HANDLE VIA BYEMAN CHANNELS ONLY

BYE-44467-67
SORS 11./8
7 December 1967

UNITED STATES INTELLIGENCE BOARD

SIGINT COMMITTEE

SIGINT OVERHEAD RECONNAISSANCE SUBCOMMITTEE

MEMORANDUM FOR ALL MEMBERS OF THE SIGINT OVERHEAD RECONNAISSANCE SUBCOMMITTEE

SUBJECT: Mission Descriptions of SIGINT Mission 7322 (LAMPAN) and Mission 7323 (SAMPAN II)

Mission Descriptions of SIGINT Missions 7322 - LAMPAN and 7323 - SAMPAN II have been provided to SORS by the NRO and are forwarded for your information.

25X1

EXECUTIVE SECRETARY

Attachment:
a/s

GROUP 1
Excluded from automatic downgrading and declassification

~~(S)~~ NATIONAL RECONNAISSANCE OFFICE

WASHINGTON, D.C.

THE NRO STAFF

4 December 1967

MEMORANDUM FOR THE CHAIRMAN, SORS

SUBJECT: Mission Descriptions of SIGINT Mission 7322 (LAMPAN) and Mission 7323 (SAMPAN II)

The mission descriptions for Missions 7322 and 7323 are forwarded as attachments to this correspondence. These ELINT Reconnaissance Systems are designed to meet the requirements of USIB-D-41.14/246, USIB-D-41.14/303, and current attachments thereto.

Mission 7322/23 is contained in a spin-stablized P-11 sub-satellite which is scheduled to be launched into a nominal 275 miles - circular orbit by an Atlas-AGENA booster. It contains two separate ELINT reconnaissance systems: LAMPAN, which is designed to intercept and record signals in the 1000 to 2100 MHz band, and SAMPAN II, which is designed to intercept and record signals in the 2100 to 4000 MHz band. [redacted] 25X1

[redacted] 25X1

The planned launch date, predicated on launch of the primary payload is 10 January 1968. Mission life is expected to be 6 months. A nominal 10 to 12 collection revs per day should be available for mission accomplishment. Under worst case power conditions, it would appear that a minimum of 5 operations per day can be sustained.

HENRY C. HOWARD
Colonel, USAF
Deputy Director for
Satellite Operations

1 Atch: System Descriptions

1. SYSTEM DESCRIPTION

1.1 GENERAL

The orbital reconnaissance system (Diagram 1) consists of two separate receivers, receiving antennas (two conical spirals and one paraboloid), two dual-channel tape recorders, four VHF/FM telemetry transmitters, a command subsystem, and ancillary equipment, including earth and sun sensors, a time reference generator, and payload status commutators.

The two conical spiral antennas provide hemispherical coverage and the parabolic antenna provides directional coverage. The antenna outputs are split by diplexers to feed both the SAMPAN III and LAMPAN II receivers. The outputs of the conical antennas are amplified, detected, and summed to provide the equivalent of an omnidirectional antenna output. This output is used to inhibit the sidelobe response of the parabolic antenna and to provide an omni video output.

Each receiver subsystem makes measurements on the input signals and provides two frequency-multiplexed outputs that contain the following information:

a. DF video

b. Omni video

c. DF frequency measurement

d. Omni frequency measurement

e. DF/omni-pulse width

f. Earth/sun sensor data

g. Payload status data

h. Time reference data

The processed receiver outputs are applied to dual-track, 75KHz, 2:1 (readout/readin) tape recorders. Inputs to the tape recorders can be transferred (upon external command) to allow either receiver to be connected to either tape recorder.

1.2 PARAMETERS

Altitude:	275 n.m.
Inclination Angle:	$90^\circ \pm 20^\circ$
Direction of Spin:	CCW when viewed from -Y axis
Spin Rates:	
Initial	Nominal 52 rpm
After 6 months	Nominal 44 rpm
After 12 months	Nominal 37 rpm
DF Antenna Elevation Angle:	$55^\circ \pm 2^\circ$ (DF Antenna is in X-Z plane pointing $55^\circ \pm 2^\circ$ up from -Y axis toward -X axis)
Earth Sensor Elevation Angle:	$64^\circ \pm 2^\circ$ (Earth sensor is in X-Z plane pointing $64^\circ \pm 2^\circ$ up from -Y axis toward -X axis)

SAMPAN III

Frequency Range:	2.1 to 4.0 GHz (S-band)
Sensitivity (receiver)	-72 dbm high - 66 dbm normal
Location Accuracy	[redacted] at 600 n.m. slant range 25X1
Pulse Width Measurement	$\pm$ 50ns @ .25 to 2.5 us
	$\pm$ .25us @ 2.5 to 10 us
RF Measurement	$\pm$ 2MHz @ 2KHz PRF
	$\pm$ 7MHz @ .5KHz PRF
	$\pm$ 30MHz @ .125 KHz PRF
Minimum PRF	250 PPS @ 4000 MHz
	125 PPS @ 2000 MHz

LAMPAN II

Frequency Range:	1.0 to 2.1 GHz (L-band)
Sensitivity (receiver)	-75 dbm
Location Accuracy	[redacted] at 600 n.m. slant range 25X1
Pulse width measurement	± .25 us @ .5-20 us
RF Measurement	± 5MHz
Minimum PRF	62 PPS @ 1000 MHz
	125 PPS @ 2000 MHz

