* ~~SECRET~~ [redacted] *
****

BIF003W/2-156913-80 25X1
[redacted]
80 SEPT 08
Sheet Count: 160
Copy No.: 14

MISSION 7346 DESCRIPTION

[redacted]

BIF003W/2-156913/80 14 S

S

Prepared by: Approved by:

[redacted] 25X1

10-6-80
Date

Approved by:

[redacted]

Date

ADDS PROCESSED
Date .... Initials ....

CLASSIFIED BY: BYE-1
REVIEW ON 9/8/2000

HANDLE VIA BYEMAN CONTROL SYSTEM ONLY

****
* ~~SECRET~~ [redacted] * 25X1

FOREWORD

This document has been prepared in accordance with the requirements of sequence No. A023 of the CDRL (exhibit A to contract [redacted] 25X1

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

Section 1

INTRODUCTION

The purpose of this manual is to assist the user in understanding Mission 7346 SIGINT satellite operations and to provide an appreciation of satellite capabilities and limitations. Holders of this manual are encouraged to submit comments and suggestions for improvement through their (to be supplied) Control Officer to the originator. Reproduction or further local distribution of this document in part or in its entirety may be accomplished only with the approval of and under the conditions specified by the local (to be supplied) Control Officer.

Section 2

SYSTEM OVERVIEW

The Mission 7346 SIGINT Collection System is capable of collecting, processing, analyzing, and reporting signals from pulse and CW emitters that operate in the 2 GHz to 18 GHz frequency range. It satisfies the following primary mission objectives:

a. General Search (GS). Search for new or unusual signals from new or modified weapons systems over wide ranges of frequency and broad geographical areas.

b. Technical Intelligence (TI). Determine the operational characteristics and performance capabilities of foreign weapons systems at specific frequencies and locations.

c. General Surveillance/Electronic Order of Battle (EOB). Monitor the operational status and deployment of emitters associated with weapons systems over wide ranges of frequency and broad geographical areas.

d. Directed Surveillance (DS). Monitor the operational status and deployment of emitters associated with weapons systems involved in tactical operations at specific frequencies and locations and provide time critical reporting (TCR) in specific crisis situations.

The orbital segment is a small, spin-stabilized spacecraft that operates in a circular orbit at an altitude of 380 nautical miles designed to permit worldwide coverage (see Figure 2-1). The orbit inclination angle is 96 degrees and the orbital period is 98.8 minutes.

The spacecraft is carried into low-altitude orbit as a subsatellite on the vehicle of another major space program. The Mission 7346 spacecraft separates from the host vehicle, spins up, and fires orbital boost rockets to achieve a

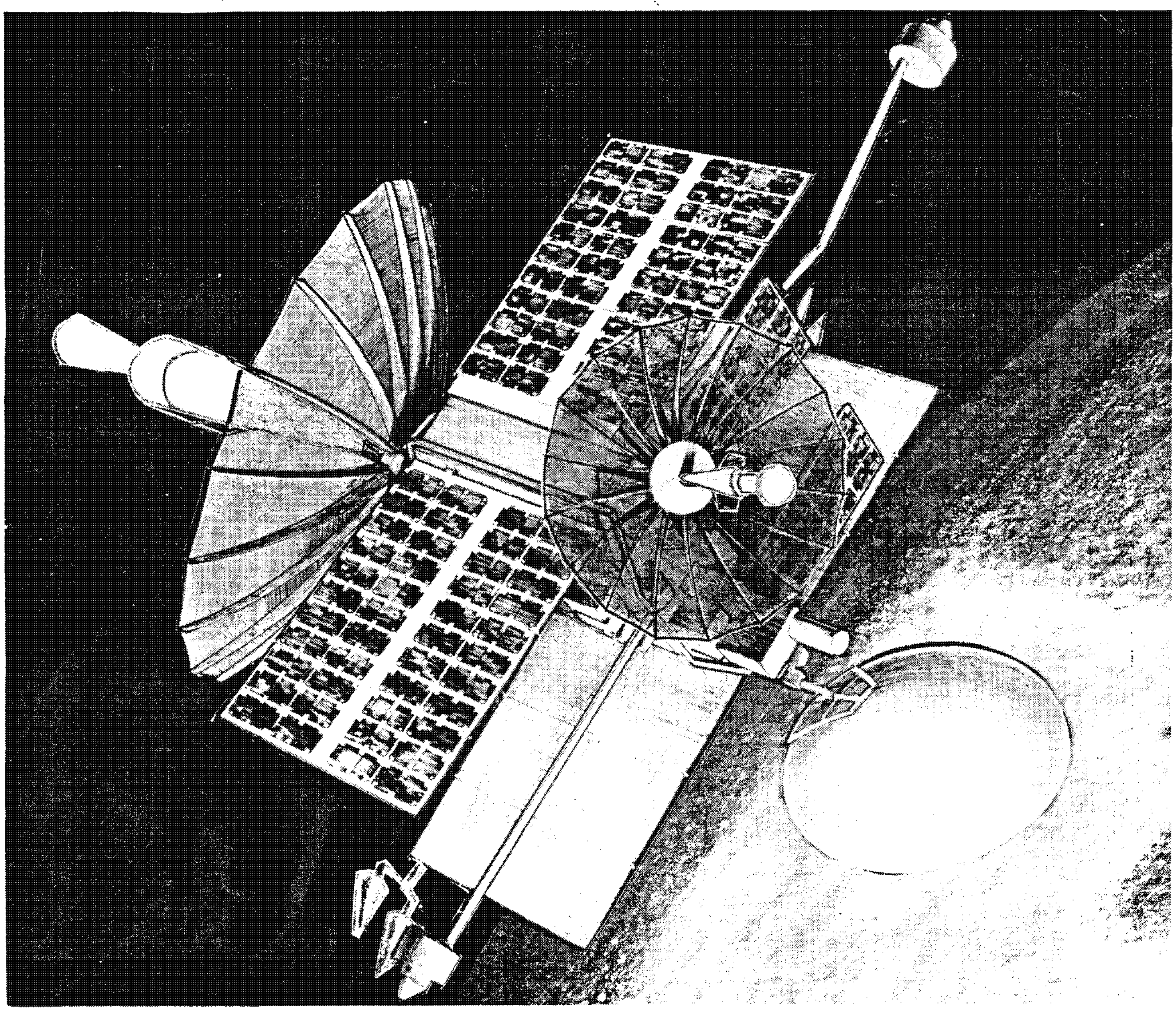


Figure 2-1 Mission 7346 Spacecraft

circular orbit at a nominal altitude of 380 nautical miles. Solar arrays and antennas are deployed to provide power for the spacecraft, collection of target emitter signals, and communications [redacted]

[redacted]

Each remote tracking station has the capability to command the spacecraft and to receive its transmitted downlink in one of three operating modes. The first and normal mode is store-and-dump, i.e., the intercepted data are stored on magnetic tape recorders contained within the spacecraft for subsequent readout when the spacecraft is in view of a tracking station. The second mode is a transpond mode in which the intercepted data are transmitted in real time to a tracking station. 25X1

In either of these operating modes, signals intercepted by the spacecraft are converted to a set of raw digital parameters and pre- and postdetection analog samples. The digital and analog data along with spacecraft status and health data are multiplexed together for transmission to a tracking station [redacted] data are processed to determine emitter type, location, and operating parameters. Once processed, the data are reported to consumers through the National Security Agency and directly to the Strategic Air Command.

The third mode is a real time processing mode in which signals of interest are processed by an on-board spacecraft processing system consisting of a small general purpose digital computer and a set of resident SIGINT processing algorithms. This real time data is transmitted directly to one or more remotely located and specially equipped mobile vans.

Detailed, in-depth, after-the-fact technical intelligence analysis, which may require from several days to several months to complete [redacted] This level of analysis provides intelligence on the operational capabilities of emitters by determining performance characteristics such as scan rate and type, scan sector limits, beamwidth, and main beam ERP. Analysis of the predetection waveform provides knowledge of an emitter's ability to resolve targets in clutter or noise and/or other abilities inherent in the waveform design. The association of individual emitters to their related weapon system is also a product of this in-depth analysis [redacted] This is extremely important to the analysis of new weapon systems. 25X1

This page left blank intentionally.

Section 3

SPACECRAFT DESCRIPTION

The Mission 7346 spacecraft is a spin-stabilized satellite equipped with SIGINT collection antennas and a SIGINT electronics payload. To support the SIGINT mission the spacecraft has: 1) a data subsystem consisting of magnetic tape recorders, data encryptors, and down link transmitters and antennas; 2) a command subsystem consisting of command receivers, command decoders, and a stored command sequencer; 3) an attitude control subsystem; 4) an attitude sensing subsystem; 5) a spin rate control subsystem; and 6) a power subsystem.

3.1 ANTENNA SUBSYSTEM

The antenna subsystem consists of a total of fourteen antennas. They include three high-gain parabolic DF antennas, three medium-gain guard inhibit antennas that provide inhibit protection of the higher order, close-in sidelobes of the parabolic antennas, six low-gain antennas that together provide inhibit protection of the far sidelobes and backlobes of the parabolic antennas, and two data downlink and command uplink antennas.

3.1.1 High-Gain DF Antennas

The three high-gain DF antennas cover the following frequency ranges:

1: 2-6 GHz (6 foot diameter reflector)
2: 6-12 GHz (3 foot diameter reflector)
3: 12-18 GHz (3 foot diameter reflector)

Each of these antennas consists of a four arm, multimode, logarithmic spiral at the focus of a parabolic reflector, and a beam forming network. The BFN generates two patterns - a sum pattern which has maximum gain on the antenna boresight and a difference pattern which has a null on the boresight. By measuring the ratio of the powers in the sum beam and the difference beam and the phase difference between these beams, signal angle-of-arrival with respect to instantaneous antenna boresight can be determined.

The three high-gain antennas are mounted on the spacecraft so that there is a 120 deg azimuthal separation between the boresight of each antenna (see Figure 3-1). This permits each antenna in turn to scan the earth essentially from western horizon to eastern horizon during one spin of the spacecraft. The spacecraft spin rate is approximately 45 rpm. Illustrations of the geographical cover of the earth provided by the scan of the high gain antennas are provided in Figures 3-2 and 3-3. Figure 3-2 illustrates the coverage for a single spacecraft nadir of 45°N latitude. Figure 3-3 illustrates the coverage for spacecraft nadir location of 20°N, 30°N, 40°N, and 50°N.

3.1.2 Guard Antennas

Three medium-gain guard antennas covering the same frequency ranges as the DF antennas are boresighted in the same direction as the high-gain antennas. The on-boresight gain of these antennas is slightly greater than the gain of the close-in sidelobes of the high-gain antennas and thus provide inhibit coverage.

3.1.3 Low-Gain Inhibit and Mainbeam Antennas

Six low-gain antennas are mounted such that their boresights are directed along the spacecraft spin axis - three are pointed along the north pointing spin axis and three along the south pointing spin axis. These two sets of low-gain omni antennas each cover the frequency range of 2 to 18 GHz with the same frequency divisions as the high-gain and medium-gain antennas. These low-gain antennas provide inhibit coverage of the far out sidelobes and backlobes of the high-gain antennas. They provide a suitable "near-omni" pattern that is optimum for collection of intercepts from the mainbeams of target emitters.

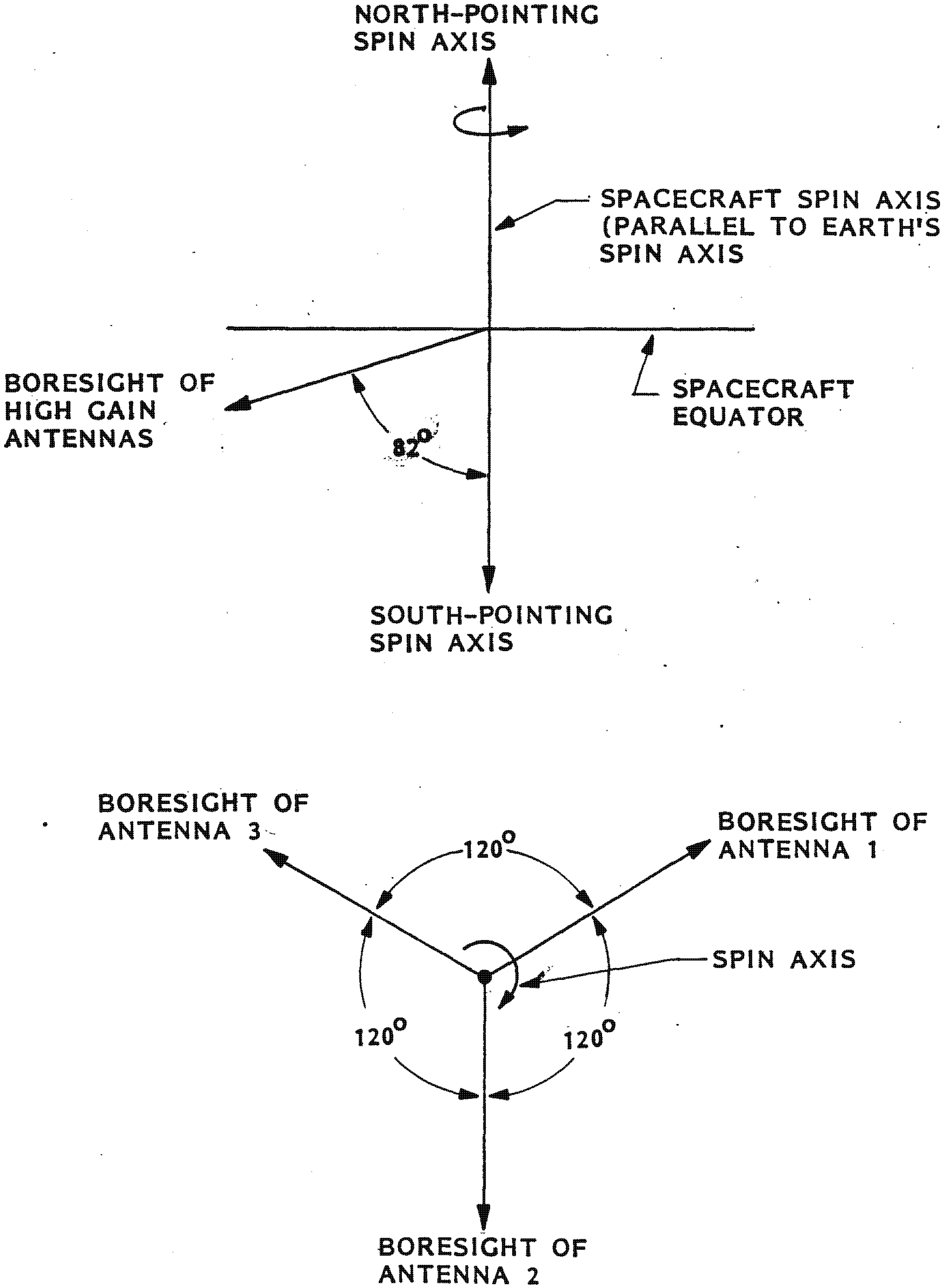


Figure 3-1 High Gain Antenna Mounting Angles

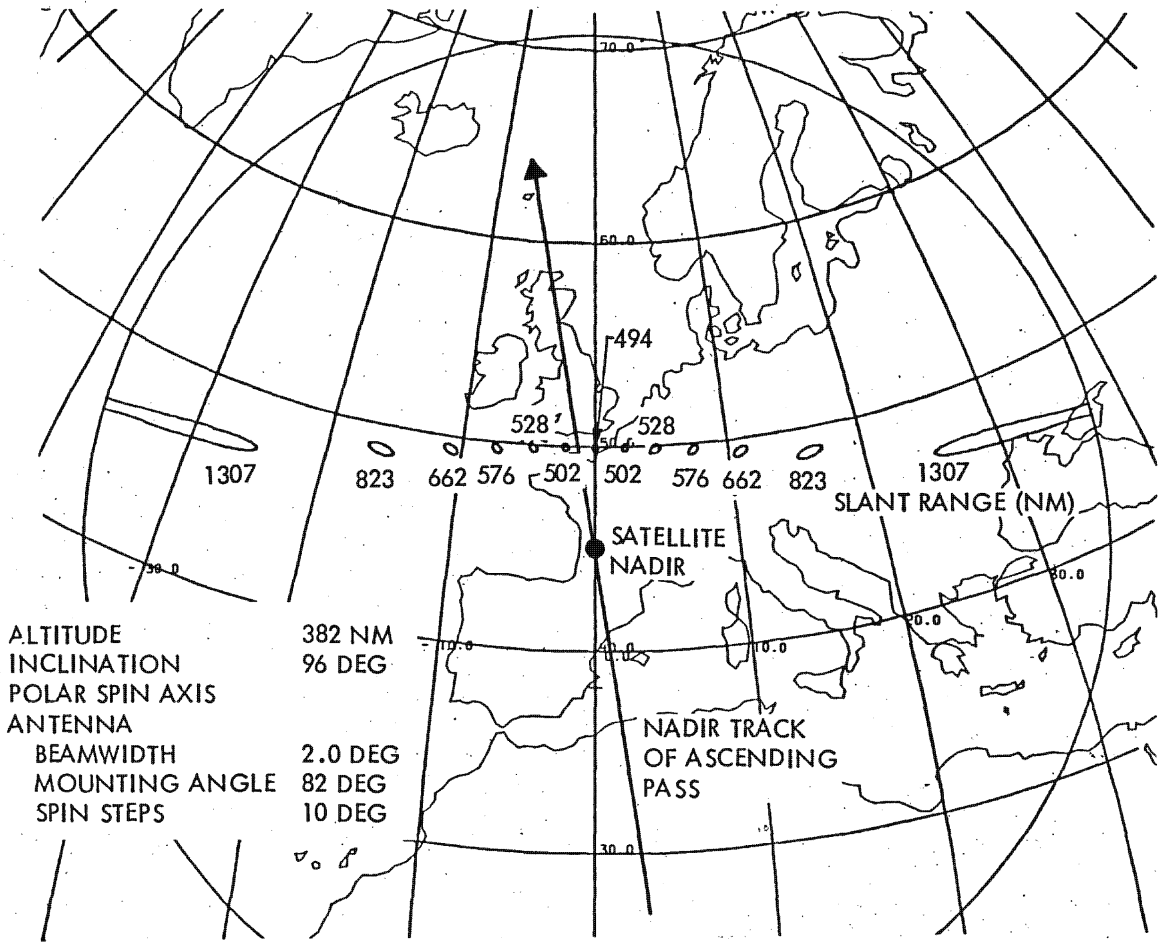


Figure 3-2 Typical Ground Coverage of High Gain Antenna System

SECRET/ 10

SECRET/ 25X1

BIF003W/2-156913-80

0128R

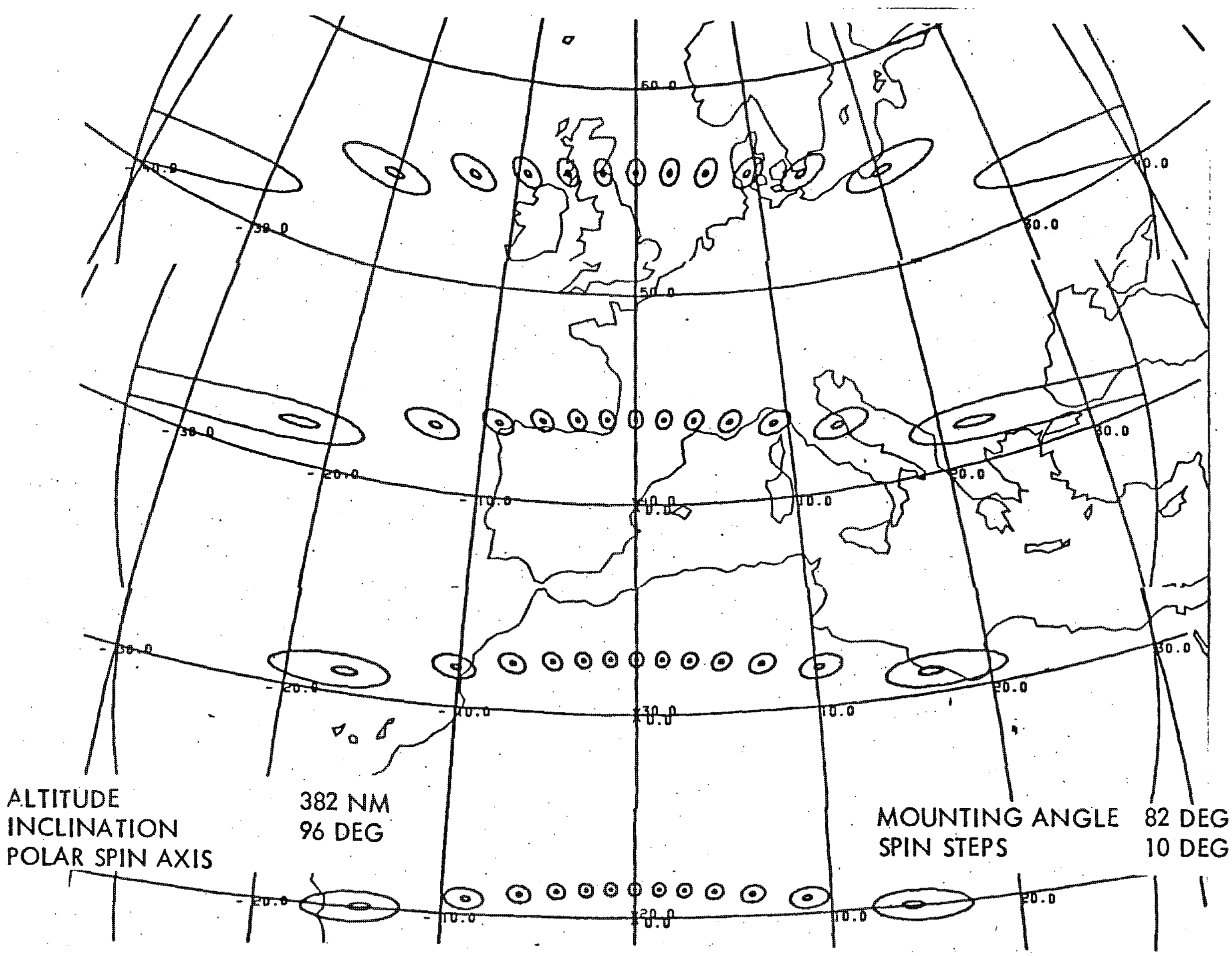


Figure 3-3 High Gain Antenna Ground Coverage for Different Subsatellite Latitudes

SECRET

25X1

BIF003W/2-156913-80

0128R

3.1.4 Command and Data Link Antennas

The last two antennas in the total complement of 14 antennas are the data link and command antennas. These two low-gain antennas are mounted with their boresights parallel to the spacecraft boresight - one pointing north and one pointing south. This dual set of antennas is required to provide near omni-directional pattern coverage about the spacecraft. Each antenna shares a dual role - command reception in the 1.7 to 1.8 GHz range and data transmission in the 2.2 to 2.3 GHz range.

3.2 ATTITUDE CONTROL SUBSYSTEM

An electromagnetic attitude control system maintains the orientation of the spacecraft spin axis at the appropriate alignment in inertial space. The spin axis is kept essentially parallel to the spin axis of the earth. With this attitude, proper antenna scanning of the earth is maintained, and proper solar power collection from the sun and spacecraft temperature control are provided.

3.3 SPIN RATE CONTROL SUBSYSTEM (SRCS)

This subsystem is used either to increase or decrease the spin rate to arrive at the optimum which is in the range of 45 rpm to 55 rpm. The subsystem is used periodically to restore the spin rate after environmental torques produce a particular decay. The spin rate control subsystem is capable of maintaining the spin rate within 0.5 rpm of the desired value.

3.4 TAPE RECORDERS

Three tape recorders each provide two tracks having a frequency response from 1 kHz to 1000 kHz at 100 ips. At this speed each tape recorder provides 5.5 minutes of readin (intercept) time. Each recorder can be operated at one quarter speed (25 ips) to provide 22 minutes of readin, but the frequency response is then 250 Hz to 250 kHz. Readout (downlink) is always accomplished in 5.5 minutes at full speed. The tape recorders are loaded with intercept data from the SIGINT payload and then read out via downlink transmitters to a ground site.

3.5 COMMAND SUBSYSTEM

Mission 7346 responds to both real-time commands from the remote tracking station network and stored commands from the onboard stored command sequencer. [redacted] remote tracking station) sends a set of programmed commands to the satellite where they are stored in a command memory. These commands control the receiver band selections, payload operating modes, and turn the tape recorders on and off according to the collection tasks specified by the mission planner. At a predetermined point in the satellite orbit, the commands are automatically initiated by the spacecraft stored command sequencer. 25X1

3.6 TRANSMITTER SUBSYSTEM

The transmitter subsystem (consisting of four transmitters) sends telemetry and data to the ground tracking station. Data are normally read out of an onboard tape recorder. In the case of a transpond operation data are routed to the transmitter directly from the SIGINT payload. The transpond operation can also be recorded for later readout [redacted] One transmitter is reserved for spacecraft telemetry, two transmitters are used to send payload data from the tape recorders, and a fourth transmitter is a spare. 25X1

3.7 ATTITUDE SENSING SUBSYSTEM

The spacecraft are equipped with two independent attitude sensing subsystems (sensors and associated electronics) that are stimulated by (1) direct exposure to the sun's rays (solar aspect sensor) and (2) exposure to changes in radiated energy as the sensor field-of-view crosses the earth horizon (horizon sensor). The telemetered data from the two systems can be used separately and in combination to determine the following parameters:

Section 4

SIGINT PAYLOAD

The Mission 7346 payload (Figure 4-1) consists of:

- o A five channel RF to IF downconverter operating in the frequency range from 2 GHz to 18 GHz
- o Five receivers operating in the frequency range from 2 GHz to 4 GHz
- o A data handler which combines the measured data from the five receivers into digital PCM intercept word groups (IWGs), stores the IWGs in a 2000 IWG solid state buffer memory which is emptied at a constant rate to the spacecraft tape recorders or data links, stores the desired payload operational command configuration, and provides time reference data from a time reference generator (TRG)
- o A data control unit (DCU) which controls the flow of all payload data to the spacecraft tape recorders and wideband data links
- o A data adapter unit (DAU) which controls the flow and form of all data between the receivers and an on-board general purpose digital computer (advanced spacecraft computer (ASC))
- o A test signal generator (TSG) which supplies test signals to the payload in order to verify proper operation of the downconverter, receivers, and data handler
- o Power supplies

The payload sensitivity, in conjunction with the receiving antenna gain, provides an emitter sidelobe detection capability as shown in Figure 4-2.

a. Spin axis orientation

b. Dynamic imbalance of the spacecraft

c. Spacecraft orientation at an instant of time within one spin

3.8 POWER SUBSYSTEM

Power for on-orbit operation of the Mission 7346 spacecraft is generated by solar collectors and stored in on-board batteries. Power generation potential is dependent upon solar illumination, and rate of discharge varies with the operation being conducted. The spacecraft is equipped with a charge rate control system that places the spacecraft in an automatic trickle charge mode to prevent overcharging and halts operations when a low-voltage condition is reached.

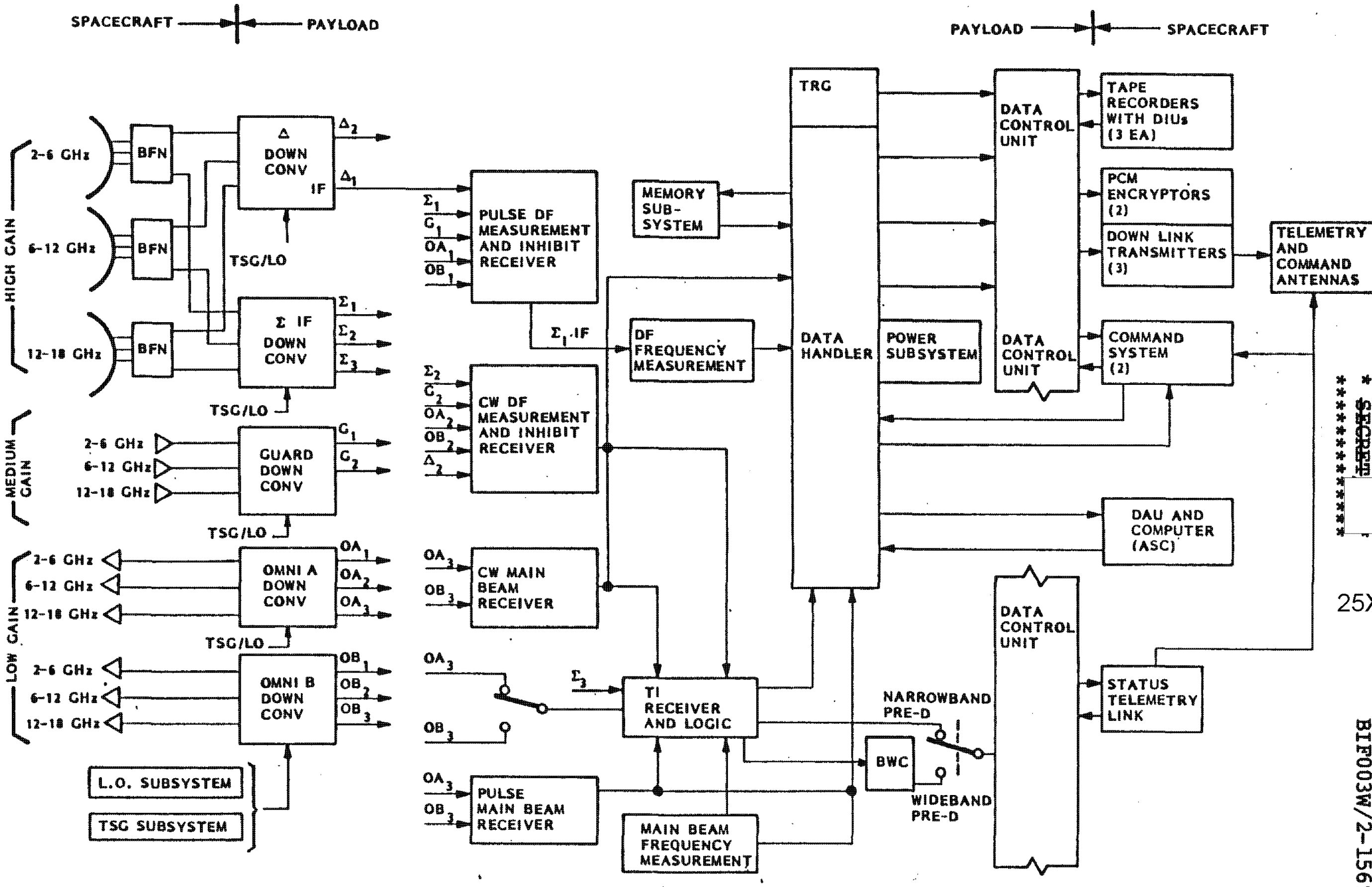


Figure 4-1 Mission 7346 Block Diagram

16

0128R

******* SECRET *******

25X1

BIF003W/2-156913-80

Page Denied

25X1

Approved for Release: 2024/08/06 C05098398

4.1 DOWNCONVERTER

The downconverter contains five channels, each served by three antennas: one for the 2- to 6-GHz band, a second for the 6- to 12-GHz band, and the third for the 12- to 18-GHz band for a total of 15 antennas. Figures 4-3 through 4-6 are block diagrams of the front end.

The DF sum channel and the two omni channels each select two RF bands, which can be the same. The other two channels (guard and DF delta) select one RF band. The data handler instructs each channel which RF bands to process. Nonrequested bands are not translated to the first IF.

The DF sum channel contains the necessary circuits to simultaneously convert all eight RF bands to the 2- to 4-GHz first IF. A maximum of two bands are actually treated at any given time - one for the DF receiver and a second for the TI receiver when it requests a different DF band. These two bands are totally independent; they can be the same band or a combination of any two bands.

With the exception that no provision is made for a TI output, the DF delta and guard channels are the same as the DF sum channel.

The omni antenna downconverter channels are the same as the DF sum channel, except that they use one band selection for the mainbeam and TI receivers and the other for the DF receivers.

Bands 2, 3, 4, and 5 employ high-side frequency conversion (IF is therefore inverted in frequency, i.e., the top of each band is converted to 2 GHz and the bottom to 4 GHz). Bands 6, 7, and 8 employ low-side frequency conversion (no IF inversion). Band 1 is not converted at all.

