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AEROFLEX

Transponder/DME Test Set
ATC-1400A-2

Operation Manual

1002-7504-200

Issue-3

OPERATION MANUAL

TRANSPONDER/DME TEST SET

ATC-1400A-2

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Aeroflex

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Cable Statement:

For continued EMC compliance, double shielded and properly terminated external interface cables must be used with this equipment when interfacing with the GPIB, INTERROGATOR, INDICATOR, IFR BUS and/or AUXILIARY Connectors.

For continued EMC compliance, all external cables must be 3 meters or less in length.

During the occurrence of a voltage dip, interruption or surge on the power line, the display readouts may momentarily dim and Transmitter Power may momentarily display an erroneous reading.

Nomenclature Statement:

The ATC-1400A-2 Transponder/DME Test Set is the official nomenclature for the EMC and Safety compliant ATC-1400A Transponder/DME Test set. The generic terms Unit and Test Set also refer to the ATC-1400A-2 Transponder/DME Test Set.

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SAFETY FIRST: TO ALL OPERATIONS PERSONNEL

REFER ALL SERVICING OF UNIT TO QUALIFIED TECHNICAL PERSONNEL. THIS UNIT CONTAINS NO OPERATOR SERVICEABLE PARTS.

WARNING: USING THIS EQUIPMENT IN A MANNER OTHER THAN SPECIFIED BY THE ACCOMPANYING DOCUMENTATION MAY IMPAIR THE SAFETY PROTECTION PROVIDED BY THE EQUIPMENT.

CASE, COVER OR PANEL REMOVAL

Removing protective covers, casings or panels from this Test Set exposes the operator to electrical hazards that can result in electrical shock or equipment damage. Do not oeprate this Test Set with the case, cover or panels removed.

SAFETY IDENTIFICATION IN TECHNICAL MANUAL

This manual uses the following terms to draw attention to possible safety hazards, that may exist when operating this equipment.

CAUTION: THIS TERM IDENTIFIES CONDITIONS OR ACTIVITIES THAT, IF IGNORED, CAN RESULT IN EQUIPMENT OR PROPERTY DAMAGE (E.G., FIRE).

WARNING: THIS TERM IDENTIFIES CONDITIONS OR ACTIVITIES THAT, IF IGNORED, CAN RESULT IN PERSONAL INJURY OR DEATH.

SAFETY SYMBOLS IN MANUALS AND ON UNITS


CAUTION: Refer to accompanying documents. (This symbol refers to specific CAUTIONS represented on the unit and clarified in the text.)


AC OR DC TERMINAL: Terminal that may supply or be supplied with ac or dc voltage.

DC TERMINAL: Terminal that may supply or be supplied with dc voltage.


AC TERMINAL: Terminal that may supply or be supplied with ac or alternating voltage.


SWITCH OFF: AC line power to the device is OFF.

SWITCH ON: AC line power to the device is ON.

EQUIPMENT GROUNDING PRECAUTION

Improper grounding of equipment can result in electrical shock.

USE OF PROBES

Check the specifications for the maximum voltage, current and power ratings of any connector on the Test Set before connecting it with a probe from a terminal device. Be sure the terminal device performs within these specifications before using it for measurement, to prevent electrical shock or damage to the equipment.

POWER CORDS

Avoid using power cords which are frayed, broken or expose bare wiring when operating this equipment.

USE RECOMMENDED FUSES ONLY

Use only fuses specifically recommended for the equipment at the specified current and voltage ratings.

CAUTION: SIGNAL GENERATORS CAN BE A SOURCE OF ELECTROMAGNETIC INTERFERENCE (EMI) TO COMMUNICATION RECEIVERS. SOME TRANSMITTED SIGNALS CAN CAUSE DISRUPTION AND INTERFERENCE TO COMMUNICATION SERVICES OUT TO A DISTANCE OF SEVERAL MILES. USERS OF THIS EQUIPMENT SHOULD SCRUTINIZE ANY OPERATION THAT RESULTS IN RADIATION OF A SIGNAL (DIRECTLY OR INDIRECTLY) AND SHOULD TAKE NECESSARY PRECAUTIONS TO AVOID POTENTIAL COMMUNICATION INTERFERENCE PROBLEMS.

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LIST OF EFFECTIVE PAGES

CHAPTER/SECTION/SUBJECT	PAGE	DATE
Title/Copyright Page		Nov 1/04
Statements		Nov 1/04
Safety Page		Nov 1/04
List of Effective Pages	1 through 2	Nov 1/04
Table of Contents	1 through 2	Nov 1/04
Introduction	1 through 2	Nov 1/04
1-Table of Contents	1 through 2	Nov 1/04
1-List of Illustrations/Tables	1 through 2	Nov 1/04
1-1-1	1 through 4	Nov 1/04
1-2-1	1 through 6	Nov 1/04
1-2-2	1 through 12	Nov 1/04
1-2-3	1 through 18	Nov 1/04
1-2-4	1 through 20	Nov 1/04
1-2-5	1 through 42	Nov 1/04
1-3-1	1 through 8	Nov 1/04
1-4-1	1 through 2	Nov 1/04
1-5-1	1 through 2	Nov 1/04
Appendix A	1 through 2	Nov 1/04
Appendix B	1 through 6	Nov 1/04
Appendix C	1 through 2	Nov 1/04
Appendix D	1 through 32	Nov 1/04
Appendix E	1 through 6	Nov 1/04
Appendix F	1 through 2	Nov 1/04
Appendix G	1 through 2	Nov 1/04
Appendix H	1 through 2	Nov 1/04
Appendix I	1 through 2	Nov 1/04
Appendix J	1 through 2	Nov 1/04
Index	1 through 2	Nov 1/04

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TABLE OF CONTENTS

Title	Chapter/Section
Title/Copyright Page	
Statements	
Safety Page	
List of Effective Pages	
Table of Contents	
Introduction	
Chapter 1	
Section 1 - Description	1-1
Section 2 - Operation	1-2
Section 3 - Specifications	1-3
Section 4 - Shipping	1-4
Section 5 - Storage	1-5
Appendix A - Multiline Interface Messages: ISO Code Representation	
Appendix B - DME Channeling and VHF Frequency Pairing	
Appendix C - ATCRBS Interrogation Modes and XPDR Reply Codes	
Appendix D - Altitude Transmission Code Chart	
Appendix E - Connector Pin Out Tables	
Appendix F - Baseline Setting using ATC-1400A-2 XMTR Detected Output	
Appendix G - Test Equipment Requirements	
Appendix H - Construction of Heterodyne Monitor	
Appendix I - Abbreviations	
Appendix J - EMC and Safety Compliance	
Index	

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INTRODUCTION – ATC-1400A-2 TEST SET

This manual contains the information necessary to install, operate and evaluate the ATC-1400A-2 Test Set.

It is strongly recommended that personnel be thoroughly familiar with the contents of this manual before attempting to operate this equipment.

Refer all servicing of the ATC-1400A-2 Test Set to qualified technical personnel.

ORGANIZATION

This manual is divided into the following Chapters and Sections:

CHAPTER 1 - OPERATION

Section 1 - DESCRIPTION (description of the ATC-1400A-2)

Section 2 - OPERATION (installation; description of controls, connectors and indicators; performance evaluation; general operating procedures; and remote operation)

Section 3 - SPECIFICATIONS

Section 4 - SHIPPING

Section 5 - STORAGE

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CHAPTER ONE

ATC-1400A-2 TRANSPONDER/DME TEST SET

OPERATION MANUAL

TABLE OF CONTENTS

Title	Chapter/Section/Subject	Page
SECTION 1 - DESCRIPTION	1-1	
1. General Description And Capabilities	1-1-1	1
A. General	1-1-1	1
B. Functional Capabilities	1-1-1	1
(1) Signal Generator	1-1-1	1
(2) DME Mode	1-1-1	1
(3) XPDR Mode	1-1-1	3
(4) UUT Measurements	1-1-1	4
(5) Auxiliary Unit Capability	1-1-1	4
C. Electrical Description	1-1-1	4
SECTION 2 - OPERATION	1-2	
1. Installation	1-2-1	1
A. General	1-2-1	1
B. Safety Precautions	1-2-1	1
(1) Complying with Instructions	1-2-1	1
(2) Grounding Requirements	1-2-1	1
(3) Operating Safety	1-2-1	1
(4) CAUTION and WARNING Labels	1-2-1	1
C. Power Requirements	1-2-1	1
D. Rack-Mount Installation	1-2-1	2
E. External Cleaning	1-2-1	2
F. System Interconnect Cables	1-2-1	3
(1) ARINC 568 Indicator Interface	1-2-1	3
(2) ARINC 568 Interrogator Interface	1-2-1	3
2. Description of Controls, Connectors and Indicators	1-2-2	1
A. ATC-1400A-2 Front Panel	1-2-2	3
B. ATC-1400A-2 Rear Panel	1-2-2	11
3. Performance Evaluation	1-2-3	1
A. General	1-2-3	1
B. Pre-Operational Considerations	1-2-3	1
C. Controls, Connectors and Indicators	1-2-3	1
D. Test Equipment Requirements	1-2-3	1
E. Corrective Maintenance Procedures	1-2-3	1
F. Test Record	1-2-3	1
G. Performance Evaluation Procedures	1-2-3	2
(1) Generate	1-2-3	2
(2) Receive	1-2-3	8
(3) Parameter Verifications	1-2-3	10
H. Performance Evaluation Data Sheet	1-2-3	14

Title	Chapter/Section/Subject	Page
4. General Operating Procedures	1-2-4	1
A. General	1-2-4	1
B. Pre-Operational Considerations	1-2-4	1
C. Controls, Connectors and Indicators	1-2-4	1
D. Test Equipment Requirements	1-2-4	1
E. Operating Precautions	1-2-4	1
F. XPDR Test Examples	1-2-4	3
(1) Measuring Receiver Bandwidth and Minimum Threshold Level (MTL)	1-2-4	3
(2) Measuring Side Lobe Suppression (SLS)	1-2-4	4
(3) Measuring Pulse Deviation	1-2-4	5
(4) Verification of Interrogator Recovery Time	1-2-4	6
(5) Pulse Width Decoder Operation	1-2-4	7
(6) Measuring Frequency and Power Output	1-2-4	8
(7) Measuring Pulse Shape and Width, Transmitter Droop and Frequency Pulling	1-2-4	8
(8) Measuring Identification and Altitude Codes	1-2-4	9
G. DME Test Examples	1-2-4	12
(1) Measuring DME Transmitter Frequency and Power	1-2-4	12
(2) Measuring Transmitter Pulse Characteristics	1-2-4	13
(3) Measuring Receiver Memory Time	1-2-4	14
(4) Measuring Receiver Bandwidth and Sensitivity	1-2-4	15
(5) Measuring Pulse Position Decoder Accuracy	1-2-4	16
(6) Adjacent Channel Test	1-2-4	17
(7) Measuring Accuracy and Tracking	1-2-4	18
(8) Measuring Acquisition Time	1-2-4	19
(9) Measuring Echo and Co-Channel Performance	1-2-4	20
5. Remote Operation	1-2-5	1
A. General	1-2-5	1
(1) GPIB Transactions	1-2-5	1
(2) Status and Service Request Transaction	1-2-5	2
B. Command and Data Structure	1-2-5	3
(1) ASCII Output Commands to ATC-1400A-2	1-2-5	3
(2) ASCII Output Command Format Example	1-2-5	3
(3) ASCII Commands to Input Data from ATC-1400A-2	1-2-5	3
(4) ASCII Input Command Format Example	1-2-5	3
C. ATC-1400A-2 Alphabetical Quick Reference ASCII Command Table	1-2-5	4
D. Explanation of Codes for Common Commands	1-2-5	8
SECTION 3 - SPECIFICATIONS	1-3	
1. General	1-3-1	1
A. Signal Generator	1-3-1	1
B. DME Mode Characteristics	1-3-1	2
C. XPDR Mode Characteristics	1-3-1	4
D. UUT Measurement Characteristics	1-3-1	6
E. Power Requirements	1-3-1	6
F. Fuse Requirements	1-3-1	7
G. Safety Conditions	1-3-1	7
SECTION 4 - SHIPPING	1-4	
1. General	1-4-1	1
A. Shipping Information	1-4-1	1
B. Repacking Procedure	1-4-1	1
SECTION 5 - STORAGE	1-5	
1. General	1-5-1	1

LIST OF ILLUSTRATIONS

Title	Chapter/Section/Subject	Page
ATC-1400A-2/ARINC 568 DME Functional Block Diagram	1-1-1	2
ATC-1400A-2/ARINC 572 XPDR Functional Block Diagram	1-1-1	3
ATC-1400A-2/ARINC 568 DME Interface	1-2-1	3
ATC-1400A-2/ARINC 572 Transponder Interface	1-2-1	4
ATC-1400A-2/ARINC 568 DME Interconnect Assemblies	1-2-1	5
ATC-1400A-2/ARINC 568 DME Interconnect Wiring Diagram	1-2-1	6
ATC-1400A-2 Front and Rear Panels	1-2-2	1
Generate Set-Up Diagram	1-2-3	3
Receive Set-Up Diagram	1-2-3	9
ATC-1400A-2 Front Panel Controls - XPDR Test Examples	1-2-4	2
ATC-1400A-2 Rear Panel Controls - XPDR Test Examples	1-2-4	2
Transmitter Droop	1-2-4	10
Transmitter Frequency Pull F_1/P_1 No. 1	1-2-4	10
Transmitter Frequency Pull F_1/P_1 No. 2	1-2-4	10
ATC-1400A-2 Front Panel Controls - DME Test Examples	1-2-4	11
ATC-1400A-2 Rear Panel Controls - DME Test Examples	1-2-4	11
Repacking Procedure	1-4-1	2

LIST OF TABLES

Title	Chapter/Section/Subject	Page
ATC-1400A-2 Major Electrical Systems	1-1-1	4
Specified Fuse Ratings	1-2-1	1
Display Frequency for DME Control Settings	1-2-3	6
XPDR Pulse Spacing	1-2-3	11
DME Reply Efficiency Control Frequency	1-2-3	12
"C" Command Data Input	1-2-5	10
6 Character String	1-2-5	10
8 Character String	1-2-5	10
Mask Bits	1-2-5	33
XPDR Modes	1-2-5	39
XPDR P_3 Pulse Spacing	1-2-5	42

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SECTION 1 - DESCRIPTION

1. GENERAL DESCRIPTION AND CAPABILITIES

1.1 GENERAL

The ATC-1400A-2 is designed for testing and calibrating DME (Distance Measuring Equipment), ATC (Air Traffic Control) Transponder Aircraft Equipment, and ARINC 568 Digital DME Indicators. The ATC-1400A-2 operates manually using front panel controls and switches, or remotely by ATE (Automatic Test Equipment) control through GPIB (General Purpose Interface Bus).

NOTE: Necessary test signals and their variations are generated within the ATC-1400A-2. An Oscilloscope is required as peripheral equipment.

1.2 FUNCTIONAL CAPABILITIES

The ATC-1400A-2 incorporates the following features and capabilities:

1.2.1 Signal Generator

Frequency Select Modes

Desired L-Band Output Frequency is selected by direct MHz, VOR-paired and TACAN channel designations. Desired frequency is selected in 1 MHz increments from 962 to 1213 MHz.

∆F Capability

Desired frequency is varied ±9.99 MHz in 10 kHz increments.

Manual or Automatic Stepping

Selected frequency is varied manually or automatically in 1 MHz steps, upward in frequency, at a rate determined by a front panel control.

Suppressor ON/OFF

Mutual suppression output is switched ON or OFF. Suppression pulse level is adjustable on front panel.

1.2.2 DME Mode

The standard test configuration for testing ARINC 568 DME in local or remote control mode of operation is shown in 1-1-1, Figure 1.

Range Delay

Switch selectable -1 NMi range for indicator calibration. When selecting -1 NMi feature, 1 NMi is subtracted from programmable range of 0 to 399.99 NMi. Actual range of UUT is displayed on DISPLAY SELECT Readout (1-2-2, Figure 5).

Velocity

Selected as inbound or outbound. Inbound velocity decreases selected range to 0 NMi, then increases to 400.00 NMi. Outbound velocity increases selected range to 400.00 NMi, then decreases to 0 NMi.

Acceleration

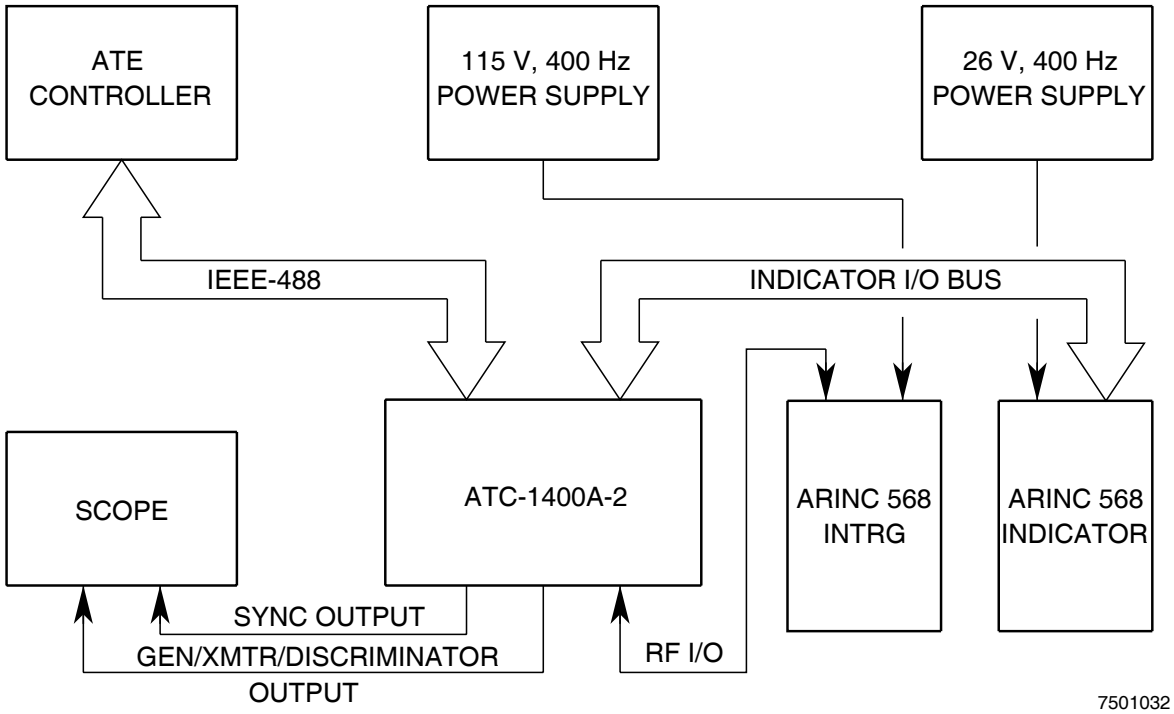
Non-zero acceleration decreases selected velocity to 0, then increases to 9990 KTS.

Squitter

Squitter provides stable rate, distribution and repeatability.

TACAN

When TACAN is selected, output pulses are AM modulated with 15 and 135 Hz signals. TACAN main burst and auxiliary burst signals are generated, representing a bearing of 180°. External AM and pulse modulation inputs are available at TACAN INPUT Connector (J2) (1-2-2, Figure 5) and EXTERNAL MEASUREMENT GATE Connector (J3) (1-2-2, Figure 5).



ATC-1400A-2/ARINC 568 DME Functional Block Diagram
Figure 1

Echo Pulses

Selected ECHO pulse replies are generated at approximately 30 NMi in response to all interrogations.

Pulse Characteristics

DME pulses are formed by filtering. Pulse spectrum has adequate side lobe shaping to allow adjacent channel rejection measurements.

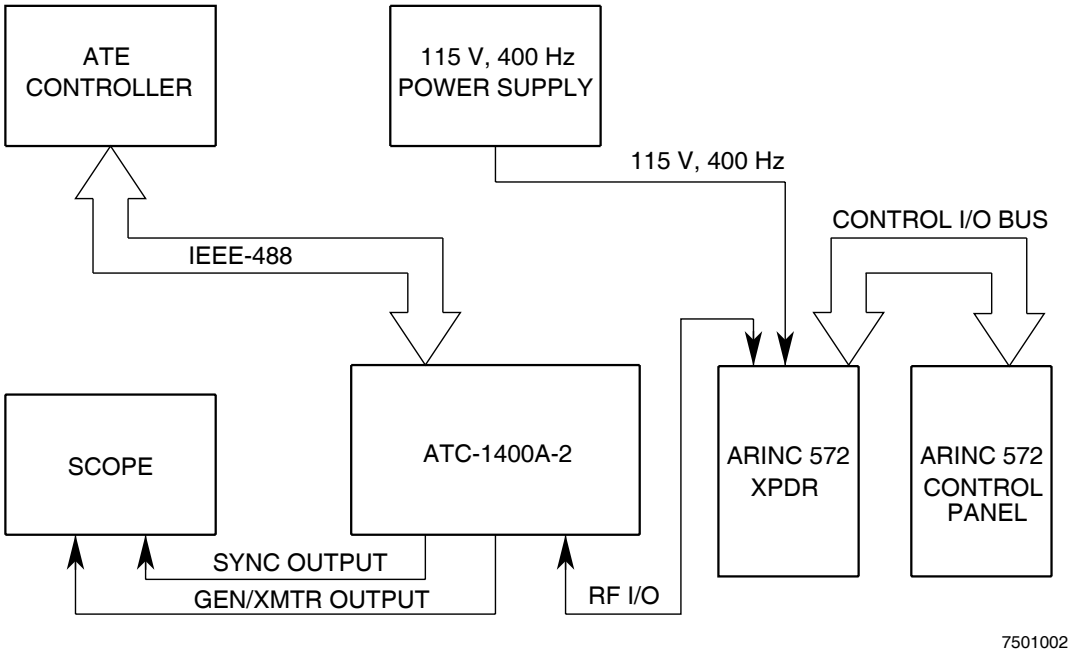
DME Serial Data Interface

Serial BCD distance word is generated by ATC-1400A-2 to correspond to range distance programmed in ATC-1400A-2. This serial BCD word is available at INDICATOR Connector (J7) (1-2-2, Figure 5). This interface is compatible with ARINC Characteristic 568 requirements for digital signals.

INTERROGATOR Connector (J8) (1-2-2, Figure 5) receives serial BCD distance data from DME UUT for display on DISPLAY SELECT Readout (1-2-2, Figure 5).

Frequency Channeling Outputs

The 2-out-of-5 VOR paired channel frequencies are available at INTERROGATOR Connector (J8) (1-2-2, Figure 5) for control of DME UUT when ATC-1400A-2 is in Automatic Frequency Stepping Mode.



ATC-1400A-2/ARINC 572 XPDR Functional Block Diagram
Figure 2

1.2.3 XPDR Mode

The standard test configuration for testing ARINC 572 XPDR in local or remote control mode of operation is shown in 1-1-1, Figure 2.

Modes

Modes 1, 2, T, A, B, C, D, AC_1 and AC_2 are available. Modes AC_1 and AC_2 alternate between Modes A and C. AC_1 results in XPDR Code data in 4 digit Octal Code for Mode A response to be displayed. AC_2 Mode has altitude data from Mode C response displayed in feet (X1000).

Variable Pulse Spacing

P_2 and P_3 pulses are varied in positive or negative direction, or set to calibrated spacing by individual switches. P_2 and P_3 cannot be varied at different amounts simultaneously.

Pulse Width

Pulse width generated in XPDR Mode is varied from 0.2 to 1.95 µs, or selected for a calibrated width.

Side Lobe Suppression

Amplitude of P_2 SLS (Side Lobe Suppression) pulse is set from -19 to +6 dB, relative to P_1, in 1 dB increments. P_1 pulse is switched ON or OFF by a selector switch.

Interference/DBL Interrogation

Interference pulse and double interrogation functions are combined in one switch selector and cannot be selected simultaneously. Either function is switched ON or OFF by selector switch. In DBL Interrogation Mode, second interrogation is 20.5 µs maximum plus Mode spacing from P_1 of first interrogation.

UUT Pulse Spacing Detector

Transponder replies are verified for proper pulse position by selection of a narrow window, using DECODER WIDE/NARROW Switch (1-2-2, Figure 5). In narrow position, pulses within 100 ns of designated position are recognized and displayed in XPDR Code Display readout. A wide window is provided by DECODER WIDE/NARROW Switch (1-2-2, Figure 5) when pulse position accuracy verification is not desired.

1.2.4 UUT Measurements

Transmitter Frequency Counter

Average frequency of one pulse in a reply (XPDR Mode) or interrogation (DME Mode) is counted and continuously displayed. In DME Mode, either P_1 or P_2 is selected for counting by a selector switch. In XPDR Mode, either F_1 or F_2 is selected for counting by a selector switch.

Transmitter Frequency Discriminator

Frequency variation within measured pulse is viewed at discriminator output. A reference voltage is supplied after measured pulse, which represents average frequency displayed on UUT transmitter frequency counter display.

Transmitter Power Meter

Transmitter power is measured by a peak power detector and displayed. Resolution of display is 1 W from 4 to 40 kW and 0.1 W from 0 to 40 W. In DME Mode, either P_1 or P_2 is measured. In XPDR Mode, either F_1 or F_2 is measured.

1.2.5 Auxiliary Unit Capability

The ATC-1400A-2 allows communication with one or more auxiliary units. Auxiliary units provide additional modulation capability needed to test TACAN, IFF, MODE S and DME P. Communication is provided via Aeroflex BUS Connector (J5) (1-2-2, Figure 5) and AUXILIARY Connector (J6) (1-2-2, Figure 5).

1.3. ELECTRICAL DESCRIPTION

The ATC-1400A-2 is microprocessor controlled, featuring a single conversion phase lock generator and a simple detector receiver. Video processing (received video and generate video) is controlled by a microprocessor through front panel control settings or GPIB commands. ATC-1400A-2 circuit description is shown in 1-1-1, Table 1.

CIRCUIT(S)	MODULES
Utility Circuits	Power Supply Module Distribution PC Board Connector PC Board Counter Module Interface PC Board Module AC Power Panel Front Panel Module
Card Cage Module Circuits	DME Range PC Board DME Timing PC Board XPDR Decoder PC Board DME Reply PC Board XPDR Control PC Board XPDR Pulse PC Board
Generate Circuits	Synthesizer Module ALC/Mixer Module 200 MHz Generator Module RF Bulkhead Module
Receive Circuits	Discriminator Module RF Bulkhead Module Video Module
Microprocessor Circuit	Microprocessor PC Board

ATC-1400A-2 Major Electrical Systems
Table 1

SECTION 2 - OPERATION

1. INSTALLATION

1.1 GENERAL

STEP	PROCEDURE

1. Set ATC-1400A-2 into operating position.
2. Connect ac power cable from AC INPUT Connector (1-2-2, Figure 5) to 100 to 120 VAC at 60 Hz or 220 to 240 VAC at 50 Hz source.

1.2 SAFETY PRECAUTIONS

Listed are several important safety precautions which must be observed during installation and operation. Aeroflex assumes no liability for failure to comply with any safety precautions outlined in this manual.

1.2.1 Complying with Instructions

Installation/operating personnel should not attempt to install or operate the ATC-1400A-2 without reading and complying with all instructions contained in this manual. All procedures must be performed in exact sequence and manner described.

1.2.2 Grounding Requirements

The power cord, equipped with standard three-prong plug, must be connected to a properly grounded three-prong wall receptacle. It is the customer's responsibility to:

Have a qualified electrician check wall receptacle(s) for proper grounding.

Replace any standard two-prong wall receptacle(s) with properly grounded three-prong receptacle(s).

WARNING: ALL EQUIPMENT CHASSIS CABINETS MUST BE CONNECTED TO AN ELECTRICAL GROUND TO MINIMIZE SHOCK HAZARD.

WARNING: DO NOT USE A THREE-PRONG TO TWO-PRONG ADAPTER PLUG. DOING SO CREATES A SHOCK HAZARD BETWEEN THE CHASSIS AND ELECTRICAL GROUND.

1.2.3 Operating Safety

Due to presence of potentially lethal voltages within ATC-1400A-2, operating personnel must not remove top or bottom covers at any time.

1.2.4 CAUTION and WARNING Labels

Extreme care should be exercised when performing any operations preceded by a CAUTION or WARNING label. CAUTION labels appear where possibility of damage to equipment exists and WARNING labels denote conditions where bodily injury or death may result.

1.3. POWER REQUIREMENTS

The ATC-1400A-2 power supply operates over a voltage range of 100 to 120 VAC at 60 Hz or 220 to 240 VAC at 50 Hz. No internal wiring or switching changes are required prior to applying ac power to ATC-1400A-2. Instantaneous surge current turn-on is <10 A. The specified fuse ratings for input voltage are shown in Table 1.

INPUT VOLTAGE	FUSE RATINGS (F1 and F2)	AEROFLEX PART NO
105 to 250 VAC	3.0 A, Type F	5106-0300-600 (Bussman AGC3)
200 to 220 VAC	3.0 A, Type F	5106-0300-600 (Bussman AGC3)

Specified Fuse Ratings
Table 1

CAUTION: FOR CONTINUOUS PROTECTION AGAINST FIRE, REPLACE ONLY WITH FUSE OF THE SPECIFIED VOLTAGE AND CURRENT RATINGS.

1.4 RACK-MOUNT INSTALLATION

The ATC-1400A-2 is installed in bench-top or rack-mount fashion. All Aeroflex test sets are shipped from factory with plastic feet installed for bench-top installation. Conversion from bench-top to rack-mount installation is possible by ordering Rack-Mount Kit (7001-7636-800). One kit per unit is required for installation.

CAUTION: AVOID RESTRICTION OF AIR FLOW TO INTAKE VENT ON REAR PANEL AND EXHAUST VENT ON LEFT SIDE PANEL. WHEN OPERATING IN THE NORMAL HORIZONTAL POSITION, MAINTAIN AT LEAST TWO INCHES (FIVE CENTIMETERS) OF CLEARANCE BETWEEN OBJECTS OR WALLS AND THE LEFT SIDE AND REAR PANELS OF THE EQUIPMENT. IF OPERATING IN A RACK, MAXIMUM AMBIENT TEMPERATURE MUST BE AT OR BELOW 40°C.

1.5 EXTERNAL CLEANING

The following procedure contains routine instructions for cleaning the outside of the Test Set.

CAUTION: DISCONNECT POWER FROM TEST SET TO AVOID POSSIBLE DAMAGE TO ELECTRONIC CIRCUITS.

STEP	PROCEDURE

1. Clean front panel, switches and display face with soft lint-free cloth. If dirt is difficult to remove, dampen cloth with water and a mild liquid detergent.
2. Remove grease, fungus and ground-in dirt from surfaces with soft lint-free cloth dampened (not soaked) with isopropyl alcohol.
3. Remove dust and dirt from connectors with soft-bristled brush.
4. Cover connectors, not in use, with suitable dust cover to prevent tarnishing of connector contacts.
5. Clean cables with soft lint-free cloth.
6. Paint exposed metal surface to avoid corrosion.

1.6 SYSTEM INTERCONNECT CABLES

For attaching interconnect cables and power cords to test ARINC 568 DME Interrogator equipment, refer to 1-2-1, Figure 1. For test setup of ARINC 572 Transponder equipment, refer to 1-2-1, Figure 2.

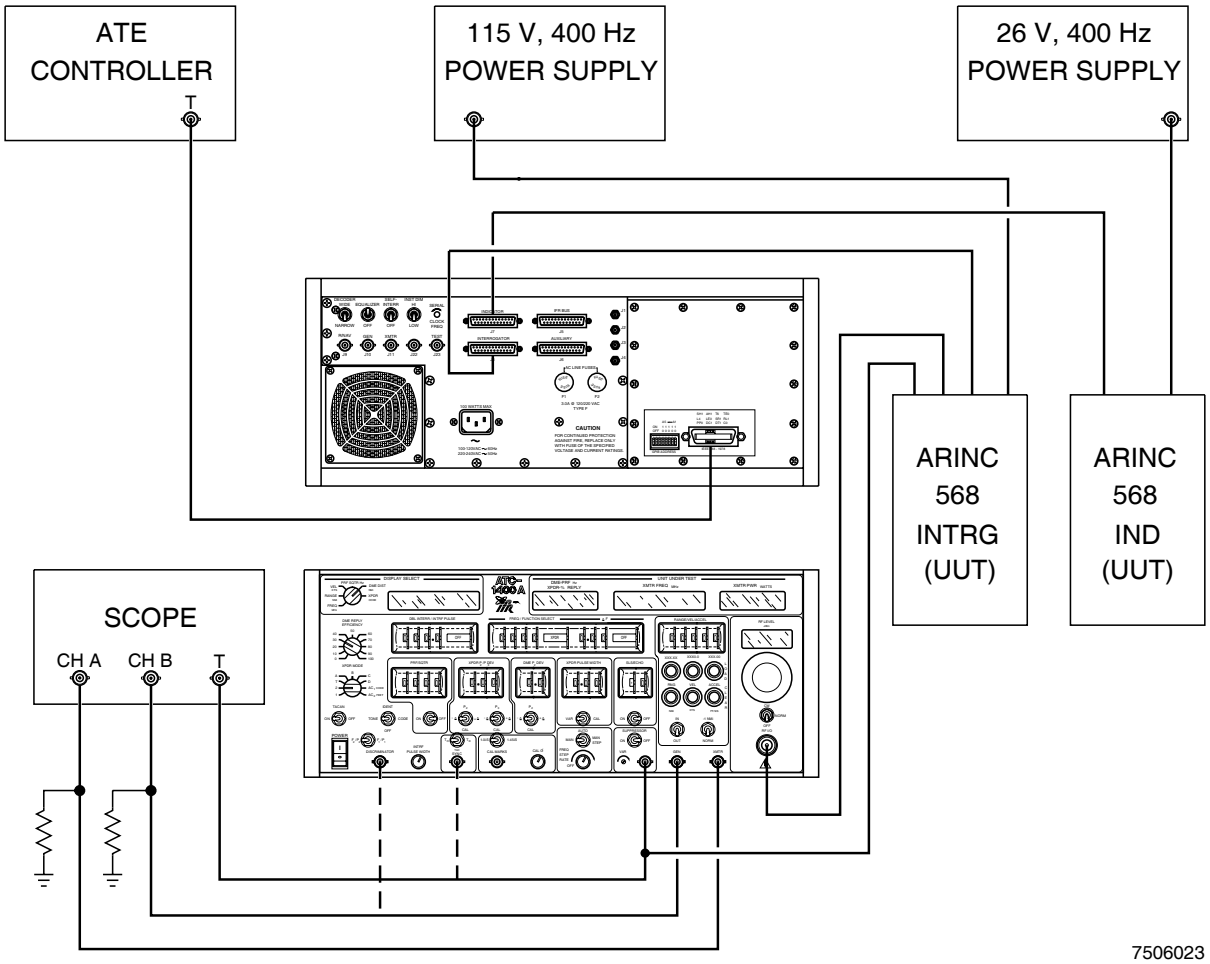
1.6.1 ARINC 568 Indicator Interface

ARINC 568 digital indicator is interfaced with ATC-1400A-2 through INDICATOR Connector (J7) (1-2-2, Figure 5) to provide signals necessary to operate control unit. Typical interconnect cable is shown in 1-2-1, Figure 3 and wiring diagram is shown in 1-2-1, Figure 4. ATC-1400A-2 is capable of reading serial range data, eliminating need for separate indicator.

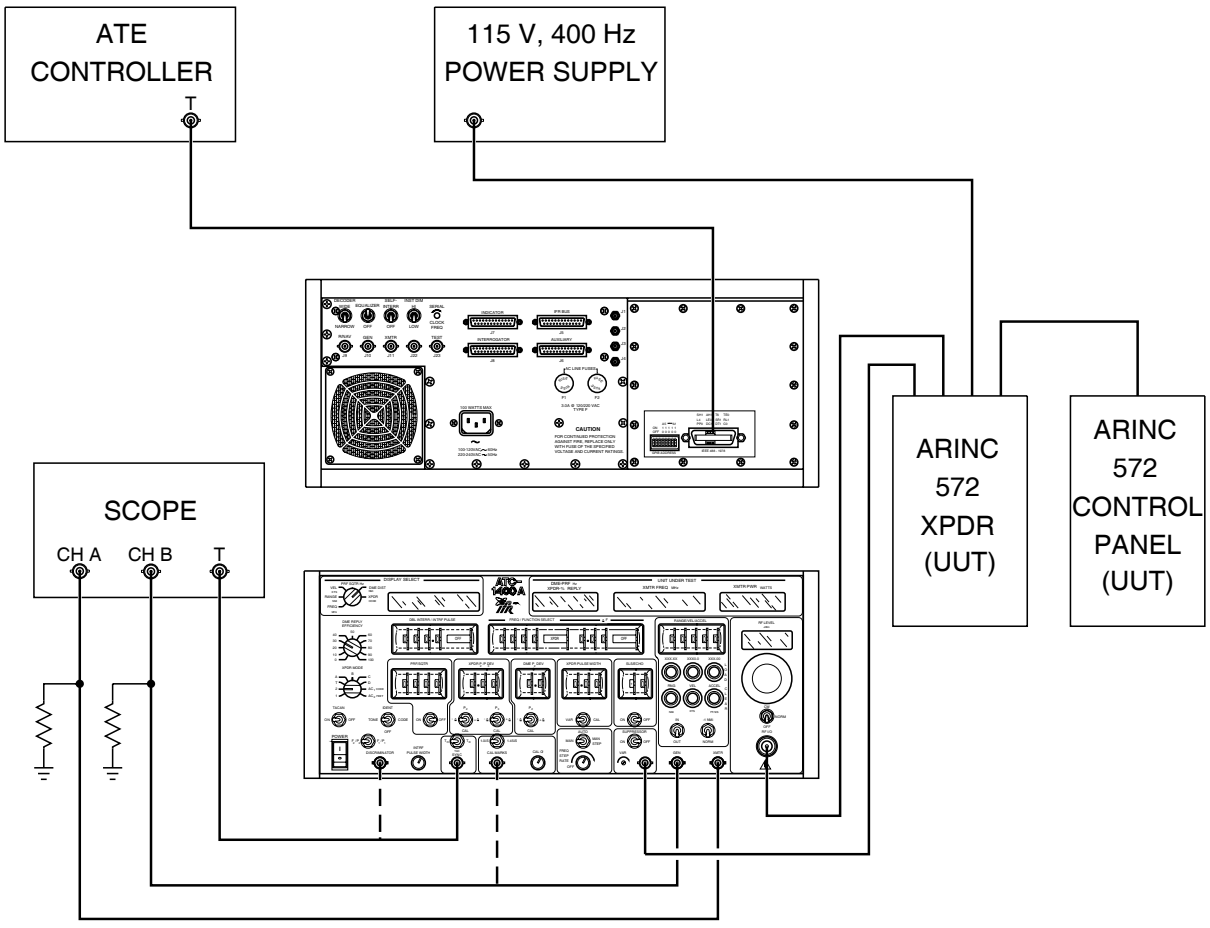
1.6.2 ARINC 568 Interrogator Interface

ARINC 568 Interrogator is interfaced with ATC-1400A-2 through INTERROGATOR Connector (J8) (1-2-2, Figure 5) to provide 2-out-of-5 VOR-Paired Channel Frequency Code necessary for channeling interrogator and to eliminate the need for a DME control unit.

NOTE: To properly interface ARINC 568 Interrogator unit to ATC-1400A-2, an accessory wiring harness is required. Wiring harness is fabricated by user. Typical accessory wiring harness is shown in 1-2-1, Figure 3 and interconnect diagram is shown in 1-2-1, Figure 4.

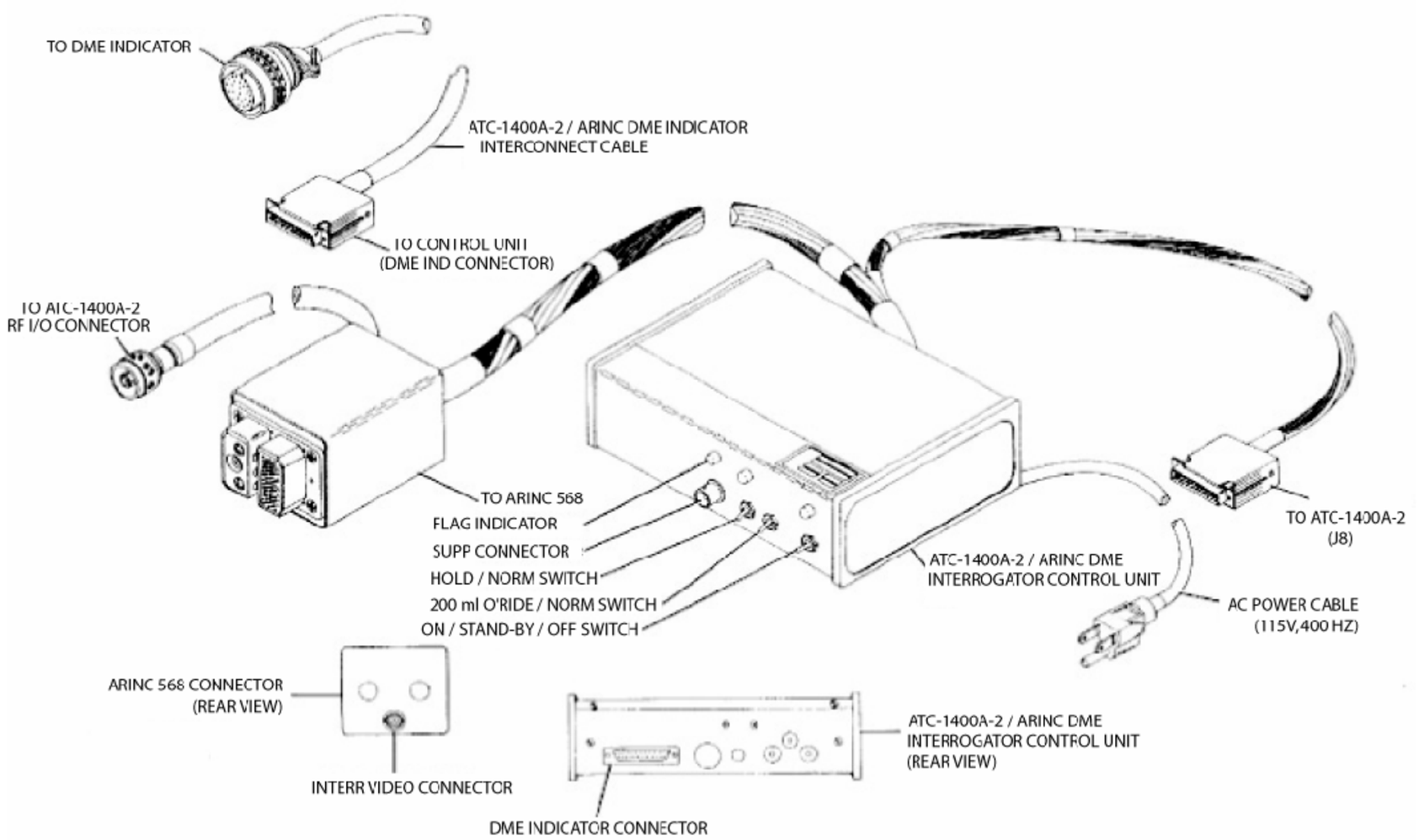


ATC-1400A-2 / ARINC 568 DME Interface
Figure 1

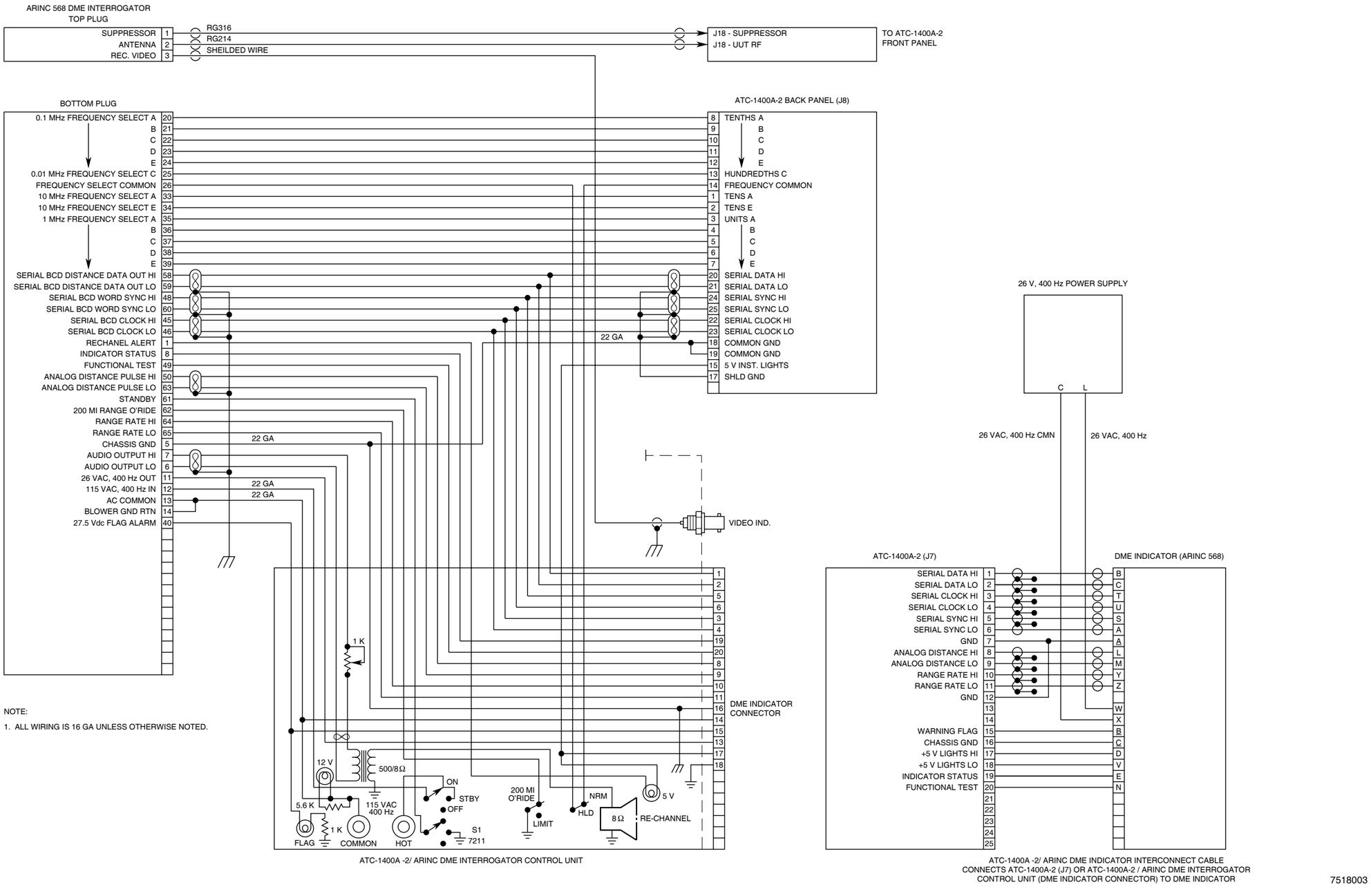


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ATC-1400A-2 / ARINC 572 XPDR Interface
Figure 2



ATC-1400A-2/ARINC 568 DME Interconnect
Assemblies Front and Rear Panels
Figure 3



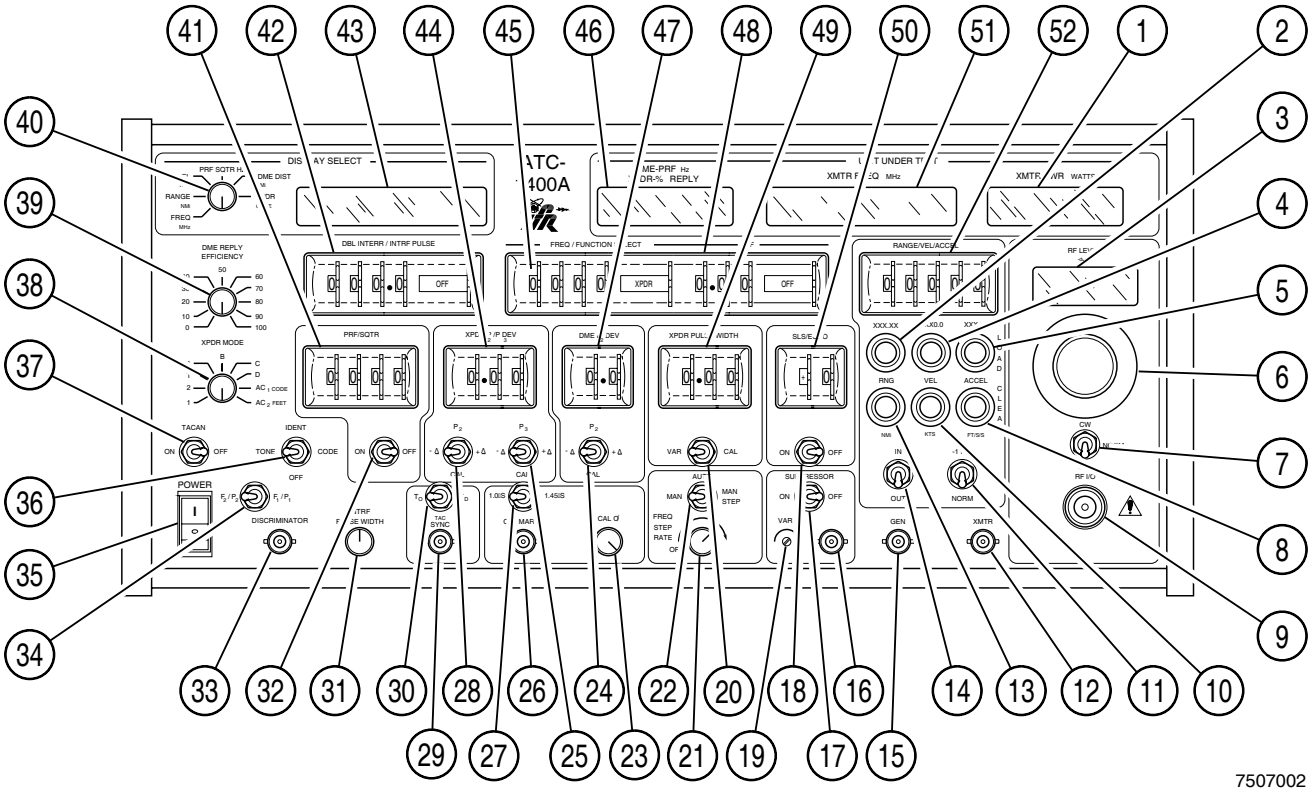
NOTE:

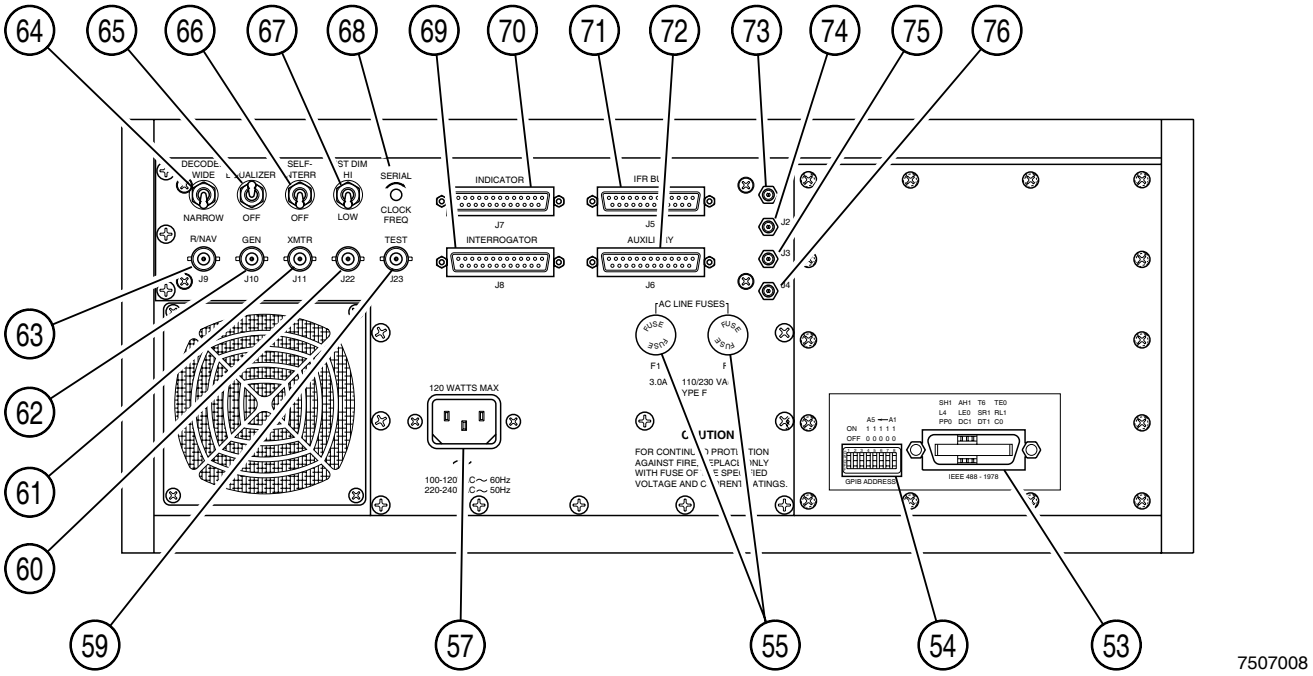
1. ALL WIRING IS 16 GA UNLESS OTHERWISE NOTED.

