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DEPARTMENT OF THE AIR FORCE
HQ. AIR FORCE COMMUNICATIONS SERVICE
RICHARDS GEBAUR AIR FORCE BASE, MISSOURI 64030

OT & E
TEST REPORT

75-AFCS-700

AN/GRC-171

RIVET SWITCH

MULTICHANNEL UHF/AM TRANSCEIVER

IOT&E TEST REPORT

MARCH 1975

Distribution limited to U.S. Gov't agencies only; Test and Evaluation; 25 Feb 75. Other requests for this document must be referred to AFCS/XP, Richards-Gebaur AFB, MO 64030

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AN/GRC-171

RIVET SWITCH

MULTICHANNEL UHF/AM TRANSCEIVER

IOT&E TEST REPORT

75-AFCS-700

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Approved by:

THEODORE F. DEMURO, Colonel, USAF
DCS Plans and Resources

This report has been reviewed and approved by Headquarters, Air Force Communications Service, Richards-Gebaur AFB, MO 64030.

FOREWORD

In accordance with AFR 80-14, an IOT&E on the AN/GRC-171 Multichannel UHF/AM Tranceiver was accomplished to support a procurement decision. Sacramento ALC is the implementing agency and is responsible for the DT&E. The IOT&E was conducted at Richards-Gebaur AFB because of availability of manpower and testing facilities. A list of key test force personnel follows:

Name	Function	Organization
Merritt, Larry D.Lt	IOT&E Test Director	AFCS/XPQO
Carmody, Emmett J.	Engineering Support	AFCS/EPELS
Blais, Clinton A.	Engineering Support	AFCS/EPELS
Stout, James E.	Engineering Support	AFCS/EPELS
Pepple, Johnny S.	Facility/Test Equipment Support	AFCS/EPEUM
Humphreys, Thomas TSgt	Test Equipment Support	AFCS/EPEUM
Smith, Anthony	Installation/Testing Support	1827EIS/EPIE
Klein, James, Sgt	Installation Support	1827EIS/EPIE
Panch, Harold	Measurements Engineer	1839EIG/EPE
Foreman, Robert	Measurements Engineer	1839EIG/EPE
Ripple, Wayne L. Capt	Chief of Maintenance	1879CS/LGM
Cribb, James G.,TSgt	Radio Maintenance	1879CS/LGMG
Astelford, Thomas SSgt	Radio Maintenance	1879CS/LGMG
Arellano, Cayetno A Capt	Chief, ATC Operations	1879CS/FFA
Rucker, William C. CMSgt	Control Tower Chief	1879CS/FFAV
McCallum, Duncan	Contractor Technical Representative	Collins Radio

ABSTRACT

The IOT&E of the AN/GRC-171 was accomplished at Richards-Gebaur AFB, MO., during the period of 2 Dec 74 through 3 Feb 75. Testing was conducted in both a laboratory and an operational environment. The technical performance of the radio was evaluated on the bench while operational characteristics were evaluated in a control tower environment.

The bench tests were designed to demonstrate the suitability of the radios for operational use. The radios were tested to either the extreme tolerances of the radio or until conditions were reached that would not be encountered in an actual operational environment.

The control tower tests were conducted by actual operators. The radio was used as it normally would be used when fielded. Here the radio was checked for compatibility with existing equipment, ease of operation, and ease of maintenance.

Aside from a few mechanical changes that should be made to the radio, the only major deficiencies found were the presence of transmitter spurious emissions and the inadequacy of the slide mounts. These items will have to be corrected before the radio will be acceptable for operational use.

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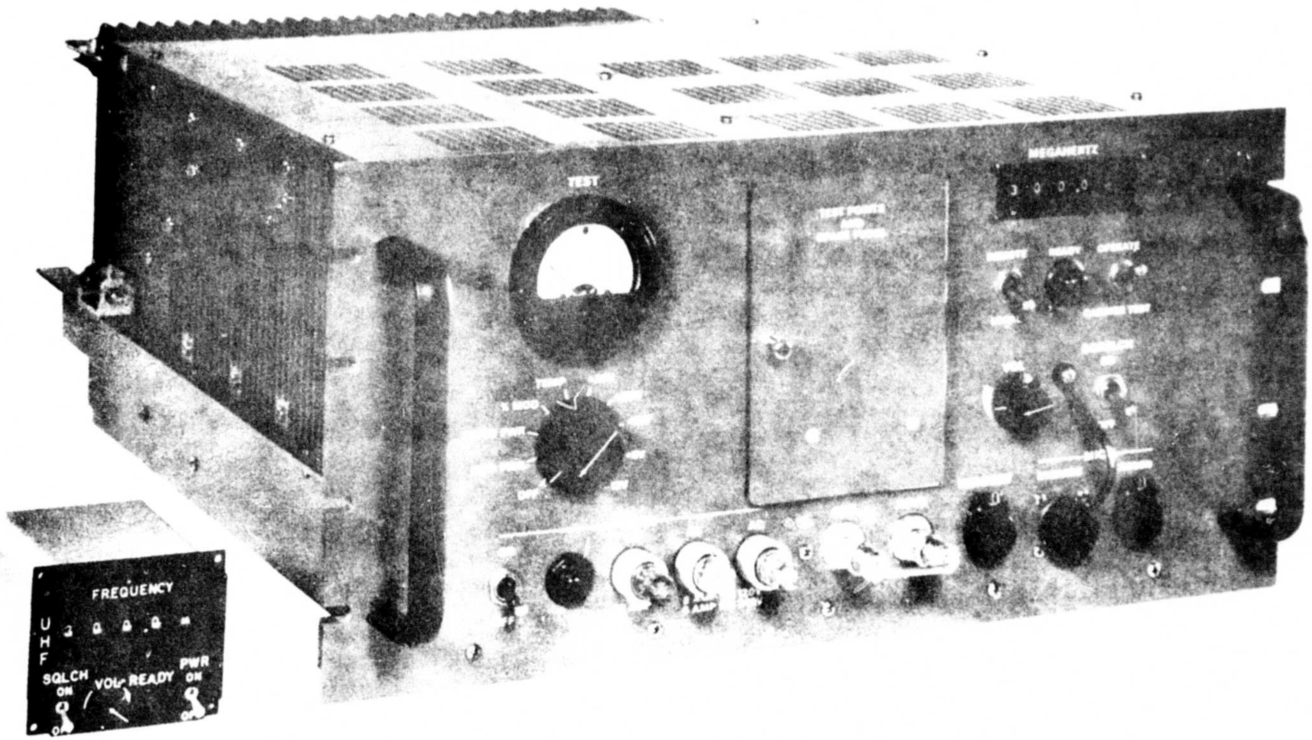
1. INTRODUCTION

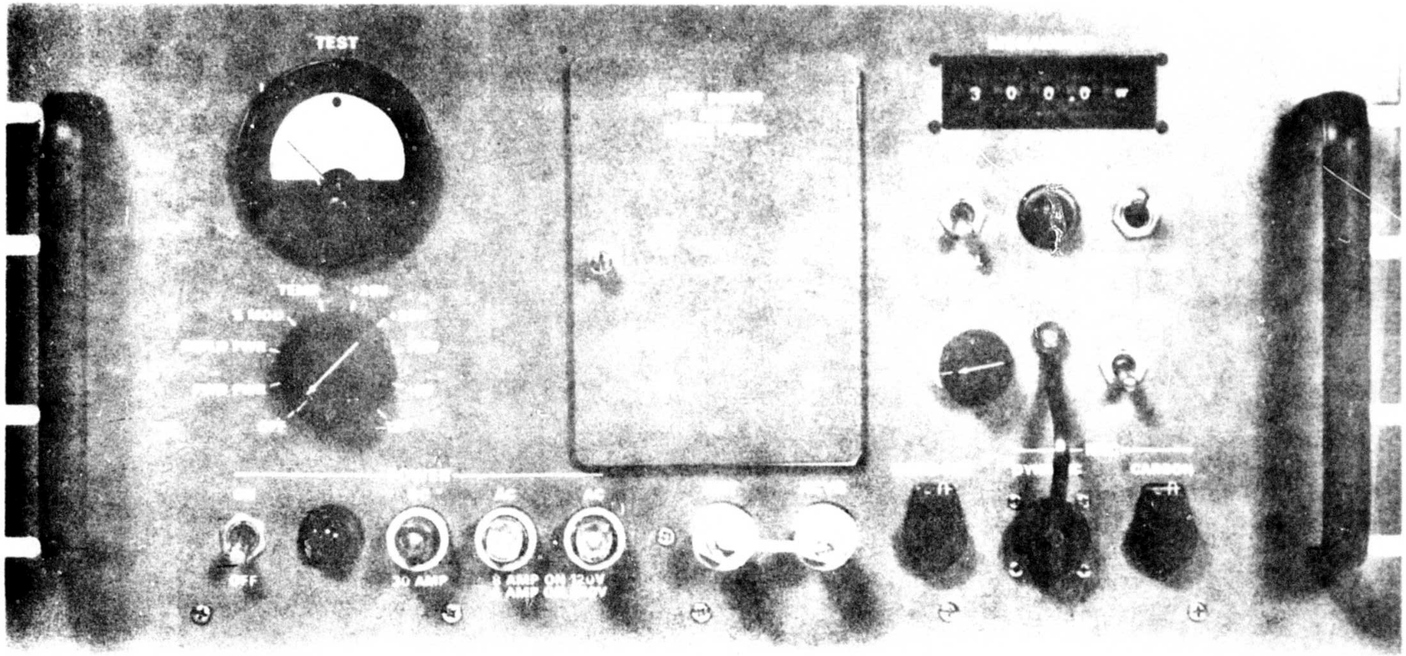
1.1 Background. The AN/GRC-171 radio is a part of the Rivet Switch program whose purpose is to replace the existing UHF/VHF ground/air voice radio communications equipments with new equipment capable of operating in a 50KHz, and ultimately a 25KHz, channel separation environment. AFLC is the implementing command for this contract with AFCS the lead using command. The AN/GRC-171 contract was awarded to Collins Radio Company on 16 March 1973. The DT&E was conducted at the Collins Radio Plant concurrently with the IOT&E. The data gained from the DT&E and IOT&E will be used to support an AFLC procurement decision.

1.2 Description of Test Item. The AN/GRC-171 is a multi-channel UHF/AM solid-state communications transceiver to be installed in ground stations engaged in UHF ground/air voice radio communications. The receiver portion of the transceiver is capable of detecting and reproducing audio (voice) or digital (secure voice) modulation contained on the amplitude modulated carriers of aircraft transmitters operating on any of 3500 channels and ultimately 7000 channels between 225 and 399.975MHz. The transmitter is capable of operating on each of 7000 communications channels with a power output of 20 watts, +2db, -1db. The transceiver obtains its operating frequency from a common synthesizer which establishes the same operating frequency for both transmitting and receiving.

1.3 Scope of Test. The IOT&E was conducted to determine the suitability of the AN/GRC-171s for operational use given conditions that are expected to be found in an actual operational environment.

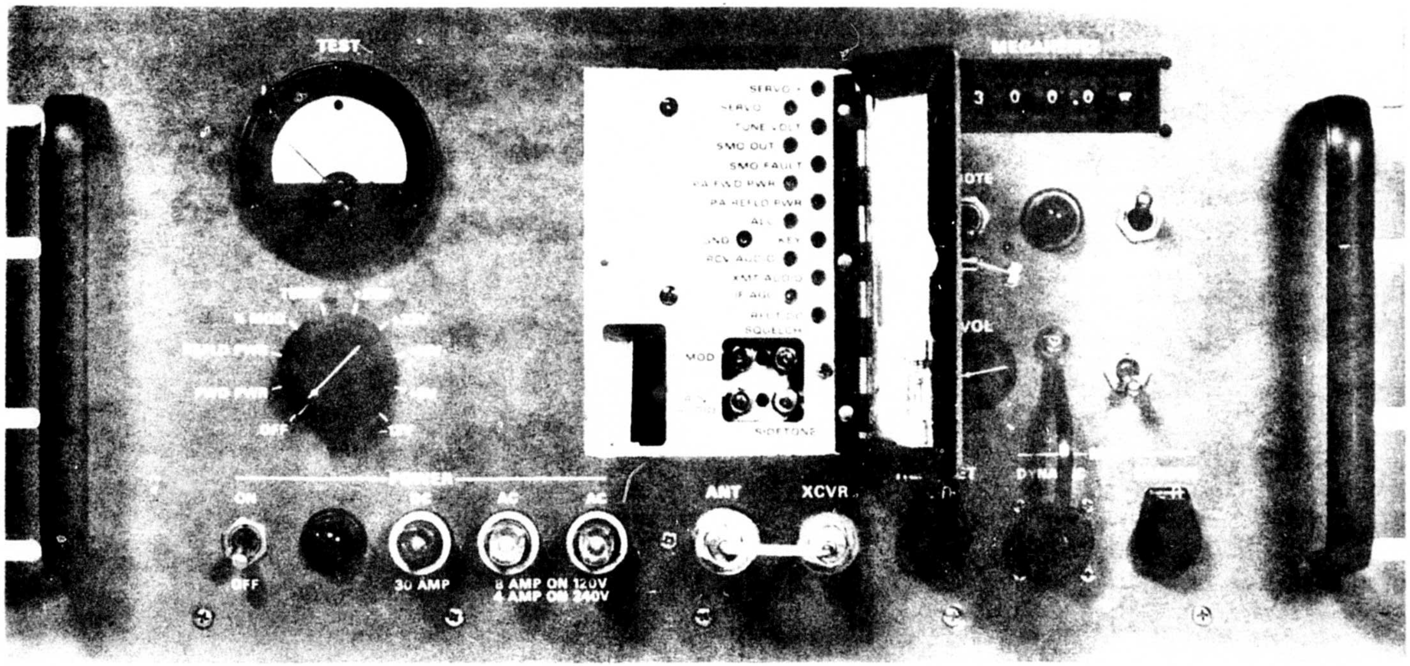


AN/GRC-171
UHF MULTICHANNEL TRANSCEIVER
WITH REMOTE CONTROL HEAD



AN/GRC-171

FRONT PANEL CONTROLS



AN/GRC-171
FRONT PANEL TEST POINTS
AND LEVEL ADJUSTMENTS

2. PURPOSE AND OBJECTIVES

2.1 Overview of Test Requirement. The purpose of this Operational Test and Evaluation (OT&E) was to investigate the operational characteristics of the AN/GRC-171 UHF Transceiver to determine its operational suitability in all Rivet Switch applications.

2.2 Specific Objectives.

2.2.1 Technical Performance: The GRC-171 was evaluated to ascertain its technical performance when subjected to conditions expected to be encountered in an operational environment. This was a quantitative test conducted in a laboratory environment by Air Force personnel trained in measurement techniques.

2.2.2 Ease of Installation: Two transceivers were installed in a mock-up configuration in accordance with Installation Standard LDBWS00893AD00 Revision B in the space proposed for mounting the UHF transceivers. This mock-up will ultimately be a standard installation configuration for the AN/GRC-171. One GRC-171 was also installed in the Richards-Gebaur AFB control tower in as close to the standard installation as possible. The radio was interfaced with all equipments it will be required to interface with in an operational control tower environment.

2.2.3 Technical Data: The technical data provided with the transceivers was assessed throughout the test period by test engineers, measurements technicians, installation technicians, and radio maintenance personnel. Additionally, a Formal Technical Order (T.O.) Verification was conducted.

2.2.4 Reliability and Maintainability: Failure data was collected and reported during the test period. The failures were categorized as an equipment defect, contractor quality control deficiency, or operator error.

2.2.5 Personnel Subsystems and Safety: Personnel safety was continually evaluated during the test period. Personnel subsystems were evaluated to include the adequacy of equipment design to allow effective operation and maintenance, and the quality of audio for ease of listening.

2.2.6 Logistic supportability was evaluated where possible. However, because of the lack of spares support, formal training, and a complete complement of AGE, it was impossible to evaluate all the areas outlined in Appendix B of the Test Plan.

3. METHOD OF ACCOMPLISHMENT

3.1 Test Schedule. The official start date for the AN/GRC-171 IOT&E was 2 December 1974. Two of the three prototype radios were on-site at this time and testing had commenced. The first two radios were initially used to verify installation standards. Subsequent to installation testing, these two radios were used for all testing accomplished in a laboratory environment. These tests were conducted by installation technicians, measurements technicians, and engineers. The third radio arrived 10 December 1974 and was installed in the control tower. The installation was accomplished by a trained installation crew. The radio was interfaced with all equipment which will be required when production units are deployed. The radio was operated and maintained by Air Force personnel from the 1879 Communications Squadron located at Richards-Gebaur AFB. During the test period, a compatibility flight test was conducted between the AN/GRC-171 and the new airborne UHF transceiver AN/ARC-164. Other tests consisted of obtaining radio checks from available aircraft in the Richards-Gebaur AFB area. Performance testing of the radios was completed 3 February 1975. However, the Technical Order (T.O.) verification was not accomplished until 11-14 February 1975.

3.2 Test Procedures. For all tests quantitative in nature, formal data sheets were used. This data reflects the actual performance of the radio. For tests qualitative in nature, operator logs and questionnaires were utilized.

3.3 Test Personnel.

3.3.1 The quantitative testing of the radio was conducted by technicians and engineers trained in the testing of radios. These tests were conducted in the prototype laboratory that is operated by AFCS/EPEUM.

3.3.2 Installation of the radios was accomplished by trained installation technicians and engineers. They followed standards that will be used in the field.

3.3.3 Personnel and facilities of the 1879 CS at Richards-Gebaur AFB, MO, were used to support the control tower tests. One maintenance technician had had some familiarization training on the radio. All other maintenance and operator personnel were completely unfamiliar with the radio. Technical data was available for their use.

3.4 Test Environment.

3.4.1 The prototype laboratory has the facilities to perform mock-up installations and to conduct screen room tests. The screen room was used to conduct performance tests so outside interference would be held to a minimum. All test equipment that was used had recently been calibrated.

3.4.2 The GRC-171 was interfaced with a four-channel key system, a recorder, a GSA-135 control tower console, and the GRA-115 remote head panel in the control tower. The radio was installed on a sliding shelf in a closed rack in the equipment room one story below the tower cab.

3.5 Changes/Deviations from Test Plan.

3.5.1 Two transceivers were installed in accordance with LDBWS00893AD000 Revision B to verify installation standards.

3.5.2 The keying tests were conducted during plain text operation only. The different keying modes would not be affected by secure voice operation.

3.5.3 Testing with a VINSON simulator or VINSON engineering model was not conducted because the VINSON equipment was not available.

3.5.4 The VSWR test was not conducted because of the lack of appropriate test equipment. This test was accomplished during DT&E. The results of that test will satisfy the IOT&E test requirement.

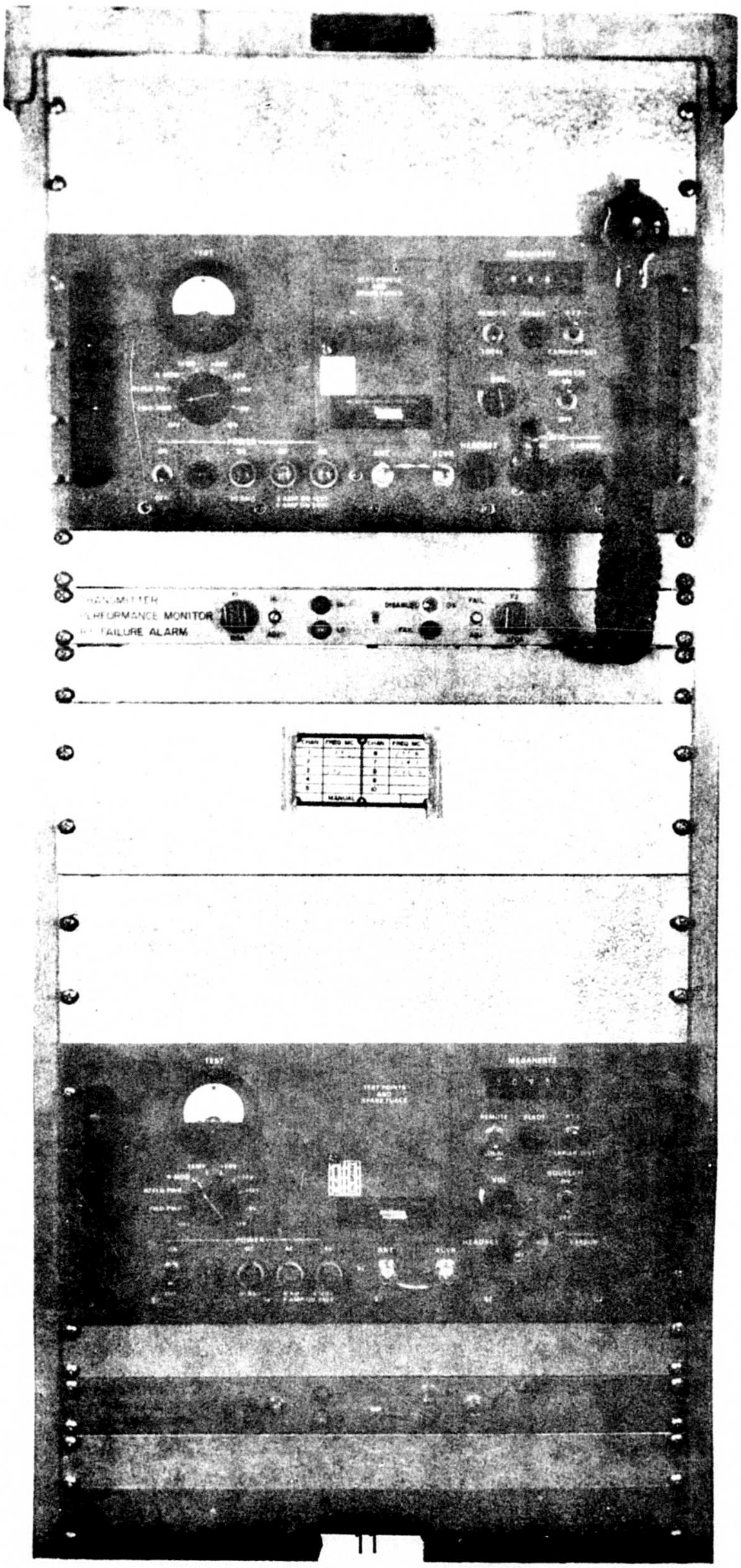
REPORT OF TEST ACTIVITY

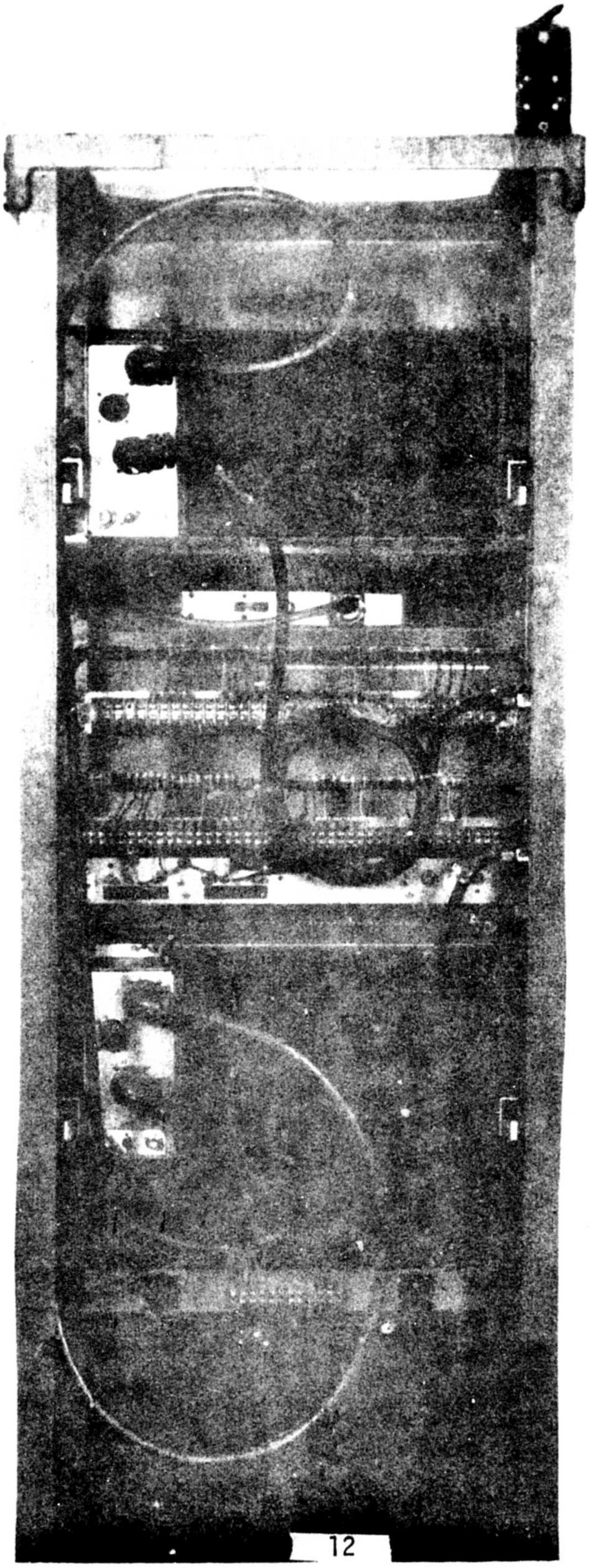
4.1 Installation.

4.1.1 Procedure: Two AN/GRC-171s were installed in a standard installation configuration LDBWS00893AD000 Revision B. A photograph of this configuration follows.

4.1.2 Results: During the process of this installation, several items were identified that could be changed. The first item is the identification of the hardware used to mount the slides. The front brackets are not interchangeable from right to left. However, they look almost identical. It would be advantageous if these brackets were physically marked right and left to avoid confusion during installation. Secondly, the slides provided were inadequate. If the slides were twisted slightly while attempting to slide the radio back in the rack, the slide had a tendency to snap apart. They were inspected by AFCS mechanical engineers and the safety technicians. Both agreed that the slides were not safe for operational use. These slides will have to be modified before they can be used in the field. Third, behind the front panel door there is a hole that provides space for the spare fuses which are mounted on the door. This hole opens directly into the high voltage section of the radio. This hole should be covered to prevent a fuse from falling onto bare contacts and to prevent a maintenance man from accidentally coming in contact with high voltage through the opening. Fourth, the low loss bridge between the "XCVR" and "ANT" terminals on the front panel should be changed to something smaller and sturdier. The present bridge protrudes far enough from the radio panel that it would be possible to break it off. Fifth, the connector at the remote control unit uses captive screws to connect the male and female connectors together. These screws appear to be very susceptible to stripping. This was the case on two remote units used for testing. Suggest a stronger captive screw be used. Sixth, a switched ground must be brought out to the back of the radio to connector J22 to provide a switched ground during transmit. This is necessary to make the radio compatible with the performance monitor. This problem has previously been documented and a favorable response to this request has been received. Lastly, the slots in the front panel that are used to secure the radio to a MT-686/GR rack are too small for the 1/4" bolts that are used. During installation, the slots had to be filed out before the bolts would go through. The above rack is the standard rack for Rivet Switch installations. These slots should be enlarged 0.265 ± 5 inches so problems are not encountered during installation in the field.

4.1.3 Conclusions: With the above changes implemented, the radio will be acceptable mechanically and should install easily.


FAILURE ALARM
MANUAL



4.2 Control Tower Tests.

4.2.1 Installation:

4.2.1.1 Procedure: The AN/GRC-171 was installed in the Richards-Gebaur Control Tower equipment room by a trained engineering installation team from Keesler AFB, MS. The radio was installed in a closed rack on a sliding shelf. The slides provided with the radio were not used for two reasons: (1) they did not fit in the closed rack and (2) they were considered unsafe. The rest of the installation was accomplished according to the available installation standards. The GRC-171 was interfaced with the four channel key system (GRA-83 and GRA-81), the recorder (AN/GSH-35), the remote control head panel (GRA-115) and the control tower console (AN/GSA-135). The radio was operated from one of the two console positions.

4.2.1.2 Results: No problems were encountered during the installation of the radio into the tower. The radio was compatible with all tower equipment. It was necessary to use a headset jack in the front of the radio in order to provide audio to the GRA-115 speaker. The main audio was used for the console speaker.

4.2.1.3 Recommendation: The headset audio should be brought out to the back of the radio along with the main audio so a jack will not have to be used when the radio is being operated remotely.

4.2.2 General Tower Test:

4.2.2.1 Procedure: Pilot information sheets were distributed to all pilots leaving the Richards-Gebaur AFB area. These sheets outlined procedures for them to initiate radio checks with the tower on a specified test frequency. The controller obtained all necessary information from the pilot and recorded it in the controller's log. Participation in the test had to be left to the discretion of the pilots. The GRC-171 was operated from one of the two operating positions at the tower console. Maintenance and radio set-up was accomplished by the radio maintenance shop of the 1879 CS.

4.2.2.2 Results: The radio did not fail at any time during the tower tests. Therefore, no maintenance was performed on the radio. Very little data was obtained during this portion of the test due to the lack of participation by the pilots. However, enough data was obtained to verify the suitability of the radio when used in a control tower environment. The operators of the radio were pleased with its performance as evidenced by the attached statement from the 1879 CS. Specific procedures used follow:

DEPARTMENT OF THE AIR FORCE
1879 COMMUNICATIONS SQUADRON (AFCS)
RICHARDS-GEBAUR AIR FORCE BASE, MISSOURI 64030

REPLY TO ATTN OF: FFA

3 March 1975

SUBJECT: OT&E GRC-171 Richards-Gebaur AFB Mo. Control Tower

TO: Project Officer (Lt. Merritt)

With the completion of the GRC-171 test at this base the following controller comments are submitted:

a. All controllers felt the GRC-171 was far superior than anything resently in use.

b. Quality of reception is equal if not better than present rivet switch equipment.

c. Selection of frequency is easier than the present (VHF GRC-175) and will be a big asset to mobile radar as well as tower operations.

FOR THE COMMANDER

CAYETANO A. A[illegible], Captain, USAF
Chief, Air Traffic Control Operations

Cy to: NCA/FFN

CONTROL TOWER PROCEDURES

1. The AN/GRC-171 will be installed in the equipment room of the Richards-Gebaur AFB control tower. The installation drawings will be developed by AFCS/EPE. The installation of the radio itself will be accomplished by the 1879CS with help from AFCS engineers and the Collins representative. The radio will be installed in as close to an operational configuration as possible. This will enable the test team to obtain some data on the radio in the following areas:

a. Ease of installation.

b. Equipment compatibility in the equipment rooms to include electromagnetic considerations and heat.

c. Equipment compatibility with older aircraft radios.

d. Accessibility for ease of maintenance.

e. Any obvious safety hazards.

f. Tools needed for installation.

2. The radio will be operated by a controller. Use of the radio will be governed by operational commitments and requirements. That is, aircraft control will be by existing equipment and the GRC-171 will be used only as time allows for testing.

3. The basic sequence for testing of the radio will be as follows:

a. Any pilot willing to participate in the test will be given a "Pilot Information Sheet" before he takes off.

b. While the aircraft is still on the ramp, try to make radio checks on all test frequencies to insure the radios are on frequency. Volume and readability on the ground will be used as a reference for all transmissions that will follow in the air.

c. Once the aircraft is in the air, the pilot will initiate the transmissions. He will be told to initiate a radio check on 303.15 MHz. The controller will then ask the pilot his range, altitude, bearing, volume, and readability. The controller will log this information along with the time, aircraft call sign, frequency and the volume and readability the controller is getting from the aircraft (see attached controller's log). The controller will then ask the pilot to make another radio check when able. The controller can tell the pilot to use the same test frequency or change to either 229.0 MHz, 392.10 MHz. An effort should be made to use all test frequencies to test the lower, middle, and upper bands of the radio.

d. The same type sequence can be used for incoming planes. Again, it is up to the pilot whether or not he participates.

e. The more aircraft we are able to do this type testing with, the more data we will have to support a production decision.

4. If the radio does need maintenance, both the maintenance man from the 1879CS and the Collins representative will be contacted. If at all possible, the 1879CS technician will do the maintenance. This will give us a rough idea of ease of maintenance and time to repair for the radio. The T.O. maintenance instructions should be used. Verification of the T.O.s will be an important aspect of this test. Any maintenance actions will be logged.

5. While the controller is operating the equipment, such things as warm-up time required from a power-off state to a ready-to-use state and time required to change channels will be monitored and logged. Any comments concerning the overall use of the radio whether good or bad should be logged by both the maintenance technician and the operator. If at all possible, a statement from the pilot of an aircraft participating in the test should also be obtained after landing giving his overall impression of the quality of the radio.

6. Attached are logs that can be used by both the operator and the maintenance technician to act as a guide in making their reports on the radio. These logs will be included in the final Test Report.

3 Atch
1. AN/GRC-171 Failure/Maintenance Report
2. Controller's Log
3. Pilot Information Sheet

AN/GRC-171 FAILURE/MAINTENANCE REPORT

DATE: ______________________ PREPARED BY: ____________________

DESCRIPTION OF FAILURE:

CORRECTIVE ACTION TAKEN:

PARTS REPLACED:

COMMENTS:

TIME TO ISOLATE FAULT: ________________

TIME TO MAKE REPAIRS: ________________

TOTAL TIME DOWN: ________________

CONTROLLER'S LOG AN/GRC-171 OT&E DATE:

CONTROLLER: (Available Test Frequencies: 229.0 303.15 392.10)

Time	Call A/C Sign	Freq	Altitude	Range	Bearing	PILOT Volume	PILOT Readability		CONTROLLER Volume	CONTROLLER Readability			

PILOT INFORMATION SHEET

1. The AN/GRC-171 is a new G/A UHF multi-channel transceiver. It is a part of the Rivet Switch program to replace existing UHF/VHF communications equipments. It is currently being tested in an operational environment. One radio is installed in the Control Tower. Testing will be confined to flight testing and will not be used for routine Air Traffic Control until the radio has been proven safe.

2. The success of the Control Tower tests depends to a great degree on the cooperation of the flight crews. We are asking for radio checks on the GRC-171 to help us evaluate the performance and quality of the radio.

3. If you are able to help us with this test, request the following procedures be followed:

a. Contact the tower every so often on test frequency 303.15 MHz.

b. The tower will request your range, altitude, bearing, volume, and readability. Try to make this as accurate as possible for this will show us just how the radio is performing. All data will be logged by the controller.

c. During the test, the controller may ask you to tune to a different test frequency. This will be done to check the performance of the radio across the frequency band. Again, your cooperation will be appreciated. The other test frequencies are 229.0 MHz and 392.10 MHz.

d. The pilot has the option of terminating the test at any point, but if it is possible to continue for a number of transmissions, it would be most helpful. If initial contact is not made or contact is lost at any time for any reason, the pilot should revert to his normal enroute radio frequency and consider the test terminated.

4. If there are any questions, please contact Lt Merritt at Ext 2901 or 3408.

4.2.3 AN/ARC-164 and AN/GRC-171 Operational Compatibility.

4.2.3.1 Procedure: The AN/GRC-171 was installed in the Richards-Gebaur AFB Control Tower. The AN/ARC-164 was installed in a VT-29D aircraft, tail number 812, call sign UTAH-34, based at Randolph AFB, TX. The aircraft flew into the Richards-Gebaur AFB area 16 Dec 74. Two short, low altitude sorties, 6,000 ft, 70-80 n miles, at a 210° radial, were flown. One sortie (Test #1) was flown with both radios in the 50KHz channel spacing configuration. The other (Test #2) was flown with the radios in the 25KHz configuration. As the aircraft was leaving the area for the return trip to Randolph AFB (Test #3), contact was maintained in the 50KHz configuration for as long as possible at an altitude of 16 K ft. The three frequencies used for these tests were 229.0 MHz (low), 303.15 MHz (middle), and 392.10MHz (high). The air traffic controller on duty during testing maintained a log consisting of range, altitude, time, the pilots' volume by readability score and the controller's volume by readability score. This test was designed to determine the compatibility between the AN/GRC-171 and the AN/ARC-164 and not to verify maximum operational range. No quantitive testing was accomplished. The test plan used for this particular test follows.

4.2.3.2 Results: Test #1 - Low profile - Wideband (50KHz). Frequency 392.10.

The pilot reported receiving the GRC-171 transmisssion 5 x 5 (Volume x Readability) at ranges out to about 85 NM. At 95 NM the GRC-171 was reported to be 4 x 3.

The controller reported receiving the ARC-164 transmissions 5 x 5 out to a range of about 63 NM. From 67 NM to about 82 NM the ARC-164 signal was below squelch but 5 x 5. The signal was weak beyond 85 NM, and was lost at 95 NM. The same signal strengths were obtained using frequencies 303.15 and 229.0 (Refer to Attached Test Logs).

When asked to rate the speech quality of the radios, the three aircrew members and the controller who participated in this test rated various speech properties to be from Fairly Good to Extremely Good. (Refer to Attached Questionnaires.)

Test #2 - Low profile - Narrowband (25KHz). Frequency 392.10.

The pilot reported receiving the GRC-171 transmissions 5 x 5 at ranges out to about 90 NM. Beyond 90 NM to about 98 NM the signal was at the level of about 3 x 3. The signal was lost beyond 98 NM.

The controller reported receiving the ARC-164 transmissions 5 x 5 out to about 65 NM. Beyond that point the signal was below squelch but 5 x 5 out to a range of about 80 NM. From 80 NM to 96 NM the signal strength was between 1 x 1 and 4 x 4 levels. Signals were unreadable beyond 96 NM.

No significant difference was found when testing frequencies 303.15 and 229.0 at 25KHz channel spacing.

As in Test #1, the three aircrew members and the controller rated the voice quality to be from Fairly Good to Extremely Good. The pilots reported that the voice was generally clearer in Test #2 than in Test #1.

Test #3 - High profile (16,000 ft MSL) - Wideband (50KHz). 392.10.

The pilots reported the GRC-171 transmissions were 5 x 5 out to a range of 155 NM. Communication was lost beyond this range.

The controller reported 5 x 5 signal levels out to 143 NM on the first outbound leg and out to 155 NM on the second outbound leg. This data was taken on the T-29D return to Randolph AFB, TX.

In addition to these three flight tests, ground radio checks were conducted between the ARC-164, GRC-171, and Richards-Gebaur RAPCON radio (GRC-27). The voice quality of the ARC-164 and the GRC-171 proved to be significantly clearer than the GRC-27.

The ARC-164 and GRC-171 had previously been used operationally. No radio "peaking" was accomplished. Later measurements of the equipment showed that the GRC-171 had a power output of approximately 21 watts across the band. The ARC-164 power out was as follows: 6.5 watts at 392.10 MHz, 8.9 watts at 303.15 MHz, and 7 watts at 229.0 MHz. The squelch setting of the GRC-171 was set at approximately 5 microvolts. The ARC-164 squelch was set at 3.2 microvolts.

No problems were encountered during the tests. The radios appear to be compatible in all respects. The operators of the radios, both on the ground and in the air reported that distortion and noise were low while understandability was excellent. The controllers were particularly impressed with the ease of operation and speed to change frequencies of the GRC-171.

CONCLUSIONS: These ARC-164/GRC-171 Interoperability tests verified clear voice operation in both wide- and narrowband operation. Based on this subjective type of test, the voice quality of these two radios is a quantum improvement over present operational radios of the same functional use.

AN/GRC-171 AN/ARC-164

Compatibility Testing

Test Plan

AN/GRC-171 IOT&E

1. Purpose: The purpose of the test is to evaluate the compatibility of the GRC-171 and the ARC-164 in an operational environment.

2. Objectives:

a. Communicate with the two radios G/A, G/G, and A/G.

b. Utilize the radios in both the 25 KHz and 50 KHz modes.

c. Obtain data on the general quality of the voice signal.

3. Test Sequence:

a. 16 Dec 74 - Morning.

Aircraft flies into Richards-Gebaur AFB. The control tower will be monitoring 303.15 MHz. All radios checks will be made on that frequency. The aircraft will land and a meeting of the aircraft crew, controllers, and maintenance men will be held. This meeting will be used to spell out specific details of the test before the plane takes off again. Tower will monitor 303.15 MHz.

b. 16 Dec 74 - Afternoon.

The aircraft will take off and data will be obtained with both radios in the 50 KHz mode. The flight profile used will be on a radial at approximately 210° magnetic north at about 5500 ft MSL. This should put the fringe of communications at about 75-80 miles. The aircraft will fly in and out of this area to determine how the radios communicate in degraded signal areas. A picture of the suggested flight pattern is attached. After the aircraft has landed and is taxiing into position on the ramp, the pilot will switch the ARC-164 into the 25 KHz mode. This will allow us to investigate the ability of the radios to communicate when in different modes.

c. 17 Dec 74 - Morning.

The GRC-171 will be converted to the 25 KHz mode. The aircraft will take off again and fly the same pattern as the day before using the 25 KHz mode. This will give a comparison of the 25 KHz and 50 KHz modes. When the aircraft lands, it will switch to the 50 KHz mode and talk to the GRC-171.

d. 17 Dec 74 - Afternoon.

The GRC-171 will be converted to the 50 KHz mode. This flight profile will be different. This will be a long range flight to determine the compatibility of the radios at longer ranges. The primary purpose of the flight will be to attempt communication at 150 to 200 miles at an altitude of between 15K and 25K feet.

e. After this, the aircraft will be free to return to Randolph AFB.

f. Total number of flying hours will be about seven(7).

g. After each flight the crew and controller will fill out the intelligibility questionnaire for later scoring.

4. On the short profile, the aircraft will fly on a radial about 210° magnetic north at about 5500 feet. Transmission should be lost at about 75 to 80 miles. A steady transmission will be made to the aircraft while he is outbound. The VHF channel will be used as order-wire. The pilot will report the range, bearing, and altitude that he lost the signal. He will then proceed on about 10 more miles to be sure that they are not just in a null. After this, he will turn around and come back on the same radial. He will then report when he again acquires signal. This will be repeated again to be sure the two points are correct. This pattern will be flown repeatedly with voice communications and using all three test frequencies. When enough data has been obtained, the aircraft will land.

5. The long profile will be at high altitude, approximately 15K to 25K feet. The aircraft will fly a radial outbound until communication is no longer possible. The aircraft will then make approximately the same turns as in the short profile, but only two or three times. He will then return to Randolph AFB.

6. During the flight profiles, the following procedures will be followed:

a. The controller will ask the pilot his readabilty, Signal Strength, altitude, bearing and range. The pilot will answer using the following format:

(1) Readability:

(a) Bad 1

(b) Poor 2

(c) Fair 3

2

(d) Good 4

(e) Excellent . . 5

(2) Signal Strength:

(a) Scarcely Perceptible . . . 1

(b) Weak 2

(c) Fairly Good 3

(d) Good 4

(e) Very Good 5

The controller will do all the logging. The controller will then make a judgment as to the readability of signal from the aircraft to the tower and make a appropriate log entry using the same format as the pilot used.

b. An effort should be made to use all three test frequencies to test the lower, middle, and upper bands of both radios. The test frequencies are 229.0 MHz, 303.15 MHz, and 392.10 MHz. A sequence of frequency "1" (low), frequency "2" (middle), and frequency "3" (high) will be used when possible. This sequence should be accomplished as many times as possible during the flight. As much data as possible around the outer limits of the radio range should be taken. The number of frequency changes will be determined by the cooperation of both the pilot and controller.

7. The test dates were established by AFCS after coordination with ASD/RWVF. ASD/RWVF then requested ATC to provide an IOT&E aircraft for the established date. ATC provided the tail number, call sign, and established time/date of arrival to AFCS/XPQO, info ASD/RWVF.

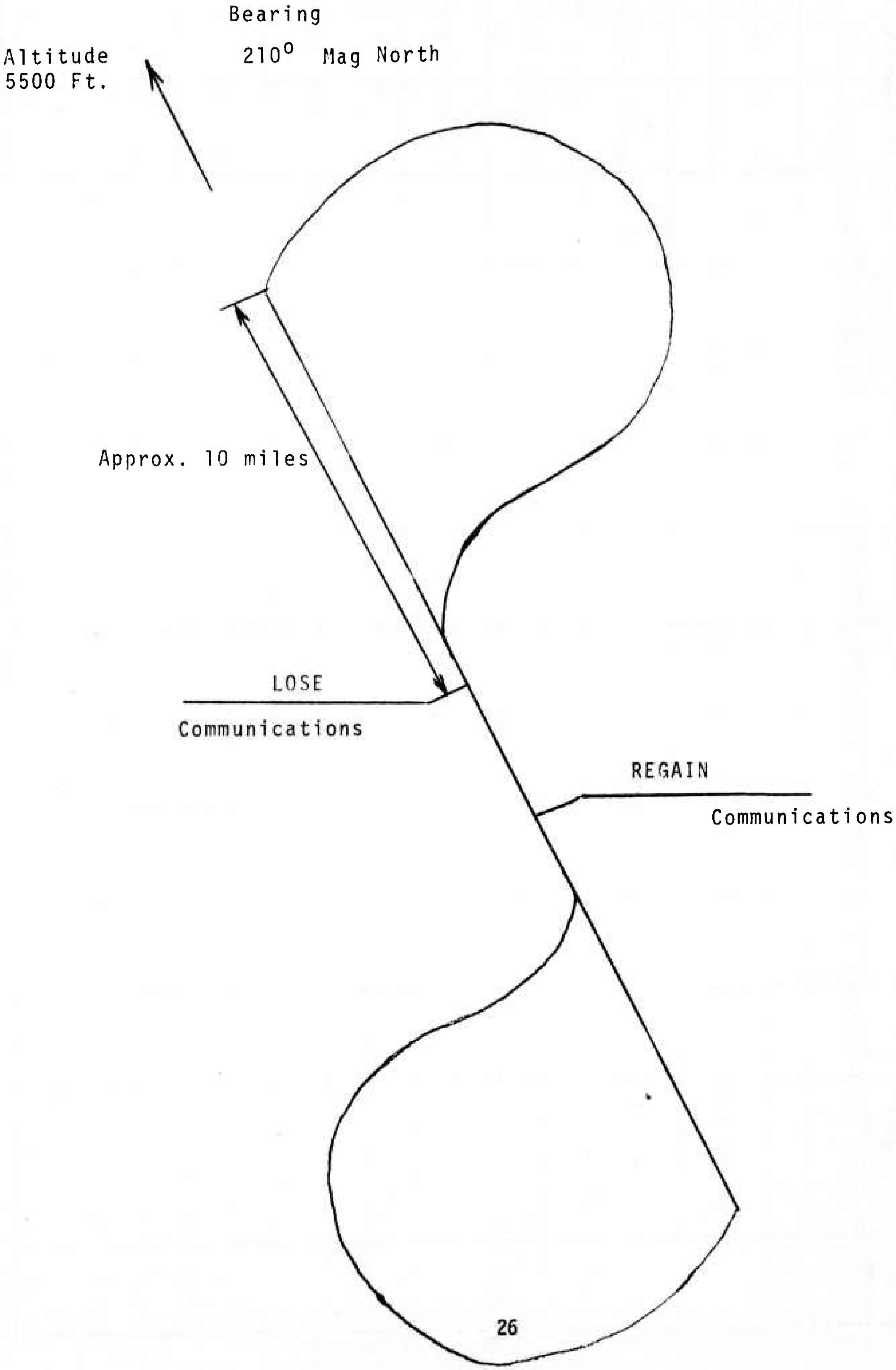
3 Atch
1. Controller's Log
2. Flight Profile Diagram
3. Personnel Data Form for Communications Personnel

CONTROLLER'S LOG AN/GRC-171 OT&E DATE:

CONTROLLER: (Available Test Frequencies: 229.0 303.15 392.10)

Time	Call A/C Sign	Freq	Altitude	Range	Bearing	PILOT Volume	PILOT Readability		CONTROLLER Volume	CONTROLLER Readability			

AFCS FORM MAY 69 199c ☆U. S. GOVERNMENT PRINTING OFFICE: 1974--665377/1008 GENERAL PURPOSE FORM AFCS-38002/1020


Bearing
Altitude
5500 Ft.
210° Mag North
Approx. 10 miles
LOSE
Communications
REGAIN
Communications

Dynastat

PERSONAL DATA FORM FOR COMMUNICATIONS PERSONNEL

Name: ____________________ Rank: __________ SN: __________

AGE: ______ Sex: ______ AFOS: ____________________

Organization: ______________________________

Nature of Duties in Present Assignment: ____________________

____

Nature of Duties in Previous Assignment: ____________________

____

Technical Training Schools Attended:

School	Course	From	To

Number of year's experience as communications equipment operator:

____

Experience with specific communications equipments:

Equipment	Years Experience

Dynastat

DATE/TIME ______________
RUN # ______________

SUBJECTIVE RATING OF VOICE CHANNEL

In the space below please rate the speech channel you have just heard with respect to the various properties indicated below. Place an "X" in the appropriate space to indicate your rating of each property.

NATURALNESS

☐	☐	☐	☐	☐
Extremely Good	Fairly Good	Adequate	Fairly Poor	Extremely Poor

FREEDOM FROM NOISE

☐	☐	☐	☐	☐
Extremely Poor	Fairly Poor	Adequate	Fairly Good	Extremely Good

FREEDOM FROM DISTORTION

☐	☐	☐	☐	☐
Extremely Good	Fairly Good	Adequate	Fairly Poor	Extremely Poor

UNDERSTANDABILITY

☐	☐	☐	☐	☐
Extremely Poor	Fairly Poor	Adequate	Fairly Good	Extremely Good

OVERALL ACCEPTABILITY

☐	☐	☐	☐	☐
Extremely Good	Fairly Good	Adequate	Fairly Poor	Extremely Poor

Comments: ____

____

Factors that may have affected your performance: ______________________

____

____
Your name

CONTROLLER'S LOG AN/ARC-164 AND AN/GRC-171 OT&E (INITIAL CONTACT) DATE: 16 DEC 74

CONTROLLER: JAMES E. SCOTT, TSgt., USAF (Available Test Frequencies: 229.0 303.15 392.10)

(Z) Time	Call A/C Sign	(MHz) Freq	(ft) Altitude	(nm) Range	Bearing	PILOT Volume	PILOT Readability		CONTROLLER Volume	CONTROLLER Readability			BANDWIDTH
1229	UTAH 34	303.15	5500	15	250	5	5		5	5			50KHz
1236			4000	11	200	5	5		5	5			
1238			3000	10	200	5	5		5	5			
1241			2600	8	180	5	5		5	5			
1243			2600	5	180	5	5		5	5			
1244				4	180	5	5		5	5			
1245				2	180	5	5		5	5			
1246			ON GRND	1/4	270	5	5		5	5			

AFCS FORM MAY 69 199c ★U. S. GOVERNMENT PRINTING OFFICE 1974--665377/1008 GENERAL PURPOSE FORM AFCS-38002/1020

CONTROLLER'S LOG AN/ARC-164 AND AN/GRC-171 OT&E (RUN #1) DATE: 16 DEC 74 SHEET 1

CONTROLLER: JACK R. BALL TSgt USAF (Available Test Frequencies: 229.0 303.15 392.10)

(Z) Time	Call A/C Sign	(MHz) Freq	(ft) Altitude	(nm) Range	Bearing	PILOT Volume	PILOT Readability		CONTROLLER Volume	CONTROLLER Readability		BAND WIDTH	
2136	UTAH 34	303.15	6000		210°	5	5		5	5		50 KHz	
2147		303.15	7000	38	210°	5	5		5	5			
2141		229.0	7000	40		5	5		5	5			
2147		392.10	7000	42		5	5		5	5			
2150		392.10	7000	47		5	5		5	5			
2152			7000	55		5	5		5	5			
2154			7000	60		5	5		5	5			
2156			7000	65		5	5		5	5			
2157			7000	70		1	0		5	5			
	SEE ATTACHED EXPLANATION SHEET												
2211			5000	64		5	5		5	5			
2212			5000	60		5	5		5	5			
2214			5000	55		5	5		5	5			
2215			5000	54		5	5		5	5			
2217			5000	59		5	5		5	5			
2219				65		5	5		5	5			
2220				67		5	5		5	5			
2221				68		5	5		5	5			
2222				69		5	5		5	5			

AFCS FORM MAY 69 199c ★U. S. GOVERNMENT PRINTING OFFICE: 1974--665377/1008 GENERAL PURPOSE FORM AFCS-38002/102C

GENERAL INFORMATION

RUN # 1   50 KHz   16 Dec 74

Ref sheet 1 short profile 50 KHz

2157 - 2211

Apparently the COAX switch used to switch the tower antenna between the GRA-53 and the GRC-171 caused a high VSWR to the GRC-171, for the radio had shut down to 5 watts out with a very high reflected power. The antenna was connected directly to the GRC-171 and everything worked correctly.

