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BYE-44446-67
SORS 11./4
12 September 1967

UNITED STATES INTELLIGENCE BOARD

SIGINT COMMITTEE

SIGINT OVERHEAD RECONNAISSANCE SUBCOMMITTEE

card in file (OSA)

MEMORANDUM FOR ALL MEMBERS OF THE SIGINT OVERHEAD RECONNAISSANCE SUBCOMMITTEE

SUBJECT: Mission Description of FACADE

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Mission 7321

1. The Mission Description of the FACADE SIGINT Intercept Payload has been provided to SORS by the NRO and is forwarded for your information.

2. The Agenda for the 20 September 1967 SORS Meeting calls for the formulation of collection guidance for the FACADE Mission and for a discussion of the NRO Mission Descriptions Format. The attached FACADE Mission Description will provide data to aid in preparing collection guidance and will also be reviewed by the Subcommittee to determine if the format and data content are appropriate and as complete as is desired

[redacted]

EXECUTIVE SECRETARY
SIGINT OVERHEAD RECONNAISSANCE SUBCOMMITTEE

Attachment
a/s

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GROUP 1
Excluded from automatic downgrading and declassification

MISSION 7321

1. Name: FACADE.

2. Objective: Mission 7321 is a general search mission designed to provide an early response to USIB-D-41.14/303 to search [redacted] the 250-2200 mhz range.

3. Operational Usage: The planned launch date is 24 October 1967 with a mission life of 3-6 months.

   The payload will be carried by a spin stabilized P-11 subsatellite into a nominal 275 NM circular orbit.

   Normal operation will consist of eight collection revs per day.

   An on-orbit programmable timer will permit the use of the payload over any area of the world.

4. System Description: The FACADE collection system consists of a conical spiral antenna, a planar spiral antenna, a receiving subsystem, a data recording and transmission subsystem, and a command subsystem. The receiver subsystem contains two sweeping superheterodyne receivers; two wideband crystal video receivers; analysis circuitry to measure parameters such as pulse width, pulse interval, and frequency modulation on pulse; and switching circuitry for the data outputs.

5. System Components:

   Payload Antennas. The low-band (250-1000 MHz) receiving antenna consists of a 30- by 57- inch dacron mesh with a sprayed-on copper planar spiral as shown in Attachment 1. The highband (1000- to 2200- MHz) receiver antenna is a 7-inch diameter (max.), 7-inch long conical spiral. The antennas are as nearly omnidirectional (0-db gain) as possible.

[redacted]

Attachment 1 shows how the antennas are mounted on the vehicle, and sections of the antenna patterns as related to the vehicle spin axis.

Receiver Subsystem. The receiver subsystem contains four receivers: a low-band (250- to 1000-MHz) crystal video receiver, a low-band sweeping superheterodyne receiver, a high-band (1000- to 2200- MHz) crystal video receiver, and a high-band sweeping superheterodyne receiver. Attachment 2 summarizes the primary receiver characteristics.

The low-band crystal video receiver is a wide-band system covering the entire 250- to 1000- MHz band. The low-band superheterodyne receiver sweeps through the band in 600 steps of 1.25- MHz. The IF bandwidth of this receiver is 2-MHz. The low-band sweeping receiver is separated into two frequency ranges: 250 to 500 MHz and 500 to 1000 MHz. The receiver first traverses the lower frequency range in 200 discrete steps, then its input is switched to the higher frequency range which is traversed in 400 discrete steps. The high-band crystal video receiver covers the entire band from 1000 to 2200 MHz, and the high-band superheterodyne receiver sweeps through this band in 600 2-MHz steps. The IF bandwidth of this receiver is 3 MHx. The high-band sweeping receiver is also separated into two frequency ranges: 1000 to 1600 MHz and 1600 to 2200 MHz. The receiver first traverses the lower frequency range in 300 discrete steps, then the output of the sweeping circuitry is switched to the higher frequency range which is also traversed in 300 discrete steps.

