford Corporation. Inquiries, suggestions, corrections, criticisms, and requests for additional copies should be directed to C. R. Berndtson.

The principal contributor to this report was G. L. Shapiro (Philco-Ford). Due to the intricate, evolutionary manner in which the programs came into being, the editors regret that it is in general impossible to give due credit to all -- mathematicians or radar analysts or programmers -- who contributed to the definition and writing of the programs.

Alan A. Grometstein
Alan A. Grometstein

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CONTENTS (cont'd)

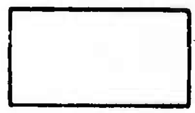
COMMON SYMBOLS AND ABBREVIATIONS

(The units given for certain quantities are the units commonly used for those quantities, unless otherwise noted.)

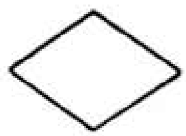
ADT	ALCOR Data Tape
AGC	Automatic Gain Control
ALCOR	ARPA-Lincoln C-band Observables Radar
ALTAIR	ARPA Long-Range Tracking and Instrumentation Radar
Alt	Altitude (km)
APS	Average Pulse Shape
ARS	ALTAIR Recording System
ARTP	ALTAIR Real Time Program
ATC	Angle Track Console
Avg	Average, Averaging
Az	Azimuth (deg)
c	Speed of Light
CADJ	Adjusted Calibration Constant (db)
C-band	ALCOR frequency, 5664 MHz (NB) and 5667 MHz (WB)
DBLT	Wide Band Pulse Doublet
DCO	Designations and Communications Operator
El	Elevation (deg)
EOF	End of File
GMT	Greenwich Mean Time
h	Hours
Hz	Hertz
IF	Intermediate Frequency
in	Inches
IRV	Inter-Range Vector
LC	Left Circular Polarization
lsb	Least Significant Bit
min	Minutes
NB	Narrow Band
NRTPOD	Non-real Time Precision Orbit Determination Program

POD	Project PRESS Operation and Data Summary Report
Phase	Presented in deg
PRF	Pulse Repetition Frequency (pps)
PRI	Pulse Repetition Interval (s)
pps	Pulses per second
pts	Points
QU	Quantum Unit
R	Range (km)
$\dot{R}$	Range Rate (km/s)
rad	Radians
RC	Right Circular Polarization
RCS	Radar Cross Section (dbsm)
RF	Radio Frequency
RGC	Receiver Gain Control
RTC	Range Track Console
s	Seconds
SD_w	Standard Deviation of Wake Velocity
SDBLT	Wide Band Slaved Pulse Doublet
S/N	Signal-to-noise Ratio
T	Time
TAL	Time After Launch (s)
TGC	Transmitter Gain Control
Tr	Traverse Angle (deg)
UHF	ALTAIR Frequency; 415 MHz
V	Velocity
V_d	Doppler Velocity
V_w	Mean Wake Velocity
VHF	ALTAIR Frequency; 155.5 MHz
WB	Wide Band
WBS	Wide Band Slaved
WTR	Western Test Range
θ	Total Off-axis Angle (deg)
λ	Wavelength
*	Denotes Multiplication

FLOW DIAGRAM SYMBOLS

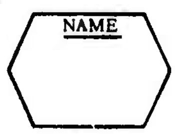


PROCESS, ANNOTATION



DECISION

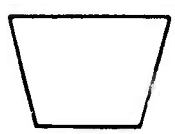
TERMINATOR



SUBROUTINE: where NAME is the entry call into the subroutine

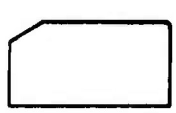
CONNECTOR: where P specifies a page in the flow diagram, and L designates a statement number in the program listing or a reference point in the flow diagram

CONNECTOR: where X implies a continuation of the diagram to the next page

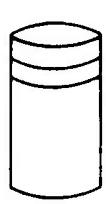


INPUT/OUTPUT OPERATION

MAGNETIC TAPE



PUNCHED CARD



DISK

ALC102

I. PURPOSE AND UTILIZATION

A. Source of Data

ALCOR[1]

B. Data Input

ALCOR data tape (ADT)

C. Description

ALC102 is designed to check an ADT by listing attenuation and PRF changes, missing pulses, parity errors, and selected metric and A/D count data.

D. Output

A listing of calibration record data, selected data records, parity errors, and attenuation and PRF changes.

II. DESCRIPTION

ALC102 is designed to list all attenuation changes, ~~PRF~~ pulse repetition frequency changes, missing pulses, parity errors, and selected metric and A/D count data. The data records are examined to determine if the range gates are being manually slewed and the records flagged. A listing of calibration constants and tables is also provided.

R

A. Calibration Data

The following information is listed from the calibration record.

1. Calibration Constants

Constant (db)	Listing Label	Calibration Record Word No.
NB LC	KRCS (NB LC)	624
NB RC	KRCS (NB RC)	625
NB LC peak	KRCS (NB PK)	626
WB LC	KRCS (WB LC)	627
WB RC	KRCS (WB RC)	628

2. Power Monitor Constants

Constant	Listing Label	Calibration Record Word No.
NB intercept (dbw)	PWR (NB INT)	620
NB slope [db/log (A/D counts)]	PWR (NB SLP)	621
WB intercept (dbw)	PWR (WB INT)	622
WB slope [db/log (A/D counts)]	PWR (WB SLP)	623

3. Angle Bias

Az bias (deg) and El bias (deg) are found in Calibration Record Word Nos. 602 and 603. They are called ABIAS and EBIAS in the listing.

4. Phase Differential

The phase differential (rad) between the reference channel and the Az channel is found in Calibration Record Word No. 5[illegible]. The phase differential (rad) between the reference channel and the El channel is found in Calibration Record Word No. 597. The differentials are called AGAMA and EGAMA in the listing.

5. Angle Error Scaling Factors

The scaling factors (revolutions/unit error) for determining monopulse angle errors are found in Calibration Record Word Nos. 612 (Az) and 613 (El). They are called AZGRAD and ELGRAD in the listing.

6. Range Bias Constants

Constant (μs)	Listing Label	Calibration Record Word No.
RBIAS(1)	NB PP CENT	604
RBIAS(2)	NB PP/OP LEAD	605
RBIAS(3)	NB PP/OP TRAIL	606
RBIAS(4)	NB OP CENT	607
RBIAS(5)	WB PP CENT	608
RBIAS(6)	WB OP CENT	609
RBIAS(7)	PP SSA BIAS	610
RBIAS(8)	OP SSA BIAS	611

7. Range Error Gradients

Gradient (QU/unit error)	Calibration Record Word No.
RGRAD(1)	614
RGRAD(2)	615
RGRAD(3)	616
RGRAD(4)	617
RGRAD(5)	618
RGRAD(6)	619

8. AGC Noise Level

Level (A/D counts)	Listing Label	Calibration Record Word No.
PP/NB	NOISE(1)	598
PP/WB	NOISE(2)	599
OP/NB	NOISE(3)	600
OP/WB	NOISE(4)	601

9. DBLT Phase

DBLT phase noise (rad) and phase bias (rad) are found in Calibration Record Word Nos. 645 and 646. The phase noise is called PHASE RMS JITTER in the listing.

10. Attenuation Constants

Constant (db)	Listing Label	Calibration Record Word No.
16 step LC IF	PIFA	512-527
16 step RC IF	OIFA	528-543
16 step reference channel IF	RIFA	544-559
16 step Az channel IF	AZIFA	560-575
16 step El channel IF	ELIFA	576-591
LC fast switch	PFSA	592
RC fast switch	OFSA	594
LC slow switch	PSSA	593
RC slow switch	OSSA	595
LC slow switch loss	PSSL	629
RC slow switch loss	OSSL	630

11. Auxiliary Range Scan Parameters

Parameter	Altitude Regime	Calibration Record Word No.
No. of dwells/scan	Endoatmospheric	633
	Exoatmospheric	639
Initial range offset (m)	Endoatmospheric	634
	Exoatmospheric	640
Range offset increment (m)	Endoatmospheric	635
	Exoatmospheric	641
Total of pulses/dwell	Endoatmospheric	636
	Exoatmospheric	642

The upper and lower auxiliary WB scan altitude limits (km) are found in Calibration Record Word Nos. 631 and 632. The upper and lower DBLT altitude limits (km) are found in Calibration Record Word Nos. 643 and 644.

12. Beacon-Skin Range Separation (μs)

Beacon Code	Calibration Record Word No.
1	649
2	650
3	651
4	652

13. Amplitude and Phase Reference Tables

Calibration Record Word Nos. 256 to 383 contain amplitude (db) for the LC and RC channels; Calibration Record Word Nos. 384 to 511 contain amplitude (db) for the peak detector channel. Phase is found in Calibration Record Word Nos. 1 to 255. These data are correlated with the A/D count.

B. Time

Time is listed in GMT h, min, s, and ms; in GMT total s, and in TAL.

C. R

R = IRANGE + TRBIAS + TTCOR + RRCOR - RCORF

where

IRANGE is uncorrected R

TRBIAS is range bias [computed from RBIAS(1) to RBIAS(8)]

TTCOR (transit time correction) = $R\dot{R}/c$

RRCOR is range doppler coupling correction

RCORF is tropospheric refraction correction

D. Pulse No.

Pulse No. is called PRI in the listing.

E. Az

Az = IAZ + AZBIAS

where

IAZ is Az encoder angle found in Data Record Bytes 709-711

AZBIAS is Az bias (Calibration Record Word No. 602)

F. El

El = IEL + ELBIAS - ECORF

where

IEL is El encoder angle found in Data Record Bytes 706-708

ELBIAS is El bias (Calibration Record Word No. 603)

ECORF is tropospheric refraction correction

G. $\dot{R}$

$\dot{R}$ is obtained from Data Record Bytes 805 to 807. This $\dot{R}$ is computed by the ARTP and only approximates the true $\dot{R}$.

H. Alt

$$\mathrm{Alt} = (R^2 + R_e^2 + 2RR_e \sin \mathrm{El})^{\frac{1}{2}} - R_e$$

where

R_e = radius of earth

J. PRF

PRF is IPRF, determined from the transmitted PRF for the particular waveform on the ADT.[#]

K. Angle Offsets

The angle offsets (ΔTr and ΔEl)[##] are determined:

$$\Delta Tr = AZGRAD\ (2\pi)\ (10^{P_a/20})\ (\cos Z1)$$

$$\Delta El = ELGRAD\ (2\pi)\ (10^{P_e/20})\ (\cos Z2)$$

where

AZGRAD is the traverse scaling factor (revolutions/unit error), Calibration Record Word 612

ELGRAD is the elevation scaling factor (revolutions/unit error), Calibration Record Word 613

$10^{P/20}$ is the normalized error voltage

P_a (db) = ΔTr (db) - REF (db)

P_e (db) = ΔEl (db) - REF (db)

ΔTr (db), ΔEl (db), and REF (db) are found by indexing the amplitude reference table (Calibration Record Words 256-383) with the log detector counts obtained in the ADT data record for the ΔTr, ΔEl, and reference channels.

Z1 = ΔTr phase - REF phase + AGAMA

Z2 = ΔEl phase - REF phase + EGAMA

ΔTr phase, ΔEl phase, and REF phase are found by indexing the phase reference table (Calibration Record Words 1-255) with the phase detector counts obtained in the data record.

AGAMA is a phase offset between the reference channel and the ΔTr channel, found in Calibration Record Word 596

EGAMA is a phase offset between the reference channel and the ΔEl channel, found in Calibration Record Word 597

[#] See Ref. 2, Appendix F.

[##] Called DELA and DELE in listing.

L. Peak Transmit Power

Peak transmit power (db) is determined:

NB POWER = PWRCN + PWRSN log XPKPWR

WB POWER = PWRSN + PWRSW log XPKPWR

where

PWRCN is Calibration Record Word 620

PWRSN is Calibration Record Word 621

PWRCW is Calibration Record Word 622

PWRSW is Calibration Record Word 623

XPKPWR is Data Record Byte 344

M. 40 Log R

40 log R is a term in the equation used to convert A/D count to dbsm.

N. Total Attenuation

The total LC (XPPAGC) and RC (XOPAGC) attenuation is computed in subroutine UNPACK and transferred to the main program through the common statement. The equations used for attenuation depend on the date of the mission.

1. Missions between 15 February 1970 and 14 October 1970

XPPAGC (db) = PIFA(I) + PFSA(J) + PSSL(K) + PSSA(L) - 16

XOPAGC (db) = OIFA(I) + OFSA(J) + OSSL(K) + OSSA(L) - 16

where

PIFA and OIFA are sixteen step IF attenuators. The attenuation is found in Calibration Record Words 512-527 (PIFA) and 528-543 (OIFA) as a function of I.

I is found in ADT Data Record Byte No. 787 [Bits 1-4 (PIFA), Bits 5-8 (OIFA)].

PFSA and OFSA are fast switch attenuators. The magnitude of the attenuation is given in Calibration Record Words 592 (PFSA) and 594 (OFSA).

J is found in ADT Data Record Byte No. 717 [Bit 7 (PFSA) and Bit 8 (OFSA)].

PSSL and OSSL are slow switch losses. The magnitude of the loss is found in Calibration Record Words 629 (PSSL) and 630 (OSSL).

K has three possible values determined from the ADT data record as follows:

For PSSL

Byte 716 Bit 1	Byte 717 Bit 3	K
0	0	#
0	1	0
1	0	1
1	1	#

For OSSL

Byte 716 Bit 2	Byte 717 Bit 4	K
0	0	#
0	1	0
1	0	1
1	1	#

PSSA and OSSA are slow switch attenuators. The magnitude of the attenuation is given in Calibration Record Words 593 (PSSA) and 595 (OSSA).

L is found in ADT Data Record Byte 815 [Bit 5 (PSSA) and Bit 6 (OSSA)].