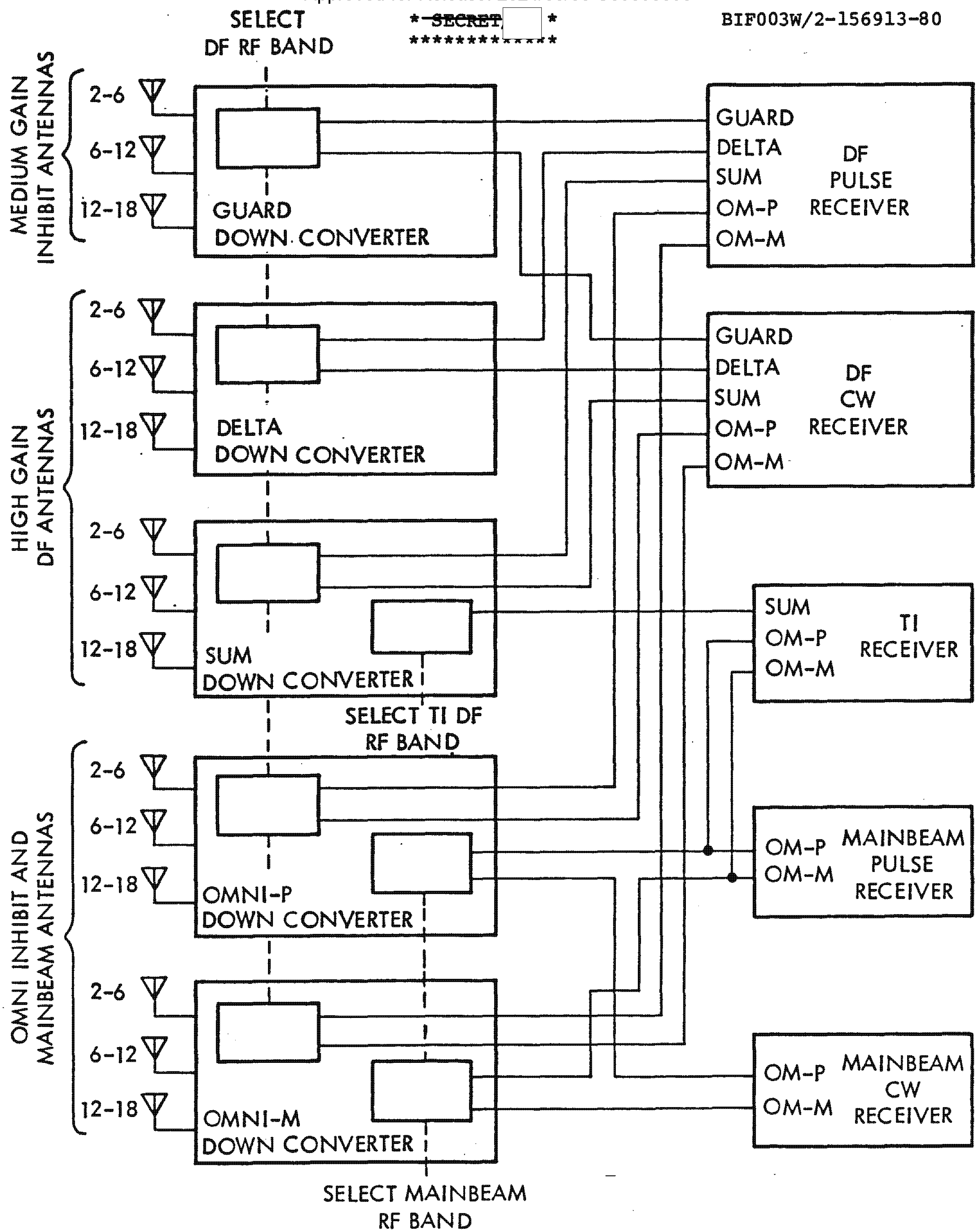


Figure 4-3 Front End Overall Block Diagram

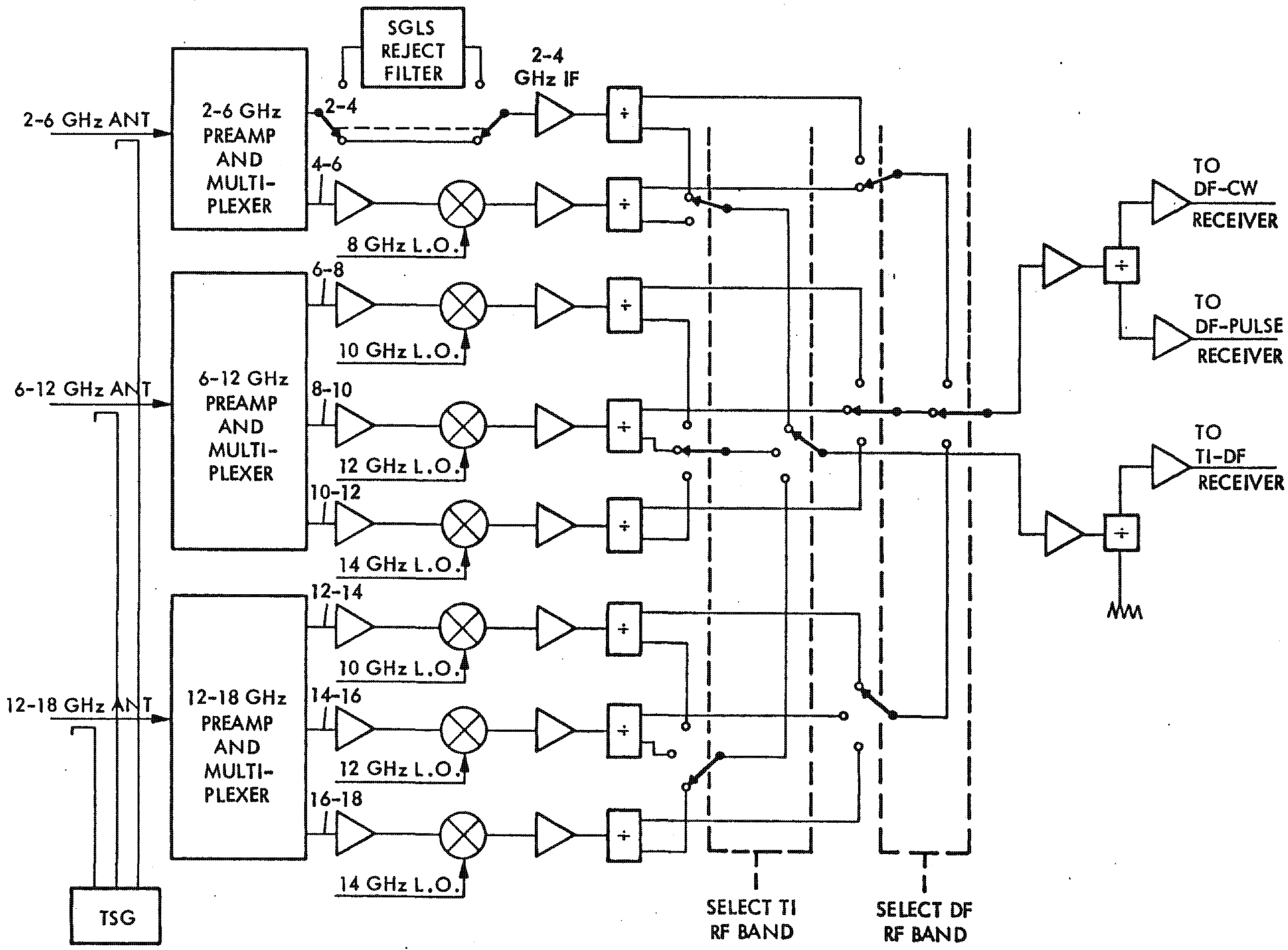


Figure 4-4 DF Sum Channel Downconverter

* SECRET/ *

20

0128R

25X1

BIF003W/2-156913-80

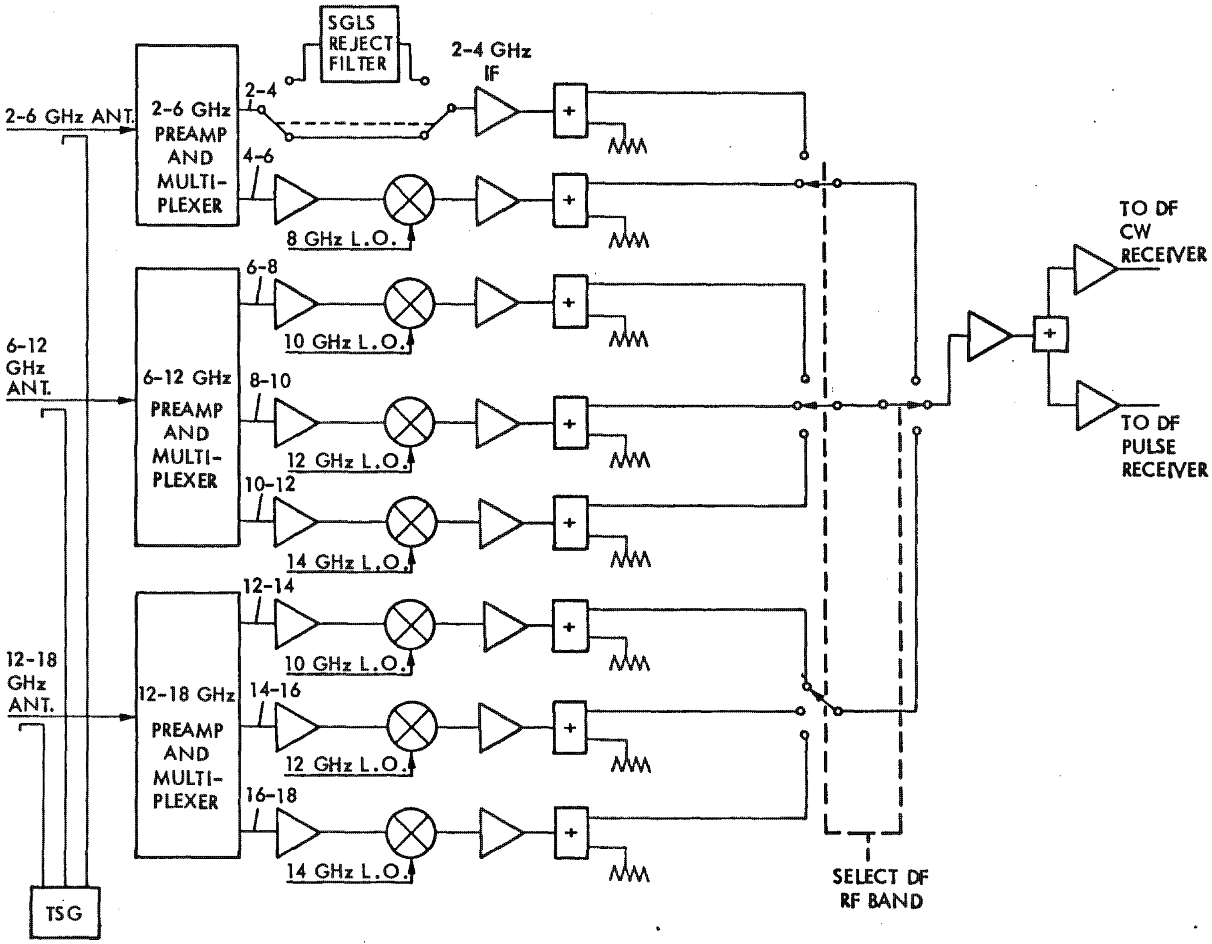


Figure 4-5 Delta or Guard Channel Downconverter

21

SECRET,

25X1

0128R

BIF003W/2-156913-80

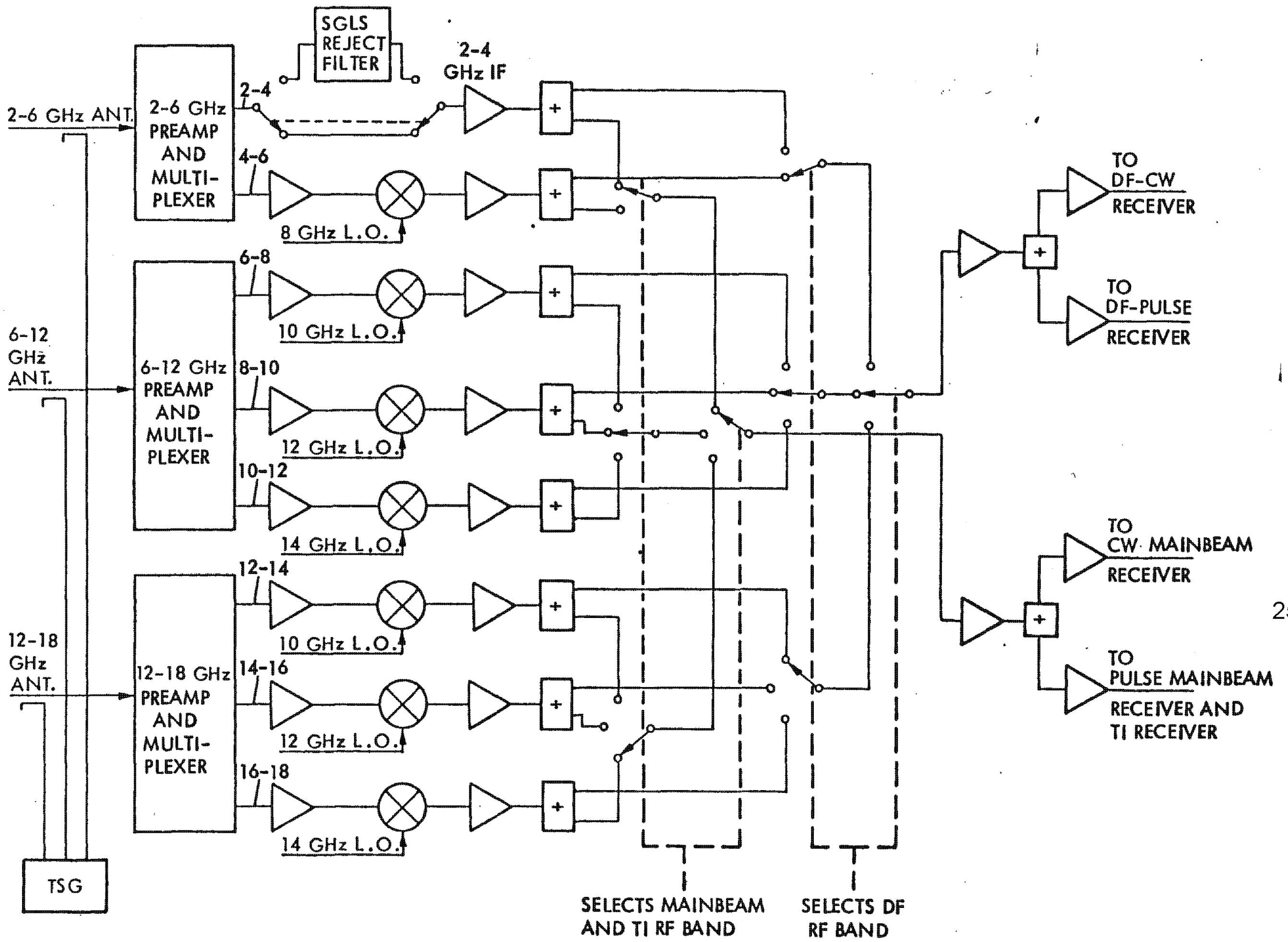


Figure 4-6 Omni Channel Downconverter

22

0128R

25X1

BIF003W/2-156913-80

4.2 DF RECEIVERS

There are two DF receivers, one for pulsed signals and one for CW signals. Each receiver has five parallel IF channels which receive inputs from the five-channel downconverter. The two DF receivers measure parameters that define the DOA (direction of arrival) of detected signals. To avoid ambiguous data, these receivers inhibit the processing of signals not received in the main lobe of the DF antenna. This inhibit is accomplished by comparing the amplitudes of the signals in the five channels and accepting only those signals for which the sum channel signal amplitude is the strongest. At least one of the omni antennas has more gain than the minor sidelobes of the DF antenna thus, intercepts via low-gain DF antenna sidelobes are rejected.

The guard antenna is a horn mounted on the DF antenna feed. It has higher gain than the first order sidelobes near the DF main lobe; therefore, intercepts via those sidelobes are rejected. Intercepts via the outer edge of the DF main lobe result in a delta signal stronger than the sum signal. Rejection of these signals is optional. Delta inhibit can be enabled full time or only when the Word Group (WG) buffer memory is over 80 percent full.

Any of the above inhibits can be turned off by command. On the other hand, any of these inhibits can be enhanced, causing inhibit to occur unless the sum channel signal is at least 5 dB stronger than the enhanced inhibit channel signal. The use of enhanced inhibits can eliminate residual poke-through areas and narrow the effective DF antenna beamwidth. This is useful when the PCM stream has difficulty passing all the available data; it leaves the portion of each intercept with the most accurate DOA information to be reported.

The DF information consists of the relative amplitudes and phases of the sum and delta channels. Rather than measure the phase directly, a bank of predetection combiners forms four new signals, the ratios of which are determined by the magnitude and phase of the ratio of sum to delta. These are:

a. A = (sum + delta)

b. B = (sum - delta)

c. C = (sum - delta $\angle 90°$)

d. D = (sum + delta $\angle 90°$)

The DF receivers report log (A/B), log (C/D), and log (sum/delta). In the central portion of the DF beam, log (A/B) and log (C/D) define a signal's direction of arrival. In the outer portions of the DF beam, one of these often will be obscured by receiver noise. In this case, the log (sum/delta) and the sign of the noisy measurement still combine with the third measurement to define the direction of arrival.

4.3 MAINBEAM RECEIVERS

There are two mainbeam receivers, one for pulsed signals, the other for CW signals. Each receiver has two IF channels which receive inputs from the omni downconverter channels. When both mainbeam channels contain a signal above threshold at the same time, the receiver reports only the signal in the channel that exceeded threshold first.

The two mainbeam pulse receiver channels are served by a single pulse frequency measurement module (PFM). The PFM is normally assigned to the first omni channel reporting a pulse. This assignment will last for 32 msec. A new decision is made based on the next omni pulse detected; that state is held for the next 32 msec.

The option exists to modify this scheme so that once assigned to a channel, the PFM will remain until 32 msec have passed without any pulses being detected in that channel. The PFM can also be assigned permanently to either of the omni channels, if preferred.

The PFM reports the frequency of any signal detected at the time predicted by the mainbeam pulse receiver threshold circuits. This should include all pulses in the channel monitored by the PFM, plus many pulses that are reported in the other omni channel, since the two antenna patterns have near equal gain in the crossover region.

Pulses received in the channel monitored by the PFM have their TOA determined by the threshold crossing time within the PFM, provided that the PFM threshold is crossed by the pulse in question. Pulses that do not exceed the PFM threshold, and, in any case, all pulses in the other omni channel, use a wideband threshold detector to establish the TOA.

4.4 PULSE RECEIVERS

4.4.1 General Description

There are two pulse receivers: a five-channel DF receiver (Figure 4-7) and a two-channel mainbeam receiver (Figure 4-8). The two pulse receivers are A-C coupled and are designed to have minimal response to all but very strong CW signals. Either receiver can process pulses separated by as little as 2.6 usec. The pulse reports are output into a PCM Intercept Word Group (IWG) buffer which accepts reports from all five receivers, plus solar aspect sensor (SAS), horizon sensor (HS), TRG, and program step reports. Each source has its own priority, with the two pulse receivers having the highest. It takes approximately 916 nsec for a word group to enter the buffer. A receiver may have to wait for the other pulse receiver or for a word group already in the process of being accepted. If it generates another report before the previous report enters the buffer, the new report will be lost. In the worst case, it might be 5.67 usec (pulse has 2 or more frequencies) before another report can be accepted if the buffer is not full and up to 7.25 msec if the buffer is overflowing. Of course, part of this time can be used to detect a signal and prepare the next report, so long as the report is not completed until the previous report has passed from the input buffer to the buffer proper.

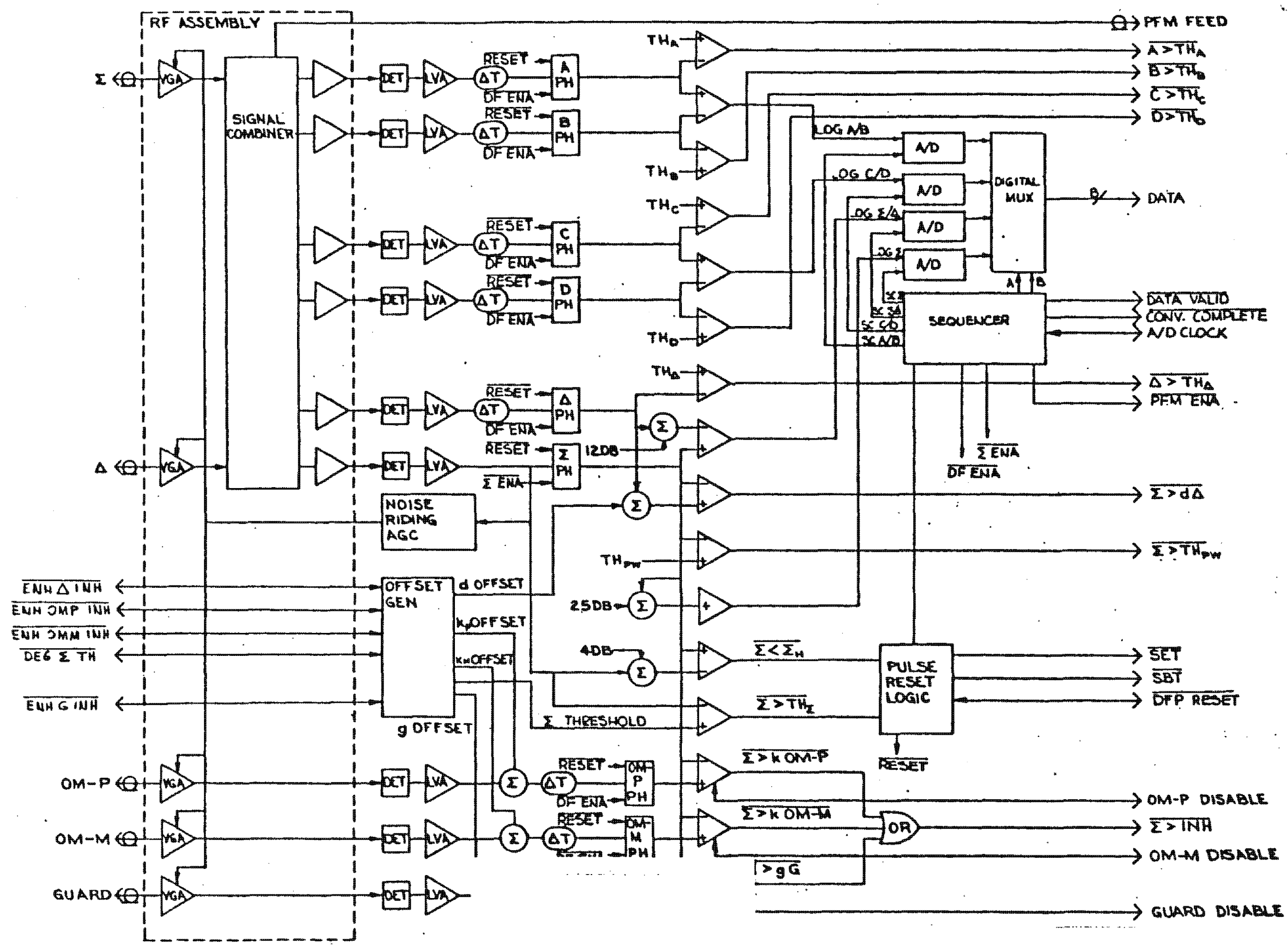


Figure 4-7 DF Pulse Receiver Functional Block Diagram

SECRET

26

0128R

25X1

BIF003W/2-156913-80

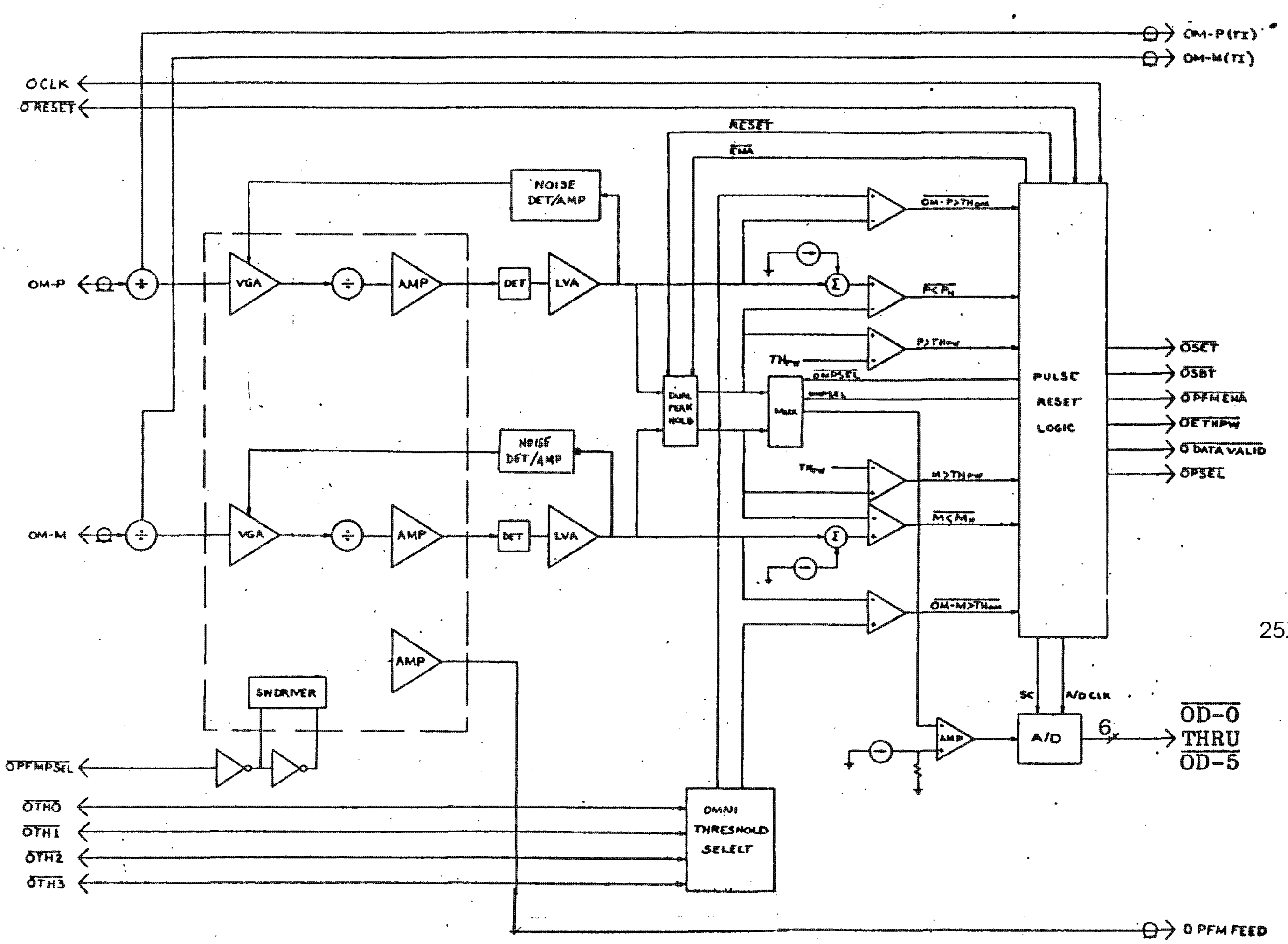


Figure 4-8 Mainbeam Pulse Receiver Functional Block Diagram

~~SECRET~~

27

25X1

BIF003W/2-156913-80

0128R

This is different from the pulse receiver report generating capacity, which is specified as the time from the end of one measured pulse to the start of the next measurable pulse.

4.4.2 Pulse Parameters

The pulse receivers measure the pulse parameters of accepted signals. Table 4-1 lists these parameters and gives the range and resolution of each measurement.

4.4.2.1 Pulse Frequency. The DF pulse receiver measures and reports the frequencies of up to three components in each pulse with a resolution of approximately one MHz and an instantaneous range of 2000 MHz. Frequencies just outside this range are sometimes measured as well. These are indicated by reporting a frequency 31.25 MHz in error and setting a flag bit (DOOB, = data out of bounds) in the IWG to indicate the error.

The mainbeam pulse receiver measures and reports the frequencies of the two strongest components in each pulse with a resolution of approximately 1 MHz and an instantaneous range of 2000 MHz.

Frequency components containing less than 10 percent of the total pulse energy are not reported by either pulse receiver.

Pulses entirely outside the 2000-MHz nominal IF band are either reported as DOOB or as having the number of frequencies equal to zero, if they are reported at all.

Pulses with some components inside the 2000-MHz nominal band and others just outside that band will have the in-band components reported; also, each component will be compared to the energy in the out-of-band guard filters. The pulse report will indicate which in-band components are weaker than either out-of-band filter signals.

Table 4-1

PULSE RECEIVER PARAMETERS

Signal Parameter	No. of Bits DF	No. of Bits Main-beam	Report Resolution	Report Range
RF Band	3	3	2 GHz	2 to 18 GHz
Frequency	11*	11*	0.977 MHz	0 to 2 GHz
Out-of-Band	2*	2*	Upper/Lower	
Pulse Width	5	6	See Table 4-2	61 nsec to 100 usec
Amplitude	5	6	0.6 dB	0 to 37.8 dB
[redacted]				
Sum/delta	8		0.125 dB	-4 to +28 dB
A/B	8		0.125 dB	-16 to +16 dB
C/D	8		0.125 dB	-16 to +16 dB
RT1	3*	3*	8 Steps	13 dB
No. of Freqs	3	3	1	1, 2, 3, or more
A > THR	1			
B > THR	1			
C > THR	1			
D > THR	1			
Delta > THR	1			
Sum > D*Delta	1			
Sum > PW THR	1	1		
Omni Antenna		1	Omni-M or Omni-P	
DOOB	1	1		

25X1

*For each of up to three frequencies for the DF receiver, and up to two frequencies for the mainbeam receiver.

Each pulse receiver reports the number of frequency components detected in band (up to four) and indicates the relative power distribution.

4.4.2.2 Pulsewidth. Each pulse receiver measures the width of detected pulses within the range of 0 to 100 usec with a resolution of 61 nsec. The measured width is converted nonlinearly to provide a six-bit word, approximating a log scale with 10 percent resolution. Table 4-2 specifies the output report versus pulsewidth.

The receivers also indicate whether or not the signal was strong enough to have a trustworthy pulsewidth report (about 4 dB above the detection threshold).

4.4.2.3 Pulse Amplitude. Each pulse receiver encodes the peak held output of a log video amplifier and reports the sum channel or mainbeam pulse amplitude with a resolution of 0.6 dB and a range of 37.8 dB (63 increments) with respect to threshold.

25X1

Table 4-2

OUTPUT REPORT VS PULSEWIDTH

CODE	PULSEWIDTH CODE MIN	MAX	MEAN	CODE	PULSEWIDTH CODE MIN	MAX	MEAN
00	NOT USED			32	4.700	5.249	4.975
01	0.000	0.061	0.030	33	5.188	5.798	5.493
02	0.000	0.122	0.061	34	5.737	6.409	6.073
03	0.061	0.183	0.122	35	6.348	7.080	6.714
04	0.122	0.244	0.183	36	7.751	7.874	7.447
05	0.183	0.305	0.244	37	7.751	8.607	8.209
06	0.244	0.366	0.305	38	8.545	9.583	9.064
07	0.305	0.427	0.366	39	9.521	10.559	10.040
08	0.366	0.488	0.427	40	10.498	11.658	11.078
09	0.427	0.549	0.488	41	11.597	12.878	12.238
10	0.488	0.610	0.549	42	12.817	14.221	13.519
11	0.549	0.671	0.610	43	14.260	15.747	14.954
12	0.610	0.732	0.671	44	15.686	17.345	16.541
13	0.671	0.793	0.732	45	17.334	19.226	18.280
14	0.732	0.854	0.793	46	19.165	21.240	20.203
15	0.793	0.977	0.885	47	21.179	23.438	22.309
16	0.916	1.099	1.008	48	23.376	25.879	24.628
17	1.038	1.221	1.130	49	25.818	28.564	27.191
18	1.160	1.343	1.252	50	28.503	31.616	30.029
19	1.282	1.465	1.374	51	31.555	34.851	33.203
20	1.404	1.648	1.526	52	34.790	38.513	36.652
21	1.587	1.831	1.709	53	38.452	42.725	40.589
22	1.776	2.014	1.892	54	42.664	47.241	44.953
23	1.953	2.197	2.075	55	47.180	52.185	49.683
24	2.136	2.411	2.289	56	52.124	57.556	54.840
25	2.380	2.686	2.533	57	57.495	63.660	60.578
26	2.625	2.930	2.778	58	63.599	70.374	66.987
27	2.869	3.235	3.357	59	70.313	77.759	74.036
28	3.174	3.540	3.357	60	77.698	85.938	81.818
29	3.479	3.906	3.693	61	85.877	95.032	90.455
30	3.845	4.272	4.059	62	94.971	105.042	100.007
31	4.211	4.761	4.486	63	104.981		

4.4.2.5 Direction of Arrival (DOA) Data. The DF pulse receiver reports the values of log (sum/delta), log (A/B), and log (C/D) to a resolution of 0.125 dB. The sum/delta report has a range of -4 to +27.875 dB, while the A/B and C/D reports have ranges of -16 to +15.875 dB.