The sweeping receivers are stepped by using voltage-tuned local

oscillators. The sweeps of the high-band receiver and the low-band receiver are synchronized, i.e., the sweeps start at the same time, and each of the 600 frequency steps of the high-band receiver occurs at the same time as the same numbered step of the low-band receiver. The 600-step sweep normally takes 60 seconds and starts at the beginning of each minute; however, the sweep rate can be changed upon command to take 120 seconds and to occur at the beginning of every even minute. The sweeping receivers can also be used in a fixed tuned mode by selecting any one of the 600 steps, as well as sweeping a range of 3 steps on both sides of the selected frequency.

The low-band crystal video receiver contains band reject filters centered at [redacted] to reject BMEWS, [redacted] and [redacted] respectively. The high-band crystal video receiver contains a 1200- to 1400- MHz band-reject filter to reduce interference from high powered friendly radars. These filters have a nominal loss of 10db and are used to reduce receiver sensitivity at the frequencies of known high power emitters.

The low-band receiver and the high-band receiver contain identical analysis circuitry. The analysis circuitry contains 20-KHz stretched video outputs of both the crystal video receiver and the sweeping receiver and a 75-KHz stretched video output of the sweeping receiver which can be switched into the output circuitry instead of the normal 20-KHz video. Additional circuitry provides the pulse width and pulse interval measurements on a high speed commutator. The high-speed commutator also contains measurements of frequency modulation on the

[redacted]

pulses (chirp). These measurements are the frequencies of the leading edge of a pulse, the trailing edge, a point within the pulse, and the difference in frequency between the leading and trailing edges. The analysis circuitry also contains a pulse-by-pulse chirp indicator that shows the difference frequency between the leading and trailing edges of the pulses. A proportional pulse stretcher gives a pulse-by-pulse measurement of pulse widths by stretching each pulse in proportion to its duration so that it can be read out on a voltage controlled oscillator.

Tape Recorders. The two tape recorders are 75-KHz, dual-track, analog recorders. Frequency response is ± 3db over the 300-Hz to 75KHz range. Dynamic range is 25db with a linear input/output response. Readin time is a nominal 12 minutes and readout time is a nominal 6 minutes.

Telemetry Down Links. Four VHF telemetry transmitters, operating on 228, 232, 238, and 242 MHz, are used to transmit payload and vehicle data.

6. Modes of Operation: In addition to the normal stepping mode of operation, the superheterodyne receivers have the capability of looking on a frequency in two manners. A fine frequency sweep mode is provided whereby it is possible to command the receiver to stop on any one of the 600 frequency steps within the bandpass. When the receiver is locked on the specified step, the receiver will sweep three steps above and below the selected step every second. A second frequency step lock is provided to lock on a single step.

It is also possible to select the inputs to be recorded from the receivers in accordance with the operational mode selected.

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~~[illegible] BYEMAN~~
~~Control System~~

In the normal mode, the outputs of each band are stored on a specified track of an assigned recorder (see Attachment 4). If data evaluation indicates that either the low or high band is of special interest two options are available. If the high band is of special interest, the outputs of the low band assigned recorder can be changed so that it will record the high band superheterodyne video at full band width and the low band superheterodyne video normally. This will result in the loss of other low band crystal video output. (See Attachment 5). Conversely, if the low band is of special interest the inputs of the recorder assigned to the high frequency band receivers will be changed (see Attachment 6).

