7309

TECHNICAL DESCRIPTION

PUNDIT IV SYSTEM

MISSION 7309

Approved: _____
W. M. Harris, Chief
ATD Staff

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~~SECRET-SPECIAL HANDLING~~

GENERAL:

The Pundit 4 system is designed to receive Soviet Type B telemetry [redacted] Many of the design concepts of the first three Pundit units have been retained, and these are reviewed briefly in this report. A detailed description of previous Pundit systems is contained in Report AW00331. This report will describe in detail those changes which have been incorporated into Pundit 4 and their effect upon the various modes of operation.

25X1

The chief areas of departure in the electrical design of Pundit 4 are the redesign of the sweeping technique of Mode A, and the increase in transponder R.F. power. In Mode B, the number of fixed-tuned receivers is increased to four, and additional attempts have been made to decrease the effect of the interference environment on the reception of the desired signal. This is accomplished by fine-tuning the R.F. band using fixed-frequency crystal oscillators, and additionally by selecting a narrow portion of the IF passband to exclude undesired signals which may be near co-channel in frequency. A third mode, Mode C has been added for sampling the signal environment.

Physically, Pundit 4 was divided into two separate units, because of vehicle limitations on the size of a single package. The natural division was the separation of the two modes A and B into separate packages, each being approximately the same in volume and weight. One package contains the sweeping receiver used for both Mode A and Mode C, the enciphering unit, and the transponder with power amplifier. The second package contains the four fixed frequency receivers with the associated video switching logic. Each package may be used independently of the other if so desired.

Phase compensation circuits have also been added to improve the data output waveform upon playback from the recorders prior to transmission, and a new receiving antenna has been designed.

DETAILED DESCRIPTION:

1.0 Pundits 1 and 2

The block diagram in Figure 1 indicates the operation of Service Test Models 1 through 3.

1.1 Mode A Operation - Service Test Models 1, 2 and 3.

Received signals pass through the hybrid power splitter, 60- to 80- Mc band-pass filter, and diode switch to the input of the receiver. This receiver is a continuously sweeping receiver, covering the band from 80 to 60 Mc in nominally 1.6 seconds. The frequency sweep is approximately linear in time, allowing a 40-millisecond dwell-time for each signal in the receiver passband. The RF-IF bandwidth is 500 kc nominal, and a 250-kc video output is provided.

The video signals are thresholded at about 10 db above the noise level, and the standardized video is sampled at the clock rate of the signal modifier. During flyback of the receiver (approximately every 1.6 seconds), the video is gated off, and the signal modifier is driven with a square wave. The frequency of this square wave is 50 kc if no qualifying signal was received. (See signal recognition circuit description below.) The duration of this flyback indicator is nominally 5.0 milliseconds. The received data and flyback indicator are therefore standardized in both amplitude and time and are ready for enciphering. The 200 kilobit

per second data from the enciphering equipment drives an FSK transmitter which outputs either one of two frequencies (134 or 135 Mc) depending upon the output level (one or zero) of the signal modifier. The transmitter output power is 2 watts minimum.

The video information is also sent to a signal recognition circuit which examines the signal characteristics on the basis of pulsewidth and PRF to determine the presence of a Type B signal. This circuitry consists basically of a threshold, pulse-width qualifier,and PRF filter. Only incoming pulses of less than 3-microsecond duration are accepted and sent to a narrow-band digital PRF filter. The PRF acceptance limits are maintained to 3000 $\pm$25 pulses per second, nominally. In order to provide positive signal recognition, seven consecutive qualifying pulses are required before a signal recognition indication is given. The yes or no output of the signal recognition circuitry is used to set the frequency of the flyback indicator square wave. (100 kc for no recognition, and 50 kc for recognition.)

The recognition output is also sampled by the commutator four times per commutator revolution (four samples per second nominally). Immediately following the recognition points on the commutator are frequency sampling points which carry a voltage analog of frequency. When a qualifying signal is receiv[illegible] frequency analog holds its value at that point until the comm[illegible] sample is taken, and a reset is received from the following commutator position. The receiver continues to sweep following a recognition; only the recognition and frequency analogs hold their values until reset.

Various other points are sampled by the commutator to give system status information, such as temperature and voltage monitors.

The data from the commutator may or may not be recorded, depending upon the command used to activate Mode A. If a delayed command is used (Command F), the narrow-band tape recorder is activated, and the commutator data are recorded on Track 1 of this tape. If a real-time command is used (Command H), no tape recorder is activated, and commutator data are not recoverable. Track 2 of the narrow-band is not used in the operation of Mode A.

1.2 Mode B Operation - Service Test Models 1, 2 and 3.

In Mode B operation, the diode switch is set to feed RF energy to the swept-tuned receiver of Mode B, which is identical in specification and operation to the Mode A receiver. Video at a 10-kc bandwidth is available from this receiver to be recorded on Track 2 of the narrow-band recorder.

In addition to the swept-tuned receiver, Mode B contains two fixed-tuned receivers at 71 Mc and 76 Mc. These receivers have IF bandwidths of 1.8 Mc each to cover the expected deviations of target signals from their nominal RF's. Two video outputs are provided from each receiver, 400-kc bandwidth for the signal recognition circuits, and 50-kc bandwidth for recording on each track of the wide-band tape recorder.

The signal recognition circuits for the swept-tuned receiver operate exactly as the Mode A circuit, and the fixed-tuned logic circuits are also identical except that they require 15 rather than 7 consecutive qualifying pulses for recognition. If Command J is sent, the outputs of the fixed-tuned logic circuits are used to start the wide-band tape recorder which then runs to the end of tape (12 minute read-in). If Command K is used, the wide-band recorder starts immediately after receipt of the command. The

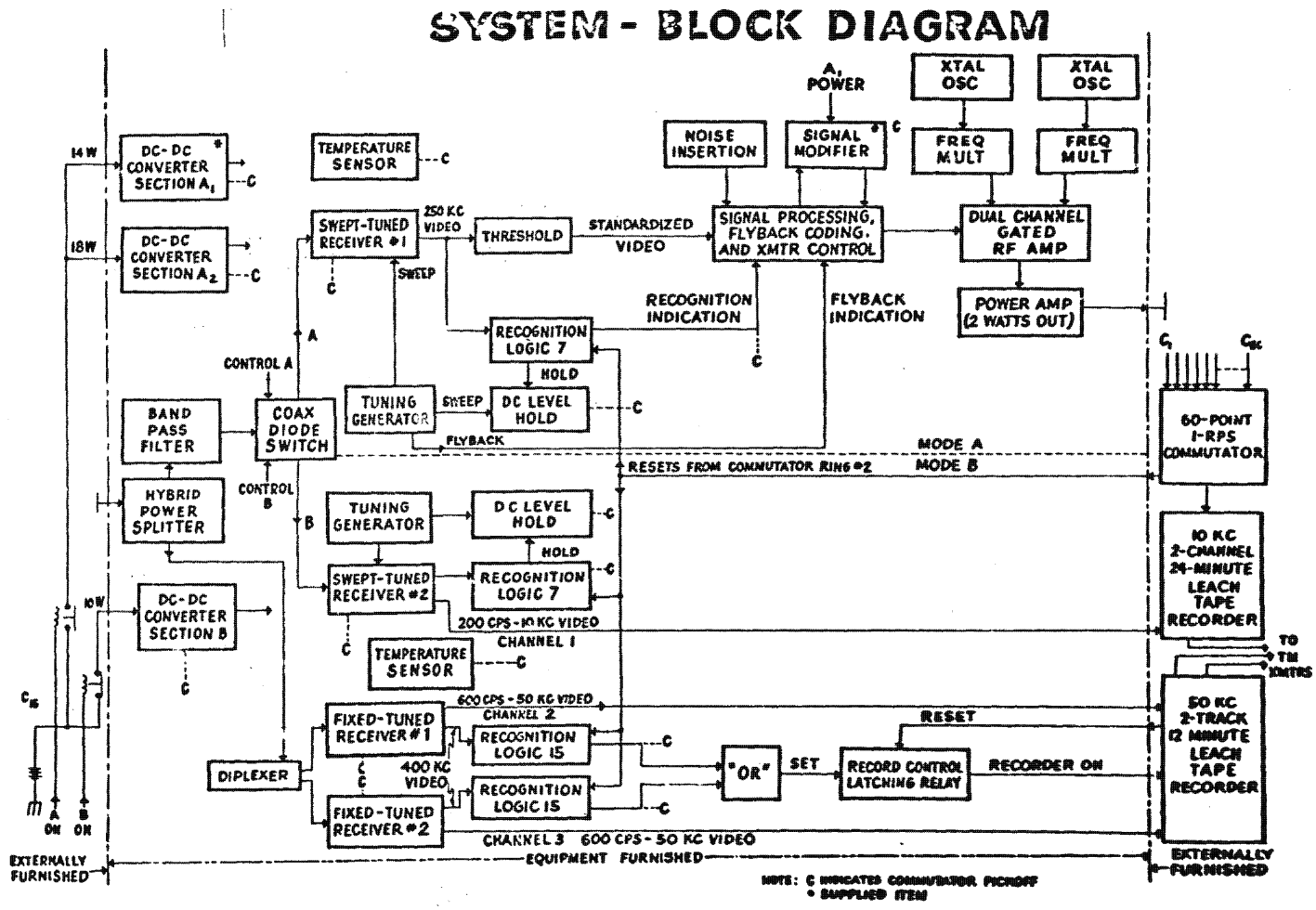


FIGURE 1. Systems 1 and 2.

narrow-band recorder operates in all cases of Mode B to provide storage for the commutated data and the 10-kc video from the sweeping receiver.

1.3 General System Comments

The recognition sensitivity (the input power level at which recognition occurs) is adjustable with the logic circuit threshold adjustment. In order to decrease the false alarm rate and thereby minimize unnecessary operation of the wide-band tape recorder on false signals, the fixed-tuned logic thresholds were set higher than those of the sweeping receivers. The fixed-tuned receivers are also slightly less sensitive due to the greater IF bandwidth. It is therefore possible for the sweeping receiver channel to recognize a signal which is of insufficient power to trigger the fixed-tuned recognition circuits.

2.0 Pundit 3

2.1 Mode A - Service Test Models 4, 5 and 6

Two major modifications of the original system concept were incorporated in the follow-on systems. Except for these changes, the design and operation are the same for all Pundit systems. Figure 2 shows the block diagram for the later system known as Pundit 3 and its back-up unit.

In Mode A, the original analog tuning generator (capacitor-discharge type) was replaced with a digitally-stepped tuning generator. The receiver is tuned from 80 to 60 Mc in 128 discrete steps, and the sweep time was increased by a factor of four to nominally 6.4 seconds. The change to a digital generator allows the receiver to lock on a qualifying signal. When a recognition output is generated by the signal qualification circuitry, the

frequency of the receiver is held for a period of about 15 seconds. At the end of this pause, the receiver skips approximately one bandwidth (to minimize successive lock-ons from the same signal) and resumes the frequency sweep. The flyback indication duration has been increased from 5.0 to 50.0 ms in these systems.

Additional advantages of the digital approach are more accurate matching of the receiver tuning curve to provide a more nearly linear frequency-versus-time plot for the receiver, and more stable sweep times over the operating temperature range.

The power output of the retransmitted Mode A signal was increased from a minimum of 2 watts to a minimum of 10 watts by the addition of a power amplifier unit which is driven by the original 2 watt transmitter.

The 10-kc video from the Mode A receiver will be recorded on the second track of the narrow-band recorder while the data from the signal modifier is being transmitted in real-time.

2.2 Mode B - Service Test Models 4, 5 and 6.

The Mode B swept-tuned receiver was eliminated entirely from the system concept, and was replaced with a third fixed-tuned receiver at 66 Mc. The new fixed-tuned receiver is identical in operation with the other Mode B receivers and signal recognition circuits.

2.2.1 Video Switching Logic. Since only two recorder tracks are available to record the wide-band video data, some method of switching the outputs of the three receivers to the two recorder inputs was necessary.

The logic circuitry as provided switches the first video

which contains a qualifying signal to the wide-band tape recorder. One of the remaining two video signals will be recorder on the remaining wide-band recorder channel as a filler signal. The identity of the filler signal is listed in Table 1. If a second signal is recognized at any time during the recorder running period, it will automatically replace the filler signal, as shown in Table 1.

Table 1

Three-Way Video Logic

First-Up	Action	Next-Up	Action and Inhibit
66	X	71	Y
66	X	76	X
71	--	66	Y
71	--	76	--
76	--	66	X
76	--	71	--

Condition	Recorder, Channel 1	Recorder, Channel 2
X	66	76
Y	71	66
-, or Command L	71	76

A single P-11 command disables the video select logic if such action becomes necessary due to excessive false alarming of the 66-Mc channel. When disabled, the video switch will revert to its normal position with only the 71- and 76-Mc signals going to (and allowed to start) the wide-band recorder. The 66-Mc video is permanently connected to the narrow-band

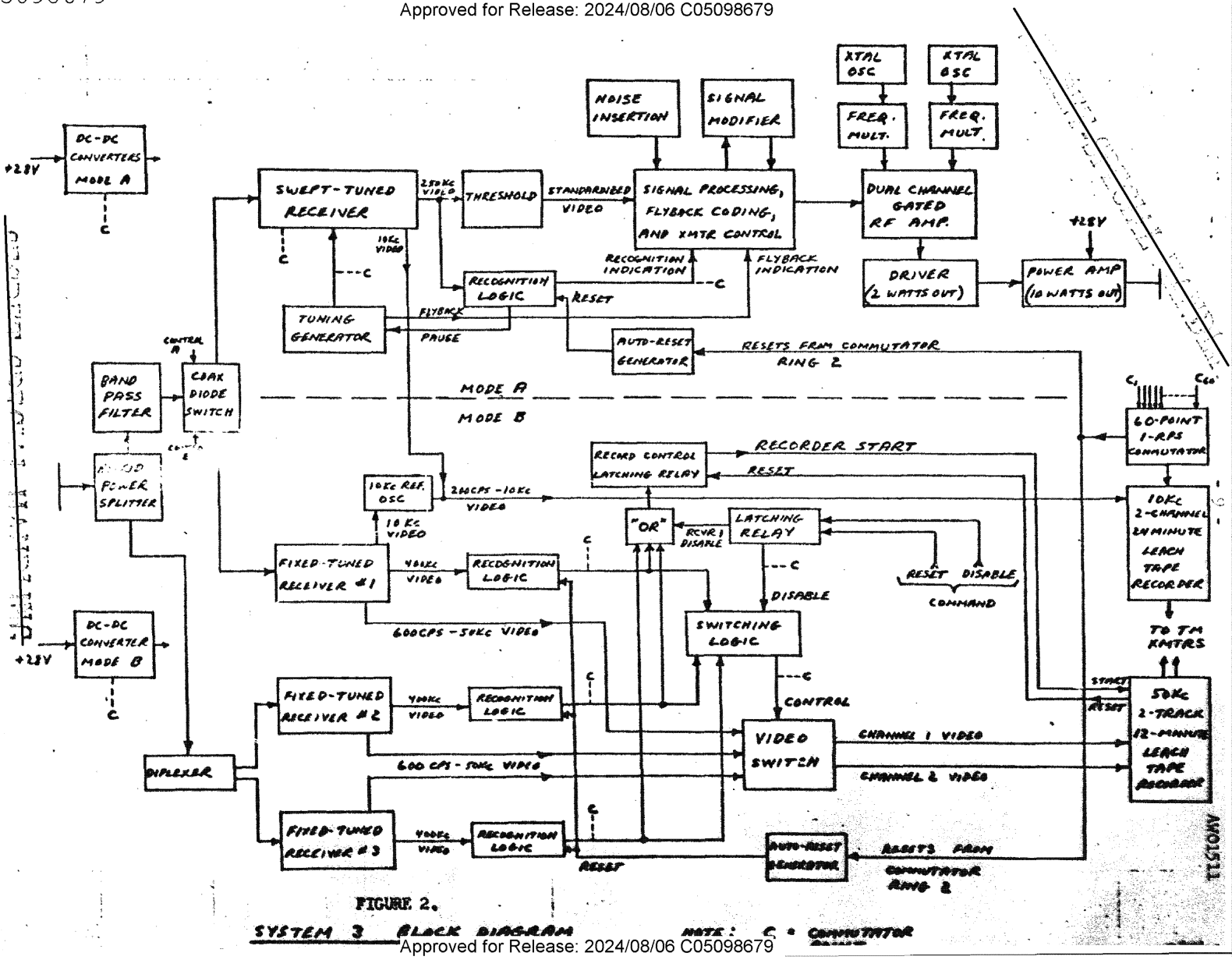


FIGURE 2.

SYSTEM 3 BLOCK DIAGRAM NOTE: C = COMMUTATOR

recorder. It will therefore be recorded on each mission, with or without recognitions, and will thus be monitored even in the disabled logic mode.

2.2.2 Recognition Logic Threshold. The acceptance threshold of each set of recognition logic was lowered in accordance with information derived from the first two Pundit operations. Lowering the thresholds of the fixed-tuned receiver logic while maintaining the 15-pulse count requirement allows the maximum sensitivity to be achieved in the presence of the existing environment. About 6 db of recognition sensitivity improvement was provided.

2.2.3 Self-Reset (Modes A and B). The Pundit 1 and 2 recognition logics require resets from the mechanical commutator at a nominal 1 per second rate for proper operation. Therefore, if the commutator should fail to run the logic would cease operation. Should this occur, the Mode A sweep pause, the Mode A flyback indicator, and the Mode B recorder start and video siwtching logic of Pundit 3 would also not operate. To remedy this, a free-running reset multivibrator with a nominal period of 1.5 seconds was provided which is normally synchronized with the commutator. Thus, while the commutator is running, the resets occur once per revolution, and if the commutator should stop, the multivibrator provides independent resets at an adequate 1 per 1.5 second rate.

3.0 Pundit 4.

Pundit 4 marks the separation of the Pundit system into two separate and nominally independent packages. Mode A and a new Mode C are in one

box and Mode B is in a second box. A block diagram of the system is shown in Figure 3.

3.1 Mode A.

The operation of Mode A has been modified only slightly from the previous systems. The RF input circuitry has been modified to provide a two-pole passive tunable preselector. This replaces the 60-80 Mc-bandpass filter of earlier systems. The noise figure of the Mode A receiver is a maximum of 7 db including preselector losses.

The digital tuning generator has been redesigned to provide 256 steps rather than the 128 of previous units. The sweep time has been lengthened to 10 seconds from 6.4 seconds. The additional steps will provide better frequency resolution. A further modification to the tuning generator inserts two additional steps immediately after recognition occurs. This shifts the center frequency about 160 kc beyond the initial lock-up point and provides a better centering of the signal within the receiver passband. The remainder of Mode A is identical to that provided for P3, including a 10 watt power amplifier for the transmitted signal. A calibration generator has been added as described in Section 3.2.5.

3.2 Mode C.

Mode C has been provided to allow an environmental survey of the 60-80-Mc frequency range. In particular, a catalog of FM and television signals as a function of frequency, location, power output, operational schedule, and antenna patterns is desired. Mode C will be used to obtain the necessary data for this survey by providing accurate measurement of power levels and frequencies of signals received by Pa[illegible]

are better than ±3 db relative power level measurement, better than ±6 db absolute power level measurement, and frequency accuracy to better than ±150 kc.

3.2.1 Power Splitting. Mode C uses a number of common components of Mode A and is capable of simultaneous operation with Modes A or B. When Mode C alone is energized, the components of Mode A which have high power drain (signal modifier unit, 2 watt driver, and 10 watt power amp) are turned off to conserve power.

The input RF for Mode C is derived from a 15 db directional coupler which allows simultaneous operation with Mode B with minimum loss of sensitivity to Mode B. The four modes which are possible are A + C, A + B, B, and C. When Mode A + C is operated, the -15 db leg of the directional coupler will be opened with a diode switch to avoid shunting of the antenna by the 50 ohm impedance of the directional coupler. The antenna in Mode A + C is connected directly to the Mode A preselector. Mode C system sensitivity will be on the order of -100 dbm with an equivalent noise figure of 22 db. This is considered more than adequate for the intended application.

3.2.2 Tuning Generator. Mode C uses the Mode A tunable preselector, tuning generator, RF head, mixer, and local oscillator. The Mode A tuning generator was redesigned to provide 256 nominally equal frequency steps to cover each 20 Mc sweep in 10 seconds. The timing source for this tuning generator is derived from the 25 kc crystal reference oscillator to allow exact reconstruction of the frequency sweep during data analysis. The

sweep linearization circuitry was redesigned to provide a more linear sweep to allow the desired frequency resolution.