LONG RUN * FINAL OUTBOUND

50 KHz

General information from pilor

OUTBOUND - Lost transmission between 140 and 150 miles

INBOUND - 1 X 1 @ 160 mi.

4 X 4 @ 148 mi.

5 X 5 @ 140 mi.

Radio Characteristics

GRC-171

POWER approximately 21 watts across the band

SQUELCH set too high approximately 5 micro volts

ARC-164

POWER 6 watts @392.10 MHz

8-9 watts @ 303.15 MHz
and @ 229 MHz, 7 watts

SQUELCH 3.2 micro volts

CONTROLLER'S LOG AN/ARC-164 AND AN/GRC-171 OT&E (RUN #1) DATE: 16 DEC 74 SHEET 2

CONTROLLER: JACK R. BALL TSgt. USAF (Available Test Frequencies: 229.0 303.15 392.10)

(Z) Time	Call A/C Sign	(MHz) Freq	(FT) Altitude	(NM) Range	Bearing	PILOT Volume	PILOT Readability		CONTROLLER Volume	CONTROLLER Readability		BAND WIDTH	
2223	UTAH 34	392.10	5000	70	210°	5	5		5	5		50KHZ	
2224				71		5	5		5	5			
2225				72		5	5		5	5			
(2227				80		5	5		BELOW SQUELCH				
2228				UNK		5	5						
2229				UNK		5	5						
2230				UNK		5	5						
2231				71		5	5						
2232				69		5	5						
2234				63		5	5		5	5			
2235				60		5	5		5	5			
(2236		303.15		58		5	5		5	5			
2238				56		5	5		5	5			
2240				62		5	5		5	5			
2240				63		5	5		5	5			
2241				64		5	5		5	5			
2241				65		5	5		5	5			
2242				66		5	4		5	5			
2242				67		5	5		5	5			

AFCS FORM MAY 69 199c ☆U. S. GOVERNMENT PRINTING OFFICE 1974--665377/1008 GENERAL PURPOSE FORM AFCS-38002/1020

CONTROLLER'S LOG   AN/ARC-164 AND AN/GRC-171 OT&E (RUN #1)   DATE: 16 DEC 74   SHEET 3

CONTROLLER: ~~JACK~~ R. BALL TSgt USAF   (Available Test Frequencies: 229.0 303.15 392.10)

(Z) Time	Call A/C Sign	(MHz) Freq	(ft) Altitude	(nm) Range	Bearing	PILOT Volume	PILOT Readability		CONTROLLER Volume	CONTROLLER Readability		BAND-WIDTH	
2242	UTAH 34	303.15	5000	68	210°	5	3		5	5		50 kHz	
2244				UNK		5	4		5	5			
2248				76		5	4		BELOW	SQUELCH			
49				75		5	4						
2249				74		5	5						
2250				73		5	5						
2250				72		5	5						
2251				70		5	5						
2252				68		5	5						
2252				66		5	4						
2253				64		5	4		5	5			
56				63		5	5		5	5			
2257				65		5	5		5	5			
2258				68		5	5		5	5			
2258				69		5	5		5	5			
2259				70		5	5		5	5			
2300				76		5	5		BELOW	SQUELCH			
2302				75		5	5						
2302				74		5	5						

AFCS FORM MAY 69 199c   ★U. S. GOVERNMENT PRINTING OFFICE 1974-665377/1008   GENERAL PURPOSE FORM   AFCS-38002/1020

CONTROLLER'S LOG AN/ARC-164 AND AN/GRC-171 OT&E (RUN # 1) DATE: 16 DEC 74 SHEET 4

CONTROLLER: JACK R. BALL TSGT (Available Test Frequencies: 229.0 303.15 392.10)

(Z) Time	Call A/C Sign	(MHz) Freq	(FT) Altitude	(NM) Range	Bearing	PILOT Volume	PILOT Readability	CONTROLLER Volume	CONTROLLER Readability	BAND-WIDTH
2303	UTPH 34	303.15	5000	73	210°	5	5	BELOW	SQUELCH	50 KHz
2304				71		5	5			
2304				70		5	5			
05				69		5	5			
2305				67		5	5	5	5	
2306		229.0		64		5	5	5	5	
2309				66		5	5	5	5	
2312				EST 74		5	5	BELOW	SQUELCH	
2313				EST 76		5	5			
2315				EST 75		5	5			
2315				ACTUAL 75		5	5			
16				74		5	5			
2317				69		5	5			
2318				67		5	5			
2318				65		5	5			
2319				64		5	5			
2319				63		5	5			
2319				63		5	5	5	5	
2322				58		5	5	5	5	

AFCS FORM MAY 68 199c ★U. S. GOVERNMENT PRINTING OFFICE 1974--665377/1008 GENERAL PURPOSE FORM AFCS-38002/1020

CONTROLLER'S LOG AN/ARC-164 AND AN/GRC-171 OT&E (RUN # 1) DATE: 16 DEC 74 SHEET 5

CONTROLLER: JACK R. BALL TSGT. (Available Test Frequencies: 229.0 303.15 392.10)

(Z) Time	Call A/C Sign	(MHz) Freq	(FT) Altitude	(NM) Range	Bearing	PILOT Volume	PILOT Readability		CONTROLLER Volume	CONTROLLER Readability		BANDWIDTH	
2322	UTAH 34	229.0	5000	60	210°	5	5		5	5		50KHz	
2324				62		5	5		5	5			
2325				65		5	5		5	5			
(26				67		5	5		BELOW	SQUELCH			
2327				71		5	5						
2328				73		5	5						
2329				EST 78		5	5						
2330				80		5	5						
2331				82		5	5						
2332				85		5	4		WEAK				
2333				89		5	4						
(34				92		5	4						
2335				95		4	3						
2336									LOST	RADIO			
2339				87		5	4		BELOW	SQUELCH			
2340				UNK		5	5		1	3			
2342				78		5	5		BELOW	SQUELCH			
2344				75									
2344				ACTUAL 73									

AFCS FORM MAY 69 199c ★U. S. GOVERNMENT PRINTING OFFICE 1974--665377/1008 GENERAL PURPOSE FORM APCS-38002/1080

CONTROLLER'S LOG AN/ARC-164 AND AN/GRC-171 OT&E (RUN #1) DATE: 16 DEC 74 SHEET 6

CONTROLLER: JACK R. BALL TSGT (Available Test Frequencies: 229.0 303.15 392.10)

(Z) Time	Call A/C Sign	(MHz) Freq	(FT) Altitude	NM Range	Bearing	PILOT Volume	PILOT Readability		CONTROLLER Volume	CONTROLLER Readability		BAND WIDTH	
2345	UTPH 34	229.0	5000	71	210°	5	5		BELOW	SQUELCH		50KHz	
2346	│	│	│	69	│	5	5		│	│		│	
2247	│	│	│	67	│	5	5		│	│		│	
47	│	│	│	65	│	5	5		│	│		│	
2348	┴	┴	┴	63	┴	5	5		5	5		┴	

AFCS FORM MAY 69 199c   ★U.S. GOVERNMENT PRINTING OFFICE: 1974--665377/1008   GENERAL PURPOSE FORM   AFCS-38002/1020

CONTROLLER'S LOG AN/ARC-164 AND AN/GRC-171 OT&E (RUN #2) DATE: 17 DEC 74 SHEET 1

CONTROLLER: SSgt Ash. (Available Test Frequencies: 229.0 303.15 392.10)

(Z) Time	Call A/C Sign	(MHz) Freq	(FT) Altitude	(NM) Range	Bearing	PILOT Volume	PILOT Readability		CONTROLLER Volume	CONTROLLER Readability		Band Width	
1445	UTAH 34	392.1	5000		210°				5	5		25 KHz	
1457				45		5	5		5	5			
1458				5.0		5	5		5	5			
00				55		5	5		5	5			
1502				60		5	5		5	5			
1503				63.5		5	5		5	5			
1504				65		5	5		5	5			
1504				66		5	5		5	5			
1504				67		5	5		5	5			
1505				68		5	5		5	5			
1505				69		5	5		5	5			
18				69.5		5	5		BELOW 2	SQUELCH 5			
1518				68		5	5		5	5			
1519				67		5	5		5	5			
1520				65		5	5		5	5			
1522				58		5	5		5	5			
1524				63		5	5		5	5			
1525				65		5	5		5	5			
1525				66		5	5		5	5			

AFCS FORM MAY 60 199c ★U. S. GOVERNMENT PRINTING OFFICE: 1974--665377/1008 GENERAL PURPOSE FORM AFCS - 38002/1020

CONTROLLER'S LOG AN/ARC-164 AND AN/GRC-171 OT&E (RUN #2) DATE: 17 DEC 74 SHEET 2

CONTROLLER: SSGT ASH (Available Test Frequencies: 229.0 303.15 392.10)

(Z) Time	Call A/C Sign	(MHz) Freq	(FT) Altitude	(NM) Range	Bearing	PILOT Volume	PILOT Readability		CONTROLLER Volume	CONTROLLER Readability		BAND-WIDTH	
1525	UTAH 34	392.1	5000	67	210°	5	5		5	5		25KHz	
1526				68		5	5		5	5			
1526				70		5	5		5	5			
(28				73		5	5		BELOW 3'	SQUELCH 5			
1528				76		5	5		3	5			
1528				77		5	5		3'	5			
1529				78		5	5		3	5			
1530				80		5	5		3	5			
1530				83		5	5		3	5			
1531				86		5	5		3	5			
1532				88		5	5		5	5			
33				90					5	5			
1534				92		4	5		5	5			
1534				95					3	5			
1535				98					2	2			
1538				95					1	2			
1538									1	2			
1539									1	4			
1540				86					1	4			

AFCS FORM MAY 69 199c ★U. S. GOVERNMENT PRINTING OFFICE 1974--665377/1008 GENERAL PURPOSE FORM AFCS-38002/1020

CONTROLLER'S LOG AN/ARC-164 AND AN/GRC-171 OT&E (RUN #2) DATE: 17DEC 74 SHEET 3

CONTROLLER: SSGT ASH (Available Test Frequencies: 229.0 303.15 392.10)

(Z) Time	Call A/C Sign	(MHz) Freq	(Ft) Altitude	(NM) Range	Bearing	PILOT Volume	PILOT Readability		CONTROLLER Volume	CONTROLLER Readability		BAND WIDTH	
1541	UTAH 34	392.1	5000	85	210°	5	5		BELOW 3	SQUELCH 3	STATIC	25KHz	
1544				80		5	5		4	5			
1545				75		5	5		5	5			
46				73		5	5		5	5			
1547				70		5	5		5	5			
1548				69		5	5		5	5			
1548				67		5	5		5	5			
1549				65		5	5		5	5			
1550				63		5	5		5	5			
1551				61		5	5		5	5			
1551				60		5	5		5	5			
51		303.5		60		5	5		5	5			
1553				63		5	5		5	5			
1554				65		5	5		5	5			
1555				67		5	5		5	5			
1555				69		5	5		5	5			
1557				71		5	5		BELOW 5	SQUELCH 5			
1558				73		5	5		5	5			
1559				80		5	5		4	5			

AFCS FORM MAY 69 199c ★U.S. GOVERNMENT PRINTING OFFICE 1974--665377/1008 GENERAL PURPOSE FORM AFCS-38002/1020

CONTROLLER'S LOG AN/ARC-164 AND AN/GRC-171 OT&E (RUN #2) DATE: 17 DEC 74 SHEET 4

CONTROLLER: SSGT ASH (Available Test Frequencies: 229.0 303.15 392.10)

(Z) Time	Call A/C Sign	(MHz) Freq	(Ft) Altitude	(NM) Range	Bearing	PILOT Volume	PILOT Readability		CONTROLLER Volume	CONTROLLER Readability		BAND WIDTH	
1600	UTAH 34	303.15	5000	83	210°	5	5		BELOW 5	SQUELCH 5		25KHz	
1601				85		5	5		4	5			
1602				90		5	5		3	3	STATIC		
03				93		4	4		3	3	STATIC		
1604				96		3	2		3	2			
1605									3	1			
1607									3	1			
1608				93					3	2			
1609				89					3	2			
1610				87		5	4		3	2			
1611				83		5	5		4	3	STATIC		
12				81		5	5		5	3	STATIC		
1614				76		5	5		5	5			
1616				70		5	5		5	5			
1618				65		5	5		5	5			
1619				63		5	5		5	5			
1620				61		5	5		5	5			
1621				58		5	5		5	5			
1623						5	5		5	5			

AFCS FORM MAY 69 199c ★U.S. GOVERNMENT PRINTING OFFICE: 1974-66537/1008 GENERAL PURPOSE FORM AFCS-38002/1020

CONTROLLER'S LOG AN/ARC-164 AND AN/GRC-171 OT&E (RUN #2) DATE: 17 DEC 74 SHEET 5

CONTROLLER: SSGT ASH (Available Test Frequencies: 229.0 303.15 392.10)

Z Time	Call A/C Sign	(MHz) Freq	(Ft) Altitude	(N M) Range	Bearing	PILOT Volume	PILOT Readability	ity	CONTROLLER Volume	CONTROLLER Readability	ity	BAND WIDTH	
1625	UTAH 34	303.15	5000	61	210°	5	5		BELOW 5	SQUELCH 5		25 KHz	
1629		229.0		72		5	5		3	3	STATIC		
1629				76					3	4			
(31				79		5	5		3	3	STATIC		
1632				85		4	4		3	3	STATIC		
1633				87		5	5		2	3	STATIC		
1634				90		5	5		3	2	FADING IN & OUT		
1636						4	4		3	2	FADING IN & OUT		
1637						4	4		3	3	STATIC		
1638				80		4	4		4	3	STATIC		
1640				76		5	5		5	5			
(42				70		5	5		5	5			
1644				66		5	5		5	5			
1645				63		5	5		5	5			
1646				60		5	5		5	5			
1647				58		5	5		5	5			
1647						5	5		5	5			
1650				60		5	5		BELOW 5	SQUELCH 5			
1652				65		5	5		5	5			

AFCS FORM MAY 69 199c ★U.S. GOVERNMENT PRINTING OFFICE 1974--665377/1008 GENERAL PURPOSE FORM AFCS-38002/1020

CONTROLLER'S LOG AN/ARC-164 AND AN/GRC-171 OT&E (RUN #2) DATE: 17 DEC 74 SHEET 6

CONTROLLER: SSGT ASH (Available Test Frequencies: 229.0 303.15 392.10)

(Z) Time	A/C Call Sign	(MHz) Freq	(Ft) Altitude	(NM) Range	Bearing	PILOT Volume	PILOT Readability		CONTROLLER Volume	CONTROLLER Readability		BAND WIDTH	
1653	UTAH 34	229.0	5000	70	210°	5	5		BELOW 5	SQUELCH 5		25KHz	
1655				75		5	5		5	5			
1657				80		5	5		5	3	STATIC		
58				85		4	4		4	3	STATIC		
1659				88		5	5		3	3	STATIC		
1659						5	5		3	3	STATIC		
1701				88		4	4		3	3	STATIC		
1702				85		4	4		3	3	STATIC		
1703				80		5	5		4	3	STATIC		
1705				75		5	5		5	5			
1707				71		5	5		5	5			
08				66		5	5		5	5			
1710				63		5	5		5	5			
1710				61		5	5		5	5			
1711				59		5	5		5	5			
1712				57		5	5		5	5			
1720				30		5	5		5	5			
1735		303.15	GND	RAMP		5	5		5	5			

CONTROLLER'S LOG AN/PRC-164 AND AN/GRC-171 OT&E (LONG RANGE FINAL OUTBOUND) DATE: 17 DEC 74

CONTROLLER: SSGT ASH (Available Test Frequencies: 229.0 303.15 392.10)

(Z) Time	Call A/C Sign	(MHz) Freq	(Ft) Altitude	(NM) Range	Bearing	PILOT Volume	PILOT Readability		CONTROLLER Volume	CONTROLLER Readability		BAND WIDTH	
2012	UTAH 34	392.1	8600	21	180°	5	5		5	5		50KHz	
2017									2	2			
2019			14000	42	170°	5	5		5	5			
23			16000	55	180°	5	5		5	5			
2027				70		5	5		5	5			
2031				90		5	5		5	5			
2036				102		5	5		5	5			
2039				115		5	5		5	5			
2041				120		5	5		5	5			
2043				130		5	5		5	5			
2045				140		5	5		5	5			
55									2	1			
2058				148		5	5		2	4			
2101				140		5	5		5	5			
2104				140		5	5		5	5			
2106				145		5	5		5	5			
2108				150		5	5		5	5			
2109				155		5	5		3	3	STATIC		
2111									2	1			

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Dynastat

PERSONAL DATA FORM FOR COMMUNICATIONS PERSONNEL

Name: NUNN, C.E Rank: CAPT SN: 536381846

AGE: 33 Sex: M AFOS: Pilot - T-29

Organization: USAF IFC

Nature of Duties in Present Assignment: Member Flight Directives - Review/Revise instrument directives

Nature of Duties in Previous Assignment: B-52 Aircraft Commander - 3yrs

Technical Training Schools Attended:

School	Course	From	To
UPT		Dec 1967	Jan 1969

Number of year's experience as communications equipment operator:

7 yrs

Experience with specific communications equipments:

Equipment	Years Experience

Dynastat

DATE/TIME 16 Dec 3.0h
RUN # 1 50KHz

SUBJECTIVE RATING OF VOICE CHANNEL

In the space below please rate the speech channel you have just heard with respect to the various properties indicated below. Place an "X" in the appropriate space to indicate your rating of each property.

NATURALNESS

[ ]	[X]	[ ]	[ ]	[ ]
Extremely Good	Fairly Good	Adequate	Fairly Poor	Extremely Poor

FREEDOM FROM NOISE

[ ]	[ ]	[ ]	[X]	[ ]
Extremely Poor	Fairly Poor	Adequate	Fairly Good	Extremely Good

FREEDOM FROM DISTORTION

[ ]	[X]	[ ]	[ ]	[ ]
Extremely Good	Fairly Good	Adequate	Fairly Poor	Extremely Poor

UNDERSTANDABILITY

[ ]	[ ]	[ ]	[X]	[ ]
Extremely Poor	Fairly Poor	Adequate	Fairly Good	Extremely Good

OVERALL ACCEPTABILITY

[ ]	[X]	[ ]	[ ]	[ ]
Extremely Good	Fairly Good	Adequate	Fairly Poor	Extremely Poor

Comments: Better than most UHFs I have used - seems more distortion free.

Factors that may have affected your performance: ______

NUNN, C. E
Your name

Dynastat

DATE/TIME 17 Dec
RUN # ~~2~~ Test

SUBJECTIVE RATING OF VOICE CHANNEL

In the space below please rate the speech channel you have just heard with respect to the various properties indicated below. Place an "X" in the appropriate space to indicate your rating of each property.

NATURALNESS

Extremely Good	Fairly Good	Adequate	Fairly Poor	Extremely Poor
☐	X	☐	☐	☐

FREEDOM FROM NOISE

Extremely Poor	Fairly Poor	Adequate	Fairly Good	Extremely Good
☐	☐	☐	☐	X

FREEDOM FROM DISTORTION

Extremely Good	Fairly Good	Adequate	Fairly Poor	Extremely Poor
☐	X	☐	☐	☐

UNDERSTANDABILITY

Extremely Poor	Fairly Poor	Adequate	Fairly Good	Extremely Good
☐	☐	☐	X	☐

OVERALL ACCEPTABILITY

Extremely Good	Fairly Good	Adequate	Fairly Poor	Extremely Poor
☐	X	☐	☐	☐

Comments: Seemed to be slightly clearer than previous test

Factors that may have affected your performance: ______

[illegible signature]
Your name

Dynastat

PERSONAL DATA FORM FOR COMMUNICATIONS PERSONNEL

Name: MORGAN HERBERTH II Rank: CAPT SN: 479469336

AGE: 30 Sex: MALE AFOS: M1355G

Organization: 12 OPERATION SQUADRON/RANDOLPH AFB TX

Nature of Duties in Present Assignment: INSTRUCTOR PILOT, STANDARDIZATION/EVALUATION PILOT + FUNCTIONAL CHECK FLIGHT PILOT

Nature of Duties in Previous Assignment: SQUADRON PILOT

Technical Training Schools Attended:

School	Course	From	To
PILOT TRAINING		1970	1971

Number of year's experience as communications equipment operator:

5

Experience with specific communications equipments:

Equipment	Years Experience
VARIOUS ACFT RADIOS	
ARC 164	APPROX 4 MONTHS

Dynastat

DATE/TIME 16 DEC 74 3..
RUN # 1 50KHz

SUBJECTIVE RATING OF VOICE CHANNEL

In the space below please rate the speech channel you have just heard with respect to the various properties indicated below. Place an "X" in the appropriate space to indicate your rating of each property.

NATURALNESS

- [ ] Extremely Good
- [X] Fairly Good
- [ ] Adequate
- [ ] Fairly Poor
- [ ] Extremely Poor

FREEDOM FROM NOISE

- [ ] Extremely Poor
- [ ] Fairly Poor
- [ ] Adequate
- [ ] Fairly Good
- [X] Extremely Good

FREEDOM FROM DISTORTION

- [X] Extremely Good
- [ ] Fairly Good
- [ ] Adequate
- [ ] Fairly Poor
- [ ] Extremely Poor

UNDERSTANDABILITY

- [ ] Extremely Poor
- [ ] Fairly Poor
- [ ] Adequate
- [ ] Fairly Good
- [X] Extremely Good

OVERALL ACCEPTABILITY

- [X] Extremely Good
- [ ] Fairly Good
- [ ] Adequate
- [ ] Fairly Poor
- [ ] Extremely Poor

Comments: USEFUL RANGE OF ARC 164 WHEN USED GRC 171 WAS EXTREMELY GOOD - EXCEEDS NORMAL RANGE OF OTHER UHF RADIOS

Factors that may have affected your performance: WEATHER DURING FIRST 1/2 HR OF FLIGHT DETRACTED FROM MISSION.

MORGAN HERBERTH
Your name

Dynastat

DATE/TIME 17 DEC 74 3.0
RUN # 2 25 KHZ

SUBJECTIVE RATING OF VOICE CHANNEL

In the space below please rate the speech channel you have just heard with respect to the various properties indicated below. Place an "X" in the appropriate space to indicate your rating of each property.

NATURALNESS

[X]	[ ]	[ ]	[ ]	[ ]
Extremely Good	Fairly Good	Adequate	Fairly Poor	Extremely Poor

FREEDOM FROM NOISE

[ ]	[ ]	[ ]	[ ]	[X]
Extremely Poor	Fairly Poor	Adequate	Fairly Good	Extremely Good

FREEDOM FROM DISTORTION

[X]	[ ]	[ ]	[ ]	[ ]
Extremely Good	Fairly Good	Adequate	Fairly Poor	Extremely Poor

UNDERSTANDABILITY

[ ]	[ ]	[ ]	[ ]	[X]
Extremely Poor	Fairly Poor	Adequate	Fairly Good	Extremely Good

OVERALL ACCEPTABILITY

[X]	[ ]	[ ]	[ ]	[ ]
Extremely Good	Fairly Good	Adequate	Fairly Poor	Extremely Poor

Comments: RANGE IS EXCELLANT

Factors that may have affected your performance: NONE

MORGAN HERBERT H.
Your name

Dynastat

PERSONAL DATA FORM FOR COMMUNICATIONS PERSONNEL

Name: James T. Maguire Rank: Maj SN: 473-40-6623

AGE: 35 Sex: Male ~~AFOS~~: AFSC: 2691A

Organization: ASD Wright-Patterson AFB

Nature of Duties in Present Assignment: Program Manager ARC-164/VINSON Compatibilities

Nature of Duties in Previous Assignment: Air Operations Staff Office-7th AF Thailand

Technical Training Schools Attended:

School	Course	From	To
Air Navigation School	Air Navigation	Sep 62	Jul 63
RF-4C Air Crew Training	Recce Aircrew Tng	Oct 68	May 69

Number of year's experience as communications equipment operator:

12 yrs

Experience with specific communications equipments:

Equipment	Years Experience
Airborne UHF/VHF & HF Radio	12 yrs

Dynastat

DATE/TIME 16 Dec 79 / 13.0
RUN # 1 50 kHz

SUBJECTIVE RATING OF VOICE CHANNEL

In the space below please rate the speech channel you have just heard with respect to the various properties indicated below. Place an "X" in the appropriate space to indicate your rating of each property.

NATURALNESS

☐ Extremely Good	☒ Fairly Good	☐ Adequate	☐ Fairly Poor	☐ Extremely Poor

FREEDOM FROM NOISE

☐ Extremely Poor	☐ Fairly Poor	☐ Adequate	☒ Fairly Good	☐ Extremely Good

FREEDOM FROM DISTORTION

☐ Extremely Good	☒ Fairly Good	☐ Adequate	☐ Fairly Poor	☐ Extremely Poor

UNDERSTANDABILITY

☐ Extremely Poor	☐ Fairly Poor	☐ Adequate	☐ Fairly Good	☒ Extremely Good

OVERALL ACCEPTABILITY

☐ Extremely Good	☒ Fairly Good	☐ Adequate	☐ Fairly Poor	☐ Extremely Poor

Comments: GRC-171 slightly garbled on two occasions for a short period of time (3 minutes) over the 2+00 hrs. test.

Factors that may have affected your performance: None

James T. Maguire

James T. Maguire
Your name

Dynastat

DATE/TIME 17 Dec 3.0
RUN # 2 25KHz

SUBJECTIVE RATING OF VOICE CHANNEL

In the space below please rate the speech channel you have just heard with respect to the various properties indicated below. Place an "X" in the appropriate space to indicate your rating of each property.

NATURALNESS

[ ] Extremely Good	[X] Fairly Good	[ ] Adequate	[ ] Fairly Poor	[ ] Extremely Poor

FREEDOM FROM NOISE

[ ] Extremely Poor	[ ] Fairly Poor	[ ] Adequate	[X] Fairly Good	[ ] Extremely Good

FREEDOM FROM DISTORTION

[X] Extremely Good	[ ] Fairly Good	[ ] Adequate	[ ] Fairly Poor	[ ] Extremely Poor

UNDERSTANDABILITY

[ ] Extremely Poor	[ ] Fairly Poor	[ ] Adequate	[ ] Fairly Good	[X] Extremely Good

OVERALL ACCEPTABILITY

[ ] Extremely Good	[X] Fairly Good	[ ] Adequate	[ ] Fairly Poor	[ ] Extremely Poor

Comments: This was the 1st of the [illegible] compatible Test conducted at 25KHz bandspacing.

Factors that may have affected your performance: None

James T. Maguire
James T. Maguire
Your name

Dynastat

PERSONAL DATA FORM FOR COMMUNICATIONS PERSONNEL

Name: JACK R BALL Rank: TSGT SN: 287 32 8265

AGE: 36 Sex: M AFOS: 27270

Organization: 1879 COMM SQ

Nature of Duties in Present Assignment: AIR TRAFFIC CONTROLLER TOWER CREW CHIEF

Nature of Duties in Previous Assignment: AIR TRAFFIC CONTROL TECHNICIAN. (RAPCON + TOWER)

Technical Training Schools Attended:

School	Course	From	To
KEESLER	27330	JAN 57	MAR 57
KEESLER	27230	DEC 63	FEB 64

Number of year's experience as communications equipment operator:

17½ YRS

Experience with specific communications equipments:

Equipment	Years Experience
ABOUT ALL G/A RADIOS	
ASSOCIATED WITH AIR	
TRAFFIC CONTROL	

Dynastat

DATE/TIME 16 DEC 74
RUN # 1 50 KHz

SUBJECTIVE RATING OF VOICE CHANNEL

In the space below please rate the speech channel you have just heard with respect to the various properties indicated below. Place an "X" in the appropriate space to indicate your rating of each property.

NATURALNESS

[X] Extremely Good	[ ] Fairly Good	[ ] Adequate	[ ] Fairly Poor	[ ] Extremely Poor

FREEDOM FROM NOISE

[ ] Extremely Poor	[ ] Fairly Poor	[ ] Adequate	[ ] Fairly Good	[X] Extremely Good

FREEDOM FROM DISTORTION

[X] Extremely Good	[ ] Fairly Good	[ ] Adequate	[ ] Fairly Poor	[ ] Extremely Poor

UNDERSTANDABILITY

[ ] Extremely Poor	[ ] Fairly Poor	[ ] Adequate	[ ] Fairly Good	[X] Extremely Good

OVERALL ACCEPTABILITY

[X] Extremely Good	[ ] Fairly Good	[ ] Adequate	[ ] Fairly Poor	[ ] Extremely Poor

Comments: A VERY NICE PIECE OF EQUIPMENT.

Factors that may have affected your performance:

JACK R BALL
Your name

Dynastat

PERSONAL DATA FORM FOR COMMUNICATIONS PERSONNEL

Name: Ash Howard L. Rank: SSgt SN: 493-56-1831

AGE: 23 Sex: M AFOS:

Organization: 1879 Comm Sq.

Nature of Duties in Present Assignment: Senior Controller/Tower

Nature of Duties in Previous Assignment: Same

Technical Training Schools Attended:

School	Course	From	To
Keesler	3ABR27230	6/70	8/70

Number of year's experience as communications equipment operator:

4½

Experience with specific communications equipments:

Equipment	Years Experience
AIR TRAFFIC CONTROL	
GROUND RADIOS	

Dynastat

DATE/TIME 17 Dec 74 1445/1
RUN # 2 2 KHz

SUBJECTIVE RATING OF VOICE CHANNEL

In the space below please rate the speech channel you have just heard with respect to the various properties indicated below. Place an "X" in the appropriate space to indicate your rating of each property.

NATURALNESS

☐ Extremely Good	☒ Fairly Good	☐ Adequate	☐ Fairly Poor	☐ Extremely Poor

FREEDOM FROM NOISE

☐ Extremely Poor	☐ Fairly Poor	☐ Adequate	☐ Fairly Good	☒ Extremely Good

FREEDOM FROM DISTORTION

☒ Extremely Good	☐ Fairly Good	☐ Adequate	☐ Fairly Poor	☐ Extremely Poor

UNDERSTANDABILITY

☐ Extremely Poor	☐ Fairly Poor	☐ Adequate	☐ Fairly Good	☒ Extremely Good

OVERALL ACCEPTABILITY

☒ Extremely Good	☐ Fairly Good	☐ Adequate	☐ Fairly Poor	☐ Extremely Poor

Comments: ______________________________

Factors that may have affected your performance: ______________________________

[signature]
Your name

4.2.4 Compatibility with the GRA-115:

4.2.4.1 Procedure: The AN/GRC-171 installed in the control tower equipment room was used to determine the ability of the headset audio output to drive the speaker in the GRA-115, located in the control tower cab, without the use of external amplifiers. The controllers determined what signal level was adequate for their use. The headset audio output was set to 100 m watts (20 dbm), 50 m watts (17 dbm), and then to 25 m watts (14 dbm). A radio check was made at each of these values.

4.2.4.2 Results: In all cases, the audio level was adequate in the control tower cab. At 25 m watts, the speaker volume control was set at nearly maximum volume before the level was adequate. However, at the other two levels, the speaker volume control had to be turned down before the volume was at a normal listening level.

4.2.4.3 Conclusion: An external amplifier is not needed to drive a remote speaker when used with the AN/GRC-171.

4.3. <u>Laboratory Tests</u>.

4.3.1 Keying Option Test:

4.3.1.1 Procedure: All five keying options were tested to include center-tap to ground, 6V, 24V, 48V, external voltage and VOX operation. All straps required to change keying methods were accomplished according to the technical order. The threshold of each option was measured. All tests were conducted in the plain mode. The attached figure illustrates the set-up used to test the VOX option.

4.3.1.2 Results: All keying options were successful. Reliable keying was accomplished with an external loop resistance of 3000 ohms by all methods. For the VOX option, the transmitter keyed reliably with - 10 dbm and 0 dbm (average reading meter) audio input. No other input levels were attempted. The GRC-171 front panel meter indicated approximately 90% modulation with 0 dbm input and 75% modulation with - 10 dbm input.

4.3.1.3 Recommendation: The TO should illustrate to a greater extent where the straps are to be made for the different keying options. It was very difficult to determine where the straps were to be located. If none of the keying methods are wanted on the audio lines, all straps must be removed from the A-4 audio module and keying options selected on the A-9 keying module. This will prevent unwanted keying due to grounding or voltage levels on the audio lines. The push-to-talk (PTT) keying option is always available, regardless of what strapping option is employed.

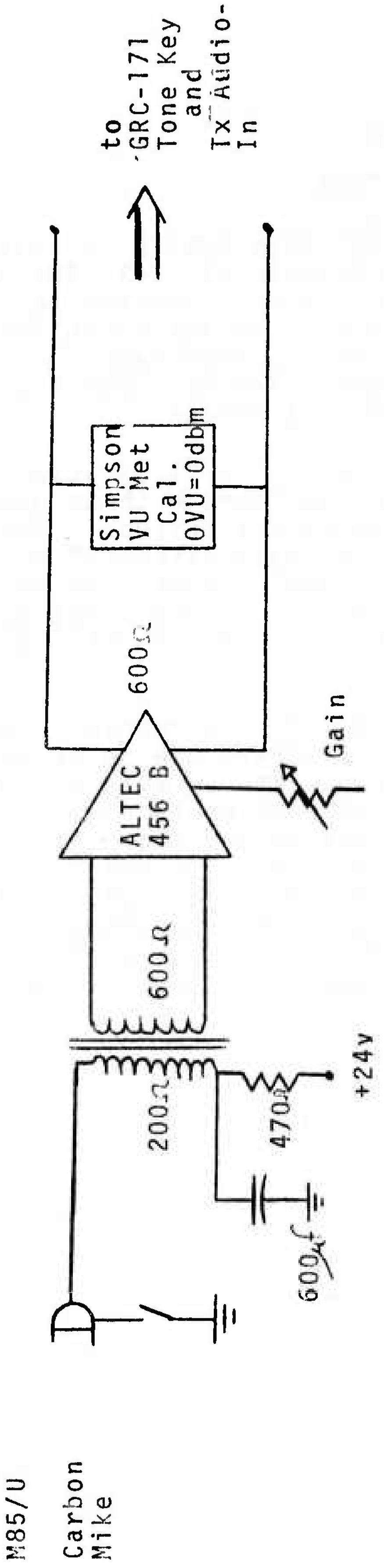

FIGURE 1

VOX Set-up

KEYING OPTION TEST PP #1

	GRND OPTION	6V OPTION				24V OPTION				48V OPTION			
	(THRESHOLD)	MODULE A4		MODULE A9		MODULE A4		MODULE A9		MODULE A4		MODULE A9	
		VOLTAGE	CURRENT	VOLTAGE	CURRENT	VOLTAGE	CURRENT	VOLTAGE	CURRENT	VOLTAGE	CURRENT	VOLTAGE	CURRENT
CENTER - TAP GROUNDED	4100 Ω	—	—	—	—	—	—	—	—	—	—	—	—
EXTERNAL VOLTAGE	—	3.95 V Theshold	0.2 mA	4.45 V THESHOLD	.09 mA	19.5 V THESHOLD	.15 mA	17.5 V Theshold	.37 mA	32.5 V THRESHOLD	.17 mA	27.6 V THRESHOLD	.60 mA
THROUGH 0 Ω	—	6V	0.5 mA	6 V	.11 mA	24 V	.84 mA	24 V	.50 mA	48 V	3.0 mA	48 V	1.20 mA
THRESHOLD VOLTS THRU 3K Ω	—	3.95 V	—	4.7 V	—	19.8 V	—	18.6 V	—	33.0 V	—	29.5 V	—

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4.3.2 Remote Control Tests:

4.3.2.1 Procedure: The remote control head was remoted from the radio by 150 ft., 1000 ft., and approximately 14 miles. Two sizes of wire were used, 22 AWG and 18 AWG. The radio remote cable connector and the control head connector were attached to two lengths of 22 AWG shielded cable approximately 10 ft., long. These cables were terminated on terminal strips thus allowing different lengths and sizes of cable and ancillary devices to be inserted. A different voltage regulator with a reference voltage of -1.0V and a multiplex system were used to evaluate the possibility of remoting the control head extended distances. A digital voltmeter was used to measure the voltage levels and an oscilloscope was used to measure the AC noise. The multiplex system was used to remote the control head approximately 14 miles over normal voice grade wireline.

4.3.2.2. Results: The control head was successfully remoted distances of 150 ft., 500 ft., and 1000 ft., using 22 AWG shielded cable. No problems were encountered when remoting 150 ft. At 500 ft., the shields on the cable needed to be grounded before reliable tuning could be accomplished. At 1000 ft., a different voltage regulator with a voltage reference of -1.0V was used in order to achieve reliable tuning. The key to reliable tuning appears to be the voltage level of a digital "zero." The advertised threshold between a digital "zero" and a digital "one" for TTL is 800mv. The closer the voltage of a digital "zero" at the radio end is to 800mv, the less reliable the tuning of the remote head is going to be. Any noise that is present on the TTL lines will add to the voltage level and could trigger a digital "one" where there is supposed to be a "zero" and thus a wrong frequency would be obtained. As can be seen by the data sheets, with a - 700mv reference voltage, 1Kft of 22 AWG cable produced a digital "zero" voltage very close to the 800mv threshold of TTL. This along with measured noise on the TTL lines was the probable cause of not being able to select all frequencies. However, when a voltage regulator with a reference level of -1.0V was used, the digital "zero" voltage dropped considerably, and all frequencies were selectable. The remote control was then remoted 1000 ft. over 18 AWG shielded cable. Note that the digital "zero" voltage was again very low and frequencies were selectable. A multiplex system was also used to remote the control head from the radio. The multiplexed signal was transmitted over an in-use voice grade telephone line for a distance of approximately 14 miles.

All frequencies were selectable.

4.3.2.3 Conclusions: For normal remoting distances less than 150 ft., no problems should be encountered. For remoting distances up to about 1000 ft., cable can be used. However, either a larger size cable must be used or a larger negative reference voltage level be provided by the voltage regulator. It appears that for distances exceeding 1000 feet, a cost comparison between long lengths of shielded cable and a multiplex system must be made. It does appear feasible that the GRC-171 can be remoted indefinite distances from an operator by utilizing a low cost multiplex system.

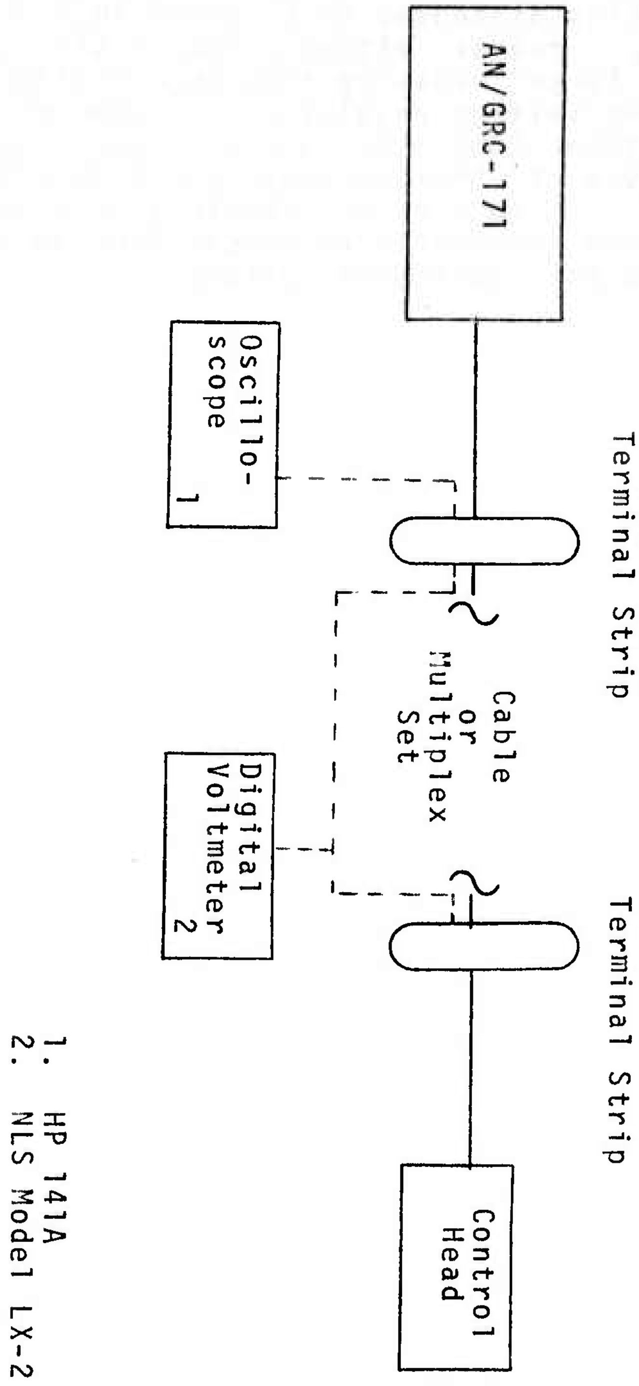


FIGURE 2

Remote Control Tests

REMOTE CONTROL TESTS — 28 JAN 75

REMOTED 1K FT #22 AWG / FREQ 300.0 MHz / NO READY LITE / NOT ALL FREQS SELECTABLE

MEASUREMENTS TAKEN APPROX. 10 FT FROM RADIO AT RADIO END

MEASUREMENTS TAKEN APPROX. 5 FT FROM CONTROL HEAD AT CONTROL HEAD END

WITH -0.7 V REFERENCE (ACTUAL -.7125 V)

TERMINAL DESCRIPTION	#	MEASURED AT RADIO END	MEASURED AT CONTROL HEAD	TERMINAL DESCRIP. #	MEASURED AT RADIO END	MEASURED AT CONTROL HEAD
100 MHz	1	+2.724	+2.722	GRND 22	+.006	+.669
80 MHz	2	+.641	+.479	GRND 23	+.006	+.6670
40 MHz	3	+.648	+.481	+26V 24	+26.1	+26.12
20 MHz	4	+.629	+.483	REMOTE READY 25	+23.9	+24.06
10 MHz	5	+.617	+.479	ON/OFF 26	+12.3	+12.166
8 MHz	6	+.586	+.464	GRND 27	+.005	+.6670
4 MHz	7	+.586	+.450	SQUELCH 28	+.523	+.6809
2 MHz	8	+.575	+.463			
1 MHz	9	+.592	+.465	AC NOISE MEASUREMENTS		
.8 MHz	10	+.584	+.459	TAKEN AT RADIO END.		
.4 MHz	11	+.587	+.461			
.2 MHz	12	+.594	+.472	ALL TTL		
.1 MHz	13	+.588	+.464	LINES	20 mV	
.05 MHz	14	+.616	+.476	(1→15)		
.025 MHz	15	+.621	+.476			
+26 V	16	+26.18	+24.0	+26V 16	100 mV	
-0.7V REF	17	-.67	-.2890	ON/OFF 26	100 mV	
-0.7V REF	18	-.673	-.2889	+26V 24	100 mV	
-0.7V REF	19	-.673	-.2888			
-0.7V REF	20	-.673	-.2887			
-0.7V REF	21	-.674	-.2885			

REMOTE CONTROL TESTS 28 JAN 75

REMOTED 1KFt #22AWG / FREQ 300 MHz / READY LITE LIT / ALL FREQS SELECTABLE EXCEPT 225.0, HOWEVER, that FREQ WAS NOT SELECTABLE IN LOCAL EITHER - PROBABLE FAULT OF VOLTAGE REGULATOR USED. DID NOT AFFECT MEASUREMENTS.

MEASUREMENTS TAKEN APPROX. 10 ft FROM RADIO AT RADIO END.

MEASUREMENTS TAKEN APPROX 5 ft FROM CONTROL HEAD AT CONTROL HEAD END

WITH -1.0V REFERENCE (ACTUAL -.9606 V)

TERMINAL DESCRIPTION	#	MEASURED AT RADIO END	MEASURED AT CONTROL HEAD	TERMINAL DSCPTN	#	MEASURED AT RADIO END	MEASURED AT CONTROL HEAD
				-1.0V REF	20	-.9400	-.5274
100 MHz	1	+2.715	+2.713	-1.0V REF	21	-.9408	-.5272
80 MHz	2	+.4238	+.2459	GND	22	+.0063	+.6656
40 MHz	3	+.4299	+.2477	GND	23	+.0061	+.6657
20 MHz	4	+.4095	+.2491	+26V	24	+26.20	+25.83
10 MHz	5	+.4009	+.2464	REMOTE READY	25	+.0591	+.4.180
8 MHz	6	+.3583	+.2283	ON/OFF	26	+12.75	+12.77
4 MHz	7	+.3585	+.2148	GND	27	+.0061	+.6659
2 MHz	8	+.3482	+.2213	SQUELCH	28	+.5209	+.6798
1 MHz	9	+.3658	+.2290				
.8 MHz	10	+.3592	+.2243				
.4 MHz	11	+.3628	+.2264				
.2 MHz	12	+.3675	+.2367				
.1 MHz	13	+.3638	+.2289				
.05 MHz	14	+.3880	+.2399				
.025 MHz	15	+.3930	+.2397				
+26V	16	+26.18	+24.00				
-1.0V REF	17	-.9426	-.5277				
-1.0V REF	18	-.9391	-.5276				
-1.0V REF	19	-.9345	-.5295				

REMOTE CONTROL TESTS

28 JAN 75

REMOTED 1.1K FT #18 AWG / FREQ 225.0 MHz / READY LITE LIT / ALL FREQS SELECTABLE

MEASUREMENTS TAKEN APPROX. 10 ft FROM RADIO AT RADIO END AND APPROX. 5 FT FROM CONTROL HEAD AT CONTROL HEAD END.

−0.7V REFERENCE (ACTUAL −.7125V)

TERMINAL DESCRIPTION	#	MEASURED AT RADIO END	MEASURED AT CONTROL HEAD	TERMINAL DESCRIP.	#	MEASURED AT RADIO END	MEASURED AT CONTROL HEAD
100 MHz	1	+.3565	+.2709	GRND	23	+.0064	+.335
80 MHz	2	+.3529	+.2708	+26V	24	+26.0	+25.9
40 MHz	3	+.3689	+.2789	REMOTE READY	25	.0591	+.228
20 MHz	4	+2.698	+2.698	ON/OFF	26	+12.5	+12.6
10 MHz	5	+.3477	+.274	GRND	27	+.0060	+.336
8 MHz	6	+.3208	+.255	SQUELCH	28	+.2818	+.350
4 MHz	7	+2.702	+2.702				
2 MHz	8	+.3233	+.255				
1 MHz	9	+2.712	+2.712				
.8 MHz	10	+.3184	+.252				
.4 MHz	11	+.3196	+.254				
.2 MHz	12	+.3346	+.263				
.1 MHz	13	+.3210	+.256				
.05 MHz	14	+.3405	+.266				
.025 MHz	15	+.3395	+.266				
+26V	16	+26.1	+25.0				
−0.7V REF	17	−.6770	−.501				
−0.7V REF	18	−.6743	−.501				
−0.7V REF	19	−.6745	−.501				
−0.7V REF	20	−.6751	−.501				
−0.7V REF	21	−.6760	−.501				
GRND	22	+.0063	+.335				

4.3.3 Frequency Accuracy:

4.3.3.1 Procedure: This test was designed to evaluate the frequency accuracy of the GRC-171. The output carrier frequency was measured to determine how close it was to the frequency dialed up on the front panel. The transceiver was then rechanneled through a wide range of frequencies, set to the original frequency, and the output frequency again measured.

4.3.3.2 Results: The frequency was very close to the dialed frequency. It far exceeded the specification for the radio The worst case measured was accurate to 0.00019 MHz and the best measured was accurate to 0.00003 MHz.

4.3.3.3 Conclusions: This type of frequency accuracy is consistent with what NSA suggests for base band secure voice communications.

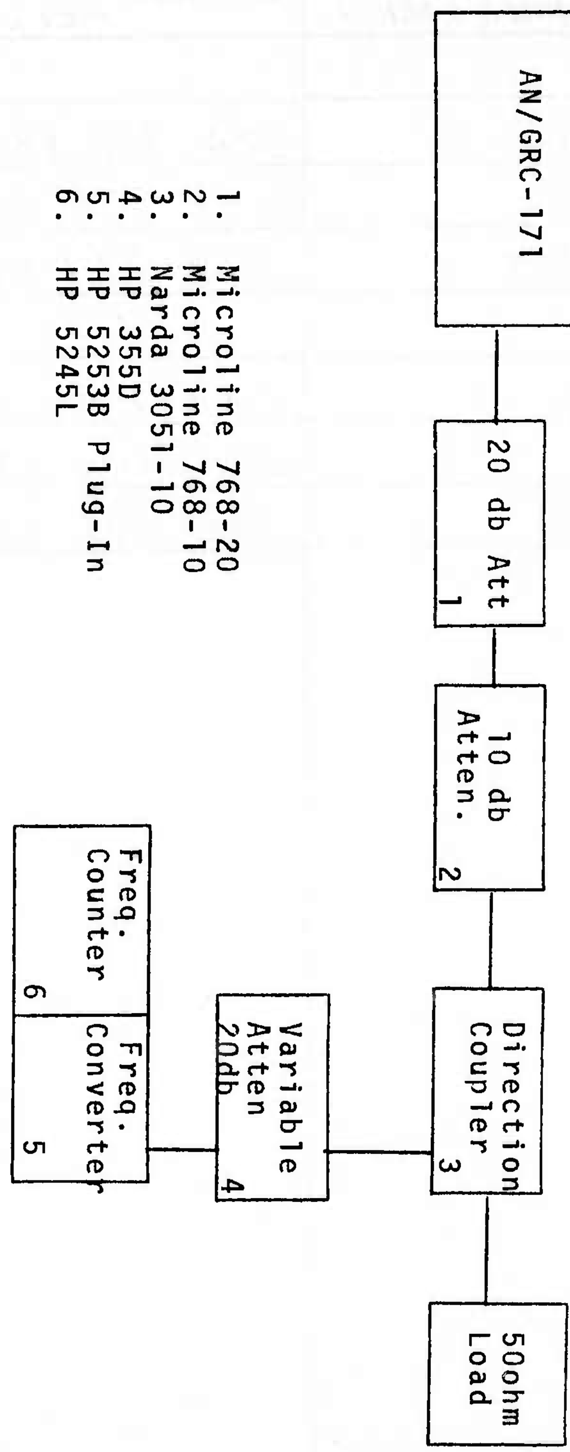


FIGURE 3

Frequency Accuracy Test

FREQUENCY ACCURACY TEST

DIALED FREQ (MHz)	MEASURED FREQ (MHz)	MEASURED FREQ (MHz) AFTER CHANNELING RADIO
PP#2		
225.0	224.999 897	224.999 897
300.0	299.999 863	299.999 863
399.975	399.974 816	399.974 816
PP#1		
225.0	225.000 030	225.000 030
300.0	300.000 040	300.000 040
399.975	399.975 052	399.975 052

4.3.4 Squelch Relay Action Test:

4.3.4.1 Procedure: A 5uv signal, 75% modulated by a 1KHz signal, was applied to the antenna input of the transceiver. The squelch was set for 3uv and the audio out set for Odbm. The action of the squelch relay and the main audio output were monitored on an oscilloscope. This test was to verify that a relay dry contact closure does occur coincident with the audio appearing on the main audio output line.