1.3 COMMANDS

Payloads on-off

Tape Recorder Bypass

Tape Recorder Transfer

SAMPAN High - Normal Sensitivity

LAMPAN High - Normal Sensitivity

SAMPAN YIG Frequency Sweep Range

2.1 ANTENNAS

2.1.1 Conical Spiral (Omni) Antennas

Each conical spiral antenna provides hemispherical coverage with an average gain of -2 db. The antennas are located on the subsatellite such that their combined patterns provide omnidirectional coverage. The conical antennas provide both receivers with omnidirectional video signals and with inhibit signals that inhibit the parabolic antenna sidelobes. Characteristics of the conical spiral antennas are as follows:

a. Frequency Range: 1.0 to 4.0 GHz

b. Nominal Gain: -2 db

c. Polarization: Circular

2.1.2. Parabolic (DF) Antenna

The 6-foot-diameter, pencil beam, parabolic antenna, connected to its diplexer via an equiangular flat spiral feed, provides a direction-finding (DF) output to the receiver subsystems. The antenna is positioned on the subsatellite such that its boresight axis is 180 degrees from that of the earth sensor and its elevation angle is 55 degrees from the spin axis of the subsatellite. Typical 3-db antenna gains (from linear to circular polarization) and beamwidths are as follows:

Frequency (GHz)	Gain (db) (At -3 db Point Linear to Circular Polarization)		Beamwidth at -3 db Points (Degrees)	
	E Plane	H Plane	E Plane	H Plane
1.0	13.0	12.4	9.8	11.1
1.5	16.6	17.0	7.4	7.4
2.0	17.8	17.7	5.4	5.4
2.6	20.0	19.7	4.4	4.3
3.1	21.5	20.3	3.3	4.1
3.5	21.5	22.3	3.0	3.4
4.0	23.9	24.5	2.6	2.5

2.2 Diplexers

Three diplexers (one for each antenna) are used to frequency divide the antenna outputs into a 1.0- to 2.1 -GHZ output (0.75-db attenuation, maximum) and into a 2.1- to 4.0-GHz output (1.25-db attenuation, maximum).

3. SAMPAN III RECEIVER

3.1 General

SAMPAN III (Diagram 2) comprises three crystal video receivers, a frequency measurement capability in the DF channel, amplifiers, detectors, pulse stretchers, logic circuits, and signal conditioning components, including voltage-controlled oscillators, a commutator, and a test signal generator. The receiver is divided into two sections: the omni section that receives its inputs from the two conical spiral antennas, and the DF section that receives its input from the DF parabolic antenna. Signals received by the omni antennas are applied to two of the crystal video receivers and combined in a summing network. The combined output is: (1) amplified, pulse stretched, and low-pass filtered to provide the omni video output, (2) summed with the detected DF signal to inhibit the sidelobe response of the DF antenna, and (3) summed with the output of the omni YIG filters. A portion of the crystal video receiver output is applied to a swept dual YIG filter whose outputs are detected, amplified, and summed to provide an omni YIG output for frequency measurement of the received omni signals. The four frequency-sweep ranges, set forth in paragraph 3.2.3, of the omni YIG are individually selectable by command.

The DF antenna is connected to the third crystal video receiver which provides a DF video output only when signals are received by the main beam of the DF antenna; thus, providing target emitter geoposition information. Any minor lobe signals received are cancelled by the inhibit function of the omni section of the receiver. DF channel sensitivity can be attenuated 6 db by command to increase the sidelobe inhibit level. The output of the crystal video receiver is also applied to a swept dual YIG filter whose output is detected, amplified, and summed to provide a DF YIG output for frequency measurement of the received DF signals. The frequency sweep ranges of the DF YIG are the same as those of the omni YIG. Outputs from the omni YIG channel and the DF YIG channel are applied to the pulsewidth measuring circuit. Received signal pulsewidths ranging from 0.25 to 10 usec can be measured in both channels.

Earth sensor or sun sensor data are received via LAMPAN. The output of the selected sensor data is used with the DF video output to provide emitter geoposition information.

SAMPAN III data outputs are applied to two summing amplifiers whose outputs, in turn, are applied to a dual-track, 75 KHz, 2:1 (readout/readin) tape recorder. The tape recorder outputs are phase-equalized in the receiver and then applied to two VHF/FM telemetry transmitters. A tape recorder bypass mode is selectable by command to permit real-time telemetry readout of the received data.

System timing is controlled by a 50-KHz reference tone time signal modulated by the AN/GSQ-53A time code word.

3.2 Details

3.2.1 Omni Video Channel. The minimum sensitivity of the omni video channel is -60 dbm. To limit the sensitivity in this channel, a threshold has been set about 10 db above the minimum sensitivity level; hence, the baseline at this point does not contain noise. The nose level for the channel is set in the tape recorder. Sensitivity is set to reference level corresponding to a 50 percent probability of detection level. The dynamic range of the omni video channel is 25 db.

RF signals received by the omni antennas are applied to crystal video receivers where they are filtered, RF amplified, detected, and post-detection amplified. The outputs are then summed and applied to a bipolar log video amplifier, a pulse stretcher, and to three pulse-count circuits. The pulse stretcher output is applied through a low-pass filter whose output is the omni video signal. The omni video is then applied through a summing amplifier to a tape recorder. The pulse-count circuits take the output of the log video amplifier and count pulses at different power levels in the omni video channel. The three counters are identical except for threshold level and counting scale factor. Each counter develops an output voltage which is an approximate logarithmic function of the number of pulses which have exceeded the threshold setting during the 20 second period preceding each commutator activation.