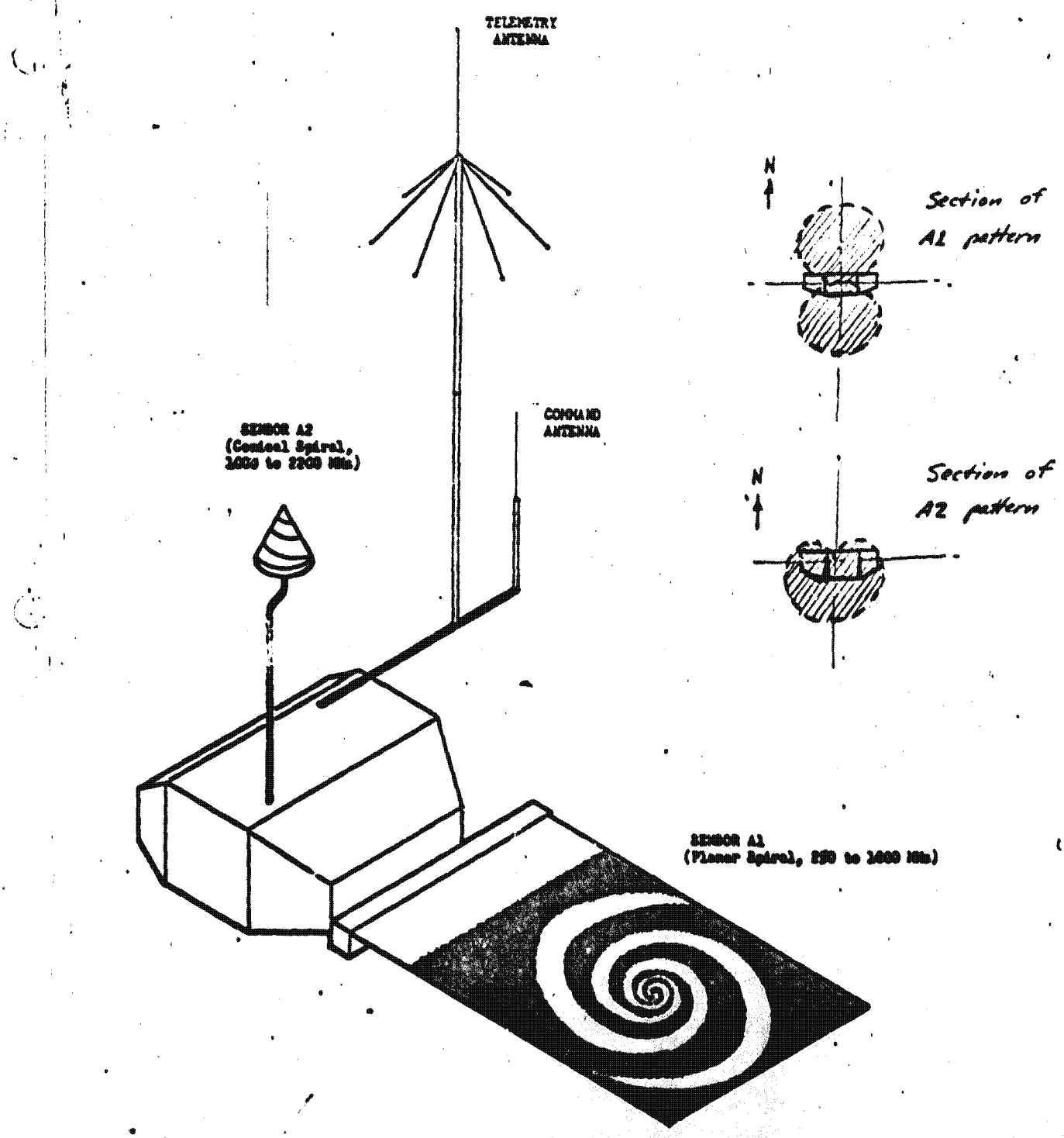
An additional recorder mode is provided should one of the two recorders fail. In this instance the outputs of both the high and low band sweeping superheterodyne receivers are recorded (Attachment 7). As a final resort a recorder bypass mode is provided so that should both recorders fail, the data could be transponded in real time to a ground station.

7. Ground Support Equipment:

Tracking Stations. The existing Air Force command and tracking stations contain all the necessary equipment for generating and transmitting commands and for recording the readouts of the intercept data.

