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A Computer-Controlled Instrumentation System for Third-Octave Analysis

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SUMMARY

An instrumentation system is described which employs a minicomputer, a one-third octave band analyzer, and a time code/tape search unit for the automatic control and analysis of third octave data. With this system the information necessary for data adjustment is formatted in such a way as to eliminate much operator interface, thereby substantially reducing the probability for error. A description of a program for the calculation of effective perceived noise level (EPNL) from aircraft noise data is included as an example of how this system can be used.

INTRODUCTION

This paper describes an instrumentation system which was evolved for the purpose of developing more efficient and accurate dynamic data acquisition and analysis procedures. The instrument system utilizes a minicomputer to control and analyze data obtained from an analog tape recorder and a one-third octave analyzer. One of the major sources of error in the analysis of data is the improper logging of the gain values used in the recording system. A unique feature of this system is the utilization of automatic digital coding of information which, when impressed on the time code frame, is recorded along with the data. The recording system gain values and other pertinent information are then available on the tape without reference to a handwritten log sheet. With this information and the ability to control motions of the tape recorder, the analysis operation requires very few operator inputs.

Acoustic noise data often requires additional weighting and computation procedures beyond the one-third octave filtering. In the analysis of aircraft noise data many of these procedures are necessary to achieve a value known as the effective perceived noise level (EPNL). A program for computing EPNL has been written, providing a means of determining which factors most influence acoustic measurement values. This program, demonstrating all the features of the described computer-controlled system, will be discussed.

DESCRIPTION OF THE INSTRUMENTATION

General

This instrumentation system consists of a minicomputer with peripheral equipment, a third-octave analyzer, a time code/tape search unit, and an analog tape recorder. The tape search unit, which has access to the data stored within the time code frame, receives command information from the computer, interprets the commands, and controls the tape recorder. The

third-octave analyzer receives the analog data from the tape recorder, processes it, and transfers the data to the computer for further analysis.

The heart of the system is the minicomputer to which all the other instruments are directly or indirectly interfaced. Some of the interfaces are standard; however, the interfaces to the third-octave analyzer and the tape search unit were not available from the manufacturers and had to be developed in-house specifically for this system.

Minicomputer

The controlling element of the system is a minicomputer utilizing 16-bit words and containing 32K words of memory. The computer functions in a disc operating system configuration which allows for program and data storage on a moving head magnetic disc. Programs can be developed in Assembly, FORTRAN, FORTRAN IV, or Algol languages. Communication with the system is via a CRT terminal. Data can be output to the disc or a digital magnetic tape for storage, while hard copy listing and graphics are available on an electrostatic printer/plotter.

The disc operating system allows segmented programs where long programs, divided into segments, are stored on the disc, and only one segment of the program is present in the computer at a time. Analyses which require many computational procedures or programs which provide for a number of optional procedures need such a capability. The EPNL program which will be described later utilizes this technique.

Figure 2 shows the computer and its standard peripherals (CRT terminal, disc, magnetic tape, and the printer/plotter).

Analog Tape Recorder

The analog tape recorder in this system can be either a 7- or 14-channel, intermediate or wideband group I, FM machine (fig. 3). One channel is dedicated to IRIG-B time code. These tape recorders have been modified so that they operate in a 120 IPS, FM mode when "tape search" is selected. This allows the time code to be recorded in either FM or direct mode and still remain under tape search control. The tape transport of either machine can be remotely controlled by the computer depending on which one is connected to the tape search unit. Further discussion on this control will occur in the section on the tape search unit. Playback speeds from 1-7/8 to 120 IPS are available. Remote control of speed selection is possible, but is not being employed at this time. Edge track voice annotation is available or an external speaker system can be utilized when voice annotation is on a data channel. The tape speed can be servo or tachometer controlled.

One-Third Octave Analyzer

The analyzer used to provide the one-third octave spectral data is a multifilter, multiplexed detector instrument (fig. 4). With this analyzer the spectrum can be divided into as many as 30 one-third octave bands ranging from 25 Hz to 20 kHz. Also an integration time ranging from 1/8 sec up to 32 sec can be selected. The filter output values are visable via a nixie readout display or in bar graph form on a CRT display. The filter outputs are also available in parallel BCD digital form which is the output that is used in the interface to the computer. Detailed information on this interface can be found in reference 3.

Time Code Reader

The recording of a serial time code has been in practice for some time and has provided a means of correlating multiple records of a single event. Along with the time of day, either the event number or the day of the year was recorded on the code. Recently the capability has been provided for superimposing additional information on the time code signal. As shown in figure 5, less than half of the serial bits in the code are needed for the time and event (or day) information. If the redundant recording of time in binary form is omitted, 45 bits of information can be recorded each second (IRIG B).

The time code reader in this system has the control bit translation feature where the state of 45 control bits is displayed on LED's and is also provided as a parallel digital output each second. The time information is also available in parallel form, and both sets of digital lines are monitored by the tape search unit. When requested by the computer the time or control bit information is relayed from the tape search unit.

Tape Search Unit

When used in conjunction with the time code reader, a tape search unit (TSU) provides for considerable versatility in tape recorder operations. If the optional characteristic of a computer interface is provided, this versatility expands to an almost unlimited degree. The system described in this paper has a unit with these features. Figure 6 shows the time code reader and the tape search unit. The various operational modes will be described in two parts. The first, TSU-Remote, will cover operation of the tape recorder from the front panel of the tape search unit. The second, Computer-Remote, will describe the features provided by the TSU-computer interface.

TSU-Remote

This mode is the standard TSU-tape recorder operation. All commands are implemented from the front panel of the TSU. The major features of this mode of operation are as follows:

(1) Set "start" and "stop" times with rotary thumbwheel switches.

(2) "Search to Start" - The tape recorder is put into a search speed from the front panel "Forward" or "Reverse" pushbutton. The search speed is a controlled speed which is higher than the normal run speed, but it is lower than the wind or rewind speeds. The time code is read and the motion direction is corrected if improper. The tape is positioned to a point at least three time frames in front of the selected start time, and the transport is then stopped.

(3) "Single Cycle" - The same procedure occurs as in "Search to Start" except that after stopping at the start time the transport is put into the "Drive" forward mode. An "interval" signal is provided when the start time is reached and is removed and the transport stopped when the stop time is reached.

(4) "Recycle" - The same procedure occurs as in "Single Cycle" except that instead of stopping when the stop time is reached the tape is rewound to the start time. This cycle is continuously repeated until another command is given.

(5) In addition to these automatic modes all the normal transport modes can be manually selected from the TSU.

Computer-Remote

All the features cited in the previous section are also available under computer control. Logic circuits in the search unit interpret commands from the computer. These commands can be for tape transport control, setting "start" or "stop" times, or requests for time code data. The time code requests can be for either time or the control bit information. Documentation concerning this interface can be found in reference 2.

SYSTEM APPLICATION

With the tape recorder, the tape search unit, and the one-third octave analyzer under computer control, programs can be written which provide data analysis with a minimum of operator interface. The EPNL program description which follows illustrates the pertinent features of this instrumentation system.

EPNL COMPUTATION - AN APPLICATION

This section presents a description of a data analysis program utilizing the instrument system described in the preceding sections. The program uses the physical properties of measured flyover history to determine the noise evaluation quantity designated as effective perceived noise level, EPNL. Calculated in accordance with the procedures as defined in Federal Aviation Regulation, Part 36 (ref. 1), EPNL is a single number measure of complex aircraft flyover noise as related to subjective response. It is calculated from a time sequence of tone adjusted perceived noise levels which are calculated from one-third octave band spectra. The tone adjustments are determined by a procedure which estimates the extent of spectral irregularities at any instant of time.

General Procedure

As described in reference 1, the EPNL calculation is basically a five-point procedure:

(1) Calculation of perceived noise levels, PNL(K), from one-third octave band levels determined at the K-th interval of time, where K is a number indicating the number of 0.5 sec intervals elapsed from an arbitrary reference time of the flyover signal.

(2) Calculation of a tone correction factor, C(K)

(3) Calculation of tone corrected perceived noise levels, PNLT(K), and determination of the maximum value, PNLTM

(4) Calculation of a duration correction, D

(5) Calculation of effective perceived noise level, EPNL, which is the algebraic sum of the maximum tone corrected perceived noise level and the duration correction factor.

$$EPNL = PNLTM + D$$

The Program

The EPNL program was edited, loaded, compiled, and stored using the disc operating system of the minicomputer system.

Many computer programs exist for the calculation of EPNL; however, this particular EPNL program has been written to provide various data analysis techniques by allowing for versatile modes of examining one set of data. Because of its complexity and length, the program is structured into a main program and two segmented programs, operating together as a single program in core.

The main program contains all input parameters, standard and optional. It allows for the following operator inputs:

(1) Test statistics - test name, run number, tape recorder channel number

(2) Correction options - pink noise, microphone, pseudotone, ambient noise

(3) Time code information - start and stop times of the calibrate signal, pink noise, ambient noise, and flyover data

(4) Selection of the number of pink noise, ambient noise, and data spectra

(5) Selection of the data averaging technique - linear, exponential, or none.

With these inputs and the associated instrumentation, the data analysis program proceeds with little or no additional operator control. Similarly, with corresponding time code inputs, correction data can be input after being automatically located on the tape. Information such as amplifier gain settings can be read and decoded automatically from time code control bit information. Subsequently, the program inputs one-third octave flyover data each 0.5 sec increment of time from the third octave analyzer and converts the data from BCD (binary coded decimal) to floating point. To calculate an EPNL value, flyover data from 1 up to 100 spectra can be used. After corrections are applied to this flyover data, control is transferred to the first segmented program.

The first segmented program does the actual calculation of EPNL as defined in the general procedure. The second segmented program controls the hard copy printout of the test statistics and other important parameters. In addition to the EPNL value, the following is output:

(1) The spectral data printed in tabular form

(2) A time history plot of PNLT values

(3) Plots of selected one-third octave spectra

After the output is completed, control is returned to the main program with the operator option of additional calculations or ending of the program.

With the segmented program feature the EPNL program is flexible, allowing for future amendments and additions. For example, corrections to the EPNL number for test day meteorological conditions and aircraft position will be incorporated when the instrumentation is completed for recording such data.

A listing of the present program is contained in the appendix.

CONCLUDING REMARKS

A computer-controlled instrumentation system to provide more efficient and accurate dynamic data acquisition and analysis procedures has been developed and an application demonstrating its use has been described. One of the outstanding features of this system is the ability to utilize digital information which has been coded within the time code signal. Also of significance is the tape search unit computer interface which provides for considerable versatility in remote control of tape recorder operations. With this instrumentation many of the probable physical and mental errors caused by human intervention have been eliminated, thus maintaining more consistent accuracy in data input and analysis. In addition to minimizing these errors, this automation has resulted in significant time savings for analysis procedures where many channels of similar type data are being processed. Future developments in increased computer control could virtually eliminate all human error involved in processing analog data stored on magnetic tape.