Note: If K is zero, PSSA and OSSA are not used and L need not be checked.

2. Missions after 15 October 1970

XPPAGC (db) = PIFA(I) + PFSA(J) + PSSA(L) - 16

XOPAGC (db) = OIFA(I) + OFSA(J) + OSSA(L) - 16

#Indeterminate, therefore RCS data cannot be calibrated. When this occurs, a flag (ISSERR) is set for the main program, and XPPAGC and XOPAGC do not include slow switch losses or attenuation.

L is determined by combining the command to the slow switch attenuators, found in ADT Data Record Byte 815 [Bit 5 (PSSA) and Bit 6 (OSSA)], and the status readback of the attenuators, found in Byte 754 [Bits 5 and 6 (PSSA) and Bits 7 and 8 (OSSA)].

L has three possible values determined from the ADT data record as follows:

For PSSA

Byte 815 Bit 5	Byte 754 Bit 5	Byte 754 Bit 6	L
0	N/A	0	#
0	N/A	1	0
1	0	N/A	#
1	1	N/A	1

For OSSA

Byte 815 Bit 6	Byte 754 Bit 7	Byte 754 Bit 8	L
0	N/A	0	#
0	N/A	1	0
1	0	N/A	#
1	1	N/A	1

O. Pulse Type

The type of returned pulse is obtained from Data Record Byte 817, Bits 1-4, where:

Code	Pulse Return
0	NB
1	WB
2	Phantom (not expected on ADT)
3	WBS
4	not used
5	DBLT
6	not used
7	SDBLT

#Indeterminate. When this condition exists, L is set equal to its previous value (previous pulse), XPPAGC and XOPAGC computed, and a flag (ISSERR) set for the main program.

P. Range Offset

Range offset (m) is obtained from Data Record Bytes 832, 833, and 834.

Q. A/D Count

LC and RC amplitude and phase A/D counts are given for selected range gates.

III. OPERATION

A. Input

Title

Launch time (GMT total ms)

Start and stop times (pulse no.)

Waveform and Polarization

Averaging and skip intervals (pulses)

Start and stop range gates for listing

Option to list attenuation changes

A sample input is given in Appendix A.

CARD 1 (I10, 7I5, 2I10, 1X, A4)

(Col.)		
1-10	ILNCH	Launch time in total GMT ms
11-15	NBAND	0 = NB; 1 = WB
16-20	IPOLAR	0 = LC; 1 = RC
21-25	ICELP1	Initial gate for listing (46)#
26-30	ICELP2	Final gate for listing (60)#
31-35	INTAV	No. of pulses in averaging interval##
36-40	ISKIP	No. of pulses between each averaging interval (499)#; if a negative no. is input, no pulses are skipped
41-45	NIFAT	Attenuation change option: 0 = no changes; 1 = print changes
46-55	NSTART	First pulse no. of processing interval
56-65	NSTOP	Last pulse no. of processing interval
67-70	TITL	Title for listing

#If left blank, program sets to indicated value.

##Program always sets INTAV to 1.

B. Output

LISTING

Calibration record data

GMT h, min, s, and ms

GMT total s

TAL

R

Pulse no. (called PRI in listing)

Az

El

$\dot{R}$ (m/s)

Alt

PRF

Tr and El errors (called DELA and DELE in listing)

Peak transmit power (db)

40 log R

Total LC and RC attenuation (db)

R offset (m)

LC and RC amplitude and phase (A/D counts)

When they occur, the following are printed:

PRF changes

Parity errors

Attenuation changes (optional)

Improper pulse no. progression

ISSERR, denoting that the slow switch attenuation is indeterminate and the data are invalid (see Section II, N.)

IMOVP and IMOVO[2]

A sample listing is given in Appendix B.

IV. PROGRAM LIMITATIONS

None.

V. PROGRAMMING

A. LO2ALC (see Appendices C and D.)

LO2ALC is the control section of ALC102. LO2ALC reads the input cards, detects changes, performs the calculations, and prints the data.

B. HEDADT (see Appendix E.)

Subroutine HEDADT unpacks the ADT header record which contains bandwidth, reel no., WTR no., date of mission, and mission designator. The call statement is HEDADT [ISIG,# INBUF(1), IEQM(1)]

INPUT

INBUF(1)	First word in the ADT header record##

OUTPUT

IEQM(1)	IZBAND	(bandwidth: 1 = WB, 0 = NB)
IEQM(2)	ITREEL	(reel no.)
IEQM(3)	ITWTR	(WTR no.)
IEQM(4)	IMTH	
IEQM(5)	IDAY	(Date of test)
IEQM(6)	IYR	
IEQM(7-9)	ITDESG	(mission designator)

C. UNPACK (see Appendix F.)[2]

Subroutine UNPACK unpacks the raw data from the ADT, and translates it into a format usable by the IBM 360/67 computer.

#Not used.

##INBUF(2) to INPUF (1803) contain the remaining words in the record.

D. READJS[2]

The first call to subroutine READJS opens the file and reads the ADT header record. The second call to READJS reads the ADT calibration record and stores the values in a buffer area. L02ALC extracts the individual calibration values it requires. Each subsequent call to READJS reads an ADT data record consisting of eight ALCOR pulses.

E. REFC (see Appendix G.)

The tropospheric refraction correction subroutine, REFC, is based on tropospheric refraction tables in PPP-36.[3] A modified version of this subroutine is now in use.

The call statement is REFC (E, R, DEE, DRR).

E = Uncorrected El (must be between 0° and 90°)

R = Uncorrected R

DEE = El tiopospheric correction

DRR = R tropospheric correction

The corrected values to be computed after exiting from the REFC subroutine are:

El = E-DEE

R = R-DRR

REFERENCES

1. "ALCOR Data Users Manual", LM-86, Lincoln Laboratory, M.I.T. (17 June 1970).

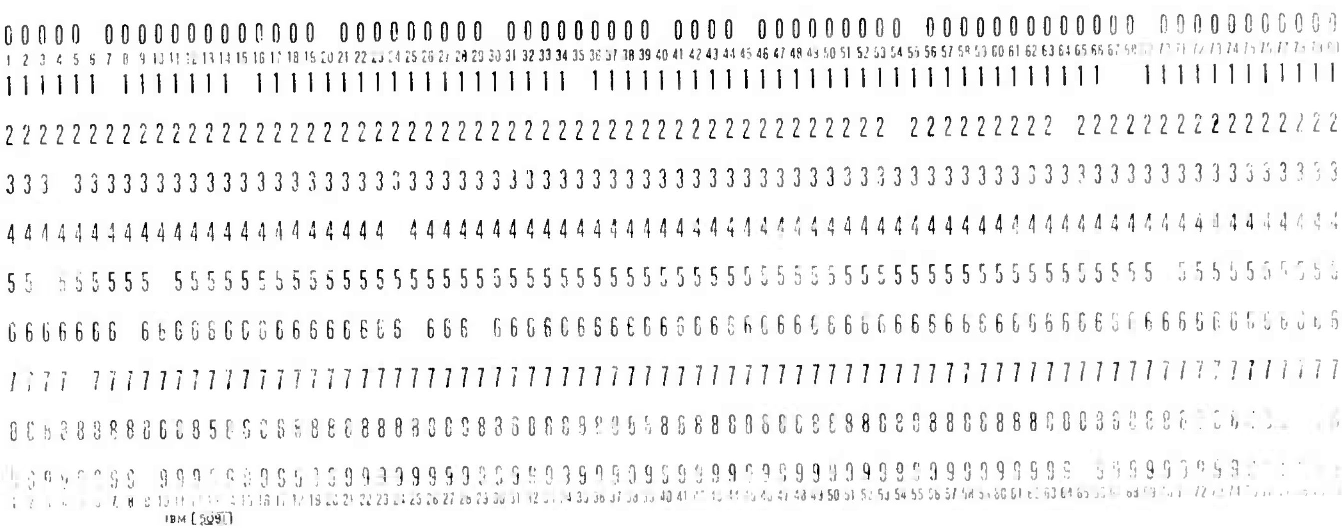
2. "Data Reduction Program Documentation, ALCOR Tape Read Package, (Effective: April 1971)", PA-229-7, Lincoln Laboratory, M.I.T. (26 April 1971).

3. J. P. Penhune, "Refraction Corrections for the TRADEX Radar", PPP-36 Lincoln Laboratory, M.I.T. (21 April 1965).

APPENDIX A

ALC102 INPUT

53701695   1   0   46   60   1   0   0   20   29 1J05



APPENDIX B
ALC102 OUTPUT

```
NIFAT =     0     NBAND=     1       IPOLAR =     0       ICELP1 =    46       ICELP2 =    60
INTAV =     1       ISKIP =  499       NSTART =          20       NSTOP =          29


REEL NO.          1
DATE =   1/ 1/71
TITLE = 1305
LAUNCH TIME =    53701.695
WIDE BAND SELECTED


KRCS(NBLC) KRCS(NBRC) KRCS(NBPK) KRCS(WBLC) KRCS(WBRC) KRCS( PP2)
    -89.40     -91.20     -90.30     -89.85     -94.20       0.0

PWR(NB INT) PWR(NB SLP) PWR(WB INT) PWR(WB SLP)
    43.64      10.66       43.64        10.66


ABIAS(DEG) =           -0.010
EBIAS(DEG) =           -0.023

AGAMA(RAD) =    -0.0        EGAMA(RAD) =    -0.0         AZGRAD(REV/UNITS ERROR) =  0.0005      ELGRAD(REV/UNITS ERROR) =  0.0005

NB PP CENT =        -2409.788  (MICROSECS)
NB PP/OP LEAD =        -0.050
NB PP/OP TRAL =         0.050
NB OP CENT =            0.048
WB PP CENT =        -2406.392
WB OP CENT =           -0.000
PP SSA BIAS=           -0.0
OP SSA BIAS=           -0.0
PP PP2 BIAS=            0.0

RGRAD(1) =           4175.000  (Q.U./UNIT ERROR)          NOISE(1) =         20.  (COUNTS)
RGRAD(2) =           7488.000                             NOISE(2) =         23.
RGRAD(3) =          -7488.000                             NOISE(3) =         28.
RGRAD(4) =             54.800                             NOISE(4) =         33.
RGRAD(5) =             -0.0
RGRAD(6) =             -0.0

PHASE RMS JITTER (RAD) =       0.192
PHASE BIAS       (RAD) =       0.0
```

ATTENUATION CONSTANTS (DB)

PIFA:							
-0.0	4.0	8.0	12.0	16.0	20.1	24.2	28.3
32.0	36.1	40.1	44.2	48.2	52.3	56.4	60.4
OIFA:							
-0.0	3.9	8.0	11.9	16.0	20.0	24.0	28.1
32.0	36.1	40.2	44.2	48.3	52.3	56.4	60.5
RIFA:							
-0.0	3.9	8.0	11.9	16.0	20.0	24.1	28.1
32.0	36.0	40.0	44.1	47.7	51.9	55.6	60.2
AZIFA:							
-0.0	4.0	8.0	12.1	16.0	20.1	24.1	28.3
32.0	36.1	40.1	44.2	48.3	52.5	56.5	60.7
ELIFA:							
-0.0	4.0	[illegible]	12.0	16.0	20.0	24.1	28.1
32.0	36.0	40.1	44.1	48.2	52.3	56.4	60.4

PFSA = 16.1 PSSA = 32.3 PSSL = -0.0
OFSA = 16.1 OSSA = 32.0 OSSL = -0.0

ENDO-ATMOSPHERIC

NUMBER OF DWELLS PER SCAN	=	-0.
INITIAL RANGE OFFSET (M)	=	0.0
RANGE OFFSET INCREMENT (M)	=	0.0
NO.OF SLAVED PRIS PER DWELL	=	-0.

EXO -ATMOSPHERIC SCAN

NUMBER OF DWELLS PER SCAN	=	9.
INITIAL RANGE OFFSET (M)	=	-119.92
RANGE OFFSET INCREMENT (M)	=	29.98
NO.OF SLAVED PRIS PER DWELL	=	4.

