General Disclaimer

One or more of the Following Statements may affect this Document

- This document has been reproduced from the best copy furnished by the organizational source. It is being released in the interest of making available as much information as possible.

- This document may contain data, which exceeds the sheet parameters. It was furnished in this condition by the organizational source and is the best copy available.

- This document may contain tone-on-tone or color graphs, charts and/or pictures, which have been reproduced in black and white.

- This document is paginated as submitted by the original source.

- Portions of this document are not fully legible due to the historical nature of some of the material. However, it is the best reproduction available from the original submission.

Produced by the NASA Center for Aerospace Information (CASI)

NASA CR-
147467

FREQUENCY MODULATION SYSTEM TEST PROCEDURE
SHUTTLE TASK 501
APPROACH AND LANDING TEST CONFIGURATION

Job Order 17-069

(NASA-CR-147467) FREQUENCY MODULATION SYSTEM TEST PROCEDURE SHUTTLE TASK 501 APPROACH AND LANDING TEST CONFIGURATION (Lockheed Electronics Co.) 76 p HC $5.00 CSCL 17B G3/17

N76-18205

Unclas
18690

Prepared By

Lockheed Electronics Company, Inc.
Aerospace Systems Division

For

SPACECRAFT SYSTEMS TEST OFFICE
TRACKING AND COMMUNICATIONS DEVELOPMENT DIVISION

National Aeronautics and Space Administration

LYNDON B. JOHNSON SPACE CENTER

Houston, Texas

January 1976

LEC-7500
SHUTTLE

FREQUENCY MODULATION SYSTEM TEST PROCEDURE
SHUTTLE TASK 501
APPROACH AND LANDING TEST CONFIGURATION

Job Order 17-069

PREPARED BY

G. D. Doland

G. D. Doland, Engineer
Spacecraft Systems Test Section
Lockheed Electronics Company, Inc.

APPROVED BY

LEC

A. L. Roelse, Supervisor
Spacecraft Systems Test Section

J. S. Creamer, Manager
Tracking and Communications
Systems Department

NASA

W. C. Long, Office Head
Spacecraft Systems Test Office

D. C. Dittmar 1/22/76

D. C. Dittmar
Quality Engineering

Prepared By

Lockheed Electronics Company, Inc.

For

Spacecraft Systems Test Office

Tracking and Communications Development Division

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER
HOUSTON, TEXAS

January 1976

LEC-7500
SHUTTLE

JSC-10860

FREQUENCY MODULATION SYSTEM TEST PROCEDURE
SHUTTLE TASK 501
APPROACH AND LANDING TEST CONFIGURATION

Job Order 17-069

APPROVED BY

D. C. Dittmar 1/22/76
D. C. Dittmar
Quality Engineering

W. C. Long
W. C. Long, Office Head
Spacecraft Systems Test Office

Prepared By

Lockheed Electronics Company, Inc.

For

Spacecraft Systems Test Office
Tracking and Communications Development Division

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER
HOUSTON, TEXAS

January 1976

LEC-7500
SHUTTLE

TECHNICAL REPORT INDEX/ABSTRACT

(See instructions on reverse side.)

1. TITLE AND SUBTITLE OF DOCUMENT

FREQUENCY MODULATION SYSTEM TEST PROCEDURE
SHUTTLE TASK 501
APPROACH AND LANDING TEST CONFIGURATION

2. JSC NO.

JSC- 10866

3. CONTRACTOR/ORGANIZATION NAME

Lockheed Electronics Co., Inc.

4. CONTRACT OR GRANT NO.

NAS 9-12200

5. CONTRACTOR/ORIGINATOR DOCUMENT NO.

LEC-7500

6. PUBLICATION DATE (THIS ISSUE)

January 1976

7. SECURITY CLASSIFICATION

Unclassified

8. OPR (OFFICE OF PRIMARY RESPONSIBILITY)

William C. Long

9. LIMITATIONS

GOVERNMENT HAS UNLIMITED RIGHTS [X] YES [ ] NO

IF NO, STATE LIMITATIONS AND AUTHORITY

10. AUTHOR(S)

George D. Doland

11. DOCUMENT CONTRACT REFERENCES

WORK BREAKDOWN STRUCTURE NO.

CONTRACT EXHIBIT NO.

DRL NO. AND REVISION

DRL LINE ITEM NO.

12. HARDWARE CONFIGURATION

SYSTEM

SUBSYSTEM

MAJOR EQUIPMENT GROUP

13. ABSTRACT

Frank Hoadley Dec. 77

14. SUBJECT TERMS

JSC Form 633 (Rev Sep 74) NASA-JSC

ACKNOWLEDGMENTS

This document was prepared in response to Action Document 75-17-069-33 submitted by the Spacecraft System Test Office of the Tracking and Communication Development Division. William C. Long, Office Head, was Technical Monitor for this task.

George D. Doland, of the Spacecraft Systems Test Section of Lockheed Electronics Company, Inc., prepared this document.

CONTENTS

FIGURES

PRECEDING PAGE BLANK NOT FILMED

ACRONYMS AND ABBREVIATIONS

ALT	Approach and Landing Test
BER	Bit Error Rate
BI-Ø	Bi-Phase
BITE	Built-In Test Equipment
CA	Constant Amplitude
C&T	Communication and Tracking
dBm	Decibel referred to 1 milliwatt
dc	Direct current
DR	Discrepancy report
ESTL	Electronic Systems Test Laboratory
FDM	Frequency Division Multiplexer
FM	Frequency modulation
GSE	Ground Support Equipment
Hz	Hertz
IDR	Interim Discrepancy Report
kc	Kilocycles
kHz	Kilohertz
MRB	Material Review Board
MHz	Megahertz
MUX	Multiplexer
MUX-T	Multiplexer-Transmit
PCM	Pulse code modulation
RF	Radiofrequency
rms	Root mean square

PRECEDING PAGE BLANK NOT FILMED

SCO	Subcarrier Oscillator
SSO	Space Shuttle Orbiter
SSTL	Spacecraft Systems Test Laboratory
V	Volt

1. INTRODUCTION

The Space Shuttle Orbiter (SSO) contains a wide variety of equipment for communication, tracking, and navigation and landing. Shuttle Task 501 is an in-line task to test the performance and compatibility of radiofrequency (rf) links between the SSO and ground, and relay via a satellite. The first Orbiter flight is a test of the approach and landing capability of the Orbiter. Under Shuttle Task 501 Approach and Landing Test (ALT) phase only a limited portion of the Communication and Tracking (C&T) equipment is to be tested. The principal item to be tested is a frequency modulated (FM) data link. To test this rf link, an ALT FM System was designed, constructed, and the console wiring verified.

The purpose of this document is to provide a step-by-step procedure to be used to perform the ALT FM System Test. The ALT FM System Test is to be performed prior to delivery of the equipment to the Electronic Systems Test Laboratory (ESTL).

Quality Assurance inspection will be required when the tests procedures are performed.

1.1 ALT FM SYSTEM TEST OBJECTIVES

The objectives of this test are to certify the consoles for ESTL compatibility and performance tests and to calibrate the equipment prior to delivery to the ESTL. These tests cannot be performed until the Approach and Landing Configuration Console Tests have been completed. Once the console tests are complete, the spacecraft equipment may be installed and the tests performed. These tests will constitute acceptance of the ALT FM System.

1.2 APPROACH AND LANDING CONFIGURATION

The ALT configuration consists of five consoles of equipment shown in figures 1-1 through 1-4. Two consoles provide stimuli signals, one console is the ALT FM System Console, and the remaining two consoles are Verification Consoles. The spacecraft equipment is installed in the ALT FM System Console. The only supporting test equipment required is a Tunable Discriminator as the necessary laboratory test equipment is installed in the verification consoles. Because of the limited availability of a Tunable Discriminator or suitable fixed frequency discriminators, this item is not mounted in the Verification Consoles. The Discriminator is required only for specific tests and may be mounted on an equipment cart or in an auxiliary equipment rack.

1.3 TEST EQUIPMENT

No list of test equipment is provided in this document because the equipment to be used, with the possible exception of the Tunable Discriminator, is mounted in the consoles. Each item of test equipment used will be documented by name, manufacturer, type or model number, and serial or inventory number for each specific test.

1.4 TEST LIMITS

Test limits are specified in the test procedure when signals measured are generated in the System Console or associated stimuli and verification consoles. No limits are specified for signals generated in the spacecraft packages as these signals are not determined by the console design or construction, and this test does not constitute acceptance tests for the spacecraft items. This data is recorded for engineering evaluation only and for reference at a later date.

ORIGINAL PAGE IS
OF POOR QUALITY

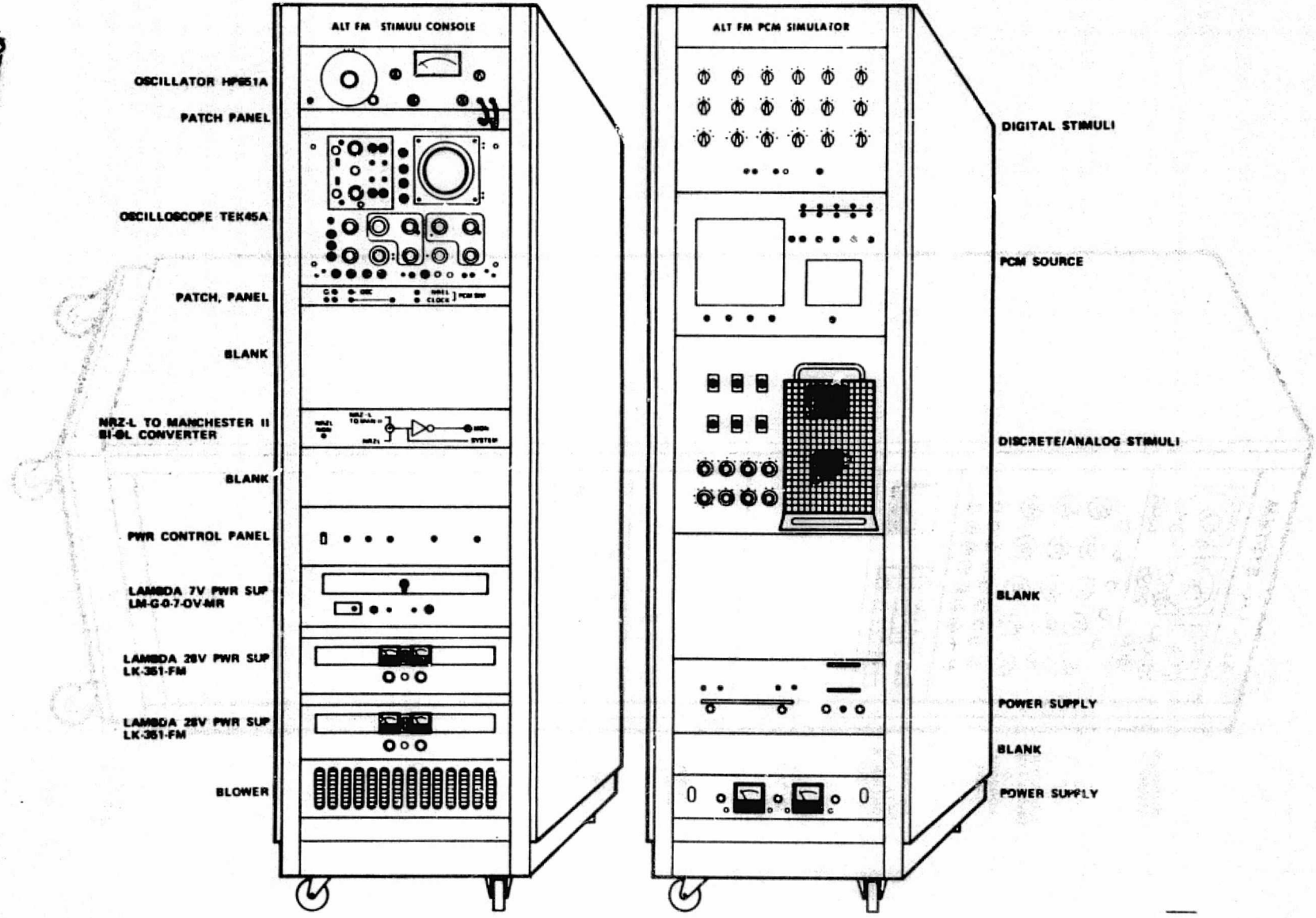


Figure 1-1. — ALT FM Stimuli Console and ALT FM PCM Simulator.