4.4.2.6 Miscellaneous DF Flags. The DF pulse receiver reports which DOA components (A, B, C, D, or delta) exceed threshold. It also reports whether or not the sum/delta ratio is less than a commandable ratio. This ratio can be set to either 0 dB or 5 dB by command.

4.4.2.7 Omni Channel. The mainbeam pulse receiver reports which omni channel is used to generate the report and whether or not the signal in each channel exceeded the detection threshold.

4.4.2.8 Accuracy. The 95% confidence accuracy for pulse parameters reported are as follows:

Parameter	Accuracy	Conditions
Pulse Frequency	± 1.56 MHz	Within selected RF band, above threshold, and PW > 0.12 usec
Pulsewidth	± 10%	Rise and fall times ≤ 35 nsec, PW > 1.0 usec, and Ampl > PW threshold
	± 100 nsec	Rise and fall times ≤ 35 nsec, PW < 1 usec, and Ampl > PW threshold
Amplitude	See Table 4-3	
[redacted]	± 42 nsec	TOA strobed from PFM
PRI	See Figure 4-9	
Scan Period	See Figure 4-10	
DOA	See Figure 4-11	

25X1

Table 4-3

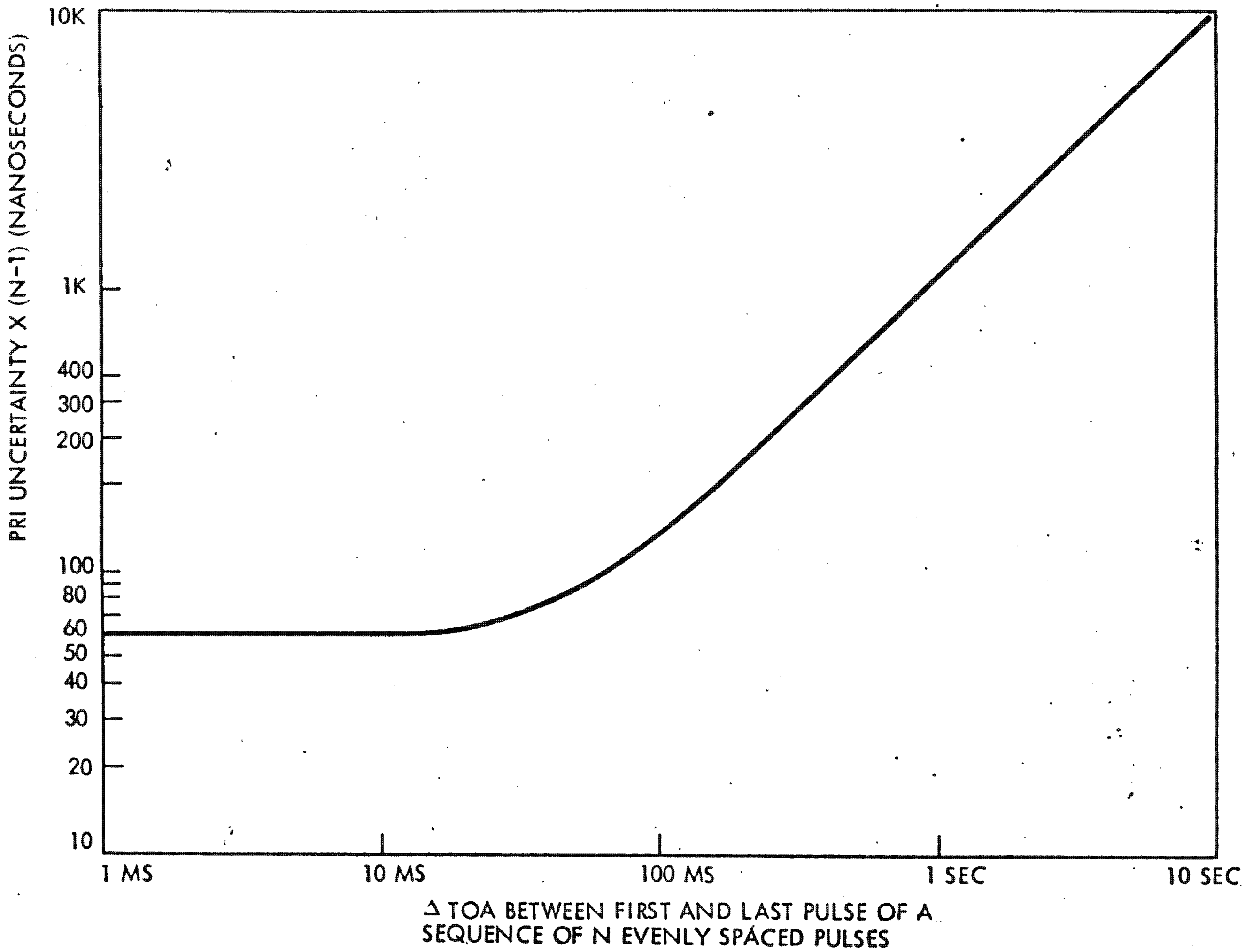
AMPLITUDE MEASUREMENT ACCURACY

Antenna	(Degrees)[1]	Accuracy (dB)
A1	0 - 30	± 4.9
	180 - 150	
A2/A3	30 - 60	± 5.2
	150 - 120	
	60 - 90	± 6.2
	120 - 90	
B1	0 - 20	± 4.9
	180 - 160	
B2/B3	20 - 45	± 5.7
	160 - 135	
	45 - 70	± 6.9
	135 - 110	
	70 - 90	± 8.3
	110 - 90	
C1	60 - 90	± 4.9
	90 - 120	
C2/C3	45 - 60	± 5.7
	120 - 135	
	25 - 45	± 12.0
	135 - 155	

NOTE: (1) Angles refer to spacecraft coordinates
Top Range = -Y axis coverage antennas
Bottom Range = +Y axis coverage antennas

34

[redacted]



25X1

BIF003W/2-156913-80

0128R

Figure 4-9 PRI Measurement Accuracy

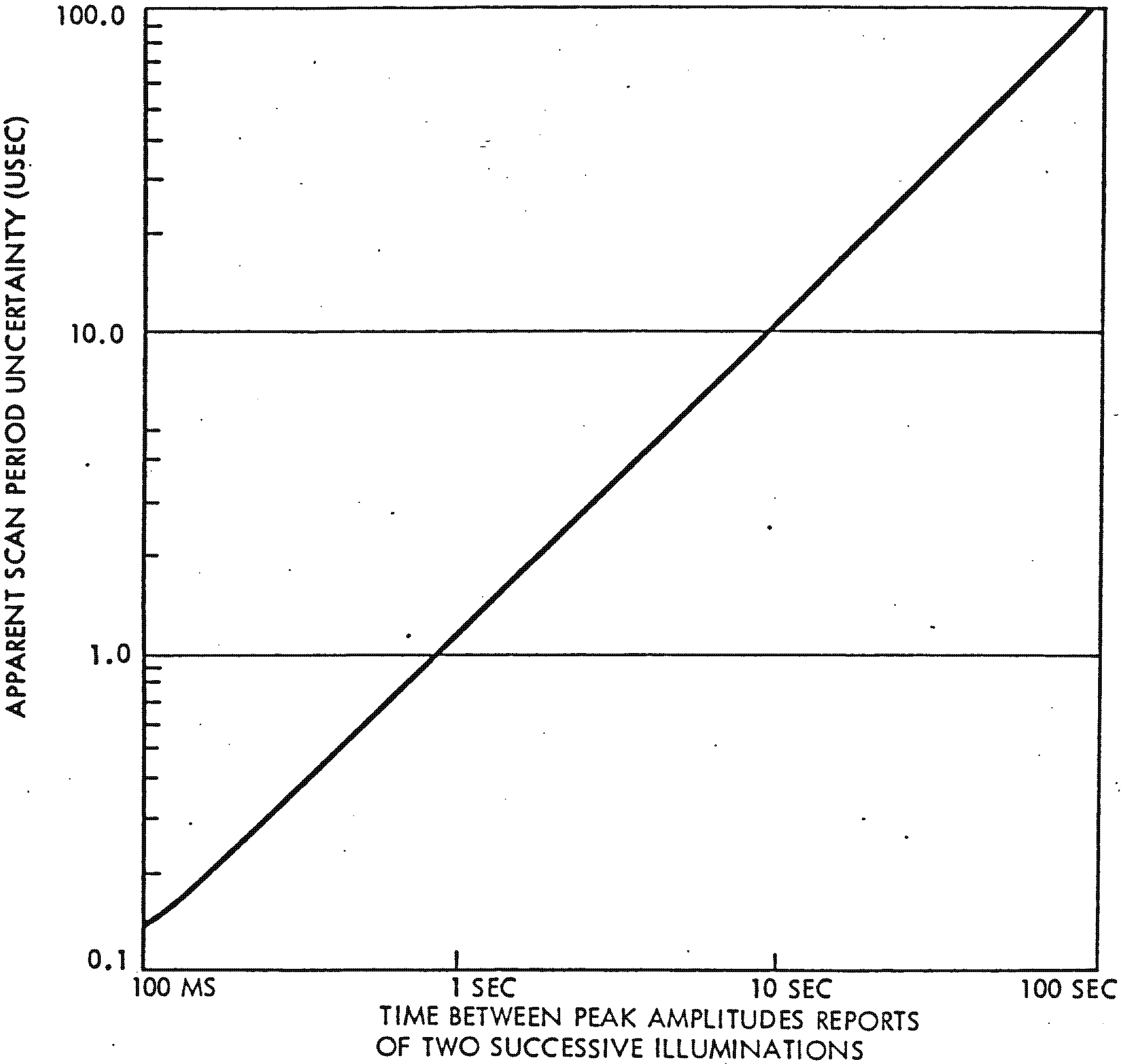
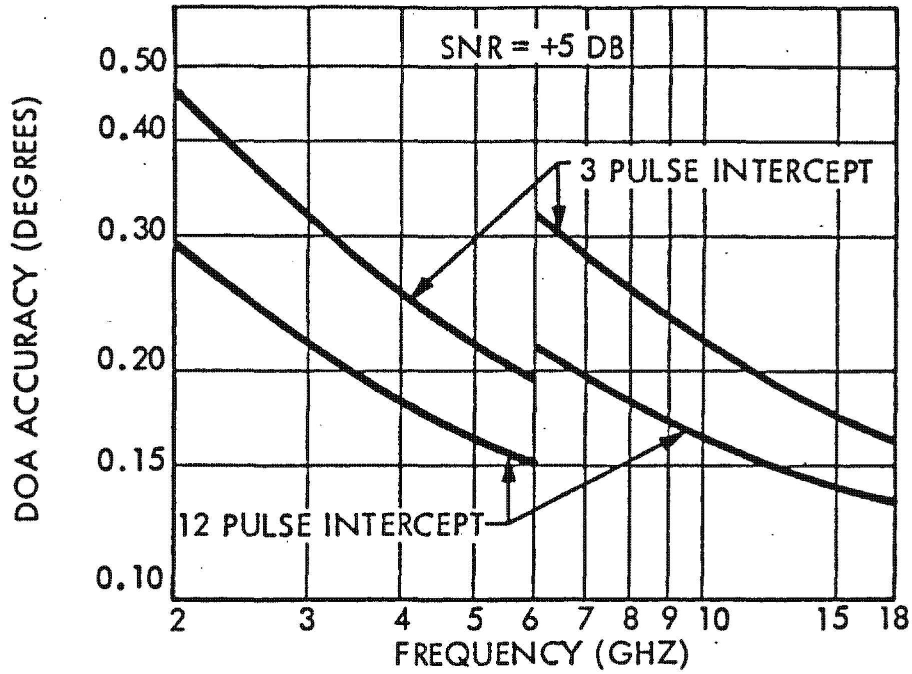
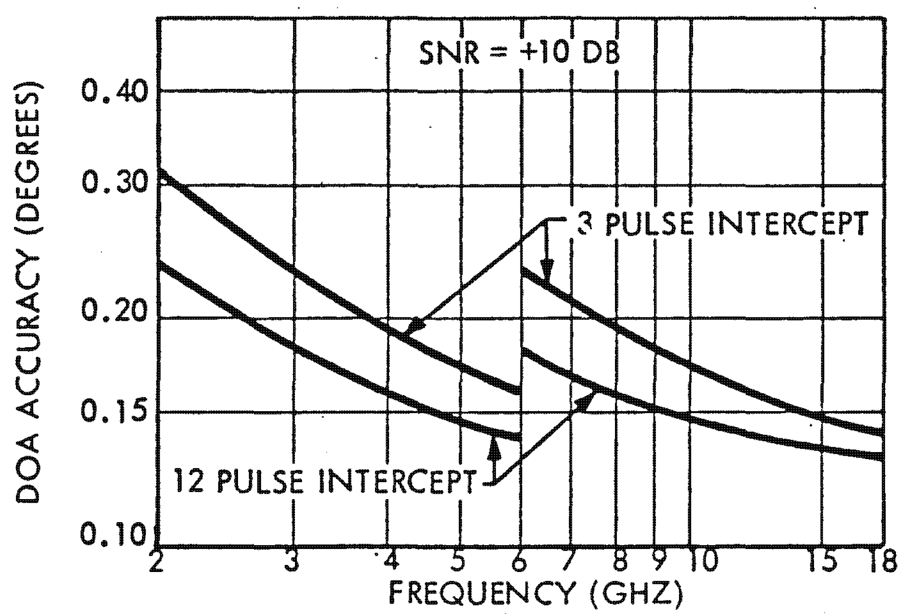


Figure 4-10 Apparent Scan Period Accuracy





NOTE: SNR = −2.2 DB AT THRESHOLD

Figure 4-11 Pulse System Direction of Arrival Accuracy

4.4.3 Pulse Data Thinning

Measured pulsed signals are subjected to a series of data thinning filters. These filters weed out low priority signals to allow room in the PCM stream for the higher priority signals.

The first filter eliminates unwanted signals on the basis of frequency. The PFM divides the selected 2-GHz band into 64 parts. This filter can be set to eliminate signals from any combination of these 64 parts.

Any pulse is rejected whose strongest RF component is in a forbidden (by command) part of the band. In addition, this inhibit can be extended to reject also those pulses with a second or third frequency component in a forbidden part of the RF band.

The second filter is more specific. This filter defines a set of pulses in terms of PRI, pulsewidth, and frequency. The specified set of pulses can be rejected or the filter can be made to eliminate everything outside that set.

All pulses surviving these two filters are reported in the PCM. Pulses that lack a valid frequency measurement (such as wideband pulses) bypass the above filtering. Special commands determine whether or not these are reported in the PCM.

4.4.4 Pulse Receiver to TI Receiver Handover Filtering

A pulse receiver to TI receiver handover filter is included in each pulse receiver to ensure that TI handovers of priority signals can be accepted. These filters, which cannot be bypassed, consider only those signals reported in the PCM.

Each filter specifies a frequency range and a pulsewidth range. Signals meeting both requirements may be either handed over to the TI receiver and all others ignored, or they may be ignored and all the others allowed as handovers. Reports lacking a valid frequency or pulsewidth are not considered for handover under any conditions.

4.4.5 Pulse Frequency Measurement (PFM)

Figure 4-12 is a block diagram of the PFM module. Each pulse receiver uses a PFM module to measure the frequency of detected pulses. The PFM modules consist of a bank of 66 coarse filters plus three fine frequency circuits for the DF receiver, and two fine frequency circuits for the mainbeam receiver.

The 66 filters consist of 64 that divide the selected 2-GHz band equally, plus an out-of-band guard filter at each end. The 64 in-band filters drive 64 detectors. The outputs of these detectors are compared to determine the filters having the three strongest RF components of the pulse (assuming there are three). A filter cannot be chosen if the adjacent filter is chosen; therefore, adjacent filters cannot be reported. The out-of-band filters also drive detectors. To estimate the relative contribution of out-of-band energy to the pulse, the outputs of these detectors are each compared to the amplitudes of all reported pulse frequencies.

The fine frequency circuits are fed through delay lines to allow the LO for each circuit to be set before the pulse arrives at the mixers.

Normally, the PFM is used for TOA determination. If the PFM does not detect a signal, then the TOA will be determined using the WB (2 GHz) threshold circuit. In general, the WB threshold is used merely as a pulse confirmation device which eliminates PFM false alarms. However, the mainbeam channel without a PFM always uses the WB threshold for its TOA data, even if the pulse is detected by the PFM via the other channel and the PFM frequency is actually included in the pulse report.

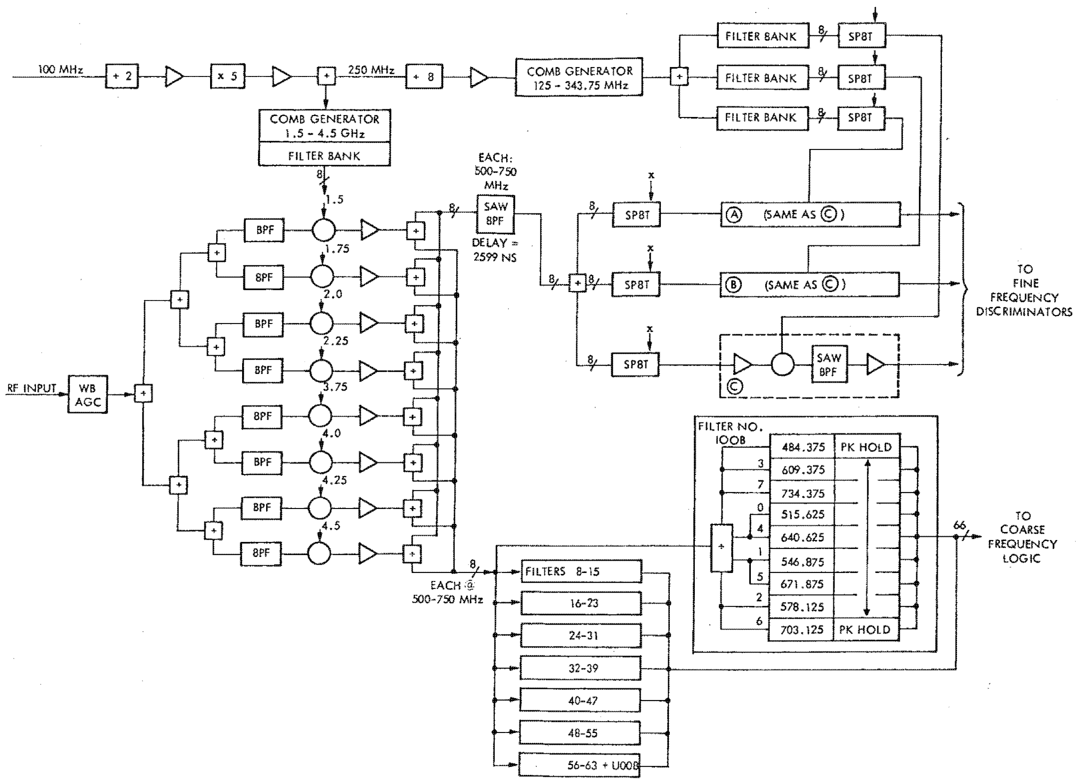


Figure 4-12 PFM Block Diagram

40

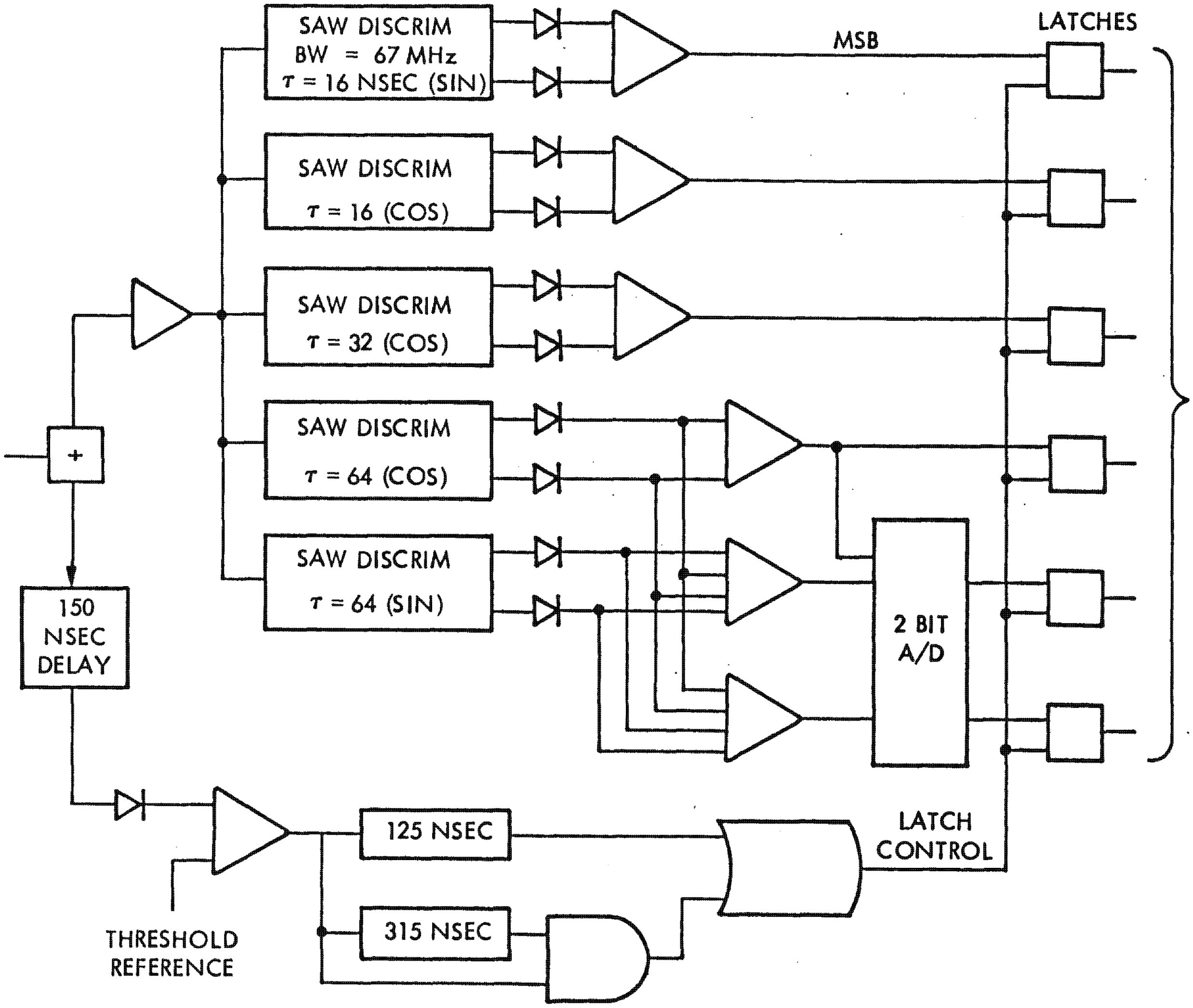


Figure 4-12 PFM Block Diagram (Continued)

0128R

25X1

BIF003W/2-156913-80

4.5 CW RECEIVERS

4.5.1 General

There are two CW receivers, a five-channel DF receiver (Figure 4-13) and a two-channel mainbeam receiver (Figure 4-14). The CW receivers measure the parameters of detected signals which are CW or which have very high duty cycles. Each receiver uses a scanning LO to sweep its selected band. Any CW signals will be detected twice; first when the LO approaches the signal frequency, and again when it is moving away after crossing that frequency. The LO sweeps up and down across the 2- to 4-GHz first IF. Figure 4-15 shows the CW receiver detection theory of operation.

Each contact should last for a time set by the CW receiver second-IF bandwidth and the LO sweep speed (about 6 usec). Contacts under 6 usec in duration are rejected if an internal threshold is exceeded (about 4 dB above the CW threshold). Wideband CW signals may be detected for much longer than normal periods. If the detection period lasts over 16 usec, the contact is also rejected.

The rejection of contacts lasting under 6 usec can be disabled by command if it is desired that high duty-cycle, high PRF pulses are to be accepted and reported by the CW receiver in question. This 6 usec refers to the time the detected signal is above threshold, and is produced by pulses lasting at least 3.5 usec. It is possible for narrower pulses at or above the CW receiver dynamic range ceiling to be accepted because of receiver saturation effects.

If a first contact is rejected as too short, the receiver will be ready for another signal after sweeping approximately 20 MHz of the input band. If the first contact is accepted, the CW receiver will ignore all signals until time for the second contact, during which time it will sweep about 120 MHz of the input band. This means that each accepted first contact casts a shadow that may conceal other signals. Provided it is over 135 MHz away from the nearest

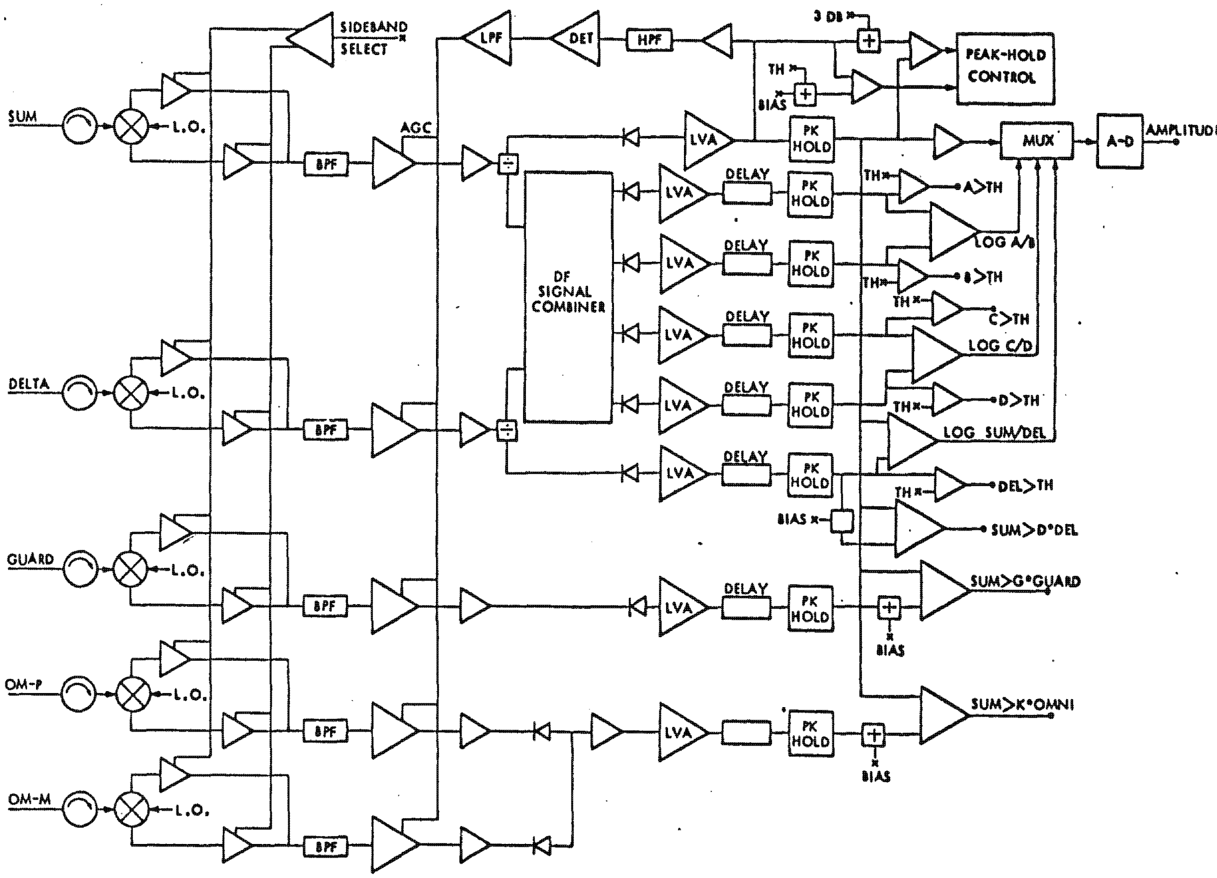


Figure 4-13 DF CW Receiver Block Diagram

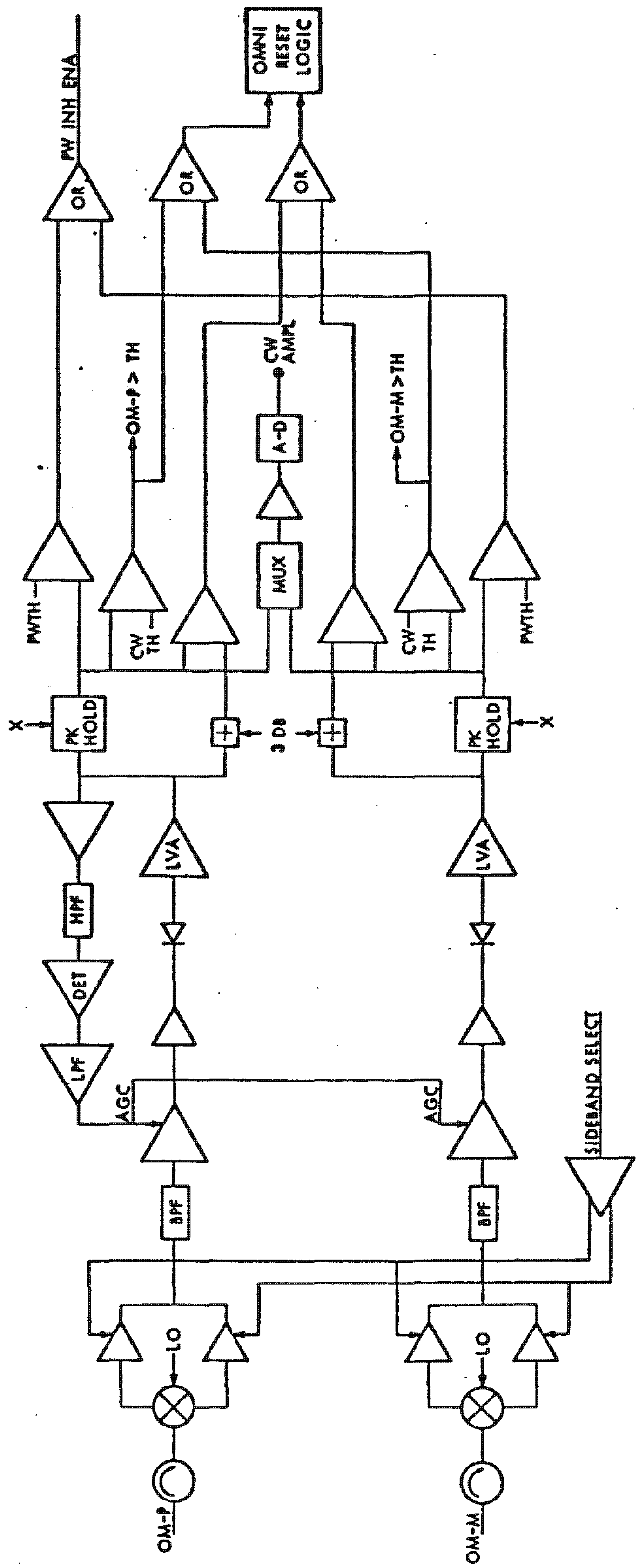
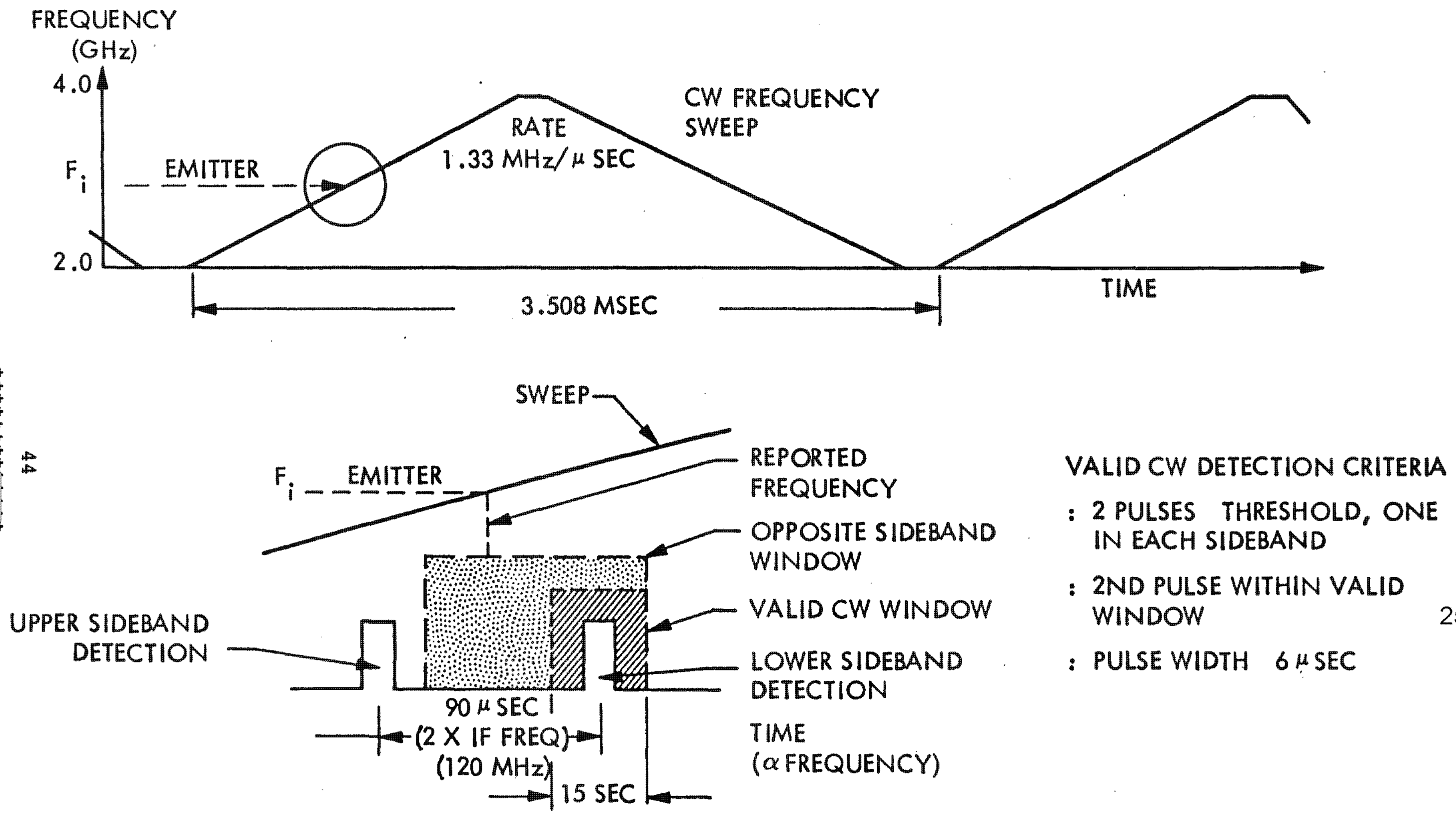


Figure 4-14 Mainbeam CW Receiver Block Diagram



25X1

SECRET

44

0128R

BIF003W/2-15691З-80

Figure 4-15 CW Detection Theory of Operation frequency on at least one side (the alteration of sweep direction causes these shadows to alternate direction), each signal will be reported half of the time. The time between the first and second contacts is used to encode the amplitude and the DF parameters (in the DF receiver).