Data Processing. Data Processing of the FACADE intercept data at [redacted] facilities consists of making the necessary duplicate tapes, demultiplexing the timing information to determine the exact times that the readin started and stopped, and reading out the various

signal parameters. Readin times are determined by relating the airborne time reference generator output to system time which is recorded during a readout pass at the tracking stations. Computer operations will be used to give a readout of the various payload signal intercept data.



Location of Payload Antennas on Vehicle

ATTACHMENT 1

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Handle Via BYEMAN
Control System

SUMMARY OF

RECEIVER SUBSYSTEM CHARACTERISTICS

Receiver Subsystem

Total receiver frequency coverage	250 to 2200 MHz
Individual receiver coverage	
Low-band sweeping superhet	250 to 1000 MHz in 1.25-MHz steps
Low-band crystal video	250 to 1000 MHz
High-band sweeping superhet	1000 to 2200 MHz in 2-MHz steps
High-band crystal video	1000 to 2200 MHz
Receiver sensitivity (50% probability of detection)	
Low band sweeping superhet	
250 to 500 MHz	-80 dbm
500 to 1000 MHz	-83 dbm
Low-band crystal video	-45 dbm
High-band sweeping superhet	-88 dbm
High-band crystal video	-45 dbm

PW Resolution - 5% of the range:

1-20 usec ± 1 usec

20-400 usec ± 20 usec

PI Resolution - 5% of the range:

10-500 usec ±

Chirp:

Frequency within 2 or 3 mc discriminator landwidth ± 500 KC

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ATTACHMENT 2

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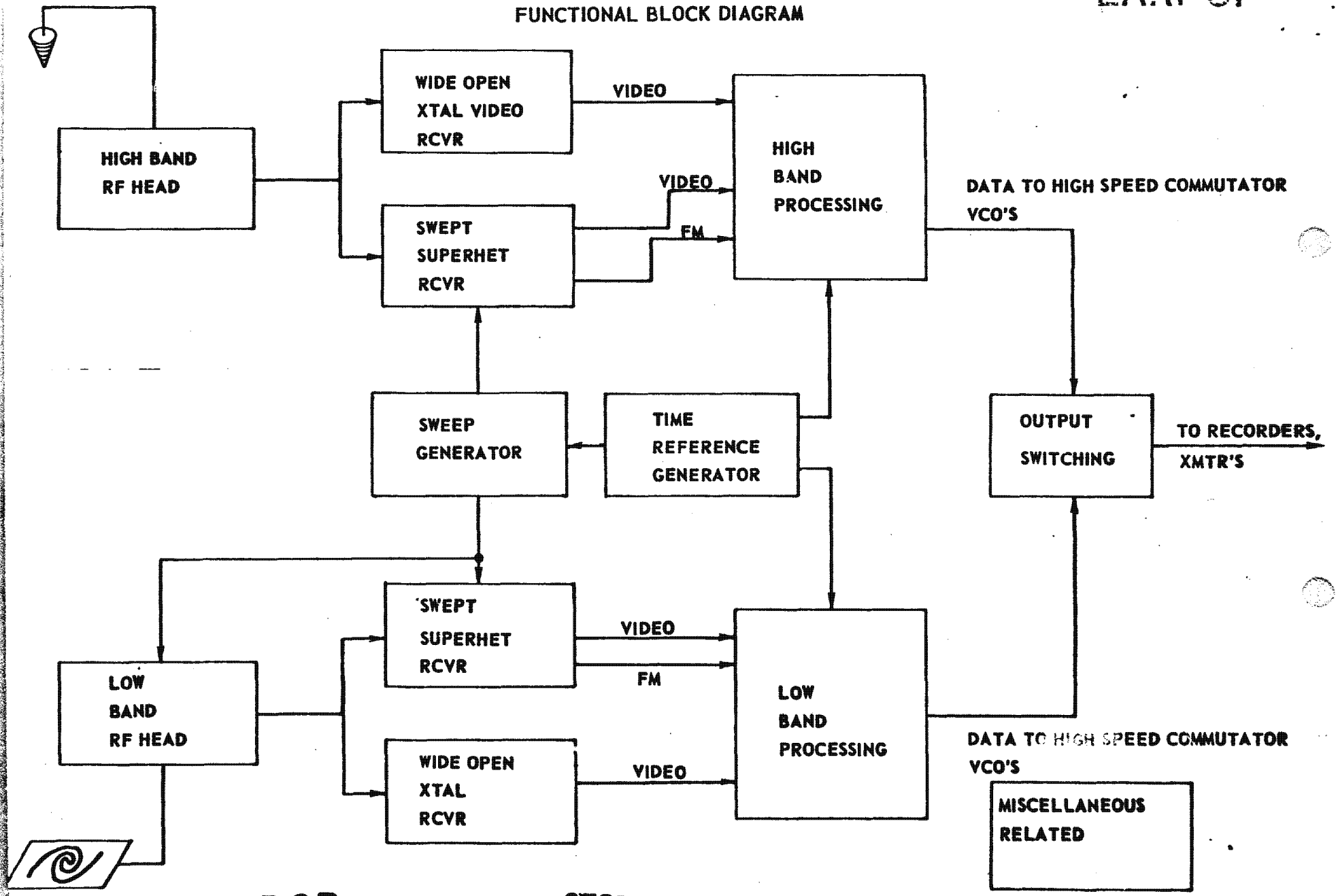
4410 – FACADE
FUNCTIONAL BLOCK DIAGRAM