ALTITUDE PARAMETERS

UPPER AUX.SCAN ALTITUDE LIMIT (KM)	=	431.00
LOWER AUX.SCAN ALTITUDE LIMIT (KM)	=	120.00
UPPER DOUBLET MODE ALTITUDE LIMIT (KM)	=	55.00
LOWER DOUBLET MODE ALTITUDE LIMIT (KM)	=	5.00

BEACON-SKIN RANGE SEPARATION

BEACON CODE 1	=	0.0	(MICROSECONDS)
BEACON CODE 2	=	0.0	
BEACON CODE 3	=	0.0	
BEACON CODE 4	=	0.0	

AMPLITUDE(OB) LOOKUP TABLE

COUNT	AMP	COUNT	AMP	COUNT	AMP	COUNT	AMP	COUNT	AMP	COUNT	AMP
0	-0.0	22	12.431	44	24.474	66	36.699	88	49.279	110	61.784
1	0.559	23	12.958	45	25.062	67	37.324	89	49.785	111	62.289
2	1.118	24	13.485	46	25.671	68	37.954	90	50.340	112	62.795
3	1.677	25	14.016	47	26.329	69	38.520	91	50.882	113	63.339
4	2.236	26	14.561	48	26.828	70	39.166	92	51.372	114	63.940
5	2.796	27	15.186	49	27.283	71	39.638	93	51.857	115	64.774
6	3.355	28	15.788	50	27.770	72	40.161	94	52.320	116	65.449
7	3.914	29	16.369	51	28.282	73	40.736	95	52.793	117	66.095
8	4.473	30	16.915	52	28.859	74	41.517	96	53.755	118	66.712
9	5.947	31	17.452	53	29.450	75	42.235	97	54.193	119	67.309
10	6.401	32	18.019	54	29.984	76	42.803	98	54.620	120	67.873
11	6.839	33	18.601	55	30.520	77	43.386	99	55.112	121	68.323
12	7.274	34	19.234	56	31.102	78	43.974	100	55.637	122	68.774
13	7.807	35	19.696	57	31.717	79	44.453	101	56.082	123	68.771
14	8.424	36	20.109	58	32.393	80	44.941	102	56.499	124	69.330
15	8.874	37	20.574	59	32.947	81	45.502	103	57.031	125	69.889
16	9.309	38	21.129	60	33.485	82	46.099	104	57.785	126	70.448
17	9.815	39	21.690	61	34.028	83	46.880	105	58.328	127	71.007
18	10.364	40	22.258	62	34.626	84	47.395	106	58.926		
19	10.870	41	22.861	63	35.474	85	47.874	107	59.774		
20	11.365	42	23.484	64	35.837	86	48.324	108	60.284		
21	11.893	43	23.979	65	36.200	87	48.774	109	60.813		

PEAK DETECTOR(OB) LOOKUP TABLE

COUNT	AMP	COUNT	AMP	COUNT	AMP	COUNT	AMP	COUNT	AMP	COUNT	AMP
0	-0.0	22	11.695	44	23.992	66	35.903	88	48.142	110	60.548
1	0.547	23	12.298	45	24.627	67	36.585	89	48.661	111	60.937
2	1.094	24	12.893	46	25.322	68	37.166	90	49.151	112	61.279
3	1.640	25	13.511	47	25.793	69	37.722	91	49.641	113	61.622
4	2.187	26	14.[illegible]7	48	26.265	70	38.222	92	50.131	114	62.622
5	2.734	27	14.761	49	26.743	71	38.722	93	50.622	115	63.122
6	3.281	28	15.311	50	27.222	72	39.303	94	51.154	116	63.622
7	3.827	29	15.966	51	27.772	73	39.945	95	51.729	117	64.403
8	4.374	30	16.522	52	28.322	74	40.742	96	52.622	118	65.035
9	4.921	31	16.956	53	28.832	75	41.295	97	52.987	119	65.610
10	5.468	32	17.440	54	29.360	76	41.822	98	53.352	120	66.117
11	4.831	33	18.177	55	30.322	77	42.322	99	53.782	121	66.622
12	5.540	34	18.669	56	30.822	78	42.822	100	54.399	122	67.122
13	6.322	35	19.146	57	31.322	79	43.272	101	55.012	123	67.622
14	6.980	36	19.708	58	31.822	80	43.722	102	55.622	124	67.801
15	7.594	37	20.287	59	32.322	81	44.272	103	56.177	125	68.348
16	8.163	38	20.806	60	32.822	82	44.822	104	56.713	126	68.895
17	8.783	39	21.322	61	33.322	83	45.783	105	57.167	127	69.441
18	9.410	40	21.832	62	33.903	84	46.262	106	57.622		
19	9.959	41	22.343	63	34.432	85	46.722	107	58.379		
20	10.519	42	22.869	64	34.827	86	47.172	108	59.026		
21	11.101	43	23.404	65	35.222	87	47.622	109	59.622		

PHASE(DEG) LOOKUP TABLE

COUNT	PHA	COUNT	PHA	COUNT	PHA	COUNT	PHA	COUNT	PHA	COUNT	PHA
-127	-176.760	-83	-115.560	-39	-57.600	5	12.600	49	63.360	93	122.760
-126	-176.760	-82	-114.120	-38	-56.520	6	14.040	50	65.160	94	124.200
-125	-172.903	-81	-112.320	-37	-55.080	7	15.480	51	66.600	95	125.640
-124	-168.120	-80	-110.880	-36	-54.000	8	17.280	52	68.040	96	126.720
-123	-165.600	-79	-109.800	-35	-53.280	9	18.720	53	69.480	97	127.440
-122	-163.800	-78	-108.720	-34	-52.200	10	19.440	54	70.920	98	128.160
-121	-162.000	-77	-106.920	-33	-51.120	11	20.520	55	72.360	99	129.240
-120	-160.560	-76	-105.120	-32	-50.040	12	21.960	56	73.800	100	130.680
-119	-159.120	-75	-103.680	-31	-48.960	13	23.040	57	75.240	101	132.120
-118	-158.040	-74	-102.480	-30	-47.880	14	24.120	58	76.320	102	133.200
-117	-156.960	-73	-100.800	-29	-46.440	15	25.020	59	77.760	103	134.280
-116	-155.520	-72	-99.720	-28	-45.360	16	25.920	60	79.920	104	135.720
-115	-154.440	-71	-98.280	-27	-44.280	17	27.360	61	81.360	105	136.800
-114	-153.000	-70	-96.840	-26	-43.200	18	28.440	62	82.440	106	137.880
-113	-151.920	-69	-95.040	-25	-42.480	19	29.520	63	83.880	107	139.320
-112	-150.840	-68	-93.600	-24	-41.400	20	30.600	64	85.320	108	140.760
-111	-149.400	-67	-92.520	-23	-39.960	21	31.680	65	86.400	109	141.840
-110	-148.320	-66	-91.080	-22	-38.880	22	32.400	66	87.840	110	142.920
-109	-146.880	-65	-89.280	-21	-37.800	23	33.480	67	89.280	111	144.720
-108	-146.160	-64	-87.480	-20	-36.720	24	34.920	68	90.720	112	146.160
-107	-145.440	-63	-86.400	-19	-35.640	25	36.000	69	92.520	113	147.240
-106	-144.000	-62	-85.680	-18	-34.200	26	36.720	70	93.600	114	148.680
-105	-142.560	-61	-84.600	-17	-33.120	27	37.440	71	95.040	115	150.120
-104	-141.840	-60	-83.160	-16	-31.680	28	38.880	72	96.480	116	151.920

```
TIME(GMT) = 15 17 30.977      TIME(SEC) = 55050.977     TAL (SEC) =    1349.282      RANGE (KM) =  1990.893      PRI =    20
AZIM(DEG) =       60.752      ELEV(DEG) =    14.147     ROOT(M/S) =   -5818.723      HEIGHT(KM) =   752.875      PRF =   100
DELA(DEG) =       -0.085      DELE(DEG) =     0.045     POWER(DB) =      63.175      40LOGR(KM) =   131.962
LC IF ATT(DB) =      0.0      RC IF ATT =       0.0
THIS PULSE IS A  W.BAND       R.OFFSET(M) =     0.0     RCODE =  1
```

RANGE CELL	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
LCAMP (A/D) =	30	29	18	12	25	32	34	28	16	3	8	6	18	16	5
LCPHA (A/D) =	18	38	38	8	24	27	43	51	70	121	-115	-83	-66	-47	-46
RCAMP (A/D) =	37	14	25	31	39	44	47	42	28	34	42	40	37	35	37
RCPHA (A/D) =	102	109	6	8	37	58	87	119	-106	-8	57	99	122	-54	-4

