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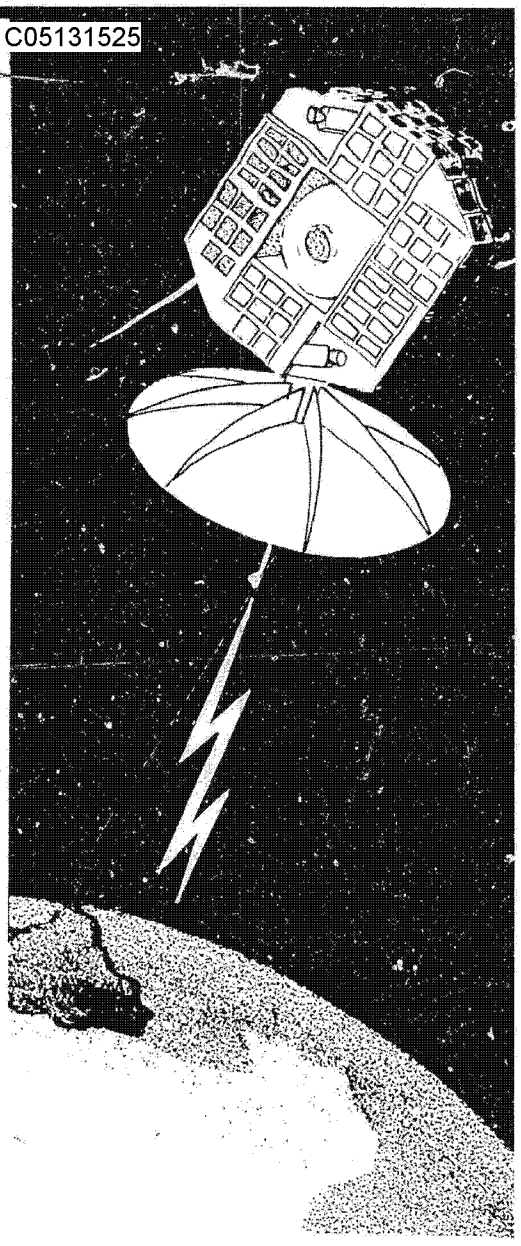

DESCRIPTION OF SIGINT MISSION 7337

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SIGINT Mission 7337 Mission Description

1. GENERAL

Mission 7337 is a reconnaissance receiver and data system that will perform general search for microwave communications signals in the 1.200-2.200 GHz and 3.400-3.900 GHz frequency ranges. The system will provide geopositioning data for the observed transmitting antennas within accuracy limits of 3 to 25 miles. In addition, the system can provide data to determine ground antenna pointing directions by postmission processing and analysis. The system will receive and screen RF signals, and for signals which meet programmed recognition criteria, will measure and record target signal frequency, power levels for the sum and difference outputs of the dual-channel receiver, peak and average output power levels, phase difference between receiver channels and average channel frequency for PPM signals. No information content is obtained. The concept of employment and typical intercept geometry of Mission 7337 is shown in Figure 1.1.

This mission description provides technical and operational characteristics of the following payload subsystems:

a. Antenna Subsystem

b. Receiver Subsystem

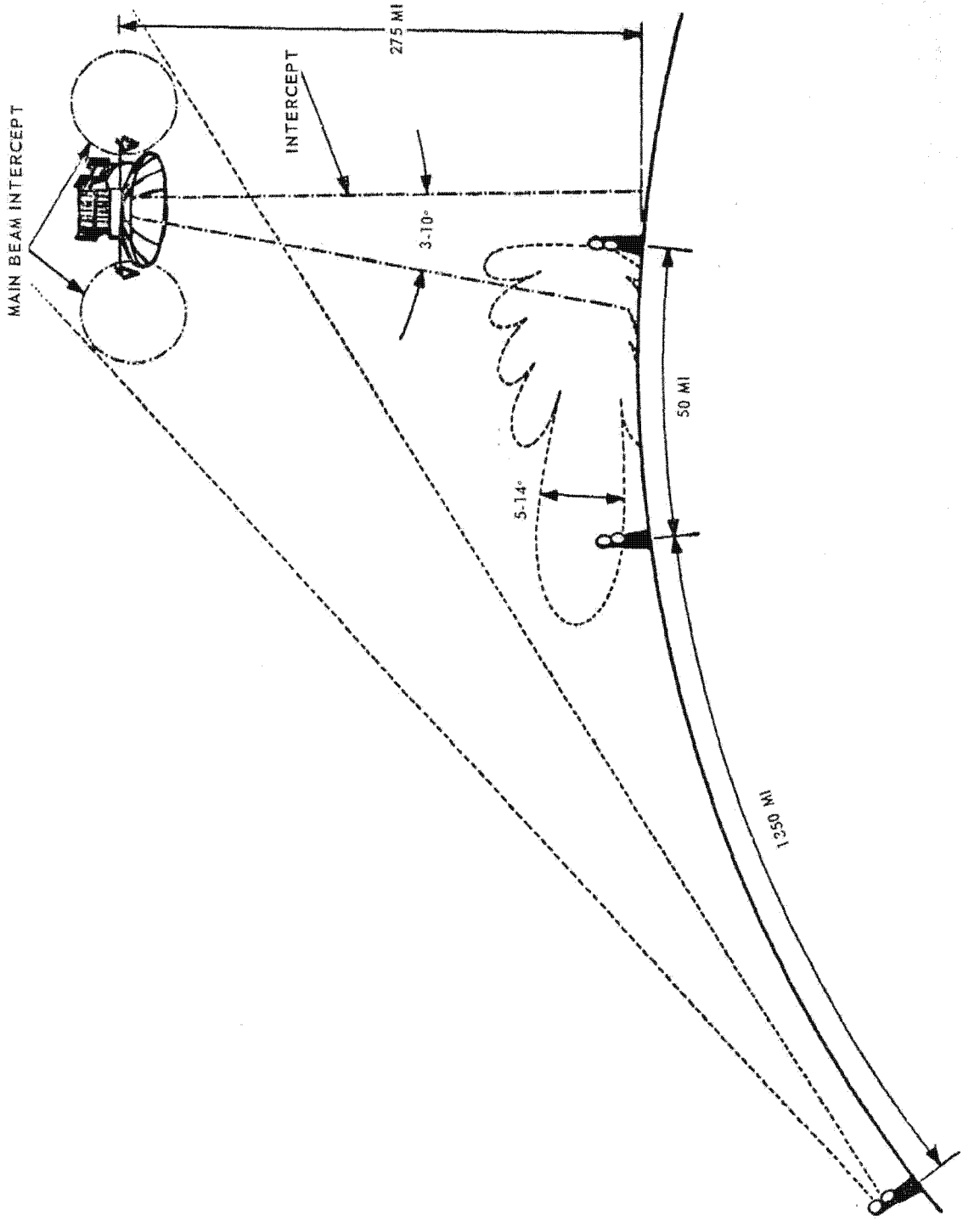
c. Recognizer Subsystem

d. Signal Measurement Subsystem

e. Tape Recorders

2. ANTENNA SUBSYSTEM

The antenna subsystem (shown in Figure 2.1) consists of antennas to produce a pencil beam for geopositioning on the side lobes of target emitters and an omnidirectional antenna