4.3.4.2 Results: The action is shown on the attached photograph. It shows that the relay action is coincident with the audio.

4.3.4.3 Conclusion: This action shows that the built-in CODAN function is operable.

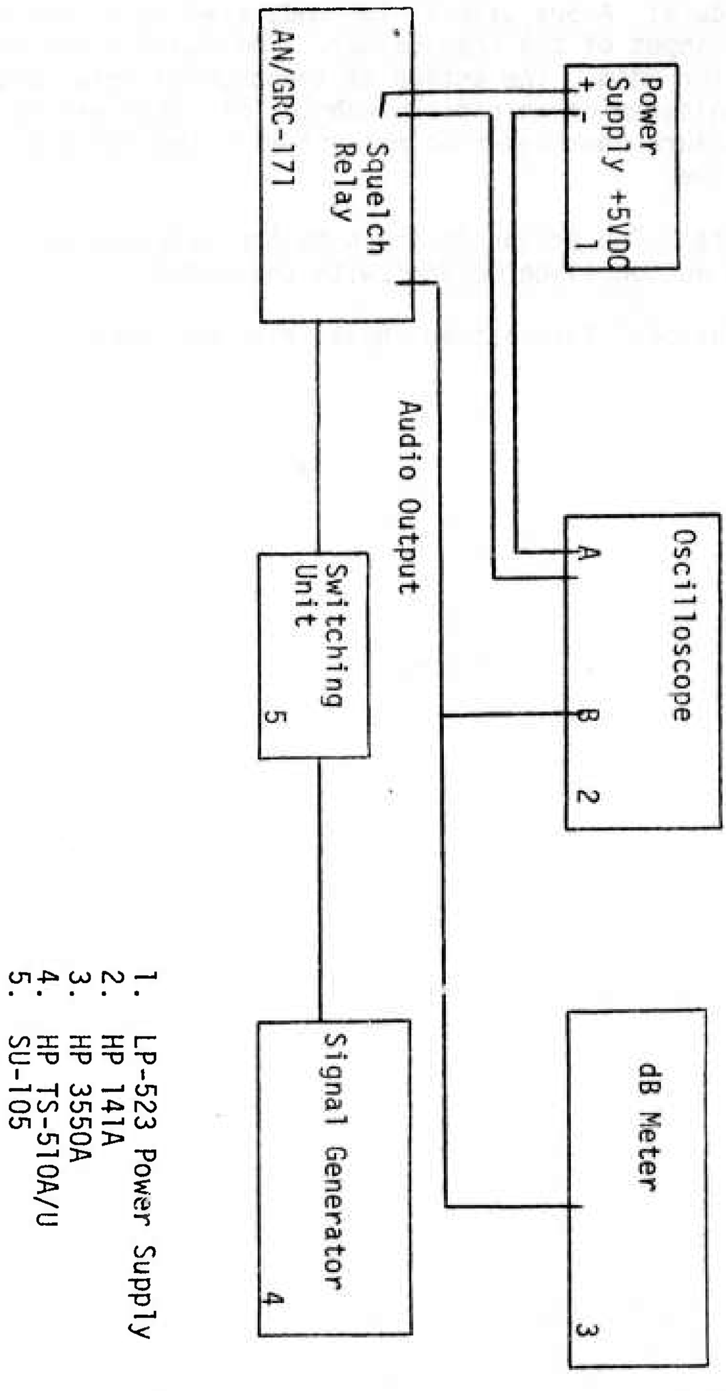
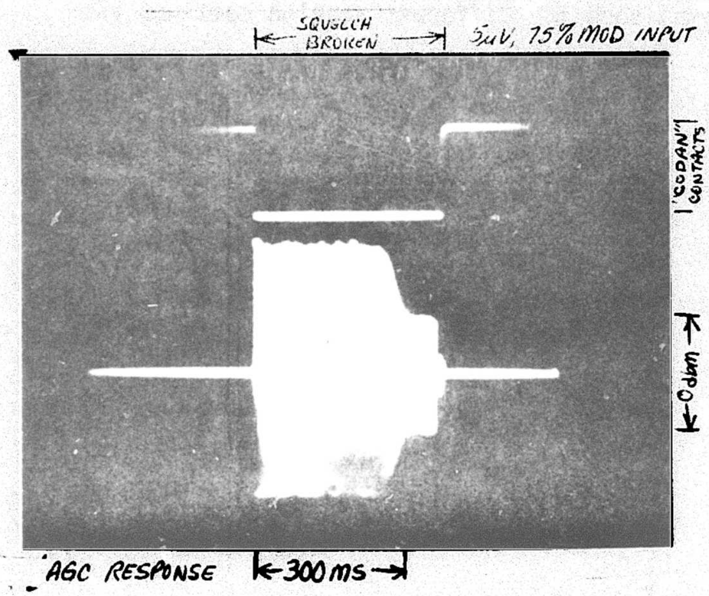


Figure 4

Squelch Relay Action Check

Squelch Relay Action



Squelch Relay Action
("CODAN" contacts)

Main audio out set
for 0dbm

Notice that the squelch relay action is coincident with the audio out.

4.3.5 Squelch Hysteresis:

4.3.5.1 Procedure: Measurements were taken as the RF signal was decreased to determine the level at which the squelch circuit closed after having once been opened. This was accomplished for different squelch settings and frequencies.

4.3.5.2 Results: There was hysteresis action of the squelch circuit. Whether the hysteresis is adequate is difficult to determine. If the hysteresis is too wide, a level of noise too low to break squelch could keep the squelch open once a strong signal has been obtained. On the other hand, if the squelch hysteresis is too narrow, a fade in a signal could cause the squelch to close and the transmission to be lost.

4.3.5.2 Conclusion: It appears that the squelch hysteresis will be adequate.

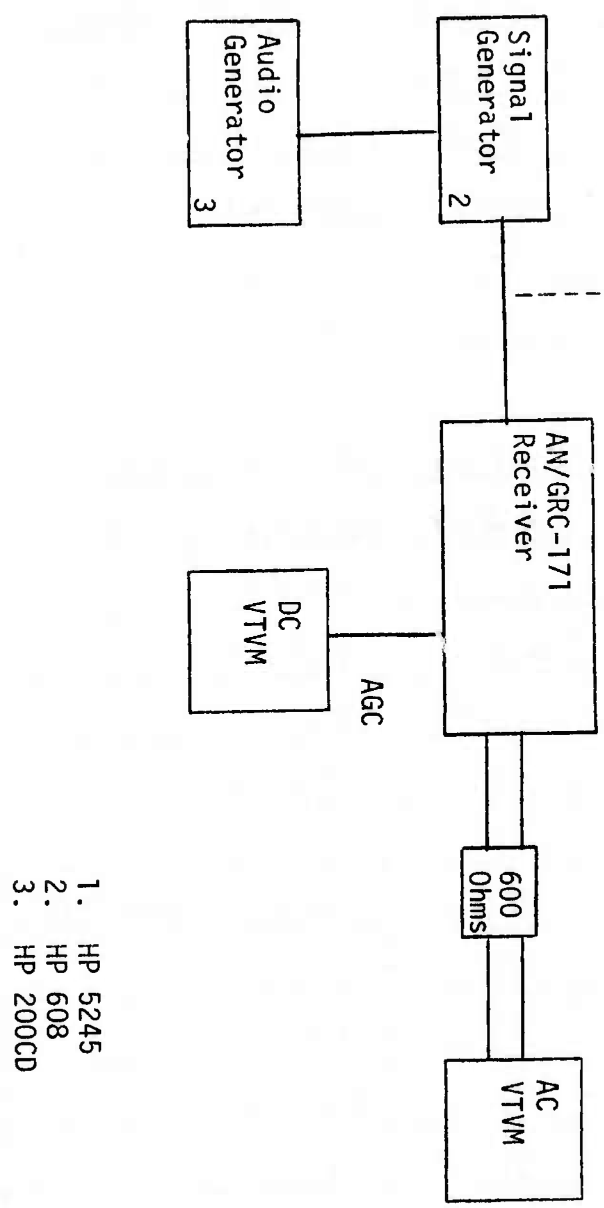


Figure 5

Squelch Hysteresis

Squelch Hysteresis PP#1

Squelch Setting	Squelch Opens	Squelch Closes	Freq. (MHz)		
Full CCW	.51 µV	.145 µV	300		
Full CW	8.4 mV	4.5 mV			
3 µV	3 µV	1.5 µV			
5 µV	5 µV	4.4 µV			
7 µV	7 µV	5.5 µV			
10 µV	10 µV	9.0 µV			
Full CCW	.65 µV	.183 µV	225		
Full CW	8.4 mV	4.2 mV			
3 µV	3 µV	1.4 µV			
5 µV	5 µV	4.5 µV			
7 µV	7 µV	5.7 µV			
10 µV	10 µV	7.5 µV			
Full CCW	.5 µV	.176 µV	399.975		
Full CW	10 mV	5 mV			
3 µV	3 µV	1.5 µV			
5 µV	5 µV	4.2 µV			
7 µV	7 µV	5 µV			
10 µV	10 µV	8.1 µV			

SQUELCH HYSTERESIS PP #2

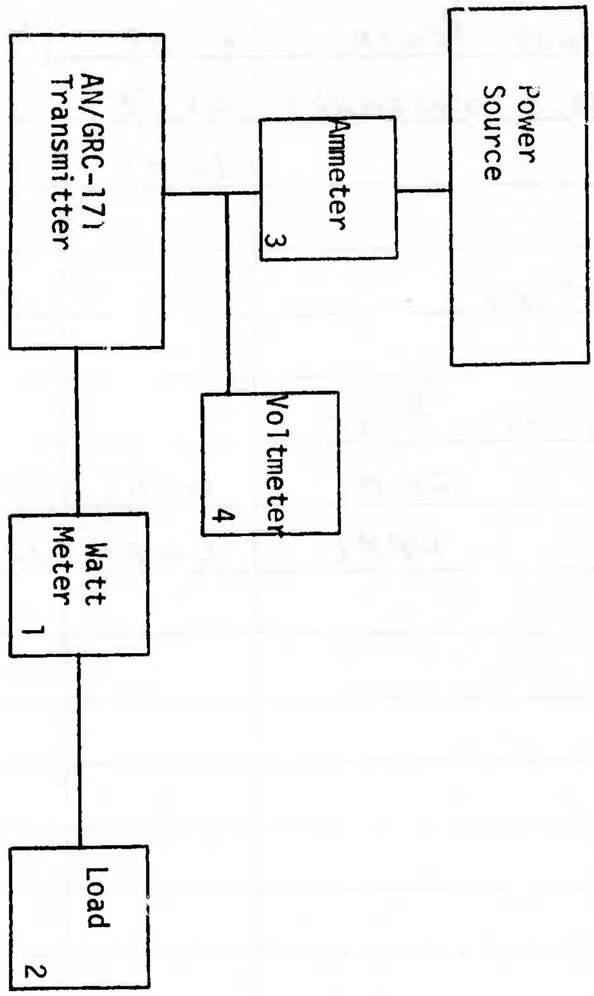
SQUELCH SETTING	SQUELCH OPENS	SQUELCH CLOSES	FREQ (MHz)		
FULL CCW	2.5 µV	1 µV	300		
FULL CW	50 mV	19 mV			
3 µV	3 µV	1.2 µV			
5 µV	5 µV	2 µV			
7 µV	7 µV	6 µV			
10 µV	10 µV	8 µV			
FULL CCW	2.8 µV	1 µV	225		
FULL CW	50 mV	19 mV			
3 µV	3 µV	1.2 µV			
5 µV	5 µV	2 µV			
7 µV	7 µV	5.2 µV			
10 µV	10 µV	8 µV			
FULL CCW	2.5 µV	1 µV	399.975		
FULL CW	50 mV	19 mV			
3 µV	3 µV	1.2 µV			
5 µV	5 µV	2 µV			
7 µV	7 µV	5 µV			
10 µV	10 µV	8 µV			

4.3.6 Power Test:

4.3.6.1 Procedure: The transceiver was operated while the primary line power was changed to diesel standby power, as the frequency of the standby power was varied through the generator's limits and while using DC power. The power out of the transceiver was used as the performance criterion. When the standby power was varied, a separate line was used so the test equipment was on primary power while the transceiver was on standby power. Power consumption was also evaluated by measuring the amount of current drawn in both the transmit and receive mode.

4.3.6.2 Results: Results appear in the attached data sheets. The power out varied very little as the line power was switched from primary to diesel power or as the frequency of the power was varied from 50Hz to 63Hz, the limits of the generator. The radio also operated satisfactorily on DC power.

4.3.6.3 Conclusions: Variations in the type or frequency of power had little effect on the radio's performance.



1. Bird 50W Thru-line Wattmeter
2. Bird 50 Ohm Dummy Load
3. GE AO-72 (0-2 Amps) or GE AO-91 (0-10 Amps)
4. Beckman Linemeter (Expanded VAC 100-130)

Figure 6

Power Tests

POWER TESTS

	LINE FREQUENCY	LINE VOLTAGE	OUTPUT POWER	(RECEIVE) CURRENT	(TRANSMIT) CURRENT
STANDBY POWER	63 Hz	117 VAC	21.0 W		
(DIESEL GENERATOR)	50 Hz	117 VAC	21.5 W		
	60 Hz	117 VAC	21.0 W		
BATTERY	DC	24 vdc	21.0 W		
PRIMARY POWER					
PP #1	60 Hz	123 VAC	21.0 W	1.3 A	3.8 A
PP #2	60 Hz	124 VAC	21.0 W	1.35 A	4.0 A

4.3.7 Transmitter Audio Input Test:

4.3.7.1 Procedure: The GRC-171 transmitter was modulated by an audio signal generator output level of -15dbm, 0dbm, and +5dbm at frequencies of 300Hz to 6000Hz. With the reference set up for 90% modulation at -15dbm at 1000Hz, the percent distortion was measured for frequencies of 229.0, 303.15, and 392.1 MHz. Also, with a reference level of -15dbm at 1000Hz on 303.15MHz, the transmitter was checked to determine how the percent of modulation changed as the modulating frequency, the input level, and the carrier frequency were changed.

4.3.7.2 Results: The transmitter audio distortion proved to be within specification and will be adequate for operational use. The percent modulation did change with changing audio input levels and with carrier frequency changes. With 90% modulation set up for -15dbm at 1000Hz on 303.15MHz, the modulation ranged from 100% to 75%. This appears to be adequate.

4.3.7.3 Conclusions: It appears that the percent modulation should be set up at some frequency in the center of those frequencies that the GRC-171 may be operated at. This could prevent undermodulation or overmodulation when a new frequency is used.

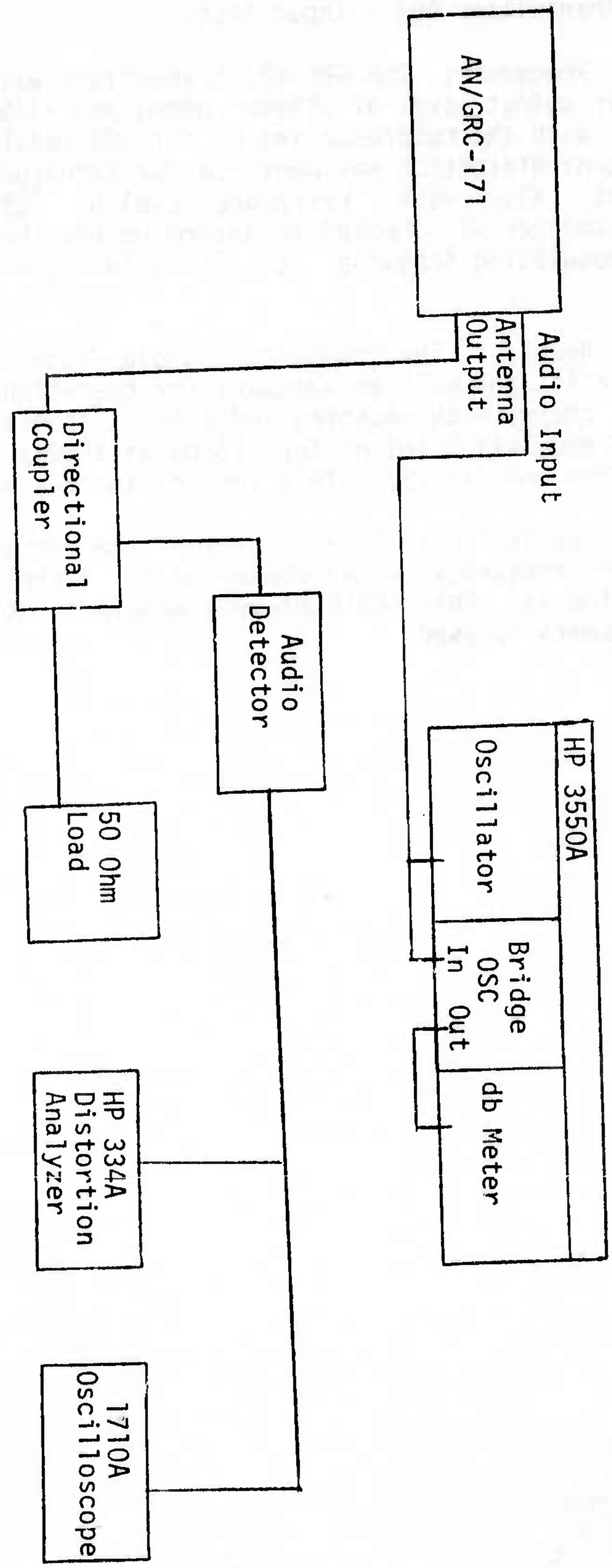


Figure 7

Transmitter Audio Input Level and Distortion Check

TRANSMITTER AUDIO INPUT TESTS - 229.0 MHz PP#1

INPUT LEVEL (dbm)	MODULATING FREQ (Hz)	% MODULATION (BITE METER)	TRANSMIT FREQ (MHz)	% DISTORTION	% MODULATION (MEASURED)
-15	300	85	229.0	7.2	98%
REFERENCE LEVEL → -15	1000	85		6.5	90%
-15	2000	81		5.8	90
-15	3000	80		5.6	90
-15	4000	79		5.6	90
-15	5000	80		5.8	90
-15	6000	78		5.6	90
0	300	85		7.1%	98
0	1000	87		6.5	90
0	2000	81		5.9	90
0	3000	80		5.6	90
0	4000	79		5.6	90
0	5000	80		5.8	90
0	6000	78		5.6	90
+5	300	85		7.1	98
+5	1000	87		6.6	90
+5	2000	81		5.9	90
+5	3000	80		5.6	90
+5	4000	79		5.6	90
+5	5000	80		5.8	90
+5	6000	78	229.0	5.6	90

TRANSMITTER AUDIO INPUT TESTS - 303.15 MHz PP#1

INPUT LEVEL (dbm)	MODULATING FREQ (Hz)	% MODULATION (BITE METER)	TRANSMIT FREQ (MHz)	% DISTORTION	% MODULATION (MEASURED)
-15	300	84	303.15	3.2	90
REFERENCE LEVEL → -15	1000	85			3.2	90
-15	2000	82			4.0	90
-15	3000	76			6.5	85
-15	4000	77			8.9	90
-15	5000	79			12.0	90
-15	6000	78			14.0	90
0	300	84			3.2	90
0	1000	86			3.6	90
0	2000	81			4.0	90
0	3000	76			6.4	90
0	4000	76			9.0	90
0	5000	79			12.0	90
0	6000	77			14.0	90
+5	300	83			3.1	90
+5	1000	86			3.0	90
+5	2000	81			3.9	90
+5	3000	76			6.4	90
+5	4000	76			8.9	90
+5	5000	80			12.0	90
+5	6000	77	303.15	14.4	90

TRANSMITTER AUDIO INPUT TESTS - 392.10 MHz PP#1

INPUT LEVEL (dbm)	MODULATING FREQ (Hz)	% MODULATION (BITE METER)	TRANSMIT FREQ (MHz)	% DISTORTION	% MODULATION (MEASURED)
-15	300	80	392.1	2.8	90
REFERENCE LEVEL → -15	1000	82		3.4	90
-15	2000	77		4.1	90
-15	3000	74		6.4	90
-15	4000	74		9.3	90
-15	5000	75		12.5	90
-15	6000	75		14.5	90
0	300	79		3.0	90
0	1000	81		2.9	90
0	2000	77		4.1	90
0	3000	74		6.5	90
0	4000	74		9.3	90
0	5000	75		12.5	90
0	6000	75		14.5	90
+5	300	79		2.7	90
+5	1000	81		3.0	90
+5	2000	76		4.1	90
+5	3000	74		6.5	90
+5	4000	74		9.2	90
+5	5000	75		12.5	90
+5	6000	15	392.1	14.5	90

TRANSMITTER AUDIO INPUT TESTS - 229.0 MHz PP#2

INPUT LEVEL (dbm)	MODULATING FREQ. (Hz)	% MODULATION (BITE METER)	TRANSMIT FREQ. (MHz)	% DISTORTION	% MODULATION (MEASURED)
-15	300	84	229.0	5.5	90
REFERENCE LEVEL → -15	1000	81		5.1	90
-15	2000	80		6.2	90
-15	3000	80		8.0	90
-15	4000	81		10.5	90
-15	5000	85		13.0	90
-15	6000	77		14.0	90
0	300	84		5.6	90
0	1000	84		5.0	90
0	2000	80		6.4	90
0	3000	80		8.2	90
0	4000	82		10.5	90
0	5000	85		13.0	90
0	6000	77		14.0	90
+5	300	84		5.7	90
+5	1000	85		5.1	90
+5	2000	80		6.3	90
+5	3000	80		8.1	90
+5	4000	81		10.5	90
+5	5000	85		13.3	90
+5	6000	77	229.0	14.0	90

TRANSMITTER AUDIO INPUT TESTS - 303.15 MHz PP #2

INPUT LEVEL	MODULATING FREQUENCY	% MODULATION (BITE METER)	TRANSMIT FREQUENCY	% DISTORTION	% MODULATION (MEASURED)
-15 dbm	300 Hz	80	303.15	2.45	90
REFERENCE LEVEL → -15 dbm	1000 Hz	80		2.55	90
-15 dbm	2000 Hz	77		4.0	90
-15 dbm	3000 Hz	75		6.3	90
-15 dbm	4000 Hz	76		9.8	90
-15 dbm	5000 Hz	81		12.5	90
-15 dbm	6000 Hz	74		14.0	90
0 dbm	300	80		2.5	90
0 dbm	1000	81		2.5	90
0 dbm	2000	78		4.0	90
0 dbm	3000	75		6.4	90
0 dbm	4000	76		10.0	90
0 dbm	5000	80		13.0	90
0 dbm	6000	74		14.0	90
+5 dbm	300	80		2.45	90
+5 dbm	1000	81		2.45	90
+5 dbm	2000	79		3.6	90
+5 dbm	3000	75		6.6	90
+5 dbm	4000	77		9.7	90
+5 dbm	5000	80		13.0	90
+5 dbm	6000	74	303.15	14.0	90

TRANSMITTER AUDIO INPUT TESTS - 392.10 MHz PP#2

	INPUT LEVEL (dbm)	MODULATING FREQ (HZ)	% MODULATION (BITE METER)	TRANSMIT FREQ (MHZ)	% DISTORTION	% MODULATION (MEASURED)
	-15	300	81	392.1	4.4	90
REFERENCE LEVEL →	-15	1000	80		3.2	90
	-15	2000	76		4.4	90
	-15	3000	76		6.6	90
	-15	4000	77		9.5	90
	-15	5000	81		12.5	90
	-15	6000	74		13.5	90
	0	300	81		4.8	90
	0	1000	80		3.2	90
	0	2000	77		4.4	90
	0	3000	76		6.8	90
	0	4000	77		9.5	90
	0	5000	81		12.5	90
	0	6000	74		13.5	90
	+5	300	81		4.4	90
	+5	1000	80		3.3	90
	+5	2000	77		4.3	90
	+5	3000	76		7.0	90
	+5	4000	77		9.5	90
	+5	5000	81		12.5	90
	+5	6000	74	392.1	13.5	90

TRANSMITTER MODULATION CHECKS PP#1

FREQUENCY (MHz)	MODULATING FREQ (Hz)	INPUT LEVEL	% MODULATION (BITE METER)	% MODULATION (MEASURED)	
303.15	300	-15 dbm	90%	83%	
REFERENCE LEVEL →	1000	-15	90	90	
	2000	-15	85	82	
	3000	-15	83	80	
	300	-10	90	88	
	1000	-10	92	90	
	2000	-10	88	87	
	3000	-10	85	84	
	300	-5	88	82	
	1000	-5	90	90	
	2000	-5	90	85	
	3000	-5	85	82	
	300	0	90	77	
	1000	0	87	90	
	2000	0	87	87	
	3000	0	85	84	
	300	+5	90	80	
	1000	+5	87	90	
	2000	+5	85	86	
	3000	+5	82	83	

TRANSMITTER MODULATION CHECKS PP #1

(REFERENCE LEVEL SET AT 303.15 MHz, 1000 Hz, -15 dbm, 90% MOD.)

FREQUENCY (MHz)	MODULATING FREQ (HZ)	INPUT LEVEL	% MODULATION (BITE METER)	% MODULATION (MEASURED)	
229.0	300	-15 dbm	75 %	82 %	
	1000	-15	75	83	
	2000	-15	72	82	
	3000	-15	70	77	
	300	-10	75	82	
	1000	-10	79	86	
	2000	-10	75	80	
	3000	-10	70	78	
	300	-5	75	77	
	1000	-5	76	85	
	2000	-5	73	80	
	3000	-5	70	77	
	300	0	78	75	
	1000	0	75	86	
	2000	0	75	81	
	3000	0	70	75	
	300	+5	75	75	
	1000	+5	75	86	
	2000	+5	73	81	
	3000	+5	70	75	

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TRANSMITTER MODULATION CHECKS PP#1

(REFERENCE LEVEL SET AT 303.15 MHz, 1000 Hz, -15 dbm, 90% MOD)

FREQUENCY (MHz)	MODULATING FREQ (Hz)	INPUT LEVEL (dbm)	% MODULATION (BITE METER)	% MODULATION (MEASURED)	
392.10	300	-15	97	97	
	1000	-15	100	95	
	2000	-15	94	95	
	3000	-15	90	95	
	300	-10	98	98	
	1000	-10	100	96	
	2000	-10	95	93	
	3000	-10	90	93	
	300	-5	98	98	
	1000	-5	100	100	
	2000	-5	95	98	
	3000	-5	90	98	
	300	0	100	100	
	1000	0	98	100	
	2000	0	93	100	
	3000	0	90	100	
	300	+5	100	98	
	1000	+5	98	100	
	2000	+5	95	98	
	3000	+5	95	98	

AFCS FORM MAY 69 199 REPLACES AFCS FORM 123 FEB 67, WHICH ARE OBSOLETE. GENERAL PURPOSE FORM

4.3.8 Receiver Audio Output Tests:

4.3.8.1 Procedure: Signals of 3uv, 6uv, 9uv, 18uv, and 75mv modulated 30%, 75%, and 90% with 300Hz, 1000Hz, 2000Hz, and 3000Hz were applied to the receiver input. The audio outputs from both the main audio and the headset audio were measured to insure that the level was automatically controlled to approximately 0dbm, +3dbm maximum.

4.3.8.2 Results: As can be seen by the attached data sheets, the main and headset audio were kept constant around 0dbm. The levels varied from -1.8dbm to +.8dbm.

4.3.8.3 Conclusions: The receiver audio leveling is adequate.

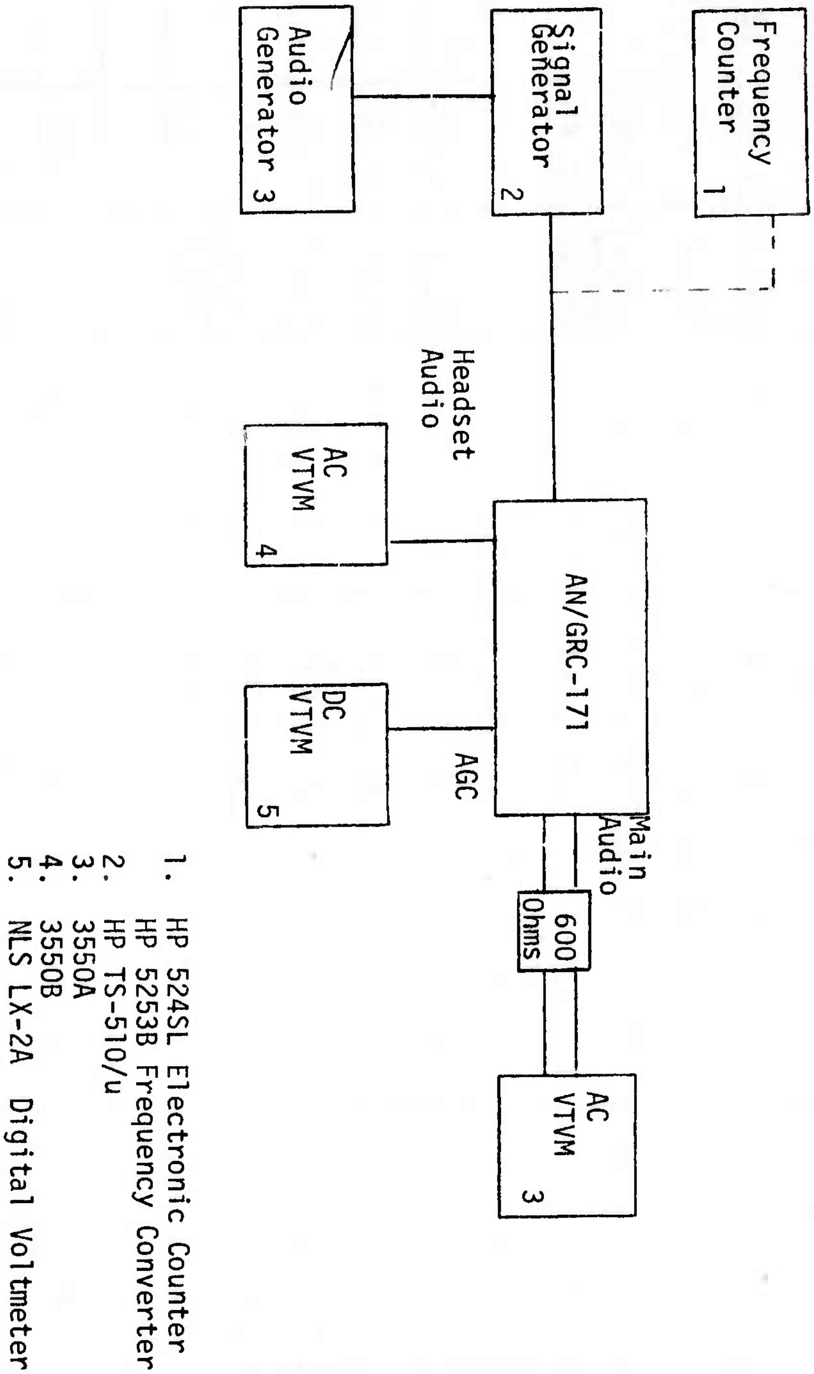

Figure 8

Receiver Audio Output Tests

Receiver Audio Output Tests

PP#1

Frequency (MHz)	% Modulation	Modulating Freq. = 300 Hz Output Main (dbm)	Modulating Freq. = 300 Hz Output Phone (dbm)	Modulating Freq = 1000 Hz Output Main (dbm)	Modulating Freq = 1000 Hz Output Phone (dbm)	Modulating Freq = 2000 Hz Output Main (dbm)	Modulating Freq = 2000 Hz Output Phone (dbm)	Modulating Freq = 3000 Hz Output Main (dbm)	Modulating Freq = 3000 Hz Output Phone (dbm)	Input	AGC (v dc)	Ref. Level
229.0	90	-.4	-.4	-.4	-.4	-.7	-.7	-.7	-.7	3µV	-.50	0dbm
	90	-.8	-.8	-.5	-.5	-.8	-.8	-.8	-.8	6µV	-1.05	1KHz
	90	-.1	-.1	-.5	-.5	-.9	-.9	-.9	-.9	9µV	-1.20	75% Mod
	90	-1.2	-1.2	-.6	-.6	-1.0	-1.0	-1.0	-1.0	18µV	-1.32	
	90	-1.3	-1.3	-.7	-.7	-1.0	-1.0	-1.0	-1.0	GEN. MAX. 75mV	-2.40	
	75	0	0	0	0	-.2	-.2	-.2	-.2	3µV	-.49	
	75	-.7	-.7	-.3	-.3	-.6	-.6	-.5	-.5	6µV	-1.04	
	75	-.9	-.9	-.5	-.5	-.8	-.8	-.8	-.8	9µV	-1.20	
	75	-1.2	-1.2	-.7	-.7	-1.0	-1.0	-1.0	-1.0	18µV	-1.35	
	75	-1.4	-1.4	-.9	-.9	-1.2	-1.2	-1.2	-1.2	GEN. MAX. 75mV	-2.37	
	30	-.6	-.6	0	0	-.3	-.3	-.3	-.3	3µV	-.50	
	30	-.7	-.7	-.1	-.1	-.4	-.4	-.4	-.4	6µV	-1.05	
	30	-.9	-.9	-.4	-.4	-.7	-.7	-.7	-.7	9µV	-1.20	
	30	-1.3	-1.3	-.7	-.7	-1.0	-1.0	-1.0	-1.0	18µV	-1.35	
229.0	30	-1.7	-1.7	-1.2	-1.2	-1.4	-1.4	-1.4	-1.4	GEN. MAX. 75mV	-2.4	

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RECEIVER AUDIO OUTPUT TESTS — PP#1

FREQUENCY (MHz)	% MODULATION	MODULATING FREQ = 300 Hz OUTPUT MAIN (dbm)	PHONE (dbm)	MODULATING FREQ = 1000 Hz OUTPUT MAIN (dbm)	PHONE (dbm)	MODULATING FREQ = 2000 Hz OUTPUT MAIN (dbm)	PHONE (dbm)	MODULATING FREQ = 3000 Hz OUTPUT MAIN (dbm)	PHONE (dbm)	INPUT	AGC (V dc)	REF LEVEL
303.15	30	+.1	+.1	+.8	+.8	+.6	+.6	+.5	+.5	3µV	-.49	0dbm
	30	+.1	+.1	+.6	+.6	+.3	+.3	+.4	+.4	6µV	-1.05	1kHz
	30	-.1	-.1	+.3	+.3	0	0	0	0	9µV	-1.20	75%
	30	-.6	-.6	-.2	-.2	-.4	-.4	-.4	-.4	18µV	-1.33	
	30	-1.1	-1.1	-.6	-.6	-.9	-.9	-.9	-.9	GEN. MAX. 75mV	-2.40	
	75	-.2	-.2	0	0	-.2	-.2	-.2	-.2	3µV	-.52	
	75	-.4	-.4	0	0	-.4	-.4	-.4	-.4	6µV	-1.1	
	75	-.7	-.7	-.2	-.2	-.5	-.5	-.5	-.5	9µV	-1.2	
	75	-.9	-.9	-.4	-.4	-.7	-.7	-.6	-.6	18µV	-1.34	
	75	-1.0	-1.0	-.5	-.5	-.8	-.8	-.8	-.8	GEN. MAX. 75mV	-2.39	
	90	-.1	-.1	0	0	-.4	-.4	-.3	-.3	3µV	-.50	
	90	-.6	-.6	-.1	-.1	-.5	-.5	-.5	-.5	6µV	-1.30	
	90	-.7	-.7	-.2	-.2	-.5	-.5	-.5	-.5	9µV	-1.24	
	90	-.8	-.8	-.2	-.2	-.5	-.5	-.5	-.5	18µV	-1.35	
303.15	90	-.7	-.7	-.1	-.1	-.4	-.4	-.4	-.4	GEN. MAX 75mV	-2.39	

RECEIVER AUDIO OUTPUT TESTS PP#1

FREQUENCY (MHz)	% MODULATION	MODULATING FREQ = 300 Hz OUTPUT MAIN (dbm)	PHONE (dbm)	MODULATING FREQ = 1000 Hz OUTPUT MAIN (dbm)	PHONE (dbm)	MODULATING FREQ = 2000 Hz OUTPUT MAIN (dbm)	PHONE (dbm)	MODULATING FREQ = 3000 Hz OUTPUT MAIN (dbm)	PHONE (dbm)	INPUT	AGC (Vdc)	REF LEVEL
392.1	30	-.9	-.9	-.2	-.2	-.6	-.6	-.8	-.8	3 µV	-.51	
│	30	-.9	-.9	-.3	-.3	-.6	-.6	-.7	-.7	6 µV	-1.06	0 dbm
│	30	-1.2	-1.2	-.6	-.6	-.9	-.9	-1.0	-1.0	9 µV	-1.23	1 KHz
│	30	-1.4	-1.4	-.9	-.9	-1.2	-1.2	-1.2	-1.2	18 µV	-1.35	75% MOD
│	30	-1.8	-1.8	-1.3	-1.3	-1.5	-1.5	-1.6	-1.6	MAX. GEN. 75 mV	-2.5	
│	75	-.1	-.1	0	0	-.2	-.2	-.2	-.2	3 µV	-.51	
│	75	-.8	-.8	-.4	-.4	-.7	-.7	-.7	-.7	6 µV	-1.1	
│	75	-1.1	-1.1	-.6	-.6	-.9	-.9	-.9	-.9	9 µV	-1.23	
│	75	-1.3	-1.3	-.8	-.8	-1.1	-1.1	-1.1	-1.1	18 µV	-1.35	
│	75	-1.5	-1.5	-1.2	-1.2	-1.2	-1.2	-1.0	-1.0	MAX. GEN. 75 mV	-2.5	
│	90	-.5	-.5	-.3	-.3	-.7	-.7	-.7	-.7	3 µV	-.52	
│	90	-.8	-.8	-.4	-.4	-.8	-.8	-.8	-.8	6 µV	-1.03	
│	90	-1.0	-1.0	-.5	-.5	-.9	-.9	-.9	-.9	9 µV	-1.2	
│	90	-1.2	-1.2	-.6	-.6	-.9	-.9	-.9	-.9	18 µV	-1.35	
392.1	90	-1.3	-1.3	-.7	-.7	-1.0	-1.0	-1.0	-1.0	MAX GEN 75 mV	-2.48	

AFCS FORM MAY 69 199c ★U. S. GOVERNMENT PRINTING OFFICE: 1974--665377/1008 GENERAL PURPOSE FORM AFCS -38002/1020

RECEIVER AUDIO OUTPUT TESTS PP#2

FREQUENCY (MHz)	% MODULATION	MODULATING FREQ = 300 Hz OUTPUT MAIN (dbm)	PHONE (dbm)	MODULATING FREQ = 1000 Hz OUTPUT MAIN (dbm)	PHONE (dbm)	MODULATING FREQ = 2000 Hz OUTPUT MAIN (dbm)	PHONE (dbm)	MODULATING FREQ = 3000 Hz OUTPUT MAIN (dbm)	PHONE (dbm)	INPUT	AGC (Vdc)	REF LEVEL
229.0	30	-1.3	+.2	-.7	-.6	-.9	-.8	-.9	-.8	3µV	-.49	
	30	-1	-.9	-.3	-.2	-.5	-.4	-.5	-.4	6µV	-.55	0dbm
	30	-.9	-.8	-.2	-.1	-.4	-.3	-.4	-.3	9µV	-.91	1kHz
	30	-.9	-.8	-.2	-.1	-.4	-.3	-.4	-.3	18µV	-1.2	75%
	30	-.9	-.8	-.1	0	-.3	-.2	-.2	-.1	GEN MAX 75mV	-2.1	
	75	-.7	-.6	0	0	-.3	-.2	-.3	-.2	3µV	-.49	
	75	-.6	-.5	+.1	+.2	-.2	0	-.1	0	6µV	-.56	
	75	-.6	-.5	+.1	+.2	-.1	0	-.1	0	9µV	-.92	
	75	-.7	-.6	+.2	+.2	-.1	0	-.1	0	18µV	-1.2	
	75	-.6	-.5	+.2	+.2	0	0	0	0	GEN MAX 75mV	-2.1	
	90	-.5	-.3	+.3	+.4	-.1	0	-.1	0	3µV	-.49	
	90	-.4	-.3	+.4	+.5	+.1	+.2	+.1	+.2	6µV	-.6	
	90	-.4	-.3	+.4	+.5	+.1	+.2	+.1	+.2	9µV	-.94	
	90	-.5	-.4	+.4	+.4	0	+.1	0	+.1	18µV	-1.2	
229.0	90	-.4	-.3	+.5	+.6	+.2	+.3	+.2	+.3	GEN MAX 75mV	-2.1	

AFCS FORM MAY 69 199c ★U. S. GOVERNMENT PRINTING OFFICE: 1974--665377/1008 GENERAL PURPOSE FORM AFCS -38002/1020

Receiver Audio Output Tests

PP#2

Frequency (MHz)	% Modulation	Modulating Freq = 300 Hz Output Main (dbm)	Modulating Freq = 300 Hz Output Phone (dbm)	Modulating Freq = 1000 Hz Output Main (dbm)	Modulating Freq = 1000 Hz Output Phone (dbm)	Modulating Freq = 2000 Hz Output Main (dbm)	Modulating Freq = 2000 Hz Output Phone (dbm)	Modulating Freq = 3000 Hz Output Main (dbm)	Modulating Freq = 3000 Hz Output Phone (dbm)	Input	AGC (Vdc)	Ref Level
303.15	30	-1.0	-1.0	-.4	-.4	-.6	-.6	-.5	-.5	3uV	-.49	
	30	-.7	-.7	0	0	-.2	-.2	-.1	-.1	6uV	-.61	
	30	-.7	-.7	0	0	-.2	-.2	-.1	-.1	9uV	-.98	0dbm
	30	-.6	-.6	+.1	+.1	-.1	-.1	0	0	18uV	-1.25	1KHz
	30	-.1	-.1	+.7	+.7	+.5	+.5	+.5	+.5	GEN MAX 75mV	-2.08	75% Mod
	75	-.7	-.7	0	0	-.2	-.2	-.1	-.1	3uV	-.47	
	75	-.5	-.5	+.2	+.2	0	0	0	0	6uV	-.52	
	75	-.5	-.5	+.2	+.2	0	0	0	0	9uV	-.77	
	75	-.5	-.5	+.2	+.2	0	0	0	0	18uV	-1.15	
	75	-.5	-.5	+.2	+.2	-.1	-.1	-.2	-.2	GEN MAX 75mV	-2.05	
	90	-.1	-.1	+.7	+.7	+.4	+.4	+.3	+.3	3uV	-.49	
	90	-.3	-.3	+.7	+.7	+.4	+.4	+.4	+.4	6uV	-.58	
	90	-.3	-.3	+.7	+.7	+.4	+.4	+.4	+.4	9uV	-.99	
	90	-.2	-.2	+.7	+.7	+.5	+.5	+.5	+.5	18uV	-1.25	
303.15	90	-.7	-.7	0	0	-.2	-.2	-.3	-.3	GEN MAX 75mV	-2.05	

AFCS FORM MAY 69 199c

★U. S. GOVERNMENT PRINTING OFFICE: 1974--665377/1008

GENERAL PURPOSE FORM

AFCS-38002/1020

RECEIVER AUDIO OUTPUT TESTS PP#2

FREQUENCY (MHz)	% MODULATION	MODULATING FREQ = 300 Hz OUTPUT MAIN (dbm)	PHONE (dbm)	MODULATING FREQ = 1000 Hz OUTPUT MAIN (dbm)	PHONE (dbm)	MODULATING FREQ = 2000 Hz OUTPUT MAIN (dbm)	PHONE (dbm)	MODULATING FREQ = 3000 Hz OUTPUT MAIN (dbm)	PHONE (dbm)	INPUT	AGC (Vdc)	REF LEVEL
392.1	30	-1.3	-1.3	-.7	-.7	-.9	-.9	-.9	-.9	3uV	-.49	
	30	-1.0	-1.0	-.2	-.2	-.5	-.5	-.6	-.6	6uV	-.51	
	30	-.9	-.9	-.1	-.1	-.4	-.4	-.4	-.4	9uV	-.58	0dbm
	30	-.9	-.9	-.1	-.1	-.3	-.3	-.3	-.3	18uV	-.96	1KHz
	30	-.8	-.8	0	0	-.2	-.2	-.1	-.1	GEN MAX 75mV	-2.18	75% MOD
	75	-.7	-.7	0	0	-.3	-.3	-.3	-.3	3uV	-.48	
	75	-.6	-.6	+.1	+.1	-.1	-.1	-.1	-.1	6uV	-.53	
	75	-.6	-.6	+.2	+.2	0	0	0	0	9uV	-.79	
	75	-.6	-.6	+.2	+.2	0	0	0	0	18uV	-1.11	
	75	-.5	-.5	+.3	+.3	+.1	+.1	+.2	+.2	GEN MAX 75mV	-2.18	
	90	-.5	-.5	+.2	+.2	-.1	-.1	-.1	-.1	3uV	-.49	
	90	-.5	-.5	+.3	+.3	+.1	+.1	+.1	+.1	6uV	-.53	
	90	-.5	-.5	+.4	+.4	+.1	+.1	+.1	+.1	9uV	-.85	
	90	-.4	-.4	+.5	+.5	+.2	+.2	+.2	+.2	18uV	-1.15	
392.1	90	-.4	-.4	+.5	+.5	+.2	+.2	+.2	+.2	GEN MAX 95mV	-2.25	

4.3.9 VSWR Test:

4.3.9.1 Procedure: An attempt was made to check the protective circuits of the radio to insure that they do activate when connected to a VSWR greater than 5 to 1. The protective circuitry was also checked by shorting the antenna and by disconnecting the antenna.

4.3.9.2 Results: Because of the lack of appropriate test equipment, most of this test was not accomplished. It was impossible to vary the impedance of the RF load enough to present a VSWR of 5 to 1 at the transmitter. The cable connecting the load to the transmitter was enough of an impedance match to limit the VSWR to less than 5 to 1. The protective circuits were activated when a short or open was present at the antenna terminal. With a short or an open, the power out of the transmitter was limited to 5 watts. Data from the DT&E will be used to verify the action of the protective circuits when a high VSWR is present.

4.3.9.3 Conclusions: The GRC-171 will recognize a high VSWR only if it is at the radio end. A problem at the antenna could exist, but because of the cable leading to the antenna, the protective circuits of the radio may not be activated and the radio will continue to operate at 20 watts. The protection for a short or an open is adequate.

4.3.10 Secure Mode Data Tests.

4.3.10.1 Procedures: A test as outlined in the attached test plan was not conducted. NSA was not able to support the GRC-171 test by supplying either VINSON Engineering Models or a VINSON Simulator. The test was attempted using KY-8 (NESTOR) equipment. The KY-8 equipment on hand was not operable and replacement equipment did not arrive until after the official end of IOT&E. However, a limited test was conducted prior to returning the transceivers to the contractor. Two radios were configured back-to-back with the KY-8's transmitting through them. The wideband audio of the radios was used. The diaphase and baseband modes of the KY-8's were used. The GRC-171 receiver was first configured with the wideband and then the narrowband i.f. filters. Because of an inoperable bit error rate measuring device and a lack of time, this test was entirely subjective in nature.

4.3.10.2 Results: Both the diphase and baseband digital signals were successfully transmitted using the GRC-171 with the wideband filter. Intelligibility was satisfactory. The baseband signal was successfully transmitted using the GRC-171 with the narrowband filter with satisfactory intelligibility. Using diphase with the narrowband filter in the radio is unsatisfactory as anticipated.

4.3.10.3 CONCLUSION: It appears that the transceiver is compatible with the NESTOR equipment.

4.3.10.4 Recommendation: Suggest more quantitative secure voice testing be accomplished as soon as possible using both the NESTOR and VINSON equipment.

AN/GRC-171 IOT&E

I SECURE VOICE TESTS - INTRODUCTION

1. The Secure Voice testing of the GRC-171 will be separated into four test configurations. Both the Nestor and VINSON equipment will be tested for compatibility. Because the VINSON program is relatively new, engineering models or simulators will have to be used. The availability of the VINSON equipment for the GRC-171 IOT&E is dependent on support received by NSA.

2. General performance criterion set up by NSA and USAFSS for radios working with the VINSON equipment is outlined in USAFSS message 301415Z Oct 74, subject: Performance Acceptance - Rejection Criteria for VINSON (Baseband)/ARC-164 Compatibility. This same criterion will be used for the GRC-171. The criterion is as follows: when a receiver is in receipt of a three microvolt signal [ten db signal plus noise-to-noise ratio (S+N/N)], the radios (both transmit and receive) should not introduce more than one percent bit error rate (BER). This criterion will be used for both Nestor and VINSON equipment. If the radios deviate from this criterion, USAFSS will be notified and they will inform us of acceptable deviations.

II TEST PROCEDURES

1. NESTOR (KY-8) in diphase mode.

   A. Connect equipment per Figure 1.

   B. Have KY-8s in diphase mode.

   C. Have wideband filter (100 KHz) in GRC-171.

   D. Set frequency of transmitter and receiver to 300 MHz.

   E. Set variable attenuator to achieve a 3 uV (-97.5 dbm) at input to receiver.

F. A tape recording of selected phrases will be used as the input to KY-8 #1. The output of KY-8 #2 will be taped and compared to the original tape. A subjective evaluation of the quality of the output signal will be made.

G. Insert the BER test set as shown in Figure 2.

H. Insure values in Steps B, C, D, and E are still correct.

I. Apply audio signal to KY-8 #1. Measure BER of system.

J. Connect KY-8 #1 and #2 back-to-back with BER tester connected. Apply same audio signal and measure BER.

K. The difference between measurements taken in Steps I and J will be the BER induced by the radios.

2. VINSON diphase mode.

A. Connect equipment as shown in Figure 3.

B. Have VINSON engineering model in diphase mode.

C. Repeat Steps C through F of test one for VINSON engineering model.

D. Connect equipment as shown in Figure 4.

E. Have simulator in diphase mode.

F. Repeat Steps I through K of test one for the VINSON simulator.

3. NESTOR (KY-8) in baseband mode.

A. Connect equipment per Figure 1.

B. Have KY-8s in baseband mode.

C. Have narrowband filter (25 KHz) in GRC-171.

D. Repeat Steps D through K of test one.

4. VINSON baseband mode.

A. Connect equipment as shown in Figure 3.

B. Have VINSON engineering model in baseband mode.

C. Have narrowband filter (25 KHz) in GRC-171.

D. Repeat Steps D through F for VINSON engineering model.

E. Connect equipment as shown in Figure 4.

F. Have simulator in baseband mode.

G. Repeat Steps I through K of test one for the VINSON simulator.

5. If unacceptable voice intelligibility or a BER of more than 1% is recorded, decrease the attenuation of the signal until an acceptable value is achieved. Record the value of attenuation. If decreasing the attenuation of the signal does not improve BER or intelligibility, assistance from NSA, USAFSS, and/or Collins will be needed. This will indicate that there is either a fault in the radio or that the criterion is too restrictive.