APPENDIX C

L02ALC PROGRAM LISTING

```
C
      DOUBLE PRECISION XLNCH,D1000,TAL,TOTL,TOOLD,TTOT
C
      DIMENSION IEQM(9),ITDESG(3)
      DIMENSION IPRFS(8),ITRFS(8)
      DIMENSION XFZLN(255),ILCOUT(255),IRCOUT(255),IDATE(3)
      DIMENSION FAZLTN(255),JCOUNT(255),NCOUNT(128)
      DIMENSION XLCSUM(170),XRCSUM(170),
     1 XATBL(128),XLCDB(170),XRCDB(170),ILCAMP(170),IRCAMP(170)
     2,ILCPHA(170) ,IRCPHA(170),           YPRNT(170)
      DIMENSION IOUT(170),IAVLC(170),IAVRC(170),QBIAS(8)
      DIMENSION XNBUF(1803),PIFA(16),CIFA(16),          XKRCS(5)
      DIMENSION XWPL1(8),XWPL2(8)
      DIMENSION DW(14),XPKTBL(128),BEACSP(4)
C
      COMMON/ICOM/INBUF(1803),IAZ,IEL,INDEX,IPPRCS,ICRS,IRANGE,IPKPWR,IR
     1DOT,IALT,INDAZ,JNDAZ,INDEL,IRB54,IRB85,ICPRCS,I240B1,I240B2,I240B3
     1,I241B1,I241B2,I241B3,XPPAGC,IBETA,NEWA,IBAND,NSW,RBIAS(8),ISVPRI,
     1IHRS,IMIN,ISEC,IMSEC,ISIAT(21),TRBIAS,ISTAT1,ISTAT2,ISTAT3,ISTAT4,
     1IALSW,ISTSW,NBWB,ISIGNO,I27B12,JCON,NBEG,NEND,ITST,NUMPRI,XOPAGC,
     1ITBAND,ITAPNC,IPRF,IPULAR,ISSERR,PIFA,CIFA,PFSA,OFSA,PSSA,CSSA,
     1PSSL,OSSL,ICODE,I273B5,I273B6,I273B7,I273B8,IMCVP,IMCVC,IOFFST,
     1IDAT(682)
C
      EQUIVALENCE (ILCAMP(1),IDAT(1)),(ILCPHA(1),IDAT(171)),(IRCAMP(1),
     1IDAT(341)),(IRCPHA(1),IDAT(511))
      EQUIVALENCE(XNBUF(1),INBUF(1))
      EQUIVALENCE (IEQM(1),IZBAND),(IEQM(2),ITREEL),(IEQM(3),ITWTR),
     2(IEQM(4) ,IMTH  ),(IEQM(5),IDAY ),(IEQM(6),IYR),
     3(IEQM(7),ITDESG(1))
C
      DATA IPRFS/200,160,100,80,50,40,25,20/
      DATA ITRFS/010,012,010,012,020,025,040,050/
      DATA KPRF/0/,NTESTS/0/
      DATA XLCSUM/170*0./,XRCSUM/170*0./,IFRST1/0/,IFRST2/0/
      DATA ZLC/'LC   '/,ZRC/'RC   '/,ZWB/'WB   '/,ZNB/'NB   '/
      DATA          IFRST3/0/,IFRST4/0/
      DATA ER /6378.145/,IAVLC/170*0 /,IAVRC/170*0 /
      DATA D1000/1000. D0/
      DATA XWPL1/'N.PAW.BAPHANWB SNOT DOUBNOT DB.S'/
      DATA XWPL2/'ND  ND   TOM LVEDUSEDLET USEDLVED'/
C
C        IPOLAR = 0 LEFT CIRCULAR DATA REQUESTED
C        IPOLAR = 1 RIGHT CIRCULAR DATA REQUESTED
C        NBAND = 0  NARROW BAND DATA REQUESTED
C        NBAND = 1  WIDE BAND DATA REQUESTED
C        NIFAT = 0  DO NOT PRINT ALL AGC CHANGES
C        NIFAT = 1  PRINT ALL AGC CHANGES
C        NEWA = 0   MISSION FLOWN BEFORE 15 OCT 70 (OLD ATTN.)
C        NEWA = 1   MISSION FLOWN AFTER  15 OCT 70 (NEW ATTN.)
C
      READ(5,1)ILNCH,NBAND,IPOLAR,ICELP1,ICELP2,INTAV,ISKIP,NIFAT,
     1NSTART,NSTOP,TITL
    1 FORMAT(I10,7I5,2I10,1X,A4)
```

```
      IF(ICELP1.LE.0)ICELP1=46
      IF(ICELP2.LE.0)ICELP2=60
      INTAV=1
      IF(ISKIP.EQ.0)ISKIP=499
      IF(ISKIP.LT.0)ISKIP=0
      IFPR=0
      IPULS=0
      NNSET=ISKIP+1
      IF(NSTART.LE.0)NSTART=1
      IF(NSTOP.LE.0)NSTOP=99999
C
      NLAST=NSTOP-1
      IEOF=0
      IERR=0
      CALL READJS(INPUF,IEOF,IERR)
      ISIG=1
      CALL HEDADT (ISIG,INBUF(1),IECM(1))
      ITBAND=IZBAND
      NEWA=0
      IF(IYR.GT.70)GO TO 282
      IF(IYR.LT.70)GO TO 283
      IF(IMTH.GT.10)GO TO 282
      IF(IMTH.LT.10)GO TO 283
      IF(IDAY.LT.15)GO TO 283
  282 NEWA=1
  283 CONTINUE
      IERR=0
      CALL READJS(INPUF,IEOF,IERR)
C
C         STORE THE DESIRED CALIBRATION VALUES
C
      N=0
      DO 20 K=256,383
      N=N+1
   20 XATBL(N)=XNBUF(K)
C
      N=0
      DO 121 K=384,511
      N=N+1
  121 XPKTBL(N)=XNBUF(K)
C
      DO 21 K=1,255
      XFZLN(K)=XNBUF(K)
      JCOUNT(K)=K-128
   21 FAZLIN(K)=XNBUF(K)*57.2958
C
      N=0
      DO 22 K=512,527
      N=N+1
   22 PIFA(N)=XNBUF(K)
      N=0
      DO 23 K=528,543
      N=N+1
   23 OIFA(N)=XNBUF(K)
C
      PFSA=XNBUF(592)
      PSSA=XNBUF(593)
```

```
      OFSA=XNBUF(594)
      OSSA=XNBUF(595)
      AGAMA=XNBUF(596)
      EGAMA=XNBUF(597)
C
      ABIAS=XNBUF(602)
      EBIAS=XNBUF(603)
      DEGCON=(180.*.0479369)/3141.59
      AZBIAS=DEGCON*ABIAS
      ELBIAS=DEGCON*EBIAS
C
      N=0
      DO 25 K=604,611
      N=N+1
      QBIAS(N)=XNBUF(K)
   25 RBIAS(N)=QBIAS(N)
C
      AZGRAD=XNBUF(612)
      ELGRAD=XNBUF(613)
C
      PWRCN=XNBUF(620)
      PWRSN=XNBUF(621)
      PWRCW=XNBUF(622)
      PWRSW=XNBUF(623)
C
      N=0
      DO 27 K=624,628
      N=N+1
   27 XKRCS(N)=XNBUF(K)
C
      PSSL=XNBUF(629)
      OSSL=XNBUF(630)
C
      N=0
      DO 28 K=631,644
      N=N+1
   28 DW(N)=XNBUF(K)
C
      CKCN=14.989625/2048.
      XLX634=DW(4)*CKON
      XLX635=DW(5)*CKON
      XLX640=DW(10)*CKCN
      XLX641=DW(11)*CKCN
C
      XRMSJ=XNBUF(645)
      PHABIA=XNBUF(646)
      XRBPP2=XNBUF(647)
      XKRPP2=XNBUF(648)
      N=0
      DO 49 K=649,652
      N=N+1
   49 BEACSP(N)=XNBUF(K)
C
      WRITE(6,1708)NIFAT,NBAND,IPOLAR,ICELP1,ICELP2,INTAV,ISKIP,NSTART,
     1NSTCP
 1708 FORMAT(' NIFAT =', I5,3X,' NBAND=',I5,5X,' IPOLAR =',I5,5X,' ICELP
     11 =',I5,5X,' ICELP2 =',I5,5X,/,' INTAV =',I5,5X,' ISKIP =',I5,5X,
```

```
     2' NSTART =',I10,5X,' NSTOP =',I10)
      WRITE(6,1709)
 1709 FORMAT(//)
      WRITE(6,80)ITREEL
   80 FORMAT(' REEL NO. 'T10,I10 )
      WRITE(6,81)IMTH,IDAY,IYR
   81  FORMAT(' DATE = ',1X,I2,'/',I2,'/',I2)
      WRITE(6,7002)TITL
 7002 FORMAT(' TITLE =',1X,A4)
      XLNCH=DFLOAT(ILNCH)/D1000
      WRITE(6,7003)XLNCH
 7003 FORMAT(' LAUNCH TIME =',F12.3)
C
      IF(NBAND.EQ.0) GO TO 88
      WRITE(6,89)
   89 FORMAT(' WIDE BAND SELECTED')
      GO TO 90
   88 CONTINUE
      WRITE(6,91)
   91 FORMAT(' NARROW BAND SELECTED')
   90 CONTINUE
      JCON=-1
      INDEX=0
      ITST=1
      JJ=0
      IADIN=2
      WRITE(6,1709)
      WRITE(6,111)(XKRCS(N),N=1,5),XKRPP2
  111 FORMAT(' KRCS(NBLC) KRCS(NBRC) KRCS(NBPK) KRCS(WBLC) KRCS(WBRC) KR
     1CS( PP2)'/6(1X,F10.2))
      WRITE(6,112)PWRCN,PWRSN,PWRCW,PWRSW
  112 FORMAT(/' PWR(NB INT) PWR(NB SLP) PWR(WB INT) PWR(WB SLP)
     1 '/(2F10.2,2X,F10.2,3X,F10.2)//)
      WRITE(6,36)AZBIAS,ELBIAS
   36 FORMAT(/' ABIAS(DEG) = 'T20,F10.3,/
     1' EBIAS(DEG) = 'T20,F10.3)
      WRITE(6,300)AGAMA,EGAMA,AZGRAD,ELGRAD
  300 FORMAT('0AGAMA(RAD) =',F9.3,5X,'EGAMA(RAD) =',F9.3,5X,' AZGRAD(REV
     1/UNITS ERROR) =',F8.4,5X,' ELGRAD(REV/UNITS ERROR) =',F8.4)
      WRITE(6,37)(RBIAS(N),N=1,8),XRBPP2
   37 FORMAT(/' NB PP CENT = 'T20,F10.3,2X,'(MICROSECS)',/
     1' NB PP/OP LEAD = 'T20,F10.3,/
     2' NB PP/OP TRAIL = 'T20,F10.3,/
     3' NB OP CENT = 'T20,F10.3,/
     4' WB PP CENT = ' T20,F10.3,/
     5' WB OP CENT = 'T20,F10.3,/
     6' PP SSA BIAS= 'T20,F10.3,/
     7' OP SSA BIAS= 'T20,F10.3,/
     8' PP PP2 BIAS= 'T20,F10.3)
      WRITE(6,4391)XNBUF(614),XNBUF(598),XNBUF(615),XNBUF(599),XNBUF(616
     1),XNBUF(600),XNBUF(617),XNBUF(601),XNBUF(618),XNBUF(619)
 4391 FORMAT('0RGRAD(1) =',T20,F10.3,2X,'(Q.U./UNIT ERROR)',10X,'NOISE(1
     1) =',T75,F5.0,2X,'(COUNTS)'/
     2                  ' RGRAD(2) =',T20,F10.3,29X,'NOISE(2) =',T75,F5.0,
     3/,                ' RGRAD(3) =',T20,F10.3,29X,'NOISE(3) =',T75,F5.0,
     3/,                ' RGRAD(4) =',T20,F10.3,29X,'NOISE(4) =',T75,F5.0,
     3/,                ' RGRAD(5) =',T20,F10.3,/,' RGRAD(6) =',T20,F10.3)
```

```
      WRITE(6,4394)XPMSJ,PHABIA
4394 FORMAT(//' PHASE RMS JITTER (RAD) = ',F10.3,
    1/,' PHASE BIAS       (RAD) = ',F10.3)
      WRITE(6,4395)(XNBUF(I),I=512,527),(XNBUF(I),I=528,543),(XNBUF(I),
    1I=544,559),(XNBUF(I),I=560,575),(XNBUF(I),I=576,591)
4395 FORMAT('1',9X,'  ATTENUATION CONSTANTS (DB)   '//' PIFAO'/   8F10.1
    1/8F10.1//' OIFAO'/   8F10.1/8F10.1//' RIFAO'/   8F10.1/8F1C.1// '
    2 AZIFAO'/   8F10.1/8F10.1//' ELIFAO'/   8F10.1/8F10.1)
      WRITE(6,4398) XNBUF(592),XNBUF(593),XNBUF(629),
    1               XNBUF(594),XN8UF(595),XNBUF(630)
4398 FORMAT('OPFSA = ',F10.1,7X,'PSSA =',F1C.1,7X,'PSSL =',F10.1/
    1        ' OFSA = ',F10.1,7X,'OSSA =',F1C.1,7X,'OSSL =',F10.1 )
      WRITE(6,7431)DW(3),DW(9),
    1XLX634,XLX640,XLX635,XLX641,DW(6),DW(12)
7431 FORMAT('0',10X,'ENDO-ATMOSPHERIC',38X,'EXO -ATMOSPHERIC SCAN'//
    515X,'NUMBER OF DWELLS PER SCAN      = ',F10.0,17X,'NUMBER OF DWELLS
    6PER SCAN     = ',F1C.0/
    715X,'INITIAL RANGE OFFSET (M)       = ',F10.2,17X,'INITIAL RANGE OFF
    8SET (M)      = ',F10.2/
    915X,'RANGE OFFSET INCREMENT (M)     = ',F10.2,17X,'RANGE OFFSET INCR
    AEMENT (M)    = ',F10.2/
    B15X,'NO.OF SLAVED PRIS PER DWELL    = ',F10.0,17X,'NO.OF SLAVED PRIS
    C PER DWELL   = ',F10.0/)
      WRITE(6,7438)DW(1),DW(2),DW(13),DW(14)
7438 FORMAT('0',10X,'ALTITUDE PARAMETERS'//,
    115X,'UPPER AUX.SCAN ALTITUDE LIMIT (KM)       = ',F10.2/
    215X,'LOWER AUX.SCAN ALTITUDE LIMIT (KM)       = ',F10.2/
    315X,'UPPER DOUPLET MODE ALTITUDE LIMIT (KM) = ',F10.2/
    415X,'LOWER DOUPLET MODE ALTITUDE LIMIT (KM) = ',F10.2)
      WRITE(6,7439)(BEACSP(I),I=1,4)
7439 FORMAT('0  BEACON-SKIN RANGE SEPARATION'/6X,'BEACON CODE 1 = ',
    1F10.3,'    (MICROSECONDS)'/6X,'BEACON CODE 2 = ',F10.3,/6X,'BEACON
    2CODE 3 = ',F10.3,/6X,'BEACON CODE 4 = ',F10.3)
      DO 32 K=1,128
   32 NCOUNT(K)=K-1
      WRITE(6,102)
  102 FORMAT('1'T41,'AMPLITUDE(DB) LOOKUP TABLE'//)
      WRITE(6,41)
   41 FORMAT(T8,'COUNT     AMP     COUNT     AMP     COUNT     AMP     COUNT
     1   AMP     COUNT     AMP     COUNT     AMP'/)
      DO 26 KA=1,22
   26 WRITE(6,77)(NCOUNT(J),XATBL(J),J=KA,128,22)
   77 FORMAT(T6,6(3XI3,F10.3))
      WRITE(6,104)
  104 FORMAT(//T41,'PEAK DETECTOR(DB) LOOKUP TABLE'//)
      WRITE(6,41)
      DO 137 KA=1,22
  137 WRITE(6,77)(NCOUNT(J),XPKTBL(J),J=KA,128,22)
      WRITE(6,903)
  903 FORMAT('1',T42,'PHASE(DEG) LOOKUP TABLE'//)
      WRITE(6,72)
   72 FORMAT(T9,'COUNT     PHA        COUNT     PHA        COUNT     PHA
     1 COUNT     PHA       COUNT     PHA       COUNT     PHA'/)
      DO 29 KP=1,44
   29 WRITE(6,78)(JCOUNT(J),FAZLIN(J),J=KP,255,44)
   78 FORMAT(T6,6(3XI5,F10.3))
      WRITE(6,139)
```

```
  139 FORMAT('1')
C
      ISK=999
      NBEG=NSTART
    3 JCON=JCON+1
      IF(JCON.EQ.9.OR.JCON.EQ.0)GO TO 97
      INDEX=(JCON-1)*900
      GO TO 99
   97 JCON=1
      INDEX=0
   98 IEOF=0
      IERR=0
      CALL READJS(INBUF,IEOF,IERR)
      IF(IERR.EQ.1)GO TO 103
   99 CALL UNPACK
      IF(IFRST2.EQ.1)GO TO 92
      ZBAN=ZNB
      IF(ITBAND.EQ.1)ZBAN=ZWB
      ZPOL=ZLC
      IF(IPOLAR.EQ.1)ZPOL=ZRC
      RRUSE=-.00943
      IF(ITBAND.EQ.1)RRUSE=-.000115
      PWRUS1=PWRCN
      IF(NBAND.EQ.1)PWRUS1=PWRCW
      PWRUS2=PWRSN
      IF(NBAND.EQ.1)PWRUS2=PWRSW
      CCNLC=XKRCS(1)
      CCNRC=XKRCS(2)
      IF(NBAND.NE.1)GO TO 17
      CCNLC=XKRCS(4)
      CCNRC=XKRCS(5)
   17 CONTINUE
C
      IF(NBAND.NE.ITBAND)GO TO 695
      IFRST2=1
   92 CONTINUE
      IF(NUMPRI.LT.NSTART)GO TO 3
C
      IF(IFRST4.EQ.1)GO TO 341
      IPROLD=IPRF
      XOPOLD=XOPAGC
      XPPOLD=XPPAGC
      NUMOLD=NUMPRI
      IFRST4=1
      GO TO 340
C
  341 CONTINUE
      IF((NUMPRI-NUMOLD).EQ.1)GO TO 344
      WRITE(6,349)NUMPRI,NUMOLD
  349 FORMAT( //' ******  ATTENTION  *******  IMPROPER PRI PROGRESSION
     1******  CURRENT PRI = ',I6,'  PREVIOUS PRI = ',I6,'  ******'//)
  344 NUMOLD=NUMPRI
  340 CONTINUE
C
      IF(NIFAT.EQ.0)GO TO 610
      IF(IPOLAR.EQ.1)GO TO 609
      IF(ABS(XPPOLD-XPPAGC).LE.1.)GO TO 610
```

```
      WRITE(6,622)NUMPRI,XPPOLD,XPPAGC
  622 FORMAT(/25X'CURRENT PRI = ',I8,'  OLD IFA = ',F5.1,'  CURRENT IFA
     1= ',F5.1)
      XPPOLD=XPPAGC
      GO TO 610
C
  609 CONTINUE
      IF(ABS(XOPOLD-XOPAGC).LE.1.)GO TO 610
      WRITE(6,622)NUMPRI,XOPOLD,XOPAGC
      XOPOLD=XOPAGC
C
  610 IF(IPRF.EQ.IPROLD)GO TO 611
      WRITE(6,624)NUMPRI,IPROLD,IPRF
  624 FORMAT(/25X'CURRENT PRI = ',I8 ,'  OLD PRF = ',I5,'  CURRENT PRF =
     1 ',I5)
      IPROLD=IPRF
  611 CONTINUE
C
      IF(NTESTS.EQ.1)GO TO 623
      IF(NBAND.EQ.0)GO TO 623
      IF(IABS(64-IMOVP).LE.IADIN)GO TO 621
      WRITE(6,6322)NUMPRI,IMOVP
 6322 FORMAT('0',25X,'CURRENT PRI = ',I8,3X,'A/D COUNT = ',I6,3X,
     1'(PRIMARY + OFFSET STARTED SLEWING)')
      NTESTS=1
      IDIR=1
      GO TO 625
  621 CONTINUE
      IF(IABS(64-IMOVO).LE.IADIN)GO TO 623
      IF(ICODE.EQ.1.OR.ICODE.EQ.5)GO TO 623
      WRITE(6,6321)NUMPRI,IMOVO
 6321 FORMAT('0',25X,'CURRENT PRI = ',I8,3X,'A/D COUNT = ',I6,3X,
     1'(OFFSET STARTED SLEWING)')
      NTESTS=1
      IDIR=2
      GO TO 625
  623 CONTINUE
      IF(NTESTS.EQ.0)GO TO 625
      IF(NBAND.EQ.0)GO TO 625
      GO TO (628,821),IDIR
  628 IF(IABS(64-IMOVP).GT.IADIN)GO TO 625
      WRITE(6,6329)NUMPRI,IMOVP
 6329 FORMAT('0',25X,'CURRENT PRI = ',I8,3X,'A/D COUNT = ',I6,3X,
     1'(PRIMARY + OFFSET STOPPED SLEWING)')
      NTESTS=0
      GO TO 625
  821 IF(IABS(64-IMOVO).GT.IADIN)GO TO 625
      IF(ICODE.EQ.1.OR.ICODE.EQ.5)GO TO 625
      WRITE(6,6328)NUMPRI,IMOVO
 6328 FORMAT('0',25X,'CURRENT PRI = ',I8,3X,'A/D COUNT = ',I6,3X,
     1'(OFFSET STOPPED SLEWING)')
      NTESTS=0
  625 CONTINUE
C
      IF(ISSERR.NE.1)GO TO 617
      WRITE(6,612)NUMPRI
  612 FORMAT(' SLOW SWITCH BITS ARE BOTH = 0',5X,'  CURRENT PRI = ',I10,
```