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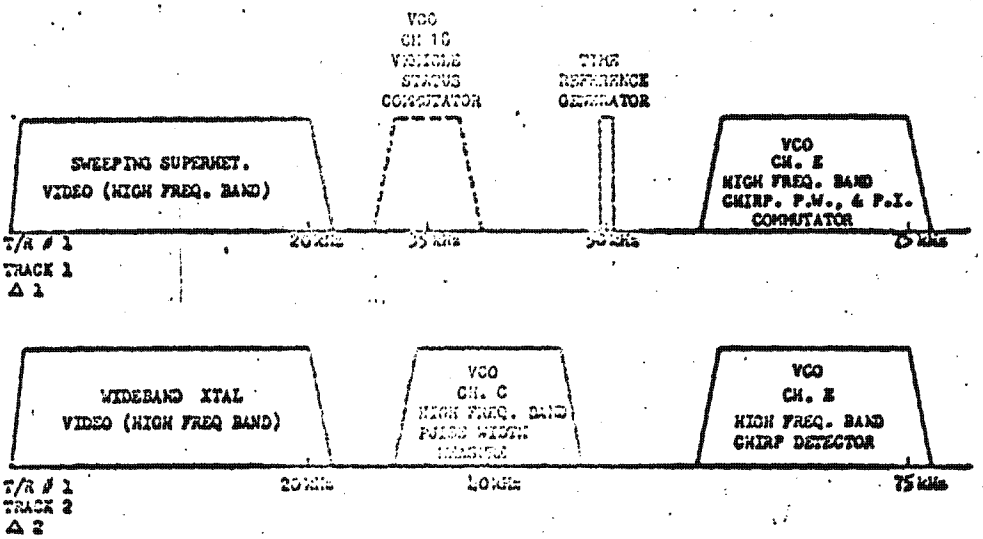
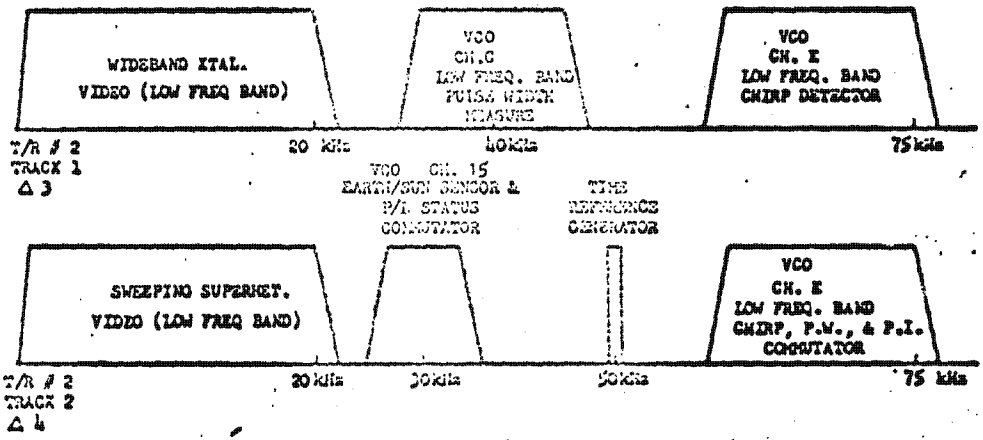
ATTACHMENT 3