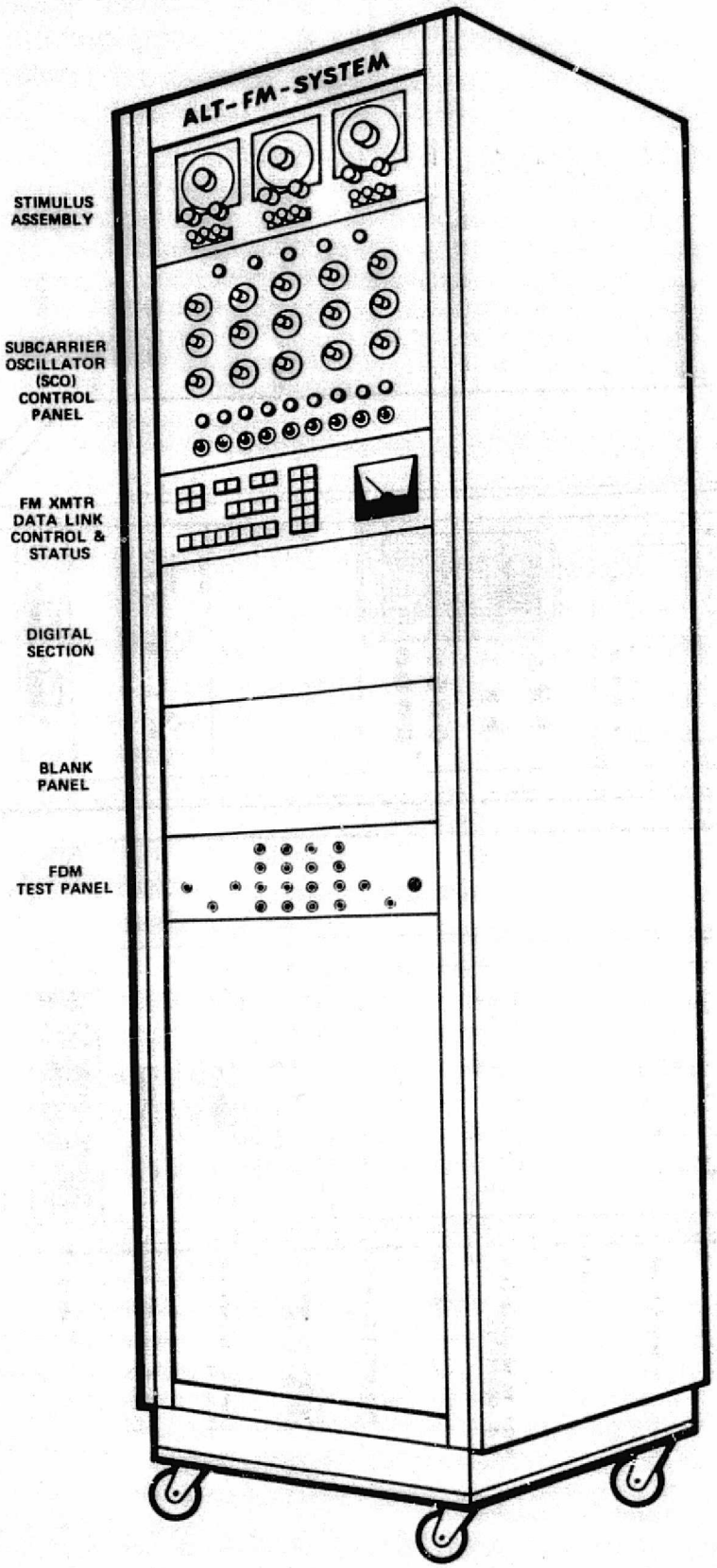


Figure 1-2. — ALT FM System console.

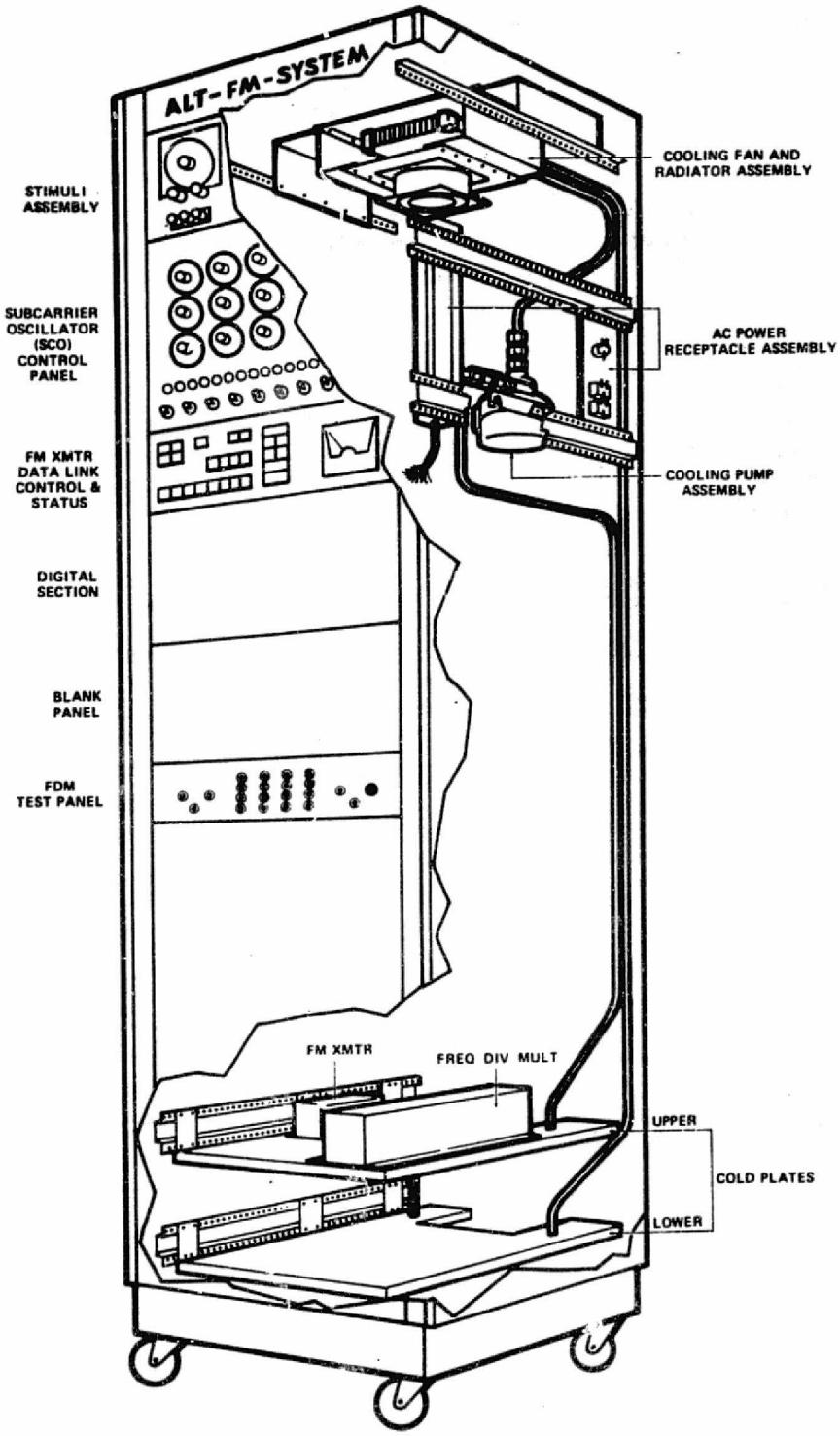


Figure 1-3. – ALT FM System Console.

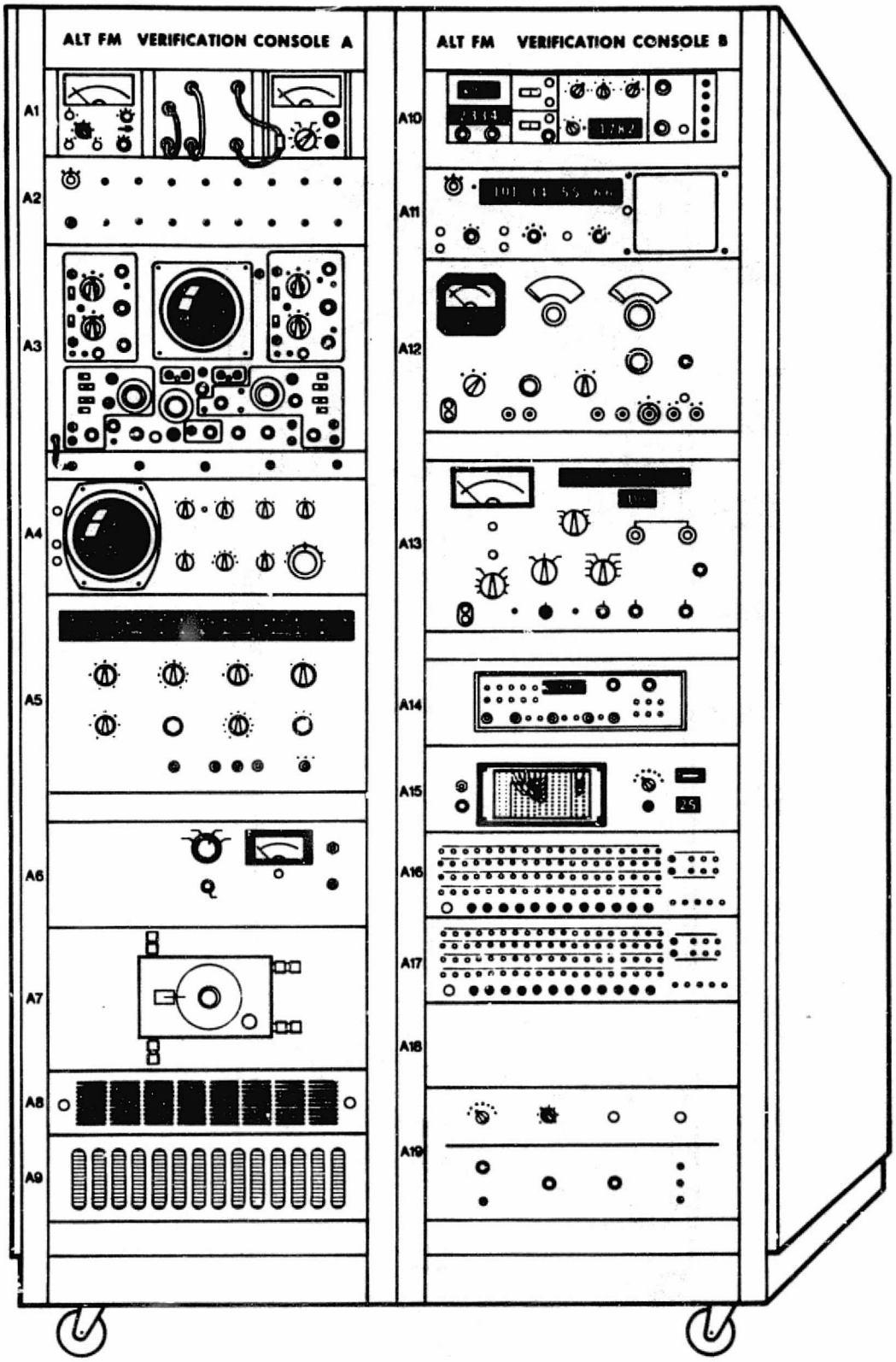


Figure 1-4. – ALT FM Verification Consoles A and B.

1.5 PRETEST PREPARATION

The steps for pretest preparation are as follows:

1. Examine the console test data and ensure all tests have been performed satisfactorily.
2. Verify that all Interim Discrepancy Reports (IDR's) and/or discrepancy reports (DR's) are either closed or provide an interim Material Review Board (MRB) disposition to allow test commencement with an open DR.
3. Install the Frequency Division Multiplexer (FDM) and FM transmitter in the ALT FM System Console if not already installed.
4. Connect the cables to these units.

2. FUNCTIONAL TESTS

The functional tests are performed to ensure the console and spacecraft equipment operates correctly prior to performing more detailed performance and calibration tests. All tests in this document assume the equipment is off when a test is started. When tests are performed in sequence and cabling changes are not required, it is not necessary to de-energize the equipment and re-energize the equipment between tests. The data sheets, contained in appendix B, reference to the test by name and paragraph number.

2.1 SYSTEM POWER TESTS

The system power test is performed to establish proper operation of the equipment on a quick-look basis without quantitative data.