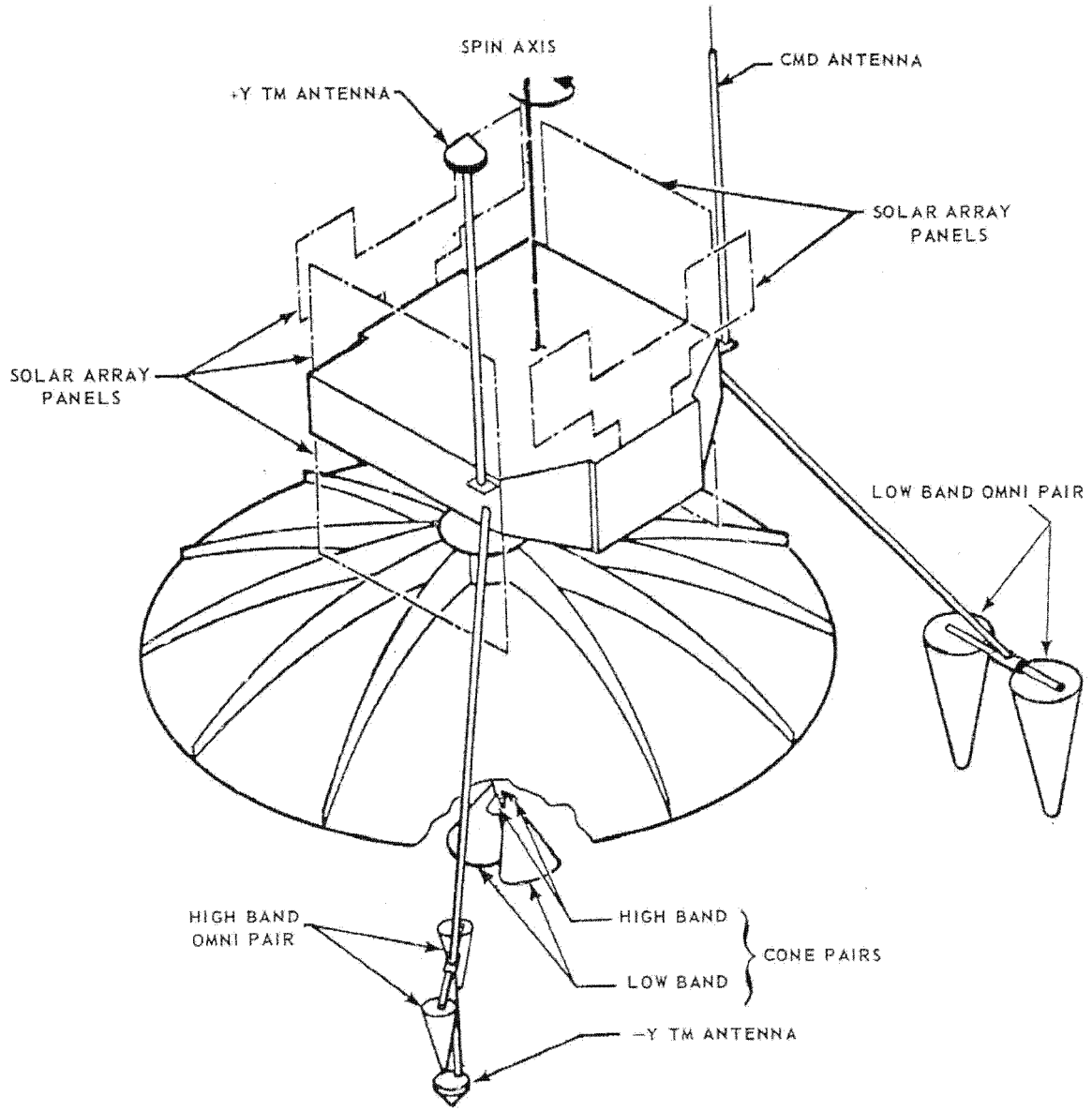


Figure 2.1 Mission 7337 Antenna Subsystem

group to obtain target antenna pointing direction. One 6-foot parabolic dish reflector with two high-band and two low-band conical spiral feeds forms a pencil beam for reception of emitter side lobes, and two high-band and two low-band omni-directional antennas provide for reception of the main beam of target emitters and dish antenna side lobe sensing. The pencil beam is positioned on the spin axis of the spacecraft and varies from a nominal 20 db gain for the low frequency band to 27 db in the high frequency band. Beam widths range from 10 to 3 degrees. Geopositioning data are provided as the phase and amplitude difference between the two antennas and the instantaneous clocking angle of the spinning spacecraft. Dish antenna side lobe sensing/inhibiting is obtained using the pencil beam and omniantennas sequentially at a rapid rate.