REFERENCES

1. Anonymous: Federal Aviation Regulation Part 36, Noise Standares: Aircraft Type Certification. Federal Register, December 1969, vol. 34, pp. 18355-18379.

2. Palumbo, Daniel L.: Program Theory DVR 27. Wyle Laboratories Work Order No. 505781-45, March 1977.

3. Zahrobsky, James: Program Summary, Program Theory, and Operating Instructions - Program DVR 17. Wyle Laboratories Work Order No. 50751-25, November 1975.

APPENDIX

EPNL PROGRAM


```
0001  FTN4,L
0002  C  EPNL COMPUTATION
0003  C
0004  C*********************************************************************
0005  C                                                                    *
0006  C  THIS PROGRAM INPUTS 1/3RD OCTAVE DATA FROM A GR1921 ANALYZER VIA  *
0007  C  CALL EXEC(1,7,----,----) AND CONVERTS THE DATA FROM BCD TO FLOAT- *
0008  C  ING POINT VIA CALL BCDFP. FLYOVER DATA UP TO 100 SPECTRA CAN BE   *
0009  C  USED TO CALCULATE AN EPNL VALUE. IN ADDITION TO THE EPNL VALUE,   *
0010  C  THE FOLLOWING IS OUTPUT:                                          *
0011  C                                                                    *
0012  C      1)  THE SPECTRAL DATA PRINTED IN TABULAR FORM                 *
0013  C      2)  A TIME HISTORY PLOT OF PNLT VALUES                        *
0014  C      3)  PLOTS OF SELECTED 1/3RD OCTAVE SPECTRA                    *
0015  C                                                                    *
0016  C*********************************************************************
0017  C
0018        PROGRAM EPNL3,3
0019        DIMENSION IBFD(2400),IBFA(400),IBUF(400),INAM(3),ICD(4)
0020        DIMENSION SPD0(24),IBUS(4),SPP(24,20),SPAM(24,20),SPDC(24)
0021        DIMENSION CAL(24),CALA(12),BD(12),BDA(12),BC(12),IBC(24)
0022        COMMON SPL(24),S(24),SN(24),SPL1(24),SPL2(24),SMB(24),SMC(24)
0023        COMMON SPLA(24),SPLB(24),SPLC(24),IC(32),ID(62)
0024        COMMON SPA(24,12),PC(24,12),DC(24,12),PNL(100),PNLT(100)
0025        COMMON DA(100),SPD(24,100),DAC(24),DDA(100),NCH
0026        COMMON DAM,KO,PNLM,KC,DAAM,KOA,KAV
0027        COMMON DAV(24,100),ATEST(3),IBND(24)
0028        COMMON SPM(24),KP,N,IBUS(4),KTO,KRUN
0029        EQUIVALENCE (IBFD(1),SPD(1,1))
0030        EQUIVALENCE (IBUF(1),SPP(1,1))
0031        EQUIVALENCE (IBFA(1),SPAM(1,1))
0032  C
0033  C     "A" WT. CORRECTION DATA (DAC) AND 1/3RD OCTAVE BAND NOS. (IBAND)
0034  C
0035        DAC(1)=-30.2
0036        DAC(2)=-26.2
0037        DAC(3)=-22.5
0038        DAC(4)=-19.1
0039        DAC(5)=-16.1
0040        DAC(6)=-13.4
0041        DAC(7)=-10.9
0042        DAC(8)=-8.6
0043        DAC(9)=-6.6
0044        DAC(10)=-4.8
0045        DAC(11)=-3.2
0046        DAC(12)=-1.9
0047        DAC(13)=-.8
0048        DAC(14)=0.
0049        DAC(15)=.6
0050        DAC(16)=1.
0051        DAC(17)=1.2
```

```
0052          OAC(18)=1.3
0053          OAC(19)=1.2
0054          OAC(20)=1.
0055          OAC(21)=.5
0056          OAC(22)=-.1
0057          OAC(23)=-1.1
0058          OAC(24)=-2.5
0059          IBND(1)=17
0060          IBND(2)=18
0061          IBND(3)=19
0062          IBND(4)=20
0063          IBND(5)=21
0064          IBND(6)=22
0065          IBND(7)=23
0066          IBND(8)=24
0067          IBND(9)=25
0068          IBND(10)=26
0069          IBND(11)=27
0070          IBND(12)=28
0071          IBND(13)=29
0072          IBND(14)=30
0073          IBND(15)=31
0074          IBND(16)=32
0075          IBND(17)=33
0076          IBND(18)=34
0077          IBND(19)=35
0078          IBND(20)=36
0079          IBND(21)=37
0080          IBND(22)=38
0081          IBND(23)=39
0082          IBND(24)=40
0083    C
0084    C     NOY TABLE CONSTANTS
0085    C
0086          SMB(1)=0.043470
0087          SMB(2)=.040570
0088          SMB(3)=.036931
0089          SMB(4)=.036931
0090          SMB(5)=.035336
0091          SMB(6)=.033333
0092          SMB(7)=.033333
0093          SMB(8)=.032051
0094          SMB(9)=.030675
0095          DO 2 I=10,22
0096        2 SMB(I)=0.
0097          SMB(23)=.042285
0098          SMB(24)=.042285
0099          DO 4 I=1,15
0100        4 SMC(I)=.030103
0101          DO 6 I=16,24
0102        6 SMC(I)=.029960
```

```
0103          SPLA(1)=91.
0104          SPLA(2)=85.9
0105          SPLA(3)=87.3
0106          SPLA(4)=79.9
0107          SPLA(5)=79.8
0108          SPLA(6)=76.
0109          SPLA(7)=74.
0110          SPLA(8)=74.9
0111          SPLA(9)=94.6
0112          DO 8 I=10,22
0113        8 SPLA(I)=0.
0114          SPLA(23)=44.3
0115          SPLA(24)=50.7
0116          SPLB(1)=64.
0117          SPLB(2)=60.
0118          SPLB(3)=56.
0119          SPLB(4)=53.
0120          SPLB(5)=51.
0121          SPLB(6)=48.
0122          SPLB(7)=46.
0123          SPLB(8)=44.
0124          SPLB(9)=42.
0125          DO 9 I=10,22
0126        9 SPLB(I)=0.
0127          SPLB(23)=37.
0128          SPLB(24)=41.
0129          SPLC(1)=52.
0130          SPLC(2)=51.
0131          SPLC(3)=49.
0132          SPLC(4)=47.
0133          SPLC(5)=46.
0134          SPLC(6)=45.
0135          SPLC(7)=43.
0136          SPLC(8)=42.
0137          SPLC(9)=41.
0138          DO 10 I=10,14
0139       10 SPLC(I)=40.
0140          SPLC(15)=38.
0141          SPLC(16)=34.
0142          SPLC(17)=32.
0143          SPLC(18)=30.
0144          SPLC(19)=29.
0145          SPLC(20)=29.
0146          SPLC(21)=30.
0147          SPLC(22)=31.
0148          SPLC(23)=34.
0149          SPLC(24)=37.
0150    C
0151          INAM(1)=2HCA
0152          INAM(2)=2HLC
0153          INAM(3)=2H
```

```
0154  C
0155        WRITE(1,11)
0156     11 FORMAT("TYPE:"/
0157       C"      1=START OF CALCALATIONS"/
0158       C"      2=ADDITIONAL CALCALATIONS"/
0159       C"      3=END OF CALCALATIONS")
0160        READ(1,*)MCAL
0161        GO TO(14,07,12)MCAL.
0162     12 STOP
0163     14 WRITE(1,16)
0164     16 FORMAT("ENTER 5 OR 6 LETTER TEST NAME. EXAMPLE: YUMAII")
0165        READ(1,15)ATEST
0166     15 FORMAT(3A2)
0167        WRITE(1,13)
0168     13 FORMAT("ENTER RUN NUMBER")
0169        READ(1,*)KRUN
0170        WRITE(1,17)
0171     17 FORMAT("ENTER NUMBER OF DATA CHANNELS")
0172        READ(1,*)JNCH
0173        WRITE(1,18)
0174     18 FORMAT("AMBIENT NOISE CORRECTION ? TYPE1=YES, 2=NO")
0175        READ(1,*)KAM
0176     19 WRITE(1,20)
0177     20 FORMAT("PINK NOISE CORRECTION ?  TYPE 1=YES, 2=NO")
0178        READ(1,*)KORP
0179        WRITE(1,22)
0180     22 FORMAT("PSEUDOTONE CORRECTION? TYPE 1= YES, 2= NO")
0181        READ(1,*)KTO
0182        WRITE(1,25)
0183     25 FORMAT("MIC FREQ RESP - WIND SCREEN CORR ? TYPE 1=YES, 2=NO")
0184        READ(1,*)KORM
0185        IF(1-KORM)35,20
0186  C
0187  C     ENTER MIC. FREQ. RESPONSE AND WIND SCREEN CORRECTIONS VIA
0188  C     PAPER TAPE
0189  C
0190     28 NCH=0.
0191     29 NCH=NCH+1
0192     30 WRITE(1,31)
0193     31 FORMAT("INSERT MIC. CORR. TAPE. TYPE  :GO")
0194        PAUSE
0195        READ(5,*)RC
0196        IF(NCH-JNCH)29,36
0197  C
0198  C     IF NO MICROPHONE CORRECTION, SET CORRECTION PARAMETER TO ZERO
0199  C
0200     35 DO 36 NCH=1,JNCH
0201        DO 36 I=1,24
