component maintenance manual

TDR-94/94D (-004 Status and Higher) ATC/Mode S Transponder (ICA)

34-50-96

(with illustrated parts list)

Notice

INFORMATION SUBJECT TO EXPORT LAWS

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Rockwell Collins

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May 20, 2010

TO: HOLDERS OF THE ROCKWELL COLLINS® TDR-94/94D (-004 STATUS AND HIGHER) ATC/MODE S TRANSPONDER (ICA) COMPONENT MAINTENANCE MANUAL WITH IPL (CPN 523-0778502)

DESCRIPTION OF REVISION NO 13, MAY 20, 2010

This page shows all pages of the manual that are added, changed, or removed. Replace the specified pages of the manual with the new pages supplied. Record the applicable data on the Record of Revisions page.

All changed pages keep data necessary to do maintenance on all equipment models. Black bars on the side of the page identify changes.

PAGE NUMBER	DESCRIPTION OF REVISION AND REASON FOR CHANGE	SERVICE BULLETIN	EFFECTIVITY
LEP-1 thru LEP-14	Updated to reflect current revision.	None	All models
LOI-3 thru LOI-5/LOI-6	Updated to reflect current revision.	None	All models
LOT-1, LOT-2	Updated to reflect current revision.	None	All models
INTRO-3	Revised Note explaining the use of XXX.	None	All models
2	Revised Equipment Covered Table 1 to add new CPNs.	None	622-9352-310, 622-9352-410, 622-9210-310, 622-9210-410
23 thru 26, 28	Revised Assembly Identification Tables, Table 6 to include new CPNs.		622-9352-310, 622-9352-410, 622-9210-310, 622-9210-410
2007, 2009/ 2010	Revised Assembly Revision Level and Diagram Reference Table 2002 to add new cards.		All models
2008	Relocation of data.	None	All models
2048.1/2048.2	Added Power Amplifier Circuit Card A2 (CPN 687-0722-006), Maintenance Aid and Schematic Changes Table 2006.1.	None	All models

PAGE NUMBER	DESCRIPTION OF REVISION AND REASON FOR CHANGE	SERVICE BULLETIN	EFFECTIVITY
2048.3/2048.4 thru 2048.7/ 2048.8	Added Power Amplifier Circuit Card A2 (CPN 687-0722-006), Maintenance Aid Diagram Figure 2008.1.	None	All models
2048.9/2048.10 thru 2048.13/ 2048.14	Added Power Amplifier Circuit Card A2 (CPN 687-0722-006), Schematic Diagram Figure 2008.2.	None	All models
2146.1/2146.2	Added CPU-I/O Programmed Assembly A5 (CPN 653-3674-025, -026) and CPU-I/O Circuit Card A5A1 (CPN 828-2700-004), Maintenance Aid and Schematic Changes Table 2012.1.	None	All models
2146.3/2146.4 thru 2146.9/ 2146.10	Added CPU-I/O Programmed Assembly A5 (CPN 653-3674-025, -026) and CPU-I/O Circuit Card A5A1 (CPN 828-2700-004), Maintenance Aid Diagram Figure 2021.1.	None	All models
2146.11/ 2146.12 thru 2146.27/ 2146.28	Added CPU-I/O Programmed Assembly A5 (CPN 653-3674-025, -026) and CPU-I/O Circuit Card A5A1 (CPN 828-2700-004), Schematic Diagram Figure 2021.2 .	None	All models
2195/2196	Revised Video Processor Circuit Card A6 (CPN 687-0726-006) and Video Processor Circuit Card Assembly A6 (CPN 983-8019-001), Maintenance Aid and Schematic Changes Table 2015.	None	All models
2220.1/2220.2	Added Video Processor Circuit Card A6 (CPN 687-0726-007), Maintenance Aid and Schematic Changes Table 2015.1.	None	All models
2220.3/2220.4 thru 2220.9/ 2220.10	Added Video Processor Circuit Card A6 (CPN 687-0726-007), Maintenance Aid Diagram Figure 2028.1.	None	All models
2220.11/ 2220.12 thru 2220.25/ 2220.26	Added Video Processor Circuit Card A6 (CPN 687-0726-007), Schematic Diagram Figure 2028.2.	None	All models

PAGE NUMBER	DESCRIPTION OF REVISION AND REASON FOR CHANGE	SERVICE BULLETIN	EFFECTIVITY
2239/2240	Revised IF Receiver, DPSK Detector, and LVPS Circuit Card A7 (CPN 687-0727-005), Maintenance Aid and Schematic Changes Table 2017.	None	All models
2259/2260, 2261/2262	Revised IF Receiver, DPSK Detector, and LVPS Circuit Card A7 (CPN 687-0727-005), Schematic Diagram (Sheets 6 and 7).	None	All models
9005	Revised Special Test Equipment Required. (Preferred List) Table 9002.	None	All models
10004 thru 10005/10006	Updated Equipment Designator Prefixes table to reflect current revision and addition of top levels CPN 622-9210-310, -410, CPN 622-9352-310, -410; addition of Chassis Assembly, Main CPN 653-2254-039, -040, -041, -042 and addition of new figures 20 thru 24 CPN 687-0726-007, CPN 828-2700-004, CPN 687-0722-006, CPN 653-0030-002 and CPN 653-0030-003.	None	All models
10007 thru 10011/10012	Updated Manufacturer's Code, Name and Address Index to reflect current revision.	None	All models
10008.1/ 10008.2	New pages added to Manufacturer's Code, Name and Address Index due to new/revised data added on previous pages (data pushed from previous page).	None	All models
10014 thru 10016, 10023 thru 10040, 10050	Updated Equipment Designator Index to reflect current revision.	None	All models

PAGE NUMBER	DESCRIPTION OF REVISION AND REASON FOR CHANGE	SERVICE BULLETIN	EFFECTIVITY
10014.1/ 10014.2, 10024.1/ 10024.2, 10026.1/ 10026.2, 10028.1/ 10028.2, 10032.1/ 10032.2, 10034.1/ 10034.2, 10036.1/ 10036.2, 10038.2/ 10038.2	New pages added to Equipment Designator Index due to new/revised data added on previous pages (data pushed from previous page). These pages also updated to reflect current revision.	None	All models
10016.1/ 10016.2, 10040.1/ 10040.2	New pages added to Equipment Designator Index due to new/revised data added on previous pages (data pushed from previous page).	None	All models
10051 thru 10083/10084	Updated Numerical Index to reflect current revision.	None	All models

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10052.1/ 10052.2, 10054.1/ 10054.2, 10056.1/ 10056.2, 10058.1/ 10058.2, 10060.1/ 10060.2, 10062.1/ 10062.2, 10064.1/ 10064.2, 10068.1/ 10068.2, 10074.1/ 10074.2, 10076.1/ 10076.2, 10078.1/ 10078.2, 10080.1/ 10080.2, 10082.1/ 10082.2	New pages added to Numerical Index due to new/revised data added on previous pages (data pushed from previous page). These pages also updated to reflect current revision.	None	All models
10085 thru 10090, 10091 thru 10101/ 10102	Updated Optional Vendor Index to reflect current revision.	None	All models
10103/10104	Updated Figure 1 illustration and illustration title to reflect current revision and addition of top levels CPN 622-9210-310, -410, CPN 622-9352-310, -410.	None	All models
10105 thru 10107/10108	Updated Figure 1 to reflect current revision, addition of top levels (items 1Y thru 2A) and correction of item 1X nomenclature.	None	All models

PAGE NUMBER	DESCRIPTION OF REVISION AND REASON FOR CHANGE	SERVICE BULLETIN	EFFECTIVITY
10111/10112, 10113 thru 10114.1/ 10114.2	Updated Figure 2 to reflect current revision for top level CPN 653-2255-006.	None	All models
10121/10122	Updated Figure 4 illustration and illustration title to reflect current revision and addition of top levels CPN 653-2254-039, -040, -041, -042.	None	All models
10123 thru 10127/10128	Updated Figure 4 to reflect current revision and addition of top level items 1U thru 1X.	None	All models
10124.1/ 10124.2, 10126.3/ 10126.4	New pages added to Figure 4 due to new/revised data added on previous pages (data pushed from previous page). These pages updated to reflect current revision.	None	All models
10157, 10158	Updated Figure 7 to reflect current next higher assembly reference for item 1.	None	All models
10158.1/ 10158.2	New pages added to Figure 7 due to new/revised data added on previous pages (data pushed from previous page).	None	All models
10349 thru 10366	Added new Figure 20, CPN 687-0726-007.	None	All models
10367 thru 10382	Added new Figure 21, CPN 828-2700-004.	None	All models
10383 thru 10396	Added new Figure 22, CPN 687-0722-006.	None	All models
10397/10398	Added new Figure 23, CPN 653-0030-002 (no illustration required).	None	All models
10399/10400	Added new Figure 24, CPN 653-0030-003 (no illustration required).	None	All models

Rockwell Collins

TDR-94/94D (-004 Status and Higher) ATC/Mode S Transponder (ICA)

component maintenance manual
(with illustrated parts list)

This manual includes data for the equipment that follows:

Unit	Model	Collins Part No
ATC/Mode S Transponder	TDR-94	622-9352-004, -005, -006, -007, -008, -108, -207, -308, -309, -310, -408, -409, -410
ATC/Mode S Transponder	TDR-94D	622-9210-004, -005, -006, -007, -008, -108, -207, -308, -309, -310, -408, -409, -410

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RECORD OF REVISIONS

REV NO	ISSUE DATE	DATE INSERTED	BY	REV NO	ISSUE DATE	DATE INSERTED	BY
1 Ed	Jul 1/98						
1 Rev	May 18/06						
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RECORD OF TEMPORARY REVISIONS

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SERVICE BULLETIN LIST

SERVICE BULLETIN NO	SUBJECT	MANUAL REVISION NUMBER	MANUAL REVISION DATE
1 thru 12	These service bulletins are marked out on the unit identification plate of each -004 status TDR-94 and TDR-94D.	1/0	Jul 1/98
13	Converts TDR-94 (-003 status) and TDR-94D (-003 status) to -004 status	1/0	Jul 1/98
14	Reduce uncommanded transitions to standby in burst tune applications	1/0	Jul 1/98
15	Reduce electromagnetic emissions	1/0	Jul 1/98
16	Add Diode Isolation to Strap Inputs	1/1	May 18/06
17	Convert -004 Status to -005 Status	1/1	May 18/06
18	Convert TDR-94 to TDR-94D	1/1	May 18/06
19	TCAS Bus Operation During Standby Mode (Convert -004/005 Status to -006 Status)	1/1	May 18/06
20	SW Update and TCAS Bus Operation During Standby Mode (Convert -004/005 Status to -006 Status and Update -006 SW)	1/1	May 18/06
21	Intermittent TCAS Bus Failure	1/1	May 18/06
22	Reduce Electromagnetic Emmisions	1/1	May 18/06
23	Update Nameplate for JTSO Approval	1/1	May 18/06
24	Repair Instructions to Replace Obsolete Synthesizer Board	1/1	May 18/06
25	Facilitate A7 Replacement Board Due to Non-Procurable Part U104	1/1	May 18/06
26	Reduce Occurrences of Extremely Cold Temp Failures at Start Up	1/1	May 18/06
501	Incorporate Elementary/Enhanced Surveillance (Converts -004/005 Status to -007 Status)	1/1	May 18/06
502	Incorporate Elementary/Enhanced Surveillance (Converts -007 Status to -008 Status)	1/1	May 18/06
503	Addition of ADS-B Capability (Convert -007/008 Status to -108)	1/1	May 18/06

NOTE: Alert Service Bulletins are produced on blue colored paper with the heading ALERT. When an ALERT Service Bulletin is received, take immediate action.

SERVICE BULLETIN NO	SUBJECT	MANUAL REVISION NUMBER	MANUAL REVISION DATE
504 Rev 3	Add GAMA Label 102G "Selected Altitude" Compatibility (Converts -007 Status to -207 Status, -008 Status to -308 Status and -108 Status to -408 Status)	1/5	May 07/07

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		14	May 18/06
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	F 2043	May 18/06		F 2071	May 18/06
	F 2044	Blank		F 2072	Blank
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*	2048.1	May 20/10		2077	May 18/06
	2048.2	Blank		2078	Blank
*	F 2048.3	May 20/10		F 2079	May 18/06
	F 2048.4	Blank		F 2080	Blank
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	2091	May 18/06		F 2133	May 18/06
	2092	May 18/06		F 2134	Blank
	F 2093	May 18/06		F 2135	May 18/06
	F 2094	Blank		F 2136	Blank
	F 2095	May 18/06		F 2137	May 18/06
	F 2096	Blank		F 2138	Blank
	F 2097	May 18/06		F 2139	May 18/06
	F 2098	Blank		F 2140	Blank
	F 2099	May 18/06		F 2141	May 18/06
	F 2100	Blank		F 2142	Blank
	F 2101	May 18/06		F 2143	May 18/06
	F 2102	Blank		F 2144	Blank
	F 2103	May 18/06		F 2145	May 18/06
	F 2104	Blank		F 2146	Blank
	F 2105	May 18/06	*	2146.1	May 20/10
	F 2106	Blank		2146.2	Blank
	F 2107	May 18/06	*	F 2146.3	May 20/10
	F 2108	Blank		F 2146.4	Blank
	F 2109	May 18/06	*	F 2146.5	May 20/10
	F 2110	Blank		F 2146.6	Blank
	F 2111	May 18/06	*	F 2146.7	May 20/10
	F 2112	Blank		F 2146.8	Blank
	F 2113	May 18/06	*	F 2146.9	May 20/10
	F 2114	Blank		F 2146.10	Blank
	F 2115	May 18/06	*	F 2146.11	May 20/10
	F 2116	Blank		F 2146.12	Blank
	F 2117	May 18/06	*	F 2146.13	May 20/10
	F 2118	Blank		F 2146.14	Blank
	2119	May 18/06	*	F 2146.15	May 20/10
	2120	Blank		F 2146.16	Blank
	F 2121	May 18/06	*	F 2146.17	May 20/10
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	F 2125	May 18/06	*	F 2146.21	May 20/10
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	F 2127	May 18/06	*	F 2146.23	May 20/10
	F 2128	Blank		F 2146.24	Blank
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	F 2130	Blank		F 2146.26	Blank

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	F 2181	May 18/06		* F 2220.3	May 20/10
	F 2182	Blank		F 2220.4	Blank
	F 2183	May 18/06		* F 2220.5	May 20/10
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	F 2185	May 18/06		* F 2220.7	May 20/10
	F 2186	Blank		F 2220.8	Blank

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	* F 2220.13	May 20/10
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	F 2220.26	Blank
	2221	May 18/06
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	F 2223	May 18/06
	F 2224	Blank
	F 2225	May 18/06
	F 2226	Blank
	F 2227	May 18/06
	F 2228	Blank
	F 2229	May 18/06
	F 2230	Blank
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	F 2232	Blank
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	F 2237	May 18/06
	F 2238	Blank
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	F 2241	May 18/06
	F 2242	Blank
	F 2243	May 18/06
	F 2244	Blank
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	F 2248	Blank
	F 2249	May 18/06
	F 2250	Blank
	F 2251	May 18/06
	F 2252	Blank
	F 2253	May 18/06
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	F 2255	May 18/06
	F 2256	Blank
	F 2257	May 18/06
	F 2258	Blank
	* F 2259	May 20/10
	F 2260	Blank
	* F 2261	May 20/10
	F 2262	Blank
DISASSEMBLY	3001	May 18/06
	3002	May 18/06
	3003	May 18/06
	3004	May 18/06
CLEANING	4001	May 18/06
	4002	Blank
INSPECTION/ CHECK	5001	May 18/06
	5002	Blank
REPAIR	6001	May 18/06
	6002	May 18/06
	6003	May 18/06
	6004	Blank
ASSEMBLY	7001	May 18/06
	7002	May 18/06
FITS AND CLEARANCES	8001	May 18/06
	8002	May 18/06
	8003	May 18/06
	8004	May 18/06

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	10185	Apr 17/07		10227	Apr 17/07
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	F 10198	Blank		F 10240	Blank
	F 10199	Apr 17/07		10241	Dec 16/09
	F 10200	Blank		10242	Dec 16/09

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	10242.1	Dec 16/09		10283	Apr 17/07
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	10243	Jun 20/08		F 10285	Apr 17/07
	10244	Apr 17/07		F 10286	Blank
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	10257	Apr 17/07		F 10299	Apr 17/07
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	F 10265	Apr 17/07		10307	Apr 17/07
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	10278	Apr 17/07		F 10320	Blank
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	10280	Apr 17/07		10322	Apr 17/07
	10281	Apr 17/07		10323	Apr 17/07
	10282	Blank		10324	Apr 17/07

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INTRODUCTION

TASK 34-50-96-99C-801-A01
1. Introduction

SUBTASK 34-50-96-99C-001-A01
A. General

NOTE: Specialized sophisticated test equipment and extensive depot level repair training are required for testing the equipment covered in this manual. Therefore, this manual may not be used to test or repair the subject equipment unless the using facility has been specifically authorized by Rockwell Collins, Inc. to do so. This manual does not need to be kept current if it is only used for reference purposes.

(1) This component maintenance manual (with illustrated parts list) includes maintenance instructions prepared with ATA Specification 2200 Information Standards for Aviation Maintenance for the Rockwell Collins TDR-94/94D.

(2) This component maintenance manual gives procedures that let an approved repair person, who does not know the equipment, repair the equipment to a serviceable condition. The procedures help approved repair personnel with maintenance of a line replaceable unit (LRU). The procedures are not for an aircraft mechanic.

(3) The sections that follow give maintenance instructions:

(a) The Description and Operation section gives the function, description, operation, and control of the unit. Mechanical and electrical descriptions of primary subassemblies are also given.

(b) The Testing and Fault Isolation section contains the procedures to identify the condition of the unit and isolate a fault (if there is one). Then the repair person can find the applicable steps to correct the problem.

(c) The Schematics and Wiring Diagrams section contains the schematic diagrams, wiring, and interconnecting diagrams of circuit cards, modules, and subassemblies of the unit.

(d) The Disassembly section contains the procedures to disassemble the unit for a repair or part replacement.

(e) The Cleaning section contains special procedures necessary to clean the unit and general procedures to handle the unit.

(f) The Inspection/Check section contains the procedures necessary to examine the unit for damage and see if the part or assembly is serviceable.

(g) The Repair section contains the repair procedures and instructions for the repair of disassembled equipment assemblies.

(h) The Assembly section contains the procedures to make the disassembled assemblies/modules into a full unit.

(i) The Fits and Clearances section gives all fits, clearances, and torque values used in procedures to assemble the unit.

(j) The Special Tools, Fixtures, Equipment and Consumables section gives a summary list of tools, fixtures, test equipment, and consumable items. These items are necessary to complete maintenance procedures given in the component maintenance manual.

(k) The Illustrated Parts List section contains the data necessary to get replacement parts. An equipment designator index, a numerical index, and an optional vendor index (where applicable) are given. Views given of each assembly, subassembly or unit help you find and identify parts in the detailed parts list.

(l) The Special Procedures section contains procedures that are necessary as a result of other maintenance procedures. These procedures are not included in other sections of the component maintenance manual.

(m) The Storage Including Transportation section contains data to prepare the unit for storage or transportation. This section includes special handling, packaging, storage, and preservation instructions.

CAUTION: THE MATERIAL IN THIS MANUAL CAN POSSIBLY CHANGE. BEFORE YOU DO MAINTENANCE OPERATIONS ON THE EQUIPMENT INCLUDED IN THIS MANUAL, MAKE SURE THAT YOU HAVE A COMPLETE AND UP TO DATE MANUAL. REFER TO THE APPLICABLE MANUAL AND SERVICE BULLETIN INDEXES.

(4) Engineering source data as of May 18/06 was used to prepare this manual. Rockwell Collins has made sure that the procedures given in this manual are serviceable.

- Procedures given in the Testing/Fault Isolation section have been done on Jul 1/98 to make sure the procedures are serviceable.
- Procedures given in the Disassembly section have been done on Jul 1/98 to make sure the procedures are serviceable.
- Procedures given in the Assembly section have been done on Jul 1/98 to make sure the procedures are serviceable.

(5) This manual uses the Maintenance Task Oriented Support System (MTOSS) for task and subtask identification. The maintenance tasks and other data have special MTOSS

numbers given for use with electronic data processing (EDP). The user of this manual can ignore the MTOSS numbers.

(6) Obey all warnings and cautions given in each section of the manual, and the general warnings and cautions given in this Introduction section.

NOTE: References to unit part numbers that end in XXX are applicable to all statuses listed in this manual.

SUBTASK 34-50-96-99C-002-A01

B. Uncommon Abbreviations/Acronyms

ABBREVIATIONS/SYMBOLS	IDENTIFICATION
ACAS	Airbourne Collision Avoidance System
Address	See Mode S address
A/D (or a/d)	Analog-to-digital (Usually this refers to the process of, or circuit involved in, converting an analog signal into a digital form.)
ADLP	Airbourne Data Link Processor
ADS-B	Automatic Dependent Surveillance-Broadcast
AP	Alignment Procedures: This is a series of procedures appropriate for those circuits or functions equipped with adjustable components; variable or test select resistors, trim capacitors, etc. An adjustment step is performed as a result of a detailed test step which has shown that a particular performance parameter has drifted beyond the specified normal limits. Depending on adjustment component accessibility, disassembly may be required. The primary objective of these procedures is to optimize unit performance. Parameter tolerances may be more stringent for alignment than for normal testing.
Altitude	This normally refers to pressure altitude as supplied by an external sensor and data supplied by an altitude encoder.
ARINC	Aeronautical Radio, Incorporated
ASA (or asa)	Airplane Separation Assurance
ATCRBS	Air Traffic Control Radar Beacon System
ATE	Automatic test equipment
BCD	Binary coded decimal
BITE (or bite)	Built-In Test Equipment
BNR (or Bnr or Bin)	Binary

ABBREVIATIONS/SYMBOLS	IDENTIFICATION
CAT or ATP	Customer Acceptance Test or Acceptance Test Procedure. A maintenance test procedure used on a new or newly repaired unit to evaluate its ability to perform its intended purpose. No disassembly is allowed. All external input and output parameters are evaluated. Successful completion of this test gives reasonable assurance that the unit will operate satisfactorily when properly installed. Adaptation is allowed for unique features and applications.
CFDIU	Central Fault Display Interface Unit
CFDS	Centralized Fault Display System
CRT	Cathode ray tube
CSDB	Commercial standard digital bus
DDT (or ddt)	Downlink Data Transfer
DLP	Data Link Processor
downlink	Refers to the message signal path (radio contact) from an airborne transmitter to a ground receiver (see also uplink which refers to the opposite path)
DPSK (or dpsk)	Differential Phase Shift Keying. (Refers to the method of logic differentiation used in mode S message transfer.)
DPT	Detailed Performance Test. A comprehensive maintenance procedure used only on a repair bench for detailed evaluation of performance capability. Disassembly is required. The objective of this procedure is to verify and locate a failure detected in a higher level test; CAT or FPT. This procedure may lead to an alignment or repair procedure and must be followed by the FPT after the necessary repair action.
ELM (or elm)	Extended Length Message (112 bits, as opposed to the normal 56-bit message length)
FIFO (or fifo)	First In, First Out (Refers to a particular data transfer method.)
FPT	Final Performance Test. The most detailed test necessary for a fully assembled unit. The objective of this test is to prove that any repair action has successfully corrected a detected fault and the final assembly process has not adversely affected unit performance. This test must be performed in its entirety and with no interruption after any repair or disassembly action.
GNSS	Global Navigation Satellite System
Host airplane	An airplane equipped with a collision warning system
I/O	Input/Output
Intruder airplane	An airplane entering a defined volume of protected airspace near a host airplane

ABBREVIATIONS/SYMBOLS	IDENTIFICATION
IRS	Inertial Reference System
LRU	Line replaceable unit
MCDU	Maintenance Control Display Unit
Mode S (or mode S)	Mode Select. Identifies an air traffic control transponder with unique airplane identification and data handling capabilities. The mode S transponder is an important first step toward eventual air traffic control automation.
Mode S address	The unique code assigned to a mode S/TCAS-equipped airplane. The address is assigned by the appropriate regulatory agency at the time of installation and is not alterable by the crew. The TCAS and ground control uses this address to selectively interrogate the airborne transponder.
MOPS	Minimum Operation Performance Specification. Performance standards published by the Radio Technical Commission for Aeronautics (RTCA), used for avionics certification and by the FAA as the basis for technical standard orders (TSO's)
MSSS	Mode-S Specific Services
MTL (or mtl)	Minimum Trigger Level (often understood to be synonymous with MDS - Minimum Discernible Signal). (Refers to unit sensitivity.)
NM	Nonvolatile Memory
NMI (or nmi)	Nautical Mile: An international unit of linear measure equal to one minute of arc of a great circle of the earth = 6,076.11549 ft. (1,852 m.), as opposed to statute mile = 5,280 ft. (1,609 m.)
PAM	Pulse Amplitude Modulation
PA (or pa)	In the radio electronics environment, PA refers to Power Amplifier or Pulse Amplitude. In the TCAS environment, PA refers to Proximity Advisory. PA is a TCAS I function that provides a warning of the approach of an intruder airplane with less than 1200 feet of vertical separation and within four nmi of the host airplane.
PDP (or pdp)	Parallel Data Processing
PPI (or ppi)	Plan Position Indicator: Typically refers to the ground ATC scope
PPM (or ppm)	Pulse Position Modulation
PSR	Primary Surveillance Radar. That part of the ATC radar system that locates the airplane by radar echo detection. See also SSR.
PWM (or pwm)	Pulse-width modulation
RA	Resolution Advisory. RA is a TCAS II function that provides a warning of, and suggested evasive maneuver(s) to provide adequate separation from, a threatening intruder airplane.

ABBREVIATIONS/SYMBOLS	IDENTIFICATION
Reply	Refers to the response of an airborne transponder to an interrogation from a ground or airborne interrogator
RIP	Receiving Inspection Procedure. A procedure to detect possible shipping damage. Includes shipping carton unpacking instructions.
RP or RI	Repair Procedures or Repair Instructions. Refers to those unique procedures or instructions appropriate for product repair, that may be beyond normal shop maintenance practices. These procedures can require unique tools and supplies and are located in the Repair section.
RTS	Return To Service (Test). A maintenance procedure used in a flightline environment, either in the airplane or on a bench, to detect a possible failure in an LRU. No disassembly is allowed. The primary objective is to isolate a reported or suspected failure to either the installation or the LRU. Possible result and disposition can be: RESULT — DISPOSITION No trouble found — Unit can be returned to service unless trouble report suggests need for further testing; like a possible intermittent fault. Inconclusive or marginal results — Unit should be sent to repair for additional and more detailed testing Failure detected — Unit should be sent to repair.
SAW (or saw)	Surface Acoustic Wave
SDI	Source destination identifier. Refers to that part of the CSDB data word which defines the unit location (left side, right side, or remote). In ARINC 429, the equivalent function is called SSM (Sign Status Matrix).
SLS (or sls)	Side Lobe Suppression
SLC	Sensitivity Level Control
SMD	Surface Mounted Device
spr	sync (synchronization) phase reversal. Refers to the technique used to identify a logic 1 in uplink or downlink message protocol.
squitter	A recognition transmission not in response to an interrogation for use in TCAS surveillance. This term is also used to describe the continuous transmissions by DME ground stations.
SSM	Sign status matrix. Refers to that part of the ARINC 429 data word which defines the unit location (left or right side). In CSDB, the equivalent function is called SDI (Source/Destination Identifier)
SSR	Secondary Surveillance Radar. That part of the ATC radar system that solicits a reply from the airborne transponder. See also PSR.

ABBREVIATIONS/SYMBOLS	IDENTIFICATION
TA	Traffic Advisory. A TCAS II function that provides a warning of an approaching intruder airplane with less than 1200 feet of vertical separation. The warning time varies depending upon altitude and precedes the time of anticipated protected airspace penetration.
TCAS	Traffic alert and Collision Avoidance System
TCAS I	A proximity warning system capable of at least 45-degree intruder bearing resolution with a minimum warning range of at least four nmi.
TCAS II	A proximity warning, threat-and-resolution advisory and alerting system capable of 8-degree intruder bearing resolution performance, producing a maximum 40-second warning, and issuing vertical escape maneuver advisories.
TCAS III	Also known as Enhanced TCAS. A proximity warning system similar to TCAS II, but issuing horizontal as well as vertical escape maneuver advisories.
Tdoa	Time difference of arrival. A means of calculating location based on plotting hyperbolic lines of position computed by measuring the time of arrival of a baseline transmitter signal and subsequent signals from other transmitters.
TSP	Trouble Shooting Procedures. Sometimes synonymous with Fault Isolation Procedures. Refers to procedures for detailed circuit analysis and is used to locate or identify a faulty component, module, or circuit function. Disassembly is required. This is usually a branch of the DPT, where the failure may be initially detected, and is followed by an alignment or repair action.
UART	Universal Asynchronous Receiver-Transmitter. Refers to the integrated circuit device which receives, temporarily stores, translates, and transmits the serial data. Data is processed between either CSDB or ARINC 429 and the format needed by the internal data processing circuits.
Udt	Uplink data transfer (see also ddt)
uplink	Refers to the message signal path (radio contact) from a ground transmitter to an airborne receiver (see also downlink which refers to the opposite path)
UUT	Unit Under Test
WOW	Weight-On-Wheels

SUBTASK 34-50-96-99C-003-A01
C. General Advisories

WARNING: BEFORE HANDLING ANY UNIT OR UNIT COMPONENT, GROUND THE REPAIR OPERATOR THROUGH A CONDUCTIVE WRIST STRAP OR OTHER DEVICE THAT USES A 470K-Ω OR 1M-Ω SERIES RESISTOR TO PREVENT PERSONNEL INJURY BY LIMITING CURRENT THROUGH THE WRIST STRAP TO GROUND.

WARNING: THIS UNIT EXHIBITS A HIGH DEGREE OF FUNCTIONAL RELIABILITY. NEVERTHELESS USERS MUST KNOW THAT IT IS NOT PRACTICAL TO MONITOR FOR ALL CONCEIVABLE SYSTEM FAILURES AND, HOWEVER UNLIKELY, IT IS POSSIBLE THAT ERRONEOUS OPERATION COULD OCCUR WITHOUT A FAULT INDICATION. THE PILOT HAS THE RESPONSIBILITY TO FIND SUCH AN OCCURRENCE BY MEANS OF CROSS-CHECKS WITH REDUNDANT OR CORRELATED DATA AVAILABLE IN THE COCKPIT.

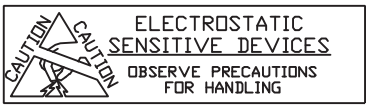
WARNING: SERVICE PERSONNEL ARE TO OBEY STANDARD SAFETY PRECAUTIONS, SUCH AS WEARING SAFETY GLASSES, TO PREVENT PERSONAL INJURY WHILE INSTALLING OR DOING MAINTENANCE ON THIS UNIT.

WARNING: THIS UNIT MAY HAVE PIECE PARTS THAT CONTAIN MATERIALS (SUCH AS BERYLLIUM OXIDE, ACIDS, LITHIUM, RADIOACTIVE MATERIAL, MERCURY, ETC) THAT CAN BE HAZARDOUS TO YOUR HEALTH. IF THE PIECE PART ENCLOSURE IS BROKEN, HANDLE THE PIECE PART IN ACCORDANCE WITH OSHA REQUIREMENTS 29CFR 1910.1000 OR SUPERSEDING DOCUMENTS TO PREVENT PERSONAL CONTACT WITH OR INHALATION OF HAZARDOUS MATERIALS. SINCE IT IS VIRTUALLY IMPOSSIBLE TO DETERMINE WHICH PIECE PARTS DO OR DO NOT CONTAIN SUCH HAZARDOUS MATERIALS, DO NOT OPEN OR DISASSEMBLE PIECE PARTS FOR ANY REASON.

WARNING: USE CARE WHEN USING SEALANTS, SOLVENTS AND OTHER CHEMICAL COMPOUNDS. DO NOT EXPOSE TO EXCESSIVE HEAT OR OPEN FLAME. USE ONLY WITH ADEQUATE VENTILATION. AVOID PROLONGED BREATHING OF VAPORS AND AVOID PROLONGED CONTACT WITH SKIN. OBSERVE ALL CAUTIONS AND WARNINGS GIVEN BY THE MANUFACTURER.

WARNING: REMOVE ALL POWER TO THE UNIT BEFORE DISASSEMBLING IT. DISASSEMBLING THE UNIT WITH POWER CONNECTED IS DANGEROUS TO LIFE.

CAUTION: TURN OFF POWER BEFORE DISCONNECTING ANY UNIT FROM WIRING. DISCONNECTING THE UNIT WITHOUT TURNING POWER OFF MAY CAUSE VOLTAGE TRANSIENTS THAT CAN DAMAGE THE UNIT.



CAUTION: ESDS DEVICES ARE SUBJECT TO DAMAGE BY EXCESSIVE LEVELS OF VOLTAGE AND/OR CURRENT, JUST AS ARE MORE CONVENTIONAL SEMICONDUCTOR DEVICES. HOWEVER, THE PRECAUTIONS NORMALLY USED TO PROTECT SEMICONDUCTORS ARE NOT SUFFICIENT FOR THE PROTECTION OF ESDS DEVICES BECAUSE OF THEIR VERY HIGH ELECTRICAL RESISTANCE. THE LOW-ENERGY SOURCE THAT MOST COMMONLY DESTROYS ESDS DEVICES IS THE HUMAN BODY WHICH, IN CONJUNCTION WITH NONCONDUCTIVE GARMENTS AND FLOOR COVERINGS, GENERATES AND RETAINS STATIC ELECTRICITY. IN ORDER TO ADEQUATELY PROTECT ESDS DEVICES, THE DEVICE AND EVERYTHING THAT CONTACTS IT MUST BE BROUGHT TO GROUND POTENTIAL BY PROVIDING A CONDUCTIVE SURFACE AND DISCHARGE PATHS. THE FOLLOWING PRECAUTIONS MUST BE FOLLOWED:

- DEENERGIZE OR REMOVE ALL POWER AND SIGNAL SOURCES AND LOADS.
- PLACE THE UNIT ON GROUNDED CONDUCTIVE SURFACE.
- GROUND THE REPAIR OPERATOR THROUGH A CONDUCTIVE WRIST STRAP OR OTHER DEVICE THAT USES A 470-KΩ OR 1-MΩ SERIES RESISTOR TO PREVENT UNIT OR UNIT COMPONENT DAMAGE.
- GROUND ANY TOOLS, SUCH AS SOLDERING EQUIPMENT, THAT WILL CONTACT THE UNIT. CONTACT WITH THE OPERATOR'S HAND PROVIDES A SUFFICIENT GROUND FOR TOOLS THAT ARE OTHERWISE ELECTRICALLY ISOLATED.
- WHEN ESDS DEVICES AND ASSEMBLIES ARE NOT IN THE UNIT, THEY SHOULD BE ON THE CONDUCTIVE WORK SURFACE OR IN CONDUCTIVE CONTAINERS.
- WHEN A DEVICE OR ASSEMBLY IS INSERTED OR REMOVED FROM A CONTAINER, THE OPERATOR SHOULD MAINTAIN CONTACT WITH THE CONDUCTIVE PORTION OF THE CONTAINER.
- DO NOT USE PLASTIC BAGS UNLESS THEY HAVE BEEN IMPREGNATED WITH A CONDUCTIVE MATERIAL.
- DO NOT HANDLE ESDS DEVICES UNNECESSARILY OR REMOVE THEM FROM THEIR PACKAGES UNTIL ACTUALLY USED OR TESTED.
- TO PREVENT DAMAGE BY TRANSIENT VOLTAGES, ONLY SOLDERING IRONS THAT MEET THE GUIDELINES STATED IN THE JOINT INDUSTRY STANDARD, J-STD-001, APPENDIX A, SHOULD BE USED.

(1) Observe all warnings and cautions listed within each section as well as the general warnings and cautions listed in the Introduction section of this manual.

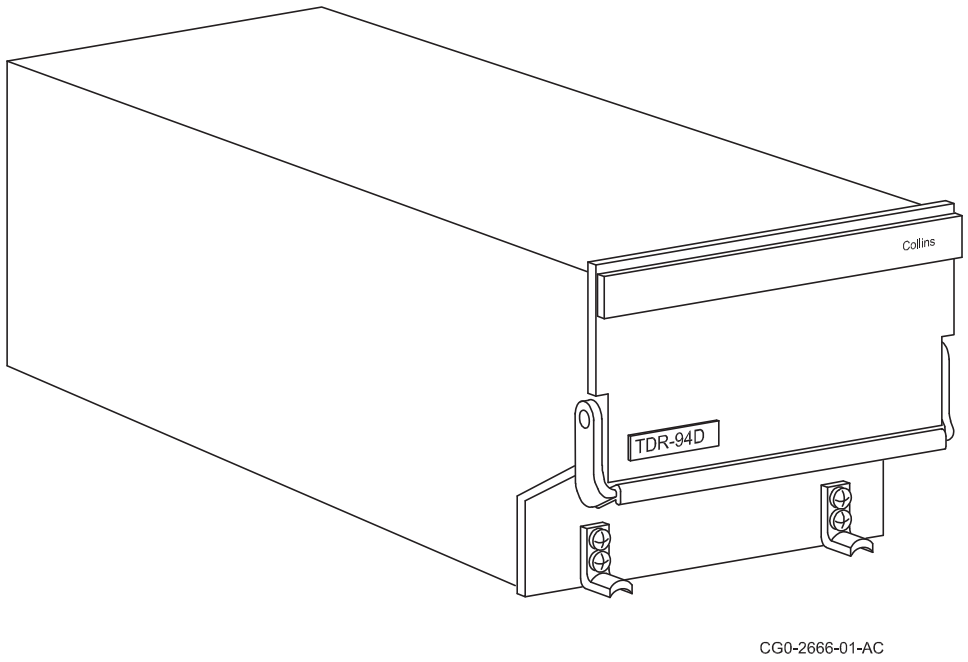
DESCRIPTION AND OPERATION

TASK 34-50-96-870-801-A01

1. General

A. The TDR 94/94D ATC/Mode S Transponder is a solid state, airborne, air traffic control (ATC) transponder that responds to ATCRBS (Air Traffic Control Radar Beacon System) Mode A and Mode C interrogations as well as Mode S (Mode Select) interrogations. The Mode-S transponder differs from earlier ATCRBS transponders in the capability of responding to discretely addressed interrogations and by the capability of receiving and sending data link communications. The TDR 94D Mode S Transponder is also capable of operating through either of two antennas for use in diversity installations for air to air surveillance and communications.

B. Figure 1/GRAPHIC 34-50-96-99B-001-A01 shows an overall view of the equipment. Table 1/Table 34-50-96-99A-001-A01 is a list of equipment covered in this manual. Table 2/Table 34-50-96-99A-002-A01 is a list of related publications. Table 3, Abbreviations and Symbols, has been moved to the Introduction section of this manual.



TDR-94/94D ATC Mode S Transponder
Figure 1/GRAPHIC 34-50-96-99B-001-A01

EQUIPMENT TYPE	DESCRIPTION	COLLINS PART NUMBER
TDR-94	TDR-94 Mode A, C, and S transponder primarily for non-TCAS applications; including CLASS 3A Automatic Dependent Surveillance-Broadcast (ADS-B) capability. The -005 unit is the same as the -004 unit but has improved software to properly report altitude resolution, when the altitude data is derived from a Gillham-based altitude encoder. The -006 is the same as a -005 but has improved software to prevent non-Collins TCAS systems displaying a TCAS flag, or intermittent TCAS flag, when the TCAS is in the Standby mode. The -007 unit has the capability to process aircraft Flight Identification inputs and to support expanded ground station Surveillance Identifier (SI) codes. The -008 status provides Elementary and Enhanced Surveillance functionality for Proline4/21 integrated systems that use IOC-851A, 3100, 4000, or 4100 Input/Output Concentrators. The -008 status may also be used in non-integrated installations. The -108 status is the same as the -008 but adds Automatic Dependent Surveillance-Broadcast (ADS-B) functionality. The -207, -308 and -408 is the same as the -007, -008, and -108 respectively but adds GAMA Label 102G "Selected Altitude" compatibility.	622-9352-004, -005, -006, 007, -008, -108, -207, -308, -309, -310, -408, -409, -410
TDR-94D (Cont)	TDR-94D Mode A, C, and S diversity transponder with full TCAS compatibility features; including CLASS 3A/ADS-B capability. The -005 unit is the same as the -004 unit but has improved software to properly report altitude resolution, when the altitude data is derived from a Gillham-based altitude encoder. The -006 is the same as a -005 but has improved software to prevent non-Collins TCAS systems displaying TCAS flag, or intermittent TCAS flag, when the TCAS is in the Standby mode.	622-9210-004, -005, -006, -007, -008, -108, -207, -308, -309, -310, -408, -409, -410

Equipment Covered Cont.
Table 1/Table 34-50-96-99A-001-A01

EQUIPMENT TYPE	DESCRIPTION	COLLINS PART NUMBER
TDR-94D (Cont)	The -007 unit has the capability to process aircraft Flight Identification inputs and to support expanded ground station Surveillance Identifier (SI) codes. The -008 status provides Elementary and Enhanced Surveillance functionality for Proline 4/21 integrated systems that use IOC-851A, 3100, 4000, or 4100 Input/Output Concentrators. The -008 status may also be used in non-integrated installations. The -108 status is the same as the -008 but adds Automatic Dependent Surveillance-Broadcast (ADS-B) functionality. The -207, -308, and -408 is the same as the -007, -008, and -108 respectively but adds GAMA Label 102G "Selected Altitude" compatibility.	

Equipment Covered
Table 1/Table 34-50-96-99A-001-A01

PUBLICATION	ATA NO	COLLINS PART NUMBER
Rockwell Collins Avionics Standard Shop Practices Manual, Instruction Manual	None	523-0768039
Collins Pro Line II Comm/Nav/Pulse System, Installation Manual	None	523-0772719
Collins TDR-94/94D Mode S Transponder System, Instruction Book (Flightline Maintenance)	None	523-0775652
Collins CTL-92T TCAS Control, Component Maintenance Manual	34-40-84	523-0776595
Collins RTU-870A/870T Radio Tuning Unit, Component Maintenance Manual	23-80-80	523-0774068
Collins CTL-X2/X2A/22C Controls, Instruction Book (Repair Manual)	23-80-80	523-0772495

Related Publications
Table 2/Table 34-50-96-99A-002-A01

Table 3/Table 34-50-96-99A-003-A01 ** Deleted **

TASK 34-50-96-870-802-A01

2. Purpose of Equipment

A. The TDR-94/94D ATC/Mode S Transponder is the airborne transponder for ATCRBS and provides the data link processing function for ATC. The TDR-94/94D provides mode A, mode C, and special identification replies to ATCRBS interrogations for tracking, identification, and altitude reporting purposes. In addition, the TDR-94/94D is capable of receiving and sending mode S message formats that will be required for air traffic control automation. The added data link capability allows the transponder to perform additional air traffic control and airplane separation assurance (ASA) functions. In mode S operation each airplane is assigned a unique address code. This code can be used to direct interrogations to a specific airplane. The reply also contains this unique address to identify the sending airplane.

TASK 34-50-96-870-803-A01

3. Equipment Specifications

A. Table 4/Table 34-50-96-99A-036-A01 lists the environmental and equipment specifications for the TDR-94/94D Transponder.