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ATC-1400A-2/ARINC 568 DME Interconnect Wiring Diagram
Figure 4

2. DESCRIPTION OF CONTROLS, CONNECTORS AND INDICATORS





ATC-1400A-2 Front and Rear Panels
Figure 5

1. XMTR PWR WATTS Display
2. LOAD RNG Pushbutton Switch
3. RF LEVEL -dBm Display
4. LOAD VEL Pushbutton Switch
5. LOAD ACCEL Pushbutton Switch
6. RF LEVEL Control
7. CW/NORM/OFF Switch
8. CLEAR ACCEL Pushbutton Switch
9. RF I/O Connector (J15)
10. CLEAR VEL Pushbutton Switch
11. -1 NMi/NORM Switch
12. XMTR Connector (J16)
13. CLEAR RNG Pushbutton Switch
14. IN/OUT Switch
15. GEN Connector (J17)
16. SUPPRESSOR OUTPUT Connector (J18)
17. SUPPRESSOR ON/OFF Switch
18. SLS/ECHO ON/OFF Switch
19. SUPPRESSOR VAR Adjustment
20. XPDR PULSE WIDTH VAR/CAL Switch
21. FREQ STEP RATE Control
22. MAN/AUTO/MAN STEP Switch
23. CAL Ø Control
24. DME DEV P_2/CAL Switch
25. XPDR DEV P_3/CAL Switch
26. CAL MARKS Connector (J19)
27. 1.0 µs/1.45 µs Switch
28. XPDR DEV P_2/CAL Switch
29. SYNC Connector (J20)
30. T_O/TAC/T_D Switch
31. INTRF PULSE WIDTH Control
32. PRF/SQTR ON/OFF Switch
33. DISCRIMINATOR Connector (J21)
34. F_2/P_2 F_1/P_1 Switch
35. POWER Switch
36. IDENT TONE/OFF/CODE Switch
37. TACAN ON/OFF Switch
38. XPDR MODE Control
39. DME REPLY EFFICIENCY Control
40. DISPLAY SELECT Control
41. PRF/SQTR Thumbwheels
42. DBL INTERR/INTRF PULSE Thumbwheels
43. DISPLAY SELECT Readout
44. XPDR P_2/P_3 DEV Thumbwheels
45. FREQ/FUNCTION SELECT Thumbwheels
46. DME-PRF Hz/XPDR-%REPLY Display
47. DME P_2 DEV Thumbwheels
48. ΔF Thumbwheels
49. XPDR PULSE WIDTH Thumbwheels
50. SLS/ECHO Thumbwheels
51. XMTR FREQ MHz Display
52. RANGE/VEL/ACCEL Thumbwheels
53. GPIB Connector
54. GPIB ADDRESS/OPTION Dip Switches
55. AC LINE Fuses
56. Not Used
57. AC INPUT Connector
58. Not Used
59. J23
60. EXTERNAL RF Connector (J22)
61. XMTR Connector (J11)
62. GEN Connector (J10)
63. R/NAV Connector (J9)
64. DECODER WIDE/NARROW Switch
65. EQUALIZER/OFF Switch
66. SELF-INTERR/OFF Switch
67. INST-DIM HI/LOW Switch
68. SERIAL CLOCK FREQ Adjustment
69. INTERROGATOR Connector (J8)
70. INDICATOR Connector (J7)
71. IFR BUS Connector (J5)
72. AUXILIARY Connector (J6)
73. DABS INPUT Connector (J1)
74. TACAN INPUT Connector (J2)
75. EXTERNAL MEASUREMENT GATE Connector (J3)
76. RF LEVEL INPUT Connector (J4)

2.1 ATC-1400A-2 FRONT PANEL (1-2-2, Figure 5)

ITEM DESCRIPTION

1. XMTR PWR WATTS Display

Provides continuous visual display of peak power of UUT from 0 to 3999 W and EEEE when over limit. In DME Mode, first or second interrogation pulse is measured. In XPDR Mode, first or second framing pulse is measured.

NOTE: ATC-1400A-2 recognizes pulses from 0 to 50 W Peak Power and for PRFs as low as 1.4 Hz PRF (0.5 dB accuracy is specified only for signals above 50 W and 10 Hz). ATC-1400A-2 does not filter out undesired DC pulses which may affect power measurement. When measured UUT power is <41 W, resolution of measurement changes to 0.1 W steps. A decimal point appears prior to last digit in display and "100" digit is deleted. Condition remains until power increases to 49.0 W and resolution reverts back to 1 W.

NOTE: Overshoot on leading edge of XPDR pulse is ignored by power meter if <50 ns in width.

2. LOAD RNG Pushbutton Switch (DME)

Programs fixed range distance from 000.00 to 399.99 NMi, as selected on RANGE/VEL/ ACCEL Thumbwheels. LOAD RNG function automatically clears velocity and acceleration function.

3. RF LEVEL -dBm Display

Displays programmed peak RF power of generator in dB <1 mW, as selected by RF LEVEL Control or Remote Control (GPIB).

NOTE: RF Level is programmed from 0 to -127 dBm in 1 dB steps with accuracy specified from 0 to -110 dBm.

4. LOAD VEL Pushbutton Switch (DME)

Programs velocity from 000.0 to 9990.0 KTS, as selected on RANGE/VEL/ACCEL Thumbwheels. Selection of LOAD VEL function clears acceleration to zero and presets acceleration to decrease velocity.

ITEM DESCRIPTION

5. LOAD ACCEL Pushbutton Switch (DME)

Programs acceleration from 000.00 to 399.00 FT/S/S, as selected on RANGE/VEL/ ACCEL Thumbwheels. Selection of LOAD ACCEL function programs ATC-1400A-2 with last programmed value of velocity. Non-zero acceleration decreases velocity to zero, then automatically switches to outbound and increases. Velocity increases to maximum value of 9990 KTS and stops.

6. RF LEVEL Control

Slowly turn RF LEVEL Control to adjust RF generator level in 1 dB steps. Spinning RF LEVEL Control rapidly causes RF LEVEL -dBm Display to change rapidly, but does not change RF generator output level. Generator output level is programmed to new value when RF LEVEL Control turning rate is slowed.

7. CW/NORM/OFF Switch

- CW Supplies continuous-wave output signal for testing and calibration of ATC-1400A-2.
- NORM Allows ATC-1400A-2 to operate as flight simulator.
- OFF Inhibits all ATC-1400A-2 generated pulses.

8. CLEAR ACCEL Pushbutton Switch (DME)

Clears previously loaded acceleration information to 0 FT/S/S. Selection of CLEAR ACCEL function programs ATC-1400A-2 with last programmed value of velocity.

NOTE: ATC-1400A-2 stores last programmed value of velocity in memory.

9. RF I/O Connector 

CAUTION: MAXIMUM INPUT TO THE RF I/O CONNECTOR MUST NOT EXCEED 5 KW PEAK OR 10 W AVERAGE.

Connects all interrogation and reply RF pulses to UUT antenna connector.

ITEM DESCRIPTION

10. CLEAR VEL Pushbutton Switch (DME)

Clears previously selected velocity information to 0 KN and acceleration to 0 FT/S/S.

11. -1 NMi/NORM Switch (DME)

- NORM Selects normal range on ATC-1400A-2 of 0 to 399.99 NMi.
- -1 NMi Subtracts 1 NMi from range, programming ATC-1400A-2 to operate from -1 to 398.99 NMi.

NOTE: Selection of 0.1 NMi allows ATC-1400A-2 to reply to all interrogations, regardless of pulse position errors.

12. XMTR Connector

RF pulses transmitted by UUT are detected by ATC-1400A-2 and present at XMTR Connector. Detected video is seen with Oscilloscope and 50 Ω Coaxial Cable.

13. CLEAR RNG Pushbutton Switch (DME)

Clears previously selected range information to 0 NMi and clears previously selected velocity and acceleration information.

14. IN/OUT Switch (DME)

- IN Inbound non-zero velocity decreases range to zero, then automatically switches to outbound and increases range.

  Range increases to maximum value of 399.99 NMi or value set internally (only by a qualified service technician), then automatically switches to inbound and decreases range again.

ITEM DESCRIPTION

- OUT Outbound non-zero velocity increases range to maximum value of 399.99 NMi or value set internally (only by a qualified service technician), then automatically switches to inbound and decreases range.

  Range decreases to zero, then automatically switches to outbound and increases range again.

NOTE: If velocity is outbound when IN/OUT Switch is set to IN, set IN/OUT Switch to OUT, then back to IN.

15. GEN Connector

RF output pulses from generator are detected and present at GEN Connector for viewing transponder interrogations and interference pulses, DME TACAN reference groups, TACAN AM, ident and equalizer pulses, range replies and squitter. Detected pulses are seen with Oscilloscope and 50 Ω Coaxial Cable.

16. SUPPRESSOR OUTPUT Connector

Mutual suppression pulses are provided for XPDR and DME. Level of suppression pulses is adjusted by SUPPRESSOR VAR Adjustment. Pulse occurs prior to range replies in DME Mode and is coincident with P_3 pulse in XPDR Mode.

17. SUPPRESSOR ON/OFF Switch

- ON Provides suppressor pulses to XPDR and DME.
- OFF Inhibits suppressor pulses within ATC-1400A-2.

18. SLS/ECHO ON/OFF Switch

- ON Echo replies are generated in DME mode. P_2 SLS suppression pulses are enabled in XPDR Mode.
- OFF Echo replies and P_2 SLS pulses are inhibited.

NOTE: SLS/ECHO Thumbwheel select amplitude of echo replies, P_2 SLS pulses and interference pulses.

ITEM DESCRIPTION

19. SUPPRESSOR VAR Adjustment

Adjusts level of suppression pulse. Clockwise rotation increases level of suppression pulse and counterclockwise rotation decreases level of suppression pulse.

20. XPDR PULSE WIDTH VAR/CAL Switch (XPDR)

- VAR Selects variable pulse width (as read from XPDR PULSE WIDTH Thumbwheels [49]) from 0.15 to 1.95 μs in 0.05 μs increases.

NOTE: Generator output level is not specified <0.2 μs pulse width.

- CAL Selects transponder pulse width of 0.8 μs.

21. FREQ STEP RATE Control

Channel frequency rate is increased automatically. Clockwise rotation increases frequency step rate. Fully counterclockwise disables automatic frequency step rate and enables manual stepping.

22. MAN/AUTO/MAN STEP Switch

- MAN Channel frequency is determined by selection of FREQ/FUNCTION SELECT Thumbwheels.

- AUTO Channel frequency is increased automatically in 1 MHz steps. Step rate is controlled by positioning of FREQ STEP RATE Control and FREQ/FUNCTION SELECT Thumbwheels are disabled.

  Power-up of ATC-1400A-2 with MAN/AUTO/MAN STEP Switch set to AUTO, defaults ATC-1400A-2 to 1031 MHz.

- MAN STEP
  Channel frequency is increased manually in 1 MHz steps.

ITEM DESCRIPTION

NOTE: In XPDR function, frequency is increased in 1 MHz steps from frequency selected on FREQ/FUNCTION SELECT Thumbwheels and terminated at 1213 MHz. In DME Function, all X and Y Channels are increased automatically by using AUTO Channel feature along with 2-out-of-5 code output at INTERROGATOR Connector (J8). Stepping starts at frequency and channel (X or Y) selected by FREQ/FUNCTION SELECT Thumbwheels after placing MAN/AUTO/MAN STEP Switch to AUTO from MAN, and proceeds in 1 MHz increments as follows:

AUTOMATIC FREQUENCY STEPPING	
X Channel	Y Channel
962 to 1020 MHz 1157 to 1213 MHz Terminate	1088 to 1146 MHz 1031 to 1087 MHz Continue

When channel stepping for X Channel reaches 1213 MHz, "AUTO" stepping terminates. "AUTO" stepping for Y Channel automatically returns to 1088 MHz, after reaching 1087 MHz, and continues stepping.

23. CAL ∅ Control (XPDR)

Adjusts phase of timing calibration pulses with respect to interrogation pulses. Clockwise rotation delays timing pulses and enables operator to align leading edge of timing pulses with P_1 of reply.

24. DME DEV P_2/CAL Switch (DME)

- -Δ Advances position of P2 pulse from nominal, by value selected on DME P2 DEV Thumbwheels, in μs.

- CAL P2 pulse remains in nominal position. DME P2 DEV Thumbwheels have no effect on deviating P2 pulses.

- +Δ Delays position of P2 pulse from nominal, by value selected of DME P2 DEV Thumbwheels, in μs.

ITEM DESCRIPTION

25. XPDR DEV P_3/CAL Switch (XPDR)

- -Δ Advances position of P3 pulse from nominal, by value selected on XPDR P2/P3 DEV Thumbwheels, in μs.
- CAL P3 pulse remains in nominal position. XPDR P2/P3 DEV Thumbwheels have no effect on deviating P3 pulses.
- +Δ Delays position of P3 pulse from nominal, by value selected on XPDR P2/P3 DEV Thumbwheels, in μs.

26. CAL MARKS Connector

1.0 and 1.45 μs pulses are present for timing measurements of various signals. Output signal of 1.0 or 1.45 μs is controlled by 1.0 μs/1.45 μs Switch.

27. 1.0 μs/1.45 μs Switch

Selects either 1.0 or 1.45 μs calibration pulse at CAL MARKS Connector.

28. XPDR DEV P_2/CAL Switch

- -Δ Advances position of P_2 pulse from nominal, by value selected on the XPDR P_2/P_3 DEV Thumbwheels, in μs.
- CAL P_2 pulse remains in nominal position. XPDR P_2/P_3 DEV Thumbwheels have no effect on deviating P_2 pulses.
- +Δ Delays position of P_2 pulse from nominal, by value selected on the XPDR P_2/P_3 DEV Thumbwheels, in μs.

29. SYNC Connector

A negative oscilloscope sync pulse is present. Signal output is controlled by T_O/TAC/T_D Switch.

ITEM DESCRIPTION

30. T_O/TAC/T_D Switch

- T_O Provides sync pulse 17.5 μs before P_1 of interrogation in XPDR Mode and sync pulse coincident with 50% point of P_1 of interrogation in DME Mode.
- TAC Provides sync transition pulse at 15 Hz to enable display of TACAN modulation, if TACAN is selected. No sync occurs if TACAN ON/OFF Switch is set to OFF.
- T_D Presents sync pulse coincident with P_3 of interrogation in XPDR Mode and sync pulse prior to P_1 of reply in DME Mode.

31. INTRF PULSE WIDTH Control (XPDR)

Adjusts width of interference pulse from 0.2 to 5 μs. Clockwise rotation increases width of pulse.

32. PRF/SQTR ON/OFF Switch

Two-position toggle switch. When set to OFF, inhibits squitter in DME Mode and inhibits interrogations in XPDR Mode.

33. DISCRIMINATOR Connector

Instantaneous frequency of RF input pulses are discriminated and present. Frequency modulation of transmitter under test is monitored within one pulse or between two pulses. Discriminator produces noise when no RF is present.

34. F_2/P_2 F_1/P_1 Switch

Measures UUT frequency and power of F_1 or F_2 reply pulse in XPDR Mode, and frequency and power of P_1 or P_2 reply pulse in DME Mode.

35. POWER Switch | or ○

Connects (I) or disconnects (O) external ac power from ATC-1400A-2.

ITEM DESCRIPTION

36. IDENT TONE/OFF/CODE Switch (DME)

- TONE Enables 1350 Hz CW tone.
- OFF Inhibits continuous and code tones.
- CODE Modulates 1350 Hz tone with morse code "IFR." Repetition rate is approximately 30 seconds.

37. TACAN ON/OFF Switch (DME)

- ON Simulates TACAN ground station. Bearing is fixed at 180°. 15 Hz sync is provided for observing TACAN modulation at SYNC Connector.
- OFF Inhibits TACAN signals generated by ATC-1400A-2.

38. XPDR MODE Control (XPDR)

Selects nominal P_3 pulse position of XPDR interrogations. AC_1 and AC_2 positions cause alternating A and C interrogations. Sync occurs before A interrogation when AC_1 is selected, and before C interrogation when AC_2 is selected.

NOTE: Mode A interrogation pulse spacing is similar to IFF Mode 3.

39. DME REPLY EFFICIENCY Control (DME)

Range replies are produced only in response to a valid interrogation (i.e., P_1 to P_2 spacing of either 12 or 36 μs). Selection of any position selects ATC-1400A-2 reply efficiency rate (i.e., 50 equals 50% reply rate and 100 equals 100% reply rate).

ITEM DESCRIPTION

40. DISPLAY SELECT Control

DISPLAY SELECT Readout displays particular test condition for setting as follows:

FREQ MHz

Displays A when simulator is in automatic operation.

Displays E for incorrect programming.

Simulator frequency in MHz is counted and displayed when selected on FREQ/FUNCTION SELECT Thumbwheels. Frequency is adjusted within 10 kHz of desired channel by monitoring this display.

Enables serial data output of simulator range replies to INDICATOR Connector (J7).

RANGE NMi (DME)

Displays range delay in NMi when LOAD RNG Pushbutton Switch is selected.

Displays C to indicate negative range. Range is <1 NMi. (i.e., display reads C--0.01).

Displays OFF when FREQ/FUNCTION SELECT Thumbwheels are set to XPDR.

Enables serial data output of simulator range to INDICATOR Connector (J7).

NOTE: This display is used to monitor range delay when non-zero velocity is loaded.

VEL KTS (DME)

Continuously displays simulator velocity in KTS and is used to monitor velocity while acceleration is loaded.

Displays OFF when FREQ/FUNCTION SELECT Thumbwheels are set to XPDR.

Enable serial data output of simulator range replies to INDICATOR Connector (J7).

NOTE: DISPLAY SELECT Readout is used to monitor velocity when acceleration is loaded. Value of acceleration is not displayed, but is read from RANGE/VEL/ACCEL Thumbwheels.

ITEM DESCRIPTION

40. DISPLAY SELECT Control (cont)

PRF/SQTR Hz (DME)

Total number and type of pulse pairs are counted and displayed:

Reference Groups (Main and Auxiliary)
Identification and Equalizer Pulse
Echo Replies
Range Replies
Squitter Pulses

Displays OFF when CW/NORM/OFF Switch is set to CW or OFF.

Enables serial data output of simulator range replies to INDICATOR Connector (J7).

PRF/SQTR Hz (XPDR)

Total number of interrogations per second selected on PRF/SQTR Thumbwheels are counted and displayed on DISPLAY SELECT Readout.

DME DIST NMi (DME)

Displays serial data input of interrogator range replies on DISPLAY SELECT Readout.

Displays DDDD.DD until ATC-1400A-2 receives valid label from Interrogator through INTERROGATOR Connector (J8). Only data following valid label and last valid data received is displayed.

Enables serial data output of interrogator range replies to indicator under test through INDICATOR Connector (J7). When DISPLAY SELECT Control is set to DME DIST NMi, indicator under test reads only interrogator output. When DISPLAY SELECT Control is in any other position, indicator under test reads ATC-1400A-2 range replies.

DISPLAY SELECT Readout is reset and last valid data received is cleared from display by cycling DISPLAY SELECT Control to any other position, then back to DME DIST NMi.

Displays OFF when FREQ/FUNCTION SELECT Thumbwheels are set to XPDR.

ITEM DESCRIPTION

XPDR CODE (XPDR)

Four digit octal code is decoded and displayed for A mode identification replies and C mode altitude replies are displayed either as four digit octal code or altitude in thousands of feet. XPDR MODE Control determines which reply is decoded and which format is displayed on DISPLAY SELECT Readout.

Displays CCCCCC or CCCCC.C when XPDR reply rate is zero.

Displays OFF when FREQ/FUNCTION SELECT Thumbwheels are set to DME.

41. PRF/SQTR Thumbwheels

- DME Selects mean squitter rate in Hz.

  NOTE: ATC-1400A-2 Squitter is defined as nominal level pulse pairs of random spacing generated at a mean squitter rate, as selected by thumbwheel setting.

- XPDR Selects interrogation rate in Hz. When double interrogation rate is selected, interrogation rate is twice thumbwheel setting. When XPDR MODE Control is set to AC_1 or AC_2, interrogations are 50% thumbwheel setting.

42. DBL INTERR/INTRF PULSE Thumbwheels (XPDR)

Selects double interrogation or interference pulse. Numbers, in μs, relate to function viewed in window. Overrides normal XPDR Mode.

43. DISPLAY SELECT Readout

Readout displays information selected on DISPLAY SELECT Control.

44. XPDR P_2/P_3 DEV Thumbwheels (XPDR)

Deviates P_2 or P_3 pulse from nominal position by value selected, in μs, on thumbwheels.

ITEM DESCRIPTION

45. FREQ/FUNCTION SELECT Thumbwheels

Selects function of operation and frequency of ATC-1400A-2. Numbers, in MHz, relate to function viewed in window. Function and frequency are as follows:

WINDOW DISPLAY	OPERATION FUNCTION	RANGE	THUMBWHEEL RANGE
XPDR	TRANSPONDER	962 to 1213 MHz	0962 to 1213
TAC X	DME-X Channel	Channel 1 to 126	0001 to 0126
TAC Y	DME-Y Channel	Channel 1 to 126	0001 to 0126
5 VOR PAIR	DME-Y Channel	108.05 to 117.95 MHz	1080 to 1179
0 VOR PAIR	DME-X Channel	108.00 to 117.90 MHz	1080 to 1179
MHz Y	DME-Y Channel	962 to 1213 MHz	0962 to 1213
MHz Z	DME-X Channel	962 to 1213 MHz	0962 to 1213

ITEM DESCRIPTION

46. DME-PRF Hz/XPDR - % REPLY Display

- DME Number of interrogations per second are counted and displayed continuously. Interrogations are decoded and "F" is displayed for approximately 0.5 seconds if P2 pulse is not present nor within decoder window.
- XPDR Ratio of transponder replies to interrogations are sampled every 100 interrogations and displayed continuously. Display reads "50" when DOUBLE INTERR is set on DBL INTERR/INTRF PULSE Thumbwheels and transponder replies to only one interrogation.
- OFF Displayed on DISPLAY SELECT Readout when PRF/SQTR ON/OFF Switch is set to OFF.

47. DME P_2 DEV Thumbwheels (DME)

Deviates P_2 pulse from nominal position, in μs, by value selected on thumbwheels.

ITEM DESCRIPTION

48. ΔF Thumbwheels

Deviates generator frequency from -9.99 to +9.99 MHz. Frequency range is increased from 952.01 to 1222.99 MHz. ΔF Thumbwheels have no effect on X or Y channel selection or 2-out-of-5 code output at INTERROGATOR Connector (J8).

49. XPDR PULSE WIDTH Thumbwheels (XPDR)

Width of P_1, P_2 and P_3 pulses are varied, in μs, by value selected.

50. SLS/ECHO Thumbwheels

Range is -19 to +9 dB with accuracy of -19 to +6 dB.

- DME Amplitude of echo reply is selected in dB, above nominal RF level.
- XPDR Amplitude of P_2 sidelobe suppression pulse and interference pulse is selected in dB, above nominal RF level.

ITEM DESCRIPTION

51. XMTR FREQ MHz Display

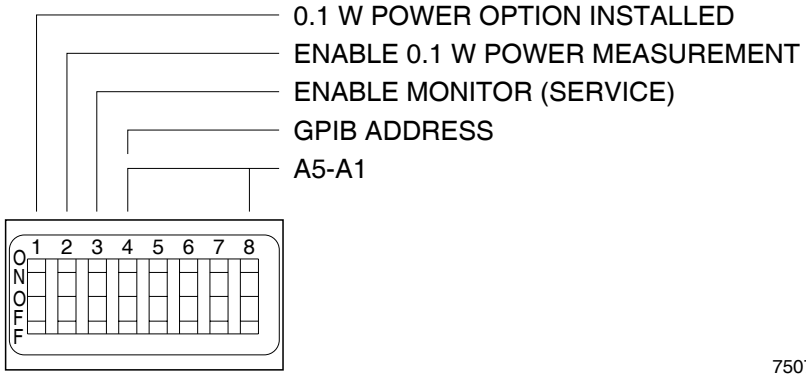
Average frequency of UUT RF pulses are measured between 50% amplitude point and displayed continuously. In DME Mode, P_1 or P_2 pulse is measured. In XPDR Mode, F_1 or F_2 pulse is measured.

52. RANGE/VEL/ACCEL Thumbwheels (DME)

Desired value of range, velocity and acceleration is simulated in ATC-1400A-2 by selection of nautical miles (NMi) for range, knots (KTS) for velocity and feet per second per second (Ft/Sec^2) for acceleration.

SELECTION	RANGE	THUMBWHEEL SETTING
Range	0 to 399.99 NMi	00000 to 39999
Velocity	0 to 9990 KTS	000XX to 999XX
Acceleration	0 to 399 Ft/Sec^2	000XX to 399XX
X = Not Used		

2.2 ATC-1400A-2 REAR PANEL (1-2-2, Figure 5)



ITEM	DESCRIPTION

53. GPIB Connector

24-pin female connector conforming to IEEE standard 488-1978 for interface of general purpose programmable instrumentation.

54. GPIB ADDRESS/OPTION Dip Switches

Eight segment DIP switch for setting configuration options and IEEE-488 bus address for remote control operation:

If left-most switch (SW1) is set to ON, ATC-1400A-2 displays proper power measurements and assumes low-power option has been installed.

NOTE: If SW1 is OFF, the ATC-1400A-2 displays double the actual power measurement.

If second-left switch (SW2) is set to ON, ATC-1400A-2 enables low-power display (tenths of a watt below 40 W) if SW1 is also ON.

NOTE: Some S-1403 tests require this mode to be disabled.

55. AC LINE Fuses

Fuses input power to the ATC-1400A-2. Refer to para 1-2-1-3 for correct fuse size and type.

56. Not Used

57. AC INPUT Connector

Contains standard 3-prong power receptacle for power cord.

58. Not Used

ITEM	DESCRIPTION

59. J23

Not used.

60. EXTERNAL RF Connector (J22)

<20 W Peak RF Input.

61. XMTR Connector (J11)

RF pulses transmitted by UUT are detected with a linear voltage detector and resultant video is clipped at 50% point and present at XMTR Connector. TTL-compatible signal is seen with Oscilloscope and 50 Ω Coaxial Cable.

62. GEN Connector (J10)

TTL-compatible signal, which modulates ATC-1400A-2 generator output, is buffered and present at GEN Connector. Generate pulses are seen with Oscilloscope and 50 Ω Coaxial Cable.

63. R/NAV Connector (J9)

Two 7 μs pulses are present to test area navigation computers. One pulse is coincident with interrogation pulse and one pulse is coincident with reply pulse.

ITEM DESCRIPTION

64. DECODER WIDE/NARROW Switch

- NARROW
  Selects 1 μs window, centered at 12 or 3 μs from P1, in DME Mode. Selects 220 ns window, centered on F2, in XPDR Mode.
- WIDE Selects 4 μs window, centered at 12 or 36 μs from P1, in DME Mode. Selects 750 ns window, centered on F2, in XPDR Mode.

NOTE: In DME Mode; if 50% point of P_2 pulse is within ARINC 568 specifications, ATC-1400A-2 generates range replies when in NARROW. If pulse spacing is suspect on UUT, WIDE is set.

65. EQUALIZER/OFF Switch (DME)

Equalizer pulse occurs 100 μs after identification pulse only if IDENT TONE/OFF/CODE Switch is set to TONE or CODE.

66. SELF-INTERR/OFF Switch (DME)

ATC-1400A-2 is interrogated and generates range replies without a DME UUT. Rate of self interrogations is determined by selection on PRF/SQTR Thumbwheels. Squitter rate is uncalibrated when SELF-INTERR is enabled.

67. INST-DIM HI/LOW Switch (DME)

Provided for testing dimming circuits of ARINC 568 DME Indicator.

- HI 5 V applied to Pin 7 of INDICATOR Connector (J7).
- LOW Open applied to Pin 7 of INDICATOR Connector (J7).

68. SERIAL CLOCK FREQ Adjustment (DME)

Adjusts serial clock frequency output of INDICATOR Connector (J7) from 7 to 14 kHz. Clockwise rotation increases frequency output.

69. INTERROGATOR Connector (J8) (DME)

25-pin female connector for interface of DME interrogator under test. ATC-1400A-2 channels UUT with 2-out-of-5 code outputs. Range data is received from UUT and displayed on DISPLAY SELECT Readout when DISPLAY SELECT Control is set to DME DIST NMi.

ITEM DESCRIPTION

70. INDICATOR Connector (J7) DME)

25-pin female connector for interface of ARINC 568 DME Indicator. Indicator under test displays exact range data transmitted by interrogator, as displayed on DISPLAY SELECT Readout, when DISPLAY SELECT Control is set to DME DIST NMi. Indicator displays ATC-1400A-2 range in all other positions.

71. IFR BUS Connector (J5)

25-pin female connector for Aeroflex use only.

72. AUXILIARY Connector (J6)

25-pin female connector used with auxiliary equipment.

73. DABS INPUT Connector (J1) (XPDR)

SMB input connector receives PSK modulation from Discrete Address Beacon System (DABS) simulator.

74. TACAN INPUT Connector (J2) (DME)

SMB input connector for interface of TACAN Simulator.

75. EXTERNAL MEASUREMENT GATE Connector (J3)

Allows pulses other than F_2/P_2 and F_1/P_1 to be measured when connected to S-1403 MODE S Test Auxiliary.

76. RF LEVEL INPUT Connector (J4)

Additional ±3 dB level control of RF Output.

3. PERFORMANCE EVALUATION

3.1 GENERAL

The Performance Evaluation contains general performance procedures to evaluate the operating condition of the ATC-1400A-2.

3.2 PRE-OPERATIONAL CONSIDERATIONS

For maximum benefit, it is strongly recommended that personnel:

Thoroughly read and understand all steps of procedure to be performed, prior to completion.

Be familiar with circuit or unit under test so some idea is perceived as to power, frequency and waveform to be expected at each test point.

3.3 CONTROLS, CONNECTORS AND INDICATORS

The Controls, Connectors and Indicators specified in the Performance Evaluation Procedures are followed by an item number. Refer to 1-2-2, Figure 5 for the location of each Control, Connector and Indicator.

3.4 TEST EQUIPMENT REQUIREMENTS

Appendix G contains a list of test equipment suitable for performing any procedure in this manual. Any other equipment meeting the specifications listed in Appendix G, may be substituted in place of the recommended models.

NOTE: For certain procedures, equipment listed in Appendix G may exceed the minimum required specifications.

3.5 CORRECTIVE MAINTENANCE PROCEDURES

The Performance Evaluation Procedures aid the technician in determining if the ATC-1400A-2 is functioning properly or a failure condition exists. A failure condition is reflected as a calibration error (measurement or reading not within prescribed tolerance) or a malfunction (signal is absent or out of tolerance).

If a failure condition is confirmed, technician should take appropriate action to return ATC-1400A-2 to normal operating condition by referring to para 2-2-3 and 2-2-4 in ATC-1400A-2 Maintenance Manual.

3.5 TEST RECORD

A Performance Evaluation Data Sheet is provided for recording results obtained in performing Performance Evaluation Procedures.

NOTE: It is recommended the technician reproduce copies of Performance Evaluation Data Sheet rather than use the copy in this manual.

3.6 PERFORMANCE EVALUATION PROCEDURES

3.6.1 Generate

PURPOSE: Measures generated P1, P2 and P3 pulse spacing, positioning, width and amplitude. Measures double interrogation and interference, TACAN, CAL Marks and suppressor pulses. Tests range, velocity and acceleration functions.

TEST EQUIPMENT:

1	Oscilloscope
1	Spectrum Analyzer
1	Frequency Counter
3	50 Ω Coaxial Cables (BNC to BNC)
1	50 Ω Coaxial Cable (BNC to Type N)

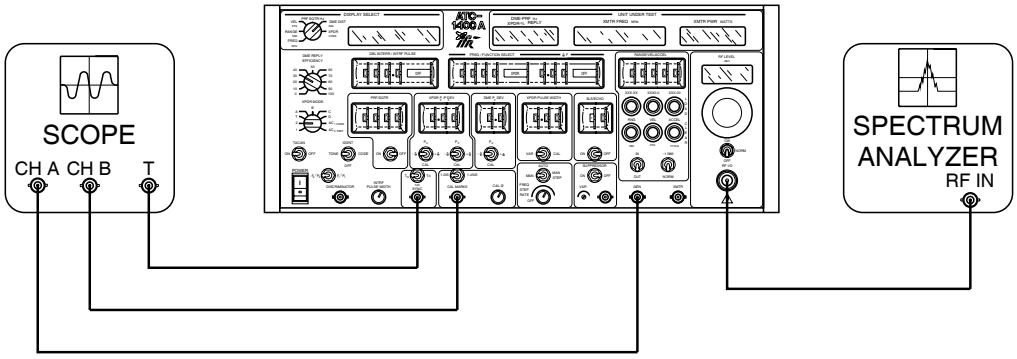
STEP	PROCEDURE

1. Connect ATC-1400A-2 to test equipment as shown in 1-2-3, Figure 6.

STEP	PROCEDURE

2. Set ATC-1400A-2 controls as follows:

CONTROL	SETTING
RF LEVEL Control	-dBm
CW/NORM/OFF Switch	CW
-1 NMi/NORM Switch	NORM
IN/OUT Switch	IN
SUPPRESSOR ON/OFF Switch	OFF
SLS/ECHO ON/OFF Switch	OFF
XPDR PULSE WIDTH VAR/CAL Switch	CAL
FREQ STEP RATE Control	OFF Fully ccw
MAN/AUTO/MAN STEP Switch	MAN
XPDR DEV P3/CAL Switch	CAL
1.0 μs/1.45 μs Switch	1.0 μs
XPDR DEV P_2/CAL Switch	CAL
T_O/TAC/T_D Switch	T_O
INTRF PULSE WIDTH Control	Midrange
PRF/SQTR ON/OFF Switch	ON
IDENT TONE/OFF/CODE Switch	OFF
TACAN ON/OFF Switch	OFF
XPDR MODE Control	1
DME REPLY EFFICIENCY Control	100%
DISPLAY SELECT Control	FREQ MHz
PRF/SQTR Thumbwheels	2500
DBL INTERR/INTRF PULSE Thumbwheels	019.0 OFF
XPDR P_2/P_3 DEV Thumbwheels	1.00
FREQ/FUNCTION SELECT Thumbwheels	0962 XPDR
DME P_2 DEV Thumbwheels	7.0
ΔF Thumbwheels	0.00 OFF
XPDR PULSE WIDTH Thumbwheels	1.85
SLS/ECHO Thumbwheels	-0 dB
RANGE/VEL/ACCEL Thumbwheels	39999
EQUALIZER/OFF Switch	OFF
SELF-INTERR/OFF Switch	SELF-INTERR



Generate Set-Up Diagram
Figure 6

STEP	PROCEDURE

3. Set POWER Switch to ON and allow 10 minute warm-up period.

4. Adjust RF LEVEL Control for 0 dBm on RF LEVEL -dBm Display and Spectrum Analyzer.

5. Decrease ATC-1400A-2 RF level in 10 dB increments to Spectrum Analyzer's maximum sensitivity. Verify RF level on RF LEVEL -dBm Display is identical to Spectrum Analyzer. (Refer to 2-2-4 of the ATC-1400A-2 Maintenance Manual for additional information.)

   NOTE: Repeat Steps 5 and 6 with FREQ/FUNCTION SELECT Thumbwheels set to 1034 XPDR and 1213 XPDR respectively to verify proper filter switching. Return FREQ/FUNCTION SELECT Thumbwheels to 0962 XPDR.

6. Set ATC-1400A-2 controls as follows:

CONTROL	SETTING
RF LEVEL Control	0 dBm
PRF/SQTR ON/OFF Switch	OFF
PRF/SQTR Thumbwheels	0000
FREQ/FUNCTION SELECT Thumbwheels	1090 XPDR

STEP	PROCEDURE

7. Set Spectrum Analyzer controls as follows:

CONTROL	SETTING
Center Frequency Control	1090 MHz
Sensitivity Control	2 dB/Div
Video Filter Control	300 Hz
Dispersion Control	50 kHz/Div
Bandwidth	30 kHz
Reference Level	0 dBm
Sweep Control	20 ms/Div

8. Adjust Spectrum Analyzer to position CW signal peak amplitude to center of display.

9. Set CW/NORM/OFF Switch to NORM. Verify all signals are -80 dBm or less on Spectrum Analyzer

10. Set ATC-1400A-2 controls as follows:

CONTROL	SETTING
RF LEVEL Control	-10 dBm
PRF/SQTR ON/OFF Switch	ON
PRF/SQTR Thumbwheels	2500
FREQ/FUNCTION SELECT Thumbwheels	0962 XPDR

11. Using DC coupling on Oscilloscope, adjust Channel A positioning to align trace over major horizontal graticule.

STEP PROCEDURE

12. Set CW/NORM/OFF Switch to NORM. Verify peak of pulses align with horizontal graticule (±0.1 div). Verify pulse width is 800 ns (±5.0 ns). Verify pulse spacing is 3 μs (±5.0 ns).

13. Set XPDR MODE Control to 2. Verify pulse spacing is 5.0 μs (±5.0 ns) on Oscilloscope.

14. Set XPDR MODE Control to T. Verify pulse spacing is 6.5 μs (±5.0 ns) on Oscilloscope.

15. Set XPDR MODE Control to A. Verify pulse spacing is 8.0 μs (±5.0 ns) on Oscilloscope.

16. Set XPDR MODE Control to B. Verify pulse spacing is 17 μs (±5.0 ns) on Oscilloscope.

17. Set XPDR MODE Control to C. Verify pulse spacing is 21 μs (±5.0 ns) on Oscilloscope.

18. Set XPDR MODE Control to D. Verify pulse spacing is 25 μs (±5.0 ns) on Oscilloscope.

19. Set XPDR MODE Control to AC_1 CODE. Verify alternating pulse pairs of 8.0 and 21 μs are on Oscilloscope.

20. Set ATC-1400A-2 controls as follows:

CONTROL	SETTING
SLS/ECHO ON/OFF Switch	ON
XPDR MODE Control	A

21. Verify 800 ns pulse appears 2.0 μs after leading edge of P_1 pulse.

22. Set XPDR DEV P_2/CAL Switch to -Δ, then +Δ. Verify P_2 pulse is 1.0 μs from leading edge of P_1 at -Δ. Verify P_2 pulse is 3.0 μs from leading edge of P_1 at +Δ.

23. Set XPDR DEV P_2/CAL Switch to CAL.

24. Set XPDR DEV P_3/CAL Switch to -Δ, then +Δ. Verify P_3 pulse is 7.0 μs from leading edge of P_1 at -Δ. Verify P_3 pulse is 9.0 μs from leading edge of P_1 at +Δ.

STEP PROCEDURE

25. Set ATC-1400A-2 controls as follows:

CONTROL	SETTING
SLS/ECHO ON/OFF Switch	OFF
XPDR DEV P3/CAL Switch	CAL

26. Set XPDR PULSE WIDTH VAR/CAL Switch to VAR. Verify width of pulses is 1.85 μs (±5.0 ns).

27. Decrease XPDR PULSE WIDTH Thumbwheels to 0.20 μs. Verify width of pulses decreases accordingly.

28. Set ATC-1400A-2 controls as follows:

CONTROL	SETTING
SLS/ECHO ON/OFF Switch	ON
XPDR PULSE WIDTH VAR/CAL Switch	CAL

29. Set SLS/ECHO Thumbwheels to -6 dB. Verify P_2 pulse is approximately half amplitude of P_1 pulse.

30. Set SLS/ECHO Thumbwheels to +6 dB. Verify P_2 pulse is approximately twice amplitude of P_1 pulse.

31. Set ATC-1400A-2 controls as follows:

CONTROL	SETTING
SLS/ECHO ON/OFF Switch	OFF
DBL INTERR/INTRF PULSE Thumbwheels	017.0 INTERF-

32. Verify (using Oscilloscope internal sync) a pulse approximately twice amplitude of P_1 pulse is 17 μs (+0.05 μs) before leading edge of P_1.

33. Set DBL INTERR/INTRF PULSE Thumbwheels to 017.0 INTERF+. Verify pulse approximately twice amplitude of P_1 pulse is 17.0 μs (-0.05 μs) after leading edge of P_1.

34. Rotate INTRF PULSE WIDTH Control fully cw, then fully ccw. Verify pulse width of displayed pulse changes a minimum of 0.4 to 5 μs.

STEP	PROCEDURE

35. Set DBL INTERR/INTRF PULSE Thumbwheels to 050.0 DOUBLE. Verify second interrogation pulse is 50.0 μs (±8 ns) after leading edge of P_3.

