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INTRASYSTEM ELECTROMAGNETIC COMPATIBILITY ANALYSIS PROGRAM. VOLUME II.  
USER'S MANUAL USAGE SECTION

J. L. Bogdanor, et al

McDonnell Aircraft Company

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| 20. ABSTRACT (Continue on reverse side if necessary and identify by block number)<br>This user's manual describes the operation and usage of the Intrasytem Electromagnetic Compatibility Analysis Program (IEMCAP). IEMCAP is a USA Standard FORTRAN program for computer-aided implementation of electromagnetic compatibility (EMC) at all stages of an Air Force system's life cycle, applicable to aircraft, space/missile, and ground-based systems. Extensive knowledge of computers is not required to use the program and all inputs are in |                       |                                                                                            |

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20. ABSTRACT (continued)

easy-to-use, free-field format.

This volume, the Usage Section, contains detailed instructions for usage of IEMCAP. A complete description of the input data requirements, formats, and rules for applying them are given. Instructions are also given for data setup and program execution for the various analysis tasks. Sample outputs are presented and described to aid in interpretation of analysis results. An example run is also presented in which a typical system is analyzed. This shows how engineering data is converted into the IEMCAP input format and gives samples from the resulting computer output.

Three appendices are provided. The first describes test methods for use with the computer-generated EMC specification limits along with an example. The second appendix describes a separate merge utility program. This program performs supplemental data file management which consolidates two files. The third appendix describes the usage of another separate program which provides supplemental intermodulation frequency analysis.

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## PREFACE

This documents work conducted by McDonnell Aircraft Company, St. Louis, Missouri, on the Intrastem Electromagnetic Compatibility (EMC) Analysis Program, sponsored by Rome Air Development Center, Griffiss Air Force Base, New York, under Contract F30602-72-C-0277, Job Order 45400127, from 19 May 1972 to 19 November 1973. Mr. James C. Brodock (RBCT) was the RADC Project Engineer.

This volume, the Usage Section of the User's Manual, contains instructions for preparing the input data, running the program, and interpreting the resulting output. Volume I, the Engineering Section of the User's Manual, contains descriptions of the program, its organization, analytic basis, operating principles, and logic flow. Volume III contains detailed descriptions of all subroutines, variables and constants used in the program. Volume IV contains complete FORTRAN source listings and detailed flow charts.

Contributions to this contract effort from Mrs. C.E. Clark, Mr. R.E. Plummer, Dr. C.D. Skouby, and Mr. G.L. Weinstock are gratefully acknowledged.

Information on these documents and on how to obtain a magnetic tape listing of the program may be obtained from Mr. Brodock, RADC/RBCT, Griffiss AFB, NY 13441.

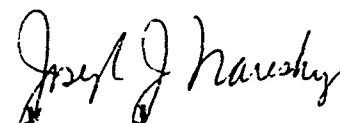
This report has been reviewed by the RADC Information Office (OI) and is releasable to the National Technical Information Service (NTIS). At NTIS it will be available to the general public, including foreign nations.

This technical report has been reviewed and approved for publication.

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## Section 1

### PRIMARY REQUIREMENTS

This volume contains detailed information for the usage of IEMCAP. Procedures and formats are given for preparing the input data, executing the program, and interpreting the resulting output. Computer requirements and resources as well as program setup are also discussed. An example test case is included to further illustrate the program use.

#### 1.1 PROGRAM OPERATION REVIEW

The first step in using IEMCAP is to assemble the appropriate data for the system to be analyzed. This data is then prepared for punched cards, which are then fed into the Input Decode and Initial Processing Routine (IDIPR) section of IEMCAP.

IDIPR consists of two major parts. The first (Input Decode or IPDCOD) decodes the punched cards and checks for errors. If an error is detected an appropriate diagnostic message is printed, the card is deleted (i.e., assumed not to have existed), and the program continues processing the rest of the data. The program normally stops after all data has been read if there were errors, but this may be overridden if desired.

If there were no input card errors, the Initial Processing Routine (IPR) section of IDIPR is entered. If this is the first run for the system, the spectrum math models are accessed for each port. These use the user-supplied spectrum parameters to generate the required and initial non-required spectra. The processed user and spectrum data is written on a permanent magnetic tape or disk file called the Intrasystem File or Intrasystem Signature File (ISF). This ISF can be used as input for subsequent runs, either as is or modified by additional card inputs; and a new ISF can be generated containing the modifications. Thus, an updated ISF can be maintained if the system design is changed. The data is also written on a number of working files for use by the Task Analysis Routine (TART) section of IEMCAP, and a printed report of the data is also generated.

The TART section of IEMCAP performs the four basic analysis tasks. These tasks, which are discussed in detail in Volume I, are summarized below:

- o Specification Generation - Adjusts the initial non-required emission and susceptibility spectra such that the system is compatible. The user-specified adjustment limit prevents too stringent adjustments. A summary of interference situations not controllable by EMC specifications is printed. The adjusted spectra are the maximum emission and minimum susceptibility specifications for use in EMC tests. (See Appendix A for test procedures.) Analysis results are written on the Baseline Transfer File (BTF) for subsequent runs.

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- o Baseline System EMC Survey - Surveys the system for interference. If maximum of the EMI margin over the frequency range for a coupled emitter-receptor port pair exceeds the user-specified previous limit, a summary of the interference is printed. Total received signal into each receptor from all emitters is also printed. The analysis results are written on the BTF for subsequent runs.
- o Trade-off Analysis - Compares the interference for a modified system to that stored on the BTF from a previous specification generation or survey run. Thus, the effect on interference of antenna changes, filter changes, spectrum parameter changes, wire changes, etc. can be assessed.
- o Specification Waiver Analysis - Shifts portions of specific port spectra as specified and compares the resulting interference to that stored on the BTF. Thus, the effect of granting waivers for specific ports can be assessed.

TART is composed of two basic routines. The Specification Generation Routine (SGR) performs the first task above, and the Comparative EMI Analysis Routine (CEAR) performs the remaining three. These interface with the coupling math model routines to compute the transfer ratios between emitter and receptor ports.

## 1.2 COMPUTER REQUIREMENTS

The two parts of IEMCAP are executed separately with data files used for intermediate storage between parts. Computer resources used are illustrated in Figure 1.

Central Processing Unit (CPU) core memory to load and execute each part of IEMCAP on a CDC 6600 using the Fortran Version 2.3 compiler are as follows:

IDIPR - 64K words (decimal)  
TART - 67K words (decimal).

These include input/output buffer storage of 1K per file.

The computer must have sufficient file storage for 4 permanent and 10 working files, in addition to normal card input and printed output. The permanent files can be either disk or tape. For the working files, disk should be used because of the number of files and large number of accesses per run. All files are sequential so that random access software is not required.

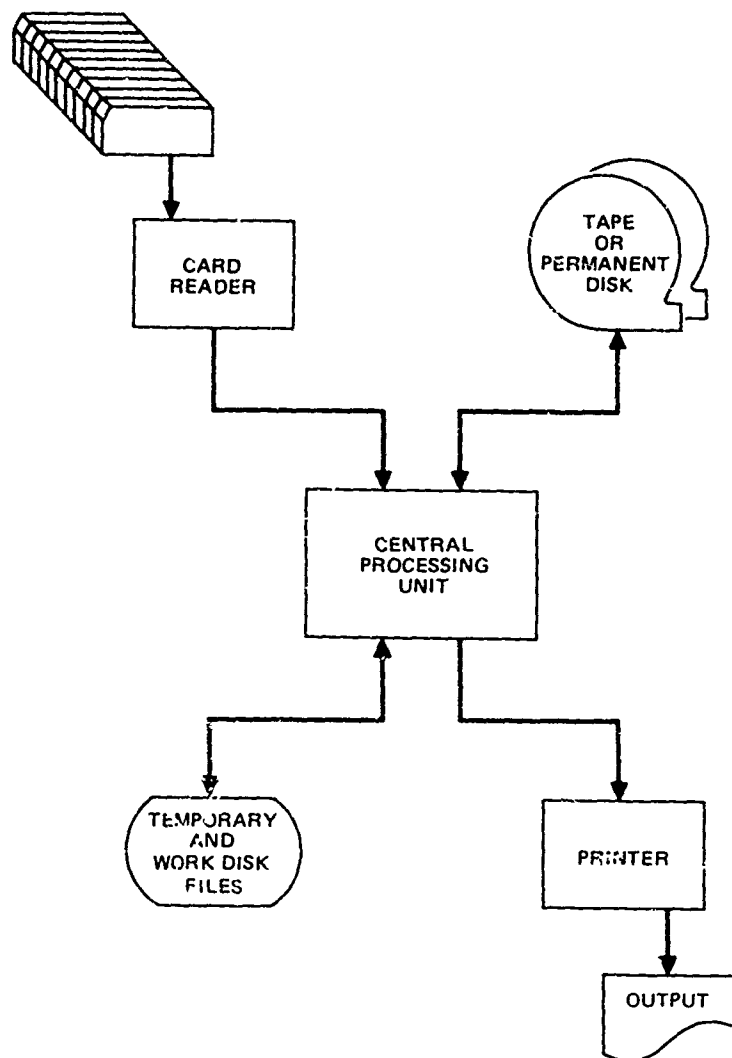


FIGURE 1  
IEMCAP COMPUTER RESOURCES

The amount of file space needed depends on the size of the system being analyzed. Except for the BTF, the size depends primarily on the number of ports. The size of the BTF depends on the number of coupled port pairs since it stores the analysis results.

The execution time also depends on the system size. IDIPR time is approximately 0.1 second per input card. TART run time primarily depends on the number of coupled port pairs. This potentially increases as the square of the number of ports. In general though, each emitter port will not be coupled to each receptor port so the actual time will be less. Also, the TART time depends on the analysis task. Specification generation requires three passes through the emitters per receptor with two passes through the receptors per run and hence runs longer than the other tasks. Table 1 gives the run times and file sizes for two test cases run on the CDC 6600. Case 1 is the "mini system" test case presented in Section 5.

### 1.3 DATA STORAGE FILES

As discussed above, IEMCAP uses a number of data files. In Table 2 these files and the input and output are summarized. Each physical file and device is assigned a logical unit number which is stored in each section of the program as a mnemonic variable name. For example, in the CDC 6600 the card input is designated as logical unit number 5. In IDIPR and TART, the variable INN is set to 5, and all card input read statements reference INN. If in a particular computer, the card reader is a different unit number, all card inputs can be changed to this unit number by changing INN. The logical unit numbers are usually assigned to files in the computer job control cards. (See Section 3.2.) Also, note that a number of files are assigned to the same logical unit. This allows multiple usage of the same physical file space.

The files are categorized as permanent, working and scratch. Permanent files are used to store data and analysis results for use in subsequent runs. Working or intermediate files provide temporary storage for the data in a form for efficient use by the various routines. They also provide intermediate data storage between IDIPR and TART. Scratch files are used for temporary storage within IDIPR and TART.

#### 1.3.1 Permanent Files

These files are generally saved after a run or are input from a previous run. They are the old and new (updated) Intrasytem Signature Files (also called the Intrasytem File or ISF) and the Baseline Transfer file. A description of these follows:

Old Intrasytem Signature File (Old ISF). This is an input file created during a previous run either by IDIPR or TART. It contains data defining the system being analyzed including user-defined input parameters, processed data, and port spectra. It may or not be present for a given run. If not present, the system is defined by card input only. If present, the

TABLE 1

## EXECUTION TIMES AND SIZE OF PERMANENT AND WORK FILES FOR SAMPLE RUNS

|                              | TEST CASE 1 | TEST CASE 2 |
|------------------------------|-------------|-------------|
| DATA CASE SIZE               |             |             |
| Total No. Cards              |             |             |
| Input to IDIPR               | 170         | 241         |
| Total No. Ports              | 33          | 56          |
| EXECUTION TIMES              |             |             |
| Execution time IDIPR         | 17.4 sec    | 24.5 sec    |
| Execution time TART-SGR      | 176 sec     | 186 sec     |
| FILE SIZE IN WORDS (Decimal) |             |             |
| New ISF                      | 10,862      | 16,000      |
| Baseline Transfer File       | 35,000      | 41,000      |
| Emitter Spectrum             | 3012        | 4200        |
| Receptor Spectrum            | 1792        | 2670        |
| Emitter Equipment            | 1634        | 2350        |
| Receptor Equipment           | 1631        | 2380        |
| Wire Bundle                  | 97          | 400         |
| Wire Map                     | 640         | 2390        |
| Array                        | 183         | 300         |
| PIF                          | 3000        | 4200        |

NOTE: All figures are based on executions on a CDC 6600

TABLE 2  
FILES USED BY ILMCAP

| FILE NAME                              | TYPE   | USE* | IDIPR<br>Mnemonic | TART<br>Mnemonic | LOGICAL<br>UNIT | USUAL<br>DEVICE | IDIPR TASK<br>Requiring File<br>(I=Input, O=output) | TART TASK<br>Requiring File<br>(I=Input, O=output) |
|----------------------------------------|--------|------|-------------------|------------------|-----------------|-----------------|-----------------------------------------------------|----------------------------------------------------|
| 1. SYSTEM INPUT                        | BCD    |      | INN               | INN              | 5               | CARDS           | All (I)                                             | All (I)                                            |
| 2. CARDIN                              | BCD    | S    | IT3               | -                | 3               | DISK            | All (O/I)                                           | -                                                  |
| 3. Processed Input File (PIF)          | BCD    | S, P | IT1               | -                | 1               | DISK            | All (O/I)                                           | -                                                  |
| 4. Old Intrasystem Signature<br>File   | BCD    | P    | IT4               | -                | 4               | TAPE/DISK       | All If JOBSTATUS =<br>OLD or MOD (I)                | -                                                  |
| 5. New ISF (Generated by IDIPP)        | BCD    | P    | IT6               | IT4              | 16              | TAPE/DISK       | SGR, CEAR, optional<br>for ISP (O)                  | All (I)                                            |
| 6. New ISF (Generated by TART)         | BCD    | P    | -                 | IT6              | 22              | TAPE/DISK       | -                                                   | SGR (O)                                            |
| 7. Unadjusted Emitter<br>Spectrum File | Binary | W    | IT10              | IUESF            | 10              | DISK            | SGR, CEAR (O)                                       | SGR (I/O)<br>All others (I)                        |
| 8. Unadjusted Receiver<br>Spectrum     | Binary | W    | IT11              | IUNSF            | 11              | DISK            | SGR, CEAR (O)                                       | SGR (I/O)<br>All others (I)                        |
| 9. Emitter Equipment File              | Binary | W    | IT12              | IEEDF            | 12              | DISK            | SGR, CEAR (O)                                       | All (I)                                            |
| 10. Receiver Equipment File            | Binary | W    | IT13              | IREDF            | 13              | DISK            | SGR, CEAR (O)                                       | All (I)                                            |
| 11. Wire Bundle File                   | Binary | W    | IT14              | IWBF             | 14              | DISK            | SGR, CEAR (O)                                       | All (I)                                            |
| 12. Wire Map File                      | Binary | W    | IT25              | IWNF             | 3               | DISK            | SGR, CEAR (O)                                       | All (I)                                            |
| 13. Array                              | Binary | W    | ITXX              | ITXX             | 21              | DISK            | SGR, CEAR (O)                                       | All (I)                                            |
| 14. Adjusted Emitter<br>Spectrum File  | Binary | S    | -                 | IAESF            | 17 or 10        | DISK            | -                                                   | SGR                                                |
| 15. Adjusted Receiver<br>Spectrum File | Binary | S    | -                 | IARSF            | 18              | DISK            | -                                                   | SGR                                                |
| 16. Baseline Transfer File             | Binary | P    | -                 | ITRNF            | 19              | DISK            | -                                                   | SGR, SU (O)<br>TO, WA (I)                          |
| 17. SGR Scratch File                   | Binary | S    | -                 | ISCRF            | 10 or 17        | DISK            | -                                                   | SGR (I/O)                                          |
| 18. Scratch Transfer File              | Binary | S    | -                 | ISCHTR           | 22              | DISK            | -                                                   | SGR (I/O)                                          |
| 19. System Output                      | BCD    |      | IOU               | IOU              | 6               | PRINTER         | All (O)                                             | All (O)                                            |

\*NOTE: S = Scratch File; P = Permanent File; W = Working File

old ISF data may be analyzed as is or modified by additional card inputs. A user can have as many different ISF's as desired, although only one is used as input per run.

New Intrasystem Signature File (Generated by IDIPR). This is an output file created by IDIPR from the card input data or from an old ISF modified by card input. The format is identical to the old ISF described above. It is used as input for TART.

New Intrasystem Signature File (Generated by TART). This is an output file created by TART during specification generation runs. It is identical to the above new ISF except that it contains the adjusted port spectra.

Baseline Transfer File. This file is built by TART during SGR or survey runs and contains the received signals, transfer ratios, and EMI margins for all coupled port pairs and from the total signal and environmental field into each receptor at all frequencies. This is an input to TART for waiver analysis and trade-off analysis runs.

### 1.3.2 Working Files

These files may or may not be saved for a given run. This would depend on whether IDIPR and TART are run independently or are run consecutively as one job. If run separately, for example to check the input data for errors only, the working files must be saved for TART. The working files can also be saved for restart in the event of errors. (See Section 3.3.) These files are as follows:

Unadjusted Emitter Spectrum File (UESF). This file, as built during initial processing, contains the initial broadband and narrowband spectra for all emitter ports. During specification generation runs, SGR adjusts these spectra and writes them on the Adjusted Emitter Spectrum File (AESF). After all emitters have been examined and adjusted in conjunction with a given receptor, the AESF and UESF are swapped, and the process is repeated for the next receptor. For analysis tasks other than SGR, the UESF is used only as input by TART since no spectrum adjustments are made.

Unadjusted Receptor Spectrum File (URSF). This file is the same as the UESF above except it contains receptor port spectra.

Emitter Equipment Data File (EEDF). This file is built during initial processing containing all equipment and port parameters, except the spectra and spectrum pointers, for emitter ports. Because TART selects a receptor and analyzes all emitter ports against it, equipment data is written on separate files for emitters and receptors for efficient processing. If a given port is both an emitter and receptor, the data is on both files.

Receptor Equipment Data File (REDF). This is the same as the EEDF above except it contains receptor data.

Wire Bundle File (WBF). This file, built during initial processing, contains all wire bundle data for the system. This data is in the form specified in the IDIPR input data.

Wire Map File (WMF). This file, built during initial processing, contains processed wire bundle data in the form of cross-reference map arrays relating the wires, segments, and ports. This data is used as input to the wire-to-wire and field-to-wire transfer model routines in TART.

Array. This file, built during initial processing, contains basic system data, control flags, data change codes, and other data for use by TART.

### 1.3.3 Scratch Files

These files are used completely within IDIPR or TART for temporary data storage. They are generally not saved after a run, but some share the same physical file as a permanent or work file which is saved. The PIF may be saved for restart. These files are as follows:

CARDIN. This file is used by IDIPR to store the card images of the input cards during input decode. It is later overwritten and used as the Wire Map File.

Processed Input File (PIF). This file is built by IDIPR during input decode. For new jobs (no old ISF exists), the format of the PIF is the same as the ISF except there are no emitter and receptor spectra. For modify jobs, the system data is not written on the PIF, but the equipment and wire bundle data is written in the same format as on the ISF. The PIF may be saved for restart as discussed in Sections 3.1 and 3.3.

Adjusted Emitter Spectrum File (AESF). This file is used by TART during specification generation and contains the adjusted spectra for the emitter ports. The logical unit switches back and forth between AESF and UESF files each time the emitter spectra are re-adjusted as discussed above for the UESF.

Adjusted Receptor Spectrum File (ARSF). This file is the same as the AESF except that it contains the adjusted receptor spectra.

SGR Scratch File (SCRF). This is used during specification generation to store adjusted emitter spectra and transfer functions used in the determination of unresolved interference. The logical unit used is the one which was not used to store the final adjusted emitter spectra.

Scratch Transfer File (SCHTR). This file is used by TART during specification generation and contains the transfer ratio from each coupled emitter into the receptor at each frequency.

## Section 2

### INPUT DATA REQUIREMENTS

#### 2.1 DATA ORGANIZATION

The input data directs the program and defines the system to be analyzed. All directives and data discussed below are inputted to IDIPR. TART has only one mandatory input card and one optional card on which basic parameters specified to IDIPR may be overridden.

The program directives specify the analysis task and the form of input and output for the run. They also supply a title and remarks which are included in the printed output to identify the run.

The rest of the data defines the system to be analyzed and is organized into three basic categories: 1.) system data, 2.) subsystem data, and 3.) wire bundle data. Each of these categories is organized into a hierarchy.

The system data defines the system type (aircraft, spacecraft, ground) overall physical dimensions, coordinate system parameters, and basic analysis parameters applying to the entire system. It also includes common model parameter tables. These tables contain basic parameters for apertures, antennas, filters, and wire characteristics which have multiple use throughout the system. They are referenced at the port level so that the basic parameters are specified only once. For example, assume a particular antenna type is used for 20 ports in the system. The antenna physical dimensions, main beam shape, gain, etc. are specified in the system data along with an identifying name. In the port data, this name is referenced, and only the antenna coordinates and main beam orientation are specified for each of the 20 ports using the antenna.

The subsystem data is organized into the hierarchy discussed in Volume I. The hierarchy is summarized here for reference:

Subsystem. A subsystem consists of well defined parts of a system usually performing a related task. A radar package and a central computer complex are examples of subsystems. This level is defined for convenience in organizing the data and is not a functional level within the program. Hence, equipments need not be specified with reference to a subsystem.

Equipment. An equipment is a physical box mounted in the system, such as a transmitter unit.

Port. A port is a point of entry or exit of electromagnetic energy from an equipment. A port may be connected to an antenna or to a wire. Leakage into and out of the equipment case is also a port. A port may be designated as a source (emitter), a receptor, or both. The analyses are performed on a port-to-port basis. All ports within the same equipment are assumed compatible with each other.

Source. A source is a port which emits electromagnetic energy. The terms source and emitter are used interchangeably throughout the program.

Receptor. A receptor is a port which is susceptible to electromagnetic energy.

Wire bundle data is also organized into a hierarchy, which allows complex wire routings to be analyzed. The components are as follows:

Bundle. A bundle is a group of wires which, for some portion of their lengths, run parallel to each other.

Bundle point. A point in the system at which a bundle branches or changes direction. Between points wires are assumed to run in straight lines, and no branching occurs.

Segment. A segment is a section of a bundle running between points. Segments are designated by giving the bundle points. Within a segment the wires are assumed to run parallel. A segment may also run by a dielectric aperture and be exposed to energy from external antennas and environmental electromagnetic fields.

Wire. A wire connects two or more ports. Its routing is specified by designating the bundle points through which it passes for which segments have been defined. Care must be taken that a wire routing not close on itself or an error will result. The wire physical parameters are given by referencing the Wire Characteristics Table, which is specified at the system level.

## 2.2 MAXIMUM SYSTEM SIZE

The capacity of IEMCAP with regard to system size is given in Table 3.

TABLE 3

| MAXIMUM SYSTEM SIZE   |     |
|-----------------------|-----|
| EQUIPMENTS            | 40  |
| PORTS PER EQUIPMENT   | 15  |
| TOTAL PORTS (40 X 15) | 600 |
| APERTURES             | 10  |
| ANTENNA TYPES         | 50  |
| FILTER TYPES          | 20  |
| WIRE BUNDLES          | 10  |
| SEGMENTS PER BUNDLE   | 10  |
| WIRE PER BUNDLE       | 50  |

## 2.3 INPUT DATA CARD FORMATS

### 2.3.1 Basic Format

The user input format provides an easy-to-use and flexible means of specifying the diverse types of data required by IEMCAP. Examples of IEMCAP input cards are listed in Figure 2. The format is easy to learn, and parameters are in units in which the engineering data is commonly available on aerospace systems. These are converted by the program to the units required by the models.

Except for TITLE and REMARK cards, inputs are free field. That is, parameters can be punched into any columns of the cards. Blanks are ignored so the entries may be indented and the parameters grouped as desired for clarity. A card may be continued on the next provided the last nonblank character on the card to be continued is a comma.

The inputs are in the form of statements, the general form of which is

KEYWORD (MODISF) = ID,  $P_1$ ,  $P_2$ ,  $P_3$ , ...  $P_n$

where

- KEYWORD - denotes the type of data on the card. It must be one of the specific keywords given in Table 4. It may be abbreviated using the first two letters, if desired.
- MODISF - optional code used only for modify runs. It indicates the type of change to the data from the old ISF (add, delete, or modify). See Section 2.4.5.
- ID - alphanumeric identification used to denote a specific equipment, port, wire, etc. It may be any combination of up to five letters and digits, the first character being a letter. ID is not given for some keyword types.
- $P_1, P_2, \dots, P_n$  - parameters associated with the keyword type as specified in the following sections. The number of parameters ( $n$ ) is fixed for most keyword types. For others a minimum is required (Table 4). The parameters are given in the order specified for the keyword type. The parameters are numbers, alphanumeric codes, or ID's as specified.

For some keyword types, some of the parameters may be followed by a variable number of subparameters in parenthesis. The group of subparameters is counted as one parameter. For example,

$\overbrace{P_4}^{\text{---}}$

KEYWORD (MODISF) = ID,  $P_1, P_2, P_3, (sp_1, sp_2, sp_3, \dots), P_5$

# INPUT CARDS

```

REMARK= FILE ID=CCOT4M CORRECTED BASELINE SYSTEM.
EXEC=ISO,NEW
OU=NO
SYSTEM=AIP,0,0,0,-06,-100.
WNGRT=55,12,225,456
WGTTP=230,16,435,490
FUSLGE=165.,56.5,18.8,25.,12.,FLAT
EFO= 1E3,100E3,1E6,100E6,1F9,4E9
OE=30,30,40,40,30,30
TE=-20,-20,5,5,-20,-20
APER=NSFWH ,0,0,46,35,50,NOW
APER=TOPCP,0,77.2,332.5,30,10,NOW
ANT=COMTA,NIPOLE,VE,(.20)
ANT=CMANF,LOOP,HZ,(.25)
ANT=TPSP,DIPOLE,VE,(.0A)
ANT=PODHR,HORN,HZ,(.10,7.5,30,30,-5,90,-20)
ANT=PODMN,NIPOLE,VE,(.05)
ANT=ALTM,HORN,HZ,(.05,7.5,25,50,-4,110,-30)
FILTER=FLTP1,SGTUN,1,(300.E6,1.E3,-1,-90)
FILTER=FLTR2,TRCOUP,1,(300.E6,-1,-80,200,.1)
FILTER=FLTR3,BUTTER,5,(1.075E9,.1E6,-1,-80)
FILTER=FLTP4,LOWPAS,4,(1.5F9,-1,-90)
FILTER=FLTP5,HYPAS,4,(.05E6,-1,-80)
FILTER=FLTR6,BPASS,6,(.9FES,4.05E6,-1,-90)
FILTER=FLTR7,BRJCT,10,(4.01E6,8.E6,-1,-90)
WRTAL=SPC22,UN,1,30,1,6,2.8
WRTBL=SPC2,SH,1,30,1,6,2.8,42,8,6.6,463
WRTBL=SPCC,NS,1,30,1,6,2.8,42,8,5.6,463,7,6.7
SUBSYS=CNI
EQPT=UHFCO,M461,ADJUST,AFCTP,NONE,21.5,23,180
COMMENT=UHF COMM
FREQ=30,18.E9,1,35
PORT=CASF,0,0
SOURCE=CASE,30,MILSPC,SP(100.,27.5,100.E3,27.5,25.E6,52.6,100.E6,
25,1.E9,-24.6)
RCPT=CASE,10.,MILSPC,MILSPC
PORT=COMLO,ANT,(COMTA,0,0,0,0,46,NOW),50,0,0,0,0,FLTR2
SOURCE=RF,30.,225E6,399.9E6,100.,50.E3,AM(VOICE,5.E3,1),(-50,-100)
RCPT=PF,30.,225E6,399.9E6,-100,50.E3,AM(VOICE,5.E3,0),1.E6
PORT=COMUP,ANT,(COMTA,0,0,0,138,625,NOW),50,0,0,0,0,FLTR1
SOURCE=RF,30.,225E6,399.9E6,100.,50.E3,AM(VOICE,5.E3,1),(-50,-100)
RCPT=RF,30.,225E6,399.9E6,-100,50.E3,AM(VOICE,5.E3,0),1.E6
PORT=ADFIN,ANT,(CMANF,0,0,0,0,129,NOW),50,0,0,0,0,0
RCPT=PF,30.,225E6,399.9E6,-100,50.E3,AM(VOICE,5.E3,0),1.E6
PORT=PHRSP,WIRE,(BNOL1,R1W1,A1,GND,NONE,EX),.5,0,0,0,0,0
SOURCE=POWER,30,115,400,2,1,M461A
RCPT=POWER,30,115,400,2,1,M461A
PORT=ATDOT,WIRE,(BNOL2,R2W2,A2,GND,NONE,NOTEX),50,0,0,0,0,0
SOURCE=SIGNAL,30.,20.E3,4.E6,RECTPL(20.E3,1.E-6),10,VLTS,4.E6
PORT=PYCON,WIRE,(BNOL2,R2W1,A2,GND,GND,EX),50,0,0,0,0,0
SOURCE=SIGNAL,30,20.E3,5.E6,RECTPL(1.E3,.2E-3),10,VLTS,4.E6
RCPT=SIGNAL,30,20.E-12,5.E6,RECTPL(1.E3,.2E-3),10,VLTS,4.E6
COMMENT=TACAN
EQPT=TACAN,M61810,ADJUST,CNTRY,NOT,-3,15,175
FREQ=30,18.E9,1,35
FOTBL=900.E6,962.E6,1025E6,1130.E6,1213.E6,1280.E6,1380E6
PORT=CASE,0,0
SOURCE=CASE,30,MILSPC,MILSPC
RCPT=CASE,30,MILSPC,MILSPC
PORT=TACRF,ANT,(COMTA,0,0,0,374,NOW),50,0,0,0,0,FLTR3
SOURCE=RF,30,1025.E6,1130E6,1500,572E3,PARAF(RECTPL,30,2.5E-6),(-50,-90)

```

FIGURE 2  
DATA INPUT EXAMPLE

TABLE 4. KEYWORDS

| KEYWORD | MAXIMUM<br>NO. OF<br>ENTRIES | NQ*<br>PARAMETERS | CARD FORMAT<br>IN SECTION | DESCRIPTION                          |
|---------|------------------------------|-------------------|---------------------------|--------------------------------------|
| ANT     | 50/RUN                       | 4                 | 2.3.4.2                   | Antenna common model                 |
| APER    | 10/RUN                       | 7                 | 2.3.4.1                   | Aperture common model                |
| BPTS    | 1/BUNDLE                     | ≥ 8               | 2.3.6.2                   | Bundle end points                    |
| BSEG    | 1/BUNDLE                     | ≥ 5               | 2.3.6.3                   | Bundle segment                       |
| BUNDLE  | 10/RUN                       | 1                 | 2.3.6.1                   | Bundle header                        |
| COMMENT | -----                        | -                 | 2.3.2.3                   | General comment                      |
| EFQ     | 1/RUN                        | ≥ 2               | 2.3.3.4                   | Environmental field frequencies      |
| EODATA  | 1/RUN                        | 0                 | 2.3.8                     | End of data                          |
| EQPT    | 40/RUN                       | 8                 | 2.3.5.2                   | Equipment header                     |
| EXEC    | 1/RUN                        | ≥ 1               | 2.3.2.1                   | Execution control                    |
| FILTER  | 20/RUN                       | 4                 | 2.3.4.3                   | Filter common model                  |
| FQTBL   | 1/EQPT                       | ≥ 1               | 2.3.5.3                   | User frequencies in table            |
| FREQ    | 1/EQPT                       | 3                 | 2.3.5.3                   | Frequency table parameters           |
| FUSLGE  | 1/RUN                        | 6                 | 2.3.3.2                   | Fuselage                             |
| IEFL    | 1/RUN                        | ≥ 2               | 2.3.3.4                   | Internal environmental field         |
| LIST    | 1/RUN                        | 2                 | 2.3.2.4                   | List control                         |
| OEFL    | 1/RUN                        | ≥ 2               | 2.3.3.4                   | Outside environmental field          |
| OUTPUT  | 1/RUN                        | ≥ 1               | 2.3.2.4                   | Output control                       |
| PORT    | 15/EQPT                      | ≥ 1               | 2.3.5.4                   | Port data                            |
| REMARK  | 5/RUN                        | 1                 | 2.3.2.2                   | General remarks                      |
| RCEPT   | 1/PORT                       | ≥ 4               | 2.3.5.5                   | Receptor spectrum parameters         |
| SOURCE  | 1/PORT                       | ≥ 4               | 2.3.5.5                   | Source (emitter) spectrum parameters |
| SUBSYS  | ≥ 1                          | 1                 | 2.3.5.1                   | Subsystem header                     |
| SYSTEM  | 1/RUN                        | 6                 | 2.3.3.1                   | System and basic run parameters      |
| TITLE   | 2/RUN                        | 1                 | 2.3.2.2                   | Run title                            |
| WAIVER  | 50/RUN                       | ≥ 9               | 2.3.7                     | Waiver analysis data                 |
| WGTIP   | 1/RUN                        | 4                 | 2.3.3.3                   | Wing tip coordinates                 |
| WIRE    | 50/BUNDLE                    | ≥ 4               | 2.3.6.4                   | Wire data for bundle                 |
| WNGRT   | 1/RUN                        | 4                 | 2.3.3.3                   | Wing root coordinates                |
| WRTBL   | 20/RUN                       | ≥ 7               | 2.3.4.4                   | Wire characteristics table           |

\* NOTE: "≥" indicates a minimum number. Otherwise the exact number of parameters must be given.

in which the subparameter group counts as one parameter (P<sub>4</sub>) so that the total number of parameters is 5. An error results if an incorrect number of parameters is given. Zero or a valid code must be given for unused parameters as placeholders. (See Rule 6, Section 2.4.1)

As an example use of the input format, consider the keyword type FUSLGE as defined in Section 2.3.3. Assume the values to be specified are as follows:

|                         |         |
|-------------------------|---------|
| Conical nose limit      | = 165.0 |
| Fuselage radius         | = 56.5  |
| Core radius             | = 18.8  |
| Centroid water line     | = 25.0  |
| Bottom water line       | = 12.0  |
| Type of cylinder bottom | = FLAT  |

The resulting IEMCAP input card would contain

FUSLGE = 165, 56.5, 18.8, 25, 12, FLAT

(If not given, the decimal point is assumed to the right of the number.)  
Complete rules for the input are given in Section 2.4.

Certain keywords, such as FUSLGE, are used only once in a run; and others, such as ANT, may occur several times. For discussion purposes, the first is called a single entry keyword, and the second is called a multiple entry keyword. Every multiple entry keyword has an ID associated with it, either explicitly or implicitly. An ID is explicitly given when it appears after the equals sign on the card itself. All ID's are explicitly given except for certain hierarchical data where the ID is implicitly given by the proceeding card or cards. Certain keyword cards, such as the equipment cards, have both an explicit ID (the equipment ID) and an implicit ID (the subsystem ID). Some keywords have more than one implicit ID. For example, a PORT card has two implicit ID's (the equipment ID and the subsystem ID) as well as an explicit ID (the port ID). Both types of ID play an important part in the modification process. In general, data given in order of the hierarchy have as implicit ID's those of the preceding higher level ID's.

The card formats associated with all keyword types are described in the following sections. The general form for each is given along with the parameters and subparameters to be supplied. The following convention is used below in describing them:

CAPITOL LETTERS - user-supplied alphanumeric ID

UNDERLINED CAPITOL LETTERS - one of the specific alphanumeric codes given

small letters - numeric value

### 2.3.2 Control and Identification Cards

The EXEC, TITLE, and REMARK cards must precede all other input cards. Of these, the EXEC card is mandatory for all runs.

2.3.2.1 Execution Control Card (EXEC) - This card controls the tasks to be performed and the type of data input. It must precede all other input data cards except the TITLE and REMARK card. See Section 3.1.1 for guidance in specifying this card. If the optional parameters are omitted, the default code is assumed. The card format is as follows:

EXEC = TASK, JOBSTATUS, CTASK, CERR

TASK -- Analysis task (required)

ISP - Input and Spectrum Processing only. Input data is decoded and checked for errors, and initial spectra are computed and printed. No working files are written.

SGR - Specification Generation Routine in TART to be used.

CEAR- Comparative EMI Analysis Routine in TART to be used.

JOBSTATUS - Job status and input description. (Optional if CTASK is not given. If omitted NEW is assumed.)

NEW - new job. Data is from cards only (default)

OLD - old job. Data is from old ISF or PIF.

MOD - modification job. Data from old ISF or PIF is to be modified by card input.

CTASK - depends on TASK and JOBSTATUS

- If TASK is ISP and JOBSTATUS is NEW, CTASK is not given.

- If TASK is ISP and JOBSTATUS is OLD or MOD, CTASK specifies the type of input file:

ISF - input file is an Intrasystem Signature File

SU - input is special user (from a Processed Input File).

- If TASK is SGR, CTASK is not given.

- If TASK is CEAR, CTASK specifies the subtask:

TO - trade-off analysis

WAIVER - waiver analysis

SURVEY - baseline system EMC survey

CERR - If given, cancels the normal error halt after input decode even though the data contains errors. IDIPR will continue into initial processing in spite of the errors. This is permitted only if TASK is ISP.

CE - Cancel error halt.

2.3.2.2 Title and Remark Cards - These two optional cards supply identification and additional information on the printed output and the permanent files. To give the user control over their printout, they are the only fixed field cards in the IDIPR input. For both types, the keyword must start in column 1 and the title or remark must start in column 8. Up to two TITLE and five REMARK cards are permitted.

## COLUMN

1            8

TITLE = title data

REMARK = remark

### 2.3.2.3 Comment Card -

COMMENT = comment

The comment card is an optional card that allows the user to insert comments into the data. It will be printed in the list of input data only and will not be saved for the report. Comments desired to appear on the report and ISF file should be inserted through the REMARKS card. Any number of comment cards may be inserted anywhere in the data.

2.3.2.4 Output Control Cards - The following optional cards give output options. If not given, the default code is assumed.

#### List Card -

LIST = NISF, OISF

##### NISF

NONEW - Do not print report of new ISF.

NEW - Print a report of the new ISF (default).

##### OISF

OLD - Print a report of the old ISF before modification.

The LIST card is optional. If no LIST card is present, the new ISF report will be listed and the old ISF report will not be. The input data cards are always listed.

#### Output Card -

OUTPUT = ISFILE, SPOUT, ISDEBUG

##### ISFILE

NOISF - Do not create a new ISF (default)

ISF - Create a new ISF

### SPOUT

- SP - Supplemental printout from TART transfer mode's is desired.
- NO - None desired.

NOTE: This specification is overridden in TART. (See Section 2.4.9.)  
Use as placeholder when using the ISDEBUG option.

### ISDEBUG

- IS - IDIPK special debug. This will cause flags, data and messages to be printed. Its purpose is strictly debug; the data is unformatted and is generally meaningful only by following a source listing of IDIPR.

OUTPUT is an optional card. Unless included, a new ISF will be created for the run. For SGR and CEAR runs, a new ISF will be generated regardless of the specification on the OUTPUT card as the ISF supplies the system data to TART.

### 2.3.3 System Data

This data defines the physical system and specifies basic analysis parameters applying to the entire system. For ground stations, a coordinate system is used with the origin at a specified reference point. All antenna locations, box locations, wire routing points, etc., are given in X, Y, Z coordinates relative to this point. Aircraft and spacecraft coordinates are in the butt line (bl), water line (wl), and fuselage station (fs) system commonly used for aerospace vehicles. As illustrated in Figure 3, butt line is the horizontal distance to the right (positive) or left (negative) from the vehicle centerline, water line is the vertical distance from the vehicle bottom, and fuselage station is the lengthwise distance from the nose (positive toward the tail). The origin of this coordinate system may vary from vehicle to vehicle. In all cases, coordinates are given of the center of the box, antenna, aperture, etc. being located.

#### 2.3.3.1 System and Basic Analysis Parameter Card -

SYSTEM = TYPE, long., lat., alt., asm, empl

1. TYPE = AIR - Aircraft model (conical nosed cylinder with wings).

Ground, (sigma, epsr) - Ground station. Antennas are over a finitely conducting ground plane as defined by the subparameters:

sigma - conductivity relative to copper  
epsr - permittivity relative to free space

SPACE - Spacecraft model (same as aircraft but without wings).

- |              |                                                                                                                  |         |
|--------------|------------------------------------------------------------------------------------------------------------------|---------|
| 2. longitude | } Reference point coordinates<br>for ground stations. All<br>other systems must specify<br>0's as a placeholder. | degrees |
| 3. latitude  |                                                                                                                  | degrees |
| 4. altitude  |                                                                                                                  | feet    |
5. asm - adjustment safety margin for SGR. Spectra are adjusted so that EMI margins are less than or equal to asm. dB
6. empl - EMI margin print limit. Cases in which the maximum EMI margin exceeds empl are printed in the TART output. dB

NOTE: asm and empl can be overridden in TART. See Section 2.3.9.

2.3.3.2 Fuselage Model Parameter Card - This card is supplied only if TYPE = AIR or SPACE on the SYSTEM card. It defines the fuselage parameters used for antenna propagation calculations for which a flat or round bottomed cylindrical model is used to approximate the vehicle shape. A visualization of the flat bottomed model fitted to an F-4 aircraft is shown in Figure 3. The model is divided into fixed and variable radius regions with the dividing point at  $fs_n$ , as shown. If one or both antennas are in the fixed cylinder region, cylindrical spirals are used to compute antenna separation and fuselage shading. If both antennas are in the variable radius region, separation is calculated by a conical spiral fitted between the locations of the two antennas. The cone will vary depending on the radii of the two antennas. The card format follows:

$$FUSLGE = fs_n, \rho_f, \rho_c, w_{lc}, w_{BOT}^l, \underline{MDL}$$

- |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                |        |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| 1. $fs_n$   | - FS of variable radius region limit, as discussed above.                                                                                                                                                                                                                                                                                                                                                                                      | inches |
| 2. $\rho_f$ | - Fuselage radius (radius of fixed cylinder). A 10 percent variation from $\rho_f$ is included in the mathematical model to allow for contours in the vehicle shape. That is, if the radius from the centroid to a given antenna is within 10 percent of $\rho_f$ , it is considered on the fuselage. For aircraft, the default value using the wing root is computed if this parameter specified as zero. It must not be zero for spacecraft. | inches |
| 3. $\rho_c$ | - Core Radius. To prevent inaccuracies resulting from very small radii in computing fuselage shading, a cylindrical core is defined. Antennas within this core are assumed at the centroid with no fuselage shading computed to them. If specified as zero, a default value of 1/3 of the fuselage radius is used.                                                                                                                             | inches |

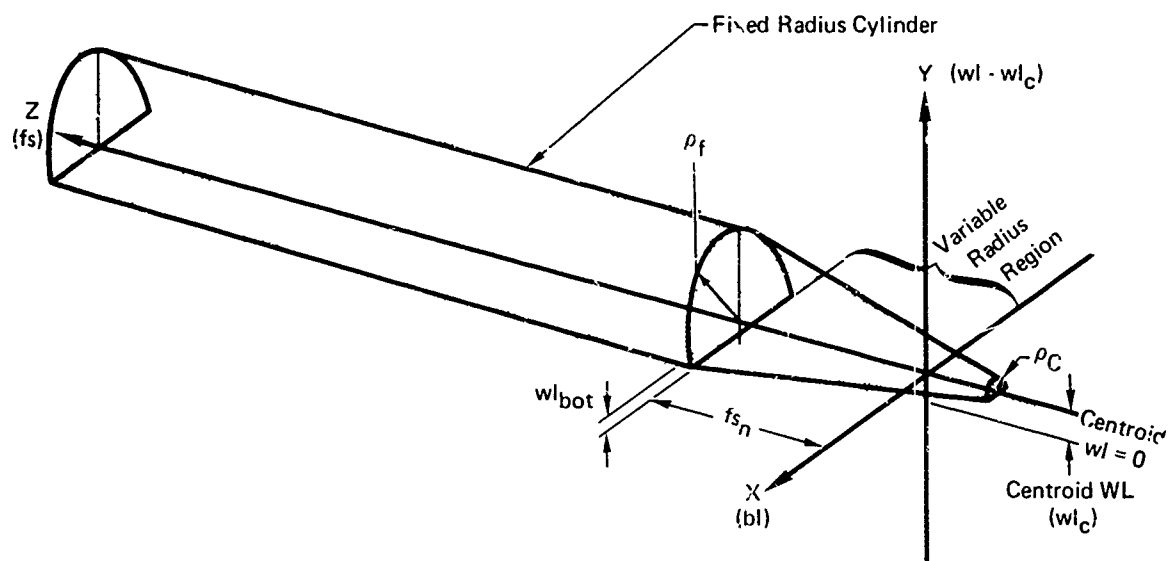


FIGURE 3  
BASIC FUSELAGE PARAMETERS  
(FLAT BOTTOMED CYLINDER)

GP74 0267 113

4.  $wl_c$  - Water line of the cylinder centroid. inches

5.  $wl_{BOT}$  - Water line of bottom when flat-bottomed cylinder is used inches

6. MDL - Cylindrical model

ROUND - round bottomed cylinder

FLAT - flat bottomed cylinder

2.3.3.3 Wingroot and Wingtip - Supplied only if TYPE = AIR. See Figure 4.

WNGRT =  $bl, wl, fs_f, fs_a$

WGTIP =  $bl, wl, fs_f, fs_a$

1.  $bl$  butt line of root/tip inches

2.  $wl$  water line of root/tip inches

3.  $fs_f$  fuselage station of forward edge of root/tip inches

4.  $fs_a$  fuselage station of aft edge of root/tip inches

2.3.3.4 Environmental Electromagnetic Fields - These are optional inputs defining levels of the ambient fields both outside and inside the system. Wire segments exposed by apertures in the system structure and antennas are presumed exposed to the external fields. Equipment cases and wire segments which do not run by apertures are exposed to the internal fields. The fields are specified by giving the levels at up to 90 sample frequencies. The program log-linearly interpolates between these levels. The EFQ statement establishes the frequencies, while the OEFL and IEFL give the levels at these frequencies. Either OEFL, IEFL, or both may be present; but if either is present, EFQ must be. The same number of levels must be specified as frequencies in EFQ. If the external field only is specified, the internal field defaults to 40 dB less than the external field. If the internal field only is specified, the external field defaults to 40 dB greater than the internal field. If neither is specified, external and internal fields are presumed zero.

EFQ =  $f_1, f_2, f_3, \dots, f_n$

IEFL =  $e_{i1}, e_{i2}, e_{i3}, \dots, e_{in}$

OEFL =  $e_{o1}, e_{o2}, e_{o3}, \dots, e_{on}$

EFQ - frequencies

Hz

IEFL - internal field levels

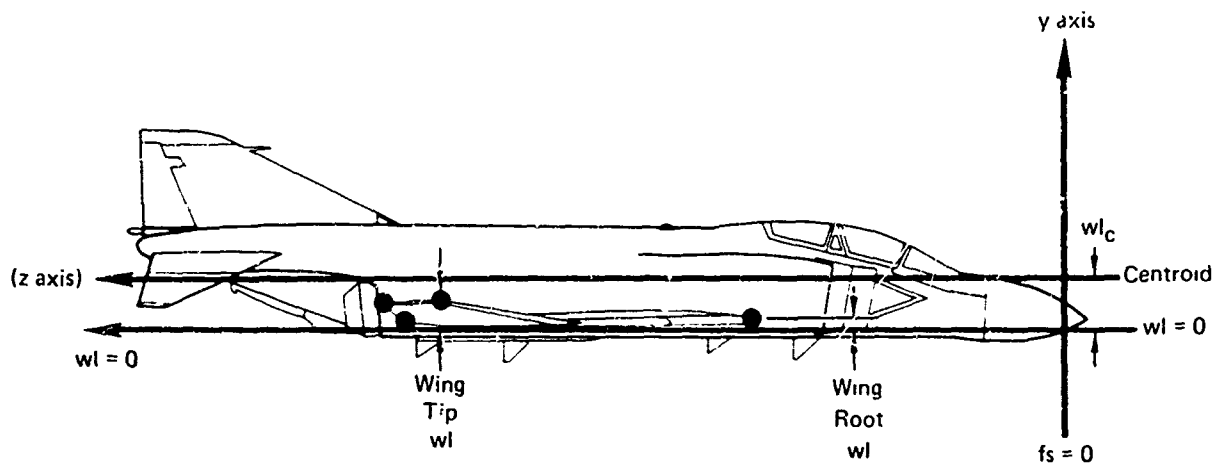
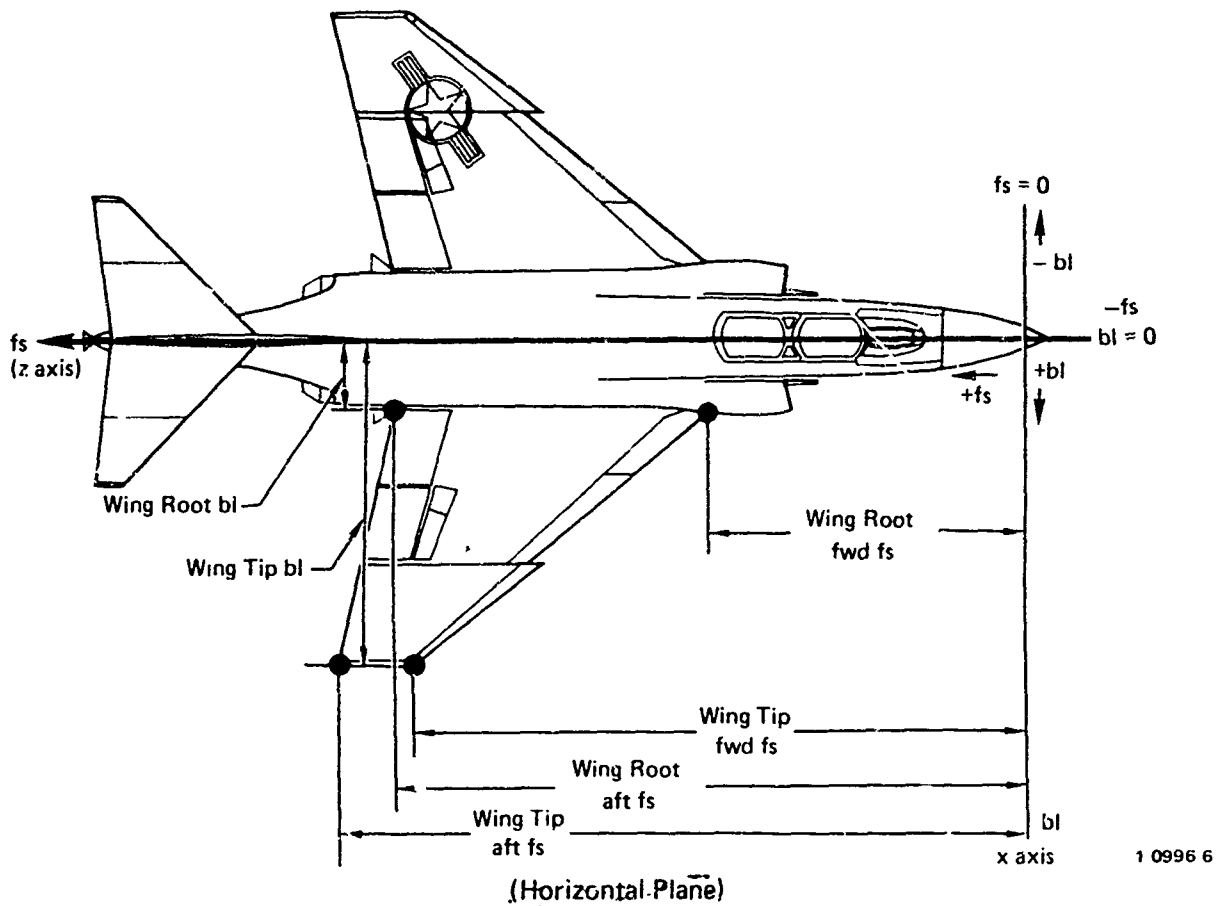
dB V/m

OEFL - outside field levels

dB V/m

n - number of sample points

( $1 \leq n \leq 90$ )



(Vertical Plane)  
**FIGURE 4'**  
**WING POINT LOCATION**

### 2.3.4 Common Model Parameters

This data specifies parameters for apertures, antennas, filters, and wire characteristics used throughout the system. Basic parameters are given for each type of aperture, antenna, filter, and wire used in the system, as well as a unique ID. These ID's are referenced in the subsystem and wire bundle data as many times as desired. These are multiple entry keywords as discussed in Section 2.3.1.

**2.3.4.1 Apertures** - These are dielectric apertures which expose wire bundle segments to external electromagnetic energy from antennas and environmental fields. For segments which are exposed over their entire length, the aperture length should be greater than or equal to the segment length. Field-to-wire coupling will be computed only for aperture-exposed wires.

APER = APID, wl, bl, fs, width, length, WGLOC

- |                 |                                                                 |                  |
|-----------------|-----------------------------------------------------------------|------------------|
| 1. APID         | = aperture identification                                       | ALPHA ID         |
| 2. bl           | = butt line for aircraft or spacecraft<br>= x for ground        | inches<br>inches |
| 3. wl           | = water line for aircraft or spacecraft<br>= y for ground       | inches<br>inches |
| 4. fs           | = fuselage station for aircraft or spacecraft<br>= z for ground | inches<br>inches |
| 5. width        | = width of aperture                                             | inches           |
| 6. length       | = length of aperture                                            | inches           |
| 7. <u>WGLOC</u> | = wing location                                                 | ALPHA code       |
| NOW             | = not on wing or system is not aircraft                         |                  |
| BGT             | = on or suspended from wing bottom                              |                  |
| TOP             | = top of wing                                                   |                  |
| FWDEDG          | = forward edge of wing                                          |                  |
| AFTEDG          | = aft edge of wing                                              |                  |
| TIP             | = tip of wing                                                   |                  |

**2.3.4.2 Antenna Data** - Main beam and side lobe limit angles are defined in the spherical angles commonly used for antennas, as illustrated in Figure 5. Elevation angle  $\theta$  is the vertical depression down from the y-axis, and azimuth angle  $\phi$  is determined clockwise from the negative z-axis. The location and main beam orientation is specified in the port data referencing AID. The subparameters required depend on the MODEL code.

ANT = AID, MODEL, POLAR, (sp<sub>1</sub>, sp<sub>2</sub>, ..)

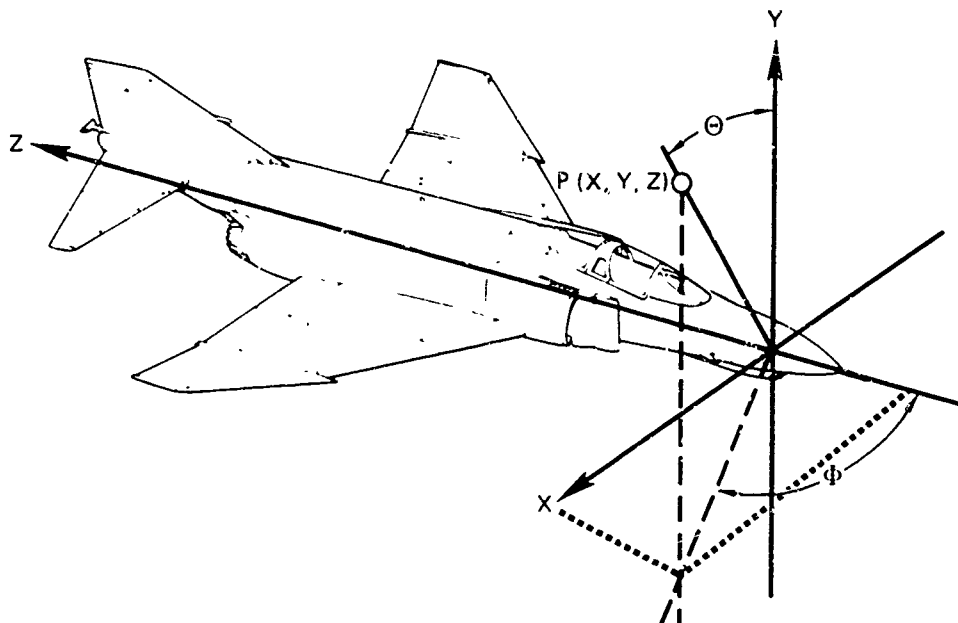


FIGURE 5  
LOOK-ANGLE  $\Theta$  AND  $\phi$  IN SPHERICAL COORDINATE SYSTEM  
FROM AN ANTENNA AT ORIGIN TO P (X, Y, Z)

1. AID identification

ALPHA ID

| 2. <u>MODEL</u> code | <u>DESCRIPTION</u> | <u>SUBPARAMETERS</u> ( $sp_1, sp_2, \dots$ )              |
|----------------------|--------------------|-----------------------------------------------------------|
| DIPOLE               | dipole             | $\ell$                                                    |
| WHIP                 | whip               | $\ell$                                                    |
| SLOT                 | slot               | $\ell$                                                    |
| LOOP                 | loop               | $d$                                                       |
| PARDSH               | parabolic dish     | $d, G_{mB}, \theta_B, \phi_B, G_{msL}, \phi_{sl}, G_{Bl}$ |
| LGPER                | log periodic       | $d, G_{mB}, \theta_B, \phi_B, G_{msL}, \phi_{sl}, G_{Bl}$ |
| HORN                 | horn               | $d, G_{mB}, \theta_B, \phi_B, G_{msL}, \phi_{sl}, G_{Bl}$ |
| PSDAR                | phased array       | $d, G_{mB}, \theta_B, \phi_B, G_{msL}, \phi_{sl}, G_{Bl}$ |
| SPIRAL               | spiral             | $d, G_{mB}, \theta_B, \phi_B, G_{msL}, \phi_{sl}, G_{Bl}$ |

Definition of subparameters

|               |                                 |                              |
|---------------|---------------------------------|------------------------------|
| $\ell$        | = antenna length                | inches                       |
| $d$           | = largest antenna dimension     | inches                       |
| $G_{mB}$      | = maximum gain                  | dB                           |
| $\theta_B$    | = 3-dB vertical half-beamwidth  | degrees                      |
| $\phi_B$      | = 3-dB azimuthal half-beamwidth | degrees                      |
| $G_{msL}$     | = major side-lobe gain          | dB                           |
| $\phi_{sl}^*$ | = side lobe angle               | from $\phi_B$ to 180 degrees |
| $G_{Bl}^*$    | = back lobe gain                | dB                           |

\*NOTE: Set equal to zero if not used.

3. POLAR = polarization

ALPHA code

HZ - horizontal  
VE - vertical  
CI - circular

2.3.4.3 Filter Data - These are filters connected between a port and its source or load. It is referenced in the port data.

