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PRO B2b
BYE-SP 11353
Cy 1.

1 AUG 1966

Subject: P-989 Comint Payload

To: SAFSS (W. Boenning) NSA (R. Potts) LMSC [redacted]

25X1

The attached report is forwarded to provide advance information.

[redacted]

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1 Atch
P-11 Troposcatter and
Microwave Comint Payloads

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BIF-107-44004-68
Copy / of 12
Page 1
Total Pages: 7

To: [redacted]

cc: D. Bradburn (6)
R. Geiger
[redacted]

17 July 1968

25X1

BYE-SP-0693-68
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Subject: P-11 Troposcatter and Microwave COMINT Payloads

From: [redacted]

System studies have been performed to configure P-989 payloads for COMINT mapping and sampling. The studies resulted in the conclusion that there is a natural division of tasks between high power low frequency troposcatter targets and low power high frequency microwave targets, and that separate P-11 vehicles should be utilized for these two basic sets of tasks. The studies then proceeded to maximize the amount of useful information that could be obtained within the practical constraints of the P-989 system.

The attached overall system specifications are a first cut result of these studies, giving a brief description of the configuration concept and a statement of the expected performance. This performance is dependent on all system elements, i.e., vheicle, antennas, electronic payloads and ground data processing. They are suitable for coordination purposes between various government agencies and contractors, and are, of course, subject to modification as a result of this coordination and/or detailed hardware design studies.

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OVERALL SYSTEM PERFORMANCE SPECIFICATION

P-11 Troposcatter Map and Sample System

I. Objectives:

A. To determine the electrical parameters of the Soviet [redacted] communication links by location. 25X1

B. To sample the signals for intelligence content to identify conversational subject matter and subscriber information.

II. Concept:

A. P-11 will be configured to perform mapping, parameter measurement, and content sampling functions against the Soviet [redacted] emitters. DF and content monitor modes of operation will be carried on simultaneously with a DF capability against emitters located anywhere within the horizon cone of coverage, and a content sampling capability for the duration of signals of sufficient strength and quality. DF information is obtained with a pair of omnidirectional spiral antennas using the same technique employed on Vehicle 4413, and is stored prior to readout on a 37.5 KHz P-11 tape recorder continuously running over the target area. The content samples from the low frequency troposcatter signal would be placed on a 150 KHz P-11 tape recorder, while those from the high frequency troposcatter signals are recorded on a 1 MHz P-11 recorder. These recorders are signal actuated. The content samples are digitized on readout and encrypted with a KGT-28 for downlink privacy. 25X1

III. System Performance Specifications

A. Coverage

1. Frequency search parameters:

450 to 700 MHz, bandwidth between 400 KHz and 1 MHz

700 to 1000 MHz, bandwidth between 1 MHz and 2 MHz

2. Frequency Lock Conditions:

Threshold - signals greater than -95 dbm at receiver terminals (nominal), adjustable by ground command from -70 dbm to -95 dbm to match environment.

Pulse width greater than 500 μsec to confirm CW. Can be disabled by ground command.

TV reject - recognizer to prevent false lock on TV, can be disabled by ground command.

3. Selectable Carrier Frequency Option:

Any frequency in 450 to 1000 MHz range, commandable to enable long intercept.

4. Average Time Between Main Beam Samples on 1° Beam:

3 weeks.

B. Mapping (DF Mode)

1. Location Accuracy

± one degree (DF by phase interferometer), long term correlation of repeat intercepts may provide beam orientation to 0.1 degree and terminal locations to [redacted] 25X1

2. Sensitivity

-95 dbm threshold, satisfactory for sidelobe intercept (nominal). Commandable from -70 dbm to -95 dbm to match environment.

3. DF Measurement Time: Several P-11 spins

4. Modulation (4 options)

Determine number of channels

Determine type and loading, e.g., voice, TV, unmod.

Measure FM bandwidth (Pre-D Spectrum).

Measure video bandwidth.

C. Sampling (Content Mode)

1. Sample Duration

Low Tropo: 2-3 min. in -20 db main beam

High Tropo: 0.5-0.8 min. in -20 db main beam

Up to 6 min. duration with sidelobe intercepts

2. Channel Activity

   Low Tropo: Retrieve total baseband to 24 channels.

   High Tropo: Retrieve total baseband to 120 channels.

3. Sensitivity

   -70 dbm threshold for main beam intercept.

   Greater than 15 db signal to noise ratio.

   -70 dbm to -95 dbm threshold adjustable by ground command.

4. Privacy

   Downlink encryption with KG-28 for baseband recovery.