Approved for Release: 2024/08/07 C05098321



TAPE RECORDER NO. 1 (HIGH-BAND RECEIVER DATA)



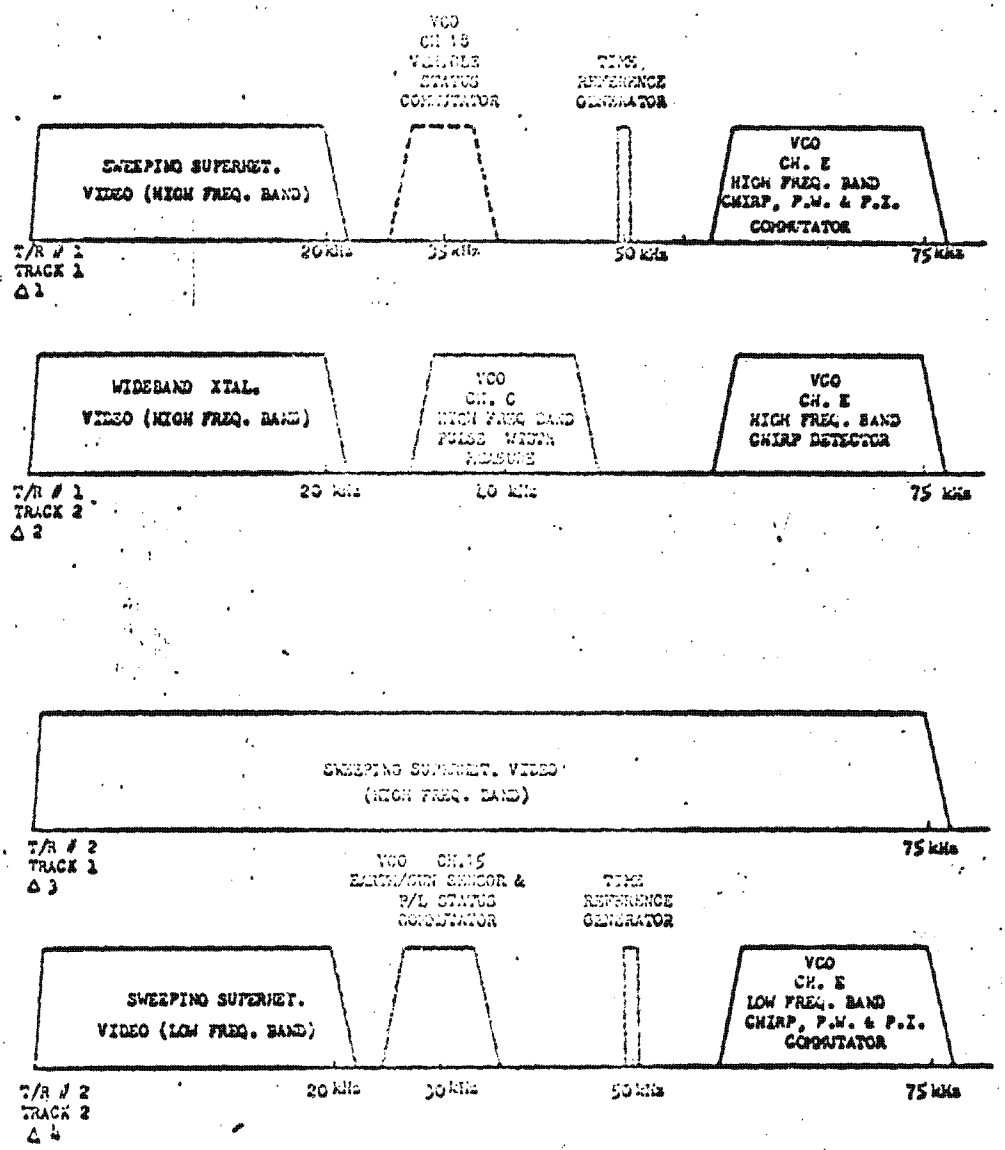
TAPE RECORDER NO. 2 (LOW-BAND RECEIVER DATA)