FILTER = FID, TYPE, { no. stages/  
order }, (sp<sub>1</sub>, sp<sub>2</sub> ...)

1. FID - filter identification

ALPHA ID

2. TYPE - type of filter

| <u>TYPE</u> | <u>DESCRIPTION</u>        | <u>SUBPARAMETERS</u>                      |
|-------------|---------------------------|-------------------------------------------|
| SGTUN       | single tuned stage        | f <sub>o</sub> , B, γ, isol               |
| TRCOUP      | transformer coupled stage | f <sub>o</sub> , γ, isol, Q, m            |
| BUTTER      | Butterworth tuned         | f <sub>o</sub> , B, γ, isol               |
| LOWPAS      | low pass                  | f <sub>u</sub> , γ, isol                  |
| HIPAS       | high pass                 | f <sub>l</sub> , γ, isol                  |
| BPASS       | band pass                 | f <sub>l</sub> , f <sub>u</sub> , γ, isol |
| BRJCT       | band reject               | f <sub>l</sub> , f <sub>u</sub> , γ, isol |

3. No. Stages - number of stages if TYPE = SGTUN, TRCOUP, BUTTER  
or  
Order - order if TYPE = LOWPAS, HIPAS, BPASS, BRJCT

4. Subparameters

|                |                         |              |
|----------------|-------------------------|--------------|
| f <sub>o</sub> | tuned frequency         | MHz          |
| B              | bandwidth               | MHz          |
| γ              | insertion loss          | dB           |
| isol           | max isolation           | dB           |
| Q              | circuit Q               | nondimension |
| m              | circuit coupling factor | nondimension |
| f <sub>u</sub> | upper break point       | MHz          |
| f <sub>l</sub> | lower break point       | MHz          |

2.3.4.4 Wire Characteristics Table - These cards define a table of general wire characteristics which are referenced for specific wires in the wire bundle data. There are three input forms:

for unshielded wires -

WRTBL = WTDID, UN,  $n_{wt}$ ,  $d_c$ ,  $\sigma_c$ ,  $t_i$ ,  $\epsilon$

for single shielded wires -

WRTBL = WTDID, SH,  $n_{wt}$ ,  $d_c$ ,  $\sigma_c$ ,  $t_i$ ,  $\epsilon$ ,  $d_{s1}$ ,  $t_{s1}$ ,  $t_j$ ,  $C_{cs}$

for double shielded wires -

WRTBL = WTDID, DS,  $n_{wt}$ ,  $d_c$ ,  $\sigma_c$ ,  $t_i$ ,  $\epsilon$ ,  $d_{s1}$ ,  $t_{s1}$ ,  $t_j$ ,  $C_{cs}$ ,  $d_{s2}$ ,  $t_{s2}$

|     |                 |                                                            |                |
|-----|-----------------|------------------------------------------------------------|----------------|
| 1.  | WTDID           | Wire Type Designation ID                                   | ALPHA ID       |
| 2.  | <u>UN/SH/DS</u> | Shield Code                                                | ALPHA code     |
|     |                 | SH shielded                                                |                |
|     |                 | UN unshielded                                              |                |
|     |                 | DS double shield                                           |                |
| 3.  | $n_{wt}$        | number of wire pairs twisted                               | integer        |
| 4.  | $d_c$           | conductor diameter                                         | mils           |
| 5.  | $\sigma_c$      | conductor conductivity                                     | rel/copper     |
| 6.  | $t_i$           | insulation thickness                                       | mils           |
| 7.  | $\epsilon$      | insulation dielectric constant                             | rel/free space |
| 8.  | $d_{s1}$        | shield internal diameter<br>(inner shield if DS)           | mils           |
| 9.  | $t_{s1}$        | shield thickness<br>(inner shield if DS)                   | mils           |
| 10. | $t_j$           | shield jacket thickness<br>(inner shield if DS)            | mils           |
| 11. | $C_{cs}$        | shield-to-conductor<br>capacitance (to inner shield if DS) | pF/ft          |
| 12. | $d_{s2}$        | outer shield internal diameter                             | mils           |
| 13. | $t_{s2}$        | outer shield thickness                                     |                |

### 2.3.5 Subsystem Data

This data gives specific parameters down to the port source and receptor level. The cards must be given in order of the hierarchy: subsystem, equipment, port, source/receptor.

#### 2.3.5.1 Subsystem card -

SUBSYS = SSID

| SSID | Subsystem identification | ALPHA ID |
|------|--------------------------|----------|
|------|--------------------------|----------|

#### 2.3.5.2 Equipment -

EQPT = EID, SPEC, FIXADJ, COMP, CLASS, b1, w1, fs

|                  |                               |            |
|------------------|-------------------------------|------------|
| 1. EID           | identification                | ALPHA ID   |
| 2. <u>SPEC</u>   | EMC spec to be used as base   | ALPHA code |
| M461A            | MIL-STD-461A                  |            |
| M6181D           | MIL-I-6181D                   |            |
| 3. <u>FIXADJ</u> | fixed or adjustable EMC limit | ALPHA code |
| FIX              | fixed EMC limit               |            |
| ADJUST           | adjustable EMC limit          |            |

NOTE: If ADJUST is used, the nonrequired spectra are adjustable by SGR to the limit defined on the source or RCPT card. If FIX is used, the spectra are not to be adjusted. Such would be the case for existing equipment for which the EMI specification limits are already defined.

|         |                |          |
|---------|----------------|----------|
| 4. COMP | compartment ID | ALPHA ID |
|---------|----------------|----------|

NOTE: This defines an RF tight compartment in which the box is located. Case to case coupling will be computed only for boxes with the same compartment ID.

|                 |                              |            |
|-----------------|------------------------------|------------|
| 5. <u>CLASS</u> | security classification      | ALPHA code |
| NOTCLS          | not classified, unclassified |            |
| CONF            | confidential                 |            |
| SECRET          | secret                       |            |
| TOPSEC          | top secret                   |            |

6. bl = butt line (aircraft, spacecraft) or inches  
x coordinate (ground station) of center of  
box location
7. wl = water line (aircraft, spacecraft) or inches  
y coordinate (ground station) of center of  
box location
8. fs = fuselage station (aircraft, space- inches  
craft or  
z coordinate (ground station) of center of  
box location

2.3.5.3 Spectrum Sample Frequency Table Data - These cards define the table of sample frequencies applicable for all port spectra within a given equipment. That is, the port spectra will be stored as maximum emission and minimum susceptibility levels occurring in the interval half way between each sample frequency and its upper and lower neighboring frequencies. (See Volume I of this manual for a complete discussion of this.) There are two cards used to define the frequency table. Either or both may be given.

The FREQ card gives basic parameters:

|                                                 |                                                                                                                       |    |
|-------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|----|
| $\text{FREQ} = f_l, f_h, n_{f_o}, n_{f_{\max}}$ |                                                                                                                       |    |
| $f_l$                                           | lowest frequency to be considered<br>(default = 30 Hz)                                                                | Hz |
| $f_h$                                           | highest frequency to be considered<br>(default = 18 GHz)                                                              | Hz |
| $n_{f_o}$                                       | number of frequencies per octave<br>(default = 3)                                                                     |    |
| $n_{f_{\max}}$                                  | maximum number of frequencies in<br>spectra (up to 90 and greater than<br>number in FQTBL if given -<br>default = 90) |    |

Use of this card alone causes a table of up to  $n_{f_{\max}}$  geometrically spaced frequencies to be generated from  $f_l$  to  $f_h$  with  $n_{f_o}$  frequencies per octave. A nonfatal error will result if more than  $n_{f_{\max}}$  frequencies are required to cover the specified frequency range, and the program will use the first  $n_{f_{\max}}$  frequencies generated. If the FREQ card is omitted, the default values are assumed.

Parameters  $f_l$  and  $f_h$  define the general frequency range. The specific frequency range is defined by the program for each port depending on the SR code on the SOURCE or RCEPT card.

The FQTBL card allows specific frequencies to be included in the table:

$$FQTBL = f_1, f_2, \dots, f_n$$

$f_1, f_2, \dots$  user specified frequencies  
( $1 \leq n \leq n_{fmax}$ )

Use of this card causes a table of  $n_{fmax} - n$  geometrically spaced frequencies to be generated from  $f_l$  to  $f_h$  ( $n_{f0}$  is ignored). The  $n$  user frequencies are then inserted in the table at the appropriate places.

2.3.5.4 Port Data - These cards give the connection, filter, termination impedance, and initial nonrequired spectrum displacement data. The first port in each equipment must be the equipment case (i.e. leakage through the case). The form for the case is:

PORT = CASE, sdfs, sdfc (a case must be both a source and a receptor)

All other ports follow, and are analyzed in the order given. The format for these PORT cards is:

PORT = PID, CONN. CODE, ( $sp_1, sp_2, \dots$ ),  $r_l, c_l, l_l$ , sdfs, sdfc, FID

1. PID                      port identification                      ALPHA ID  
  
     PID                      user supplied port ID  
  
     CASE                      the equipment case is specified  
                                  as a port with CASE as the ID;  
                                  user will supply spectrum
2. CONN. CODE              connection code                      ALPHA code  
  
     ANT                      antenna  
     WIRE                      wire
3. If CONN. CODE = WIRE, the subparameters are:

(BID, WID, PTID, RETURN, SH. TERM, APEXP)

|      |                         |          |
|------|-------------------------|----------|
| BID  | bundle ID (See 2.3.6.1) | ALPHA ID |
| WID  | wire ID (See 2.3.6.4)   | ALPHA ID |
| PTID | point ID (See 2.3.6.2)  | ALPHA ID |

NOTE: All ID's must match ID's in bundle data.

|               |                                              |            |
|---------------|----------------------------------------------|------------|
| <u>RETURN</u> | return path of signal                        | ALPHA code |
| UNBAL         | unbalanced (wire return, unbalanced circuit) |            |
| BAL           | balanced (wire return, balanced circuit)     |            |
| SHD           | own shield                                   |            |
| GND           | ground                                       |            |

NOTE: No abbreviation of first two characters is permitted on the REFWIRE alpha codes.

| <u>SH. TERM</u> | shield termination | ALPHA code                              |
|-----------------|--------------------|-----------------------------------------|
| NONE            | blank              |                                         |
| OPN             | open               | } single shield                         |
| GND             | ground             |                                         |
| OO              | open open          | } double shield<br>(inner shield first) |
| OG              | open ground        |                                         |
| GO              | ground open        |                                         |
| GG              | ground ground      |                                         |

| <u>APEXP</u> | aperture exposed wire | ALPHA code |
|--------------|-----------------------|------------|
| NOTEX        | not exposed           |            |
| EX           | exposed               |            |

If CONN. CODE = ANTENNA, the subparameters are:

(AID,  $\theta_o$ ,  $\phi_o$ ,  $c_1$ ,  $c_2$ ,  $c_3$ , WGLOC)

|              |                                                                                                     |            |
|--------------|-----------------------------------------------------------------------------------------------------|------------|
| AID          | antenna ID (Must match one table ID. See 2.3.4.2)                                                   |            |
| $\theta_o$   | main beam peak coordinates,<br>vertical "look" angle                                                | degrees    |
| $\phi_o$     | main beam peak coordinates,<br>azimuthal "look" angle                                               | degrees    |
| $c_1$        | butt line for aircraft or<br>spacecraft of antenna location<br><br>x - coordinate for Ground        | inches     |
| $c_2$        | water line for aircraft or<br>spacecraft of antenna location<br><br>y - coordinate for Ground       | inches     |
| $c_3$        | fuselage station for aircraft or<br>spacecraft of antenna location<br><br>z - coordinate for Ground | inches     |
| <u>WGLOC</u> | wing location                                                                                       | ALPHA code |
| NOW          | not on wing (use also if system is<br>spacecraft or ground)                                         |            |
| BOT          | on or suspended from wing bottom                                                                    |            |

|                                                                                                                       |                                                                                                             |          |
|-----------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|----------|
| TOP                                                                                                                   | top of wing                                                                                                 |          |
| FWDEDG                                                                                                                | forward edge of wing                                                                                        |          |
| AFTEDG                                                                                                                | aft edge of wing                                                                                            |          |
| TIP                                                                                                                   | tip of wing                                                                                                 |          |
| 4. $r_l$                                                                                                              | termination resistance*                                                                                     | Ohms     |
| 5. $c_l$                                                                                                              | termination capacitance*                                                                                    | Farads   |
| 6. $l_l$                                                                                                              | termination inductance*                                                                                     | henries  |
| *NOTE: See Figure 6 for impedance configuration. At least one parameter ( $r_l$ , $c_l$ , or $l_l$ ) must be nonzero. |                                                                                                             |          |
| 7. $s_{dfs}$                                                                                                          | initial spectrum displacement factor for source (0 if not source port). Added to spectrum level.            | dB       |
| 8. $s_{dfr}$                                                                                                          | initial spectrum displacement factor for receptor (0 if not receptor port). Subtracted from spectrum level. | dB       |
| 9. FID                                                                                                                | filter identification (Must match an ID of a filter given in the filter table. See Section 2.3.4.3)         | ALPHA ID |

2.3.5.5 Source and Receptor Data - These cards, which follow the PORT card, define the type, adjustment limit, and spectrum parameters. A port is designated as a source, a receptor, or both depending whether the SOURCE, RCEPT, or both cards are present. (At least one of them must be present.) If both are present, they can be in either order. The general format of these cards is

SOURCE = SR,  $P_1$ ,  $P_2$ , ...

RCEPT = SR,  $P_1$ ,  $P_2$ , ...

| <u>SR</u>           | source/receptor type code                                    | ALPHA code |
|---------------------|--------------------------------------------------------------|------------|
| RF                  | radio frequency                                              |            |
| POWER               | AC & DC power leads                                          |            |
| SIGNAL              | signal                                                       |            |
| CNTRLO              | control                                                      |            |
| EED                 | electro-explosive device                                     |            |
| CASE                | equipment case                                               |            |
| $P_1$ , $P_2$ , ... | parameters and subparameters on <u>SR</u> as described below |            |

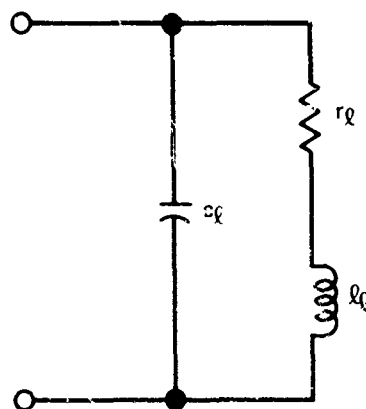


FIGURE 6  
PORT TERMINATION IMPEDANCE CONFIGURATION

The SR codes must be the same on the SOURCE and RCEPT cards for the same port.

The specific format for these cards varies with the SR code. Each of these formats is discussed below.

#### 2.3.5.5.1 Radio Frequency -

SOURCE = RF, adjlim,  $f_l$ ,  $f_h$ , p, bwc, MODSIG, ( $sp_1$ ,  $sp_2$ , ...),  
( $h_2$ ,  $h_3$ , ...)

RCEPT = RF, adjlim,  $f_l$ ,  $f_h$ , s, bwc, MODSIG, ( $sp_1$ ,  $sp_2$ , ...),  $f_{if}$

- |                            |                                                                                                                                                                 |            |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| 1. <u>RF</u>               | Radio frequency <u>SR</u> code                                                                                                                                  | ALPHA code |
| 2. adjlim                  | Adjustment limit displacement from the initial spectrum level.<br>(SGR can adjust the spectrum this number of dB from its initial amplitude. Must be positive.) | dB         |
| 3. $f_l$                   | lowest carrier frequency *                                                                                                                                      | Hz         |
| 4. $f_h$                   | highest carrier frequency *                                                                                                                                     | Hz         |
| 5. p                       | maximum output power (source)                                                                                                                                   | watts      |
| 6. s                       | minimum sensitivity (receptor)                                                                                                                                  | dBm        |
| 7. bwc                     | bandwidth of channel (6 dB width)                                                                                                                               | Hz         |
| 8. <u>MODSIG</u>           | modulation/signal code<br>(see below)                                                                                                                           | ALPHA code |
| 9. ( $sp_1, sp_2, \dots$ ) | subparameters depending on <u>MODSIG</u><br>(see below)                                                                                                         |            |
| 10. ( $h_2, h_3, \dots$ )  | harmonic displacement level relative to fundamental for the 2nd, 3rd, ... up to 10th. Specify as many as necessary up to highest significant.                   | dB         |

\* Note:  $f_l = f_h$  if non-tunable.

11.  $f_{if}$  intermediate frequency; negative Hz  
if below tuned frequency, positive  
if above tuned frequency

The required frequency range of an RF port is set from  $f_l$  to  $f_h$  plus or minus half of bwc except where the modulation spectrum is user-specified. In this case the required range includes the user frequencies.

If MODSIG is CW, there are no subparameters and the first parenthesis are omitted. For sources, follow CW by harmonics:

SOURCE = RF, adjlim,  $f_l$ ,  $f_h$ , p, bwc, CW, ( $h_2$ ,  $h_3$ , ...)

RCEPT = RF, adjlim,  $f_l$ ,  $f_h$ , s, bwc, CW,  $f_{if}$

If the harmonics are not specified, a zero must signify the omission:

SOURCE = RF, adjlim,  $f_l$ ,  $f_h$ , p, bwc, MODSIG, ( $sp_1$ ,  $sp_2$ ), (0)

The MODSIG codes and required subparameters for each are as follows:

| <u>MODSIG</u> | <u>Description</u>            | <u>Subparameters</u>                                                                                                                                                               |
|---------------|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CW            | continuous wave               | none (see above)                                                                                                                                                                   |
| PDM           | pulse duration modulation     | $r_b$                                                                                                                                                                              |
| NRZPCM        | NRZ pulse code modulation     | $r_b$                                                                                                                                                                              |
| BPPCM         | biphase pulse code modulation | $r_b$ , em                                                                                                                                                                         |
| PPM           | pulse position modulation     | $r_b$ , t                                                                                                                                                                          |
| TELEG         | conventional telegraph        | wpm, ftone                                                                                                                                                                         |
| FSK           | frequency-shift keying        | $r_b$ , diff                                                                                                                                                                       |
| PAMFM         | pulse amplitude modulation    | df                                                                                                                                                                                 |
| RADAR         | radar (pulsed RF)             | <u>PTYPE</u> , other subparameters as follows:<br><br>RECTPL, $r_b$ , t<br>TPZD, $r_b$ , t, $t_r$ , $t_f$<br>COSQD, $r_b$ , t<br>GAUSS, $r_b$ , t<br>CHIRP, $r_b$ , t, tr, tf, pcr |
| AM            | amplitude modulation          | <u>SIG</u> , b, em                                                                                                                                                                 |

|       |                                         |                                                                 |
|-------|-----------------------------------------|-----------------------------------------------------------------|
| DSBSC | double side band suppressed carrier     | <u>SIG</u> , b                                                  |
| LSSB  | single side band, lower                 | <u>SIG</u> , b                                                  |
| USSB  | single side band, upper                 | <u>SIG</u> , b                                                  |
| FM    | frequency modulation                    | <u>SIG</u> , b, df                                              |
| LCLKG | local oscillator leakage from receivers | $lo_{nb}$ , $lo_{bb}$                                           |
| SPECT | user supplied modulation spectrum       | $f_1, g_1, f_2, g_2, \dots, f_n, g_n$<br>( $2 \leq n \leq 10$ ) |

Where the subparameters are defined as follows:

| <u>Subparameter</u> | <u>Description</u>                                        | <u>Units</u> |
|---------------------|-----------------------------------------------------------|--------------|
| $r_b$               | bit rate or pulse repetition                              | bits/sec     |
| t                   | pulse width                                               | sec          |
| wpm                 | words per minute                                          |              |
| ftone               | tone frequency (zero if no tone)                          | Hz           |
| diff                | difference between upper and lower oscillator frequencies | Hz           |
| df                  | maximum frequency deviation from carrier                  | Hz           |
| <u>PTYPE</u>        | pulse type                                                | ALPHA CODE   |
| RECTPL              | rectangular                                               |              |
| TPZD                | trapezoid                                                 |              |
| COSQD               | cosine squared                                            |              |
| GAUSS               | Gauss                                                     |              |
| CHIRP               | chirp                                                     |              |
| t                   | pulse width                                               | sec          |
| $t_r$               | rise time                                                 | sec          |
| $t_f$               | fall time                                                 | sec          |

| <u>Subparameter</u>                                   | <u>Description</u>                                                                   | <u>Units</u> |
|-------------------------------------------------------|--------------------------------------------------------------------------------------|--------------|
| pcr                                                   | pulse compression ratio (neg. if frequency deviation is negative)                    | none         |
| <u>SIG</u>                                            | signal type code                                                                     | ALPHA code   |
| VOICE                                                 | voice                                                                                |              |
| CVOICE                                                | clipped voice                                                                        |              |
| NONVCE                                                | telegraphy digital                                                                   |              |
| em                                                    | modulation index if AM                                                               |              |
| b                                                     | if non voice, bandwidth (6 dB)                                                       | Hz           |
| lo <sub>nb</sub>                                      | initial narrowband local oscillator leakage                                          | dBm          |
| lo <sub>bb</sub>                                      | initial broadband local oscillator leakage                                           | dBm/MHz      |
| f <sub>1</sub> , f <sub>2</sub> , ..., f <sub>n</sub> | User modulation frequencies (relative to carrier freq)                               | Hz           |
| g <sub>1</sub> , g <sub>2</sub> , ..., g <sub>n</sub> | User modulation spectrum levels where 2 ≤ n ≤ 10 (Receptor spectra are input in dBm) | dBm/MHz      |

User-supplied modulation spectrum frequencies are relative to the carrier. That is, negative frequencies are below the carrier, and positive are above. The user spectrum is quantized to the equipment frequency table using the maximum in the interval for emitters and minimum for receptors as with any other spectrum. This allows changing the table without having to change the port data.

#### 2.3.5.5.2 Power Lines -

SOURCE = POWER, adjlim, v, f, nh, nphase, RS, (sp<sub>1</sub>, ...)

RCEPT = POWER, adjlim, v, f, nh, nphase, RS, (sp<sub>1</sub>, ...)

- |           |                                                               |            |
|-----------|---------------------------------------------------------------|------------|
| 1. POWER  | SR code for power line                                        | ALPHA code |
| 2. adjlim | adjustment limit displacement from the initial spectrum level | dB         |
| 3. v      | voltage (RMS) of line                                         | volts      |
| 4. f      | frequency (0 if DC)                                           | Hz         |

- |    |                |                                                                                                                              |
|----|----------------|------------------------------------------------------------------------------------------------------------------------------|
| 5. | nh             | highest harmonic                                                                                                             |
| 6. | nphase         | number of phases                                                                                                             |
| 7. | <u>RS</u> code | Ripple or noise spectrum code<br>(This overrides the <u>SPEC</u> parameter<br>on the EQPT card.)                             |
|    | M461A          | MIL-STD-461A                                                                                                                 |
|    | M6181D         | MIL-I-6181D                                                                                                                  |
|    | M704A          | MIL-STD-704A                                                                                                                 |
|    | SPECT          | user supplied ripple spectrum                                                                                                |
| 8. | Parameters     | Supply only if <u>RS</u> = SPECT, omit<br>for all others.<br>( $f_1, g_1, f_2, g_2, \dots, f_n, g_n$ ) where<br>$2 < n < 10$ |

where

The required frequency range for power lines includes only the power frequency.

SOURCE = SC, adjlim,  $f_{\ell}$ ,  $f_h$ , MODSIG, ( $sp_1$ ,  $sp_2$ , ...), a, UNIT, bw  
 RCEPT = SC, adjlim,  $f_{\ell}$ ,  $f_h$ , MODSIG, ( $sp_1$ ,  $sp_2$ , ...), a, UNIT, bw  
 IF MODSIG = VOICE or CVOICE, omit the subparameter group, for example:

- |    |                |                                                                    |            |
|----|----------------|--------------------------------------------------------------------|------------|
| 1. | <u>SC</u> code |                                                                    | ALPHA code |
|    | SIGNAL         | signal line                                                        |            |
|    | CNTR0L         | control line                                                       |            |
| 2. | adjlim         | spectrum adjustment limit displacement from initial spectrum level | dB         |
| 3. | $f_{\ell}$     | lowest required frequency                                          | Hz         |
| 4. | $f_h$          | highest required frequency                                         | Hz         |

| 5. MODSIG     | modulation/signal code                           | ALPHA code                  |
|---------------|--------------------------------------------------|-----------------------------|
| <u>MODSIG</u> | <u>Description</u>                               | <u>Subparameters</u>        |
| PDM           | pulse duration                                   | $r_b$                       |
| NRZPCM        | nonreturn to zero pulse code modulation          | $r_b$                       |
| BPPCM         | biphase pulse code                               | $r_b, em$                   |
| PPM           | pulse position modulation                        | $r_b, t$                    |
| TELEG         | Morse telegraphy                                 | wpm, ftone                  |
| PAM           | pulse amplitude modulation                       | $r_b, t$                    |
| ESPIKE        | exponential decay spike                          | $r_b, t$                    |
| RECT?L        | rectangular                                      | $r_b, t$                    |
| TPZD          | trapezoidal pulse train                          | $r_b, t, t_r$               |
| TRIANG        | triangular                                       | $r_b, t$                    |
| SAWTH         | sawtooth                                         | $r_b, t$                    |
| DMPSIN        | damped sinusoid                                  | $r_b, f_r, f_I$             |
| VOICE         | voice                                            | -                           |
| CVOICE        | clipped voice                                    | -                           |
| SPECT         | user supplied spectrum<br>( $2 \leq n \leq 10$ ) | $f_1, g_1, \dots, f_n, g_n$ |

where

|       |                                                      |      |
|-------|------------------------------------------------------|------|
| $t$   | pulse duration (10-90% of max. amplitude for ESPIKE) | sec  |
| $r_b$ | pulse repetition rate                                | Hz   |
| $t_r$ | rise time                                            | sec  |
| wpm   | words per minute                                     |      |
| ftone | tone frequency (0 if no tone)                        | Hz   |
| em    | modulation index                                     | none |

|                |                                                                              |               |
|----------------|------------------------------------------------------------------------------|---------------|
| $f_r$          | oscillatory frequency of damped sinusoid                                     | Hz            |
| $f_I$          | decay frequency of damped sinusoid                                           | Hz            |
| $f_i$          | user supplied spectrum frequencies                                           | Hz            |
| $g_i$          | user supplied spectrum levels (see <u>UNIT</u> )                             |               |
| 6. a           | amplitude in units given by <u>UNIT</u> (0 if <u>MODSIG</u> = <u>SPECT</u> ) | volts or amps |
| 7. <u>UNIT</u> | unit code for a and $g_i$                                                    | ALPHA code    |
| VLTS           | Volts (dPuV/MHz if <u>MODSIG</u> = <u>SPECT</u> )                            |               |
| AMPS           | Amps (dBuA/MHz if <u>MODSIG</u> = <u>SPECT</u> )                             |               |
| 8. bw          | bandwidth of information                                                     | Hz            |

#### 2.3.5.5.4 Electro-explosive device -

RCEPT = EED, adjlim,  $P_{nf}$ ,  $i_{nf}$ , ( $f_i$ ,  $r_i$ ,  $x_i$ , ...)

|             |                             |            |
|-------------|-----------------------------|------------|
| 1. EED      | Electro-explosive device    | ALPHA code |
| 2. adjlim   | adjustment limit            |            |
| 3. $P_{nf}$ | maximum power for no fire   | watts      |
| 4. $i_{nf}$ | maximum current for no fire | amps       |
| 5. function |                             |            |

$f_i$  = frequency (maximum of 10 frequencies)  
 $r_i$  = real part of complex impedance at  $f_i$   
 $x_i$  = imaginary part of complex impedance at  $f_i$

There is no required frequency range for EED's. The entire spectrum is adjustable by SGR. Also, a SOURCE card cannot be specified for an EED.

#### 2.3.5.5.5 Equipment Case Leakage

SOURCE = CASE, adjlim, NBSPEC, BBSPEC

RCEPT = CASE, adjlim, NBSPEC, BBSPEC

|                |                                   |            |
|----------------|-----------------------------------|------------|
| 1. <u>CASE</u> | code word denoting equipment case | ALPHA code |
|----------------|-----------------------------------|------------|

2. adjlim            spectrum adjustment limit displacement from initial spectrum level            dB
3. NBSPEC            narrowband specification spectrum            ALPHA code
- MILSPEC            SPEC given in EQPT card
- SPECT, ( $f_1, g_1, f_2, g_2, \dots, f_n, g_n$ )
- user supplied spectra
- $f_i$  - frequency            Hz
- $g_i$  - level            dB $\mu$ V/meter at 1 meter from box
- $2 \leq n \leq 10$
4. BBSPEC            broadband specification spectrum            ALPHA code
- MILSPEC            same as above
- SPECT, ( $f_1, g_1, f_2, g_2, \dots, f_n, g_n$ )
- same as above
- $f_i$  - frequency            Hz
- $g_i$  - level            dB $\mu$ V/meter/MHz at 1 meter from box
- $2 \leq n \leq 10$

There is no required frequency range for equipment cases. That is, the entire spectrum is adjustable by SGR.

### 2.3.6 Wire Bundle Data

These cards follow the subsystem data. Like the subsystem data, the cards must be in order of the bundle, point, segment, and wire hierarchy.

#### 2.3.6.1 Bundle Card -

BUNDLE = ID

ID - bundle ID

ALPHA ID

#### 2.3.6.2 Bundle Points and Coordinates -

BPTS =  $PT_1, x_1, y_1, z_1, PT_2, x_2, y_2, z_2, \dots, PT_n, x_n, y_n, z_n$

$PT_i$  - ID of Point  $i$   
 $x_i$  - x coordinate of point in ground, inches  
           butt line in aircraft or spacecraft  
 $y_i$  - y coordinate of point in ground, inches  
           waterline in aircraft or spacecraft  
 $z_i$  - z coordinate of point in ground, inches  
           fuselage station in aircraft or  
           spacecraft

$$n \leq 11$$

Only one card with BPTS on it is permitted per bundle. Continuation cards (terminate continued card with comma) must be used if data will not fit on one card.

#### 2.3.6.3 Bundle Segment -

BSSEG = PTID<sub>1</sub>, PTID<sub>2</sub>,  $\ell_1$ ,  $h_1$ , compt.<sub>1</sub>, APID, ...

$PTID_1$  - point ID ALPHA ID  
 $PTID_2$  - point ID ALPHA ID  
 $\ell_1$  - length of segment inches  
 $h_1$  - average height above ground inches  
 compt.<sub>1</sub> - compartment ID through which segment runs (see EQPT card) ALPHA ID  
 APID - aperture ID if aperture exposed. ALPHA ID  
       If not exposed, 0. Must match ID  
       on one APER card (Section 2.3.4.1)

Only one card with BESEG on it is permitted per bundle. Use continuation cards, as with the BPTS card, if data for all segments will not fit on one card. Only one compartment may be specified per segment. If a segment runs through more than one compartment, break into smaller segments.

#### 2.3.6.4 Wire -

WIRE = WID, WTDID, PTID<sub>1</sub>, PTID<sub>2</sub>, PTID<sub>3</sub>, ...

WID wire ID (Referenced on PORT card) ALPHA ID  
 WTDID type ID in Wire Characteristics table. ALPHA ID  
       Must match an ID given on one WRTBL  
       card at system level (Section 2.3.4.4)  
 $PTID_i$  Point ID ALPHA ID

### 2.3.7 Waiver Analysis Spectrum Shift Data

These are specified if, on the EXEC card, TASK = CEAR and CTASK = WAIVER. These cards specify portions of the emission, susceptibility, or both spectra which are to be shifted by the amount specified. The resulting interference is compared to that on the baseline run. The shifts are temporary and do not affect the permanent file data.

Any number of cards are allowed referencing the same port. This allows multiple shifts of a given spectrum. Overlapping ranges are allowed and are cumulative. (See Section 3.1.5)

If either the source or receptor spectrum displacement is not given, the omission must be shown by zero placeholders. The cards may be placed in any order, and up to 50 cards may be used in one run.

The format is:

WA = SID, EID, PID, fs<sub>1</sub>, fs<sub>2</sub>, ds, fr<sub>1</sub>, fr<sub>2</sub>, dr

where

SID = subsystem ID

EID = equipmer. ID

PID = port ID

fs<sub>1</sub> = low frequency of source shift range Hz

fs<sub>2</sub> = high frequency of source shift range Hz

ds = displacement for source spectra dB

fr<sub>1</sub> = low frequency of receptor shift range Hz

fr<sub>2</sub> = high frequency of receptor shift range Hz

dr = displacement for receptor spectra dB

### 2.3.8 End of Data

EODATA

This card indicates the end of all IDIPR input data.

### 2.3.9 TART Input Cards

As previously discussed, the input data for TART consists primarily of the work files generated by IDIPR. In addition to these work files, TART requires the user input card described below.

2.3.9.1 TART Control Card - Only TASK is required. The rest is optional

TART = TASK, AI, SP

1. TASK

Task code (required) must agree with TASK and CTASK on IDIPR EXEC card as follows:

|  | IDIPR <u>TASK</u> | IDIPR <u>CTASK</u> |
|--|-------------------|--------------------|
|--|-------------------|--------------------|

|        |      |        |
|--------|------|--------|
| SGR    | SGR  | -      |
| TO     | CEAR | TO     |
| WAIVER | CEAR | WAIVER |
| SURVEY | CEAR | SURVEY |

2. AI

Code for additional input card (optional)

|      |                                         |
|------|-----------------------------------------|
| AI   | Additional input card follows TART card |
| NOAI | No additional input (default)           |

3. SP

Code for supplemental printout from transfer models

|      |                                                       |
|------|-------------------------------------------------------|
| SP   | Supplemental printout desired                         |
| NOSP | No supplemental printout desired (default)            |
| DB   | Debug output. Gives additional outputs for debugging. |

2.3.9.2 Additional Input Card - This card is supplied if AI code = AI on TART card. If used, it overrides the asm and empl parameters on the SYSTEM card. It is a fixed field card, and both parameters must be right-justified in their fields.

| <u>Columns</u> | <u>Parameter</u> | <u>Description</u>           |
|----------------|------------------|------------------------------|
| 1-10           | empl             | EMI margin printout limit    |
| 11-20          | asm              | SGR adjustment safety margin |

## 2.4 INPUT DATA RULES

The following rules apply to the IDIPR input data.

### 2.4.1 General Rules

1. All cards (except EODATA) must have a keyword, an optional ISF modify code, and an equals sign, followed by the parameters associated with the keyword. There are no column specifications. Parameters can be continued onto following cards by specifying the last non-blank character as a comma. Blanks are ignored and may be inserted between parameters for clarity, if desired. Parameters cannot have imbedded blanks.
2. Only those keywords specified in 2.3 are valid.
3. All parameters denoted as ALPHA CODES have a list of valid options to be selected by the user. Only these options will be recognized.
4. All keywords and alpha code words may be abbreviated by the first two letters or given in full (except for the REFWIRE codes on the PORT card).
5. Parameters and subparameter groups must be separated by commas.
6. The exact number of parameters associated with a keyword must be given except for control cards (EXEC, LIST, OUTPUT) and in those instances where alternate ways are given. If a parameter is not used or is inapplicable, a placeholder, such as 0, must be given to show the omission. This holds even when the parameter is the last one. The number of parameters given on each card is checked, and if the correct number is not given for the keyword, it is flagged as an error. On control cards, the position of a parameter must be preserved with placeholders; but if default options for parameters at the end are to be used, they may be omitted. For example, on an EXEC card, EXEC = ISP, NEW is sufficient. (The third parameter defaults to ISF.) If, however, CE (cancel error stop) is desired, the third parameter must be explicitly given to keep the position of CE; i.e., EXEC = ISP, NEW, ISF, CE.
7. Subparameters are enclosed in parentheses. There is either a variable or fixed number of these depending upon the particular use. If the number is fixed, the exact number must be given. For example, on the SOURCE = CTRL card, MODSIG determines the subparameter specifications. If MODSIG is PDM, there is one and only one subparameter,  $r_p$ . If MODSIG is equal to SPECT, a variable number of subparameters is given (up to 10 frequencies and 10 amplitudes).

#### 2.4.2 Alphanumeric ID's

All parameters denoted as ALPHA ID are user supplied alphanumeric identifications (ID). The following conventions apply to ID's:

1. An ID is composed of 1 to 5 alphabetic letters and digits. (More than 5 results in a syntax error.)
2. The first character of the ID must be alphabetic.
3. No special characters may be used in an ID.
4. In general, the ID should be unique for that keyword type. Some exceptions to this are permitted. For example, only port ID's within an equipment need to be unique, and each new equipment must have the first port ID specified as CASE.

#### 2.4.3 Numeric Parameter Formats

All parameters not specified as ALPHA ID or ALPHA CODE are supplied as numeric values. The following conventions are used for numeric values:

1. Numbers with no fractional parts may be given with or without the decimal point. If omitted, the decimal is assumed to the right of the digits. For example, 243 is read as 243.0.
2. Floating point numbers may be expressed in exponential form, such as .nE+s, n.nE+s where n is the base and s is the exponent to the base 10. The plus sign may be omitted if s is positive (3.E1, 3E12, 31.4E-01, .314E+1 are all valid). If the decimal is omitted, it is assumed to be just before the "E". Thus, 3E12 is  $3 \times 10^{12}$ .
3. Double precision values are not allowed.
4. There is no complex value input except where specifically expressed. In such cases, the real and imaginary values are given as two parameters; for example, for a RCEPT = EED (electro-explosive device), the function is given as a complex number specified as 2 parameters; e.g., RC = EED, 30, 1, 1, (30, 1, 0, 1.E10, 1, 0).

#### 2.4.4 Order of IDIPR Input Cards

The order of the input data is shown in Figure 7. The following rules apply:

1. The EXEC card can be preceded only by the TITLE and REMARK cards.

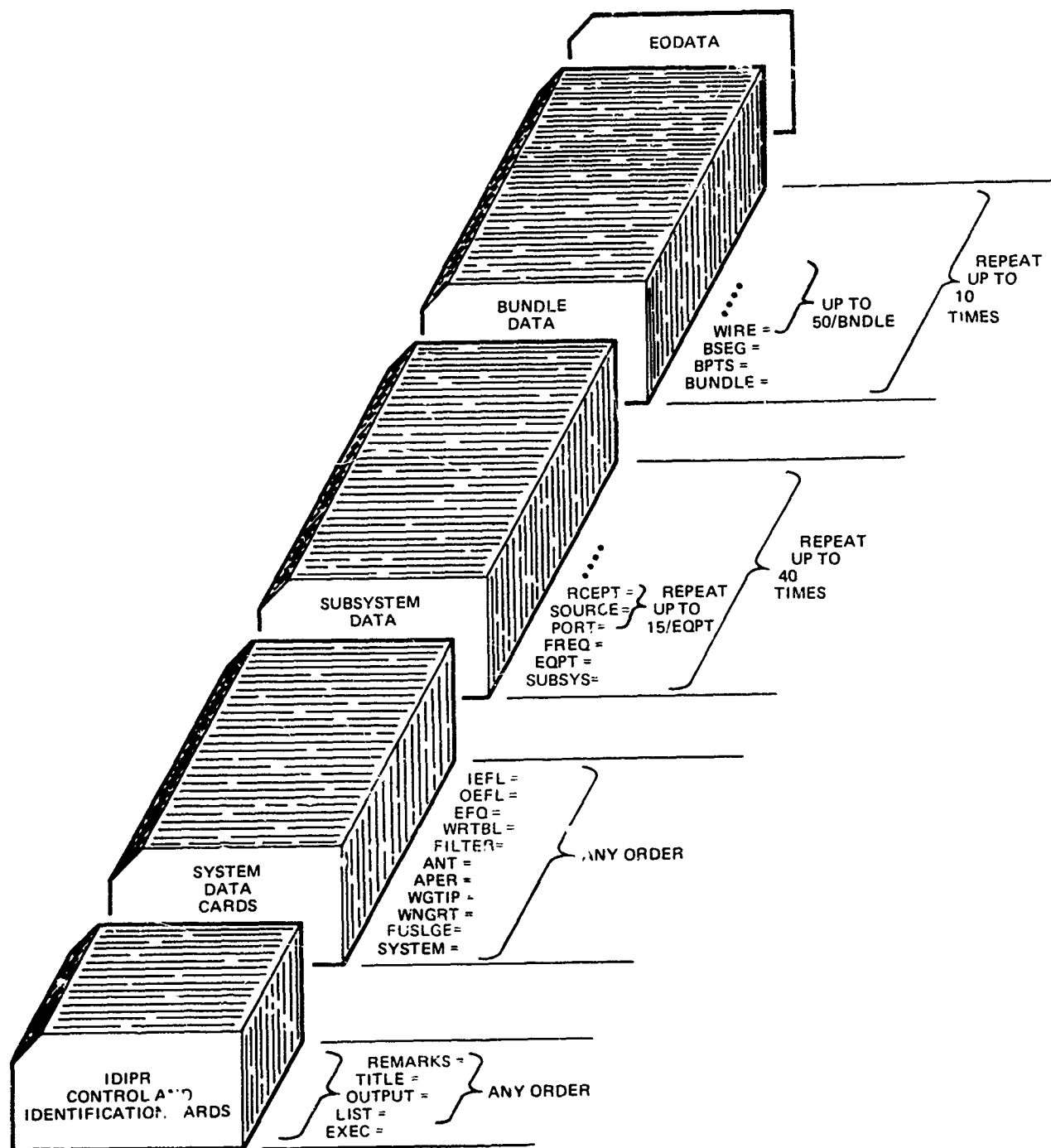


FIGURE 7  
ORDER OF IDIPR DATA

2. The execute and identification cards should be followed by the input/output control cards (LIST and OUTPUT). There is no specified order to these cards.
3. The data is divided into three groups, and these groups must be given in the following order:
  - A. System data
  - B. Subsystem data
  - C. Bundle data
4. The data cards belonging to group (A), system data (SYSTEM, ANTENNA, FILTER, etc.), can be in any order.
5. In group (B), the data must be given in hierarchical order as follows:
  - a. Subsystem
  - b. Equipment
  - c. Frequency
  - d. Port
  - e.,f. Source and/or receptor (either order)

d-f cards repeat for a maximum of 15 ports; b-f repeat for a maximum of 40 equipments; a is inserted where applicable.
6. For new jobs (no old ISF), the first port of an equipment must be the equipment case. Its source or receptor cards must be given also.
7. At least one subsystem card must be given prior to the equipment data.
8. Port ID's must be unique within an equipment.
9. A subsystem must have at least one equipment.
10. In new jobs, an equipment must have at least one port other than the case. A port must have a SOURCE card or RCEPT card or both. It may not have multiple SOURCE or RCEPT cards.
11. In group (C), bundle data, the BUNDLE card containing the bundle identification must be the first card, followed by other bundle cards in any order.

12. Each bundle must have one and only one BSEG keyword card and one and only one BPTS keyword card. Continuation cards as needed should be used. A bundle must have at least one and up to 50 wire cards.
13. For multiple entry keywords, the maximum system specifications as given in Section 2.2 must not be exceeded.
14. The last card must be an EODATA card.

#### 2.4.5 Modifying the ISF

Any ISF from a previous run can be used as input, and data cards can be used to modify any of the data on it. This ISF may have been created by an IDIPR run, an SGR run, or by the MERGE utility program (Appendix B).

To use an ISF with input modifications, JOBSTATUS on the EXEC card must be MOD. Three types of modifications can be made to the existing data on the ISF as indicated by the MODISF code. These are add (A), delete (D), and modify (M). These are specified by A, D, or M in parentheses following the keyword and before the equal sign on a data card. The rules governing the modify process are given below:

1. All data from the old ISF will be included unless overridden or deleted by an input card.
2. All rules given above for input data apply except where noted in this section.
3. All added subsystems must follow those to be modified or deleted.
4. Within a subsystem, all new equipments to be added must follow those equipments modified or deleted.
5. The data to modify subsystems and equipments must be given in the same order as they are on the ISF which is being modified. Hence, in setting up a modify run, the user must have a listing of the equipments on the ISF as this gives the order of equipments on the file.
6. Within an equipment, new ports and modifications to existing ports may be in any order.
7. A system data entry, such as an ANTENNA or FILTER, is deleted by giving the keyword, modify code, equals sign and identification. For example, ANT(D) = ABX2.
8. There is no order to the system data entries, including those which modify the ISF data.

9. Wire bundles to be modified must be in the same order as they appear on the ISF.
10. All bundles to be added must follow those which modify existing ISF bundles.
11. Since subsystem data and bundle data belong to the hierarchical system, modifications to an upper level also apply to the associated lower components. These are the components that have the upper level component ID as an implicit ID. Also, to modify a lower level, it is necessary to specify all upper level ID's that define it; that is, all its implicit ID's. For example, to delete port, XY2 of equipment TACAN of subsystem AC01, the following would be specified:

SU(M) = AC01  
 EQ(M) = TACAN  
 PO(D) = XY2

12. If a higher level keyword card has only a modification code, an equals sign, and an ID on it; the parameters of the keyword itself will not be modified. Instead, the ID will be used to give an implicit ID to a lower level keyword. If, however, parameters follow the ID, they will override those parameters of the keyword. If any parameters are specified on a modify card, all parameters must be re-specified.
13. Any higher level keyword, such as SUBSYSTEM, can be used to denote all equipments associated with it. For example, a subsystem with a DELETE (D) modification code and an ID would delete all equipments associated with it. If one equipment of a subsystem is to be deleted, the subsystem must have MODIFY (M) specified so as not to delete the other equipments. For example, to delete only TACAN, specify:

SU(M) = AC01  
 EQ(D) = TACAN

14. If not specified, the default modification status, is ADD.

#### 2.4.6 Additional Rules for Trade-off Runs

The following rules apply to CEAR trade-off runs, in addition to the above rules for any modification to an ISF.

1. No ports may be deleted; hence, no equipments or subsystems may be deleted.
2. The frequencies at which the baseline spectra were generated may not be changed.

3. If changes are made to the common model parameter tables (antennas, filters, apertures, and wire characteristics), all ports that reference these tables must be "dummy" modified in order to be analyzed. Also, if bundle data is changed, ports referencing that bundle must be "dummy" modified. A dummy port modification is done by specifying a modify port card for identification but with the parameters unchanged from the baseline:

SU(M) = ID  
EQ(M) = ID  
PORT(M) = ID,  $p_1$ ,  $p_2$ , . . .

where  $p_1$ ,  $p_2$ , . . . are same parameters used in the baseline.

The source and receptor cards need not be given.

4. Any system data, other than the tables discussed in 3 above, cannot be changed.

#### 2.4.7 CEAR Waiver Analysis Run

Up to a maximum of 50 waiver analysis cards may be given in any one run. Any number of spectrum shift cards referencing the same port are permitted. This allows multiple shifts on the same spectrum. Shifts are cumulative if the frequency ranges overlap. For example, two 10 dB shifts would result in a 20 dB shift where the ranges overlap.

## Section 3

### RUNNING IEMCAP

#### 3.1 IEMCAP RUN OPTIONS AND CONTROL PARAMETERS

This section discusses the use of the data cards described in the previous section to run the program. Since IEMCAP is a diverse program with many task, subtask, and data options this section provides guidance in selecting the appropriate options for a given run.

##### 3.1.1 Options on EXEC Card

The EXEC card controls the basic task and data input options to IDIPR. As discussed in Section 2.3.2.1, this card contains four parameters. The first, TASK, specifies the basic task or task routine. The options for this are ISP, SGR, and CEAR. ISP directs that input decode and initial processing are to be performed, but no working files are to be created. The other two options direct IDIPR to process the data and create working files for the designated TART analysis routine. SGR is used for specification generation, and CEAR for the other three analysis tasks.

The second parameter, JOBSTATUS, gives the job input status and has three options: NEW, OLD, and MOD. NEW indicates that input data is from cards only. That is, no ISF is used for input. This is used for an initial run. The OLD option indicates that input data is from an ISF created during a previous IDIPR or TART SGR run. The data on this file is to be used as is; that is, not modified by card input. If the data is to be modified, the MOD option is used.

The third parameter, CTASK, has a dual role. If TASK = CEAR, it specifies the subtask to be performed. These are TO for trade-off, WAIVER for specification waiver, and SURVEY for baseline EMC survey. If TASK = ISP and JOBSTATUS = OLD or MOD, CTASK indicates whether the input is an ISF or special user (SU) meaning a PIF. The PIF is identical to an ISF except it has no spectrum data. The SU option, therefore, indicates that the input file has no spectrum data. CTASK is normally not given if TASK = ISP and JOBSTATUS = NEW since this implies that no existing ISF exists. However, if the CERR option is used, CTASK must be specified as ISF as a placeholder. If TASK = SGR, CTASK is not given.

CERR, the fourth parameter, is optional and can only be used if TASK = ISP. If given, CERR can only be CE. Normally, IDIPR halts after reading and decoding the input cards if they contain errors. However, as each input card is read and decoded, the data is written on the PIF. But, if a card contains an error, for example the wrong number of parameters, the card is "deleted." That is, its data is not written on the PIF. Consequently, the PIF contains only "good" data. In some cases, it may be desirable to proceed into the initial processing section of IDIPR in spite of input errors so that further error analysis can be performed on the PIF data and to obtain a report. But, because some input data will have been

dropped due to the errors, erroneous error messages and possibly unpredictable results may occur from using this option.

It is suggested that the CERR option not be used by one unfamiliar with IEMCAP especially during initial stages with new data which may contain numerous errors causing unpredictable results during initial processing.

If CERR is used, the three other parameters on the card must be specified as placeholders even though they could have been omitted and the default options used. For example,

EXEC = ISP, NEW, ISF, CE.

If the CE option had not been specified, the card would have been

EXEC = ISP, NEW

### 3.1.2 Input and Spectrum Processing (ISP) Runs

If the system to be analyzed is new and large, it may be desirable to run the data through IDIPR for error analysis and to obtain the initial spectra before beginning the time-consuming analysis task. The errors can be corrected, and the data re-run through IDIPR until all errors have been eliminated and the initial spectra are as desired. The number of runs of this type depends on the size and complexity of the data as well as the familiarity of the user with the IEMCAP input format. For this type of run, use of the ISP execution option causes all input decode, initial processing, and error analysis to be performed, but the eight working files are not created. This reduces the run and input/output time of IDIPR. Once the input is error free, or should be on the next run, TASK must be changed to the analysis task desired and CTASK supplied if needed before TART can be run.

There are two ways to handle the re-submission of the data if there are errors. The first and simplest is to fix the cards and re-run the job. However, for large systems with several boxes of data cards, it might be advantageous to use the PIF from the previous run as input to a modify run and correct the errors as updates to the PIF. The EXEC card for such a run would be

EXEC = ISP, MOD, SU

See Section 2.4.5, Modifying the ISF, for rules in updating the file. Note that SU is used to indicate that the input file is a PIF.

As an alternative to using the CERR option, if a run had been made with a few or insignificant errors and the PIF was saved, it can later be used as input to initial processing for additional error analysis, for initial spectrum generation, and to obtain a report. The EXEC card for this is

EXEC = ISP, OLD, SU

The advantage of this over using the CEIR option is that the user can examine the errors and determine their severity before proceeding into initial processing. Note that

EXEC = ISP, NEW, SU

is not valid since there is no input file for NEW runs. If used this will give an error.

### 3.1.3 Specification Generation Runs

The user has several parameters at various levels in the data which provide control over the specifications generated by SGR. The two main control parameters are the adjustment safety margin (asm) and EMI margin printout limit (empl) located on the SYSTEM card (Section 2.3.3.1). (These can be overridden by use of the additional input card in TART.) If interference is found in a non-required portion of an emitter or receptor spectrum (i.e., the EMI margin is greater than asm), the emission or susceptibility level is adjusted so that the received signal is below the susceptibility by an amount equal to -asm. For example, if, at a given frequency, the EMI margin is 10 dB and asm is -6, the emission spectrum is reduced or the susceptibility is raised, depending on which was being adjusted, by 16 dB.

After emitter and receptor spectra have been adjusted, SGR determines any unresolved interference cases and prints a summary of each. It does this by computing the EMI margins for each coupled port pair using the adjusted spectra. If the maximum margin exceeds empl for a given port pair, the case is considered unresolved EMI and the summary is printed.

At the equipment level, the FIXADJ parameter on the EQPT card (Section 2.3.5.2) specifies whether or not its port spectra are adjustable. If an equipment exists and EMI specifications for it have been determined, FIXADJ is FIX meaning that all port spectra are not adjustable. For new equipments, this parameter should be ADJ so that SGR will adjust them.

At the port level, three parameters exist for use in controlling specification generation. On the PORT card (Section 2.3.5.4), sdfs and sdfc specify the displacement of the initial non-required spectra from the MIL-STD-461A or MIL-I-6181D levels. The first, sdfs, applies to source spectra; and sdfc, to receptor spectra. For example, if sdfs = 20 for an RF port, the non-required broadband and narrowband spectra will initially be set 20 dB higher than the MIL-STD-461A CE06 level. Parameter sdfs is algebraically added to the emitter spectrum, and sdfc is subtracted from the receptor spectrum.

On the SOURCE and RCEPT cards, adjlim sets the amount by which the initial spectra can be adjusted. This prevents extremely stringent specifications from being generated. For example, if adjlim is 30, the non-required portion of the spectrum can be adjusted 30 dB from the initial value. It must be a positive number.

The EXEC card for running SGR is

EXEC = SGR, NEW

or

EXEC = SGR, OLD

depending on whether or not an old ISF exists.

#### 3.1.4 Baseline EMC Survey Runs

This analysis surveys the baseline system for interference. The control parameter is empl on the SYSTEM card. Emitter-receptor port pairs with maximum EMI margin exceeding empl are printed in the output as interference cases. The EXEC card for this analysis is

EXEC = CEAR, NEW, SURVEY

The OLD option is valid if it is desired to survey an old system.

#### 3.1.5 Waiver Analysis Runs

A waiver analysis must be an OLD run with an ISF used as baseline input to IDIPR and a Baseline Transfer File (BTF) as baseline input to TART. The ISF and BTF can be from either a previous SGR or SURVEY run. The requests for waiver are specified as spectrum shift data on the WA card (Section 2.3.7). This causes a temporary shift of the port spectrum by the amount and in the frequency range specified. For example,

WA = CNI, TACAN, POWER, 100, 500, 30, 150, 800, -20

causes the source broadband and narrowband emission from 100 to 500 Hz to be increased 30 dB and the receptor susceptibility from 150 to 800 Hz to be reduced by 20 dB. More than one shift per spectrum can be specified by additional cards. The interference resulting from the shifted spectra is compared to that in the baseline, and a summary is printed if the maximum margin exceeds empl. The spectrum shifts are temporary and do not affect the permanent files.

The EXEC card for a waiver analysis must be

EXEC = CEAR, OLD, WAIVER.

#### 3.1.6 Trade-off Analysis Runs

In a trade-off analysis, the interference in a system with modifications is compared to the baseline system. The baseline system is defined by an ISF input to IDIPR and a BTF input to TART. The modified system is defined by modification card input to IDIPR as discussed in Section 2.4.5 on modifying the ISF. Also, the rules for trade-off discussed in Section 2.4.6

must be observed. In particular, no ports may be deleted as this will cause alignment errors in TART between the working files and the BTF. New ports may be added, however. Also, an equipment frequency table cannot be changed since the analysis results stored on the BTF are at the baseline frequencies.

A trade-off run must always be a MOD run so that the EXEC card must be

EXEC = CEAR, MOD, TO.

### 3.1.7 Additional IDIPR Options

The LIST and OUTPUT cards provide optional control over the IDIPR output. The LIST card allows the user to override the program defaults for listing reports of the old and new ISF's. A report gives a complete summary of all data on the ISF. Normally, IDIPR prints a report of the new ISF, containing the modifications if any. The old ISF report is normally not listed. If the user wishes a report of both old and new ISF's the following card is included:

LIST = NEW, OLD

The primary purpose of the OUTPUT card is to suppress the creation of the new ISF. If this card is omitted, IDIPR generates an ISF with the updated data. However, for some ISP runs it might be desirable to not generate the new ISF. For example, this might be used for a new set of data in the error analysis stage where it is likely that initial processing will not be reached due to errors. This would particularly apply to small data sets for which correcting and re-submitting the cards is more expeditious than switching to a modify run. Another example is an ISP run made to obtain a report of an ISF only. To suppress creation of the new ISF, the card is

OUTPUT = NOISF

The second and third parameters on the OUTPUT card are normally not used. The second parameter is for supplemental TART outputs. But, since this is overridden on the TART card, this parameter is used only as a placeholder when the third parameter is specified. The third parameter is used to obtain debug outputs from IDIPR. It causes control flags, data arrays, and program flow trace information to be printed. A program listing is necessary to identify these outputs. See the Computer Program Documentation for definitions of the flags and control variables.

### 3.1.8 Additional TART Options

TART has a basic input card, discussed in Section 2.3.9, which controls the task and run options. Generally, the task specified on this card must agree with the IDIPR execute card. The only exception involves the SGR and SURVEY tasks. Work files created by IDIPR under either option are identical and can be used interchangeably with TART for either task. TART will not execute if its task and the IDIPR task are incompatible.

The second input card, which is optional, allows the printout limit and SGR safety margin specified in the IDIPR input to be overridden. This feature allows TART to be rerun without having to rerun IDIPR. For example, assume SGR is run with a -12 dB adjustment safety margin and a large amount of unresolved interference results. A second SGR run may be made with a less stringent safety margin using the same working files without having to go through IDIPR. The supplemental printout is also specified

Examples of these cards are as follows. To run specification generation with a 10 dB printout limit, a -20 dB safety margin, and supplemental printouts, the two input cards to TART are

TART = SGR, AI, SP

and

10.      -20.

To run a trade-off analysis with no additional input card and no supplemental printout requires only one card:

TART = TO

To run a baseline survey with no additional input but with supplemental printout, the card is

TART = SURVEY, NOAI, SP

### 3.2 JOB SETUP

The previous sections described the input data, format, organization, and options for the various tasks performed by IEMCAP. This section discusses the setup of the cards and files running the program.

As previously discussed, the IDIPR and TART sections of IEMCAP are run as two separate executions. IDIPR generates a number of working files containing the processed data which are read by TART in performing the analysis task. IDIPR can be run alone, the working files saved, and TART run at a later time. This might be advantageous for large, new data sets in detecting and correcting data errors. It also allows the user to look at the data and initial spectra before running TART. Alternatively, IDIPR and TART can be run consecutively as one job. This might be used for small data sets or a small number of modifications to an existing ISF.

Control cards for the particular computer must be supplied to execute the two program sections, provide and save the appropriate files, and define the input, output, and file logical units. In general, these will consist of the following types of cards:

- o Identification and accounting cards

- o Select card to fetch program from library
- o Data definition cards
- o Initiate execution card
- o Error condition directives
- o Core request card
- o Delimiters

Check the computer system manuals for the specific cards.

