NASA CONTRACTOR REPORT

NASA CR-114739

SIMULATION STUDY OF COMMUNICATION LINK FOR PIONEER SATURN/URANUS ATMOSPHERIC ENTRY PROBE

by Carl A. Hinrichs

Prepared by

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for Ames Research Center

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION • WASHINGTON, D. C. • MARCH 1974

NASA CR-114739

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SIMULATION STUDY OF COMMUNICATION LINK FOR PIONEER SATURN/URANUS ATMOSPHERIC ENTRY PROBE

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FOREWORD

This digital simulation study, Contract NAS2-7395, was performed under the auspices of the NASA Ames Research Center. It has determined the performance characteristics of an outer planet's atmospheric probe communications link including the transmitter modulator, the RF channel, and the receiver/bit synchronizer. The study emphasized the acquisition properties and bit error performance of the system under conditions of signal attenuation, Doppler, Doppler rate, and turbulence effects which were modeled during a previous study for a Saturn/Uranus atmospheric probe system definition, Contract NAS2-7328. The simulated flight equipment design was formulated by the TRW Systems Group under subcontract to McDonnell Douglas Astronautics - East.

The author expresses his appreciation for the assistance provided by Dr. Marvin Stone and Mr. Marshall Huang of TRW Systems Group, Redondo Beach, who provided input data and consultation services during the course of this study.

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SUMMARY

A digital simulation is presented for a candidate modulator-demodulator (modem) in a modeled atmospheric scintillation environment with Doppler, Doppler rate, and signal attenuation typical of the radio link conditions for an outer planets atmospheric entry probe. The results indicate that the signal acquisition characteristics and the channel error rate are acceptable for the system requirements of the radio link. The simulation also outputs data for calculating other error statistics and a quantized symbol stream from which error correction decoding can be analyzed. The results from these data have not yet been evaluated.

The receiver and bit synchronizer are modeled in the simulation at the level of hardware component parameters rather than at the level of loop equation parameters, and the report defines the resultant hardware parameters. Likewise, the scintillation is modeled as a low-pass Gaussian process with the parameters defined in the report.

The receiver performance is plotted for nominal hardware parameters and a range of signal-to-noise ratios both with and without scintillation. The performance is also shown for critical receiver parameter variations.

INTRODUCTION

The objective of this simulation is to determine the performance and to refine design parameters for a receiver which serves as one terminal in an outer planet relay link. The transmitting terminal is a probe entering the planetary atmosphere, and the receiving terminal is in a spacecraft in hyperbolic trajectory about the planet. As with most planetary space systems, the link is power starved, inferring minimal data rates and the use of error correction coding. The link is unique in two respects: First, because of the low data rate, the initial frequency uncertainty due to Doppler and oscillator uncertainty is about 400 times the data bandwidth. Second, atmosphere turbulence may cause significant scintillation on the received signal.

The initial system design (Ref. 1), Saturn/Uranus Atmospheric Entry Probe, conceived a noncoherent link to combat the scintillation at a data rate of 44 bits per second, which was rate 1/2 coded to 88 symbols per second. Preliminary specifications for the transmit and receive terminals were prepared in conjunction with this study (Refs. 2 and 3). In response to these requirements, a preliminary hardware design was defined in Reference 4. Due to the nonanalytic nature of the effect of scintillation on the receiver performance, a simulation was deemed necessary to verify the suitability of the design. A simulation program was written to allow a quantized data stream to be generated on magnetic tape for subsequent decoding and analysis, as well as to investigate receiver acquisition and channel error rate performance, but only the latter two programs are described here.

CONFIGURATION

The configuration details described below are the results of the TRW Systems Group design from Reference 4, and as amended in subsequent meetings. The configuration consists of three pieces of equipment: the modulator, the receiver, and the bit synchronizer.

The modulator, shown in Figure 1, is a continuous phase frequency-shift-keyed modulator. This represents a change from the modulator of the initial study which was a discontinuous phase frequency-shift-keyed modulator, as preliminary studies indicated a severe degradation in performance of a discontinuous phase modulator when operating in conjunction with the candidate receiver. The data symbols drive a 20 MHz VCXO which is upconverted by mixing with a fixed local oscillator to the output frequency. The oscillator will typically switch in 20 microseconds; hence, at an 88 symbol per second rate, the modulation may be considered as true continuous phase frequency shift keying.

Two other continuous phase modulators were also considered, but discarded because of hardware complexity: a three step up-converter and an indirect FM modulator. The modulator candidates are discussed in Appendix X.

The receiver is shown in Figure 2. The receiver signal is first converted to an intermediate frequency and the narrow band filtered and output to two loops: an automatic gain control (AGC) loop, and an automatic frequency control (AFC) loop. The input to the AGC loop drives the coherent amplitude detector via an amplifier which is a soft limiter, i.e., it only limits when the signal is very large (typically 13 dB above nominal). This is to protect the coherent amplitude detector during acquisition, when the gain is wide open, at high signal levels. The AGC loop is completed by low-pass filtering and signal conditioning to the variable gain IF amplifiers.

In the AFC loop, the amplifier before the phase detector originally was a hard limiter, i.e., its output was always $\pm A$. However, early in this study it was felt that the AGC should adequately maintain the signal level and a soft limiter should be used in its place, performing a function similar to that of the coherent amplitude detector amplifier. The AFC loop which tracks the incoming frequency is completed by the loop filter and voltage controlled

oscillator.

If the AGC signal is below threshold, a sweep is activated to acquire the signal. The input to the sweep from the AFC loop is a polarity sense; that is, it reverses the sign of the sweep voltage if the sensed sweep voltage exceeds the design level. The design used in the simulation is different from what is now proposed in the actual hardware. As used, if the voltage to the detector drops below threshold, sweep is immediately initiated. Because of the nature of the scintillation, it was decided during the study to incorporate a resweep initiation delay into the hardware. Thus, if the scintillation caused only a short drop out, the receiver would not start a long (in terms of symbols) search operation. The minimum value for the delay is determined by the fading time constants. Since the amplitude scintillation has a low-pass characteristic with a 3 dB cutoff at 2 Hz (or 4π radians/second), the delay should be greater than 80 msec. The maximum value of the delay is constrained by the Doppler rate and the actual loop parameters, e.g., the amount of drift the VCO will undergo during the signal absence condition. The Doppler rate is 13.3 Hz/sec. Assuming a nominal VCO scale factor of 4 KHz/V, phase detector offsets of 1.2 mv, and a loop filter time constant τ_1 of 0.45, the phase detector offset voltage will charge up the loop filter capacitor at the rate of $\Delta V/\tau_1 \simeq 2.7$ mv/sec. This means the VCO will then drift at approximately 10.7 Hz/sec so the total loop drift, including Doppler rates, is of the order of 24 Hz/sec. Since the receiver has a lock-in range of 38 Hz ($\Delta f_L \simeq 2\zeta f_n$), the delay should be less than 1.6 sec. Given these two extrema, a time constant of 0.5 sec is recommended to delay the start of sweep after the lock indicator indicates loss of lock. This value could be varied if tests indicate a better value.

Mixer offsets were not simulated since the mixer output drift was only $\pm$0.15% over the anticipated voltage range.

A square foot function was considered proper and implementable for the AGC signal conditioner, since the proposed device was linear over a 50 dB range, and the receiver requirements only covered 20 dB, i.e., nonlinearities in the implementation device need not be simulated.

Figure 3 shows the bit synchronizer. This is a conventional early-late gate synchronizer with the addition of a baseline correction circuit to "correct" the effective drift of large numbers of identical bits. As in the case of the receiver proper, drift of the multipliers was determined to have only a 4% timing error, and was judged to be small enough to be idealized as zero for the simulation. A 1-Hz loop noise bandwidth was chosen to maximize the signal-to-noise ratio in the loop while maintaining reasonable acquisition times.

SOFTWARE

In order to simulate the hardware as closely as possible, the approach taken is to simulate the lowest feasible component. For example, each multiplier and filter in a loop are individually simulated, rather than an expression describing the operation of the loop.

A powerful simulation tool is the concept of complex amplitude notation. In this concept, used in the simulation, and described more fully in Appendix I, the "carrier" is normalized out of the simulation. Generically the signal is of the form

$$x(t) = A \cos (w_0 t + \theta),$$

wherein A is the amplitude, w_0 the carrier and θ the phase. By suitable normalization, the signal is thus represented in complex notation as

$$\tilde{x}(t) = A \exp (j\theta).$$

As an example, a frequency-shift-keyed signal (used herein) has two tones,

$$\tilde{x}_1(t) = A \exp (j\pi\Delta f t)$$

and

$$\tilde{x}_2(t) = A \exp (-j\pi\Delta f t)$$

where Δf is the frequency separation between tones.
Amplitude and phase noise are simply introduced as

$$x(t) = A(1 + N_A) \exp [j (\theta + N_p)].$$

One of the principal reasons for this simulation was the determination of the effects, on the modem, of atmospheric scintillation. Atmospheric scintillation arises from localized variations in the refractive index of the atmosphere, chiefly occurring due to temperature variations. Given that a "blob" of atmosphere occurs, it successively breaks into smaller and smaller "blobs" until its energy is dissipated. With numerous blobs across the propagation path, the electromagnetic ray is diffracted in a random fashion, resulting in variations in the signal amplitude and phase. This simulation has modeled amplitude and phase scintillation as

$$A(t) = A_0(1 + x(t))$$

and

$$\theta(t) = \theta_0 + \theta_1 t + \theta_2 t^2 + s(t),$$

i.e., a linear variation of the amplitude with its scintillation, x(t), and the phase with its scintillation, s(t). The $\theta_1 t$ and $\theta_2 t^2$ terms represent Doppler and Doppler rate, respectively. The x(t) and s(t) terms are taken as low-pass zero-mean Gaussian processes with root variances of 0.23 and 0.47, respectively. The filter corner frequencies are 2. and 0.2 Hz, respectively and both roll off in proportion to frequency to the -4/3 power.

The 4/3 f rolloff presents significant modeling effort, and is detailed in Appendix II. It was seen that the "more efficient" Z transform approach yielded little or no benefit for a 4/3 order filter, in marked contrast to its effect on integer order filters. Thus, tapped delay lines were employed in the computer routine. To decrease computer time, the simulation linearly interpolates the scintillation between "tap times".

Figure 4 is a block diagram of the simulation receiver. This is "identical" to the hardware block diagram with two exceptions: first, the simulation receiver starts with the input to the first mixer, the radio frequency amplifier being only a constant; and second, the soft limiters before the coherent amplitude detector and phase detector are not modeled as they only serve in the hardware to protect the following devices from excessive power. It may be argued that the soft limiters would have an effect during high signal-to-noise acquisitions. However, this region of operation was judged to be inappropriate in this study. It should also be noted that the AGC signal processor, a square root device, is treated specially. In the routine, because the square root function is one of the more time consuming functions, the square root is linearly interpolated between logarithmic values yielding a maximal 1.46% error. For similar reasons the trignometric functions are rounded to one degree and tabulated. Note also in Figure 4 that a soft output is added to aid in coding analyses. A rationale for setting the quanta levels is found in Appendix III.

An abbreviated flow chart for the error rate routine is presented in Figure 5. After the initial conditions are established (data, dimension and complex statements) the conditions for this problem are read in. Typically these are variations in signal strength, bandwidths, etc. Next the loop conditions are calculated (time constants, etc) and the turbulence delay lines

initialized. The routine then generates samples (typically 40) for each bit and the loops (AGC, AFC, and bit synchronizer) exercised. The receiver starts below threshold, i.e., the AGC/AFC must acquire and the number of bits to initial lock is determined. The error counter begins when the receiver and bit synchronizer have locked, typically after the reciprocal of the natural frequency of the bit synchronizer loop or approximately 100 bits. This eliminates the error rate "contamination" by both receiver and bit synchronizer lockup effects. Additionally, three other statistics are tabulated: the bit spacing between errors; the conditional probabilities of each quanta level, given the "preceding" level of the soft decision; and the number of times the AGC signal drops below threshold and the number of bits in that dropout. The printout gives the average number of bits per dropout. The routine then continues until the specified number of bits has been processed. A complete list of symbols is found in Appendix IV, and a complete listing in Appendix V. The language is standard Fortran IV. No special computer library subroutines are required.

A typical error rate printout is found in Figure 6. Block 1 has the inputs (signal level, bandwidths, etc.). Block 2 contains intermediate information such as VCO gains and time constants. Block 3 has the mean error rate data: line 1 for the (baseline) filter and sample, and line 2 for an integrate and dump output. For this run of 9.4 dB E/No, the mean error was 0.0247 with a standard deviation of 0.0035. The mean absolute sample level was 0.456 with a standard deviation of 0.205. Reading in block 4, lockup occurred in one bit, but there was one AGC dropout four bits long. Block 5 is the error spacing matrix, where for this run 8 bits were in error 1 bit spacing apart, 3 bits 2 spacing, 1 bit 3 spacing . . . 1 bit 96 spacing and 4 bits with 100 or greater spacings. In this run a moderate amount of "burstiness" occurred, i.e., errors not randomly spaced. Block 6 is the data for four conditional probability matricies, which are read by the figure in the block. The columns of the matrix signify the quantized level of the "B" symbol (current symbol) and the rows signify the level of the "A" symbol (preceding symbol). The most negative levels occur in the first column and the first row, or the upper left position. For example, given the input was -1, -1, which occurred 453 times, an error occurred 22 times. For this

matrix the -1, -1 quadrant contains all the "corrects", the +1, -1 and -1, +1 quadrants single errors and the +1, +1 quadrant double errors. Reading in the -1, +1 quadrant when B (current bit) was position 5 (in error) the last bit, A, was four times in 1, two times in 2, two times in 3 and two times in 4. Finally block 7 has the end points of the random number generators plus a monitor recommending the best sampling time (phase of the bit synchronizer in sample counts).

As the complete receiver simulation is somewhat lengthy, plus having special steering and routines for error measurement, a special routine was adapted for acquisition studies with its own steering requirements. An abbreviated flow chart is shown in Figure 7, with details in Appendix VI. The initial setup, problem reading and conversions are identical to those of the error rate routine. In this case, however, Doppler is injected, and once the receiver acquires, another "case" is run to determine the probabilities of acquisition under various conditions. It should be noted on the simulation block diagram that the Doppler is injected as a loop stress, rather than a phase time product at the input. Comparing the loop responses in the two cases reveals identical baseband performance even though the double frequency terms which are filtered out are slightly different. Returning to the flow chart, after each acquisition trial, intermediate results are printed. For each trial the receiver is reinitialized and samples are generated. If the sweep goes past the input Doppler, a miss is registered. If the AGC signal goes above threshold an acquisition may have occurred. A check of whether the sweep got to the Doppler determines whether the condition was a true or a false acquisition.

A typical acquisition printout is shown in Figure 8. Blocks 1 and 2 are as stated before. Block 3 shows the conditions at the end of each trial. In the first 12 sweeps the receiver acquired. In the 13th sweep it missed acquisition. From the 14th to the 20th trials it acquired, but missed again on the 21st trial. In no case was a false acquisition found. The fifth column contains the bit count at the end of that run, the following three columns give the sweep voltage, its value after the AFC loop filter, and the value input to the bit synchronizer.

During the "fabrication" of the acquisition software, it was found that serious aliasing could occur if the sample rate were insufficient. Referring to the input mixer in Figure 4, it is seen that as far as the computer is concerned it is merely multiplying two strings of complex numbers. If they appear to correlate after filtering, large correlated numbers (rather than random zero mean numbers) are detected in the CAD circuit signifying lock. Now, if the samples are widely spaced in the time domain, apparent correlation due to aliasing can occur. This happens periodically when uniformly sweeping the VCO, resulting in a false acquisition. Because of the relatively low sweep rates, this condition occurred long enough for the CAD filter to respond. During the error rate studies a sample rate of 40 samples per bit was used. When this rate was used in the acquisition studies, false acquisitions always occurred. The sample rate had to be increased to 200 samples per bit for 1 kHz Doppler before the aliasing effect was negligible. Higher Doppler shifts would require correspondingly higher sampling rates. Therefore, the acquisition studies were run at 1 kHz Hertz Doppler to conserve computer time.

Both of the routines have seven subroutines:

NRANDM:	Gaussian Number Generator
RANDM:	Uniform Number Generator
BIFILT:	Bandpass Filter
BLOBA(P):	Amplitude and Phase Scintillation Lines
TRIG:	Trigonometry (1-deg table for computer speed up)
ASQRTF:	Square Root (linear interpolation for computer speed up)
DATAS:	Data Source (six-bit feedback shift register)

Some subroutines used in the checkout phases, but not used in the production runs, are given in Appendix VII.

RESULTS FOR NOMINAL CONDITIONS

The first step in the production runs was to determine the performance for nominal conditions. These are given in Table I. All the performance data points are based on 1900 bit scintillation runs. Before this simulation could be done, however, two additional parameters had to be found: the proper threshold level and the AGC gain.

TABLE I
NOMINAL CONDITIONS

Parameter	Symbol	Value
Bit Rate	BRATE	88. bps
Minimum Loop Signal	ENOMIN	9. dB
Tone Separation	DELF	62. Hz
IF Bandwidth	BIF	1000. Hz
AFC Loop Bandwidth	BL2	176. Hz
AFC Phase Error	PHIDEG	10. deg
AFC Pull-In Range	FDIFF	342. Hz
Bit Sync Bandwidth	BL2B	1. Hz
Bit Sync Phase Error	PHIB	10. deg
Bit Sync Pull-In	FDLFFB	5. Hz
AGC Filter Constant	TAU3	.07957
Sampling Filter Constant	TAU4	.001808
Baseline Filter Constant	TAU5	.01808
Doppler Filter Constant	TAU6	.10603
Baseline Filter Gain	A5	.5

Normally the threshold is initially set at some factor greater than the noise-only output, and then varied to minimize dropouts and minimize false acquisitions. For the simulation, the probabilities of a voltage occurring with noise only (herein -20 dB E/N_0, since it was easier to reduce the signal than to eliminate it) and with signal was determined. This is shown in Figure 9. All of the data referred to in this section appear in Appendix VIII. It should be noted that these early runs employed a slightly different printout format with more internal diagnostics than used in the production

runs. The symbols are all identical however; thus no confusion is anticipated in reading the data. Based on this information a threshold of 6.5 was used.

The AGC signal processor attempts to keep the voltage into the phase detector constant, to keep a constant open loop gain. This is done by setting the IF gain according to the reciprocal of the square root of the filtered coherent amplitude detector output. For a noise-only input, the gain is maximum, and a gain function ABC on Figure 10 is produced. While determining this function during the debugging operation, it appeared that additional gain below "minimum signal" would be beneficial, particularly in a scintillation environment, e.g., curve ADE or curve AFG. The additional gain herein is termed the dynamic range, DYNR. Results of such runs are shown in Figure 11. A DYNR of 3 dB appears to offer the best performance with scintillation, and was thus chosen for the nominal conditions.

The first parameter of interest is the mean error rate. This is shown in Figure 12. The vertical marks about each experimental point indicate the measurement standard deviation. Note that these runs count errors even during AGC dropout after initial acquisition. The mean error rate without scintillation is well within the "specified" value in the receiver specification, Ref. 3. With scintillation the performance is acceptable to about 10.5 dB. It should be noted that this performance refers only to the mean error rate. In a coded system the distribution of errors is also important. The data dumps in Appendix VIII show that the nonscintillation error distributions are roughly random (the error history matrix), but the scintillation runs have significant burst errors, i.e., groupings of errors. Further coding analysis is required to evaluate the performance of the system with scintillation.

Further study of the conditional probability matrices should enhance the evaluation of the system's capability to support coding. As noted in the previous section, this is moderately influenced by the soft quantization level. The bulk of the data was generated prior to the coding analysis of Appendix III and used a soft quanta of ASOFT/2 = 0.15. Figure 13 shows the mean and standard deviation of the sampled level voltages of the data of Figure 12. This was diagnostic information to determine the quantization level. At an E/N_0 of 9.4 dB, the nominal minimum, the standard deviation is 0.2; thus,

ASOFT/2 = 0.15 corresponds to a quanta level of 0.75 (ASOFT/2/std. dev.) of the standard deviation. According to Appendix III, 0.6 would be more appropriate, or ASOFT/2 = (0.6 std. dev.) or 0.12.

Another interesting factor seen in Figure 13 is the slight increase in "output" signal-to-noise ratio with the input. At E/N_0 of 7 dB we have a mean to standard deviation of 0.45/0.23 (5.83 dB) and at E/N_0 of 11 dB we have a mean to standard deviation of 0.47/0.19 (7.87 dB). There is only a 2.04 dB apparent increase in output for a 4 dB input increase indicating some memory, intersymbol interference, or possibly implied "noncoherent" signal detection, i.e., autocorrelation of signal plus noise.

The second parameter of interest is the probability of acquisition. Runs were made at 9.4 and 12.4 dB, with and without scintillation. The data in the appendix indicate 100% acquisition. At lower signal to noise, as in Figure 8, missed acquisitions occur. There was insufficient data, however, to plot the function.

RESULTS FOR PARAMETER VARIATIONS

A number of runs were made to investigate the effects of varying the parameters of the receiver. These may be roughly broken into two cases: system variations, and hardware variations. Table II lists the system variations. The data for this section are given in Appendix IX.

The results of modulation index variation is shown in Figure 14. As expected the optimum is 0.7, with and without scintillation.

TABLE II

SYSTEM PARAMETER VARIATIONS

PARAMETER	VALUES	
DELF (Modulation index oriented)	26.4, 44, 62, 88, 132	Hz
BIF (IF Bandwidth)	500, 750, 1000, 1500, 2000	Hz
BL2 (AFC $2B_L$)	88, 100, 164, 176, 188	Hz
TAU4 (Sampled Output Filter)	88, 144, 200	Hz

The second system parametric, the intermediate frequency bandwidth, is of some implementation importance. If the bandwidth is too narrow the filter could produce sufficient phase shift in the loop to cause instability. An intermediate frequency bandwidth of ten times the loop filter bandwidth, or 1 kHz was initially recommended. Because of the high Q of this device, wider bandwidths might be easier to fabricate. Figure 15 illustrates the data. These represent a second set of runs, because an initial set was required to establish the proper level at the sampled output and to define the simulation sampling requirements in the scintillation. The runs at and below 1 kHz were run with 40 samples per bit, and those above proportionally higher. Without scintillation, the higher bandwidths give slightly better performance; apparently beginning to level out in the vicinity of 1500-2000 Hz. With scintillation, the "knee" appears to be between 1000 and 1500 Hz.

The results with the receiver loop bandwidth parametric are shown in Figure 16. The nominal 176 Hz case is optimal both with and without scintillation.

The final system parametric is the variation of the corner frequency of the sampling filter. In conjunction with this, the output of the

synchronizer integrate-and-dump was also measured. These data, in Figure 17, are also the second set of runs, the first being required to optimize the sampling time. It is seen that wider bandwidths degrade the performance, although less dramatically when scintillation is present. The integrate-and-dump output appears to be uniformly better. Incidentally, the three points shown for each integrate-and-dump output represent one datum; since no parameter change is made for it; the apparent variations are experiment scatter.

The expected hardware variations are summarized in Table III. Of these, only ENODB, DELF, and BL2 are judged significant. Two "worst cases" were defined; ENODB of 9.2, DELF of 66, and BL2 of 164; and ENODB of 9.2, DELF of 60, and BL2 of 188. The simulation results are shown in Figure 18. Worst case 2 shows little variation from the nominal, within one sigma of the measurement. Worst case 1 shows between 0.5 and 0.75 dB degradation.

TABLE III

HARDWARE VARIATIONS

Parameter	Nominal	Min	Max	Comment
ENODB	9.4 dB	9.2	9.9	Based on -142.8 dBm, noise at -174 dBm and NF of 2.3 dB.
DELF	62 Hz	60	66	Oscillator pulling range accuracy
BIF	1000 Hz	- Negligible -		Crystal manufacturer data
BL2	176 Hz	164	188	RSS estimate of gain changes, and scale factors
SVRHZ	2.2 kHz/sec	2.1	2.3	5% variance to sweep and VCO scale factor
EVMAX-EVMIN	35 kHz	33	37	5% sweep drift and VCO scale factor
TAU3	.07957	.07718	.08196	3% RSS time constant
TAU4	.001808	.001754	.001862	Same as TAU3
TAU5	.01808	.01754	.01862	Same as TAU3

CONCLUSION

Digital computer simulation of a data link has shown that the candidate modem appears, from the mean error rate viewpoint, to be acceptable to the systems requirements. A complete verification of the usage of the modem for a coded telemetry system must await further coding analyses. The performance is well within the specified error rate bounds without atmospheric scintillation, and the errors appear to be random. Performance is also acceptable with scintillation but the errors appear to be bursty.

The system parametric studies reveal that:

- a slightly larger intermediate frequency bandwidth of 1500-Hz would be more advantageous than the current 1000-Hz nominal.
- the data output sampling filter of the bit synchronizer could be improved, e.g., a straight integrate-and-dump, or perhaps a higher order filter.
- the effect of hardware degradations are within acceptable range.
- in the range of signal strengths anticipated by the Reference 1 system studies, the receiver appears to acquire every time. Additional runs are required to fully trace the probability-of-acquisition curve.

Because of scintillation modeling uncertainties, it appears worthwhile to try other scintillation models and also to explore the effects of the resulting error distributions in coding studies.

REFERENCES

1 Saturn/Uranus Atmospheric Entry Probe, MDC Report E0870, July 18, 1973.

2 Transmitter Specification, SAEP-ES-7 Rev. B, April 30, 1973.

3 Receiver Specification, SAEP-ES-8 Rev. B, April 30, 1973.

4 Data Handling and Communication Subsystem Definition Study for Saturn Atmsopheric Entry Probe, TRW S/N 23765, July 1973.

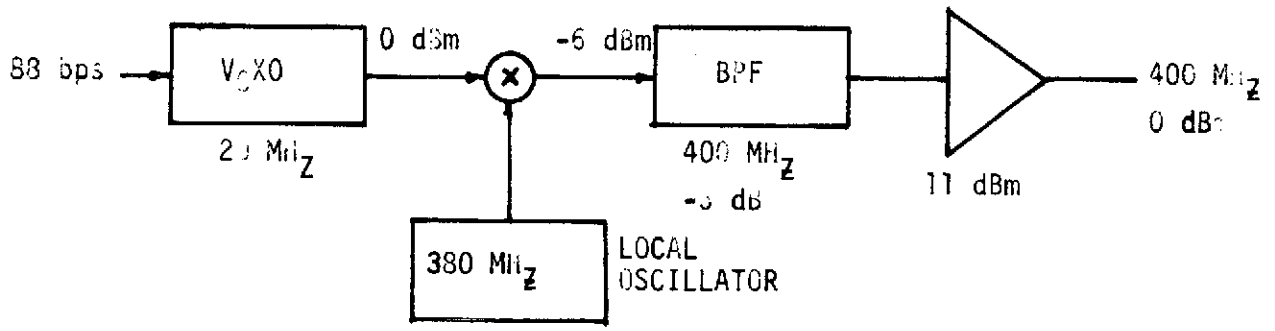


FIGURE 1

SINGLE CONVERSION DIRECT FM MODULATOR

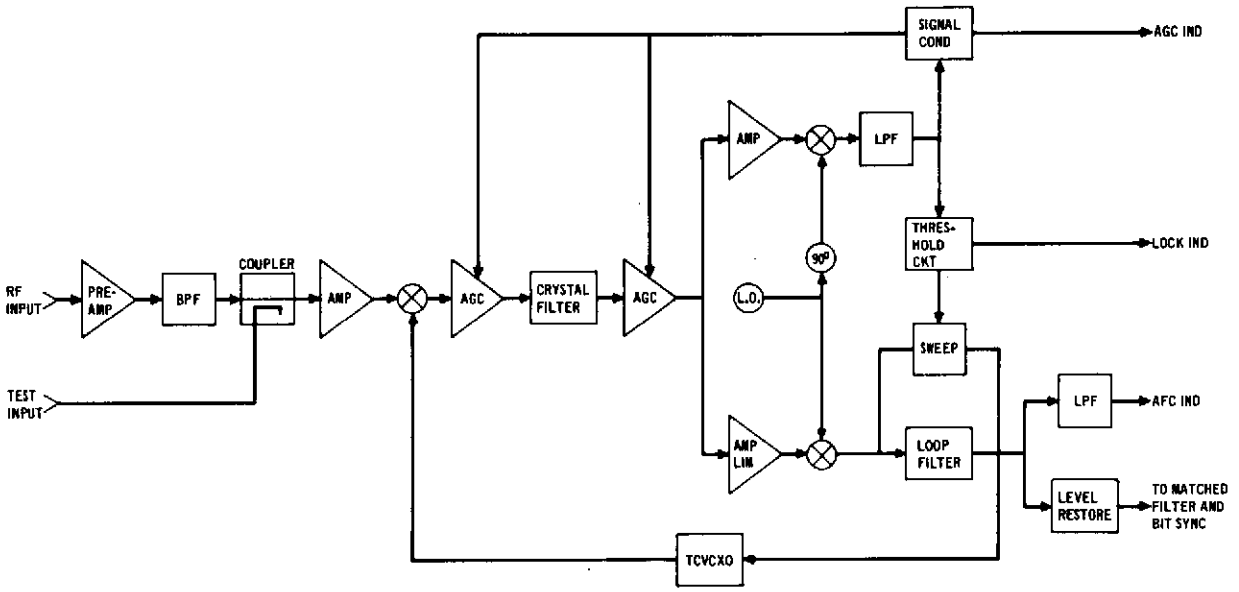


FIGURE 2

RECEIVER DETAILED BLOCK DIAGRAM

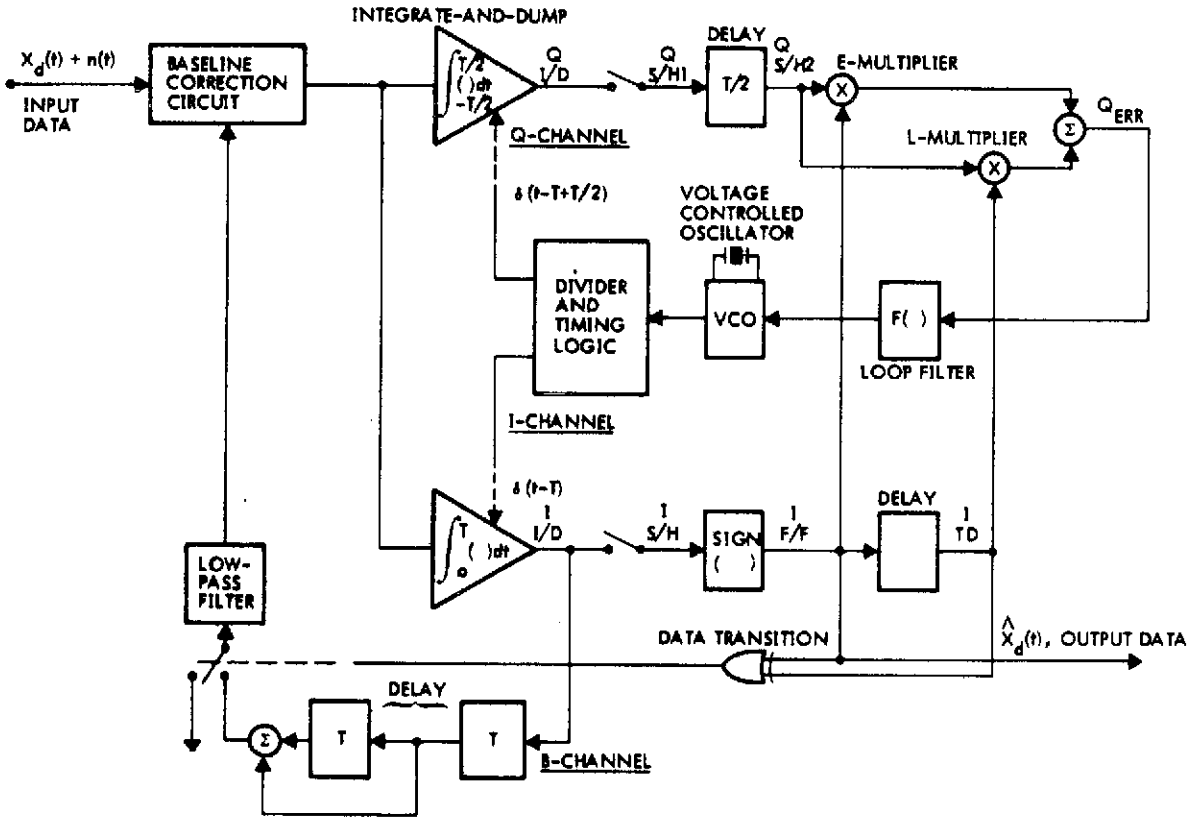


FIGURE 3

BIT SYNCHRONIZER

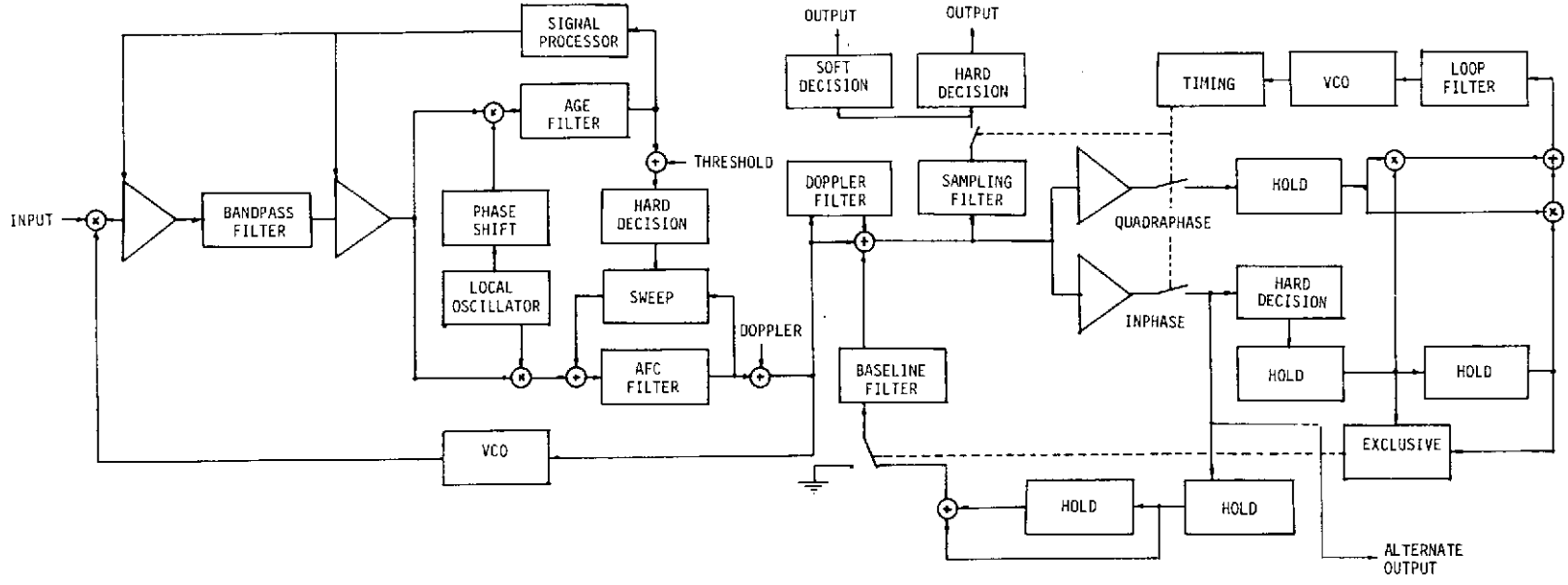


FIGURE 4

SIMULATION BLOCK DIAGRAM

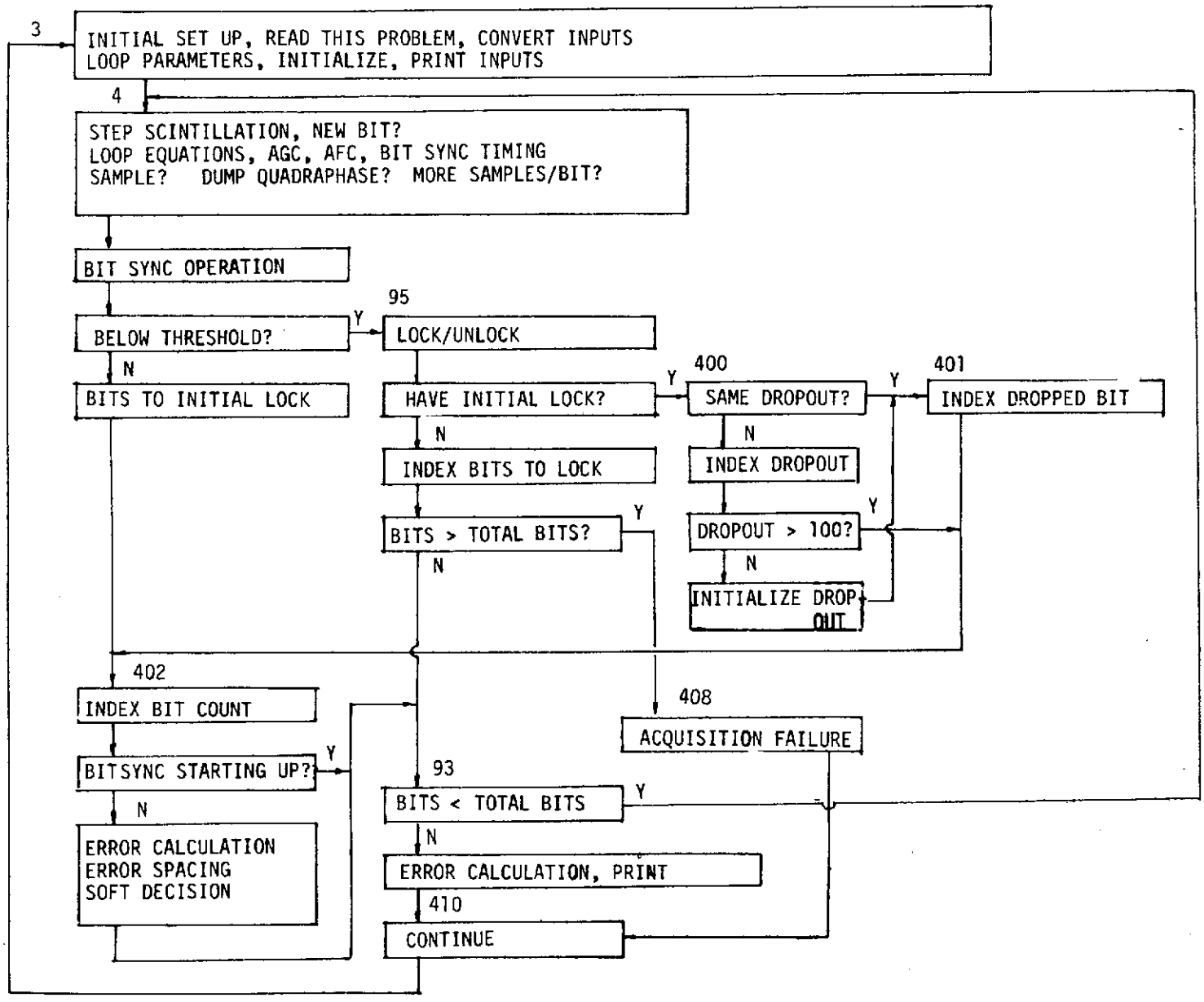
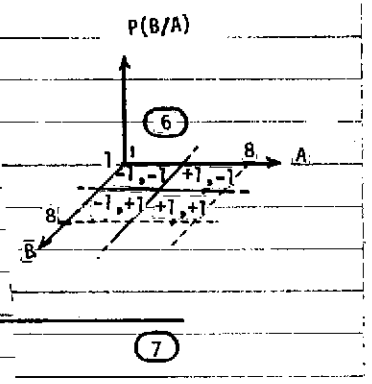


FIGURE 5

ABBREVIATED ERROR RATE FLOW CHART

FIGURE 6 TYPICAL ERROR RATE PRINTOUT

```
ENOOB=   9.4 ,DELF=  62.0 ,BIF=  1000 ,BL2=   176 ,NSLICE=    25 ,ASOFT= .3000                                    (1)
SVRHZ=  0.          ,SWMX= 2.8150E+04 ,SWMN= 6.8500E+03 ,FLO= 1.0000E+01 ,FRQDOP=  0.          ,FQDPRT= 1.0800E+01
TL= -6.50 ,DYNR=   3.0 ,SDAMP=  .230 ,SDPHA=  .470 ,I1,I2,I11,I22   129   130     1     1
WN= 165.9 ,K= 468.6 ,TAU1=  4.5000E-01 ,TAU2=  8.4420E-03 ,WNB=   .9 ,KB= 614.9 ,TAUB1=  2.0353E+02 ,TAUB2=  1.4945E+00 (2)
PE=  2.4737E-02 ,STDEV=  3.5633E-03 ,V MEAN=  4.5633E-01V STD DEV=  2.0598E-01 ,BITS=  1900                        (3)
PEI=  2.4737E-02 ,STDEV=  3.5633E-03 ,I MEAN=  1.6284E+01 I STD DEV=  6.2517E+00 ,BITS=  0.                       (4)
LOCKIN=     1 ,DROPOUTS=     1 ,AVE=  4.0000E+00 ,STD DEV=  0.
ERRM
 8.0000E+00  3.0000E+00  1.0000E+00  1.0000E+00  1.0000E+00  0.          3.0000E+00  1.0000E+00  1.0000E+00  0.
 0.          1.0000E+00  0.          1.0000E+00  1.0000E+00  1.0000E+00  1.0000E+00  0.          0.          0.
 0.          1.0000E+00  0.          0.          0.          1.0000E+00  0.          0.          0.          0.
 1.0000E+00  0.          1.0000E+00  0.          1.0000E+00  1.0000E+00  0.          1.0000E+00  0.          1.0000E+00 (5)
 0.          0.          1.0000E+00  0.          0.          0.          0.          0.          0.          0.
 0.          0.          0.          1.0000E+00  0.          0.          1.0000E+00  0.          0.          0.
 0.          0.          0.          0.          0.          0.          0.          0.          1.0000E+00  0.
 0.          0.          0.          0.          0.          1.0000E+00  0.          0.          0.          0.
 0.          0.          0.          3.0000E+00  0.          0.          0.          0.          1.0000E+00  0.
 0.          0.          0.          1.0000E+00  0.          1.0000E+00  0.          0.          0.          4.0000E+00

-1,-1 P(B/A)TIMES   453                                  -1,+1 P(B/A)TIMES   482
  107   35   23    6    1    1    0    0                 2    1    0    0    0    0    0    0
   76   25   20    5    2    0    0    0                 2    0    0    0    0    0    0    0
   34   28   20   12    2    0    0    0                 0    0    0    1    0    0    0    0
   12   13    9    6    4    0    0    0                 4    1    0    1    0    0    0    0
    4    2    2    2    0    0    0    0                14    3    2    1    0    0    1    0
    0    0    0    1    0    0    0    0                30   10    8    6    0    0    1    0
    0    0    0    1    0    0    0    0                90   27    5    4    1    0    0    0
    0    0    0    0    0    0    0    0               131   64   44   20    3    2    0    2
+1,-1 P(B/A)TIMES   483                                  +1,+1 P(B/A)TIMES   482
    0    1    0    1   24   69  108  130                 1    0    0    1    0    2    0    1
    0    0    0    3    1   13   23   41                 0    0    0    1    1    0    1    0
    2    0    1    0    0    7   11   18                 0    1    0    0    0    1    0    0
    3    1    0    1    3    4    7    3                 0    0    0    0    1    2    1    1
    0    0    0    0    1    2    0    0                 0    0    0    0    0    7   11   10
    0    0    0    0    0    1    0    1                 1    0    0    2    5   13   34   51
    0    0    0    0    0    0    1    0                 0    1    2    0    6   19   45   86
    0    0    0    0    0    1    1    6                 1    1    0    2    7   20   45   98
I1,I2,I11,I22   538  1850   529   737
REC SLICE=  2.6261E+01 ,STD DEV=  3.5289E+00
```



(1) INPUTS
(2) INTERMEDIATE VALUES
(3) MEAN ERROR RATES
(4) LOCK/UNLOCK
(5) ERROR SPREAD MATRIX
(6) CONDITIONAL PROBABILITY MATRIX
(7) END CONDITIONS

FIGURE 6

TYPICAL ERROR RATE PRINTOUT

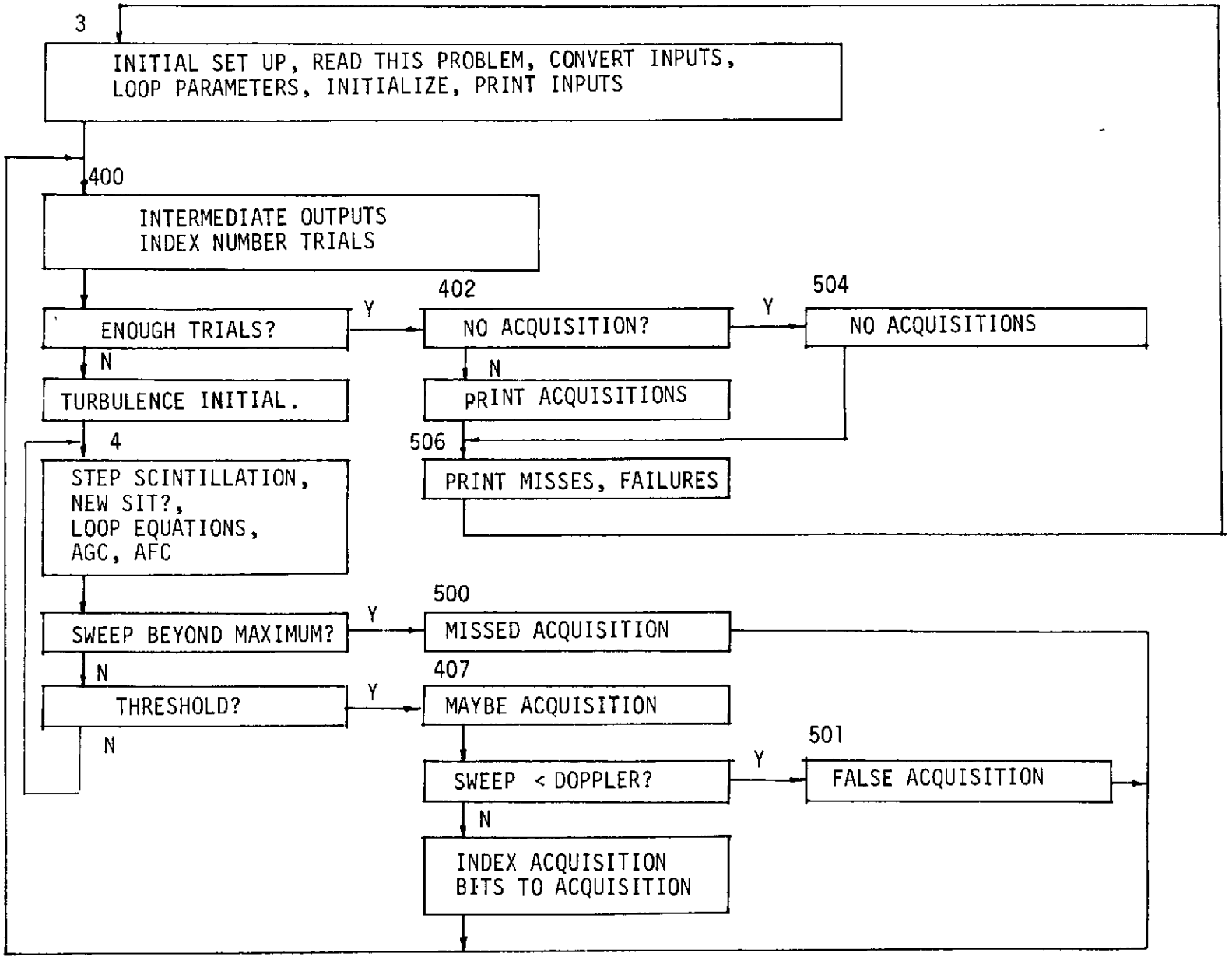


FIGURE 7 ABBREVIATED ACQUISITION FLOW CHART

```
ENODB=    6.0 ,DELF=   62.0 ,RTF=   1000 ,RL2=    176
SVRHZ=   2.2000E+03 ,SWMX=   2.5000E+03 ,SWMN=   6.8500E+03 ,FLO=   1.0000E+01 ,FRDDOP=   1.0000E+03 ,FODPRT=   1.0000E+01 (1)
TL= -6.50 ,DYNR=    3.0 ,SDAMP=   .230 ,SOPHA=   .470 ,I1,I2,I11,I22      1      1      1      1
HN= 166.9 ,K= 468.6 ,TAU1=   4.5000E-01 ,TAU2=   8.4420E-03                                                                (2)
NACQ,AMISS,AFAL,KDATA,ES,EV,EV1
     1   0.              0.            1.0000E+00     68   2.2635E+01   1.3609E+01   9.3935E-02
     2   0.              0.            2.0000E+00     71   2.3685E+01   1.4497E+01   9.8541E-01
     3   0.              0.            3.0000E+00     70   2.3151E+01   1.4069E+01   5.5659E-01
     4   0.              0.            4.0000E+00     70   2.3461E+01   1.2962E+01  -5.6855E-01
     5   0.              0.            5.0000E+00     69   2.2980E+01   1.4216E+01   5.3746E-01
     6   0.              0.            6.0000E+00     66   2.2120E+01   1.3086E+01  -4.1763E-01
     7   0.              0.            7.0000E+00     72   2.4047E+01   1.2802E+01  -6.1208E-01
     8   0.              0.            8.0000E+00     71   2.3622E+01   1.3369E+01  -1.5158E-01
     9   0.              0.            9.0000E+00     67   2.2152E+01   1.2975E+01  -5.3987E-01
    10   0.              0.            1.0000E+01     63   2.1071E+01   1.2742E+01  -7.7637E-01
    11   0.              0.            1.1000E+01     68   2.2522E+01   1.3121E+01  -3.4843E-01
    12   0.              0.            1.2000E+01     74   2.4729E+01   1.4045E+01   5.2396E-01
    13   1.0000E+00      0.            1.2000E+01    134   4.4907E+01   3.3571E+01   1.9858E+01                            (3)
    14   1.0000E+00      0.            1.3000E+01     69   2.2827E+01   1.3989E+01   4.2894E-01
    15   1.0000E+00      0.            1.4000E+01     75   2.5100E+01   1.3664E+01   2.4033E-02
    16   1.0000E+00      0.            1.5000E+01     72   2.4031E+01   1.3116E+01  -4.1164E-01
    17   1.0000E+00      0.            1.6000E+01     71   2.3726E+01   1.3435E+01  -1.2380E-01
    18   1.0000E+00      0.            1.7000E+01     73   2.4257E+01   1.2685E+01  -8.1762E-01
    19   1.0000E+00      0.            1.8000E+01     77   2.5477E+01   1.4113E+01   5.8743E-01
    20   1.0000E+00      0.            1.9000E+01     70   2.3132E+01   1.4589E+01   1.0603E+00
    21   2.0000E+00      0.            1.9000E+01    136   4.5311E+01   3.3569E+01   1.9858E+01
    22   2.0000E+00      0.            2.0000E+01     70   2.3287E+01   1.4397E+01   8.5247E-01
    23   2.0000E+00      0.            2.1000E+01     77   2.5757E+01   1.3887E+01   3.1475E-01
    24   2.0000E+00      0.            2.2000E+01     74   2.4483E+01   1.2782E+01  -6.8782E-01
    25   2.0000E+00      0.            2.3000E+01     81   2.6995E+01   1.3366E+01  -1.1882E-01
    26   2.0000E+00      0.            2.4000E+01     70   2.3246E+01   1.3267E+01  -3.0114E-01
    27   2.0000E+00      0.            2.5000E+01     72   2.3830E+01   1.3939E+01   4.2498E-01
    28   2.0000E+00      0.            2.6000E+01     64   2.1327E+01   1.3163E+01  -3.4685E-01
    29   2.0000E+00      0.            2.7000E+01     69   2.2935E+01   1.4568E+01   1.1191E+00
    30   3.0000E+00      0.            2.7000E+01    131   4.3645E+01   3.3573E+01   1.9824E+01
PACQ=   9.0000E-01 ,STDEV=   5.4772E-02                                                                                      (4)
AVEES=   2.3577E+01 ,STDES=   1.2897E+00
AVE KDATA=   7.0852E+01 ,STD DEV=   3.8558E+00
PR MISSED ACQ=   1.0000E-01
PR FALSE ACQ=   0.
I1,I2,I11,I22    282    841   1855   1849
```

(1) INPUTS (2) LOOP VALUES (3) INTERMEDIATE VALUES (4) ACQUISITION PROBABILITIES

FIGURE 8

TYPICAL ACQUISITION PRINTOUT

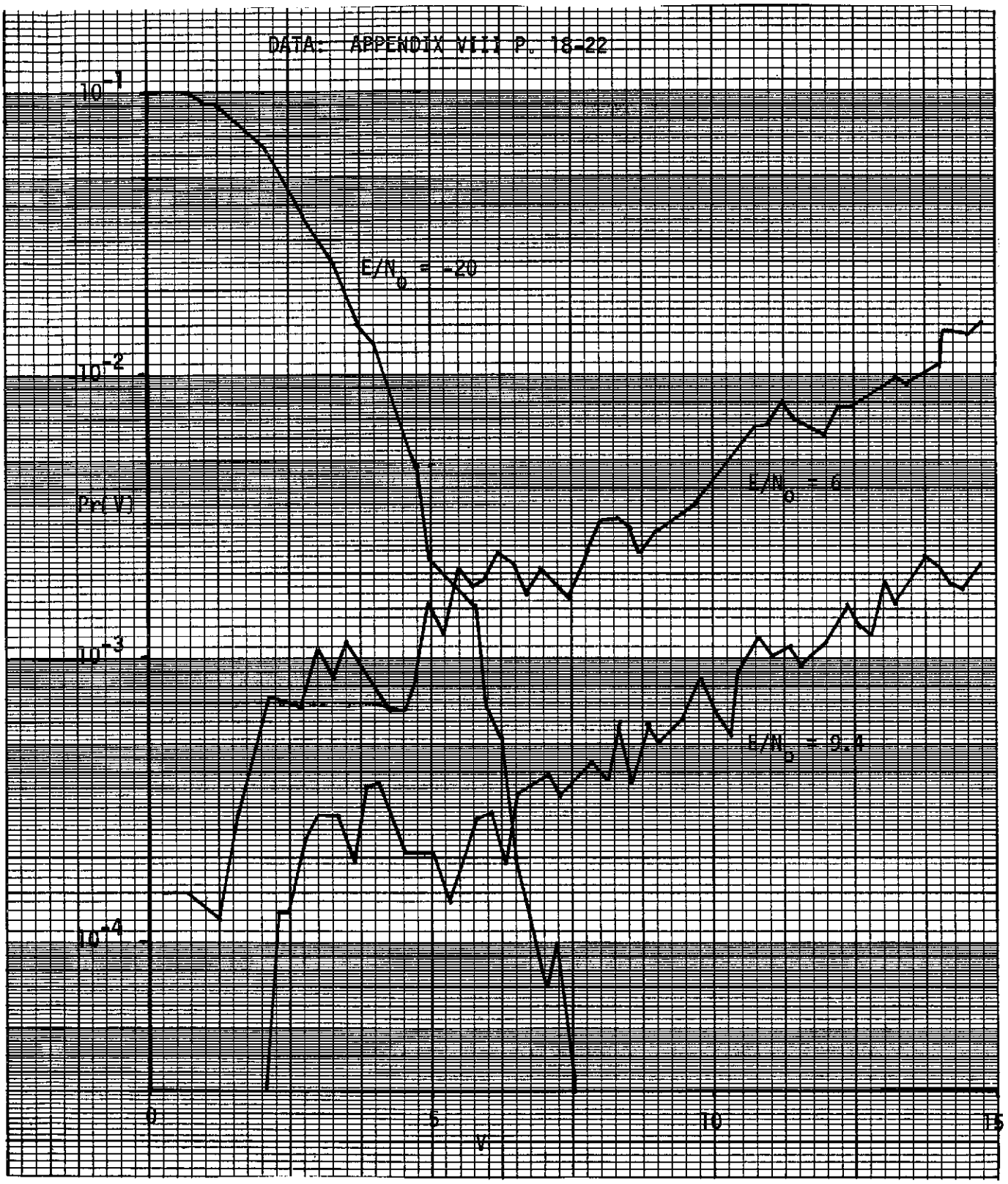


FIGURE 9
AGC VOLTAGE DISTRIBUTION

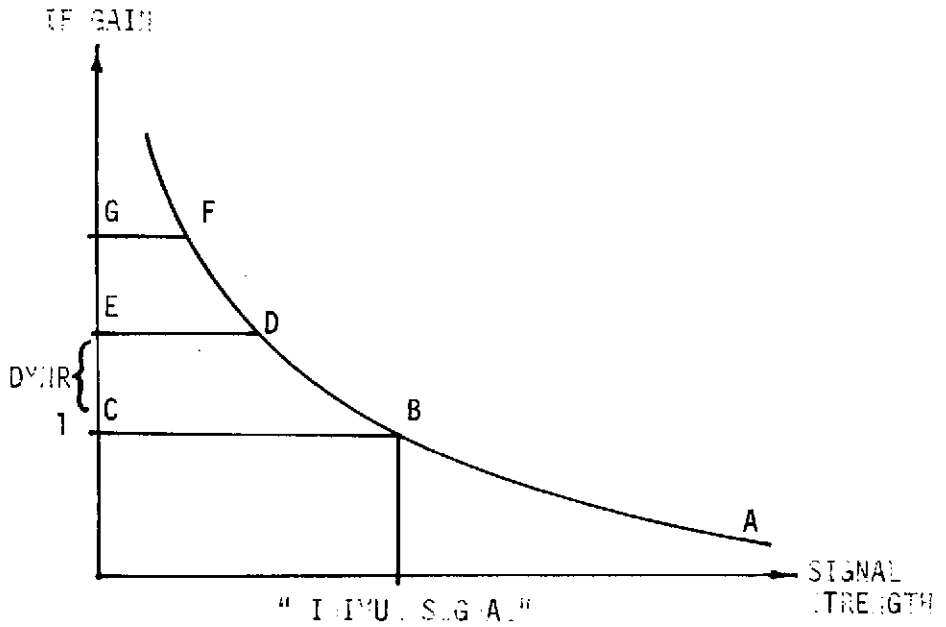


FIGURE 10
AGC GAIN FUNCTION

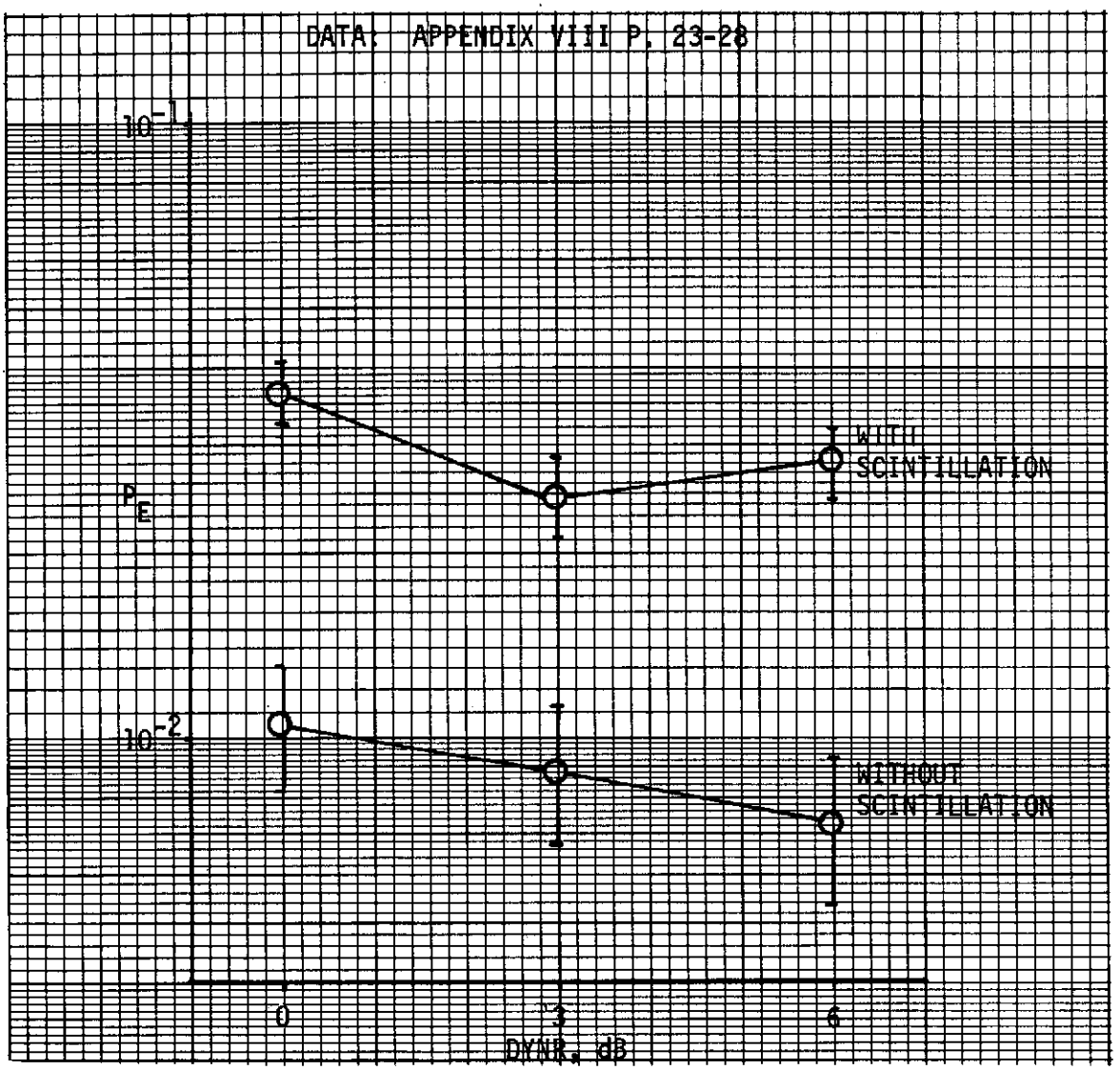


FIGURE 11

MEAN ERROR RATE VERSUS
AGC DYNAMIC RANGE PARAMETRIC

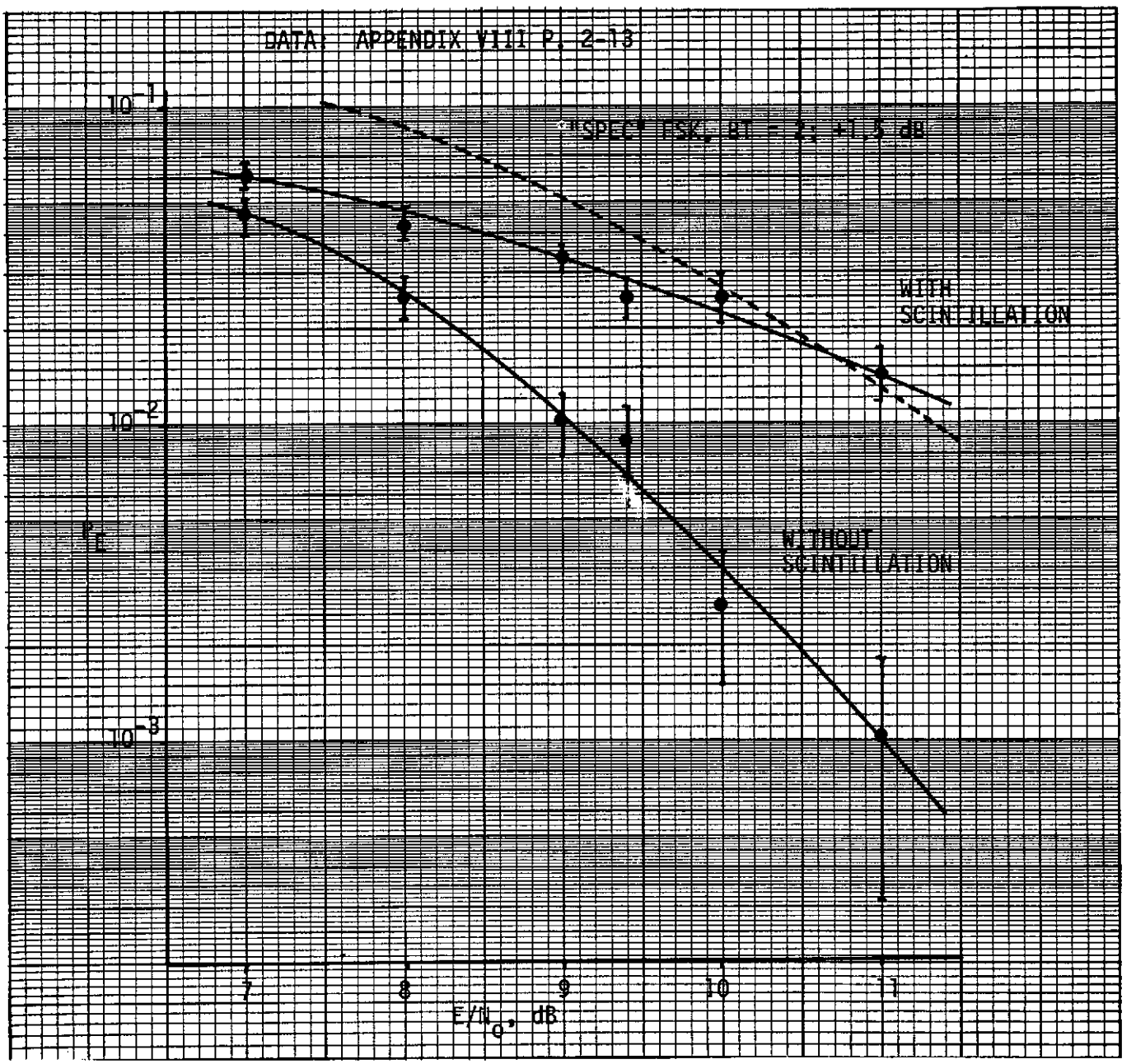


FIGURE 12

MEAN ERROR RATE VERSUS E/N_o
FOR NOMINAL CONDITIONS

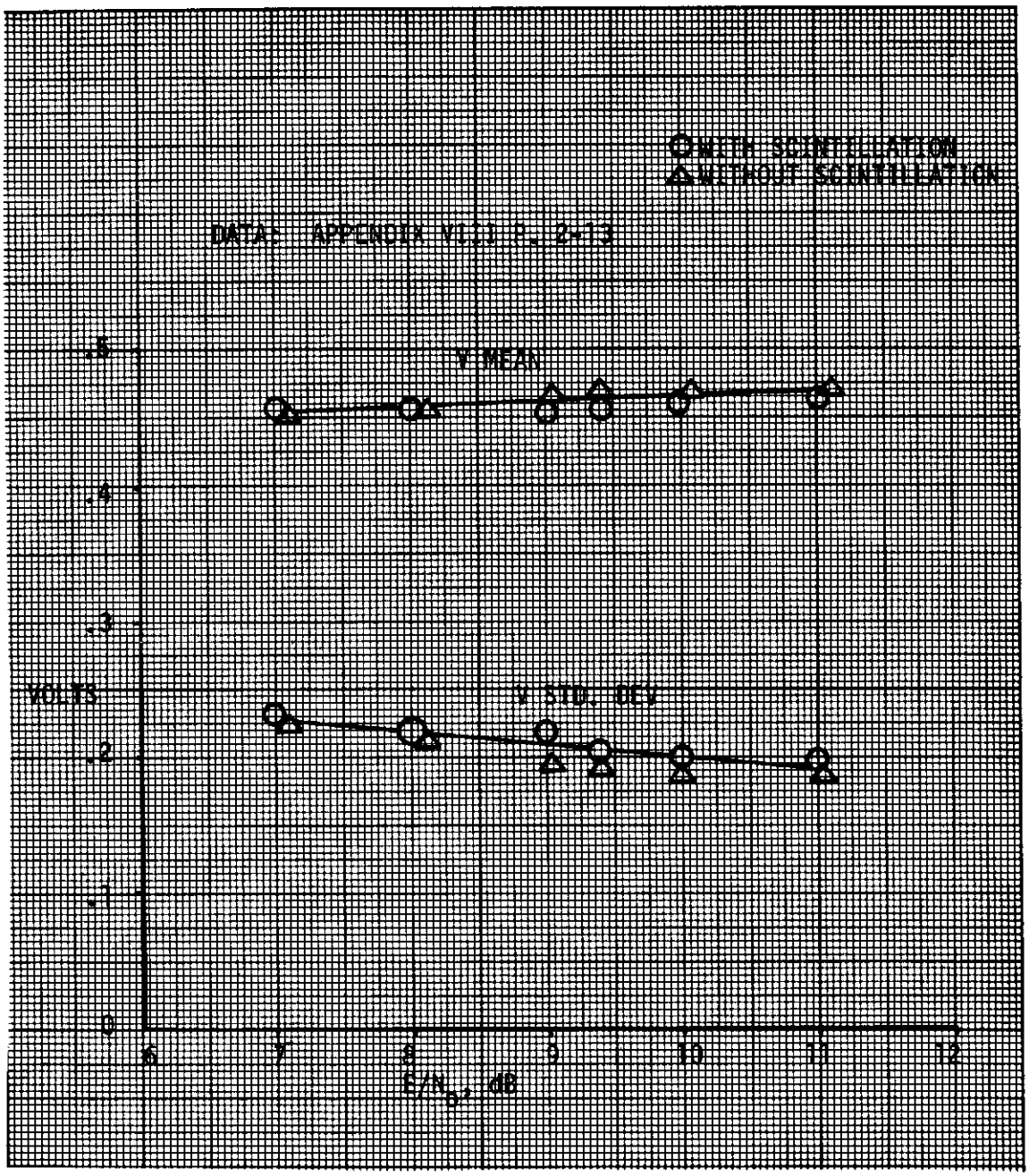


FIGURE 13

FILTER AND SAMPLE OUTPUT
VOLTAGE VERSUS E/N_o

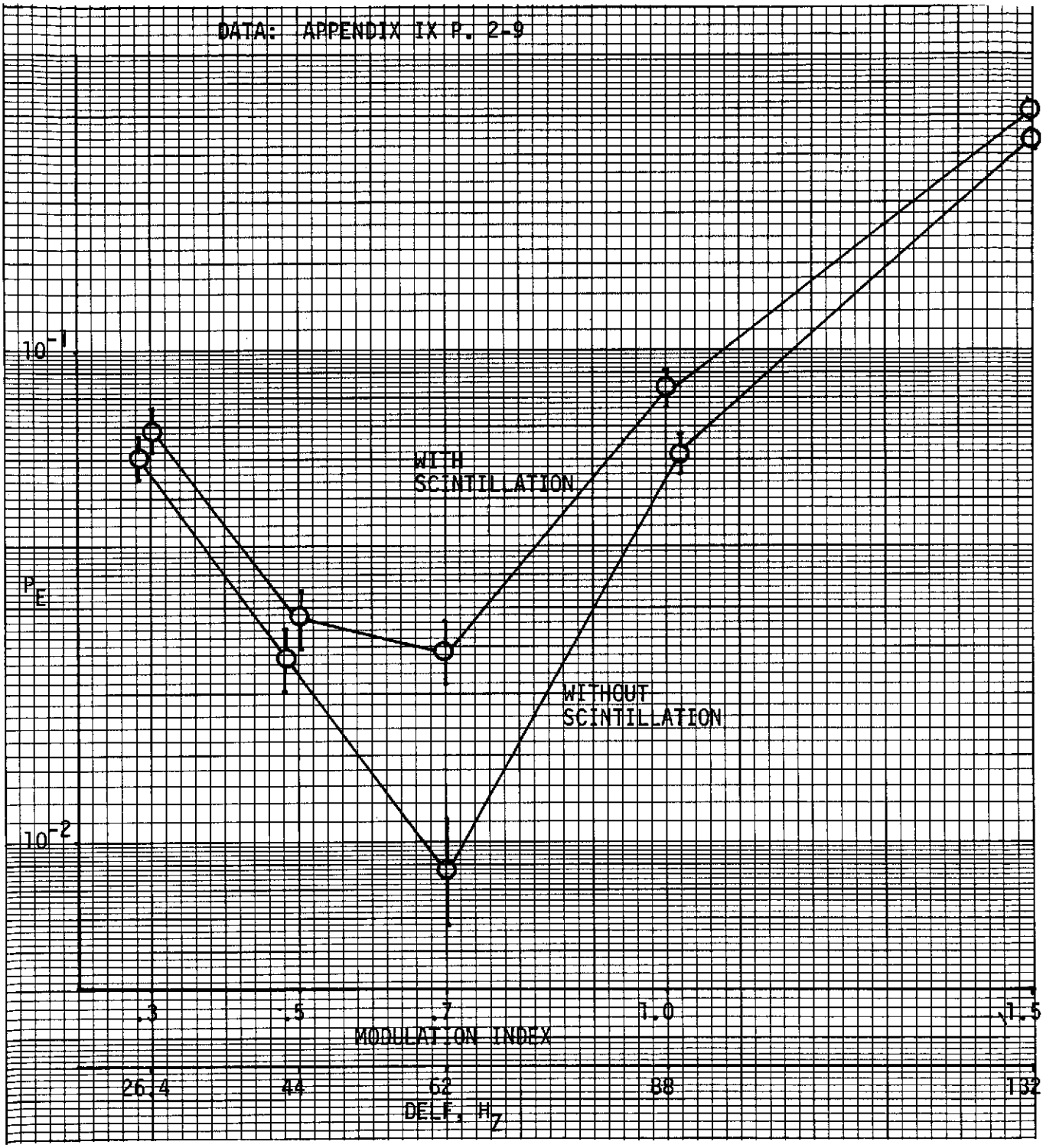


FIGURE 14

MEAN ERROR RATE VERSUS
MODULATION INDEX PARAMETRIC

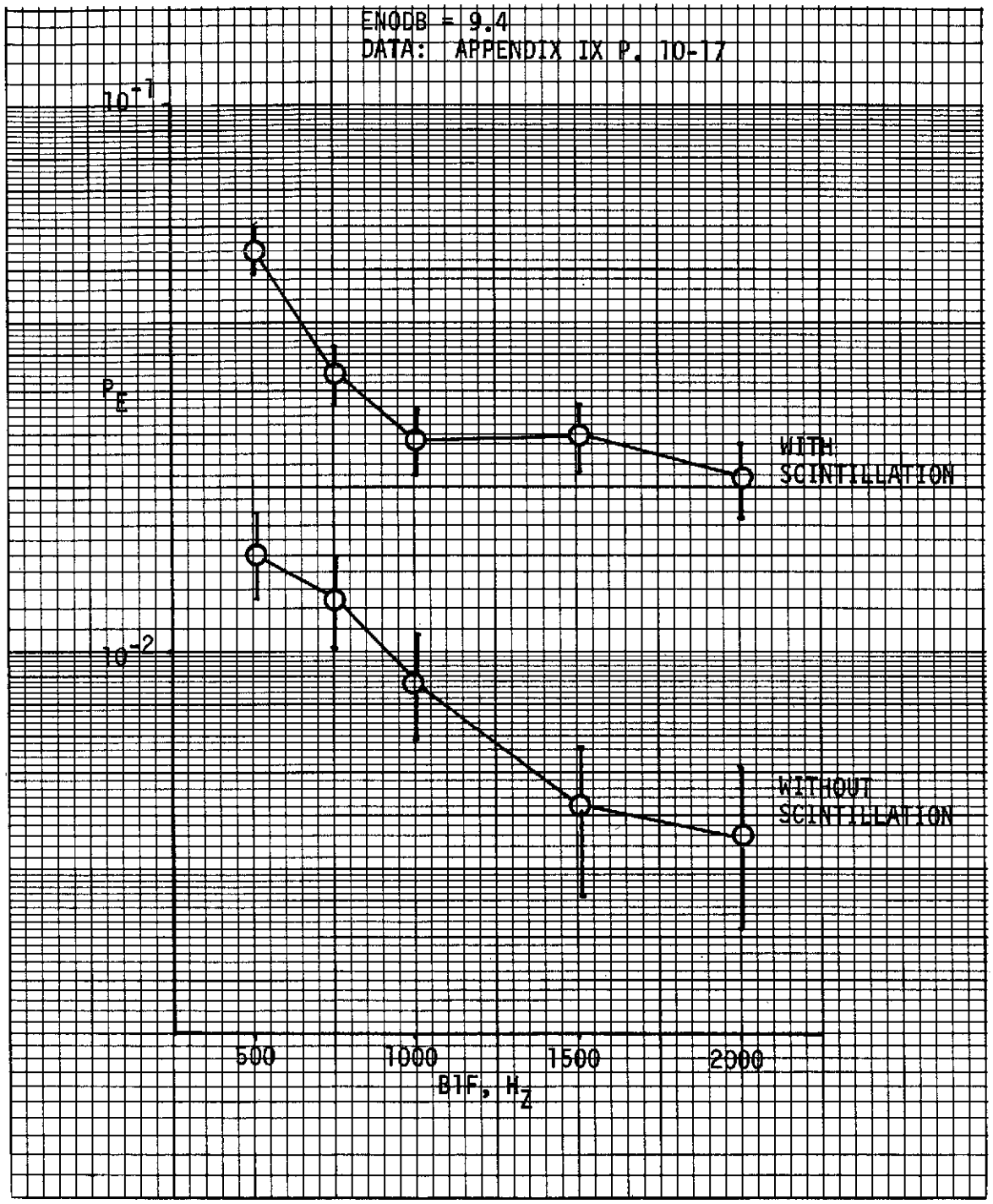


FIGURE 15
MEAN ERROR RATE VERSUS
BIF PARAMETRIC

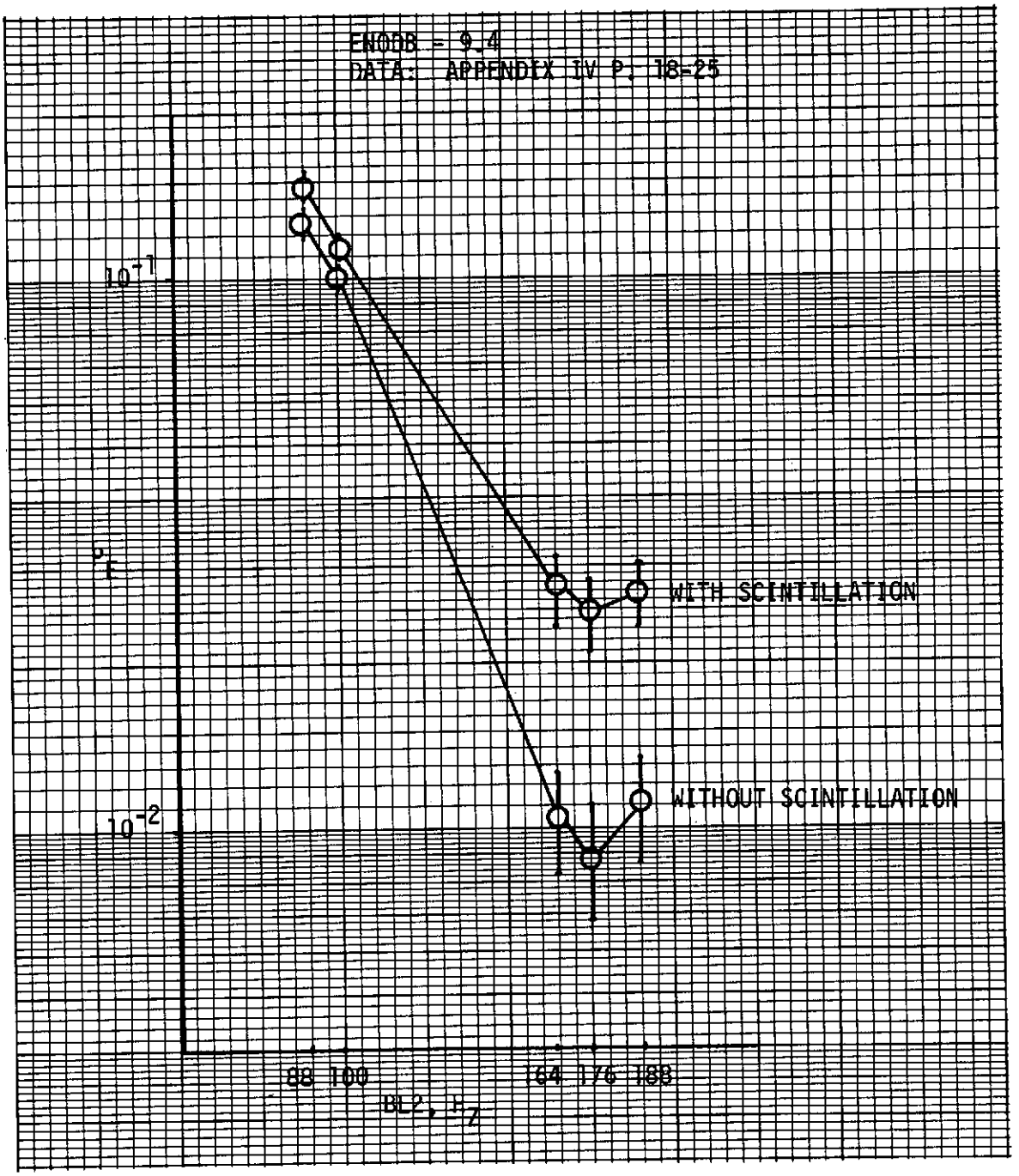


FIGURE 16
MEAN ERROR RATE VERSUS
BL2 PARAMETRIC

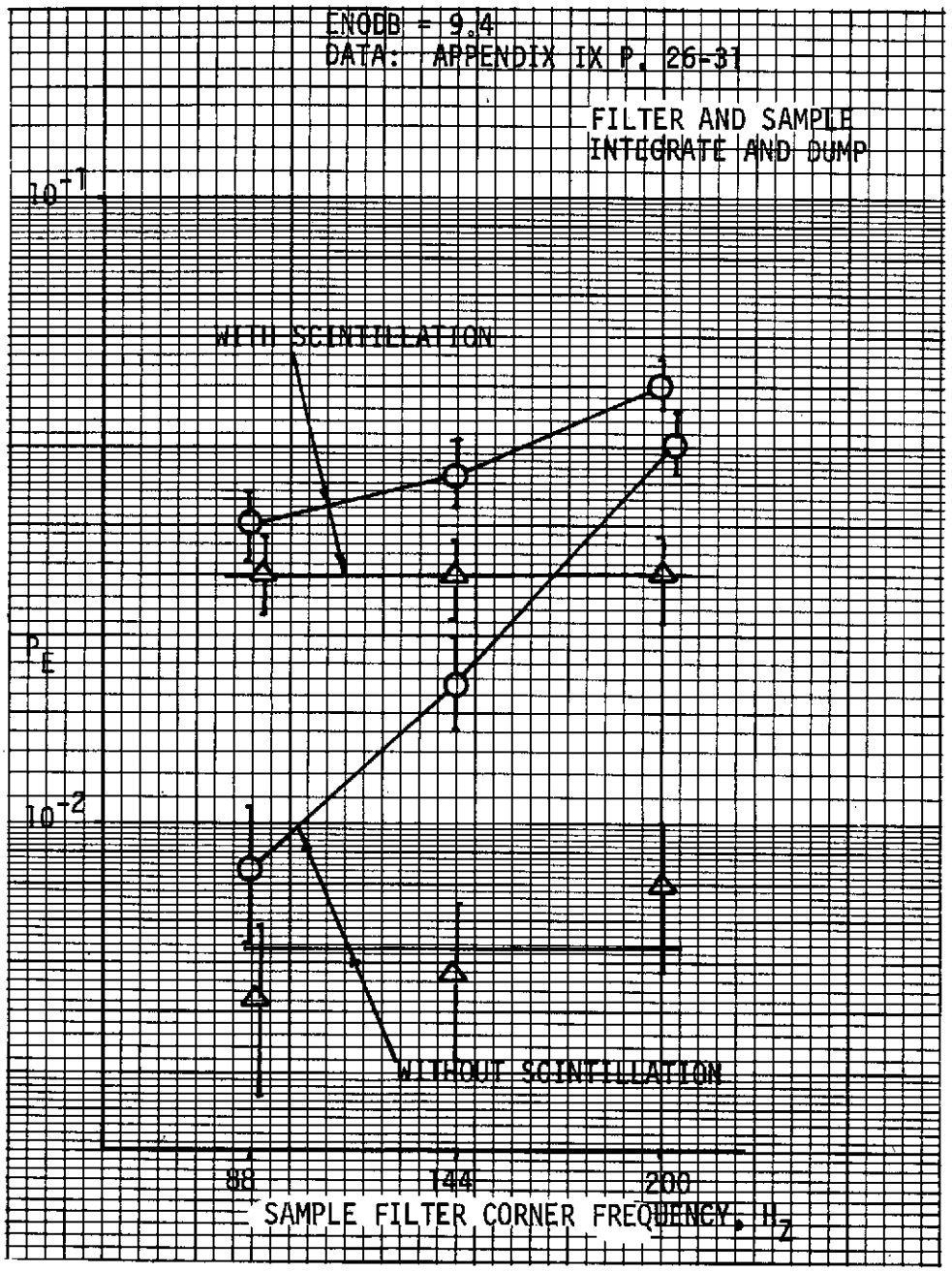


FIGURE 17

MEAN ERROR RATE VERSUS
TAU4 PARAMETRIC

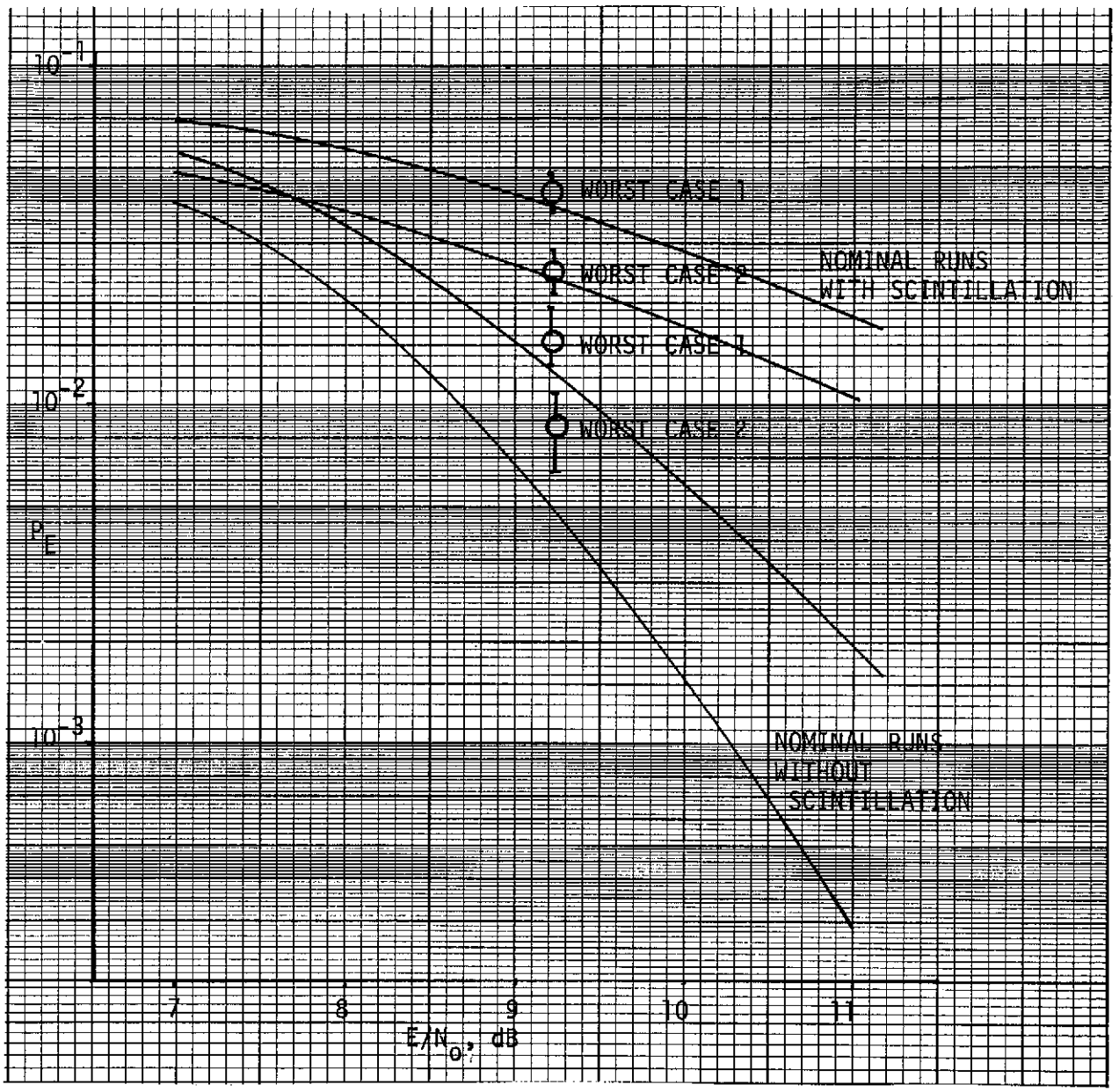


FIGURE 18

MEAN ERROR RATE UNDER TWO
WORST CASE HARDWARE VARIATIONS

APPENDIX I

COMPLEX AMPLITUDE NOTATION

Complex amplitude notation is a convenient way to normalize the notation to a reference frequency. The signal waveform is thus

$$x(t) = \mathrm{Re}\{\tilde{x}(t) \exp(j w_0 t)\},$$

where the reference frequency is w_0, and the complex amplitude is

$$\tilde{x}(t) = A \exp(j\theta) = A\cos\theta + j A \sin\theta.$$

Herein, A is the signal amplitude, and θ the signal phase. The conventional notation is apparent by combining,

$$\begin{aligned} x(t) &= \mathrm{Re}\{ A \exp(j\theta) \exp(j w_0 t)\} \\ &= A \cos(w_0 t + \theta). \end{aligned}$$

When multiplying in complex amplitudes

$$z(t) = x(t)\, y(t)$$

or

$$z(t) = \mathrm{Re}\{\tilde{x}(t) \exp(j w_0 t)\}\ \mathrm{Re}\{\tilde{y}(t) \exp(j w_0 t)\}.$$

Using the identity

$$\mathrm{Re}\{\tilde{x}(t)\}\ \mathrm{Re}\{\tilde{y}(t)\} = \frac{1}{2}\mathrm{Re}\{\tilde{x}(t)\, \tilde{y}(t) + \tilde{x}(t)\, \tilde{y}^*(t)\},$$

the star denoting the complex conjugate, we have

$$\begin{aligned} z(t) = \frac{1}{2} \mathrm{Re}\{&\tilde{x}(t)\, \tilde{y}(t) \exp(j (w_0+w_1)t) \\ &+ \tilde{x}(t)\, \tilde{y}^*(t) \exp(j (w_0-w_1)t)\}. \end{aligned}$$

Normally one beats down, so the complex amplitude of the difference frequency term is $\frac{1}{2}\tilde{x}(t)\, \tilde{y}^*(t)$.