3.2.3 Log IF and IF Attenuator. The 21.4-Mc IF from the Mode A mixer is sent through a crystal filter with 120-kc bandwidth to achieve the desired frequency resolution. A Log IF amplifier follows the crystal filter. The amplifier compresses a 30-db input range into a 20-db output range. The output is made nearly linear in db (i.e., 1.5 db in = 1.0 db out) to retain resolution for data analysis. A 30-db attenuator which precedes the IF amplifier is switched in and out on alternate frequency sweeps. This provides a total power handling range of 60 db above the -100 dbm system noise level. Thus, signals which saturate the IF amplifier with 0-db attenuation will be measurable on the next sweep when the 30-db attenuation will be in the line.

3.2.4 Detectors and Reference Tone. A detector on the IF output provides signal amplitude information which is used to modulate an IRIG channel 14 voltage controlled oscillator. A discriminator on the same IF output provides FM detection and a video output from 100 cps to 15 kc. A band reject filter from 7 to 13 kc in this video output will help to minimize beats between the video and the reference tone which might be in the range of the VCO. A 12.5 kc reference tone is derived from the existing 25 kc reference oscillator and added to the VCO output and the discriminator video output. The combined output is sent to the 25-kc recorder.

3.2.5 Additional Modifications. Solid-state power and control switching will be provided to accomplish the transition between

Modes A + C and C. Mode A + C will operate when +28 v power is supplied on two separate lines. Mode C will operate when power is removed from the appropriate one of the two lines.

Three crystal-controlled calibration frequencies have been provided in a calibration generator to provide an accurate frequency calibration and turned on sequentially at 5 minute intervals, therefore, all three will be checked within 15 minutes. Pulse modulation consisting of 1.5 microsecond pulses at a 3-kc rate will be provided as the calibration signal. The calibration signal level will be 20 to 30 db above system noise level. The duration of the test signal will be 15 seconds.

3.3 Mode B.

3.3.1 Power Splitting. In Mode B (and B + C) the antenna is connected to the directional coupler. The -2 db leg is connected to a quadriplexer which provides outputs at 61, 66, 71, and 76 Mc. Each output is sent to a receiver which is tunable over a narrow range around the frequency of interest. The quadriplexer has a nominal loss of 2 db in each channel and allows each receiver to achieve a noise figure of less than 8 db referred to the antenna input terminal.

3.3.2 Narrow-Scan Receivers. The four narrow-scan receivers which comprise Mode B and which replace the three fixed-tuned receivers of Pundit 3 are essentially identical in operation. The components of the typical 61-Mc receiver are indicated in block diagram of Figure 3. The narrow-scan receivers were designed to make maximum use of existing equipment and equipment designs, while providing a signal-seeking optimum-bandwidth

system. Each receiver incorporates the "fixed-tuned" Pundit RF head with 2-Mc bandwidth centered at the nominal target frequency. The mixer in the RF head will be supplied with a sequence of four L.O. frequencies. The resultant IF will be amplified with a 500-kc bandwidth, and the 250 kc video signal derived from the IF will be sent to the recognition circuitry. To provide frequency stepping across the band of interest, the four L.O. frequencies will be sequentially switched to the mixer. The normal dwell on each frequency is about 1 second. When the recognizer qualifies a valid signal, the L.O. switching will be stopped on the signal of interest. The 500-kc IF is sent through 5 narrow-band (120 kc) crystal filters which are stagger-tuned to cover the 500-kc IF passband. A diode stepping switch samples the output of each of the filters in turn, and the sampled IF is detected and sent to the four-way video switch to the recorder. The video is also sent through 3- and 6-kc audio filters. The output of these audio filters is used to stop the diode stepping switch on the IF filter which has the strongest 3- or 6-kc component.

3.3.3 Four-Way Video Switching Logic. A logic and video switching system switches to the recorder the video signals from the first two receivers which recognize a valid signal on each given mission. This unit will be similar in principle and operation to that designed for P3, but is more complex since it provides six possible combinations rather than the three combinations which were used for P3. The logic table for this video switching system is presented in Table 2. The recorder

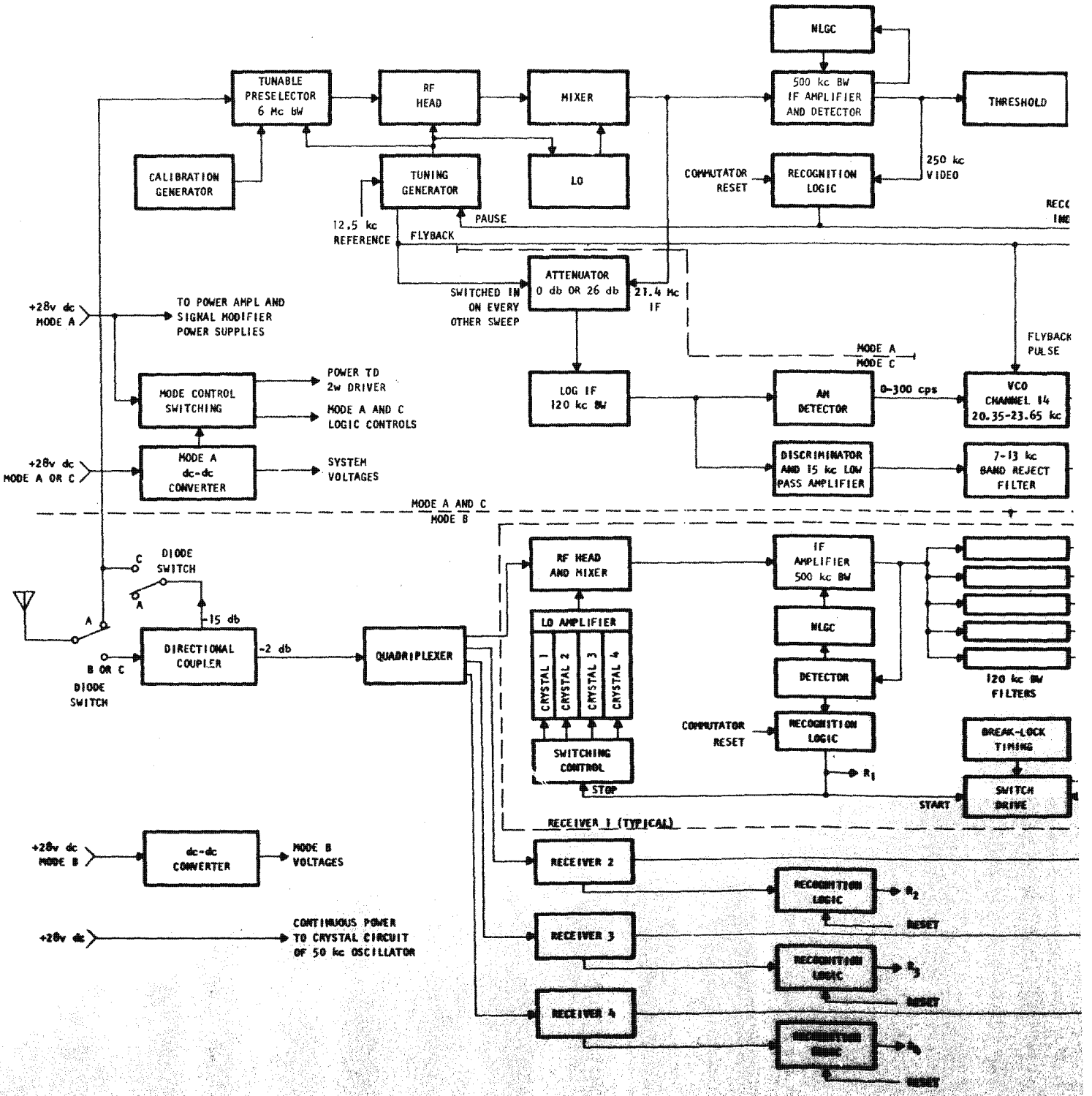
will normally be started by a recognition in any one of the four receiving channels.

Table 2

Four-Way Video Logic

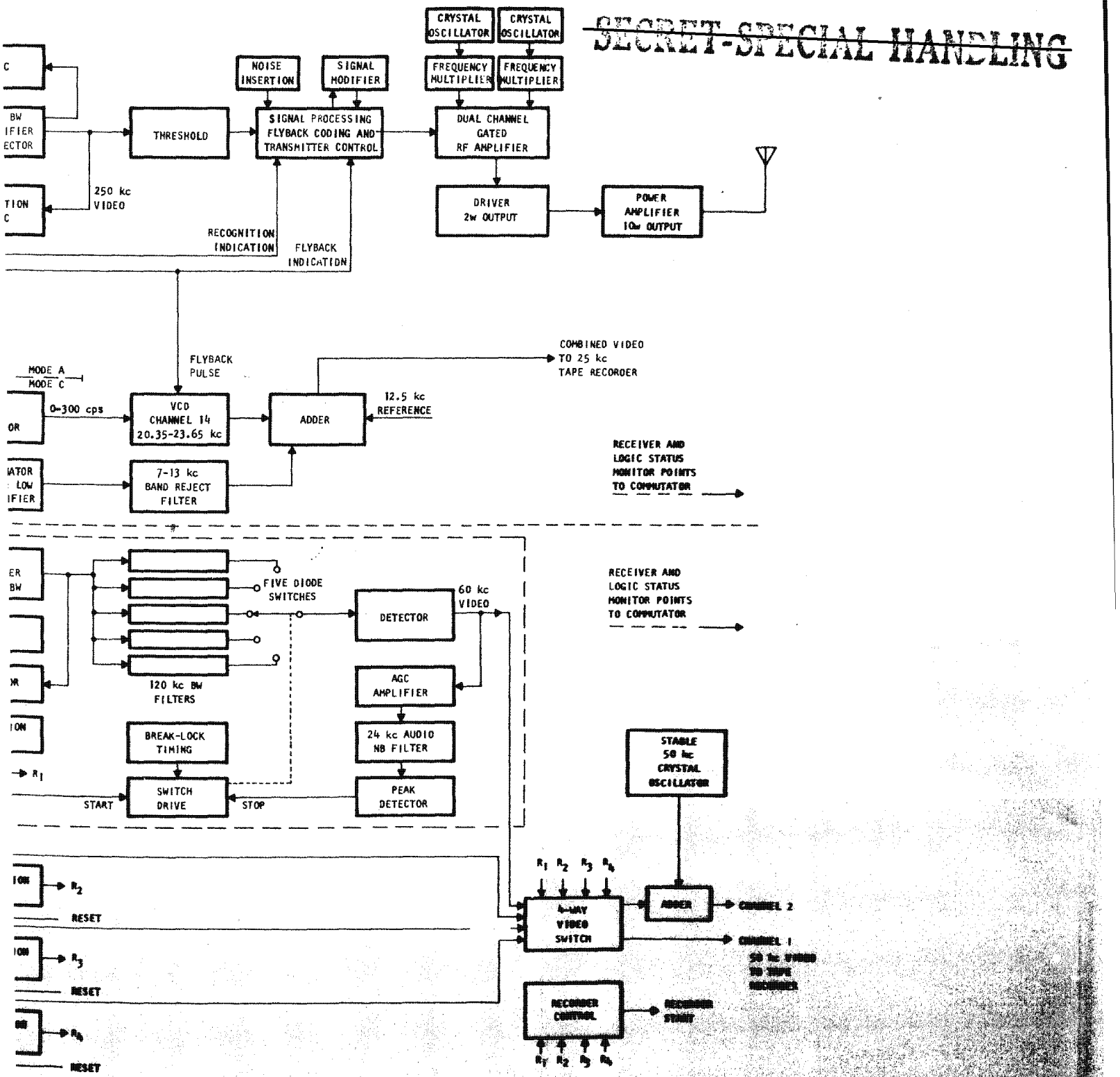
First-Up	Action	Next-Up	Action and Inhibit
61	Z	66	V
61	Z	71	W
61	Z	76	Z
66	X	61	V
66	X	71	Y
66	Y	76	X
71	--	61	W
71	--	66	Y
71	--	76	--
76	--	61	Z
76	--	66	X
76	--	71	--

Condition	Recorder, Channel 1	Recorder, Channel 2
V	66	61
W	71	61
X	66	76
Y	71	66
Z	61	76



GLASS HOUSE BLOCK DIAGRAM, SYSTEM IV

SECRET-SPECIAL HANDLING



IAGRAM, SYSTEM IV

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4.0 Antennas

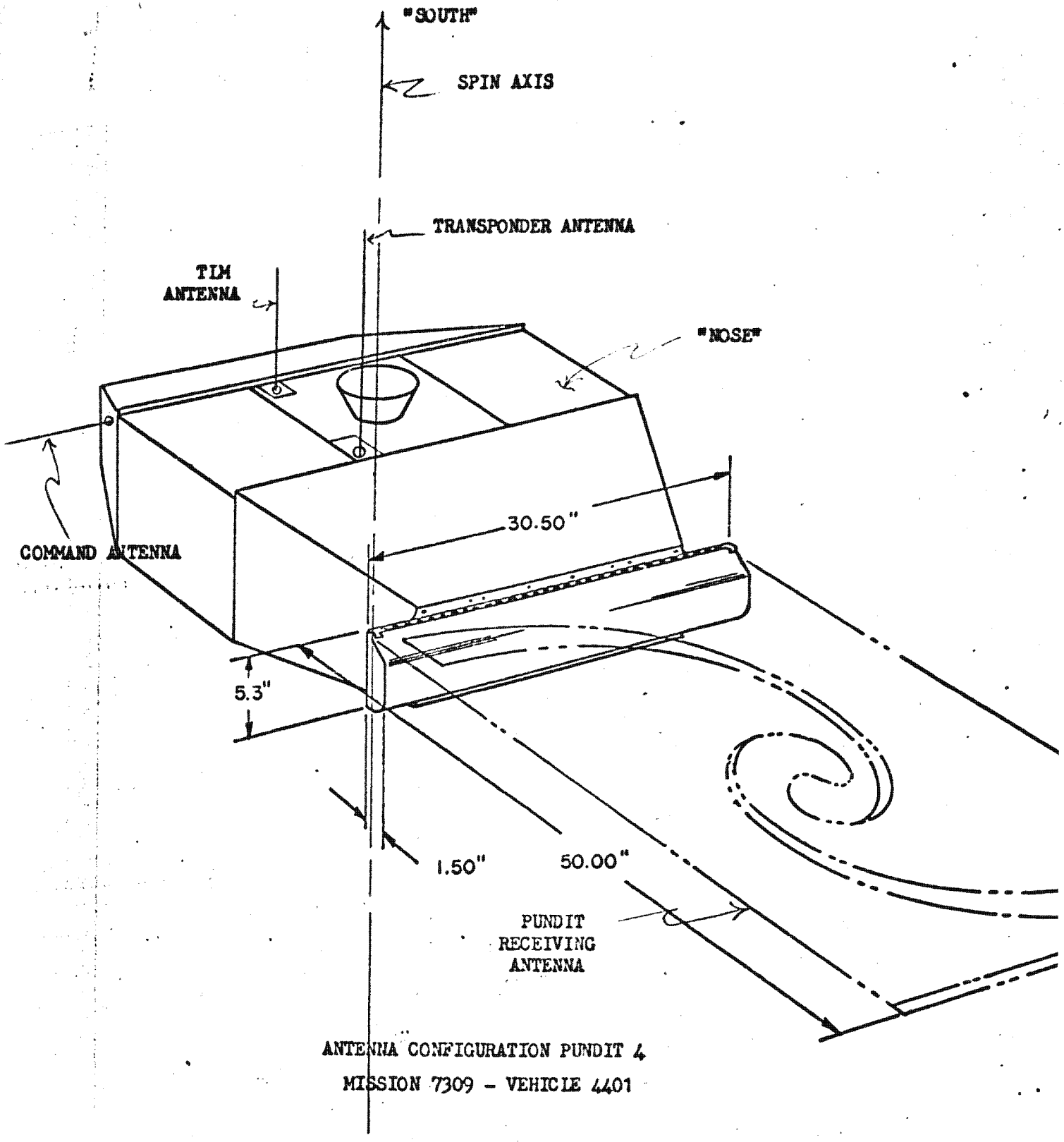
4.1 Receiving Antenna. The receiving antenna was redesigned to give better coverage, reduce antenna losses, and provide a better match for the receivers. A flexible metallized cloth type of antenna with a log-spiral antenna pattern adjusted to operate below 60 mc. was designed. With its natural broadband characteristics this antenna can operate up to several hundreds of megacycles. V.S.W.R. throughout the 60-80 mc. band is less than 2:1.

The radiation pattern of the receiving antenna is shown in Figure 5. The "nose" of the vehicle is in the direction of the "south" pointing end of the spin axis, shown on Figure 4. Thus a wide range of look angles can be achieved in the major lobe of the pattern when passing over the area of interest.

4.2 Transpond Antenna. The transpond antenna is a monopole located on the face of the vehicle as shown in Figure 4, and points in the "south" direction. This location is the best for read-out over a wide range of elevation angles and latitudes for the orientation of the P-11 vehicle. Figure 6 is the radiation pattern of the transpond antenna.

4.3 Command Antenna. The location of the command antenna has been unchanged. Figure 7 shows the radiation pattern of the command antenna.

4.4 The T/M antenna is shown on Figure 4 for reference only.



ANTENNA CONFIGURATION PUNDIT 4

MISSION 7309 - VEHICLE 4401

Figure 4.