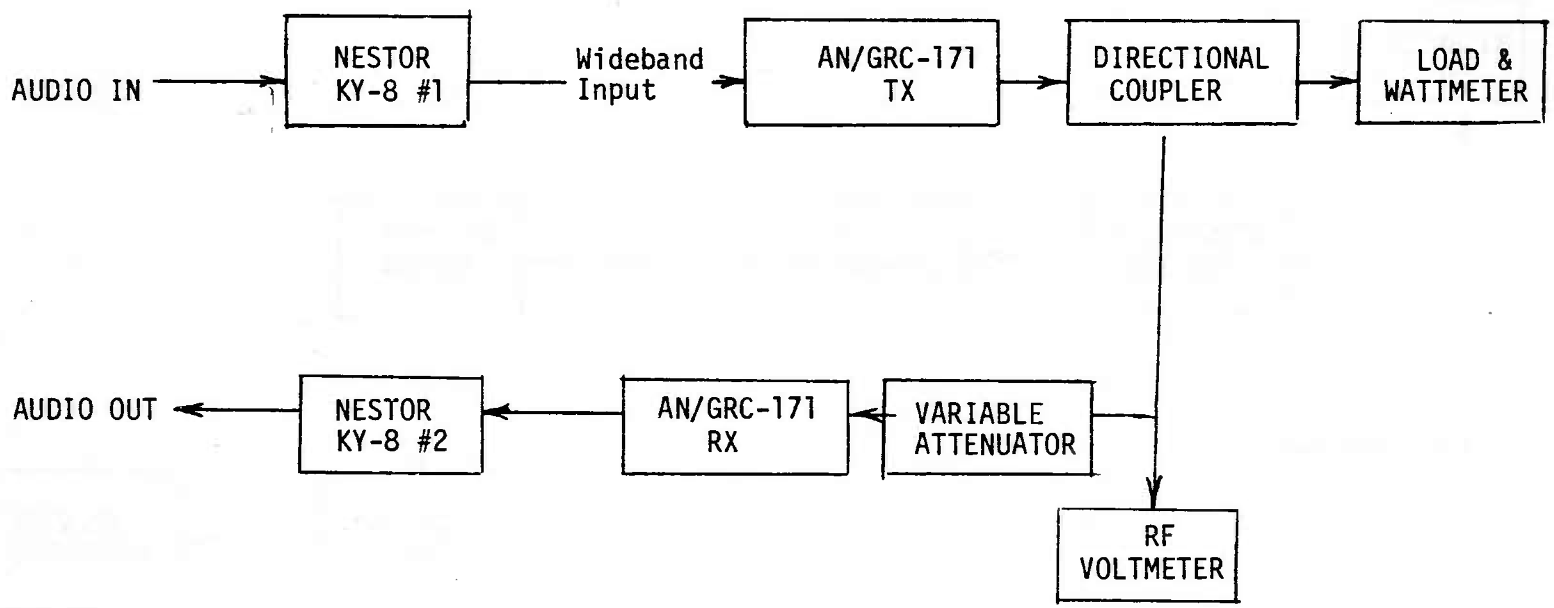

AUDIO IN
NESTOR KY-8 #1
Wideband Input
AN/GRC-171 TX
DIRECTIONAL COUPLER
LOAD & WATTMETER
RF VOLTMETER
VARIABLE ATTENUATOR
AN/GRC-171 RX
NESTOR KY-8 #2
AUDIO OUT

Figure 1

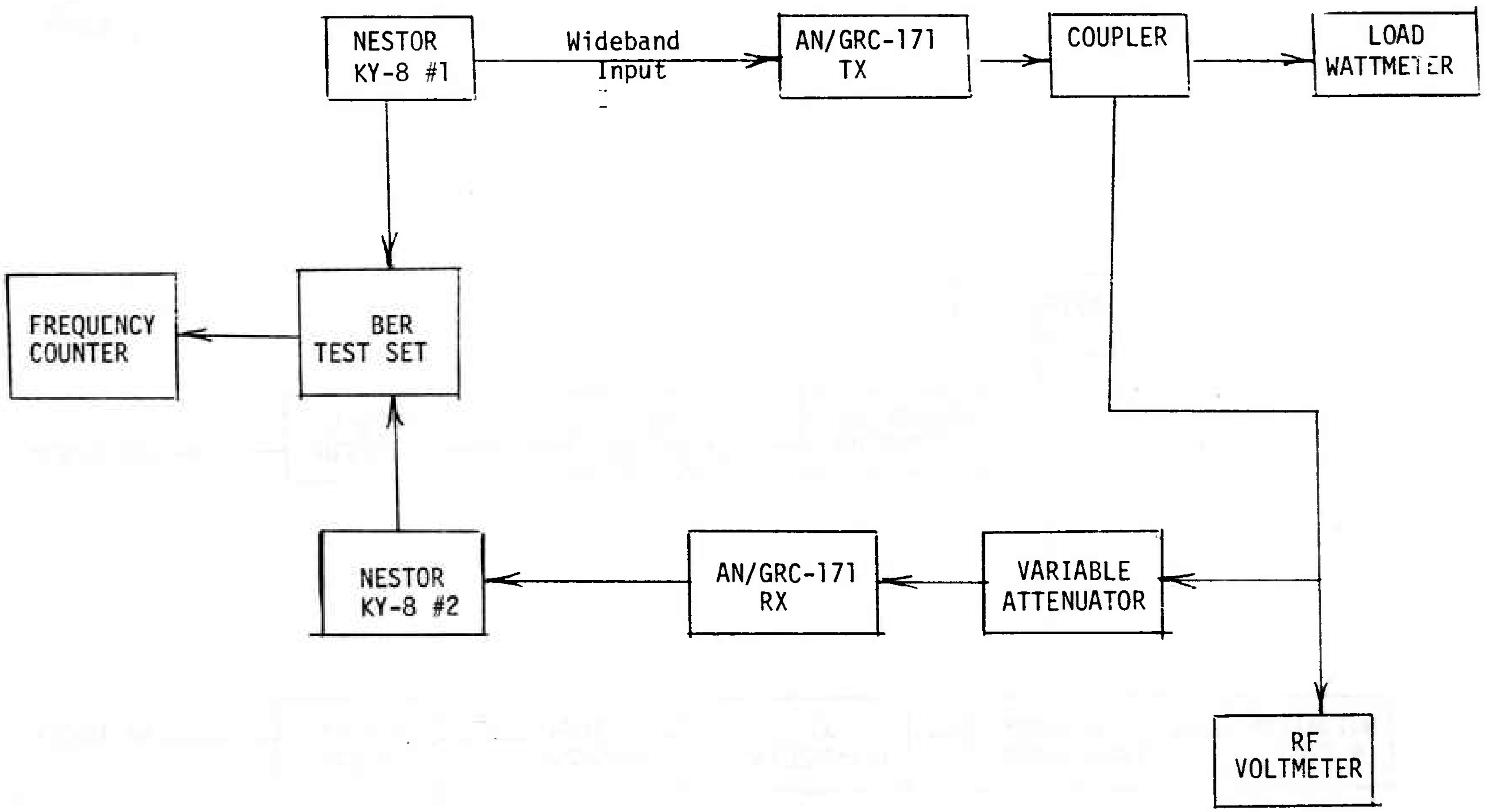

NESTOR
KY-8 #1
Wideband
Input
AN/GRC-171
TX
COUPLER
LOAD
WATTMETER
FREQUENCY
COUNTER
BER
TEST SET
NESTOR
KY-8 #2
AN/GRC-171
RX
VARIABLE
ATTENUATOR
RF
VOLTMETER

Figure 2

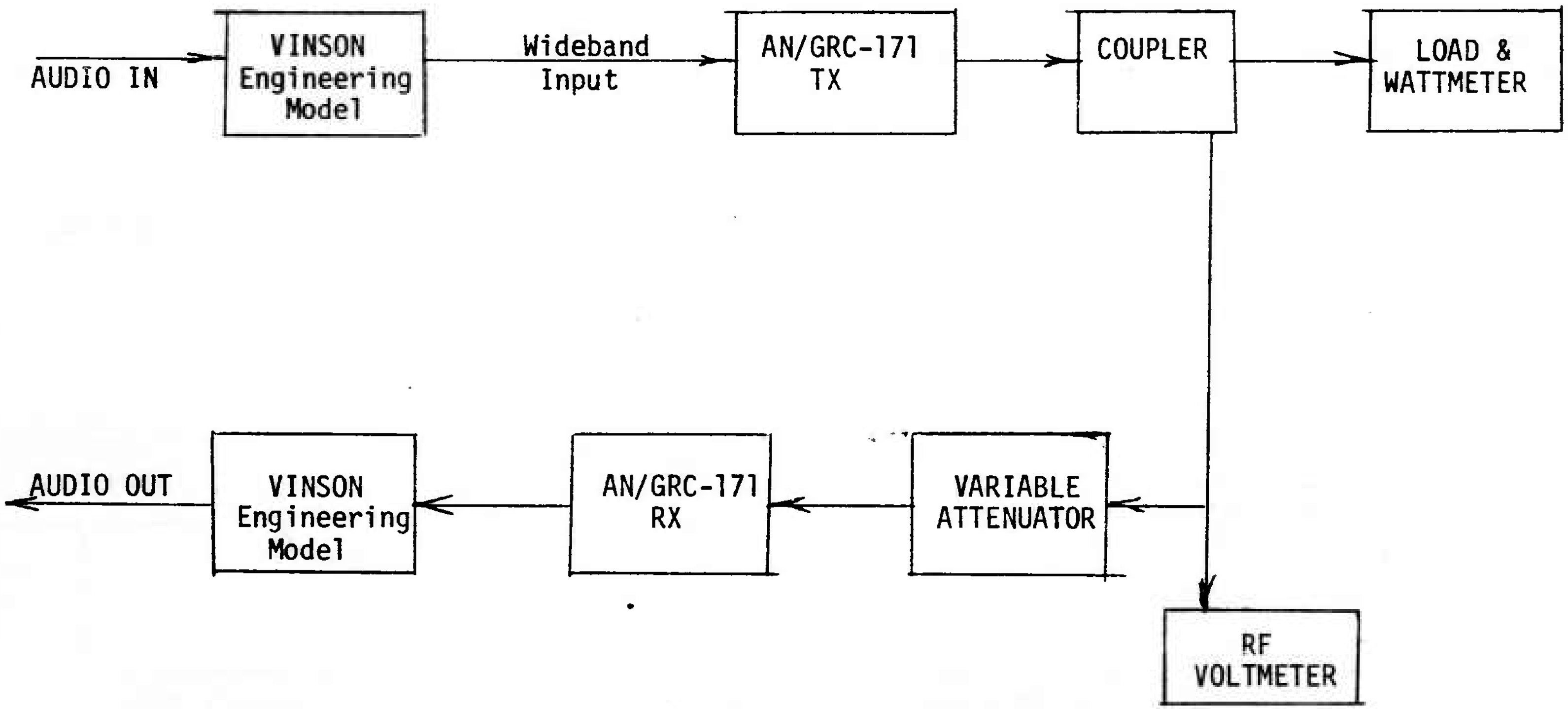

AUDIO IN
VINSON Engineering Model
Wideband Input
AN/GRC-171 TX
COUPLER
LOAD & WATTMETER
AUDIO OUT
VINSON Engineering Model
AN/GRC-171 RX
VARIABLE ATTENUATOR
RF VOLTMETER

Figure 3

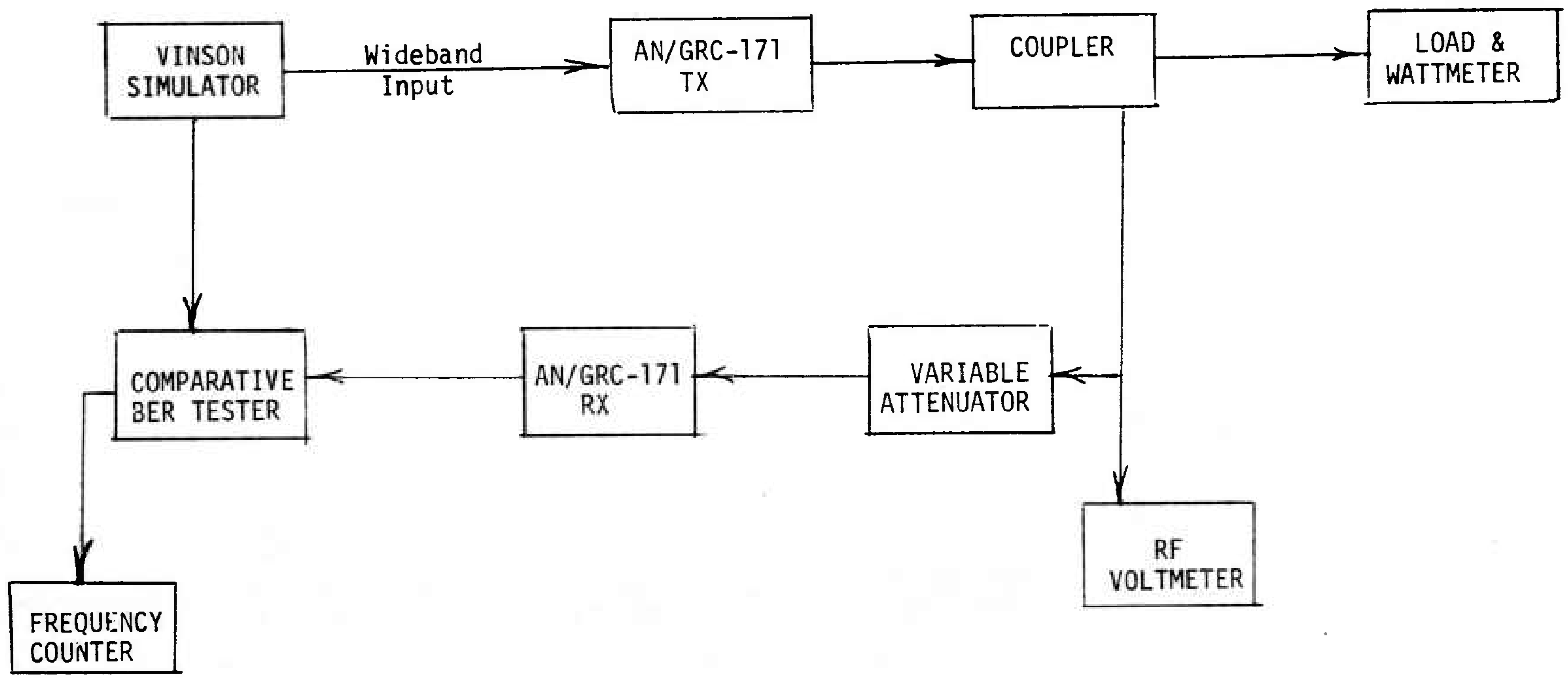

VINSON
SIMULATOR
Wideband
Input
AN/GRC-171
TX
COUPLER
LOAD &
WATTMETER
COMPARATIVE
BER TESTER
AN/GRC-171
RX
VARIABLE
ATTENUATOR
RF
VOLTMETER
FREQUENCY
COUNTER

Figure 4

4.3.11 AN/GRC-171 3rd Order Transmitter Intermodulation Test

4.3.11.1 Procedure: The AN/GRC-171 transmitter was used to provide a 20 watt desired signal on 240 MHz (Fo). An AN/GRC-27 transmitter provided a 200 mw undesired signal input to the AN/GRC-171 on frequency Fx. The amount of third order intermodulation product (F_p) present at the AN/GRC-171 output was measured. Two products were present (F_p = 2 Fo-Fx and F_p = 2 Fx-Fo) at each frequency setting of the GRC-27. Two GRC-171 transmitters, PP-1 and PP-2, were tested at 3 Fo values (240, 312 and 385 MHz). Delta f values of ±1, 2, 4, 8, 12, and 24 MHz were used.

4.3.11.2 Results: The product with the higher level was the 2 Fo - Fx product in nearly all cases. Results appear in the attached Data Sheets and have been graphed. The IM product level decreased as delta f was increased, due to the selectivity of the built-in RF filter. At delta f of 1 MHz the highest product measured was - 27 dB below the offending level of + 23 dBm, or -4 dBm. Set PP-2 tested from 5 to 13 dB inferior to set PP-1.

4.3.11.3 Conclusions: The level of IM product ±1 MHz was found to be better than equipment specifications require (+ 3 dBm allowed), and better than that obtained with the older ground/air radio equipment (GRT-3, GRC-27). The decrease of product level with delta f is also superior (GRC-171: 32 to 41 dB in the first 10 MHz; GRT-3/GRC-27: 23 to 27 dB over 10 MHz). However, it should be pointed out that IM problems can still occur, especially when two GRC-171's are collocated and delta f's of about 1 MHz are utilized. Sufficient space isolation and frequency separation will still be essential to avoid this type of RFI.

4.3.11.4 Recommendation: Further testing be accomplished to determine what caused the poor performance of PP-2 and determine what level of Third Order IM will be the most representative when the radio is fielded.

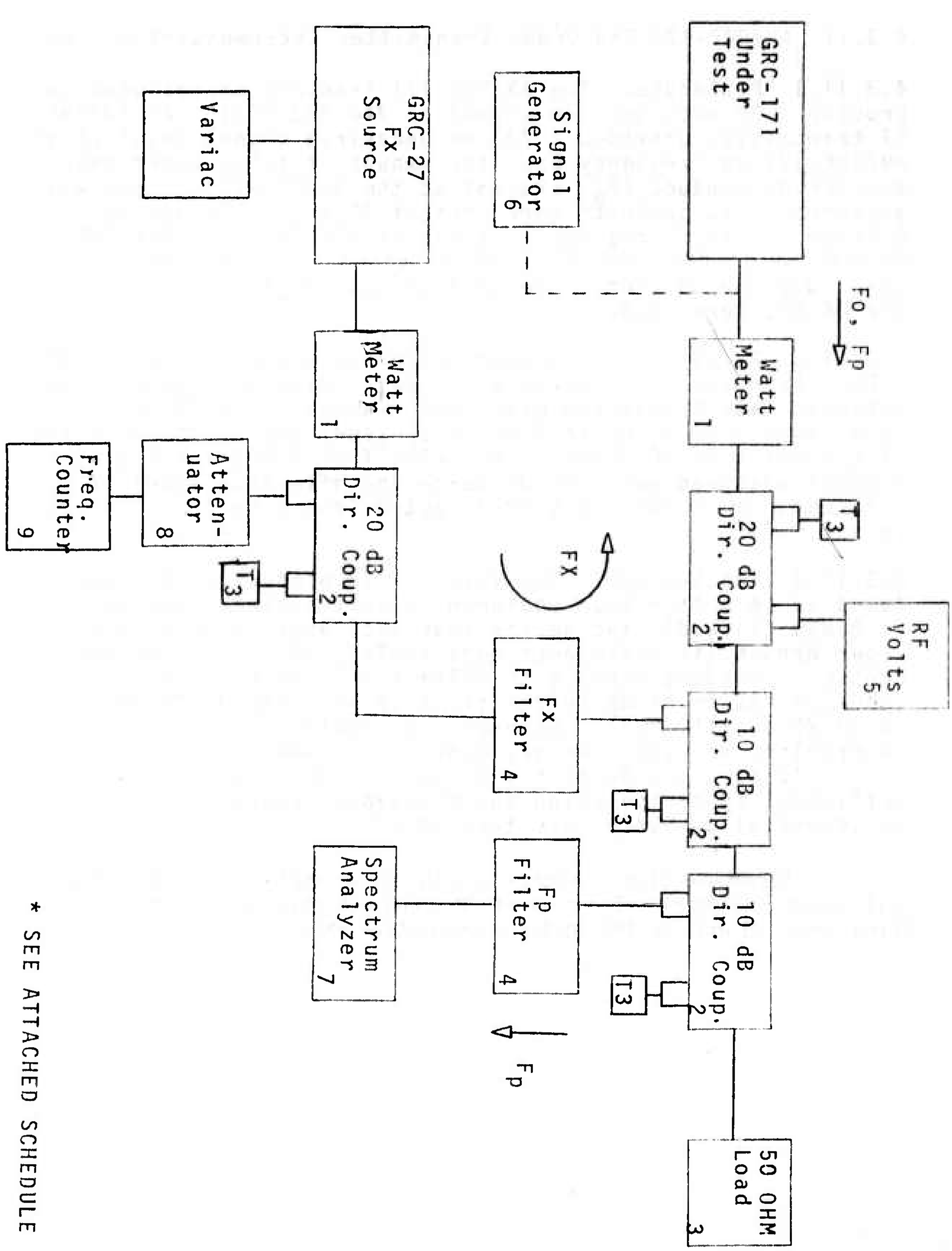


FIGURE 9

AN/GRC-171 3rd Order Transmitter Intermodulation Test

* ATTACHED SCHEDULE

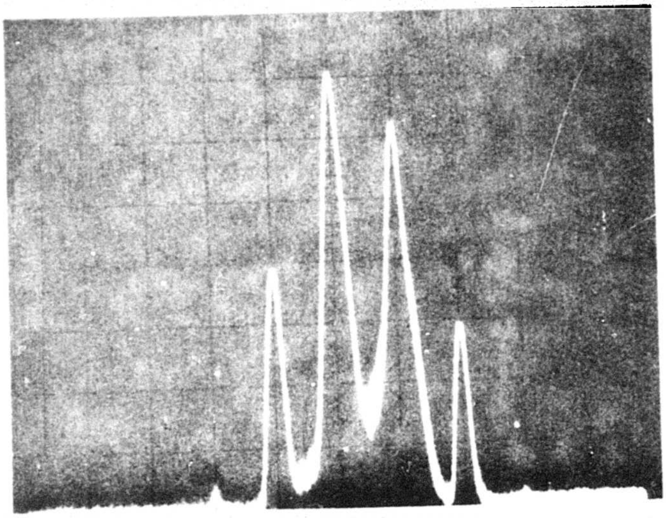
1. Bird Wattmeter
2. Narda Directional Coupler
3. 50 OHM Load/Termination
4. Collins 156C Filter
5. Boonton RF Voltmeter
6. HP 8640 Signal Gen.
7. HP 851/8551B Spect. Anal.
8. HP 355 Attenuator
9. HP 5245 Counter

Fo Test Frequency
Fx Offending Frequency
Fp Product Frequency

$$Fp = 2\,Fo - Fx$$
$$Fp = 2\,Fx - Fo$$

Third Order Intermodulation Test

Representative Spectrum Analyzer Photograph

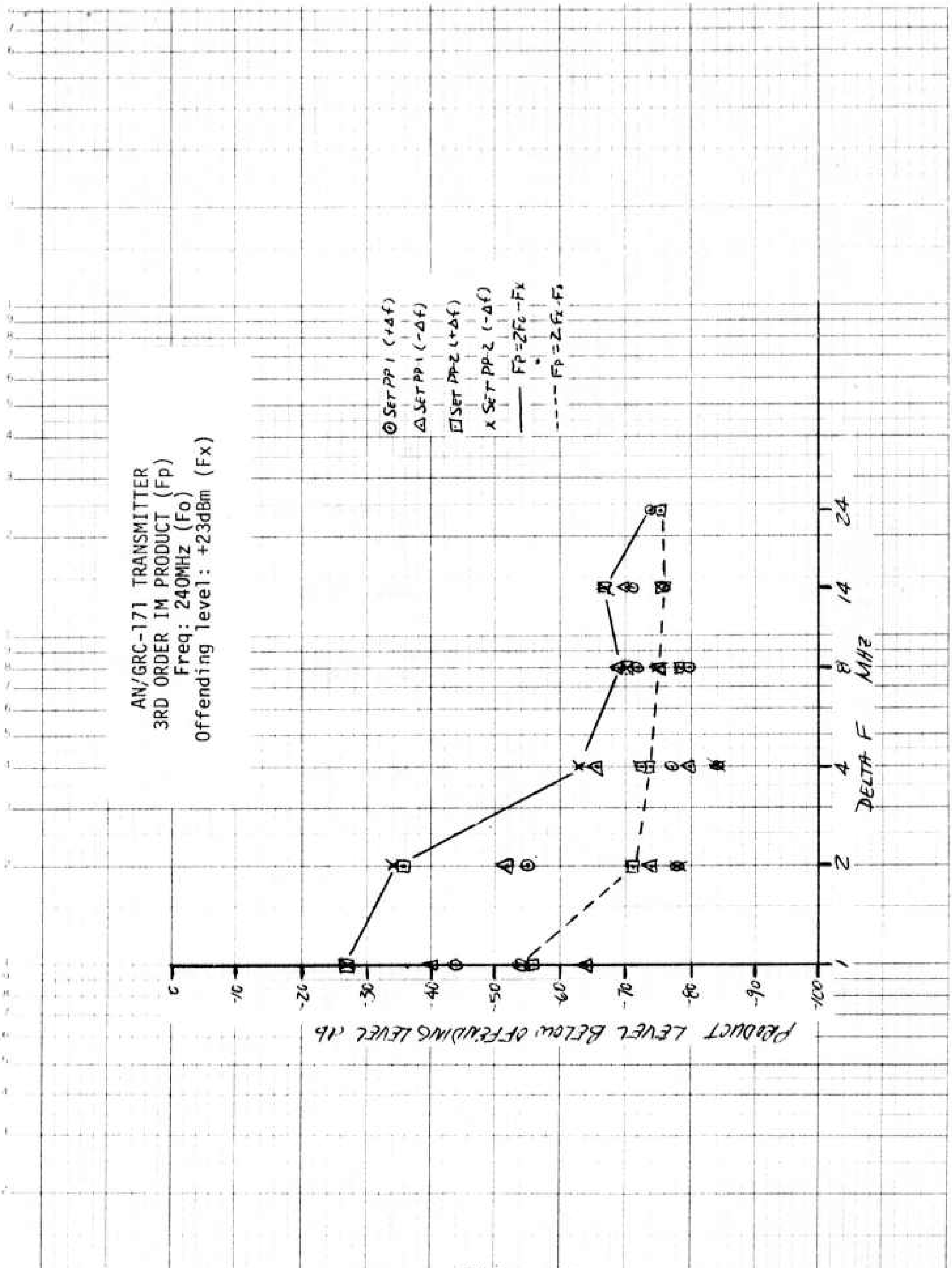


PP #1

Fo= 240.0 MHz Center Frequency
Fx= 239.0 MHz
Fp= 241.0 MHz

Intermod Filter tuned to
241.0 MHz

Ref. Level= 0dbm (Top Line)
Fp= -17 dbm



AN/GRC-171 TRANSMITTER
3RD ORDER IM PRODUCT (Fp)
Freq: 240MHz (Fo)
Offending level: +23dBm (Fx)
⊙ SET PP 1 (+Δf)
△ SET PP 1 (-Δf)
⊡ SET PP-2 (+Δf)
x SET PP-2 (-Δf)
Fp=2Fo-Fx
Fp=2Fx-Fo
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
PRODUCT LEVEL BELOW OFFENDING LEVEL dB
1
2
4
8
14
24
DELTA F MHz

Figure 10

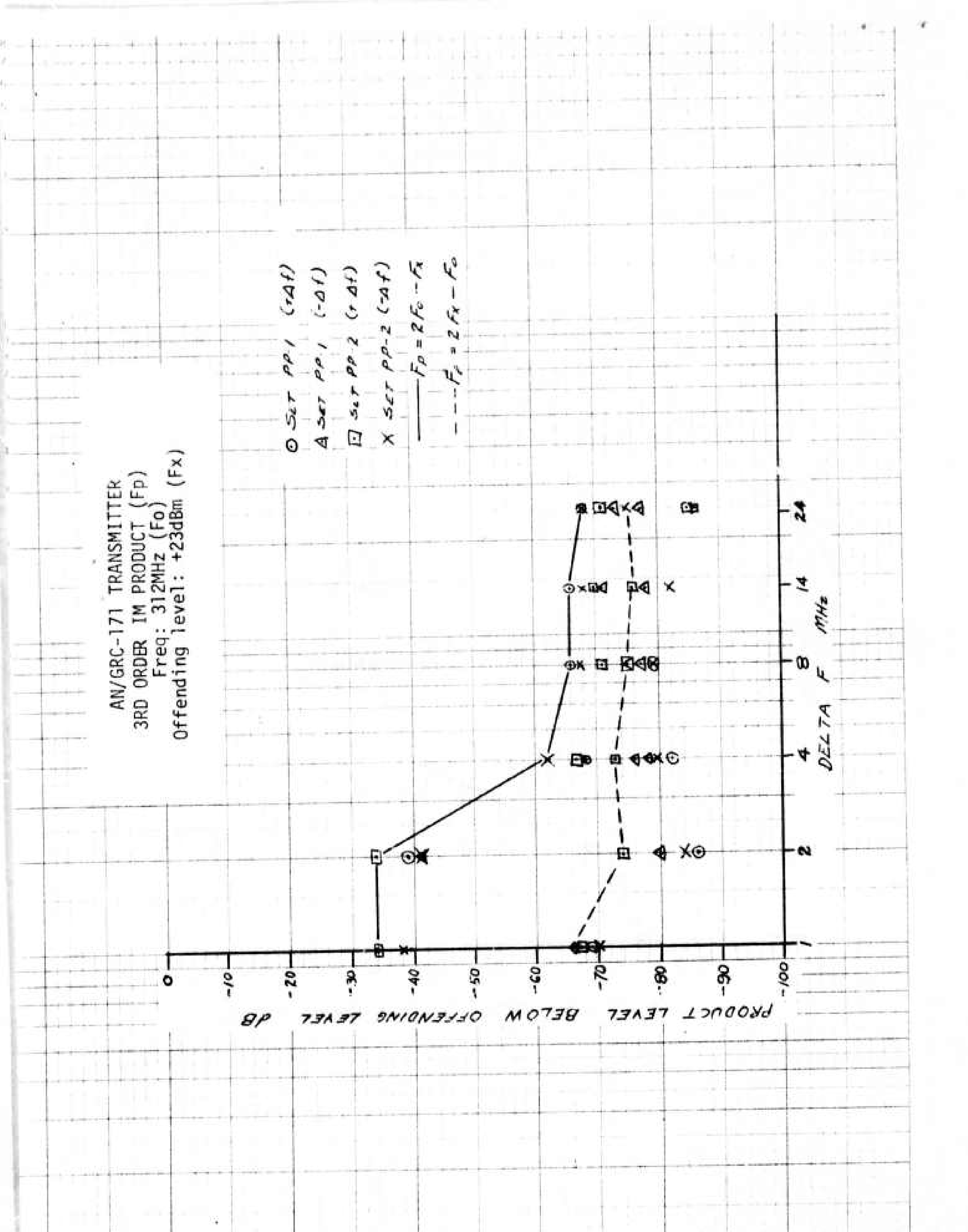

AN/GRC-171 TRANSMITTER
3RD ORDER IM PRODUCT (Fp)
Freq: 312MHz (Fo)
Offending level: +23dBm (Fx)
SET PP1 (+Δf)
SET PP1 (-Δf)
SET PP2 (+Δf)
SET PP-2 (-Δf)
Fp = 2Fo - Fx
Fp = 2Fx - Fo
PRODUCT LEVEL BELOW OFFENDING LEVEL dB
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
DELTA F MHz
1
2
4
8
14
24

Figure 11

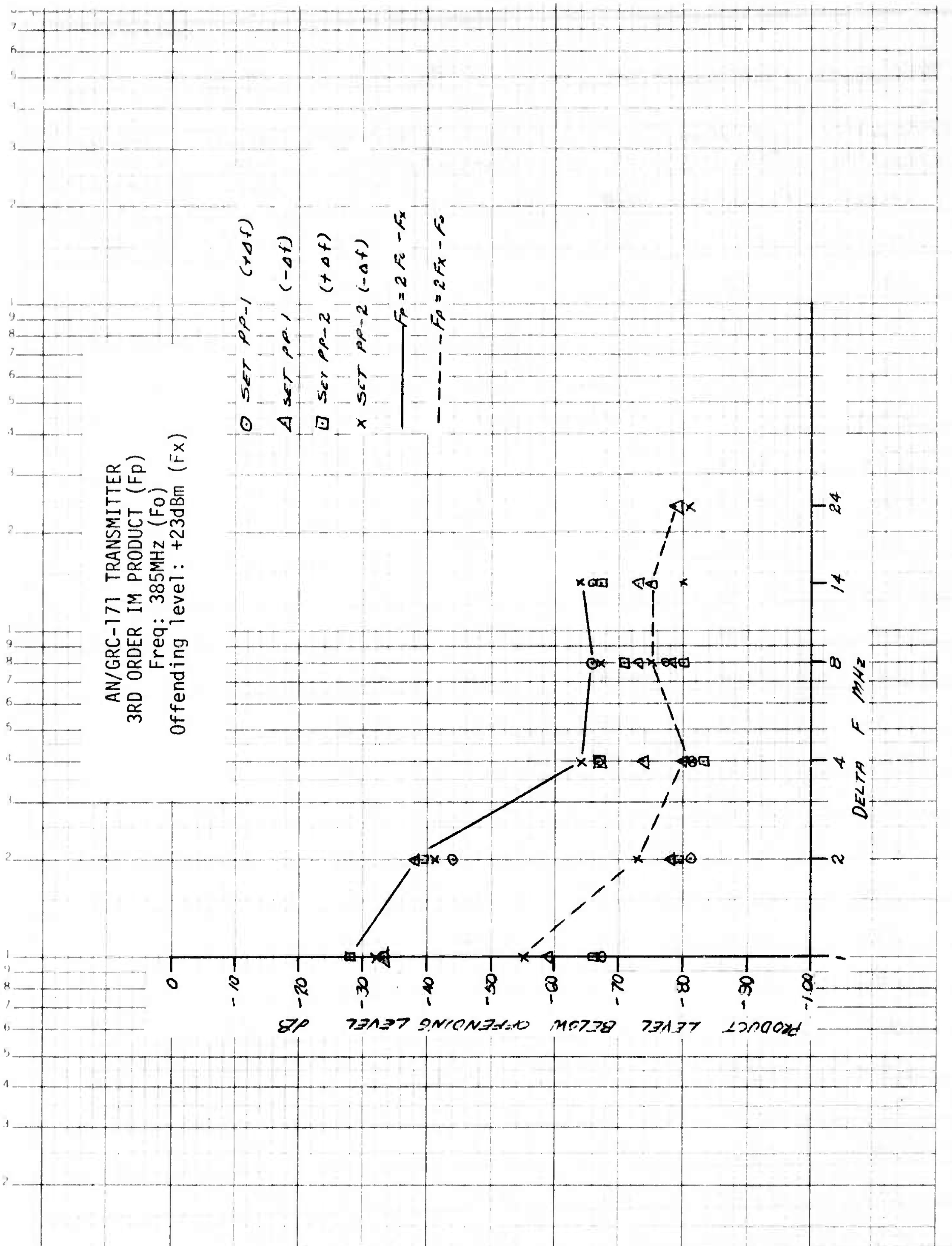

AN/GRC-171 TRANSMITTER
3RD ORDER IM PRODUCT (Fp)
Freq: 385MHz (Fo)
Offending level: +23dBm (Fx)
⊙ SET PP-1 (+Δf)
Δ SET PP-1 (-Δf)
⊡ SET PP-2 (+Δf)
x SET PP-2 (-Δf)
Fp = 2Fo - Fx
Fp = 2Fx - Fo
PRODUCT LEVEL BELOW OFFENDING LEVEL dB
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
1
2
4
8
14
24
DELTA F MHz

Figure 12

SHEET # 4

THIRD ORDER INTERMODULATION PP#1 14 JAN 75

TRANSMITTER FREQUENCY Fo (MHz)	OFFENDING FREQUENCY Fk (MHz)	ΔF (MHz)	PRODUCT FREQUENCY Fp (MHz)	OFFENDING INPUT LEVEL (dbm)	PRODUCT OUTPUT LEVEL (dbm)	PRODUCT LEVEL BELOW OFFENDING LEVEL (db)
240	241	+1	239	+23	-21.0	44
240	242	+2	238	+23	-32.0	55
240	244	+4	236	+23	-54.0	77
240	248	+8	232	+23	-49.0	72
240	254	+14	226	+23	-48.0	71
240	264	+24	216	+23		
240	241	+1	242	+23	-31.0	54
240	242	+2	244	+23	-55.0	78
240	244	+4	248	+23	-61.0	84
240	248	+8	256	+23	-57.0	80
240	254	+14	268	+23	-53.0	76
240	264	+24	288	+23	-51.0	74
240	239	-1	241	+23	-17.0	40
240	238	-2	242	+23	-29.0	52
240	236	-4	244	+23	-43.0	66
240	232	-8	248	+23	-46.0	69
240	226	-14	254	+23	-47.0	70
240	216	-24	264	+23		
240	239	-1	238	+23	-41.0	64
240	238	-2	236	+23	-51.0	74
240	236	-4	232	+23	-57.0	80
240	232	-8	224	+23	-52.0	75
240	226	-14	212	+23		
240	216	-24	192	+23		

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SHEET #5

THIRD ORDER INTERMODULATION PP#1 A JAN 75

TRANSMITTER FREQUENCY Fo (MHz)	OFFENDING FREQUENCY Fx (MHz)	ΔF (MHz)	PRODUCT FREQUENCY Fp (MHz)	OFFENDING INPUT LEVEL (dbm)	PRODUCT OUTPUT LEVEL (dbm)	PRODUCT LEVEL BELOW OFFENDING LEVEL (db)
312	313	+1	311	+23	-16.0	39
312	314	+2	310	+23	-16.0	39
312	316	+4	308	+23	-45.0	68
312	320	+8	304	+23	-43.0	66
312	326	+14	298	+23	-43.0	66
312	336	+24	288	+23	-45.0	68
312	313	+1	314	+23	-46.0	69
312	314	+2	316	+23	-63.0	86
312	316	+4	320	+23	-59.0	82
312	320	+8	328	+23	-56.0	79
312	326	+14	340	+23	-55.0	78
312	336	+24	360	+23	-62.0	85
312	311	-1	313	+23	-16.0	39
312	310	-2	314	+23	-18.0	41
312	308	-4	316	+23	-55.0	78
312	304	-8	320	+23	-52.0	75
312	298	-14	326	+23	-48.0	71
312	288	-24	336	+23	-50.0	73
312	311	-1	310	+23	-44.0	66
312	310	-2	308	+23	-57.0	80
312	308	-4	304	+23	-53.0	76
312	304	-8	296	+23	-54.0	77
312	298	-14	284	+23	-55.0	78
312	288	-24	264	+23	-54.0	77

SHEET #6

THIRD ORDER INTERMODULATION — PP#1 — 14 JAN 75

TRANSMITTER FREQUENCY Fo (MHz)	OFFENDING FREQUENCY Fx (MHz)	ΔF (MHz)	PRODUCT FREQUENCY Fp (MHz)	OFFENDING INPUT LEVEL (dbm)	PRODUCT OUTPUT LEVEL (dbm)	PRODUCT LEVEL BELOW OFFENDING LEVEL (db)
385	386	+1	384	+23	-10.0	33
385	387	+2	383	+23	-14.0	44
385	389	+4	381	+23	-44.0	67
385	393	+8	377	+23	-42.0	65
385	399	+14	371	+23	-43.0	66
385	409	+24	361	+23		
385	386	+1	387	+23	-44.0	67
385	387	+2	389	+23	-58.0	81
385	389	+4	393	+23	-58.0	81
385	393	+8	401	+23	-54.0	77
385	399	+14	413	+23		
385	409	+24	433	+23		
385	384	-1	386	+23	-10.0	33
385	383	-2	387	+23	-15.0	38
385	381	-4	389	+23	-57.0	80
385	377	-8	393	+23	-55.0	78
385	371	-14	399	+23	-50.0	73
385	361	-24	409	+23		
385	384	-1	383	+23	-36.0	59
385	383	-2	381	+23	-55.0	78
385	381	-4	377	+23	-51.0	74
385	377	-8	369	+23	-50.0	73
385	371	-14	357	+23	-52.0	75
385	361	-24	337	+23	-56.0	79

THIRD ORDER INTERMODULATION PP#2 14 JAN 75

P_o = 43.2 dbm

TRANSMITTER FREQUENCY Fo (MHz)	OFFENDING FREQUENCY Fx (MHz)	ΔF (MHz)	PRODUCT FREQUENCY Fp (MHz)	OFFENDING INPUT LEVEL (dbm)	PRODUCT OUTPUT LEVEL (dbm)	PRODUCT LEVEL BELOW OFFENDING LEVEL (db)
240	241	+1	239	+23	-4.0	27
240	242	+2	238	+23	-12.0	35
240	244	+4	236	+23	-51.0	74
240	248	+8	232	+23	-47.0	70
240	254	+14	226	+23	-44.0	67
240	264	+24	216	+23		
240	241	+1	242	+23	-32.0	55
240	242	+2	244	+23	-48.0	71
240	244	+4	248	+23	-50.0	73
240	248	+8	256	+23	-56.0	79
240	254	+14	268	+23	-53.0	76
240	264	+24	288	+23	-52.0	75
240	239	-1	241	+23	-4.0	27
240	238	-2	242	+23	-11.0	34
240	236	-4	244	+23	-40.0	63
240	232	-8	248	+23	-47.0	70
240	226	-14	254	+23	-44.0	67
240	216	-24	264	+23		
240	239	-1	238	+23	-31.0	54
240	238	-2	236	+23	-55.0	78
240	236	-4	232	+23	-61.0	84
240	232	-8	224	+23	-52.0	75
240	226	-14	212	+23		
240	216	-24	192	+23		

SHEET #2

THIRD ORDER INTERMODULATION PP #2 14 JAN 75

TRANSMITTER FREQUENCY Fo (MHz)	OFFENDING FREQUENCY Fx (MHz)	ΔF (MHz)	PRODUCT FREQUENCY Fp (MHz)	OFFENDING INPUT LEVEL (dbm)	PRODUCT OUTPUT LEVEL (dbm)	PRODUCT LEVEL BELOW OFFENDING LEVEL (db)
312	313	+1	311	+23	-11.0	34
312	314	+2	310	+23	-11.0	34
312	316	+4	308	+23	-44.0	67
312	320	+8	304	+23	-48.0	71
312	326	+14	298	+23	-47.0	70
312	336	+24	288	+23	-48.0	71
312	313	+1	314	+23	-44.0	67
312	314	+2	316	+23	-51.0	74
312	316	+4	320	+23	-50.0	73
312	320	+8	328	+23	-52.0	75
312	326	+14	340	+23	-53.0	76
312	336	+28	360	+23	-63.0	86
312	311	-1	313	+23	-15.0	38
312	310	-2	314	+23	-18.0	41
312	308	-4	316	+23	-39.0	62
312	304	-8	320	+23	-44.0	67
312	298	-14	326	+23	-45.0	68
312	288	-24	336	+23	-45.0	68
312	311	-1	310	+23	-47.0	70
312	310	-2	308	+23	-61.0	84
312	308	-4	304	+23	-56.0	79
312	304	-8	296	+23	-56.0	79
312	298	-14	284	+23	-59.0	82
312	288	-24	264	+23	-52.0	75

SHEET #3

THIRD ORDER INTERMODULATION — PP #2 — 14 JAN 75

TRANSMITTER FREQUENCY Fo (MHz)	OFFENDING FREQUENCY Fx (MHz)	ΔF (MHz)	PRODUCT FREQUENCY Fp (MHz)	OFFENDING INPUT LEVEL (dbm)	PRODUCT OUTPUT LEVEL (dbm)	PRODUCT LEVEL BELOW OFFENDING LEVEL (db)
385	386	+1	384	+23	-5.0	28
385	387	+2	383	+23	-16.0	39
385	389	+4	381	+23	-44.0	67
385	393	+8	377	+23	-48.0	71
385	399	+14	371	+23	-44.0	67
385	409	+24	361	+23		
385	386	+1	387	+23	-43.0	66
385	387	+2	389	+23	-56.0	79
385	389	+4	393	+23	-60.0	83
385	393	+8	401	+23	-57.0	80
385	399	+14	413	+23		
385	409	+24	433	+23		
385	384	-1	386	+23	-9.0	32
385	383	-2	387	+23	-18.0	41
385	381	-4	389	+23	-41.0	64
385	377	-8	393	+23	-44.0	67
385	371	-14	399	+23	-41.0	64
385	361	-24	409	+23		
385	384	-1	383	+23	-32.0	55
385	383	-2	381	+23	-50.0	73
385	381	-4	377	+23	-58.0	81
385	377	-8	369	+23	-52.0	75
385	371	-14	357	+23	-57.0	80
385	361	-24	337	+23	-58.0	81

4.3.12 AN/GRC-171 Transmitter Spurious Emissions:

4.3.12.1 Procedure: The AN/GRC-171 transmitter was set on 240MHz and carrier power verified to be +43dBm into a 50 ohm load. A small portion of the output was fed to a spectrum analyzer and the frequency band 100-1000MHz was searched for spurious emissions. When spurious emissions were found, signal substitutions using a calibrated signal generator were employed to measure the spurious output level. The test was repeated at 312 and 385MHz for both prototypes PP-1 and PP-2.

4.3.12.2 Results: The results appear in the attached Data Sheet and in the photographs taken of the spectrum analyzer cathode ray tube. Second, third, and fourth harmonics of 240MHz; second and third harmonics of 312MHz and the second harmonic of 385MHz were found and measured. Most were at least 80dB below the carrier. Those that were not occurred at the higher frequencies beyond the generator range and were not measured as accurately. All harmonics were outside the 225-400MHz band.

A more interesting type of spurious emission was noted on both sets close in to the carrier. Here, discrete frequencies extending ± 1.3MHz, all of a level above the -70dB point, were noted. These are documented in the photographs and were attributed by the manufacturer's representative to harmonics of the dc - dc converter 40KHz multivibrator. Additional filtering was added by the manufacturer's representative and this reduced the spread of the visible spurious emissions but did not appear to reduce the level of those that could still be seen.

4.3.12.3 Conclusion: Harmonic spurious emissions do not appear to be a problem, since the levels are low. The power supply harmonics are more serious and deviate from the equipment specifications (all spurious emission should be 80dB below the carrier). These spurious emissions should be eliminated before a favorable production decision is made.

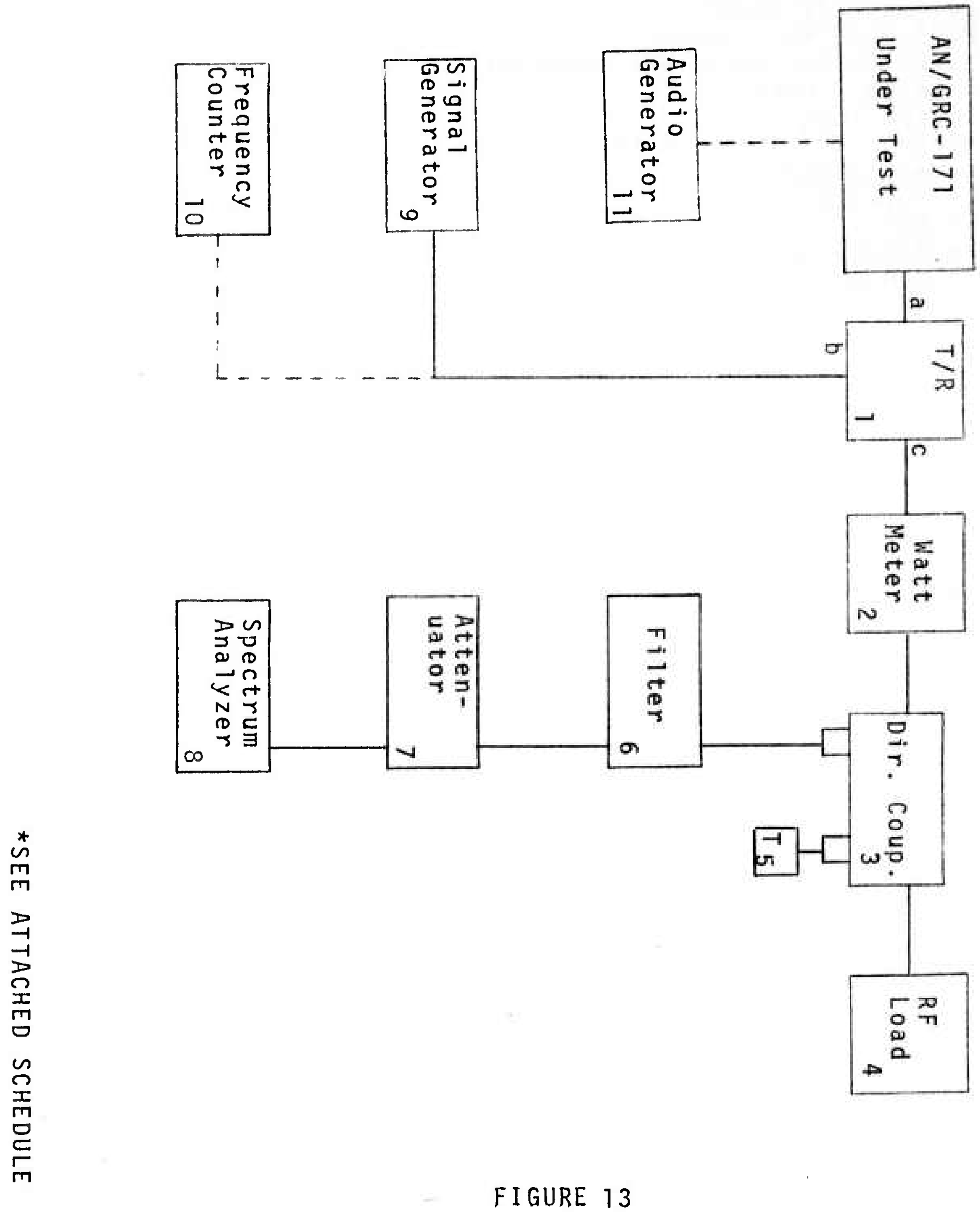


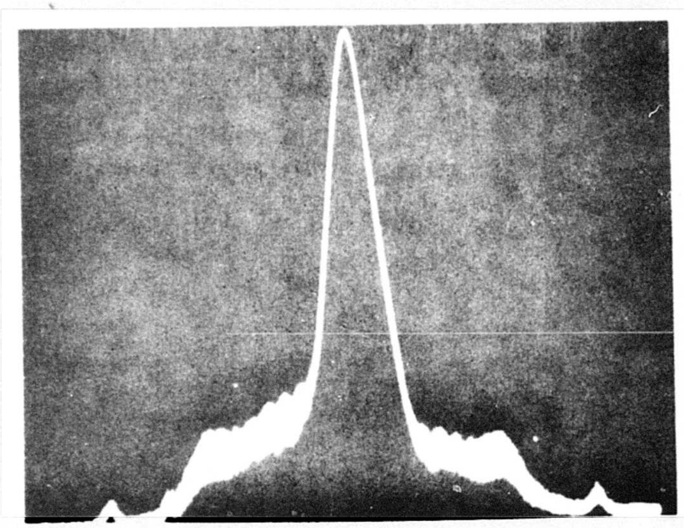
FIGURE 13

Transmitter Spurious Emissions Test

* ATTACHED SCHEDULE

1. Collins T/R Relay
2. Bird 50 W Watt Meter
3. Narda 20 db Directional Coupler
4. Bird 50 W Load
5. 50 ohm Term
6. Tunable Rejection Filter
7. HP Attenuator
8. HP 851/8551B
9. HP 608C
10. HP 5245/5253
11. HP 200 CD

Transmitter Spurious Emissions



Before Modification
Δf= 0.5 MHz/div

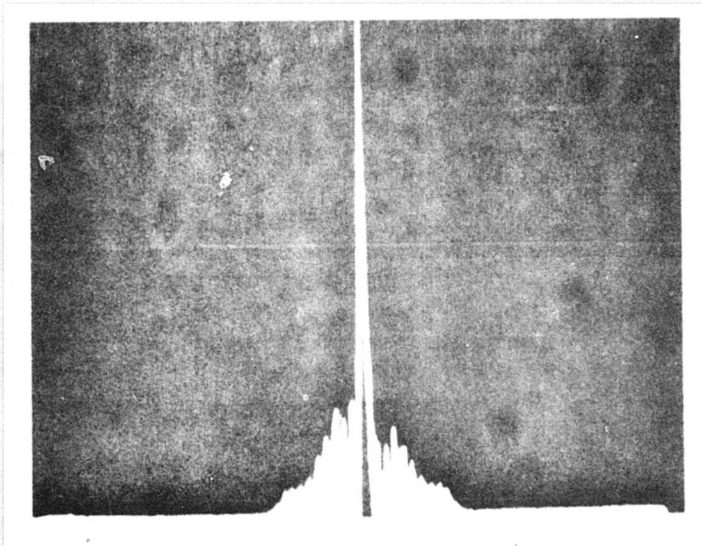
Ref.= odbm top line
-80 dbm bottom line

Spurious extends about
± 1.3 MHz from Carrier

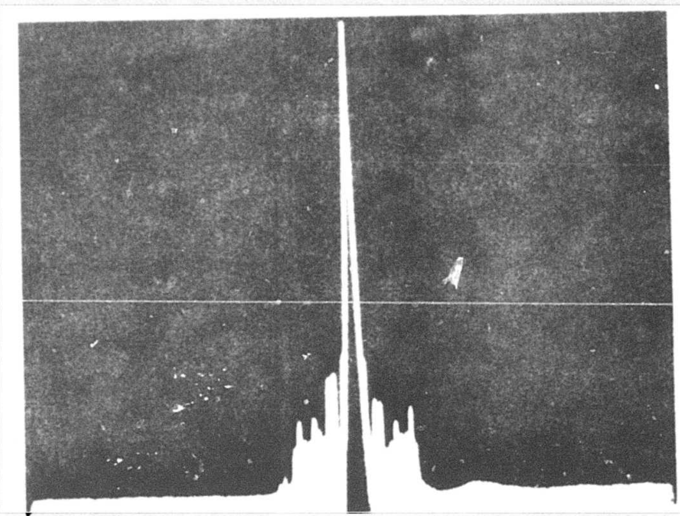
Before Modification
Δf= 1 MHz/div

Ref.=0dm top line
-80 dbm bottom line

Spurious extends about
± 1.3 MHz from Carrier



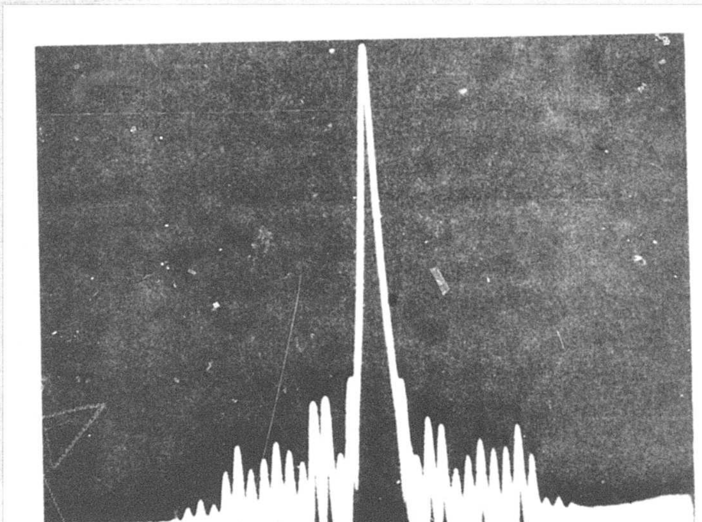
Transmitter Spurious Emissions



After Modification
Δf=500 KHz/div.