CHARACTERISTIC	SPECIFICATION
Certification	
TSO	
FAA	TDR-94 TSO-C112, 3A2, 121, 010 TDR-94D TSO-C112, 3A2, 121, 011
RTCA	DO-181A (through change 2c “TCAS Change No. 7 Compatibility”), DO-144
Software, RTCA	DO-178A (Level 2), DO-178B (Level B)
Software, EUROCAE	ED-12A, ED-12B
Deutsche Bundespost FTZ	A44652010
ICAO	Annex 10
Environmental	
RTCA	DO-160C, refer to Table 5/Table 34-50-96-99A-037-A01 for additional information
EUROCAE	ED-14B
Physical	

Equipment Specifications Cont.
Table 4/Table 34-50-96-99A-036-A01

CHARACTERISTIC	SPECIFICATION
Size	
Height	84.6 mm (3.33 in)
Width	124.5 mm (4.90 in)
Length	353.2 mm (13.91 in)
Weight	3.8 kg (8.5 lb)
Mounting	MMT-150 Mounting Tray; 1/2 ATR, short, dwarf (Refer to Pro Line II Comm/NAV/Pulse Installation Manual for additional information.)
Mating Connector	Thinline II, qty 2, 60-pin (Kits: CPN: 628-8661-001/002 or 628-8660-001/002) (Refer to Pro Line II Comm/Nav/Pulse Installation Manual for additional information.)
Cooling	Convection If installed transponder is in an enclosed area with minimum air flow, it is advisable for the installer to mount a small fan in the vicinity to generate air flow around the unit. Although not required, use of the fan will result in reduced component temperatures and corresponding increase in reliability.
Time between overhaul	On condition of failure or as required by Federal Regulations (see example below), other regulations may apply. Consult appropriate regulatory documents and agencies for complete information.
Regulatory requirement for flightline test	FAR 91.413 ATC TRANSPONDER TESTS AND INSPECTIONS. "(a) No person may use an ATC transponder that is specified in Part 125 §91.24 (a), §121.345, §127.123 (b), or §135.143 (c) of this chapter unless, within the preceding 24 calendar months, that ATC transponder has been tested and inspected and found to comply with Appendix F of Part 43 of this chapter; and following any installation or maintenance on an ATC transponder where data correspondence error could be introduced, the integrated system has been tested, inspected, and found to comply with paragraph Appendix E of Part 43 of this chapter."
Power requirements	27.5 ±2.5 V dc at 28 watts nominal, 100 watts peak
Transmitter	
Frequency	1090 ±1 MHz
Power output	250 watts min and 625 watts max (measured at the unit's antenna connector terminated into a 50-ohm resistive load.)
Load impedance	50 nominal
VSWR	1.5:1 service max; 3:1 survival
Receiver	

Equipment Specifications Cont.
Table 4/Table 34-50-96-99A-036-A01

CHARACTERISTIC	SPECIFICATION
Frequency	1030 ±0.2 MHz from ATCRBS interrogators and 1030 ±0.01 MHz from Mode-S interrogators
IF	60 MHz nominal
Sensitivity	73 dBm ±4 dBm
Reply modes	ATCRBS mode A ATCRBS mode C ATCRBS mode A/Mode S All Call ATCRBS mode C/Mode S All Call Mode S, short (56-bit) Mode S, long (112-bit)
Reply rate	
ATCRBS	500 15-pulse replies/sec, or 1200 15-pulse replies in 100 ms - burst

Equipment Specifications Cont.
Table 4/Table 34-50-96-99A-036-A01

CHARACTERISTIC	SPECIFICATION
Mode S	50 short including 16 long replies in 1 sec, or 18 short including 6 long replies in 100 ms, or 8 short including 4 long replies in 25 ms, or 4 short including 2 long in 1.6 ms
ATCRBS SLS	
Max of 10% replies and sls initiated	P1 pulse is MTL +3 dB to -21 dBm and P2 equal to or greater than P1
Max of 10% replies and sls may be initiated	P1 pulse is MTL to MTL +3 dB and P2 equal to or greater than P1
Minimum of 90% replies and no sls	P1 pulse is MTL +3 dB to -21 dBm, and P1 pulse is min of 9 dB greater than P2
	No P2 pulse occurs at 2.0 ±0.7 µs after leading edge of P1, or P2 pulse duration is less than 0.3 µs
Mode S side lobe suppression	Max of 10%
Electrical	
Primary power (P1-58)	27.5, ±2.5, V dc
Primary power common (P1-60)	27.5 V dc common
Data bus:	
CSDB:	
Structure	8-bits/byte, 6-bytes/block
Rate	12.5 kbps, 10-frames/s nominal, 18-blocks/frame max
Data blocks	(All labels are in hexadecimal form.) A0: altitude data; input 1E: ATC code/altitude; input or output 1F: ATC data; output F3: diagnostic data; output
ARINC 429:	
Structure	8-bits/byte, 4-bytes/word
Rate	5-words/sec min

Equipment Specifications Cont.
Table 4/Table 34-50-96-99A-036-A01

CHARACTERISTIC	SPECIFICATION
Data labels	(All labels are in octal form.) *013: TDR and TCAS control, input/output *015: Altitude select limits, input/output *016: Mode S control, input/output *031: ATC Transponder Control, input/output *200: Gillham altitude encoder data, input/output *203: TDR altitude data to TCAS, input/output 204: TDR corrected barometric altitude to TCAS, output 272: TCAS coordination data, part 1, output 273: TCAS data for downlink message formats 16, 20, 21, input 274: TCAS coordination data, part 2, output 274: TCAS data for downlink message formats 0 and 16, input 275: TCAS control, part 1, output 275: TCAS acknowledge, input 276: TCAS control, part 2, output 277: TCAS acknowledge, input 277: Diagnostic data request, input 350: Maintenance data, output 352: Control maintenance word pass-through 371: Equipment ident, output * These labels are normally echoed and/or passed through to the TCAS as received, except for the SSM which may be different depending on the state of the transponder.
Tuning inputs	Monitored only if Burst Mode (P2-59) is not selected; i.e., P2-59 is open
P2-31 P2-32	CSDB, A CSDB, B
P2-17 P2-18	ARINC 429, A (tune input port A) ARINC 429, B (tune input port A)
P2-13 P2-14	ARINC 429, A (tune input port B) ARINC 429, B (tune input port B)
P2-21 P2-22	ARINC 429, A (tune input port C) ARINC 429, B (tune input port C)
P2-27* P2-28*	*ARINC 429, A (FMS/IRS data in) *ARINC 429, B (FMS/IRS data in)
P2-39* P2-40*	*ARINC 429, A (AIS/ADS data in) *ARINC 429, B (AIS/ADS data in)
P2-49* P2-50*	*ARINC 429, A (GPS data in) *ARINC 429, B (GPS data in)

Equipment Specifications Cont.
Table 4/Table 34-50-96-99A-036-A01

<table>
<tr><th>CHARACTERISTIC</th><th>SPECIFICATION</th></tr>
<tr><td>*These busses can be set for low speed (12.5 kHz) or high speed (100 kHz) operation using their associated low/high speed selection straps (see Chart 1).</td><td>Chart 1. Low/High Speed Bus Selection.

<table>
<tr><th>Bus Name</th><th>Bus Pins</th><th>Strap Name</th><th>Strap Pin</th><th>GND</th></tr>
<tr><td>GPS Data In</td><td>J2-49/50</td><td>GPS_Lo/Hi_Sel</td><td>J1-18</td><td>High Speed</td></tr>
<tr><td>FMS/IRS Data In</td><td>J2-27/27</td><td>FMS/IRS_Lo/Hi_Sel</td><td>J1-24</td><td>High Speed</td></tr>
<tr><td>AIS/ADS Data In</td><td>J2-39/40</td><td>AIS/ADS_Lo/Hi_Set</td><td>J1-57</td><td>High Speed</td></tr>
</table></td></tr>
<tr><td>Altitude inputs

P2-33
P2-34

P2-35
P3-36

P2-25**
P2-26**

P2-29**
P2-30**

** On the -008/-108 statuses only, the Altitude Port A/B High Speed Select discrete input (P1-26) selects the bus speed (100 or 12.5 kbps).</td><td>

CSDB, A (altitude input port A)
CSDB, B (altitude input port A)

CSDB, A (altitude input port B)
CSDB, B (altitude input port B)

ARINC 429/575, A (altitude input port A)
ARINC 429/575, B (altitude input port A)

ARINC 429/575, A (altitude input port B)
ARINC 429/575, B (altitude input port B)</td></tr>
<tr><td>Data outputs

P2-23
P2-24

P2-15
P2-16

P2-19
P2-20</td><td>

CSDB, A (Bus 1)
CSDB, B (Bus 1)

ARINC 429, A (Port A)
ARINC 429, B (Port B)

ARINC 429, A (Port A)
ARINC 429, B (Port B)</td></tr>
</table>

CHARACTERISTIC	SPECIFICATION
Peripheral data	
P2-1	ARINC 429, A (Comm A/B input)
P2-2	ARINC 429, B (Comm A/B input)
P2-3	ARINC 429, A (Comm A/B output)
P2-4	ARINC 429, B (Comm A/B output)
P2-5	ARINC 429, A (Comm C/D input)
P2-6	ARINC 429, B (Comm C/D input)
P2-7	ARINC 429, A (Comm C/D output)
P2-8	ARINC 429, B (Comm C/D output)
P2-9	ARINC 429, A (TCAS coord data input)
P2-10	ARINC 429, B (TCAS coord data input)
P2-11	ARINC 429, A (TCAS coord data output)
P2-12	ARINC 429, B (TCAS coord data output)
Discrete inputs	
P1-1	B4, ARINC 572 altitude input
P1-2	B2, ARINC 572 altitude input
P1-3	B1, ARINC 572 altitude input
P1-4	A4, ARINC 572 altitude input
P1-5	A2, ARINC 572 altitude input
P1-6	A1, ARINC 572 altitude input
P1-7	D4, ARINC 572 altitude input
P1-8	D2, ARINC 572 altitude input
P1-9	C4, ARINC 572 altitude input
P1-10	C2, ARINC 572 altitude input
P1-11	C1, ARINC 572 altitude input
P1-12	Common, ARINC 572 altitude input

Equipment Specifications Cont.
Table 4/Table 34-50-96-99A-036-A01

CHARACTERISTIC	SPECIFICATION
Mode S address discretes	
P1-32	Common
P1-33	B1
P1-34	B2
P1-35	B3
P1-36	B4
P1-37	B5
P1-38	B6
P1-39	B7
P1-40	B8
P1-41	B9
P1-42	B10
P1-43	B11
P1-44	B12
P1-45	B13
P1-46	B14
P1-47	B15
P1-48	B16
P1-49	B17
P1-50	B18
P1-51	B19
P1-52	B20
P1-53	B21
P1-54	B22
P1-55	B23
P1-56	B24
Single discrete straps	
P2-51	Antenna, dual/single select (gnd = single bottom antenna used and all diversity functions are inhibited)
P2-56	CSDB/ARINC 429 control select (gnd = CSDB control bus is selected for control of data input)
P2-60	ADLP select (gnd = ADLP included in installation)
P1-13	TCAS installed (gnd = TCAS included in installation) NOTE: There is no provision for TCAS control in CSDB. Therefore, the TDR-94D will not report TCAS capability in its replies to interrogations when CSDB is enabled (P2-56 grounded), even if TCAS is selected (P1-13 grounded) and dual antenna enabled (P2-51 open).

Equipment Specifications Cont.
Table 4/Table 34-50-96-99A-036-A01

CHARACTERISTIC	SPECIFICATION
P1-17 (-004 thru -007 status only)	IRS enable (gnd = transponder uses IRS/FMS data input on P1-2-27 and P2-28)
P1-17 (-008/-108 status only)	Configuration select 1 (See Combination Discretes below)
P1-18	GPS Lo/Hi speed select (gnd = enables the transponder to send high speed DGPS information to an on-board GNNS receiver via the Comm-C/D Output bus (P2-7 and P2-8) using a modified Williamsburg protocol).
P1-19 (-004 thru -007 status only)	MSSS enable (gnd = transponder is enables to perform Mode-S specific functions)
Functional I/O	
P2-55	Standby discrete (gnd = in standby)
P1-28 (-004 thru -007 status only)	Automatic altitude select enable (gnd = auto alt select enabled)
P1-28 (-008/-108 status only)	Configuration select 0 (See Combination Discretes below)
P1-14	Control Altitude Select (See Combination Discretes below) (gnd = port A altitude data supplied on control port, port B same as open), (open = ports A and B altitude selectable via altitude type select discretes, P2-41/42)
P2-53	Air/ground discrete #1 (gnd = WOW); continue replying to all interrogations while on the ground.
P1-27	Air/ground discrete #2 (gnd = WOW); inhibit replies to ATCRBS, ATCRBS/Mode-S All-call, and Mode-S only All-call interrogations when on the ground
P2-48	Reporting altitude port select (gnd = port B)
P2-59	Burst tune enable (gnd = burst) NOTE: In Burst Tune mode the control port strapping (P2-57/58) is ignored. Burst tune data is accepted on ports A, B, and C as 30 ARINC-429 words spaced over an interval of 1.5 seconds with 500 msec dwell time on each port (dwell time is suspended when data is present). Continuous data is always accepted if available. If continuous data is available on part B, then the burst data on ports A and C will be ignored.

Equipment Specifications Cont.
Table 4/Table 34-50-96-99A-036-A01

CHARACTERISTIC	SPECIFICATION
P1-15 P1-30	Cross-side input (connected to opposite TDR P1-30, gnd input = command to standby) Cross-side output (connected to opposite TDR P1-15, gnd output = active mode) (These connections are used in dual burst-tune TDR installations to ensure that only one transponder is operating at a time)
P1-31	Fault monitor output (28 V dc = valid, 200 mA max)
P1-26 (-004 thru -007 status only)	Acquisition squitter inhibit (when grounded, this discrete commands the transponder to stop executing the acquisition squitter (DF=11) function).
P1-26 (-008/ -108 status only)	Altitude port A/B high speed select. When ground, the transponder accepts altitude data from altitude ports A and B at a 100 kbps rate. When open, the transponder accepts altitude data from altitude ports A and B at a 12.5 kbps rate.
P1-59	Extended squitter disable discrete input (gnd = transponder must not perform the extended squitter functions but it must continue to perform all required acquisition squitter functions; open = transponder must perform all extended squitter functions as well as all acquisition squitter functions.)
P1-29	Suppression input/output pulse (connected to all other L-band equipment)
P1-25	Suppression shield (this pin is used for proper termination of suppression input/output shield)
P1-16	SPI (remote ident) input (gnd = ident on)
Maintenance specific:	
P2-38 (-004 thru -007 status) P1-19 (-008/-108 status)	Self-test inhibit (gnd = all self-test and squitter functions are inhibited) (for maintenance purposes only)
P2-37, 38 (-008/-108 status)	GPS time tag high and low inputs (respectively). This differential input pair is conditioned on the CPU-I/O card to provided a positive-going pulse to the NMI input of the CPU.
P2-54 (-004 thru -008 status)	Self-test discrete (gnd = enable self-test or diagnostic mode) (for bench test/maintenance purposes only)
P2-54 (-108 status)	ADS-B SIL Designator

Equipment Specifications Cont.
Table 4/Table 34-50-96-99A-036-A01

CHARACTERISTIC	SPECIFICATION
Combination discrete straps: P1-14, P2-41, P2-42,) (-004 thru -007 status only)	P1-14 / P2-41 / P2-42 / Altitude Type Selected open / gnd / gnd — ARINC 429 on ARINC ports A and B open / open / gnd — CSDB on CSDB ports A and B open / gnd / open — ARINC 575 on ARINC ports A and B open / open / open — ARINC 572 (Gillham) on the Gillham parallel port gnd / gnd / gnd — Port A altitude on the selected control bus (either ARINC 429 or CSDB) and port B altitude type ARINC 429 on ARINC port B. gnd / open / gnd — Port A altitude on the selected control bus (either ARINC 429 or CSBB) and port B altitude type CSDB on CSDB port B. gnd / gnd / open — Port A altitude on the selected control bus (either ARINC 429 or CSDB) and port B altitude type ARINC 575 on ARINC port B gnd / open / open — Port A altitude on the selected control bus (either ARINC 429 or CSDB) and port B altitude type Gillham on the Gillham parallel port.
Combination discrete straps: P1-17, P1-28, P2-41, P2-42) (-008/-108 status only)	P2-42 / P2-41 / P1-17 / P1-28 / Configuration Selected See Note 1 / Open / Open — Standard TDR Configuration per -007 and Note 6 See Note 1 / Open / Ground — Standard TDR Configuration with GAMA 429 FMS (ignores label 335) Ground / Open / Ground / Open — Proline 4/21 Concentrated Inputs on FMS/IRS and AIS/ADS Buses. A dual AHS installation is indicated when P2-42 is ground Ground / Ground / Ground / Open — Proline 4/21 Concentrated Inputs on FMS/IRS and AIS/ADS Buses. A ground on P2-41 disables GPS data on the FMS/IRS and AIS/ ADS Buses. GPS data is then accepted only on the GPS and A429 Altitude Port B inputs (P2-29, 30). When P2-41 is open circuit, GPS selection is restricted. A dual AHS installation is indicated when P2-42 is ground Open / Open / Ground / Open — Proline 4/21 Concentrated Inputs on FMS/IRS and AIS/ADS Buses. A tripple installation is indicated with P2-42 open circuit.

Equipment Specifications Cont.
Table 4/Table 34-50-96-99A-036-A01

CHARACTERISTIC	SPECIFICATION
	Open Ground Ground Open Proline 4/21 Concentrated Inputs on FMS/IRS and AIS/ADS Buses. A ground on P2-41 disables GPS data on the FMS/IRS and AIS/ ADS Buses. GPS data is then accepted only on the GPS and A429 Altitude Port B inputs (P2-29, 30). When P2-41 is open circuit, GPS selection is restricted. A tripple installation is indicated with P2-42 open circuit. See Note 1 Ground Ground Reserved for future configuration assignment. Notes: 1. When Config Sel 1 and 0 are '00' or '01', the standard TDR configuration is selected and Altitude Sel 1 or 0 function in the normal manner to select the altitude type provided to the altitude ports. When Config Sel 1 and 0 are '10', concentrated inputs supply data to the transponder. In this configuration, altitude data (labels 203 and 204) is supplied to the transponder via the selected control bus or the concentrated inputs. All other air data parameters are provided on the concentrated buses. The Control/Altitude Select input (P1-14) controls whether the transponder accepts altitude data from the Selected Control Bus or as directed by the Config Sel 0 and 1 discretes. When the configuration discrete inputs indicate that all other altitude data is accepted via the concentrated buses, the altitude select discrete inputs are not needed and can be reassigned to other select functions. No configuration is currently assigned to configuration select input of '11'. This is reserved for a future configuration assignment. 2. Note that configuration discretes P1-17 and P1-28 are logic 1 with the input grounded and logic 0 with the input open circuit. 3. Note that altitude select discretes P2-42 and P2-41 are logic 1 with the input open circuit and logic 0 with the input grounded. 4. The -008 and -108 status TDR-94/94D adds the following capabilities to the standard configuration: •Low/high speed selection of the ARINC 429 Altitude Port A and B inputs. •Acceptance of label 102 via the ARINC 429 Altitude Port A and B inputs. Standard TDR Configuration for the -007 status release is defined in the above row (labelled -004 thru -007 status only) by discrete straps P1-14, P2-41, and P2-42.

Equipment Specifications Cont.
Table 4/Table 34-50-96-99A-036-A01

CHARACTERISTIC	SPECIFICATION
	GAMA Configuration:This configuration is the same as the standard TDR Configuration for the -007 status release, except that the transponder will not accept label 335, since the data contained in this label does not represent track angle rate in the GAMA configuration.
P2-43, P2-44, P2-45	Max airspeed programming (gnd to P2-52) P2-43 P2-44 P2-45 Definition open open open none selected gnd open open 0 to 75 knots open gnd open 75 to 150 knots gnd gnd open 150 to 300 knots open open gnd 300 to 600 knots gnd open gnd 600 to 1200 knots open gnd gnd more than 1200 knots gnd gnd gnd (not defined)
P2-46, P2-47	SDI input (gnd to P2-52) P2-46 P2-47 Definition open open (not used) open gnd side 1 gnd open side 2 gnd gnd (not used)
P2-57, P2-58	Control port select (gnd to P2-52) P2-57 P2-58 Definition gnd open Port A selected (P2-17, P2-18) open open Port B selected (P2-13, P2-14) open gnd Port C selected (P2-21, P2-22) gnd gnd (reserved for internal self-test)

Equipment Specifications Cont.
Table 4/Table 34-50-96-99A-036-A01

<table>
<tr><th>CHARACTERISTIC</th><th>SPECIFICATION</th></tr>
<tr><td>P1-22, P1-21, P1-20, P1-23</td><td>
The configuration of these pins tells the transponder the vehicle type in which it is installed.

Chart 2. Type_X Select Straps (Type Set A)

Aircraft Type Set A (Type_3 (P1-23) = open)
<table>
<tr><th></th><th>Type_2</th><th>Type_1</th><th>Type_0</th><th></th><th></th></tr>
<tr><th>Code</th><th>P1-22</th><th>P1-21</th><th>P1-20</th><th>Meaning</th></tr>
<tr><td>0</td><td>open</td><td>open</td><td>open</td><td>No aircraft type information</td></tr>
<tr><td>1</td><td>open</td><td>open</td><td>gnd</td><td>Small (<12 500 lb)</td></tr>
<tr><td>2</td><td>open</td><td>gnd</td><td>open</td><td>Medium (12 500 to 75 000 lb)</td></tr>
<tr><td>3</td><td>open</td><td>gnd</td><td>gnd</td><td>Large (75 000 to 190 000 lb)</td></tr>
<tr><td>4</td><td>gnd</td><td>open</td><td>open</td><td>Extra large (190 000 to 300 000 lb)</td></tr>
<tr><td>5</td><td>gnd</td><td>open</td><td>gnd</td><td>Heavy (>300 000 lb)</td></tr>
<tr><td>6</td><td>gnd</td><td>gnd</td><td>open</td><td>High performance</td></tr>
<tr><td>7</td><td>gnd</td><td>gnd</td><td>gnd</td><td>Rotor craft</td></tr>
</table>
Chart 3. Type_X Select Straps (Type Set B)

Aircraft Type Set B (Type_3 (P1-23) = gnd)
<table>
<tr><th></th><th>Type_2</th><th>Type_1</th><th>Type_0</th><th></th><th></th></tr>
<tr><th>Code</th><th>P1-22</th><th>P1-21</th><th>P1-20</th><th>Meaning</th></tr>
<tr><td>0</td><td>open</td><td>open</td><td>open</td><td>No aircraft type information</td></tr>
<tr><td>1</td><td>open</td><td>open</td><td>gnd</td><td>Glider/sail plane</td></tr>
<tr><td>2</td><td>open</td><td>gnd</td><td>open</td><td>Lighter-than-air</td></tr>
<tr><td>3</td><td>open</td><td>gnd</td><td>gnd</td><td>Parachutist/skydiver</td></tr>
<tr><td>4</td><td>gnd</td><td>open</td><td>open</td><td>Surface vehicle</td></tr>
<tr><td>5</td><td>gnd</td><td>open</td><td>gnd</td><td>Fixed ground or tethered obstruction</td></tr>
<tr><td>6</td><td>gnd</td><td>gnd</td><td>open</td><td>Unmanned aerial vehicle</td></tr>
<tr><td>7</td><td>gnd</td><td>gnd</td><td>gnd</td><td>Unassigned</td></tr>
</table>
</td></tr>
</table>

Equipment Specifications
Table 4/Table 34-50-96-99A-036-A01

CONDITIONS	DO-160C PARA NO	SPECIFICATION
Temp and Altitude Low Operating Temp High Operating Temp Low Storage Temp High Storage Temp Altitude	4.0 4.5.1 4.5.3 4.5.1 4.5.2 4.6.1	Categories 'A2' and 'E1'. -55 °C (-67 °F) +70 °C (+158 °F) -65 °C (-85 °F) +85 °C (+185 °F) Category 'A2'. Certified for installation in a controlled temperature location in an aircraft where pressures are no lower than an altitude equivalent of 4600 m (15 000 ft) msl. Category 'E1'. Certified for installation in a nonpressurized but noncontrolled temperature location in an aircraft that is operated at altitudes up to 21 300 m (70 000 ft) msl.
Temperature Variation	5.0	Category 'B'. Certified for installation in a controlled or noncontrolled temperature location in the aircraft.
Humidity	6.0	Category 'B'. Certified for a Severe Humidity Environment.
Shock Operational Crash Safety: Impulse Sustained	7.0 7.2 7.3 7.3.1 7.3.2	 Tested at 6 g peak (11 ±2 ms duration, 6 positions) Tested at 15 g, 6 positions Tested at 12 g, 6 positions
Vibration	8.0	Categories C, L, M, and Y Category C: Certified for fuselage mounting in a fixed wing turbojet or turbofan aircraft. Category L: Certified for fuselage mounting in a fixed wing aircraft having multiple reciprocating or turbopropeller engines and a weight over 5700 kg (12 500 lb). Category M: Certified for fuselage mounting in a fixed wing aircraft having multiple, or a single reciprocating or turbopropeller engines and a weight less than 5700 kg (12 500 lb). Category Y: Certified for fuselage mounting in piston or turbojet rotary wing aircraft.
Explosion Proofness	9.0	Category E1: Certified for installation in an environment in which uncovered flammable fluids or vapors exist, either continuously or intermittently.
Waterproofness	10.0	Category X (no test required): Certified for installation in locations not subject to falling water (including condensation), rainwater, or sprayed water.

Environmental Qualifications Form Cont.
Table 5/Table 34-50-96-99A-037-A01

CONDITIONS	DO-160C PARA NO	SPECIFICATION
Fluids Susceptibility	11.0	Category X (no test required): Certified for installation in locations not exposed to fluid contamination from fuel, hydraulic fluids, oil, solvents, etc.
Sand and Dust	12.0	Category X: (no test required): Certified for installation in locations not subject to blowing sand and dust.
Fungus Resistance	13.0	Category F: Fungus test not performed. However, the unit is composed entirely of non-nutrient materials and is therefore classified as Category F.
Salt Spray	14.0	Category X: Certified for installation in locations not subject to a salt atmosphere.
Magnetic Effect	15.0	Category Z: Unit causes a 1° deflection of an uncompensated compass at a distance less than 0.3 m (1.0 ft).
Power Input	16.0	Category Z: Certified for use on aircraft electrical systems not applicable to any other category. For example, a dc system from a variable range generator where a small capacity or no battery is floating on the dc bus.
Voltage Spike	17.0	Category A: Certified for installation in systems where a high degree of voltage spike protection is required.
Audio Frequency Conducted Susceptibility - power inputs	18.0	Category Z: Certified for use on aircraft electrical systems not applicable to any other category. For example, a dc system from a variable range generator where a small capacity or no battery is floating on the dc bus.
Induced Signal Susceptibility	19.0	Category Z: Certified for operation in systems where interference-free operation is required.
RF Susceptibility (radiated and conducted)	20.0	Category R: Certified for operation in systems where bench testing is allowed to meet the high intensity radiated field (HIRF) associated with the normal environment intended for the unit installation.
Emission of RF Energy	21.0	Category Z: Certified for operation in systems where interference-free operation is required.
Lightning Induced Transient Susceptibility	22.0	Category Z3Z3: Certified for installation in a moderate environment, such as the more electromagnetically open areas of an aircraft composed principally of metal (e.g., cockpit).

Environmental Qualifications Form Cont.
Table 5/Table 34-50-96-99A-037-A01

CONDITIONS	DO-160C PARA NO	SPECIFICATION
Lightning Direct Effects	23.0	Category X (no test required): Certified for operation in which lightning effects are insignificant or not applicable.
Icing	24.0	Category X (no test performed): Certified for installation in a location not subject to ice formation.

Environmental Qualifications Form
Table 5/Table 34-50-96-99A-037-A01

TASK 34-50-96-870-804-A01

4. Equipment Description

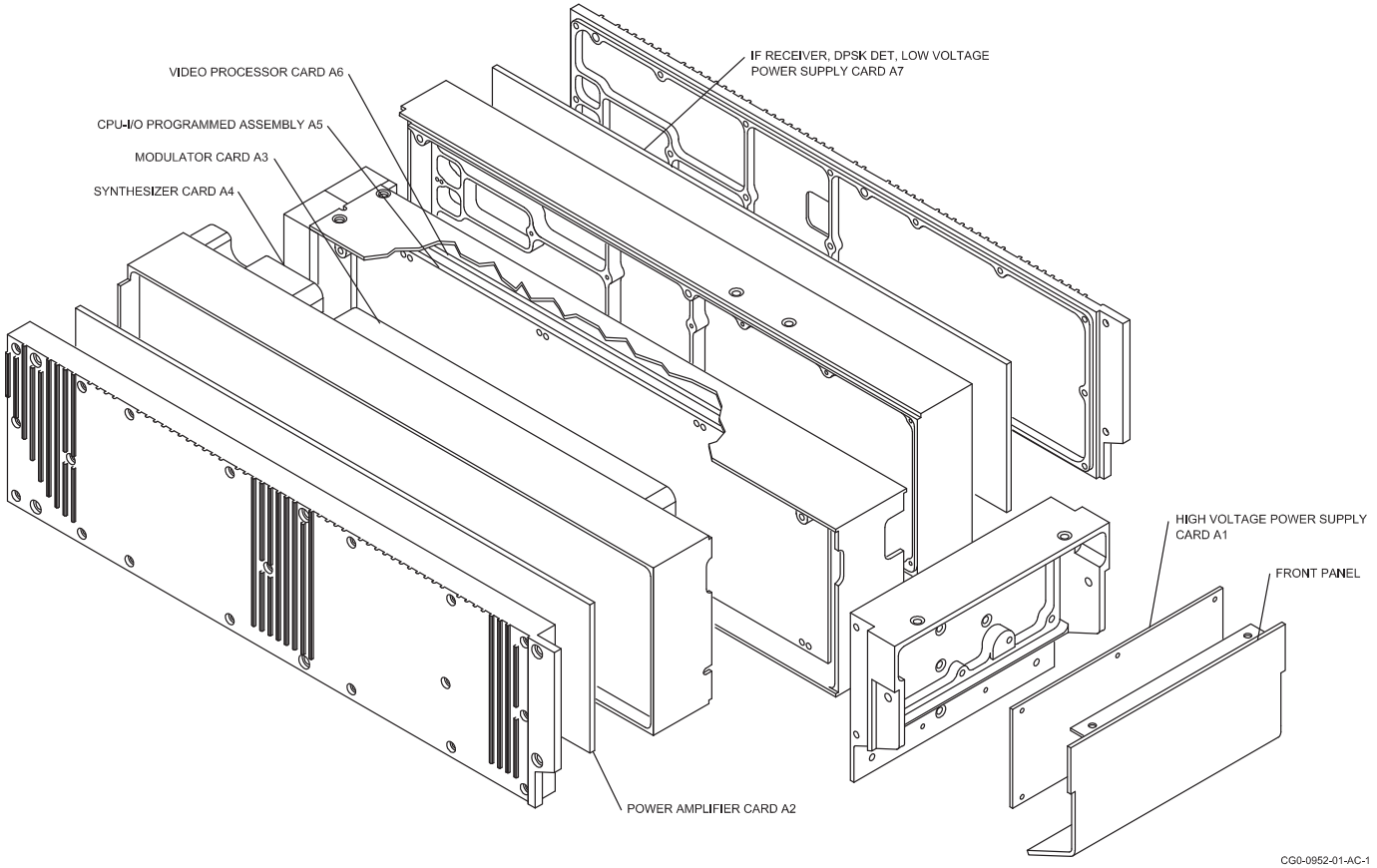
A. Mechanical Description

(1) The TDR-94/94D is a half-ATR short low rack mounted unit. Electrical connections are made through two ThinLine II, 60-pin connectors. Refer to Table 4/Table 34-50-96-99A-036-A01, Equipment Specifications, for additional mount and mating connector information.

(2) Refer to the Collins Pro Line II Comm/Nav/Pulse System Installation Manual, 523-0772719, for mounting and dimensional information.

(3) Figure 2/GRAPHIC 34-50-96-99B-002-A01 lists the three major subassemblies in the TDR-94/94D. The main chassis occupies the center of the unit and includes the high-voltage power supply card A1 at the front, the CPU-I/O card A5, and video processor card A6 assemblies in the center-rear. One of the two main rear connectors is mounted on each of these circuit cards. As viewed from the front, A5 is on the left side, and A6 is on the right.

(4) The two outer subassemblies are the RFPA chassis assembly on the left and the IF receiver chassis assembly on the right. Each of these also contains various circuit card assemblies. These are all illustrated in Figure 2/GRAPHIC 34-50-96-99B-002-A01. Table 6/Table 34-50-96-99A-004-A01 also gives listings showing the top level configuration as well as the configurations of each of these major subassemblies.



Assembly Identification Diagram
Figure 2/GRAPHIC 34-50-96-99B-002-A01

TDR-94 Top Level, Configuration Matrix				
TDR-94 622-9352-	REV	MAIN CHASSIS CPN 653-2254-	RFPA CHASSIS CPN 653-2255-	IF/RCVR/DPSK/ LVPS CHASSIS CPN 653-2256-
004	V (SB 13)	012	004	005
004	W (SB 14)	016	004	005
004	AC	016	005	005
004	AT	016	005	006
005	AE (SB17)	018	005	005
005	AT	018	005	006
006	AG	020	005	005
006	AH	022	005	005
006	AT	022	005	006
007	AL	024	005	005
007	AT	024	005	006
008	AR	026	005	006
108	AR	028	005	006
207	BF	030	005	006
308	BJ	032	005	006
408	BJ	034	005	006
309	BM	036	005	006
409	BM	038	005	006
310	BW	040	005	006
410	BW	042	005	006

Assembly Identification Tables Cont.
Table 6/Table 34-50-96-99A-004-A01

TDR-94D Top Level, Configuration Matrix				
TDR-94D 622-9210-	REV	MAIN CHASSIS CPN 653-2254-	RFPA CHASSIS CPN 653-2255-	IF/RCVR/DPSK/ LVPS CHASSIS CPN 653-2256-
004	U (SB13)	011	001	005
004	V (SB 14)	015	001	005
004	AB	015	003	005
004	AK	015	006	005
004	AV	015	006	006
005	AD (SB17)	017	003	005
005	AK	017	006	005
005	AV	017	006	006
006	AG	019	003	005
006	AJ	021	003	005
006	AK	021	006	005
006	AV	021	006	006
007	AN	023	006	005
007	AV	023	006	006
008	AU	025	006	006
108	AU	027	006	006
207	BF	029	006	006
308	BJ	031	006	006
408	BJ	033	006	006
309	BM	035	006	006
409	BM	037	006	006
310	BW	039	006	006
410	BW	041	006	006

Assembly Identification Tables Cont.
Table 6/Table 34-50-96-99A-004-A01

Main Chassis Assembly (With SB 13 and SB 14 Installed), Configuration Matrix.						
MAIN CHASSIS CPN 653-2254-	REV	HVPS CCA A1 CPN 687-0721-	VIDEO PROC CCA A6		CPU-I/O PROG ASSY A5	
			CPN 687-0726-	CPN 983-8019-		CPN 653-3674-
011 (-94D)	AA	002	005			001
015 (-94D)	-	002	004			003
015 (-94D)	B	002	005			003
015 (-94D)	F	003	005			003
015 (-94D)	J	003	006			003
017 (-94D)	-	002	005			005
017 (-94D)	C	003	005			005
017 (-94D)	F	003	006			005
019 (-94D)	-	003	005			007
019 (-94D)	C	003	006			007
021 (-94D)	-	003	005			009
021 (-94D)	B	003	005			011
021 (-94D)	E	003	006			011
023 (-94D)	-	003	005			013
023 (-94D)	B	003	006			013
025 (-94D)	-	003	006			015
025 (-94D)	A	003		001		015
027 (-94D)	-	003	006			015
027 (-94D)	A	003	006			017
029 (-94D)	-	003	006			019
029 (-94D)	A	003	006			019
031 (-94D)	-	003		001		021
033 (-94D)	-	003	006			021
035 (-94D)	-	003		001		023
037 (-94D)	-	003	006			023
039 (-94D)	-	003		001		025
041 (-94D)	-	003	007			025

Assembly Identification Tables Cont.
Table 6/Table 34-50-96-99A-004-A01

Main Chassis Assembly (With SB 13 and SB 14 Installed), Configuration Matrix. (Cont.)						
MAIN CHASSIS CPN 653-2254-	REV	HVPS CCA A1 CPN 687-0721-	VIDEO PROC CCA A6		CPU-I/O PROG ASSY A5	
			CPN 687-0726-	CPN 983-8019-		CPN 653-3674
012 (-94)	-	002	005			002
016 (-94)	-	002	004			004
016 (-94)	B	002	005			004
016 (-94)	E	003	005			004
016 (-94)	H	003	006			004
018 (-94)	-	002	005			006
018 (-94)	B	003	005			006
018 (-94)	E	003	006			006
020 (-94)	-	003	005			008
020 (-94)	D	003	006			008
022 (-94)	-	003	005			010
022 (-94)	B	003	005			012
022 (-94)	E	003	006			012
024 (-94)	-	003	005			014
024 (-94)	B	003	006			014
026 (-94)	-	003		001		016
028 (-94)	-	003	006			016
028 (-94)	A	003	006			018
030 (-94)	-	003	006			020
030 (-94)	A	003	006			020
032 (-94)	-	003		001		022
034 (-94)	-	003	006			022
036 (-94)	-	003		001		024
038 (-94)	-	003	006			024
040 (-94)	-	003		001		026
042 (-94)	-	003	007			026

Assembly Identification Tables Cont.
Table 6/Table 34-50-96-99A-004-A01

Programmed Assembly, Configuration Matrix			
CPU-I/O PROGRAMMED ASSEMBLY A5 CPN 653-3674-	REV	PROGRAMMED ASSEMBLY CPN 831-6270-	CPU-I/O CCA A5A1 CPN 828-2700-
001	-		002
002	-		002
003	-		002
004	-		002
005	-		002
006	-		002
007	-	007	002
008	-	007	002
009	-	008	002
010	-	008	002
011	-	009	002
012	-	009	002
013	-	010	002
014	-	010	002
015	-		003
015	B	108	003
016	-		003
016	B	108	003
017	-		003
017	A	109	003
018	-		003
018	A	109	003
019	-	011	002
019	A	011	002
020	-	011	002
020	A	011	002
021	-	110	003
022	-	110	003

Assembly Identification Tables Cont.
Table 6/Table 34-50-96-99A-004-A01

Programmed Assembly, Configuration Matrix (Cont.)			
CPU-I/O PROGRAMMED ASSEMBLY A5 CPN 653-3674-	REV	PROGRAMMED ASSEMBLY CPN 831-6270-	CPU-I/O CCA A5A1 CPN 828-2700-
023	-	111	003
024	-	111	003
025	-	112	004
026	-	112	004

RFPA Chassis Assembly, Configuration Matrix				
RFPA CHASSIS ASSEMBLY CPN 653-2255-	REV	SYNTHESIZER CCA A4 CPN 687-0724-	MODULATOR CCA A3 CPN 687-0723-	POWER AMPLIFIER CCA A2 CPN 687-0722-
001	V	002	004	003
001	AD	002	005	003
001	AE	003	005	003
003	W	002	004	004
003	AE	003	004	004
004	Y	002	004	003
004	AE	003	004	003
005	Y	002	004	004
005	AD	002	005	004
005	AE	003	005	004
006	AC	002	005	004
006	AE	003	005	004
005	AK	003	005	004 or 006
006	AK	003	005	004 or 006

Assembly Identification Tables Cont.
Table 6/Table 34-50-96-99A-004-A01

IF Receiver Chassis Assembly, Configuration Matrix		
IF RECEIVER CHASSIS 653-2256-	 REV	IF RCVR/LVPS CCA A7 CPN 687-0727-
005	P	004
006	W	005

Assembly Identification Tables
Table 6/Table 34-50-96-99A-004-A01

B. Electrical Description

(1) Refer to Table 4/Table 34-50-96-99A-036-A01, Equipment Specifications, for detailed listing and descriptions of all input/output signals used in the TDR-94/94D Transponder.

C. Controls and Indicators

(1) Refer to the system pilot's guide or operation section of the system installation manual for complete descriptions of indicators and displays.

TASK 34-50-96-870-805-A01
5. Installation Data

A. Refer to the TDR-94/94D Installation Section in the Pro Line II Comm/Nav/Pulse System Installation Manual for installation information relative to the TDR-94/94D Mode S Transponder.

TASK 34-50-96-870-806-A01
6. System Theory of Operation

SUBTASK 34-50-96-870-001-A01
A. Introduction

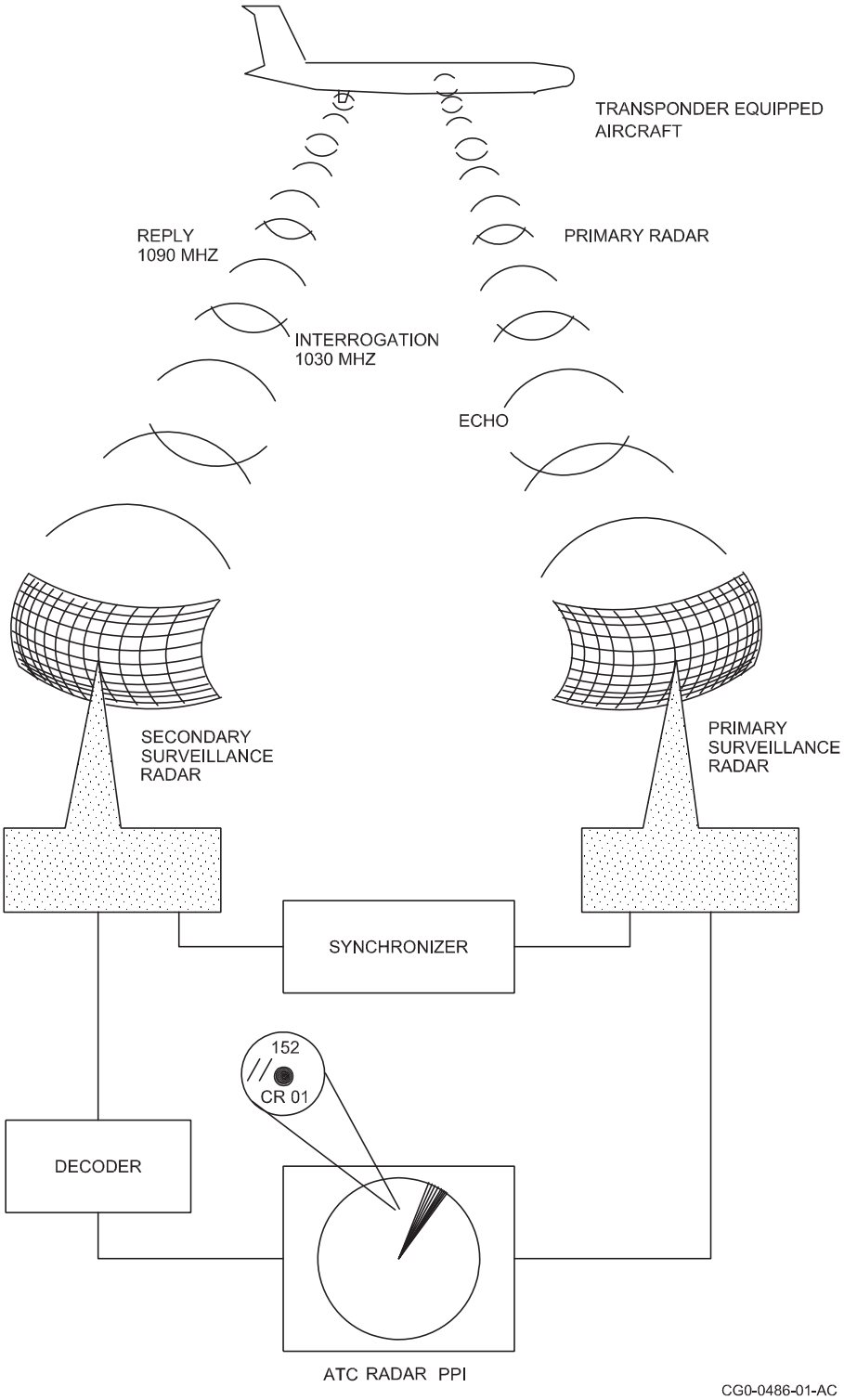
(1) The air traffic control radar beacon system (ATCRBS) is a surveillance system in wide use to locate and identify airplanes within an airspace. However, because of increasing air traffic, this system is expanding to include additional facilities for airborne collision avoidance. To gain a good understanding of Mode S transponder operation, it is necessary to understand the operation of the existing air traffic control (ATC) system.

(2) If this is your first contact with the ATCRBS and related equipment, this paragraph will give you an overall description of the present ATCRBS and then expand that understanding into the new Mode S system.

SUBTASK 34-50-96-870-002-A01
B. Radar Systems

(1) Refer to Figure 3/GRAPHIC 34-50-96-99B-070-A01. The ATCRBS consists of a primary surveillance radar (PSR) and a secondary surveillance radar (SSR). The large rotating radar antenna that can be seen at or near most air terminals is that of the PSR. This system uses conventional radar to locate all airplanes within its range in terms of range and azimuth. It transmits a burst of energy and then measures the time to an echo. The time thus measured is converted into range (refer to the note below for additional information). The direction the antenna is pointing at the time of echo detection establishes the azimuth to the reflecting target. This target information is displayed Figure 3/GRAPHIC 34-50-96-99B-070-A01 on the air traffic controller's PPI (Plan Position Indicator).

NOTE: The time is easily converted into range. The mathematical formula for distance is: D = velocity x time. The propagation velocity of radio energy is usually expressed as 12.359 µs / radar mile.