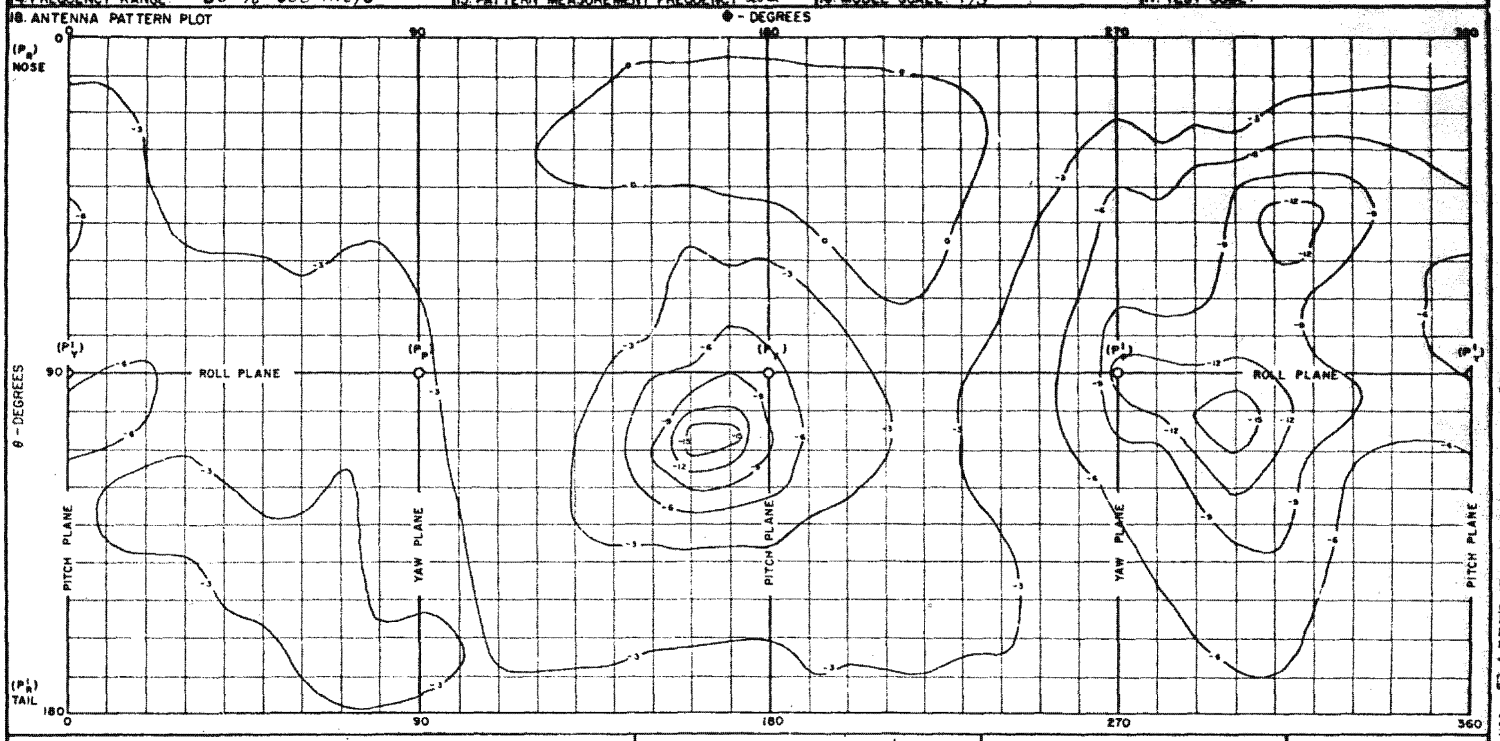
ANTENNA PATTERN
(OTHER)

1. SECURITY CLASSIFICATION
2. PAGE
3. DATE
4. REPLACES PAGE(s)
DATED:

5. PROGRAM TITLE: P-11 VEHICLE ANTENNA
6. PROGRAM REQUIREMENT CODE
7. SYSTEM CODE
8. CONTRACTOR

10. INSTRUMENTATION SYSTEM: ROTATING DIPOLE FEED
11. ANTENNA TYPE: PLANAR EQUIANGULAR SLOT SPIRAL
12. ANTENNA POLARIZATION: CIRCULAR
13. POLARIZATION PLOTTED: LINEAR
14. FREQUENCY RANGE: 60 to 600 mc/s
15. PATTERN MEASUREMENT FREQUENCY: 525 Mc
16. MODEL SCALE: 1/3
17. TEST CODE:

18. ANTENNA PATTERN PLOT



PUNDIT RECEIVING ANTENNA PATTERN MISSION 7309

19. PHYSICAL LOCATION OF POINT P'_V:

1. SECURITY CLASSIFICATION
9. REVISION NO.

AMPLITUDE PLOTTED IN DECIBELS RELATIVE TO ISOTROPIC LEVEL
NOTES: POLARIZATION PLOTTED IS THE MAXIMUM LINEAR POLARIZATION

LOCKHEED AIRCRAFT CORPORATION
MEASURED BY: BULLOCK
DATE MEASURED: 1/10/64
A-272
PATTERN 1 OF SET OF 1

AM05211

FIGURE 5

~~SECRET-SPECIAL HANDLING~~

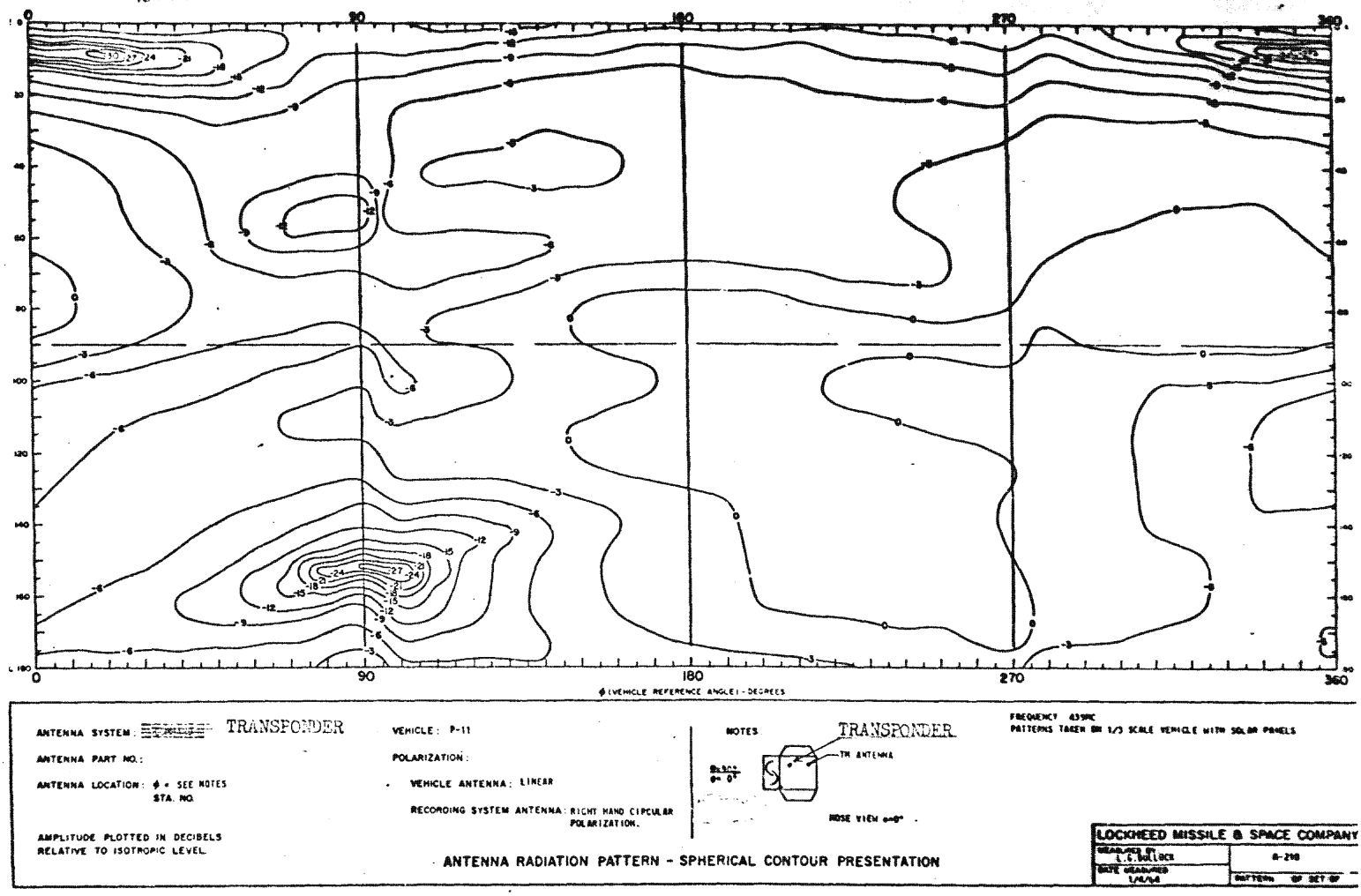


FIGURE 6. TRANSPONDER ANTENNA PATTERN

~~SECRET-SPECIAL HANDLING~~

AH0157

	NAME	
Prepared		
Checked		
Approved		

LOCKHEED MISSILES & SPACE COMPANY
A GROUP DIVISION OF LOCKHEED AIRCRAFT CORPORATION

TITLE COMMAND ANTENNA PATTERN
MISSION 7399
VEHICLE 4-01

Page
Model
Report No.

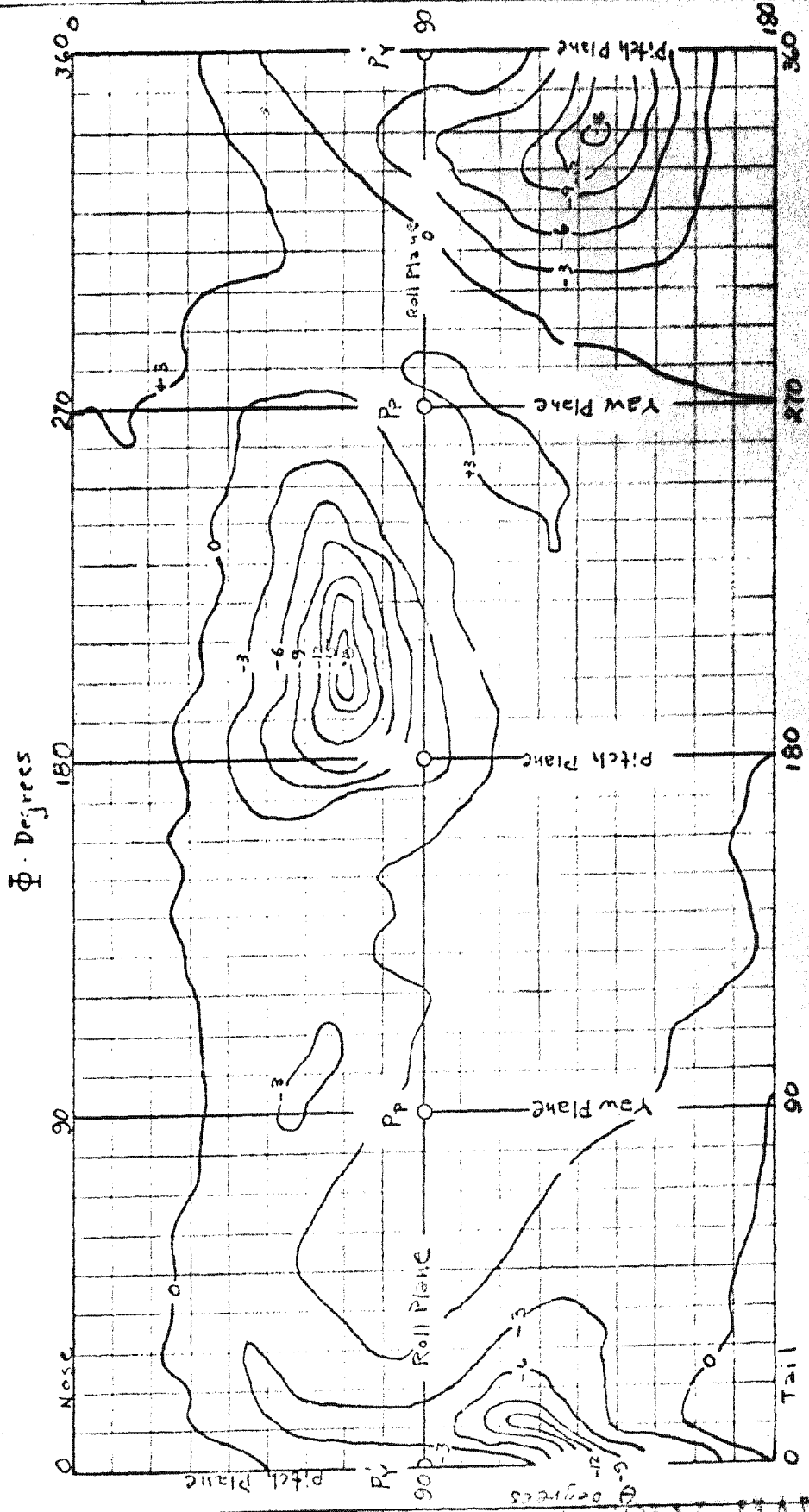


FIGURE 7.

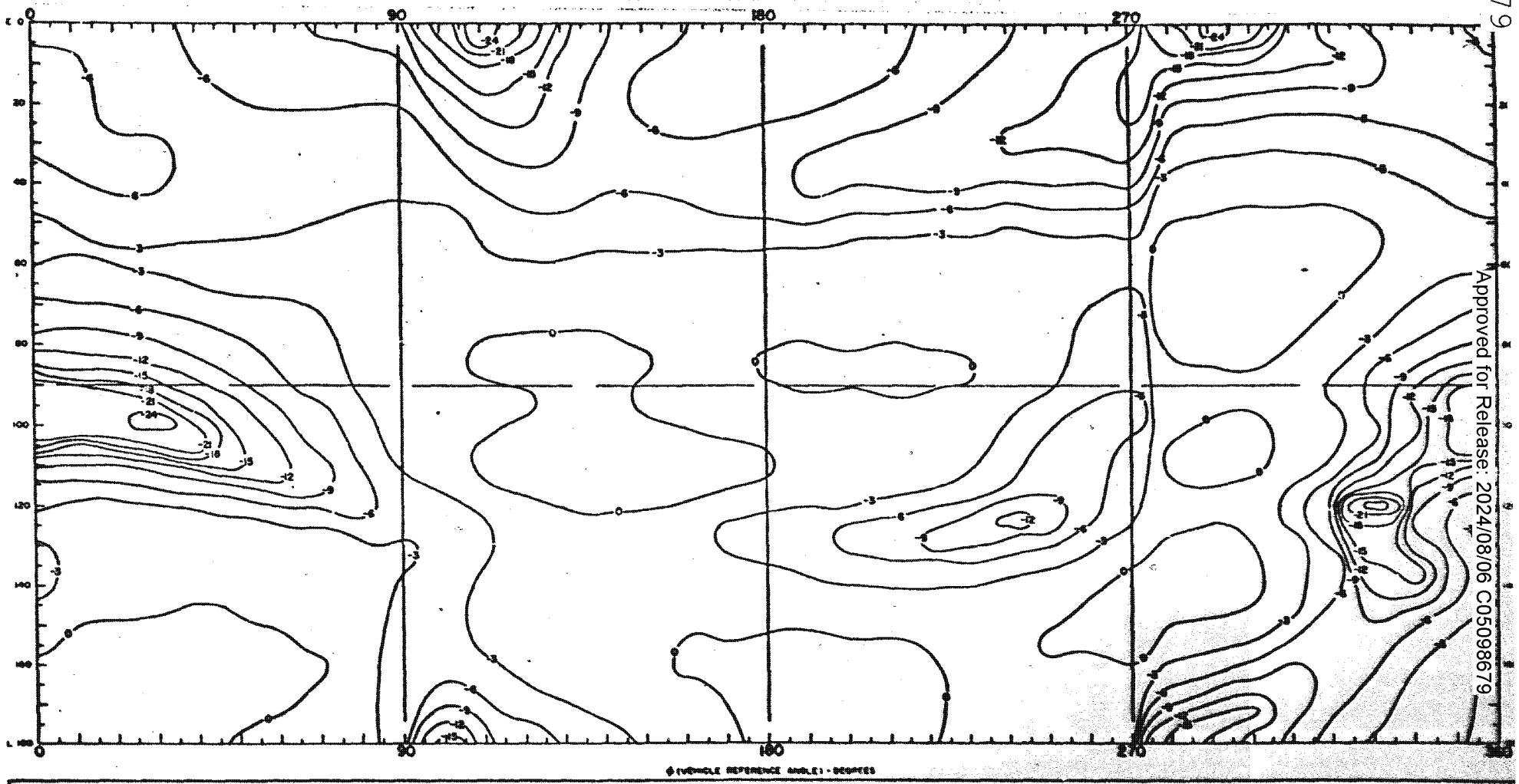


FIGURE 9 TELEMETERING ANTENNA PATTERN

Approved for Release: 2024/08/06 C05098679

5.0 Recorders. Two Leach recorders are used with Pundit 4. They are connected as shown in the system block diagram, Figure 8.

5.1 Narrow-band Recorder. Recorder #1 is a two-track direct recording tape recorder with a normal 4:1 read-out/read-in ratio. It has a storage time of 24 minutes with a nominal maximum frequency response of 25 kc/s. It can additionally be commanded to change to a 1:1 read-out/read-in mode of operation. When this is done, there is a corresponding increase in read-in frequency response to 100 kc/s.

This recorder is normally used for Mode A and Mode C read-ins utilizing one track for analog data from Mode A and Mode C, and the second track for commutated payload and other vehicle status data.

In the event of failure of Recorder No. 2, Recorder #1 will be commanded to a 1:1 mode of operation. Upon recognition, Recorder No. 1 will start and continue to read-in for a period of six minutes.

5.2 Wide Band Recorder. Recorder No. 2, the wide-band recorder, is a two-track direct-recording tape recorder with a storage time of 12 minutes and a nominal maximum frequency response of 50 kc/s. It has a read-out/read-in ratio of 2:1. It also has the capability to be commanded for a 1:1 read-out/read-in ratio, but is not so connected for Pundit 4. However, it can be commanded to switch to accept the normal inputs of Recorder No. 1 in the event of No. 1 failure, and will read-in for a period of 12 minutes. The table below shows the comparative failure rates.

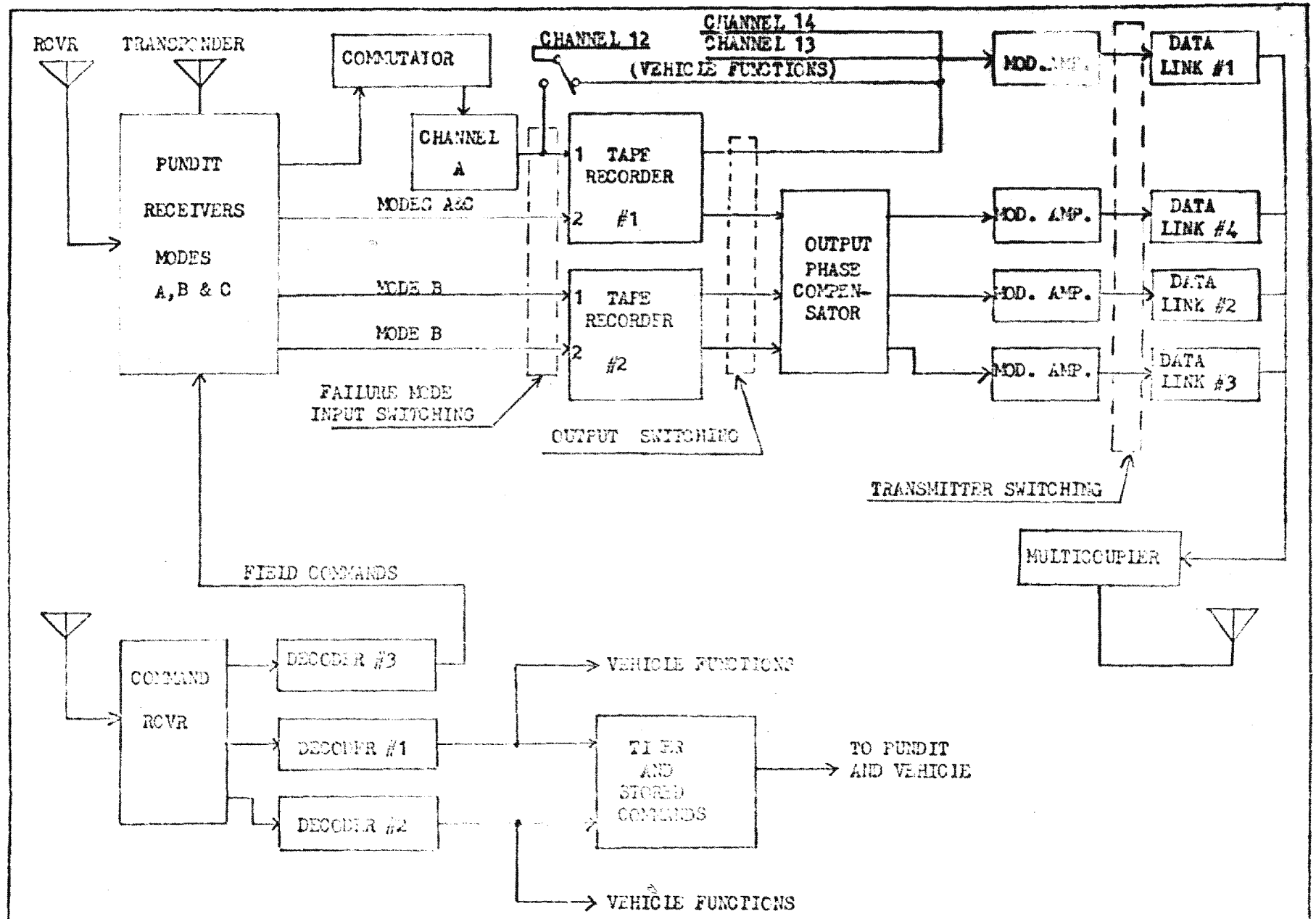


FIG.8 BASIC BLOCK DIAGRAM - PUNDIT SYSTEM, MISSION 7309

Tape Recorder Number	Normal Mode R/I	Normal Mode R/O	Recorder #1 Failure R/C	Recorder #1 Failure R/O	Recorder #2 Failure R/I	Recorder #2 Failure R/O
1.	24 min. 25 kc/s	6 min. 100 kc/s	Inputs switched to #2		6 min. 100 kc/s	6 min. 100 kc/s
2.	12 min. 50 kc/s	6 min. 100 kc/s	12 min. 50 kc/s	6 min. 100 kc/s	Inputs switched to #1	

Additional protection against losing data because of data link transmitter failure is provided by being able to command data transmitter switching in pairs. Thus the preferred data may be selected for transmission to the ground station.

6.0. Command System. The command receiver is a V.H.F. tone-modulated receiver operating at 141.54 mc/s. Three decoders are provided, each one having four tone filters. One tone is used for address, leaving eleven tones to execute functions, seven of which are available at the Agena tracking stations and four at the field sites.

In order to provide the necessary command capability for Mission 7309, it was necessary to expand the use of the seven commands at the Agena stations by forming two Command Sequence matrices as shown in the Payload Command-Function Summary. In this way four read-in time delays were made selectable from the stored program control unit, as well as Mode selectors. Only those commands which are applicable to the payload or its associated equipment are listed.