When filtering x(t) with h(t) to yield y(t), one normally expresses this as

$$y(t) = \int_{-\infty}^{\infty} x(\tau)\, h(t-\tau) d\tau .$$

In complex amplitude notation

$$\begin{aligned} y(t) &= \int_{-\infty}^{\infty} \mathrm{Re}\{\tilde{x}(t) \exp(j w_0 \tau)\}\ \mathrm{Re}\{\tilde{h}(t-\tau) \exp(j w_1 (t-\tau))\}\, d\tau \\ &= \frac{1}{2} \mathrm{Re}\{\int_{-\infty}^{\infty} \tilde{x}(\tau)\, \tilde{h}(t-\tau) \exp(j(w_0-w_1)\tau) \exp(j w_1 t)\, d\tau\} \\ &+ \frac{1}{2} \mathrm{Re}\{\int_{-\infty}^{\infty} \tilde{x}(\tau)\, \tilde{h}^*(t-\tau) \exp(j(w_0+w_1)\tau) \exp(-j w_1 t) d\tau\}. \end{aligned}$$

Normally, x(t) and h(t) are referenced to the same frequency, so that

$$y(t) = \frac{1}{2}\,\mathrm{Re}\,\{\exp(jwt)\int_{-\infty}^{\infty}\tilde{x}(\tau)\,\tilde{h}(t-\tau)\,d\tau\}$$
$$+\frac{1}{2}\,\mathrm{Re}\,\{\exp(-jwt)\int_{-\infty}^{\infty}\tilde{x}(\tau)\,\tilde{h}^{*}(t-\tau)\exp(2jwt)\,d\tau\}.$$

When the bandwidths of the signal and the filter are narrow compared to the center frequency, one may neglect the second term, so

$$\tilde{y}(t) = \frac{1}{2}\int_{\infty}^{\infty}\tilde{x}(t)\,\tilde{h}(t-\tau)\,d\tau.$$

Finally, when the carrier is zero, to represent baseband signals,

$$\tilde{y}(t) = \int_{-\infty}^{\infty}\tilde{x}(t)\,\tilde{h}(t-\tau)\,d\tau.$$

Figure I-1 illustrates the usage of complex amplitudes in the simulation. The input has the signal amplitude M_0 and phase θ_1 plus noise θ_n. This represents the radio frequency, and is beat down by the first mixer to intermediate frequency by straightforward multiplication. After filtering, the extraneous phase is represented by ϕ, with M_f representing the filtered amplitude. The real part of the signal from the phase detector is just the amplitude times the sine of the phase. Similarly the real part of the signal from the coherent amplitude detector is just the negative of the amplitude times the cosine of the phase.

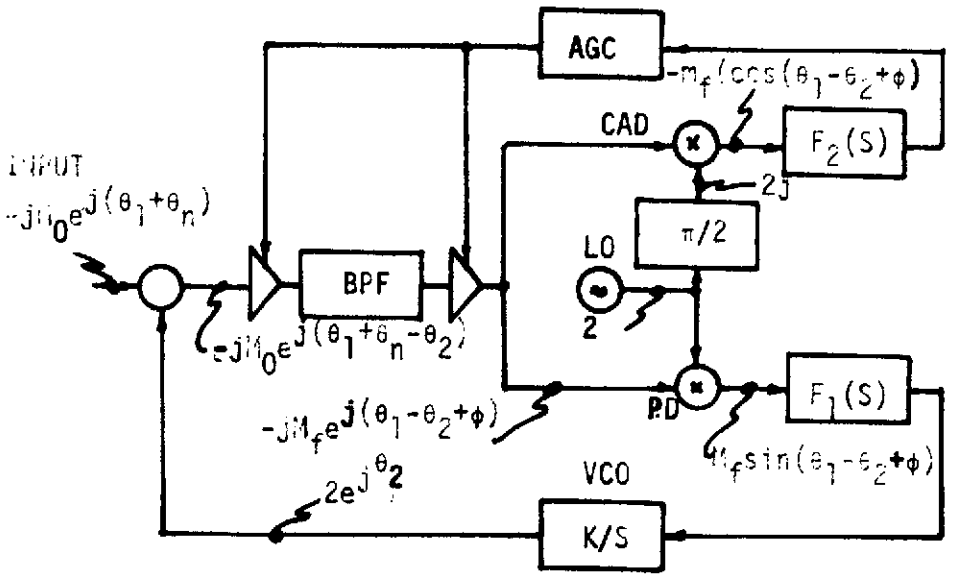


FIGURE I-1
COMPLEX AMPLITUDE USAGE

APPENDIX II

SCINTILLATION FILTERING

ABSTRACT: A tapped delay line filter is presented to represent atmospheric scintillation effects. Data is given to show the aliasing effects of the truncation.

1. Introduction - It is well known that atmospheric turbulence, herein defined as variations in the complex dielectric constant, can cause variation in the amplitude and phase of a received electromagnetic wave. From Tatarski in Ref (A2-1), the power spectral densities of the amplitude and the phase is proportional to the -8/3 power of the frequency above cutoff. This assumes the Kolmogorov form of the turbulent flow. The nature of the fluctuations is different however for amplitude and phase; amplitude fluctuations being dominated by the microscale of the turbulence, and phase fluctuations being dominated by the macroscale of the turbulence.

According to Ames Research Center RFP, the atmospheric effects can be adequately modeled by assuming the amplitude effects of the form

$$A(t) = A_o(1 + x(t))$$

where x(t) is a Gaussian process of zero mean and a root variance of 0.23, low pass filtered with a cutoff of 2.0 Hertz and a $f^{-4/3}$ roll off (note herein the signal is a voltage term). Similarly, the phase effects could be modeled as

$$\theta(t) = \theta_o + \theta_1 t + \theta_2 t^2 + s(t)$$

where s(t) is a Gaussian process of zero mean and a root variance of 0.47, low pass filtered with a cutoff of 0.2 Hertz and a -4/3 roll off.

This note presents the digital form these filters will take.

2. Filter Form - In electrical engineering terms the transfer function of the filter is

$$F(s) = (a/(s+a))^{4/3},$$

where a is the cutoff frequency in radians, and s is $j\omega$.

By simple algebra, the corner is then

$$\omega/a = (2^{3/4} - 1)^{1/2} = .8257074727,$$

or for amplitude $a_x = 15.21891351$

and for phase $a_s = 1.521891351$.

The Laplace transform of the impulse response from Ref (A2-2), is

$$h(t) = [a^{4/3}/\Gamma(4/3)]t^{1/3}\exp(-at),$$

and $$\Gamma(4/3) = .892979511 .$$

For t of zero or infinity of course

$$h(t)\Big|_{\substack{t=0\\ t=\infty}} = 0$$

The function has a maxima at

$$dh(t)/dt \Big|_{t=\frac{1}{3a}} = 0$$

The impulse response is shown in Figure II-1.

3. Z Transform - The quickest computational form of a filter is generally the Z transform (Ref (A2-3)). This is just the Laplace transform with the substitution:

$$z = \exp(sT)$$

Utilizing the simplest interpolator, zero order hold, the discrete transform is

$$(1 - z^{-1})\ Z\ (\tfrac{1}{s}\ F(s)).$$

Since for the case in question

$$\mathcal{L}((a/(s+a))^{4/3}) = a^{4/3}\ \Gamma^{-1}(4/3)\ t^{-1/3}\ e^{-at}\ ,$$

then $$\mathcal{L}(\tfrac{1}{s}F(s)) = \int_0^t a^{4/3}\ \Gamma^{-1}\ (4/3)\ t^{-1/3}\ e^{-at}\ dt = f(t)$$

and by definition

$$Z(\tfrac{1}{s}F(s)) = \sum_{n=0}^{\infty} f(nt)z^{-n}$$

Thus

$$Z(\frac{1}{s}F(s))= \sum_{n=0}^{\infty} \{a^{4/3} \Gamma^{-1}(4/3) \int_0^t (nT)^{-1/3} e^{-ant} d(nT)\} z^{-n}$$

From Abramowitz and Stegun, Ref (A2-2), the above incomplete gamma function can be written as a Chi-Squared function, or

$$Z(\frac{1}{s}F(s)) = \sum_{n=0}^{\infty} \{P(2ant|\frac{8}{3})\} z^{-n} ,$$

Then the complete transform is

$$(1-z^{-1}) \; Z \; (\frac{1}{s}F(s))= (1-z^{-1})\{ \sum_{n=0}^{\infty} P(2anT|\frac{8}{3}) z^{-n}\}$$

$$= P(o|\frac{8}{3}) z^{-0} + P(2aT|\frac{8}{3}) z^{-1} + P(4aT|\frac{8}{3}) z^{-2} + \ldots$$

$$- P(2aT|\frac{8}{3}) z^{-2} - P(4aT|\frac{8}{3}) z^{-3} - \ldots$$

$$= 0 + P(2aT|\frac{8}{3}) z^{-1} + \{P(4aT|\frac{8}{3}) - P(2aT|\frac{8}{3})\} z^{-2}$$

$$+ \{P(6aT|\frac{8}{3}) - P(4aT|\frac{8}{3})\} z^{-3}$$

$$+ \ldots$$

The output ϕ for the input I is then

$$\phi = P(2aT|\frac{8}{3}) I((n-1)T) + \{P(4aT|\frac{8}{3}) - P(2aT|\frac{8}{3})\} I((n-2)T)$$

$$+ \{P(6aT \; \frac{8}{3}) - P(4aT|\frac{8}{3})\} I((n-3)T)$$

$$+ \ldots$$

Since there appears to be no more concise form, at least to the writer, in this case it appears that the Z transform is no better than a conventional delay line representation. Also, since the Chi-Squared function is evaluated as a series,

$$P(\chi^2|\upsilon) = \Gamma^{-1}(\upsilon/2) \sum_{n=0}^{\infty} \frac{(-1)^n (\chi^2/2)^{\frac{\upsilon}{2}+n}}{n! \; (\frac{\upsilon}{2}+n}$$

the conventional delay line representation appears preferable.

4. Delay Line - There are two design parameters which must be set when representing a filter as a tapped delay line: the tap spacing, T, and the line length, NT. The former describes the "graininess" of the impulse response, and effectively defines the highest frequency represented,

$$f_m = a/(2\gamma) = Kf_b/\gamma$$

Therein $T = \gamma/a$,

f_b is the corner frequency, and for the 4/3 filter

$$K = 3.804728378.$$

The latter describes the fold over aliasing, and effectively defines the lowest frequency (excluding zero) represented,

$$f_L = 1/(NT)$$

As a rule of thumb, the maximum tap contribution, Th(t), should be of the order of 0.1, or

$$T \simeq (0.1)3^{1/3}\,\Gamma(4/3)/(ae^{-1/3}) \simeq .179740828/a .$$

Similarly, the "length" should sum to 0.95 to 0.99, i.e., for the filter in question

$$P(2aNT|\tfrac{8}{3}) = a^{4/3}\,\Gamma^{-1}(4/3)\int_0^{\tau=2aNT} (\tfrac{\tau}{2a})^{1/3} e^{-\frac{\tau}{2}} \frac{1}{2a}\,d\tau,$$

where $\tau = nT = \tau/(2a)$.

The function is plotted in Figure II-2. From the figure it appears that a length 2aNT of 8 to 10 should be adequate, or for 10,

$$NT = (\chi^2 = 10)/2a = 5/a .$$

Figures II-3 and II-4 illustrate the amplitude and phase response of three delay lines: T = .1707/a, N = 32; T = .09/a, N = 64 and T = .09/a, N = 128. The magnitude of the error is shown in Figure II-5. The number of taps shown are integer powers of two for convenience in the fast Fourier transform. The rule of thumb filter, T = .17/a, N = 32 appears quite reasonable to an octave beyond the corner, after which the phase response falls off quickly. The second filter, T = .09/a, N = 64 is approximately the same length as the first, but with twice the resolution. This filter holds the correct phase response to two octaves beyond the corner. The third filter, T = .09/a, N = 128 has the same resolution as the second but has twice the length. It shows very little improvement over the second filter.

5. Conclusion - A model for turbulence effects on propagation has been reviewed, and a digital representation designed. The design is summarized in Figure II-6. The magnitude of the amplitude error is less than 1.5% over a decade of frequency beyond the corner.

Reference

A2-1 - V. I. Tatarski, "The Effects of Turbulent Atmosphere on Wave Propagation", NSF TT-68-50464, 1971.

A2-2 - C. Abramowitz and I. A. Stegun, "Handbook of Mathematical Functions", NBS App. Math Se. 55, Dec. 1965.

A2-3 - J. D. Markel, "Z Transform Applications Using Digital Computers", Engineering Technology, Dec. 1968.

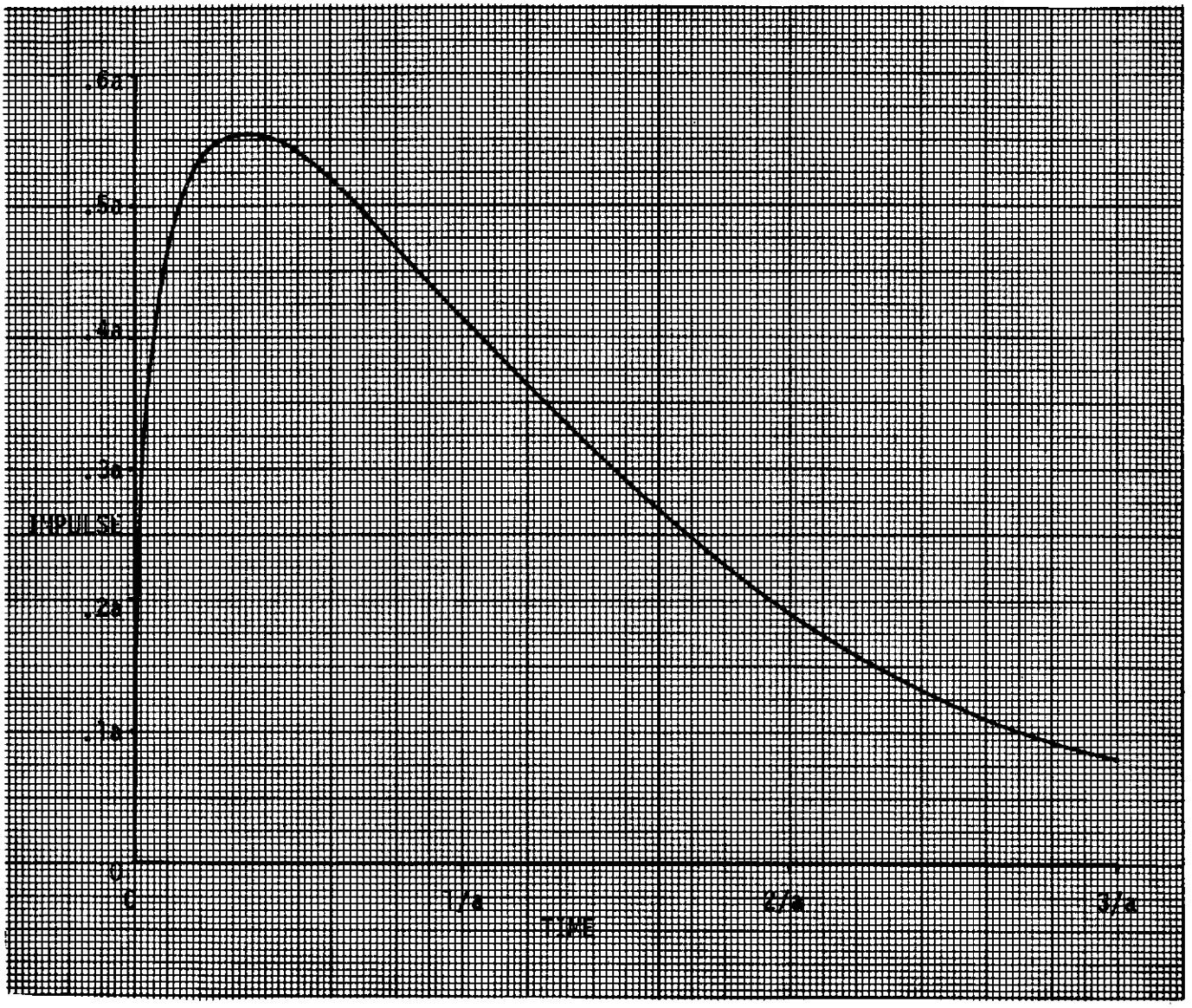


FIGURE II-1
IMPULSE RESPONSE
OF $(a/(s+a))^{4/3}$

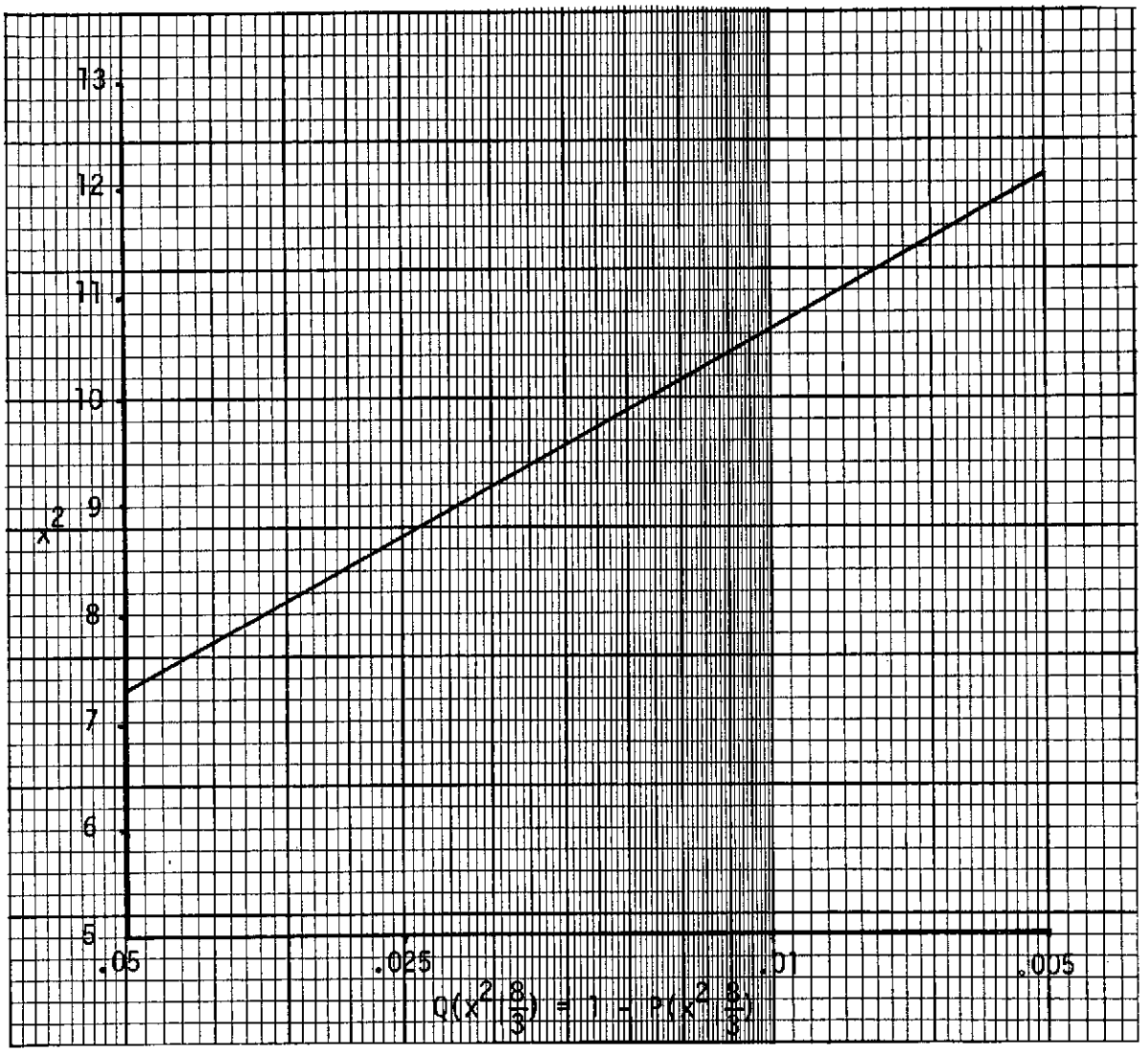


FIGURE II-2
LINE LENGTH APPROXIMATION

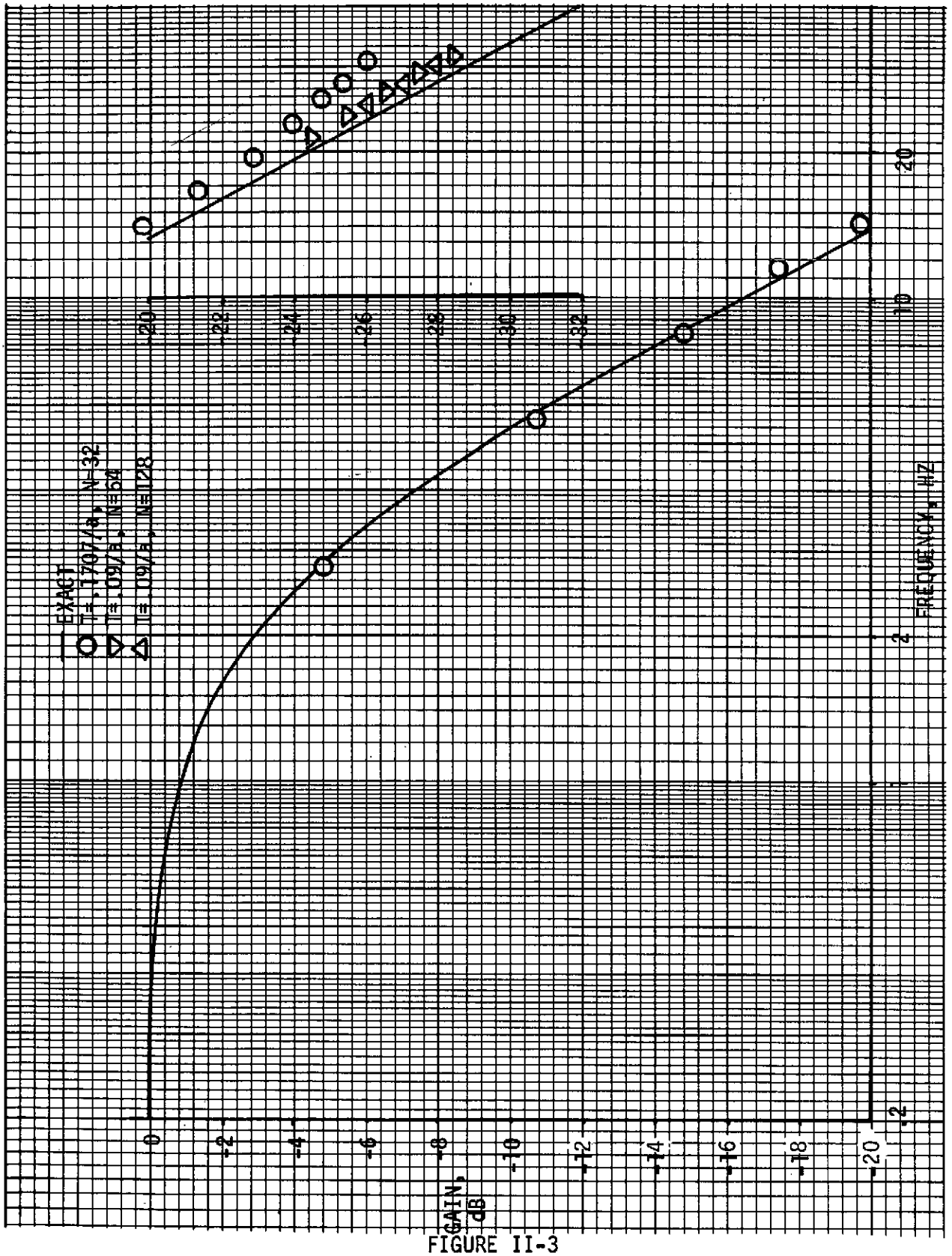


FIGURE II-3

AMPLITUDE RESPONSE

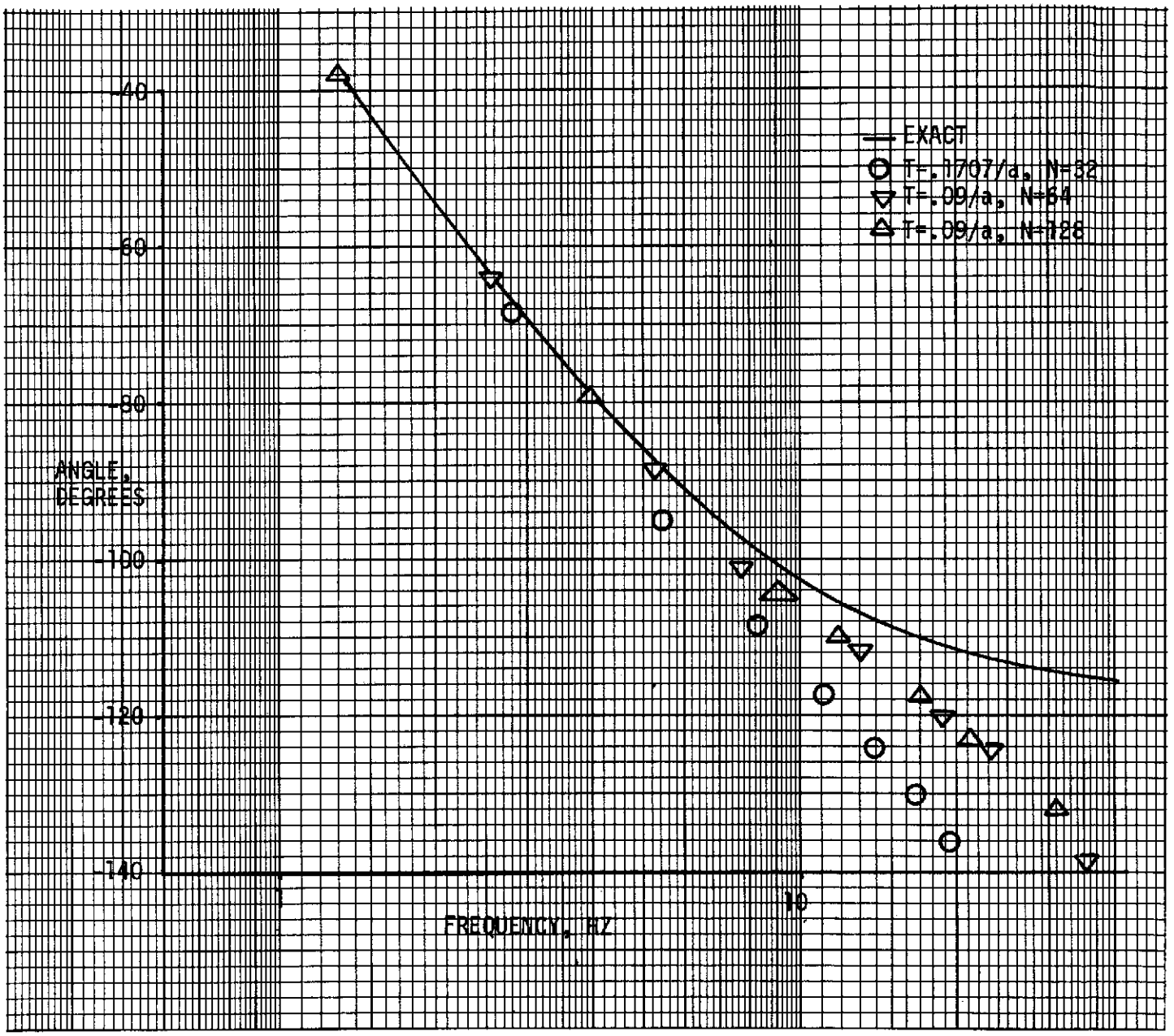


FIGURE II-4
PHASE RESPONSE

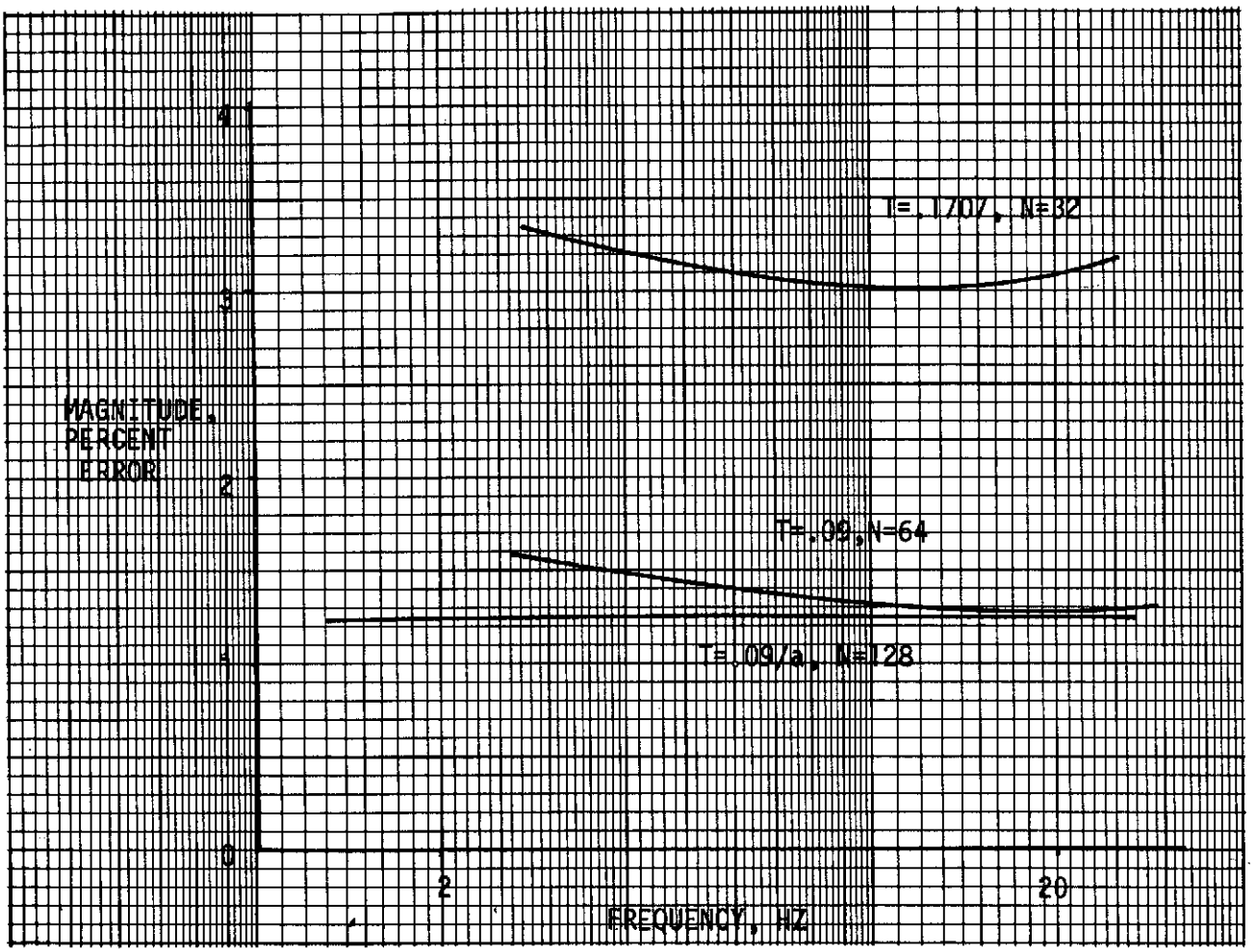
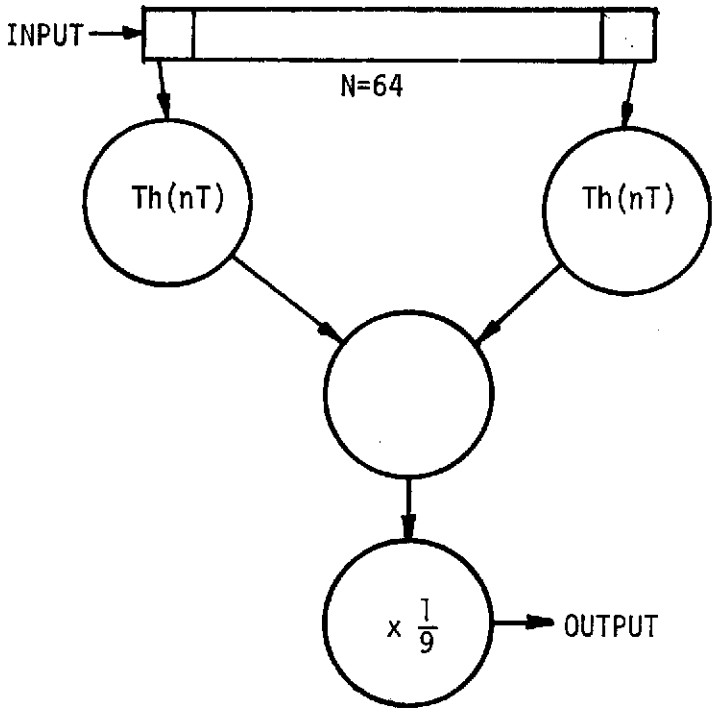


FIGURE II-5
TRUNCATION ERROR



$$Th(nT) = \gamma\Gamma^{-1}(4/3)(n\gamma)^{1/3} \exp(-n\gamma)$$

$$\gamma = .09$$

$$g = .9807$$

FIGURE II-6
TAPPED DELAY LINE FILTER

APPENDIX III

QUANTIZING STRATEGY FOR INPUTS TO VA DECODERS

1. A Viterbi Algorithm (VA) decoder can function with either hard or soft decisions on the input symbols. Typically, the use of 8 level soft decisions on the symbols permits the decoder to operate satisfactorily with ∿2dB less E_b/N_o than if hard decisions are employed. The normally used quantizing strategy results in quantization level spacings of about 0.5 to 0.7 times the standard deviation of the channel noise. This memo explores the derivation of a rationale for choosing the spacings based on the mean and variance of the received symbols. The selected spacings are found to vary between ∿0.58 and 0.64 for means between 1. and 2. sigmas.(3 to 9dB E_b/N_o). These results are equally applicable to a sequential decoder.

2. Theory of VA decoder operation

The VA decoder is a device which chooses the most likely state sequence of the encoded data from the set of possible state sequences. The formal statements of this principle are adequately covered in the published literature. The basic operating technique is to associate a path metric with each state sequence which allows the decoder to select the maximum likelyhood state sequence, based on a set of observations. The path metric, is formally defined as $-\ln \Pr\{\overline{X}|\overline{Z}\}$, where $\overline{X}$ is the set of observations, and $\overline{Z}$ is the state sequence. For a memorly less, binary symetric channel, with Gaussian noise statistics, the path metrics can be simply the sum of the observations, weighted by the expected observation, given the state sequence for the specific path metric. In simpler terms, if $M(=\pm 1)$ is the expected symbol at a given point in time, then $\Gamma_k(i) = \Gamma_k(i-1)-X_iM_i$, where $\Gamma_k(i)$ is the Kth path metric at time i. The state sequence with the smallest path metric is the maximum likelyhood state sequence.

Any two state sequences will have a number of expected symbols which have the same sense, and a number of expected symbols with the opposite sense. If one of these state sequences is the correct state sequence, then $D_{k,j}(i)=\Gamma_k(i)-\Gamma_j(i)$ will be less than zero unless $\sum_i X_iM_i<0$, where the set, i, includes only those observations where the state sequences differ in interpretation. For the correct path, $E\{X_iM_i\} = \eta_X$.

Clearly, if X is a normal random variable, then $\Delta_{K,J}(i)$ is also a normal random variable, with a mean $\eta_\Delta = N\eta_X$, and $\sigma_\Delta^2 = N\sigma_X^2$, where N is the number of observations contributing to the decision. Then, at any point, an error is committed only if $\Delta_{K,J}(i)>0$, which would occur with probability $Q(\eta_X\sqrt{N}/\sigma_X)$ given N pertinent observations. While this cannot be used to directly predict the decoder performance, it can be used to predict the degradation in performance when X is not normally distributed.

3. Quantization

When the symbols are quantized prior to decoding, the X's are no longer normally distributed, since they take only integer values, and finite range, linear quantization results in significant population groups in only a few values of X. Consider the quantization strategy shown in Figure III-1. We have arbitrarily assigned integer values to Z, the quantized estimate of X. If X is a normal random variable with mean η_X and unit variance, then the probability distribution of Z is given by,

$$\Pr\{Z = -7\} = Q(\eta_X+3a)$$
$$\Pr\{Z = -5\} = Q(\eta_X+2a)-Q(\eta_X+3a)$$
$$\Pr\{Z = -3\} = Q(\eta_X+a)-Q(\eta_X+2a)$$

$$\Pr\{Z = +5\} = Q(\eta_X-3a)-Q(\eta_X-2a)$$
$$\Pr\{Z = +7\} = 1-Q(\eta_X-3a)$$

where $Q(X) = \frac{1}{\sigma_X\sqrt{2\pi}} \int_X^\infty \exp-(t-\eta_X)^2/2\sigma_X^2 dt$ and "a" is the quantization level.

It is rather awkward to compute the probability that $\Delta>0$ directly, since the probability distribution of Δ is the result of N convolutions. A more useful approach is to use a Chernov bounds. In this case, we derive these bounds using the Laplace transform of the probability distribution of Z, proceeding as follows:

$$\phi_Z(S) = \sum_{J=1}^{8} \Pr\{Z = 2J-9\}e^{S(2J-9)}$$

Since convolution in normal space is simply a product in transform space, the transform of the probability distribution of Δ is,

$$\phi_\Delta(S) = [\phi_Z(S)]^N$$

Let $\Psi_\Delta(S) = \ln \phi_\Delta(S)$

$$\Psi_\Delta(S) = N\ln\left[\sum_{J=1}^{8} \Pr\{Z = 2J-9\}e^{S(2J-9)}\right]$$

$$\Psi_\Delta(S) = \frac{d\Psi_\Delta(S)}{dS} = \frac{N\sum_{J=1}^{8}(2J-9)\Pr\{Z=2J-9\}e^{S(2J-9)}}{\sum_{J=1}^{8}\Pr\{Z=2J-9\}e^{S(2J-9)}}$$

Now, the Chernov bound can be expressed,

$$\Pr\{\Delta>o\} \leq e^{\Psi\Delta(S)}\Big|_{\Psi_\Delta'(S)=0}$$

Thus, we need to solve for the value of S such that,

$$\sum_{J=1}^{8} (2J-9)\Pr\{Z=2J-9\}e^{S(2J-9)} = 0$$

This can be solved numerically, and a value for $\Pr\{\Delta>o\}$ found for any N. Note, however, that

$$\Pr\{\Delta>o\} \leq \left[e^{\Psi_Z(S)}\right]^N \Big|_{\Psi_Z'(S) = 0}$$

Thus, we need only solve for the case N=1, and find the value of "a" which minimized $\Pr\{\Delta>o\}\big|_{N=1}$. For the case $\eta_\chi = 2\sigma_\chi$, which is one of the conditions of interest, the variation of $\Pr\{\Delta>o\}$ with "a" is shown in Figure III-2. We can clearly see that varying "a" over rather broad limits does not change the probability value greatly, however, the optimum is clearly in the vicinity of $a = .62\sigma_\chi$. Figure III-3 illustrates the same information over a wider range of mean to standard deviation.

Now, we note that there is a hazard in using any bound to draw a conclusion of this nature, since varying the parameter "a" may result in variations in the relative tightness of the bound which could be on the order of the variations in the results. Thus, if our conclusions were at significant variance with emperical data, it would be necessary to use a more sophisticated approach to eliminate the uncertainty resulting from the use of bounds. However, the fact that the emperical data is in close agreement with the predicted results, and that the optimum is rather broad, suggests that the increased sophistication is unnecessary.

4. Conclusions

It has been shown that the criteria of minimizing the Chernov bounding value of $\Pr\{\Delta>o\}$ leads to a choice of quantization level of $\sim 0.6\sigma_\chi$, which is halfway between the emperically determined values of 0.5 to $0.7\sigma_\chi$.

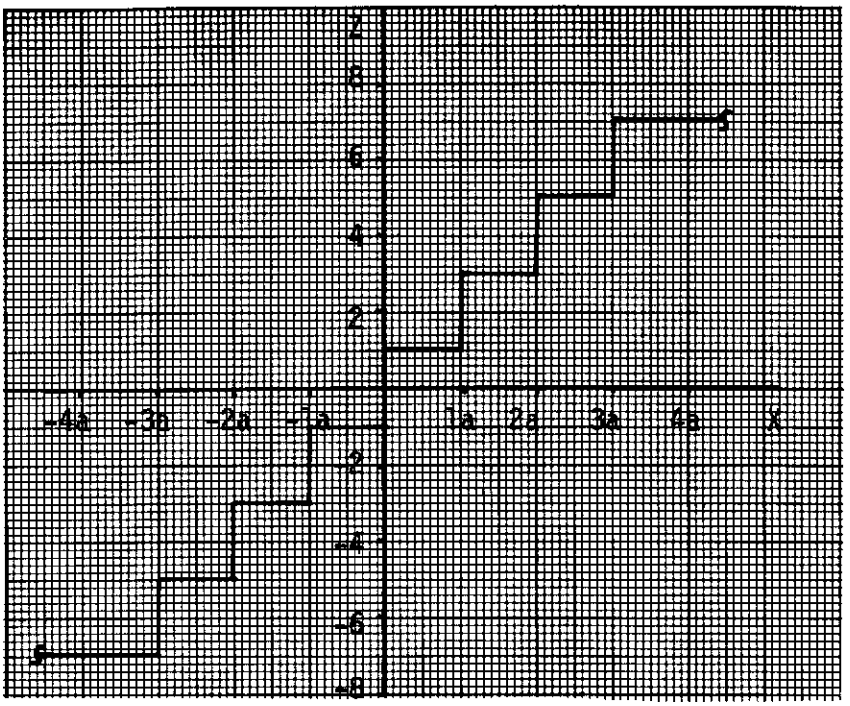


FIGURE III-1
QUANTIZATION SCHEME

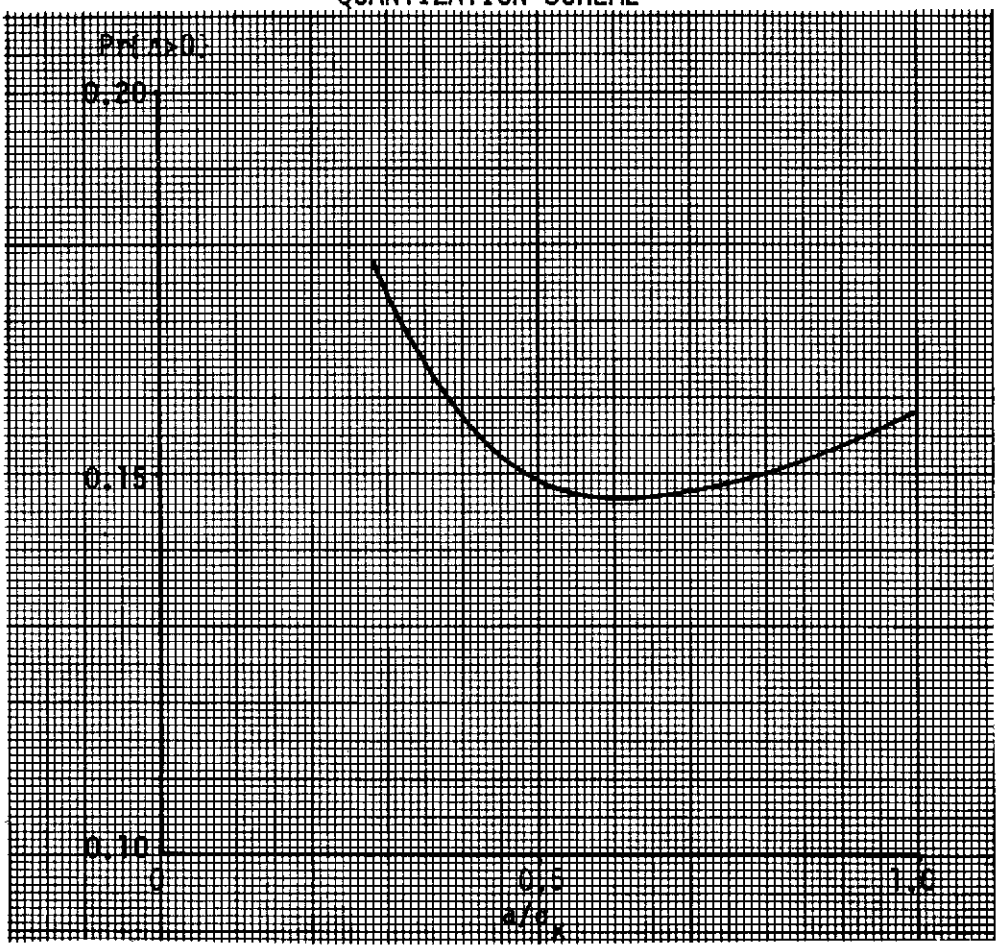


FIGURE III-2
BOUND ON Pr {Δ>0} VS QUANTIZATION LEVEL

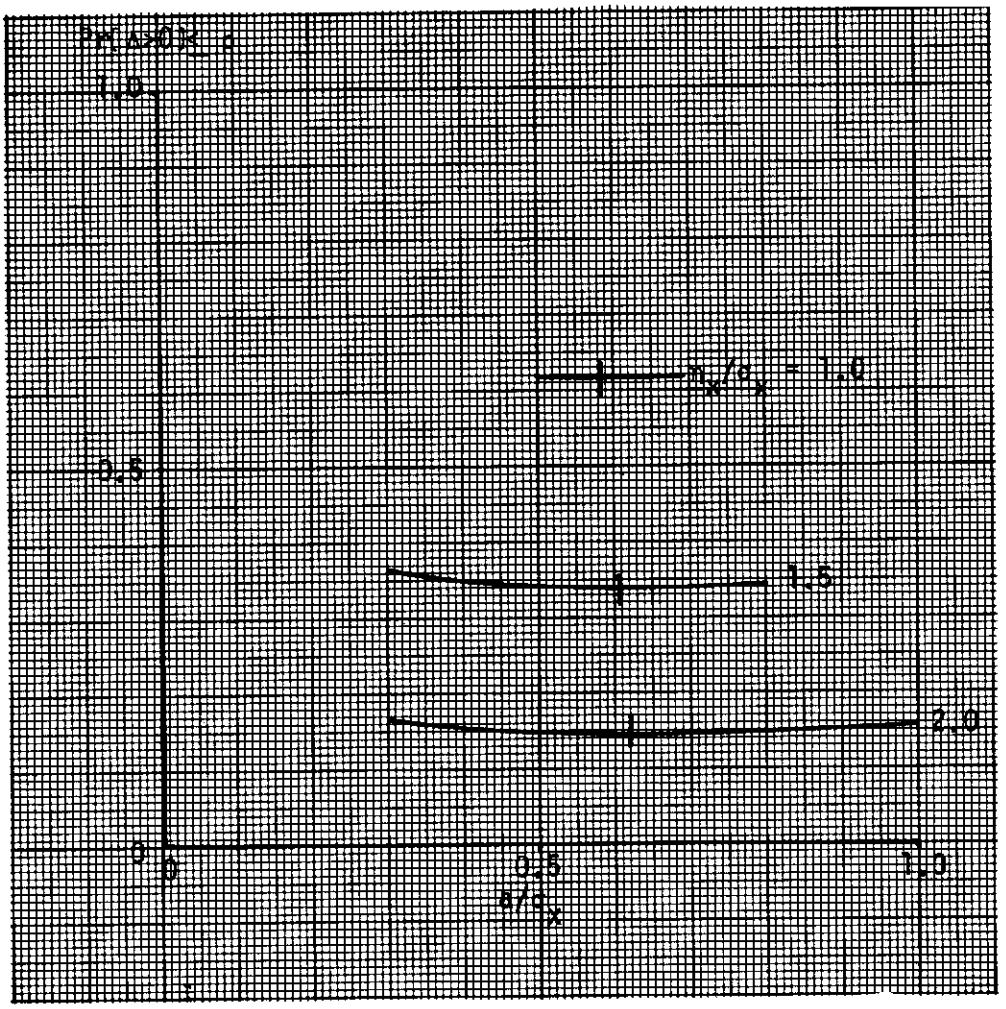


FIGURE III-3

EFFECT OF VARYING MEAN ON
CHOICE OF QUANTIZATION LEVEL

APPENDIX IV
LIST OF SYMBOLS
(Input Symbols)

ASOFT	Soft decision quantization reference
BIF	IF Bandwidth
BL2	2 B_{LO} (AFC)
DELF	Delta frequency
DYNR	Dynamic range of AGC below "minimum" signal
ENODB	Energy to noise density in decibels
FLO	LO detune
FQDPRT	Frequency Doppler rate
FRQDOP	Frequency Doppler
I1	Random generator number
I11	Random generator number
I2	Random generator number
I22	Random generator number
NSLICE	Phase of bit synchronizer sample data filter
SDAMP	Gam of amplitude scintillation
SDPHA	Gam of phase scintillation
SVRHZ	Sweep slope in Hertz
SWNM	Sweep minimum
SWMX	Sweep maximum
TL	Threshold

(All Symbols)

A	Signal voltage
AAMP	Normalized amplitude scintillation
ACOR	Scintillation normalization
ACQ	Number of true acquisitions
ACTH1	A cos (TH1)
AFAL	Number of false acquisitions
ADB	A dropped bit
ADOA	Average number of bits in a dropout
ADOS	Standard deviation of number of bits per dropout
AGC	AGC gain function
AK	AFC Loop gain
AKOU	KDATA at acquisition
AKBMIN	Bit synchronizer AK minimum
AMIN	Minimum A to AFC
AMIN2	AMIN/SQRT(2)
AMIN3	AMIN for dynamic range
AMISS	Number of missed acquisitions
APHA	Normalized phase scintillation
ASOFT	Soft decision quantization reference
ASOFTI	Soft decision quantization slope
ASTH1	Asin (TH1)
AVEES	Average ES
A5	Baseline connection filter gain
BAMP	Amplitude scintillation approximation intercept
BIF	IF Bandwidth
BL2	$2\ B_{LO}$ (AFC)
BL2B	$2\ B_{LO}$ (bit synchronizer)
BPER	Bit period
BPHA	Phase scintillation approximation intercept
BRATE	Bit rate
CAMP	Complex amplitude into BIF
CBINI	Hits in SBINSI

CBIN2	Hits in SBINS2
CBIN3	Hits in SBINS3
CBIN4	Hits in SBINS4
CB1	Bit synchronizer Z transform constant 1
CB2	Bit synchronizer Z transform constant 2
CB3	Bit synchronizer Z transform constant 3
CCL	Control function for scintillation subroutines
CCLT	Control function for TRIG subroutine
CCOUT	Output of last IF amplifier
CDTHX	Cos (DTHX)
CDTH1	Cos (DTH1)
CFILT	IF filter output
COUT	CCOUT
CSCIN	Cos (YP)
CTHX	Cos (THX)
CTH1	Cos (TH1)
CTH2	Cos (TH2)
C1	AFC filter Z Transform constant 1
C2	AFC filter Z transform constant 2
C3	AFC filter Z transform constant 3
C4	Normalized AFC VCO gain
C5	AGC Z transform constant 1
C5DP	Doppler Z transform constant 1
C5MH	Baseline Z transform constant 1
C5MS	Sampling Z transform constant 1 (word "sampling" is synonomous with word "slice" in computer listings)
C6	AGC Z transform constant 2
C6DP	Doppler Z transform constant 2
C6MH	Baseline Z transform constant 2
C6MS	Sampling Z transform constant 2
DELF	Delta frequency
DES	DT*SVR
DT	Delta time
DTHX	Delta THX
DTH1	Delta TH1

DYNR	Dynamic range of AGC below "minimum" signal
E	Voltage into AFC filter
EDOP	Doppler voltage
EDOPR	Doppler rate voltage
EDOPRX	Doppler plus Doppler rate voltage
ENO	Energy to noise density
ENODB	ENO in decibels
ENOM	Minimum ENO
ENOMIN	ENOM in decibels
ERR	Error count
ERRM	Error spacing matrix
ES	Sweep voltage
EV	Voltage from AFC filter
EVMAX	Maximum sweep voltage
EVMIN	Minimum sweep voltage
EVO	Last EV
EV1	Voltage after Doppler addition
EV1C	Voltage into bit synchronizer
EV1O	Last EV1
EV1OC	Last EV1C
EO	Last E
FBAMP	Amplitude scintillation filter corner
FBPHA	Phase scintillation filter corner
FDIFF	AFC pull in
FDIFFB	Bit synchronizer pull in
FIDO	Float (IDO)
FLO	LO detune
FQDPRT	Frequency Doppler rate
FRQDOP	Frequency Doppler
FVCOB	Frequency VCO bit synchronizer
GAM43	Scintillation filter tap spacing target
GAM43A	GAM43 for amplitude
GAM43P	GAM43 for phase
G1	First IF amplifier gain

G2	Second IF amplifier gain
I	Dummy index
IAMP	Amplitude scintillation counter
IAMPC	Phase scintillation counter
IBIT	Phase of bit synchronizer
IDATA	Current bit
IDATAO	Last IDATA
IDATAW	Last IDATAO
IDLBIT	Number of output bits before error count
IDO	Number of dropouts
IDON	IDO counter
IERRSP	Error space
IH	Histogram bin
IHOLD	In phase bit synchronizer level
IHOLD1	Last IHOLD
ILOC	Counter, bits to lock
ILOCF	Final ILOC
IMS	Hard decision from sampling filter
INIT	Control function for BIFILT subroutine
IPHA	Phase scintillation counter
IPHAC	Amplitude scintillation counter
IX	Bin of soft decision
IXM	Last IX
I1	Random generator number
I1S	I1 to start
I11	I1 for scintillation
I11S	I11 to start
I2	Random generator number
I2S	I2 to start
I22	I2 for scintillation
I22S	I22 to start
J	Counter for samples per bit
K	AFC VCO gain
KB	Bit synchronizer VCO gain

KDATA	Counter of IDATA
KOUNT	Counter of IMS
NACQ	Counter of NACQT trials
NACQT	Number of acquisition
NBIT	Phase of IBIT to dump in phase integrator
NBIT2	Phase of IBIT to dump quadraphase integrator
NC	Quadrature noise
NRUNS	Number of bits per run
NS	Quadrature noise
NSLICE	Phase of IBIT to sample data filter
NSPB	Number of samples per bit
NO	Noise density
N43	Number of scintillation filter taps
OMC	Baseband equivalent of IF in radians
PACQ	Probability of acquisition
PFAL	Probability of false acquisition
PE	Probability of error
PEAK	Peak voltage from sampling filter
PHIB	Steady state bit synchronizer phase error
PHIDEG	Steady state AFC phase error
PHISS	PHIB in radians
PHISSB	PHIDEG in radians
PI	Pi
PI2	2*Pi
PMISS	Probability of missed acquisition
PKAV	Average of IBIT when PEAK occurs
PKSD	Standard deviation of IBIT when PEAK occurs
QERR	Voltage to bit synchronizer filter
QERRO	Last QERR
QV	Voltage from bit synchronizer filter
SBINS1	Probability matrix for -1-1 input
SBINS2	Probability matrix for +1-1 input
SBINS3	Probability matrix for -1+1 input
SBINS4	Probability matrix for +1+1 input

SDAMP	Gain of amplitude scintillation
SDPHA	Gain of phase scintillation
SDTHX	Sin (DTHX)
SDTH0	Sin (DTH0)
SDTH1	Sin (DTH1)
SIG	Normalized noise
SKOU	Standard deviation of acquisition at KDATA
SLOA	Amplitude scintillation approximation slope
SLOP	Phase scintillation approximation slope
SLSIG	Standard deviation of sampling output
SLSUM	Mean of sampling output
SSCIN	Sin (YP)
STDEV	Standard deviation of measurement
STHX	Sin (THX)
STH1	Sin (TH1)
STH2	Sin (TH2)
SVR	Sweep slope
SVRHZ	SVR in hertz
SWMN	Sweep minimum
SWMX	Sweep maximum
TAUB1	Bit synchronizer filter constant 1
TAUB2	Bit synchronizer filter constant 2
TAU1	AFC filter constant 1
TAU2	AFC filter constant 2
TAU3	AGC filter constant
TAU4	Sample filter constant
TAU5	Baseline filter constant
TAU6	Doppler filter constant
TEMP	Temporary dummy
TH2	Phase angle from AFC VCO
TL	Threshold
TSYNC	Period of bit synchronizer VCO
U	Voltage into AGC filter
UMH	Voltage into baseline filter

V	Voltage from AGC filter
VD	Limited version of V
VDP	Voltage from doppler filter
VHIST	V histogram
VMH	Voltage from baseline filter
VMS	Voltage from sampling filter
VMSS	VMS at sampling time
VMSO	Last VMS
VSQRT	Square root of VD
WN	AFC loop natural frequency
WNB	Bit synchronizer natural frequency
X	Dummy
XI	In phase integrator voltage
XIBIT	Random starter for IBIT
XIO	Last XI
XIOO	Last XIO
XISIG	Standard deviation of in phase integrator
XISUM	Mean of in phase integrator
XQ	Quadraphase integrator voltage
XQO	Last XQ
YA	Scintillation amplitude
YP	Scintillation phase
ZETA	AFC damping factor
ZETAB	Bit synchronizer damping factor

APPENDIX V

ERROR RATE

COMPUTER SOFTWARE

```
                      PROGRAM CARL(INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT)
000003                COMPLEX CAMP(4),CFILT(4),COUT,CCOUT
000003                REAL NS,NC,N0,K,KB
000003                DIMENSION SBINS1(8,8),SBINS2(8,8),SBINS3(8,8),SBINS4(8,8
000003                DIMENSION ADB(100)
000003                DIMENSION F1(8),F2(8)
000003                DIMENSION ERRM(100)
000003                DATA FBAMP,FBPHA,SDAMP,SDPHA,N0/2.,.2,.23,.47,1./
000003                DATA GAM43,N43/.09,64/
000003                DATA ENODB,BRATE,ENOMIN/8.,88.,9./
000003                DATA DELF,NSPB,NRUNS,BIF/62.,40,10,1000./
000003                DATA BL2,PHIDEG,FDIFF/176.,10.,342.433/
000003                DATA BL2B,PHIB,FDIFFB/1.,10.,5./
000003                DATA I1,I2,I11,I22,NSLICE/1,1,1,1,24/
000003                DATA FRQDOP,FQDPRT,TL,AGC/0.,0.,-2.6,1./
000003                DATA TAU3,ASOFT/.07957,.2474/
000003                DATA TAU4,TAU5,TAU6,A5,FLO/.001808,.01808,.10603,.5,0./
000003                DATA SVRHZ,SWMX,SWMN/2.2E3,28.15E3,6.85E3/
000003                DATA IDLBIT/20/
000003                DATA DYNR/0./
000003                NAMELIST/IN1/NRUNS,NSPB,ENODB,DELF,BIF,ENOMIN
                     +,BL2,PHIDEG,FDIFF,BL2B,PHIB,FDIFFB
                     +,FBAMP,FBPHA,SDAMP,SDPHA,GAM43,N43,NSLICE
                     +,FLO,FRQDOP,FQDPRT,ASOFT,I1,I2,I11,I22
                     +,SVRHZ,SWMX,SWMN,TL,AGC
                     +,IBIT,TSYNC,IDLBIT,DYNR
                     +,TAU4
000003                PI=4.*ATAN(1.)
000007                PI2=2.*PI
000010                ZETA=SQRT(0.5)
000013                ZETAB=ZETA
000014                CCLT=0.
000015                CALL TRIG(CCLT,PI,SSCIN,CSCIN)
000020                CCLT=1.
000022          3     CONTINUE
                C     READ INPUTS
000022                READ(5,IN1)
000025                NSLICE=26
000026                CBIN1=0.
000027                CBIN2=0.
000030                CBIN3=0.
000031                CBIN4=0.
000032                ILOC=0
000033                ILOCF=-1
000034                IDO=0
000035                IDON=-1
000036                FLO=10.
000037                DYNR=3.
000041                I1=1
000042                I2=1
000043                I11=1
000044                I22=1
000045                FQDPRT=10.8
000046                NRUNS=2000
000047                TL=-6.5
000051                SVRHZ=0.
000052                ASOFT=.3
```

```
000053          IOLBIT=100
000054          ASOFTI=2./ASOFT
000056          DO 199 I=1,8
000060          DO 198 J=1,8
000061          SBINS1(I,J)=0.
000064          SBINS2(I,J)=0.
000066          SBINS3(I,J)=0.
000067          SBINS4(I,J)=0.
000071      198 CONTINUE
000073      199 CONTINUE
000075          IXM=0
000076          CALL RANDM(I1,I2,XIBIT)
000100          IBIT=INT(39.*XIBIT+1.)
              C     CONVERT INPUTS (ENO,BPER,PHISS,PHISSB)
000104          ENO=10.**(ENODB/10.)
000111          ENOM=10.**(ENOMIN/10.)
000117          BPER=1./BRATE
000121          DT=BPER/NSPB
000123          PHISS=PHIDEG*PI/180.
000126          PHISSB=PHIB*PI/180.
000130          AMIN=SQRT(ENOM*NO*BRATE)
000135          AMIN2=AMIN/1.4142
000137          AGC=SQRT(AMIN2)
000141          AMIN3=AMIN2/SQRT(10.**(DYNR/10.))
000152          A=SQRT(ENO*NO*BRATE)
              C     CALCULATE LOOP PARAMETERS (TAU1,TAU2,K,TAUB1,TAUB2,KB)
000157          WN=BL2/(ZETA+0.25/ZETA)
000162          AK=PI2*FDIFF/SIN(PHISS)
000167          TAU1=AK/(WN*WN)
000171          TAU2=2.*(ZETA-0.5/(WN*TAU1))/WN
000176          K=AK/AMIN
000200          EOOP=PI2*FRQOOP/K
000202          EOOPR=PI2*FOOPRT*DT/K
000205          EOOPRX=EOOP+EOOPR
000207          EVMAX=PI2*SWMX/K
000211          EVMIN=-PI2*SWMN/K
000213          SVR=PI2*SVRHZ/K
000215          WNB=BL2B/(ZETAB+0.25/ZETAB)
000220          AK=PI2*FDIFFB/SIN(PHISSB)
000225          TAUB1=AK/(WNB*WNB)
000227          TAUB2=2.*(ZETAB-0.5/(WNB*TAUB1))/WNB
000234          AKBMIN=PI2*(DELF/2.)/(K*1.4125)
000240          KB=AK/AKBMIN
              C     DEFINE CONSTANTS
000242          C1=1.-DT/TAU1
000245          C2=TAU2/TAU1
000246          C3=C1+C2-1.
000251          C4=DT*K
000253          C5=DT/TAU3
000255          C6=1.-C5
000256          DTH1=PI*DELF*DT
000261          SDTH0=SIN(DTH1)
000263          CDTH1=COS(DTH1)
000265          DTHX=PI2*FLO*DT
000267          SDTHX=SIN(DTHX)
000272          CDTHX=COS(DTHX)
000274          CB1=1.-BPER/TAUB1
000277          CB2=TAUB2/TAUB1
```

```
000300          C83=C81+C82-1.
000303          C5MS=DT/TAU4
000305          C6MS=1.-C5MS
000306          C5MH=DT/TAU5
000310          C6MH=1.-C5MH
000311          C5DP=DT/TAU6
000313          C6DP=1.-C5DP
000314          SIG=0.5*SQRT(N0/DT)
              C INITIALIZE LOOPS (TH2,E0,XI,XQ,QV,QERR0,ERR)
000321          SLSUM=0.
000322          SLSIG=0.
000323          XISUM=0.
000324          XISIG=0.
000325          NBIT=BPER/DT*.5
000330          NBIT2=NBIT/2
000331          TSYNC=BPER
000332          CAMP(1)=(0.,0.)
000335          CAMP(2)=(0.,0.)
000337          CAMP(3)=(0.,0.)
000342          CFILT(1)=(0.,0.)
000344          CFILT(2)=(0.,0.)
000347          CFILT(3)=(0.,0.)
000351          INIT=0
000352          OMC=PI*BIF
000354          IDATA=-1
000355          PRINT 201,ENODB,DELF,BIF,BL2,NSLICE,ASOFT
000375    201   FORMAT(1X,*ENODB=*,F6.1,* ,DELF=*,F6.1,* ,BIF=*,F6.0,
              +* ,BL2=*,F6.0,* ,NSLICE=*,I6,* ,ASOFT=*,F5.4)
000375          PRINT 202,SVRHZ,SWMX,SWMN,FLO,FRQDOP,FQDPRT
000415    202   FORMAT(1X,*SVRHZ=*,E12.4,* ,SWMX=*,E12.4,* ,SWMN=*,E12.4,
              +* ,FLO=*,E12.4,* ,FRQDOP=*,E12.4,* ,FQDPRT=*,E12.4)
000415          PRINT 203,TL,DYNR,SDAMP,SDPHA,I1,I2,I11,I22
000441    203   FORMAT(1X,*TL=*,F6.2,* ,DYNR=*,F6.1,
              +* ,SDAMP=*,F6.3,* ,SDPHA=*,F6.3,* ,I1,I2,I11,I22*,4I6)
000441          PRINT 204,WN,K,TAU1,TAU2,WNB,KB,TAUB1,TAUB2
000465    204   FORMAT(1X,*WN=*,F6.1,* ,K=*,F6.1,* ,TAU1=*,E12.4,* ,TAU2=*,E12.4
              +* ,WNB=*,F6.1,* ,KB=*,F6.1,* ,TAUB1=*,E12.4,* ,TAUB2=*,E12.4)
000465          IERRSP=0
000466          DO 220 I=1,100
000470          ADB(I)=0.
000471    220   ERRM(I)=0.
000474          U=0.
000475          EV0=0.
000476          TH2=0.
000477          CTH2=1.
000500          STH2=0.
000501          CTHX=1.
000502          STHX=0.
000503          E0=0.
000504          EV=0.
000505          XI=0.
000506          XQ=0.
000507          QV=0.
000510          QERR0=0.
000511          G1=1.
000512          G2=1.
000513          V=.1
000514          ES=0.
```

```
000515          SIH1=0.
000516          CTH1=1.
000517          DES=DT*SVR
000521          ERR=0.
000522          ERRDMP=0.
000523          KOUNT=-1
000524          IHOLD=0
000525          IHOLD1=0
000526          VMS=EV-EDOP
000530          EV10=VMS
000531          EV10C=VMS
000532          VMH=0.
000533          UMH=0.
000534          VDP=0.
000535          XIOC=0.
000536          XIO=0.
000537          J=NSPB
000540          PKAV=0.
000541          PKSD=0.
          C     TURBULENCE INITIALIZATION
000542          ACOR=SQRT(2.**.75-1.)
000551          AAMP=PI2*FBAMP/ACOR
000553          APHA=PI2*FBPHA/ACOR
000555          IAMP=INT(.5+GAM43/(AAMP*DT))
000561          IPHA=INT(.5+GAM43/(APHA*DT))
000564          GAM43A=DT*FLOAT(IAMP)*AAMP
000567          GAM43P=DT*FLOAT(IPHA)*APHA
000572          CCL=0.
000573          CALL BLOBA(N43,GAM43A,SDAMP,CCL,IAMP,SLOA,BAMP,I11,I22)
000604          CALL BLOBP(N43,GAM43P,SDPHA,CCL,IPHA,SLOP,BPHA,I11,I22)
000615          CCL=1.
000617          IAMPC=0
000620          IPHAC=0
          C     SELECT DATA (IDATA)
000621          KDATA=1
000622     4    CONTINUE
000622          IAMPC=IAMPC+1
000624          IPHAC=IPHAC+1
000625          IF(IAMPC.GT.IAMP) GO TO 10
000630     13   IF(IPHAC.GT.IPHA) GO TO 11
000634          GO TO 12
000634     10   IAMPC=1
000635          CALL BLOBA(N43,GAM43A,SDAMP,CCL,IAMP,SLOA,BAMP,I11,I22)
000646          GO TO 13
000647     11   IPHAC=1
000650          CALL BLOBP(N43,GAM43P,SDPHA,CCL,IPHA,SLOP,BPHA,I11,I22)
000661     12   CONTINUE
000661          YA=SLOA*FLOAT(IAMPC)+BAMP
000665          YP=SLOP*FLOAT(IPHAC)+BPHA
000670          CALL TRIG(CCLT,YP,SSCIN,CSCIN)
000673          IF(J.LT.NSPB)GO TO 1
000676          J=0
000676          IDATAW=IDATA
000700          IDATAJ=IDATA
000701          CALL DATAS(IDATA)
000702          SDTH1=SDTH0*IDATA
000705          IF(V.GT.TL)GO TO 1
000710          PKAV=PKAV+PEAK
```

```
000712          PKSD=PKSD+PEAK*PEAK
000714          PEAK=0.
000714          KDATA=KDATA+1
                C       DEFINE INPUTS (TH1,NS,NC)
000716        1 CONTINUE
000716          TEMP=STHX*CDTHX+CTHX*SDTHX
000722          CTHX=CTHX*CDTHX-STHX*SDTHX
000724          STHX=TEMP
000725          TEMP=STH1*CDTH1+CTH1*SDTH1
000731          CTH1=CTH1*CDTH1-STH1*SDTH1
000733          STH1=TEMP
000734          ASTH1=1.+142*A*(1.+YA)*(STH1*CSCIN+CTH1*SSCIN)
000744          ACTH1=1.+142*A*(1.+YA)*(CTH1*CSCIN-STH1*SSCIN)
000754          CALL NRANDM(I1,I2,X)
000756          NC=X*SIG
000760          CALL NRANDM(I1,I2,X)
000763          NS=X*SIG
000765          IBIT=IBIT+1
000767          J=J+1
                C       LOOP EQUATIONS
000770          CAMP(4)=CMPLX(ASTH1+NC,-ACTH1-NS)*CMPLX(CTH2,-STH2)*G1
001007          CALL B1FILT(CAMP,CFILT,CMC,DT,INIT)
001012          CCOUT=G2*CFILT(4)
001020          COUT=CCOUT
001022          V=C6*V+C5*U
                C       AGC
001026          VD=V
001027          IF(ABS(VD).LT.AMIN3)VD=AMIN3
001033          IF(VD.NE.0.)CALL ASQRTF(VD,VSQRT)
001036          G1=AGC/VSQRT
001040          G2=G1
001041          U=AIMAG(COUT)*CTHX-REAL(COUT)*STHX
                C       AFC
001046          E=REAL(COUT)*CTHX+AIMAG(COUT)*STHX+ES
001053          EV=C1*EV+G2*E-C3*EB
001061          EV1=EV0-EDOPPX
001063          IF(EV.GT.EVMAX)DES=-DES
001066          IF(EV.LT.EVMIN)DES=-DES
001072          EDOPRX=EDOPRX+EDOPR
001074          TH2=TH2+C4*EV1
001077          TH2=AMOD(TH2,PI2)
001102          CALL TRIG(CCLT,TH2,STH2,CTH2)
001105          VMSO=VMS
001107          VMS=C6MS*VMS+C5MS*EV1OC
001112          IF(ABS(VMS).GT.ABS(VMSO))PEAK=FLOAT(IBIT)
001120          VDP=C6DP*VDP+C5DP*EV1O
001124          EV1C=EV1-VMH-VDP
001127          XI=XI+EV1C
001130          XQ=XQ+EV1C
001132          EVO=EV
001133          EO=E
001134          EV1O=EV1
001135          IF(V.GT.TL)ES=ES+DES
001142          EV1OC=EV1C
                C       BIT SYNC TIMING
001144          IF(IBIT.NE.NSLICE)GOTO81
001146          IMS=-1
001147          IF(VMS.GT.0.)IMS=1
```

```
001151          VMSS=VMS
001152     81   CONTINUE
001152          IF(IBIT.NE.NBIT2)GO TO 2
001154          XQ0=XQ/FLOAT(NBIT)
001157          XQ=0.
001157        2 IF(IBIT.LT.NBIT)GO TO 4
001162          IF(KOUNT.LT.IDLBIT)GOTO91
001164          XISUM=XISUM+ABS(XI)
001167          XISIG=XISIG+XI*XI
001171     91   CONTINUE
001171          IHOLD1=IHOLD
001173          IHOLD=-1
001174          IF(XI.GT.0.)IHOLD=1
001176          XIOO=XIO
001200          XIO=XI/FLOAT(NBIT)
001202          VMH=(C6MH*VMH+C5MH*UMH)*A5
001206          UMH=0.
001206          IF(IHOLD.NE.IHOLD1) UMH=XIOO+XIO
001212          XI=0.
001213          QERR=XQ0*((IHOLD-IHOLD1)/2)
001217          QV=C81*QV+CB2*QERR-CB3*QERR0
001224          QERR0=QERR
001225          IBIT=0
001226          FVCOB=BRATE+KB*QV
001231          TSYNC=TSYNC-NBIT*DT+1./FVCOB
001236          NBIT=TSYNC/DT+.5
001241          NBIT2=NBIT/2
001243          IF(V.GT.TL)GO     TO 95
001246          ILOCF=ILOC
001247     402  CONTINUE
001247          KOUNT=KOUNT+1
001251          IF(KOUNT.LT.IDLBIT)GOTO93
001253          IF(IMS.NE.IDATA0)ERR=ERR+1.
001257          IF(IHOLD.NE.IDATA0)ERRDMP=ERRDMP+1.
          C     ERROR SPACING
001263          IF(IMS.EQ.IDATA0)GOTO221
001264          IF(IERRSP.LT.1)IERRSP=1
001270          IF(IERRSP.GT.100)IERRSP=100
001273          ERRM(IERRSP)=ERRM(IERRSP)+1.
001276          IERRSP=0
001276          GOTO222
001277     221  IERRSP=IERRSP+1
001301     222  CONTINUE
001301          SLSUM=SLSUM+ABS(VMSS)
001304          SLSIG=SLSIG+VMSS*VMSS
          C     SOFT DECISION
001306          IX=INT(ASOFTI*VMSS+4.)+1
001312          IF(IX.GT.8)IX=8
001315          IF(IX.LT.1)IX=1
001320          IF(IXM.EQ.0)GOTO96
001321          IF(IDATAW.EQ.-1.AND.IDATA0.EQ.-1)SBINS1(IX,IXM)=SBINS1(IX,IXM)+1
001334          IF(IDATAW.EQ.-1.AND.IDATA0.EQ.-1)CBIN1=CBIN1+1.
001345          IF(IDATAW.EQ.-1.AND.IDATA0.EQ.+1)SBINS2(IX,IXM)=SBINS2(IX,IXM)+1
001360          IF(IDATAW.EQ.-1.AND.IDATA0.EQ.+1)CBIN2=CBIN2+1.
001371          IF(IDATAW.EQ.+1.AND.IDATA0.EQ.-1)SBINS3(IX,IXM)=SBINS3(IX,IXM)+1
001404          IF(IDATAW.EQ.+1.AND.IDATA0.EQ.-1)CBIN3=CBIN3+1.
001415          IF(IDATAW.EQ.+1.AND.IDATA0.EQ.+1)SBINS4(IX,IXM)=SBINS4(IX,IXM)+1
001427          IF(IDATAW.EQ.+1.AND.IDATA0.EQ.+1)CBIN4=CBIN4+1.
```

```
001437     96   CONTINUE
001437          IXM=IX
001441          GOTO93
001441     95   CONTINUE
          C     LOCK/UNLOCK
001441          IF(ILOCF.EQ.ILOC)GOTO400
001443          ILOC=ILOC+1
001444          IF(ILOC.GT.NRUNS)GOTO408
001447          GOTO93
001447     400  IF(IDO.EQ.IDON)GOTO401
001451          IDO=IDO+1
001452          IF(IDO.GT.100)GOTO402
001455          IDON=IDO
001455          ADB(IDON)=0.
001456     401  ADB(IDON)=ADB(IDON)+1.
001461          GOTO402
001461     408  PRINT 409
001465     409  FORMAT(1X,*ACQUISITION FAILURE*)
001465          GOTO410
001466     93   CONTINUE
001466          IF(KOUNT.LT.NRUNS)GO TO 4
          C     ERROR RATE CALCULATION
001471     92   CONTINUE
001471          PE=ERR/(KOUNT-IDLBIT)
001475          STDEV=SQRT(PE*(1.-PE)/(KOUNT-IDLBIT))
001505          SLSUM=SLSUM/(KOUNT-IDLBIT)
001511          SLSIG=SQRT(SLSIG/(KOUNT-IDLBIT)-SLSUM*SLSUM)
001517          KKK=KOUNT-IDLBIT
001521          PRINT 301,PE,STDEV,SLSUM,SLSIG,KKK
001536     301  FORMAT(1X,*PE=*,E12.4,* ,STDEV=*,E12.4,* ,V MEAN=*,E12.4,
                +* V STD DEV=*,E12.4,* ,BITS=*,I6)
001536          PEI=ERRDMP/(KOUNT-IDLBIT)
001542          SPEI=SQRT(PEI*(1.-PEI)/(KOUNT-IDLBIT))
001552          XISUM=XISUM/(KOUNT-IDLBIT)
001556          XISIG=SQRT(XISIG/(KOUNT-IDLBIT)-XISUM*XISUM)
001564          PRINT 411,PEI,SPEI,XISUM,XISIG,KKK
001601     411  FORMAT(1X,*PEI=*,E12.4,* ,STDEV=*,E12.4,* ,I MEAN=*,E12.4,
                +* I STD DEV=*,E12.4,* ,BITS=*,E12.4)
001601          ADOA=0.
001602          ADOS=0.
001603          IF(IDO.EQ.0)GOTO405
001604          DO 403 I=1,IDO
001605          ADOA=ADOA+ADB(I)
001607     403  ADOS=ADOS+ADB(I)*ADB(I)
001614          FIDO=FLOAT(IDO)
001615          ADOA=ADOA/FIDO
001616          ADOS=SQRT(ADOS/FIDO-ADOA*ADOA)
001623          PRINT 404,ILOCF,IDO,ADOA,ADOS
001636     404  FORMAT(1X,*LOCKIN=*,I6,* ,DROPOUTS=*,I6,* ,AVE=*,E12.4,
                +* ,STD DEV=*,E12.4)
001636          GOTO406
001637     405  PRINT 407,ILOCF
001645     407  FORMAT(1X,*LOCKIN=*,I6,* ,DROPOUTS=0*)
001645     406  CONTINUE
001645          PRINT 223,ERRM
001653     223  FORMAT(1X,*ERRM*,/,10(1X,10E12.4,/))
001653          PRINT 313,CBIN1,CBIN2
001663     313  FORMAT(1X,*-1,-1 P(B/A)TIMES*,F6.0,37X,*-1,+1 P(B/A)TIMES*,F5.0)
```

```
001663          DO 314 I=1,8
001665          DO 315 J=1,8
001666          F1(J)=SBINS1(I,J)
001672      315 F2(J)=SBINS2(I,J)
001676      314 PRINT 316,F1,F2
001710      316 FORMAT(1X,8F6.0,6X,8F6.0)
001710          PRINT 317,CBIN3,CBIN4
001720      317 FORMAT(1X,*+1,-1 P(B/A)TIMES*,F6.0,37X,*+1,+1 P(B/A)TIMES*,F6.0)
001720          DO 318 I=1,8
001722          DO 319 J=1,8
001723          F1(J)=SBINS3(I,J)
001727      319 F2(J)=SBINS4(I,J)
001733      318 PRINT 316,F1,F2
001745          PRINT 304,I1,I2,I11,I22
001761      304 FORMAT(1X,*I1,I2,I11,I22*,4I6)
001761          PKAV=PKAV/KDATA
001763          PKSD=SQRT(PKSD/KDATA-PKAV*PKAV)
001771          PRINT 305,PKAV,PKSD
002000      305 FORMAT(1X,*REC SLICE=*,E12.4,* ,STD DEV=*,E12.4)
002000      410 CONTINUE
002000      307 PRINT 104
002004      104 FORMAT(1H1,////)
002004          GO TO 3
002005          END
```

```
                SUBROUTINE NRANDM(IYN,IZN,RDMN)
000006          RDMN=-6.
000007          DO 1 N=1,12
000010          CALL RANDM(IYN,IZN,RDM)
000011        1 RDMN=RDMN+RDM
000017          RETURN
000017          END
```

```
                SUBROUTINE RANDM(IYN,IZN,RDM)
000006          DATA IA,IB/129,1/
000006          DATA T,IRT/4194304.,2048/
000006          IYN=IA*IYN+(IB+IA*IZN)/IRT
000014          IYN=MOD(IYN,IRT)
000020          IZN=MOD((IB+IA*IZN),IRT)
000026          RDM=FLOAT(IYN*IRT+IZN)/T
000031          RETURN
000032          END
```

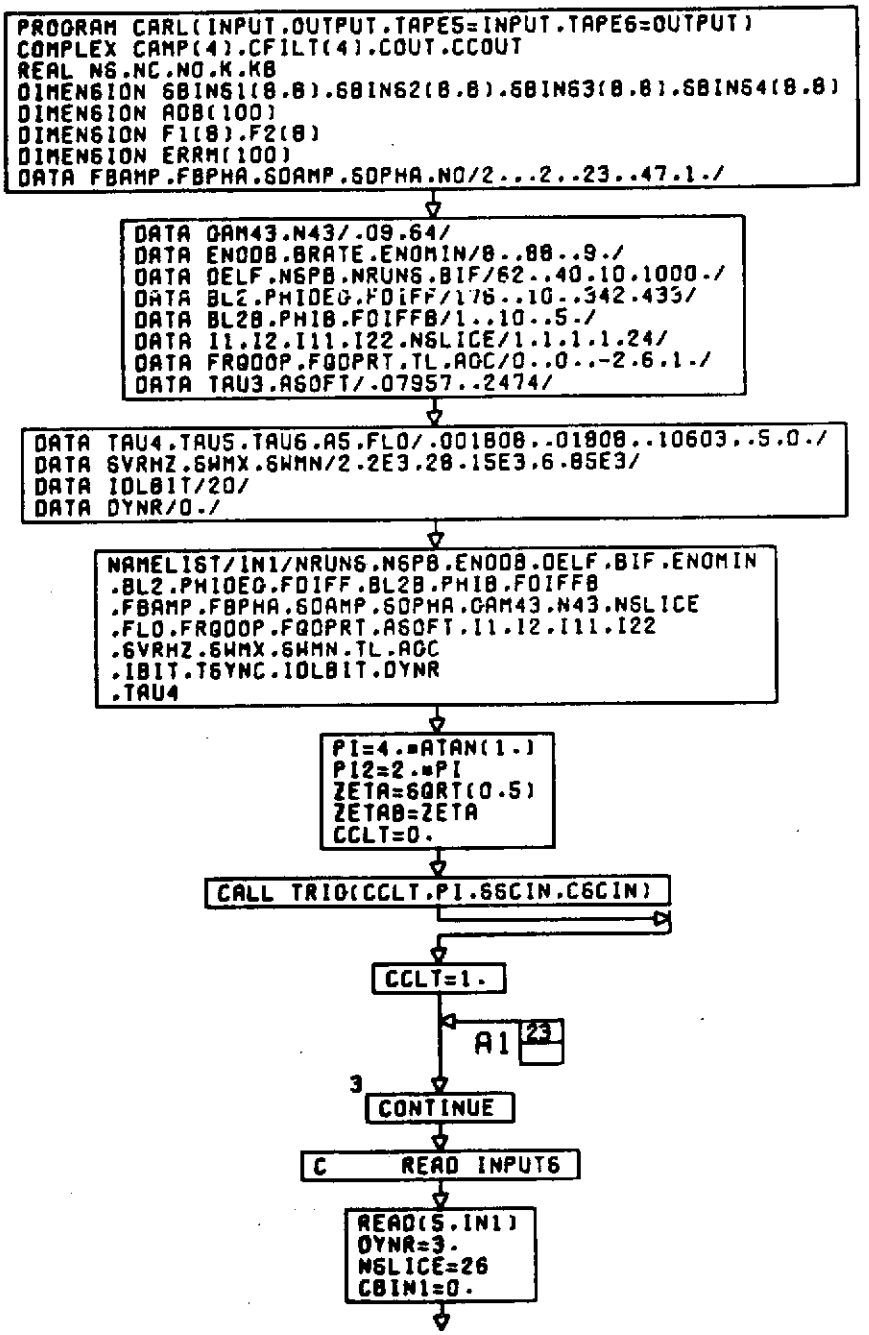
```
                SUBROUTINE B1FILT(X,Y,OMC,T,INIT)
          C     INPUT INTO X(4), OUTPUT FROM Y(4), INIT=0 FOR NEW OMC OR T
          C     FIRST ORDER INTERPOLATION
000010          COMPLEX X(4),Y(4)
000010          IF(INIT.NE.0)GO TO 1
000011          INIT=1
000011          OMT=OMC*T
000012          B1=((OMT+8.)*OMT/24.+1.)*OMT+1.
000020          B2=(((11.*OMT/24.+1.)*OMT-1.)*OMT-3.)/B1
000027          B3=(((11.*OMT/24.-1.)*OMT-1.)*OMT+3.)/B1
000035          B4=(((OMT-8.)*OMT/24.+1.)*OMT-1.)/B1
000044          A1=OMT*OMT*OMT/(24.*B1)
000046          A2=11.*A1
          C     OUTPUT OMT,A1,A2,B1,B2,B3,B4
000050        1 Y(4)=A1*(X(4)+X(1))+A2*(X(3)+X(2))-B2*Y(3)-B3*Y(2)-B4*Y(1)
000125          DO 2 I=1,3
000126          X(I)=X(I+1)
000134        2 Y(I)=Y(I+1)
000144          RETURN
000144          END
```

```
                SUBROUTINE BLOBA(N,GAM,VAL,CCL,IL,S,B,IYN,IZN)
000014          DIMENSION TG(128),RC(128)
000014          DATA G43/.892979511/
000014          IF(VAL.EQ.0.) GO TO 30
000015          IF(CCL.EQ.1.) GO TO 10
000017          EX=1./3.
000020          YN=0.
000020          S2=0.
000022          DO 11 I=1,N
000023          V=FLOAT(I-1)*GAM
000025          TG(I)=GAM/G43*V**EX*EXP(-V)
000043          S2=S2+TG(I)*TG(I)
000046          CALL NRANDM(IYN,IZN,RC(I))
000052    11    YN=YN+TG(I)*RC(I)
000064          S22=SQRT(S2)
000066          YN=YN/S22*VAL
000074          GO TO 20
000075    10    YT=YT
000077    20    NN=N-1
000101          DO 12 J=1,NN
000102    12    RC(N+1-J)=RC(N-J)
000111          CALL NRANDM(IYN,IZN,RC(1))
000115          YT=0.
000116          DO 13 JJ=1,N
000123    13    YT=YT+TG(JJ)*RC(JJ)
000130          YT=YT/S22*VAL
000132          FILM=FLOAT(IL-1)
000133          S=(YT-YN)/FILM
000136          B=-S*FLOAT(IL)+YT
000142          GO TO 31
000142    30    S=0.
000143          B=0.
000144    31    RETURN
000145          END
```