1. Connect the FM transmitter rf output to the rf path and establish that the FM transmitter has an adequate load, the spectrum analyzer is connected to the rf path, the rf power meter is connected, and there is adequate attenuation in the path to ensure the power level cannot damage any item of equipment. (See figure A-1.)
2. Energize the Spectrum Analyzer, Power Meter and FM Receiver. Record the test equipment data listed in paragraph 1.3.
3. Energize the System at the Power Control Panel of the Stimuli Console using the following sequence:
   (a) Place the 5-volt (V) power ON.
   (b) Select LOCAL control.
   (c) Place the RESET switch ON then OFF.
   (d) Place the 28-volt lamp power ON.

4. Initialize the ALT FM System by depressing the following switches:

   (a) FDM POWER OFF

   (b) FM XMTR OFF

   (c) MODE 0

Verify the status by observing the illuminated switches selected.

5. Energize the spacecraft equipment as follows:

   (a) Place the 28-volt spacecraft equipment power ON.

   (b) Depress the FDM POWER ON switch and observe that both the FDM POWER ON and FDM BITE indicators are illuminated.

   (c) Depress the FM XMTR POWER ON and observe that both the FM XMTR POWER ON and FM XMTR POWER BITE indicators are illuminated.

6. Establish that the equipment is operating as follows:

   (a) Observe on the Spectrum Analyzer the carrier and sub-carriers are present, adjusting the Spectrum Analyzer as required.

   (b) Observe and record the rf power output.

7. Turn off all equipment only if this test is the last test for the day; otherwise, proceed to next test.

2.2 FDM TEST PANEL VOLTAGES

This test is performed to provide reference data relative to the FDM operation for future reference as well as establish correct operation of the FDM. The voltages are to be measured using a digital voltmeter and recorded with at least a two-decimal place accuracy.

1. If the system is off, energize the system as per section 2.1 steps 1 through 5 (except no data recording is required). If the equipment is on, proceed to step 2.

2. Record the Digital Voltmeter data listed in paragraph 1.3 and connect the Digital Voltmeter common lead to the SIG RET on the FDM Test Panel.

3. Measure and record the +12 V, -12 V, and +24 V signals for MUX 1 through MUX 4 sections at the FDM Test Panel. These voltages are recorded for future reference and no limits are specified. See paragraph 1.4.

4. Measure and record the MUX 1 through MUX 4 and Multiplexer-Transmit (MUX-T) BITE signals. These voltages must be 4 ± 1.5 V.

5. Measure and record the calibrator and MUX-T Vdc signals.

6. Measure and record the STATUS DATA/VERIFICATION switch voltage in the 0 mode and each mode from 1 to 7. In the 0 mode, the voltage must be 4 ± 1.5 V and in modes 1 through 7 the voltage must be 0.5 ± 0.5 V. When this step is complete select mode 0.

7. Turn off the equipment, only if this is the last test for the day; otherwise, proceed to the next test.

2.3 MODE SELECTION

The purpose of this test is to establish proper operation of the BITE circuits in the FDM.

1. If the equipment is off, energize the system per section 2.1 steps 1 through 5 (except no data recording is required). If the equipment is on, proceed to step 2.

2. Select Mode 0 and observe that the DATA BITE and MODE STATUS 0 indicators are illuminated.

3. Select Mode 1 and observe that the TEST BITE and MODE STATUS 1 indicators are illuminated.

4. Select Mode 2 and observe that the TEST BITE and MODE STATUS 1 indicators are illuminated.

5. Select Mode 3 and observe that the TEST BITE and MODE STATUS 1 and 2 indicators are illuminated.

6. Select Mode 4 and observe that the TEST BITE and MODE STATUS 4 indicators are illuminated.

7. Select Mode 5 and observe that the TEST BITE and MODE STATUS 1 and 4 indicators are illuminated.

8. Select Mode 6 and observe that the TEST BITE and MODE STATUS 2 and 4 indicators are illuminated.

9. Select Mode 7 and observe that the TEST BITE and MODE STATUS 1, 2, and 4 indicators are illuminated.

10. Select Mode 0 and observe that the MUX 1 through MUX 4 and MUX-T indicators are illuminated.

11. If this is the last test for the day, turn the equipment off; otherwise, proceed to the next test.

2.4 FIFTY-HERTZ CALIBRATOR SIGNAL TEST

The purpose of this test is to determine the characteristics of the 50-Hertz (Hz) calibrator signal.

1. If the equipment is off energize the system per section 2.1 steps 1 through 5 except no data recording is required. If the equipment is on, proceed to the next step.

2. Turn on the oscilloscope and record the oscilloscope data.

3. Verify the oscilloscope calibration with the internal calibrator and adjust the controls to observe a signal within the limits 0 and +5 volts.

4. Connect the oscilloscope to the 50-Hz calibrated output on the FDM Test Panel and adjust the oscilloscope sweep rate to

view a 50-Hz signal. Measure and record the direct current (dc) offset and peak-to-peak amplitude. Also observe the waveform for clipping or obvious distortion.

5. If this is the last test for the day, turn the equipment off; otherwise, proceed to the next test.

2.5 MULTIPLEXER TEST

1. If the equipment is on, turn the FDM and FM Transmitter off by depressing the FDM POWER OFF and FM XMTR OFF switches. If the equipment is off, energize the system by performing steps 1 through 4 of section 2.1. Then place the 28-volt spacecraft equipment power ON at the Power Panel of the Stimuli Console.

2. Record the data indicated in paragraph 1.3 for the Tunable Discriminator, voltmeter and the oscilloscope.

3. Set Oscillator 1 to 500 Hz, Oscillator 2 to 2 kilohertz (kHz), and Oscillator 3 to 8 kHz. These frequencies do not need to be exact. Set the amplitude control on the oscillators to 1.75 ± 0.10 volt using the Root-Mean-Square (rms) voltmeter. For subcarrier oscillators 1 through 7, select Oscillator 1; for subcarriers 8 through 14 select Oscillator 2; and for subcarrier 15 select Oscillator 3. Adjust the individual amplitude controls between 25 and 75 percent of full scale.

4. Cable the equipment for MUX 1 operation. (See figure A-2.) Also provide a cable from the MUX 1 data output (A3J17) to the Tunable Discriminator. Provide a cable from the Tunable Discriminator output to the oscilloscope. During this test, the oscilloscope may be adjusted to observe Tunable Discriminator output as required.

5. Depress the FDM POWER ON switch and select in sequence Mode 0 through Mode 7 while observing the oscilloscope for the data signal, automatic calibration sequencing, 50-Hz

calibrator signal, and 0, 25, 50, 75, and 100 percent reference signals as each of these modes are selected. When the sequence is complete, depress the FDM POWER OFF switch.

6. Move the cable from the MUX 1 data output to the MUX 1 Ground Support Equipment (GSE) output (A3J22). Repeat step 5.

7. Remove the MUX 1 cable and configure for MUX 2 testing using the MUX 2 data output (A3J18). Repeat step 5.

8. Move the cable from MUX 2 data output to the MUX 2 GSE output (A3J23). Repeat step 5.

9. Reconfigure for MUX 3 data output (A3J19) and repeat step 5.

10. Reconfigure for MUX 3 GSE output (A3J24) and repeat step 5.

11. Reconfigure for MUX 4 data output (A3J20) and repeat step 5.

12. Reconfigure for MUX 4 GSE output (A3J25) and repeat step 5.

13. Reconfigure for MUX-T data output (A3J21) and repeat step 5.

14. Reconfigure for MUX-T GSE output (A3J26) and repeat step 5.

15. Reconfigure the system so that the MUX-T data output (A3J21) is fed to the FM Transmitter data input. Also, de-energize the system.

3. PERFORMANCE TESTS

The purpose of the following tests is to establish the performance capability of the ALT FM System. The data obtained will be retained for future reference so that any change in performance can be determined by repeating tests at a later date.

3.1 RADIO FREQUENCY POWER OUTPUT

The purpose of this test is to determine the power output of the FM Transmitter, the power output measured at the ALT FM Console, and the power input to the FM Receiver. In order to perform this test, a calibrated cable is required and the RF cables and attenuators in the ALT FM System Console and Verification Console must have been previously calibrated. (See figure A-1.)

1. Ensure that the FM Transmitter power is OFF.
2. Record the rf attenuation for the calibrated cables, attenuators and directional couplers on the data sheet where indicated. Also add the fixed losses and record on the data sheet. Record the Cable 26, Cable 27, and fixed attenuator losses on a second data sheet.
3. Remove the cable connected to the Power Meter. Remove one end of Cable 27 from Directional Coupler 1 and connect it to the Power Meter. (See figure A-3.) Energize the system per steps 1 through 4 of section 2.1 (except data recording is not required). Turn the 28-volt spacecraft power on. Depress the FM XMTR POWER ON switch. Read and record the rf power on the RF Power Meter. Depress the FM XMTR POWER OFF switch.
4. Calculate the Console Power output and record on the data sheet. Also, calculate the FM Transmitter Power output.
5. Reconnect the system in the original configuration (figure A-1). Calculate the power excluding the variable attenuator.
6. Depress the FM XMTR POWER ON switch; measure and record the rf power. Then depress the FM XMTR POWER OFF switch. This

power reading should agree with that recorded on the data sheet for the System Power Test RF Power Reference.

7. Depress the FDM POWER ON switch; measure and record the rf power output. Then depress the FDM POWER OFF switch and FM XMTR POWER OFF switch.

8. Record the data on the RF Power Meter.

9. If this is the last test for the day, turn all equipment off; otherwise, proceed to the next test.

3.2 TRANSMITTER DEVIATION SENSITIVITY

The purpose of this test is to determine the deviation sensitivity and linearity of the FM Transmitter frequency modulator. This test requires a variable voltage from -4 to +4 volts.

1. Ensure that the FM Transmitter power is off. Remove the cable from the A3J16 which provides the MUX-T signal to the FM Transmitter. Connect a variable voltage source which has a range of -4 to +4 volts to J16, the FM Transmitter modulation input jack, and to a digital voltmeter. (See figure A-4.)

2. Insert a 0.3 to 3.0 gigahertz Frequency Converter in the Counter in place of the Time Base Unit. Connect the Frequency Converter to the rf path in place of the Spectrum Analyzer. Set the rf attenuator to provide a signal level to the FM Receiver of about -50 decibels referred to 1 milliwatt (dBm).

3. If the ALT FM System is off, energize the system per steps 1 through 4 of section 2.1. Energize the 28-volt spacecraft power supply. Then depress the FM XMTR POWER ON switch. If the system is already on, then depress the FM XMTR POWER ON switch. Set the variable voltage source to -4.00 ± 0.01 volt and adjust the counter to measure the rf frequency.

4. Record the data for the Digital Voltmeter, Frequency Converter, and Counter.

5. Record the voltage indicated by the Digital Voltmeter and the frequency measured by the Counter.

6. Decrease the voltage by 0.50 ± .01 volt and repeat step 5.

7. Repeat step 6 to obtain the frequency for voltages from -4.0 to +4.0 volts in 0.5-volt increments.

8. Depress the FM XMTR POWER OFF switch. Remove the Frequency Converter from the Counter and replace with the Time Base Unit. Reconnect the Spectrum Analyzer. Also, disconnect the variable voltage source and reconnect the original cable to A3J16.

9. If this is the last test for the day, de-energize the system; otherwise, proceed to the next test.

3.3 TRANSMITTER FREQUENCY RESPONSE

The purpose of this test is to determine the FM Transmitter frequency response. The frequency response must be flat to within ±1 dB from dc to 1.5 megahertz (MHz). The response is measured by the test from 10 Hz to 3 MHz.

1. Ensure that the FM Transmitter is off. Remove the cable from A3J16 and connect a cable from the oscillator in the Stimuli Console to A3J16 and to the Frequency Counter. Set the output voltage to a low value; turn on the oscillator and after a sufficient warm-up time, set the amplitude to 1.5 volts. (See figure A-5.)

2. Remove the cable from the FM Receiver output and connect a cable from the RMS Voltmeter to the FM Receiver output.

3. Record the data on the Oscillator, Frequency Counter, RMS Meter, and FM Receiver.

4. If the ALT FM System is off, energize the system per steps 1 through 4 of section 2.1. Energize the 28-volt spacecraft

power supply; then depress the FM XMTR ON switch. If the system is already on, depress the FM XMTR ON switch. Set the rf attenuator to provide a signal level of about -50 dBm to the FM Receiver.

5. Set the oscillator frequency to 10 Hz at a signal level of 1.5 volts. Measure and record the FM Receiver output voltage read on the rms meter.

