AEROFLEX

XPDR/DME/TCAS ADS-B/TIS/TIS-B Test Set IFR 6000

Operation Manual

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Issue 4

OPERATION MANUAL

XPDR/DME/TCAS/ADS-B/TIS/TIS-B

TEST SET

IFR 6000

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10200 West York / Wichita, Kansas 67215 U.S.A. / (316) 522-4981 / FAX (316) 524-2623

Cable Statement:

For continued EMC compliance, all external cables must be double shielded.

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

Nomenclature Statement:

In this manual Test Set or Unit refers to the IFR 6000 XPDR/DME/TCAS/ADS-B/TIS/TIS-B Test Set.

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SAFETY FIRST: TO ALL OPERATIONS PERSONNEL

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

WARNING: USING THIS EQUIPMENT IN A MANNER NOT SPECIFIED BY THE ACCOMPANYING DOCUMENTATION MAY IMPAIR THE SAFETY PROTECTION PROVIDED BY THE EQUIPMENT.

CASE, COVER OR PANEL REMOVAL

Opening the Case Assembly exposes the operator to electrical hazards that can result in electrical shock or equipment damage. Do not operate this Test Set with the Case Assembly open.

SAFETY IDENTIFICATION IN TECHNICAL MANUAL

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

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

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

SAFETY SYMBOLS IN MANUALS AND ON UNITS

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

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

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

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

EQUIPMENT GROUNDING PRECAUTION

Improper grounding of equipment can result in electrical shock.

USE OF PROBES

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

POWER CORDS

Power cords must not be frayed, broken nor expose bare wiring when operating this equipment.

USE RECOMMENDED FUSES ONLY

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

INTERNAL BATTERY

This unit contains a Lithium Ion Battery, serviceable only by a qualified technician.

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

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INTRODUCTION

This manual contains operating instructions for the IFR 6000. It is strongly recommended that personnel be thoroughly familiar with the contents of this manual before attempting to operate this equipment.

Refer all servicing of unit to qualified technical personnel.

ORGANIZATION

This manual is divided into the following Chapters and Sections:

CHAPTER 1 - OPERATION

- Section 1 - DESCRIPTION and Quick Start (for operators familiar with avionics systems)
- Section 2 - OPERATION (installation, description of controls, connectors and indicators, performance evaluation and operating procedures)
- Section 3 - SPECIFICATIONS
- Section 4 - SHIPPING
- Section 5 - STORAGE

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CHAPTER ONE

IFR 6000 XPDR/DME/TCAS/ADS-B/TIS/TIS-B TEST SET

OPERATION MANUAL

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LIST OF TABLES

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SERVICE UPON RECEIPT OF MATERIAL

Unpacking

Special-design packing material inside this shipping carton provides maximum protection for the IFR 6000. Avoid damaging the carton and packing material during equipment unpacking. Use the following steps for unpacking the IFR 6000.

- Cut and remove the sealing tape on the carton top and open the carton.
- Grasp the IFR 6000 transit case firmly, while restraining the shipping carton, and lift the equipment and packing material vertically.
- Place the IFR 6000 transit case and end cap packing on a suitable flat, clean and dry surface.
- Remove the protective plastic bag from the IFR 6000 transit case.
- Place protective plastic bag and end cap packing material inside shipping carton.
- Store the shipping carton for future use should the IFR 6000 need to be returned.

Checking Unpacked Equipment

- Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, report the damage to Aeroflex.
- Check the equipment against the packing slip to see if the shipment is complete. Report all discrepancies to Aeroflex.

IFR 6000 with Standard Accessories

DESCRIPTION	PART NUMBER	QTY
IFR 6000	9001-5802-000	1
POWER SUPPLY	7110-5600-200	1
ANTENNA	7005-5840-500	1
BREAKOUT BOX	7005-5841-000	1
ANTENNA SHIELD	7005-8142-200	1
12 IN. COAXIAL CABLE	6041-5880-800	1
72 IN. COAXIAL CABLE	6041-5880-900	1
5 A FUSE	5106-0000-057	1
TRANSIT CASE	1412-5853-000	1
POWER CORD (US ONLY)	6041-0001-000	1
POWER CORD (EUROPEAN)	7001-9903-000	1
OPERATION MANUAL (CD-ROM)	1002-5800-2C0	1
OPERATION MANUAL (PAPER)	(OPTIONAL)	