0202        RC(I,NCH)=0.
0203     36 CONTINUE
0204  C
```

```
C     SET UP FOR CAL. SIGNAL
C
   39 WRITE(1,40)
   40 FORMAT("READY FOR CAL SIGNAL - ? ENTER DB VALUE FOR CAL LEVEL")
      READ(1,*)CC
   41 WRITE(1,42)
   42 FORMAT(/"ENTER TIME CODE AT START (DAY, HR., MIN., SEC.)"/)
      READ(1,*)IBUS(4),IBUS(3),IBUS(2),IBUS(1)
      WRITE(1,44)
   44 FORMAT(/"ENTER STOP TIME (DAY, HR., MIN., SEC.)"/)
      READ(1,*)MBUS(4),MBUS(3),MBUS(2),MBUS(1)
   45 WRITE(1,46)
   46 FORMAT(/"ENTER CHANNEL NUMBER(1-12)"/)
      READ(1,*)NCH
      CALL EXEC(2,13148,IBUS,400)
      CALL EXEC(2,14148,MBUS,400)
      CALL EXEC(2,15148,129,400)
   49 CALL EXEC(1,1148,ICD,1)
      INCH=IAND(ICD(2),7408)
      INCH=INCH/32
      IF(INCH.NE.NCH) GO TO 49
      ITG=IAND(ICD(2),178)
      IUG=IAND(ICD(2),208)
      IF(IUG.NE.0)IUG=5.
      BC(NCH)=FLOAT(10*ITG+60+IUG)
      CALL EXEC(2,15149,16,100)
      CALL EXEC(2,15148,130,100)
      CALA(NCH)=0
      DO 60 NCAL=1,10
      CALL EXEC(1,7,IBC,24)
      CALL BCDFP(IBC,CAL,24,IERR)
      IF(0-IERR) 50,54
   50 WRITE(1,52)
   52 FORMAT(///"DATA OVERLOAD!")
      CALL EXEC(2,15148,16,100)
      GO TO 3
   54 CALM=0
      DO 59 I=1,24
      IF(CAL(I).GE.CALM)56,59
   56 CALM=CAL(I)
   59 CONTINUE
      CALA(NCH)=((CALM-CALA(NCH))/NCAL)+CALA(NCH)
   60 CONTINUE
      IF(NCH-JNCH)62,64
   62 WRITE(1,63)
   63 FORMAT(/"READY FOR NEXT CAL SIGNAL."/
     C"NEW TIME CODE?  TYPE:  1=YES,  2=NO"/)
      READ(1,*)KTC
      IF(KTC.EQ.2)GO TO 45
      GO TO 41
   64 IF(1-KORP)80,65
```

```
0256  C
0257  C     SET UP FOR PINK NOISE
0258  C
0259     65 WRITE(1,66)
0260     66 FORMAT("SELECT NO. OF PINK NOISE SPECTRA. MAX=20")
0261        READ(1,*)NP
0262        IF(20-NP)65,68
0263  C
0264  C     ENTER PINK NOISE
0265  C
0266     68 WRITE(1,70)
0267     70 FORMAT(/"READY FOR PINK NOISE: ENTER TIME CODE AT START"/
0268       C"(DAY, HR., MIN.,SEC.)"/)
0269        READ(1,*)IBUS(4),IBUS(3),IBUS(2),IBUS(1)
0270        WRITE(1,72)
0271     72 FORMAT(/"ENTER STOP TIME (DAY, HR., MIN., SEC.)"/)
0272        READ(1,*)MBUS(4),MBUS(3),MBUS(2),MBUS(1)
0273     73 WRITE(1,74)
0274     74 FORMAT(/"ENTER CHANNEL NUMBER (1-12)"/)
0275        READ(1,*)NCH
0276        CALL EXEC(2,13148,IBUS,400)
0277        CALL EXEC(2,14148,MBUS,400)
0278        CALL EXEC(2,15148,130,400)
0279        NPP=NP*24
0280        CALL EXEC(1,7,IBUF,NPP)
0281        CALL BCMAP(IBUF,SPP,NPP,IERR)
0282        IF(0-IERR)78,80
0283     78 WRITE(1,79)
0284     79 FORMAT("DATA OVERLOAD!")
0285        CALL EXEC(2,15148,16,100)
0286        GO TO 68
0287  C
0288  C     ALL INITIAL VALUES OF AVERAGE PINK NOISE SPECTRUM SET TO ZERO
0289  C
0290     80 DO 84 I=1,24
0291        SPA(I,NCH)=0.
0292        IF(1-KORP)84,82
0293  C
0294  C     IF PINK NOISE ENTERED, RESET PINK SPECTRUM TO AVG. OF NP SPECTRA
0295  C     ENTERED
0296  C
0297     82 DO 84 K=1,NP
0298        SPA(I,NCH)=SPA(I,NCH)+SPP(I,K)/FLOAT(NP)
0299     84 CONTINUE
0300  C
0301  C     CALCULATION OF PINK NOISE CORRECTION VALUES
0302  C
0303        DO 86 I=1,24
0304     86 PC(I,NCH)=SPA(8,NCH)-SPA(I,NCH)
0305        IF(KORP.EQ.2) GO TO 87
0306        IF(NCH-JNCH)83,87
```

```
0307      83 WRITE(1,85)
0308      85 FORMAT(/"READY FOR NEXT PINK NOISE CHANNEL."/
0309        C"NEW TIME CODE?  TYPE:  1=YES,  2=NO"/)
0310         READ(1,*)KTC
0311         IF(KTC.EQ.2)GO TO 73
0312         GO TO 68
0313      87 IF(1-KAM)102,88
0314   C
0315   C     SET UP FOR AMBIENT DATA
0316   C
0317      88 WRITE(1,89)
0318      89 FORMAT("SELECT NO. OF AMBIENT DATA SPECTRA (NA). MAX=20")
0319         READ(1,*)NA
0320         IF(20-NA) 88,90
0321      90 WRITE(1,92)
0322      92 FORMAT("READY FOR AMBIENT DATA: ENTER TIME CODE AT START"/
0323        C"(DAY, HR., MIN., SEC.)"/)
0324         READ(1,*)IBUS(4),IBUS(3),IBUS(2),IBUS(1)
0325         WRITE(1,94)
0326      94 FORMAT(/"ENTER STOP TIME (DAY, HR., MIN., SEC.)"/)
0327         READ(1,*)MBUS(4),MBUS(3),MBUS(2),MBUS(1)
0328         WRITE(1,96)
0329      96 FORMAT(/"ENTER CHANNEL NUMBER (1-12)"/)
0330         READ(1,*)NCH
0331         CALL EXEC(2,13148,IBUS,400)
0332         CALL EXEC(2,14148,MBUS,400)
0333         CALL EXEC(2,15148,130,400)
0334      98 CALL EXEC(1,1148,ICD,1)
0335         INCH=IAND(ICD(2),740B)
0336         INCH=INCH/32
0337         IF(INCH.NE.NCH)GO TO 98
0338         ITG=IAND(ICD(2),17B)
0339         IUG=IAND(ICD(2),20B)
0340         IF(IUG.NE.0)IUG=5.
0341         BDA(NCH)=FLOAT(10*ITG+60+IUG)
0342         CALL EXEC(2,15148,16,100)
0343         CALL EXEC(2,15148,130,100)
0344         NAA=NA*24
0345         CALL EXEC(1,7,IBFA,NAA)
0346         CALL BCDFP(IBFA,SPAM,NAA,IERR)
0347         IF(0-IERR) 100,102
0348     100 WRITE(1,101)
0349     101 FORMAT("DATA OVERLOAD!")
0350         CALL EXEC(2,15148,16,100)
0351         GO TO 90
0352   C
0353   C     SET AMBIENT SPECTRUM TO AVG. OF NA SPECTRA ENTERED
0354   C
0355     102 DO 104 I=1,24
0356         SPM(I)=0.
0357         IF(1-KAM)104,103
```

```
0358     103 DO 104 K=1,NA
0359         SPM(I)=SPM(I)+SPAM(I,K)/FLOAT(NA)
0360     104 CONTINUE
0361         IF(1-KAM)122,105
0362   C
0363   C     CORRECTION OF AMBIENT DATA FOR PINK NOISE, MIC., CAL. LEVEL,
0364   C     GAINS AND ANALYZER SETTINGS
0365   C
0366     105 DO 106 I=1,24
0367     106 SPM(I)=SPM(I)+PC(I,NCH)+RC(I,NCH)+(CC-CALA(NCH))
0368        C+(BDA(NCH)-BC(NCH))
0369   C
0370   C     ENTER RUN PARAMETER DATA
0371   C
0372     122 WRITE(1,123)
0373     123 FORMAT("SELECT NO. OF DATA SPECTRA (N), MAX=100")
0374         READ(1,*)N
0375         IF(100-N) 122,124
0376     124 WRITE(1,125)
0377     125 FORMAT("SELECT AVG TECH TIQUE, TYPE 1=LIN., 2=EXP., 3=NONE")
0378         READ(1,*)KAV
0379     127 WRITE(1,128)
0380     128 FORMAT("READY TO COMPUTE EPNL.  ENTER TIME CODE AT START"/
0381        C"(DAY, HR., MIN., SEC.)"/)
0382         READ(1,*)IBUS(4),IBUS(3),IBUS(2),IBUS(1)
0383         WRITE(1,130)
0384     130 FORMAT(/"ENTER STOP TIME (DAY, HR., MIN., SEC.)"/)
0385         READ(1,*)MBUS(4),MBUS(3),MBUS(2),MBUS(1)
0386         WRITE(1,132)
0387     132 FORMAT(/"ENTER CHANNEL NUMBER (1-12)"/)
0388         READ(1,*)NCH
0389         CALL EXEC(2,13148,IBUS,400)
0390         CALL EXEC(2,14148,MBUS,400)
0391         CALL EXEC(2,15148,130,400)
0392     134 CALL EXEC(1,1148,ICD,1)
0393         INCH=IAND(ICD(2),7408)
0394         INCH=INCH/32
0395         IF(INCH.NE.NCH)GO TO 134
0396         ITG=IAND(ICD(2),178)
0397         IUG=IAND(ICD(2),208)
0398         IF(IUG.NE.0) IUG=5.
0399         BD(NCH)=FLOAT(10*ITG+60+IUG)
0400         CALL EXEC(2,15140,16,100)
0401         CALL EXEC(2,15149,130,160)
0402         ND=N*24
0403         CALL EXEC(1,7,IBFD,ND)
0404         CALL BCDFP(IBFD,SPD,ND,IERR)
0405         IF(0-IERR)136,150
0406     136 WRITE(1,137)
0407     137 FORMAT("DATA OVERLOAD!")
0408         CALL EXEC(2,15148,16,100)
```

```
0409          GO TO 127
0410    C
0411    C     CORRECTION OF RAW DATA FOR PINK NOISE, MICROPHONE, CAL. LEVEL,
0412    C     GAINS AND ANALYZER SETTINGS
0413    C
0414      150 DO 151 K=1,N