NOTES:

1. Readin format of 2:1 speed ratio recorders is shown here. Readout format is two times frequencies shown.
2. CH 16 VCO is read out in real time. It is shown at half frequency (35 kHz) to indicate its placement in readin spectrum of T/R.

Output Data Format (Mode [redacted], Normal)

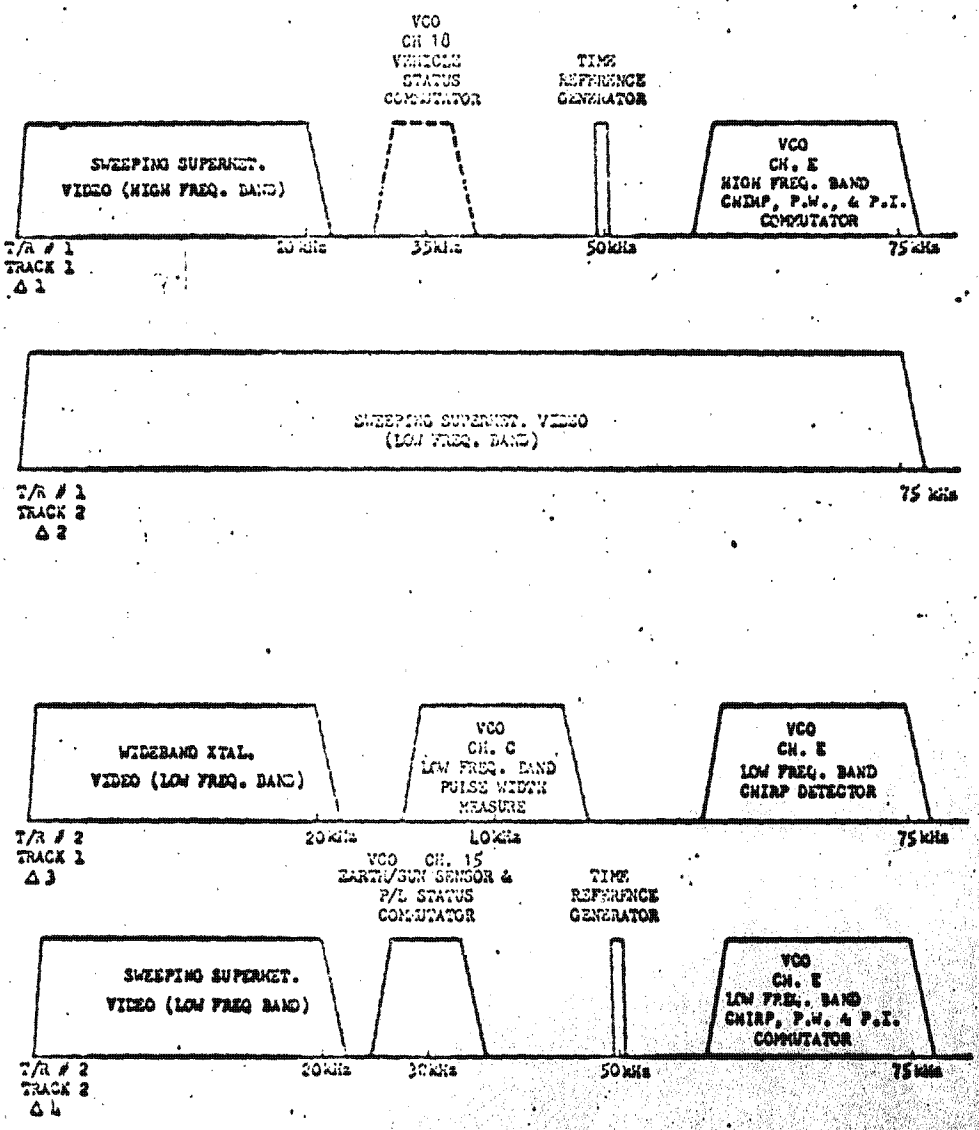
ATTACHMENT 4



NOTES:

1. Readin format of 2:1 speed ratio recorders is shown here. Readout format is two times frequencies shown.
2. CH 18 VCO is read out in real time. It is shown at half frequency (35 kHz) to indicate its placement in readin spectrum of T/R.

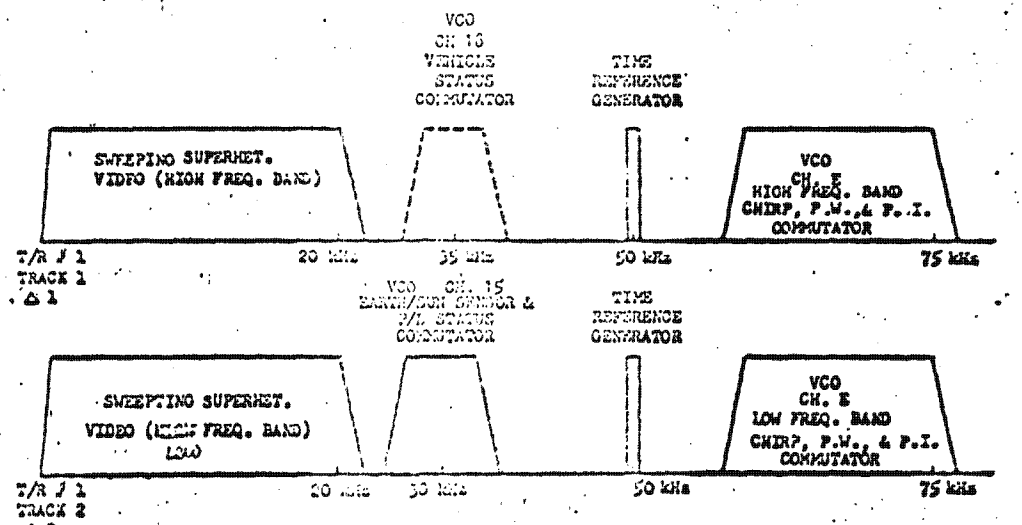
Output Data Format (Mode [illegible], High-Frequency Band of Interest



NOTES:

1. Readin format of 2:1 speed ratio recorders is shown here. Readout format is two times frequencies shown.
2. CH 15 VCO is read out in real time. It is shown at half frequency (35 kHz) to indicate its placement in readin spectrum of T/R.

Output Data Format (Mode [redacted], Low-Frequency Band of Interest)



(MODE D-4 TAPE RECORDER FAILURE MODE)

NOTES:

1. T/R No. 2 is inoperative during this mode.
2. Readin format of 2:1 speed ratio recorders is shown here. Readout is two times frequencies shown.
3. CH 18 VCO is read out in real time. It is shown at half frequency (35 kHz) to indicate its placement in readin spectrum of T/R.

Output Data Format (Mode [illegible], Tape Recorder Failure Mode)

ATTACHMENT 7