6. Repeat step 4 for a frequency of 0.25 MHz and each 0.25-MHz increment to 3.00 MHz. At the discretion of the test conductor, additional data points may be taken.

7. Depress the FM XMTR OFF switch. Reconfigure the equipment to the configuration prior to the test. If this is the last test for the day, turn the equipment off; otherwise, proceed to the next test.

3.4 INTERMODULATION DISTORTION

The purpose of this test is to ensure that nonlinearity of the modulating circuit does not result in intermodulation products being generated. This would degrade the performance of any subcarrier channel.

1. Ensure that the FM Transmitter is off and remove the cable from A3J16. Connect a cable from the two-signal linear adder network to the FM Transmitter modulating signal input at Connector A3J16 and to the high frequency wave analyzer. Connect a cable from the oscillator in the Stimuli Console to one input of the two-signal linear adder network. Connect a cable from Oscillator 1 output connector on the ALT FM System Console to the other input of the two-signal linear adder network. (See figure A-6.)

2. If the ALT FM System is off, energize the system per steps 1 through 4 of section 2.1. Energize the 28-volt spacecraft power supply. Then depress the FM XMTR ON switch. If already on, then depress the FM XMTR ON switch. Set the rf

attenuator to provide a signal of about -50 dBm to the FM Receiver.

3. Set the oscillator in the Stimuli Console to a frequency of about 1 MHz (dial setting is sufficiently accurate) and adjust the amplitude to 0.70 volt rms using the Wave Analyzer for the measurement. Set Oscillator 1 in the ALT FM System Console to about 100 kHz (dial setting is sufficiently accurate) and adjust the amplitude to 0.70 volts rms using the Wave Analyzer for the measurement. The signal levels specified are inputs to the FM Transmitter.

4. Record the data indicated in paragraph 1.3 on the Oscillators, Wave Analyzer, and FM Receiver.

5. Remove the Wave Analyzer cable from the input linear adder network to the output of the FM Receiver.

6. Measure and record the signal amplitude at nominal frequencies of 100 kHz, 900 kHz, 1.0 MHz, and 1.1 MHz.

7. Depress the FM XMTR POWER OFF switch. Reconfigure the equipment to the original configuration prior to the test.

8. If this is the last test for the day, de-energize the system; otherwise proceed to the next test.

3.5 SUBCARRIER OSCILLATOR CALIBRATION

The purpose of this test is to determine the subcarrier taper provided by the Frequency Division Multiplexer (FDM) and also calibrate the oscillator deviation sensitivity.

1. Verify system cabling for MUX-T operation. (See figure A-2.) Disconnect the cable to the FM Transmitter at A3J13 and connect this cable or an extension of the cable to the high frequency Wave Analyzer. Connect a cable from the Wave Analyzer output to a counter. Disconnect the modulation

signal for the 1.024-MHz subcarrier at connectors A3J15 and A3J28. At the Stimuli Control Panel on the ALT FM System Console, select the MOD OFF position for all 15 subcarriers. See figure A-7.

2. If the equipment is de-energized, energize the equipment using steps 1 through 4 of section 2.1. Energize the 28-volt spacecraft power supply. Then depress the FDM POWER ON switch.

3. Record the data for the Wave Analyzer, Digital Voltmeter, and Counter.

4. Use the Digital Voltmeter to measure the bias voltage to each of the subcarriers at the test points provided on the Stimuli Panel; record these voltages.

5. Set the Wave Analyzer to each subcarrier frequency and measure and record the frequency using the Counter and the signal amplitude using the Wave Analyzer. Use the 200-Hz bandwidth for subcarriers 1 through 14 and the 1000-Hz bandwidth for subcarrier 15 and the 1.024-MHz subcarrier.

6. At the Stimuli Control Panel on the ALT FM System Console select the +5 volt position for each subcarrier. Set the amplitude control for each subcarrier to zero. Use the Digital Voltmeter to measure any residual voltage at the Subcarrier Oscillator test points. Record these voltages.

7. Repeat step 5 omitting the 1.024-MHz subcarrier measurement.

8. At the Stimuli Control Panel, set the amplitude control for each subcarrier to the maximum position. Measure the voltage using the Digital Voltmeter and record the data.

9. Repeat step 5 omitting the 1.024-MHz subcarrier measurement.

10. Depress the FDM POWER OFF switch and reconfigure the equipment to the original configuration prior to the test.

11. If this is the last test for the day, de-energize the system; otherwise, proceed to the next test.

3.6 PULSE CODE MODULATION PERFORMANCE TEST

The purpose for this test is to ensure that the pulse code modulation (PCM) data link performance is adequate and that the 15 subcarriers do not degrade performance.

1. In the rear of the Filter, set both sections for a flat response. Connect a cable from the oscillator in the Stimuli Console to the Filter input and Counter. Connect both Filter sections together. Connect the output of the Filter to the RMS Meter. Set both sections for bandpass operation with the low frequency cutoff point at 500 kHz and the high frequency cutoff at 1500 kHz. Turn on this equipment. (See figure A-8.)

2. Record the Oscillator, Counter, Filter, and RMS Meter data.

3. Determine the frequency response of the filter taking sufficient points to plot a smooth curve between the -30-decibel points referenced to the response at 1000 kHz.

4. Disconnect the Oscillator from the Filter and connect to a high frequency Wave Analyzer. Set the frequency to 1.024 MHz using the dial reading on the Wave Analyzer to determine the frequency. Set the level below that measured in section 3.5 for the 1.024-MHz subcarrier. Connect the Oscillator to the Wave Analyzer and the FM Transmitter input at A3J16 after removing the cable at this connector. Connect the FM Receiver output to the input of the Filter making provisions to connect the Wave Analyzer to the FM Receiver output. Connect the filter output to an RMS Meter. (See figure A-8.)

5. If the equipment is de-energized, energize the equipment using steps 1 through 4 of section 2.1. Energize the 28-volt spacecraft power supply. Depress the FM XMTR POWER ON

switch. If the equipment is energized, depress the FM XMTR POWER ON switch.

6. Record the Wave Analyzer, and FM Receiver data.

7. Set the 1.024-MHz signal level to that recorded in section 3.5. Move the Wave Analyzer to the FM Receiver output at the connector provided in step 4.

8. Set the rf level at -50 dBm and measure and record the amplitude of the 1.024 MHz signal using the Wave Analyzer with a 1000-Hz bandwidth.

9. Decrease the signal level and determine the RF Attenuator setting where the 1.024 MHz signal decreases 1 dB. Record the RF Attenuator setting and the 1.024-MHz signal amplitude.

10. Remove the 1.024-MHz signal at connector A3J16. Set the rf level to -50 dBm. Measure the noise using the RMS Meter and record the data.

11. Decrease the signal level and determine the RF Attenuator setting where the noise level increases by 1 dB as measured on the RMS Meter. Record the RF Attenuator setting and the rms noise.

12. Compare the attenuator settings recorded in steps 9 and 11. Set the attenuator to the setting recorded which is the smaller attenuation of the two readings. At this point, measure the 1.024-MHz signal with the Wave Analyzer and measure the noise with the RMS Meter with the 1.024-MHz signal removed.

13. Decrease the signal level 5 dB and measure the 1.024-MHz signal with the Wave Analyzer and the noise with the RMS Meter with the 1.024-MHz signal removed.

14. Repeat step 13 until the rf signal is reduced to a value which is 5 dB larger than that recorded in step 9. Obtain additional data in RF Attenuator steps of 1 dB for a range of ±5 dB from that recorded in step 9. These points will define the knee of the FM detector curve.

15. Make a sketch of the signal-to-noise ratio as a function of RF Attenuator setting and obtain additional data, if required, to make a smooth curve.

16. Depress the FM XMTR POWER OFF switch. Verify the system is cabled for MUX-T operation. (See figure A-2.) Set Oscillator 1 to 500 Hz, Oscillator 2 to 2,000 Hz, and Oscillator 3 to 8,000 Hz. Set control switches 1 through 7 to Oscillator 1; switches 8 through 14 to Oscillator 2, and switch 15 to Oscillator 3. Verify the output level at 1.75 volts using the RMS Meter. (See figure A-9.) Connect the Square Wave Generator output to the Counter and ALT FM PCM Simulator clock input. Also, provide for a signal to the Oscilloscope. Connect the ALT FM PCM Simulator data output to the Oscilloscope, Bit Error Rate (BER) Monitor REF data input, and the Stimuli Console Code Converter input. Connect the Code Converter output to the ALT FM System Console connector A3P15. Reconnect the cable from A3J20 to A3J16. Connect the FM Receiver output to the 1.024-MHz Bi-Ø Demodulator input. Connect the 1.024-MHz Bi-Ø Demodulator output to the Bit Synchronizer input. Connect the Bit Synchronizer data output to the Frame Synchronizer, Bit Error Rate Monitor test data input, and to a second input on the Oscilloscope. Connect the 0° Clock to the Frame Synchronizer 0° Clock input and to the REC Clock input of the Bit Error Monitor. Connect the 90° Clock from the Bit Synchronizer to the 90° Clock input to the Frame Synchronizer and make provision to also connect the 90° Clock signal to the Bit Error Monitor. Connect the Frame Synchronizer output on the front panel of the Frame Synchronizer to the Oscilloscope external trigger input.

17. At the ALT FM Simulator set the Frame Synchronizer word controls to 7, 1, 6, and 2, respectively. Set the data word controls to 3, 4, 5, 4, 5, 4, 3, 4, 4, 5, 3, and 4, respectively. At the Frame Synchronizer set the Frame Synchronizer

length to 32 bits. Set the general word length to 8 bits. Set the controls for 16 words per frame including the Frame Synchronizer word. Set the Frame Synchronizer pattern to 0111 1111 0000 0001 0111 1011 0010 0001. (Note - Spaces are provided for clarity in reading.) At the 1.024-MHz Bi-Ø Demodulator, set the Channel Bandwidth for 600 kilocycles (kc) and the Loop Bandwidth to 600 cycles per second. At the Bit Synchronizer set the Bit Rate to 1.024×10^3; set the Loop Bandwidth to 2, the Code to BiØ-L and the DET switch to I/D. At the Bit Error Rate Monitor, set the input Code Convert switch to Bi-PH L and the Mode switch to Mode 1. Set the rf level to the FM Receiver to -50 dBm.

18. Turn on the Oscilloscope and Counter. Temporarily disconnect the Square Wave Generator from the ALT FM Simulator and connect the cable to one Oscilloscope input in place of the existing signal. Turn on the Square Wave Generator and adjust the frequency to 1.024 ± 0.004 MHz and the positive peak value to 4.00 ± 0.25 volts peak with the negative peak at approximately zero volts. Connect the Square Wave signal to the ALT FM PCM Simulator and energize the ALT FM PCM Simulator. Verify or readjust the Square Wave signal amplitude to 4.00 ± 0.25 volts peak.

19. Temporarily remove the cable from the Code Converter output. Remove the cable from the Oscilloscope to the Square Wave Generator and connect the Oscilloscope to the Code Converter output. Adjust the positive pulse peak to 4.00 ± 0.25 volts and adjust the negative pulse peak to -4.00 ± 0.25 volts. Reconnect the cable to the ALT FM System Console.

20. If the system is de-energized, energize the system per steps 1 through 4 of section 2.1. Energize the 28-volt spacecraft power supply. Depress the FDM POWER ON switch. Verify or adjust the positive peak voltage on the Oscilloscope to 4.00 ± 0.25 volts peak and the negative peak voltage to

-4.00 ± 0.25 volts peak. Recable the Oscilloscope as connected in step 16. Depress the FM POWER ON switch.

21. Obtain Bit Synchronizer lock and zero phase error. Obtain Frame Synchronizer lock. (Note: If Bit Synchronizer lock is achieved and Frame Synchronizer lock cannot be achieved, the signal from the Bit Synchronizer may be inverted.)

    If this is the case, invert the signal at the Bit Synchronizer using the control for this purpose. Adjust the Oscilloscope to trigger once per frame using the external Frame Synchronizer pulse. Also adjust the Oscilloscope to compare the Reference Data and Test Data timing or phase. The Test Data will lag the Reference Data by one or more bits. Determine the number of bits by which the Reference Data must be delayed to be most nearly in phase with the Test Data. Insert this delay in the Reference Data using the Delay Control on the Bit Error Rate Monitor. If the Reference Data signal after being delayed by the number of bits determined leads the Test Data signal by more than 90°, move the Bit Error Rate Monitor Clock signal from the 0° Clock to the 270° Clock output signal on the Bit Synchronizer. If the Reference Data signal, after being delayed by the number of bits determined, lags the Test Data signal by more than 90°, move the Bit Error Rate Clock signal from the 0° Clock to the 90° Clock output signal on the Bit Synchronizer. This step establishes the correct timing for a Bit Error Rate test.