3.2.2 <u>DF Video Channel</u>. The minimum sensitivity of the DF video channel is -72 dbm for the high sensitivity mode and -66 dbm for the normal sensitivity mode based on a single pulse, either of which can be commanded, 50 percent probability of detection. The dynamic range of this channel is 35db. RF signals received by the DF antenna are processed through a crystal video receiver identical to those used in the omni channels. The output is then summed with the omni channel output to provide the inhibit function (i.e., the DF signal must exceed that of the omni channel to produce an output). The DF bipolar log-video amplifier output is applied to a baseline clipper and pulse stretcher and to a low-pass filter whose output is the DF video signal. The DF video is then applied through the summing amplifier to the tape recorder.

3.2.3 Omni YIG Channel. The minimum sensitivity of the omni YIG channel is -59 dbm, and its dynamic range is 25 db, minimum. The 3-db YIG bandwidth is 30 MHz. The YIG's can sweep one of four frequency ranges selected by command. (The same commands are used for the DF YIG channel.) Frequency ranges and sweep times are as follows:

Frequency Range (GHz) Start	Stop	Sweep Time (msec) Nominal
2.6	3.2	85
2.0	4.0	280
3.2	4.0	115
2.0	2.6	85

Flyback time is approximately 8 msec, during which time the output is blanked. An RF input signal from one of the omni antennas is coupled from the tunnel-diode amplifier in the omni crystal video receiver and applied to one of the dual YIG filters, both of which are swept synchronously in frequency by a sweep generator. (The sweep generator output is also used to drive the DF channel dual YIG filter.) The YIG filter output is detected by a tunnel-diode detector, amplified by a postdetection amplifier, and applied to a summing network. The summing network resistively combines both YIG outputs (positive signals) and the summed omni output (negative signals) which has been attenuated to approximately 20 db below the YIG output. The skirts of the YIG filters are thus cancelled at their 20-db points, limiting the maximum bandwidth to about 85 MHz. (This is the same technique used in DF inhibiting.) The summed output is amplified in a bipolar log-video amplifier and threshold amplified and pulse stretched to provide a constant amplitude, constant pulsewidth (250 usec) output. A 500-usec lower sweep marker and a 300-usec upper sweep marker followed by a 300-usec sync marker are summed into the output. This output modulates a VCO.

3.2.4 DF YIG Channel. The minimum sensitivity of the DF YIG channel is -68 db and its dynamic range is 35 db, minimum. Each of the dual YIG filters has a 3-db bandwidth of approximately 30 MHz and is displaced in frequency 30 MHz from the other, thus providing a total bandwidth of approximately 60 MHz. The YIG's can sweep one of four frequency ranges selected by command similiar to that of the omni YIG channel. An RF input signal from the DF antenna is coupled from the tunnel-diode amplifier in the DF crystal video receiver and applied to both inputs of the dual YIG filter which are swept synchronously (though displaced in frequency by 30 MHz) by a sweep generator. (This sweep generator output is also used to drive the omni channel dual YIG filter.) The two YIG filter outputs are detected by opposite-polarity, tunnel-diode detectors; amplified by a post-detection amplifier; and resistively summed. (This output is, in essence, a sweeping YIG discriminator output.) The summed output is amplified in a bipolar log-video amplifier split into two paths, and inverted in one path. Sidelobe inhibiting is obtained in this channel by performing a linear AND operation between the signals in each of the paths and in the output of the DF video log-video amplifier. The outputs of the two AND circuits are fed to threshold amplifiers and pulse stretchers, which provide a constant amplitude, constant pulsewidth (250 usec) output. The inverted channel is again inverted and summed with the other path and with the bandend and sync markers as with the omni YIG. The crossover point for the two filters, relative to the banded markers, determines the frequency measured. The accuracy to which the crossover point can be extrapolated is a function of the PRF of the signal. The summed output modulates a VCO.

3.2.5 Pulsewidth Measurement Channel. When pulse signal strength exceeds -66 dbm in the DF channel or -57 dbm in the omni YIG channel, pulsewidth measurements are made on pulses whose width ranges from 0.25 to 10 usec. The pulsewidth measuring circuits receive a signal from the omni YIG bipolar log-video amplifier and a signal from the DF channel, which is a combined output from the DF video and DF YIG channels. The output of the DF YIG bipolar log-video amplifier is split into two paths and inverted in the one path. Sidelobe inhibiting is obtained in this channel by performing a linear AND operation between the signals in each of the paths and in the output of the DF video log-video amplifier. The outputs of the two AND circuits are fed into an OR circuit whose output is the DF input to the pulsewidth measuring circuit. The pulsewidth measuring circuit produces an output pulse of constant amplitude whose width is linearly related to the width of the input pulse by a constant factor. The output of the pulsewidth measuring circuit is applied to a VCO.

3.2.6 Summing Amplifiers. The SAMPAN II receiver system contains two summing amplifiers that resistively sum and then amplify the data information inputs. The outputs of the summing amplifiers are applied to the 75-KHz readin/150-KHz tape recorder. The format is depicted in

Diagram 4.

3.2.7. Tape Recorder Bypass Mode. Upon external command, the outputs of the summing amplifiers can be switched directly to the input of the final amplifiers; thus, bypassing the tape recorders. The bypass command latches a relay in the receiver whose contacts enable the bypass mode. In the event of tape recorder failure, a programmable event can also be used to turn on telemetry power in the LAMPAN receiver as well as both receivers for real time readout over a tracking station that does not have a commanding capability.