The input card deck will consist of

- o Computer control cards, as discussed above
- o IEMCAP program deck if not stored on permanent library file in the computer
- o IEMCAP input arranged as discussed in Section 2.4.4.

Basic setups for the five tasks are illustrated graphically in Figures 8 through 12. The first of these (Figure 8) is an ISP run. The temporary PIF (CARDIN) and, optionally, the new ISF are created, and a report of the data is printed. Figures 9 through 12 show specification generation, waiver analysis, trade-off, and survey runs. The figures show the two steps as separate jobs, but as discussed above, they may be run separately or together. (In Figure 12, the IDIPR step is assumed.) During the Step 1 (IDIPR) the seven work files and the new ISF are generated and the report of the data is printed. In Step 2 (TART) reads these files. The Baseline Transfer File (BTF) is generated for specification generation and survey runs and read as input for waiver and trade-off runs. During specification generation an updated ISF is also generated containing the adjusted port spectra, and four scratch files are used which are released after the run. In all cases, printed reports are generated from both IDIPR and TART of the data parameters and the analysis results.

### 3.3 RESTART CAPABILITY

IEMCAP saves analysis results at several stages of execution and provides file updating capability to use these on subsequent runs to avoid reprocessing data. During Input Decode, error-free data is written to the Processed Input File. If errors occur during decoding, IDIPR halts after printing all errors and offending cards. The user can use the PIF as he does an old ISF file and update it with corrected data on the following run. An option also allows the user to proceed into Initial Processing even though errors occurred. Spectra will be generated for those ports for which the data was found error-free. The results of Initial Processing, which performs file updates and generates initial spectra for new and modified

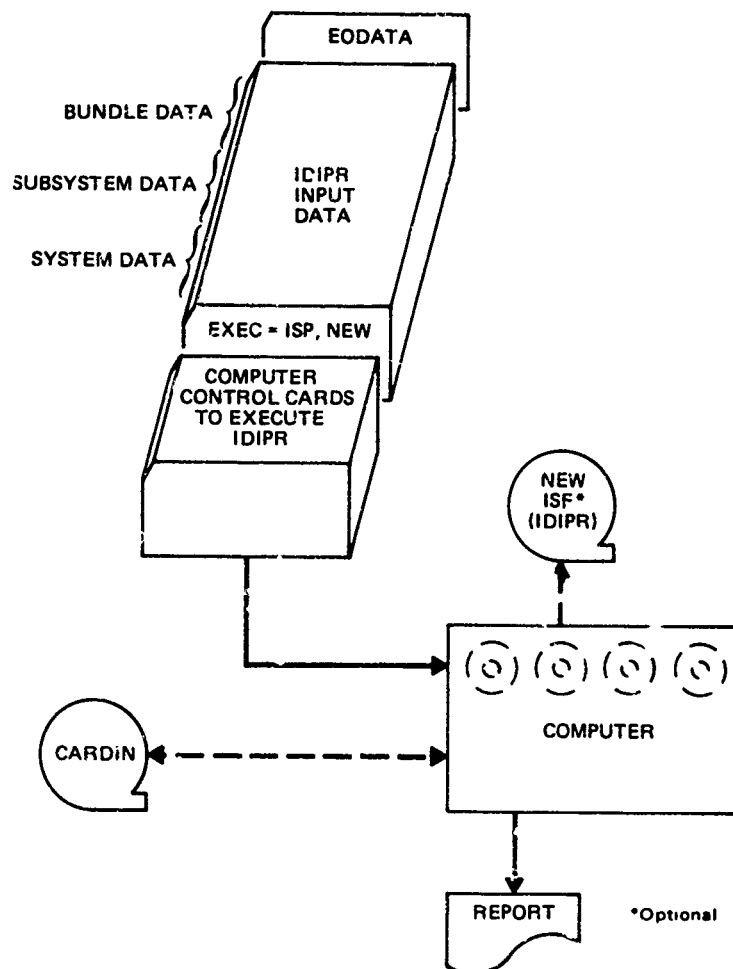


**FIGURE 8**  
**INFUT AND SPECTRUM PROCESSING**  
**(ISP) RUN**

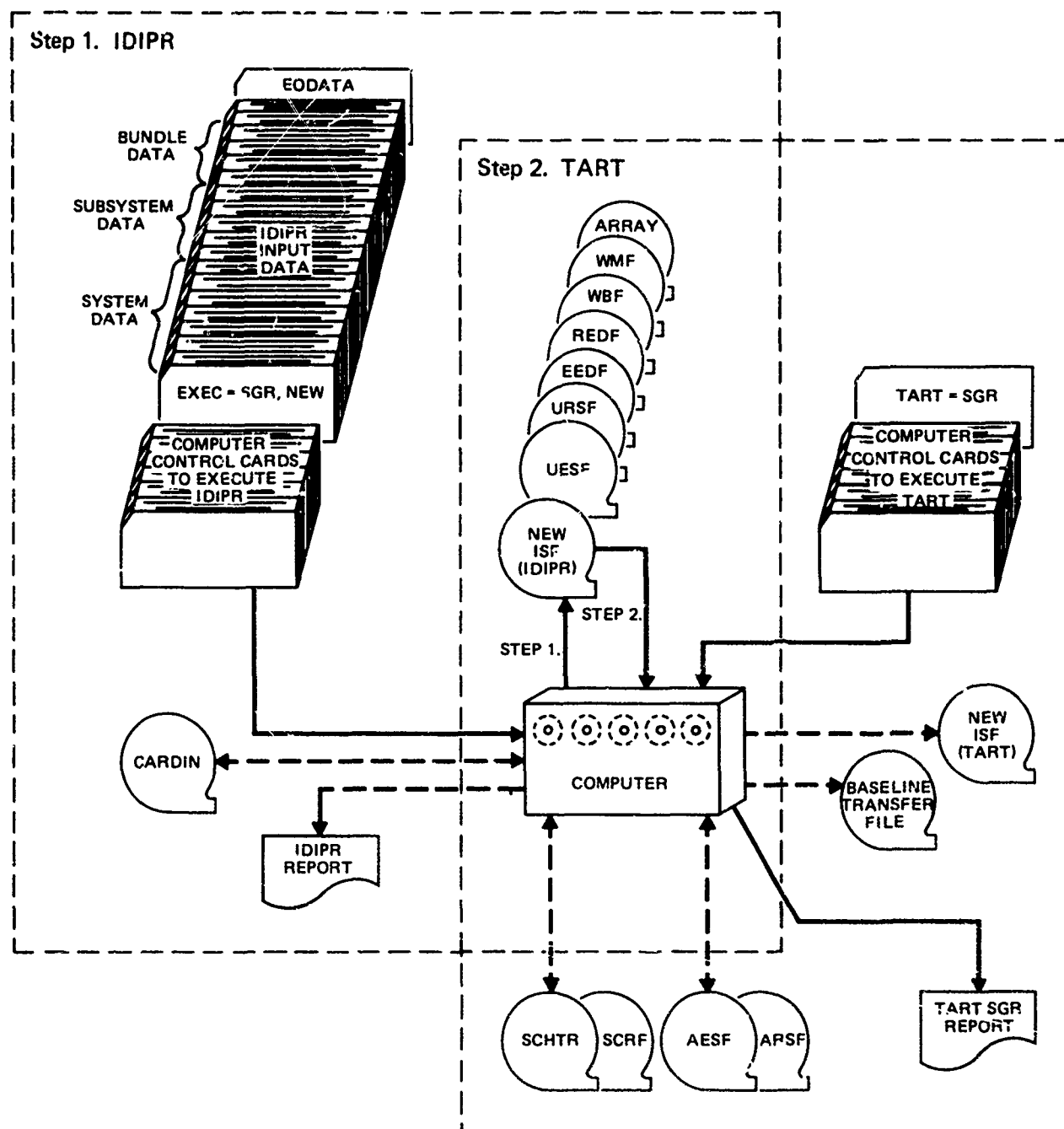


FIGURE 9  
SPECIFICATION GENERATION RUN (NEW SYSTEM)

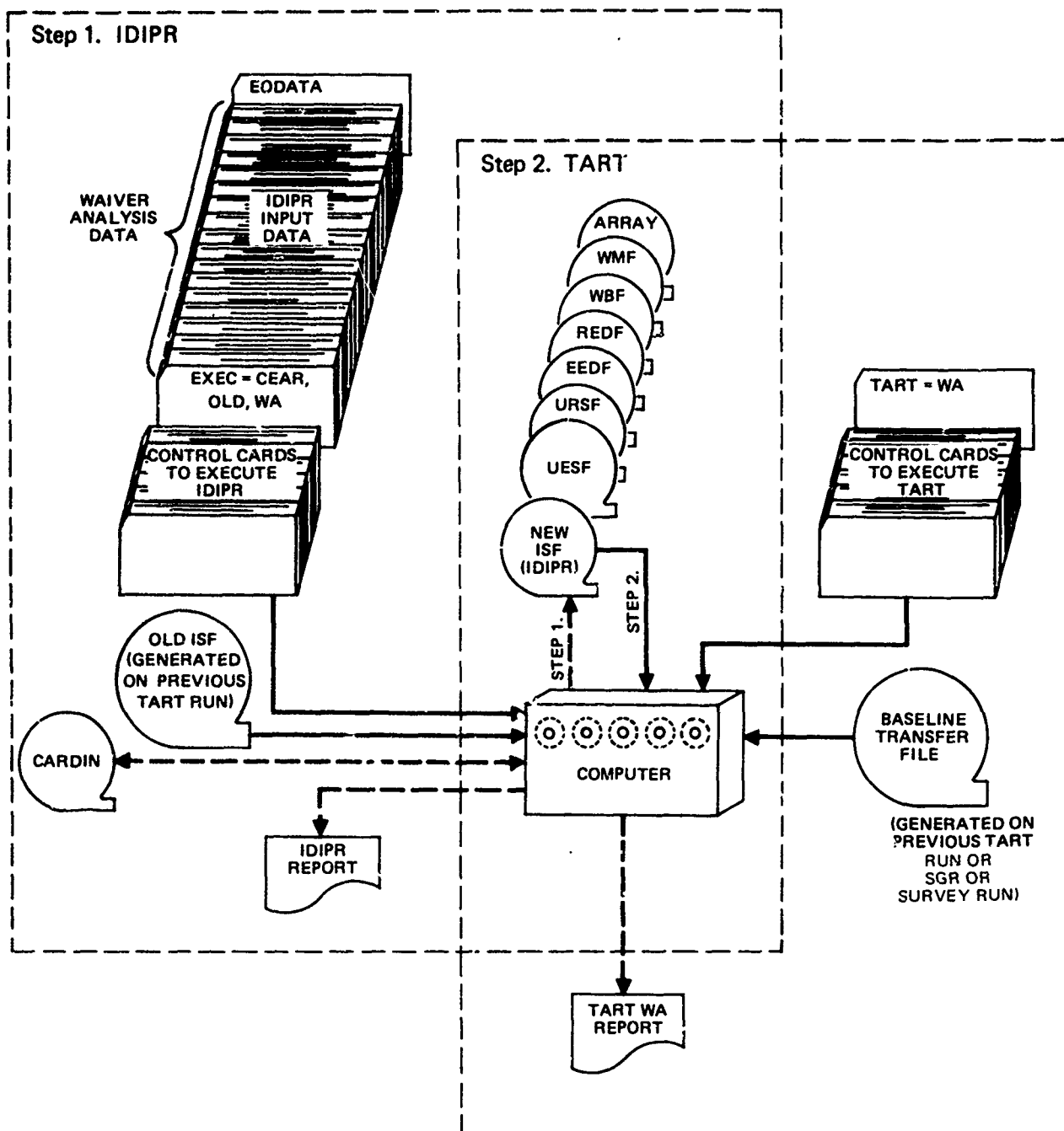


FIGURE 10  
WAIVER ANALYSIS RUN

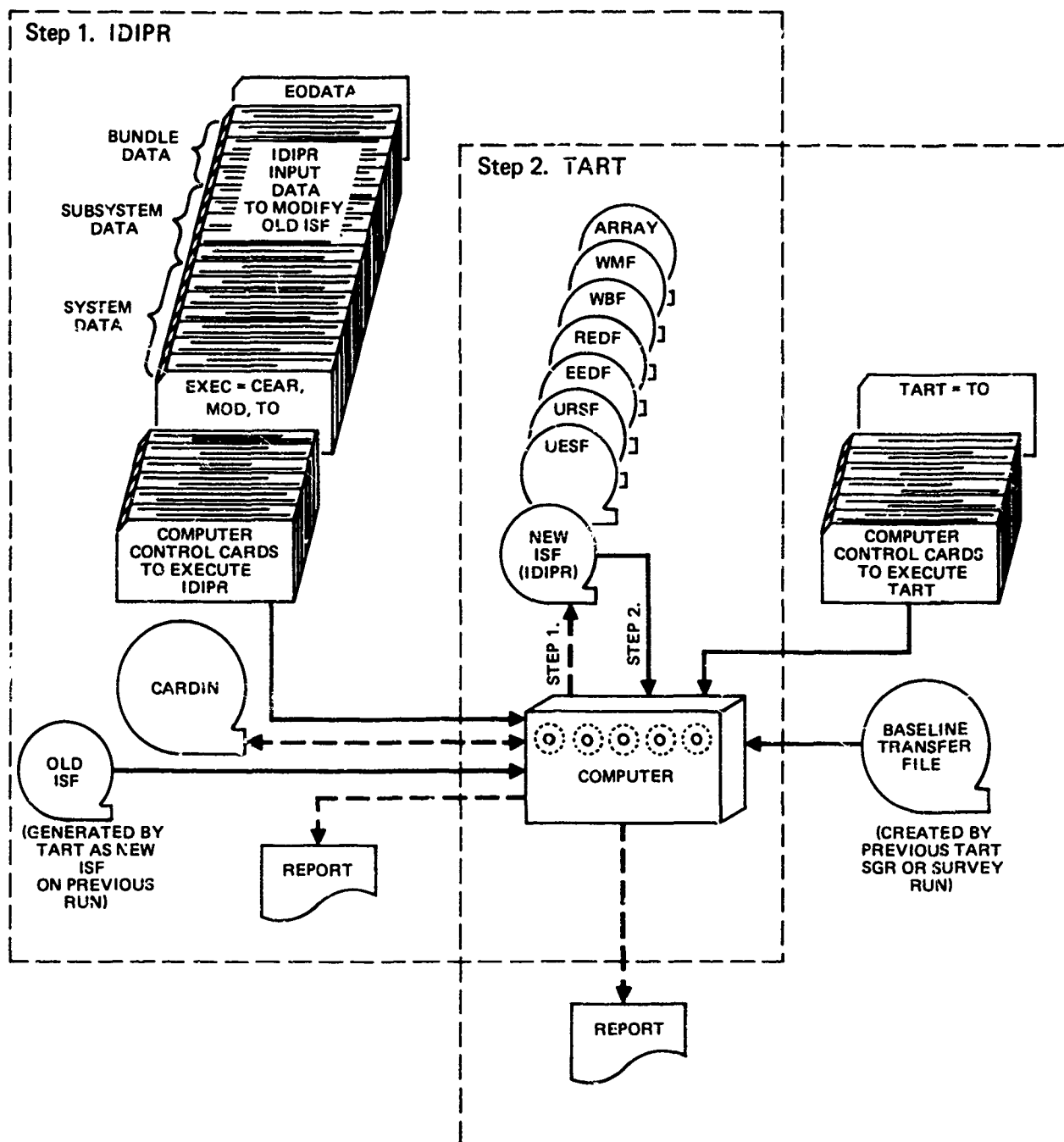


FIGURE 11  
TRADE-OFF RUN

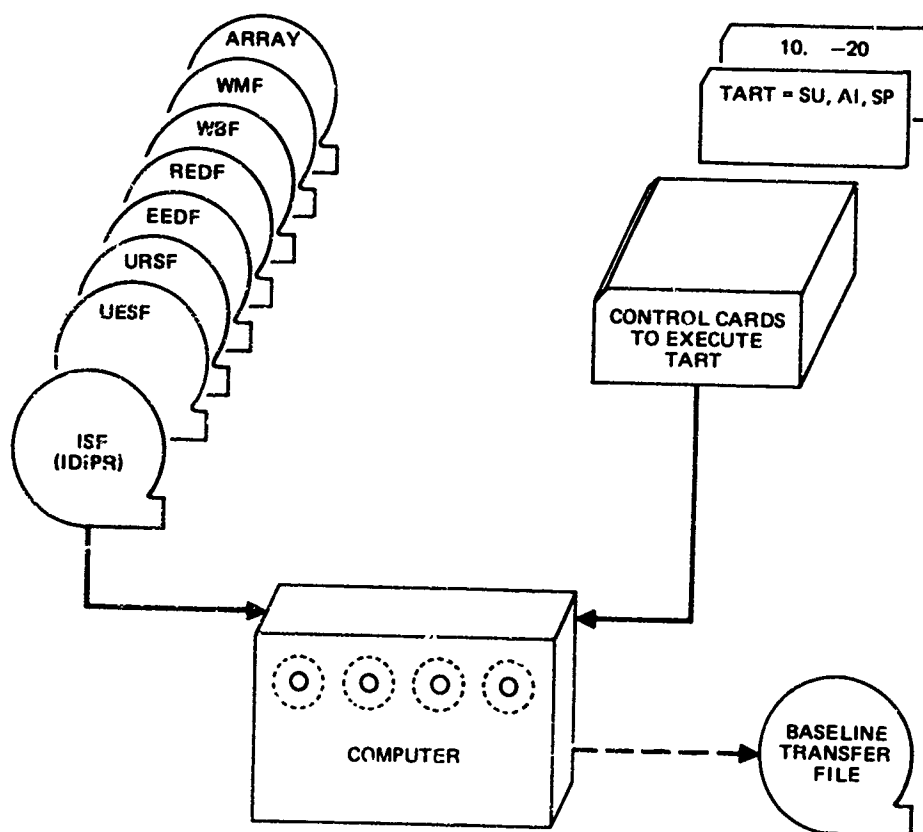


FIGURE 12  
SURVEY RUN

ports, are saved on the ISF. This file can be updated as many times as are needed until the user is satisfied with the result. If the SGR/CEAR option has been selected and provisions made to save the work files, the user is ready to run TART whenever IDIPR executes without error.

## Section 4

### PRINTED OUTPUTS

During execution, a number of printed outputs are generated by IEMCAP. This section describes these outputs and gives examples. The examples are from a test case called the "mini-system" which is presented in detail in Section 5, Example Test Case.

#### 4.1 IDIPR PRINTED OUTPUTS

##### 4.1.1 Error Messages

During input decode, if errors are found in the data, an appropriate error message is printed with the data card. Additional error messages are printed during initial processing if errors are encountered during file updating or in generating initial spectra. Examples of the input decode error messages are shown in Figure 13. Note that some errors can precipitate additional errors. For example, if an error occurs on a PORT card, it is deleted; i.e., it is presumed not to exist in the input data. The SOURCE and RCEPT cards following the deleted card will therefore have no heirarchy data, and messages to that effect will be generated. The error codes are discussed in Section 4.3.

##### 4.1.2 Input Data Card Listing

After all cards have been read, decoded, and checked for errors, a listing of these cards is printed. An example of such a listing is given in Section 5.

##### 4.1.3 Intrasystem Signature File Report

During initial processing, a report of all the data that comprises the system for which the analysis task is to be performed is printed. As this data is also saved on the ISF generated by IDIPR, this report gives a listing of the data on the new ISF. During initial processing, a report of the old ISF used as input to IDIPR may optionally be printed. The ISF report consists of a summary of the system data and the equipment data, followed by each equipment's frequency table and initial spectra of each port in the equipment and, lastly, the bundle data. The spectrum printout for each port in the system consists of the initial broadband and narrowband emission spectra and receptor susceptibility levels dependent on their specification as a source and/or receptor. These levels are obtained from spectrum model synthesis from the input data and quantized to the equipment table frequencies. If an old ISF is used that was generated by a TART SGR run, for ports with no changes to the input data, the adjusted spectra are printed. Initial spectra are computed and printed only for new or modified ports. (In the spectra, -1000 dB indicates no emission and +1000 dB indicates no response.) All spectrum levels printed by both IDIPR and TART are in the units shown in Table 1. Example report outputs are given in Section 5.

```

***CARD NO.      4
FU=1,2,3,4,5,FAAT
***ERROR NO.      3
*****NO MATCH FOR ALPHA CODE
***THIS CARD WILL BE DELETED***

***CARD NO.      7
ANT=COMTA,DI,HZ(U,2)
***ERROR NO.      3
*****NO MATCH FOR ALPHA CODE
***THIS CARD WILL BE DELETED***

SOURCE=SIGNAL,3.,20.E3,4.E6,RECTPL(20.E3,1.E-6),10,VLTS,4.E6
-----}
***CARD NO.      22
SOURCE=SIGNAL,3.,20.E3,4.E6,RECTPL(20.E3,1.E-6),10,VLTS,4.E6
***ERROR NO.      5
*****ILLEGAL SYNTAX
***THIS CARD WILL BE DELETED***

***CARD NO.      24
RC(M)=RF,30,1E6,4E6,1E-9,3E6,SPECT(-.5E6,-18.2,0,71.8,.5E6,-18.2),0
***ERROR NO.      16
*****WRONG MOD. CODE FOR JOB TYPE
***THIS CARD WILL BE DELETED***

***CARD NO.      25
PORT=AIDOT,WIRE,(8NDL2,82W2,A2,GND,GND,NOTEX),53,0,0,0
***ERROR NO.      4
*****NO. PARAMETERS INCORRECT
***THIS CARD WILL BE DELETED***

SOURCE=SIGNAL,3.,20.E3,4.E6,RECTPL(20.E3,1.E-6),13,VLTS,4.E6
-----}
***CARD NO.      26
SOURCE=SIGNAL,3.,20.E3,4.E6,RECTPL(20.E3,1.E-6),13,VLTS,4.E6
***ERROR NO.      5
*****ILLEGAL SYNTAX
***THIS CARD WILL BE DELETED***

***ERROR NO.      26
*****MISSING SO/RC FOR PORT
PORT AIDOT OF EQPT. UHFCO WILL BE DELETED.

***ERROR NO.      26

```

FIGURE 13  
EXAMPLE IDIPR ERROR DIAGNOSTIC OUTPUTS

#### 4.1.4 Debug Printout

An option is available to print debug information that, if used in conjunction with a source listing, provides internal flags and messages to aid in debugging.

#### 4.2 TART PRINTED OUTPUTS

The TART outputs are summaries of EMI margins between emitter-receptor port pairs and to the total received signal from all emitters into each receptor. These margins are printed for each frequency, and the integrated margin is also printed. For specification generation runs, summaries of emitter and receptor spectrum adjustments are printed. Optionally, the user may request supplemental printouts which provide detailed transfer model outputs. These outputs are described below in relation to the four TART analysis tasks.

##### 4.2.1 Specification Generation Outputs

Outputs are provided for the three SGR phases: emitter spectrum adjustment, receptor adjustment, and unresolved EMI. After these, the finally adjusted spectra are summarized for each port.

4.2.1.1 Adjusted Emitter Spectra Summary - An example summary of the adjusted emitter broadband and narrowband spectra is shown in Figure 14. In this, as well as all other emitter-receptor pair summaries, entries are listed by ascending frequency from both the emitter and receptor frequency tables. Hence, the first column gives the frequency, and the second gives the base (i.e., EMTR or RCPT frequency table) from which that frequency was taken. In the third column, the letters "REQD" are printed if the table frequency interval contains the emitter's required frequency range. The transfer ratio in dB, which is printed next, includes all transfer from the emitter port generator to the receptor port load, including filters, antenna gains, propagation loss, inter-wire coupling, etc.

The next series of output columns give narrowband and broadband emitter spectrum and EMI margin data after adjustment in conjunction with the receptor. The EMI margin and received signal level are printed at both emitter and receptor frequencies. However, the adjusted emitter spectrum level, the amount of spectrum adjustment, the relation to the present spectrum level and the adjustment limit are printed at emitter frequencies only. In addition, the bandwidth factor in dB is printed for broadband. Narrowband and/or broadband outputs at a given frequency are not printed where the EMI margin is below -900 dB. This is true for all port pair margin summaries printed by TART.

The received signals at the receptor frequencies are computed by interpolation between the emitter frequencies on either side. Hence, if one of these emitter points is -1000 dB (indicating no emission), the interpolated signal will be between -1000 and the non-zero emitter point. An example of

# ADJUSTED Emitter SPECTRA

EMTR -- SUBS = CNI EQPT 5 = TACAN PORT 2 = TACRF

REP: SUBS = IMGP0 EQPT 6 = ORPVL PORT 4 = ORBP

PAT: ANT TO ANT

| FREQUENCY<br>MHz | FREQ<br>BASE | TRANSFER<br>Ratio | NARROWBAND |         |                |                      | BROADBAND |                |                      |                      |
|------------------|--------------|-------------------|------------|---------|----------------|----------------------|-----------|----------------|----------------------|----------------------|
|                  |              |                   | EMT MGN    | ADJUSTO | RCVD<br>SIGNAL | ADJ EMTR<br>SPCT LEV | ADJUSTO   | RCVD<br>SIGNAL | ADJ EMTR<br>SPCT LEV | SPCT LEV<br>TO LIMIT |
| 1.13689E+04      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 2.07602E+04      | QNT          | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 2.53633E+04      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 3.90795E+04      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 5.34919E+04      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 7.50033E+04      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 1.13096E+05      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 1.43973E+05      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 2.39069E+05      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 2.76342E+05      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 5.05549E+05      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 5.30413E+05      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 1.00043E+06      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 1.01803E+06      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 1.06455E+06      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 1.95413E+06      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 2.25872E+06      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 3.75070E+06      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 4.00003E+06      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 4.77517E+06      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 5.08003E+06      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 7.19913E+06      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 8.00958E+06      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 1.33103E+07      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 2.13414E+07      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 2.65223E+07      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 4.71169E+07      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 5.09069E+07      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 9.53796E+07      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 9.77103E+07      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 1.87547E+08      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 2.01639E+08      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 3.59970E+08      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 4.26274E+08      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 6.00942E+08      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 8.00500E+08      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 9.01149E+08      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 9.62000E+08      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 1.02510E+09      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 1.13000E+09      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 1.21300E+09      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |
| 1.29000E+09      | EMTR         | 0.0               | -94.0      | 6.0     | 6.0            | 5.0                  | 0.0       | 0.0            | 26.0                 | 0.0                  |

FIGURE 14  
SAMPLE OUTPUT - SGR ADJUSTED EMITTER SPECTRA

# A D J U S T E D E M I T T E R S P E C T R A

EMTP -- SUBS = CNI EOPT 5 = TACAN PORT 2 = TACRF

RCPT -- SUBS = INGP0 EOPT 6 = ORPVL PORT 4 = OROR

PATH = ANT TO ANT

(CONT'D)

| FREQUENCY<br>MHz | FREQ<br>BASE | TRANSFER<br>RATIO | NARROWBAND        |                |                   |                      | BROADBAND         |                |                   |                      |
|------------------|--------------|-------------------|-------------------|----------------|-------------------|----------------------|-------------------|----------------|-------------------|----------------------|
|                  |              |                   | ADJSTO<br>EMI MGN | QCVO<br>SIGNAL | ADJMT<br>SPCT LEV | SPCT LEV<br>TO LIMIT | ADJSTO<br>EMI MGN | QCVO<br>SIGNAL | ADJMT<br>SPCT LEV | SPCT LEV<br>TO LIMIT |
| 1.32620E+09      | RCPT RF00    | -68.6             | -162.6            | -62.6          | 6.0               | 30.0                 | -123.9            | -23.8          | 37.5              | 30.0                 |
| 1.35010E+09      | EMTO         | -69.2             | -163.2            | -63.2          | 6.0               | 30.0                 | -134.8            | -34.8          | 0.0               | 12.0                 |
| 1.94512E+09      | EMTR         | -74.1             | -99.3             | .7             | 74.8              | 30.0                 | -152.4            | -52.4          | 0.0               | 14.1                 |
| 2.54551E+09      | QCPT         | -78.6             | -111.6            | -11.6          | 54.8              | 30.0                 | -417.3            | -317.3         | 0.0               | 16.1                 |
| 4.02783E+09      | EMIR         | -85.9             | -131.2            | -31.2          | 6.0               | 30.0                 |                   |                |                   |                      |
| 4.92585E+09      | QCPT         | -89.1             | -146.4            | -46.4          |                   |                      |                   |                |                   |                      |
| 8.51443E+09      | EMTR         | -98.7             | -192.6            | -92.6          |                   |                      |                   |                |                   |                      |
| 9.37792E+09      | RCPT         | -100.4            | -194.3            | -94.3          |                   |                      |                   |                |                   |                      |
| 1.58800E+10      | RCPT         | -112.5            | -206.5            | -106.5         |                   |                      |                   |                |                   |                      |

PORT PAIR INTEGRATED EMI MARGIN = -.9

FIGURE 14 (Continued)  
SAMPLE OUTPUT - ADJUSTED EMITTER SPECTRA

such a case is in Figure 14 at 4.88585 GHz where the broadband received signal is -317.3 dB  $\mu$ A/MHz caused by interpolation between 17.5 dB at 4.02753 GHz and -1000.0 dB at 8.514435 GHz (not printed). Such points should be ignored.

4.2.1.2 Receptor Spectrum Adjustment Summary - After each emitter has been adjusted in conjunction with each receptor, the receptors are adjusted. This receptor adjustment is made in conjunction with the total received signal from all emitters coupled to the given receptor. SGR prints a summary of this, as illustrated in Figure 15. The frequency is printed first, followed by "REQD" if the frequency is within the receptor's required frequency range. Next, the adjusted EMI margin to the total signal, the total signal level, and the adjusted receptor spectrum susceptibility level are printed. The amount of adjustment and the relation to the adjustment limit of the receptor spectrum are also printed.

4.2.1.3 Unresolved Interference Summary - After a given receptor port has been adjusted, SGR scans through the emitters coupled to it and computes the margins. If the maximum margin exceeds empl on the SYSTEM card (or TART additional input card) a summary is printed, as illustrated in Figure 16.

The outputs in this summary are similar to those described in Section 4.2.1.1 without the adjustment data. The frequency, frequency base, and transfer ratio are printed as before. The receptor spectrum level at the receptor frequencies and the interpolated values at the emitter frequencies (identified by an "I") are printed. If the table frequency interval is within the receptor frequency range, an "R" is printed also. At each receptor frequency, the relation of the receptor spectrum level to the adjustment limit is printed next.

Following the receptor outputs, the EMI margin, the emitter spectrum level, the relation of the spectrum level to the adjustment limit, and the received signal level are printed for the narrowband and broadband emitter spectra. The interpolated emitter spectrum values are identified by an "I," and the required emitter spectrum points are identified by an "R" next to the spectrum level. The bandwidth factor, in dB, is also printed.

4.2.1.4 Finally Adjusted Port Spectra - After all of the spectra have been adjusted and all unresolved interference has been determined and printed, the spectra for each port are printed. The format is identical to that of the IDIPR initial port spectrum outputs.

#### 4.2.2 Baseline System EMC Survey Outputs

For each case with maximum EMI margin exceeding empl, CEAR prints a summary, as shown in Figure 17. The format is identical to that of the SGR Unresolved Interference EMI Summary except that the relation of the emitter and receptor spectra to their adjustment limits are not printed since there are no adjustments in this analysis. The discussion in Section 4.2.1.1 for the SGR output regarding erroneous values due to interpolation with one spectrum point at -1000 dB also applies here.

# ADJUSTED RECEPTOR SPECTRUM

SUBS = CNI EQPT 6 = IFF PCRT 2 = IFFRF

| FREQUENCY<br>(HERTZ) | ADJUSTED<br>EMI MGN | RCVD<br>SIGNAL | ADJUSTED<br>SPECTRUM | ADJMT<br>AMOUNT | SPT LEV<br>TO LIMIT |
|----------------------|---------------------|----------------|----------------------|-----------------|---------------------|
| 9.83032E+03          | -56.3               | 46.7           | 103.0                | 0.0             | 30.0                |
| 1.66071E+04          | -56.3               | 46.7           | 103.0                | 0.0             | 30.0                |
| 3.12320E+04          | -56.3               | 46.7           | 103.0                | 0.0             | 30.0                |
| 5.87392E+04          | -56.3               | 46.7           | 103.0                | 0.0             | 30.0                |
| 1.10470E+05          | -56.3               | 46.7           | 103.0                | 0.0             | 30.0                |
| 2.07760E+05          | -56.4               | 46.7           | 103.0                | 0.0             | 30.0                |
| 3.90733E+05          | -6.0                | 97.2           | 103.2                | .2              | 29.8                |
| 7.34347E+05          | 12.1                | 145.1          | 133.0                | 30.0            | 0.0                 |
| 1.32202E+06          | 12.2                | 145.2          | 133.0                | 30.0            | 0.0                 |
| 2.59915E+06          | 12.1                | 145.1          | 133.0                | 30.0            | 0.0                 |
| 4.08920E+06          | 11.1                | 144.1          | 133.0                | 30.0            | 0.0                 |
| 9.19318E+06          | -30.0               | 73.0           | 103.0                | 0.0             | 30.0                |
| 1.72095E+07          | -47.2               | 55.9           | 103.0                | 0.0             | 30.0                |
| 3.25162E+07          | -65.1               | 37.9           | 103.0                | 0.0             | 30.0                |
| 6.11530E+07          | -72.9               | 30.2           | 103.0                | 0.0             | 30.0                |
| 1.15010E+08          | -81.2               | 21.9           | 103.0                | 0.0             | 30.0                |
| 2.14290E+08          | -43.2               | 59.9           | 103.0                | 0.0             | 30.0                |
| 4.06729E+08          | -50.7               | 52.3           | 103.0                | 0.0             | 30.0                |
| 7.65044E+08          | -53.9               | 34.2           | 103.0                | 0.0             | 30.0                |
| 1.03003E+09          | 31.9                | 54.9           | 23.0                 | 0.0             | 30.0                |
| 1.09000E+09          | -49.9               | 54.2           | 103.0                | 0.0             | 30.0                |
| 1.4391E+09           | -113.3              | -10.3          | 103.0                | 0.0             | 30.0                |
| 2.70576E+09          | -125.3              | -22.3          | 103.0                | 0.0             | 30.0                |
| 5.08907E+09          | -77.5               | 25.5           | 103.0                | 0.0             | 30.0                |
| 9.57096E+09          | -144.3              | -41.3          | 103.0                | 0.0             | 30.0                |
| 1.90030E+10          | -154.3              | -43.3          | 103.0                | 0.0             | 30.0                |

FIGURE 15  
SAMPLE OUTPUT - SGR RECEPTOR SPECTRUM ADJUSTMENT

NOTE: The program also prints out "BASELINE SYSTEM INTERFERENCE FROM TOTAL SIGNAL" which includes a TOTAL INTEGRATED EMI MARGIN. The printout is identical to that shown in Figure 18.

# UNRESOLVED INTERFERENCE

EMTD --- SUBS = CNT EQPT 1 = UNFCO PORT 2 = COMLO

RCPT --- SUBS = CNT EQPT 6 = IFF PORT 2 = IFFRF

PATH = ANT TO ANT

NOTE - R = IN RECD RANGE, I = INTERPOLATED VALUE

| FREQUENCY<br>(HERTZ) | FREQ<br>BASE | TRANSFER<br>RATIO | RECEPTOR<br>SPRT LEV | RCPT LEV<br>TO LIMIT | NARROWBAND    |                     |                      |                | BROADBAND     |                     |                      |                |
|----------------------|--------------|-------------------|----------------------|----------------------|---------------|---------------------|----------------------|----------------|---------------|---------------------|----------------------|----------------|
|                      |              |                   |                      |                      | EMI<br>MARGIN | EMITTED<br>SPEC LEV | EMTP LEV<br>TO LIMIT | RCVP<br>SIGNAL | EMI<br>MARGIN | EMITTED<br>SPEC LEV | EMTP LEV<br>TO LIMIT | RCVP<br>SIGNAL |
| 1.53440E+04          | FMTD         | -8.0              | 103.0 I              | 30.0                 | -69.5         | 42.0                | 30.0                 | 35.0           | -292.9        | -112.2 IR           | 30.0                 | -189.9         |
| 1.64071E+04          | RCPT         | -8.0              | 103.0                | 30.0                 | -68.0         | 43.0 I              | 30.0                 | 35.0           | -47.9         | 135.9 R             | 30.0                 | 55.2           |
| 1.07200E+04          | EMTD         | -8.1              | 103.0 I              | 30.0                 | -68.1         | 43.0 I              | 30.0                 | 34.9           | -58.3         | 135.9 IR            | 30.0                 | 44.8           |
| 1.12320E+04          | RCPT         | -8.1              | 103.0                | 30.0                 | -69.1         | 43.0 I              | 30.0                 | 34.0           | -58.3         | 135.9 IR            | 30.0                 | 44.8           |
| 5.87392E+04          | RCPT         | -8.2              | 103.0                | 30.0                 | -68.2         | 43.0 I              | 30.0                 | 34.8           | -63.2         | 135.9 P             | 30.0                 | 39.8           |
| 6.14400E+04          | FMTD         | -8.2              | 103.0 I              | 30.0                 | -68.2         | 43.0 I              | 30.0                 | 34.8           | -78.5         | 105.7 I             | 30.0                 | 24.5           |
| 1.10470E+05          | RCPT         | -8.4              | 103.0                | 30.0                 | -68.4         | 43.0 I              | 30.0                 | 34.6           | -36.7         | 85.9 I              | 30.0                 | -7.5           |
| 1.22000E+05          | EMTD         | -8.4              | 103.0 I              | 30.0                 | -68.4         | 43.0 I              | 30.0                 | 34.6           | -67.1         | 43.9 I              | 30.0                 | -44.1          |
| 2.02240E+05          | RCPT         | -8.7              | 103.0                | 30.0                 | -68.7         | 43.0 I              | 30.0                 | 34.3           | -235.6        | -38.8 I             | 30.0                 | -132.6         |
| 2.45740E+05          | EMTD         | -8.7              | 103.0 I              | 29.8                 | -68.8         | 43.0 I              | 30.0                 | 34.3           | -579.0        | -473.7 I            | 30.0                 | -575.0         |
| 3.90733E+05          | RCPT         | -9.0              | 103.2                | 29.8                 | -79.6         | 32.7 I              | 14.5                 | 18.4           |               |                     |                      |                |
| 4.01520E+05          | EMTD         | -9.2              | 114.1 I              | 0.0                  | -95.7         | 27.6 I              | 0.0                  | 9.6            |               |                     |                      |                |
| 7.34447E+05          | RCPT         | -9.5              | 133.0                | 0.0                  | -123.4        | 19.1 I              | 0.0                  | 3.2            |               |                     |                      |                |
| 9.83040E+05          | EMTD         | -9.8              | 133.0 I              | 0.0                  | -129.6        | 13.0 I              | 0.0                  | 2.9            |               |                     |                      |                |
| 1.38240E+06          | RCPT         | -10.2             | 133.0                | 0.0                  | -130.2        | 13.0 I              | 0.0                  | 2.4            |               |                     |                      |                |
| 1.96649E+06          | EMTD         | -10.6             | 133.0 I              | 0.0                  | -130.6        | 13.0 I              | 0.0                  | 2.0            |               |                     |                      |                |
| 2.59015E+06          | RCPT         | -11.0             | 133.0                | 0.0                  | -131.5        | 13.0 I              | 0.0                  | 1.2            |               |                     |                      |                |
| 3.93216E+06          | EMTD         | -11.8             | 133.0 I              | 0.0                  | -131.8        | 13.0 I              | 0.0                  | 0.8            |               |                     |                      |                |
| 4.44840E+06          | RCPT         | -12.3             | 133.0                | 0.0                  | -132.3        | 13.0 I              | 0.0                  | 0.0            |               |                     |                      |                |
| 7.86432E+06          | EMTD         | -15.1             | 110.4 I              | 30.0                 | -112.5        | 13.0 I              | 0.0                  | 2.0            |               |                     |                      |                |
| 9.13140E+06          | RCPT         | -16.9             | 103.0                | 30.0                 | -100.1        | 19.8 I              | 30.0                 | 19.7           |               |                     |                      |                |
| 1.57286E+07          | EMTD         | -23.3             | 103.0 I              | 30.0                 | -87.3         | 43.0 I              | 30.0                 | 18.5           |               |                     |                      |                |
| 1.72895E+07          | RCPT         | -24.5             | 103.0                | 30.0                 | -84.5         | 43.0 I              | 30.0                 | 10.5           |               |                     |                      |                |
| 3.14573E+07          | FMTD         | -32.5             | 103.0 I              | 30.0                 | -92.5         | 43.0 I              | 30.0                 | 10.1           |               |                     |                      |                |
| 3.25182E+07          | RCPT         | -32.9             | 103.0                | 30.0                 | -92.9         | 43.0 I              | 30.0                 | 7.7            |               |                     |                      |                |
| 6.11530E+07          | RCPT         | -42.3             | 103.0                | 30.0                 | -102.3        | 43.0 I              | 30.0                 | 3.3            |               |                     |                      |                |
| 6.29146E+07          | EMTD         | -42.7             | 103.0 I              | 30.0                 | -102.7        | 43.0 I              | 30.0                 | 3.3            |               |                     |                      |                |
| 1.15010E+08          | RCPT         | -52.8             | 103.0                | 30.0                 | -112.8        | 43.0 I              | 30.0                 | 3.3            |               |                     |                      |                |
| 1.25899E+08          | FMTD         | -54.4             | 103.0 I              | 30.0                 | -114.4        | 43.0 I              | 30.0                 | 3.3            |               |                     |                      |                |
| 2.16208E+08          | RCPT         | -64.6             | 103.0                | 30.0                 | -121.1        | 105.5 IR            | 30.0                 | 3.3            |               |                     |                      |                |
| 2.51648E+08          | EMTD         | -67.7             | 103.0 I              | 30.0                 | -121.1        | 105.5 IR            | 30.0                 | 3.3            |               |                     |                      |                |
| 4.55749E+08          | RCPT         | -75.1             | 103.0                | 30.0                 | -121.1        | 105.5 IR            | 30.0                 | 3.3            |               |                     |                      |                |
| 5.03146E+08          | EMTD         | -83.0             | 103.0 I              | 30.0                 | -121.1        | 105.5 IR            | 30.0                 | 3.3            |               |                     |                      |                |
| 7.65044E+08          | RCPT         | -94.0             | 103.0                | 30.0                 | -104.2        | 92.8 I              | 30.0                 | 3.3            |               |                     |                      |                |
| 1.80606E+09          | EMTD         | -101.8            | 29.2 IR              | 30.0                 | -56.0         | 73.0 I              | 30.0                 | 3.3            |               |                     |                      |                |
| 1.93000E+09          | RCPT         | -102.5            | 23.0 R               | 30.0                 | -63.5         | 72.0 I              | 30.0                 | 3.3            |               |                     |                      |                |
| 1.09800E+09          | RCPT         | -104.2            | 103.0                | 30.0                 | -137.7        | 69.6 I              | 30.0                 | 3.3            |               |                     |                      |                |
| 1.43801E+09          | RCPT         | -112.9            | 103.0                | 30.0                 | -158.3        | 57.6 I              | 30.0                 | 3.3            |               |                     |                      |                |
| 2.01322E+09          | EMTD         | -124.1            | 103.0 I              | 30.0                 | -164.1        | 43.0 I              | 30.0                 | 3.3            |               |                     |                      |                |
| 2.70596E+09          | RCPT         | -134.5            | 103.0                | 30.0                 | -194.6        | 43.0 I              | 30.0                 | 3.3            |               |                     |                      |                |
| 4.82548E+09          | EMTD         | -149.7            | 103.0 I              | 30.0                 | -209.7        | 43.0 I              | 30.0                 | 3.3            |               |                     |                      |                |
| 5.04907E+09          | RCPT         | -159.1            | 103.0                | 30.0                 | -219.1        | 43.0 I              | 30.0                 | 3.3            |               |                     |                      |                |

FIGURE 16  
SAMPLE OUTPUT - SGR UNRESOLVED INTERFERENCE

# BASELINE SYSTEM INTERFERENCE FROM TOTAL SIGNAL

RCPT -- SUBS = CNI EQPT 1 = UHFCC PORT 2 = CCMLO (UNCHANGED)

NOTE - R = IN REQD RANGE, I = INTERPOLATED VALUE

| FREQUENCY<br>(HERTZ) | RECEPTOR<br>SUSC LEVEL | EMI<br>MARGIN | TOTAL RCVD<br>SIGNAL |
|----------------------|------------------------|---------------|----------------------|
| 7.6000E+03           | 103.0                  | 7.0           | 110.1                |
| 1.5360E+04           | 103.0                  | 1.0           | 104.0                |
| 3.0720E+04           | 103.0                  | -5.0          | 98.0                 |
| 6.1440E+04           | 103.0                  | -11.0         | 92.0                 |
| 1.2288E+05           | 103.0                  | -14.4         | 88.6                 |
| 2.4576E+05           | 103.0                  | -17.4         | 85.6                 |
| 4.9152E+05           | 103.0                  | -20.4         | 82.7                 |
| 9.8304E+05           | 103.0                  | -24.9         | 78.1                 |
| 1.9661E+06           | 103.0                  | -30.6         | 72.4                 |
| 3.9322E+06           | 103.0                  | -35.7         | 67.4                 |
| 7.8643E+06           | 103.0                  | -42.2         | 60.8                 |
| 1.5729E+07           | 103.0                  | -47.3         | 55.8                 |
| 3.1457E+07           | 103.0                  | -51.1         | 51.9                 |
| 6.2915E+07           | 103.0                  | -51.7         | 51.3                 |
| 1.2583E+08           | 103.0                  | -34.7         | 68.3                 |
| 2.5166E+08           | -27.0 R                | 106.0         | 79.0                 |
| 5.0332E+08           | -27.0 R                | 96.9          | 69.9                 |
| 1.0066E+09           | 103.0                  | -92.0         | 11.0                 |
| 2.0133E+09           | 103.0                  | -103.3        | -3                   |
| 4.0265E+09           | 103.0                  | -109.2        | -6.2                 |
| 8.0531E+09           | 103.0                  | -174.3        | -71.3                |
| 1.6106E+10           | 103.0                  | -1103.0       | -1000.0              |
| 3.2212E+10           | 103.0                  | -1103.0       | -1000.0              |

TOTAL INTEGRATED EMI MARGIN = 38.4

FIGURE 18  
SAMPLE OUTPUT - CEAR SURVEY TOTAL SIGNAL EMI

# BASELINE SYSTEM EMTR-RCPT PAIR INTERFERENCE

EMTR -- SUBS = IMGPD EQPT 4 = IMPVL PORT 3 = IPAX (UNCHANGED)  
 RCPT -- SUBS = CMI EQPT 1 = UNFECO - PORT 2 = COMLO (UNCHANGED)

PATN = ANY TO ANT

NOTE - R = IN REQD RANGE, I = INTERPOLATED VALUE

| FREQUENCY<br>(MHZ) | FREQ<br>BASE | TRANSFER<br>RATIO | RECEPTOR<br>SUSC LEVEL | NARROWBAND    |                    |                       | BROADBAND     |                    |                       | BANDWIDTH<br>FACTOR |
|--------------------|--------------|-------------------|------------------------|---------------|--------------------|-----------------------|---------------|--------------------|-----------------------|---------------------|
|                    |              |                   |                        | EMI<br>MARGIN | RECEIVED<br>SIGNAL | EMITTER<br>SPCT LEVEL | EMI<br>MARGIN | RECEIVED<br>SIGNAL | EMITTER<br>SPCT LEVEL |                     |
| 1.06026E+04        | EMTR         | -186.0            | 103.0 I                | -246.9        | -143.6             | 42.1                  |               | -195.8             | -21.0                 | -60.0               |
| 1.53600E+04        | RCPT         | -186.0            | 103.0 I                | -246.9        | -143.6             | 42.1 I                |               | -65.0              | 108.4                 | -60.0               |
| 2.03600E+04        | EMTR         | -186.0            | 103.0 I                | -246.6        | -143.6             | 42.1 I                |               | -127.6             | 142.2                 | -60.0               |
| 3.07200E+04        | RCPT         | -186.0            | 103.0 I                | -246.6        | -143.6             | 42.1 I                |               | -126.7             | 143.2                 | -60.0               |
| 3.90795E+04        | EMTR         | -186.0            | 103.0 I                | -246.8        | -143.6             | 42.1                  |               | -126.6             | 143.2                 | -60.0               |
| 6.14400E+04        | RCPT         | -186.0            | 103.0 I                | -246.8        | -143.6             | 42.1                  |               | -126.6             | 143.2                 | -60.0               |
| 7.50092E+04        | EMTR         | -181.0            | 103.0 I                | -241.9        | -138.9             | 42.1                  |               | -127.1             | 143.2                 | -60.0               |
| 1.22800E+05        | RCPT         | -162.9            | 103.0 I                | -223.8        | -120.6             | 42.1 I                |               | -127.3             | 143.2                 | -60.0               |
| 1.43476E+05        | EMTR         | -158.4            | 103.0 I                | -219.3        | -116.2             | 42.1 I                |               | -127.6             | 143.2                 | -60.0               |
| 2.45760E+05        | RCPT         | -138.0            | 103.0 I                | -199.7        | -96.7              | 42.1 I                |               | -219.4             | 53.2                  | -60.0               |
| 2.76342E+05        | EMTR         | -135.7            | 103.0 I                | -196.6        | -93.6              | 42.1                  |               | -135.2             | 83.2                  | -3.0                |
| 4.91520E+05        | RCPT         | -114.7            | 103.0 I                |               |                    |                       |               | -138.2             | 80.5                  | -2.5                |
| 5.30412E+05        | EMTR         | -113.4            | 103.0 I                |               |                    |                       |               | -158.7             | 63.2                  | -1.0                |
| 9.83040E+05        | RCPT         | -106.9            | 103.0 I                |               |                    |                       |               | -370.1             | -146.0                | -1.0                |
| 1.00000E+06        | EMTR         | -106.0            | 103.0 I                |               |                    |                       |               |                    |                       |                     |
| 1.01000E+06        | RCPT         | -106.9            | 103.0 I                | -97.6         | 5.7                | 112.3 IR              |               |                    |                       |                     |
| 1.95410E+06        | EMTR         | -106.7            | 103.0 I                | -66.8         | 36.2               | 143.1 R               |               |                    |                       |                     |
| 1.96600E+06        | RCPT         | -106.7            | 103.0 I                | -66.6         | 36.3               | 143.1 R               |               |                    |                       |                     |
| 3.75870E+06        | EMTR         | -107.2            | 103.0 I                | -66.5         | 36.4               | 143.1 IR              |               |                    |                       |                     |
| 3.93216E+06        | RCPT         | -107.5            | 103.0 I                | -67.1         | 35.9               | 143.1 R               |               |                    |                       |                     |
| 4.00000E+06        | EMTR         | -107.7            | 103.0 I                | -67.4         | 35.6               | 143.1 IR              |               |                    |                       |                     |
| 5.00000E+06        | RCPT         | -109.6            | 103.0 I                | -67.6         | 35.4               | 143.1 R               |               |                    |                       |                     |
| 7.19910E+06        | EMTR         | -112.4            | 103.0 I                | -132.3        | -29.2              | 83.1                  |               |                    |                       |                     |
| 7.86432E+06        | RCPT         | -113.0            | 103.0 I                | -135.6        | -32.0              | 80.4 I                |               |                    |                       |                     |
| 1.30100E+07        | EMTR         | -117.2            | 103.0 I                | -157.1        | -54.1              | 63.1                  |               |                    |                       |                     |
| 1.57206E+07        | RCPT         | -116.1            | 103.0 I                | -162.1        | -58.1              | 59.0 I                |               |                    |                       |                     |
| 2.65236E+07        | EMTR         | -121.2            | 103.0 I                | -182.1        | -79.1              | 42.1                  |               |                    |                       |                     |
| 3.14573E+07        | RCPT         | -121.9            | 103.0 I                | -182.8        | -79.8              | 42.1 I                |               |                    |                       |                     |
| 5.09069E+07        | EMTR         | -123.2            | 103.0 I                | -184.1        | -81.1              | 42.1                  |               |                    |                       |                     |
| 6.19146E+07        | RCPT         | -122.5            | 103.0 I                | -183.4        | -80.4              | 42.1 I                |               |                    |                       |                     |
| 9.77109E+07        | EMTR         | -118.3            | 103.0 I                | -179.1        | -76.1              | 42.1                  |               |                    |                       |                     |
| 1.25829E+08        | RCPT         | -105.5            | 103.0 I                | -166.4        | -63.4              | 42.1 I                |               |                    |                       |                     |
| 1.82847E+08        | EMTR         | -89.5             | 28.2 IR                | -75.8         | -47.4              | 42.1                  |               |                    |                       |                     |
| 2.51650E+08        | RCPT         | -92.1             | 27.0 R                 | -73.0         | -49.9              | 42.1 I                |               |                    |                       |                     |
| 3.59978E+08        | EMTR         | -95.2             | 27.0 IR                | -76.1         | -53.1              | 42.1                  |               |                    |                       |                     |
| 5.03316E+08        | RCPT         | -96.1             | 27.0 R                 | -79.0         | -56.0              | 42.1 I                |               |                    |                       |                     |
| 6.90942E+08        | EMTR         | -132.5            | 32.4 I                 | -122.8        | -90.4              | 42.1                  |               |                    |                       |                     |
| 1.00663E+09        | RCPT         | -154.0            | 103.0 I                | -214.9        | -111.9             | 42.1 I                |               |                    |                       |                     |
| 1.32606E+09        | EMTR         | -160.5            | 103.0 I                | -221.4        | -118.3             | 42.1                  |               |                    |                       |                     |
| 2.01327E+09        | RCPT         | -164.1            | 103.0 I                | -225.0        | -122.0             | 42.1 I                |               |                    |                       |                     |
| 2.54551E+09        | EMTR         | -166.1            | 103.0 I                | -227.8        | -124.0             | 42.1                  |               |                    |                       |                     |
| 4.02653E+09        | RCPT         | -170.1            | 103.0                  | -231.0        | -128.0             | 42.1 I                |               |                    |                       |                     |

FIGURE 17  
 SAMPLE OUTPUT - CEAR SURVEY PORT PAIR EMI SUMMARY

# BASELINE SYSTEM EMTR-RCPT PAIR INTERFERENCE

EMTR -- SUBS = INCPD EQPT 4 = IMPVL PORT 3 = IPAX (UNCHANGED)  
 RCPT -- SUBS = CNI EQPT 1 = UNECO PORT 2 = COMLO (UNCHANGED)

PATH = ANT TO ANT (CONT D)

NOTE - R = IN REQD RANGE, I = INTERPOLATED VALUE

| FREQUENCY<br>(HERTZ) | FREQ<br>BASE | TRANSFER<br>RATIO | RECEPTOR<br>SUSC LEVEL | NARROWBAND    |                    |                       |               | BROADBAND          |                       |               |                 |
|----------------------|--------------|-------------------|------------------------|---------------|--------------------|-----------------------|---------------|--------------------|-----------------------|---------------|-----------------|
|                      |              |                   |                        | EMI<br>MARGIN | RECEIVED<br>SIGNAL | EMITTER<br>SPOT LEVEL | EMI<br>MARGIN | RECEIVED<br>SIGNAL | EMITTER<br>SPOT LEVEL | EMI<br>MARGIN | 80MHz<br>FACTOR |
| 4.00505E+09          | EMTR         | -171.0            | 103.0 I                | -232.7        | -129.7             | 42.1                  |               |                    |                       |               |                 |
| 8.05306E+09          | RCPT         | -176.1            | 103.0                  | -237.0        | -134.0             | 42.1 I                |               |                    |                       |               |                 |
| 9.27292E+09          | EMTR         | -172.5            | 103.0 I                | -238.3        | -135.3             | 42.1                  |               |                    |                       |               |                 |
| 1.61061E+10          | RCPT         | -182.2            | 103.0                  | -243.0        | -140.0             | 42.1 I                |               |                    |                       |               |                 |
| 1.60000E+10          | EMTR         | -183.1            | 103.0 I                | -244.0        | -141.0             | 42.1                  |               |                    |                       |               |                 |

INTEGRATED EMI MARGIN = 9.5

FIGURE 17 (Continued)  
 SAMPLE OUTPUT - CEAR SURVEY PORT PAIR EMI SUMMARY

An output is also printed giving the margins to the total received signal, and an example of such an output is shown in Figure 18. The format is similar to the SGR Receptor Spectrum Adjustment Summary except that no adjustment data is printed.

#### 4.2.3 Trade-Off and Waiver Outputs

These outputs are similar to those for the baseline EMC survey. If there was a path between a given port pair in the baseline system analysis, the baseline EMI margin and the change in the margin are also printed. If one or both ports were added or there was no path in the baseline system, the outputs are the same as for the baseline survey. The trade-off and waiver analysis outputs are illustrated in Figures 19 and 20.

#### 4.2.4 Supplemental Outputs

TART has two types of outputs, normal and supplemental. The normal outputs, described above, do not provide information on emitter-receptor pair coupling other than the composite transfer ratio. The supplemental outputs provide such information, but because they may be quite voluminous, these outputs are optional. These outputs are printed if the SP option is specified on the TART control card.

4.2.4.1 Antenna-to-Antenna Coupling Supplemental Outputs - The antenna coupling math model routine outputs provide information on propagation path and the factors involved in computing the path loss. The basic format, as shown in Figure 21, is used for coupling on aircraft where the wings are not in the propagation path, coupling on spacecraft, and coupling over ground. The first two parameters, ISEG and IAP, apply to antenna-to-wire and are always zero for antenna-to-antenna coupling. The next two lines give the location coordinates of the two antennas and the main beam angles. For aircraft, the cylindrical coordinates (RHO and THETA) and wing location codes (LWA) are given. (The LWA codes are in Table 5.) Following these outputs, the antenna pattern model parameters are given. They are THO and PHO, the antenna main beam angles in radians; TH and PH, the look-angles between antennas; G, the computed antenna gain in dB; and IERR, the error code. Each of these parameters has an "X" or "R" suffix to indicate transmitting and receiving antennas, respectively.

In the next line the basic propagation parameters are given. The first four designate the propagation path, and their meanings are given in Tables 6 through 8. As an example use of this code, Figure 21 shows ISH = 10, ISHW = 0, IROX = 0, and IRO = 13. From Table 6, the ISH code indicates that wing shading was considered but rejected because the path did not intersect the wing. ISHW and IROX are zero since there is no wing shading. (They are always zero for spacecraft and ground systems.) Parameter IRO designates the path model used. The first digit gives the relation to the vehicle body, and the second digit gives the path. In this case, both antennas are on the fuselage, and the path was computed using the conical spiral model.