22. Adjust the Bit Error Rate Monitor operation for zero errors for 100,000 bits. If this cannot be achieved, the timing is incorrect or a signal inverted. Repeat step 21 if required.

23. Obtain the Bit Error Rate as a function of RF Attentuator setting in 1-dB intervals for a range from one error per million bits until Bit Synchronizer lock cannot be maintained. Use at least 100 times as many bits as there are errors; except, do not exceed 10 million bits per sample.

24. If this is the last test of the day, shut down the system; otherwise, depress the FM XMTR POWER ON switch and the FDM POWER ON switch. Also, de-energize the Bit Synchronizer,

3.7 SUBCARRIER OSCILLATOR DATA PERFORMANCE TEST

The purpose of this test is to ensure that the data transmitted via subcarriers is not degraded because of interference between the various subcarriers. The performance is evaluated based on the data signal-to-noise ratio.

1. Verify that the system is cabled for MUX-T operation. Verify that the FDM output at connector A3J2, is cabled to the FM Transmitter data input at A3J16. Set the RF Attenuator at a setting which will provide a signal level of -50 dBm to the FM Receiver. Connect the output of the FM Receiver to the input of the Tunable Discriminator. Connect the output of the Tunable Discriminator to the low frequency Wave Analyzer and the true RMS Meter. Also ensure that the ALT FM PCM Simulator output is connected to the FDM data input at A3J15. (See figure A-10.)

2. Record the data listed in paragraph 1.3 on the FM Receiver, Tunable Discriminator, Wave Analyzer, and RMS Meter.

3. If the equipment is de-energized, energize the equipment using steps 1 through 4 of section 2.1. Then depress the FDM POWER ON and the FM XMTR POWER ON switches. If the equipment is on, depress the FDM POWER ON and the FM XMTR POWER ON switches.

4. Set Oscillator 1 to 500 Hz, Oscillator 2 to 2000 Hz and Oscillator 3 to 8000 Hz. Using the dial on the oscillator as the frequency is not a critical parameter. Disconnect the RMS Meter from the Tunable Discriminator output and use the RMS Meter to set the oscillator outputs to 1.75 volts rms. Set the control switches for Subcarrier 1 through 7 to Oscillator 1; set the control switches for Subcarrier 8 through

14 to Oscillator 2; and the control switch for Subcarrier 15 to Oscillator 3. Set the subcarrier amplitude controls to 1.75 volts rms using the RMS Meter to determine the amplitude at the test points on the Subcarrier Control Panel. Reconnect the RMS Meter to the output of the FM Receiver.

5. Set the Tunable Discriminator center frequency to 12 kHz; the deviation to 1 kHz; the output filter to Constant Amplitude (CA) and to 500 Hz. Tune the Wave Analyzer to the modulating frequency for the subcarrier selected.

6. Measure and record the amplitude of the modulating frequency at an rf signal level of -50 dBm. Decrease the signal level until the modulating frequency decreases 1 dB. Record the RF Attenuator setting and measure and record the modulating frequency amplitude using the Wave Analyzer. Reset the RF Attenuator for a signal level of -50 dBm.

7. Decrease the rf attenuation 5 dB and measure and record the modulation signal amplitude using the Wave Analyzer. Reduce the signal level 5 dB and repeat the measurement. Repeat this sequence until the RF Attenuator setting is 5 dB more than that recorded in the preceding step. Continue the measurements in a range from +5 dB to -5 dB from that recorded in the preceding step using RF Attenuator setting increments of 1 dB.

8. Place the control switch for the subcarrier being tested to the MOD OFF position. Set the RF Attenuator to obtain a signal level of -50 dBm. Measure and record the noise level using the RMS Meter. Repeat the noise measurement for all RF Attenuator settings used in the preceding step. Place the control switch to Oscillator 1.

9. Repeat steps 5 through 8 for Subcarrier 2 using a center frequency of 16 kHz, a deviation of 1 kHz and an output bandwidth of 500 Hz.

10. Repeat steps 5 through 9 until data is obtained for all conditions in the following table:

Subcarrier	Oscillator	Center Frequency (kHz)	Deviation kHz	Bandwidth Hz
1	1	12	1	500
2	1	16	1	500
3	1	20	1	500
4	1	24	1	500
5	1	28	1	500
6	1	32	1	500
7	1	36	1	500
8	2	48	4	2000
9	2	64	4	2000
10	2	80	4	2000
11	2	96	4	2000
12	2	112	4	2000
13	2	128	4	2000
14	2	144	4	2000
15	3	184	8	4000

11. Depress the FM XMTR POWER OFF switch and the FDM POWER OFF switch. De-energize all equipment.

APPENDIX A

BLOCK DIAGRAMS

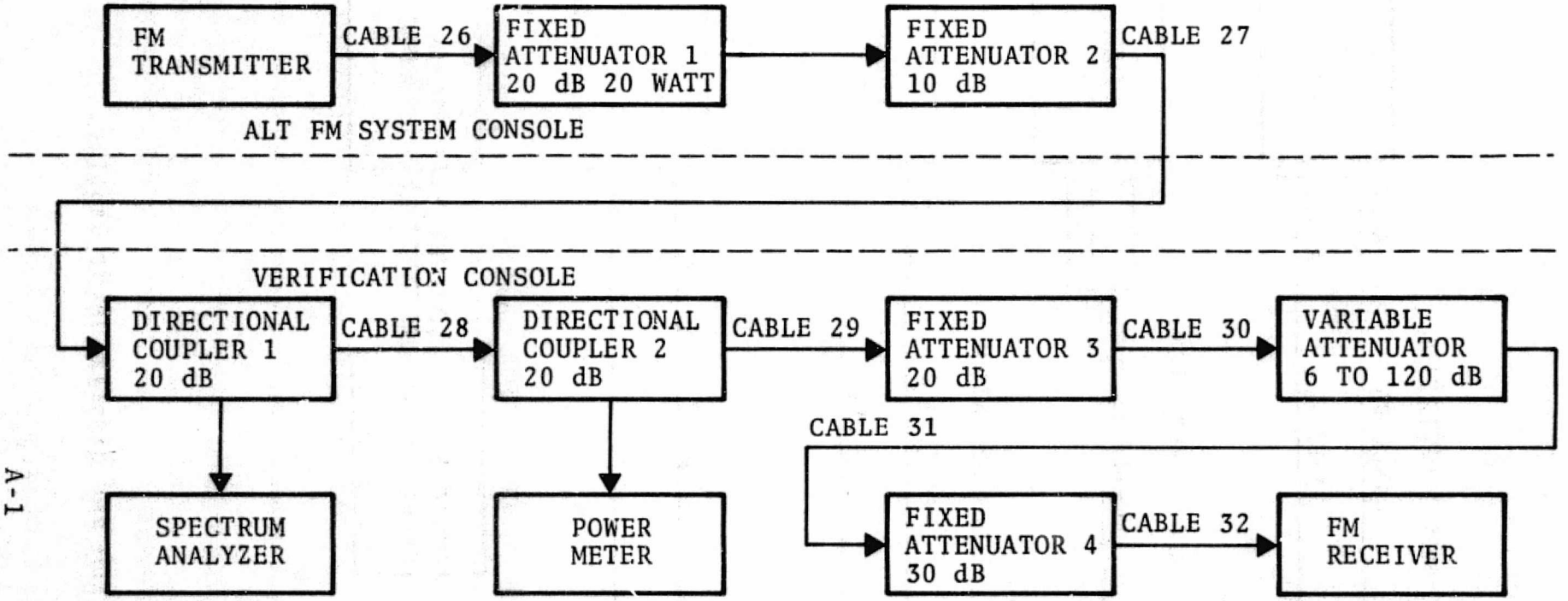


Figure A-1. — Radiofrequency path.

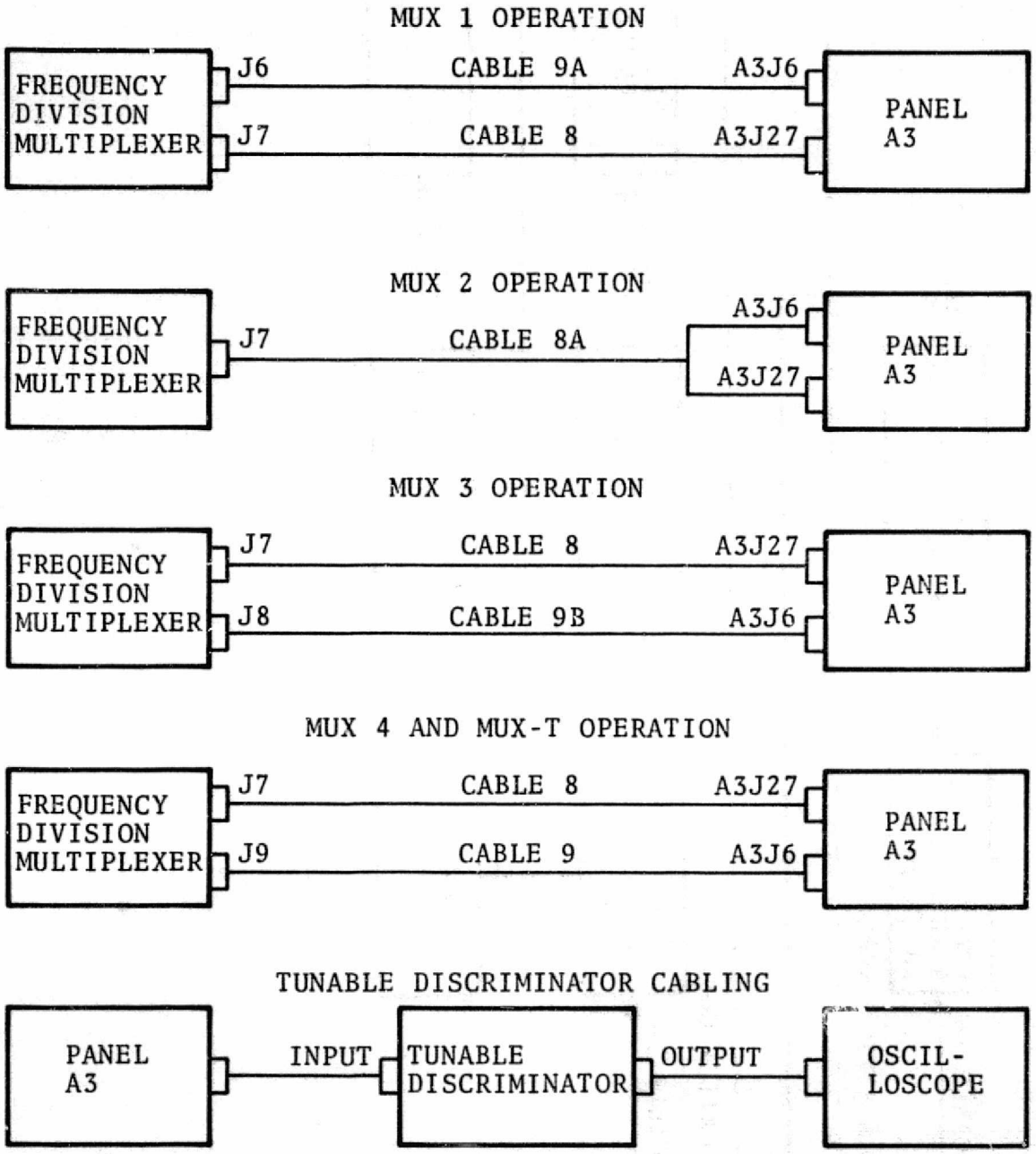


Figure A-2. — FDM and discriminator cabling.

Figure A-3. — Power measurement configuration.