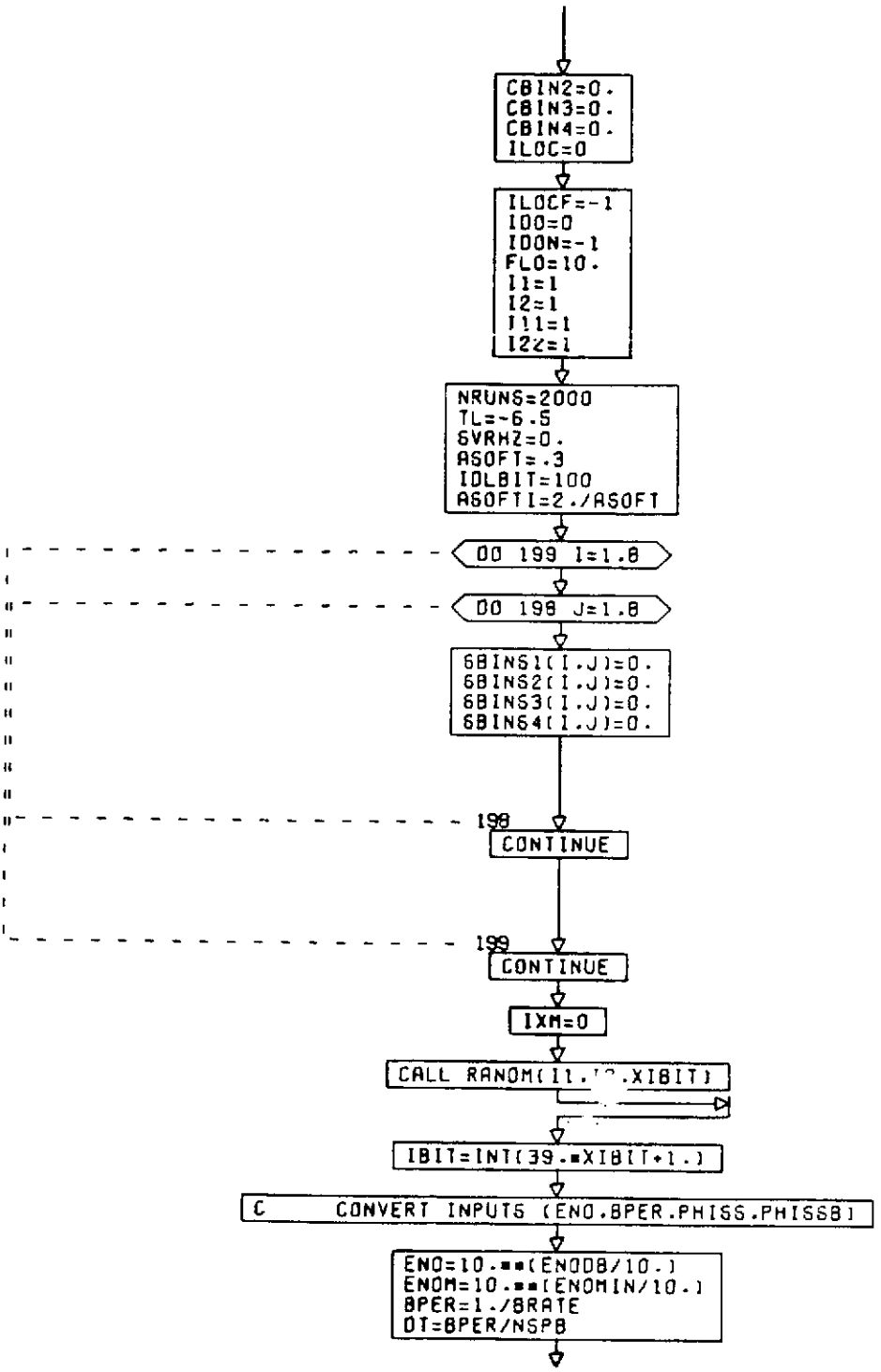
```
                SUBROUTINE BLOBP(N,GAM,VAL,CCL,IL,S,B,IYN,IZN)
000014          DIMENSION TG(128),RC(128)
000014          DATA G43/.892979511/
000014          IF(VAL.EQ.0.) GO TO 30
000015          IF(CCL.EQ.1.) GO TO 10
000017          EX=1./3.
000020          YN=0.
000020          S2=0.
000022          DO 11 I=1,N
000023          V=FLOAT(I-1)*GAM
000025          TG(I)=GAM/G43*V**EX*EXP(-V)
000043          S2=S2+TG(I)*TG(I)
000046          CALL NRANDM(IYN,IZN,RC(I))
000052    11    YN=YN+TG(I)*RC(I)
000064          S22=SQRT(S2)
000066          YN=YN/S22*VAL
000074          GO TO 20
000075    10    YN=YT
000077    20    NN=N-1
000101          DO 12 J=1,NN
000102    12    RC(N+1-J)=RC(N-J)
000111          CALL NRANDM(IYN,IZN,RC(1))
000115          YT=0.
000116          DO 13 JJ=1,N
000123    13    YT=YT+TG(JJ)*RC(JJ)
000130          YT=YT/S22*VAL
000132          FILM=FLOAT(IL-1)
000133          S=(YT-YN)/FILM
000136          B=-S*FLOAT(IL)+YT
000142          GO TO 31
000142    30    S=0.
000143          B=0.
000144    31    RETURN
000145          END


                SUBROUTINE TRIG(CCLT,ANGR,S,C)
000007          DIMENSION SINE(91)
000007          DR=.0174532925
000010          IF(CCLT.EQ.1.) GO TO 10
000012          NT=91
000013          DO 9 I=1,NT
000014    9     SINE(I)=SIN(FLOAT(I-1)*DR)
000027    10    IR=INT(ANGR/DR+.5)
000032          IM=ABS(ANGR/DR+.5)
000036          IF(IM.GT.270) GO TO 4
000042          IF(IM.GT.180) GO TO 3
000045          IF(IM.GT.90) GO TO 2
000050          S=SINE(IM+1)
000051          C=SINE(-IM+90+1)
000053          GO TO 30
000053    2     S=SINE(-IM+180+1)
000055          C=-SINE(IM-90+1)
000057          GO TO 30
000057    3     S=-SINE(IM-180+1)
000061          C=-SINE(-IM+270+1)
000063          GO TO 30
000063    4     S=-SINE(-IM+360+1)
000065          C=SINE(IM-270+1)
000067    30    IF(IR.LT.0) S=-S
000072          RETURN
000073          END
```

```
                      SUBROUTINE ASQRTF(XU,S)
000005                X=ABS(XU)
000006                IF(X.GT.128.) GO TO 1
000012                IF(X.GT.64.) GO TO 2
000015                IF(X.GT.32.) GO TO 3
000020                IF(X.GT.16.) GO TO 4
000023                IF(X.GT.8.) GO TO 5
000026                IF(X.GT.4.) GO TO 6
000031                IF(X.GT.2.) GO TO 7
000034                IF(X.GT.1.) GO TO 8
000037                IF(X.GT..5)GO TO 9
000042                IF(X.GT..25)GO TO 10
000045                IF(X.GT..125)GO TO 11
000050                S=.3535
000051                RETURN
000051          1     S=11.3137
000052                RETURN
000053          2     S=.0517.*(X-128.)+11.3137
000057                RETURN
000057          3     S=.07322*(X-64.)+8.
000063                RETURN
000063          4     S=.10355*(X-32.)+5.6568
000067                RETURN
000067          5     S=.14644*(X-16.)+4.
000073                RETURN
000073          6     S=.2071*(X-8.)+2.8284
000077                RETURN
000077          7     S=.2928*(X-4.)+2.
000103                RETURN
000103          8     S=.4142*(X-2.)+1.4142
000107                RETURN
000107          9     S=.5857*(X-1.)+1.
000112                RETURN
000113          10    S=.6284*(X-.5)+.7071
000117                RETURN
000117          11    S=1.17157*(X-.25)+.5
000123                RETURN
000123                END
```

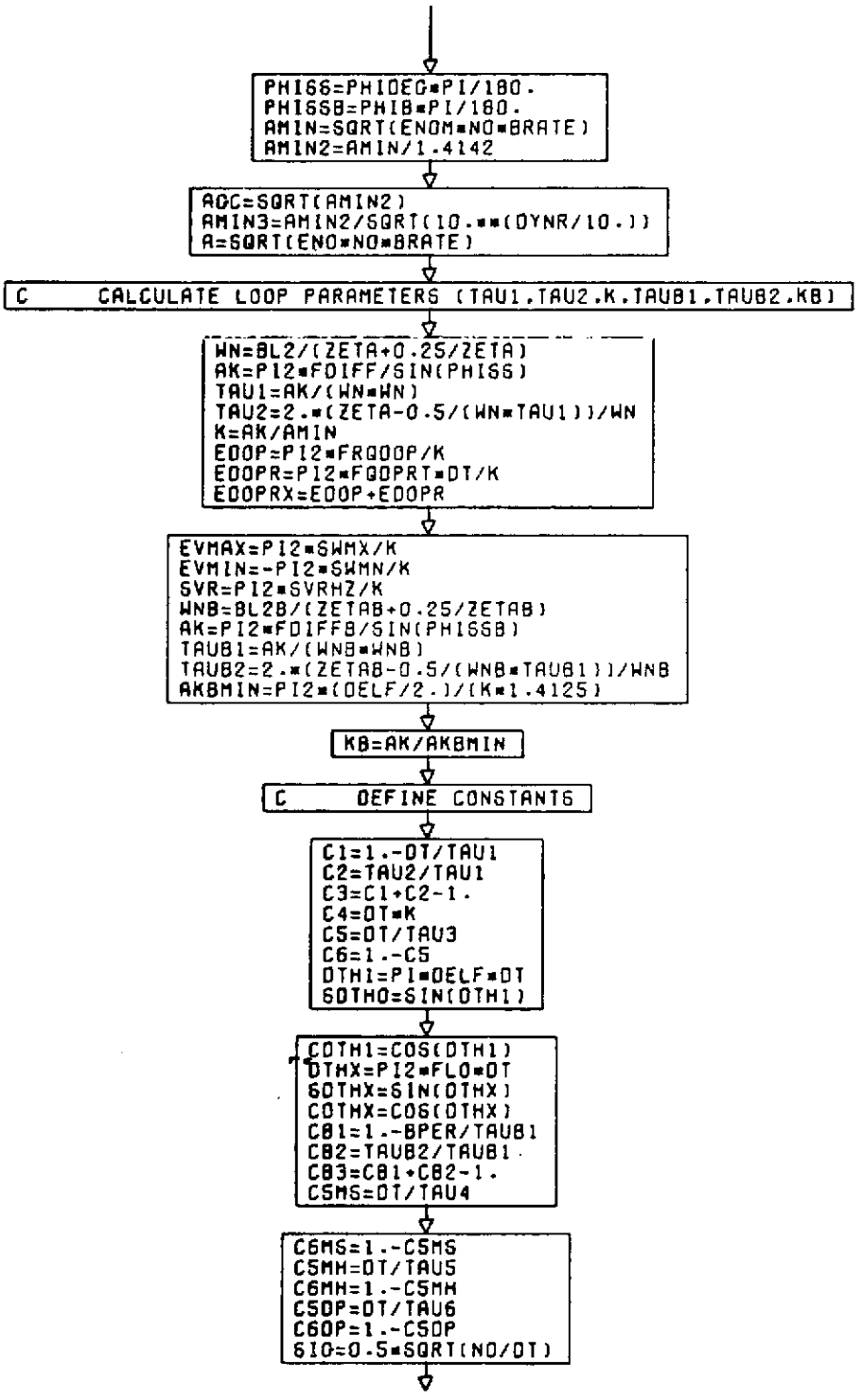
```
                      SUBROUTINE DATAS(IXU)
000003                DIMENSION IRC(6)
000003                DATA IRC/0,0,0,0,0,1/
000003                IX=0
000003                IF(IRC(1).NE.IRC(6))IX=1
000007                DO 1 I=1,5
000011          1     IRC(7-I)=IRC(6-I)
000017                IRC(1)=IX
000020                IXU=1
000021                IF(IX.EQ.0)IXU=-1
000023                RETURN
000024                END
```

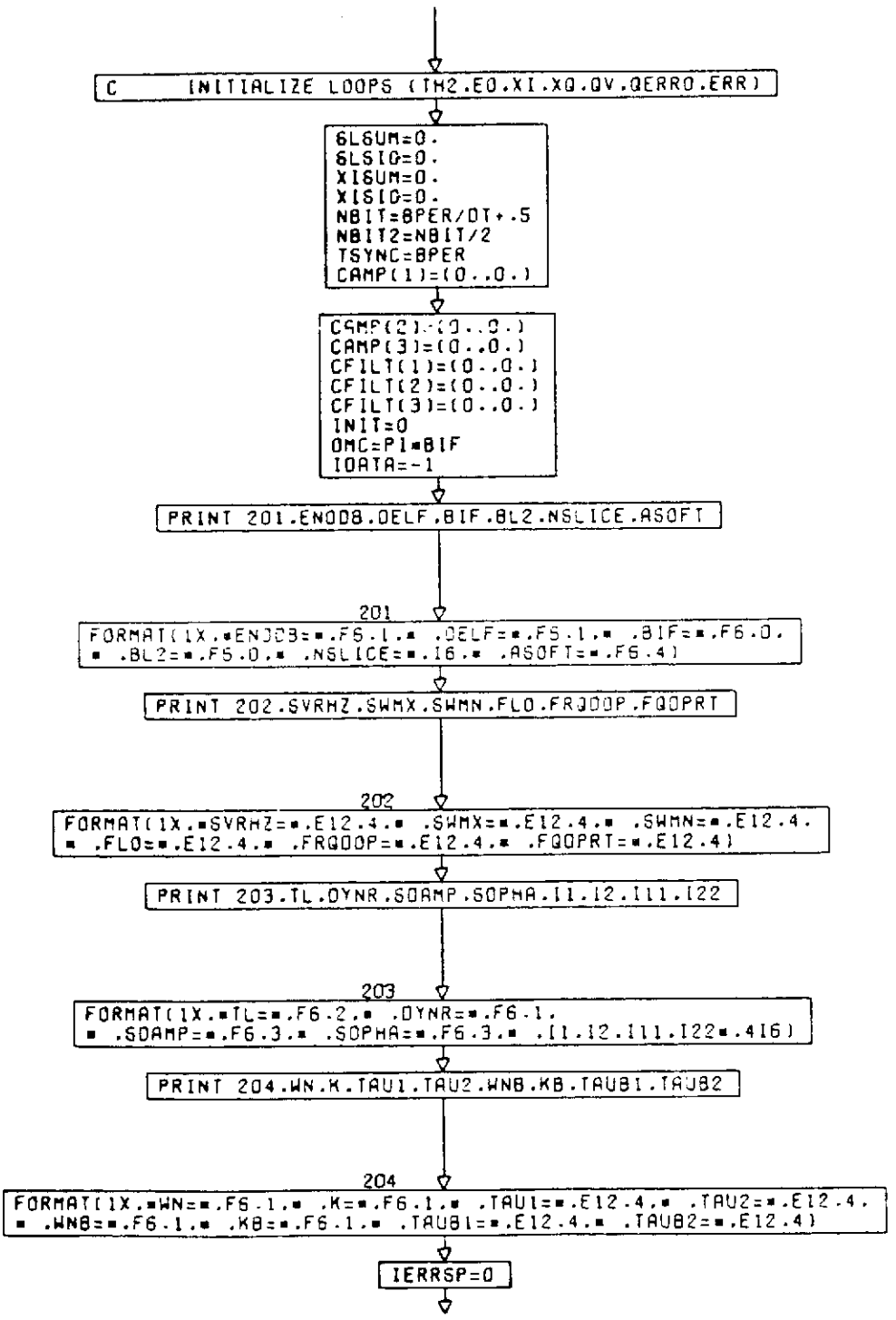

PROGRAM CARL(INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT)
COMPLEX CAMP(4),CFILT(4),COUT,CCOUT
REAL NS,NC,NO,K,KB
DIMENSION SBIN51(8,8),SBIN52(8,8),SBIN53(8,8),SBIN54(8,8)
DIMENSION ADB(100)
DIMENSION F1(8),F2(8)
DIMENSION ERRM(100)
DATA FBAMP,FBPHA,SDAMP,SDPHA,NO/2...2..23..47.1./
DATA GAM43,N43/.09,64/
DATA ENODB,BRATE,ENOMIN/8..88..9./
DATA DELF,NSPB,NRUNS,BIF/62..40,10,1000./
DATA BL2,PHIDEG,FDIFF/176..10..342,433/
DATA BL2B,PHIB,FDIFFB/1..10..5./
DATA I1,I2,I11,I22,NSLICE/1,1,1,1,24/
DATA FRQOOP,FQOPRT,TL,AGC/0..0..-2,6,1./
DATA TAU3,ASOFT/.07957..2474/
DATA TAU4,TAU5,TAU6,A5,FLO/.001808..01808..10603..5,0./
DATA SVRMZ,SWMX,SWMN/2.2E3,28.15E3,6.85E3/
DATA IDLBIT/20/
DATA DYNR/0./
NAMELIST/IN1/NRUNS,NSPB,ENODB,DELF,BIF,ENOMIN
,BL2,PHIDEG,FDIFF,BL2B,PHIB,FDIFFB
,FBAMP,FBPHA,SDAMP,SDPHA,GAM43,N43,NSLICE
,FLO,FRQOOP,FQOPRT,ASOFT,I1,I2,I11,I22
,SVRMZ,SWMX,SWMN,TL,AGC
,IBIT,TSYNC,IDLBIT,DYNR
,TAU4
PI=4.*ATAN(1.)
PI2=2.*PI
ZETA=SQRT(0.5)
ZETAB=ZETA
CCLT=0.
CALL TRIO(CCLT,PI,SSCIN,CSCIN)
CCLT=1.
A1 23
3 CONTINUE
C READ INPUT6
READ(5,IN1)
DYNR=3.
NSLICE=26
CBIN1=0.

CONT. ON PD 2

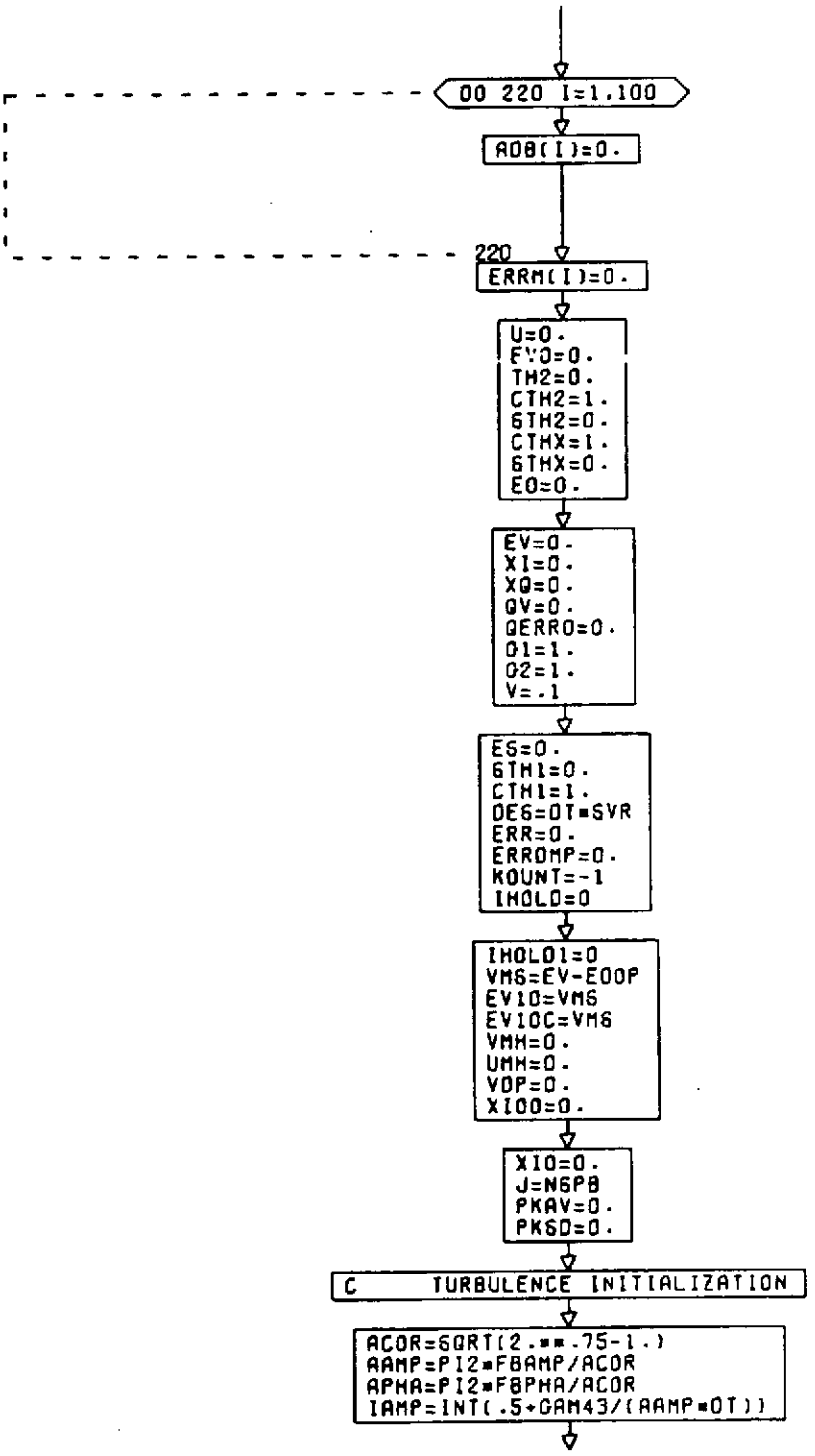

CBIN2=0.
CBIN3=0.
CBIN4=0.
ILOC=0
ILOCF=-1
I00=0
I00N=-1
FLO=10.
I1=1
I2=1
I11=1
I22=1
NRUNS=2000
TL=-6.5
SVRHZ=0.
ASOFT=.3
IDLBIT=100
ASOFTI=2./ASOFT
DO 199 I=1,8
DO 198 J=1,8
SBINS1(I,J)=0.
SBINS2(I,J)=0.
SBINS3(I,J)=0.
SBINS4(I,J)=0.
198
CONTINUE
199
CONTINUE
IXM=0
CALL RANDM(I1,I2,XIBIT)
IBIT=INT(39.*XIBIT+1.)
C CONVERT INPUTS (ENO,BPER,PHISS,PHISSB)
ENO=10.**(ENODB/10.)
ENOM=10.**(ENOMIN/10.)
BPER=1./BRATE
DT=BPER/NSPB

CONT. ON PG 3

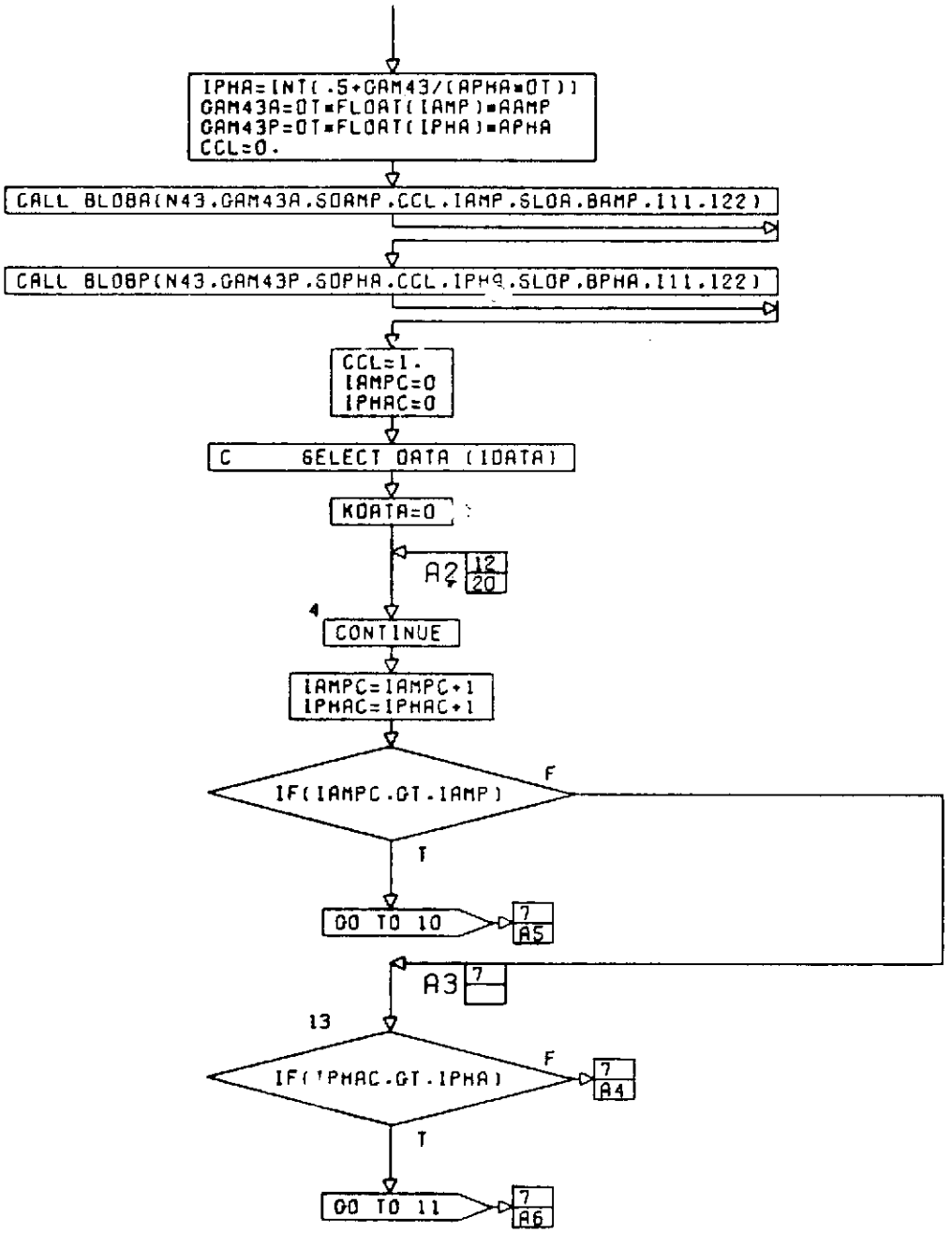

PHI66=PHIDEG*PI/180.
PHI66B=PHIB*PI/180.
AMIN=SQRT(ENOM*NO*BRATE)
AMIN2=AMIN/1.4142
AOC=SQRT(AMIN2)
AMIN3=AMIN2/SQRT(10.**(DYNR/10.))
A=SQRT(ENO*NO*BRATE)
C CALCULATE LOOP PARAMETERS (TAU1,TAU2,K,TAUB1,TAUB2,KB)
WN=BL2/(ZETA+0.25/ZETA)
AK=P12*FDIFF/SIN(PHI66)
TAU1=AK/(WN*WN)
TAU2=2.*(ZETA-0.5/(WN*TAU1))/WN
K=AK/AMIN
EOOP=P12*FRQOOP/K
EOOPR=P12*FQOPRT*DT/K
EOOPRX=EOOP+EOOPR
EVMAX=P12*SWMX/K
EVMIN=-P12*SWMN/K
SVR=P12*SVRHZ/K
WNB=BL2B/(ZETAB+0.25/ZETAB)
AK=P12*FDIFFB/SIN(PHI66B)
TAUB1=AK/(WNB*WNB)
TAUB2=2.*(ZETAB-0.5/(WNB*TAUB1))/WNB
AKBMIN=P12*(DELF/2.)/(K*1.4125)
KB=AK/AKBMIN
C DEFINE CONSTANTS
C1=1.-DT/TAU1
C2=TAU2/TAU1
C3=C1+C2-1.
C4=DT*K
C5=DT/TAU3
C6=1.-C5
DTH1=PI*DELF*DT
SDTHO=SIN(DTH1)
CDTH1=COS(DTH1)
DTHX=P12*FLO*DT
SDTHX=SIN(DTHX)
CDTHX=COS(DTHX)
CB1=1.-BPER/TAUB1
CB2=TAUB2/TAUB1
CB3=CB1+CB2-1.
C5MS=DT/TAU4
C6MS=1.-C5MS
C5MH=DT/TAU5
C6MH=1.-C5MH
C5OP=DT/TAU6
C6OP=1.-C5OP
G10=0.5*SQRT(NO/DT)
CONT. ON PG 4


C INITIALIZE LOOPS (TH2,E0,XI,X0,DV,QERRO,ERR)
SLSUM=0.
SLSIG=0.
XISUM=0.
XISIG=0.
NBIT=BPER/DT+.5
NBIT2=NBIT/2
TSYNC=BPER
CAMP(1)=(0.,0.)
CAMP(2)=(0.,0.)
CAMP(3)=(0.,0.)
CFILT(1)=(0.,0.)
CFILT(2)=(0.,0.)
CFILT(3)=(0.,0.)
INIT=0
OMC=PI*BIF
IDATA=-1
PRINT 201,ENODB,DELF,BIF,BL2,NSLICE,ASOFT
201
FORMAT(1X,'ENODB=',F6.1,' DELF=',F6.1,' BIF=',F6.0,
' BL2=',F5.0,' NSLICE=',I6,' ASOFT=',F6.4)
PRINT 202,SVRHZ,SWMX,SWMN,FLO,FRQOOP,FQOPRT
202
FORMAT(1X,'SVRHZ=',E12.4,' SWMX=',E12.4,' SWMN=',E12.4,
' FLO=',E12.4,' FRQOOP=',E12.4,' FQOPRT=',E12.4)
PRINT 203,TL,DYNR,SOAMP,SOPHA,I1,I2,I11,I22
203
FORMAT(1X,'TL=',F6.2,' DYNR=',F6.1,
' SOAMP=',F6.3,' SOPHA=',F6.3,' ',I1,I2,I11,I22,'=',4I6)
PRINT 204,WN,K,TAU1,TAU2,WNB,KB,TAUB1,TAUB2
204
FORMAT(1X,'WN=',F6.1,' K=',F6.1,' TAU1=',E12.4,' TAU2=',E12.4,
' WNB=',F6.1,' KB=',F6.1,' TAUB1=',E12.4,' TAUB2=',E12.4)
IERRSP=0

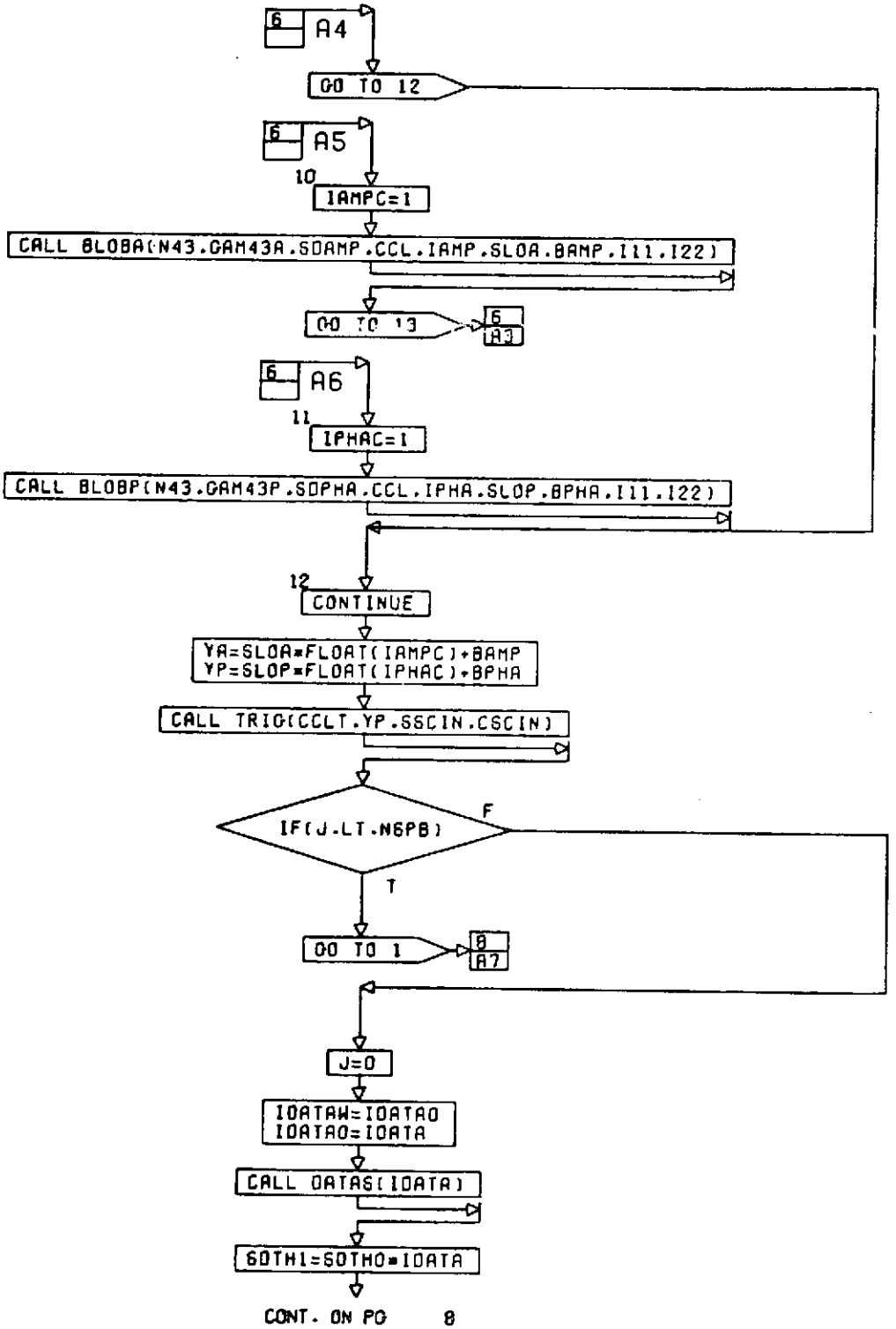
CONT. ON PG 5


DO 220 I=1,100
ADB(I)=0.
220
ERRM(I)=0.
U=0.
FV0=0.
TH2=0.
CTH2=1.
STH2=0.
CTHX=1.
STHX=0.
E0=0.
EV=0.
XI=0.
X0=0.
QV=0.
QERR0=0.
Q1=1.
Q2=1.
V=.1
ES=0.
STH1=0.
CTH1=1.
DES=DT*SVR
ERR=0.
ERRMP=0.
KOUNT=-1
IHOLD=0
IHOLD1=0
VMS=EV-EOOP
EV10=VMS
EV10C=VMS
VMM=0.
UMM=0.
VDP=0.
X100=0.
X10=0.
J=N6P8
PKAV=0.
PKSD=0.
C TURBULENCE INITIALIZATION
ACOR=SQRT(2.**.75-1.)
AAMP=PI2*FBAMP/ACOR
APHA=PI2*FBPHA/ACOR
IAMP=INT(.5+GAM43/(AAMP*DT))

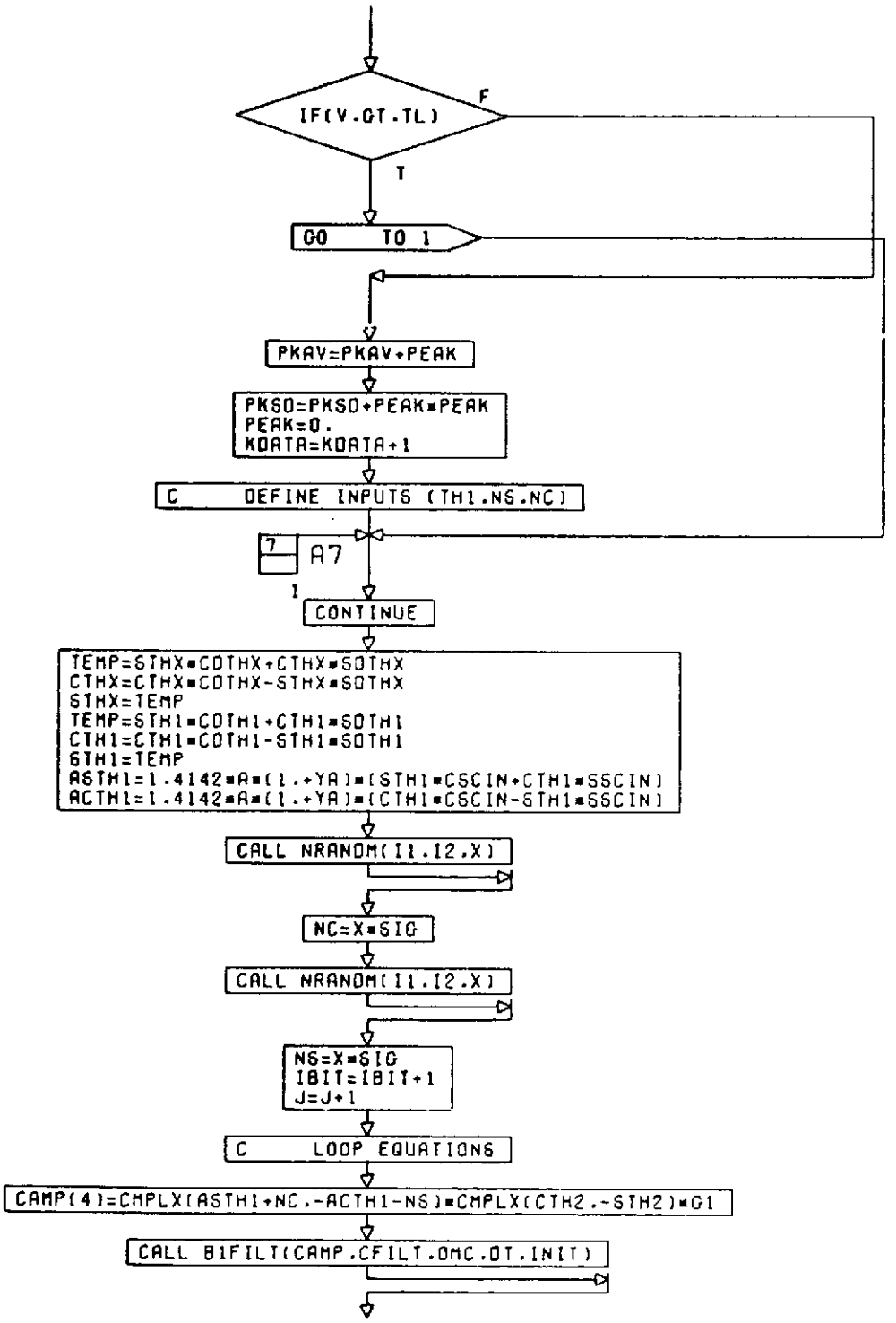
CONT. ON PG 6

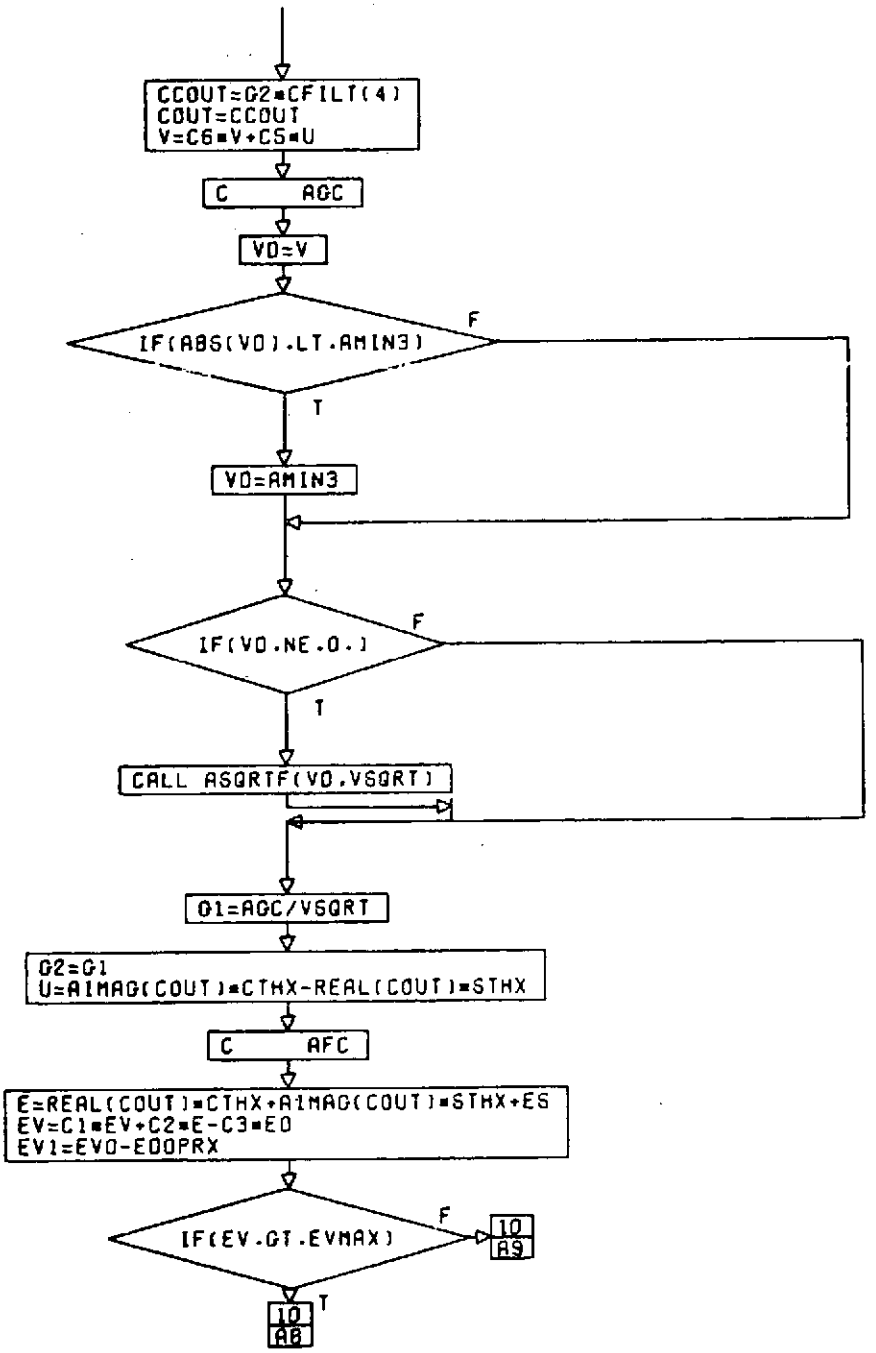

IPHA=INT(.5+GAM43/(APHA*DT))
GAM43A=DT*FLOAT(IAMP)*AAMP
GAM43P=DT*FLOAT(IPHA)*APHA
CCL=0.
CALL BLOBA(N43,GAM43A,SOAMP,CCL,IAMP,SLOA,BAMP,111,122)
CALL BLOBP(N43,GAM43P,SOPHA,CCL,IPHA,SLOP,BPHA,111,122)
CCL=1.
IAMPC=0
IPHAC=0
C SELECT DATA (IDATA)
KDATA=0
A2 12 20
4 CONTINUE
IAMPC=IAMPC+1
IPHAC=IPHAC+1
IF(IAMPC.GT.IAMP)
F
T
GO TO 10
7 A5
A3 7
13
IF(IPHAC.GT.IPHA)
F
7 A4
T
GO TO 11
7 A6

CONT. ON PG 7

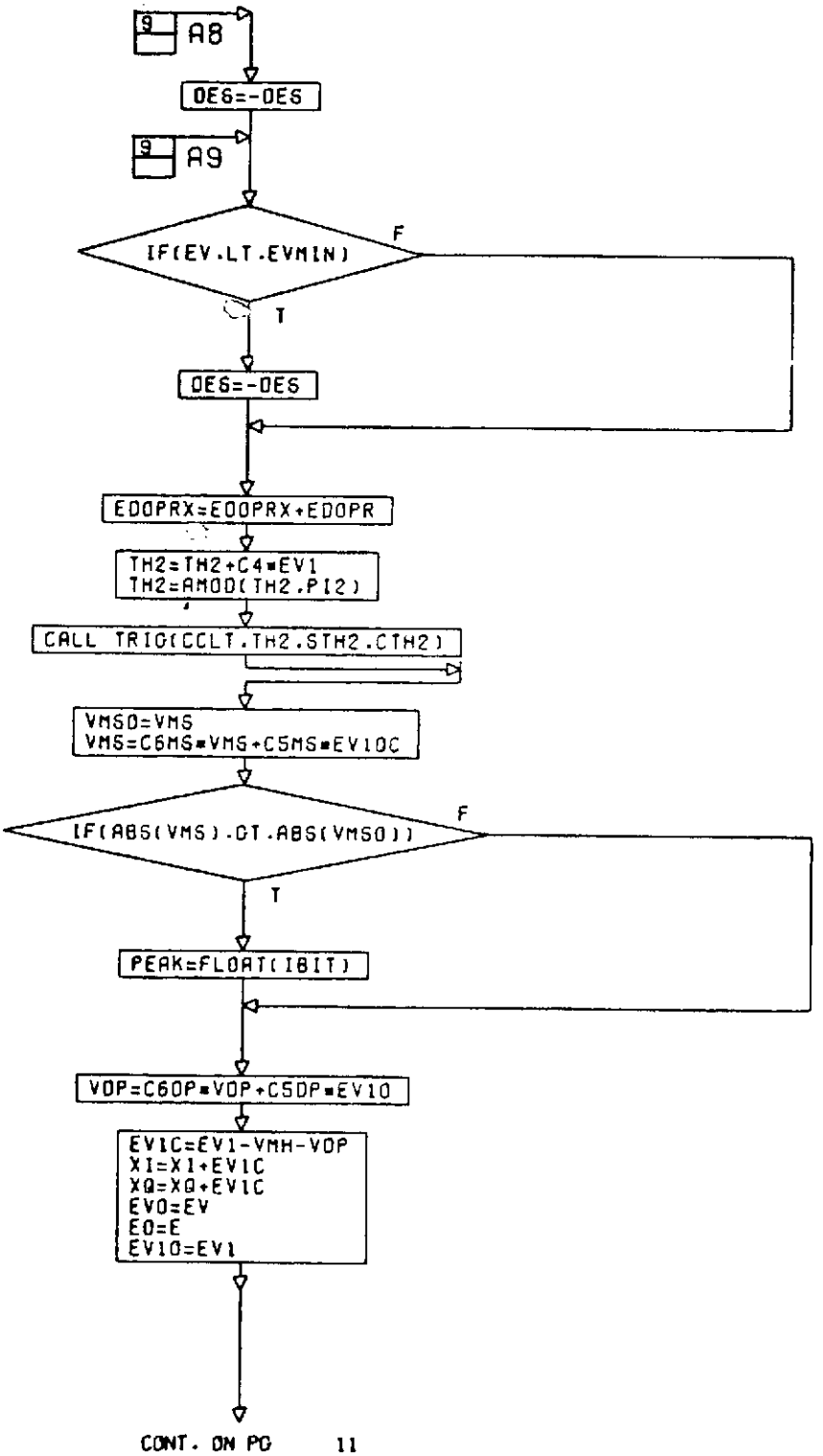

6 A4
GO TO 12
6 A5
10 IAMPC=1
CALL BLOBA(N43.GAM43A.SDAMP.CCL.IAMP.SLOA.BAMP.I11.I22)
GO TO 13
6 A3
6 A6
11 IPHAC=1
CALL BLOBP(N43.GAM43P.SDPHA.CCL.IPHA.SLOP.BPHA.I11.I22)
12 CONTINUE
YA=SLOA*FLOAT(IAMPC)+BAMP
YP=SLOP*FLOAT(IPHAC)+BPHA
CALL TRIG(CCLT.YP.SSCIN.CSCIN)
IF(J.LT.N6PB)
F
T
GO TO 1
8 A7
J=0
IDATAW=IDATAO
IDATAO=IDATA
CALL DATAS(IDATA)
SOTH1=SOTH0=IDATA
CONT. ON PG 8

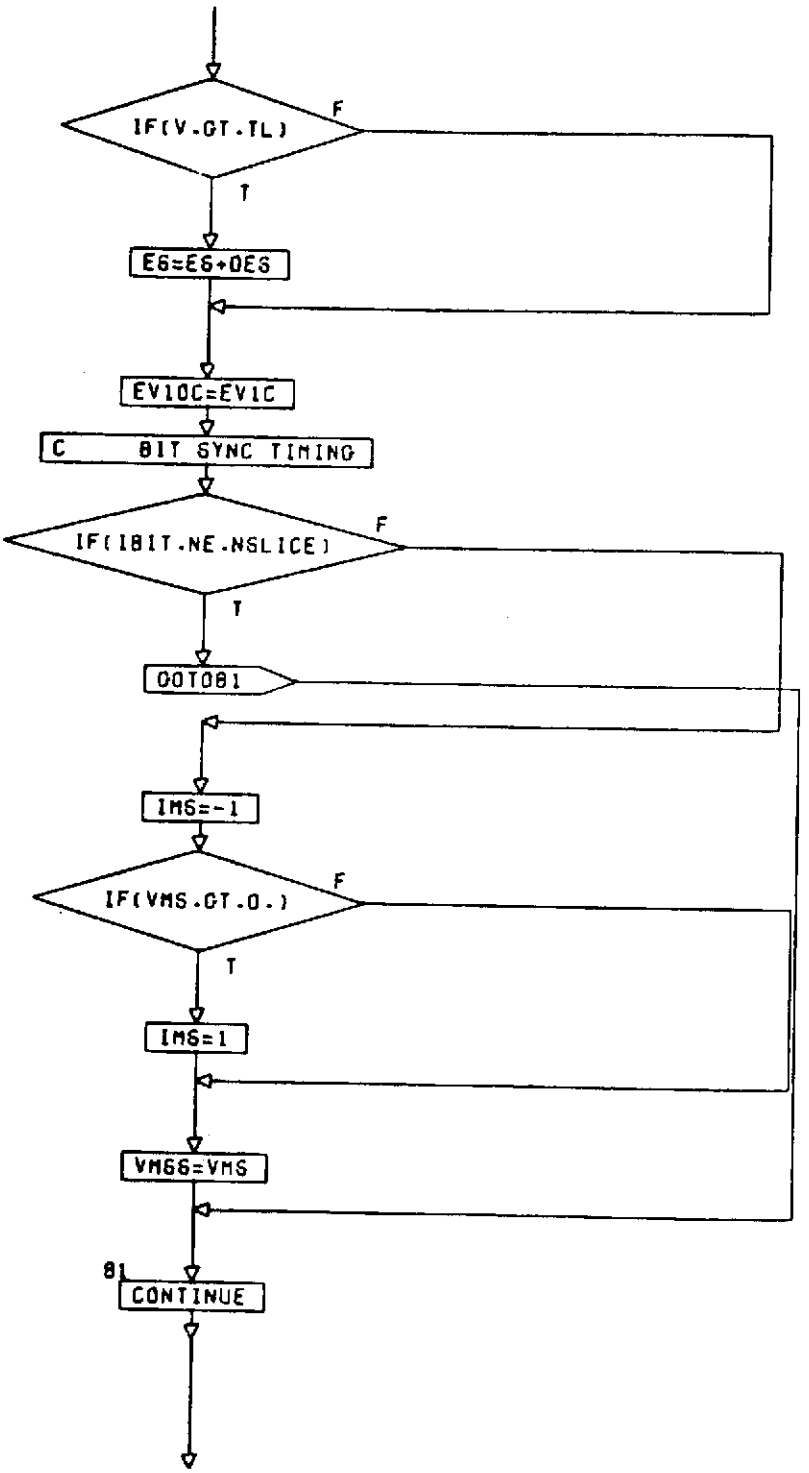
PG 7 OF 23

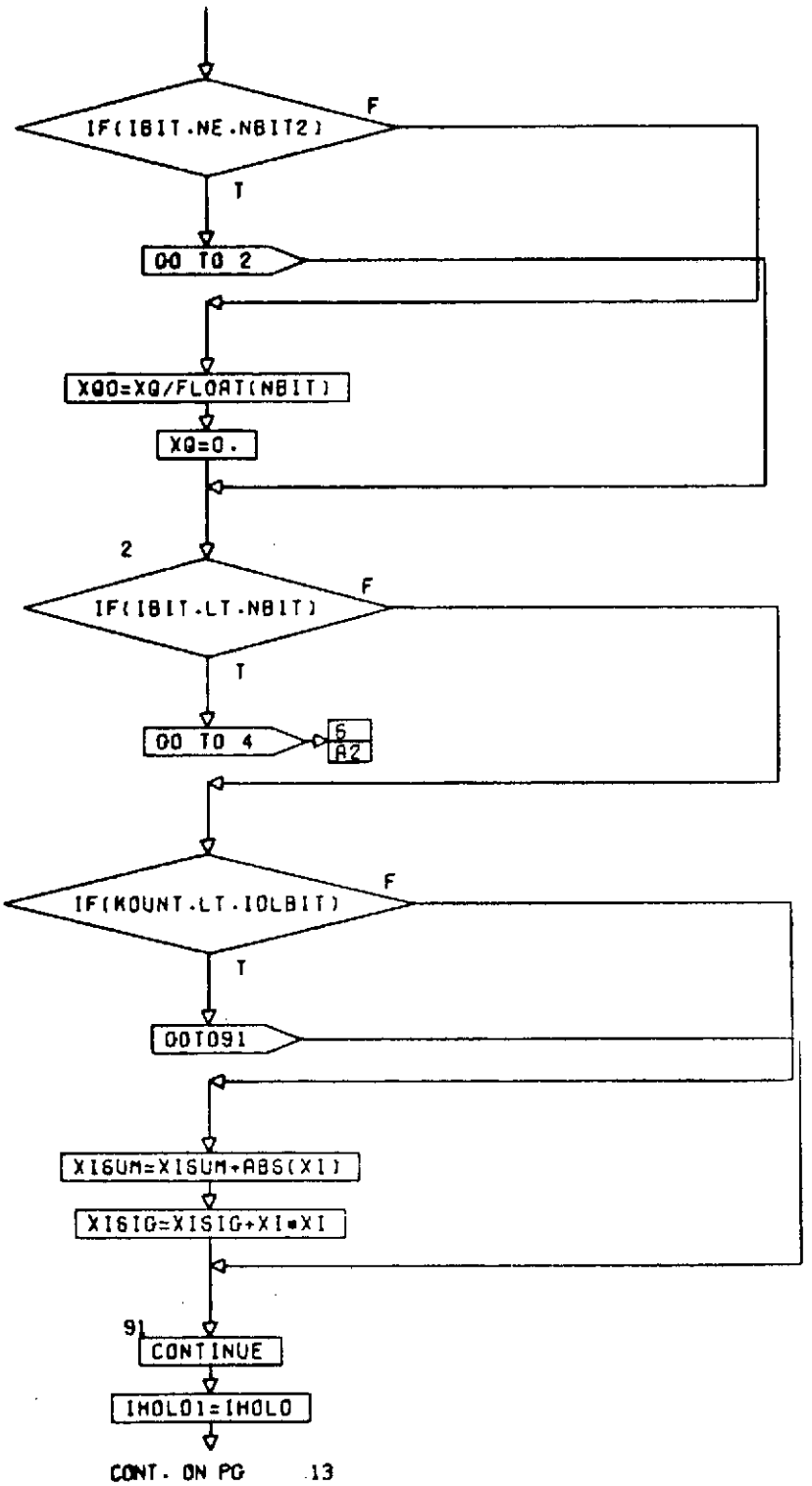

IF(V.GT.TL)
F
T
GO TO 1
PKAV=PKAV+PEAK
PKSO=PKSO+PEAK*PEAK
PEAK=0.
KOATA=KOATA+1
C DEFINE INPUTS (TH1,NS,NC)
7
A7
1
CONTINUE
TEMP=STHX*CDTHX+CTHX*SDTHX
CTHX=CTHX*CDTHX-STHX*SDTHX
STHX=TEMP
TEMP=STH1*CDTH1+CTH1*SDTH1
CTH1=CTH1*CDTH1-STH1*SDTH1
STH1=TEMP
ASTH1=1.4142*A*(1.+YA)*(STH1*CSCIN+CTH1*SSCIN)
ACTH1=1.4142*A*(1.+YA)*(CTH1*CSCIN-STH1*SSCIN)
CALL NRANDM(I1,I2,X)
NC=X*SIG
CALL NRANDM(I1,I2,X)
NS=X*SIG
IBIT=IBIT+1
J=J+1
C LOOP EQUATIONS
CAMP(4)=CMPLX(ASTH1+NC,-ACTH1-NS)*CMPLX(CTH2,-STH2)*G1
CALL BIFILT(CAMP,CFILT,OMC,DT,INIT)
CONT. ON PG 9
PG 8 OF 23

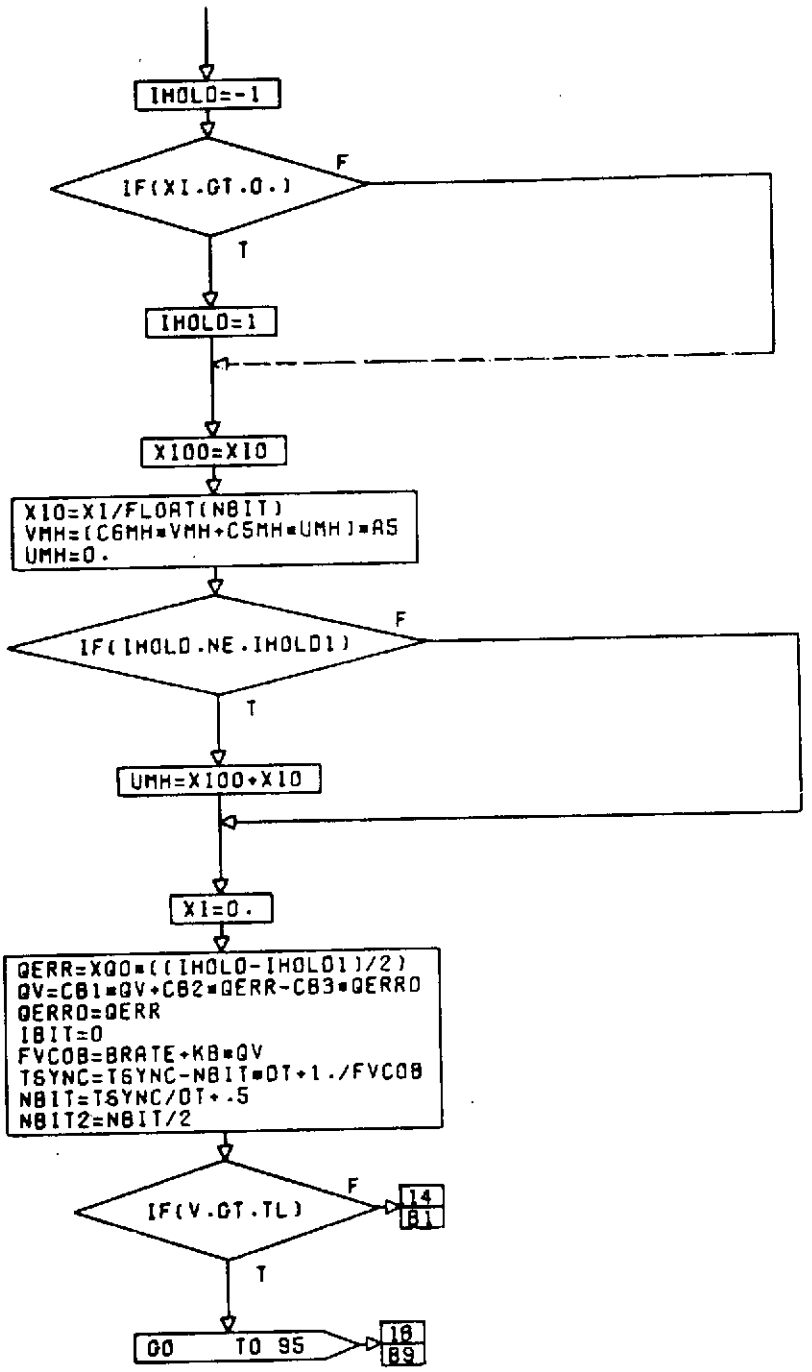

CCOUT=G2*CFILT(4)
COUT=CCOUT
V=C6*V+C5*U
C AGC
VO=V
IF(ABS(VO).LT.AMIN3)
F
T
VO=AMIN3
IF(VO.NE.0.)
F
T
CALL ASQRTF(VO,VSQRT)
G1=AGC/VSQRT
G2=G1
U=AIMAG(COUT)*CTHX-REAL(COUT)*STHX
C AFC
E=REAL(COUT)*CTHX+AIMAG(COUT)*STHX+ES
EV=C1*EV+C2*E-C3*E0
EV1=EV0-E00PRX
IF(EV.GT.EVMAX)
F
10
A9
10
A8
T

CONT. ON PG 10

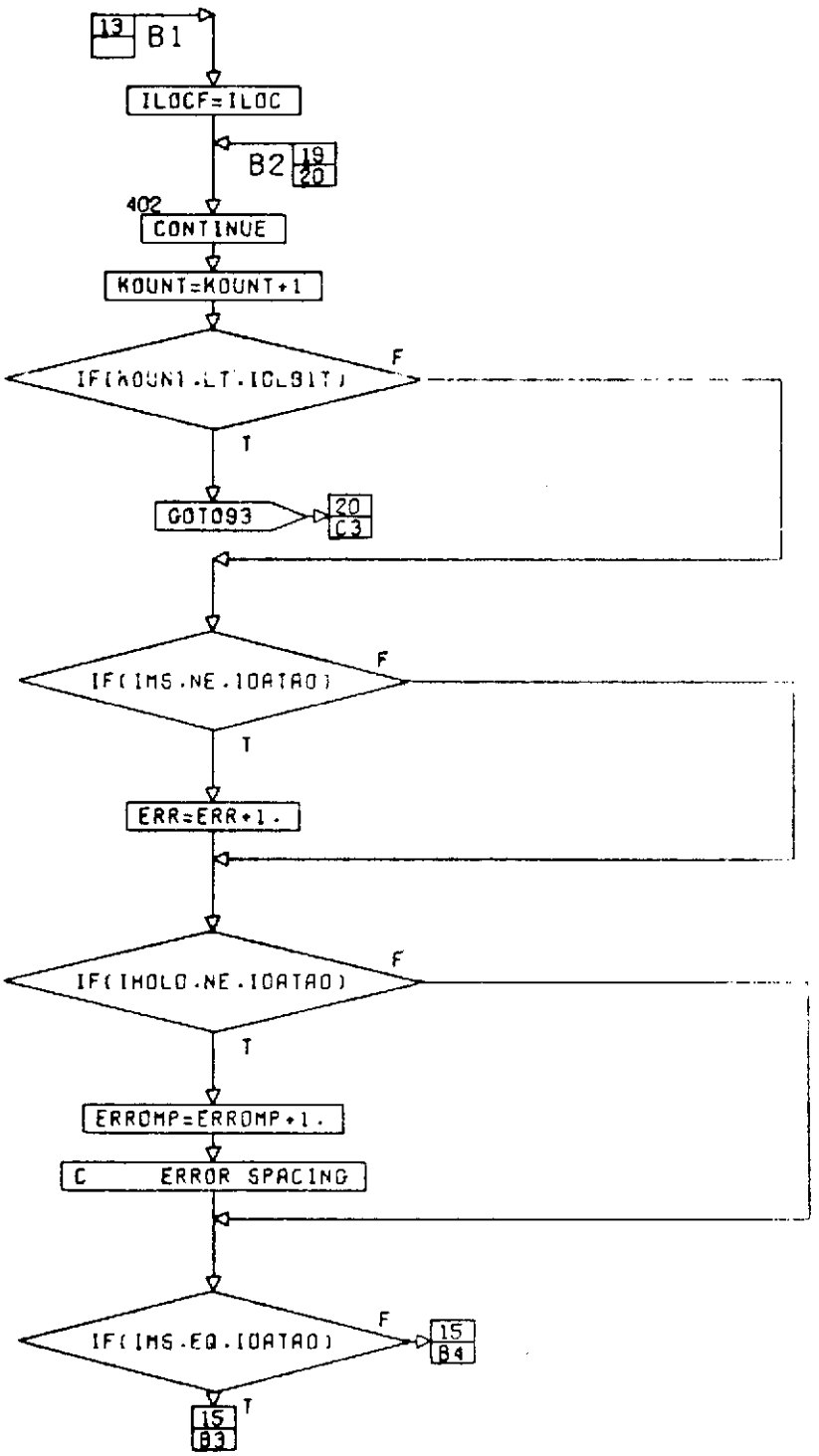

9 A8
DE6=-DES
9 A9
IF(EV.LT.EVMIN)
F
T
DE6=-DES
EDOPRX=EOOPRX+EDOPR
TH2=TH2+C4*EV1
TH2=AMOD(TH2,P12)
CALL TRIG(CCLT,TH2,STH2,CTH2)
VMSO=VMS
VMS=C6MS*VMS+C5MS*EV10
IF(ABS(VMS).GT.ABS(VMSO))
F
T
PEAK=FLOAT(IBIT)
VOP=C6OP*VOP+C5OP*EV10
EV1C=EV1-VMH-VOP
XI=XI+EV1C
XQ=XQ+EV1C
EVO=EV
EO=E
EV10=EV1
CONT. ON PG 11


IF(V.GT.TL)
F
T
E6=E6+DES
EV10C=EV1C
C 81T SYNC TIMING
IF(1B1T.NE.NSLICE)
F
T
GOTO81
IMS=-1
IF(VMS.GT.0.)
F
T
IMS=1
VM66=VMS
81
CONTINUE
CONT. ON PG 12

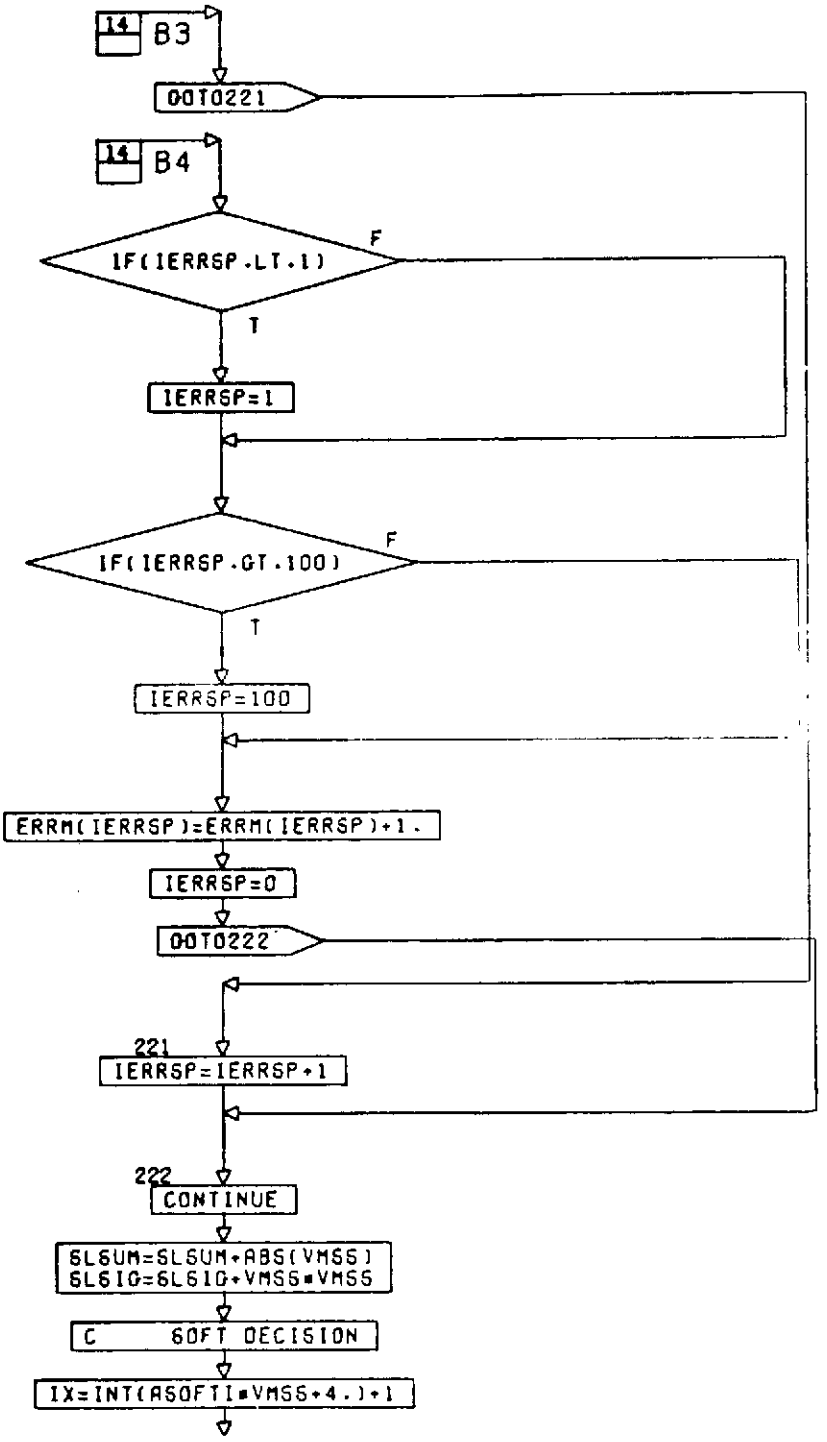

IF(IBIT.NE.NBIT2)
F
T
GO TO 2
XGO=XG/FLOAT(NBIT)
XG=0.
2
IF(IBIT.LT.NBIT)
F
T
GO TO 4
5
A2
IF(KOUNT.LT.IOLBIT)
F
T
GOTO91
XISUM=XISUM+ABS(XI)
XISIG=XISIG+XI*XI
91
CONTINUE
IHOLO1=IHOLO
CONT. ON PG 13


IHOLD=-1
IF(XI.GT.0.)
F
T
IHOLD=1
X100=X10
X10=X1/FLOAT(NBIT)
VMH=(C6MH*VMH+C5MH*UMH)*AS
UMH=0.
IF(IHOLD.NE.IHOLD1)
F
T
UMH=X100+X10
XI=0.
QERR=XQ0*((IHOLD-IHOLD1)/2)
QV=CB1*QV+CB2*QERR-CB3*QERR0
QERR0=QERR
IBIT=0
FVCOB=BRATE+KB*QV
TSYNC=TSYNC-NBIT*DT+1./FVCOB
NBIT=TSYNC/DT+.5
NBIT2=NBIT/2
IF(V.GT.TL)
F
14
B1
T
GO TO 95
16
B9

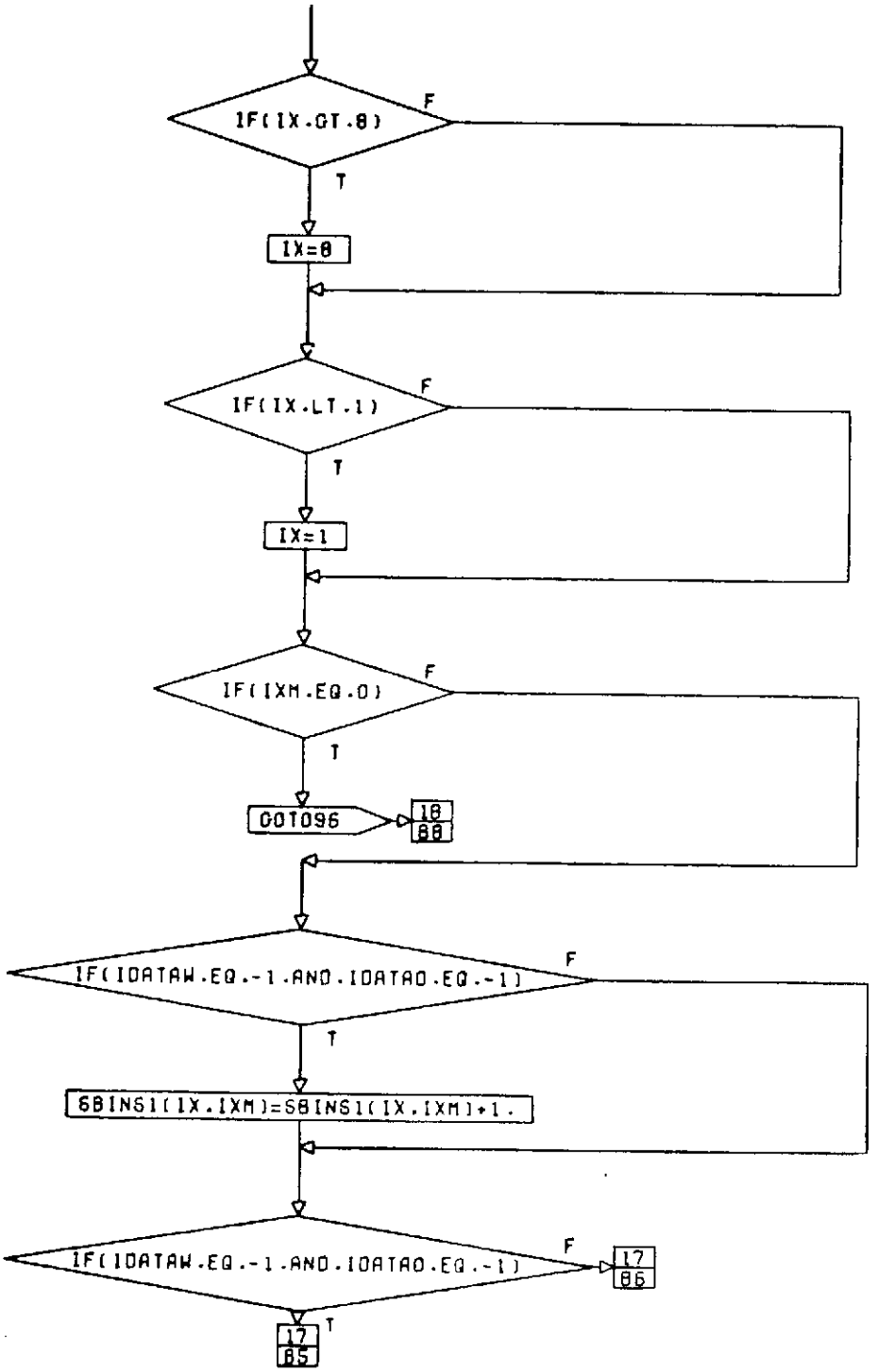
CONT. ON PG 14


13
B1
ILOCF=ILOC
B2
19
20
402
CONTINUE
KOUNT=KOUNT+1
IF(KOUNT.LT.ICLSIT)
F
T
GOTO93
20
C3
IF(IMS.NE.IDATAO)
F
T
ERR=ERR+1.
IF(IHOLD.NE.IDATAO)
F
T
ERROMP=ERROMP+1.
C ERROR SPACING
IF(IMS.EQ.IDATAO)
F
15
B4
T
15
B3

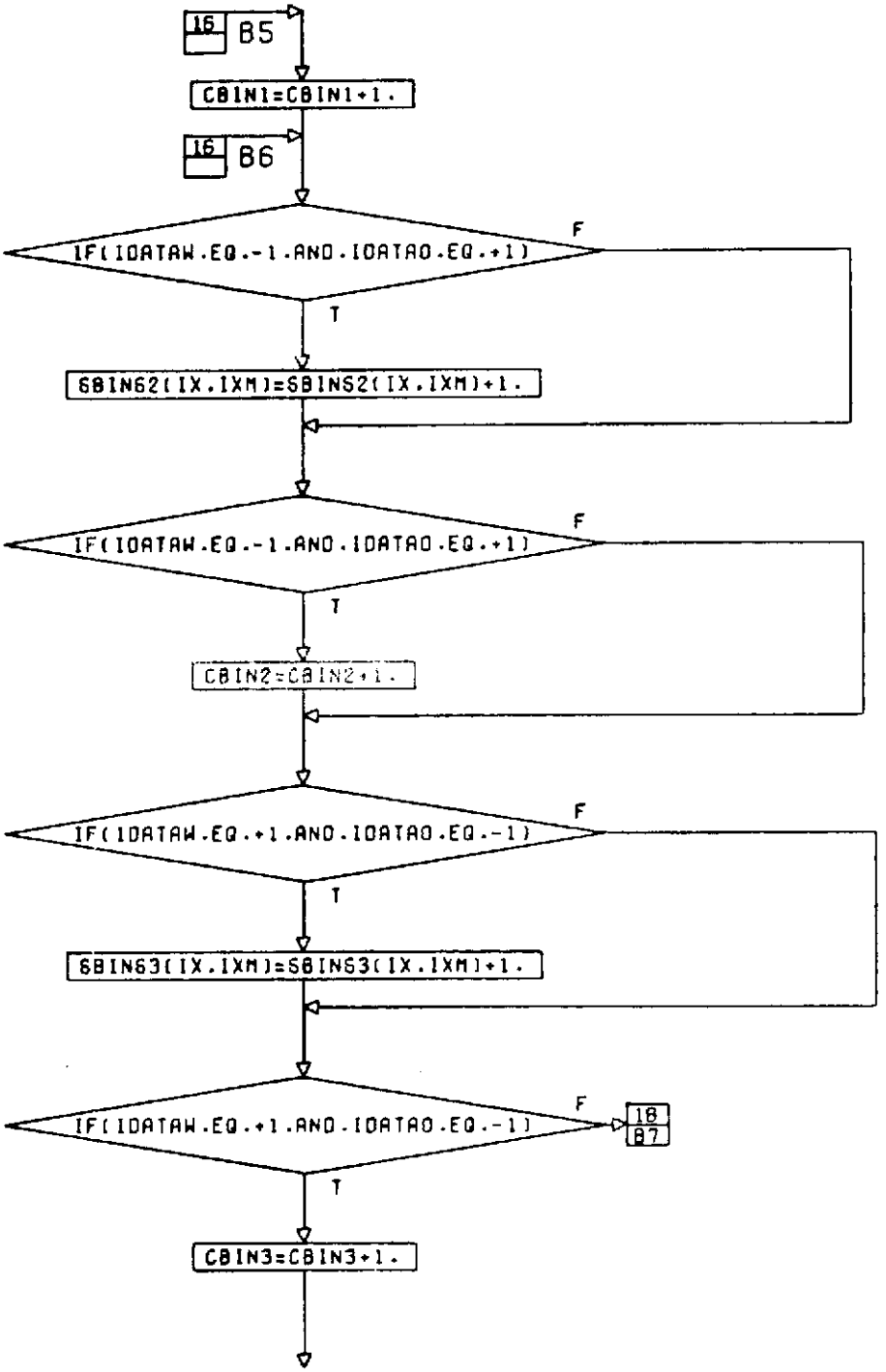
CONT. ON PG 15


14 B3
GOTO221
14 B4
IF(IERRSP.LT.1)
F
T
IERRSP=1
IF(IERRSP.GT.100)
F
T
IERRSP=100
ERRM(IERRSP)=ERRM(IERRSP)+1.
IERRSP=0
GOTO222
221
IERRSP=IERRSP+1
222
CONTINUE
SLSUM=SLSUM+ABS(VMSS)
SLSIG=SLSIG+VMSS*VMSS
C 60FT DECISION
IX=INT(ASOFTI*VMSS+4.)+1

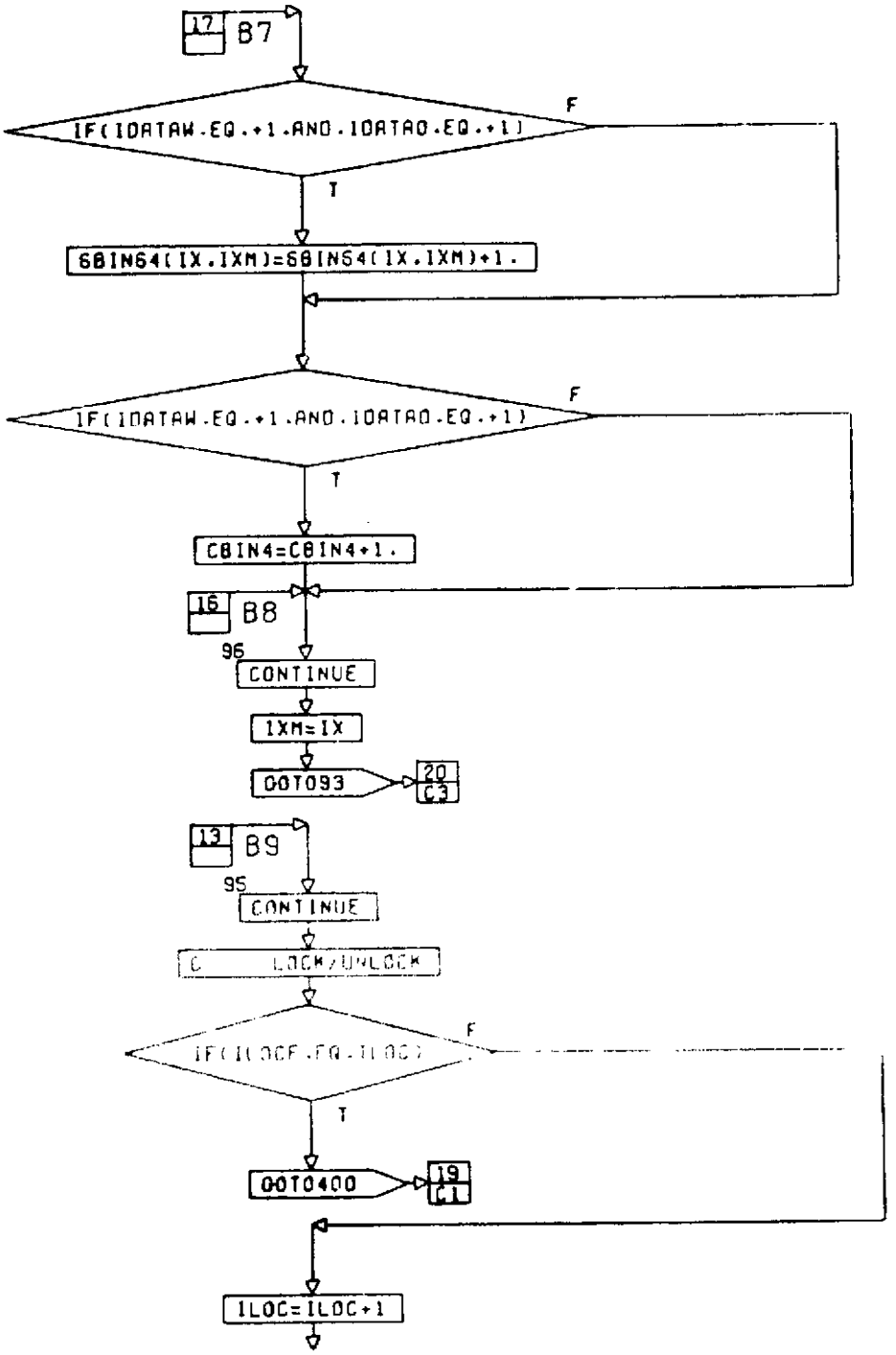
CONT. ON PG 16


IF(IX.GT.0)
F
T
IX=0
IF(IX.LT.1)
F
T
IX=1
IF(IXM.EQ.0)
F
T
GOTO96
18
88
IF(IDATAW.EQ.-1.AND.IDATA0.EQ.-1)
F
T
SBINS1(IX,IXM)=SBINS1(IX,IXM)+1.
IF(IDATAW.EQ.-1.AND.IDATA0.EQ.-1)
F
17
86
T
17
85

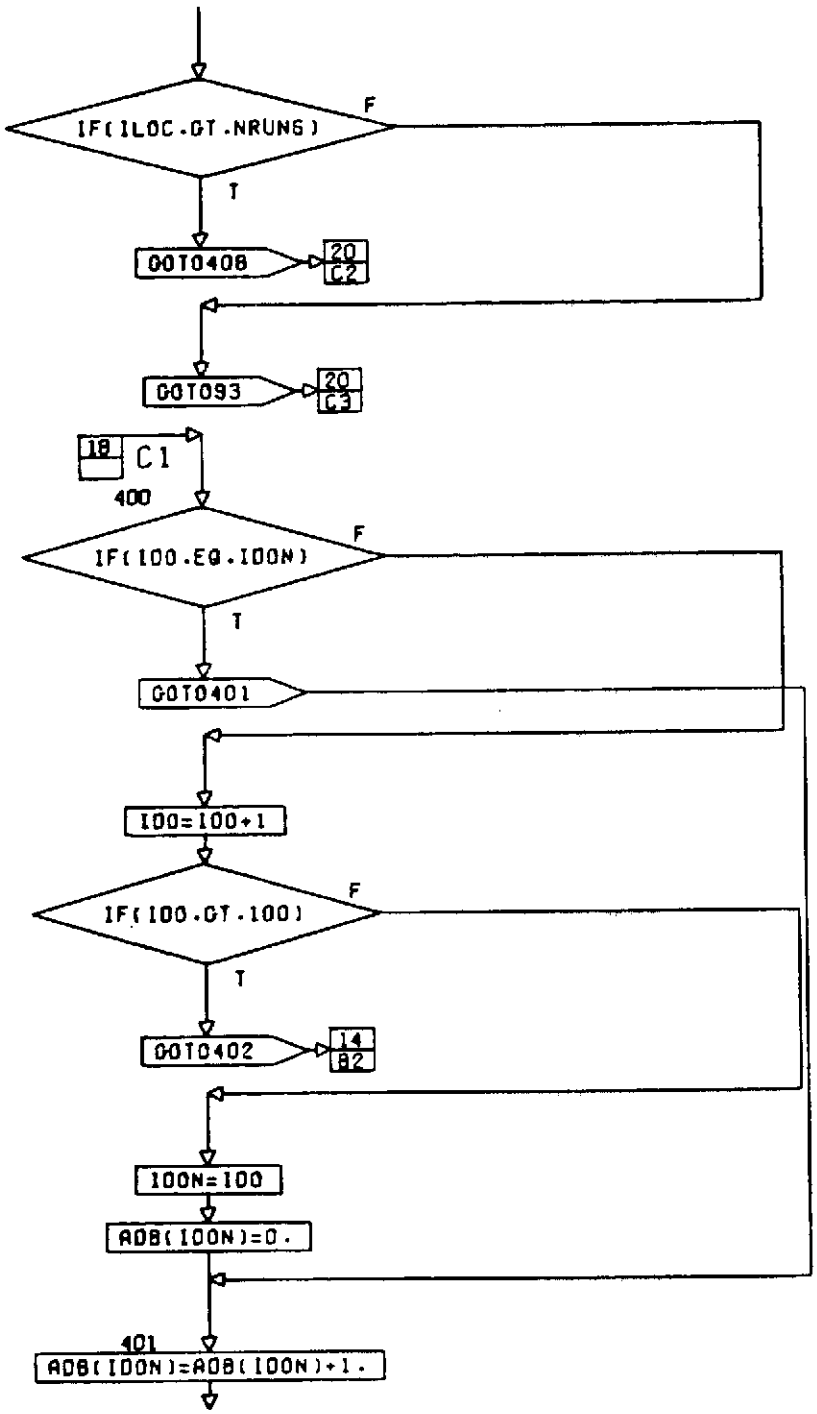
CONT. ON PG 17


16
B5
CBIN1=CBIN1+1.
16
B6
IF(IDATAW.EQ.-1.AND.IDATAO.EQ.+1)
F
T
SBIN62(IX,IXM)=SBINS2(IX,IXM)+1.
IF(IDATAW.EQ.-1.AND.IDATAO.EQ.+1)
F
T
CBIN2=CBIN2+1.
IF(IDATAW.EQ.+1.AND.IDATAO.EQ.-1)
F
T
SBIN63(IX,IXM)=SBINS3(IX,IXM)+1.
IF(IDATAW.EQ.+1.AND.IDATAO.EQ.-1)
F
18
B7
T
CBIN3=CBIN3+1.