ATCRBS, PSR and SSR System
Figure 3/GRAPHIC 34-50-96-99B-070-A01

SUBTASK 34-50-96-870-003-A01
C. ATCRBS Operation

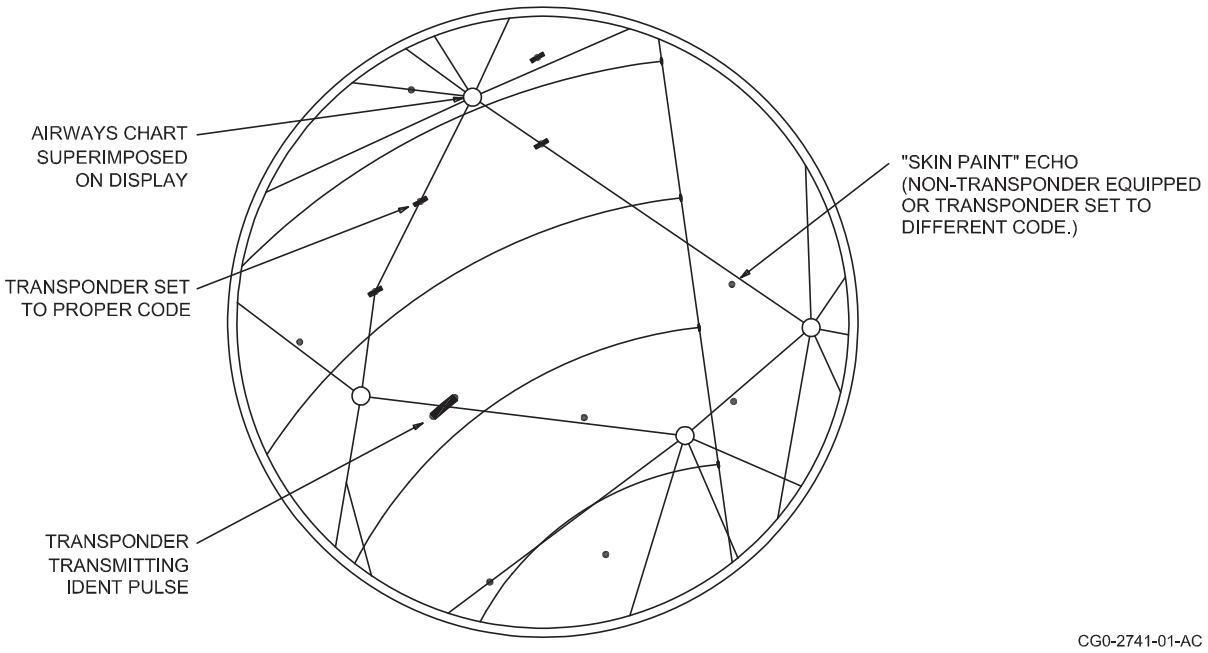
(1) ATCRBS Interrogation Modes

(a) The SSR system interrogates the airplane transponder for airplane identity and altitude. The interrogations are in the form of two modes: mode A for airplane identity and mode C which is used to request altitude information (refer to the note below for additional information).

NOTE: In the original definition of ATC modes, two other modes were defined; mode B and mode D. These also differ only in pulse spacing with mode B pulses spaced 17 µs, and mode D pulses spaced 25 µs. Mode D was widely used in Great Britain but recently the aviation industry has settled on mode A for ATCRBS operation and mode C for altitude reporting. Modes B and D have been largely abandoned.

The US Military uses a system similar to ATCRBS. It is known as IFF (Identification - Friend or Foe). As this name implies, it is concerned primarily with mission security. Three modes are defined; modes 1, 2, and 3. Mode 3 is common to the civil mode A with a pulse spacing of 8 µs. This allows air traffic control visibility of all airplanes, both civil and military.

(b) All pulses are 0.8 µs wide. The interrogations from the ground station are at a frequency of 1030 MHz. The transponder replies at a frequency of 1090 MHz. The received signal from the airborne transponder is decoded by the ground system and displayed on the ATC radar screen (see Figure 4/GRAPHIC 34-50-96-99B-071-A01). The replies produce either a single or double slash target display on the controller screen. The controller can also elect to display the airplane identification number (as selected by the aircrew) and altitude.



Air Traffic Presentation on the ATC Radarscope
Figure 4/GRAPHIC 34-50-96-99B-071-A01

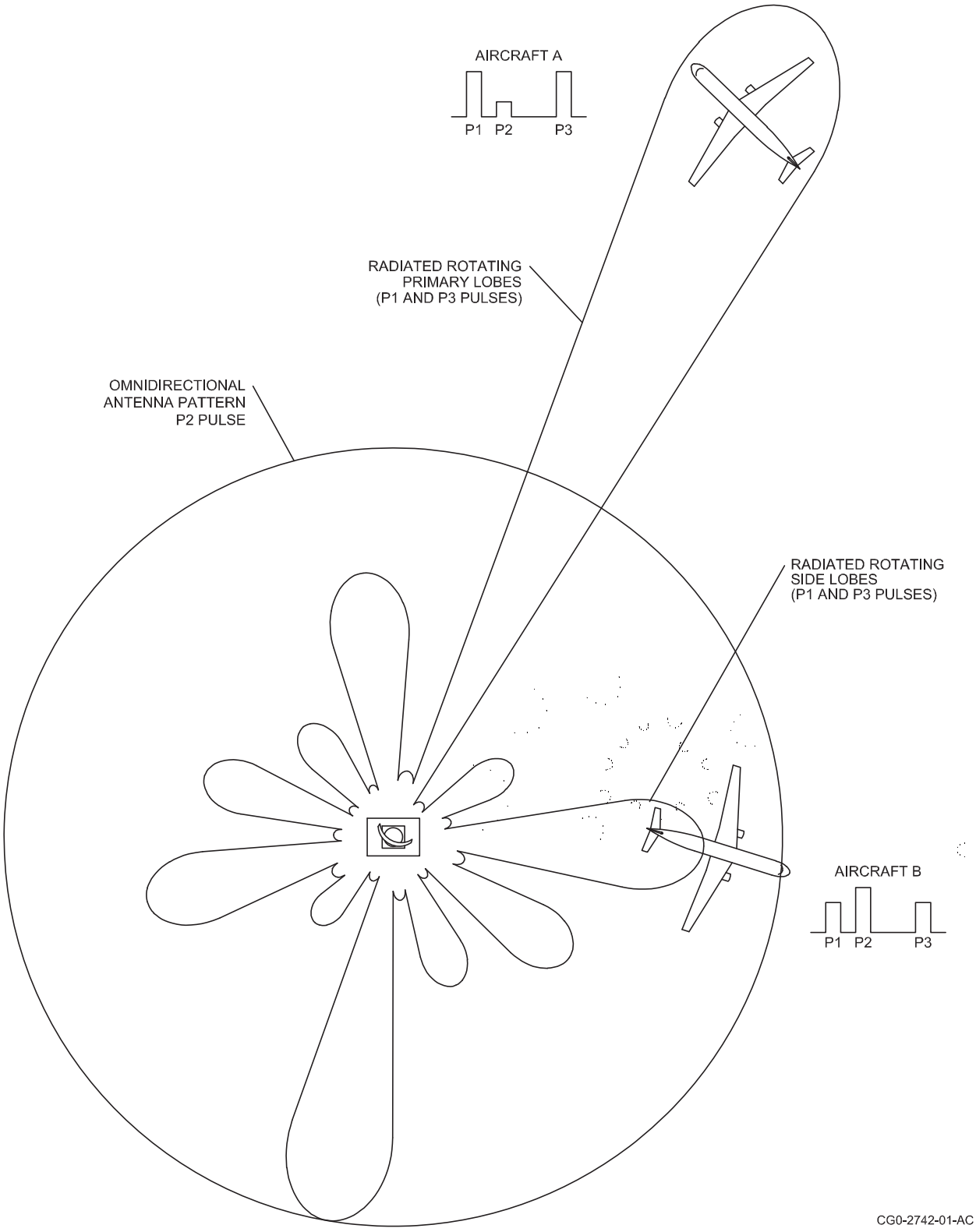
(2) SSR System Interrogation Description

(a) Refer to Figure 5/GRAPHIC 34-50-96-99B-072-A01 and Figure 6/GRAPHIC 34-50-96-99B-073-A01. The SSR uses a rotating directional antenna to transmit two pulses which are identified as P1 and P3. The spacing of these pulses determines the mode. In mode A the pulses are spaced 8 µs while in mode C the pulses are spaced 21 µs. The SSR also uses an omnidirectional antenna to transmit a third pulse designated P2. This pulse is transmitted 2 µs after the P1 pulse and provides a reference for side lobe suppression (SLS). The amplitude of the P2 pulse is about the same as the peak side lobe of the directional antenna. Typically, this is about 18 dB below the peak of the directional (main) beam.

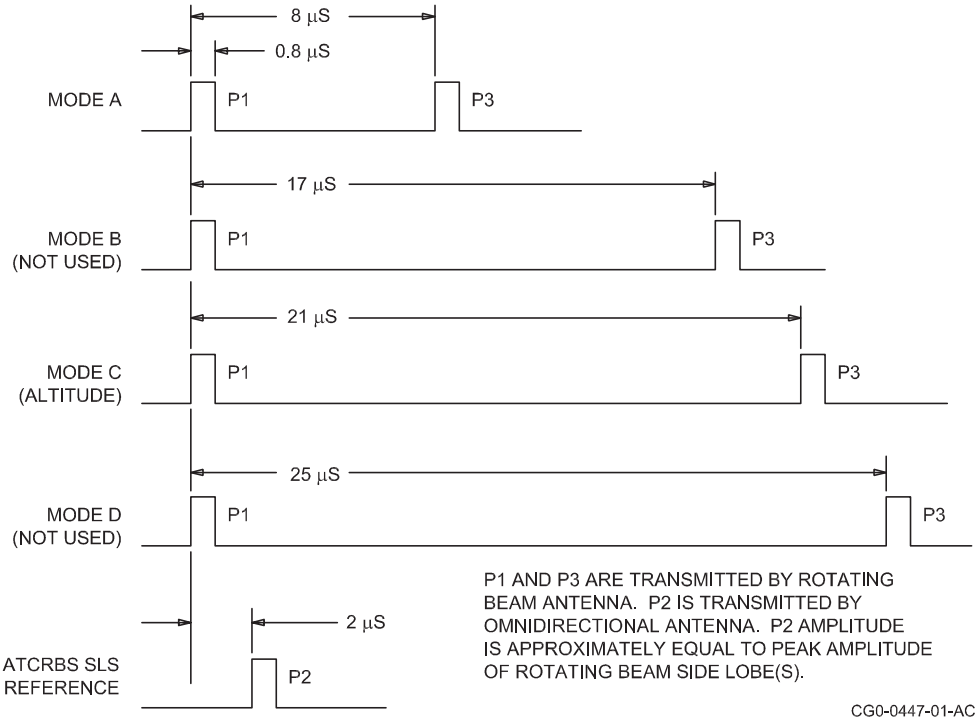
(b) Refer to Figure 5/GRAPHIC 34-50-96-99B-072-A01. Notice the two airplanes on the drawing. Airplane A is shown within the main lobe of the directional antenna. The amplitude of the P1 and P3 pulses will be substantially greater here than the P2 pulse radiated from the omnidirectional antenna. Therefore, the transponder in this airplane will interpret this interrogation as valid.

(c) Airplane B, however, is outside the main lobe and within one of the side lobes. The P1 and P3 pulses detected here will be the result of side lobe radiation. Recall that the P2 pulse is transmitted by an omnidirectional antenna and is about

equal in amplitude to that of the peak side lobe. Therefore, the P2 pulse detected by airplane B will be at least as great in amplitude as the P1/P3 pulses. The transponder in airplane B will detect this relationship in pulses and discard the interrogation as invalid, because the P2 pulse is not substantially less than the P1/P3 pulses. As a further safeguard against replies to late-arriving echoes to this invalid interrogation, the transponder suppresses replies to all interrogations for an additional 25 to 45 µs. In addition, the receiver is desensitized for reception of P1/P3 pulses. The rationale here is that if the side lobes are detectable, then the main lobe must be much greater.



ATCRBS, SSR Antenna Radiation Pattern
Figure 5/GRAPHIC 34-50-96-99B-072-A01



ATCRBS Interrogator Pulse
Figure 6/GRAPHIC 34-50-96-99B-073-A01

(3) ATC Transponder Replies

(a) As mentioned earlier, the most common transponder modes are mode A and mode C. Mode A provides ident (identification) information, while mode C provides altitude data. The reply formats are very similar, differing only in pulse spacing (delay).

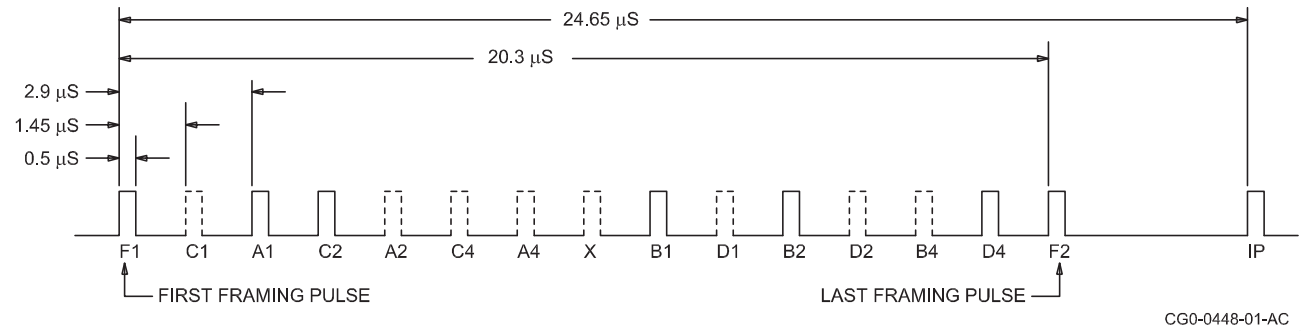
(b) The ATCRBS mode A transponder reply signal is shown in Figure 7/GRAPHIC 34-50-96-99B-074-A01. Notice that the signal can consist of from 2 to 16 pulses. The two framing pulses F1 and F2 are always present and spaced 20.3 µs. An identification pulse may be transmitted 4.35 µs after the last framing pulse F2. The intervening pulses, A1 through D4, make up the coded reply. The X pulse is not used. The coded reply consists of twelve pulses; four groupings of three pulses each. These groupings give four digits of octal data. The digits are formed by the sum of the pulse (bit) values; 1, 2, or 4, which can produce a digit value from 0 through 7. The A group (A1, A2, and A4) makes up the first digit, the B group makes up the second digit, etc. (On the figure, a pulse outlined with a solid line indicates that the pulse is present. A pulse outlined with dashed lines indicates the position for that pulse when it is present.) The pulse configuration on the figure indicates a reply code 1324. The first digit, 1, is formed by the presence of only the A1 pulse. The second digit, 3, is formed by the presence of B1 and B2 (1 + 2 = 3). A digit 7 is formed when all three pulses of the group are present (1 + 2 + 4 =

7). Therefore, a reply sequence with all pulses present constitutes a code 7777. The X pulse is not defined in ATCRBS replies. This combination of four digits, each ranging from 0 through 7, makes 4096 (212) different codes possible which explains the label 4096 code.

(c) The ATCRBS mode C transponder reply consists of the same framing pulses F1 and F2 but spaced 21 µs. The intervening pulses, A1 through D4 (except for D1), make up the coded reply. The coding scheme is defined by ARINC 572, commonly referred to as the Gillham code, and provides encoded altitude data in the range of -1000 to 127 000 feet, to the nearest 100 feet. Recall that in mode A the individual bits assume a binary value which combines into four, three-bit groups, each group forming an octal digit. In mode C the individual pulses are combined into three groups. The A, B, and D (except for bit D1) pulses are grouped into two four-bit groups to encode the altitude to the nearest 500 feet. The C pulses provide the 100-feet deviation (above or below) from the 500-feet level. The mode C encoding scheme is described in Figure 8/GRAPHIC 34-50-96-99B-075-A01. Notice that the bit pattern does not follow a conventional binary progression. This scheme was designed to provide a sequence in which only one bit changes at a time as the altitude increases or decreases.

(d) The upper part of the table consists of a matrix of numbers arranged into rows and columns. These numbers can be referred to as segment numbers. To find the altitude to the nearest 500 feet, represented by a given bit pattern, you must first find the segment that corresponds to that bit sequence. Multiply the segment number by 500 and subtract 1000 (or subtract 2 from the segment number and then multiply by 500).

(e) The 100-feet altitude is not as easy. To determine the 100-feet level, it is first necessary to decide whether the 500-feet segment is odd or even. Knowing that, you add or subtract 0, 100, or 200 feet to or from the 500-feet level depending on the C bit sequence as shown in the lower portion of the table.



Transponder 4096 Reply Code, Signal Format
Figure 7/GRAPHIC 34-50-96-99B-074-A01

D_2, D_4, A_1, A_2	A_4, B_1, B_2, B_4															
	0000	0001	0011	0010	0110	0111	0101	0100	1100	1101	1111	1110	1010	1011	1001	1000
0000	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0001	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
0011	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
0010	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
0110	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
0111	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
0101	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111
0100	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112
1100	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143
1101	159	158	157	156	155	154	153	152	151	150	149	148	147	146	145	144
1111	160	161	162	163	164	165	166	167	168	169	170	171	171	173	174	175
1110	191	190	189	188	187	186	185	184	183	182	181	180	179	178	177	176
1010	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207
1011	223	222	221	220	219	218	217	216	215	214	213	212	211	210	209	208
1001	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239
1000	255	254	253	252	251	250	249	248	247	246	245	244	243	242	241	240

256 segments, at 500 - feet intervals, from - 1000 feet to 127,000 feet.

100 - feet bits			100 - feet value if 500 - feet segment is:	
C_1	C_2	C_4	Odd	Even
0	0	1	7 (+200)	8 (-200)
0	1	1	6 (+100)	9 (-100)
0	1	0	5 (00)	0 (00)
1	1	0	4 (-100)	1 (+100)
1	0	0	3 (-200)	2 (+200)

It is important to note that this scheme has no provision for C_1 , C_2 , and C_4 , bit patterns 000, 111, or 101.

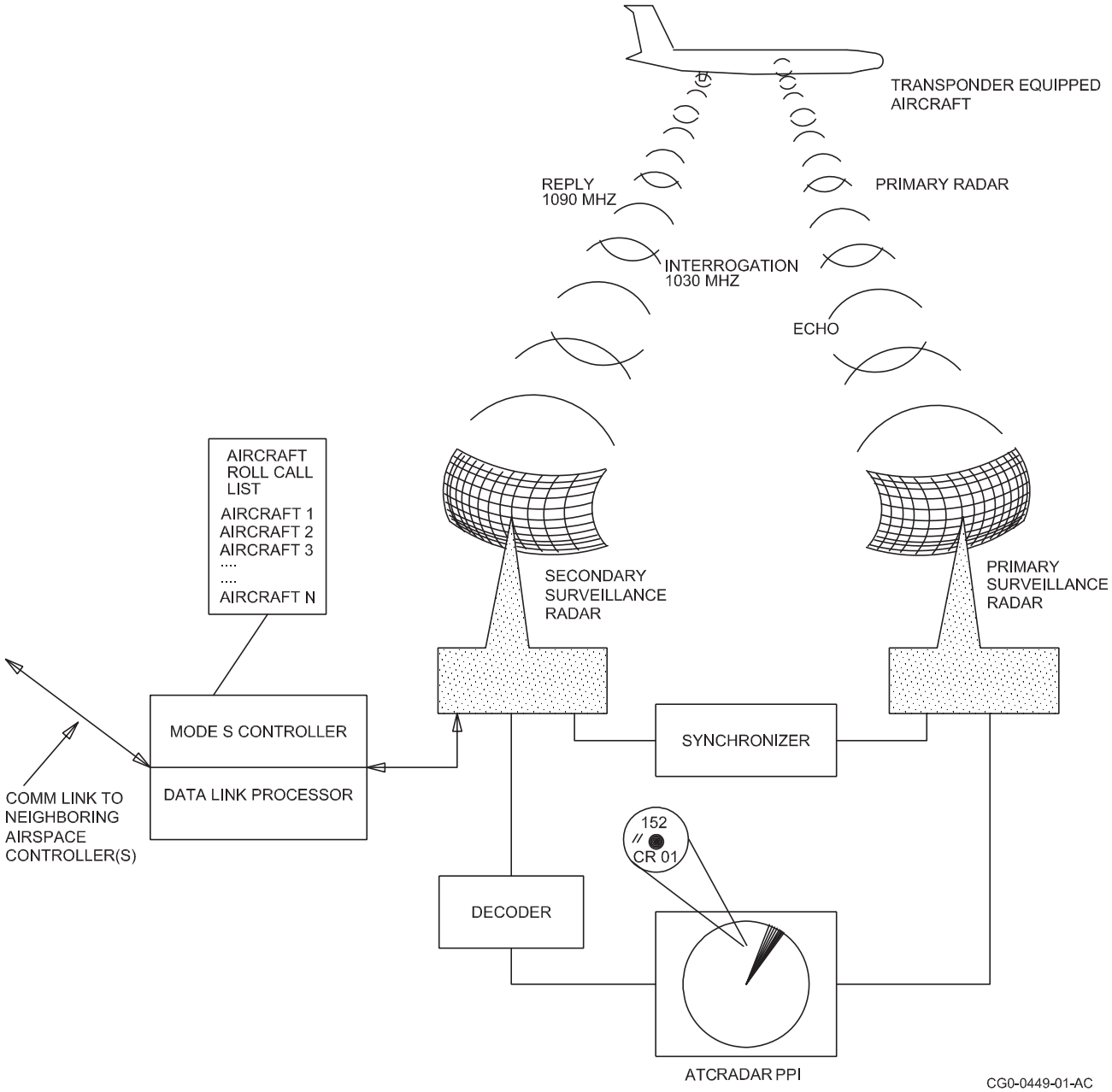
TPH6598_01

Gillham Altitude, ARINC 572, Encoding Scheme
Figure 8/GRAPHIC 34-50-96-99B-075-A01

SUBTASK 34-50-96-870-004-A01
D. ATCRBS with Mode S

(1) Introduction

(a) Refer to Figure 9/GRAPHIC 34-50-96-99B-076-A01. Mode S substantially enhances the capability of the ATCRBS by adding data link and select interrogation features. The data link capability includes air to air information exchange, ground to air (data uplink or Comm A), air to ground (data downlink or Comm B), and multisite (ground station-to-ground station) message protocol. The mode S transponder can also function as part of an airborne separation assurance (ASA) system when interfaced with a Traffic alert and Collision Avoidance System (TCAS).



Mode S, PSR and SSR System
Figure 9/GRAPHIC 34-50-96-99B-076-A01

(2) Mode S Interrogation Modes

(a) Eight different formats of interrogation are used in mode S. These eight can be summarized as three basic types. These are shown in Figure 10/GRAPHIC 34-50-96-99B-077-A01 and Figure 11/GRAPHIC 34-50-96-99B-078-A01. Table 7/Table 34-50-96-99A-038-A01 is a summary of all eight. The three basic types are as follows:

1 Universal ATCRBS All Call
This interrogation is in the form of P1, P3, and an 0.8 µs P4 pulse. This interrogation is recognized by all non mode S transponders in the airspace. ATCRBS transponders reply as usual with the 4096 identification code for mode A interrogations and altitude data for mode C. Mode S transponders do not react to this interrogation.

2 Mode S Only All Call
The second type is the same as the previous universal ATCRBS All Call interrogation except that the P4 pulse is 1.6 µs long. This interrogation is recognized only by mode S transponders. However, mode S transponders may suppress replies if in the lockout condition. Mode S transponders in lockout reply only to the select address interrogation.

3 Mode S (Select) Interrogation
The third interrogation type is directed to a specific Mode-S equipped airplane. This interrogation is in the form of P1, P2, and P6. The presence of the P2 pulse at the normal ATCRBS SLS location effectively suppresses the non mode S transponder reply.

(b) This variety of interrogation capability gives the ground controller the flexibility of addressing airplanes of immediate interest, as opposed to processing replies from every airplane in the area.

(c) All of the Mode-S uplink or interrogation message formats are summarized in Table 7/Table 34-50-96-99A-038-A01. The fields are described in the following paragraphs. These descriptions mirror Document RTCA/DO 181 with minor changes to clarify the text.

1 Address/Parity (AP)
The 24 bit AP field contains the parity overlaid on the address. The field appears at the end of all transmissions for uplink interrogations and downlink replies, except for Downlink Format (DF) number 11.

2 Acquisition Special (AQ)
The 1 bit AQ field designates uplink format (UF) numbers 0 and 16 as acquisition transmissions and repeats as received by the transponder in DF numbers 0 and 16.

3 Comm B Data Selector (BDS)
This 8 bit BDS field in UF number 1 contains the identity of the ground-initiated Comm B register whose contents appear in the MV field of the corresponding reply.

4 Designator Identification (DI)
The 3 bit DI field identifies the coding within the special designator (SD) field in UF numbers 4, 5, 20, and 21. The codes are defined as follows:

DI	DEFINITION
0	SD contains Interrogator Identification (IIS) information. IIS data is basically the same as the II field except that it appears as a subfield in multisite data protocol.
1	SD contains multisite information
2	SD contains extended squitter control information
3-6	(not assigned)
7	SD contains extended data readout requests

5 Interrogator Identification (II)
The 4 bit II field identifies the interrogator and appears in UF number 11 (Mode S only all call).

6 Message, Comm A (MA)
The 56 bit MA field contains messages directed to the airplane during Comm A interrogations (UF numbers 20 and 21).

7 Message, Comm C (MC)
The 80 bit MC field contains one of a sequence of segments transmitted to the transponder in the extended length message (ELM) (112 bits) using UF number 24.

8 Message, Comm U (MU)
The 56 bit MU field contains information used in air to air message exchanges and is part of the long special surveillance interrogation using UF number 16. This message field does not use the Comm A protocol.

9 Number of C Segment (NC)
The 4 bit NC field provides the number of a segment transmitted in an uplink ELM message and is part of the Comm C interrogation using UF number 24.

10 Protocol (PC)
The 3 bit PC field contains operating commands to the transponder and is part of surveillance and Comm-A interrogations using UF numbers 4, 5, 20, and 21. The codes used in this field are as follows:

PC	DESCRIPTION
0	No changes in transponder state
1	Nonselective all call lockout
2 - 3	(not assigned)
4	Close out B
5	Close out C
6	Close out D
7	(not assigned)

11 Probability of Reply (PR)
The 4 bit PR field contains commands to the transponder to specify the reply probability to the mode S only all call interrogation, UF number 11. A command to disregard any lockout state can also be given. The assigned codes are as follows:

PR	DESCRIPTION
0	Reply with probability = 1
1	Reply with probability = 1/2
2	Reply with probability = 1/4
3	Reply with probability = 1/8
4	Reply with probability = 1/16
5 -7	Do not reply
8	Disregard lockout, reply with probability = 1
9	Disregard lockout, reply with probability = 1/2
10	Disregard lockout, reply with probability = 1/4
11	Disregard lockout, reply with probability = 1/8
12	Disregard lockout, reply with probability = 1/16
13 -15	Do not reply

After receiving a mode S only all call containing a PR code other than 0 or 8, the transponder will execute a random process and make a reply decision, for this interrogation, in accordance with the command probability. Random occurrence of replies enables the interrogator to acquire closely-spaced airplanes whose replies would otherwise synchronously garble each other.

12 Reply Control (RC)
The 2 bit RC field designates the transmitted segment as initial (0), intermediate (1), or final (3). An RC field (3) is used to request a Comm D downlink action by the transponder. RC is part of the Comm C interrogation, UF number 24.

13 Reply Length (RL)
The 1 bit RL field commands a reply in DF number 0 if the bit is logic 0, and a reply in DF number 16 if the bit is logic 1.

14 Reply Request (RR)
The 5 bit RR field contains the length and content of the reply

requested by the interrogators. The RR field is part of the surveillance and Comm A interrogations using UF numbers 4, 5, 20, and 21. The codes used in the RR field are described as follows:

RR	REPLY LENGTH	MB CONTENT
0 - 15	short	----------
16	long	Air-initiated Comm B
17	long	Extended capability
18	long	Flight ID
19	long	TCAS resolution advisory report
20 - 31	long	Not assigned

If the first bit of the RR code is logic 1, then the decimal equivalent of the last four bits designates the requested source.

15 Special Designator (SD)
The 16 bit SD field contains control codes affecting the transponder protocol and is part of surveillance and Comm A interrogations using UF numbers 4, 5, 20, and 21. The content is specified by the DI field. A 4-bit IIS subfield is within all SD fields of UF numbers 4, 5, 20, and 21 if the DI code is 0, 1, or 7. The IIS is used to specify the interrogator identifier.

16 Uplink Format (UF)
UF is a general term referring to the first field in all uplink formats and is the transmission descriptor in all interrogations. UF refers to all messages described in Table 7/Table 34-50-96-99A-038-A01.

FORMAT NUMBER	UPLINK BIT FORMAT								
HEX/ DEC	UF	SHORT MESSAGE STRUCTURE							MESSAGE TYPE
0 / 0	0 0000	−3−	RL: 1	−4−	AQ: 1	BDS: 8	−10−	AP: 24	SHORT SPECIAL (Air-Air) SURVEILLANCE
1 / 1	0 0001	Length, content, and structure undefined						AP: 24	NOT PRESENTLY DEFINED OR NOT USED
2 / 2	0 0010							AP: 24	
3 / 3	0 0011							AP: 24	
4 / 4	0 0100	PC: 3	RR: 5	DI: 3	SD: 16			AP: 24	SURVEILLANCE, ALTITUDE REQUEST

Mode S, Interrogation Code Summary Cont.
Table 7/Table 34-50-96-99A-038-A01

FORMAT NUMBER	UPLINK BIT FORMAT							
5 / 5	0 0101	PC: 3	RR: 5	DI: 3	SD: 16		AP: 24	SURVEILLANCE, IDENTITY REQUEST
6 / 6	0 0110	Length, content, and structure undefined					AP: 24	NOT PRESENTLY DEFINED OR NOT USED
7 / 7	0 0111						AP: 24	
8 / 8	0 1000						AP: 24	
9 / 9	0 1001						AP: 24	
A / 10	0 1010						AP: 24	
B / 11	0 1011	PR: 4	II: 4	−19 (ALL ONES)−			AP: 24	MODE S ONLY, ALL-CALL
C / 12	0 1100	Length, content, and structure undefined					AP: 24	NOT PRESENTLY DEFINED OR NOT USED
D / 13	0 1101						AP: 24	
E / 14	0 1110						AP: 24	
F / 15	0 1111						AP: 24	

LEGEND: XX: M designates a field containing M bits, −N− denotes free space with N available bits.

FIELD DESIGNATORS:

AP = Address/Parity	II = Interrogator Identification	RR = Reply Request
AQ = Acquisition Special	PC = Protocol	SD = Special Designator
BDS = Comm-B Data Selector	PR = Probability of Reply	UF = Uplink Format
DI = Designator Identification	RL = Reply Length	

HEX/ DEC	UF	LONG MESSAGE STRUCTURE							MESSAGE TYPE
01/ 16	1 0000	−3−	RL: 1	−4−	AQ: 1	-18-	MU-56	AP: 24	LONG SPECIAL SURVEILLANCE
11/ 17	1 0001	Length, content, and structure undefined						AP: 24	NOT DEFINED OR NOT USED
12/ 18	1 0010							AP: 24	
13/ 19	1 0011							AP: 24	
14/ 20	1 0100	PC: 3	RR: 5	DI: 3	SD: 16	MA: 56		AP: 24	COMM-A, ALTITUDE REQUEST
15/ 21	1 0101	PC: 3	RR: 5	DI: 3	SD: 16	MA: 56		AP: 24	COMM-A, IDENTITY REQUEST

Mode S, Interrogation Code Summary Cont.
Table 7/Table 34-50-96-99A-038-A01

FORMAT NUMBER	UPLINK BIT FORMAT					
16/ 22	1 0110	Length, content, and structure undefined			P: 24	NOT PRESENTLY DEFINED OR NOT USED
17/ 23	1 0111				P: 24	
18/ 24 (see note)	11	RC: 2	NC: 4	MC: 80	AP: 24	COMM-C, EXTENDED LENGTH MESSAGE

LEGEND:
XX: M designates a field containing M bits, −N− denotes free space with N available bits.

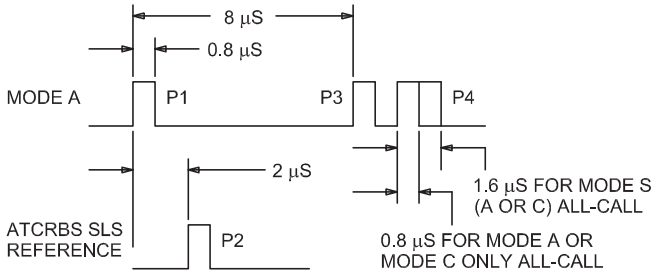
NOTE:
Format number 18 / 24 is defined as the beginning with "11" in the first two bit positions while the following three bits vary with the interrogation content; i.e., two bits are the C field and the remaining bit is in the NC field.

FIELD DESIGNATORS:

AP = Address/Parity
AQ = Acquisition Special
DI = Designator Identification
MA = Message, Comm-A
MC = Message, Comm-C
MU = Message, Comm-U
NC = Number of C-Segment
PC = Protocol
RC = Reply Control
RL = Reply Length
RR = Reply Request
SD = Special Designator
UF = Uplink Format

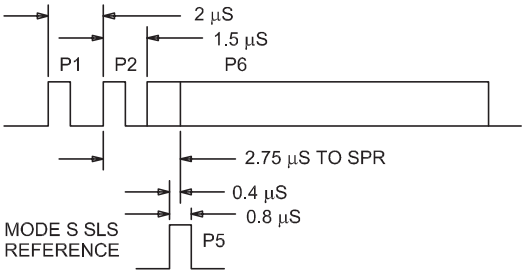
Mode S, Interrogation Code Summary
Table 7/Table 34-50-96-99A-038-A01

ATCRBS/MODE S, ALL-CALL INTERROGATION PULSE SPACING



P1, P3, AND P4 ARE RADIATED BY THE ROTATING BEAM ANTENNA. P2 IS RADIATED BY THE OMNIDIRECTIONAL ANTENNA. THE AMPLITUDE OF P2 IS APPROXIMATELY EQUAL TO THE PEAK AMPLITUDE OF THE MAXIMUM ROTATING SIDE LOBE.

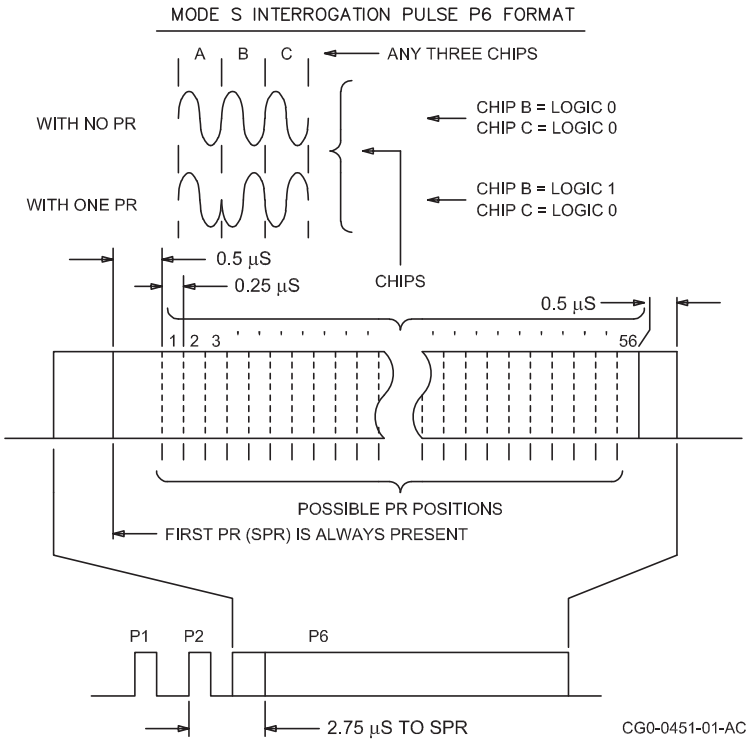
MODE S DISCRETE ADDRESS DPSK INTERROGATION SIGNAL



P1, P2, AND P6 ARE RADIATED BY THE ROTATING BEAM ANTENNA. P5 IS RADIATED BY THE OMNIDIRECTIONAL ANTENNA. THE AMPLITUDE OF P5 IS 3 DB GREATER THAN THE PEAK AMPLITUDE OF THE MAXIMUM ROTATING SIDE LOBE.

CG0-0450-01-AC

Mode S, All-Call, and Discrete Addressing, Interrogation Format
Figure 10/GRAPHIC 34-50-96-99B-077-A01



Mode S Discrete Addressing, Pulse P6 Definition
Figure 11/GRAPHIC 34-50-96-99B-078-A01

(3) Mode S SSR Radiation Pattern and SLS

(a) Refer to Figure 12/GRAPHIC 34-50-96-99B-079-A01. In mode S, the omnidirectional antenna transmits pulse P5 as the SLS reference pulse. The P5 pulse occurs within the P6 pulse and is timed 0.4 µs before the first spr. Thus, if the amplitude of P5 is sufficient to blank the first spr of P6, the interrogation is most likely from a side lobe and not from the main lobe. In this case the spr is hidden from the transponder and the reply is suppressed.

(b) The transmission of mode S interrogation uses a technique known as binary differential phase shift keying (DPSK). This technique is illustrated in Figure 11/GRAPHIC 34-50-96-99B-078-A01. For greater detail, refer to the information below.

(c) The SSR mode S interrogation pulse spacing and identification is different from earlier ATCRBS. Notice that the rotating beam transmits two different pulse combinations. For all call interrogations, the transmitted pulses are P1, P3, and P4. In these interrogations the SLS reference pulse P2 is transmitted by the omnidirectional antenna as in conventional ATCRBS. The P1-to-P3 pulse spacing is either 8 µs (for mode A) or 21 µs (for mode C), also as in ATCRBS. The P4 pulse follows the P3 pulse by 2 µs and can be either 0.8 µs (the same as P1 and P3) or 1.6

µs. The pulse width of P4 determines the all-call objective. A 0.8 µs pulse is only for non-mode S transponders, while the 1.6 µs pulse is only for mode S transponders.

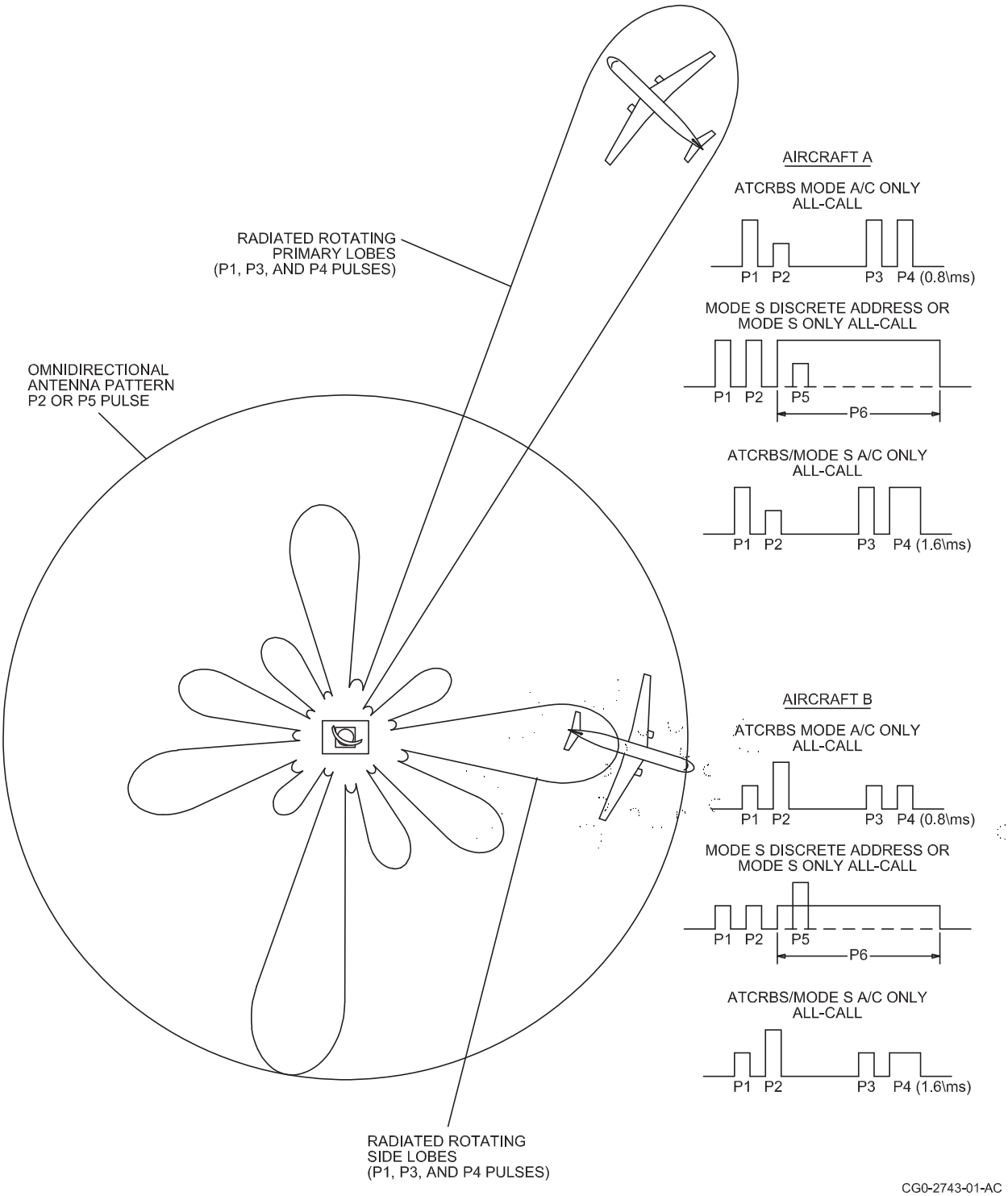
(d) The mode S discrete addressing interrogation takes yet another form. For this interrogation the rotating beam antenna transmits pulses P1, P2, and P6. P1 and P2 are 0.8 µs pulses spaced 2 µs between leading edges. P6 is a single pulse that is either 16.00 or 30.00 µs long. A data technique known as DPSK decodes the information transmitted in the P6 pulse. This technique involves the detection of the phase relationship of the signal at certain intervals. These intervals are referred to as chips. Therefore, timing is the critical factor in this decoding process. Each chip is defined as an unmodulated interval of 0.25 µs and may be in phase or out of phase with the preceding chip. If it is out of phase, it is recognized as representing a bit value of 1. A chip that is in phase with the preceding chip represents a bit value of 0.

(e) As shown in Figure 10/GRAPHIC 34-50-96-99B-077-A01, P6 begins 1.5 µs after the start of pulse P2. At 1.25 µs after the start of P6, the first phase reversal (pr) occurs. This first pr is identified as the sync phase reversal (spr). This spr must be detected in order to enable a reply response. The final chip is followed by a 0.5 µs guard interval. This prevents the trailing edge of P6 from interfering with the demodulation process.

(f) The ground mode S interrogator system uses a monopulse processing scheme to determine the azimuth bearing to the airplane. This scheme requires only a single reply from an airborne transponder, as opposed to the two replies necessary in the earlier ATCRBS system to establish the azimuth to the airplane. In this scheme, the monopulse system generates two separate patterns; a single (sum) pattern and a dual lobe (difference) pattern. The ratio of the energy received by the sum pattern to the energy received by the difference pattern determines the bearing of the airplane from the antenna beam centerline. The address (derived from the reply) and location (azimuth and range) of the mode S airplane is entered into a roll-call file. This file can be visualized as a list of the mode S-equipped airplanes within their assigned airspace. On a later scan, the mode S airplane is discretely addressed. This discrete address contains a command field that is used to desensitize the mode S transponder to further mode S all-call interrogations. This desensitization is called Mode S Lockout. The ATCRBS-only transponders are not affected by this lockout technique and mode S transponders continue to reply to ATCRBS interrogations.

(g) When a mode S-equipped airplane moves from one assigned airspace into another, the first ground interrogator can communicate with the next interrogator and pass airplane information to that second interrogator. This communication link can be via ground lines or radio link. If this method is used, the mode S lockout is not disabled on the affected airplane and the second interrogator will schedule discrete roll-call interrogations for that airplane as needed. This technique makes it possible to increase the airplane handling capacity of the ground interrogator.

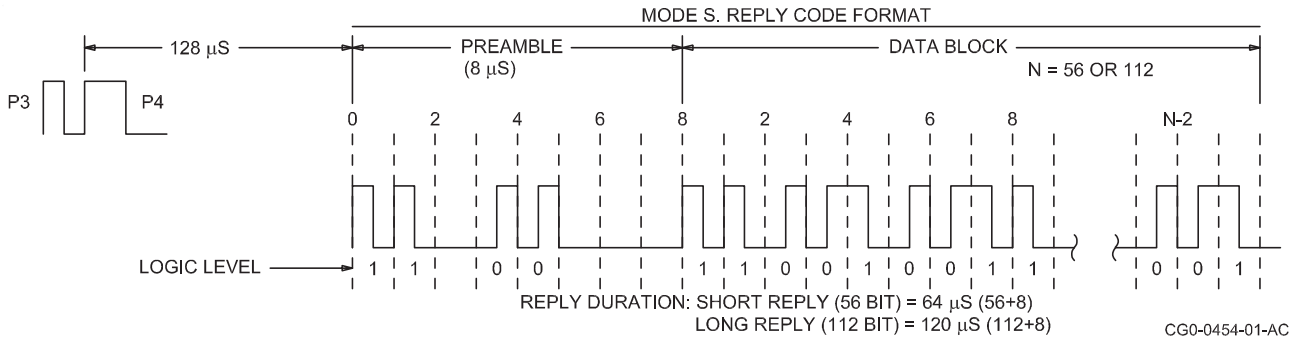
(h) In regions where mode S interrogators are not connected via ground or radio link, the protocol for the transponder allows it to be in mode S lockout only for those interrogators that have the airplane on the roll-call list. This enables a second ground interrogator to acquire an airplane into its assigned airspace using the all-call technique as previously described.