0415          DO 151 I=1,24
0416      151 SPD(I,K)=SPD(I,K)+PC(I,NCH)+RC(I,NCH)+(CC-CALA(NCH))+(BD(NCH)-
0417         CBC(NCH))
0418          IF(1-KAM)190,158
0419    C
0420    C     CORRECTION OF RAW DATA FOR AMBIENT NOISE
0421    C
0422      159 DO 180 K=1,N
0423          SPDC(1)=0.
0424          DO 176 I=1,24
0425          SPDC(I+1)=0.
0426          IF((SPD(I,K)-SPM(I)).GT.10.)164,160
0427      160 IF((SPD(I,K)-SPM(I)).GT.5)162,166
0428      162 SPD(I,K)=10*(ALOG(10.**(SPD(I,K)/10.)
0429         C-10.**(SPM(I)/10.))/2.459)
0430      164 SPDC(I)=SPD(I,K)
0431          GO TO 176
0432      166 IF(12-I)172,168
0433      168 IF(SPD(I+1,K).EQ.SPDC(I+1))170,176
0434      170 SPD(I,K)=SPD(I+1,K)-(((SPD(I+2,K)-SPD(I+1,K))
0435         C+(SPD(I+3,K)-SPD(I+2,K))+(SPD(I+4,K)-SPD(I+3,K))
0436         C+(SPD(I+5,K)-SPD(I+4,K)))/4.)
0437          GO TO 164
0438      172 IF(SPD(I-1,K).EQ.SPDC(I-1))174,176
0439      174 SPD(I,K)=SPD(I-1,K)-(((SPD(I-2,K)-SPD(I-1,K))
0440         C+(SPD(I-3,K)-SPD(I-2,K))+(SPD(I-4,K)-SPD(I-3,K))
0441         C+(SPD(I-5,K)-SPD(I-4,K)))/4.)
0442          GO TO 164
0443      176 CONTINUE
0444          DO 180 I=12,1,-1
0445          IF(SPD(I,K).EQ.SPDC(I))180,178
0446      178 SPD(I,K)=SPD(I+1,K)-(((SPD(I+2,K)-SPD(I+1,K))
0447         C+(SPD(I+3,K)-SPD(I+2,K))+(SPD(I+4,K)-SPD(I+3,K))
0448         C+(SPD(I+5,K)-SPD(I+4,K)))/4.)
0449          SPDC(I)=SPD(I,K)
0450      180 CONTINUE
0451      190 WRITE(6,181)BC(NCH),BD(NCH)
0452      181 FORMAT(2X,10HCAL GAIN= ,I4/2X,11HDATA GAIN= ,I4//)
0453          CALL EXEC(8,INAM)
0454          END

**  NO ERRORS*
```

```
0001  C
0002  C
0003  C
0004        PROGRAM CALC,5
0005        DIMENSION INM(3)
0006        COMMON SPL(24),S(24),SN(24),SPL1(24),SPL2(24),SMB(24),SMC(24)
0007        COMMON SPLA(24),SPLB(24),SPLC(24),IC(32),ID(62)
0008        COMMON SPA(24,12),PC(24,12),RC(24,12),PNL(100),PNLT(100)
0009        COMMON OA(100),SPD(24,100),OAC(24),OAA(100),NCH
0010        COMMON OAM,KO,PNLM,KC,OAAM,KOA,KAV
0011        COMMON DAV(24,100),ATEST(3),IBND(24)
0012        COMMON SPM(24),KP,N,IBUS(4),KTO,KRUN
0013  C
0014        INM(1)=2HLI
0015        INM(2)=2HST
0016        INM(3)=2H
0017  C
0018  C     PRESET EPNL PARAMETERS
0019        OAM=0.
0020        PNLM=0.
0021        CMAX=0.
0022  C
0023  C     BEGIN CALCULATION OF 3-SPECTRUM AVG., OVERALL, "A" WT.,
0024  C     NOY, TONE CORRECTION AND SAVE AVG. SPECTRUM DAV(I,K)
0025  C
0026        DO 400 K=1,N
0027        IF(1-K)194,192
0028    192 DO 193 I=1,24
0029    193 SPL(I)=SPD(I,K)
0030        GO TO 214
0031  C
0032    194 IF(2-KAV)192,210,196
0033  C
0034  C     3-SPECTRUM LINEAR AVERAGING
0035  C
0036    196 IF(2-K)204,198
0037    198 DO 202 I=1,24
0038    200 SPL(I)=-3.0103+40.+10.*(ALOG(10.**((SPD(I,1)-40.)/10.)
0039       C +10.**((SPD(I,2)-40.)/10.))/2.30259)
0040    202 CONTINUE
0041        GO TO 214
0042    204 DO 208 I=1,24
0043    206 SPL(I)=-4.7712+40.+10.*(ALOG(10.**((SPD(I,K-2)-40.)/10.)
0044       C +10.**((SPD(I,K-1)-40.)/10.)+10.**((SPD(I,K)-40.)/10.))/2.30259)
0045    208 CONTINUE
0046        GO TO 214
0047  C
0048  C     EXPONENTIAL AVERAGING
0049  C
```

```
0050      210 DO 214 I=1,24
0051      212 SPL(I)=10.*ALOG(10.**(SPL(I)/10.)+(1.-EXP(-.55))*
0052         C (10.**(SPD(I,K)/10.)-10.**(SPL(I)/10.)))/2.30259
0053      214 CONTINUE
0054  C
0055  C       OVERALL CALCULATION
0056  C
0057          OA(K)=SPL(1)
0058          DO 220 I=2,24
0059          DIF = ABS(SPL(I) -OA(K))
0060          ADD=10.*ALOG(1.+10.**(-DIF/10.))/2.30259
0061          IF(SPL(I)-OA(K))216,218
0062      216 OA(K) = OA(K)+ADD
0063          GO TO 220
0064      218 OA(K) = SPL(I)+ADD
0065      220 CONTINUE
0066          IF(OAM-OA(K))222,224
0067      222 OAM=OA(K)
0068          KO=K
0069  C
0070  C       "A" WT. CALCULATION
0071  C
0072      224 OAA(K)=SPL(1)+OAC(1)
0073          DO 230 I=2,24
0074          DIF=ABS(SPL(I)+OAC(I)-OAA(K))
0075          ADD=10.*ALOG(1.+10.**(-DIF/10.))/2.30259
0076          IF(SPL(I)+OAC(I)-OAA(K))226,228
0077      226 OAA(K)=OAA(K)+ADD
0078          GO TO 230
0079      228 OAA(K)=SPL(I)+OAC(I)+ADD
0080      230 CONTINUE
0081          IF(OAAM-OAA(K))232,234
0082      232 OAAM=OAA(K)
0083          KOA=K
0084  C
0085  C       PNLT(K) CALCULATION
0086  C
0087      234 SUMN=0.
0088          SNM=0.
0089          I=0
0090      236 I=I+1
0091          IF(24-I)250,238
0092      238 IF(9-I)240,246
0093      240 IF(22-I)246,242
0094      242 IF(SPL(I)-SPLC(I))252,244
0095      244 SN(I)=EXP(2.30259*SMC(I)*(SPL(I)-SPLC(I)))
0096          GO TO 254
0097      246 IF(SPL(I)-SPLB(I))252,248
0098      248 IF(SPL(I)-SPLA(I))250,244
0099      250 SN(I)=EXP(2.30259*SMB(I)*(SPL(I)-SPLB(I)))
0100          GO TO 254
```

```
0101     252 SN(I)=0.
0102     254 SUMN=SUMN+SN(I)
0103         IF(SNM-SN(I))256,236
0104     256 SNM=SN(I)
0105         GO TO 236
0106     258 TSN=0.85*SNM+0.15*SUMN
0107         PNL(K)=40.0+33.3*(ALOG(TSN)/2.30259)
0108         IF(PNLM-PNL(K))260,262
0109     260 PNLM=PNL(K)
0110         KP=K
0111   C
0112   C     PNLT(K) CALCULATION (10 STEP TONE CORRECTION)
0113   C
0114     262 DO 264 I=1,3
0115         S(I)=0.
0116     264 SPL1(I)=SPL(I)
0117         I=3
0118     265 I=I+1
0119         IF(24-I)305,266
0120     266 S(I)=SPL(I)-SPL(I-1)
0121         IF(5.-ABS(S(I)-S(I-1)))268,285
0122     268 IF(S(I))270,270,274
0123     270 IF(S(I-1))285,285,272
0124     272 SPL1(I-1)=(SPL(I)+SPL(I-2))/2.
0125         GO TO 285
0126     274 IF(S(I-1)-S(I))276,285
0127     276 IF(23-I)278,280
0128     278 SPL1(I)=SPL(I-1)+S(I-1)
0129         GO TO 265
0130     280 SPL1(I)=(SPL(I+1)+SPL(I-1))/2.
0131         GO TO 265
0132     285 SPL1(I)=SPL(I)
0133         GO TO 265
0134     305 SPL2(3)=SPL(3)
0135         SPL2(4)=SPL2(3)+(SPL1(4)+SPL1(5)-2.*SPL1(3))/3.
0136         I=4
0137     310 I=I+1
0138         IF(23-I)320,315
0139     315 SPL2(I)=SPL2(I-1)+(SPL1(I+1)-SPL1(I-2))/3.
0140         GO TO 310
0141     320 SPL2(24)=SPL2(23)+(2.*SPL1(24)-SPL1(23)-SPL1(22))/3.
0142         CM=0.
0143         I=2
0144     325 I=I+1
0145         IF(24-I)380,330
0146     330 F=SPL(I)-SPL2(I)
0147         IF(F-3.)325,335
0148     335 IF(F-20.)340,345
0149     340 C=F/6.
0150         GO TO 350
0151     345 C=10./3.
```

```
0152     350 IF(21-I)370,355
0153     355 IF(10-I)360,370
0154     360 C=2.*C
0155     370 IF(CM-C)371,325
0156     371 IF(1-KTO)375,372
0157     372 IF(13-I)375,325
0158     375 CM=C
0159         GO TO 325
0160     380 PNLT(K)=PNL(K)+CM
0161         IF(CMAX-CM)390,394
0162     390 CMAX=CM
0163         KC=K
0164   C
0165   C     SAVE AVG. SPECTRUM
0166   C
0167     394 DO 395 I=1,24
0168     395 DAV(I,K)=SPL(I)
0169     400 CONTINUE
0170         CALL EXEC(8,INM)
0171         CALL EPNL3
0172         END

*** NO ERRORS***
```

```
0001  C
0002  C
0003        PROGRAM LIST.5
0004        DIMENSION SPDO(24).SPDP(24)
0005        COMMON SPL(24).S(24).SN(24).SPL1(24).SPL2(24).SMB(24).SMC(24)
0006        COMMON SPLA(24).SPLB(24).SPLC(24).IC(32).ID(62)
0007        COMMON SPA(24.12).PC(24.12).RC(24.12).PNL(100).PNLT(100)