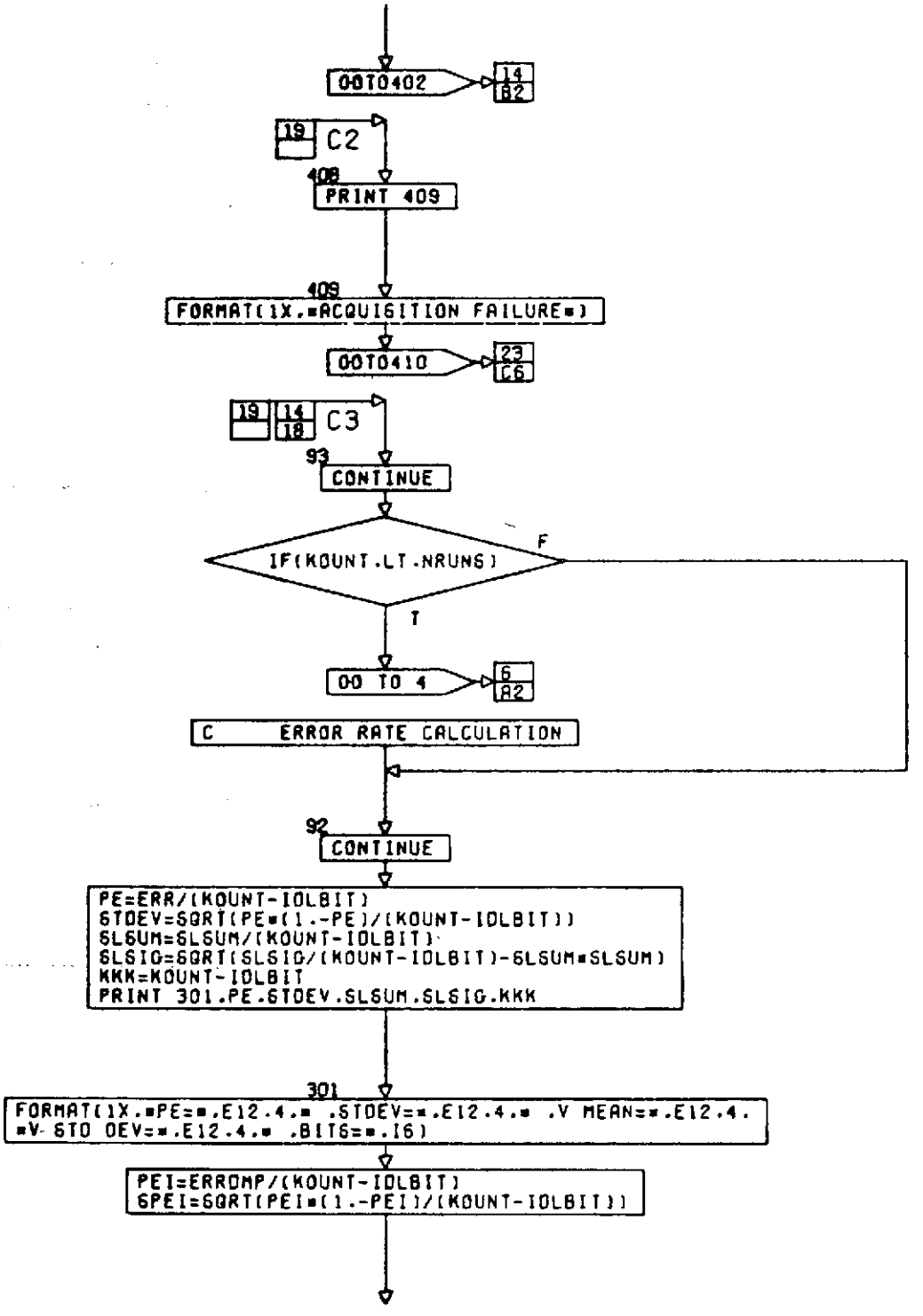
CONT. ON PG 18


17 B7
IF(IDATAW.EQ.+1.AND.IDATAO.EQ.+1)
F
T
6BIN64(IX,IXM)=6BIN64(IX,IXM)+1.
IF(IDATAW.EQ.+1.AND.IDATAO.EQ.+1)
F
T
CBIN4=CBIN4+1.
16 B8
96
CONTINUE
IXM=IX
GOTO93
20
C3
13 B9
95
CONTINUE
C LOCK/UNLOCK
F
T
GOTO400
19
C1
ILOC=ILOC+1

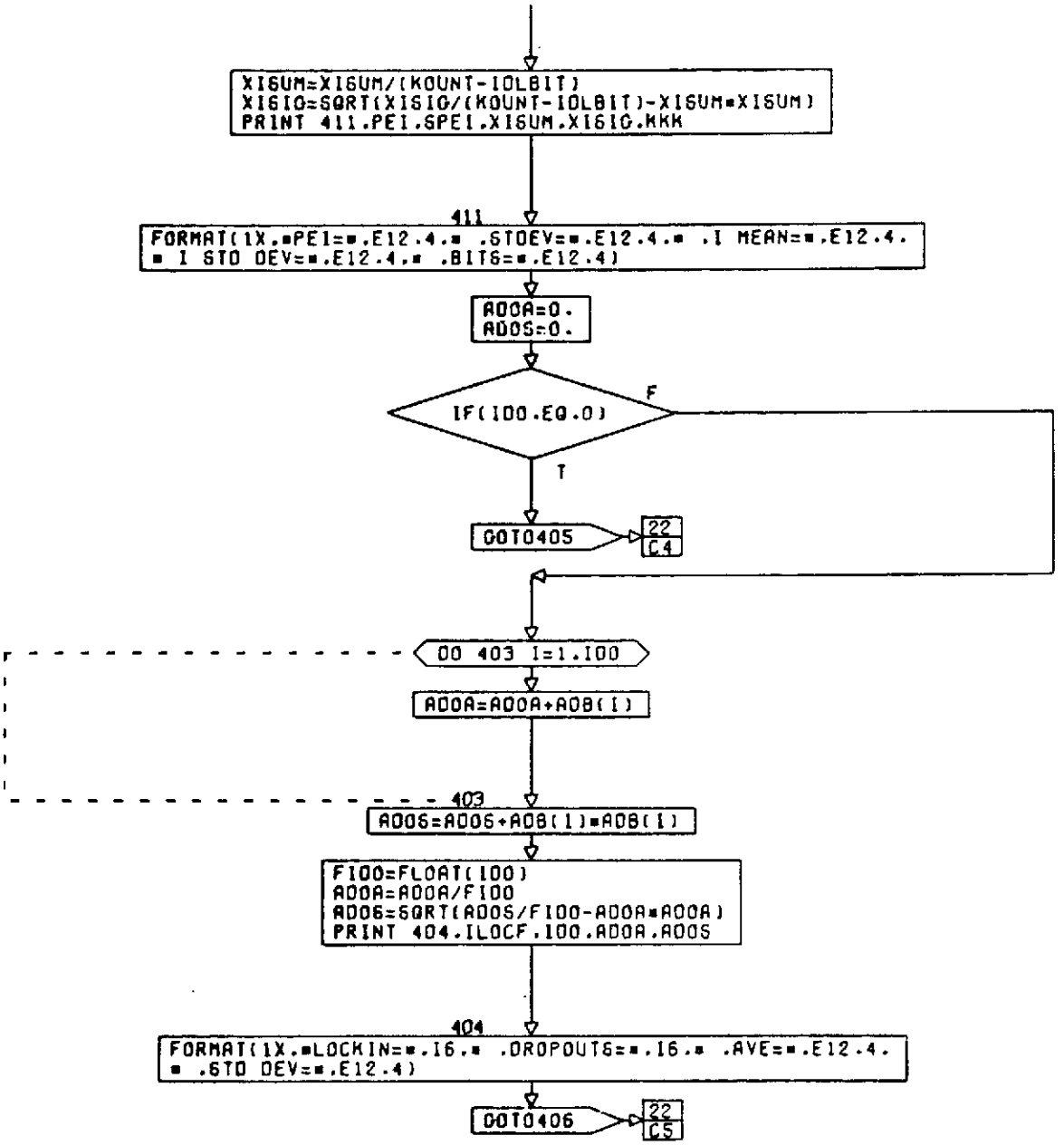
CONT. ON PG 19


IF(ILOC.GT.NRUNS)
F
T
GOTO408
20
C2
GOTO93
20
C3
18
C1
400
IF(IOO.EQ.IOON)
F
T
GOTO401
IOO=IOO+1
IF(IOO.GT.100)
F
T
GOTO402
14
B2
IOON=IOO
AOB(IOON)=0.
401
AOB(IOON)=AOB(IOON)+1.

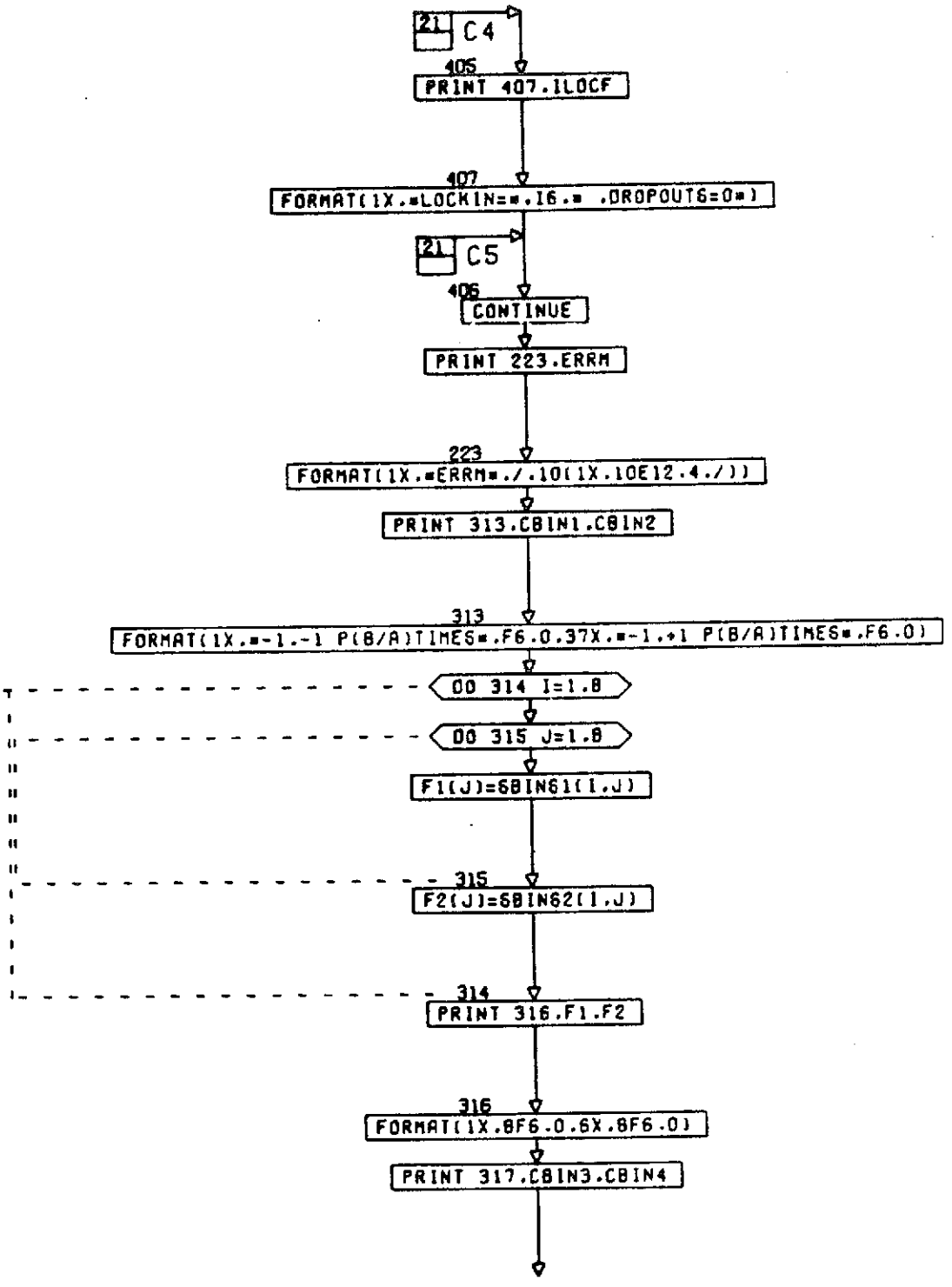
CONT. ON PG 20


GOTO402
14
B2
19
C2
408
PRINT 409
409
FORMAT(1X,*ACQUISITION FAILURE*)
GOTO410
23
C6
19
14
18
C3
93
CONTINUE
IF(KOUNT.LT.NRUNS)
F
T
GO TO 4
6
B2
C ERROR RATE CALCULATION
92
CONTINUE
PE=ERR/(KOUNT-IOLBIT)
STDEV=SQRT(PE*(1.-PE)/(KOUNT-IOLBIT))
SLSUM=SLSUM/(KOUNT-IOLBIT)
SLSIG=SQRT(SLSIG/(KOUNT-IOLBIT)-SLSUM*SLSUM)
KKK=KOUNT-IOLBIT
PRINT 301,PE,STDEV,SLSUM,SLSIG,KKK
301
FORMAT(1X,*PE=*,E12.4,* .STDEV=*,E12.4,* .V MEAN=*,E12.4,
V- STD DEV=,E12.4,* .BITS=*,I6)
PEI=ERRMP/(KOUNT-IOLBIT)
SPEI=SQRT(PEI*(1.-PEI)/(KOUNT-IOLBIT))

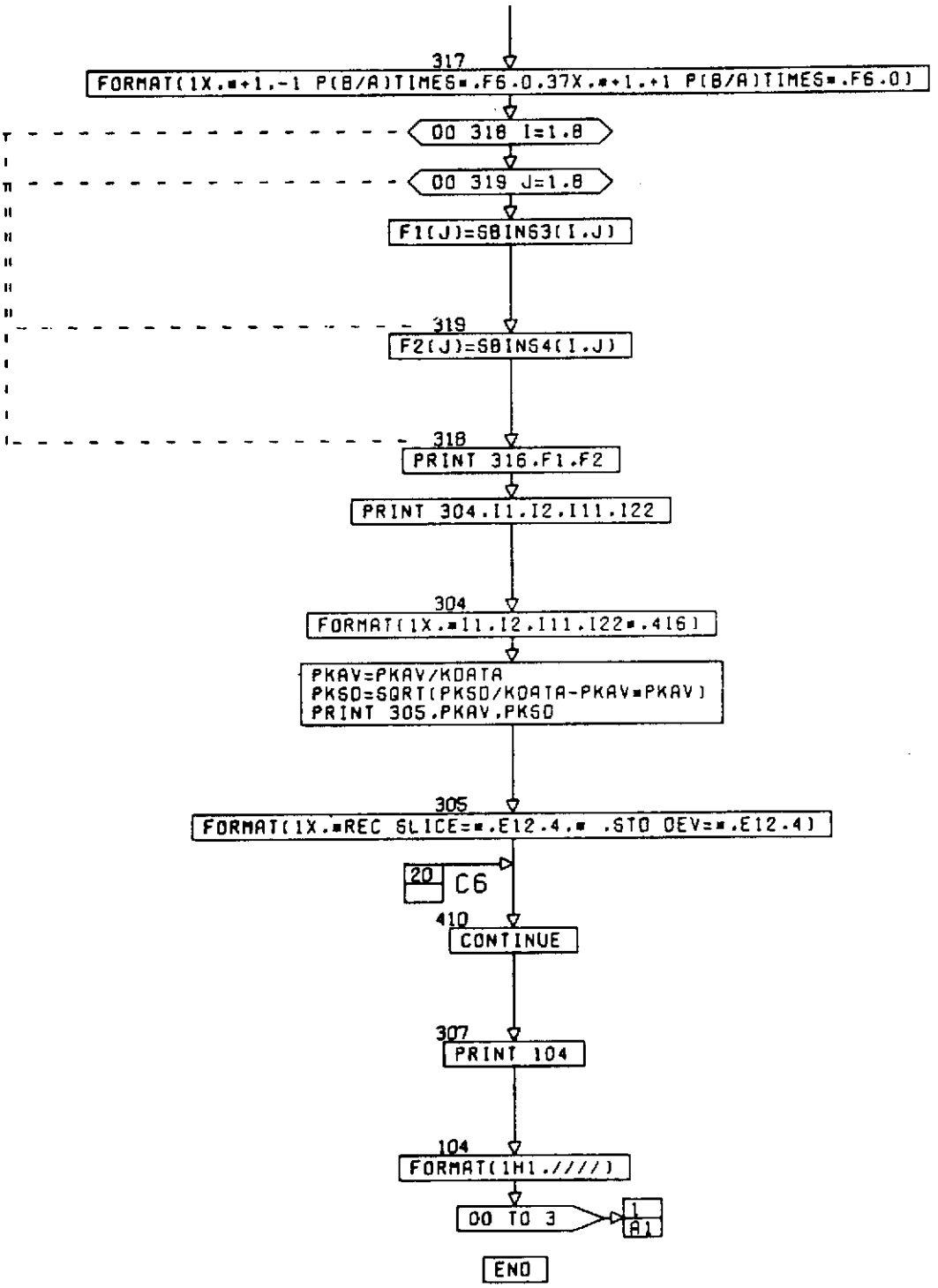
CONT. ON PG 21


XISUM=XISUM/(KOUNT-IOLBIT)
XISIG=SQRT(XISIG/(KOUNT-IOLBIT)-XISUM*XISUM)
PRINT 411,PEI,SPEI,XISUM,XISIG,KKK
411
FORMAT(1X,*PEI=*,E12.4,* ,STDEV=*,E12.4,* ,I MEAN=*,E12.4,
* I STD DEV=*,E12.4,* ,BITS=*,E12.4)
AOOA=0.
AOOS=0.
IF(IOO.EQ.0)
F
T
GOTO405
22
C4
DO 403 I=1,IOO
AOOA=AOOA+AOB(I)
403
AOOS=AOOS+AOB(I)*AOB(I)
FIOO=FLOAT(IOO)
AOOA=AOOA/FIOO
AOOS=SQRT(AOOS/FIOO-AOOA*AOOA)
PRINT 404,ILOCF,IOO,AOOA,AOOS
404
FORMAT(1X,*LOCKIN=*,I6,* ,DROPOUTS=*,I6,* ,AVE=*,E12.4,
* ,STD DEV=*,E12.4)
GOTO406
22
C5

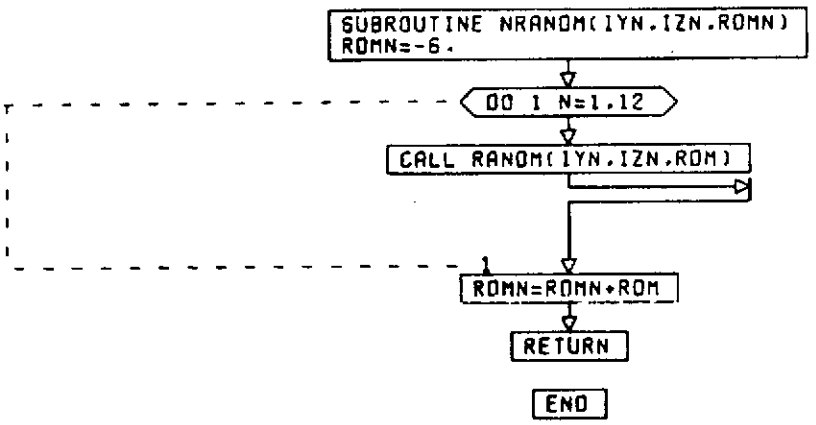
CONT. ON PG 22


21 C4
405
PRINT 407,ILOCF
407
FORMAT(1X,*LOCKIN=*,I6,* ,DROPOUT6=0*)
21 C5
406
CONTINUE
PRINT 223,ERRM
223
FORMAT(1X,*ERRM=*,/,10(1X,10E12.4,/))
PRINT 313,CBIN1,CBIN2
313
FORMAT(1X,*-1.-1 P(B/A)TIMES=*,F6.0,37X,*-1.+1 P(B/A)TIMES=*,F6.0)
DO 314 I=1,8
DO 315 J=1,8
F1(J)=6BIN61(I,J)
315
F2(J)=6BIN62(I,J)
314
PRINT 316,F1,F2
316
FORMAT(1X,8F6.0,6X,8F6.0)
PRINT 317,CBIN3,CBIN4

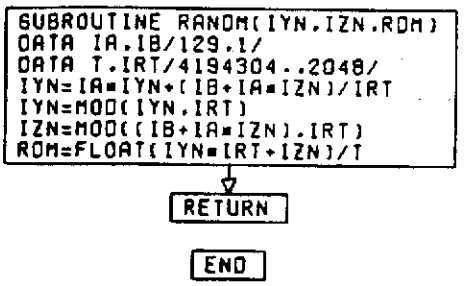
CONT. ON PG 23


317
FORMAT(1X,*+1,-1 P(B/A)TIMES=,F6.0,37X,*+1,+1 P(B/A)TIMES=,F6.0)
DO 318 I=1,8
DO 319 J=1,8
F1(J)=SBINS3(I,J)
319
F2(J)=SBINS4(I,J)
318
PRINT 316,F1,F2
PRINT 304,I1,I2,I11,I22
304
FORMAT(1X,*I1,I2,I11,I22=,4I6)
PKAV=PKAV/KDATA
PKSD=SQRT(PKSD/KDATA-PKAV*PKAV)
PRINT 305,PKAV,PKSD
305
FORMAT(1X,*REC SLICE=*,E12.4,* ,STD DEV=*,E12.4)
20
C6
410
CONTINUE
307
PRINT 104
104
FORMAT(1H1,////)
DO TO 3
1
A1
END

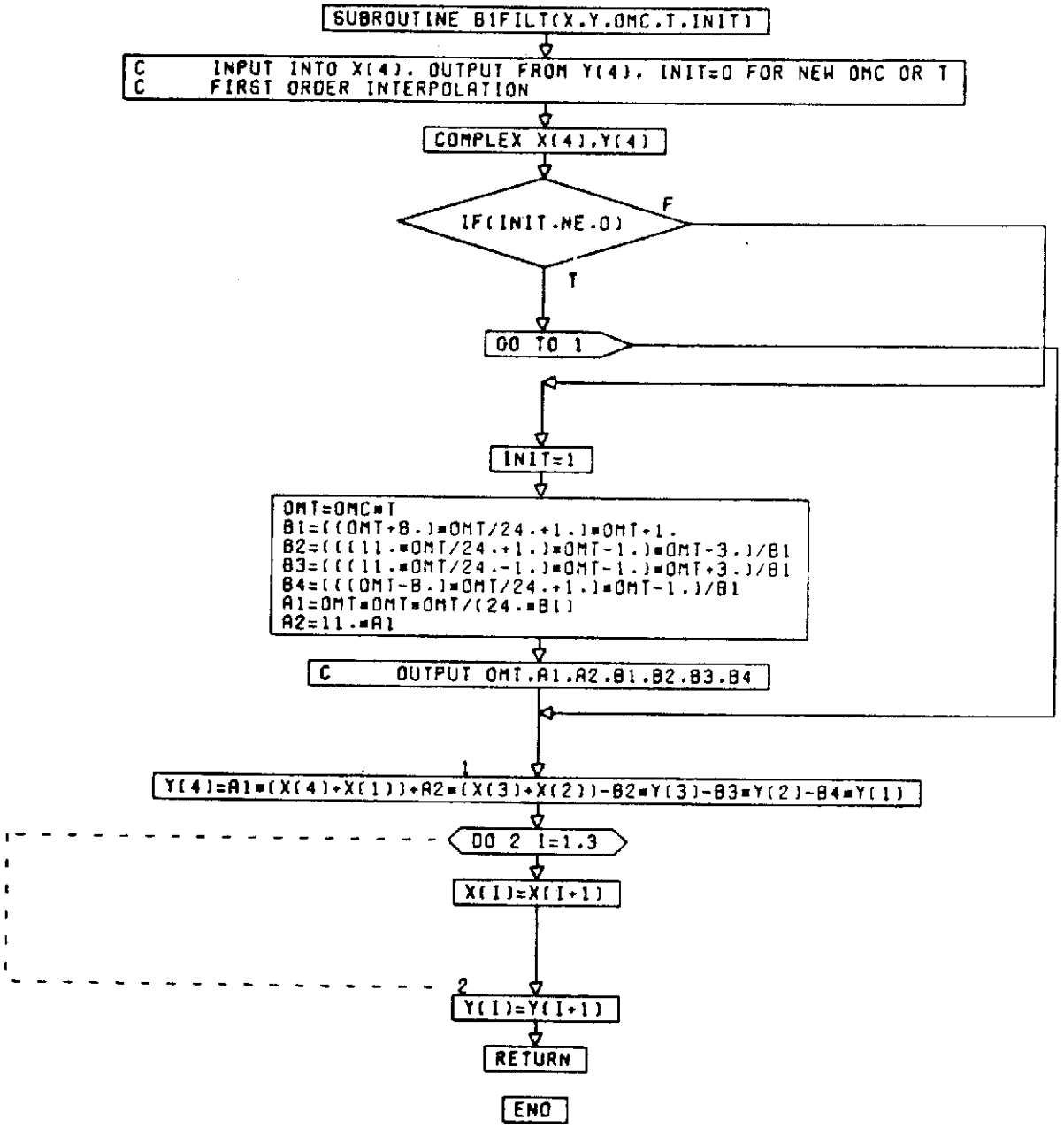
PG 23 FINAL


SUBROUTINE NRANDM(IYN,IZN,RDMN)
RDMN=-6.
DO 1 N=1,12
CALL RANDM(IYN,IZN,RDM)
1
RDMN=RDMN+RDM
RETURN
END

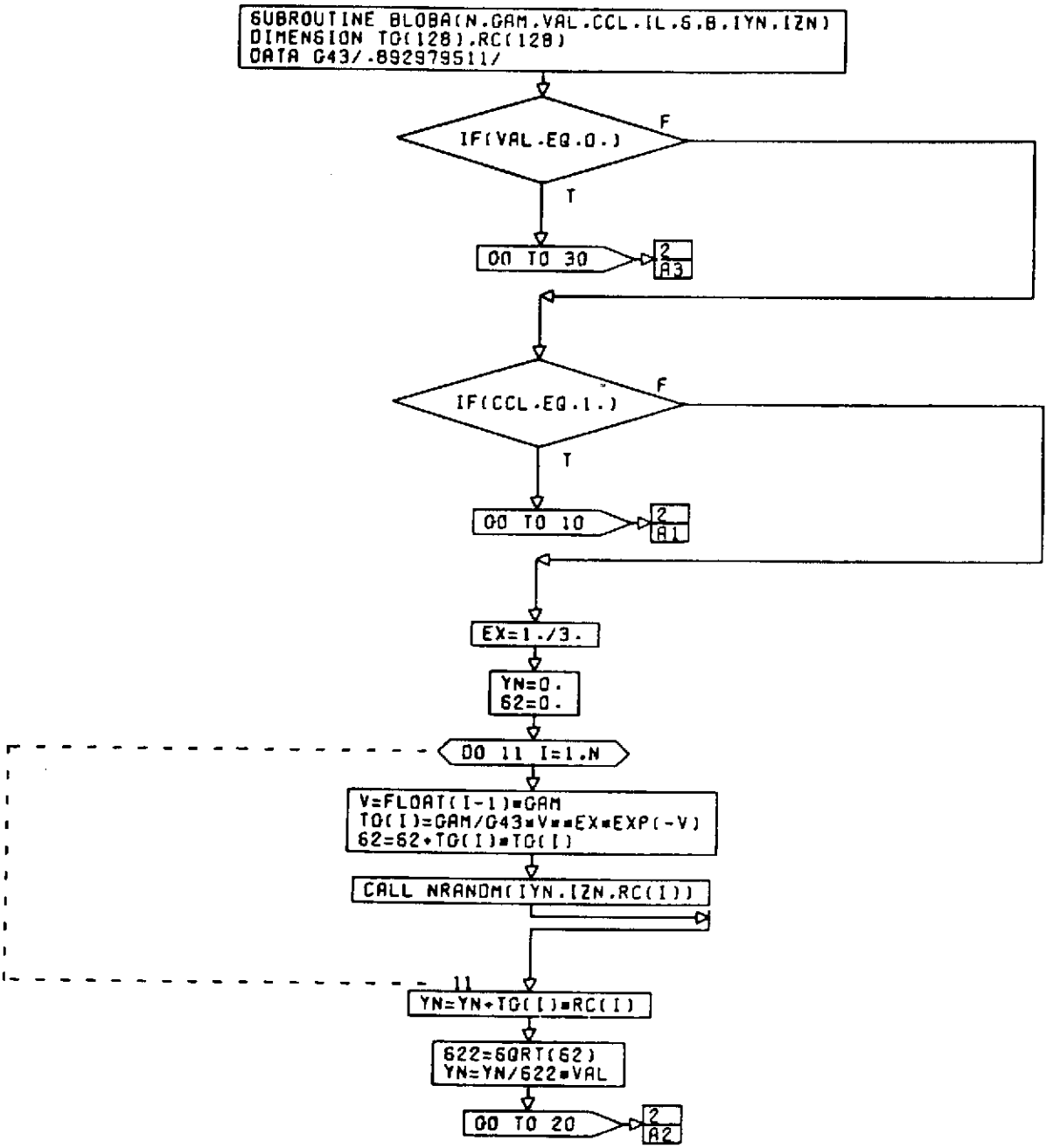
PO 1 FINAL


SUBROUTINE RANDM(IYN,IZN,RDM)
DATA IA,IB/129,1/
DATA T,IRT/4194304.,2048/
IYN=IA*IYN+(IB+IA*IZN)/IRT
IYN=MOD(IYN,IRT)
IZN=MOD((IB+IA*IZN),IRT)
RDM=FLOAT(IYN*IRT+IZN)/T
RETURN
END

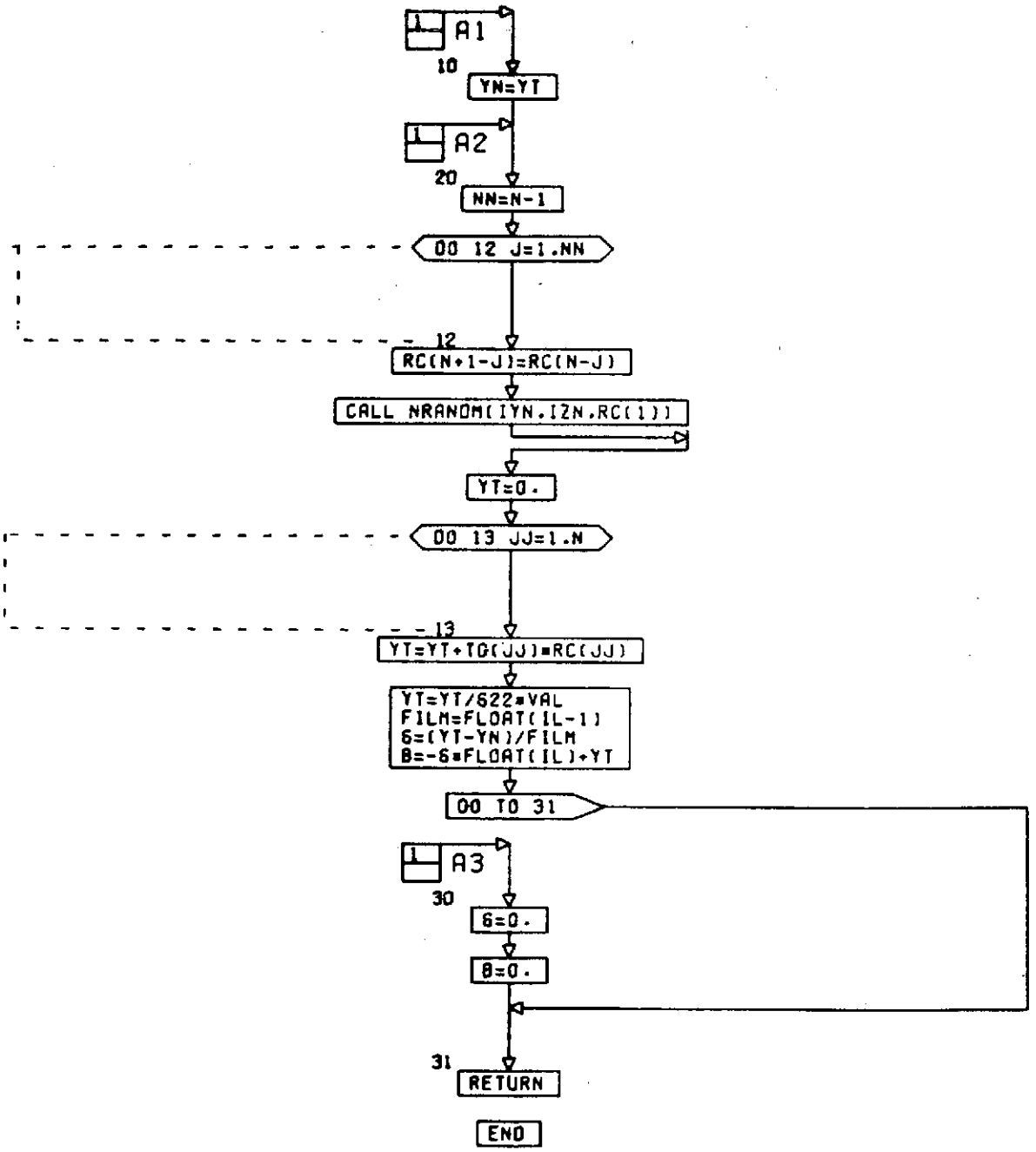
PG 1 FINAL


SUBROUTINE B1FILT(X,Y,OMC,T,INIT)
C INPUT INTO X(4), OUTPUT FROM Y(4), INIT=0 FOR NEW OMC OR T
C FIRST ORDER INTERPOLATION
COMPLEX X(4),Y(4)
IF(INIT.NE.0)
F
T
GO TO 1
INIT=1
OMT=OMC*T
B1=((OMT+8.)*OMT/24.+1.)*OMT+1.
B2=(((11.*OMT/24.+1.)*OMT-1.)*OMT-3.)/B1
B3=(((11.*OMT/24.-1.)*OMT-1.)*OMT+3.)/B1
B4=(((OMT-8.)*OMT/24.+1.)*OMT-1.)/B1
A1=OMT*OMT*OMT/(24.*B1)
A2=11.*A1
C OUTPUT OMT,A1,A2,B1,B2,B3,B4
1
Y(4)=A1*(X(4)+X(1))+A2*(X(3)+X(2))-B2*Y(3)-B3*Y(2)-B4*Y(1)
DO 2 I=1,3
X(I)=X(I+1)
2
Y(I)=Y(I+1)
RETURN
END

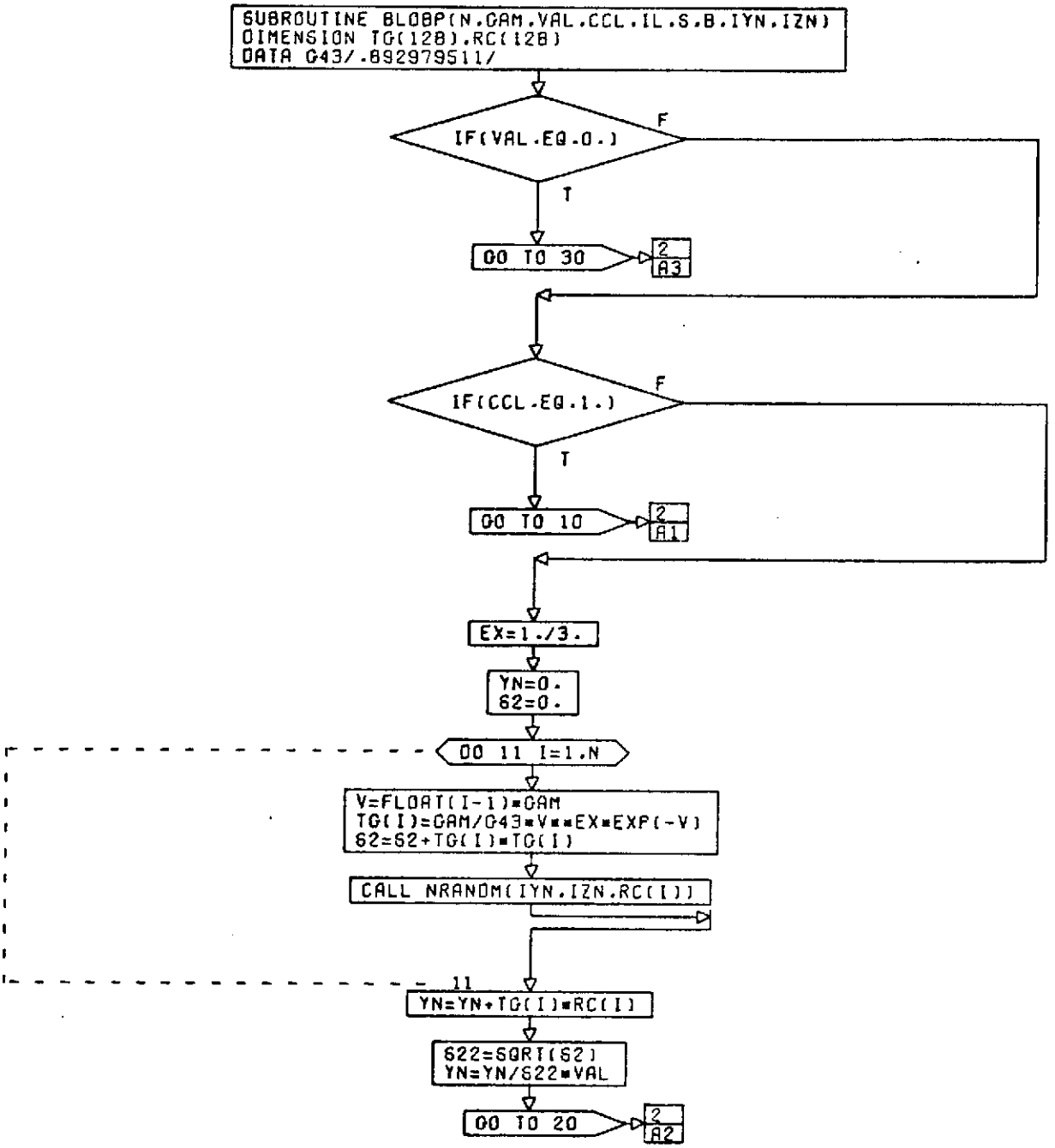
PQ 1 FINAL


SUBROUTINE BLOBA(N,GAM,VAL,CCL,IL,G,B,IYN,IZN)
DIMENSION TG(128),RC(128)
DATA G43/.892979511/
IF(VAL.EQ.0.)
F
T
GO TO 30
2
A3
IF(CCL.EQ.1.)
F
T
GO TO 10
2
A1
EX=1./3.
YN=0.
G2=0.
DO 11 I=1,N
V=FLOAT(I-1)*GAM
TG(I)=GAM/G43*V**EX*EXP(-V)
G2=G2+TG(I)*TG(I)
CALL NRANDM(IYN,IZN,RC(I))
11
YN=YN+TG(I)*RC(I)
G22=SQRT(G2)
YN=YN/G22*VAL
GO TO 20
2
A2

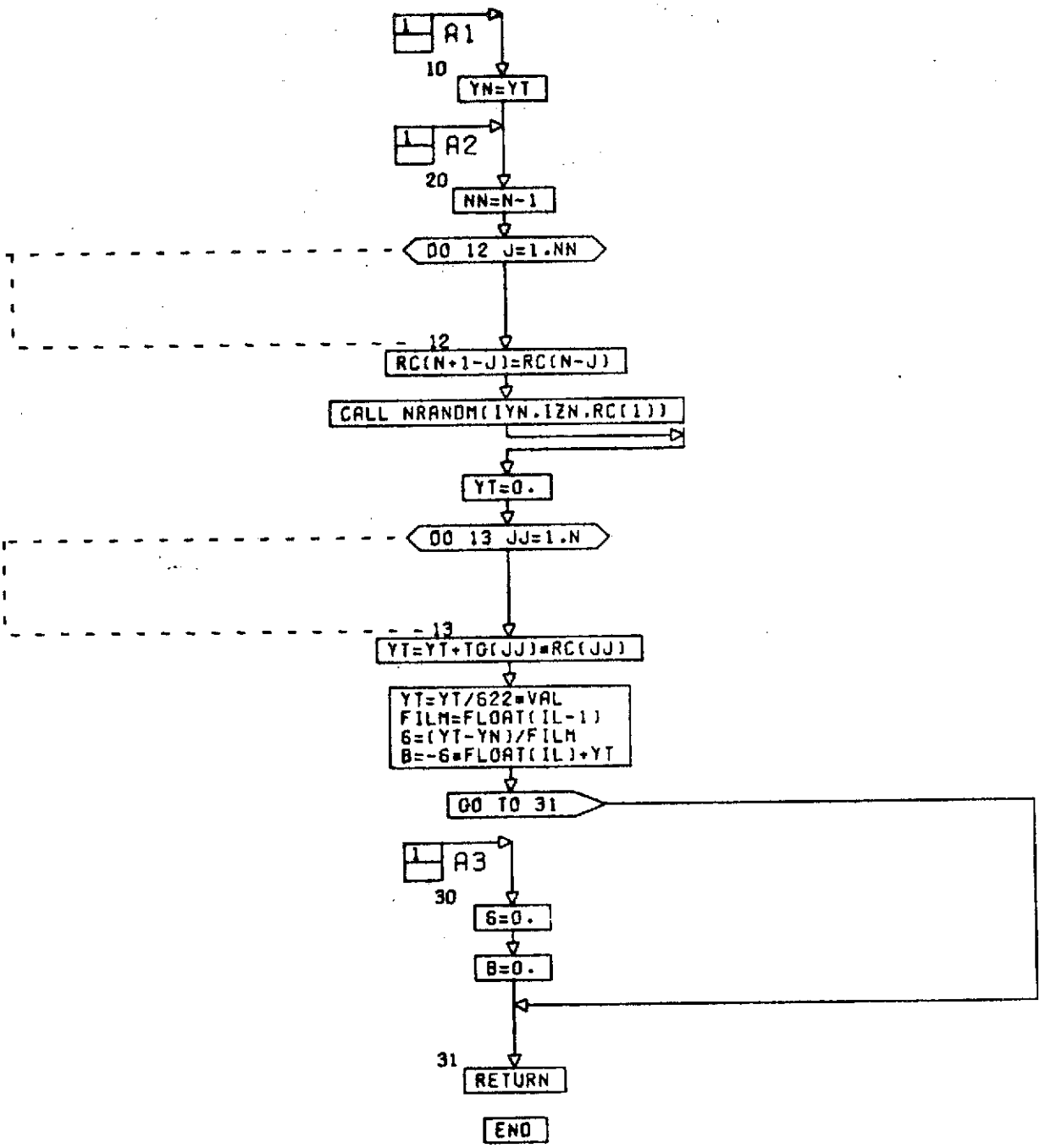
CONT. ON PG 2


A1
10
YN=YT
A2
20
NN=N-1
DO 12 J=1,NN
12
RC(N+1-J)=RC(N-J)
CALL NRANDM(IYN,IZN,RC(1))
YT=0.
DO 13 JJ=1,N
13
YT=YT+TG(JJ)*RC(JJ)
YT=YT/622.*VAL
FILM=FLOAT(IL-1)
G=(YT-YN)/FILM
B=-G*FLOAT(IL)+YT
DO TO 31
A3
30
G=0.
B=0.
31
RETURN
END

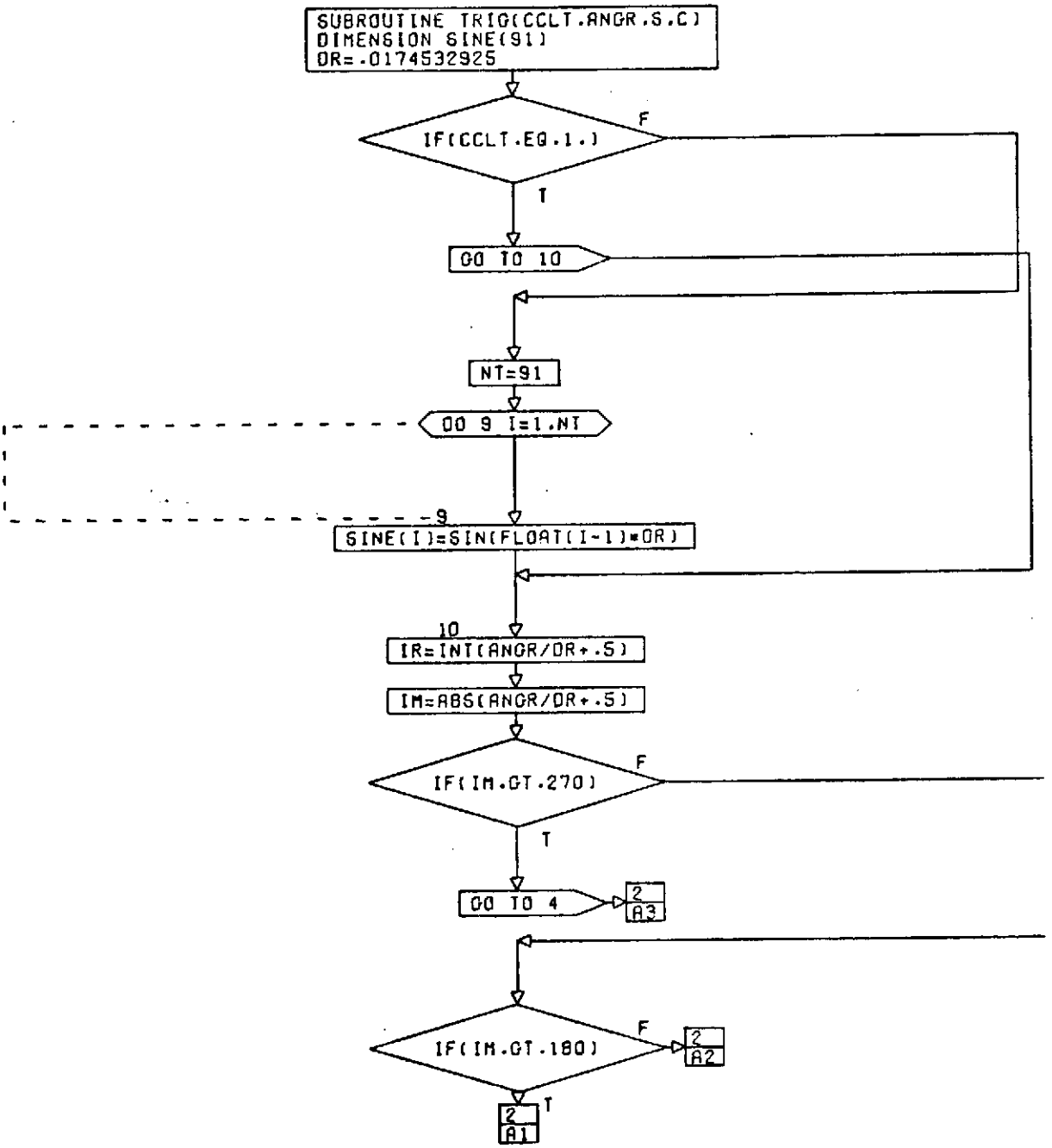
PO 2 FINAL


SUBROUTINE BLOBP(N,GAM,VAL,CCL,IL,S,B,IYN,IZN)
DIMENSION TG(128),RC(128)
DATA G43/.892979511/
IF(VAL.EQ.0.)
F
T
GO TO 30
2
A3
IF(CCL.EQ.1.)
F
T
GO TO 10
2
A1
EX=1./3.
YN=0.
G2=0.
DO 11 I=1,N
V=FLOAT(I-1)*GAM
TG(I)=GAM/G43*V**EX*EXP(-V)
G2=G2+TG(I)*TG(I)
CALL NRANDM(IYN,IZN,RC(I))
11
YN=YN+TG(I)*RC(I)
G22=SQRT(G2)
YN=YN/G22*VAL
GO TO 20
2
A2

CONT. ON PG 2

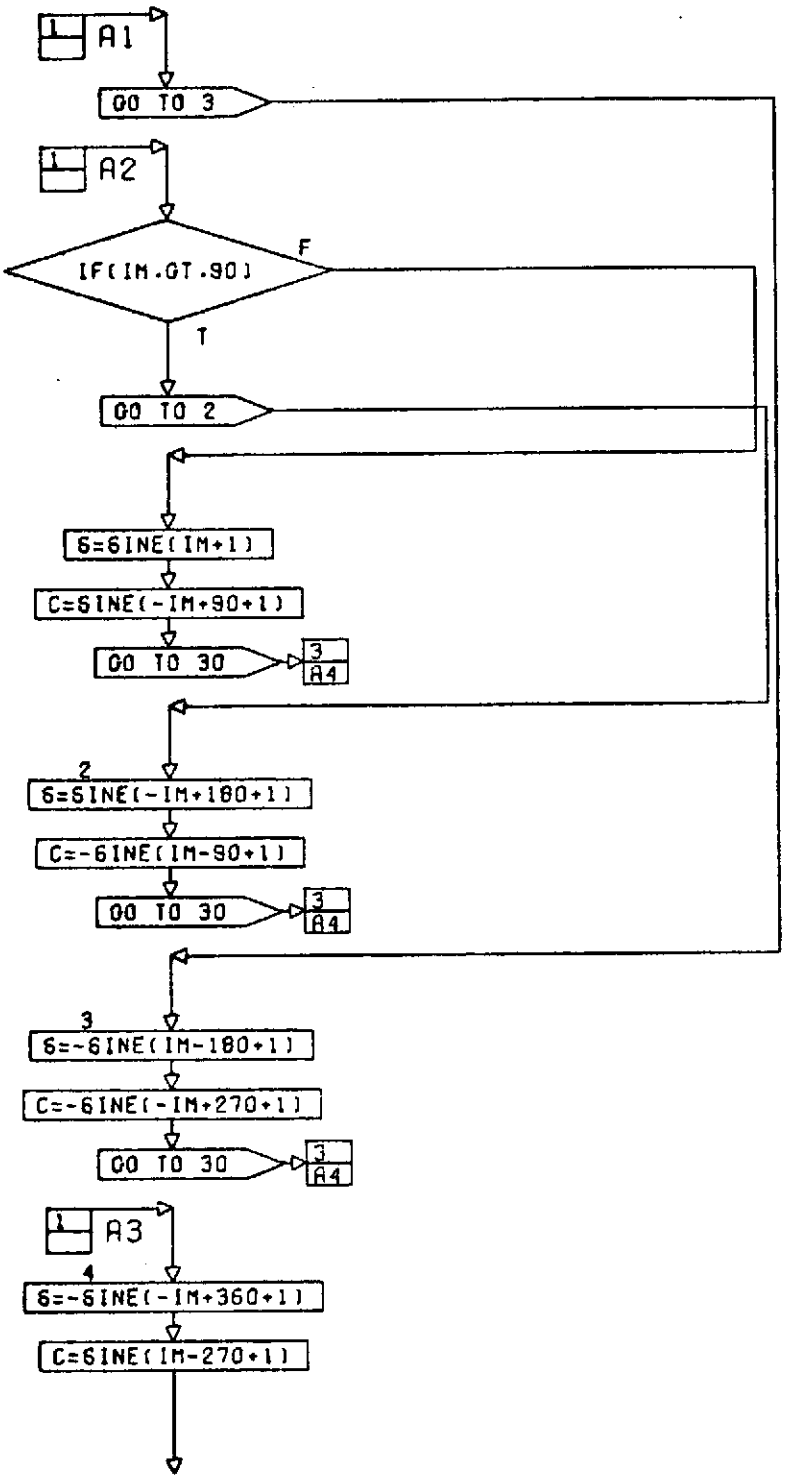

A1
10
YN=YT
A2
20
NN=N-1
DO 12 J=1.NN
12
RC(N+1-J)=RC(N-J)
CALL NRANDM(IYN.IZN.RC(1))
YT=0.
DO 13 JJ=1.N
13
YT=YT+TG(JJ)*RC(JJ)
YT=YT/622*VAL
FILM=FLOAT(IL-1)
G=(YT-YN)/FILM
B=-G*FLOAT(IL)+YT
GO TO 31
A3
30
G=0.
B=0.
31
RETURN
END

PG 2 FINAL

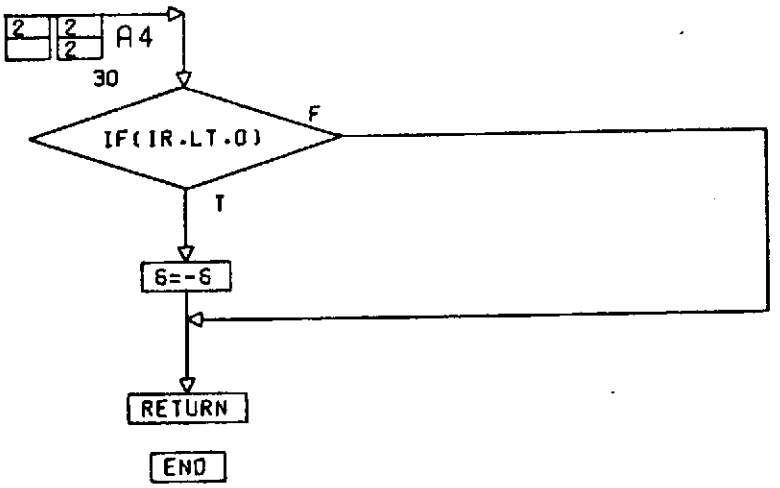


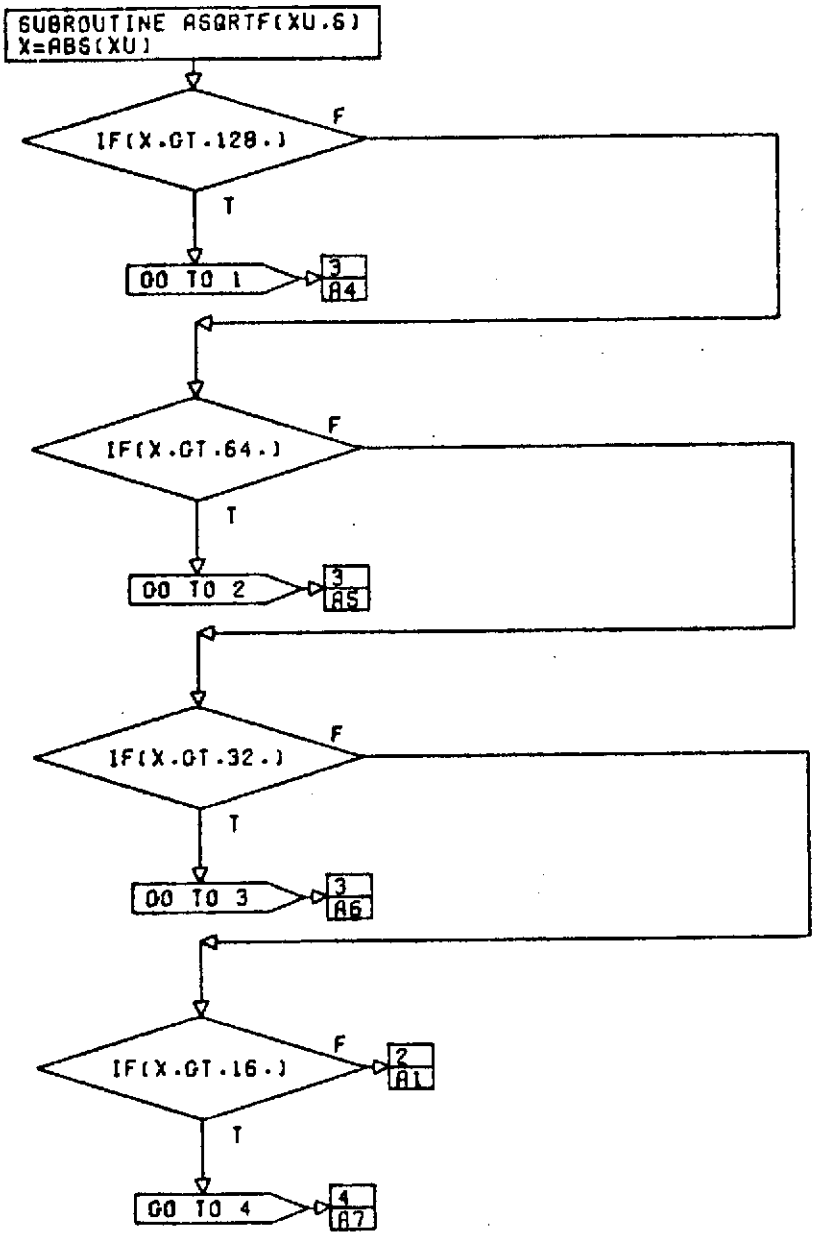
CONT. ON PG 2

PG 1 OF 3

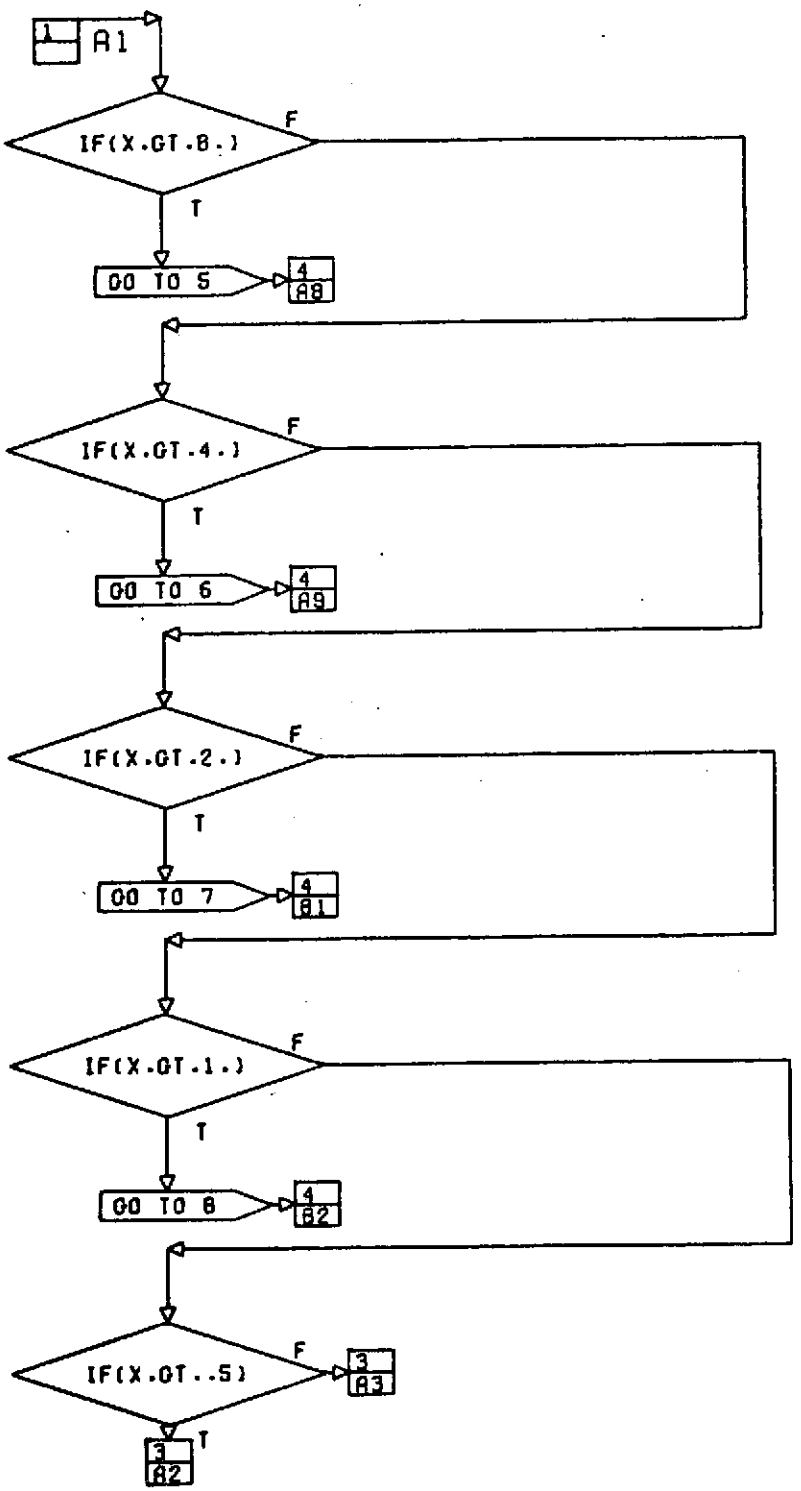

1
A1
GO TO 3
1
A2
IF(IM.GT.90)
F
T
GO TO 2
6=SINE(IM+1)
C=SINE(-IM+90+1)
GO TO 30
3
A4
2
6=SINE(-IM+180+1)
C=-SINE(IM-90+1)
GO TO 30
3
A4
3
6=-SINE(IM-180+1)
C=-SINE(-IM+270+1)
GO TO 30
3
A4
1
A3
4
6=-SINE(-IM+360+1)
C=SINE(IM-270+1)

CONT. ON PG 3

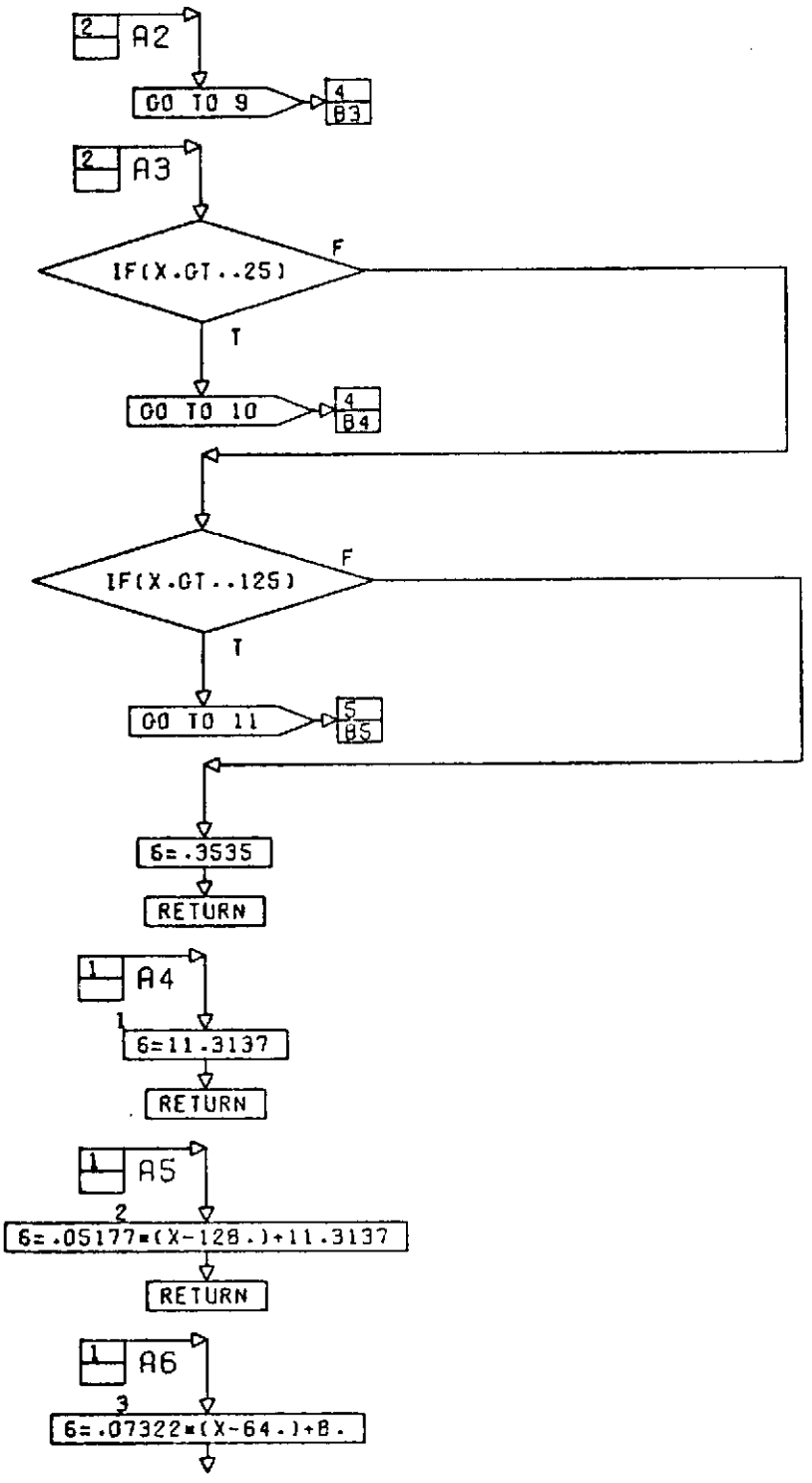

2
2
2
A4
30
IF(IR.LT.0)
F
T
6=-6
RETURN
END


SUBROUTINE ASQRTF(XU,S)
X=ABS(XU)
IF(X.GT.128.)
F
T
GO TO 1
3
A4
IF(X.GT.64.)
F
T
GO TO 2
3
A5
IF(X.GT.32.)
F
T
GO TO 3
3
A6
IF(X.GT.16.)
F
2
A1
T
GO TO 4
4
A7

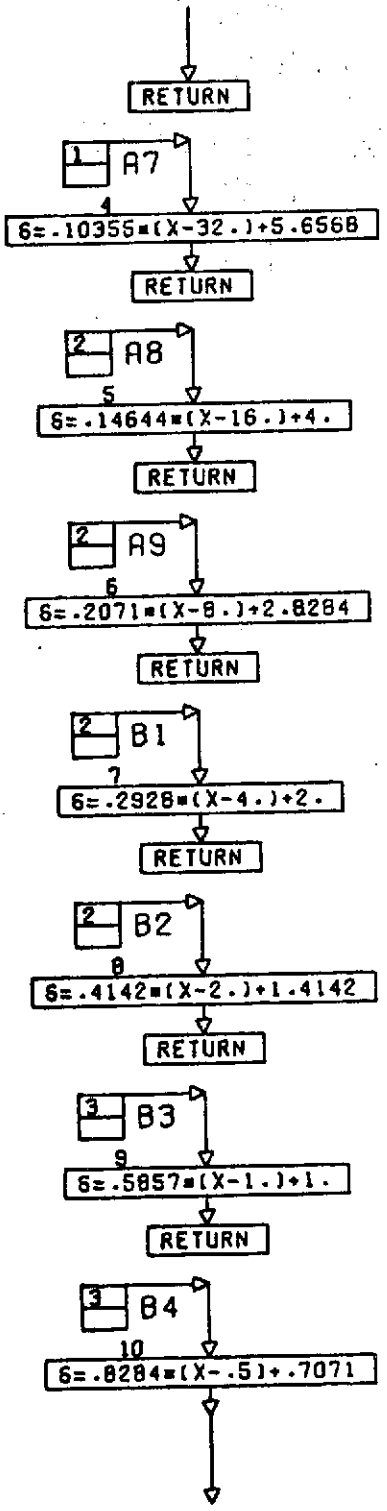
CONT. ON PG 2


1
A1
IF(X.GT.8.)
F
T
GO TO 5
4
A8
IF(X.GT.4.)
F
T
GO TO 6
4
A9
IF(X.GT.2.)
F
T
GO TO 7
4
A1
IF(X.GT.1.)
F
T
GO TO 8
4
A2
IF(X.GT..5)
F
3
A3
T
3
A2

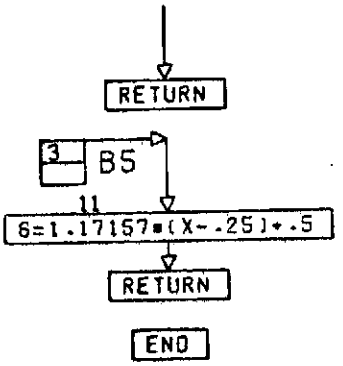
CONT. ON PO 3


2
A2
GO TO 9
4
B3
2
A3
IF(X.GT..25)
F
T
GO TO 10
4
B4
IF(X.GT..125)
F
T
GO TO 11
5
B5
6=.3535
RETURN
1
A4
1
6=11.3137
RETURN
1
A5
2
6=.05177*(X-128.)+11.3137
RETURN
1
A6
3
6=.07322*(X-64.)+8.

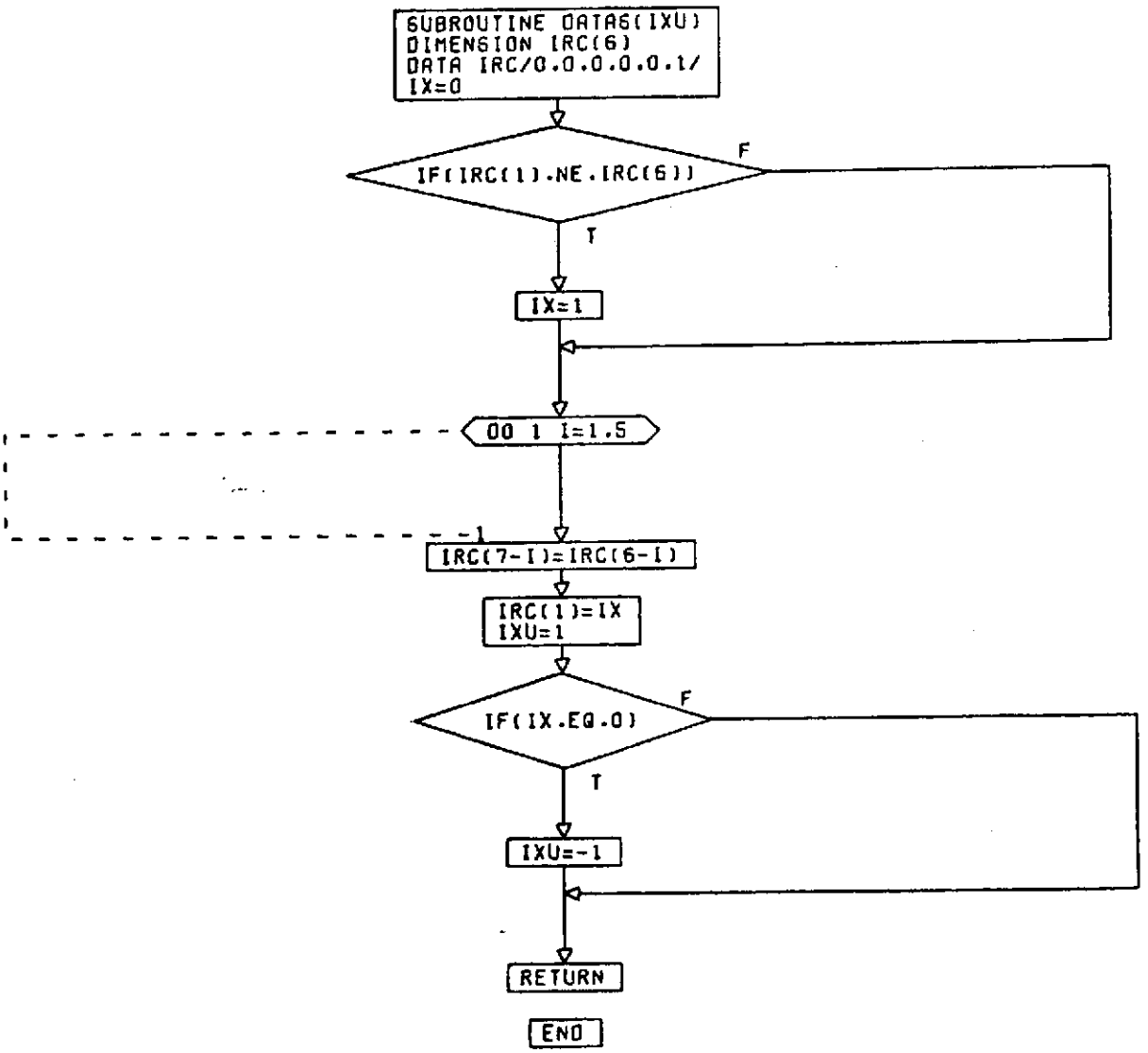
CONT. ON PG 4


RETURN
1
A7
4
6=.10355*(X-32.)+5.6568
RETURN
2
A8
5
6=.14644*(X-16.)+4.
RETURN
2
A9
6
6=.2071*(X-8.)+2.8284
RETURN
2
B1
7
6=.2928*(X-4.)+2.
RETURN
2
B2
8
6=.4142*(X-2.)+1.4142
RETURN
3
B3
9
6=.5857*(X-1.)+1.
RETURN
3
B4
10
6=.8284*(X-.5)+.7071

CONT. ON PG 5



PG 5 FINAL


SUBROUTINE DATA6(IXU)
DIMENSION IRC(6)
DATA IRC/0,0,0,0,0,1/
IX=0
IF(IRC(1).NE.IRC(6))
F
T
IX=1
DO 1 I=1,5
IRC(7-I)=IRC(6-I)
1
IRC(1)=IX
IXU=1
IF(IX.EQ.0)
F
T
IXU=-1
RETURN
END

PO 1 FINAL

APPENDIX VI

ACQUISITION

COMPUTER SOFTWARE

```
                      PROGRAM MARK(INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT)
000003                REAL NS,NC,ND,K,KB
000003                COMPLEX CAMP(4),CFILT(4),COUT,CCOUT
000003                DATA FBAMP,FBPHA,SDAMP,SDPHA,ND/2.,.2,.23,.47,1./
000003                DATA GAM43,N43/.09,64/
000003                DATA ENODB,BRATE,ENOMIN/8.,88.,9./
000003                DATA DELF,NSPB,NACQT,BIF/62.,40,100,1000./
000003                DATA BL2,PHIDEG,FDIFF/176.,10.,342.433/
000003                DATA I1,I2,I11,I22/1,1,1,1/
000003                DATA FRQOOP,FODPRT,TL/13.E3,10.8,-6.5/
000003                DATA TAU3/.07957/
000003                DATA FLO/10./
000003                DATA SVRHZ,SWMX,SWMN/2.2E3,28.15E3,6.85E3/
000003                DATA DYNR/3./
000003                NAMELIST/IN1/NACQT,NSPB,ENODB,DELF,BIF,ENOMIN
                     +,BL2,PHIDEG,FDIFF
                     +,FBAMP,FBPHA,SDAMP,SDPHA,GAM43,N43
                     +,FLO,FRQOOP,FODPRT,I1,I2,I11,I22
                     +,SVRHZ,SWMX,SWMN,TL,DYNR
000003                PI=4.*ATAN(1.)
000006                PI2=2.*PI
000010                ZETA=SQRT(0.5)
000013                CALL TRIG(CCLT,PI,SSCIN,CSCIN)
000016                CCLT=1.
000020           3    CONTINUE
                 C    READ INPUTS
000020                READ(5,IN1)
000023                NSPB=200
000024                NACQT=30
000025                SWMX=2500.
000026                FRQOOP=1000.
000030                I1=1
000031                I2=1
000032                I11=1
000033                I22=1
000034                I1S=I1
000035                I2S=I2
000037                I11S=I11
000040                I22S=I22
                 C    CONVERT INPUTS (ENO,BPER,PHISS,PHISSB)
000042                ENO=10.**(ENODB/10.)
000050                ENOM=10.**(ENOMIN/10.)
000056                BPER=1./BRATE
000060                DT=BPER/NSPB
000062                PHISS=PHIDEG*PI/180.
000064                AMIN=SQRT(ENO*M*ND*BRATE)
000071                AMIN2=AMIN/1.4142
000073                A=SQRT(ENO*ND*BRATE)
000100                AGC=SQRT(AMIN2)
000102                AMIN3=AMIN2/SQRT(10.**(DYNR/10.))
                 C    CALCULATE LOOP PARAMETERS (TAU1,TAU2,K,TAUB1,TAUB2,KB)
000113                WN=BL2/(ZETA+0.25/ZETA)
000117                AK=PI2*FDIFF/SIN(PHISS)
000123                TAU1=AK/(WN*WN)
000126                TAU2=2.*(ZETA-0.5/(WN*TAU1))/WN
000132                K=AK/AMIN
000134                ENOP=PI2*FRQOOP/K
```

```
000137          EDOPR=PI2*FQDPRT*DT/K
000142          EVMAX=PI2*SWMX/K
000144          EVMIN=-PI2*SWMN/K
000146          SVR=PI2*SVRHZ/K
000150          DES=DT*SVR
                C     DEFINE CONSTANTS
000152          C1=1.-DT/TAU1
000155          C2=TAU2/TAU1
000156          C3=C1+C2-1.
000161          C4=DT*K
000163          C5=DT/TAU3
000164          C6=1.-C5
000165          DTH1=PI*DELF*DT
000170          SDTH0=SIN(DTH1)
000172          CDTH1=COS(DTH1)
000174          DTHX=PI2*FLO*DT
000177          SDTHX=SIN(DTHX)
000201          CDTHX=COS(DTHX)
000203          NACQ=0
000204          ACQ=0.
000205          AVEES=0.
000206          STDES=0.
000207          AKOU=0.
000210          SKOU=0.
000211          AMISS=0.
000212          AFAL=0.
000213          SIG=0.5*SQRT(N0/DT)
000221          PRINT 202,EN0DB,DELF,BIF,BL2
000234    202   FORMAT(1X,*EN0DB=*,F6.1,* ,DELF=*,F6.1,
               +* ,BIF=*,F6.0,* ,BL2=*,F6.0)
000234          PRINT 204,SVRHZ,SWMX,SWMN,FLO,FRQDOP,FQDPRT
000254    204   FORMAT(1X,*SVRHZ=*,E12.4,* ,SWMX=*,E12.4,* ,SWMN=*,E12.4,
               +* ,FLO=*,E12.4,* ,FRQDOP=*,E12.4,* ,FQDPRT=*,E12.4)
000254          PRINT 206,TL,DYNR,SDAMP,SDPHA,I1S,I2S,I11S,I22S
000300    206   FORMAT(1X,*TL=*,F6.2,* ,DYNR=*,F6.1,* ,SDAMP=*,F6.3,
               +* ,SDPHA=*,F6.3,* ,I1,I2,I11,I22*,4I6)
000300          PRINT 207,WN,K,TAU1,TAU2
000314    207   FORMAT(1X,*WN=*,F6.1,* ,K=*,F6.1,
               +* ,TAU1=*,E12.4,* ,TAU2=*,E12.4)
                C     INITIALIZE LOOPS (TH2,E0,XI,XQ,QV,QERR0,ERR)
000314    400   CONTINUE
000314          IF(NACQ.EQ.1)PRINT399
000322    399   FORMAT(1X,*NACQ,AMISS,AFAL,KDATA,ES,EV,EV1*)
000322          IF(NACQ.EQ.0)GOTO396
000323          PRINT 797,NACQ,AMISS,AFAL,ACQ,KDATA,ES,EV,EV1
000347    797   FORMAT(1X,I6,3E12.4,I6,3E12.4)
000347    396   CONTINUE
000347          NACQ=NACQ+1
000351          IF(NACQ.GT.NACQT)GOTO402
000354          CAMP(1)=(0.,0.)
000356          CAMP(2)=(0.,0.)
000361          CAMP(3)=(0.,0.)
000363          CFILT(1)=(0.,0.)
000366          CFILT(2)=(0.,0.)
000370          CFILT(3)=(0.,0.)
000373          INIT=0
000373          OMC=PI*BIF
000375          TDATA=-1
```

```
000376          U=0.
000377          EV0=0.
000400          TH2=0.
000401          CTH2=1.
000403          STH2=0.
000403          CTHX=1.
000404          STHX=0.
000405          E0=0.
000406          EV=0.
000407          EDOPRX=EDCP+EDOPR
000411          EV1=EV+EDOPRX
000413          G1=1.
000414          G2=1.
000415          V=.1
000417          ES=0.
000417          STH1=0.
000420          CTH1=1.
000422          J=NSPR
                C     TURBULENCE INITIALIZATION
000423          ACOR=SQRT(2.**.75-1.)
000432          AAMP=PI2*FRAMP/ACOR
000435          APHA=PI2*FRPHA/ACOR
000437          IAMP=INT(.5+GAM43/(AAMP*DT))
000444          IPHA=INT(.5+GAM43/(APHA*DT))
000447          GAM43A=DT*FLOAT(IAMP)*AAMP
000452          GAM43P=DT*FLOAT(IPHA)*APHA
000455          CCL=0.
000457          CALL BLOBA(N43,GAM43A,SDAMP,CCL,IAMP,SLOA,BAMP,I11,I22)
000467          CALL BLOBP(N43,GAM43P,SDPHA,CCL,IPHA,SLOP,BPHA,I11,I22)
000500          CCL=1.
000501          IAMPC=0
000502          IPHAC=0
                C     SELECT DATA (IDATA)
000503          KDATA=0
000505      4   CONTINUE
000505          IAMPC=IAMPC+1
000507          IPHAC=IPHAC+1
000510          IF(IAMPC.GT.IAMP) GO TO 10
000513      13  IF(IPHAC.GT.IPHA) GO TO 11
000517          GO TO 12
000517      10  IAMPC=1
000520          CALL BLOBA(N43,GAM43A,SDAMP,CCL,IAMP,SLOA,BAMP,I11,I22)
000531          GO TO 13
000532      11  IPHAC=1
000533          CALL BLOBP(N43,GAM43P,SDPHA,CCL,IPHA,SLOP,BPHA,I11,I22)
000544      12  CONTINUE
000544          YA=SLOA*FLOAT(IAMPC)+BAMP
000547          YP=SLOP*FLOAT(IPHAC)+BPHA
000553          CALL TRTG(CCLT,YP,SSCIN,CSCIN)
000556          IF(J.LT.NSPR)GO TO 1
000561          J=0
000561          CALL DATAS(IDATA)
000563          SDTH1=SDTH0*IDATA
000565          KDATA=KDATA+1
                C     DEFINE INPUTS (TH1,NS,NC)
000567      1   CONTINUE
000567          TEMP=STHX*CDTHX+CTHX*SDTHX
000573          CTHX=CTHX*CDTHX-STHX*SDTHX
```

```
000575          STHX=TEMP
000576          TEMP=STH1*CDTH1+CTH1*SDTH1
000602          CTH1=CTH1*CDTH1-STH1*SDTH1
000604          STH1=TEMP
000604          ASTH1=1.4142*A*(1.+YA)*(STH1*CSCIN+CTH1*SSCIN)
000614          ACTH1=1.4142*A*(1.+YA)*(CTH1*CSCIN-STH1*SSCIN)
000625          CALL NRANDM(I1,I2,X)
000627          NC=X*SIG
000631          CALL NRANDM(I1,I2,X)
000634          NS=X*SIG
000636          J=J+1
          C     LOOP EQUATIONS
000640          CAMP(4)=CMPLX(ASTH1*NC,-ACTH1-NS)*CMPLX(CTH2,-STH2)*G1
000657          CALL B1FILT(CAMP,CFILT,CMC,DT,INIT)
000662          CCOUT=G2*CFILT(4)
000670          COUT=CCOUT
000672          V=C6*V+C5*U
000676          VD=V
000676          IF(ABS(VD).LT.AMIN3)VD=AMIN3
000703          IF(VD.NE.0.)CALL ASQRTF(VD,VSQRT)
000706          G1=AGC/VSQRT
000710          G2=G1
000711          U=AIMAG(COUT)*CTHX-REAL(COUT)*STHX
000716          E=REAL(COUT)*CTHX+AIMAG(COUT)*STHX+ES
000723          EV=C1*EV+C2*E-C3*E0
000730          EV1=EV0-EDOPRX
000732          IF(EV.GT.EVMAX)GOTO500
000736          IF(V.LT.TL)GOTO401
          C     IF(EV.GT.EVMAX)DES=-DES
          C     IF(EV.LT.EVMIN)DES=-DES
000740          EDOPRX=EDOPRX+EDOPR
000741          TH2=TH2+C4*EV1
000744          TH2=AMOD(TH2,PI2)
000750          CALL TRIG(CCLT,TH2,STH2,CTH2)
000753          EV0=EV
000754          E0=E
000756          EV10=EV1
000757          IF(V.GT.TL)ES=ES+DES
000764          GOTO4
000765    401   CONTINUE
          C     MAYBE AN ACQUISITION
000765          IF(ES.LT.EDOPRX)GOTO501
000770          ACQ=ACQ+1
000772          AVEES=AVEES+ES
000773          STDES=STDES+ES*ES
000776          AKOU=AKOU+FLOAT(KDATA)
001000          SKOU=SKOU+FLOAT(KDATA)*FLOAT(KDATA)
001002          GOTO400
001003    402   PACQ=ACQ/FLOAT(NACQT)
001005          IF(ACQ.EQ.0.)GOTO504
001006          STDEV=SQRT(PACQ*(1.-PACQ)/FLOAT(NACQT))
001013          AVEES=AVEES/ACQ
001015          STDES=SQRT(STDES/ACQ-AVEES*AVEES)
001022          AKOU=AKOU/ACQ
001024          SKOU=SQRT(SKOU/ACQ-AKOU*AKOU)
001032          PRINT 403,PACQ,STDEV
001041    403   FORMAT(1X,*PACQ=*,E12.4,* ,STDEV=*,E12.4)
001041          PRINT 404,AVEES,STDES
```

```
001051     404  FORMAT(1X,*AVEES=*,E12.4,* ,STDES=*,E12.4)
001051          PRINT 405,AKOU,SKOU
001061     405  FORMAT(1X,*AVE KDATA=*,E12.4,* ,STD DEV=*,E12.4)
001061     506  CONTINUE
001061          PMISS=AMISS/FLOAT(NACQT)
001064          PRINT 502,PMISS
001071     502  FORMAT(1X,*PR MISSED ACQ=*,E12.4)
001071          PFAL=AFAL/FLOAT(NACQT)
001074          PRINT 503,PFAL
001101     503  FORMAT(1X,*PR FALSE ACQ=*,E12.4)
001101          PRINT 304,I1,I2,I11,I22
001115     304  FORMAT(1X,*I1,I2,I11,I22*,4I6)
001115     307  PRINT 104
001121      104 FORMAT(1H1)
001121          GO TO 3
001122     500  CONTINUE
           C    MISSED ACQ
001122          AMISS=AMISS+1.
001124          GOTO400
001125     501  CONTINUE
           C    FALSE ACQ
001125          AFAL=AFAL+1.
001127          GOTO400
001130     504  PRINT 505
001134     505  FORMAT(1X,*NO ACQUISITIONS*)
001134          GOTO506
001135          END
```