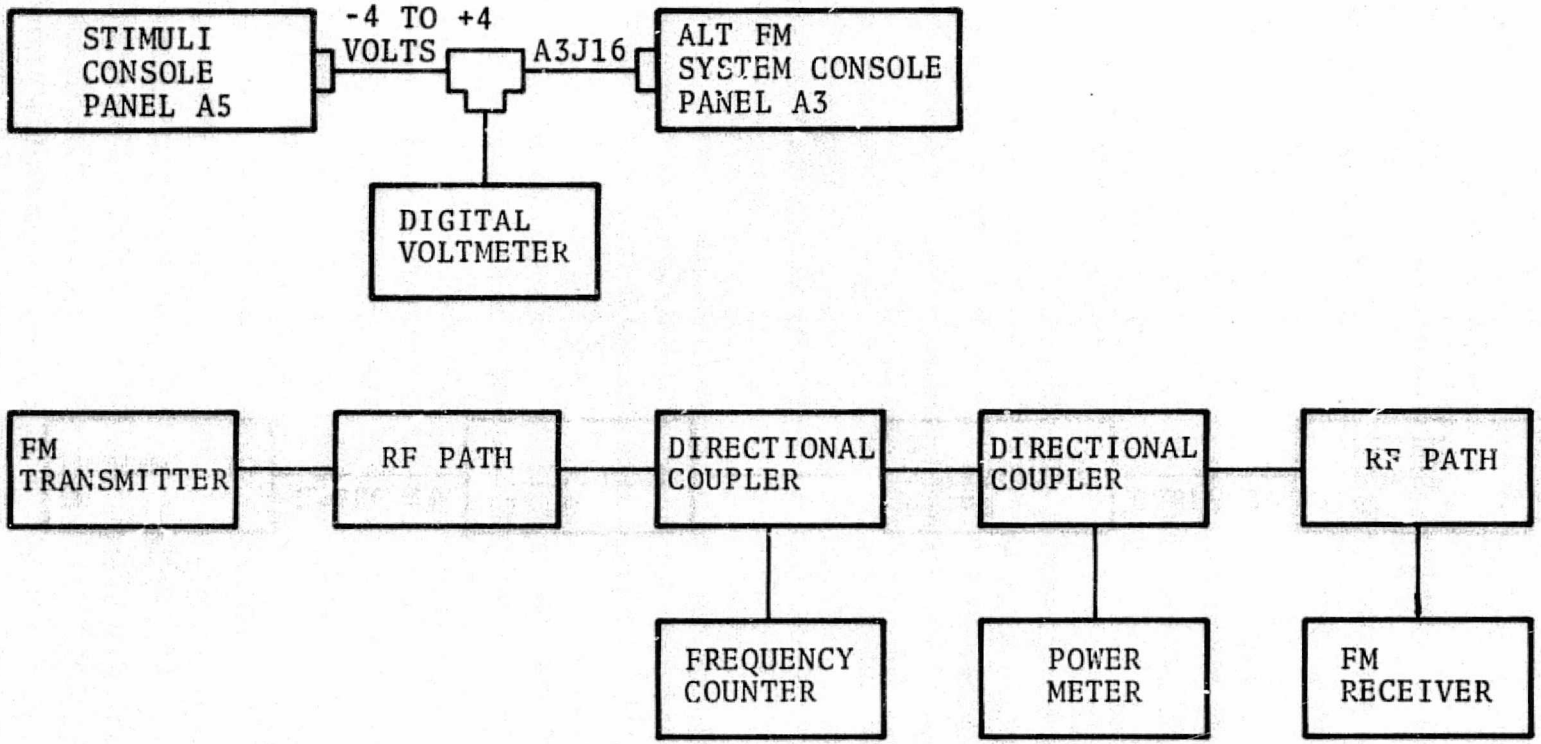


Figure A-4. — Transmitter deviation sensitivity.

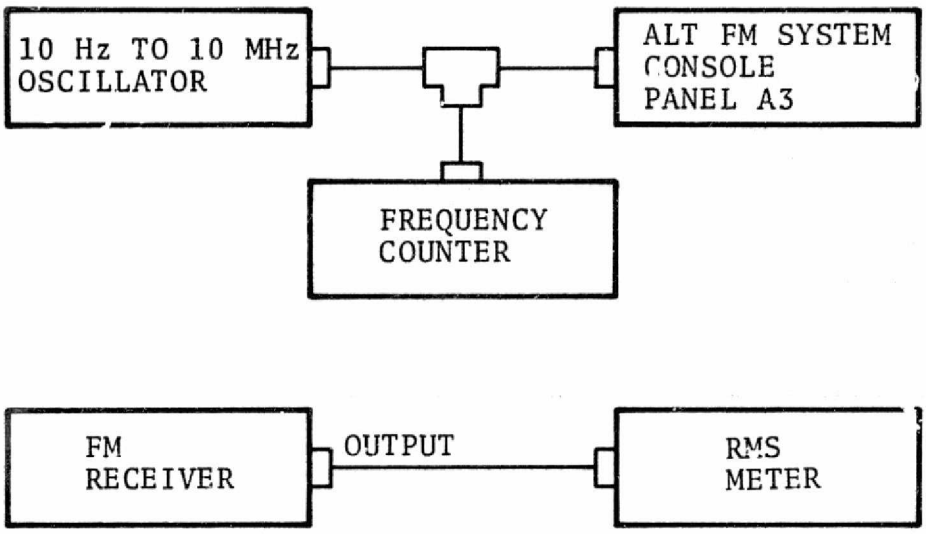


Figure A-5. – Transmitter frequency response.

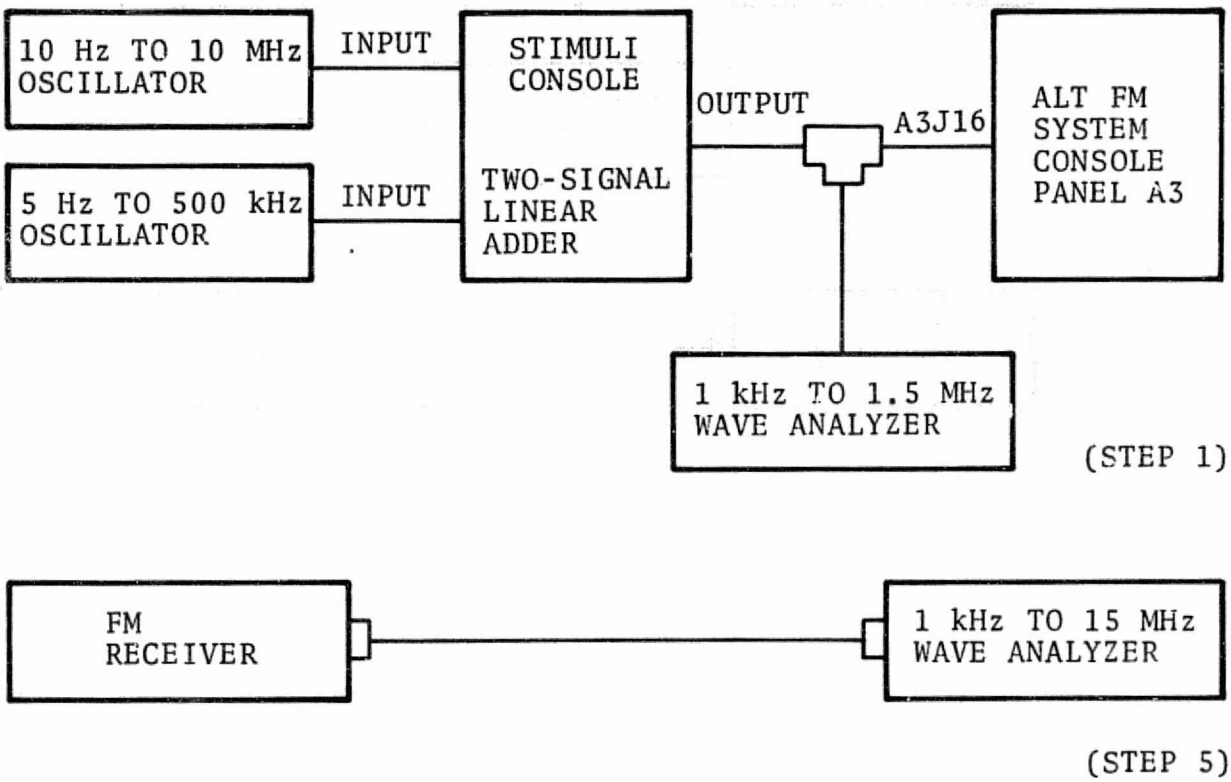


Figure A-6. — Intermodulation distortion.

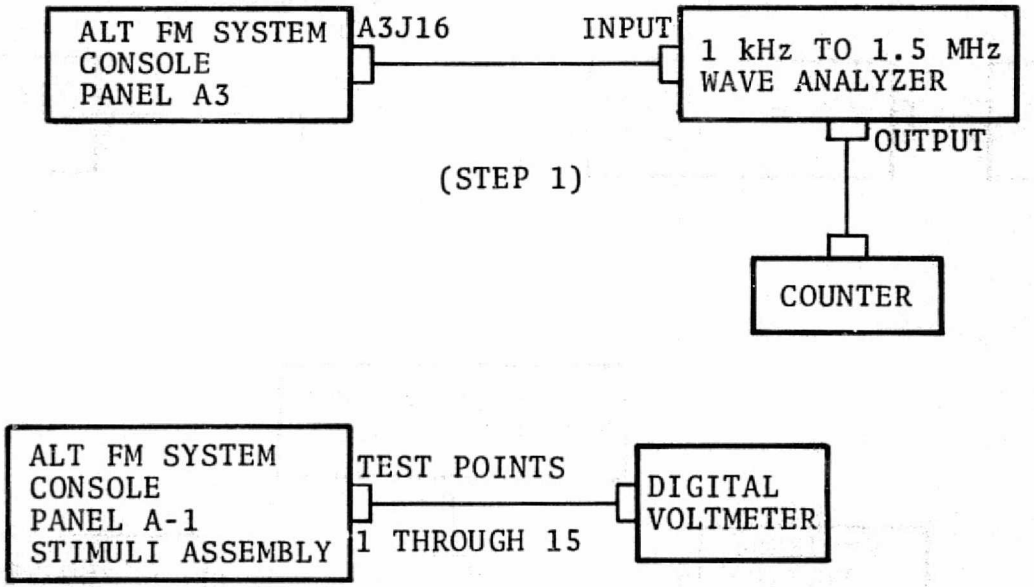
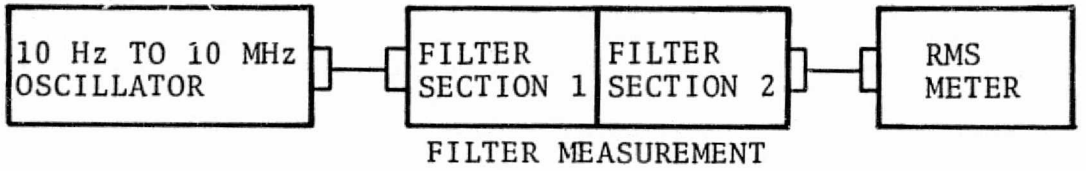
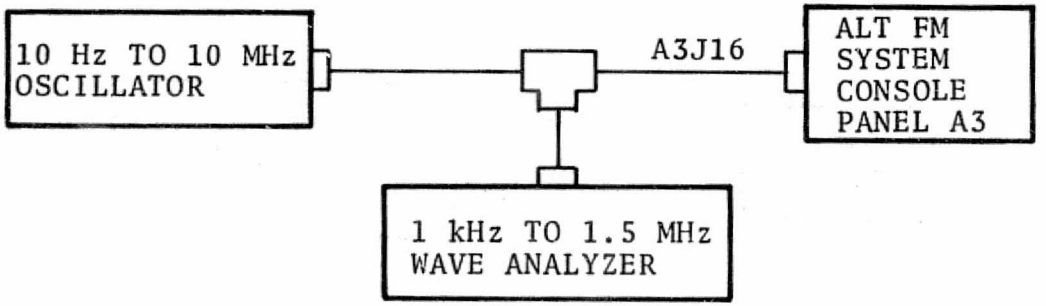
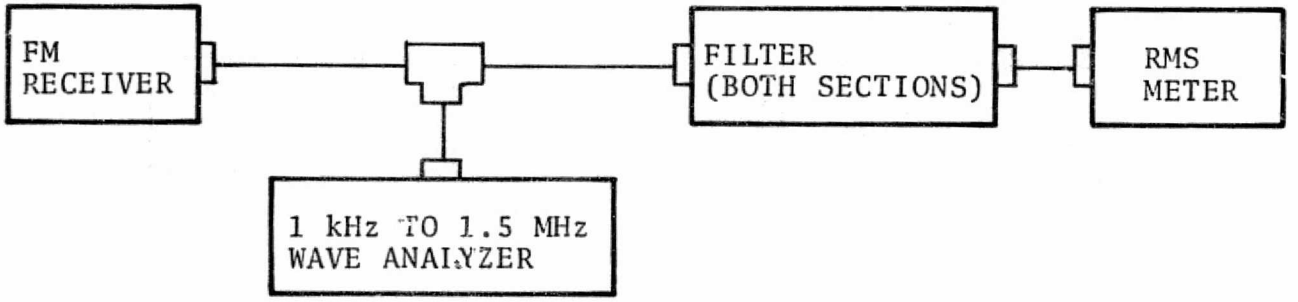


Figure A-7. — Subcarrier oscillator calibration.