Mode S, SSR Antenna Radiation Pattern
Figure 12/GRAPHIC 34-50-96-99B-079-A01

(4) Mode S Transponder Replies

(a) Typically, the ground-based interrogator tracks an airplane throughout its assigned airspace. The mode S transponder equipped airplane responds to mode S interrogations with the ATCRBS 4096 code and the mode S reply format. During each scan, the SSR interrogations are in both mode A and mode C. The mode S transponder reply uses a technique known as pulse position modulation (PPM). This is illustrated in Figure 13/GRAPHIC 34-50-96-99B-080-A01. A pulse transmitted in the first half of the interval represents a logic 1, while a pulse transmitted in the second half represents a logic 0. In addition to the message data contained within each reply transmission, the mode S interrogation also contains a 24-bit discrete address. This uniquely identifies the reply and provides for a large number of airplanes, each with its own distinct address. The mode S reply format is described in the following paragraphs.



Mode S, Transponder Reply Code Pulse Format
Figure 13/GRAPHIC 34-50-96-99B-080-A01

(5) Mode S Reply Description

(a) The reply pulse pattern is shown in Figure 13/GRAPHIC 34-50-96-99B-080-A01. The reply data block is formed by PPM encoding of the reply data. The first pulse occurs 128 µs after the start of the P4 interrogation pulse. The mode S transponder reply to an ATCRBS interrogation is identical to the reply transmitted by a non mode S transponder (see Figure 7/GRAPHIC 34-50-96-99B-074-A01). However, the reply to a mode S interrogation can assume several different formats as summarized in Figure 14/GRAPHIC 34-50-96-99B-081-A01. The fields are described in the following paragraphs.

1 Announced Address (AA)
The 24-bit AA field contains the airplane address in the clear (no special coding) and is used in DF number 11.

2 Altitude Code (AC) Field
The 13 bit AC field contains the altitude code and is used in downlink format

(DF) numbers 0, 4, 16, and 20. The field is similar to that shown in Figure 7/GRAPHIC 34-50-96-99B-074-A01 except that the X bit is defined as the M bit. In mode S the M bit may be used in the future for encoding the altitude in metric units. Zero is transmitted in each of the 13 bits if altitude information is not available.

3 Address/Parity (AP) Field
The 24 bit AP field contains the parity overlaid on the address and appears at the end of all transmissions on both uplink interrogations and downlink replies (except for DF number 11).

4 Capability, Transponder (CA) Field
The 3 bit CA field reports transponder capability and is used in DF number 11, i.e. the Mode S All Call reply. The CA codes are defined as follows:

CA	DESCRIPTION
0	No communications capability (surveillance only)
1 - 3	Not used
4	Comm A and Comm B capability, ability to set code 7 on the ground
5	Comm A and Comm B capability, ability to set code 7 airbourne
6	Comm A, Comm B, ability to set code 7 on the ground or airbourne
7	Indicates DR is not = 0; or FS = 2, 3, 4, or 5, either airborne or on ground

CA codes 1 - 3 were used by earlier mode S transponders that did not have the ability to set code 7.

5 Crosslink Capability (CC) Field
This 1-bit CC field indicates the ability of the transponder to support the crosslink capability, i.e. decode the contents of the BDS field in UF number 0 interrogation and respond with the contents of the specified ground-initiated Comm B register in the MV field of the corresponding DF number 16 reply. Codes are: logic 0 if aircraft supports crosslink capability; logic 1 if aircraft cannot support crosslink capability.

6 Downlink Format (DF)
Field DF is a general term referring to the first field in all downlink format and is the transmission descriptor in all replies. DF refers to all messages described in Figure 14/GRAPHIC 34-50-96-99B-081-A01.

7 Downlink Request (DR) Field
The 5 bit DR field is used to request extraction of downlink messages from the transponder by the interrogator. The codes are defined as follows:

DR	DESCRIPTION
0	No downlink request
1	Request to send Comm B message
2	TCAS information available
3	TCAS information available and request to send Comm B message
4	Comm B broadcast #1 available
5	Comm B broadcast #2 available
6	TCAS information and Comm B broadcast #1 available
7	TCAS information and Comm B broadcast #2 available
8 - 15	(Not assigned)
16 - 31	Comm D, not implemented in TDR-94/94D Class 3A Mode S Transponders

8 Flight Status (FS) Field
The 3 bit FS field reports the flight status of the airplane. The codes are defined as follows:

FS	ALERT	SPI	AIRBORNE/ON THE GROUND
0	no	no	airborne
1	no	no	on the ground
2	yes	no	airborne
3	yes	no	on the ground
4	yes	yes	either
5	no	yes	either
6 - 7	(Not assigned)		

9 Identification (ID) Field
The 13 bit ID field contains the 4096 identification code as selected by the operator.

10 ELM Control (KE) Field
The 1 bit KE field defines the content of the ND and MD fields in Comm D replies, i.e. DF number 24. This function is not implemented in the TDR-94/94D Class 3A Mode S Transponders.

11 Message Comm B (MB) Field
The 56 bit MB field contains messages transmitted to the interrogator. In those formats that use the ground initiated Comm B protocol, the MB field contains an 8 bit subfield (BDS) defining the contents of the Comm B message. BDS is expressed in two 4-bit groups identified as BDS1 and BDS2.

12 Extended Squitter Message (ME) Field
The 56 bit ME field is used to transmit extended squitter Automatic Dependent Surveillance (ADS) and Aircraft Identification (AI) in DF number 17 messages.

13 Message Comm V (MV) Field
The 56 bit MV field contains information used in the air to air exchanges between mode S transponders and is part of the long special surveillance reply using DF number 16. Note that this message field does not follow the Comm B protocol.

14 Number of D Segment (ND) Field
The 4 bit ND field provides the number of the segment transmitted in a downlink ELM and is part of the Comm D reply. It is not implemented in the TDR-94/94D Class 3A Mode S Transponders.

15 Parity/Interrogator Identity (PI) Field
The 24 bit PI field contains the parity overlaid on the interrogator identity code.

16 Reply Information (RI) Field
The 4 bit RI field (used in special surveillance replies DF numbers 0 and 16) reports the airspeed capability and type of reply to an interrogating airplane. Codes are defined as follows:

RI	DESCRIPTION
0	No on-board TCAS
1	(Not assigned)
2	On-board TCAS with resolution capability inhibited
3	On-board TCAS with vertical-only resolution capability (TCAS II)
4	On-board TCAS with vertical and horizontal resolution capability (TCAS III)
5 - 7	(Not assigned)
8 - 15	Indicates that downlink is an acquisition reply, further defined as follows:
8	No maximum airspeed data available
9	Airspeed up to 75 knots
10	Airspeed is greater than 75, up to and including 150 knots
11	Airspeed is greater than 150, up to and including 300 knots
12	Airspeed is greater than 300, up to and including 600 knots
13	Airspeed is greater than 600, up to and including 1200 knots
14	Airspeed is greater than 1200 knots
15	(Not assigned)

Bit 14 of this field is the AQ bit of the interrogation.

17 Sensitivity Level (SL) Field
This 3-bit UM field reports the sensitivity level at which the TCAS unit is currently operating. This field appears in special surveillance reply formats DF numbers 0 and 16 (for TCAS compatible transponders only). The codes are defined as follows:

0 = No TCAS sensitivity level reported
1 = TCAS is operating at sensitivity level 1
2 = TCAS is operating at sensitivity level 2
3 = TCAS is operating at sensitivity level 3
4 = TCAS is operating at sensitivity level 4
5 = TCAS is operating at sensitivity level 5
6 = TCAS is operating at sensitivity level 6
7 = TCAS is operating at sensitivity level 7

Note the SL field has no meaning for aircraft that set RI = 0, 1, or 2 (no on board capability to generate resolution advisories).

18 Utility Message (UM) Field
The 6 bit UM field contains transponder status readouts and are used in DF numbers 4, 5, 20, and 21.

19 Vertical Status (VS) Field
The 1 bit VS field indicates the airplane is airborne (VS = 0), or the airplane is on the ground (VS = 1). This field is used in DF numbers 0 and 16.

20 Free and Unassigned Coding Space Fields
Free coding space contains all zeros as transmitted by the interrogators and transponders. Unassigned coding space existing within fields is reserved for possible future use.

FORMAT NUMBER	DOWNLINK BIT FORMAT										
HEX/DEC	DF	SHORT MESSAGE STRUCTURE								MESSAGE TYPE	
0 / 0	0 0000	VS: 1	CC: 1	1	SL: 3	2	RI: 4	2	AC: 13	AP: 24	SHORT SPECIAL SURVEILLANCE
1 / 1	0 0001	Length, content, and structure undefined								P: 24	NOT PRESENTLY DEFINED OR NOT USED
2 / 2	0 0010									P: 24	
3 / 3	0 0011									P: 24	
4 / 4	0 0100	FS: 3		DR: 5		UM: 6			AC: 13	AP: 24	SURVEILLANCE, ALTITUDE REPLY
5 / 5	0 0101	FS: 3		DR: 5		UM: 6			ID: 13	AP: 24	SURVEILLANCE, IDENTITY REPLY
6 / 6	0 0110	Length, content, and structure undefined								P: 24	NOT PRESENTLY DEFINED OR NOT USED
7 / 7	0 0111									P: 24	
8 / 8	0 1000									P: 24	
9 / 9	0 1001									P: 24	
A / 10	0 1010									P: 24	
B / 11	0 1011	CA: 3		AA: 24						AP: 24	ALL CALL REPLY
C / 12	0 1100	Length, content, and structure undefined								P: 24	NOT PRESENTLY DEFINED OR NOT USED
D / 13	0 1101									P: 24	
E / 14	0 1110									P: 24	
F / 15	0 1111									P: 24	

LEGEND:
XX: M designates a field containing M bits, N denotes free space with N available bits.

FIELD DESIGNATORS:

AA = Address Announced	CC = Crosslink Capability	FS = Flight Status	SL = Sensitivity Level
AC = Altitude Code	DF = Downlink Format	ID = Interrogator Ident	UM = Utility Message
AP = Address/Parity	DR = Downlink Request	RI = Reply Info; Air-to-Air	VS = Vertical Status
CA = (XPDR) Capability			

TPH6708_01

Mode S, Reply Code Summary
Figure 14 (Sheet 1 of 2)/GRAPHIC 34-50-96-99B-081-A01

FORMAT NUMBER	DOWNLINK BIT FORMAT										
HEX/DEC	DF	LONG MESSAGE STRUCTURE									MESSAGE TYPE
10 / 16	1 0000	VS: 1	2	SL: 3	2	RI: 4	2	AC: 13	MV: 56	AP: 24	LONG SPECIAL SURVEILLANCE
11 / 17	1 0001	CA: 3		AA: 24					ME: 56	PI: 24	EXTENDED SQUITTER
12 / 18	1 0010	Length, content, and structure undefined								P: 24	NOT PRESENTLY DEFINED
13 / 19	1 0011									P: 24	OR NOT USED
14 / 20	1 0100	FS: 3	DR: 5	UM: 6	AC: 13				MB: 56	AP: 24	COMM-A ALTITUDE REQUEST
15 / 21	1 0101	FS: 3	DR: 5	UM: 6	ID: 13				MB: 56	AP: 24	COMM-A IDENTITY REQUEST
16 / 22	1 0110	Length, content, and structure undefined								AP: 24	NOT PRESENTLY DEFINED
17 / 23	1 0111									AP: 24	OR NOT USED
18 / 24 (see note)	11	1	KE: 1	ND: 4	MC: 80					AP: 24	COMM-D, EXTENDED LENGTH MESSAGE

LEGEND:
XX: M designates a field containing M bits, N denotes free space with N available bits.

NOTE:
Format number 18 / 24 is defined as the format beginning with "11" in the first two bit positions while the following three bits vary with the interrogation content; i.e., two bits are the RC field, and the remaining bit is in the NC field.

FIELD DESIGNATORS:

AA = Address Announced	DR = Downlink Request	ME = Message, Comm-E	SL = Sensitivity Level
AC = Altitude Code	FS = Flight Status	MV = Message, Comm-V	UM = Utility Message
AP = Address/Parity	ID = Interrogator Ident	ND = Number of D Segments	VS = Vertical Status
CA = (XPDR) Capability	KE = (not used)	PI = Parity/Interrogator	
DF = Downlink Format	MB = Message, Comm-B	RI = Reply Info; Air-to-Air	

TPH6708_02

Mode S, Reply Code Summary
Figure 14 (Sheet 2 of 2)/GRAPHIC 34-50-96-99B-081-A01

SUBTASK 34-50-96-870-005-A01

E. Typical TDR 94/94D ATC/Mode S Transponder Installations

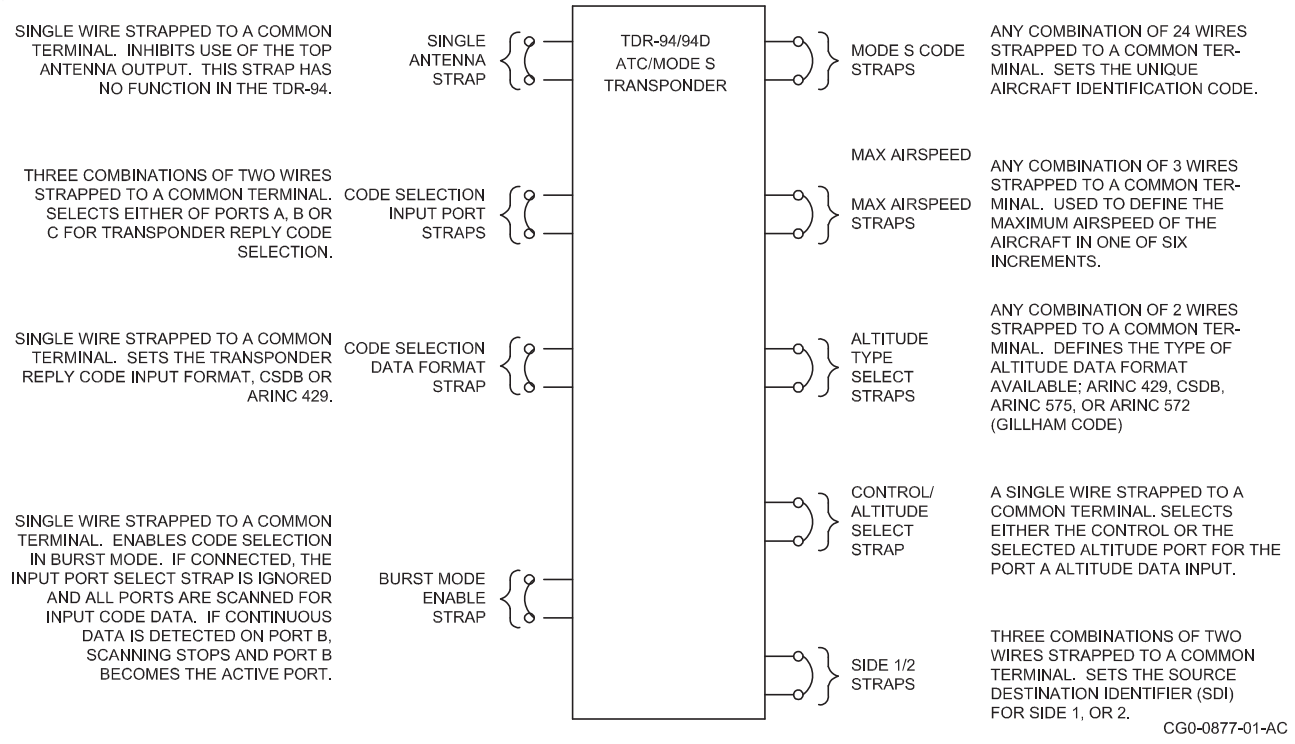
(1) Introduction

(a) This paragraph gives you an overview of the TDR 94/94D operating environment. For installation detail, refer to the TDR 94/94D ATC/Mode S Transponder, Installation Manual which is contained in the Collins Pro Line II Comm/Nav/Pulse System Installation Manual, CPN 523-0772719.

(b) The TDR 94/94D ATC/Mode S Transponder offers a wide range of installation options. First you should recognize the difference between the TDR 94 and the TDR 94D; the TDR 94 is for single antenna installations, while the TDR 94D can operate with single or dual antenna installations. You are likely to find the TDR 94D in most TCAS installations because dual antennas are required in TCAS.

(c) Both transponders can accept control data in CSDB or ARINC 429 format; this is set at installation by means of special external straps and is determined by the type of control being used.

(d) The following paragraphs and accompanying diagrams describe various installation configurations. The first diagram, Figure 15/GRAPHIC 34-50-96-99B-082-A01, shows the various strapping options that must be considered for all installations. These strapping options are applicable to all installations even though they are not shown on the other block diagrams.



TDR-94/94D ATC Mode S Transponder Strapping Options
Figure 15/GRAPHIC 34-50-96-99B-082-A01

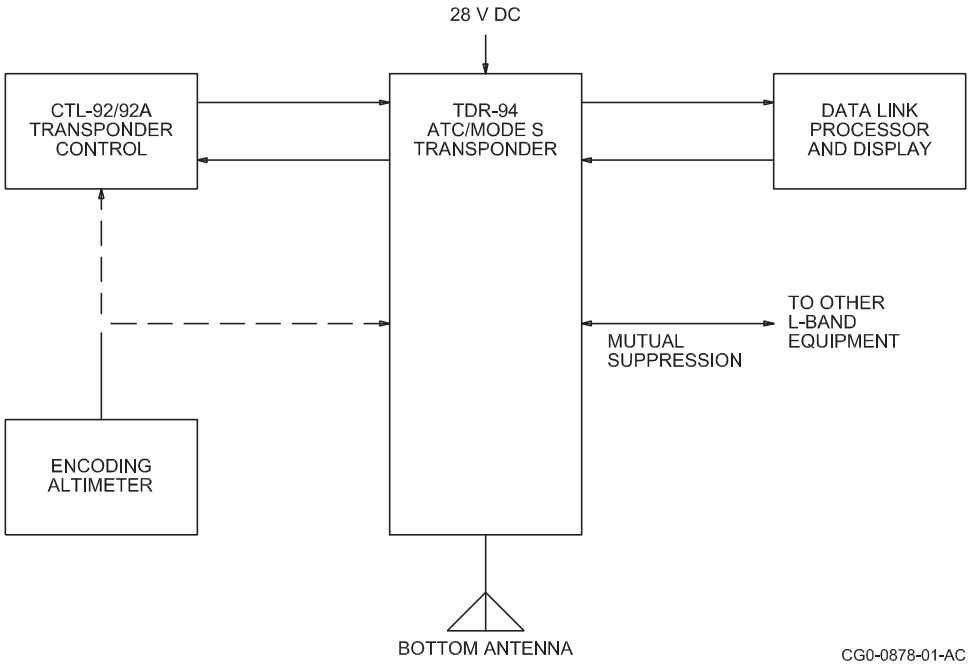
(2) TDR-94 with CSDB Code Selection

(a) Figure 16/GRAPHIC 34-50-96-99B-083-A01 shows a TDR 94 installation with a CTL 92/92A CSDB transponder control unit and an altitude encoder. This type of encoder typically supplies altitude data in Gillham code (ARINC 572) format. The encoder data can be supplied to the CTL 92/92A or directly to the TDR 94. However, because the encoder is likely to be located in the radio rack, with or near the transponder, most installations will have the encoder connected directly to the transponder to keep the wire run short.

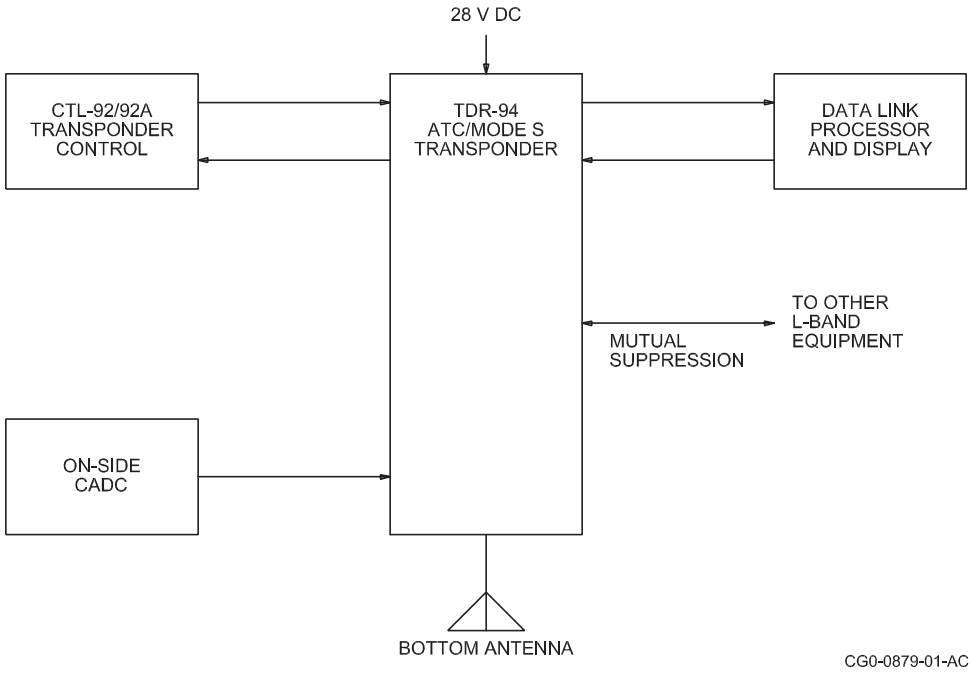
(b) Figure 17/GRAPHIC 34-50-96-99B-084-A01 shows an installation using a Central Air Data Computer (CADC) for altitude data which is similar to Figure 16/GRAPHIC 34-50-96-99B-083-A01. In each of these cases, external strapping is required according to the type of altitude data being used.

(c) An alternate installation configuration is possible using ARINC 429 code selection. In this case, an ARINC 429 source, such as an FMS, would be shown in place of the CTL 92/92A with appropriate strapping as shown of Figure 15/GRAPHIC 34-50-96-99B-082-A01.

(d) In TCAS installations using Gillham code encoders, two independent encoders are required for monitoring redundancy and integrity. In this case, one encoder is connected to the transponder, while the other supplies data to the CTL-92/92A. In the control the altitude data is converted to CSDB data which is supplied to the CTL-92T. The CSDB data is converted here to ARINC 429 and supplied to the transponder. In the transponder the altitude from the directly-connected encoder is compared to the ARINC 429 data from the other encoder. If the two altitude sources do no agree within 500 feet, a diagnostic code is generated.



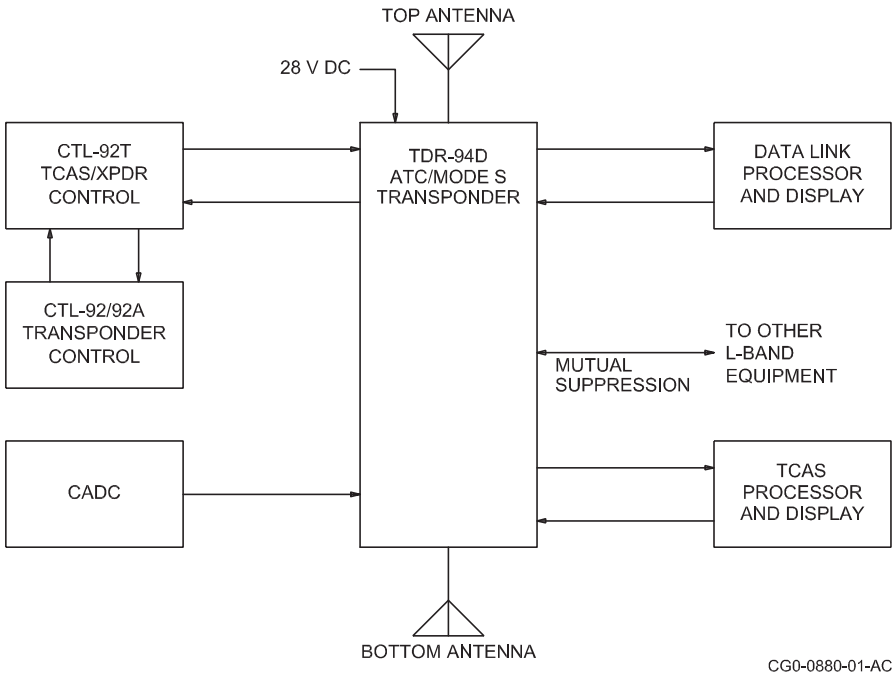
TDR-94 ATC/Mode S Transponder, with CTL-92/92A Transponder Control Unit, Typical Installation Diagram
Figure 16/GRAPHIC 34-50-96-99B-083-A01



TDR-94 ATC/Mode S Transponder, With CTL-92/92A Transponder Control and CADC Altitude Source, Typical Installation Diagram
Figure 17/GRAPHIC 34-50-96-99B-084-A01

(3) TDR-94D with CSDB Code Selection and Dual Antenna Operation

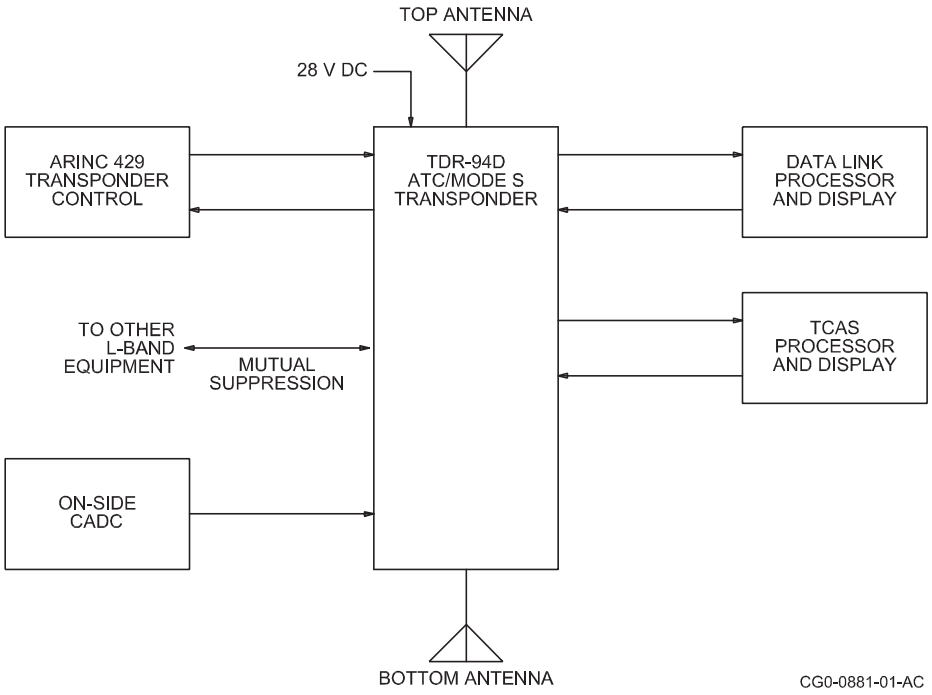
(a) Figure 18/GRAPHIC 34-50-96-99B-085-A01 shows a TDR 94D in a TCAS installation with a CSDB control and dual antennas. If the transponder is operated with only a single antenna, a special strap is required. The diagram also shows a CADC for altitude data. This can be an encoder as shown in Figure 16/GRAPHIC 34-50-96-99B-083-A01. Either way, appropriate strapping is required. The CTL-92T, a requirement for TCAS control, is connected between the TDR-94D and the CTL-92/92A. In this installation, transponder control data is entered on the CTL-92/92A, and the TCAS control data is added to the data word in the CTL-92T.



TDR-94D ATC/Mode S Transponder, Datalink and TCAS Installation, With CSDB Control and CADC Altitude Data Source, Typical Installation Diagram
Figure 18/GRAPHIC 34-50-96-99B-085-A01

(4) TDR-94D/TCAS with ARINC 429 Code Selection and Dual Antenna

(a) Figure 19/GRAPHIC 34-50-96-99B-086-A01 shows a TDR 94D in a relatively complex installation. This can be seen as a typical TCAS and data link installation using an ARINC 429 source for code selection.



TDR-94D ATC/Mode S Transponder, with ARINC 429 Tuning Source, Typical Installation Diagram
Figure 19/GRAPHIC 34-50-96-99B-086-A01

TASK 34-50-96-870-807-A01

7. Integrated Circuit Descriptions

A. The TDR-94/94D uses numerous types of integrated circuits. Always refer to the Illustrated Parts List (IPL) when replacement parts are necessary. Table 8/Table 34-50-96-99A-039-A01 shows the different types of integrated circuits that the TDR-94/94D uses. Refer to the manufacturer's data manuals (or WEB sites) if special data is necessary.

IC TYPE	DESCRIPTION
Refer to Figure 20/GRAPHIC 34-50-96-99B-087-A01	Basic Logic Gate Descriptions
Refer to Figure 21/GRAPHIC 34-50-96-99B-088-A01	Basic Operational Amplifier Descriptions
02	+5V Precision Voltage Reference/Temperature Transducer
117	Adjustable 3-Terminal Positive Voltage Regulator (1.2 to 37V)
1596	Balance Modulator − Demodulator Microcircuit
1825	High Speed Pulse Width Modulator Regulator
10135	2X J-K Master/Slave Flip Flop
12093	Low Power Prescaler
2222A	4X 2222A Transistor Package
22V10C	Programmed PAL
26LS32	4X Differential Line Receiver
28HC256	32k x 8-Bit EEPROM
29F010	128k x 8-Bit Flash Memory
3127	High Frequency Low Current Transmitter Array
317L	Adjustable Positive Voltage Regulator
31015	ARINC 429 Receiver/Transmitter ASIC
580	Voltage Reference
7C109	128k x 8-Bit Static RAM
7C291L	Programmed 2k x 8-Bit UV EPROM
7C291L	Programmed 2k x 8-Bit UV EPROM
7130	1k x 8-Bit Dual Port Static RAM

Integrated Circuit Descriptions Cont.
Table 8/Table 34-50-96-99A-039-A01

IC TYPE	DESCRIPTION
74AHC1G04	Inverting Buffer
74HC259	8-Bit Addressable Latch/1 of 8 Decoder
74HC373	Octal 3-State Inverting D-Type Transparent Latch
74HC74	Dual D-Type Flip Flop with Set and Reset
74HCT244	Octal 3- State Buffer
74AC245	Octal Bus Transceiver, 3-State Non-Inverting
74AC374	Octal D-Type Flip Flop with 3-State Outputs
74HCT74	Dual D-Type Flip Flop
7800-10B	Pulse Decoder Gate Array
80C196KC	16-Bit Microcontroller
831-7172-001	Programmed FPGA
835-1681-030	Memory Decode and Mux Logic Microcircuit
9638	Dual Differential Line Driver
9665-052	Message Processor Gate Array
AD580TH	Low Drift Voltage Reference
AS214-92	0.1-3 GHz SPDT Switch
ATtiny 13	Programmed 8-Bit Microcontroller
ERA-2SM	RF/MMIC Surface Mount Amplifier
ERA-5SM	RF/MMIC Surface Mount Amplifier
JMS-5LH	Double Balance RF Mixer (Surface Mount Package)
LM235	Temperature Sensor
LM317M	Adjustable Positive Voltage Regulator
LMX2326TM	Frequency Synthesis Phase-Lock Loop Microcircuit
M27C256B-70C6	Programmed 32k x 8-Bit UV EPROM
MAX2606EUT-T	Voltage-Controlled Oscillator Microcircuit
MAX693A	Microprocessor Supervisory Circuit
MB1501	Serial Input Phase-Lock Loop Frequency Synthesizer
MC149680	Modulator/Demodulator Microcircuit
MC74HC4316AD	Quad Switch Microcircuit
MMPQ2907	Quad General Purpose PNP Transistor Package

Integrated Circuit Descriptions Cont.
Table 8/Table 34-50-96-99A-039-A01

IC TYPE	DESCRIPTION
MSA-0686	RF/MMIC Amplifier Microcircuit
MSA-386	RF/MMIC Amplifier Microcircuit
RF MIXER	Double Balance RF Mixer (Surface Mount Package)
RMS-5	Double Balance RF Mixer (Surface Mount Package)
SGA-4586	Cascadeable 50-Ohm Amplifier
SL1451	Wide-Band Phase Lock Loop FM Detector
SN74BNT2244ADB	Octal Buffer and Line/MOS Drivers with 3-State Outputs
UPC1663GV	Ultra Wide-Band Amplifier
UPC2712TB	MMIC Wide-Band Amplifier

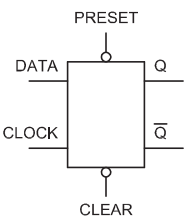
Integrated Circuit Descriptions
Table 8/Table 34-50-96-99A-039-A01

DESCRIPTION

BASIC LOGIC GATES ARE DESCRIBED WITH ITS OWN CORRESPONDING FUNCTION TABLE.

TYPICAL FLIP-FLOP DEVICES (1)

TTL 5474 D TYPE

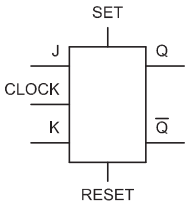


FUNCTIONAL TABLE TTL 5474 (3) (4)

INPUTS				OUTPUTS	
CLOCK	DATA	CLEAR	PRESET	Q	$\overline{Q}$
⌐⌐	1	1	1	1	0
⌐⌐	0	1	1	0	1
⌐⌐	X	1	1	Q_0	$\overline{Q}_0$
X	X	1	0	1	0
X	X	0	1	0	1
X	X	0	0	1*	1*

* NONSTABLE WILL NOT STAY WHEN PRESET AND CLEAR INPUTS RETURN TO THEIR INACTIVE (HIGH) LEVEL.

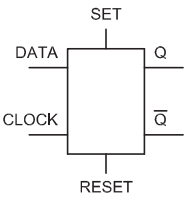
CMOS 4027 J-K TYPE



FUNCTIONAL TABLE CMOS 4027 (3)

INPUTS						OUTPUTS	
CLOCK	J	K	S	R	Q_0	Q	$\overline{Q}$
⌐⌐	1	X	0	0	0	1	0
⌐⌐	X	0	0	0	1	1	0
⌐⌐	0	X	0	0	0	0	1
⌐⌐	X	1	0	0	1	0	1
⌐⌐	X	X	0	0	X	Q_0	$\overline{Q}_0$
X	X	X	1	0	X	1	0
X	X	X	0	1	X	0	1
X	X	X	1	1	X	1	1

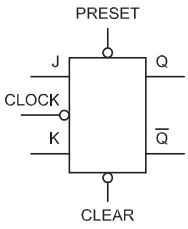
CMOS 4013 D TYPE



FUNCTIONAL TABLE CMOS 4013 (3)

INPUTS				OUTPUTS	
CLOCK	DATA	RESET	SET	Q	$\overline{Q}$
⌐⌐	0	0	0	0	1
⌐⌐	1	0	0	1	0
⌐⌐	X	0	0	Q_0	$\overline{Q}_0$
X	X	1	0	0	1
X	X	0	1	1	0
X	X	1	1	1	1

TTL 5478 J-K TYPE

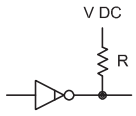


FUNCTIONAL TABLE TTL 5478 (3)

INPUTS					OUTPUTS	
CLOCK	J	K	P	CLEAR	Q	$\overline{Q}$
⌐⌐	0	0	1	1	Q_0	$\overline{Q}_0$
⌐⌐	1	0	1	1	1	0
⌐⌐	0	1	1	1	0	1
⌐⌐	1	1	1	1	TOGGLE	
X	X	X	0	1	1	0
X	X	X	1	0	0	1
X	X	X	0	0	1*	1*

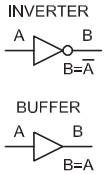
* NONSTABLE WILL NOT STAY WHEN PRESET AND CLEAR INPUTS RETURN TO THEIR INACTIVE (HIGH) LEVEL.

BUFFER GATES



A VERTICAL LINE, WITHIN THE SYMBOL, INDICATES A OPEN COLLECTOR OR OPEN DRAIN OUTPUT. THE PULL-UP RESISTOR IS NOT ALWAYS EVIDENT.

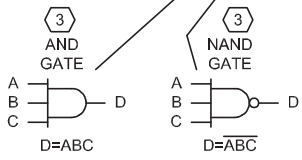
INPUT	OUTPUT	
A	B	B
1	1	0
0	0	1



INPUT		OUTPUT
A	ENABLE	B
0	0	0
1	0	1
X	1	Z

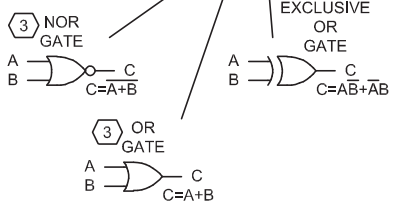
AND/NAND GATES

INPUT			OUTPUT	
A	B	C	D	D
0	0	0	0	1
0	0	1	0	1
0	1	0	0	1
0	1	1	0	1
1	0	0	0	1
1	0	1	0	1
1	1	0	0	1
1	1	1	1	0



OR/NOR GATES

INPUT			OUTPUT		
A	B	C	C	C	
0	0	1	0	0	1
1	0	0	1	1	0
0	1	0	1	1	0
1	1	0	1	1	0



NOTES:

(1) FLIP-FLOP DEVICES SHOWN ARE EDGE TRIGGERED DEVICES.

2. 1=HIGH LEVEL, 0=LOW LEVEL, X=IRRELEVANT, Z=HIGH IMPEDANCE.

(3) Q_0 AND $\overline{Q}_0$ INDICATE NO CHANGE FROM STATE BEFORE CLOCK TRANSITION.

(4) POSITIVE LOGIC-LOW INPUT TO PRESET SETS Q TO HIGH LEVEL, LOW INPUT TO CLEAR SETS 1 TO LOW LEVEL.

5. GATES CONTAINING A ⊓ SYMBOL, WITHIN THE LOGIC SYMBOL, CONTAIN SCHMITT TRIGGER CIRCUITS.

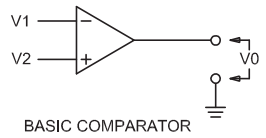
CG0-2287-AC-01

Basis Logic Gate Descriptions
Figure 20/GRAPHIC 34-50-96-99B-087-A01

DESCRIPTION

OPERATIONAL AMPLIFIERS (OP-AMPS) ARE USED TO ADD, SUBTRACT, AVERAGE, INTEGRATE AND COMPARE. THE OP-AMP PRODUCES AN OUTPUT WHEN THERE IS A VOLTAGE DIFFERENCE BETWEEN THE TWO INPUT TERMINALS. A POSITIVE GOING SIGNAL AT THE INVERTING INPUT PRODUCES A NEGATIVE GOING OUTPUT SIGNAL, WHEREAS A POSITIVE GOING SIGNAL AT THE NON-INVERTING INPUT PRODUCES A POSITIVE GOING OUTPUT SIGNAL. SHOWN IN FUNCTIONAL DIAGRAMS A THRU G ARE SEVERAL BASIC OP-AMP CONFIGURATIONS.

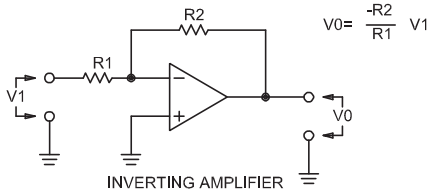
FUNCTIONAL DIAGRAM A



BASIC COMPARATOR

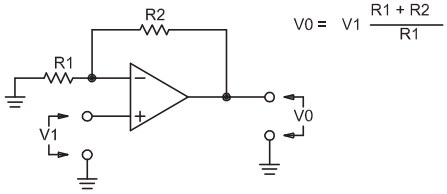
V1	V2	V0
0	0	UNDEFINED
0	1	V+
1	0	V-
1	1	UNDEFINED

FUNCTIONAL DIAGRAM B



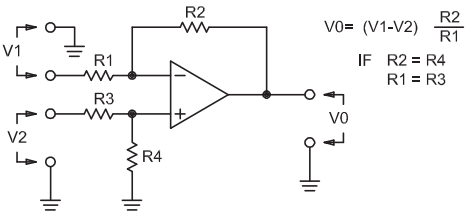
INVERTING AMPLIFIER

FUNCTIONAL DIAGRAM C



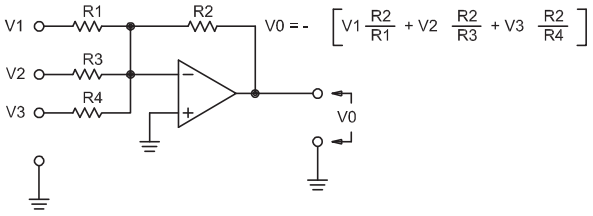
NONINVERTING AMPLIFIER

FUNCTIONAL DIAGRAM D



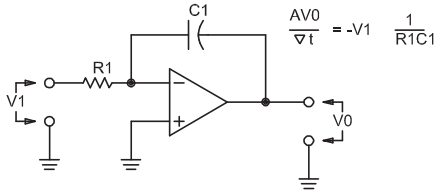
DIFFERENTIAL AMPLIFIER

FUNCTIONAL DIAGRAM E



SUMMING INVERTER

FUNCTIONAL DIAGRAM F

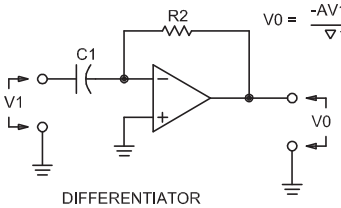


INTEGRATOR

FUNCTION TABLE

VI	V0
DC	RAMP
RAMP	
SINE	-COS
SQUARE	TRIANGLE

FUNCTIONAL DIAGRAM G



DIFFERENTIATOR

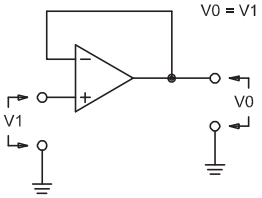
FUNCTION TABLE

VI	V0
RAMP	DC

COMPENSATION NETWORKS

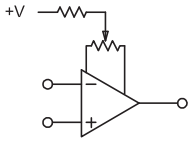
COMPENSATION NETWORKS ARE ADDED TO OP-AMP CIRCUITS TO OFFSET UNDESIRED CHARACTERISTICS. TWO EXAMPLES ARE SHOWN BELOW. OFFSET BALANCING IS REQUIRED IN SMALL SIGNAL APPLICATIONS WHERE VARIATIONS IN THE OP-AMP PARAMETERS MAY CAUSE INPUT DIFFERENCES. PHASE COMPENSATION IS ADDED TO PROVIDE CLOSED LOOP STABILITY TO THE CIRCUIT.

FUNCTIONAL DIAGRAM H

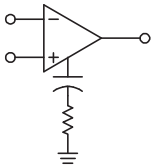


VOLTAGE FOLLOWER

FUNCTIONAL DIAGRAM I

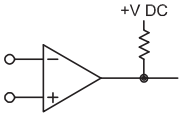


OFFSET BALANCING



PHASE COMPENSATION

FUNCTIONAL DIAGRAM J



OPEN COLLECTOR
OR
OPEN DRAIN
(ACTIVE V0 = GROUND)

CG0-0362-AC-01

Basis Operational Amplifier Descriptions
Figure 21/GRAPHIC 34-50-96-99B-088-A01

TESTING AND FAULT ISOLATION

TASK 34-50-96-700-801-A01
1. Introduction

A. Performance (customer acceptance) test procedures, calibration procedures, and schematics for the -004, -005, -006, -007, -008, -108, -308, -309, -408, and -409 statuses of the TDR-94/94D Mode S Transponder are provided in this section.

TASK 34-50-96-700-802-A01
2. Test Equipment

A. Refer to the Special Tools, Fixtures, and Equipment section for information on the test equipment required.

TASK 34-50-96-700-803-A01
3. Test Procedures

SUBTASK 34-50-96-700-001-A01
A. Use of Test Procedures

NOTE: Testing is restricted to only authorized Rockwell Collins service centers.

(1) Use Table 1001/Table 34-50-96-99A-009-A01, Final Performance (Customer Acceptance) Test to determine if the TDR-94/94D is operating properly. Use the alignment procedures in Table 1002/Table 34-50-96-99A-010-A01 to calibrate the TDR-94/94D.

SUBTASK 34-50-96-700-002-A01
B. Final Performance (Customer Acceptance) Test

(1) The Final Performance (Customer Acceptance) Test, Table 1001/Table 34-50-96-99A-009-A01, is performed with the cover on the unit and provides a relatively high degree of assurance that the TDR-94/94D is properly operating. The final performance test is essentially a return-to-service test. The final performance test can also be used as a customer acceptance or receiving inspection test. After any repairs, all final performance test steps must be successfully completed with the cover installed before returning a unit to service. The final performance test can also be used to isolate a fault to a functional area, thus determining which alignment procedures may be applicable. Some of the performance criteria have been adjusted to allow for the tolerances of typical test equipment.

SUBTASK 34-50-96-700-003-A01
C. Detailed Performance Test

(1) The detailed performance test is combined with the final performance test in Table 1001/Table 34-50-96-99A-009-A01.

SUBTASK 34-50-96-700-004-A01
D. Alignment Procedures

(1) Refer to Table 1002/Table 34-50-96-99A-010-A01 for the alignment procedures for the TDR-94/94D. If the final performance (customer acceptance) test successfully completes, no alignment procedures are required.

TASK 34-50-96-810-801-A01
4. Fault Isolation

SUBTASK 34-50-96-810-001-A01
A. Fault Isolation Philosophy

CAUTION: REFER TO ADVISORIES PARAGRAPH IN THE INTRODUCTION FOR ESDS HANDLING CAUTION AND COMPONENT WARNING.