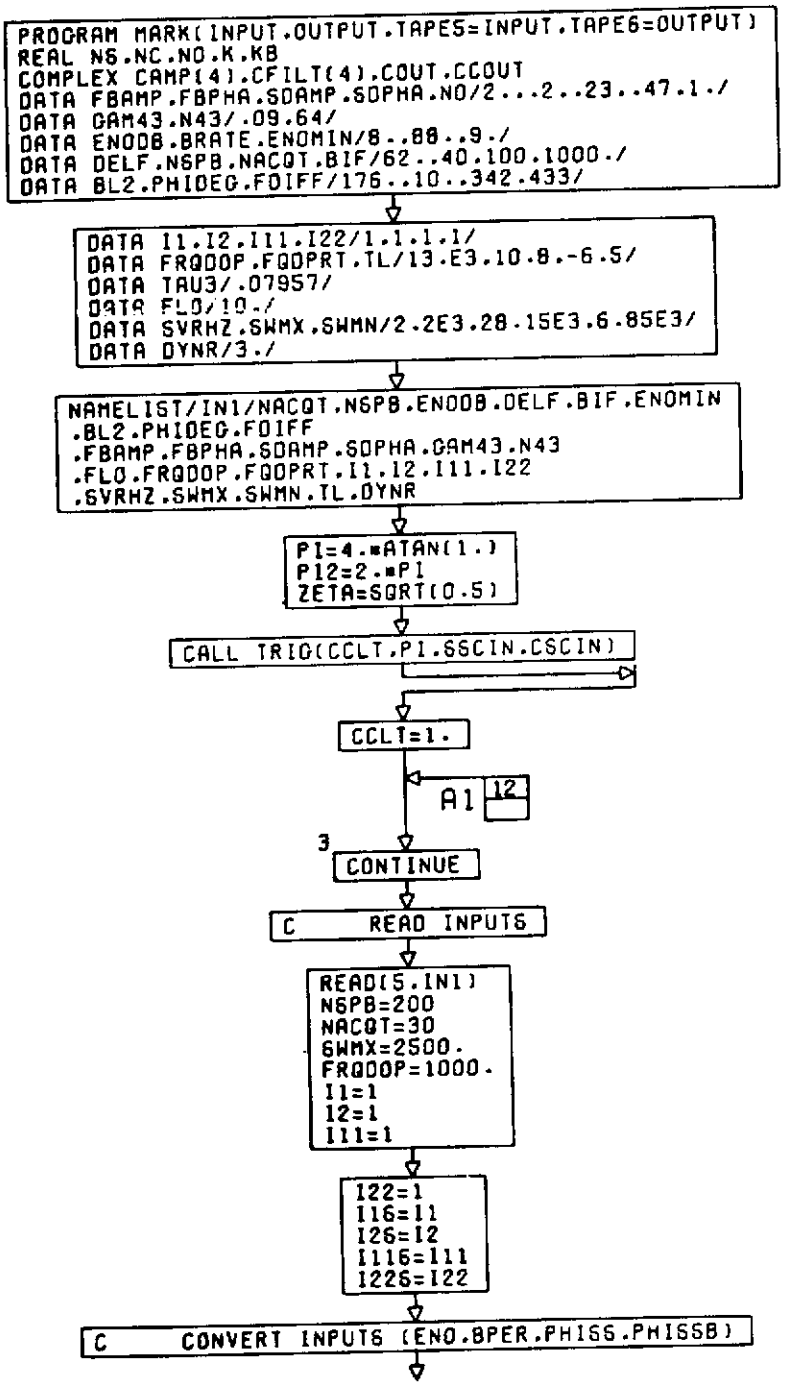
```
                SUBROUTINE NRANDM(IYN,IZN,RDMN)
000006          RDMN=-6.
000007          DO 1 N=1,12
000010          CALL RANDM(IYN,IZN,RDM)
000011        1 RDMN=RDMN+RDM
000017          RETURN
000017          END
```

```
                SUBROUTINE RANDM(IYN,IZN,RDM)
000006          DATA IA,IB/129,1/
000006          DATA T,IRT/4194304.,2048/
000006          IYN=IA*IYN+(IB+IA*IZN)/IRT
000014          IYN=MOD(IYN,IRT)
000020          IZN=MOD((IB+IA*IZN),IRT)
000026          RDM=FLOAT(IYN*IRT+IZN)/T
000031          RETURN
000032          END
```

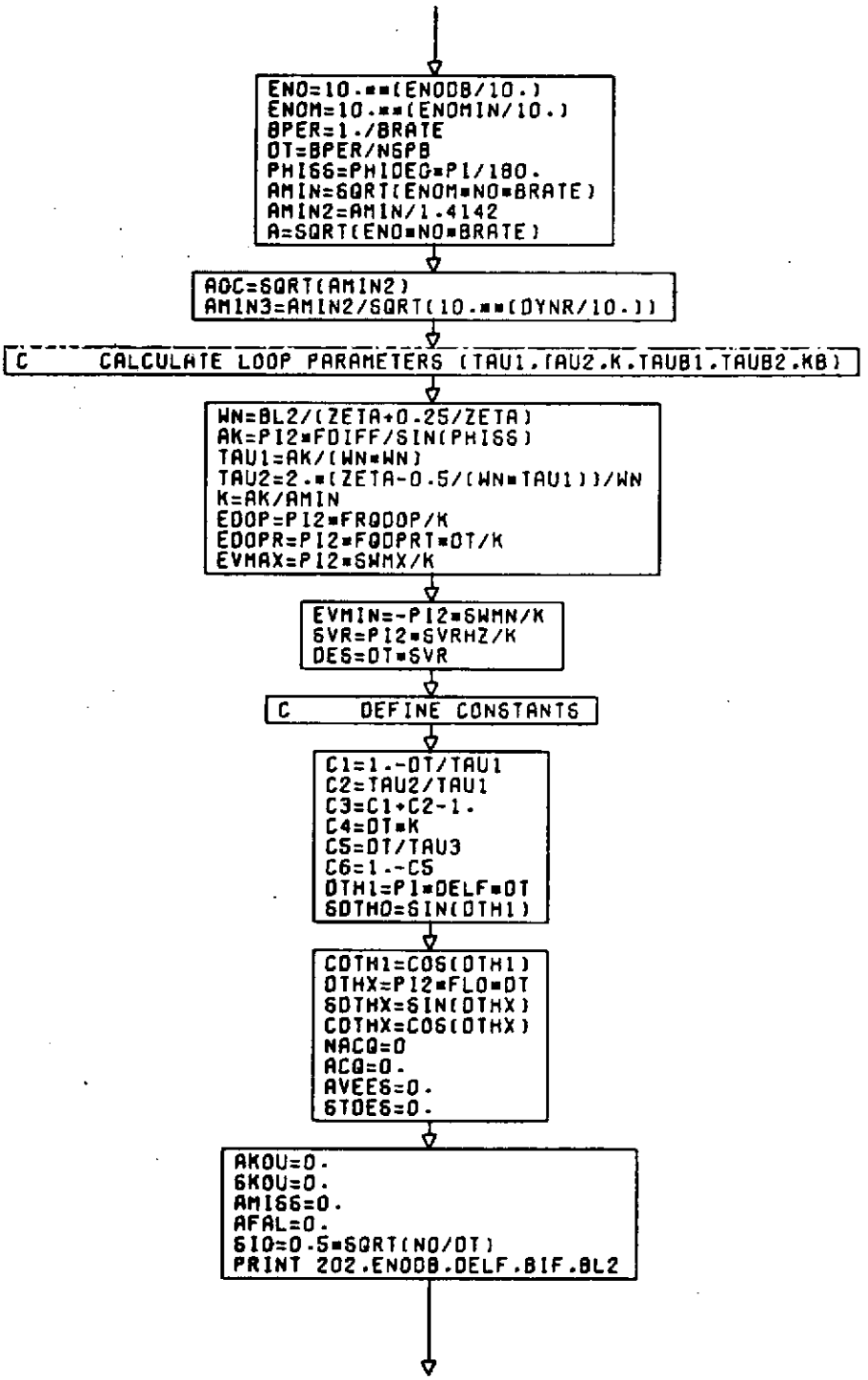
```
                      SUBROUTINE B1FILT(X,Y,OMC,T,INIT)
                C     INPUT INTO X(4), OUTPUT FROM Y(4), INIT=0 FOR NEW OMC OR T
                C     FIRST ORDER INTERPOLATION
000010                COMPLEX X(4),Y(4)
000010                IF(INIT.NE.0)GO TO 1
000011                INIT=1
000011                OMT=OMC*T
000012                B1=((OMT+8.)*OMT/24.+1.)*OMT+1.
000020                B2=(((11.*OMT/24.+1.)*OMT-1.)*OMT-3.)/B1
000027                B3=(((11.*OMT/24.-1.)*OMT-1.)*OMT+3.)/B1
000035                B4=(((OMT-8.)*OMT/24.+1.)*OMT-1.)/B1
000044                A1=OMT*OMT*OMT/(24.*B1)
000046                A2=11.*A1
                C     OUTPUT OMT,A1,A2,B1,B2,B3,B4
000050              1 Y(4)=A1*(X(4)+X(1))+A2*(X(3)+X(2))-B2*Y(3)-B3*Y(2)-B4*Y(1)
000125                DO 2 I=1,3
000126                X(I)=X(I+1)
000134              2 Y(I)=Y(I+1)
000144                RETURN
000144                END


                      SUBROUTINE BLOBA(N,GAM,VAL,CCL,IL,S,B,IYN,IZN)
000014                DIMENSION TG(128),RC(128)
000014                DATA G43/.892979511/
000014                IF(VAL.EQ.0.) GO TO 30
000015                IF(CCL.EQ.1.) GO TO 10
000017                EX=1./3.
000020                YN=0.
000020                S2=0.
000022                DO 11 I=1,N
000023                V=FLOAT(I-1)*GAM
000025                TG(I)=GAM/G43*V**EX*EXP(-V)
000043                S2=S2+TG(I)*TG(I)
000046                CALL NRANDM(IYN,IZN,RC(I))
000052          11    YN=YN+TG(I)*RC(I)
000064                S22=SQRT(S2)
000066                YN=YN/S22*VAL
000074                GO TO 20
000075          10    YN=YT
000077          20    NN=N-1
000101                DO 12 J=1,NN
000102          12    RC(N+1-J)=RC(N-J)
000111                CALL NRANDM(IYN,IZN,RC(1))
000115                YT=0.
000116                DO 13 JJ=1,N
000123          13    YT=YT+TG(JJ)*RC(JJ)
000130                YT=YT/S22*VAL
000132                FILM=FLOAT(IL-1)
000133                S=(YT-YN)/FILM
000136                B=-S*FLOAT(IL)+YT
000142                GO TO 31
000142          30    S=0.
000143                B=0.
000144          31    RETURN
000145                END
```

```
000014            DIMENSION TG(128),RC(128)
000014            DATA G43/.892979511/
000014            IF(VAL.EQ.0.) GO TO 30
000015            IF(CCL.EQ.1.) GO TO 10
000017            EX=1./3.
000020            YN=0.
000020            S2=0.
000022            DO 11 I=1,N
000023            V=FLOAT(I-1)*GAM
000025            TG(I)=GAM/G43*V**EX*EXP(-V)
000043            S2=S2+TG(I)*TG(I)
000046            CALL NRANDM(IYN,IZN,RC(I))
000062     11     YN=YN+TG(I)*RC(I)
000064            S22=SQRT(S2)
000066            YN=YN/S22*VAL
000074            GO TO 20
000075     10     YN=YT
000077     20     NN=N-1
000101            DO 12 J=1,NN
000102     12     RC(N+1-J)=RC(N-J)
000111            CALL NRANDM(IYN,IZN,RC(1))
000115            YT=0.
000116            DO 13 JJ=1,N
000123     13     YT=YT+TG(JJ)*RC(JJ)
000130            YT=YT/S22*VAL
000132            FILM=FLOAT(IL-1)
000133            S=(YT-YN)/FILM
000136            B=-S*FLOAT(IL)+YT
000142            GO TO 31
000142     30     S=0.
000143            B=0.
000144     31     RETURN
000145            END


                  SUBROUTINE TRTG(CCLT,ANGR,S,C)
000007            DIMENSION SINE(91)
000007            DR=.0174532925
000010            IF(CCLT.EQ.1.) GO TO 10
000012            NT=91
000013            DO 9 I=1,NT
000014     9      SINE(I)=SIN(FLOAT(I-1)*DR)
000027     10     IR=INT(ANGR/DR+.5)
000032            IM=ABS(ANGR/DR+.5)
000036            IF(IM.GT.270) GO TO 4
000042            IF(IM.GT.180) GO TO 3
000045            IF(IM.GT.90) GO TO 2
000050            S=SINE(IM+1)
000051            C=SINE(-IM+90+1)
000053            GO TO 30
000053     2      S=SINE(-IM+180+1)
000055            C=-SINE(IM-90+1)
000057            GO TO 30
000057     3      S=-SINE(IM-180+1)
000061            C=-SINE(-IM+270+1)
000063            GO TO 30
000063     4      S=-SINE(-IM+360+1)
000065            C=SINE(IM-270+1)
000067     30     IF(IR.LT.0) S=-S
000072            RETURN
000073            END
```

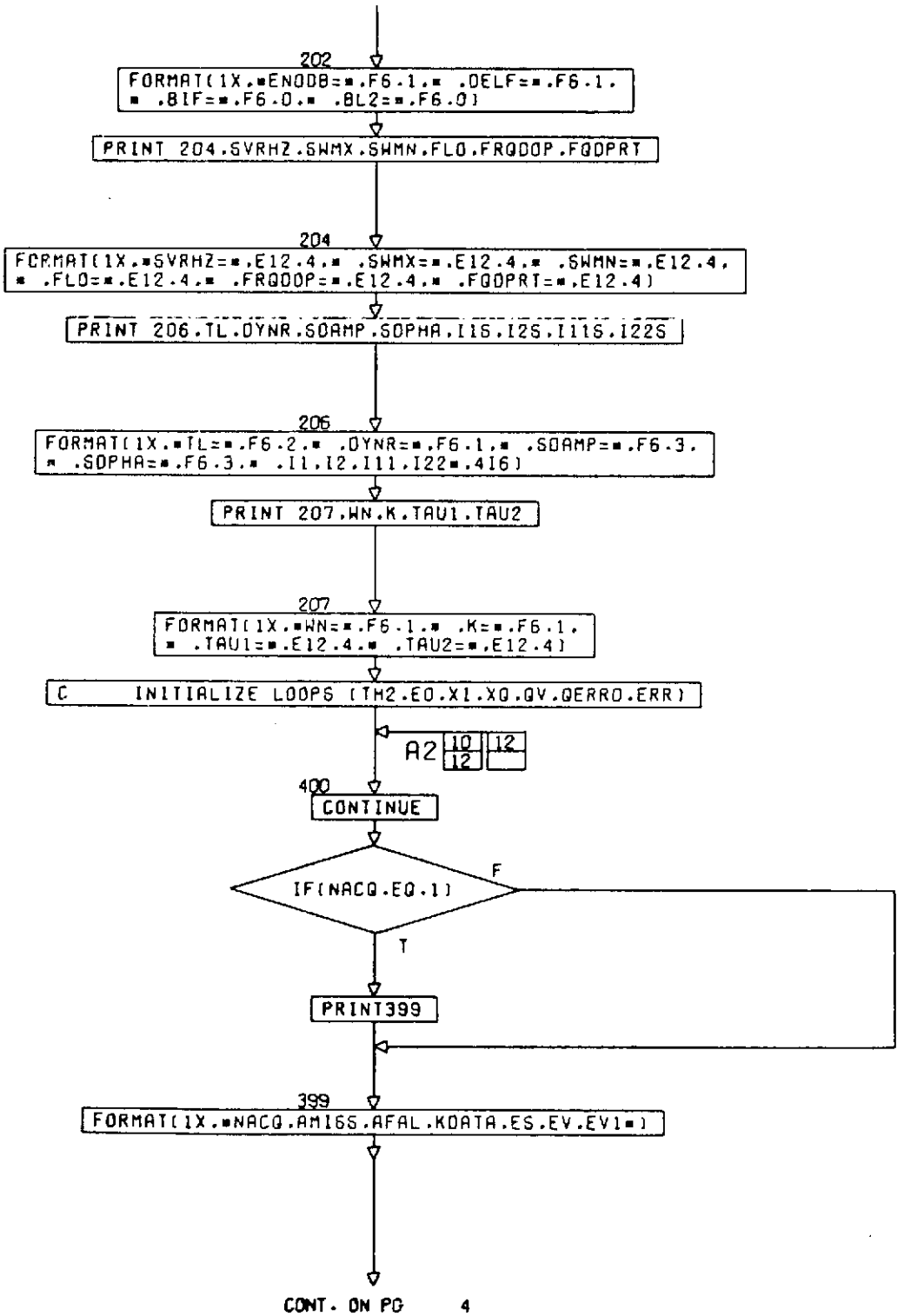
```
                SUBROUTINE ASQRTF(XU,S)
          C     MAX INTERP ERR=1.46(;1.LE.X.LE.128
000005          X=ABS(XU)
000006          IF(X.GT.128.) GO TO 1
000012          IF(X.GT.64.) GO TO 2
000015          IF(X.GT.32.) GO TO 3
000020          IF(X.GT.16.) GO TO 4
000023          IF(X.GT.8.) GO TO 5
000026          IF(X.GT.4.) GO TO 6
000031          IF(X.GT.2.) GO TO 7
000034          IF(X.GT.1.) GO TO 8
000037          IF(X.GT..5)GO TO 9
000042          IF(X.GT..25)GO TO 10
000046          IF(X.GT..125)GO TO 11
000050          S=.3535
000051          RETURN
000051     1    S=11.3137
000052          RETURN
000053     2    S=.05177*(X-128.)+11.3137
000057          RETURN
000057     3    S=.07322*(X-64.)+8.
000063          RETURN
000063     4    S=.10355*(X-32.)+5.6568
000067          RETURN
000067     5    S=.14644*(X-16.)+4.
000073          RETURN
000073     6    S=.2071*(X-8.)+2.8284
000077          RETURN
000077     7    S=.2928*(X-4.)+2.
000103          RETURN
000103     8    S=.4142*(X-2.)+1.4142
000107          RETURN
000107     9    S=.5857*(X-1.)+1.
000112          RETURN
000113     10   S=.8284*(X-.5)+.7071
000117          RETURN
000117     11   S=1.1715*(X-.25)+.5
000123          RETURN
000123          END


                SUBROUTINE DATAS(IXU)
000003          DIMENSION IRC(6)
000003          DATA IRC/0,0,0,0,0,1/
000003          IX=0
000003          IF(IRC(1).NE.IRC(6))IX=1
000007          DO 1 I=1,5
000011     1    IRC(7-I)=IRC(6-I)
000017          IRC(1)=IX
000020          IXU=1
000021          IF(IX.EQ.0)IXU=-1
000023          RETURN
000024          END
```

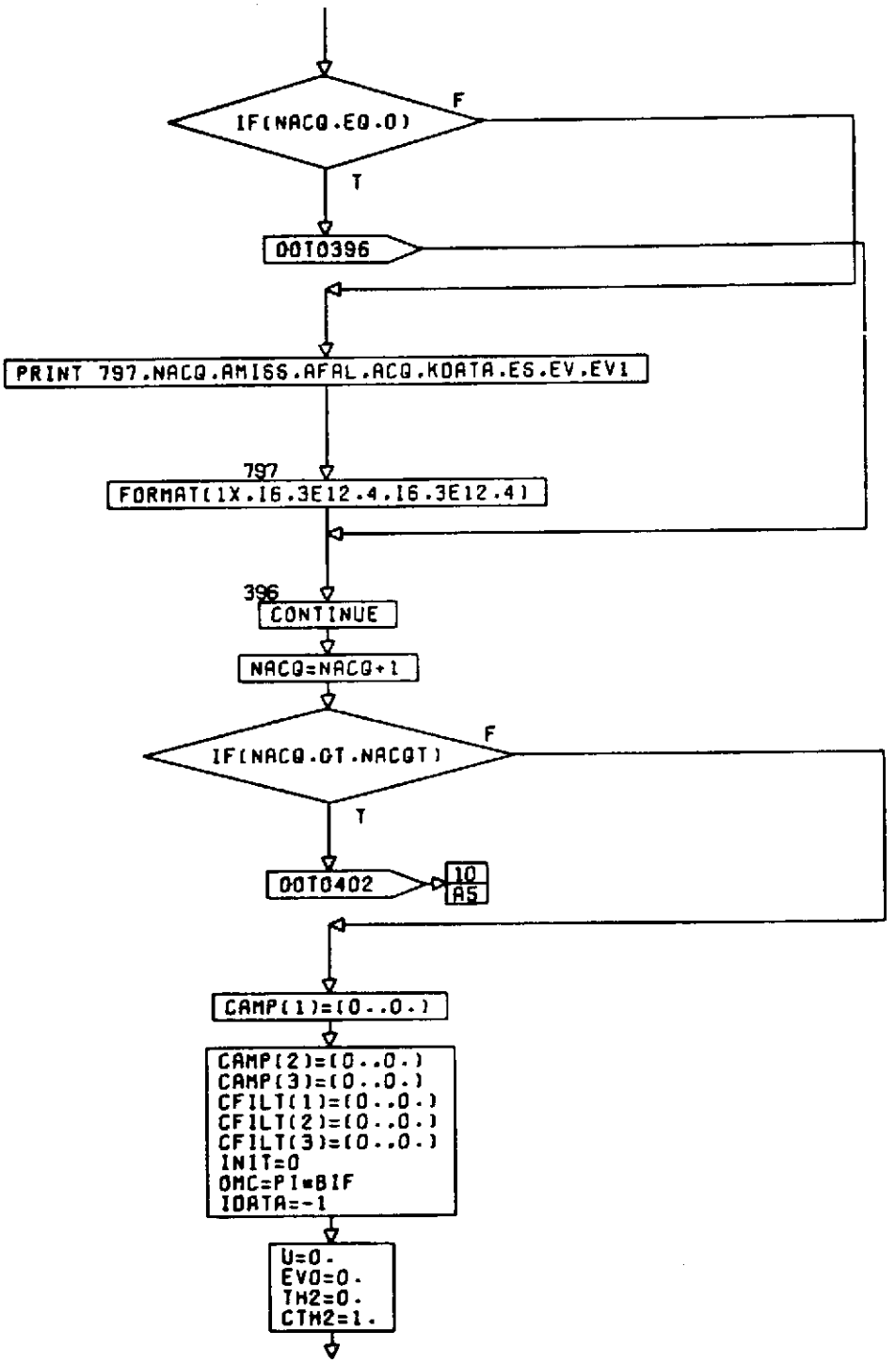

PROGRAM MARK(INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT)
REAL N6,NC,NO,K,KB
COMPLEX CAMP(4),CFILT(4),COUT,CCOUT
DATA FBAMP,FBPHA,SDAMP,SDPHA,NO/2...2..23..47.1./
DATA CAM43,N43/.09,64/
DATA ENODB,BRATE,ENOMIN/8..88..9./
DATA DELF,N6PB,NACQT,BIF/62..40,100,1000./
DATA BL2,PHIDEG,FDIFF/176..10..342,433/
DATA I1,I2,I11,I22/1,1,1,1/
DATA FRQDOP,FQDPRT,TL/13,E3,10,8,-6,5/
DATA TAU3/.07957/
DATA FLO/10./
DATA SVRHZ,SWMX,SWMN/2,2E3,28,15E3,6,85E3/
DATA DYNR/3./
NAMELIST/IN1/NACQT,N6PB,ENODB,DELF,BIF,ENOMIN
,BL2,PHIDEG,FDIFF
,FBAMP,FBPHA,SDAMP,SDPHA,CAM43,N43
,FLO,FRQDOP,FQDPRT,I1,I2,I11,I22
,SVRHZ,SWMX,SWMN,TL,DYNR
PI=4.*ATAN(1.)
PI2=2.*PI
ZETA=SQRT(0.5)
CALL TRIG(CCLT,PI,SSCIN,CSCIN)
CCLT=1.
A1
12
3
CONTINUE
C READ INPUTS
READ(5,IN1)
N6PB=200
NACQT=30
SWMX=2500.
FRQDOP=1000.
I1=1
I2=1
I11=1
I22=1
I16=I1
I26=I2
I116=I11
I226=I22
C CONVERT INPUTS (ENO,BPER,PHISS,PHISSB)

CONT. ON PG 2

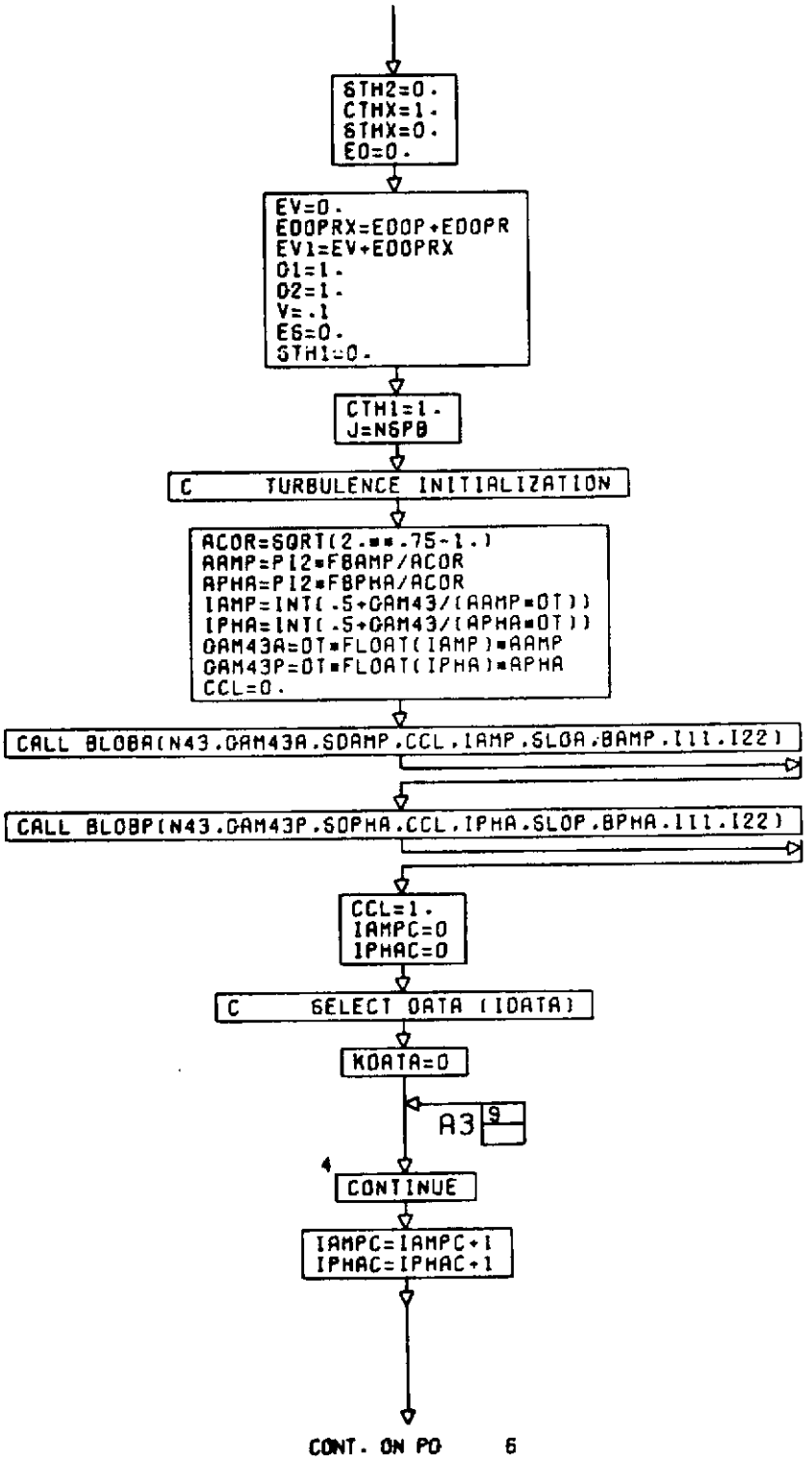

ENO=10.**(ENODB/10.)
ENOM=10.**(ENOMIN/10.)
BPER=1./BRATE
DT=BPER/NSPB
PHI66=PHIDEG=PI/180.
AMIN=SQRT(ENOM*NO*BRATE)
AMIN2=AMIN/1.4142
A=SQRT(ENO*NO*BRATE)
AGC=SQRT(AMIN2)
AMIN3=AMIN2/SQRT(10.**(DYNR/10.))
C CALCULATE LOOP PARAMETERS (TAU1,TAU2,K,TAUB1,TAUB2,KB)
WN=BL2/(ZETA+0.25/ZETA)
AK=PI2*FDIFF/SIN(PHI66)
TAU1=AK/(WN*WN)
TAU2=2.*(ZETA-0.5/(WN*TAU1))/WN
K=AK/AMIN
EDOP=PI2*FRQDOP/K
EDOPR=PI2*FQDPRT*DT/K
EVMAX=PI2*SWMX/K
EVMIN=-PI2*SWMN/K
SVR=PI2*SVRHZ/K
DES=DT*SVR
C DEFINE CONSTANTS
C1=1.-DT/TAU1
C2=TAU2/TAU1
C3=C1+C2-1.
C4=DT*K
C5=DT/TAU3
C6=1.-C5
DTH1=PI*DELF*DT
SDTH0=SIN(DTH1)
CDTH1=COS(DTH1)
DTHX=PI2*FLO*DT
SDTHX=SIN(DTHX)
CDTHX=COS(DTHX)
NACQ=0
ACQ=0.
AVEES=0.
STDES=0.
AK0U=0.
SK0U=0.
AMI66=0.
AFAL=0.
SI0=0.5*SQRT(NO/DT)
PRINT 202,ENODB,DELF,BIF,BL2

CONT. ON PG 3

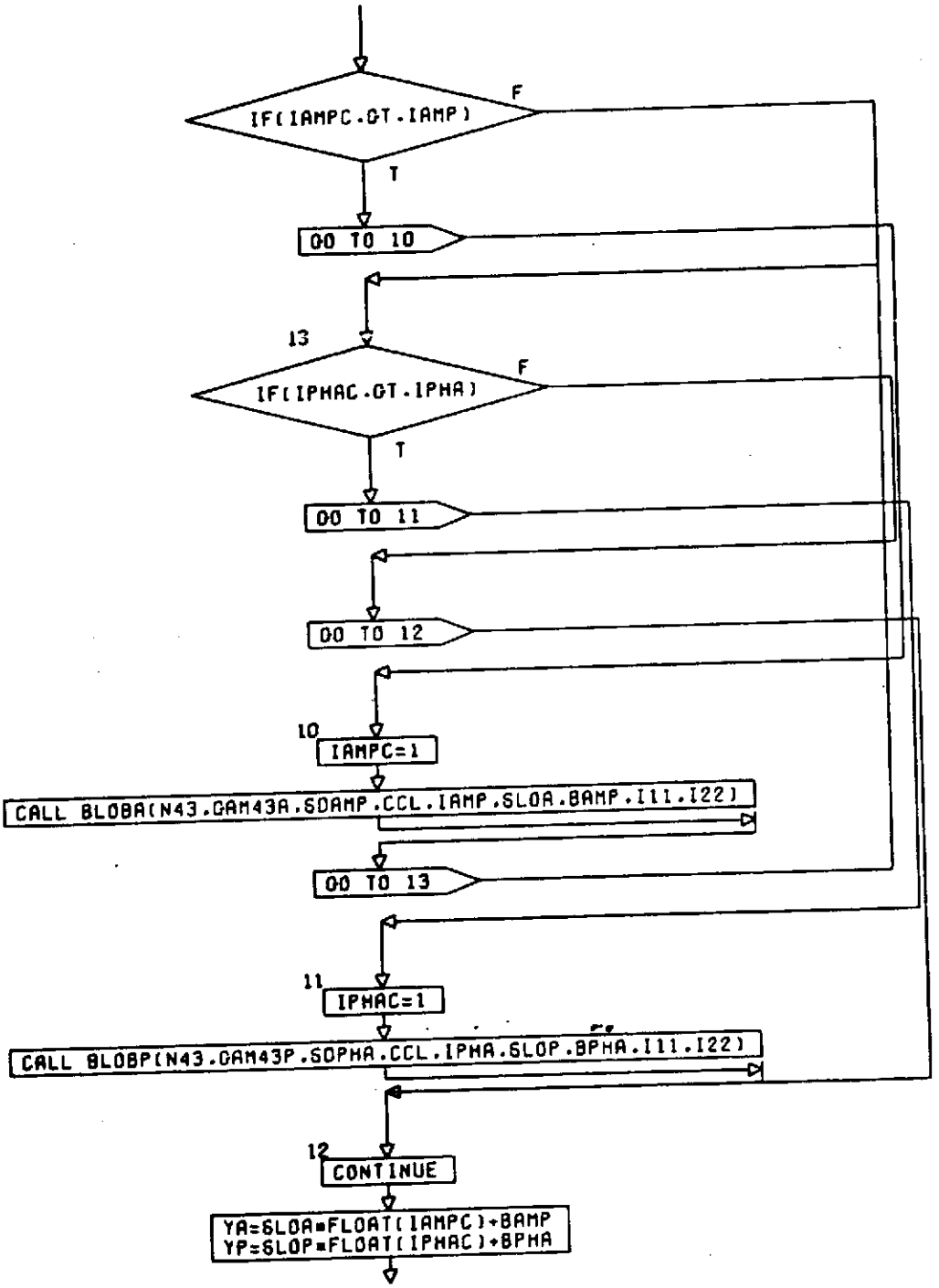

202
FORMAT(1X,*ENODB=*,F6.1,* ,DELF=*,F6.1,
* ,BIF=*,F6.0,* ,BL2=*,F6.0)
PRINT 204,SVRHZ,SWMX,SWMN,FLO,FRQDOP,FQDPRT
204
FORMAT(1X,*SVRHZ=*,E12.4,* ,SWMX=*,E12.4,* ,SWMN=*,E12.4,
* ,FLO=*,E12.4,* ,FRQDOP=*,E12.4,* ,FQDPRT=*,E12.4)
PRINT 206,TL,DYNR,SOAMP,SOPHA,I1S,I2S,I11S,I22S
206
FORMAT(1X,*TL=*,F6.2,* ,DYNR=*,F6.1,* ,SOAMP=*,F6.3,
* ,SOPHA=*,F6.3,* ,I1,I2,I11,I22=*,4I6)
PRINT 207,WN,K,TAU1,TAU2
207
FORMAT(1X,*WN=*,F6.1,* ,K=*,F6.1,
* ,TAU1=*,E12.4,* ,TAU2=*,E12.4)
C INITIALIZE LOOPS (TH2,E0,X1,X0,GV,QERRO,ERR)
A2
10
12
12
400
CONTINUE
IF(NACQ.EQ.1)
F
T
PRINT399
399
FORMAT(1X,*NACQ,AMIGS,AFAL,KDATA,ES,EV,EV1=)
CONT. ON PG 4


IF(NACQ.EQ.0)
F
T
DOTO396
PRINT 797,NACQ,AMISS,AFAL,ACQ,KDATA,ES,EV,EV1
797
FORMAT(1X,I6,3E12.4,I6,3E12.4)
396
CONTINUE
NACQ=NACQ+1
IF(NACQ.GT.NACQT)
F
T
DOTO402
10
A5
CAMP(1)=(0.,0.)
CAMP(2)=(0.,0.)
CAMP(3)=(0.,0.)
CFILT(1)=(0.,0.)
CFILT(2)=(0.,0.)
CFILT(3)=(0.,0.)
INIT=0
OMC=PI*BIF
IDATA=-1
U=0.
EVO=0.
TH2=0.
CTH2=1.

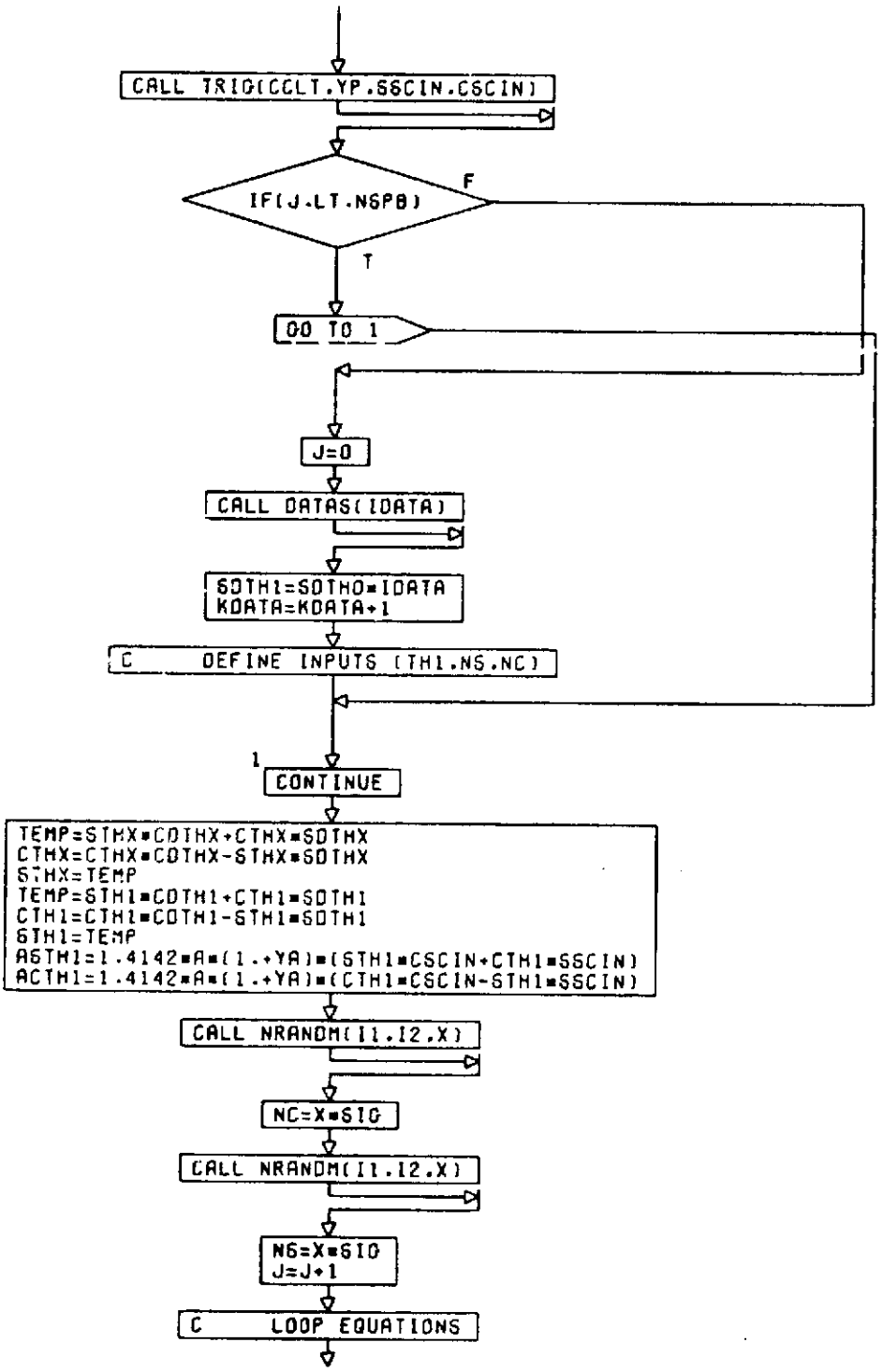
CONT. ON PG 5


STH2=0.
CTHX=1.
STHX=0.
E0=0.
EV=0.
E0OPRX=E0OP+E0OPR
EV1=EV+E0OPRX
01=1.
02=1.
V=.1
E6=0.
STH1=0.
CTH1=1.
J=N6P8
C TURBULENCE INITIALIZATION
ACOR=SQRT(2.**.75-1.)
AAMP=PI2*FBAMP/ACOR
APHA=PI2*FBPHA/ACOR
IAMP=INT(.5+GAM43/(AAMP*DT))
IPHA=INT(.5+GAM43/(APHA*DT))
GAM43A=DT*FLOAT(IAMP)*AAMP
GAM43P=DT*FLOAT(IPHA)*APHA
CCL=0.
CALL BLOBA(N43,GAM43A,SDAMP,CCL,IAMP,SLOA,BAMP,I11,I22)
CALL BLOBP(N43,GAM43P,SDPHA,CCL,IPHA,SLOP,BPHA,I11,I22)
CCL=1.
IAMPC=0
IPHAC=0
C SELECT DATA (IDATA)
KDATA=0
A3
9
4
CONTINUE
IAMPC=IAMPC+1
IPHAC=IPHAC+1
CONT. ON PG 6

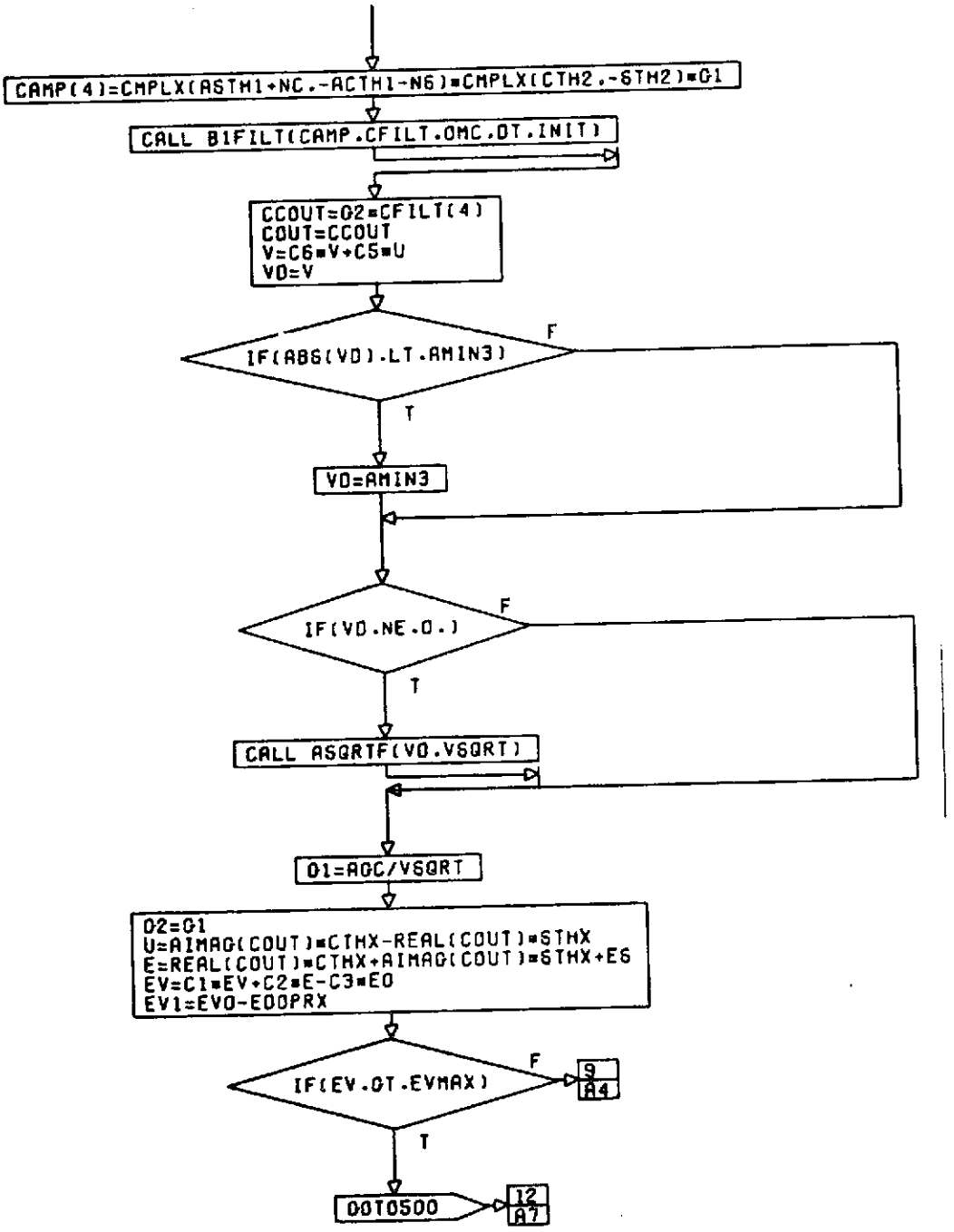
PG 5 OF 12


IF(IAMPC.GT.IAMP)
F
T
GO TO 10
13
IF(IPHAC.GT.IPHA)
F
T
GO TO 11
GO TO 12
10
IAMPC=1
CALL BLOBA(N43,GAM43A,SDAMP,CCL,IAMP,SLOA,BAMP,I11,I22)
GO TO 13
11
IPHAC=1
CALL BLOBP(N43,GAM43P,SDPHA,CCL,IPHA,SLOP,BPHA,I11,I22)
12
CONTINUE
YA=SLOA*FLOAT(IAMPC)+BAMP
YP=SLOP*FLOAT(IPHAC)+BPHA

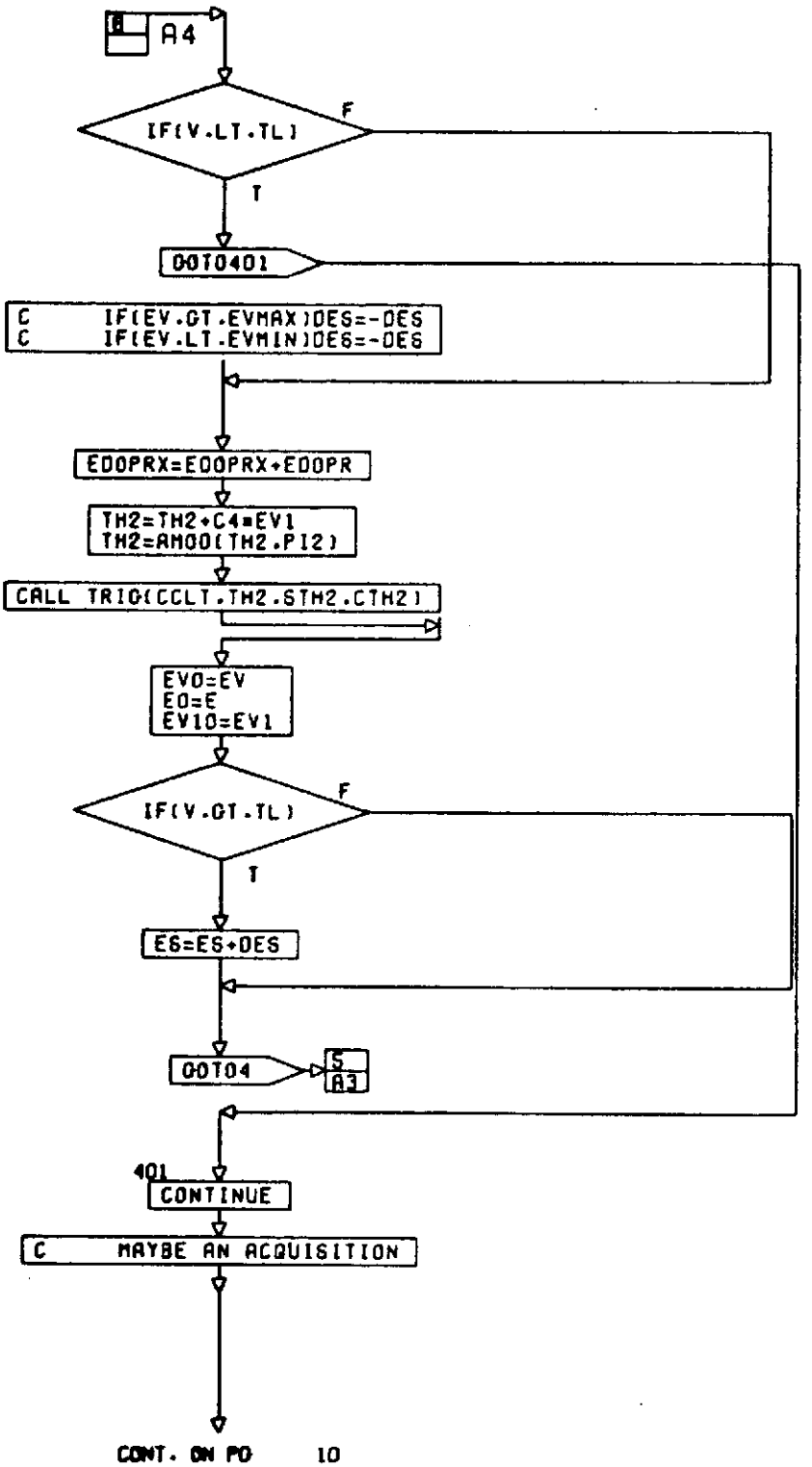
CONT. ON PG 7


CALL TRIG(CCLT.YP.SSCIN.CSCIN)
IF(J.LT.NSPB)
F
T
GO TO 1
J=0
CALL DATAS(IDATA)
SOTH1=SOTHO=IDATA
KDATA=KDATA+1
C DEFINE INPUTS (TH1.NS.NC)
1
CONTINUE
TEMP=STHX*COTHX+CTHX*SOTHX
CTHX=CTHX*COTHX-STHX*SOTHX
STHX=TEMP
TEMP=STH1*COTH1+CTH1*SOTH1
CTH1=CTH1*COTH1-STH1*SOTH1
STH1=TEMP
A6TH1=1.4142*A*(1.+YA)*(STH1*CSCIN+CTH1*SSCIN)
ACTH1=1.4142*A*(1.+YA)*(CTH1*CSCIN-STH1*SSCIN)
CALL NRANDM(I1.I2.X)
NC=X*SIG
CALL NRANDM(I1.I2.X)
N6=X*SIG
J=J+1
C LOOP EQUATIONS

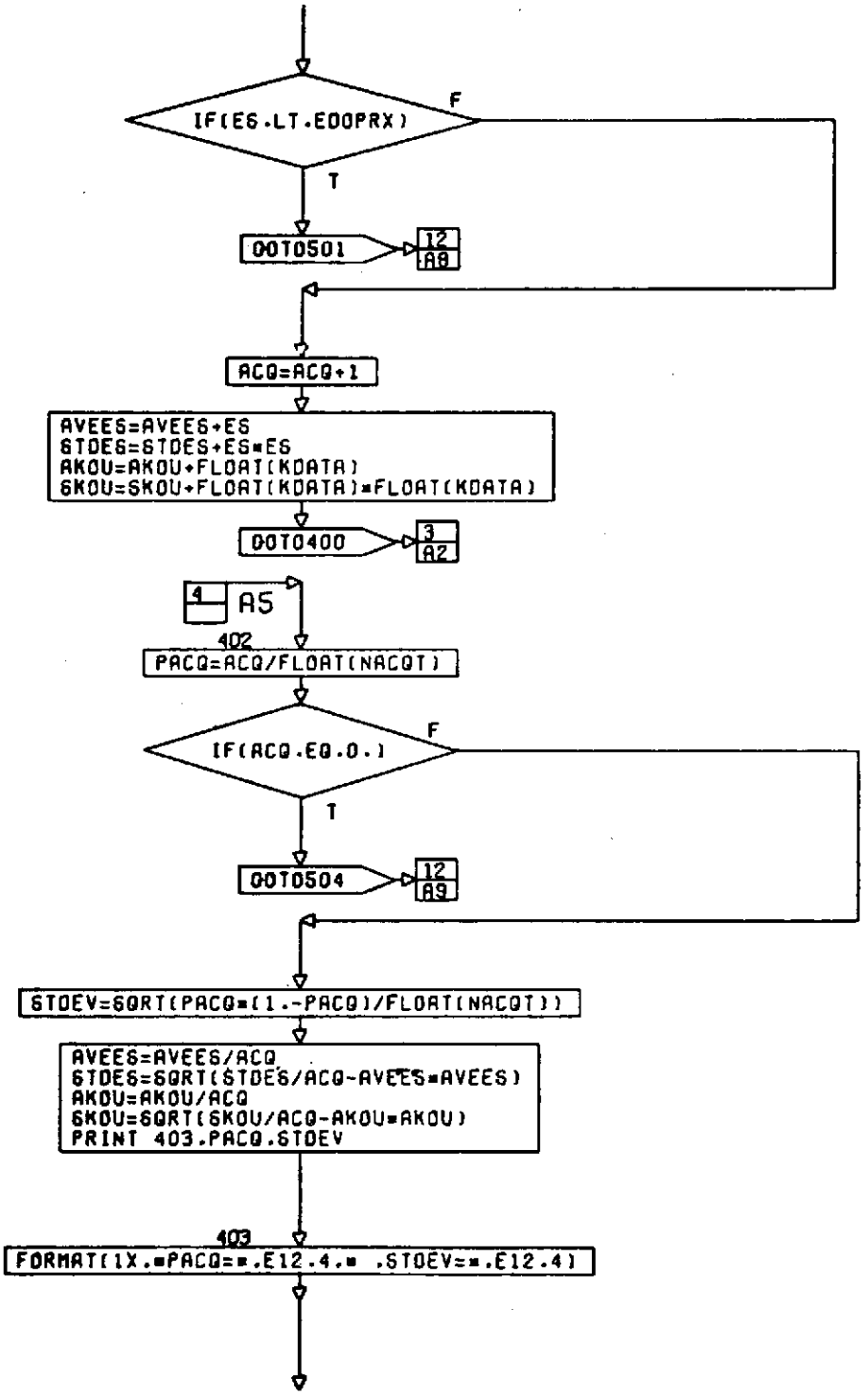
CONT. ON PG 8


CAMP(4)=CMPLX(ASTH1*NC,-ACTH1-N6)*CMPLX(CTH2,-STH2)*G1
CALL B1FILT(CAMP,CFILT,OMC,DT,INIT)
CCOUT=G2*CFILT(4)
COUT=CCOUT
V=C6*V+C5*U
VO=V
IF(ABS(VO).LT.AMIN3)
F
T
VO=AMIN3
IF(VO.NE.0.)
F
T
CALL ASQRTF(VO,VSQRT)
G1=AGC/VSQRT
G2=G1
U=AIMAG(COUT)*CTHX-REAL(COUT)*STHX
E=REAL(COUT)*CTHX+AIMAG(COUT)*STHX+E6
EV=C1*EV+C2*E-C3*E0
EV1=EV0-E00PRX
IF(EV.GT.EVMAX)
F
9
A4
T
00T0500
12
A7

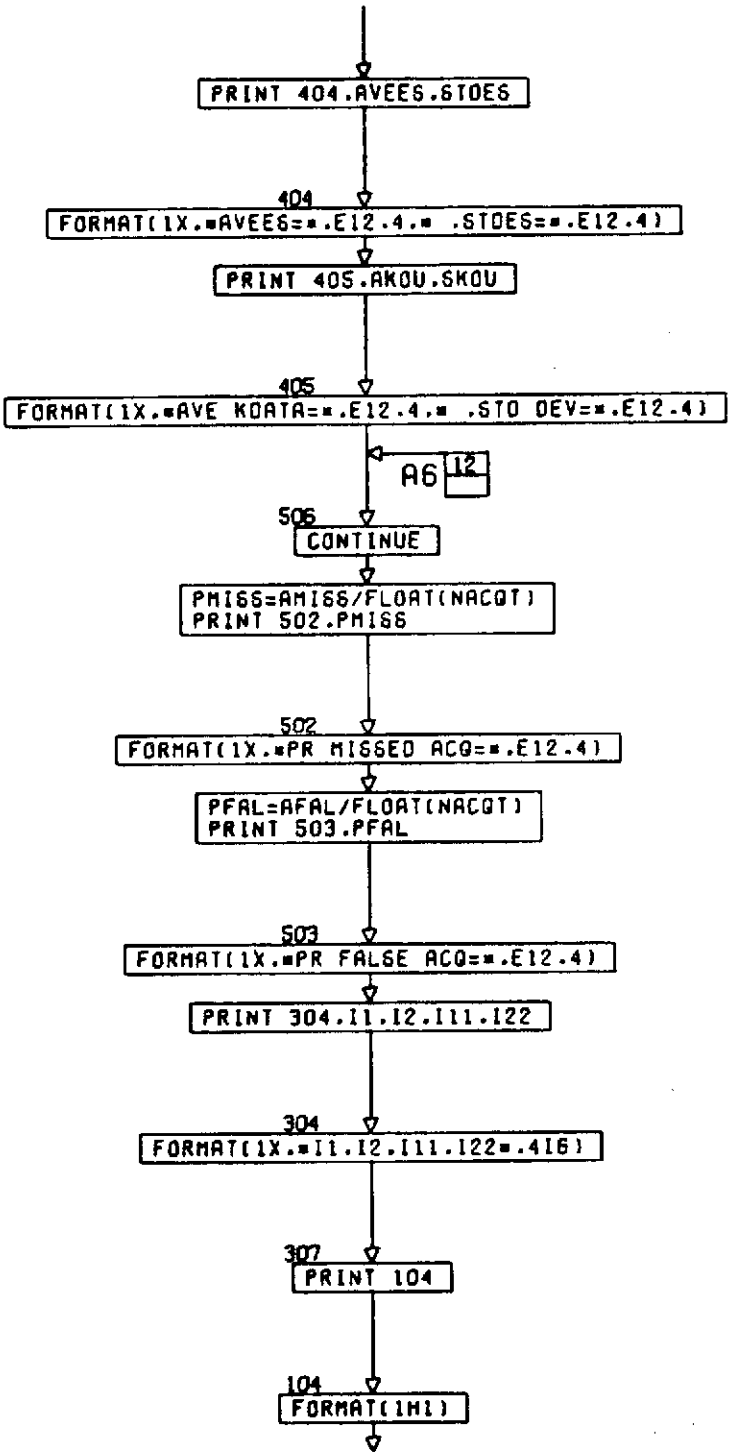
CONT. ON PG 9


A4
IF(V.LT.TL)
F
T
GOTO401
C IF(EV.GT.EVMAX)DES=-DES
C IF(EV.LT.EVMIN)DES=-DES
EDOPRX=EDOPRX+EDOPR
TH2=TH2+C4*EV1
TH2=AMOD(TH2,PI2)
CALL TRIG(CCLT,TH2,STH2,CTH2)
EV0=EV
E0=E
EV10=EV1
IF(V.GT.TL)
F
T
ES=ES+DES
GOTO4
5
A3
401
CONTINUE
C MAYBE AN ACQUISITION
CONT. ON PG 10

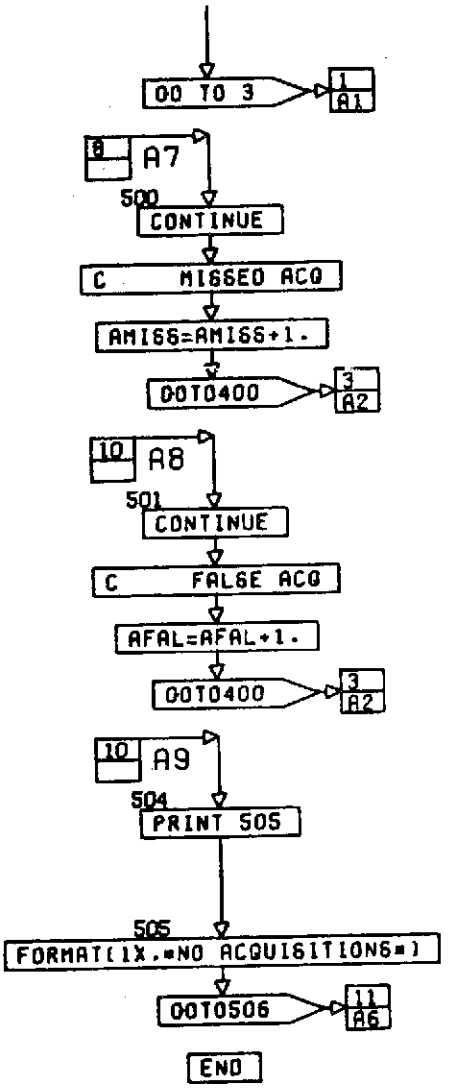
PG 9 OF 12

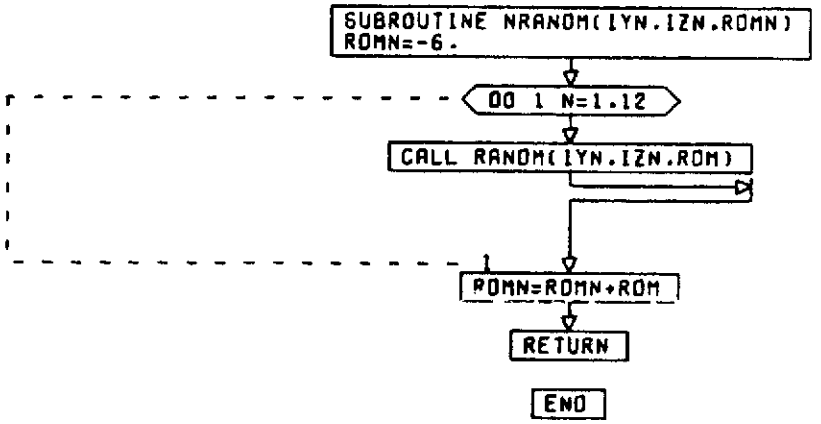

IF(ES.LT.EOOPRX)
F
T
GOTO501
12
A8
ACQ=ACQ+1
AVEES=AVEES+ES
STDES=STDES+ES*ES
AKOU=AKOU+FLOAT(KDATA)
SKOU=SKOU+FLOAT(KDATA)*FLOAT(KDATA)
GOTO400
3
A2
4
A5
402
PACQ=ACQ/FLOAT(NACQT)
IF(ACQ.EQ.0.)
F
T
GOTO504
12
A9
STDEV=SQRT(PACQ*(1.-PACQ)/FLOAT(NACQT))
AVEES=AVEES/ACQ
STDES=SQRT(STDES/ACQ-AVEES*AVEES)
AKOU=AKOU/ACQ
SKOU=SQRT(SKOU/ACQ-AKOU*AKOU)
PRINT 403,PACQ,STDEV
403
FORMAT(1X,'PACQ=',E12.4,' ,STDEV=',E12.4)

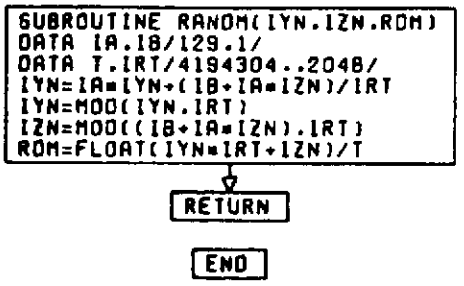
CONT. ON PG 11

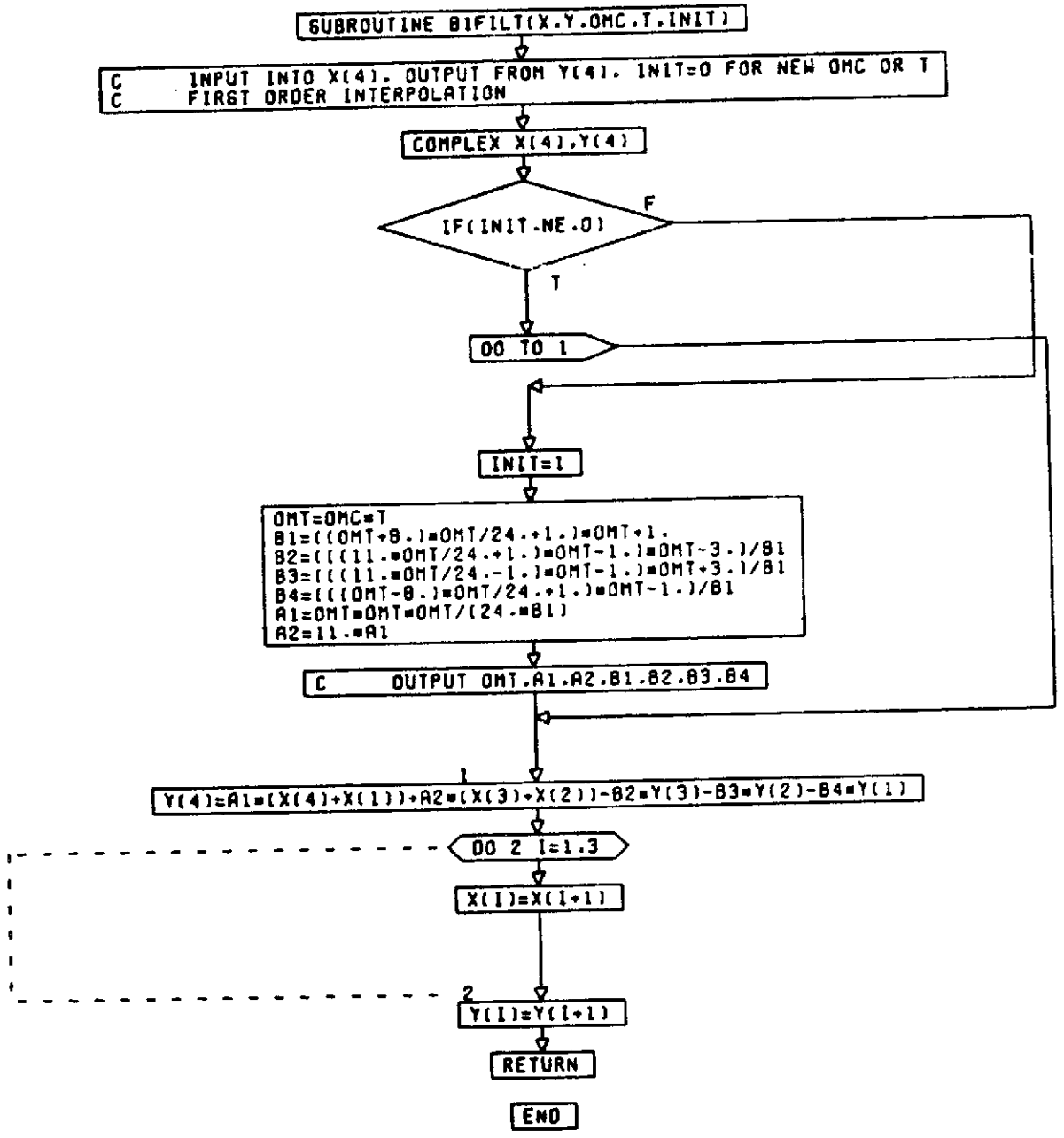

PRINT 404,AVEES,STDES
404
FORMAT(1X,'AVEES=',E12.4,' STDES=',E12.4)
PRINT 405,AKOU,SKOU
405
FORMAT(1X,'AVE KOATA=',E12.4,' STD DEV=',E12.4)
A6
12
506
CONTINUE
PMISS=AMISS/FLOAT(NACQT)
PRINT 502,PMISS
502
FORMAT(1X,'PR MISSED ACQ=',E12.4)
PFAL=AFAL/FLOAT(NACQT)
PRINT 503,PFAL
503
FORMAT(1X,'PR FALSE ACQ=',E12.4)
PRINT 304,I1,I2,I11,I22
304
FORMAT(1X,'I1,I2,I11,I22=',4I6)
307
PRINT 104
104
FORMAT(1H1)

CONT. ON PG 12

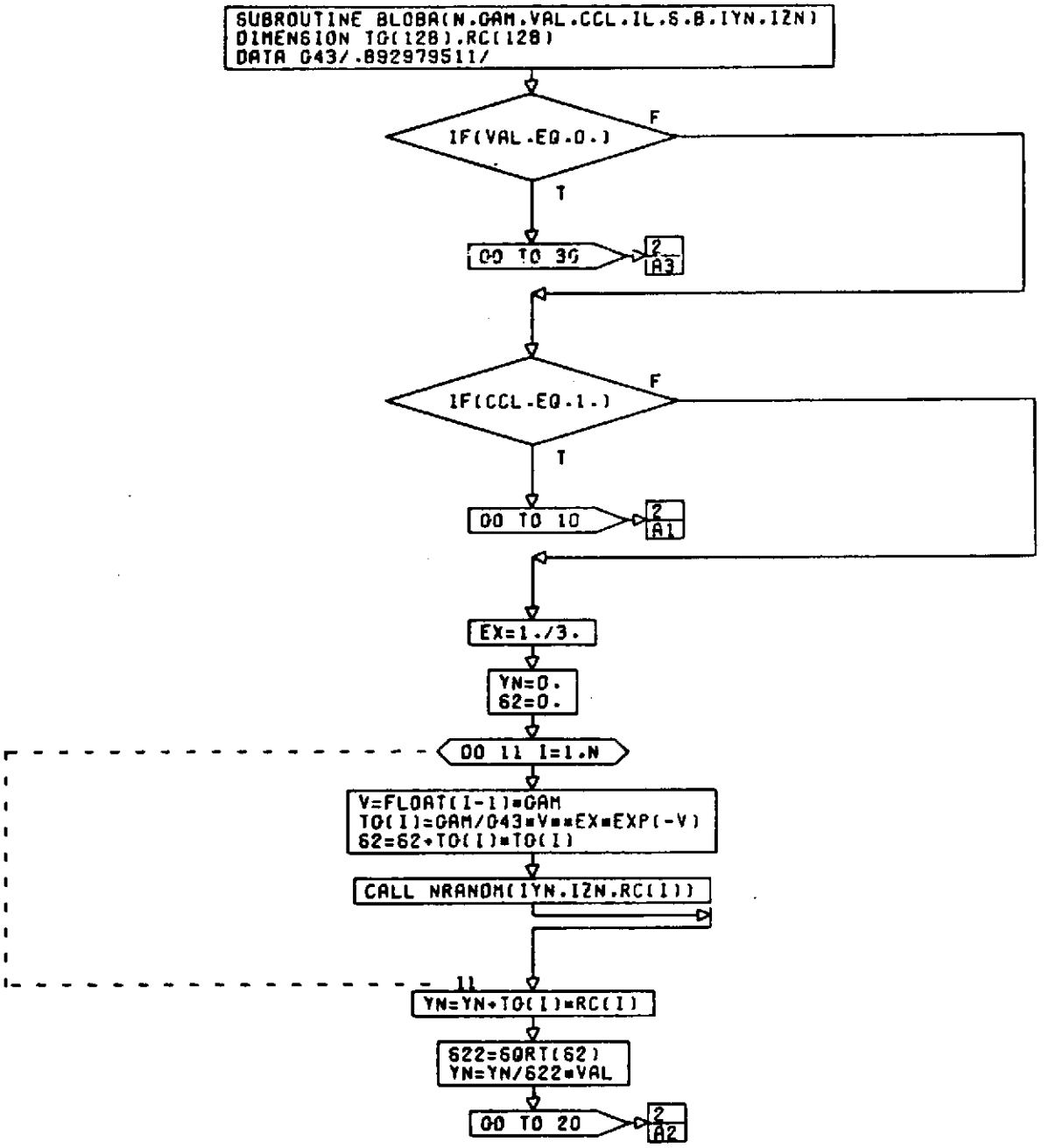

DO TO 3
1
A1
8
A7
500
CONTINUE
C MISSED ACQ
AMISS=AMISS+1.
GOTO400
3
A2
10
A8
501
CONTINUE
C FALSE ACQ
AFAL=AFAL+1.
GOTO400
3
A2
10
A9
504
PRINT 505
505
FORMAT(1X,'NO ACQUISITIONS')
GOTO506
11
A6
END


SUBROUTINE NRANDM(IYN.IZN.RDMN)
RDMN=-6.
DO 1 N=1.12
CALL RANDM(IYN.IZN.RDM)
RDMN=RDMN+RDM
RETURN
END

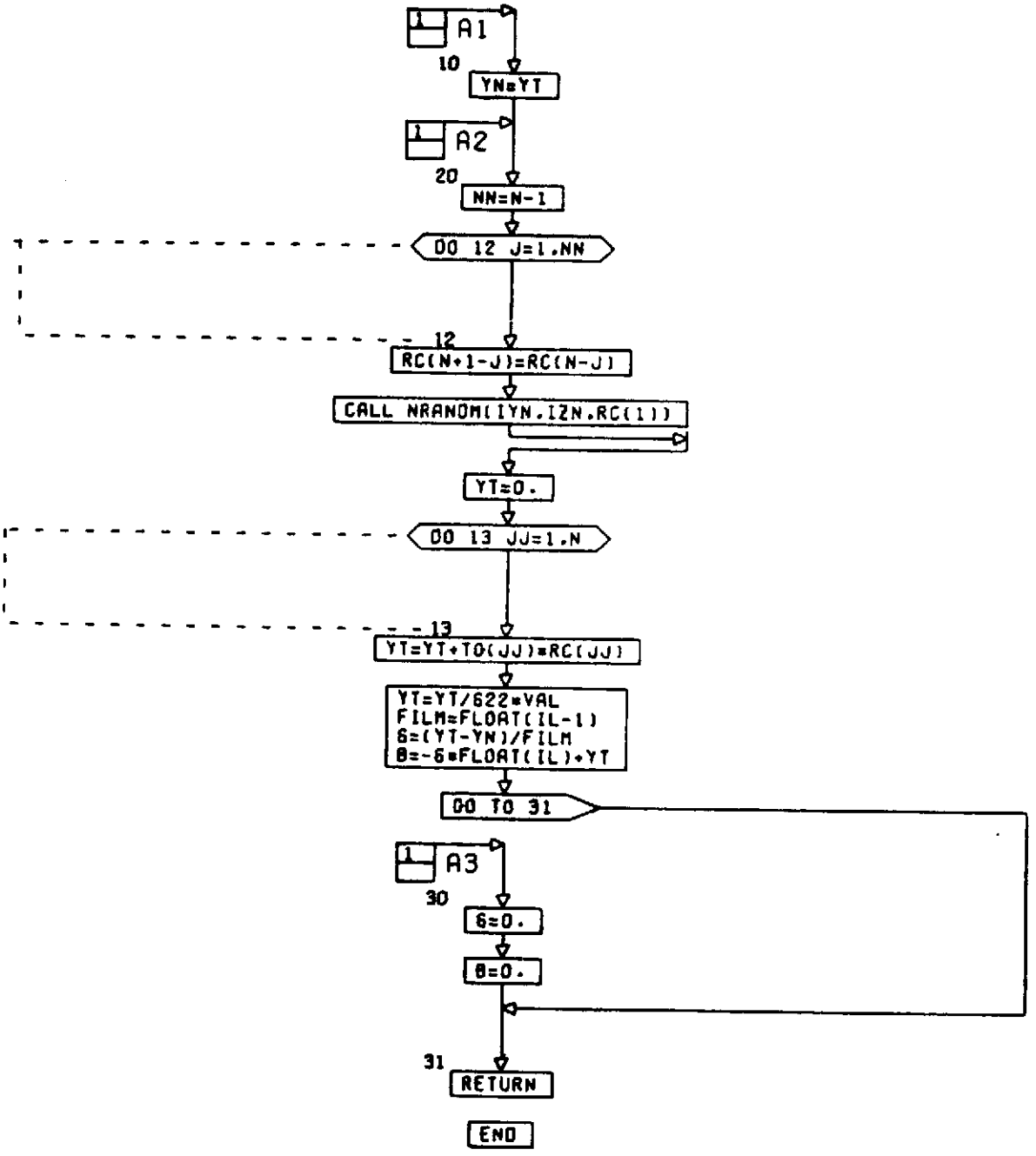

SUBROUTINE RANDM(IYN,IZN,RDM)
DATA IA,IB/129,1/
DATA T,IRT/4194304.,2048/
IYN=IA*IYN+(IB+IA*IZN)/IRT
IYN=MOD(IYN,IRT)
IZN=MOD((IB+IA*IZN),IRT)
RDM=FLOAT(IYN*IRT+IZN)/T
RETURN
END


SUBROUTINE B1FILT(X,Y,OMC,T,INIT)
C INPUT INTO X(4), OUTPUT FROM Y(4). INIT=0 FOR NEW OMC OR T
C FIRST ORDER INTERPOLATION
COMPLEX X(4),Y(4)
IF(INIT.NE.0)
F
T
GO TO 1
INIT=1
OMT=OMC*T
B1=((OMT+8.)*OMT/24.+1.)*OMT+1.
B2=(((11.*OMT/24.+1.)*OMT-1.)*OMT-3.)/B1
B3=(((11.*OMT/24.-1.)*OMT-1.)*OMT+3.)/B1
B4=(((OMT-8.)*OMT/24.+1.)*OMT-1.)/B1
A1=OMT*OMT*OMT/(24.*B1)
A2=11.*A1
C OUTPUT OMT,A1,A2,B1,B2,B3,B4
1
Y(4)=A1*(X(4)+X(1))+A2*(X(3)+X(2))-B2*Y(3)-B3*Y(2)-B4*Y(1)
DO 2 I=1,3
X(I)=X(I+1)
2
Y(I)=Y(I+1)
RETURN
END

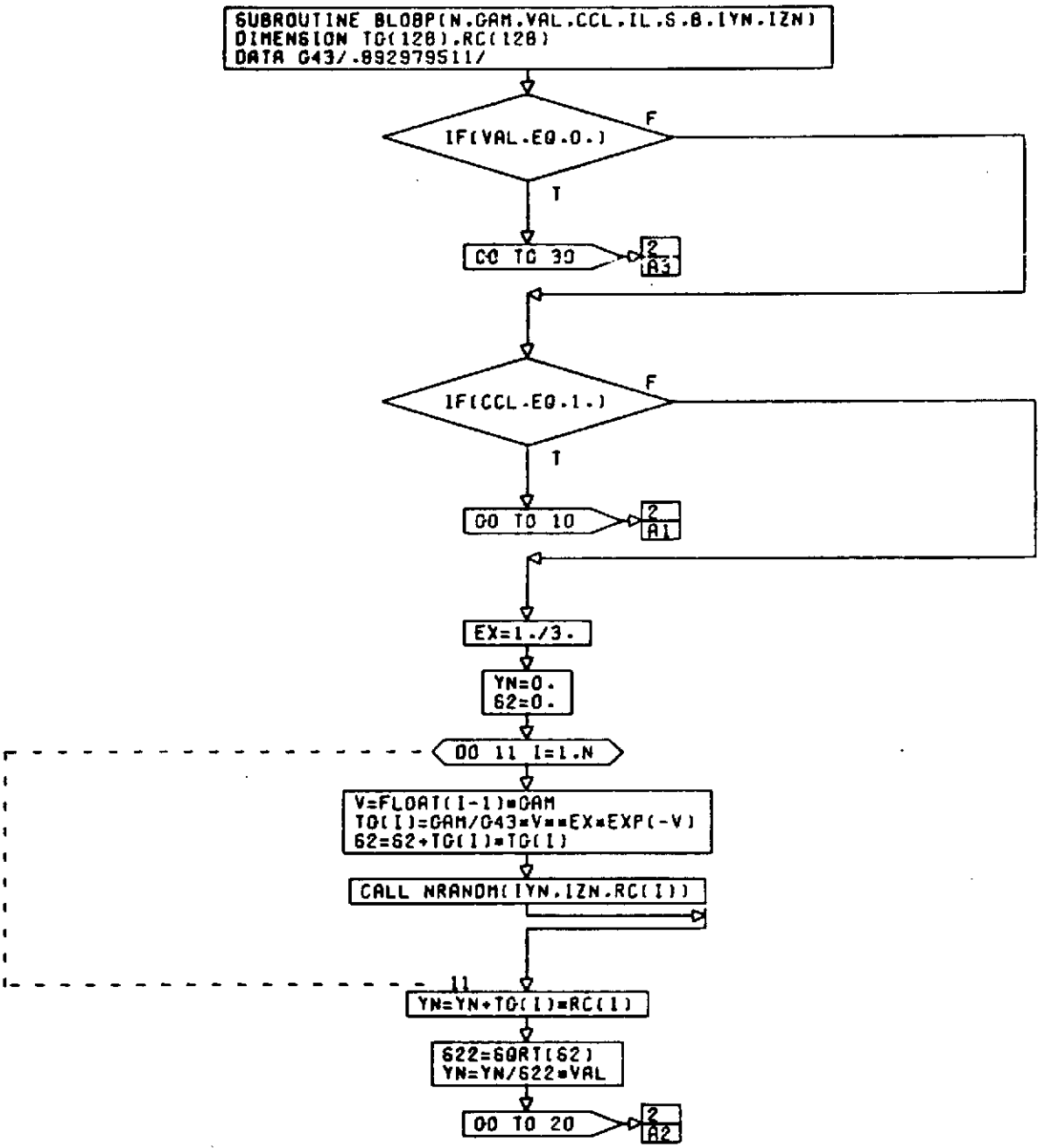
PO 1 FINAL


SUBROUTINE BLOBA(N,GAM,VAL,CCL,IL,S,B,IYN,IZN)
DIMENSION TO(128),RC(128)
DATA 043/.892979511/
IF(VAL.EQ.0.)
F
T
GO TO 30
2
A3
IF(CCL.EQ.1.)
F
T
GO TO 10
2
A1
EX=1./3.
YN=0.
62=0.
DO 11 I=1,N
V=FLOAT(I-1)*GAM
TO(I)=GAM/043*V**EX*EXP(-V)
62=62+TO(I)*TO(I)
CALL NRANDM(IYN,IZN,RC(I))
11
YN=YN+TO(I)*RC(I)
622=SQRT(62)
YN=YN/622*VAL
GO TO 20
2
A2

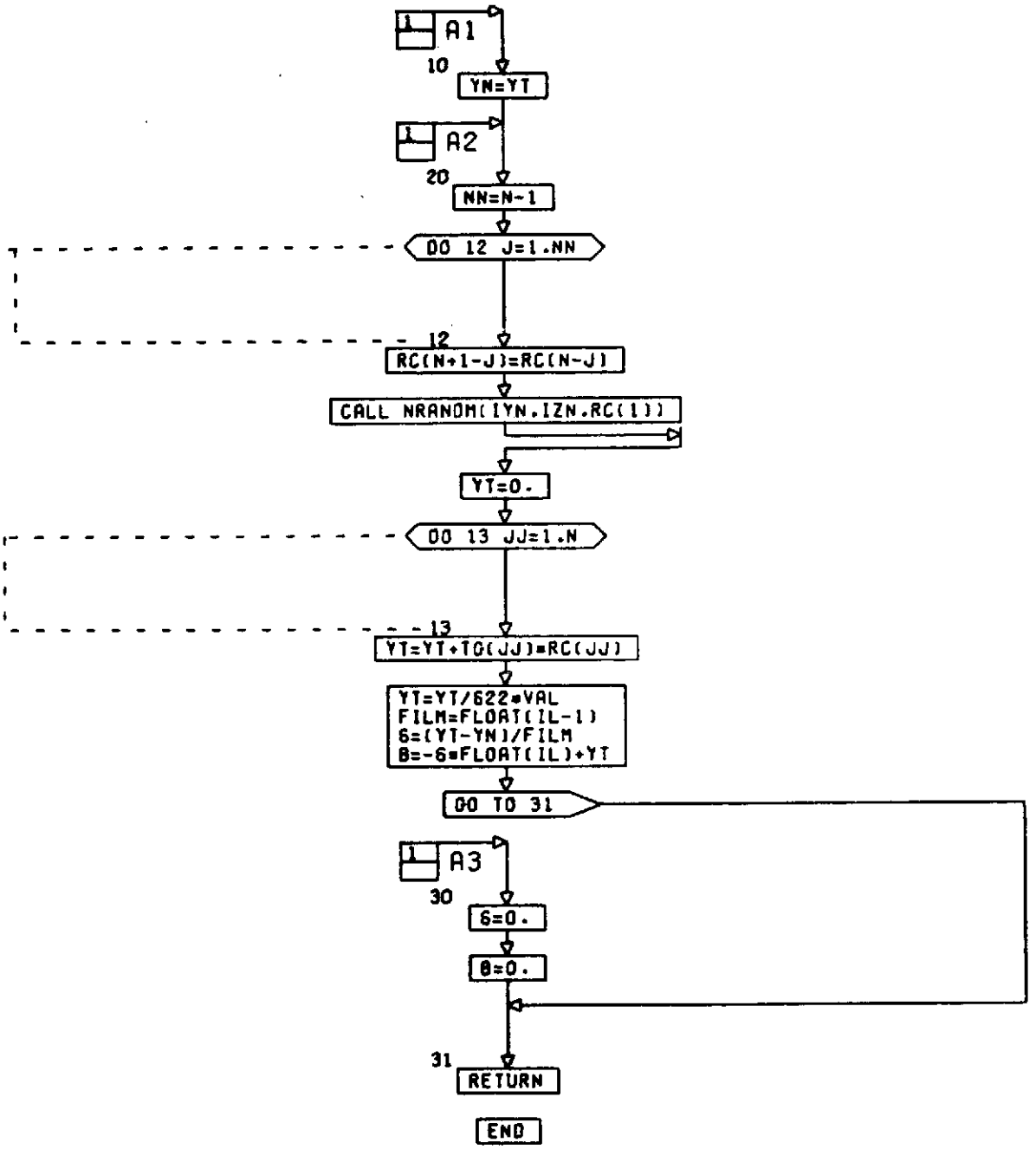
CONT. ON PG 2


A1
10
YN=YT
A2
20
NN=N-1
DO 12 J=1,NN
12
RC(N+1-J)=RC(N-J)
CALL NRANDM(IYN,IZN,RC(1))
YT=0.
DO 13 JJ=1,N
13
YT=YT+TO(JJ)*RC(JJ)
YT=YT/622*VAL
FILM=FLOAT(IL-1)
G=(YT-YN)/FILM
B=-G*FLOAT(IL)+YT
DO TO 31
A3
30
G=0.
B=0.
31
RETURN
END

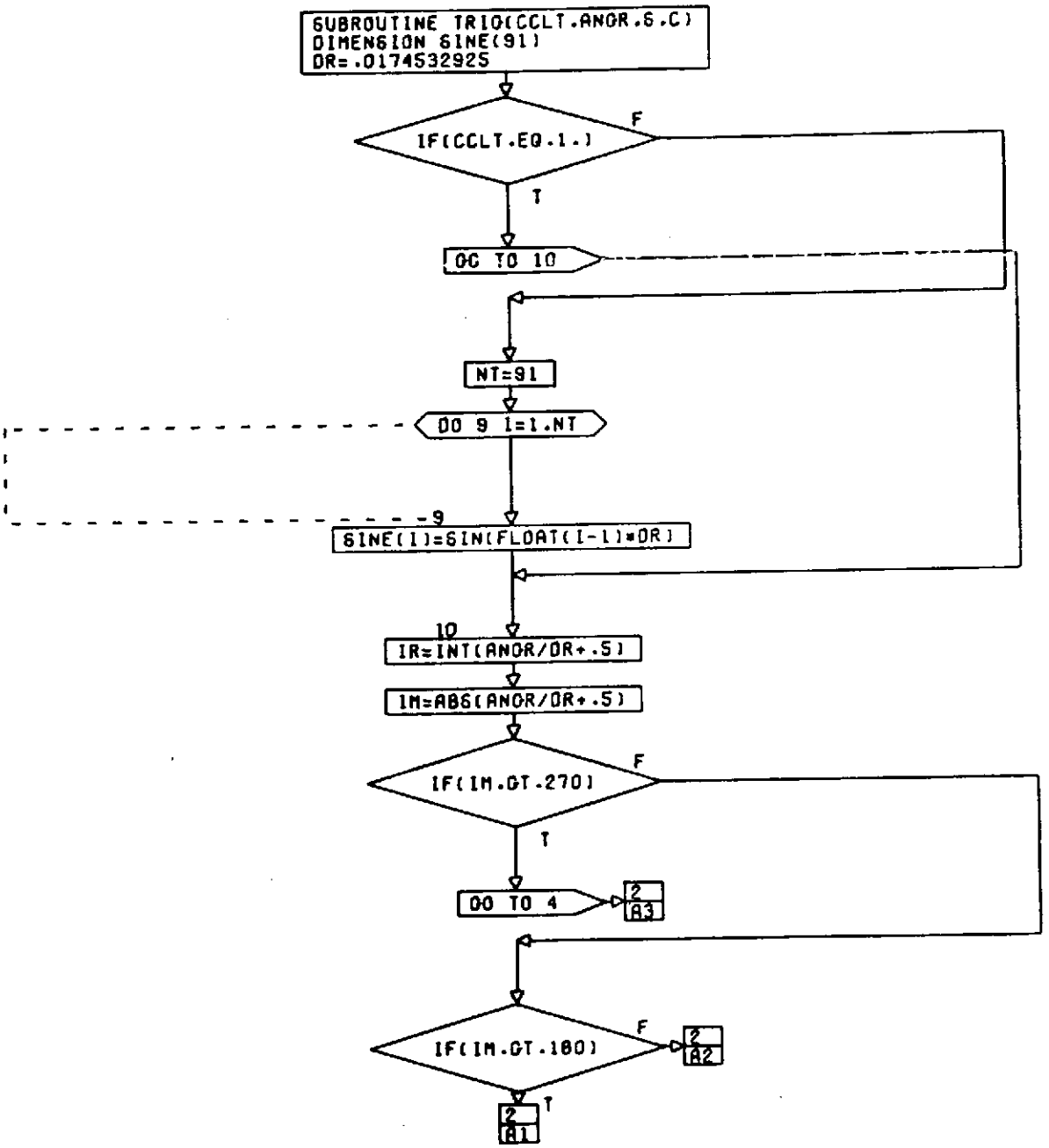
PQ 2 FINAL


SUBROUTINE BLOBP(N,GAM,VAL,CCL,IL,S,B,IYN,IZN)
DIMENSION TG(128),RC(128)
DATA G43/.892979511/
IF(VAL.EQ.0.)
F
T
GO TO 30
2
A3
IF(CCL.EQ.1.)
F
T
GO TO 10
2
A1
EX=1./3.
YN=0.
G2=0.
DO 11 I=1,N
V=FLOAT(I-1)*GAM
TG(I)=GAM/G43*V**EX*EXP(-V)
G2=G2+TG(I)*TG(I)
CALL NRANDM(IYN,IZN,RC(I))
11
YN=YN+TG(I)*RC(I)
G22=SQRT(G2)
YN=YN/G22*VAL
GO TO 20
2
A2