36. Set DBL INTERR/INTRF PULSE Thumbwheels to 17.0 OFF.

37. Verify CAL MARKS pulses are spaced 1.0 μs apart. Verify pulse width of 0.45 μs (±40 ns).

38. Set 1.0 μs/1.45 μs Switch to 1.45. Verify CAL MARKS pulses are spaced 1.45 μs apart.

39. Rotate CAL Ø Control fully cw, then fully ccw. Verify CAL MARKS Phase shifts a minimum of 360°. Set SUPPRESSOR ON/OFF Switch to ON.

40. Remove Oscilloscope Channel B from CAL MARKS Connector. Connect Oscilloscope Channel B to SUPPRESSOR OUTPUT Connector. Verify rising edge of suppression pulse is 0.8 μs before rising edge of P_3.

41. Set DBL INTERR/INTRF PULSE Thumbwheels to INTERF- 17.0. Verify suppression pulse leading edge is coincident with INTERF leading edge (INTERF removed).

42. Set DBL INTERR/INTRF PULSE Thumbwheels to INTERF+. Verify suppression pulse leading edge is coincident with INTERF leading edge (INTERF removed).

43. Set DBL INTERR/INTRF PULSE Thumbwheels to DOUBLE. Verify leading edge of suppression pulse is coincident with position of first INTERR P_3 leading edge (first INTERR removed). Set SUPPRESSOR ON/OFF Switch to OFF.

44. Remove Spectrum Analyzer from RF I/O Connector. Connect Frequency Counter to RF I/O Connector.

45. Set ATC-1400A-2 controls as follows:

CONTROL	SETTING
CW/NORM/OFF Switch	CW
FREQ/FUNCTION SELECT Thumbwheels	1000 MHz

STEP	PROCEDURE

46. Verify 1000 MHz (±10 kHz) on Frequency Counter.

47. Set FREQ/FUNCTION SELECT Thumbwheels to 962 MHz. Press MAN/AUTO/MAN STEP Switch to MAN STEP. Verify A963.00 MHz on DISPLAY SELECT Readout.

48. Rotate FREQ STEP RATE Control fully cw. Verify frequency increases from A963.00 to A213.00 MHz in 1 MHz steps on DISPLAY SELECT Readout.

    NOTE: Letter "A" occupies 1000 MHz digit location. 1213.00 MHz is displayed as A213.00. 0963.00 MHz is displayed as A963.00.

49. Set ATC-1400A-2 controls as follows:

CONTROL	SETTING
CW/NORM/OFF Switch	NORM
MAN/AUTO/MAN STEP Switch	MAN
$T_O/TAC/T_D$ Switch	T_D
PRF/SQTR ON/OFF Switch	OFF
FREQ/FUNCTION SELECT Thumbwheels	0962 MHz X

50. Verify two gaussian shaped pulses spaced 12 μs (-0.1 μs) apart on Oscilloscope.

51. Set FREQ/FUNCTION SELECT Thumbwheels to 0962 MHz Y. Verify two gaussian shaped pulses on Oscilloscope are spaced 30 μs (±0.1 μs) apart.

52. Set DME DEV P_2/CAL Switch to -Δ, then +Δ. Verify P_2 pulse is positioned 23 μs from leading edge of P_2 at -Δ. Verify P_2 pulse is 37 μs from leading edge of P_1 at +Δ.

53. Set ATC-1400A-2 controls as follows:

CONTROL	SETTING
IDENT TONE/OFF/CODE Switch	TONE
DISPLAY SELECT Control	PRF SQTR Hz

54. Verify 1350 on DISPLAY SELECT Readout.

STEP PROCEDURE

55. Set EQUALIZER/OFF Switch to EQUALIZER. Verify 2700 on DISPLAY SELECT Readout.

56. Set IDENT TONE/OFF/CODE Switch to OFF.

57. Verify DME REPLY EFFICIENCY Control settings in Table 2 are within tolerance on DISPLAY SELECT Readout.

NOTE: All DME replies selected by DME REPLY EFFICIENCY Control have random functions except for 0% and 100%, which are stable.

DME REPLY EFFICIENCY Control Setting	DISPLAY SELECT Readout
0%	0 Hz (±0.0 Hz)
10%	250 Hz (±125.0 Hz)
20%	500 Hz (±125.0 Hz)
30%	750 Hz (±125.0 Hz)
40%	1000 Hz (±125.0 Hz)
50%	1250 Hz (±125.0 Hz)
60%	1500 Hz (±125.0 Hz)
70%	1750 Hz (±125.0 Hz)
80%	2000 Hz (±125.0 Hz)
90%	2250 Hz (±125.0 Hz)
100%	2500 Hz (±25.0 Hz)

Display Frequency for DME Control Settings
Table 2

58. Set ATC-1400A-2 controls as follows:

CONTROL	SETTING
PRF/SQTR ON/OFF Switch	ON
SELF-INTERR/OFF Switch	OFF

59. Verify 2500 (±250) on DISPLAY SELECT Readout.

NOTE: DISPLAY SELECT Readout changes continually due to random squitter pulses.

STEP PROCEDURE

60. Set ATC-1400A-2 controls as follows:

CONTROL	SETTING
T_O/TAC/T_D Switch	TAC
TACAN ON/OFF Switch	ON

61. Set Oscilloscope Channel A sweep to 10 ms/Div. Verify 15 and 135 Hz TACAN AM are present on squitter pulses.

62. Set PRF/SQTR ON/OFF Switch to OFF. Verify 877 (±2) on DISPLAY SELECT Readout.

63. Set FREQ/FUNCTION SELECT Thumbwheels to 0962 MHz X. Verify 900 (±2) on DISPLAY SELECT Readout.

64. Set DISPLAY SELECT Control to RANGE NMi. Press LOAD RNG Pushbutton Switch. Verify 399.99 on DISPLAY SELECT Readout.

65. Set -1 NMi/NORM Switch to -1 NMi. Verify 398.99 on DISPLAY SELECT Readout. Reset -1 NMi/NORM Switch to NORM.

66. Press LOAD VEL Pushbutton Switch. Verify DISPLAY SELECT Readout is decreasing.

67. Set IN/OUT Switch to OUT. Verify DISPLAY SELECT Readout is increasing.

68. Set DISPLAY SELECT Control to VEL KTS. Verify 3990 on DISPLAY SELECT Readout.

69. Press LOAD ACCEL Pushbutton Switch. Verify DISPLAY SELECT Readout is decreasing.

NOTE: When digits in DISPLAY SELECT Readout reach 0000, display automatically increases.

70. Press CLEAR ACCEL Pushbutton Switch. Verify DISPLAY SELECT Readout remains constant.

71. Press CLEAR VEL Pushbutton Switch. Verify 000 on DISPLAY SELECT Readout.

STEP	PROCEDURE
72.	Set DISPLAY SELECT Control to RANGE NMi. Verify DISPLAY SELECT Readout remains constant.
73.	Press CLEAR RNG Pushbutton Switch. Verify 0.00 on DISPLAY SELECT Readout.
74.	Set POWER Switch to OFF and disconnect test equipment.

3.6.2 Receive

PURPOSE: Measures ATC-1400A-2's ability to measure DME (UUT) power, frequency, PRF and XPDR (UUT) reply and decoder efficiency.

TEST EQUIPMENT:

1	Transponder
1	DME (ARINC)
1	Peak Power Meter
1	Frequency Counter
1	50 Ω Coaxial Cable (BNC to BNC)
1	50 Ω Coaxial Cable (BNC to Type N)

STEP PROCEDURE

1. Connect ATC-1400A-2 to test equipment as shown in 1-2-3, Figure 7.

2. Set ATC-1400A-2 controls as follows: P_1 at +Δ

CONTROL	SETTING
CW/NORM/OFF Switch	NORM
-1 NMi/NORM Switch	NORM
IN/OUT Switch	OUT
SLS/ECHO ON/OFF Switch	OFF
XPDR PULSE WIDTH VAR/CAL Switch	CAL
MAN/AUTO/MAN STEP Switch	MAN
DME DEV P_2/CAL Switch	CAL
XPDR DEV P_3/CAL Switch	CAL
XPDR DEV P_2/CAL Switch	CAL
PRF/SQTR ON/OFF Switch	ON
F_2/P_2 F_1/P_1 Switch	F_1/P_1
XPDR MODE Control	1
DME REPLY EFFICIENCY Control	100%
DISPLAY SELECT Control	FREQ MHz
PRF/SQTR Thumbwheels	2700
FREQ/FUNCTION SELECT Thumbwheels	0001 TAC-X
ΔF Thumbwheels	OFF
RANGE/VEL/ACCEL Thumbwheels	10000
DECODER WIDE/NARROW Switch	NARROW
EQUALIZER/OFF Switch	OFF
SELF-INTERR/OFF Switch	OFF

STEP PROCEDURE

3. Set POWER Switch to ON and allow 10 minute warm-up period.

4. Apply ac power to DME and Peak Power Meter and allow 10 minute warm-up period.

5. Set DME to channel TAC-X. Record reading on Peak Power Meter.

6. Set DME power switch to stand-by position.

7. Disconnect coaxial cable from Peak Power Meter. Connect coaxial cable to RF I/O Connector.

8. Set DME power switch to ON. Verify peak power in Step 5 (±0.5 dB plus Power Meter Specifications) on XMTR PWR WATTS Display.

9. Adjust ΔF Thumbwheels for 962 MHz on DISPLAY SELECT Readout.

10. Set ATC-1400A-2 controls as follows:

CONTROL	SETTING
RF LEVEL Control	-50 dBm
DISPLAY SELECT Control	DME DIST NMi

11. Verify 0 NMi (±0.1 NMi) on DISPLAY SELECT Readout and/or DME Indicator.

12. Adjust ΔF Thumbwheels for 0017 MHz on DISPLAY SELECT Readout.

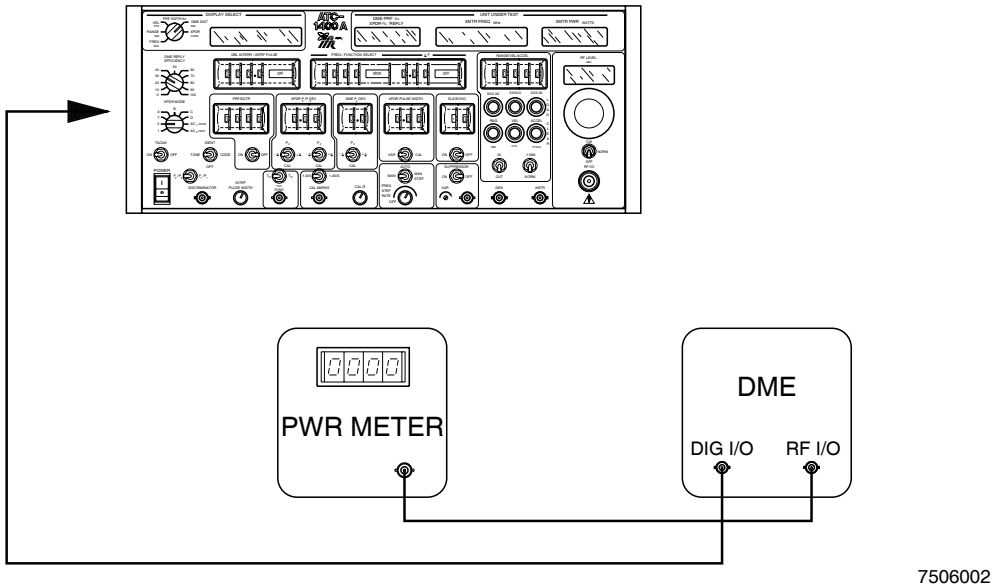
13. Verify 0 NMi (±0.1 NMi) on DISPLAY SELECT Readout and/or DME Indicator.

14. Adjust ΔF Thumbwheels for 0126 MHz on DISPLAY SELECT Readout.

15. Verify 0 NMi (±0.1 NMi) on DISPLAY SELECT Readout and/or DME Indicator.

16. Press LOAD RNG Pushbutton Switch. Verify 100 NMi on DISPLAY SELECT Readout and/or DME indicator.

17. Connect Frequency Counter to XMTR Connector. Verify value approximately twice value on DME-PRF Hz/XPDR - % REPLY Display on Frequency Counter. (Allow for a tolerance of 5%.)



Receive Set-Up Diagram
Figure 7

STEP	PROCEDURE
18.	Verify 1025 MHz on XMTR FREQ MHz Display. (Reference DME Manufacturer's specifications for allowable tolerance.)
19.	Set DISPLAY SELECT Control to XPDR CODE.
20.	Remove DME from RF I/O Connector. Connect Transponder to RF I/O Connector.
21.	Set ATC-1400A-2 controls as follows:

CONTROL	SETTING
PRF/SQTR Thumbwheels	0500
FREQ/FUNCTION SELECT Thumbwheels	1030 XPDR

STEP	PROCEDURE
22.	Enable Mode A on Transponder. Verify code on Transponder is on DISPLAY SELECT Readout.
23.	Set XPDR CODE Control to AC_1 CODE or AC_2 FEET.
24.	If a Transponder Altitude Encoder is available, connect to ATC-1400A-2. Enter altitude code selected at random. Verify altitude is identical on DISPLAY SELECT Readout and Transponder Altitude Encoder.
25.	Repeat Steps 22 through 24, two to three times, using various Transponder codes, to verify proper decoding of ATC-1400A-2.
26.	Set POWER Switch to OFF and disconnect test equipment.

3.6.3 Parameter Verifications

PURPOSE: Measures Residual FM, CW vs. Transponder and DME Pulse Level, Transponder Pulse Spacing, Double Interrogation/ Interference Pulse, DME Reply Efficiency/Ident Tone/ Interrogation Rate, Equalizer, Velocity and Acceleration

TEST EQUIPMENT:

1	Oscilloscope
1	Modulation Meter
1	Signal Generator
1	Heterodyne Monitor

STEP	PROCEDURE

1. Set POWER Switch to ON and allow 10 minute warm-up period.

RESIDUAL FM

2. Connect Modulation Meter input to RF I/O Connector.

3. Set ATC-1400A-2 controls as follows:

CONTROL	SETTING
CW/NORM/OFF Switch	CW
FREQ/FUNCTION SELECT Thumbwheels	1090 XPDR

4. Adjust RF LEVEL Controlfor a level 5 dB above point where level light on Modulation Meter is extinguished (approximately 20 to 25 dB).

5. Set Modulation Meter controls as follows:

CONTROL	SETTING
Tuning	AUTO
High-Pass	300 Hz
Low-Pass	3 kHz
Peak	PK-PK
Range	10
Function	kHz Deviation

6. Verify FM Deviation is <5 kHz.

7. Set FREQ/FUNCTION SELECT Thumbwheels to 0962. Verify FM Deviation is <5 kHz.

8. Set FREQ/FUNCTION SELECT Thumbwheels to 1090. Verify twice peak reading, over a 10-second period, is <10 kHz.

STEP	PROCEDURE

CW VS. TRANSPONDER AND DME PULSE LEVEL

9. Set ATC-1400A-2 controls as follows:

CONTROL	SETTING
RF LEVEL Control	-10 dBm
CW/NORM/OFF Switch	NORMAL
SLS/ECHO ON/OFF Switch	OFF
XPDR PULSE WIDTH VAR/CAL Switch	CAL
FREQ STEP RATE Control	OFF Fully ccw
MAN/AUTO/MAN STEP Switch	MAN
XPDR DEV P_3/CAL Switch	CAL
XPDR DEV P_2/CAL Switch	CAL
T_O/TAC/T_D Switch	T_O
PRF/SQTR ON/OFF Switch	ON
XPDR MODE Control	A
PRF/SQTR Thumbwheels	1000
FREQ/FUNCTION SELECT Thumbwheels	1090 XPDR
SLS/ECHO Thumbwheels	-0

10. Connect Signal Generator to Heterodyne Monitor LO input.

11. Set Signal Generator for 1090 MHz at +6 dBm.

12. Connect Heterodyne Monitor to Oscilloscope input. Connect Oscilloscope external trigger input to SYNC Connector.

13. Set Oscilloscope controls as follows:

CONTROL	SETTING
Vertical Sensitivity	0.01 V/Div
Trigger Source Control	EXT SYNC Trigger

14. Using Oscilloscope Vernier Control, position peak of positive going P_1 pulse on fifth horizontal axis (one graticule division above major horizontal axis). Verify P_1 pulse amplitude is five graticule divisions on Oscilloscope.

15. Set Oscilloscope Verticle Sensitivity Control to 0.005 V/Div.

16. Using positioning control, position peak of P_1 pulse on horizontal axis one graticule position under top of Oscilloscope display.

STEP PROCEDURE

17. Set CW/NORM/OFF Switch to CW. Verify pulse level between CW and transponder pulse is ≤2%.

18. Set ATC-1400A-2 controls as follows:

CONTROL	SETTING
CW/NORM/OFF Switch	OFF
T_O/TAC/T_D Switch	T_D
FREQ/FUNCTION SELECT Thumbwheels	MHz X

19. Verify pulse level between CW and DME pulse is ≤2%.

TRANSPONDER PULSE SPACING

20. Set ATC-1400A-2 controls as follows:

CONTROL	SETTING
TO/TAC/TD Switch	TO
FREQ/FUNCTION SELECT Thumbwheels	1090 XPDR

21. Verify XPDR pulse spacing for each XPDR MODE Control setting in Table 3 is within tolerance.

SETTING	PULSE SPACING
Mode 1	3.0 µs (±5 ns)
Mode 2	5.0 µs (±5 ns)
Mode T	6.5 µs (±5 ns)
Mode A/Mode 3	8.0 µs (±5 ns)
Mode B	17.0 µs (±5 ns)
Mode C	21.0 µs (±5 ns)
Mode D	25.0 µs (±5 ns)

XPDR Pulse Spacing
Table 3

STEP PROCEDURE

DOUBLE INTERROGATION/ INTERFERENCE PULSE

22. Set ATC-1400A-2 controls as follows:

CONTROL	SETTING
SLS/ECHO ON/OFF Switch	ON
DBL INTERR/INTRF PULSE Thumbwheels	019.0 INTERF+
SLS/ECHO Thumbwheels	+6

23. Verify a pulse approximately twice amplitude of P_1 pulse positioned 19.0 µs (±50 ns) after leading edge of P_1.

24. Rotate INTRF PULSE WIDTH Control fully cw, then fully ccw. Verify pulse width of displayed pulse changes from 0.2 to 5 µs.

25. Set DBL INTERR/INTRF PULSE Thumbwheels to 050.0 DOUBLE. Verify second interrogation pulse is 50.0 µs (±8 ns) after leading edge of P_1.

26. Set DBL INTERR/INTRF PULSE Thumbwheels to 050.0 OFF.

DME REPLY EFFICIENCY/IDENT TONE/INTERROGATION RATE

27. Set FREQ/FUNCTION SELECT Thumbwheels to 1090 MHz Y.

28. Set ATC-1400A-2 controls as follows:

CONTROL	SETTING
IDENT TONE/OFF/CODE Switch	TONE
DISPLAY SELECT Control	PRF SQTR Hz

29. Verify 1350 on DISPLAY SELECT Readout.

30. Set EQUALIZER/OFF Switch to EQUALIZER. Verify 2700 on DISPLAY SELECT Readout.

31. Set IDENT TONE/OFF/CODE Switch to OFF.

STEP PROCEDURE

32. Set ATC-1400A-2 controls as follows:

CONTROL	SETTING
PRF/SQTR ON/OFF Switch	OFF
PRF/SQTR Thumbwheels	2500
SELF-INTERR/OFF Switch	SELF-INTERR

33. Verify DME REPLY EFFICIENCY Control settings in Table 4 are within tolerance on DISPLAY SELECT Readout.

NOTE: All DME replies selected by DME REPLY EFFICIENCY Control have random readouts except 0% and 100%, which are stable.

DME REPLY EFFICIENCY Control Setting	DISPLAY SELECT Readout
0%	0 Hz (±0.0 Hz)
10%	250 Hz (±125.0 Hz)
20%	500 Hz (±125.0 Hz)
30%	750 Hz (±125.0 Hz)
40%	1000 Hz (±125.0 Hz)
50%	1250 Hz (±125.0 Hz)
60%	1500 Hz (±125.0 Hz)
70%	1750 Hz (±125.0 Hz)
80%	2000 Hz (±125.0 Hz)
90%	2250 Hz (±125.0 Hz)
100%	2500 Hz (±25.0 Hz)

DME Reply Efficiency Control Frequency
Table 4

34. Set PRF/SQTR ON/OFF Switch to ON and SELF-INTERR/OFF Switch to OFF

35. Verify 2500 (±250) on DISPLAY SELECT Readout.

NOTE: DISPLAY SELECT Readout changes continually due to random squitter pulses.

STEP PROCEDURE

36. Set ATC-1400A-2 controls as follows:

CONTROL	SETTING
PRF/SQTR ON/OFF Switch	ON
FREQ/FUNCTION SELECT Thumbwheels	1090 XPDR

37. Verify 2500 on DISPLAY SELECT Readout.

EQUALIZER

38. Connect Oscilloscope to GEN Connector (J10).

39. Set ATC-1400A-2 controls as follows:

CONTROL	SETTING
IDENT TONE/OFF/ CODE Switch	TONE
FREQ/FUNCTION SELECT Thumbwheels	MHz Y
EQUALIZER/OFF Switch	EQUALIZER

40. Verify leading edge of first pulse in first pulse pair is 100 µs (±10 µs) ahead of leading edge of first pulse in second pair.

VELOCITY

41. Set ATC-1400A-2 controls as follows:

CONTROL	SETTING
IN/OUT Switch	OUT
DISPLAY SELECT Control	RANGE
RANGE/VEL/ACCEL Thumbwheels	600 KTS

42. Press LOAD VEL Pushbutton Switch. Verify range advances 10.00 NMi in 60 seconds on DISPLAY SELECT Readout.

43. Set DISPLAY SELECT Control to VEL KTS. Verify 600 on DISPLAY SELECT Readout.

44. Press LOAD ACCEL Pushbutton Switch. Verify DISPLAY SELECT Readout decreases to zero, then automatically increases.

STEP	PROCEDURE
	ACCELERATION
45.	Press CLEAR RNG Pushbutton Switch to clear all previous entered range, velocity and acceleration data.
46.	Set RANGE/VEL/ACCEL Thumbwheels to 1000.
47.	Press LOAD ACCEL Pushbutton Switch. Verify 1770 in 30 seconds on DISPLAY SELECT Readout.
48.	Set POWER Switch to OFF and disconnect test equipment.

3.7 PERFORMANCE EVALUATION DATA SHEET

Technician: _____ Date: _____

ATC-1400A-2 S/N:_____

STEP	DATA	RESULT
(1)	Generate	
6.	RF level on RF LEVEL -dBm Display (3) is identical to Spectrum Analyzer	_____(√)
10.	All signals are -80 dBm or less	_____(√)
12.	Peak of pulses align with horizontal graticule (±0.1 Div)	_____
	Pulse width is 800 ns (±5.0 ns)	_____
	Pulse spacing is 3 μs (±5.0 ns)	_____
13.	Pulse spacing is 5.0 μs (±5.0 ns)	_____
14.	Pulse spacing is 6.5 μs (±5.0 ns)	_____
15.	Pulse spacing is 8.0 μs (±5.0 ns)	_____
16.	Pulse spacing is 17 μs (±5.0 ns)	_____
17.	Pulse spacing is 21 μs (±5.0 ns)	_____
18.	Pulse spacing is 25 μs (±5.0 ns)	_____
19.	Alternating pulse pairs of 8.0 and 21 μs	_____(√)
21.	800 ns pulse appears 2.0 μs after leading edge of P_1 pulse	_____(√)
22.	P_2 pulse is 1.0 μs from leading edge of P_1 at -Δ	_____(√)
	P_2 pulse is 3.0 μs from leading edge of P_1 at +Δ	_____(√)
24.	P_3 pulse is 7.0 μs from leading edge of P_1 at -Δ	_____(√)
	P_3 pulse is 9.0 μs from leading edge of P_1 at +Δ	_____(√)
26.	Width of pulses is 1.85 μs (±5.0 ns)	_____
27.	Width of pulses decreases accordingly	_____(√)
29.	P_2 pulse is approximately half amplitude of P_1 pulse	_____(√)
30.	P_2 pulse is approximately twice amplitude of P_1 pulse	_____(√)
32.	Pulse approximately twice amplitude of P_1 pulse is 17 μs (+0.05 μs) before leading edge of P_1	_____
33.	Pulse approximately twice amplitude of P_1 pulse is 17.0 μs (-0.05 μs) after leading edge of P_1	_____
34.	Pulse width of displayed pulse changes a minimum of 0.4 to 5 μs	_____(√)

STEP	DATA		RESULT
35.	Second interrogation pulse is 50.0 μs (±8 ns) after leading edge of P_3		_____
37.	CAL MARKS pulses are spaced 1.0 μs apart		_____(√)
	Pulse width of 0.45 μs (±40 ns)		_____
38.	CAL MARKS pulses are spaced 1.45 μs apart		_____(√)
39.	CAL MARKS Phase shifts a minimum of 360°		_____(√)
40.	Rising edge of suppression pulse is 0.8 μs before rising edge of P_3		_____(√)
41.	Suppression pulse leading edge is coincident with INTERF leading edge (INTERF removed)		_____(√)
42.	Suppression pulse leading edge is coincident with INTERF leading edge (INTERF removed)		_____(√)
43.	Leading edge of suppression pulse is coincident with position of first INTERR P3 leading edge (first INTERR removed)		_____(√)
46.	1000 MHz (±10 kHz)		_____
47.	A963.00 MHz		_____(√)
48.	Frequency increases from A963.00 to A213.00 MHz in 1 MHz steps		_____(√)
50.	Two gaussian shaped pulses spaced 12 μs (-0.1 μs) apart		_____
51.	Two gaussian shaped pulses spaced 30 μs (±0.1 μs) apart		_____
52.	P_2 pulse is 23 μs from leading edge of P_2 at -Δ		_____(√)
	P_2 pulse is 37 μs from leading edge of P_1 at +Δ		_____(√)
54.	1350		_____(√)
55.	2700		_____(√)
57.	0%	0 Hz (±0.0 Hz)	_____
	10%	250 Hz (±125.0 Hz)	_____
	20%	500 Hz (±125.0 Hz)	_____
	30%	750 Hz (±125.0 Hz)	_____
	40%	1000 Hz (±125.0 Hz)	_____
	50%	1250 Hz (±125.0 Hz)	_____
	60%	1500 Hz (±125.0 Hz)	_____
	70%	1750 Hz (±125.0 Hz)	_____
	80%	2000 Hz (±125.0 Hz)	_____
	90%	2250 Hz (±125.0 Hz)	_____
	100%	2500 Hz (±25.0 Hz)	_____
59.	2500 (±250)		_____
61.	15 Hz and 135 Hz TACAN AM are present on squitter pulses		_____(√)
62.	877 (±2)		_____

STEP	DATA	RESULT
63.	900 (±2)	_____
64.	399.99	_____(√)
65.	398.99	_____(√)
66.	DISPLAY SELECT Readout is decreasing	_____(√)
67.	DISPLAY SELECT Readout is increasing	_____(√)
68.	3990	_____(√)
69.	DISPLAY SELECT Readout is decreasing	_____(√)
70.	DISPLAY SELECT Readout remains constant	_____(√)
71.	000	_____(√)
72.	DISPLAY SELECT Readout remains constant	_____(√)
73.	0.00	_____(√)
(2)	Receive	
5.	Record reading on Peak Power Meter	_____(√)
8.	Peak power in Step 5 (±0.5 dB plus Power Meter Specifications)	_____(√)
11.	0 NMi (±0.1 NMi)	_____
13.	0 NMi (±0.1 NMi)	_____
15.	0 NMi (±0.1 NMi)	_____
16.	100 NMi	_____(√)
17.	Value approximately twice value on DME-PRF Hz/ XPDR - % REPLY Display	_____
18.	1025 MHz	_____(√)
22.	Code on Transponder is on DISPLAY SELECT Readout	_____(√)
24.	Altitude is identical on DISPLAY SELECT Readout and Transponder Altitude Encoder	_____(√)
(3)	Parameter Verifications	
6.	FM Deviation is <5 kHz	_____
7.	FM deviation is <5 kHz	_____
8.	Twice peak reading, over a 10-second period, is <10 kHz	_____
14.	P_1 pulse amplitude is five graticule divisions	_____(√)
17.	Pulse level between CW and transponder pulse is ≤2%	_____
19.	Pulse level between CW and DME pulse is ≤2%	_____

STEP	DATA		RESULT
21.	Mode 1	3.0 μs (±5 ns)	_____
	Mode 2	5.0 μs (±5 ns)	_____
	Mode T	6.5 μs (±5 ns)	_____
	Mode A/Mode 3	8.0 μs (±5 ns)	_____
	Mode B	17.0 μs (±5 ns)	_____
	Mode C	21.0 μs (±5 ns)	_____
	Mode D	25.0 μs (±5 ns)	_____
23.	Pulse approximately twice amplitude of P_1 pulse positioned 19.0 μs (±50 ns) after leading edge of P_1		_____
24.	Pulse width of displayed pulse changes from 0.2 to 5 μs		_____(√)
25.	Second interrogation pulse is 50.0 μs (±8 ns) after leading edge of P_1		_____
29.	1350		_____(√)
30.	2700		_____(√)
33.	0%	0 Hz (±0.0 Hz)	_____
	10%	250 Hz (±125.0 Hz)	_____
	20%	500 Hz (±125.0 Hz)	_____
	30%	750 Hz (±125.0 Hz)	_____
	40%	1000 Hz (±125.0 Hz)	_____
	50%	1250 Hz (±125.0 Hz)	_____
	60%	1500 Hz (±125.0 Hz)	_____
	70%	1750 Hz (±125.0 Hz)	_____
	80%	2000 Hz (±125.0 Hz)	_____
	90%	2250 Hz (±125.0 Hz)	_____
	100%	2500 Hz (±25.0 Hz)	_____
35.	2500 (±250)		_____
37.	2500		_____(√)
40.	Leading edge of first pulse in first pulse pair is 100 μs (±10 μs) ahead of leading edge of first pulse in second pair		_____
42.	Range advances 10.00 NMi in 60 seconds		_____(√)
43.	600		_____(√)
44.	DISPLAY SELECT Readout decreases to zero, then automatically increases		_____(√)
47.	1770 in 30 seconds		_____(√)

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4. GENERAL OPERATING PROCEDURES

TEST EXAMPLE PAGE

XPDR Test Examples 3
Measuring Receiver Bandwidth and Minimum Threshold Level (MTL) 3
Measuring Side Lobe Suppression (SLS) 4
Measuring Pulse Deviation 5
Verification of Interrogator Recovery Time 6
Pulse Width Decoder Operation 7
Measuring Frequency and Power Output 8
Measuring Pulse Shape and Width, Transmitter Droop and Frequency Pulling 8
Measuring Identification and Altitude Codes 9

DME Test Examples 12
Measuring DME Transmitter Frequency and Power 12
Measuring Transmitter Pulse Characteristics 13
Measuring Receiver Memory Time 14
Measuring Receiver Bandwidth and Sensitivity 15
Measuring Pulse Position Decoder Accuracy 16
Adjacent Channel Test 17
Measuring Accuracy and Tracking 18
Measuring Acquisition Time 19
Measuring Echo and Co-Channel Performance 20

4.1 GENERAL

Contains Test Examples relating to local control (front panel) operation of ATC-1400A-2.

4.2 PRE-OPERATIONAL CONSIDERATIONS

For maximum benefit, it is strongly recommended that personnel thoroughly read and understand all steps of Test Example to be performed, prior to completion.

4.3 CONTROLS, CONNECTORS AND INDICATORS

The Controls, Connectors and Indicators specified in the Test Examples are followed by an item number. Refer to 1-2-4, Figures 8 and 9 (XPDR Test Examples) and 1-2-4, Figures 13 and 14 (DME Test Examples) for the location of each Control, Connector and Indicator.

4.4 TEST EQUIPMENT REQUIREMENTS

Appendix G contains a list of test equipment suitable for performing any procedure in this manual. Other equipment meeting the specifications listed in Appendix G, may be substituted in place of the recommended models.

NOTE: For certain procedures, equipment listed in Appendix G may exceed the minimum required specifications.

4.5 OPERATING PRECAUTIONS

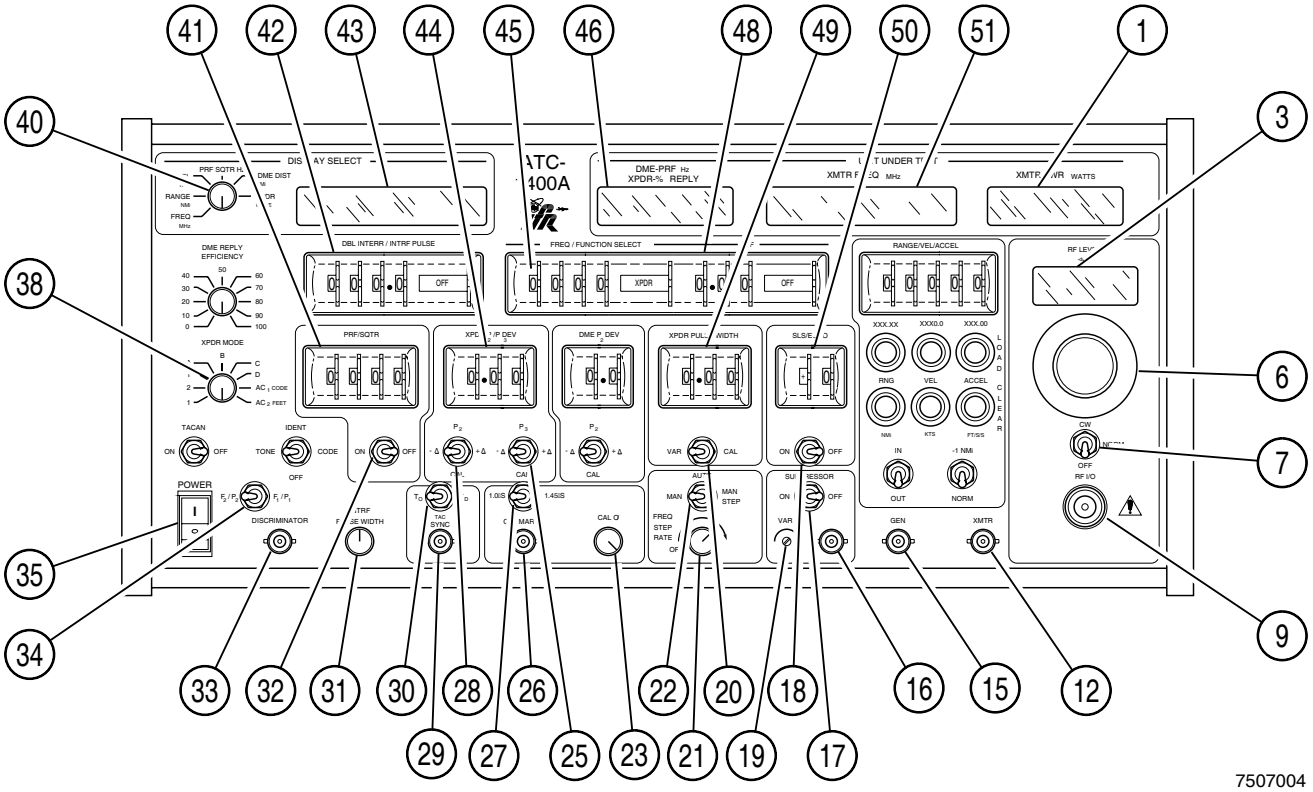
WARNING: WHEN WORKING WITH LIVE CIRCUITS OF HIGH POTENTIAL, KEEP ONE HAND IN POCKET OR BEHIND BACK TO AVOID SERIOUS SHOCK HAZARD.

WARNING: REMOVE ALL JEWELRY OR OTHER COSMETIC APPAREL BEFORE PERFORMING ANY TEST PROCEDURES INVOLVING LIVE CIRCUITS.

WARNING: USE ONLY INSULATED TROUBLESHOOTING TOOLS WHEN WORKING WITH LIVE CIRCUITS.

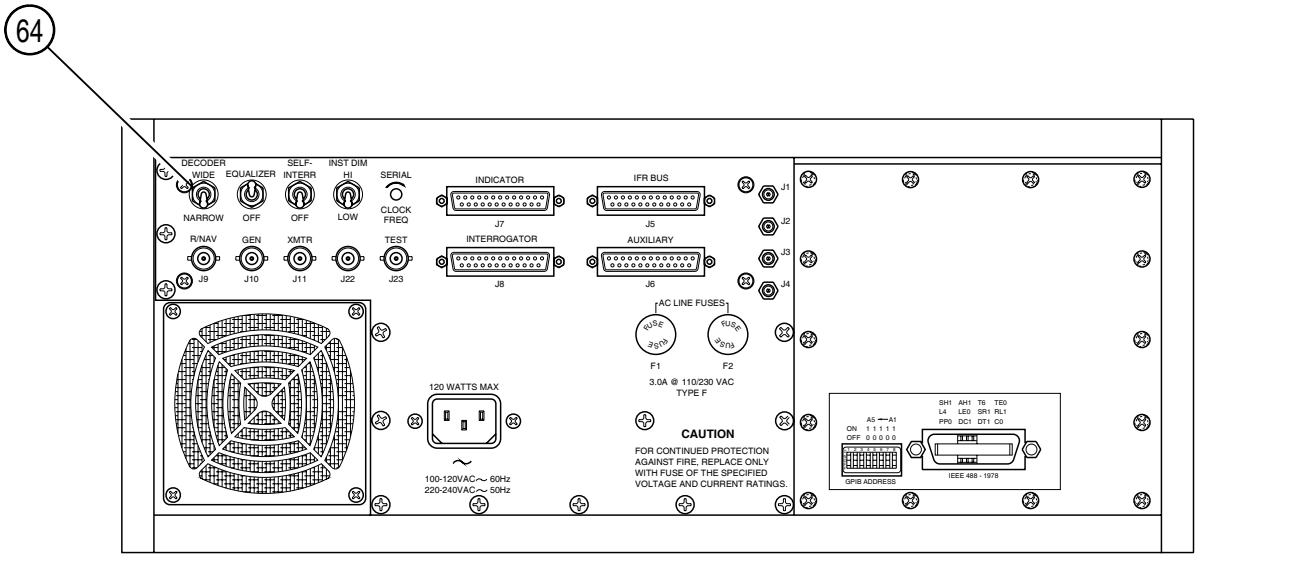
WARNING: FOR ADDED INSULATION, PLACE RUBBER BENCH MAT UNDER ALL POWERED BENCH EQUIPMENT AND A RUBBER FLOOR MAT UNDER OPERATOR'S CHAIR.

WARNING: HEED ALL WARNINGS AND CAUTIONS CONCERNING MAXIMUM VOLTAGE AND POWER INPUTS.



7507004

ATC-1400A-2 Front Panel Controls - XPDR Test Examples
Figure 8



7507009

ATC-1400A-2 Rear Panel Controls - XPDR Test Examples
Figure 9

4.6 XPDR TEST EXAMPLES

The XPDR Test Examples are for general application of ATC-1400A-2 for testing ATC (air traffic control) XPDR aircraft equipment. Refer to XPDR manufacturer's instruction manual for detailed XPDR Test Procedures.

The XPDR Test Examples are used to illustrate operation of ATC-1400A-2 and are not intended to supersede or modify manufacturer's recommended test procedure or intended to include all tests necessary to certify XPDR equipment. Specifications called out in the following Test Examples are for illustration purposes only and do not apply to any specific XPDR equipment model.

The Initial Control Settings for XPDR Test Examples Figure 8 are as follows:

CONTROL	SETTING
RF LEVEL Control	-70 dBm
CW/NORM/OFF Switch	NORM
SUPPRESSOR ON/OFF Switch	OFF
SLS/ECHO ON/OFF Switch	OFF
XPDR PULSE WIDTH VAR/CAL Switch	CAL
FREQ STEP RATE Control	OFF
MAN/AUTO/MAN STEP Switch	MAN
XPDR DEV P_3/CAL Switch	CAL
1.0 μS/1.45 μS Switch	1.45 μS
XPDR DEV P2/CAL Switch	CAL
T_O/TAC/T_D Switch	T_D
PRF/SQTR ON/OFF Switch	ON
F_2/P_2 F_1/P_1 Switch	F_1/P_1
POWER Switch	OFF
XPDR MODE Control	A
DISPLAY SELECT Control	FREQ MHz
PRF/SQTR Thumbwheels	500 Hz
DBL INTERR/INTRF PULSE Thumbwheels	047.9 μs, OFF
XPDR P_2/P_3 DEV Thumbwheels	0.20 μs
FREQ/FUNCTION SELECT Thumbwheels	1030 MHz, XPDR
ΔF Thumbwheels	0.00 MHz, OFF
XPDR PULSE WIDTH Thumbwheels	0.00 μs
SLS/ECHO Thumbwheels	0 dB

4.6.1 Measuring Receiver Bandwidth and Minimum Threshold Level (MTL)

TEST EQUIPMENT: None

SET-UP DIAGRAM: 1-2-1, Figure 2

STEP	PROCEDURE

1. Set ATC-1400A-2 controls for general XPDR operation as shown in para 1-2-4-6(2).
2. Set POWER Switch to ON and allow 3 minute warm-up period.
3. Set XPDR (UUT) to stand-by, allow sufficient warm-up time and set to NORM position.
4. Verify % reply is >90% on DME-PRF Hz/XPDR - % REPLY Display.

   NOTE: When testing XPDR equipment, a steady or flashing "F" displayed in first character position of DME-PRF Hz/XPDR - % REPLY Display indicates XPDR F_1 or F_2 pulse is not within specifications.

5. Decrease RF LEVEL Control in 1 dB steps until <90% on DME-PRF Hz/ XPDR - % REPLY Display.
6. Increase RF LEVEL Control 1 dB. Minimum threshold level (MTL) of UUT is on RF LEVEL -dBm Display. Record level.
7. Set RF LEVEL Control 3 dB above level in Step 6.
8. Set ΔF Thumbwheels to +Δ.
9. Increase ΔF Thumbwheels in 1 MHz steps until <90% is on DME-PRF Hz/XPDR - % REPLY Display. Record generator frequency (Fhi) on DISPLAY SELECT Readout.
10. Set ΔF Thumbwheels to -Δ.
11. Decrease ΔF Thumbwheels in 1 MHz steps until <90% is on DME-PRF Hz/XPDR - % REPLY Display. Record generator frequency (Flo) on DISPLAY SELECT Readout.

STEP	PROCEDURE

12. Determine 3 dB bandwidth and center frequency (Fo) by applying following formulas to values in Steps 9 and 11:

    Center frequency: Fo = (Fhi + Flo) ÷ 2

    3 dB bandwidth: 3 dB BW = Fhi - Flo

13. Set ΔF Thumbwheels to OFF.
14. Increase RF LEVEL Control to increase level +17 dB above level in Step 7.
15. Set ΔF Thumbwheels to +Δ.
16. Increase ΔF MHz Thumbwheels in 1 MHz steps until <90% is on DME-PRF Hz/XPDR - % REPLY Display. Record frequency (Fhi) on DISPLAY SELECT Readout.
17. Set ΔF Thumbwheels to -Δ.
18. Decrease ΔF Thumbwheels until <90% is on DME-PRF Hz/XPDR - % REPLY Display. Record frequency (Flo) on DISPLAY SELECT Readout.
19. Determine 20 dB bandwidth by applying following formula to values in Steps 16 and 18:

    20 dB BW = Fhi - Flo

20. Set ΔF Thumbwheels to OFF.

4.6.2 Measuring Side Lobe Suppression (SLS)

TEST EQUIPMENT: None

SET-UP DIAGRAM: 1-2-1, Figure 2

STEP	PROCEDURE

1. Set ATC-1400A-2 controls for general XPDR operation as shown in para 1-2-4-6(2).
2. Set POWER Switch to ON and allow 3 minute warm-up period.
3. Set XPDR (UUT) to stand-by, allow sufficient warm-up time and set to NORM position.
4. Verify % reply is >90% on DME-PRF Hz/XPDR - % REPLY Display.

   NOTE: When testing XPDR equipment, a steady or flashing "F" displayed in first character position of DME-PRF Hz/XPDR - % REPLY Display indicates XPDR F_1 or F_2 pulse is not within specifications.

5. Decrease RF LEVEL Control in 1 dB steps until <90% on DME-PRF Hz/ XPDR - % REPLY Display.
6. Increase RF LEVEL Control 1 dB. Minimum threshold level (MTL) of UUT is on RF LEVEL -dBm Display. Record level.
7. Set RF LEVEL Control 3 dB above level in Step 6.
8. Set SLS/ECHO ON/OFF Switch to ON.
9. Using RF LEVEL Control, increase RF output in 10 dB steps to insure a 0% reply rate up to 50 dB above level in Step 6.
10. Set RF LEVEL Control to 3 dB above level recorded in Step 6.
11. Set SLS/ECHO Thumbwheels to -9 dB.
12. Using RF LEVEL Control, increase RF output in 10 dB steps to insure a 100% reply rate up to 50 dB above level in Step 6.

STEP	PROCEDURE

13. Set RF LEVEL Control 3 dB above level in Step 6.
14. Set SLS/ECHO ON/OFF Switch to OFF.
15. Using RF LEVEL Control, increase RF output in 10 dB steps to insure a >90% reply rate >50 dB above level in Step 6.

4.6.3 Measuring Pulse Deviation

TEST EQUIPMENT: None

SET-UP DIAGRAM: 1-2-1, Figure 2

STEP	PROCEDURE

1. Set ATC-1400A-2 controls for general XPDR operation as shown in para 1-2-4-6(2).
2. Set POWER Switch to ON and allow 3 minute warm-up period.
3. Set XPDR (UUT) to stand-by, allow sufficient warm-up time and set to NORM position.
4. Verify % reply is 100% on DME-PRF Hz/XPDR - % REPLY Display.

   NOTE: When testing XPDR equipment, a steady or flashing "F" displayed in first character position of DME-PRF Hz/XPDR - % REPLY Display indicates XPDR F_1 or F_2 pulse is not within specifications.

5. Decrease RF LEVEL Control in 1 dB steps until <90% on DME-PRF Hz/ XPDR - % REPLY Display.
6. Increase RF LEVEL Control 1 dB. Minimum threshold level (MTL) of UUT is on RF LEVEL -dBm Display. Record level.
7. Set XPDR DEV P_3/CAL Switch to $+\Delta$.
8. Using RF LEVEL Control, increase RF output in 10 dB steps to verify % reply rate is >90% for a level of 50 dB above level in Step 6.
9. Set XPDR P_3/CAL Switch to $-\Delta$.
10. Using RF LEVEL Control, decrease RF output in 10 dB steps to level in Step 6. Verify % reply rate is >90% for a level of 50 dB above level in Step 6, down to level in Step 6.
11. Set XPDR P_2/P_3 DEV Thumbwheels to 1.05 μs.
12. Set RF LEVEL Control to level in Step 6.