4. LAMPAN I RECEIVER

4.1 General

LAMPAN I (Diagram 3) comprises three crystal video receivers with RF amplification, four superheterodyne receivers, and ancillary items, including amplifiers, pulse stretchers, logic circuits, phase equalizers, voltage-controlled oscillators, a commutator, and a time reference generator. The receiver is divided into two sections: the omni section that receives its inputs from the two conical spiral antennas, and the DF section that receives its inputs from the DF parabolic antenna.

The two conical spiral antennas are connected to two of the crystal video receivers. The receiver outputs are summed and the combined output is used to inhibit the sidelobe responses of the DF parabolic antenna and to provide an omni video output of the received omni-directional signals. The output of each crystal video receiver RF amplifier is also applied to a swept dual YIG filter. The filter outputs are detected and summed to provide an omni frequency measurement.

The DF parabolic antenna is connected to the third crystal video receiver, which has a DF video output only when signals are received by the main beam of the DF antenna; thus, providing target emitter geoposition information. The DF channel sensitivity can be attenuated by 6 db on command to increase the sidelobe inhibit level. The crystal video receiver RF amplifier output is also applied to four frequency-stepped, superheterodyne FM receivers. The receiver outputs provide frequency measurement on signals received by the main DF antenna beam.

An output from the omni YIG channel and an output from the DF video channel are applied to a pulsewidth measurement circuit whose output provides a pulsewidth measurement of signals in both channels.

Earth sensor or sun sensor data are selected by command. The output of the selected sensor is used with the DF video output to provide emitter geoposition information. Earth sensor and sun sensor information is interrupted once a minute for one second to allow readout of the status commutator.

The LAMPAN received signal measurements are summed in two summing amplifiers whose outputs are applied to a dual-track, 2:1 (readout/readin) tape recorder.

A tape recorder bypass mode is selectable by command to permit real time telemetry readout of the received data.

The system time reference is a 50-KHz signal modulated by the AN/GSQ-53A time code word.

4.2 Details.

4.2.1 Omni Video Channel. The minimum sensitivity of the omni video channels for an inhibit output is -76 dbm (50 percent detection probability). To reduce its signal density, the omni video channel is thresholded and its minimum sensitivity is -60 dbm (50 percent detection probability). The dynamic range of the omni video channel is 20 db, minimum. An RF input signal from each of the two conical spiral antennas is applied to a crystal video receiver, where it is filtered, RF amplified by a transistor amplifier, detected by a tunnel-diode detector, amplified by a postdetection amplifier, and applied to two summing networks. The omni summing network resistively combines and then amplifies (in an operational amplifier) the two omni video signals. The summed omni video is further amplified and compressed in a compression amplifier, exponentially pulsestretched, and low-pass filtered. The filter output (omni video) is applied to a summing amplifier, and in turn to the tape recorder.

4.2.2 DF Video Channel. The minimum sensitivity of the DF video channel is -74 dbm (50 percent detection probability) for the high-gain mode and -68 dbm (50 percent detection probability) for the normal mode. In the high gain mode the dynamic range of the DF video channel is 35 db, minimum.

An RF input signal from the DF antenna is applied to a crystal video receiver where it is filtered, RF amplified by a transistor amplifier, detected by a tunnel-diode detector, amplified by a postdetection amplifier, and applied to a summing network.

The DF summing amplifier resistively combines the DF and the omni video of opposite polarities and amplifies the difference in an operational amplifier. The negative omni pulses are clipped, and only the positive DF pulses are amplified by the compression amplifier. Signals from the sidelobes of the DF parabolic antenna are thus inhibited by signals from the conical spirals. Since the sensitivity of the omni crystal video receivers is nominally 2 db higher than than of the DF crystal video receivers, an extra 2-db margin of inhibit level is provided.

The inhibited DF video is amplified and compressed in a compression amplifier, exponentially pulse-stretched, and low-pass filtered. The filter output (DF video) is applied to a summing amplifier, and in turn to a tape recorder.

4.2.3 Omni YIG Channel. The minimum sensitivity of the omni YIG channel is -60 dbm and its dynamic range is 20 db, minimum. The 3-db YIG bandwidth is 40 MHz and the total sweep time is 1.110 sec., of which 1.100 sec. is sweep, 0.006 sec. is flyback, and 0.004 sec. is dwell between flyback and sweep. An RF input signal from each of the conical spiral antennas is coupled from each omni crystal video pre-amplifier and applied to each filter of a dual YIG filter, both of which are swept synchronously in frequency by a sweep generator. Each YIG filter output is detected by a tunnel-diode detector, amplified by a postdetection amplifier and applied to a summing network. The summing network resistively combines and then amplifies the output from both YIG filters. The summed omni video is further amplified and compressed in a compression amplifier, exponentially pulsestretched, and summed with banded and sync markers from the sweep generator YIG driver. The markers are a 1.0 usec, lower sweep marker and a 1.0 usec, upper sweep marker followed by a 1.0 usec sync marker. The signal in the omni YIG channel is then low-pass filtered and applied to a VCO.