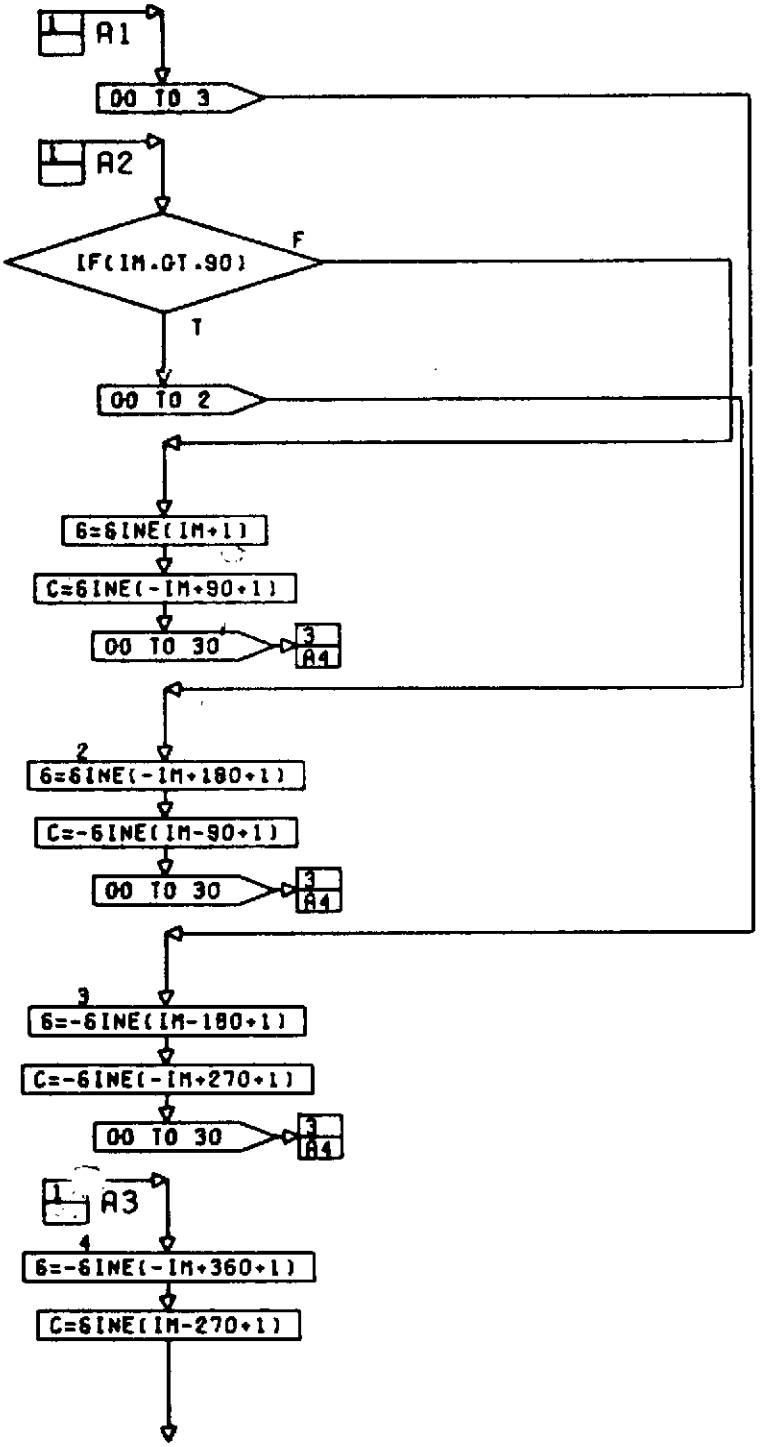
CONT. ON PG 2


A1
10
YN=YT
A2
20
NN=N-1
DO 12 J=1.NN
12
RC(N+1-J)=RC(N-J)
CALL NRANDM(IYN.IZN.RC(1))
YT=0.
DO 13 JJ=1.N
13
YT=YT+TG(JJ)*RC(JJ)
YT=YT/622*VAL
FILM=FLOAT(IL-1)
G=(YT-YN)/FILM
B=-G*FLOAT(IL)+YT
GO TO 31
A3
30
G=0.
B=0.
31
RETURN
END

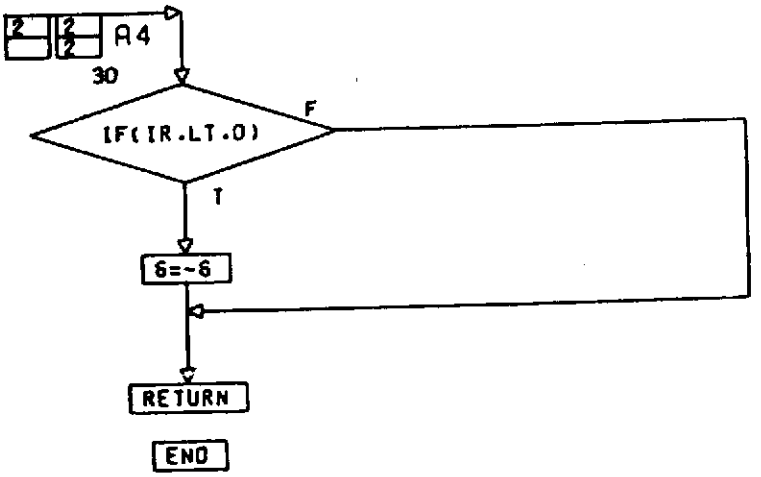
PQ 2 FINAL


SUBROUTINE TRIO(CCLT,ANOR,S,C)
DIMENSION SINE(91)
DR=.0174532925
IF(CCLT.EQ.1.)
F
T
GO TO 10
NT=91
DO 9 I=1,NT
9
SINE(I)=SIN(FLOAT(I-1)*DR)
10
IR=INT(ANOR/DR+.5)
IM=ABS(ANOR/DR+.5)
IF(IM.GT.270)
F
T
GO TO 4
2
A3
IF(IM.GT.180)
F
2
A2
T
2
A1

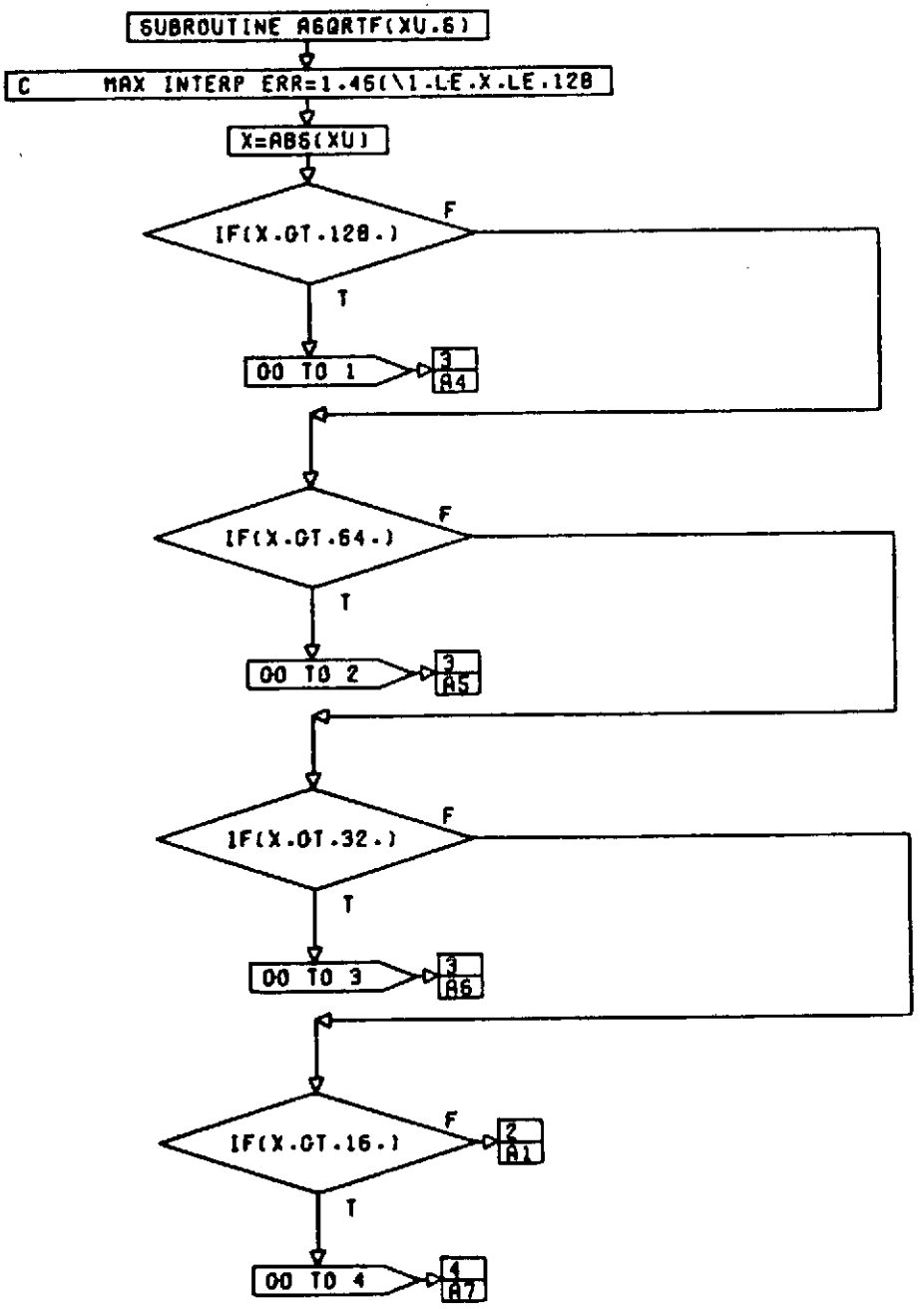
CONT. ON PG 2


A1
DO TO 3
A2
IF(IM.GT.90)
F
T
DO TO 2
6=SINE(IM+1)
C=SINE(-IM+90+1)
DO TO 30
3
A4
2
6=SINE(-IM+180+1)
C=-SINE(IM-90+1)
DO TO 30
3
A4
3
6=-SINE(IM-180+1)
C=-SINE(-IM+270+1)
DO TO 30
3
A4
A3
4
6=-SINE(-IM+360+1)
C=SINE(IM-270+1)

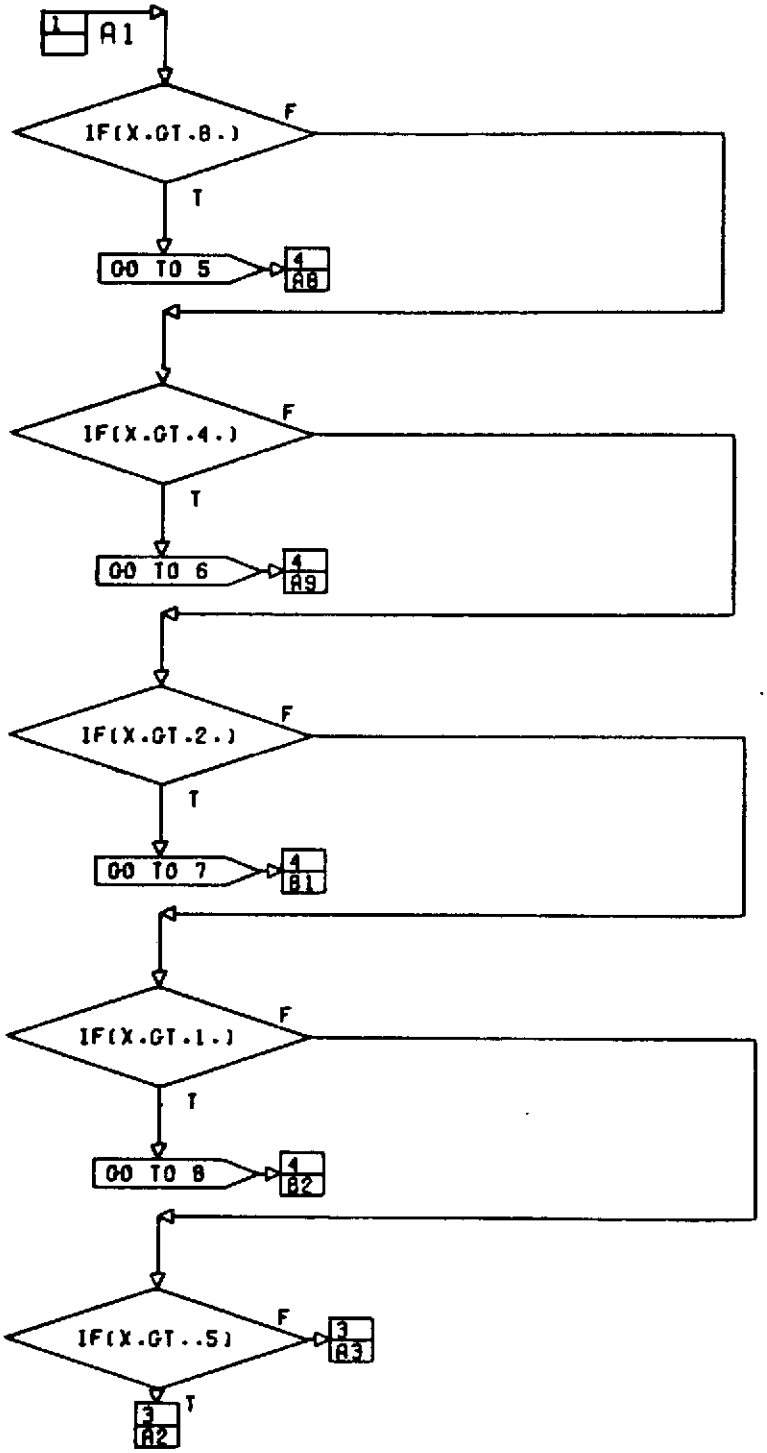
CONT. ON PG 3



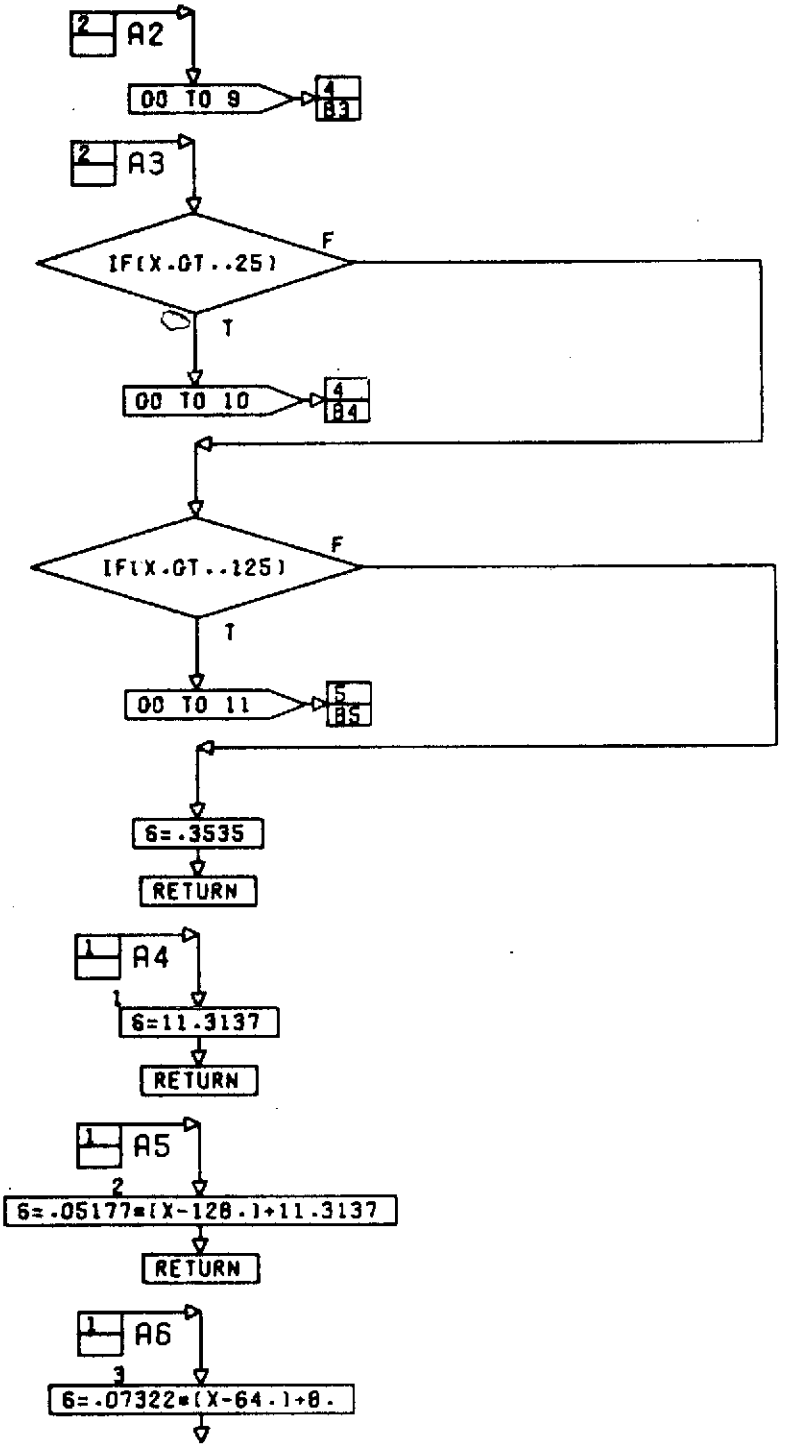
PO 3 FINAL


SUBROUTINE A6QRTF(XU,6)
C MAX INTERP ERR=1.46(\1.LE.X.LE.128
X=ABS(XU)
IF(X.GT.128.)
F
T
GO TO 1
3
A4
IF(X.GT.64.)
F
T
GO TO 2
3
A5
IF(X.GT.32.)
F
T
GO TO 3
3
A6
IF(X.GT.16.)
F
2
A1
T
GO TO 4
4
A7

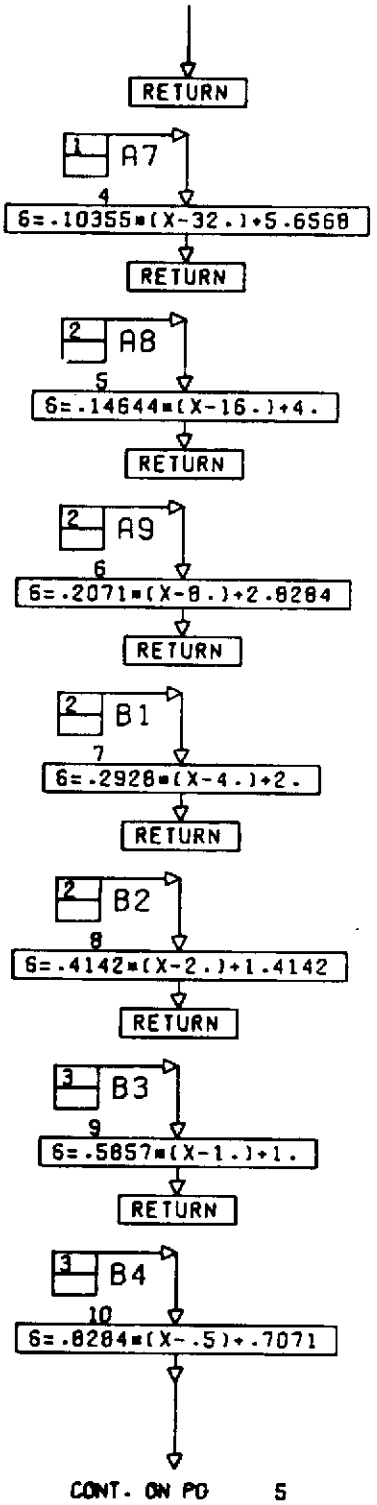
CONT. ON PG 2

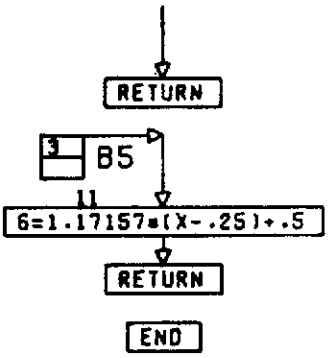

1
A1
IF(X.GT.8.)
F
T
GO TO 5
4
A8
IF(X.GT.4.)
F
T
GO TO 6
4
A9
IF(X.GT.2.)
F
T
GO TO 7
4
B1
IF(X.GT.1.)
F
T
GO TO 8
4
B2
IF(X.GT..5)
F
3
A3
T
3
A2

CONT. ON PG 3

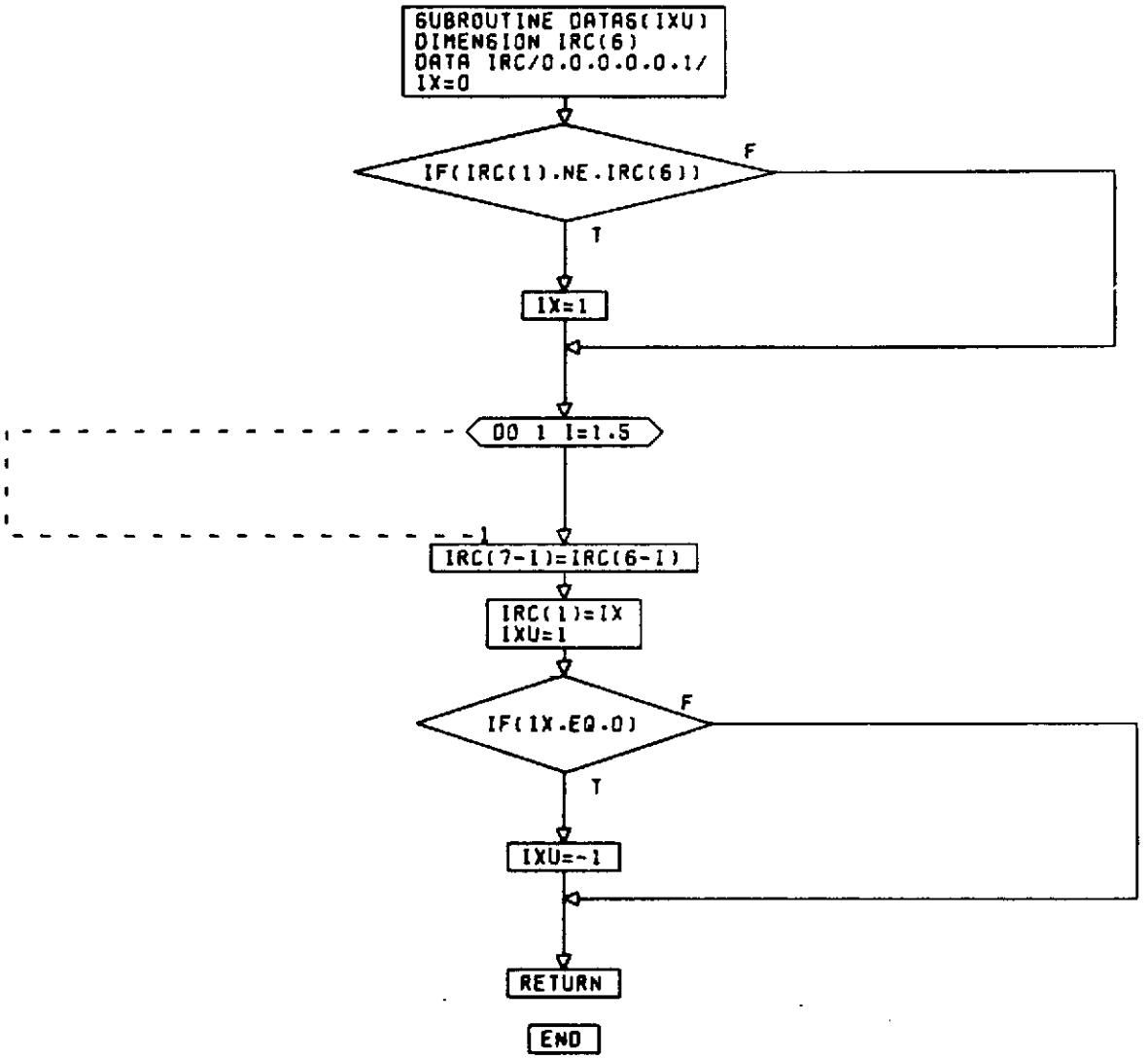

2
A2
GO TO 9
4
B3
2
A3
IF(X.GT..25)
F
T
GO TO 10
4
B4
IF(X.GT..125)
F
T
GO TO 11
5
B5
6=.3535
RETURN
1
A4
1
6=11.3137
RETURN
1
A5
2
6=.05177*(X-128.)+11.3137
RETURN
1
A6
3
6=.07322*(X-64.)+8.

CONT. ON PO 4


RETURN
1 A7
4
6=.10355*(X-32.)+5.6568
RETURN
2 A8
5
6=.14644*(X-16.)+4.
RETURN
2 A9
6
6=.2071*(X-8.)+2.8284
RETURN
2 B1
7
6=.2928*(X-4.)+2.
RETURN
2 B2
8
6=.4142*(X-2.)+1.4142
RETURN
3 B3
9
6=.5857*(X-1.)+1.
RETURN
3 B4
10
6=.8284*(X-.5)+.7071
CONT. ON PG 5



PQ 5 FINAL


SUBROUTINE DATA6(IXU)
DIMENSION IRC(6)
DATA IRC/0,0,0,0,0,1/
IX=0
IF(IRC(1).NE.IRC(6))
F
T
IX=1
DO 1 I=1,5
IRC(7-I)=IRC(6-I)
1
IRC(1)=IX
IXU=1
IF(IX.EQ.0)
F
T
IXU=-1
RETURN
END

PO 1 FINAL

APPENDIX VII
MISCELLANEOUS SUBROUTINES

This appendix presents three subroutines which were found useful in trouble-shooting the receiver during the software development, but were not used in the production runs.

The first is OSCILL which is an oscilloscope and plots three inputs. These are entered into the routine by lists. The routine automatically scales the output.

The second is SURV which is a voltmeter. It gives the mean and standard deviation of the input, as well as the mean and standard deviation of the absolute value of the input.

The third is CHMEM. This was used early in the analysis when there was one conditional probability matrix which was the position by position summation of all four of the matrices of this report, i.e., just P(B/A). It generates information to determine the skew of the matrix.

```
                      SUBROUTINE OSCILL(LLL,X,Y,Z)
              C       XYZ PLOTTED VS LLL
000007                DIMENSION OUT(66),X(90),Y(90),Z(90)
000007                DATA BLANK,STAR,XX,YY,ZZ,AZ/
                     +1H ,1H*,1HX,1HY,1HZ,1HO/
000007                L=LLL-1
              C       1 ST MAX+MIN
000010                XMAX=-1.E10
000012                XMIN=1.E10
000014                DO 10 I=1,L
000015                IF(Z(I).GT.XMAX) XMAX=Z(I)
000022                IF(Y(I).GT.XMAX) XMAX=Y(I)
000027                IF(Z(I).LT.XMIN) XMIN=Z(I)
000034                IF(Y(I).LT.XMIN) XMIN=Y(I)
000041                IF(X(I).GT.XMAX) XMAX=X(I)
000046    10          IF(X(I).LT.XMIN) XMIN=X(I)
000056                SLO=65./(XMAX-XMIN)
000060                B=-65.*XMAX/(XMAX-XMIN)+66.
              C       THEN SCALE
000064                XINT=(XMAX-XMIN)/65.
000067                PRINT 99,XMAX,XMIN,XINT
000101    99          FORMAT(1X,*MAX= *,G14.6,* MIN= *,G14.6,
                     +* INT= *,G14.6)
000101                IF(XMAX.GT.0..AND.XMIN.LT.0.) IYZ=INT(B)
000114                STEER=0.
000115    24          DO 20 I=1,66
000117    20          OUT(I)=STAR
000123                IF(XMAX.GT.0..AND.XMIN.LT.0.) OUT(IYZ)=AZ
000134                IF(STEER.EQ.1.) GO TO 25
000136                OUT(INT(SLO*X(1)+B))=XX
000144                OUT(INT(SLO*Y(1)+B))=YY
000150                OUT(INT(SLO*Z(1)+B))=ZZ
000154                LL=1
000155                PRINT 22,LL,OUT
000164    22          FORMAT(1X,I3,66A1)
000164                LEND=L-1
000166                DO 23 LL=2,LEND
000172                DO 28 I=1,66
000173    28          OUT(I)=BLANK
000177                OUT(1)=STAR
000200                OUT(66)=STAR
000200                IF(XMAX.GT.0..AND.XMIN.LT.0.) OUT(IYZ)=STAR
000212                OUT(INT(SLO*X(LL)+B))=XX
000221                OUT(INT(SLO*Y(LL)+B))=YY
000230                OUT(INT(SLO*Z(LL)+B))=ZZ
000237    23          PRINT 22,LL,OUT
000253                STEER=1.
000255                GO TO 24
000255    25          OUT(INT(SLO*X(L)+B))=XX
000264                OUT(INT(SLO*Y(L)+B))=YY
000273                OUT(INT(SLO*Z(L)+B))=ZZ
000302                PRINT 22,L,OUT
000311                RETURN
000312                END
```

```
                        SUBROUTINE SURV(CX,V,VS)
000006                  DIMENSION VS(6)
000006                  IF(CX.EQ.1.)GO    TO 1
000010                  VS(1)=VS(1)+1.
000011                  VS(2)=VS(2)+V
000013                  VS(4)=VS(4)+ABS(V)
000015                  VS(6)=VS(6)+V*V
000020                  GO TO 2
000020          1       CONTINUE
000020                  IF(VS(1).EQ.0.)GOTO3
000021                  VS(2)=VS(2)/VS(1)
000023                  VS(4)=VS(4)/VS(1)
000025                  DUM=VS(6)/VS(1)-VS(2)*VS(2)
000030                  IF(DUM.LT.0.)GOTO4
000032                  VS(3)=SQRT(DUM)
000036                  DUM=VS(6)/VS(1)-VS(4)*VS(4)
000042                  IF(DUM.LT.0.)GOTO5
000044                  VS(5)=SQRT(DUM)
000050                  PRINT 20,VS
000057          20      FORMAT(6E12.4)
000057                  RETURN
000060          3       PRINT 10
000064          10      FORMAT(1X,*MISSED COUNT*)
000064                  RETURN
000065          4       PRINT 11
000071          11      FORMAT(1X,*SQRT PBLM 1*)
000071                  RETURN
000072          5       PRINT 12
000076          12      FORMAT(1X,*SQRT PBLM 2*)
000076          2       RETURN
000077                  END
```

```
                      SUBROUTINE  CHMEM(SB)
000003                DIMENSION  SB(8,8)
000003                A=0.
000004                AUL=0.
000005                AUR=0.
000006                ALL=0.
000007                ALR=0.
000010                S=0.
000011                DO 10 I=1,4
000012                DO 20 J=1,4
000013                V=SB(I,J)+SB(9-I,9-J)-SB(I,9-J)-SB(9-I,J)
000033                A=A+V
000035                AUL=AUL+SB(I,J)
000041                AUR=AUR+SB(I,9-J)
000046                ALL=ALL+SB(9-I,J)
000052                ALR=ALR+SB(9-I,9-J)
000057          20    S=S+V*V
000063          10    CONTINUE
000065                A=A/16.
000067                S=SQRT(S/16.-A*A)
000074                PRINT 30,A,S
000103          30    FORMAT(1X,*M+SD MEMORY *,2E12.4)
000103                PRINT 31,AUL,AUR,ALL,ALR
000117          31    FORMAT(1X,*BY QUADRENTS*,2E12.4,/,13X,2E12.4)
000117                RETURN
000120                END
```

APPENDIX VIII
NOMINAL RUN PRINTOUTS

```
ENODB=   7.0 ,DELF=  62.0 ,BIF=  1000 ,BL2=   176 ,NSLICE=    26 ,ASOFT=  .3000
SVRHZ=   0.          ,SWMX=  2.8150E+04 ,SWMN=  6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=   0.          ,FQDPRT=  1.0000E+01
TL= -6.50 ,DYNR=   3.0 ,SDAMP=  .230 ,SDPHA=  .470 ,I1,I2,I11,I22  129  130    1    1
WN= 165.9 ,K= 468.6 ,TAU1=  4.5000E-01 ,TAU2=  8.4420E-03 ,NNB=     .9 ,KB= 614.9 ,TAUB1=  2.0353E+02 ,TAUB2=  1.4945E+00
PE=  6.1053E-02 ,SIDEV=  5.4928E-03 ,V MEAN=  4.5483E-01V STD DEV=  2.3263E-01 ,BITS=  1900
LOCKIN=      1 ,DROPOUTS=      1 ,AVE=  4.4000E+01 ,STD DEV=  0.
ERRM
  4.6000E+01  9.0000E+00  6.0000E+00  2.0000E+00  1.0000E+00  2.0000E+00  0.          1.0000E+00  1.0000E+00  4.0000E+00
  2.0000E+00  2.0000E+00  1.0000E+00  1.0000E+00  1.0000E+00  2.0000E+00  0.          1.0000E+00  2.0000E+00  0.
  3.0000E+00  1.0000E+00  1.0000E+00  3.0000E+00  1.0000E+00  1.0000E+00  0.          1.0000E+00  1.0000E+00  1.0000E+00
  0.          1.0000E+00  2.0000E+00  1.0000E+00  0.          0.          0.          0.          1.0000E+00  0.
  2.0000E+00  1.0000E+00  0.          0.          0.          0.          1.0000E+00  1.0000E+00  0.          0.
  0.          0.          0.          0.          0.          0.          1.0000E+00  0.          0.          0.
  0.          0.          0.          1.0000E+00  0.          0.          0.          0.          0.          0.
  1.0000E+00  0.          0.          1.0000E+00  0.          1.0000E+00  0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          1.0000E+00  0.          0.          0.
  0.          0.          0.          0.          0.          0.          1.0000E+00  0.          0.          2.0000E+00

-1,-1 P(B/A)TIMES   451                                    -1,+1 P(B/A)TIMES   483
  109   36   18   15    2    1    1    5          6    1    2    0    1    0    0    0
   50   26   15   10    2    1    0    1          2    0    0    0    0    0    0    0
   36   19   20    9    3    1    0    1          5    2    1    1    0    1    0    0
   19   11   12    4    2    1    0    0          7    0    2    2    0    0    1    0
    2    5    1    2    1    0    0    1         16    6    5    1    2    0    1    1
    1    0    0    2    1    0    0    0         42   13   11    2    1    1    0    2
    1    0    1    0    0    0    0    0         66   34   16   10    2    1    0    1
    0    0    2    0    0    0    1    0         97   50   33   18    7    1    3    6
+1,-1 F(B/A)TIMES   483                                    +1,+1 F(B/A)TIMES   483
    4    0    3    2   20   50   90  103          4    1    2    1    1    2    0    1
    2    0    2    1    8   21   31   33          1    0    1    0    0    0    0    1
    2    0    0    0    5    9   15   19          1    0    1    0    0    1    0    1
    0    0    0    3    2    5    7   10          0    0    0    0    3    0    1    2
    2    1    0    0    2    2    1    4          1    1    0    1    2    5    7   13
    0    0    0    0    2    1    0    1          2    0    2    1    5   18   23   48
    0    0    0    1    1    0    1    2          0    1    1    2    3   24   34   65
    1    0    1    3    2    1    0    7          2    1    1    3    6   32   50  104
I1,I2,I11,I22   371   874  1326   493
REC SLICE=  2.4869E+01 ,STD DEV=  3.7233E+00
                                                                                    ENODB = 7    FADING
                                                                                    1/31/74M
```

```
ENODB=   8.0 ,DELF=  62.0 ,BIF=  1000 ,BL2=   176 ,NSLICE=    26 ,ASOFT= .3000
SVRHZ=  0.        ,SWMX=  2.8150E+04 ,SWMN=  6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=  0.          ,FQDPRT=  1.0800E+01
TL= -6.50 ,DYNR=  3.0 ,SDAMP=  .230 ,SDFHA=  .470 ,I1,I2,I11,I22  129   130     1     1
WN= 165.9 ,K= 468.6 ,TAU1=  4.5000E-01 ,TAU2=  8.4420E-03 ,WNB=     .9 ,KB= 614.9 ,TAUB1=  2.0353E+02 ,TAUB2=  1.4946E+00
PE=  8.2632E-02 ,STDEV=  4.6348E-03 ,V MEAN=  4.5854E-01V STD DEV=  2.1929E-01 ,BITS=  1900
LOCKIN=      1 ,DROPOUTS=      1 ,AVE=  1.4000E+01 ,STD DEV=  0.
ERRM
  3.0000E+01  3.0000E+00  4.0000E+00  0.          1.0000E+00  1.0000E+00  0.          2.0000E+00  0.          2.0000E+00
  0.          1.0000E+00  1.0000E+00  0.          3.0000E+00  2.0000E+00  0.          0.          0.          0.
  3.0000E+00  1.0000E+00  1.0000E+00  1.0000E+00  1.0000E+00  1.0000E+00  0.          0.          2.0000E+00  1.0000E+00
  0.          0.          2.0000E+00  0.          0.          0.          0.          0.          1.0000E+00  0.
  1.0000E+00  1.0000E+00  0.          0.          0.          1.0000E+00  0.          0.          1.0000E+00  0.
  0.          1.0000E+00  0.          0.          0.          0.          1.0000E+00  0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  2.0000E+00  0.          0.          0.          1.0000E+00  0.          0.          0.          1.0000E+00  1.0000E+00
  0.          0.          0.          0.          0.          0.          1.0000E+00  0.          0.          0.
  0.          0.          0.          1.0000E+00  0.          0.          1.0000E+00  0.          0.          3.0000E+00

-1,-1 P(B/A)TIMES   451                                  -1,+1 P(B/A)TIMES   483
  111  31  21   9   3   3   1   1          4   0   2   1   1   0   0   0
   62  29  17   9   0   1   0   0          2   0   0   0   0   1   0   0
   38  18  12  13   3   1   1   0          0   0   1   0   0   0   0   0
   15  16  13   4   1   0   0   0          9   1   1   1   0   1   0   0
    1   2   1   2   0   0   0   1         14   3   4   2   0   0   0   1
    1   0   1   1   0   0   0   1         37   9   8   3   0   1   0   2
    0   0   0   0   0   0   0   0         68  28  17   4   2   0   0   0
    1   0   0   0   0   0   1   0        121  67  33  23   5   2   0   4

+1,-1 P(B/A)TIMES   483                                  +1,+1 P(B/A)TIMES   483
    2   1   1   2  10  63  99 117          1   2   1   1   1   2   0   1
    3   0   0   2   6  17  19  40          0   0   0   0   0   0   0   1
    0   1   0   0   2   9  16  17          1   0   0   0   1   0   0   1
    2   0   0   0   0   5   4  11          0   0   0   1   0   1   0   3
    0   0   0   0   2   3   1   2          0   0   1   0   1   5   6  10
    0   0   0   2   0   0   1   3          0   0   0   4   6  13  31  45
    0   0   0   1   0   1   0   1          3   0   0   2   1  22  41  82
    0   0   0   1   1   0   2   4          5   0   1   2   7  18  50 109

I1,I2,I11,I22   371   874  1326   493
REC SLICE=  2.5389E+01 ,STD DEV=  3.6756E+00
```

ENODB = 8 FADING
1/31/74A

```
ENODB=  9.0 ,DELF=  62.0 ,BIF=  1000 ,BL2=   176 ,NSLICE=   26 ,ASOFT= .3000
SVRH2=  0.          ,SWMX=  2.8150E+04 ,SWMN=  6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=  0.          ,FDOPRT=  1.0800E+01
TL= -6.50 ,DYNR=  3.0 ,SDAMP=  .230 ,SDPHA=  .470 ,I1,I2,I11,I22  129  130    1    1
WN=  165.9 ,K=  468.6 ,TAU1=  4.5000E-01 ,TAL2=  8.4420E-03 ,WNB=  .9 ,KB=  614.9 ,TAUB1=  2.0353E+02 ,TAUB2=  1.4945E+00
PE=  3.2632E-02 ,STDEV=  4.0760E-03 ,V MEAN=  4.5188E-01V STD DEV=  2.0716E-01 ,BITS=  1900
LOCKIN=     1 ,DROPOUTS=     1 ,AVE=  6.0000E+00 ,STD DEV=  0.
ERRM
  1.5000E+01  4.0000E+00  2.0000E+00  2.0000E+00  2.0000E+00  1.0000E+00  4.0000E+00  1.0000E+00  0.          0.
  0.          1.0000E+00  0.          1.0000E+00  1.0000E+00  2.0000E+00  1.0000E+00  0.          0.          0.
  0.          1.0000E+00  1.0000E+00  0.          0.          1.0000E+00  0.          0.          0.          0.
  2.0000E+00  0.          0.          1.0000E+00  0.          0.          1.0000E+00  0.          1.0000E+00  1.0000E+00
  0.          2.0000E+00  1.0000E+00  0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          1.0000E+00  0.          0.          0.          0.          1.0000E+00  0.
  1.0000E+00  0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          1.0000E+00  0.          0.          0.          1.0000E+00  0.          0.          0.          0.
  0.          0.          1.0000E+00  2.0000E+00  0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          5.0000E+00

-1,-1 P(B/A)TIMES   453                                   -1,+1 P(B/A)TIMES   482
  102   38   24    9    0    2    1    0                   3    1    0    0    0    0    0    0
   75   23   20    6    3    0    0    0                   1    0    0    1    0    0    0    0
   37   26   20   11    4    0    0    0                   1    0    0    0    0    0    0    0
   13   12    6    7    2    1    0    0                   6    3    0    1    0    1    0    0
    3    3    3    1    0    0    0    0                  12    5    3    0    0    1    0    0
    0    0    1    2    1    0    0    0                  32    7   10    4    0    1    1    0
    0    4    0    0    0    0    0    0                  84   31    8    3    3    0    1    0
    0    0    0    0    0    0    0    0                 129   61   41   21    4    1    0    1
+1,-1 P(B/A)TIMES   483                                   +1,+1 P(B/A)TIMES   482
    0    0    0    2   24   64  102  127                   1    0    0    1    0    3    1    0
    1    0    1    1    3   16   25   36                   0    0    0    1    0    2    0    0
    1    1    0    0    1    9    8   25                   0    1    0    0    1    0    0    1
    1    2    0    1    4    4    6    3                   0    0    0    1    0    1    0    2
    1    1    0    0    1    2    2    0                   0    0    0    1    2    7   14   10
    0    0    0    1    1    2    0    0                   1    0    0    2    4   17   28   50
    0    0    0    0    1    0    1    1                   1    0    1    1    5   14   46   84
    0    0    0    0    0    0    1    0                   3    0    2    3    8   16   49   97
I1,I2,I11,I22   231   338   529   737
REC SLICE=  2.6015E+01 ,STD DEV=  3.6146E+00                                        ENODB = 9     FADING
                                                                                    1/31/74M
```

```
ENODB=   9.4 ,DELF=   62.0 ,BIF=   1000 ,BL2=    176 ,NSLICE=     26 ,ASOFT=  .3000
SVRMZ=  0.          ,SWMX=  2.8150E+04 ,SWMN=  6.8500E+03 ,FLC=  1.0000E+01 ,FRQDOP=  0.          ,FQDPRT=  1.0800E+01
TL= -6.60 ,DYNR=   3.0 ,SDAMP=   .230 ,SDPHA=   .470 ,I1,I2,I11,I22   129   130     1     1
WN= 165.9 ,K= 468.6 ,TAU1=  4.5000E-01 ,TAU2=  8.4420E-03 ,WNB=     .9 ,KB= 614.9 ,TAUB1=  2.0353E+02 ,TAUB2=  1.4945E+00
PE=  2.4737E-02 ,STDEV=  3.5633E-03 ,V MEAN=  4.5633E-01V STD DEV=  2.0598E-01 ,BITS=  1900
LOCKIN=      1 ,DROPOUTS=      1 ,AVE=  4.0000E+00 ,STD DEV=  0.
ERRM
  8.0000E+00  8.0000E+00  1.0000E+00  1.0000E+00  1.0000E+00  0.          3.0000E+00  1.0000E+00  1.0000E+00  0.
  0.          1.0000E+00  0.          1.0000E+00  1.0000E+00  1.0000E+00  1.0000E+00  0.          0.          0.
  0.          1.0000E+00  0.          0.          0.          1.0000E+00  0.          0.          0.          0.
  1.0000E+00  0.          1.0000E+00  0.          1.0000E+00  1.0000E+00  0.          1.0000E+00  0.          1.0000E+00
  0.          0.          1.0000E+00  0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          1.0000E+00  0.          0.          1.0000E+00  0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          1.0000E+00  0.
  0.          0.          0.          0.          0.          1.0000E+00  0.          0.          0.          0.
  0.          0.          0.          8.0000E+00  0.          0.          0.          0.          1.0000E+00  0.
  0.          0.          0.          1.0000E+00  0.          1.0000E+00  0.          0.          0.          4.0000E+00

-1,-1 P(B/A)TIMES  463                                    -1,+1 P(B/A)TIMES   482
  107   36   23    6    1    1    0    0                  2    1    0    0    0    0    0    0
   76   25   20    5    2    0    0    0                  2    0    0    0    0    0    0    0
   34   28   20   12    2    0    0    0                  0    0    0    1    0    0    0    0
   12   13    9    6    4    0    0    0                  4    1    0    1    0    0    0    0
    4    2    2    2    0    0    0    0                 14    3    2    1    0    0    1    0
    0    0    0    1    0    0    0    0                 30   10    8    6    0    2    1    0
    0    0    0    1    0    0    0    0                 90   27    6    4    1    0    0    0
    0    0    0    0    0    0    0    0                131   64   44   20    3    2    0    2
+1,-1 P(B/A)TIMES   483                                   +1,+1 P(B/A)TIMES   482
    0    1    0    1   24   69  108  130                  1    0    0    1    0    2    0    1
    0    0    0    3    1   13   23   41                  0    0    0    1    1    0    1    0
    2    0    1    0    0    7   11   18                  0    1    0    0    0    1    0    0
    3    1    6    1    3    4    7    3                  0    0    0    0    1    2    1    1
    0    0    0    0    1    2    0    0                  0    0    0    0    0    7   11   10
    0    0    0    0    0    1    0    1                  1    0    0    2    5   13   34   51
    0    0    0    0    0    0    1    0                  0    1    2    0    6   19   45   86
    0    0    0    0    0    1    1    0                  1    1    0    2    7   20   45   98
I1,I2,I11,I22   638  1850   529   737                                        ENODB = 9.4     FADING
REC SLICE=  2.6261E+01 ,STD DEV=  3.5269E+00                                 1/31/74A
```

ENODB= 10.0 ,DELF= 62.0 ,BIF= 1000 ,BL2= 176 ,NSLICE= 26 ,ASOFT= .3000
SVRHZ= 0. ,SWMX= 2.815CE+04 ,SWMN= 6.8500E+03 ,FLO= 1.0000E+01 ,FRQDOF= 0. ,FQDFRT= 1.0800E+01
IL= -6.50 ,DYNR= 3.0 ,SDAMP= .230 ,SDPHA= .470 ,I1,I2,I11,I22 129 130 1 1
WN= 165.9 ,K= 468.6 ,TAU1= 4.5000E-01 ,TAU2= 8.4420E-03 ,WNR= .9 ,KR= 614.9 ,TAUR1= 2.0353E+02 ,TAUR2= 1.4945E+00
PE= 2.5263E-02 ,STDEV= 3.6001E-03 ,V MEAN= 4.6380E-01V STD DEV= 2.0078E-01 ,BITS= 1000
LOCKIN= 0 ,DROPOUTS= 1 ,AVE= 5.0000E+00 ,STD DEV= 0.
ERRM

1.0000E+01	1.0000E+00	2.0000E+00	1.0000E+00	2.0000E+00	2.0000E+00	1.0000E+00	1.0000E+00	2.0000E+00	0.
1.0000E+00	1.0000E+00	0.	0.	1.0000E+00	0.	2.0000E+00	1.0000E+00	1.0000E+00	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	2.0000E+00	0.	2.0000E+00	1.0000E+00
0.	0.	0.	0.	0.	0.	1.0000E+00	0.	0.	1.0000E+00
1.0000E+00	0.	0.	0.	0.	0.	0.	1.0000E+00	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	1.0000E+00	1.0000E+00	0.	0.
0.	0.	0.	0.	1.0000E+00	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	7.0000E+00

-1,-1 P(B/A)TIMES 481

104	32	16	9	0	1	0	0
64	34	29	3	1	0	0	0
43	27	21	12	1	1	0	1
11	8	12	5	2	0	0	0
5	1	3	2	0	0	1	0
0	0	1	0	1	0	0	0
0	0	0	0	0	0	0	0
0	0	1	0	0	0	0	0

-1,+1 P(B/A)TIMES 482

2	2	0	0	1	0	0	0
0	1	0	0	1	1	0	0
1	0	0	0	0	0	0	0
0	2	0	0	0	0	0	0
8	3	1	0	0	1	1	0
36	10	4	0	4	0	0	0
73	27	11	4	1	2	0	0
159	71	37	13	5	0	0	1

+1,-1 P(B/A)TIMES 483

1	2	0	2	14	64	122	141
2	2	0	1	0	11	27	44
1	1	1	0	2	6	3	16
0	0	0	0	2	4	1	2
0	0	0	1	1	0	0	3
0	0	0	0	1	1	0	1
0	0	0	0	0	1	1	0
0	0	0	0	1	0	0	0

+1,+1 P(B/A)TIMES 484

0	0	0	0	1	1	0	0
1	1	0	0	0	2	1	0
0	0	0	0	0	1	0	0
0	0	0	0	1	0	0	2
0	1	0	0	0	3	13	6
1	0	1	0	3	6	30	43
0	0	0	0	3	18	71	104
1	1	0	1	7	20	46	92

I1,I2,I11,I22 1412 890 1522 1225
REC SLICE= 2.6277E+01 ,STD DEV= 3.7702E+00

ENODB = 10 FADING
1/31/74A

```
ENODB=  11.0 ,DELF=  62.0 ,STF=- 1000 ,BL2=   176 ,NSLICE=    26 ,ASOFT=  3000
SVRHZ=  0.          ,SMMX=  2.8150E+04 ,SMMN=  6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=  0.          ,FQDPRT=  1.0000E+01
TL= -6.50 ,DYNR=  3.0 ,SQAMP=  .230 ,SQFRA=  .470 ,I1,I2,I11,I22  129  130  1  1
WN= 165.9 ,K= 468.5 ,TAU1=  4.5000E-01 ,TAU2=  8.4420E-03 ,WNB=  .9 ,KB= 614.9 ,TAUB1=  2.0353E+02 ,TAUB2=  1.4945E+00
PE=  1.4211E-02 ,STDE4=  2.7153E-03 ,V MEAN=  4.7851E-01V STD DEV=  1.9098E-01 ,BITS=  1900
LOCKIN=     0 ,DROPOUTS=     1 ,AVE=  1.0000E+00 ,STD DEV=  0.
ERRM
  6.0000E+00  1.0000E+00  1.0000E+00  0.          0.          0.          1.0000E+00  0.          1.0000E+00  1.0000E+00
  0.          0.          0.          0.          0.          0.          1.0000E+00  1.0000E+00  1.0000E+00  0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          1.0000E+00  0.          0.
  0.          0.          0.          1.0000E+00  0.          0.          0.          0.          1.0000E+00  1.0000E+00
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          1.0000E+00  0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.0000E+00

-1,-1 P(B/A)TIMES   451                                   -1,+1 P(B/A)TIMES   482
  107   30   15    4    1    0    0    0                   1    0    0    0    0    0    0    0
   78   28   26    4    1    0    0    0                   0    1    1    1    0    0    0    0
   49   33   25    9    1    1    0    0                   1    0    0    0    0    0    0    0
    6   10   12    4    1    0    0    0                   0    0    0    1    1    0    0    0
    4    0    2    0    0    0    0    0                   3    2    1    1    0    0    0    0
    0    0    0    0    0    0    0    0                  25    5    7    2    2    0    0    0
    0    0    4    0    0    0    0    0                  79   27    6    3    0    1    0    0
    0    0    0    0    0    0    0    0                 176   77   41   14    2    0    1    0
+1,-1 P(B/A)TIMES   483                                   +1,+1 P(B/A)TIMES   484
    2    1    0    4   11   64  142  149                   0    0    0    0    0    1    0    0
    0    0    0    0    1    8   17   50                   0    0    0    1    0    0    0    0
    0    0    1    0    2    4    6    5                   0    0    2    0    0    0    0    0
    0    0    0    1    0    1    2    6                   0    0    0    0    1    1    0    2
    0    1    0    0    0    0    1    1                   0    0    0    0    0    3   11    5
    0    0    0    0    0    2    0    0                   0    1    0    0    2    8   29   48
    0    0    0    0    0    0    0    1                   0    0    0    0    5   21   69  111
    0    0    0    0    0    0    0    0                   0    1    0    0    3   16   47   95
I1,I2,I11,I22  1412  890  1522  1225
REC SLICE=  2.6837E+01 ,STD DEV=  3.7227E+00
```

ENODB = 11 FADING
1/31/74M

```
ENODB=   7.0 ,DELF=  62.0 ,BIF=  1000 ,BL2=   176 ,NSLICE=    26 ,ASOFT=  .3000
SVRHZ=  0.          ,SWMX=  2.8150E+04 ,SWMN=  6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=  0.          ,FQDPRT=  1.0800E+01
TL= -6.50 ,DYNR=   3.0 ,SDAMP= 0.000 ,SDPHA= 0.000 ,I1,I2,I11,I22   129   130     1     1
WN=  165.9 ,K=  468.6 ,TAU1=  4.5000E-01 ,TAU2=  8.4420E-03 ,WNB=    .9 ,KB=  614.9 ,TAUB1=  2.0353E+02 ,TAUB2=  1.4945E+00
PE=  4.5789E-02 ,STDEV=  4.7954E-02 ,V MEAN=  4.5711E-01V STD DEV=  2.3731E-01 ,BITS=  1900
LOCKIN=      1 ,DROPOUTS=0
ERRM
  1.4000E+01  4.0000E+00  2.0000E+00  5.0000E+00  2.0000E+00  2.0000E+00  5.0000E+00  3.0000E+00  1.0000E+08  0.
  2.0000E+00  3.0000E+00  1.0000E+00  0.          1.0000E+00  3.0000E+00  5.0000E+00  1.0000E+00  0.          0.
  0.          0.          0.          4.0000E+00  2.0000E+00  0.          1.0000E+00  0.          1.0000E+00  1.0000E+00
  1.0000E+00  2.0000E+00  1.0000E+00  0.          0.          1.0000E+00  1.0000E+00  2.0000E+00  1.0000E+00  1.0000E+00
  2.0000E+00  0.          0.          0.          1.0000E+00  0.          2.0000E+00  0.          0.          0.
  0.          0.          2.0000E+00  0.          0.          0.          0.          1.0000E+00  0.          1.0000E+00
  0.          0.          0.          0.          0.          0.          0.          1.0000E+00  1.0000E+00  0.
  0.          0.          0.          0.          0.          0.          0.          1.0000E+00  0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          1.0000E+00  0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          1.0000E+00

-1,-1 P(B/A)TIMES   451                                   -1,+1 P(B/A)TIMES   482
    93    37    17    12     3     1     1     0           6     2     0     0     0     0     0     0
    60    27    17    15     2     0     1     0           1     1     0     0     0     0     0     0
    38    21    19    11     5     0     1     0           0     0     1     0     0     0     0     0
    17    16    10     3     1     2     0     0          11     0     4     1     0     0     0     1
     6     3     6     0     1     0     0     0          21     7     8     0     0     0     0     1
     1     1     0     0     1     0     0     0          36    11     7     2     3     0     0     0
     0     1     0     1     0     0     0     0          59    20    11     6     2     0     1     1
     0     0     0     0     0     0     0     0         119    67    37    25     8     1     1     0
+1,-1 P(B/A)TIMES   482                                   +1,+1 P(B/A)TIMES   485
     1     2     3     9    23    53    73   141           0     0     0     2     2     0     2     0
     2     0     0     2     8    11    30    39           0     0     0     0     0     3     0     0
     1     0     1     0     3     6    13    18           0     0     0     0     2     2     1     0
     2     0     0     1     3     3     4    13           0     0     0     0     2     1     0     4
     1     0     0     0     3     1     3     2           0     0     0     2     7     3     7    19
     0     0     0     0     0     0     0     1           0     0     0     1     4    13    15    57
     1     0     0     1     0     1     0     0           2     0     1     1     5    19    28    63
     0     0     0     1     0     0     1     1           4     3     1     4    13    33    42   117
I1,I2,I11,I22   638  1850     1     1
REC SLICE=  2.4163E+01 ,STD DEV=  3.5649E+00

ENODB = 7   NO FADE
1/31/74M
```

```
ENODB=   8.0 ,DELF=  62.0 ,BIF=  1000 ,BL2=   176 ,NSLICE=    26 ,ASOFT= .3000
SWRHZ=  0.          ,SWMX=  2.8150E+04 ,SWMN=  6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=  0.          ,FQDPRT=  1.0800E+01
TL= -6.50 ,DYNR=   3.0 ,SDAMP= 0.000 ,SOPHA= 0.000 ,I1,I2,I11,I22   129   136     1     1
WN= 165.9 ,K= 468.6 ,TAU1=  4.5000E-01 ,TAU2=  8.4420E-03 ,WNB=    .9 ,K9= 614.9 ,TAUR1=  2.0353E+02 ,TAUR2=  1.4945E+00
PE=  2.5263E-02 ,STDEV=  3.6061E-03 ,V MEAN=  4.5835E-01V STD DEV=  2.1459E-01 ,RITS=  1900
LOCKIN=      1 ,DROPOUTS=0
ERRM
  8.0000E+00  2.0000E+00  1.0000E+00  0.          1.0000E+00  2.0000E+00  1.0000E+00  1.0000E+00  0.          0.
  0.          1.0000E+00  1.0000E+00  0.          0.          0.          0.          1.0000E+00  0.          0.
  0.          1.0000E+00  2.0000E+00  2.0000E+00  1.0000E+00  0.          0.          1.0000E+00  0.          0.
  1.0000E+00  0.          0.          1.0000E+00  0.          0.          0.          1.0000E+00  0.          0.
  0.          1.0000E+00  1.0000E+00  0.          0.          0.          2.0000E+00  0.          1.0000E+00  0.
  0.          0.          1.0000E+00  0.          1.0000E+00  0.          0.          0.          0.          0.
  1.0000E+00  1.0000E+00  0.          1.0000E+00  0.          0.          0.          1.0000E+00  1.0000E+00  1.0000E+00
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          2.0000E+00  0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          4.0000E+00

-1,-1 P(B/A)TIMES   461                                   -1,+1 P(B/A)TIMES   482
    98    34    13     8     2     1     0     1           1     1     1     0     0     0     0     0
    76    26    20    13     1     0     0     0           2     1     0     0     0     0     0     0
    38    27    19     9     4     1     0     0           1     2     1     0     0     0     0     0
    20    11     5     3     2     0     0     0           1     1     1     0     0     0     0     0
     4     2     4     1     2     0     0     0          15     3     5     1     0     0     0     2
     1     0     0     0     0     0     0     0          43     5    12     1     1     0     0     0
     1     0     0     0     0     0     0     0          65    30    11     4     1     0     0     0
     0     0     0     0     0     0     0     0         125    69    47    23     5     0     1     0
+1,-1 P(B/A)TIMES   482                                   +1,+1 P(B/A)TIMES   485
     2     0     1     4    24    58   106   140           0     0     0     0     1     1     2     0
     2     0     0     0     2    14    27    31           0     0     0     0     0     0     0     0
     0     1     1     0     3     8     8    23           0     0     0     0     0     2     0     0
     1     2     1     0     2     4     2     6           0     0     0     0     1     1     0     3
     0     0     1     0     1     1     1     1           0     0     1     0     4     2    10    15
     0     0     0     1     0     0     0     0           0     0     0     1     4    12    26    52
     0     0     0     0     0     0     0     0           0     0     0     0     5    25    42    84
     0     0     1     0     1     0     1     0           2     0     0     2    10    29    42   106
I1,I2,I11,I22  1584  1314     1     1
REC SLICE=  2.4951E+01 ,STD DEV=  3.4991E+00                                                    ENODB = 8     NO FADE
                                                                                                1/31/74D
```

```
ENODB=   9.0 ,DELF=  62.6 ,BIF=  1000 ,BL2=   176 ,NSLICE=   26 ,ASOFT= .3000
SVRHZ=  0.          ,SAMX=  2.9150E+04 ,SAMN=  6.8500E+03 ,FLC=  1.0000E+01 ,FRQDOP=  0.          ,FQDPRT=  1.0000E+01
TL= -6.50 ,DYNR=  3.0 ,SDAMP= 0.000 ,SDFMA= 0.000 ,I1,I2,I11,I22  129  130   1   1
WN= 165.9 ,K= +68.6 ,TAU1=  4.5000E-01 ,TAU2=  8.4420E-03 ,WNR=    .9 ,KB= 614.9 ,TAUB1=  2.0353E+02 ,TAU92=  1.4945E+00
PE=  1.0000E-02 ,STDEV=  2.2827E-03 ,V MEAN=  4.7164E-01V STD DEV=  1.9349E-01 ,BITS=  1900
LOCKIN=     2 ,DROPOUTS=0
ERRM
  2.0000E+00  0.          0.          1.0000E+00  0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          1.0000E+00  0.          1.0000E+00  0.
  1.0000E+00  0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          1.0000E+00  0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          2.0000E+00
  1.0000E+00  0.          1.0000E+00  0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          1.0000E+00  0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          7.0000E+00

-1,-1 P(B/A)TIMES  455                                    -1,+1 P(B/A)TIMES  482
  108   39   14    2    1    0    0    0      0    0    0    0    0    0    0    0
   76   37   21    7    3    0    1    0      0    0    0    0    0    0    0    0
   43   27   19    9    1    0    1    0      2    0    0    0    0    0    0    0
   17   11    5    2    2    0    0    0      2    0    0    0    0    0    0    0
    5    2    2    1    0    0    0    0      6    2    0    0    0    0    0    0
    0    0    0    0    0    0    0    0     45   12    6    0    0    0    0    0
    0    0    0    0    0    0    0    0     86   24   14    5    0    0    0    0
    0    0    0    0    0    0    0    0    136   67   53   18    4    0    0    0

+1,-1 P(B/A)TIMES  482                                    +1,+1 P(B/A)TIMES  481
    0    0    1    2   18   71  130  140      0    0    0    0    0    0    0    0
    0    0    0    0    4   10   23   39      0    0    0    0    0    0    0    0
    0    0    1    0    0    5    8   21      0    0    0    0    1    0    0    0
    0    0    0    0    0    1    2    3      0    0    0    0    0    0    0    1
    0    0    0    0    0    0    0    1      0    0    0    0    0    5    2   16
    0    0    0    0    0    0    0    0      0    0    1    0    1   12   26   41
    0    0    0    1    0    1    0    0      0    0    0    0    5   20   55   94
    0    0    0    0    0    0    0    0      0    0    0    0    2   19   57  123
I1,I2,I11,I22  121  262   1   1
RET SLICE=  2.5673E+01 ,STD DEV=  3.4843E+00

ENODB = 9     NO FADE
1/31/74M
```

ENODB= 9.4 ,DELF= 62.0 ,BIF= 1000 ,BL2= 176 ,NSLICE= 26 ,ASOFT= .3000
SVRHZ= 0. ,SWMX= 2.8150E+04 ,SWMN= 6.8500E+03 ,FLO= 1.0000E+01 ,FQDOP= 0. ,FQDPRT= 1.0800E+01
TL= -6.50 ,DYNR= 3.0 ,SDAMP= 0.000 ,SDPHA= 0.000 ,T1,I2,I11,I22 129 130 1 1
WN= 165.9 ,K= 468.6 ,TAU1= 4.5000E-01 ,TAU2= 8.4420E-03 ,WNB= .9 ,KB= 614.9 ,TAUP1= 2.0353E+02 ,TAUP2= 1.4949E+00
PE= 8.9474E-03 ,SIDEV= 2.1503E-03 ,V MEAN= 4.7353E-01V STD DEV= 1.8772E-01 ,ITS= 1900
LOCKIN= 1 ,DROPOUTS=0
ERRM

2.0000E+00	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	1.0000E+00	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	1.0000E+00	0.	1.0000E+00	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	2.0000E+00
1.0000E+00	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	1.0000E+00	0.
0.	0.	0.	0.	0.	0.	0.	1.0000E+00	0.	7.0003E+00

-1,-1 P(B/A)TIMES 455

117	32	11	3	1	0	0	0
73	39	27	4	3	0	0	0
45	29	21	7	1	0	0	0
16	9	4	3	2	0	0	0
3	2	1	1	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0

-1,+1 P(B/A)TIMES 482

0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0
5	1	0	0	0	0	0	0
46	8	5	0	0	0	0	0
81	25	11	3	0	0	0	0
148	71	57	16	2	0	0	0

+1,-1 P(B/A)TIMES 482

0	1	0	3	20	69	131	149
0	0	1	0	2	10	23	35
0	0	0	0	1	2	8	22
0	0	0	0	0	0	2	1
0	0	0	0	0	1	0	1
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0

+1,+1 P(B/A)TIMES 481

0	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0
0	0	0	0	0	1	0	0
0	0	0	1	0	1	0	1
0	0	0	0	0	4	3	17
0	0	0	0	0	11	30	36
0	0	0	0	5	20	57	101
0	0	1	1	1	17	49	123

I1,I2,I11,I22 1594 1314 1 1
REC SLICE= 2.5978E+01 ,STD DEV= 3.3165E+00

ENODB = 9A NO FADE
1/31/74A

```
ENODB=  10.0 ,DELF=  62.0 ,BIF=  1000 ,BL2=   176 ,NSLICE=    26 ,ASOFT= .3000
SVRHZ=  0.        ,SWMX=  2.815CE+04 ,SWMN=  6.9500E+03 ,FLC=  1.0000E+01 ,FRQDOP=  0.        ,FQDPRT=  1.0800E+01
TL= -6.50 ,DYNR=  3.0 ,SDAMP= 0.000 ,SDPHA= 0.000 ,I1,I2,I11,I22  129  130    1    1
WN= 165.9 ,K= 468.6 ,TAU1=  4.5000E-01 ,TAU2=  8.4420E-03 ,WNB=    .9 ,KB= 614.9 ,TAUB1=  2.0353E+02 ,TAUB2=  1.4945E+00
PE=  2.6316E-03 ,STDEV=  1.1753E-03 ,V MEAN=  4.7376E-01V STD DEV=  1.8538E-01 ,BITS=  1900
LOCKIN=     1 ,DROPOUTS=0
ERRM
  1.0000E+00  0.        0.        0.        0.        0.        0.        0.        0.        0.
  0.          0.        0.        0.        0.        0.        0.        0.        0.        0.
  0.          0.        0.        0.        0.        0.        0.        0.        0.        0.
  0.          0.        0.        0.        0.        0.        0.        0.        0.        0.
  0.          0.        0.        0.        0.        0.        0.        0.        0.        0.
  0.          0.        0.        0.        0.        0.        0.        0.        0.        0.
  0.          0.        0.        0.        0.        0.        0.        0.        0.        0.
  0.          0.        0.        0.        0.        0.        0.        0.        0.        0.
  0.          0.        0.        0.        0.        0.        0.        0.        0.        0.
  0.          0.        0.        0.        1.0000E+00  0.      0.        0.        0.        3.0000E+00

-1,-1 P(B/A)TIMES   452                                  -1,+1 P(B/A)TIMES   483
  113   22   10    2    0    0    0    0                 0    0    0    0    0    0    0    0
   74   45   24    8    0    0    0    0                 0    0    0    0    0    0    0    0
   44   44   21    6    0    0    0    0                 0    0    0    0    0    0    0    0
    8   16   11    2    0    0    0    0                 0    0    0    0    0    0    0    0
    0    1    1    0    0    0    0    0                 2    1    2    0    0    0    0    0
    0    0    0    0    0    0    0    0                23    9    2    0    0    0    0    0
    0    0    0    0    0    0    0    0               100   24   11    3    0    0    0    0
    0    0    0    0    0    0    0    0               159   77   52   16    2    0    0    0
+1,-1 P(B/A)TIMES   482                                  +1,+1 P(B/A)TTMES   483
    1    0    0    0   14   70  122  169                 0    0    0    0    0    0    1    0
    0    0    0    0    3   11   25   48                 0    0    0    0    0    0    0    0
    0    0    0    0    2    0    4   13                 0    0    0    0    0    0    0    0
    0    0    0    0    0    0    0    0                 0    0    0    0    0    0    0    2
    0    0    0    0    0    0    0    0                 0    0    0    0    1    4    4   12
    0    0    0    0    0    0    0    0                 0    0    0    0    1   14   39   50
    0    0    0    0    0    0    0    0                 0    0    0    1    1   18   55   96
    0    0    0    0    0    0    0    0                 0    0    0    1    4   21   59   99
I1,I2,I11,I22   638  1856     1     1
REF SLICE=  2.5980E+01 ,STD DEV=  3.7947E+00
```

ENODB = 10 NO FADE
1/31/74A

```
ENODB= 11.0 ,DELF= 62.0 ,BIF= 1000 ,BL2= 176 ,NSLICE= 26 ,ASOFT= .3000
SVRHZ= 0.          ,SWMX= 2.8150E+04 ,SWMN= 6.8500E+03 ,FLO= 1.0000E+01 ,FRQDOP= 0.          ,FODPRT= 1.0800E+01
TL= -6.50 ,DYNR= 3.0 ,SDAMP= 0.000 ,SDPHA= 0.000 ,I1,I2,I11,I22 129 130 1 1
WN= 165.9 ,K= 468.6 ,TAU1= 4.5000E-01 ,TAU2= 8.4420E-03 ,WNB= .9 ,KB= 614.9 ,TAUB1= 2.0353E+02 ,TAUB2= 1.4945E+00
RE= 1.0526E-03 ,STDEV= 7.4393E-04 ,V MEAN= 4.7298E-01V STD DEV= 1.8251E-01 ,BITS= 1900
LOCKIN= 1 ,DROPOUTS=0
ERRM
   0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
   0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
   0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
   0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
   0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
   0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
   0.          0.          0.          0.          0.          0.          0.          0.          1.0000E+00  0.
   0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
   0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
   0.          0.          0.          0.          0.          0.          0.          0.          0.          1.0000E+00

-1,-1 P(B/A)TIMES  451                                  -1,+1 P(B/A)TIMES  483
   112   11    6    2    0    0    0    0              0    0    0    0    0    0    0    0
    86   44   25    6    0    0    0    0              0    0    0    0    0    0    0    0
    39   48   24   10    0    0    0    0              0    0    0    0    0    0    0    0
     7    8   15    3    0    0    0    0              0    0    0    0    0    0    0    0
     0    0    1    0    0    0    0    0              2    1    0    0    0    0    0    0
     0    0    0    0    0    0    0    0             26    8    4    0    0    0    0    0
     0    0    0    0    0    0    0    0             63   19    7    1    0    0    0    0
     0    0    0    0    0    0    0    0            179   87   53   12    1    0    0    0
+1,-1 P(B/A)TIMES  483                                  +1,+1 P(B/A)TIMES  483
     0    0    0    1   10   87  138  168              0    0    0    0    0    0    0    0
     0    0    0    0    2    6   13   39              0    0    0    0    0    0    0    0
     0    0    0    0    0    0    4   14              0    0    0    0    0    0    0    0
     0    0    0    0    0    0    0    1              0    0    0    0    0    0    1    0
     0    0    0    0    0    0    0    0              0    0    0    0    0    5    7    7
     0    0    0    0    0    0    0    0              0    0    0    0    4   15   38   56
     0    0    0    0    0    0    0    0              0    0    0    0    2   21   61  102
     0    0    0    0    0    0    0    0              0    0    0    0    4   17   34  109
I1,I2,I11,I22  1050  778  1  1
REC SLICE= 2.6949E+01 ,STD DEV= 4.0822E+00                                   ENODB = 11    NO FADE
                                                                             1/31/74M
```

ENODB= 9.4 ,DELF= 62.0 ,BIF= 1000 ,BL2= 176
SVRHZ= 2.2000E+03 ,SHMX= 2.5000E+03 ,SHMN= 6.8500E+03 ,FLO= 1.6000E+01 ,FRODOP= 1.0000E+03 ,FQDPRT= 1.0800E+01
TL= -6.50 ,DYNR= 3.0 ,SDAMP= .230 ,SDPHA= .470 ,I1,I2,I11,I22 1 1 1 1
HN= 165.9 ,K= 464.6 ,TAU1= 4.5060E-01 ,TAU2= 8.4428E-03
NACQ,AMISS,AFAL,KDATA,ES,EV,EV1

1	0.	0.	1.0000E+00	69	2.2827E+01	1.4074E+01	5.8374E-01
2	0.	0.	2.0000E+00	68	2.2470E+01	1.3472E+01	-5.3055E-02
3	0.	0.	3.0000E+00	68	2.2743E+01	1.3875E+01	3.3307E-01
4	0.	0.	4.0000E+00	72	2.3811E+01	1.3907E+01	3.4400E-01
5	0.	0.	5.0000E+00	74	2.4520E+01	1.2216E+01	-1.2795E+00
6	0.	0.	6.0000E+00	75	2.4941E+01	1.3900E+01	4.6619E-01
7	0.	0.	7.0000E+00	72	2.3830E+01	1.2615E+01	-9.5723E-01
8	0.	0.	8.0000E+00	67	2.2288E+01	1.3022E+01	-4.2562E-01
9	0.	0.	9.0000E+00	71	2.3514E+01	1.3099E+01	-4.0001E-01
10	0.	0.	1.0000E+01	72	2.3912E+01	1.3345E+01	-1.9361E-01
11	0.	0.	1.1000E+01	66	2.2143E+01	1.3134E+01	-4.4800E-01
12	0.	0.	1.2000E+01	72	2.3963E+01	1.3283E+01	-2.0432E-01
13	0.	0.	1.3000E+01	65	2.1738E+01	1.4556E+01	9.7550E-01
14	0.	0.	1.4000E+01	71	2.3541E+01	1.3793E+01	2.2185E-01
15	0.	0.	1.5000E+01	71	2.3535E+01	1.2560E+01	-9.7664E-01
16	0.	0.	1.6000E+01	70	2.3152E+01	1.3611E+01	1.4561E-01
17	0.	0.	1.7000E+01	72	2.3933E+01	1.3486E+01	-1.4073E-01
18	0.	0.	1.8000E+01	71	2.3749E+01	1.3470E+01	-1.0426E-02
19	0.	0.	1.9000E+01	73	2.4175E+01	1.3367E+01	-1.0955E-01
20	0.	0.	2.0000E+01	73	2.4424E+01	1.3756E+01	3.1282E-01
21	0.	0.	2.1000E+01	66	2.1927E+01	1.3814E+01	3.0624E-01
22	0.	0.	2.2000E+01	70	2.3221E+01	1.3273E+01	-2.9962E-01
23	0.	0.	2.3000E+01	73	2.4217E+01	1.3482E+01	-5.4756E-02
24	0.	0.	2.4000E+01	73	2.4388E+01	1.3154E+01	-3.0937E-01
25	0.	0.	2.5000E+01	75	2.4892E+01	1.3045E+01	-3.2742E-01
26	0.	0.	2.6000E+01	70	2.3397E+01	1.4643E+01	1.1306E+00
27	0.	0.	2.7000E+01	70	2.3231E+01	1.3816E+01	2.4060E-01
28	0.	0.	2.8000E+01	67	2.2252E+01	1.3197E+01	-2.5854E-01
29	0.	0.	2.9000E+01	67	2.2385E+01	1.3494E+01	-9.3494E-02
30	0.	0.	3.0000E+01	67	2.2185E+01	1.2524E+01	-9.8497E-01

PACQ= 1.0000E+00 ,STDEV= 0.
AVEES= 2.3377E+01 ,STDES= 8.9371E-01
AVE KDATA= 7.0333E+01 ,STD DEV= 2.7366E+00
PR MISSED ACQ= 0.
PR FALSE ACQ= 0.
I1,I2,I11,I22 312 1977 67 1981

ENODB = 9.4. ACQUISITION FADING
2/6/74A

```
ENODB=   9.4 ,DELF=  62.0 ,BIF=  1000 ,BL2=   176
SVRHZ=  2.2000E+03 ,SWMX=  2.5000E+03 ,SWMN=  6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=  1.0000E+03 ,FQDPRT=  1.3800E+01
TL= -6.30 ,DYNR=   3.0 ,SDAMP= 0.000 ,SDPHA= 0.000 ,I1,I2,I11,I22     1     1     1     1
MN= 165.9 ,K= +58.6 ,TAU1=  4.5000E-01 ,TAU2=  8.4420E-13
NACQ,AMISS,AFAL,KDATA,ES,EV,EV1
     1  0.          0.          1.0000E+00    67  2.2232E+01  1.4811E+01  1.4328E+00
     2  0.          0.          2.0000E+00    70  2.3221E+01  1.3254E+01 -3.3428E-01
     3  0.          0.          3.0000E+00    68  2.2569E+01  1.2780E+01 -7.2919E-01
     4  0.          0.          4.0000E+00    73  2.4379E+01  1.3613E+01  2.0185E-01
     5  0.          0.          5.0000E+00    73  2.4248E+01  1.2040E+01 -1.4811E+00
     6  0.          0.          6.0000E+00    75  2.5112E+01  1.3833E+01  3.3289E-01
     7  0.          0.          7.0000E+00    71  2.3471E+01  1.2966E+01 -5.7815E-01
     8  0.          0.          8.0000E+00    69  2.2889E+01  1.3427E+01 -2.2844E-01
     9  0.          0.          9.0000E+00    73  2.4161E+01  1.3854E+01  3.5261E-01
    10  0.          0.          1.0000E+01    70  2.3382E+01  1.5306E+01  1.8587E+00
    11  0.          0.          1.1000E+01    73  2.4260E+01  1.3547E+01  4.2381E-02
    12  0.          0.          1.2000E+01    69  2.3085E+01  1.3990E+01  4.6624E-01
    13  0.          0.          1.3000E+01    71  2.3755E+01  1.4570E+01  1.0965E+00
    14  0.          0.          1.4000E+01    71  2.3560E+01  1.3617E+01  1.3730E-01
    15  0.          0.          1.5000E+01    69  2.3107E+01  1.3035E+01 -4.7169E-01
    16  0.          0.          1.6000E+01    70  2.3149E+01  1.2883E+01 -5.5778E-01
    17  0.          0.          1.7000E+01    75  2.5127E+01  1.4168E+01  6.5151E-01
    18  0.          0.          1.8000E+01    71  2.3575E+01  1.3339E+01 -1.9897E-01
    19  0.          0.          1.9000E+01    67  2.2314E+01  1.3275E+01 -2.7460E-01
    20  0.          0.          2.0000E+01    72  2.3853E+01  1.2641E+01 -9.7835E-01
    21  0.          0.          2.1000E+01    73  2.4238E+01  1.3759E+01  2.1434E-01
    22  0.          0.          2.2000E+01    74  2.4574E+01  1.3484E+01 -6.9096E-02
    23  0.          0.          2.3000E+01    69  2.2864E+01  1.4139E+01  5.6728E-01
    24  0.          0.          2.4000E+01    67  2.2291E+01  1.2612E+01 -8.4230E-01
    25  0.          0.          2.5000E+01    73  2.4284E+01  1.2445E+01 -1.1641E+00
    26  0.          0.          2.6000E+01    77  2.5675E+01  1.3988E+01  4.2820E-01
    27  0.          0.          2.7000E+01    73  2.4428E+01  1.2721E+01 -7.7898E-01
    28  0.          0.          2.8000E+01    69  2.3099E+01  1.4109E+01  6.4353E-01
    29  0.          0.          2.9000E+01    69  2.2998E+01  1.2769E+01 -7.1159E-01
    30  0.          0.          3.0000E+01    71  2.3531E+01  1.3569E+01  7.8444E-02
PACQ=  1.0000E+00 ,STDEV=  0.
AVEES=  2.3648E+01 ,STDES=  8.5854E-01
AVE KDATA=  7.1067E+01 ,STD DEV=  2.5157E+00
PR MISSED ACQ=  0.
PR FALSE ACQ=  0.
I1,I2,I11,I22    554    713      1      1
```

ENODB = 9.4 ACQUISITION NO FADE
2/7/74M

```
ENODB=  12.4 ,DELF=  62.0 ,BIF=  1000 ,BL2=   176
SVRHZ=  2.2000E+03 ,SWMX=  2.5000E+03 ,SWMN=  6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=  1.0000E+03 ,FQDPRT=  1.0800E+01
TL= -6.50 ,DYNR=  3.0 ,SDAMP=  .230 ,SDPHA=  .+70 ,I1,I2,I11,I22     1     1     1     1
WN= 165.9 ,K=  468.6 ,TAU1=  4.5000E-01 ,TAU2=  8.4420E-03
NACQ,AMISS,AFAL,KDATA,ES,EV,EV1
     1  0.          0.          1.0000E+00    64  2.1237E+01  1.4830E+01  1.4056E+00
     2  0.          0.          2.0000E+00    72  2.3809E+01  1.3014E+01 -5.9865E-01
     3  0.          0.          3.0000E+00    76  2.5169E+01  1.4236E+01  6.6512E-01
     4  0.          0.          4.0000E+00    76  2.5152E+01  1.3398E+01 -2.6947E-01
     5  0.          0.          5.0000E+00    72  2.4106E+01  1.3916E+01  4.2874E-01
     6  0.          0.          6.0000E+00    79  2.6253E+01  1.3597E+01  4.9693E-03
     7  0.          0.          7.0000E+00    82  2.7250E+01  1.3391E+01 -1.4508E-01
     8  0.          0.          8.0000E+00    74  2.4733E+01  1.2888E+01 -7.0808E-01
     9  0.          0.          9.0000E+00    78  2.5971E+01  1.3726E+01  1.2707E-01
    10  0.          0.          1.0000E+01    74  2.4694E+01  1.2798E+01 -6.5254E-01
    11  0.          0.          1.1000E+01    79  2.6358E+01  1.2965E+01 -5.0201E-01
    12  0.          0.          1.2000E+01    76  2.5277E+01  1.4778E+01  1.2345E+00
    13  0.          0.          1.3000E+01    73  2.4140E+01  1.3675E+01  4.6815E-02
    14  0.          0.          1.4000E+01    79  2.6338E+01  1.4090E+01  4.9934E-01
    15  0.          0.          1.5000E+01    64  2.1121E+01  1.4074E+01  4.3983E-01
    16  0.          0.          1.6000E+01    74  2.4502E+01  1.2881E+01 -6.6133E-01
    17  0.          0.          1.7000E+01    74  2.4597E+01  1.4949E+01  1.5002E+00
    18  0.          0.          1.8000E+01    73  2.4398E+01  1.3452E+01 -7.1677E-02
    19  0.          0.          1.9000E+01    72  2.4116E+01  1.3141E+01 -4.6447E-01
    20  0.          0.          2.0000E+01    75  2.4843E+01  1.3276E+01 -2.4706E-01
    21  0.          0.          2.1000E+01    67  2.2366E+01  1.3852E+01  3.2170E-01
    22  0.          0.          2.2000E+01    73  2.4195E+01  1.1549E+01 -2.0853E+00
    23  0.          0.          2.3000E+01    72  2.4049E+01  1.3130E+01 -3.8302E-01
    24  0.          0.          2.4000E+01    65  2.1589E+01  1.3612E+01  1.2866E-01
    25  0.          0.          2.5000E+01    77  2.5688E+01  1.3564E+01 -1.2554E-02
    26  0.          0.          2.6000E+01    73  2.4168E+01  1.3319E+01 -3.5070E-01
    27  0.          0.          2.7000E+01    66  2.2063E+01  1.4865E+01  1.1704E+00
    28  0.          0.          2.8000E+01    74  2.4507E+01  1.2953E+01 -5.8080E-01
    29  0.          0.          2.9000E+01    67  2.2244E+01  1.3348E+01 -1.0998E-01
    30  0.          0.          3.0000E+01    71  2.3573E+01  1.3723E+01  1.2119E-01
PACQ=  1.0000E+00 ,STDEV=  0.
AVEES=  2.4284E+01 ,STDES=  1.5236E+00
AVE KDATA=  7.3033E+01 ,STD DEV=  4.5496E+00
PR MISSED ACQ=  0.
PR FALSE ACQ=  0.
I1,I2,I11,I22   261   951  1634   241
```