3. RECEIVER SUBSYSTEM

The receiver subsystem consists of one dual-channel receiver which can be switched to any one of four receiver bands designated C-1, C-2, and C-3 for [redacted] reception and P for PPM reception. Each receiver band can be connected to the appropriate dish reflector antenna feed pair for side lobe mode operation or to the appropriate omniantenna pair for main beam mode operation. The gross receiver characteristics are shown in Figure 3.1. A simplified block diagram is shown in Figure 3.2.

(b)(1)
(b)(3)

The receiver is capable of being operated in any one of three frequency scanning modes: (a) full band scan, (b) selected scan and (c) preset-discrete scan. In full band scan mode, the entire range of each enabled band is scanned. In selected scan, any three frequency segments of the receiver range can be selected by specifying the lower and upper limits of each frequency segment. Preset-discrete scan mode causes the receiver to dwell on preset frequencies, skipping intervening steps.

Band	C-1	C-2	C-3	P
Frequency (GHz)	1.2-1.6	1.6-2.2	3.4-3.9	1.5-2.2
Step Size (MHz)	1	1	1	2
No. of steps	400	600	500	350
Dwell/Step (msec)	0.5	1.0	0.5	2.0
Sensitivity dBm	-106.5	-113.5	-112.5	-103.5
Frequency Accuracy (2σ) kHz	120	120	120	500
Frequency Resolution kHz	16	16	16	16
Power Measurement Accuracy	To be determine during system test			
PPM Average Channel	Deviation from nominal over a ±200 Hz range			
Frequency Accuracy (2σ)(Hz)	40	40	40	40
Number of 4 kHz Channels	12 or 24	60 or 120	60 to 600	12, 24 or 28

Figure 3.1 Payload Characteristics

4. SIGNAL RECOGNIZER SUBSYSTEM

During each frequency step of the programmed frequency scan range, a recognition process tests any received signal for specified characteristics, and if the received signal is accepted, signal parameters are measured and stored for later transmission.

The signal tests performed are:

a. Minimum Threshold. This test is performed in all bands. The input signal must exceed one of four preset thresholds selected by command.

b. Maximum Threshold (Optional). To discriminate against unwanted high power signals, the average power level must not exceed the upper limit of the receiver dynamic range more than 5 percent of the time.

c. Pulse Duty Factor (Optional). To discriminate against pulsed signals during [redacted] recognition, the composite duty factor of all pulses received in the 1-MHz bandwidth IF must not exceed a preset threshold of 11 percent. (b)(1) (b)(3)

d. In-Band Limits Test. To insure proper tuning, the signal center frequency must be within the passband limits of the step to which the receiver is tuned.

e. Amplitude Inhibit Test (Optional). To discriminate against signals received on the dish antenna side lobes, the sum output level of the two receiver channels is first stored. Then, an omniantenna input is switched into the receiver and its output level is compared with the previously stored level from the DF antennas. For a valid intercept, the difference in levels must not exceed a positive (omnidish) preset threshold. This threshold will be adjusted prior to flight to be consistent with the measured gain difference between the DF antenna side lobes and the omniantenna. Different values can be used for the lower and upper frequency bands.

f. Phase Inhibit Limits Test (Optional). To help assure that relative phase measurements from the dish antenna are made from within the usable central portion of its main beam, the phase difference between channels must not exceed one of four positive or one of four negative limits that are command-selected separately for the 1.2-2.2 GHz and the 3.4-3.9 GHz frequency ranges. These eight phase-inhibit limits are within the $\pm$ 120° range and are to be spaced 10° apart. The selected values are $\pm$ 86°, $\pm$ 96°, $\pm$ 106°, and $\pm$ 116°. The phase inhibit can be enabled for each signal band as desired.