4.2.4 DF Frequency Channel. The DF frequency channel has a minimum sensitivity of -66 dbm, a 20-db minimum dynamic range, and a measurement accuracy of ± 5 MHz. An RF signal from the DF parabolic antenna is amplified in the crystal video receiver and applied through a quadraplexer where the 1.0- to 2.1 -GHz frequency band is divided into four 275-MHz sub-bands (1.000 to 1.275, 1.275 to 1.550, 1.550 to 1.825, and 1.825 to 2.100 GHz). Each quadraplexer output sub-band signal is applied to one of four superheterodyne receivers where it is mixed with a stepping local oscillator (LO) signal and down-converted to a 300-MHz IF. Each LO generates a series of five discrete frequencies and is stepped synchronously (through a fixed time delay) with the earth sensor output. When there is no earth sensor pulse, or when the pulse is not acceptable, the LO is free-running at a rate of two seconds per step.

The IF signal is applied through a 60-MHz passband filter (which provides a 5-MHz overlap over the 55-MHz passband resulting from one-fifth of the 275-MHz quadraplexer output). The filtered signal is then amplified, amplitude limited, and FM discriminated. The discriminator converts the frequency of a signal in the IF to a voltage output which is linear with frequency over the 60-MHz IF bandwidth.

The output of the discriminator is applied to a pulse stretcher (having a 400-usec constant pulsewidth output) and summed with another superhet channel output and a 4-bit binary word (providing LO step information) in a differential amplifier. The composite signal is applied through a low pass filter to VCO's.

The discriminator output is switched into the pulse stretcher via an FET (field effect transitor) switch which is controlled by the output of the stretcher logic circuitry. The stretcher logic provides an output when the following criteria are met:

a. A signal is present in the IF amplifier

b. A signal is present in the inhibited DF channel

c. The pulse stretcher is not in the process of stretching a previously received pulse.

d. The companion superheterodyne channel is not processing a signal.

The stretcher logic also performs the following two functions:

a. Provides a chirp measurement when a superheterodyne channel receives two or more pulses. Chirp detection is accomplished by allowing the pulse stretcher to sample the discriminator output voltage (and, therefore, the input frequency) only at the following times: for the first usec on the first pulse, the output voltage at the end of the second pulse, the first usec on the third pulse, etc. (Chirp detection is not possible on pulses having the same leading and trailing edge frequencies.)

b. Alternately measures the outputs of two companion superheterodyne channels when simultaneous pulses are received in both channels.

The 4-bit binary word summed with the pulse stretcher output in the differential amplifier provides the LO step information. The binary word is generated in the earth sensor processor, which also performs the two following functions:

a. Steps the superheterodyne LO through five fine-frequency steps.

b. Generates a 4-bit, return-to-zero binary word that indicates the frequency to which the LO has been stepped.

4.2.5 <u>Pulsewidth Measurement Channel</u>. Pulsewidth measurements are made on signals having pulsewidths from 0.5 to 20 usec in the DF frequency channel when signal strength equals or exceeds -66 dbm and in the omni YIG channel when signal strength equals or exceeds -48 dbm. Output signals from the DF and omni YIG compression amplifiers are applied to threshold and priority circuits in the proportional pulse stretcher. The threshold circuit provides an output trigger pulse whose pulsewidth is equal to the 3-db width of the input pulse. The priority circuit provides a DF pulsewidth output only when a signal is present in the DF frequency channel. This circuit also blanks the omni YIG pulsewidth measurements for 35 msec after receipt of a DF pulse.

The trigger pulse output of the threshold circuit is applied to a proportional pulse stretcher that operates as follows: The trigger input charges a capacitor (at one rate for the first three usec and at a second rate after three usec) to a voltage which, at the end of the trigger pulse, is proportional to the width of the input trigger pulse. The charge on the capacitor drives a voltage-variable, one-shot multivibrator; thus, converting voltage amplitude back to pulsewidth.

The output of the proportional pulse stretcher is low-pass filtered and applied to a VCO. The VCO output is summed in a summing amplifier, and recorded.

4.2.6 Summing Amplifiers. LAMPAN I contains two summing amplifiers that resistively sum and then amplify all of the LAMPAN I measurements previously described. The outputs of the summing amplifiers are applied to the tape recorder. The format is depicted in Diagram 4.

5 DATA STORAGE AND TRANSMISSION SUBSYSTEM

5.1 Data Storage

The receiver system contains two 75-KHz, dual-track, 2:1 (readout/readin) tape recorders. Delayed commands are used to turn on the recorders for readin; readout is accomplished by real time command. The payload timer permits selective readin for any time delay between 2 and 16,378 seconds. The payload on duration can be programmed for a continuous 14 minute period or split into two 7 minute periods. Maximum tape recorder readin time is approximately 12 minutes which can be split into a 7 minute and 5 minute recording. Diagram 4 displays the data format from each recorder track that modulates the four telemetry transmitters. Data inputs can be interchanged between the two recorders by command and can be returned to normal operation by command.

5.2 Data Transmission

The telemetry data link configuration for the payload is also depicted in Diagram 4. Each transmitter is rated at two watts minimum power output. The output of each transmitter is applied via a multicoupler to a common telemetry antenna. Vehicle status data is transmitted via telemetry link No. 1, except during a tape recorder transfer mode when data is transmitted via link No. 3. Vehicle status and payload mode monitor telemetry points appear on a 5-rps, 60-point commutator that frequency-modulates a VCO. Earth sensor and sun sensor data modulate VCO's, and the solar array current monitor data also modulates a VCO. During the tape recorder bypass mode the foregoing VCO's are inoperative.

The telemetry antenna is a VHF monopole having extended radial elements to provide a good ground plane. The location of the telemetry antenna on the spacecraft is shown in Diagram 1.