ENODB = 12.4 ACQUISITION FADING
2/6/74M

```
ENODB=  12.4 ,DELF=  62.0 ,BIF=  1000 ,BL2=   176
SVRMZ=  2.2000E+03 ,SMMX=  2.5000E+03 ,SMMN=  6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=  1.0000E+03 ,FQDPRT=  1.0800E+01
TL= -6.50 ,DYNR=   3.0 ,SDAMP= 0.000 ,SDPHA= 0.000 ,I1,I2,I11,I22      1      1      1      1
MN= 165.9 ,K= 468.6 ,TAU1=  4.5000E-01 ,TAU2=  8.4420E-03
NACQ,AMISS,AFAL,KDATA,ES,EV,EV1
     1  0.          0.          1.0000E+00    71  2.3516E+01  1.2265E+01 -1.1345E+00
     2  0.          0.          2.0000E+00    77  2.5584E+01  1.2110E+01 -1.3762E+00
     3  0.          0.          3.0000E+00    76  2.5373E+01  1.2996E+01 -5.2821E-01
     4  0.          0.          4.0000E+00    70  2.3223E+01  1.4250E+01  6.9029E-01
     5  0.          0.          5.0000E+00    76  2.5190E+01  1.2952E+01 -5.3322E-01
     6  0.          0.          6.0000E+00    72  2.4071E+01  1.3547E+01  4.7392E-02
     7  0.          0.          7.0000E+00    78  2.5938E+01  1.4894E+01  1.3724E+00
     8  0.          0.          8.0000E+00    75  2.4959E+01  1.2817E+01 -6.9791E-01
     9  0.          0.          9.0000E+00    76  2.5395E+01  1.3250E+01 -3.4141E-01
    10  0.          0.          1.0000E+01    68  2.2725E+01  1.3790E+01  2.5845E-01
    11  0.          0.          1.1000E+01    75  2.4926E+01  1.4054E+01  5.1976E-01
    12  0.          0.          1.2000E+01    74  2.4755E+01  1.4168E+01  6.6020E-01
    13  0.          0.          1.3000E+01    77  2.5487E+01  1.4116E+01  5.6072E-01
    14  0.          0.          1.4000E+01    70  2.3235E+01  1.3964E+01  3.7138E-01
    15  0.          0.          1.5000E+01    73  2.4170E+01  1.2082E+01 -1.4648E+00
    16  0.          0.          1.6000E+01    72  2.3969E+01  1.3680E+01  8.7723E-02
    17  0.          0.          1.7000E+01    77  2.5789E+01  1.2266E+01 -1.2720E+00
    18  0.          0.          1.8000E+01    75  2.5132E+01  1.2247E+01 -1.2798E+00
    19  0.          0.          1.9000E+01    73  2.4346E+01  1.3938E+01  4.3054E-01
    20  0.          0.          2.0000E+01    73  2.4385E+01  1.3620E+01  4.1238E-02
    21  0.          0.          2.1000E+01    70  2.3357E+01  1.2656E+01 -8.8830E-01
    22  0.          0.          2.2000E+01    72  2.3900E+01  1.2971E+01 -7.2588E-01
    23  0.          0.          2.3000E+01    72  2.3819E+01  1.3358E+01 -1.1341E-01
    24  0.          0.          2.4000E+01    71  2.3575E+01  1.3110E+01 -3.1621E-01
    25  0.          0.          2.5000E+01    74  2.4798E+01  1.3950E+01  3.7404E-01
    26  0.          0.          2.6000E+01    72  2.4131E+01  1.4326E+01  8.5348E-01
    27  0.          0.          2.7000E+01    73  2.4383E+01  1.3338E+01 -3.0933E-01
    28  0.          0.          2.8000E+01    71  2.3566E+01  1.2102E+01 -1.4967E+00
    29  0.          0.          2.9000E+01    71  2.3786E+01  1.2928E+01 -6.8400E-01
    30  0.          0.          3.0000E+01    74  2.4548E+01  1.2764E+01 -6.9476E-01
PACQ=  1.0000E+00 ,STDEV=  0.
AVEES=  2.4401E+01 ,STDES=  8.3758E-01
AVE KDATA=  7.3267E+01 ,STD DEV=  2.4891E+00
PR MISSED ACQ=  0.
PR FALSE ACQ=  0.
I1,I2,I11,I22  1657   745     1     1                                    ENODB = 12.4  ACQUISITION  NO FADE-
                                                                                      2/6/74N
```

```
NRUNS,NSPB,ENODB,DELF,BIF,ENOMIN
 2000    40  6.0000E+00  6.2000E+01  1.0000E+03  9.0000E+00
BL2,PHIDEG,FDIFF,BL2E,PHIB,FDIFFB
 1.760CE+02  1.0000E+01  3.4243E+02  1.0000E+00  1.0300E+01  5.0000E+00
FBAMP,FBPHA,SDAMP,SDPHA,GAM43,N43,NSLICE
 2.0000E+00  2.0000E-01  0.          0.          9.0000E-02    64    26
FLO,FRQDOP,FQOPRT,ASCFT,I1,I2,I11,I22
 1.0000E+01  0.          0.          2.6496E-01     1     1     1     1
SVRMZ,SWMX,SWMN,        ,TL
 0.          2.8150E+04  6.8500E+03                -8.0000E+00
CCLOSC,IDLBIT,DYNR
 0.            100  3.0000E+00
WN,K,TAU1,TAU2
 1.659344E+02  4.686449E+02  4.499999E-01  8.442820E-03
WNB,KB,TAUB1,TAUB2
 .4281E-01  6.1405E+02  2.0353E+02  1.4945E+00
 IT,TSYNC
    6  1.1364E-02
PE,STDEV,MSSUM,MSSIG,KOUNT
 6.1579E-02  5.5149E-03  4.5272E-01  2.4763E-01  2000
LOOKIN     1DRCPOUTS     1AVE  4.0000E+00SD  8.
ERRM
  2.1000E+01  7.0000E+00  3.0000E+00  5.0000E+00  8.0000E+00  4.0000E+00  1.0000E+01  3.0000E+00  5.0000E+00  3.0000E+00
  1.0000E+00  1.0000E+00  2.0000E+00  3.0000E+00  1.0000E+00  1.0000E+00  0.          1.0000E+00  1.0000E+00  2.0000E+00
  3.0000E+00  1.0000E+00  4.0000E+00  1.0000E+00  1.0000E+00  1.0000E+00  0.          2.0000E+00  1.0000E+00  1.0000E+00
  3.0000E+00  1.0000E+00  1.0000E+00  1.0000E+00  0.          1.0000E+00  2.0000E+00  2.0000E+00  0.          0.
  0.          0.          0.          0.          0.          0.          0.          1.0000E+00  1.0000E+00  0.
  1.0000E+00  0.          1.0000E+00  1.0000E+00  1.0000E+00  0.          0.          0.          0.          0.
  0.          1.0000E+00  0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          1.0000E+00  0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          1.0000E+00

  1140  1830   408  1137
REC SLICE=   2.3453E+01  5.2509E+00
XXXC,ASUM1,ASUM2,VSUM1,VSUM2,VSUM3,
 7.6017E+04  1.9179E+06  5.8981E+07 -1.3095E+06  2.3027E+07 -4.1166E+08
V HISTOGRAM
  0.          1.2486E-05  2.4972E-05  1.2486E-05  3.7458E-05  2.4972E-05  1.2486E-05  1.2486E-05  2.4972E-05  4.9944E-05
  4.9944E-05  4.9944E-05  8.7402E-05  6.2430E-05  4.9944E-05  3.7458E-05  6.2430E-05  4.9944E-05  4.9944E-05  1.8729E-04
  7.4916E-05  1.2486E-04  9.9888E-05  1.3735E-04  4.9944E-05  4.9944E-05  1.2486E-04  1.9978E-04  2.1226E-04  2.2475E-04
  7.8662E-04  5.7435E-04  6.4927E-04  8.3656E-04  1.3360E-03  1.2611E-03  1.6232E-03  1.6981E-03  1.7855E-03  2.0352E-03
  1.8979E-03  1.7355E-03  2.2350E-03  2.7469E-03  2.8718E-03  3.7208E-03  4.5449E-03  3.7333E-03  4.5449E-03  5.0194E-03
  6.4178E-03  6.5676E-03  8.1159E-03  8.7776E-03  8.9275E-03  1.0064E-02  1.2411E-02  1.3435E-02  1.7438E-02  1.9891E-02
  2.1351E-02  2.4023E-02  2.6046E-02  2.5796E-02  3.0253E-02  3.2289E-02  3.5972E-02  4.0167E-02  4.1741E-02  4.5824E-02
  4.6648E-02  4.7447E-02  4.6573E-02  4.8346E-02  4.3389E-02  4.1965E-02  4.1154E-02  3.9331E-02  3.7395E-02  3.0428E-02
  2.4972E-02  1.9765E-02  1.4034E-02  1.1999E-02  7.3667E-03  5.6312E-03  5.1692E-03  2.8468E-03  1.6856E-03  1.2361E-03
  7.2419E-04  1.6232E-04  0.          0.          0.          0.          0.          0.          0.          0.

                                                                                ENODB = 6   Pr(v)   NO FADE
                                                                                            T/28/74N
```

```
NRUNS,NSPB,ENODB,DELF,BIF,ENOMIN
 2000    40  9.4000E+00  6.2000E+01  1.0000E+03  9.0000E+00
BL2,PHIDEG,FDIFF,BL2B,PHIB,FDIFFB
 1.7600E+02  1.8000E+01  3.4243E+02  1.0000E+00  1.0000E+01  5.0000E+00
FBAMP,FBPHA,SDAMP,SDPHA,GAM43,N43,NSLICE
 2.0000E+00  2.0000E-01  0.          0.          9.0000E-02    64    26
FLO,FRQDOP,FQDPRT,ASCFT,I1,I2,I11,I22
 1.8000E+01  0.          0.          2.6496E-01     1     1     1     1
SVRMZ,SWMX,SWMN,        TL
 0.          2.8150E+04  6.8500E+03          -8.0000E+00
CCLOSC,IOLBIT,OYNR
 0.           100  3.0000E+00
WN,K,TAU1,TAU2
 1.659344E+02  4.666449E+02  4.499999E-01  8.442020E-03
WNB,KB,TAUB1,TAUB2
 9.4281E-01  6.1485E+02  2.0353E+02  1.4945E+00
IBIT,TSYNC
   27  1.1364E-02
PE,STDEV,MSSUM,MSSIG,KOUNT
 6.3158E-03  1.8174E-03  4.7202E-01  1.9372E-01  2000
LOCKIN      2DROPOUTS=0
ERRM
  1.0080E+00  1.0000E+00  0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          1.0000E+00  0.          0.          0.
  0.          0.          0.          0.          0.          0.          1.0000E+00  0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          1.0000E+00  0.          0.
  0.          0.          0.          0.          0.          0.          0.          1.0000E+00  0.          6.0000E+00

  1431  1957   408  1137
REC SLICE=   2.5968E+01  2.8701E+00
XXXC,ASUM1,ASUM2,VSUM1,VSUM2,VSUM3,
 7.5999E+04  1.9013E+06  5.3991E+07 -1.7817E+06  4.1964E+07 -9.9279E+08
V HISTOGRAM
  3.7459E-05  7.4918E-05  2.4973E-05  1.2486E-05  1.2486E-05  2.4973E-05  3.7459E-05  1.2486E-05  1.2486E-05  1.2486E-05
  1.2486E-05  2.4973E-05  1.2486E-05  2.4973E-05  1.2486E-05  1.2486E-05  1.2486E-05  2.4973E-05  1.2486E-05  1.2486E-05
  1.2486E-05  1.2486E-05  1.2486E-05  1.2486E-05  2.4973E-05  1.2486E-05  1.2486E-05  2.4973E-05  1.2486E-05  6.2431E-05
  1.2486E-05  3.7459E-05  2.4973E-05  1.2486E-05  1.2486E-05  2.4973E-05  1.2486E-05  2.4973E-05  3.7459E-05  4.9945E-05
  3.7459E-05  2.4973E-05  1.2486E-05  2.4973E-05  2.4973E-05  2.4973E-05  2.4973E-05  1.2486E-05  2.4973E-05  2.4973E-05
  1.2486E-05  1.2486E-05  1.2486E-05  0.          1.2486E-05  1.2486E-05  2.4973E-05  3.7459E-05  1.2486E-05  7.4918E-05
  7.4918E-05  7.4918E-05  1.2486E-04  1.6232E-04  9.9890E-05  3.6210E-04  2.7470E-04  3.8707E-04  5.8685E-04  6.9923E-04
  6.8674E-04  1.0486E-03  1.2486E-03  1.5982E-03  1.2861E-03  1.9104E-03  2.1227E-03  3.5336E-03  4.1579E-03  4.2828E-03
  6.7176E-03  9.1899E-03  1.0801E-02  1.4971E-02  1.8317E-02  2.1252E-02  2.4810E-02  3.2202E-02  3.8732E-02  4.6624E-02
  5.5377E-02  5.9722E-02  6.4217E-02  6.9848E-02  6.7838E-02  6.2069E-02  5.8536E-02  5.5214E-02  4.8284E-02  2.0923E-01
```

ENODB = 9.4 Pr(v) NO FADE
T/28/74N

```
NRUNS,NSPE,ENODB,DELF,BIF,ENOMIN
 2000    40 -2.0000E+01  6.2000E+01  1.0000E+03  9.0000E+00
BL2,PHIDEG,FOIFF,BL2B,PHIB,FOIFFB
 1.7600E+02  1.0000E+01  3.4243E+02  1.0000E+00  1.0000E+01  5.0000E+00
FBAMP,FBPHA,SDAMP,SDPHA,GAM43,N43,NSLICE
 2.0000E+00  2.0000E-01  2.3000E-01  4.7000E-01  9.0000E-02    64    26
FLO,FRQDOP,FOCPRT,ASCFT,I1,I2,I11,I22
 1.0000E+01  0.          0.          2.6496E-01     1     1     1     1
SVRHZ,SWMX,SWMN,       TL
 0.          2.5150E+04  6.8500E+03             -8.0000E+00
CCLOSC,IDLBIT,CYNR
 0.            100  3.0000E+00
WN,K,TAU1,TAU2
 1.659344E+02  4.686449E+02  4.499999E-01  8.442020E-03
WNB,KB,TAUB1,TAUB2
 9.4281E-01  6.1485E+02  2.0353E+02  1.4945E+00
IBIT,TSYNC
    11  1.1364E-02
ACQUISITION FAILURE
V HISTOGRAM
  9.8989E-02  1.0171E-01  1.0127E-01  9.4058E-02  9.0196E-02  8.2107E-02  7.8609E-02  6.6681E-02  5.9782E-02  4.8802E-02
  3.6997E-02  3.2673E-02  2.6964E-02  1.9142E-02  1.5863E-02  1.3263E-02  1.0688E-02  7.3362E-03  4.8827E-03  2.3563E-03
  1.9913E-03  1.9434E-03  1.6516E-03  6.8017E-04  5.3442E-04  1.9434E-04  1.2146E-04  7.2876E-05  9.7168E-05  3.4889E-04
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
```

ENODB = -20 Pr{v} FADING
T/28/74N

```
NRUNS,NSPB,ENODB,DELF,BIF,ENOMIN
 2000     40  6.0000E+00  6.2000E+01  1.0000E+03  9.0000E+00
BL2,PHIDEG,FDIFF,BL2B,PHIB,FDIFFB
 1.7600E+02  1.0000E+01  3.4243E+02  1.0000E+00  1.0000E+01  5.0000E+00
FBAMP,FBPHA,SCAMP,SDPHA,GAM43,N43,NSLICE
 2.0000E+00  2.0000E-01  2.3000E-01  4.7000E-01  9.0000E-02     64     26
FLO,FRQDOP,FQDPRT,ASOFT,I1,I2,I11,I22
 1.0000E+01  0.          0.          2.6496E-01     1      1      1      1
SVRHZ,SWMX,SWMN,       TL
 0.          2.8150E+04  6.8500E+03              -8.0000E+00
CCLOSC,IDLBIT,DYNR
  0.          100  3.0000E+00
WN,K,TAU1,TAU2
 1.659344E+02  4.666449E+02  4.499999E-01  8.442020E-03
WNB,KB,TAUB1,TAUB2
 9.4281E-01  6.1405E+02  2.0353E+02  1.4945E+00
IBIT,TSYNC
    16  1.1364E-02
PE,STDEV,MSSUM,MSSIG,KCUNT
 8.3158E-02  6.3346E-03  4.3254E-01  2.3406E-01  2000
LOCKIN     2DROPOUTS     1AVE  7.4000E+01SD  0.
ERRM
  5.7000E+01  1.0000E+01  6.0000E+00  9.0000E+00  1.0000E+01  4.0000E+00  2.0000E+00  5.0000E+00  2.0000E+00  2.0000E+00
  2.0000E+00  4.0000E+00  4.0000E+00  0.          2.0000E+00  1.0000E+00  3.0000E+00  2.0000E+00  1.0000E+00  3.0000E+00
  3.0000E+00  2.0000E+00  0.          3.0000E+00  1.0000E+00  0.          1.0000E+00  0.          1.0000E+00  3.0000E+00
  1.0000E+00  1.0000E+00  1.0000E+00  0.          0.          0.          1.0000E+00  0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          1.0000E+00  0.
  1.0000E+00  0.          0.          0.          2.0000E+00  0.          1.0000E+00  0.          0.          0.
  3.0000E+00  0.          0.          0.          1.0000E+00  1.0000E+00  0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          1.0000E+00  0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.

   639    803    934   1229
REC SLICE=    2.4566E+01  3.9388E+00
XXXC,ASUM1,ASUM2,VSUM1,VSUM2,VSUM3,
 7.6002E+04  1.9156E+06  5.8738E+07 -1.3133E+06  2.4084E+07 -4.5885E+08
V HISTOGRAM
  1.4996E-04  1.4996E-04  1.4996E-04  1.3746E-04  1.2497E-04  2.7492E-04  3.8739E-04  5.1236E-04  7.4979E-04  7.1230E-04
  6.8731E-04  1.0747E-03  8.6226E-04  1.1872E-03  9.3724E-04  7.6229E-04  6.7481E-04  6.4982E-04  8.6226E-04  1.5746E-03
  1.2122E-03  2.0369E-03  1.6121E-03  1.9745E-03  2.3119E-03  2.2244E-03  1.7120E-03  2.1119E-03  1.7870E-03  1.6745E-03
  2.3868E-03  3.0742E-03  3.1241E-03  2.9367E-03  2.3743E-03  2.7243E-03  2.8742E-03  3.1991E-03  3.4116E-03  4.0989E-03
  4.6987E-03  5.3485E-03  6.4607E-03  6.6607E-03  8.0228E-03  7.1855E-03  6.4857E-03  6.3732E-03  7.4604E-03  7.7979E-03
  8.2227E-03  9.1100E-03  9.8223E-03  9.6224E-03  1.0335E-02  1.0735E-02  1.4971E-02  1.4171E-02  1.5283E-02  1.8520E-02
  1.8482E-02  1.8182E-02  2.1094E-02  1.9232E-02  1.9770E-02  2.3469E-02  2.2844E-02  2.2344E-02  2.1981E-02  2.0682E-02
  2.3843E-02  2.3731E-02  2.3494E-02  2.2856E-02  2.1944E-02  2.4068E-02  2.5780E-02  2.8017E-02  2.6768E-02  2.6605E-02
  2.6243E-02  2.8255E-02  2.7955E-02  2.6430E-02  2.2219E-02  2.0569E-02  1.9382E-02  1.7520E-02  1.4746E-02  1.5571E-02
  1.5046E-02  1.3471E-02  1.0972E-02  8.8351E-03  8.3852E-03  6.9231E-03  4.2863E-03  1.7995E-03  1.5371E-03  5.8984E-03
```


ENODB = 6 Pr{v} FADING -
1728/74N

```
NRUNS,NSPB,ENODB,DELF,BIF,ENOMIN
 2000    40  9.4000E+00  6.2800E+01  1.0000E+03  9.0000E+00
BL2,PHIDEG,FDIFF,BL2B,PHIB,FDIFFB
 1.7600E+02  1.0000E+01  3.4243E+02  1.0000E+00  1.0000E+01  5.0000E+00
FBAMP,FBPHA,SDAMP,SDPHA,GAM43,N43,NSLICE
 2.0000E+00  2.0000E-01  2.3000E-01  4.7000E-01  9.0000E-02    64    26
FLO,FRQDOP,FODPRT,ASOFT,I1,I2,I11,I22
 1.0000E+01  0.          0.          2.6496E-01     1     1     1     1
SVRHZ,SWMX,SWMN,       TL
 0.          2.8150E+04  6.8500E+03              -8.0000E+00
CCLOSC,IDLBIT,OVNR
  0.           100  3.0000E+00
WN,K,TAU1,TAU2
 1.659344E+02  4.686449E+02  4.499999E-01  8.442020E-03
WNB,KB,TAUB1,TAUB2
 9.4281E-01  6.1485E+02  2.0393E+02  1.4945E+00
IBIT,TSYNC
     3  1.1364E-02
PE,STDEV,MSSUM,MSSIG,KCUNT
 2.4211E-02  3.5262E-03  4.6386E-01  2.0249E-01  2000
LOCKIN     1DROPOUTS     1AVE  1.2000E+01SD  0.
ERRM
  1.3000E+01  3.0000E+00  0.          1.0000E+00  0.          0.          2.0000E+00  1.0000E+00  0.          0.
  1.0000E+00  0.          0.          0.          2.0000E+00  0.          0.          0.          0.          0.
  0.          0.          1.0000E+00  1.0000E+00  0.          1.0000E+00  0.          0.          0.          0.
  0.          0.          1.0000E+00  1.0000E+00  0.          0.          0.          0.          0.          0.
  1.0000E+00  0.          0.          0.          0.          2.0000E+00  0.          0.          0.          0.
  0.          1.0000E+00  1.0000E+00  0.          0.          0.          0.          0.          1.0000E+00  0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  1.0000E+00  0.          0.          0.          0.          0.          0.          0.          0.          1.0000E+00
  0.          0.          0.          0.          0.          1.0000E+00  0.          0.          0.          0.
  0.          1.0000E+00  1.0000E+00  0.          0.          0.          0.          0.          0.          7.0000E+00

   371   874  1326   493
REC SLICE=   2.6286E+01  3.5789E+00
XXXC,ASUM1,ASUM2,VSUM1,VSUM2,VSUM3,
 7.6004E+04  1.9150E+06  5.5352E+07 -1.7414E+06  4.1054E+07 -9.8850E+08
V HISTOGRAM
  1.2486E-05  1.2486E-05  1.2486E-05  1.2486E-05  1.2486E-05  1.2486E-05  1.2486E-05  1.2486E-05  1.2486E-04  1.2486E-04
  2.2474E-04  2.7468E-04  2.6220E-04  1.9977E-04  3.4960E-04  3.4960E-04  2.6220E-04  1.9977E-04  1.9977E-04  1.8728E-04
  1.3734E-04  1.8728E-04  2.7468E-04  2.7468E-04  1.8728E-04  3.2463E-04  3.9954E-04  1.4983E-04  3.7457E-04  3.1214E-04
  3.4960E-04  4.2451E-04  3.6208E-04  5.6185E-04  3.4960E-04  5.6185E-04  4.8694E-04  5.4937E-04  6.1180E-04  8.3654E-04
  6.1180E-04  5.3688E-04  9.6139E-04  1.1237E-03  1.0113E-03  1.0863E-03  9.3642E-04  1.0863E-03  1.1737E-03  1.5732E-03
  1.2985E-03  1.1986E-03  1.8728E-03  1.9607E-03  1.8728E-03  2.2849E-03  2.1226E-03  1.8354E-03  1.7979E-03  2.0352E-03
  2.6470E-03  3.0840E-03  2.7344E-03  2.7344E-03  3.1089E-03  3.9455E-03  4.8569E-03  5.2440E-03  5.4188E-03  6.2803E-03
  6.7422E-03  7.7161E-03  1.0001E-02  1.1162E-02  1.1237E-02  1.1262E-02  1.1524E-02  1.3023E-02  1.4383E-02  1.5595E-02
  1.7018E-02  1.7255E-02  1.8217E-02  2.0352E-02  2.0801E-02  2.1263E-02  2.3710E-02  2.4697E-02  2.3286E-02  2.5845E-02
  2.7031E-02  3.0415E-02  3.0477E-02  2.7231E-02  2.7955E-02  2.9766E-02  3.0452E-02  3.2550E-02  2.7056E-02  3.3337E-01
```

ENODB = 9.4 Pr{v} FADING
T/28/74N

```
ENOD9=    9.4 ,DELF=  62.0 ,BIF=  1000 ,BL2=   176 ,NSLICE=    26 ,ASOFT= .3000
SVRHZ=  0.          ,SWMX=  2.8150E+04 ,SWMN=  6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=  0.          ,FQOPRT=  1.0800E+01
TL= -6.50 ,DYNR=    0.0 ,SDAMP=   .230 ,SDPHA=   .470 ,I1,I2,I11,I22   129   130     1     1
WN=  165.9 ,K=  468.6 ,TAU1=  4.5000E-01 ,TAU2=  8.4420E-03 ,WNB=     .9 ,KB=  614.9 ,TAUB1=  2.0353E+02 ,TAUB2=  1.4945E+00
PE=  3.6842E-02 ,STDEV=  4.3216E-03 ,V MEAN=  4.6193E-01V STD DEV=  2.0616E-01 ,BITS=  1900
PEI=  3.2632E-02 ,STDEV=  4.0760E-03 ,I MEAN=  1.6209E+01 I STD DEV=  6.3919E+00 ,BITS=  0.
LOCKIN=     1 ,DROPOUTS=     1 ,AVE=  2.8000E+01 ,STD DEV=  0.
ERRM
  3.1000E+01  4.0000E+00  3.0000E+00  2.0000E+00  2.0000E+00  1.0000E+00  0.          0.          0.          0.
  1.0000E+00  0.          0.          0.          2.0000E+00  0.          0.          1.0000E+00  0.          0.
  2.0000E+00  0.          1.0000E+00  0.          0.          0.          0.          0.          0.          0.
  0.          0.          2.0000E+00  0.          0.          0.          1.0000E+00  0.          0.          0.
  1.0000E+00  0.          0.          0.          0.          1.0000E+00  0.          1.0000E+00  0.          0.
  0.          1.0000E+00  0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          1.0000E+00  0.
  1.0000E+00  0.          0.          0.          1.0000E+00  0.          0.          0.          1.0000E+00  1.0000E+00
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          8.0000E+00

-1,-1 P(B/A)TIMES   451                                   -1,+1 P(B/A)TIMES   483
   115   24   16    5    0    1    1    0                 4    8    2    0    0    0    0    0
    62   27   23    5    1    0    0    0                 1    0    0    1    0    0    0    0
    41   31   21   13    2    4    1    0                 2    0    1    1    0    1    0    0
     9   10   18    4    1    0    0    0                 6    1    0    0    0    0    0    0
     2    3    2    1    0    0    0    1                 8    1    4    1    0    1    0    0
     2    2    1    0    2    0    0    0                22    8    5    4    0    1    0    1
     0    0    0    0    0    0    0    0                70   33   17    6    1    0    0    1
     0    0    0    0    0    0    0    0               163   65   41   19    5    5    1    0
+1,-1 P(B/A)TIMES   483                                   +1,+1 P(B/A)TIMES   483
     2    3    3    2   19   57  111  129                 2    1    1    1    2    1    0    0
     1    0    0    3    5   10   27   40                 1    1    0    1    0    2    1    0
     2    1    0    0    1    5   12   17                 0    0    0    0    0    1    0    1
     1    0    0    0    1    4    4    8                 0    0    0    0    0    1    1    1
     0    0    0    0    2    0    1    0                 0    0    1    0    2    4   11    8
     0    0    0    1    0    1    1    3                 2    0    1    0    4   14   28   44
     1    0    0    0    0    1    0    1                 1    0    0    0    2   21   51   89
     0    0    0    1    0    0    1    1                 1    2    1    1    3   12   43  118
I1,I2,I11,I22   638  1850   529   737                                                    DYNR = 0   FADE
REC SLICE=  2.6322E+01 ,STD DEV=  3.6734E+00                                           2/7/74N
```

```
ENDDB=    9.4 ,DELF=  62.0 ,BIF=  1000 ,BL2=   176 ,NSLICE=    25 ,ASOFT= .3000
SVRHZ=  0.          ,SWMX=  2.8150E+04 ,SWMN=  6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=  0.          ,FQDPRT=  1.0000E+01
TL= -6.50 ,DYNR=   3.0 ,SDAMP=  .230 ,SDPHA=  .470 ,I1,I2,I11,I22   129   130     1     1
WN= 165.9 ,K= 468.6 ,TAU1=  4.5000E-01 ,TAU2=  8.4420E-03 ,WNB=    .9 ,KB= 614.9 ,TAUB1=  2.0353E+02 ,TAUB2=  1.4945E+00
PE=  2.4737E-02 ,STDEV=  3.5633E-03 ,V MEAN=  4.5633E-01V STD DEV=  2.0598E-01 ,BITS=  1900
PEI=  2.4737E-02 ,STDEV=  3.5633E-03 ,I MEAN=  1.6284E+01 I STD DEV=  6.2517E+00 ,BITS=  0.
LOCKIN=     1 ,DROPOUTS=     1 ,AVE=  4.0000E+00 ,STD DEV=  0.
ERRM
  8.0000E+00  3.0000E+00  1.0000E+00  1.0000E+00  1.0000E+00  0.          3.0000E+00  1.0000E+00  1.0000E+00  0.
  0.          1.0000E+00  0.          1.0000E+00  1.0000E+00  1.0000E+00  1.0000E+00  0.          0.          0.
  0.          1.0000E+00  0.          0.          0.          1.0000E+00  0.          0.          0.          0.
  1.0000E+00  0.          1.0000E+00  0.          1.0000E+00  1.0000E+00  0.          1.0000E+00  0.          1.0000E+00
  0.          0.          1.0000E+00  0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          1.0000E+00  0.          0.          1.0000E+00  0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          1.0000E+00  0.
  0.          0.          0.          0.          0.          1.0000E+00  0.          0.          0.          0.
  0.          0.          0.          3.0000E+00  0.          0.          0.          0.          1.0000E+00  0.
  0.          0.          0.          1.0000E+00  0.          1.0000E+00  0.          0.          0.          4.0000E+00

-1,-1 P(B/A)TIMES   453                                   -1,+1 P(B/A)TIMES   482
  107    35    23     6     1     1     0     0           2     1     0     0     0     0     0     0
   76    25    20     5     2     0     0     0           2     0     0     0     0     0     0     0
   34    28    20    12     2     0     0     0           0     0     0     1     0     0     0     0
   12    13     9     6     4     0     0     0           4     1     0     1     0     0     0     0
    4     2     2     2     0     0     0     0          14     3     2     1     0     0     1     0
    0     0     0     1     0     0     0     0          30    10     8     6     0     0     1     0
    0     0     0     1     0     0     0     0          90    27     6     4     1     0     0     0
    0     0     0     0     0     0     0     0         131    64    44    20     3     2     0     2
+1,-1 P(B/A)TIMES   483                                   +1,+1 P(B/A)TIMES   482
    0     1     0     1    24    69   108   130           1     0     0     1     0     2     0     1
    0     0     0     3     1    13    23    41           0     0     0     1     1     0     1     0
    2     0     1     0     0     7    11    18           0     1     0     0     0     1     0     0
    3     1     0     1     3     4     7     3           0     0     0     0     1     2     1     1
    0     0     0     0     1     2     0     0           0     0     0     0     0     7    11    10
    0     0     0     0     0     1     0     1           1     0     0     2     5    13    34    51
    0     0     0     0     0     0     1     0           0     1     2     0     6    19    45    86
    0     0     0     0     0     1     1     0           1     1     0     2     7    20    45    98
I1,I2,I11,I22   638  1050   529   737
REC SLICE=  2.6261E+01 ,STD DEV=  3.5269E+00                                                    DYNR = 3   FADE
                                                                                                2/7/74N
```

```
ENODB=   9.4 ,DELF=  62.0 ,BIF=  1000 ,BL2=   176 ,NSLICE=    26 ,ASOFT= .3000
SVRHZ=  0.          ,SWMX=  2.8150E+04 ,SWMN=  6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=  0.          ,FQDPRT=  1.0800E+01
TL= -6.50 ,DYNR=   6.0 ,SDAMP=   .230 ,SDPHA=   .470 ,I1,I2,I11,I22   129   130     1     1
WN= 165.9 ,K= 468.6 ,TAU1=  4.5000E-01 ,TAU2=  8.4420E-03 ,WN8=     .9 ,K8= 514.9 ,TAUB1=  2.0353E+02 ,TAUB2=  1.4945E+00
PE=  2.8421E-02 ,STDEV=  3.8123E-03 ,V MEAN=  4.6307E-01V STD DEV=  2.0835E-01 ,BITS=  1900
PEI=  2.4737E-02 ,STDEV=  3.5633E-03 ,I MEAN=  1.6438E+01 I STD DEV=  6.2763E+00 ,BITS=  0.
LOCKIN=      0 ,DROPOUTS=      1 ,AVE=  8.0000E+00 ,STD DEV=  0.
ERRM
  1.4000E+01  3.0000E+00  3.0000E+00  0.          1.0000E+00  1.0000E+00  1.0000E+00  0.          1.0000E+00  0.
  3.0000E+00  1.0000E+00  0.          0.          1.0000E+00  0.          2.0000E+00  1.0000E+00  0.          0.
  0.          1.0000E+00  0.          1.0000E+00  1.0000E+00  0.          0.          0.          0.          0.
  0.          0.          0.          0.          1.0000E+00  1.0000E+00  1.0000E+00  0.          0.          0.
  0.          0.          0.          0.          1.0000E+00  0.          1.0000E+00  0.          0.          2.0000E+00
  0.          0.          0.          0.          0.          0.          0.          1.0000E+00  1.0000E+00  0.
  0.          0.          0.          0.          1.0000E+00  0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          1.0000E+00  0.          0.
  0.          0.          0.          1.0000E+00  0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          7.0000E+00

-1,-1 P(B/A)TIMES   451                                     -1,+1 P(B/A)TIMES   482
    93    32    14     5     2     0     2     1           3     1     0     0     0     0     0     0
    74    37    30     4     1     0     1     0           0     0     0     0     0     0     0     1
    35    34    22    10     2     0     0     3           0     1     1     0     0     0     0     0
    11     8    11     6     1     0     0     0           4     3     0     1     0     0     0     0
     2     3     1     1     0     0     0     0          14     3     2     0     0     0     0     0
     1     0     0     0     0     0     0     0          31    16     5     1     1     1     0     1
     0     0     0     2     0     0     0     0          71    36    11     3     0     0     0     1
     0     0     0     1     1     0     0     0         137    72    39    15     3     2     0     2
+1,-1 P(B/A)TIMES   483                                     +1,+1 P(B/A)TIMES   484
     1     0     0     4    18    59   111   136           0     0     0     0     2     0     0     0
     0     1     0     1     3    16    24    54           0     0     1     0     1     1     0     0
     2     0     2     0     2     5    10     9           0     0     0     0     2     0     0     0
     0     0     0     1     1     4     2     4           0     0     0     2     1     0     1     2
     0     0     0     0     1     0     2     1           0     0     0     1     0     4    12     7
     0     0     1     0     0     9     8     1           1     1     0     1     1    10    25    41
     0     1     0     0     0     0     0     0           0     0     0     0     4    17    68   101
     1     0     0     1     1     1     1     2           1     1     0     3     6    20    56    90
I1,I2,I11,I22  1412   890  1522  1225
REC SLICE=  2.6006E+01 ,STD DEV=  3.7812E+00                                                    DYNR = 6   FADE
                                                                                                2/7/74N
```

```
ENODB=    9.4 ,DELF=   62.0 ,BIF=   1000 ,BL2=    176 ,NSLICE=     25 ,ASOFT= .3000
SVRHZ=   0.          ,SWMX=  2.8150E+04 ,SWMN=  6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=   0.          ,FQDPRT=  1.0000E+01
TL= -6.50 ,DYNR=    0.0 ,SDAMP= 0.000 ,SDPHA= 0.000 ,I1,I2,I11,I22    129    130      1      1
WN= 165.9 ,K= 468.6 ,TAU1=  4.5000E-01 ,TAU2=  8.4420E-03 ,WNB=     .9 ,KB= 614.9 ,TAUB1=  2.0353E+02 ,TAUB2=  1.4945E+00
PE=  1.0526E-02 ,STDEV=  2.3413E-03 ,V MEAN=  4.7068E-01V STD DEV=  1.9479E-01 ,BITS=  1900
PEI=  6.3158E-03 ,STDEV=  1.8174E-03 ,I MEAN=  1.6735E+01 I STD DEV=  5.8807E+00 ,BITS=  0.
LOCKIN=      1 ,DROPOUTS=0
ERRM
  1.0000E+00  0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          1.0000E+00  0.          0.          0.          0.          0.
  0.          0.          0.          1.0000E+00  1.0000E+00  0.          0.          0.          0.          1.0000E+00
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          1.0000E+00  0.          0.          0.          1.0000E+00  0.          0.          1.0000E+00
  0.          1.0000E+00  2.0000E+00  0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          1.0000E+00  0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          8.0000E+00

-1,-1 P(B/A)TIMES   451                                   -1,+1 P(B/A)TIMES   482
   102     26      9      4      0      1      1      0          0      0      0      0      0      0      0      0
    95     38     15      6      3      0      0      0          1      0      0      0      1      0      0      0
    42     30     26      8      1      0      0      0          0      0      0      0      0      0      0      0
    12     12      9      3      1      0      0      0          1      0      0      1      0      0      0      0
     2      0      2      2      0      0      0      0          9      3      2      0      0      0      0      0
     1      0      0      0      0      0      0      0         35      7      4      2      0      0      0      0
     0      0      0      0      0      0      0      0         69     29      9      3      1      0      0      0
     0      0      0      0      0      0      0      0        149     86     53     15      1      1      0      0
+1,-1 P(B/A)TIMES   482                                   +1,+1 P(B/A)TIMES   485
     1      1      0      3     16     68    125    162          0      0      0      0      0      2      0      0
     0      0      0      0      2     11     20     41          0      0      0      0      0      0      0      0
     0      0      0      0      2      4      4     12          0      0      0      0      0      1      0      0
     0      0      0      0      0      0      3      3          0      0      0      0      0      0      0      2
     0      0      0      0      0      1      0      1          0      0      0      0      1      3      7     10
     0      0      0      0      1      0      0      0          0      0      0      0      5      6     31     60
     0      0      0      0      1      0      0      0          0      0      0      0      3     29     52     88
     0      0      0      0      0      0      0      0          1      1      1      1      4     25     41    111
I1,I2,I11,I22  1594  1314     1      1
REC SLICE=  2.5830E+01 ,STD DEV=  3.5020E+00                                                    DYNR = 0   NO FADE
                                                                                                2/7/74N
```

```
ENODB=    9.4 ,DELF=  62.0 ,BIF=  1000 ,BL2=   176 ,NSLICE=    25 ,ASOFT= .3000
SVRHZ=   0.          ,SWMX= 2.8150E+04 ,SWMN= 6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=  0.          ,FQDPRT=  1.0800E+01
TL= -6.50 ,DYNR=    3.0 ,SDAMP= 0.000 ,SDPHA= 0.000 ,I1,I2,I11,I22   129   130     1     1
MN= 165.9 ,K= 468.6 ,TAU1=  4.5000E-01 ,TAU2=  8.4420E-03 ,MNB=     .9 ,KB= 614.9 ,TAUB1=  2.0353E+02 ,TAUB2=  1.4945E+00
PE=  8.9474E-03 ,STDEV=  2.1603E-03 ,V MEAN=  4.7353E-01V STD DEV=  1.8772E-01 ,BITS=  1900
PEI=  5.2632E-03 ,STDEV=  1.6600E-03 ,I MEAN=  1.6677E+01 I STD DEV=  5.7401E+00 ,BITS=  0.
LOCKIN=      1 ,DROPOUTS=0
ERRM
  2.0000E+00  0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          1.0000E+00  0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          1.0000E+00  0.          1.0000E+00  0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          2.0000E+00
  1.0000E+00  0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          1.0000E+00  0.
  0.          0.          0.          0.          0.          0.          0.          1.0000E+00  0.          7.0000E+00

-1,-1 P(B/A)TIMES   455                                   -1,+1 P(B/A)TIMES   482
  117   32   11    3    1    0    0    0          0    0    0    0    0    0    0    0
   73   39   27    4    3    0    0    0          0    0    0    0    0    0    0    0
   46   29   21    7    1    0    0    0          1    0    0    0    0    0    0    0
   16    9    4    3    2    0    0    0          2    0    0    0    0    0    0    0
    3    2    1    1    0    0    0    0          5    1    0    0    0    0    0    0
    0    0    0    0    0    0    0    0         46    8    3    0    0    0    0    0
    0    0    0    0    0    0    0    0         81   25   11    3    0    0    0    0
    0    0    0    0    0    0    0    0        148   71   57   16    2    0    0    0
+1,-1 P(B/A)TIMES   482                                   +1,+1 P(B/A)TIMES   481
    0    1    0    3   20   69  131  149          0    0    0    0    0    0    0    0
    0    0    1    0    2   10   23   35          0    0    0    0    1    0    0    0
    0    0    0    0    1    2    8   22          0    0    0    0    0    1    0    0
    0    0    0    0    0    0    2    1          0    0    0    1    0    1    0    1
    0    0    0    0    0    1    0    1          0    0    0    0    0    4    3   17
    0    0    0    0    0    0    0    0          0    0    0    0    0   11   30   36
    0    0    0    0    0    0    0    0          0    0    0    0    5   20   57  101
    0    0    0    0    0    0    0    0          0    0    1    1    1   17   49  123
I1,I2,I11,I22  1594  1314     1     1                                        DYNR = 3   NO FADE
REC SLICE=  2.5978E+01 ,STD DEV=  3.3165E+00                                2/7/74N
```

```
ENJDB=   9.4 ,DELF=  62.0 ,BIF=  1000 ,BL2=   176 ,NSLICE=    26 ,ASOFT= .3800
SVRHZ=  0.          ,SWMX= 2.8150E+04 ,SWMN=  6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=  0.          ,FQDPRT=  1.0000E+01
TL= -6.50 ,DWNR=   6.0 ,SDAMP= 0.000 ,SDPHA= 0.000 ,I1,I2,I11,I22   129   130     1     1
WN= 165.9 ,K= 468.6 ,TAU1=  4.5000E-01 ,TAU2=  8.4420E-03 ,WNB=    .9 ,KB= 514.9 ,TAUB1=  2.0353E+02 ,TAUB2=  1.4945E+00
PE=  7.3684E-03 ,STDEV=  1.9620E-03 ,V MEAN=  4.7061E-01V STD DEV=  1.9234E-01 ,BITS=  1980
PEI=  3.6842E-03 ,STDEV=  1.3899E-03 ,I MEAN=  1.6722E+01 I STD DEV=  5.7873E+00 ,BITS=  0.
LOCKIN=     1 ,DROPOUTS=0
ERRM
  3.0000E+00  0.          0.          0.          0.          0.          1.0000E+00  0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          1.0000E+00  0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          1.0000E+00  0.          0.          0.          0.          0.          0.          0.          0.
  0.          1.0000E+00  0.          0.          0.          0.          0.          1.0000E+00  0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          1.0000E+00  0.          0.          0.          0.          5.0000E+00

-1,-1 P(B/A)TIMES   452                                     -1,+1 P(B/A)TIMES   483
   106    27    17     1     0     0     0     0            0     0     0     0     0     0     0     0
    77    48    23    11     2     0     0     0            0     0     0     0     0     0     0     0
    45    35    14     5     2     0     0     0            0     0     0     0     0     0     0     0
    12    16    10     2     0     0     0     0            0     0     0     1     0     0     0     0
     0     5     2     0     0     0     0     0            5     2     1     0     0     0     0     0
     0     0     0     0     0     0     0     0           30    11     3     0     1     0     0     0
     0     0     0     0     0     0     0     0           92    27    13     4     0     0     0     0
     0     0     0     0     0     0     0     0          151    71    51    18     2     0     0     0
+1,-1 P(B/A)TIMES   482                                     +1,+1 P(B/A)TIMES   483
     0     0     0     2    17    64   125   159            0     0     0     0     0     2     0     0
     1     0     0     0     3    15    21    48            0     0     0     0     0     0     0     0
     0     0     0     1     3     0     9    20            0     0     0     0     0     0     0     0
     0     0     0     0     0     0     1     1            0     0     0     0     0     0     1     3
     0     0     0     0     0     0     0     0            0     0     0     0     2     5     6    10
     0     0     0     0     0     0     0     0            0     0     0     0     1    15    33    49
     0     0     0     0     0     0     0     0            0     0     0     1     3    21    52    92
     0     0     0     0     0     0     0     0            1     0     0     1     2    21    56   106
I1,I2,I11,I22   638  1858     1     1                                                    DYNR = 6   NO FADE -
REC SLICE=  2.5550E+01 ,STD DEV=  3.8740E+00                                           2/7/74N
```

APPENDIX IX

PARAMETER VARIATION PRINTOUTS

```
ENODB=   9.4 ,DELF=  26.4 ,BIF=  1000 ,BL2=   176 ,NSLICE=    26 ,ASOFT= .3000
SVRHZ=  0.          ,SWMX=  2.8150E+04 ,SWMN=  6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=  0.          ,FQDPRT=  1.0800E+01
TL= -6.50 ,DYNR=   3.0 ,SDAMP=  .230 ,SDPHA=  .470 ,I1,I2,I11,I22   129   130     1     1
WN= 165.9 ,K= 468.6 ,TAU1=  4.5000E-01 ,TAU2=  8.4428E-03 ,WNB=   .9 ,KB=1444.0 ,TAUB1=  2.0353E+02 ,TAUB2=  1.4945E+00
PE=  6.9474E-02 ,STDEV=  5.8331E-03 ,V MEAN=  2.1639E-01V STD DEV=  1.2837E-01 ,BITS=  1980
LOCKIN=     1 ,DROPOUTS=     1 ,AVE=  1.0000E+00 ,STD DEV=  0.
ERRM
  2.7000E+01  6.0000E+00  3.0000E+00  9.0000E+00  6.0000E+00  5.0000E+00  5.0000E+00  3.0000E+00  6.0000E+00  8.0000E+00
  7.0000E+00  5.0000E+00  1.0000E+00  1.0000E+00  2.0000E+00  6.0000E+00  1.0000E+00  0.          2.0000E+00  0.
  3.0000E+00  1.0000E+00  2.0000E+00  3.0000E+00  1.0000E+00  1.0000E+00  0.          0.          2.0000E+00  0.
  2.0000E+00  2.0000E+00  1.0000E+00  1.0000E+00  0.          0.          0.          1.0000E+00  1.0000E+00  0.
  1.0000E+00  0.          1.0000E+00  0.          0.          1.0000E+00  0.          1.0000E+00  0.          0.
  0.          0.          0.          0.          0.          1.0000E+00  0.          0.          0.          0.
  0.          1.0000E+00  1.0000E+00  0.          0.          0.          0.          0.          1.0000E+00  0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          1.0000E+00

-1,-1 P(B/A)TIMES   451                                  -1,+1 P(B/A)TIMES   483
      1     3     3     3     1     1     0     0          0     0     0     0     0     0     0     0
      5    10    25    10     2     0     0     0          0     0     0     1     0     0     0     0
      9    28    72    53    13     2     0     0          1     0     0     0     0     0     0     0
      6    38    62    48    10     0     0     0          1     4     8    10     5     0     1     0
      2     6    17    10     2     1     0     0          4    22    31    32     5     0     0     0
      0     2     2     2     0     0     0     0          6    48    79    57    11     3     0     0
      0     0     0     0     0     0     0     1          9    23    54    33     4     3     0     0
      0     0     0     1     0     0     0     0          6     4    11     6     1     0     0     0
+1,-1 P(B/A)TIMES   483                                  +1,+1 P(B/A)TIMES   483
      0     0     0     0    18    13     2     6          0     0     0     0     0     0     0     0
      0     0     0     5    45    53    27     6          0     0     0     1     0     0     0     0
      0     1     1    10    62    89    37     7          0     0     0     0     1     3     0     0
      0     1     3     9    23    41    21     4          0     0     0     0     9    14     6     1
      0     0     0     4     2     8     0     1          0     0     1     9    45    78    37     6
      0     0     0     1     0     2     0     1          0     0     0    16    43    91    43     7
      0     0     0     0     0     0     0     0          0     0     0     3    17    30     6     2
      0     0     0     0     0     0     0     0          0     0     0     1     5     2     5     1
I1,I2,I11,I22  2032   434  1326   493
REG SLICE=  2.6042E+01 ,STD DEV=  4.6885E+00

DELF = 26.4
2/4/74M                                                  FADING
```

```
ENODB=   9.4 ,DELF=  44.0 ,BIF=  1000 ,BLZ=   176 ,NSLICE=    26 ,ASOFT= .3000
SVRHZ=  0.          ,SWMX=  2.8150E+04 ,SWMN=  6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=  0.          ,FQOPRT=  1.0800E+01
TL= -6.50 ,DYNR=   3.0 ,SDAMP=  .230 ,SDPHA=  .470 ,I1,I2,I11,I22   129   130     1     1
WN= 165.9 ,K= 468.6 ,TAU1=  4.5000E-01 ,TAU2=  8.4420E-03 ,WNB=  .9 ,KB= 866.4 ,TAUB1=  2.0353E+02 ,TAUB2=  1.4945E+00
PE=  2.842:E-02 ,STDEV=  3.8123E-03 ,V MEAN=  3.3653E-01V STD DEV=  1.6479E-01 ,BITS=  1900
LOCKIN=     1 ,DROPOUTS=0
ERRM
 7.0000E+00  4.0000E+00  2.0000E+00  2.0000E+00  2.0000E+00  2.0000E+00  0.          1.0000E+00  0.          0.
 1.0000E+00  0.          0.          1.0000E+00  0.          0.          1.0000E+00  0.          1.0000E+00  1.0000E+00
 0.          1.0000E+00  2.0000E+00  0.          0.          1.0000E+00  0.          1.0000E+00  1.0000E+00  1.0000E+00
 1.0000E+00  0.          1.0000E+00  1.0000E+00  0.          1.0000E+00  0.          1.0000E+00  0.          0.
 0.          1.0000E+00  1.0000E+00  0.          0.          0.          1.0000E+00  0.          0.          0.
 0.          0.          0.          0.          0.          0.          1.0000E+00  0.          0.          0.
 1.0000E+00  2.0000E+00  0.          1.0000E+00  1.0000E+00  0.          0.          1.0000E+00  0.          0.
 0.          0.          2.0000E+00  0.          0.          0.          0.          0.          0.          0.
 0.          0.          0.          0.          0.          0.          0.          0.          1.0000E+00  0.
 0.          0.          0.          0.          0.          0.          0.          0.          1.0000E+00  3.0000E+00

-1,-1 P(B/A)TIMES   453                                   -1,+1 P(B/A)TIMES   482
  16  20  15   7   1   1   0   0        1   0   0   0   0   0   0   0
  37  48  31  10   3   1   0   0        0   0   0   0   0   0   0   0
  46  55  48  11   3   1   1   0        0   0   2   0   0   0   0   0
   9  24  24  10   4   0   0   0        1   3   1   0   1   0   0   0
   2   8   8   3   1   0   0   0        6  18   9   5   0   0   0   0
   0   0   1   1   1   0   0   1       36  39  35  14   3   0   0   0
   1   0   0   0   0   0   0   0       59  62  39  14   3   1   0   0
   0   0   0   0   0   0   0   0       28  35  42  19   6   0   0   0
+1,-1 P(B/A)TIMES   483                                   +1,+1 P(B/A)TIMES   482
   0   0   0   4  23  78  43  34        1   0   0   0   0   0   0   0
   0   0   0   6  25  53  65  34        0   0   0   0   0   0   0   0
   1   0   0   0  13  33  28  16        0   0   0   0   0   0   0   0
   0   0   1   0   3   5   8   6        0   0   0   0   1   2   7   2
   0   0   0   0   2   1   0   1        0   1   0   4   9  29  22  22
   0   0   0   0   0   0   0   0        0   0   0   1  24  47  63  32
   0   0   0   0   0   0   0   0        0   0   0   2  13  28  50  40
   0   0   0   0   1   0   0   0        0   0   1   1  10  19  25  27
I1,I2,I11,I22  1594  1314   529   737
REG SLICE=  2.6237E+01 ,STD DEV=  3.7963E+00

                                                                                DELF = 44    FADING
                                                                                2/4/74M
```

```
ENODB=   9.4 ,DELF=  88.0 ,BIF=  1000 ,BL2=   176 ,NSLICE=    26 ,ASOFT= .3000
SVRHZ=  0.          ,SWMX=  2.8150E+04 ,SWMN=  6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=  0.          ,FQDPRT=  1.0800E+01
TL= -6.50 ,DYNR=   3.0 ,SDAMP=   .230 ,SDPHA=   .470 ,I1,I2,I11,I22   129   130     1     1
WN= 165.9 ,K= 468.6 ,TAU1=  4.5000E-01 ,TAU2=  8.4420E-03 ,WN8=    .9 ,R8= 433.2 ,TAU81=  2.0353E+02 ,TAU82=  1.4945E+00
PE=  8.4737E-02 ,STDEV=  6.3890E-03 ,V MEAN=  5.8023E-01V STD DEV=  3.0239E-01 ,BITS=  1900
LOCKIN=     1 ,DROPOUTS=     1 ,AVE=  3.0000E+01 ,STD DEV=  0.
ERRM
  4.6000E+01  1.1000E+01  6.0000E+00  1.1000E+01  1.0000E+01  6.0000E+00  3.0000E+00  6.0000E+00  4.0000E+00  5.0000E+00
  2.0000E+00  3.0000E+00  1.0000E+00  2.0000E+00  2.0000E+00  5.0000E+00  2.0000E+00  0.          4.0000E+00  3.0000E+00
  1.0000E+00  1.0000E+00  2.0000E+00  3.0000E+00  0.          0.          0.          2.0000E+00  0.          3.0000E+00
  1.0000E+00  2.0000E+00  1.0000E+00  0.          1.0000E+00  2.0000E+00  0.          0.          1.0000E+00  2.0000E+00
  1.0000E+00  1.0000E+00  0.          1.0000E+00  1.0000E+00  0.          0.          0.          1.0000E+00  0.
  0.          0.          0.          0.          0.          1.0000E+00  0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          1.0000E+00  0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.

-1,-1 P(B/A)TIMES   451                          -1,+1 P(B/A)TIMES   483
  161    22    19    10     4     3     0     6        22     0     3     2     0     0     0     0
   45    17    15     7     2     3     0     0         3     4     3     1     1     0     0     0
   25    12    23    11     3     1     0     1         9     2     1     0     1     0     0     0
   14    12     7     5     4     1     0     1         5     5     2     0     0     0     1     0
    2     3     3     3     0     0     0     0        16     2     3     1     0     0     0     0
    0     1     0     1     0     0     0     0        26     6     2     6     1     0     0     1
    0     0     1     0     0     0     0     0        41     8     9     3     2     1     0     1
    0     1     0     1     0     0     0     1       193    34    25    15     7     1     1     5
+1,-1 P(B/A)TIMES   483                          +1,+1 P(B/A)TIMES   483
   10     4     7     6    11    34    55   210         6     0     1     1     1     2     1     4
    3     0     4     1     4     5     7    24         0     0     0     0     0     1     1     1
    7     4     1     0     3     4     4    17         5     2     1     0     0     0     0     0
    2     0     1     2     1     1     3    12         3     1     1     0     0     0     1     2
    0     0     1     1     1     0     1    10         3     1     0     1     2     1     2     9
    1     0     0     0     0     0     2     5         0     0     0     0     3     3     5    21
    0     0     0     0     0     0     0     1         0     0     1     3     3     5    12    41
    1     0     0     0     1     1     2     8        10     3     3     6    11    16    34   249
I1,I2,I11,I22   638  1850   529   737
REC SLICE=  2.7043E+01 ,STD DEV=  4.0306E+00

DELF = 88     FADING
2/4/74M
```

```
ENODB=   9.4 ,DELF= 132.0 ,BIF=  1000 ,BL2=   176 ,NSLICE=    26 ,ASOFT= .3000
SVRHZ=  0.          ,SWMX=  2.8150E+04 ,SWMN=  6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=  0.          ,FQDPRT=  1.0000E+01
TL= -6.50 ,DYNR=   3.0 ,SDAMP=  .230 ,SDPHA=  .470 ,I1,I2,I11,I22   129   130     1     1
WN= 165.9 ,K= 468.6 ,TAU1=  4.5000E-01 ,TAU2=  8.4420E-03 ,WN8=     .9 ,KB= 288.8 ,TAUB1=  2.0353E+02 ,TAUB2=  1.4945E+00
PE=  3.0789E-01 ,STDEV=  1.0590E-02 ,V MEAN=  6.4424E-01V STD DEV=  4.1994E-01 ,BITS=  1900
LOCKIN=     1 ,DROPOUTS=     1 ,AVE=  2.5900E+02 ,STD DEV=  0.
ERRM
 2.9100E+02  8.7000E+01  5.2000E+01  5.0000E+01  5.2000E+01  1.0000E+01  9.0000E+00  9.0000E+00  6.0000E+00  5.0000E+00
 2.0000E+00  2.0000E+00  1.0000E+00  0.          0.          1.0000E+00  0.          0.          0.          0.
 0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
 0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
 0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
 0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
 0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
 0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
 0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
 0.          0.          0.          0.          0.          0.          0.          0.          0.          0.

-1,-1 P(B/A)TIMES   451                                    -1,+1 P(B/A)TIMES   484
 147   28   13   10   13    5    6   18          81   12   13    6    4    1    1    8
  41   12   10    2    1    1    1    2           9    4    7    3    0    3    2    4
  19   13    6    9    4    0    1    5          15    5    3    3    5    0    1    2
   8    3    9    2    2    0    1    4           9    3    5    3    1    2    0    3
   5    2    2    1    1    2    4    2           5    2    4    3    3    1    0    5
   3    0    0    1    1    0    0    4          13    4    4    0    2    4    1    3
   4    0    1    2    0    1    0    2           9    5    2    3    5    2    1   12
   5    0    0    0    0    3    2    7          65   10   11    4    6   14   12   51
+1,-1 P(B/A)TIMES   481                                    +1,+1 P(B/A)TIMES   484
 48   11   20   10   10    6   15   75          20    3    5    0    3    3    1    4
  8    4    3    0    2    1    2   13           5    2    1    2    2    4    1    1
  3    1    3    2    1    7    3   13          15    2    6    3    2    1    2    4
  6    2    2    1    1    3    1    7           7    1    2    2    2    2    5    2
  8    1    2    1    3    0    3   11           7    1    2    3    2    1    0   10
  5    2    1    2    0    1    5   14           3    2    3    5    1    2    3    9
  1    0    3    2    2    0    0   15           3    3    0    1    2    4    6   20
  8    5    1    5    3    6   11   76          16   10   15   18   13   18   20  174
I1,I2,I11,I22  1054   242   529   737
REC SLICE=  2.7268E+01 ,STD DEV=  9.8678E+00

DELF = 132    FADING
2/4/74M
```

```
 ENODB=   9.4 ,DELF=  26.4 ,BIF=  1000 ,BL2=   176 ,NSLICE=    25 ,ASOFT= .3000
 SWRHZ=  0.          ,SWMX=  2.8150E+04 ,SWMN=  6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=  0.          ,FQDPRT=  1.0800E+01
 TL= -6.50 ,DYNR=   3.0 ,SDAMP= 0.000 ,SDPHA= 0.000 ,I1,I2,I11,I22   129   130     1     1
 WN= 165.9 ,K= 468.6 ,TAU1=  4.5000E-01 ,TAU2=  8.4420E-03 ,WNB=    .9 ,KB=1444.8 ,TAUB1=  2.0353E+02 ,TAUB2=  1.4945E+00
 PE=  6.0526E-02 ,STDEV=  5.4706E-03 ,V MEAN=  2.1416E-01V STD DEV=  1.2434E-01 ,BITS=  1900
 REI=  7.8947E-03 ,STDEV=  2.0303E-03
 LOCKIN=     1 ,DROPOUTS=0
 ERRM
   1.7000E+01  4.0000E+00  2.0000E+00  8.0000E+00  8.0000E+00  4.0000E+00  3.0000E+00  4.0000E+00  3.0000E+00  4.0000E+00
   8.0000E+00  2.0000E+00  1.0000E+00  3.0000E+00  2.0000E+00  5.0000E+00  1.0000E+00  0.          1.0000E+00  3.0000E+00
   0.          1.0000E+00  2.0000E+00  2.0000E+00  0.          3.0000E+00  2.0000E+00  0.          2.0000E+00  0.
   1.0000E+00  2.0000E+00  0.          4.0000E+00  0.          1.0000E+00  0.          0.          0.          1.0000E+00
   2.0000E+00  0.          1.0000E+00  2.0000E+00  0.          2.0000E+00  0.          0.          0.          0.
   0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
   0.          2.0000E+00  0.          1.0000E+00  0.          0.          1.0000E+00  0.          0.          0.
   0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
   0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
   0.          0.          0.          0.          0.          0.          0.          0.          0.          0.

 -1,-1 P(B/A)TIMES   451                                    -1,+1 P(B/A)TIMES   483
      0     1     2     0     0     0     0     0           0     0     0     0     0     0     0     0
      7    13    21    21     1     0     0     0           0     0     0     0     0     0     0     0
      5    33    65    45    11     4     0     0           0     0     0     1     0     0     0     0
      5    41    66    48     9     1     0     0           1     1     5     8     4     0     0     0
      2     6    11    19     4     1     0     0           3    26    45    28     4     1     0     0
      0     3     4     2     0     0     0     0          10    33    81    57    13     1     0     0
      0     0     0     0     0     0     0     0           7    24    61    37     6     1     0     0
      0     0     0     0     0     0     0     0           1     3    11     5     4     0     0     0
 +1,-1 P(B/A)TIMES   483                                    +1,+1 P(B/A)TIMES   483
      0     0     0     1    14    16     6     1           0     0     0     0     0     0     0     0
      0     0     0     9    37    48    25     2           0     0     0     0     0     0     0     0
      0     0     0     8    56    98    44     4           0     0     0     0     0     1     0     0
      0     0     1     4    29    33    31     3           0     0     0     2     6    12     7     1
      0     0     0     2     6     4     1     0           0     0     0     5    42    71    35     9
      0     0     0     0     0     0     0     0           0     0     1    14    52    93    41     8
      0     0     0     0     0     0     0     0           0     0     0     3    25    25    10     3
      0     0     0     0     0     0     0     0           0     0     0     0     2     3     3     1
 I1,I2,I11,I22  1609   450     1     1
 REC SLICE=  2.6199E+01 ,STD DEV=  4.4629E+00

                                                                                  DELF = 26.4    NO FADING
                                                                                  2/5/74E
```

```
ENODB=   9.4 ,DELF=  44.0 ,BIF=  1000 ,BL2=   176 ,NSLICE=    26 ,ASOFT= .3000
SVRMZ=  0.          ,SWMX=  2.8150E+04 ,SWMN=  6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=  0.          ,FQDPRT=  1.0000E+01
TL= -6.50 ,DYNR=   3.0 ,SDAMP= 0.000 ,SDPHA= 0.000 ,I1,I2,I11,I22   129   130     1     1
WN= 165.9 ,K= 468.6 ,TAU1=  4.5000E-01 ,TAU2=  8.4420E-03 ,WNB=    .9 ,KB= 866.4 ,TAUB1=  2.0353E+02 ,TAUB2=  1.4945E+00
PE=  2.3684E-02 ,STDEV=  3.4886E-03 ,V MEAN=  3.4551E-01V STD DEV=  1.5815E-01 ,BITS=  1900
PEI=  1.5789E-03 ,STDEV=  9.1089E-04
LOCKIN=     1 ,DROPOUTS=0
ERRM
  4.0000E+00  2.0000E+00  0.          0.          1.0000E+00  0.          2.0000E+00  3.0000E+00  1.0000E+00  0.
  1.0000E+00  0.          3.0000E+00  1.0000E+00  1.0000E+00  1.0000E+00  0.          0.          0.          1.0000E+00
  0.          1.0000E+00  0.          1.0000E+00  0.          0.          0.          0.          1.0000E+00  0.
  0.          1.0000E+00  0.          0.          1.0000E+00  0.          2.0000E+00  0.          1.0000E+00  0.
  1.0000E+00  0.          0.          0.          0.          0.          0.          0.          1.0000E+00  0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          1.0000E+00
  1.0000E+00  0.          0.          0.          0.          2.0000E+00  2.0000E+00  0.          0.          0.
  0.          0.          0.          0.          0.          1.0000E+00  0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          1.0000E+00  0.          0.          0.          1.0000E+00  5.0000E+00

-1,-1 P(B/A)TIMES   452                          -1,+1 P(B/A)TIMES   483
   23   18   13    3    0    0    0    0          0    0    0    0    0    0    0    0
   52   48   28    6    5    1    0    0          0    0    0    0    0    0    0    0
   36   52   38   17    8    0    0    0          0    0    0    0    0    0    0    0
   18   23   24   10    1    0    0    0          1    1    0    0    0    0    0    0
    3    7    9    5    0    0    0    0         15    7    4    1    1    0    0    0
    0    2    1    1    0    0    0    0         25   52   23    4    2    0    0    0
    0    0    0    0    0    0    0    0         50   77   45   17    5    3    0    0
    0    0    0    0    0    0    0    0         29   44   49   21    6    0    0    0
+1,-1 P(B/A)TIMES   483                          +1,+1 P(B/A)TIMES   482
    0    0    1    5   28   75   57   29          0    0    0    0    0    0    0    0
    0    0    0    3   19   59   72   38          0    0    0    0    0    0    0    0
    0    0    0    1   11   23   38   11          0    0    0    0    0    1    0    0
    0    0    0    0    1    1    4    3          0    0    0    0    0    4    3    3
    0    0    0    0    0    3    0    1          0    0    0    0    7   16   29   15
    0    0    0    0    0    0    0    0          0    0    0    2   12   52   69   39
    0    0    0    0    0    0    0    0          0    0    0    1   13   39   64   44
    0    0    0    0    0    0    0    0          0    0    0    0    5    8   22   33
I1,I2,I11,I22  1050   778     1     1
REC SLICE=  2.5927E+01 ,STD DEV=  4.2009E+00                    DELF = 44    NO FADING
                                                                2/5/74E
```

```
 ENODB=   9.4 ,DELF=  88.0 ,BIF=  1000 ,BL2=   176 ,NSLICE=    26 ,ASOFT= .3000
 SVRHZ=  0.          ,SWMX=  2.8150E+04 ,SWMN=  6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=  0.          ,FQDPRT=  1.0800E+01
 TL= -6.50 ,DYNR=   3.0 ,SDAMP= 0.000 ,SDPHA= 0.000 ,I1,I2,I11,I22   129   130     1     1
 WN= 165.9 ,K= 468.6 ,TAU1=  4.5000E-01 ,TAU2=  8.4420E-03 ,WNB=    .9 ,KB= 433.2 ,TAUB1=  2.0353E+02 ,TAUB2=  1.4945E+00
 PE=  6.2105E-02 ,STDEV=  5.5369E-03 ,V MEAN=  5.9443E-01V STD DEV=  2.8558E-01 ,BITS=  1900
 PEI=  7.3684E-02 ,STDEV=  5.9936E-03
 LOCKIN=     2 ,DROPOUTS=     1 ,AVE=  6.0000E+00 ,STD DEV=  0.
 ERRM
  1.4000E+01  4.0000E+00  9.0000E+00  5.0000E+00  6.0000E+00  5.0000E+00  5.0000E+00  2.0000E+00  5.0000E+00  5.0000E+00
  4.0000E+00  4.0000E+00  4.0000E+00  2.0000E+00  1.0000E+00  5.0000E+00  1.0000E+00  3.          1.0000E+00  2.0000E+00
  1.0000E+00  3.0000E+00  2.0000E+00  1.0000E+00  4.0000E+00  5.0000E+00  1.0000E+00  0.          2.0000E+00  1.0000E+00
  0.          3.0000E+00  1.0000E+00  0.          0.          0.          0.          0.          0.          0.
  1.0000E+00  0.          2.0000E+00  2.0000E+00  0.          0.          0.          0.          0.          0.
  0.          1.0000E+00  1.0000E+00  0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          1.0000E+00  0.          1.0000E+00  0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  1.0000E+00  0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.

-1,-1 P(B/A)TIMES   451                                    -1,+1 P(B/A)TIMES   483
   170    24    15     7     2     1     3     4            31     1     1     0     0     0     0     0
    61    21    19     2     0     1     1     1             3     2     3     0     0     3     0     0
    29    19    11     8     0     2     1     0             6     2     2     0     0     0     0     0
    11     9     7     3     0     0     0     0            11     5     0     1     0     0     0     0
     1     0     1     0     0     0     0     0            10     2     3     0     0     0     3     0
     0     2     1     0     0     0     0     0            17    12     2     2     0     0     0     2
     2     2     0     0     0     0     0     0            37    10     7     0     0     1     0     2
     3     1     0     1     0     0     0     0           204    45    32    13     3     2     3     6

+1,-1 P(B/A)TIMES   483                                    +1,+1 P(B/A)TIMES   483
    12     1     1    10    15    30    63   238             3     0     0     0     0     1     1     2
     5     2     0     0     0     6     8    25             0     0     0     0     0     0     0     3
     8     0     2     1     1     3     3    13             1     0     0     0     0     0     0     0
     1     2     0     0     0     0     1     8             0     0     0     0     0     0     2     2
     1     0     0     0     0     1     0     1             0     0     0     1     0     0     2    11
     0     0     0     0     0     0     1     3             0     1     0     0     2     3     7    18
     0     0     0     0     1     2     3     1             0     0     0     0     4     4    13    65
     0     0     0     0     1     1     1     7             9     2     8     9     8    16    38   247

I1,I2,I11,I22  1748  1736     1     1
REC SLICE=  2.6151E+01 ,STD DEV=  3.8503E+00                                    DELF = 88.    NO FADING
                                                                                2/5/74E
```

```
ENODB=   9.4 ,DELF= 132.0 ,BIF=  1000 ,BL2=   176 ,NSLICE=    25 ,ASOFT= .3000
SVRHZ=   0.          ,SWMX= 2.8150E+04 ,SWMN= 6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=  0.          ,FQDPRT= 1.0800E+01
TL= -6.50 ,DYNR=   3.0 ,SDAMP= 0.000 ,SDPHA= 0.000 ,I1,I2,I11,I22   129   130     1     1
HN= 165.9 ,K= 468.6 ,TAU1= 4.5000E-01 ,TAU2= 8.4420E-03 ,HN8=    .9 ,KB= 288.8 ,TAUB1= 2.0353E+02 ,TAUB2= 1.4945E+00
PE=  2.7789E-01 ,STDEV=  1.0277E-02 ,V MEAN=  6.7795E-01V STD DEV=  4.2504E-01 ,BITS=  1900
PEI= 2.3368E-01 ,STDEV=  9.7083E-03
LOCKIN=     2 ,DROPOUTS=     1 ,AVE=  1.5000E+02 ,STD DEV=  0.
ERRM
  2.2300E+02  8.2000E+01  7.4000E+01  3.7000E+01  5.2000E+01  2.3000E+01  1.1000E+01  3.0000E+00  4.0000E+00  8.0000E+00
  7.0000E+00  2.0000E+00  2.0000E+00  0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.

-1,-1 P(B/A)TIMES   450                          -1,+1 P(B/A)TIMES   483
   171    20     9     5     9     9     6    21        90    11     6     7     1     0     2     1
    27    30    13     8     3     0     1     1         9    10     1     2     3     1     0     0
    14    11    10     4     0     2     2     3        13     2     7     1     0     2     1     1
     9     6     6     2     1     0     0     2        12     3     1     1     0     1     2     4
     2     1     0     2     2     1     1     5        11     6     1     0     1     2     2     4
     1     1     1     0     1     0     1     4        11     1     2     2     1     6     3     5
     4     0     0     0     1     1     0     3        11     1     0     0     2     5     5     7
     3     0     1     0     0     1     1     7        64    15    11    17    10     9    15    58

+1,-1 P(B/A)TIMES   482                          +1,+1 P(B/A)TIMES   485
    44     7    12    13    16    18    10    82        20     7     4     3     3     1     0     1
     7     1     3     0     4     1     2    17         4     0     0     1     0     4     1     1
     4     2     2     6     1     0     3    11         7     0     3     3     0     1     1     4
     1     1     3     2     1     1     0    15         8     0     2     1     3     1     1     5
     4     0     0     1     0     2     4    10         8     5     0     0     2     1     2     3
     4     1     1     0     0     4     4    17         9     2     3     2     3     5     3    12
     0     1     1     1     0     7     4    19         5     6     2     3     1     3     5    20
     2     0     1     2     0     3    11    94        29     4     9    13    14    18    25   178

I1,I2,I11,I22  1685   226     1     1
REC SLICE=  2.7370E+01 ,STD DEV=  7.1083E+00
                                                                                    DELF = 132     NO FADING
                                                                                    2/5/74E
```

ENODB= 9.4 ,DELF= 62.0 ,BIF= 500 ,BL2= 176 ,NSLICE= 24 ,ASOFT= .3000
SVRHZ= 0. ,SWMX= 2.8150E+04 ,SWMN= 6.8500E+03 ,FLO= 1.0000E+01 ,FRQDOP= 0. ,FQDPRT= 1.0800E+01
TL= -6.50 ,DYNR= 3.0 ,SDAMP= .230 ,SDPHA= .470 ,I1,I2,I11,I22 129 130 1 1
WN= 165.9 ,K= 468.6 ,TAU1= 4.5000E-01 ,TAU2= 8.4420E-03 ,WNB= .9 ,K9= 614.9 ,TAUB1= 2.0353E+02 ,TAUB2= 1.4945E+00
PE= 5.5789E-02 ,STDEV= 5.2654E-03 ,V MEAN= 4.7524E-01V STD DEV= 2.4526E-01 ,BITS= 1900
PEI= 3.6316E-02 ,STDEV= 4.2918E-03
LOCKIN= 1 ,DROPOUTS= 1 ,AVE= 2.1000E+01 ,STD DEV= 0.

ERRM

3.6000E+01	1.1000E+01	3.0000E+00	0.	1.0000E+00	2.0000E+00	3.0000E+00	1.0000E+00	3.0000E+00	0.
2.0000E+00	2.0000E+00	1.0000E+00	2.0000E+00	1.0000E+00	2.0000E+00	2.0000E+00	0.	1.0000E+00	0.
1.0000E+00	0.	3.0000E+00	2.0000E+00	3.0000E+00	1.0000E+00	0.	0.	1.0000E+00	1.0000E+00
2.0000E+00	0.	1.0000E+00	1.0000E+00	0.	0.	0.	0.	1.0000E+00	1.0000E+00
1.0000E+00	1.0000E+00	0.	2.0000E+00	0.	0.	1.0000E+00	0.	2.0000E+00	0.
0.	1.0000E+00	0.	0.	0.	1.0000E+00	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	1.0000E+00	0.	1.0000E+00	0.	0.	0.
0.	0.	0.	0.	0.	1.0000E+00	0.	0.	0.	0.
0.	0.	1.0000E+00	0.	0.	0.	0.	0.	0.	2.0000E+00

-1,-1 P(B/A)TIMES 451

88	27	18	3	3	2	0	1
74	21	14	11	3	0	0	0
38	24	22	15	6	0	3	0
23	9	18	4	0	0	0	0
5	4	7	0	0	0	1	1
2	0	0	0	0	0	0	0
1	1	0	0	1	0	1	0
0	0	0	0	0	0	0	0

-1,+1 P(B/A)TIMES 483

7	0	0	0	0	1	0	0
1	1	0	0	0	0	0	0
2	0	2	0	1	0	0	0
6	2	3	0	2	0	0	1
6	1	2	2	0	0	0	0
25	5	4	5	1	0	0	0
55	25	10	3	2	1	0	0
159	63	45	24	9	5	1	1

+1,-1 P(B/A)TIMES 483

3	2	6	14	25	49	96	155
1	0	0	1	1	11	16	30
2	0	0	0	3	5	11	16
1	0	0	1	0	3	4	4
1	0	0	0	1	4	3	1
1	0	0	2	0	0	3	1
0	0	0	0	1	0	0	1
0	0	0	0	1	0	1	2

+1,+1 P(B/A)TIMES 483

3	2	0	1	1	1	0	0
1	0	0	2	0	0	0	1
0	0	0	0	1	0	0	1
0	0	1	0	2	2	2	9
1	0	0	1	1	4	12	20
0	0	0	-1	4	12	30	33
1	1	0	4	6	13	40	95
1	1	0	3	3	16	38	112

I1,I2,I11,I22 371 874 1326 498
REC SLICE= 2.3894E+01 ,STD DEV= 5.2927E+00

BIF = 500 FADING
4/5/74M

```
ENDDB= 9.4 ,DELF= 62.6 ,BIF= 750 ,BL2= 176 ,NSLICE= 25 ,ASOFT= .3000
SYRHZ= 0.          ,SWMX= 2.8150E+04 ,SWMN= 6.8500E+03 ,FLO= 1.0000E+01 ,FRQDOP= 0.          ,FQDPRT= 1.0800E+01
TL= -6.50 ,DYNR= 3.0 ,SDAMP= .230 ,SDFHA= .470 ,I1,I2,I11,I22 129 130 1 1
WN= 165.9 ,K= 468.6 ,TAU1= 4.5000E-01 ,TAU2= 8.4420E-03 ,WNB= .9 ,KB= 614.9 ,TAUB1= 2.0353E+02 ,TAUB2= 1.4945E+00
PE= 3.2632E-02 ,STDEV= 4.0768E-03 ,V MEAN= 4.6891E-01V STD DEV= 2.1695E-01 ,BITS= 1900
PEI= 2.7895E-02 ,STDEV= 3.7778E-03
LOCKIN= 1 ,ORCFOUTS= 1 ,AVE= 1.3000E+01 ,STD DEV= 0.
ERRM
1.6000E+01 3.0000E+00 3.0000E+00 2.0000E+00 2.0000E+00 1.0000E+00 2.0000E+00 2.0000E+00 1.0000E+00 0.
1.0000E+00 1.0000E+00 0. 0. 1.0000E+00 1.0000E+00 2.0000E+00 2.0000E+00 0. 0.
0. 0. 0. 0. 0. 0. 0. 0. 0. 1.0000E+00
0. 0. 0. 2.0000E+00 0. 0. 1.0000E+00 0. 0. 0.
0. 0. 1.0000E+00 0. 0. 0. 1.0000E+00 2.0000E+00 1.0000E+00 0.
0. 0. 0. 0. 0. 0. 0. 1.0000E+00 1.0000E+00 0.
0. 1.0000E+00 0. 0. 1.0000E+00 0. 0. 0. 0. 0.
0. 0. 0. 0. 0. 0. 0. 0. 0. 0.
0. 0. 0. 1.0000E+00 0. 0. 0. 0. 0. 0.
0. 0. 0. 0. 0. 0. 1.0000E+00 0. 0. 6.0000E+00

-1,-1 P(B/A)TIMES 451
92 41 18 7 2 0 0 -1
71 26 21 9 3 1 1 1
41 27 17 6 2 0 0 0
13 12 8 6 1 0 0 0
8 2 4 2 2 0 0 0
2 0 0 0 0 0 0 0
0 1 0 0 0 0 0 0
0 1 1 1 0 0 0 0

-1,+1 P(B/A)TIMES 483
3 0 1 0 0 0 0 0
1 0 0 1 0 0 0 0
2 1 0 0 0 0 0 0
1 3 1 0 0 0 0 0
12 1 2 2 0 0 0 0
36 13 7 1 2 1 0 0
67 28 9 3 1 0 1 1
154 64 37 15 9 2 0 1

+1,-1 P(B/A)TIMES 483
0 3 1 4 21 53 116 144
2 0 0 1 1 15 28 40
1 1 1 0 2 5 4 18
0 0 0 0 2 5 5 1
0 0 0 0 0 0 1 3
0 0 0 0 0 0 0 2
0 0 0 0 0 0 0 1
0 0 0 0 1 0 0 0

+1,+1 P(B/A)TIMES 483
2 1 1 0 1 1 0 0
0 0 1 0 2 1 0 0
0 0 0 0 0 0 0 1
1 0 0 0 0 0 1 3
0 0 0 0 1 8 10 6
1 0 0 2 1 8 26 44
0 0 0 0 7 14 53 103
3 1 0 3 3 31 43 99

I1,I2,I11,I22 231 338 529 737
REC SLICE= 2.5239E+01 ,STD DEV= 4.1892E+00
```

BIF = 750 FADING
4/5/74M

```
ENODB=   9.4 ,DELF=  62.6 ,BIF=  1500 ,BL2=   176 ,NSLICE=    40 ,ASOFT= .3000
SVRHZ=  0.          ,SWMX=  2.8150E+04 ,SWMN=  6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=  0.          ,FQDPRT=  1.0800E+01
TL= -6.50 ,DYNR=   3.0 ,SDAMP=   .230 ,SDPHA=   .470 ,I1,I2,I11,I22   129   130     1     1
WN= 165.9 ,K= 468.6 ,TAU1=  4.5000E-01 ,TAU2=  8.4420E-03 ,WNB=     .9 ,KB= 614.9 ,TAUB1=  2.0353E+02 ,TAUB2=  1.4945E+00
PE=  2.5263E-02 ,STDEV=  3.6001E-03 ,V MEAN=  4.5685E-01V STD DEV=  1.9627E-01 ,BITS=  1900
PEI=  1.5789E-02 ,STDEV=  2.8599E-03
LOCKIN=      1 ,DROPOUTS=      1 ,AVE=  3.0000E+00 ,STD DEV=  0.
ERRM
 1.1000E+01  5.0000E+00  1.0000E+00  1.0000E+00  3.0000E+00  1.0000E+00  0.          1.0000E+00  0.          0.
 0.          0.          0.          0.          0.          0.          1.0000E+00  0.          2.0000E+00  1.0000E+00
 1.0000E+00  0.          0.          0.          0.          1.0000E+00  0.          3.0000E+00  1.0000E+00  0.
 1.0000E+00  0.          0.          0.          0.          0.          0.          0.          0.          1.0000E+00
 0.          0.          0.          0.          0.          1.0000E+00  0.          0.          1.0000E+00  0.
 0.          0.          1.0000E+00  1.0000E+00  0.          0.          0.          0.          0.          0.
 0.          1.0000E+00  0.          0.          1.0000E+00  0.          0.          0.          0.          0.
 0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
 0.          0.          1.0000E+00  0.          0.          0.          0.          0.          0.          0.
 0.          0.          0.          0.          0.          0.          0.          0.          0.          6.0000E+00

-1,-1 P(B/A)TIMES   450                                                 -1,+1 P(B/A)TIMES   483
 111    38    18     5     2     0     0     0                 0     0     0     0     0     0     0     0
  61    42    20     6     3     0     1     0                 1     0     0     0     0     0     0     0
  43    33    16     7     0     1     0     0                 2     1     0     0     0     0     0     0
  10     9     8     3     0     0     0     0                 5     3     1     1     1     0     0     0
   2     2     1     1     0     1     0     0                11     5     6     0     0     0     0     0
   0     2     0     2     0     1     0     0                25    12     6     1     2     0     1     0
   0     0     1     0     0     0     0     0                82    30     8     5     1     1     0     0
   0     0     0     0     0     0     0     0               139    63    52    11     5     1     1     0
+1,-1 P(B/A)TIMES   482                                                 +1,+1 P(B/A)TIMES   485
   2     0     2     5    11    50    97   151                 0     0     0     1     0     1     2     0
   1     0     0     2     7    18    27    51                 0     0     0     0     0     0     0     0
   0     0     0     2     4     3     5    23                 0     0     0     0     0     0     2     0
   0     0     1     0     1     5     3     2                 0     0     0     0     3     1     1     0
   0     0     0     0     0     3     3     1                 0     0     1     1     1     1     4     7
   0     0     0     0     0     0     0     0                 0     1     1     0     3    15    34    36
   0     0     0     1     0     1     0     0                 0     0     0     2     1    21    55    82
   0     0     0     0     0     0     0     0                 1     0     0     2     6    18    54   127
I1,I2,I11,I22  1122  1858  1930  1993
REC SLICE=  3.9812E+01 ,STD DEV=  4.4721E+00
```