Ref.=0dbm top line
-80 dbm bottom line

Spurious extends about
± 500 KHz from Carrier



After Modification
Δf= 200 KHz/div

Ref.=0dbm top line
-80 dbm bottom line

Spurious extends about
± 500 KHz from Carrier

TRANSMITTER SPURIOUS EMISSIONS 18 DEC 74

SERIAL No.	FUNDAMENTAL FREQUENCY (MHz)	CARRIER POWER (dbm)	SPURIOUS FREQUENCY (MHz)	SPURIOUS POWER (dbm)	SPURIOUS BELOW CARRIER (db)
PP#1	240	43.2	480	-43.2	86.4
			720	-36.9	80.1
			960	-42.8	86.0
	312	43.0	624	-38.7	81.7
			936	-36.0	79.0
	385	43.1	770	-31.8	74.9
PP #2	240	43.9	480	-39.8	83.7
			720	-28.6	72.5 *
	312	43.6	624	-38	81.6
			936	-24.1	67.7 *
	385	43.4	770	-30.5	73.9
PP#1	240	43.0	±1.3		<70
	SEE PHOTOS				

* MEASUREMENTS QUESTIONABLE - BEYOND LIMITS OF AVAILABLE TEST EQUIPMENT.

4.3.13 AN/GRC-171 Receiver Composite Response:

4.3.13.1 Procedure: Two signal generators, A and B, provided two inputs to the receiver. Generator A provided -97.5dBm modulated 30% by 1000Hz on 229MHz. Generator B, modulated 90% by noise, was varied in frequency and output level to degrade the output signal plus noise-to-noise ratio to 8db. Receiver audio output at J22 was adjusted to 0dbm with only the desired signal (Generator A) present. At given delta f's above and below 229MHz, the amount of offending signal (GeneratorB) required to degrade the output (S+N)/N to 8db was measured. Additional tests were made at 300 and 395MHz for (S+N)/N ratios of 3, 6, and 8db. Tests were also made at 300MHz utilizing the narrowband "-10" IF filter and the wideband "-30" IF filter.

4.3.13.2 Results: The results appear in the attached data sheets and have been graphed. At 229MHz, due to fluctuations in signal generator output and degree of modulation, difficulty was experienced in obtaining the constant output (S+N)/N ratio as required in this test. This limited the number of readings which could be taken in the given test time. In subsequent tests at 300 and 395MHz, the offending level was set and the resulting (S+N)/N ratios were measured and used to interpolate offending levels at (S+N)/N ratios of 3, 6, and 8db.

4.3.13.3 Conclusions: The results obtained conform to results of other VHF and UHF receivers: for a delta f of 1MHz an offending level should not exceed approximately -40dbm; for a delta f of 3MHz an offending level of approximately 0dbm should not be exceeded. The minimal change in AGC voltage that was observed indicates desensitization was not a factor in the range of RF levels and delta f's tested. Since a multicoupler will not be used with the AN/GRC-171, and its associated selectivity not available, the correct combination of frequency separation and space isolation will have to be employed to avoid RFI to the AN/GRC-171 receiver.

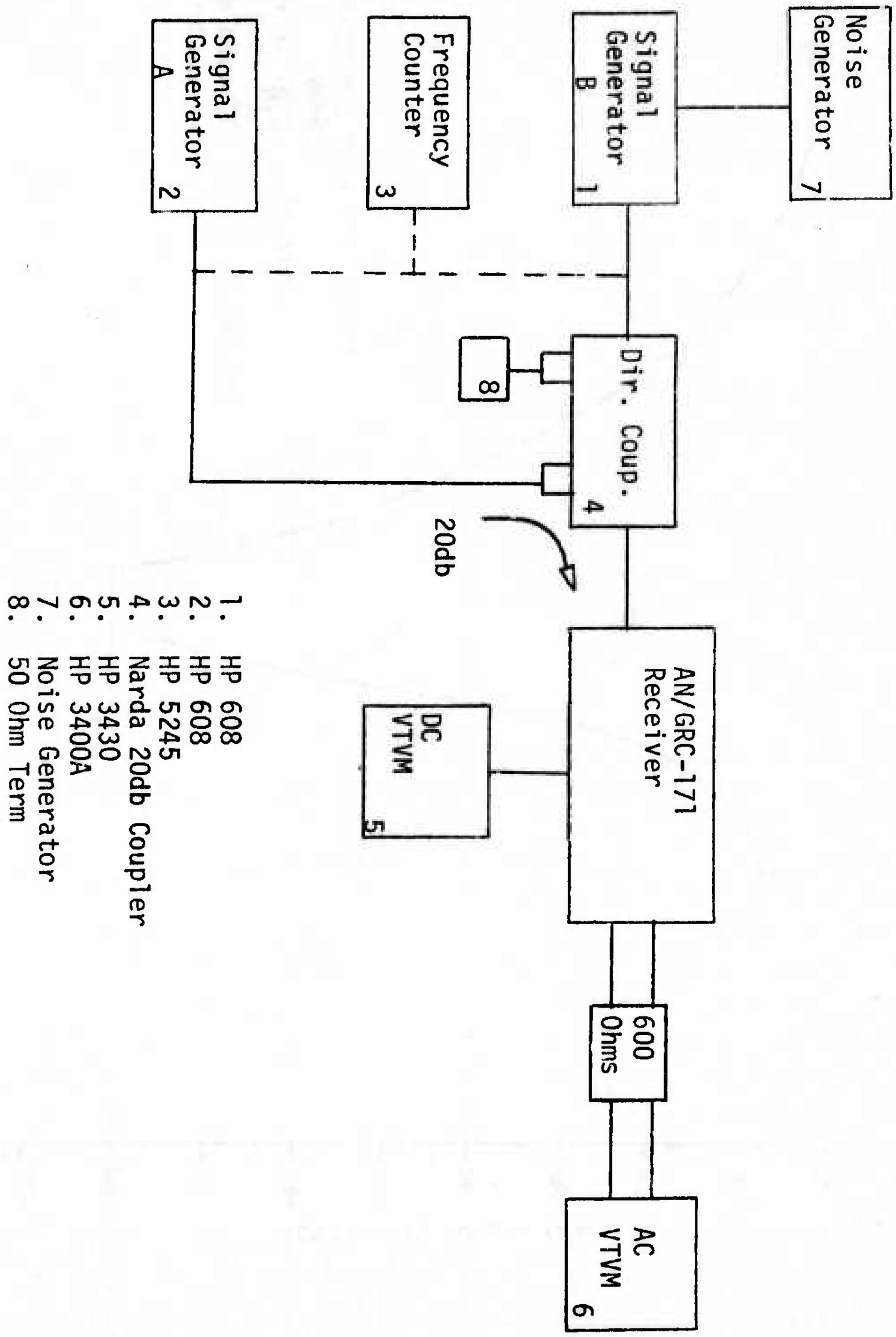
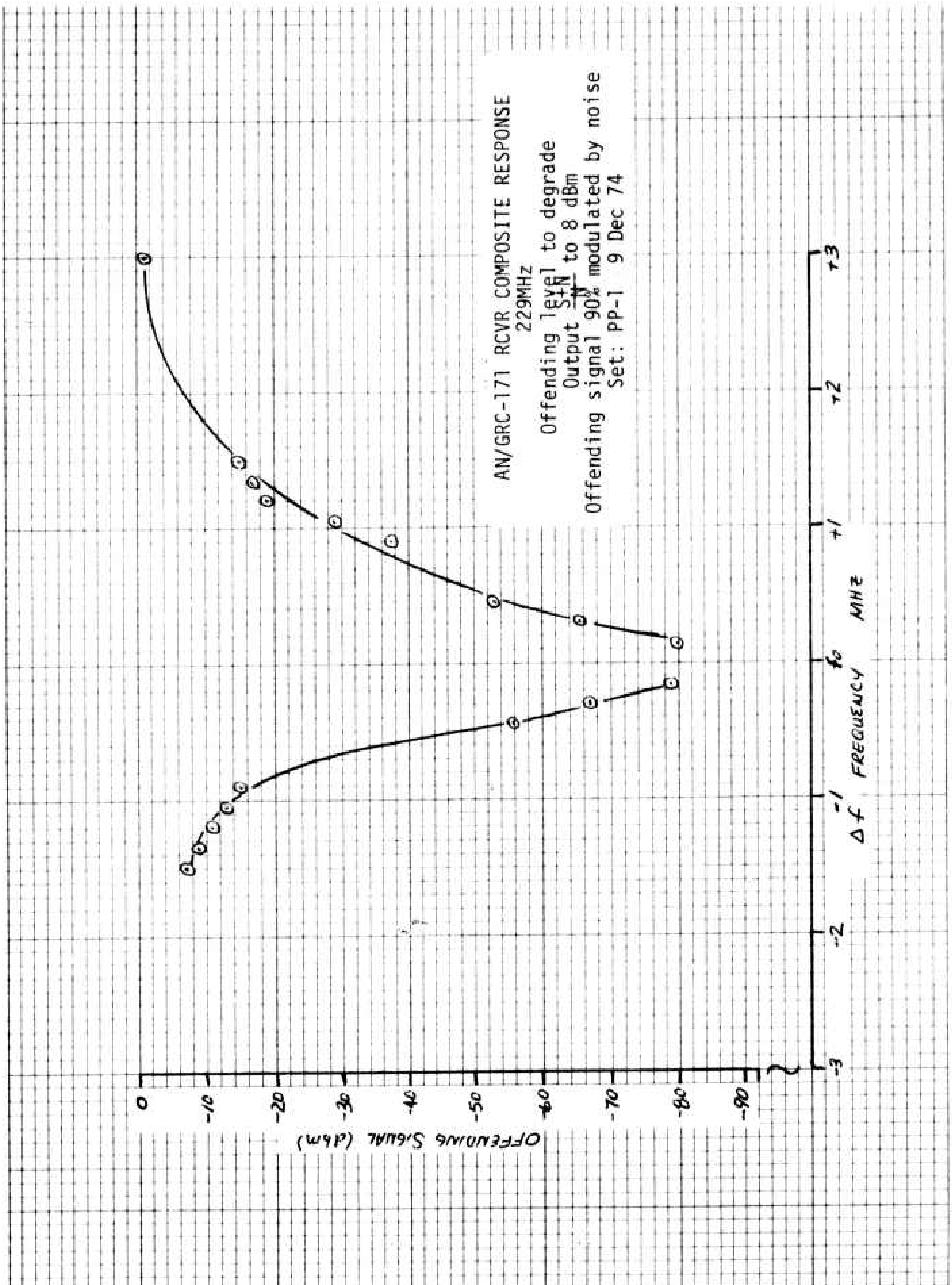


Figure 14

Receiver Composite Response



AN/GRC-171 RCVR COMPOSITE RESPONSE
229MHz
Offending level to degrade
Output $\frac{S+N}{N}$ to 8 dBm
Offending signal 90% modulated by noise
Set: PP-1 9 Dec 74
OFFENDING SIGNAL (dbm)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-3
-2
-1
f_0
+1
+2
+3
Δf FREQUENCY MHZ

Figure 15

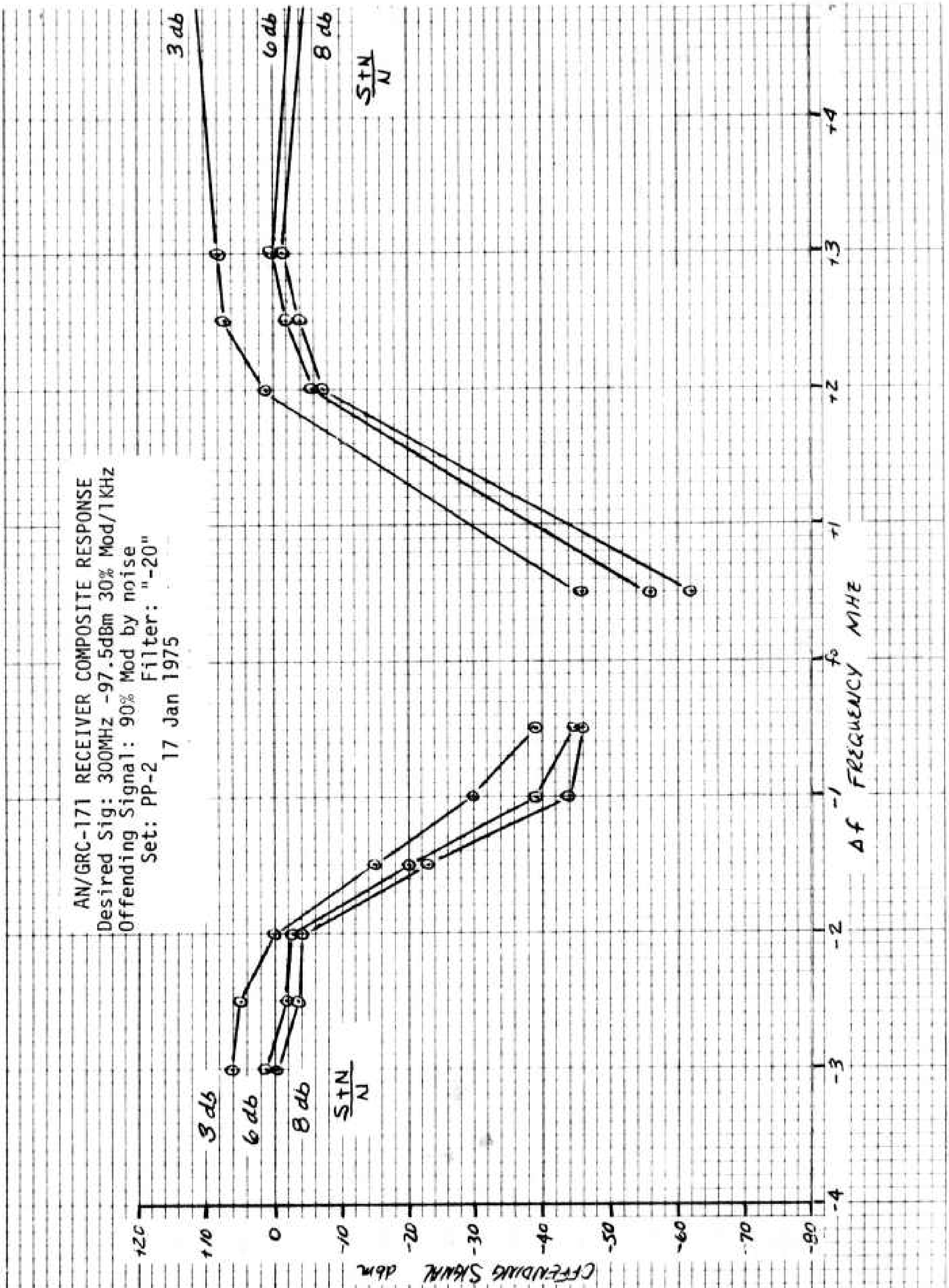

AN/GRC-171 RECEIVER COMPOSITE RESPONSE
Desired Sig: 300MHz -97.5dBm 30% Mod/1KHz
Offending Signal: 90% Mod by noise
Set: PP-2 Filter: "-20"
17 Jan 1975
3 db
6 db
8 db
S+N
N
+120
+10
0
-10
-20
-30
-40
-50
-60
-70
-80
OFFENDING SIGNAL dbm
-4
-3
-2
-1
fo
+1
+2
+3
+4
Δf FREQUENCY MHz

Figure 16

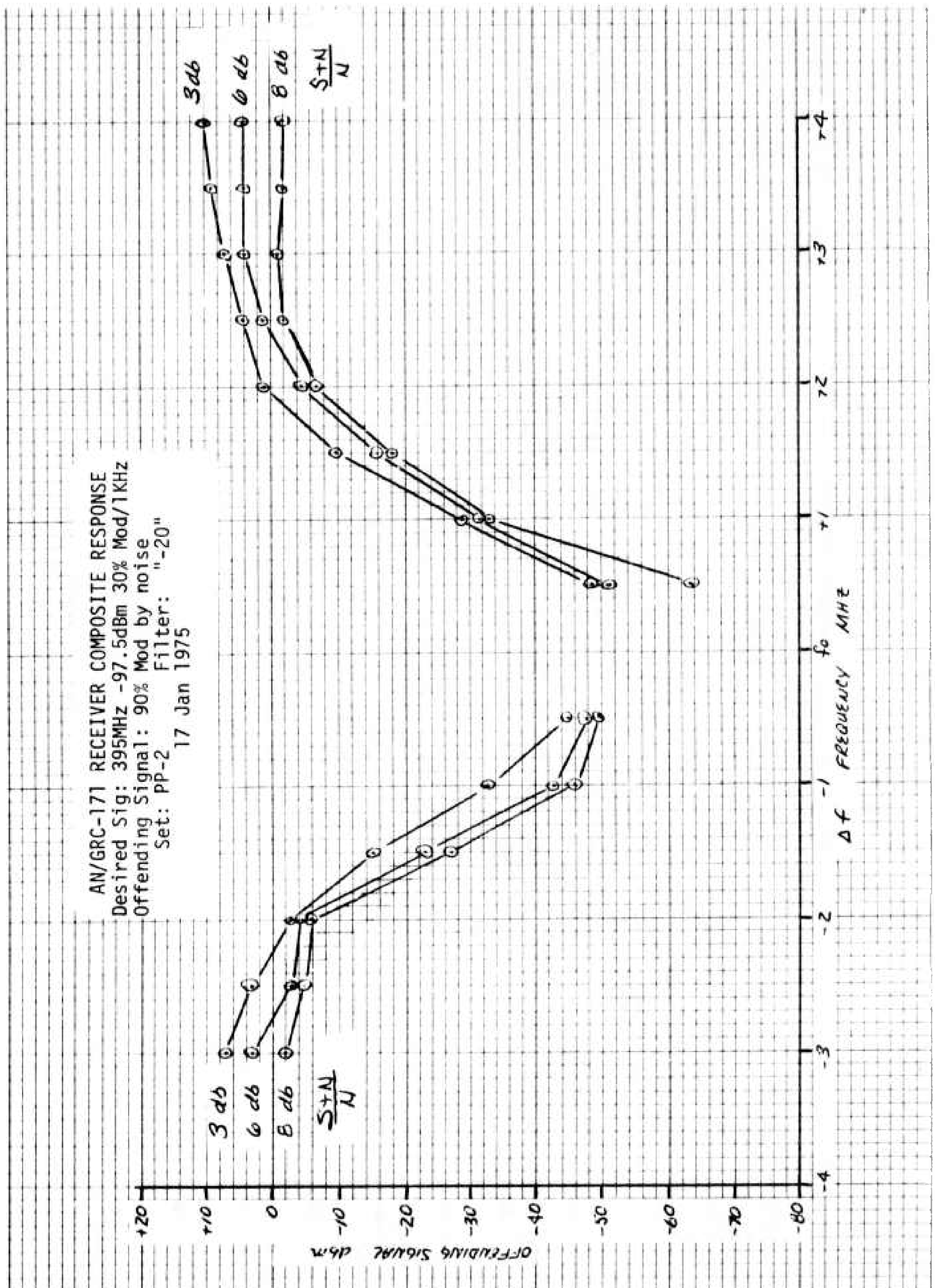

AN/GRC-171 RECEIVER COMPOSITE RESPONSE
Desired Sig: 395MHz -97.5dBm 30% Mod/1KHz
Offending Signal: 90% Mod by noise
Set: PP-2 Filter: "-20"
17 Jan 1975
3 db
6 db
8 db
S+N/N
OFFENDING SIGNAL dbm
+20
+10
0
-10
-20
-30
-40
-50
-60
-70
-80
Δf FREQUENCY MHz
-4
-3
-2
-1
fo
+1
+2
+3
+4

Figure 17

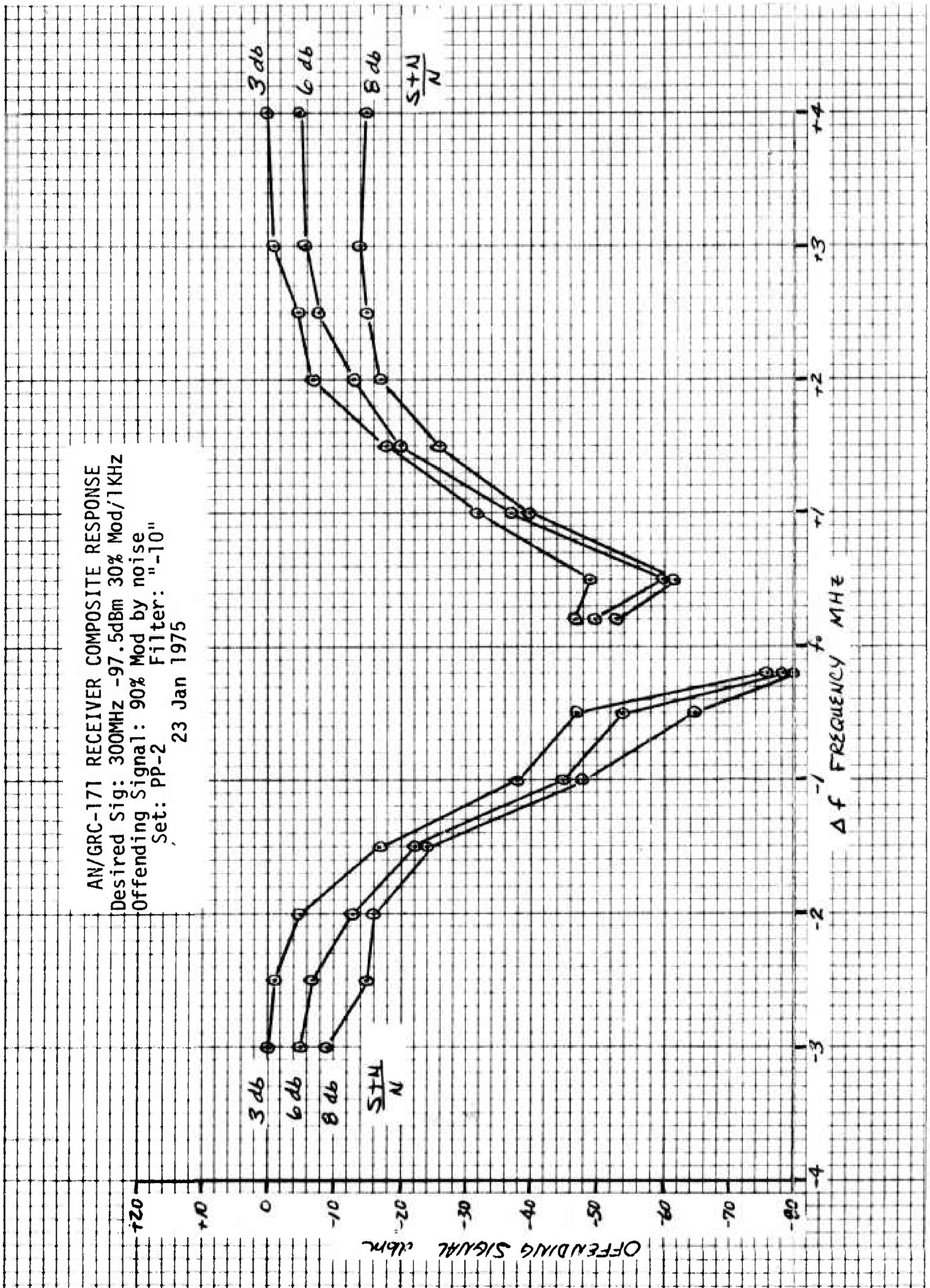

AN/GRC-171 RECEIVER COMPOSITE RESPONSE
Desired Sig: 300MHz -97.5dBm 30% Mod/1KHz
Offending Signal: 90% Mod by noise
Set: PP-2 Filter: "-10"
23 Jan 1975
3 db
6 db
8 db
S+N/N
Δf FREQUENCY MHz
OFFENDING SIGNAL dbm
+20
+10
0
-10
-20
-30
-40
-50
-60
-70
-80
-4
-3
-2
-1
0
+1
+2
+3
+4

Figure 18

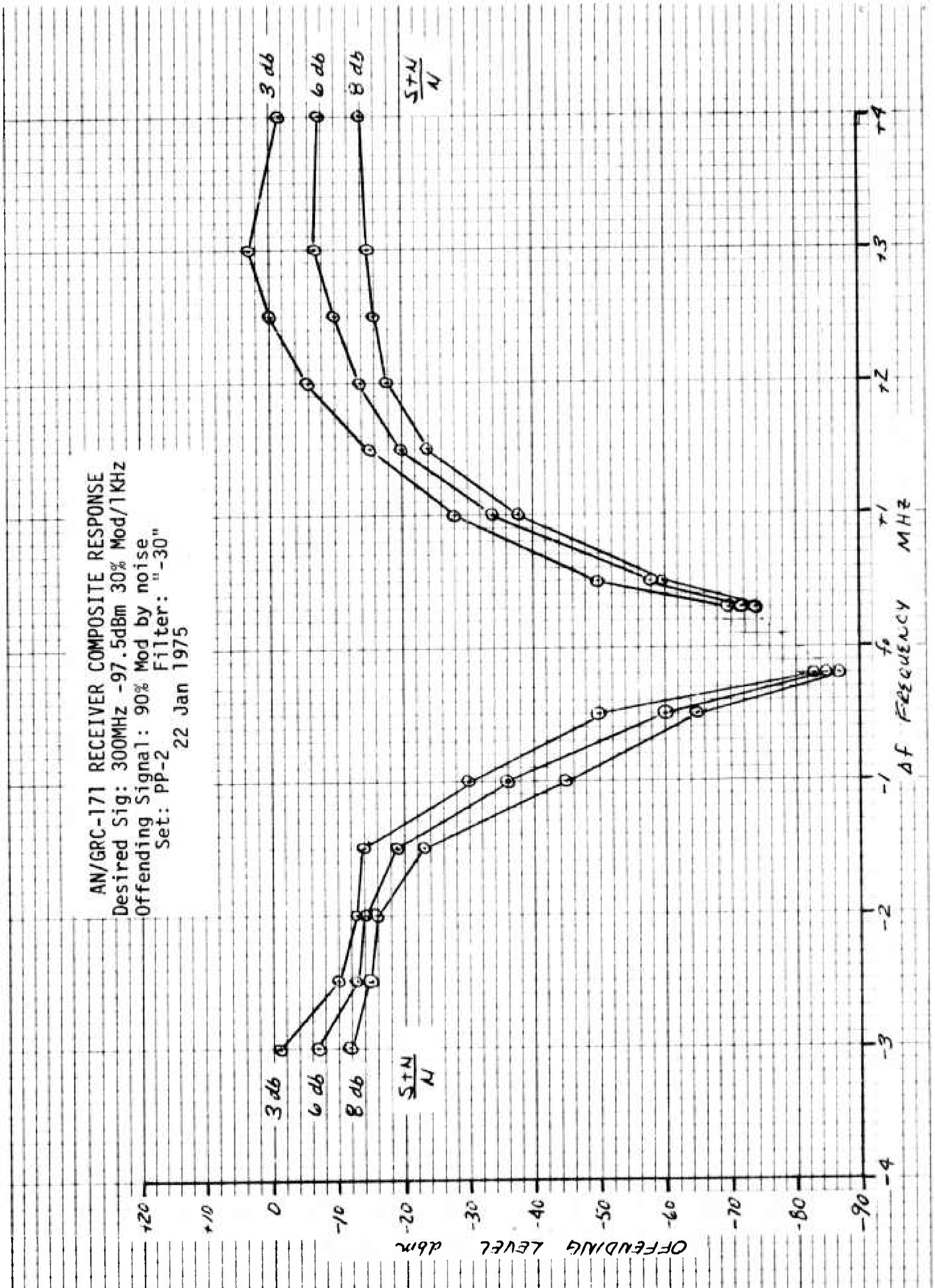

AN/GRC-171 RECEIVER COMPOSITE RESPONSE
Desired Sig: 300MHz -97.5dBm 30% Mod/1KHz
Offending Signal: 90% Mod by noise
Set: PP-2 Filter: "-30"
22 Jan 1975
3 db
6 db
8 db
S+N / N
OFFENDING LEVEL dbm
+20
+10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-4
-3
-2
-1
fo
+1
+2
+3
+4
Δf FREQUENCY MHz

Figure 19

ADJACENT CHANNEL INTERFERENCE PP#1 9 DEC 74

1 mW = AUDIO OUTPUT / RCVR INPUT = 3uV / GENERATOR #1 = 1000Hz AT 30% (ADJACENT CHANNEL INTERFERENCE / GENERATOR #2 = NOISE AT 90%

FREQUENCY (MHz) 228.994	RF #2 INPUT (dbm)	AGC VOLTS	AF OUTPUT 30% MOD. (dbm)	AF OUTPUT No MOD (dbm)	S+N/N db	ΔF (MHz)
229.144	-79.8	-.50	+.25	-7.75	+8.0	0.15
229.294	-67.8	-.50	+.25	-7.75	+8.0	0.30
229.444	-52.6	-.50	0.0	-8.0	+8.0	0.45
229.894	-37.8	-.49	0.0	-8.0	8.0	0.90
230.044	-28.2	-.49	+0.5	-7.5	8.0	1.05
230.194	-19.0	-.48	0.0	-8.0	+8.0	1.20
230.344	-16.4	-.50	0.0	-8.0	8.0	1.35
230.494	-14.5	-.50	0.0	-8.0	8.0	1.50
231.994	-1.0	-.48	0.0	-8.0	8.0	3.00
228.844	-78.7	-.51	-.25	-7.75	7.50	-0.15
228.694	-66.6	-.51	+.5	-7.50	8.0	-0.30
228.544	-56.0	-.51	+.5	-7.50	8.0	-0.45
228.094	-15.2	-.51	-.25	-7.75	7.5	-0.90
227.944	-13.0	-.51	+1.0	-7.0	8.0	-1.05
227.794	-10.8	-.51	+1.0	-7.0	8.0	-1.20
227.644	-9.2	-.51	+1.0	-7.0	8.0	-1.35
227.494	-7.5	-.51	+1.0	-7.0	8.0	-1.50

RECEIVER COMPOSITE. PP#2 17 JAN 75

FREQ = 300 MHz MEDIUM BANDWIDTH FILTER No. 293-1292-020

GENERATOR B Δf (MHz)	GEN B LEVEL AT RCVR INPUT	AGC VOLTS	S+N+I OUTPUT (dbm) GEN A MODULATED	N+I OUTPUT (dbm) GEN A UNMODULATED	S+N+I / N+I
+3.0	+13.0	-0.53	-1.3	-2.2	0.9
+3.5	+13.0	-0.53	-1.7	-3.3	1.6
+4.0	+13.0	-0.53	-1.6	-3.2	1.6
+4.5	+13.0	-0.51	-1.6	-3.2	1.6
+5.0	+13.0	-0.53	-1.5	-3.6	2.1
+5.5	+13.0	-0.54	-1.7	-4.7	3.0
+6.0	+13.0	-0.67	-1.0	-5.8	4.8
Δf = +5.5 Freq. = 305.5	+13.0	-0.54	-1.5	-4.6	3.1
"	+10.0	-0.67	-1.1	-5.8	4.7
"	+7.0	-0.70	-0.9	-6.5	5.6
"	+4.0	-0.70	-0.8	-7.0	6.2
"	+1.0	-0.70	-0.7	-7.4	6.7
"	-2.0	-0.70	-0.6	-7.9	7.3
"	-5.0	-0.73	+0.1	-15.7	15.8
Δf = +5.0 Freq = 305.0	+13.0	-0.53	-1.7	-3.5	1.8
"	+10.0	-0.54	-1.7	-4.9	3.2
"	+7.0	-0.65	-1.3	-5.9	4.6
"	+4.0	-0.65	-1.3	-6.0	4.7
"	+1.0	-0.64	-1.1	-6.2	5.1
"	-2.0	-0.66	-1.0	-6.4	5.4
"	-5.0	-0.72	0.0	-14.8	14.8

SHEET #2

RECEIVER COMPOSITE PP#2 17 JAN 75

GENERATOR B Δf (MHz)	GEN B LEVEL AT RCVR INPUT	AGC VOLTS	S+N+I OUTPUT (dbm) GEN A MODULATED	N+I OUTPUT (dbm) GEN A UNMODULATED	S+N+I / N+I
Δf = +4.5 Freq = 304.5	+10.0	-0.54	-1.9	-4.7	2.8
"	+7.0	-0.62	-1.6	-5.8	4.2
"	+4.0	-0.62	-1.3	-6.0	4.7
"	+1.0	-0.63	-1.2	-6.2	5.0
"	-2.0	-0.65	-0.8	-6.4	5.6
"	-5.0	-0.72	+0.1	-14.5	14.6
Δf = +4.0 Freq = 304.0	+10.0	-0.54	-2.1	-4.8	2.7
"	+7.0	-0.61	-1.7	-5.8	4.1
"	+4.0	-0.62	-1.4	-6.2	4.8
"	+1.0	-0.63	-1.2	-6.0	4.8
"	-2.0	-0.64	-1.0	-6.4	5.4
"	-5.0	-0.72	0.0	-14.6	14.6
Δf = +3.5 Freq = 303.5	+7.0	-0.62	-1.5	-5.9	4.4
"	+4.0	-0.63	-1.2	-6.3	5.1
"	+1.0	-0.64	-1.0	-6.4	5.4
"	-2.0	-0.66	-0.8	-6.6	5.8
"	-5.0	-0.72	-0.0	-14.7	14.7

SHEET #3

RECEIVER COMPOSITE PP#2 17 JAN 75

GENERATOR B Δf (MHz)	GEN B LEVEL AT RCVR INPUT	AGC VOLTS	S+N+I OUTPUT (dbm) GEN A MODULATED	N+I OUTPUT (dbm) GEN A UNMODULATED	S+N+I / N+I
Δf = +3.0 FREQ = 303.0	+7.0	-.58	-1.7	-5.2	3.5
"	+4.0	-.66	-1.3	-6.3	5.0
"	+1.0	-.63	-0.8	-6.2	5.4
"	-2.0	-.73	-0.1	-11.5	11.4
Δf = +2.5 302.5	+7.0	-.54	-1.9	-5.1	3.2
"	+4.0	-.59	-1.5	-5.6	4.1
"	+1.0	-.67	-1.2	-6.3	5.1
"	-2.0	-.68	-0.8	-6.9	6.1
"	-5.0	-.73	-0.0	-12.0	12.0
Δf = +2.0 FREQ = 302.0	+7.0	-.54	-1.5	-1.8	.3
	+4.0	-.53	-1.8	-3.7	1.9
	+1.0	-.54	-1.8	-5.0	3.2
	-2.0	-.62	-1.3	-6.0	4.7
	-5.0	-.54	-0.7	-4.6	3.9
	-8.0	-.71	-0.1	-9.5	9.4
	-11.0	-.72	+0.1	-13.1	13.2

RECEIVER COMPOSITE PP#2 SHEET # 4

17 JAN 75

GENERATOR B Δf (MHz)	GEN B LEVEL AT RCVR INPUT	AGC VOLTS	S+N+I OUTPUT (dbm) GEN A MODULATED	N+I OUTPUT (dbm) GEN A UNMODULATED	S+N+I / N+I
Δf = +1.5 Freq = 301.5	+1	-1.19	-0.4	-0.4	0.0
"	-2	-0.75	-2.4	-2.4	0.0
"	-5	-0.53	-1.5	-2.5	1.0
"	-8	-0.53	-0.6	-4.4	3.8
"	-11	-0.54	-1.0	-4.5	3.5
"	-14	-0.63	-0.5	-6.7	6.2
"	-17	-0.54	0.0	-5.0	5.0
"	-20	-0.73	+0.1	-11.5	11.6
Δf = +1.0 Freq = 301.0	-8.0	-1.63	-1.4	-1.4	0.0
"	-11.0	-1.57	-1.9	-1.9	0.0
"	-14.0	-1.4	-0.5	-0.5	0.0
"	-17.0	-0.53	-1.7	-1.7	0.0
"	-20.0	-0.86	-0.9	-0.9	0.0
"	-23.0	-0.53	-1.8	-1.8	0.0
"	-26.0	-0.51	-0.5	-1.7	1.2
"	-29.0	-0.52	+0.6	-3.0	2.4
"	-32.0	-0.53	+1.0	-6.4	7.4
"	-35.0	-0.62	0.0	-7.5	7.5
"	-38.0	-0.62	0.0	-8.0	8.0
"	-41.0	-0.73	+0.2	-19.0	19.2

RECEIVER COMPOSITE   PP#2   SHEET #5
17 JAN 75

GENERATOR B Δf (MHz)	GEN B LEVEL AT RCVR INPUT	AGC VOLTS	S+N+I OUTPUT (dbm) GEN A MODULATED	N+I OUTPUT (dbm) GEN A UNMODULATED	S+N+I / N+I
Δf = +0.5 Freq = 300.5	-29.0	-1.23	+7.0	+7.0	0.0
"	-35.0	-0.85	+1.8	+1.8	0.0
"	-41.0	-0.61	-1.6	+1.6	0.0
"	-44.0	-0.53	-1.5	-1.5	0.0
"	-47.0	-0.53	-1.8	-5.4	3.6
"	-50.0	-0.53	-1.0	-5.3	4.3
"	-53.0	-0.52	-0.5	-7.5	7.0
"	-56.0	-0.52	+0.2	-8.5	8.7
"	-59.0	-0.52	+0.7	-7.6	8.3
"	-62.0	-0.53	+0.6	-7.7	8.3
"	-65.0	-0.54	+0.2	-6.5	6.8
"	-68.0	-0.64	-0.5	-8.2	7.7
"	-71.0	-0.73	+0.3	-19.5	19.8
Δf = -0.5 Freq = 299.5	-32.0	-0.84	+1.4	+1.4	0.0
"	-35.0	-0.53	+0.6	-2.2	2.8
"	-38.0	-0.54	+0.4	-2.2	2.6
"	-41.0	-0.53	-0.1	-3.4	3.3
"	-44.0	-0.52	-0.9	-4.6	3.7
"	-47.0	-0.52	+0.5	-11.4	11.9

SHEET # 6

RECEIVER COMPOSITE PP#2 17 JAN 75

GENERATOR B Δf (MHz)	GEN B LEVEL AT RCVR INPUT	AGC INPUT	S+N+I OUTPUT (dbm) GEN A MODULATED	N+I OUTPUT (dbm) GEN A UNMODULATED	S+N+I / N+I
Δf = -1.0 Freq = 299.0	-20.0	-0.77	-3.4	-3.4	0.0
"	-23.0	-0.52	-3.7	-3.7	0.0
"	-26.0	-0.49	-0.6	-2.9	2.3
"	-29.0	-0.52	-1.4	-3.9	2.5
"	-32.0	-0.49	-1.6	-4.2	2.6
"	-35.0	-0.5	-0.3	-4.4	4.1
"	-38.0	-0.52	+0.3	-7.4	7.1
"	-41.0	-0.51	-0.6	-7.2	6.6
"	-44.0	-0.52	+1.5	-7.4	6.1
"	-47.0	-0.61	-0.5	-8.8	8.3
"	-50.0	-0.69	+0.3	-19.9	19.6
Δf = -1.5 Freq = 298.5	-5.0	-0.8	-1.4	-1.4	0.0
	-8.0	-0.84	-2.6	-2.6	0.0
	-11.0	-0.74	-2.8	-2.8	0.0
	-14.0	-0.53	-3.5	-6.0	2.5
	-17.0	-0.53	+1.0	-6.8	7.8
	-20.0	-0.52	-3.2	-5.8	2.6
	-23.0	-0.53	-0.2	-5.5	5.3
	-26.0	-0.69	+0.4	-8.9	9.3
	-29.0	-0.73	+0.3	-19.2	19.5

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SHEET #7

RECEIVER COMPOSITE. PP#2 17 JAN 75

GENERATOR B Δf (MHz)	GEN B LEVEL AT RCVR INPUT	AGC VOLTS	S+N+I OUTPUT (dbm) GEN A MODULATED	N+I OUTPUT (dbm) GEN A UNMODULATED	S+N+I / N+I
Δf = -2.0 Freq = 298.0	+7.0	-0.8	-1.6	-1.6	0.0
"	+4.0	-0.53	-1.4	-2.8	1.4
"	+1.0	-0.54	-1.8	-4.4	2.6
"	-2.0	-0.79	-0.9	-1.4	0.5
"	-5.0	-0.71	-0.6	-9.2	8.6
"	-8.0	-0.74	0.0	-12.5	12.5
Δf = -2.5 Freq = 297.5	+10.0	-0.86	-1.5	-1.5	0.0
"	+7.0	-0.61	-2.3	-4.4	2.1
"	+4.0	-0.62	-1.8	-5.1	3.3
"	+1.0	-0.76	-1.2	-6.0	4.8
"	-2.0	-0.54	-0.8	-3.9	3.1
"	-5.0	-0.74	0.0	-13.2	13.2
Δf = -3.0 Freq = 297.0	+10.0	-0.54	-1.8	-3.0	1.2
"	+7.0	-0.67	-1.7	-4.8	3.1
"	+4.0	-0.74	-1.2	-5.4	4.2
"	+1.0	-0.53	-1.2	-4.0	2.8
"	-2.0	-0.73	0.0	-12.5	12.5

RECEIVER COMPOSITE — PP #2 — 17 JAN 75

FREQ = 395 MHz — MEDIUM BANDWIDTH FILTER, 6293-1292-020

GENERATOR B Δf (MHz)	GEN B LEVEL AT RCVR INPUT	AGC VOLTS	S+N+I OUTPUT dbm GEN A MODULATED	N+I OUTPUT dbm GEN A UNMODULATED	S+N+I / N+I
+3.0	+13.0	-.58	-2.0	-2.3	.3
+2.5	+13.0	-.76	-2.7	-3.0	.3
+2.0	+13.0	-1.46	-1.7	-1.7	0.0
+1.5	+13.0	-1.56	-0.5	-0.5	0.0
+1.0	+13.0	-1.58	-0.4	-0.4	0.0
+0.5	+13.0	-1.80	+8.2	+8.2	0.0
+0.2	+13.0	-1.93	-2.8	-2.8	0.0
+3.5	+13.0	-0.54	-1.8	-2.6	0.8
+4.0	+13.0	-.54	-1.4	-3.0	1.6
+4.5	+13.0	-.54	-1.3	-3.2	1.9
+5.0	+13.0	-.54	-1.6	-4.0	2.4
+5.5	+13.0	-.57	-1.4	-5.2	3.8
Δf = +5.5 freq in MHZ					
400.5	+13.0	-.58	-1.6	-4.5	3.5
400.5	+10.0	-.70	-0.6	-7.2	6.6
400.5	+7.0	-.70	-0.4	-8.5	8.1
400.5	+4.0	-.70	-0.4	-9.0	8.6
400.5	+1.0	-.70	+0.2	-14.7	14.5
Δf = +5.0 freq in MHZ					
400.0	+13.0	-.54	-1.4	-3.7	2.3
400.0	+10.0	-.61	-1.3	-4.7	3.4
400.0	+7.0	-.69	-0.8	-6.3	5.5
400.0	+4.0	-.69	-0.7	-7.1	6.4
400.0	+1.0	-.69	-0.6	-7.5	6.9

SHEET #2

RECEIVER COMPOSITE PP#2 17 JAN 75

FREQ = 395 MHz MEDIUM BANDWIDTH FILTER No. 293-1292-020

GENERATOR B Δf (MHz)	GEN B LEVEL AT RCVR INPUT	AGC VOLTS	S+N+I OUTPUT dbm GEN A MODULATED	N+I OUTPUT dbm GEN A UNMODULATED	(S+N+I)/(N+I)
Δf = +5.0 freq in MHZ					
400.0	-2.0	-.68	-0.5	-7.9	7.4
400.0	-5.0	-.69	+0.2	-15.4	15.2
Δf = +4.5 freq in MHZ					
399.5	+13.0	-.53	-1.4	-3.3	1.9
399.5	+10.0	-.56	-1.6	-5.2	3.6
399.5	+7.0	-.66	-1.1	-6.2	5.1
399.5	+4.0	-.66	-1.0	-6.5	5.5
399.5	+1.0	-.67	-0.7	-6.9	6.2
399.5	-2.0	-.68	-0.6	-7.4	6.8
399.5	-5.0	-.70	+0.1	-15.1	15.0
Δf = +4.0 freq in MHZ					
399.0	+13.0	-.53	-1.1	-2.4	1.3
399.0	+10.0	-.54	-1.4	-4.4	3.0
399.0	+7.0	-.66	-1.0	-5.7	4.7
399.0	+4.0	-.67	-0.8	-6.6	5.8
399.0	+1.0	-.68	-0.6	-7.4	6.8
399.0	-2.0	-.68	-0.5	-8.2	7.7
399.0	-5.0	-.69	+0.1	-15.3	15.2
Δf = +3.5 freq in MHZ					
398.5	+13.0	-.53	-2.0	-2.6	.6
398.5	+10.0	-.53	-1.4	-3.9	2.5
398.5	+7.0	-.61	-1.2	-5.3	4.1
398.5	+4.0	-.66	-0.8	-6.7	5.9

SHEET #3

RECEIVER COMPOSITE — PP#2 — 17 JAN 75

FREQ = 395 MHz — MEDIUM BANDWIDTH FILTER No. 293-1242-020

GENERATOR B Δf (MHz)	GEN B LEVEL AT RCVR INPUT	AGC VOLTS	S+N+I OUTPUT dbm GEN A MODULATED	N+I OUTPUT dbm GEN A UNMODULATED	S+N+I / N+I
398.5	+1.0	-.67	-0.6	-7.6	7.0
398.5	-2.0	-.67	-0.4	-8.4	8.0
398.5	-5.0	-.69	+0.1	-15.2	15.3
Δf = +3.0 freq in MHZ					
398.0	+13	-.61	-2.2	-2.2	0.0
398.0	+10	-.53	-1.3	-2.4	1.1
398.0	+7	-.55	-1.3	-4.3	3.0
398.0	+4	-.67	-0.8	-6.7	5.9
398.0	+1	-.67	-0.6	-7.8	7.2
398.0	-2	-.67	-0.5	-8.8	8.3
398.0	-5	-.69	+0.1	-15.2	15.1
Δf = +2.5 freq in MHZ					
397.5	+13	-.75	-3.1	-3.1	0.0
397.5	+10	-.54	-1.7	-2.3	0.6
397.5	+7	-.53	-1.5	-4.1	2.6
397.5	+4	-.58	-1.2	-4.7	3.5
397.5	+1	-.67	-0.8	-6.9	6.1
397.5	-2	-.67	-0.5	-8.1	7.6
397.5	-5	-.69	0.0	-12.0	12.0
Δf = +2.0 freq in MHZ					
397.0	+13	-.92	-2.0	-2.0	0.0
397.0	+10	-.83	-1.5	-1.5	0.0
397.0	+7	-.58	-1.0	-1.0	0.0
397.0	+4	-.53	-1.0	-2.8	1.8

SHEET #4

RECEIVER COMPOSITE PP#2 17 JAN 75

FREQ. = 395 MHz MEDIUM BANDWIDTH FILTER No. 293 1292-020

GENERATOR B Δf (MHz)	GEN B LEVEL AT RCVR INPUT	AGC VOLTS	S+N+I OUTPUT dbm GEN A MODULATED	N+I OUTPUT dbm GEN A UNMODULATED	S+N+I / N+I
397.0	+1	-.54	-1.4	-4.3	2.9
397.0	-2	-.66	-1.0	-5.8	4.8
397.0	-5	-.54	-0.5	-4.0	3.5
397.0	-8	-.68	-0.0	-10.2	10.2
Δf = +1.5 freq in MHZ					
396.5	+13	-1.31	-0.0	-0.0	0.0
396.5	+10	-1.02	+0.0	-0.0	0.0
396.5	+7	-.83	-1.2	-1.2	0.0
396.5	+4	-.72	-1.3	-1.3	0.0
396.5	+1	-.53	-1.0	-1.0	0.0
396.5	-2	-.74	-1.2	-1.2	0.0
396.5	-5	-.53	-1.4	-1.4	0.0
396.5	-8	-.52	-0.8	-2.6	1.8
396.5	-11	-.53	-0.6	-5.3	4.7
396.5	-14	-.58	-0.5	-6.2	5.7
396.5	-17	-.54	-0.5	-4.3	3.8
396.5	-20	-.68	+0.3	-10.5	10.2
Δf = 1.0 FREQ IN MHz					
396.0	-8.0	-1.15	-1.2	-1.2	0.0
396.0	-11.0	-.92	-2.6	-2.6	0.0
396.0	-14.0	-.54	-2.7	-2.7	0.0
396.0	-17.0	-.53	-2.0	-2.0	0.0
396.0	-20.0	-.52	+0.8	+0.8	0.0
396.0	-23.0	-.51	-0.0	-1.3	1.3