STEP	PROCEDURE

13. Using RF LEVEL Control, increase RF output in 10 dB steps to 50 dB above MTL. Verify % reply rate is <10% on DME-PRF Hz/XPDR - % REPLY Display.
14. Set XPDR DEV P_3/CAL Switch to +Δ.
15. Verify % reply is <10% on DME-PRF Hz/XPDR - % REPLY Display.
16. Using RF LEVEL Control, decrease RF output in 10 dB steps down to level in Step 6. Verify % reply rate is <10% on DME-PRF Hz/XPDR - % REPLY Display.
17. Set XPDR DEV P_3/CAL Switch to CAL.

4.6.4 Verification of Interrogator Recovery Time

TEST EQUIPMENT: None

SET-UP DIAGRAM: 1-2-1, Figure 2

STEP	PROCEDURE

1. Set ATC-1400A-2 controls for general XPDR operation as shown in para 1-2-4-6(2).
2. Set POWER Switchto ON and allow 3 minute warm-up period.
3. Set XPDR (UUT) to stand-by, allow sufficient warm-up time and set to NORM position.
4. Verify % reply is 100% on DME-PRF Hz/XPDR - % REPLY Display.

   NOTE: When testing XPDR equipment, a steady or flashing "F" displayed in first character position of DME-PRF Hz/XPDR - % REPLY Display indicates XPDR F_1 or F_2 pulse is not within specifications.

5. Decrease RF LEVEL Control in 1 dB steps until <90% on DME-PRF Hz/ XPDR - % REPLY Display.
6. Increase RF LEVEL Control 1 dB. Minimum threshold level (MTL) of UUT is on RF LEVEL -dBm Display. Record level.
7. Set RF LEVEL Control 3 dB above level in Step 6.
8. Set SLS/ECHO ON/OFF Switch to ON.
9. Set DBL INTERR/INTRF PULSE Thumbwheels to 047.9 DOUBLE.
10. Verify % reply is 50% on DME-PRF Hz/XPDR - % REPLY Display.
11. Set SLS/ECHO ON/OFF Switch to OFF.
12. Set DBL INTERR/INTRF PULSE Thumbwheels to 125.0 DOUBLE.
13. Verify % reply is >90% on DME-PRF Hz/XPDR - % REPLY Display.
14. Set DBL INTERR/INTRF PULSE Thumbwheels to OFF.

4.6.5 Pulse Width Decoder Operation

TEST EQUIPMENT: None

SET-UP DIAGRAM: 1-2-1, Figure 2

STEP	PROCEDURE

1. Set ATC-1400A-2 controls for general XPDR operation as shown in para 1-2-4-6(2).
2. Set POWER Switch to ON and allow 3 minute warm-up period.
3. Set XPDR (UUT) to stand-by, allow sufficient warm-up time and set to NORM position.
4. Verify % reply is 100% on DME-PRF Hz/XPDR - % REPLY Display.

   NOTE: When testing XPDR equipment, a steady or flashing "F" displayed in first character position of DME-PRF Hz/XPDR - % REPLY Display indicates XPDR F_1 or F_2 pulse is not within specifications.

5. Decrease RF LEVEL Control in 1 dB steps until <90% on DME-PRF Hz/ XPDR - % REPLY Display.
6. Increase RF LEVEL Control 1 dB. Minimum threshold level (MTL) of UUT is on RF LEVEL -dBm Display. Record level.
7. Set ATC-1400A-2 controls as follows:

CONTROL	SETTING
XPDR PULSE WIDTH Thumbwheels	0.25 µs
XPDR PULSE WIDTH VAR/CAL Switch	VAR

8. Verify % reply is <10% on DME-PRF Hz/XPDR - % REPLY Display.
9. Using RF LEVEL Control, increase RF output in 10 dB steps to 50 dB above level in Step 6. Verify % reply rate is <10% on DME-PRF Hz/XPDR - % REPLY Display.
10. Set XPDR PULSE WIDTH Thumbwheels to 1.55 µs. Verify % reply is <10% on DME-PRF Hz/XPDR - % REPLY Display.

STEP	PROCEDURE

11. Using RF LEVEL Control, decrease RF output in 10 dB steps to level in Step 6. Verify % reply rate is <10% on DME-PRF Hz/XPDR - % REPLY Display .

4.6.6 Measuring Frequency and Power Output

TEST EQUIPMENT: None

SET-UP DIAGRAM: 1-2-1, Figure 2

STEP	PROCEDURE

1. Set ATC-1400A-2 controls for general XPDR operation as shown in para 1-2-4-6(2).
2. Set POWER Switch to ON and allow 3 minute warm-up period.
3. Set XPDR (UUT) to stand-by, allow sufficient warm-up time and set to NORM position.
4. Verify UUT transmitter frequency (F_1) of 1090 MHz (±3 MHz) is on XMTR FREQ MHz Display. Record transmitter frequency (F_{F2}).
5. Verify UUT transmitter power output (P_1) is within Manufacturer's specifications on XMTR PWR WATTS Display. Record power output (P_{F1}).
6. Set F_2/P_2 F_1/P_1 Switch to F_2/P_2.
7. Verify UUT transmitter frequency (F2) of 1090 MHz (±3 MHz) is on XMTR FREQ MHz Display. Record transmitter frequency (F_{F2}).
8. Verify UUT transmitter power output (P_2) is within manufacturer's specifications on XMTR PWR WATTS Display. Record power output (P_{F2}).
9. Determine ΔF by applying following formula to values in Steps 4 and 7:

   $\Delta F = F_{F1} - F_{F2}$

   NOTE: Desired ΔF is <3 MHz.
10. Determine ΔP by applying following formula to values in Steps 5 and 8:

    $\Delta P = 10 \log (P_{F1} \div P_{F2})$

    NOTE: Desired ΔP is <1 dB.

4.6.7 Measuring Pulse Shape and Width, Transmitter Droop and Frequency Pulling

TEST EQUIPMENT: Oscilloscope

SET-UP DIAGRAM: 1-2-1, Figure 2

STEP	PROCEDURE

1. Set ATC-1400A-2 controls for general XPDR operation as shown in para 1-2-4-6(2).
2. Set POWER Switch to ON and allow 3 minute warm-up period.
3. Set XPDR (UUT) to stand-by, allow sufficient warm-up time and set to NORM position.
4. Using three coaxial cables terminated into a 50 Ω Load through a BNC T-Connector, connect Oscilloscope Channel A to XMTR Connector , Oscilloscope Channel B to DISCRIMINATOR Connector and Oscilloscope Sync to SYNC Connector.
5. Measure UUT reply delay from leading edge of P_3 pulse to leading edge of F_1 pulse. Record measured delay (i.e. D_1). Verify D_1 = 3.0 μs (±0.5 μs).
6. Set XPDR MODE Control to C. Measure UUT reply delay from leading edge of P_3 pulse to leading edge of F_1 pulse. Record measured delay (i.e. D_2). Verify D_2 = 3.0 μs (±0.5 μs).
7. Subtract D_1 from D_2 . Verify >-0.2 to <0.2 μs difference in delay from Mode A to Mode C. Reset XPDR MODE Control to A.
8. Sync Oscilloscope to leading edge of F_1 pulse for a stable trace on display (using Oscilloscope Internal Sync).
9. Verify on Oscilloscope Channel A a UUT reply train pulse width rise time of 0.05 μs to 0.1 μs and fall time of 0.05 μs to 0.2 μs, measured between 90% and 10% amplitude points. Verify pulse shape is 0.35 to 0.55 μs, measured at 50% amplitude point.

   NOTE: Refer to Appendix F for baseline setting using ATC-1400A-2 XMTR detected output.

STEP	PROCEDURE

10. Verify amplitude of pulses between F_1 and F_2 framing pulse are within amplitude of F_1 and F_2 with exception of X pulse. Refer to 1-2-4, Figure 10 for example.

11. Verify SPI pulse width and shape is within specifications as outlined in Step 9 and amplitude of SPI pulse is within 12% of F_1 framing pulse.

12. Set PRF/SQTR Thumbwheels to 1200 Hz. Verify SPI pulse width and shape is within specifications as outlined in Step 9 and amplitude of SPI pulse is within 12% of F_1 framing pulse.

13. Set PRF/SQTR Thumbwheels to 500 Hz.

14. With discriminator output on Oscilloscope Channel B, verify all pulses are within levels of the F_1 and F_2 framing pulse. For pulses not within specified range, measure voltage difference between reference line and pulse (ΔE). To determine frequency of pulse, apply pulse voltage to formulas in following examples:

    NOTE: Using vertical position control on Oscilloscope, align F_1 or F_2 framing pulse on major horizontal axis depending on position of F_2/P_2 F_1/P_1 Switch (Figure 11 and 12).

    NOTE: Waveform shown in Figure 11 and 12 is for F_2/P_2 F_1/P_1 Switch set to F_1/P_1.

    EXAMPLE #1:
    Transmitter Frequency Pull F1/P1, Figure 11:

    $F = F_{F1} + (\Delta E \div G)$

    $G = 0.5$ V ÷ MHz into 50 Ω Load

    EXAMPLE #2:
    Transmitter Frequency Pull F_1/P_1, Figure 12:

    $F = F_{F2} + (\Delta E \div G)$

    $G = 0.5$ V ÷ MHz into 50 Ω Load

4.6.8 Measuring Identification and Altitude Codes

TEST EQUIPMENT: None

SET-UP DIAGRAM: 1-2-1, Figure 2

STEP	PROCEDURE

1. Set ATC-1400A-2 controls for general XPDR operation as shown in para 1-2-4-6(2).

2. Set DISPLAY SELECT Control to XPDR CODE.

3. Set POWER Switch to ON and allow 3 minute warm-up period.

4. Set XPDR (UUT) to stand-by, allow sufficient warm-up time and set to NORM position.

5. Verify letter "F" is not on DISPLAY SELECT Readout. With 7777 set on UUT, verify 7777 on DISPLAY SELECT Readout.

6. Enable squawk ident function of UUT. Verify UUT ID Code IDXXXX is on DISPLAY SELECT Readout.

7. Step through UUT Mode A Codes. Verify correct code is on DISPLAY SELECT Readout.

8. Set XPDR MODE Control to C.

9. Enable C Mode operation on UUT.

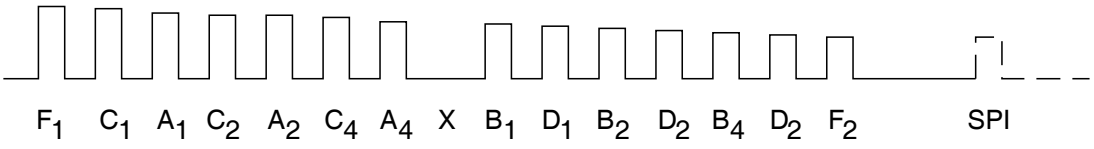
10. Step through UUT Mode C Codes. Verify correct code is on DISPLAY SELECT Readout.

11. Set XPDR MODE Control to AC_2 FEET.

12. Set UUT Altitude Reporting Code C_2 to position one and all other bits to zero. Verify C1.0 on DISPLAY SELECT Readout.

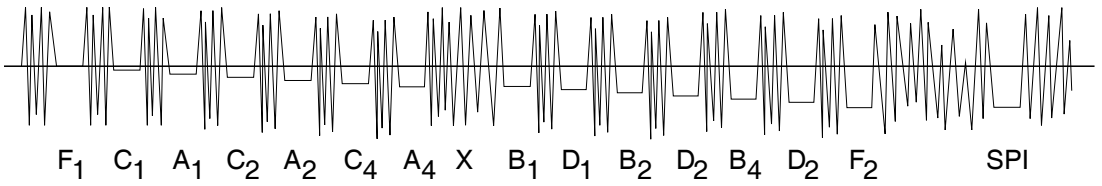
13. Set UUT Altitude Reporting Code $A_1A_2A_4B_1B_2B_4C_1C_2D_2D_4$ to position one and all other bits to zero. Verify ID84.1 on DISPLAY SELECT Readout.

14. Set UUT Altitude Reporting Code C_4D_2 to position one and all other bits to zero. Verify 126.7 on DISPLAY SELECT Readout.



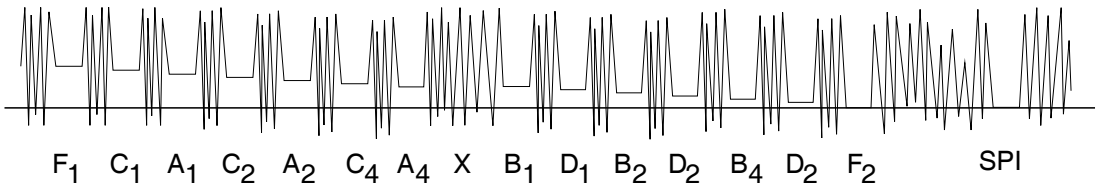
7518005

Transmitter Droop
Figure 10



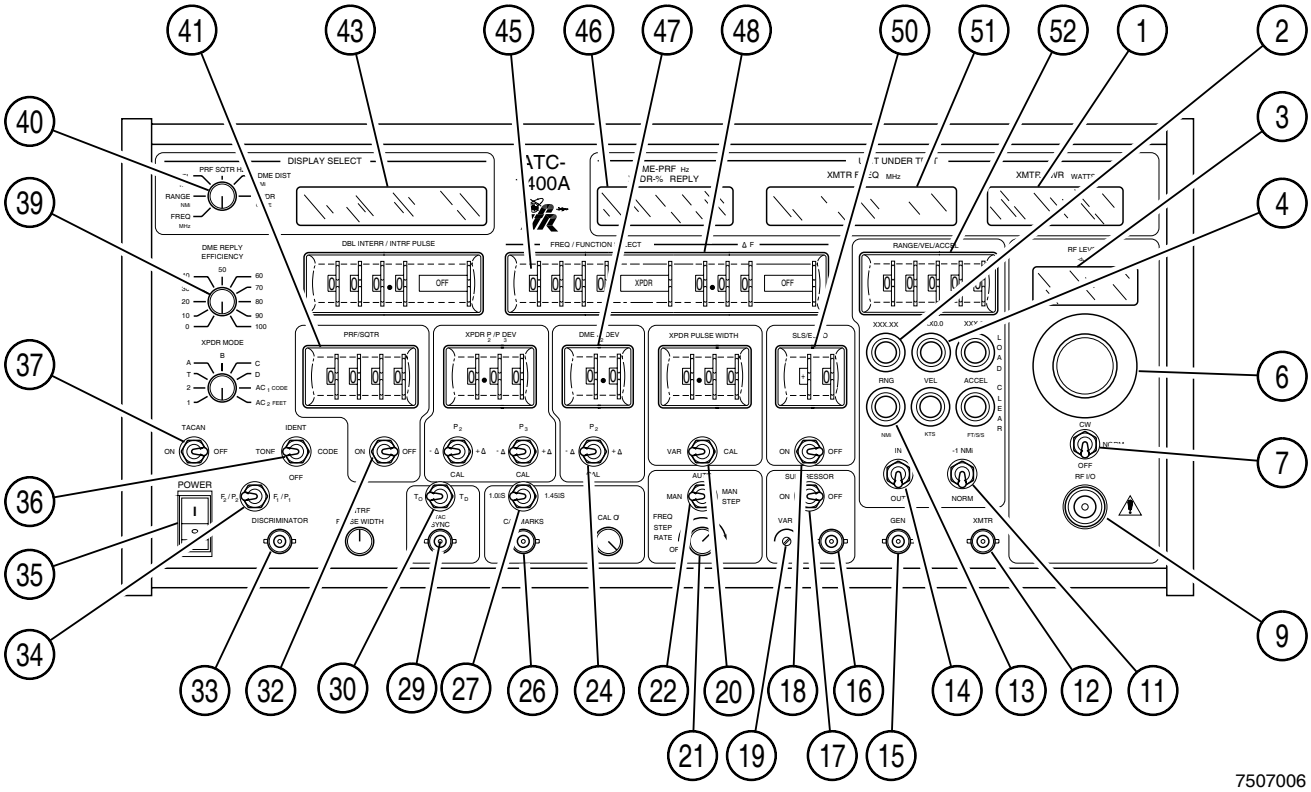
7518004

Transmitter Frequency Pull F1/P1 No. 1
Figure 11

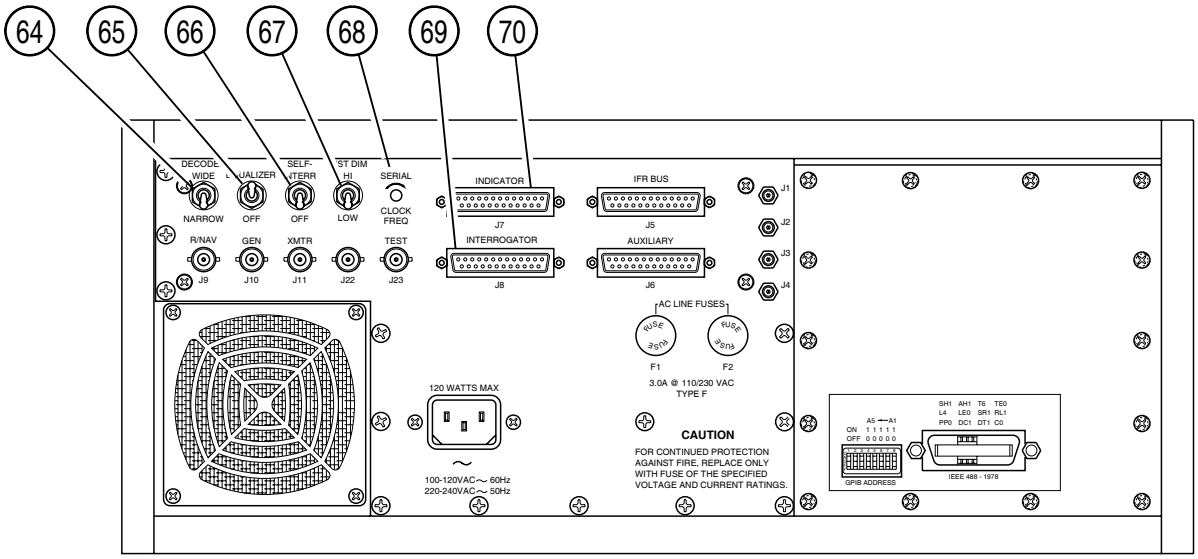


7518006

Transmitter Frequency Pull F1/P1 No. 2
Figure 12



ATC-1400A-2 Front Panel Controls - DME Test Examples
Figure 13



ATC-1400A-2 Rear Panel Controls - DME Test Examples
Figure 14

4.7 DME TEST EXAMPLES

The DME Test Examples are for general application of ATC-1400A-2 for testing ATC (air traffic control) DME aircraft equipment. Refer to DME manufacturer's instruction manual for detailed DME Test Procedures.

The DME Test Examples are used to illustrate operation of ATC-1400A-2 and are not intended to supersede or modify manufacturer's recommended test procedure or intended to include all tests necessary to certify DME equipment. Specifications called out in the following Test Examples are for illustration purposes only and do not apply to any specific DME equipment model.

The Initial Control Settings for DME Test Examples (Figure 13 and 14) are as follows:

CONTROL	SETTING
RF LEVEL Control	-48 dBm
CW/NORM/OFF Switch	NORM
-1 NMi/NORM Switch	NORM
IN/OUT Switch	OUT
SUPPRESSOR ON/OFF Switch	OFF
SLS/ECHO ON/OFF Switch	OFF
FREQ STEP RATE Control	OFF
MAN/AUTO/MAN STEP Switch	MAN
DME DEV P22/CAL Switch	CAL
1.0 μS/1.45 μS Switch	1.0 μS
TO/TAC/TD Switch	TO
PRF/SQTR ON/OFF Switch	ON
F2/P2 F1/P1 Switch	F1/P1
POWER Switch	OFF
IDENT TONE/OFF/CODE Switch	OFF
TACAN ON/OFF Switch	OFF
DME REPLY EFFICIENCY Switch	70%
DISPLAY SELECT Control	FREQ MHz
PRF/SQTR Thumbwheels	2700 Hz
FREQ/FUNCTION SELECT Thumbwheels	108.00 MHz, VOR PAIR
DME P2 DEV Thumbwheels	0.5 μs
ΔF Thumbwheels	0.00 MHz, OFF
SLS/ECHO Thumbwheels	-8 dB
RANGE/VEL/ACCEL Thumbwheels	04000
DECODER WIDE/NARROW Switch	NARROW
EQUALIZER/OFF Switch	ON
SELF-INTERR/OFF Switch	OFF

4.7.1 Measuring DME Transmitter Frequency and Power

TEST EQUIPMENT: 1 Spectrum Analyzer
1 60 dB Pad

SET-UP DIAGRAM: 1-2-1, Figure 1

STEP	PROCEDURE

1. Set ATC-1400A-2 controls for general DME operation as shown in para 1-2-4-7(2).
2. Set POWER Switch to ON and allow 3 minute warm-up period.
3. Set DME (UUT) to stand-by, allow sufficient warm-up time and set to NORM position.
4. Press CLEAR RNG Pushbutton Switch to clear ATC-1400A-2 of any previously loaded range, velocity and acceleration information.
5. Verify UUT transmitter frequency on XMTR FREQ MHz Display. Record XMTR frequency (F_{P1}). (F_{P1} = 1041 MHz [±0.07 MHz])
6. Verify UUT transmitter power on XMTR PWR WATTS Display is within Manufacturer's specifications.
7. Set F_2/P_2 F_1/P_1 Switch to F_2/P_2.
8. Verify UUT transmitter frequency on XMTR FREQ MHz Display. Record XMTR frequency (F_{P2}). (F_{P2} = 1041 MHz [±0.07 MHz])
9. Verify UUT transmitter power on XMTR PWR WATTS Display is within Manufacturer's specifications.
10. Determine frequency stability of UUT by applying following formula to values in Steps 5 and 8:

    $100 \times (1 - [F_{P1} \div F_{P2}]) =$ % Frequency Stability

11. Verify Frequency Stability of UUT transmitter is within ±0.0007%.
12. Connect output of UUT, through 60 dB Pad, to Spectrum Analyzer. Verify 90% of transmitted power falls within ±0.5 MHz of assigned channel frequency.

STEP	PROCEDURE

13. Set F_2/P_2 F_1/P_1 Switch to F_1/P_1.
14. Connect UUT output to RF I/O Connector.
15. Set FREQ/FUNCTION SELECT Thumbwheels to 117.90 MHz VOR PAIR.
16. Perform Steps 4 through 12 for three other channels to assure proper operation and frequency stability of UUT.

    NOTE: For best results, select two X channels and two Y channels for testing.

4.7.2 Measuring Transmitter Pulse Characteristics

TEST EQUIPMENT: 1 Oscilloscope

SET-UP DIAGRAM: 1-2-1, Figure 1

STEP	PROCEDURE

1. Set ATC-1400A-2 controls for general DME operation as shown in para 1-2-4-7(2).
2. Set POWER Switch to ON and allow 3 minute warm-up period.
3. Set DME (UUT) to stand-by, allow sufficient warm-up time and set to NORM position.
4. Press CLEAR RNG Pushbutton Switch to clear ATC-1400A-2 of any previously loaded range, velocity and acceleration information.
5. Connect BNC T-Connector to Oscilloscope Channel A.
6. Connect 50 Ω Load to one end of BNC T-Connector and 50 Ω coaxial cable from other end of BNC T-Connector to XMTR Connector.
7. Connect 50 Ω coaxial cable from Oscilloscope External Trigger to SYNC Connector.

   NOTE: If viewing total P_1 pulse is desired, remove Oscilloscope External Trigger coaxial cable from SYNC Connector. Connect Oscilloscope External Trigger coaxial cable to UUT suppression output.

8. Verify UUT transmitted pulse rise and fall time is <3.0 μs. Verify pulse width, measured between leading and trailing edges, is 3.5 μs (±0.5 μs).

   NOTE: Refer to Appendix F for baseline setting using ATC-1400A-2 XMTR detected output.

9. Verify Lock Mode pulse repetition frequency (PRF) is ≤30 pp/s.

STEP	PROCEDURE
10.	Set DME REPLY EFFICIENCY Control to 0%. Allow ATC-1400A-2 a 15-second interval to exit from memory.
11.	Verify Search Mode PRF is in accordance to Manufacturer's specifications (≤150 pp/s).

4.7.3 Measuring Receiver Memory Time

TEST EQUIPMENT: 1 Stopwatch

SET-UP DIAGRAM: 1-2-1, Figure 1

STEP	PROCEDURE
1.	Set ATC-1400A-2 controls for general DME operation as shown in para 1-2-4-7(2).
2.	Set POWER Switch to ON and allow 3 minute warm-up period.
3.	Press CLEAR RNG Pushbutton Switch to clear ATC-1400A-2 of any previously loaded range, velocity and acceleration information.
4.	Set DME (UUT) to stand-by, allow sufficient warm-up period, set to NORM position and wait for a lock-on condition.
5.	Using Stopwatch, record elapsed time DME REPLY EFFICIENCY Control is set to 0% and DME-PRF Hz/XPDR - % REPLY Display reflects an increase of UUT PRF. Verify elapsed time is 8 seconds (±4 seconds).
6.	Set RANGE/VEL/ACCEL Thumbwheels to 400 KTS.
7.	Set DME REPLY EFFICIENCY CONTROL to 70%. Press CLEAR RNG Pushbutton Switch and LOAD VEL Pushbutton Switch. Allow UUT to lock-on and track.
8.	Set DME REPLY EFFICIENCY Control to 0% and allow an interval of 8 seconds (±4 seconds) for ATC-1400A-2 to exit from memory. Set DME REPLY EFFICIENCY Control to 70%. Verify distance, in accuracy, is ≤±0.2 NMi.

4.7.4 Measuring Receiver Bandwidth and Sensitivity

TEST EQUIPMENT: None

SET-UP DIAGRAM: 1-2-1, Figure 1

STEP	PROCEDURE

1. Set ATC-1400A-2 controls for general DME operation as shown in para 1-2-4-7(2).
2. Set POWER Switch to ON and allow 3 minute warm-up period.
3. Press CLEAR RNG Pushbutton Switch to clear ATC-1400A-2 of any previously loaded range, velocity and acceleration information.
4. Set DME (UUT) to stand-by, allow sufficient warm-up period and set to NORM position.
5. Set RF LEVEL Control to -79 dBm.
6. Decrease RF LEVEL Control in 1 dB steps, pausing 10 to 15 seconds between steps, until UUT breaks lock-on condition and starts search.
7. Increase RF LEVEL Control 1 dB. Verify track sensitivity on RF LEVEL -dBm Display. Record level.
8. Set IDENT TONE/OFF/CODE Switch to CODE. Verify a clear modulated tone with Morse Code "IFR." If tone is garbled, increase RF LEVEL Control until code is clear and useful. This is receiver sensitivity level (≤-90 dBm).
9. Set FREQ/FUNCTION SELECT Thumbwheels to 117.90 MHz (DME [UUT] receive frequency 1213 MHz) VOR PAIR. Perform Steps 6 through 8.
10. Set IDENT TONE/OFF/CODE Switch to OFF.
11. Set ATC-1400A-2 controls as follows:

CONTROL	SETTING
ΔF Thumbwheels	+Δ
DISPLAY SELECT Control	FREQ MHz

12. Increase ΔF Thumbwheels until frequency is assigned channel frequency plus receiver frequency stability of 0.06 MHz on DISPLAY SELECT Readout.

STEP	PROCEDURE

13. Repeat Steps 5 through 9. Verify results are ≤-90 dBm.
14. Decrease ΔF Thumbwheels until frequency is assigned channel frequency minus receiver frequency stability of 0.06 MHz on DISPLAY SELECT Readout.
15. Repeat Steps 5 through 9. Verify results are ≤-90 dBm.
16. Repeat Steps 6 through 15 for three other channels to assure proper receiver sensitivity of UUT.

    NOTE: For best results, select two X Channels and two Y Channels for testing.

17. If DME connected to INTERROGATOR Connector (J8) is automatically channeled using the 2-out-of-5 code, proceed at Step 18. If not, proceed at Step 20.
18. Set ATC-1400A-2 controls as follows:

CONTROL	SETTING
RF LEVEL Control	(Step 8)
MAN/AUTO/MAN STEP Switch	AUTO
IDENT TONE/OFF/CODE Switch	TONE
FREQ/FUNCTION SELECT Thumbwheels	0001 TAC X

19. Set FREQ STEP RATE Control for maximum channeling delay of UUT in accordance with Manufacturer's specifications.
20. Verify clear IDENT Tone for all TACAN X Channels.
21. Set FREQ/FUNCTION SELECT Thumbwheels to 0001 TAC Y.
22. Set MAN/AUTO/MAN STEP Switch to MAN, then back to AUTO to initiate automatic channel stepping and verify a clear IDENT Tone for all TACAN Y Channels.

4.7.5 Measuring Pulse Position Decoder Accuracy

TEST EQUIPMENT: None

SET-UP DIAGRAM: 1-2-1, Figure 1

STEP	PROCEDURE

1. Set ATC-1400A-2 controls for general DME operation as shown in para 1-2-4-7(2).
2. Set POWER Switch to ON and allow 3 minute warm-up period.
3. Press CLEAR RNG Pushbutton Switch to clear ATC-1400A-2 of any previously loaded range, velocity and acceleration information.
4. Set DISPLAY SELECT Control to DME DIST NMi.
5. Set DME (UUT) to stand-by, allow sufficient warm-up period and set to NORM position.
6. Set RF LEVEL Control to -79 dBm.
7. Increase RF LEVEL Control by 1 dB. Verify track sensitivity on RF LEVEL -dBm Display. Record level.
8. Set IDENT TONE/OFF/CODE Switch to CODE. Verify a clear modulated tone with Morse Code "IFR." If tone is garbled, increase RF Level until code is clear and useful. This is receiver sensitivity level (≤-90 dBm).
9. Press LOAD RNG Pushbutton Switch to load previously selected range of 40 NMi in ATC-1400A-2. Allow 15 seconds for UUT to obtain lock-on.
10. Set DME DEV P_2/CAL Switch to +Δ. Pause for duration of memory time. Verify UUT does not break lock-on condition. Verify range is 040.00 NMi (±1.2 NMi) on DISPLAY SELECT Readout.
11. Set DME DEV P_2/CAL Switch to -Δ. Pause for duration of memory time. Verify UUT does not break lock-on condition. Verify range is 040.00 NMi (±1.2 NMi) on DISPLAY SELECT Readout.

STEP	PROCEDURE

12. Rotate RF LEVEL Control until -20 dBm is on RF LEVEL -dBm Display. Perform Steps 10 and 11.
13. Repeat Steps 7 through 9 to establish previous receiver sensitivity level.
14. Set DME P_2 DEV Thumbwheels to 6.0 μs. Pause for duration of memory time. Verify UUT breaks lock-on condition.
15. Set DME DEV P_2/CAL Switch to CAL. Pause for duration of memory time. Verify UUT lock-on condition.
16. Set DME DEV P_2/CAL Switch to +Δ. Pause for duration of memory time. Verify UUT breaks lock-on condition.
17. Set ATC-1400A-2 controls as follows:

CONTROL	SETTING
RF LEVEL Control	-48 dBm
DME DEV P_2/CAL Switch	CAL

18. Pause for duration of memory time. Verify UUT lock-on condition.
19. Set DME P_2 DEV Thumbwheels to 0.5 μs.
20. Set FREQ/FUNCTION SELECT Thumbwheels to 108.05 MHz (DME [UUT] receive frequency 983.00 MHz). Repeat Steps 10, 11, 14, 15 and 16.

4.7.6 Adjacent Channel Test

TEST EQUIPMENT: None

SET-UP DIAGRAM: 1-2-1, Figure 1

STEP	PROCEDURE

1. Set ATC-1400A-2 controls for general DME operation as shown in para 1-2-4-7(2).
2. Set POWER Switch to ON and allow 3 minute warm-up period.
3. Press CLEAR RNG Pushbutton Switch to clear ATC-1400A-2 of any previously loaded range, velocity and acceleration information.
4. Set DISPLAY SELECT Control to FREQ MHz.
5. Set DME (UUT) to stand-by, allow sufficient warm-up period and set to NORM position.
6. Set ΔF Thumbwheels to +Δ.
7. Adjust ΔF Thumbwheels for a frequency of +0.94 MHz above assigned channel frequency on DISPLAY SELECT Readout.
8. Set RF LEVEL Control to -79 dBm.
9. Decrease RF LEVEL Control in 1 dB steps, pausing one second between steps, until UUT breaks lock-on condition.
10. Increase RF LEVEL Control 1 dB. Verify track sensitivity on RF LEVEL -dBm Display. Record level.
11. Set RF LEVEL Control 30 dB above lock-on sensitivity (established in Step 10). Verify UUT does not lock-on for more than 1 out of 5 search cycles. If UUT lock-on, verify UUT does not track for more than 5 seconds.

    NOTE: To verify UUT is tracking and not in memory, PRF is ≤30 pp/s for 5 seconds plus memory time.

12. Set ΔF Thumbwheels to -Δ.
13. Set ΔF Thumbwheels for a frequency of -0.94 MHz below assigned channel frequency on DISPLAY SELECT Readout.

STEP	PROCEDURE

14. Verify UUT does not lock-on for more than 1 out of 5 search cycles. If UUT lock-on, verify UUT does not track for more than 5 seconds.

    NOTE: To verify UUT is tracking and not in memory, PRF is ≤30 pp/s for 5 seconds plus memory time.

15. Set ΔF Thumbwheels to OFF.

4.7.7 Measuring Accuracy and Tracking

TEST EQUIPMENT: None

SET-UP DIAGRAM: 1-2-1, Figure 1

STEP	PROCEDURE

1. Set ATC-1400A-2 controls for general DME operation as shown in para 1-2-4-7(2).
2. Set POWER Switch to ON and allow 3 minute warm-up period.
3. Press CLEAR RNG Pushbutton Switch to clear ATC-1400A-2 of any previously loaded range, velocity and acceleration information.
4. Set DISPLAY SELECT Control to DME DIST NMi.
5. Set RANGE/VEL/ACCEL Thumbwheels to 100.00 NMi.
6. Set DME (UUT) to stand-by, allow sufficient warm-up period, set to NORM position and pause until UUT locks-on. Verify 0.00 NMi (±0.5 NMi).
7. Set DISPLAY SELECT Control to RANGE NMi.
8. Press LOAD VEL Pushbutton Switch. Verify reading of UUT distance indicator (±0.5 NMi) or 3%, whichever is greater, on DISPLAY SELECT Readout.
9. Press LOAD RNG Pushbutton Switch. Pause until UUT locks-on. Verify UUT distance indicator is 100.00 NMi (±3 NMi). After 30 second delay, verify UUT distance is 100 NMi (±0.13 NMi).
10. Set RANGE/VEL/ACCEL Thumbwheels to 0600 KTS.
11. Set IN/OUT Switch to IN.
12. Press LOAD VEL Pushbutton Switch. Verify UUT tracks inbound.
13. Set IN/OUT Switch to OUT. Verify UUT does not lose lock-on and tracks outbound.
14. Press LOAD RNG Pushbutton Switch. Pause until UUT locks-on. Press LOAD VEL Pushbutton Switch. Verify UUT tracks inbound.

STEP	PROCEDURE

15. Set DME REPLY EFFICIENCY Control to 0%. Verify reading of UUT distance indicator (±0.3 NMi) or 3%, whichever is greater on DISPLAY SELECT Readout for duration of memory.
16. Set ATC-1400A-2 controls as follows:

CONTROL	SETTING
PRF/SQTR ON/OFF Switch	OFF
DME REPLY EFFICIENCY Control	100%

17. Verify UUT locks-on and tracks.
18. Set DME REPLY EFFICIENCY Control to 0%. Pause for duration of memory time. Verify flag on UUT indicator comes into view.

4.7.8 Measuring Acquisition Time

TEST EQUIPMENT: Stopwatch

SET-UP DIAGRAM: 1-2-1, Figure 1

STEP	PROCEDURE

1. Set ATC-1400A-2 controls for general DME operation as shown in para 1-2-4-7(2).
2. Set POWER Switch to ON and allow 3 minute warm-up period.
3. Press CLEAR RNG Pushbutton Switch to clear ATC-1400A-2 of any previously loaded range, velocity and acceleration information.
4. Set DME (UUT) to stand-by and allow 2 minute warm-up period.
5. Set RANGE/VEL/ACCEL Thumbwheels to 100.00 NMi.
6. Press LOAD RNG Pushbutton Switch to load previously selected range of 100 NMi.
7. Set UUT to NORM position. Start a stopwatch to measure time required for UUT to reach lock-on and UUT indicator to display 100 NMi (±0.23 NMi).

   If acquisition time is >1 second, repeat previous action several times. Verify UUT demonstrates >50% probability to lock-on in 1 second and >90% probability to lock-on in 1.5 seconds.
8. Set DME (UUT) to stand-by.
9. Set DISPLAY SELECT Control to RANGE NMi.
10. Set ATC-1400A-2 controls as follows:

CONTROL	SETTING
IN/OUT Switch	IN
RANGE/VEL/ACCEL Thumbwheels	1000 KTS

11. Press LOAD VEL Pushbutton Switch. Pause 10 seconds before proceeding.

STEP	PROCEDURE

12. Set UUT to NORM position. Start Stopwatch to measure time required for UUT to reach lock-on. Verify UUT indicator and DISPLAY SELECT Readout display 100 NMi (±0.23 NMi).

    If acquisition time is >1 second, repeat previous action several times. Verify UUT demonstrates >50% probability to lock-on in 1 second and >90% probability to lock-on in 1.5 seconds.

4.7.9 Measuring Echo and Co-Channel Performance

TEST EQUIPMENT: Stopwatch

SET-UP DIAGRAM: 1-2-1, Figure 1

STEP	PROCEDURE

1. Set ATC-1400A-2 controls for general DME operation as shown in para 1-2-4-7(2).
2. Set POWER Switch to ON and allow 3 minute warm-up period.
3. Press CLEAR RNG Pushbutton Switch to clear ATC-1400A-2 of any previously loaded range, velocity and acceleration information.
4. Set DME (UUT) to stand-by, allow sufficient warm-up period and set UUT to NORM position.
5. Press LOAD RNG Pushbutton Switch to load previously selected range of 40 NMi in ATC-1400A-2.
6. Using Stopwatch, record elapsed time DME REPLY EFFICIENCY Control is set to 0% and DME-PRF Hz/XPDR - % REPLY Display reflects increase of UUT PRF. Verify elapsed time is 8 seconds (±4 seconds).
7. Set SLS/ECHO ON/OFF Switch to ON.
8. Set DISPLAY SELECT Control to DME DIST NMi.
9. Verify 40 NMi on DISPLAY SELECT Readout.
10. Set SLS/ECHO Thumbwheels to -0 dB.
11. Pause for duration of elapsed time in Step 6 before proceeding.
12. Verify 30 NMi nominal on UUT indicator.
13. Set SLS/ECHO Thumbwheels to -5 dB.
14. Switch UUT to stand-by and back to NORM position. Verify UUT locks-on and displays approximately 40 NMi.

5. REMOTE OPERATION

5.1 GENERAL

Remote communication with ATC-1400A-2 is by General Purpose Interface Bus (GPIB), which conforms to IEEE standard 488-1978. ATC-1400A-2 performs to following IEEE-488 subsets:

SH1, AH1, T8, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT1 and C0.

ATC-1400A-2 is a talker, listener, primary address only with remote and local capability, device clear capability, device trigger capability, serial poll capability and no parallel poll capability nor controller capability.

All communication with ATC-1400A-2 over GPIB is implemented with ASCII encoded character strings. Invalid or improperly formulated characters are discarded and an error status flag is set. All ATC-1400A-2 commands are transmitted as packed ASCII character strings as defined in 2-2-4E(1) except ASCII character "!". This command is decoded immediately upon receipt and causes ATC-1400A-2 to return to local control via front panel. Other commands not included in instruction set, but operated on immediately, are following IEEE-488 bus messages:

MNEMONIC MESSAGE	ASCII CODE (HEX)	IEEE-488 INSTRUCTION
MLA	XX (20 to 3E)	My Listen Address
MTA	XX (40 to 5E)	My Talk Address
GTL	01	Go To Local
GET	08	Group Execute
LLO	11	Trigger
DCL	14	Local Lockout
SPE	18	Device Clear
SPD	19	Serial Poll Enable Serial Poll Disable

5.1.1 GPIB Transactions

Several examples of GPIB transactions showing ASCII string to be transmitted followed by necessary BUS operations to complete transactions are as follows. These examples were generated and executed using a GPIB controller that uses an ANSI Standard Basic Interpreter with enhancements allowing direct communication over GPIB using special GPIB interface hardware.

EXAMPLE: Command ATC-1400A-2 to set RF Output to 1080 MHz

ASCII String: "F1080"

BUS Transaction:
MLA, MTA, DAB"F", DAB"1",DAB"0", DAB"8", DAB"0", DAB CR, DAB LF, UNT,UNL.

EXAMPLE: Command ATC-1400A-2 to read back RF output of 1080 MHz

ASCII String: "F?", followed by a controller input command to input data.

Return String: "#1080.00"

BUS Transaction:
MLA, MTA, DAB "F", DAV "?", DAB CR, DAB LF, UNT, UNL, MLA, MTA, DAB " ", DAB "1", DAB "0", DAB "8", DAB "0", DAB ".", DAB "0", DAB "0", DAB CR, DAB LF, UNT, UNL.

NOTE: # Denotes Blank Space

EXAMPLE: Command ATC-1400A-2 to return to local mode (Front Panel Operation)

ASCII String: "!"

BUS Transactions:
MLA, MTA, DAB"!", DAB CR, DAB LF, UNT, UNL, or just issuing GTB BUS message has the same effect.

5.1.2 Status and Service Request Transaction

ATC-1400A-2 has ability to provide status information (SPE) and issue request for service (SRQ) depending on conditions set by user with ATC-1400A-2 “SRM=XXXXXX” command. After ATC-1400A-2 is placed in remote operation mode, ATC-1400A-2 is interrogated for one byte status information. If user sets any SRQ mask bits to “1," and error condition matches mask bit, a request for service (SRQ) is issued by ATC-1400A-2. Status bits are shown as follows:

STATUS BIT NO.	CONDITION	DEFINITION
7	0	XPDR Function
7	1	DME Function
6	1	RSV (Request for Service)
5	1	UUT Pulse Position Error
4	1	UUT Frequency Invalid/Out of Lock
3	1	UUT Inactive (Low Power)
2	1	Invalid Command/Syntax Error
1	1	Auxiliary Error (No Connection/Invalid Command)
0	1	DME/XPDR Function Select Error

EXAMPLE: Status Transaction

Request is made for status from ATC-1400A-2 with an address of 8:

GPSTAT(8)

Returned information is:

Bit No.: 7 6 5 4 3 2 1 0

Condition: “1 0 0 1 1 0 0 1"

Indicates ATC-1400A-2 is in DME Function of operation. UUT frequency is out of lock, lost power and last command sent was a XPDR command, creating an operation function error indication.

When user queries if there is a pulse position error or operation function select error, command “SRM=100001" is issued to trigger a service request whenever either of two masked bits are active. Data string for “SRM=" is right-hand justified so not all six characters need to be output depending on desired mask. If only an operation function error detect SRQ is desired, output string “SRM=1". All previously masked bits are cleared each time mask command is given.

EXAMPLE: Service Request Transaction

If a service request is triggered by issuing an “SRM=1" command prior to XPDR command before status was requested (Example: Status Transaction), returned status byte would have Bit 6 set in addition to other Bits shown as follows:

Bit No: 7 6 5 4 3 2 1 0

Condition: “1 1 0 1 1 0 0 1"

Most controllers respond to Bit No. 6 being set (1) as a request for service from addressed device during a serial poll sequence.

NOTE: ATC-1400A-2 powers up in local mode and remains until addressed to talk or listen (MTA or MLA), or until ATC-1400A-2 receives a local lockout or remote (LLO or REM) BUS message.

5.2 COMMAND AND DATA STRUCTURE

All communication with ATC-1400A-2 is done with uppercase ASCII character strings, which are designed to replace front panel controls. There is a one-for-one correspondence between ASCII Commands and ATC-1400A-2 front panel switches and displays, with exception of MAN/AUTO/MAN STEP Switch, "XPDR" "VOR" "DME" and TACAN channeling function of the FREQ/FUNCTION SELECT Thumbwheels, INTRF PULSE WIDTH Control, CAL 0 Control and FREQ STEP RATE Control. Front panel switches are used to program initial condition or local state of ATC-1400A-2. Device clear message (GPIB DCL) resets ATC-1400A-2 to current front panel conditions.

5.2.1 ASCII Output Commands to ATC-1400A-2

All ASCII Commands sent to ATC-1400A-2 with exception of "!", are placed on an input stack to be processed at completion of transmission. Maximum command string length is sixty-four characters with spaces being optional.

Commands are packed together in random order within one long (≤64 character) string, without any separation delimiters.

5.2.2 ASCII Output Command Format Example

Commands F1030, R39.50, ID0, D? are transmitted as follows:

"F1030R39.50ID0D?"

Variable formats and ranges are explained in detail in 2-2-4G. In general, variables greater than allowable limit are set to maximum limit and variables less than allowable limit are set to minimum limit. Invalid commands and data are ignored, but an error status flag is set.

5.2.3 ASCII Commands to Input Data from ATC-1400A-2

ASCII command instructions pass data from ATC-1400A-2 to GPIB end with a "?". These commands are placed on an internal stack in ATC-1400A-2 until a group execute trigger BUS message (GET) is received or ATC-1400A-2 is addressed to talk. All measurements are made when trigger is received or first time unit is addressed to talk after measurement command string is received. Resulting data from all measurements are stored and passed to BUS, one measurement at a time, in order requested. When all data has been passed to BUS, ATC-1400A-2 outputs an ASCII "#?" command to indicate there are no more pending results.

NOTE: All ATC-1400A-2 responses are in form of an ASCII decimal character string, preceded by an ASCII space character " ", and terminated by a carriage return and line feed.

Once ATC-1400A-2 has made measurements, no new measurements are requested until all previous results have been passed to BUS, as this action destroys data remaining to be transmitted.

5.2.4 ASCII Input Command Format Example

Following input example uses a GPIB controller with an enhanced ANSI compatible basic interpreter:

NOTE: ATC-1400A-2 GPIB address is 8.

Measurement Request:

```
0010 Print #8, "R123.45V100A100R?V?"
0020 Input #8, A$
0030 IF A$="#?", then STOP
0040 Print A$
0050 GOTO 20
RUN
```

Reply response:

```
#0123.45     #0100
(Range)    (Velocity)
```

5.3 ATC-1400A-2 ALPHABETICAL QUICK REFERENCE ASCII COMMAND TABLE

All commands are in ASCII Code.

Data listed under Data List column reflects input/output data of ATC-1400A-2. Data shown in parentheses is input data, data not enclosed in parentheses is output data and a dash is used for commands having no input/output data.

Under Function column, symbol represents which ATC-1400A-2 function ASCII command is used. X is for XPDR function, D is for DME function and X/D is for DME and XPDR functions.

Following Instruction column of command table is a column listing page number where detailed description of ASCII command is found.