# BASELINE SYSTEM INTERFERENCE FROM TOTAL SIGNAL

RCPT -- SUBS = CNI EQPT 1 = UMFCO PORT 2 = CCMLO (UNCHANGED)

NOTE - R = IN REQD RANGE, -I-- INTERPOLATED VALUE

| FREQUENCY<br>(HERTZ)  | RECEPTOR<br>SUSC LEVEL | EMI<br>MARGIN     | TOTAL RCVD<br>SIGNAL |
|-----------------------|------------------------|-------------------|----------------------|
| 7.6000E+03            | 103.0                  | 7.0               | 110.1                |
| 1.5360E+04            | 103.0                  | 1.0               | 104.0                |
| <del>2.8720E+04</del> | <del>103.0</del>       | <del>-5.0</del>   | <del>98.0</del>      |
| 6.1440E+04            | 103.0                  | -11.0             | 92.0                 |
| 1.2268E+05            | 103.0                  | -14.4             | 88.6                 |
| 2.4576E+05            | 103.0                  | -17.4             | 85.6                 |
| 4.9152E+05            | 103.0                  | -20.4             | 82.7                 |
| 9.8304E+05            | 103.0                  | -24.9             | 78.1                 |
| <del>1.9661E+06</del> | <del>103.0</del>       | <del>-30.6</del>  | <del>72.4</del>      |
| 3.9322E+06            | 103.0                  | -35.7             | 67.4                 |
| 7.8643E+06            | 103.0                  | -42.2             | 60.8                 |
| 1.5729E+07            | 103.0                  | -47.3             | 55.8                 |
| 3.1457E+07            | 103.0                  | -51.1             | 51.9                 |
| 6.2915E+07            | 103.0                  | -51.7             | 51.3                 |
| <del>1.2583E+08</del> | <del>103.0</del>       | <del>-34.7</del>  | <del>68.3</del>      |
| 2.5166E+08            | -27.0 R                | 106.0             | 79.0                 |
| <del>5.0332E+08</del> | <del>-27.0 R</del>     | <del>96.9</del>   | <del>69.9</del>      |
| 1.0066E+09            | 103.0                  | -92.0             | 11.0                 |
| <del>2.0133E+09</del> | <del>103.0</del>       | <del>-103.3</del> | <del>-0.3</del>      |
| 4.0265E+09            | 103.0                  | -109.2            | -6.2                 |
| <del>8.0531E+09</del> | <del>103.0</del>       | <del>-174.3</del> | <del>-71.3</del>     |
| 1.6106E+10            | 103.0                  | -1103.0           | -1000.0              |
| 3.2212E+10            | 103.0                  | -1103.0           | -1000.0              |

TOTAL INTEGRATED EMI MARGIN = 38.4

FIGURE 18  
SAMPLE OUTPUT - CEAR SURVEY TOTAL SIGNAL EMI



**FIGURE 19 (Continued)**  
**SAMPLE OUTPUT - CEAR TRADE-OFF OR WAIVER ANALYSIS**

MODIFIED SYSTEM INTERFERENCE FROM TOTAL SIGNAL

RCPT -- SUBS = CNI EQPT 1 = UHFCD PORT 2 = COMLO (UNCHANGED)

NOTE - R = IN READ RANGE, I = INTERPOLATED VALUE

| FREQUENCY<br>(HERTZ)                          | RECEPTOR<br>SUSC LEVEL | MOD EMI<br>MARGIN | OL EMI<br>MARGIN | MARGIN<br>CHANGE | TOTAL<br>RCVD SIG |
|-----------------------------------------------|------------------------|-------------------|------------------|------------------|-------------------|
| 7.6000E+03                                    | 103.0                  | -142.5            | -142.5           | -0.0             | -39.5             |
| 1.5360E+04                                    | 103.0                  | -142.6            | -142.6           | -0.0             | -39.5             |
| 3.0720E+04                                    | 103.0                  | -142.6            | -142.6           | -0.0             | -39.5             |
| 6.1440E+04                                    | 103.0                  | -142.6            | -142.6           | -0.0             | -39.6             |
| 1.2280E+05                                    | 103.0                  | -142.7            | -142.7           | -0.0             | -39.7             |
| 2.4576E+05                                    | 103.0                  | -142.8            | -142.8           | -0.0             | -39.8             |
| 4.9152E+05                                    | 103.0                  | -138.1            | -138.2           | -1.1             | -35.1             |
| 9.8304E+05                                    | 103.0                  | -42.7             | -42.6            | -0.1             | 60.2              |
| 1.9661E+06                                    | 103.0                  | -42.5             | -42.5            | -0.0             | 60.5              |
| 3.9322E+06                                    | 103.0                  | -42.4             | -42.4            | -0.0             | 60.6              |
| 7.8643E+06                                    | 103.0                  | -101.6            | -103.1           | 1.5              | 1.4               |
| 1.5729E+07                                    | 103.0                  | -125.7            | -127.5           | 1.8              | -22.7             |
| 3.1457E+07                                    | 103.0                  | -153.0            | -153.0           | -0.0             | -50.0             |
| 6.2915E+07                                    | 103.0                  | -154.4            | -154.4           | -0.0             | -51.4             |
| 1.2583E+08                                    | 103.0                  | -121.4            | -121.4           | -0.0             | -16.4             |
| 2.5166E+08                                    | -27.0 R                | 6.0               | 6.0              | -0.0             | -20.0             |
| 5.0332E+08                                    | -27.0 R                | -0.0              | -0.0             | -0.0             | -27.0             |
| 1.0066E+09                                    | 103.0                  | -154.0            | -152.4           | -1.7             | -51.0             |
| 2.0133E+09                                    | 103.0                  | -196.0            | -196.0           | -0.0             | -93.0             |
| 4.0265E+09                                    | 103.0                  | -127.3            | -127.3           | -0.0             | -24.3             |
| 8.0531E+09                                    | 103.0                  | -174.3            | -174.3           | -0.0             | -71.3             |
| 1.6106E+10                                    | 103.0                  | -1103.0           | -1103.0          | -0.0             | -1000.0           |
| 3.2212E+10                                    | 103.0                  | -1103.0           | -1103.0          | -0.0             | -1000.0           |
| TOTAL INTEGRATED EMI MARGIN =                 |                        |                   |                  |                  | 38.2              |
| BASELINE SYSTEM TOTAL INTEGRATED EMI MARGIN = |                        |                   |                  |                  | 36.4              |
| DIFFERENCE =                                  |                        |                   |                  |                  | -1.8              |

FIGURE 20  
SAMPLE OUTPUT - CEAR TRADE-OFF OR WAIVER ANALYSIS TOTAL SIGNAL EMI

```

-- ISEC= 0 IAL= 0
X      Y      Z      RHO      TH      THO      PHU      LWA
XMR-----0.0-----55.0      224.0      55.0      1.5708      0.0000      0.0000      1
RCP7      0.0      -25.0      129.0      25.0      4.7124      0.0000      0.0000      1

-- THX,PHX,THY,PHY,GX,IERR
0.00000      0.00000      2.27069      6.29319      -1.68045      0
-- THY,PHY,THX,PHX,GY,IERR
0.00000      0.00000      .07090      3.14159      -1.68038      0

-- ISH ISHW IROX IRO      OMIN      OMR      TFS      PRP      SFWF      SFC      GX      GR
-- 10      0      0      13      103.2      0.0      -101.2      139.2      0.0      -57.6      -1.7      -1.7

-- NO WING SHADING
FREQ      TFS      SFC      SFM      PRP
RCPT FREQS
7.6800E+03      0.0      -2.2      0.0      -3.6
1.5360E+04      0.0      -3.3      0.0      -3.7
3.0720E+04      0.0      -4.4      0.0      -3.8
6.1440E+04      0.0      -6.6      0.0      -4.0
1.2288E+05      0.0      -9.9      0.0      -4.2
2.4576E+05      0.0      -1.2      0.0      -4.6
4.9152E+05      0.0      -1.7      0.0      -5.1
9.8304E+05      0.0      -2.4      0.0      -5.8
1.9661E+06      0.0      -3.4      0.0      -6.8
3.9322E+06      0.0      -4.6      0.0      -8.2
7.8643E+06      0.0      -6.7      0.0      -10.1
1.5729E+07      0.0      -9.4      0.0      -17.5
3.1457E+07      0.0      -10.8      0.0      -27.1
6.2915E+07      0.0      -17.8      0.0      -38.0
1.2583E+08      0.0      -22.8      0.0      -50.4
2.5166E+08      0.0      -28.8      0.0      -64.7
5.0332E+08      0.0      -34.9      0.0      -81.5
1.0066E+09      0.0      -40.9      0.0      -101.9
2.0133E+09      0.0      -46.9      0.0      -125.8
4.0266E+09      0.0      -52.9      0.0      -153.0
8.0531E+09      0.0      -58.9      0.0      -183.0
1.6106E+10      0.0      -65.0      0.0      -214.8
3.2212E+10      0.0      -71.0      0.0      -245.4
ENTR FREQS
8.0303E+03      0.0      -2.2      0.0      -3.6
1.6080E+04      0.0      -3.3      0.0      -3.7
3.1233E+04      0.0      -4.4      0.0      -3.8
5.0739E+04      0.0      -6.6      0.0      -4.0
1.1047E+05      0.0      -8.8      0.0      -4.2
2.0776E+05      0.0      -1.1      0.0      -4.5
3.9073E+05      0.0      -1.5      0.0      -4.9
7.8445E+05      0.0      -2.1      0.0      -5.5
1.3020E+06      0.0      -2.9      0.0      -6.2
2.5991E+06      0.0      -3.9      0.0      -7.3
4.8682E+06      0.0      -5.3      0.0      -8.7
7.1932E+06      0.0      -7.3      0.0      -10.7
1.7290E+07      0.0      -9.8      0.0      -13.7
3.4581E+07      0.0      -13.2      0.0      -27.6
5.1153E+07      0.0      -17.6      0.0      -37.5
1.1501E+08      0.0      -23.3      0.0      -48.7
2.1630E+08      0.0      -30.5      0.0      -61.4
4.0679E+08      0.0      -39.4      0.0      -75.8
7.6504E+08      0.0      -51.6      0.0      -93.4
1.0300E+09      0.0      -58.2      0.0      -102.7
1.0900E+09      0.0      -59.6      0.0      -104.5
1.4388E+09      0.0      -66.5      0.0      -113.8
2.7000E+09      0.0      -84.2      0.0      -137.1

```

FIGURE 21  
SAMPLE ANTENNA-TO-ANTENNA COUPLING SUPPLEMENTAL OUTPUT  
BASIC FORMAT

TABLE 5  
WING ANTENNA CODE (LWA)

| LWA | MEANING                          |
|-----|----------------------------------|
| 1   | Not on wing                      |
| 2   | On or suspended from wing bottom |
| 3   | Top of wing                      |
| 4   | Forward edge of wing             |
| 5   | Aft edge of wing                 |
| 6   | Tip of wing                      |

TABLE 5  
WING ANTENNA CODE (LWA)

| LWA | MEANING                          |
|-----|----------------------------------|
| 1   | Not on wing                      |
| 2   | On or suspended from wing bottom |
| 3   | Top of wing                      |
| 4   | Forward edge of wing             |
| 5   | Aft edge of wing                 |
| 6   | Tip of wing                      |

TABLE 5  
SHADING/PATH AROUND VEHICLE CODE (ISH)

| ISH | MEANING                                                                   |
|-----|---------------------------------------------------------------------------|
| 1   | TOP OF FUSELAGE ONLY                                                      |
| 2   | BOTTOM OF FUSELAGE ONLY                                                   |
| 3   | OVER RIGHT WING ONLY                                                      |
| 4   | OVER LEFT WING ONLY                                                       |
| 5   | FUSELAGE TO RIGHT WING                                                    |
| 6   | FUSELAGE TO LEFT WING                                                     |
| 7   | FUSELAGE TO RIGHT WING TO FUSELAGE                                        |
| 8   | FUSELAGE TO LEFT WING TO FUSELAG                                          |
| 9   | FREE SPACE                                                                |
| 10  | WING SHADING CONSIDERED BUT REJECTED BECAUSE PATH DOES NOT INTERSECT WING |

TABLE 7  
WING EDGE CODE (ISHW)

| ISHW | MEANING         |
|------|-----------------|
| 0    | NOT AROUND WING |
| 1    | FWD EDGE        |
| 2    | AFT EDGE        |

TABLE 8

ANTENNA - FUSELAGE CODE, XMTR ANT TO WING (IROX) AND  
ANTENNA - FUSELAGE CODE, WING TO RCVR ANT (IRO)

| FIRST DIGIT (RELATION TO BODY) |                                      |            |                                      |                  |
|--------------------------------|--------------------------------------|------------|--------------------------------------|------------------|
|                                | IROX <sup>2</sup>                    |            | IRO <sup>2</sup>                     |                  |
| VALUE                          | TRANSMITTER ANTENNA                  | WING POINT | WING POINT (XMTR IF NO WING SHADING) | RECEIVER ANTENNA |
| 1                              | ON                                   | ON         | ON                                   | ON               |
| 2                              | ON                                   | OFF        | ON                                   | OFF              |
| 3                              | OFF                                  | ON         | OFF                                  | ON               |
| 4                              | OFF                                  | OFF        | OFF                                  | OFF              |
| BLANK                          | (SEE NOTE 1)                         |            | (SEE NOTE 1)                         |                  |
| SECOND DIGIT (CURVE)           |                                      |            |                                      |                  |
| VALUE                          | CURVE USED                           |            |                                      |                  |
| 0                              | STRAIGHT LINE ONLY                   |            |                                      |                  |
| 1                              | STRAIGHT LINE AND CYLINDRICAL SPIRAL |            |                                      |                  |
| 2                              | CYLINDRICAL SPIRAL ONLY              |            |                                      |                  |
| 3                              | CONICAL SPIRAL ONLY                  |            |                                      |                  |

## NOTES:

1. BLANK IF ANTENNAS HAVE SAME  $\theta$  COORDINATES OR FREE SPACE
2. IF NO WING SHADING, IROX IS ZERO AND IRO CODE APPLIES FOR TRANSMITTER ANTENNA TO RECEIVER ANTENNA

ISEG= 0 IAP= 0

|      | X    | Y     | Z     | RHO   | TH     | THO    | PHO    | LWA |
|------|------|-------|-------|-------|--------|--------|--------|-----|
| XMTR | 81.5 | -49.0 | 210.0 | 93.1  | 5.7787 | 1.7453 | 0.0000 | 2   |
| RCPT | 0.0  | 113.0 | 625.0 | 113.0 | 1.5708 | 0.0000 | 0.0000 | 1   |

THSX,PHSX,THX,PMX,GX,IERR  
 1.74533 0.00000 1.47169 3.17766 -20.00000 0  
 THOR,PHOR,THR,PHR,GR,IERR  
 0.00040 0.00000 2.17801 .41266 -1.48466 0

THSX,PHSX,THX,PMX,GX,IERR  
 1.74533 0.00000 .75060 4.19732 -20.00000 0  
 THOR,PHOR,THR,PHR,GR,IERR  
 0.00000 0.00000 1.87328 .13664 -7.62128 0

| ISM | ISHW | IROX | IRO | DMIN  | DWR   | TFS   | PRP   | SFWP | SFC  | GX    | GR   |
|-----|------|------|-----|-------|-------|-------|-------|------|------|-------|------|
| 7   | 2    | 0    | 31  | 49.3  | 405.6 | -76.5 | 145.0 | 79.0 | -4.0 | -23.0 | -7.6 |
| ISM | ISHW | IROX | IRO | DMIN  | DWR   | TFS   | PRP   | SFWP | SFC  | GX    | GR   |
| 7   | 1    | 40   | 41  | 255.1 | 223.8 | -87.8 | 131.3 | 71.9 | -0.0 | -20.0 | -1.0 |

| RCPT       | FREQ  | FORWARD EDGE |       |        |       | AFT EDGE |       |        |        | PROP |
|------------|-------|--------------|-------|--------|-------|----------|-------|--------|--------|------|
|            |       | TFS          | SFC   | SFW    | PRP   | TFS      | SFC   | SFW    | PRP    |      |
| 7.6800E+03 | 0.0   | -0.0         | 0.0   | -21.5  | 0.0   | -0.0     | 0.0   | -27.6  | -21.5  |      |
| 1.5360E+04 | 0.0   | -0.0         | 0.0   | -21.5  | 0.0   | -0.0     | 0.0   | -27.6  | -21.5  |      |
| 3.0720E+04 | 0.0   | -0.0         | 0.0   | -21.5  | 0.0   | -0.0     | 0.0   | -27.6  | -21.5  |      |
| 6.1440E+04 | 0.0   | -0.0         | 0.0   | -21.5  | 0.0   | -0.0     | 0.0   | -27.7  | -21.5  |      |
| 1.2288E+05 | 0.0   | -0.0         | 0.0   | -21.5  | 0.0   | -0.0     | 0.0   | -27.7  | -21.5  |      |
| 2.4576E+05 | 0.0   | -0.0         | 0.0   | -21.5  | 0.0   | -0.0     | 0.0   | -27.7  | -21.5  |      |
| 4.9152E+05 | 0.0   | -0.0         | 0.0   | -21.5  | 0.0   | -0.0     | 0.0   | -27.7  | -21.5  |      |
| 9.8304E+05 | 0.0   | -0.0         | 0.0   | -21.5  | 0.0   | -0.0     | 0.0   | -27.7  | -21.5  |      |
| 1.9661E+06 | 0.0   | -0.0         | 0.0   | -21.5  | 0.0   | -0.0     | 0.0   | -27.8  | -21.5  |      |
| 3.9322E+06 | -6.6  | -0.0         | 0.0   | -22.1  | 0.0   | -0.0     | 0.0   | -27.9  | -22.1  |      |
| 7.8643E+06 | -6.6  | -0.0         | 0.0   | -28.1  | 0.0   | -0.0     | 0.0   | -28.0  | -28.0  |      |
| 1.5729E+07 | -12.6 | -0.0         | -0.1  | -34.2  | 0.0   | -0.0     | 0.0   | -28.1  | -28.1  |      |
| 3.1457E+07 | -18.6 | -0.0         | -3.1  | -43.2  | -4.3  | -0.0     | 0.0   | -32.7  | -32.7  |      |
| 6.2915E+07 | -24.7 | -0.0         | -6.1  | -52.3  | -10.4 | -1.0     | 0.0   | -39.0  | -39.0  |      |
| 1.2583E+08 | -30.7 | -0.0         | -9.1  | -61.3  | -16.4 | -1.4     | -2.0  | -47.4  | -47.4  |      |
| 2.5166E+08 | -36.7 | -0.0         | -12.1 | -70.3  | -22.4 | -2.0     | -5.0  | -57.1  | -57.1  |      |
| 5.0332E+08 | -42.7 | -0.0         | -15.2 | -79.4  | -28.4 | -2.5     | -8.0  | -66.9  | -66.9  |      |
| 1.0066E+09 | -48.7 | -0.0         | -18.2 | -88.4  | -34.5 | -3.0     | -11.0 | -77.1  | -77.1  |      |
| 2.0133E+09 | -54.8 | -0.0         | -21.2 | -97.4  | -40.5 | -3.6     | -14.0 | -87.7  | -87.7  |      |
| 4.0266E+09 | -60.8 | -0.0         | -24.2 | -106.4 | -46.5 | -4.2     | -17.1 | -99.0  | -99.0  |      |
| 8.0531E+09 | -66.8 | -0.0         | -27.2 | -115.5 | -52.5 | -4.8     | -20.1 | -111.1 | -111.1 |      |
| 1.6106E+10 | -72.8 | -0.0         | -30.2 | -124.5 | -58.5 | -5.4     | -23.1 | -124.3 | -124.3 |      |
| 3.2212E+10 | -78.8 | -0.0         | -33.2 | -133.5 | -64.5 | -6.0     | -26.1 | -136.8 | -133.5 |      |
| ENTR FREQS |       |              |       |        |       |          |       |        |        |      |
| 1.0600E+04 | 0.0   | -0.0         | 0.0   | -21.5  | 0.0   | -0.0     | 0.0   | -27.6  | -21.5  |      |
| 2.0360E+04 | 0.0   | -0.0         | 0.0   | -21.5  | 0.0   | -0.0     | 0.0   | -27.6  | -21.5  |      |
| 3.9080E+04 | 0.0   | -0.0         | 0.0   | -21.5  | 0.0   | -0.0     | 0.0   | -27.6  | -21.5  |      |
| 7.5009E+04 | 0.0   | -0.0         | 0.0   | -21.5  | 0.0   | -0.0     | 0.0   | -27.7  | -21.5  |      |
| 1.4397E+05 | 0.0   | -0.0         | 0.0   | -21.5  | 0.0   | -0.0     | 0.0   | -27.7  | -21.5  |      |
| 2.7634E+05 | 0.0   | -0.0         | 0.0   | -21.5  | 0.0   | -0.0     | 0.0   | -27.7  | -21.5  |      |
| 5.3041E+05 | 0.0   | -0.0         | 0.0   | -21.5  | 0.0   | -0.0     | 0.0   | -27.7  | -21.5  |      |
| 1.0030E+06 | 0.0   | -0.0         | 0.0   | -21.5  | 0.0   | -0.0     | 0.0   | -27.8  | -21.5  |      |
| 1.0181E+06 | 0.0   | -0.0         | 0.0   | -21.5  | 0.0   | -0.0     | 0.0   | -27.8  | -21.5  |      |
| 1.9541E+06 | 0.0   | -0.0         | 0.0   | -21.5  | 0.0   | -0.0     | 0.0   | -27.8  | -21.5  |      |
| 3.7507E+06 | -2.2  | -0.0         | 0.0   | -21.6  | 0.0   | -0.0     | 0.0   | -27.9  | -21.6  |      |
| 4.0000E+06 | -2.7  | -0.0         | 0.0   | -22.2  | 0.0   | -0.0     | 0.0   | -27.9  | -22.2  |      |
| 5.0000E+06 | -2.7  | -0.0         | 0.0   | -24.1  | 0.0   | -0.0     | 0.0   | -27.9  | -24.1  |      |
| 7.1991E+06 | -5.8  | -0.0         | 0.0   | -27.3  | 0.0   | -0.0     | 0.0   | -29.0  | -27.3  |      |

FIGURE 22  
 SAMPLE ANTENNA-TO-ANTENNA COUPLING SUPPLEMENTAL  
 OUTPUT WITH WING SHADING

```

ISEG= 1 IAP= 2
X      Y      Z      RHO      TH      THO      PHO      LWA
XMTX   0.0    55.0   374.0   55.0   1.5708  0.0000  0.0000    1
RCPT    0.0    77.2   332.5   52.2   1.5708  0.0000  0.0000    1

THOX,PHOX,THX,PHX,GX,IERR
0.00000  0.00000  1.63816  6.28319 -17.86000  0

ISM ISHM IROX IRO  DMIN  DWR  TFS  PRP  SFWR  SFC  GX  GR
-----
  0  0  0  0  41.6  0.0 -73.8 114.4  0.0  0.0 -17.9  C.0

FREQ      SFC      SFM      PRP      PRPA      AMRTO      YE      YR      TRNSF
RCPT FREQS
7.6800E+03  0.0  0.0 -3.6  .0  1.3974E-05  2.0000E-02  2.0000E+00  1.7106E-06
1.5360E+04  0.0  0.0 -3.6  .0  2.7948E-05  2.0000E-02  2.0000E+00  6.8603E-08
3.0720E+04  0.0  0.0 -3.6  .0  5.5896E-05  2.0000E-02  2.0000E+00  2.7405E-07
6.1440E+04  0.0  0.0 -3.6  .0  1.1179E-04  2.0000E-02  2.0000E+00  1.0986E-06
1.2288E+05  0.0  0.0 -3.6  .0  2.2358E-04  2.0000E-02  2.0000E+00  4.3945E-06
2.4576E+05  0.0  0.0 -3.6  .0  4.4716E-04  2.0000E-02  2.0000E+00  1.7578E-05
4.9152E+05  0.0  0.0 -3.6  .0  8.9433E-04  2.0000E-02  2.0000E+00  7.0311E-05
9.8304E+05  0.0  0.0 -3.6  .0  1.7887E-03  2.0000E-02  2.0000E+00  2.6125E-04
1.9661E+06  0.0  0.0 -3.6  .0  3.5773E-03  2.0000E-02  2.0000E+00  1.1208E-03
3.9322E+06  0.0  0.0 -3.6  .0  7.1546E-03  2.0000E-02  2.0000E+00  4.4999E-03
7.8643E+06  0.0  0.0 -3.6  .0  1.4307E-02  2.0000E-02  2.0000E+00  1.8000E-02
1.5729E+07  0.0  0.0 -3.6  .1  2.8619E-02  2.0000E-02  2.0000E+00  7.1999E-02
3.1457E+07  0.0  0.0 -3.6  .3  5.7237E-02  2.0000E-02  2.0000E+00  2.8799E-01
6.2915E+07  0.0  0.0 -3.6  .2  4.0987E-02  2.0000E-02  2.0000E+00  2.1095E-01
1.2583E+08  0.0  0.0 -3.6  .1  2.9251E-02  2.0000E-02  2.0000E+00  7.5219E-02
2.5166E+08  0.0  0.0 -3.6  .1  2.9251E-02  2.0000E-02  2.0000E+00  7.5219E-02
5.0332E+08  0.0  0.0 -3.6  .1  2.9251E-02  2.0000E-02  2.0000E+00  7.5219E-02
EMTR FREQS
1.1969E+04  0.0  0.0 -3.6  .0  2.1718E-05  2.0000E-02  2.0000E+00  4.1692E-08
2.5303E+04  0.0  0.0 -3.6  .0  4.3039E-05  2.0000E-02  2.0000E+00  1.8633E-07
5.0606E+04  0.0  0.0 -3.6  .0  8.6078E-05  2.0000E-02  2.0000E+00  7.4276E-07
1.0121E+05  0.0  0.0 -3.6  .0  1.7216E-04  2.0000E-02  2.0000E+00  2.9721E-06
2.0242E+05  0.0  0.0 -3.6  .0  3.4432E-04  2.0000E-02  2.0000E+00  1.1884E-05
4.0484E+05  0.0  0.0 -3.6  .0  6.8864E-04  2.0000E-02  2.0000E+00  4.7539E-05
8.0968E+05  0.0  0.0 -3.6  .0  1.3773E-03  2.0000E-02  2.0000E+00  1.9016E-04
1.6194E+06  0.0  0.0 -3.6  .0  2.7546E-03  2.0000E-02  2.0000E+00  7.6064E-04
3.2388E+06  0.0  0.0 -3.6  .0  5.5092E-03  2.0000E-02  2.0000E+00  3.0426E-03
6.4776E+06  0.0  0.0 -3.6  .0  1.1018E-02  2.0000E-02  2.0000E+00  1.2169E-02
1.2955E+07  0.0  0.0 -3.6  .1  2.2036E-02  2.0000E-02  2.0000E+00  4.8676E-02
2.5910E+07  0.0  0.0 -3.6  .1  4.4072E-02  2.0000E-02  2.0000E+00  1.9469E-01
5.1820E+07  0.0  0.0 -3.6  .4  8.8144E-02  2.0000E-02  2.0000E+00  7.7877E-01
1.0364E+08  0.0  0.0 -3.6  .1  1.7629E-02  2.0000E-02  2.0000E+00  7.5219E-02
2.0728E+08  0.0  0.0 -3.6  .1  1.7629E-02  2.0000E-02  2.0000E+00  7.5219E-02
4.1456E+08  0.0  0.0 -3.6  .1  1.7629E-02  2.0000E-02  2.0000E+00  7.5219E-02

```

FIGURE 23  
SAMPLE ANTENNA-TO-WIRE COUPLING SUPPLEMENTAL OUTPUT

| FREQUENCY   | XFERV       | XFERI       |
|-------------|-------------|-------------|
| 3.00000E+01 | 1.15989E-08 | 2.66499E-03 |
| 6.34217E+01 | 2.43911E-08 | 5.38444E-03 |
| 1.34077E+02 | 5.11685E-08 | 1.03347E-02 |
| 2.83447E+02 | 1.06969E-07 | 1.63409E-02 |
| 5.99222E+02 | 2.22487E-07 | 1.88021E-02 |
| 1.26679E+03 | 4.69353E-07 | 1.54947E-02 |
| 2.67807E+03 | 9.38284E-07 | 9.38089E-03 |
| 5.66159E+03 | 1.88697E-06 | 4.77718E-03 |
| 1.19689E+04 | 3.71020E-06 | 2.30063E-03 |
| 2.53030E+04 | 7.06057E-06 | 1.09272E-03 |
| 5.34919E+04 | 1.28172E-05 | 5.17357E-04 |
| 1.13085E+05 | 2.17428E-05 | 2.44773E-04 |
| 2.39068E+05 | 3.35001E-05 | 1.15789E-04 |
| 5.05404E+05 | 4.51926E-05 | 5.47715E-05 |
| 1.06845E+06 | 5.14950E-05 | 2.59083E-05 |
| 2.25877E+06 | 5.03241E-05 | 1.22552E-05 |
| 4.77517E+06 | 5.24512E-05 | 7.79703E-06 |
| 1.00950E+07 | 8.12981E-05 | 2.74213E-06 |
| 2.13414E+07 | 1.64038E-04 | 1.29710E-06 |
| 4.61169E+07 | 3.46002E-04 | 6.13557E-07 |
| 9.53796E+07 | 7.31071E-04 | 2.90227E-07 |
| 3.00000E+01 | 1.15989E-08 | 2.66499E-03 |
| 6.00000E+01 | 2.30859E-08 | 5.11332E-03 |
| 1.20000E+02 | 4.61718E-08 | 9.45925E-03 |
| 2.40000E+02 | 9.08321E-08 | 1.51353E-02 |
| 4.80000E+02 | 1.79198E-07 | 1.86753E-02 |
| 9.60000E-02 | 3.51538E-07 | 1.73134E-02 |
| 1.92000E+03 | 6.84134E-07 | 1.20972E-02 |
| 3.84000E+03 | 1.31047E-06 | 6.86203E-03 |
| 7.68000E+03 | 2.49322E-06 | 3.55877E-03 |
| 1.53600E+04 | 4.61696E-06 | 1.79642E-03 |
| 3.07200E+04 | 8.28359E-06 | 9.00375E-04 |
| 6.14400E+04 | 1.42169E-05 | 4.50453E-04 |
| 1.22880E+05 | 2.29336E-05 | 2.25264E-04 |
| 2.45760E+05 | 3.39604E-05 | 1.12636E-04 |
| 4.91520E+05 | 4.48194E-05 | 5.63180E-05 |
| 9.83040E+05 | 5.12044E-05 | 2.81593E-05 |
| 1.96608E+06 | 5.68374E-05 | 1.40797E-05 |
| 3.93216E+06 | 5.03389E-05 | 7.03984E-06 |
| 7.86432E+06 | 6.71021E-05 | 3.51992E-06 |
| 1.57286E+07 | 1.21722E-04 | 1.75996E-06 |
| 3.14573E+07 | 2.41320E-04 | 8.79980E-07 |
| 6.29146E+07 | 4.82414E-04 | 4.39990E-07 |
| 1.25829E+08 | 9.63986E-04 | 2.19995E-07 |
| 2.51658E+08 | 1.92129E-03 | 1.09996E-07 |

FIGURE 24  
SAMPLE WIRE-TO-WIRE COUPLING SUPPLEMENTAL OUTPUT

### 4.3 ERROR CONDITION CODES

IEMCAP performs extensive checks for errors at various stages of execution. When an error occurs, the program prints a message giving the error code and a brief description of the error. In some cases, it prints key parameters to further define the error.

An error condition can be fatal or non-fatal. A fatal error causes execution to terminate and generally results from an unreconcilable situation such as a missing EXEC card or working file misalignment. The majority of the error conditions, however, are non-fatal. The program ignores the bad data or parameters and continues. Although continuing may produce incomplete results, it allows the program to check for additional errors.

The error messages described here are from program-detectable errors. They are conditions which the program logic is able to detect and are different from computer-detectable errors. The latter are detected by the system support software for the particular computer and are not controllable by IEMCAP. A memory overflow is an example of a computer-detectable error.

In some of the error messages, alpha ID's are printed in IEMCAP internal code consisting of a 10 digit number. This is broken into five groups of 2 digits each. (The number may be 9 digits in which the first group is one digit with a suppressed leading zero.) The character associated with each group is obtained from Table 9 to form the ID. For example, the code 1801040118 is broken into groups 18-01-04-01-18 which, from Table 9, is RADAR.

#### 4.3.1 IDIPR Errors

There are fifty-eight program detectable errors in IDIPR, of which only three are fatal: exceeding the maximum number of equipments, an EXEC card out of order, or an ISF spectrum ID record not matching a port. The IDIPR error codes are given in Table 10.

#### 4.3.2 TART Errors

After the input data is processed by IDIPR, it is possible that there are still errors in the input that could not be detected by IDIPR. A likely type of error would be a specified component that does not exist, such as a port-associated antenna ID that cannot be matched in the antenna data. Such errors that can be detected by TART cause an error diagnostic to be printed out. The fatal errors are an invalid TART task control card, file alignment errors, invalid system type code, or a zero fuselage radius for a spacecraft. If there were non-fatal errors during a TART run, a message is printed at the end giving the number of errors which occurred. The TART errors are given in Table 11. The TART subroutine is given as an aid to tracing the cause of the error.

TABLE 9

## IFMCAP ALPHA ID INTERNAL CODE

| CODE | CHARACTER |
|------|-----------|
| 00   | blank     |
| 01   | A         |
| 02   | B         |
| 03   | C         |
| 04   | D         |
| 05   | E         |
| 06   | F         |
| 07   | G         |
| 08   | H         |
| 09   | I         |
| 10   | J         |
| 11   | K         |
| 12   | L         |
| 13   | M         |
| 14   | N         |
| 15   | O         |
| 16   | P         |
| 17   | Q         |
| 18   | R         |

| CODE | CHARACTER |
|------|-----------|
| 19   | S         |
| 20   | T         |
| 21   | U         |
| 22   | V         |
| 23   | W         |
| 24   | X         |
| 25   | Y         |
| 26   | Z         |
| 27   | 1         |
| 28   | 2         |
| 29   | 3         |
| 30   | 4         |
| 31   | 5         |
| 32   | 6         |
| 33   | 7         |
| 34   | 8         |
| 35   | 9         |
| 36   | 0         |

TABLE 10 IDIPR ERRORS

| Error Number | Fatal/<br>Non-Fatal | Description                                                                                              |
|--------------|---------------------|----------------------------------------------------------------------------------------------------------|
| 1            | NF                  | No match for keyword - use a legitimate keyword                                                          |
| 2            | NF                  | Missing equal sign                                                                                       |
| 3            | NF                  | No match for alpha code - check list of acceptable alpha codes                                           |
| 4            | NF                  | Number of parameters is incorrect                                                                        |
| 5            | NF                  | Illegal syntax                                                                                           |
| 6            | NF                  | Alphanumeric must begin with alpha                                                                       |
| 7            | NF                  | Invalid ID syntax - check the input rules                                                                |
| 8            | NF                  | Mismatched parenthesis                                                                                   |
| 9            | NF                  | Number of values for inner environmental field, outer environmental field and frequency must be the same |
| 10           | NF                  | Multiple card of the same type                                                                           |
| 11           | NF                  | Index equals zero or exceeds the maximum                                                                 |
| 12           | NF                  | Card is out of order                                                                                     |
| 13           | NF                  | Illegal S/R code - check input rules                                                                     |
| 14           | NF                  | Missing hierarchy data - check input rules                                                               |
| 15           | NF                  | Incomplete equipment or bundle data                                                                      |

TABLE 10 IDIPR ERRORS (Continued)

| Error Number | Fatal/<br>Non-Fatal | Description                                                                       |
|--------------|---------------------|-----------------------------------------------------------------------------------|
| 31           | NF                  | Invalid initial spectrum option - check input rules                               |
| 32           | NF                  | Invalid spectrum request to SPCMDL                                                |
| 33           | NF                  | Invalid receptor port Source/Receptor (SR) code index                             |
| 34           | NF                  | Invalid source port SR code index                                                 |
| 35           | NF                  | Source and receptor SR codes must be the same for the same port                   |
| 36           | NF                  | The load impedance is zero - at least one termination component must be non-zero. |
| 37           | NF                  | Electro-explosive device may not be entered as a source, only as a receptor.      |
| 38           | NF                  | The specification option for a power line has an invalid index                    |
| 39           | NF                  | The modulation code for a source or receptor has an invalid index                 |
| 40           | NF                  | The AM modulation index must be between zero and one                              |
| 41           | NF                  | The signal type code has an invalid index                                         |
| 42           | NF                  | The SR code has a bad index when entering subroutine SCARFE                       |
| 43           | NF                  | The stated pulse width of a wave form exceeds the pulse separation                |
| 44           | NF                  | MIL-STD-461A may not be specified for an EED                                      |
| 45           | NF                  | Incorrectly specified RF power level was detected by subroutine M461              |

TABLE 10 IDIPR ERRORS (Continued)

| Error Number | Fatal/<br>Non-Fatal | Description                                                                                                           |
|--------------|---------------------|-----------------------------------------------------------------------------------------------------------------------|
| 16           | NF                  | Wrong MOD code for job type - check input rules                                                                       |
| 17           | NF                  | MOD code conflict - check input rules                                                                                 |
| 18           | NF                  | All modifies and deletes must precede adds                                                                            |
| 19           | NF                  | ID of system component to be deleted cannot be found                                                                  |
| 20           | NF                  | ID of antenna connected to port cannot be found in system data                                                        |
| 21           | NF                  | ID of bundle associated with wire port cannot be found in system data                                                 |
| 22           | NF                  | ID of wire connected to port cannot be found in system data                                                           |
| 23           | NF                  | The first port of an equipment must be equipment case                                                                 |
| 24           | NF                  | The frequency table has an error - check frequencies in table                                                         |
| 25           | NF                  | Number of ports for equipment is less than one or greater than fifteen                                                |
| 26           | NF                  | SOURCE/RECEPTOR card for port is missing                                                                              |
| 27           | NF                  | There was an error in initial spectrum generation                                                                     |
| 28           | NF                  | Number of equipments exceeds the maximum                                                                              |
| 29           | NF                  | Bundle/wire ID cannot be found in system data. If bundle and wire ID are not in error, look for error in system data. |
| 30           | NF                  | TI and RE must be in columns 1-2                                                                                      |

TABLE 10 IDIYR ERRORS (Continued)

| Error Number | Fatal/ Non-Fatal | Description                                                                                                                           |
|--------------|------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| 46           | NF               | MIL-STD-704 may not be specified for a power line receptor                                                                            |
| 47           | NF               | MIL-I-6181 may not be specified for an EED                                                                                            |
| 48           | NF               | Invalid duplicate ID                                                                                                                  |
| 49           | NF               | Bundle segment point ID is not defined in list of bundle points                                                                       |
| 50           | NF               | Wire point ID is not defined in list of bundle points                                                                                 |
| 51           | NF               | Port bundle point connection is not a legitimate wire point                                                                           |
| 52           | NF               | Wire type ID cannot be found in wire characteristics table                                                                            |
| 53           | NF               | Bundle segment point indices are identical or invalid. Specify correct bundle points defining the segment                             |
| 54           | NF               | A wire either has more than ten segments or it loops on itself. If less than ten segments, ensure that wire cannot form a closed loop |
| 55           | NF               | The end of a wire does not connect to any port                                                                                        |
| 901          | F                | The Intrasystem File spectrum ID record does not match port                                                                           |
| 902          | F                | EXEC card must precede all data cards except TITLE and REMARKS                                                                        |
| 903          | F                | Maximum number of equipments has been exceeded                                                                                        |

TABLE 11 TART ERRORS

| Error Number | Fatal/<br>Non-Fatal | Subroutine | Description                                                                                                                                                                        |
|--------------|---------------------|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1            | F                   | TART       | Invalid task code                                                                                                                                                                  |
| 2            | F                   | PAREAD     | Invalid tart control card                                                                                                                                                          |
| 3            | F                   | PAREAD     | Invalid task code on tart control card                                                                                                                                             |
| 4            | F                   | PAREAD     | Initial processing and TART tasks incompatible (change task code to agree with IDIPR task)                                                                                         |
| 101          | F                   | CEAR       | File alignment error between Baseline Transfer File and URSF (survey and trade-off).*                                                                                              |
| 102          | F                   | CEAR       | Baseline Transfer file alignment error. End-of-emitters not read when expected for this receptor and no ports were added. (Probable cause: deleted port during trade-off analysis) |
| 103          | F                   | CEAR       | File alignment error between Baseline Trans File and URSF (waiver analysis or trade-off with spectrum changes only).*                                                              |
| 104          | F                   | CEAR       | UESF file alignment error.* Unexpected end-of-file during waiver analysis or trade-off with spectrum changes only.                                                                 |
| 201          | F                   | SCR        | File alignment error between SCHTR and AESF. Unexpected end-of-file.*                                                                                                              |
| 301          | F                   | RCPTRD     | File alignment error between REDF and URSF working files. Eqpt indices do not match.*                                                                                              |
| 302          | F                   | RCPTRD     | File alignment error between REDF and URSF working files. Subsystem, equipment, and port ID's do not match.*                                                                       |
| 303          | F                   | RCPTRD     | Invalid receptor change code. (Probable cause: deleted port for trade-off analysis.)                                                                                               |

\* See Section 1.3 for file abbreviations

TABLE 11 TART ERRORS (Continued)

| Error Number | Fatal/<br>Non-Fatal | Subroutine | Description                                                                                                       |
|--------------|---------------------|------------|-------------------------------------------------------------------------------------------------------------------|
| 401          | F                   | EMTRD      | File alignment error. Same as 301 except emitter between EEDF and UESF                                            |
| 402          | F                   | EMTRD      | File alignment error. Same as 302 except emitter between EEDF and UESF                                            |
| 403          | F                   | EMTRD      | Same as 303. Invalid emitter change code.                                                                         |
| 501          | NF                  | COUPLE     | Bundle ID specified by port cannot be found in wire bundle data.                                                  |
| 502          | NF                  | COUPLE     | Bundle file alignment error. Bundle index in port data does not match the wire map file index for same bundle ID. |
| 503          | NF                  | COUPLE     | Wire ID specified for emitter port cannot be found in wire bundle data.                                           |
| 504          | NF                  | COUPLE     | Wire ID specified for receptor port cannot be found in wire bundle                                                |
| 505          | NF                  | COUPLE     | Filter ID specified for emitter port cannot be found in filter data.                                              |
| 506          | NF                  | COUPLE     | Filter ID specified for receptor port cannot be found in filter data.                                             |
| 601          | NF                  | ACTFER     | Invalid path code.                                                                                                |
| 602          | NF                  | ACTFER     | Antenna ID specified for receptor port cannot be found in antenna data.                                           |
| 603          | NF                  | ACTFER     | Aperture ID specified for receptor wire segment cannot be found in aperture data.                                 |

TABLE 11 TART ERRORS (Continued)

| Error Number | Fatal/<br>Non-Fatal | Subroutine | Description                                                                                                                      |
|--------------|---------------------|------------|----------------------------------------------------------------------------------------------------------------------------------|
| 604          | NF                  | ACTFER     | Antenna ID specified for emitter port cannot be found in antenna data.                                                           |
| 605          | NF                  | ACTFER     | Wire characteristics table ID specified for receptor wire cannot be found in table.                                              |
| 701          | NF                  | GAIN       | Bad antenna orientation. Angles outside allowable ranges:<br>$0 \leq \theta_0 \leq 180^\circ$ and $0 \leq \phi_0 \leq 360^\circ$ |
| 702          | NF                  | GAIN       | Bad antenna look angles. Angles outside allowable ranges:<br>$0 \leq \theta \leq 180^\circ$ and $0 \leq \phi \leq 360^\circ$     |
| 703          | NF                  | GAIN       | Bad antenna vertical half-beamwidth. Outside allowable range: $0 \leq \theta_B \leq 90^\circ$                                    |
| 704          | NF                  | GAIN       | Bad antenna horizontal half-beamwidth. Outside allowable range: $0 \leq \phi_B \leq 180^\circ$                                   |
| 705          | NF                  | GAIN       | Bad antenna sidelobe half-beamwidth. Outside allowable range: $0 \leq \phi_{SR} \leq 180^\circ$                                  |
| 801          | F                   | VEHSET     | Invalid system type code                                                                                                         |
| 802          | F                   | VEHSET     | Zero fuselage radius specified for spacecraft.                                                                                   |
| 901          | NF                  | WTWTFR     | Subscript for emitter wire ID in wire characteristics table out of range                                                         |
| 902          | NF                  | WTWTFR     | Subscript for receptor wire ID in wire characteristics table out of range                                                        |

TABLE 11 TART ERRORS (Continued)

| Error Number | Fatal/Non-Fatal | Subroutine | Description                                                            |
|--------------|-----------------|------------|------------------------------------------------------------------------|
| 903          | NF              | WTWTFR     | Code for emitter shield configuration out of range                     |
| 904          | NF              | WTWTFR     | Code for receptor shield configuration out of range                    |
| 905          | NF              | WTWTFR     | Code for emitter twist/untwist configuration out of range              |
| 906          | NF              | WTWTFR     | Code for receptor twist/untwist configuration out of range             |
| 907          | NF              | WTWTFR     | Code for emitter balance/unbalance configuration out of range          |
| 908          | NF              | WTWTFR     | Code for receptor balance/unbalance configuration out of range         |
| 909          | NF              | WTWTFR     | Code for emitter right/left identification out of range                |
| 910          | NF              | WTWTFR     | Code for receptor right/left identification out of range               |
| 911          | NF              | WTWTFR     | Code for emitter end or internal segment out of range                  |
| 912          | NF              | WTWTFR     | Code for receptor end or internal segment out of range                 |
| 913          | NF              | WTWTFR     | Zero emitter wire load admittance                                      |
| 914          | NF              | WTWTFR     | Zero receptor wire load admittance                                     |
| 1001         | NF              | FILTER     | Invalid filter type                                                    |
| 1002         | NF              | FILTER     | Invalid filter Q or coupling coefficient                               |
| 1101         | NF              | ENVIRN     | Antenna ID specified for receptor port cannot be found in antenna data |

TABLE 11 TART ERRORS (Continued)

| Error Number | Fatal/<br>Non-Fatal | Subroutine | Description                                                                            |
|--------------|---------------------|------------|----------------------------------------------------------------------------------------|
| 1102         | NF                  | ENVIRN     | Wire type ID specified for receptor port cannot be found in wire characteristics table |
| 1103         | NF                  | ENVIRN     | Aperture ID specified for receptor wire cannot be found in aperture data               |
| 1104         | NF                  | ENVIRN     | Filter ID specified for receptor port cannot be found in filter data                   |

## Section 5

### EXAMPLE TEST CASE

In this section, a use of IEMCAP is illustrated by a test case, called the "mini-system." This test case can also be used to verify the operation of IEMCAP on a particular computer by comparing the answers to those reproduced herein. This data is designed to test the various routines and math models in the program and is not necessarily relatable to a physical system. The engineering data is presented along with the resulting IEMCAP inputs and sample computer outputs.

#### 5.1 MINI-SYSTEM DESCRIPTION

The test case system ("mini-system") is an aircraft with physical dimensions as shown in Table 12. These parameters can be related to Figures 3 and 4. The subsystems and equipments which compose the mini-system are shown in a basic schematic diagram in Figure 25. The eight equipments are shown along with their ports and port connections. Each equipment is designated by a subsystem and equipment ID. For example, equipment 1 has equipment ID "UHFCO" and subsystem ID "CNI." Each equipment box location is given in terms of buttline, waterline, and fuselage station in that order. Also given is the compartment ID in which each box is located. (Compartments isolate boxes; that is, no coupling can occur between boxes in different compartments).

Equipment case leakage is taken as the first port in each equipment. All other ports are shown with their ID's for each equipment. For antenna-connected ports, the antenna ID is shown along with the location coordinates. This antenna ID refers to the system-level parameters for the particular antenna type. Note that the same antenna may be deployed at several locations on the aircraft. For wire-connected ports, the bundle and wire ID's, port interconnections, shield terminations, and exposing apertures are shown. Ports are indicated as sources, receptors, or both by inward arrows, outward arrows, or both, respectively.

Wire bundling and routing is shown in Figure 26. Each wire termination, branch, or direction change is represented by a point with an ID and location coordinates, as shown. Also, dielectric apertures in the aircraft which expose bundle segments are shown with their locations.

With the basic system established, the detailed parameters of the ports are defined. As an example, the equipment case and first intentional port of equipment "UHFCO" of subsystem "CNI" are discussed in detail. This equipment represents a UHF communications transceiver. The EMC specification used as an initial for non-required spectra is MIL-STD-461A.

TABLE 12

## MINI-SYSTEM AIRCRAFT PARAMETERS

|                                     |              |
|-------------------------------------|--------------|
| Conical Nose Limit Fuselage Station | 165.0 inches |
| Fuselage Radius                     | 56.5 inches  |
| Core Radius                         | 18.8 inches  |
| Centroid Water line                 | 25.0 inches  |
| Bottom Water line                   | 12.0 inches  |
| Bottom Option                       | FLAT         |
| Wing Root Coordinates               |              |
| Butt line                           | 55.0 inches  |
| Water line                          | 12.0 inches  |
| Forward Fuselage Station            | 225.0 inches |
| Aft Fuselage Station                | 456.0 inches |
| Wing Tip Coordinates                |              |
| Butt line                           | 230.0 inches |
| Water line                          | 16.0 inches  |
| Forward Fuselage Station            | 435.0 inches |
| Aft Fuselage Station                | 490.0 inches |

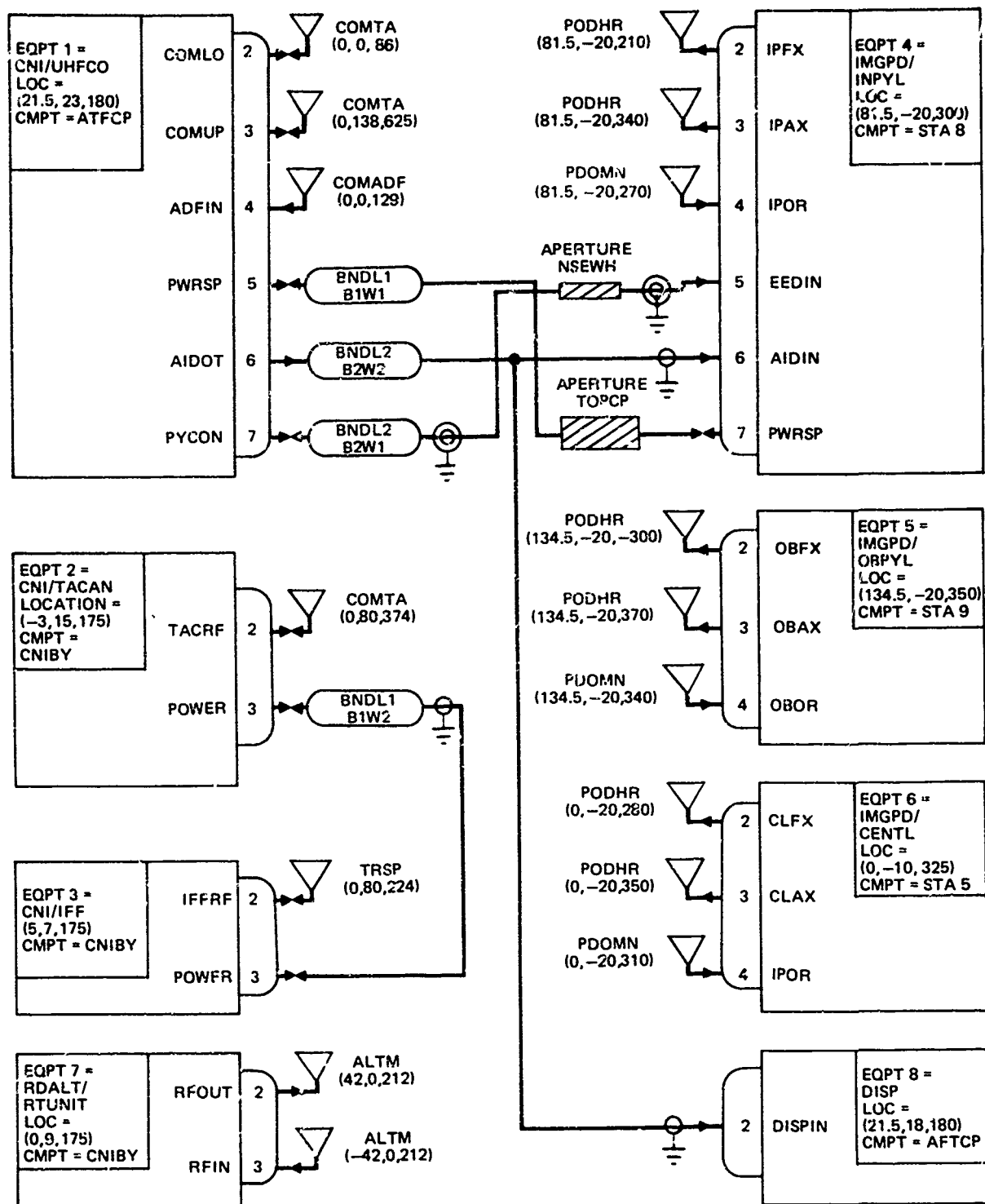


FIGURE 25  
MINI-SYSTEM BASIC SCHEMATIC DIAGRAM

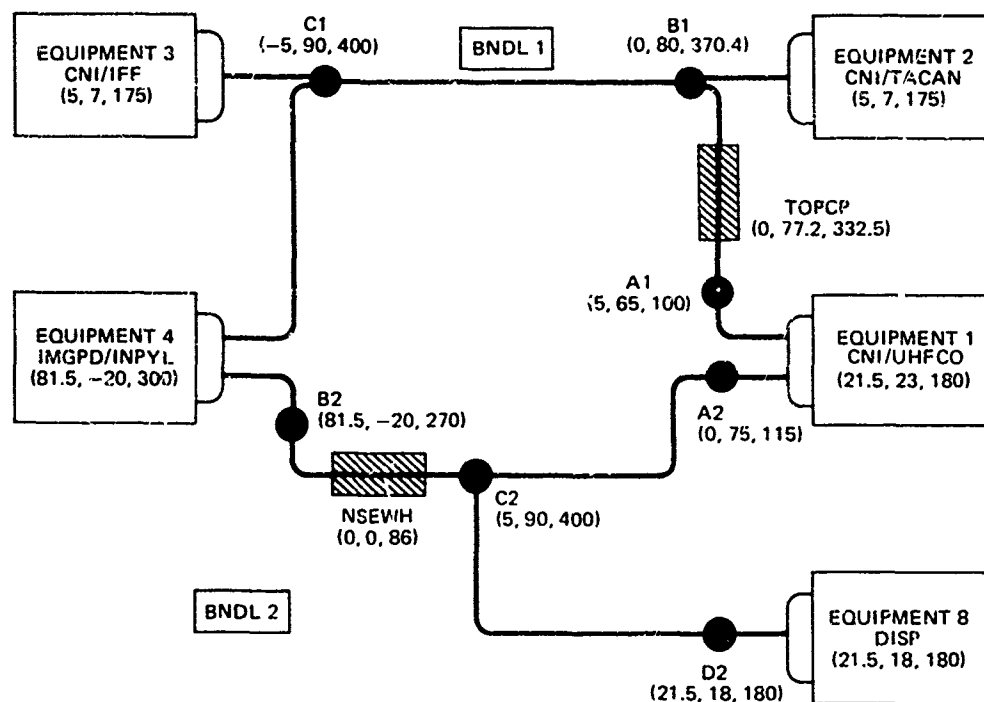


FIGURE 26  
MINI-SYSTEM WIRE BUNDLE ROUTING DIAGRAM

GP73 1075

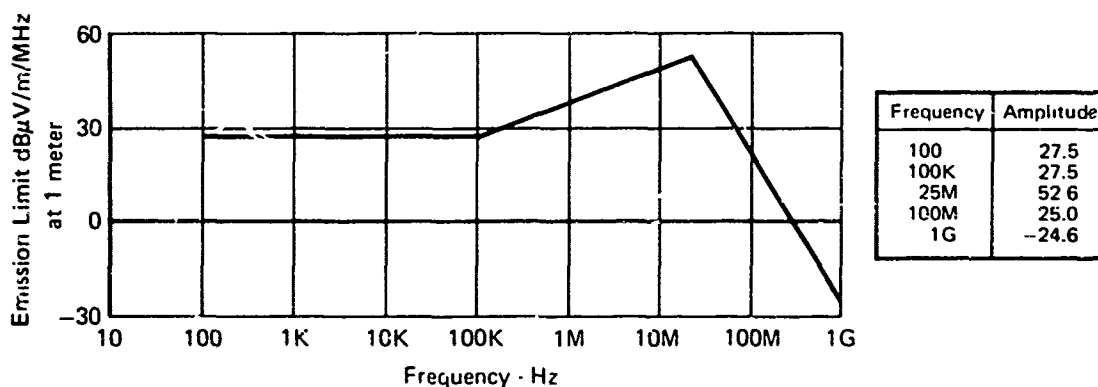


FIGURE 27  
BROADBAND EQUIPMENT CASE EMISSION SPECTRUM FOR "UHFCO"

GP73 1075 33

ANTENNA = COMTA  
 TYPE = DIPOLE  
 POLARIZATION = VERTICAL  
 LENGTH = 0.2 INCHES

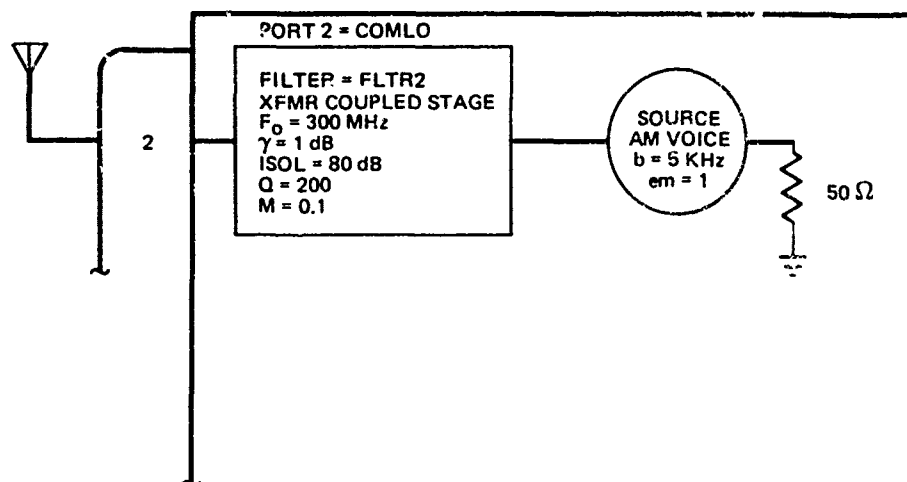


FIGURE 28  
 DETAIL OF PORT "COMLO"

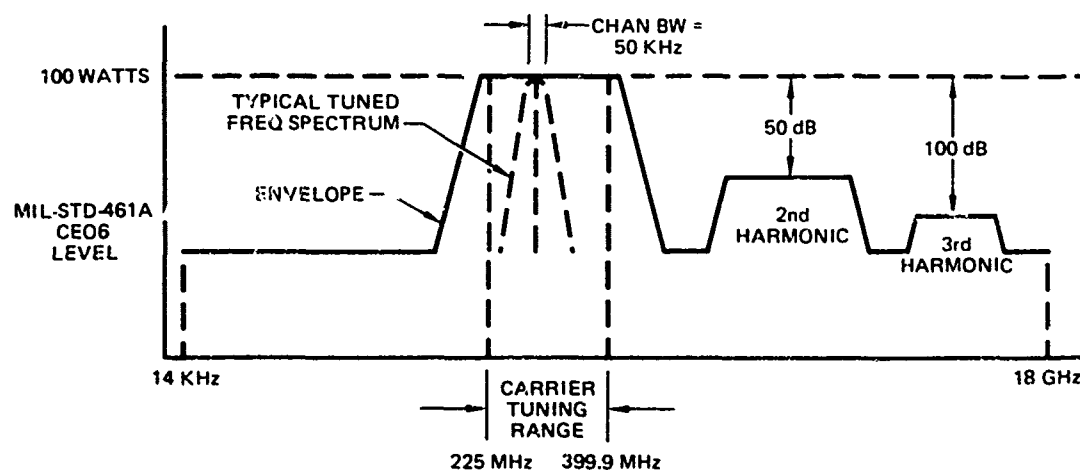


FIGURE 29  
 EMISSION SPECTRUM OF PORT "COMLO"

GP771 1075

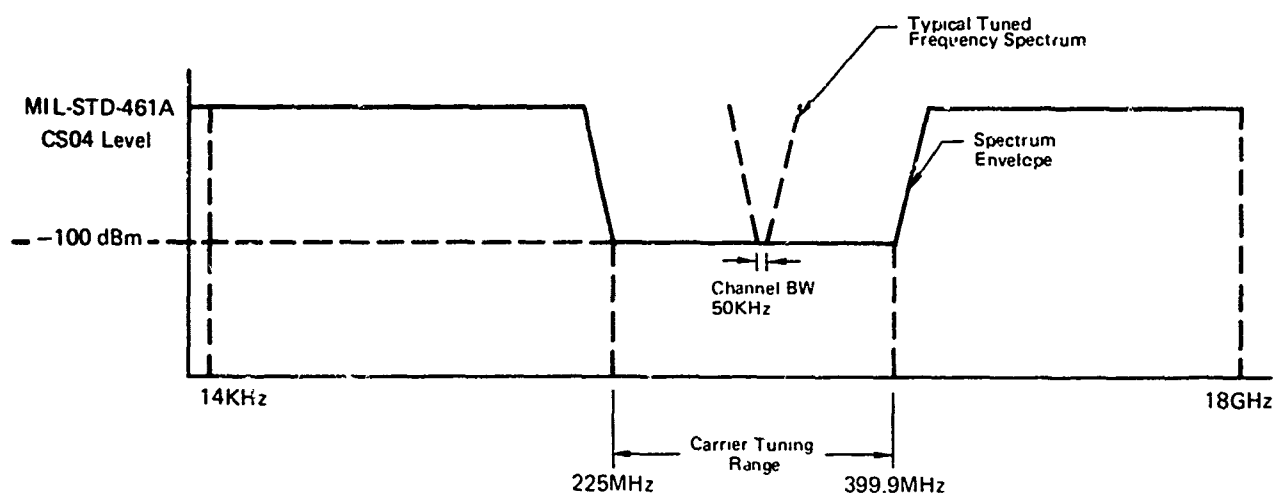


**FIGURE 30**  
**SUSCEPTIBILITY SPECTRUM OF PORT "COMLO"**

CP13 1075 31

Since case leakage is not an intentional port, it has no required outputs or susceptibilities. For the particular port in question, the susceptibility and narrowband emission spectra are the MIL-STD-461A limits. The broadband emission spectrum, however, is user defined and is shown in Figure 27.