0008        COMMON OA(100).SPD(24.100).OAC(24).OAA(100).NCH
0009        COMMON OAM.KO.PNLM.KC.OAAM.KOA.KAV
0010        COMMON DAV(24.100).ATEST(3).IBND(24)
0011        COMMON SPM(24).KP.N.IBUS(4).KTO.KRUN
0012  C
0013        PNLTM=0.
0014        KCOP=0
0015  C
0016  C     LISTING OF TEST NAME. RUN NUMBER. AND INPUT PARAMETER DATA
0017  C
0018        WRITE(6.405)ATEST.KRUN.NCH
0019    405 FORMAT(2X.11HTEST NAME: .3A2/2X.7HRUN NO..I2/2X."CH NO.".I3//)
0020        DO 401 I=1.24
0021        SPDO(I)=SPA(I.NCH)
0022    401 CONTINUE
0023        DO 402 I=1.24
0024        SPDP(I)=PC(I.NCH)
0025    402 CONTINUE
0026        WRITE(6.406)SPDO.SPDP
0027    406 FORMAT(9H PINK SP .24(1X.F4.2)/4X.5HCORR .24(1X.F4.2)/)
0028        DO 407 I=1.24
0029        SPDO(I)=RC(I.NCH)
0030    407 CONTINUE
0031        WRITE(6.408)SPDO
0032    408 FORMAT(9H MIC CORR.24(1X.F4.2)///)
0033        WRITE(6.409)SPM
0034    409 FORMAT(9H AMB. SP .24(1X.F4.1)/)
0035  C
0036  C     SPECTRA DATA TABLE
0037  C
0038    410 WRITE(6.420)
0039    420 FORMAT(2X.1HK.6H OASPL.5H  50 .5H  63 .5H  80 .5H 100 .5H 125
0040       C5H 160 .5H 200 .5H 250 .5H 315 .5H 400 .5H 500 .5H 630 .5H 800
0041       C5H 1K  .5H 1.25.5H 1.6 .5H 2.0 .5H 2.5 .5H 3.15.5H 4.0 .5H 5.0
0042       C5H 6.3 .5H 8.0 .5H 10K /)
0043        DO 428 K=1.N
0044        DO 421 I=1.24
0045    421 SPDO(I)=DAV(I.K)
0046    426 WRITE(6.427)K.OA(K).SPDO
0047    427 FORMAT(I4.25(1X.F4.1))
0048    428 CONTINUE
0049  C
```

```
0050  C      DURATION CALCULATION
0051  C
0052         LT1=0
0053         LT11=0
0054         LKT=0
0055         TOT=0.
0056         DO 440 K=1,N
0057         IF(PNLTM-PNLT(K))430,440
0058     430 PNLTM=PNLT(K)
0059         KT=K
0060     440 CONTINUE
0061         DO 580 K=1,N
0062         IF(PNLT(K)+10.-PNLTM)495,460
0063     460 IF(1-K)470,465
0064     465 LT1=1
0065         LT11=1
0066         GO TO 580
0067     470 IF(LT1)485,475,485
0068     475 LT1=K
0069         IF(LT11)580,480,580
0070     480 LT11=K
0071         GO TO 580
0072     485 IF(K-N)580,490
0073     490 LT2=N
0074         GO TO 504
0075     495 IF(LT1)501,580,501
0076     501 LT2=K-1
0077     504 DO 510 M=LT1,LT2
0078     510 TOT=TOT+10.**((PNLT(M)-40.)/10.)
0079         LK=LT2-LT1+1
0080         LKT=LKT+LK
0081         LT1=0
0082     580 CONTINUE
0083         LKT=IAND(LKT,1)
0084         IF(0-LKT)585,605
0085     585 IF(PNLT(LT11)-PNLT(LT2))595,590
0086     590 KX=LT11
0087         LT11=LT11+1
0088         GO TO 596
0089     595 KX=LT2
0090         LT2=LT2-1
0091     596 TOT=TOT-10.**((PNLT(KX)-40.)/10.)
0092     605 DUR=10.*ALOG(TOT)/2.30259-PNLTM-13.+40.
0093  C
0094  C      EPNL CALCULATION
0095  C
0096         EPNL=PNLTM+DUR
0097  C
0098  C
0099  C      TIME HISTORY PLOT OF PNLT.  EACH X= 0.5 DB
0100  C
```

```
0101          WRITE(6,598)IBUS(4),IBUS(3),IBUS(2),IBUS(1)
0102      598 FORMAT(2/3X,19HSTART TIME AT K=1= ,3(I2,1H:),I2)
0103      890 WRITE(6,900)
0104      900 FORMAT(2/3X,1HK,36X,4HPNLT,5X,3HPNL,6X,5HOASPL,5X,3HSLA/)
0105          DO 930 K=1,N
0106          INX=IFIX(2.*(PNLTM-PNLT(K)))
0107          IF(29-INX)910,920
0108      910 INX=29
0109      920 DO 925 M=1,30-INX
0110      925 IC(M)=88
0111          DO 928 M=31-INX,32
0112      928 IC(M)=32
0113          WRITE(6,930)K,IC,PNLT(K),PNL(K),OA(K),OAA(K)
0114      930 FORMAT(I4,2X,32R1,4(2X,F7.2))
0115    C
0116    C     IMPORTANT PARAMETERS LISTING
0117    C
0118          WRITE(6,940)OAM,KO,PNLM,KP,CMAX,KC,PNLTM,KT,OAAM,KOA
0119      940 FORMAT(2/5X,7HOA MAX=,F7.2,6X,2HK=,I3/5X,8HPNL MAX=,F7.2,5X,2HK=,
0120         CI3/5X,6HC MAX=,F6.2,8X,2HK=,I3/5X,9HPNLT MAX=,F7.2,4X,2HK=,I3/
0121         C5X,6HSLA MAX=,F7.2,5X,2HK=,I3/)
0122          WRITE(6,950)DUR,LT11,LT2,KAV
0123      950 FORMAT(5X,15HDURATION CORR.=,F6.2,2X,6H,   K=I3,1X,3HAND,I4//
0124         C5X,25HSPECTRA AVG. TECHNIQUE = ,I1/
0125         C5X,8H1 = LIN./5X,8H2 = EXP./5X,8H3 = NONE///)
0126          IF(KTO.EQ.2) GO TO 952
0127          WRITE(6,951)
0128      951 FORMAT(5X,31PSEUDOTONE CORRECTIONS INCLUDED,//)
0129          GO TO 954
0130      952 WRITE(6,953)
0131      953 FORMAT(5X,25HNO PSEUDOTONE CORRECTIONS,//)
0132      954 WRITE(6,955)EPNL
0133      955 FORMAT(5X,5HEPNL=,F7.2,4/)
0134    C
0135          WRITE(1,960)
0136      960 FORMAT("ADDITIONAL DATA COPY ? YES-TYPE 1, NO-TYPE 2")
0137          READ(1,*)KCOP
0138          IF(1-KCOP)959,410
0139    C
0140      959 WRITE(1,961)
0141      961 FORMAT("DATA SPECTRUM PLOT?"/
0142         C" TYPE: 1=AMBIENT DATA PLOT"/
0143         C"       2=INPUT DATA PLOT"/
0144         C"       3=NO PLOTS DESIRED"/)
0145          READ(1,*)KSPC
0146          IF(KSPC-2)963,970,992
0147      970 WRITE(1,971)
0148      971 FORMAT("ENTER NO. OF SPECTRUM TO BE PLOTTED"/
0149         C"ENTER 0 IF NO PLOTS DESIRED"/)
0150          READ(1,*)K
0151      962 IF(K.EQ.0)992,972
```

```
0152     963 SMAX=0.
0153         DO 965 I=1,24
0154         SPDO(I)=SPM(I)
0155     965 SMAX=AMAX1(SPDO(I),SMAX)
0156         K=0
0157         GO TO 969
0158   C
0159   C     SELECTED SPECTRUM PLOT
0160   C
0161     972 SMAX=0
0162         DO 973 I=1,24
0163         SPDO(I)=DAV(I,K)
0164     973 SMAX=AMAX1(SPDO(I),SMAX)
0165     969 IF(AMOD(SMAX,10.).GE.5.)974,975
0166     974 SMAX=10.*(AINT(SMAX/10.)+1.)
0167         GO TO 976
0168     975 SMAX=10.*AINT(SMAX/10.)+5.
0169     976 SLO=SMAX-30.
0170         WRITE(6,977)SLO,K,SMAX
0171     977 FORMAT(20/6X,1H),X,F3.0,X,2HDB,15X,2HK=,I3,32X,1H(,X,F3.0,X,2HDB)
0172         WRITE(6,978)
0173     978 FORMAT(/X,4HBAND,66X,3HSPL/)
0174         DO 989 I=1,24
0175         INS=IFIX(2.*(SMAX-SPDO(I)))
0176         IF(59-INS)980,992
0177     980 INS=59
0178     982 DO 984 M=1,60-INS
0179     984 ID(M)=88
0180         DO 986 M=61-INS,62
0181     986 ID(M)=32
0182         WRITE(6,988)IBND(I),ID,SPDO(I)
0183     988 FORMAT(I4,2X,62R1,F7.2)
0184     989 CONTINUE
0185         WRITE(6,990)
0186     990 FORMAT(10/)
0187         GO TO 970
0188   C
0189   C     FINISH PROGRAM OR LOOP BACK FOR MORE DATA
0190   C
0191     992 CALL EPNL3
0192   C
0193   C
0194   C       IMPORTANT PARAMETERS DEFINED
0195   C
0196   C     BC:      CAL GAIN
0197   C     BD:      DATA GAIN
0198   C     BDA:     AMBIENT NOISE GAIN
0199   C     CMAX:    MAX. TONE CORRECTION
0200   C     DAV:     AVERAGE DATA SPECTRUM
0201   C     DUR:     DURATION CORRECTION
0202   C     OA:      OVERALL DATA SPECTRUM
```

```
0203  C      OAA:     OVERALL "A" WT.
0204  C      OAAM:    OVERALL "A" WT. MAX.
0205  C      OAM:     OVERALL MAX.
0206  C      PC:      PINK NOISE CORRECTION
0207  C      PNL:     PERCEIVED NOISE LEVEL
0208  C      PNLT:    TONE CORRECTED PERCEIVED NOISE LEVEL
0209  C      PNLTM:   MAX. TONE CORRECTED PERCEIVED NOISE LEVEL
0210  C      RC:      MICROPHONE CORRECTION
0211  C      SPA:     AVERAGE PINK NOISE SPECTRUM
0212  C      SPAM:    AMBIENT NOISE SPECTRUM
0213  C      SPD:     DATA SPECTRUM
0214  C      SPDC:    CORRECTED DATA SPECTRUM
0215  C      SPP:     PINK NOISE SPECTRUM
0216  C
0217  C
0218     398 END

***  NO ERRORS***
```