ASCII Command Table

COMMAND	DATA LIST	FUNCTION	INSTRUCTION	PAGE
!	---	X/D	Set ATC-1400A-2 in Local Mode	8
A	XXX	D	Set Acceleration (000 to 399 ft/sec^2)	98
AXn	AAA-A (AAA-A), X10	X10 X10	X10, Auxiliary Unit Instructions (n = 1 to 4) Auxiliary Unit Response if required ("?" Command was sent)	9
C?	(#XXXXXX)	X	Get XPDR Code/Altitude	9
C.	---	X	Display XPDR Code	11
CM0	---	X/D	Select 1.45 µs CAL MARKS	11
CM1	---	X/D	Select 1.0 µs CAL MARKS	11
D?	(#XXXX.XX)	D	Get DME Distance (-1 to 399.00 NMi)	12
DC	'HHHHHH'	X/D	Display Message (1 to 6 Hex Characters)	12
DCL.	---	X10	Device Clear (Return to Front Panel Setup)	13
DF=	X.XX	X/D	Set Delta Frequency Value (0.00 to 9.99 MHz)	13
DF0	---	X/D	Cancel Delta Frequency	13
DF+	---	X/D	Add Delta Frequency to RF	14
DF-	---	X/D	Subtract Delta Frequency	14
D.	---	D	Display DME Distance	14
DI=	XXX.X	X	Enables Double Interr P_1 to P_1 Spacing (20.5 + Mode Spacing to 399.0 µs)	15
DMEX	---	D	Set DME Function to X Channel	15
DMEY	---	D	Set DME Function to Y Channel	16
DV2=	X.X	D	Set DME P_2 Pulse Spacing	16
DV20	---	D	Set DME P_2 to CAL	16

ASCII Command Table

COMMAND	DATA LIST	FUNCTION	INSTRUCTION	PAGE
DV2+	---	D	Deviate DME P_2 Positive (-19 to 9 dB)	17
DV2-	---	D	Deviate DME P_2 Negative	17
EQ0	---	D	Disable Equalizer Pulses	17
EQ1	---	D	Enable Equalizer Pulses	18
ES=	±XX	X/D	Set ECHO/SLS Pulse Amplitude	18
E0	---	D	Disable ECHO Pulses	18
E1	---	D	Enable ECHO Pulses	19
E%	XXX	D	Set DME Reply Efficiency (0% to 100%)	19
F	XXXX	X/D	Set RF Output (962 to 1213 MHz)	19
F?	(#XXXX.XX)	X/D	Get RF Output (962 to 1213 MHz + DF)	20
F.	---	X/D	Display RF Output	20
FP1	---	X/D	Sample and Measure UUT's 1st Pulse	20
FP2	---	X/D	Sample and Measure UUT's 2nd Pulse	21
ID0	---	D	Disable IDENT Tone	21
ID1	---	D	Enable IDENT Tone	21
ID2	---	D	Enable CODE Message	22
ID3=	XXXXXX	D	Set CODE Message	22
IDD=	XXX	D	Set CODE Dot Time in ms (100, 125 or 160)	2
IDP=	XXX	D	Set Number of Dot Times for Period (1 to 999)	34
IP=	±XXX.X	X	Enable and Deviate INTRF Pulse (-17.5 to 399.9 µs)	24
IP0	---	X	Disable INTRF Pulse and Double INTERR Pulse	24
NM0	---	D	Disable -1 NMi Range	24
NM1	---	D	Enable -1 NMi Range	25
P?	(#XXXX)	X/D	Get PRF	25
P.	---	X/D	Display PRF	25
PS=	XXXX	X/D	Set XPDR PRF or DME Squitter Rate	26
P0	---	X	Disable XPDR PRF	26
P1	---	X	Enable XPDR PRF	26
R	XXX.XX	D	Set DME Range Delay (0 to 399.00 NMi)	27
R?	(#XXXX.XX)	D	Get DME Range Delay (-1 to 399.00 NMi)	27
R.	---	D	Display DME Range Delay	27
RF	XXX	X/D	Set RF Output Level (0 to –127 dBm)	28
RI	---	D	Set Range Delay Inbound	28

ASCII Command Table

COMMAND	DATA LIST	FUNCTION	INSTRUCTION	PAGE
RO	---	D	Set Range Delay Outbound	28
RT0	---	X/D	Set RF Output to Normal	29
RT1	---	X/D	Set RF Output to OFF	29
RT2	---	X/D	Set RF Output to CW	29
S0	---	X	Disable XPDR SLS Pulse	30
S1	---	X	Enable XPDR SLS Pulse	30
SI0	---	D	Disable Self-Interrogation	30
SI1	---	D	Enable Self-Interrogation	31
SP0	---	X/D	Disable Suppressor Pulse (Front Panel)	31
SP1	---	X/D	Enable Suppressor Pulse (Front Panel)	31
SQ0	---	D	Disable DME Squitter	32
SQ1	---	D	Enable DME Squitter	32
SRM=	XXXXXX	X/D	Set SRQ Mask for Desired SRQ Signal	32
TC0	---	D	Disable TACAN Modulation	33
TC1	---	D	Enable TACAN Modulation	33
T0	---	X/D	Set SYNC to Interrogation	34
TD	---	X/D	Set SYNC to Reply	34
TT	---	X/D	Set SYNC to 15 Hz TACAN Modulation	34
UF?	(#XXXX.XX)	X/D	Get UUT Frequency (1020 to 1155 MHz)	35
UP?	(#XXXX)	D	Get UUT DME PRF	35
UW?	(#XXXX)	X/D	Get UUT Power in Watts (0.0 to 3999 W)	36
U%?	(#XXXX)	X	Get UUT XPDR % Reply (0% to 159%)	36
V	XXX0	D	Set DME Velocity (0 to 9990 KTS)	37
V?	(#XXX0)	D	Get DME Velocity (0 to 9990 KTS)	37
V.	---	D	Display DME Velocity	37
WN	---	X/D	Set Narrow Tolerance Window	38
WW	---	X/D	Set Wide Tolerance Window	38
Xm	---	X	Sets XPDR Modes 1 through AC_2	38
X1	---	X	Set XPDR Mode 1	39
X2	---	X	Set XPDR Mode 2	39
XA	---	X	Set XPDR Mode A	39
XB	---	X	Set XPDR Mode B	39
XC	---	X	Set XPDR Mode C	39
XD	---	X	Set XPDR Mode D	39
XT	---	X	Set XPDR Mode T	39

ASCII Command Table

COMMAND	DATA LIST	FUNCTION	INSTRUCTION	PAGE
XA1	---	X	Set XPDR Mode AC_1	39
XA2	---	X	Set XPDR Mode AC_2	39
XP=	X.XX	X	Set XPDR Pulse Width (0.10 to 1.95 µs in 0.05 µs steps)	39
XP0	---	X	Set XPDR Pulse Width to CAL	39
XP1	---	X	Set XPDR Pulse Width (0.10 to 1.95 µs)	40
XV=	X.XX	X	Set P_2/P_3 Deviation (0.00 to 1.95 µs in 0.05 µs steps)	40
XV20	---	X	Set P_2 Pulse Spacing to CAL	40
XV2+	---	X	Increase P_2 Pulse Spacing by Value set in "XV=X.XX"	41
XV2-	---	X	Decrease P_2 Pulse Spacing by Value set in "XV=X.XX"	41
XV30	---	X	Set P_3 Pulse Spacing to CAL	41
XV3+	---	X	Increase P_3 Pulse Spacing by Value set in "XV=X.XX"	42
XV3-	---	X	Decrease P_3 Pulse Spacing by Value set in "XV=X.XX"	42

5.4 EXPLANATION OF CODES FOR COMMON COMMANDS

Following are detailed descriptions of ASCII Commands used in DME function of operation and XPDR function of operation for ATC-1400A-2.

NOTE: All commands are in ASCII Code.

NOTE: Data listed under Data List column reflects input/output data of ATC-1400A-2. Data shown enclosed in parentheses is input data, data not enclosed in parentheses is output data and “None” indicates no input/output data flow.

NOTE: # Denotes Blank Space.

!	
FUNCTION	XPDR/DME
INSTRUCTION FORMAT	ASCII Command - ! Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to go to local or front panel mode of operation immediately upon entry. If ASCII character “!” is inserted within a longer command string, all other characters are ignored.
DATA LIST DEFINITION	No input/output data.
EXAMPLE	ASCII character string “!" or “A100DF=1.11!" commands ATC-1400A-2 to return to local mode of operation and ignore acceleration and delta frequency commands.
ERROR CONDITION	N/A
RESPONSE	N/A

AXXX	
FUNCTION	DME
INSTRUCTION FORMAT	ASCII Command - A Data List - XXX
COMMAND DEFINITION	Instructs ATC-1400A-2 to set acceleration value from 000 to 399 ft/sec^2 in 1 ft/sec^2 increments (i.e., ASCII character string “A123" or “A123" sets DME acceleration to 123 ft/sec^2).
DATA LIST DEFINITION	Output a maximum of three (3) ASCII decimal digits from 000 to 399.
ERROR CONDITION	ATC-1400A-2 in XPDR function.
RESPONSE	GPSTAT bit/0 set.
NOTE: ASCII Command “AXXX” loads last programmed input value of velocity ("VXXX0") rather than latest value obtained through acceleration.	

AXn	
FUNCTION	XPDR/DME
INSTRUCTION FORMAT	ASCII Command - AXn Data List - (send) AAA-A (receive) (AAA-A)
COMMAND DEFINITION	Transfers data list to auxiliary unit for processing. If "?" command appears in "send" data list, ATC-1400A-2 waits for a "receive" data list to be transferred back.
DATA LIST DEFINITION	Send 1 to 60 ASCII characters and (Receive) 1 to 64 ASCII characters.
ERROR CONDITION	<1 character or >60 characters to be transferred (data list is truncated). >64 characters in "receive" data list (truncated) or invalid command.
RESPONSE	A "#?" is inserted in "receive" data list.

C?	
FUNCTION	XPDR
INSTRUCTION FORMAT	ASCII Command - C? Data List - (#XXXXXX)
COMMAND DEFINITION	Instructs ATC-1400A-2 to output XPDR CODE or altitude information through GPIB when addressed to talk.
DATA LIST DEFINITION	Data input from ATC-1400A-2 in response to "C?" command consists of inputs shown in 1-2-4, Table 5.
ERROR CONDITION	ATC-1400A-2 in DME function.
RESPONSE	A question mark (#?) is returned. GPIB status bit 0 and 2 are set.
NOTE: ASCII character string generated in response to "C?" command consists of 6 to 8 characters depending on XPDR Mode.	
All Modes except Modes AC_2 and C	Character string consists of 6 characters as follows (1-2-4, Table 6): 1 2 3 4 5 6 A A N N N N
AC_2 and C Modes	ASCII character string consists of 7 or 8 characters as follows (1-2-4, Table 7): 1 2(1) 3(2) 4(3) 5(4) 6(5) 7(6) 8(7) - A A N N N N N **NOTE:** If improper altitude is received, character string is "EEE.E".

DATA	VALID/INVALID	XPDR MODE	DEFINITION
XX0000	VALID	A Mode	0000 = OCTAL Format
XX0000	VALID	C Mode	0000 = OCTAL Format
XX0000	VALID	AC1 Mode	0000 = OCTAL Format
XXdddd	VALID	AC2 Mode	dddd = ft : 1000
CCCCCC	INVALID	------	No Incoming Interrogations

"C" Command Data Input
Table 5

CHARACTER	FUNCTION
1	Minus (-) sign (2D Hex) character is present only when BCD altitude is below sea level; otherwise 7 characters as denoted in parentheses ( ).
2, 3, (1, 2)	Characters are 1 of 4 combinations of ASCII characters: F0 Indicates XPDR F_2 Pulse is missing. ID Indicates SPI (IDENT) Pulse is present. FD Indicates SPI (IDENT) Pulse is present and F_2 Pulse is missing. 00 Indicates F_2 Pulse is present and SPI (IDENT) Pulse is missing.
4, 5, 6, 7, 8	Characters are decimal numbers representing ft ÷1000 (-01.0 to 126.5 thousand feet).

6 Character String
Table 6

CHARACTER	FUNCTION
1, 2	Characters are 1 of 4 combinations of ASCII characters: F0 Indicates XPDR F_2 Pulse is missing. ID Indicates SPI (IDENT) Pulse is present. FD Indicates SPI (IDENT) Pulse is present and F_2 Pulse is missing. 00 Indicates F_2 Pulse is present and SPI (IDENT) Pulse is missing.
3, 4, 5, 6	Characters represent 4 digit octal code received from UUT.

8 Character String
Table 7

C.	
FUNCTION	XPDR
INSTRUCTION FORMAT	ASCII Command - C. Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to display the XPDR CODE function of DISPLAY SELECT Control on DISPLAY SELECT Readout.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	ATC-1400A-2 in DME function.
RESPONSE	GPIB status bit 0 (GPSTAT 0) is set. "OFF" is displayed on DISPLAY SELECT Readout.

CM0	
FUNCTION	XPDR/DME
INSTRUCTION FORMAT	ASCII Command - CM0 Data List - None
COMMAND DEFINITION	Selects 1.45 μs calibration marks (present at CAL MARKS Connector [26]) for UUT calibration and alignment.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	N/A
RESPONSE	N/A

CM1	
FUNCTION	XPDR/DME
INSTRUCTION FORMAT	ASCII Command - CM1 Data List - None
COMMAND DEFINITION	Selects 1.0 μs calibration marks (present at CAL MARKS Connector [26]) for UUT calibration and alignment.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	N/A
RESPONSE	N/A

D?	
FUNCTION	DME
INSTRUCTION FORMAT	ASCII Command - D? Data List - (#XXXX.XX)
COMMAND DEFINITION	Instructs ATC-1400A-2 to output DME serial BCD distance data to GPIB when addressed to talk.
DATA LIST DEFINITION	ASCII character string returned in response to ASCII Command "D?" consists of a space " " and 7 characters including decimal point. If no serial data is received when receiver is activated by "D?" command, string is "#DDDD.D". Under normal operating conditions, all 6 characters represent decimal numbers.
ERROR CONDITION	(a) Improper non-zero pad detected. (b) Word status indicates no data. (c) Word status indicates function test. (d) Word status not defined. (e) Command "D." not issued previously. (f) ATC-1400A-2 in XPDR function.
RESPONSE	(a) "#AXXX.XX" (b) "#DXXX.XX" (c) "#FXXX.XX" (d) "#EXXX.XX" (e) "#EEEE.EE" (f) Question mark returned; "#?" and GPSTAT bit 0 and 2 are set.
NOTE: If "D?" command is included in same command line as "D." command, correct DME distance is not returned. A delay of 2 seconds between "D." and "D?" commands allows ATC-1400A-2 enough time to switch modes and sample DME distance from UUT.	

DC'HHHHHH'	
FUNCTION	XPDR/DME
INSTRUCTION FORMAT	ASCII Command - DC Data List - 'HHHHHH'
COMMAND DEFINITION	Display 6 hexadecimal characters on DISPLAY SELECT Readout.
DATA LIST DEFINITION	Up to 6 hexadecimal ASCII characters enclosed by ASCII are displayed.
EXAMPLE	ASCII character string "DC'123ABC'" instructs ATC-1400A-2 to display "123ABC" on DISPLAY SELECT Readout.
ERROR CONDITION	Invalid data in data list.
RESPONSE	Character is set to 0.

DCL.	
FUNCTION	XPDR/DME
INSTRUCTION FORMAT	ASCII Command - DCL. Data List - None
COMMAND DEFINITION	Returns ATC-1400A-2 to Front Panel Setupp.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	N/A
RESPONSE	N/A

DF=X.XX	
FUNCTION	XPDR/DME
INSTRUCTION FORMAT	ASCII Command - DF= Data List - X.XX
COMMAND DEFINITION	Instructs ATC-1400A-2 ΔF offset to be fixed at X.XX MHz. Operates in conjunction with “DF0”, “DF+” and “DF-” commands.
DATA LIST DEFINITION	A maximum of 3 ASCII digits and a decimal point between first and second digits are output to ATC-1400A-2, with a range of 0.00 to 9.99 MHz.
EXAMPLE	ASCII character string “DF=1.00” instructs ATC-1400A-2 to offset RF output by 1.00 MHz.
ERROR CONDITION	(a) Data value >9.99 MHz. (b) Data value <0.0 MHz.
RESPONSE	(a) Defaults to 9.99 MHz. (b) Defaults to 9.99 MHz.

DF0	
FUNCTION	XPDR/DME
INSTRUCTION FORMAT	ASCII Command - DF0 Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to cancel ΔF offset previously set by DF+ and DF- commands.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	N/A
RESPONSE	N/A

DF+	
FUNCTION	XPDR/DME
INSTRUCTION FORMAT	ASCII Command - DF+ Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to add previously set ΔF offset value to RF output.
DATA LIST DEFINITION	No input/output data.
EXAMPLE	ASCII character string “DF+” adds value set by “DF=X.XX” command to present frequency.
ERROR CONDITION	N/A
RESPONSE	N/A

DF-	
FUNCTION	XPDR/DME
INSTRUCTION FORMAT	ASCII Command - DF- Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to subtract previously set ΔF offset value to RF output.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	N/A
RESPONSE	N/A

D.	
FUNCTION	DME
INSTRUCTION FORMAT	ASCII Command - D. Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to display DME serial BCD distance data on DISPLAY SELECT Readout. Serial data is received from UUT to INTERROGATOR Connector (J8) when command is active, and ATC-1400A-2 outputs serial data to UUT when any other front panel display select control commands are active.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	ATC-1400A-2 in XPDR Function.
RESPONSE	GPSTAT bit 0 set. Display goes to “OFF”.

NOTE: If "D?" command is included in same command line as "D." command, correct DME distance is not returned. A delay of 2 seconds between "D." and "D?" commands allows ATC-1400A-2 enough time to switch modes and sample DME distance from UUT.

DI=XXX.X	
FUNCTION	XPDR
INSTRUCTION FORMAT	ASCII Command - DI= Data List - XXX.X
COMMAND DEFINITION	Instructs ATC-1400A-2 to initiate double interrogations with a P_1 to P_2 spacing of 20.5 μs + mode spacing to 399.9 μs. **NOTE:** Mode spacing is P_1 to P_3 spacing of current XPDR Mode. Double Interrogations are terminated by ASCII Command "DI=0" or by initiating interference pulse with ASCII Command "IP=". (i.e., ASCII character string "DI=100.0" is double interrogation at 100.0 μs, "DI=50.5" is double interrogation at 50.5 μs and "DI=0.0" disables double interrogations.)
DATA LIST DEFINITION	Output a maximum of 4 decimal ASCII digits including a decimal point prior to last digit if resolution >1 μs is desired.
EXAMPLE	ASCII character string "DI=100.0", "DI=50.5" and "DI=0.0" initiates double interrogations at 100.0 μs, 50.5 μs and disables double interrogations.
ERROR CONDITION	ATC-1400A-2 in DME Function. Data value >399.9 or <20.5 + mode spacing.
RESPONSE	GPSTAT bit 0 set. GPSTAT bit 2 set. Defaults to 399.9 or 20.5 + mode spacing.

DMEX	
FUNCTION	DME
INSTRUCTION FORMAT	ASCII Command - DMEX Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to operate in DME X channel. Enables all DME Functions and disables all XPDR Functions.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	N/A
RESPONSE	N/A

DMEY	
FUNCTION	DME
INSTRUCTION FORMAT	ASCII Command - DMEY Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to operate in DME Y channel. Enables all DME Functions and disables all XPDR Functions.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	N/A
RESPONSE	N/A

DV2=X.X	
FUNCTION	DME
INSTRUCTION FORMAT	ASCII Command - DV2= Data List - X.X
COMMAND DEFINITION	Instructs ATC-1400A-2 to deviate P_1 pulse spacing from calibrated position ±7.9 µs in X and Y Channel. "DV2=" command works in conjunction with ASCII Commands "DV20", "DV2+" or "DV2-".
DATA LIST DEFINITION	Output a maximum of 2 decimal ASCII digits including a decimal point between first and second digits.
ERROR CONDITION	ATC-1400A-2 in XPDR Function.
RESPONSE	GPSTAT bit 0 set, command is executed.

DV20	
FUNCTION	DME
INSTRUCTION FORMAT	ASCII Command - DV20 Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to cancel any deviation of P_2 pulse and return to calibrated position.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	ATC-1400A-2 in XPDR Function.
RESPONSE	GPSTAT bit 0 set, command is executed.

DV2+	
FUNCTION	DME
INSTRUCTION FORMAT	ASCII Command - DV2+ Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to deviate P_2 pulse spacing in a positive direction from calibrated value by amount previously set by ASCII Command “DV2=X.X”. (i.e., “DV2=1.5" sets variable deviation of P_2 pulse to 1.5 μs. When “DV2+" is received, pulse spacing is increased by 1.5 μs from calibrated position.)
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	ATC-1400A-2 in XPDR Function.
RESPONSE	(a) Invalid positive offset. (b) GPSTAT bit 0 set, command is executed.

DV2-	
FUNCTION	DME
INSTRUCTION FORMAT	ASCII Command - DV2- Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to deviate P_2 pulse spacing in a negative direction from calibrated value by amount previously set by ASCII Command “DV2=X.X”. (i.e., “DV2=1.5” sets deviation of P_2 pulse to 1.5 μs. When “DV-“ is received, pulse spacing is decreased by 1.5 μs from calibrated position.)
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	ATC-1400A-2 in XPDR Function.
RESPONSE	(a) Invalid negative deviation. (b) GPSTAT bit 0 set.

EQ0	
FUNCTION	DME
INSTRUCTION FORMAT	ASCII Command - EQ0 Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to disable EQUALIZER pulses.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	ATC-1400A-2 in XPDR Function.
RESPONSE	GPSTAT bit 0 set, command is executed.

EQ1	
FUNCTION	DME
INSTRUCTION FORMAT	ASCII Command - EQ1 Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to enable EQUALIZER pulses.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	ATC-1400A-2 in XPDR Function.
RESPONSE	GPSTAT bit 0 set, command is executed.

ES=±XX	
FUNCTION	XPDR/DME
INSTRUCTION FORMAT	ASCII Command - ES= Data List - ±XX
COMMAND DEFINITION	Instructs ATC-1400A-2 to set amplitude of ECHO pulse (DME Function) when enabled by “E1" command, or amplitude of SLS pulse (XPDR Function) when enabled by “S1" command, to value given in data list.
DATA LIST DEFINITION	Send an optional “+” or “-” sign followed by 2 decimal ASCII digits from 9 to -19 dB.
EXAMPLE	Following ASCII character strings are valid commands: "ES=5", “ES=+9", “ES=-10". “ES=“ command defaults to “ES=0”.
ERROR CONDITION	Data list values over range.
RESPONSE	Default to maximum value for sign given.

E0	
FUNCTION	DME
INSTRUCTION FORMAT	ASCII Command - E0 Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to disable ECHO pulses.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	ATC-1400A-2 in XPDR Function.
RESPONSE	GPSTAT bit 0 and 2 are set.

E1	
FUNCTION	DME
INSTRUCTION FORMAT	ASCII Command - E1 Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to enable ECHO pulses to an amplitude value set by ASCII Command “ES=“.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	ATC-1400A-2 in XPDR Function.
RESPONSE	GPSTAT bit 0 and 2 are set.

E%XXX	
FUNCTION	DME
INSTRUCTION FORMAT	ASCII Command - E% Data List - XXX
COMMAND DEFINITION	Instructs ATC-1400A-2 to set DME reply efficiency rate from 0% to 100% in 1% increments.
DATA LIST DEFINITION	Output a maximum of 3 decimal ASCII digits from 0 to 100.
EXAMPLE	ASCII character string “E%75” instructs ATC-1400A-2 to set reply efficiency rate to 75%.
ERROR CONDITION	ATC-1400A-2 in XPDR Function. GPSTAT bit 2 is set.
RESPONSE	(a) Command is ignored. (b) GPSTAT bit 0 and 2 are set.

FXXXX	
FUNCTION	XPDR/DME
INSTRUCTION FORMAT	ASCII Command - F Data List - XXXX
COMMAND DEFINITION	Instructs ATC-1400A-2 to set RF output to XXXX MHz. Actual frequency is offset from set value in 0.01 MHz steps by using ASCII Command “DF=“.
DATA LIST DEFINITION	Output a maximum of 4 decimal ASCII digits between 962 and 1213 MHz.
EXAMPLE	ASCII character string “F1030” sets RF output to 1030.00 MHz providing no delta frequency was previously set.
ERROR CONDITION	Frequency selection is out of specified range.
RESPONSE	MSD of frequency display (if selected) or “F?” command is set to “E”.

F?	
FUNCTION	XPDR/DME
INSTRUCTION FORMAT	ASCII Command - F? Data List - (#XXXX.XX)
COMMAND DEFINITION	Instructs ATC-1400A-2 to read RF output and return RF output via GPIB.
DATA LIST DEFINITION	ASCII code generated in response to “F?” command consists of a space “ “ and 7 ASCII characters including a decimal point between fourth and fifth digits.
ERROR CONDITION	Frequency setting exceeds allowable frequency range.
RESPONSE	“EXXX.XX” is displayed.

F.	
FUNCTION	XPDR/DME
INSTRUCTION FORMAT	ASCII Command - F. Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to display RF output on DISPLAY SELECT Readout and transmit serial range data (DME Function) to INDICATOR Connector (J7).
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	Frequency setting exceeds allowable range.
RESPONSE	"EXXX.XX" displayed on DISPLAY SELECT Readout.

FP1	
FUNCTION	XPDR/DME
INSTRUCTION FORMAT	ASCII Command - FP1 Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to sample and measure frequency and power of UUT XPDR F_1 framing pulse and DME P_1 interrogation pulse.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	N/A
RESPONSE	N/A

FP2	
FUNCTION	XPDR/DME
INSTRUCTION FORMAT	ASCII Command - FP2 Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to sample and measure frequency and power of UUT XPDR F_2 framing pulse and DME P_2 interrogation pulse.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	N/A
RESPONSE	N/A

ID0	
FUNCTION	DME
INSTRUCTION FORMAT	ASCII Command - ID0 Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to turn off IDENT modulation.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	ATC-1400A-2 in XPDR Function.
RESPONSE	GPSTAT bit 0 set. Command is executed.

ID1	
FUNCTION	DME
INSTRUCTION FORMAT	ASCII Command - ID1 Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to modulate RF Output with a fixed audio (IDENT) tone.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	ATC-1400A-2 in XPDR Function.
RESPONSE	GPSTAT bit 0 set. Command is executed.

ID2	
FUNCTION	DME
INSTRUCTION FORMAT	ASCII Command - ID2 Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to modulate RF Output with an encoded message (initial “IFR” in Morse code).
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	ATC-1400A-2 in XPDR Function.
RESPONSE	GPSTAT bit 0 set. Command is executed.

ID3=XXXXXX	
FUNCTION	DME
INSTRUCTION FORMAT	ASCII Command - ID3= Data List - XXXXXX
COMMAND DEFINITION	Instructs ATC-1400A-2 to set desired Ident code word for modulating RF Output.
DATA LIST DEFINITION	One to eight alpha characters (A to Z only). Must be exactly eight characters if additional ATC-1400A-2 commands follow this command. For less than eight characters, input string must be terminated with the end of line character (CR or LF).
EXAMPLE	ASCII character string “ID3=IFR" sets Ident code word to "IFR."
ERROR CONDITION	ATC-1400A-2 in XPDR Function.
RESPONSE	GPSTAT bit 0 set. Command is executed.

IDD=XXX	
FUNCTION	DME
INSTRUCTION FORMAT	ASCII Command - IDD= Data List – XXX
COMMAND DEFINITION	Instructs ATC-1400A-2 to set value for code dot time in milliseconds (ms). Default is 125 ms. (Accuracy is ±5 ms.)
DATA LIST DEFINITION	Three decimal ASCII characters representing one of three valid values: 100, 125 or 160.
EXAMPLE	ASCII character string “IDD=100" sets code dot time to 100 ms.
ERROR CONDITION	ATC-1400A-2 in XPDR Function. Less than three characters or invalid value causes command to be ignored.
RESPONSE	GPSTAT bit 0 set. Command is executed.
NOTE: New dot time is not used until Ident is turned OFF, then back ON again.	

IDP=XXX	
FUNCTION	DME
INSTRUCTION FORMAT	ASCII Command - IDP= Data List - XXX
COMMAND DEFINITION	Instructs ATC-1400A-2 to set number of dot times for period (e.g. 300 at 100 ms = 30 seconds). Default is 223 at 125 ms (27.875 seconds).
DATA LIST DEFINITION	One to three decimal ASCII characters from 1 to 999.
EXAMPLE	ASCII character string “IDP=100” sets number of dot times for period to 100 (with 125 ms dot time, period is 100 X 125 ms or 12.5 seconds).
ERROR CONDITION	ATC-1400A-2 in XPDR Function. Invalid value (zero) or any character other than ASCII numbers from 0 to 9.
RESPONSE	GPSTAT bit 0 set. Command is executed.

IP=±XXX.X	
FUNCTION	XPDR
INSTRUCTION FORMAT	ASCII Command - IP= Data List - ±XXX.X
COMMAND DEFINITION	Instructs ATC-1400A-2 to enable interference pulse and deviate interference pulse from P_1 pulse –17.5 to 399.9μs. Interference pulses are terminated by ASCII Command "IP0" or by initiating Double Interrogation Command "DI=". (i.e., ASCII character string "IP=-5.6" turns on interference pulse 5.6 μs before P_1 pulse and "IP0" turns interference pulse off.)
DATA LIST DEFINITION	Outputs a maximum of 5 decimal ASCII digits including a decimal point between least significant digit and preceding digit. A negative sign is inserted if value to be output is <0, whereas positive sign is optional.
EXAMPLE	ASCII character string "IP=-5.6" turns on interference pulse 5.6 μs before P_1 pulse. "IP=0.0" turns off interference pulse.
ERROR CONDITION	ATC-1400A-2 in DME Function.
RESPONSE	GPSTAT bit 0 and 2 are set. Command is executed.

IP0	
FUNCTION	XPDR
INSTRUCTION FORMAT	ASCII Command - IP0 Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to turn off INTERFERENCE pulse.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	ATC-1400A-2 in DME Function.
RESPONSE	GPSTAT bit 0 set.

NM0	
FUNCTION	DME
INSTRUCTION FORMAT	ASCII Command - NM0 Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to disable –1 NMi range calibration feature.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	ATC-1400A-2 in XPDR Function.
RESPONSE	GPSTAT bit 0 set. Command is executed.

NM1	
FUNCTION	DME
INSTRUCTION FORMAT	ASCII Command - NM1 Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to set -1 NMi range feature which substracts -1.0 NMi from range value.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	ATC-1400A-2 in XPDR Function.
RESPONSE	GPSTAT bit 0 set. Command is executed.

P?	
FUNCTION	XPDR/DME
INSTRUCTION FORMAT	ASCII Command - P? Data List - (#XXXX)
COMMAND DEFINITION	Instructs ATC-1400A-2 to read internal PRF counter and transfer value to GPIB when addressed to talk.
DATA LIST DEFINITION	ATC-1400A-2 response to “P?” command consists of a space “ “ and 4 characters.
ERROR CONDITION	Data value out of range.
RESPONSE	Value defaults to maximum.
NOTE: ATC-1400A-2 must be allowed a set-up time before performing measurement. Parameter measured must remain stable for 2.0 seconds prior to command execution.	

P.	
FUNCTION	XPDR/DME
INSTRUCTION FORMAT	ASCII Command - P. Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 display internal PRF of ATC-1400A-2 on DISPLAY FUNCTION Readout and transmit serial range data (DME Function) to INDICATOR Connector (J7).
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	Data value out of range.
RESPONSE	Value defaults to maximum.

PS=XXXX	
FUNCTION	XPDR/DME
INSTRUCTION FORMAT	ASCII Command - PS= Data List - XXXX
COMMAND DEFINITION	Instructs ATC-1400A-2 to set XPDR PRF or DME squitter rate from 0000 to 7999 Hz.
DATA LIST DEFINITION	Output a maximum of 4 decimal ASCII characters from 0000 to 7999.
EXAMPLE	ASCII character string “PS=100” sets PRF to 100 Hz in XPDR Function or squitter to 100 Hz in DME in conjunction with ASCII Commands “SQ0” and “SQ1”.
ERROR CONDITION	Data value out of range.
RESPONSE	GPSTAT bit 2 is set. Value defaults to maximum or zero if data is ≤0.

P0	
FUNCTION	XPDR
INSTRUCTION FORMAT	ASCII Command - P0 Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to turn off XPDR PRF.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	ATC-1400A-2 in DME Function.
RESPONSE	GPSTAT bit 0 and 2 are set.

P1	
FUNCTION	XPDR
INSTRUCTION FORMAT	ASCII Command - P1 Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to enable XPDR PRF.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	ATC-1400A-2 in DME Function.
RESPONSE	GPSTAT bit 0 and 2 are set.

RXXX.XX	
FUNCTION	DME
INSTRUCTION FORMAT	ASCII Command - R Data List - XXX.XX
COMMAND DEFINITION	Instructs ATC-1400A-2 to set range delay from 00.0 to 399.99 NMi. (i.e., "R145.50" sets range delay to 145.50 NMi.)
DATA LIST DEFINITION	Output a maximum of 5 decimal ASCII digits with a decimal point between third and fourth digits.
ERROR CONDITION	ATC-1400A-2 in XPDR Function. Data out of range.
RESPONSE	GPSTAT bit 0 set and command is executed. Defaults to maximum. Sets GPSTAT to bit 2.

R?	
FUNCTION	DME
INSTRUCTION FORMAT	ASCII Command - R? Data List - (#XXX.XX)
COMMAND DEFINITION	Instructs ATC-1400A-2 to read internal range delay and transfer data to GPIB when addressed to talk.
DATA LIST DEFINITION	Data returned from ATC-1400A-2 in response to ASCII Command "R?" consists of a space " " and 5 decimal ASCII characters including a decimal point between third and fourth digits.
ERROR CONDITION	ATC-1400A-2 in XPDR Function.
RESPONSE	GPSTAT bit 0 and 2 are set.

R.	
FUNCTION	DME
INSTRUCTION FORMAT	ASCII Command - R. Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to continuously display current range delay on DISPLAY SELECT Readout and transmit serial range data to INDICATOR Connector (J7).
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	ATC-1400A-2 in XPDR Function.
RESPONSE	GPSTAT bit 0 set. "Display Select" display goes to "OFF."

RFXXX	
FUNCTION	XPDR/DME
INSTRUCTION FORMAT	ASCII Command - RF Data List - XXX
COMMAND DEFINITION	Instructs ATC-1400A-2 to set RF output level from 0 to -127 dBm in 1 dBm steps.
DATA LIST DEFINITION	Output a maximum of 3 decimal ASCII digits between 0 and 127.
EXAMPLE	ASCII character string “RF60" sets RF output level to -60 dBm.
ERROR CONDITION	Data value out of range.
RESPONSE	GPSTAT set to bit 2. Value defaults to maximum or minimum if data is <0.

RI	
FUNCTION	DME
INSTRUCTION FORMAT	ASCII Command - RI Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to set range delay to simulate an inbound aircraft.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	ATC-1400A-2 in XPDR Function.
RESPONSE	GPSTAT bit 0 set. Command is executed.

RO	
FUNCTION	DME
INSTRUCTION FORMAT	ASCII Command - RO Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to set range delay to simulate an outbound aircraft.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	ATC-1400A-2 in XPDR Function.
RESPONSE	GPSTAT bit 0 set. Command is executed.

RT0	
FUNCTION	XPDR/DME
INSTRUCTION FORMAT	ASCII Command - RT0 Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to set RF <%-1>output to NORM mode, permitting DME and XPDR modulation.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	N/A
RESPONSE	N/A

RT1	
FUNCTION	XPDR/DME
INSTRUCTION FORMAT	ASCII Command - RT1 Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to turn RF output to OFF, inhibiting all pulses generated by ATC-1400A-2.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	N/A
RESPONSE	N/A

RT2	
FUNCTION	XPDR/DME
INSTRUCTION FORMAT	ASCII Command - RT2 Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to set RF output for CW operation to provide a continuous wave output for testing and calibration of ATC-1400A-2.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	N/A
RESPONSE	N/A

S0	
FUNCTION	XPDR
INSTRUCTION FORMAT	ASCII Command - S0 Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to turn off XPDR SLS (P_2) pulse.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	ATC-1400A-2 in DME Function.
RESPONSE	GPSTAT bit 0 and 2 are set.

S1	
FUNCTION	XPDR
INSTRUCTION FORMAT	ASCII Command - S1 Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to enable XPDR SLS (P_2) pulse. ATC-1400A-2 SLS level is set by ASCII Command “ES=“.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	ATC-1400A-2 in DME Function.
RESPONSE	GPSTAT bit 0 and 2 are set.

SI0	
FUNCTION	DME
INSTRUCTION FORMAT	ASCII Command - SI0 Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to turn off self-interrogation feature (normal mode of operation).
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	ATC-1400A-2 in XPDR Function.
RESPONSE	GPSTAT bit 0 and 2 are set.

SI1	
FUNCTION	DME
INSTRUCTION FORMAT	ASCII Command - SI1 Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to turn on self-interrogation feature.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	ATC-1400A-2 in XPDR Function.
RESPONSE	GPSTAT bit 0 and 2 are set.

SP0	
FUNCTION	XPDR/DME
INSTRUCTION FORMAT	ASCII Command - SP0 Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to disable suppressor pulse at SUPPRESSOR OUTPUT Connector.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	N/A
RESPONSE	N/A

SP1	
FUNCTION	XPDR/DME
INSTRUCTION FORMAT	ASCII Command - SP1 Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to enable suppressor pulses at SUPPRESSOR OUTPUT Connector.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	N/A
RESPONSE	N/A

SQ0	
FUNCTION	DME
INSTRUCTION FORMAT	ASCII Command - SQ0 Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to turn off DME Squitter.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	ATC-1400A-2 in XPDR Function.
RESPONSE	GPSTAT bit 0 and 2 are set.

SQ1	
FUNCTION	DME
INSTRUCTION FORMAT	ASCII Command - SQ1 Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to turn on DME Squitter.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	ATC-1400A-2 in XPDR Function.
RESPONSE	GPSTAT bit 0 and 2 are set.
NOTE: ASCII Command “PS=“ sets DME Squitter Rate and precedes “SQ1” command. If not, last Front Panel values set are used.	

SRM=XXXXXX	
FUNCTION	XPDR/DME
INSTRUCTION FORMAT	ASCII Command - SRM= Data List - XXXXXX
COMMAND DEFINITION	Instructs ATC-1400A-2 to set service request mask to enable an SRQ signal to be sent to GPIB controller when an error condition within ATC-1400A-2 causes 1 to 6 error flags to be set. Service request mask ensures, regardless of how many different errors occur, only those that correspond to bits set in mask actually cause an SRQ signal to be transmitted. When controller responds to SRQ signal, controller issues a serial poll command or a read status command to obtain status byte.
DATA LIST DEFINITION	Outputs up to 6 decimal ASCII characters ("1" enable, “0" disable) to indicate which error condition is to be serviced. Mask bits are defined in 1-2-4, Table 8.
EXAMPLE	Output of ASCII character string “SRM=1001" causes ATC-1400A-2 to request servicing from GPIB controller if UUT is disconnected, or if an invalid function command is sent.
ERROR CONDITION	N/A
RESPONSE	N/A

STATUS BIT NO.	CONDITION	DEFINITION
5	1	UUT Pulse Position Error
4	1	UUT Frequency Invalid/Out of Lock
3	1	UUT Inactive (Low Power)
2	1	GPIB Command/Syntax Error
1	1	Auxiliary Unit Error
0	1	DME/XPDR Function Select Error

Mask Bits
Table 8

TC0	
FUNCTION	DME
INSTRUCTION FORMAT	ASCII Command - TC0 Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to turn off TACAN modulation.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	ATC-1400A-2 in XPDR Function.
RESPONSE	GPSTAT bit 0 set.

TC1	
FUNCTION	DME
INSTRUCTION FORMAT	ASCII Command - TC1 Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to turn ON TACAN modulation.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	ATC-1400A-2 in XPDR Function.
RESPONSE	GPSTAT bit 0 set.

T0	
FUNCTION	XPDR/DME
INSTRUCTION FORMAT	ASCII Command - T0 Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to set SYNC output to coincide with DME or XPDR interrogation.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	N/A
RESPONSE	N/A

TD	
FUNCTION	XPDR/DME
INSTRUCTION FORMAT	ASCII Command - TD Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to set SYNC output to coincide with DME or XPDR reply.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	N/A
RESPONSE	N/A

TT	
FUNCTION	XPDR/DME
INSTRUCTION FORMAT	ASCII Command - TT Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to set SYNC output to coincide with 15 Hz TACAN modulation.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	TACAN not enabled.
RESPONSE	No sync output at SYNC Connector.

UF?	
FUNCTION	XPDR/DME
INSTRUCTION FORMAT	ASCII Command - UF? Data List - (XXXX.XX)
COMMAND DEFINITION	Instructs ATC-1400A-2 to measure UUT frequency and transfer data to GPIB.
DATA LIST DEFINITION	Returns a space " " and up to 7 decimal ASCII digits including decimal point between fourth and fifth digits.
ERROR CONDITION	UUT frequency invalid/out of lock.
RESPONSE	GPIB status bit 3 set.
NOTE: UUT frequency measurements must be allowed a set-up time before commanding a measurement. UUT frequency must remain stable during set-up. ASCII character string is "0000.00" when frequency discriminator is unlocked. Maximum set-up time required is ≤40 XPDR replies or ≤40 DME interrogations.	

UP?	
FUNCTION	DME
INSTRUCTION FORMAT	ASCII Command - UP? Data List - (#XXXX)
COMMAND DEFINITION	Instructs ATC-1400A-2 to measure UUT PRF and transfer reading to GPIB when addressed to talk.
DATA LIST DEFINITION	ASCII character string transfer in response to "UP?" command consists of a space " " and 4 decimal ASCII digits with a range from 0 to 9999 pulses.
ERROR CONDITION	(a) An invalid P_1 to P_2 spacing is detected. (b) ATC-1400A-2 in XPDR function.
RESPONSE	(a) Most significant (first) digit is replaced by letter "E". (b) GPSTAT bit 0 set. XPDR INTERR PRF returned.

UW?	
FUNCTION	XPDR/DME
INSTRUCTION FORMAT	ASCII Command - UW? Data List - (#XXXX)
COMMAND DEFINITION	Instructs ATC-1400A-2 to measure UUT output power and transfer DATA to GPIB when addressed to talk.
DATA LIST DEFINITION	Returns a space " " and up to 4 decimal ASCII digits in response to "UW?" command representing power in watts from 0.0 to 3999 W.
ERROR CONDITION	Power exceeds 3999 W.
RESPONSE	"EEEE" is displayed on XMTR PWR WATTS Display and returned on GPIB BUS.
NOTE: When measured UUT power decreases below 41 W, resolution of measurement changes to 0.1 W steps. A decimal point is inserted in data list at third character position and 100's digit is deleted. Condition remains until power increases to >49.0 W, when position reverts back to 1 W. A setup time must be allowed before commanding a measurement. UUT power must remain stable during setup. Maximum setup time required is ≤40 XPDR replies or ≤40 DME interrogations.	

U%?	
FUNCTION	XPDR
INSTRUCTION FORMAT	ASCII Command - U%? Data List - (#XXX)
COMMAND DEFINITION	Instructs ATC-1400A-2 to measure UUT percent reply and transfer data to GPIB when addressed to talk.
DATA LIST DEFINITION	The ASCII character string generated in response to "U%?" command consists of a space " " and up to 3 decimal digits representing percent reply from 0% to 159%.
ERROR CONDITION	ATC-1400A-2 in DME Function.
RESPONSE	Question mark is returned. GPSTAT bit 0 and 2 are set.
NOTE: ATC-1400A-2 must be allowed a setup time before measuring percent reply. Parameters measured must remain stable for 200 interrogations prior to execution of percent reply command.	

VXXX0	
FUNCTION	DME
INSTRUCTION FORMAT	ASCII Command - V Data List - XXX0
COMMAND DEFINITION	Instructs ATC-1400A-2 to set velocity from 0 to 9990 knots in 10 knot increments.
DATA LIST DEFINITION	Output a maximum of 4 decimal ASCII characters, the last with a value of “0”. Ones digit is internally forced to a zero by ATC-1400A-2.
EXAMPLE	ASCII character string “V1230” sets DME velocity to 1230 knots.
ERROR CONDITION	ATC-1400A-2 in XPDR Function.
RESPONSE	(a) Units digit is dropped to 0. (b) GPSTAT bit 0 set, command is executed.

V?	
FUNCTION	DME
INSTRUCTION FORMAT	ASCII Command - V? Data List - (#XXX0)
COMMAND DEFINITION	Instructs ATC-1400A-2 to read internal velocity counters and transfer data to GPIB when addressed to talk.
DATA LIST DEFINITION	Returns a space “ “ and up to 4 decimal characters, the last of which is zero (0).
ERROR CONDITION	ATC-1400A-2 in XPDR Function.
RESPONSE	GPSTAT bit 0 and 2 are set. Returns “?”.
NOTE: ASCII Command “AXXX” loads latest programmed value of velocity.	

V.	
FUNCTION	DME
INSTRUCTION FORMAT	ASCII Command - V. Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to continuously display current loaded value of velocity on DISPLAY SELECT Readout and transmit serial range data to INDICATOR Connector (J7).
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	ATC-1400A-2 in XPDR Function.
RESPONSE	GPSTAT bit 0 set. Command is executed.

WN	
FUNCTION	XPDR/DME
INSTRUCTION FORMAT	ASCII Command - WN Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to select a narrow tolerance for window used to detect DME or XPDR pulses.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	N/A
RESPONSE	N/A

WW	
FUNCTION	XPDR/DME
INSTRUCTION FORMAT	ASCII Command - WW Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to select a wide tolerance for window used to detect XPDR or DME pulses.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	N/A
RESPONSE	N/A

Xm	
FUNCTION	XPDR
INSTRUCTION FORMAT	ASCII Command - Xm Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to set one of following XPDR Modes as listed in 1-2-4, Table 9.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	N/A
RESPONSE	N/A

ASCII COMMAND	XPDR MODE
X1	1
X2	2
XT	T
XA	A
XB	B
XC	C
XD	D
XA1	AC1
XA2	AC2

XPDR Modes
Table 9

XP=X.XX	
FUNCTION	XPDR
INSTRUCTION FORMAT	ASCII Command - XP= Data List - X.XX
COMMAND DEFINITION	Instructs ATC-1400A-2 to set XPDR pulse width variable from 0.10 to 1.95 μs.
DATA LIST DEFINITION	Send a maximum of 3 decimal ASCII digits including a decimal point between first and second digits.
ERROR CONDITION	(a) Variable is not a multiple of 0.05 μs. (b) ATC-1400A-2 in DME Function.
RESPONSE	(a) Command is ignored, bit 2 is set. (b) GPSTAT bit 0 set, command is executed.
NOTE: Preceding command is active only when ATC-1400A-2 is set to variable pulse width mode by ASCII command “XP1".	