As an example of an intentional port, consider port "COMLO" connected to the lower communications antenna. A schematic of this port is shown in Figure 28, and its spectra are shown in Figures 29 and 30. This port is an input and output for voice AM signals whose carrier ranges from 225 to 399.9 MHz. As shown in Figures 29 and 30, the total frequency range of interest is 14 KHz to 18 GHz. The frequency range of the required outputs and responses is 225 to 399.9 MHz. In this required range, IEMCAP will compute the emission spectra. Since this is a tunable port, the envelope formed by tuning the carrier over its range will be used. The second and third harmonics are 50 and 100 dB, respectively, below the carrier as shown. All other spurious outputs are limited to MIL-STD-461A levels. The susceptibility threshold spectrum is similarly computed.

## 5.2 IEMCAP RUN FOR MINI-SYSTEM

With the system to be analyzed defined, the data is written in the IEMCAP input format and punched into cards for use by the program. These cards are read, decoded, and listed by IDIPR. Any diagnostics generated are included in this listing.

The input card listing of the data described above is reproduced in Figure 31. (Note that some of the key words are abbreviated by their first two characters; e.g., "BU" for "BUNDLE"). The task specified on the EXEC card is for an EMC survey, and the job status is new (no old ISF). There are no diagnostics, so the program continues into initial processing.

After the spectra, the working files, and the new ISF are generated, a report of all data processed and spectra generated is printed. Sample outputs from the report for the mini-system run are reproduced in Figures 32 through 36.

With the data successfully processed by IDIPR, the TART section of IEMCAP is run. Samples from the TART output for a mini-system survey run are reproduced in Figures 37 through 39. The analysis output is given for the first two receptor ports in UHFCO, described in the previous section. Note that no intrasystem EMI was found for the equipment case (Figure 38). The EMI summaries from the emitter ports coupled to COMLO are reproduced in Figure 39.

# INPUT CARDS

```

CONTROL { REMARK= FILE ID=CCOT4M CORRECTED BASELINE SYSTEM.  REVISED 9-4-73
          EXEC=CEAR,NEW,SURVEY
          OU=NO
SYSTEM { SYSTEM=AIR,0,0,0,-06,-100.
          WNGRT=55,12,225,456
          WGTIP=230,16,435,490
ENVIRON- FUSLGE=165.,56.5,18.8,25.,12.,FLAT
MENTAL { EFO= 1E3,100E3,1E6,100E6,1E9,4E9
          OE=30,30,40,40,30,30
          IE=-20,-20,5,5,-20,-20
FIELD { APER=NSFWH ,0,0,AF,35,50,NOW
APER- { APER=TOPCP,0,77.2,332.5,30,10,NOW
        ANT=COMTA,DIPOLE,VE,(.20)
        ANT=CHANF,LOMP,HZ,(.25)
ANTENNA { ANT=TPSP,DIPOLE,VE,(.0A)
          ANT=PODMR,HORN,HZ,(.10,7.5,30,30,-5,90,-20)
          ANT=PODMN,DIPOLE,VE,(.05)
          ANT=ALTM,HORN,HZ,(.05,7.5,25,50,-4,110,-30)
          FILTER=FLTR1,SGTUN,1,(300.E6,1.E3,-1,-80)
          FILTER=FLTR2,TRCOUP,1,(300.E6,-1,-80,260,-.1)
          FILTER=FLTR3,BUTTER,5,(1.075E9,.1E6,-1,-80)
FILTERS { FILTER=FLTR4,LOWPAS,4,(1.5E9,-1,-80)
          FILTER=FLTR5,HIPAS,4,(.95E6,-1,-80)
          FILTER=FLTR6,8PASS,6,(.95E6,4.05E6,-1,-80)
          FILTER=FLTR7,BRJCT,10,(4.01E6,8.E6,-1,-80)
          WRTBL=SPCC22,UN,1,30,1,6,2.8
WIRE { WRTBL=SPCS2,SH,1,30,1,6,2.8,42,8,6.6,463
TABLE { WRTBL=SPCCC,NS,1,30,1,6,2.8,42,9,6.6,463,7,6.7
        SUBSYS=CNI
        EQPT=UHFCC,4461,ADJUST,AFCTP,NONE,21.5,23,180
        COMMENT=UHF COMM
        FREQ=30,18.E9,1,35
EQUIPMENT { PORT=CASE,0,0
CASE { SOURCE=CASE, 30,MILSPC,SP(100.,27.5,100.E3,27.5,25.E6,52.6,100.E6,
        25, 1.E9,-24.6)
        RCEPT=CASE,10.,MILSPC,MILSPC
PORT COMLO { PORT=COMLO,ANT,(COMTA,0,0,0,0,96,NOW),50,0,0,0,0 ,FLTR2
          SOURCE=RF, 30.,225E6,399.9E6,100.,50.E3,AM(VOICE,5.E3,1),(-50,-100)
          RCEPT=RF, 30.,225E6,399.9E6,-100 ,50.E3,AM(VOICE,5.E3,0),1.E6
          PORT=COMUP,ANT,(COMTA,0,0,0,138,625,NOW),50,0,0,0,0 ,FLTR1
          SOURCE=RF, 30.,225E6,399.9E6,100.,50.E3,AM(VOICE,5.E3,1),(-50,-100)
          RCEPT=RF, 30.,225E6,399.9E6,-100,50.E3,AM(VOICE,5.E3,0),1.E6
          PORT=ADFIN,ANT,(CHANF ,0,0,0,0,129,NOW),50,0,0,0,0 ,0
          RCEPT=RF, 30.,225E6,399.9E6,-100,50.E3,AM(VOICE,5.E3,0),1.E6
          PORT=PHRSP,WIRE,(BNOL1,91W1,A1,GND,NONE,EX),.5,0,0,0,0 ,0
          SOURCE=POWER,30,115,400,2,1,M461A
          RCEPT=POWER,30,115,400,2,1,M461A
          PORT=AIDOT,WIRE,(BNOL2,B2W2,A2,GND,NONE,NOTEX),50,0,0,0,0 ,0
          SOURCE=SIGNAL, 30.,20.E3,4.E6,RECTPL( 20.E3,1.E-6),10,VLTS,4.E6
          PORT=PYCON,WIRE,(BNOL2,B2W1,A2,GND,GND,EX),50,0,0,0,0,0
          SOURCE=SIGNAL,30,20.E3,5.E6,RECTPL(1.E3,.2E-3),10,VLTS,4.E6
          RCEPT=SIGNAL,30,20.E-12,5.E6,RECTPL(1.E3,.2E-3),10,VLTS,4.E6
COMMENT=TACAN
EQPT=TACAN,M6101D,ADJUST,CNIBY,NOT,-3.15,175
FREQ=30,18.E9,1,35
FOTBL=800.E6,962.E6,1025E6,1130.E6,1213.E6,1280.E6,1380E6
PORT=CASE,0,0
SOURCE=CASE,30,MILSPC,MILSPC
RCEPT=CASE, 30,MILSPC,MILSPC
PORT=TACRF,ANT,(COMTA,0,0,0,80,374,NOW),50,0,0,0,0 ,FLTR3
SOURCE=RF, 30,1025.E6,1130E6,1500,572E3,RADAR(RECTPL,30,2.5E-6),(-60,-80)

```

FIGURE 31  
DATA INPUT FOR MINI-SYSTEM

```

RCEPT=RF,30,962E6,1213E6,-100,500E3,RADAR(RECTPL,30,2.5E-6),100E6
PORT=POWER,WIPE,(BNOL1,B1W2,B1,GND,GND,NOTEX),.5,0,0,0,0,0
SOURCE=POWER,30,11F,400,0,3,M461A
RCEPT=POWER,30,11F,400,0,3,M461A
EQPT=IFF,M461,ADJUST,CNTRY,NOT,5,7,175
FREQ=30,18.E9,1,3F
FOTBL=1030.E6,1090F6
PORT=CASE,0,0
SOURCE=CASE,30,MIL,MIL
RCEPT=CASE,30,MIL,MIL
PORT=IFFRF,ANT,(TRSP,0,0,0,80,224,NOM),50,0,0,0,0,0,FLTR4
SOURCE=RF,30,1090E6,1090E6,1000,5E6,RADAR,(TPZD,2200,.45E-5,
.1E-6,.1E-6),(-60,-90)
RCEPT=RF,30,1030E6,1030E6,-70,7E6,RADAR(TPZD,2200,.45E-6,.1E-6,
.1E-6),0
PORT=POWER,WIPE,(BNOL1,B1W2,C1,GND,NONE,NOTEX),.5,0,0,0,0,0
SOURCE=POWER,30,11F,400,3,3,M461A
RCEPT=POWER,30,11F,400,0,3,M461A
SUBSYS=IMGPD
COMMENT=IN-BOARD PYLON
EQPT=INPYL,M461A,ADJUST,STA8,NOM,81.5,-20,300
FREQ=30,18.E9,1,35
FOTBL=1E6,4E6,5E6
PORT=CASE,0,0
SOURCE=CASE,30,MILSPC,MILSPC
RCEPT=CASE,30,MILSPC,MILSPC
PORT=IPFX,ANT,(PQDHR,100,0,81.5,-20,210,ROT),73,0,0,0,0,0,FLTR5
SOURCE=RF,30,1E6,4E6,15000,3E6,SPECT(-.5E6,-18.2,0,.71.8,
.5E6,-18.2),(-60,-90)
PORT=TPAX,ANT,(PQDHR,100,130,81.5,-20,340,ROT),73,0,0,0,0,0,FLTR5
SOURCE=RF,30,1E6,4E6,15000,3E6,SPECT(-.5E6,-18.2,0,.71.8,
.5E6,-18.2),(-60,-90)
PORT=TPCX,ANT,(PQDHR,0,0,81.5,-20,270,ROT),100,0,0,0,0,0
RCEPT=RF,30,1E6,4E6,-90,3E6,SPECT(-.5E6,-18.2,
0,.71.8,.5E6,-18.2),0
PORT=EFQIN,WIPE,(BNOL2,B2W1,B2,GND,GND,EX),1,0,0,0,0,0
RCEPT=EFQ,30,1,1,(30,1,0,1.E10,1,0)
PORT=AJDIN,WIPE,(BNOL2,B2W2,B2,GND,GND,NOTEX),100E3,0,0,0,0,0
RCEPT=SIGNAL,30,1E3,5.E6,PECTPL(20.E3,1.E-6),10,VLTS,4.E6
PORT=POWER,WIPE,(BNOL1,B1W1,C1,GND,NONE,EX),.5,0,0,0,0,0
SOURCE=POWER,30,11F,400,2,1,M461A
RCEPT=POWER,30,11F,400,2,1,M461A
COMMENT=OUTBOARD PYLON
EQPT=OUTPYL,M461A,ADJUST,STA9,NOM,134.5,-20,350
FREQ=30,18.E9,1,35
FOTBL=1E6,4E6,5E6
PORT=CASE,0,0
SOURCE=CASE,30,MILSPC,MILSPC
RCEPT=CASE,30,MILSPC,MILSPC
PORT=IPFX,ANT,(PQDHR,100,0,134.5,-20,300,ROT),73,0,0,0,0,0,FLTR5
SOURCE=RF,30,1E6,4E6,15000,3E6,SPECT(-.5E6,-18.2,0,.71.8,
.5E6,-18.2),(-60,-90)
PORT=TPAX,ANT,(PQDHR,100,130,134.5,-20,370,ROT),73,0,0,0,0,0,FLTR6
SOURCE=RF,30,1E6,4E6,15000,3E6,SPECT(-.5E6,-18.2,0,.71.8,
.5E6,-18.2),(-60,-90)
PORT=OPND,ANT,(PQDHR,0,0,134.5,-20,340,ROT),100,0,0,0,0,0
RCEPT=RF,30,1E6,4E6,-90,3E6,SPECT(-.5E6,-18.2,
0,.71.8,.5E6,-18.2),0
COMMENT=CENTER LINE STATION
EQPT=CENTL,M461A,ADJUST,STA5,NOM,0,-20,325
FREQ=30,18.E9,1,35
FOTBL=1E6,4E6,5E6
PORT=CASE,0,0
SOURCE=CASE,30,MILSPC,MILSPC

```

FIGURE 31 (Continued)  
DATA INPUT FOR MINI-SYSTEM

```

RCEPT= CASE,30,MILSPC,MILSPC
PORT=CLFX,ANT,(PODHR,100,0,0,-20,280,NOW),73,0,0,0,0,FLTR7
SOURCE=RF,30,1E6,4E6,15000,3E6,SPECT(-.5E6,-18.2,0.,71.8,
.5E6,-18.2),(-60.,-90.)
PORT=CLAX,ANT,(PODHR,100,180,0,-20,350,NOW),73,0,0,0,0,FLTR7
SOURCE=RF,30,1E6,4E6,15000,3E6,SPECT(-.5E6,-18.2,0.,71.8,
.5E6,-18.2),(-60.,-90.)
PORT=IPOP,ANT,(PODMN,0,0,0,-20,310,NOW),100,0,0,0,0,U
RCEPT=RF,30,1E6,4E6,-90,3E6,SPECT(-.5E6,-18.2,
0,71.8,.5E6,-18.2),0
SUBSYS=RQALT
EQPT=PTUNT,M461,ADJUST,CNIBY,NOT,0,9,175
FREQ=30,18E9,1,35
FOTBL=4200E6,4300E6,4400E6
PORT=CASE,0,0
SOURCE=CASE,30,MIL,MIL
RCEPT=CASE,30,MIL,MIL
PORT=PFOUT,ANT,(ALTM,0,180,42,0,212,NOW),50,0,0,0,0,0
SOURCE=RF,30,4200E6,4400E6,100,8E6,RADAR(TPZD,10F3,.1E-6,.01E-6,
.01E-6),(-40,-40,-40)
PORT=RFIN,ANT,(ALTM,0,180,-42,0,212,NOW),50,0,0,0,0,0
RCEPT=PF,30,4200E6,4300E6,-90,60E6,RADAR(TPZD,10F3,.1E-6,.01E-6,
.01E-6),0
SUBSYS=NISO
EQPT=OTSP,M461,ADJUST,AFYCP,NOT,21.5,18,180
FREQ=30,18.E9,1,35
PORT=CASE,0,0
SOURCE=CASE,30,MIL,MIL
RCEPT=CASE,30,MIL,MIL
PORT=NSPIN,WIRE,(ANOL2,B2W2,D2,GND,GND,EX),50,0,0,0,0,0
RCEPT=SIGNAL,30,1E3,5.E5,RECTPL(20.E3,1.E-6),10,VLTS,4.E6
RU=ANOL1
BPTS=A1,5,65,100,B1,0,80.,370.4,C1,-5,90,400
BSEG=A1,B1,270.9,4,COMP1,TOPCO,
B1,C1,32.0,4,COMP1,0
WIRE=P1W1,SPCS2,A1,B1,C1
WIRE=P1W2,SPCS2,B1,C1
BUNDLE=ANOL2
BPTS=A2,0,75,115,B2,-91.5,-20,270,C2,5,90,400,D2,21.5,18,180
BSEG=A2,C2,119.2,4,COMP1,NSEWH,
B2,C2,191.0,4,COMP2,0,
C2,C2,220,4,COMP1,0
WIRE=B2W1,SPCS2,A2,C2,B2
WIRE=P2W2,SPCS2,B2,C2,D2,A2
ENDATA

```

FIGURE 31 (Continued)  
INPUT FOR MINI-SYSTEM

NEW ISF FILE  
\*\*\*\*\*

FILE ID=CCDT4M CORRECTED BASELINE SYSTEM, REVISED 9-4-73

SYSTEM TYPE AIRCRAFT  
ADJUSTMENT SAFETY MARGIN =OP SGR -6.0 DB  
EMI MARGIN MINIMUM PRINTOUT LIMIT -100.0 DB

FUSELAGE DATA

CON NOSE LIMIT FS(FSN) 165.0  
FUSELAGE RADIUS 56.5  
CORE RADIUS (RHOC) 18.8  
CENTROID WL (WLC) 25.0  
BOTTOM WL (WL90T) 12.0  
CYL. BOTTOM OPTION USE' F1

NO. APERTURES 2  
NO. ANTENNAS 6  
NO. FILTERS 7  
NO. ENTORIES IN WIRE TABLE 3

| APERTURE<br>ID | WATER LINE | RUT--LINE | FUSELAGE SY. | WIDTH | LENGTH | WING-LOC |
|----------------|------------|-----------|--------------|-------|--------|----------|
| 1 NSEWH        | 0.0        | 0.0       | 86.0         | 35.0  | 50.0   | NO       |
| 2 TOPCP        | 0.0        | 77.2      | 132.5        | 30.0  | 10.0   | NO       |

| WING POINTS | AL    | WL   | FS FWD | FS AFT |
|-------------|-------|------|--------|--------|
| ROOT        | 55.0  | 12.0 | 225.0  | 456.0  |
| TIP         | 230.0 | 16.0 | 435.0  | 490.0  |

ENVIRONMENTAL FIELD LEVELS

| FREQUENCY   | OUTSIDE L. | INSIDE L.  | FREQUENCY   | OUTSIDE L. | INSIDE L.  |
|-------------|------------|------------|-------------|------------|------------|
| 1 .1000E+04 | .3000E+02  | -.2000E+12 | 4 .1000E+09 | .4000E+02  | .5000E+01  |
| 2 .1070E+06 | .3000E+02  | -.2000E+02 | 5 .1000E+10 | .3000E+02  | -.2000E+02 |
| 3 .1000E+07 | .4000E+02  | .5000E+01  | 6 .4000E+10 | .3000E+02  | -.2000E+02 |

FIGURE 32  
SYSTEM DATA  
IDIPR OUTPUT FOR MINI-SYSTEM

| ANTENNAS |            |               |            |             |               |                                    |                 |                     |                     |
|----------|------------|---------------|------------|-------------|---------------|------------------------------------|-----------------|---------------------|---------------------|
| ID       | MODEL CODE | POLARIZ. CODE | LENGTH (M) | MAX DIA (M) | MAX GAIN (DB) | 3-DB HALF-REACTIVITY VOLT (V) A714 | MAJOR GAIN (DB) | SIDE LOBE ANG (DEG) | BACK LOBE GAIN (DB) |

|   |       |    |    |     |      |       |       |        |        |
|---|-------|----|----|-----|------|-------|-------|--------|--------|
| 1 | COMTA | DI | .2 |     |      |       |       |        |        |
| 2 | CMADF | HZ |    | .25 |      |       |       |        |        |
| 3 | TRSP  | DI | .1 |     | 7.50 | 30.00 | -5.00 | 20.00  | -20.00 |
| 4 | PDMR  | HZ | .1 |     | 7.50 | 25.00 | -4.00 | 110.00 | -30.00 |
| 5 | PDMR  | DI |    |     |      |       |       |        |        |
| 6 | ALTM  | HZ |    |     |      |       |       |        |        |

| FILTERS |      |                  |          |         |            |           |   |   |          |
|---------|------|------------------|----------|---------|------------|-----------|---|---|----------|
| ID      | TYPE | NUMBER OF STAGES | F0 (MHZ) | P (MHZ) | GAMMA (DB) | ISOL (DB) | O | M | FL (MHZ) |

|   |       |    |    |           |            |            |           |           |           |
|---|-------|----|----|-----------|------------|------------|-----------|-----------|-----------|
| 1 | FLTR1 | SG | 1  | .3000E+00 | .1000E+01  | -.3000E+02 |           |           |           |
| 2 | FLTR2 | TR | 1  | .3000E+09 | -.1000E+01 | -.3000E+02 | .2000E+03 | .1000E+00 |           |
| 3 | FLTR3 | QU | 5  | .107E+10  | -.1000E+01 | -.3000E+02 |           |           | .1500E+10 |
| 4 | FLTR4 | LN | 4  |           | -.1000E+01 | -.3000E+02 |           |           | .4050E+07 |
| 5 | FLTR5 | HI | 4  |           | -.1000E+01 | -.3000E+02 |           |           | .6000E+07 |
| 6 | FLTR6 | BP | 6  |           | -.1000E+01 | -.3000E+02 |           |           | .9500E+06 |
| 7 | FLTR7 | BR | 10 |           | -.1000E+01 | -.3000E+02 |           |           | .4010E+07 |

| WIRE CHARACTERISTICS TABLE |              |                   |          |          |                    |                |                               |               |               |
|----------------------------|--------------|-------------------|----------|----------|--------------------|----------------|-------------------------------|---------------|---------------|
| TYPE DESIGNATION           | CH/UNSM CODE | NO. WIRES TWISTED | COND. O. | CONDUCY. | INSULAT. THICKNESS | DIALECT CONST. | S H I E L D INTERNAL DIAMETER | JACKET THICK. | SH-CONN. CAP. |
| 1 SPC22                    | UM           | 1                 | 30.0     | 1.0      | 6.0                | 2.8            |                               |               |               |
| 2 SPC52                    | SH           | 1                 | 30.0     | 1.0      | 6.0                | 2.8            | 42.0                          | 6.6           | 463.0         |
| 3 SPCCC                    | NS           | 1                 | 30.0     | 1.0      | 6.0                | 2.8            | 42.0                          | 6.6           | 463.0         |
|                            |              |                   |          |          |                    |                |                               |               | 7.0           |
|                            |              |                   |          |          |                    |                |                               |               | 6.7           |

FIGURE 32 (Continued)  
SYSTEM DATA  
IDIPR OUTPUT FOR MINI-SYSTEM

IN - 61  
WASASGIS

| EQUIPMENT NO. | IS | 1 | COMPARTMENT |
|---------------|----|---|-------------|
| 1             | 1  | 1 | 1           |

| WATER<br>LINE | GUTT<br>LINE | FUSELASE<br>STATION | QDEP | FIXA%,J | CLASS |
|---------------|--------------|---------------------|------|---------|-------|
| 21.5          | 27.0         | 100.0               | M4   | AD      | N0    |

| LO. FREQ.=   | HI. FREQ. =  | NO. FREQ. PER OCTAVE= | MAX. NO. OF FREQS.= |
|--------------|--------------|-----------------------|---------------------|
| .3000000E+02 | .1800000E+11 | 1                     | 35                  |

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| PORT# | INDU ID | CONNECT. CODE    | SO/PC          | FILTER ID     | TERM. RESIST.          | CAPACIT.   | INDUCTION SUBPARAMETERS | SPECT. DISP SO | RC       |
|-------|---------|------------------|----------------|---------------|------------------------|------------|-------------------------|----------------|----------|
| 1     | 15SE    | CASE             | 90TH           |               |                        |            |                         | 0.             | 0.       |
| 2     | 10M3    | ANT<br>47D=C04TA | 90TH<br>THETA= | FLTR2         | .500000E+02<br>PMI= U. | LOC COORD= | 0.                      | 0.             | 0.       |
| 3     | 10OHUP  | 10=C04TA         | 90TH<br>THETA= | FLTR1         | .500000E+02<br>PMI= 0. | LOC COORD= | 0.                      | 0.             | 0.       |
| 4     | 10FIN   | ANT<br>47D=C04DF | 90TH<br>THETA= |               | .500000E+02<br>PMI= C. | LOC COORD= | 0.                      | 0.             | 0.       |
| 5     | 10W50   | WIRE             | 90TH           | 9NOL ID=9NOL1 | WIRE ID=9NOL1          | PT ID=A1   | REFWIRE=GND             | SH. TERM=NO    | APEXP=EX |
| 6     | 10UOT   | WIRE             | 90TH           | 9NOL ID=9NOL2 | WIRE ID=9NOL2          | PT ID=A2   | REFWIRE=GND             | SH. TERM=NO    | APEXP=NO |
| 7     | 10YOM   | WIRE             | 90TH           | 9NOL ID=9NOL2 | WIRE ID=9NOL2          | PT ID=A2   | REFWIRE=GND             | SH. TERM=GN    | APEXP=EX |

**FIGURE 33**  
**SUBSYSTEM DATA**  
**SAMPLE IDIPR OUTPUT FOR MINI-SYSTEM**

# EMITTERS AND RECEIVERS

| INDX | PORT ID | SR CODE       | ADJLIM        | NSPEC         | SRSPEC       | MAX P/S/A    | UNIT IF A   | 9WC          | MOD/SIG      | PTYP/SIG | FIF          |
|------|---------|---------------|---------------|---------------|--------------|--------------|-------------|--------------|--------------|----------|--------------|
| 1    | CASE    | SRCE          | CASE          | MIL           | SPEC         |              |             |              |              |          |              |
|      | 99=     | .1000000E+03  | .2750000E+02  | .1000000E+06  | .2750000E+02 | .2500000E+04 |             | .5260000E+09 | .1000000E+02 |          | .2500000E+02 |
|      |         | .1000000E+10  | -.2450000E+02 |               |              |              |             |              |              |          |              |
| 1    | CASE    | RCPT          | CASE          | MIL           | MIL          |              |             |              |              |          |              |
|      |         |               | .1000000E+02  |               |              |              |             |              |              |          |              |
| 2    | COMLO   | SRCE          | RF            | .30000E+02    | .22500E+09   | .39900E+09   | .10000E+03  | .50000E+05   | AM           | V0       |              |
|      | 9=      | .5000000E+04  | EM=           | .1000000E+01  |              |              |             |              |              |          |              |
|      | HARM.   | -.5000000E+02 |               | -.1000000E+03 |              |              |             |              |              |          |              |
| 2    | COMLO   | RCPT          | RF            | .30000E+02    | .22500E+09   | .39900E+09   | -.10000E+03 | .50000E+05   | AM           | V0       | .10000E+07   |
|      | 9=      | .5000000E+04  | EM=           | 0.            |              |              |             |              |              |          |              |
| 3    | COMUP   | SRCE          | RF            | .30000E+02    | .22500E+09   | .39900E+09   | .10000E+03  | .50000E+05   | AM           | V0       |              |
|      | 9=      | .5000000E+04  | EM=           | .1000000E+01  |              |              |             |              |              |          |              |
|      | HARM.   | -.5000000E+02 |               | -.1000000E+03 |              |              |             |              |              |          |              |
| 3    | COMUP   | RCPT          | RF            | .30000E+02    | .22500E+09   | .39900E+09   | -.10000E+03 | .50000E+05   | AM           | V0       | .10000E+07   |
|      | 9=      | .5000000E+04  | EM=           | 0.            |              |              |             |              |              |          |              |
| 4    | ADFIN   | SRCE          | RF            | .30000E+02    | .22500E+09   | .39900E+09   | -.10000E+03 | .50000E+05   | AM           | V0       | .10000E+07   |
|      | 9=      | .5000000E+04  | EM=           | 0.            |              |              |             |              |              |          |              |

| INDX | PORT ID | SR CODE | ADJLIM | VOLTAGE      | FREQ         | HI.HARM. NO.PHASES. | RS CODE |
|------|---------|---------|--------|--------------|--------------|---------------------|---------|
| 1    | PMRSP   | SRCE    | PMR    | .3000000E+02 | .1150000E+03 | .4000000E+03        | 2 1 M4  |
| 5    | PMRSP   | RCPT    | PMR    | .3000000E+02 | .1150000E+03 | .4000000E+03        | 2 1 M4  |

FIGURE 33 (Continued)  
SUBSYSTEM DATA  
SAMPLE IDIPR OUTPUT FOR MINI-SYSTEM

| INRX PORT ID                                                             | SR CODE | ADJLTM | LOW F.     | HI F       | MAX P/S/A  | UNIT IF A | BWC        | MOD/SIG | PTYP/SIG | FIF |
|--------------------------------------------------------------------------|---------|--------|------------|------------|------------|-----------|------------|---------|----------|-----|
| 6 AIDOT SRE SIG<br>PR= .2000000E+05<br>T= .30000E+02<br>T= .1000000E-05  |         |        | .20000E+05 | .40000E+07 | .10000E+02 | VL        | .40000E+07 |         |          | RE  |
| 7 PYCON SRCF SIG<br>R9= .1000000E+04<br>T= .30000E+02<br>T= .2000000E-03 |         |        | .20000E+05 | .50000E+07 | .10000E+02 | VL        | .40000E+07 |         |          | RE  |
| 7 PYCON RCPY SIG<br>R9= .1000000E+04<br>T= .30000E+02<br>T= .2000000E-03 |         |        | .20000E-10 | .50000E+07 | .10000E+02 | VL        | .40000E+07 |         |          | PF  |

FIGURE 33 (Continued)  
SUBSYSTEM DATA  
SAMPLE IDIPR OUTPUT FOR MINI-SYSTEM

SURS = CNI EOPT = UHFCO

FLO2= .3000E+02 FHI2= .800E+11 NFQ02= 1 NFQ02= 0 NFRQ= 31

# F R E Q U E N C Y   T A B L E

| I  | FROTBL    | I  | FROTBL    | I  | FROTBL    |
|----|-----------|----|-----------|----|-----------|
| 1  | .3000E+02 | 12 | .6144E+05 | 23 | .1258E+09 |
| 2  | .6000E+02 | 13 | .1229E+06 | 24 | .2517E+09 |
| 3  | .1200E+03 | 14 | .2458E+06 | 25 | .5033E+09 |
| 4  | .2400E+03 | 15 | .4915E+06 | 26 | .1007E+10 |
| 5  | .4800E+03 | 16 | .9830E+06 | 27 | .2013E+10 |
| 6  | .9600E+03 | 17 | .1965E+07 | 28 | .4027E+10 |
| 7  | .1920E+04 | 18 | .3932E+07 | 29 | .8053E+10 |
| 8  | .3840E+04 | 19 | .7864E+07 | 30 | .1611E+11 |
| 9  | .7680E+04 | 20 | .1573E+08 | 31 | .3221E+11 |
| 10 | .1536E+05 | 21 | .3146E+08 |    |           |
| 11 | .3072E+05 | 22 | .6291E+08 |    |           |

## EMTR FREQ INDEX TABLE

| ISR | PRT TYPE | IFMIN | FMIN      | IFMAX | FMAX      |
|-----|----------|-------|-----------|-------|-----------|
| 1   | RF       | 9     | .7680E+04 | 31    | .3221E+11 |
| 2   | PWR      | 1     | .3000E+02 | 22    | .6291E+08 |
| 3   | SIG      | 1     | .3000E+02 | 22    | .6291E+08 |
| 4   | CTRL     | 1     | .3000E+02 | 22    | .6291E+08 |
| 5   | EED      | 1     | .3000E+02 | 1     | .3000E+02 |
| 6   | CASE     | 1     | .3000E+02 | 30    | .1611E+11 |

## RCPT FREQ INDEX TABLE

| ISR | PRT TYPE | IFMIN | FMIN      | IFMAX | FMAX      |
|-----|----------|-------|-----------|-------|-----------|
| 1   | RF       | 9     | .7680E+04 | 31    | .3221E+11 |
| 2   | PWR      | 1     | .3000E+02 | 25    | .5033E+09 |
| 3   | SIG      | 1     | .3000E+02 | 30    | .1611E+11 |
| 4   | CTRL     | 1     | .3000E+02 | 30    | .1611E+11 |
| 5   | EED      | 1     | .3000E+02 | 30    | .1611E+11 |
| 6   | CASE     | 1     | .3000E+02 | 30    | .1611E+11 |

FIGURE 34  
FREQUENCY TABLE  
IDIPR OUTPUT FOR MINI-SYSTEM

NEW ISF FILE  
\*\*\*\*\*

# INITIAL PORT SPECTRA

SUBS = CMI EQPT 1 = UMFCO PORT 1 = CASE

| IFRD | FREQUENCY | *-----EMITTER-----* |          |          |          | *---RECEPTOR---* |        |
|------|-----------|---------------------|----------|----------|----------|------------------|--------|
|      |           | NR SPECT            | NR LIMIT | BB SPECT | BB LIMIT | SPECT            | LIMIT  |
| 1    | .3888E+02 | -1000.0             | -1030.0  | -1000.0  | -1030.0  | 1000.0           | 1010.0 |
| 2    | .6000E+02 | -1000.0             | -1030.0  | -1000.0  | -1030.0  | 1000.0           | 1010.0 |
| 3    | .1200E+03 | -1000.0             | -1030.0  | 27.5     | -2.5     | 1000.0           | 1010.0 |
| 4    | .2409E+03 | -1000.0             | -1030.0  | 27.5     | -2.5     | 1000.0           | 1010.0 |
| 5    | .4818E+03 | -1000.0             | -1030.0  | 27.5     | -2.5     | 1000.0           | 1010.0 |
| 6    | .9600E+03 | -1000.0             | -1030.0  | 27.5     | -2.5     | 1000.0           | 1010.0 |
| 7    | .1920E+04 | -1000.0             | -1030.0  | 27.5     | -2.5     | 1000.0           | 1010.0 |
| 8    | .3840E+04 | -1000.0             | -1030.0  | 27.5     | -2.5     | 1000.0           | 1010.0 |
| 9    | .7680E+04 | -1000.0             | -1030.0  | 27.5     | -2.5     | 1000.0           | 1010.0 |
| 10   | .1536E+05 | 35.0                | 5.0      | 27.5     | -2.5     | 140.0            | 150.0  |
| 11   | .3072E+05 | 34.0                | 4.0      | 27.5     | -2.5     | 140.0            | 150.0  |
| 12   | .6144E+05 | 32.6                | 2.6      | 27.5     | -2.5     | 140.0            | 150.0  |
| 13   | .1229E+06 | 31.2                | 1.2      | 30.3     | .3       | 140.0            | 150.0  |
| 14   | .2458E+06 | 29.8                | -.2      | 33.4     | 3.4      | 140.0            | 150.0  |
| 15   | .4915E+06 | 28.4                | -1.6     | 35.6     | 6.6      | 140.0            | 150.0  |
| 16   | .9830E+06 | 27.1                | -2.9     | 39.7     | 9.7      | 140.0            | 150.0  |
| 17   | .1966E+07 | 25.7                | -4.3     | 42.9     | 12.9     | 140.0            | 150.0  |
| 18   | .3932E+07 | 24.3                | -5.7     | 45.0     | 16.0     | 140.0            | 150.0  |
| 19   | .7864E+07 | 22.9                | -7.1     | 49.2     | 19.2     | 140.0            | 150.0  |
| 20   | .1573E+08 | 21.5                | -8.5     | 52.3     | 22.3     | 140.0            | 150.0  |
| 21   | .3146E+08 | 24.2                | -5.8     | 52.6     | 22.6     | 134.0            | 144.0  |
| 22   | .6291E+08 | 28.0                | -1.1     | 40.0     | 10.0     | 134.0            | 144.0  |
| 23   | .1258E+09 | 33.5                | 3.5      | 25.2     | -3.5     | 134.0            | 144.0  |
| 24   | .2517E+09 | 38.1                | 8.1      | 11.3     | -19.7    | 134.0            | 144.0  |
| 25   | .5033E+09 | 42.8                | 12.8     | -3.6     | -33.6    | 134.0            | 144.0  |
| 26   | .1007E+10 | 47.4                | 17.4     | -19.5    | -48.5    | 134.0            | 144.0  |
| 27   | .2013E+10 | 52.0                | 22.0     | -1000.0  | -1030.0  | 134.0            | 144.0  |
| 28   | .4027E+10 | 56.6                | 26.6     | -1000.0  | -1030.0  | 134.0            | 144.0  |
| 29   | .8053E+10 | 60.0                | 30.0     | -1000.0  | -1030.0  | 134.0            | 144.0  |
| 30   | .1611E+11 | -1000.0             | -1030.0  | -1000.0  | -1030.0  | 146.0            | 156.0  |

NEW ISF FILE  
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# INITIAL PORT SPECTRA

SUBS = CMI EQPT 1 = UMFCO PORT 2 = COMLO

| IFRD | FREQUENCY | *-----EMITTER-----* |          |          |          | *---RECEPTOR---* |       |
|------|-----------|---------------------|----------|----------|----------|------------------|-------|
|      |           | NR SPECT            | NR LIMIT | BB SPECT | BB LIMIT | SPECT            | LIMIT |
| 9    | .7680E+04 | 43.0                | 13.0     | -1000.0  | -1030.0  | 103.0            | 133.0 |
| 10   | .1536E+05 | 43.0                | 13.0     | -1000.0  | -1030.0  | 103.0            | 133.0 |
| 11   | .3072E+05 | 43.0                | 13.0     | -1000.0  | -1030.0  | 103.0            | 133.0 |
| 12   | .6144E+05 | 43.0                | 13.0     | -1000.0  | -1030.0  | 103.0            | 133.0 |
| 13   | .1229E+06 | 43.0                | 13.0     | -1000.0  | -1030.0  | 103.0            | 133.0 |
| 14   | .2458E+06 | 43.0                | 13.0     | -1000.0  | -1030.0  | 103.0            | 133.0 |
| 15   | .4915E+06 | 43.0                | 13.0     | -1000.0  | -1030.0  | 103.0            | 133.0 |
| 16   | .9830E+06 | 43.0                | 13.0     | -1000.0  | -1030.0  | 103.0            | 133.0 |
| 17   | .1966E+07 | 43.0                | 13.0     | -1000.0  | -1030.0  | 103.0            | 133.0 |
| 18   | .3932E+07 | 43.0                | 13.0     | -1000.0  | -1030.0  | 103.0            | 133.0 |
| 19   | .7864E+07 | 43.0                | 13.0     | -1000.0  | -1030.0  | 103.0            | 133.0 |
| 20   | .1573E+08 | 43.0                | 13.0     | -1000.0  | -1030.0  | 103.0            | 133.0 |
| 21   | .3146E+08 | 43.0                | 13.0     | -1000.0  | -1030.0  | 103.0            | 133.0 |
| 22   | .6291E+08 | 43.0                | 13.0     | -1000.0  | -1030.0  | 103.0            | 133.0 |
| 23   | .1258E+09 | 43.0                | 13.0     | -1000.0  | -1030.0  | 103.0            | 133.0 |
| 24   | .2517E+09 | 123.0               | 93.0     | 149.5    | 119.5    | -27.0            | 3.0   |
| 25   | .5033E+09 | 123.0               | 93.0     | 149.5    | 119.5    | -27.0            | 3.0   |
| 26   | .1007E+10 | 73.0                | 43.0     | 98.5     | 68.5     | 103.0            | 133.0 |
| 27   | .2013E+10 | 43.0                | 13.0     | -1000.0  | -1030.0  | 103.0            | 133.0 |
| 28   | .4027E+10 | 43.0                | 13.0     | -1000.0  | -1030.0  | 103.0            | 133.0 |
| 29   | .8053E+10 | 43.0                | 13.0     | -1000.0  | -1030.0  | 103.0            | 133.0 |
| 30   | .1611E+11 | 43.0                | 13.0     | -1000.0  | -1030.0  | 103.0            | 133.0 |
| 31   | .3221E+11 | 43.0                | 13.0     | -1000.0  | -1030.0  | 103.0            | 133.0 |

FIGURE 35  
INITIAL PORT SPECTRA  
IDIPR OUTPUT FOR MINI-SYSTEM

NEW ISF FILE  
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# INITIAL PORT SPECTRA

SUMS = CNI EQPT 1 = UMFCO PORT 3 = COMUP

| IFRQ | FREQUENCY | *-----EMITTER-----* |          |          |          | *---RECEPTOR---* |       |
|------|-----------|---------------------|----------|----------|----------|------------------|-------|
|      |           | NA SPECT            | NA LIMIT | BA SPECT | BA LIMIT | SPECT            | LIMIT |
| 9    | .7640E+04 | 43.0                | 13.0     | -1000.0  | -1030.0  | 103.0            | 133.0 |
| 10   | .1536E+05 | 43.0                | 13.0     | -1000.0  | -1030.0  | 103.0            | 133.0 |
| 11   | .3072E+05 | 43.0                | 13.0     | -1000.0  | -1030.0  | 103.0            | 133.0 |
| 12   | .6144E+05 | 43.0                | 13.0     | -1000.0  | -1030.0  | 103.0            | 133.0 |
| 13   | .1229E+06 | 43.0                | 13.0     | -1000.0  | -1030.0  | 103.0            | 133.0 |
| 14   | .2458E+06 | 43.0                | 13.0     | -1000.0  | -1030.0  | 103.0            | 133.0 |
| 15   | .4915E+06 | 43.0                | 13.0     | -1000.0  | -1030.0  | 103.0            | 133.0 |
| 16   | .9830E+06 | 43.0                | 13.0     | -1000.0  | -1030.0  | 103.0            | 133.0 |
| 17   | .1966E+07 | 43.0                | 13.0     | -1000.0  | -1030.0  | 103.0            | 133.0 |
| 18   | .3932E+07 | 43.0                | 13.0     | -1000.0  | -1030.0  | 103.0            | 133.0 |
| 19   | .7864E+07 | 43.0                | 13.0     | -1000.0  | -1030.0  | 103.0            | 133.0 |
| 20   | .1573E+08 | 43.0                | 13.0     | -1000.0  | -1030.0  | 103.0            | 133.0 |
| 21   | .3146E+08 | 43.0                | 13.0     | -1000.0  | -1030.0  | 103.0            | 133.0 |
| 22   | .6291E+08 | 43.0                | 13.0     | -1000.0  | -1030.0  | 103.0            | 133.0 |
| 23   | .1258E+09 | 43.0                | 13.0     | -1000.0  | -1030.0  | 103.0            | 133.0 |
| 24   | .2517E+09 | 123.0               | 93.0     | 140.5    | 110.5    | -27.0            | 3.0   |
| 25   | .5033E+09 | 123.0               | 93.0     | 140.5    | 110.5    | -27.0            | 3.0   |
| 26   | .1007E+10 | 73.0                | 43.0     | 90.5     | 60.5     | 103.0            | 133.0 |
| 27   | .2013E+10 | 43.0                | 13.0     | -1000.0  | -1030.0  | 103.0            | 133.0 |
| 28   | .4027E+10 | 43.0                | 13.0     | -1000.0  | -1030.0  | 103.0            | 133.0 |
| 29   | .8053E+10 | 43.0                | 13.0     | -1000.0  | -1030.0  | 103.0            | 133.0 |
| 30   | .1611E+11 | 43.0                | 13.0     | -1000.0  | -1030.0  | 103.0            | 133.0 |
| 31   | .3221E+11 | 43.0                | 13.0     | -1000.0  | -1030.0  | 103.0            | 133.0 |

NEW ISF FILE  
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# INITIAL PORT SPECTRA

SUMS = CNI EQPT 1 = UMFCO PORT 4 = ADFIN

| IFRQ | FREQUENCY | *-----EMITTER-----* |          |          |          | *---RECEPTOR---* |       |
|------|-----------|---------------------|----------|----------|----------|------------------|-------|
|      |           | NA SPECT            | NA LIMIT | BA SPECT | BA LIMIT | SPECT            | LIMIT |
| 9    | .7640E+04 | 0.0                 | 0.0      | 0.0      | 0.0      | 103.0            | 133.0 |
| 10   | .1536E+05 | 0.0                 | 0.0      | 0.0      | 0.0      | 103.0            | 133.0 |
| 11   | .3072E+05 | 0.0                 | 0.0      | 0.0      | 0.0      | 103.0            | 133.0 |
| 12   | .6144E+05 | 0.0                 | 0.0      | 0.0      | 0.0      | 103.0            | 133.0 |
| 13   | .1229E+06 | 0.0                 | 0.0      | 0.0      | 0.0      | 103.0            | 133.0 |
| 14   | .2458E+06 | 0.0                 | 0.0      | 0.0      | 0.0      | 103.0            | 133.0 |
| 15   | .4915E+06 | 0.0                 | 0.0      | 0.0      | 0.0      | 103.0            | 133.0 |
| 16   | .9830E+06 | 0.0                 | 0.0      | 0.0      | 0.0      | 103.0            | 133.0 |
| 17   | .1966E+07 | 0.0                 | 0.0      | 0.0      | 0.0      | 103.0            | 133.0 |
| 18   | .3932E+07 | 0.0                 | 0.0      | 0.0      | 0.0      | 103.0            | 133.0 |
| 19   | .7864E+07 | 0.0                 | 0.0      | 0.0      | 0.0      | 103.0            | 133.0 |
| 20   | .1573E+08 | 0.0                 | 0.0      | 0.0      | 0.0      | 103.0            | 133.0 |
| 21   | .3146E+08 | 0.0                 | 0.0      | 0.0      | 0.0      | 103.0            | 133.0 |
| 22   | .6291E+08 | 0.0                 | 0.0      | 0.0      | 0.0      | 103.0            | 133.0 |
| 23   | .1258E+09 | 0.0                 | 0.0      | 0.0      | 0.0      | 103.0            | 133.0 |
| 24   | .2517E+09 | 0.0                 | 0.0      | 0.0      | 0.0      | -27.0            | 3.0   |
| 25   | .5033E+09 | 0.0                 | 0.0      | 0.0      | 0.0      | -27.0            | 3.0   |
| 26   | .1007E+10 | 0.0                 | 0.0      | 0.0      | 0.0      | 103.0            | 133.0 |
| 27   | .2013E+10 | 0.0                 | 0.0      | 0.0      | 0.0      | 103.0            | 133.0 |
| 28   | .4027E+10 | 0.0                 | 0.0      | 0.0      | 0.0      | 103.0            | 133.0 |
| 29   | .8053E+10 | 0.0                 | 0.0      | 0.0      | 0.0      | 103.0            | 133.0 |
| 30   | .1611E+11 | 0.0                 | 0.0      | 0.0      | 0.0      | 103.0            | 133.0 |
| 31   | .3221E+11 | 0.0                 | 0.0      | 0.0      | 0.0      | 103.0            | 133.0 |

FIGURE 35 (Continued)  
INITIAL PORT SPECTRA  
IDIPR OUTPUT FOR MINI-SYSTEM

NEW ISF FILE  
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# INITIAL PORT SPECTRA

SUBS = CNI EQPT 1 = UHFCC PORT 5 = PWRSP

| IFREQ | FREQUENCY | -----EMITTER----- |          |          |          | +---RECEPTOR---+ |       |
|-------|-----------|-------------------|----------|----------|----------|------------------|-------|
|       |           | NA SPECT          | NA LIMIT | 9B SPECT | 9B LIMIT | SPECT            | LIMIT |
| 1     | .3000E+02 | 130.0             | 100.0    | 132.0    | 102.0    | 135.6            | 165.6 |
| 2     | .6000E+02 | 130.0             | 100.0    | 132.0    | 102.0    | 135.6            | 165.6 |
| 3     | .1200E+03 | 130.0             | 100.0    | 132.0    | 102.0    | 135.6            | 165.6 |
| 4     | .2400E+03 | 130.0             | 100.0    | 132.0    | 102.0    | 135.6            | 165.6 |
| 5     | .4800E+03 | 130.0             | 100.0    | 132.0    | 102.0    | 135.6            | 165.6 |
| 6     | .9600E+03 | 130.0             | 100.0    | 132.0    | 102.0    | 135.4            | 165.4 |
| 7     | .1920E+04 | 130.0             | 100.0    | 132.0    | 102.0    | 134.4            | 164.4 |
| 8     | .3840E+04 | 122.1             | 92.1     | 132.0    | 102.0    | 133.4            | 163.4 |
| 9     | .7680E+04 | 107.0             | 77.0     | 132.0    | 102.0    | 132.5            | 162.5 |
| 10    | .1536E+05 | 92.0              | 62.0     | 132.0    | 102.0    | 131.5            | 161.5 |
| 11    | .3072E+05 | 78.2              | 49.2     | 129.5    | 99.5     | 130.5            | 160.5 |
| 12    | .6144E+05 | 69.1              | 39.1     | 117.1    | 87.1     | 129.6            | 159.6 |
| 13    | .1229E+06 | 60.1              | 30.1     | 104.0    | 74.0     | 128.6            | 158.6 |
| 14    | .2458E+06 | 51.1              | 21.1     | 92.5     | 62.5     | 127.7            | 157.7 |
| 15    | .4915E+06 | 42.0              | 12.0     | 80.1     | 50.1     | 127.2            | 157.2 |
| 16    | .9830E+06 | 33.0              | 3.0      | 67.0     | 37.0     | 127.2            | 157.2 |
| 17    | .1966E+07 | 24.0              | -6.0     | 55.4     | 25.4     | 127.2            | 157.2 |
| 18    | .3932E+07 | 20.0              | -10.0    | 50.0     | 20.0     | 127.2            | 157.2 |
| 19    | .7864E+07 | 20.0              | -10.0    | 50.0     | 20.0     | 127.2            | 157.2 |
| 20    | .1573E+08 | 20.0              | -10.0    | 50.0     | 20.0     | 127.2            | 157.2 |
| 21    | .3146E+08 | 20.0              | -10.0    | 50.0     | 20.0     | 127.2            | 157.2 |
| 22    | .6291E+08 | 20.0              | -10.0    | 50.0     | 20.0     | 127.2            | 157.2 |
| 23    | .1258E+09 | 0.0               | 0.0      | 0.0      | 0.0      | 127.2            | 157.2 |
| 24    | .2517E+09 | 0.0               | 0.0      | 0.0      | 0.0      | 127.2            | 157.2 |
| 25    | .5033E+09 | 0.0               | 0.0      | 0.0      | 0.0      | 127.2            | 157.2 |

NEW ISF FILE  
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# INITIAL PORT SPECTRA

SUBS = CNI EQPT 1 = UHFCC PORT 6 = AIDOT

| IFREQ | FREQUENCY | -----EMITTER----- |          |          |          | +---RECEPTOR---+ |       |
|-------|-----------|-------------------|----------|----------|----------|------------------|-------|
|       |           | NA SPECT          | NA LIMIT | 9B SPECT | 9B LIMIT | SPECT            | LIMIT |
| 1     | .3000E+02 | 130.0             | 100.0    | 132.0    | 102.0    | 0.0              | 0.0   |
| 2     | .6000E+02 | 130.0             | 100.0    | 132.0    | 102.0    | 0.0              | 0.0   |
| 3     | .1200E+03 | 130.0             | 100.0    | 132.0    | 102.0    | 0.0              | 0.0   |
| 4     | .2400E+03 | 130.0             | 100.0    | 132.0    | 102.0    | 0.0              | 0.0   |
| 5     | .4800E+03 | 130.0             | 100.0    | 132.0    | 102.0    | 0.0              | 0.0   |
| 6     | .9600E+03 | 130.0             | 100.0    | 132.0    | 102.0    | 0.0              | 0.0   |
| 7     | .1920E+04 | 130.0             | 100.0    | 132.0    | 102.0    | 0.0              | 0.0   |
| 8     | .3840E+04 | 122.1             | 92.1     | 132.0    | 102.0    | 0.0              | 0.0   |
| 9     | .7680E+04 | 107.0             | 77.0     | 132.0    | 102.0    | 0.0              | 0.0   |
| 10    | .1536E+05 | -1034.0           | -1064.0  | 92.0     | 62.0     | 0.0              | 0.0   |
| 11    | .3072E+05 | -1034.0           | -1064.0  | 92.0     | 62.0     | 0.0              | 0.0   |
| 12    | .6144E+05 | -1034.0           | -1064.0  | 92.0     | 62.0     | 0.0              | 0.0   |
| 13    | .1229E+06 | -1034.0           | -1064.0  | 92.0     | 62.0     | 0.0              | 0.0   |
| 14    | .2458E+06 | -1034.0           | -1064.0  | 92.0     | 62.0     | 0.0              | 0.0   |
| 15    | .4915E+06 | -1034.0           | -1064.0  | 90.0     | 60.0     | 0.0              | 0.0   |
| 16    | .9830E+06 | -1034.0           | -1064.0  | 80.7     | 50.7     | 0.0              | 0.0   |
| 17    | .1966E+07 | -1034.0           | -1064.0  | 70.7     | 40.7     | 0.0              | 0.0   |
| 18    | .3932E+07 | -1034.0           | -1064.0  | 72.7     | 42.7     | 0.0              | 0.0   |
| 19    | .7864E+07 | 20.0              | -10.0    | 50.0     | 20.0     | 0.0              | 0.0   |
| 20    | .1573E+08 | 20.0              | -10.0    | 50.0     | 20.0     | 0.0              | 0.0   |
| 21    | .3146E+08 | 20.0              | -10.0    | 50.0     | 20.0     | 0.0              | 0.0   |
| 22    | .6291E+08 | 20.0              | -10.0    | 50.0     | 20.0     | 0.0              | 0.0   |

FIGURE 35 (Continued)  
INITIAL PORT SPECTRA  
IDIPR OUTPUT FOR MINI-SYSTEM

NEW ISF FILE  
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# INITIAL PORT SPECTRA

SUBS = CWI EQPT 1 = UHFCO PORT 7 = PYCON

| IFWG | FREQUENCY | -----EMITTER----- |          |          |          | +---RECEPTOR---+ |       |
|------|-----------|-------------------|----------|----------|----------|------------------|-------|
|      |           | NS SPECT          | NS LIMIT | BS SPECT | BS LIMIT | SPECT            | LIMIT |
| 1    | .3000E+02 | 130.0             | 100.0    | 132.0    | 102.0    | 86.0             | 116.0 |
| 2    | .6000E+02 | 130.0             | 100.0    | 132.0    | 102.0    | 86.0             | 116.0 |
| 3    | .1200E+03 | 130.0             | 100.0    | 132.0    | 102.0    | 86.0             | 116.0 |
| 4    | .2400E+03 | 130.0             | 100.0    | 132.0    | 102.0    | 86.0             | 116.0 |
| 5    | .4000E+03 | 130.0             | 100.0    | 132.0    | 102.0    | 86.0             | 116.0 |
| 6    | .9600E+03 | 130.0             | 100.0    | 132.0    | 102.0    | 86.0             | 116.0 |
| 7    | .1920E+04 | 130.0             | 100.0    | 132.0    | 102.0    | 86.0             | 116.0 |
| 8    | .3040E+04 | 122.1             | 92.1     | 132.0    | 102.0    | 86.0             | 116.0 |
| 9    | .7680E+04 | 107.0             | 77.0     | 132.0    | 102.0    | 86.0             | 116.0 |
| 10   | .1536E+05 | -1034.0           | -1064.0  | 107.9    | 77.9     | 86.0             | 116.0 |
| 11   | .3072E+05 | -1034.0           | -1064.0  | 101.8    | 71.8     | 86.0             | 116.0 |
| 12   | .6144E+05 | -1034.0           | -1064.0  | 95.8     | 65.8     | 86.0             | 116.0 |
| 13   | .1229E+06 | -1034.0           | -1064.0  | 89.8     | 59.8     | 86.0             | 116.0 |
| 14   | .2450E+06 | -1034.0           | -1064.0  | 83.8     | 53.8     | 86.0             | 116.0 |
| 15   | .4915E+06 | -1034.0           | -1064.0  | 77.8     | 47.8     | 86.0             | 116.0 |
| 16   | .9830E+06 | -1034.0           | -1064.0  | 71.7     | 41.7     | 86.0             | 116.0 |
| 17   | .1966E+07 | -1034.0           | -1064.0  | 65.7     | 35.7     | 86.0             | 116.0 |
| 18   | .3932E+07 | -1034.0           | -1064.0  | 59.7     | 29.7     | 86.0             | 116.0 |
| 19   | .7864E+07 | 20.0              | -10.0    | 50.0     | 20.0     | 103.0            | 133.0 |
| 20   | .1573E+08 | 20.0              | -10.0    | 50.0     | 20.0     | 103.0            | 133.0 |
| 21   | .3146E+08 | 20.0              | -10.0    | 50.0     | 20.0     | 103.0            | 133.0 |
| 22   | .6291E+08 | 20.0              | -10.0    | 50.0     | 20.0     | 103.0            | 133.0 |
| 23   | .1250E+09 | 0.0               | 0.0      | 0.0      | 0.0      | 103.0            | 133.0 |
| 24   | .2517E+09 | 0.0               | 0.0      | 0.0      | 0.0      | 103.0            | 133.0 |
| 25   | .5033E+09 | 0.0               | 0.0      | 0.0      | 0.0      | 103.0            | 133.0 |
| 26   | .1007E+10 | 0.0               | 0.0      | 0.0      | 0.0      | 103.0            | 133.0 |
| 27   | .2013E+10 | 0.0               | 0.0      | 0.0      | 0.0      | 103.0            | 133.0 |
| 28   | .4027E+10 | 0.0               | 0.0      | 0.0      | 0.0      | 103.0            | 133.0 |
| 29   | .8053E+10 | 0.0               | 0.0      | 0.0      | 0.0      | 103.0            | 133.0 |
| 30   | .1611E+11 | 0.0               | 0.0      | 0.0      | 0.0      | 103.0            | 133.0 |