BIF = 1500
4/5/74M

FADING

```
 ENOOB=    9.4 ,DELF=  62.0 ,BIF=  2000 ,BL2=   176 ,NSLICE=    54 ,ASOFT= .3000
  SVRHZ=  0.        ,SWMX=  2.8150E+04 ,SWMN=  5.8500E+03 ,FLO=  1.0000E+01 ,FRQOOP=  0.        ,FQDPRT=  1.0800E+01
 TL= -6.50 ,DYNR=   3.0 ,SOAMP=  .230 ,SOFHA=  .470 ,I1,I2,I11,I22   129   130     1     1
  WN= 165.9 ,K= 458.6 ,TAU1=  4.5000E-01 ,TAU2=  8.4420E-03 ,WN8=    .9 ,K8= 614.9 ,TAUB1=  2.0353E+02 ,TAUB2=  1.4945E+00
 PE=  2.1053E-02 ,STDEV=  3.2935E-03 ,V MEAN=  4.5533E-01V STD DEV=  1.9202E-01 ,BITS=  1900
  PEI=  2.3158E-02 ,STDEV=  3.4505E-03
 LOCKIN=     1 ,DROPOUTS=     1 ,AVE=  6.0000E+00 ,STD DEV=  0.
  ERRM
 1.0000E+01  1.0000E+00  3.0000E+01  1.0000E+00  1.0000E+00  1.0000E+00  0.         0.         0.         0.
    0.          0.          0.          1.0000E+00  0.          0.          1.0000E+00  0.          1.0000E+00  0.
    0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
    0.          0.          0.          0.          0.          1.0000E+00  0.          0.          1.0000E+00  1.0000E+00
    0.          0.          0.          1.0000E+00  0.          0.          1.0000E+00  1.0000E+00  1.0000E+00  0.
    0.          1.0000E+00  0.          0.          0.          1.0000E+00  0.          0.          0.          0.
    0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
 1.0000E+00  0.          1.0000E+00  0.          0.          0.          0.          0.          1.0000E+00  0.
    0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
    0.          0.          0.          0.          0.          0.          0.          0.          0.          7.0000E+00

 -1,-1 P(B/A)TIMES   453                                          -1,+1 P(B/A)TIMES   482
  112   40    5    8    1    0    0    0                          2    0    0    0    0    0    0    0
   72   45   17    9    0    0    0    0                          2    0    0    0    0    0    0    0
   33   25   24    7    3    0    0    0                          3    1    1    2    0    0    0    0
    7   13   11    9    0    2    0    0                          1    1    1    1    0    0    0    0
    1    4    2    0    0    0    0    0                         11    2    3    0    0    1    0    0
    1    0    0    1    0    0    0    0                         39    9    5    0    0    0    0    0
    0    1    0    0    0    0    0    0                         73   41   14    2    1    0    0    0
    0    0    0    0    0    0    0    0                        125   74   45   16    4    1    1    0
 +1,-1 P(B/A)TIMES   483                                          +1,+1 P(B/A)TIMES   482
    2    0    2    2    9   58  112  132                          3    0    2    0    0    2    1    0
    1    1    1    0    7   16   39   48                          0    0    0    0    0    0    0    0
    0    0    1    1    3    4   11   16                          0    0    1    0    0    0    0    0
    1    0    0    0    1    1    2    8                          0    0    0    0    1    0    1    0
    0    0    0    1    0    0    1    0                          0    0    1    0    2    3    4   12
    0    0    0    0    1    0    0    1                          0    0    0    0    5   15   30   44
    0    0    0    0    0    0    0    0                          0    1    0    1    6   20   57   84
    0    0    0    0    0    0    0    0                          3    0    0    1    4   28   42  108
 I1,I2,I11,I22   564   450   529   737
 REC SLICE=  5.4213E+01 ,STD DEV=  5.5437E+00

                                                                                                  BIF = 2000   FADING
                                                                                                  4/5/74M      NSPB = 80
```

```
 ENOOS=   9.4 ,OELF=  62.0 ,BIF=   500 ,BL2=   176 ,NSLICE=    2+ ,ASOFT= .3000
 SVRHZ=   0.          ,SWMX=  2.8150E+04 ,SWMN=  6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=  0.          ,FQDPRT=  1.0000E+01
 TL= -6.50 ,DYNR=   3.0 ,SDAMP= 0.000 ,SOPHA= 0.000 ,I1,I2,I11,I22   129   130     1     1
 HN= 165.9 ,K= 468.6 ,TAU1=  4.5000E-01 ,TAU2=  8.4208E-03 ,HNB=      .9 ,KB= 614.9 ,TAUB1=  2.0353E+02 ,TAUB2=  1.4945E+00
 PE=  1.5263E-02 ,STDEV=  2.8126E-03 ,V MEAN=  4.7884E-01V STD DEV=  2.2147E-01 ,BITS=  1900
 PEI=  1.0526E-02 ,STDEV=  2.3413E-03
 LOCKIN=     1 ,DROPOUTS=0
 ERRM
   1.0000E+00  2.0000E+00  0.          1.0000E+00  1.0000E+00  0.          1.0000E+00  0.          1.0000E+00  0.
   0.          0.          0.          0.          1.0000E+00  0.          0.          1.0000E+00  0.          0.
   0.          0.          0.          0.          0.          0.          1.0000E+00  0.          0.          1.0000E+00
   0.          1.0000E+00  0.          0.          0.          0.          0.          1.0000E+00  0.          0.
   1.0000E+00  0.          0.          0.          0.          0.          0.          0.          0.          0.
   0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
   0.          1.0000E+00  0.          0.          0.          0.          1.0000E+00  0.          0.          0.
   0.          0.          0.          0.          0.          1.0000E+00  0.          0.          0.          0.
   0.          1.0000E+00  0.          0.          0.          0.          0.          1.0000E+00  0.          0.
   0.          0.          1.0000E+00  0.          2.0000E+00  0.          0.          1.0000E+00  0.          6.0000E+08

 -1,-1 P(B/A)TIMES   455                          -1,+1 P(B/A)TIMES   482
      90     25      7      3      2      0      1      0          0      0      0      0      0      0      0      0
      86     32     19     13      2      0      0      0          0      0      0      0      0      0      0      0
      51     28     19     11      2      0      0      0          0      1      0      0      0      0      0      0
      14     19     15      4      1      1      0      0          5      0      0      0      0      0      0      0
       1      2      3      2      0      0      0      0         10      4      1      0      0      0      0      0
       0      0      0      1      0      0      0      0         23      7      2      1      0      0      0      1
       1      0      0      0      0      0      0      0         67     25      9      4      0      1      0      0
       0      0      0      0      0      0      0      0        161     83     53     21      3      0      0      0
 +1,-1 P(B/A)TIMES   482                          +1,+1 P(B/A)TIMES   481
       0      0      0      6     31     65    101    178          0      0      0      0      1      0      1      0
       0      0      0      1      2     12     21     38          0      0      0      1      0      0      0      1
       0      1      0      0      3      4      3      6          0      0      0      0      0      0      0      0
       0      0      0      0      1      1      2      2          0      0      0      0      0      1      0      4
       0      0      0      0      0      1      0      1          0      0      0      2      0      7      5     23
       0      0      0      0      0      0      0      1          0      0      0      0      5     17     21     65
       0      0      0      0      0      0      0      0          0      0      0      0      4     12     45     76
       0      0      0      0      1      0      0      0          2      1      1      0      4     22     44    116
 I1,I2,I11,I22   371   874     1     1
 REC SLICE=  2.3501E+01 ,STD DEV=  5.4618E+00

                                                                                                  BIF = 500      NO FADING
                                                                                                  2/5/74A
```

```
ENODB=   9.4 ,DELF=  62.0 ,BIF=   750 ,BL2=   176 ,NSLICE=    25 ,ASOFT= .3000
SVRHZ=  0.          ,SWMX=  2.8150E+04 ,SWMN=  6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=  0.          ,FQDPRT=  1.0800E+01
TL= -6.50 ,DYNR=   3.0 ,SDAMP= 0.000 ,SDPHA= 0.000 ,I1,I2,I11,I22   129   130     1     1
WN= 165.9 ,K= 468.6 ,TAU1=  4.5000E-01 ,TAU2=  8.4420E-03 ,WNB=    .9 ,KB= 514.9 ,TAUB1=  2.0353E+02 ,TAUB2=  1.4945E+00
PE=  1.2632E-02 ,STDEV=  2.5621E-03 ,V MEAN=  4.6825E-01V STD DEV=  1.9377E-01 ,BITS=  1900
PEI=  7.8947E-03 ,STDEV=  2.0303E-03
LOCKIN=     1 ,DROPOUTS=0
ERRM
  2.0000E+00  0.          0.          0.          0.          1.0000E+00  0.          0.          1.0000E+00  1.0000E+00
  0.          0.          0.          0.          0.          0.          1.0000E+00  0.          0.          0.
  0.          1.0000E+00  0.          0.          0.          0.          1.0000E+00  0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          1.0000E+00  0.          0.          1.0000E+00  0.          1.0000E+00  1.0000E+00  0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          1.0000E+00  0.          1.0000E+00  0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  1.0000E+00  0.          0.          0.          0.          0.          0.          0.          0.          9.0000E+00

-1,-1 P(B/A)TIMES   451                                    -1,+1 P(B/A)TIMES   483
  104   30   11    3    1    0    1    1                    1    0    0    0    0    0    0    0
   81   28   18    6    2    0    0    0                    0    0    0    0    0    0    0    0
   39   29   29   11    3    0    0    0                    0    0    0    0    0    0    0    0
   16   13    7    6    1    0    0    0                    1    1    0    0    0    0    0    0
    5    1    3    1    0    0    0    0                    7    2    2    0    0    0    0    0
    0    0    0    0    0    0    0    0                   36   10    5    1    0    0    0    0
    0    0    0    0    0    0    0    0                   63   28   12    7    3    0    0    1
    0    0    1    0    0    0    0    0                  167   73   42   13    1    0    0    0
+1,-1 P(B/A)TIMES   483                                    +1,+1 P(B/A)TIMES   483
    0    0    1    0   15   71  123  159                    0    0    0    1    0    0    0    0
    0    0    0    1    2   11   24   42                    0    0    0    0    1    0    0    0
    0    0    1    0    2    5    4   14                    0    0    0    1    0    0    1    0
    0    1    0    0    0    2    1    1                    0    0    0    0    0    0    0    3
    0    0    0    0    0    1    0    0                    0    0    0    0    0    5    7    7
    0    0    0    0    0    0    0    0                    1    0    0    1    0   16   28   52
    0    0    0    0    1    0    0    0                    0    0    0    0    3   20   47  102
    0    0    0    0    1    0    0    0                    1    0    0    1    5   19   52  109
I1,I2,I11,I22   638  1850     1     1
REC SLICE=  2.5109E+01 ,STD DEV=  4.1300E+00                                          BIF = 750      NO FADING
                                                                                      2/6/74A        NSPB = 40
```

```
ENODB=    9.4 ,DELF=  62.0 ,BIF=  1500 ,BL2=   176 ,NSLICE=    40 ,ASOFT= .3000
SVRHZ=  0.          ,SWMX=  2.8150E+04 ,SWMN=  6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=  0.          ,FQDPRT=  1.0000E+01
TL= -6.50 ,DYNR=    3.0 ,SDAMP= 0.000 ,SDPHA= 0.000 ,I1,I2,I11,I22   129   130     1     1
WN= 165.9 ,K= 468.6 ,TAU1=  4.5000E-01 ,TAU2=  8.4420E-03 ,WNB=     .9 ,KB= 514.9 ,TAUB1=  2.0353E+02 ,TAU92=  1.4945E+00
PE=  5.2632E-03 ,STDEV=  1.6600E-03 ,V MEAN=  4.6625E-01V STD DEV=  1.8393E-01 ,BITS=  1900
PEI=  3.1579E-03 ,STDEV=  1.2872E-03
LOCKIN=     1 ,DROPOUTS=0
ERRM
   0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
   0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
   0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
   0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
   0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
   0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  1.0000E+00   0.          0.          0.          0.          0.          0.          0.          0.          0.
   0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  1.0000E+00   0.          0.          0.          0.          0.          0.  1.0000E+00   0.          0.
   0.          0.          0.          0.          0.          0.          0.          0.          0.  6.0000E+00

-1,-1 P(B/A)TIMES   450                                          -1,+1 P(B/A)TIMES   483
   130    27    15     0     0     0     0     0                   1     0     0     0     0     0     0     0
    68    42    20     8     1     3     0     0                   0     0     0     0     0     0     0     0
    39    29    17     9     2     0     0     0                   0     0     0     0     0     0     0     0
    14    14     8     1     0     0     0     0                   1     0     0     0     0     0     0     0
     1     1     2     1     0     0     0     0                  10     1     0     0     0     0     0     0
     0     1     0     0     0     0     0     0                  35    16     4     1     0     0     0     0
     0     0     0     0     0     0     0     0                  96    27    15     7     0     0     0     0
     0     0     0     0     0     0     0     0                 135    60    43    17     4     1     0     0
+1,-1 P(B/A)TIMES   482                                          +1,+1 P(B/A)TIMES   485
     0     0     0     0    11    58   120   170                   0     0     0     0     0     0     0     0
     0     0     0     0     6    17    29    35                   0     0     0     0     0     0     0     0
     0     0     0     0     1     6     9    11                   0     0     0     0     0     0     0     0
     0     0     0     0     0     0     5     2                   0     0     0     0     0     0     0     0
     0     0     0     0     0     2     0     0                   0     0     0     0     0     3     4    10
     0     0     0     0     0     0     0     0                   0     0     0     0     0    21    34    38
     0     0     0     0     0     0     0     0                   1     0     0     0     6    20    55    86
     0     0     0     0     0     0     0     0                   0     0     0     1     4    22    56   124
I1,I2,I11,I22  1301   882     1     1
REC SLICE=  3.9769E+01 ,STD DEV=  4.1080E+00                                        BIF = 1500   NO FADING
                                                                                    2/6/74A      NSPB = 60
```

```
ENOOS=    9.4 ,DELF=  62.0 ,BIF=  2000 ,BL2=   176 ,NSLICE=    54 ,ASOFT= .3000
SVRHZ=  0.        ,SHMX=  2.8150E+04 ,SHMN=  6.8500E+03 ,FLO=  1.0000E+01 ,FRQOOP=  0.        ,FQDPRT=  1.0800E+01
TL= -6.50 ,DYNR=   3.0 ,SDAMP= 0.000 ,SDPHA= 0.000 ,I1,I2,I11,I22   129   130     1     1
MN= 165.9 ,K= 468.6 ,TAU1=  4.5000E-01 ,TAU2=  8.4420E-13 ,MN8=    .9 ,KB= 614.9 ,TAUB1=  2.0353E+02 ,TAUB2=  1.4945E+00
PE=  4.7368E-03 ,STDEV=  1.5752E-03 ,V MEAN=  4.5318E-01V STD DEV=  1.7100E-01 ,BITS=  1900
PEI=  3.1579E-03 ,STDEV=  1.2872E-03
LOCKIN=     1 ,DROPOUTS=0
ERRM
   0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
   0.          0.          0.          0.          0.          0.          0.          0.          0.          2.0000E+00
   0.          0.          0.          0.          0.          0.          0.          0.          1.0000E+00  0.
   0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
   0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
   0.          0.          0.          0.          0.          0.          0.          0.          0.          1.0000E+00
   0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
   0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
   0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
   0.          0.          0.          0.          0.          0.          0.          0.          0.          5.0000E+00

-1,-1 P(B/A)TIMES   451                                    -1,+1 P(B/A)TIMES   483
   121    37     7     1     0     0     1     0            0     1     0     0     0     0     0     0
    73    41    25     7     1     0     0     0            0     0     0     0     0     0     0     0
    40    36    21     7     0     0     0     0            0     0     0     0     0     0     0     0
     9    11     7     3     0     0     0     0            1     1     0     0     0     0     0     0
     1     2     0     0     0     0     0     0            8     2     1     0     0     0     0     0
     0     0     0     0     0     0     0     0           41    13     5     0     0     0     0     0
     0     0     0     0     0     0     0     0           97    41    16     2     0     0     0     0
     0     0     0     0     0     0     0     0          117    67    53    14     3     0     0     0
+1,-1 P(B/A)TIMES   483                                    +1,+1 P(B/A)TIMES   483
     0     0     0     2    16    72   113   139            0     0     0     0     0     1     0     0
     1     0     0     0     4    17    29    53            0     0     0     0     0     0     0     0
     0     0     0     0     0     5    11    15            0     0     0     0     0     0     0     0
     0     0     0     0     0     0     1     3            0     0     0     0     0     0     0     0
     0     0     0     0     0     0     0     1            0     0     0     0     0     4     7    10
     0     0     0     0     0     0     0     0            0     0     0     0     5     6    42    38
     0     0     0     0     1     0     0     0            0     0     0     0     4    21    66    81
     0     0     0     0     0     0     0     0            1     0     0     0     2    24    59   112
I1,I2,I11,I22   567  1426     1     1
REC SLICE=  5.4336E+01 ,STD DEV=  5.1068E+00
```

BIF = 2000
2/5/74A

NO FADING
NSPB = 80

```
ENOSS=   9.4 ,DELF=  62.0 ,BIF=  1000 ,BL2=    88 ,NSLICE=    26 ,ASOFT= .3000
SVRHZ=  0.          ,SWMX=  2.8150E+04 ,SWMN=  6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=  0.          ,FQDPRT=  1.0800E+01
TL= -6.50 ,CYNR=   3.0 ,SDAMP=  .230 ,SDEHA=  .470 ,I1,I2,I11,I22   129   130     1     1
WN=  83.0 ,K= 468.6 ,TAU1=  1.8000E+00 ,TAU2=  1.6965E-02 ,WNB=    .9 ,KB= 614.9 ,TAUB1=  2.0353E+02 ,TAUB2=  1.4945E+00
PE=  1.4421E-01 ,STDEV=  8.0594E-03 ,V MEAN=  3.0538E-01V STD DEV=  1.8453E-01 ,BITS=  1900
LOCKIN=     1 ,DROPOUTS=     1 ,AVE=  8.3000E+01 ,STD DEV=  0.
ERRM
  8.8000E+01  1.2000E+01  2.8000E+01  3.5000E+01  2.6000E+01  2.1000E+01  1.2000E+01  6.0000E+00  2.0000E+00  5.0000E+00
  4.0000E+00  2.0000E+00  1.0000E+00  4.0000E+00  1.0000E+00  1.0000E+00  1.0000E+00  3.0000E+00  0.          2.0000E+00
  2.0000E+00  0.          0.          2.0000E+00  2.0000E+00  1.0000E+00  1.0000E+00  1.0000E+00  4.0000E+00  0.
  0.          2.0000E+00  0.          2.0000E+00  0.          0.          0.          0.          1.0000E+00  0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          1.0000E+00
  0.          0.          0.          1.0000E+00  0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.

-1,-1 P(B/A)TIMES   450                                    -1,+1 P(B/A)TIMES   483
    32    38    30     9     2     0     1     0            1     1     2     2     0     0     0     0
    21    35    36     7     5     3     0     0            0     1     2     4     2     1     0     0
    12    30    54    15     2     3     1     1            3     4    10     4     3     1     0     0
     5    18    15    21     7     2     0     0            9    14     9    12     7     3     0     0
     5     1     5     9     8     4     0     1           20    32    32    15     6     2     0     0
     0     0     4     5     0     1     0     0           32    39    37    14     9     1     3     2
     0     0     3     5     0     0     0     0           17    24    28    13     8     3     4     0
     0     0     2     0     0     0     0     0            3     7    12    14     4     4     1     2
+1,-1 P(B/A)TIMES   484                                    +1,+1 P(B/A)TIMES   483
     2     2     4     7     8    14     4     7            0     0     0     0     4     3     2     1
     3     4     5     8    27    36    27    20            0     0     1     2     7     4     0     0
     2     3     5    13    21    31    46    42            1     2     0     1     7     4     3     1
     2     0     2     6    11    14    24    30            1     1     2     8     8     3     3     3
     0     0     1     0     8     6     7     8            1     2     7    11     4     5     2     2
     0     0     0     7     2     2     4     3            1     6     1     8    11    12    10    10
     0     0     0     0     2     0     0     0            2     3     9     7    15    26    43    31
     0     0     1     1     1     0     1     0            1     1     6     4     5    37    57    71
I1,I2,I11,I22   247  1946  1326   493
REC SLICE=  2.0003E+01 ,STD DEV=  6.2894E+00
```

BL2 = 88
2/1/74A

FADING

```
ENOISE=   9.4 ,DELF=  62.0 ,BIF=  1000 ,BL2=   100 ,NSLICE=    26 ,ASOFT= .3000
SVRHZ=  0.          ,SWMX=  2.8150E+04 ,SWMN=  6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=  0.          ,FCDPRT=  1.0800E+01
TL= -6.50 ,DYNR=   3.0 ,SCAMP=  .230 ,SDPHA=  .470 ,I1,I2,I11,I22   129   130     1     1
WN=  94.3 ,K= 468.6 ,TAU1=  1.3939E+00 ,TAU2=  1.4919E-02 ,WNB=     .9 ,KB= 614.9 ,TAUB1=  2.0353E+02 ,TAUB2=  1.4945E+00
PE=  1.1053E-01 ,STDEV=  7.1932E-03 ,V MEAN=  3.3669E-01V STD DEV=  1.8291E-01 ,BITS=  1900
LOCKIN=     1 ,DROPOUTS=     1 ,AVE=  2.7000E+01 ,STD DEV=  0.
ERRM
  4.9000E+01  1.6000E+01  1.2000E+01  2.4000E+01  2.1000E+01  9.0000E+00  6.0000E+00  8.0000E+00  6.0000E+00  5.0000E+00
  6.0000E+00  6.0000E+00  3.0000E+00  1.0000E+00  3.0000E+00  3.0000E+00  1.0000E+00  3.0000E+00  2.0000E+00  3.0000E+00
  2.0000E+00  0.          1.0000E+00  2.0000E+00  1.0000E+00  3.0000E+00  1.0000E+00  1.0000E+00  2.0000E+00  0.
  3.0000E+00  0.          1.0000E+00  0.          0.          2.0000E+00  1.0000E+00  0.          1.0000E+00  2.0000E+00
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.

-1,-1 P(B/A)TIMES   453                                   -1,+1 P(B/A)TIMES   482
    32    56    29    11     5     0     3     0          0     0     0     0     1     0     0     0
    25    33    39    11     6     2     1     2          1     2     2     4     1     0     0     0
    18    36    50    11     6     2     3     1          7     2     7     3     0     0     0     0
     3     6    13     8     6     2     2     3         10     7    14     8     1     0     0     0
     0     3     4     3     1     0     1     0         17    25    19    12     3     1     0     1
     0     0     0     2     0     0     0     0         55    44    28    13     2     1     1     4
     0     1     3     2     0     0     0     0         27    51    36    14     2     5     2     1
     0     1     3     2     2     0     0     0         12    10    13     7     2     2     1     1
+1,-1 P(B/A)TIMES   483                                   +1,+1 P(B/A)TIMES   482
     2     4     0     4     8    18    16    19          0     1     0     1     5     3     4     2
     3     2     7     5    12    38    55    37          0     0     1     0     6     9     1     0
     2     4     3    10     8    30    43    33          0     0     2     1     7     4     0     0
     0     1     0     5     7    19    26    10          0     0     1     1     3     4     4     0
     1     0     3     4     4     3     7     4          0     2     2     4    12     8     3     0
     0     0     1     1     2     6     1     2          0     4     2     6     9    13    20    17
     0     0     1     1     2     2     1     1          2     3     6     6    12    23    31    46
     0     0     0     2     0     1     1     1          7     6     4     2    13    38    54    67
I1,I2,I11,I22   268   970  1326   493
REC SLICE=  2.1070E+01 ,STD DEV=  6.3472E+00
```

BL2 = 100
2/1/74A

FADING

```
ENODB=   9.4 ,DELF=  62.0 ,BIF=  1000 ,BL2=   164 ,NSLICE=    26 ,ASOFT= .3000
SVRHZ=  0.          ,SWMX=  2.8150E+04 ,SWMN=  6.8500E+03 ,FLO=   1.0000E+01 ,FRQDOP=  0.          ,FQDPRT=  1.0800E+01
TL= -6.50 ,DYNR=   3.0 ,SDAMP=  .230 ,SDPHA=  .470 ,I1,I2,I11,I22   129   130     1     1
WN= 154.6 ,K= 468.6 ,TAU1=  5.1826E-01 ,TAU2=  9.0656E-03 ,WNB=     .9 ,KB= 614.9 ,TAUB1=  2.0353E+02 ,TAUB2=  1.4945E+00
RE=  2.7368E-02 ,STDEV=  3.7430E-03 ,V MEAN=  4.5167E-01V STD DEV=  2.0411E-01 ,BITS=  1900
LOCKIN=      1 ,DROPOUTS=      1 ,AVE=  6.8000E+00 ,STD DEV=  0.
ERRM
  1.8000E+01  2.0000E+00  1.0000E+00  4.0000E+00  1.0000E+00  2.0000E+00  0.          1.0000E+00  1.0000E+00  0.
  2.0000E+00  0.          1.0000E+00  0.          0.          1.0000E+00  1.0000E+00  1.0000E+00  1.0000E+00  0.
  0.          1.0000E+00  0.          0.          1.0000E+00  0.          1.0000E+00  1.0000E+00  0.          0.
  0.          0.          0.          1.0000E+00  0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          1.0000E+00  0.
  0.          0.          0.          0.          0.          1.0000E+00  0.          0.          1.0000E+00  0.
  0.          0.          0.          0.          0.          0.          0.          1.0000E+00  0.          0.
  0.          0.          0.          0.          1.0000E+00  0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          7.0000E+00

-1,-1 P(B/A)TIMES   451                                     -1,+1 P(B/A)TIMES   483
    95    36    16     6     2     1     1     0              2     2     0     0     0     0     0     0
    64    46    21     9     0     0     0     2              1     0     0     0     0     0     0     0
    32    27    26    10     1     0     0     0              2     0     1     0     0     1     0     0
    13    11    13     8     2     0     0     0              4     1     1     0     0     0     0     0
     2     2     0     1     1     0     0     0             18     5     2     0     2     1     0     0
     1     0     0     0     0     0     0     0             30    18     4     3     0     1     0     0
     0     0     1     0     0     0     0     0             90    36    12     6     0     0     0     0
     0     0     0     1     0     0     0     0            111    73    31    19     2     1     0     3
+1,-1 P(B/A)TIMES   483                                     +1,+1 P(B/A)TIMES   483
     2     2     1     3    19    52   102   127              0     1     0     1     1     1     1     1
     0     1     3     0    11    13    38    49              1     0     0     0     2     0     0     0
     0     0     1     1     2     4    14    10              0     0     0     1     3     1     0     0
     1     0     1     0     2     5     1     6              1     0     0     0     0     0     0     1
     0     0     0     1     0     0     0     3              1     0     1     0     1     4    10    12
     0     0     0     0     0     2     2     0              1     0     1     0     2     8    28    32
     0     0     0     0     0     0     0     0              0     0     0     0     1    13    58    89
     0     0     0     0     2     0     1     1              3     0     1     1    11    25    51   113
I1,I2,I11,I22   638  1854   529   737
REC SLICE=  2.4849E+01 ,STD DEV=  3.8404E+00
```

BL2 = 164
2/1/74A

FADING

```
ENOOB=   9.4 ,DELF=  62.0 ,BIF=  1000 ,BL2=   188 ,NSLICE=    26 ,ASOFT= .3000
SVRHZ=  0.          ,SWMX=  2.8150E+04 ,SWMN=  6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=  0.          ,FQDPRT=  1.0800E+01
TL= -6.50 ,DYNR=   3.0 ,SDAMP=  .230 ,SDENA=  .470 ,I1,I2,I11,I22   129   130     1     1
WN= 177.2 ,K= 468.6 ,TAU1=  3.9439E-01 ,TAU2=  7.8980E-03 ,WNB=     .9 ,KB= 614.9 ,TAUB1=  2.0353E+02 ,TAUB2=  1.4945E+00
RE=  2.6842E-02 ,STDEN=  3.7079E-03 ,V MEAN=  4.6826E-01V STD DEV=  2.1528E-01 ,BITS=  1900
LOCKIN=      1 ,DROPOUTS=      1 ,AVE=  1.0000E+01 ,STD DEV=  0.
ERRM
  1.0000E+01  2.0000E+00  5.0000E+00  1.0000E+00  1.0000E+00  1.0000E+00  3.0000E+00  2.0000E+00  2.0000E+00  0.
  1.0000E+00  1.0000E+00  0.          0.          1.0000E+00  1.0000E+00  1.0000E+00  1.0000E+00  1.0000E+00  1.0000E+00
  0.          0.          1.0000E+00  0.          0.          0.          0.          0.          0.          0.
  0.          1.0000E+00  0.          0.          0.          1.0000E+00  1.0000E+00  0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  1.0000E+00  0.          0.          0.          0.          0.          0.          1.0000E+00  1.0000E+00  1.0000E+00
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          1.0000E+00  1.0000E+00  0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          6.0000E+00

-1,-1 P(B/A)TIMES   450                                    -1,+1 P(B/A)TIMES   483
  100    23    14     7     0     0     0     0             2     1     0     0     0     0     0     0
   74    29    14     7     6     0     1     1             0     1     0     0     0     0     0     0
   39    37    29     9     2     0     0     0             2     0     0     1     0     0     0     0
   22    13     7     4     0     0     0     0             3     4     0     1     1     0     0     0
    5     2     3     2     0     0     0     0             9     4     1     3     2     0     0     0
    0     0     0     0     0     0     0     0            27    15     3     2     1     0     0     0
    0     0     0     0     0     0     0     0            66    17    11     3     3     1     0     1
    0     0     0     0     0     0     0     0           139    83    52    19     4     0     1     0
+1,-1 P(B/A)TIMES   482                                    +1,+1 P(B/A)TIMES   485
    1     0     3     6    23    57   102   152             0     0     0     0     2     0     0     0
    2     1     0     0     3    15    30    46             0     0     0     0     0     0     0     0
    0     0     0     0     1     5     2    10             0     0     1     0     0     1     0     1
    0     0     1     1     2     0     2     5             0     0     0     0     0     2     1     3
    1     0     0     2     0     1     1     2             1     0     0     0     0     4    10    13
    0     0     0     0     0     0     1     0             0     0     0     1     3    19    34    44
    0     0     0     0     1     0     1     0             0     0     0     1     4    18    35    97
    0     0     0     1     1     0     0     0             0     0     1     3     7    27    38   114
I1,I2,I11,I22  1594  1314   529   737
REC SLICE=  2.7187E+01 ,STD DEV=  3.4492E+00
```

BL2 = 188 FADING
2/1/74A

```
ENODB=   9.4 ,DELF=  62.0 ,BIF=  1000 ,BL2=    88 ,NSLICE=    26 ,ASOFT= .3000
SVRHZ=  0.          ,SWMX= 2.8150E+04 ,SWMN=  6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=  0.          ,FQDPRT=  1.0800E+01
TL= -6.50 ,DYNR=   3.0 ,SDAMP= 0.000 ,SOPHA= 0.000 ,I1,I2,I11,I22   129   130     1     1
WN=  83.0 ,K= 468.6 ,TAU1=  1.0000E+00 ,TAU2=  1.6965E-02 ,WN0=     .9 ,KB=  614.9 ,TAUB1=  2.0353E+02 ,TAUB2=  1.4945E+00
PE=  1.2526E-01 ,STDEV=  7.5941E-03 ,V MEAN=  3.0949E-01V STD DEV=  1.7849E-01 ,BITS=  1900
LOCKIN=     1 ,DROPOUTS=     1 ,AVE=  3.2000E+01 ,STD DEV=  0.
ERRM
 6.6000E+01  1.0000E+01  1.7000E+01  3.6000E+01  2.0000E+01  1.5000E+01  1.0000E+01  6.0000E+00  3.0000E+00  6.0000E+00
 4.0000E+00  2.0000E+00  1.0000E+00  2.0000E+00  1.0000E+00  0.          0.          2.0000E+00  3.0000E+00  2.0000E+00
 3.0000E+00  0.          0.          0.          0.          2.0000E+00  2.0000E+00  3.0000E+00  2.0000E+00  2.0000E+00
 0.          2.0000E+00  2.0000E+00  1.0000E+00  1.0000E+00  1.0000E+00  1.0000E+00  0.          1.0000E+00  0.
 0.          0.          0.          0.          0.          0.          0.          1.0000E+00  0.          0.
 0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
 0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
 0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
 0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
-1,-1 P(B/A)TIMES   451                                    -1,+1 P(B/A)TIMES   483
   34   44   30    0    0    0    1    1                    0    0    1    0    1    0    1    0
   17   46   39   11    1    1    2    0                    0    1    2    1    2    1    0    0
   15   34   57    0    5    4    3    4                    4    4    5    4    1    0    0    0
    4    8   14    6    9    4    0    2                    9   12   14   11    2    1    1    0
    1    2    4    0    6    3    0    0                   23   35   41   14    6    1    0    0
    0    0    3    0    2    0    0    0                   34   51   37   18    7    5    4    1
    0    0    5    2    0    0    0    0                   13   22   37   15    3    4    1    0
    0    0    0    2    1    0    0    0                    4    7    8   10    1    1    1    1
+1,-1 P(B/A)TIMES   483                                    +1,+1 P(B/A)TIMES   483
    1    2    6    4   12   12    0    3                    0    0    0    0    5    7    0    0
    1    2    5   10   30   45   29   27                    0    0    0    2    2   11    3    0
    1    3    4    4   23   32   59   41                    0    1    0    1    6    7    3    0
    0    0    0    7    0   11   17   28                    0    0    1    4    4    5    1    1
    0    0    0    2    3    6   10    2                    1    2    6    4   12    0    4    2
    0    0    0    3    0    3    4    2                    5    2    3   10    0    7    7    9
    0    0    1    4    2    0    0    0                    4    3    6    6   17   24   41   37
    0    0    0    2    4    0    0    0                    3   10    4    3   13   30   56   71
I1,I2,I11,I22  1974  1082    1     1
REG SLICE=  1.0119E+01 ,STD DEV=  5.5119E+00
```

BL2 = 88
2/1/74M

NO FADE

```
ENODB=   9.4 ,DELF=  62.0 ,BIF=  1000 ,BL2=   100 ,NSLICE=    26 ,ASOFT= .3000
SVRHZ=  0.          ,SWMX=  2.8150E+04 ,SWMN=  6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=  0.          ,FQDPRT=  1.0000E+01
TL= -6.50 ,DYNR=   3.0 ,SDAMP= 0.000 ,SDPHA= 0.000 ,I1,I2,I11,I22   129   130     1     1
WN=  94.3 ,K=  460.6 ,TAU1=  1.3939E+00 ,TAU2=  1.4919E-02 ,WND=     ,9 ,KB=  614.9 ,TAUB1=  2.0353E+02 ,TAUB2=  1.4945E+00
PE=  1.0053E-01 ,STDEV=  6.8985E-03 ,V MEAN=  3.4439E-01V STD DEV=  1.8716E-01 ,BITS=  1900
LOCKIN=     1 ,DROPOUTS=     1 ,AVE=  2.2000E+01 ,STD DEV=  0.
ERRM
  4.0000E+01  1.1000E+01  5.0000E+00  1.9000E+01  2.6000E+01  1.7000E+01  1.3000E+01  4.0000E+00  6.0000E+00  5.0000E+00
  4.0000E+00  7.0000E+00  0.          2.0000E+00  0.          2.0000E+00  0.          3.0000E+00  0.          2.0000E+00
  0.          1.0000E+00  0.          0.          2.0000E+00  1.0000E+00  3.0000E+00  2.0000E+00  3.0000E+00  0.
  2.0000E+00  0.          0.          0.          1.0000E+00  3.0000E+00  1.0000E+00  1.0000E+00  0.          0.
  0.          2.0000E+00  0.          0.          0.          1.0000E+00  0.          0.          1.0000E+00  1.0000E+00
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.

-1,-1 P(B/A)TIMES   452                                  -1,+1 P(B/A)TIMES   483
   42    53    31     4     1     0     1     0          1     0     0     0     1     0     0     0
   30    36    31     9     3     2     2     3          1     3     0     0     0     0     1     0
   13    30    61    10     6     6     0     1          1     1     3     2     3     0     0     0
    3     7    16     9     4     2     1     0         12    11    15     3     3     2     0     0
    2     1     4     3     2     0     0     0         24    27    23     8     2     0     1     1
    0     0     5     1     0     0     0     0         55    43    23    17     1     3     3     1
    1     1     5     1     0     0     0     0         30    48    39    10     6     2     3     3
    0     0     5     4     0     0     0     0          6     8    15     7     5     1     2     3
+1,-1 P(B/A)TIMES   483                                  +1,+1 P(B/A)TIMES   482
    3     3     5     4    15    22    25    12          0     0     0     0     3     8     2     0
    3     0     2     0    10    39    50    33          0     0     0     0     4     5     0     1
    1     0     1     3    15    44    43    42          1     0     0     1     3     3     3     0
    0     1     0     4     1    15    14    11          0     0     0     3     1     5     2     1
    0     0     0     4     6     5     4     6          0     0     1     3     2     7     7     4
    0     0     1     0     5     1     4     1          1     3     1    13    10    10    14    23
    0     0     0     1     4     1     0     0          4     5     3     7    13    23    35    41
    0     0     0     2     0     1     0     0          2     3     6     6    10    32    69    78
I1,I2,I11,I22  2032   434     1     1
REG SLICE=  1.9960E+01 ,STD DEV=  6.3881E+00                                                    BL2 = 100   NO FADE
                                                                                                2/1/74M
```

```
ENODB=   9.4 ,DELF=  62.0 ,BIF=  1000 ,BL2=   164 ,NSLICE=    26 ,ASOFT= .3000
SVRHZ=  0.          ,SWMX= 2.8150E+04 ,SWMN=  6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=  0.          ,FQDPRT= 1.0000E+01
TL= -6.50 ,DYNR=   3.0 ,SOAMP= 0.000 ,SOPHA= 0.000 ,I1,I2,I11,I22   129   130     1     1
WN= 154.6 ,K= 468.6 ,TAU1=  5.1826E-01 ,TAU2=  9.0656E-03 ,WN0=     .9 ,KB= 614.9 ,TAUB1=  2.0353E+02 ,TAUB2=  1.4945E+00
PE=  1.0526E-02 ,STDEV=  2.3413E-03 ,V MEAN=  4.5776E-01V STD DEV=  1.8332E-01 ,BITS=  1900
LOCKIN=     1 ,DROPOUTS=0
ERRM
 1.0000E+00  1.0000E+00  0.          0.          0.          0.          0.          0.          1.0000E+00  0.
 0.          0.          0.          0.          0.          2.0000E+00  0.          0.          0.          0.
 0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
 0.          0.          0.          0.          0.          1.0000E+00  0.          0.          0.          0.
 0.          0.          2.0000E+00  0.          0.          0.          2.0000E+00  1.0000E+00  0.          0.
 0.          0.          0.          1.0000E+00  0.          0.          0.          0.          0.          0.
 0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
 0.          0.          0.          0.          0.          0.          0.          1.0000E+00  0.          0.
 0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
 0.          0.          0.          0.          0.          0.          0.          0.          0.          7.0000E+00

-1,-1 P(B/A)TIMES   451                                     -1,+1 P(B/A)TIMES   482
 118    45    18     2     0     1     0     1              0     1     0     0     0     0     0     0
  65    25    24     5     1     1     0     0              1     0     0     0     0     0     0     0
  43    20    26     9     1     0     0     0              1     1     1     0     0     0     0     0
  11    11    11     1     0     0     0     0              2     1     0     0     0     0     0     0
   0     1     3     0     0     0     0     0              6     2     1     1     0     0     0     0
   0     0     0     0     0     0     0     0             40    15     6     3     0     0     0     0
   0     0     0     0     0     0     0     0            104    26    11     3     0     0     0     0
   0     0     0     0     0     0     0     0            132    60    42    19     3     0     0     0
+1,-1 P(B/A)TIMES   483                                     +1,+1 P(B/A)TIMES   484
   0     0     2     1    20    65   114   137              0     0     0     0     0     0     1     0
   0     0     2     0     1    19    30    43              0     0     0     0     0     0     0     0
   0     1     0     0     1     6     5    23              0     0     0     0     0     1     0     1
   0     0     0     1     1     2     3     2              0     0     0     0     0     0     1     0
   0     0     0     0     0     1     0     0              0     0     0     0     0     3     6    13
   0     0     0     0     0     1     0     1              0     0     0     1     3    11    35    48
   0     0     0     0     0     0     0     0              1     0     0     1     1    23    54    77
   0     0     0     0     0     1     0     0              1     0     1     0     4    30    53   114
I1,I2,I11,I22   231   338     1     1
REG SLICE=  2.5097E+01 ,STD DEV=  3.5464E+00                                                BL2 = 164      NO FADE
                                                                                            2/1/74M
```

```
ENDDB=   9.4 ,DELF=  62.0 ,BIF=  1000 ,BL2=   188 ,NSLICE=    26 ,ASOFT= .3000
SYRHZ=  0.          ,SWMX= 2.8150E+04 ,SWMN= 6.8500E+03 ,FLO= 1.0000E+01 ,FRQDOP=  0.          ,FQDPRT= 1.0000E+01
TL= -6.50 ,DYNR=    3.0 ,SDAMP= 0.000 ,SOPHA= 0.000 ,I1,I2,I11,I22   129   130     1     1
WN= 177.2 ,K= 468.6 ,TAU1=  3.9439E-01 ,TAU2=  7.8980E-03 ,WN0=     .9 ,KD= 614.9 ,TAUD1=  2.0353E+02 ,TAUD2=  1.4945E+03
PE=  1.1053E-02 ,STDEV=  2.3985E-03 ,V MEAN=  4.8037E-01V STD DEV=  2.0585E-01 ,BITS=  1900
LOCKIN=     1 ,DROPOUTS=0
ERRM
  1.0000E+00  0.          0.          0.          0.          1.0000E+00  0.          1.0000E+00  1.0000E+00  0.
  0.          0.          0.          1.0000E+00  0.          0.          0.          1.0000E+00  0.          0.
  0.          0.          0.          1.0000E+00  0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  1.0000E+00  0.          1.0000E+00  0.          0.          0.          1.0000E+00  0.          0.          0.
  0.          0.          3.0000E+00  0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          1.0000E+00
  0.          0.          0.          0.          0.          0.          0.          0.          0.          7.0000E+00

-1,-1 P(B/A)TIMES   451                                    -1,+1 P(B/A)TIMES   482
    94    23     6     5     1     0     1     0          0     0     0     0     0     0     0     0
   107    27    20     5     3     0     0     0          0     0     0     0     0     0     0     0
    42    31    25     9     1     0     0     0          0     0     0     0     0     0     0     0
    14    10     9     6     1     0     0     0          2     0     0     0     0     0     0     0
     6     1     2     1     0     0     0     0          7     1     2     1     0     0     0     0
     1     0     0     0     0     0     0     0         29     9     4     0     0     0     0     0
     0     0     0     0     0     0     0     0         64    19    10     3     0     0     0     0
     0     0     0     0     0     0     0     0        157   105    47    16     5     1     0     0
+1,-1 P(B/A)TIMES   402                                    +1,+1 P(B/A)TIMES   485
     0     0     0     4    16    80   116   176          0     0     0     0     0     0     2     0
     0     0     0     0     2    10    13    39          0     0     0     0     0     0     0     0
     0     0     0     0     0     2     2    12          0     0     0     0     0     0     0     0
     0     0     0     0     0     1     3     2          0     0     0     0     0     0     1     3
     0     0     0     0     0     1     0     0          0     0     0     0     1     4     6    13
     0     0     0     0     0     0     0     0          0     0     0     1     3    14    30    68
     0     0     0     0     0     1     0     0          0     0     0     0     8    29    42    84
     0     0     0     0     0     0     0     0          2     0     0     1     3    16    44   110
I1,I2,I11,I22  1050   778     1     1
REC SLICE=  2.6731E+01 ,STD DEV=  3.4284E+00                                          BL2 = 188    NO FADE
                                                                                      2/1/74M
```

```
ENOB=   9.4 ,DELF=  62.0 ,BIF=  1000 ,BL2=  176 ,NSLICE=   26 ,ASOFT= .3000
SVRHZ=  0.        ,SWMX=  2.8150E+04 ,SWMN=  6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=  0.        ,FQOPRT=  1.0800E+01
TL= -6.50 ,DYNR=  3.0 ,SDAMP=  .230 ,SDPHA=  .470 ,I1,I2,I11,I22  129  130    1    1
WN= 165.9 ,K= 468.6 ,TAU1=  4.5000E-01 ,TAU2=  6.4420E-03 ,WNB=    .9 ,KB= 614.9 ,TAUB1=  2.0353E+02 ,TAUB2=  1.4945E+00
PE=  3.0000E-02 ,STDEV=  3.9135E-03 ,V MEAN=  4.6358E-01V STD DEV=  2.0403E-01 ,BITS=  1900
PEI=  2.5263E-02 ,STDEV=  3.6001E-03
LOCKIN=    1 ,DROPOUTS=    1 ,AVE=  9.0000E+00 ,STD DEV=  0.
ERRM
  2.2000E+01  2.0000E+00  1.8000E+00  0.          1.0000E+00  1.0000E+00  0.          1.0000E+00  0.          2.0000E+00
  1.0000E+00  0.          0.          0.          2.0000E+00  0.          0.          0.          0.          1.0000E+00
  1.0000E+00  0.          1.0000E+00  0.          0.          0.          0.          0.          0.          1.0000E+00
  0.          0.          1.0000E+00  0.          0.          1.0000E+00  1.0000E+00  0.          0.          0.
  1.0000E+00  0.          0.          0.          0.          1.0000E+00  0.          0.          0.          0.
  0.          2.0000E+00  0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          1.0000E+00  0.
  1.0000E+00  0.          0.          0.          1.0000E+00  0.          0.          0.          1.0000E+00  1.0000E+00
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          1.0000E+00  0.          0.          0.          0.          0.          0.          0.          7.0000E+00

-1,-1 P(B/A)TIMES   451                                   -1,+1 P(B/A)TIMES   483
  112   26   16    5    2    0    0    0                   4    0    1    1    0    0    0    0
   66   29   23    5    1    0    1    0                   0    0    0    0    1    0    0    0
   41   26   21   12    2    2    1    0                   1    0    0    0    0    0    0    0
   13   11   17    6    0    0    0    1                   4    1    1    0    0    2    0    0
    1    4    1    0    0    0    0    0                   0    1    5    1    0    0    0    0
    1    1    0    2    1    0    0    0                  26    7    4    3    0    0    0    0
    1    0    0    0    0    0    0    0                  69   34   19    6    0    0    1    1
    0    0    0    0    0    0    0    0                 146   68   38   20    5    4    0    1
+1,-1 P(B/A)TIMES   483                                   +1,+1 P(B/A)TIMES   483
    3    1    2    2   19   60  110  136                   2    0    0    2    0    3    1    0
    1    0    0    1    6    0   27   39                   0    0    0    0    1    0    0    0
    2    1    0    1    3    6   13   15                   1    0    0    0    0    1    0    1
    0    0    0    0    1    2    4    6                   0    0    1    0    0    0    1    1
    0    0    0    0    0    1    3    2                   0    0    0    1    2    3   11   10
    0    0    0    0    0    0    2    1                   0    0    0    0    4   12   29   43
    0    0    0    1    0    0    0    1                   1    0    0    0    3   17   56   92
    0    0    0    2    0    0    1    0                   4    0    1    1    3   15   41  119
I1,I2,I11,I22   638  1850   529   737
REC SLICE=  2.6309E+01 ,STD DEV=  3.5759E+00
```

TAU4 = 1.808E-3 (88 Hz) FADING
2/4/74A

```
ENOOB=   9.4 ,DELF=  62.0 ,BIF=  1000 ,BL2=   176 ,NSLICE=    26 ,ASOFT= .3000
SVRHZ=  0.          ,SWMX=  2.8150E+04 ,SWMN=  6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=  0.          ,FQDPRT=  1.0000E+01
TL= -6.50 ,DYNR=   3.0 ,SDAMP=  .230 ,SOPHA=  .470 ,I1,I2,I11,I22   129   130     1     1
WN= 165.9 ,K= 468.6 ,TAU1=  4.5000E-01 ,TAU2=  8.4420E-03 ,WNB=     .9 ,KB= 614.9 ,TAUB1=  2.0353E+02 ,TAUB2=  1.4945E+00
PE=  3.6316E-02 ,STDEV=  4.2918E-03 ,V MEAN=  4.7428E-01V STD DEV=  2.3727E-01 ,BITS=  1900
PEI=  2.4737E-02 ,STDEV=  3.5633E-03
LOCKIN=     1 ,DROPOUTS=     1 ,AVE=  4.0000E+00 ,STD DEV=  0.
ERRM
  1.3000E+01  4.0000E+00  3.0000E+00  2.0000E+00  1.0000E+00  2.0000E+00  2.0000E+00  1.0000E+00  3.0000E+00  2.0000E+00
  0.          1.0000E+00  1.0000E+00  1.0000E+00  1.0000E+00  2.0000E+00  1.0000E+00  0.          0.          1.0000E+00
  1.0000E+00  1.0000E+00  0.          1.0000E+00  0.          0.          2.0000E+00  0.          0.          0.
  1.0000E+00  0.          1.0000E+00  1.0000E+00  1.0000E+00  1.0000E+00  1.0000E+00  1.0000E+00  0.          2.0000E+00
  0.          0.          0.          0.          0.          0.          0.          1.0000E+00  0.          0.
  0.          0.          0.          1.0000E+00  0.          0.          1.0000E+00  0.          1.0000E+00  0.
  0.          0.          0.          0.          0.          0.          0.          1.0000E+00  0.          0.
  1.0000E+00  0.          1.0000E+00  0.          0.          0.          0.          0.          0.          0.
  0.          1.0000E+00  1.0000E+00  0.          0.          1.0000E+00  0.          0.          0.          0.
  0.          1.0000E+00  0.          0.          0.          0.          0.          0.          0.          3.0000E+00

-1,-1 P(B/A)TIMES   453                                    -1,+1 P(B/A)TIMES   482
 109   31   21    6    3    2    0    0          3    1    0    0    0    0    0    0
  64   19   22    6    1    0    0    0          1    0    0    0    0    0    0    0
  45   23   24    7    2    0    0    0          0    0    0    0    1    0    0    0
  18    6   12    5    5    2    0    0          6    0    1    0    0    0    0    0
   6    2    2    3    0    1    0    0          0    2    1    1    0    0    0    0
   1    0    3    0    0    0    0    0         31   12    7    4    0    1    2    0
   0    0    0    1    1    0    0    0         65   24   11    5    0    1    0    0
   0    0    0    0    0    0    0    0        157   61   41   26    6    0    1    2
+1,-1 P(B/A)TIMES   483                                    +1,+1 P(B/A)TIMES   482
   0    1    0    6   26   70   97  142          1    0    0    1    0    1    1    1
   0    0    0    2    3   17   15   32          0    1    0    0    2    0    1    0
   2    1    1    0    1    7    9   24          0    0    0    0    0    1    0    0
   2    0    0    1    1    4    6    2          0    0    0    0    1    3    5    6
   0    0    0    0    0    1    2    2          0    0    0    1    2   11    8   18
   1    0    0    0    0    1    0    1          1    0    0    5    4   11   24   66
   0    0    0    0    0    0    1    0          1    1    1    2    7   17   29   73
   0    0    0    0    0    1    1    0          1    1    0    4    5   23   38  103
I1,I2,I11,I22   638  1850   529   737
REG SLICE=  2.6399E+01 ,STD DEV=  3.2639E+00
```

TAU4 = 1.1052E-3 (144 Hz) FADING
2/4/74A

ENOOB= 9.4 ,DELF= 62.0 ,BIF= 1000 ,BL2= 176 ,NSLICE= 26 ,ASOFT= .3000
SVRHZ= 0. ,SWMX= 2.8150E+04 ,SWMN= 6.8500E+03 ,FLO= 1.0000E+01 ,FRQDOP= 0. ,FQDPRT= 1.0800E+01
TL= -6.50 ,OYNR= 3.0 ,SOAMP= .230 ,SOFHA= .470 ,I1,I2,I11,I22 129 130 1 1
WN= 165.9 ,K= 468.6 ,TAU1= 4.5000E-01 ,TAU2= 8.4420E-03 ,WNB= .9 ,KB= 614.9 ,TAUB1= 2.0353E+02 ,TAUB2= 1.4945E+00
PE= 5.0000E-02 ,STDEV= 5.0000E-03 ,V MEAN= 4.8705E-01V STD DEV= 2.5952E-01 ,BITS= 1900
PEI= 2.5263E-02 ,STDEV= 3.6001E-03
LOCKIN= 1 ,DROPOUTS= 1 ,AVE= 0.0000E+00 ,STD DEV= 0.
ERRM

1.6000E+01	6.6600E+00	8.0000E+00	1.0000E+00	3.0000E+00	3.0000E+00	1.0000E+00	0.	2.0000E+00	5.0000E+00
1.0000E+00	4.0000E+00	2.0000E+00	1.0000E+00	3.0000E+00	2.0000E+00	4.0000E+00	0.	3.0000E+00	3.0000E+00
0.	0.	1.0000E+00	0.	1.0000E+00	1.0000E+00	1.0000E+00	2.0000E+00	1.0000E+00	1.0000E+00
0.	2.0000E+00	0.	0.	0.	2.0000E+00	1.0000E+00	1.0000E+00	0.	1.0000E+00
0.	0.	0.	0.	0.	0.	0.	1.0000E+00	0.	0.
1.0000E+00	0.	0.	1.0000E+00	1.0000E+00	0.	0.	1.0000E+00	0.	1.0000E+00
0.	0.	0.	0.	0.	0.	1.0000E+00	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	2.0000E+00
0.	0.	0.	0.	1.0000E+00	0.	0.	0.	0.	0.
0.	2.0000E+00	0.	0.	0.	0.	0.	0.	0.	0.

-1,-1 P(B/A)TIMES 451

92	24	28	9	4	2	0	2
55	18	17	10	1	0	0	0
56	9	13	10	9	0	0	1
24	8	12	11	1	2	0	0
12	2	5	3	0	1	0	1
3	1	0	2	0	0	0	0
0	1	0	0	0	0	0	0
0	0	0	1	0	1	0	0

-1,+1 P(B/A)TIMES 483

1	2	0	1	0	0	0	0
0	0	0	0	3	0	0	0
3	0	1	1	0	0	0	0
1	3	1	0	0	0	0	0
17	5	0	0	1	1	0	0
24	10	6	2	0	0	0	1
52	14	13	5	0	1	0	2
177	63	39	20	10	1	1	1

+1,-1 P(B/A)TIMES 483

1	1	2	11	29	56	78	178
0	1	0	3	5	12	11	27
1	2	1	1	0	5	9	18
1	2	0	0	2	2	3	7
0	0	0	0	0	1	1	3
0	0	0	0	0	1	1	1
0	0	0	0	0	0	0	0
0	0	1	1	1	1	1	1

+1,+1 P(B/A)TIMES 483

0	0	0	0	2	0	0	0
0	0	0	1	3	0	0	0
1	0	0	0	1	0	1	0
0	0	0	1	2	2	3	14
0	0	1	1	4	7	6	27
1	0	1	3	7	11	17	51
0	0	0	1	5	12	26	72
1	1	2	4	9	25	46	111

I1,I2,I11,I22 638 1850 529 737
REC SLICE= 2.6220E+01 ,STD DEV= 3.3752E+00

TAU4 = 7.9577E-4 (200 Hz) FADING
2/4/74A

```
ENODB=   9.4 ,DELF=  62.0 ,DIF=  1008 ,DL2=   176 ,NSLICE=    26 ,ASOFT= .3000
SVRHZ=  0.        ,SWMX=  2.8150E+04 ,SWMN=  6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=  0.        ,FQDPRT=  1.0800E+01
TL= -6.50 ,DYNR=   3.0 ,SDAMP= 0.000 ,SDPHA= 0.000 ,I1,I2,I11,I22   129   130     1     1
WN= 165.9 ,K= 468.6 ,TAU1=  4.5000E-01 ,TAU2=  8.4420E-03 ,WNB=     .9 ,KB= 614.9 ,TAUB1=  2.0353E+02 ,TAUB2=  1.4945E+00
PE=  8.4211E-03 ,STDEV=  2.0964E-03 ,V MEAN=  4.6061E-01V STD DEV=  1.9806E-01 ,BITS=  1900
PEI=  5.2632E-03 ,STDEV=  1.6600E-03
LOCKIN=     1 ,DROPOUTS=0
ERRM
    0.          1.0000E+00  0.          0.          0.          1.0000E+00  0.          0.          0.          0.
    0.          1.0000E+00  0.          0.          0.          1.0000E+00  0.          0.          0.          0.
    0.          1.0000E+00  0.          0.          0.          0.          0.          0.          0.          0.
    0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
    0.          0.          0.          0.          1.0000E+00  0.          0.          0.          0.          0.
    0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
    0.          0.          0.          0.          1.0000E+00  1.0000E+00  0.          0.          0.          0.
    0.          0.          0.          0.          0.          0.          0.          0.          1.0000E+00  0.
    0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
    0.          0.          1.0000E+00  0.          0.          0.          0.          0.          0.          6.0000E+00

-1,-1 P(B/A)TIMES   450                                         -1,+1 P(B/A)TIMES   483
  115    31    14     3     1     0     0     0                  0     0     0     0     0     0     0     0
   75    26    13    11     3     0     0     0                  0     1     0     0     0     0     0     0
   38    41    20     6     1     0     0     0                  1     0     0     0     0     0     0     0
   15    10     8     1     1     0     0     0                  0     0     0     0     0     0     0     0
    4     2     3     0     0     0     0     0                  0     4     0     0     0     0     0     0
    0     0     0     0     0     0     0     0                 37    10     3     1     0     0     0     0
    0     0     0     0     0     0     0     0                 91    26    16     3     0     0     0     0
    0     0     0     0     0     0     0     0                142    64    52    19     5     0     0     0
+1,-1 P(B/A)TIMES   482                                         +1,+1 P(B/A)TIMES   485
    0     0     1     2    22    74   118   145                  0     0     0     0     0     0     1     0
    0     1     0     0     3    15    21    47                  0     0     0     0     0     0     0     0
    0     0     0     0     0     5     8    10                  0     0     0     0     0     0     0     0
    0     0     0     0     1     1     3     3                  0     0     0     0     0     0     1     1
    0     0     0     0     2     0     0     0                  0     0     0     0     2     4    13    14
    0     0     0     0     0     0     0     0                  0     0     0     0     6    19    30    50
    0     0     0     0     0     0     0     0                  0     0     0     0     6    14    41    91
    0     0     0     0     0     0     0     0                  1     0     0     0     3    24    52   112
I1,I2,I11,I22  1594  1314     1     1
REC SLICE=  2.6191E+01 ,STD DEV=  3.2335E+00                                   TAU4 = 1.8086E-8  (88 Hz)   NO FADING
                                                                               2/24/74A
```

ENOOD= 9.4 ,DELF= 62.0 ,BIF= 1000 ,BL2= 176 ,NSLICE= 26 ,ASOFT= .3000
SVRHZ= 0. ,SWMX= 2.8150E+04 ,SWMN= 6.8500E+03 ,FLO= 1.0000E+01 ,FRQDOP= 0. ,FQDPRT= 1.0800E+01
TL= -6.50 ,DYNR= 3.0 ,SDAMP= 0.000 ,SDPHA= 0.000 ,I1,I2,I11,I22 129 130 1 1
WN= 165.9 ,K= 468.6 ,TAU1= 4.5000E-01 ,TAU2= 8.4420E-03 ,WNB= .9 ,KB= 614.9 ,TAUB1= 2.0353E+02 ,TAUB2= 1.4945E+00
PE= 1.6842E-02 ,STDEV= 2.9521E-03 ,V MEAN= 4.8570E-01V STD DEV= 2.2475E-01 ,BITS= 1900
PEI= 5.7895E-03 ,STDEV= 1.7405E-03
LOCKIN= 1 ,DROPOUTS=0
ERRM

1.0000E+00	1.0000E+00	2.0000E+00	1.0000E+00	0.	1.0000E+00	0.	0.	0.	0.
0.	0.	0.	0.	1.0000E+00	0.	0.	0.	1.0000E+00	1.0000E+00
0.	1.0000E+00	0.	0.	0.	0.	0.	1.0000E+00	0.	1.0000E+00
0.	1.0000E+00	0.	0.	0.	0.	1.0000E+00	0.	0.	0.
1.0000E+00	0.	0.	0.	0.	0.	1.0000E+00	0.	0.	0.
0.	1.0000E+00	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	2.0000E+00	1.0000E+00	0.	0.	1.0000E+00	0.	1.0000E+00	0.
0.	0.	0.	1.0000E+00	0.	1.0000E+00	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	1.0000E+00	0.	1.0000E+00
0.	1.0000E+00	0.	0.	1.0000E+00	0.	0.	0.	0.	4.0000E+00

-1,-1 P(B/A)TIMES 455

97	41	7	5	2	0	0	0
81	21	20	12	1	2	0	0
50	21	20	10	3	1	0	1
17	10	12	5	2	0	0	1
4	4	0	2	0	0	0	0
1	1	0	1	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0

-1,+1 P(B/A)TIMES 482

0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0
4	1	0	0	0	0	0	0
11	2	0	0	1	0	0	0
33	6	1	1	0	0	0	0
63	19	11	3	1	0	0	0
170	83	53	15	3	0	0	0

+1,-1 P(B/A)TIMES 482

0	0	0	5	20	77	98	178
0	0	0	0	0	9	19	38
0	0	1	0	0	1	4	12
0	0	0	0	0	0	2	5
0	0	0	0	0	1	0	2
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	1	0	1	0	0

+1,+1 P(B/A)TIMES 481

0	0	0	0	0	1	0	0
0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0
0	0	0	0	0	1	1	4
0	0	0	1	3	5	10	19
0	0	0	2	7	13	24	57
0	0	0	0	8	17	33	77
1	1	0	2	6	18	41	128

I1,I2,I11,I22 638 1850 1 1
REC SLICE= 2.5999E+01 ,STD DEV= 3.5218E+00

TAU4 = 1.1052E-3 (144 Hz) NO FADING
2/4/74A

```
ENDD=   9.4 ,DELF=  62.0 ,DIF=  1000 ,DL2=   176 ,NSLICE=    26 ,ASOFT= .3000
SVRHZ=  0.          ,SWMX=  2.8150E+04 ,SWMN=  6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=  0.          ,FQDPRT=  1.0800E+01
TL= -6.50 ,DYNR=   3.0 ,SDAMP= 0.000 ,SDPHA= 0.000 ,I1,I2,I11,I22   129   130     1     1
WN= 165.9 ,K= 468.6 ,TAU1=  4.5000E-01 ,TAU2=  8.4420E-03 ,WN0=    .9 ,KB= 614.9 ,TAUB1=  2.0353E+02 ,TAUB2=  1.4945E+00
PE=  4.8526E-02 ,STDEV=  4.5239E-03 ,V MEAN=  4.8521E-01V STD DEV=  2.5101E-01 ,BITS=  1900
PEI=  7.8947E-03 ,STDEV=  2.0303E-03
LOCKIN=     1 ,DROPOUTS=0
ERRM
 1.0000E+01  3.0000E+00  3.0000E+00  3.0000E+00  1.0000E+00  1.0000E+00  0.          2.0000E+00  1.0000E+00  2.0000E+00
 0.          2.0000E+00  1.0000E+00  1.0000E+00  0.          3.0000E+00  2.0000E+00  2.0000E+00  1.0000E+00  1.0000E+00
 2.0000E+00  1.0000E+00  1.0000E+00  0.          1.0000E+00  1.0000E+00  0.          2.0000E+00  3.0000E+00  1.0000E+00
 0.          0.          0.          3.0000E+00  1.0000E+00  2.0000E+00  0.          0.          2.0000E+00  1.0000E+00
 1.0000E+00  0.          3.0000E+00  0.          1.0000E+00  0.          0.          1.0000E+00  0.          0.
 1.0000E+00  0.          1.0000E+00  1.0000E+00  0.          0.          0.          0.          0.          0.
 0.          0.          0.          0.          1.0000E+00  1.0000E+00  0.          0.          0.          0.
 0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
 0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
 0.          1.0000E+00  0.          0.          0.          0.          0.          0.          0.          2.0000E+00

-1,-1 P(B/A)TIMES   451                                   -1,+1 P(B/A)TIMES   483
 106    21    18     6     2     1     0     1            1     1     0     0     0     0     0     0
  59    24    13    11     3     0     0     0            0     0     0     0     0     0     0     0
  49    24    29     5     7     0     0     0            0     2     0     0     0     0     0     0
  20    15     9     4     0     1     0     0            3     1     1     1     0     0     0     0
   4     5     8     0     3     1     0     0           10     6     4     0     2     0     0     0
   5     1     4     0     0     0     0     0           25     6     2     2     0     0     0     0
   0     0     0     0     0     0     0     0           67    13    13     3     1     1     0     0
   0     0     0     0     0     0     0     0          178    58    47    22     7     6     0     0
+1,-1 P(B/A)TIMES   483                                   +1,+1 P(B/A)TIMES   483
   0     0     2    16    34    57    93   178            1     0     0     0     1     0     1     1
   0     0     2     2     5    10    10    39            0     0     0     0     0     0     0     0
   0     0     0     1     2     2     5    15            0     0     0     2     0     2     0     0
   1     0     0     0     1     1     1     1            0     0     0     2     0     6     4    11
   0     0     0     0     1     0     1     2            0     0     0     0     1     7    17    20
   0     0     0     0     0     0     0     0            0     0     0     3     5    19    27    49
   0     0     0     0     0     0     0     0            1     0     1     0     3    18    23    82
   0     0     0     0     0     0     0     1            3     0     1     3    14    16    44    95

I1,I2,I11,I22  1594  1314     1     1
REG SLICE=  2.6126E+01 ,STD DEV=  3.3029E+00
```

TAU4 = 7.9577E-4 (200 Hz) NO FADING
2/4/74A

```
ENODB=    9.2 ,DELF=  66.0 ,BIF=  1000 ,BL2=   164 ,NSLICE=    26 ,ASOFT= .3000
SVRHZ=  0.          ,SWMX=  2.8150E+04 ,SWMN=  6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=  0.          ,FQDPRT=  1.0800E+01
TL= -6.50 ,DYNR=    3.0 ,SDAMP=   .230 ,SDPHA=   .470 ,I1,I2,I11,I22   129   130     1     1
HN= 154.6 ,K= 468.6 ,TAU1=  5.1826E-01 ,TAU2=  9.0656E-03 ,WNB=    .9 ,KB= 577.6 ,TAJB1=  2.0353E+02 ,TAUB2=  1.4945E+00
PE=  4.3158E-02 ,STDEV=  4.6620E-03 ,V MEAN=  4.6717E-01V STD DEV=  2.1551E-01 ,BITS=  1900
PEI=  4.6316E-02 ,STDEV=  4.8216E-03
LOCKIN=     1 ,DROPOUTS=     1 ,AVE=  9.0000E+00 ,STD DEV=  0.
ERRM
  2.6000E+01  2.0000E+00  3.0000E+00  2.0000E+00  4.0000E+00  0.          3.0000E+00  0.          2.0000E+00  0.
  1.0000E+00  0.          1.0000E+00  0.          2.0000E+00  3.0000E+00  1.0000E+00  0.          0.          2.0000E+00
  1.0000E+00  0.          0.          1.0000E+00  1.0000E+00  1.0000E+00  0.          1.0000E+00  0.          0.
  2.0000E+00  2.0000E+00  1.0000E+00  0.          0.          2.0000E+00  0.          1.0000E+00  2.0000E+00  0.
  1.0000E+00  0.          0.          1.0000E+00  1.0000E+00  0.          0.          0.          0.          1.0000E+00
  0.          0.          0.          0.          0.          0.          0.          0.          0.          1.0000E+00
  0.          0.          1.0000E+00  1.0000E+00  0.          0.          0.          1.0000E+00  0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          1.0000E+00
  0.          1.0000E+00  0.          0.          0.          0.          0.          0.          0.          0.
  0.          2.0000E+00  0.          0.          0.          0.          1.0000E+00  0.          0.          2.0000E+00

-1,-1 P(B/A)TIMES   451
  111    39    22    12     2     5     0     1
   71    20    16     7     0     1     0     0
   32    27    14     9     2     0     0     0
   15     9    14     5     2     0     0     0
    2     1     4     0     0     0     0     1
    1     0     1     0     2     0     0     1
    0     0     0     0     0     0     0     0
    0     1     1     0     0     0     0     0

-1,+1 P(B/A)TIMES   483
    3     2     0     1     0     0     0     0
    2     1     0     1     0     0     0     0
    3     1     1     0     0     0     0     0
    5     1     4     2     0     0     0     0
   18     9     5     1     0     0     0     0
   31     9     8     1     1     1     0     0
   74    20     7     5     3     0     0     1
  137    66    30    19     3     6     1     0

+1,-1 P(B/A)TIMES   483
    3     0     1     5    11    47    98   148
    3     2     1     2     5    13    29    36
    1     1     0     1     7     7    11    15
    1     0     0     0     3     2     5     7
    0     0     0     3     1     2     1     0
    0     0     0     1     0     3     3     1
    1     0     0     0     0     0     0     0
    0     0     0     0     0     0     0     2

+1,+1 P(B/A)TIMES   483
    1     1     0     1     4     0     1     1
    1     0     0     0     0     0     0     0
    0     0     0     0     0     2     1     0
    1     1     2     1     1     2     0     1
    0     0     0     2     0     1     3     8
    0     0     1     2     1     7    16    38
    0     0     0     1     4    15    43    84
    3     0     3     2    10    15    46   156

I1,I2,I11,I22   231   338   529   737
REC SLICE=  2.5264E+01 ,STD DEV=  3.8017E+00
```

WORST CASE 1 2/5/74A

FADING

```
 ENODB=   9.2 ,DELF=  60.0 ,BIF=  1000 ,BL2=   188 ,NSLICE=    25 ,ASOFT= .3000
 SVRHZ=  0.          ,SWMX=  2.8150E+04 ,SWMN=  6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=  0.          ,FQDPRT=  1.0800E+01
 TL= -6.50 ,DYNR=   3.0 ,SDAMP=  .230 ,SDPHA=  .470 ,I1,I2,I11,I22   129   130     1     1
 WN= 177.2 ,K= 468.6 ,TAU1=  3.9439E-01 ,TAU2=  7.8980E-03 ,WNB=   .9 ,KB= 635.3 ,TAUB1=  2.0353E+02 ,TAUB2=  1.4945E+00
 PE=  2.4737E-02 ,STDEV=  3.5633E-03 ,V MEAN=  4.6380E-01V STD DEV=  2.1519E-01 ,BITS=  1900
 PEI=  1.5789E-02 ,STDEV=  2.8599E-03
 LOCKIN=     1 ,DROPOUTS=     1 ,AVE=  2.0000E+00 ,STD DEV=  0.
 ERRM
   1.1000E+01  1.0000E+00  3.0000E+00  0.          1.0000E+00  0.          0.          0.          1.0000E+00  0.
   0.          0.          1.0000E+00  0.          1.0000E+00  0.          0.          1.0000E+00  0.          0.
   0.          0.          0.          0.          1.0000E+00  0.          1.0000E+00  0.          0.          1.0000E+00
   0.          1.0000E+00  1.0000E+00  0.          0.          0.          0.          0.          1.0000E+00  0.
   1.0000E+00  0.          0.          1.0000E+00  1.0000E+00  0.          0.          0.          0.          2.0000E+00
   1.0000E+00  0.          0.          0.          1.0000E+00  0.          0.          1.0000E+00  1.0000E+00  0.
   0.          1.0000E+00  1.0000E+00  0.          0.          0.          0.          0.          1.0000E+00  0.
   0.          0.          0.          0.          1.0000E+00  1.0000E+00  0.          0.          0.          0.
   1.0000E+00  0.          0.          0.          0.          0.          0.          0.          0.          0.
   1.0000E+00  0.          0.          0.          0.          0.          0.          0.          0.          5.0000E+00

 -1,-1 P(B/A)TIMES   453                                   -1,+1 P(B/A)TIMES   482
      97     38      7      6      2      1      0      0          2      1      1      0      1      0      0      1
      73     30     18     10      0      1      0      0          0      0      0      0      1      0      0      0
      42     24     22     10      3      0      0      0          2      0      0      0      0      0      0      0
      16     16     14      9      2      0      0      0          6      0      0      0      0      0      0      0
       2      3      3      1      0      0      0      0          5      2      2      1      0      0      0      0
       1      0      0      1      0      0      0      0         28     12      4      0      0      0      0      0
       0      0      0      0      0      0      0      0         75     19     15      6      0      0      0      1
       0      1      0      0      0      0      0      0        154     72     40     27      3      1      0      0
 +1,-1 P(B/A)TIMES   483                                   +1,+1 P(B/A)TIMES   482
       0      0      1      4     24     76    102    146          1      0      0      1      0      0      0      0
       1      0      0      0      6     15     19     45          1      0      0      1      2      0      0      0
       1      1      0      0      2      5      6     10          0      2      0      0      0      1      0      0
       2      0      1      1      1      2      3      4          0      0      0      0      1      2      1      2
       1      1      0      0      0      1      0      0          0      0      1      1      2      5     11     17
       0      0      0      0      0      0      0      1          0      0      0      1      3     22     32     64
       0      0      0      0      0      0      0      0          0      0      0      1      1     12     46     82
       0      0      0      0      0      0      0      1          1      1      2      2      5     25     38     92
 I1,I2,I11,I22  1594  1314   529   737
 REC SLICE=  2.6816E+01 ,STD DEV=  3.6702E+00                                                  WORST CASE 2   FADING
                                                                                               2/5/74A
```

```
 ENODB=   9.2 ,DELF=  66.0 ,BIF=  1000 ,BL2=   164 ,NSLICE=    26 ,ASOFT= .3000
 SVRHZ=  0.          ,SWMX=  2.8150E+04 ,SWMN=  6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=  0.          ,FQDPRT=  1.0000E+01
 TL= -6.50 ,DYNR=   3.8 ,SDAMP= 0.000 ,SDPHA= 0.000 ,I1,I2,I11,I22   129   130     1     1
 HN=  154.6 ,K=  468.6 ,TAU1=  5.1826E-01 ,TAU2=  9.0656E-03 ,HNB=     .9 ,KB=  577.6 ,TAUB1=  2.0353E+02 ,TAUB2=  1.4945E+00
 PE=  1.5789E-02 ,STDEV=  2.8599E-03 ,V MEAN=  4.7442E-01V STD DEV=  2.0162E-01 ,BITS=  1900
 PEI=  1.4211E-02 ,STDEV=  2.7153E-03
 LOCKIN=     1 ,DROPOUTS=     1 ,AVE=  1.0000E+00 ,STD DEV=  0.
 ERRM
   3.0000E+00  1.0000E+00  1.0000E+00  1.0000E+00  1.0000E+00  1.0000E+00  0.          0.          0.          0.
   2.0000E+00  0.          1.0000E+00  0.          0.          0.          0.          0.          0.          1.0000E+00
   0.          0.          0.          0.          0.          0.          1.0000E+00  0.          1.0000E+00  0.
   0.          0.          0.          1.0000E+00  0.          0.          0.          0.          0.          0.
   0.          1.0000E+00  1.0000E+00  0.          0.          0.          0.          0.          0.          0.
   0.          1.0000E+00  0.          0.          0.          0.          0.          0.          0.          1.0000E+00
   0.          0.          0.          0.          1.0000E+00  0.          1.0000E+00  1.0000E+00  1.0000E+00  0.
   0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
   0.          0.          0.          0.          0.          0.          0.          0.          0.          1.0000E+00
   0.          0.          0.          0.          0.          0.          0.          0.          0.          6.0000E+00

-1,-1 P(B/A)TIMES   451                          -1,+1 P(B/A)TIMES   483
   123    43    15     3     0     1     0     1          1     0     0     0     0     0     0     0
    67    34    21     6     2     0     0     1          0     0     0     0     0     0     0     0
    46    22    19     9     2     0     1     0          3     0     1     0     0     0     0     0
     8    14     6     1     0     0     0     0          3     1     1     0     0     0     0     0
     2     1     0     0     0     0     0     0         11     2     4     0     0     0     0     1
     0     0     0     0     0     0     0     0         30    14     5     1     0     0     0     1
     0     0     0     0     0     0     0     0        105    28    14     1     0     0     0     0
     0     1     2     0     0     0     0     0        129    65    46    13     3     0     0     0

+1,-1 P(B/A)TIMES   483                          +1,+1 P(B/A)TIMES   483
     0     0     1     3    18    48   126   146          0     0     0     0     0     0     1     0
     1     0     0     1     3    13    31    45          0     0     0     0     0     0     0     0
     0     0     1     0     0     0     9    17          0     0     0     0     0     0     1     0
     0     0     0     0     1     0     1     3          0     0     0     0     1     1     0     3
     0     0     1     1     0     1     1     0          0     0     1     0     0     0     0     5
     0     0     0     0     1     0     0     0          0     0     0     3     3    10    23    39
     0     0     0     0     0     0     0     1          1     0     0     0     1    20    48    91
     0     0     0     0     1     0     0     0          0     0     1     2     4    28    60   127

 I1,I2,I11,I22   231   338     1     1
 REC SLICE=  2.4832E+01 ,STD DEV=  3.6204E+00
                                                                                  WORST CASE I   NO FADING
                                                                                  2/5/74A
```

```
ENODB=    9.2 ,DELF=   60.0 ,BIF=   1000 ,BL2=    188 ,NSLICE=     25 ,ASOFT= .3000
SVRHZ=   0.          ,SHMX=  2.8150E+04 ,SHMN=  6.8500E+03 ,FLO=  1.0000E+01 ,FRQDOP=  0.          ,FQDPRT=  1.0000E+01
TL= -6.50 ,DYNR=    3.0 ,SDAMP= 0.000 ,SDPHA= 0.000 ,I1,I2,I11,I22    129    130      1      1
HN= 177.2 ,K= 468.6 ,TAU1=  3.9439E-01 ,TAU2=  7.8980E-03 ,HNB=     .9 ,KB= 635.3 ,TAU81=  2.0353E+02 ,TAU82=  1.4945E+00
PE=  8.4211E-03 ,STDEV=  2.0964E-03 ,V MEAN=  4.6102E-01V STD DEV=  1.9944E-01 ,BITS=  1900
PEI=  2.1053E-03 ,STDEV=  1.0515E-03
LOCKIN=      1 ,DROPOUTS=0
ERRM
  1.0000E+00  1.0000E+00  1.0000E+00  0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          1.0000E+00  0.
  0.          0.          0.          0.          0.          0.          0.          0.          1.0000E+00  0.
  1.0000E+00  0.          1.0000E+00  0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
  0.          0.          0.          0.          0.          0.          0.          0.          0.          9.0000E+00

-1,-1 P(B/A)TIMES   450                                   -1,+1 P(B/A)TIMES   483
    95    20    15     2     0     0     0     0          0     0     0     0     0     0     0     0
    72    40    14    12     3     1     0     0          0     0     0     0     0     0     0     0
    49    33    28    11     1     0     0     0          1     0     0     0     0     0     0     0
    15    12    12     2     2     0     0     0          1     0     0     0     0     0     0     0
     5     2     2     1     0     0     0     0          9     2     2     0     0     0     0     0
     1     0     0     0     0     0     0     0         33     6     4     0     0     0     0     0
     0     0     0     0     0     0     0     0         83    27    13     4     1     0     0     0
     0     0     0     0     0     0     0     0        147    80    49    18     7     0     0     0
+1,-1 P(B/A)TIMES   482                                   +1,+1 P(B/A)TIMES   485
     0     0     1     3    26    67   132   150          0     0     0     0     0     0     0     0
     0     0     0     0     6    16    24    34          0     0     0     0     0     0     0     0
     0     0     0     0     1     3     6     7          0     0     0     0     0     0     0     0
     0     0     0     0     2     0     3     1          0     0     0     0     0     1     0     2
     0     0     0     0     0     0     0     0          0     0     0     0     0     8    13    15
     0     0     0     0     0     0     0     0          0     0     0     0     1    25    36    58
     0     0     0     0     0     0     0     0          0     0     0     1     8    24    43    89
     0     0     0     0     0     0     0     0          0     0     0     0     5    19    35   102
I1,I2,I11,I22  1594  1314     1     1
REC SLICE=  2.6949E+01 ,STD DEV=  3.2632E+00                                   WORST CASE 2
                                                                               2/5/74A
                                                                                          NO FADING
```

APPENDIX X
ALTERNATE CONTINUOUS PHASE MODULATORS

Three alternate continuous phase modulators, a three step upconverter, an indirect FM modulator and a single step upconverter were considered during the course of this study. The latter was finally selected because of its simplicity and minimum parts count. This appendix discusses these alternate designs.

Three Step Upconverter

Figure 1 shows the block diagram for the modulator and upconverter. The 400 MHz FSK signal is synthesized by generating a 1 MHz signal in a voltage controlled crystal oscillator and up-converting this signal by mixing it with higher frequencies derived from a 23 MHz crystal oscillator. The mixing is done in three steps to make filtering practical at each frequency. FSK is accomplished by pulling the 1 MHz VCXO with a $\pm$3.2 volt DC signal amplified from the TTL data.

The oscillators are specified to have an end-of-life long term drift of $\pm$10 ppm. The 1 MHz oscillator is voltage controlled to provide the 64 Hz frequency shift. A VCO was chosen over frequency switching to provide phase continuity between frequencies.

A typical modulation range for a crystal oscillator is 80 ppm (Frequency Electronics, Inc.). For the needed 64 Hz modulation, this requires a 1 MHz center frequency and a DC control voltage of $\pm$3.2 volts. The frequency will typically switch in 20 microseconds.

The power losses and gains are indicated in Figure X-1. The criteria for the design are:

- o An input of 6 dBm into the local oscillator port of the mixer.
- o 0 dBm or less into the signal port to maintain at least a 6 dB ratio to minimize spurs.
- o Limit amplifier gain to approximately 10 dB due to environmental constraints.

The mixers have a loss of approximately 6 dB at a ratio of 6 dB between signal and L.O. (per Relcom Co.).

Filters are provided in the L.O. lines to eliminate the harmonics of the square waves generated by multiplying and dividing. This application is not critical.

Filters are also provided after each mixing operation to eliminate harmonic spurs. The filter bandwidths were chosen to have a -60 dB bandwidth at less than the separation of the closest low order spurs.

The spurs of the first mixer were the closest and a crystal filter is required. The crystal filter is specified by Crystal Network Products. The 2nd and 3rd mixer filters are designed according to Texscan tubular filter specifications and are summarized in Figure 1. The main objection to the Figure 1 design* is its overall hardware complexity, high parts count, and consequently, its lower reliability, higher power consumption, and added weight. Based on information obtained from a crystal oscillator manufacturer alternate designs are possible.

The following are the constraints which dictated the design parameters:

1. The modulation index is .7 radians $\pm$5% over the temperature range of -40°F to +160°F.
2. Over the temperature range, an ovenized oscillator can be pulled a minimum of $\pm$1 ppm and a maximum of $\pm$100 ppm. The minimum value is indicated by a crystal oscillator vendor as being the value one could pull an oscillator to an accuracy of <5%. The maximum is constrained by the phase noise of an oscillator which should be >76 dBc at 100 Hz from the carrier in a 1 Hz bandwidth. To deviate $\pm$31 Hz, this implies a VCXO may be centered between 300 KHz and 30 MHz. However, due to the limitations of practical crystal cuts, the best oscillators are constructed in the 5 to 20 MHz range.
3. The minimum two-sided bandpass filter 3 dB bandwidth is to be 3%. The filter attenuation of the closest spur should be at least 40 dB down at the modulator output. This is because the non-linear power amplifiers will enhance the spurs approximately 15 dB and also create intermodulation products. Because of the extreme temperature range and associated filter drift problems, 60 dB will be used as the design

*M. D. Saferstain, "SAEP Modulator", TRW IOC 7322.4-15, November 19, 1973.

constraint. The filter will have a maximum of 5 poles to minimize filter size and number of elements and maximize reliability.

Given these constraints, two alternate modulator configurations are realizable as shown in Figures X-2 and X-3.

Indirect FM Modulator

The indirect FM modulator design based on the narrowband phase modulator concept conceived by Armstrong, integrates the data, linearly phase modulates the resultant waveform with a modulation index of 0.0775, and multiplies the modulated carrier 8 times to achieve an output frequency of 400 MHz at a modulation index of 0.7. Linear phase modulation is achieved by summing the carrier in quadrature with the double sideband suppressed carrier modulated signal; i.e., the output Y(t) as a function of the input signal X(t) is,

$$Y(t) = \cos(\omega_c t) + X(t)\sin(\omega_c t)$$

$$= \cos(\omega_c t + \tan^{-1}X(t)) \simeq \cos(\omega_c t + X(t))$$

for $|X(t)| << 1$. In this case, $X(t) = \beta\int\phi(t)dt$ where β is the modulation index

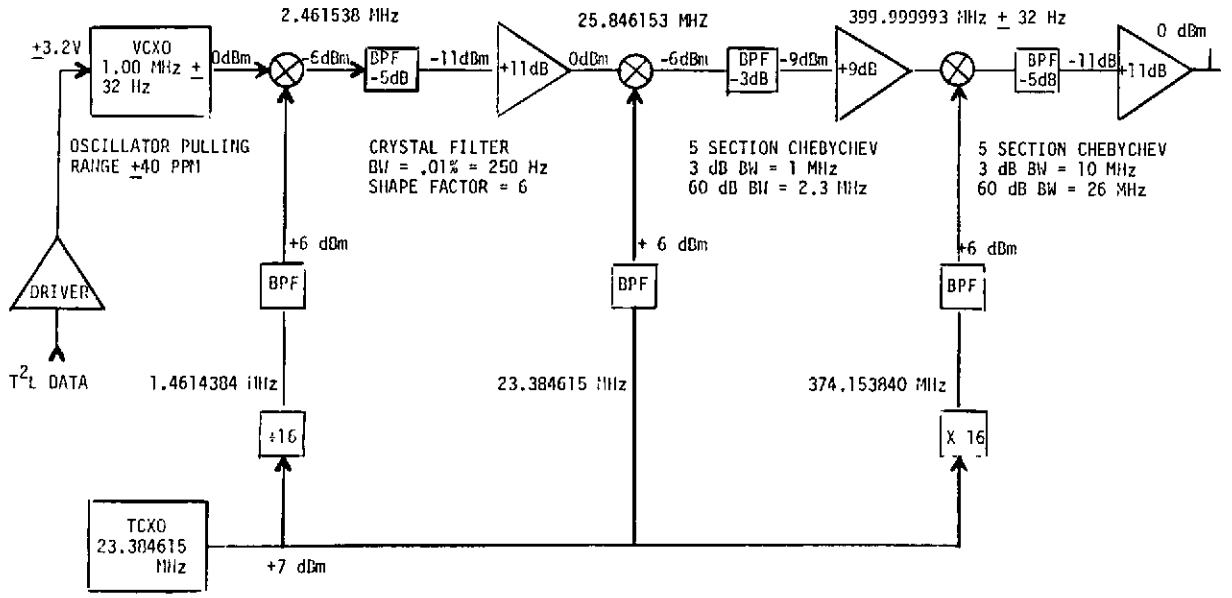


FIGURE X-1
THREE STEP UPCONVERTER MODULATOR

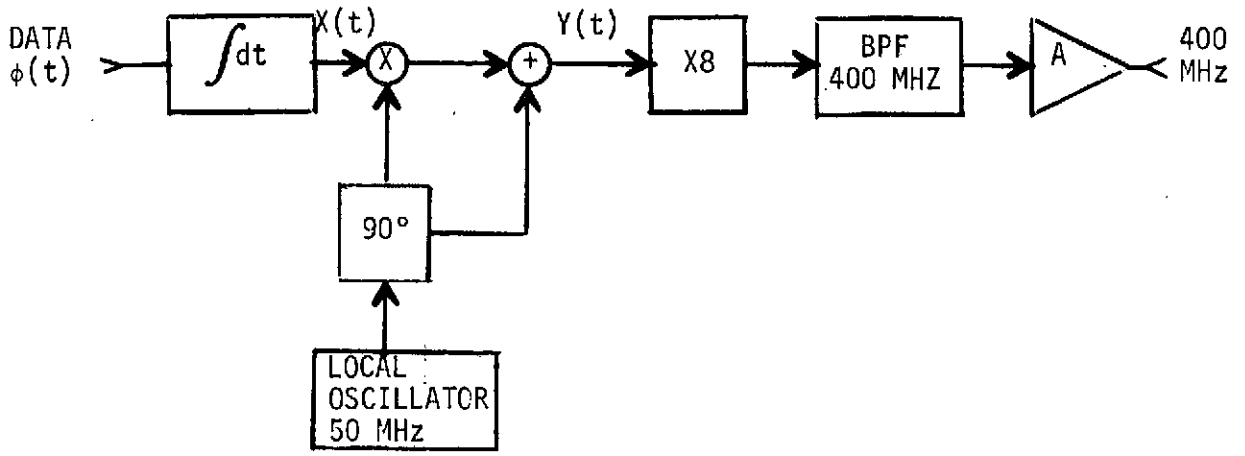


FIGURE X-2
INDIRECT FM MODULATOR

and $\phi(t)$ is the digital data. The one fundamental drawback to this concept is the practical implementation of the integrator and mixer. For long strings of marks or spaces, or where the average number of marks and spaces are not equal, the integrator and mixer must have sufficient dynamic range to operate over the entire period of data transmission. Furthermore, the phase modulation approximation holds only for the range where $|X(t)| << 1$. Since $\tan^{-1}\alpha = \alpha - \frac{\alpha^3}{3} + \frac{\alpha^5}{5} \ldots$, if we modulate one bit at a modulation index of .0775, a string of data where the marks outnumber the spaces by 10 bits would increase the distortion from .2% to 20%**, clearly an unacceptable situation. Lower modulation indices may be possible by decreasing the 50 MHz LO and increasing the multiplication factor. However, in view of the simplicity of the single conversion direct FM design discussed below, this design is untenable.

** The desired signal at the output of an FM modulator is:

$$Y(t) = \cos(\omega_{ct} + \beta\int\phi(t)dt).$$

The actual signal out of the narrowband FM modulator is:

$$Y(t) = \cos\left[\omega_c t + \tan^{-1}(\beta\int\phi(t)dt)\right]$$

$$= \cos\left[\omega_c t + \beta\int\phi(t)dt - \frac{\beta^3}{3}(\int\phi(t)dt)^3 + \frac{\beta^5}{5}(\quad)^5 - + \cdots\right]$$

where the higher power terms in the expansion are the distortion terms. If for one bit, $\beta\int\phi(t)dt = .0775$ radians, then the distortion is in the order of $(.0775)^2/3 \simeq .2\%$. Where the data is such that $\int\phi(t)dt = 10\int\phi(t)dt$, the distortion increases to $(.775)^2/3 \simeq 20\%$.

Single Conversion FM Modulator

The single conversion direct FM modulator shown in Figure 3 takes the 0 dBm output of a FCXO at 20 MHz and upconverts in one step to the output frequency of 400 MHz. The nearest mixer sideband in the upconversion is 40 MHz away using a doubly balanced mixer which also suppresses the 380 MHz LO a minimum of 25 dB. This implies a 3% bandwidth, 5 pole Chebyshev filter may be used at 400 MHz which would result in the 380 MHz LO being attenuated an additional 40 dB to a total level of 65 dB and the 40 MHz sideband attenuated to 68 dB. The total loss in the filter is approximately 5 dB, thus an 11 dB gain amplifier is needed to bring the output to 0 dBm. This modulation technique is simple and straightforward, requiring a minimum of parts, meets all the design constraints and, based on the new oscillator data, is the TRW recommended design.

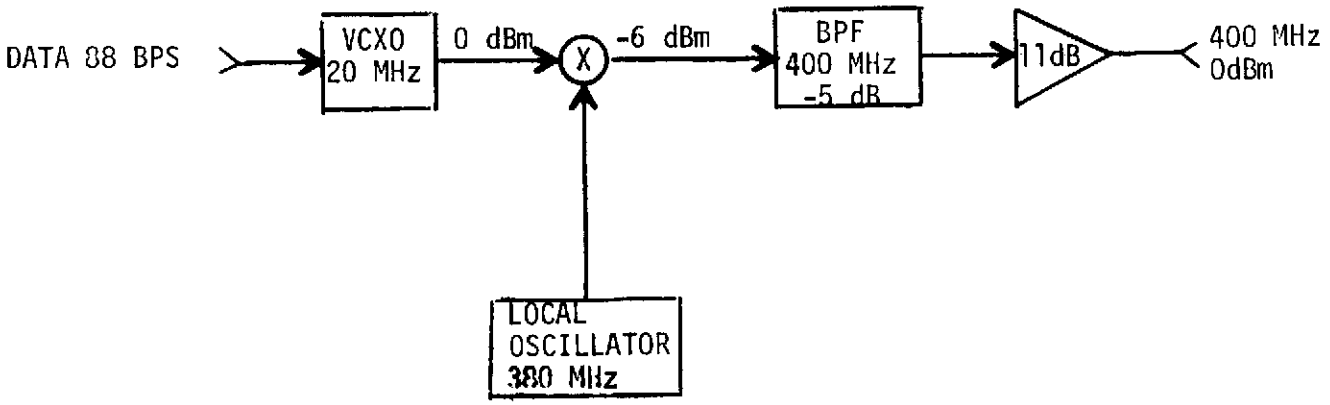


FIGURE X-3
SINGLE CONVERSION DIRECT FM MODULATOR