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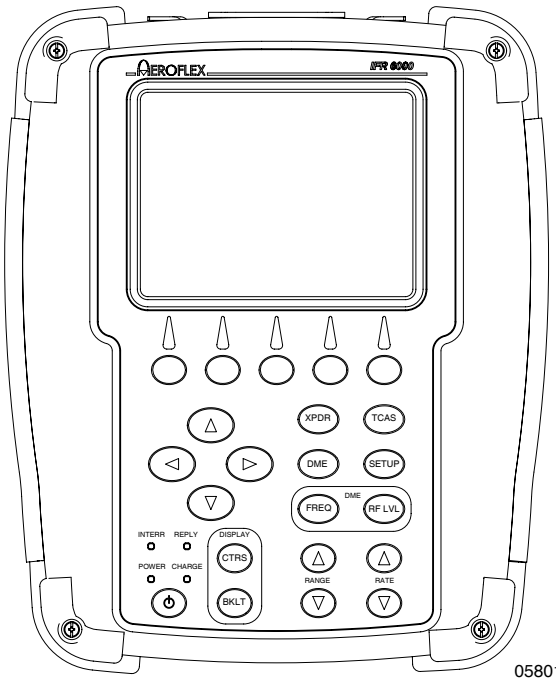
SECTION 1 - DESCRIPTION

1. GENERAL DESCRIPTION AND CAPABILITIES

1.1 DESCRIPTION



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The IFR 6000 is a precision simulator that enables one person to functionality test airborne transponder (XPDR) modes A/C/S, distance measuring equipment (DME) systems, TCAS I and II and ADS-B equipped transponders and 1090 MHz emitters.

The Test Set contains built-in signal generators and modulators for XPDR and selected DME frequencies. For ramp operation, the RF output is coupled to the airborne equipment by a lightweight directional antenna that may be mounted on the Test Set or tripod. For bench operation, coaxial cables are required between the Test Set and UUT.

1.2 FUNCTIONAL CAPABILITIES

The IFR 6000 has the following features and capabilities:

Functional Modes:

XPDR, DME, TCAS I and II, ADS-B MON, GICB and TIS.

Functional modes in future manual releases:

TIS-B and ADS-B GEN.

- XPDR Auto Test provides a full FAR Part 43 Appendix F test. All normal user verified parameters are displayed on one screen.
- Parametric tests include ERP, MTL, Pulse Widths and Spacings.
- Separate screens for display of primary Elementary and Enhanced Surveillance parameters.
- Predetermined user selectable XPDR config files allow different classes of ATCRBS and Mode S transponder to be tested.
- Altitude Encoder screen for monitoring encoding altimeter grey code.
- XPDR and DME Setup screens provide user defined operation parameters.
- Single DME test screen provides control over DME Frequency/Channel, Range, Rate, RF level, % reply, squitter, ident and echo. UUT frequency, ERP, PRF P1/P2 width and Spacing are also displayed.
- LCD Display with automatic light sensing illumination control
- Internal Battery allowing six hours operation before recharge.
- Automatic power shutdown after approximately 15 minutes of non-use when ac power is not connected.
- Compact size and lightweight for one person operation.

1.3 REGULATORY RESPONSIBILITIES

Effective April 6, 1987, the Federal Aviation Administration (FAA) has required certain tests be performed on transponders, both conventional ATCRBS and Mode S. In preparation for the installation of new air traffic control radar facilities, the FAA required new measurements to be performed on existing transponders and instituted required tests for Mode S transponders. FAR (Federal Aviation Regulations) Part 43, Maintenance, Preventive Maintenance, Rebuilding and Alteration section has been modified to reflect current technologies and improvements. Aeroflex has met all FAA requirements and recommends that the user of this type of equipment review the appropriate FAR, or contact the manufacturer of their particular model of transponder to ensure that proper procedures are followed.

Eurocontrol and the JAA have also incorporated new regulations for Mode S Elementary and Enhanced Surveillance. These requirements include Selective Identifiers for high-density traffic areas and became mandatory in May, 2003 for Elementary Surveillance and March, 2005 for Enhanced Surveillance.

The IFR 6000 has the capability to thoroughly test these new functions to comply with upcoming requirements. For further information regarding these requirements, visit www.eurocontrol.int/.

2. QUICK START

The Quick Start is for operators who are familiar with avionics systems/test equipment and want to use the IFR 6000 before reading the complete Operation Manual. Refer to para 1-2-4.1 for detailed operation instructions.

2.1 CONTROLS

Controls
Figure 1

⏻ Turns Test Set ON or OFF.

POWER: Indicator illuminates when Test Set is operational.

CHARGE: Indicator illuminates to show battery charge status;

Red	Charging
Yellow	Partially charged
Green	Fully charged

NOTE: Operates when External DC Power Supply is connected.

INTERR: Indicator illuminates when Test Set is interrogating (XPDR Mode) or receiving interrogations (DME Mode).

REPLY: Indicator illuminates when Test Set is receiving replies (XPDR Mode) or replying to interrogations (DME Mode).

CTRS: Adjusts display contrast.

BKLT: Adjusts display backlight.

RANGE ▲: Increases DME range and TCAS start range.

RANGE ▼: Decreases DME range and TCAS start range.

RATE ▲: Increases DME and TCAS rate.

RATE ▼: Decreases DME and TCAS rate.

FREQ: Frequency/channel selection for DME Mode only.