5. Resume Scan Condition - Signal below threshold for several P-11 spins.

D. Other Parameter Measurements

1. Carrier Frequency Measurement Accuracy: ± 100 KHz.
2. Amplitude Measurement Accuracy: ± 3 db including antenna uncertainties.

OVERALL SYSTEM PERFORMANCE SPECIFICATION

P-11 Microwave Collection System

I. Mission

To map and determine the electrical parameters of microwave communications systems over the frequency range from 1200 to 3900 MHz.

II. P-11 Configuration

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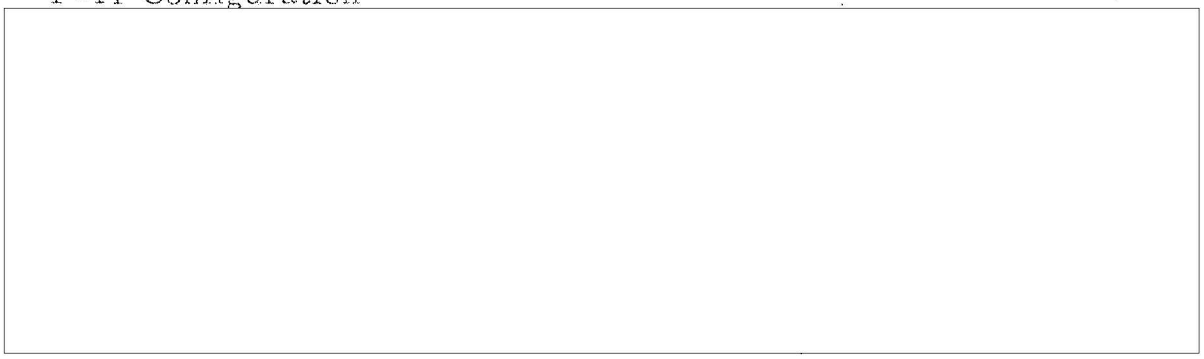

It is proposed that the P-11 carry a six foot flex rib antenna with a flat spiral feed (similar to the 1000-4000 MHz LAMPAN/SAMPAN antenna) to collect sidelobes, and a 15 db 1200-3900 MHz fan beam antenna consisting of corporate fed log periodic elements printed on a window-shade to collect main beams. The main beam and sidelobe collection systems can operate independently, each with its own 37.5 KHz, 26 minute P-11 recorder. Because of P-11 spin, the antenna beams will have a dwell time per signal of roughly 20 msec. To locate signals in frequency, a YIG filter can be swept over selected portions of the 1200-3900 MHz frequency range each 2.0 msec. A frequency synthesizer can be set on the strongest CW or PPM signal within this range after each YIG sweep to obtain the above parameter measurements. No encryption should be required. Pencil beam sidelobe poke-thrus can be identified in data processing by correlation with fan beam collection.

III. System Performance Goals

A. Coverage

1. Frequency search range options (modes)

1200 - 3900 MHz
1200 - 2200 MHz
1200 - 1500 MHz and 3500 - 3900 MHz
It is felt that sub-frequency ranges such as the above might be required to control traffic and/or to permit tasking selectivity.

2. Recognition Logic
FDM - The strongest CW (PW $>$ 10 μsec) signal in the YIG filter output on each sweep will be locked onto by the narrowband receiver and its parameters measured until a stronger signal appears on a subsequent YIG filter sweep.
PPM - The strongest pulsed signal in the YIG filter with PRF $>$ 10,000 on each sweep will be locked onto by the narrowband receiver and its parameters measured until a stronger PPM signal appears on a subsequent YIG filter sweep.

3. Parameters measured
Frequency to $\pm$0.5 MHz
Number of channels
Average pulse rate of PPM
Type of frame synch.
Pre-D bandwidth
Received power to $\pm$3 db.

4. Tangential Receiver Sensitivity and Range
-105 dbm in narrowband receiver, -95 dbm in YIG.
Main beam power quantized to one db over 50 db linear dynamic range above -105 dbm at receiver terminals.

5. Sampling Rate
1000 samples per second irrespective of signal presence (signal presence can be determined by computer sorting on signal amplitude).

6. Recorded Data Format - PCM

B. Mapping Accuracy

1. Pencil beam

Single hit terminal locations to [redacted] with goal of [redacted] by long term network correlation incorporated in the ground data processing. 25X1

2. Fan Beam

Single hit main beam direction to within a beamwidth. Correlation with pencil beam data permits projecting patterns to synchronous sphere after network correlation (roughly 0.1 degree).

3. Data Reduction

To achieve the above results, computer correlation and parameter averaging must be performed on the pattern of hits obtained over several months.