The tone frequency for each command is listed as well as the function it performs and bears a Z designation with a numerical digit. Where two commands are listed and one bears an A or B designation, the numerical portion of the listing is the governing factor in indicating tone frequency.

In normal practice, when the payload has been commanded for a delayed read-in in any mode, the command receiver is disabled when telemetry is turned off. It is not then possible for intentional or spurious commands to affect the designated tasking of the vehicle. Upon completing the read-in, the command receiver is enabled and a read-out command will be accepted by the system. Therefore, for tasking from the field sites, some prior knowledge of such tasking must be transmitted to the Agena tracking station so that the command receiver will be enabled to accept a command from the field sites.

Only one command at a time can be given to task the vehicle at the field sites. Since the receiver is disabled after the first function command is executed, additional commands will not be accepted by the system. Therefore, Modes B and C cannot be tasked simultaneously from the field sites, but can be tasked simultaneously from the Agena tracking stations.

For purposes of ease in communication in designating tasking from the Agena stations, the following nomenclature correlation has been agreed upon by LMSC and the Air Force.

Designate Mode	Equivalent to Mode
A	A & C
B	B
C	C
D	B & C

7.0 Transponder. The transponder is a frequency-shift-keyed transmitter operating for alternately keyed conditions at frequencies of 138.5 mc/s and 139.5 mc/s, with a nominal power output of 10 watts. Transponding time duration is fixed at 24 minutes.

8.0 Encipherment Equipment. No change has been made in this equipment. Output bit rate remains at 200,000.

9.0 Vehicle. The vehicle will be a dual burn P-11 subsatellite which will be launched into a circular orbit at 270 nautical miles altitude. The spin axis will be closely aligned with the spin axis of the earth. At this altitude the drag life expectancy may be well in excess of one year. Orbit inclination and delay times are not available at time of this report.

APPENDIX 1

MISSION 7309

VEHICLE 4401 PAYLOAD COMMUTATOR SCHEDULE

COMMUTATED CHANNEL NO. A LINK NO. I COMM. TYPE S/S NO. ___ RATE 1 RPS POINT 60

COMM POS	MEASUREMENT	RANGE VOLTS	
1	Cal 1/2	2.5v	
2	OTE #1 'A' RF Head Temp.	1.25v to 3.0 v	
3	OTE #2 'B' Base Plate Temp.	0.4-4.5v	
4	OTE #3 'A' Recognition	0.5 or 5.0v	0.5v = Recognition
5	OTE #36 RF Cal. Mon.	1.2 or 3.0v	
6	OTE #4 'A' Freq.Monitor	0.5-4.5v	
7	OTE #5 'A' Rcvr Noise Lev.	2.0v Nominal	
8	OTE #6 'B4' Rcvr Noise Lev.	1.5v Nominal	
9	OTE #7 'B1' Recognition	0.5 or 5.0v	0.5v = Recognition
10	OTE #8 'B1' Rcvr Noise Lev.	1.5v Nominal	
11	OTE #9 'B2' Recognition	0.5 or 5.0v	0.5v = Recognition
12	OTE #10 'B2' Rcvr Noise Lev.	1.5v Nominal	
13	OTE #11 'B3' Recognition	0.5 or 5.0v	0.5v = Recognition
14	OTE #12 'B3' Rcvr Noise Lev.	1.5v Nominal	
15	OTE #13 'B4' Recognition	0.5 or 5.0v	0.5v = Recognition
16	Repeat Pos. #6		
17	OTE #14 'A' Input Volt. Mon.	3.4v @ 26.5 VDC IN	
18	Spare		
19	OTE #15 'B' Input Volt. Mon.	3.6v @ 28 VDC IN	
20	OTE #16 'B1' L.O.	0.5 or 1.8v or 3.1v or 4.5v	
21	Spare		
22	OTE #17 'B2' L.O.	0.5 or 1.8v or 3.1v or 4.5v	
23	Spare		

COM POS	MEASUREMENT	RANGE VOLTS
24	OTE #18 'B3' L.O.	0.5 or 1.84 or 3.18 or 4.5v
25	Spare	
26	Repeat Pos. #6	
27	OTE #19 'B4' L.O.	0.5 or 1.84 or 3.18 or 4.5v
28	OTE #20 Sig. Modif. Volt. Mon.	1.7v @ 28 VDC IN
29	OTE #21 'B1' IF	0.0 or 0.9 or 1.8 or 2.7 or 3.6 or 4.5v
30	Cal +	5.0v
31	Mode A or C Operation Monitor	0.0v = Mode C. 4.2v = Mode A
32	Attenuator Condition	0.5 or 2.1v 0.5 = Atten. In. 2.1v = Atten. Out.
33	OTE #23 'B2' IF	Same as 'B1' IF
34	OTE #24 'B' 10 Volt Mon.	3.0v Nominal
35	OTE #25 'B3' IF	Same as 'B1' IF
36	Repeat Pos. #6	
37	OTE #26 'B4' IF	Same as 'B1' IF
38	OTE #27 'A' 10v Mon.	3.15v Nominal
39	Spare	
40	OTE #28 'B' Vid. Switch X	0.0 or 1.0v
41	OTE #29 'B' Vid. Switch Y	0.0 or 1.0v
42	GT Fuse Mon.	0-5v P11 Vehicle Monitors
43	GT Status Mon.	0-5v " " "
44	+28v Unreg. Mon.	0-5v " " "
45	OTE #30 'B' Vid. Switch V	0.0 or 1.0v
46	Repeat Pos. #6	
47	OTE #31 'B'Vid. Switch W	0.0 or 1.0v

COM POS	MEASUREMENT	RANGE VOLTS
48	OTE #32 'B' Vid. Switch Z	0.0 or 1.0v
49	TRG #1 4 Sec. Mon.	8 Equally Spaced Steps (0-5v)
50	TRG #2 32 Sec. Mon.	Same as TRG #1
51	Battery Temp. (Center)	P11 Vehicle Monitor 0.5v
52	TRG #3 256 Sec. Mon.	Same as TRG #1
53	TRG #4 2048 Sec. Mon.	Same as TRG #1
54	OTE #33 'A' Base Plate Temp.	0.9v to 3.7v
55	TRG #5 16,384 Sec. Mon.	Same as TRG #1
56	Repeat Pos. #6	
57	Cal Z	0.0v
58	Sync	5.3v
59	Sync	5.3v
60	Sync	5.3v

APPENDIX II

PAYLOAD COMMAND-FUNCTION SUMMARY

Ref.: Mission 7309
Command Sequence A

Command	Freq. (KC)	Function
--	5.4	Address
Z 1	3.9	T/M on: Select command sequence "A". Initiate R/O deck, Payload Timer. Reset Aux. Timer No. 3, back up to failure mode, command receiver.
Z 4	4.2	Payload selector No. 1, (#1 R/I time delay). Initiate Deck #2 of payload timer. Enable command receiver off.
Z 5	4.5	P/L selector No. 2 (#2 R/I timer delay). Initiate deck #2, payload timer. Enable command receiver off.
Z 6	4.8	P/L selector #3 (#3 R/I time delay). Initiate Deck #2 of P/L timer. Enable command receiver off.
Z 7	5.1	
Z 7 + 4A		P/L selector #4 (#4 R/I time delay). Initiate Deck #2 of P/L timer. Enable command receiver off.
Z 7 + 5A		Select P/L Mode A. Tape Recorder Readout "ON"
Z 7 + 6A		Select P/L Mode B. Tape Recorder Readout "ON"

Command Sequence B

Command	Freq. (KC)	Function
Z 3	5.7	T/M On.: Select command sequence B. Initiate Deck #1 of P/L Timer.
Z 7 + 5B		Select Payload Mode C. Tape Recorder ON
Z 7 + 6B (Before SPC-11)		Tape Recorders Normal Position
Z 7 + 6B (After SPC-11)		Tape Recorder Transfer. Input and Output: 4:1 to 1:1 transfer

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Commands Independent of Command Sequences A and B

Z 2	**6.0**	Main Reset T/M off Tape Recorders Stop
H (Z 8)	**2.7**	Mode A - Transpond ON. Tape Recorder #1 Readin ON. Command Receiver OFF
J (Z 9)	**3.0**	Mode B - ON. Tape Recorder #1 ON. Tape Recorder #2 enable to R/I upon recognition. Command Receiver "OFF"
K (Z10)	**3.3**	Mode B - ON. Tape Recorders #1 and #2 ON. Command Receiver OFF
L (Z11)	**3.6**	Mode C - ON. Tape Recorder #1 ON. Command Receiver OFF

The command system for Mission 7309, vehicle 4401, utilizes two matrices, or command sequences to achieve the necessary command capability. This summary includes only those commands which affect P/L operation. A detailed description of all commands will be furnished with the Vehicle Operations Plan as soon as it is released.

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 ~~SECRET-SPECIAL HANDLING~~

MISSION 7309

NOMINAL VOLTAGE VALUES FOR MODES A/C FUNCTIONS

STM NO. 7A

Commutator Pos. No.						
2	OTE #1 'A' R.F. Head Temp	2.2 to 4.1 V				
6	OTE #4 'A' Freq. Monitor (Also Nos. 16, 26, 36, 46, 56)	0.4 to 4.5				
7	OTE #5 'A' Receiver Noise Level	2.0 V				
54	OTE #33 'A' Base Plate Temp.	0.3 to 5.0 V				
		Yes	No			
4	OTE #3 Recognition	0.75	4.95 VDC			
		Cal Off	Frequency (MC/S) 61.0	69.5	79.5	
5	OTE #36 R.F. Calibrate	0 volts	1.0 V	2.0 V	3.0 V	
		Mode C	Mode A			
31	Mode A or C Operation Monitor	0 V	4.2 V			
		Atten. In	Out			
32	Attenuator Condition	0.5	2.9			

~~SECRET-SPECIAL HANDLING~~

MISSION 7309

NOMINAL VOLTAGE VALUES FOR MODES A/C FUNCTIONS

STM NO. 8A

Commutator Pos. No.					
2	OTE #2 'A' R.F. Head Temp	2.16 to 4.0 V DC			
6	OTE #4 'A' Freq. Monitor (Also Nos. 16, 26, 36, 46, 56)	0.48 to 4.60			
7	OTE #5 'A' Receiver Noise Level	2.0 V			
54	OTE #33 'A' Base Plate Temp.	0.33 to 5.0 V			
4	OTE #3 Recognition	Recognition 0.6 V	No 4.8 V		
5	OTE #36 R.F. Cal	Cal Off 0 volts	Frequency (MC/S) 61.0 1.0 V	69.5 2.0 V	79.5 3.0 V
31	Mode A or C Operation Monitor	Mode C 0 V	Mode A 4.2 V		
32	Attenuator Condition	Atten: In. 0.5	Out 2.9		

MISSION 7309

NOMINAL VOLTAGE VALUES FOR MODE B FUNCTIONS

STM NOS. 7B AND 8B

Commutator Pos. No.	Measurement	LO-1 (fc+750 kc) ±250 kc	LO-2 (fc+250 kc) ±250 kc	LO-3 (fc-250 kc) ±250 kc	LO-4 (fc-750 kc) ±250 kc
20	OTE #16 Receiver B-1 L.O.	0.6 V DC	1.3	2.1	2.8
22	OTE #17 Receiver B-2 L.O.	0.6 V DC	1.3	2.1	2.8
		LO-1 (fc-750 kc) ±250 kc	LO-2 (fc-250 kc) ±250 kc	LO-3 (fc+250 kc) ±250 kc	LO-4 (fc+750 kc) ±250 kc
24	OTE #18 Receiver B-3 L.O.	0.6 V DC	1.3	2.1	2.8
27	OTE #19 Receiver B-4 L.O.	0.6 V DC	1.3	2.1	2.8

Note: Normal direction of Local Oscillator stepping is from position LO-1 towards position LO-4.

120 kc Bandpass Monitor

		120 kc Crystal Filter Monitors				
		Highest (IF-1)	Upper (IF-2)	Middle (IF-3)	Lower (IF-4)	Lowest (IF-5)
29	OTE #21 'B1' IF	0.3	0.8	1.4	2.0	2.9
33	OTE #23 'B2' IF	0.3	0.8	1.4	2.0	2.9
35	OTE #25 'B3' IF	0.3	0.8	1.4	2.0	2.9
37	OTE #26 'B4' IF	0.3	0.8	1.4	2.0	2.9

FIXED FREQUENCY RECEIVERS
DESIGN CENTER FREQUENCIES (fc)

B_1 _____ 61 mc B_3 _____ 71 mc

B_2 _____ 66 mc B_4 _____ 76 mc

MISSION 7309

NOMINAL VOLTAGE VALUES FOR MODE B FUNCTIONS

STM NOS. 7B AND 8B

Recognition

Commutator Pos. No.	Measurement	No	Yes
9	OTE # 7 'B1' Recognition	4.5 V DC	0.5 V DC
11	OTE # 9 'B2' Recognition	4.5 V DC	0.5 V DC
13	OTE #11 'B3' Recognition	4.5 V DC	0.5 V DC
15	OTE #13 'B4' Recognition	4.5 V DC	0.5 V DC
		On	Off
40	OTE #28 'B' Video Switch X	1.1 V DC	0.2 V DC
41	OTE #29 'B' Video Switch Y	1.1 V DC	0.2 V DC
45	OTE #30 'B' Video Switch V	1.1 V DC	0.2 V DC
47	OTE #31 'B' Video Switch W	1.1 V DC	0.2 V DC
48	OTE #32 'B' Video Switch Z	1.1 V DC	0.2 V DC

Time Reference Generator Calibration
Voltage Values For All Modes

Commutator Pos. No.	49	50	52	53	55
TRG. No.	1	2	3	4	5
Step Increment	4 Sec.	32 Sec.	256 Sec.	2,048 Sec.	16,384 Sec.
Output Volts					
5.0	0	0	0	0	0
4.2	4	32	256	2,048	16,384
3.6	8	64	512	4,096	32,768
2.9	12	96	768	6,144	49.152
2.1	16	128	1,024	8,192	65,536
1.5	20	160	1,280	10.240	81,920
0.7	24	192	1,536	12,288	98,304
0.0	28	224	1,792	14,336	114,688

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MISSION 7309

NOMINAL VOLTAGE VALUES FOR MODE B FUNCTIONS

STM NOS. 7B AND 8B

Mode B-Receiver Noise Level Monitors

Commutator Pos. No.	Measurement	Unit No. STM - 7B Output Volts	Unit No. STM - 8B Output Volts
8	OTE # 6 'B4' Receiver Noise Level	2.0	2.3
10	OTE # 8 'B1' Receiver Noise Level	1.85	2.25
12	OTE #10 'B2' Receiver Noise Level	2.0	2.1
14	OTE #12 'B3' Receiver Noise Level	1.85	2.4

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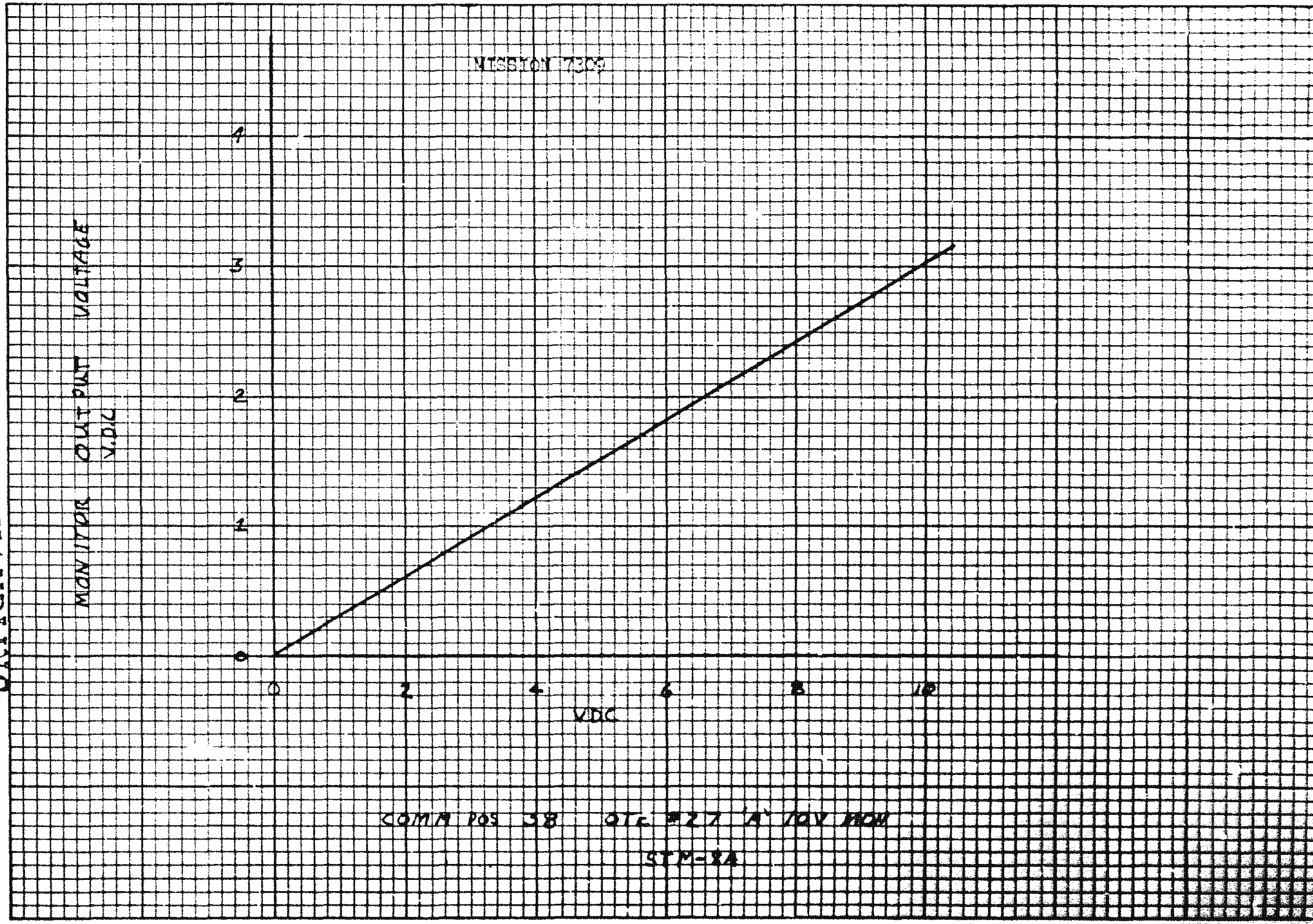