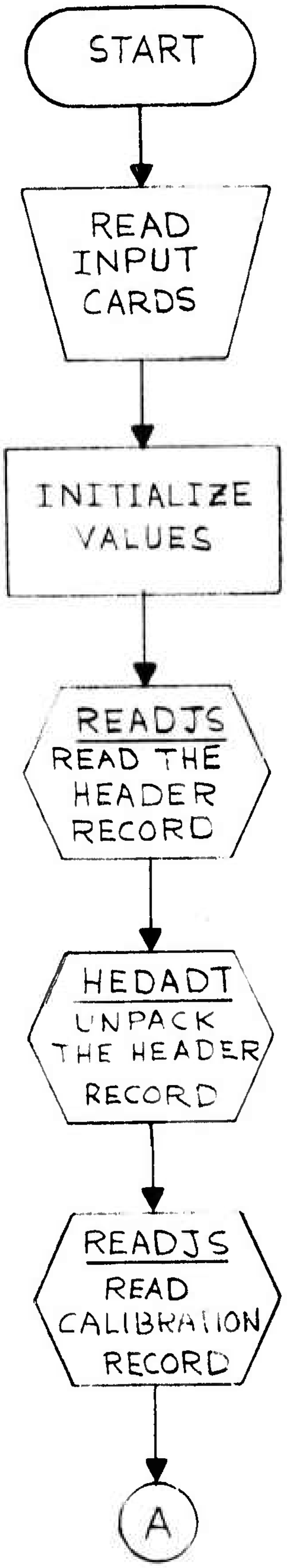
```
     15X,' DATA IS BAD')
      GO TO 8998
C
  617 CONTINUE
      ITOT=(3600*IHRS+60*IMIN+ISEC)*1000+IMSEC
      ITAL=ITOT-ILNCH
      TOTL=DFLOAT(ITOT)/D1000
      TAL=DFLOAT(ITAL)/D1000
C
 8998 CONTINUE
C
      IF(NUMPRT.EQ.NSTOP)GO TO 10
      IFPR=IFPR+1
      IF(IFPR.LT.4)GO TO 10
      IPULS=IPULS+1
      IF(IPULS.LT.NNSET)GO TO 118
      IPULS=0
C
   10 CONTINUE
      RDOT=(IRDOT/(8192.0))*14.989625
      RANGE=(FLOAT(IRANGE)/2048000.)*14.989625+TRBIAS*.14989625
      TTCOR=    (RANGE/299776.)*(RDOT/1000.)
      RANGE=RANGE+TTCOR
      RRCOR=RRUSE*RDOT
      RANGE=RANGE+RRCOR/1000.
      AZ=(IAZ*2*3141.59265358)/(2.0**17)
      XAZ=AZ*.0572958
      XAZ=XAZ+AZBIAS
      EL=(IEL*2*3141.59265358)/(2.0**17)
      XEL=EL*.0572958
      XEL=XEL+ELBIAS
      CALL REFC(XEL,RANGE,ECORF,RCORF)
      RNGF=RANGE-RCORF
      ELVF=XEL-ECORF
      RADEL=ELVF*.017453
      CALT=SQRT(RNGF**2+ER*ER+2.*RNGF*ER*SIN(RADEL))-ER
      RANGE=RNGF
      XEL=ELVF
      XTRR=40.*ALOG10(RANGE)
      XPKPWR=IPKPWR
      IF(IPKPWR.LE.0)GO TO 39
      POWERT=PWRUS1+PWRUS2*ALOG10(XPKPWR)
   39 CONTINUE
      XOFFST=(FLOAT(IOFFST)/2048.)*14.989625
C
      IF(I241B1.GT.127)GO TO 6310
      I241B1=I241B1+128
      GO TO 6311
 6310 CONTINUE
      IF(I241B1.LT.129)GO TO 6311
      I241B1=256-I241B1
 6311 CONTINUE
      IF(I241B2.GT.127)GO TO 6312
      I241B2=I241B2+128
      GO TO 6313
 6312 CONTINUE
      IF(I241B2.LT.129)GO TO 6313
```

```
      I241B2=256-I241B2
 6313 CONTINUE
      IF(I241B3.GT.127)GO TO 6314
      I241B3=I241B3+128
      GO TO 6315
 6314 CONTINUE
      IF(I241B3.LT.129)GO TO 6315
      I241B3=256-I241B3
 6315 CONTINUE
C
      Z1=XFZLN(I241B2)-XFZLN(I241B1)+AGAMA
      COSTA=COS(Z1)
      P=XATBL(I240B2)-XATBL(I240B1)
      DELAZ=AZGRAD*2.*3141.6*(10.**(P/20.))*COSTA
      DELAZ=DELAZ*.0572958
C
      Z2=XFZLN(I241B3)-XFZLN(I241B1)+EGAMA
      COSTE=COS(Z2)
      P=XATBL(I240B3)-XATBL(I240B1)
      DELEL=ELGRAD*2.*3141.6*(10.**(P/20.))*COSTE
      DELEL=DELEL*.0572958
C
      IF(ISSERR.EQ.1) GO TO 533
      WRITE(6,602)
  602 FORMAT(////)
C
      WRITE(6,6009)
 6009 FORMAT(T44,' -------------------------------')
C
      WRITE(6,301)IHRS,IMIN,ISEC,IMSEC,TOTL,TAL,RANGE,NUMPRI,XAZ,XEL,
     1RDOT,CALT,IPRF,DELAZ,DELEL,POWERT,XTRR,XPPAGC,XOPAGC
  301 FORMAT(' TIME(GMT) ='3I3,'.',I3,7X,'TIME(SEC) =',F10.3,7X,'TAL (SE
     1C) =',F11.3,7X,'RANGE (KM) =',F10.3,7X,'PRI =',I6/' AZIM(DEG) =',
     2F13.3,7X,'ELEV(DEG) =',F10.3,7X,'RDOT(M/S) =',F11.3,7X,'HEIGHT(KM)
     3 =',F10.3,7X,'PRF =',I6/' DELA(DEG) =',F13.3,7X,'DELE(DEG) =',F10.
     43,7X,'POWER(DB) =',F11.3,7X,'40LOGR(KM) =',F10.3/' LC IF ATT(DB) =
     5',F9.1,7X,'RC IF ATT =',F10.1)
      ICDU=ICODE+1
      IF(ICODE.GT.7.OR.ICODE.LT. 0)ICDU=7
      WRITE(6,302)XWPL1(ICDU),XWPL2(ICDU),XOFFST,ICODE
  302 FORMAT(' THIS PULSE IS A  ',2A4, 5X,'R.OFFSET(M) =',F8.1,5X,
     1'RCODE =',I4)
  533 CONTINUE
C
      NPREND=NUMPRI
C
   19 CONTINUE
C
      IOUTBG=IPPBEG
      IF(IPOLAR.EQ.1)IOUTBG=IOPBEG
      NSWTCH=0
      INDX1=0
      N=0
      DO 82 J=171,340
      N=N+1
      ILCPHA(N)=IDAT(J)
      ILCOUT(N)=ILCPHA(N)
```

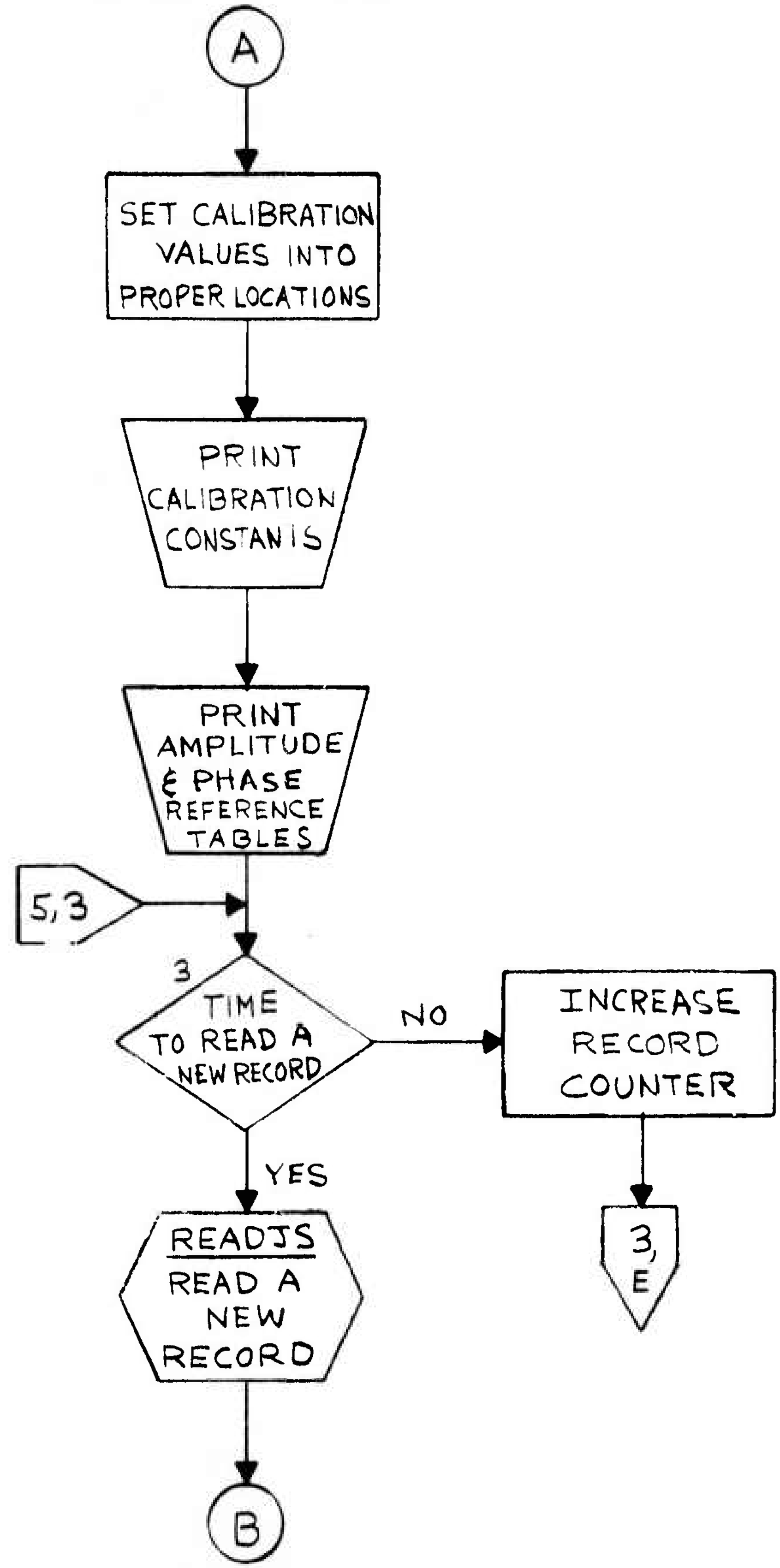
```
   82 IF(ILCPHA(N).GF.128)ILCOUT(N)=-(ILCPHA(N)-128)
      N=0
      DO 83 J=511,680
      N=N+1
      IRCPHA(N)=IDAT(J)
      IRCOUT(N)=IRCPHA(N)
   83 IF(IRCPHA(N).GF.128)IRCOUT(N)=-(IRCPHA(N)-128)
C
      DO 52 K=1,170
      IF(K.LT.ICELP1.OR.K.GT.ICELP2)GO TO 52
      IF(NSWTCH.EQ.1)GO TO 51
      IXA=K
      NSWTCH=1
   51 CONTINUE
      IXZ=K
      IOUT(K)=K
      INDX1=INDX1+1
      IF(K.EQ.ICELP2)GO TO 53
      IF(INDX1.NE.15)GO TO 52
   53 NSWTCH=0
      INDX1=0
      WRITE(6,59)(IOUT(N),N=IXA,IXZ)
   59 FORMAT( /'     RANGE CELL ',4X,15I6)
      WRITE(6,62)(ILCAMP(N),N=IXA,IXZ)
   62 FORMAT (' LCAMP (A/D) = ',4X,15I6)
      WRITE(6,63)(ILCOUT(N),N=IXA,IXZ)
   63 FORMAT (' LCPHA (A/D) = ',4X,15I6)
      WRITE(6,64)(IRCAMP(N),N=IXA,IXZ)
   64 FORMAT (' RCAMP (A/D) = ',4X,15I6)
      WRITE(6,65)(IRCOUT(N),N=IXA,IXZ)
   65 FORMAT (' RCPHA (A/D) = ',4X,15I6)
   52 CONTINUE
  118 IF(NUMPRI.LT.NSTCP)GO TO 3
C
      GO TO 125
  103 WRITE(6,107)NUMPRI
  107 FORMAT('OPARITY ERROR ON READ AFTER PRI = ',I10)
      GO TO 99
  680 WRITE(6,109)NUMPRI
  109 FORMAT(' END OF FILE REACHED LAST NUMPRI VALUE = ',I10)
      GO TO 125
  695 WRITE(6,114)NBAND,ITBAND
  114 FORMAT(' INPUT BAND= 'I10,'    BAND ON TAPE = 'I10)
  125 RETURN
      END
```