g. Baseband Tests (Optional, C Bands Only). To discriminate FDM/FM signals from the general class of [redacted] various baseband spectrum components (listed below) can be selected as requirements for recognition. (b)(1) (b)(3)

(1) 8, 40-KHz tones (independent selection available)

(2) 70, 120, 140 and 304-KHz tone groups (presence of at least one in the group)

(3) 12 to 60-KHz, 60 to 108-KHz groups (independent selection available)

(4) 12 to 252, 312 to 552-KHz supergroups (independent selection available)

h. PPM Channel Frequency Tests (P Band Only). Pulse signals must have an average channel frequency within ± 100 Hz of the nominal P1, P2, or P3 channel frequencies.

P1 = 96 KHz

P2 = 192 KHz

P3 = 224 KHz

i. Continued Presence Test (Optional). This test terminates signal processing if the signal remains below the highest receiver sensitivity threshold continuously for longer than 3.2 sec.

Programmable dwell periods for the signal parameter measurement duration range from 1.2 seconds to 51.2 seconds.

5. SIGNAL MEASUREMENT SUBSYSTEM

The signal parameters measured and recorded are:

a. Relative phase difference between channels of the dual-channel receiver.

b. Receiver frequency.

c. Power level of sum of receiver channels.

d. Power level of difference of receiver channels.

e. Wideband peak amplitude.

f. Wideband average amplitude.

The state of each commandable option is also recorded.

6. RECORDER SUBSYSTEM

Mission 7337 is equipped with three magnetic tape recorders for storage of payload data. Each recorder can store up to 24 minutes of data, and reads out at four times the readin speed. Two of the recorders can be used to readin sequentially up to 48 minutes of data. Each recorder can be switched to either of the two downlink transmitters. Both recorders can be dumped in parallel in 6 minutes. The third recorder is a stand-by unit in case of a failure. This payload cannot be operated in a transpond mode.

7. ATTITUDE CONTROL SYSTEM

The spacecraft for Mission 7337 is a spinning platform with the axis of rotation oriented nominally parallel to the local vertical at 55°N. An attitude control system, in addition to the normal spin system, is incorporated in Mission 7337 in order to:

a. compensate for spin axis drift due to the earth's magnetic field,

b. make cross-track and in-track pointing maneuvers.

8. GENERAL

The primary characteristics of the communications systems which Mission 7337 was designed to intercept are shown in Figure 7.1. Each receiver band in the payload receiver is tailored to one of these signals, and recognition tests for each band are programmed for the target signal characteristics of that band. Figure 7.2 shows the baseband channel allocations for band C-1. Figure 7.3 shows typical baseband channel allocation for bands C-2 and C-3.

	Target Signal			
	C1	C2	C3	P
Frequency Range (MHz)	1200-1600	1600-2000	3400-3900	1550-22
Modulation Type	FDM/FM	FDM/FM	FDM/FM	PPM/AM
Number of 4-kHz Channels	12 or 24	60 or 120	60 to 600 in increments of 60	12, 24 o 28
Typical Emitter Types	RVG-903/2	R-60/120	R-600	R-400 R-404
Zenith-Lobe ERP* (dBm)	+28.5	+21.3	+20.2	+31.2
Main-Lobe ERP (dBm)	+60.8	+63.2	+65.0	+66.6
Antenna Beamwidth (degrees)	11	4	2	8

*Assumes zenith-lobe gain is 10 dB below isotropic.