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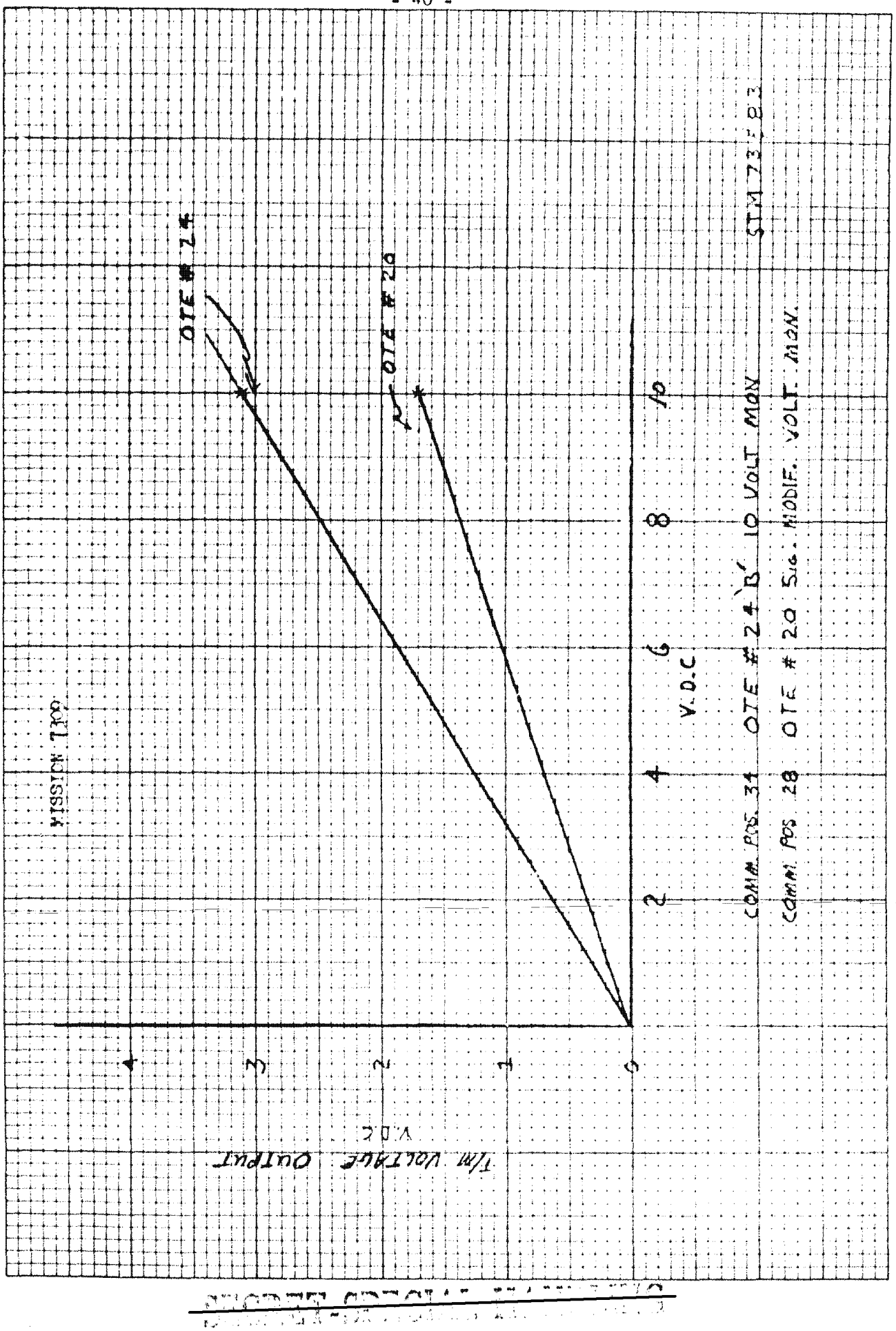

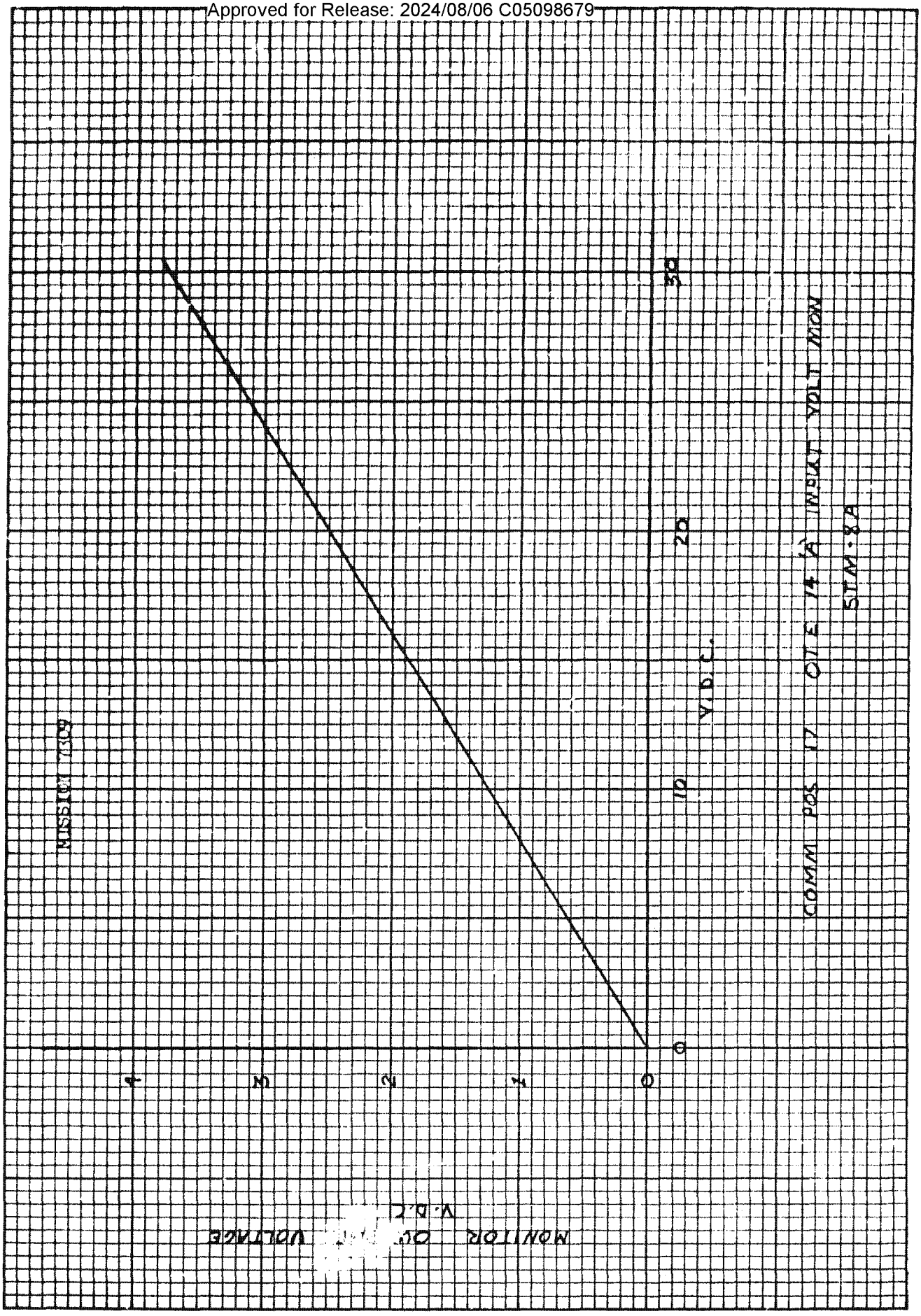

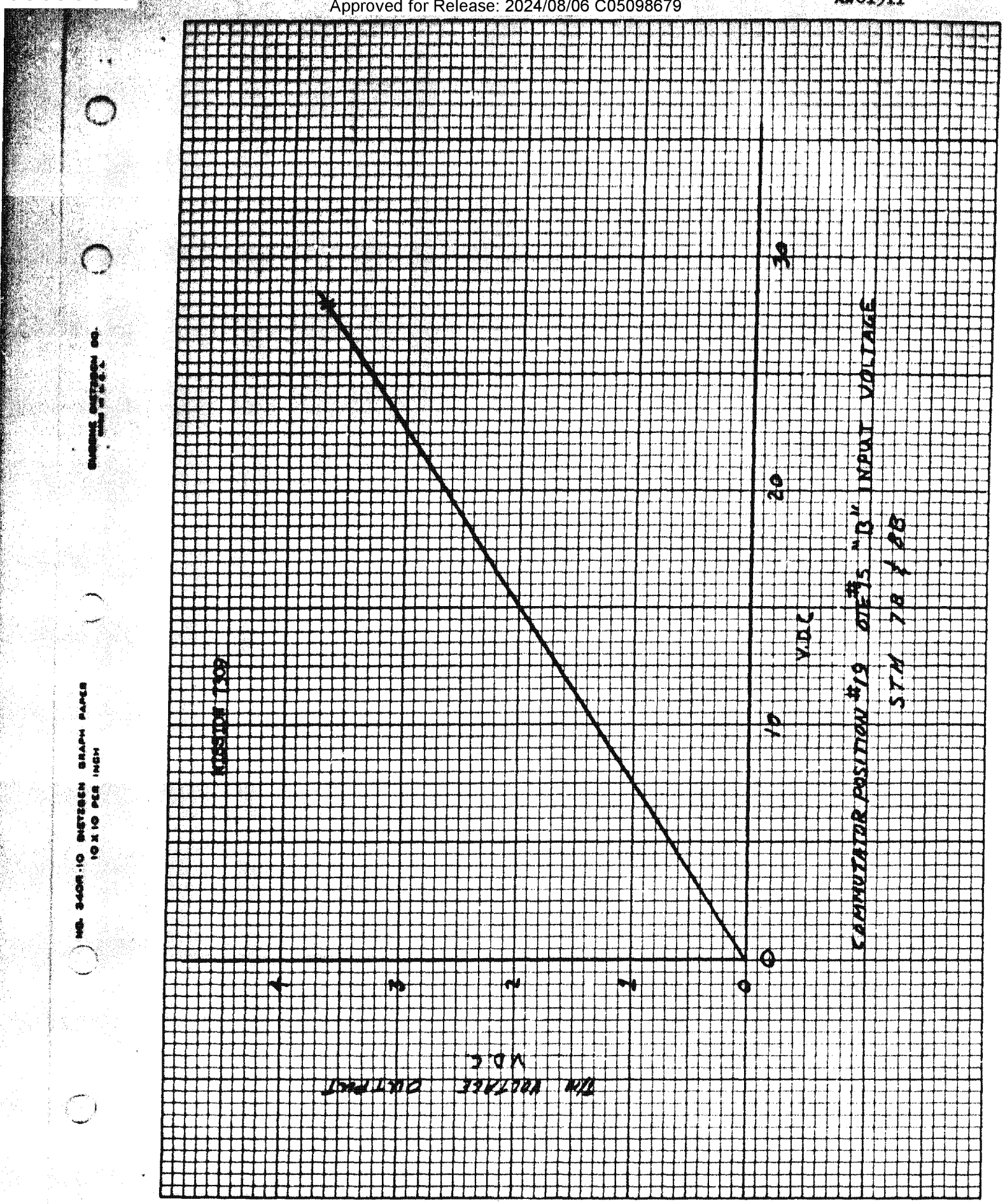

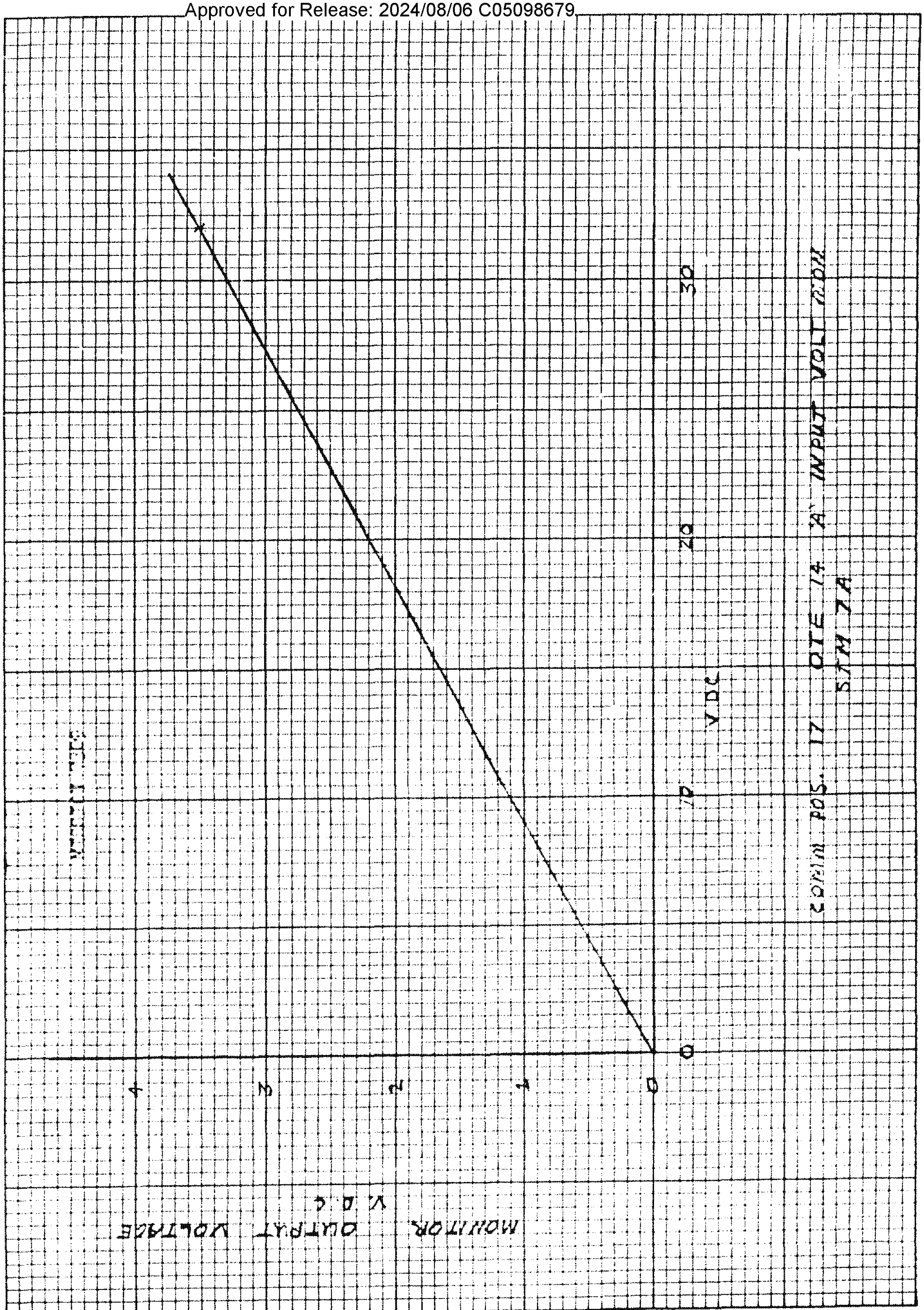

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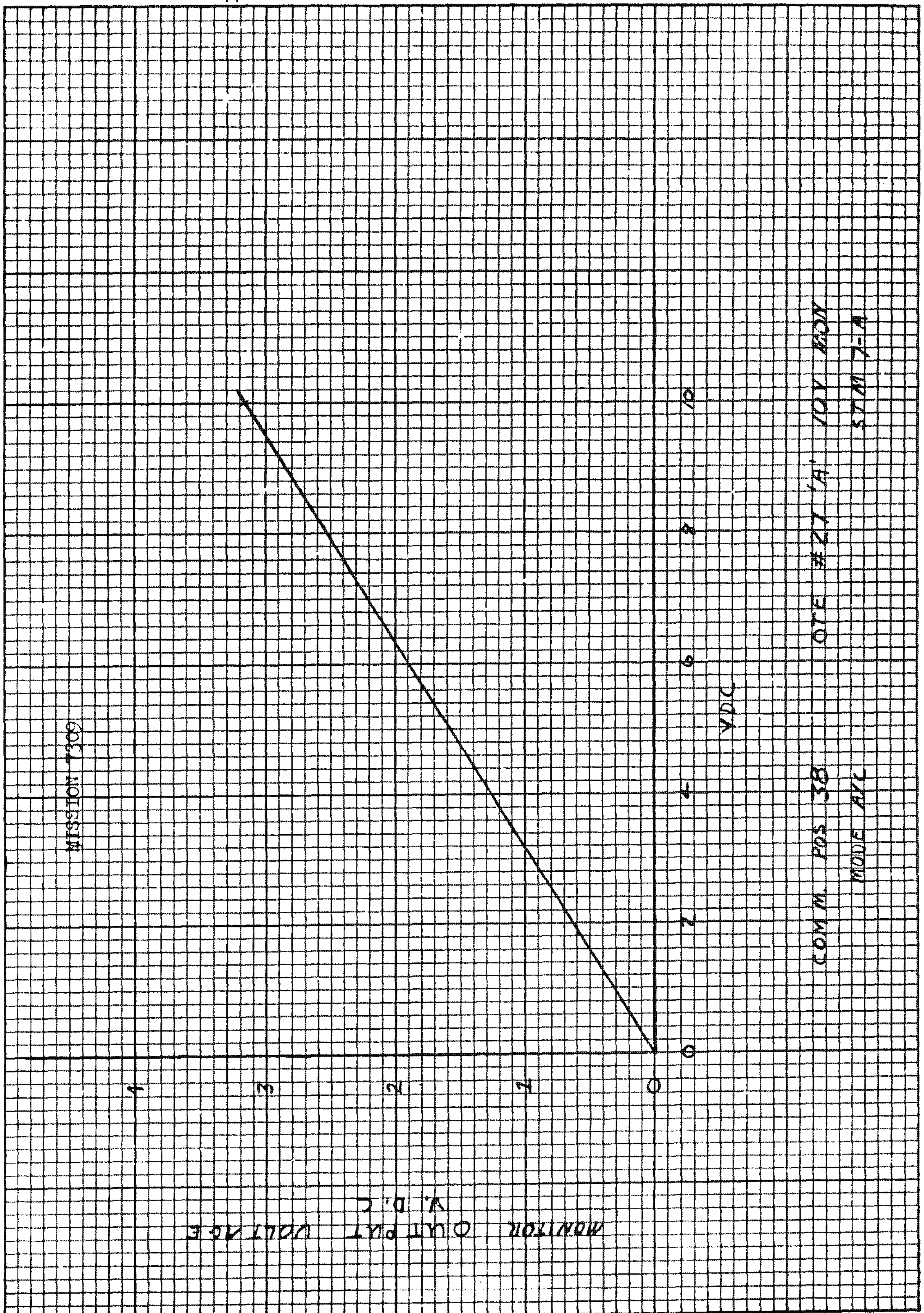

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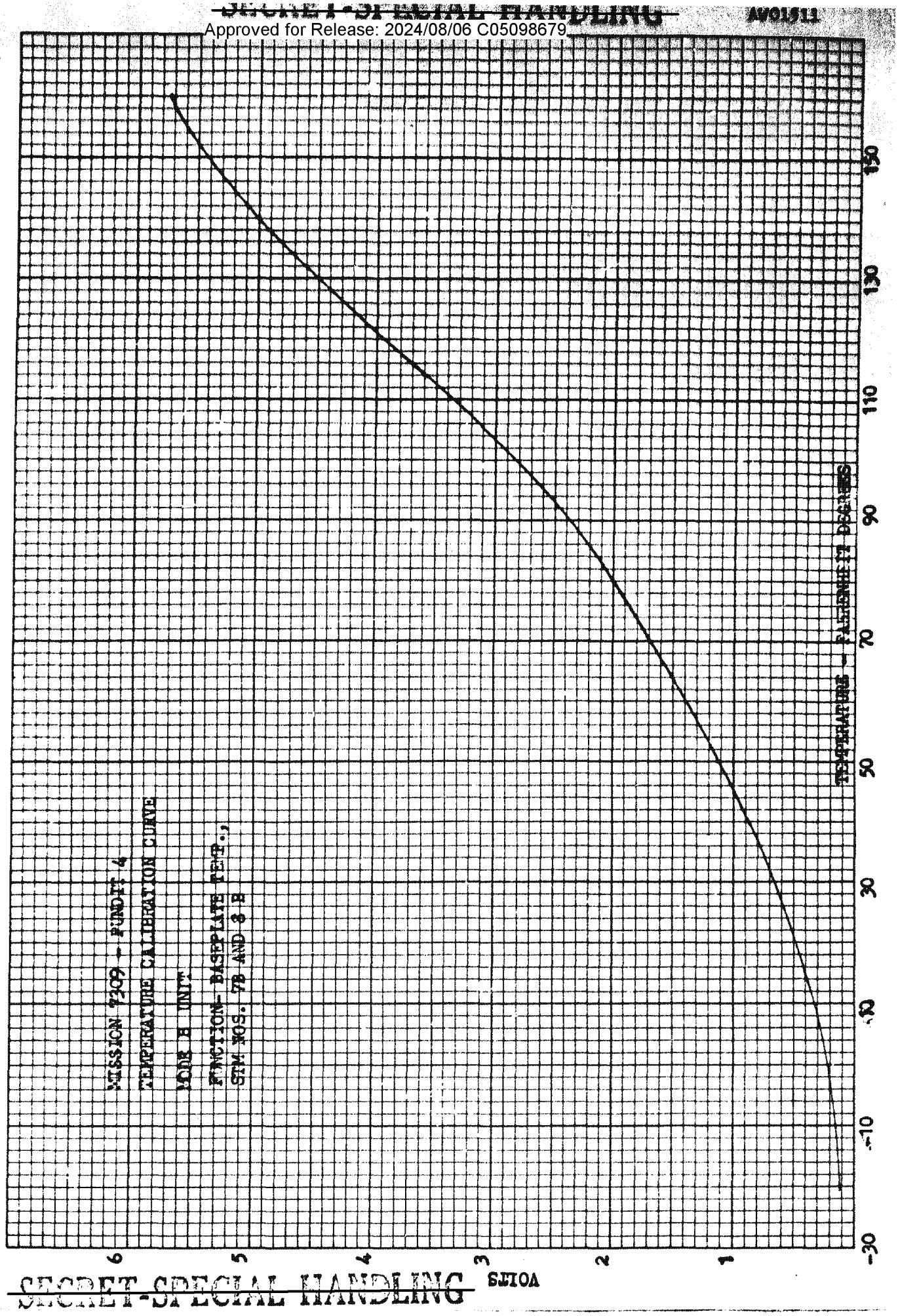
KEUFFEL & ESSER CO. MADE IN U.S.A.