APPENDIX D

L02ALC FLOW DIAGRAM

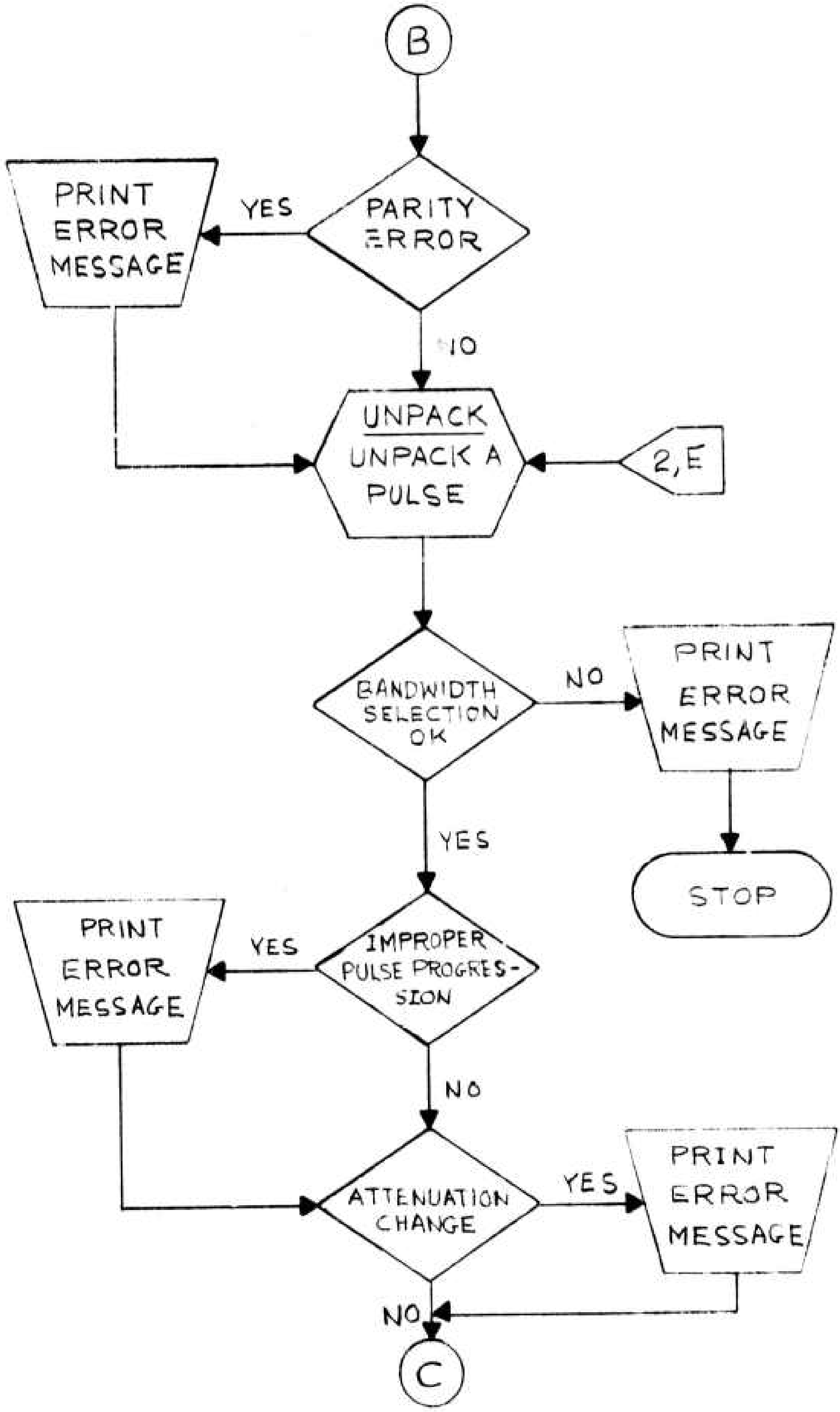


APPENDIX D-2

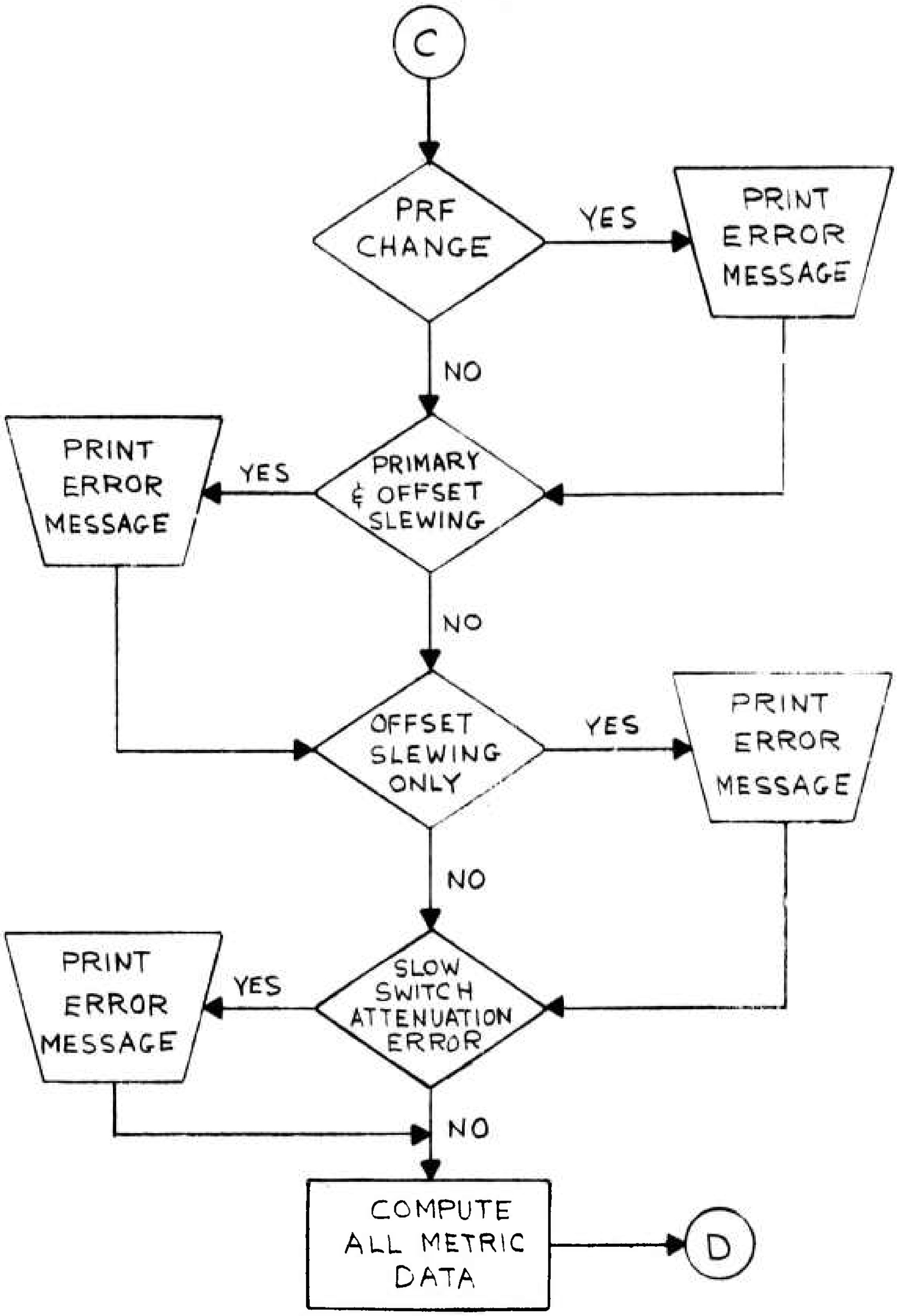


A
SET CALIBRATION VALUES INTO PROPER LOCATIONS
PRINT CALIBRATION CONSTANTS
PRINT AMPLITUDE & PHASE REFERENCE TABLES
5,3
3
TIME TO READ A NEW RECORD
NO
INCREASE RECORD COUNTER
3, E
YES
READJS
READ A NEW RECORD
B

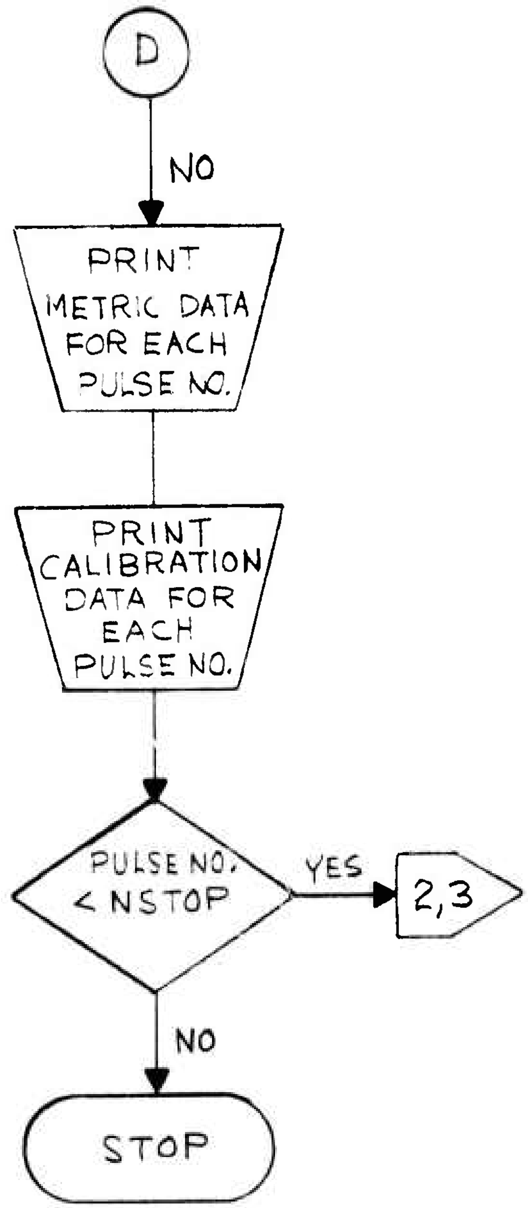
APPENDIX D-3


B
PARITY ERROR
YES
PRINT ERROR MESSAGE
NO
UNPACK
UNPACK A PULSE
2,E
BANDWIDTH SELECTION OK
NO
PRINT ERROR MESSAGE
STOP
YES
IMPROPER PULSE PROGRES-SION
YES
PRINT ERROR MESSAGE
NO
ATTENUATION CHANGE
YES
PRINT ERROR MESSAGE
NO
C

APPENDIX D-4


C
PRF CHANGE
YES
PRINT ERROR MESSAGE
NO
PRINT ERROR MESSAGE
YES
PRIMARY & OFFSET SLEWING
NO
OFFSET SLEWING ONLY
YES
PRINT ERROR MESSAGE
NO
PRINT ERROR MESSAGE
YES
SLOW SWITCH ATTENUATION ERROR
NO
COMPUTE ALL METRIC DATA
D

APPENDIX D-5



D
NO
PRINT METRIC DATA FOR EACH PULSE NO.
PRINT CALIBRATION DATA FOR EACH PULSE NO.
PULSE NO. < NSTOP
YES
2,3
NO
STOP

APPENDIX E

SUBROUTINE HEDADT PROGRAM LISTING

```
*                CALL HEDADT (ISIG,INBUF,IEQU)
*                ISIG = 1     UNPACK THE 20 WORD ADT HEADER
         START
         ENTRY HEDADT
         SPACE
XISIG    EQU   4
XICAL    EQU   5
XIEQU    EQU   6
BASE     EQU   12
         SPACE
HEDADT   SAVE  (14,12),T,*
         BALR  12,0
         USING *,BASE
         ST    13,SAVEA+4
         LA    7,SAVEA
         ST    7,8(0,13)
         LR    13,7
         SPACE
         LM    XISIG,XIEQU,0(1)
         SPACE
         L     8,0(XICAL)
         ST    8,TEMP1
         ST    8,TEMP2
         SRL   8,31
         ST    8,0(XIEQU)      MBAND
         L     8,TEMP1
         SLL   8,1
         SRL   8,25
         ST    8,4(XIEQU)      MREEL
         SPACE
         L     8,4(XICAL)
         ST    8,TEMP1
         ST    8,TEMP2
         SRL   8,16
         ST    8,8(XIEQU)      MWTR
         L     8,TEMP1
         SLL   8,16
         SRL   8,24
         ST    8,12(XIEQU)     MMNTH
         L     8,TEMP2
         SLL   8,24
         SRL   8,24
         ST    8,16(XIEQU)     MDAY
         SPACE
         SR    8,8
         IC    8,8(XICAL)
         ST    8,20(XIEQU)     MYEAR
         MVC   24(9,XIEQU),12(XICAL)     MISSION DESIGNATOR
         SPACE
RETURN   L     13,SAVEA+4
         RETURN (14,12),T
         CNOP  0,4
TEMP1    DC    F'0'
TEMP2    DC    F'0'
SAVEA    DC    18A(*)
         END
```