5.3. GROUND SUPPORT EQUIPMENT

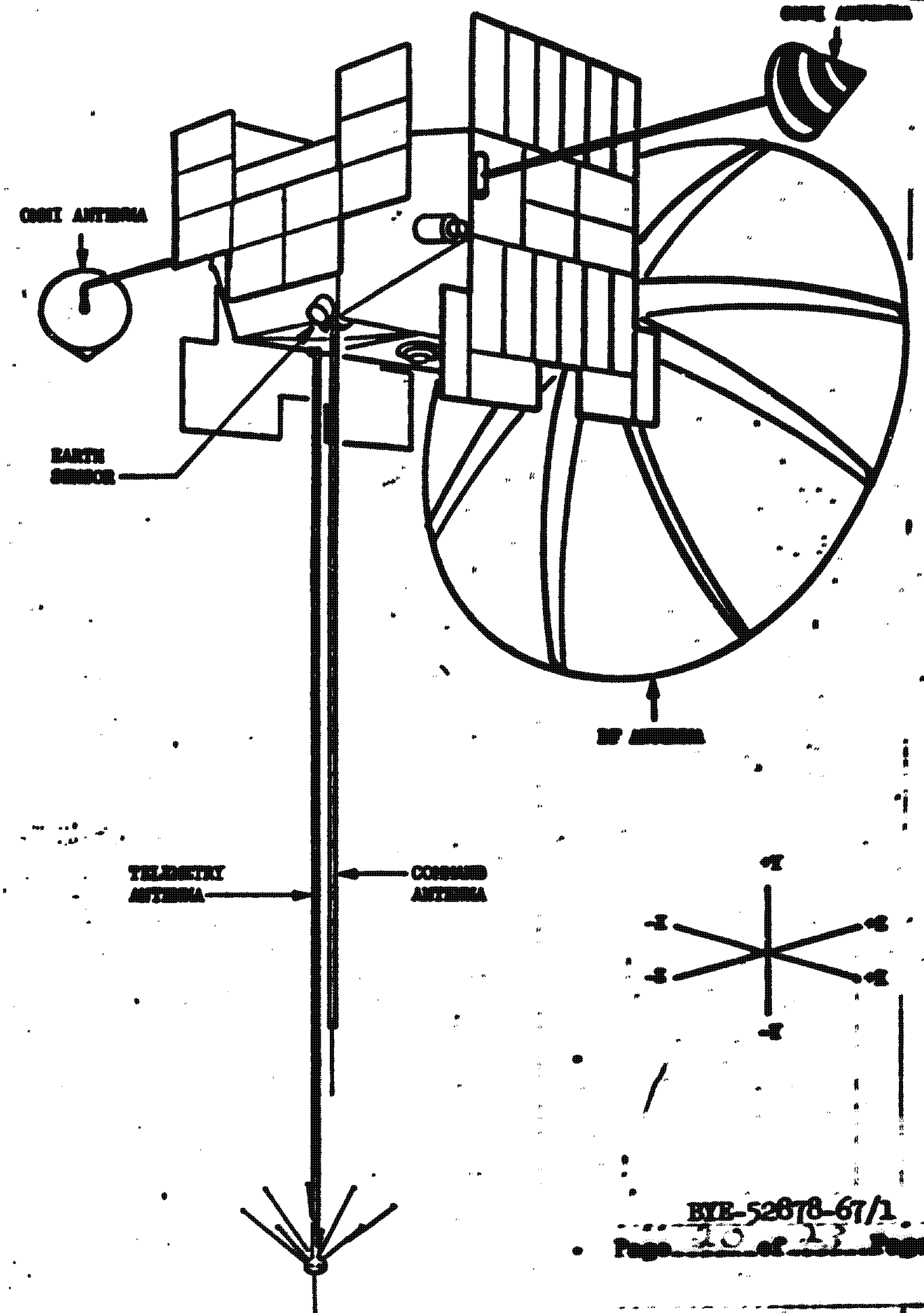
<u>Tracking Stations</u>.

The existing United States Air Force command and tracking network contains the required equipment for generating and transmitting commands to the spacecraft and for recording the readout of the intercepted data.

5.4 DATA PROCESSING:

Data processing includes shipment of recordings from the collection site to the West Coast facilities, performing engineering evaluation of demultiplexed payload status data, and delivery of ELINT intercept to NSA for exploitation.