FIGURE 35 (Continued)  
INITIAL PORT SPECTRA  
IDIPR OUTPUT FOR MINI-SYSTEM

NEW TSF FILE  
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BUNDLE 1

-----  
ID:BNL1

NODE POINTS:

| NODE | X    | Y    | Z     |
|------|------|------|-------|
| A1   | 5.0  | 65.0 | 100.0 |
| B1   | 0.0  | 80.0 | 370.4 |
| C1   | -5.0 | 90.0 | 400.0 |

BUNDLE SEGMENTS:

| POINT 1 | POINT 2 | CMPT  | APERTURE | LENGTH | HEIGHT |
|---------|---------|-------|----------|--------|--------|
| A1      | B1      | COMP1 | TOPCP    | 270.9  | 4.0    |
| B1      | C1      | COMP1 |          | 32.0   | 4.0    |

WIRES:

-----

ID W.C.T. TYPE

POINTS:

|      |       |    |    |    |
|------|-------|----|----|----|
| B1W1 | SPC22 | A1 | B1 | C1 |
| B1W2 | SPCS2 | B1 | C1 |    |

FIGURE 36  
WIRE BUNDLE DATA  
IDIPR OUTPUT FOR MINI-SYSTEM

ITEMCAP TASK ANALYSIS ROUTINE

TITLE = SGR TEST DATA MINI-SYSTEM

REMARK = \*FILE ID=CCOTEM CORRECTED BASELINE SYSTEM. REVISED 9-4-73

ANALYSIS TASK.....BASELINE EMC SURVEY  
SYSTEM TYPE.....AIRCRAFT  
EMI MARGIN MINIMUM PRINTOUT LIMIT.... -1000.0 DB

FIGURE 37  
TART OUTPUT FOR MINI-SYSTEM  
TITLE PAGE

# ENVIRONMENTAL FIELD INTERFERENCE SUMMARY

RCPT -- SURS = CJI RCPT 1 = UHFCC PORT 1 = CASE

RECEIVED RECEIVED  
SUSC LFV SIG-03 SIG-NU4

FREQUENCY  
(HERTZ)

EMI  
MARGIN

RECEIVED  
SUSC LFV

SIG-03

SIG-NU4

|             |         |        |         |            |
|-------------|---------|--------|---------|------------|
| 3.00000E+01 | -2000.0 | 1000.0 | -1000.0 | 0.         |
| 6.00000E+01 | -2000.0 | 1000.0 | -1000.0 | 0.         |
| 1.20000E+02 | -2000.0 | 1000.0 | -1000.0 | 0.         |
| 2.40000E+02 | -2000.0 | 1000.0 | -1000.0 | 0.         |
| 4.80000E+02 | -2000.0 | 1000.0 | -1000.0 | 0.         |
| 9.60000E+02 | -2000.0 | 1000.0 | -1000.0 | 0.         |
| 1.92000E+03 | -900.0  | 1000.0 | 200.0   | 1.0000E+10 |
| 3.84000E+03 | -800.0  | 1000.0 | 200.0   | 1.0000E+10 |
| 7.68000E+03 | -300.0  | 1000.0 | 200.0   | 1.0000E+10 |
| 1.53600E+04 | 60.0    | 1000.0 | 200.0   | 1.0000E+10 |
| 3.07200E+04 | 60.0    | 1000.0 | 200.0   | 1.0000E+10 |
| 6.14400E+04 | 60.0    | 1000.0 | 200.0   | 1.0000E+10 |
| 1.22880E+05 | 70.0    | 1000.0 | 200.0   | 1.0000E+10 |
| 2.45760E+05 | 80.0    | 1000.0 | 200.0   | 1.0000E+10 |
| 4.91520E+05 | 100.0   | 1000.0 | 200.0   | 1.0000E+10 |
| 9.83040E+05 | 110.0   | 1000.0 | 200.0   | 1.0000E+10 |
| 1.96608E+06 | 110.0   | 1000.0 | 200.0   | 1.0000E+10 |
| 3.93216E+06 | 110.0   | 1000.0 | 200.0   | 1.0000E+10 |
| 7.86432E+06 | 110.0   | 1000.0 | 200.0   | 1.0000E+10 |
| 1.57286E+07 | 110.0   | 1000.0 | 200.0   | 1.0000E+10 |
| 3.14573E+07 | 110.0   | 1000.0 | 200.0   | 1.0000E+10 |
| 6.29146E+07 | 110.0   | 1000.0 | 200.0   | 1.0000E+10 |
| 1.25829E+08 | 110.0   | 1000.0 | 200.0   | 1.0000E+10 |
| 2.51658E+08 | 102.0   | 1000.0 | 200.0   | 1.0000E+10 |
| 5.03316E+08 | 87.0    | 1000.0 | 200.0   | 1.0000E+10 |
| 1.00663E+09 | 72.0    | 1000.0 | 200.0   | 1.0000E+10 |
| 2.01327E+09 | 65.0    | 1000.0 | 200.0   | 1.0000E+10 |
| 4.02653E+09 | 60.0    | 1000.0 | 200.0   | 1.0000E+10 |
| 8.05306E+09 | -113.0  | 1000.0 | -1000.0 | 0.         |
| 1.61061E+10 | -110.0  | 1000.0 | -1000.0 | 0.         |

RCPT -- SURS = CJI RCPT 1 = UHFCC PORT 1 = CASE  
NO EMI INTO THIS RECEPTOR

FIGURE 38  
TART OUTPUT FOR MINI-SYSTEM  
UHFCC EQUIPMENT CASE

# BASELINE SYSTEM ENTR-RCPT PAIR INTERFERENCE

EMT 2 -- SUBS = CNI EOPT 2 = TACAN PORT 2 = TACRF (UNCHANGED)

RCPT -- SUBS = CNI EOPT 1 = UHFCC PORT 2 = COMLO (UNCHANGED)

PATH = ANT TO ANT

NOTE - R = IN RECD RANGE, I = INTERPOLATED VALUE

| FREQUENCY<br>(HERTZ) | FREQ<br>BASE | TRANSFER<br>RATIO | RECEPTOR<br>SUSC LEVEL | -----NARROWBAND-----      |                           |        | -----BROADBAND-----       |                           |        | BANDWTH<br>FACTOR |
|----------------------|--------------|-------------------|------------------------|---------------------------|---------------------------|--------|---------------------------|---------------------------|--------|-------------------|
|                      |              |                   |                        | EMI<br>RECEIVED<br>SIGNAL | EMI<br>RECEIVED<br>SIGNAL | MARGIN | EMI<br>RECEIVED<br>SIGNAL | EMI<br>RECEIVED<br>SIGNAL | MARGIN |                   |
| 1.19689E+04          | EMTR         | -175.0            | 103.0 I                | -273.0                    | -170.0                    | 0.0    | -270.3                    | -175.2                    | 26.0   | -26.4             |
| 1.5360E+04           | RCPT         | -175.6            | 103.0                  | -273.0                    | -170.0                    | 0.0 I  | -277.2                    | -174.2                    | 26.0 I | -23.4             |
| 2.53030E+04          | EMTR         | -175.3            | 103.0 I                | -273.9                    | -170.9                    | 0.0    | -275.1                    | -172.1                    | 26.0   | -21.2             |
| 3.07200E+04          | RCPT         | -175.9            | 103.0                  | -273.9                    | -170.9                    | 0.0 I  | -274.3                    | -171.2                    | 26.0 I | -20.4             |
| 5.34913E+04          | EMTR         | -177.0            | 103.0 I                | -274.0                    | -171.0                    | 0.0    | -276.1                    | -173.1                    | 26.0 I | -22.7             |
| 6.14400E+04          | RCPT         | -177.0            | 103.0                  | -274.0                    | -171.0                    | 0.0 I  | -276.1                    | -173.1                    | 26.0 I | -22.7             |
| 1.13085E+05          | EMTR         | -177.1            | 103.0 I                | -274.1                    | -171.1                    | 0.0    | -273.5                    | -170.6                    | 26.0   | -19.5             |
| 1.22800E+05          | RCPT         | -177.2            | 103.0                  | -274.2                    | -171.2                    | 0.0 I  | -273.3                    | -170.2                    | 26.0 I | -19.1             |
| 2.39060E+05          | EMTR         | -177.4            | 103.0 I                | -274.3                    | -171.3                    | 0.0    | -270.5                    | -167.5                    | 26.0   | -16.2             |
| 2.45760E+05          | RCPT         | -177.4            | 103.0                  | -274.4                    | -171.3                    | 0.0 I  | -273.4                    | -167.4                    | 26.0 I | -16.2             |
| 4.91520E+05          | EMTR         | -177.5            | 103.0                  | -274.6                    | -171.5                    | 0.0 I  | -267.7                    | -164.7                    | 26.0 I | -13.1             |
| 5.05400E+05          | RCPT         | -177.5            | 103.0 I                | -274.6                    | -171.5                    | 0.0    | -267.5                    | -164.6                    | 26.0   | -13.0             |
| 9.03040E+05          | EMTR         | -178.0            | 103.0                  | -275.0                    | -172.0                    | 0.0 I  | -265.1                    | -162.1                    | 26.0 I | -10.1             |
| 1.0845E+06           | RCPT         | -178.0            | 103.0 I                | -275.0                    | -172.0                    | 0.0    | -265.3                    | -163.3                    | 26.0   | -11.3             |
| 1.96600E+06          | EMTR         | -178.2            | 103.0                  | -275.2                    | -172.2                    | 0.0 I  | -264.1                    | -161.1                    | 26.0 I | -8.6              |
| 2.25077E+06          | RCPT         | -178.3            | 103.0 I                | -275.3                    | -172.3                    | 0.0    | -263.5                    | -160.5                    | 26.0   | -8.0              |
| 3.93210E+06          | EMTR         | -180.8            | 103.0                  | -277.8                    | -174.8                    | 0.0 I  | -263.4                    | -160.4                    | 26.0   | -5.6              |
| 4.77517E+06          | RCPT         | -182.7            | 103.0 I                | -279.5                    | -176.5                    | 0.0    | -264.4                    | -161.4                    | 26.0   | -4.8              |
| 7.86432E+06          | EMTR         | -19.3             | 103.0                  | -284.3                    | -181.3                    | 0.0 I  | -267.1                    | -164.1                    | 26.0 I | -2.6              |
| 1.00950E+07          | RCPT         | -19.9             | 103.0 I                | -284.3                    | -181.3                    | 0.0    | -263.3                    | -166.3                    | 26.0   | -3.0              |
| 1.57280E+07          | EMTR         | -19.2             | 103.0                  | -291.2                    | -188.2                    | 0.0 I  | -272.2                    | -169.2                    | 26.0 I | -1.0              |
| 2.1341E+07           | RCPT         | -19.5             | 103.0 I                | -293.9                    | -190.9                    | 0.0    | -273.5                    | -170.5                    | 26.0   | .3                |
| 3.1573E+07           | EMTR         | -20.3             | 103.0                  | -297.3                    | -194.3                    | 0.0 I  | -279.3                    | -172.3                    | 26.0 I | 2.0               |
| 4.51160E+07          | RCPT         | -20.5             | 103.0 I                | -299.5                    | -196.5                    | 0.0    | -275.3                    | -172.3                    | 26.0   | 3.5               |
| 6.2914E+07           | EMTR         | -20.0             | 103.0                  | -301.0                    | -198.0                    | 0.0 I  | -276.3                    | -173.0                    | 26.0 I | 5.0               |
| 9.53790E+07          | RCPT         | -20.5             | 103.0 I                | -307.5                    | -204.5                    | 0.0    | -273.3                    | -167.8                    | 26.0   | 6.8               |
| 1.25020E+08          | EMTR         | -191.2            | 103.0                  | -303.2                    | -201.2                    | 0.0 I  | -263.2                    | -160.2                    | 26.0 I | 5.0               |
| 2.01630E+08          | RCPT         | -173.1            | 14.0 I                 | -168.0                    | -173.1                    | 0.0    | -181.3                    | -175.3                    | 26.0   | -13.0             |
| 2.51650E+08          | EMTR         | -163.3            | -27.0                  | -163.3                    | -17.3                     | 0.0 I  | -143.3                    | -170.3                    | 26.0 I | -13.0             |
| 4.26270E+08          | RCPT         | -193.3            | -27.0 I                | -163.3                    | -16.3                     | 0.0    | -153.3                    | -160.3                    | 26.0   | -13.0             |
| 5.03310E+08          | EMTR         | -190.7            | -27.0 R                | -173.7                    | -190.7                    | 0.0 I  | -150.7                    | -163.7                    | 26.0 I | -13.0             |
| 8.00000E+08          | RCPT         | -242.7            | 59.9 I                 | -301.5                    | -241.7                    | 0.0    | -268.7                    | -208.7                    | 26.0   | 13.0              |
| 9.01160E+08          | EMTR         | -263.3            | 82.3 I                 | -339.0                    | -261.3                    | 0.0    | -303.1                    | -223.8                    | 26.0   | 13.5              |
| 9.62000E+08          | RCPT         | -25.5             | 94.5 I                 | -336.3                    | -256.3                    | 0.0    | -316.5                    | -225.0                    | 26.0   | 13.8              |
| 1.03660E+09          | EMTR         | -162.3            | 103.0                  | -167.3                    | -8.3                      | 95.1 I | -212.5                    | -109.5                    | 77.1 R | -4.0              |
| 1.02500E+09          | RCPT         | -18.7             | 103.0 I                | -195.5                    | -52.7                     | 13.6 R | -195.3                    | -93.3                     | 97.5 R | -4.0              |
| 1.13000E+09          | EMTR         | -150.7            | 103.0 I                | -17.5                     | -5.5                      | 13.6 R | -199.2                    | -96.2                     | 97.5 R | -4.0              |
| 1.21300E+09          | RCPT         | -27.3             | 103.0 I                | -35.7                     | -28.3                     | 0.0    |                           |                           |        |                   |
| 1.24000E+09          | EMTR         | -27.2             | 103.0 I                | -37.0                     | -28.0                     | 0.0    |                           |                           |        |                   |
| 1.35000E+09          | RCPT         | -27.0             | 103.0 I                | -37.0                     | -28.0                     | 0.0    |                           |                           |        |                   |
| 1.90512E+09          | EMTR         | -263.5            | 103.0 I                | -311.3                    | -206.3                    | 7.9 R  | -332.7                    | -232.7                    | 37.5   | 12.3              |
| 2.01320E+09          | RCPT         | -24.5             | 103.0                  | -314.4                    | -211.4                    | 73.3 I | -333.6                    | -235.6                    | 36.0 I | 13.0              |

FIGURE 39  
TART OUTPUT FOR MINI-SYSTEM  
RCPT = UHFCC COMLO

| RELATIVE SYSTEM EMI-RCPT PAIR INTERFERENCE       |              |                   |                        |                |                    |                  |               |                            |                  |               |                  |
|--------------------------------------------------|--------------|-------------------|------------------------|----------------|--------------------|------------------|---------------|----------------------------|------------------|---------------|------------------|
| EMI2 -- SUSS = CNI                               |              |                   |                        | EQPT 2 = TACAN |                    |                  |               | PORT 2 = TACOF (UNCHANGED) |                  |               |                  |
| RCPT -- SUSS = CNI                               |              |                   |                        | EQPT 1 = UHFCC |                    |                  |               | PORT 2 = COMLO (UNCHANGED) |                  |               |                  |
| CATH = ANT TO ANT                                |              |                   |                        |                |                    |                  |               |                            |                  |               |                  |
| NOTE - R = 14 REQD RANGE, I = INTERPOLATED VALUE |              |                   |                        |                |                    |                  |               |                            |                  |               |                  |
|                                                  |              | NARROWBAND        |                        |                |                    | BROADBAND        |               |                            |                  |               |                  |
| FREQUENCY<br>(MHz)                               | FREQ<br>BASE | TRANSFER<br>RATIO | RECEPTOR<br>SUSS LEVEL | EMI<br>MARGIN  | RECEIVED<br>SIGNAL | EMI<br>SPT LEVEL | EMI<br>MARGIN | RECEIVED<br>SIGNAL         | EMI<br>SPT LEVEL | EMI<br>MARGIN | BUNJTH<br>FACTOR |
|                                                  |              |                   |                        |                |                    |                  |               |                            |                  |               |                  |
| 7.02634439                                       | RCPT         | -30.0             | 103.0                  | -30.0          | -292.1             | 0.0              | I             | -273.3                     | 17.5             | I             | 15.1             |
| 4.02734439                                       | EMI2         | -30.0             | 103.0                  | -30.0          | -292.1             | 0.0              | I             | -273.3                     | 17.5             | I             | 15.1             |
| 6.02934539                                       | RCPT         | -332.0            | 103.0                  | -422.0         | -322.0             | 0.0              | I             |                            |                  |               |                  |
| 6.02934539                                       | EMI2         | -33.0             | 103.0                  | -431.0         | -322.0             | 0.0              | I             |                            |                  |               |                  |
| 1.61000000                                       | RCPT         | -30.0             | 103.0                  | -40.0          | -35.0              | 0.0              | I             |                            |                  |               |                  |
| 1.30000000                                       | EMI2         | -30.0             | 103.0                  | -40.0          | -35.0              | 0.0              | I             |                            |                  |               |                  |
| INTERPOLATED EMI MARGIN = -339.0                 |              |                   |                        |                |                    |                  |               |                            |                  |               |                  |

INTEGRATED EMI MARGIN = -0.000

FIGURE 39 (Continued)  
TART OUTPUT FOR MINI-SYSTEM  
RCPT = UHFCC COMLO

# BASELINE SYSTEM EMTR-RCPT PAIR INTERFERENCE

EMTR -- SUBS = CNI EOPT 3 = IFF PORT 2 = IFFR (UNCHANGED)

RCPT -- SUBS = CNI EOPT 1 = UHFCO PORT 2 = COMLO (UNCHANGED)

PATH = ANT TO ANT

NOTE - R = IN PED RANGE, I = INTERPOLATED VALUE

| FREQUENCY<br>(HERTZ) | FRFQ<br>BASE | TRANSFER<br>RATIO | RECEPTOR<br>SUSC LEVEL | NARROWBAND    |                    |                       | BROADBAND     |                    |                       | BANDWIDTH<br>SPCT LEVEL | FACTOR |
|----------------------|--------------|-------------------|------------------------|---------------|--------------------|-----------------------|---------------|--------------------|-----------------------|-------------------------|--------|
|                      |              |                   |                        | EMI<br>MARGIN | RECEIVED<br>SIGNAL | EMITTER<br>SPCT LEVEL | EMI<br>MARGIN | RECEIVED<br>SIGNAL | EMITTER<br>SPCT LEVEL |                         |        |
| 0.83032E+03          | EMTR         | -85.9             | 103.0 I                | -16.9         | -43.9              | 43.0                  |               |                    |                       |                         |        |
| 1.53600E+04          | RCPT         | -87.0             | 103.0 I                | -147.0        | -44.0              | 43.0 I                |               |                    |                       |                         |        |
| 1.66071E+04          | EMTR         | -87.0             | 103.0 I                | -147.0        | -44.0              | 43.0                  |               |                    |                       |                         |        |
| 3.07200E+04          | RCPT         | -87.1             | 103.0 I                | -147.1        | -44.1              | 43.0 I                |               |                    |                       |                         |        |
| 3.13228E+04          | EMTR         | -87.1             | 103.0 I                | -147.1        | -44.1              | 43.0                  |               |                    |                       |                         |        |
| 5.87392E+04          | EMTR         | -87.3             | 103.0 I                | -147.3        | -44.3              | 43.0 I                |               |                    |                       |                         |        |
| 6.14400E+04          | RCPT         | -87.3             | 103.0 I                | -147.3        | -44.3              | 43.0 I                |               |                    |                       |                         |        |
| 1.10470E+05          | EMTR         | -87.4             | 103.0 I                | -147.4        | -44.4              | 43.0                  |               |                    |                       |                         |        |
| 1.22880E+05          | RCPT         | -87.5             | 103.0 I                | -147.5        | -44.5              | 43.0 I                |               |                    |                       |                         |        |
| 2.07760E+05          | EMTR         | -87.7             | 103.0 I                | -147.7        | -44.7              | 43.0                  |               |                    |                       |                         |        |
| 2.45760E+05          | RCPT         | -87.8             | 103.0 I                | -147.8        | -44.8              | 43.0 I                |               |                    |                       |                         |        |
| 3.90733E+05          | EMTR         | -88.0             | 103.0 I                | -148.0        | -45.0              | 43.0                  |               |                    |                       |                         |        |
| 4.91520E+05          | RCPT         | -88.2             | 103.0 I                | -148.2        | -45.2              | 43.0 I                |               |                    |                       |                         |        |
| 7.34847E+05          | EMTR         | -88.5             | 103.0 I                | -148.5        | -45.5              | 43.0                  |               |                    |                       |                         |        |
| 9.83040E+05          | RCPT         | -88.7             | 103.0 I                | -148.7        | -45.7              | 43.0 I                |               |                    |                       |                         |        |
| 1.32202E+06          | EMTR         | -89.5             | 103.0 I                | -149.0        | -46.5              | 43.0                  |               |                    |                       |                         |        |
| 1.96608E+06          | RCPT         | -89.8             | 103.0 I                | -149.8        | -46.8              | 43.0 I                |               |                    |                       |                         |        |
| 2.59915E+06          | EMTR         | -89.8             | 103.0 I                | -149.8        | -46.8              | 43.0                  |               |                    |                       |                         |        |
| 3.93216E+06          | RCPT         | -90.4             | 103.0 I                | -150.4        | -47.4              | 43.0 I                |               |                    |                       |                         |        |
| 4.88820E+06          | EMTR         | -91.7             | 103.0 I                | -150.7        | -47.7              | 43.0                  |               |                    |                       |                         |        |
| 7.85832E+06          | RCPT         | -93.2             | 103.0 I                | -153.2        | -50.1              | 43.0 I                |               |                    |                       |                         |        |
| 9.19318E+06          | EMTR         | -94.8             | 103.0 I                | -154.8        | -51.5              | 43.0                  |               |                    |                       |                         |        |
| 1.57286E+07          | RCPT         | -100.5            | 103.0 I                | -160.5        | -57.5              | 43.0 I                |               |                    |                       |                         |        |
| 1.72895E+07          | EMTR         | -101.5            | 103.0 I                | -161.5        | -58.5              | 43.0                  |               |                    |                       |                         |        |
| 3.14573E+07          | RCPT         | -107.4            | 103.0 I                | -167.4        | -64.4              | 43.0 I                |               |                    |                       |                         |        |
| 3.25162E+07          | EMTR         | -107.9            | 103.0 I                | -167.9        | -64.9              | 43.0                  |               |                    |                       |                         |        |
| 6.11530E+07          | EMTR         | -112.5            | 103.0 I                | -172.5        | -69.5              | 43.0                  |               |                    |                       |                         |        |
| 6.23146E+07          | RCPT         | -112.3            | 103.0 I                | -172.3        | -69.3              | 43.0 I                |               |                    |                       |                         |        |
| 1.13016E+08          | EMTR         | -107.4            | 103.0 I                | -168.4        | -64.4              | 43.0                  |               |                    |                       |                         |        |
| 1.25829E+08          | RCPT         | -107.8            | 103.0 I                | -168.8        | -64.8              | 43.0 I                |               |                    |                       |                         |        |
| 2.16298E+08          | EMTR         | -91.5             | 103.0 I                | -151.5        | -56.5              | 43.0                  |               |                    |                       |                         |        |
| 2.51658E+08          | RCPT         | -94.1             | 103.0 I                | -154.1        | -59.1              | 43.0 I                |               |                    |                       |                         |        |
| 4.0679E+08           | EMTR         | -107.2            | 103.0 I                | -167.2        | -64.2              | 43.0                  |               |                    |                       |                         |        |
| 5.03316E+08          | RCPT         | -110.1            | 103.0 I                | -170.1        | -67.1              | 43.0 I                |               |                    |                       |                         |        |
| 7.65044E+08          | EMTR         | -153.5            | 103.0 I                | -213.5        | -113.5             | 43.0                  |               |                    |                       |                         |        |
| 1.00663E+09          | RCPT         | -171.9            | 103.0 I                | -238.9        | -138.9             | 43.0 I                |               |                    |                       |                         |        |
| 1.03000E+09          | EMTR         | -183.5            | 103.0 I                | -243.5        | -143.5             | 43.0                  |               |                    |                       |                         |        |
| 1.03000E+09          | EMTR         | -154.2            | 103.0 I                | -215.2        | -115.2             | 43.0                  |               |                    |                       |                         |        |
| 2.0327E+09           | RCPT         | -193.9            | 103.0 I                | -253.9        | -153.9             | 43.0                  |               |                    |                       |                         |        |
| 2.0327E+09           | RCPT         | -207.1            | 103.0 I                | -267.1        | -167.1             | 43.0                  |               |                    |                       |                         |        |
| 2.70596E+09          | EMTR         | -223.6            | 103.0 I                | -283.6        | -183.6             | 43.0                  |               |                    |                       |                         |        |
| 4.02653E+09          | RCPT         | -257.1            | 103.0 I                | -312.1        | -212.1             | 43.0                  |               |                    |                       |                         |        |

FIGURE 39 (Continued)  
TART OUTPUT FOR MINI-SYSTEM  
RCPT = UHFCO COMLO

# BASELINE SYSTEM ENTR-RCPT PAIR INTERFERENCE

EMTR -- SUBS = CNI EOPT 3 = IFF PORT 2 = IFFRE (UNCHANGED)  
 RCPT -- SUBS = CNI EOPT 1 = UHFCO PORT 2 = COMLO (UNCHANGED)

PATH = ANT TO ANT (CONTD)

NOTE - R = IN REQD RANGE, I = INTERPOLATED VALUE

| FREQUENCY<br>(HERTZ) | TXF0<br>BASE | TRANSFER<br>RATIO | RECEPTOR<br>SUBC LEVEL | NARROWBAND    |                    |                   | BROADBAND          |                   |                     |
|----------------------|--------------|-------------------|------------------------|---------------|--------------------|-------------------|--------------------|-------------------|---------------------|
|                      |              |                   |                        | EMI<br>MARGIN | RECEIVED<br>SIGNAL | EMI<br>SPCT LEVEL | RECEIVED<br>SIGNAL | EMI<br>SPCT LEVEL | BANDWIDTH<br>FACTOR |
| 5.00907E+09          | EMTR         | -272.3            | 103.0 I                | -332.3        | -226.3             | 43.0              |                    |                   |                     |
| 8.00306E+09          | RCPT         | -103.9            | 103.0                  | -300.9        | -253.9             | 43.0 I            |                    |                   |                     |
| 9.57096E+09          | EMTR         | -321.2            | 103.0 I                | -301.2        | -270.1             | 43.0              |                    |                   |                     |
| 1.61006E+10          | RCPT         | -331.9            | 103.0                  | -221.9        | -310.9             | 43.0 I            |                    |                   |                     |
| 1.60000E+10          | EMTR         | -471.0            | 103.0 I                | -431.0        | -321.0             | 43.0              |                    |                   |                     |

INTEGRATED EMI MARGIN = 0.0

FIGURE 39 (Continued)  
 TART OUTPUT FOR MINI-SYSTEM  
 RCPT = UHFCO COMLO

BASELINE SYSTEM EMTR-RCPT PAIR INTERFERENCE

EMTR -- SUBS = IMGPD EQPT 4 = INPVL PORT 2 = IPFX (UNCHANGED)

R PT -- SUBS = CNI EQPT 1 = UHFCO PORT 2 = CONLO (UNCHANGED)

PATH = ANT TO ANT

NOTE - R = IN REQD RANGE, I = INTERPOLATED VALUE

| FREQUENCY<br>(MRTZ) | FREQ<br>BASE | TRANSFER<br>RATIO | RECEIVER<br>SUSC LEVEL | NARROWBAND    |                    |                      | BROADBAND     |                    |                      |
|---------------------|--------------|-------------------|------------------------|---------------|--------------------|----------------------|---------------|--------------------|----------------------|
|                     |              |                   |                        | EMI<br>MARGIN | RECEIVED<br>SIGNAL | EMTYER<br>SPCT LEVEL | EMI<br>MARGIN | RECEIVED<br>SIGNAL | EMTYER<br>SPCT LEVEL |
| 1.06076E+04         | EMTR         | -165.9            | 103.0 I                | -226.6        | -123.6             | 42.1                 | -276.7        | -175.7             | -21.0 IR             |
| 1.53600E+04         | RCPT         | -155.9            | 103.0                  | -226.6        | -123.6             | 42.1 I               | -148.0        | -45.0              | 108.4 R              |
| 2.03602E+04         | EMTR         | -165.9            | 103.0 I                | -226.6        | -123.6             | 42.1                 | -107.5        | -6.5               | 123.2 IR             |
| 3.07200E+04         | RCPT         | -165.9            | 103.0                  | -226.6        | -123.6             | 42.1 I               | -100.7        | -3.7               | 143.2 R              |
| 3.90795E+04         | EMTR         | -165.9            | 103.0 I                | -226.6        | -123.6             | 42.1                 | -106.7        | -3.6               | 143.2 R              |
| 6.14400E+04         | RCPT         | -165.9            | 103.0                  | -226.6        | -123.6             | 42.1 I               | -106.5        | -3.5               | 143.2 R              |
| 7.50093E+04         | EMTR         | -161.0            | 103.0 I                | -221.9        | -116.3             | 42.1                 | -106.5        | -3.5               | 143.2 IR             |
| 1.22880E+05         | RCPT         | -142.9            | 103.0                  | -203.3        | -100.6             | 42.1 I               | -106.5        | -3.5               | 143.2 R              |
| 1.43973E+05         | EMTR         | -138.3            | 103.0 I                | -199.2        | -96.2              | 42.1                 | -106.4        | -3.4               | 143.2 R              |
| 2.45760E+05         | RCPT         | -119.6            | 103.0                  | -179.7        | -75.7              | 42.1 I               | -106.4        | -3.4               | 143.2 R              |
| 2.76342E+05         | EMTR         | -115.7            | 103.0 I                | -176.5        | -73.5              | 42.1                 | -106.4        | -3.4               | 143.2 R              |
| 4.91520E+05         | RCPT         | -94.7             | 103.0                  | -93.4         | -46.6              | 42.1 I               | -106.4        | -3.4               | 143.2 R              |
| 5.30413E+05         | EMTR         | -93.4             | 103.0 I                | -86.6         | -46.7              | 42.1                 | -106.4        | -3.4               | 143.2 R              |
| 9.83040E+05         | RCPT         | -86.6             | 103.0                  | -86.6         | -46.7              | 42.1 I               | -106.4        | -3.4               | 143.2 R              |
| 1.00000E+06         | EMTR         | -86.6             | 103.0 I                | -86.6         | -46.7              | 42.1                 | -106.4        | -3.4               | 143.2 R              |
| 1.01000E+06         | RCPT         | -86.6             | 103.0                  | -86.6         | -46.7              | 42.1 I               | -106.4        | -3.4               | 143.2 R              |
| 1.95410E+06         | EMTR         | -86.7             | 103.0 I                | -86.7         | -46.7              | 42.1                 | -106.4        | -3.4               | 143.2 R              |
| 1.96600E+06         | RCPT         | -86.7             | 103.0                  | -86.7         | -46.7              | 42.1 I               | -106.4        | -3.4               | 143.2 R              |
| 3.75070E+06         | EMTR         | -86.7             | 103.0 I                | -86.7         | -46.7              | 42.1                 | -106.4        | -3.4               | 143.2 R              |
| 3.93216E+06         | RCPT         | -86.7             | 103.0                  | -86.7         | -46.7              | 42.1 I               | -106.4        | -3.4               | 143.2 R              |
| 4.00000E+06         | EMTR         | -86.7             | 103.0 I                | -86.7         | -46.7              | 42.1                 | -106.4        | -3.4               | 143.2 R              |
| 5.00000E+06         | RCPT         | -86.7             | 103.0                  | -86.7         | -46.7              | 42.1 I               | -106.4        | -3.4               | 143.2 R              |
| 7.15910E+06         | EMTR         | -86.7             | 103.0 I                | -86.7         | -46.7              | 42.1                 | -106.4        | -3.4               | 143.2 R              |
| 7.86432E+06         | RCPT         | -86.7             | 103.0                  | -86.7         | -46.7              | 42.1 I               | -106.4        | -3.4               | 143.2 R              |
| 1.38180E+07         | EMTR         | -92.2             | 103.0 I                | -132.0        | -29.0              | 42.1                 | -110.1        | -7.1               | 83.2 R               |
| 1.57266E+07         | RCPT         | -93.0             | 103.0                  | -137.0        | -34.0              | 42.1 I               | -113.1        | -10.1              | 80.5 I               |
| 2.65223E+07         | EMTR         | -93.2             | 103.0 I                | -137.0        | -34.0              | 42.1                 | -133.6        | -30.6              | 63.2                 |
| 3.15573E+07         | RCPT         | -93.2             | 103.0                  | -137.0        | -34.0              | 42.1 I               | -133.6        | -30.6              | 63.2                 |
| 5.09069E+07         | EMTR         | -93.2             | 103.0 I                | -137.0        | -34.0              | 42.1                 | -133.6        | -30.6              | 63.2                 |
| 6.29146E+07         | RCPT         | -93.2             | 103.0                  | -137.0        | -34.0              | 42.1 I               | -133.6        | -30.6              | 63.2                 |
| 9.77109E+07         | EMTR         | -93.2             | 103.0 I                | -137.0        | -34.0              | 42.1                 | -133.6        | -30.6              | 63.2                 |
| 1.25829E+08         | RCPT         | -93.2             | 103.0                  | -137.0        | -34.0              | 42.1 I               | -133.6        | -30.6              | 63.2                 |
| 1.87547E+08         | EMTR         | -93.2             | 103.0 I                | -137.0        | -34.0              | 42.1                 | -133.6        | -30.6              | 63.2                 |
| 2.51658E+08         | RCPT         | -93.2             | 103.0                  | -137.0        | -34.0              | 42.1 I               | -133.6        | -30.6              | 63.2                 |
| 3.59470E+08         | EMTR         | -93.2             | 103.0 I                | -137.0        | -34.0              | 42.1                 | -133.6        | -30.6              | 63.2                 |
| 5.03316E+08         | RCPT         | -93.2             | 103.0                  | -137.0        | -34.0              | 42.1 I               | -133.6        | -30.6              | 63.2                 |
| 6.90942E+08         | EMTR         | -107.4            | 103.0 I                | -197.7        | -6.3               | 42.1                 | -242.0        | -146.0             | -1.0                 |
| 1.00663E+09         | RCPT         | -123.2            | 103.0                  | -197.7        | -6.3               | 42.1 I               | -242.0        | -146.0             | -1.0                 |
| 1.32620E+09         | EMTR         | -130.7            | 103.0 I                | -197.7        | -6.3               | 42.1                 | -242.0        | -146.0             | -1.0                 |
| 2.01327E+09         | RCPT         | -131.5            | 103.0                  | -197.7        | -6.3               | 42.1 I               | -242.0        | -146.0             | -1.0                 |
| 2.54551E+09         | EMTR         | -141.1            | 103.0 I                | -201.9        | -90.9              | 42.1                 | -242.0        | -146.0             | -1.0                 |
| 4.02653E+09         | RCPT         | -141.1            | 103.0                  | -201.9        | -90.9              | 42.1 I               | -242.0        | -146.0             | -1.0                 |

FIGURE 39 (Continued)  
TART OUTPUT FOR MINI-SYSTEM  
RCPT = UHFCO COMLO

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A/C LINE SYSTEM EMI-R-RCPT PAID INTERFERE ENCE
EMI -- SU3S = INUPC EOPT + = INPYL PORT 2 = IOFX (UNCHANGED)
RCPT -- SU3S = UMI EOPT 1 = UHFCC PORT 2 = COMLO (UNCHANGED)