(1) This section provides the primary information that repair personnel should use to isolate faults in the TDR 94/94D. All sections of this manual have important data to aid in the total repair and understanding of the unit. These sections are referenced, as necessary, to facilitate completion of the repair tasks.

(2) Defective avionics equipment will usually fall into one of two categories: failure with a specific complaint and failures with an unspecified complaints. The function of this section is to guide fault isolation, first to a specific malfunction, then to the applicable circuit area. Voltages and waveforms, in addition to the theory of operation help the technician to isolate the faulty parts.

(3) Fault isolation and troubleshooting are performed using the test equipment listed in the Special Tools, Fixtures, Equipment and Consumables section of this manual.

SUBTASK 34-50-96-810-002-A01
B. Troubleshooting Approach

(1) Unspecified Complaint

(a) Troubleshooting a unit with an unspecified complaint requires the technician to test the unit according to the performance test to determine if a fault actually exists. In cases where the unit passes all portions of the test and no fault is discovered, the unit can be returned to the aircraft as good and reinstalled. However, an actual fault may still persist and all associated equipment and aircraft wiring should be checked.

(b) When a unit does fail the performance test, the next objective is to isolate the actual fault or faults, and begin in-depth troubleshooting procedures. Begin by performing the specific fault isolation procedure(s) in this section.

(2) Specified Complaint

(a) Maintenance tags that indicate specific complaints help expedite the troubleshooting process. The technician may, in many cases, choose to omit the performance test and proceed directly to the any applicable fault isolation procedure.

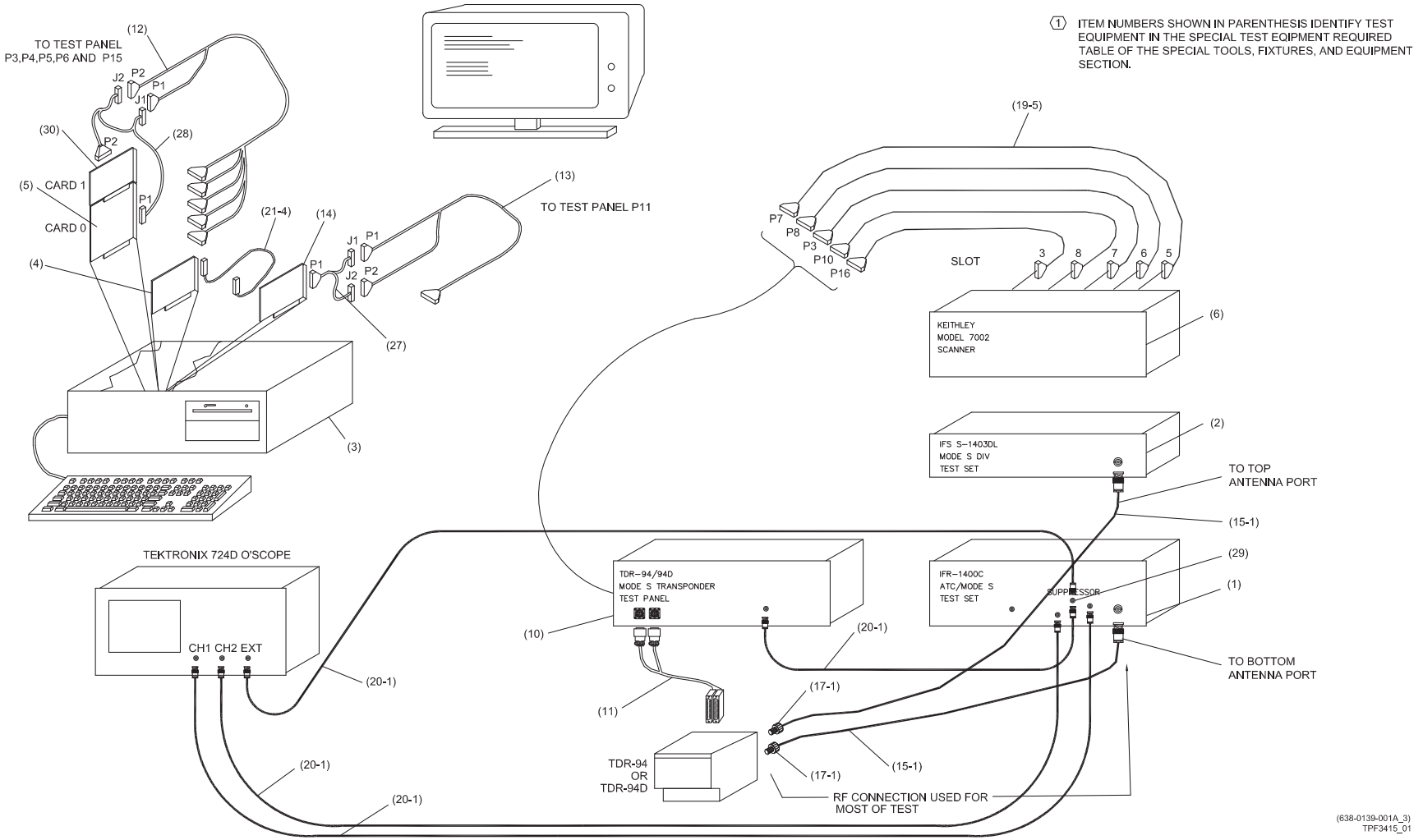
SUBTASK 34-50-96-810-003-A01
C. Troubleshooting Aids

(1) Maintenance Aid Diagrams - Maintenance aid diagrams are provided in the Schematics and Wiring Diagrams section of this manual, facing the schematic diagrams, to aid in component location and identification/location of test points. Waveforms (if applicable) are shown at troubleshooting test points.

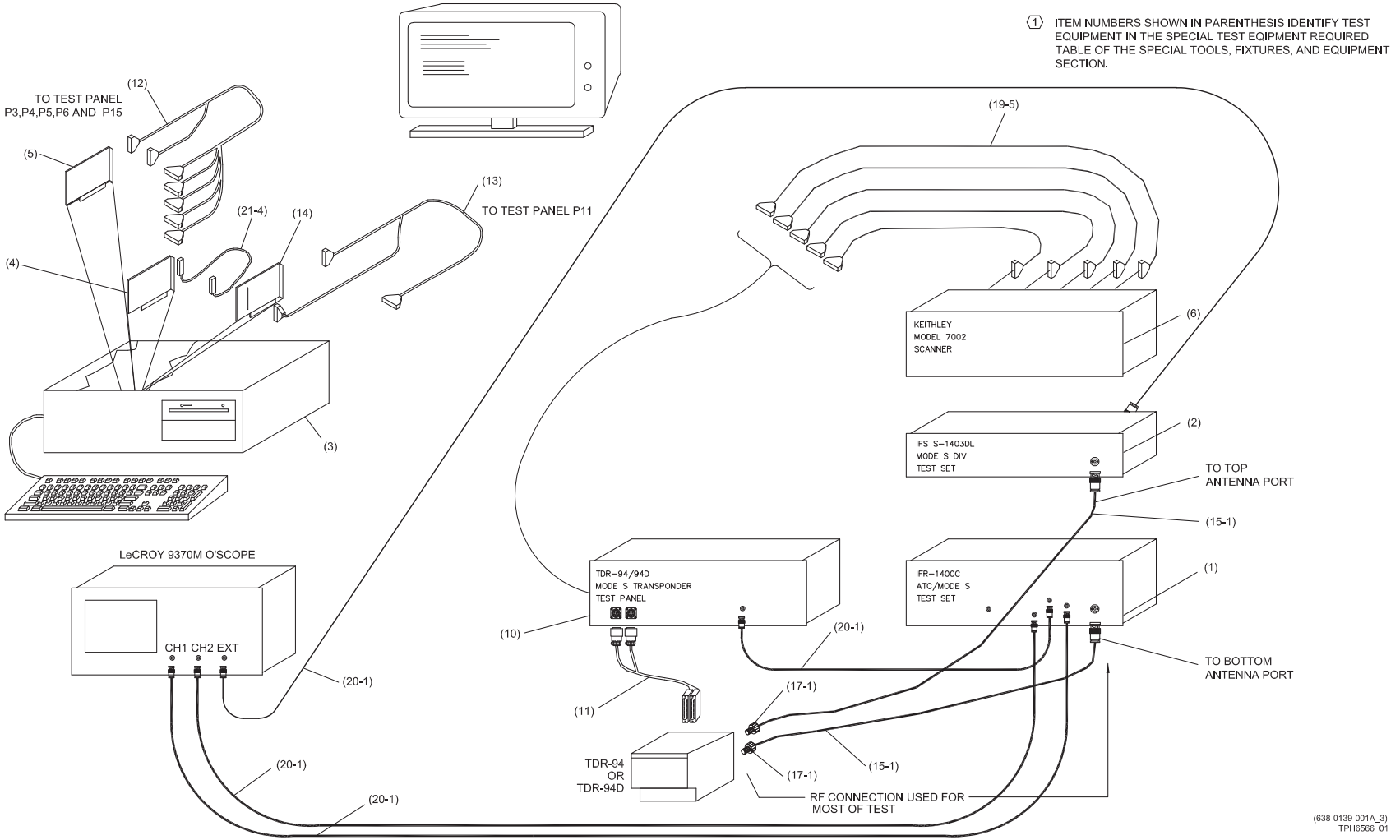
(2) Maintenance Aid and Schematic Change Pages - Maintenance Aid and Schematic Change Pages are included in the Schematic and Wiring Diagrams section of this manual to provide information on schematic changes necessitated by production changes of service bulletin modifications.

(3) Schematic Diagrams - Schematic diagrams are provided in the Schematic and Wiring Diagrams section of this manual as an aid to signal tracing and fault isolation.

(4) Fault Isolation and Diagnostic Procedures - Digital circuit card troubleshooting will be accomplished using standard digital troubleshooting techniques with standard test equipment.



TDR-94/94D Test Setup Diagram (Preferred Method)
Figure 1001/GRAPHIC 34-50-96-99B-020-A01



TDR-94/94D Test Setup Diagram (Alternate Method)
Figure 1002/GRAPHIC 34-50-96-99B-036-A01

TASK 34-50-96-810-802-A01
5. Procedures

SUBTASK 34-50-96-810-004-A01
A. TDR-94/94D Final Performance (Customer Acceptance) Test Procedure

STEP	PROCEDURE	DESIRED RESULTS
0.0	SETUP INSTRUCTIONS	
0.1	Preferred Setup: Connect TDR-94/94D as shown in Figure 1001/GRAPHIC 34-50-96-99B-020-A01. Test equipment item numbers (XX) that appear in the illustration identify test equipment in Table 9002/Table 34-50-96-99A-032-A01 of the Special Tools, Fixtures, and Equipment section. Alternate Setup: Connect TDR-94/94D as shown in Figure 1002/GRAPHIC 34-50-96-99B-036-A01. Test equipment item numbers (XX) that appear in the illustration identify test equipment in the Special Tools, Fixtures, and Equipment section Table 9003/Table 34-50-96-99A-042-A01. NOTE: Interrogation power levels and transmitter output power are referenced to the rear connector(s) of the unit under test (UUT). The insertion loss of coaxial cables between the UUT and the test equipment must be accounted for.	

STEP	PROCEDURE	DESIRED RESULTS
0.2	AUTOMATIC TEST EQUIPMENT (FINAL) TESTS Preferred Setup: The TDR-94 and TDR-94D are "semi-automatically" tested on a station configured per Figure 1001/GRAPHIC 34-50-96-99B-020-A01 and Table 9002/Table 34-50-96-99A-032-A01. Test software is listed in Table 9002/Table 34-50-96-99A-032-A01. Insert Disk 1 and run SETUP procedure. Alternate Setup: The TDR-94 and TDR-94D are "semi-automatically" tested on a station configured per Figure 1002/GRAPHIC 34-50-96-99B-036-A01and Table 9003/Table 34-50-96-99A-042-A01. Test software is listed in Table 9003/Table 34-50-96-99A-042-A01. Insert Disk 1 and run SETUP procedure. NOTE: Software is written/used by the factory, and may contain specifications which are actually tighter than required per the performance test requirements (ptr). Therefore, refer to this test document for test specifications for those automatic tests which fail.	
0.3	IFR S-1403DL SETUP INFORMATION The IFR S-1403DL test set must have C-Menu setup information stored into memory for proper operation. Ensure that all S-Menus (including S-Menu 00) are turned off. Set the following C-Menu configuration and save it to store locations 1 and 2. C-10 "f01 ATC" ANT B "off" C-50 Counts "10s" C-71 Trig Source "Selfinterr" C-72 All On, Cal C-73 All On C-74 All On C-75 ANT A mod source: "Int", ANT A Enable: "On" C-76 S menu Radix: Octal	
0.4	TEST CONDITIONS Final data is to be taken after a 30 minute warm-up with primary power applied. Perform the setup instructions in Table 1002/Table 34-50-96-99A-010-A01 for standard switch settings prior to running an automatic test.	

STEP	PROCEDURE	DESIRED RESULTS
0.5	BUS NAMING CONVENTIONS When reading this test procedure, the terms CSDB and PLII are used interchangeably to denote the Commercial Standard Digital Bus, commonly known as the Pro-Line II bus at Rockwell Collins, Inc. The ARINC 429 data bus is commonly called the ARINC bus or the 429 bus and either term may appear in documentation. Selection of busses from the test software will refer to port "A" as port 0, port "B" as port 1, and port "C" as port 2.	
1.0	RECEIVER TESTS	
	Perform the following tests on both the top and bottom antenna ports for the TDR-94D. For the TDR-94, perform only those tests specified for the bottom channel.	
1.1	MTL Test Test MTL is defined as the minimum interrogation power level which produces a reply rate of at least 90%. Determine the minimum interrogation level (MTL) required to obtain at least a 90% reply rate for the following interrogations. Verify that these levels are between -75 and -79 dBm. Interrogations A. MODE-S only All-Call B. ATCRBS MODE-A/MODE-S All-Call C. ATCRBS MODE-C NOTE: If the MTL cannot be established within the specification limits, A7R127 and/or A7R137 (CPN 833-6008-020) may be added as required to adjust temperature compensation. Refer to the A7 maintenance aid diagram for component location. This information is provided for reference only, after initial values are determined in production, no further temperature compensation adjustments should be necessary.	TOP BOTTOM _____ _____ _____ _____ _____ _____ NOTE: Refer to step 22.0 in Table 1002/Table 34-50-96-99A-010-A01, Alignment Procedure.
1.2	Sensitivity Variation with Frequency Test Using ATCRBS MODE-C interrogations, ensure that MTL does not vary by more than ±1 dB for interrogation frequencies between 1029.8 and 1030.2 MHz.	TOP BOT 1029.8 MHz ____ ____ 1030.2 MHz ____ ____

STEP	PROCEDURE	DESIRED RESULTS
1.3	Receiver Bandwidth Test Vary the interrogation RF frequency to 1007, 1053, 1060, and 1150 MHz. Verify the MODE-A interrogation level, required to produce 90% reply efficiency is greater than -17 dBm.	TOP BOT 1007 MHz ____ ____ 1053 MHz ____ ____ 1060 MHz ____ ____ 1150 MHz ____ ____
1.4	Dynamic Range Test Verify a minimum reply rate of at least 90% for the following interrogations at input signal levels of -73 dBm and -19 dBm. Interrogations A. MODE-S only All-Call B. ATCRBS MODE-A/MODE-S All-Call C. ATCRBS MODE-C	Signal level (dBm) -73 dBm -19 dBm TOP BOT TOP BOT ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___
1.5	Sensitivity Limit Test For the following interrogations at a -81 dBm input signal level, verify that the reply rate does not exceed 10%. Interrogations A. MODE-S only All-Call B. ATCRBS MODE-A/MODE-S All-Call C. ATCRBS MODE-C	TOP BOTTOM _____ _____ _____ _____ _____ _____
1.6	Undesired Replies For this test, squitter must be disabled by setting Self-Test Inhibit discrete input, P2-38 (-004 thru -007) or P1-19 (-008, -108, -308, -309, -408, -409) to ground. Turn off all interrogations. Verify that the ATCRBS random replies are less than 5 per second and the MODE-S replies are less than 1 per 10 seconds, averaged over a period of at least 30 seconds. After this test, turn interrogations back on and remove the ground from P2-38 or P1-19.	TOP BOT ATCRBS ____ ____ MODE-S ____ ____
2.0	TRANSMITTER REQUIREMENTS	
	Unless otherwise specified, perform the following tests on both the top and bottom antenna ports using a MODE-S test set. For the TDR-94, you must do only the tests for the bottom antenna port.	
2.1	Transmitter Frequency Test Ensure that the output transmitter frequency is 1090 ±0.5 MHz.	_____ MHz

STEP	PROCEDURE	DESIRED RESULTS
2.2	Transmitter Power Test a. Interrogate ATCRBS interrogations at a rate of 450 per second, or MODE-S interrogations at a rate of 50 per second. Verify that the output transmitter power is between 315 and 500 watts measured at the strongest reply pulse. Verify that the weakest pulse is within 1 dB of the strongest for ATCRBS replies and within 2 dB for MODE-S replies. Verify the weakest pulse exceeds 250 watts. Strongest ATCRBS pulse Spec: 315 to 500 watts Weakest ATCRBS pulse Spec: = strongest ±1 dB Weakest MODE-S pulse Spec: = strongest ±2 dB NOTE: Record the peak level of the strongest pulse in dBm to use as a reference for measurements made in step 2.3. CAUTION: BEFORE PERFORMING STEP B, SEPARATE THE TRANSMITTER MODULE FROM THE MAIN CHASSIS AND DISCONNECT HIGH VOLTAGE FROM THE TRANSMITTER. FAILURE TO DO THIS WILL RESULT IN SEVERE DAMAGE TO THE SPECTRUM ANALYZER. ALL COVERS MUST REMAIN INTACT FOR DATA TO BE VALID.	TOP BOTTOM _____ _____ _____ _____ _____ _____
	b. Connect the transmitter output directly to the spectrum analyzer. Ensure that the 1090 MHz L.O. leakage from the antenna port is less than -70 dBm when not transmitting. Reconnect high voltage to the transmitter and reassemble the transmitter module to the main chassis after completing the test. 1090 MHz L.O. leakage Spec: less than -70 dBm	TOP BOTTOM _____ _____

STEP	PROCEDURE	DESIRED RESULTS
2.2 (Cont)	(This test applies to TDR-94D only.) c. Set the self-test inhibit discrete to active to prevent squittering. Ensure that the transmitter power output of the nonselected antenna is attenuated at least 20 dB relative to the selected antenna during the time the transmitter is transmitting on the other antenna port. Set the self-test inhibit discrete to disable after completing the test. Nonselected antenna power Spec: MIN. 20 dB attenuation	 _____
2.3	Transmitter Spectrum and Reply Pulse Shape Set up to transmit only MODE-S replies at 50/second. Observe the output spectrum with a spectrum analyzer. Use a 100-kHz resolution bandwidth or less. Use the peak level reference recorded in step 2.2. for the measurements below. Verify the spectrum does not exceed the following limits: Frequency Difference (MHz from Carrier) — Spec: — Max Relative Response (dB down from peak ref) TOP / BOTTOM >= 1.3 and <7 — 3 — _____ _____ >= 7 and <23 — 20 — _____ _____ >= 23 and <78 — 40 — _____ _____ >= 78 — 60 — _____ _____	
2.4	Reply Pulse Shape For both ATCRBS and MODE-S replies, verify that the pulse rise time is less than 100 ns and that the pulse decay time is less than 200 ns. ATCRBS MODE-S	TOP BOTTOM RISE FALL RISE FALL ____ ____ ____ ____ ____ ____ ____ ____ If these results are not met, select A3C216 test select value from page 10150 (figure 6) to get results into specs.
2.5	Burst Tests For these tests, verify correct replies and output power for all interrogations.	
2.5.1	ATCRBS Burst Tests Verify that at least 120 ATCRBS 15-pulse replies can be generated in 100 ms. Repeat the test at a once per second rate.	TOP BOTTOM _____ _____ (x)

STEP	PROCEDURE	DESIRED RESULTS
2.5.2	MODE-S Burst Tests Verify the following MODE-S reply capabilities: 50 MODE-S replies in a 1-second interval including at least 16 long replies. 18 MODE-S replies in a 100-ms interval including at least 6 long replies. 8 MODE-S replies in a 25-ms interval including at least 4 long replies. 4 MODE-S replies in a 1.6-ms interval including at least 2 long replies.	TOP _____ BOTTOM _____ (x) _____ _____ (x) _____ _____ (x) _____ _____ (x)
2.6	MODE-A Reply Format, Ident Interval, and Reply Delay Inject a normal MODE-A interrogation on the bottom channel only. Select 7777 ident code on the test bench control head simulator (computer). Verify IFR displays a 7777 code. Ensure the downlink first framing pulse occurs 3.00 ±0.45 µs after the P3 leading edge of the interrogation input. Momentarily activate the Ident switch and verify that the SPI pulse is present for 18 ±2 seconds. Verify that the ATCRBS Downlink modulation has pulse widths of 0.45 ±0.05 µs. Verify the following spacings from the first framing pulse. All spacing and width tolerances are ±50 ns. Repeat the reply delay test on the top channel (TDR-94D only). Downlink first framing pulse. Spec: 3.00 ±0.45 µs after P3 input SPI pulse time Spec: 18 ±2 seconds ATCRBS Downlink pulse width Spec: 0.45 ±0.05 µs	TOP _____ µs BOTTOM _____ µs BOTTOM _____ s BOTTOM _____ µs

Final Performance (Customer Acceptance) Test. Cont.
Table 1001/Table 34-50-96-99A-009-A01

STEP	PROCEDURE		DESIRED RESULTS
2.6 (Cont)	Reply Pulse	Position (µs)	BOTTOM
	C1	1.45 ±50 ns	_____ (x)
	A1	2.90 ±50 ns	_____ (x)
	C2	4.35 ±50 ns	_____ (x)
	A2	5.80 ±50 ns	_____ (x)
	C4	7.25 ±50 ns	_____ (x)
	A4	8.70 ±50 ns	_____ (x)
	B1	11.60 ±50 ns	_____ (x)
	D1	13.05 ±50 ns	_____ (x)
	B2	14.50 ±50 ns	_____ (x)
	D2	15.95 ±50 ns	_____ (x)
	B4	17.40 ±50 ns	_____ (x)
	D4	18.85 ±50 ns	_____ (x)
	2ND framing pulse	20.30 ±50 ns	_____ (x)
	SPI	24.65 ±50 ns	_____ (x)
2.7	MODE-C Reply Format and Reply Delay Interrogate with a normal MODE-C signal on the bottom channel only. Select the Gillham discretes as the altitude source by disconnecting rear connector P2 pins 41 and 42 from ground. Verify that F1 of the ATCRBS reply occurs 3.00 ±0.45 µs after the interrogation P3 leading edge. Observe the transmitted MODE-C reply. Verify that each of the Gillham ALT bits will go low individually with a 39-kΩ pull-down resistor. Use the following table listed to locate the Gillham ALT bits. Repeat the reply delay test on the top channel (TDR-94D only). ATCRBS F1 spacing from P3 Spec: 3.00 ±0.45 µs		TOP _____ µs BOTTOM _____ µs

STEP	PROCEDURE	DESIRED RESULTS
2.7 (Cont)	LOCATION / SIGNAL NAME	Bit Toggles (BOTTOM) / Reply Pulse Spacing from F1 (µs)
	P1-1 Gillham ALT B4	_____ 17.40
	P1-2 Gillham ALT B2	_____ 14.50
	P1-3 Gillham ALT B1	_____ 11.60
	P1-4 Gillham ALT A4	_____ 8.70
	P1-5 Gillham ALT A2	_____ 5.80
	P1-6 Gillham ALT A1	_____ 2.90
	P1-7 Gillham ALT D4	_____ 18.85
	P1-8 Gillham ALT D2	_____ 15.95
	P1-9 Gillham ALT C4	_____ 7.25
	P1-10 Gillham ALT C2	_____ 4.35
	P1-11 Gillham ALT C1	_____ 1.45
	F2 (2nd Framing Pulse)	_____ 20.30
3.0	DECODER TESTS Unless otherwise specified, perform the following tests at -74 dBm and -20 dBm interrogation levels at each antenna port.	
3.1	MODE-A P3 Deviation Negative, Max Interrogate MODE-A with a P3 deviation of -0.9 µs on the appropriate channel. Verify that the reply rate is NOT GREATER than 10%.	Signal level (dBm) -74 -20 BOT _____ _____ TOP _____ _____
3.2	MODE-A P3 Deviation Positive, Max Interrogate MODE-A with a P3 deviation of +0.9 µs on the appropriate channel. Verify that the reply rate is NOT GREATER than 10%.	Signal level (dBm) -74 -20 BOT _____ _____ TOP _____ _____
3.3	MODE-A Pulse Width, Narrow Interrogate MODE-A with 0.30 µs pulse width at a level of -45 dBm on the appropriate channel. Verify that the reply rate is NOT GREATER than 10%.	Signal level (dBm) -45 BOT _____ TOP _____
3.4	MODE-A Pulse Width, Normal Interrogate MODE-A with 0.60 µs pulse width on the appropriate channel. Verify AT LEAST 90% MODE-A replies are transmitted.	Signal level (dBm) -74 -20 BOT _____ _____ TOP _____ _____
3.5	MODE-A P3 Deviation Negative, Min Interrogate MODE-A with a P3 deviation of -0.30 µs on the appropriate channel. Verify AT LEAST 90% MODE-A replies are transmitted.	Signal level (dBm) -74 -20 BOT _____ _____ TOP _____ _____

Final Performance (Customer Acceptance) Test. Cont.
Table 1001/Table 34-50-96-99A-009-A01

STEP	PROCEDURE	DESIRED RESULTS
3.6	MODE-A P3 Deviation Positive, Min Interrogate MODE-A with a P3 deviation of +0.30 µs on the appropriate channel. Verify AT LEAST 90% MODE-A replies are transmitted.	Signal level (dBm) -74 -20 BOT _____ _____ TOP _____ _____
3.7	MODE-C P3 Deviation Negative, Max Interrogate MODE-C with a P3 deviation of -0.90 µs on the appropriate channel. Verify that the reply rate is NOT GREATER than 10%.	Signal level (dBm) -74 -20 BOT _____ _____ TOP _____ _____
3.8	MODE-C P3 Deviation Positive, Max Interrogate MODE-C with a P3 deviation of +0.90 µs on the appropriate channel. Verify that the reply rate is NOT GREATER than 10%.	Signal level (dBm) -74 -20 BOT _____ _____ TOP _____ _____
3.9	MODE-C P3 Deviation Negative, Min Interrogate MODE-C with a P3 deviation of -0.30 µs on the appropriate channel. Verify that the reply rate is AT LEAST 90%.	Signal level (dBm) -74 -20 BOT _____ _____ TOP _____ _____
3.10	MODE-C P3 Deviation Positive, Min Interrogate MODE-C with a P3 deviation of +0.30 µs on the appropriate channel. Verify that the reply rate is AT LEAST 90%.	Signal level (dBm) -74 -20 BOT _____ _____ TOP _____ _____
4.0	ATCRBS SLS TEST Perform the following tests at MTL +3 dB or -74 dBm. Test also at -60 dBm, -40 dBm, and -22 dBm input signal levels. Conduct the following tests on the bottom antenna port for both TDR-94 and TDR-94D. Repeat the tests on the top antenna port of the TDR-94D only.	
4.1	MODE-C P2 at -1 dB Interrogate with a MODE-C P1, P2, P3 triad with P2 at -1 dB. Deviate the P2 position +0.2 and -0.2 µs. Verify that the reply rate is NOT GREATER than 10%.	Signal level (dBm) -74 -60 -40 -22 BOT __ __ __ __ TOP __ __ __ __
4.2	MODE-C P2 at -9 dB Interrogate with a MODE-C P1, P2, P3 triad with P2 at -9 dB. Verify that the reply rate is AT LEAST 90%.	Signal level (dBm) -74 -60 -40 -22 BOT __ __ __ __ TOP __ __ __ __
4.3	MODE-C P2 at 0 dB Interrogate with a MODE-C P1, P2, P3 triad with P2 at 0 dB. Set P2 pulse width to 0.60 µs and verify that the reply rate is NOT GREATER than 1%.	Signal level (dBm) -74 -60 -40 -22 BOT __ __ __ __ TOP __ __ __ __

Final Performance (Customer Acceptance) Test. Cont.
Table 1001/Table 34-50-96-99A-009-A01

STEP	PROCEDURE	DESIRED RESULTS
4.4	MODE-A P2 at 0 dB Interrogate with a MODE-A P1, P2, P3 triad with P2 at 0 dB. Deviate the P2 position +0.65 µs and -0.65 µs and verify that the reply rate is AT LEAST 90%.	Signal level (dBm) -74 -60 -40 -22 BOT __ __ __ __ TOP __ __ __ __
4.5	SLS Suppression Interval Interrogate with a P1, P2, ATCRBS suppression pair with P2 at 0 dB relative to P1. Follow with a normal MODE-A P1, P3 interrogation. Delay the second interrogation 26 µs from P2 of the first interrogation and verify that the reply rate is NOT GREATER than 10%. Delay the second interrogation 44 µs from P2 of the first interrogation and verify that replies are generated in response to the second interrogation at a rate of AT LEAST 90%. Second interrogation delayed 26 µs. NOT GREATER than 10% ATCRBS reply Second interrogation delayed 44 µs. AT LEAST 90% replies to second interrogation	_____ _____
5.0	MODE-S SLS TEST	
	Perform the following tests at MTL +3 dB or -73 dBm and also at -22 dBm interrogation input signal levels applied to the bottom antenna port. Repeat the test for the top antenna port of the TDR-94D only.	
5.1	P5 Greater than P6 Ensure that a P5 pulse overlaying the SPR (Sync Phase Reversal) of a MODE-S interrogation results in a reply rate of NOT GREATER than 10% if its amplitude is greater than P6 by 3 dB.	Signal level (dBm) -73 -22 BOT _____ _____ TOP _____ _____
5.2	P5 Less Than P6 Ensure that a P5 pulse overlaying the SPR of a MODE-S interrogation results in greater than 99% replies if its amplitude is less than P6 by 12 dB	Signal level (dBm) -73 -22 BOT _____ _____ TOP _____ _____
6.0	ALL-CALL DECODER TEST	
	Perform the following tests at MTL +1 dB or -75 dBm and also at -22 dBm interrogation input signal levels. Unless otherwise specified, test the bottom antenna port for the TDR-94, and both antenna ports for the TDR-94D.	

STEP	PROCEDURE	DESIRED RESULTS
6.1	P4 Pulse Width Variation, ATCRSB/MODE-S All-Call a. Interrogate with a P1, P3, P4 ATCRBS/MODE-S ALL-CALL. Vary the P4 pulse width from 1.45 to 1.75 µs. Ensure that the downlink MODE-S reply rate exceeds 90%.	Signal level (dBm) -75 -22 BOT _____ _____ TOP _____ _____
	b. Ensure the downlink first preamble pulse occurs 128.00 ±0.50 µs after the P4 pulse leading edge.	Signal level (dBm) -75 -22 BOT _____ _____ TOP _____ _____
	c. Ensure that the downlink modulation has proper spacing and widths for the preamble and information pulses. All spacing and width tolerances are ±30 ns.	Signal level (dBm) -75 -22 BOT _____ _____ TOP _____ _____
6.2	MODE-S Address Ensure that the MODE-S address bits will go low individually with a 1.82-kΩ pull-down resistor and remain high individually with a 18.2-kΩ pull-down resistor. Use the following table to locate and address the MODE-S address bits. NOTE: TDR-94/94D transponders -004 status and later, read and accept the MODE-S Address during power-on initialization only. If the MODE-S Address is changed after power-on initialization, the address will not be accepted for use in replies to interrogations. Consequently, if the MODE-S Address provided to the UUT is changed, power to the UUT may have to be cycled before proceeding with this test. NOTE: If the resistor pull-down tests are performed at an assembly level test, the top-level test may substitute a short-to-ground, or open circuit, for 1.82 kΩ and 18.2 kΩ, respectively. Conduct this test for the bottom antenna port only and at a convenient input signal level.	

STEP	PROCEDURE		DESIRED RESULTS
6.2 (Cont)	SIGNAL NAME	LOCATION	
	MODE-S ADDR B1	P1-33	_____
	MODE-S ADDR B2	P1-34	_____
	MODE-S ADDR B3	P1-35	_____
	MODE-S ADDR B4	P1-36	_____
	MODE-S ADDR B5	P1-37	_____
	MODE-S ADDR B6	P1-38	_____
	MODE-S ADDR B7	P1-39	_____
	MODE-S ADDR B8	P1-40	_____
	MODE-S ADDR B9	P1-41	_____
	MODE-S ADDR B10	P1-42	_____
	MODE-S ADDR B11	P1-43	_____
	MODE-S ADDR B12	P1-44	_____
	MODE-S ADDR B13	P1-45	_____
	MODE-S ADDR B14	P1-46	_____
	MODE-S ADDR B15	P1-47	_____
	MODE-S ADDR B16	P1-48	_____
	MODE-S ADDR B17	P1-49	_____
	MODE-S ADDR B18	P1-50	_____
	MODE-S ADDR B19	P1-51	_____
	MODE-S ADDR B20	P1-52	_____
	MODE-S ADDR B21	P1-53	_____
	MODE-S ADDR B22	P1-54	_____
	MODE-S ADDR B23	P1-55	_____
	MODE-S ADDR B24	P1-56	_____

Final Performance (Customer Acceptance) Test. Cont.
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STEP	PROCEDURE	DESIRED RESULTS
6.3	P4 Pulse Width Variation, ATCRBS-ONLY ALL Interrogate with a P1, P3, P4 ATCRBS-Only All-Call. Vary the P4 pulse width from 0.60 to 1.00 µs. Verify that the reply rate is NOT GREATER than 10%.	Signal level (dBm) -75 -22 BOT _____ _____ TOP _____ _____
6.4	P4 Pulse Width Variation, ATCRBS/MODE-S ALL CALL Interrogate with a P1, P3, P4 ATCRBS/MODE-S All-Call. Set the P4 pulse width to 1.1 and 2.4 µs. Verify that the reply rate is NOT GREATER than 10%.	Signal level (dBm) -75 -22 BOT _____ _____ TOP _____ _____
6.5	P4 Minimum Pulse Width, ATCRBS-ONLY ALL CALL Interrogate with a P1, P3, P4 ATCRBS-Only All-Call. Set P4 pulse width to 0.30 µs. Verify that an ATCRBS reply occurs within 3.00 ±0.50 µs from P3, at a rate of AT LEAST 90%, and the MODE-S reply rate is NOT GREATER than 10%. 10% or < MODE-S reply 90% or > ATCRBS reply	Signal level (dBm) -75 -22 BOT _____ _____ TOP _____ _____ BOT _____ _____ TOP _____ _____
6.6	P4 Position Variation, ATCRBS/MODE-S ALL CALL Interrogate with normal P1, P3, P4 ATCRBS/MODE-S All-Call interrogations. Deviate the P4 position ±50 ns. Verify that the All-Call replies are transmitted at a rate of AT LEAST 90%.	Signal level (dBm) -75 -22 BOT _____ _____ TOP _____ _____
6.7	P4 Amplitude 6 dB Below P3 Interrogate with ATCRBS/MODE-S All-Call interrogations. Adjust the P4 amplitude 6 dB below the amplitude of P3. Verify that the MODE-S reply rate is NOT GREATER than 10% and the ATCRBS rate is AT LEAST 90%. 10% or < MODE-S reply 90% or > ATCRBS reply	Signal level (dBm) -75 -22 BOT _____ _____ TOP _____ _____ BOT _____ _____ TOP _____ _____

Final Performance (Customer Acceptance) Test. Cont.
Table 1001/Table 34-50-96-99A-009-A01

STEP	PROCEDURE	DESIRED RESULTS
6.8	P4 Deviation, ATCRBS/MODE-S ALL CALL Interrogate with ATCRBS/MODE-S All-Call interrogations. Deviate P4 ±0.30 µs and verify that the ATCRBS reply rate is AT LEAST 90% and the MODE-S reply rate is NOT GREATER than 10%. 10% or < MODE-S reply 90% or > ATCRBS reply	Signal level (dBm) -75 -22 BOT _____ _____ TOP _____ _____ BOT _____ _____ TOP _____ _____
6.9	P4 Amplitude 1 dB Below P3 Interrogate with ATCRBS-Only All-Call interrogation having a signal level of -73 dBm. Adjust the P4 amplitude 1 dB below amplitude of P3. Verify that the reply rate is NOT GREATER than 10%.	Signal level (dBm) -73 BOT _____ TOP _____
7.0	MODE-S DECODER TEST Perform the following tests at MTL +1 dB or -75 dBm and also -22 dBm interrogation levels. Test the bottom antenna port of the TDR-94, and both antenna ports of the TDR-94D. Set the ADLP select to active. If air/ground discrete is set to airborne, cycle power before beginning tests.	Signal level (dBm) -75 -22 BOT _____ _____ TOP _____ _____
7.1	MODE-S Reply Delay Interrogate with Uplink Format UF=11 interrogations. Verify that the first downlink preamble pulse occurs 128.00 ±0.25 µs after the SPR (Sync Phase Reversal) of the interrogation inputs. Verify that the Downlink Response is DF=11.	
7.2	SPR Deviation -Low Interrogate with Uplink Format UF=11 interrogations. Deviate the SPR position over +50 and -50 ns. Verify that the DF=11 downlink response rate is AT LEAST 90%. +50 ns -50 ns	Signal level (dBm) -75 -22 BOT _____ _____ TOP _____ _____ BOT _____ _____ TOP _____ _____

Final Performance (Customer Acceptance) Test. Cont.
Table 1001/Table 34-50-96-99A-009-A01

STEP	PROCEDURE	DESIRED RESULTS
7.3	SPR Deviation -High Interrogate with Uplink Format UF=11 interrogations. Deviate the SPR position to +200 ns and -200 ns. Verify that the DF=11 downlink response rate is NOT GREATER than 10%.	Signal level (dBm) -75 -22 +200 ns BOT _____ _____ TOP _____ _____ -200 ns BOT _____ _____ TOP _____ _____
7.4	UF = 5/DF = 5 Interrogate with Uplink Format UF=5 interrogations. Verify that the downlink response is DF=5. Conduct this test for bottom antenna port only and at a convenient input signal level.	BOTTOM _____
7.5	UF = 5 Different Address Interrogate with Uplink Format UF=5 interrogations that have an address different than that of the unit under test. Verify no reply occurs other than normal DF=11 squitter transmissions. Conduct this test for the bottom antenna port only and at a convenient input signal level.	BOTTOM _____
7.6	UF = 21/DF = 21 Interrogate with Uplink Format UF=21 interrogations. Verify that the downlink response is DF=21. Conduct this test for bottom antenna port only and at a convenient input signal level.	BOTTOM _____
7.7	UF = 0, Max Airspeed Interrogate with Uplink Format UF=0 interrogations. Verify that the MAX AIR SPEED bits independently toggle in the downlink response of DF=0 when discrete pins P2-43, 44, 45 are switched. Conduct this test for bottom antenna port only and at a convenient input signal level.	BOTTOM _____
7.8	UF = 11, Low-Level Interrogate with Uplink Format UF=11 interrogations that have an input signal level at MTL or -76 dBm. Trigger the scope from the generator output of the IFR. Connect the transmitter jack of the IFR to the vertical scope channel. Use the delayed sweep function of the scope to view the first reply pulse with a horizontal rate of 50 ns/div. Verify the jitter of the pulse does not exceed 160 ns total (±80 ns.).	Signal level (dBm) -76 -22 BOT _____ _____ TOP _____ _____

Final Performance (Customer Acceptance) Test. Cont.
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STEP	PROCEDURE	DESIRED RESULTS
8.0	INTERFERENCE TEST Perform the following tests for UF=11 MODE-S interrogations at signal levels of -68 and -22 dBm. Inject an interference pulse of 0.80 µs duration, at a carrier frequency of 1030 MHz, but incoherent with the interrogation signal. Test the bottom antenna port for the TDR-94, and both antenna ports for the TDR-94D. NOTE: For steps 8.1 and 8.2, the interference pulse can be coincident with a group of 3 or more phase transitions spaced 0.25 µs.	
8.1	Interference Level 3 dB Less Than Signal Level Verify that when the interference pulse overlays the MODE-S interrogation anywhere after the Sync Phase Reversal, the reply rate exceeds 50% if the interference amplitude is 3 dB less than the interrogation signal level.	Signal level (dBm) -68 -22 BOT _____ _____ TOP _____ _____
8.2	Interference Level 9 dB Less Than Signal Level Verify that when the interference pulse overlays the MODE-S interrogation anywhere after the MODE-S P1 pulse leading edge, the reply rate is AT LEAST 90% if the interference amplitude is 9 dB less than the interrogation signal level.	Signal level (dBm) -68 -22 BOT _____ _____ TOP _____ _____
9.0	SQUITTER TEST For this test, turn off the input interrogations.	
9.1	Dual Antenna Squitter Rate Ensure that squitter is generating a DF=11 (Acquisition Squitter) reply at an average rate of 1.0 Hz, alternating between the top and bottom antenna ports for the TDR-94D, and fixed on the bottom antenna port for the TDR-94.	____ (check if okay)
9.2	Single Antenna Squitter Rate Ensure that grounding the single antenna strap (by selecting single antenna active on the test computer) prevents squitter transmissions on the top antenna port, and that the bottom antenna port alone continues to squitter at a 1.0-Hz rate. NOTE: Unit input power must be cycled to recognize the Single Antenna Strap discrete change.	____ (check if okay)

STEP	PROCEDURE	DESIRED RESULTS
9.3	Airborne Position Extended Squitter (-004 through -007 and -207 status TDR-94/94D)	
	a. Ensure that neither Air/Ground Discrete #1 or #2 (P2-53 or P1-27) are connected to ground (i.e., establishes the airborne state).	
	b. Via the GPS/GNSS Input Data Bus, provide the transponder with the appropriate labels and data indicated in Figure 1003/GRAPHIC 34-50-96-99B-021-A01. Each data parameter shall be updated at least once per second.	
	c. Verify that the transponder properly transmits an “Even_Second" DF=17 Extended Squitter transmission that has the exact structure for the 'ME" field as shown in Figure 1003/GRAPHIC 34-50-96-99B-021-A01.	
	d. Verify that the transponder properly transmits the Airborne Position Message at random intervals that are uniformly distributed over the range from 0.4 to 0.6 second.	
	e. Verify that the transponder properly transmits the Airborne Position alternately from the top and bottom antenna ports for the TDR-94D and from the bottom antenna port only for the TDR-94.	
	f. Verify the transponder continues to transmit DF=11 Acquisition Squitters while continuing to transmit the Airborne Position Squitter Messages as specified in previous steps c, d, and e.	
	g. Maintain the data inputs as provided in step b with the exception that the UTC Time input should be changed to read as indicated in Figure 1003/GRAPHIC 34-50-96-99B-021-A01.	
	h. Verify that the transponder properly transmits an "Odd_Second" DF=17 Extended Squitter transmission that has the exact structure for the "ME" field shown in Figure 1003/GRAPHIC 34-50-96-99B-021-A01.	

Final Performance (Customer Acceptance) Test. Cont.
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STEP	PROCEDURE	DESIRED RESULTS
9.3A	GPS Bus/Airborne Position Extended Squitter/Time Tag Verification (-108 status TDR-94/94D only)	
	a. Ensure that neither Air/Ground Discrete #1 or #2 (P2-53 or P1-27) are connected to ground (i.e., establishes the airborne state).	
	b. Ensure that neither Configuration Select discrete 0 or 1 (P1-28 or P1-17) are connected to ground.	
	c. Ensure that ARINC 429 label 203 is not present on the selected Altitude Input Bus.	
	d. Provide the transponder with a GPS Time Tag signal via the GPS Time Tag input (P2-37 high, P2-38 low). The GPS Time Tag signal is a differential (0-5 Vdc) 1 ms pulse that repeats once per second.	
	e. Via the GPS/GNSS Input Data Bus, provide the transponder with the appropriate labels and data indicated in Figure 1004/GRAPHIC 34-50-96-99B-022-A01. Each data parameter must be updated at least one time each second.	
	f. Verify that the transponder properly transmits an Even-Second DF=17 Extended Squitter transmission that has the exact structure for the "ME" field indicated in Figure 1004/GRAPHIC 34-50-96-99B-022-A01.	
	g. Verify that the transponder properly transmits the Airborne Position Message at random intervals that are uniformly distributed over the range from 0.4 to 0.6 seconds.	
	h. Verify that the transponder properly transmits the Airborne Position alternately from the top and bottom antenna ports of the TDR-94D and from the bottom antenna port only of the TDR-94.	
	i. Verify that the transponder continues to transmit DF=11 Acquisition Squitters while continuing to transmit the Airborne Position Squitter messages indicated in steps f, g, and h. above.	
	j. Verify that the transponder properly transmits an Odd-Second DF=17 Extended Squitter transmission that has the exact structure for the "ME" field indicated in Figure 1004/GRAPHIC 34-50-96-99B-022-A01.	