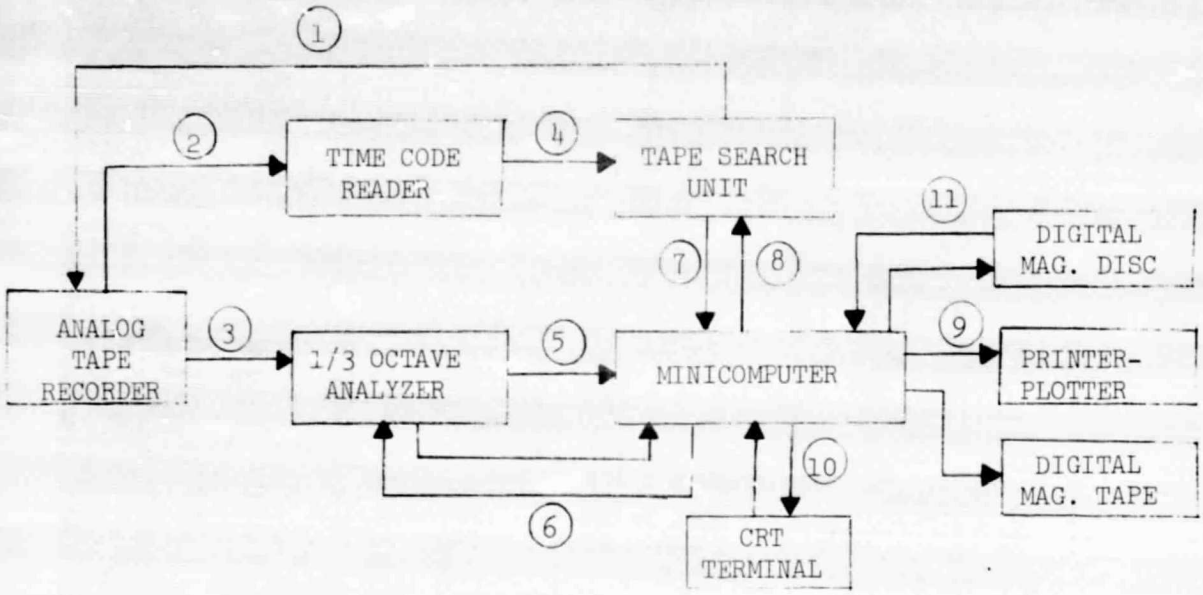
Table 1. Spectral Data

CAL GAIN= 90
DATA GAIN= 70

TEST NAME: MM0000
RUN NO. 1
CH NO. 1

PINK SP	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CORR	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
MIC CORR	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AMB. SP	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

K	OASPL	50	63	80	100	125	160	200	250	315	400	500	630	800	1K	1.25	1.6	2.0	2.5	3.15	4.0	5.0	6.3	8.0	10K
1	86.3	72.5	76.0	74.8	70.3	63.3	64.5	70.5	76.3	79.8	75.8	70.5	74.3	72.8	72.5	71.0	70.0	72.8	71.5	64.0	58.0	52.5	52.0	52.0	52.3
2	90.8	73.8	74.8	75.5	74.5	66.0	71.3	78.0	82.5	83.0	81.3	77.3	79.0	77.5	78.3	76.5	76.5	79.3	77.0	69.3	62.3	57.5	52.0	52.0	52.0
3	90.0	72.8	76.5	76.3	76.3	67.3	72.0	79.0	80.0	79.5	77.0	78.3	77.8	78.5	78.0	77.0	77.0	78.5	76.3	69.8	64.3	60.0	52.0	52.0	52.0
4	91.4	77.8	78.5	76.5	73.5	67.3	75.8	83.0	83.0	80.0	75.8	80.8	77.3	80.5	78.5	76.8	76.0	79.3	76.5	71.0	66.8	63.0	52.0	52.0	52.0
5	90.0	74.0	78.8	74.3	73.8	69.0	78.5	83.0	81.0	76.8	73.5	77.8	75.0	77.0	77.3	75.0	76.5	76.8	74.3	69.8	67.8	63.5	52.0	52.0	52.0
6	91.4	76.8	75.5	75.5	69.5	70.5	79.3	83.3	83.8	78.3	78.8	79.8	77.5	77.8	79.3	77.5	78.3	77.5	75.5	72.8	72.3	64.3	52.0	52.0	52.0
7	91.0	78.0	73.3	72.3	66.3	73.3	79.0	83.5	84.8	76.8	78.3	80.0	76.5	76.8	77.3	74.8	77.0	75.0	73.3	71.3	72.5	62.8	52.0	52.0	52.5
8	91.0	77.5	76.8	75.3	66.8	74.5	80.8	80.0	81.8	74.5	81.8	77.5	79.5	79.0	76.3	76.8	77.8	75.8	75.5	74.8	77.0	64.5	53.8	52.0	52.0
9	96.1	76.3	78.0	76.0	70.8	80.8	85.3	89.5	85.3	82.0	87.8	80.8	84.3	84.0	82.5	81.3	81.8	79.3	77.5	77.5	81.0	67.5	57.3	53.0	52.5
10	94.4	80.0	75.5	75.5	71.0	80.3	86.5	87.0	83.3	82.8	85.0	79.0	79.8	81.0	79.8	78.8	78.0	75.8	75.3	76.8	80.5	64.0	56.0	53.3	53.0
11	94.2	75.3	74.3	72.0	72.0	82.3	85.8	89.3	82.8	81.8	82.5	80.3	79.3	80.5	77.8	76.3	76.0	73.8	74.5	78.5	78.3	63.5	56.5	53.0	52.3
12	96.9	75.8	72.5	73.3	74.3	84.0	88.3	88.0	81.5	87.3	87.3	85.3	83.3	84.5	82.8	81.8	81.5	79.0	81.0	85.3	82.3	69.0	63.0	56.0	53.8
13	96.3	78.5	78.5	75.8	78.0	84.0	89.0	89.0	81.5	85.0	86.0	81.3	80.5	81.3	80.0	80.0	79.0	75.5	77.3	86.0	79.0	66.5	62.8	55.0	53.8
14	97.0	79.0	77.5	76.8	75.5	84.5	90.5	89.5	82.8	85.0	84.5	83.5	82.3	82.0	82.5	82.3	81.3	77.8	75.0	86.5	78.3	66.5	63.8	56.5	54.5
15	99.0	78.3	79.3	74.5	76.8	86.5	91.5	90.5	84.3	87.8	87.3	86.0	85.0	84.3	84.8	84.0	82.5	80.3	83.3	90.3	79.0	68.6	66.8	56.5	55.8
16	96.7	79.3	78.0	77.8	75.3	85.0	88.3	87.5	82.8	86.3	87.3	85.0	84.5	82.0	79.8	80.5	79.8	77.5	80.8	85.8	74.8	65.8	62.8	53.8	54.5
17	97.6	82.0	79.3	77.0	76.5	83.0	90.3	91.0	86.5	85.5	89.3	81.5	83.3	80.8	80.0	80.0	77.8	76.3	80.3	84.5	73.0	65.5	62.5	54.0	54.8
18	99.0	83.5	81.5	81.8	77.0	83.5	92.0	93.0	86.3	85.8	89.5	82.5	84.5	83.0	80.8	81.3	79.0	77.3	83.3	86.3	74.0	66.0	62.5	53.8	55.3
19	99.4	84.5	81.8	76.0	77.0	84.3	90.8	93.8	89.5	84.5	90.5	84.3	85.5	85.3	81.8	81.0	80.8	78.8	84.3	85.0	74.0	65.3	60.0	53.5	54.8
20	99.6	86.3	83.5	82.3	77.3	86.5	90.5	94.5	91.0	84.5	88.3	84.0	85.8	83.5	82.0	79.5	78.5	76.5	82.8	81.0	70.8	62.3	57.0	52.8	55.0
21	98.5	84.8	87.3	83.5	78.3	85.5	91.0	91.0	90.0	83.5	87.8	84.8	85.0	81.5	80.5	78.8	76.0	75.5	78.8	77.0	68.3	59.5	54.5	52.5	55.3
22	98.7	88.3	87.8	89.3	81.0	84.3	87.3	91.0	90.8	82.3	86.0	85.5	87.3	82.3	79.5	77.5	74.5	74.0	76.5	75.3	66.0	58.8	53.5	52.5	54.8
23	99.3	84.3	89.0	89.3	86.0	80.8	89.0	93.5	91.5	87.5	84.0	85.3	81.0	79.8	77.0	76.3	74.5	71.8	75.5	73.5	65.0	56.3	52.0	52.5	54.8
24	98.0	86.8	85.3	87.5	85.3	79.8	86.0	89.8	91.5	87.5	81.0	87.0	81.8	83.3	79.3	78.0	75.5	73.3	76.8	74.3	65.0	56.0	52.0	52.5	54.8
25	94.8	85.8	87.3	85.8	84.3	76.0	83.8	86.8	85.5	83.0	75.3	79.8	74.5	74.3	71.3	69.8	68.3	65.5	69.8	68.5	58.0	52.0	52.0	52.3	53.0
26	93.5	85.3	83.8	85.3	83.8	77.8	80.3	84.5	85.8	80.5	72.5	77.3	73.8	74.5	72.3	71.0	67.8	65.8	68.5	66.8	58.5	52.0	52.0	52.0	53.3
27	96.4	88.3	88.8	86.3	86.5	81.5	83.5	87.5	88.3	84.8	77.0	76.0	74.3	72.8	69.8	68.5	66.8	64.8	69.5	67.3	57.8	52.0	52.0	52.0	53.8
28	97.0	83.5	90.3	90.5	86.3	85.5	88.8	87.0	88.0	85.5	77.5	78.0	75.3	71.8	69.3	68.0	65.0	64.3	67.0	64.5	55.3	52.0	52.0	52.5	55.3
29	94.6	84.5	87.5	89.0	86.5	84.0	78.0	81.8	82.5	79.3	73.0	69.3	71.0	65.5	64.5	63.0	60.5	60.5	63.5	60.0	52.0	52.0	52.0	52.0	53.5
30	92.7	83.5	87.3	86.5	83.5	80.5	75.8	80.0	79.3	76.0	70.3	66.3	68.5	65.0	63.8	62.5	60.8	58.0	61.8	58.0	52.0	52.0	52.0	52.0	52.5



1 TAPE MOTION CONTROLS

2 SERIAL TIME CODE AND TEST CONDITION INFORMATION (GAIN, ETC.)

3 ANALOG NOISE DATA

4 PARALLEL TIME CODE AND TEST CONDITION INFORMATION

5 DIGITAL (PARALLEL) 1/3 OCTAVE FILTER DATA

6 CONTROL LINES (DATA READY, ADVANCE CHANNEL, ETC.)

7 a. PARALLEL TIME CODE AND TEST CONDITION INFORMATION

b. "START TIME" SIGNAL

8 CONTROL WORDS FOR:

a. READ TIME INFORMATION

b. READ TEST CONDITION INFORMATION

c. MOTION COMMANDS FOR ANALOG TAPE RECORDER

9 RECORDING OF PROCESSED DATA

10 COMMUNICATION LINK FOR OPERATOR

11 DISC OPERATING SYSTEM COMMUNICATION

Figure 1.- System block diagram.