FILTER MEASUREMENT





SIGNAL AND NOISE MEASUREMENTS

Figure A-8. – Signal and noise measurements.

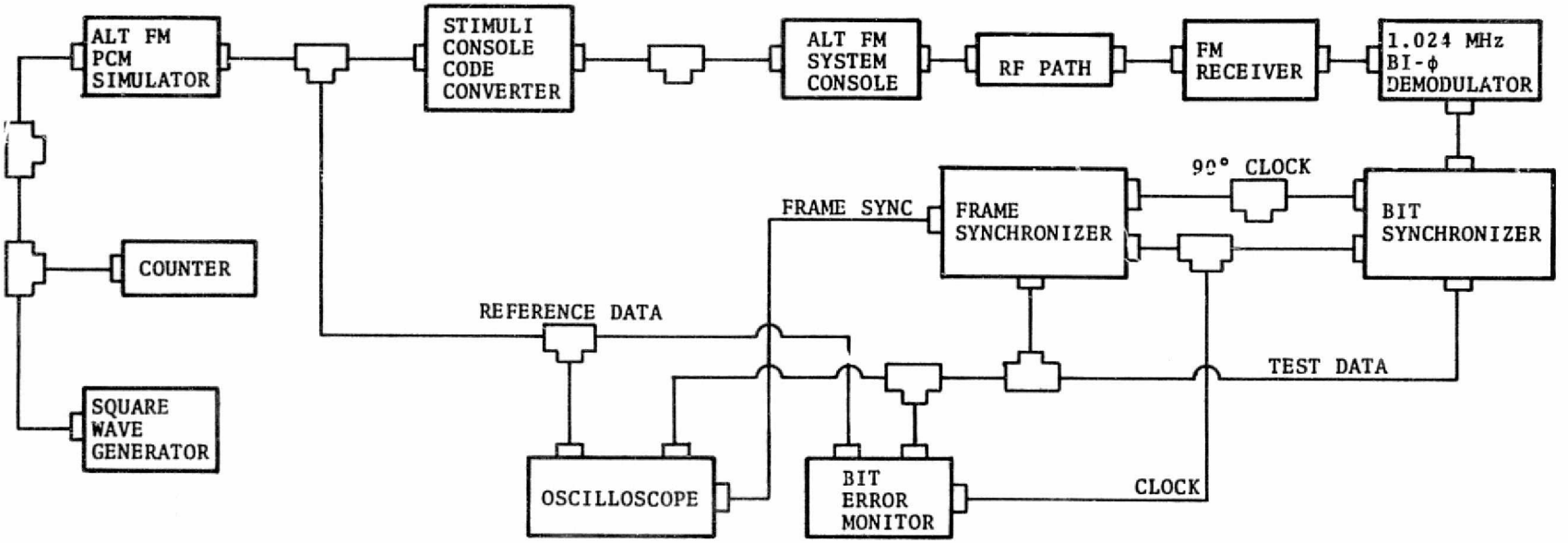


Figure A-9. — Bit error rate test.

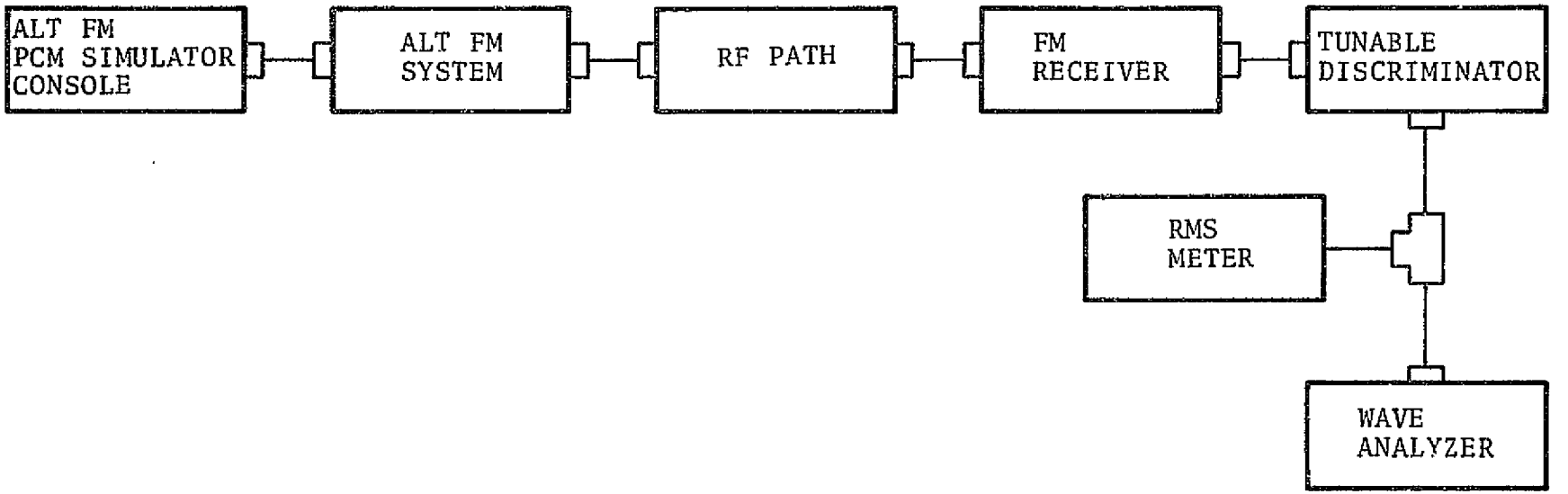


Figure A-10. – Subcarrier oscillator data performance.

APPENDIX B

DATA SHEETS

2.1 SYSTEM POWER TEST

DATE _____

Quality Control

(1) RF PATCH CHECK _____

(2) RF PATH DRAWING _____

SPECTRUM ANALYZER DATA

_____

_____ _____

RF POWER METER DATA

_____

_____ _____

FM RECEIVER DATA

_____

_____ _____

(3) SYSTEM ENERGIZED _____

(4) SYSTEM INITIALIZED _____

(5) SPACECRAFT POWER APPLIED _____

2.1 SYSTEM POWER TEST

DATE _____

Quality Control

(6) SUBCARRIER PRESENT _____

RF POWER REFERENCE _____

Sheet 2 of 2 Sheets

2.2 FDM TEST PANEL VOLTAGES

DATE _____

Quality Control

(1) SYSTEM POWER ON

(2) DIGITAL VOLTMETER DATA

_____

_____ _____

(3) MUX 1 +12 V _____

-12 V _____

+24 V _____

MUX 2 +12 V _____

-12 V _____

+24 V _____

MUX 3 +12 V _____

-12 V _____

+24 V _____

MUX 4 +12 V _____

-12 V _____

+24 V _____ _____

(4) MUX 1 BITE _____

MUX 2 BITE _____

MUX 3 BITE _____

MUX 4 BITE _____

MUX 5 BITE _____ _____

2.2 FDM TEST PANEL VOLTAGES

DATE _____

Quality Control

(5)	CALIBRATOR	+5 V	_____	
	MUX-T	+5 V	_____	_____
(6)	STATUS DATA VERIFICATION SWITCH.			
	MODE 0		_____	
	MODE 1		_____	
	MODE 2		_____	
	MODE 3		_____	
	MODE 4		_____	
	MODE 5		_____	
	MODE 6		_____	
	MODE 7		_____	_____

2.3 MODE SELECTION TEST

DATE _____

Quality Control

(1) EQUIPMENT ENERGIZED _____

(2) MODE 0 TEST _____

(3) MODE 1 TEST _____

(4) MODE 2 TEST _____

(5) MODE 3 TEST _____

(6) MODE 4 TEST _____

(7) MODE 5 TEST _____

(8) MODE 6 TEST _____

(9) MODE 7 TEST _____

(10) MUX 1 THROUGH MUX 4 AND MUX-T TEST _____

2.4 FIFTY-HERTZ CALIBRATOR TEST

DATE _____

Quality Control

(1) POWER ON _____

(2) OSCILLOSCOPE DATA

_____

_____

_____ _____

(3) OSCILLOSCOPE CALIBRATION _____

(4) DC OFFSET _____ _____

PEAK-TO-PEAK AMPLITUDE _____ _____

DISTORTION _____ _____

2.5 MULTIPLEXER FUNCTIONAL TEST

DATE _____

Quality Control

(1) SYSTEM POWER _____

(2) TUNABLE DISCRIMINATOR DATA

_____

_____

RMS VOLTMETER DATA

_____

_____

OSCILLOSCOPE DATA

_____

_____ _____

(3) STIMULI ADJUSTED _____

(4) CABLING COMPLETE _____

(5) MUX 1 DATA OUTPUT _____

(6) MUX 1 GSE OUTPUT _____

(7) MUX 2 DATA OUTPUT _____

2.5 MULTIPLEXER FUNCTIONAL TEST

DATE _____

Quality Control

(8)	MUX 2	GSE	OUTPUT	_____
(9)	MUX 3	DATA	OUTPUT	_____
(10)	MUX 3	GSE	OUTPUT	_____
(11)	MUX 4	DATA	OUTPUT	_____
(12)	MUX 4	GSE	OUTPUT	_____
(13)	MUX-T	DATA	OUTPUT	_____
(14)	MUX-T	GSE	OUTPUT	_____
(15)	SYSTEM OFF AND RECONFIGURED			_____

3.1 RF POWER OUTPUT

DATE _____

Quality Control

(1) POWER OFF _____

(2) FIXED LOSSES

CABLE 26	_____
CABLE 27	_____
CABLE 28	_____
CABLE 29	_____
CABLE 30	_____
CABLE 31	_____
CABLE 32	_____
FIXED ATTENUATOR 1	_____
FIXED ATTENUATOR 2	_____
FIXED ATTENUATOR 3	_____
FIXED ATTENUATOR 4	_____
DIRECTIONAL COUPLER 1	_____
DIRECTIONAL COUPLER 2	_____
TOTAL FIXED LOSSES	_____ _____

3.1 RF POWER OUTPUT
(PATH CALIBRATION)

DATE _____

Quality Control

(3)	RF POWER MEASUREMENT	_____	dBm	_____
(2)	CABLE 27 LOSS	_____	dB	_____
(4)	ALT FM SYSTEM CONSOLE POWER OUTPUT	_____	dBm	_____
(2)	CABLE 26 LOSS	_____	dB	
(2)	FIXED ATTENUATOR 1	_____	dB	
(2)	FIXED ATTENUATOR 2	_____	dB	
(2)	LOSS TOTAL	_____	dB	
(4)	FM TRANSMITTER OUTPUT	_____	dBm	_____
(5)	TOTAL FIXED LOSSES	_____	dB	_____
(6)	FM RECEIVER POWER (at 0 dB equivalent variable attenuation)	_____	dBm	_____
(7)	POWER METER READING NO MODULATION	_____	dBm	_____

3.1 RF POWER OUTPUT
(PATH CALIBRATION)

DATE _____

Quality Control

(8) POWER METER READING WITH MODULATION _____ dBm _____

(9) POWER METER DATA

_____

_____ _____

3.2 TRANSMITTER DEVIATION SENSITIVITY

DATE _____

Quality Control

(1) CABLING COMPLETE _____

(2) FREQUENCY CONVERTER INSTALLED _____

(3) POWER ON AND INITIAL ADJUSTMENT _____

(4) DIGITAL VOLTMETER

_____

_____ _____

FREQUENCY CONVERTER

_____

_____ _____

COUNTER

_____

_____ _____

3.2 TRANSMITTER DEVIATION SENSITIVITY

DATE _____

Quality Control

(5-7) VOLTAGE	FREQUENCY	
_____	_____	
_____	_____	
_____	_____	
_____	_____	
_____	_____	
_____	_____	
_____	_____	
_____	_____	
_____	_____	
_____	_____	
_____	_____	
_____	_____	
_____	_____	
_____	_____	
_____	_____	
_____	_____	
_____	_____	
_____	_____	_____