Final Performance (Customer Acceptance) Test. Cont.
Table 1001/Table 34-50-96-99A-009-A01

STEP	PROCEDURE	DESIRED RESULTS
9.3B	GPS Bus/Airborne Position Extended Squitter/Time Tag Verification (-008 status TDR-94/94D only)	
	a. Ensure that neither Air/Ground Discrete #1 or #2 (P2-53 or P1-27) are connected to ground (i.e., establishes the airborne state).	
	b. Ensure that neither Configuration Select discrete 0 or 1 (P1-28 or P1-17) are connected to ground.	
	c. Ensure that ARINC 429 label 203 is not present on the selected Altitude Input Bus.	
	d. Provide the transponder with a GPS Time Tag signal via the GPS Time Tag input (P2-37 high, P2-38 low). The GPS Time Tag signal is a differential (0-5 Vdc) 1 ms pulse that repeats once per second.	
	e. Via the GPS/GNSS Input Data Bus, provide the transponder with the appropriate labels and data indicated in Figure 1004/GRAPHIC 34-50-96-99B-022-A01 (for step e of test 9.3A). Each data parameter must be updated at least one time each second.	
	f. Interrogate the transponder with the MODE-S interrogations indicated in Figure 1005/GRAPHIC 34-50-96-99B-023-A01 to request BDS register 0.5.	
	g. Verify that the transponder responds properly with two DF=20 replies that have the exact structures for the "MB" field indicated in Figure 1005/GRAPHIC 34-50-96-99B-023-A01.	
	h. Repeat step f. as necessary.	
	i. Verify that the transponder responds properly with two DF=20 replies that have the exact structures for the "MB" field indicated in Figure 1005/GRAPHIC 34-50-96-99B-023-A01. NOTE: Steps h. and i. may have to be repeated to get an odd encoding since the transponder alternates the encoding of latitude and longitude data on odd and even intervals at rates of either 100 or 200 ms.	
9.3C	GPS Bus / Airborne Position Extended Squitter / Time Tag Verification (-408/-409)	

Final Performance (Customer Acceptance) Test. Cont.
Table 1001/Table 34-50-96-99A-009-A01

STEP	PROCEDURE	DESIRED RESULTS
	a. Ensure that both Air/Ground Discrete #1 (P2-53) and Air/Ground Discrete #2 (P1-27) are NOT connected to ground (i.e., establish the airborne state).	
	b. Ensure that both Configuration Select “0” (P1-28) and Configuration Select “1” (P1-17) are NOT connected to ground.	
	c. Ensure that there is no Arinc 429 Label 203 present on the selected Altitude Input Bus.	
	d. Provide the transponder unit with a GPS Time Tag signal via the GPS Time Tag inputs (P2-37 High, P2-38 Low). The GPS time tag signal shall be a differential (0 –5 vdc) 1 millisecond pulse, at a repetition rate of 1 per second.	
	e. Via the GPS/GNSS Input Data Bus, provide the transponder with the appropriate labels and data indicated in Figure 1018/GRAPHIC 34-50-96-99B-089-A01. Each data parameter shall be updated at least once per second.	
	f. Verify that the transponder properly transmits an ”Even-Second” DF=17 Extended Squitter transmission having the exact structure for the ”ME” field indicated in Figure 1018/GRAPHIC 34-50-96-99B-089-A01. NOTE: The single Antenna Bit (RF bit 40) will be set to a "0" for the TDR-94D and a "1" for the TDR-94.	
	g. Verify that the transponder properly transmits the Airborne Position Message at random intervals that are uniformly distributed over the range from 0.4 to 0.6 seconds (i.e., 0.5 +/-0.1 seconds).	
	h. Verify that the transponder properly transmits the Airborne Position alternately from the top and bottom antenna ports for the TDR-94D and from the bottom antenna only for the TDR-94.	
	i. Verify that the transponder continues to transmit DF=11 Acquisition Squitters while continuing to transmit the Airborne Position Squitter Messages as specified steps f, g, and h.	
	j. Verify that the transponder properly transmits an ”Odd-Second” DF=17 Extended Squitter transmission having the exact structure for the ”ME” field indicated in Figure 1018/GRAPHIC 34-50-96-99B-089-A01.	
9.3D	GPS Bus / Airborne Position Extended Squitter / Time Tag Verification (-308, -309 ONLY)	

Final Performance (Customer Acceptance) Test. Cont.
Table 1001/Table 34-50-96-99A-009-A01

STEP	PROCEDURE	DESIRED RESULTS
	a. Ensure that both Air/Ground Discrete #1 (P2-53) and Air/Ground Discrete #2 (P1-27) are NOT connected to ground (i.e., establish the airborne state).	
	b. Ensure that both Configuration Select “0” (P1-28) and Configuration Select “1” (P1-17) are NOT connected to ground.	
	c. Ensure that there is no Arinc 429 Label 203 present on the selected Altitude Input Bus.	
	d. Provide the transponder unit with a GPS Time Tag signal via the GPS Time Tag inputs (P2-37 High, P2-38 Low). The GPS time tag signal shall be a differential (0 –5 vdc) 1 millisecond pulse, at a repetition rate of 1 per second.	
	e. Via the GPS/GNSS Input Data Bus, provide the transponder with the appropriate labels and data indicated in Figure 1019/GRAPHIC 34-50-96-99B-090-A01. Each data parameter shall be updated at least once per second.	
	f. Interrogate the transponder with the Mode-S interrogation indicated in Figure 1019/GRAPHIC 34-50-96-99B-090-A01 to request BDS Register 0,5.	
	g. Verify that the transponder responds properly with two DF=20 replies containing the exact structures for the ”MB” field indicated in Figure 1019/GRAPHIC 34-50-96-99B-090-A01. NOTE: The single Antenna Bit (RF bit 40) will be set to a "0" for the TDR94D and a "1" for the TDR-94. NOTE: Steps f and g may need to be repeated in order to get an even encoding since the transponder is alternating encoding of latitude and longitude data on odd and even intervals at rates of either 100 or 200 milliseconds.	
	h. Repeat step f as needed.	

Final Performance (Customer Acceptance) Test. Cont.
Table 1001/Table 34-50-96-99A-009-A01

STEP	PROCEDURE	DESIRED RESULTS
	i. Verify that the transponder responds properly with two DF=20 replies containing the exact structures for the ”MB” field indicated in Figure 1019/GRAPHIC 34-50-96-99B--A01. NOTE: The single Antenna Bit (RF bit 40) will be set to a "0" for the TDR94D and a "1" for the TDR-94. NOTE: Steps h and i may need to be repeated in order to get an even encoding since the transponder is alternating encoding of latitude and longitude data on odd and even intervals at rates of either 100 or 200 milliseconds.	

STEP	PROCEDURE	DESIRED RESULTS
9.4	Acquisition Squitter Inhibit (-004 through -007 and -207 status TDR-94/94D)	
	a. Connect the Acquisition Squitter Inhibit (F) Discrete (P1-26) to ground. Verify that the transponder ceases to transmit DF=11 Acquisition Squitter messages but continues to transmit either airborne or Surface Position Squitter DF= 17 messages.	
	b. Set the Aquisition Squitter Inhibit (F) discrete (P1-26) to open before continuing to the next step.	
9.5	Surface Position Extended Squitter (-004 through -007 and -207 status TDR-94/94D)	
	a. Connect either Air/Ground Discrete #1 (P2-53) or Air/Ground Discrete #2 (P1-27) to ground (i.e., establish the surface state).	
	b. Via the GPS/GNSS Input Data Bus, provide the transponder with the appropriate labels and data indicated in Figure 1006/GRAPHIC 34-50-96-99B-024-A01 . Each data parameter is updated at least once per second.	
	c. Verify that the transponder properly transmits an "Even_Second" DF=17 Extended Squitter transmission that has the exact structure for the “ME" fieldas shown in Figure 1006/GRAPHIC 34-50-96-99B-024-A01.	
	d. Verify that the transponder properly transmits the Surface Position Message at random intervals that are uniformly distributed over the range from 0.4 to 0.6 second.	
	e. Verify that the transponder properly transmits the Surface Position alternately from the top antenna port for the TDR-94D and from the bottom antenna port only for the TDR-94.	
	f. Verify the transponder continues to transmit DF=11 Acquisition Squitters while continuing to transmit the Surface Position Squitter Messages indicated in steps c, d, and e.	
	g. Maintain the data inputs as provided in step b with the exception that the UTC Time input should be changed to read as shown in Figure 1006/GRAPHIC 34-50-96-99B-024-A01.	

Final Performance (Customer Acceptance) Test. Cont.
Table 1001/Table 34-50-96-99A-009-A01

STEP	PROCEDURE	DESIRED RESULTS
	h. Verify that the transponder properly transmits an "Odd_Second" DF=17 Extended Squitter transmission that has the exact structure for the "ME" field as shown in Figure 1006/GRAPHIC 34-50-96-99B-024-A01.	
9.5A	GPS Bus/Surface Position Extended Squitter/Time Tag Verification (-108 status TDR-94/94D only)	
	a. Connect either air/ground discrete #1 or #2 (P2-53 or P1-27) to ground (i.e., establishes the surface state).	
	b. Ensure that neither configuration select discrete 0 or 1 (P1-28 or P1-17) are connected to ground.	
	c. Provide the transponder with a GPS Time Tag signal via the GPS Time Tag inputs (P2-37 high, P2-38 low). The GPS Time Tag signal is a differential (0-5 Vdc) 1 ms pulse, that repeats once per second.	
	d. Via the GPS/GNSS Input Data Bus, provide the transponder with the appropriate labels and data indicated in Figure 1007/GRAPHIC 34-50-96-99B-025-A01. Each data parameter must be updated at least one time each second.	
	e. Verify that the transponder properly transmits an Even-Second DF=17 Extended Squitter Transmission that has the exact structure for the "ME" field indicated in Figure 1007/GRAPHIC 34-50-96-99B-025-A01.	
	f. Verify that the transponder properly transmits the Surface Position Message at random intervals that are uniformly distributed over the range from 0.4 to 0.6 seconds.	
	g. Verify that the transponder properly transmits the Surface Position from the top antenna port only of the TDR-94D and from the bottom antenna port only of the TDR-94.	
	h. Verify that the transponder does not transmit DF=11 Acquisition Squitters while transmitting the Surface Position Squitter Messages indicated in steps e, f, and g.	
	i. Do not provide the transponder with a GPS Time Tag signal via the GPS Time Tag inputs (P2-37 high, P2-38 low).	
	j. Verify that the transponder properly transmits an Odd-Second DF=17 Extended Squitter transmission that has the exact structure for the "ME" field indicated in Figure 1007/GRAPHIC 34-50-96-99B-025-A01.	

Final Performance (Customer Acceptance) Test. Cont.
Table 1001/Table 34-50-96-99A-009-A01

STEP	PROCEDURE	DESIRED RESULTS
9.5B	GPS Bus/Airborne Surface Extended Squitter/Time Tag Verification (-008 status TDR-94/94D only)	
	a. Connect either air/ground discrete #1 or #2 (P2-53 or P1-27) to ground (i.e., establishes the surface state).	
	b. Ensure that neither configuration select discrete 0 or 1 (P1-28 or P1-17) are connected to ground.	
	c. Provide the transponder with a GPS Time Tag signal via the GPS Time Tag inputs (P2-37 high, P2-38 low). The GPS Time Tag signal is a differential (0-5 Vdc) 1 ms pulse, that repeats once per second.	
	d. Via the GPS/GNSS Input Data Bus, provide the transponder with the appropriate labels and data indicated in Figure 1007/GRAPHIC 34-50-96-99B-025-A01 (for step d of test 9.5A). Each data parameter must be updated at least one time each second.	
	e. Interrogate the transponder with the MODE-S interrogations indicated in Figure 1008/GRAPHIC 34-50-96-99B-026-A01 to request BDS register 0,6.	
	f. Verify that the transponder responds properly with two DF=20 replies that have the exact structures for the "MB" field indicated in Figure 1008/GRAPHIC 34-50-96-99B-026-A01.	
	g. Do not provide the transponder with a GPS Time Tag signal via the GPS Time Tag inputs (P2-37 high, P2-38).	
	h. Repeat step e. as necessary.	
	i. Verify that the transponder responds properly with two DF=20 replies that have the exact structure for the "MB" field in Figure 1008/GRAPHIC 34-50-96-99B-026-A01. NOTE: Steps h and i may have to be repeated to get an odd encoding since the transponder alternates the encoding of latitude and longitude data on odd and even intervals at rates of either 100 or 200 ms.	
9.5C	GPS Bus / Surface Position Extended Squitter / Time Tag Verification/ (-408/-409)	
	a. Connect either Air/Ground Discrete #1 (P2-53) or Air/Ground Discrete #2 (P1-27) to ground (i.e., establish the surface state).	

Final Performance (Customer Acceptance) Test. Cont.
Table 1001/Table 34-50-96-99A-009-A01

STEP	PROCEDURE	DESIRED RESULTS
	b. Ensure that both Configuration Select “0” (P1-28) and Configuration Select “1” (P1-17) are NOT connected to ground.	
	c. Provide the transponder unit with a GPS Time Tag signal via the GPS Time Tag inputs (P2-37 High, P2-38 Low). The GPS time tag signal shall be a differential (0 –5 vdc) 1 millisecond pulse, at a repetition rate of 1 per second.	
	d. Via the GPS/GNSS Input Data Bus, provide the transponder with the appropriate labels and data indicated in Figure 1020/GRAPHIC 34-50-96-99B-091-A01. Each data parameter shall be updated at least once per second.	
	e. Verify that the transponder properly transmits an ”Even-Second” DF=17 Extended Squitter transmission having the exact structure for the ”ME” field indicated in Figure 1020/GRAPHIC 34-50-96-99B-091-A01.	
	f. Verify that the transponder properly transmits the Surface Position Message at random intervals that are uniformly distributed over the range from 0.4 to 0.6 seconds (i.e., 0.5 +/-0.1 seconds).	
	g. Verify that the transponder properly transmits the Surface Position from the top antenna port only for the TDR-94D and from the bottom antenna only for the TDR-94.	
	h. Verify that the transponder does not transmit DF=11 Acquisition Squitters while transmitting the Surface Position Squitter Messages as specified steps e, f, and g.	
	i. Do NOT provide the transponder unit with a GPS Time Tag signal via the GPS Time Tag inputs (P2-37 High, P2-38 Low).	
	j. Verify that the transponder properly transmits an ”Odd-Second” DF=17 Extended Squitter transmission having the exact structure for the ”ME” field Figure 1020/GRAPHIC 34-50-96-99B-091-A01.	
9.5D	GPS Bus / Surface Position Extended Squitter / Time Tag Verification (-308, -309 ONLY)	
	a. Connect either Air/Ground Discrete #1 (P2-53) or Air/Ground Discrete #2 (P1-27) to ground (i.e., establish the surface state).	
	b. Ensure that both Configuration Select “0” (P1-28) and Configuration Select “1” (P1-17) are NOT connected to ground.	

Final Performance (Customer Acceptance) Test. Cont.
Table 1001/Table 34-50-96-99A-009-A01

STEP	PROCEDURE	DESIRED RESULTS
	c. Provide the transponder unit with a GPS Time Tag signal via the GPS Time Tag inputs (P2-37 High, P2-38 Low). The GPS time tag signal shall be a differential (0 –5 vdc) 1 millisecond pulse, at a repetition rate of 1 per second.	
	d. Via the GPS/GNSS Input Data Bus, provide the transponder with the appropriate labels and data indicated in Figure 1021/GRAPHIC 34-50-96-99B-092-A01. Each data parameter shall be updated at least once per second.	
	e. Interrogate the transponder with the Mode-S interrogation indicated in Figure 1021/GRAPHIC 34-50-96-99B-092-A01 to request BDS Register 0,6.	
	f. Verify that the transponder responds properly with two DF 20 replies containing the exact structures for the “MB” field indicated in Figure 1021/GRAPHIC 34-50-96-99B-092-A01. NOTE: Steps e and f may need to be repeated in order to get an even encoding since the transponder is alternating encoding of latitude and longitude data on odd and even intervals at rates of either 100 or 200 milliseconds.	
	g. Do NOT provide the transponder unit with a GPS Time Tag signal via the GPS Time Tag inputs (P2-37 High, P2-38 Low).	
	h. Repeat step e as needed.	
	i. Verify that the transponder responds properly with two DF 20 replies containing the exact structures for the “MB” field indicated in Figure 1021/GRAPHIC 34-50-96-99B-092-A01.	

STEP	PROCEDURE	DESIRED RESULTS
9.6	FMS/INS Primary Data(-004 through -007 and -207 status TDR-94/94D)	
	a. Ensure that neither Air/Ground Discrete #1 or #2 (P2-53 or P1-27) are connected to ground (i.e., establishes the airborne state).	
	b. Via the FMS/IRS Input Data Bus, provide the transponder with the appropriate labels and data indicated in Figure 1009/GRAPHIC 34-50-96-99B-027-A01. Each data parameter is updated at least once per second.	
	c.Via the selected ARINC-429 Altitude Input Data Bus, provide the transponder with the appropriate labels and data indicated in Figure 1009/GRAPHIC 34-50-96-99B-027-A01. Each data parameter is updated at least once per second.	
	d. Connect the IRS ENABLE (F) Discrete (P1-17) to ground to select the FMS/IRS input as the primary navigation data source.	
	e. Verify that the transponder properly transmits a DF=17 Extended Squitter transmission that has the exact structure for the “ME" field shown in Figure 1009/GRAPHIC 34-50-96-99B-027-A01.	
9.6A	FMS/INS Primary Data (-008 and -108 status TDR-94/94D only)	
	a. Ensure that neither Air/Ground Discrete #1 or #2 (P2-53 or P1-27) are connected to ground (i.e., establishes the airborne state).	
	b. Ensure that all GPS labels are removed from the GPS Input Data Bus.	
	c. Via the FMS/IRS Input Data Bus, provide the transponder with the appropriate labels and data indicated in Figure 1010/GRAPHIC 34-50-96-99B-028-A01. Each data parameter must be updated at least once per second.	
	d. Via the selected ARINC-429 Altitude Input Data Bus, provide the transponder with the appropriate label and data indicated in Figure 1010/GRAPHIC 34-50-96-99B-028-A01. Each data parameter must be updated at least once per second.	
	e. Interrogate the transponder with the MODE-S interrogation indicated in Figure 1010/GRAPHIC 34-50-96-99B-028-A01 to request BDS register 0,5.	

Final Performance (Customer Acceptance) Test. Cont.
Table 1001/Table 34-50-96-99A-009-A01

STEP	PROCEDURE	DESIRED RESULTS
9.6A (Cont)	f. Verify that the transponder responds properly with two DF=20 replies that have the exact structure for the "MB" field in Figure 1010/GRAPHIC 34-50-96-99B-028-A01. NOTE: It may be necessary to repeat steps e. and f. to get an even encoding since the transponder alternates the encoding of latitude and longitude data on odd and even intervals at rates of either 100 and 200 ms.	
	g. Repeat step e. as necessary.	
	h. Verify that the transponder responds properly with two DF=20 replies that have the exact structures for the "MB" field in Figure 1010/GRAPHIC 34-50-96-99B-028-A01. NOTE: It may be necessary to repeat steps g and h to get an even encoding since the transponder alternates the encoding of latitude and longitude data on odd and even intervals at rates of either 100 and 200 ms.	
	i. Remove ARINC-429 labels 310, 311, and 313 from the FMS/IRS Input Data Bus.	
9.7	Aircraft Identification Squitter (-004 through -007 and -207 status TDR-94/94D)	
	a. Ensure that Ground Speed Data provided to the transponder via either the GPS/GNSS or FMS/IRS Input Data Buses is set to 0.	
	b. Connect either Air/Ground Discrete #1 or #2 (P2-53 or P1-27) to ground (i.e., establishes the surface state).	
	c. Verify that TYPE_3 (F) (P1-23) discrete input is in the open-circuit state in order to select Aircraft Type Set A.	
	d. Connect TYPE_2 (F) and TYPE_0 (F) discrete inputs (P1-22 and P1-20) to ground to select Aircraft Type 5, (Heavy, >300,000 lbs).	
	e. Via the selected Control Input Data Bus, provide the transponder with the appropriate labels and data indicated in Figure 1011/GRAPHIC 34-50-96-99B-029-A01. Each data parameter must be updated at least once per second.	

STEP	PROCEDURE	DESIRED RESULTS
9.7 (Cont)	f. Verify that the transponder properly transmits a DF=17 Extended Squitter transmission that has the exact structure for the "ME" field indicated in Figure 1011/GRAPHIC 34-50-96-99B-029-A01.	
	g. Verify that the transponder properly transmits the Aircraft Identification Message that has same "ME" field given in step f at random intervals that are uniformly distributed over the range from 9.6 to 10.4 seconds.	
	h. Ensure that neither Air/Ground Discrete #1 or #2 (P2-53 or P1-27) are connected to ground (i.e., establishes the airborne state).	
	i. Verify that the transponder properly transmits the Aircraft Identification Message that has same "ME" field given in step f at random intervals that are uniformly distributed over the range from 4.8 to 5.2 seconds.	
9.7A	Aircraft Identification Squitter (-108 status TDR-94/94D only)	
	a. Ensure that Ground Speed Data provided to the transponder via the GPS/GNSS or FMS/IRS Input Data Buses is set to 0 or not available.	
	b. Connect either Air/Ground Discrete #1 or #2 (P2-53 or P1-27) to ground (i.e., establishes the surface state).	
	c. Verify that the TYPE_3 (F) discrete input (P1-23) is in the open-circuit state to select Aircraft Type Set A.	
	d. Connect TYPE_2 (F) and TYPE_0 (F) discrete inputs (P1-22 and P1-20) to ground to select Aircraft Type 5 (greater than 300,000 pounds).	
	e. Via the selected Control Input Data Bus, provide the transponder with the appropriate labels and data indicated in Figure 1012/GRAPHIC 34-50-96-99B-030-A01. Each data parameter must be updated at least once per second.	
	f. Verify that the transponder properly transmits a DF=17 Extended Squitter transmission that has the exact structure for the "ME" field in Figure 1012/GRAPHIC 34-50-96-99B-030-A01.	
	g. Connect TYPE_3 (F) discrete input (P-23) to ground to select Aircraft Type Set B.	

Final Performance (Customer Acceptance) Test. Cont.
Table 1001/Table 34-50-96-99A-009-A01

STEP	PROCEDURE	DESIRED RESULTS
9.7A (Cont)	h. Connect TYPE _1 (F) discrete input (P1-21) to ground and verify that TYPE_2 (F) and TYPE_0 (F) discrete inputs (P1-22 and P1-20) are in the open-circuit state to select Aircraft Type 2 (lighter-than-air).	
	i. Verify that the transponder properly transmits a DF=17 Extended Squitter transmission that has the exact structure for the "ME" field in Figure 1012/GRAPHIC 34-50-96-99B-030-A01.	
	j. Verify that the transponder properly transmits the Aircraft Identification Message that has the "ME" field from step i at random intervals that are uniformly distributed over the range from 9.6 to 10.4 seconds.	
	k. Ensure that neither Air/Ground Discrete #1 or #2 (P2-53 or P1-27) are connected to ground (i.e., establishes the airborne state.	
	l. Verify that the transponder properly transmits the Aircraft Identification Message that has the "ME" field from step i at random intervals that are uniformly distributed over the range from 4.8 to 5.2 seconds.	
9.7B	Aircraft Identification Message (-008 status TDR-94/94D only)	
	a. Ensure that Ground Speed Data provided to the transponder via the GPS/GNSS or FMS/IRS Input Data Buses is set to 0 or not available.	
	b. Connect either Air/Ground Discrete #1 or #2 (P2-53 or P1-27) to ground (i.e., establishes the surface state).	
	c. Verify that the TYPE_3 (F) discrete input (P1-23) is in the open-circuit state to select Aircraft Type Set A.	
	d. Connect TYPE_2 (F) and TYPE_0 (F) discrete inputs (P1-22 and P1-20) to ground to select Aircraft Type 5 (greater than 300,000 pounds).	
	e. Via the selected Control Input Data Bus, provide the transponder with the appropriate labels and data indicated in Figure 1012/GRAPHIC 34-50-96-99B-030-A01 (for step e of test 9.7A). Each data parameter must be updated at least once per second.	

Final Performance (Customer Acceptance) Test. Cont.
Table 1001/Table 34-50-96-99A-009-A01

STEP	PROCEDURE	DESIRED RESULTS
9.7B (Cont)	f. Interrogate the transponder with the MODE-S interrogations indicated Figure 1013/GRAPHIC 34-50-96-99B-031-A01 to request BDS register 0, 8.	
	g. Verify that the transponder responds properly with a DF=20 reply that has the exact structure for the "MB" field in Figure 1013/GRAPHIC 34-50-96-99B-031-A01.	
	h. Connect the TYPE_3 discrete input (P1-23) to ground to select Aircraft Type Set B.	
	i. Connect the TYPE_1 (F) discrete input (P1-21) to ground and verify that the TYPE_2 (F) and TYPE_0 (F) discrete inputs (P1-22 and P1-20) are both in the open-circuit state to select Aircraft Type 2 (lighter-than-air).	
	j. Repeat step f.	
	k. Verify that the transponder responds properly with a DF=20 reply that has the exact structure for the "MB" field in Figure 1013/GRAPHIC 34-50-96-99B-031-A01.	
9.7C	Aircraft Identification Squitter (-408/-409)	
	a. Ensure that Ground Speed Data provided to the transponder via either the GPS/GNSS or FMS/IRS Input Data buses is set to ZERO or is NOT Available.	
	b. Connect either Air/Ground Discrete #1 (P2-53) or Air/Ground Discrete #2 (P1-27) to ground (i.e., establish the surface state).	
	c. Verify that TYPE_3 (F) (P1-23) discrete input is in the open-circuit state in order to select Aircraft Type Set A.	
	d. Connect TYPE_2 (F) (P1-22) and TYPE_0 (F) (P1-20) discrete inputs to ground in order to select Aircraft Type 5, i.e., Heavy (>300,000 lbs.).	
	e. Via the selected Control Input Data Bus, provide the transponder with the appropriate labels and data indicated in Figure 1022/GRAPHIC 34-50-96-99B-093-A01. Each data parameter shall be updated at least once per second. NOTE: All characters are set equal to the ICAO ANNEX 10 Character "U".	

Final Performance (Customer Acceptance) Test. Cont.
Table 1001/Table 34-50-96-99A-009-A01

STEP	PROCEDURE	DESIRED RESULTS
	f. Verify that the transponder properly transmits a DF=17 Extended Squitter transmission having the exact structure for the ”ME” field indicated in Figure 1022/GRAPHIC 34-50-96-99B-093-A01.	
	g. Connect TYPE_3 (F) (P1-23) discrete input to ground in order to Select Aircraft Type Set B.	
	h. Connect TYPE_1 (F) (P1-21) discrete input to ground and verify that TYPE_2 (F) (P1-22) and TYPE_0 (F) (P1-20) are in the open-circuit state in order to Select	
	i. Verify that the transponder properly transmits a DF=17 Extended Squitter transmission having the exact structure for the ”ME” field indicated in Figure 1022/GRAPHIC 34-50-96-99B-093-A01.	
	j. Verify that the transponder properly transmits the Aircraft Identification Message having the "ME" field given in step f. at random intervals that are uniformly distributed over the range from 9.6 to 10.4 seconds (i.e., 10.0+/- 0.4 seconds).	
	k. Ensure that both Air/Ground Discrete #1 (P2-53) and Air/Ground Discrete #2 (P1-27) are NOT connected to ground (i.e., establish the airborne state).	
	l. Verify that the transponder properly transmits the Aircraft Identification Message having the ”ME” field given in step f. at random intervals that are uniformly distributed over the range from 4.8 to 5.2 seconds (i.e., 5.0 +/- 0.2 seconds).	
9.7D	Aircraft Identification Message -308, -309 ONLY	
	a. Ensure that Ground Speed Data provided to the transponder via either the GPS/GNSS or FMS/IRS Input Data buses is set to ZERO or is NOT Available.	
	b. Connect either Air/Ground Discrete #1 (P2-53) or Air/Ground Discrete #2 (P1-27) to ground (i.e., establish the surface state).	
	c. Verify that TYPE_3 (F) (P1-23) discrete input is in the open-circuit state in order to select Aircraft Type Set A.	
	d. Connect TYPE_2 (F) (P1-22) and TYPE_0 (F) (P1-20) discrete inputs to ground in order to select Aircraft Type 5, i.e., Heavy (>300,000 lbs.).	

Final Performance (Customer Acceptance) Test. Cont.
Table 1001/Table 34-50-96-99A-009-A01

STEP	PROCEDURE	DESIRED RESULTS
	e. Via the selected Control Input Data Bus, provide the transponder with the appropriate labels and data indicated in Figure 1023/GRAPHIC 34-50-96-99B-094-A01. Each data parameter shall be updated at least once per second.	
	f. Interrogate the transponder with the Mode-S interrogation indicated in Figure 1023/GRAPHIC 34-50-96-99B-094-A01 to request BDS Register 0,8.	
	g. Verify that the transponder responds properly with a DF20 reply containing the exact structure for the ”MB” field indicated in Figure 1023/GRAPHIC 34-50-96-99B-094-A01.	
	h. Connect TYPE_3 (F) (P1-23) discrete input to ground in order to Select Aircraft Type Set B.	
	i. Connect TYPE_1 (F) (P1-21) discrete input to ground and verify that TYPE_2 (F) (P1-22) and TYPE_0 (F) (P1-20) are in the open-circuit state in order to Select Aircraft Type 2, i.e., Lighter-than-Air.	
	j. Repeat Step f	
	k. Verify that the transponder responds properly with a DF20 reply containing the exact structure for the ”MB” field indicated in Figure 1023/GRAPHIC 34-50-96-99B-094-A01.	
9.8	AIS/ADSS Primary Data (-008 and -108 status TDR-94/94D)	
	a. Ensure that neither Air/Ground discrete inputs #1 or #2 (P2-53 or P1-27) are connected to ground (i.e., establishes the airborne state).	
	b. Ensure that all GPS labels are removed from the GPS Input Data Bus.	
	c. Ensure that all GPS labels are removed from the FMS/IRS Input Data Bus.	
	d. Ensure that Configuration Select S0 discrete input (P1-28) is in the open-circuit state.	
	e. Connect Configuration Select S1 discrete input (P1-17) to ground to select configuration 2.	
	f. Via the AIS/ADS Input Data Bus, provide the transponder with the appropriate labels and data indicated in Figure 1014/GRAPHIC 34-50-96-99B-032-A01. Each data parameter must be updated at least once per second.	

Final Performance (Customer Acceptance) Test. Cont.
Table 1001/Table 34-50-96-99A-009-A01

STEP	PROCEDURE	DESIRED RESULTS
	g. Interrogate the transponder with the MODE-S interrogations indicated in Figure 1014/GRAPHIC 34-50-96-99B-032-A01 to request BDS register 0,5.	

STEP	PROCEDURE	DESIRED RESULTS
9.8 (Cont)	h. Verify that the transponder responds properly with DF=20 replies that have the exact structures for the "MB" field in Figure 1014/GRAPHIC 34-50-96-99B-032-A01.	
9.8B	AIS/ADSS Primary Data (-308, -309, -408, -409)	
	a. Ensure that both Air/Ground Discrete #1 (P2-53) and Air/Ground Discrete #2 (P1-27) are NOT connected to ground (i.e., establish the airborne state).	
	b. Ensure that all GPS labels are removed from the GPS Input Data Bus.	
	c. Ensure that all GPS labels are removed from the FMS IRS Input Bus.	
	d. Ensure that Configuration Select 'S0' (P1-28) discrete input is in the open-circuit state.	
	e. Connect Configuration Select 'S1' (P1-17) discrete to ground in order to select Configuration 2.	
	f. Via the AIS/ADS Input Data Bus, provide the transponder with the appropriate labels and data indicated in Figure 1024/GRAPHIC 34-50-96-99B-095-A01. Each data parameter shall be updated at least once per second.	
	g. Interrogate the transponder with the Mode-S interrogation indicated in Figure 1024/GRAPHIC 34-50-96-99B-095-A01 to request BDS Register 0,5.	
	h. Verify that the transponder responds properly with DF=20 replies containing the exact structures for the "MB" field indicated in Figure 1024/GRAPHIC 34-50-96-99B-095-A01.	
9.9	Illegal Configuration Select Check (-008 , -108, -308, -309, -408, and -409 status TDR-94/94D only).	
	a. Do not change the existing settings from Test 9.8.	
	b. Connect Configuration Select S0 discrete input (P1-28) to ground to select configuration 3.	
	c. Verify bit 14 in label 353 on the TDR Output Bus is set to 1.	
	d. Ensure that the Configuration Select S0 and S1 discrete inputs (P1-28 and P1-17) are both set to the open-circuit state to select configuration 0 before you continue to the next test.	
10.0	ATCRBS LIMITING	

Final Performance (Customer Acceptance) Test. Cont.
Table 1001/Table 34-50-96-99A-009-A01

STEP	PROCEDURE	DESIRED RESULTS
	Test the bottom antenna port for the TDR-94, and both antenna ports for the TDR-94D.	
10.1	500 Hz Rate Interrogate with MODE-C at a 500-Hz rate with an input level of -75 dBm. Verify that the reply rate is AT LEAST 90%.	TOP BOTTOM _____ (x) _____ (x)
10.2	750 Hz Rate Interrogate with MODE-C at a 750-Hz rate and adjust the input level to -45 dBm. Verify that the average reply rate is LESS THAN 90%.	TOP BOTTOM _____ (x) _____ (x)
11.0	STANDBY/ON CROSS-FEED	
	For these tests, the Burst Enable strap, P2-59, must be grounded (set to active). The input (P1-15) "ground" state must be verified at 2.0 V dc; additional tests may be conducted at 0 to 2.0 V dc. The input "open" state must be verified at 15 V dc; additional testing may be conducted using an open circuit input. The output (P1-30) "high impedance" state must be verified to sink less than 100 µA from a > +20 volt source, and its "low-impedance" state must be verified to sink 1.0 ma at an output level less than 1.0 V dc.	
11.1	High Impedance State Test Set STBY/ON XF IN to the active state (ground P1-15) and verify that STBY/ON XF OUT (P1-30) is in a high-impedance state. Also verify the unit is in Standby Mode and does not respond to interrogations. STBY/ON XF OUT HIGH IMPEDANCE Unit is in standby.	 _____ (x) _____ (x)
11.2	Low Impedance State Test Set STBY/ON XF IN to the inactive state (P1-15 open circuit) and verify that STBY/ON XF OUT (P1-30) is in a low-impedance state. Also verify the unit is active and responds to interrogations in normal fashion. STBY/ON XF OUT HIGH IMPEDANCE Unit is in active.	 _____ (x) _____ (x)
12.0	FAIL-WARNING REQUIREMENTS	

Final Performance (Customer Acceptance) Test. Cont.
Table 1001/Table 34-50-96-99A-009-A01

STEP	PROCEDURE	DESIRED RESULTS
12.1	Bad MODE-S Discrete Address Input Remove power from the UUT and ground all MODE-S Discrete Address inputs. Restore power to the UUT. After initialization has been completed, ensure that Fail-Warning output, P1-31, is active low (less than 1.5 V dc).	
12.2	Restored MODE-S Discrete Address Input Remove power from the UUT and set MODE-S Discrete Address Inputs for a valid address, i.e. one where all such inputs are not the same (ground or open). Restore power to the UUT and after initialization has been completed, ensure that Fail-Warning output, P1-31, is set high (greater than 23 V dc when loaded with 140 ohms). Method: Interrogate the unit with MODE-S interrogations set for address 52525252. Set the computer strapping for a MODE-S UUT address of 52525252. Cycle the power and verify that the fail-warn light comes on. Set the computer strapping for a MODE-S UUT address of 00000000. Cycle the power and verify that the Fail warning light goes out. Reset the computer strapping for a MODE-S UUT address of 52525252 and cycle the power. Fail warning lamp on Switches off with a bad address	 _____ (x) _____ (x)

STEP	PROCEDURE	DESIRED RESULTS
13.0	MUTUAL SUPPRESSION REQUIREMENTS	
	Ensure that a mutual suppression output pulse occurs that brackets any transmissions at an amplitude of 20 volts or more. Verify that a suppression pulse of 15 volts or more prevents ATCRBS decoding during that pulse's time interval. Verify decoder suppression for both top and bottom antenna ports on the TDR-94D, and only for the bottom antenna port on the TDR-94. Output pulse 20 or > volts ATCRBS suppression	 ___ (x) TOP ___ (x) BOT ___ (x)
14.0	SELF TEST REQUIREMENTS (-004 through -008 status TDR-94/94D only)	
	Ensure that the UUT initiates Self-Test by grounding the Self-Test Discrete, P2-54. Only one Self-Test cycle should be executed each time the P2-54 discrete input is grounded. Verify that the label 350 output word SSM code changes from 11 to 10 to 01 and back to 11 (normal operation). Transitions from 11 to 10 to 11 are also acceptable. Method: Switch the Air/ground discrete to ground. Use "Select card type" (31) from the computer menu to select CONTROL-ALT CARD TYPE. Use menu option (9), "Control Select Lines", to set the control to ARINC bus 0. Use menu option (36) "TDR Bus A", to change to ARINC label 350. Note the 350 word displayed on the computer screen. Set the Self-Test discrete to active and update the 350 word display by rapidly selecting option 11 three times and pushing the enter key. Verify that the third two-digit number in the 350 word changes from 60 to 40 to 20 then back to 60, or from 60 to 40 back to 60. Reset the Self-Test discrete to inactive. NOTE: The 350 word may blank at the first update, if so repeat procedure. Unit executes a self test cycle	 ____ (x)

STEP	PROCEDURE	DESIRED RESULTS
14A.0	SIL Designator Requirements (-108, -308, -309, -408, -409 status TDR-94/94D only)	
	a. Verify that the SIL Designator discrete input, P2-54 is in the open-circuit state.	
	b. Interrogate to transponder with MODE-S interrogation as indicated in Figure 1015/GRAPHIC 34-50-96-99B-033-A01 to request BDS register 6,5 (Aircraft Operational Status).	
	c. Verify that the transponder responds properly with a DF=20 reply that has the "MB" field indicated in Figure 1015/GRAPHIC 34-50-96-99B-033-A01.	
	d. Connect the SIL Designator discrete input, P2-54, to ground to initiate a higher Surveillance Integrity Level.	
	e. Interrogate the transponder with the MODE-S interrogations indicated in Figure 1015/GRAPHIC 34-50-96-99B-033-A01 to request BDS register 6,5.	
	f. Verify that the transponder responds properly with a DF=20 reply that has the "MB" field indicated in Figure 1015/GRAPHIC 34-50-96-99B-033-A01.	
	g. Remove the ground from SIL Designator discrete input, P2-54.	
15.0	TDR-94D DIVERSITY TEST	
15.1	Bottom Signal Greater Than Top Signal Interrogate into the top antenna port with a UF=11 MODE-S interrogation that has a signal level of -53 dBm. Interrogate into the bottom antenna port with a UF=11 signal at -50 dBm that is delayed not less than 100 ns from the top signal. Verify that the reply transmits on the bottom antenna port at a rate of AT LEAST 90%, and replies from the top antenna port are at a rate NOT GREATER than 10%. 90% or > replies on the bottom antenna port, 10% or < on top antenna port	 ____ (x)

Final Performance (Customer Acceptance) Test. Cont.
Table 1001/Table 34-50-96-99A-009-A01

STEP	PROCEDURE	DESIRED RESULTS
15.2	Top Signal Greater Than Bottom Signal Interrogate into the bottom antenna port with an UF=11 MODE-S signal at -53 dBm. Interrogate into the top antenna port with a UF=11 signal at -50 dBm that is delayed not less than 100 ns from the bottom signal. Verify that the reply transmits on the top antenna port at a rate of AT LEAST 90%, and replies from the bottom antenna port are NOT GREATER than 10%. 90% or > replies on the bottom antenna port, 10% or < on top antenna port	____ (x)
15.3	Top Signal Leads Bottom Signal Interrogate into the top antenna port with a UF=11 MODE-S signal at -73 dBm. Interrogate into the bottom antenna port with a UF=11 signal at -50 dBm that is delayed not more than 350 ns from the top signal. Verify that the reply transmits on the top antenna port at a rate of AT LEAST 90%, and replies from the bottom antenna port are NOT GREATER than 10%. 90% or > replies on the bottom antenna port, 10% or < on top antenna port	____ (x)
15.4	Bottom Signal Leads Top Signal Interrogate into the bottom antenna port with a UF=11 MODE-S signal at -73 dBm. Interrogate into the top antenna port with a UF=11 signal at -50 dBm that is delayed not more 350 ns from the bottom signal. Verify that the reply transmits on the bottom antenna port at a rate of AT LEAST 90%, and replies from the top antenna port are NOT GREATER than 10%. 90% or > replies on the bottom antenna port, 10% or < on top antenna port	____ (x)
16.0	I/O REQUIREMENTS	
	Ensure that the following tests meet the appropriate ARINC 429 or CSDB specification.	
16.1	Comm-A/B I/O Set ADLP Present Discrete, P2-60, to its active state (ground). Verify that data can be received on the Comm A/B serial input port, P2-1 and P2-2. Also verify that data is transmitted on the Comm A/B serial output port, P2-3 and P2-4. Data may be transmitted at a low repetition rate. Comm-A/B I/O operation O.K.	____ (x)

STEP	PROCEDURE	DESIRED RESULTS
16.2	ADLP Present Discrete (P2-60) Verify that when this discrete is ground, the Comm-A/B serial/output bus, P2-3 and P2-4, transmits appropriate ARINC 429 words at a 100 kBps rate. Present Discrete operation O.K.	 ____ (x)
16.3	TX/XT I/O Ports (Applies to TDR-94D only) Ensure that data can be received on the TX port, P2-9 and P2-10, and transmitted on the XT port, P2-11 and P2-12. Ensure that grounding the TCAS Select [F] Discrete input, P1-13, results in periodic transmissions on the XT bus. When the TCAS Select [F] discrete input is open, there should be no transmissions on the XT bus. Verify that the word transmissions have a bit rate of 100 kbps. Data can be received on the TX port. Data can be transmitted on the XT port. TCAS Select operation O.K.	 ____ (x) ____ (x) ____ (x)
16.4	Altitude Inputs a. Set the S-1403 function to 1 (ATCRBS). Set IFR display select to XPDR CODE. Set XPDR CODE switch on IFR to AC2 FEET. Set ARINC altitude on the test computer to output standard ARINC 429 on PORT 0. Set the altitude select on the computer menu for ARINC 429 altitude, PORT 0 Verify that the altitude data displayed on the IFR matches data being sent by the test computer. ARINC Altitude operation O.K.	 ____ (x)
	b. Set ARINC altitude on the test computer to output standard ARINC 429 on PORT 1. Verify the IFR does not display valid altitude. Set the altitude select on the computer menu for ARINC 429 altitude, PORT 1. Verify that the altitude data displayed on the IFR matches data being sent by the test computer. ARINC Altitude operation O.K.	 ____ (x)

STEP	PROCEDURE	DESIRED RESULTS
16.4 (Cont)	c. Set the test computer to output PLII altitude on PLII altitude PORT 0. Change the ARINC bus used for altitude data in the previous steps to ADLP. Verify the IFR does not display valid altitude. Set the altitude select on the computer menu for PLII altitude, PORT 0. Verify that the altitude data displayed on the IFR matches data being sent by the test computer. PLII Altitude operation O.K.	____ (x)
	d. Set the test computer to output PLII altitude on PLII altitude PORT 1. Verify the IFR does not display valid altitude. Set the altitude select on the computer menu for PLII altitude, PORT 1. Verify that the altitude data displayed on the IFR matches data being sent by the test computer. PLII Altitude operation O.K.	____ (x)
	e. Set the altitude select lines to GILLHAM. Verify the altitude displayed on the IFR matches what the test computer shows is being sent. GILLHAM Altitude operation O.K.	____ (x)
16.5	ARINC 429 Control Selection a. Select ARINC control. Use the PLII/A429 Control Select to set the control discretes for ARINC 0 input (ARINC 429 PORT 0). Set the ARINC control bus to PORT 0 on the test computer. Monitor label 350 on the TDR bus and verify that valid data is returned. ARINC 0 operation O.K.	____ (x)
	b. Set the control discretes for ARINC 1 input (ARINC 429 PORT 1). Verify that valid data is not returned. Set the ARINC control bus to PORT 1 on the test computer. Monitor label 350 on the TDR bus and verify that valid data is returned. ARINC 1 operation O.K.	____ (x)
	c. Set the control discretes for ARINC 2 input (ARINC 429 PORT 2). Verify that valid data is not returned. Set the ARINC control bus to PORT 2 on the test computer. Verify that valid data is returned. ARINC 2 operation O.K.	____ (x)

STEP	PROCEDURE	DESIRED RESULTS
16.5 (Cont)	d. Set the Burst Enable to active and verify that burst data can be extracted from all three ports. Reset the burst enable discrete to inactive. Burst Enable discrete operation O.K.	____ (x)
16.6	CSDB/PLII Control Selection Set the CSDB (PLII)/A429 Control Select discrete to PLII (ground P2-56). Set the PLII output on the test computer to output data on the control bus (P2-31, 32). Verify that PLII echo is transmitted on PLII output bus (P2-23, 24), Option 40 on the computer. CSDB/A429 Control Select/CSDB operation O.K.	____ (x)
16.7	Source Ident Straps (P2-46 and P2-47) a. Connect P2-46 to P2-50 (common). Open circuit P2-47. Verify that the TDR output data reflects side two in the SDI bits if ARINC 429 configured, or SI bits if CSDB configured. Method A: Set SDI discretes to 1. Set PLII data to SDI 1 using option 39 on the computer. Verify unit responds with valid data on the PLII bus. Source Ident Straps operation O.K.	____ (x)
	b. Connect P2-47 to P2-50 (common). Open circuit P2-46. Verify that the TDR output data reflects side two in the SDI bits if ARINC 429 is configured, or SI bits if CSDB is configured. Method B: Set SDI discretes to 2. Verify no valid data is echoed on the PLII bus. Source Ident Straps operation O.K.	____ (x)
16.8	Self-Test Inhibit Discrete (P2-38 for -004, -005, -006, -007, -207 status TDR-94/94D or P1-19 for -008/-108, -308/-309/ -408/-409 status TDR-94/94D) Verify that when this discrete input (P2-38 or P1-19) is grounded, the unit suspends monitoring and test functions associated with squitter generation. Reduce signal level to a low level that will not cause replies. Ensure that the IFR test set indicates squitter output. Switch the Self-Test inhibit discrete to active (ground). Verify squitter generation is suspended. Reset the Self-Test inhibit to inactive. Self-Test Inhibit Discrete operation O.K.	____ (x)

Final Performance (Customer Acceptance) Test. Cont.
Table 1001/Table 34-50-96-99A-009-A01

STEP	PROCEDURE	DESIRED RESULTS
16.9	Air/Ground Discretes	
16.9.1	Air/Ground Discrete #1 (P2-53) Ensure that grounding the Air/Ground Discrete #1, P2-53, sets bit 6 (vertical status) in DF=1 downlink replies to 1. Verify that transponder continues to reply to ATCRBS and MODE-S interrogations when the Air/Ground Discrete #1, P2-53, is connected to ground. Verify that bit 6 (Vertical Status) in DF= 0 downlink replies is set to 0 when the Air/Ground Discrete #1 is disconnected from ground. Air/Ground Discrete #1 operation O.K.	____ (x)
16.9.2	Air/Ground Discrete #2 (P1-27) Ensure that grounding the Air/Ground Discrete #2, P1-27, sets bit 6 (vertical status) in DF=0 downlink replies to 1. Verify that the transponder continues to reply properly to ATCRBS interrogations while the Air/Ground Discrete #2, P1-27, is connected to ground. Verify that transponder DOES NOT reply to ATCRBS interrogations while the Air/Ground Discrete #2, P1-27, is connected to ground. Verify that bit 6 (Vertical Status) in DF=0 downlink replies is set to 0 when the Air/Ground Discrete #2 is disconnected from ground. Air/Ground Discrete #2 operation O.K.	____ (x)

STEP	PROCEDURE	DESIRED RESULTS
16.10	Auto Altitude Selection Test (-004 through -006 status TDR-94/94D)	
	NOTE: The Auto Altitude Selection test applies to -004 through -006 status TDR-94 and TDR-94D units only. a. Establish ARINC-429 Control for the UUT and ensure that the UUT is configured for altitude selections as follows: PIN NAME / PIN NUMBER / CONDITION CNTRL/ALT P1-14 OPEN AS0 P2-41 GROUND AS1 P2-42 GROUND AUTO ALT SEL P1-28 OPEN ALT PORT SEL P2-48 OPEN Ensure that the Alternate Source Select Bit (bit 14) is "0" in the "031" control word provided to the UUT. Alternate Source Select bit is "0".	____ (x)
	b. Connect a valid ARINC-429 Altitude source to Altitude Port B of the UUT (P2-29, 30). Select XPONDER MODE, AC2, on the IFR test set and interrogate the UUT with standard MODE-C ATCRBS interrogations. Verify that the altitude displayed by the IFR test set is "EEEE". Displayed altitude is "EEEE".	____ (x)
	c. Connect Auto Alt Sel (P1-28) to ground and continue to interrogate the UUT with standard MODE-C ATCRBS interrogations. Verify that the altitude displayed by the IFR test set is the same as that provided by the altitude source connected to altitude Port B. Displayed altitude matches Port B source altitude.	____ (x)
16.10A	Configuration Select Discretes (-008, -108, -308, -309, -408, -409 TDR-94/94D only)	

STEP	PROCEDURE	DESIRED RESULTS
16.10A.1	Configuration Select S0 (P1-28)	
	a. Verify that Configuration Select S0 and S1 discrete inputs P1-28 and P1-17 are in the open-circuit state to select configuration 0.	
	b. Via FMS/IRS Input Data Bus, provide the transponder with the appropriate label and data indicated in Figure 1016/GRAPHIC 34-50-96-99B-034-A01. Each data parameter must be updated at least once per second.	
	c. Interrogate the transponder with the MODE-S interrogations indicated in Figure 1016/GRAPHIC 34-50-96-99B-034-A01 to request BDS register 5,0.	
	d. Verify that the transponder responds properly with a DF=20 reply that has the "MB" field in Figure 1016/GRAPHIC 34-50-96-99B-034-A01.	
	e. Connect Configuration Select S0 discrete input P1-28 to ground to select configuration 1.	
	f. Interrogate the transponder with the MODE-S interrogation indicated in Figure 1016/GRAPHIC 34-50-96-99B-034-A01 to request BDS register 5,0.	
	g. Verify that the transponder responds properly with a DF=20 reply that has the "MB" field indicated in Figure 1016/GRAPHIC 34-50-96-99B-034-A01.	
	h. Remove the ground from Configuration Select S0 discrete input P1-28.	
	i. Remove ARINC label 335 from the FMS/IRS Data Input Bus.	
16.10A.2	Configuration Select S1 (P1-17)	
	a. Connect Configuration Select S1 discrete input P1-17 to ground to select configuration 2.	
	b. Verify that Altitude Select AS0 and AS1 discrete inputs P2-41 and P2-42 are in the open-circuit state.	
	c. Ensure that no GPS data is being applied to the transponder via the GPS Input Data Bus.	
	d. Via the FMS/IRS Input Data Bus, provide the transponder with the labels and data indicated in Figure 1017/GRAPHIC 34-50-96-99B-035-A01. Each data parameter must be updated at least once per second.	