4.5.2 CW Receiver Measurements

Each CW receiver measures the frequency, amplitude, and time of measurement (TOM) of every signal it accepts. The DF CW receiver also measures the DOA parameters of the signal and flags any reports for which a DOA component is below threshold. Table 4-4 lists the measurements made by the CW receivers.

Table 4-4

CW RECEIVER PARAMETERS

Parameter	No. of Bits DF	No. of Bits Omni	Resolution	Range
RF Band	3	3	2 GHz	2 to 18 GHz
Frequency	10	10	2 MHz	0 to 2 GHz
Amplitude	6	6	0.75 dB	o to 47.25 dB
TOM	13	13	0.977 usec	0 to 8 msec
Ambiguity	2	2		
Sum/Delta	8		0.125 dB	-4 to +28 dB
A/B	8		0.125 dB	-16 to +16 dB
C/D	8		0.125 dB	-16 to +16 dB
A > Threshold	1			
B > Threshold	1			
C > Threshold	1			
D > Threshold	1			
Delta > Threshold	1			
Sum/Delta > Threshold	1			
Sweep Sense	1	1		Up/Down
Omni Channel		1		Omni-P or Omni-M

4.5.2.1 <u>CW Frequency</u>. The CW receivers measure and report the frequency of recognized CW signals over a range of 2000 MHz. The reported frequency is the average of the LO frequencies at the trailing edge of each of two contacts, compensated for the effect of sweep direction. Each contact is measured to a 2-MHz resolution. The above applies only to narrowband CW signals. A broadband CW signal will have the upper edge frequency reported on upsweeps and the lower edge frequency reported on downsweeps.

4.5.2.2 <u>CW Amplitude</u>. The CW receivers report the amplitude of CW signals with a resolution of 0.75 dB over a range of 47.25 dB (63 steps).

4.5.2.3 <u>Time of Measurement (TOM)</u>. The CW receivers report the TOM of CW signals with a resolution of better than 1 usec over a range of 8 msec. Two extra bits are provided to resolve any ambiguity as to the proper TRG report to use as a reference. The combination of CW and TRG reports provides a range of over 1553 days.

4.5.2.4 <u>DOA Data</u>. The DF CW receiver also reports the values of log (sum/delta), log (A/B), and log (C/D) to a resolution of 0.125 dB. The sum/delta report has a range of -4 to +27.875 dB, while the A/B and C/D reports have ranges of -16 to +15.875 dB.

4.5.2.5 <u>Miscellaneous Flags</u>. The DF CW receiver flags any DOA components (A, B, C, D, or delta) that do not exceed threshold. It also reports whether or not the sum/delta ratio is less than a commandable constant "P." This constant can be set to either 0 dB or 5 dB. The mainbeam CW receiver reports which antenna provided the contact and whether each channel had a signal above threshold.

4.5.2.6 <u>Sweep Sense</u>. The CW receivers report the direction of scan across the first IF band. The direction of scan across the RF band is the same as at IF in bands 1, 6, 7, and 8. In bands 2, 3, 4, and 5 the direction of scan across the RF is opposite to that in the IF.

4.5.2.7 Accuracy. The 95% confidence accuracy for CW measurements are as follows:

Parameter	Accuracy	Conditions
Frequency	± 4.4 MHz	Above threshold
Amplitude	See Table 4-3	
DOA	See Figure 4-16	

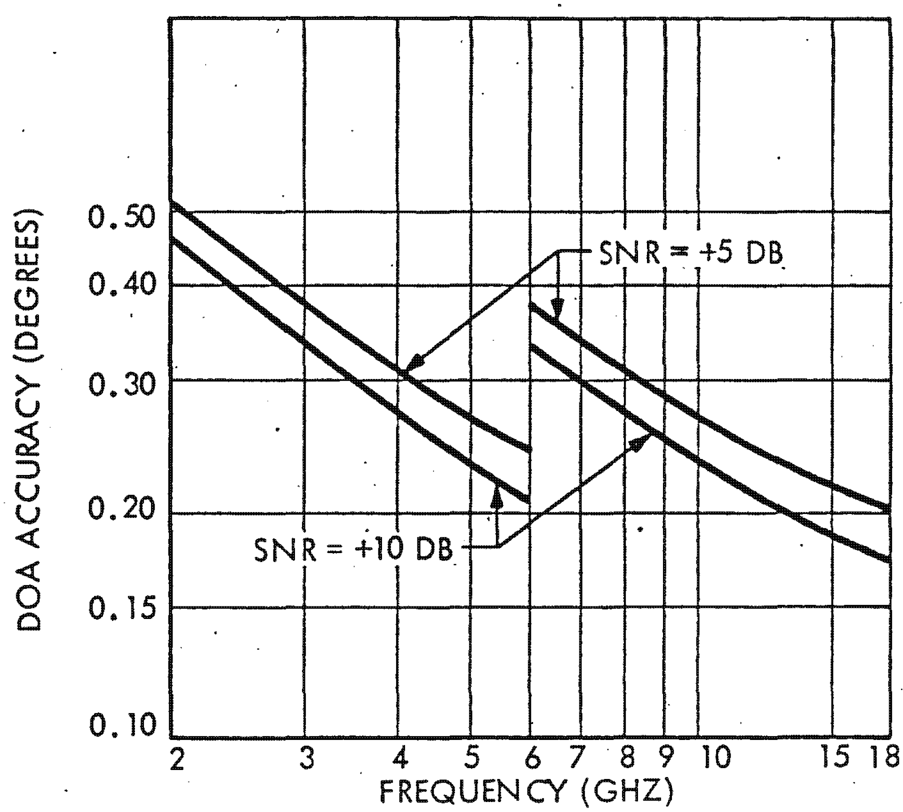
4.5.3 CW Signal Data Thinning

CW signals are sorted by frequency to eliminate unwanted intercepts. This CW thinning is accomplished by dividing the selected 2-GHz band into five parts. The four dividing frequencies are specified by command. If less than five parts are wanted, the extras can be set to zero width or even to negative width. This filter operates by rejecting all signals in a "reject" part - not by accepting those in an "accept" part. If the parts overlap, the "reject" function will control.

Eight options are provided for this thinning, differing as to which parts permit reporting of CW contacts or provide TI handovers. These options are:

Report in PCM	Handover to TI
All 5 parts	All 5 parts
All 5 parts	Parts 1, 3, 5 only
All 5 parts	Parts 2, 4 only
All 5 parts	None
Parts 1, 3, 5 only	Parts 1, 3, 5 only
Parts 1, 3, 5 only	None
Parts 2, 4 only	Parts 2, 4 only
Parts 2, 4 only	None

It can be seen that handovers are allowed only when the CW signal is reported in the PCM.



NOTE: SNR = -2.2 DB AT THRESHOLD

Figure 4-16 CW System Direction of Arrival Accuracy

4.6 TI RECEIVER

The TI receiver is a single-channel, narrowband receiver that can be switched to monitor the DF sum, the omni-P, or the omni-M antenna. (See Figure 4-17.)

The TI receiver monitors about 13 MHz at a time. The location of this frequency window is controlled by handovers received from the other four receivers. When not monitoring in response to a handover, the TI receiver frequency and mode are determined by commands. This last condition is called the high-sensitivity mode because its narrow bandwidth makes the TI receiver more sensitive than any of the other four receivers. To more nearly match the sensitivity of the search receivers, the TI receiver sensitivity is deliberately reduced when processing handovers.

The TI receiver outputs a 10-MHz wide pre-D signal to a bandwidth compressor (BWC) that provides 625-kHz bandwidth output samples. When the BWC is not used, the TI receiver outputs a 750-kHz wide, pre-D signal instead. In this case, the pre-D signal is interrupted and a burst of PCM is substituted occasionally to identify the analog signal.

4.6.1 Handovers

The TI receiver uses a commandable priority table to select a signal handover when more than one receiver offers a signal candidate. This table also specifies the antenna and type of signal for the high-sensitivity mode. Table 4-5 shows the priority table options.

Handovers from a DF receiver are monitored for a short, fixed period and then abandoned. This period is command selected for each RF band. The TI receiver stores the frequency and time of signal contact and returns for a chain of four signal refresh visits at the same time in each of the next four spins of the spacecraft.

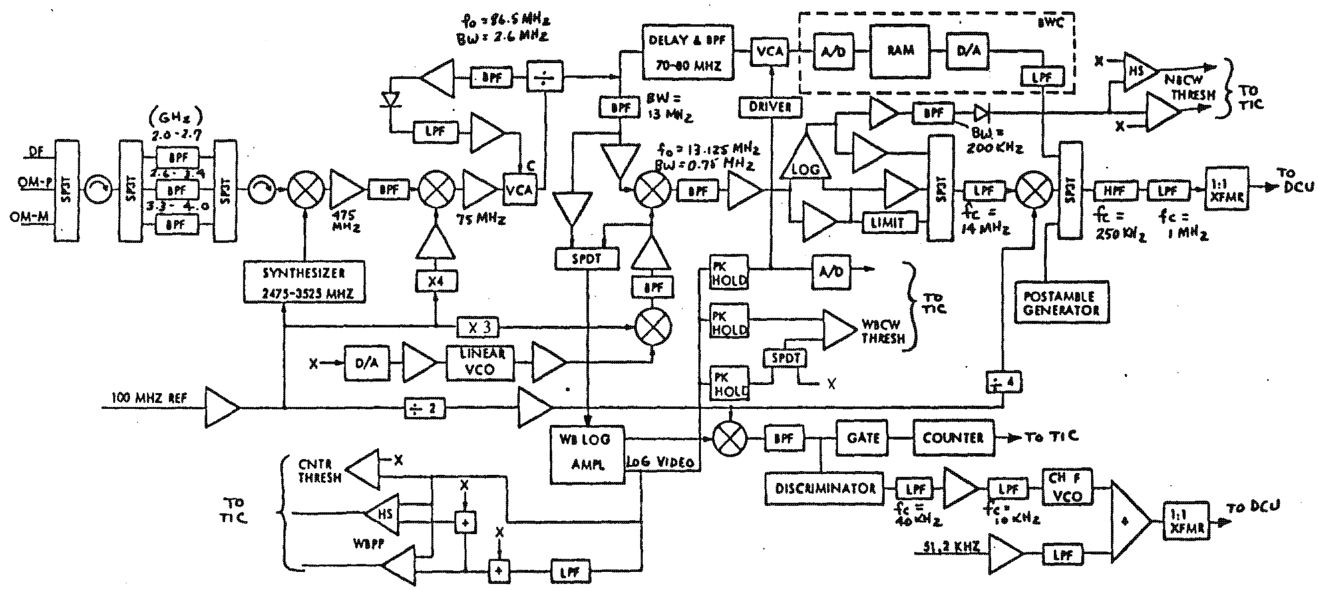


Figure 4-17 TI Receiver Block Diagram

50

0128R

25X1

BIF003W/2-156913-80

Table 4-5

TI PRIORITIES

MODE	DF-PU	DF-CW	Mainbeam PU	Mainbeam CW	HIGH SENSITIVITY
1	1	2	3	4	5 (DF-PU)
2	2	1	4	3	5 (DF-CW)
3	3	4	1	2	5 (MB-PU) *
4	4	3	2	1	5 (MB-CW) *
5	1	2			3 (DF-PU)
6	2	1			3 (DF-CW)
7			1	2	3 (MB-PU) *
8			2	1	3 (MB-CW) *
9					1 (DF-PU)
10					1 (DF-CW)
11					1 (MB-PU) *
12					1 (MB-CW) *

* Mainbeam channel specified in mainbeam mode block of command memory.

The TI receiver can accept up to two signal handovers per DF antenna, assuming that the normal DF program is used. This means that there can be six DF signal revisit chains at one time, two for each one-third spin.

Handovers from a mainbeam receiver are monitored by the TI receiver until one of the following occurs: signal disappears for at least 40 msec; a higher priority handover is offered; or a mainbeam program step (potential RF band change) occurs.

The TI receiver cannot accept a mixture of DF and mainbeam dwells. Therefore, it does not accept a mainbeam signal handover when DF is preferred unless there are no DF chains in memory at the time. If mainbeam is preferred, all DF chains are broken and discarded whenever a handover is offered for a mainbeam signal.

The TI receiver always terminates any revisit chain that attempts to interrupt a higher priority dwell. It ignores handovers with equal or lower priority during a dwell, but allows revisits that have a priority equal to or higher than that of the current dwell to interrupt (and so shorten) the current dwell.

Figure 4-18 illustrates a typical portion of a read-in. At the top of this figure, in spin N the TI receiver has two DF chains active for the bands 1 and 2 antenna, and one for the bands 3, 4, 5 antenna.

During spin N, a band 2 pulse handover pre-empts the chain previously used for a CW chain, since pulse has priority over CW in this example. Also, a band 8 pulse chain is set up for the third antenna.

In the next spins, the DF pulse chains run for the full visits and terminate. By the last third of spin N + 6, no DF chains are active. Accordingly, a mainbeam handover is accepted and held until the contact disappears during the following spin.

Another mainbeam handover is accepted during spin N + 8, it is preempted near the end by a band 6 DF pulse handover.

The mainbeam step number changes every fourth DF step, alternating between steps 0 and 1, while the DF step numbers run from 0 to 17. The RF bands selected for each step are arbitrary; however, useful tasking requires that each DF step select a band from the antenna which is scanning the earth during that step.

4.6.2 High-Sensitivity Mode

Whenever the TI receiver is not responding to a handover, it enters the high-sensitivity mode, which is the lowest priority TI option at all times. The high-sensitivity mode is an unlimited (in time) dwell at a command selected coarse frequency. A separate frequency is provided for each mainbeam step and

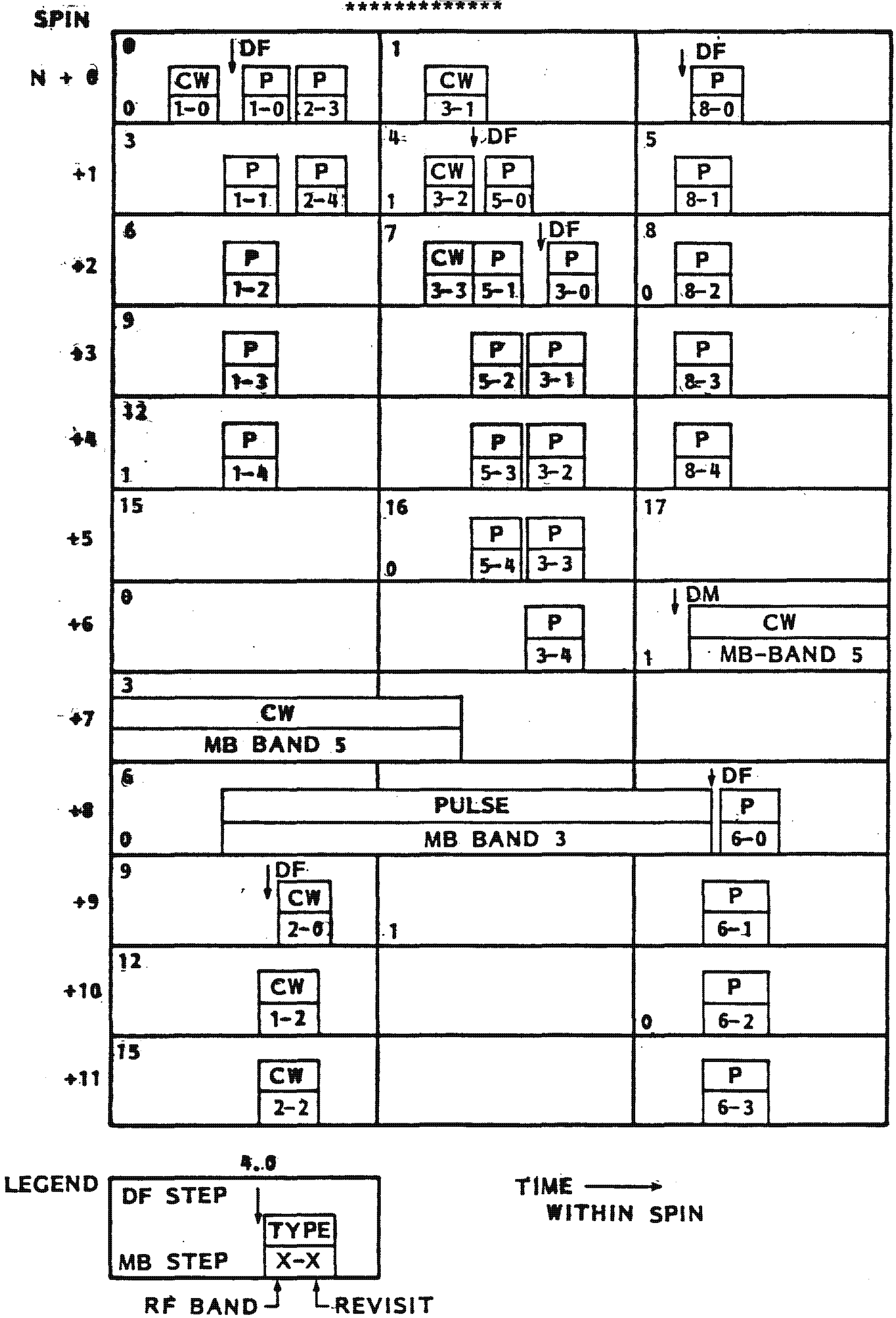


Figure 4-18 Typical TI Sequence

for each DF band. Either the DF or the mainbeam selection is used, according to the TI priority table.

If the TI receiver is looking for pulses, it merely coarse tunes in frequency. The TI receiver triggers the BWC whenever a pulse is detected unless the BWC is busy with the previous pulse sample. This continues until a DF revisit occurs, a handover is offered, or a program step threatens to change the coarse frequency.

If the TI receiver is looking for CW, it goes to the search mode after coarse tuning, and stays there until a signal is found. It then decides whether the signal is narrowband or wideband and sets its mode accordingly. Whenever the signal disappears for at least 40 msec, the receiver returns to search until another CW signal is found. This process continues until a DF revisit occurs, a program step changes the RF band, or until a handover occurs, whichever happens first.

4.6.3 Pre-D Conditioning

The TI receiver pre-D signal can be conditioned in any one of three ways: the linear, the logarithmic, or the limiter modes. A hard limiter is present in all three modes; the difference lies in the behavior below hard limiting.

The linear mode is linear up to about 20 dB above noise before the limiter takes hold. The logarithmic mode is logarithmic up to about 55 dB above noise. In the limiter mode, there is enough gain for noise alone to cause clipping. Thus, the output is a square wave, with only the noise level changing with signal strength. This mode is also called the zero crossing detector, since only the zero crossings (and so the frequency) are retained from the original signal.

4.6.4 Dwell Modes

The TI receiver can dwell in either the BWC mode, the spectrum analysis (SA) mode, or the narrowband fine-tune mode. When a pulse receiver handover is accepted, the TI receiver must use the BWC. Thus, it merely does a coarse tune to the handover frequency and thereafter signals the BWC each time a pulse is detected.

When a CW receiver handover is accepted, the TI receiver first checks the handover frequency for accuracy. The TI receiver tunes to the handover frequency and performs an IF sweep. If a signal is detected, the bandwidth and centering are tested. Whenever the center frequency is more than 2 MHz from the TI receiver band center, the coarse frequency is corrected to move the signal 4 MHz toward center. The bandwidth is next compared to 700 kHz. If wider than 700 kHz, the command option for wideband CW (WBCW) is used. If less than 700 kHz, the narrowband CW (NBCW) command option is used to select the operational mode unless the counter reports a center frequency more than 528.5 kHz from the frequency step selected during the IF sweep. This last would again cause the WBCW option to be used.

If a signal is not detected, the dwell is aborted unless the repeat IF sweep option has been commanded. The PCM IWG initialization report for the dwell is output only after the final frequency has been established. If repeat IF sweep is selected and the signal is not detected before the end of dwell, there will be no initialization IWG report for the initial dwell. Should this be a DF dwell, normal revisits will occur in IF sweep mode until the signal is detected, or all four revisits have timed out.

Wideband CW is monitored with the BWC or in SA mode; narrowband CW can use either the BWC or SA modes, or it can be monitored in the narrowband, fine-tune mode. A final option is to abort the signal tuneup if the signal turns out to be narrowband CW.

During CW dwells, the TI receiver monitors its 13-MHz window with a counter providing an accurate measure of the signal frequency in that window. Whenever the signal is above the counter threshold, the counter measures the frequency and the TI receiver outputs that frequency in the next TI CW IWG report. However, the first TI CW IWG in each dwell always reports the fine-frequency step selected instead of the counter report. This counter monitors the signal for 248 cycles of a 1024-kHz clock, to provide a resolution of about 4.129 kHz.

This counter is also used in deciding whether a given CW contact is wideband or narrowband. To be treated as narrowband, a CW signal must have both a bandwidth under 700 kHz and a location within 528.5 kHz of the frequency measured by the counter. The disagreement is allowed to be so large only because the TI fine frequency used is the nominal step value, not the calibrated value. If the signal is below the counter threshold, this test is bypassed.

4.6.4.1 <u>BWC Mode</u>. The BWC consists of a high-speed sampler and digitizer, a digital memory, and a lower speed digital-to-analog converter.

The TI IF signal is filtered and delayed by a SAW (surface acoustic wave) filter which passes the 70- to 80-MHz band. By the time the signal exits from this filter, the TI receiver has made the decision to accept or reject. If accepted, the BWC starts read-in before the signal arrives. Thus, each sample includes the leading edge of the pulse.

The BWC sample rate is 32.768 million samples/sec. Each sample is digitized to 6 bits (64 amplitude levels) and stored in a memory which can hold 250 usec of signal. The BWC reads the signal back at 2.048 million samples/sec. This signal is converted to analog and filtered to produce a pre-D signal in the 279- to 907-kHz band that is 16 times longer in duration than the original signal ($32.768 \div 2.048 = 16$).

The BWC read-in can be selected to last for 250, 125, 62.5, 31.25, 15.62, 7.81, 3.91, or 1.95 usec, which is the maximum capacity divided by any power of two from zero to seven. Pulse read-ins can have any of these durations, but CW read-ins are always set to maximum (250 usec). The two shortest durations are not expected to be used.

Each read-in is allowed to start only when in synchronism with a 1024-kHz clock. This clock drives a 20-bit counter that is reset once per second by the TRG. The state of this counter at the start of a BWC read-in is stored and output as part of a postamble that follows the BWC sample readout period. Thus, the exact starting time of the sample is reported.

Each readout is allowed to start in synchronism with a 512-kHz clock. This same clock is used to control the output of the postamble. Thus, a fixed time relationship exists between the start of readout and the postamble.

4.6.4.2 Spectrum Analysis (SA) Mode. The SA mode is provided by stepping a linear VCO across 512 steps. The oscillator frequency slew rate is limited to give a nearly linear ramp instead of a staircase of steps. This VCO is used to sweep a 750-kHz-wide filter across approximately 13 MHz. The signals within this window appear at the TI receiver pre-D output as a chirp in the 250- to 1000-kHz range. Each sweep is followed by a postamble containing a PCM sync burst to allow synchronization of ground equipment with the TI sweep. The sweep rate is held constant so that the pre-D can be dechirped on the ground, improving the effective receiver sensitivity and frequency resolution.

4.6.4.3 Narrowband Fine-Tune Mode. The narrowband fine-tune mode consists of selecting the linear VCO step that best centers the signal within a 750-kHz window. For this purpose, the VCO has a granularity of about 52 kHz, instead of the 26-kHz step size used during spectrum analysis periods.

4.6.5 TI Postambles

In all operating modes, the TI receiver alternates between producing an analog output and a PCM [redacted] in the frequency window between 250 and 1000 MHz. Two types of PCM [redacted] are generated: a 41-data-bit burst is a BWC postamble, while a 20-data-bit [redacted] is an SA or narrowband fine-tune postamble. The postamble sizes are given as so many data bits, because each data bit is output as two PCM bits. Thus, the data rate is 256 kbps, while the PCM rate is 512 kbps. 25X1 25X1 25X1

Figure 4-19 shows the formats for the two types of postamble. Each postamble follows the Pre-D sample which it describes. When the data are time-sequence-reversed by the flight tape recorder, it will provide a convenient strobe ahead of that sample.

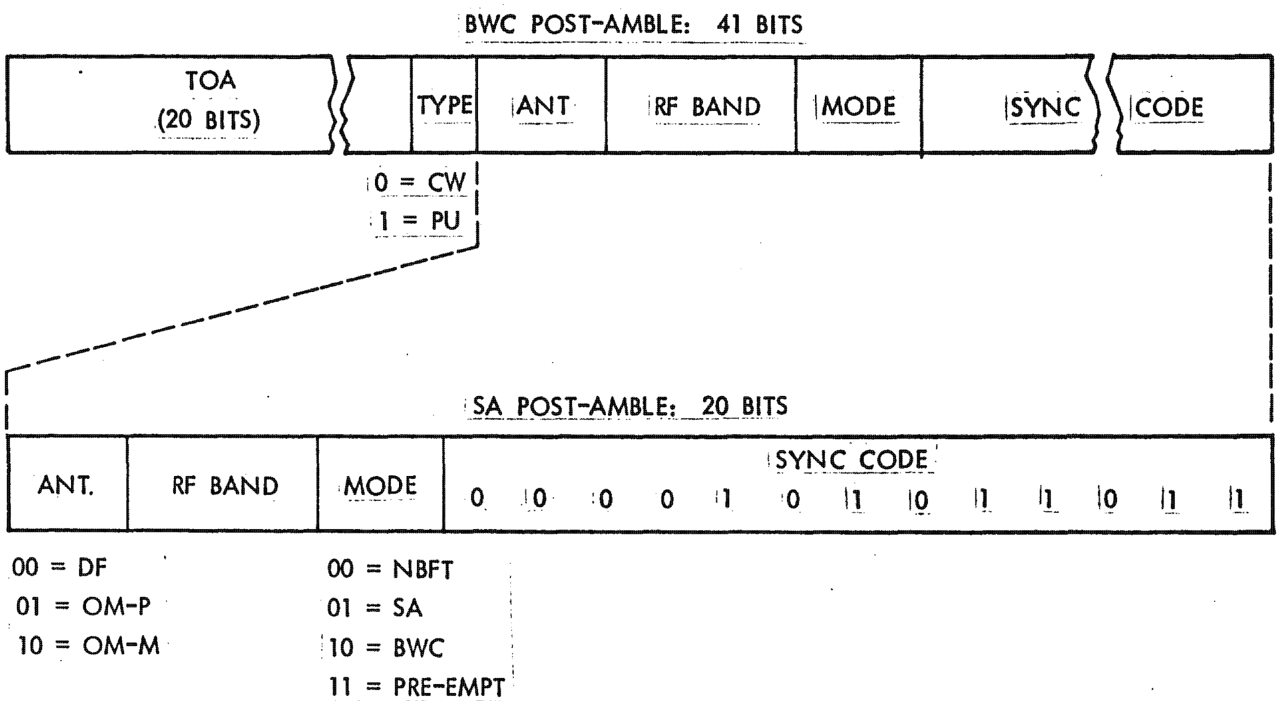
4.6.6 TI Reports

The TI receiver outputs PCM reports which are incorporated into the payload 256-kbps main PCM. Depending on its current activity, it generates one of four types of reports: initiation reports, CW reports, pulse reports, or end-of-dwell reports.

4.6.6.1 Initiation Reports. The TI receiver outputs an initiation report when it completes retuning its first LO (the TI synthesizer) for a dwell. If this retuning is not completed, as may be the case in CW handovers, no report is made. Table 4-6 lists the parameters in these reports.

4.6.6.2 CW Reports. During CW dwells, the TI receiver outputs CW reports at the following times:

a. During TI VCO calibration at each VCO step



CLOCK: 256 KBPS

FORMAT: PHASE-REVERSAL MODULATION OF 512 KHZ SIGNAL

Figure 4-19 Postamble Formats

Table 4-6

TI RECEIVER PARAMETERS

BITS	
4	LEAD ID = 0100
3	RF BAND
1	FREQ RANGE 0 = 2-3 GHZ 1 = 3-4 GHZ
11	SYNTHESIZER FREQUENCY 2475 TO 3525 MHZ BY 1 MHZ
2	OFFSET FROM HANDOVER 00 = NONE 10 = BAND EDGE (SIG 0-0-B) 01 = +4 MHZ 11 = -4 MHZ
2	SOURCE ANTENNA 00 = DF 01 = MB-P 10 = MB-M
1	SIGNAL TYPE 0 = PULSE 1 = CW
16	TIME OF EVENT 0 TO 64 MSEC BY .977 USEC
3	NEXT EVENT 000 = SEARCH 011 = NBFT 110 = CALIB 001 = BWC 100 = ASSIGN 010 = SA 101 = PRE-EMPT
3	REFRESH COUNT 000 = NOT A CHAIN 001 TO 101 = VISIT NO.
1	ASSIGN 0 = HS ASSIGN 1 = HANDOVER
3	PRE-EMPT SOURCE 000 = DF-PU 011 = MB-CW 110 = DF STEP 001 = DF-CW 100 = CAL 111 = MB STEP 010 = MB-PU 101 = SEGMENT START
3	CHAIN NUMBER 000 = NOT A CHAIN 011-100 = GRP 2 CHAINS 001-010 = GRP 1 CHAINS 101-110 = GRP 3 CHAINS
1	WIDE-BAND THRESHOLD
1	COUNTER THRESHOLD
1	BUFFER OVERFLOW FLAG
4	TRAIL ID = 0010
4	SPARES
64	WORD GROUP TOTAL

b. Every 2.1875 msec if a signal has been detected since the previous report, starting with a report at the completion of a successful IF search

c. At the end of each BWC read-in period

d. In the high-sensitivity mode, when returning to search, and when leaving the search mode.

Table 4-7 lists the parameters included in the TI CW reports.

The CW reports have a variable content, defined as follows:

Calib Flag	Counter/ VCO Flag	Counter Threshold	Synthesizer Word	Counter Word
1	0	1 or 0	VCO Step	VCO Step Freq
0	0	1	Synthesizer	Counter
0	1	1 or 0	Synthesizer	VCO Step No.
0	0	0	Forbidden State	
1	1	1 or 0	Forbidden State	

4.6.6.3 Pulse Reports. During pulse dwells, the TI receiver outputs a pulse report at the end of each BWC read-in period. Table 4-8 lists the parameters in pulse reports.