SHEET #5

RECEIVER COMPOSITE PP#2 17 JAN 75

FREQ = 395 MHz MEDIUM BANDWIDTH FILTER No. 293-1292-020

GENERATOR B Δf (MHz)	GEN B LEVEL AT RCVR INPUT	AGC VOLTS	S+N+I OUTPUT dbm GEN A MODULATED	N+I OUTPUT dbm GEN A UNMODULATED	S+N+I / N+I
396.0	-26.0	-.52	+1.0	-3.2	2.2
396.0	-29.0	-.52	+1.5	-1.5	3.0
396.0	-32.0	-.54	+0.5	-6.0	6.5
396.0	-35.0	-.65	+0.4	-10.0	10.4
Δf = +0.5 FREQ IN MHz					
395.5	-23.0	-1.26	-1.0	-1.0	0.0
395.5	-26.0	-.99	+7.8	+7.8	0.0
395.5	-29.0	-.97	+7.7	+7.7	0.0
395.5	-32.0	-.86	+6.5	+6.5	0.0
395.5	-35.0	-.77	+5.0	+5.0	0.0
395.5	-38.0	-.67	+5.2	+5.2	0.0
395.5	-41.0	-.55	+2.2	+2.2	0.0
395.5	-44.0	-.53	-0.7	-1.7	1.0
395.5	-47.0	-.53	+0.7	-0.7	1.0
395.5	-50.0	-.52	-0.2	-5.0	4.8
395.5	-53.0	-.52	+1.2	-6.3	7.5
395.5	-56.0	-.53	+1.3	-6.4	7.7
395.5	-59.0	-.54	+0.6	-6.8	7.4
395.5	-62.0	-.54	+0.4	-6.2	6.6
395.5	-65.0	-.65	+0.4	-8.8	9.2
395.5	-68.0	-.67	+0.3	-18.0	18.3
Δf = -0.5 FREQ IN MHz					
394.5	-44.0	-.54	0.0	-1.5	1.5
394.5	-47.0	-.53	-0.3	-5.5	5.2

SHEET #6

RECEIVER COMPOSITE PP#2 17 JAN 75

FREQ 395 MHz MEDIUM BANDWIDTH FILTER No. 793-1792-020

GENERATOR B Δf (MHz)	GEN B LEVEL AT RCVR INPUT	AGC VOLTS	S+N+I OUTPUT dbm GEN A MODULATED	N+I OUTPUT dbm GEN A UNMODULATED	S+N+I / N+I
394.5	-50.0	-.53	-0.4	-8.4	8.0
394.5	-53.0	-.52	+0.5	-13.7	14.2
Δf = -1.0 FREQ IN MHz					
394.0	-26	-.50	+0.7	0.0	.7
394.0	-29	-.52	-1.8	-3.4	1.6
394.0	-32	-.52	+0.4	-2.2	2.6
394.0	-35	-.52	+1.4	-2.5	3.9
394.0	-38	-.53	+1.3	-4.2	5.5
394.0	-41	-.52	+0.2	-4.8	5.0
394.0	-44	-.52	+1.8	-5.0	6.8
394.0	-47	-.53	+1.4	-7.8	9.2
394.0	-50	-.68	+0.3	-18.4	18.7
Δf = -1.5 FREQ IN MHz					
393.5	-14.0	-0.54	-0.5	-3.2	2.7
393.5	-17.0	-0.54	0.0	-4.2	4.2
393.5	-20.0	-0.54	-0.3	6.6	6.3
393.5	-23.0	-0.53	-0.1	6.4	6.3
393.5	-26.0	-0.54	-0.1	-7.2	7.1
393.5	-29.0	-0.64	+0.1	-17.6	17.7
Δf = -2 FREQ IN MHz					
393.0	-2	-0.65	-2.7	-4.0	1.3
393.0	-5	-0.62	-0.7	-6.0	5.3
393.0	-8	-0.64	-0.3	-12.3	12.0

SHEET #7

RECEIVER COMPOSITE PP#2 17 JAN 75

FREQ = 395 MHz MEDIUM BANDWIDTH FILTER No 293-1292-020

GENERATOR B Δf (MHz)	GEN B LEVEL AT RCVR INPUT	AGC VOLTS	S+N+I OUTPUT dbm GEN A MODULATED	N+I OUTPUT dbm GEN A UNMODULATED	S+N+I / N+I
Δf = -2.5 FREQ in MHz					
392.5	+10.0	-0.78	-0.2	-1.4	1.2
392.5	+7.0	-0.59	-2.2	-4.5	2.3
392.5	+4.0	-0.61	-1.7	-5.2	3.5
392.5	+1.0	-0.54	-2.2	-4.9	2.7
392.5	-2.0	-0.54	-0.6	-5.0	4.4
392.5	-5.0	-0.65	0.0	-10.0	10.0
Δf = -3 FREQ in MHz					
392.0	+10.0	-0.53	-1.7	-4.1	2.4
392.0	+7.0	-0.55	-1.5	-5.1	3.6
392.0	+4.0	-0.64	-1.0	-6.4	5.4
392.0	+1.0	-0.64	-0.7	-7.9	7.2
392.0	-2.0	-0.64	-0.6	-8.4	7.8
392.0	-5.0	-0.66	+0.1	-14.5	14.6

RECEIVER COMPOSITE PP#2 22 JAN 75

FREQUENCY = 300 MHz NARROW BANDWIDTH FILTER No. 293-1292-010

GENERATOR B Δf (MHz)	GEN B LEVEL AT RCVR INPUT	AGC VOLTS	S+N+I OUTPUT (dBm) GEN A MODULATED	N+I OUTPUT (dBm) GEN A UNMODULATED	S+N+I / N+I
+3.0	+13.0	-0.50	-0.6	-0.6	0.0
+3.5		-0.50	-1.5	-1.5	0.0
+3.5		-0.50	-0.6	-0.6	0.0
+4.0		-0.50	-0.6	-0.6	0
+4.5		-0.51	-0.3	-0.3	0
+5.0		-0.51	-0.5	-0.5	0
+5.5		-0.51	-1.3	-2.4	1.1
+6.0		-0.51	-1.8	-3.2	1.4
+6.5		-0.51	-1.5	-3.2	1.7
+7.0		-0.51	-1.1	-3.0	1.9
+7.5		-0.52	-1.1	-3.4	2.3
+8.0		-0.52	-1.0	-3.4	2.4
+8.5		-0.52	-1.0	-3.3	2.3
+9.0		-0.52	-1.0	-3.4	2.4
+9.5		-0.52	-0.9	-3.3	2.4
+10.0		-0.52	-1.2	-3.6	2.4
Δf = +8.0 FREQ IN MHz					
308.0	+10.0	-.52	-1.0	-3.1	2.1
	+7.0		-1.0	-3.2	2.2
	+4.0		-0.9	-3.2	2.3
	+1.0		-0.8	-3.1	2.3
	-2.0		-0.8	-3.1	2.3
	-5.0		+0.6	-8.4	9.0
	-8.0		+0.7	-8.4	9.1

SHEET #2

RECEIVER COMPOSITE PPAC 22 JAN 75

GENERATOR B Δf (MHz)	GEN B LEVEL AT RCVR INPUT	AGC VOLTS	S+N+I OUTPUT (dbm) GEN A MODULATED	N+I OUTPUT (dbm) GEN A UNMODULATED	S+N+I / N+I
	-11.0	-0.52	+0.7	-8.4	9.1
	-14.0	-0.52	+1.0	-10.6	11.6
Δf = +7.5 FREQ IN MHz					
307.5	+1.0	-0.52	+0.6	-7.6	8.2
	-2.0	-0.52	+0.4	-7.7	8.1
	-5.0	-0.52	+0.6	-7.8	8.4
	-8.0	-0.52	+0.8	-7.8	8.6
	-11.0	-0.52	+0.7	-7.9	8.6
	-14.0	-0.52	+1.0	-10.2	11.2
Δf = +7.0 FREQ IN MHz					
307.0	+1	-0.52	+0.6	-7.4	8.0
	-2		+0.6	-7.7	8.3
	-5		+0.6	-7.8	8.4
	-8		+0.6	-7.7	8.3
	-11		+0.7	-7.8	8.5
	-14		+0.8	-8.0	8.8
Δf = +6.5 FREQ IN MHz					
306.5	+1	-0.52	+0.7	-7.0	7.7
	-2		+0.7	-7.2	7.9
	-5		+0.6	-7.4	8.0
	-8		+0.6	-7.6	8.2
	-11		+0.6	-8.0	8.6
	-14		+0.7	-7.8	8.6
	-17		+0.9	-10.0	10.9

SHEET # 3

RECEIVER COMPOSITE — 77#2 — 22 JAN 75

GENERATOR B Δf (MHz)	GEN B LEVEL AT RCVR INPUT	AGC VOLTS	S+N+I OUTPUT (dbm) GEN A MODULATED	N+I OUTPUT (dbm) GEN A UNMODULATED	S+N+I / N+I
Δf = +16.0 FREQ IN MHz					
306.0	+1	-0.52	+0.4	-6.4	6.8
	-2		+0.5	-6.8	7.3
	-5		-0.3	-7.8	7.5
	-8		-0.1	-8.2	8.1
	-11		-0.1	-8.3	8.2
	-14		+0.1	-10.6	10.7
305.5	+1	-0.52	-0.6	-5.5	4.9
	-2		-0.4	-6.8	6.4
	-5		-0.3	-7.1	6.8
	-8		-0.3	-7.3	7.0
	-11		-0.2	-7.5	7.3
	-14		-0.3	-7.7	7.4
	-17		0.0	-11.4	11.4
Δf = +16.5 FREQ IN MHz					
306.5	+1	-0.52	+0.7	-7.0	7.7
	-2		+0.7	-7.2	7.9
	-5		+0.6	-7.4	8.0
	-8		+0.6	-7.6	8.2
	-11		+0.6	-8.0	8.6
	-14		+0.7	-7.8	8.6
	-17		+0.9	-10.0	10.9

SHEET #4

RECEIVER COMPOSITE — PP#2 — 22 JAN 75

GENERATOR B Δf (MHz)	GEN B LEVEL AT RCVR INPUT	AGC VOLTS	S+N+I OUTPUT (dbm) GEN A MODULATED	N+I OUTPUT (dbm) GEN A UNMODULATED	(S+N+I)/(N+I)
Δf = +6.0 FREQ IN MHz					
306.0	+1	-0.52	+0.4	-6.4	6.8
	-2		+0.5	-6.8	7.3
	-5		-0.3	-7.8	7.5
	-8		-0.1	-8.2	8.1
	-11		-0.1	-8.3	8.2
	-14		+0.1	-10.6	10.7
305.5	+1	-0.52	-0.6	-5.5	4.9
	-2		-0.4	-6.8	6.4
	-5		-0.3	-7.1	6.8
	-8		-0.3	-7.3	7.0
	-11		-0.2	-7.5	7.3
	-14		-0.3	-7.7	7.4
	-17		0.0	-11.4	11.4
Δf = +5.0 FREQ = +5.0					
305.0	+1	-0.53	-2.7	-4.1	1.4
	-2	-0.53	-2.9	-4.2	1.3
	-5	-0.52	-0.5	-6.6	6.1
	-8	-0.52	-0.5	-6.9	6.4
	-11	-0.52	-0.4	-7.1	6.7
	-14	-0.52	-0.3	-7.3	7.0
	-17	-0.52	+0.1	-10.6	10.7

SHEET AS

RECEIVER COMPOSITE | PP #2 | 22 JAN 75

GENERATOR B Δf (MHz)	GEN B LEVEL AT RCVR INPUT	AGC VOLTS	S+N+I OUTPUT (dbm) GEN A MODULATED	N+I OUTPUT (dbm) GEN A UNMODULATED	S+N+I / N+I
Δf = +4.5 FREQ IN MHz					
304.5	-2	-0.52	-0.7	-5.5	4.8
	-5		-0.7	-6.4	5.7
	-8		-0.2	-8.5	8.3
	-11		-0.1	-9.4	9.3
	-14		0.0	-10.3	10.3
Δf = +4.0 FREQ IN MHz					
304.0	+1	-0.53	-1.3	-4.0	2.7
	-2	-0.52	-0.8	-5.4	4.6
	-5		-0.5	-6.6	6.1
	-8		-0.5	-7.0	6.5
	-11		-0.4	-7.3	6.9
	-14		-0.3	-7.6	7.3
	-17		0.0	-10.8	10.8
Δf = +3.5 FREQ IN MHz					
303.5	+1.0	-0.53	-1.4	-3.8	2.4
	-2.0		-0.9	-5.4	4.5
	-5.0		-0.5	-6.6	6.1
	-8.0		-0.5	-7.2	6.7
	-11.0		-0.4	-7.7	7.3
	-14.0		-0.4	-8.0	7.6
	-17.0		0.0	-10.9	10.9

SHEET #6

RECEIVER COMPOSITE　　　PP#2　　　22 JAN 75

GENERATOR B Δf (MHz)	GEN B LEVEL AT RECVR INPUT	AGC VOLTS	S+N+I OUTPUT (dbm) GEN A MODULATED	N+I OUTPUT (dbm) GEN A UNMODULATED	(S+N+I)/(N+I)
Δf=+3.0 FREQ IN MHz					
303.0	+1	-0.53	-1.9	-3.4	1.5
	-2		-1.1	-4.7	3.6
	-5		-0.7	-6.2	5.5
	-8		-0.6	-7.4	6.8
	-11		-0.4	-7.6	7.2
	-14		-0.4	-8.2	7.8
	-17		0.0	-10.8	10.8
Δf=+2.5 FREQ IN MHz					
302.5	+1	-0.53	-3.1	-4.4	1.3
	-2		-3.0	-4.4	1.4
	-5		-1.0	-4.5	3.5
	-8		-0.6	-6.7	6.1
	-11		-0.5	-7.5	7.0
	-14		-0.4	-8.0	7.6
	-17		0.0	-10.1	10.1
Δf=+2.0 FREQ IN MHz					
302.0	+1	-0.53	-2.4	-3.4	1.0
	-2		-3.1	-4.4	1.3
	-5		-2.0	-3.4	1.4
	-8		-1.2	-4.9	3.7
	-11		-0.8	-5.8	5.0
	-14		-0.5	-7.0	6.5
	-17		-0.2	-8.4	8.2
	-20		-0.1	-10.3	10.2

SHEET #7

RECEIVER COMPOSITE. PP#2. 22 JAN 75

GENERATOR B Δf (MHz)	GEN B LEVEL AT RCVR INPUT	AGC VOLTS	S+N+I OUTPUT (dbm) GEN A MODULATED	N+I OUTPUT (dbm) GEN A UNMODULATED	S+N+I / N+I
Δf = +1.5 FREQ IN MHz					
301.5	-17	-0.52	-1.5	-3.4	1.9
	-20		-0.3	-6.5	6.2
	-23		-0.6	-10.1	9.5
	-26		-0.4	-8.4	8.0
	-29		-0.6	-5.8	5.2
	-32		-0.5	-9.3	8.8
	-35		-0.2	-11.5	11.3
Δf = +1.0 FREQ IN MHz					
301.0	-29	-0.49	-1.5	-2.0	0.5
	-32	-0.50	-1.6	-4.4	2.8
	-35	-0.52	-1.3	-7.3	6.0
	-38		-1.2	-6.7	5.5
	-41		-0.6	-10.5	9.9
	-44		-0.6	-12.3	11.7
Δf = +0.5 FREQ IN MHz					
300.5	-44.0	-0.51	+0.8	-0.2	0.6
	-47.0	-0.51	+2.0	+0.1	1.9
	-50.0	-0.49	+0.6	-3.4	4.0
	-53.0	-0.48	-1.3	-6.6	5.3
	-56.0	-0.47	-0.4	-4.9	4.5
	-59.0	-0.47	-0.5	-5.6	5.1
	-62.0	-0.52	-0.3	-8.0	7.7
	-65.0	-0.52	-0.2	-11.3	11.1

RECEIVER COMPOSITE PP #2 SHEET #8 22 JAN 75

GENERATOR B Δf (MHz)	GEN B LEVEL AT RCVR INPUT	AGC VOLTS	S+N+I OUTPUT (dbm) GEN A MODULATED	N+I OUTPUT (dbm) GEN A UNMODULATED	(S+N+I)/(N+I)
Δf = +0.2 FREQ IN MHz					
300.2	-47.0	-0.53	-1.7	-4.8	3.1
	-50.0		-0.6	-6.8	6.2
	-53.0		-0.2	-8.3	8.1
	-56.0		0.0	-9.6	9.6
	-59.0		0.0	-10.6	10.6
Δf = -0.2 FREQ IN MHz					
299.8	-74.0	-0.50	-3.9	-6.3	2.4
	-77.0	-0.50	-2.4	-6.0	3.6
	-80	-0.53	0.0	-11.8	11.8
Δf = -0.5 FREQ IN MHz					
299.5	-47.0	-0.48	+0.1	-2.5	2.6
	-50.0	-0.47	-0.1	-5.7	5.6
	-53.0	-0.46	-0.6	-5.2	4.6
	-56.0	-0.47	-0.1	-8.0	7.9
	-59.0	-0.46	-0.1	-6.7	6.6
	-62.0	-0.47	0.0	-7.8	7.8
	-65.0	-0.47	+0.1	-8.2	8.3
	-68.0	-0.48	+0.1	-7.3	7.4
	-71.0	-0.49	-0.2	-6.7	6.5
	-74.0	-0.50	+0.1	-8.2	8.3
	-77.0	-0.50	+0.2	-11.4	11.6

SHEET #9

RECEIVER COMPOSITE   TP#2   22 JAN 75

GENERATOR B Δf (MHz)	GEN B LEVEL AT RCVR INPUT	AGC VOLTS	S+N+I OUTPUT (dbm) GEN A MODULATED	N+I OUTPUT (dbm) GEN B UNMODULATED	S+N+I / N+I
Δf = -1.0 FREQ IN MHz					
299.0	-29	-0.45	-1.5	-2.2	0.7
	-32	-0.45	-1.8	-3.3	1.5
	-35	-0.47	-1.0	-4.2	3.2
	-38	-0.46	-1.0	-3.0	2.0
	-41	-0.48	-0.3	-5.6	5.3
	-44	-0.48	+0.1	-7.5	7.6
	-47	-0.49	+0.2	-4.8	5.0
	-50	-0.51	+0.1	-11.2	11.3
Δf = -1.5 FREQ IN MHz					
298.5	-17.0	-0.48	-1.4	-4.4	3.0
	-20.0	-0.50	-0.4	-4.5	4.1
	-23.0	-0.51	0.0	-8.7	8.7
	-26.0	-0.51	0.0	-9.4	9.4
	-29.0	-0.51	+0.2	-10.8	11.1
Δf = -2.0 FREQ IN MHz					
298.0	-2	-0.52	-2.9	-4.3	1.4
	-5	-0.51	-1.2	-4.2	3.0
	-8	-0.51	-0.7	-5.2	4.5
	-11	-0.51	-0.6	-5.6	5.0
	-14	-0.51	-0.4	-7.2	6.8
	-17	-0.52	-0.1	-10.3	10.2

SHEET #10

RECEIVER COMPOSITE | PP#2 | 22 JAN 75

GENERATOR B Δf (MHz)	GEN B LEVEL AT RCVR INPUT	AGC VOLTS	S+N+I OUTPUT (dbm) GEN A MODULATED	N+I OUTPUT (dbm) GEN A UNMODULATED	(S+N+I)/(N+I)
Δf= -2.5 FREQ IN MHz					
297.5	-2	-0.52	-0.9	-5.7	4.8
	-5		-0.8	-5.3	4.5
	-8		-0.6	-7.1	6.5
	-11		-0.4	-7.8	7.4
	-14		-0.4	-8.1	7.7
	-17	-0.51	-0.1	-10.2	10.1
Δf= -3.0 FREQ IN MHz					
297.0	+1.0	-0.51	-1.3	-3.7	2.4
	-2.0		-0.9	-4.9	4.0
	-5.0		-0.6	-6.6	6.0
	-8.0		-0.4	-6.8	6.4
	-11.0		-0.1	-10.2	10.1

RECEIVER COMPOSITE PP#2 22 JAN 75

FREQ = 300 MHz WIDEBAND FILTER No. 293-1292-030

GENERATOR B Δf (MHz)	GEN B LEVEL AT RCVR INPUT	AGC VOLTS	S+N+I OUTPUT dbm GEN A MODULATED	N+I OUTPUT dbm GEN A UNMODULATED	S+N+I / N+I
+3.0	+13.0	-.78	-5.1	-5.1	0
+2.5	+13.0	-1.00	-4.6	-4.6	0
+2.0	+13.0	-1.29	-3.7	-3.7	0
+1.5	+13.0	-1.52	-4.8	-4.8	0
+3.5	+13.0	-.63	-6.0	-6.0	0
+4.0	+13.0	-.59	-6.2	-6.2	0
+4.5	+13.0	-.73	-5.4	-5.8	0.4
+5.0	+13.0	-.68	-5.5	-6.0	0.5
+5.5	+13.0	-.53	-4.9	-6.0	1.1
+6.0	+13.0	-.52	-4.5	-6.3	1.8
+6.5	+13.0	-.51	-4.2	-6.6	2.4
+7.0	+13.0	-.51	-4.2	-6.7	2.5
+7.5	+13.0	-.51	-4.1	-6.9	2.8
+8.0	+13.0	-.51	-4.1	-6.9	2.8
+8.5	+13.0	-.51	-4.1	-6.9	2.8
+9.0	+13.0	-.51	-4.2	-7.0	2.8
+9.5	+13.0	-.51	-4.2	-7.0	2.8
Δf = +7.5 freq in MHZ					
307.5	+13	-.51	-3.6	-6.1	2.5
	+10	-.51	-3.6	-6.1	2.5
	+7	-.51	-3.6	-6.2	2.6
	+4	-.51	-3.4	-6.2	2.8
	+1	-.51	-3.4	-6.4	3.0
	-2	-.51	-3.4	-6.4	3.0
	-5	-.50	-1.2	-9.6	8.4

SHEET #2

RECEIVER COMPOSITE PP#2 22 JAN 75

GENERATOR B Δf (MHz)	GEN B LEVEL AT RCVR INPUT	AGC VOLTS	S+N+I OUTPUT dbm GEN A MODULATED	N+I OUTPUT dbm GEN A UNMODULATED	S+N+I / N+I
Δf = +7.5 freq in MHZ 307.5	-8	-.50	-1.2	-9.6	8.4
	-11	-.50	-1.2	-9.8	8.4
	-14	-.50	-1.2	-9.6	8.4
	-17	-.50	-0.9	-11.8	10.9
Δf = +7.0 freq in MHZ					
307.0	+10.0	-.51	-4.4	-7.1	2.7
	+7.0	-.51	-4.3	-7.2	2.9
	+4.0	-.51	-4.2	-7.3	3.1
	+1.0	-.51	-4.2	-7.3	3.1
	-2.0	-.51	-4.2	-7.3	3.1
	-5.0	-.50	-1.6	-9.5	7.9
	-8.0	-.50	-1.5	-9.6	8.1
	-11.0	-.50	-1.4	-9.7	8.3
	-14.0	-.50	-1.3	-9.8	8.5
	-17.0	-.50	-0.8	-11.9	10.1
Δf = +6.5 freq in MHZ					
306.5	+4.0	-.51	-4.3	-5.2	0.9
	+1.0	-.50	-1.5	-9.1	7.6
	-2.0	-.50	-1.5	-9.4	7.9
	-5.0	-.50	-1.5	-9.5	8.0
	-8.0	-.50	-1.4	-9.4	8.0
	-11.0	-.50	-1.4	-9.6	8.2
	-14.0	-.49	-1.4	-9.6	8.2
	-17.0	-.49	-0.8	-11.8	10.0

SHEET #3

RECEIVER COMPOSITE PP#2 22 JAN 75

GENERATOR B	GEN B LEVEL AT RCVR INPUT	AGC VOLTS	S+N+I OUTPUT dbm GEN A MODULATED	N+I OUTPUT dbm GEN A UNMODULATED	S+N+I / N+I
Δf = +6.0 freq in MHZ 306.0	+4.0	-.52	-4.4	-5.1	0.7
	+1.0	-.52	-4.4	-7.1	2.4
	-2.0	-.51	-4.2	-7.3	3.1
	-5.0	-.50	-1.7	-9.0	7.3
	-8.0	-.50	-1.6	-9.2	7.6
	-11.0	-.50	-1.5	-9.2	7.7
	-14.0	-.50	-1.5	-9.4	7.9
	-17.0	-.50	-0.8	-11.6	10.8
Δf = +5.5 freq in MHZ 305.5	+4	-.52	-4.3	-6.5	2.2
	+1	-.52	-4.3	-6.6	2.3
	-2	-.52	-4.3	-6.8	2.5
	-5	-.50	-1.7	-8.6	6.9
	-8	-.50	-1.7	-8.7	7.0
	-11	-.50	-1.7	-8.8	7.1
	-14	-.50	-1.6	-8.9	7.3
	-17	-.50	-0.8	-11.6	10.8
Δf = +5.0 freq in MHZ 305.0	+4	-.52	-4.9	-6.5	1.6
	+1	-.52	-4.8	-6.6	1.8
	-2	-.52	-4.6	-6.6	2.0
	-5	-.50	-2.3	-8.0	5.7
	-8	-.50	-2.3	-8.0	5.7
	-11	-.50	-2.0	-8.2	8.0
	-14	-.50	-2.0	-8.4	8.2

SHEET #4

RECEIVER COMPOSITE PP#2 22 JAN 75

GENERATOR B	GEN B LEVEL AT RCVR INPUT	AGC VOLTS	S+N+I OUTPUT dbm GEN A MODULATED	N+I OUTPUT dbm GEN A UNMODULATED	S+N+I / N+I
Δf=+5.0 freq in MHZ					
305.0	-17	-.50	-0.9	-11.4	10.5
Δf=+4.5 freq in MHZ					
304.5	+4	-.53	-5.0	-6.4	1.4
	+1	-.53	-4.9	-6.4	1.5
	-2	-.52	-4.8	-6.6	1.8
	-5	-.50	-2.5	-8.0	5.5
	-8	-.50	-2.3	-8.2	5.9
	-11	-.50	-2.2	-8.1	5.9
	-14	-.50	-2.0	-8.3	6.3
	-17	-.50	-1.0	-11.4	10.4
Δf=+4.0 freq in MHZ					
304.0	+4.0	-.53	-4.9	-6.4	1.5
	+1.0	-.52	-4.8	-6.6	1.8
	-2.0	-.52	-4.7	-6.8	2.1
	-5.0	-.50	-2.4	-8.0	5.6
	-8.0	-.50	-2.2	-8.2	6.0
	-11.0	-.50	-2.1	-8.2	6.1
	-14.0	-.50	-1.0	-11.2	10.2
Δf=+3.5 freq in MHZ					
303.5	+4	-.52	-4.9	-6.5	1.6
	+1	-.52	-4.8	-6.6	1.8
	-2	-.52	-4.6	-6.8	2.2
	-5	-.50	-2.3	-8.0	5.7
	-8	-.50	-2.1	-8.2	6.1
	-11	-.50	-2.0	-8.4	6.4

SHEET #5

RECEIVER COMPOSITE   PP#2   22 JAN 75

GENERATOR B	GEN B LEVEL AT RCVR INPUT	AGC VOLTS	S+N+I OUTPUT dbm GEN A MODULATED	N+I OUTPUT dbm GEN A UNMODULATED	S+N+I / N+I
Δf = +3.5 freq in MHZ 303.5°	-14	-.50	-1.0	-11.1	10.1
Δf = +3.0 freq in MHZ 303.0°					
	+4	-.52	-4.0	-6.5	2.5
	+1	-.51	-3.4	-7.2	3.8
	-2	-.51	-2.7	-8.0	5.3
	-5	-.51	-2.1	-7.9	5.8
	-8	-.51	-1.9	-8.1	6.2
	-11	-.51	-1.7	-8.4	6.7
	-14	-.51	-1.6	-8.8	7.2
	-17	-.50	-0.8	-11.4	10.6
Δf = +2.5 freq in MHZ 302.5°					
	+4	-.55	-4.2	-4.4	0.2
	+1	-.52	-4.2	-6.2	2.0
	-2	-.51	-3.5	-7.5	4.0
	-5	-.51	-2.7	-8.4	5.7
	-8	-.51	-2.1	-7.8	5.7
	-11	-.51	-1.8	-8.2	6.4
	-14	-.51	-1.8	-8.6	6.8
	-17	-.50	-0.9	-11.4	10.5
Δf = +2.0 freq in MHZ 302.0					
	+4	-.57	-5.6	-6.2	0.6
	+1	-.54	-4.7	-6.0	1.3
	-2	-.53	-4.6	-6.7	2.1
	-5	-.52	-3.6	-6.2	2.6
	-8	-.51	-2.9	-6.7	3.8

SHEET #6

RECEIVER COMPOSITE PP#2 22 JAN 75

GENERATOR B	GEN B LEVEL AT RCVR INPUT	AGC VOLTS	S+N+I OUTPUT dbm GEN A MODULATED	N+I OUTPUT dbm GEN A UNMODULATED	S+N+I / N+I
Δf= +2.0 freq in MHZ					
302.0	-11	-.51	-1.1	-6.3	5.2
	-14	-.51	-0.7	-5.7	5.0
	-17	-.51	0.0	-8.4	8.4
	-20	-.50	-0.8	-9.5	8.7
	-23	-.50	-0.7	-10.0	9.3
	-26	-.50	+0.3	-10.5	10.8
Δf= +1.5 freq in MHZ					
301.5	-2	-.96	-2.3	-2.3	0.0
	-5	-.59	-2.3	-2.6	0.3
	-8	-.53	-2.3	-3.5	1.2
	-11	-.52	-3.7	-6.1	2.4
	-14	-.53	-3.0	-4.4	1.4
	-17	-.51	-1.4	-5.9	4.5
	-20	-.51	-0.5	-8.8	8.3
	-23	-.51	0.0	-8.2	8.2
	-26	-.51	-0.1	-8.8	8.7
	-29	-.50	+0.4	-10.3	10.7
Δf= +1.0 freq in MHZ					
301.0	-11.0	-.98	-2.2	-2.2	0.0
	-14.0	-.84	-1.6	-1.6	0.0
	-17.0	-.84	-2.0	-2.0	0.0
	-20.0	-.57	-5.9	-6.3	0.4
	-23.0	-.53	-3.9	-5.2	1.3
	-26.0	-.53	-3.8	-5.3	1.5
	-29.0	-.52	-3.4	-7.5	4.1

RECEIVER COMPOSITE PP#2 22 JAN 75

GENERATOR B	GEN B LEVEL AT RCVR INPUT	AGC VOLTS	S+N+I OUTPUT dbm GEN A MODULATED	N+I OUTPUT dbm GEN A UNMODULATED	S+N+I / N+I
Δf = +1.0 freq in MHZ 301.0	-32.0	-.51	-1.6	-6.7	5.1
	-35.0	-.51	-0.7	-7.4	6.7
	-38.0	-.51	-0.6	-8.0	7.4
	-41.0	-.51	-0.1	-10.2	10.3
Δf = +0.5 freq in MHZ					
300.5	-29	-1.31	-1.8	-1.8	0.0
	-32				
	-35				
	-38	-.98	-3.4	-3.4	0.0
	-41	-.80	-5.2	-5.2	0.0
	-44	-.60	-6.0	-6.8	0.8
	-47	-.55	-6.1	-7.0	0.9
	-50	-.52	-4.4	-7.5	3.1
	-53	-.51	-2.8	-6.4	3.6
	-56	-.51	-1.4	-6.5	5.1
	-59	-.51	-0.5	-7.4	6.9
	-62	-.51	0.0	-9.3	9.3
	-65	-.51	+0.3	-10.0	10.3
Δf = +0.3 freq in MHZ					
300.2	-71	-.54	-7.5	-12.0	4.5
	-74	-.53	-4.6	-13.0	8.4
	-77	-.52	-2.4	-13.0	10.6
Δf = - 0.2 freq in MHZ					
299.8	-83	-.51	-2.9	-5.3	2.4
	-86	-.51	-1.3	-8.5	7.2

SHEET #8

RECEIVER COMPOSITE PP#2 22 JAN 75

GENERATOR B	GEN B LEVEL AT RCVR INPUT	AGC VOLTS	S+N+F OUTPUT dbm GEN A MODULATED	N+I OUTPUT dbm GEN A UNMODULATED	S+N+F / N+I
Δf = -0.2 freq in MHZ 299.8	-89	-.51	-0.6	-10.0	9.4
	-92	-.51	+0.1	-10.9	11.0
Δf = -0.5 freq in MHZ 299.5					
	-50	-.53	-4.3	-7.4	3.1
	-53	-.52	-3.3	-9.1	5.8
	-56	-.52	-2.8	-9.1	6.3
	-59	-.51	-1.1	-9.4	8.3
	-62	-.51	-0.7	-6.6	5.9
	-66	-.51	-0.8	-6.6	5.8
	-68	-.51	-0.3	-7.5	7.2
	-71	-.51	+0.1	-8.7	8.6
	-74	-.51	+0.3	-9.5	9.8
	-77	-.51	+0.5	-10.4	10.9
Δf = -1.0 freq in MHZ 299.0					
	-26	-.55	-3.7	-4.0	0.3
	-29	-.52	-3.6	-5.8	2.2
	-32	-.51	-1.5	-6.2	4.7
	-35	-.51	-0.7	-7.2	6.5
	-38	-.51	-2.0	-6.0	5.8
	-41	-.50	-0.5	-7.6	7.1
	-44	-.50	-0.3	-8.9	8.6
	-47	-.50	-0.5	-7.5	7.0
	-50	-.50	+0.3	-10.3	10.6

SHEET #9

RECEIVER COMPOSITE PP#2 22 JAN 75

GENERATOR B	GEN B LEVEL AT RCVR INPUT	AGC VOLTS	S+N+I OUTPUT dbm GEN A MODULATED	N+I OUTPUT dbm GEN A UNMODULATED	S+N+I / N+I
Δf = -1.5 freq in MHZ 298.5	-14	-.51	-1.8	-6.0	4.2
	-17	-.51	-2.2	-6.2	4.0
	-20	-.51	-0.5	-6.8	6.3
	-23	-.51	0.0	-8.8	8.8
	-26	-.51	+0.2	-9.2	9.4
	-29	-.51	+0.3	-10.3	10.6
Δf = -2.0 freq in MHZ 298.0					
	-8	-.67	-3.9	-4.1	0.2
	-11	-.54	-2.8	-3.7	0.9
	-14	-.51	-1.2	-6.5	5.3
	-17	-.51	0.0	-9.6	9.6
	-20	-.51	+0.3	-10.0	10.3
Δf = -2.5 freq in MHZ 297.5					
	-2	-.51	-1.7	-6.0	4.3
	-5	-.51	-0.9	-5.1	4.2
	-8	-.52	-2.3	-4.2	1.9
	-11	-.51	-0.7	-4.4	3.7
	-14	-.51	+0.2	-9.8	10.0
	-17	-.50	+0.2	-10.0	10.2
Δf = -3.0 freq in MHZ 297.0					
	+1	-.53	-3.1	-4.7	1.6
	-2	-.53	-3.0	-4.8	1.8
	-5	-.51	-0.9	-6.3	5.4
	-8	-.51	-0.6	-7.0	6.4
	-11	-.51	-0.5	-7.4	6.9

SHEET #10

RECEIVER COMPOSITE PP#2 22 JAN 75

GENERATOR B' Δf = -3.0 freq in MHZ	GEN B LEVEL AT RCVR INPUT	AGC VOLTS	S+N+I OUTPUT dbm GEN A MODULATED	N+I OUTPUT dbm GEN A UNMODULATED	S+N+I / N+I
297.0	-14	-.50	+0.2	-9.7	9.9
	-17	-.50	+0.3	-10.2	10.5

4.3.14 AN/GRC-171 Spurious Response Test:

4.3.14.1 Procedure: The receiver was tuned to one of three UHF frequencies with an input of 3 microvolts 30% modulated by 1000Hz and adjusted for 0dbm output. Output (S+N)/N ratio was noted. Input RF was increased to 6 microvolts (-91.5dbm) unmodulated, and the AGC voltage recorded for reference. The signal generator was adjusted to maximum output, still unmodulated, and tuned from 50 - 1000MHz searching for spurious receiver responses (frequencies above 500MHz were obtained by mixing outputs of two generators). When a spurious response was found, the signal level was adjusted to that which caused the reference AGC volts. This corresponds to an on-channel undesired signal 6db above minimum desired signal. The difference between the generator level and -91.5dbm was taken as the rejection ratio. Next, the generator was modulated 95% by 1000Hz and the RF level resulting in an audio output 1db above noise level was noted. Three UHF frequencies (225, 300, and 399.975MHz) were checked using Prototype PP-2.

4.3.14.2 Results: The results appear in the attached data sheets. Except for those cases where the generator frequency was harmonically related to the test frequency, rejection ratios of the order of 89 - 110db were measured. The harmonically related readings were much lower (42 - 62db rejection), but these are attributed to harmonics of the generator frequency and therefore are not true spurious responses. Very low rejection was measured at double the test frequency of 225. This is attributed to the method of obtaining the higher frequencies (mixing of two generators) and not the receiver under test. An unusual number of responses were observed in the vicinity of 400MHz where it was found that, if the receiver is unsquelched, undesired signals as low as -25.8dbm can be heard. A level of +0.7dbm is 6db above that required to break squelch.

4.3.14.3 Conclusions: Normally the AN/GRC-171 will not have the protective selectivity of a multicoupler, since it must be capable of being tuned quickly to any desired frequency and the CU-547 multicoupler is a manually-tuned device. When receiver squelch is set at 3uv, undesired levels in the range -5.3 to +12.6dbm at the receiver input may break squelch and cause RFI. This will require approximately 35 - 42db of net isolation (transmitter output connector to receiver input connector) when the GRC-171 is collocated with a 50 watt transmitter.

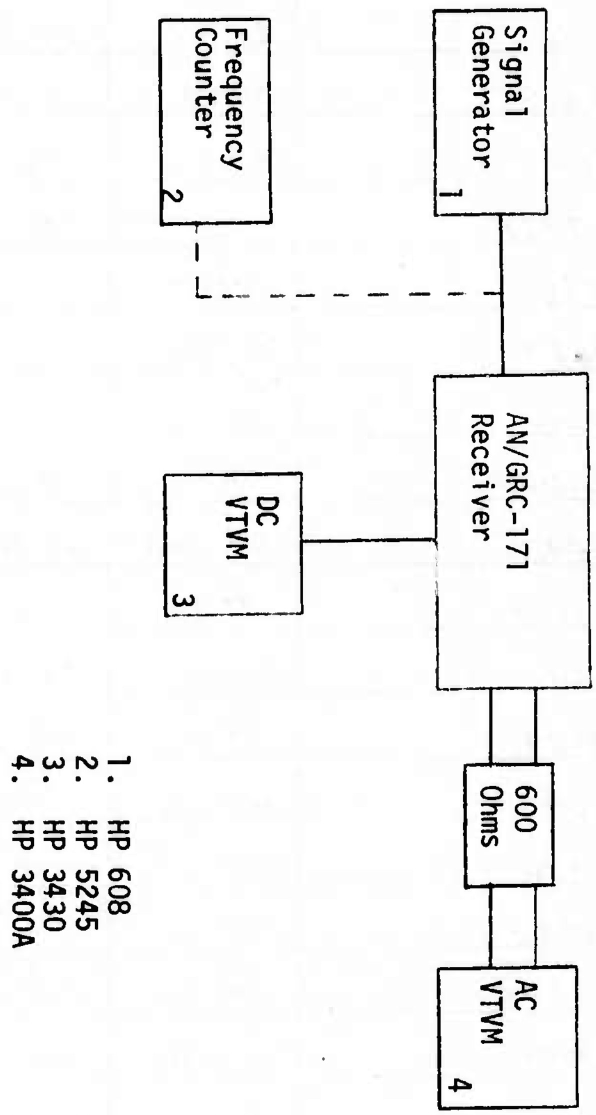

Figure 20

Receiver Spurious Response

RECEIVER SPURIOUS RESPONSE AP#2 24 JAN 75

RCVR TUNED FREQ = 399.975 MHz AGC voltage at -91.5 dbm input = -.52V

SPURIOUS FREQ (MHz)	SPURIOUS RATIO (db)	SPURIOUS LEVEL (db)	NOISE LEVEL (db)	GEN. LEVEL MODULATED	REJECTION RATIO
99.99071	62.20	-29.30	-3.1	-55.0	36.50
133.32015	55.10	-36.40	-3.1	-71.0	20.50
199.9816	43.10	-48.40	-3.1	-75.00	16.50
224.9788	107.50	+16.0	-3.1	+9.75	101.25
339.9866	110.10	+18.60	-3.1	+2.50	94.0
379.9687	108.30	+16.80	-3.1	OUT OF RANGE OF EQUIP	
396.7626	94.30	+2.80	-3.1	-22.70	68.80
398.3060	99.10	+7.60	-3.1	-14.30	77.20
398.5443	102.20	+10.70	-3.1	-16.50	75.00
399.2759	92.20	+0.70	-3.1	-21.80	69.70
400.7411	100.30	+8.80	-3.1	-25.80	65.70
400.8824	99.50	+9.00	-3.1	-22.70	68.80
569.9658	107.20	+15.70	-3.1	+9.75	101.25
619.9408	109.80	+18.30	-3.1	+5.50	97.0
759.9439	108.10	+16.60	-3.1	-5.60	85.90
793.5244	94.50	+3.0	-3.1	-22.70	68.80
796.6109	101.80	+10.30	-3.1	-13.50	78.0
797.0870	102.30	+10.80	-3.1	-16.30	75.20
799.9371	1.20	-90.30	-3.1	-116.50	25.0
801.4828	100.20	+8.70	-3.1	-20.20	71.30

SHEET #C

RECEIVER SPURIOUS RESPONSE PP#2 24 JAN 75

RCVR TUNED FREQ = 225 MHz AGC VOLTAGE AT -91.5 dBm INPUT = -.54V

SPURIOUS FREQ (MHz)	SPURIOUS RATIO (db)	SPURIOUS LEVEL (db)	NOISE LEVEL (db)	GEN. LEVEL MODULATED	REJECTION RATIO
112.49969	42.70	-48.8	-3.3	-71.5	20.0
599.9955	111.70	+20.2	-3.3	+10.0	101.5

RCVR TUNED FREQ = 300 MHz AGC VOLTAGE AT -91.5 dBm INPUT = -.56V

SPURIOUS FREQ (MHz)	SPURIOUS RATIO (db)	SPURIOUS LEVEL (db)	NOISE LEVEL (db)	GEN. LEVEL MODULATED	REJECTION RATIO
74.9991	61.3	-30.2	-3.5	-59.0	32.50
99.9960	55.1	-36.4	-3.5	-64.5	27.0
149.9968	42.0	-49.5	-3.5	-74.0	17.5
350.0035	106.50	+15.0	-3.5	-0.25	91.25
525.0048	89.50	-2.0	-3.5	-31.40	60.10
593.5741	101.50	+10.0	-3.5	-15.70	75.80
599.9865	2.0	-89.5	-3.5	-115.0	23.50
1050.0091	90.10	-1.40	-3.5	-31.6	59.90

4.3.15 AN/GRC-171 Transmitter - AN/GRC-171 Receiver Compatibility:

4.3.15.1 Procedure: Two AN/GRC-171s were utilized, one as a transmitter with a power output of +43dbm and modulated 90% by 400Hz; the other as a receiver receiving a -97.5dbm input signal on the test frequency 30% modulated by 1KHz and adjusted for 0dbm audio output. The connector-to-connector isolation between transmitter and receiver was adjusted to 26, 36, 46, and 56dbm. The transmitter frequency was varied above and below the receiver frequency by various delta f's and two measurements were made: signal plus noise plus interference (S+N+I) with both receiver inputs modulated and noise plus interference (N+I) with only the AN/GRC-171 transmitter modulated.

4.3.15.2 Results: The results of the measurements appear in the attached data sheets and have been plotted. It can be seen that the (S+N+I)/(N+I) is 8db or better for the following combinations of delta f and isolation: 26db/4.0MHz; 36db/3.5MHz; 46db/3.0MHz; 56db/2.5MHz.

4.3.15.3 Conclusions: The AN/GRC-171 is normally used as either a back-up or spare for single channel radios and thus must be capable of changing frequencies rapidly. Installations having collocated single channel receivers have the capability of utilizing antenna multicouplers, tunable filters, different types of antennas, and different antenna configurations to reduce collocation interference. Because of the need to rapidly change frequencies, multicouplers and tunable filters are not normally used with a multichannel transceiver. Therefore, the type of antenna, antenna configuration, and frequency separation becomes more critical. While the AN/GRC-171 specification criteria of 7MHz and 24db are met, it was found that utilization of collocated channels closer than 4MHz must be carefully checked. When the transceiver is used as a back-up or spare, a small amount of collocation interference can be tolerated until the primary radio is back on-line. However, for those applications where the AN/GRC-171 is used as the primary radio and collocation interference must be held to a minimum, some of the versatility of the transceiver may have to be sacrificed when ancillary equipment is required to obtain satisfactory performance for channels collocated closer than 4MHz. Although the AN/GRC-171 appears to be a great improvement over the older UHF multichannel transceivers in the area of collocation compatibility, each installation will have to be surveyed to determine if collocation interference will be a problem and what will have to be done to eliminate any interference.

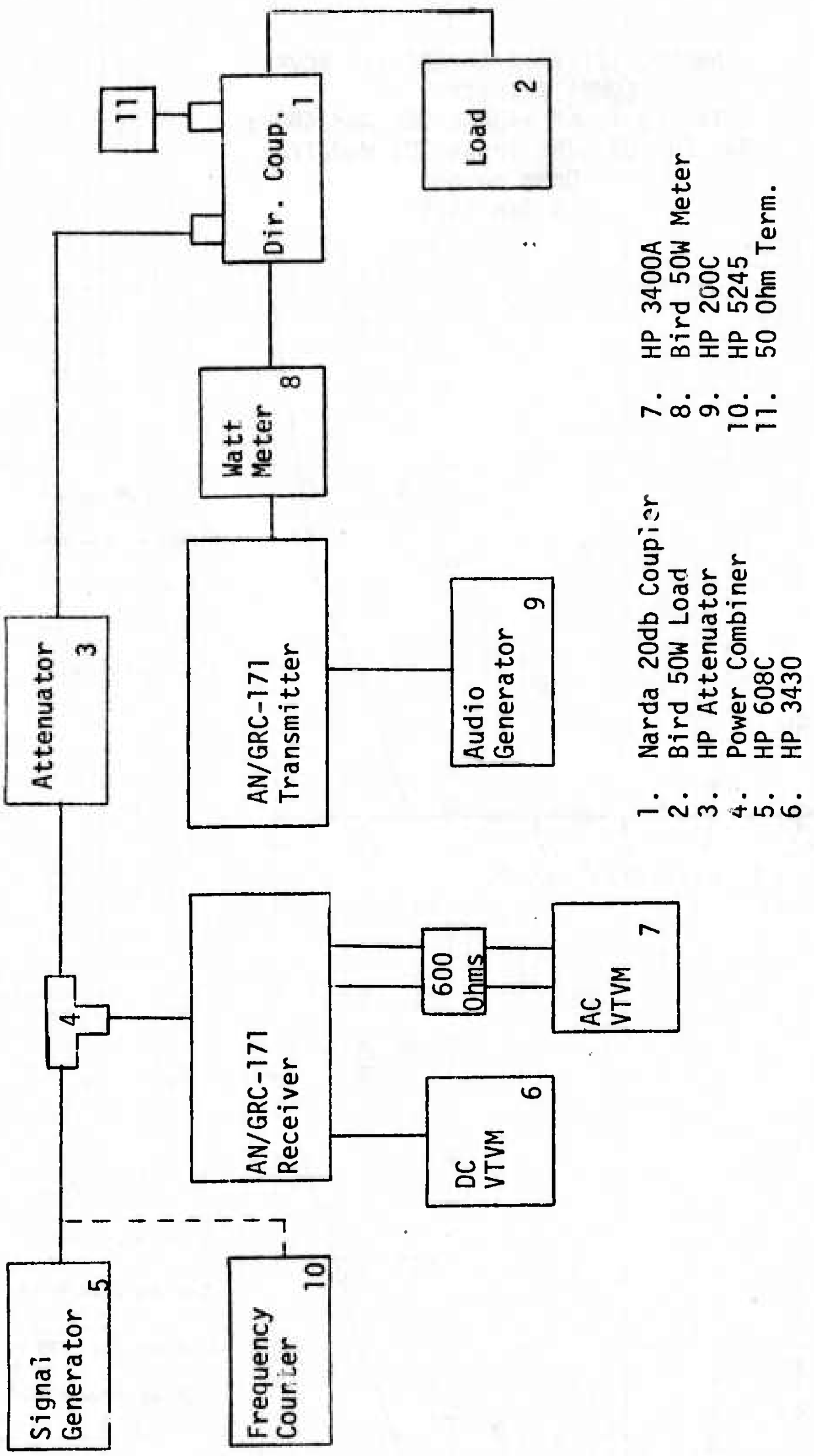

Figure 21

AN/GRC-171 Transmitter to Receiver Compatibility

AN/GRC-171 XMTR/AN/GRC-171 RCVR
COMPATIBILITY
TX: Fo ± Δf +43dBm 90% Mod/400Hz
RX: Fo -97.5dBm input 30% Mod/1KHz
OdBm output
9 Jan 1975

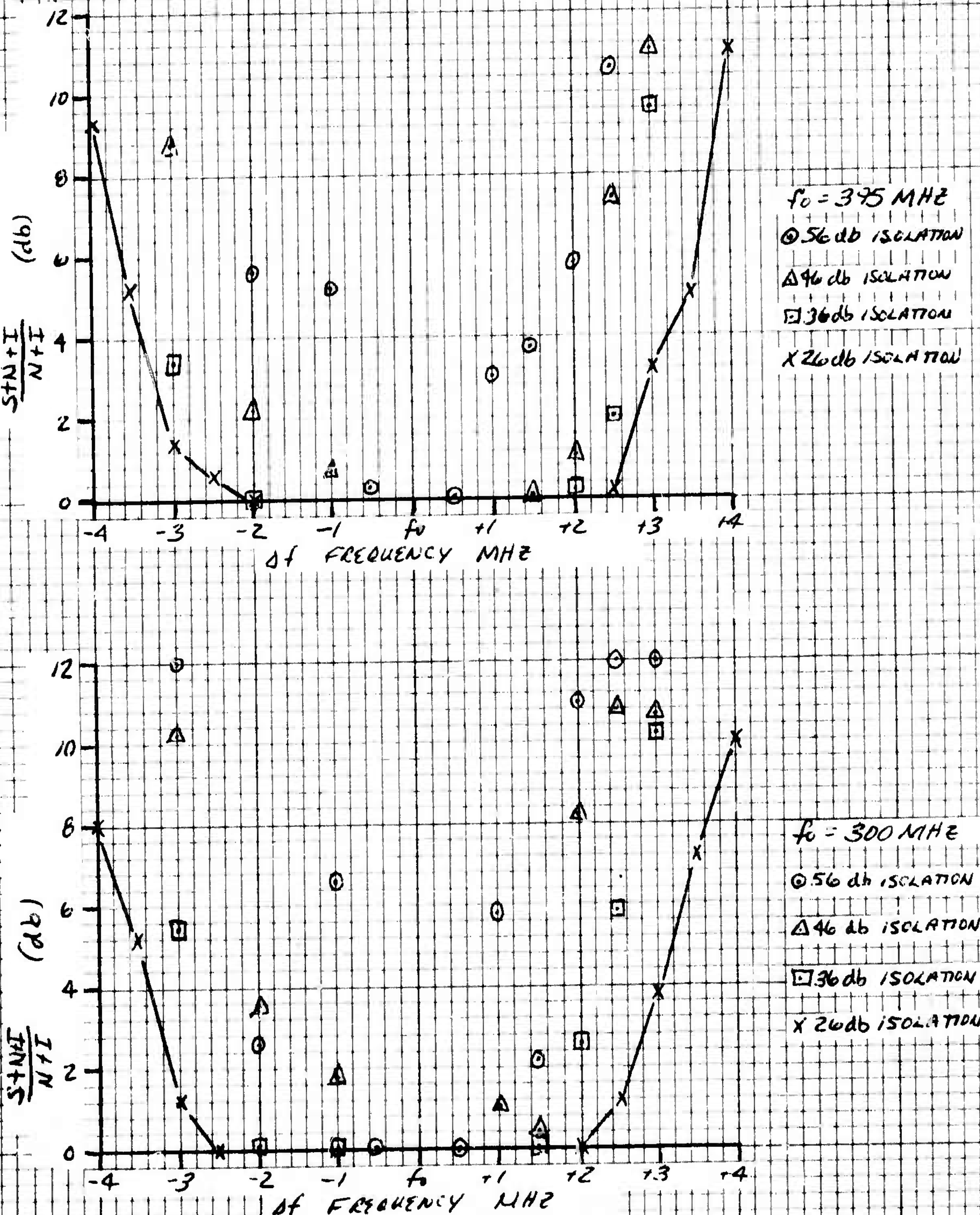

Figure 22

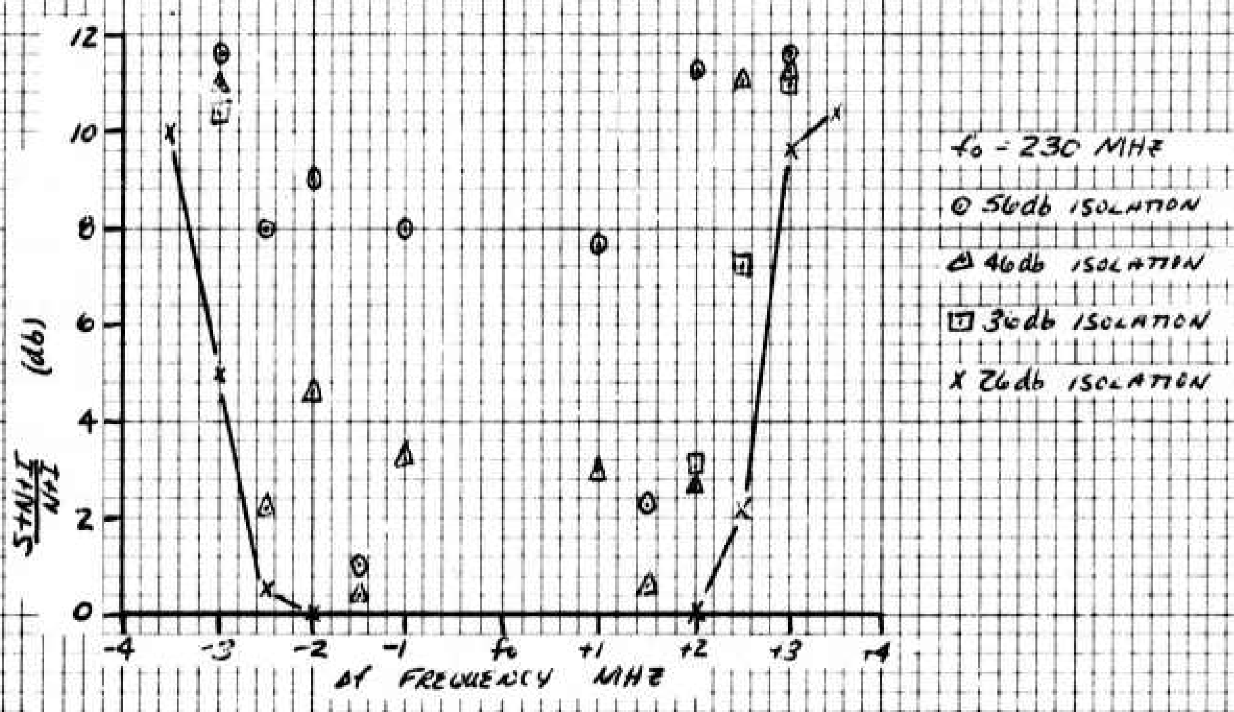
12
10
8
6
4
2
0
S+N+I / N+I (db)
-4
-3
-2
-1
fo
+1
+2
+3
+4
Δf FREQUENCY MHZ
fo - 230 MHZ
⊙ 56db ISOLATION
△ 46db ISOLATION
⊡ 36db ISOLATION
X 26db ISOLATION

Figure 22A

GRC 171 TRANSMITTER / GRC-171 RECEIVER COMPATABILITY 9 JAN 75

SIGNAL INPUT 3µV - 30% MODULATED - 1KHz MODULATING FREQ.