Final Performance (Customer Acceptance) Test. Cont.
Table 1001/Table 34-50-96-99A-009-A01

STEP	PROCEDURE	DESIRED RESULTS
16.10A.2 (Cont)	e. Interrogate the transponder with the MODE-S interrogations in Figure 1017/GRAPHIC 34-50-96-99B-035-A01 to request BDS register 0,5.	
	f. Verify that the transponder responds properly with a DF=20 reply that has the Type Code indicated in Figure 1017/GRAPHIC 34-50-96-99B-035-A01 for the "MB" field.	
	g. Remove the ground from Configuration Select S1 discrete input P1-17.	
	h. Interrogate the transponder with the MODE-S interrogation indicated in Figure 1017/GRAPHIC 34-50-96-99B-035-A01 to request BDS register 0,5.	
	i. Verify that the transponder responds properly with a DF=20 reply that has the Type Code for the "MB" field indicated in Figure 1017/GRAPHIC 34-50-96-99B-035-A01.	
16.11	Remote Ident Test	
	a. Ensure that the SPI IDENT (F) discrete input, P1-16, is in the open-circuit state. SPI IDENT (F) is in open-circuit state.	 _____ (x)
	b. Interrogate the UUT with standard ATCRBS MODE-A interrogations. Verify that the reply displayed on the IFR test set DOES NOT indicate "ID". IFR reply does not indicate "ID".	 _____ (x)
	c. Momentarily connect the SPI IDENT (F) discrete input, P1-16, to ground. Verify that the reply displayed on the IFR test set indicates "ID" for approximately 18 seconds. IFR reply indicates "ID" for approximately 18 sec.	 _____ (x)
16.12	FMS/IRS Lo/Hi Select Discrete (P1-24) (-008, -108, -308, -309, -408, -409 TDR-94/94D only)	
	a. Connect the FMS/IRS Lo/Hi Select input P1-24 to ground. Cycle UUT power off and then back on so that the transponder accepts the configuration change.	
	b. Repeat FMS/INS Primary Data test 9.6A and verify high-speed operation of the FMS/INS Input Data Bus (P2-27, P2-28).	

Final Performance (Customer Acceptance) Test. Cont.
Table 1001/Table 34-50-96-99A-009-A01

STEP	PROCEDURE	DESIRED RESULTS
16.12 (Cont)	c. Remove the ground from FMS/INS Lo/Hi Select Discrete, P1-24. Cycle UUT power off and then back on so that the transponder accepts the configuration change.	
	d. Repeat FMS/INS Primary Data test 9.6A and verify low-speed operation of the FMS/INS Input Data Bus (P2-27, P2-28)	
16.13	AIS/ADS Lo/Hi Select Discrete (P1-57) (-008, -108, -308, -309, -408, -409 TDR-94/94D only)	
	a. Connect the AIS/ADS Lo/Hi Select Discrete, P1-57 to ground. Cycle UUT power off and then back on so that the transponder accepts the configuration change.	
	b. Repeat AIS/ADSS Primary Data test 9.8 and verify high-speed operation of AIS/ADS Input Data Bus (P2-39, P2-40).	
	c. Remove the ground from the AIS/ADS Lo/Hi Select Discrete, P1-24. Cycle UUT power off and then back on so that the transponder accepts the configuration change.	
	d. Repeat AIS/AADSS Primary Data test 9.8 and verify low-speed operation of AIS/ADS Input Data Bus (P2-39, P2-40).	
16.14	GPS Lo/Hi Select Discrete (P1-18) (-008 , -108, -308, -309, -408, -409 TDR-94/94D only)	
	a. Connect the GPS Lo/Hi Select Discrete, P1-18, to ground. Cycle UUT power off and then back on so that the transponder accepts the configuration change.	
	b. Repeat GPS Bus/Airborne Position Extended Squitter test 9.3A (for -108 status TDR-94/94D), test 9.3B (for -008 status TDR-94/94D), test 9.3C (for -408, -409 status) or test 9.3D (for -308, -309 status) and verify high-speed operation of GPS Input Data Bus (P2-49, P2-50).	
	c. Remove the ground from GPS Lo/Hi Select Discrete, P1-18 . Cycle UUT power off and then back on so that the transponder accepts the configuration change.	
	d. Repeat GPS Bus/Airborne Position Extended Squitter test 9.3A (for -108 status TDR-94/94D) or test 9.3B (for -008 status TDR-94/94D) and verify low-speed operation of GPS Input Data Bus P2-49, P2-50.	

Final Performance (Customer Acceptance) Test. Cont.
Table 1001/Table 34-50-96-99A-009-A01

STEP	PROCEDURE	DESIRED RESULTS
16.15	Altitude Port A/B Lo/Hi Select Discrete (P1-26) (-008, -108, -308, -309, -408, -409 TDR-94/94D only)	
	a. Connect Altitude Port A/B Lo Hi Select Discrete, P1-26, to ground. Cycle UUT power off and then back on so that the transponder accepts the configuration change.	
	b. Verify high-speed operation of the Altitude Port A Input Data Bus (P2-25, P2-26).	
	c. Remove the ground from Altitude Port A/B Lo/Hi Select Discrete, P1-26. Cycle UUT power off and then back on so that the transponder accepts the configuration change.	
	d. Verify low-speed operation of the Altitude Port A Input Data Bus (P2-25, P2-26).	
16.16	Maximum Airspeed Select Discretes (P2-43, P2-44, P2-45) (-008, -108, -308, -309, -408, -409 TDR-94/94D only)	
	a. Connect either of Air/Ground discrete inputs #1 or #2 (P2-53 or P1-27) to ground (i.e., establishes a surface state).	
	b. Verify on the TDR Output Bus (P2-15, P2-16) that bits 22 through 25 of ARINC label 276 are set correctly for the input states of the Maximum Airspeed Select Discretes as indicated below. UUT power must be cycled off and then back on each time the maximum airspeed configuration is changed. P2-45 MAX A/S BIT 17 / P2-44 MAX A/S BIT 16 / P2-43 MAX A/S BIT 15 / LABEL 276 MSB 22 LSB 24 OPEN OPEN OPEN 000 OPEN OPEN GROUND 001 OPEN GROUND OPEN 010 GROUND OPEN OPEN 100	

STEP	PROCEDURE	DESIRED RESULTS
17.0	TRANSPONDER TESTS AND INSPECTIONS	
	COMPLIANCE WITH CODE OF FEDERAL REGULATIONS (CFR), TITLE 14, CHAPTER 1, FEDERAL AVIATION ADMINISTRATION, DEPARTMENT OF TRANSPORTATION, PART 43, APPENDIX F-ATC TRANSPONDER TESTS AND INSPECTIONS. THE FOLLOWING TESTS OR NOTATIONS HAVE BEEN ADDED TO MORE EASILY DEMONSTRATE COMPLIANCE WITH CFR, TITLE 14, CHAPTER 1, PART 43, APPENDIX F, FOR RETURNING THE TDR-94/94D TRANSPONDER TO SERVICE.	
17.1	Radio Reply Frequency (Appendix F, Paragraph (a)(4)) The requirement to demonstrate proper compliance with this paragraph has been stated in step 2.1. of this procedure, and will not be repeated here.	
17.2	Suppression (Appendix F, Paragraph (b)(1)) The requirement to demonstrate proper compliance with this paragraph has been stated in step 4.3. of this procedure and will not be repeated here. NOTE: RTCA DO-181 paragraph 2.2.5.1.a. and c. set the limits at 10% versus the 1% limit set by CFR, TITLE 14, CHAPTER 1, PART 43, APPENDIX F, Paragraph (b)(1).	
17.3	Suppression (Appendix F, Paragraph (b)(2)) The requirement to demonstrate proper compliance with this paragraph has been stated in step 4.2. of this procedure, and will not be repeated here.	
17.4	Receiver Sensitivity (Appendix F, Paragraph (c)(1)) The requirement to demonstrate proper compliance with this paragraph has been stated in step 1.1. of this procedure and will not be repeated here.	

STEP	PROCEDURE	DESIRED RESULTS
17.5	Receiver Sensitivity (Appendix F, Paragraph (c)(2)) MTL is defined as the minimum interrogation power level which produces a reply rate of at least 90%. Interrogate the transponder with standard MODE-A interrogations, and verify that the MTL is between -75 and -79 dBm. Interrogate the transponder with standard MODE-C interrogations, and verify that the MTL is between -75 and -79 dBm. Verify that the difference between the MODE-A MTL and the MODE-C MTL does not exceed 1 dB. Difference between MODE-A MTL and MODE-C MTL is 1dB or less.	 ____ (x)
17.6	Radio Frequency (RF) Peak Output Power (Appendix F, Paragraphs (d)(iii) and (d)(v)) The requirement to demonstrate proper compliance with these paragraphs has been stated in step 2.2.A. of this procedure and will not be repeated here.	
17.7	MODE-S Diversity Transmission Channel Isolation Appendix F, Paragraph (e) The requirement to demonstrate proper compliance with this paragraph has been stated in step 2.2.C. of this procedure and will not be repeated here.	
17.8	MODE-S Address (Appendix F, Paragraph (f)) Ensure that some of the MODE-S Discrete Address inputs to the UUT are set to open circuit and some are shorted to ground. A MODE-S Address of all 0s, or all 1s, is NOT acceptable and will result in a Fail/Warn condition. Likewise, a MODE-S Address of all 0s or all 1s will result in the UUT remaining in the "STANDBY" mode. NOTE: The MODE-S Address is binary, however, when using the IFR S-1403 and manual test software the MODE-S Address must be is entered in octal. If the Address is changed at this time, UUT power must be removed and then reapplied to make the TDR Transponder recognize and use the new address.	

<table>
<tr><th>STEP</th><th>PROCEDURE</th><th>DESIRED RESULTS</th></tr>
<tr><td>17.8
(Cont)</td><td>Interrogate the transponder with UF=4 interrogations using the same address as that provided to the UUT, and at a nominal rate of 50 per second. Verify that the transponder properly replies with DF=4 and with AT LEAST a 90% reply ratio.

Interrogate the transponder with at least two UF=4 interrogations using addresses that are different than the discrete address provided to the UUT, at a nominal rate of 50 per second. Verify that the transponder does not reply to the interrogations.</td><td></td></tr>
<tr><td>17.9</td><td>MODE-S Formats (Appendix F, Paragraph (g))

<u>PART A:</u> ALTITUDE/MODE-C/UF=4/UF=20

Ensure that Gillham Altitude is selected via the Altitude Selects and set the discrete Gillham Altitude inputs as follows:

<table>
<tr><th></th><th colspan="11">Gillham Altitude Bits</th></tr>
<tr><th>BIT POSITION</th><th>D2</th><th>D4</th><th>A1</th><th>A2</th><th>A4</th><th>B1</th><th>B2</th><th>B4</th><th>C1</th><th>C2</th><th>C4</th></tr>
<tr><td>Data:
(49,950 to 50,050 feet)</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td></tr>
</table>
"1" indicates connection to ground (selected)
"0" indicates open-circuited (not selected)
Reference (Gillham code 2524).

Interrogate the transponder with standard MODE-C interrogations. Verify that the transponder replies with the altitude value provided via the Gillham inputs.

Interrogate the transponder with MODE-S UF=4 interrogations with the PC, RR, DI and SD fields set to 0, and the MODE-S address set the same as that provided to the transponder. Verify that the transponder replies with the altitude value provided via the Gillham inputs.

Interrogate the transponder with MODE-S UF=20 interrogations and that have the MODE-S address set the same as that provided to the transponder. Verify that the transponder replies with the altitude value provided via the Gillham inputs.</td><td></td></tr>
</table>

STEP	PROCEDURE	DESIRED RESULTS
17.9 (Cont)	Gillham Altitude Bits BIT POSITION D2 D4 A1 A2 A4 B1 B2 B4 C1 C2 C4 Data: 0 0 1 0 1 0 1 0 1 0 0 (24, 250 to 24,350 feet) "1" indicates connection to ground (selected) "0" indicates open-circuited (not selected) Reference (Gillham code 5210).	
	PART B: IDENT/MODE-A/UF=5/UF=21 Via the selected control bus, supply the transponder with a valid 4096 identification code. Interrogate the transponder with standard MODE-A interrogations. Verify that the transponder replies with the Ident Code provided via the control bus. Interrogate the transponder with MODE-S UF=5 interrogations with the PC, RR, DI and SD fields set to 0, and the MODE-S address set the same as that provided to the transponder. Verify that the transponder replies with the Ident Code provided via the control bus. Interrogate the transponder with MODE-S UF=21 interrogations and that have the MODE-S address set the same as that provided to the transponder. Verify that the transponder replies with the Ident Code provided via the control bus.	

STEP	PROCEDURE	DESIRED RESULTS
17.10	MODE-S All-Call Interrogations (Appendix F, Paragraph (h)) Interrogate the transponder with MODE-S ONLY ALL-CALL (UF=11) interrogations. Verify that the transponder replies with DF=11 replies that have the same MODE-S Address as the one provided to the transponder via the discrete MODE-S Address inputs. Verify that the Transponder replies with DF=11 replies that have the "CA" field set to one of the following "0, 4, 5, or 7". NOTE: RTCA Document No. DO-181, paragraph 2.2.14.4.5, Change 3, pages 4-5, totally redefined the "CA" filed. Prior to Change 3, the "CA" field was defined for codes "0" through "3" only, and the code remained fixed for the UUT after the installation was completed. Change 3, now defines codes "0, 4, 5, 6, and 7" with codes "1, 2, and 3" being "Not Defined". In addition, the "CA" field is no longer fixed, but will be dynamic depending on the UUT status at the time of reply.	
17.11	ATCRBS-ONLY All-Call Interrogations (Appendix F, Paragraph (i)) Interrogate the transponder with ATCRBS MODE-A ONLY ALL-CALL interrogations that have the nominal pulse spacing and signal level of -50 dBm. Verify that the transponder does not reply to the interrogations. Essentially, a reply ratio NOT GREATER THAN 1% constitutes the NO REPLY condition. Interrogate the transponder with ATCRBS MODE-C ONLY ALL-CALL interrogations having the nominal pulse spacing and signal level of -50 dBm. Verify that the transponder does not reply to the interrogations. Essentially, a reply ratio NOT GREATER THAN 1% constitutes the NO REPLY condition.	
17.12	Squitter Appendix F, Paragraph (j) The requirement to demonstrate proper compliance with this paragraph has been stated in steps 9.1 and 9.2 of this procedure and will not be repeated here.	
18.0	MAINTENANCE FAULT COUNTER RESET	
	The steps of this test may be accomplished using option 17 of the automatic test program if so desired.	

STEP	PROCEDURE	DESIRED RESULTS
18.1	Reset Function After completion of all tests, reset the maintenance fault counter by entering the current date as the Last Maintenance Date via the ARINC control bus word having Label = 277, bits 31, 30 = 10, and data for the current date as follows: BITS — DATA 29 — Month (BCD Tens) 25 - 28 — Month (BCD Units) 21 - 24 — Day (BCD Tens) 17 - 20 — Day (BCD Units) 13 - 16 — Year (BCD Tens) 9 - 12 — Year (BCD Units) Fault counter has been reset.	____ (x)
18.2	Reset Function Close Out Enter ARINC control word having Label = 277, bits 31, 30 = 11, and data as follows: BITS — DATA 17 - 29 — PAD 12 - 16 — 0 9 - 11 — 1 Verify that the UUT responds on the TDR Output Bus with a ARINC word having Label = 351, bits 31, 30 = 11, and maintenance date data in the same format as that given in step 18.1.	
19.0	Service Bulletin Tests	
19.1	Verify SW Version Date	
	Send an ARINC label 277 with bits 31,30 set to 0 to request an ARINC label 351 from the UUT.	
	Verify that the UUT responds by transmitting an ARINC label 351 data word on the TDR Output Bus that has bits 31, 30 set to 0 and the Last Software Version date data given in the same format as shown in the table of test 18.1.	

Final Performance (Customer Acceptance) Test.
Table 1001/Table 34-50-96-99A-009-A01

FIELD BITS:				1 8	9 10	11 29	30 31	32
PARAMETER	VALUE	AWB VALUE	HEX LABEL	LABEL	SDI (1)	BINARY DATA	SSM	P
GPS/GNSS TRACK	0 DEG	0000	103	01000011	10	0000 0000 0000 0000 000	11	P
GPS/GNSS ALTITUDE	33,856 FT	N/A	076	00111110	00	0000 0001 0001 0000 100	11	P
GPS/GNSS UTC## TIME	0	N/A	150	01101000	10	0000 0000 0000 0000 000	11	P
LATITUDE-COURSE	-86.0 DEG	C2D82D83	110	01001000	10	1000 0011 0110 1000 011	11	P
LATITUDE-FINE			120	01010000	10	0000 0001 1000 0011 010	11	P
LONGITUDE-CRS	-171.5 DEG	860B60B6	111	01001001	00	1101 1010 0000 1100 001	11	P
LONGITUDE-FINE			121	01010001	10	0000 0000 1101 1010 000	11	P
NOTE: THE SDI FIELD OF VARIOUS WORDS RECEIVED FROM THE GPS/GNSS RECEIVER ACTUALLY REPRESENT DATA AS OPPOSED TO SOURCE-DESTINATION IDENTIFICATION INFORMATION.								

INPUT DATA FOR TEST 9.3, STEP b.

BIT SIGNIFICANCE:				MSB LSB		EVEN	MSB LSB	MSB LSB
"ME" RF BIT:	33 37	38 39	40	41 52	53	54	55 71	72 88
BDS BUFFER BIT:	1 5	6 7	8	9 20	21	22	23 (15555) 39	40 (12444) 56
FIELD:	TYPE	SSS	TURN	ALTITUDE	PAD	TIME	ENCODED LATITUDE	ENCODED LONGITUDE
DATA:	0 1101	00	0	1010 1111 0010	0	0	1 0101 0101 0101 0101	1 0010 0100 0100 0100

EVEN-SECOND AIRBORNE POSITION SQUITTER FOR TEST 9.3, STEP c.

FIELD BITS:				1 8	9 10	11 29	30 31	32
PARAMETER	VALUE	AWB VALUE	HEX LABEL	LABEL	SDI (1)	BINARY DATA	SSM	P
GPS/GNSS UTC## TIME	1	N/A	150	01101000	10	0100 0000 0000 0000 000	11	P

INPUT DATA FOR TEST 9.3, STEP g.

BIT SIGNIFICANCE:				MSB LSB		EVEN	MSB LSB	MSB LSB
"ME" RF BIT:	33 37	38 39	40	41 52	53	54	55 71	72 88
BDS BUFFER BIT:	1 5	6 7	8	9 20	21	22	23 (1CFA5) 39	40 (0182D) 56
FIELD:	TYPE	SSS	TURN	ALTITUDE	PAD	TIME	ENCODED LATITUDE	ENCODED LONGITUDE
DATA:	0 1101	00	0	1010 1111 0010	0	1	1 1100 1111 1010 0101	0 0001 1000 0010 1101

ODD-SECOND AIRBORNE POSITION SQUITTER FOR TEST 9.3, STEP h.

TPH6662_01

Airborne Position Extended Squitter Test 9.3, Input Data and Results
Figure 1003/GRAPHIC 34-50-96-99B-021-A01

FIELD BITS:				1 8	9 10	11 29	30 31	32
PARAMETER	VALUE	AWB VALUE	HEX LABEL	LABEL	SDI [1]	BINARY DATA	SSM	P
GPS/GNSS TRACK	0 deg.	0000	103	01000011	10	0000 0000 0000 0000 000	11	P
GPS/GNSS ALTITUDE	33,856 ft.	N/A	370	11111000	00	0000 0001 0001 0000 100	11	P
LATITUDE-COURSE	-86.0 deg.	C2D82D83	110	01001000	10	1000 0011 0110 1000 011	11	P
LATITUDE -FINE			120	01010000	10	0000 0001 1000 0011 010	11	P
LONGITUDE-COURSE	-171.5 deg.	860B60B6	111	01001001	00	1101 1010 0000 1100 001	11	P
LONGITUDE-FINE			121	01010001	10	0000 0000 1101 1010 000	11	P
NOTE: The SDI field of various words received from the GPS/GNSS Receiver actually respresents data as opposed to Source-Destination Identification information.								

INPUT DATA FOR TEST 9.3A, STEP e.

BIT SIGNIFICANCE:				MSB LSB		EVEN	MSB LSB	MSB LSB
"ME" RF BIT:	33 37	38 39	40	41 52	53	54	55 71	72 88
BDS BUFFER BIT:	1 5	6 7	8	9 20	21	22	23 (15555) 39	40 (12444) 56
FIELD:	TYPE	SSS	Single ANT	ALTITUDE	TIME (T)	Format (F)	ENCODED LATITUDE	ENCODED LONGITUDE
DATA:	1 0110	00	0 or 1	1010 1111 0010	1	0	1 0101 0101 0101 0101	1 0010 0100 0100 0100
NOTE: The Single Antenna Bit (RF bit 40) is a "0" for the TDR-94D and a "1" for the TDR-94.								

EVEN-SECOND, AIRBORNE POSITION SQUITTER TRANSMISSION FOR TEST 9.3A, STEP f.

BIT SIGNIFICANCE:				MSB LSB		ODD	MSB LSB	MSB LSB
"ME" RF BIT:	33 37	38 39	40	41 52	53	54	55 71	72 88
BDS BUFFER BIT:	1 5	6 7	8	9 20	21	22	23 (1CFA5) 39	40 (0182D) 56
FIELD:	TYPE	SSS	Single ANT	ALTITUDE	TIME (T)	Format (F)	ENCODED LATITUDE	ENCODED LONGITUDE
DATA:	1 0110	00	0 or 1	1010 1111 0010	1	1	1 1100 1111 1010 0101	0 0001 1000 0010 1101
NOTE: The Single Antenna Bit (RF bit 40) is a "0" for the TDR-94D and a "1" for the TDR-94.								

ODD-SECOND, AIRBORNE POSITION SQUITTER TRANSMISSION FOR TEST 9.3A, STEP j.

TPH6632_01

GPS Bus/Airborne Position Extended Squitter/Time Tag Verification Test 9.3A, Input Data and Results
Figure 1004/GRAPHIC 34-50-96-99B-022-A01

RF BIT:	1 5	6 8	9 13	14 16	17 32	33 56
FIELD:	UF #	PC	RR	DI	SD	AP
DATA:	0 0100	000	1 0000	111	0000 0101 0000 0000	UUT Mode-S Address
DECODED DATA:	4	0	10 (Hex)	7 (Hex)	0500 (Hex)	Example: AAAAAA (Hex)

AIRBORNE POSITION INTERROGATION – UF4 For TEST 9.3B, STEP f.

BIT SIGNIFICANCE:				MSB LSB		EVEN	MSB LSB	MSB LSB
"ME" RF BIT:	33 37	38 39	40	41 52	53	54	55 71	72 88
BDS BUFFER BIT:	1 5	6 7	8	9 20	21	22	23 (15555) 39	40 (12444) 56
FIELD:	TYPE	SSS	Single ANT	ALTITUDE	TIME (T)	Format (F)	ENCODED LATITUDE	ENCODED LONGITUDE
DATA:	1 0110	00	0 or 1	1010 1111 0010	1	0	1 0101 0101 0101 0101	1 0010 0100 0100 0100
NOTE: The Single Antenna Bit (RF Bit 40) is a "0" for the TDR-94D and a "1" for the TDR-94.								

EVEN-SECOND, AIRBORNE POSITION MESSAGE TRANSMISSION FOR TEST 9.3B, STEP g.

BIT SIGNIFICANCE:				MSB LSB		ODD	MSB LSB	MSB LSB
"ME" RF BIT:	33 37	38 39	40	41 52	53	54	55 71	72 88
BDS BUFFER BIT:	1 5	6 7	8	9 20	21	22	23 (1CFA5) 39	40 (0182D) 56
FIELD:	TYPE	SSS	Single ANT	ALTITUDE	TIME (T)	Format (F)	ENCODED LATITUDE	ENCODED LONGITUDE
DATA:	1 0110	00	0 or 1	1010 1111 0010	1	1	1 1100 1111 1010 0101	0 0001 1000 0010 1101
NOTE: The Single Antenna Bit (RF Bit 40) is a "0" for the TDR-94D and a "1" for the TDR-94.								

ODD-SECOND, AIRBORNE POSITION MESSAGE TRANSMISSION FOR TEST 9.3B, STEP i.

TPH6633_01

GPS Bus/Airborne Position Extended Squitter/Time Tag Verification Test 9.3B, Input Data and Results
Figure 1005/GRAPHIC 34-50-96-99B-023-A01

FIELD BITS:				1 8	9 10	11 29	30 31	32
PARAMETER	VALUE	AWB VALUE	HEX LABEL	LABEL	SDI (1)	BINARY DATA	SSM	P
GPS/GNSS TRACK	119.9982 DEG	N/A	103	01000011	10	0001 0101 0101 0101 010	11	P
GPS/GNSS GROUND SPEED	74.0 KNOTS	N/A	112	01001010	10	0000 0001 0100 1000 000	11	P
GPS/GNSS ALTITUDE	33,856 FT	N/A	076	00111110	00	0000 0001 0001 0000 100	11	P
GPS/GNSS UTC## TIME	0	N/A	150	01101000	10	0000 0000 0000 0000 000	11	P
LATITUDE - COURSE	-86.5 DEG	C27D27D2	110	01001000	00	1001 0111 1100 1000 011	11	P
LATITUDE - FINE			120	01010000	10	0000 0000 1001 0111 110	11	P
LONGITUDE - CRS	-172.5 DEG	85555555	111	01001001	01	0101 0101 0101 0100 001	11	P
LONGITUDE - FINE			121	01010001	10	0000 0001 0101 0101 010	11	P
NOTE : THE SDI FIELD OF VARIOUS WORDS RECEIVED FROM THE GPS/GNSS RECEIVER ACTUALLY REPRESENT DATA AS OPPOSED TO SOURCE-DESTINATION IDENTIFICATION INFORMATION.								

INPUT DATA FOR TEST 9.5 , STEP b .

BIT SIGNIFICANCE:		MSB LSB	MSB LSB		EVEN	MSB (-86.5) LSB	MSB (- 172.5) LSB
"ME" RF BIT:	33 37	38 44	45 51	52 53	54	55 71	72 88
BDS BUFFER BIT:	1 5	6 12	13 (118) 19	20 21	22	23 (0AAAB) 39	40 (08000) 56
FIELD:	TYPE	MOVEMENT	GROUND TRACK	PAD	TIME	ENCODED LATITUDE	ENCODED LONGITUDE
DATA:	00101	110 0000	0101010	00	0	0 1010 1010 1010 1011	0 1000 0000 0000 0000

EVEN-SECOND SURFACE POSITION SQUITTER FOR TEST 9. 5, STEP c.

FIELD BITS:				1 8	9 10	11 29	30 31	32
PARAMETER	VALUE	AWB VALUE	HEX LABEL	LABEL	SDI (1)	BINARY DATA	SSM	P
GPS/GNSS UTC## TIME	1	N/A	150	01101000	10	0100 0000 0000 0000 000	11	P

INPUT DATA FOR TEST 9.5, STEP g.

BIT SIGNIFICANCE:		MSB LSB	MSB LSB		ODD	MSB LSB	MSB LSB
"ME" RF BIT:	33 37	38 44	45 51	52 53	54	55 71	72 88
BDS BUFFER BIT:	1 5	6 12	13 (118) 19	20 21	22	23 (096C1) 39	40 (05555) 56
FIELD:	TYPE	MOVEMENT	GROUND TRACK	PAD	TIME	ENCODED LATITUDE	ENCODED LONGITUDE
DATA:	0 0101	110 0000	0101010	00	1	0 1001 0110 1100 0001	0 0101 0101 0101 0101

ODD - SECOND SURFACE POSITION SQUITTER FOR TEST 9. 5, STEP h.

TPH6668_01

Surface Position Extended Squitter Test 9.5, Input Data and Results
Figure 1006/GRAPHIC 34-50-96-99B-024-A01

FIELD BITS:				1 8	9 10	11 29	30 31	32
PARAMETER	VALUE	AWB VALUE	HEX LABEL	LABEL	SDI [1]	BINARY DATA	SSM	P
GPS/GNSS TRACK	119.9982 deg.	N/A	103	01000011	10	0001 0101 0101 0101 010	11	P
GPS/GNSS GROUND SPEED	74.0 Kts.	N/A	112	01001010	10	0000 0001 0100 1000 000	11	P
GPS/GNSS ALTITUDE	33,856 ft.	N/A	370	11111000	00	0000 0001 0001 0000 100	11	P
LATITUDE-COURSE	-86.5 deg.	C27D27D2	110	01001000	00	1001 0111 1100 1000 011	11	P
LATITUDE -FINE			120	01010000	10	0000 0000 1001 0111 110	11	P
LONGITUDE-COURSE	-172.5 deg.	85555555	111	01001001	01	0101 0101 0101 0100 001	11	P
LONGITUDE-FINE			121	01010001	10	0000 0001 0101 0101 010	11	P
NOTE: The SDI field of various words received from the GPS/GNSS Receiver actually represents data as opposed to Source-Destination Identification information.								

INPUT DATA FOR TEST 9. 5 A, STEP d.

BIT SIGNIFICANCE:		MSB LSB				EVEN	MSB (-86.5) LSB	MSB (-172.5) LSB
"ME" RF BIT:	33 37	38 44	45	46 52	53	54	55 71	72 88
BDS BUFFER BIT:	1 5	6 12	13	14 20	21	22	23 (0AAAB) 39	40 (08000) 56
FIELD:	TYPE	MOVEMENT	ST	GROUND TRACK	TIME (T)	Format (F)	ENCODED LATITUDE	ENCODED LONGITUDE
DATA:	0 1000	110 0000	1	0101011	1	0	0 1010 1010 1010 1011	0 1000 0000 0000 0000

EVEN-SECOND, SURFACE POSITION SQUITTER TRANSMISSION FOR TEST 9. 5 A, STEP e.

BIT SIGNIFICANCE:		MSB LSB		MSB LSB		ODD	MSB (-86.5) LSB	MSB (-172.5) LSB
"ME" RF BIT:	33 37	38 44	45	46 52	53	54	55 71	72 88
BDS BUFFER BIT:	1 5	6 12	13	14 20	21	22	23 (096C1) 39	40 (05555) 56
FIELD:	TYPE	MOVEMENT	ST	GROUND TRACK	TIME (T)	Format (F)	ENCODED LATITUDE	ENCODED LONGITUDE
DATA:	0 1000	110 0000	1	0101011	0	1	0 1001 0110 1100 0001	0 0101 0101 0101 0101

ODD-SECOND, SURFACE POSITION SQUITTER TRANSMISSION FOR TEST 9. 5 A, STEP j.

TPH6630_01

GPS Bus/Airborne Surface Position Extended Squitter/Time Tag Verification
Test 9.5A, Input Data and Results
Figure 1007/GRAPHIC 34-50-96-99B-025-A01

RF BIT:	1 5	6 8	9 13	14 16	17 32	33 56
FIELD:	UF #	PC	RR	DI	SD	AP
DATA:	0 0100	000	1 0000	111	0000 0110 0000 0000	UUT Mode-S Address
DECODED DATA:	4	0	10 (Hex)	7 (Hex)	0600 (Hex)	Example: AAAAAA (Hex)

SURFACE POSITION INTERROGATION - UF4 FOR TEST 9.5B, STEP e.

BIT SIGNIFICANCE:		MSB LSB				EVEN	MSB (-86.5) LSB	MSB (-172.5) LSB
"ME" RF BIT:	33 37	38 44	45	46 52	53	54	55 71	72 88
BDS BUFFER BIT:	1 5	6 12	13	14 20	21	22	23 (0AAAB) 39	40 (08000) 56
FIELD:	TYPE	MOVEMENT	ST	GROUND TRACK	TIME (T)	Format (F)	ENCODED LATITUDE	ENCODED LONGITUDE
DATA:	0 1000	110 0000	1	0101011	1	0	0 1010 1010 1010 1011	0 1000 0000 0000 0000

EVEN-SECOND, SURFACE POSITION MESSAGE TRANSMISSION FOR TEST 9.5B, STEP f.

BIT SIGNIFICANCE:		MSB LSB		MSB LSB		ODD	MSB (-86.5) LSB	MSB (-172.5) LSB
"ME" RF BIT:	33 37	38 44	45	46 52	53	54	55 71	72 88
BDS BUFFER BIT:	1 5	6 12	13	14 20	21	22	23 (096C1) 39	40 (05555) 56
FIELD:	TYPE	MOVEMENT	ST	GROUND TRACK	TIME (T)	Format (F)	ENCODED LATITUDE	ENCODED LONGITUDE
DATA:	0 1000	110 0000	1	0101011	0	1	0 1001 0110 1100 0001	0 0101 0101 0101 0101

ODD-SECOND, SURFACE POSITION MESSAGE TRANSMISSION FOR TEST 9.5B, STEP i.

TPH6629_01

GPS Bus/Airborne Surface Position Extended Squitter/Time Tag Verification
Test 9.5B, Input Data and Results
Figure 1008/GRAPHIC 34-50-96-99B-026-A01

FIELD BITS:				1 8	9 10	11 29	30 31	32
PARAMETER	VALUE	AWB VALUE	HEX LABEL	LABEL	SDI (1)	BINARY DATA	SSM	P
TRACK ANGLE	0 DEG	0000	313	01000011	10	0000 0000 0000 0000 000	11	P
LATITUDE-COURSE	-86.0 DEG	C2D82800	310	01001000	10	1000 0011 0110 1000 011	11	P
LONGITUDE-CRS	-171.5 DEG	860B6000	311	01001001	00	1101 1010 0000 1100 001	11	P

INPUT DATA FOR TEST 9.6, STEP b .

FIELD BITS:				1 8	9 10	11 29	30 31	32
PARAMETER	VALUE	AWB VALUE	HEX LABEL	LABEL	SDI (1)	BINARY DATA	SSM	P
PRESSURE ALTITUDE	33,856 ft	N/A	203	10000011	10	0000 0001 0001 0000 100	11	P

INPUT DATA FOR TEST 9.6, STEP c.

BIT SIGNIFICANCE:				MSB LSB		EVEN	MSB LSB	MSB LSB
"ME" RF BIT:	33 37	38 39	40	41 52	53	54	55 71	72 88
BDS BUFFER BIT:	1 5	6 7	8	9 (33,856 ft) 20	21	22	23 (15552) 39	40 (12444) 56
FIELD:	TYPE	SSS	TURN	ALTITUDE	PAD	TIME	ENCODED LATITUDE	ENCODED LONGITUDE
DATA:	0 1010	00	0	1010 1111 0010	0	0	1 0101 0101 0101 0010	1 0010 0100 0100 0100

EXTENDED SQUITTER TRANSMISSIONS FOR TEST 9.6, STEP e .

TPH6675_01

FMS/INS Primary Data Test 9.6, Input Data and Results
Figure 1009/GRAPHIC 34-50-96-99B-027-A01

FIELD BITS:				1 8	9 10	11 29	30 31	32
PARAMETER	VALUE	AWB VALUE	HEX LABEL	LABEL	SDI [1]	BINARY DATA	SSM	P
TRACK ANGLE	0 deg.	0000	313	01000011	10	0000 0000 0000 0000 000	11	P
LATITUDE-COURSE	-86.0 deg.	C2D82800	310	01001000	10	1000 0011 0110 1000 011	11	P
LONGITUDE-CRS	-171.5 deg.	860B6000	311	01001001	00	1101 1010 0000 1100 001	11	P

INPUT DATA FOR TEST 9.6A, STEP c.

FIELD BITS:				1 8	9 10	11 29	30 31	32
PARAMETER	VALUE	AWB VALUE	HEX LABEL	LABEL	SDI [1]	BINARY DATA	SSM	P
PRESSURE ALTITUDE	33,856 ft.	N/A	203	10000011	10	0000 0001 0001 0000 100	11	P

INPUT DATA FOR TEST 9.6A, STEP d.

RF BIT:	1 5	6 8	9 13	14 16	17 32	33 56
FIELD:	UF #	PC	RR	DI	SD	AP
DATA:	0 0100	000	1 0000	111	0000 0101 0000 0000	UUT Mode-S Address
DECODED DATA:	4	0	10 (Hex)	7 (Hex)	0500 (Hex)	Example: AAAAAA (Hex)

AIRBORNE POSITION INTERROGATION - UF4 FOR TEST 9.6 A, STEP e.

BIT SIGNIFICANCE:				MSB LSB		EVEN	MSB LSB	MSB LSB
"ME" RF BIT:	33 37	38 39	40	41 52	53	54	55 71	72 88
BDS BUFFER BIT:	1 5	6 7	8	9 (33,856 ft,) 20	21	22	23 (15552) 39	40 (12444) 56
FIELD:	TYPE	SSS	Single ANT	ALTITUDE	TIME (T)	Format (F)	ENCODED LATITUDE	ENCODED LONGITUDE
DATA:	1 0010	00	0 or 1	1010 1111 0010	0	0	1 0101 0101 0101 0010	1 0010 0100 0100 0100
NOTE: The Single Antenna Bit (RF bit 40) is set to "0" for TDR-94D and to "1" for TDR-94.								

EVEN - SECOND, AIRBORNE FMS/IRS POSITION MESSAGE TRANSMISSION FOR TEST 9.6A, STEP f.

BIT SIGNIFICANCE:				MSB LSB		EVEN	MSB LSB	MSB LSB
"ME" RF BIT:	33 37	38 39	40	41 52	53	54	55 71	72 88
BDS BUFFER BIT:	1 5	6 7	8	9 (33,856 ft,) 20	21	22	23 (1CFA2) 39	40 (0182D) 56
FIELD:	TYPE	SSS	Single ANT	ALTITUDE	TIME (T)	Format (F)	ENCODED LATITUDE	ENCODED LONGITUDE
DATA:	1 0010	00	0 or 1	1010 1111 0010	0	1	1 1100 1111 1010 0010	0 0001 1000 0010 1101
NOTE: The Single Antenna Bit (RF bit 40) is set to "0" for TDR-94D and to "1" for TDR-94.								

ODD - SECOND, AIRBORNE FMS/IRS POSITION MESSAGE TRANSMISSION FOR TEST 9.6A, STEP h.

TPH6638_01

FMS/INS Primary Data Test 9.6A, Input Data and Results
Figure 1010/GRAPHIC 34-50-96-99B-028-A01

FIELD BITS:		1 8	9 10	11 29	30 31	32
PARAMETER	HEX LABEL	LABEL	SDI	BINARY DATA	SSM	P
FLIGHT IDENT WORD 1 (CH 1, CH 2)	233	1001 1011	10	1010101 0 1010101 0000	00	P
FLIGHT IDENT WORD 2 (CH 3, CH 4)	234	1001 1100	10	1010101 0 1010101 0000	00	P
FLIGHT IDENT WORD 3 (CH 5, CH 6)	235	1001 1101	10	1010101 0 1010101 0000	00	P
FLIGHT IDENT WORD 4 (CH 7, CH 8)	236	1001 1110	10	1010101 0 1010101 0000	00	P
NOTE: ALL CHARACTERS ARE SET EQUAL TO THE ICAO ANNEX 10 CHARACTER "U".						

INPUT DATA FOR TEST 9.7, STEP e .