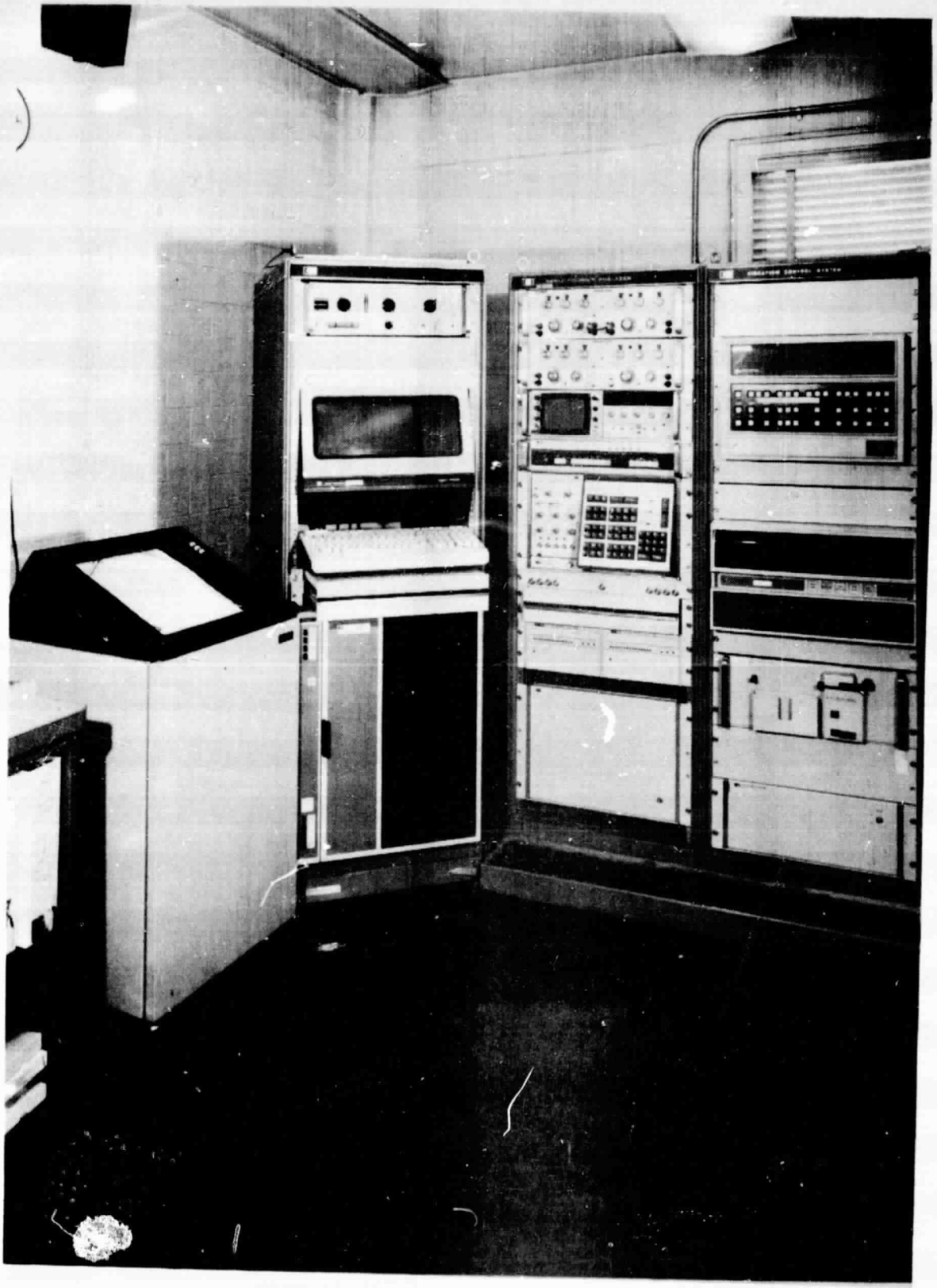


Figure 2.- Minicomputer and standard peripherals (CRT terminal, disc, magnetic tape, printer/plotter)

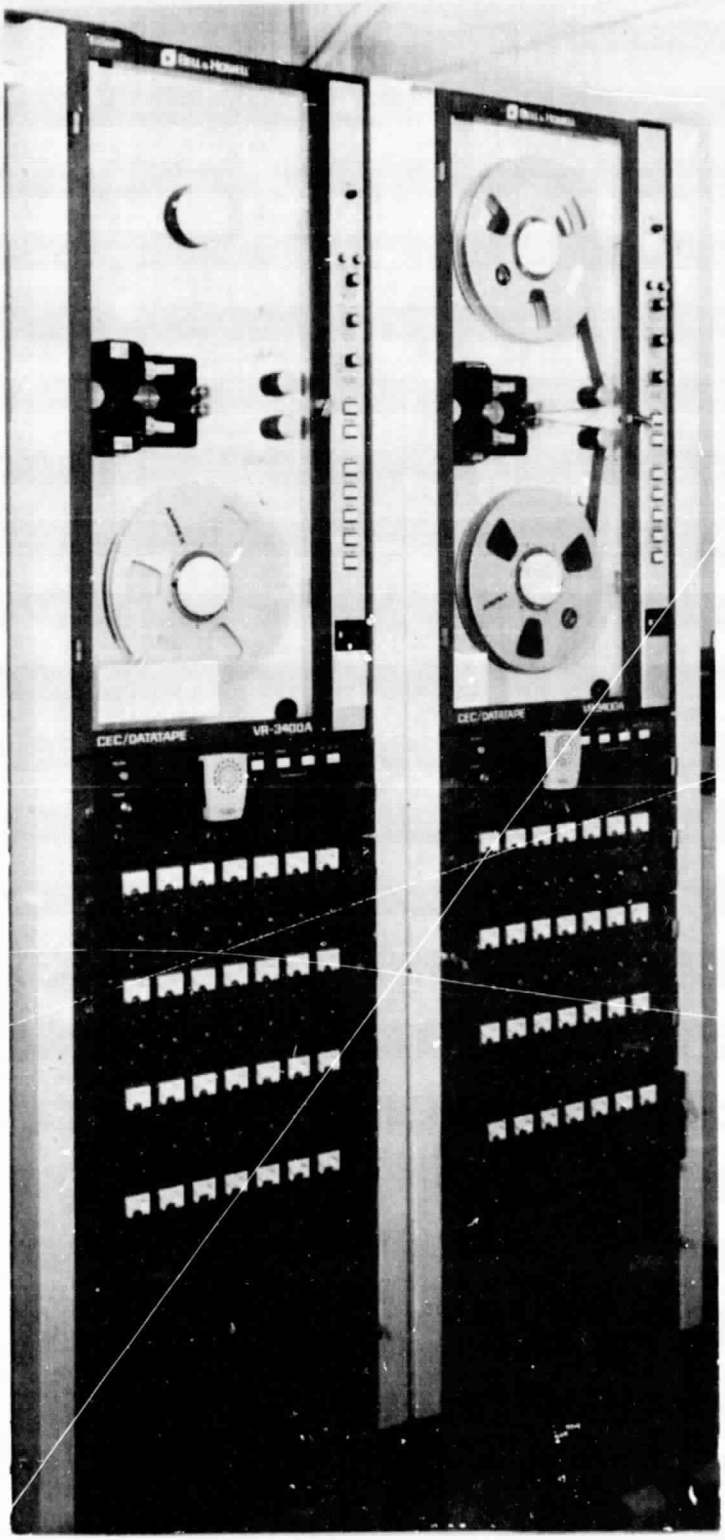


Figure 3.- Analog tape recorder.

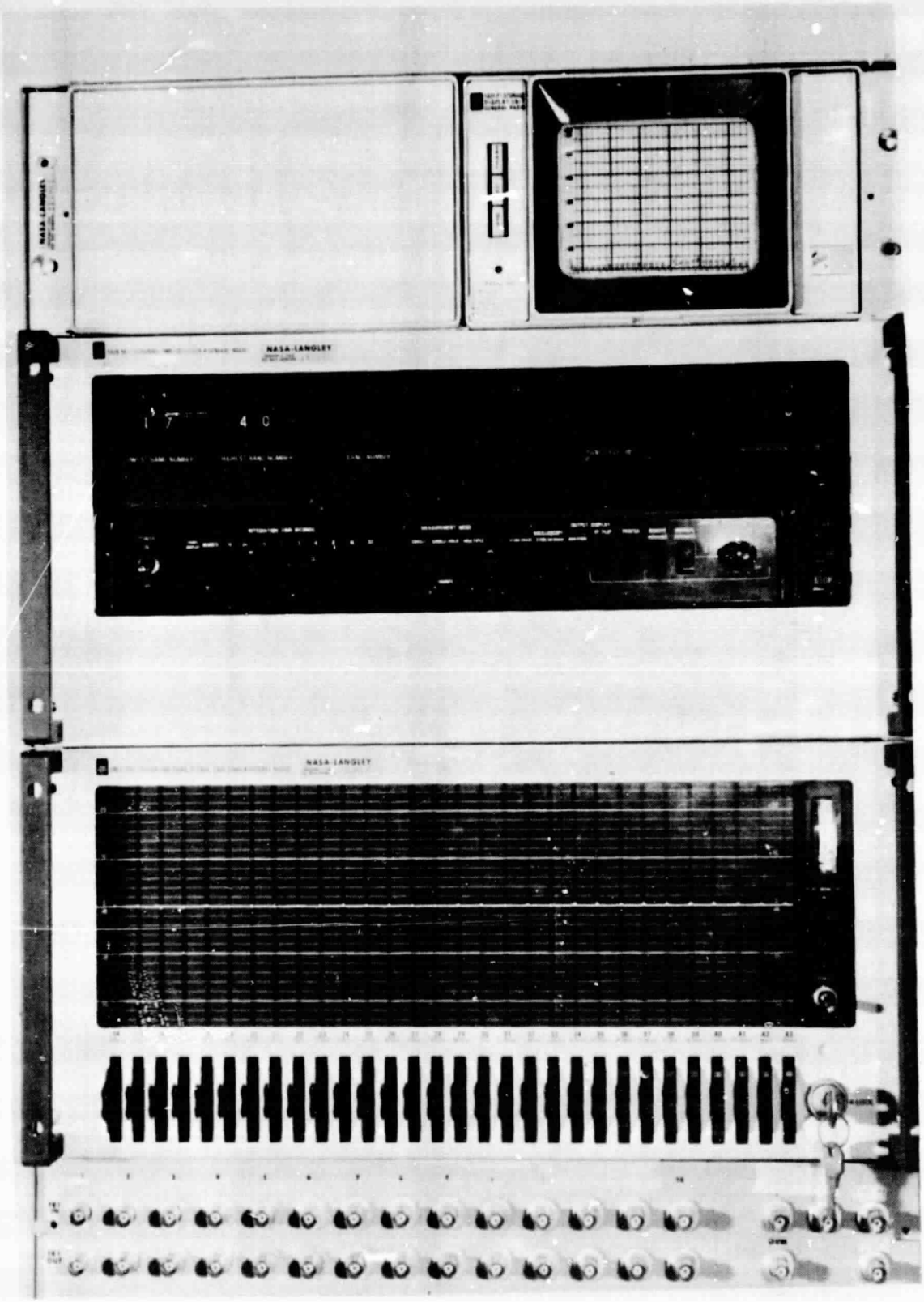


Figure 4.- One-third octave analyzer.