SPECIAL HANDLING



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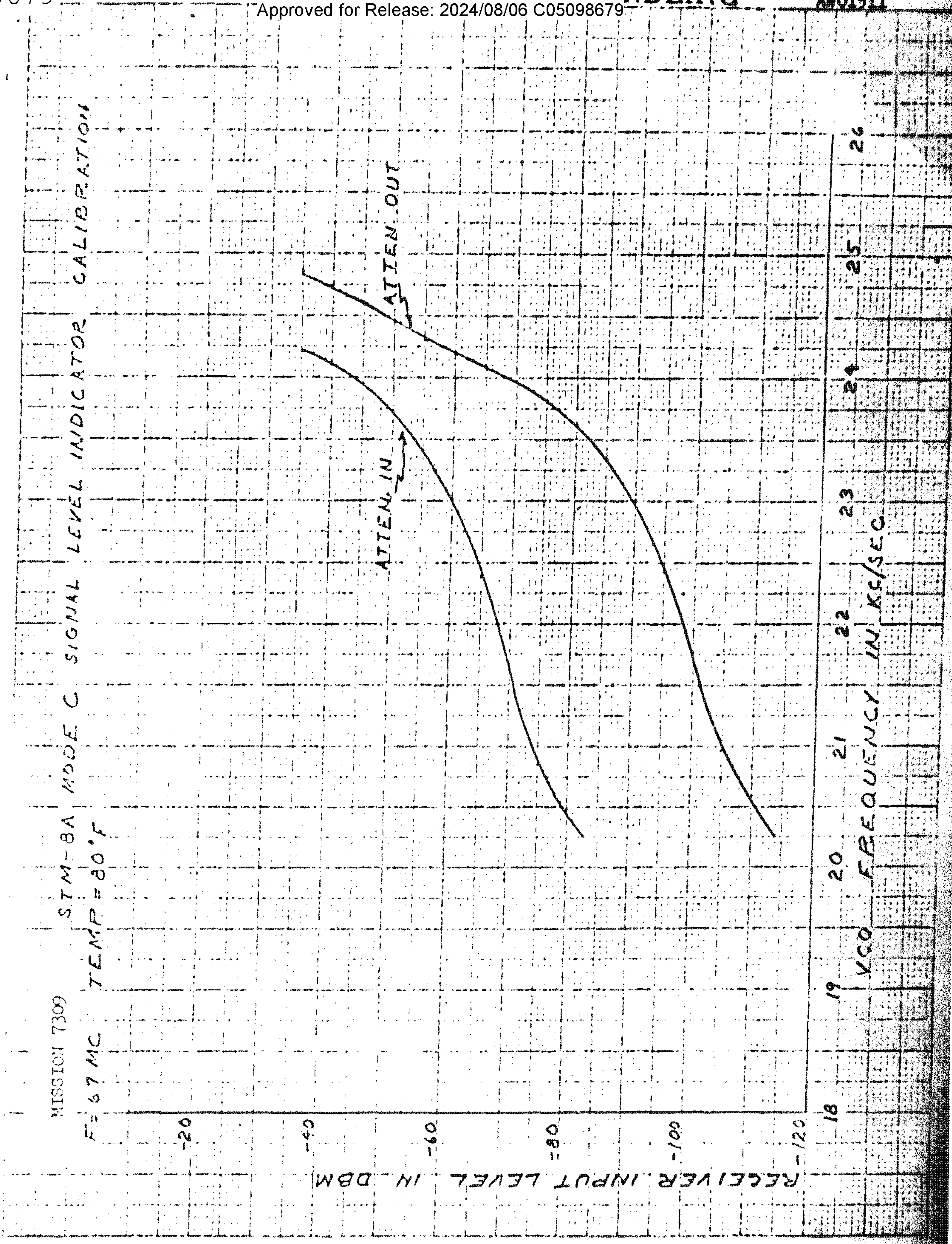
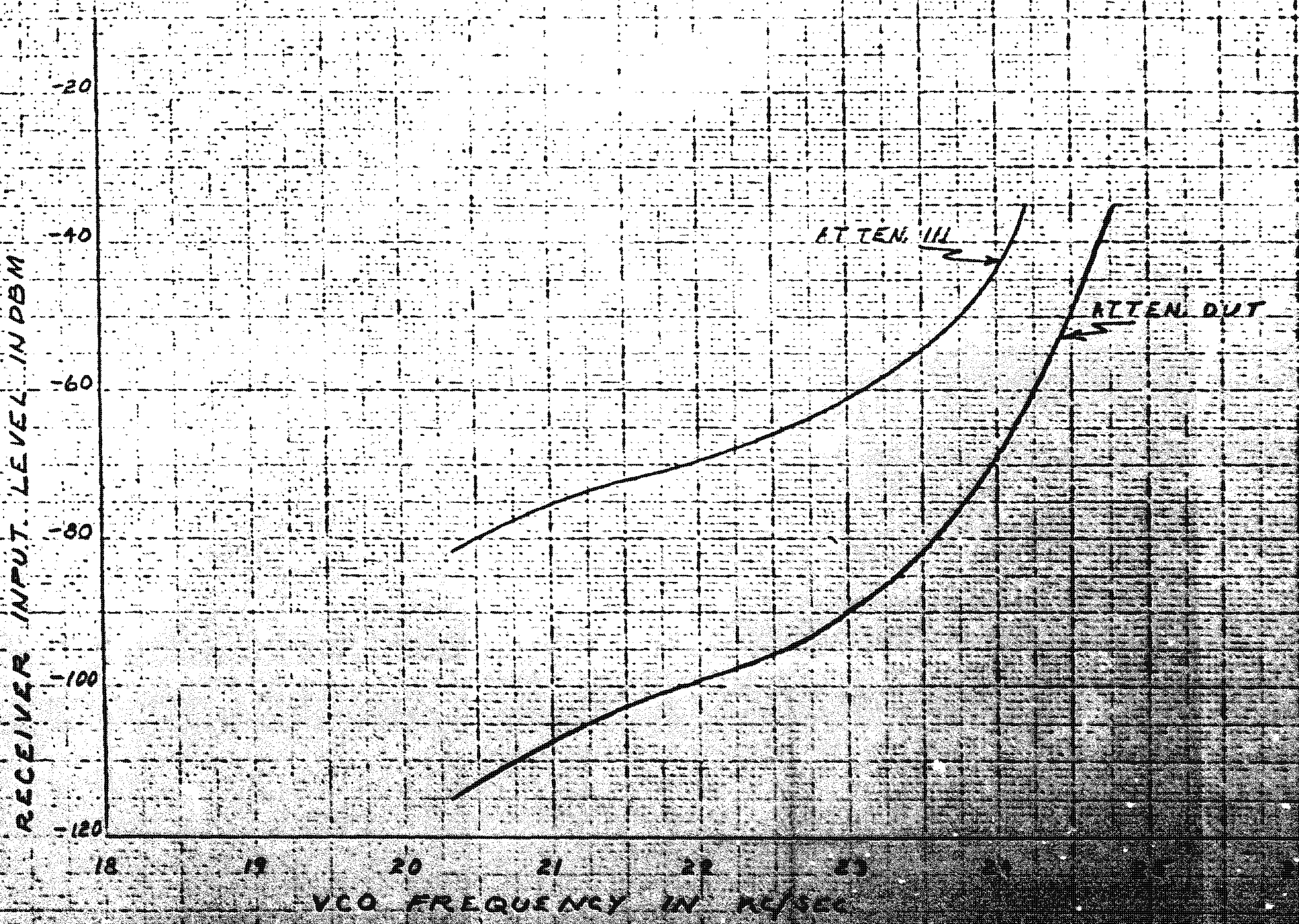


HANDLING

MISSION 7309 STM-8A MODE C SIGNAL LEVEL INDICATOR CALIBRATION

F = 67 MC TEMP = 60°F



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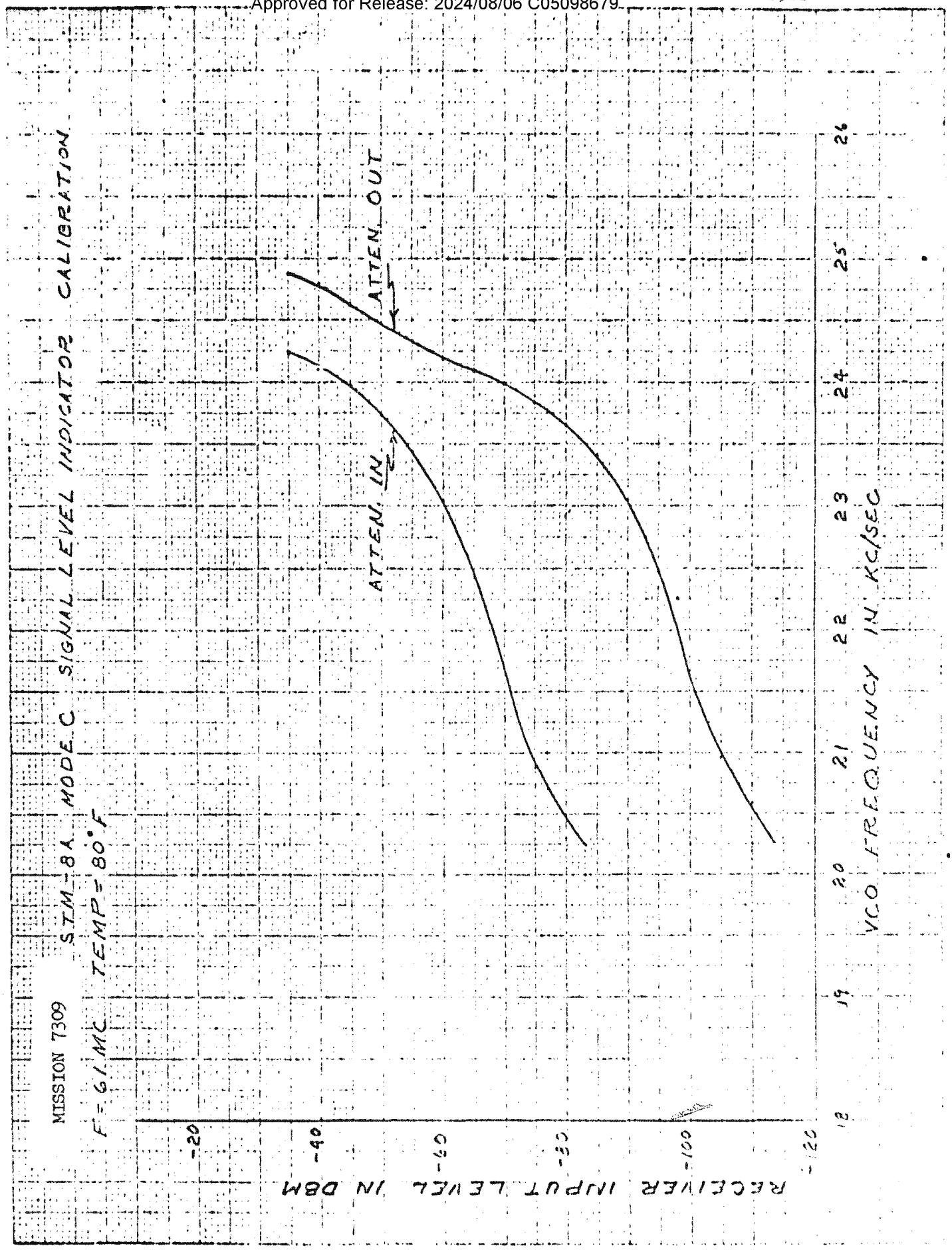

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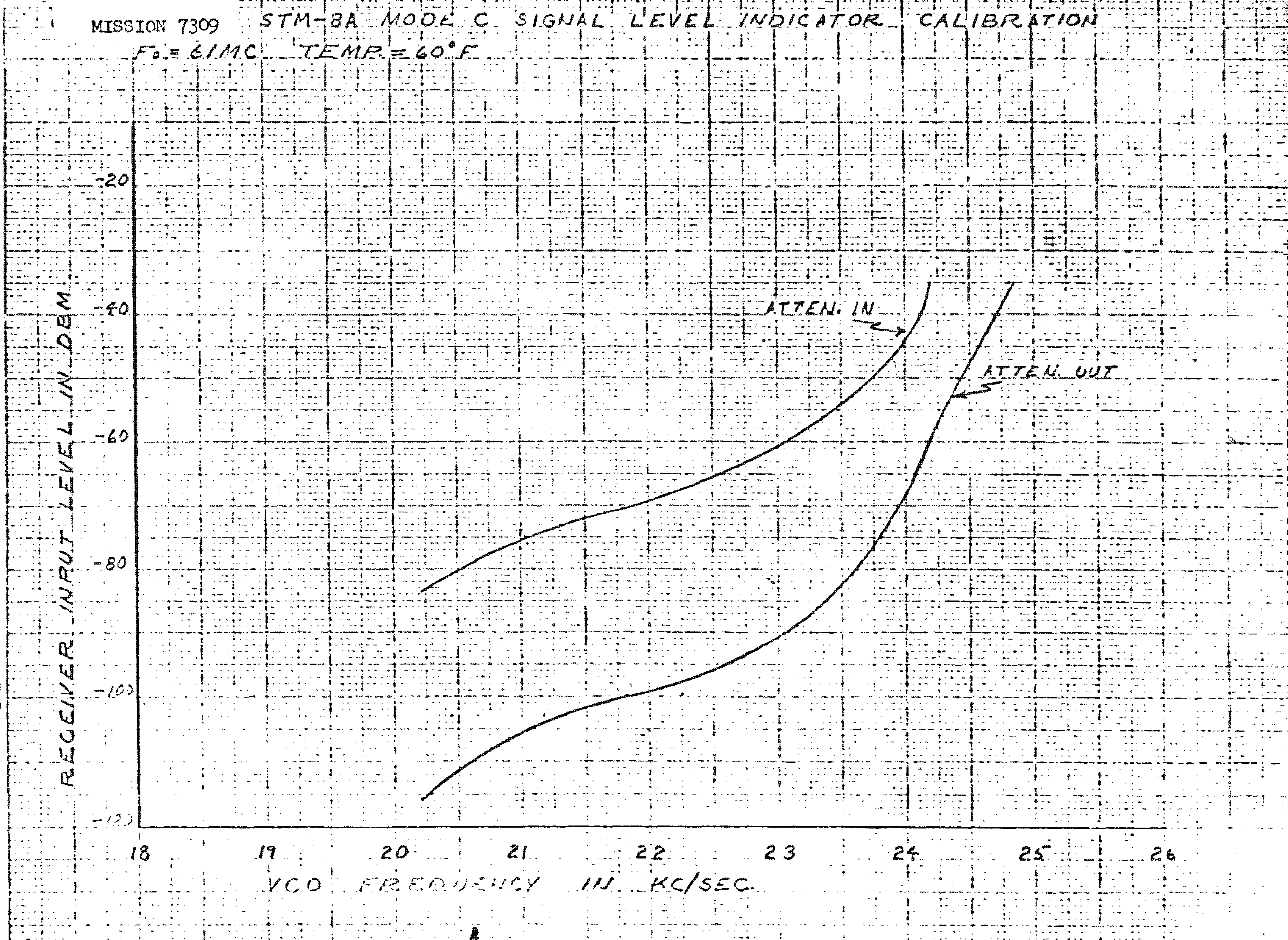

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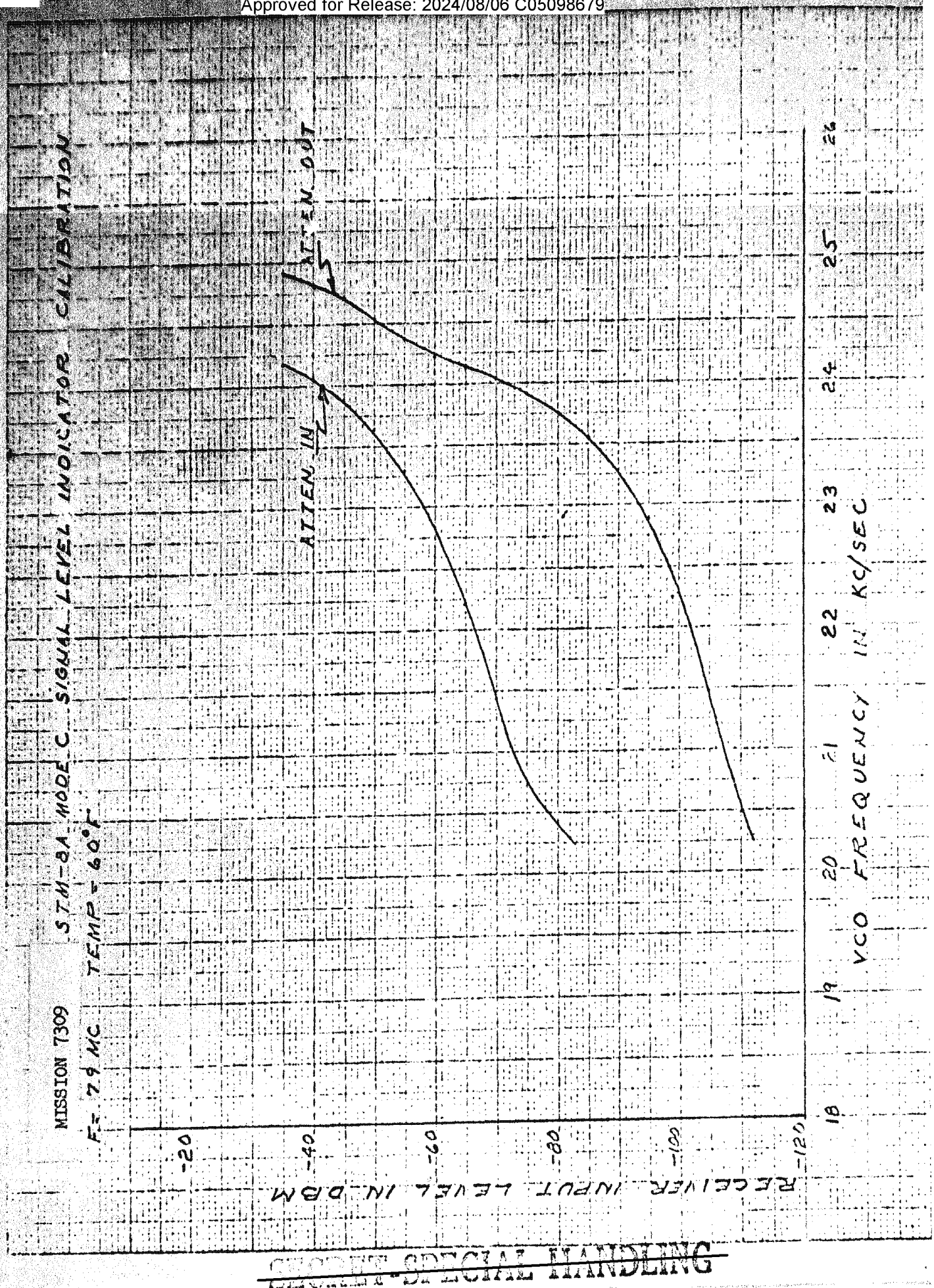