PAID = ANT TO ANT
NOTE - R = IN RECD RANGE, I = INTERPOLATED VALUE

-----BROADBAND-----
FREQUENCY FREQ TRANSFER RECEPTOR EMI RECEIVED EMI EMITTER BROADTH
(4F97Z) 1AUF RATIO SUSC LEVEL MARGIN SIGNAL SPCL LEVEL SIGNAL SPC1 LEVEL FACTOR
-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
4.9555E+09 EMT2 -15.0 103.0 I -277.5 -10.0 2.1 I 2.1
8.0233E+09 RCS -15.1 103.0 -211.9 -10.0 2.1 I 2.1
9.3752E+09 EMT2 -12.0 103.0 I -213.3 -11.0 2.1 I 2.1
1.6131E+10 PCM1 -15.1 103.0 -213.0 -11.0 2.1 I 2.1
1.6000E+10 EMT2 -15.0 103.0 I -213.9 -11.0 2.1 I 2.1

```

FIGURE 39 (Continued)  
TART OUTPUT FOR MINI-SYSTEM  
RCPT = UHFCC COMLO

NOTE - R - IN RUN RANGE. Y - INTERPOLATED VALUE

| FREQUENCY   |       |       | TRANSFER |         | RECEPTOR |         | NARROWBAND |        | BROADBAND |         |
|-------------|-------|-------|----------|---------|----------|---------|------------|--------|-----------|---------|
| FREQ        | RATIO | BASE  | RECEIVED | EMITTER | RECEIVED | EMITTER | SIGNAL     | MARGIN | SIGNAL    | EMITTER |
| (WERTZ)     |       |       | LEVEL    | LEVEL   | LEVEL    | LEVEL   |            |        |           | LEVEL   |
| 1.06076E+04 | EMTR  | 103.0 | I        | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 1.53600E+04 | RCPT  | 103.0 | I        | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 2.03602E+04 | EMTR  | 103.0 | I        | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 3.07200E+04 | RCPT  | 103.0 | I        | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 3.90795E+04 | EMTR  | 103.0 | I        | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 6.16430E+04 | RCPT  | 103.0 | I        | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 7.50093E+04 | EMTR  | 103.0 | I        | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 1.22800E+05 | RCPT  | 103.0 | I        | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 1.43973E+05 | EMTR  | 103.0 | I        | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 2.45760E+05 | RCPT  | 103.0 | I        | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 2.78342E+05 | EMTR  | 103.0 | I        | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 4.91520E+05 | RCPT  | 103.0 | I        | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 5.30413E+05 | EMTR  | 103.0 | I        | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 9.830-0E+05 | RCPT  | 103.0 | I        | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 1.00000E+06 | EMTR  | 103.0 | I        | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 1.01808E+06 | EMTR  | 103.0 | I        | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 1.95410E+06 | EMTR  | 103.0 | I        | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 1.96608E+06 | RCPT  | 103.0 | I        | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 3.75670E+06 | EMTR  | 103.0 | I        | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 3.93216E+06 | RCPT  | 103.0 | I        | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 4.00000E+06 | EMTR  | 103.0 | I        | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 5.00000E+06 | EMTR  | 103.0 | I        | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 7.19910E+06 | EMTR  | 103.0 | I        | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 7.86432E+06 | RCPT  | 103.0 | I        | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 1.38180E+07 | EMTR  | 103.0 | I        | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 1.57286E+07 | RCPT  | 103.0 | I        | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 2.65223E+07 | EMTR  | 103.0 | I        | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 3.14573E+07 | RCPT  | 103.0 | I        | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 5.09069E+07 | EMTR  | 103.0 | I        | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 6.29146E+07 | RCPT  | 103.0 | I        | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 9.77109E+07 | EMTR  | 103.0 | I        | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 1.25629E+08 | RCPT  | 103.0 | I        | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 1.87547E+08 | EMTR  | 28.2  | IR       | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 2.51650E+08 | RCPT  | 28.2  | IR       | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 3.59978E+08 | EMTR  | 27.0  | I2       | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 5.83316E+08 | RCPT  | 27.0  | R        | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 6.90942E+08 | EMTR  | 32.4  | I        | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 1.00663E+09 | RCPT  | 103.0 | I        | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 1.32620E+09 | EMTR  | 103.0 | I        | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 2.01327E+09 | RCPT  | 103.0 | I        | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 2.54551E+09 | EMTR  | 103.0 | I        | 42.1    | -143.8   | 42.1    |            |        |           |         |
| 4.02653E+09 | RCPT  | 103.0 | I        | 42.1    | -143.8   | 42.1    |            |        |           |         |

**FIGURE 39 (Continued)**  
**START OUTPUT FOR MINI-SYSTEM**  
**RCPT = UHFCO COMLO**

# BASELINE SYSTEM EMIT-RCPT PAIR INTERFERENCE

EMTR -- SUBS = IMSPU EMPT + = INPYL PORT 3 = IPAX (UNCHANGED)

RCPT -- SUBS = CNI EPT 1 = UHFCO PORT 2 = COMLO (UNCHANGED)

DATA = ANT TO ANT

(CONT'D)

NOTE - R = IN REQD RANGE, I = INTERPOLATED VALUE

| FREQUENCY<br>(HERTZ) | REQD<br>BASE | RANGE<br>RATIO | RECEIVED<br>SUSC LEVEL | JAWBAND       |                    |                      | BROADBAND     |                    |                      | BANDTH<br>FACTOR |
|----------------------|--------------|----------------|------------------------|---------------|--------------------|----------------------|---------------|--------------------|----------------------|------------------|
|                      |              |                |                        | EMI<br>MARGIN | RECEIVED<br>SIGNAL | EMITTER<br>SPC LEVEL | EMI<br>MARGIN | RECEIVED<br>SIGNAL | EMITTER<br>SPC LEVEL |                  |
| 4.94566E+09          | EMTR         | -17.1          | 103.0 I                | -232.7        | -129.0             | 42.1                 |               |                    |                      |                  |
| 6.05366E+09          | RCPT         | -17.1          | 103.0                  | -237.0        | -134.0             | 42.1 I               |               |                    |                      |                  |
| 9.37292E+09          | EMTR         | -17.1          | 103.0 I                | -249.3        | -131.3             | 42.1                 |               |                    |                      |                  |
| 1.61061E+10          | RCPT         | -17.1          | 103.0                  | -243.0        | -140.0             | 42.1 I               |               |                    |                      |                  |
| 1.80000E+10          | EMTR         | -17.1          | 103.0 I                | -244.0        | -141.0             | 42.1                 |               |                    |                      |                  |

INTEGRATED EMI MARGIN = 12.2

FIGURE 39 (Continued)  
TART OUTPUT FOR MINI-SYSTEM  
RCPT = UHFCO COMLO

# BASELINE SYSTEM ENTR-RCPT PAIR INTERFERENCE

ENTR -- SUBS = IMGPD EQPT 5 = OBPYL PORT 2 = DBFX (UNCHANGED)

RCPT -- SUBS = CNI EQPT 1 = UHFCO PORT 2 = COMLO (UNCHANGED)

PATH = ANT TO ANT

NOTE - R = IN RECD RANGE, I = INTERPOLATED VALUE

| FREQUENCY<br>(HERTZ) | FREQ<br>BASE | TRANSFER<br>RATIO | RECEPTOR<br>SUSC LEVEL | NARROWBAND    |                    |                       |               | BROADBAND          |                       |                       |                       |
|----------------------|--------------|-------------------|------------------------|---------------|--------------------|-----------------------|---------------|--------------------|-----------------------|-----------------------|-----------------------|
|                      |              |                   |                        | EMI<br>MARGIN | RECEIVED<br>SIGNAL | EMITTER<br>SPCT LEVEL | EMI<br>MARGIN | RECEIVED<br>SIGNAL | EMITTER<br>SPCT LEVEL | EMITTER<br>SPCT LEVEL | EMITTER<br>SPCT LEVEL |
| 1.06976E+04          | EMTR         | -87.3             | 103.0 I                | -148.2        | -45.2              | 42.1                  |               |                    |                       |                       |                       |
| 1.53680E+04          | RCPT         | -87.3             | 103.0                  | -148.2        | -45.2              | 42.1 I                |               |                    |                       |                       |                       |
| 2.03602E+04          | EMTR         | -87.3             | 103.0 I                | -148.2        | -45.2              | 42.1                  |               |                    |                       |                       |                       |
| 3.07280E+04          | RCPT         | -87.3             | 103.0                  | -148.2        | -45.2              | 42.1 I                |               |                    |                       |                       |                       |
| 3.90795E+04          | EMTR         | -87.3             | 103.0 I                | -148.2        | -45.2              | 42.1                  |               |                    |                       |                       |                       |
| 6.14400E+04          | RCPT         | -87.3             | 103.0                  | -148.2        | -45.2              | 42.1 I                |               |                    |                       |                       |                       |
| 7.50093E+04          | EMTR         | -87.3             | 103.0 I                | -148.2        | -45.2              | 42.1                  |               |                    |                       |                       |                       |
| 1.22880E+05          | RCPT         | -87.3             | 103.0                  | -148.2        | -45.2              | 42.1 I                |               |                    |                       |                       |                       |
| 1.43973E+05          | EMTR         | -87.3             | 103.0 I                | -148.2        | -45.2              | 42.1                  |               |                    |                       |                       |                       |
| 2.45760E+05          | RCPT         | -87.3             | 103.0                  | -148.2        | -45.2              | 42.1 I                |               |                    |                       |                       |                       |
| 2.76342E+05          | EMTR         | -87.3             | 103.0 I                | -148.2        | -45.2              | 42.1                  |               |                    |                       |                       |                       |
| 4.91520E+05          | RCPT         | -87.3             | 103.0                  | -148.2        | -45.2              | 42.1 I                |               |                    |                       |                       |                       |
| 5.30413E+05          | EMTR         | -87.3             | 103.0 I                | -148.2        | -45.2              | 42.1                  |               |                    |                       |                       |                       |
| 9.83040E+05          | RCPT         | -87.2             | 103.0                  | -148.2        | -45.2              | 42.1 I                |               |                    |                       |                       |                       |
| 1.00000E+06          | EMTR         | -87.2             | 103.0 I                | -148.2        | -45.2              | 42.1                  |               |                    |                       |                       |                       |
| 1.01000E+06          | RCPT         | -87.2             | 103.0                  | -148.2        | -45.2              | 42.1 I                |               |                    |                       |                       |                       |
| 1.95410E+06          | EMTR         | -87.1             | 103.0 I                | -148.2        | -45.2              | 42.1                  |               |                    |                       |                       |                       |
| 1.96608E+06          | RCPT         | -87.1             | 103.0                  | -148.2        | -45.2              | 42.1 I                |               |                    |                       |                       |                       |
| 3.75070E+06          | EMTR         | -87.1             | 103.0 I                | -148.2        | -45.2              | 42.1                  |               |                    |                       |                       |                       |
| 3.93215E+06          | RCPT         | -87.1             | 103.0                  | -148.2        | -45.2              | 42.1 I                |               |                    |                       |                       |                       |
| 4.00000E+06          | EMTR         | -87.1             | 103.0 I                | -148.2        | -45.2              | 42.1                  |               |                    |                       |                       |                       |
| 5.00000E+06          | RCPT         | -87.1             | 103.0                  | -148.2        | -45.2              | 42.1 I                |               |                    |                       |                       |                       |
| 7.19910E+06          | EMTR         | -87.1             | 103.0 I                | -148.2        | -45.2              | 42.1                  |               |                    |                       |                       |                       |
| 7.66332E+06          | RCPT         | -87.1             | 103.0                  | -148.2        | -45.2              | 42.1 I                |               |                    |                       |                       |                       |
| 1.38160E+07          | EMTR         | -87.1             | 103.0 I                | -148.2        | -45.2              | 42.1                  |               |                    |                       |                       |                       |
| 1.57286E+07          | RCPT         | -87.1             | 103.0                  | -148.2        | -45.2              | 42.1 I                |               |                    |                       |                       |                       |
| 2.65223E+07          | EMTR         | -87.1             | 103.0 I                | -148.2        | -45.2              | 42.1                  |               |                    |                       |                       |                       |
| 3.18773E+07          | RCPT         | -87.1             | 103.0                  | -148.2        | -45.2              | 42.1 I                |               |                    |                       |                       |                       |
| 5.09069E+07          | EMTR         | -87.1             | 103.0 I                | -148.2        | -45.2              | 42.1                  |               |                    |                       |                       |                       |
| 6.29146E+07          | RCPT         | -87.1             | 103.0                  | -148.2        | -45.2              | 42.1 I                |               |                    |                       |                       |                       |
| 9.77109E+07          | EMTR         | -87.1             | 103.0 I                | -148.2        | -45.2              | 42.1                  |               |                    |                       |                       |                       |
| 1.25629E+08          | RCPT         | -87.1             | 103.0                  | -148.2        | -45.2              | 42.1 I                |               |                    |                       |                       |                       |
| 1.87547E+08          | EMTR         | -87.1             | 103.0 I                | -148.2        | -45.2              | 42.1                  |               |                    |                       |                       |                       |
| 2.51658E+08          | RCPT         | -87.1             | 103.0                  | -148.2        | -45.2              | 42.1 I                |               |                    |                       |                       |                       |
| 3.59978E+08          | EMTR         | -87.1             | 103.0 I                | -148.2        | -45.2              | 42.1                  |               |                    |                       |                       |                       |
| 5.03316E+08          | RCPT         | -87.1             | 103.0                  | -148.2        | -45.2              | 42.1 I                |               |                    |                       |                       |                       |
| 6.96942E+08          | EMTR         | -87.1             | 103.0 I                | -148.2        | -45.2              | 42.1                  |               |                    |                       |                       |                       |
| 1.00663E+09          | RCPT         | -87.1             | 103.0                  | -148.2        | -45.2              | 42.1 I                |               |                    |                       |                       |                       |
| 1.32620E+09          | EMTR         | -87.1             | 103.0 I                | -148.2        | -45.2              | 42.1                  |               |                    |                       |                       |                       |
| 2.01327E+09          | RCPT         | -87.1             | 103.0                  | -148.2        | -45.2              | 42.1 I                |               |                    |                       |                       |                       |
| 2.54551E+09          | EMTR         | -87.1             | 103.0 I                | -148.2        | -45.2              | 42.1                  |               |                    |                       |                       |                       |
| 4.02653E+09          | RCPT         | -87.1             | 103.0                  | -148.2        | -45.2              | 42.1 I                |               |                    |                       |                       |                       |

FIGURE 39 (Continued)  
TART OUTPUT FOR MINI-SYSTEM  
RCPT = UHFCO COMLO

# BASELINE SYSTEM EMT-RCPT PAIR INTERFERENCE

EMTR -- SU9S = IMSPD EOPT 5 = ORPYL PORT 2 = DRFX (UNCHANGED)

RCPT -- SU9S = CNI EOPT 1 = UHFCO PORT 2 = COMLO (UNCHANGED)

PATH = ANT TO ANT (CONTD)

NOTE - R = 1/4 RECD RANGE, I = INTERPOLATED VALUE

| FREQUENCY<br>(HERTZ) | BASE | TRANSFER<br>RATIO | RECEPTOR<br>SU9C LEV'L | NARROWBAND    |                    |                      |                | BROADBAND          |                      |                |                     |
|----------------------|------|-------------------|------------------------|---------------|--------------------|----------------------|----------------|--------------------|----------------------|----------------|---------------------|
|                      |      |                   |                        | EMI<br>MARGIN | RECEIVED<br>SIGNAL | EMITTER<br>SPT LEVEL | EMTR<br>MARGIN | RECEIVED<br>SIGNAL | EMITTER<br>SPT LEVEL | EMTR<br>MARGIN | BANDWIDTH<br>FACTOR |
| 4.300055E+09         | EMTR | -121.7            | 103.0 I                | -212.5        | -109.7             | -2.1                 | -212.5         | -109.7             | -2.1                 | -212.5         | -109.7              |
| 8.05306E+09          | RCPT | -133.0            | 103.0                  | -215.9        | -113.3             | -2.1                 | -215.9         | -113.3             | -2.1                 | -215.9         | -113.3              |
| 9.37722E+09          | EMTR | -133.0            | 103.0 I                | -215.2        | -113.2             | -2.1                 | -215.2         | -113.2             | -2.1                 | -215.2         | -113.2              |
| 7.61061E+10          | RCPT | -142.2            | 103.0                  | -222.5        | -113.3             | -2.1                 | -222.5         | -113.3             | -2.1                 | -222.5         | -113.3              |
| 1.800055E+10         | EMTR | -143.2            | 103.0 I                | -223.9        | -121.3             | -2.1                 | -223.9         | -121.3             | -2.1                 | -223.9         | -121.3              |

INTEGRATED EMI MARGIN = 32.4

FIGURE 39 (Continued)  
TART OUTPUT FOR MINI-SYSTEM  
RCPT = UHFCO COMLO

# BASELINE SYSTEM EMTR-RCPT PAIR INTERFERENCE

EMTR -- SUBS = IMGPD EQPT 5 = 08PYL PORT 3 = 08AX (UNCHANGED)

RCPT -- SUBS = CHI EQPT 1 = UHFCO PORT 2 = COMLO (UNCHANGED)

PATH = ANT TO ANT

NOTE - R = IN REQD RANGE, I = INTERPOLATED VALUE

| FREQUENCY<br>(HERTZ) | BASE | TRANSFER<br>RATIO | RECEPTOR<br>SUSC LEVEL | NARROWBAND    |                    |                       | BROADBAND     |                    |                       |
|----------------------|------|-------------------|------------------------|---------------|--------------------|-----------------------|---------------|--------------------|-----------------------|
|                      |      |                   |                        | EMI<br>MARGIN | RECEIVED<br>SIGNAL | EMITTER<br>SPCT LEVEL | EMI<br>MARGIN | RECEIVED<br>SIGNAL | EMITTER<br>SPCT LEVEL |
| 1.06076E+04          | EMTR | -10.2             | 103.0 I                | -155.1        | -62.1              | 42.1                  | -280.2        | -185.2             | -21.0 IR              |
| 1.53600E+04          | RCPT | -10.2             | 103.0                  | -155.1        | -62.1              | 42.1 I                | -150.7        | -55.7              | 108.4 R               |
| 2.03602E+04          | EMTR | -10.2             | 103.0 I                | -155.1        | -62.1              | 42.1                  | -124.9        | -21.8              | 162.2 IR              |
| 3.07200E+04          | RCPT | -10.2             | 103.0                  | -155.1        | -62.1              | 42.1 I                | -124.0        | -20.9              | 143.2 R               |
| 3.96795E+04          | EMTR | -10.2             | 103.0 I                | -155.1        | -62.1              | 42.1                  | -123.9        | -20.9              | 143.2 R               |
| 6.14400E+04          | RCPT | -10.2             | 103.0                  | -155.1        | -62.1              | 42.1 I                | -123.8        | -20.8              | 143.2 R               |
| 7.50093E+04          | EMTR | -10.2             | 103.0 I                | -155.1        | -62.1              | 42.1                  | -123.7        | -20.7              | 143.2 R               |
| 1.22000E+05          | RCPT | -10.2             | 103.0                  | -155.1        | -62.1              | 42.1 I                | -126.3        | -23.0              | 143.2 R               |
| 1.43973E+05          | EMTR | -10.2             | 103.0 I                | -155.1        | -62.0              | 42.1                  | -126.2        | -23.2              | 143.2 R               |
| 2.45760E+05          | RCPT | -10.2             | 103.0                  | -155.0        | -62.0              | 42.1                  | -115.0        | -15.0              | 53.2 R                |
| 2.7342E+05           | EMTR | -10.2             | 103.0 I                | -155.0        | -62.0              | 42.1                  | -133.8        | -30.8              | 83.2 R                |
| 4.91520E+05          | RCPT | -10.1             | 103.0                  | -154.8        | 39.0               | 112.3 IR              | -136.5        | -33.5              | 80.5 I                |
| 5.30413E+05          | EMTR | -10.1             | 103.0 I                | -154.0        | 39.0               | 143.1 R               | -157.3        | -54.3              | 63.2                  |
| 9.83040E+05          | RCPT | -10.1             | 103.0                  | -154.0        | 39.0               | 143.1 R               | -265.6        | -148.0 I           | -1.0                  |
| 1.00000E+06          | EMTR | -10.1             | 103.0 I                | -154.0        | 39.0               | 143.1 R               |               |                    |                       |
| 1.95419E+06          | RCPT | -10.0             | 103.0                  | -13.9         | 39.2               | 143.1 IR              |               |                    |                       |
| 1.96603E+06          | EMTR | -10.0             | 103.0 I                | -13.8         | 39.2               | 143.1 R               |               |                    |                       |
| 3.75070E+06          | RCPT | -10.9             | 103.0                  | -5.8          | 37.2               | 143.1 R               |               |                    |                       |
| 3.93216E+06          | EMTR | -10.1             | 103.0                  | -6.0          | 37.0               | 143.1 IR              |               |                    |                       |
| 4.00000E+06          | RCPT | -10.5             | 103.0 I                | -6.3          | 36.7               | 143.1 R               |               |                    |                       |
| 5.00000E+06          | EMTR | -10.2             | 103.0                  | -130.9        | -27.9              | 83.1                  |               |                    |                       |
| 7.19918E+06          | RCPT | -11.6             | 103.0                  | -130.3        | -31.3              | 80.4 I                |               |                    |                       |
| 7.86432E+06          | EMTR | -11.7             | 103.0                  | -155.8        | -52.7              | 63.1                  |               |                    |                       |
| 1.36180E+07          | RCPT | -11.9             | 103.0                  | -150.8        | -57.7              | 59.0 I                |               |                    |                       |
| 1.57285E+07          | EMTR | -11.9             | 103.0                  | -150.6        | -72.6              | 42.1                  |               |                    |                       |
| 2.65223E+07          | RCPT | -12.0             | 103.0                  | -181.4        | -78.7              | 42.1 I                |               |                    |                       |
| 3.14573E+07          | EMTR | -12.5             | 103.0 I                | -182.7        | -79.7              | 42.1                  |               |                    |                       |
| 5.00069E+07          | RCPT | -12.1             | 103.0                  | -152.1        | -79.1              | 42.1 I                |               |                    |                       |
| 6.29146E+07          | EMTR | -11.9             | 103.0                  | -17.8         | -7.8               | 42.1                  |               |                    |                       |
| 9.77109E+07          | RCPT | -11.9             | 103.0                  | -165.0        | -62.0              | 42.1 I                |               |                    |                       |
| 1.25829E+08          | EMTR | -10.1             | 103.0                  | -74.2         | -42.1              | 42.1                  |               |                    |                       |
| 1.67574E+08          | RCPT | -8.2              | 29.2 IR                | -21.5         | -46.5              | 42.1 I                |               |                    |                       |
| 2.31658E+08          | EMTR | -9.7              | -27.0 R                | -24.7         | -51.7              | 42.1                  |               |                    |                       |
| 3.59978E+08          | RCPT | -9.8              | -27.0 IR               | -27.5         | -55.0              | 42.1 I                |               |                    |                       |
| 5.03316E+09          | EMTR | -9.5              | -27.0 R                | -121.5        | -89.0              | 42.1                  |               |                    |                       |
| 6.90942E+09          | RCPT | -13.2             | 32.4 I                 | -213.6        | -113.0             | 42.1 I                |               |                    |                       |
| 1.00663E+09          | EMTR | -15.7             | 103.0                  | -220.0        | -117.0             | 42.1                  |               |                    |                       |
| 1.32620E+09          | RCPT | -15.1             | 103.0                  | -223.0        | -120.0             | 42.1 I                |               |                    |                       |
| 2.01327E+09          | EMTR | -16.2             | 103.0                  | -225.7        | -122.0             | 42.1                  |               |                    |                       |
| 2.54551E+09          | RCPT | -16.0             | 133.0 I                | -229.0        | -125.0             | 42.1 I                |               |                    |                       |
| 4.02653E+09          | EMTR | -15.6             | 151.0                  |               |                    |                       |               |                    |                       |

FIGURE 39 (Continued)  
TART OUTPUT FOR MINI-SYSTEM  
RCPT = UHFCO COMLO

# BASELINE SYSTEM EMR-RCPT 301F INTERFERENCE

EMTR -- SUBS = IMGPD FQPT 2 = 032VL PORT 3 = 09AX (UNCHANGED)

RCPT -- SUBS = CNL FQPT 1 = UHFCD PORT 2 = COMLO (UNCHANGED)

PATH = ANT TO ANT (CONTD)

NOTE - R = IN RECD RANGE, I = INTERPOLATED VALUE

| FREQUENCY BASE<br>(HEPTZ) | TRANSFER<br>RATIO | RECEPTOR<br>SUBC LEVEL | -----NARROWBAND----- |                    |               |                    | -----BROADBAND----- |                    |               |                    |
|---------------------------|-------------------|------------------------|----------------------|--------------------|---------------|--------------------|---------------------|--------------------|---------------|--------------------|
|                           |                   |                        | EMI<br>MARGIN        | RECEIVED<br>SIGNAL | EMI<br>MARGIN | RECEIVED<br>SIGNAL | EMI<br>MARGIN       | RECEIVED<br>SIGNAL | EMI<br>MARGIN | RECEIVED<br>SIGNAL |
| 4.40000E+09               | EMTR              | 103.0 I                | -231.3               | -12.3              | -231.3        | -12.3              | -231.3              | -12.3              | -231.3        | -12.3              |
| 8.37000E+09               | RCPT              | 103.0                  | -235.7               | -132.7             | -235.7        | -132.7             | -235.7              | -132.7             | -235.7        | -132.7             |
| 9.37000E+09               | EMTR              | 103.0 I                | -237.0               | -13.0              | -237.0        | -13.0              | -237.0              | -13.0              | -237.0        | -13.0              |
| 1.61000E+10               | RCPT              | 103.0                  | -21.7                | -13.7              | -21.7         | -13.7              | -21.7               | -13.7              | -21.7         | -13.7              |
| 1.00000E+10               | EMTR              | 103.0 I                | -22.0                | -13.0              | -22.0         | -13.0              | -22.0               | -13.0              | -22.0         | -13.0              |

INTEGRATED EMI MARGIN = 13.0

FIGURE 39 (Continued)  
TART OUTPUT FOR MINI-SYSTEM  
RCPT = UHFCD COMLO

# BASELINE SYSTEM EATR-RCPT PAIR INTERFERENCE

EMTR -- SUBS = IMGPD RCPT 6 = CENTL PORT 2 = CLFX (UNCHANGED)

RCPT -- SUBS = CNI ECPT 1 = UHFCD PORT 2 = COMLO (UNCHANGED)

PATH = ANT TO ANT

NOTE - R = IN REQD RANGE, I = INTERPOLATED VALUE

| FREQUENCY<br>(HERTZ) | FREQ<br>BASE | TRANSFER<br>RATIO | RECEPTOR<br>SUSC LEVEL | NARROWBAND    |                    |                       |               | BROADBAND          |                       |               |                   |
|----------------------|--------------|-------------------|------------------------|---------------|--------------------|-----------------------|---------------|--------------------|-----------------------|---------------|-------------------|
|                      |              |                   |                        | EMI<br>MARGIN | RECEIVED<br>SIGNAL | EMITTER<br>SPCT LEVEL | ERY<br>MARGIN | RECEIVED<br>SIGNAL | EMITTER<br>SPCT LEVEL | ERY<br>MARGIN | BOUNDYH<br>FACTOR |
| 1.06076E+04          | EMTR         | -89.2             | 103.0 I                | -150.1        | -47.1              | 42.1                  |               | -170.2             | -21.0 IR              | -80.0         |                   |
| 1.53600E+04          | RCPT         | -89.2             | 103.0                  | -150.1        | -47.1              | 42.1 I                |               | -143.7             | 108.4 R               | -80.0         |                   |
| 2.03622E+04          | EMTR         | -89.2             | 103.0 I                | -150.1        | -47.1              | 42.1                  |               | -109.8             | -5.8                  | 152.2 IR      | -80.0             |
| 3.07200E+04          | RCPT         | -89.2             | 103.0                  | -150.1        | -47.1              | 42.1 I                |               | -108.3             | -5.9                  | 153.2 R       | -80.0             |
| 3.50795E+04          | EMTR         | -89.2             | 103.0 I                | -150.1        | -47.0              | 42.1                  |               | -108.3             | -5.9                  | 153.2 R       | -80.0             |
| 6.14400E+04          | RCPT         | -89.2             | 103.0                  | -150.1        | -47.0              | 42.1 I                |               | -108.8             | -5.8                  | 153.2 IR      | -80.0             |
| 7.50093E+04          | EMTR         | -89.2             | 103.0 I                | -150.1        | -47.0              | 42.1                  |               | -108.7             | -5.7                  | 153.2 R       | -80.0             |
| 1.22860E+05          | RCPT         | -89.2             | 103.0                  | -150.1        | -47.0              | 42.1 I                |               | -108.5             | -5.6                  | 153.2 IR      | -80.0             |
| 1.43973E+05          | EMTR         | -89.2             | 103.0 I                | -150.0        | -47.0              | 42.1                  |               | -108.7             | -5.7                  | 153.2 R       | -80.0             |
| 2.45760E+05          | RCPT         | -89.2             | 103.0                  | -150.0        | -47.0              | 42.1 I                |               | -108.7             | -5.7                  | 153.2 R       | -80.0             |
| 2.76342E+05          | EMTR         | -89.2             | 103.0 I                | -150.0        | -47.0              | 42.1                  |               | -108.7             | -5.7                  | 153.2 R       | -80.0             |
| 4.91500E+05          | RCPT         | -89.1             | 103.0                  | -150.0        | -47.0              | 42.1                  |               | -108.7             | -5.7                  | 153.2 R       | -80.0             |
| 5.30433E+05          | EMTR         | -89.1             | 103.0 I                | -150.0        | -47.0              | 42.1                  |               | -108.7             | -5.7                  | 153.2 R       | -80.0             |
| 9.83840E+05          | RCPT         | -89.1             | 103.0                  | -150.0        | -47.0              | 42.1                  |               | -108.7             | -5.7                  | 153.2 R       | -80.0             |
| 1.00000E+06          | EMTR         | -89.1             | 103.0 I                | -150.0        | -47.0              | 42.1                  |               | -108.7             | -5.7                  | 153.2 R       | -80.0             |
| 1.01808E+06          | RCPT         | -89.1             | 103.0                  | -150.0        | -47.0              | 42.1                  |               | -108.7             | -5.7                  | 153.2 R       | -80.0             |
| 1.95410E+06          | EMTR         | -89.0             | 103.0 I                | -150.0        | -47.0              | 42.1                  |               | -108.7             | -5.7                  | 153.2 R       | -80.0             |
| 1.96608E+06          | RCPT         | -89.0             | 103.0                  | -150.0        | -47.0              | 42.1                  |               | -108.7             | -5.7                  | 153.2 R       | -80.0             |
| 3.75070E+06          | EMTR         | -88.9             | 103.0 I                | -150.0        | -47.0              | 42.1                  |               | -108.7             | -5.7                  | 153.2 R       | -80.0             |
| 3.53216E+06          | RCPT         | -88.7             | 103.0                  | -150.0        | -47.0              | 42.1                  |               | -108.7             | -5.7                  | 153.2 R       | -80.0             |
| 4.00000E+06          | EMTR         | -88.5             | 103.0 I                | -150.0        | -47.0              | 42.1                  |               | -108.7             | -5.7                  | 153.2 R       | -80.0             |
| 5.00000E+06          | RCPT         | -88.5             | 103.0                  | -150.0        | -47.0              | 42.1                  |               | -108.7             | -5.7                  | 153.2 R       | -80.0             |
| 7.19910E+06          | EMTR         | -91.6             | 103.0 I                | -111.7        | -2.7               | 63.1                  |               | -114.7             | -14.6                 | 83.2          | -3.0              |
| 7.86432E+06          | RCPT         | -92.5             | 103.0                  | -115.1        | -12.1              | 60.4 I                |               | -117.6             | -16.6                 | 80.5 I        | -2.6              |
| 1.38180E+07          | EMTR         | -95.7             | 103.0 I                | -136.6        | -33.5              | 63.1                  |               | -138.1             | -35.1                 | 63.2          | -1.6              |
| 1.57286E+07          | RCPT         | -97.5             | 103.0                  | -141.6        | -36.9              | 59.0 I                |               | -149.5             | -349.5                | -168.0 I      | -1.0              |
| 2.65223E+07          | EMTR         | -102.7            | 103.0 I                | -161.6        | -58.5              | 42.1                  |               | -168.0             | -168.0                | -168.0        | -1.0              |
| 3.14573E+07          | RCPT         | -101.4            | 103.0                  | -162.3        | -59.3              | 42.1 I                |               | -168.0             | -168.0                | -168.0        | -1.0              |
| 5.09069E+07          | EMTR         | -102.7            | 103.0 I                | -163.6        | -60.9              | 42.1                  |               | -168.0             | -168.0                | -168.0        | -1.0              |
| 6.29146E+07          | RCPT         | -102.0            | 103.0                  | -162.9        | -59.9              | 42.1 I                |               | -168.0             | -168.0                | -168.0        | -1.0              |
| 9.77109E+07          | EMTR         | -97.7             | 103.0 I                | -158.6        | -51.2              | 42.1                  |               | -168.0             | -168.0                | -168.0        | -1.0              |
| 1.22029E+08          | RCPT         | -94.4             | 103.0                  | -145.0        | -42.4              | 42.1 I                |               | -168.0             | -168.0                | -168.0        | -1.0              |
| 1.87547E+08          | EMTR         | -89.2             | 28.2 IR                | -55.0         | -26.9              | 42.1                  |               | -168.0             | -168.0                | -168.0        | -1.0              |
| 2.51656E+08          | RCPT         | -71.5             | -27.0 R                | -2.4          | -29.4              | 42.1 I                |               | -168.0             | -168.0                | -168.0        | -1.0              |
| 3.59974E+08          | EMTR         | -77.7             | -27.0 IR               | -5.5          | -32.9              | 42.1                  |               | -168.0             | -168.0                | -168.0        | -1.0              |
| 5.03316E+08          | RCPT         | -77.5             | -27.0 R                | -8.4          | -35.4              | 42.1 I                |               | -168.0             | -168.0                | -168.0        | -1.0              |
| 6.30942E+08          | EMTR         | -112.0            | 32.4 I                 | -102.3        | -59.9              | 42.1 I                |               | -168.0             | -168.0                | -168.0        | -1.0              |
| 1.00663E+09          | RCPT         | -133.5            | 103.0                  | -194.7        | -91.1              | 42.1 I                |               | -168.0             | -168.0                | -168.0        | -1.0              |
| 1.32620E+09          | EMTR         | -133.9            | 103.0 I                | -200.9        | -97.6              | 42.1                  |               | -168.0             | -168.0                | -168.0        | -1.0              |
| 2.01327E+09          | RCPT         | -143.0            | 103.0                  | -244.4        | -101.4             | 42.1 I                |               | -168.0             | -168.0                | -168.0        | -1.0              |
| 2.54551E+09          | EMTR         | -143.5            | 103.0 I                | -206.5        | -103.2             | 42.1                  |               | -168.0             | -168.0                | -168.0        | -1.0              |
| 4.02653E+09          | RCPT         | -143.5            | 103.0                  | -210.5        | -107.5             | 42.1 I                |               | -168.0             | -168.0                | -168.0        | -1.0              |

FIGURE 39 (Continued)  
TART OUTPUT FOR MINI-SYSTEM  
RCPT = UHFCD COMLO

BASELINE SYSTEM FMT-RCPT = AIR INTERFERENCE

EMTR -- SUBS = INGPU EPT 6 = DEVL PORT 2 = CLFX (UNCHANGED)

RCPT -- SUBS = CNI FORT 1 = UHF20 PORT 2 = COMLO (UNCHANGED)

PAT = ANT TO ANT (CONTD)

NOTE - R = IN P200 RANGE, I = INTERPOLATED VALUE

| FREQUENCY<br>(MHz) | BASE | TRANSFER<br>RATIO | RECEIVER<br>SUBS LEVEL | NA-RANGE      |                |              |                | BROADBAND     |                |              |                |
|--------------------|------|-------------------|------------------------|---------------|----------------|--------------|----------------|---------------|----------------|--------------|----------------|
|                    |      |                   |                        | EMI<br>MARGIN | RFCV<br>SIGNAL | EMI<br>LEVEL | RCPT<br>SIGNAL | EMI<br>MARGIN | RCPT<br>SIGNAL | EMI<br>LEVEL | RCPT<br>SIGNAL |
| 1.83367E+09        | EMT3 | -1.1.3            | 1.3.1 I                | -212.1        | -109.1         | 42.1         |                |               |                |              |                |
| 6.32304E+09        | RCPT | -1.1.3            | 1.3.1 I                | -210.3        | -113.1         | 42.1         |                |               |                |              |                |
| 9.37792E+09        | EMT3 | -1.1.3            | 1.3.1 I                | -217.3        | -111.1         | 42.1         |                |               |                |              |                |
| 1.81000E+10        | RCPT | -1.1.3            | 1.3.1 I                | -223.3        | -119.1         | 42.1         |                |               |                |              |                |
| 1.80000E+10        | EMT3 | -1.1.3            | 1.3.1 I                | -223.3        | -120.1         | 42.1         |                |               |                |              |                |

INTEGRATED EMI MARGIN = 32.8

FIGURE 39 (Continued)  
TART OUTPUT FOR MINI-SYSTEM  
RCPT = UHF20 COMLO

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# BASELINE SYSTEM ENTR-RCPT PAIR INTERFERENCE

ENTR -- SUBS = IMGPO EOPT 5 = CENTL PORT 3 = CLAX (UNCHANGED)

RCPT -- SUBS = CNI EOPT 1 = UHFCC PORT 2 = COMLO (UNCHANGED)

PATH = ANT TO ANT

NOTE - R = IN REQD RANGE, I = INTERPOLATED VALUE

| FREQUENCY<br>(HERTZ) | REQ<br>BASE | TRANSFER<br>RATIO | RECEPTOR<br>SUSC LEVEL | NARROWBAND     |                    |                      |        | BROADBAND          |                      |                |                    |
|----------------------|-------------|-------------------|------------------------|----------------|--------------------|----------------------|--------|--------------------|----------------------|----------------|--------------------|
|                      |             |                   |                        | ENTR<br>MARGIN | RECEIVED<br>SIGNAL | EMITTER<br>SPT LEVEL | MARGIN | RECEIVED<br>SIGNAL | EMITTER<br>SPT LEVEL | ENTR<br>MARGIN | RECEIVED<br>SIGNAL |
| 1.06076E+04          | ENTR        | -116.9            | 103.0 I                | -177.0         | -74.0              | 42.1                 |        | -197.9             | -21.0 IR             |                | -58.8              |
| 1.51600E+04          | RCPT        | -115.9            | 103.0                  | -177.0         | -74.0              | 42.1 I               |        | -171.4             | -68.4                | 100.4 R        | -68.8              |
| 2.03602E+04          | ENTR        | -116.9            | 103.0 I                | -177.0         | -74.0              | 42.1                 |        | -137.6             | -34.6                | 142.2 IR       | -68.8              |
| 3.07200E+04          | RCPT        | -115.9            | 103.0                  | -177.0         | -74.0              | 42.1 I               |        | -136.7             | -33.7                | 143.2 R        | -68.8              |
| 3.90795E+04          | ENTR        | -116.9            | 103.0 I                | -177.0         | -74.0              | 42.1                 |        | -136.6             | -33.6                | 143.2 R        | -68.8              |
| 5.14400E+04          | RCPT        | -115.9            | 103.0                  | -177.0         | -74.0              | 42.1 I               |        | -136.5             | -33.5                | 143.2 IR       | -68.8              |
| 7.50093E+04          | ENTR        | -116.9            | 103.0 I                | -177.0         | -74.0              | 42.1                 |        | -136.3             | -33.3                | 143.2 R        | -68.8              |
| 1.22680E+05          | RCPT        | -115.9            | 103.0                  | -177.0         | -74.0              | 42.1 I               |        | -137.2             | -34.2                | 143.2 IR       | -68.8              |
| 1.43973E+05          | ENTR        | -116.9            | 103.0 I                | -177.0         | -74.0              | 42.1                 |        | -137.4             | -34.4                | 143.2 R        | -68.8              |
| 2.45760E+05          | RCPT        | -115.9            | 103.0                  | -177.0         | -74.7              | 42.1 I               |        | -236.3             | -135.2               | 53.2 R         | -68.8              |
| 2.76342E+05          | ENTR        | -116.9            | 103.0 I                | -177.0         | -74.7              | 42.1                 |        | -145.0             | -42.0                | 83.2           | -3.0               |
| 4.91520E+05          | RCPT        | -115.9            | 103.0                  | -177.0         | -74.7              | 42.1                 |        | -168.3             | -45.0                | 80.5 I         | -2.6               |
| 5.30413E+05          | ENTR        | -116.6            | 103.0 I                | -107.5         | -4.5               | 112.3 IR             |        | -169.5             | -65.5                | 63.2           | -1.6               |
| 9.63040E+05          | RCPT        | -116.0            | 103.0                  | -76.7          | 20.3               | 143.1 R              |        | -383.5             | -277.0               | -168.0 I       | -1.0               |
| 1.00000E+06          | ENTR        | -116.4            | 103.0 I                | -76.7          | 20.3               | 143.1 R              |        |                    |                      |                |                    |
| 1.01808E+06          | RCPT        | -115.6            | 103.0                  | -76.5          | 20.3               | 143.1 R              |        |                    |                      |                |                    |
| 1.95410E+06          | ENTR        | -115.7            | 103.0 I                | -76.5          | 20.3               | 143.1 R              |        |                    |                      |                |                    |
| 1.36608E+06          | RCPT        | -110.7            | 103.0                  | -72.0          | 26.0               | 143.1 R              |        |                    |                      |                |                    |
| 3.75070E+06          | ENTR        | -117.1            | 103.0 I                | -77.2          | 25.0               | 143.1 IR             |        |                    |                      |                |                    |
| 3.93216E+06          | RCPT        | -117.3            | 103.0                  | -77.5          | 21.5               | 143.1 R              |        |                    |                      |                |                    |
| 4.00000E+06          | ENTR        | -117.6            | 103.0 I                | -142.1         | -39.1              | 83.1                 |        |                    |                      |                |                    |
| 5.00000E+06          | RCPT        | -128.4            | 103.0                  | -145.5         | -42.5              | 80.4 I               |        |                    |                      |                |                    |
| 7.19910E+06          | ENTR        | -122.2            | 103.0 I                | -167.0         | -63.9              | 63.1                 |        |                    |                      |                |                    |
| 7.86432E+06          | RCPT        | -122.9            | 103.0                  | -172.0         | -68.9              | 59.0 I               |        |                    |                      |                |                    |
| 1.30180E+07          | ENTR        | -127.1            | 103.0 I                | -192.0         | -89.0              | 42.1                 |        |                    |                      |                |                    |
| 1.57246E+07          | RCPT        | -127.9            | 103.0                  | -193.6         | -89.2              | 42.1 I               |        |                    |                      |                |                    |
| 2.65223E+07          | ENTR        | -131.1            | 103.0 I                | -193.9         | -90.9              | 42.1 I               |        |                    |                      |                |                    |
| 3.14573E+07          | RCPT        | -131.8            | 103.0                  | -193.9         | -90.9              | 42.1 I               |        |                    |                      |                |                    |
| 5.09069E+07          | ENTR        | -133.0            | 103.0 I                | -193.9         | -90.9              | 42.1 I               |        |                    |                      |                |                    |
| 6.29146E+07          | RCPT        | -132.4            | 103.0                  | -193.9         | -90.9              | 42.1 I               |        |                    |                      |                |                    |
| 9.77109E+07          | ENTR        | -124.1            | 103.0 I                | -189.0         | -80.0              | 42.1                 |        |                    |                      |                |                    |
| 1.25829E+08          | RCPT        | -115.3            | 103.0                  | -176.2         | -73.2              | 42.1 I               |        |                    |                      |                |                    |
| 1.87547E+08          | ENTR        | -99.4             | 20.2 IR                | -65.4          | -51.2              | 42.1                 |        |                    |                      |                |                    |
| 2.51658E+08          | RCPT        | -101.3            | -27.0 R                | -32.8          | -59.6              | 42.1 I               |        |                    |                      |                |                    |
| 3.59970E+08          | ENTR        | -101.0            | -27.0 IR               | -35.9          | -62.9              | 42.1                 |        |                    |                      |                |                    |
| 5.03316E+08          | RCPT        | -107.3            | -27.0 R                | -38.4          | -65.0              | 42.1 I               |        |                    |                      |                |                    |
| 6.90942E+08          | ENTR        | -142.4            | 32.4 I                 | -132.7         | -100.2             | 42.1                 |        |                    |                      |                |                    |
| 1.00663E+09          | RCPT        | -161.9            | 103.0                  | -224.8         | -121.5             | 42.1 I               |        |                    |                      |                |                    |
| 1.32620E+09          | ENTR        | -170.3            | 103.0 I                | -231.2         | -126.2             | 42.1                 |        |                    |                      |                |                    |
| 2.01327E+09          | RCPT        | -173.3            | 103.0                  | -234.9         | -131.9             | 42.1 I               |        |                    |                      |                |                    |
| 2.54551E+09          | ENTR        | -170.0            | 103.0 I                | -236.9         | -133.9             | 42.1                 |        |                    |                      |                |                    |
| 4.02653E+09          | RCPT        | -180.0            | 103.0                  | -240.5         | -137.5             | 42.1 I               |        |                    |                      |                |                    |

FIGURE 39 (Continued)  
TART OUTPUT FOR MINI-SYSTEM  
RCPT = UHFCC COMLO

# BASELINE SYSTEM EMT-RCPT PAIR INTERFERENCE

EMTR -- SUBS = IMCPD EOPT 6 = GENTL PORT 3 = CLAX (UNCHANGED)

RCPT -- SUBS = CNI EOPT 1 = UHFCD PORT 2 = CONLO (UNCHANGED)

PATH = ANT TO ANT

(CONTO)

NOTE - R = 14 RECD RANGE, I = INTERPOLATED VALUE

| FREQUENCY<br>(MHz) | FREQ<br>BASE | TRANSFCK<br>RATIO | RECEPTOR<br>SUSC LEVEL | NARROWBAND    |                    |                      | BROADBAND     |                    |                      |
|--------------------|--------------|-------------------|------------------------|---------------|--------------------|----------------------|---------------|--------------------|----------------------|
|                    |              |                   |                        | EMI<br>MARGIN | RECEIVED<br>SIGNAL | EMITTER<br>SPT LEVEL | EMI<br>MARGIN | RECEIVED<br>SIGNAL | EMITTER<br>SPT LEVEL |
| 4.99565E+09        | EMTR         | -10.0             | 133.0 I                | -2.2.3        | -130.2             | -2.1                 |               |                    |                      |
| 8.03306E+09        | RCPT         | -16.0             | 133.0                  | -2.5.3        | -143.9             | 42.1 I               |               |                    |                      |
| 9.37792E+09        | EMTR         | -16.0             | 133.0 I                | -2.5.2        | -145.2             | 42.1                 |               |                    |                      |
| 1.61061E+10        | RCPT         | -19.0             | 133.0                  | -2.2.3        | -149.3             | 42.1 I               |               |                    |                      |
| 1.83003E+10        | EMTR         | -19.0             | 133.0 I                | -2.3.0        | -150.3             | 42.1                 |               |                    |                      |

INTERPOLATED EMI MARGIN = 2.0

FIGURE 39 (Continued)  
TART OUTPUT FOR MINI-SYSTEM  
RCPT = UHFCD COMLO

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# BASELINE SYSTEM ENTR-RCPT PAIR INTERFERENCE

EMTR -- SUBS = RDALT EMPT 7 = RTUNT PORT 2 = RFOUT (UNCHANGED)

RCPT -- SUBS = CNI EMPT 1 = UNFCO PORT 2 = COMLO (UNCHANGED)

PATH = ANT TO ANT

NOTE - R = IN REQD RANGE, I = INTERPOLATED VALUE

| FREQUENCY<br>(HERTZ) | FREQ<br>BASE | TRANSFER<br>RATIO | RECEPTOR<br>SUSC LEVEL | NARROWBAND    |                    |               |                    | BROADBAND     |                    |               |                    |
|----------------------|--------------|-------------------|------------------------|---------------|--------------------|---------------|--------------------|---------------|--------------------|---------------|--------------------|
|                      |              |                   |                        | EMI<br>MARGIN | RECEIVED<br>SIGNAL | EMI<br>MARGIN | RECEIVED<br>SIGNAL | EMI<br>MARGIN | RECEIVED<br>SIGNAL | EMI<br>MARGIN | RECEIVED<br>SIGNAL |
| 1.06076E+04          | EMTR         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 1.53600E+04          | RCPT         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 2.03602E+04          | EMTR         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 3.07200E+04          | RCPT         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 3.90795E+04          | EMTR         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 6.14400E+04          | RCPT         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 7.50093E+04          | EMTR         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 1.22800E+05          | RCPT         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 1.43973E+05          | EMTR         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 2.45760E+05          | RCPT         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 2.76342E+05          | EMTR         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 4.91500E+05          | RCPT         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 5.30413E+05          | EMTR         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 9.83040E+05          | RCPT         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 1.01400E+06          | EMTR         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 1.95410E+06          | RCPT         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 3.96600E+06          | EMTR         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 3.75070E+06          | RCPT         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 3.93216E+06          | EMTR         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 7.19910E+06          | RCPT         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 7.86432E+06          | EMTR         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 1.38100E+07          | RCPT         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 1.57206E+07          | EMTR         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 2.65223E+07          | RCPT         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 3.14573E+07          | EMTR         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 5.09069E+07          | RCPT         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 6.29146E+07          | EMTR         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 9.77109E+07          | RCPT         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 1.25829E+08          | EMTR         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 1.07547E+08          | RCPT         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 2.51658E+08          | EMTR         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 3.59978E+08          | RCPT         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 5.03316E+08          | EMTR         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 6.90942E+08          | RCPT         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 1.00663E+09          | EMTR         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 1.32622E+09          | RCPT         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 2.01327E+09          | EMTR         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 2.54551E+09          | RCPT         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 4.02633E+09          | EMTR         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 4.20000E+09          | RCPT         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 4.30000E+09          | EMTR         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |
| 4.40000E+09          | RCPT         | -89.9             | 103.0 I                | -149.9        | -46.9              | 43.0          | 43.0               |               |                    |               |                    |

FIGURE 39 (Continued)  
TART OUTPUT FOR MINI-SYSTEM  
RCPT = UHFCO COMLO

# BASISLINE SYSTEM - MTS-RCPT AIR INTERFERENCE

EMTR -- SUBS = M0ALT F0PT 1 = RTUNT PORT 2 = RFOUT (UNCHANGED)

RCPT -- SUBS = CHL F0PT 1 = UHFCC PORT 2 = COMLO (UNCHANGED)

PATH = ANT TO AJT

(CONTD)

NOTE - R = IN RECD RANGE, I = INTERPOLATED VALUE

| FREQUENCY<br>(MHZ) | FREQ<br>BASE | TRANSMIT<br>RATIO | RECEIVER<br>SUSC LEVEL | NARROWBAND |                    |                       |        | BROADBAND |                    |                       |                   |
|--------------------|--------------|-------------------|------------------------|------------|--------------------|-----------------------|--------|-----------|--------------------|-----------------------|-------------------|
|                    |              |                   |                        | FMI        | RECEIVED<br>SIGNAL | EMITTER<br>SPCT LEVEL | MARGIN | FMI       | RECEIVED<br>SIGNAL | EMITTER<br>SPCT LEVEL | BANDWTH<br>FACTOR |
| 4.85505E+09        | EMTP         | -12.0             | 103.0 I                | -200.0     | -10.0              | 43.0                  |        |           |                    |                       |                   |
| 6.03305E+09        | RCPT         | -12.0             | 103.0                  | -152.3     | -70.3              | 73.7 I                | -37.0  | -336.6    | -200.6 I           | 19.1                  |                   |
| 9.37792E+09        | EMTR         | -12.0             | 103.0 I                | -14.3      | -71.3              | 63.0                  | -19.0  | -91.6     | 43.0               | 19.7                  |                   |
| 1.61063E+10        | RCPT         | -12.0             | 103.0                  | -129.0     | -72.0              | 83.0 I                | -19.0  | -93.9     | 43.0 I             | 22.1                  |                   |
| 1.85003E+10        | EMTR         | -12.0             | 103.0 I                | -150.0     | -73.0              | 83.0                  | -19.0  | -94.0     | 43.0               | 22.0                  |                   |

INTEGRATED FMI MARG IN = 30.3

FIGURE 39 (Continued)  
TART OUTPUT FOR MINI-SYSTEM  
RCPT = UHFCC COMLO

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# ENVIRONMENTAL FIELD INTERFERENCE SUMMARY

RCPT -- SUBS = CNI EOPT 1 = UHFCC PORT 2 = COMLO

| FREQUENCY<br>(MERTZ) | EMI<br>MARGIN | RECEPTOR<br>SUSC LEV | RECEIVED<br>SIG-03 | SIG-03     | SIG-03 |
|----------------------|---------------|----------------------|--------------------|------------|--------|
| 7.53000E+03          | 117.1         | 103.0                | 220.1              | 1.0110E+11 |        |
| 1.53600E+04          | 106.1         | 103.0                | 203.1              | 2.9299E+10 |        |
| 3.07200E+04          | 93.0          | 103.0                | 190.0              | 1.3274E+09 |        |
| 6.14400E+04          | 91.0          | 103.0                | 180.0              | 1.0831E+09 |        |
| 1.22880E+05          | 70.3          | 103.0                | 177.3              | 1.3071E+08 |        |
| 2.45760E+05          | 66.3          | 103.0                | 171.3              | 3.0606E+08 |        |
| 4.91520E+05          | 62.3          | 103.0                | 165.3              | 1.0439E+08 |        |
| 9.83040E+05          | 53.0          | 103.0                | 150.0              | 1.3330E+07 |        |
| 1.96608E+06          | 41.2          | 103.0                | 140.2              | 1.0274E+07 |        |
| 3.93216E+06          | 29.5          | 103.0                | 132.7              | 1.2925E+06 |        |
| 7.86432E+06          | 18.6          | 103.0                | 121.6              | 1.1973E+06 |        |
| 1.57286E+07          | 9.5           | 103.0                | 111.5              | 3.7510E+05 |        |
| 3.14573E+07          | 0             | 103.0                | 103.0              | 1.5504E+05 |        |
| 6.29146E+07          | -0.5          | 103.0                | 102.5              | 1.3339E+05 |        |
| 1.25829E+08          | 33.6          | 103.0                | 135.7              | 5.8030E+06 |        |
| 2.51658E+08          | 195.0         | -27.0                | 15.0               | 7.9067E+07 |        |
| 5.03316E+08          | 160.9         | -27.0                | 139.9              | 9.0834E+06 |        |
| 1.00663E+09          | -81.0         | 103.0                | 22.0               | 1.2504E+01 |        |
| 2.01327E+09          | -103.6        | 103.0                | -0.5               | 9.3739E-01 |        |
| 4.02653E+09          | -115.6        | 103.0                | -12.6              | 2.3435E-01 |        |
| 8.05306E+09          | -1103.0       | 103.0                | -1030.0            | 0.         |        |
| 1.61061E+10          | -1103.0       | 103.0                | -1000.0            | 0.         |        |
| 3.22123E+10          | -1103.0       | 103.0                | -1000.0            | 0.         |        |

FIGURE 39 (Continued)  
TART OUTPUT FOR MINI-SYSTEM  
RCPT = UHFCC COMLO

BASELINE SYSTEM INTERFERENCE FROM TOTAL SIGNAL

RCPT -- SURS = CNI EQPT 1 = UHFCD PORT 2 = COMLO (UNCHANGED)

NOTE - R = IN REQD RANGE, I = INTERPOLATED VALUE

| FREQUENCY<br>(HERTZ) | RECEPTOR<br>SUSC LEVEL | EMI<br>MARGIN | TOTAL RCVD<br>SIGNAL |
|----------------------|------------------------|---------------|----------------------|
| 7.830E+03            | 103.0                  | 7.0           | 110.1                |
| 1.536E+04            | 103.0                  | 1.0           | 104.0                |
| 3.072E+04            | 103.0                  | -3.0          | 98.0                 |
| 6.144E+04            | 103.0                  | -11.0         | 92.0                 |
| 1.228E+05            | 103.0                  | -14.4         | 84.0                 |
| 2.457E+05            | 103.0                  | -17.4         | 85.0                 |
| 4.915E+05            | 103.0                  | -20.4         | 82.7                 |
| 9.830E+05            | 103.0                  | -24.9         | 78.1                 |
| 1.966E+06            | 103.0                  | -33.6         | 72.0                 |
| 3.932E+06            | 103.0                  | -35.7         | 67.0                 |
| 7.864E+06            | 103.0                  | -42.2         | 60.0                 |
| 1.572E+07            | 103.0                  | -47.3         | 55.0                 |
| 3.145E+07            | 103.0                  | -51.1         | 51.9                 |
| 6.291E+07            | 103.0                  | -51.7         | 51.3                 |
| 1.258E+08            | 103.0                  | -54.7         | 51.3                 |
| 2.516E+08            | -27.0 R                | 105.0         | 79.0                 |
| 5.032E+08            | -27.0 R                | 96.9          | 59.0                 |
| 1.006E+09            | 103.0                  | -92.0         | 11.0                 |
| 2.013E+09            | 103.0                  | -103.3        | -3                   |
| 4.026E+09            | 103.0                  | -109.2        | -8.2                 |
| 8.053E+09            | 103.0                  | -124.3        | -71.3                |
| 1.610E+10            | 103.0                  | -110.0        | -100.0               |
| 3.221E+10            | 103.0                  | -110.0        | -100.0               |

TOTAL INTEGRATED EMI MARGIN = +1.2

FIGURE 39 (Continued)  
TART OUTPUT FOR MINI-SYSTEM  
RCPT = UHFCD COMLO

## Section 6

### PROGRAM OPERATION

This section discusses the operation of IEMCAP including initial stages of implementation, maintaining the program, termination and restart, and FORTRAN source updating.

#### 6.1 PROGRAM IMPLEMENTATION

Procedures for operating the two sections of IEMCAP are given below. As there will be different methods of operation at different installations, the step-by-step procedure outlined below describes one method of operation on a CDC 6600 with suggested alternatives.

##### 6.1.1 Storing the Source Program

IEMCAP is comprised of approximately 16,000 FORTRAN source statements, 9000 for IDIPR and 7000 for TART. Hence, the source program is usually stored on a disk file to avoid having to submit five boxes of cards each time the program is run. The details of doing this will vary with different computers and with different installations. The implementation used on the CDC 6600 was to store each section of the program on a disk file using MODIFY, a source file library editing program that maintains and updates a system of programs in any source language. If the user is not familiar with the method used at his installation he should check with his computer systems personnel. It is not absolutely necessary to store the source program, but merely a convenience, especially if any updating of the FORTRAN source is required.

An alternative to storing the source program is to store only the compiled binary out, as discussed below.

##### 6.1.2 Compiling the Program and Storing the Binary Output

IDIPR and TART are compiled using a FORTRAN compiler. The binary relocatable output for IDIPR and TART is saved, and this binary file is loaded and executed. On the CDC 6600, the output of the compiler is a file called "LGO." It is saved after compilation, and all future runs are made by loading and executing this file. If changes are made to the source, it must be recompiled. On CDC 6600, the MODIFY program is invoked to transfer the source file from the program library to a file called "COMPILE" which is input to the compiler. A binary file is created by the compiler using the control statement RUN23 to invoke the CDC FORTRAN compiler, Version 2.3 or by FTN to invoke the FORTRAN extended compiler, Version 3.

##### 6.1.3 Executing the Program

Once the source file has been compiled the binary file is loaded and executed for each run. The control statement to execute the program varies with the computer. On the CDC 6600, a binary relocatable file can be loaded and executed by the job control statement, LGO.

## APPENDIX A

### COMPUTED GENERATED SPECIFICATION TEST METHODS

#### A.1 PURPOSE AND SCOPE

The following test methods are recommended as those which will allow the program user to correlate measured data on equipment with the specification limits generated by the Specification Generation Routine (SGR). The measured data will also be fed back into the program for more detailed system compatibility analysis.

The recommendations include a system test method and subsystem/equipment test methods. The system test method includes equipment interaction tests and a limited number of critical line tests. The subsystem/equipment test methods include conducted emission on each interconnect wire, conducted susceptibility on each wire, radiated emission from equipment cases, and radiated susceptibility of equipment cases.

#### A.2 SYSTEM TEST METHODS

The test methods specified in MIL-E-6051 are recommended for use as system test requirements. The system tests will consist of equipment interactions and critical line measurements. The definition of critical lines will be established by the user and may include any safety margins the user chooses to select. The test criteria, including definition of critical lines and test levels, will be obtained from the results of the system computerized analysis and subsystem/equipment tests. Standard voltage and current measurement techniques can be tailored to the specific line to be measured.

These tests are concerned with only intrasystem compatibility therefore no system emission tests are to be performed. The intrasystem environment is defined by the computer program analysis and the subsystem test data, thereby eliminating the need to measure the system environment parameters during the system tests. The system tests will include only those cases where the analyses indicate questionable operational margins.

#### A.3 SUBSYSTEM/EQUIPMENT TEST METHODS

##### A.3.1 TEST LIMIT GENERATION

The test limits for subsystem/equipment testing are based on allowable extraneous emissions from equipment interconnect wiring and cases, and susceptibility of the wiring and cases to levels equal to the effects of these emissions. The interconnect wiring consists of all types of wiring including power wiring, signal wiring between equipments, and coax cables between RF equipment and their associated antennas. The computer program will generate an emission and susceptibility limit for each emitter and/or receptor depending on circuit characteristics. The limits are set for each

The user should decide before submitting the run what files he wishes to save upon abnormal termination and supply the proper control cards. In all cases, for IDIPR OLD or MODIFY runs or any TART run, care should be exercised to save the input files so they can be re-used once the nature of the abnormal termination is determined. On the CDC 6600, a special control card, EXIT, allows the user to specify the disposition of all files upon an abnormal termination; hence, all old files and any new files to be created during the run can be saved.

Restarting a program after an abnormal termination will depend upon several factors. Hence, the user must determine the nature of the termination and decide which of the below solutions is most expeditious and cost effective for his case. The three suggested restarts are given below:

1. Re-submit with no change. This is done if the factors are as follows:
  - a. The cause of the termination was outside the user's realm, such as the computer "going down."
  - b. Little execution was done prior to termination.
  - c. No new data sets were saved.
  - d. Even though partial new data sets were saved, the total job time is small enough to make resubmitting more efficient than setting up a new data set structure to use the partially created data sets.
2. Make data correction and re-submit with same data set up. If the nature of the termination is determined to have been caused by bad data but the factors describing the case are essentially as described in (1), the data should be corrected and the job resubmitted.
3. Make new data file set up definition and re-submit. The user may wish to use the partial output of the abnormally terminated run in the following cases:
  - a. The execution time has been considerable.
  - b. Partially created data sets have been saved.
  - c. A re-start is available as either a MODIFY run to change the data on the ISF or an OLD run using the ISF unchanged, as discussed in Sections 3.1.2 and 3.3. As an example, assume that during an IDIPR NEW run, 40 equipments with a total of 250 ports had initial spectra successfully generated, but on the forty-first and last equipment, an abnormal termination occurred. If the ISF was saved by means of an abnormal termination command,

the ISF could be used as input to a MODIFY run with cards used to correct the error in the forty-first equipment data. However, the work files are not useable on an abnormal termination, and these must be regenerated on the MODIFY run for all the equipments.

#### 6.4 SOURCE FILE UPDATING

If a change in the source file is required or perhaps an entire routine is being replaced, the following steps are required:

1. Recreate the source file. This can be done most expeditiously through a file editing routine such as CDC 6600 MODIFY. However, the changes could be made to the original card deck and procedures for initiating the program followed.
2. Compile only the changes routines and update the binary deck. The source decks which have been changed would be compiled and a binary file management routine (such as the CDC 6600 LIBEDIT) used to replace the changed routines in the binary files. An alternative to this is to recompile all routines and save a new binary file.

## APPENDIX A

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These tests are concerned with only intrasystem compatibility therefore no system emission tests are to be performed. The intrasystem environment is defined by the computer program analysis and the subsystem test data, thereby eliminating the need to measure the system environment parameters during the system tests. The system tests will include only those cases where the analyses indicate questionable operational margins.

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input or output terminal of the equipment. The mechanics for generating these limits are described in the paragraphs on SGR.

The emitter limits are related to MIL-STD-461 limits in that the basic emission curves of MIL-STD-461 are adjusted by the computer program to apply to a specific equipment port. The receptor limits are based on the receptor circuit bandwidth, threshold sensitivity levels, and the system environment due to the emitter effects.

The emission limits for equipment interconnect wires are specified in terms of both broadband and CW current levels versus a given frequency spectrum conducted on each wire. Each wire has unique limits. The susceptibility limits are plotted as the equivalent CW current levels versus frequency that the receptor wires must tolerate. There are no limits generated by the program directly relating to the radiated limits of MIL-STD-461 for wiring.

Emissions from equipment cases are specified in terms of the radiated field existing 1 meter from the case. The limits are adjusted from the limits of test method RE02 of MIL-STD-461 and are tailored to each case depending on subsystem configuration. The case susceptibility limits are established by comparison of the receptor circuit thresholds within the equipment case to the fields existing outside the case. These fields are specified by the system internal environment.

#### A.3.2 APPLICABLE TEST METHODS

##### A.3.2.1 Emission Tests

Emission tests will consist of current measurements on the equipment interconnect wiring and field intensity measurements of the radiation from equipment cases.

A3.2.1.1 Conducted Current Measurements - The most feasible means of measuring the current on a non-coax wire without disturbing the circuit characteristics is with a current probe. Present current probe technology allows calibrated current probe measurements although it is not expected that measurements for extraneous RF emissions on wires carrying unintentionally generated RF currents will be required above 1 GHz. Coax lines will be measured either by direct connection to an RF receiver, or where the power levels are greater than the power handling capabilities of the receiver, an RF power sampling device such as a directional coupler will be used to measure the RF current on the coax line.

Since the current limits are given for each equipment port, the current measurement must be made on each individual wire connected directly to that port (before any branching point). A precaution that must be observed when using the current probe is that the maximum current point along the line will vary with frequency when the line length approaches a significant portion of a wavelength. The current probe must therefore be moved along

the line to obtain a maximum reading because the SGR computes the maximum allowable current from the port without regard to any standing wave effects.

A.3.2.1.2 Conducted Current Test Setups - The physical configuration of the test setup for conducted current measurements will be similar to that of MIL-STD-462, Method CE03. Differences include possible elimination of the 10 microfarad feedthru capacitors in the power lines, height of the test bundle above the ground plane, and cable lengths.

The 10 microfarad feedthru capacitors may be eliminated from the test setup if a measurement of the ambient current on each power line shows the current from the power source is below the test wire current limit by at least 6 dB.

The height above the ground plane of the wire being measured can be any convenient height.

Cable lengths used for the test setup can be any convenient length. The only limitation is the size of the test area.

A.3.2.1.3 Equipment Case Radiation - The test method for equipment case radiation must relate to the computer generated test limits. The limits are specified in terms of field strength versus frequency at a distance of 1 meter from the test sample. The measurement method will therefore be the same as that of MIL-STD-462, Test Method RE02.

Case radiation does not, of course, include wire radiation; therefore the test setup must reflect this condition. This means that the wiring must be electromagnetically isolated from the measuring antenna. An alternative is that the test requirements are considered to be satisfied if the combined radiation from the case and wiring is below the case radiation limits.

#### A.3.2.2 Susceptibility Tests

Susceptibility tests will be performed to measure the susceptibility of equipment to a specified value of current impressed on interconnect wiring and to a radiation field impressed on the equipment case. Intermodulation tests for receivers are to be performed in accordance with MIL-STD-462, Method CS03. Frequency intermodulation products will be selected from the utility program for intermodulation.

A.3.2.2.1 Conducted Susceptibility - Conducted susceptibility tests will be accomplished by inducing a current on each specified receptor wire leading into an equipment. The induced current levels are to be those specified in the susceptibility test limit for that receptor.

The most feasible method for inducing the specified current levels into non-coax wires is the current probe method used in measurement of conducted current emissions. This method eliminates the need to break into the receptor circuit directly which would change the circuit parameters. A second current probe can be clamped around the receptor wire close to the equipment input terminal to measure the injected current. The proper injection point for the source probe is that point along the line which provides the proper current level at the equipment input terminal with the least amount of power applied to the probe. This is required when the line length approaches a significant portion of a wavelength.

A.3.2.2.2 Radiated Susceptibility - Radiated susceptibility tests are to be performed to determine the susceptibility of the equipment internal circuitry to a radiated field at the equipment case. The method for developing this field is similar to that for MIL-STD-462, Test Method RS03. The field generating setup can be calibrated to produce a specified field at a distance of 1 meter from the transmitting antenna as in MIL-STD-462 or at a distance specified by the user. The primary consideration is the field level at the equipment case.

The test limits apply only to the levels existing at the equipment case but the wire bundles can be included with certain conditions applied. The wire bundles can be included if the combination of the case and wire bundle susceptibility tests show no effects from the field specified for the case alone.

#### A.3.2.3 Test Instrumentation

The test instrumentation to be used for these test measurements is the standard equipment used in MIL-STD-462 testing. The test methods for emission tests can be easily accomplished with automatic or semiautomatic measurement techniques. Test probes and antennas are readily available in most test labs. The conducted measurements could be accomplished without setting up in a shielded room but a shielded room is necessary for the radiated measurements.

#### A.4 SAMPLE TEST PROCEDURE

A.4.1 The following test procedure is presented as an example of the application of the SGR test methods to a subsystem unit. A single unit procedure is sufficient illustration since the SGR specifies individual wire current limits and individual box radiation.

##### A.4.2 OBJECTIVES AND SUCCESS CRITERIA

The objectives and success criteria of these tests are as follows:

- a. Conducted Current Measurements - to determine whether extraneous current is present on each of the external interconnect wires to the unit. The success criteria is that these extraneous emissions do not exceed the levels specified in Figures A-5 thru A-12.
- b. Conducted Susceptibility Measurements - to determine whether there is a response in the output of the receiver when the specified current levels, Figures A-15 and A-16 are applied to the RF and power wire, respectively. The success criteria is the range and bearing indicator does not lose lock.
- c. Case Radiated Emission - to determine whether the radiation from the case exceeds the case radiation limits of Figures A-13 and A-14. The success criteria is that the case radiation is less than the spec limits.
- d. Case Radiated Susceptibility - to determine whether there is a receiver output response when the case is subjected to a radiated field at the levels specified in Figure A-17. The success criteria is the range and bearing indicator does not lose lock.

##### A.4.3 TEST SAMPLE DESCRIPTION

The test sample is an airborne TACAN R/T unit. It has a transmitter and receiver packaged in a single unit. For the purposes of this example it is assumed that there are 5 wires interfacing with the unit. These consist of 1) RF coax to upper antenna, 2) Audio output, 3) Heading output, 4) Primary power input, and 5) Bearing output. The audio output of the receiver is fed to a speaker for a convenient aural indication.

#### A.4.4 INSTRUMENTATION

All measurements shall be made with instruments whose accuracies conform to acceptable laboratory standards, and which are appropriate for measurement of the parameter concerned. The accuracy of the instrument and test equipment shall be verified periodically utilizing acceptable calibration procedures as defined by MIL-C-45662A, "Calibration System Requirements."

##### A.4.4.1 Placement and Selection of Measuring Antennas

Each face of the test sample shall be probed with a 3-inch electrostatic probe to determine the localized area(s) producing maximum emission or susceptibility. Those areas shall be located 1 meter from the applicable test antenna. Probing shall be performed using a spectrum analyzer to determine the worse case condition. The probe shall be oriented for maximum pickup approximately 5 cm from the surface of the test sample.

When performing radiated emission measurements, no point of the measuring antenna shall be less than 1 meter from the walls of the enclosure or obstruction.

For susceptibility measurements no point of the field-generating and the field-measuring antennas shall be less than 1 meter from the walls of the enclosure or obstruction.

For radiated emission measurements between 25 and 200 MHz, the biconical antenna shall be positioned alternately to measure the vertical and horizontal components of the emission. For radiated susceptibility measurements between 20 and 200 MHz, the biconical antenna shall be positioned so as to generate alternately vertical and horizontal fields.

##### A.4.4.2 Measuring Frequencies

The entire specified frequency range for each applicable test shall be scanned. Measurements shall be taken at not less than three frequencies per octave representing the maximum indications within the octave. All measurements will be made using the peak detector function of the measurement receiver.

##### A.4.4.3 Ground Plane

A copper ground plane which is 0.75 mm thick and 4.80 square meters in area with a width of 90 cm (minimum) is required for performing the tests described herein. The ground plane shall be bonded at both ends to the shielded enclosure and at intervals between the ends no greater than 90 cm apart.

#### A.4.4.4 bonding

The test sample shall be bonded to the ground plane by the same means with which it is bonded to the aircraft structure.

#### A.4.4.5 Bonding Measuring Instruments

Interference measuring instruments shall be bonded to the ground plane or shielded enclosure with the ground clip on the power cord. The counterpoise on rod antennas shall be bonded to the ground plane with a strap of sufficient length to permit the antenna to be correctly positioned. The strap shall be as wide as the counterpoise. This applies to rod antennas mounted on a separate counterpoise. The interference measuring instrument shall be physically grounded to the ground plane with only one connection. If the cooper strap is used, neither the ground clip, the ground terminals, nor the power supply shall be connected at any test frequency. When tuned and calibrated for a measurement, and loaded with a dummy antenna, the measuring instrument shall show no change from the internal background during on-off operation of the test sample.

#### A.4.4.6 Operator Position

No part of the operator's body shall make electrical contact with the ground plane during EMI tests. In addition, during radiated interference tests, the position of the operator's body shall be such as to produce minimum effect on the measurement being made, insofar as practical.

#### A.4.5 Test Procedure

For the purpose of this example, it is assumed that a performance test has been completed prior to the start of EMI tests.

##### A.4.5.1 Conducted Emission (non-coax lines)

A.4.5.1.1 Connect a test setup as shown in Figure A-1 and perform a functional check on the test sample.

A.4.5.1.2 Clamp the current probe around the AC power input wire and set the spectrum analyzer to sweep from 30 Hz to 50 MHz. Search along the power line for the maximum reading.

A.4.5.1.3 Record the peak instantaneous and average current spectrum on the power wire from 30 Hz to 50 MHz.

A.4.5.1.4 Conducted emissions in excess of the limits shown in Figures A-5 and A-6 shall not appear on the power wire.

A.4.5.1.5 Repeat the conducted current measurements for the heading, and bearing and audio wires.

A.4.5.1.6 Conducted emissions shall not exceed the limits shown in Figures A-7 and A-8 for the heading wire, Figures A-9 and A-10 for the audio wire.

#### A.4.5.2 Conducted Emission (coax lines)

A.4.5.2.1 Connect a setup as shown in Figure A-2 for the TACAN T/R mode and select channel 50.

A.4.5.2.1.1 Set up the recording system to cover the frequency range of 12 KHz to 12.4 GHz and record the peak instantaneous and average current.

A.4.5.2.1.2 The conducted emissions shall not exceed the limits shown in Figures A-11 and A-12.

#### A.4.5.3 Equipment Case Radiated Emissions

A.4.5.3.1 Connect the test setup as shown in Figure A-3 for the T/R mode and select channel 50.

A.4.5.3.2 Probe each face of the test sample at frequencies from 50 KHz to 10 GHz to determine the location of maximum radiation from the case. Orient the test sample so that the test antenna is directed at the maximum radiation point.

A.4.5.3.3 Record the peak instantaneous and average electric radiated field emission from 50 KHz to 10 GHz.

A.4.5.3.4 If the recorded values are below the limits of Figures A-13 & A-14, the sample is considered acceptable, if the values are above the limits, the test sample loads shall be located outside the shielded room and the wires run through a shield from the test sample to the shielded room wall as shown in Figure A-3.

A.4.5.3.5 Rerun the radiated tests for compliance to the limits.

#### A.4.5.4 Conducted Susceptibility

A.4.5.4.1 Connect a test setup as shown in Figure A-4 for the T/R mode. Set to channel 50 and adjust the volume control for a discernable level. Adjust the Beacon Simulator for a -90 dBm signal.

A.4.5.4.2 Inject the signal levels and frequencies indicated in Figure A-15 for the coax line.

A.4.5.4.3 The interfering signal shall not cause the Range Indicator or Bearing Indicator to lose lock.

A.4.5.4.4 With the TACAN still in the T/R mode, inject the signals of Figure A-16 into the primary power line.

A.4.5.4.5 The interfering signals shall not cause the Range Indicator or Bearing Indicator to lose lock.

A.4.5.5 Radiated Susceptibility

A.4.5.5.1 Connect a test setup as shown in Figure A-3 for the T/R mode. Set to channel 50 and adjust the volume control for a discernable level. Adjust the Beacon Simulator for a -90 dBm signal.

A.4.5.5.2 Calibrate the susceptibility source by substituting a calibrated receiving antenna in place of the test sample and recording the transmitted power required to establish the field intensity levels at the test sample as shown in Figure A-17.

A.4.5.5.3 Aim the source antenna at the test sample face established as the highest emission location.

A.4.5.5.4 Establish the required field intensity levels and observe that the bearing and range indicator does not lose lock.

A.4.5.5.5 If degradation is observed, change the test setup to that of Figure A-3 with the test loads and power lines located outside the shielded room and connected from the room wall to the test sample through an overall shield. Repeat the test.

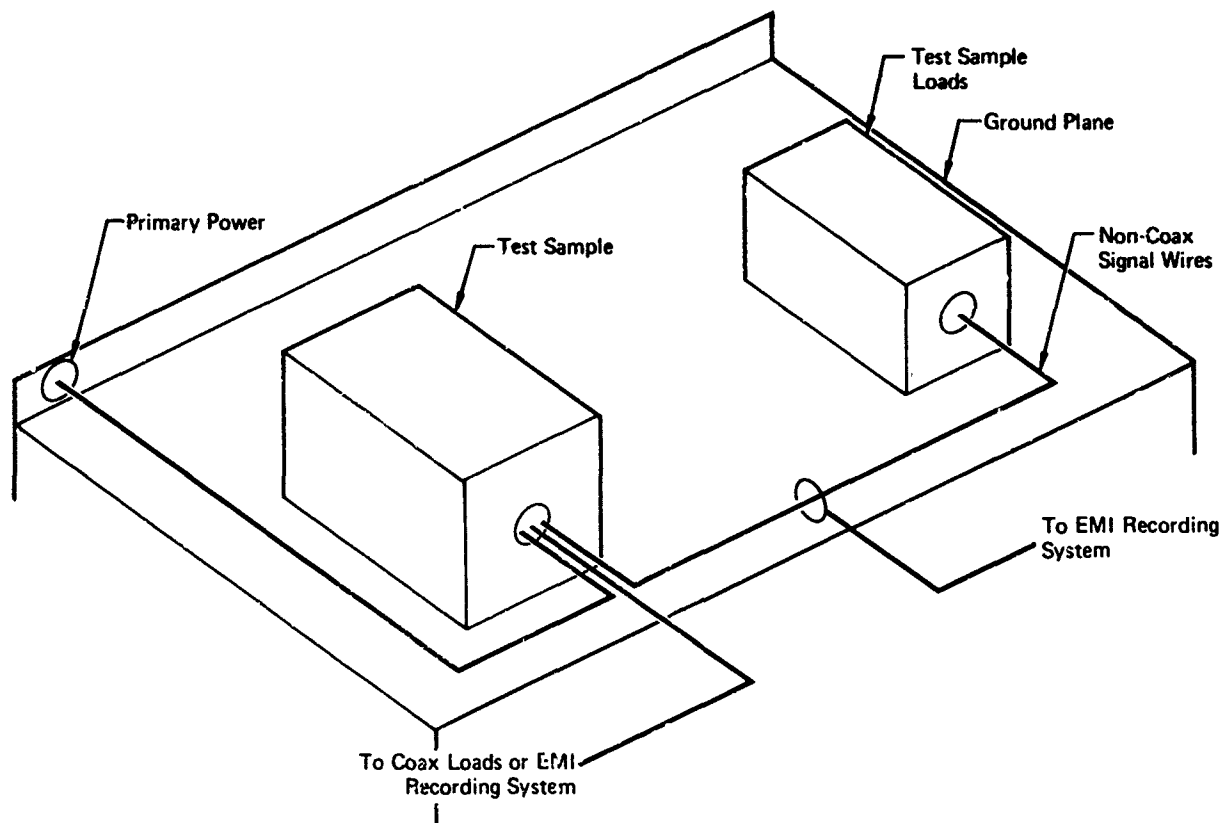


**FIGURE A-1**  
**CONDUCTED EMISSION TEST SETUP**

0-73 1075 40

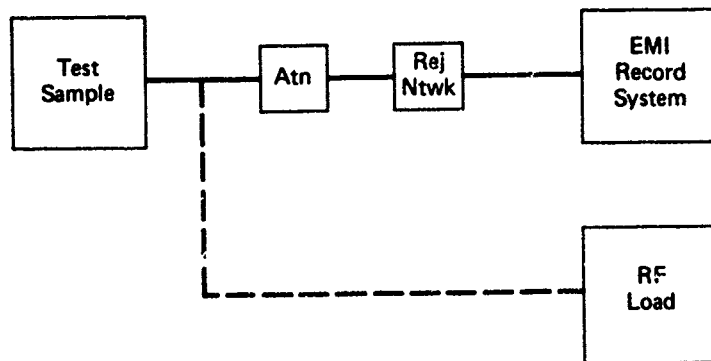


**FIGURE A-2**  
**BLOCK DIAGRAM KEY-DOWN TESTS**

GP73-1075-39

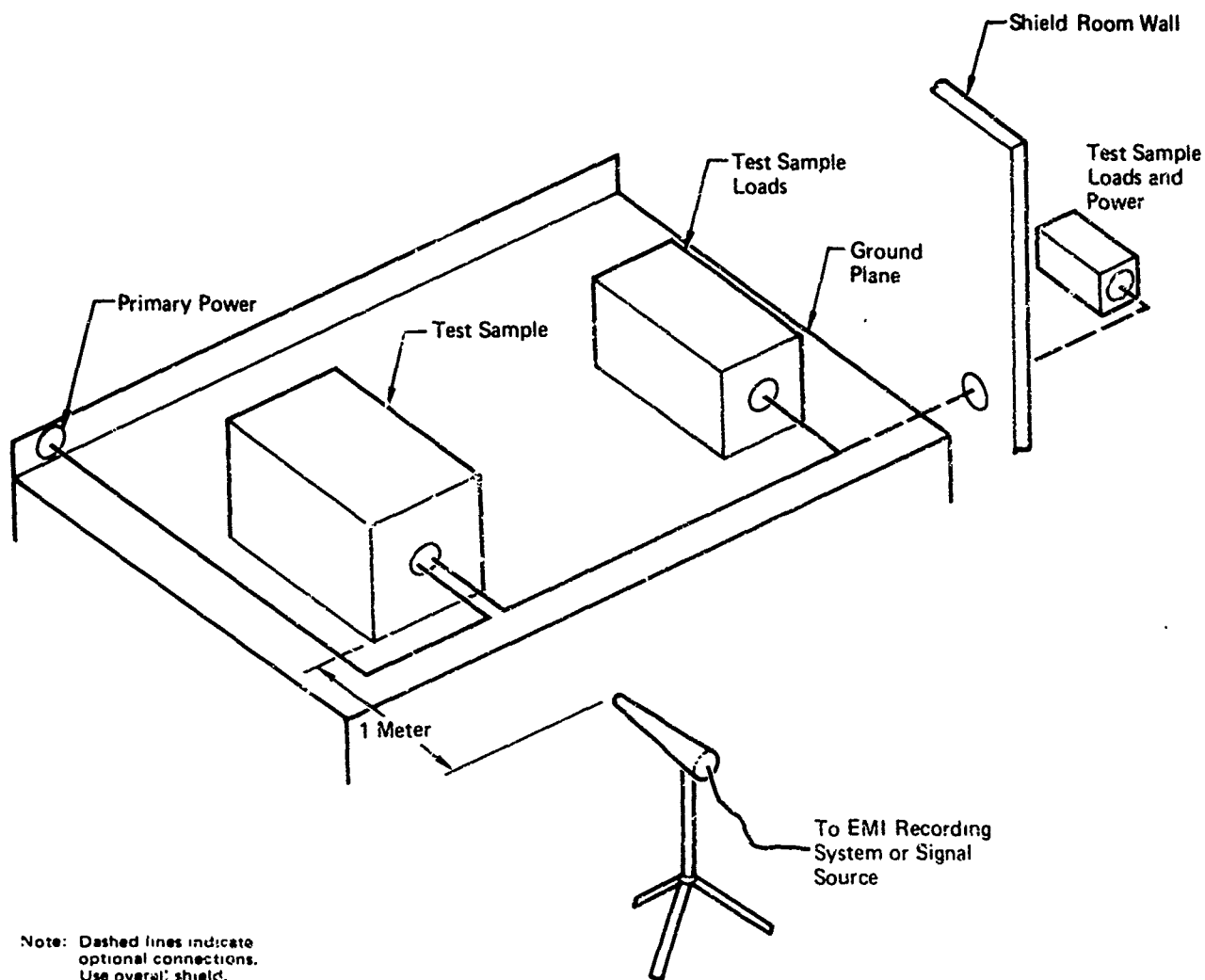


**FIGURE A-3**  
**RADIATED EMISSION/SUSCEPTIBILITY TEST SETUP**

GP73 1075 41

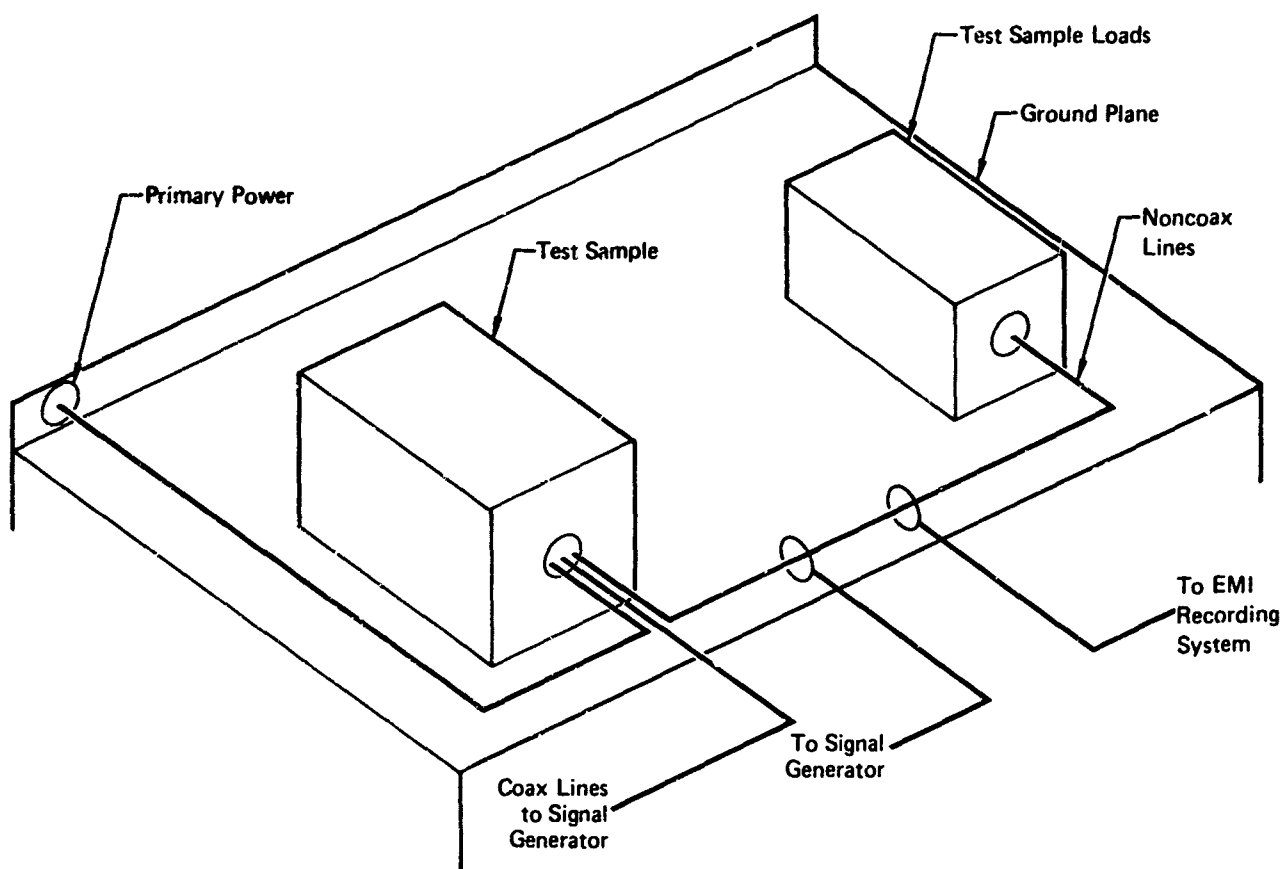


**FIGURE A-4**  
**CONDUCTED SUSCEPTIBILITY TEST SETUP**

GP 73 1075 42

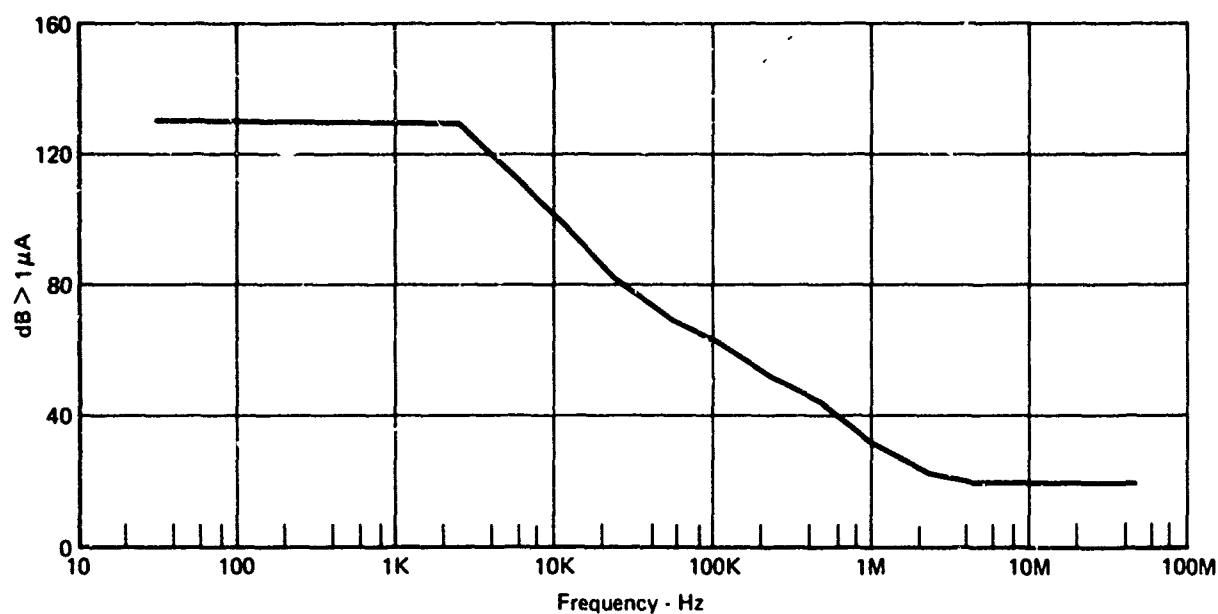


**FIGURE A-5**  
**EMI NARROWBAND SPECIFICATION LIMIT**  
**TACAN POWER**

GP73 1075 43

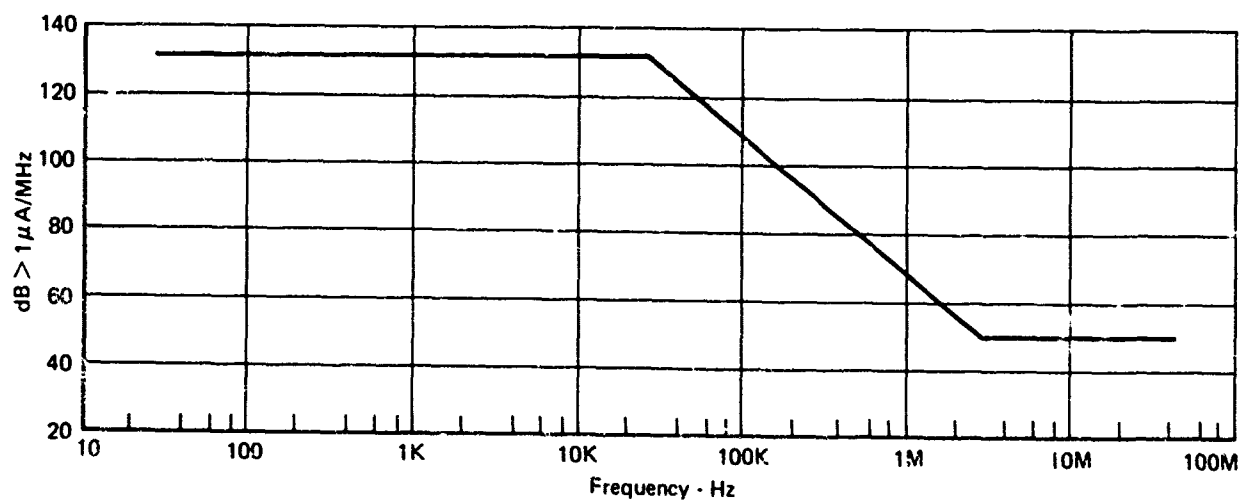


**FIGURE A-6**  
**EMI BROADBAND SPECIFICATION LIMIT**  
**TACAN POWER**

GP73 1075 44

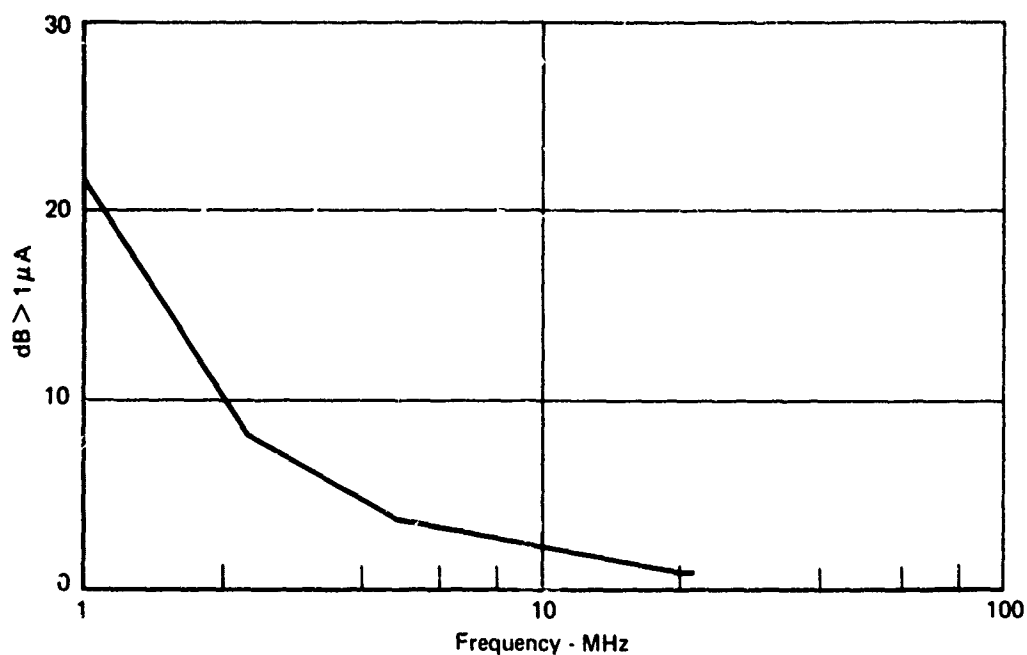


**FIGURE A-7**  
**EMI NARROWBAND SPECIFICATION LIMIT**  
**TACAN BEARING AND HEADING**

GP73 1075 55

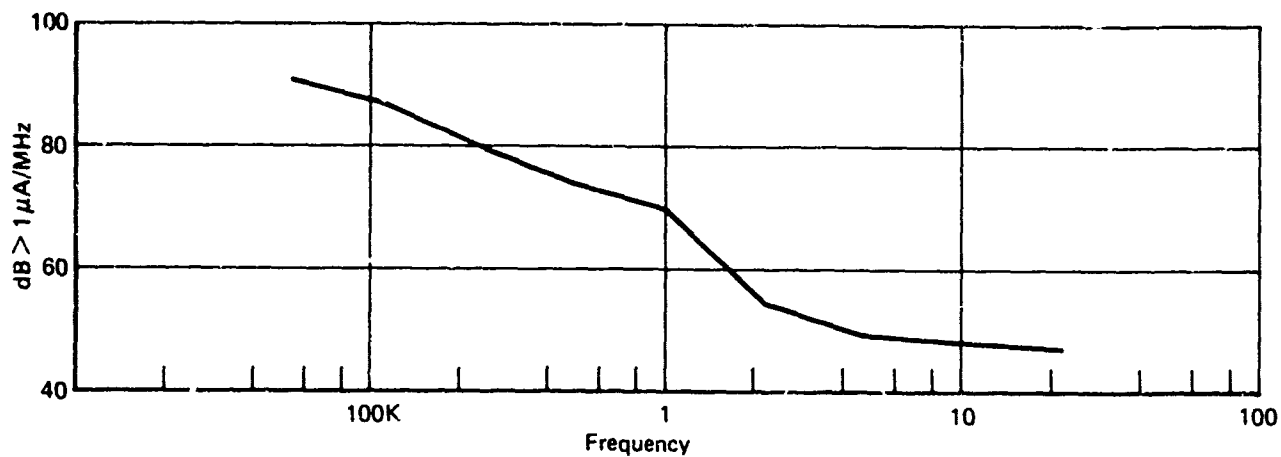


**FIGURE A-8**  
**EMI BROADBAND SPECIFICATION LIMIT**  
**TACAN BEARING AND HEADING**

GP73 1075 54

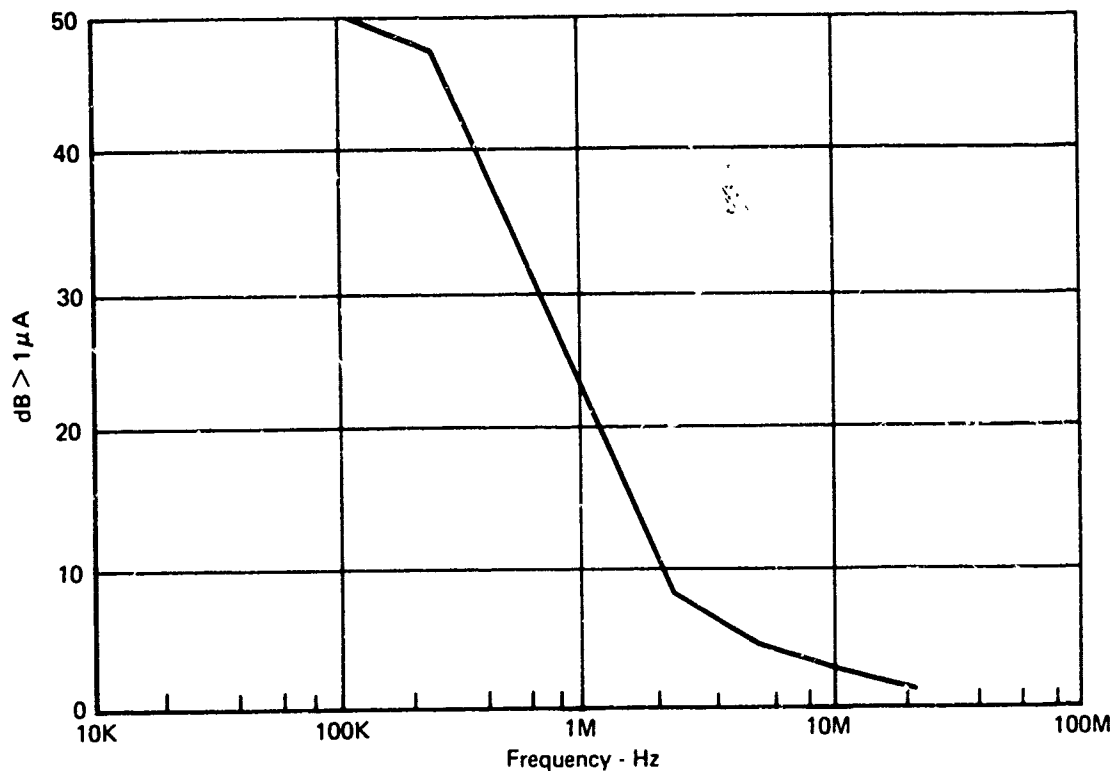


**FIGURE A-9**  
**EMI NARROWBAND SPECIFICATION LIMIT**  
**TACAN AUDIO**

GP73 1075 53

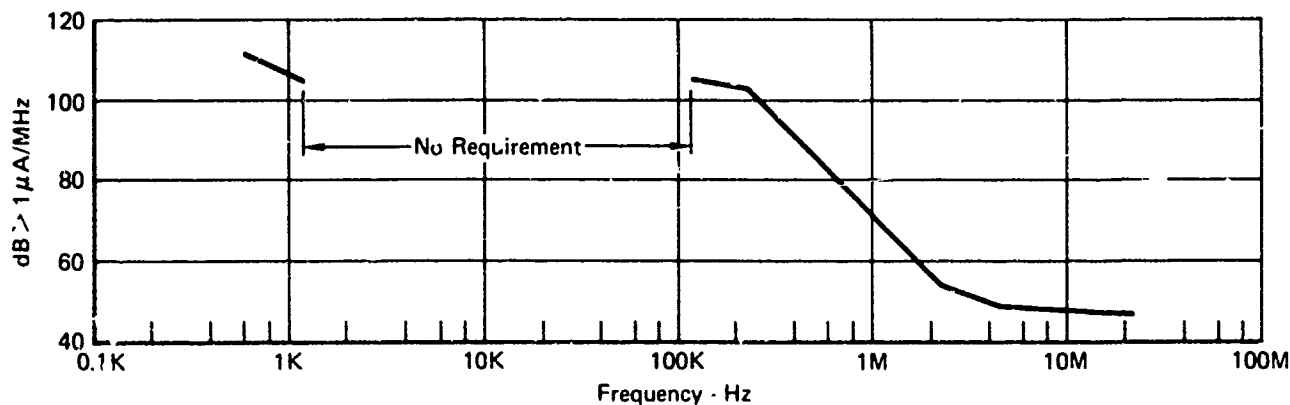


**FIGURE A-10**  
**EMI BROADBAND SPECIFICATION LIMIT**  
**TACAN AUDIO**

GP73 1075 52

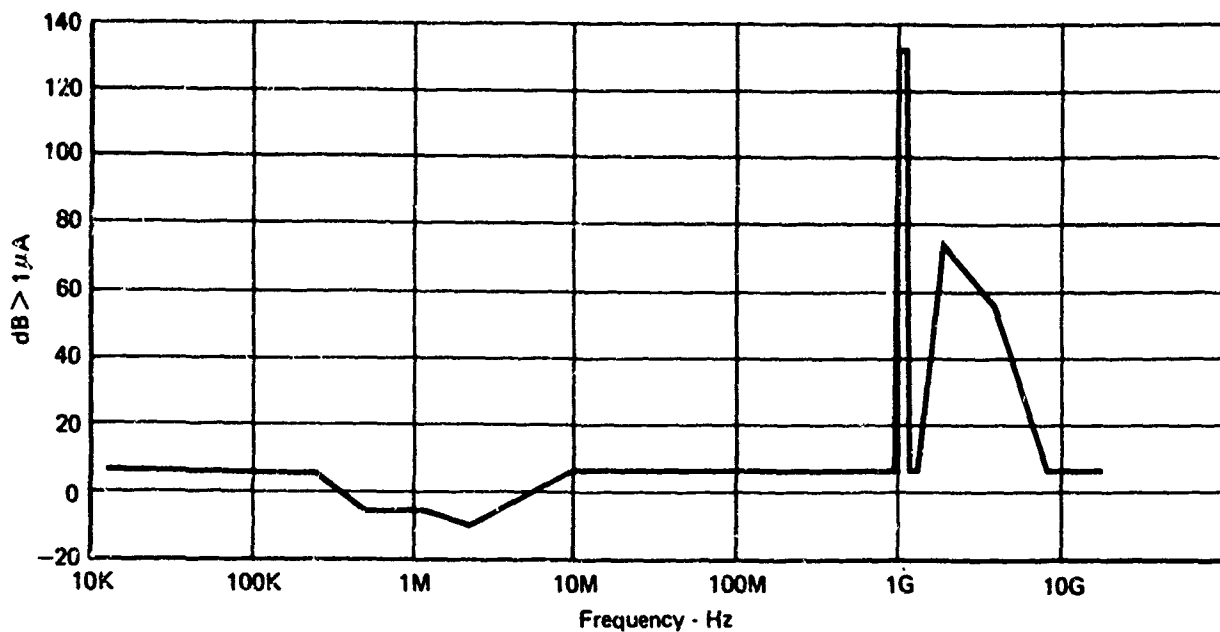


**FIGURE A-11**  
**EMI NARROWBAND SPECIFICATION LIMIT**  
**TACAN RF**

GP73-1075 51

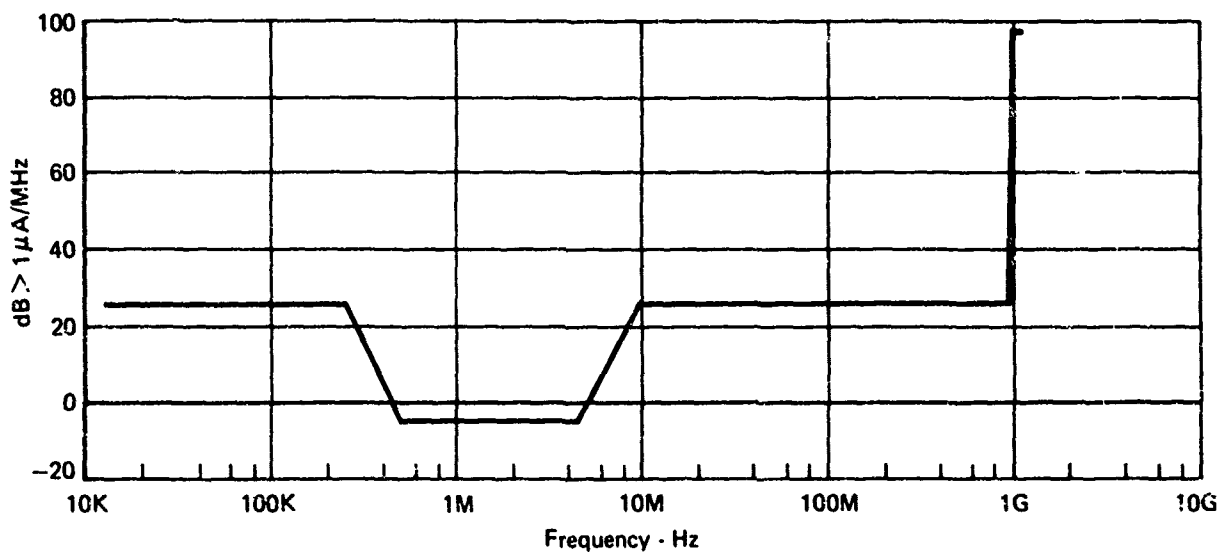


**FIGURE A-12**  
**EMI BROADBAND SPECIFICATION LIMIT**  
**TACAN RF**

GP73 1075 50

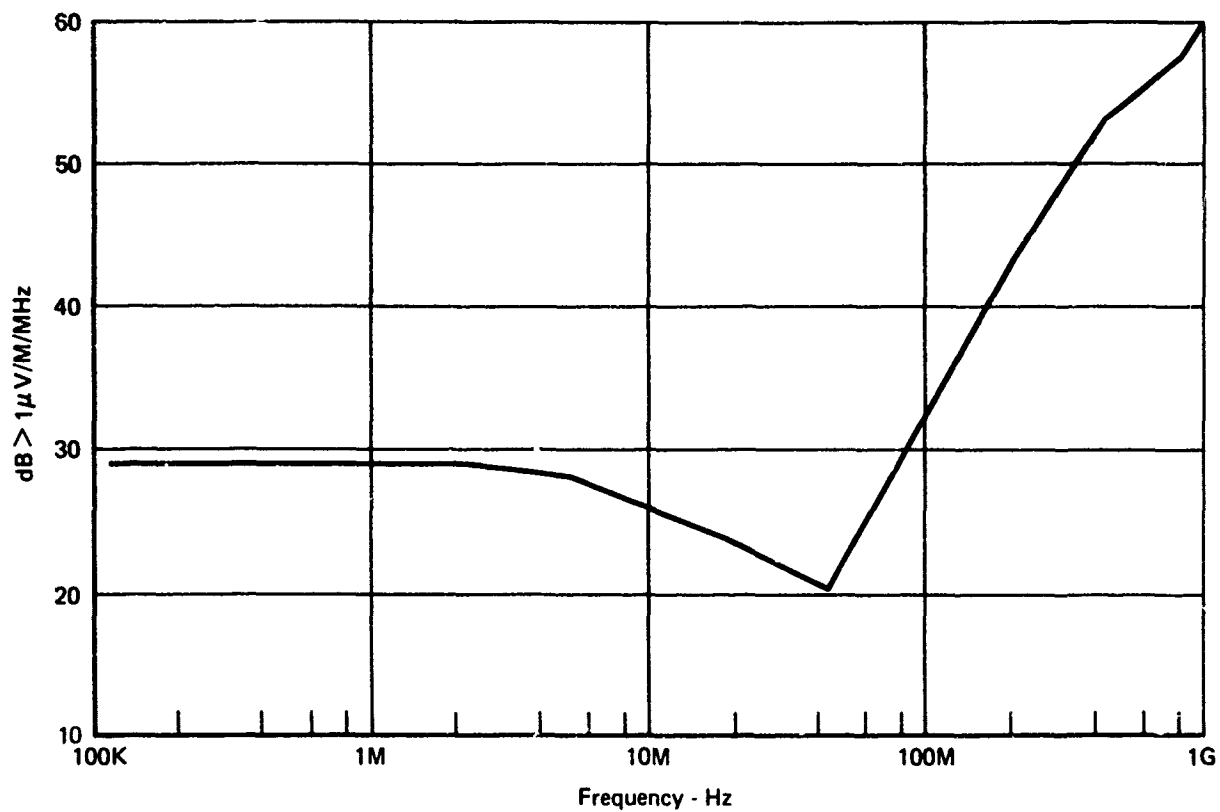


FIGURE A-13  
EMI NARROWBAND RADIATION LIMIT  
TACAN CASE

GP73 1075 49

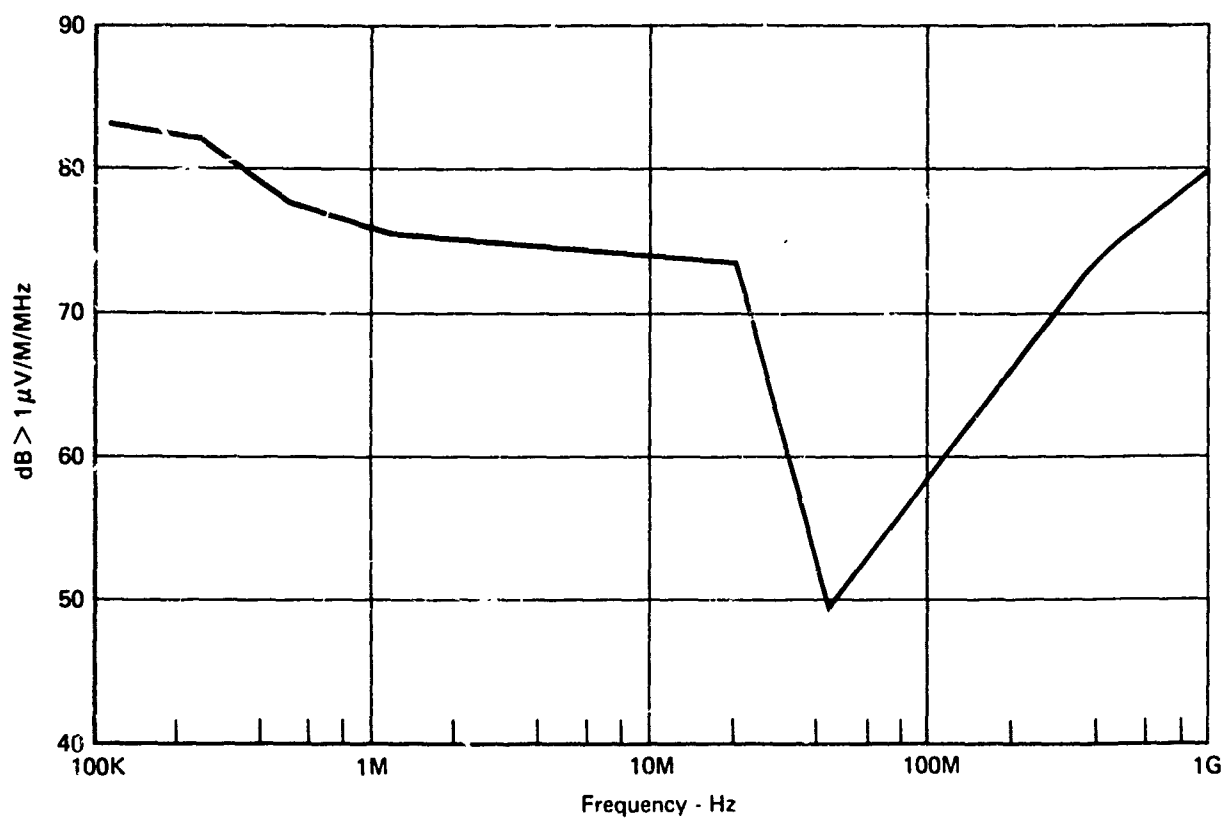


**FIGURE A-14**  
**EMI BROADBAND RADIATION LIMIT**  
**TACAN CASE**

7P73 1075 48

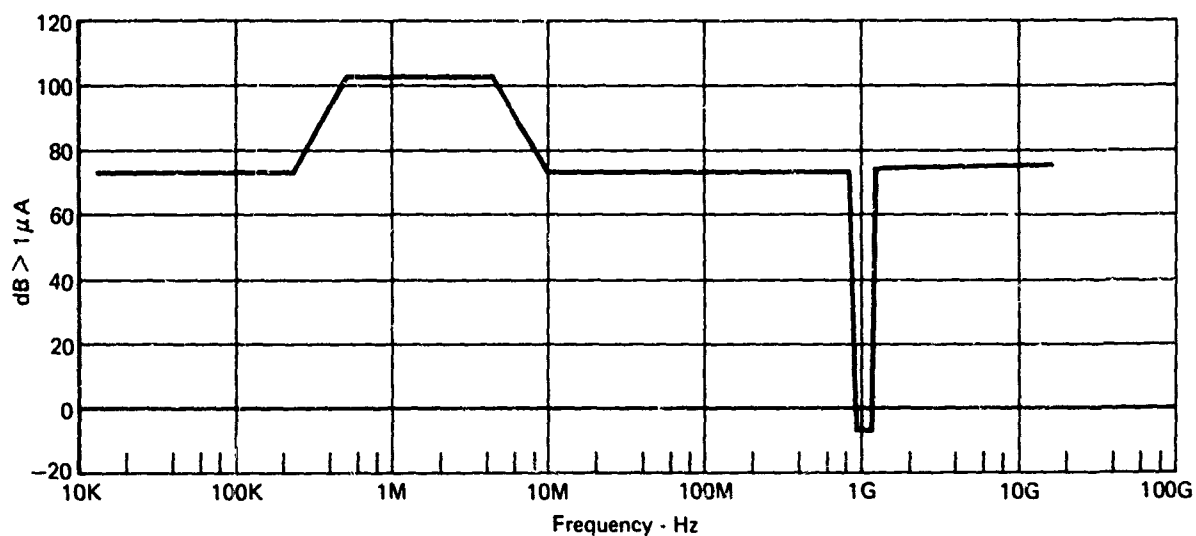


**FIGURE A-15**  
**CONDUCTED SUSCEPTIBILITY LIMIT**  
**TACAN RF**

GP73 1075 47

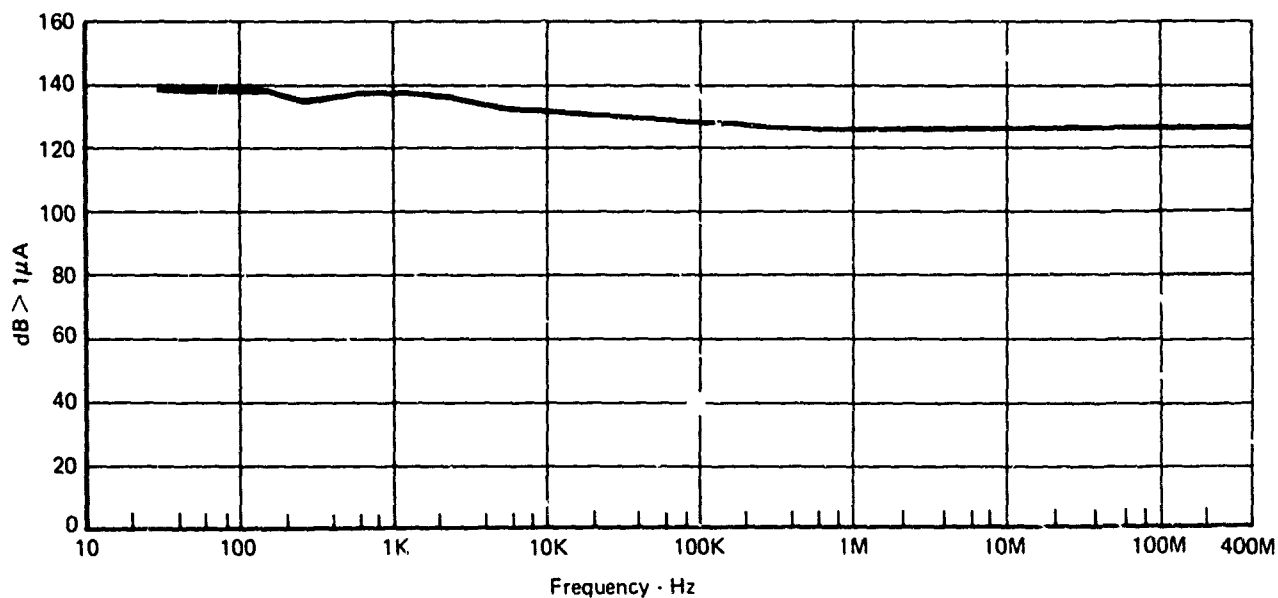


**FIGURE A-16**  
**SUSCEPTIBILITY LIMIT**  
**TACAN POWER**

GP73 1075 46

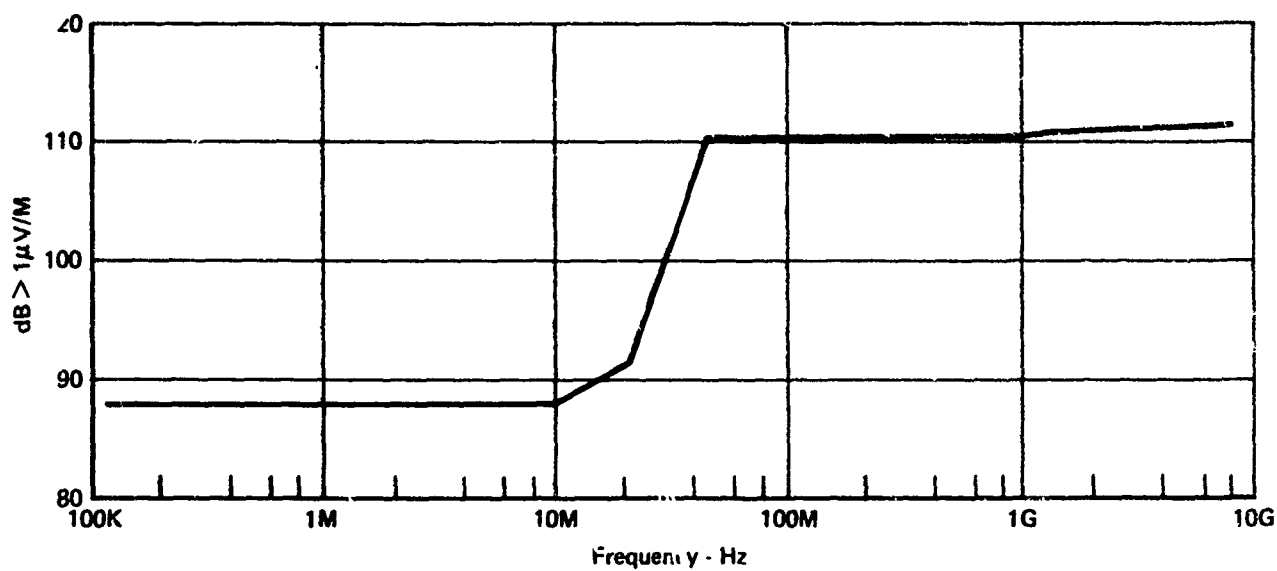


**FIGURE A-17**  
**RADIATED SUSCEPTIBILITY LIMIT**  
**TACAN CASE**

GP73 1075-45

## APPENDIX B

### MERGE UTILITY PROGRAM

#### B.1 GENERAL

The supplementary computer program called MERGE is supplied with the IEMCAP program for the purpose of manipulating ISF files. It provides the capability of combining the data on two existing ISF files, as directed by the user, to form a composite file consisting of selected portions of the original files.

For this process, one of the two original files is designated as the Master file and the other as the Modify file. The new file created is called the Updated file. During the MERGE run, all data on the Master file is automatically written on the new Updated file unless instructions are given for this data to be deleted. Conversely, none of the data on the Modify file is written on the Updated file unless the appropriate add commands are given to MERGE.

The data input for the MERGE program consists of fixed format statements which define the data to be deleted from the Master file and the data to be added from the Modify file. The only provisions for insertion of new data (data not on either existing file) is the option of writing a new file title and/or new remarks.

#### B.2 DATA ORGANIZATION

For purposes of MERGE, the ISF data is organized into data blocks (section B.3.1). These data blocks are subdivided into data sets or parameters which have ID's which are used to specify the data to be manipulated. That is, the only manner in which data may be divided for manipulation by MERGE is by the ID's which identify the various data sets or parameters as described in section B.3.2. Any changes in ISF data which do not correspond to these data sets must be performed via an IDIPR modify run.

##### B.2.1 SIZE LIMITATIONS

The maximum dimensions of the Updated file data (except equipment data and wire bundle data) must be the same as the corresponding limits for the IEMCAP program (see section 5.3). Any instructions to the MERGE program which attempt to add data sets larger than these dimensions to the Updated file will produce an error. There is no limitation to the number of equipments or wire bundles which may be written on the Updated file. However, it should be noted that if the IEMCAP size limitations for equipment or wire bundles is exceeded, the Update file cannot be used as an old ISF for an IEMCAP run.

#### B.3 INPUT DATA

The MERGE program is designed to accept user inputs in the form of fixed format only. These instructions may be either commands to add or delete data or they may be instructions to insert a new ISF title or remark.

The delete command (D= ) is used to delete data from the Master ISF as the modified ISF is written by MERGE. Similarly, the add command (A= ) is used to add data to the Updated ISF from the Modify ISF. In cases where the data may

have many different sets of values (as for example in the case of aperture data), the Updated ISF is written from the Master ISF aperture data (less the deleted apertures) plus the apertures added from the Modify ISF. When the data may have only one value (for example, the EMI margin print limit) either the command to delete the Master ISF data or to add the Modify ISF data have the effect of replacing the Master file data with the Modify file data in the Updated file. In this case it is not necessary to give both the delete and add commands (although this is permissible) as either of these commands suffices.

### B.3.1 DATA BLOCKS

For purposes of user instructions to MERGE, the ISF data has been divided into data blocks which have title records. These title records indicate that the data immediately following belongs to that data block. Certain data blocks also have ending markers which mark the end of the data block.

The data blocks may have any order. Also, instructions within a data block may be in any order. However, each block must be preceded by its title record and all data blocks which have ending markers must be terminated with this end record.

The data blocks are divided as shown in Table B-1. The data block titles (and end markers) are required only for those data blocks which have add or delete commands. The only card which is always required is the end of data card. This card has the form

END DATA

and must be physically the last data card. If this card is used as the only data input, the Updated file becomes a copy of the Master file.

### B.3.2 INPUT DATA FORMATS FOR MERGE

The format of all MERGE input data is given in this paragraph. All inputs must begin in Column 1 and no blanks are permitted except for the blanks which are a part of the system parameter identifications or the data block title records or end markers.

#### B.3.2.1 SYSTEM DATA

As shown in Table B-1, the title records for new ISF title data (NEW TITLE) and for new remarks data (NEW REMARKS) do not have an end marker while all other System data blocks have both title records and end markers. The title records (and end markers) are required only for those data blocks which have add or delete commands. If there is system data of any type, the end of the system data is marked by an end of system data card. This card has the form

END OF SYSTEM

If there is no system data, this card is not required.

TABLE B-1

## MERGE DATA BLOCKS

| DATA BLOCK      |                   | END MARKER     |
|-----------------|-------------------|----------------|
| SYSTEM DATA     | NEW TITLE         |                |
|                 | NEW REMARKS       |                |
|                 | SYSTEM, BASIC     | END BASIC      |
|                 | SYSTEM, APERTURES | END APERTURES  |
|                 | SYSTEM, ANTENNAS  | END ANTENNAS   |
|                 | SYSTEM, FILTERS   | END FILTERS    |
|                 | SYSTEM, WCT       | END WCT        |
| SUB-SYSTEM DATA | SYSTEM, FIELDS    | END FIELDS     |
|                 | EQUIPMENTS        | END EQUIPMENTS |
|                 | WIRE BUNDLES      | END BUNDLES    |

#### INPUTS FOR TITLE DATA -

Two options are possible for the title on MERGE created ISF. Either the Master file title may be used or a new title may be written. To use the Master file title, no input to MERGE is required. For a new title the following input cards are required:

NEW TITLE  
L=nnn  
New ISF title (up to 160 characters)

where nnn is the exact character length of the title record, including blanks. A maximum of 80 characters per card are allowed but the total number of characters must not be greater than 160 (2 cards). For example, the title "Updated ISF for Aircraft Test Case" could be written by the following cards.

NEW TITLE  
L=34  
Updated ISF for Aircraft Test Case

#### INPUTS FOR REMARKS DATA -

Exactly the same options as described in the previous paragraph for title data apply for the remarks data. The input cards required for the insertion of the new remarks are:

NEW REMARKS  
L=nnn  
New remarks for ISF (up to 400 characters)

where nnn is the exact character length of the remarks record including blanks. A maximum of 80 characters per card are allowed. The record may be continued for a total of 5 cards (400 characters).

#### INPUTS FOR BASIC SYSTEM DATA -

The data described in Sections 5.7.4.1 through 5.7.4.3 are classified as basic system data for purposes of MERGE. If it is necessary to write basic system data from the Modify ISF instead of the Master ISF, two instructions are necessary. First, the data block title (SYSTEM, BASIC) must be given followed by add (or delete) commands for every parameter to be written from the Modify file. Either the command to add data from the Modify file (A=) or the command to delete Master file data (D=) causes the specified data to be written from the Modify file.

The general form for replacing the Master file basic system data with the Modify file data is

TABLE B-2

## BASIC SYSTEM DATA

| Parameter Identification | Explanation                               |
|--------------------------|-------------------------------------------|
| SYSTEMTYPE               | System Type                               |
| LONGITUDE                | Longitude                                 |
| LATITUDE                 | Latitude                                  |
| ALTITUDE                 | Altitude                                  |
| ASM                      | Adjustment Safety Margin                  |
| EMPL                     | EMI Margin Print Limit                    |
| SIGMA                    | Conductivity                              |
| EPSILON                  | Relative Permittivity                     |
| CON NOS LIM              | Conical Nose Limit                        |
| FUSE RAD                 | Fuselage Radius                           |
| CORE RAD                 | Core Radius                               |
| CNTR WL                  | Waterline of Centroid                     |
| BOT WL                   | Waterline of Bottom                       |
| MOD COD                  | Model Code                                |
| WNGRTBL                  | Wing Root Butt Line                       |
| WNGRTWL                  | Wing Root Waterline                       |
| WNGRTFFS                 | Wing Root Fuselage Station (Forward Edge) |
| WNGRTAFS                 | Wing Root Fuselage Station (Aft Edge)     |
| WNGTPBL                  | Wingtip Butt Line                         |
| WNGTPWL                  | Wingtip Waterline                         |
| WNGTPFFS                 | Wingtip Fuselage Station (Forward Edge)   |
| WNGTPAFS                 | Wingtip Fuselage Station (Aft Edge)       |