RECEIVER FREQUENCY (MHz)	Δf (MHz)	TOTAL ATTENUATION (db)	S+N+I (db)	N+I (db)	AGC (VOLTS)	S+N+I / N+I
300.00	+7.0	36	0	-11.0	-.49	11.0
		46	0	-11.0	-.49	11.0
		56	0	-11.0	-.49	11.0
	+4.0	26	0	-10.0	-.51	10.0
	+3.5	26	-0.6	-7.7	-.51	7.1
	+3.0	26	-1.7	-5.6	-.51	3.9
		36	-0.5	-10.7	-.49	10.2
		46	0	-10.7	-.49	10.7
		56	0	-11.0	-.49	12.0
	+2.5	26	-3.0	-4.2	-.53	1.2
		36	-0.9	-6.8	-.49	5.9
		46	-0.2	-11.0	-.49	10.8
		56	0	-12.0	-.49	12.0
	+2.0	26	-3.0	-3.0	-.57	0
		36	-4.0	-6.6	-.49	2.6
		46	-0.7	-9.0	-.49	8.3
		56	0.0	-11.0	-.49	11.0
	+1.5	26	-4.2	-4.2	-1.15	0
		36	-3.8	-3.8	-.69	0
		46	-2.3	-2.7	-.51	0.4
		56	-2.4	-4.5	-.48	2.1
	+1.0	36	-5.8	-5.8	-.49	0
		46	-5.1	-6.0	-.52	0.9
		56	-2.6	-8.5	-.50	5.9

SHEET #2

GRC-171 TRANSMITTER / GRC-171 RECEIVER COMPATABILITY 9 JAN 75

RECEIVER FREQ (MHz)	Δf (MHz)	TOTAL ATTENUATION (db)	S+N+I (db)	N+I (db)	AGC (VOLTS)	S+N+I / N+I
300.00	+.5	36	-1.3	-1.3	-1.45	0
		46	+0.6	+0.6	-1.33	0
		56	+0.5	+0.5	-.92	0
	-.5	36	-2.1	-2.2	-1.20	0.1
		46	-1.7	-1.8	-1.07	0.1
		56	-1.5	-1.6	-.56	0.1
	-1.0	36	-5.6	-5.6	-.57	0
		46	-5.4	-7.2	-.52	1.8
		56	-2.0	-8.6	-.49	6.6
	-1.5	26	-5.6	-5.6	-1.33	0
	-2	26	-4.0	-4.0	-.99	0
		36	-3.7	-3.8	-.54	0.1
		46	-3.4	-6.8	-.50	3.4
		56	-0.7	-9.6	-.49	8.9
	-2.5	26	-2.5	-2.5	-.55	0
	-3.0	26	-2.8	-4.0	-.53	1.2
		36	-1.0	-6.5	-.50	5.5
		46	-0.2	-10.5	-.49	10.3
		56	0.0	-12.0	-.49	12.0
	-3.5	26	-1.0	-6.2	-.51	5.2
	-4.0	26	-0.2	-8.2	-.51	8.0
	-4.5	26	-0.2	-10.5	-.51	10.3
	-7	36	0.0	-12.0	-.49	12.0
		46	0.0	-12.0	-.49	12.0

SHEET #3

GRC-171 TRANSMITTER / GRC-171 RECEIVER COMPATIBILITY 9 JAN 75

RECEIVER FREQ (MHz)	Δf (MHz)	TOTAL ATTENUATION (db)	S+N+I (db)	N+I (db)	AGC (VOLTS)	S+N+I / N+I
395.00	+4.975	36	-0.2	-10.0	-.48	9.8
		46	0.0	-11.0	-.48	11.0
		56	0.0	-11.0	-.48	11.0
	+4.0	26	0.0	-11.0	-.51	11.0
	+3.5	26	-1.0	-6.0	-.51	5.0
	+3.0	26	-2.8	-6.0	-.52	3.2
		36	0.0	-9.8	-.48	9.8
		46	0.0	-11.0	-.49	11.0
		56	0.0	-11.0	-.49	11.0
	+2.5	26	-1.8	-2.0	-.55	0.2
		36	-2.6	-4.6	-.50	2.0
		46	-0.6	-8.0	-.49	7.4
		56	0.0	-10.5	-.49	10.5
	+2.0	26	-2.8	-2.8	-.85	0.0
		36	-2.1	-2.3	-.54	0.2
		46	-2.2	-3.3	-.49	1.1
		56	-0.6	-6.4	-.49	5.8
	+1.5	26	-3.8	-3.8	-1.10	0.0
		36	-4.2	-4.2	-.79	0.0
		46	-4.6	-4.6	-.52	0.0
		56	-4.1	-7.8	-.48	3.7
	+1.0	36	-4.7	-4.7	-.81	0.0
		46	-4.3	-4.3	-.54	0.0
		56	-3.1	-6.2	-.49	3.1

SHEET #4

GRC 171 TRANSMITTER / GRC 171 RECEIVER COMPATABILITY 9 JAN 75

RECEIVER FREQ (MHZ)	Δf (MHZ)	TOTAL ATTENUATION (db)	S+N+I (db)	N+I (db)	AGC (VOLTS)	S+N+I / N+I
395.00	+.5	36	-1.0	-1.0	-.85	0.0
		46	-0.4	-0.4	-1.24	0.0
		56	-1.0	-1.0	-.85	0.0
	-.5	36	-1.1	-1.3	-1.24	0.2
		46	-2.0	-2.2	-.95	0.2
		56	-2.4	-2.7	-.57	0.3
	-1	36	-5.0	-5.0	-.70	0.0
		46	-5.0	-5.7	-.53	0.7
		56	-3.2	-8.5	-.49	5.3
	-2	26	-4.0	-4.0	-.82	0.0
		36	-4.2	-4.2	-.55	0.0
		46	-3.8	-6.0	-.50	2.2
		56	-1.6	-7.2	-.48	5.6
	-2.5	26	-3.5	-4.0	-.52	0.5
	-3	26	-3.5	-5.0	-.52	1.5
		36	-2.0	-5.5	-.49	3.5
		46	-0.2	-9.0	-.49	8.8
		56				
	-3.5	26	-1.0	-6.2	-.51	5.2
	-4.0	26	-0.2	-9.5	-.51	9.3
	-4.5	26	0.0	-11.0	-.51	11.0
	-7	36	0.0	-11.0	-.49	11.0
		46	0.0	-11.0	-.49	11.0
		56	0.0	-11.0	-.49	11.0

GRC-171 TRANSMITTER / GRC-171 RECEIVER COMPATABILITY

9 JAN 75

RECEIVER FREQ (MHz)	Δf (MHz)	TOTAL ATTENUATION (db)	S+N+I (db)	N+I (db)	AGC (VOLTS)	S+N+I / N+I
230.00	-3.5	26	0.0	-10.0	-.51	10.0
	-3.0	26	-1.0	-6.0	-.51	5.0
		36	0.0	-10.5	-.51	10.5
		46	0.0	-11.5	-.51	11.5
		56	0.0	-11.8	-.51	11.8
	-2.5	26	-5.5	-6.0	-.55	0.5
		36	-7.0	-7.0	-.83	0.0
		46	-7.4	-9.5	-.54	2.1
		56	-3.0	-11.0	-.51	8.0
	-2.0	26	-4.5	-4.5	-.74	0.0
		36	-4.0	-4.5	-.64	0.5
		46	-2.5	-7.0	-.51	4.5
		56	-0.1	-10.0	-.51	9.9
	-1.5	26	0.0	0.0	-.51	0.0
		36	+1.0	+1.0	-.57	0.0
		46	-1.0	-1.4	-.58	0.4
		56	-5.0	-6.0	-.55	1.0
	-1.0	26	-3.5	-3.5	-.86	0.0
		36	-7.0	-7.0	-.57	0.0
		46	-6.8	-10.0	-.53	3.2
		56	-1.5	-9.5	-.51	8.0
	-0.5	36	+1.2	+1.2	-.57	0.0
		46	-1.0	-1.0	-.58	0.0
		56	-4.0	-4.5	-.56	0.5

SHEET #6

GRC-171 TRANSMITTER / GRC-171 RECEIVER COMPATABILITY 9 JAN 75

RECEIVER FREQ (MHz)	Δf (MHz)	TOTAL ATTENUATION (db)	S+N+I (db)	N+I (db)	AGC (VOLTS)	S+N+I / N+I
230.00	+0.5	36	-1.8	-2.0	-1.52	0.2
		46	-1.2	-1.2	-1.31	0.0
		56	-1.8	-1.8	-.90	0.0
	+1.0	26	-7.0	-7.0	-.95	0.0
		36	-7.0	-7.0	-.59	0.0
		46	-6.2	-9.2	-.54	3.0
		56	-1.8	-9.5	-.51	7.7
	+1.5	26	-4.8	-4.8	-.93	0.0
		36	-3.5	-3.5	-.57	0.0
		46	-2.0	-2.6	-.52	0.6
		56	-1.5	-3.8	-.51	2.3
	+2.0	26	-2.8	-2.8	-.56	0.0
		36	-4.2	-7.2	-.51	3.0
		46	-0.6	-9.2	-.52	8.6
		56	0.0	-11.2	-.52	11.2
	+2.5	26	-3.5	-5.6	-.53	2.1
		36	-0.8	-8.0	-.52	7.2
		46	0.0	-11.0	-.52	11.0
		56	0.0	-11.0	-.52	11.0
	+3.0	26	-0.2	-9.8	-.52	9.6
		36	0.0	-11.2	-.52	11.2
		46	0.0	-11.5	-.52	11.5
		56	0.0	-11.8	-.52	11.8
	+3.5	26	0.0	-10.5	-.52	10.5

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4.3.16 AN/GRC-171 Receiver Third Order IM Test:

4.3.16.1 Procedure: The AN/GRC-171 receiver was supplied with the standard minimum input on Fo = 300MHz (-97.5dbm 30% modulated with 1KHz) and adjusted for 0dbm output. Then two signal generators were used to supply inputs of (Fo + delta f) and (Fo + 2 delta f). The generator closest in frequency to Fo was modulated 90% by 1KHz; the other generator was unmodulated. Both input levels were kept equal and adjusted so that an audio output 3db above noise level was obtained. This RF level was recorded for each delta f used. Delta f's of ± 0.1, 0.2, 0.4, 0.7, 1.0, 2.0, 3.0, and 5.0 MHz were utilized.

4.3.16.2 Results: The results are tabulated in the attached data sheet and are graphed. The curve represents the amount of offending signal level (two equal signals having an exact frequency ratio to the GRC-171 receiver frequency) that will result in degradation of the output (S+N)/N (measured as 11.1db) to a (S+N+I)/(N+I) of 8.4db.

4.3.16.3 Conclusions: In collocated installations it is very possible to have signals originating from other transmitters still at levels of about -10dbm at the GRC-171 receiver input. If two such signals can combine in the GRC-171 to produce a product equal to the GRC-171 frequency, the results of this test indicate that degradation can occur. The best prevention is proper frequency choice for collocated radios.

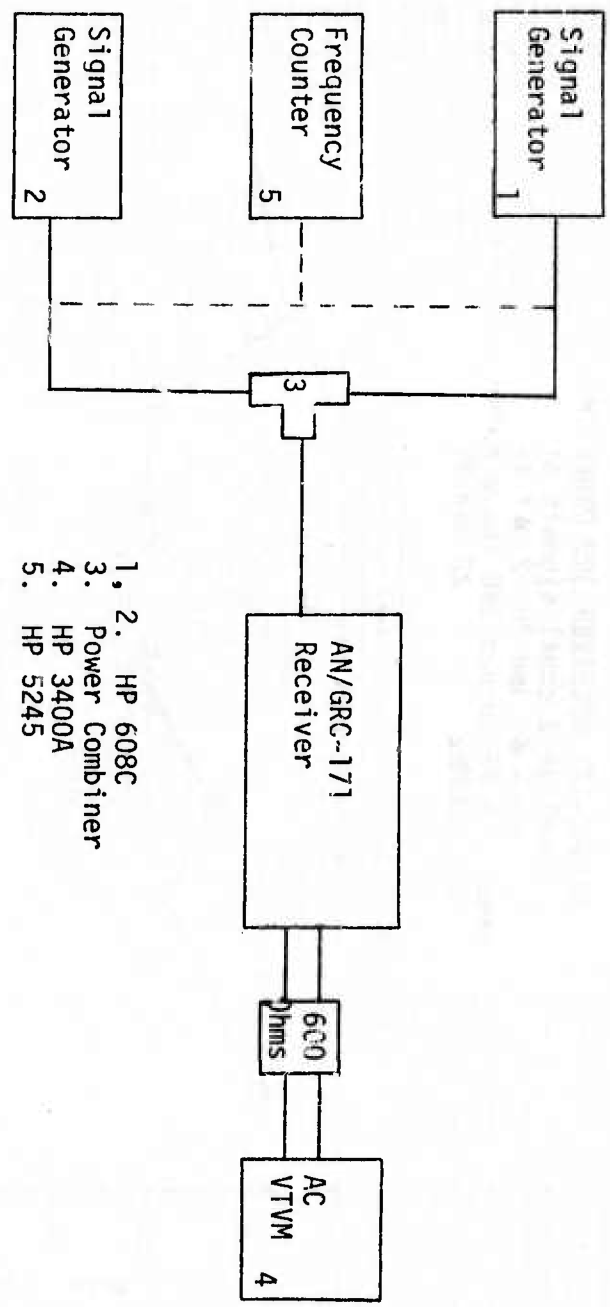
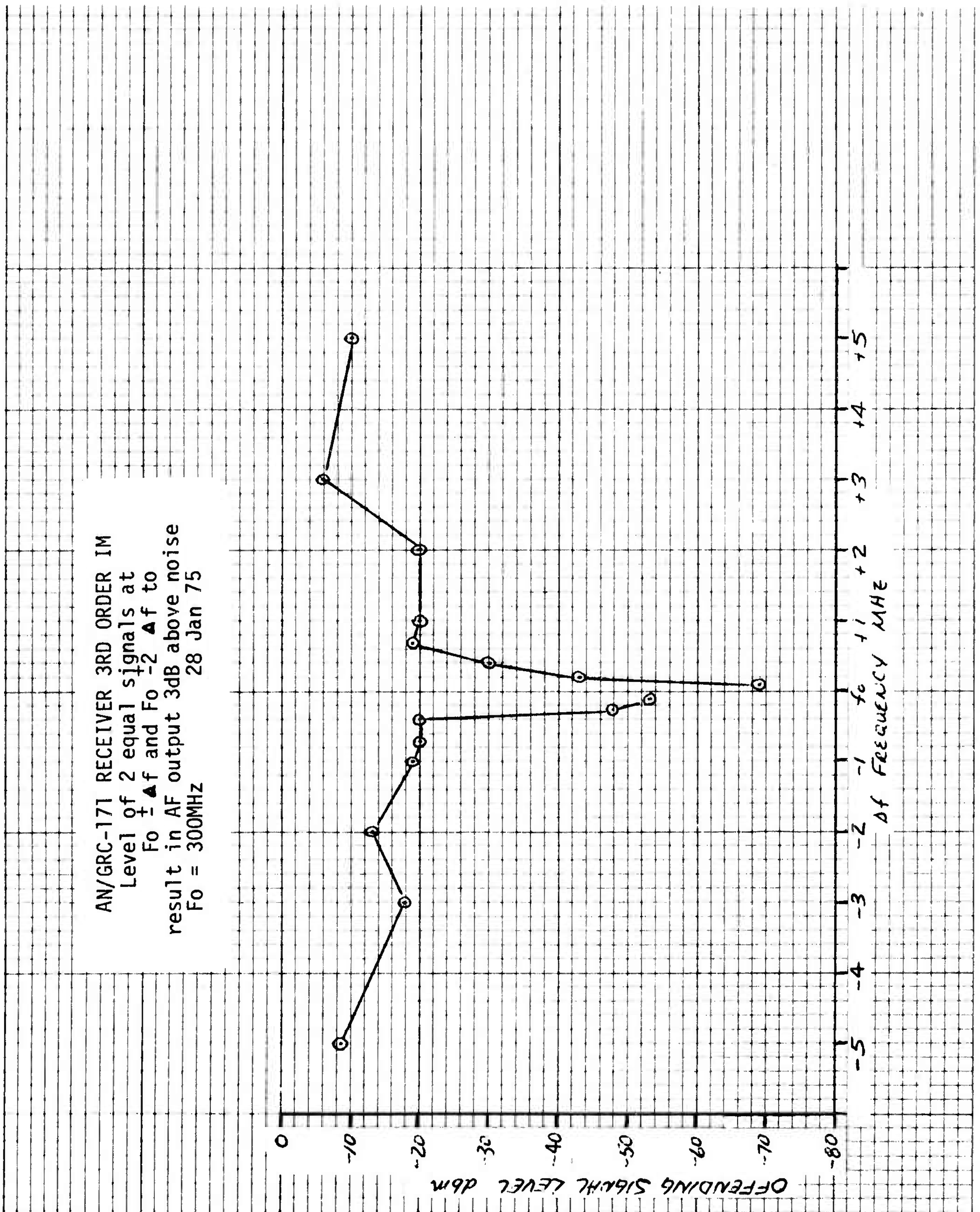


Figure 23

AN/GRC-171 Receiver Third Order IM Product Test



AN/GRC-171 RECEIVER 3RD ORDER IM
Level of 2 equal signals at
Fo ± Δf and Fo -2 Δf to
result in AF output 3dB above noise
Fo = 300MHz
28 Jan 75
0
-10
-20
-30
-40
-50
-60
-70
-80
OFFENDING SIGNAL LEVEL dbm
-5
-4
-3
-2
-1
fo
+1
+2
+3
+4
+5
Δf FREQUENCY MHz

Figure 24

RECEIVER INTERMOD. PP#2 28 JAN 75

RF INPUT = 3µV MODULATED 30% WITH 1000 HZ AUDIO OUT = 1mW S+N/N = 11:1

Fo (MHz)	Δf (MHz)	GEN 1 MOD 90%-1kHz (MHz)	GEN 2 UNMOD (MHz)	RF INPUT 3db above NOISE	
300	+0.1	300.1	300.2	-69.0	
	+0.2	300.2	300.4	-43.0	
	+0.4	300.4	300.8	-30.0	
	+0.7	300.7	301.4	-19.0	
	+1.0	301.0	302.0	-20.0	
	+2.0	302.0	304.0	-20.0	
	+3.0	303.0	306.0	-6.0	
	+5.0	305.0	310.0	-10.0	
	-0.1	299.9	299.8	-53.5	
	-0.2	299.8	299.6	-48.0	
	-0.4	299.6	299.2	-20.0	
	-0.7	299.3	298.6	-20.0	
	-1.0	299.0	298.0	-19.0	
	-2.0	298.0	296.0	-13.0	
	-3.0	297.0	294.0	-18.0	
300	-5.0	295.0	290.0	-8.5	

4.3.17 AN/GRC-171 Sensitivity and AGC Characteristics:

4.3.17.1 Procedure: A signal generator provided a modulated RF input to the AN/GRC-171 receiver. The squelch switch was left off and the headset audio output and the main audio output at J22 were adjusted to 0dBm with the RF input of -97.5dBm 30% modulated by 1000Hz. The RF input level was varied from -112.5dBm to 0dBm and measurements were made of the audio output signal-plus-noise, the output noise (RF modulation removed) and the AGC voltage. The test was run at 3 frequencies: 225, 300, and 399.975MHz.

4.3.17.2 Results: The results appear in the attached data sheets and have been graphed. As can be seen in the graphs, audio output was held well within 3dB over the entire range, and the output signal-plus-noise-to-noise ratio is acceptable at -97.5dBm (12dB) and improves significantly to a maximum of about 48dB when the RF carrier level is above -60dBm. The AGC voltage which was that measured at the front panel test jack, did not begin to rise significantly until the RF level was increased above -95dBm (4uv).

4.3.17.3 Conclusions: The results indicate that receiver sensitivity and AGC action are adequate. However, it is noted that the AGC cut in at the initial occurrence of RF input. It would be more ideal if the AGC did not start clamping until the -100dBm point and then rise more significantly thereafter. As it is, use of AGC voltage for an external indication of a received signal level around -97.5dBm (3uv) may present a problem due to the fact that the AGC voltage does not rise significantly until the RF level is more than -95dBm (4uv).

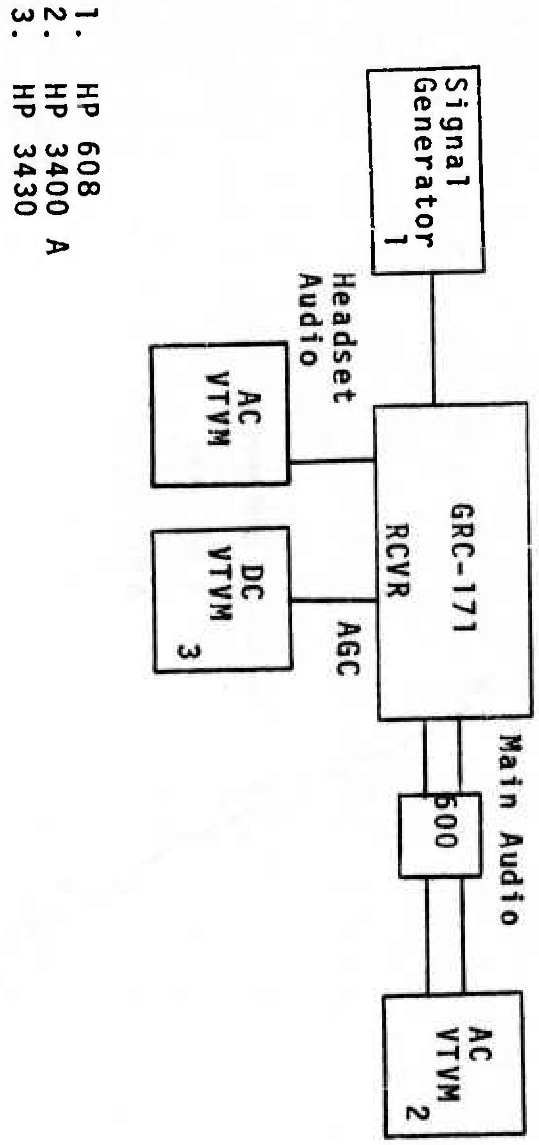


FIGURE 25

Receiver Sensitivity at High (S+N)/N and Various % Modulation

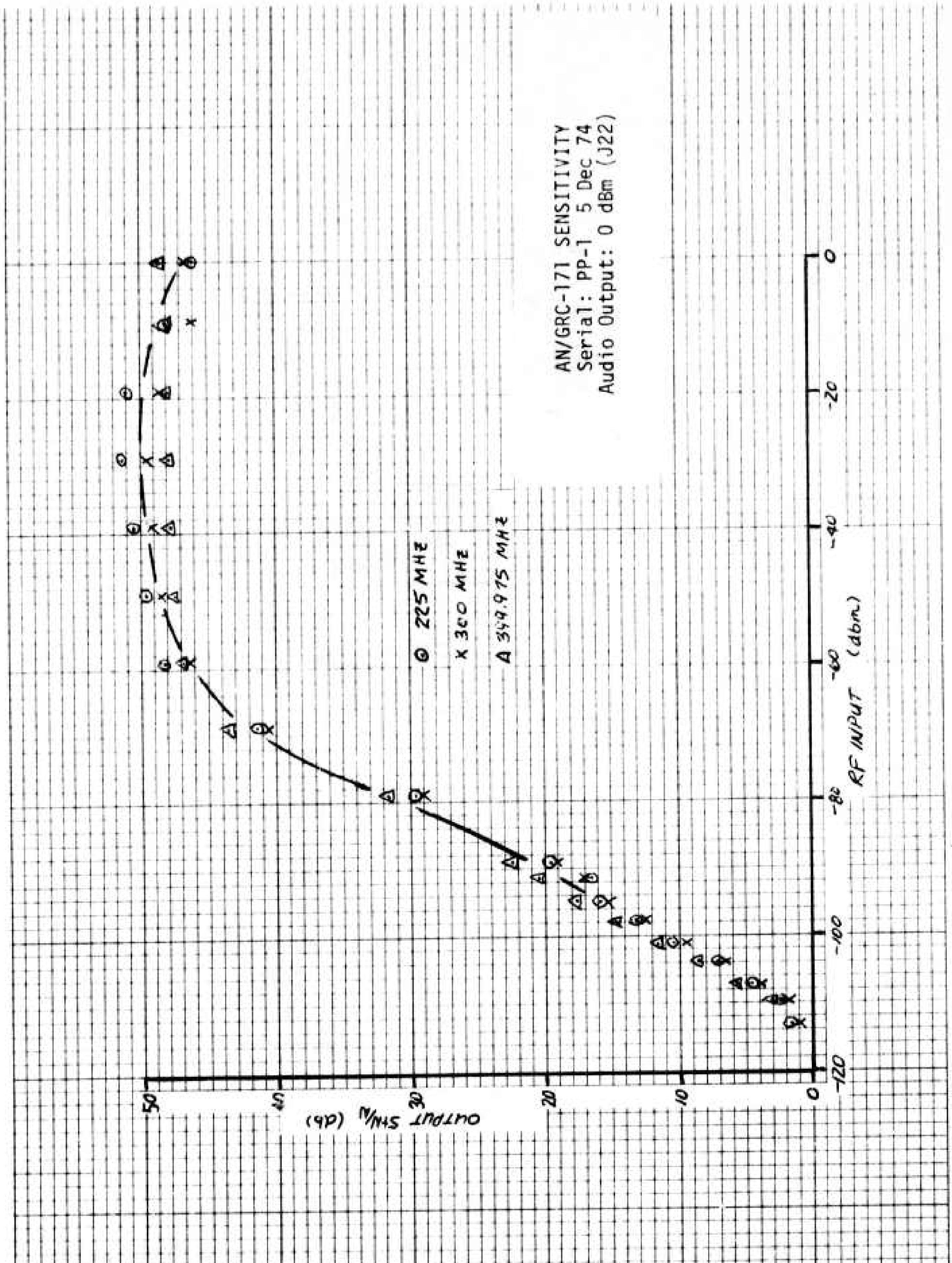

AN/GRC-171 SENSITIVITY
Serial: PP-1 5 Dec 74
Audio Output: 0 dBm (J22)
⊙ 225 MHz
X 300 MHz
Δ 349.975 MHz
RF INPUT (dbm)
OUTPUT S+N/N (db)
0
-20
-40
-60
-80
-100
-120
50
40
30
20
10
0

Figure 26

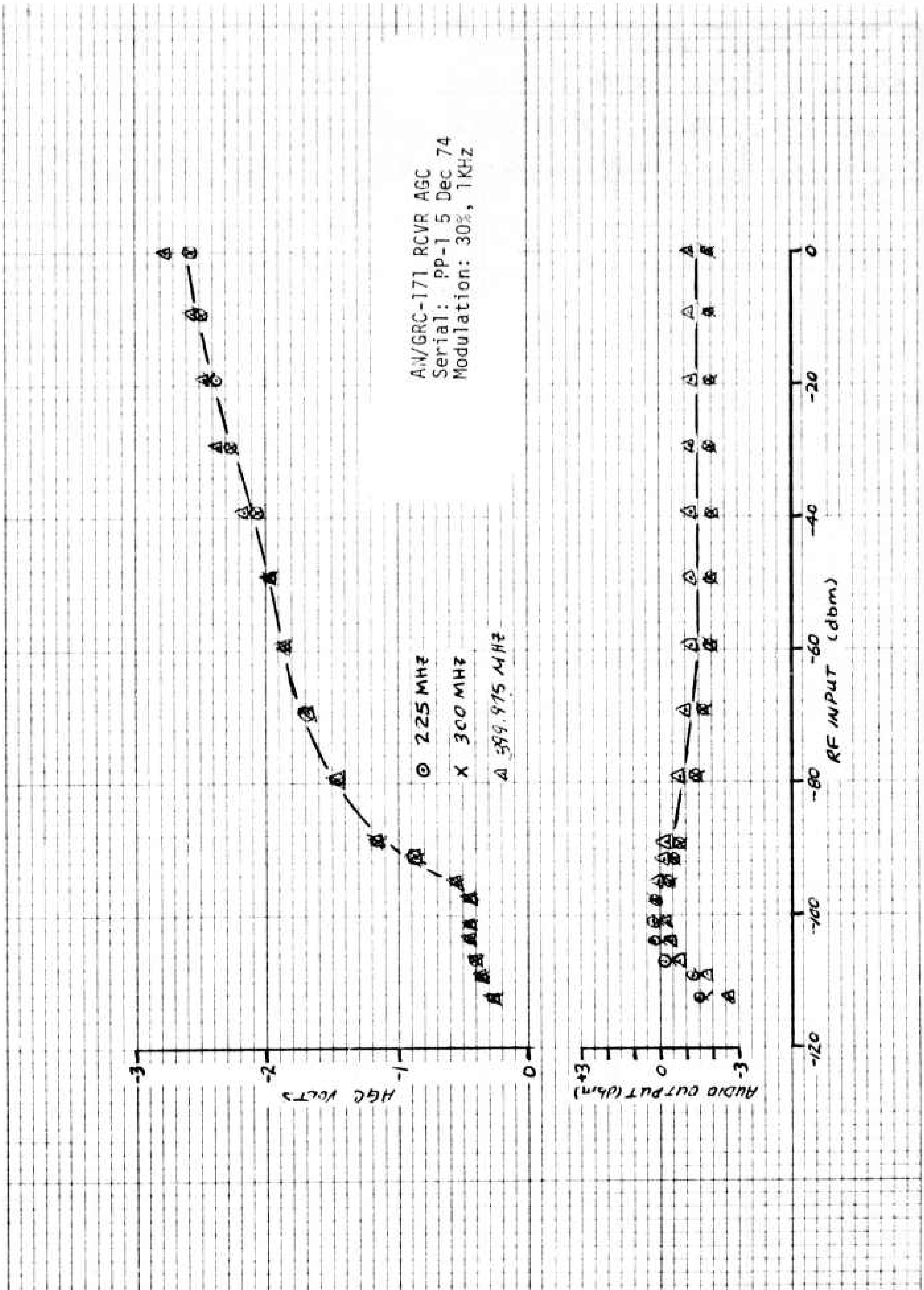

AN/GRC-171 RCVR AGC
Serial: PP-1 5 Dec 74
Modulation: 30%, 1KHz
⊙ 225 MHz
X 300 MHz
Δ 399.975 MHz
AGC VOLTS
-3
-2
-1
0
AUDIO OUTPUT (dbm)
+3
0
-3
RF INPUT (dbm)
-120
-100
-80
-60
-40
-20
0

Figure 27

SCREEN ROOM

RECEIVER SENSITIVITY TEST PPA1 4 DEC 74

FRONT PANEL AUDIO / PEAKED ON AGC VOLTS

RF INPUT (dbm)	% MODULATION	FREQ (MHz)	OUTPUT S+N (dbm)	OUTPUT NOISE (dbm)	S+N/N	AGC VOLTS
-112.5	30	225	-1.6	-2.7	1.4	0.32
-109.5	30	225	-1.2	-3.2	2.6	0.36
-106.5	30	225	-0.4	-5.0	4.2	0.39
-103.5	30	225	-0.2	-7.7	5.3	0.36
-100.5	30	225	-0.0	-10.1	8.6	0.46
-97.5	30	225	0.0	-12.7	12.7	0.48
-94.5	30	225	0.0	-15.6	15.6	0.50
-91.5	30	225	0.0	-18.1	18.1	0.82
-88.5	30	225	0.0	-20.3	20.3	1.10
-78.5	30	225	-0.4	-30.8	30.4	1.70
-68.5	30	225	-0.7	-42.2	41.5	1.60
-58.5	30	225	-0.7	-49.6	48.9	1.80
-48.5	30	225	-0.8	-52.2	51.4	1.90
-38.5	30	225	-0.8	-53.8	53.0	2.00
-28.5	30	225	-0.8	-54.5	53.7	2.20
-18.5	30	225	-0.8	-53.4	52.6	2.65
-8.5	30	225	-0.8	-50.4	49.6	2.40
+4.0	30	225	-1.0	-49.5	48.5	2.50
-112.5	30	300	-1.4	-2.3	1.0	0.33
-109.5	30	300	-1.3	-3.0	1.7	0.36
-106.5	30	300	-0.3	-4.2	3.9	0.39
-103.5	30	300	0.0	-6.5	6.4	0.42
-100.5	30	300	+0.1	-9.2	9.3	0.45
-97.5	30	300	0.0	-12.1	12.1	0.48
-94.5	30	300	+0.1	-14.8	14.9	0.50

SHEET # 2

SCREEN ROOM

RECEIVER SENSITIVITY TEST PP#1 4 DEC 74

FRONT PANEL AUDIO / PEAKED ON AGC VOLTS

RF INPUT (dbm)	% MODULATION	FREQ (MHz)	OUTPUT S+N (dbm)	OUTPUT NOISE (dbm)	S+N/N	AGC VOLTS
-91.5	30	300	0.0	-17.0	17.0	0.87
-88.5	30	300	+0.2	-19.3	19.5	1.2
-78.5	30	300	-0.3	-29.5	29.2	1.35
-68.5	30	300	-0.6	-40.5	39.9	1.60
-58.5	30	300	-0.7	-47.0	46.3	1.75
-48.5	30	300	-0.7	-51.4	50.7	1.85
-38.5	30	300	-0.7	-53.0	52.3	2.00
-28.5	30	300	-0.7	-53.5	52.8	2.18
-18.5	30	300	-0.7	-49.0	48.3	2.30
-8.5	30	300	-0.7	-48.0	47.3	2.39
+4.0	30	300	-0.8	-50.3	49.5	2.50
-112.5	30	399.975	-1.1	-2.3	1.2	-0.33
-109.5	30		-0.6	-3.2	2.6	-0.36
-106.5	30		0.0	-5.2	5.2	-0.40
-103.5	30		+0.1	-7.8	7.7	-0.43
-100.5	30		0.0	-10.5	10.5	-0.46
-97.5	30		0.0	-13.0	13.0	-0.48
-94.5	30		+0.1	-16.0	15.9	-0.51
-91.5	30		+0.1	-18.4	18.3	-0.87
-88.5	30		+0.1	-21.0	20.9	-1.10
-78.5	30		-0.1	-31.3	31.2	-1.40
-68.5	30		-0.2	-40.5	40.3	-1.65
-58.5	30		-0.3	-44.2	43.9	-1.75
-48.5	30	399.975	-0.3	-46.0	45.7	-1.80

SCREEN ROOM

SHEET #3

RECEIVER SENSITIVITY TEST PP#1 4 DEC 74

RF INPUT (dbm)	% MODULATION	FREQ (MHz)	OUTPUT S+N (dbm)	OUTPUT NOISE (dbm)	S+N/N	AGC VOLTS
-38.5	30	399.975	-0.4	-47.1	46.7	-2.05
-28.5	30		-0.4	-48.7	48.3	-2.25
-18.5	30		-0.4	-48.8	48.4	-2.35
-8.5	30		-0.4	-42.2	41.8	-2.45
+4.0	30	399.975	-0.5	-39.6	39.1	-2.80

AFCS FORM MAY 69 199 GENERAL PURPOSE FORM AFCS 38002/1062

SCREEN ROOM

RECEIVER SENSITIVITY TEST PP#1 5 DEC 74

AUDIO FROM REAR CONNECTOR J22 / PEAKED ON AGC VOLTS

RF INPUT (dbm)	% MODULATION	FREQ (MHz)	OUTPUT S+N (dbm)	OUTPUT NOISE (dbm)	S+N/N	AGC VOLTS
-112.5	30	225	-1.5	-3.2	1.7	-0.35
-109.5			-1.3	-3.5	2.2	-0.37
-106.5			-0.4	-4.9	4.5	-0.40
-103.5			+0.2	-7.2	7.0	-0.43
-100.5			+0.25	-10.0	10.25	-0.46
-97.5			0.0	-13.1	13.1	-0.49
-94.5			-0.3	-16.1	15.8	-0.51
-91.5			-0.6	-17.5	16.9	-0.82
-88.5			-0.9	-20.5	19.6	-1.11
-78.5			-1.5	-31.2	29.7	-1.42
-68.5			-1.8	-43.0	41.2	-1.68
-58.5			-1.9	-50.0	48.1	-1.84
-48.5			-1.9	-51.5	49.6	-1.94
-38.5			-1.9	-52.5	50.6	-2.07
-28.5			-1.9	-53.0	51.1	-2.25
-18.5			-2.0	-53.0	51.0	-2.39
-8.5			-2.0	-50.0	48.0	-2.48
0.0	30	225	-2.0	-48.0	46.0	-2.54

Screen Room

Receiver Sensitivity Test   PP#1   5 Dec 74

RF Input (dbm)	% Mod.	Freq (MHz)	Output S+N (dbm)	Output Noise (dbm)	S+N/N	AGC Volts
-112.5	30	300	-1.7	-3.0	1.3	-0.35
-109.5			-1.6	-3.4	1.8	-0.38
-106.5			-0.6	-4.5	3.9	-0.41
-103.5			-0.1	-6.9	6.8	-0.43
-100.5			+0.2	-9.5	9.3	-0.46
-97.5			0.0	-12.3	12.3	-0.5
-94.5			-0.2	-15.5	15.3	-0.52
-91.5			-0.6	-17.6	17.0	-0.87
-88.5			-0.8	-20.1	19.3	-1.17
-78.5			-1.6	-30.8	29.2	-1.45
-68.5			-1.9	-42.7	40.8	-1.71
-58.5			-2.0	-48.6	46.6	-1.85
-48.5			-2.0	-50.2	48.2	-1.94
-38.5			-2.0	-50.8	48.8	-2.08
-28.5			-2.0	-51.2	49.2	-2.27
-18.5			-2.0	-50.5	48.5	-2.41
-8.5			-2.0	-48.0	46.0	-2.49
0.0	30	300	-2.0	-48.7	46.7	-2.57

SCREEN ROOM

RECEIVER SENSITIVITY TEST PDA1 5 DEC 74

RF INPUT (dbm)	% MOD.	FREQ (MHz)	OUTPUT S+N (dbm)	OUTPUT NOISE (dbm)	S+N/N	AGC VOLTS
-112.5	30	399.975	-2.7	-4.5	1.8	-0.34
-109.5			-1.7	-4.7	3.0	-0.37
-106.5			-0.9	-6.6	5.7	-0.40
-103.5			-0.3	-9.1	8.8	-0.43
-100.5			-0.2	-11.7	11.5	-0.46
-97.5			0.0	-14.8	14.8	-0.49
-94.5			0.0	-17.8	17.8	-0.52
-91.5			-0.2	-20.4	20.2	-0.88
-88.5			-0.3	-22.9	22.6	-1.17
-78.5			-0.9	-34.8	33.9	-1.44
-68.5			-1.1	-44.4	43.3	-1.70
-58.5			-1.2	-47.8	46.6	-1.84
-48.5			-1.3	-48.7	47.4	-1.96
-38.5			-1.3	-49.0	47.7	-2.15
-28.5			-1.3	-49.1	47.8	-2.34
-18.5			-1.3	-49.2	47.9	-2.45
-8.5			-1.3	-49.3	48.0	-2.54
0.0	30	399.975	-1.4	-49.5	48.1	-2.78

IN RACK

RECEIVER SENSITIVITY AND AGC CHARACTERISTICS - 225 MHz PP#1

SIGNAL AND NOISE MEASURED AT HEADSET AUDIO AND VERIFIED AT MAIN AUDIO

INPUT LEVEL (dbm)	S+N (dbm)	NOISE (dbm)	S+N/N	AGC (Vdc)	% MODULATION	MODULATING FREQ (Hz)
-97.5	0	-12	12	-.49	30	1000
-94	0	-15	15	-.52	30	1000
-84	0	-20	20	-1.11	30	1000
-79.5	0	-25	25	-1.28	30	1000
-97.5	+3.0	-11.5	14.5	-.49	50	1000
-94	+2.5	-15	17.5	-.52	50	1000
-84	+2	-20	22	-1.15	50	1000
-80	+1.5	-25	26.5	-1.29	50	1000
-97.5	+2	-12	14	-.49	80	1000
-94	+1.9	-15	16.9	-.52	80	1000
-84	+1.5	-20	21.5	-1.16	80	1000
-80	+1.2	-25	26.2	-1.29	80	1000
-97.5	+1.7	-13	14.7	-.50	90	1000
-94	+1.6	-15	16.6	-.52	90	1000
-85	+1.4	-20	21.4	-1.14	90	1000
-80	+1.2	-25	26.2	-1.29	90	1000

REFERENCE LEVEL SET AT -97.5 dbm INPUT, 30% MODULATION WITH A 1000 Hz MODULATING FREQUENCY

IN RACK

RECEIVER SENSITIVITY AND AGC CHARACTERISTIC - 300 MHz PP#1

SIGNAL AND NOISE MEASURED AT HEADSET AUDIO AND VERIFIED AT MAIN AUDIO

INPUT LEVEL (dbm)	S+N (dbm)	NOISE (dbm)	S+N/N	AGC (Vdc)	% MODULATION	MODULATING FREQ (HZ)
-97.5	0	-12	12	-.50	30	1000
-94	0	-15	15	-.60	30	1000
-85	0	-20	20	-1.20	30	1000
-80	0	-25	25	-1.32	30	1000
-97.5	+2.5	-12	14.5	-.50	50	1000
-94	+2.2	-15	17.2	-.61	50	1000
-84	+1.6	-20	21.6	-1.23	50	1000
-80	+1.4	-25	26.4	-1.34	50	1000
-97.5	+2	-12	14	-.50	80	1000
-94	+1.6	-15	16.6	-.54	80	1000
-83	+1.3	-20	21.3	-1.23	80	1000
-79	+1.0	-25	26	-1.35	80	1000
-97.5	+1.4	-12	13.4	-.50	90	1000
-93	+1.0	-15	16.0	-.70	90	1000
-85	+1.0	-20	21	-1.18	90	1000
-80	+1.0	-25	26	-1.33	90	1000

REFERENCE SET AT -97.5dbm INPUT, 30% MODULATION WITH A 1000 Hz MODULATING FREQUENCY

IN RACK

RECEIVER SENSITIVITY AND AGC CHARACTERISTICS -399.975 MHz PP#1

SIGNAL AND NOISE MEASURED AT HEADSET AUDIO AND VERIFIED AT MAIN AUDIO

INPUT LEVEL (dbm)	S+N (dbm)	Noise (dbm)	S+N/N	AGC (Vdc)	% MODULATION	MODULATING FREQ (Hz)
-97.5	0	-13	13	-.46	30	1000
-95.1	0	-15	15	-.53	30	1000
-85	+.1	-20	20.1	-1.13	30	1000
-80.1	+.25	-25	25.25	-1.25	30	1000
-97.5	+3	-13.2	16.2	-.47	50	1000
-95.8	+2.8	-15	17.8	-.49	50	1000
-85.1	+2.1	-20	22.1	-1.12	50	1000
-80.5	+1.8	-25	26.8	-1.24	50	1000
-97.5	2.5	-13.2	15.7	-.48	80	1000
-95.6	2.4	-15	17.4	-.49	80	1000
-85.1	2.0	-20	22	-1.13	80	1000
-80.4	1.8	-25	26.8	-1.25	80	1000
-97.5	2.2	-13.3	15.5	-.48	90	1000
-95.5	2.2	-15	17.2	-.49	90	1000
-85.1	2.0	-20	22	-1.12	90	1000
-80.9	1.8	-25	26.8	-1.24	90	1000

REFERENCE SET AT -97.5 dbm INPUT, 30% MODULATION WITH A 1000 Hz MODULATING FREQUENCY

N RACK

RECEIVER SENSITIVITY AND AGC CHARACTERISTICS - 225 MHz PP#2

SIGNAL AND NOISE MEASURED AT HEADSET AUDIO AND VERIFIED AT MAIN AUDIO

INPUT LEVEL (dbm)	S+N (dbm)	Noise (dbm)	S+N/N	AGC (Vdc)	% Modulation	MODULATING FREQ (HZ)
-97.5	0	-10	10	-.47	30	1000
-92.5	0	-15	15	-.51	30	1000
-82	0	-20	20	-.91	30	1000
-75	0	-25	25	-1.21	30	1000
-97.5	+.5	-10.5	11	-.47	50	1000
-92.5	+.6	-15	15.6	-.51	50	1000
-82.5	+.6	-20	20.6	-.89	50	1000
-75	+.6	-25	25.6	-1.21	50	1000
-97.5	1.2	-10.5	11.7	-.47	80	1000
-92	1.2	-15	16.2	-.51	80	1000
-81.5	1.2	-20	21.2	-.93	80	1000
-75	1.2	-25	26.2	-1.22	80	1000
-97.5	1.8	-10.5	12.3	-.47	90	1000
-92	1.8	-15	16.8	-.51	90	1000
-81.5	1.8	-20	21.8	-.92	90	1000
-75	1.8	-25	26.8	-1.22	90	1000

REFERENCE SET AT -97.5 dbm INPUT, 30% MODULATION WITH A 1000 HZ MODULATING FREQUENCY

IN RACK

RECEIVER SENSITIVITY AND AGC CHARACTERISTICS - 300 MHz PP#2

SIGNAL AND NOISE MEASURED AT HEADSET AUDIO AND VERIFIED AT MAIN AUDIO

INPUT LEVEL (dbm)	S+N (dbm)	NOISE (dbm)	S+N/N	AGC (Vdc)	% MODULATION	MODULATING FREQ (Hz)
-97.5	0	-10.5	10.5	-.45	30	1000
-93	0	-15	15	-.49	30	1000
-86	0	-20	20	-.81	30	1000
-77	+.4	-25	25.4	-1.23	30	1000
-97.5	0	-12.5	12.5	-.46	50	1000
-93	0	-15	15	-.49	50	1000
-87	0	-20	20	-.81	50	1000
-79	0	-25	25	-1.21	50	1000
-97.5	0	-11.8	11.8	-.47	80	1000
-94	0	-15	15	-.50	80	1000
-89	0	-20	20	-.60	80	1000
-79	0	-25	25	-1.19	80	1000
-97.5	0	-12	12	-.47	90	1000
-94	0	-15	15	-.50	90	1000
-89	0	-20	20	-.59	90	1000
-79	0	-25	25	-1.19	90	1000

REFERENCE SET AT -97.5 dbm INPUT, 30% MODULATION WITH A 1000 Hz MODULATING FREQUENCY

IN RACK

RECEIVER SENSITIVITY AND AGC CHARACTERISTICS - 399.975 MHz PP#2

SIGNAL AND NOISE MEASURED AT HEADSET AUDIO AND VERIFIED AT MAIN AUDIO

INPUT LEVEL (dbm)	S+N (dbm)	NOISE (dbm)	S+N/N	AGC (V dc)	% MODULATION	MODULATING FREQ (Hz)
-97.5	0	-11	+11	-.47	30	1000
-93.5	0	-15	15	-.50	30	1000
-83.5	0	-20	20	-.83	30	1000
-74	0	-25	25	-1.21	30	1000
-97.5	.6	-11	11.6	-.48	50	1000
-93	.6	-15	15.6	-.51	50	1000
-82.5	.6	-20	20.6	-.86	50	1000
-74	.6	-25	25.6	-1.21	50	1000
-97.5	.8	-11.3	12.1	-.48	80	1000
-93	.8	-15	15.8	-.51	80	1000
-82	.8	-20	20.8	-.89	80	1000
-74	.8	-25	25.8	-1.21	80	1000
-97.5	+1	-11	12	-.47	90	1000
-93.5	+1	-15	16	-.51	90	1000
-82.5	+1	-20	21	-.86	90	1000
-74	+1	-25	26	-1.21	90	1000

REFERENCE SET AT -97.5 dbm INPUT, 30% MODULATION WITH A 1000 Hz MODULATING FREQUENCY

4.3.18 AN/GRC-171 Low Level Audio Tests.

4.3.18.1 Procedure: The receiver audio output at J22 was adjusted to 0 dBm with an RF input of 3 microvolts on 300 MHz, 30% modulated by 1000 Hz. In the first test, the audio modulating frequency was varied from 100 Hz to 10,000 Hz and output signal plus noise was measured. In the second test, the per cent modulation was varied and output signal plus noise and noise alone were measured. This test was performed at 3 carrier levels, 3, 10, and 20 uv. In the third test, the load resistor was varied and the audio output signal plus noise was measured.