Figure 7.1 Typical Target Emitter Characteristics

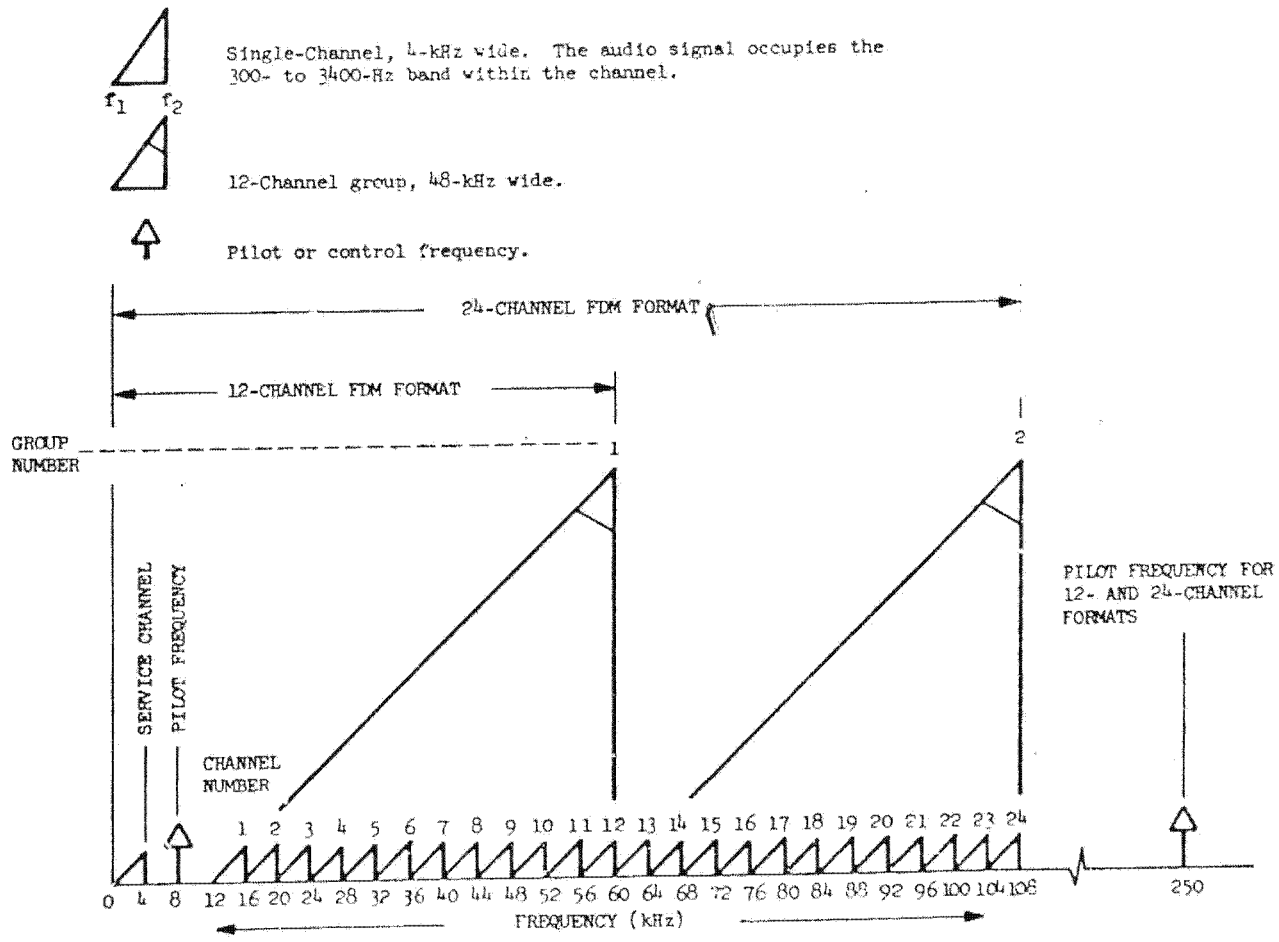


Figure 7.2 12- and 24-Channel FDM Format for RVG 902/3 Target Signal in C-1 Band.