APPENDIX F

SUBROUTINE UNPACK PROGRAM LISTING

```
         CSECT
         ENTRY UNPACK
UNPACK   SAVEL
         DROP  15
         CNOP  0,4
         BALR  2,0
         USING START,2,3
START    L     3,BASA
         L     4,DUBUF
         L     5,DUBUF
         L     6,DUBUF
         A     5,=F'4096'
         A     6,=F'8192'
         USING DBUF,4,5,6
         B     START1
DUBUF    DC    V(ICOM)
BASA     DC    A(START+4096)
START1   LA    8,INBUF   NUMPRI=8*(NPR-1)+JCON
         MVC   TEMP(3),0(8)
         MVC   TEMP2(3),0(8)
         L     9,TEMP
         SLL   9,8
         SRL   9,16
         S     9,ONE
         SR    8,8
         M     8,EIGHT
         A     9,JCON
         ST    9,NUMPRI
         L     9,NBEG
         C     9,NUMPRI
         BH    CDELTAR
         SPACE
         LA    8,WD273
         A     8,INDEX
         MVC   TEMP(3),0(8)
         L     9,TEMP
         N     9,=X'F0000000'
         SRL   9,28
         ST    9,ICODE               COMPUTE THE CODE FOR PRI
         SPACE
         L     9,TEMP
         N     9,=X'08000000'
         SRL   9,27
         ST    9,I273B5              WBS MODE INDICA .R
         L     9,TEMP
         N     9,=X'04000000'
         SRL   9,26
         ST    9,I273B6              ENDO-EXO SCAN INDICATOR
         L     9,TEMP
         N     9,=X'02000000'
         SRL   9,25
         ST    9,I273B7              WBS SCAN MODE INDICATOR
         L     9,TEMP
         N     9,=X'01000000'
         SRL   9,24
         ST    9,I273B8              DOUBLET MODE INDICATOR
```

```
         L       9,TEMP
         N       9,=X'00100000'
         SRL     9,20
         ST      9,I27P12                 NB/WB INDICATOR
         SPACE
GOODI    LA      8,WD233  COMPUTE GMT
         A       8,INDEX
         MVC     TEMP(3),0(8)
         L       9,TEMP
         N       9,=X'1F000000'
         SRL     9,24
         ST      9,IHRS                   STORE HRS
         L       9,TEMP
         N       9,=X'003F0000'
         SRA     9,16
         ST      9,IMIN                   STORE MINS
         L       9,TEMP
         N       9,=X'00003F00'
         SRA     9,8
         ST      9,ISEC                   STORE SECS
         LA      8,WD234
         A       8,INDEX
         MVC     TEMP(3),0(8)
         L       9,TEMP
         N       9,=X'7FE00000'
         SRL     9,21
         ST      9,IMSEC                  STORE MSEC
         SPACE
         L       10,ONE
         ST      10,IXC
         LA      10,IDAT
         LA      9,WD1
         SR      11,11
LOOPC    A       9,INDEX
         SR      12,12
         LA      8,170
         SPACE
LOOPD    IC      7,0(12,9) STORE ONE POLARIZATION (PP OR OP)
         SLL     7,24
         SRL     7,24
         ST      7,0(11,10)
         BCT     8,INDUP
         LA      11,4(11)
         SPACE
         L       9,IXC     GET NEXT POLARIZATION
         A       9,ONE
         ST      9,IXC
         C       9,TWO
         BE      PPPH
         C       9,THREE
         BE      OPLOG
         C       9,FOUR
         BE      OPPH
         B       OUT
         SPACE
INDUP    LA      12,1(12)
         LA      11,4(11)
```

```
        B      LOOPD
PPPH    LA     9,WD5P
        B      LOOPC
CPLOG   LA     9,WD118
        B      LOOPC
CPPH    LA     9,WD175
        B      LOOPC
        SPACE
CUT     LA     8,WD264                  PRF CALCULATION
        A      8,INDEX
        MVC    TEMP(3),0(8)
        L      9,TEMP
        ST     9,WCRD64
        LA     8,WD273
        A      8,INDEX
        MVC    TEMP(3),0(8)
        L      9,TEMP
        ST     9,WCRD73
        L      9,WCRD64
        N      9,=X'FFFFE000'
        SRL    9,13
NZSTMP  ST     9,STEMP
        L      9,=F'10000000'
        SR     8,8
        D      8,STEMP
        ST     9,STEMP                  TRANSMITTED PRF
        SPACE
        L      9,INBUF
        SRL    9,31
        C      9,ZERO
        BNE    WBAND
        SPACE
        L      9,WCRD73                 IN NARROW BAND
        N      9,=X'01000000'           BIT 8
        SRL    9,24
        C      9,ZERO
        BE     SLVDUB1
        SPACE
XDIV    L      8,FOUR                   IN DOUBLET MODE
XDIV1   ST     8,DIVSR
        B      NEWPRF
        SPACE
SLVDUB1 L      9,WCRD73
        N      9,=X'08000000'           BIT 5
        SRL    9,27
        C      9,ZERO
        BE     NBNWBN
        B      XDIV                     IN SLAVED DOUBLET MODE
NBNWBN  L      9,WCRD73
        N      9,=X'00100000'           BIT 12
        SRL    9,20
        C      9,ZERO
        BE     NCDIVS
        L      8,TWO
        B      XDIV1                    NB/WB E.C.P.
NCDIVS  L      8,ONE
        B      XDIV1                    NB ONLY
```

```
         SPACE
WBAND    L     9,WORD73
         N     9,=X'01000000'          BIT 8
         SRL   9,24
         C     9,ZERO
         BNE   SLVDUB2
         L     8,TWO                   IN DOUBLET MODE
         B     XDIV1
SLVDUB2  L     9,WORD73
         N     9,=X'08000000'          BIT 5
         SRL   9,27
         C     9,ZERO
         BNE   XDIV                    IN SLAVED DOUBLET MODE
         L     8,TWO
         B     XDIV1                   WB ONLY
         SPACE
NEWPRF   SR    8,8
         L     9,STEMP
         D     8,DIVSR
         ST    9,IPRF
         SPACE
NEXTW    LA    8,WD237
         A     8,INDEX
         MVC   TEMP(3),0(8)
         L     9,TEMP
         N     9,=X'7FFFC000'
         SRL   9,14
         ST    9,IAZ                    STORE A2
         LA    8,WD236
         A     8,INDEX
         MVC   TEMP(3),0(8)
         L     9,TEMP
         N     9,=X'7FFFC000'
         SRL   9,14
         ST    9,IEL                    STORE ELEV
GOCON    LA    8,WD265
         A     8,INDEX
         MVC   TEMP(3),0(8)
         L     9,TEMP
         N     9,=X'FFFFE000'
         SRL   9,13
         ST    9,TEMP2
         LA    8,WD267
         A     8,INDEX
         MVC   TEMP(3),0(8)
         L     9,TEMP
         N     9,=X'FFFF0000'
         SRL   9,16
         A     9,TEMP2
         SLL   9,11
         ST    9,TEMP2
         LA    8,WD266
         A     8,INDEX
         MVC   TEMP(3),0(8)
         L     9,TEMP
         N     9,=X'FFE00000'
         SRL   9,21
```

```
         A      9,TEMP2
         ST     9,IRANGE                STORE RANGE
         LA     8,WD115
         A      8,INDEX
         MVC    TEMP(3),0(8)
         L      9,TEMP
         N      9,=X'00FF0000'
         SRA    9,16
         ST     9,IPKPWR                STORE PEAK POWER
         LA     8,WD269
         A      8,INDEX
         MVC    TEMP(3),0(8)
         L      9,TEMP
         C      9,=F'0'
         BNL    DOTG1
         N      9,=X'7FFFFF00'
         SRA    9,8
         LCR    9,9
         B      DOTG2
DOTG1    SRA    9,8
DOTG2    ST     9,IRDOT                 STORE R-DOT
         SPACE
         LA     8,WD117
         A      8,INDEX
         MVC    TEMP(3),0(8)
         L      9,TEMP
         N      9,=X'FF000000'
         SRL    9,24
         ST     9,IMOVP                ARE PRIMARY AND OFFSET MOVING
         SPACE
         L      9,TEMP
         N      9,=X'0000FF00'
         SRL    9,8
         ST     9,IMOVO                IS OFFSET WINDOW MOVING
         SPACE
         SR     9,9
         ST     9,IOFFST
         L      9,ICODE
         C      9,THREE
         BE     OFFCOM
         C      9,SEVEN
         BE     OFFCOM
         B      OFFSKP
         SPACE
OFFCOM   LA     8,WD278
         A      8,INDEX
         MVC    TEMP(3),0(8)
         SR     9,9
         L      9,TEMP
         C      9,ZERO
         BNL    RPLUS
         N      9,=X'7FFFFF00'
         SRA    9,8
         LCR    9,9
         B      RNEG
RPLUS    SRA    9,8
RNEG     ST     9,IOFFST               RANGE OFFSET FOR SLAVED WINDOW
```

```
         SPACE
OFFSKP   LA     8,WD240
         A      8,INDEX
         MVC    TEMP(3),0(8)
         L      9,TEMP
         N      9,=X'7F000000'
         SRL    9,24
         LA     9,1(9)
         ST     9,I240B1
         L      9,TEMP
         N      9,=X'007F0000'
         SRL    9,16
         LA     9,1(9)
         ST     9,I240B2
         L      9,TEMP
         N      9,=X'00007F00'
         SRL    9,8
         LA     9,1(9)
         ST     9,I240B3
         LA     8,WD241
         A      8,INDEX
         MVC    TEMP(3),0(8)
         L      9,TEMP
         N      9,=X'FF000000'
         SRL    9,24
         LA     9,1(9)
         ST     9,I241B1
         L      9,TEMP
         N      9,=X'00FF0000'
         SRL    9,16
         LA     9,1(9)
         ST     9,I241B2
         L      9,TEMP
         N      9,=X'0000FF00'
         SRL    9,8
         LA     9,1(9)
         ST     9,I241B3
         LA     8,WD263
         A      8,INDEX
         MVC    TEMP(3),0(8)
         L      9,TEMP
         N      9,=X'F0000000'
         SRL    9,26
         LA     11,PIFA
         LE     0,0(9,11)                     GET VALUE FROM PIFA TABLE
         STE    0,XPPAGC
         L      9,TEMP
         N      9,=X'0F000000'
         SRL    9,22
         LA     11,OIFA
         LE     0,0(9,11)                     GET VALUE FROM OIFA TABLE
         STE    0,XOPAGC
         L      9,ZERO
         ST     9,ISWSSP
         ST     9,ISWSSC
         ST     9,ISSERR
         LA     8,WD239
```

```
         A       8,INDEX
         MVC     TEMP(3),0(8)
         L       9,TEMP
         N       9,=X'00000200'          CHECK BIT 23 (PFSA)
         C       9,ZERO
         BE      CKFSOP
         LE      0,PFSA
         AE      0,XPPAGC
         STE     0,XPPAGC                ADD IN PFSA VALUE
CKFSOP   L       9,TEMP
         N       9,=X'00000100'          CHECK BIT 24 (OFSA)
         C       9,ZERO
         BE      CKSSPP
         LE      0,OFSA
         AE      0,XOPAGC
         STE     0,XOPAGC                ADD IN OFSA VALUE
CKSSPP   L       11,TEMP
         N       11,=X'00802000'
         C       11,=F'0'
         BNE     CKSSOP
INDET    L       8,ONE                   INDETERMINATE SITUATION
         ST      8,ISSERR
         B       CDELTAR
CKSSOP   L       11,TEMP
         N       11,=X'00401000'
         C       11,=F'0'
         BE      INDET
PPTEST   LA      9,WD239
         A       9,INDEX
         MVC     TEMP(3),0(9)
         L       10,TEMP                 AUX.MICR.WORD INTO REG.10
         LA      9,WD252                 AUX.MICROWAVE WORD INTO REG.1.
         A       9,INDEX
         MVC     TEMP(3),0(9)
         L       11,TEMP
         LA      9,WD272
         A       9,INDEX
         MVC     TEMP(3),0(9)            RANGE TR.WORD INTO TEMP
         N       10,=X'00802000'
         C       10,=X'00800000'
         BNE     S74
         LE      0,PSSL                  ADD IN PSSL (COND.B)
         AE      0,XPPAGC
         STE     0,XPPAGC
         L       9,ONE
         ST      9,ISWSSP
S74      L       8,NEWA                  OLD OR NEW ATTEN.
         C       8,ZERO
         BE      OPTEST
         L       9,TEMP
         N       9,=X'00080000'
         C       9,=F'0'
         BE      RDBKLC                  ATTENUATOR READBACK
         N       11,=X'08000000'         S74 ARMED
         C       11,ZERO                 STATUS READ BACK
         BNE     SLC
NOATTLC  LE      0,PREVLC
```

```
         STE    0,XPPAGC
         MVC    JSWLC(4),ONE
         MVC    ISSERR(4),ONE
         B      OPTEST
RDBKLC   N      11,=X'04000000'          S74 NOT ARMED
         C      11,ZERO                   STATUS READBACK
         BE     NOATTLC
         B      OPTEST
SLC      LE     0,PSSA
         AE     0,XPPAGC                     IN PSSA (COND.8)
STORLC   STE    0,XPPAGC
         MVC    ISWSSP(4),ONE
OPTEST   LA     9,WD239
         A      9,INDEX
         MVC    TEMP(3),0(9)
         L      10,TEMP                  AUX.MICR.WORD INTO REG.10
         LA     9,WD252                  AUX.MICROWAVE WORD INTO REG.11
         A      9,INDEX
         MVC    TEMP(3),0(9)
         L      11,TEMP
         LA     9,WD272
         A      9,INDEX
         MVC    TEMP(3),0(9)             RANGE TR.WORD INTO TEMP
         N      10,=X'00401000'
         C      10,=X'00400000'
         BNE    S75
     LE         0,OSSL                   ADD IN OSSL (COND.8)
         AE     0,XOPAGC
         STE    0,XOPAGC
         L      9,ONE
         ST     9,ISWSSC
S75      L      8,NEWA                   OLD OR NEW ATTEN.
         C      8,ZERO
         BE     OUT1
         L      9,TEMP
         N      9,=X'00040000'
         C      9,=F'0'
         BE     RDBKRC                   ATTENUATOR READBACK
         N      11,=X'02000000'          S75 ARMED
         C      11,ZERO                  STATUS READ BACK
         BNE    SRC
NOATTRC  LE     0,PREVRC
         STE    0,XOPAGC
         MVC    JSWRC(4),ONE
         MVC    ISSERR(4),ONE
         B      OUT1
RDBKRC   N      11,=X'01000000'          S75 NOT ARMED
         C      11,ZERO                   STATUS READBACK
         BE     NOATTRC
         B      OUT1
SRC      LE     0,OSSA
         AE     0,XOPAGC                 ADD IN OSSA (COND.8)
STORCC   STE    0,XOPAGC
         MVC    ISWSSP(4),ONE
OUT1     L      9,JSWLC
         C      9,ZERO
         BNE    OUT2
```

```
         LE     0,XPPAGC
         SE     0,=E'16'
         STE    0,XPPAGC
         STE    0,PREVLC
CUT2     L      9,JSWRC
         C      9,ZERO
         BNE    ENDALERT
         LE     0,XOPAGC
         SE     0,=E'16'
         STE    0,XOPAGC
         STE    0,PREVRC
ENDALERT MVC    JSWLC(4),ZERO
         MVC    JSWRC(4),ZERO
         L      9,ITBAND                    COMPUTE RANGE BIASES
         C      9,ZERO
         BE     NBAND
         LE     2,RBIAS+16                  WIDE BAND TAPE
         STE    2,TRBIAS
         L      9,IPOLAR
         C      9,ZERO
         BE     LCPOLAR
         LE     2,RBIAS+20                  OP POLARIZATION
         AE     2,TRBIAS                    ADD WB OP BIAS
         STE    2,TRBIAS
         L      9,ISWSSC                    ISWSSC WAS SET IN AGC COMP.
         C      9,ONE                       =1,ADD 32 DB (OP)
         BNE    CDELTAR
         LE     2,RBIAS+28                  ADD IN OPSSA- RBIAS(8)
         AE     2,TRBIAS
         STE    2,TRBIAS
         B      CDELTAR
LCPOLAR  L      9,ISWSSP
         C      9,ONE
         BNE    CDELTAR
         LE     2,RBIAS+24
         AE     2,TRBIAS                    ADD IN PSSA-RBIAS(7)
         STE    2,TRBIAS
         B      CDELTAR
NBAND    LE     2,RBIAS                     NARROW BAND
         STE    2,TRBIAS
         LA     8,WD273                     CENTER OR EDGE TRACK
         A      8,INDEX
         MVC    TEMP(3),0(8)
         L      9,TEMP
         N      9,=X'00010000'
         C      9,ZERO
         BNE    CKNBEDGE                    EDGE TRACKING
         B      CKPOLAR                     CENTER TRACK
CKNBEDGE L      8,IRDOT                     CHECK SIGN OF R DOT
         C      8,ZERO
         BH     CKNBLOW
         LE     2,RBIAS+4                   LEADING EDGE BIAS
         AE     2,TRBIAS
         STE    2,TRBIAS
         B      CKPOLAR
CKNBLOW  LE     2,RBIAS+8                   TRAILING EDGE BIAS
         AE     2,TRBIAS
```

```
         STE     2,TRBIAS
CKPOLAR  L       9,IPOLAR                           CHECK POLARIZATION CESIREC
         C       9,ZERC
         BE      CDELTAR
         LE      2,RBIAS+12                         ACC NB OP BIAS
         AE      2,TRBIAS
         STE     2,TRBIAS
CDELTAR  RETL
TEMP     DC      F'0'
TEMP2    DC      F'D'
IXC      DC      F'0'
NPTAPE   DC      F'0'
PRINUM   DC      F'0'
IPASS    DC      F'0'
ISWSSO   DC      F'0'
ISWSSP   DC      F'0'
DIVSR    DC      F'0'
WORD64   DC      F'0'
WORD73   DC      F'0'
STEMP    DC      F'0'
PREVLC   DC      E'0.0'
PREVRC   DC      E'0.0'
JSWLC    DC      F'0'
JSWRC    DC      F'0'
ZERO     DC      F'0'
ONE      DC      F'1'
TWC      DC      F'2'
THREE    DC      F'3'
FOUR     DC      F'4'
SEVEN    DC      F'7'
EIGHT    DC      F'8'
C10      DC      F'10'
C100     DC      F'100'
C1000    DC      F'1000'
DBUF     DSECT
INBUF    DS      CL3
WD1      DS      CL3        PP LOG D.
         DS      CL48
WD18     DS      CL3
WD19     DS      CL3
         DS      CL27
WD29     DS      CL3
WD30     DS      CL3
         DS      CL81
WD58     DS      CL171      PP PHASE D.
WD115    DS      CL3
WD116    DS      CL3
WD117    DS      CL3
WD118    DS      CL171      CP LOG D.
WD175    DS      CL171      CP PHASE D.
WD232    DS      CL3
WD233    DS      CL3
WD234    DS      CL3
         DS      CL3
WD236    DS      CL3
WD237    DS      CL3
         DS      CL3
```

```
WD239    DS    CL3
WD240    DS    CL3
WD241    DS    CL3
WD242    DS    CL3
         DS    CL27
WD252    DS    CL3
WD253    DS    CL3
         DS    CL27
WD263    DS    CL3
WD264    DS    CL3
WD265    DS    CL3
WD266    DS    CL3
WD267    DS    CL3
WD268    DS    CL3
WD269    DS    CL3
WD270    DS    CL3
WD271    DS    CL3
WD272    DS    CL3
WD273    DS    CL3
WD274    DS    CL3
WD275    DS    CL3
WD276    DS    CL3
WD277    DS    CL3
WD278    DS    CL3
WD279    DS    CL3
WD280    DS    CL3
         DS    CL6369
IAZ      DS    1F
IEL      DS    1F
INDEX    DS    1F
IPPRCS   DS    1F
IORS     DS    1F
IRANGE   DS    1F
IPKPWR   DS    1F
IRDOT    DS    1F
IALT     DS    1F
INDAZ    DS    1F
JNDAZ    DS    1F
INDEL    DS    1F
IRB54    DS    1F
IRB85    DS    1F
IOPRCS   DS    1F
I240B1   DS    1F
I240B2   DS    1F
I240B3   DS    1F
I241B1   DS    1F
I241B2   DS    1F
I241B3   DS    1F
XPPAGC   DS    1F
IBETA    DS    1F
NEWA     DS    1F
BAND     DS    1F
NSW      DS    1F
RBIAS    DS    8F
ISVPRI   DS    1F
IHRS     DS    1F
IMIN     DS    1F
```

```
ISEC      DS     1F
IMSEC     DS     1F
STAT      DS     21F
TRBIAS    DS     1F
ISTAT1    DS     1F
ISTAT2    DS     1F
ISTAT3    DS     1F
ISTAT4    DS     1F
IALSW     DS     1F
ISTSW     DS     1F
NBWB      DS     1F
ISIGNO    DS     1F
I27B12    DS     1F
JCCN      DS     1F
NBEG      DS     1F
NEND      DS     1F
ITST      DS     1F
NUMPRI    DS     1F
XOPACC    DS     1F
ITBAND    DS     1F
ITAPNO    DS     1F
IPRF      DS     1F
IPOLAR    DS     F
ISSERR    DS     F
PIFA      DS     16F
CIFA      DS     16F
PFSA      DS     1F
CFSA      DS     1F
PSSA      DS     1F
CSSA      DS     1F
PSSL      DS     1F
CSSL      DS     1F
ICODE     DS     F
I273B5    DS     F
I273B6    DS     F
I273B7    DS     F
I273B8    DS     F
IMCVP     DS     F
IMCVO     DS     F
IOFFST    DS     F
IDAT      DS     682F
          END
```