XP0	
FUNCTION	XPDR
INSTRUCTION FORMAT	ASCII Command - XP0 Data List - None
COMMAND DEFINITION	Instructs ACT-1400A-2 to reset XPDR pulse width to the calibration value of 0.8 μs.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	Test set in DME Function.
RESPONSE	GPSTAT bit 0 set. Command is executed.

XP1	
FUNCTION	XPDR
INSTRUCTION FORMAT	ASCII Command - XP1 Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to set XPDR pulse width to a variable value set by ASCII command “XP=X.XX”. (Refer to ASCII Command “XP0.”)
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	ATC-1400A-2 in DME Function.
RESPONSE	GPSTAT bit 0 set. Command is executed.

XV=X.XX	
FUNCTION	XPDR
INSTRUCTION FORMAT	ASCII Command - XV= Data List - X.XX
COMMAND DEFINITION	Instructs ATC-1400A-2 to set XPDR P_2/P_3 deviation from 0.00 to 1.95 μs in 0.05 μs steps.
DATA LIST DEFINITION	Output a maximum of 3 decimal ASCII digits including a decimal point between first and second digits.
ERROR CONDITION	ATC-1400A-2 in DME Function.
RESPONSE	GPSTAT bit 0 set. Command is executed.
NOTE: Deviation value is applied to P_3 or P_2 pulse as a positive or negative value by following ASCII command “XV=“ with “XV2+”, “XV2-”, “XV3+” or “XV3-”.	

XV20	
FUNCTION	XPDR
INSTRUCTION FORMAT	ASCII Command - XV20 Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to set XPDR P_2 pulse spacing to calibrated position of 2.0 μs.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	ATC-1400A-2 in DME Function.
RESPONSE	GPSTAT bit 0 set. Command is executed.
NOTE: ASCII Command “XV20” disables variable value set by ASCII Command “XV=X.XX”.	

XV2+	
FUNCTION	XPDR
INSTRUCTION FORMAT	ASCII Command - XV2+ Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to increase XPDR P_2 pulse spacing by value set by ASCII Command “XV=X.XX”.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	ATC-1400A-2 in DME Function.
RESPONSE	GPSTAT bit 0 set Command is executed.

XV2-	
FUNCTION	XPDR
INSTRUCTION FORMAT	ASCII Command - XV2- Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to decrease XPDR P_2 pulse spacing by value set by ASCII command “XV=X.XX”.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	ATC-1400A-2 in DME Function.
RESPONSE	GPSTAT bit 0 set.

XV30	
FUNCTION	XPDR
INSTRUCTION FORMAT	ASCII Command - XV30 Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to set XPDR P_3 pulse spacing to calibrated value as shown in 1-2-4, Table 10.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	ATC-1400A-2 in DME Function.
RESPONSE	GPSTAT bit 0 set. Command is executed.

MODE OF OPERATION	P_3 PULSE SPACING
MODE 1	3.0 µs
MODE 2	5.0 µs
MODE T	6.5 µs
MODE A	8.0 µs
MODE B	17.0 µs
MODE C	21.0 µs
MODE D	25.0 µs

XPDR P_3 Pulse Spacing
Table 10

XV3+	
FUNCTION	XPDR
INSTRUCTION FORMAT	ASCII Command - XV3+ Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to increase XPDR P_3 pulse spacing by value set by ASCII Command “XV=X.XX”.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	ATC-1400A-2 in DME Function.
RESPONSE	GPSTAT bit 0 set. Command is executed.

XV3-	
FUNCTION	XPDR
INSTRUCTION FORMAT	ASCII Command - XV3- Data List - None
COMMAND DEFINITION	Instructs ATC-1400A-2 to decrease XPDR P_3 pulse spacing by value set by ASCII Command “XV=X.XX”.
DATA LIST DEFINITION	No input/output data.
ERROR CONDITION	ATC-1400A-2 in DME Function.
RESPONSE	GPSTAT bit 0 set.

SECTION 3 - SPECIFICATIONS

1. GENERAL

Following are specifications for the ATC-1400A-2.

NOTE: Specifications and features are subject to change without notice.

1.1 SIGNAL GENERATOR:

Frequency:

Range:	952.01 to 1222.99 MHz
Accuracy:	±0.001%
Display Resolution:	10 kHz
Channel Selection:	962 to 1213 MHz in 1 MHz increments
ΔF:	±9.99 MHz in 10 kHz increments from selected frequency

RF Output:

Range:	0 to -127 dBm in 1 dB increments
Overall Accuracy:	±2.0 dB, 0 to -90 dBm ±2.5 dB, -90 to -110 dBm
Frequency Flatness:	±0.6 dB maximum
Composite Attenuator Accuracy:	(Measured from 0 dB Reference Level)
	010 (±0.4) 020 (±0.4) 030 (±0.4) 040 (±0.5) 050 (±0.6) 060 (±0.7) 070 (±0.81) 080 (±0.92) 090 (±1.04) 100 (±1.23) 110 (±1.60) 120 (+2.44, -2.62) 127 (+3.8, -4.7)
ON/OFF Ratio:	80 dB minimum
Output Impedance:	50 Ω, VSWR <1.2:1

Spectral Purity (CW):

Residual FM:	5 kHz peak-to-peak maximum in a 300 to 3 kHz bandwidth
Phase Noise:	<-90 dBc/Hz measured at 150 kHz from carrier
Spurious (non-harmonic):	<-60 dBc measured from 350 to 1800 MHz

1.1 SIGNAL GENERATOR: (CONT)

Suppressor Pulse Output:	(Into a 2 kΩ resistive load)
Pulse Width:	33 μs (±3 μs)
Amplitude:	Adjustable from 3 to 27 V
Timing:	
DME Function:	Nominally 3.5 μs before P_1 of range reply
XPDR Function:	
Single Interrogation:	0.8 μs prior to P_3
Interference:	Coincident with INTERF pulse position. (INTERF pulse is removed.)
Double Interrogation:	First Interrogation is removed. Double Interrogation spacing indicates time from leading edge of suppressor to P_1 of second interrogation.

1.2 DME MODE CHARACTERISTICS:

Range Delay:	
Range:	-1.00 to 399.99 NMi (selectable in 0.01 NMi increments)
Accuracy:	±0.02 NMi plus ±0.005% of selected range
Velocity:	
Range:	0 to 9990 KTS selectable in 10 KT increments
Accuracy:	±0.05% (including jitter)
Acceleration:	
Range:	0 to 399 ft/sec^2 selectable in 1 ft/sec^2 increments
Accuracy:	±0.5 ft/sec^2
Squitter:	
Range:	Selectable from 10 to 5999 Hz in 1 Hz increments (Average Rate)
Accuracy:	±2% from 200 to 5000 Hz.
Dead Time:	60 μs (±10 μs)
Distribution:	At 2700 Hz, distribution is in compliance with requirements presented in ARINC characteristic 568.
TACAN Simulation (Internal):	
AM Modulation Frequencies:	15 and 135 Hz (±0.02%)
AM Modulation Percent:	21% (±3%) (Each component)
Bearing:	≈180°

1.2 DME MODE CHARACTERISTICS: (CONT)

Echo Pulse:

Position:	30 NMi (±1 NMi) (X Channel)
Amplitude:	-19 to 6 dB, selectable in 1 dB increments
Accuracy:	±0.2 dB for -10 to 0 dB ±0.5 dB for -19 to -11 dB

Ident Pulse:

Rate:	1350 Hz (±0.02%)

Equalizer Pulse:

Position:	100 μs (±10 μs) after IDENT pulse

Reply Efficiency:

Range:	0% to 100% selectable in 10% increments (1% under GPIB Control)
Accuracy:	±1.0% of interrogations 0% and 100% ±5.0% of interrogations 10% to 90% (Typical)
Statistics:	Random

Pulse Characteristics:

Spectrum:	>55 dB down from center frequency measured at ±800 kHz.
Spacing:	12 μs (±0.1 μs) (X Channel), P_1 to P_2, 50% peak 30 μs (±0.1 μs) (Y Channel), P_1 to P_2, 50% peak
P_2 Deviation:	±7.9 μs in 0.1 μs increments (X and Y Channel)

NOTE: In X Channel, P_1 and P_2 merge when P_2 is deviated >-5.0 μs.

Rise Time:	2.0 μs (±0.25 μs) (10% to 90%)
Fall Time:	2.5 μs (±0.25 μs) (90% to 10%)
Width:	3.5 μs (±0.5 μs) (50% to 50%)

R-NAV Pulse:

Spacing:	50 μs (±0.25 μs) at 0 NMi (X Channel) 56 μs (±0.25 μs) at 0 NMi (Y Channel) P_1 at time of interrogation P_2 at time of reply
Width:	7 μs (±1 μs)
Level:	Logic 0 is 2.8 V (±0.2 V) Logic 1 is 7.5 V (±0.5 V)

Serial Data Output:	ARINC 568 Digital Receiver Test Levels
Level:	Logic 0 is 2.8 V (±0.2 V) Logic 1 is 7.5 V (±0.5 V)
Clock Frequency:	Adjustable from 7 to 15 kHz

1.2 DME MODE CHARACTERISTICS: (CONT)

Serial Data Input:	Readout front panel, ARINC 568 Digital Transmitter Test Levels and Load
Schmitt Trigger Level:	Logic 0 is <1.0 V Logic 1 is >10.0 V
Input Resistance:	1200 Ω (±10%)
Scope Sync:	
TO:	50% of P_1 interrogations
TAC:	15 Hz (coincident with main reference group)
TD:	3.5 μs before range replies (TD_1) 3.5 μs before generator pulses (TD_2) (Internal switch setting selects either TD_1 or TD_2)
Automatic Frequency Stepping:	
Period:	1 to 10 seconds adjustable
UUT Pulse Spacing Detector:	(Centered: 12 μs for X Channel, 36 μs for Y Channel)
Window Width:	Accept: <±0.5 μs Reject: >±1.0 μs Referenced to 50% of P_1 for narrow window.
	Accept: <±2.0 μs Reject: >±3.0 μs Referenced to 50% of P_1 for wide window.

1.3 XPDR MODE CHARACTERISTICS:

Interrogation Rate:	
Range:	10 to 7999 Hz selectable in 1 Hz increments
Accuracy:	±0.005%
Pulse Characteristics:	
RF Pulling:	<10 kHz
Mode Spacing:	03.0 μs (±5 ns) (Mode 1) 05.0 μs (±5 ns) (Mode 2) 06.5 μs (±5 ns) (Mode T) 08.0 μs (±5 ns) (Mode A/Mode 3) 17.0 μs (±5 ns) (Mode B) 21.0 μs (±5 ns) (Mode C) 25.0 μs (±5 ns) (Mode D)
P_2, P_3 Deviation:	±1.85 μs selectable in 0.05 μs increments for both P_2 and P_3
	P_2 and P_3 independently variable in direction relative to P_1

1.3 XPDR MODE CHARACTERISTICS: (CONT)

Pulse Characteristics: (cont)

Width:	Calibrate 0.8 μs (±5 ns) (CAL Switch position) Variable 0.20 to 1.85 μs (±5 ns), selectable in 0.05 μs increments (VAR Switch position)
Rise Time:	70 ns (+10 ns, -20 ns) (10% to 90%)
Fall Time:	70 ns (+10 ns, -20 ns) (90% to 10%)

Side Lobe Suppression (SLS):

Amplitude:	-19 to 6 dB, relative to P_1, selectable in 1 dB increments
Accuracy:	±0.2 dB for -10 to +3 dB ±0.5 dB for -19 to -11 dB ±0.5 dB for 4 to 6 dB

Interference Pulse:

Amplitude:	-19 to +6 dB, relative to P_1, selectable in 1 dB increments
Position Range:	-17.5 to 399 μs, referenced to P_1 ,selectable in 0.1 μs increments
Accuracy:	±0.05 μs
Width:	Adjustable from 0.2 to 5 μs

Double Interrogation:

Range:	Measured from P_1 first interrogation to P_1 second interrogation, selectable in 0.1 μs increments Minimum: P_3 first interrogation + 20.5 μs Maximum: 399.9 μs
Accuracy:	±5 ns plus 0.005%

Scope Sync:

TO:	20 μs before P_1
TD:	Leading edge of P_3

CAL Marks:

Accuracy:	±0.005%
Phase Adjustment:	>360° at 1.45 μs

UUT Pulse Spacing Detector:

Window Width:	220 ns nominal for narrow window 750 ns nominal for wide window
Position:	Centered at 1.45 μs intervals from F_1
Narrow Window Accuracy:	Accept: <±100 ns Reject: >±120 ns Referenced to 50% amplitude of F_1 to F_2 Trailing edge from center, 110 ns (±10 ns)

1.4 UUT MEASUREMENT CHARACTERISTICS:

NOTE: * indicates measurement of F_1/P_1 or F_2/P_2.

*Transmitter Frequency Counter:

Range:	1020 to 1155 MHz
Accuracy:	±20 kHz (DME Function) ±50 kHz (XPDR Function)

*Transmitter Frequency Discriminator Output:

Response:	1 MHz/Volt (±10%) into an open load 2 MHz/Volt (±10%) into a 50 Ω load
Bandwidth:	10 MHz minimum

*Transmitter Power Meter:

Frequency Range:	1020 to 1155 MHz
Amplitude Range:	0 to 3999 W
Accuracy:	±0.5 dB from a 50 Ω source (100 to 3999 W) ±0.7 dB or 5 W from a 50 Ω source (1 to 99 W)
Input Impedance:	50 Ω, VSWR <1.20:1
Absolute Maximum:	5 kW Peak, 10 W Average

*Transmitter Detector Output (XMTR):

Amplitude:	0.5 V Nominal at 500 W Input into a 50 Ω load
Rise Time:	<50 ns
Fall Time:	<50 ns

DME PRF:

Range:	0 to 6000 Hz
Accuracy:	±0.01% (+1, -0 Counts) (1 Hz Resolution)

XPDR Percent Reply:

Range:	0 to 159%
Accuracy:	+1, -0 Counts (1% Resolution)

1.5 POWER REQUIREMENTS:

Source Voltage and Frequency:	100 to 120 VAC, 60 Hz 220 to 240 VAC, 50 Hz
Power Consumption:	120 W Maximum 94 W Nominal at 115 VAC 86 W Nominal at 230 VAC
Nominal Input Current:	1.49 A at 115 VAC 0.88 A at 230 VAC

1.6 FUSE REQUIREMENTS

F1 and F2:

100 to 120 VAC:	3.0 A, Type F
220 to 240 VAC:	3.0 A, Type F

1.7 SAFETY CONDITIONS

Use:	Indoors
Altitude:	≤4000 meters (13,124 feet)
Temperature:	5° to 40°C
Relative Humidity:	≤80% for temperatures up to 31°C decreasing linearly to 50% at 40°C
Mains Supply Voltage Fluctuations:	≤±10% of the nominal voltage
Transient Overvoltages:	According to Installation Category II
Pollution Degree:	2

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SECTION 4 - SHIPPING

1. SHIPPING TEST SETS

1.1 INFORMATION

Test Sets returned to factory for calibration, service or repair must be repackaged and shipped according to the following conditions:

Authorization

Do not return any products to factory without first receiving authorization from Aeroflex Customer Service Department.

CONTACT: Aeroflex
Customer Service

Telephone: (800) 835-2350
FAX: (316) 524-2623
email: *service@aeroflex.com*

Tagging Test Sets

All Test Sets must be tagged with:

- Identification and address of owner
- Nature of service or repair required
- Model Number
- Serial Number

Shipping Containers

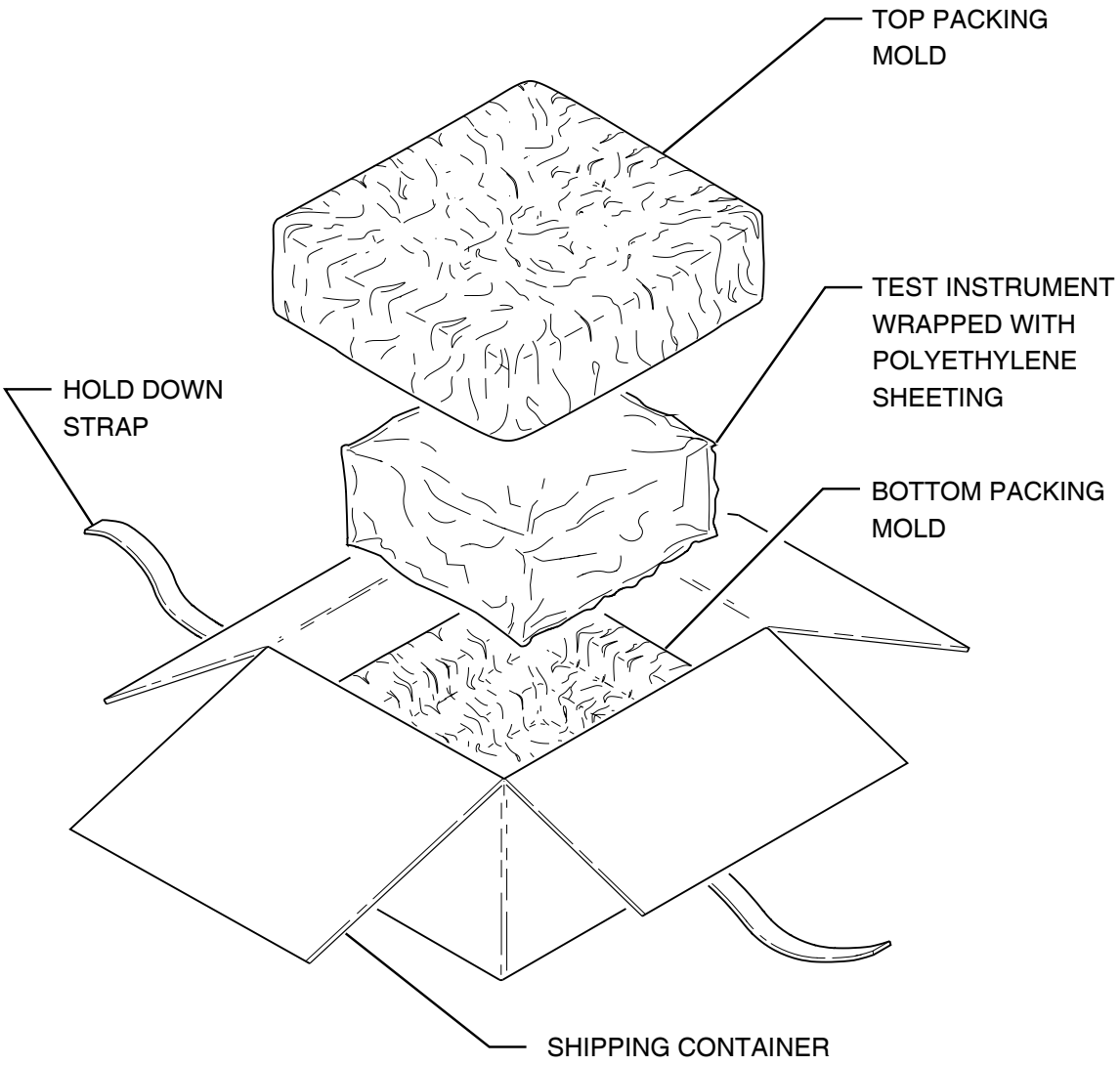
Test Sets must be repackaged in original shipping containers using Aeroflex packing molds. If original shipping containers and materials are not available, contact Aeroflex Customer Service for shipping instructions.

Freight Costs

All freight costs on non-warranty shipments are assumed by the customer. (See "Warranty Packet" for freight charge policy on warranty claims.)

1.2 REPACKING PROCEDURE

- Make sure bottom packing mold is seated on floor of shipping container.
- Carefully wrap Test Set with polyethylene sheeting to protect finish.
- Place Test Set into shipping container, making sure Test Set is securely seated in bottom packing mold.
- Place top packing mold over top of Test Set and press down until mold rests solidly in bottom packing mold.
- Close shipping container lids and seal with shipping tape or an industrial stapler. Tie all sides of container with break resistant rope, twine or equivalent.



Repacking Procedure
Figure 1

SECTION 5 - STORAGE

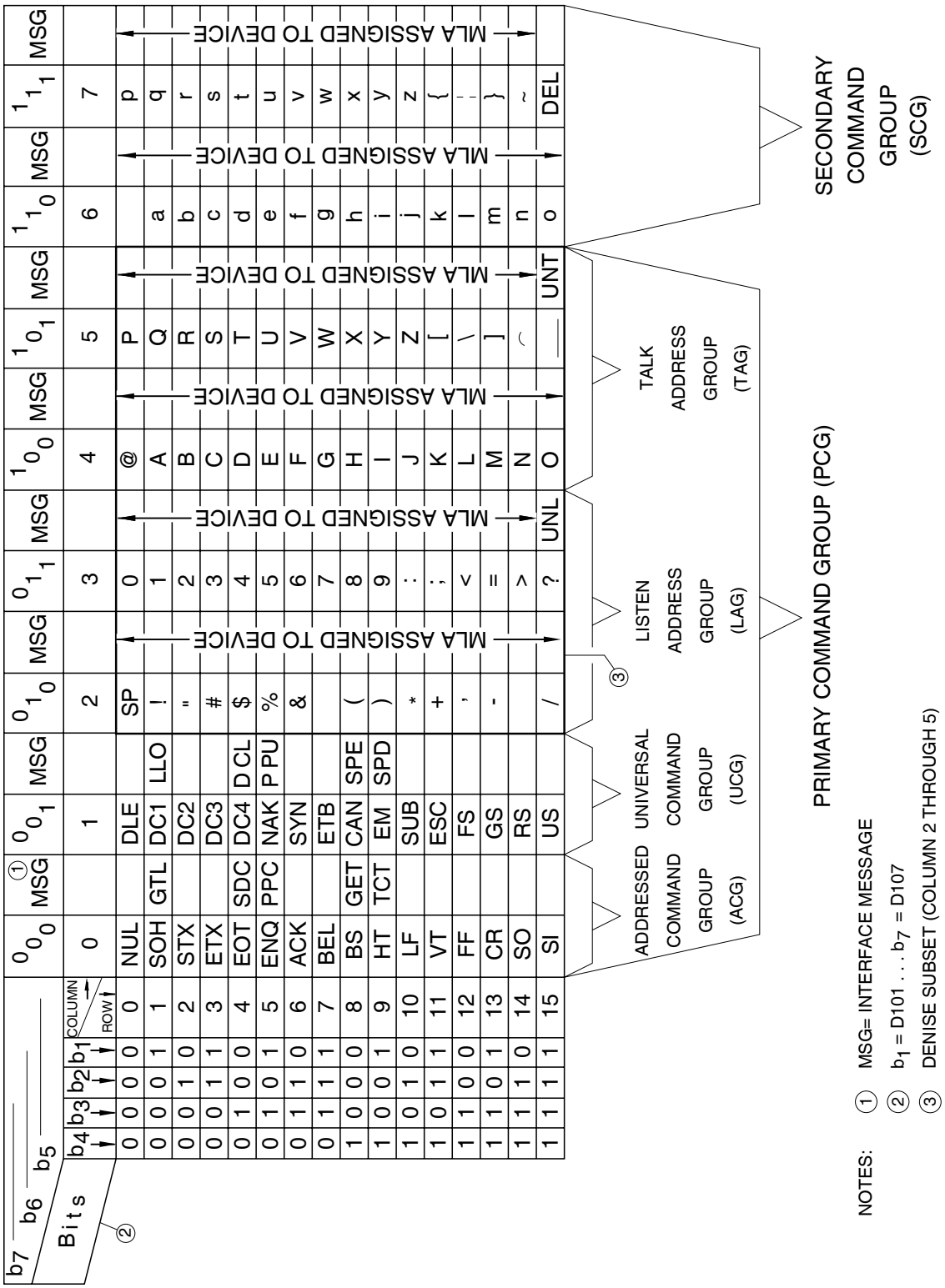
1. STORING TEST SETS

Perform the following storage precautions whenever the Test Set is stored for extended periods:

- Disconnect Test Set from any electrical power source.
- Disconnect and store ac power cable and other accessories with Test Set.
- Cover Test Set to prevent dust and debris from covering and entering Test Set.

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APPENDIX A - MULTILINE INTERFACE MESSAGES: ISO CODE REPRESENTATION



NOTES:
① MSG= INTERFACE MESSAGE
② b_1 = D101 . . . b_7 = D107
③ DENISE SUBSET (COLUMN 2 THROUGH 5)

7502001

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APPENDIX B - DME CHANNELING AND VHF FREQUENCY PAIRING

TACAN CHANNEL SPACING	VHF CHANNEL (MHz)	AIRBORNE DME TRANSMITTER FREQUENCY (MHz)	SPACING (μs)	GROUND STATION TRANSMITTER FREQUENCY (MHz)	SPACING (μs)
1X	134.40	1025	12	962	12
1Y	134.45	1025	36	1088	30
2X	134.50	1026	12	963	12
2Y	134.55	1026	36	1089	30
3X	134.60	1027	12	964	12
3Y	134.65	1027	36	1090	30
4X	134.70	1028	12	965	12
4Y	134.75	1028	36	1091	30
5X	134.80	1029	12	966	12
5Y	134.85	1029	36	1092	30
6X	134.90	1030	12	967	12
6Y	134.95	1030	36	1093	30
7X	135.00	1031	12	968	12
7Y	135.05	1031	36	1094	30
8X	135.10	1032	12	969	12
8Y	135.15	1032	36	1095	30
9X	135.20	1033	12	970	12
9Y	135.25	1033	36	1096	30
10X	135.30	1034	12	971	12
10Y	135.35	1034	36	1097	30
11X	135.40	1035	12	972	12
11Y	135.45	1035	36	1098	30
12X	135.50	1036	12	973	12
12Y	135.55	1036	36	1099	30
13X	135.60	1037	12	974	12
13Y	135.65	1037	36	1100	30
14X	135.70	1038	12	975	12
14Y	135.75	1038	36	1101	30
15X	135.80	1039	12	976	12
15Y	135.85	1039	36	1102	30
16X	135.90	1040	12	977	12
16Y	135.95	1040	36	1103	30
17X	108.00	1041	12	978	12
17Y	108.05	1041	36	1104	30
18X	108.10	1042	12	979	12
18Y	108.15	1042	36	1105	30
19X	108.20	1043	12	980	12
19Y	108.25	1043	36	1106	30
20X	108.30	1044	12	981	12
20Y	108.35	1044	36	1107	30
21X	108.40	1045	12	982	12
21Y	108.45	1045	36	1108	30

TACAN CHANNEL SPACING	VHF CHANNEL (MHz)	AIRBORNE DME TRANSMITTER FREQUENCY (MHz)	SPACING (μs)	GROUND STATION TRANSMITTER FREQUENCY (MHz)	SPACING (μs)
22X	108.50	1046	12	983	12
22Y	108.55	1046	36	1109	30
23X	108.60	1047	12	984	12
23Y	108.65	1047	36	1110	30
24X	108.70	1048	12	985	12
24Y	108.75	1048	36	1111	30
25X	108.80	1049	12	986	12
25Y	108.85	1049	36	1112	30
26X	108.90	1050	12	987	12
26Y	108.95	1050	36	1113	30
27X	109.00	1051	12	988	12
27Y	109.05	1051	36	1114	30
28X	109.10	1052	12	989	12
28Y	109.15	1052	36	1115	30
29X	109.20	1053	12	990	12
29Y	109.25	1053	36	1116	30
30X	109.30	1054	12	991	12
30Y	109.35	1054	36	1117	30
31X	109.40	1055	12	992	12
31Y	109.45	1055	36	1118	30
32X	109.50	1056	12	993	12
32Y	109.55	1056	36	1119	30
33X	109.60	1057	12	994	12
33Y	109.65	1057	36	1120	30
34X	109.70	1058	12	995	12
34Y	109.75	1058	36	1121	30
35X	109.80	1059	12	996	12
35Y	109.85	1059	36	1122	30
36X	109.90	1060	12	997	12
36Y	109.95	1060	36	1123	30
37X	110.00	1061	12	998	12
37Y	110.05	1061	36	1124	30
38X	110.10	1062	12	999	12
38Y	110.15	1062	36	1125	30
39X	110.20	1063	12	1000	12
39Y	110.25	1063	36	1126	30
40X	110.30	1064	12	1001	12
40Y	110.35	1064	36	1127	30
41X	110.40	1065	12	1002	12
41Y	110.45	1065	36	1128	30
42X	110.50	1066	12	1003	12
42Y	110.55	1066	36	1129	30
43X	110.60	1067	12	1004	12
43Y	110.65	1067	36	1130	30
44X	110.70	1068	12	1005	12
44Y	110.75	1068	36	1131	30
45X	110.80	1069	12	1006	12
45Y	110.85	1069	36	1132	30

TACAN CHANNEL SPACING	VHF CHANNEL (MHz)	AIRBORNE DME TRANSMITTER FREQUENCY (MHz)	SPACING (μs)	GROUND STATION TRANSMITTER FREQUENCY (MHz)	SPACING (μs)
46X	110.90	1070	12	1007	12
46Y	110.95	1070	36	1133	30
47X	111.00	1071	12	1008	12
47Y	111.05	1071	36	1134	30
48X	111.10	1072	12	1009	12
48Y	111.15	1072	36	1135	30
49X	111.20	1073	12	1010	12
49Y	111.25	1073	36	1136	30
50X	111.30	1074	12	1011	12
50Y	111.35	1074	36	1137	30
51X	111.40	1075	12	1012	12
51Y	111.45	1075	36	1138	30
52X	111.50	1076	12	1013	12
52Y	111.55	1076	36	1139	30
53X	111.60	1077	12	1014	12
53Y	111.65	1077	36	1140	30
54X	111.70	1078	12	1015	12
54Y	111.75	1078	36	1141	30
55X	111.80	1079	12	1016	12
55Y	111.85	1079	36	1142	30
56X	111.90	1080	12	1017	12
56Y	111.95	1080	36	1143	30
57X	112.00	1081	12	1018	12
57Y	112.05	1081	36	1144	30
58X	112.10	1082	12	1019	12
58Y	112.15	1082	36	1145	30
59X	112.20	1083	12	1020	12
59Y	112.25	1083	36	1146	30
60X	133.30	1084	12	1021	12
60Y	133.35	1084	36	1147	30
61X	133.40	1085	12	1022	12
61Y	133.45	1085	36	1148	30
62X	133.50	1086	12	1023	12
62Y	133.55	1086	36	1149	30
63X	133.60	1087	12	1024	12
63Y	133.65	1087	36	1150	30
64X	133.70	1088	12	1151	12
64Y	133.75	1088	36	1025	30
65X	133.80	1089	12	1152	12
65Y	133.85	1089	36	1026	30
66X	133.90	1090	12	1153	12
66Y	133.95	1090	36	1027	30
67X	134.00	1091	12	1154	12
67Y	134.05	1091	36	1028	30
68X	134.10	1092	12	1155	12
68Y	134.15	1092	36	1029	30
69X	134.20	1093	12	1156	12
69Y	134.25	1093	36	1030	30

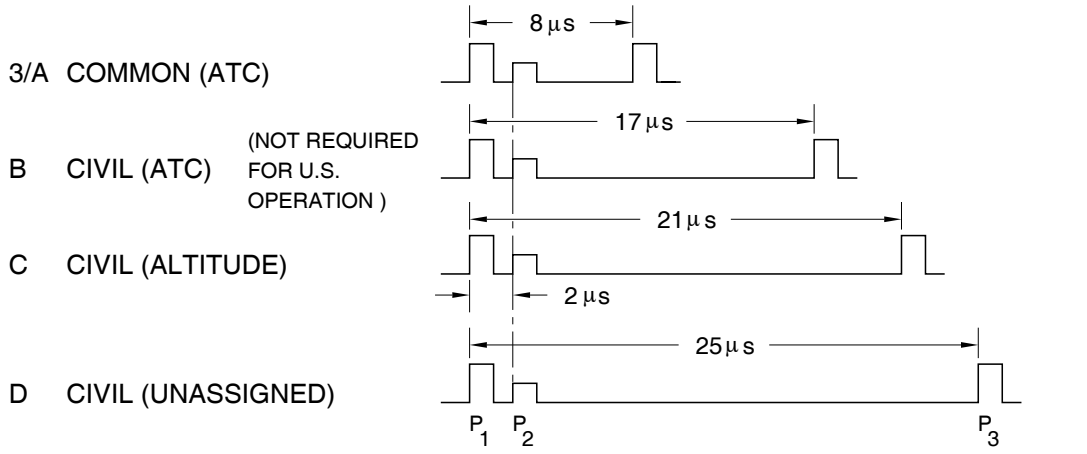
TACAN CHANNEL SPACING	VHF CHANNEL (MHz)	AIRBORNE DME TRANSMITTER FREQUENCY (MHz)	SPACING (μs)	GROUND STATION TRANSMITTER FREQUENCY (MHz)	SPACING (μs)
70X	112.30	1094	12	1157	12
70Y	112.35	1094	36	1031	30
71X	112.40	1095	12	1158	12
71Y	112.45	1095	36	1032	30
72X	112.50	1096	12	1159	12
72Y	112.55	1096	36	1033	30
73X	112.60	1097	12	1160	12
73Y	112.65	1097	36	1034	30
74X	112.70	1098	12	1161	12
74Y	112.75	1098	36	1035	30
75X	112.80	1099	12	1162	12
75Y	112.85	1099	36	1036	30
76X	112.90	1100	12	1163	12
76Y	112.95	1100	36	1037	30
77X	113.00	1101	12	1164	12
77Y	113.05	1101	36	1038	30
78X	113.10	1102	12	1165	12
78Y	113.15	1102	36	1039	30
79X	113.20	1103	12	1166	12
79Y	113.25	1103	36	1040	30
80X	113.30	1104	12	1167	12
80Y	113.35	1104	36	1041	30
81X	113.40	1105	12	1168	12
81Y	113.45	1105	36	1042	30
82X	113.50	1106	12	1169	12
82Y	113.55	1106	36	1043	30
83X	113.60	1107	12	1170	12
83Y	113.65	1107	36	1044	30
84X	113.70	1108	12	1171	12
84Y	113.75	1108	36	1045	30
85X	113.80	1109	12	1172	12
85Y	113.85	1109	36	1046	30
86X	113.90	1110	12	1173	12
86Y	113.95	1110	36	1047	30
87X	114.00	1111	12	1174	12
87Y	114.05	1111	36	1048	30
88X	114.10	1112	12	1175	12
88Y	114.15	1112	36	1049	30
89X	114.20	1113	12	1176	12
89Y	114.25	1113	36	1050	30
90X	114.30	1114	12	1177	12
90Y	114.35	1114	36	1051	30
91X	114.40	1115	12	1178	12
91Y	114.45	1115	36	1052	30
92X	114.50	1116	12	1179	12
92Y	114.55	1116	36	1053	30
93X	114.60	1117	12	1180	12
93Y	114.65	1117	36	1054	30

TACAN CHANNEL SPACING	VHF CHANNEL (MHz)	AIRBORNE DME TRANSMITTER FREQUENCY (MHz)	SPACING (μs)	GROUND STATION TRANSMITTER FREQUENCY (MHz)	SPACING (μs)
94X	114.70	1118	12	1181	12
94Y	114.75	1118	36	1055	30
95X	114.80	1119	12	1182	12
95Y	114.85	1119	36	1056	30
96X	114.90	1120	12	1183	12
96Y	114.95	1120	36	1057	30
97X	115.00	1121	12	1184	12
97Y	115.05	1121	36	1058	30
98X	115.10	1122	12	1185	12
98Y	115.15	1122	36	1059	30
99X	115.20	1123	12	1186	12
99Y	115.25	1123	36	1060	30
100X	115.30	1124	12	1187	12
100Y	115.35	1124	36	1061	30
101X	115.40	1125	12	1188	12
101Y	115.45	1125	36	1062	30
102X	115.50	1126	12	1189	12
102Y	115.55	1126	36	1063	30
103X	115.60	1127	12	1190	12
103Y	115.65	1127	36	1064	30
104X	115.70	1128	12	1191	12
104Y	115.75	1128	36	1065	30
105X	115.80	1129	12	1192	12
105Y	115.85	1129	36	1066	30
106X	115.90	1130	12	1193	12
106Y	115.95	1130	36	1067	30
107X	116.00	1131	12	1194	12
107Y	116.05	1131	36	1068	30
108X	116.10	1132	12	1195	12
108Y	116.15	1132	36	1069	30
109X	116.20	1133	12	1196	12
109Y	116.25	1133	36	1070	30
110X	116.30	1134	12	1197	12
110Y	116.35	1134	36	1071	30
111X	116.40	1135	12	1198	12
111Y	116.45	1135	36	1072	30
112X	116.50	1136	12	1199	12
112Y	116.55	1136	36	1073	30
113X	116.60	1137	12	1200	12
113Y	116.65	1137	36	1074	30
114X	116.70	1138	12	1201	12
114Y	116.75	1138	36	1075	30
115X	116.80	1139	12	1202	12
115Y	116.85	1139	36	1076	30
116X	116.90	1140	12	1203	12
116Y	116.95	1140	36	1077	30
117X	117.00	1141	12	1204	12
117Y	117.05	1141	36	1078	30

TACAN CHANNEL SPACING	VHF CHANNEL (MHz)	AIRBORNE DME TRANSMITTER FREQUENCY (MHz)	SPACING (μs)	GROUND STATION TRANSMITTER FREQUENCY (MHz)	SPACING (μs)
118X	117.10	1142	12	1205	12
118Y	117.15	1142	36	1079	30
119X	117.20	1143	12	1206	12
119Y	117.25	1143	36	1080	30
120X	117.30	1144	12	1207	12
120Y	117.35	1144	36	1081	30
121X	117.40	1145	12	1208	12
121Y	117.45	1145	36	1082	30
122X	117.50	1146	12	1209	12
122Y	117.55	1146	36	1083	30
123X	117.60	1147	12	1210	12
123Y	117.65	1147	36	1084	30
124X	117.70	1148	12	1211	12
124Y	117.75	1148	36	1085	30
125X	117.80	1149	12	1212	12
125Y	117.85	1149	36	1086	30
126X	117.90	1150	12	1213	12
126Y	117.95	1150	36	1087	30

APPENDIX C - ATCRBS INTERROGATION MODES AND XPDR REPLY CODES

1. ATCRBS Interrogation Modes



7502002

2. XPDR Reply Codes



SPACING (µs) LEADING EDGE TO LEADING EDGE	0	1.45	2.9	4.35	5.8	7.25	8.7	10.15	11.6	13.06	14.5	15.95	17.4	18.85	20.3
PULSE NOMENCLATURE	F_1	C_1	A_1	C_2	A_2	C_4	A_4	X	B_1	D_1	B_2	D_2	B_4	D_4	F_2

7502003

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APPENDIX D - ALTITUDE TRANSMISSION CODE CHART

RANGE (Altitude in Thousands)	PULSE POSITION										
	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
-1.0	0	0	0	0	0	0	0	0	0	1	0
-0.9	0	0	0	0	0	0	0	0	1	1	0
-0.8	0	0	0	0	0	0	0	0	1	0	0
-0.7	0	0	0	0	0	0	0	1	1	0	0
-0.6	0	0	0	0	0	0	0	1	1	1	0
-0.5	0	0	0	0	0	0	0	1	0	1	0
-0.4	0	0	0	0	0	0	0	1	0	1	1
-0.3	0	0	0	0	0	0	0	1	0	0	1
-0.2	0	0	0	0	0	0	1	1	0	0	1
-0.1	0	0	0	0	0	0	1	1	0	1	1
0.0	0	0	0	0	0	0	1	1	0	1	0
0.1	0	0	0	0	0	0	1	1	1	1	0
0.2	0	0	0	0	0	0	1	1	1	0	0
0.3	0	0	0	0	0	0	1	0	1	0	0
0.4	0	0	0	0	0	0	1	0	1	1	0
0.5	0	0	0	0	0	0	1	0	0	1	0
0.6	0	0	0	0	0	0	1	0	0	1	1
0.7	0	0	0	0	0	0	1	0	0	0	1
0.8	0	0	0	0	0	1	1	0	0	0	1
0.9	0	0	0	0	0	1	1	0	0	1	1
1.0	0	0	0	0	0	1	1	0	0	1	0
1.1	0	0	0	0	0	1	1	0	1	1	0
1.2	0	0	0	0	0	1	1	0	1	0	0
1.3	0	0	0	0	0	1	1	1	1	0	0
1.4	0	0	0	0	0	1	1	1	1	1	0
1.5	0	0	0	0	0	1	1	1	0	1	0
1.6	0	0	0	0	0	1	1	1	0	1	1
1.7	0	0	0	0	0	1	1	1	0	0	1
1.8	0	0	0	0	0	1	0	1	0	0	1
1.9	0	0	0	0	0	1	0	1	0	1	1
2.0	0	0	0	0	0	1	0	1	0	1	0
2.1	0	0	0	0	0	1	0	1	1	1	0
2.2	0	0	0	0	0	1	0	1	1	0	0
2.3	0	0	0	0	0	1	0	0	1	0	0
2.4	0	0	0	0	0	1	0	0	1	1	0
2.5	0	0	0	0	0	1	0	0	0	1	0
2.6	0	0	0	0	0	1	0	0	0	1	1
2.7	0	0	0	0	0	1	0	0	0	0	1
2.8	0	0	0	0	1	1	0	0	0	0	1
2.9	0	0	0	0	1	1	0	0	0	1	1

RANGE (Altitude in Thousands)	PULSE POSITION										
	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
3.0	0	0	0	0	1	1	0	0	0	1	0
3.1	0	0	0	0	1	1	0	0	1	1	0
3.2	0	0	0	0	1	1	0	0	1	0	0
3.3	0	0	0	0	1	1	0	1	1	0	0
3.4	0	0	0	0	1	1	0	1	1	1	0
3.5	0	0	0	0	1	1	0	1	0	1	0
3.6	0	0	0	0	1	1	0	1	0	1	1
3.7	0	0	0	0	1	1	0	1	0	0	1
3.8	0	0	0	0	1	1	1	1	0	0	1
3.9	0	0	0	0	1	1	1	1	0	1	1
4.0	0	0	0	0	1	1	1	1	0	1	0
4.1	0	0	0	0	1	1	1	1	1	1	0
4.2	0	0	0	0	1	1	1	1	1	0	0
4.3	0	0	0	0	1	1	1	0	1	0	0
4.4	0	0	0	0	1	1	1	0	1	1	0
4.5	0	0	0	0	1	1	1	0	0	1	0
4.6	0	0	0	0	1	1	1	0	0	1	1
4.7	0	0	0	0	1	1	1	0	0	0	1
4.8	0	0	0	0	1	0	1	0	0	0	1
4.9	0	0	0	0	1	0	1	0	0	1	1
5.0	0	0	0	0	1	0	1	0	0	1	0
5.1	0	0	0	0	1	0	1	0	1	1	0
5.2	0	0	0	0	1	0	1	0	1	0	0
5.3	0	0	0	0	1	0	1	1	1	0	0
5.4	0	0	0	0	1	0	1	1	1	1	0
5.5	0	0	0	0	1	0	1	1	0	1	0
5.6	0	0	0	0	1	0	1	1	0	1	1
5.7	0	0	0	0	1	0	1	1	0	0	1
5.8	0	0	0	0	1	0	0	1	0	0	1
5.9	0	0	0	0	1	0	0	1	0	1	1
6.0	0	0	0	0	1	0	0	1	0	1	0
6.1	0	0	0	0	1	0	0	1	1	1	0
6.2	0	0	0	0	1	0	0	1	1	0	0
6.3	0	0	0	0	1	0	0	0	1	0	0
6.4	0	0	0	0	1	0	0	0	1	1	0
6.5	0	0	0	0	1	0	0	0	0	1	0
6.6	0	0	0	0	1	0	0	0	0	1	1
6.7	0	0	0	0	1	0	0	0	0	0	1
6.8	0	0	0	1	1	0	0	0	0	0	1
6.9	0	0	0	1	1	0	0	0	0	1	1

RANGE (Altitude in Thousands)	PULSE POSITION										
	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
7.0	0	0	0	1	1	0	0	0	0	1	0
7.1	0	0	0	1	1	0	0	0	1	1	0
7.2	0	0	0	1	1	0	0	0	1	0	0
7.3	0	0	0	1	1	0	0	1	1	0	0
7.4	0	0	0	1	1	0	0	1	1	1	0
7.5	0	0	0	1	1	0	0	1	0	1	0
7.6	0	0	0	1	1	0	0	1	0	1	1
7.7	0	0	0	1	1	0	0	1	0	0	1
7.8	0	0	0	1	1	0	1	1	0	0	1
7.9	0	0	0	1	1	0	1	1	0	1	1
8.0	0	0	0	1	1	0	1	1	0	1	0
8.1	0	0	0	1	1	0	1	1	1	1	0
8.2	0	0	0	1	1	0	1	1	1	0	0
8.3	0	0	0	1	1	0	1	0	1	0	0
8.4	0	0	0	1	1	0	1	0	1	1	0
8.5	0	0	0	1	1	0	1	0	0	1	0
8.6	0	0	0	1	1	0	1	0	0	1	1
8.7	0	0	0	1	1	0	1	0	0	0	1
8.8	0	0	0	1	1	1	1	0	0	0	1
8.9	0	0	0	1	1	1	1	0	0	1	1
9.0	0	0	0	1	1	1	1	0	0	1	0
9.1	0	0	0	1	1	1	1	0	1	1	0
9.2	0	0	0	1	1	1	1	0	1	0	0
9.3	0	0	0	1	1	1	1	1	1	0	0
9.4	0	0	0	1	1	1	1	1	1	1	0
9.5	0	0	0	1	1	1	1	1	0	1	0
9.6	0	0	0	1	1	1	1	1	0	1	1
9.7	0	0	0	1	1	1	1	1	0	0	1
9.8	0	0	0	1	1	1	0	1	0	0	1
9.9	0	0	0	1	1	1	0	1	0	1	1
10.0	0	0	0	1	1	1	0	1	0	1	0
10.1	0	0	0	1	1	1	0	1	1	1	0
10.2	0	0	0	1	1	1	0	1	1	0	0
10.3	0	0	0	1	1	1	0	0	1	0	0
10.4	0	0	0	1	1	1	0	0	1	1	0
10.5	0	0	0	1	1	1	0	0	0	1	0
10.6	0	0	0	1	1	1	0	0	0	1	1
10.7	0	0	0	1	1	1	0	0	0	0	1
10.8	0	0	0	1	0	1	0	0	0	0	1
10.9	0	0	0	1	0	1	0	0	0	1	1