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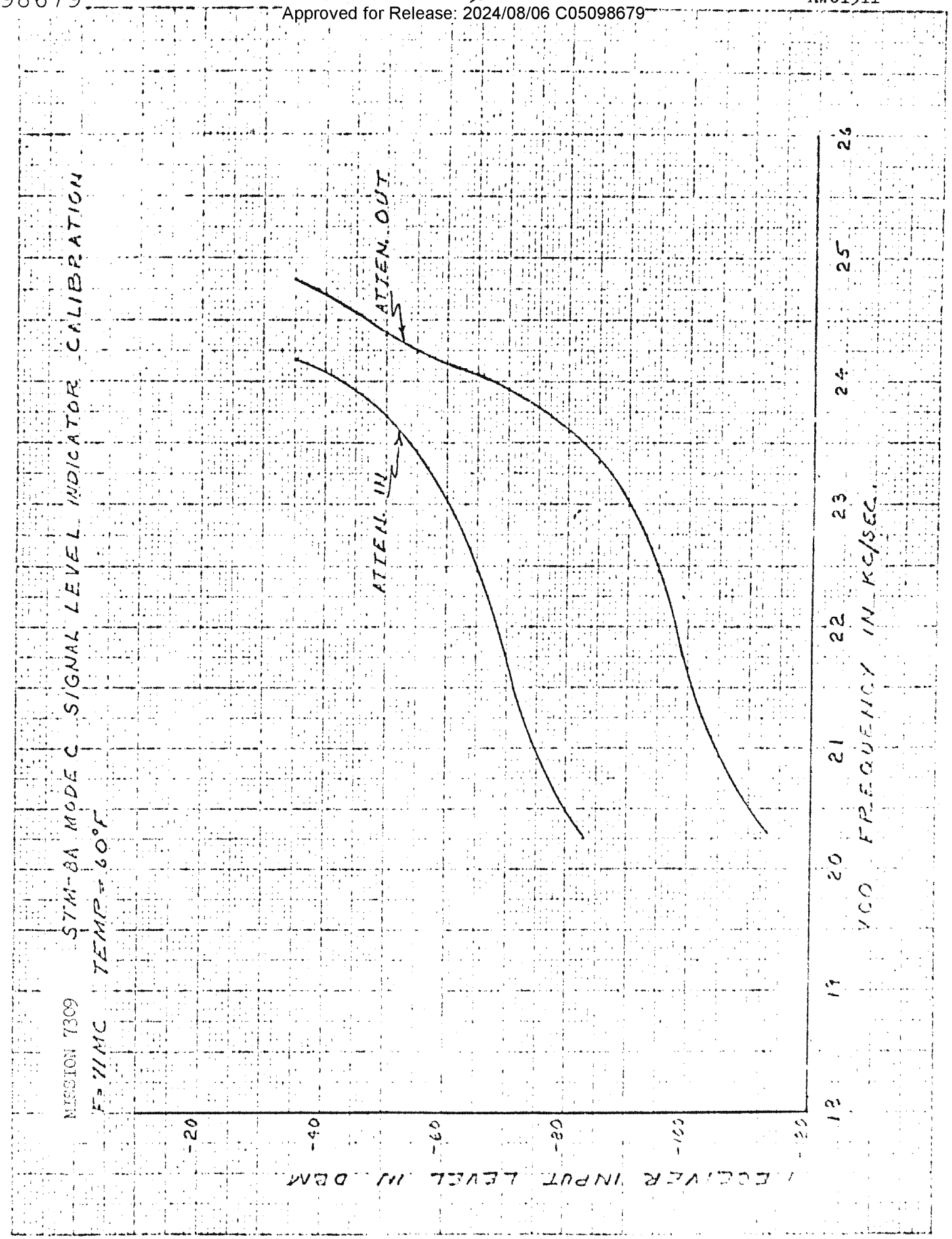

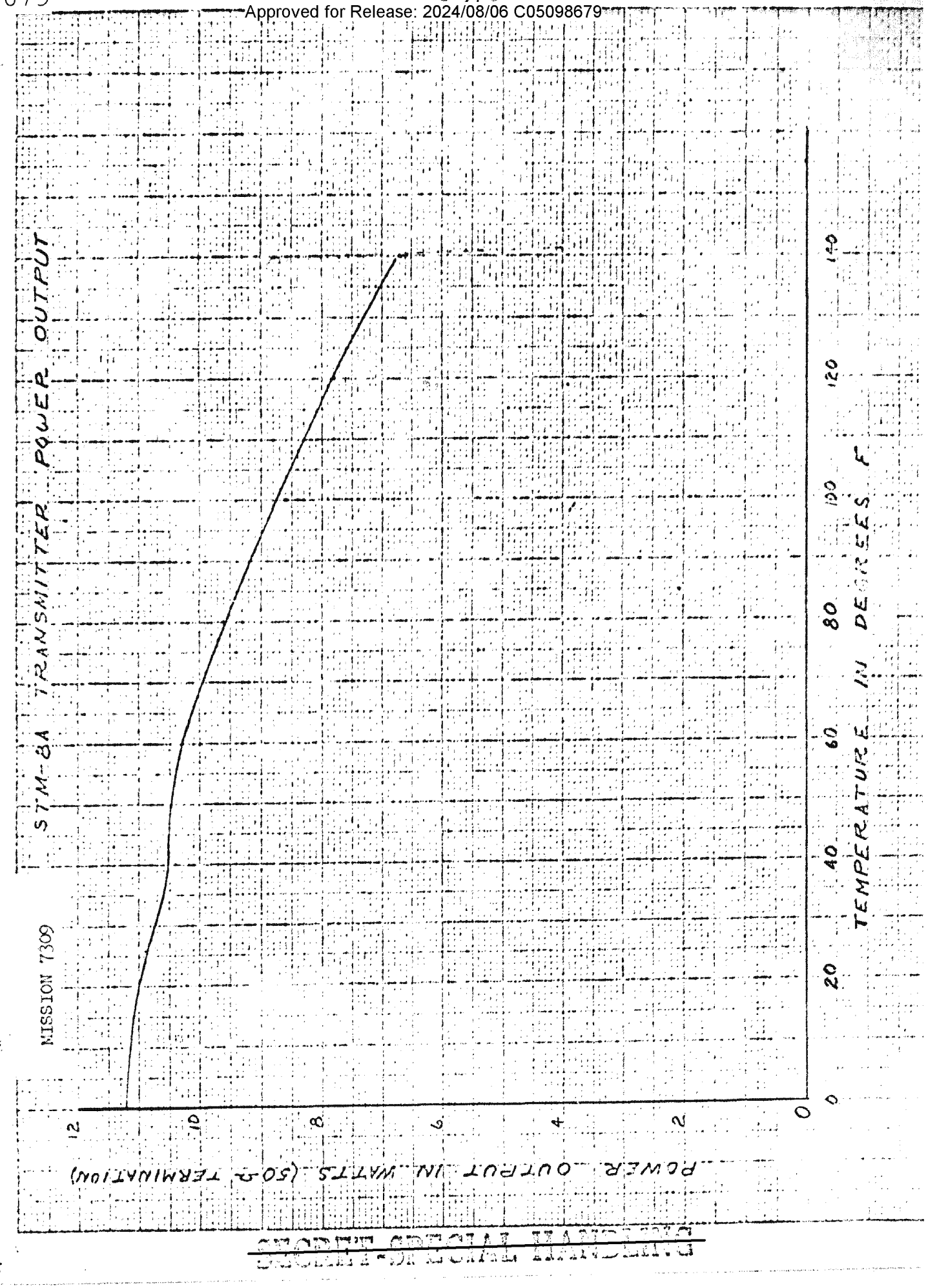

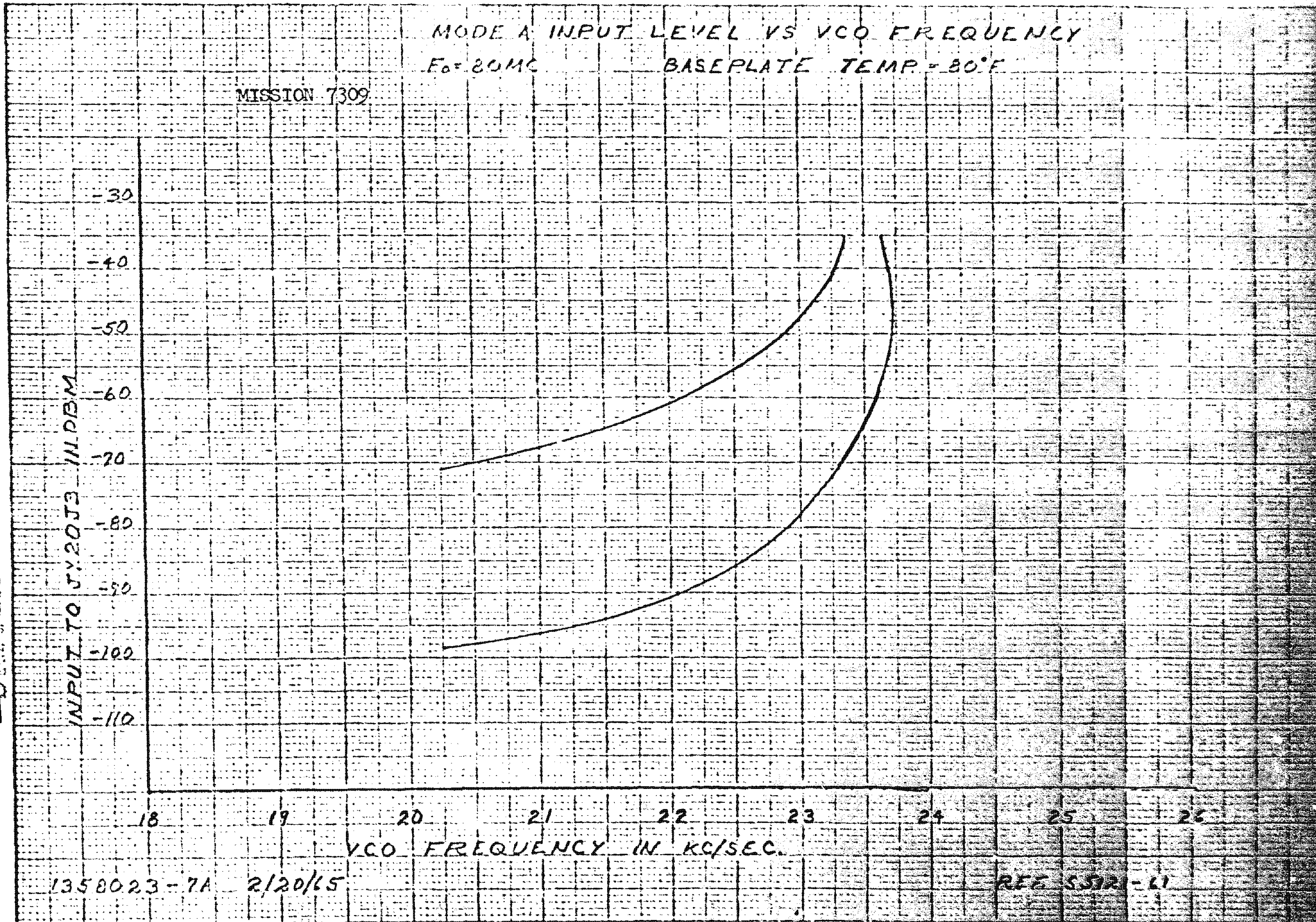

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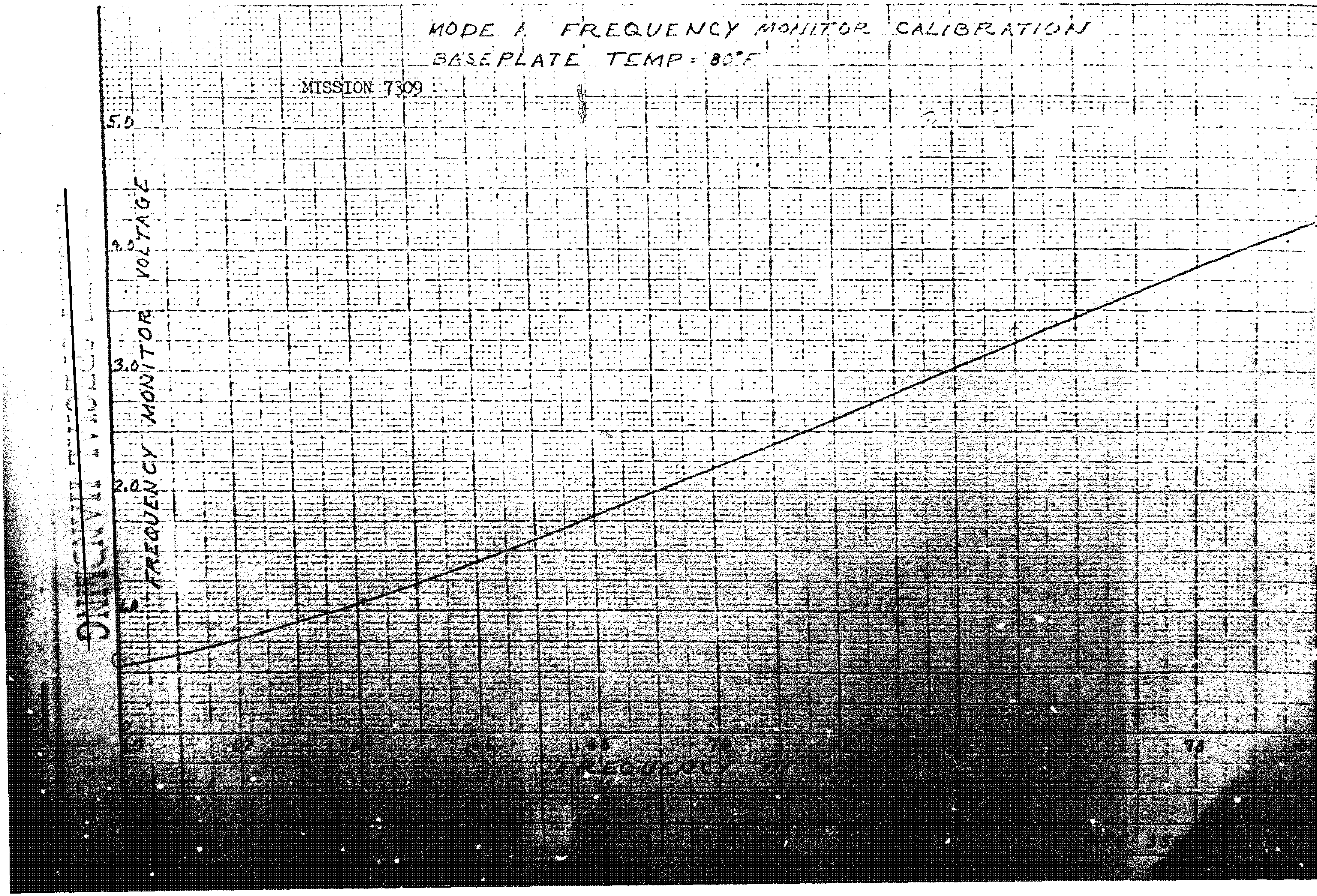

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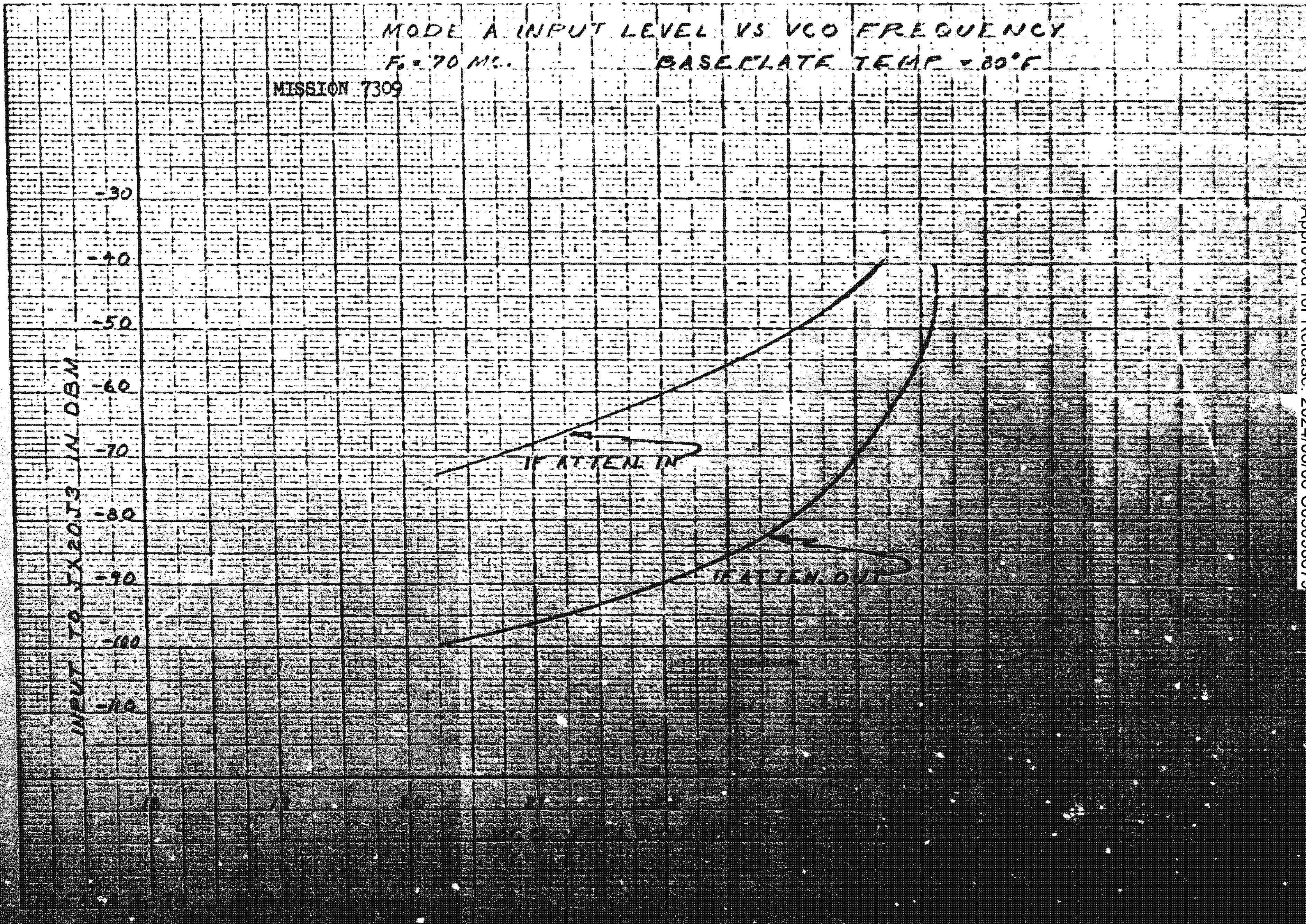

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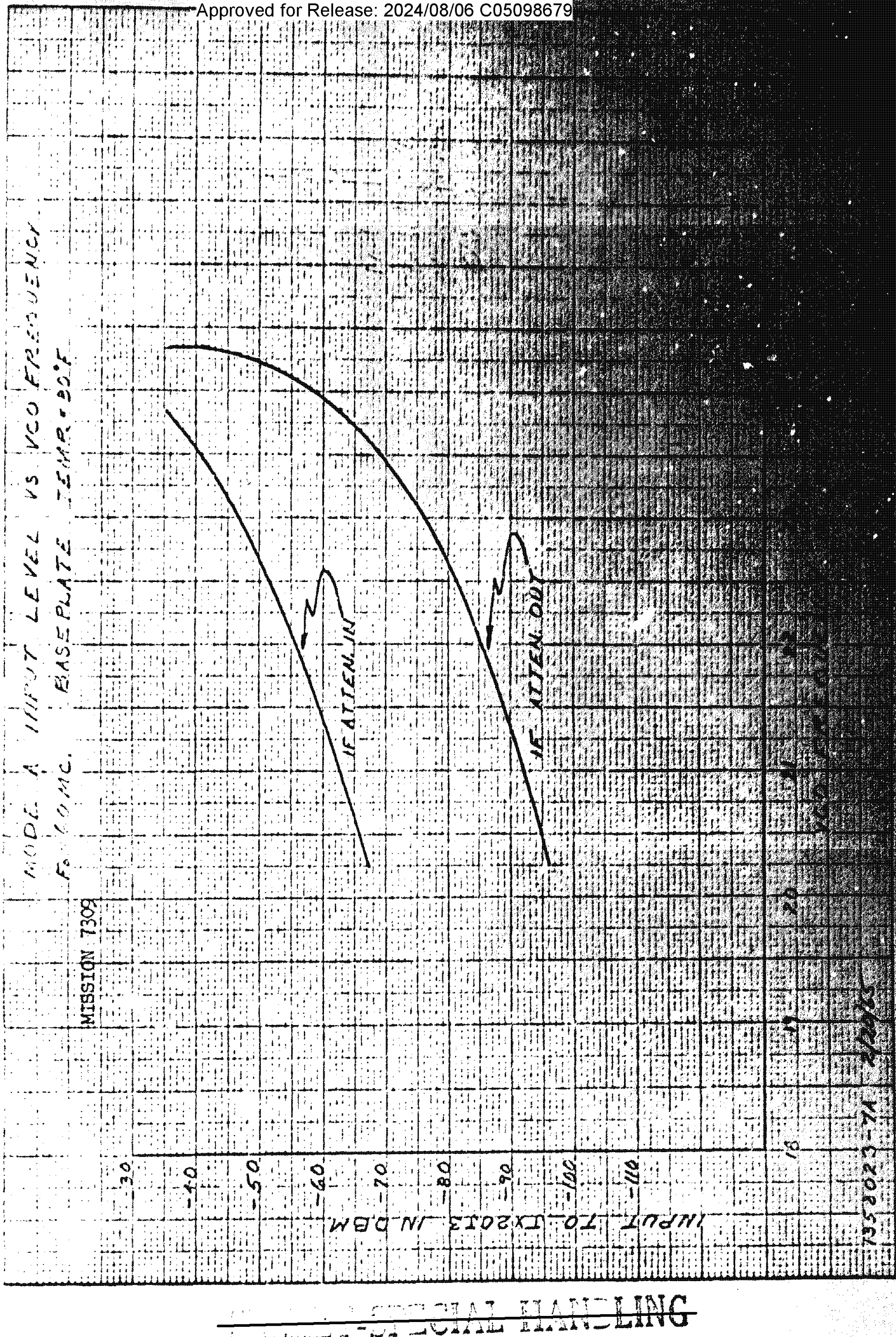