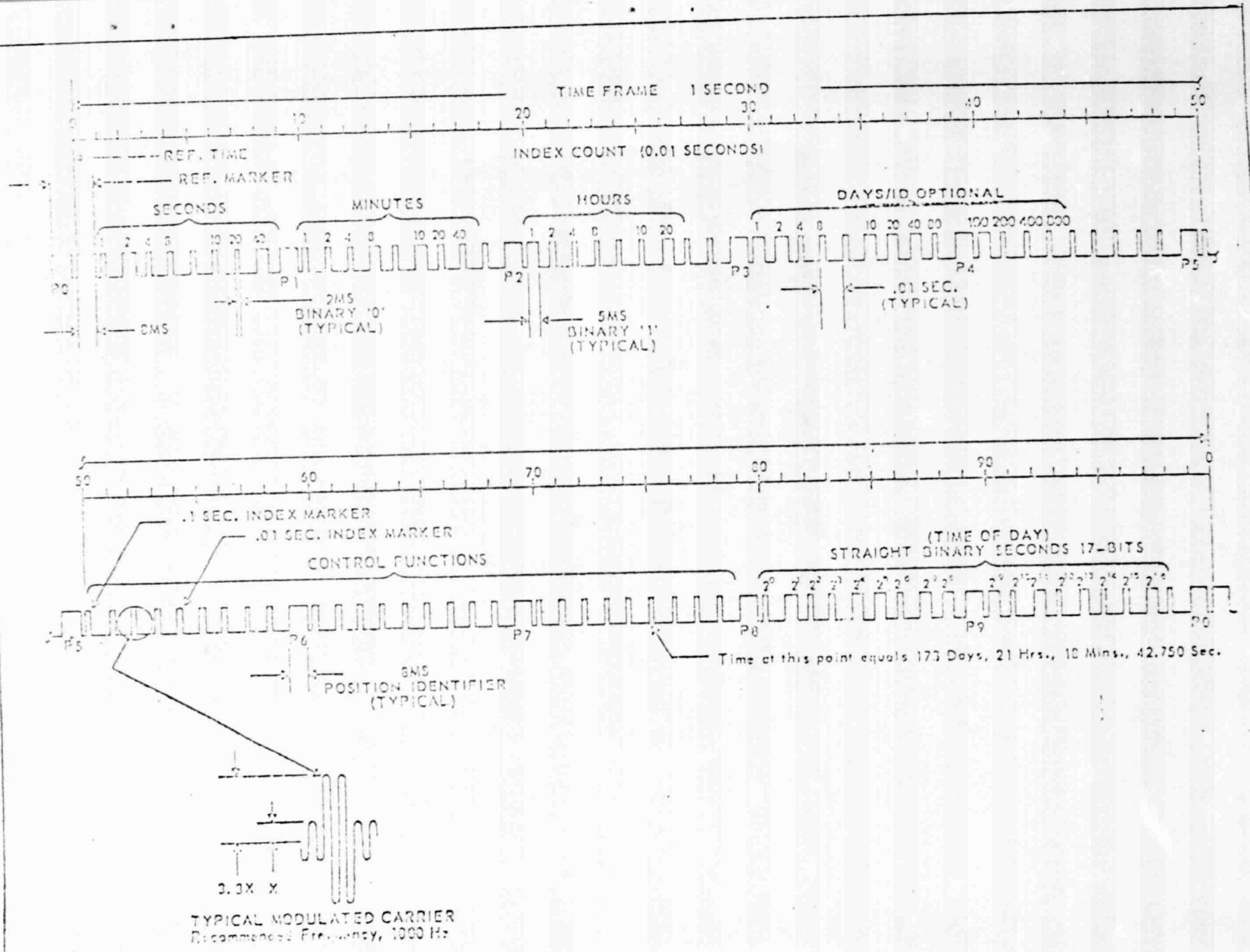


Figure 5.- IRIG standard time code.

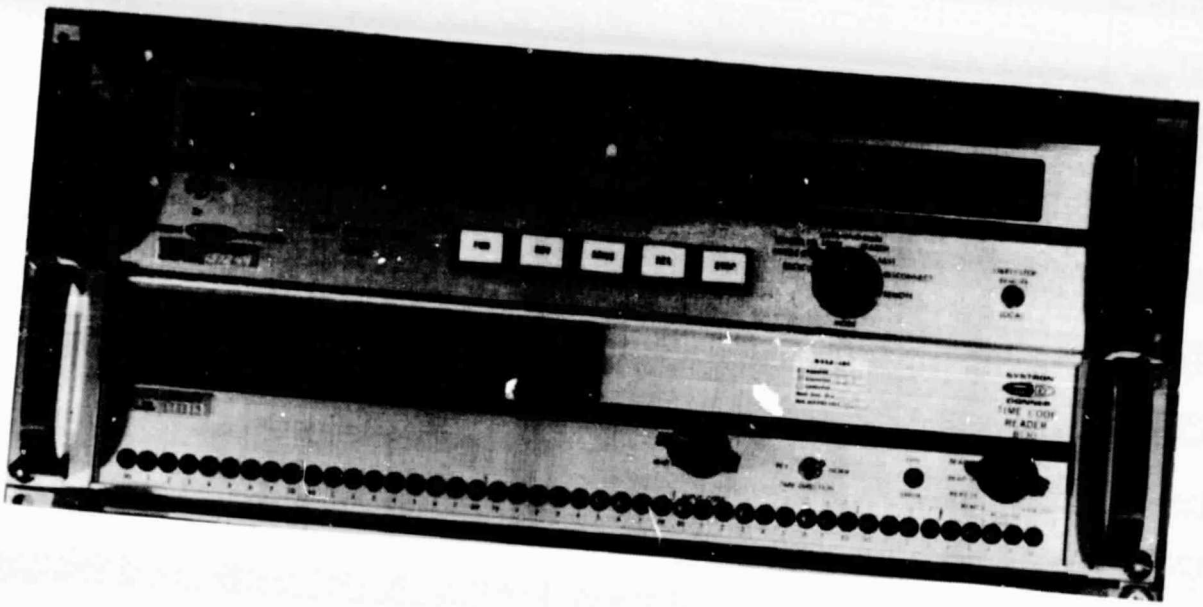


Figure 6.- Time code reader/tape search unit.

START TIME AT K#1= 12:13:59: 4

K		PNLT	PNL	OASPL	SLA
1	X	95.40	94.77	86.30	82.41
2	XXX	100.04	100.04	90.84	87.90
3	XXX	100.12	99.62	89.99	87.46
4	XXXXXXX	101.95	100.53	91.40	88.06
5	XXX	99.99	98.82	89.99	86.21
6	XXXXX	100.73	100.23	91.39	88.04
7	XXXXX	100.79	98.95	91.03	86.82
8	XXXXXXXXXX	103.60	101.14	91.01	87.95
9	XXXXXXXXXXXXXXXXXX	108.17	105.34	96.09	92.49
10	XXXXXXXXXXXXXXXXX	107.34	103.96	94.40	90.07
11	XXXXXXXXXXX	104.40	102.79	94.25	89.16
12	XXXXXXXXXXXXXXXXXXXX	109.40	107.85	96.94	93.87
13	XXXXXXXXXXXXXXXXXXXX	109.55	107.32	96.25	92.20
14	XXXXXXXXXXXXXXXXXXXXX	110.61	107.99	97.00	93.21
15	XXXXXXXXXXXXXXXXXXXXXXXXXX	113.72	110.90	98.96	95.93
16	XXXXXXXXXXXXXXXXXXXX	110.11	107.54	96.65	92.97
17	XXXXXXXXXXXXXXXXXXX	109.57	106.96	97.60	92.53
18	XXXXXXXXXXXXXXXXXXXXX	111.16	108.45	98.95	93.91
19	XXXXXXXXXXXXXXXXXXXX	110.47	108.24	99.44	94.52
20	XXXXXXXXXXXXXXXXX	107.98	106.59	99.60	93.37
21	XXXXXXXXXXX	105.02	104.41	98.48	91.83
22	XXXXXXXXXXXX	105.36	104.24	98.73	91.69
23	XXXXXXXXXXXX	105.47	104.43	99.31	90.81
24	XXXXXXXXXXXXX	105.90	104.02	98.00	91.18
25	XXXX	100.28	98.65	94.78	84.81
26	XX	99.42	98.05	93.51	83.89
27	XXXXX	101.16	99.96	96.45	85.46
28	XXXXX	100.82	99.78	97.03	85.51
29	X	96.77	95.57	94.62	80.49
30	X	94.49	93.24	92.68	78.03

OA MAX= 99.60 K= 20
PNL MAX= 110.90 K= 15
C MAX= .00 K= 10
PNLT MAX= 113.72 K= 15
SLA MAX= 115.71 K= 13

DURATION CORR.= -5.53 , K= 9 AND 24

SPECTRA AVG. TECHNIQUE = 3
1 = LIN.
2 = EXP.
3 = NONE

NO PSEUDOTONE CORRECTIONS

EPNL= 108.18

Figure 7.- PNLT Plot.

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15. Supplementary Notes

16. Abstract

An instrumentation system is described which employs a minicomputer, a one-third octave band analyzer, and a time code/tape search unit for the automatic control and analysis of third-octave data. With this system the information necessary for data adjustment is formatted in such a way as to eliminate much operator interface, thereby substantially reducing the probability for error. A description of a program for the calculation of effective perceived noise level (EPNL) from aircraft noise data is included as an example of how this system can be used.

17. Key Words (Suggested by Author(s))	18. Distribution Statement
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