RANGE (Altitude in Thousands)	PULSE POSITION										
	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
11.0	0	0	0	1	0	1	0	0	0	1	0
11.1	0	0	0	1	0	1	0	0	1	1	0
11.2	0	0	0	1	0	1	0	0	1	0	0
11.3	0	0	0	1	0	1	0	1	1	0	0
11.4	0	0	0	1	0	1	0	1	1	1	0
11.5	0	0	0	1	0	1	0	1	0	1	0
11.6	0	0	0	1	0	1	0	1	0	1	1
11.7	0	0	0	1	0	1	0	1	0	0	1
11.8	0	0	0	1	0	1	1	1	0	0	1
11.9	0	0	0	1	0	1	1	1	0	1	1
12.0	0	0	0	1	0	1	1	1	0	1	0
12.1	0	0	0	1	0	1	1	1	1	1	0
12.2	0	0	0	1	0	1	1	1	1	0	0
12.3	0	0	0	1	0	1	1	0	1	0	0
12.4	0	0	0	1	0	1	1	0	1	1	0
12.5	0	0	0	1	0	1	1	0	0	1	0
12.6	0	0	0	1	0	1	1	0	0	1	1
12.7	0	0	0	1	0	1	1	0	0	0	1
12.8	0	0	0	1	0	0	1	0	0	0	1
12.9	0	0	0	1	0	0	1	0	0	1	1
13.0	0	0	0	1	0	0	1	0	0	1	0
13.1	0	0	0	1	0	0	1	0	1	1	0
13.2	0	0	0	1	0	0	1	0	1	0	0
13.3	0	0	0	1	0	0	1	1	1	0	0
13.4	0	0	0	1	0	0	1	1	1	1	0
13.5	0	0	0	1	0	0	1	1	0	1	0
13.6	0	0	0	1	0	0	1	1	0	1	1
13.7	0	0	0	1	0	0	1	1	0	0	1
13.8	0	0	0	1	0	0	0	1	0	0	1
13.9	0	0	0	1	0	0	0	1	0	1	1
14.0	0	0	0	1	0	0	0	1	0	1	0
14.1	0	0	0	1	0	0	0	1	1	1	0
14.2	0	0	0	1	0	0	0	1	1	0	0
14.3	0	0	0	1	0	0	0	0	1	0	0
14.4	0	0	0	1	0	0	0	0	1	1	0
14.5	0	0	0	1	0	0	0	0	0	1	0
14.6	0	0	0	1	0	0	0	0	0	1	1
14.7	0	0	0	1	0	0	0	0	0	0	1
14.8	0	0	1	1	0	0	0	0	0	0	1
14.9	0	0	1	1	0	0	0	0	0	1	1

RANGE (Altitude in Thousands)	PULSE POSITION										
	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
15.0	0	0	1	1	0	0	0	0	0	1	0
15.1	0	0	1	1	0	0	0	0	1	1	0
15.2	0	0	1	1	0	0	0	0	1	0	0
15.3	0	0	1	1	0	0	0	1	1	0	0
15.4	0	0	1	1	0	0	0	1	1	1	0
15.5	0	0	1	1	0	0	0	1	0	1	0
15.6	0	0	1	1	0	0	0	1	0	1	1
15.7	0	0	1	1	0	0	0	1	0	0	1
15.8	0	0	1	1	0	0	1	1	0	0	1
15.9	0	0	1	1	0	0	1	1	0	1	1
16.0	0	0	1	1	0	0	1	1	0	1	0
16.1	0	0	1	1	0	0	1	1	1	1	0
16.2	0	0	1	1	0	0	1	1	1	0	0
16.3	0	0	1	1	0	0	1	0	1	0	0
16.4	0	0	1	1	0	0	1	0	1	1	0
16.5	0	0	1	1	0	0	1	0	0	1	0
16.6	0	0	1	1	0	0	1	0	0	1	1
16.7	0	0	1	1	0	0	1	0	0	0	1
16.8	0	0	1	1	0	1	1	0	0	0	1
16.9	0	0	1	1	0	1	1	0	0	1	1
17.0	0	0	1	1	0	1	1	0	0	1	0
17.1	0	0	1	1	0	1	1	0	1	1	0
17.2	0	0	1	1	0	1	1	0	1	0	0
17.3	0	0	1	1	0	1	1	1	1	0	0
17.4	0	0	1	1	0	1	1	1	1	1	0
17.5	0	0	1	1	0	1	1	1	0	1	0
17.6	0	0	1	1	0	1	1	1	0	1	1
17.7	0	0	1	1	0	1	1	1	0	0	1
17.8	0	0	1	1	0	1	0	1	0	0	1
17.9	0	0	1	1	0	1	0	1	0	1	1
18.0	0	0	1	1	0	1	0	1	0	1	0
18.1	0	0	1	1	0	1	0	1	1	1	0
18.2	0	0	1	1	0	1	0	1	1	0	0
18.3	0	0	1	1	0	1	0	0	1	0	0
18.4	0	0	1	1	0	1	0	0	1	1	0
18.5	0	0	1	1	0	1	0	0	0	1	0
18.6	0	0	1	1	0	1	0	0	0	1	1
18.7	0	0	1	1	0	1	0	0	0	0	1
18.8	0	0	1	1	1	1	0	0	0	0	1
18.9	0	0	1	1	1	1	0	0	0	1	1

RANGE (Altitude in Thousands)	PULSE POSITION										
	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
19.0	0	0	1	1	1	1	0	0	0	1	0
19.1	0	0	1	1	1	1	0	0	1	1	0
19.2	0	0	1	1	1	1	0	0	1	0	0
19.3	0	0	1	1	1	1	0	1	1	0	0
19.4	0	0	1	1	1	1	0	1	1	1	0
19.5	0	0	1	1	1	1	0	1	0	1	0
19.6	0	0	1	1	1	1	0	1	0	1	1
19.7	0	0	1	1	1	1	0	1	0	0	1
19.8	0	0	1	1	1	1	1	1	0	0	1
19.9	0	0	1	1	1	1	1	1	0	1	1
20.0	0	0	1	1	1	1	1	1	0	1	0
20.1	0	0	1	1	1	1	1	1	1	1	0
20.2	0	0	1	1	1	1	1	1	1	0	0
20.3	0	0	1	1	1	1	1	0	1	0	0
20.4	0	0	1	1	1	1	1	0	1	1	0
20.5	0	0	1	1	1	1	1	0	0	1	0
20.6	0	0	1	1	1	1	1	0	0	1	1
20.7	0	0	1	1	1	1	1	0	0	0	1
20.8	0	0	1	1	1	0	1	0	0	0	1
20.9	0	0	1	1	1	0	1	0	0	1	1
21.0	0	0	1	1	1	0	1	0	0	1	0
21.1	0	0	1	1	1	0	1	0	1	1	0
21.2	0	0	1	1	1	0	1	0	1	0	0
21.3	0	0	1	1	1	0	1	1	1	0	0
21.4	0	0	1	1	1	0	1	1	1	1	0
21.5	0	0	1	1	1	0	1	1	0	1	0
21.6	0	0	1	1	1	0	1	1	0	1	1
21.7	0	0	1	1	1	0	1	1	0	0	1
21.8	0	0	1	1	1	0	0	1	0	0	1
21.9	0	0	1	1	1	0	0	1	0	1	1
22.0	0	0	1	1	1	0	0	1	0	1	0
22.1	0	0	1	1	1	0	0	1	1	1	0
22.2	0	0	1	1	1	0	0	1	1	0	0
22.3	0	0	1	1	1	0	0	0	1	0	0
22.4	0	0	1	1	1	0	0	0	1	1	0
22.5	0	0	1	1	1	0	0	0	0	1	0
22.6	0	0	1	1	1	0	0	0	0	1	1
22.7	0	0	1	1	1	0	0	0	0	0	1
22.8	0	0	1	0	1	0	0	0	0	0	1
22.9	0	0	1	0	1	0	0	0	0	1	1

RANGE (Altitude in Thousands)	PULSE POSITION										
	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
23.0	0	0	1	0	1	0	0	0	0	1	0
23.1	0	0	1	0	1	0	0	0	1	1	0
23.2	0	0	1	0	1	0	0	0	1	0	0
23.3	0	0	1	0	1	0	0	1	1	0	0
23.4	0	0	1	0	1	0	0	1	1	1	0
23.5	0	0	1	0	1	0	0	1	0	1	0
23.6	0	0	1	0	1	0	0	1	0	1	1
23.7	0	0	1	0	1	0	0	1	0	0	1
23.8	0	0	1	0	1	0	1	1	0	0	1
23.9	0	0	1	0	1	0	1	1	0	1	1
24.0	0	0	1	0	1	0	1	1	0	1	0
24.1	0	0	1	0	1	0	1	1	1	1	0
24.2	0	0	1	0	1	0	1	1	1	0	0
24.3	0	0	1	0	1	0	1	0	1	0	0
24.4	0	0	1	0	1	0	1	0	1	1	0
24.5	0	0	1	0	1	0	1	0	0	1	0
24.6	0	0	1	0	1	0	1	0	0	1	1
24.7	0	0	1	0	1	0	1	0	0	0	1
24.8	0	0	1	0	1	1	1	0	0	0	1
24.9	0	0	1	0	1	1	1	0	0	1	1
25.0	0	0	1	0	1	1	1	0	0	1	0
25.1	0	0	1	0	1	1	1	0	1	1	0
25.2	0	0	1	0	1	1	1	0	1	0	0
25.3	0	0	1	0	1	1	1	1	1	0	0
25.4	0	0	1	0	1	1	1	1	1	1	0
25.5	0	0	1	0	1	1	1	1	0	1	0
25.6	0	0	1	0	1	1	1	1	0	1	1
25.7	0	0	1	0	1	1	1	1	0	0	1
25.8	0	0	1	0	1	1	0	1	0	0	1
25.9	0	0	1	0	1	1	0	1	0	1	1
26.0	0	0	1	0	1	1	0	1	0	1	0
26.1	0	0	1	0	1	1	0	1	1	1	0
26.2	0	0	1	0	1	1	0	1	1	0	0
26.3	0	0	1	0	1	1	0	0	1	0	0
26.4	0	0	1	0	1	1	0	0	1	1	0
26.5	0	0	1	0	1	1	0	0	0	1	0
26.6	0	0	1	0	1	1	0	0	0	1	1
26.7	0	0	1	0	1	1	0	0	0	0	1
26.8	0	0	1	0	0	1	0	0	0	0	1
26.9	0	0	1	0	0	1	0	0	0	1	1

RANGE (Altitude in Thousands)	PULSE POSITION										
	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
27.0	0	0	1	0	0	1	0	0	0	1	0
27.1	0	0	1	0	0	1	0	0	1	1	0
27.2	0	0	1	0	0	1	0	0	1	0	0
27.3	0	0	1	0	0	1	0	1	1	0	0
27.4	0	0	1	0	0	1	0	1	1	1	0
27.5	0	0	1	0	0	1	0	1	0	1	0
27.6	0	0	1	0	0	1	0	1	0	1	1
27.7	0	0	1	0	0	1	0	1	0	0	1
27.8	0	0	1	0	0	1	1	1	0	0	1
27.9	0	0	1	0	0	1	1	1	0	1	1
28.0	0	0	1	0	0	1	1	1	0	1	0
28.1	0	0	1	0	0	1	1	1	1	1	0
28.2	0	0	1	0	0	1	1	1	1	0	0
28.3	0	0	1	0	0	1	1	0	1	0	0
28.4	0	0	1	0	0	1	1	0	1	1	0
28.5	0	0	1	0	0	1	1	0	0	1	0
28.6	0	0	1	0	0	1	1	0	0	1	1
28.7	0	0	1	0	0	1	1	0	0	0	1
28.8	0	0	1	0	0	0	1	0	0	0	1
28.9	0	0	1	0	0	0	1	0	0	1	1
29.0	0	0	1	0	0	0	1	0	0	1	0
29.1	0	0	1	0	0	0	1	0	1	1	0
29.2	0	0	1	0	0	0	1	0	1	0	0
29.3	0	0	1	0	0	0	1	1	1	0	0
29.4	0	0	1	0	0	0	1	1	1	1	0
29.5	0	0	1	0	0	0	1	1	0	1	0
29.6	0	0	1	0	0	0	1	1	0	1	1
29.7	0	0	1	0	0	0	1	1	0	0	1
29.8	0	0	1	0	0	0	0	1	0	0	1
29.9	0	0	1	0	0	0	0	1	0	1	1
30.0	0	0	1	0	0	0	0	1	0	1	0
30.1	0	0	1	0	0	0	0	1	1	1	0
30.2	0	0	1	0	0	0	0	1	1	0	0
30.3	0	0	1	0	0	0	0	0	1	0	0
30.4	0	0	1	0	0	0	0	0	1	1	0
30.5	0	0	1	0	0	0	0	0	0	1	0
30.6	0	0	1	0	0	0	0	0	0	1	1
30.7	0	0	1	0	0	0	0	0	0	0	1
30.8	0	1	1	0	0	0	0	0	0	0	1
30.9	0	1	1	0	0	0	0	0	0	1	1

RANGE (Altitude in Thousands)	PULSE POSITION										
	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
31.0	0	1	1	0	0	0	0	0	0	1	0
31.1	0	1	1	0	0	0	0	0	1	1	0
31.2	0	1	1	0	0	0	0	0	1	0	0
31.3	0	1	1	0	0	0	0	1	1	0	0
31.4	0	1	1	0	0	0	0	1	1	1	0
31.5	0	1	1	0	0	0	0	1	0	1	0
31.6	0	1	1	0	0	0	0	1	0	1	1
31.7	0	1	1	0	0	0	0	1	0	0	1
31.8	0	1	1	0	0	0	1	1	0	0	1
31.9	0	1	1	0	0	0	1	1	0	1	1
32.0	0	1	1	0	0	0	1	1	0	1	0
32.1	0	1	1	0	0	0	1	1	1	1	0
32.2	0	1	1	0	0	0	1	1	1	0	0
32.3	0	1	1	0	0	0	1	0	1	0	0
32.4	0	1	1	0	0	0	1	0	1	1	0
32.5	0	1	1	0	0	0	1	0	0	1	0
32.6	0	1	1	0	0	0	1	0	0	1	1
32.7	0	1	1	0	0	0	1	0	0	0	1
32.8	0	1	1	0	0	1	1	0	0	0	1
32.9	0	1	1	0	0	1	1	0	0	1	1
33.0	0	1	1	0	0	1	1	0	0	1	0
33.1	0	1	1	0	0	1	1	0	1	1	0
33.2	0	1	1	0	0	1	1	0	1	0	0
33.3	0	1	1	0	0	1	1	1	1	0	0
33.4	0	1	1	0	0	1	1	1	1	1	0
33.5	0	1	1	0	0	1	1	1	0	1	0
33.6	0	1	1	0	0	1	1	1	0	1	1
33.7	0	1	1	0	0	1	1	1	0	0	1
33.8	0	1	1	0	0	1	0	1	0	0	1
33.9	0	1	1	0	0	1	0	1	0	1	1
34.0	0	1	1	0	0	1	0	1	0	1	0
34.1	0	1	1	0	0	1	0	1	1	1	0
34.2	0	1	1	0	0	1	0	1	1	0	0
34.3	0	1	1	0	0	1	0	0	1	0	0
34.4	0	1	1	0	0	1	0	0	1	1	0
34.5	0	1	1	0	0	1	0	0	0	1	0
34.6	0	1	1	0	0	1	0	0	0	1	1
34.7	0	1	1	0	0	1	0	0	0	0	1
34.8	0	1	1	0	1	1	0	0	0	0	1
34.9	0	1	1	0	1	1	0	0	0	1	1

RANGE (Altitude in Thousands)	PULSE POSITION										
	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
35.0	0	1	1	0	1	1	0	0	0	1	0
35.1	0	1	1	0	1	1	0	0	1	1	0
35.2	0	1	1	0	1	1	0	0	1	0	0
35.3	0	1	1	0	1	1	0	1	1	0	0
35.4	0	1	1	0	1	1	0	1	1	1	0
35.5	0	1	1	0	1	1	0	1	0	1	0
35.6	0	1	1	0	1	1	0	1	0	1	1
35.7	0	1	1	0	1	1	0	1	0	0	1
35.8	0	1	1	0	1	1	1	1	0	0	1
35.9	0	1	1	0	1	1	1	1	0	1	1
36.0	0	1	1	0	1	1	1	1	0	1	0
36.1	0	1	1	0	1	1	1	1	1	1	0
36.2	0	1	1	0	1	1	1	1	1	0	0
36.3	0	1	1	0	1	1	1	0	1	0	0
36.4	0	1	1	0	1	1	1	0	1	1	0
36.5	0	1	1	0	1	1	1	0	0	1	0
36.6	0	1	1	0	1	1	1	0	0	1	1
36.7	0	1	1	0	1	1	1	0	0	0	1
36.8	0	1	1	0	1	0	1	0	0	0	1
36.9	0	1	1	0	1	0	1	0	0	1	1
37.0	0	1	1	0	1	0	1	0	0	1	0
37.1	0	1	1	0	1	0	1	0	1	1	0
37.2	0	1	1	0	1	0	1	0	1	0	0
37.3	0	1	1	0	1	0	1	1	1	0	0
37.4	0	1	1	0	1	0	1	1	1	1	0
37.5	0	1	1	0	1	0	1	1	0	1	0
37.6	0	1	1	0	1	0	1	1	0	1	1
37.7	0	1	1	0	1	0	1	1	0	0	1
37.8	0	1	1	0	1	0	0	1	0	0	1
37.9	0	1	1	0	1	0	0	1	0	1	1
38.0	0	1	1	0	1	0	0	1	0	1	0
38.1	0	1	1	0	1	0	0	1	1	1	0
38.2	0	1	1	0	1	0	0	1	1	0	0
38.3	0	1	1	0	1	0	0	0	1	0	0
38.4	0	1	1	0	1	0	0	0	1	1	0
38.5	0	1	1	0	1	0	0	0	0	1	0
38.6	0	1	1	0	1	0	0	0	0	1	1
38.7	0	1	1	0	1	0	0	0	0	0	1
38.8	0	1	1	1	1	0	0	0	0	0	1
38.9	0	1	1	1	1	0	0	0	0	1	1

RANGE (Altitude in Thousands)	PULSE POSITION										
	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
39.0	0	1	1	1	1	0	0	0	0	1	0
39.1	0	1	1	1	1	0	0	0	1	1	0
39.2	0	1	1	1	1	0	0	0	1	0	0
39.3	0	1	1	1	1	0	0	1	1	0	0
39.4	0	1	1	1	1	0	0	1	1	1	0
39.5	0	1	1	1	1	0	0	1	0	1	0
39.6	0	1	1	1	1	0	0	1	0	1	1
39.7	0	1	1	1	1	0	0	1	0	0	1
39.8	0	1	1	1	1	0	1	1	0	0	1
39.9	0	1	1	1	1	0	1	1	0	1	1
40.0	0	1	1	1	1	0	1	1	0	1	0
40.1	0	1	1	1	1	0	1	1	1	1	0
40.2	0	1	1	1	1	0	1	1	1	0	0
40.3	0	1	1	1	1	0	1	0	1	0	0
40.4	0	1	1	1	1	0	1	0	1	1	0
40.5	0	1	1	1	1	0	1	0	0	1	0
40.6	0	1	1	1	1	0	1	0	0	1	1
40.7	0	1	1	1	1	0	1	0	0	0	1
40.8	0	1	1	1	1	1	1	0	0	0	1
40.9	0	1	1	1	1	1	1	0	0	1	1
41.0	0	1	1	1	1	1	1	0	0	1	0
41.1	0	1	1	1	1	1	1	0	1	1	0
41.2	0	1	1	1	1	1	1	0	1	0	0
41.3	0	1	1	1	1	1	1	1	1	0	0
41.4	0	1	1	1	1	1	1	1	1	1	0
41.5	0	1	1	1	1	1	1	1	0	1	0
41.6	0	1	1	1	1	1	1	1	0	1	1
41.7	0	1	1	1	1	1	1	1	0	0	1
41.8	0	1	1	1	1	1	0	1	0	0	1
41.9	0	1	1	1	1	1	0	1	0	1	1
42.0	0	1	1	1	1	1	0	1	0	1	0
42.1	0	1	1	1	1	1	0	1	1	1	0
42.2	0	1	1	1	1	1	0	1	1	0	0
42.3	0	1	1	1	1	1	0	0	1	0	0
42.4	0	1	1	1	1	1	0	0	1	1	0
42.5	0	1	1	1	1	1	0	0	0	1	0
42.6	0	1	1	1	1	1	0	0	0	1	1
42.7	0	1	1	1	1	1	0	0	0	0	1
42.8	0	1	1	1	0	1	0	0	0	0	1
42.9	0	1	1	1	0	1	0	0	0	1	1

RANGE (Altitude in Thousands)	PULSE POSITION										
	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
43.0	0	1	1	1	0	1	0	0	0	1	0
43.1	0	1	1	1	0	1	0	0	1	1	0
43.2	0	1	1	1	0	1	0	0	1	0	0
43.3	0	1	1	1	0	1	0	1	1	0	0
43.4	0	1	1	1	0	1	0	1	1	1	0
43.5	0	1	1	1	0	1	0	1	0	1	0
43.6	0	1	1	1	0	1	0	1	0	1	1
43.7	0	1	1	1	0	1	0	1	0	0	1
43.8	0	1	1	1	0	1	1	1	0	0	1
43.9	0	1	1	1	0	1	1	1	0	1	1
44.0	0	1	1	1	0	1	1	1	0	1	0
44.1	0	1	1	1	0	1	1	1	1	1	0
44.2	0	1	1	1	0	1	1	1	1	0	0
44.3	0	1	1	1	0	1	1	0	1	0	0
44.4	0	1	1	1	0	1	1	0	1	1	0
44.5	0	1	1	1	0	1	1	0	0	1	0
44.6	0	1	1	1	0	1	1	0	0	1	1
44.7	0	1	1	1	0	1	1	0	0	0	1
44.8	0	1	1	1	0	0	1	0	0	0	1
44.9	0	1	1	1	0	0	1	0	0	1	1
45.0	0	1	1	1	0	0	1	0	0	1	0
45.1	0	1	1	1	0	0	1	0	1	1	0
45.2	0	1	1	1	0	0	1	0	1	0	0
45.3	0	1	1	1	0	0	1	1	1	0	0
45.4	0	1	1	1	0	0	1	1	1	1	0
45.5	0	1	1	1	0	0	1	1	0	1	0
45.6	0	1	1	1	0	0	1	1	0	1	1
45.7	0	1	1	1	0	0	1	1	0	0	1
45.8	0	1	1	1	0	0	0	1	0	0	1
45.9	0	1	1	1	0	0	0	1	0	1	1
46.0	0	1	1	1	0	0	0	1	0	1	0
46.1	0	1	1	1	0	0	0	1	1	1	0
46.2	0	1	1	1	0	0	0	1	1	0	0
46.3	0	1	1	1	0	0	0	0	1	0	0
46.4	0	1	1	1	0	0	0	0	1	1	0
46.5	0	1	1	1	0	0	0	0	0	1	0
46.6	0	1	1	1	0	0	0	0	0	1	1
46.7	0	1	1	1	0	0	0	0	0	0	1
46.8	0	1	0	1	0	0	0	0	0	0	1
46.9	0	1	0	1	0	0	0	0	0	1	1

RANGE (Altitude in Thousands)	PULSE POSITION										
	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
47.0	0	1	0	1	0	0	0	0	0	1	0
47.1	0	1	0	1	0	0	0	0	1	1	0
47.2	0	1	0	1	0	0	0	0	1	0	0
47.3	0	1	0	1	0	0	0	1	1	0	0
47.4	0	1	0	1	0	0	0	1	1	1	0
47.5	0	1	0	1	0	0	0	1	0	1	0
47.6	0	1	0	1	0	0	0	1	0	1	1
47.7	0	1	0	1	0	0	0	1	0	0	1
47.8	0	1	0	1	0	0	1	1	0	0	1
47.9	0	1	0	1	0	0	1	1	0	1	1
48.0	0	1	0	1	0	0	1	1	0	1	0
48.1	0	1	0	1	0	0	1	1	1	1	0
48.2	0	1	0	1	0	0	1	1	1	0	0
48.3	0	1	0	1	0	0	1	0	1	0	0
48.4	0	1	0	1	0	0	1	0	1	1	0
48.5	0	1	0	1	0	0	1	0	0	1	0
48.6	0	1	0	1	0	0	1	0	0	1	1
48.7	0	1	0	1	0	0	1	0	0	0	1
48.8	0	1	0	1	0	1	1	0	0	0	1
48.9	0	1	0	1	0	1	1	0	0	1	1
49.0	0	1	0	1	0	1	1	0	0	1	0
49.1	0	1	0	1	0	1	1	0	1	1	0
49.2	0	1	0	1	0	1	1	0	1	0	0
49.3	0	1	0	1	0	1	1	1	1	0	0
49.4	0	1	0	1	0	1	1	1	1	1	0
49.5	0	1	0	1	0	1	1	1	0	1	0
49.6	0	1	0	1	0	1	1	1	0	1	1
49.7	0	1	0	1	0	1	1	1	0	0	1
49.8	0	1	0	1	0	1	0	1	0	0	1
49.9	0	1	0	1	0	1	0	1	0	1	1
50.0	0	1	0	1	0	1	0	1	0	1	0
50.1	0	1	0	1	0	1	0	1	1	1	0
50.2	0	1	0	1	0	1	0	1	1	0	0
50.3	0	1	0	1	0	1	0	0	1	0	0
50.4	0	1	0	1	0	1	0	0	1	1	0
50.5	0	1	0	1	0	1	0	0	0	1	0
50.6	0	1	0	1	0	1	0	0	0	1	1
50.7	0	1	0	1	0	1	0	0	0	0	1
50.8	0	1	0	1	1	1	0	0	0	0	1
50.9	0	1	0	1	1	1	0	0	0	1	1

RANGE (Altitude in Thousands)	PULSE POSITION										
	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
51.0	0	1	0	1	1	1	0	0	0	1	0
51.1	0	1	0	1	1	1	0	0	1	1	0
51.2	0	1	0	1	1	1	0	0	1	0	0
51.3	0	1	0	1	1	1	0	1	1	0	0
51.4	0	1	0	1	1	1	0	1	1	1	0
51.5	0	1	0	1	1	1	0	1	0	1	0
51.6	0	1	0	1	1	1	0	1	0	1	1
51.7	0	1	0	1	1	1	0	1	0	0	1
51.8	0	1	0	1	1	1	1	1	0	0	1
51.9	0	1	0	1	1	1	1	1	0	1	1
52.0	0	1	0	1	1	1	1	1	0	1	0
52.1	0	1	0	1	1	1	1	1	1	1	0
52.2	0	1	0	1	1	1	1	1	1	0	0
52.3	0	1	0	1	1	1	1	0	1	0	0
52.4	0	1	0	1	1	1	1	0	1	1	0
52.5	0	1	0	1	1	1	1	0	0	1	0
52.6	0	1	0	1	1	1	1	0	0	1	1
52.7	0	1	0	1	1	1	1	0	0	0	1
52.8	0	1	0	1	1	0	1	0	0	0	1
52.9	0	1	0	1	1	0	1	0	0	1	1
53.0	0	1	0	1	1	0	1	0	0	1	0
53.1	0	1	0	1	1	0	1	0	1	1	0
53.2	0	1	0	1	1	0	1	0	1	0	0
53.3	0	1	0	1	1	0	1	1	1	0	0
53.4	0	1	0	1	1	0	1	1	1	1	0
53.5	0	1	0	1	1	0	1	1	0	1	0
53.6	0	1	0	1	1	0	1	1	0	1	1
53.7	0	1	0	1	1	0	1	1	0	0	1
53.8	0	1	0	1	1	0	0	1	0	0	1
53.9	0	1	0	1	1	0	0	1	0	1	1
54.0	0	1	0	1	1	0	0	1	0	1	0
54.1	0	1	0	1	1	0	0	1	1	1	0
54.2	0	1	0	1	1	0	0	1	1	0	0
54.3	0	1	0	1	1	0	0	0	1	0	0
54.4	0	1	0	1	1	0	0	0	1	1	0
54.5	0	1	0	1	1	0	0	0	0	1	0
54.6	0	1	0	1	1	0	0	0	0	1	1
54.7	0	1	0	1	1	0	0	0	0	0	1
54.8	0	1	0	0	1	0	0	0	0	0	1
54.9	0	1	0	0	1	0	0	0	0	1	1

RANGE (Altitude in Thousands)	PULSE POSITION										
	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
55.0	0	1	0	0	1	0	0	0	0	1	0
55.1	0	1	0	0	1	0	0	0	1	1	0
55.2	0	1	0	0	1	0	0	0	1	0	0
55.3	0	1	0	0	1	0	0	1	1	0	0
55.4	0	1	0	0	1	0	0	1	1	1	0
55.5	0	1	0	0	1	0	0	1	0	1	0
55.6	0	1	0	0	1	0	0	1	0	1	1
55.7	0	1	0	0	1	0	0	1	0	0	1
55.8	0	1	0	0	1	0	1	1	0	0	1
55.9	0	1	0	0	1	0	1	1	0	1	1
56.0	0	1	0	0	1	0	1	1	0	1	0
56.1	0	1	0	0	1	0	1	1	1	1	0
56.2	0	1	0	0	1	0	1	1	1	0	0
56.3	0	1	0	0	1	0	1	0	1	0	0
56.4	0	1	0	0	1	0	1	0	1	1	0
56.5	0	1	0	0	1	0	1	0	0	1	0
56.6	0	1	0	0	1	0	1	0	0	1	1
56.7	0	1	0	0	1	0	1	0	0	0	1
56.8	0	1	0	0	1	1	1	0	0	0	1
56.9	0	1	0	0	1	1	1	0	0	1	1
57.0	0	1	0	0	1	1	1	0	0	1	0
57.1	0	1	0	0	1	1	1	0	1	1	0
57.2	0	1	0	0	1	1	1	0	1	0	0
57.3	0	1	0	0	1	1	1	1	1	0	0
57.4	0	1	0	0	1	1	1	1	1	1	0
57.5	0	1	0	0	1	1	1	1	0	1	0
57.6	0	1	0	0	1	1	1	1	0	1	1
57.7	0	1	0	0	1	1	1	1	0	0	1
57.8	0	1	0	0	1	1	0	1	0	0	1
57.9	0	1	0	0	1	1	0	1	0	1	1
58.0	0	1	0	0	1	1	0	1	0	1	0
58.1	0	1	0	0	1	1	0	1	1	1	0
58.2	0	1	0	0	1	1	0	1	1	0	0
58.3	0	1	0	0	1	1	0	0	1	0	0
58.4	0	1	0	0	1	1	0	0	1	1	0
58.5	0	1	0	0	1	1	0	0	0	1	0
58.6	0	1	0	0	1	1	0	0	0	1	1
58.7	0	1	0	0	1	1	0	0	0	0	1
58.8	0	1	0	0	0	1	0	0	0	0	1
58.9	0	1	0	0	0	1	0	0	0	1	1

RANGE (Altitude in Thousands)	PULSE POSITION										
	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
59.0	0	1	0	0	0	1	0	0	0	1	0
59.1	0	1	0	0	0	1	0	0	1	1	0
59.2	0	1	0	0	0	1	0	0	1	0	0
59.3	0	1	0	0	0	1	0	1	1	0	0
59.4	0	1	0	0	0	1	0	1	1	1	0
59.5	0	1	0	0	0	1	0	1	0	1	0
59.6	0	1	0	0	0	1	0	1	0	1	1
59.7	0	1	0	0	0	1	0	1	0	0	1
59.8	0	1	0	0	0	1	1	1	0	0	1
59.9	0	1	0	0	0	1	1	1	0	1	1
60.0	0	1	0	0	0	1	1	1	0	1	0
60.1	0	1	0	0	0	1	1	1	1	1	0
60.2	0	1	0	0	0	1	1	1	1	0	0
60.3	0	1	0	0	0	1	1	0	1	0	0
60.4	0	1	0	0	0	1	1	0	1	1	0
60.5	0	1	0	0	0	1	1	0	0	1	0
60.6	0	1	0	0	0	1	1	0	0	1	1
60.7	0	1	0	0	0	1	1	0	0	0	1
60.8	0	1	0	0	0	0	1	0	0	0	1
60.9	0	1	0	0	0	0	1	0	0	1	1
61.0	0	1	0	0	0	0	1	0	0	1	0
61.1	0	1	0	0	0	0	1	0	1	1	0
61.2	0	1	0	0	0	0	1	0	1	0	0
61.3	0	1	0	0	0	0	1	1	1	0	0
61.4	0	1	0	0	0	0	1	1	1	1	0
61.5	0	1	0	0	0	0	1	1	0	1	0
61.6	0	1	0	0	0	0	1	1	0	1	1
61.7	0	1	0	0	0	0	1	1	0	0	1
61.8	0	1	0	0	0	0	0	1	0	0	1
61.9	0	1	0	0	0	0	0	1	0	1	1
62.0	0	1	0	0	0	0	0	1	0	1	0
62.1	0	1	0	0	0	0	0	1	1	1	0
62.2	0	1	0	0	0	0	0	1	1	0	0
62.3	0	1	0	0	0	0	0	0	1	0	0
62.4	0	1	0	0	0	0	0	0	1	1	0
62.5	0	1	0	0	0	0	0	0	0	1	0
62.6	0	1	0	0	0	0	0	0	0	1	1
62.7	0	1	0	0	0	0	0	0	0	0	1
62.8	1	1	0	0	0	0	0	0	0	0	1
62.9	1	1	0	0	0	0	0	0	0	1	1

RANGE (Altitude in Thousands)	PULSE POSITION										
	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
63.0	1	1	0	0	0	0	0	0	0	1	0
63.1	1	1	0	0	0	0	0	0	1	1	0
63.2	1	1	0	0	0	0	0	0	1	0	0
63.3	1	1	0	0	0	0	0	1	1	0	0
63.4	1	1	0	0	0	0	0	1	1	1	0
63.5	1	1	0	0	0	0	0	1	0	1	0
63.6	1	1	0	0	0	0	0	1	0	1	1
63.7	1	1	0	0	0	0	0	1	0	0	1
63.8	1	1	0	0	0	0	1	1	0	0	1
63.9	1	1	0	0	0	0	1	1	0	1	1
64.0	1	1	0	0	0	0	1	1	0	1	0
64.1	1	1	0	0	0	0	1	1	1	1	0
64.2	1	1	0	0	0	0	1	1	1	0	0
64.3	1	1	0	0	0	0	1	0	1	0	0
64.4	1	1	0	0	0	0	1	0	1	1	0
64.5	1	1	0	0	0	0	1	0	0	1	0
64.6	1	1	0	0	0	0	1	0	0	1	1
64.7	1	1	0	0	0	0	1	0	0	0	1
64.8	1	1	0	0	0	1	1	0	0	0	1
64.9	1	1	0	0	0	1	1	0	0	1	1
65.0	1	1	0	0	0	1	1	0	0	1	0
65.1	1	1	0	0	0	1	1	0	1	1	0
65.2	1	1	0	0	0	1	1	0	1	0	0
65.3	1	1	0	0	0	1	1	1	1	0	0
65.4	1	1	0	0	0	1	1	1	1	1	0
65.5	1	1	0	0	0	1	1	1	0	1	0
65.6	1	1	0	0	0	1	1	1	0	1	1
65.7	1	1	0	0	0	1	1	1	0	0	1
65.8	1	1	0	0	0	1	0	1	0	0	1
65.9	1	1	0	0	0	1	0	1	0	1	1
66.0	1	1	0	0	0	1	0	1	0	1	0
66.1	1	1	0	0	0	1	0	1	1	1	0
66.2	1	1	0	0	0	1	0	1	1	0	0
66.3	1	1	0	0	0	1	0	0	1	0	0
66.4	1	1	0	0	0	1	0	0	1	1	0
66.5	1	1	0	0	0	1	0	0	0	1	0
66.6	1	1	0	0	0	1	0	0	0	1	1
66.7	1	1	0	0	0	1	0	0	0	0	1
66.8	1	1	0	0	1	1	0	0	0	0	1
66.9	1	1	0	0	1	1	0	0	0	1	1

RANGE (Altitude in Thousands)	PULSE POSITION										
	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
67.0	1	1	0	0	1	1	0	0	0	1	0
67.1	1	1	0	0	1	1	0	0	1	1	0
67.2	1	1	0	0	1	1	0	0	1	0	0
67.3	1	1	0	0	1	1	0	1	1	0	0
67.4	1	1	0	0	1	1	0	1	1	1	0
67.5	1	1	0	0	1	1	0	1	0	1	0
67.6	1	1	0	0	1	1	0	1	0	1	1
67.7	1	1	0	0	1	1	0	1	0	0	1
67.8	1	1	0	0	1	1	1	1	0	0	1
67.9	1	1	0	0	1	1	1	1	0	1	1
68.0	1	1	0	0	1	1	1	1	0	1	0
68.1	1	1	0	0	1	1	1	1	1	1	0
68.2	1	1	0	0	1	1	1	1	1	0	0
68.3	1	1	0	0	1	1	1	0	1	0	0
68.4	1	1	0	0	1	1	1	0	1	1	0
68.5	1	1	0	0	1	1	1	0	0	1	0
68.6	1	1	0	0	1	1	1	0	0	1	1
68.7	1	1	0	0	1	1	1	0	0	0	1
68.8	1	1	0	0	1	0	1	0	0	0	1
68.9	1	1	0	0	1	0	1	0	0	1	1
69.0	1	1	0	0	1	0	1	0	0	1	0
69.1	1	1	0	0	1	0	1	0	1	1	0
69.2	1	1	0	0	1	0	1	0	1	0	0
69.3	1	1	0	0	1	0	1	1	1	0	0
69.4	1	1	0	0	1	0	1	1	1	1	0
69.5	1	1	0	0	1	0	1	1	0	1	0
69.6	1	1	0	0	1	0	1	1	0	1	1
69.7	1	1	0	0	1	0	1	1	0	0	1
69.8	1	1	0	0	1	0	0	1	0	0	1
69.9	1	1	0	0	1	0	0	1	0	1	1
70.0	1	1	0	0	1	0	0	1	0	1	0
70.1	1	1	0	0	1	0	0	1	1	1	0
70.2	1	1	0	0	1	0	0	1	1	0	0
70.3	1	1	0	0	1	0	0	0	1	0	0
70.4	1	1	0	0	1	0	0	0	1	1	0
70.5	1	1	0	0	1	0	0	0	0	1	0
70.6	1	1	0	0	1	0	0	0	0	1	1
70.7	1	1	0	0	1	0	0	0	0	0	1
70.8	1	1	0	1	1	0	0	0	0	0	1
70.9	1	1	0	1	1	0	0	0	0	1	1

RANGE (Altitude in Thousands)	PULSE POSITION										
	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
71.0	1	1	0	1	1	0	0	0	0	1	0
71.1	1	1	0	1	1	0	0	0	1	1	0
71.2	1	1	0	1	1	0	0	0	1	0	0
71.3	1	1	0	1	1	0	0	1	1	0	0
71.4	1	1	0	1	1	0	0	1	1	1	0
71.5	1	1	0	1	1	0	0	1	0	1	0
71.6	1	1	0	1	1	0	0	1	0	1	1
71.7	1	1	0	1	1	0	0	1	0	0	1
71.8	1	1	0	1	1	0	1	1	0	0	1
71.9	1	1	0	1	1	0	1	1	0	1	1
72.0	1	1	0	1	1	0	1	1	0	1	0
72.1	1	1	0	1	1	0	1	1	1	1	0
72.2	1	1	0	1	1	0	1	1	1	0	0
72.3	1	1	0	1	1	0	1	0	1	0	0
72.4	1	1	0	1	1	0	1	0	1	1	0
72.5	1	1	0	1	1	0	1	0	0	1	0
72.6	1	1	0	1	1	0	1	0	0	1	1
72.7	1	1	0	1	1	0	1	0	0	0	1
72.8	1	1	0	1	1	1	1	0	0	0	1
72.9	1	1	0	1	1	1	1	0	0	1	1
73.0	1	1	0	1	1	1	1	0	0	1	0
73.1	1	1	0	1	1	1	1	0	1	1	0
73.2	1	1	0	1	1	1	1	0	1	0	0
73.3	1	1	0	1	1	1	1	1	1	0	0
73.4	1	1	0	1	1	1	1	1	1	1	0
73.5	1	1	0	1	1	1	1	1	0	1	0
73.6	1	1	0	1	1	1	1	1	0	1	1
73.7	1	1	0	1	1	1	1	1	0	0	1
73.8	1	1	0	1	1	1	0	1	0	0	1
73.9	1	1	0	1	1	1	0	1	0	1	1
74.0	1	1	0	1	1	1	0	1	0	1	0
74.1	1	1	0	1	1	1	0	1	1	1	0
74.2	1	1	0	1	1	1	0	1	1	0	0
74.3	1	1	0	1	1	1	0	0	1	0	0
74.4	1	1	0	1	1	1	0	0	1	1	0
74.5	1	1	0	1	1	1	0	0	0	1	0
74.6	1	1	0	1	1	1	0	0	0	1	1
74.7	1	1	0	1	1	1	0	0	0	0	1
74.8	1	1	0	1	0	1	0	0	0	0	1
74.9	1	1	0	1	0	1	0	0	0	1	1

RANGE (Altitude in Thousands)	PULSE POSITION										
	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
75.0	1	1	0	1	0	1	0	0	0	1	0
75.1	1	1	0	1	0	1	0	0	1	1	0
75.2	1	1	0	1	0	1	0	0	1	0	0
75.3	1	1	0	1	0	1	0	1	1	0	0
75.4	1	1	0	1	0	1	0	1	1	1	0
75.5	1	1	0	1	0	1	0	1	0	1	0
75.6	1	1	0	1	0	1	0	1	0	1	1
75.7	1	1	0	1	0	1	0	1	0	0	1
75.8	1	1	0	1	0	1	1	1	0	0	1
75.9	1	1	0	1	0	1	1	1	0	1	1
76.0	1	1	0	1	0	1	1	1	0	1	0
76.1	1	1	0	1	0	1	1	1	1	1	0
76.2	1	1	0	1	0	1	1	1	1	0	0
76.3	1	1	0	1	0	1	1	0	1	0	0
76.4	1	1	0	1	0	1	1	0	1	1	0
76.5	1	1	0	1	0	1	1	0	0	1	0
76.6	1	1	0	1	0	1	1	0	0	1	1
76.7	1	1	0	1	0	1	1	0	0	0	1
76.8	1	1	0	1	0	0	1	0	0	0	1
76.9	1	1	0	1	0	0	1	0	0	1	1
77.0	1	1	0	1	0	0	1	0	0	1	0
77.1	1	1	0	1	0	0	1	0	1	1	0
77.2	1	1	0	1	0	0	1	0	1	0	0
77.3	1	1	0	1	0	0	1	1	1	0	0
77.4	1	1	0	1	0	0	1	1	1	1	0
77.5	1	1	0	1	0	0	1	1	0	1	0
77.6	1	1	0	1	0	0	1	1	0	1	1
77.7	1	1	0	1	0	0	1	1	0	0	1
77.8	1	1	0	1	0	0	0	1	0	0	1
77.9	1	1	0	1	0	0	0	1	0	1	1
78.0	1	1	0	1	0	0	0	1	0	1	0
78.1	1	1	0	1	0	0	0	1	1	1	0
78.2	1	1	0	1	0	0	0	1	1	0	0
78.3	1	1	0	1	0	0	0	0	1	0	0
78.4	1	1	0	1	0	0	0	0	1	1	0
78.5	1	1	0	1	0	0	0	0	0	1	0
78.6	1	1	0	1	0	0	0	0	0	1	1
78.7	1	1	0	1	0	0	0	0	0	0	1
78.8	1	1	1	1	0	0	0	0	0	0	1
78.9	1	1	1	1	0	0	0	0	0	1	1

RANGE (Altitude in Thousands)	PULSE POSITION										
	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
79.0	1	1	1	1	0	0	0	0	0	1	0
79.1	1	1	1	1	0	0	0	0	1	1	0
79.2	1	1	1	1	0	0	0	0	1	0	0
79.3	1	1	1	1	0	0	0	1	1	0	0
79.4	1	1	1	1	0	0	0	1	1	1	0
79.5	1	1	1	1	0	0	0	1	0	1	0
79.6	1	1	1	1	0	0	0	1	0	1	1
79.7	1	1	1	1	0	0	0	1	0	0	1
79.8	1	1	1	1	0	0	1	1	0	0	1
79.9	1	1	1	1	0	0	1	1	0	1	1
80.0	1	1	1	1	0	0	1	1	0	1	0
80.1	1	1	1	1	0	0	1	1	1	1	0
80.2	1	1	1	1	0	0	1	1	1	0	0
80.3	1	1	1	1	0	0	1	0	1	0	0
80.4	1	1	1	1	0	0	1	0	1	1	0
80.5	1	1	1	1	0	0	1	0	0	1	0
80.6	1	1	1	1	0	0	1	0	0	1	1
80.7	1	1	1	1	0	0	1	0	0	0	1
80.8	1	1	1	1	0	1	1	0	0	0	1
80.9	1	1	1	1	0	1	1	0	0	1	1
81.0	1	1	1	1	0	1	1	0	0	1	0
81.1	1	1	1	1	0	1	1	0	1	1	0
81.2	1	1	1	1	0	1	1	0	1	0	0
81.3	1	1	1	1	0	1	1	1	1	0	0
81.4	1	1	1	1	0	1	1	1	1	1	0
81.5	1	1	1	1	0	1	1	1	0	1	0
81.6	1	1	1	1	0	1	1	1	0	1	1
81.7	1	1	1	1	0	1	1	1	0	0	1
81.8	1	1	1	1	0	1	0	1	0	0	1
81.9	1	1	1	1	0	1	0	1	0	1	1
82.0	1	1	1	1	0	1	0	1	0	1	0
82.1	1	1	1	1	0	1	0	1	1	1	0
82.2	1	1	1	1	0	1	0	1	1	0	0
82.3	1	1	1	1	0	1	0	0	1	0	0
82.4	1	1	1	1	0	1	0	0	1	1	0
82.5	1	1	1	1	0	1	0	0	0	1	0
82.6	1	1	1	1	0	1	0	0	0	1	1
82.7	1	1	1	1	0	1	0	0	0	0	1
82.8	1	1	1	1	1	1	0	0	0	0	1
82.9	1	1	1	1	1	1	0	0	0	1	1