4.6.6.4 End-of-Dwell (EOD) Reports. When it terminates a dwell, the TI receiver outputs an EOD report. Table 4-9 lists the parameters in end of dwell reports.

Table 4-7

TI CW WORD GROUP DATA

BITS	
4	LEAD ID = 0101
3	RF BAND
1	FREQ RANGE 0 = 2-3 GHZ 1 = 3-4 GHZ
11	SYNTHESIZER FREQUENCY 2475 TO 3525 MHZ BY 1 MHZ (VCO STEP DURING CAL)
13	COUNTER FREQUENCY 4 KHZ RESOLUTION (VCO STEP WHEN FLAGGED)
5	WB AMPLITUDE 0 TO 47.25 DB BY .75 DB
2	SOURCE ANTENNA 00 = DF 01 = OM-P 10 = OM-M
1	TF MODE 0 = DWELL 1 = TF SWEEP
6	TIME OF EVENT 0 TO 64 MSEC BY 1 MSEC
2	NEXT EVENT 00 = SEARCH 10 = SA 01 = BWC 11 = NBFT
1	WIDE-BAND THRESHOLD
1	COUNTER THRESHOLD
1	NB THRESHOLD
1	TI CALIB FLAG
1	BUFFER OVERFLOW FLAG
1	COUNTER/VCO STEP FLAG 0 = COUNTER 1 = VCO STEP
4	TRAIL ID = 1010
6	SPARES
64	WORD GROUP TOTAL

Table 4-8

TI PULSE WORD GROUP DATA

BITS	
4	LEAD ID = 0110
3	RF BAND
1	FREQ RANGE 0 = 2-3 GHZ 1 = 3-4 GHZ
11	SYNTHESIZER FREQUENCY 2475 TO 3525 MHZ BY 1 MHZ
5	WB AMPLITUDE 0 TO 47.25 DB BY .75 DB
2	SOURCE ANTENNA 00 = DF 01 = OM-P 10 = OM-M
16	TIME OF EVENT 0 TO 64 MSEC BY .977 USEC
1	BUFFER OVERFLOW FLAG
4	TRAIL ID = 0110
1	SPARE
48	WORD GROUP TOTAL

Table 4-9

TI END-OF-DWELL WORD GROUP DATA

BITS	
4	LEAD ID = 0111
3	RF BAND
1	FREQ RANGE 0 = 2-3 GHZ 1 = 3-4 GHZ
11	SYNTHESIZER FREQUENCY 2475 TO 3525 MHZ BY 1 MHZ
6	VCO STEP NUMBER
2	OFFSET FROM HANDOVER 00 = NO OFFSET 01 = +4 MHZ 11 = -4 MHZ
2	SOURCE ANTENNA 00 = DF 01 = OM-P 10 = OM-M
1	SIGNAL TYPE 0 = PULSE 1 = CW
6	TIME OF EVENT 0 TO 64 MSEC BY 1 MSEC
1	NEXT EVENT 0 = ASSIGN 1 = CALIB
3	REFRESH COUNT 000 = NOT A CHAIN 001 TO 101 = VISIT NUMBER
1	ASSIGN 0 = HS 1 = HANDOVER
3	PRE-EMPT SOURCE 000 = DF-PU 011 = OM-CW 110 = DF STEP 001 = DF-CW 100 = CAL 111 = OM STEP 010 = OM-PU 101 = PROGRAM SEG
3	CHAIN NUMBER 000 = NOT A CHAIN 001-010 = GRP 2 CHAIN 001-010 = GRP 1 CHAIN 101-110 = GRP 3 CHAIN
2	TERMINATION TYPE 00 = END OF DWELL 10 = PRE-EMPT 01 = SAT > 40 MSEC 11 = NB ABORT
1	BUFFER OVERFLOW FLAG
4	TRAIL ID = 1110
8	SPARES

4.6.7 TI Measurements

4.6.7.1 Synthesizer Frequency. The TI receiver reports the synthesizer frequency in every output word group except for the TI VCO calibration reports. The synthesizer is the first LO in the TI receiver, converting the desired 13-MHz window in the 2- to 4-GHz TI input band to 475 $\pm$ 6.5 MHz.

During VCO calibration, no signal is applied to the TI receiver; thus, the synthesizer frequency is not needed and its place in the CW word group is taken by the VCO step number (0 to 511).

The TI receiver also reports which half of the 2- to 4-GHz input band is selected, since one half uses the synthesizer above the RF and the other half uses it under the RF.

4.6.7.2 TI Counter. The TI receiver measures the frequency of CW signals with a resolution of about 4.129 kHz (128/31) and a range of 13 MHz from 18.5 MHz to 31.5 MHz. A signal at the center of the 13 MHz band monitored by the TI receiver will be at 25 MHz for this counter.

4.6.7.3 Wideband Amplitude. The TI receiver measures the signal amplitude within its 13-MHz window. The peak amplitude just before a BWC sample read-in is used to control a variable attenuator. The attenuator control input is locked throughout a BWC sample read-in period. For CW, this input tends to follow the signal amplitude, leveling the pre-D output. The peak amplitude used to set this attenuator is included in each pulse or CW TI report. Only the BWC input is gain controlled by the above attenuator.

4.6.7.4 Time of Event. The time of each event reported by the TI receiver is included in these reports. Initialization and pulse reports provide the time to a resolution of better than 1 usec over a range of 64 msec. This allows pulses sampled by the BWC to be matched with reports from the DF or mainbeam pulse receiver. CW and EOD reports provide the time to a resolution of 1 msec over a range of 64 msec. Each of these reports can be combined with the TRG reports to provide a range of over 1553 days.

4.6.7.5 Accuracy. The 95% confidence accuracy for TI parameters are as follows:

Parameter	Accuracy	Conditions
Pre-D Frequency	± 50 kHz	S/N > 8 dB, CW signal
	±100 kHz	S/N > 8 dB, CW signal
	± 86 kHz	above threshold, pulse signal
Amplitude	N/A	N/A
TOE	±500 nsec	Initialization and Pulse reports
	±500 usec	CW and EOD reports

4.7 TEST SIGNAL GENERATOR

4.7.1 General

The test signal generator (TSG) generates CW and pulsed signals in the 2- to 4-GHz region. Band 1 is calibrated with this signal directly, while bands 2 through 8 are calibrated by translating these signals to higher frequencies using the same LOs as does the payload front end. Thus, the first IF always contains the same frequencies in the same pattern.

The TSG sequence automatically turns on the TI receiver for the duration of the TSG sequence, overriding the selection in command memory block zero. The four search receivers are not automatically on; only those selected in block zero will operate during the TSG sequence.

The TSG uses a fixed sequence of 16 program steps as shown in Figure 4-20. These steps are not locked to the spacecraft spin, but are fixed in length. The first eight steps calibrate the pulse and CW receivers in all bands, and the remaining steps exercise the TI revisit chain capability in band 1. Finally, the TI linear VCO is calibrated by itself. Each TSG step consists of a pulse calibration followed by a CW calibration in the same band. Both DF and mainbeam receivers are tuned to the selected band for each step. After the TSG sequence is completed (about 10 sec), the system waits for the next

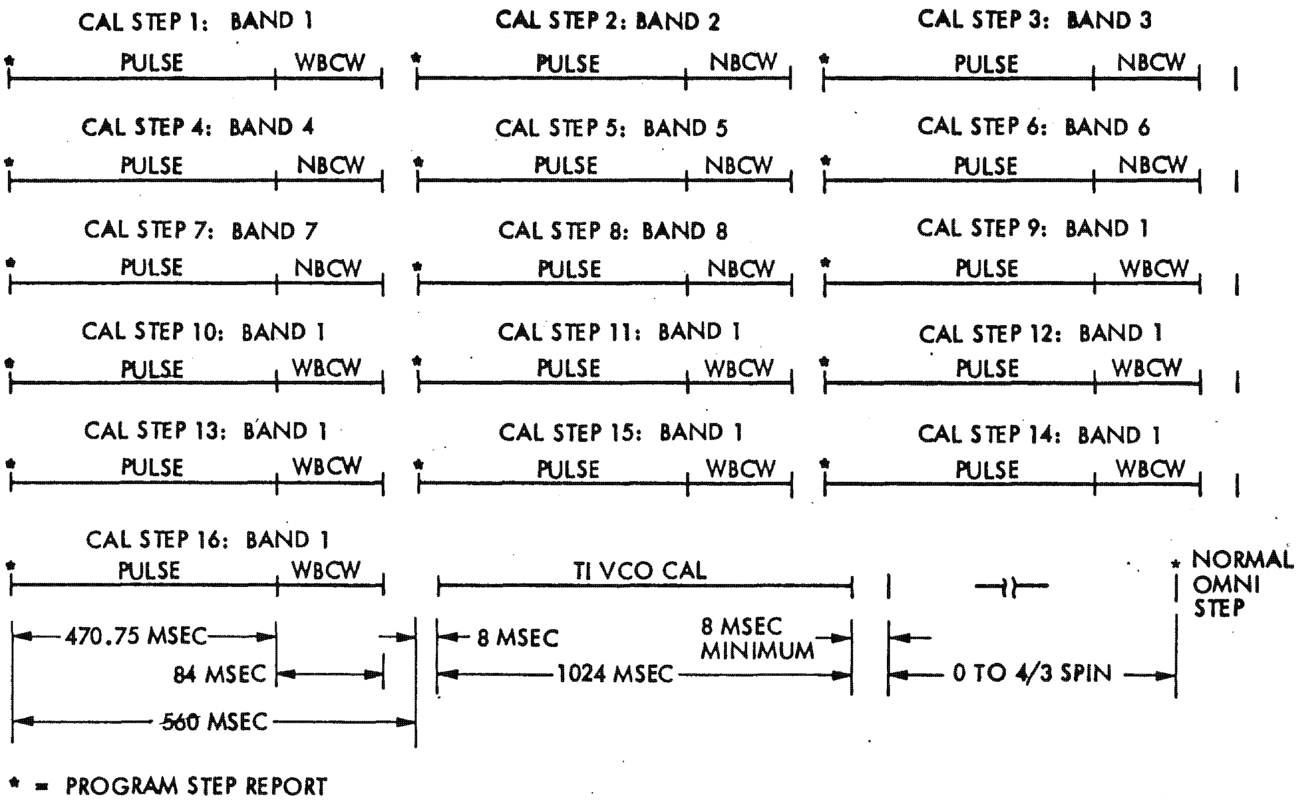


Figure 4-20 TSG Sequence of Program Steps

~~SECRET~~

67

25X1

BIF003W/2-156913-80

0128R

mainbeam program step before starting actual data collection. Thus, the total time required is 11.2 sec, or 9 1/3 spins of the spacecraft at the nominal rate.

4.8 DATA HANDLER

The data handler is responsible for all digital data other than the TI post-ambles. Most of these data are received from other units. However, the data handler does create the basic timing information for the entire spacecraft, including the payload receivers.

Pulse data thinning (see paragraph 4.4.3) is performed in the data handler. CW data thinning, on the other hand, occurs in the CW receivers before the data are passed to the data handler.

4.8.1 Time Reference Generator (TRG)

The data handler contains a TRG, to which all reported times are referenced. The TRG counts time within each second using a 1.024-MHz clock. It also counts seconds over a range of 1553 + days. Every 8 msec a TRG report gives the current time.

All event times are given with respect to the most recent TRG report. However, the TRG report may not get into the PCM in correct time order with the other reports, allowing a timing error of 8 msec to occur. This can happen for events starting just before a TRG change if they end after it. This can also happen if the TRG report entering the PCM buffer is delayed by a large waiting list of other reports with higher priority.

Such irregularities are identified and corrected by comparing the LSB and the third LSB of the assumed reference TRG report to the corresponding bits of the report time. Reports having a range of only 8 msec have these two bits also included as ambiguity bits. For pulse or CW reports, if either ambiguity bit does not match, the 5 MSBs of the TOA must be tested. If they are 10111 or more, subtract 8 msec (shift to next preceding TRG report), otherwise add 8 msec (shift to following TRG report).

TI reports have a range of 64 msec, so they can be verified by comparing their 3 MSBs to the 3 LSBs of the TRG report. Only the correct report will match all 3 bits.

The time reports for the various word groups are as follows:

Word Group	Time Range	Resolution	Bits Used
TRG	1553+ Days	8 msec	34
HS	8 msec	0.977 usec	13
SAS	8 msec	0.977 usec	13
Program	1 sec	8 msec	7
TI Init	64 msec	0.977 usec	16
TI CW	64 msec	1 msec	6
TI Pulse	64 msec	0.977 usec	16
TI EOD	64 msec	1 msec	6
DF CW	8 msec	0.977 usec	13
DF Pulse	8 msec	61 nsec	17
MB CW	8 msec	0.977 usec	13
MB Pulse	8 msec	61 nsec	17

The pulse receivers use a 16.384-MHz clock which is phase locked to the TRG clock to allow [redacted] The counters driven by this clock are reset by the TRG periodically to guarantee the TOA can be combined correctly with the TRG time.

4.8.2 PCM

The data handler generates a 256 kbps PCM data stream whenever it has power applied. At the time power is first applied, the PCM generator is reset and held blanked until the start of a 125-Hz clock cycle. This is the same clock that controls the generation of TRG reports. Thereafter, the PCM outputs a master frame cycle every 2 seconds.

Each frame must start with a 12-word frame sync word group. Under normal conditions, each frame will contain a 6-word TRG report. All remaining word group types must be contained in the 238 words left in the PCM frames. Further, whenever the next intended word group will not fit in the current frame, 16-bit filler word groups are used for the rest of this frame, and the pending word group is placed after the following frame sync word group.

The following table shows the rate at which the PCM can output reports for each receiver alone. Except for TI-CW, these rates are much smaller than the rates at which these sources can generate reports. All five receivers can generate reports at the same time. A 2048 word-group buffer is provided to allow short periods of high data generation to be accepted and stored for later output when, hopefully, fewer reports than the PCM capacity are being generated.

All word groups other than frame sync, no-data, and filler must pass through the word group buffer to appear in the output data stream. The buffer will not accept intercept reports unless there is also enough room for all possible time, attitude, and program (TAP) reports; these housekeeping reports are never lost for any reason.

Data Type		Reports/Frame	Reports/Second
DF-Pulse	(12 words)	19	2375
	(12+6 words)	13	1623
DF-CW	(10 words)	23	2875
Mainbeam-Pulse	(10 words)	23	2875
	(10+6 words)	14	1750
Mainbeam-CW	(6 words)	39	4492
TI-Pulse	(6 words)	39	4492
TI-CW	(8 words)	29	3625

Figure 4-21 is a flow diagram of the buffer interface logic. This logic ensures each accepted word group will wait no longer than 23 usec to be loaded into the buffer. Each word group type is provided a dedicated slot for its use while waiting for entry. If the slot is full when a new word group is ready, the new word group is scrapped. Except for horizon sensor reports, TAP word groups will not encounter this situation. Theoretically, the horizon sensor reports could occur as close-spaced pairs, but not within the intended tasking region.

Word groups can be read out of the buffer at opportunities that occur at least once every 6 usec. Until the buffer is filled, it can keep up with anything less than both pulse receivers simultaneously producing reports at their maximum rates with multi-frequency signals.

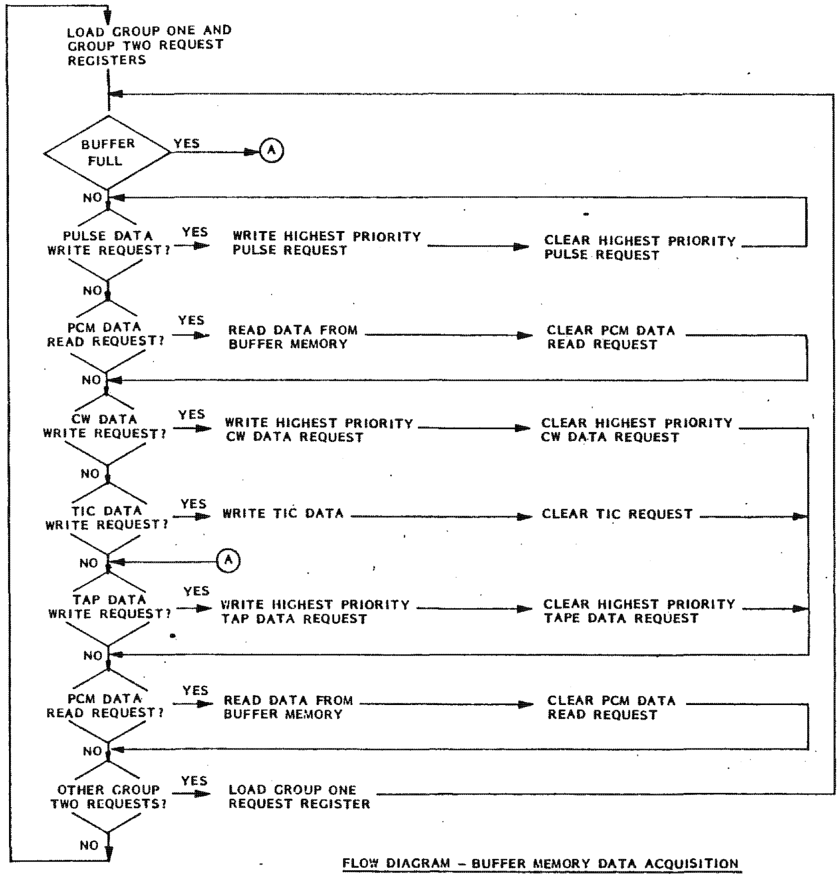
When the buffer is full, the worst case delay for accepting a word group is 3.375 msec for pulse reports, 5.625 msec for CW, and 8 msec for TI reports. This means it is always possible to associate each word group with the correct base TRG report. The ambiguity bits allow for correct association over an 8 msec range.

PCM reports vary in length from two words (16 bits) to 16 words (96 bits). They are all a multiple of two words long. The first and last four or six bits in each report contain an ID specifying the word group type, and so its length. By placing these bits at each end, the PCM can be read either forward and backwards. Table 4-10 gives the ID and length of each word group type.

4.8.3 Program Steps

The data handler controls the time of each program step. During calibration periods, these steps occur at a fixed rate. At all other times, the program step timing is synchronized to the spacecraft spin.

The data handler monitors the earth sensor output. When power is applied to the data handler, the program step controller is initialized. After one to



PRIORITY TABLE

GROUP ONE

PULSE DF FIRST FREQUENCY
PULSE DF SECOND/THIRD FREQUENCY
PULSE MB FIRST FREQUENCY
PULSE MB SECOND FREQUENCY
READ

GROUP TWO

CW DF
CW MB
TI CONTROLLER
TAP TRG
TAP SAS
TAP HS
TAP PROGRAM STEP
READ

MEMORY INPUT REGISTER BUSY TIMES*

NO. OF PULSE DATA REQUESTS	MIR BUSY TIME (MIN)	MIR BUSY TIME (MAX)
ONE	1.65 μSEC	2.92 μSEC
TWO	2.57 μSEC	3.84 μSEC
THREE	3.48 μSEC	4.76 μSEC
FOUR	4.40 μSEC	5.67 μSEC

*(1) FOR PULSE DATA
(2) WITH MEMORY CYCLE TIME EQUAL TO 915.5 nSEC

FLOW DIAGRAM – BUFFER MEMORY DATA ACQUISITION

Figure 4-21 Diagram - Buffer Memory

25X1

BIF003W/2-156913-80

0128R

Table 4-10

PCM WORD GROUPS

Report Type	ID	Length (Words)
Frame Sync	0000	12
No Data	0001	10
Filler	0010	2
TAP		
TRG	001100	6
E-S	001101	6
SAS	001110	6
Program	001111	6
TI		
Initialization	0100	8
CW	0101	8
Pulse	0110	6
End of Dwell	0111	8
DF		
CW	1000	10
Pulse-freq No. 1	1001	12
-freq No. 2 & 3	1010	6
Mainbeam		
CW	1100	6
Pulse-freq No. 1	1101	10
-freq No. 2	1110	6

two spins, the controller has determined the spin period and the time of earth-contact center. Thereafter the controller schedules three program steps each time the earth-contact center point passes. The first of these is delayed by a commanded offset, while the other two follow one-third and two-thirds spin periods. At turn-on, the offset is 32 msec.

The program step controller schedules steps with an 8 msec granularity. Each step will tend to walk within an 8 msec window with respect to the spin. This should be considered when selecting the DF dwell duration for the TI receiver.

The controller starts by scheduling step number zero at the first earth-contact center time, and thereafter cycles around through the 18 DF steps. The first step (step zero) and every fourth DF step thereafter is also a mainbeam step. Initially, the program steps are all phantoms. They are not reported, nor do they control anything. After an EXECUTE command is received, the data handler waits until the next scheduled mainbeam step to obey the command. Each read-in segment starts with a mainbeam step, but the DF step number can be any number.

After an execute command is obeyed, the previously scheduled steps continue until the next earth-contact center time. Only then is the commanded offset allowed to take effect. This results in an offset-lengthened DF step.

At subsequent executes, the offset can be changed. If reduced, the last step from the old sequence is shortened. If the shortening is greater than a DF step, the result is a resetting of the DF step count to zero for the first new step as well as canceling the last step of the old sequence. This would shift the mainbeam steps from even DF steps to odd DF steps. However, it would remain true that every fourth DF step, starting with the first step in the segment, is an mainbeam step.

4.9 PAYLOAD COMMANDING

Payload commands consist of real time commands (RTCs) from the command decoder, magnitude commands (MCs) from the command decoder, and timed commands from the spacecraft stored command sequencer (SCS). RTCs are used to control latching relays and to control the payload configuration during readout. MCs are used to configure the advanced spacecraft computer (ASC). The timed commands are actually loaded into the SCS using MCs.

Timed commands are used to configure the payload during data collection intervals. This is exclusive of the selecting of primary or backup devices, which is accomplished via RTCs. Timed commands also are used to configure the spacecraft for transpond periods to ground stations lacking command capability. Table 4-8 lists the various timed commands.

4.9.1 Command Memory Loads

Command memory loads are performed by the SCS in the spacecraft in response to type 2 timed commands. Each load requires that 1024 words be transmitted to one of the two payload memories. These memories are volatile and must be loaded before each use.

The 1024 words in a command memory load are formatted as 16 sections of 64 words each. Each section is assigned to control the mode of a specific part of the payload. Table 4-11 shows these assignments, along with the number of significant words in each section. Appendix A gives detailed descriptions of the various types of sections in the memory load.

4.9.2 Program Constants

Block zero contains the program constants, i.e., parameters that are fixed for a given read-in segment. The first eight words are sufficient for this purpose; the next 10 words are reserved for the task ID block - data that

Table 4-11

PAYLOAD MEMORY DATA ASSIGNMENTS

Block	Words Used	Words Spares	Assignment
0	8		Program constants
	10	46	Task IDs
1	32	32	Mainbeam mode: CALIB periods
2	2	62	DF calibration program step data
3	40	24	DF mode: CALIB periods
4	32	32	Mainbeam mode: step 1
5	32	32	Mainbeam mode: step 2
6	36	28	DF program step data
7		52	Spare section
		12	Blanks -- not monitored by PCM
10	40	24	DF mode: band 1
11	40	24	DF mode: band 2
12	40	24	DF mode: band 3
13	40	24	DF mode: band 4
14	40	24	DF mode: band 5
15	40	24	DF mode: band 6
16	40	24	DF mode: band 7
17	40	12	DF mode: band 8
		12	Blanks -- not monitored by PCM

assist the ground processors, but have no meaning to the payload. The remaining words in this block are spares. Functions of the program constants are as follows (addresses are in octal):

a. Word 0 contains six bits specifying which payload subsystems are to be turned on in the current segment. It also includes a bit to control use of the SGLS reject filter in band 1.

b. Word 1 contains five bits to specify which task counters are to be incremented at the start of this segment.

c. Word 2 controls the TSG mode: off, once at start, or continuous. It also specifies the relative timing of the DF program stepping relative to the horizon sensor signal. Any desired relationship is available with a resolution of 8 msec.

d. Word 3 controls the mainbeam PFM inhibit (no frequencies measured) plus the ability to correct the coarse frequency using the fine frequency. It also controls the reporting of out-of-band pulses and of pulses not detected by the PFM for the mainbeam pulse receiver.

e. Word 4 controls inhibit overrides for the DF pulse receiver. Separate overrides are provided for the guard, OMNI P, and OMNI-M inhibits. This word also provides the same PFM controls for the DF receiver as the Word 3 provided for the mainbeam receiver, except there is no timer required in the DF receiver.

f. Word 5 provides guard and OMNI inhibit overrides for the DF CW receiver.

g. Word 6 specifies the relative priorities of DF versus mainbeam and of pulse versus CW handovers. It also specifies the channel and signal type to monitor during high-sensitivity mode periods. This word controls the BWC power and use of the channel F VCO. It also specifies the pre-D (analog) output conditioning mode.

h. Word 7 is unused at present, but is reserved for expansion of the program constants if needed.

i. Words 10 through 21 are reserved for a special task ID block. However, any of the spare words in any part of the memory can be used in this manner.

4.9.3 Mainbeam Mode Definition

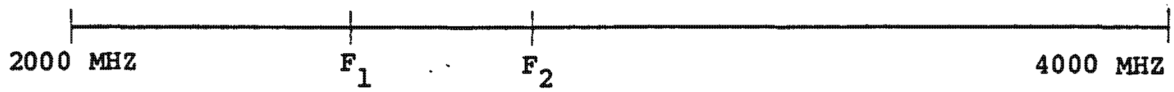
Blocks 1, 4, and 5 contain mainbeam mode definitions. Block 1 controls the mainbeam receivers during calibration periods. Blocks 5 and 6 alternate at other times, with each in control for four DF steps in a row, or about 1.6 seconds per mainbeam step.

Words 0 through 7 contain 64 bits that select the coarse frequency filters from which contacts will be accepted. Any signal whose strongest component lies in a forbidden filter will be ignored. Word 31 also contains a master control for this signal filtering.

Words 10 through 16 control a pulse parameter filter. This filter defines a class of signals as having frequency, PRI, and pulsewidth within specified ranges as illustrated in Figure 4-22. The mainbeam pulse receiver can either reject all signals in this defined set or reject all outside that set; thus reducing the number of reports it outputs to the PCM stream. The use of this filter can be enabled continously, or only while the PCM buffer is near overflow, or it can be disabled and all signals accepted. Pulse reports, which do not include a valid frequency, bypass this filter; however, they can be separately commanded as accepted or rejected.

Words 17 through 20 are not used.

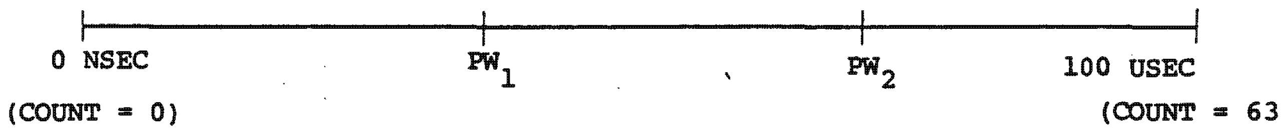
FREQUENCY TEST



CHOICE 1: FAIL IF FREQ < F_1 OR FREQ > F_2, OR FREQ NOT VALID

CHOICE 2: FAIL IF FREQ > F_1 AND FREQ < F_2, OR FREQ NOT VALID

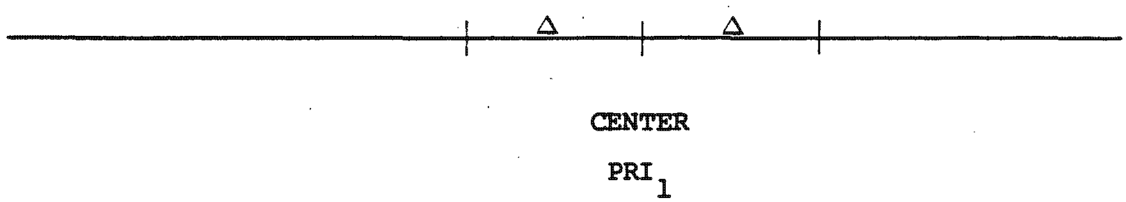
PULSEWIDTH TEST



CHOICE 1: FAIL IF PW < PW_1 OR PW > PW_2, OR AMPL < PW THRESHOLD

CHOICE 2: FAIL IF PW > PW_1 AND PW < PW_2, OR AMPL < PW THRESHOLD

PRI TEST



CHOICE 1: FAIL IF PRI < $(PRI_1 - \Delta)$ OR PRI > $(PRI_1 + \Delta)$

CHOICE 2: FAIL IF PRI > $(PRI_1 - \Delta)$ AND PRI < $(PRI_1 + \Delta)$

OVERALL CHOICES

1. IGNORE PULSE PARAMETER FILTER TESTS
2. REJECT WHEN ADAPTIVE: ANY TEST FAILED
3. REJECT WHEN ADAPTIVE: ALL TESTS PASSED
4. REJECT ANY TIME: ANY TEST FAILED
5. REJECT ANY TIME: ALL TESTS PASSED

Figure 4-22 Pulse Parameter Filter Range

Words 21 through 24 control a pulse handover filter limiting the handovers to the TI receiver. This filter specifies the frequency and pulsewidth required for a handover to occur. If filter is off, no handovers are allowed. Pulses not exceeding the pulsewidth threshold are not considered for handovers.

If a mainbeam antenna is to be used, words 25 and 26 specify the TI high-sensitivity frequency and BWC read-in duration. Word 27 specifies the TI options to use for mainbeam CW signals. These options are as follows:

a. Whether to use the BWC or spectrum analysis mode for WBCW signals
b. Whether to use BWC, SA, or fixed tune mode
c. Whether to abort for narrowband CW signals

The choice is provided to either abort or continue in IF sweep when the TI cannot find the CW signal on which it just performed coarse tuning.

Word 30 specifies the RF band for the mainbeam receivers subsystems. These data are ignored when in calibration mode. This word also controls the output of CW data, which can be disabled full time, disabled only when the PCM buffer is nearly full, or enabled full time.

Word 31 controls the assignment of the mainbeam PFM between the two channels. Either channel can be selected by command or the PFM can be set according to signal activity. In the latter case, the PFM remains with the selected channel for 32 msec before checking the next pulse to determine the correct channel with which to continue. This 32-msec timer can be commanded to reset each time a pulse is detected by the PFM channel. This word also controls the frequency thinning specified in words 0 through 7. The filtering can be extended to reject pulses with any of the strongest 3 components in a forbidden filter. On the other hand, the filtering can be disabled. Finally, this word controls the reporting of the second frequency of multifrequency pulses. This can be enabled, disabled, or disabled only when the PCM buffer is nearly full.

Word 32 is not used.

Word 33 specifies the sensitivity of the CW (4 levels) receiver and the pulse (2 levels) receiver.

Words 34 through 37 control a CW data filter. The selected 2-GHz band is divided into five segments. Then, the PCM can be restricted to receiving only signals in the odd segments, or only in the even segments. Alternately, all segments may be passed to the PCM and the filtering done only for CW TI handovers. The option also exists to reject all CW handovers if desired. These words also control the mainbeam CW pulse reject test.

4.9.4 DF Mode Definition

Block 3 plus Blocks 10 through 17 (in octal) contain DF mode definitions. Block 3 controls the DF subsystem during calibration periods. Blocks 10 through 17 are each assigned one RF band and are in control whenever that band is called by the current DF program step.

Words 0 through 7 contain 64 bits that select the coarse frequency filters from which contacts will be accepted. Any signal whose strongest component lies in a forbidden filter will be ignored. Word 25 also acts as a master control for this signal filtering.

Words 10 through 16 control a pulse parameter filter. This filter defines a class of signals as having frequency, PRI, and pulsewidth within specified ranges which are illustrated in Appendix A. The DF pulse receivers can then either reject all signals in the defined set or all outside that set for reporting in the PCM data stream. The use of this filter can be enabled continuously, or only while the PCM buffer is near overflow, or it can be disabled and all signals accepted. Pulse reports which do not include a valid frequency bypass this filter. However, they can be commanded to be accepted or rejected by the PCM separately.

Word 17 controls the omni-M inhibit bias of the DF pulse receiver.

Words 20 through 24 control a pulse handover filter that limits the handovers to the TI receiver. This filter specifies the frequency and pulsewidth required for a handover to occur. Word 20 also controls the omni-P inhibit bias of the DF pulse receiver.

Words 25 and 26 specify the TI high-sensitivity frequency in lieu of a hand-over if the DF antenna is to be used. Resolution of this frequency is 1 MHz. The BWC read-in duration is also specified in these words.