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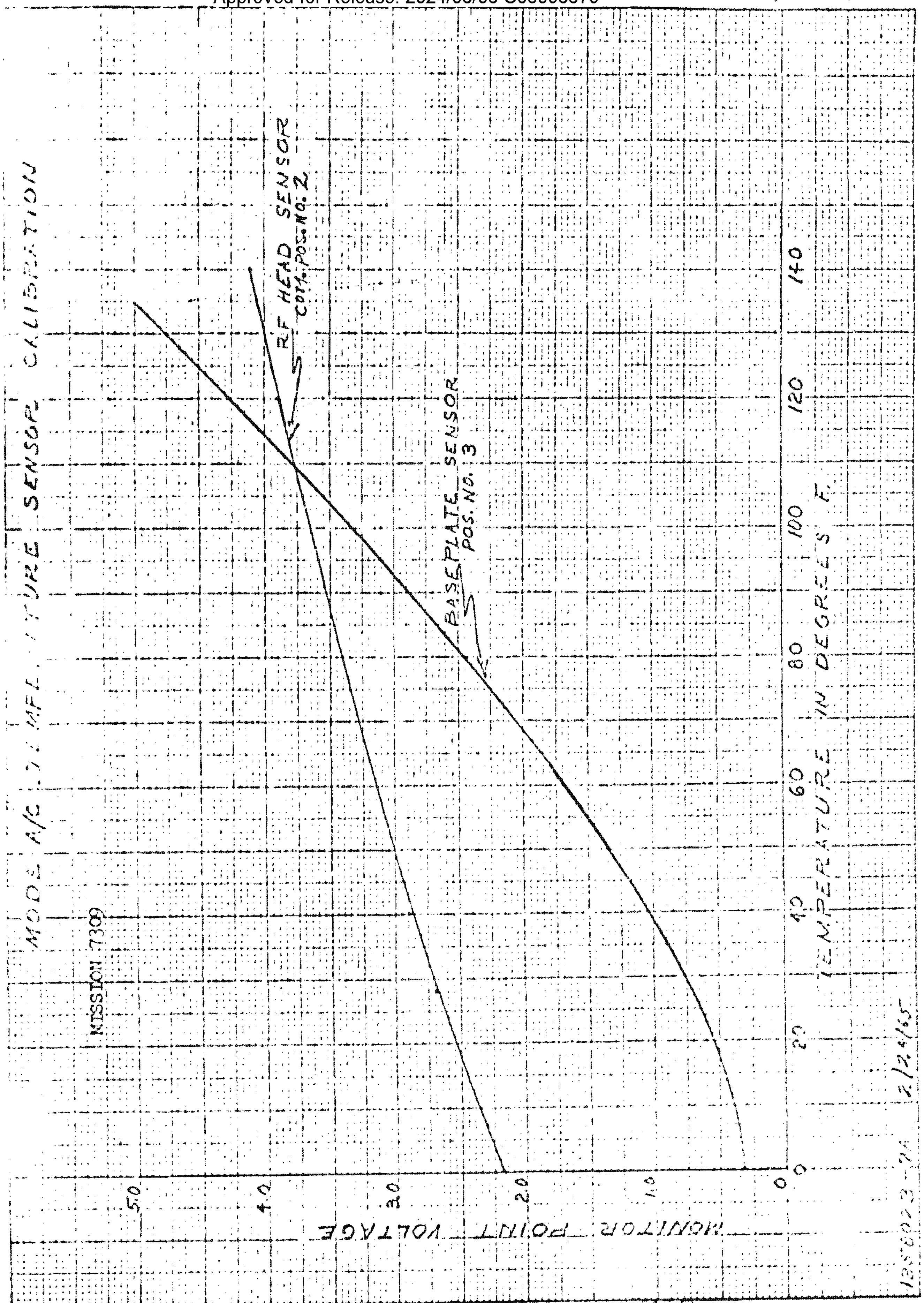

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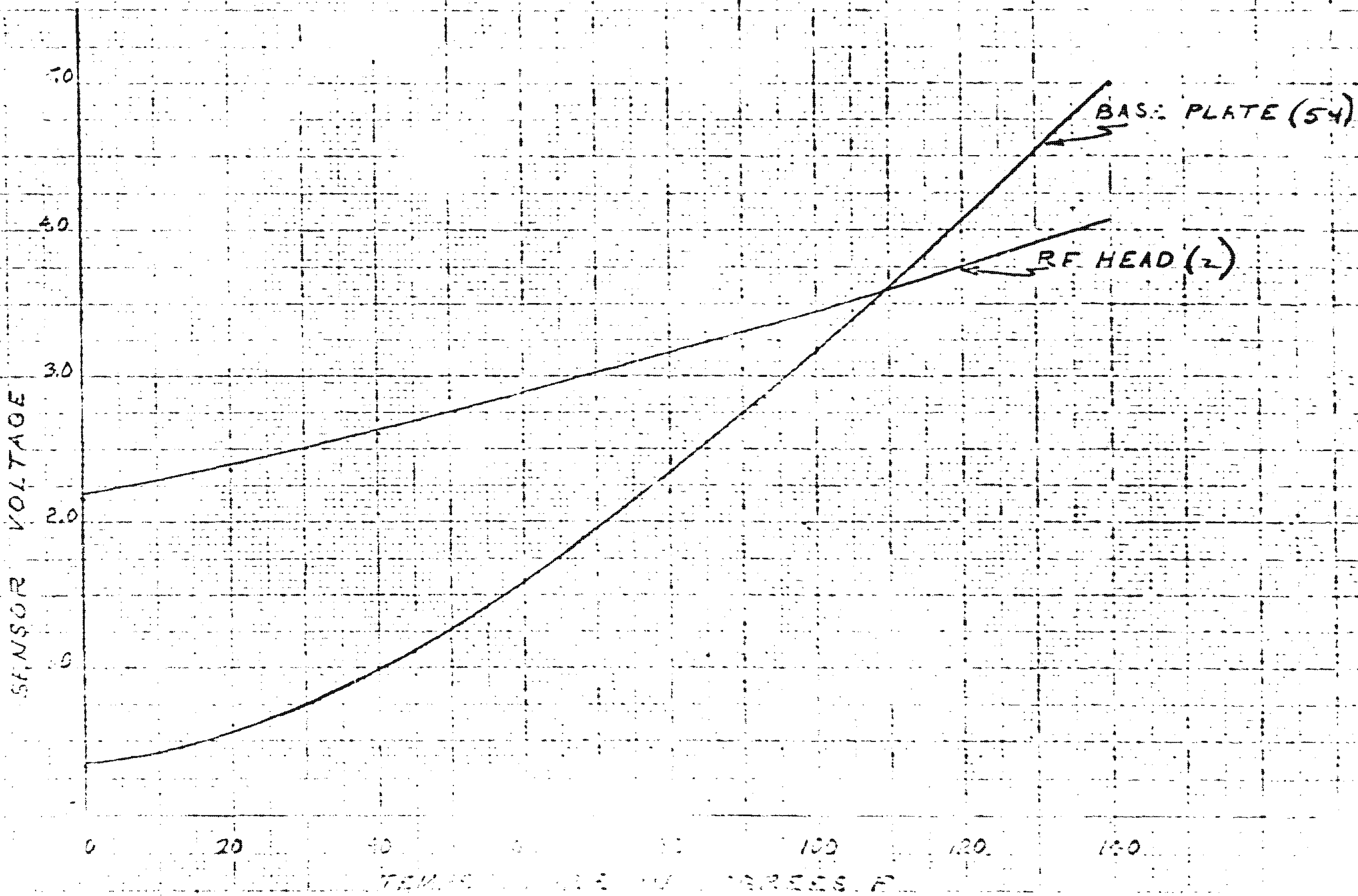
MISSION 7309 STM-8A TEMPERATURE SENSOR CALIBRATION
MODE C ONLY OR MODE B+C OPERATION



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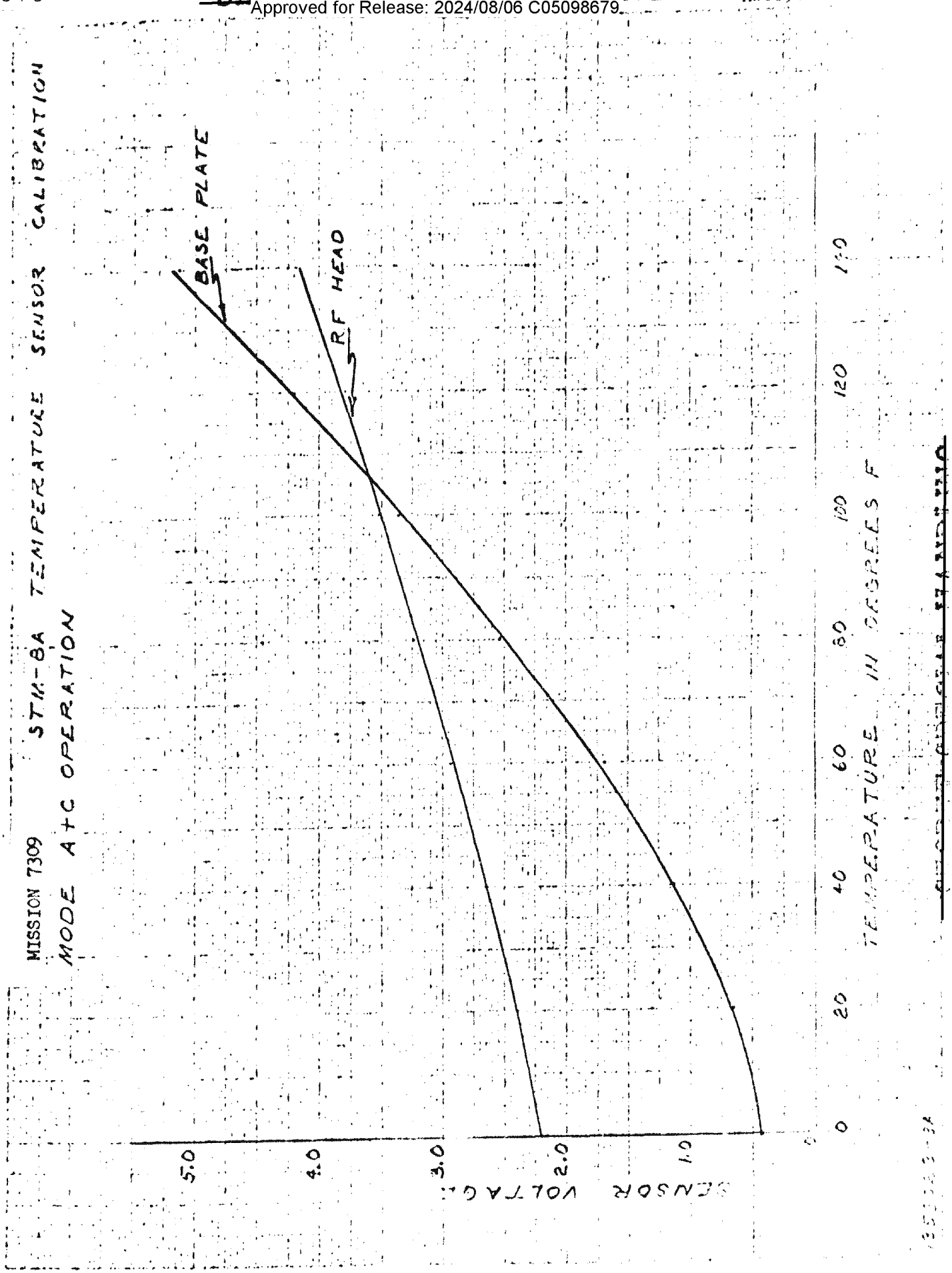
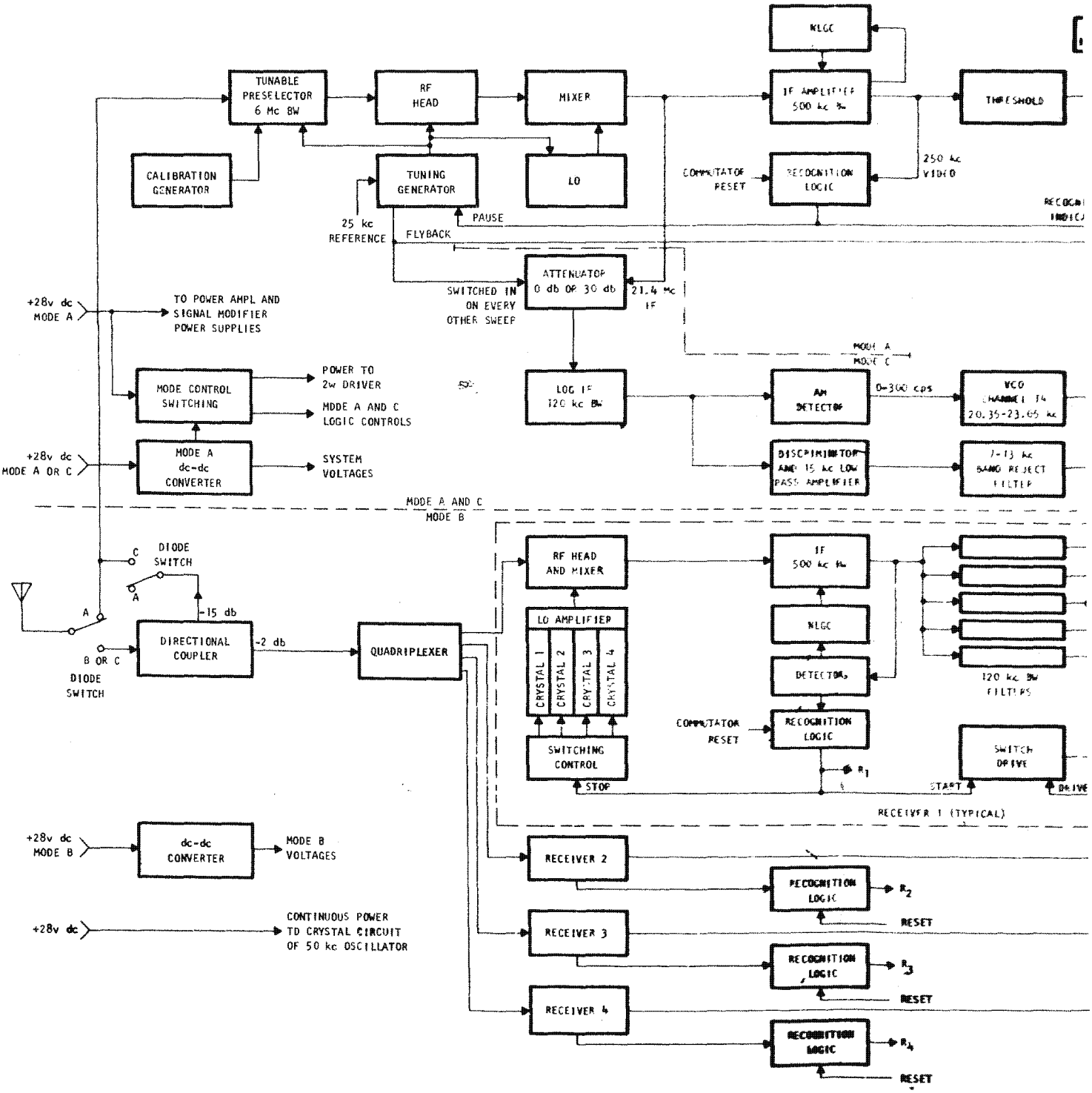
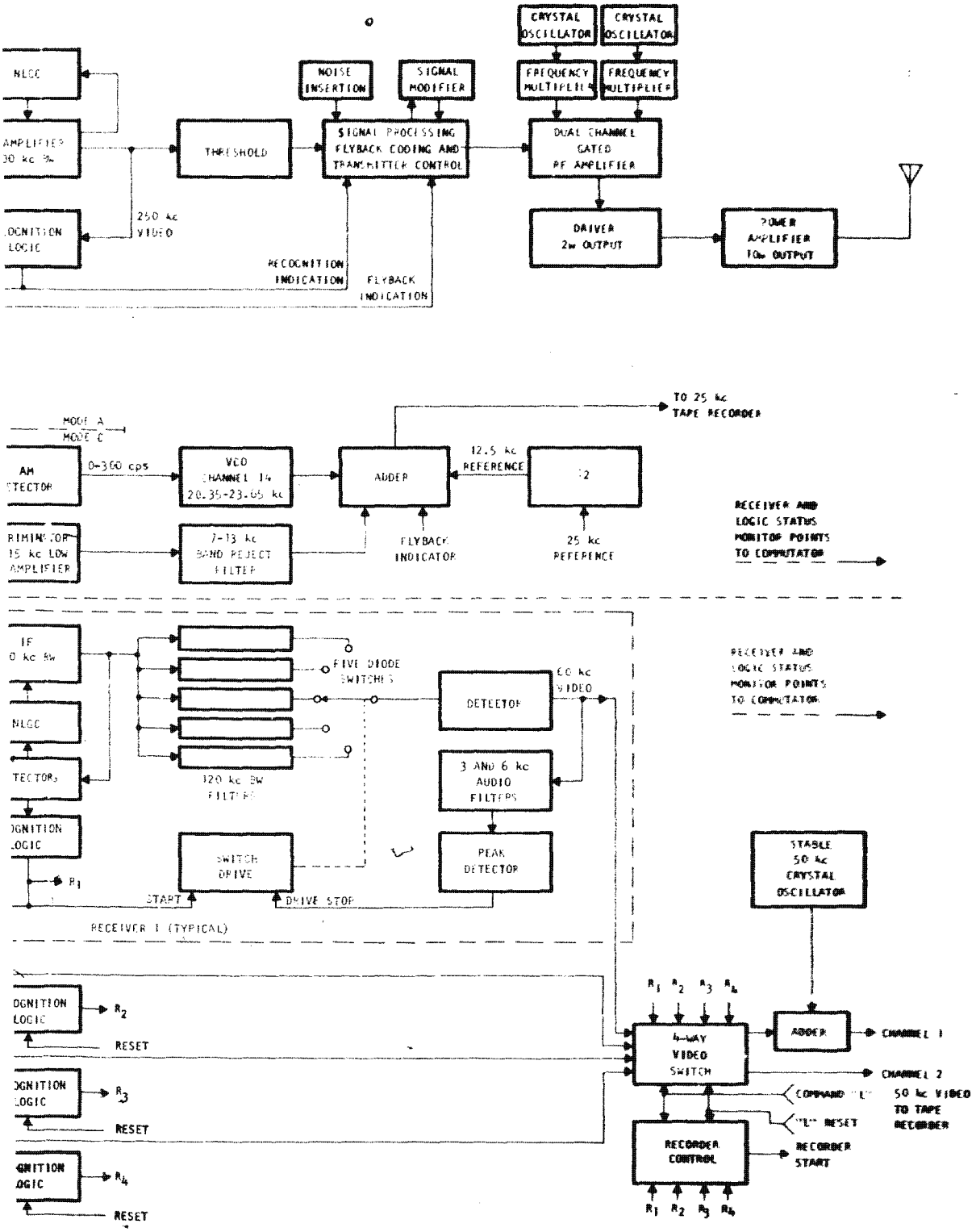




GLASS HOUSE BLOCK DIAGRAM, SYSTEM IV

Exh 730

see also TECHDOC 12.6.5



CK DIAGRAM, SYSTEM IV

20Nov64