(8) RECONFIGURE SYSTEM _____

3.3 TRANSMITTER FREQUENCY RESPONSE

DATE _____

Quality Control

(1) OSCILLATOR CABLING _____

(2 RMS VOLTMETER CABLING _____

(3) OSCILLATOR DATA

_____

_____ _____

FREQUENCY COUNTER DATA

_____

_____ _____

RMS METER DATA

_____

_____ _____

FM RECEIVER

_____

_____ _____

(4) POWER ON _____

Sheet 1 of 2 Sheets

3.3 TRANSMITTER FREQUENCY RESPONSE

DATE _____

Quality Control

	NOMINAL FREQ.	MEASURED FREQ.	RMS AMPLITUDE
(5)	10 Hz	_____	_____
(6)	0.25 MHz	_____	_____
	0.50 MHz	_____	_____
	0.75 MHz	_____	_____
	1.00 MHz	_____	_____
	1.25 MHz	_____	_____
	1.50 MHz	_____	_____
	1.75 MHz	_____	_____
	2.00 MHz	_____	_____
	2.25 MHz	_____	_____
	2.50 MHz	_____	_____
	2.75 MHz	_____	_____
	3.00 MHz	_____	_____
		_____	_____
		_____	_____
		_____	_____
		_____	_____
		_____	_____
		_____	_____
		_____	_____ _____

(7) RECONFIGURE EQUIPMENT _____

3.4 INTERMODULATION DISTORTION

DATE _____

Quality Control

(1) MODULATION SIGNAL CABLING _____

(2) ENERGIZE SYSTEM _____

(3) STIMULI ADJUSTMENT _____

(4) STIMULI CONSOLE OSCILLATOR

_____

_____ _____

ALT FM SYSTEM OSCILLATOR 1

_____

_____ _____

WAVE ANALYZER

_____

_____ _____

FM RECEIVER

_____

_____ _____

(5) WAVE ANALYZER CABLE TO FM RECEIVER _____

3.4 INTERMODULATION DISTORTION

DATE _____

Quality Control

(6) NOMINAL FREQ.	AMPLITUDE	
100 kHz	_____	
900 kHz	_____	
1.00 MHz	_____	
1.10 MHz	_____	_____

(7) RECONFIGURE _____

3.5 SUBCARRIER OSCILLATOR CALIBRATION

DATE _____

Quality Control

(1) SYSTEM CONFIGURATION _____

(2) ENERGIZE SYSTEM _____

(3) WAVE ANALYZER

_____

_____ _____

DIGITAL VOLTMETER

_____

_____ _____

COUNTER

_____

_____ _____

3.5 SUBCARRIER OSCILLATOR CALIBRATION

DATE _____

Quality Control

(5) (6)

	BAND CENTER			
SUBCARRIER	VOLTAGE	FREQUENCY	AMPLITUDE	
1	_____	_____	_____	
2	_____	_____	_____	
3	_____	_____	_____	
4	_____	_____	_____	
5	_____	_____	_____	
6	_____	_____	_____	
7	_____	_____	_____	
8	_____	_____	_____	
9	_____	_____	_____	
10	_____	_____	_____	
11	_____	_____	_____	
12	_____	_____	_____	
13	_____	_____	_____	
14	_____	_____	_____	
15	_____	_____	_____	
1.024 MHz	_____	_____	_____	_____

3.5 SUBCARRIER OSCILLATOR CALIBRATION

DATE _____

Quality Control

(7)(8)

LOWER BAND EDGE

SUBCARRIER	VOLTAGE	FREQUENCY	AMPLITUDE	
1	_____	_____	_____	
2	_____	_____	_____	
3	_____	_____	_____	
4	_____	_____	_____	
5	_____	_____	_____	
6	_____	_____	_____	
7	_____	_____	_____	
8	_____	_____	_____	
9	_____	_____	_____	
10	_____	_____	_____	
11	_____	_____	_____	
12	_____	_____	_____	
13	_____	_____	_____	
14	_____	_____	_____	
15	_____	_____	_____	_____

3.5 SUBCARRIER OSCILLATOR CALIBRATION

DATE _____

Quality Control

(9) (10)

UPPER BAND EDGE

SUBCARRIER	VOLTAGE	FREQUENCY	AMPLITUDE	
1	_____	_____	_____	
2	_____	_____	_____	
3	_____	_____	_____	
4	_____	_____	_____	
5	_____	_____	_____	
6	_____	_____	_____	
7	_____	_____	_____	
8	_____	_____	_____	
9	_____	_____	_____	
10	_____	_____	_____	
11	_____	_____	_____	
12	_____	_____	_____	
13	_____	_____	_____	
14	_____	_____	_____	
15	_____	_____	_____	_____

(11) RECONFIGURE SYSTEM _____

3.6 PCM PERFORMANCE TEST

DATE _____

Quality Control

(1) CABLING _____

(2) OSCILLATOR

_____

_____ _____

COUNTER

_____

_____ _____

FILTER

_____

_____ _____

RMS METER

_____

_____ _____

(3) (SEE NEXT SHEET FOR FILTER DATA)

(4) SYSTEM CABLING _____

(5) ENERGIZE SYSTEM _____

3.6 PCM PERFORMANCE TEST
(FILTER BANDWIDTH)
MAX FLAT 500 kHz TO 1500 kHz TWO SECTIONS

DATE _____

Quality Control

(3)	FREQUENCY (kHz)	AMPLITUDE
	1,000 (REF)	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____

_____

3.6 PCM PERFORMANCE TEST

DATE _____

Quality Control

(6) WAVE ANALYZER

_____ _____

_____ _____

FILTER

_____

_____ _____

(7) 1.024 MHz SIGNAL LEVEL _____

		RF ATTENUATOR	1.024 MHz AMPLITUDE	
(8)	-50 dBm	_____	_____	_____
(9)		_____	_____	_____

		RF ATTENUATOR	NOISE AMPLITUDE	
(10)	-50 dBm	_____	_____	_____
(11)		_____	_____	_____

3.6 PCM PERFORMANCE TEST

DATE _____

Quality Control

(12-14)

RF ATTENUATOR	SIGNAL	NOISE

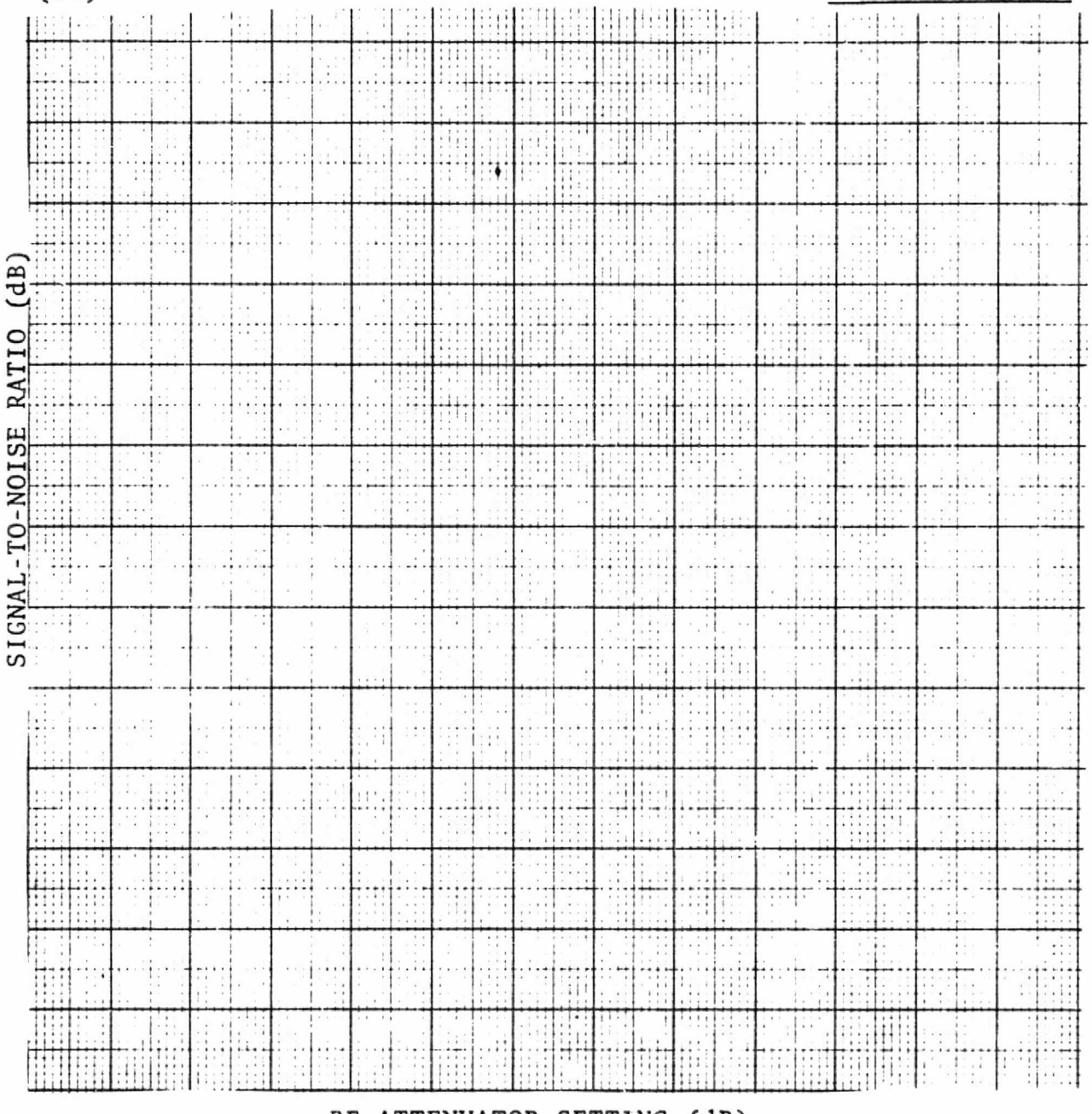
Sheet 4 of 7 Sheets

3.6 PCM PERFORMANCE TEST

DATE _____

Quality Control

(15)



3.6 PCM PERFORMANCE TEST
(BIT ERROR RATE CONFIGURATION)

DATE _____

Quality Control

(16) CONFIGURE EQUIPMENT FOR BER TEST _____

(17) INITIAL ADJUSTMENTS _____

(18) ALT FM PCM SIMULATOR SIGNAL _____

(19) CODE CONVERTER SIGNAL _____

(20) ENERGIZE SYSTEM _____

(21) BIT ERROR MONITOR SETUP _____

(22) ZERO ERRORS _____

3.6 PCM PERFORMANCE TEST
(BIT ERROR RATE CONFIGURATION)

DATE _____

Quality Control

(23)

RF ATTENUATOR	RF POWER	NUMBER OF SAMPLES	ERROR RATE

_____

(24) SYSTEM OFF _____

3.7 SUBCARRIER OSCILLATOR DATA PERFORMANCE TEST

DATE _____

Quality Control

(1) SYSTEM CABLING _____

(2) FM RECEIVER

_____

_____ _____

TUNABLE DISCRIMINATOR

_____

_____ _____

WAVE ANALYZER

_____

_____ _____

RMS METER

_____

_____ _____

(3) ENERGIZE EQUIPMENT _____

(4) MODULATION SELECTION _____

(5-10) (SEE SEPARATE DATA SHEETS) _____

Sheet 1 of 3 Sheets

3.7 SUBCARRIER OSCILLATOR DATA PERFORMANCE TEST

DATE _____

Quality Control

SUBCARRIER OSCILLATOR NUMBER _____

SUBCARRIER FREQUENCY _____

DEVIATION _____

BANDWIDTH _____ _____

(6)	RF ATTENUATOR	DATA SIGNAL AMPLITUDE	
-50 dBm	_____	_____	_____

(7 & 8)

_____	_____	_____	
_____	_____	_____	
_____	_____	_____	
_____	_____	_____	
_____	_____	_____	
_____	_____	_____	
_____	_____	_____	
_____	_____	_____	
_____	_____	_____	
_____	_____	_____	
_____	_____	_____	
_____	_____	_____	
_____	_____	_____	

3.7 SUBCARRIER OSCILLATOR DATA PERFORMANCE TEST

DATE _____

Quality Control

(7 & 8)	RF ATTENUATOR	DATA SIGNAL AMPLITUDE	
_____	_____	_____	
_____	_____	_____	
_____	_____	_____	
_____	_____	_____	
_____	_____	_____	
_____	_____	_____	
_____	_____	_____	
_____	_____	_____	
_____	_____	_____	
_____	_____	_____	
_____	_____	_____	
_____	_____	_____	
_____	_____	_____	
_____	_____	_____	
_____	_____	_____	_____

(11) SYSTEM OFF _____