Word 27 specifies both the DF dwell period for the current RF band and the TI options to use for CW signals. These options involve using either the BWC or spectrum analysis mode for WBCW signals or the BWC, SA, or fine-tune mode, and aborting for NBCW signals. The choice is provided to either abort or continue in IF sweep when the TI cannot find the CW signal on which it just performed coarse tuning.

Word 30 controls the CW delta inhibit function. Options are to enable the inhibit full-time or only when the PCM buffer is nearly full, or to disable the inhibit entirely. This word also controls the output of CW data. These reports can be disabled full time, disabled only when the PCM buffer is nearly full, or enabled full-time. In addition, this word controls the DF pulse receiver guard inhibit bias.

Word 31 controls the DF swath width reduction factor. The reduction specified in the program step words can be enabled, or disabled, or enabled only when the PCM buffer is nearly full. This word also controls the frequency thinning specified in words 0 through 7. The filtering can be extended to reject pulses with any of the strongest three components in a forbidden filter. On the other hand, the filtering can be disabled. Control of the pulse delta inhibit is located in this word also. This inhibit can be set continuously, disabled continuously, or set to apply when the PCM buffer is nearly full.

Finally, this word controls the reporting of the second and third frequencies of multifrequency pulses. This can be enabled, disabled, or disabled only when the PCM buffer is nearly full.

Word 32 controls the bias for the CW DOA inhibits. Separate bits allow enhancement of the omni, guard, and delta inhibits. This word also specifies the CW receiver sensitivity (2 levels).

Word 33 specifies the pulse receiver sensitivity (2 levels). This word also controls the pulse DOA inhibits, with separate bits for omni-P, omni-M, guard, and delta inhibits. This allows added bias which will ensure all antenna sidelobes are suppressed.

Words 34 through 37 control a CW data filter. The selected 2-GHz band is divided into five segments. The PCM can be restricted to receiving signals only in the odd segments or even segments. Alternately, all segments may be passed to the PCM and the filtering done only for CW TI handovers. The option also exists to reject all CW handovers. Word 37 also controls the DF CW pulse reject test.

Words 40 through 47 specify the PCM intercept reports which are to be passed to the ASC by the DAU. The DF reports are separated into three classes: single frequency pulses, multifrequency pulses, and CW. In each class, one bit specifies whether or not that class is desired. For each class, the current 2-GHz band is divided into three parts and either the center or the two edges is allowed to be passed to the ASC by the DAU.

4.9.5 DF Program Steps

Blocks 2 and 6 contain program step definitions. Block 2 contains one step (defined in the first two words) that is used during calibration. The remaining 62 words (3 through 77 in octal) are unused. Block 6 contains 18 program steps which are employed when the TSG is not in use. Each step definition uses two memory words.

In each block, the even-numbered word of a pair selects the RF band for the DF subsystem and the RF band for the TI receiver if DF fix-tune mode is selected. In each block, the odd-numbered word of a pair selects the DF swath width reduction desired. Half of this reduction is at the start of the step and half at the end.

4.9.6 Spare Block

Block 7 is a spare. It passes messages into the PCM stream from the tracking stations (actually from the command load originator). A maximum of 52 bytes can be used for this purpose.

Section 5

ADVANCED SPACECRAFT COMPUTER

The payload contains a general purpose minicomputer known as the Advanced Spacecraft Computer (ASC). The ASC is interfaced with the payload data handler by a data adapter unit (DAU) and permits the compaction of payload digital data in real time for narrowband transmission [redacted] 25X1 The ASC hardware and software comprises the satellite portion of the real time ASC processing subsystem.

5.1 ASC CAPABILITIES

Capabilities of the ASC are as follows:

a. The ASC can receive and process intercept and time/attitude data from the payload data handler at rates of up to 400 pulses per second.

b. The ASC can receive and use data sent to it via the ground data processing system's (GDPS) command system.

c. The ASC program can reconstruct signals from the DF pulsed and DF CW data intercepted by the payload to produce bursts (a collection of pulse or CW data from the same emitter) and series (a collection of bursts from the same emitter).

d. The ASC can execute self-diagnostic programs and transmit the results to the DAU for relay [redacted] 25X1

e. The DAU can, on command from the command subsystem, suppress input data on the basis of signature (intercept word group type), RF range, and band/antenna number.

f. The ASC can, on command of the command subsystem or in response to critical data densities, selectively discard data or suppress execution of sections of the data processing program.

The DAU accepts data from the ASC and creates a serial PCM bit stream of 4 kbps or 32 kbps by adding frame synchronization and no-data words, and directs the data, as commanded by the command subsystem, to the vehicle transmitter and/or the payload tape recorder.

5.2 ASC/DAU COMMAND AND CONTROL

The ASC/DAU subsystem is not automatically activated each time a payload data collection period starts, but only for such collection segments as are specifically requested by the command load from the SCS. Real time commands are available to activate the ASC service program, initiate an ASC memory bank swap, or trigger the reloading of the ASC bootstrap program. Real time commands are also used to load the ASC program and to send support data to the ASC.

Support data includes ephemeris, spin axis, TRG-to-GMT clock correlation, and a status block which is used to send messages to the site where the ground-based subsystem is located. Support data are not used directly by the ASC but are reformatted and included in the ASC output to be used by [redacted] for geopositioning and formatting the data received from the on-board subsystem.

The command subsystem is used to change the contents of ASC memory. The changes include program modification, algorithm parameter changes, and flag settings. The flag settings can be used to control the operation of the ASC programs. For example, the flag settings tell the ASC service program when it should execute a specific diagnostic program.

5.3 ADVANCED SPACECRAFT COMPUTER (ASC)

The ASC is a minicomputer with 16K 16-bit words of CMOS memory. A low voltage is normally applied continuously to a section of memory to prevent loss of the stored program during periods of no operation. The ASC contains two independent programs: the service program and the payload data processing program.

If the stored program should become degraded, the DAU can, on command from the command subsystem, load a bootstrap program into the ASC memory using the ASC DIRECT EXECUTE feature. This permits reloading of the data processing and service programs by the command subsystem. A section of memory is protected (writing into it is inhibited) but this feature can be disabled when necessary.

5.4 DATA ADAPTER UNIT (DAU)

The DAU provides all ASC voltages and is responsible for operating the ASC. When appropriate it executes a startup sequence which includes turning on power, activating the MASTER CLEAR signal, releasing the STOP INPUT state, and sending a signal which selects one of two starting addresses, one being for the ASC service program and the other for the data processing program. The DAU initiates the ASC data processing program at the start of every collection segment which the command subsystem designates as a real time processing segment. It initiates the ASC service program whenever the command subsystem has data involving the ASC.

The DAU is also responsible for halting the ASC by setting the STOP INPUT state and shutting off power to the ASC. The ASC has a standby, low-voltage, keep-alive circuit which protects the section of the ASC's volatile CMOS memory which contains the stored program. On command from the command subsystem, the DAU reloads the ASC bootstrap program from the read only memory (ROM). The DAU uses the ASC DIRECT EXECUTE feature for writing the bootstrap program to the ASC. This is the only use that will be made of the DIRECT EXECUTE feature in the ASC.

5.5 THE ASC SERVICE PROGRAM

The ASC service program can perform a number of support functions under control of the command subsystem and the DAU. Communication is data sent via the command subsystem. Each data type contains an identification code. The service program is capable of receiving support data as described in Section 4.3 and storing it in memory for later use by the data processing program. The service program is capable of accepting data to be stored in specified locations in memory. This capability may be used to modify an ASC program, change parameters used in algorithms or to set flags controlling the ASC service or data processing programs. The service program, when the appropriate flags are set, performs diagnostic routines and returns the results via the DAU.

5.6 THE PAYLOAD DATA PROCESSING PROGRAM

The payload data processing program will accept DF pulse first, second, and third frequency intercept word groups, DF CW intercept word groups and time-attitude program step word groups (TAP) originating in the payload data handler. The data processing program forms bursts and series to represent the emitters from which the intercepted signals originated.

The first step in the burst formation routine is to deinterleave related DF pulses on the basis of time of arrival (TOA) interval, commonly referred to as pulse repetition interval (PRI) as a first criterion and RF consistency as a second criterion. This process may be repeated several times, the tolerances being relaxed on each iteration. The second step in the deinterleaving process is to correlate the DF pulses which were not correlated on the first step, the residue on the basis of matching RF as the first criterion, and PRI consistency as a second criteria. AT the end of the program step an attempt is made to combine discrete [redacted] formed during the spin which represent 25X1
signals from the same emitter. This is done by means of harmonic analysis and by identifying and compensating for PRI stagger and jitter. The last step is

an attempt to correlate the new [redacted] with the active series formed on previous spins and to create new series by correlating the unmatched [redacted] with the active unmatched [redacted] from previous spins. The criteria used are centroid time, relative to the start of the spin, as the primary criterion and PRI and RF consistency as secondary criteria. 25X1 25X1 25X1

The DAU is responsible for activating, on command from the command subsystem, the memory BANK SWAP feature of the ASC. This feature swaps the addresses of the two 8K banks comprising the ASC's 16K memory. This feature is useful if a section of memory fails. The DAU acts as an interface, transmitting data from the payload data handler to the ASC and from the ASC to the payload data control unit which passes it to the vehicle transmitter and/or tape recorder, as commanded by the command subsystem. Before sending the data to the baseband assembly unit, the DAU converts the data to a 4-kbps or 32-kbps PCM stream by adding frame synchronization and no-date fill words to create the appropriate rate.

Two types of data will be received by the DAU: payload data and data from the command subsystem. The command data are type coded. Certain data types are passed to the ASC, others are used by the DAU. All data intended for the ASC, whether payload or command, are sent to the ASC, one 16-bit word at a time, via the ASC input bus under ASC interrupt control. Data from the payload are analyzed by the DAU. Only those words groups which meet the data type and RF criteria for the given collection segment and program step are passed to the ASC.

The DAU has input buffering for word groups. Output data from the ASC are sent to the DAU via the ASC output bus under ASC interrupt control. Output data may be routed to the vehicle tape recorder, the vehicle transmitter, or both, as directed by the command subsystem.

Processing of CW intercepts is similar in concept to pulse processing except that PRI is not used, since it is not relevant to CW deinterleaving. The ASC program is also process time/attitude word groups and output timing, spacecraft rotation and activity and status information at the end of each program step. Support data are output at approximately 60-second intervals.

An option, which may be invoked via the tasking subsystem, suppresses the [redacted] association and series formation funtions in the ASC and perform them in [redacted] When this option is commanded, the output data rate from the DAU is 32 kbps. 25X1

5.7 ASC INPUTS

The ASC inputs are received via a 16-bit data bus, four ID lines, and nine discrete command lines. The discrete command lines are responsible for setting the ASC operating mode, including control of data input via the bus.

The following inputs are received via the data bus and ID lines.

a. <u>Program Input</u>. All operating routines are transmitted to the ASC from a tracking station in the form of data blocks. Each block includes an address in the ASC memory where it is stored. The only routines not transmitted in this manner are the bootstrap routines that allow the ASC to accept the above data blocks.

b. <u>Support Data</u>. The ASC receives predicted ephemeris data for specific times at which the ASC is to be used. These data are stored and then output along with the other ASC output data to allow calculation of signal locations by the stations receiving the ASC data.

c. <u>Intercept Data</u>. The ASC receives selected DF intercept reports copies from the payload PCM. It also receives all TAP (time, attitude, and program step) reports.

d. Miscellaneous Data. The ASC also receives commands via the input bus (plus ID lines). These commands can set the following modes:

(1) Memory dump enable
(2) Memory dump disable
(3) Status telemetry reset
(4) Initialize memory checksum routine
(5) Initialize processor diagnostic routine
(6) Initialize nonprocessing mode
(7) Initialize processing mode

In addition, the DAU provides the following commands on discrete lines to the ASC:

a. Level 3 Interrupt. Orders the ASC to accept program or support data and store it in memory.

b. Level 2 Interrupt. Orders the ASC to accept an intercept or TAP report.

c. Level 1 Interrupt. Orders the ASC to output an 8-word report.

d. RAM Protect. Prevents the alteration of the ASC program area. The command is present except during program load periods.

e. Bank Swap. Orders the ASC to interchange its upper and lower RAM halves. All programs must be reloaded after a bank swap.

f. Double Start. Selects either the diagnostic program or the processing program start address.

g. Master Clear. Resets programs counter to starting address selected by double start line.

h. Stop/Run. This is the halt/run control to the ASC. It must be in "run" for the ASC to operate.

i. ROM Load. This line is used to control the transfer of a bootstrap routine from a ROM in the DAU. The bootstrap words are transferred using level 3 interrupts. This line places the ASC in a special mode (direct execute) in which an address is received for each data word.

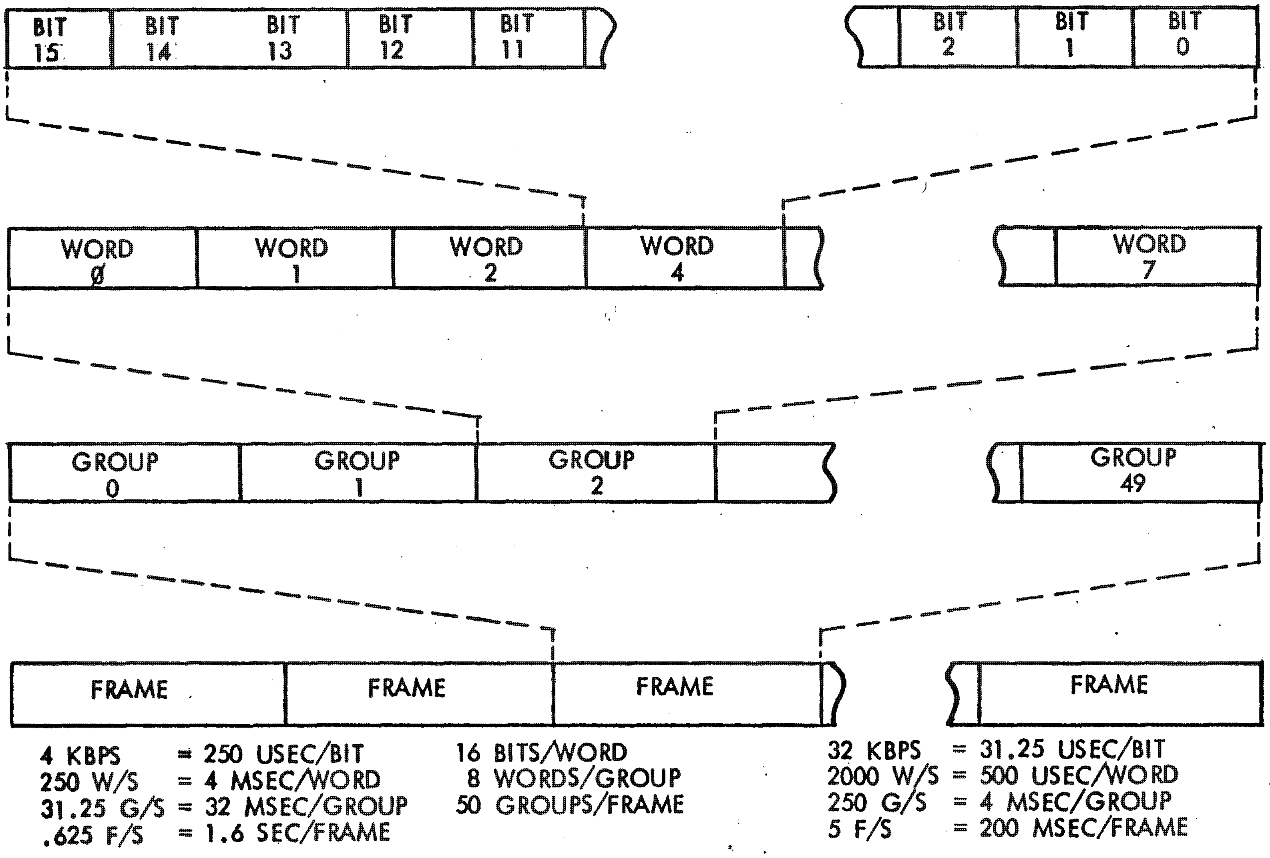
5.8 ASC OUTPUTS

The ASC outputs the following data to the DAU for incorporation in various output data streams. The ASC identifies the data on its output bus using the four ID lines.

a. Status Information. The ASC outputs eight status bits to the DAU. These data are output as subcommutated data by the payload PCM (frames 9 and 137) and by the vehicle PCM (word 8 from payload).

b. Data for 4/32 kbps PCM. The ASC outputs reports which the DAU places in a 4- or 32-kbps PCM data stream. Figure 5-1 shows the format of this stream. Each report includes an ID at each end. Table 5-1 lists the leading-end IDs. The trailing end IDs are the same, but bit-order reversed for convenience in reading the data stream in reverse.

93



25X1

BIF003W/2-156913-80

0128R

Figure 5-1 ASC/DAU PCM Format

Table 5-1

PCM ID CODES

LEAD ID	TRAIL ID	WORD GROUP TYPE
0 0 0 0	0 0 0 0	FRAME SYNCH
0 0 0 1	1 0 0 0	NO DATA
0 0 1 0	0 1 0 0	START OF RUN/END OF SPIN
0 0 1 1		UNUSED
0 1 0 0 0	0 0 1 0	FIRST MEMORY DUMP
0 1 0 0 1	0 0 1 0	MEMORY DUMP CONTINUATIONS
0 1 0 1		UNUSED
0 1 1 0	0 1 1 0	CW [redacted] 25X1
0 1 1 1	1 1 1 0	CW SERIES
1 0 0 0	0 0 0 1	GENERAL CONTINUATION MESSAGE
1 0 0 1	1 0 0 1	PULSE OUTPUT
1 0 1 0	0 1 0 1	PULSE [redacted] (NO SPIN ASSOCIATION) 25X1
1 0 1 1		UNUSED
1 1 0 0	0 0 1 1	PULSE SERIES
1 1 0 1	1 0 1 1	SUPPORT DATA
1 1 1 0 0	0 1 1 1	PULSE [redacted] 25X1
1 1 1 0 1	0 1 1 1	PULSE [redacted] (BUNCH)
1 1 1 1		UNUSED

Section 6

MAINBEAM TI MEASUREMENTS

The Mission 7346 spacecraft is capable of intercepting signals radiated from the mainbeam and close-in sidelobes of both pulse and CW emitters. The analysis of these intercepts results in significant technical intelligence on the operational characteristics of the emitter, and what its role is in the overall weapon system of which it is a part.

Figure 6-1 illustrates the radiation characteristics of several different types of emitters that make up a typical weapon system. The raster scan and multibeam circular scan are typical of early warning or acquisition radars. The two-beam sector scan is typical of a track-while-scan target tracker, and the pencil beam is typical of a communication emitter or a target or missile tracker. These are just a few of the many possible examples that could be shown. The hemisphere above the emitters represents the orbital sphere that contains the Mission 7346 spacecraft orbit. All orbit tracks within the horizon of the illustrated emitters lie on this hemisphere.

A representative orbit track is shown passing through all the elevation beams of the raster scan emitter. Such an intercept provides the elevation pattern and the azimuth sector of the target emitter. Scan period can also be determined. The beamwidth of the emitter's antenna pattern can be measured as can the effective radiated power. Whether or not azimuth scan or elevation scan is accompanied by a change in transmitted radio frequency can also be determined.

All of these measurements are provided by the Mission 7346 spacecraft because of its unique combination of capabilities: low-altitude, near-polar orbit; wide frequency range; near omnidirectional antenna patterns (from the low-gain antenna sets); amplitude measurement circuits; and pulse and CW receivers.

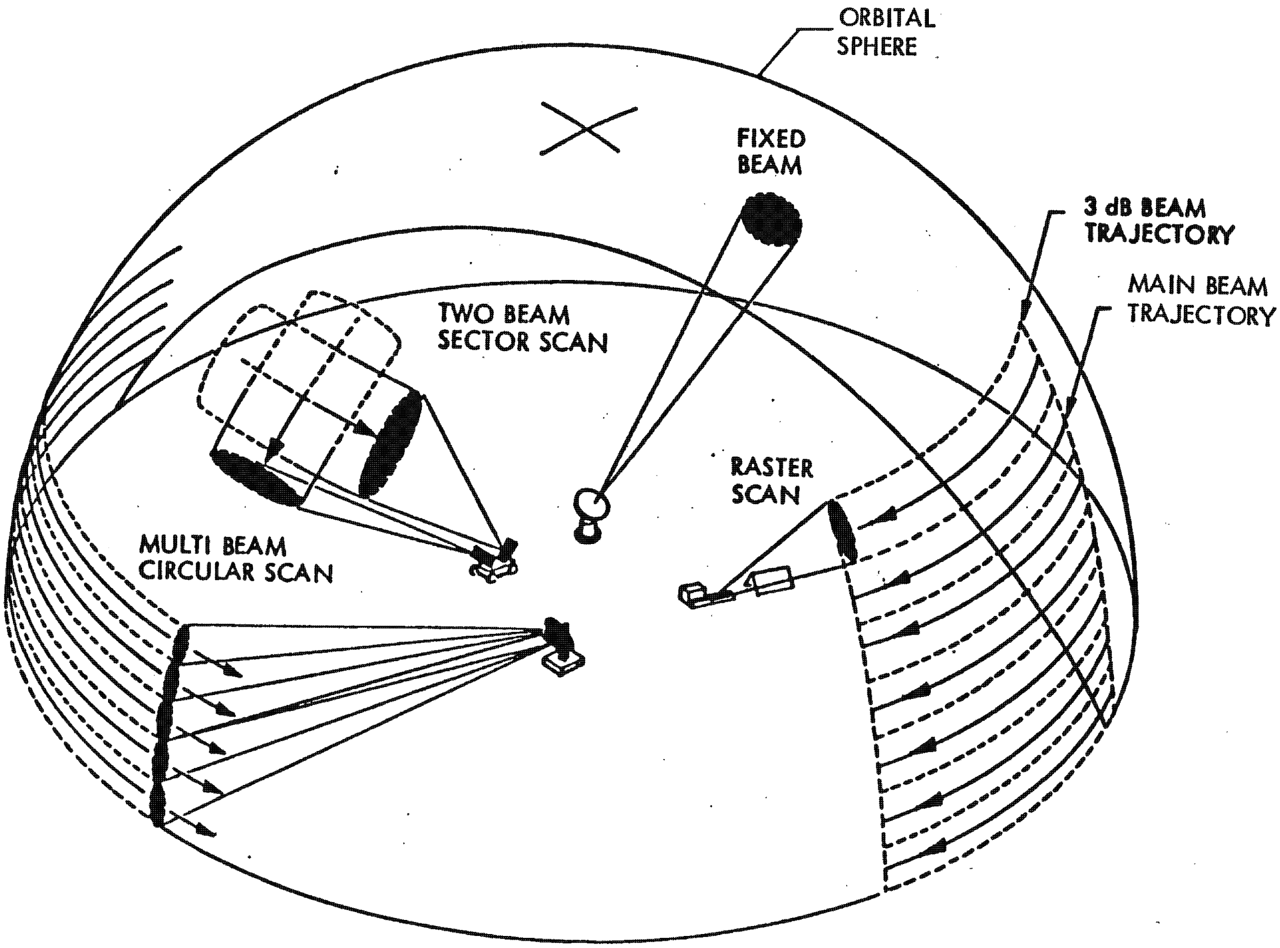


Figure 6-1 Examples of Mainbeam Intercepts

Section 7

PROCESSING AND REPORTING

The processing and reporting of 7346 intercept data is performed in three ways; in-line digital processing, off-line analog processing, and special off-line processing analysis. In-line processing supports all requirements. The off-line processing primarily supports the technical intelligence and search missions.

7.1 IN-LINE DIGITAL PROCESSING

The in-line digital processing function automatically detects, characterizes, locates, identifies, and directly reports emitters to NSA and the Strategic Air Command (SAC). In addition to direct reporting, most of the processed data is placed in files where a quick scan is made to identify those data areas requiring more detailed off-line analysis.

[redacted] 25X1

7.2 OFF-LINE PROCESSING

The off-line analog processing and the special off-line processing analysis functions characterize and report new emitters, and look for deviations in parameters of established emitters that cannot be properly handled by the automatic in-line digital processing system. When adequate information is known about a new emitter, its parameters are added to the automatic system to permit processing of signals of interest that present problems to the in-line digital processing system.

The off-line analog processing and the special off-line processing analysis functions additionally permit a detailed analysis of a particular emitter, generally using the data collected during many intercepts (sometimes from more than one mission). [redacted] 25X1

[redacted] 25X1

The information resulting from these processing and analysis efforts is published by NSA in the ELINT Technical Reports series (ELTs).

Section 8

TASKING

Operational tasking for Mission 7346 will be accomplished at the national level (as is the tasking for all overhead resources). Tasking is levied according to the priority that the SIGINT Overhead Reconnaissance Subcommittee (SORS) assigns a validated intelligence requirement. Intelligence users initiate their requirements for overhead collection in accordance with the collection requests/validation procedures specified by their individual Service or Agency. Requirements from the Unified and Specified Commands are handled by the Defense Intelligence Agency. The Service or Agency SORS member will then present the Service/Agency validated requirement to the SORS who will act upon the request.

8.1 ROUTINE TASKING

Routine, daily operational tasking for Mission 7346 is administered by the [redacted] in accordance with the 7346 Basic Mission Guidance. 25X1 The Basic Mission Guidance is a comprehensive document promulgated by the SORS [redacted] that identifies primary and secondary mission tasks, collection priorities by frequency and geographical area and establishes processing and reporting guidelines. This guidance is reviewed by the SORS and revised as basic requirements and system capabilities/status change. Minor changes are provided in the form of supplemental guidance. Revised mission guidance is issued as major changes occur. A change to the Basic Mission Guidance may be proposed by any SORS member at any time based on supportable recommendations.

8.2 TIME CRITICAL REQUIREMENTS (TCR)

Needs for special collection, processing, and reporting of selected data or targets/events of interest can be levied on overhead SIGINT systems by request of a SORS member to the SORS, or by direct request to the National Reconnaissance Office (NRO)/National Security Agency (NSA) if the SORS is not in session and cannot be immediately convened. The NRO will direct [redacted] initiate the TCR action and the NSA will provide [redacted] the technical guidance and the applicable processing and reporting instructions necessary for implementation. If the TCR request was made directly to the NRO/NSA, the NRO will inform the entire SORS membership (within 24 hours) of the TCR action taken. Within 48 hours the SORS will formally approve or disapprove the TCR. If disapproved, the TCR will be immediately cancelled. If approved, the TCR will remain in effect for a maximum of 14 days unless sooner curtailed or officially extended by SORS action. 25X1

8.3 TASKING CONSIDERATIONS

Satellite tasking in response to user requirements is a complex process. The more information the user can provide about the emitter to be collected, especially where the emitter is not a well known standard, the more precisely the satellite can be tasked to provide the intercept. Data on effective radiated power, azimuth, and elevation constraints, duty cycle, etc. should be provided (if available).

The amount of coverage allocated against an emitter or specific set of emitters is dependent on several factors. Satellites pass over targets near the earth's poles much more frequently than those near the equator. Thus access to a target is greater at the higher latitudes. Severe time and positioning constraints may be difficult to meet. Only a few of the possible passes over the target area may meet these constraints. Problems with the spacecraft and wide variations in available power may also limit coverage. The power available to conduct intercept operations is dependent on the amount of solar energy the spacecraft can capture. During the course of a year, power availability varies up to a factor of three due to sun conditions and collection varies accordingly.

In initiating their requests, consumers do not specify or ask for the collection to be accomplished by a specific overhead SIGINT satellite. Determination of the spacecraft to be tasked will be decided by the SORS (with the advice of the NRO). When considering tasking for Mission 7346 the SORS makes its judgment in view of other intelligence requirements and priorities, the present health/status of the spacecraft, orbital accessibility to the target area, and certain collection trade-offs.

The prelaunch planning process culminated in another electrical message [redacted] 25X1 outlining the collection tasks to be performed. This message included a prioritization for implementing the tasking, identification of target emitters, and rate of collection. As part of the continuing collection review process, subsequent messages may include updated tasking for the spacecraft based on modified requirements or may contain cooperative tasking against a specific object.