APPENDIX G
SUBROUTINE REFC PROGRAM LISTING

VERSION: 6/16/70

```
      SUBROUTINE REFC(E,R,DEE,DRR)
      DIMENSION DE(16,8),DR(16,8),EO(16),RO(8)
      DATA DE/0.0   ,0.0   ,0.0   ,0.0   ,0.C   ,C.0   ,0.0   ,0.0   ,
     10.0   ,0.0   ,0.0   ,0.0   ,0.0   ,0.0   ,0.0   ,0.0   ,0.0313,
     20.0303,0.0292,0.0287,0.0282,0.0272,0.0262,0.0253,0.C243,0.C223,
     30.0214,0.0195,0.0171,0.0135,0.0075,0.0   ,0.0937,0.0848,0.0770,
     40.0732,0.0694,0.0627,C.0571,0.0522,C.0480,0.0412,0.0385,0.0337,
     50.0278,0.0205,0.0105,0.0   ,0.1850,0.1520,0.1250,0.1140,0.1050,
     60.0904,0.0795,0.0708,0.0636,0.0523,0.0478,0.0405,0.0323,0.0229,
     70.0114,0.0   ,0.5310,0.3070,0.2120,0.1830,0.1600,0.128C,0.1060,
     80.0899,0.0780,0.0612,0.0550,0.0455,0.0354,0.0246,0.0120,0.0   ,
     90.7550,0.3720,0.2400,0.2020,0.1750,0.1370,0.1120,0.0942,0.0811,
     A0.0631,0.0566,0.0466,0.0361,0.0250,0.0122,0.0   ,0.9120,0.4110,
     B0.2560,0.214C,0.1840,0.1420,0.1150,0.0967,0.0830,0.C643,0.0575,
     C0.0472,0.0365,0.0252,0.0122,0.0   ,0.9700,0.4200,0.260C,0.2200,
     D0.1900,0.1460,0.1170,0.0980,0.0840,0.0653,0.0584,0.0478,0.C369,
     E0.0254,0.0123,0.0 /
      DATA DR/  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,
     1  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0, 22.6, 21.5, 20.4, 19.9,
     2 19.4, 18.5, 17.6, 16.8, 16.1, 14.8, 14.2, 13.2, 12.0, 1C.4,  8.6,
     3  7.7, 67.3, 57.9, 50.2, 47.0, 44.1, 39.3, 35.4, 32.1, 29.3, 24.8,
     4 22.9, 19.7, 16.3, 12.7,  9.4,  8.1,132.0, 98.5, 77.4, 69.7, 63.2,
     5 52.9, 44.7, 39.0, 33.4, 26.4, 23.9, 20.1, 16.4, 12.7,  9.4,  8.1,
     6340.0,167.0,103.0, 86.1, 73.4, 56.7, 46.2, 38.9, 33.6, 26.4, 24.0,
     7 20.2, 16.4, 12.8,  9.5,  8.2,405.0,17C.0,104.0, 86.3, 73.6, 56.8,
     8 46.3, 38.9, 32.7, 26.5, 24.1, 20.3, 16.5, 12.8,  9.5,  8.2,421.0,
     9171.0,104.C, 86.6, 73.9, 57.1, 46.4, 39.0, 33.8, 26.8, 24.3, 20.5,
     A 16.6, 13.C,  9.8,  8.4,446.0,172.0,105.0, 87.4, 74.0, 58.0, 46.6,
     B 39.2, 34.0, 27.0, 24.6, 20.7, 16.7, 13.0, 1C.0,  8.4/
      DATA EO,RTDEG/0.C1,2.0,4.0,5.0,6.0,8.0,10.0,12.0,14.0,18.,20.,
     124.,3C.,40.,60.,90.,57.29578/
      DATA RO/0.01,10.,30.,60.,200.,400.,100C.,2000./
      IF(R.LE.0.0)GO TC 300
      RG=R/1.852D+C0
      DO 100 IEO=2,15
      I=17-IEO
      IF(E.GE.EO(I))GO TO 120
  100 CONTINUE
      I=1
  120 DO 200 JRO=2,8
      J=10-JRO
      IF(RG.GE.RO(J))GO TC 220
  200 CONTINUE
      J=1
  220 IF(J.EQ.8)GO TO 340
      ZR=ALOG(RG/RO(J))/ALOG(RO(J+1)/RO(J))
      IF(E.LE.0.0)GO TC 320
      ZE=ALOG(E/EO(I))/ALOG(EO(I+1)/EO(I))
      DE1=((DE(I+1,J)-DE(I,J))*(1.-ZR)+(DE(I,J+1)-DE(I,J))*ZR)*ZE
      DE2=((DE(I,J+1)-DE(I,J))*(1.-ZE)+(DE(I+1,J+1)-DE(I,J+1))*ZE)*ZR
      DEE=DE1+DE2+DE(I,J)
      DR1=((DR(I+1,J)-DR(I,J))*(1.-ZR)+(DR(I,J+1)-DR(I,J))*ZR)*ZE
      DR2=((DR(I,J+1)-DR(I,J))*(1.-ZE)+(DR(I+1,J+1)-DR(I,J+1))*ZE)*ZR
      DRR=(DR1+DR2+DR(I,J))
      GO TO 400
  300 DEE=0.0
      DRR=0.0
      GO TO 400
  320 DEE=DE(I,J)+(DE(I,J+1)-DE(I,J))*ZR
      DRR=DR(I,J)+(DR(I,J+1)-DR(I,J))*ZR
      GO TO 400
  340 DELT=(E-EO(I))/(EO(I+1)-EO(I))
      DEE=DELT*(DE(I+1,J)-DE(I,J))+DE(I,J)
      DRR=DELT*(DR(I+1,J)-DR(I,J))+DR(I,J)
  400 DRR=DRR*.30480-03
      RETURN
      END
```