RANGE (Altitude in Thousands)	PULSE POSITION										
	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
83.0	1	1	1	1	1	1	0	0	0	1	0
83.1	1	1	1	1	1	1	0	0	1	1	0
83.2	1	1	1	1	1	1	0	0	1	0	0
83.3	1	1	1	1	1	1	0	1	1	0	0
83.4	1	1	1	1	1	1	0	1	1	1	0
83.5	1	1	1	1	1	1	0	1	0	1	0
83.6	1	1	1	1	1	1	0	1	0	1	1
83.7	1	1	1	1	1	1	0	1	0	0	1
83.8	1	1	1	1	1	1	1	1	0	0	1
83.9	1	1	1	1	1	1	1	1	0	1	1
84.0	1	1	1	1	1	1	1	1	0	1	0
84.1	1	1	1	1	1	1	1	1	1	1	0
84.2	1	1	1	1	1	1	1	1	1	0	0
84.3	1	1	1	1	1	1	1	0	1	0	0
84.4	1	1	1	1	1	1	1	0	1	1	0
84.5	1	1	1	1	1	1	1	0	0	1	0
84.6	1	1	1	1	1	1	1	0	0	1	1
84.7	1	1	1	1	1	1	1	0	0	0	1
84.8	1	1	1	1	1	0	1	0	0	0	1
84.9	1	1	1	1	1	0	1	0	0	1	1
85.0	1	1	1	1	1	0	1	0	0	1	0
85.1	1	1	1	1	1	0	1	0	1	1	0
85.2	1	1	1	1	1	0	1	0	1	0	0
85.3	1	1	1	1	1	0	1	1	1	0	0
85.4	1	1	1	1	1	0	1	1	1	1	0
85.5	1	1	1	1	1	0	1	1	0	1	0
85.6	1	1	1	1	1	0	1	1	0	1	1
85.7	1	1	1	1	1	0	1	1	0	0	1
85.8	1	1	1	1	1	0	0	1	0	0	1
85.9	1	1	1	1	1	0	0	1	0	1	1
86.0	1	1	1	1	1	0	0	1	0	1	0
86.1	1	1	1	1	1	0	0	1	1	1	0
86.2	1	1	1	1	1	0	0	1	1	0	0
86.3	1	1	1	1	1	0	0	0	1	0	0
86.4	1	1	1	1	1	0	0	0	1	1	0
86.5	1	1	1	1	1	0	0	0	0	1	0
86.6	1	1	1	1	1	0	0	0	0	1	1
86.7	1	1	1	1	1	0	0	0	0	0	1
86.8	1	1	1	0	1	0	0	0	0	0	1
86.9	1	1	1	0	1	0	0	0	0	1	1

RANGE (Altitude in Thousands)	PULSE POSITION										
	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
87.0	1	1	1	0	1	0	0	0	0	1	0
87.1	1	1	1	0	1	0	0	0	1	1	0
87.2	1	1	1	0	1	0	0	0	1	0	0
87.3	1	1	1	0	1	0	0	1	1	0	0
87.4	1	1	1	0	1	0	0	1	1	1	0
87.5	1	1	1	0	1	0	0	1	0	1	0
87.6	1	1	1	0	1	0	0	1	0	1	1
87.7	1	1	1	0	1	0	0	1	0	0	1
87.8	1	1	1	0	1	0	1	1	0	0	1
87.9	1	1	1	0	1	0	1	1	0	1	1
88.0	1	1	1	0	1	0	1	1	0	1	0
88.1	1	1	1	0	1	0	1	1	1	1	0
88.2	1	1	1	0	1	0	1	1	1	0	0
88.3	1	1	1	0	1	0	1	0	1	0	0
88.4	1	1	1	0	1	0	1	0	1	1	0
88.5	1	1	1	0	1	1	1	0	0	1	0
88.6	1	1	1	0	1	1	1	0	1	1	0
88.7	1	1	1	0	1	1	1	0	1	0	0
88.8	1	1	1	0	1	1	1	1	1	0	0
88.9	1	1	1	0	1	1	1	1	1	1	0
89.0	1	1	1	0	1	1	1	1	0	1	0
89.1	1	1	1	0	1	1	1	1	0	1	1
89.2	1	1	1	0	1	1	1	1	0	0	1
89.3	1	1	1	0	1	1	0	1	0	0	1
89.4	1	1	1	0	1	1	0	1	0	1	1
89.5	1	1	1	0	1	1	0	1	0	1	0
89.6	1	1	1	0	1	1	0	1	1	1	0
89.7	1	1	1	0	1	1	0	1	1	0	0
89.8	1	1	1	0	1	1	0	0	1	0	0
89.9	1	1	1	0	1	1	0	0	1	1	0
90.0	1	1	1	0	1	1	0	0	0	1	0
90.1	1	1	1	0	1	1	0	0	0	1	1
90.2	1	1	1	0	1	1	0	0	0	0	1
90.3	1	1	1	0	0	1	0	0	0	0	1
90.4	1	1	1	0	0	1	0	0	0	1	1
90.5	1	1	1	0	0	1	0	0	0	1	0
90.6	1	1	1	0	0	1	0	0	1	1	0
90.7	1	1	1	0	0	1	0	0	1	0	0
90.8	1	1	1	0	0	1	0	1	1	0	0
90.9	1	1	1	0	0	1	0	1	1	1	0

RANGE (Altitude in Thousands)	PULSE POSITION										
	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
91.0	1	1	1	0	0	1	0	1	0	1	0
91.1	1	1	1	0	0	1	0	1	0	1	1
91.2	1	1	1	0	0	1	0	1	0	0	1
91.3	1	1	1	0	0	1	1	1	0	0	1
91.4	1	1	1	0	0	1	1	1	0	1	1
91.5	1	1	1	0	0	1	1	1	0	1	0
91.6	1	1	1	0	0	1	1	1	1	1	0
91.7	1	1	1	0	0	1	1	1	1	0	0
91.8	1	1	1	0	0	1	1	0	1	0	0
91.9	1	1	1	0	0	1	1	0	1	1	0
92.0	1	1	1	0	0	1	1	0	0	1	0
92.1	1	1	1	0	0	1	1	0	0	1	1
92.2	1	1	1	0	0	1	1	0	0	0	1
92.3	1	1	1	0	0	0	1	0	0	0	1
92.4	1	1	1	0	0	0	1	0	0	1	1
92.5	1	1	1	0	1	0	1	0	0	1	0
92.6	1	1	1	0	1	0	1	0	0	1	1
92.7	1	1	1	0	1	0	1	0	0	0	1
92.8	1	1	1	0	1	1	1	0	0	0	1
92.9	1	1	1	0	1	1	1	0	0	1	1
93.0	1	1	1	0	0	0	1	0	0	1	0
93.1	1	1	1	0	0	0	1	0	1	1	0
93.2	1	1	1	0	0	0	1	0	1	0	0
93.3	1	1	1	0	0	0	1	1	1	0	0
93.4	1	1	1	0	0	0	1	1	1	1	0
93.5	1	1	1	0	0	0	1	1	0	1	0
93.6	1	1	1	0	0	0	1	1	0	1	1
93.7	1	1	1	0	0	0	1	1	0	0	1
93.8	1	1	1	0	0	0	0	1	0	0	1
93.9	1	1	1	0	0	0	0	1	0	1	1
94.0	1	1	1	0	0	0	0	1	0	1	0
94.1	1	1	1	0	0	0	0	1	1	1	0
94.2	1	1	1	0	0	0	0	1	1	0	0
94.3	1	1	1	0	0	0	0	0	1	0	0
94.4	1	1	1	0	0	0	0	0	1	1	0
94.5	1	1	1	0	0	0	0	0	0	1	0
94.6	1	1	1	0	0	0	0	0	0	1	1
94.7	1	1	1	0	0	0	0	0	0	0	1
94.8	1	0	1	0	0	0	0	0	0	0	1
94.9	1	0	1	0	0	0	0	0	0	1	1

RANGE (Altitude in Thousands)	PULSE POSITION										
	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
95.0	1	0	1	0	0	0	0	0	0	1	0
95.1	1	0	1	0	0	0	0	0	1	1	0
95.2	1	0	1	0	0	0	0	0	1	0	0
95.3	1	0	1	0	0	0	0	1	1	0	0
95.4	1	0	1	0	0	0	0	1	1	1	0
95.5	1	0	1	0	0	0	0	1	0	1	0
95.6	1	0	1	0	0	0	0	1	0	1	1
95.7	1	0	1	0	0	0	0	1	0	0	1
95.8	1	0	1	0	0	0	1	1	0	0	1
95.9	1	0	1	0	0	0	1	1	0	1	1
96.0	1	0	1	0	0	0	1	1	0	1	0
96.1	1	0	1	0	0	0	1	1	1	1	0
96.2	1	0	1	0	0	0	1	1	1	0	0
96.3	1	0	1	0	0	0	1	0	1	0	0
96.4	1	0	1	0	0	0	1	0	1	1	0
96.5	1	0	1	0	0	0	1	0	0	1	0
96.6	1	0	1	0	0	0	1	0	0	1	1
96.7	1	0	1	0	0	0	1	0	0	0	1
96.8	1	0	1	0	0	1	1	0	0	0	1
96.9	1	0	1	0	0	1	1	0	0	1	1
97.0	1	0	1	0	0	1	1	0	0	1	0
97.1	1	0	1	0	0	1	1	0	1	1	0
97.2	1	0	1	0	0	1	1	0	1	0	0
97.3	1	0	1	0	0	1	1	1	1	0	0
97.4	1	0	1	0	0	1	1	1	1	1	0
97.5	1	0	1	0	0	1	1	1	0	1	0
97.6	1	0	1	0	0	1	1	1	0	1	1
97.7	1	0	1	0	0	1	1	1	0	0	1
97.8	1	0	1	0	0	1	0	1	0	0	1
97.9	1	0	1	0	0	1	0	1	0	1	1
98.0	1	0	1	0	0	1	0	1	0	1	0
98.1	1	0	1	0	0	1	0	1	1	1	0
98.2	1	0	1	0	0	1	0	1	1	0	0
98.3	1	0	1	0	0	1	0	0	1	0	0
98.4	1	0	1	0	0	1	0	0	1	1	0
98.5	1	0	1	0	0	1	0	0	0	1	0
98.6	1	0	1	0	0	1	0	0	0	1	1
98.7	1	0	1	0	0	1	0	0	0	0	1
98.8	1	0	1	0	1	1	0	0	0	0	1
98.9	1	0	1	0	1	1	0	0	0	1	1

RANGE (Altitude in Thousands)	PULSE POSITION										
	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
99.0	1	0	1	0	1	1	0	0	0	1	0
99.1	1	0	1	0	1	1	0	0	1	1	0
99.2	1	0	1	0	1	1	0	0	1	0	0
99.3	1	0	1	0	1	1	0	1	1	0	0
99.4	1	0	1	0	1	1	0	1	1	1	0
99.5	1	0	1	0	1	1	0	1	0	1	0
99.6	1	0	1	0	1	1	0	1	0	1	1
99.7	1	0	1	0	1	1	0	1	0	0	1
99.8	1	0	1	0	1	1	1	1	0	0	1
99.9	1	0	1	0	1	1	1	1	0	1	1
100.0	1	0	1	0	1	1	1	1	0	1	0
100.1	1	0	1	0	1	1	1	1	1	1	0
100.2	1	0	1	0	1	1	1	1	1	0	0
100.3	1	0	1	0	1	1	1	0	1	0	0
100.4	1	0	1	0	1	1	1	0	1	1	0
100.5	1	0	1	0	1	1	1	0	0	1	0
100.6	1	0	1	0	1	1	1	0	0	1	1
100.7	1	0	1	0	1	1	1	0	0	0	1
100.8	1	0	1	0	1	0	1	0	0	0	1
100.9	1	0	1	0	1	0	1	0	0	1	1
101.0	1	0	1	0	1	0	1	0	0	1	0
101.1	1	0	1	0	1	0	1	0	1	1	0
101.2	1	0	1	0	1	0	1	0	1	0	0
101.3	1	0	1	0	1	0	1	1	1	0	0
101.4	1	0	1	0	1	0	1	1	1	1	0
101.5	1	0	1	0	1	0	1	1	0	1	0
101.6	1	0	1	0	1	0	1	1	0	1	1
101.7	1	0	1	0	1	0	1	1	0	0	1
101.8	1	0	1	0	1	0	0	1	0	0	1
101.9	1	0	1	0	1	0	0	1	0	1	1
102.0	1	0	1	0	1	0	0	1	0	1	0
102.1	1	0	1	0	1	0	0	1	1	1	0
102.2	1	0	1	0	1	0	0	1	1	0	0
102.3	1	0	1	0	1	0	0	0	1	0	0
102.4	1	0	1	0	1	0	0	0	1	1	0
102.5	1	0	1	0	1	0	0	0	0	1	0
102.6	1	0	1	0	1	0	0	0	0	1	1
102.7	1	0	1	0	1	0	0	0	0	0	1
102.8	1	0	1	1	1	0	0	0	0	0	1
102.9	1	0	1	1	1	0	0	0	0	1	1

RANGE (Altitude in Thousands)	PULSE POSITION										
	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
103.0	1	0	1	1	1	0	0	0	0	1	0
103.1	1	0	1	1	1	0	0	0	1	1	0
103.2	1	0	1	1	1	0	0	0	1	0	0
103.3	1	0	1	1	1	0	0	1	1	0	0
103.4	1	0	1	1	1	0	0	1	1	1	0
103.5	1	0	1	1	1	0	0	1	0	1	0
103.6	1	0	1	1	1	0	0	1	0	1	1
103.7	1	0	1	1	1	0	0	1	0	0	1
103.8	1	0	1	1	1	0	1	1	0	0	1
103.9	1	0	1	1	1	0	1	1	0	1	1
104.0	1	0	1	1	1	0	1	1	0	1	0
104.1	1	0	1	1	1	0	1	1	1	1	0
104.2	1	0	1	1	1	0	1	1	1	0	0
104.3	1	0	1	1	1	0	1	0	1	0	0
104.4	1	0	1	1	1	0	1	0	1	1	0
104.5	1	0	1	1	1	0	1	0	0	1	0
104.6	1	0	1	1	1	0	1	0	0	1	1
104.7	1	0	1	1	1	0	1	0	0	0	1
104.8	1	0	1	1	1	0	1	0	0	0	1
104.9	1	0	1	1	1	1	1	0	0	1	1
105.0	1	0	1	1	1	1	1	0	0	1	0
105.1	1	0	1	1	1	1	1	0	1	1	0
105.2	1	0	1	1	1	1	1	0	1	0	0
105.3	1	0	1	1	1	1	1	1	1	0	0
105.4	1	0	1	1	1	1	1	1	1	1	0
105.5	1	0	1	1	1	1	1	1	0	1	0
105.6	1	0	1	1	1	1	1	1	0	1	1
105.7	1	0	1	1	1	1	1	1	0	0	1
105.8	1	0	1	1	1	1	0	1	0	0	1
105.9	1	0	1	1	1	1	0	1	0	1	1
106.0	1	0	1	1	1	1	0	1	0	1	0
106.1	1	0	1	1	1	1	0	1	1	1	0
106.2	1	0	1	1	1	1	0	1	1	0	0
106.3	1	0	1	1	1	1	0	0	1	0	0
106.4	1	0	1	1	1	1	0	0	1	1	0
106.5	1	0	1	1	1	1	0	0	0	1	0
106.6	1	0	1	1	1	1	0	0	0	1	1
106.7	1	0	1	1	1	1	0	0	0	0	1
106.8	1	0	1	1	0	1	0	0	0	0	1
106.9	1	0	1	1	0	1	0	0	0	1	1

RANGE (Altitude in Thousands)	PULSE POSITION										
	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
107.0	1	0	1	1	0	1	0	0	0	1	0
107.1	1	0	1	1	0	1	0	0	1	1	0
107.2	1	0	1	1	0	1	0	0	1	0	0
107.3	1	0	1	1	0	1	0	1	1	0	0
107.4	1	0	1	1	0	1	0	1	1	1	0
107.5	1	0	1	1	0	1	0	1	0	1	0
107.6	1	0	1	1	0	1	0	1	0	1	1
107.7	1	0	1	1	0	1	0	1	0	0	1
107.8	1	0	1	1	0	1	1	1	0	0	1
107.9	1	0	1	1	0	1	1	1	0	1	1
108.0	1	0	1	1	0	1	1	1	0	1	0
108.1	1	0	1	1	0	1	1	1	1	1	0
108.2	1	0	1	1	0	1	1	1	1	0	0
108.3	1	0	1	1	0	1	1	0	1	0	0
108.4	1	0	1	1	0	1	1	0	1	1	0
108.5	1	0	1	1	0	1	1	0	0	1	0
108.6	1	0	1	1	0	1	1	0	0	1	1
108.7	1	0	1	1	0	1	1	0	0	0	1
108.8	1	0	1	1	0	0	1	0	0	0	1
108.9	1	0	1	1	0	0	1	0	0	1	1
109.0	1	0	1	1	0	0	1	0	0	1	0
109.1	1	0	1	1	0	0	1	0	1	1	0
109.2	1	0	1	1	0	0	1	0	1	0	0
109.3	1	0	1	1	0	0	1	1	1	0	0
109.4	1	0	1	1	0	0	1	1	1	1	0
109.5	1	0	1	1	0	0	1	1	0	1	0
109.6	1	0	1	1	0	0	1	1	0	1	1
109.7	1	0	1	1	0	0	1	1	0	0	1
109.8	1	0	1	1	0	0	0	1	0	0	1
109.9	1	0	1	1	0	0	0	1	0	1	1
110.0	1	0	1	1	0	0	0	1	0	1	0
110.1	1	0	1	1	0	0	0	1	1	1	0
110.2	1	0	1	1	0	0	0	1	1	0	0
110.3	1	0	1	1	0	0	0	0	1	0	0
110.4	1	0	1	1	0	0	0	0	1	1	0
110.5	1	0	1	1	0	0	0	0	0	1	0
110.6	1	0	1	1	0	0	0	0	0	1	1
110.7	1	0	1	1	0	0	0	0	0	0	1
110.8	1	0	0	1	0	0	0	0	0	0	1
110.9	1	0	0	1	0	0	0	0	0	1	1

RANGE (Altitude in Thousands)	PULSE POSITION										
	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
111.0	1	0	0	1	0	0	0	0	0	1	0
111.1	1	0	0	1	0	0	0	0	1	1	0
111.2	1	0	0	1	0	0	0	0	1	0	0
111.3	1	0	0	1	0	0	0	1	1	0	0
111.4	1	0	0	1	0	0	0	1	1	1	0
111.5	1	0	0	1	0	0	0	1	0	1	0
111.6	1	0	0	1	0	0	0	1	0	1	1
111.7	1	0	0	1	0	0	0	1	0	0	1
111.8	1	0	0	1	0	0	1	1	0	0	1
111.9	1	0	0	1	0	0	1	1	0	1	1
112.0	1	0	0	1	0	0	1	1	0	1	0
112.1	1	0	0	1	0	0	1	1	1	1	0
112.2	1	0	0	1	0	0	1	1	1	0	0
112.3	1	0	0	1	0	0	1	0	1	0	0
112.4	1	0	0	1	0	0	1	0	1	1	0
112.5	1	0	0	1	0	0	1	0	0	1	0
112.6	1	0	0	1	0	0	1	0	0	1	1
112.7	1	0	0	1	0	0	1	0	0	0	1
112.8	1	0	0	1	0	1	1	0	0	0	1
112.9	1	0	0	1	0	1	1	0	0	1	1
113.0	1	0	0	1	0	1	1	0	0	1	0
113.1	1	0	0	1	0	1	1	0	1	1	0
113.2	1	0	0	1	0	1	1	0	1	0	0
113.3	1	0	0	1	0	1	1	1	1	0	0
113.4	1	0	0	1	0	1	1	1	1	1	0
113.5	1	0	0	1	0	1	1	1	0	1	0
113.6	1	0	0	1	0	1	1	1	0	1	1
113.7	1	0	0	1	0	1	1	1	0	0	1
113.8	1	0	0	1	0	1	0	1	0	0	1
113.9	1	0	0	1	0	1	0	1	0	1	1
114.0	1	0	0	1	0	1	0	1	0	1	0
114.1	1	0	0	1	0	1	0	1	1	1	0
114.2	1	0	0	1	0	1	0	1	1	0	0
114.3	1	0	0	1	0	1	0	0	1	0	0
114.4	1	0	0	1	0	1	0	0	1	1	0
114.5	1	0	0	1	0	1	0	0	0	1	0
114.6	1	0	0	1	0	1	0	0	0	1	1
114.7	1	0	0	1	0	1	0	0	0	0	1
114.8	1	0	0	1	1	1	0	0	0	0	1
114.9	1	0	0	1	1	1	0	0	0	1	1

RANGE (Altitude in Thousands)	PULSE POSITION										
	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
115.0	1	0	0	1	1	1	0	0	0	1	0
115.1	1	0	0	1	1	1	0	0	1	1	0
115.2	1	0	0	1	1	1	0	0	1	0	0
115.3	1	0	0	1	1	1	0	1	1	0	0
115.4	1	0	0	1	1	1	0	1	1	1	0
115.5	1	0	0	1	1	1	0	1	0	1	0
115.6	1	0	0	1	1	1	0	1	0	1	1
115.7	1	0	0	1	1	1	0	1	0	0	1
115.8	1	0	0	1	1	1	1	1	0	0	1
115.9	1	0	0	1	1	1	1	1	0	1	1
116.0	1	0	0	1	1	1	1	1	0	1	0
116.1	1	0	0	1	1	1	1	1	1	1	0
116.2	1	0	0	1	1	1	1	1	1	0	0
116.3	1	0	0	1	1	1	1	0	1	0	0
116.4	1	0	0	1	1	1	1	0	1	1	0
116.5	1	0	0	1	1	1	1	0	0	1	0
116.6	1	0	0	1	1	1	1	0	0	1	1
116.7	1	0	0	1	1	1	1	0	0	0	1
116.8	1	0	0	1	1	0	1	0	0	0	1
116.9	1	0	0	1	1	0	1	0	0	1	1
117.0	1	0	0	1	1	0	1	0	0	1	0
117.1	1	0	0	1	1	0	1	0	1	1	0
117.2	1	0	0	1	1	0	1	0	1	0	0
117.3	1	0	0	1	1	0	1	1	1	0	0
117.4	1	0	0	1	1	0	1	1	1	1	0
117.5	1	0	0	1	1	0	1	1	0	1	0
117.6	1	0	0	1	1	0	1	1	0	1	1
117.7	1	0	0	1	1	0	1	1	0	0	1
117.8	1	0	0	1	1	0	0	1	0	0	1
117.9	1	0	0	1	1	0	0	1	0	1	1
118.0	1	0	0	1	1	0	0	1	0	1	0
118.1	1	0	0	1	1	0	0	1	1	1	0
118.2	1	0	0	1	1	0	0	1	1	0	0
118.3	1	0	0	1	1	0	0	0	1	0	0
118.4	1	0	0	1	1	0	0	0	1	1	0
118.5	1	0	0	1	1	0	0	0	0	1	0
118.6	1	0	0	1	1	0	0	0	0	1	1
118.7	1	0	0	1	1	0	0	0	0	0	1
118.8	1	0	0	0	1	0	0	0	0	0	1
118.9	1	0	0	0	1	0	0	0	0	1	1

RANGE (Altitude in Thousands)	PULSE POSITION										
	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
119.0	1	0	0	0	1	0	0	0	0	1	0
119.1	1	0	0	0	1	0	0	0	1	1	0
119.2	1	0	0	0	1	0	0	0	1	0	0
119.3	1	0	0	0	1	0	0	1	1	0	0
119.4	1	0	0	0	1	0	0	1	1	1	0
119.5	1	0	0	0	1	0	0	1	0	1	0
119.6	1	0	0	0	1	0	0	1	0	1	1
119.7	1	0	0	0	1	0	0	1	0	0	1
119.8	1	0	0	0	1	0	1	1	0	0	1
119.9	1	0	0	0	1	0	1	1	0	1	1
120.0	1	0	0	0	1	0	1	1	0	1	0
120.1	1	0	0	0	1	0	1	1	1	1	0
120.2	1	0	0	0	1	0	1	1	1	0	0
120.3	1	0	0	0	1	0	1	0	1	0	0
120.4	1	0	0	0	1	0	1	0	1	1	0
120.5	1	0	0	0	1	0	1	0	0	1	0
120.6	1	0	0	0	1	0	1	0	0	1	1
120.7	1	0	0	0	1	0	1	0	0	0	1
120.8	1	0	0	0	1	1	1	0	0	0	1
120.9	1	0	0	0	1	1	1	0	0	1	1
121.0	1	0	0	0	1	1	1	0	0	1	0
121.1	1	0	0	0	1	1	1	0	1	1	0
121.2	1	0	0	0	1	1	1	0	1	0	0
121.3	1	0	0	0	1	1	1	1	1	0	0
121.4	1	0	0	0	1	1	1	1	1	1	0
121.5	1	0	0	0	1	1	1	1	0	1	0
121.6	1	0	0	0	1	1	1	1	0	1	1
121.7	1	0	0	0	1	1	1	1	0	0	1
121.8	1	0	0	0	1	1	0	1	0	0	1
121.9	1	0	0	0	1	1	0	1	0	1	1
122.0	1	0	0	0	1	1	0	1	0	1	0
122.1	1	0	0	0	1	1	0	1	1	1	0
122.2	1	0	0	0	1	1	0	1	1	0	0
122.3	1	0	0	0	1	1	0	0	1	0	0
122.4	1	0	0	0	1	1	0	0	1	1	0
122.5	1	0	0	0	1	1	0	0	0	1	0
122.6	1	0	0	0	1	1	0	0	0	1	1
122.7	1	0	0	0	1	1	0	0	0	0	1
122.8	1	0	0	0	0	1	0	0	0	0	1
122.9	1	0	0	0	0	1	0	0	0	1	1

RANGE (Altitude in Thousands)	PULSE POSITION										
	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
123.0	1	0	0	0	0	1	0	0	0	1	0
123.1	1	0	0	0	0	1	0	0	1	1	0
123.2	1	0	0	0	0	1	0	0	1	0	0
123.3	1	0	0	0	0	1	0	1	1	0	0
123.4	1	0	0	0	0	1	0	1	1	1	0
123.5	1	0	0	0	0	1	0	1	0	1	0
123.6	1	0	0	0	0	1	0	1	0	1	1
123.7	1	0	0	0	0	1	0	1	0	0	1
123.8	1	0	0	0	0	1	1	1	0	0	1
123.9	1	0	0	0	0	1	1	1	0	1	1
124.0	1	0	0	0	0	1	1	1	0	1	0
124.1	1	0	0	0	0	1	1	1	1	1	0
124.2	1	0	0	0	0	1	1	1	1	0	0
124.3	1	0	0	0	0	1	1	0	1	0	0
124.4	1	0	0	0	0	1	1	0	1	1	0
124.5	1	0	0	0	0	1	1	0	0	1	0
124.6	1	0	0	0	0	1	1	0	0	1	1
124.7	1	0	0	0	0	1	1	0	0	0	1
124.8	1	0	0	0	0	0	1	0	0	0	1
124.9	1	0	0	0	0	0	1	0	0	1	1
125.0	1	0	0	0	0	0	1	0	0	1	0
125.1	1	0	0	0	0	0	1	0	1	1	0
125.2	1	0	0	0	0	0	1	0	1	0	0
125.3	1	0	0	0	0	0	1	1	1	0	0
125.4	1	0	0	0	0	0	1	1	1	1	0
125.5	1	0	0	0	0	0	1	1	0	1	0
125.6	1	0	0	0	0	0	1	1	0	1	1
125.7	1	0	0	0	0	0	1	1	0	0	1
125.8	1	0	0	0	0	0	0	1	0	0	1
125.9	1	0	0	0	0	0	0	1	0	1	1
126.0	1	0	0	0	0	0	0	1	0	1	0
126.1	1	0	0	0	0	0	0	1	1	1	0
126.2	1	0	0	0	0	0	0	1	1	0	0
126.3	1	0	0	0	0	0	0	0	1	0	0
126.4	1	0	0	0	0	0	0	0	1	1	0
126.5	1	0	0	0	0	0	0	0	0	1	0
126.6	1	0	0	0	0	0	0	0	0	1	1
126.7	1	0	0	0	0	0	0	0	0	0	1

APPENDIX E - CONNECTOR PIN-OUT TABLES

1. Table of User I/O Connectors

PIN NO.		ASSIGNMENT	INPUT/OUTPUT
J1	DABS	SMB	INPUT
J2	TACAN	SMB	INPUT
J3	EXT MEASUREMENT GATE	SMB	INPUT
J4	RF LEVEL INPUT	SMB	INPUT
J5	IFR BUS	25 PIN, TYPE D	INPUT/OUTPUT
J6	AUXILIARY	25 PIN, TYPE D	INPUT/OUTPUT
J7	INDICATOR	25 PIN, TYPE D	INPUT/OUTPUT
J8	INTERROGATOR	25 PIN, TYPE D	INPUT/OUTPUT
J9	R/NAV	BNC	OUTPUT
J10	GEN	BNC	OUTPUT
J11	XMTR	BNC	OUTPUT
J12	PRIMARY POWER	EAC-301	INPUT
J14	GPIB INTERFACE	IEEE	INPUT/OUTPUT
J15	RF	TYPE N	INPUT/OUTPUT
J16	XMTR	BNC	OUTPUT
J17	GEN	BNC	OUTPUT
J18	SUPPRESSOR	BNC	OUTPUT
J19	CAL MARKS	BNC	OUTPUT
J20	SYNC	BNC	OUTPUT
J21	DISCRIMINATOR	BNC	OUTPUT
J22	EXTERNAL RF	BNC	INPUT
J23	ANTENNA OPTION	BNC	INPUT

2. Pin-Out Table for IFR BUS Connector (J5)

PIN NO.	ASSIGNMENT	INPUT/OUTPUT
1	GND	
2	A∅	OUTPUT
3	A1	OUTPUT
4	GND	
5	A2	OUTPUT
6	D7	INPUT/OUTPUT
7	D6	INPUT/OUTPUT
8	A3	OUTPUT
9	GND	
10	GND	
11	A4	OUTPUT
12	D5	INPUT/OUTPUT
13	GND	
14	A5	OUTPUT
15	D4	INPUT/OUTPUT
16	GND	
17	WRITE	OUTPUT
18	D3	INPUT/OUTPUT
19	GND	
20	READ	OUTPUT
21	$\overline{D2}$	INPUT/OUTPUT
22	$\overline{INTA}$	OUTPUT
23	INTR	OUTPUT
24	D1	INPUT/OUTPUT
25	D∅	INPUT/OUTPUT

3. Pin-Out Table for AUXILIARY Connector (J6)

PIN NO.	ASSIGNMENT	INPUT/OUTPUT
1	GND	
2	A/A PRIORITY	INPUT
3	SERIAL DATA	INPUT/OUTPUT
4	SERIAL SYNC	INPUT/OUTPUT
5	EXTERNAL PULSE	INPUT
6	EXTERNAL SLS	INPUT
7	EXTERNAL PRIORITY	INPUT
8	PULSE	OUTPUT
9	20 MHz	OUTPUT
10	A/A INTERRS	INPUT
11	50% VIDEO	OUTPUT
12	N/C	
13	N/C	
14	SELF-INTERR	INPUT/OUTPUT
15	GND	
16	SERIAL CLOCK	INPUT/OUTPUT
17	GND	
18	GND	
19	GND	
20	GND	
21	GND	
22	GND	
23	GND	
24	GND	
25	N/C	

4. Pin-Out Table for INDICATOR Connector (J7)

PIN NO.	ASSIGNMENT	INPUT/OUTPUT
1	SERIAL DATA HI	OUTPUT
2	SERIAL DATA LO	
3	SERIAL CLOCK HI	OUTPUT
4	SERIAL CLOCK LO	
5	SERIAL SYNC HI	OUTPUT
6	SERIAL SYNC LO	
7	N/C	
8	ANALOG DISTANCE HI	OUTPUT
9	ANALOG DISTANCE LO	
10	RANGE RATE HI	OUTPUT
11	RANGE RATE LO	
12	CHASSIS GND	
13	N/C	
14	N/C	
15	WARNING FLAG	OUTPUT
16	CHASSIS GND	
17	5 V INSTR LIGHT DIM	OUTPUT
18	RETURN INSTR LIGHT	
19	N/C	
20	N/C	
21	N/C	
22	N/C	
23	N/C	
24	N/C	
25	N/C	

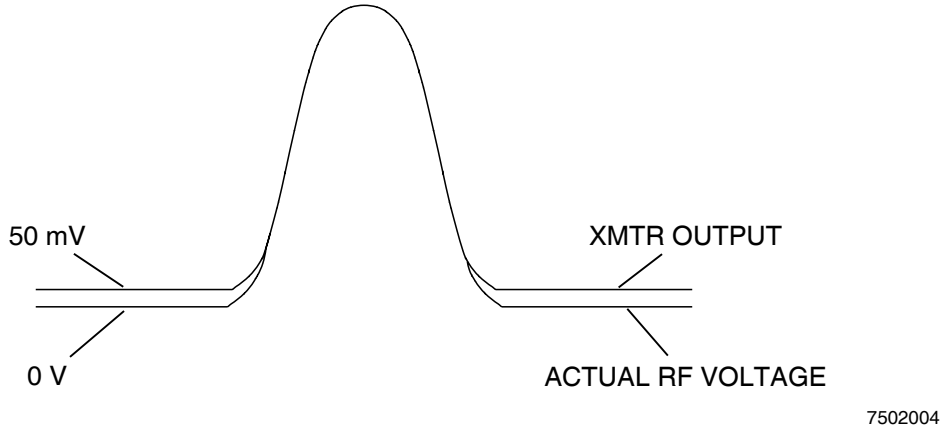
5. Pin-Out Table for INTERROGATOR Connector (J8)

PIN NO.	ASSIGNMENT	INPUT/OUTPUT
1	TENS A	OUTPUT
2	TENS B	OUTPUT
3	UNITS A	OUTPUT
4	UNITS B	OUTPUT
5	UNITS C	OUTPUT
6	UNITS D	OUTPUT
7	UNITS E	OUTPUT
8	TENTHS A	OUTPUT
9	TENTHS B	OUTPUT
10	TENTHS C	OUTPUT
11	TENTHS D	OUTPUT
12	TENTHS E	OUTPUT
13	HUNDREDTHS C	OUTPUT
14	FREQUENCY COMMON	OUTPUT
15	N/C	
16	N/C	
17	N/C	
18	CHASSIS GND	
19	CHASSIS GND	
20	SERIAL DATA HI	INPUT
21	SERIAL DATA LO	INPUT
22	SERIAL CLOCK HI	INPUT
23	SERIAL CLOCK LO	INPUT
24	SERIAL SYNC HI	INPUT
25	SERIAL SYNC LO	INPUT

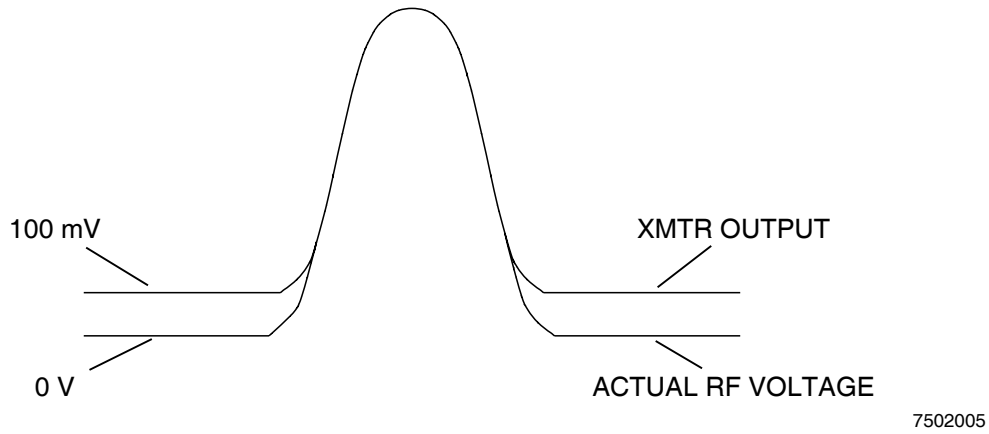
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APPENDIX F - BASELINE SETTING USING ATC-1400A XMTR DETECTED OUTPUT

The detector is non-linear below 3 W and is offset from zero by a voltage equivalent to 1.5 W (0.2 W in x10 mode) at the RF input. When measuring the 10%, 50% and 90% points using the XMTR output, it is necessary to offset the baseline on the Oscilloscope by 50 mV when operating into a 50 Ω load. Use the Oscilloscope ground reference to set the true baseline at 0 V.



Typical XMTR Display for 50 W Transmitter
Figure 1



Typical XMTR Display for 500 W Transmitter
Figure 2

When operating into an open load, the actual baseline is not at 0 V. The actual baseline is 100 mV below the indicated baseline.

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APPENDIX G - TEST EQUIPMENT REQUIREMENTS

This Appendix contains a list of test equipment suitable for performing all of the maintenance procedures contained in this manual. Any other equipment meeting the specifications listed in this Appendix may be substituted in place of the recommended models. The equipment listed in this Appendix may exceed the minimum required specifications for some of the procedures contained in this manual.

TYPE	MODEL
60 dB Pad	HP8491A Option 060 or Equivalent
Frequency Counter	FLUKE 7220A or Equivalent
Heterodyne Monitor	N/A
Modulation Meter	BOONTON 82AD or Equivalent
Oscilloscope	TEKTRONIX 5032B or Equivalent
Power Meter	HP8991A or Equivalent
Power Meter Sensor	HP84815A or Equivalent
Signal Generator	Aeroflex 2023B or Equivalent
Spectrum Analyzer	Aeroflex 2399A or Equivalent

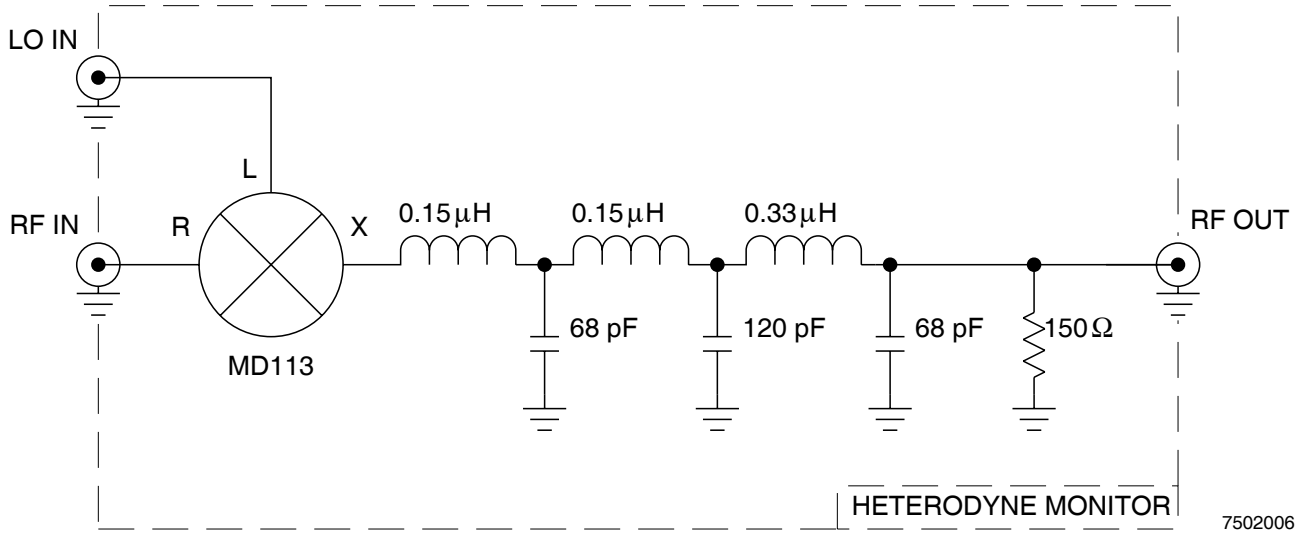
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APPENDIX H - CONSTRUCTION OF HETERODYNE MONITOR

The materials and circuit schematic required to construct the Heterodyne Monitor used in the Performance Evaluation of the ATC-1400A-2 are as follows:

CAUTION: KEEP ALL LEADS TO COMPONENTS AS SHORT AS POSSIBLE TO REDUCE STRAY INDUCATANCE.

QUANTITY	DESCRIPTION
1	SHIELDED ENCLOSURE
2	BNC CONNECTOR (FEMALE)
1	BNC CONNECTOR MALE)
1	MIXER (MD113)
2	INDUCTOR (0.15 μH)
1	INDUCTOR (0.33 μH)
2	CAPACITOR (68 pF)
1	CAPACITOR (120 pF)
1	RESISTOR (5%, 1/4 W, 150 Ω)



Heterodyne Monitor Circuit Schematic
Figure 1

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APPENDIX I - ABBREVIATIONS

A

AM	Amplitude Modulation
ANSI	American National Standard Institute
ARINC	Aeronautical Research, Inc.
ARINC 572	Aeronautical Radio Inc Characteristic NR 572-1 "Mark 2 Air Traffic Control Transponder"
ASCII	American National Standard Code for Information Interchange
ATC	Air Traffic Control
ATCRBS	Air Traffic Control Radar Beacon System
ATE	Automatic Test Equipment

B

BCD	Binary-Coded Data

C

CAL	Calibrate
CR	ASCII Carriage Return
cm	Centimeter

D

dB	Decibel
dBm	Decibels relative to Milliwatts
DABS	Discrete Address Beacon System
DBL	Double
DCL	Device Clear, GPIB Standard
DME	Distance Measuring Equipment

F

F1	First Framing Pulse (XPDR)
F2	Second Framing Pulse (XPDR)
ft/sec	Feet per second
ft/sec2	Feet per second squared
Fhi	Frequency High
Flo	Frequency Low

G

GET	Group Execute Trigger
GPIB	General Purpose Interface Bus
GTL	Go To Local, GPIB Standard

H

Hz	Hertz

K

kHz	Kilohertz
KTS	Knots

L

LLO	Local Lockout, GPIB Standard
LF	Line feed

M

MHz	Megahertz
MLA	My Listen Address, GPIB Standard
MTA	My Talk Address, GPIB Standard
MTL	Minimum Threshold Level

N

ns	Nanosecond
NMi	Nautical mile

P

P_1	First Interrogation Pulse (DME)
P_2	Second Interrogation Pulse (DME)
pk	Peak
PP/S	Pulse pairs per second
PRF	Pulse Repetition Frequency

R

RF	Radio Frequency
RMS	Root-Mean-Square

S

SLS	Side Lobe Suppression
SPI	Special Position ID Pulse

T

TACAN	Tactical Air Navigation
TTL	Transistor-Transistor Logic

U

UNL	Unlisten, GPIB Standard
UNT	Untalk, GPIB Standard
UUT	Unit under test

V

V	Volt
VAC	Volts Alternating Current
VOR	Very High Frequency OMNI Directional Radio Range
VSWR	Voltage Standing-Wave Ratio

X

XMTR	Transmitter
XPDR	Transponder

APPENDIX J - EMC AND SAFETY COMPLIANCE

1. EMC

   The ATC-1400A-2 complies with the following EMC standards:

   - EN 55011, Group 1, Class B for emissions
   - EN 50082-1:1992 for immunity

2. Safety

   The ATC-1400A-2 complies with the following safety standards:

   - EN 61010-1:1993
   - UL 3111-1, 1st Edition
   - CSA C22.2, No. 1010.1-92

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INDEX

Abbreviations App I, p 1
Alphabetical Quick Reference ASCII Command Table 1-2-5, p 4
Altitude Transmission Code Chart App D, p 1
ATCRBS Interrogation Modes and XPDR Reply Codes App C, p 1

Baseline Settings Using ATC-1400A-2 XMTR Detected Output App F, p 1

Command and Data Structure
- ASCII Commands to Input Data from ATC-1400A-2 1-2-5, p 3
- ASCII Input Command Format Example 1-2-5, p 3
- ASCII Output Command Format Example 1-2-5, p 3
- ASCII Output Commands to ATC-1400A-2 1-2-5, p 3

Connector Pin Out Tables
- User I/O Connectors App E, p 1
- IFR BUS Connector (J5) App E, p 2
- AUXILIARY Connector (J6) App E, p 3
- INDICATOR Connector (J7) App E, p 4
- INTERROGATOR Connector (J8) App E, p 5

Construction of Heterodyne Monitor App H, p 1
Controls, Connectors and Indicators 1-2-2, p 1
- ATC-1400A-2 Front Panel 1-2-2, p 3
- ATC-1400A-2 Rear Panel 1-2-2, p 11

Description 1-1-1, p 1
DME Channeling and VHF Frequency Pairing App B, p 1
DME Mode Characteristics 1-3-1, p 2
DME Test Examples 1-2-4, p 12
- Adjacent Channel Test 1-2-4, p 17
- Measuring Accuracy and Tracking 1-2-4, p 18
- Measuring Acquisition Time 1-2-4, p 19
- Measuring DME Transmitter Frequency and Power 1-2-4, p 12
- Measuring Echo and Co-Channel Performance 1-2-4, p 20
- Measuring Pulse Position Decoder Accuracy 1-2-4, p 16
- Measuring Receiver Bandwidth and Sensitivity 1-2-4, p 15
- Measuring Receiver Memory Time 1-2-4, p 14
- Measuring Transmitter Pulse Characteristics 1-2-4, p 13

Electrical Description 1-1-1, p 4
EMC and Safety Compliance App J, p 1
Explanation of Codes for Common Commands 1-2-5, p 8
External Cleaning 1-2-1, p 2

Front Panel Connectors 1-2-2, p 5
Functional Capabilities 1-1-1, p 1
- Auxiliary Unit Capability 1-1-1, p 4
- DME Mode 1-1-1, p 1
- Signal Generator 1-1-1, p 1
- UUT Measurements 1-1-1, p 4
- XPDR Mode 1-1-1, p 3

Fuse Requirements 1-2-1, p 1, 1-3-1, p 7

General Description and Capabilities 1-1-1, p 1
General Operating Procedures 1-2-4, p 1

Initial Control Settings for DME Test Examples 1-2-4, p 12
Initial Control Settings for XPDR Test Examples 1-2-4, p 3
Installation 1-2-1, p 1

Multiline Interface Messages:
- ISO Code Representation App A, p 1

Operation 1-2-1, p 1
Operating Precautions 1-2-4, p 0

Performance Evaluation 1-2-3, p 1
Performance Evaluation Data Sheet 1-2-3, p 14
Performance Evaluation Procedures
- Generate 1-2-3, p 2
- Parameter Verifications 1-2-3, p 10
- Receive 1-2-3, p 8

Power Requirements 1-2-1, p 1, 1-3-1, p 6
Pre-Operational Considerations 1-2-4, p 1

Rack-Mount Installation 1-2-1, p 2
Rear Panel Connectors 1-2-2, p 11
Remote Operation 1-2-5, p 1
- GPIB Transactions 1-2-5, p 1
- Status and Service Request Transactions 1-2-5, p 2

Repacking Procedure 1-4-1, p 1

Safety Compliance, EMC and App J, p 1
Safety Conditions 1-3-1, p 7
Safety Precautions 1-2-1, p 1
Shipping 1-4-1, p 1
Shipping Information 1-4-1, p 1
Signal Generator, Specifications 1-3-1, p 1
Specifications 1-3-1, p 1
Storage 1-5-1, p 1
System Interconnect Cables 1-2-1, p 3

Test Equipment Requirements 1-2-4, p 1
App G, p 1
UUT Measurement Characteristics 1-3-1, p 6

XPDR Mode Characteristics 1-3-1, p 4
XPDR Test Examples 1-2-4, p 3
Measuring Frequency and Power Output 1-2-4, p 8
Measuring Identification and Altitude Codes 1-2-4, p 9
Measuring Pulse Deviation 1-2-4, p 5
Measuring Pulse Shape and Width, Transmitter Droop and Frequency Pulling 1-2-4, p 8
Measuring Receiver Bandwidth and Minimum Threshold Level (MTL) 1-2-4, p 3
Measuring Side Lobe Suppression (SLS) 1-2-4, p 4
Pulse Width Decoder Operation 1-2-4, p 7
Verification of Interrogator Recovery Time 1-2-4, p 6

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