APPENDIX A
PAYLOAD COMMANDS

BLOCK 0: PROGRAM CONSTANTS

WORD	
0	COPIED FROM CURRENT TIF WORD 0
1	CONTAINS 5 BITS FROM VSPC-1, 3 BLANKS
2- 7	COPIED FROM CURRENT TIF WORDS 1-6
10-22	COPIED FROM TASK ID BLOCK SELECTED BY TIF WORD 7
23-77	FILLED WITH FIXED PATTERN

Approved for Release: 2024/08/06 C05098398

	BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
00	PAYLOAD SUBSYSTEM POWER ENABLES DF-PO	DF-CW	MB-PO	MB-CW	TI	DAU	DAU PCM RATE	SGLS FILTER ENABLE
01	INCREMENT TASK COUNTERS 1	2	3	4	5	UNASSIGNED		
02	TSG MODE ENABLE	CONTINUOUS	PROGRAM STEP OFFSET 0 TO 3 TIMES 8 MSEC					
03					MB PFM N(PF) = 0	C F CORRECT	MB WBTOA INHIBIT	MB DOOB REPORT
04	DF PULSE INHIBIT DISABLES GUARD	SPARE	DM-P	DM-M	DF PFM N(PF) = 0	C F CORRECT	DF WBTOA INHIBIT	DF DOOB REPORT
05	DF CW INHIBIT DISABLES GUARD	DM	UNASSIGNED					
06	TI PRIORITY MODE				BWC ENABLE	CW F ENABLE	PRE-D MODE	
07	UNASSIGNED							
10	RESERVED FOR TASK ID BLOCK							
11								
12								
13								
14								
15								
16								
17								

******* * SECRET *******

A-3

0128R

******* * SECRET *******

25X1

BIF003W/2-15691-80

****
* ~~SECRET~~
****

BIF003W/2-156913-80 25X1

	BIT 0	BIT 1	BIT 2	BIT 3	BIT 4	BIT 5	BIT 6	BIT 7
20								
21								
22								
23								
24								
25								
26								
27								
30							UNASSIGNED	
31								
32								
33								
34								
35								
36								
37								

****
* ~~SECRET~~

0128R 25X1

BIT 0

BIT 1

BIT 2

BIT 3

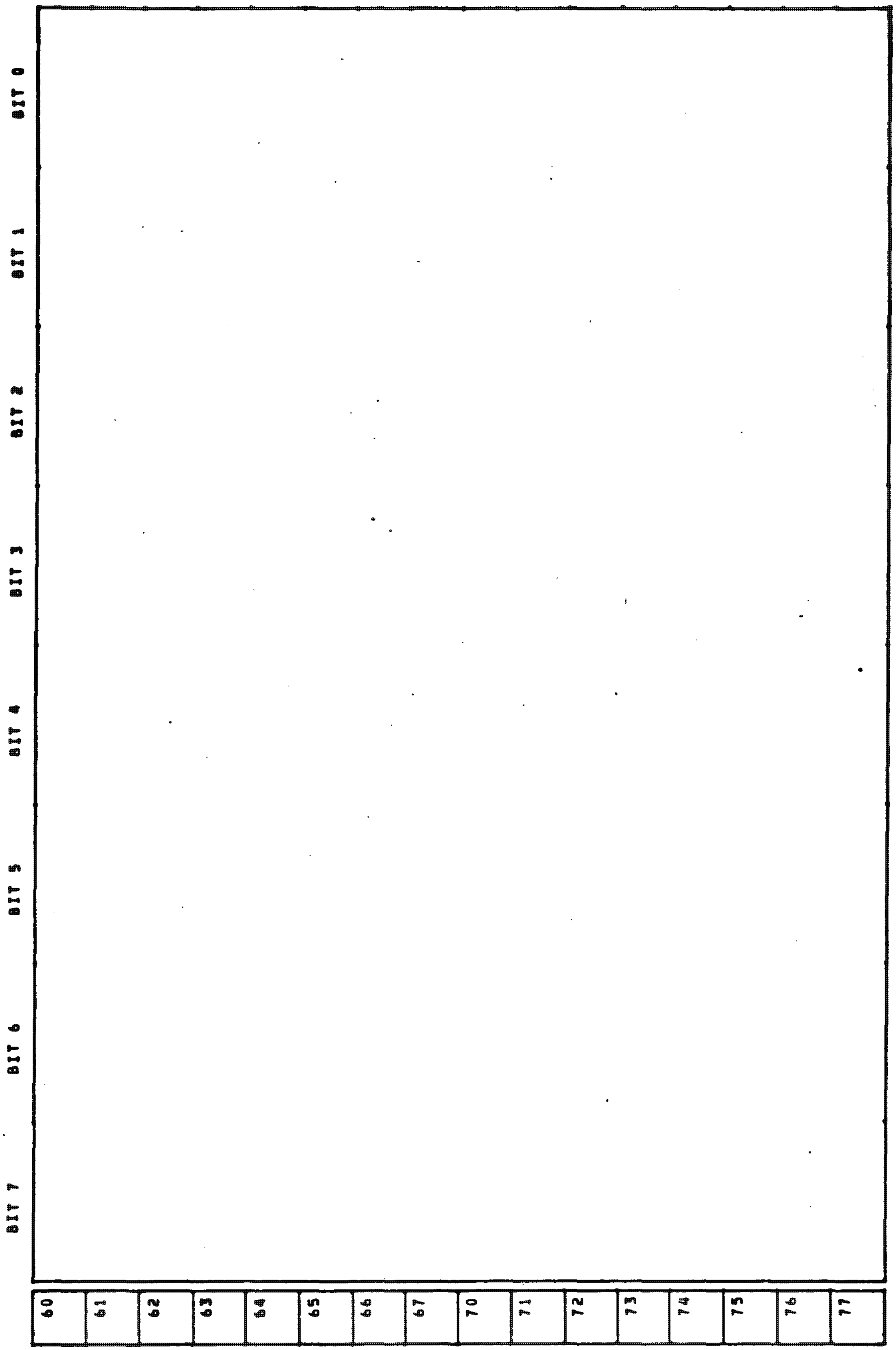
BIT 4

BIT 5

BIT 6

BIT 7

40	41	42	43	44	45	46	47	50	51	52	53	54	55	56	57


BIT 0
BIT 1
BIT 2
BIT 3
BIT 4
BIT 5
BIT 6
BIT 7
60
61
62
63
64
65
66
67
70
71
72
73
74
75
76
77

BLOCK 00: PROGRAM CONSTANTS

WORD	BITS	CONTENT
00	7	DF-PULSE RCVR 0 = OFF 1 = ON
	6	DF-CW RCVR 0 = OFF 1 = ON
	5	MAINBEAM-PULSE RCVR 0 = OFF 1 = ON
	4	MAINBEAM-CW RCVR 0 = OFF 1 = ON
	3	TI RCVR 0 = OFF 1 = ON
	2	DAU SUBSYSTEM 0 = OFF 1 = ON
	1	DAU PCM RATE 0 = 4 KBPS 1 = 32 KBPS
	0	SGLS REJECT FILTER 0 = FILTER ENABLED 1 = FILTER DISABLED
01	7-3	TASK COUNTERS 1 THROUGH 5: EACH 0 = NO INCREMENT 1 = INCREMENT AT MEMORY EXECUTE TIME
	2-0	UNASSIGNED
02	7-6	TSG MODE (7 IS MSB) 0# = OFF 10 = CALIB AT MEMORY EXECUTE START 11 = CONTINUOUS CALIBRATION MODE
	5-0	PROG. STEP OFFSET (DF SWATH POSITION) REL TO H/S OFFSET = (32 + 8*COUNT) MSEC = 32 TO 536 MSEC

03 7-4 UNASSIGNED

3 MAINBEAM: NO FREQ MEASURED
0 = ALLOW IWG'S
1 = INHIBIT IWG'S

2 MAINBEAM PFM COARSE FREQUENCY:
0 = REPORT WITHOUT CORRECTION (DO NOT USE)
1 = ENABLE CORRECTION BY FINE FREQ

1 MAINBEAM WB TOA
0 = ALLOW IWG'S
1 = INHIBIT IWG'S

0 MAINBEAM DOOB
0 = ALLOW IWG'S
1 = INHIBIT IWG'S

04 7 DF PULSE GUARD INHIBIT
0 = DISABLED
1 = ENABLED

6 SPARE

5 DF PULSE OMNI-P INHIBIT
0 = DISABLED
1 = ENABLED

4 DF PULSE OMNI-M INHIBIT
0 = DISABLED
1 = ENABLED

3 DF: NO FREQ MEASURED
0 = ALLOW IWG'S
1 = INHIBIT IWG'S

2 DF PFM COARSE FREQUENCY:
0 = REPORT WITHOUT CORRECTION (DO NOT USE)
1 = ENABLE CORRECTION BY FINE FREQ

1 DF WB TOA
0 = ALLOW IWG'S
1 = INHIBIT IWG'S

0 DF DOOB
0 = ALLOW IWG'S
1 = INHIBIT IWG'S

05 7 DF CW GUARD INHIBIT
0 = ENABLED
1 = OVERRIDDEN

6 DF CW OMNI INHIBIT
0 = ENABLED
1 = OVERRIDDEN

5-0 UNASSIGNED

06 7-4 TI HANDOVER/HI SENS PRIORITY SEQUENCE

BITS 7-6-5-4	---DF--- PU	---DF--- CW	MAINBEAM PU	MAINBEAM CW	HIGH SENSITIVITY
0 0 0 0	1	2	3	4	5: DF-PU
0 0 0 1	2	1	4	3	5: DF-CW
0 0 1 0	3	4	1	2	5: MB-*-PU
0 0 1 1	4	3	2	1	5: MB-*-CW
0 1 0 0	1	2			3: DF-PU
0 1 0 1	2	1			3: DF-CW
0 1 1 0			1	2	3: MB-*-PU
0 1 1 1			2	1	3: MB-*-CW
1 # 0 0					1: DF-PU
1 # 0 1					1: DF-CW
1 # 1 0					1: MB-*-PU
1 # 1 1					1: MB-*-CW

* OMNI CHANNEL SPECIFIED IN CURRENT MAINBEAM MODE BLOCK
# = ANY VALUE

3 TI BWC POWER
0 = OFF
1 = ON

2 TI CHANNEL F VCO
0 = DISABLED
1 = ENABLED

1-0 TI PRE-D MODE (1 IS MSB)
00 = LOGRITHMIC
01 = LINEAR
10 = LOG + LINEAR (DO NOT USE)
11 = LIMITER

07 SPARE

10-21 RESERVED FOR TASK ID DATA

22-77 UNASSIGNED

BLOCK 1: MAINBEAM MODE DURING TSG PERIODS--TIF WORD 8
4: MAINBEAM MODE DURING MAINBEAM STEP 0 PERIODS--TIF WORD 12
5: MAINBEAM MODE DURING MAINBEAM STEP 1 PERIODS--TIF WORD 13

WORD	
0-37	COPIED FROM MAINBEAM BLOCK SELECTED BY TIF
40-77	FILLED WITH FIXED PATTERN

	BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
00								
01								
02								
03	PFM COARSE FILTER							
04	ENABLE BITS							
05	FILTERS 1 THROUGH 64							
06								
07								
10	PULSE PARAMETER FILTER CONTROL DISABLE	ADAPT	MODE	PPF WINDOW SIZE 0 TO +/- 14 6 USEC				
11	FREQ WINDOW ACCEPT		UPPER WINDOW LIMIT: FREQUENCY					
12			LOWER WINDOW LIMIT: FREQUENCY					
13	PW WINDOW ACCEPT		UPPER WINDOW LIMIT: PW					
14			LOWER WINDOW LIMIT: PW					
15	PRI WINDOW ACCEPT	UNASSIGNED			MSB			
16	PULSE PARAMETER FILTER: PRI							LSB
17	UNASSIGNED							

A-11

0128R

******** * SECRET ********

******** * SECRET ********

25X1

BIF003W/2-156913-80

	BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
20	UNASSIGNED							
21	FREQ WINDOW ACCEPT		UPPER WINDOW LIMIT: FREQUENCY					
22	H O FILTER ENABLE		LOWER WINDOW LIMIT: FREQUENCY					
23	PW WINDOW ACCEPT		UPPER WINDOW LIMIT: PW					
24			LOWER WINDOW LIMIT: PW					
25	MSB TI HIGH SENSITIVITY FIXED COARSE FREQUENCY							
26			LSB	BWC READ-IN DURATION				
27				TI OMNI ANT OM-M	TI OPTIONS WBCW	NBCW		IF SWEEP
30	OMNI RF BAND						CW READ OUT DISABLE	ADAPT
31	PFM ASSIGNMENT FIXED	OM-P	PFM INHIBIT MODE ENABLE		PFM TIMER	DISABLE	MULTI-FREQ ADAPT	READ-OUT
32	UNASSIGNED							
33			OMNI PULSE SENSITIVITY					OMNI CW
34	CW DATA	CW FREQUENCY BOUNDARY: 1-2						
35	THINNING	CW FREQUENCY BOUNDARY: 2-3						
36	MODE	CW FREQUENCY BOUNDARY: 3-4						
37	PULSE INHIBIT	CW FREQUENCY BOUNDARY: 4-5						

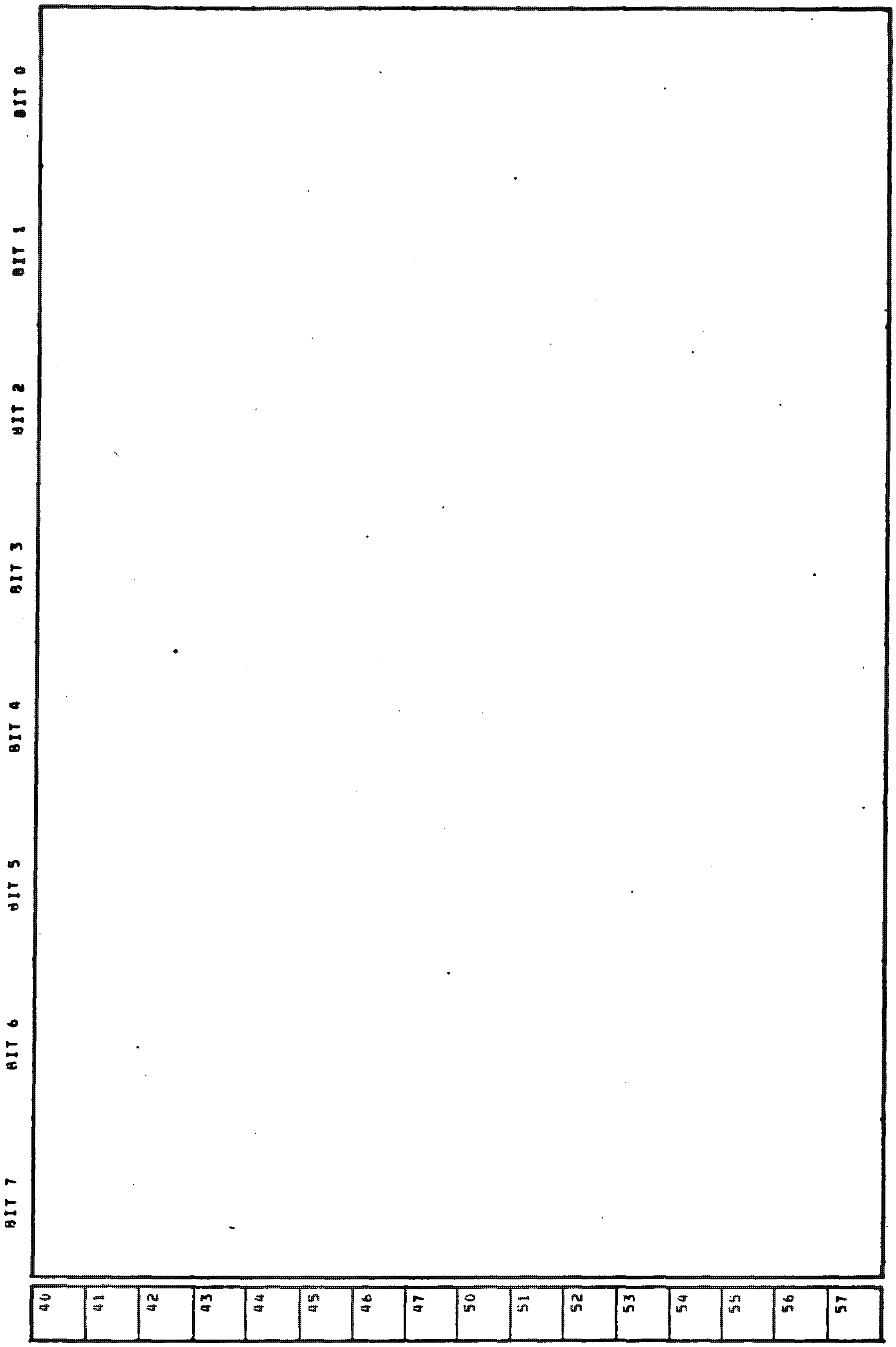
******* SECRET *******

A-12

25X1

BIF003W/2-156913-80

0128R


BIT 0
BIT 1
BIT 2
BIT 3
BIT 4
BIT 5
BIT 6
BIT 7
40
41
42
43
44
45
46
47
50
51
52
53
54
55
56
57

	60	61	62	63	64	65	66	67	70	71	72	73	74	75	76	77
BIT 0																
BIT 1																
BIT 2																
BIT 3																
BIT 4																
BIT 5																
BIT 6																
BIT 7																

MAINBEAM MODE BLOCK 1 : USED DURING TSG
BLOCK 4 : USED DURING STEP 0 PERIODS
BLOCK 5 : USED DURING STEP 1 PERIODS

WORD	BITS	CONTENT
00	7-0	PFM FILTER ENABLES: 1- 8
01	7-0	PFM FILTER ENABLES: 9-16
02	7-0	PFM FILTER ENABLES: 17-24
03	7-0	PFM FILTER ENABLES: 25-32
04	7-0	PFM FILTER ENABLES: 33-40
05	7-0	PFM FILTER ENABLES: 41-48
06	7-0	PFM FILTER ENABLES: 49-56
07	7-0	PFM FILTER ENABLES: 57-64
		0 = PFM REJECT
		1 = PFM ACCEPT
10	7-5	PULSE PARAMETER FILTER (PPF) CONTROL (7 IS MSB)
		0## = FILTER DISABLED
		100 = ENABLED. REJECT DEFINED SET
		101 = " ACCEPT " "
		110 = ADAPTIVE. REJECT " "
		111 = " ACCEPT " "
	4	UNASSIGNED
	3-0	PPF: PRI WINDOW SIZE (3 IS MSB)
		0000 = 0
		0001 = 0.977 USEC
		1111 = 14.65 USEC
11	7	PPF: FREQUENCY WINDOW:
		0 = REJECT OUTSIDE WINDOW
		1 = REJECT IN WINDOW
	6	UNASSIGNED
	5-0	PPF: UPPER FREQUENCY LIMIT MAX COARSE FILTER NUMBER
12	7-6	UNASSIGNED
	5-0	PPF: LOWER FREQUENCY LIMIT MIN COARSE FILTER NUMBER

13	7	PPF: PULSE DURATION WINDOW: 0 = REJECT OUTSIDE WINDOW 1 = REJECT IN WINDOW
	6	UNASSIGNED
	5-0	PPF: UPPER PULSE DURATION LIMIT MAX PW CODE
14	7-6	UNASSIGNED
	5-0	PPF: LOWER PULSE DURATION LIMIT MIN PW CODE
15	7	PPF: PRI WINDOW: 0 = REJECT OUTSIDE WINDOW 1 = REJECT IN WINDOW
	6-4	UNASSIGNED
	3-0	PPF: 4 MSB OF PRI WINDOW CENTER
16	7-0	PPF: 8 LSB OF PRI WINDOW CENTER 3.9 TO 4000 US BY .977 USEC
17		UNASSIGNED
20		UNASSIGNED
21	7	PULSE HANDOVER (PHO): FREQUENCY WINDOW 0 = REJECT OUTSIDE WINDOW 1 = REJECT IN WINDOW
	6	UNASSIGNED
	5-0	PHO: UPPER FREQUENCY LIMIT MAX COARSE FILTER NUMBER
22	7	PHO FILTER CONTROL 0 = NO HANDOVERS 1 = HANDOVER PER FILTER
	6	UNASSIGNED
	5-0	PHO: LOWER FREQUENCY LIMIT MIN COARSE FILTER NUMBER

23	7	PHO: PULSE DURATION WINDOW: 0 = REJECT OUTSIDE WINDOW 1 = REJECT IN WINDOW
	6	UNASSIGNED
	5-0	PHO: UPPER PULSE DURATION LIMIT MAX PW CODE
24	7-6	UNASSIGNED
	5-0	PHO: LOWER PULSE DURATION LIMIT MIN PW CODE
25 26	7-0) 7-5)	TI HIGH SENSITIVITY (HI SENS) FREQUENCY 2000 TO 4000 MHZ BY 1 MHZ
	4-0	TI BWC SAMPLING DURATION (4 IS MSB) ##000 = 1.95 USEC ##001 = 3.91 USEC ##010 = 7.81 USEC ##011 = 15.62 USEC ##100 = 31.25 USEC ##101 = 62.50 USEC ##110 = 125.00 USEC ##111 = 250.00 USEC
27	7-5	UNASSIGNED
	4	TI MAINBEAM ANTENNA (HI SENS) 0 = MAINBEAM-P 1 = MAINBEAM-M
	3	TI WB CW MODE 0 = SPECT. ANAL. 1 = BWC
	2-1	TI NB CW MODE (2 IS MSB) 00 = BWC 01 = SPECT. ANAL. 10 = NB TUNE 11 = ABORT
	0	TI IF SWEEP OPTION 0 = DWELL IN SWEEP MODE 1 = RETURN TO ASSIGNMENT

30 7-5 RF BAND (7 IS LSB)

000 = BAND	1	001 = BAND	5
100	2	101	6
010	3	011	7
110	4	111	8

4-2 UNASSIGNED

1-0 MAINBEAM CW REPORTING (1 IS MSB)
1# = DISABLED
00 = ENABLED
01 = ADAPTIVE

31 7-6 MAINBEAM PFM ASSIGNMENT (7 IS MSB)
0# = AUTO
10 = MAINBEAM-M
11 = MAINBEAM-P

5-4 MAINBEAM PFM FILTER CONTROL (5 IS MSB)
#0 = DISABLE FILTER
01 = INHIBIT ONLY IF FIRST FREQ FORBIDDEN
11 = INHIBIT IF ANY COMPONENT FORBIDDEN

3 MAINBEAM PFM ASSIGNMENT TIMER
0 = NO RESET
1 = RESET AT EVERY PULSE IN SELECTED CHANNEL

2 UNASSIGNED

1-0 MAINBEAM PULSE SECOND FREQ READ-OUT (1 IS MSB)
#1 = DISABLED
00 = ENABLED
10 = ADAPTIVE

32 7-0 UNASSIGNED

33 7-6 UNASSIGNED

5-4 MAINBEAM PULSE SENSITIVITY (5 IS MSB)
00 = MAX
01 = - 7 DB
10 = -14 DB
11 = -21 DB

3-1 UNASSIGNED

0 MAINBEAM CW SENSITIVITY
0 = - 7 DB
1 = MAX

```
34     7)     MAINBEAM CW DATA THINNING CONTROL
35     7)        REPORT IN PCM    HANDOVER TO TI
36     7)        34-7 IS MSB
                000 =       ALL         ALL
                001 =        "        SEG 1,3,5
                010 =        "          NONE
                011 =        "        SEG 2,4
                100 =    SEG 1,3,5      NONE
                101 =        "        SEG 1,3,5
                110 =    SEG 2,4        NONE
                111 =        "        SEG 2,4

37     7      CW RCVR PULSE INHIBIT CONTROL
                  0 = PULSEWIDTH TEST ENABLED
                  1 = PULSEWIDTH TEST DISABLED

34    6-0     MAINBEAM CW: SEG 1-2 FREQ BOUNDARY
35    6-0     MAINBEAM CW: SEG 2-3 FREQ BOUNDARY
36    6-0     MAINBEAM CW: SEG 3-4 FREQ BOUNDARY
37    6-0     MAINBEAM CW :SEG 4-5 FREQ BOUNDARY
                     6 IS MSB
                 2000 TO 3984 MHZ BY 16 MHZ

40--77        UNASSIGNED
```

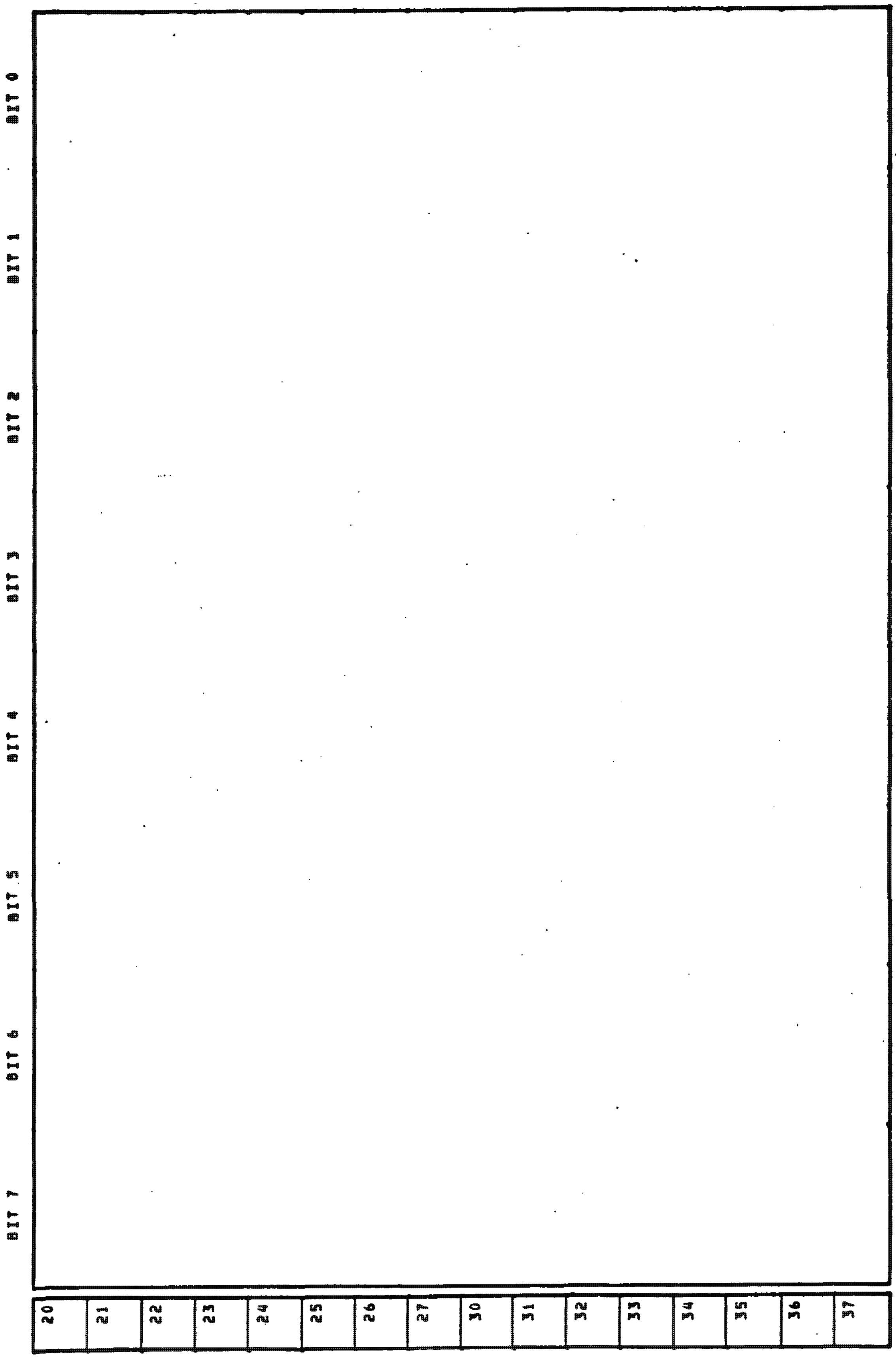
BLOCK 2: DF PROGRAM DURING TSG PERIODS

WORD

0- 1 COPIED FROM CURRENT TIF WORDS 9-10

2-77 FILLED WITH FIXED PATTERN

	BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
00	DF RF BAND (IGNORED)				TI OF RF BAND: HIGH SENSITIVITY			
01				SWATHWIDTH REDUCTION (IGNORED)				
02								
03								
04								
05								
06								
07								
10								
11								
12								
13								
14								
15								
16								
17								


BIT 0
BIT 1
BIT 2
BIT 3
BIT 4
BIT 5
BIT 6
BIT 7
20
21
22
23
24
25
26
27
30
31
32
33
34
35
36
37

BIT 0

BIT 1

BIT 2

BIT 3

BIT 4

BIT 5

BIT 6

BIT 7

40	41	42	43	44	45	46	47	50	51	52	53	54	55	56	57

	60	61	62	63	64	65	66	67	70	71	72	73	74	75	76	77
BIT 0																
BIT 1																
BIT 2																
BIT 3																
BIT 4																
BIT 5																
BIT 6																
BIT 7																

BLOCK 02: DF PROGRAM DURING TSG

WORD	BITS	CONTENT
00	7-5	DF RF BAND: CALIB MODE IGNORED BY PAYLOAD
	4	UNASSIGNED
	3-1	DF TI RF BAND: HIGH SENSITIVITY 000 = BAND 1 100 = BAND 5 001 2 101 6 010 3 110 7 011 4 111 8
	0	UNASSIGNED
01	7-5	UNASSIGNED
	4-0	DF SWATHWIDTH REDUCTION IGNORED BY PAYLOAD
02--77		UNASSIGNED

```
BLOCK 3:  DF MODE DURING TSG PERIODS--TIF WORD 11
     10:  DF MODE DURING RF BAND 1 PERIODS--TIF WORD 15
     11:  DF MODE DURING RF BAND 2 PERIODS--TIF WORD 16
     12:  DF MODE DURING RF BAND 3 PERIODS--TIF WORD 17
     13:  DF MODE DURING RF BAND 4 PERIODS--TIF WORD 18
     14:  DF MODE DURING RF BAND 5 PERIODS--TIF WORD 19
     15:  DF MODE DURING RF BAND 6 PERIODS--TIF WORD 20
     16:  DF MODE DURING RF BAND 7 PERIODS--TIF WORD 21
     17:  DF MODE DURING RF BAND 8 PERIODS--TIF WORD 22
```

WORD

0-47 COPIED FROM DF BLOCK SELECTED BY TIF

50-77 FILLED WITH FIXED PATTERN

	BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
00	PFM COARSE FILTER ENABLE BITS FILTERS 1 THROUGH 64							
01								
02								
03								
04								
05								
06								
07								
10	PULSE PARAMETER FILTER CONTROL DISABLE	ADAPT	MODE	PPF WINDOW SIZE 0 TO +/- 14 6 USEC				
11	FREQ WINDOW ACCEPT		UPPER WINDOW LIMIT: FREQUENCY					
12			LOWER WINDOW LIMIT: FREQUENCY					
13	PW WINDOW ACCEPT		UPPER WINDOW LIMIT: PW					
14			LOWER WINDOW LIMIT: PW					
15	PRI WINDOW ACCEPT	UNASSIGNED			MSB			
16	PULSE PARAMETER FILTER: PRI							LSB
17	OMNI-H INHIBIT BIAS CONTROL				UNASSIGNED			

****
* SECRET
****

A-27

0128R

****
* SECRET
****

25X1

BIF003W/2-156913-80

	BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
20	OMNI-P INHIBIT BIAS CONTROL				UNASSIGNED			
21	FREQ WINDOW ACCEPT		UPPER WINDOW LIMIT: FREQUENCY					
22	H O FILTER ENABLE		LOWER WINDOW LIMIT: FREQUENCY					
23	PW WINDOW ACCEPT		UPPER WINDOW LIMIT: PW					
24	UNASSIGNED		LOWER WINDOW LIMIT: PW					
25	MSB TI HIGH SENSITIVITY FIXED COARSE FREQUENCY							
26			LSB	BWC READ-IN DURATION				
27	DF TI DWELL DURATION			UNASSIGNED	TI OPTIONS: WBCW	NBCW		IF SWEEP
30	GUARD INHIBIT BIAS CONTROL				CW DELTA INHIBIT: DISABLE	ADAPT	CW READ OUT: DISABLE	ADAPT
31	SWATHWIDTH: DISABLE	ADAPT	PFM INHIBIT MODE ENABLE		PULSE DELTA INHIBIT: DISABLE	ADAPT	MULTI-FREQ READ-OUT: DISABLE	ADAPT
32	DF CW INHIBITS ENHANCED: OMNI	GUARD	DELTA	CW SENSITIVITY	UNASSIGNED			
33	DF PULSE SENSITIVITY	DF PULSE INHIBITS ENHANCED: MB-P	MB-M	GUARD	DELTA	UNASSIGNED		
34	CW DATA	CW FREQUENCY BOUNDARY: 1-2						
35	THINNING	CW FREQUENCY BOUNDARY: 2-3						
36	MODE	CW FREQUENCY BOUNDARY 3-4						
37	PULSE INHIB	CW FREQUENCY BOUNDARY: 4-5						

******* SECRET *******

A-28

0128R

25X1

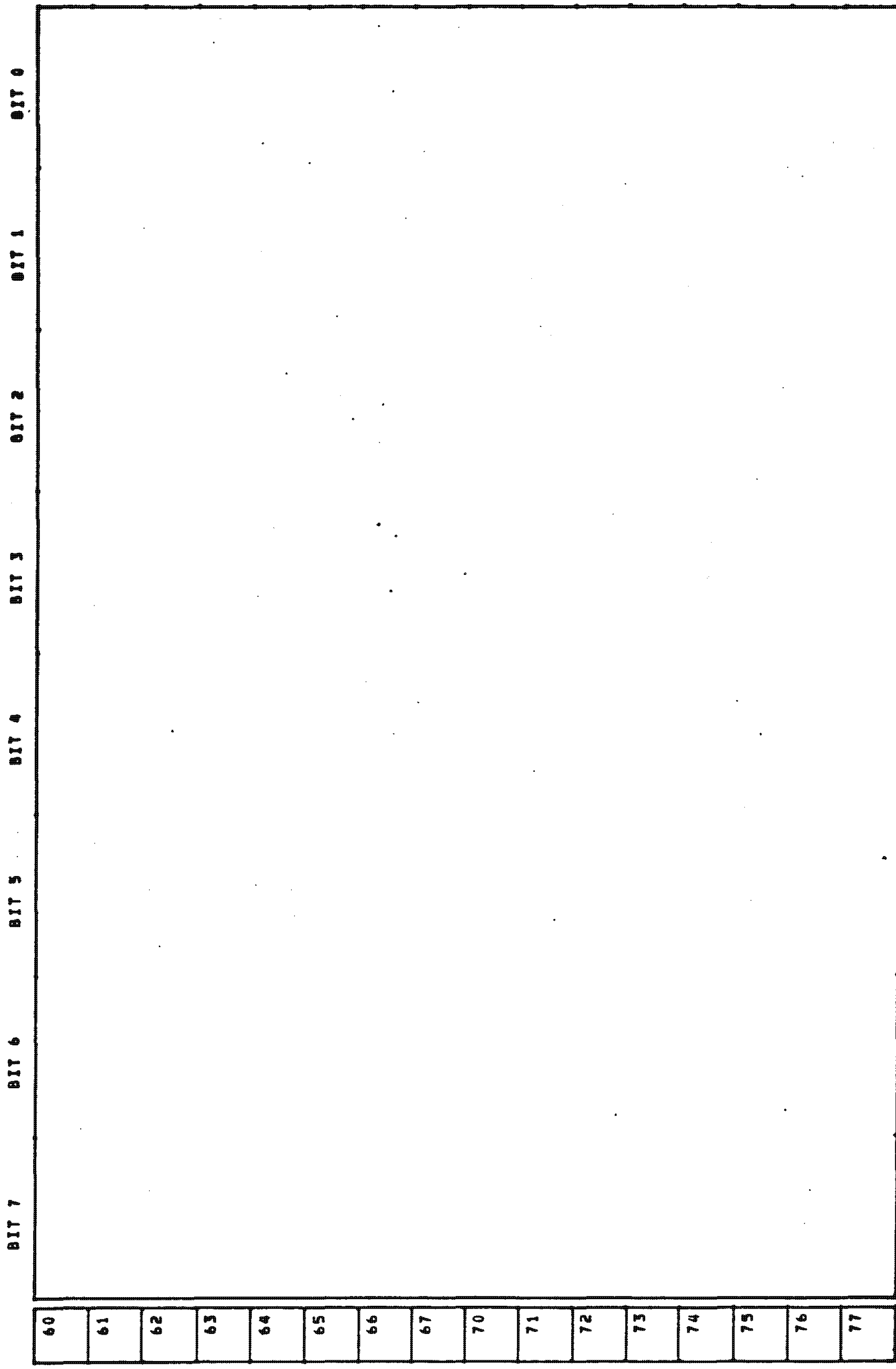
BIF003W/2-156913-80

	BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
40	DAU DATA FILTER ENABLES PULSE-A	PULSE-B	CW	UNASSIGNED				
41	SINGLE FREQ ACCEPT WINDOW		FILTER A (SINGLE FREQ) UPPER FREQUENCY LIMIT					
42			FILTER A LOWER FREQUENCY LIMIT					
43	MULTI-FREQ ACCEPT WINDOW		FILTER B (MULTI-FREQ) UPPER FREQUENCY LIMIT					
44			FILTER B LOWER FREQUENCY LIMIT					
45	CW WINDOW		CW FILTER UPPER FREQUENCY LIMIT (6MSB)					
46	UNASSIGNED		CW FILTER LOWER FREQUENCY LIMIT (6 MSB)					
47	UPPER CW LIMIT (4 LSB)				LOWER CW LIMIT (4 LSB)			
50	UNASSIGNED							
51								
52								
53								
54								
55								
56								
57								

A-29

0128R

BIF003W/2-156913-80


BIT 0
BIT 1
BIT 2
BIT 3
BIT 4
BIT 5
BIT 6
BIT 7
60
61
62
63
64
65
66
67
70
71
72
73
74
75
76
77

DF MODE: BLOCK 3 USED DURING TSG
BLOCKS 10-17 USED FOR BANDS 1-8 RESP.