```

SYSTEM,BASIC
D=basic parameter #1
D=basic parameter #2
o
o
o
END BASIC

```

where the basic parameters are any of the parameters given in Table R-2 (any or all of the instructions D= could be replaced by A= if desired).

The command END BASIC marks the end of basic system data and is required if the SYSTEM,BASIC title is used.

#### INPUTS FOR APERTURE DATA -

The Aperture Data (Section 5.7.4.4) is manipulated by MERGE in blocks of data corresponding to the aperture ID's. MERGE writes all aperture data from the Master file, except that deleted by a D=command, to the Updated file. It then writes the aperture data (if any) which is added from the Modify file by add commands.

The general form for this is

```

SYSTEM,APERTURES
D=Master File Aperture ID #1
D=Master File Aperture ID #2
o
o
o
A=Modify File Aperture ID #1
A=Modify File Aperture ID #2
o
o
o
END APERTURES

```

where the aperture ID's are the 5 letter alpha code aperture ID's in the Master and Modify files.

#### INPUTS FOR ANTENNA DATA -

The Antenna Data (Section 5.7.4.5) is handled in the same manner as the aperture data previously described.

The general input format for these instructions is

```

SYSTEM,ANTENNAS
D=Master File Antenna ID #1
D=Master File Antenna ID #2
o
o
o
A=Modify File Antenna ID #1
A=Modify File Antenna ID #2
o
o
o
END ANTENNAS

```

#### INPUTS FOR FILTER DATA -

Filter Data (Section 5.7.4.6) is manipulated according to the filter ID as described in the previous sections. The general input format is

```

SYSTEM,FILTERS
D=Master File Filter ID #1
D=Master File Filter ID #2
o
o
o
A=Modify File Filter ID #1
A=Modify File Filter ID #2
o
o
o
END FILTERS

```

#### INPUT FOR WIRE CHARACTERISTICS TABLE DATA -

Wire Characteristics Table Data (Section 5.7.4.7) is manipulated according to Wire type ID (see previous sections).

The general input format is

```

SYSTEM,WCT
D=Master File Wire Type ID #1
D=Master File Wire Type ID #2
o
o
o
A=Modify File Wire Type ID #1
A=Modify File Wire Type ID #2
o
o
o
END WCT

```

#### INPUTS FOR ENVIRONMENTAL FIELD DATA -

The Environmental Field Data (Section 5.7.4.8) for the Updated ISF is written either in total from the Master file (default) or in total from the Modify file. The input instruction for use of the Modify file environmental fields is

```
SYSTEM,FIELDS
D=EVFLDS
END FIELDS
```

#### B.3.2.2 SUBSYSTEM DATA

The MERGE, all data pertaining to equipment and wire bundles is classified as subsystem data. If any instructions for merging this subsystem data are given, these instructions must be preceded by a subsystem card and followed by an end of subsystem card. These cards have the form

```
SUB-SYSTEM
END OF SUB-SYSTEM
```

where all cards with instructions for merging equipment and bundle data must be between these two cards.

#### INPUTS FOR EQUIPMENT DATA -

The Equipment Data (Section 5.7.5.2) can be manipulated by MERGE only in blocks containing all data associated with a particular equipment. This includes all port data, including port spectra, for the equipment in question.

The basic form for the instructions for merging equipment data is as follows

```
EQUIPMENTS
D=Master File Equipment ID #1
D=Master File Equipment ID #2
o
o
o
A=Modify File Equipment ID #1
A=Modify File Equipment ID #2
o
o
o
END EQUIPMENTS
```

where all the ID's following the D= are deleted from the Master file and all ID's following the A= are added from the Modify file as the Updated file is written. The title record, EQUIPMENTS, and the end of data block marker, END EQUIPMENTS, are required only if equipment records are added to (or deleted from) the Master file.

# INPUTS FOR BUNDLE DATA -

The Bundle Data (Section 5.7.6) is merged in the same manner as the Equipment Data. The form for the instructions is

```

WIRE BUNDLES
D=Master File Bundle ID #1
D=Master File Bundle ID #2
o
o
o
A=Modify File Bundle ID #1
A=Modify File Bundle ID #2
o
o
o
END BUNDLES
    
```

## B.3.2.3 EXAMPLE INPUT

An example of a possible data input to MERGE is as follows:

TABLE B-3  
EXAMPLE INPUT

| INPUT                     | COLUMNS |
|---------------------------|---------|
| NEW TITLE                 | 1-9     |
| L=25                      | 1-4     |
| UPDATED INTRA-SYSTEM FILE | 1-25    |
| SYSTEM,BASIC              | 1-12    |
| D=ASM                     | 1-5     |
| D=EMPL                    | 1-6     |
| END BASIC                 | 1-9     |
| SYSTEM,ANTENNAS           | 1-15    |
| D=URFCM                   | 1-7     |
| A=TACAN                   | 1-7     |
| END ANTENNAS              | 1-12    |
| SYSTEM,FILTERS            | 1-14    |
| A=FLTR8                   | 1-7     |
| END FILTERS               | 1-11    |
| END OF SYSTEM             | 1-13    |
| SUB-SYSTEM                | 1-10    |
| EQUIPMENTS                | 1-10    |
| D=INPYL                   | 1-7     |
| A=DISP                    | 1-6     |
| A=CENL                    | 1-7     |
| END EQUIPMENTS            | 1-13    |
| WIRE BUNDLES              | 1-12    |
| D=BNDL2                   | 1-7     |
| END BUNDLES               | 1-10    |
| END OF SUB-SYSTEM         | 1-17    |
| END DATA                  | 1-8     |

#### B.4 OUTPUTS

The MERGE program printed output consists of a copy of the Updated ISF file created by the run (plus possible error messages - see Paragraph B.5). If a comparison of the data on the old files (Master and Modify) with that on the Updated file is desired, the appropriate JCL cards may be inserted in the MERGE deck to give a printout of the old files. Alternatively, the Updated file can be used for an IDIPR run with a report requested. This gives a formatted summary of all data on the ISF.

#### B.5 ERRORS

Several types of errors may be encountered in running the MERGE program. These types are:

1. Data which is formatted incorrect.
2. Unrecognizable statements in input data.
3. Omission of required data cards such as an end marker for a data block or an END OF DATA card.
4. Creation of an ISF which is not a compatible system for IEMCAP runs.

Type 1 errors simply cause a read error in MERGE. Cards which have type 2 errors are deleted and have no contribution to the merging instructions. Type 3 errors cause fatal errors in the data input. An error message to this effect is printed by MERGE when this error occurs.

The errors classified as type 4 are not detectible by MERGE. Thus, the errors of this type simply create an ISF which is incompatible for an IEMCAP run. These errors are caused by adding (or deleting) data in such a way as to form a nonphysical system. Checks for type 4 errors can be made only by using the Updated file for an IDIPR run.

## APPENDIX C

### IMOD UTILITY PROGRAM

#### C.1 GENERAL

A supplemental computer program, IMOD is supplied with IEMCAP to enable an EMC engineer to calculate possible intermodulation frequency situations on USAF systems. The program can be used for both transmitter and receiver intermodulation.

A possible application of this program might be for a flying command post utilizing a number of transmitters simultaneously. For instance, suppose there are three transmitters of frequencies of 115 MHz, 120 MHz, and 125 MHz respectively, where the latter two transmitters are higher power than the former. There is a possible third order combination between the latter two producing an output at 115 MHz.

The program has the capability of analyzing five transmitter frequency intervals to any order of mix, for up to ten frequency intervals of interest.

#### C.2 INPUTS

The required inputs to IMOD are:

- o Number of transmitters (maximum = 5)
- o Lower and upper ends of emission channels or tunable ranges
- o Highest order intermodulation combination to be considered
- o Number of frequency intervals for which intermodulation combinations are to be calculated (maximum = 10)
- o Upper and lower ends of the frequency intervals described above

The program then proceeds to calculate all possible intermodulation combinations of interest and prints these in a hierarchical fashion up to the maximum order desired. In addition, orders of each transmitter frequency that go into the intermodulation order are printed along with the appropriate plus or minus sign as illustrated below:

TABLE C-1

THIRD ORDER INTERMODULATION INDICES CONSIDERED FOR TWO TRANSMITTERS

|   |    |
|---|----|
| 0 | +3 |
| 1 | 2  |
| 1 | -2 |
| 2 | -1 |
| 2 | 1  |
| 3 | 0  |

The input to the program uses a fixed field form described below:

TABLE C-2

## INPUT CARD FORMATS

| <u>Card</u> | <u>Format</u> | <u>Description</u>                                       |
|-------------|---------------|----------------------------------------------------------|
| NT          | I5            | Columns 1-5 Number of transmitter frequency intervals    |
| Intervals   | F9.2          | Columns 1-9 Lower end of frequency interval              |
|             | F9.2          | Columns 10-18 Upper end of frequency interval            |
| NOR         | I5            | Columns 1-5 Maximum order to be analyzed                 |
| NR          | I5            | Columns 1-5 Number of frequency intervals to be analyzed |
| Intervals   | F9.2          | Columns 1-9 Lower end of frequency interval              |
|             | F9.2          | Columns 10-18 Upper end of frequency interval            |

The output contains the order of mix, lower and upper ends of the inter-modulation frequency intervals and the indices that go into the calculation.

A sample input case is shown below:

TABLE C-3

## SAMPLE INPUT DATA

| <u>Card</u> | <u>Input</u> |
|-------------|--------------|
| NT          | 5            |
| Interval    | 122., 125.   |
| Interval    | 118., 125.   |
| Interval    | 127., 130.   |
| Interval    | 50., 75.     |
| Interval    | 132., 140.   |
| NOR         | 3            |
| NR          | 2            |
| Interval    | 225., 275.   |
| Interval    | 350., 400.   |

The output for this input case is in the following form:

TABLE C-4

## SAMPLE OUTPUT

| ORDER | FLOW   | FHIGH  | M | N | P | R | S  |
|-------|--------|--------|---|---|---|---|----|
| 2     | 264.00 | 280.00 | 0 | 0 | 0 | 0 | 2  |
| 2     | 264.00 | 280.00 | 0 | 0 | 0 | 0 | -2 |
| 2     | 259.00 | 270.00 | 0 | 0 | 1 | 0 | 1  |

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