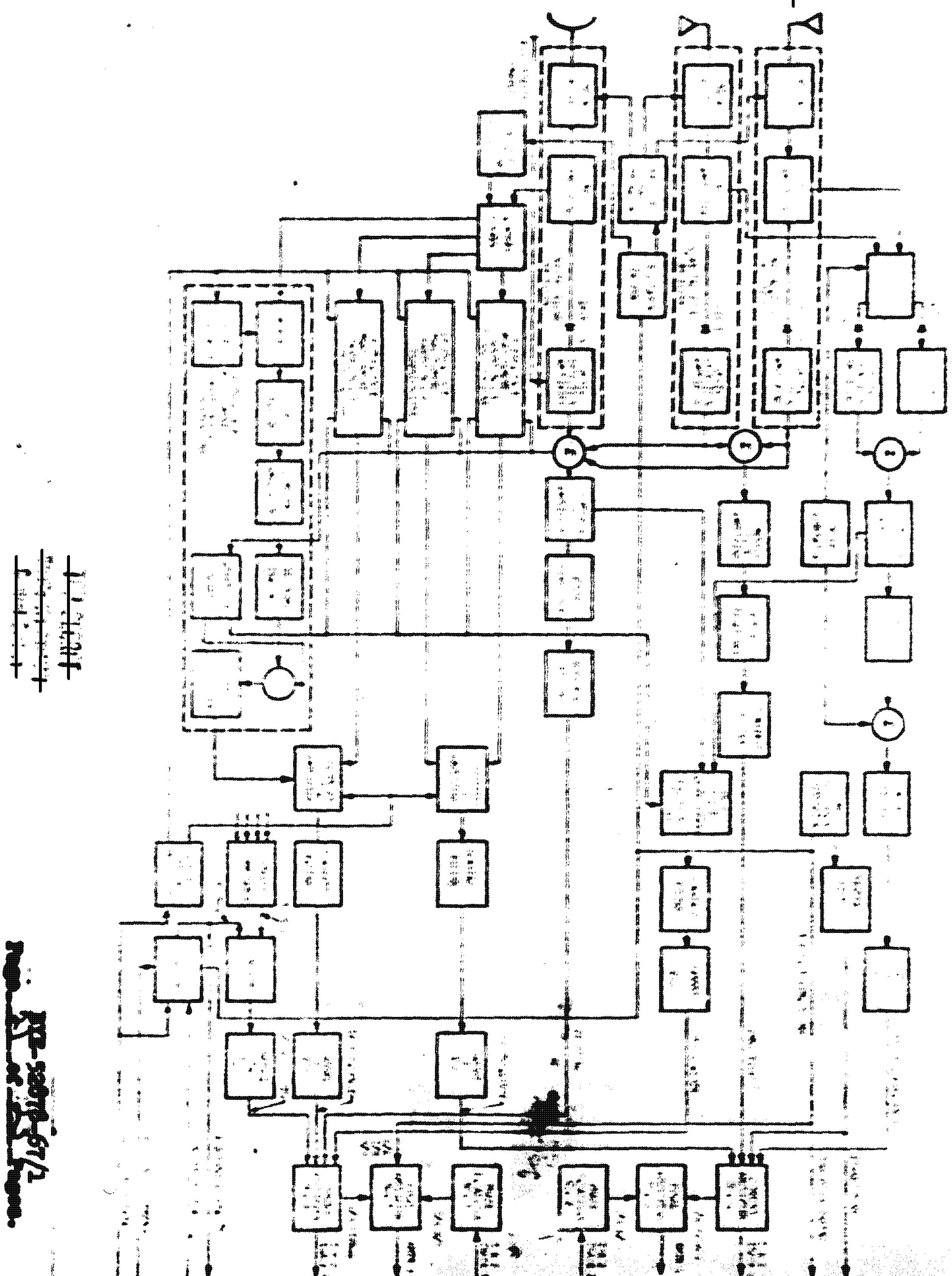
~~TOP SECRET~~
~~Handle Via BYEMAN~~
~~Control System~~