WORD	BITS	CONTENT
00	7-0	PFM FILTER ENABLES: 1- 8
01	7-0	PFM FILTER ENABLES: 9-16
02	7-0	PFM FILTER ENABLES: 17-24
03	7-0	PFM FILTER ENABLES: 25-32
04	7-0	PFM FILTER ENABLES: 33-40
05	7-0	PFM FILTER ENABLES: 41-48
06	7-0	PFM FILTER ENABLES: 49-56
07	7-0	PFM FILTER ENABLES: 57-64 0 = PFM REJECT 1 = PFM ACCEPT
10	7-5	PULSE PARAMETER FILTER (PPF) CONTROL 7 IS MSB 0## = FILTER DISABLED 100 = ENABLED. REJECT DEFINED SET 101 = " ACCEPT " " 110 = ADAPTIVE. REJECT " " 111 = " ACCEPT " "
	4	UNASSIGNED
	3-0	PPF: PRI WINDOW SIZE (3 IS MSB) 0000 = 0 USEC 0001 = 0.977 USEC 1111 = 14. 65 USEC
11	7	PPF: FREQUENCY WINDOW: 0 = REJECT OUTSIDE WINDOW 1 = REJECT IN WINDOW
	6	UNASSIGNED
	5-0	PPF: UPPER FREQ LIMIT (5 IS MSB) MAX COARSE FILTER NUMBER
12	7-6	UNASSIGNED
	5-0	PPF: LOWER FREQ LIMIT (5 IS MSB) MIN COARSE FILTER NUMBER

13	7	PPF: PULSE DURATION WINDOW: 0 = REJECT OUTSIDE WINDOW 1 = REJECT IN WINDOW
	6	UNASSIGNED
	5-0	PPF: UPPER PULSE-DURATION LIMIT (5 IS MSB) MAX PW CODE
14	7-6	UNASSIGNED
	5-0	PPF: LOWER PULSE-DURATION LIMIT (5 IS MSB) MIN PW CODE
15	7	PPF: PRI WINDOW: 0 = REJECT OUTSIDE WINDOW 1 = REJECT IN WINDOW
	6-4	UNASSIGNED
	3-0	PPF: 4 MSB OF PRI WINDOW CENTER (3 IS MSB)
16	7-0	PPF: 8 LSB OF PRI WINDOW CENTER 3.9 TO 4000 US BY .977 USEC
17	7-4	OMNI-M INHIBIT MARGIN CONTROL 0000 = REF 0001 = REF+1 DB 1111 = REF+15DB
	3-0	UNASSIGNED
20	7-4	OMNI-P INHIBIT MARGIN CONTROL 0000 = REF 0001 = REF+1 DB 1111 = REF+15DB
	3-0	UNASSIGNED
21	7	PULSE HANDOVER (PHO): FREQUENCY WINDOW 0 = REJECT OUTSIDE WINDOW 1 = REJECT IN WINDOW
	6	UNASSIGNED
	5-0	PHO: UPPER FREQ LIMIT (5 IS MSB) MAX COARSE FILTER NUMBER
22	7	PHO FILTER CONTROL 0 = NO HANDOVERS 1 = HANDOVER PER FILTER
	6	UNASSIGNED
	5-0	PHO: LOWER FREQ LIMIT (5 IS MSB) MIN COARSE FILTER NUMBER

23	7	PHO: PULSE DURATION WINDOW: 0 = REJECT OUTSIDE WINDOW 1 = REJECT IN WINDOW
	6	UNASSIGNED
	5-0	PHO: UPPER PULSE-DURATION LIMIT (5 IS MSB) MAX PW CODE
24	7-6	UNASSIGNED
	5-0	PHO: LOWER PULSE-DURATION LIMIT (5 IS MSB) MIN PW CODE
25 26	7-0) 7-5)	TI HIGH SENSITIVITY (HI SENS) FREQ (25-7 IS MSB, 26-5 IS LSB) 2000 TO 4000 MHZ BY 1 MHZ
	4-0	TI BWC SAMPLING DURATION (4 IS MSB) ##000 = 1.95 USEC ##001 = 3.91 USEC ##010 = 7.81 USEC ##011 = 15.62 USEC ##100 = 31.25 USEC ##101 = 62.50 USEC ##110 = 125.00 USEC ##111 = 250.00 USEC
27	7-5	DF DWELL DURATION (7 IS MSB) 8 TO 64 MSEC BY 8 MSEC
	4	UNASSIGNED
	3	TI WB CW MODE 0 = SPECT. ANAL. 1 = BWC
	2-1	TI NB CW MODE (2 IS MSB) 00 = BWC 01 = SPECT. ANAL. 10 = NB TUNE 11 = ABORT
	0	TI IF SWEEP OPTION 0 = DWELL IN SWEEP MODE 1 = RETURN TO ASSIGNMENT

30	7-4	GUARD INHIBIT MARGIN CONTROL
		0000 = REF
		0001 = REF+1 DB
		1111 = REF+15 DB
	3-2	DF CW DELTA INHIBIT (3 IS MSB)
		1# = DISABLED
		00 = ENABLED
		01 = ADAPTIVE
	1-0	DF CW REPORTING (1 IS MSB)
		1# = DISABLED
		00 = ENABLED
		01 = ADAPTIVE
31	7-6	DF SWATHWIDTH REDUCTION (7 IS MSB)
		0# = DISABLED
		10 = ENABLED
		11 = ADAPTIVE
	5-4	DF PFM FILTER CONTROL (5 IS MSB)
		01 = INHIBIT ONLY IF FIRST FREQ FORBIDDEN
		11 = INHIBIT IF ANY COMPONENT FORBIDDEN
		#0 = DISABLE FILTER
	3-2	DF PULSE DELTA INHIBIT (3 IS MSB)
		0# = DISABLED
		10 = ENABLED
		11 = ADAPTIVE
	1-0	DF PULSE MULTI-FREQ SECOND IWG (1 IS MSB)
		#1 = DISABLED
		00 = ENABLED
		10 = ADAPTIVE
32	7	DF CW OMNI INHIBIT MARGIN
		0 = ENHANCED 5 DB
		1 = NORMAL
	6	DF CW GUARD INHIBIT MARGIN
		0 = ENHANCED 5 DB
		1 = NORMAL
	5	DF CW DELTA INHIBIT MARGIN
		0 = ENHANCED 5 DB
		1 = NORMAL
	4	DF CW SENSITIVITY
		0 = - 7 DB
		1 = MAX
	3-0	UNASSIGNED

```
33    7     DF PULSE SENSITIVITY
                 0 =  - 7 DB
                 1 =  MAX

      6     DF PULSE OMNI-P INHIBIT MARGIN
                 0 =  ENHANCED 5 DB
                 1 =  NORMAL

      5     DF PULSE OMNI-M INHIBIT MARGIN
                 0 =  ENHANCED 5 DB
                 1 =  NORMAL

      4     DF PULSE GUARD INHIBIT MARGIN
                 0 =  ENHANCED 5 DB
                 1 =  NORMAL

      3     DF PULSE DELTA INHIBIT MARGIN
                 0 =  ENHANCED 5 DB
                 1 =  NORMAL

     2-0    UNASSIGNED

34    7)    DF CW DATA THINNING CONTROL
35    7)       REPORT IN PCM     HANDOVER TO TI
36    7)      34-7 IS MSB
            000 =        ALL                ALL
            001 =         "              SEG 1,3,5
            010 =         "                NONE
            011 =         "              SEG 2,4
            100 =     SEG 1,3,5            NONE
            101 =         "              SEG 1,3,5
            110 =     SEG 2,4              NONE
            111 =         "              SEG 2,4

37    7     CW RCVR PULSE INHIBIT CONTROL
                 0 =  PULSEWIDTH TEST ENABLED
                 1 =  PULSEWIDTH TEST DISABLED

34   6-0    DF CW: SEG 1-2 FREQ BOUNDARY
35   6-0    DF CW: SEG 2-3 FREQ BOUNDARY
36   6-0    DF CW: SEG 3-4 FREQ BOUNDARY
37   6-0    DF CW: SEG 4-5 FREQ BOUNDARY
                   6 IS MSB
                 2000 TO 3984 MHZ BY 16 MHZ

40    7     DAU FILTER A: SINGLE FREQ PULSES
                 0 =  REJECT ALL
                 1 =  TRANSFER AS SPECIFIED

      6     DAU FILTER B: MULTI FREQ PULSES
                 0 =  REJECT ALL
                 1 =  TRANSFER AS SPECIFIED
```

	5	DAU CW FILTER 0 = REJECT ALL 1 = TRANSFER AS SPECIFIED
41	7	DAU: PULSE FREQUENCY FILTER A 0 = REJECT IN WINDOW 1 = REJECT OUTSIDE WINDOW
	6	UNASSIGNED
	5-0	DAU: FILTER A UPPER FREQ LIMIT (5 IS MSB) MAX COARSE FILTER NUMBER
42	7-6	UNASSIGNED
	5-0	DAU: FILTER A LOWER FREQ LIMIT (5 IS MSB) MIN COARSE FILTER NUMBER
43	7	DAU: PULSE FREQUENCY FILTER B 0 = REJECT IN WINDOW 1 = REJECT OUTSIDE WINDOW
	6	UNASSIGNED
	5-0	DAU: FILTER B UPPER FREQ LIMIT (5 IS MSB) MAX COARSE FILTER NUMBER
44	7-6	UNASSIGNED
	5-0	DAU: FILTER B LOWER FREQ LIMIT (5 IS MSB) MIN COARSE FILTER NUMBER
45	7	DAU: CW FREQUENCY FILTER MODE 0 = REJECT IN WINDOW 1 = REJECT OUTSIDE WINDOW
	6	UNASSIGNED
 47	5-0) 7-4)	DAU: CW UPPER FREQ LIMIT (45-5 IS MSB, 47-4 IS LSB) 2000 TO 4000 MHZ BY 2 MHZ
46	7-6	UNASSIGNED
46 47	5-0) 3-0)	DAU: CW LOWER FREQ LIMIT (46-5 IS MSB, 47-0 IS LSB) 2000 TO 4000 MHZ BY 2 MHZ
50--77		UNASSIGNED

BLOCK 6: DF PROGRAM DURING NON-TSG PERIODS--TIF WORD 14

WORD	
0-35	COPIED FROM BLOCK SELECTED BY TIF
36-77	FILLED WITH FIXED PATTERN

A-38

	BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
00	DF RF BAND: STEP 0 LSB MSB			UNASSIGNED	TI DF RF BAND: HIGH SENSITIVITY LSB MSB			UNASSIGNED
01	UNASSIGNED			SWATHWIDTH REDUCTION				
02	DF RF BAND: STEP 1			UNASSIGNED	TI DF RF BAND: HIGH SENSITIVITY			UNASSIGNED
03	UNASSIGNED			SWATHWIDTH REDUCTION				
04	DF RF BAND: STEP 2			UNASSIGNED	TI DF RF BAND: HIGH SENSITIVITY			UNASSIGNED
05	UNASSIGNED			SWATHWIDTH REDUCTION				
06	DF RF BAND: STEP 3			UNASSIGNED	TI DF RF BAND: HIGH SENSITIVITY			UNASSIGNED
07	UNASSIGNED			SWATHWIDTH REDUCTION				
10	DF RF BAND: STEP 4			UNASSIGNED	TI DF RF BAND: HIGH SENSITIVITY			UNASSIGNED
11	UNASSIGNED			SWATHWIDTH REDUCTION				
12	DF RF BAND: STEP 5			UNASSIGNED	TI DF RF BAND: HIGH SENSITIVITY			UNASSIGNED
13	UNASSIGNED			SWATHWIDTH REDUCTION				
14	DF RF BAND :STEP 6			UNASSIGNED	TI DF RF BAND: HIGH SENSITIVITY			UNASSIGNED
15	UNASSIGNED			SWATHWIDTH REDUCTION				
16	DF RF BAND: STEP 7			UNASSIGNED	TI DF RF BAND: HIGH SENSITIVITY			UNASSIGNED
17	UNASSIGNED			SWATHWIDTH REDUCTION				

0128R

25X1

BIF003W/2-156913-80

	BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
20	DF RF BAND: STEP 8			UNASSIGNED	TI DF RF BAND: HIGH SENSITIVITY			UNASSIGNED
21	UNASSIGNED			SWATHWIDTH REDUCTION				
22	DF RF BAND: STEP 9			UNASSIGNED	TI DF RF BAND: HIGH SENSITIVITY			UNASSIGNED
23	UNASSIGNED			SWATHWIDTH REDUCTION				
24	DF RF BAND: STEP 10			UNASSIGNED	TI DF RF BAND: HIGH SENSITIVITY			UNASSIGNED
25	UNASSIGNED			SWATHWIDTH REDUCTION				
26	DF RF BAND: STEP 11			UNASSIGNED	TI DF RF BAND: HIGH SENSITIVITY			UNASSIGNED
27	UNASSIGNED			SWATHWIDTH REDUCTION				
30	DF RF BAND: STEP 12			UNASSIGNED	TI DF RF BAND: HIGH SENSITIVITY			UNASSIGNED
31	UNASSIGNED			SWATHWIDTH REDUCTION				
32	DF RF BAND: STEP 13			UNASSIGNED	TI DF RF BAND: HIGH SENSITIVITY			UNASSIGNED
33	UNASSIGNED			SWATHWIDTH REDUCTION				
34	DF RF BAND :STEP 14			UNASSIGNED	TI DF RF BAND: HIGH SENSITIVITY			UNASSIGNED
35	UNASSIGNED			SWATHWIDTH REDUCTION				
36	DF RF BAND: STEP 15			UNASSIGNED	TI DF RF BAND: HIGH SENSITIVITY			UNASSIGNED
37	UNASSIGNED			SWATHWIDTH REDUCTION				

******* SECRET *******

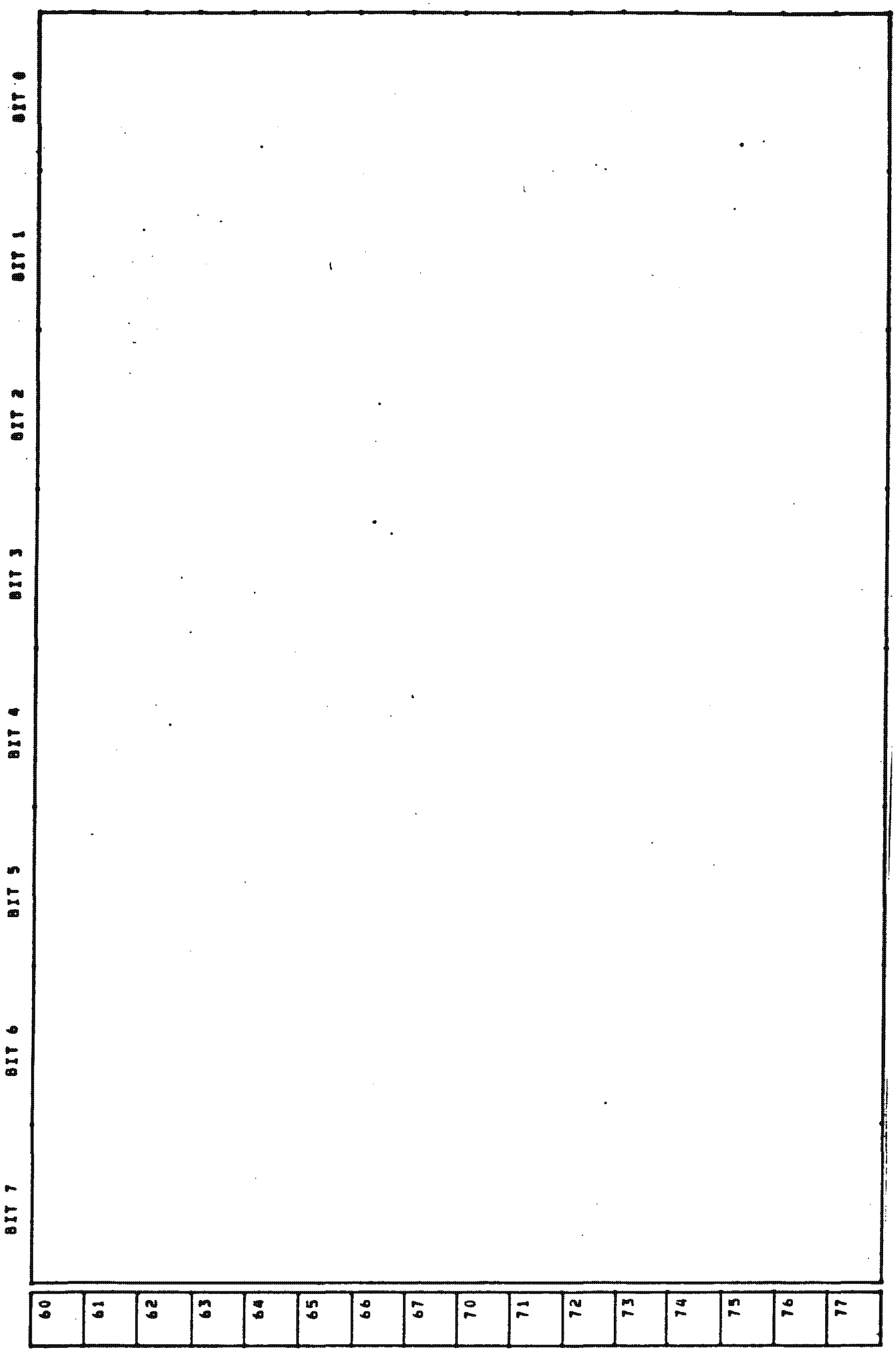
A-39

0128R

25X1

BIF003W/2-156913-80

	BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
40	DF RF BAND: STEP 16			UNASSIGNED	TI OF RF BAND: HIGH SENSITIVITY			UNASSIGNED
41	UNASSIGNED			SWATHWIDTH REDUCTION				
42	DF RF BAND: STEP 17			UNASSIGNED	TI OF RF BAND: HIGH SENSITIVITY			UNASSIGNED
43	UNASSIGNED			SWATHWIDTH REDUCTION				
44	UNASSIGNED							
45								
46								
47								
50								
51								
52								
53								
54								
55								
56								
57								


BIT 0
BIT 1
BIT 2
BIT 3
BIT 4
BIT 5
BIT 6
BIT 7
60
61
62
63
64
65
66
67
70
71
72
73
74
75
76
77

BLOCK 6: DF PROGRAM (NON-TSG PERIODS)

WORD	BITS	CONTENT
DF STEP 0		
00	7-5	DF RF BAND 7 IS LSB 000 = BAND 1 001 = BAND 5 100 2 101 6 010 3 011 7 110 4 111 8
	4	UNASSIGNED
	3-1	TI DF HIGH SENSITIVITY BAND (3 IS MSB)
	0	UNASSIGNED
01	7-5	UNASSIGNED
	4-0	DF SWATHWIDTH REDUCTION (4 IS MSB) 0 TO 248 MSEC IN STEPS OF 8 MSEC. REMOVED FROM EACH END OF SWATH
DF STEP 1		
02	7-5	DF RF BAND
	4	UNASSIGNED
	3-1	TI DF HIGH SENSITIVITY BAND
	0	UNASSIGNED
03	7-5	UNASSIGNED
	4-0	DF SWATHWIDTH REDUCTION
DF STEP 2		
04	7-5	DF RF BAND
	4	UNASSIGNED
	3-1	TI DF HIGH SENSITIVITY BAND
	0	UNASSIGNED
05	7-5	UNASSIGNED
	4-0	DF SWATHWIDTH REDUCTION

DF STEP 3		
06	7-5	DF RF BAND
	4	UNASSIGNED
	3-1	TI DF HIGH SENSITIVITY BAND
	0	UNASSIGNED
07	7-5	UNASSIGNED
	4-0	DF SWATHWIDTH REDUCTION
DF STEP 4		
10	7-5	DF RF BAND
	4	UNASSIGNED
	3-1	TI DF HIGH SENSITIVITY BAND
	0	UNASSIGNED
11	7-5	UNASSIGNED
	4-0	DF SWATHWIDTH REDUCTION
DF STEP 5		
12	7-5	DF RF BAND
	4	UNASSIGNED
	3-1	TI DF HIGH SENSITIVITY BAND
	0	UNASSIGNED
13	7-5	UNASSIGNED
	4-0	DF SWATHWIDTH REDUCTION
DF STEP 6		
14	7-5	DF RF BAND
	4	UNASSIGNED
	3-1	TI DF HIGH SENSITIVITY BAND
	0	UNASSIGNED
15	7-5	UNASSIGNED
	4-0	DF SWATHWIDTH REDUCTION

DF STEP 7

16	7-5	DF RF BAND
	4	UNASSIGNED
	3-1	TI DF HIGH SENSITIVITY BAND
	0	UNASSIGNED
17	7-5	UNASSIGNED
	4-0	DF SWATHWIDTH REDUCTION

DF STEP 8

20	7-5	DF RF BAND
	4	UNASSIGNED
	3-1	TI DF HIGH SENSITIVITY BAND
	0	UNASSIGNED
21	7-5	UNASSIGNED
	4-0	DF SWATHWIDTH REDUCTION

DF STEP 9

22	7-5	DF RF BAND
	4	UNASSIGNED
	3-1	TI DF HIGH SENSITIVITY BAND
	0	UNASSIGNED
23	7-5	UNASSIGNED
	4-0	DF SWATHWIDTH REDUCTION

DF STEP 10

24	7-5	DF RF BAND
	4	UNASSIGNED
	3-1	TI DF HIGH SENSITIVITY BAND
	0	UNASSIGNED
25	7-5	UNASSIGNED
	4-0	DF SWATHWIDTH REDUCTION

DF STEP 11		
26	7-5	DF RF BAND
	4	UNASSIGNED
	3-1	TI DF HIGH SENSITIVITY BAND
	0	UNASSIGNED
27	7-5	UNASSIGNED
	4-0	DF SWATHWIDTH REDUCTION
DF STEP 12		
30	7-5	DF RF BAND
	4	UNASSIGNED
	3-1	TI DF HIGH SENSITIVITY BAND
	0	UNASSIGNED
31	7-5	UNASSIGNED
	4-0	DF SWATHWIDTH REDUCTION
DF STEP 13		
32	7-5	DF RF BAND
	4	UNASSIGNED
	3-1	TI DF HIGH SENSITIVITY BAND
	0	UNASSIGNED
33	7-5	UNASSIGNED
	4-0	DF SWATHWIDTH REDUCTION
DF STEP 14		
34	7-5	DF RF BAND
	4	UNASSIGNED
	3-1	TI DF HIGH SENSITIVITY BAND
	0	UNASSIGNED
35	7-5	UNASSIGNED
	4-0	DF SWATHWIDTH REDUCTION

DF STEP 15

36	7-5	DF RF BAND
	4	UNASSIGNED
	3-1	TI DF HIGH SENSITIVITY BAND
	0	UNASSIGNED
37	7-5	UNASSIGNED
	4-0	DF SWATHWIDTH REDUCTION

DF STEP 16

40	7-5	DF RF BAND
	4	UNASSIGNED
	3-1	TI DF HIGH SENSITIVITY BAND
	0	UNASSIGNED
41	7-5	UNASSIGNED
	4-0	DF SWATHWIDTH REDUCTION

DF STEP 17

42	7-5	DF RF BAND
	4	UNASSIGNED
	3-1	TI DF HIGH SENSITIVITY BAND
	0	UNASSIGNED
43	7-5	UNASSIGNED
	4-0	DF SWATHWIDTH REDUCTION

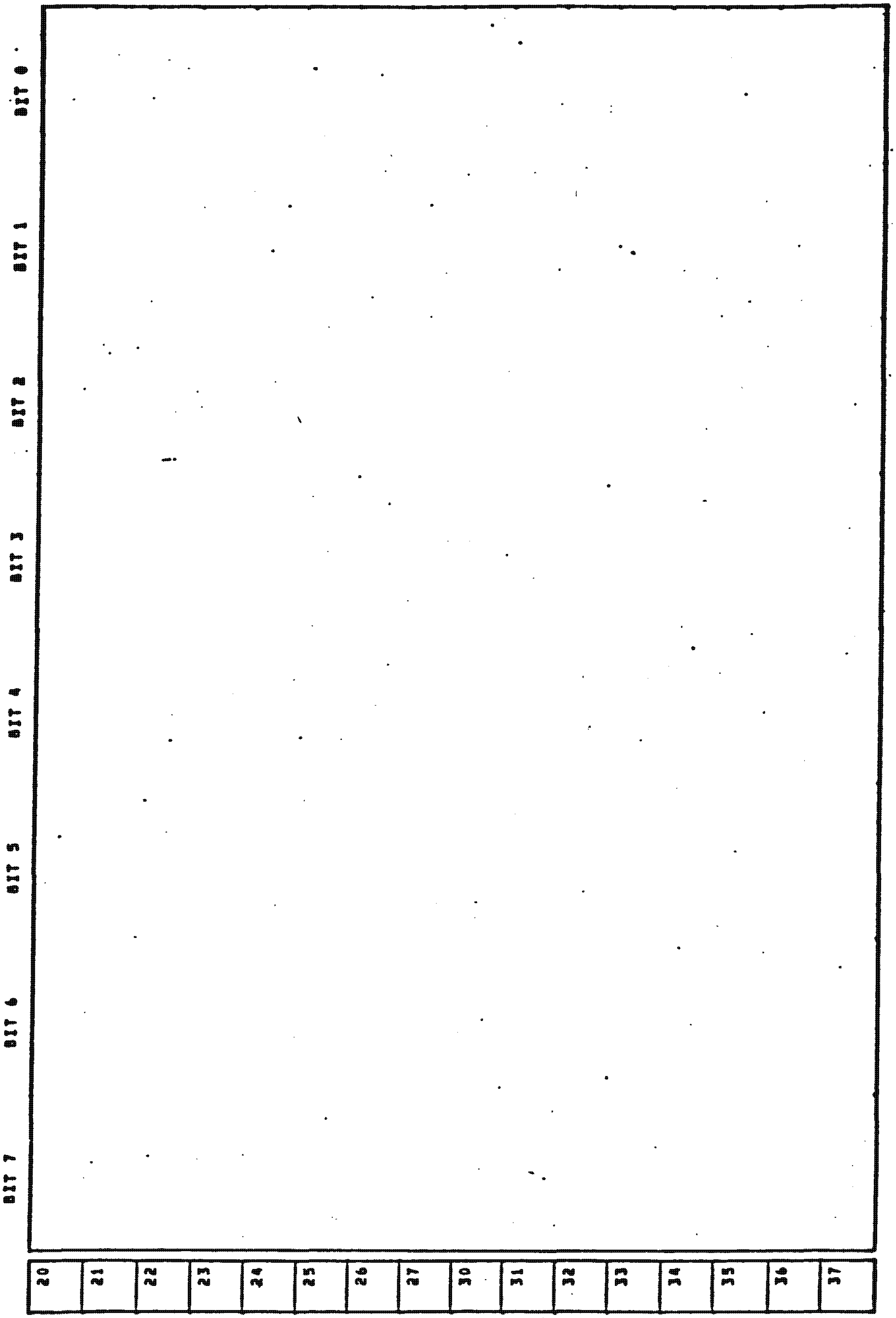
44--77 UNASSIGNED

BLOCK 7: SPARE / MESSAGE BLOCK PERIODS

ALL WORDS COPIED FROM MESSAGE AREA

BIT 0
BIT 1
BIT 2
BIT 3
BIT 4
BIT 5
BIT 6
BIT 7

00	01	02	03	04	05	06	07	10	11	12	13	14	15	16	17


BIT 0
BIT 1
BIT 2
BIT 3
BIT 4
BIT 5
BIT 6
BIT 7
20
21
22
23
24
25
26
27
30
31
32
33
34
35
36
37

BIT 0

BIT 1

BIT 2

BIT 3

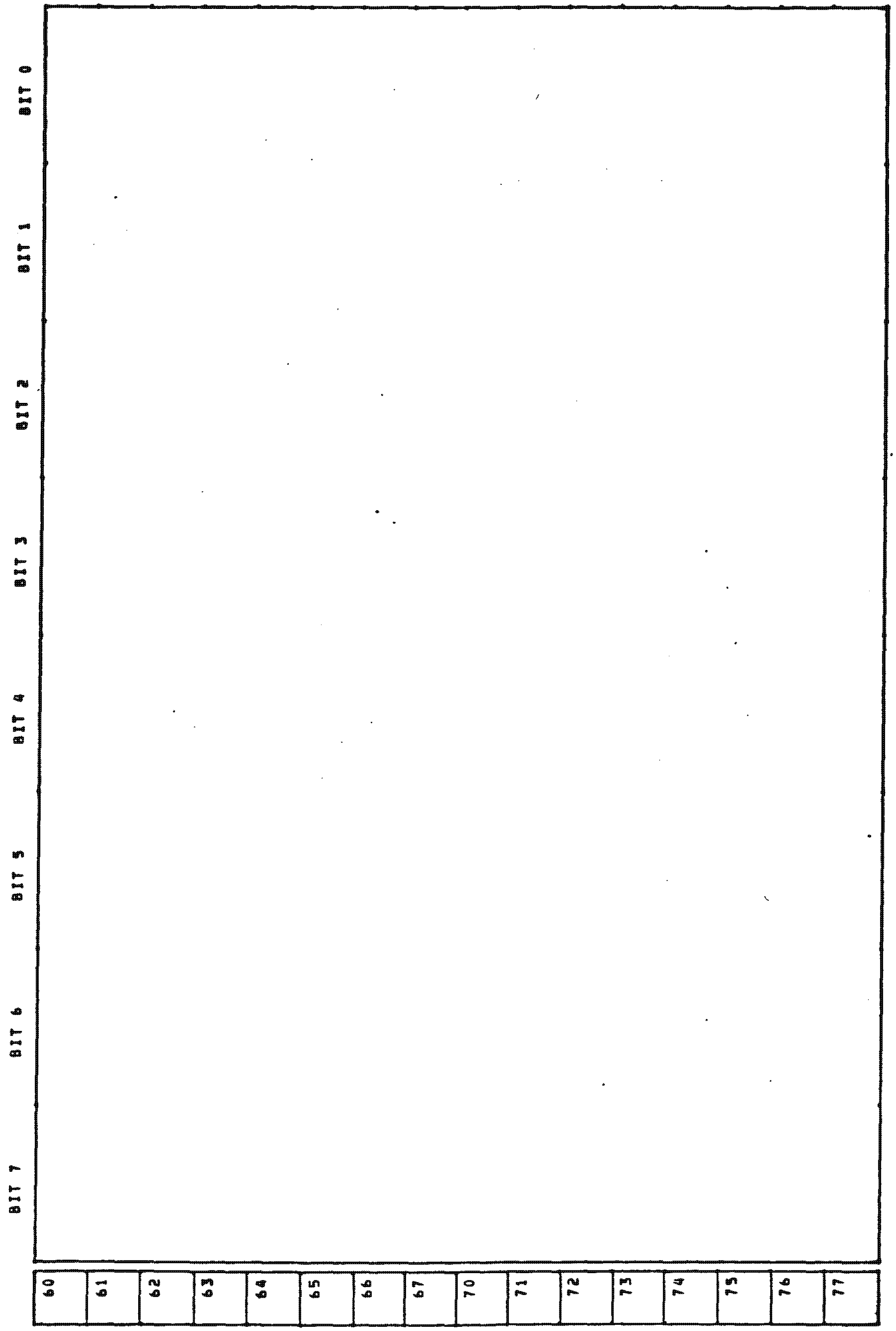
BIT 4

BIT 5

BIT 6

BIT 7

40	41	42	43	44	45	46	47	50	51	52	53	54	55	56	57


BIT 0
BIT 1
BIT 2
BIT 3
BIT 4
BIT 5
BIT 6
BIT 7
60
61
62
63
64
65
66
67
70
71
72
73
74
75
76
77

BLOCK 07: SPARE

WORDS 00 TO 63 UNASSIGNED, AVAILABLE AS MESSAGE PAD

WORDS 64 TO 77 UNASSIGNED AND NOT MONITORED BY PCM