4.3.18.2 Results: The results appear in the attached data sheets and have been graphed. The first test checked the narrow band AF response and established that the 3 dB audio bandwidth is 210 - 3500 Hz. The second test checked the audio levelling and established that above 30% modulation the output is held constant. All readings except one were within ± 0.5 dB of 0 dBm and that reading was +1.2 dB. Two readings were taken below 30% modulation (10% and 20% with a 10 microvolt carrier). This showed that, below 30% modulation, output falls off rapidly. The signal plus noise to noise ratio appears to remain constant above 30% modulation at whatever ratio is obtained at 30%. In the third test, the load resistor was reduced from 600 ohms to 300 and then to 120 ohms. The output fell by 0.4 and 1.6 dB respectively.

4.3.18.3 Conclusions: The AN/GRC-171 low level audio response, levelling and regulation appear to be adequate. The effect of audio levelling on output (S+N)/N appears to be due to the following: The leveling circuit works on the signal peaks but is not active when the input to the audio amplifier is noise alone, since the noise voltage is lower than the signal voltage. Therefore, both the signal-plus-noise and noise alone remain constant for all values of per cent modulation above 30%. Actually, the output noise present along with the signal should decrease when signal gain is decreased, giving an improved (S+N)/N during signal reception.

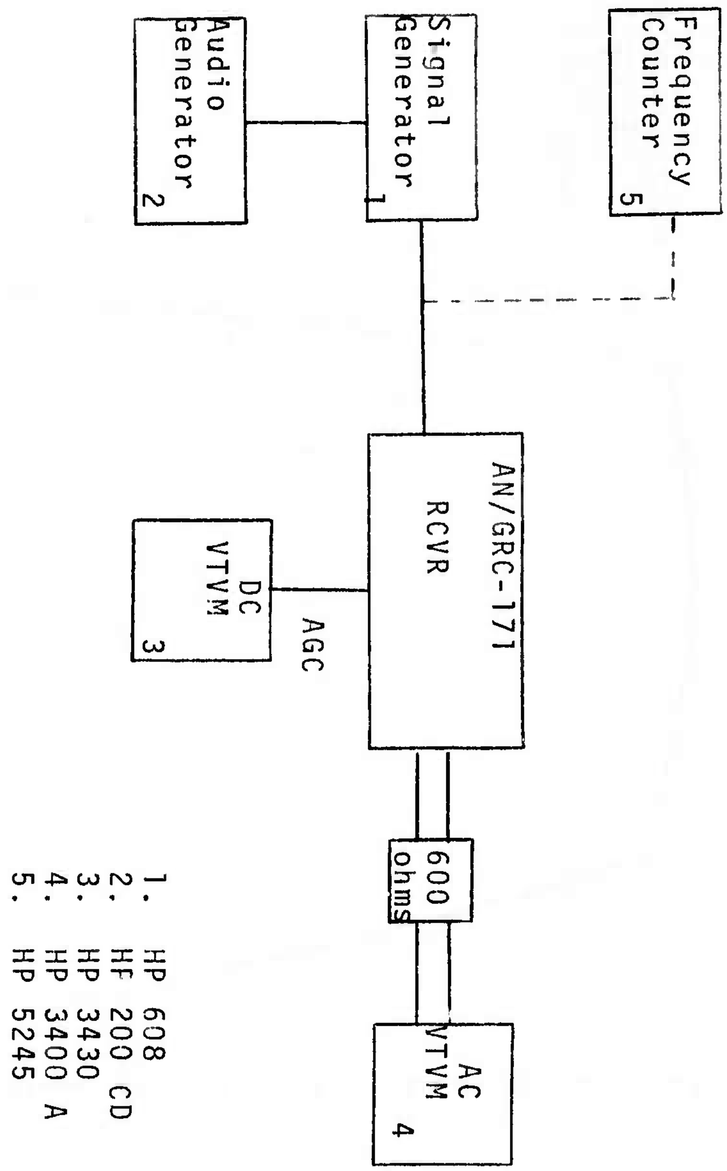


FIGURE 28

Receiver Low Level Audio Test

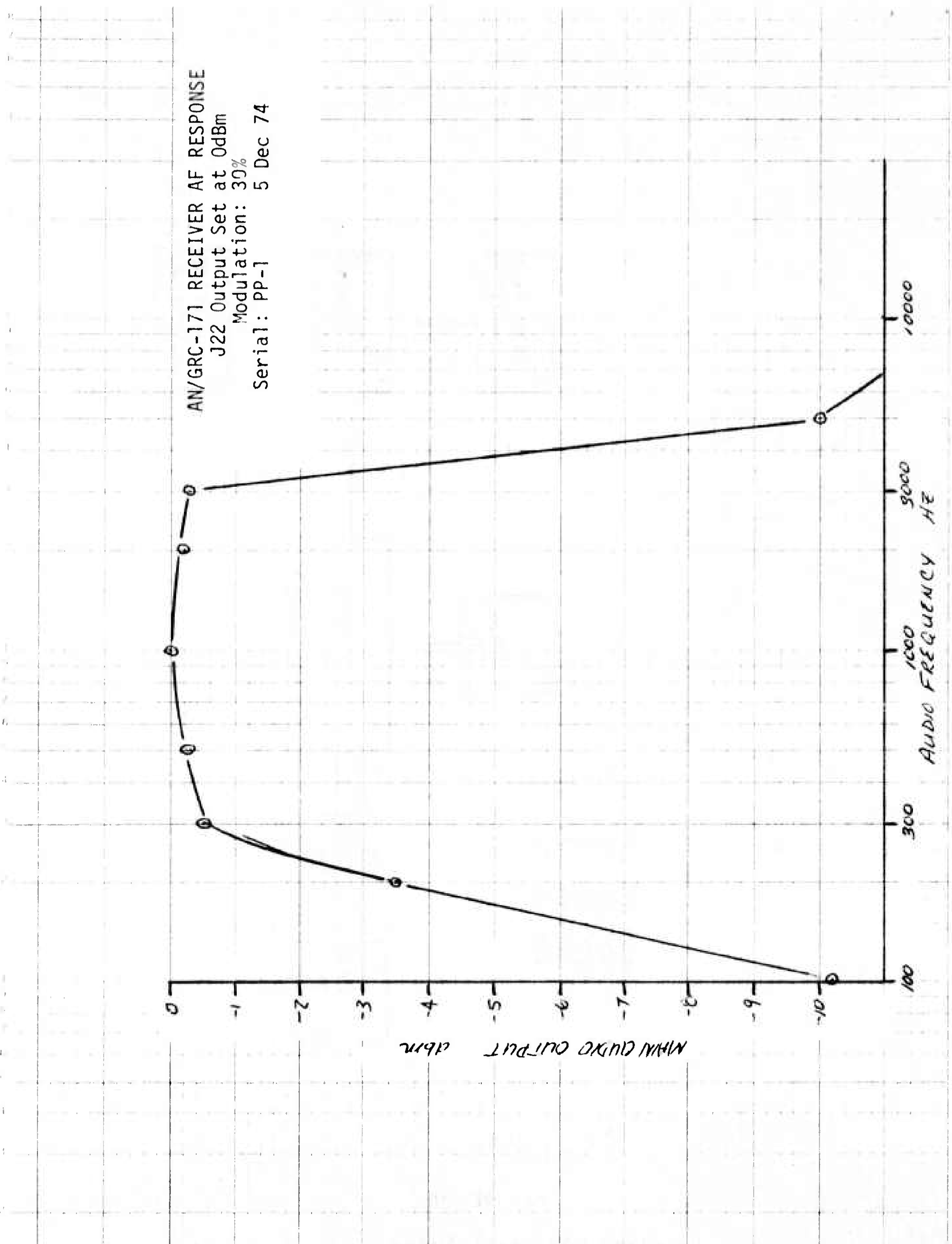

AN/GRC-171 RECEIVER AF RESPONSE
J22 Output Set at OdBm
Modulation: 30%
Serial: PP-1 5 Dec 74
AUDIO FREQUENCY HZ
100
300
1000
3000
10000
MAIN AUDIO OUTPUT dbm
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10

Figure 29

AN/GRC-171 RCVR AUDIO LEVELING
J22 Output Set at 0 dBm
with 3uv 30% mod. RF (300MHz)
Serial: PP-1
5 Dec 1974

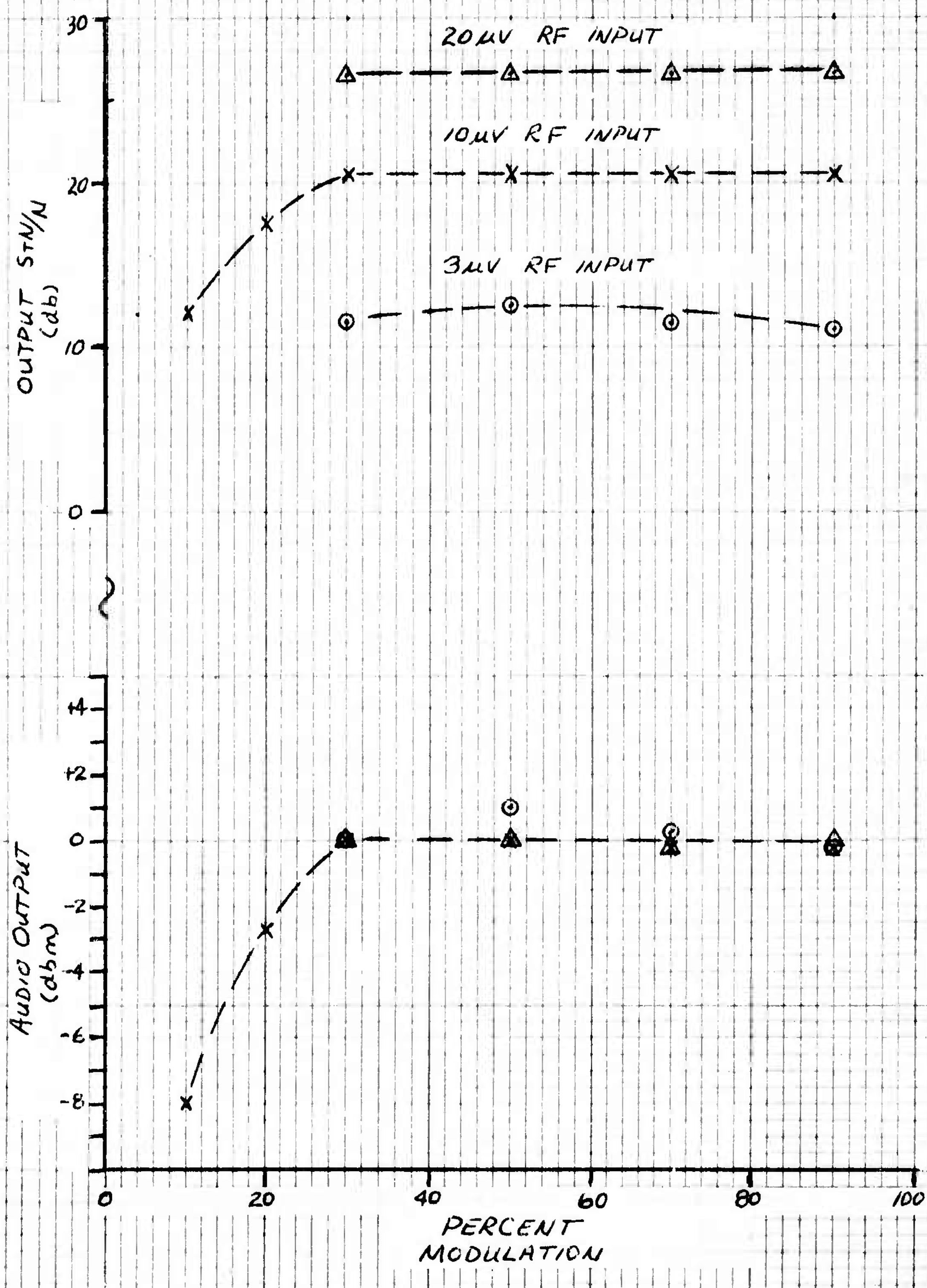


Figure 30

SCREEN ROOM

RECEIVER LOW-LEVEL AUDIO TEST PP#1 5 DEC 74

RF = 300 MHz, 3uV, 30% MOD BY 1 KHz to GET 0dbm AF OUTPUT

AUDIO FREQ (HZ)	MAIN AUDIO OUTPUT (dbm)	% MOD	LOAD (OHMS)	NOISE (db)	S+N/N
1000	0	30	600		
100	-10.2				
200	-3.5				
300	-0.5				
500	+0.25				
1000	0.0				
2000	-0.2				
3000	-0.3				
5000	-10.0				
10000	-12.2	30	600		
1000	0	30	600	-11.3	11.3
1000	+1.0	50	600	-11.2	12 [illegible]
1000	0.0	70	600	-11.3	11.3
1000	-0.4	90	600	-11.3	10.9
1000	0	30	600		
1000	-0.4	30	300		
1000	-1.6	30	120		

SCREEN ROOM
RECEIVER LOW-LEVEL AUDIO TEST PP#1 5 DEC 74

RF INPUT LEVEL	MOD (%)	MAIN AUDIO OUT (dbm)	NOISE OUT (dbm)	S+N/N	
3 µV	30	0.0	-11.2	11.2	
	50	+1.1	-11.2	12.3	
	70	+0.2	-11.2	11.4	
	90	-0.2	-11.2	11.0	
10 µV	10	-8.0	-20.0	12.0	
	20	-2.7	-20.0	17.3	
	30	0.0	-20.0	20.0	
	50	0.0	-20.5	20.5	
	70	-0.1	-20.5	20.4	
	90	-0.2	-20.5	20.3	
20 µV	30	0.0	-26.5	26.5	
	50	0.0	-26.5	26.5	
	70	-0.1	-26.5	26.4	
	90	0.0	-26.5	26.5	

(1)

IN-RACK
RECEIVER LOW-LEVEL AUDIO TEST PP#1

INPUT LEVEL	FREQ (MHz)	OUTPUT (db)	% MODULATION	MODULATING FREQ (Hz)	RESISTIVE LOAD (Ω)
3µV	300	0	30%	1000	600
3µV	300	-.2	30	2000	600
3µV	300	-.25	30	3000	600
3µV	300	-10.2	30	5000	600
3µV	300	-11.9	30	10000	600
3µV	300	-.5	30	300	600
3µV	300	-10	30	100	600
3µV	300	+2.8	50	1000	600
3µV	300	+2.6	50	2000	600
3µV	300	+2.6	50	3000	600
3µV	300	+1.2	50	5000	600
3µV	300	-9	50	10000	600
3µV	300	+2.5	50	300	600
3µV	300	-8	50	100	600
3µV	300	+2.2	70	1000	600
3µV	300	+2.0	70	2000	600
3µV	300	+2.1	70	3000	600
3µV	300	-9.5	70	5000	600
3µV	300	-12	70	10000	600
3µV	300	+2	70	300	600
3µV	300	-7.5	70	100	600

(21)

IN RACK

RECEIVER LOW-LEVEL AUDIO TEST

PP #1

INPUT LEVEL	FREQ (MHz)	OUTPUT (db)	% MODULATION	MODULATING FREQ (Hz)	RESISTIVE LOAD (Ω)
3 μV	300	+1.5	90	1000	600
3 μV	300	+1.3	90	2000	600
3 μV	300	+1.5	90	3000	600
3 μV	300	-10.5	90	5000	600
3 μV	300	-12.7	90	10000	600
3 μV	300	+1.4	90	300	600
3 μV	300	-7.3	90	100	600
LOAD VARIED { 3 μV	300	-.5	30	1000	300
3 μV	300	-2	30	1000	120

(1)

IN RACK

RECEIVER LOW-LEVEL AUDIO TEST

PP#2

INPUT LEVEL	FREQ (MHz)	OUTPUT (db)	% MODULATION	MODULATING FREQ (Hz)	RESISTIVE LOAD (Ω)
3µV	300	0	30	1000	600
3µV	300	-.3	30	2000	600
3µV	300	-.9	30	3000	600
3µV	300	-10.5	30	5000	600
3µV	300	-11.5	30	10 000	600
3µV	300	-.7	30	300	600
3µV	300	-10	30	100	600
3µV	300	+.5	50	1000	600
3µV	300	+.4	50	2000	600
3µV	300	+.5	50	3000	600
3µV	300	-10.8	50	5000	600
3µV	300	-13.8	50	10000	600
3µV	300	-.1	50	300	600
3µV	300	-10.7	50	100	600
3µV	300	+.6	70	1000	600
3µV	300	+.4	70	2000	600
3µV	300	+.5	70	3000	600
3µV	300	-11.4	70	5000	600
3µV	300	-16.3	70	10 000	600
3µV	300	0	70	300	600
3µV	300	-11.5	70	100	600

(2)

IN RACK

RECEIVER LOW-LEVEL AUDIO TEST

PP#2

INPUT LEVEL	FREQ (MHz)	OUTPUT (db)	% MODULATION	MODULATING FREQ (Hz)	RESISTIVE LOAD (Ω)
3μV	300	+1	90	1000	600
3μV	300	+.8	90	2000	600
3μV	300	+.8	90	3000	600
3μV	300	-11.3	90	5000	600
3μV	300	-18.5	90	10000	600
3μV	300	+.3	90	300	600
3μV	300	-11.5	90	100	600
3μV	300	-1.8	30	1000	120
3μV	300	-.8	30	1000	240

4.3.19 AN/GRC-171 Wide Band Audio Response:

4.3.19.1 Procedure: The receiver was modified by substituting first the 30 KHz IF filter, and then the 10 KHz IF filter, for the standard 18 KHz IF filter. The audio output was measured at J22 pins L and M across a 10 K ohm load resistor. RF input was 3 uv on 300 MHz, 30% modulated by an audio signal varied in frequency from 16 Hz to 25 KHz. Additional tests were made with 500 uv RF input. Output level and (S+N)/N were noted.

4.3.19.2 Results: The results appear in the attached data sheets and are graphed. The 30 KHz IF filter yielded a 16 Hz to 25 KHz 1 dB bandwidth and a 3 dB (S+N)/N ratio. The 10 KHz IF filter yielded a 16 Hz to 7 KHz 1 dB bandwidth and an 8 dB (S+N)/N ratio.

4.3.19.3 Conclusions: The bandwidth of the 30 KHz IF filter is adequate for the cipher data signal. However, the low (S+N)/N could cause an increase in error rate at low RF levels. The (S+N)/N improved significantly with a 500 uv input (34 dB). The (S+N)/N of 8 db for the 10 KHz IF filters should help keep error rate low. However, the bandwidth of this filter appears inadequate for the baseband signal. This filter should be looked at carefully before being procured.

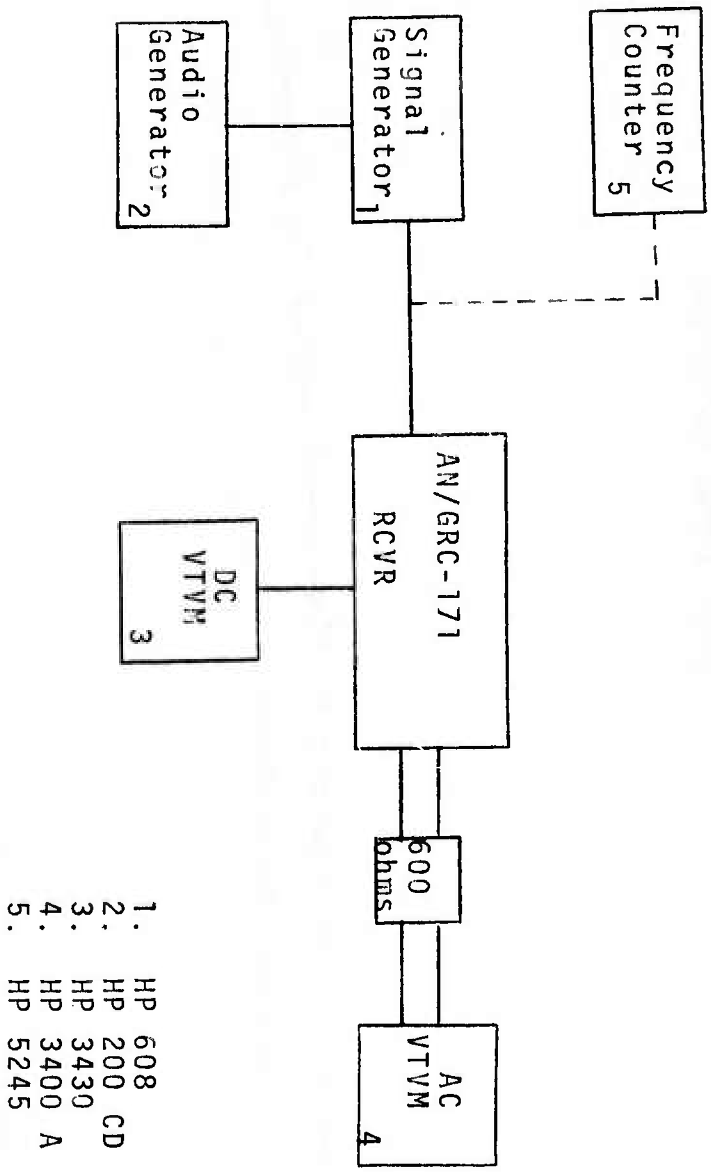


FIGURE 31

Wide Band Audio Response

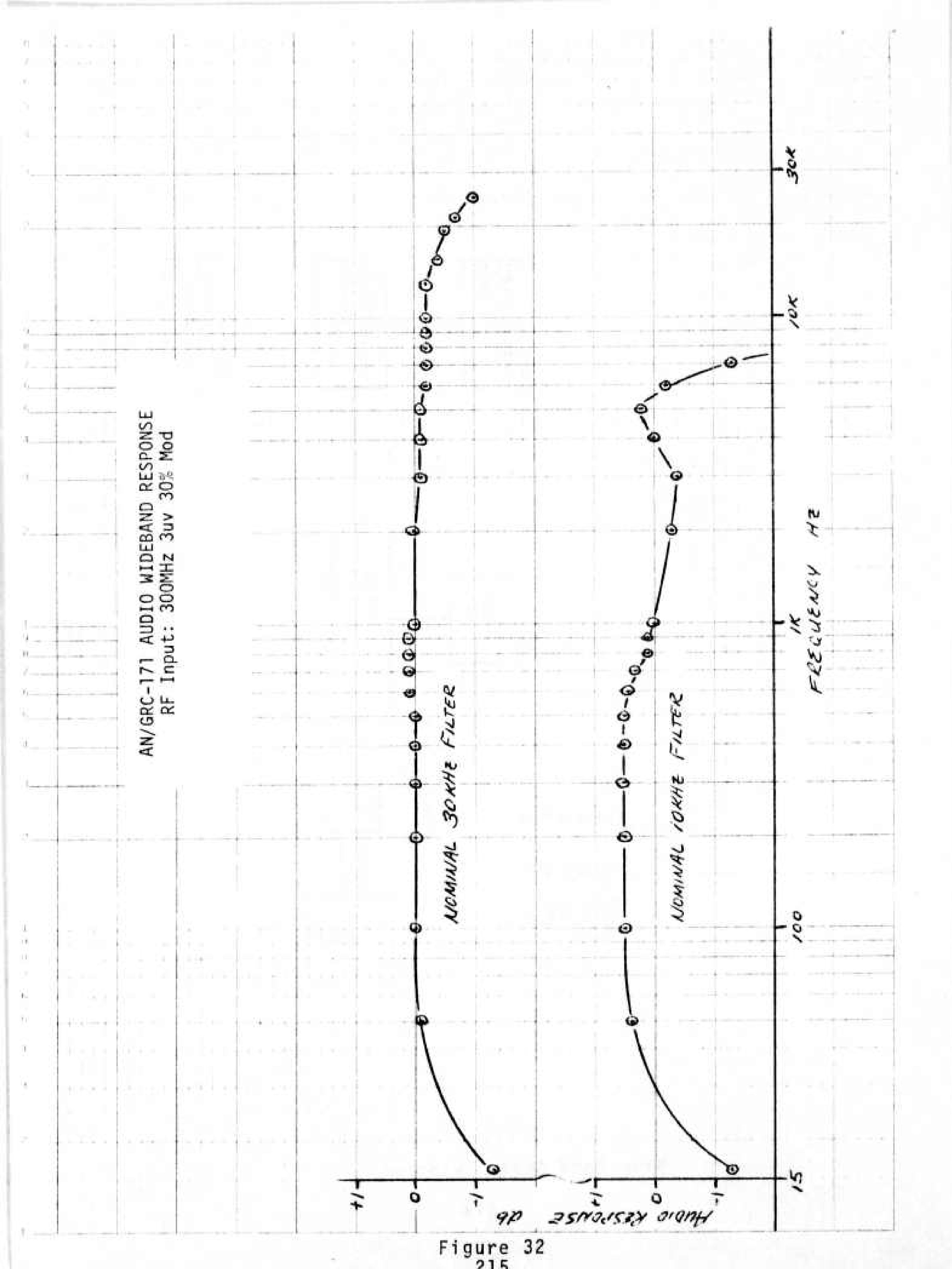
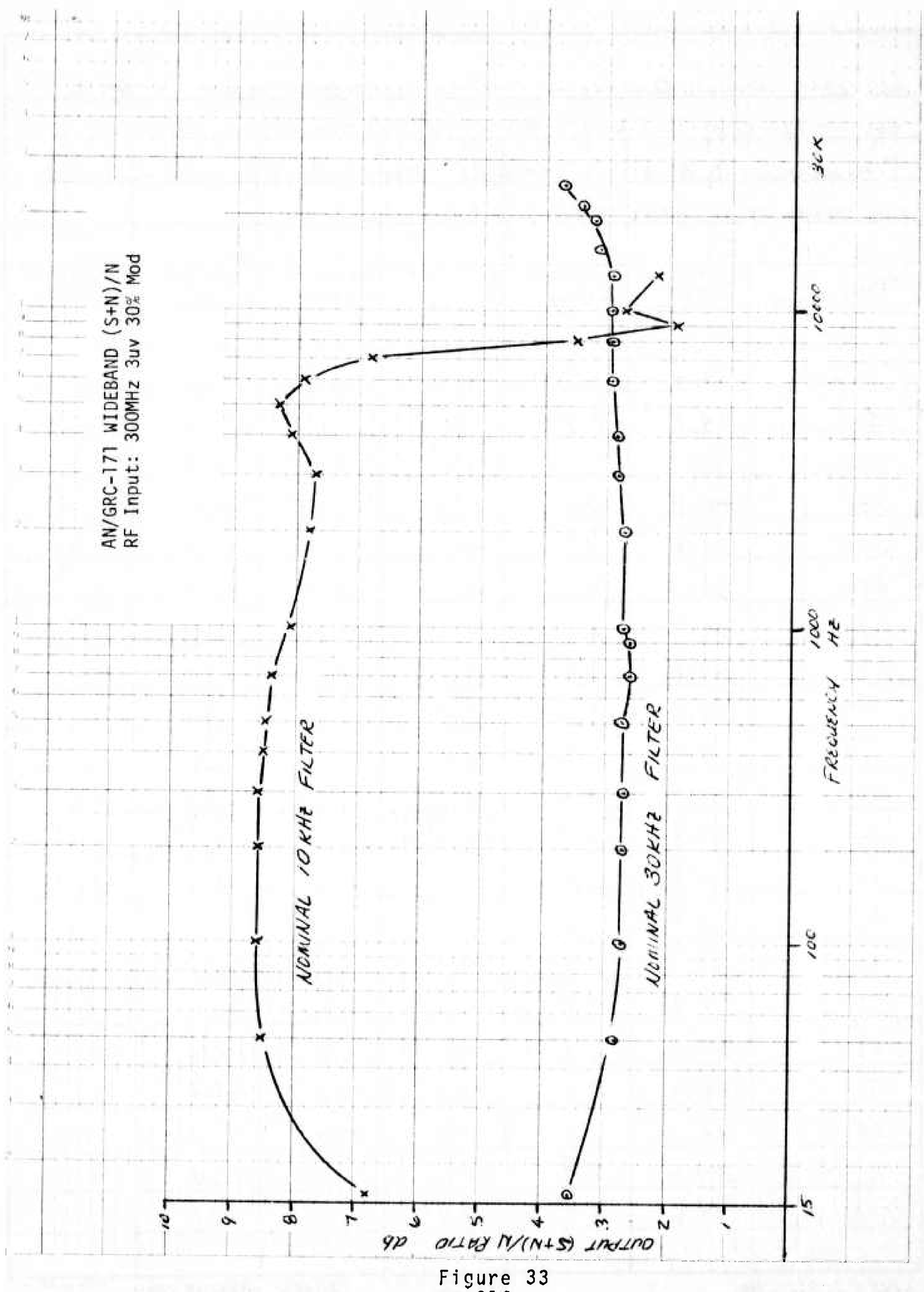

AN/GRC-171 AUDIO WIDEBAND RESPONSE
RF Input: 300MHz 3uv 30% Mod
NOMINAL 30KHz FILTER
NOMINAL 10KHz FILTER
FREQUENCY HZ
AUDIO RESPONSE db
15
100
1K
10K
30K
+1
0
-1
+1
0
-1

Figure 32



AN/GRC-171 WIDEBAND (S+N)/N
RF Input: 300MHz 3uv 30% Mod
NOMINAL 10KHz FILTER
NOMINAL 30KHz FILTER
OUTPUT (S+N)/N RATIO db
10
9
8
7
6
5
4
3
2
1
15
100
1000
10000
30K
FREQUENCY Hz

Figure 33

WIDEBAND FREQUENCY RESPONSE   PP#2 WIDEBAND FILTER   21 JAN 75

AGC AT LOW RF LEVEL (3uV) = -0.50V / AGC AT HIGH RF LEVEL (500uV) = -1.72V

% MODULATION = 30% ACROSS 10K OHMS / HIGH SIGNAL LEVEL NOISE LEVEL = -34.7db

LOW SIGNAL LEVEL NOISE LEVEL = -3.8db

AUDIO FREQUENCY	HIGH LEVEL S+N/N	LOW LEVEL S+N/N	RCVR OUT AT 3 µV	DEVIATION FROM REF.	RCVR OUT AT 500µV	DEVIATION FROM REF.
16 Hz	33.3	3.6	-0.2	-1.3	-1.4	-1.8
50	34.2	2.8	+1.0	-0.1	+0.5	+0.1
100	34.3	2.7	+1.1	0.0	+0.4	0.0
200	34.3	2.7	+1.1	0.0	+0.4	0.0
300	34.3	2.7	+1.1	0.0	+0.4	0.0
400	34.3	2.7	+1.1	0.0	+0.4	0.0
500	34.3	2.7	+1.1	0.0	+0.4	0.0
600	34.4	2.6	+1.2	+0.1	+0.3	-0.1
700	34.3	2.6	+1.2	+0.1	+0.4	0.0
800	34.4	2.6	+1.2	+0.1	+0.3	-0.1
900	34.4	2.6	+1.2	+0.1	+0.3	-0.1
1K	34.3	2.7	+1.1 REF LEVEL	0.0	+0.4 REF LEVEL	0.0
2K	34.4	2.7	+1.1	0.0	+0.3	-0.1
3K	34.4	2.8	+1.0	-0.1	+0.3	-0.1
4K	34.4	2.8	+1.0	-0.1	+0.3	-0.1
5K	34.4	2.8	+1.0	-0.1	+0.3	-0.1
6K	34.4	2.9	+0.9	-0.2	+0.3	-0.1
7K	34.3	2.9	+0.9	-0.2	+0.4	0.0
8K	34.6	2.9	+0.9	-0.2	+0.1	-0.3
9K	34.6	2.9	+0.9	-0.2	+0.1	-0.3
10K	34.6	2.9	+0.9	-0.2	+0.1	-0.3

SHEET #2

WIDEBAND FREQUENCY RESPONSE   TP#2 WIDEBAND FILTER   21 JAN 75

AUDIO FREQUENCY	HIGH LEVEL S+N/N	LOW LEVEL S+N/N	RCVR OUT AT 3µV	DEVIATION FROM REF.	RCVR OUT AT 500µV	DEVIATION FROM REF.
13K Hz	34.1	2.9	+0.9	-0.2	0.0	-0.4
16K	34.3	3.1	+0.1	-0.4	-0.4	-0.8
19K	34.1	3.2	+0.6	-0.5	-0.6	-1.0
22K	34.0	3.4	+0.4	-0.7	-0.7	-1.1
25K	33.5	3.7	+0.1	-1.0	-1.2	-1.6

WIDEBAND FREQUENCY RESPONSE   PP#2 NARROWBAND FILTER   23 JAN 75

AGC AT LOW RF LEVEL (3µV) = -.52V / AGC AT HIGH RF LEVEL (500µV) = -1.71V

% MODULATION = 30% ACROSS 10K OHMS / HIGH SIGNAL LEVEL NOISE LEVEL = -32.8 db

LOW SIGNAL LEVEL NOISE LEVEL = -8.1 db

AUDIO FREQUENCY	HIGH LEVEL S+N/N	LOW LEVEL S+N/N	RCVR OUT AT 3µV	DEVIATION FROM REF.	RCVR OUT AT 500µV	DEVIATION FROM REF.
16 Hz	31.9	6.8	-1.3	-1.3	-0.9	-0.9
50	33.5	8.5	+0.4	+0.4	+0.7	+0.7
100	33.2	8.6	+0.5	+0.5	+0.4	+0.4
200	33.2	8.6	+0.5	+0.5	+0.4	+0.4
300	33.1	8.6	+0.5	+0.5	+0.3	+0.3
400	33.1	8.5	+0.4	+0.4	+0.3	+0.3
500	33.1	8.5	+0.4	+0.4	+0.3	+0.3
600	33.0	8.5	+0.4	+0.4	+0.2	+0.2
700	32.9	8.4	+0.3	+0.3	+0.1	+0.1
800	32.9	8.2	+0.1	+0.1	+0.1	+0.1
900	32.9	8.2	+0.1	+0.1	+0.1	+0.1
1K	32.8	8.1	0.0 REF LEVEL	0.0	0.0 REF LEVEL	0.0
2K	32.0	7.8	-0.3	-0.3	-0.8	-0.8
3K	32.1	7.7	-0.4	-0.4	-0.7	-0.7
4K	32.6	8.1	0.0	0.0	-0.2	-0.2
5K	32.8	8.3	+0.2	+0.2	0.0	0.0
6K	32.3	7.9	-0.2	-0.2	-0.5	-0.5
7K	31.2	6.8	-1.3	-1.3	-1.6	-1.6
8K	28.3	3.5	-4.6	-4.6	-4.5	-4.5
9K	23.2	1.9	-6.2	-6.2	-9.6	-9.6
10K	25.2	2.8	-5.3	-5.3	-7.6	-7.6

SHEET #2

WIDEBAND FREQUENCY RESPONSE PP#2 NARROWBAND FILTER 23 JAN 75

AUDIO FREQUENCY	HIGH LEVEL S+N/N	LOW LEVEL S+N/N	RCVR OUT AT 3uV	DEVIATION FROM REF	RCVR OUT AT 500uV	DEVIATION FROM REF
13K Hz	24.8	2.2	-5.9	-5.9	-8.0	-8.0
16K	7.1	0.0	-8.1	-8.1	-25.7	-25.7
19K	0.8	0.0	-8.1	-8.1	-33.7	-33.7
22K	0.8	0.0	-8.1	-8.1	-32.0	-32.0
25K	3.8	0.0	-8.1	-8.1	-29.0	-29.0

4.3.20 AN/GRC-171 Selectivity with Narrow and Wide Band IF Filters:

4.3.20.1 Procedure: The AN/GRC-171 receiver was adjusted for 0 dBm audio output with an RF input of 3 μ volts on 300 MHz, 30% modulated by a 1 KHz signal. Modulation was removed and the AGC voltage recorded for reference at various input levels. Then, for each RF input level the frequency was varied above and below 300 MHz till the AGC voltage dropped to that present with a 3 μvolt input. The RF input levels were selected to give the 6, 20, 40, 60, 80 and 100 dB points on the IF selectivity curve.

4.3.20.2 Results: The results appear in the attached data sheet and are graphed.

4.3.20.3 Conclusions: Expected results are obtained with the wideband filter: 6 dB response, of better than ± 33 MHz. The narrow band filter checked out at ± 20 MHz, but these results are somewhat inexact, since varying of the generator frequency over small increments was found to be very critical.

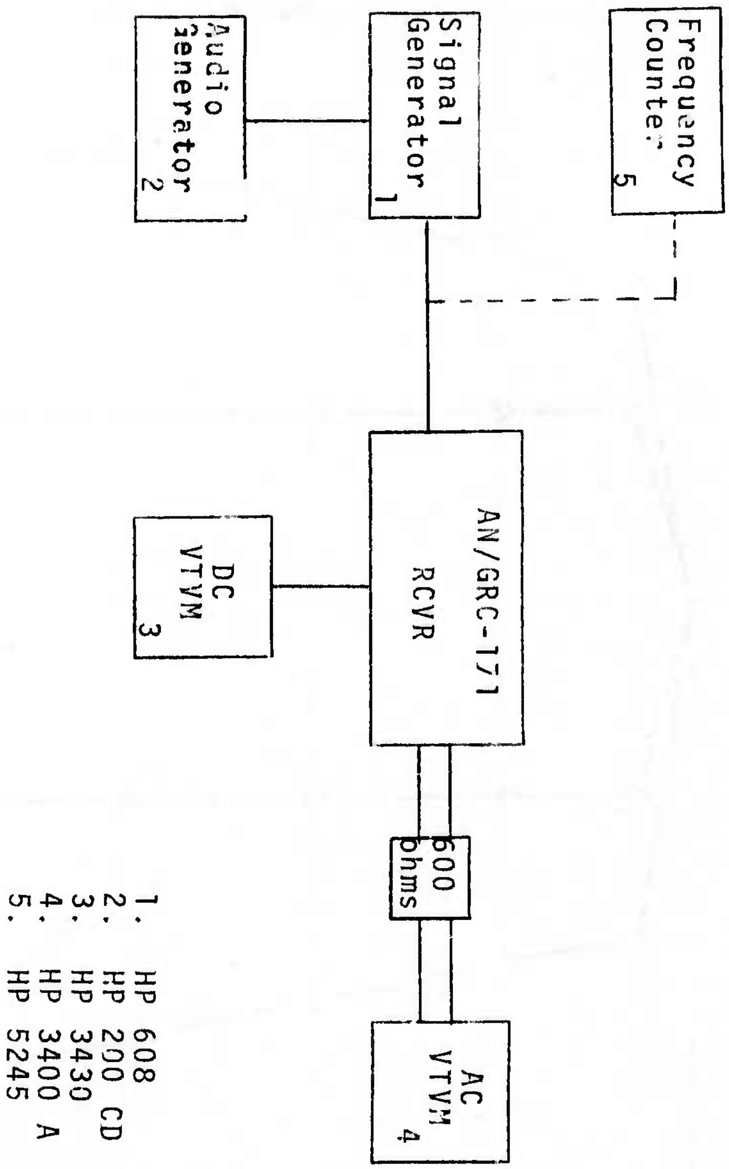


FIGURE 34

Selectivity with Narrow and Wide Band IF Filters

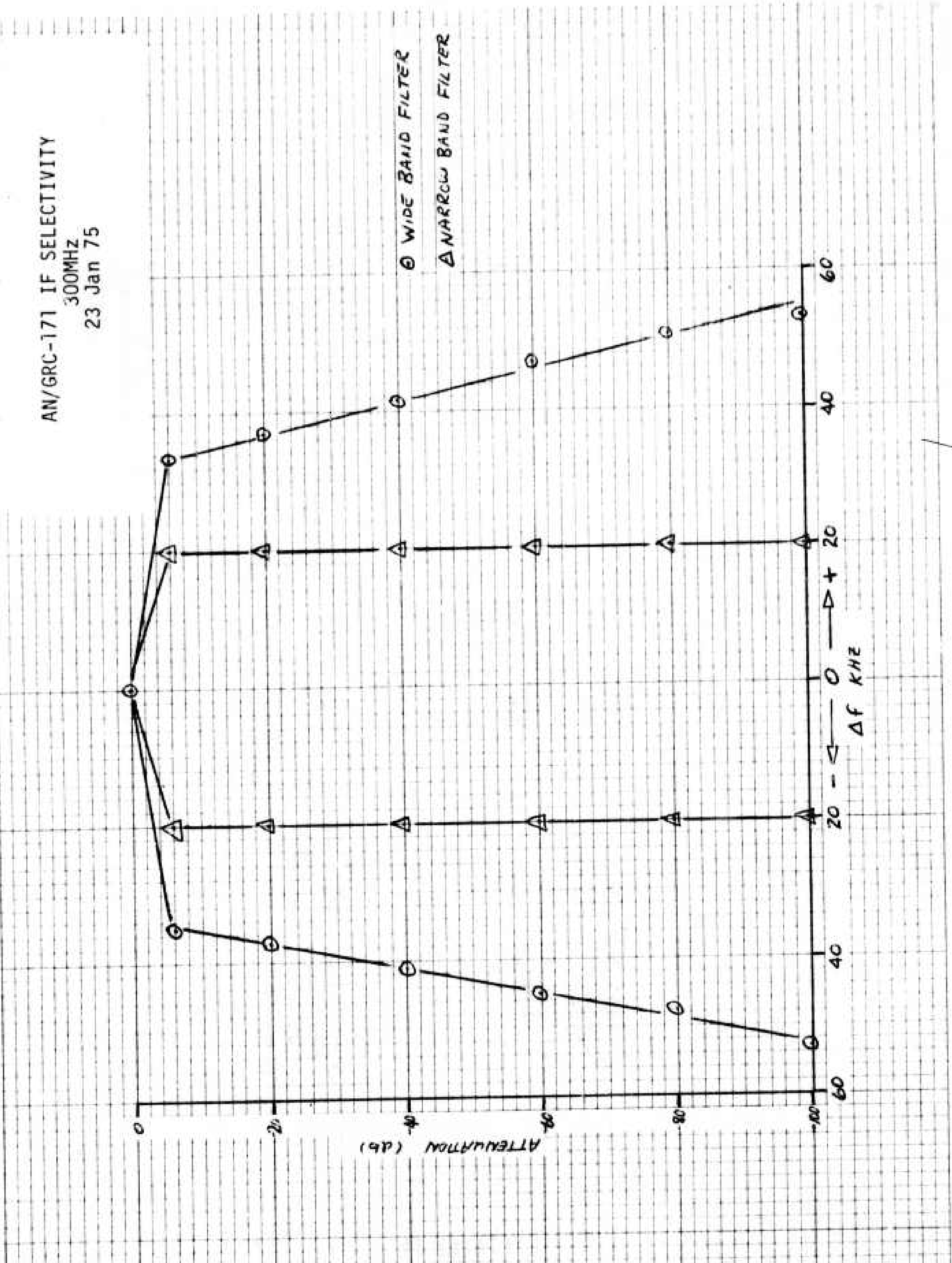

AN/GRC-171 IF SELECTIVITY
300MHz
23 Jan 75
WIDE BAND FILTER
NARROW BAND FILTER
Δf KHz
ATTENUATION (db)
60
40
20
0
20
40
60
0
20
40
60
80
100

Figure 35

IF SELECTIVITY TEST PP#2 23 JAN 75

INPUT WITH	INPUT LEVEL	AGC VOLTS	+Δf (MHz)	-Δf (MHz)	
NARROWBAND FILTER	-97.5	-.52	REFERENCE	LEVEL	
	-91.5	-.80	300.02	299.90	
	77.5	-1.37	300.02	299.90	
	-57.5	-1.69	300.02	299.98	
	-37.5	-1.89	300.02	299.98	
	-17.5	-2.07	300.02	299.98	
	+2.5	-2.48	300.02	299.98	
WIDEBAND FILTER	-97.5	-.48	REFERENCE	LEVEL	
	-91.5	-.59	300.0335	299.9651	
	-77.5	-1.29	300.0363	299.9628	
	-57.5	-1.63	300.0408	299.9588	
	-37.5	-1.81	300.0469	299.9549	
	-17.5	-1.97	300.0502	299.9523	
	+2.5	-2.35	300.0523	299.9474	

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4.4 Maintainability/Reliability.

4.4.1 Report of Failures: During the entire IOT&E, five failures were experienced. In each case the fault isolation diagrams supplied with the T.O.s were used to determine which module had failed. The following modules failed:

PP#1	PP#2
A-5 DC-DC Converter	A-5 DC-DC Converter
A-2 Frequency Synthesizer	
A-1 D/A Servo Amplifier	
A-7 T/R Switch in the RF Filter	

The only two failures that could be directly attributed to an equipment deficiency were the two DC-DC Converter (A-5) failures. The Frequency Synthesizer (A-2) and D/A Servo Amplifier (A-1) failed during the remote control tests and probably were caused by the shorting of two wires while taking voltage measurements. A diode in the T/R switch in the RF Filter Module failed during testing. It has not been established what caused the failure. No failures were encountered during the control tower tests. Overall, the reliability of the radio was acceptable.

4.4.2 Safety: There were two items identified that could present a safety hazard. One item was the weakness of slides provided with the radio. The other was the hole in the front panel that leads to the high voltage section of the radio. Both of these items have been discussed in the installation section, 4.1. Otherwise, the radio presented no safety hazards. The high voltage sections were adequately marked and no shock hazards were identified.

4.4.3 Spares Support: Because of the way the contract was written, no on-site spares support was required. Because of this, this section cannot be evaluated. The support that was received from the contractor on supplying needed parts was excellent.

4.4.4 Tools, Test Equipment and Special Support: No problems were encountered in installing the equipment. No special tools were required. The test equipment needed to maintain the AN/GRC-171 during the test was adequate as identified in the preliminary T.O. with the following exceptions:

a. Two RF Signal Generators were required to perform the noise blanker test whereas only one AN/USM-323 was identified.

b. A power supply was not identified to perform keying tests.

PMEL support was limited to calibration of the test equipment provided by the various base activities for testing. No unusual requirement was levied on PMEL nor was it evident that there would be any in the future.

4.4.5 Training: No formal training was provided prior to testing. There was familiarization training held. However, there was no formal class outline. It appears that special training will not be required to maintain the radio.

4.4.6 Technical Data: The formal technical order verification was conducted. The TOs were reviewed in depth and corrections and additions were marked in master copies of these TOs. The contractor agreed to include all corrections as a result of design changes or as a result of qualification and reliability test failures. These changes will include schematic changes as well as principles of operation. Some of the items identified during TO verification include the following:

a. Audio and Keyer Card Strapping Options will be drawn for easier identification.

b. The noise blanker performance test needs a major rewrite.

c. The receiver wideband audio response performance test will be expanded to include all three options of IF filters.

d. A power supply and a second RF generator are required for intermediate maintenance which previously were not identified.

e. The Preventive Maintenance Instructions (PMIs) were reviewed. The daily inspections were changed to seven day inspections.

Only the organizational level maintenance instructions were verified. The intermediate maintenance instructions will have to be verified at a later date when they are available.

4.4.7 Maintenance: There were very few failures during the test. Ease of maintenance was difficult to verify. However, it appears that the flow diagram method for fault isolation is adequate. The flow diagram was used for the failures that were encountered during testing. In all cases, the diagram pin-pointed the bad modules. A maintenance technician should have no problem fault isolating the radio and correcting the fault.

5. Summary:

All major performance test objectives were satisfied except the secure voice testing. Two deficiencies in performance were documented. One, the transmitter spurious emissions, was brought to the attention of Sacramento ALC and Collins Radio shortly after having been documented. Collins has been working on the problem and has presented Sacramento ALC with a suggested correction to the problem. Second, the limited frequency response of the narrowband IF filter, was brought to the attention of Sacramento ALC. Apparently, the IF crystal filter vendors have corrected deficiencies in the filters and they will meet specifications.

The problem with the radio slides was identified to Sacramento ALC and Collins Radio. Collins contacted their vendor and the slides will be modified to prevent them from falling apart. The proposed switched ground needed to make the GRC-171 compatible with the performance monitor was approved by Sacramento ALC and will be included in the production equipments. Remoting the headset audio to the back of the radio has been approved by Sacramento ALC and will be included in the production equipments. It is understood from Sacramento ALC that the hole behind the front panel door will be covered and the low-loss bridge on the front panel will be replaced with a bridge that will be flatter and epoxied for strength.

The problem with the DC-DC converter failing has been analyzed by Collins and a redesign of the module is intended to give greater reliability. To date, all suggested changes to the Technical Order (T.O.) have been incorporated. The only items that have not been previously identified are the size of the slots on the front panel that are used to bolt the radio to the rack and the marking of the installation hardware "right and left." These items will be discussed with Sacramento ALC for inclusion into the production items.

None of the changes or modifications that have been made to the radio have been tested operationally.

With the above changes implemented and performance deficiencies corrected, it is recommended that the AN/GRC-171 be procured for operational use.

6. Suggestions for further testing:

Although the AN/GRC-171 was thoroughly tested there are a few tests that were not conducted because of lack of time and/or resources. Suggest further testing of the AN/GRC-171 be accomplished to include the investigation of the following areas.

6.1 Suggest spot checks be accomplished to determine if any modifications made to the radios after the IOT&E have affected performance.

6.2 More detailed Secure Voice Tests,with both the NESTOR and VINSON eqiupment should be accomplished. Investigation of the effect of the noise blanker on a secure voice digital signal should be made.

6.3 Characterization of the radio for envelope delay and phase jitter should be accomplished.

6.4 Detailed, quantitative altitude and range checks to the maximum limits of the radio should be accomplished.

6.5 Determine the effect of power fluctuations on the frequency accuracy of the radio.

6.6 Determine what level of 3rd order intermodulation can be expected on the majority of the radios fielded. In doing this, try to determine if the large discrepancy found between the two radios tested in the IOT&E was due to a production defect or if one radio had degraded in performance more than the other.

6.7 Some testing may be necessary to determine if collocation interference is going to be a problem in certain system configurations. Testing in an actual operational environment may best answer this question.

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