"ME" RF BIT:	33 37	38 40	41 46	47 52	53 58	59 64	65 70	71 76	77 82	83 88
BDS BUFFER BIT:	1 5	6 8	9 14	15 20	21 26	27 32	33 38	39 44	45 50	51 56
FIELD:	FORMAT TYPE	AIRCRAFT TYPE	CHAR. 1	CHAR. 2	CHAR. 3	CHAR. 4	CHAR. 5	CHAR. 6	CHAR. 7	CHAR. 8
DATA:	0 0100	101	010101	010101	010101	010101	010101	010101	010101	010101

AIRCRAFT IDENTIFICATION SQUITTER FOR TEST 9.7, STEP f. TPH6679_01

Aircraft Identification Squitter Test 9.7, Input Data and Results
Figure 1011/GRAPHIC 34-50-96-99B-029-A01

FIELD BITS:		1 8	9 10	11 29	30 31	32
PARAMETER	HEX LABEL	LABEL	SDI	BINARY DATA	SSM	P
FLIGHT IDENT WORD 1 (CH 1, CH 2)	233	10011011	10	1010101 0 1010101 0000	00	P
FLIGHT IDENT WORD 2 (CH 3, CH 4)	234	10011100	10	1010101 0 1010101 0000	00	P
FLIGHT IDENT WORD 3 (CH 5, CH 6)	235	10011101	10	1010101 0 1010101 0000	00	P
FLIGHT IDENT WORD 4 (CH 7, CH 8)	236	10011110	10	1010101 0 1010101 0000	00	P

INPUT DATA FOR TEST 9.7A, STEP e.

"ME" RF BIT:	33 37	38 40	41 46	47 52	53 58	59 64	65 70	71 76	77 82	83 88
BDS BUFFER BIT:	1 5	6 8	9 14	15 20	21 26	27 32	33 38	39 44	45 50	51 56
FIELD:	FORMAT TYPE	AIRCRAFT TYPE	CHAR. 1	CHAR. 2	CHAR. 3	CHAR. 4	CHAR. 5	CHAR. 6	CHAR. 7	CHAR. 8
DATA:	0 0100	101	010101	010101	010101	010101	010101	010101	010101	010101

AIRCRAFT IDENTIFICATION SQUITTER TRANSMISSION FOR TEST 9.7A, STEP f.

"ME" RF BIT:	33 37	38 40	41 46	47 52	53 58	59 64	65 70	71 76	77 82	83 88
BDS BUFFER BIT:	1 5	6 8	9 14	15 20	21 26	27 32	33 38	39 44	45 50	51 56
FIELD:	FORMAT TYPE	AIRCRAFT TYPE	CHAR. 1	CHAR. 2	CHAR. 3	CHAR. 4	CHAR. 5	CHAR. 6	CHAR. 7	CHAR. 8
DATA:	0 0011	010	010101	010101	010101	010101	010101	010101	010101	010101

AIRCRAFT IDENTIFICATION SQUITTER TRANSMISSION FOR TEST 9.7A, STEP i.

TPH6639_01

Aircraft Identification Squitter Test 9.7A, Input Data and Results
Figure 1012/GRAPHIC 34-50-96-99B-030-A01

RF BIT:	1 5	6 8	9 13	14 16	17 32	33 56
FIELD:	UF #	PC	RR	DI	SD	AP
DATA:	0 0100	000	1 0000	111	0000 1000 0000 0000	UUT MODE-S ADDRESS
DECODED DATA:	4	0	10 (HEX)	7 (HEX)	0800 (HEX)	EXAMPLE: AAAAAA (HEX)

AIRCRAFT IDENTIFICATION INTERROGATION - UF4 FOR TEST 9.7B, STEP f.

"ME" RF BIT:	33 37	38 40	41 46	47 52	53 58	59 64	65 70	71 76	77 82	83 88
BDS BUFFER BIT:	1 5	6 8	9 14	15 20	21 26	27 32	33 38	39 44	45 50	51 56
FIELD:	FORMAT TYPE	AIRCRAFT TYPE	CHAR. 1	CHAR. 2	CHAR. 3	CHAR. 4	CHAR. 5	CHAR. 6	CHAR. 7	CHAR. 8
DATA:	0 0100	101	010101	010101	010101	010101	010101	0101 01	010101	010101

AIRCRAFT IDENTIFICATION SQUITTER TRANSMISSON FOR TEST 9.7B, STEP g.

"ME" RF BIT:	33 37	38 40	41 46	47 52	53 58	59 64	65 70	71 76	77 82	83 88
BDS BUFFER BIT:	1 5	6 8	9 14	15 20	21 26	27 32	33 38	39 44	45 50	51 56
FIELD:	FORMAT TYPE	AIRCRAFT TYPE	CHAR. 1	CHAR. 2	CHAR. 3	CHAR. 4	CHAR. 5	CHAR. 6	CHAR. 7	CHAR. 8
DATA:	0 0011	010	010101	010101	010101	010101	010101	010101	010101	010101

AIRCRAFT IDENTIFICATION SQUITTER TRANSMISSION FOR TEST 9.7B, STEP k. TPH6644_01

Aircraft Identification Message Test 9.7B, Input Data and Results
Figure 1013/GRAPHIC 34-50-96-99B-031-A01

FIELD BITS:				1 8	9 10	11 29	30 31	32
PARAMETER	VALUE	AWB VALUE	HEX LABEL	LABEL	SDI [1]	BINARY DATA	SSM	P
GPS/GNSS TRACK	0 deg.	0000	103	01000011	10	0000 0000 0000 0000 000	11	P
GPS/GNSS ALTITUDE	33,856 ft.	N/A	370	11111000	00	0000 0001 0001 0000 100	11	P
LATITUDE-COURSE	-86.0 deg.	C2D82D83	110	01001000	10	1000 0011 0110 1000 011	11	P
LATITUDE -FINE			120	01010000	10	0000 0001 1000 0011 010	11	P
LONGITUDE-COURSE	-171.5 deg.	860B60B6	111	01001001	00	1101 1010 0000 1100 001	11	P
LONGITUDE-FINE			121	01010001	10	0000 0000 1101 1010 000	11	P

INTPUT DATA FOR TEST 9.8, STEP f.

RF BIT:	1 5	6 8	9 13	14 16	17 32	33 56
FIELD:	UF #	PC	RR	DI	SD	AP
DATA:	0 010 0	000	1 0000	111	0000 0101 0000 0000	UUT MODE-S ADDRESS
DECODED DATA:	4	0	10 (HEX)	7 (HEX)	0500 (HEX)	EXAMPLE: AAAAAA (HEX)

AIRBORNE POSITION INTERROGATION - UF4 FOR TEST 9.8 STEP g.

BIT SIGNIFICANCE:				MSB LSB		EVEN	MSB LSB	MSB LSB
"ME" RF BIT:	33 37	38 39	40	41 52	53	54	55 71	72 88
BDS BUFFER BIT:	1 5	6 7	8	9 20	21	22	23 (15555) 39	40 (12444) 56
FIELD:	TYPE	SSS	SINGLE ANT	ALTITUDE	TIME (T)	FORMAT (F)	ENCODED LATITUDE	ENCODED LONGITUDE
DATA:	1 0110	00	0 OR 1	1010 1111 0010	0	0	1 0101 0101 0101 0101	1 0010 0100 0100 0100
NOTE: THE SINGLE ANTENNA BIT (RF BIT 40) IS SET TO "0" FOR THE TDR-94D AND TO "1" FOR THE TDR-94.								

EVEN-SECOND AIRBORNE POSITION MESSAGE TRANSMISSION FOR TEST 9.8, STEP h. TPH6645_01

AIS/ADSS Primary Data Test 9.8, Input Data and Results
Figure 1014/GRAPHIC 34-50-96-99B-032-A01

RF BIT:	1 5	6 8	9 13	14 16	17 32	33 56
FIELD:	UF #	PC	RR	DI	SD	AP
DATA:	0 0100	000	1 0110	111	0000 0101 0000 0000	UUT MODE - S ADDRESS
DECODED DATA:	4	0	16 (HEX)	7 (HEX)	0500 (HEX)	EXAMPLE: AAAAAA (HEX)

AIRCRAFT OPERATIONAL STATUS INTERROGATION - UF4 FOR TEST 14A.0, STEP b.

"ME" RF BIT:	33 37	38 40	41 56	57 72	73 75	76	77 80	81 82	83 84	85	86	87 88
BDS BUFFER BIT:	1 5	6 8	9 24	25 40	41 43	44	45 48	49 50	51 52	53	54	55 56
FIELD:	FORMAT TYPE CODE	SUBTYPE CODE	CC CODES	OM CODES	VN	NIC	NAC_P	BAQ OR RES	SIL	NIC_B OR TRKHDG	HRD	RES
DATA:	11111	XXX	XXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXX	XXX	X	XXXX	XX	00	X	X	XX

AIRCRAFT OPERATIONAL STATUS - DF20 FOR TEST 14A.0, STEP c .

RF BIT:	1 5	6 8	9 13	14 16	17 32	33 56
FIELD:	UF #	PC	RR	DI	SD	AP
DATA:	0 0100	000	1 0110	111	0000 0101 0000 0000	UUT MODES ADDRESS
DECODED DATA:	4	0	16 (HEX)	7 (HEX)	0500 (HEX)	EXAMPLE: AAAAAA (HEX)

AIRCRAFT OPERATIONAL STATUS INTERROGATION - UF4 FOR TEST 14A.0, STEP e.

"ME" RF BIT:	33 37	38 40	41 56	57 72	73 75	76	77 80	81 82	83 84	85	86	87 88
BDS BUFFER BIT:	1 5	6 8	9 24	25 40	41 43	44	45 48	49 50	51 52	53	54	55 56
FIELD:	FORMAT TYPE CODE	SUBTYPE CODE	CC CODES	OM CODES	VN	NIC	NAC_P	BAQ OR RES	SIL	NIC_B OR TRKHDG	HRD	RES
DATA:	11111	XXX	XXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXX	XXX	X	XXXX	XX	10	X	X	XX

AIRCRAFT OPERATIONAL STATUS - DF20 FOR TEST 14A.0, STEP f .

TPH6659_01

SIL Designator Requirements Test 14A.0, Input Data and Results
Figure 1015/GRAPHIC 34-50-96-99B-033-A01

FIELD BITS:				1 8	9 10	11 17	18 28	29	30 31	32
PARAMETER	VALUE	AWB VALUE	HEX LABEL	LABEL	SDI [1]	PAD	BINARY DATA	PAD	SSM	P
TRACK ANGLE RATE	15 DEG/SEC	N/A	335	11011101	10	0000 000	0000 0011 110	0	11	P

INPUT DATA FOR TEST 16.10A.1, STEP b.

RF BIT:	1 5	6 8	9 13	14 16	17 32	33 56
FIELD:	UF #	PC	RR	DI	SD	AP
DATA:	0 0100	000	1 0101	111	0000 0000 0000 0000	UUT MODE-S ADDRESS
DECODED DATA:	4	0	15 (HEX)	7 (HEX)	0000 (HEX)	EXAMPLE: AAAAAA (HEX)

TRACK AND TURN REPORT INTERROGRATION - UF4 FOR TEST 16.10A.1, STEP c.

"ME" RF BIT:	33	34	35 43	44	45	46 55	56	57 66	67	68	69 77	78	79 88
BDS BUFFER BIT:	1	2	3 11	12	13	14 23	24	25 34	35	36	37 45	46	47 56
FIELD:	ST	SIGN	ROLL ANGLE	ST	SIGN	TRUE TRACK ANGLE	ST	GROUND SPEED	ST	SIG N	TRACK ANGLE RATE	ST	TRUE AIRSPEED
DATA:	X	X	XXXXXXXXX	X	X	XXXXXXXXXX	X	XXXXXXXXXX	1	0	111100000	X	XXXXXXXXXX

TRACK AND TURN REPORT - DF20 FOR TEST 16.10A.1, STEP d.

RF BIT:	1 5	6 8	9 13	14 16	17 32	33 56
FIELD:	UF #	PC	RR	DI	SD	AP
DATA:	0 0100	000	1 0101	111	0000 0000 0000 0000	UUT MODE-S ADDRESS
DECODED DATA:	4	0	15 (HEX)	7 (HEX)	0000 (HEX)	EXAMPLE: AAAAAA (HEX)

TRACK AND TURN REPORT INTERROGRATION - UF4 FOR TEST 16.10A.1, STEP f.

"ME" RF BIT:	33	34	35 43	44	45	46 55	56	57 66	67	68	69 77	78	79 88
BDS BUFFER BIT:	1	2	3 11	12	13	14 23	24	25 34	35	36	37 45	46	47 56
FIELD:	ST	SIGN	ROLL ANGLE	ST	SIGN	TRUE TRACK ANGLE	ST	GROUND SPEED	ST	SIGN	TRACK ANGLE RATE	ST	TRUE AIRSPEED
DATA:	X	X	XXXXXXXXX	X	X	XXXXXXXXXX	X	XXXXXXXXXX	0	0	000000000	X	XXXXX XXXXX

TRACK AND TURN REPORT - DF20 FOR TEST 16.10A.1, STEP g.

TPH6653_01

Configuration Select S0 Discrete Test 16.10A.1, Input Data and Results
Figure 1016/GRAPHIC 34-50-96-99B-034-A01

FIELD BITS:				1 8	9 10	11 29	30 31	32
PARAMETER	VALUE	AWB VALUE	HEX LABEL	LABEL	SDI [1]	BINARY DATA	SSM	P
GNSS N/S VELOCITY	0 KNOTS	N/A	166	01110110	10	0000 0000 0000 0000 000	11	P
GNSS E/W VELOCITY	0 KNOTS	N/A	174	01111100	10	0000 0000 0000 0000 000	11	P
LATITUDE-COURSE	-86.0 DEG.	C2D82D83	110	01001000	10	1000 0011 0110 1000 011	11	P
LATITUDE –FINE			120	01010000	10	0000 0001 1000 0011 010	11	P
LONGITUDE-CRS	-171.5 DEG.	860B60B6	111	01001001	00	1101 1010 0000 1 100 001	11	P
LONGITUDE-FINE			121	01010001	10	0000 0000 1101 1010 000	11	P
GPS/GNSS TRACK	0 DEG.	0000	103	01000011	10	0000 0000 0000 0000 000	11	P
NOTE: THE SDI FIELDS OF VARIOUS WORDS RECEIVED FROM THE GPS/GNSS RECEIVER ACTUALLY REPRESENT DATA AS OPPOSED TO SOURCE-DESTINATION IDENTIFICATION INFORMATION.								

INPUT DATA FOR TEST 16.10A.2, STEP d.

RF BIT:	1 5	6 8	9 13	14 16	17 32	33 56
FIELD:	UF #	PC	RR	DI	SD	AP
DATA:	0 0100	000	1 0000	111	0000 0101 0000 0000	UUT MODE - S ADDRESS
DECODED DATA:	4	0	10 (HEX)	7 (HEX)	0500 (HEX)	EXAMPLE: AAAAAA (HEX)

AIRBORNE POSITION INTERROGATION - UF4 FOR TEST 16.10 A.2, STEP e.

BIT SIGNIFICANCE:				MSB LSB		EVEN	MSB LSB	MSB LSB
"ME" RF BIT:	33 37	38 39	40	41 52	53	54	55 71	72 88
BDS BUFFER BIT:	1 5	6 7	8	9 20	21	22	23 (15555) 39	40 (12444) 56
FIELD:	TYPE	SSS	SNGL ANT	ALTITUDE	UTC	CPR FMT	ENCODED LATITUDE	ENCODED LONGITUDE
DATA:	1 0010	XX	X	XXXXXXXXXXXX	X	X	XXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXX

AIRBORNE POSITION DF20 REPLY FOR TEST 16.10A.2, STEP f.

RF BIT:	1 5	6 8	9 13	14 16	17 32	33 56
FIELD:	UF #	PC	RR	DI	SD	AP
DATA:	0 0100	000	1 0000	111	0000 0101 0000 0000	UUT MODE - S ADDRESS
DECODED DATA:	4	0	10 (HEX)	7 (HEX)	0500 (HEX)	EXAMPLE: AAAAAA (HEX)

AIRBORNE POSITION INTERROGATION - UF4 FOR TEST 16.10A.2 , STEP h.

BIT SIGNIFICANCE:				MSB LSB		EVEN	MSB LSB	MSB LSB
"ME" RF BIT:	33 37	38 39	40	41 52	53	54	55 71	72 88
BDS BUFFER BIT:	1 5	6 7	8	9 20	21	22	23 (15555) 39	40 (12444) 56
FIELD:	TYPE	SSS	SNGL ANT	ALTITUDE	UTC	CPR FMT	ENCODED LATITUDE	ENCODED LONGITUDE
DATA:	0 0000	XX	X	XXXXXXXXXXXX	X	X	XXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXX

AIRBORNE POSITION DF20 REPLY FOR TEST 16.10A.2, STEP i.

TPH6654_01

Configuration Select S1 Discrete Test 16.10A.2, Input Data and Results
Figure 1017/GRAPHIC 34-50-96-99B-035-A01

FIELD BITS:				1 8	9 10	11 29	30 31	32
PARAMETER	VALUE	AWB VALUE	HEX LABEL	LABEL	SDI [1]	BINARY DATA	SSM	P
GPS/GNSS TRACK	0 deg.	0000	103	01000011	10	0000 0000 0000 0000 000	11	P
GPS/GNSS ALTITUDE	33,856 ft.	N/A	370	11111000	00	0000 0001 0001 0000 100	11	P
LATITUDE-COURSE	-86.0 deg.	C2D82D83	110	01001000	10	1000 0011 0110 1000 011	11	P
LATITUDE -FINE			120	01010000	10	0000 0001 1000 0011 010	11	P
LONGITUDE-COURSE	-171.5 deg.	860B60B6	111	01001001	00	1101 1010 0000 1100 001	11	P
LONGITUDE-FINE			121	01010001	10	0000 0000 1101 1010 000	11	P

INPUT DATA FOR TEST 9.3C STEP e.

AIRBORNE POSITION SQUITTER_EVEN SECOND											
BIT SIGNIFICANCE:				MSB LSB		EVEN	MSB LSB		MSB LSB		
ME RF BIT:	33 37	38 39	40	41 52	53	54	55 71		72 88		
BDS BUFFER BIT:	1 5	6 7	8	9 20	21	22	23	(15555)	39	40 (12444)	56
FIELD:	TYPE	SSS	Single ANT	ALTITUDE	TIME (T)	Format (F)	ENCODED LATITUDE			ENCODED LONGITUDE	
DATA:	1 0110	00	0 or 1	1010 1111 0010	1	0	1 0101 0101 0101 0101			1 0010 0100 0100 0100	

AIRBORNE POSITION SQUITTER EVEN SECOND FOR TEST 9.3C STEP f.

AIRBORNE POSITION SQUITTER_ODD SECOND											
BIT SIGNIFICANCE:				MSB LSB		ODD	MSB LSB		MSB LSB		
ME RF BIT:	33 37	38 39	40	41 52	53	54	55 71		72 88		
BDS BUFFER BIT:	1 5	6 7	8	9 20	21	22	23	(1CFA5)	39	40 (0182D)	56
FIELD:	TYPE	SSS	Single ANT	ALTITUDE	TIME (T)	Format (F)	ENCODED LATITUDE			ENCODED LONGITUDE	
DATA:	1 0110	00	0 or 1	1010 1111 0010	1	1	1 1100 1111 1010 0101			0 0001 1000 0010 1101	

AIRBORNE POSITION SQUITTER ODD SECOND FOR TEST 9.3C STEP j.

TPI2530_01

Airborne Position Extended Squitter Test 9.3C, Input Data and Results
Figure 1018/GRAPHIC 34-50-96-99B-089-A01

FIELD BITS:				1 8	9 10	11 29	30 31	32
PARAMETER	VALUE	AWB VALUE	HEX LABEL	LABEL	SDI [1]	BINARY DATA	SSM	P
GPS/GNSS TRACK	0 deg.	0000	103	01000011	10	0000 0000 0000 0000 000	11	P
GPS/GNSS ALTITUDE	33,856 ft.	N/A	370	11111000	00	0000 0001 0001 0000 100	11	P
LATITUDE-COURSE	-86.0 deg.	C2D82D83	110	01001000	10	1000 0011 0110 1000 011	11	P
LATITUDE -FINE			120	01010000	10	0000 0001 1000 0011 010	11	P
LONGITUDE-COURSE	-171.5 deg.	860B60B6	111	01001001	00	1101 1010 0000 1100 001	11	P
LONGITUDE-FINE			121	01010001	10	0000 0000 1101 1010 000	11	P

INPUT DATA FOR TEST 9.3D STEP e.

AIRBORNE POSITION INTERROGATION UF4						
RF BIT:	1 5	6 8	9 13	14 16	17 32	33 56
FIELD:	UF #	PC	RR	DI	SD	AP
DATA:	0 0100	000	1 0000	111	0000 0101 0000 0000	UUT Mode-S Address
DECODED DATA:	4	0	10 (Hex)	7 (Hex)	0500 (Hex)	Example: AAAAAA (Hex)

AIRBORNE POSITION INTERROGATION UF4 FOR 9.3D STEP f.

AIRBORNE POSITION MESSAGE_EVEN SECOND											
BIT SIGNIFICANCE:				MSB	LSB		EVEN	MSB	LSB	MSB	LSB
MB RF BIT:	33 37	38 39	40	41	52	53	54	55	71	72	88
BDS BUFFER BIT:	1 5	6 7	8	9	20	21	22	23 (15555)	39	40 (12444)	56
FIELD:	TYPE	SSS	Single ANT	ALTITUDE		TIME (T)	Format (F)	ENCODED LATITUDE		ENCODED LONGITUDE	
DATA:	1 0110	00	0 or 1	1010 1111 0010		1	0	1 0101 0101 0101 0101		1 0010 0100 0100 0100	

EVEN SECOND, AIRBORNE POSITION MESSAGE FOR 9.3D STEP g.

AIRBORNE POSITION MESSAGE_ODD SECOND											
BIT SIGNIFICANCE:				MSB	LSB		ODD	MSB	LSB	MSB	LSB
MB RF BIT:	33 37	38 39	40	41	52	53	54	55	71	72	88
BDS BUFFER BIT:	1 5	6 7	8	9	20	21	22	23 (1CFA5)	39	40 (0182D)	56
FIELD:	TYPE	SSS	Single ANT	ALTITUDE		TIME (T)	Format (F)	ENCODED LATITUDE		ENCODED LONGITUDE	
DATA:	1 0110	00	0 or 1	1010 1111 0010		1	1	1 1100 1111 1010 0101		0 0001 1000 0010 1101	

ODD SECOND AIRBORNE POSITION MESSAGE STEP i.

TPI2531_01

GPS Bus / Airborne Position Extended Squitter / Time Tag Test 9.3D, Input Data and Results
Figure 1019/GRAPHIC 34-50-96-99B-090-A01

FIELD BITS:				1 8	9 10	11 29	30 31	32
PARAMETER	VALUE	AWB VALUE	HEX LABEL	LABEL	SDI [1]	BINARY DATA	SSM	P
GPS/GNSS TRACK	119.9982 deg.	N/A	103	01000011	10	0001 0101 0101 0101 010	11	P
GPS/GNSS GROUND SPEED	74.0 Kts.	N/A	112	01001010	10	0000 0001 0100 1000 000	11	p
GPS/GNSS ALTITUDE	33,856 ft.	N/A	370	11111000	00	0000 0001 0001 0000 100	11	P
LATITUDE-COURSE	-86.5 deg.	C27D27D2	110	01001000	00	1001 0111 1100 1000 011	11	P
LATITUDE -FINE			120	01010000	10	0000 0000 1001 0111 110	11	P
LONGITUDE-COURSE	-172.5 deg.	85555555	111	01001001	01	0101 0101 0101 0100 001	11	P
LONGITUDE-FINE			121	01010001	10	0000 0001 0101 0101 010	11	P

INPUT DATA FOR TEST 9.5C STEP d.

SURFACE POSITION SQUITTER_EVEN SECOND										
BIT SIGNIFICANCE:		MSB LSB				EVEN	MSB (-86.5) LSB		MSB (-172.5) LSB	
ME RF BIT:	33 37	38 44	45	46 52	53	54	55	71	72	88
BDS BUFFER BIT:	1 5	6 12	13	14 20	21	22	23 (0AAAB)	39	40 (08000)	56
FIELD:	TYPE	MOVEMENT	ST	GROUND TRACK	TIME (T)	Format (F)	ENCODED LATITUDE		ENCODED LONGITUDE	
DATA:	0 1000	110 0000	1	0101011	1	0	0 1010 1010 1010 1011		0 1000 0000 0000 0000	

EVEN SECOND POSITION SQUITTER TRANSMISSION FOR TEST 9.5C STEP e.

SURFACE POSITION SQUITTER_ODD SECOND										
BIT SIGNIFICANCE:		MSB LSB		MSB LSB		ODD	MSB (-86.5) LSB		MSB (-172.5) LSB	
ME RF BIT:	33 37	38 44	45	46 52	53	54	55	71	72	88
BDS BUFFER BIT:	1 5	6 12	13	14 20	21	22	23 (096C1)	39	40 (05555)	56
FIELD:	TYPE	MOVEMENT	ST	GROUND TRACK	TIME (T)	Format (F)	ENCODED LATITUDE		ENCODED LONGITUDE	
DATA:	0 1000	110 0000	1	0101011	0	1	0 1001 0110 1100 0001		0 0101 0101 0101 0101	

ODD SECOND POSITION SQUITTER TRANSMISSION FOR TEST 9.5C STEP j.

TPI2532_01

GPS Bus / Surface Position Extended Squitter / Time Tag Verification Test 9.5C, Input Data and Results
Figure 1020/GRAPHIC 34-50-96-99B-091-A01

FIELD BITS:				1 8	9 10	11 29	30 31	32
PARAMETER	VALUE	AWB VALUE	HEX LABEL	LABEL	SDI [1]	BINARY DATA	SSM	P
GPS/GNSS TRACK	0 deg.	0000	103	01000011	10	0000 0000 0000 0000 000	11	P
GPS/GNSS ALTITUDE	33,856 ft.	N/A	370	11111000	00	0000 0001 0001 0000 100	11	P
LATITUDE-COURSE	-86.0 deg.	C2D82D83	110	01001000	10	1000 0011 0110 1000 011	11	P
LATITUDE -FINE			120	01010000	10	0000 0001 1000 0011 010	11	P
LONGITUDE-COURSE	-171.5 deg.	860B60B6	111	01001001	00	1101 1010 0000 1100 001	11	P
LONGITUDE-FINE			121	01010001	10	0000 0000 1101 1010 000	11	P

INPUT DATA FOR TEST 9.5D STEP d.

SURFACE POSITION INTERROGATION UF4						
RF BIT:	1 5	6 8	9 13	14 16	17 32	33 56
FIELD:	UF #	PC	RR	DI	SD	AP
DATA:	0 0100	000	1 0000	111	0000 0110 0000 0000	UUT Mode-S Address
DECODED DATA:	4	0	10 (Hex)	7 (Hex)	0600 (Hex)	Example: AAAAAA (Hex)

SURFACE POSITION INTERROGATION UF-4 FOR TEST 9.5D STEP e.

SURFACE POSITION MESSAGE_EVEN SECOND									
BIT SIGNIFICANCE:		MSB LSB				EVEN	MSB (-86.5) LSB	MSB (-172.5) LSB	
MB RF BIT:	33 37	38 44	45	46 52	53	54	55 71	72	88
BDS BUFFER BIT:	1 5	6 12	13	14 20	21	22	23 (0AAAB) 39	40 (08000)	56
FIELD:	TYPE	MOVEMENT	ST	GROUND TRACK	TIME (T)	Format (F)	ENCODED LATITUDE	ENCODED LONGITUDE	
DATA:	0 1000	110 0000	1	0101011	1	0	0 1010 1010 1010 1011	0 1000 0000 0000 0000	

EVEN SECOND SURFACE POSITION INTERROGATION FOR TEST 9.5D STEP f.

SURFACE POSITION MESSAGE_ODD SECOND									
BIT SIGNIFICANCE:		MSB LSB		MSB LSB		ODD	MSB (-86.5) LSB	MSB (-172.5) LSB	
MB RF BIT:	33 37	38 44	45	46 52	53	54	55 71	72	88
BDS BUFFER BIT:	1 5	6 12	13	14 20	21	22	23 (096C1) 39	40 (05555)	56
FIELD:	TYPE	MOVEMENT	ST	GROUND TRACK	TIME (T)	Format (F)	ENCODED LATITUDE	ENCODED LONGITUDE	
DATA:	0 1000	110 0000	1	0101011	0	1	0 1001 0110 1100 0001	0 0101 0101 0101 0101	

ODD SECOND SURFACE POSITION INTERROGATION FOR TEST 9.5D STEP i.

TPI2533_01

GPS Bus / Surface Position Extended Squitter / Time Tag Verification Test 9.5D
Figure 1021/GRAPHIC 34-50-96-99B-092-A01

FIELD BITS:		1 8	9 10	11 29	30 31	32
PARAMETER	HEX LAB EL	LABEL	SDI	BINARY DATA	SSM	P
FLIGHT IDENT WORD 1 (CH 1, CH 2)	233	10011011	10	1010101 0 1010101 0000	00	P
FLIGHT IDENT WORD 2 (CH 3, CH 4)	234	10011100	10	1010101 0 1010101 0000	00	p
FLIGHT IDENT WORD 3 (CH 5, CH 6)	235	10011101	10	1010101 0 1010101 0000	00	P
FLIGHT IDENT WORD 4 (CH 7, CH 8)	236	10011110	10	1010101 0 1010101 0000	00	P

INPUT DATA FOR TEST 9.7C STEP e.

AIRCRAFT IDENTIFICATION SQUITTER										
ME RF BIT:	33 37	38 40	41 46	47 52	53 58	59 64	65 70	71 76	77 82	83 88
BDS BUFFER BIT:	1 5	6 8	9 14	15 20	21 26	27 32	33 38	39 44	45 50	51 56
FIELD:	FORMAT TYPE	AIRCRAFT TYPE	CHAR. 1	CHAR. 2	CHAR. 3	CHAR. 4	CHAR. 5	CHAR. 6	CHAR. 7	CHAR. 8
DATA:	0 0100	101	010101	010101	010101	010101	010101	010101	010101	010101

AIRCRAFT IDENTIFICATION SQUITTER TRANSMISSION FOR TEST 9.7C STEP f.

AIRCRAFT IDENTIFICATION SQUITTER										
ME RF BIT:	33 37	38 40	41 46	47 52	53 58	59 64	65 70	71 76	77 82	83 88
BDS BUFFER BIT:	1 5	6 8	9 14	15 20	21 26	27 32	33 38	39 44	45 50	51 56
FIELD:	FORMAT TYPE	AIRCRAFT TYPE	CHAR. 1	CHAR. 2	CHAR. 3	CHAR. 4	CHAR. 5	CHAR. 6	CHAR. 7	CHAR. 8
DATA:	0 0011	010	010101	010101	010101	010101	010101	010101	010101	010101

AIRCRAFT IDENTIFICATION SQUITTER TRANSMISSION FOR TEST 9.7C STEP i.

TPI2534_01

Aircraft Identification Massage (-408 ONLY) Test 9.7C
Figure 1022/GRAPHIC 34-50-96-99B-093-A01

FIELD BITS:		1 8	9 10	11 29	30 31	32
PARAMETER	HEX LABEL	LABEL	SDI	BINARY DATA	SSM	P
FLIGHT IDENT WORD 1 (CH 1, CH 2)	233	10011011	10	1010101 0 1010101 0000	00	P
FLIGHT IDENT WORD 2 (CH 3, CH 4)	234	10011100	10	1010101 0 1010101 0000	00	p
FLIGHT IDENT WORD 3 (CH 5, CH 6)	235	10011101	10	1010101 0 1010101 0000	00	P
FLIGHT IDENT WORD 4 (CH 7, CH 8)	236	10011110	10	1010101 0 1010101 0000	00	P

INPUT DATA FOR TEST 9.7D STEP e.

AIRCRAFT IDENTIFICATION INTERROGATION UF4						
RF BIT:	1 5	6 8	9 13	14 16	17 32	33 56
FIELD:	UF #	PC	RR	DI	SD	AP
DATA:	0 0100	000	1 0000	111	0000 1000 0000 0000	UUT Mode-S Address
DECODED DATA:	4	0	10 (Hex)	7 (Hex)	0800 (Hex)	Example: AAAAAA (Hex)

AIRCRAFT IDENTIFICATION INTERROGATION FOR TEST 9.7D STEP f.

AIRCRAFT IDENTIFICATION SQUITTER										
MB RF BIT:	33 37	38 40	41 46	47 52	53 58	59 64	65 70	71 76	77 82	83 88
BDS BUFFER BIT:	1 5	6 8	9 14	15 20	21 26	27 32	33 38	39 44	45 50	51 56
FIELD:	FORMAT TYPE	AIRCRAFT TYPE	CHAR. 1	CHAR. 2	CHAR. 3	CHAR. 4	CHAR. 5	CHAR. 6	CHAR. 7	CHAR. 8
DATA:	0 0011	010	010101	010101	010101	010101	010101	010101	010101	010101

AIRCRAFT IDENTIFICATION INTERROGATION FOR TEST 9.7D STEP g.

AIRCRAFT IDENTIFICATION SQUITTER										
MB RF BIT:	33 37	38 40	41 46	47 52	53 58	59 64	65 70	71 76	77 82	83 88
BDS BUFFER BIT:	1 5	6 8	9 14	15 20	21 26	27 32	33 38	39 44	45 50	51 56
FIELD:	FORMAT TYPE	AIRCRAFT TYPE	CHAR. 1	CHAR. 2	CHAR. 3	CHAR. 4	CHAR. 5	CHAR. 6	CHAR. 7	CHAR. 8
DATA:	0 0011	010	010101	010101	010101	010101	010101	010101	010101	010101

AIRCRAFT IDENTIFICATION INTERROGATION FOR TEST 9.7D STEP k.

TPI2535_01

Aircraft Identification Massage (-308, -309 ONLY) Test 9.7D
Figure 1023/GRAPHIC 34-50-96-99B-094-A01

FIELD BITS:				1 8	9 10	11 29	30 31	32
PARAMETER	VALUE	AWB VALUE	HEX LABEL	LABEL	SDI [1]	BINARY DATA	SSM	P
GPS/GNSS TRACK	0 deg.	0000	103	01000011	10	0000 0000 0000 0000 000	11	P
GPS/GNSS ALTITUDE	33,856 ft.	N/A	370	11111000	00	0000 0001 0001 0000 100	11	P
LATITUDE-COURSE	-86.0 deg.	C2D82D83	110	01001000	10	1000 0011 0110 1000 011	11	P
LATITUDE -FINE			120	01010000	10	0000 0001 1000 0011 010	11	P
LONGITUDE-COURSE	-171.5 deg.	860B60B6	111	01001001	00	1101 1010 0000 1100 001	11	P
LONGITUDE-FINE			121	01010001	10	0000 0000 1101 1010 000	11	P

INPUT DATA FOR TEST 9.8B STEP f.

AIRBORNE POSITION INTERROGATION UF4						
RF BIT:	1 5	6 8	9 13	14 16	17 32	33 56
FIELD:	UF #	PC	RR	DI	SD	AP
DATA:	0 0100	000	1 0000	111	0000 0101 0000 0000	UUT Mode-S Address
DECODED DATA:	4	0	10 (Hex)	7 (Hex)	0500 (Hex)	Example: AAAAAA (Hex)

AIRBORNE POSITION INTERROGATION UF4 FOR TEST 9.8B STEP g.

AIRBORNE POSITION MESSAGE_EVEN SECOND										
BIT SIGNIFICANCE:				MSB LSB		EVEN	MSB LSB		MSB LSB	
MB RF BIT:	33 37	38 39	40	41 52	53	54	55 71		72 88	
BDS BUFFER BIT:	1 5	6 7	8	9 20	21	22	23 (15555)	39	40 (12444)	56
FIELD:	TYPE	SSS	Single ANT	ALTITUDE	TIME (T)	Format (F)	ENCODED LATITUDE		ENCODED LONGITUDE	
DATA:	1 0110	00	0 or 1	1010 1111 0010	0	0	1 0101 0101 0101 0101		1 0010 0100 0100 0100	

EVEN - SECOND, AIRBORNE POSITION MESSAGE FOR TEST 9.8B STEP h.

TPI2536_01

AIS/ADSS Primary Data (-308, -309, -408, -409) Test 9.8B
Figure 1024/GRAPHIC 34-50-96-99B-095-A01

SUBTASK 34-50-96-810-005-A01
B. TDR-94/94D Alignment Procedures

STEP	PROCEDURE	DESIRED RESULTS
0.0	SETUP INSTRUCTIONS	
0.1	Remove UUT dust cover. Connect TDR-94/94D as shown in Figure 1002/GRAPHIC 34-50-96-99B-036-A01 or Figure 1001/GRAPHIC 34-50-96-99B-020-A01. Test equipment item numbers (XX) that appear in the test setup diagrams are identified in Table 9003/Table 34-50-96-99A-042-A01 or Table 9002/Table 34-50-96-99A-032-A01 of the Special Tools, Fixtures, and Equipment section.	
0.2	Set up IFR 1400C front panel as follows: SWITCH — POSITION DISPLAY SELECT — FREQ MHZ DME REPLY EFFICENXPDR MODE — C TACAN — OFF DBL INTERR — 000.0 /INTRF PULSE — OFF PRF — 50 SQTR — ON IDENT — OFF F2/P2-F1/P1 — F2/P2 XPDR P2/P3 DEV — 0.00 P2, P3 — CAL, CAL FREQ — 1030 FUNCTION SELECT — XPDR DELTA F — 0.00 OFF DME P2 DEV, P2 — 0.0, CAL XPDR PULSE WIDTH — 0.80 CAL SLS/ECHO — -0, OFF RANGE/VEL/ACCEL — 00000 IN/OUT, -1 NMI/NORM — OUT, NORM RF LEVEL -DBM — 90 CW/NORM/OFF — NORM SUPPRESSOR — OFF SYNC T0/TAC/TD — T0 SUPPRESSOR VAR — ADJ to 15V P-P CAL MARKS — 1.45 US AUTO MAN/MAN STEP — MAN FREQ STEP RATE — OFF	

Alignment Procedure Cont.
Table 1002/Table 34-50-96-99A-010-A01

STEP	PROCEDURE	DESIRED RESULTS
0.3	Set up rear of ATC-1400C/S1403C test set as follows: SWITCH — POSITION DECODER — NARROW EQUALIZER — OFF SELF-INTERR — OFF INST DIM — LOW ADDRESS — 10101100	
0.4	Set up front panel of 5359A time synthesizer as follows: SWITCH — POSITION SLOPE — N LEVEL — +2V SYNC DELAY — PRESET OUTPUT POLARITY — NORM, POS AMPLITUDE — ADJ to 2.5V OFFSET — OFF, 0	
0.5	Set up rear of 5359A time synthesizer as follows: SWITCH — POSITION EXT TIMING — DISABLE EVENTS,SLOPE — P FREQ-STD — INT ADDRESS — 0001000 NOTE: Interrogation power levels and transmitter output power levels specified in this document are referenced to the rear connector(s) of the Unit Under Test (UUT). The insertion loss of coaxial cables between the UUT and the test equipment must be accounted for. NOTE: Perform alignment steps 1.X for Receiver IF/LVPS Assembly, CPN 687-0727-004. Perform alignment steps 2.X for Receiver IF/LVPS Assembly, CPN 687-0727-005.	
1.0	Receiver IF/LVPS Assembly, Alignment for CPN 687-0727-004 or prior.	
1.1	Monitor the +5 V dc output at J7-26 with a DVM. Adjust A7R507 if necessary	Verify a reading between 4.99 to 5.01 V dc.
1.2	Monitor J7-33 on Video Processor A6 with an oscilloscope.	

STEP	PROCEDURE	DESIRED RESULTS
1.3	Set the MODE-S test set to generate ATCRBS MODE-C interrogations and apply to the bottom antenna connector. Set the interrogation rate to 450 per second	
1.4	a. Set the MODE-S test set signal strength to -79 dBm. Monitor the Bottom Video signal at A6P22-Pin 33. Adjust A7R131 fully clockwise. NOTE: The oscilloscope must be set to the averaging mode to properly measure the video pulse at the low signal levels required.	Adjust A7R140 for an observed video level of 0.7 volts peak.
	b. Set the MODE-S test set signal strength to -77 dBm.	Adjust A7R131 for an observed video level of 0.7 volts peak.
	c. Verify that the reply rate is between 90% and 100%. If not, readjust A7R140 for desired result.	Reply rate is between 90% and 100%.
1.5	Set the signal strength to -31 dBm. Adjust A7R133 for desired results.	Amplitude of the P1 pulse at J7-33 is 5.00 ±0.05 volts.
1.6	Repeat steps 1.4 and 1.5 as required.	
1.7	Monitor the positive end of A6C67 on top side of the card.	
1.8	Interrogate with a normal MODE-S signal at -27 dBm. Adjust A6R118 until the ditch-slope waveform resulting from P1 has the desired results.	16.2 ±0.2 microseconds wide at its base.
1.9	Do steps 1.10 thru 1.16 for the TDR-94D only. Apply MODE-C interrogations to the UUT top antenna connector.	
1.10	a. Set the MODE-S test set signal strength to -79 dBm. Monitor the Top Video signal at A6P22-Pin 31. Adjust A7R124 fully clockwise. NOTE: The oscilloscope must be set to the averaging mode to properly measure the video pulse at the low signal levels required.	Adjust A7R111 for an observed video level of 0.7 volts peak.
	b. Set the MODE-S test set signal strength to -77 dBm.	Adjust A7R124 for an observed video level of 0.7 volts peak.

STEP	PROCEDURE	DESIRED RESULTS
1.11	Verify that the reply rate is between 90% and 100%. If not, readjust A7R111 for a reply rate between 90% and 100%. NOTE: If the Minimum Trigger Level (MTL) cannot be established within the specified limits, or if the MTL does not stay within the specified limits over the operational temperature range, the A7R127 (for the Top channel) and/or A7R137 (for the Bottom channel) (CPN 705-3543-020) may be added as needed.	
1.12	Set the MODE-S test set signal strength for -31 dBm. Adjust A7R123 for desired results.	Amplitude of the P1 pulse at J7-31 is 5.00 ±0.05 volts.
1.13	Repeat steps 1.11 and 1.12 as required.	
1.14	a. Set the MODE-S test set signal strength to -50 dBm. Measure and note the amplitude of the P1 pulse at J7-31. b. Apply the same input signal level to the bottom channel. Measure and note the amplitude of the P1 pulse at J7-33. c. Verify that the two amplitudes are within 0.1 volts of each other. If this is not the case, reduce the stronger of the two measurements by adjusting the appropriate Slope Adjust, A7R123 or A7R133, until the difference is less than 0.1 volts. NOTE: If this readjustment is performed, then the MTL must be readjusted in accordance with either step 1.4 or 1.11, whichever is appropriate for the Top or Bottom channel requiring adjustment.	____ V _____V Voltage difference should be less than 0.1 volt
1.15	Monitor the positive end of A6C59 on the Video Processor board.	
1.16	Set the MODE-S test set signal strength to -27 dBm. Adjust A6R117 on the Video Processor board such that the ditch-slope waveform resulting from P1 has the desired results. NOTE: Extra care must be taken in the adjustments made in the following steps 1.17 through 1.19. DPSK trimmer capacitor A7C301 adjustments should be made in very small increments or steps. These adjustments are critical to the performance of the UUT. Capacitor A7C301 should only be adjusted at the board or card level (if possible).	16.2 ±0.2 µs wide at its base

STEP	PROCEDURE	DESIRED RESULTS
1.17	To align the DPSK Demodulator VCO, interrogate the bottom channel with MODE-S ONLY ALL-CALL interrogations having a signal strength of -60 dBm. Vary the interrogation center frequency above 1030 MHz until the reply rate reduces to 90% and note the frequency as the upper frequency limit. Vary the interrogation center frequency below 1030 MHz and note the frequency as the lower frequency limit. Adjust A7C306 such that the two limit frequencies are equidistant from 1030.00 MHz. Verify that both frequencies are removed from 1030 MHz by at least 0.6 MHz. If exact centering of the center frequency is difficult to achieve, the adjustment should be made to slightly favor the higher frequency limit.	_____ _____
1.18	The IF bandwidth may be adjusted with A7R305. Adjustment of A7R305 is critical to the performance of the unit and should not be performed at the top-level assembly unless necessary. If adjustment of A7R205 is necessary, then the frequency centering adjustments performed in step 1.17 must be rechecked.	
1.19	To align the DPSK demodulator VCO, interrogate the top channel with a Mode-S Only All-Call interrogations having a signal level of -60 dBm and a center frequency of 1030.0 MHz. Monitor A7TP303 with the oscilloscope and slowly adjustA7C352 for the cleanest and most square observed signal pulses. NOTE: DPSK adjustments are interactive. Steps 1.17 through 1.19 should be rechecked prior to continuing with the following procedures.	
1.20	Monitor J7-33. Interrogate the bottom channel with MODE-A or MODE-C interrogations having a signal level of -67 dBm and measure the video amplitude of P1 observed. Turn off all interrogations to the UUT. NOTE: Enable the Self-Test function and adjust A7R122 such that the observed self-test signal P1 is equal to the video amplitude previously observed within ±0.2 volts.	