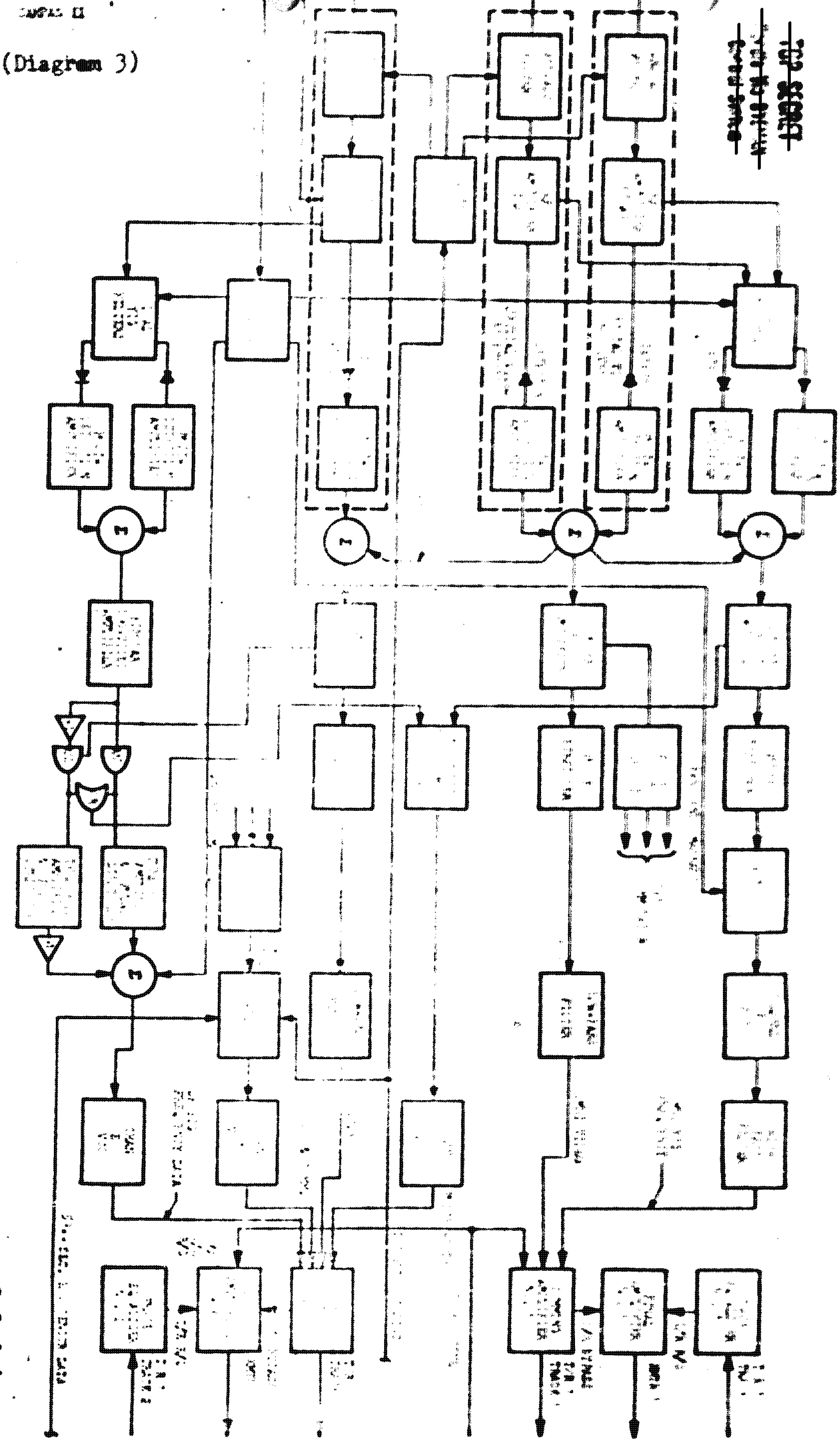
BYE-52878-67/1
Page 23 of 23 Pages

Diagram 1. Vehicle Antenna Configuration

(Diagram 2)



(Diagram 3)



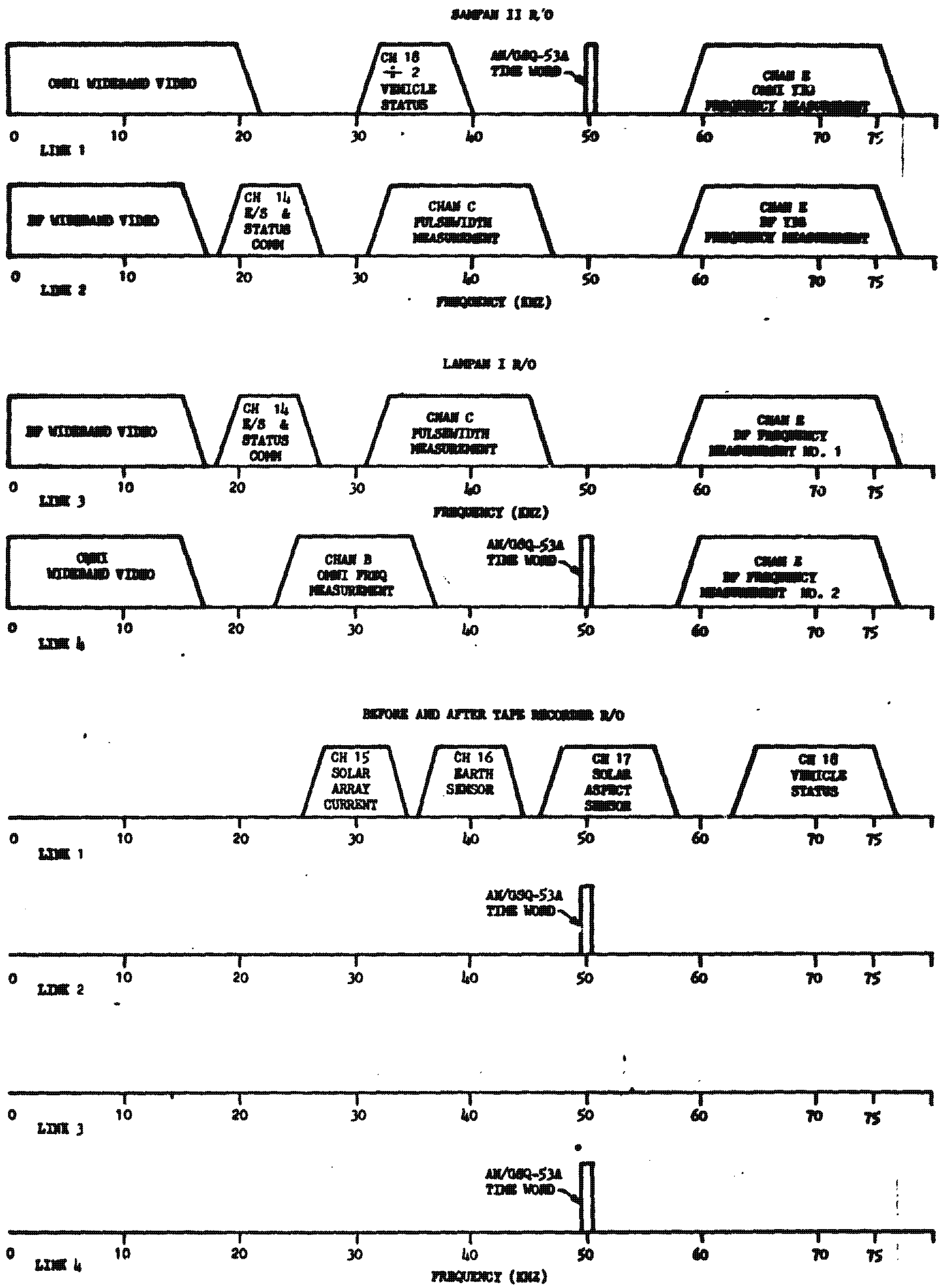


Diagram 4. Data Output Format