RF LVL: RF level setting for DME Mode only.

XPDR: Selects XPDR, ADS-B/GICB and ALT ENCODER screens.

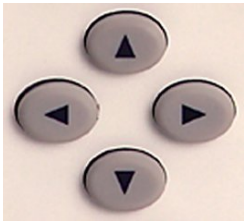
DME: Selects DME screen.

TCAS: Selects TCAS and TIS screens.

SETUP: Displays the setup screens associated with the selected functional mode.

SOFT KEYS: Five Application dependent keys provide test specific information and movement between test screens.

Soft Keys
Figure 2



DATA Keys
Figure 3

DATA KEYS

▲ DATA KEY: Selects or slews data.

▼ DATA KEY: Selects or slews data.

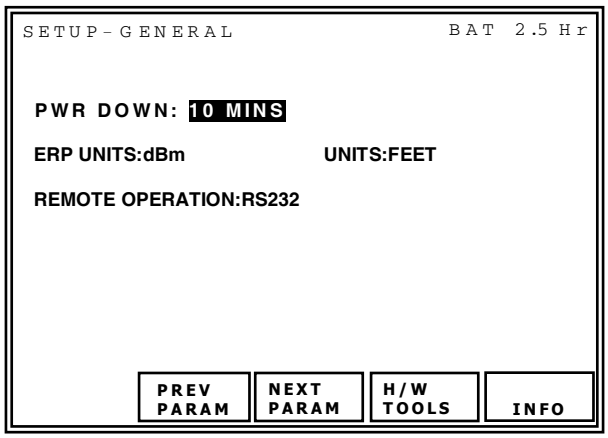
◀ DATA KEY: Moves the cursor to the left in a data field.

▶ DATA KEY: Moves the cursor to the right in a data field.

2.2 GENERAL SETUP

STEP	PROCEDURE

1. Power Up: Press the POWER Key to power the Test Set On.
2. Refer to 1-1-2, Figure 4. Press SETUP Control Key to display setup screens. Continue pressing SETUP Control Key to cycle to SETUP-GENERAL Screen. Use NEXT PARAM and PREV PARAM Soft Keys to select each parameter.



GENERAL SETUP Screen
Figure 4

3. Select PWR: Set to preferred power down timeout.
4. Select ERP UNITS: Set to preferred ERP units.
5. Select UNITS: Set to preferred units.

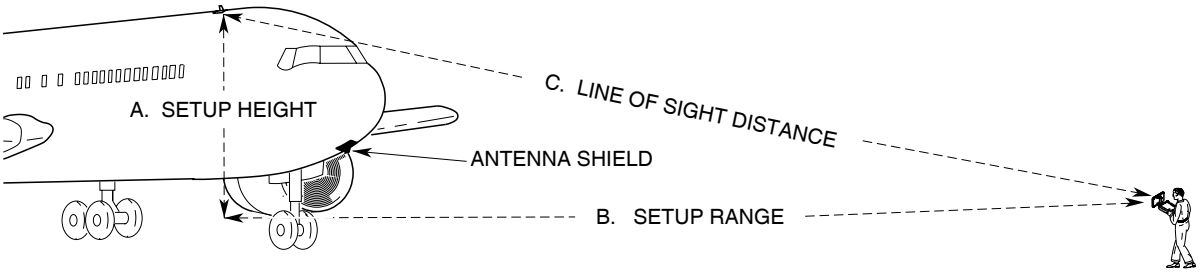
2.3 XPDR SETUP ANTENNA

STEP	PROCEDURE

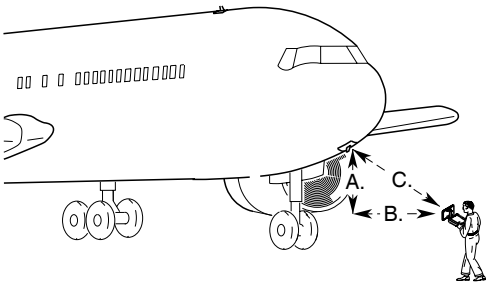
1. Refer to 1-1-2, Figure 5. Mount Directional Antenna on Test Set and position friction hinge so Directional Antenna is as shown. Connect short RF coaxial cable between Antenna Connector and Test Set ANT Connector.

Antenna Mounting
Figure 5

2. Position Test Set ≤50 ft (15.24 m) from and in line of sight with top/bottom antenna. Refer to 1-1-2, Figure 6.
3. Power On Aircraft and configure aircraft for weight off wheels.
4. Press POWER Key to power up the Test Set.



TESTING TOP ANTENNA



WHEN DESELECTING, TERMINATING OR SHIELDING TOP ANTENNA IS NOT POSSIBLE OR PRACTICAL, USE SETUP POSITION THAT HAS AIRCRAFT BLOCKING LINE OF SIGHT TO TOP ANTENNA.

TESTING BOTTOM ANTENNA

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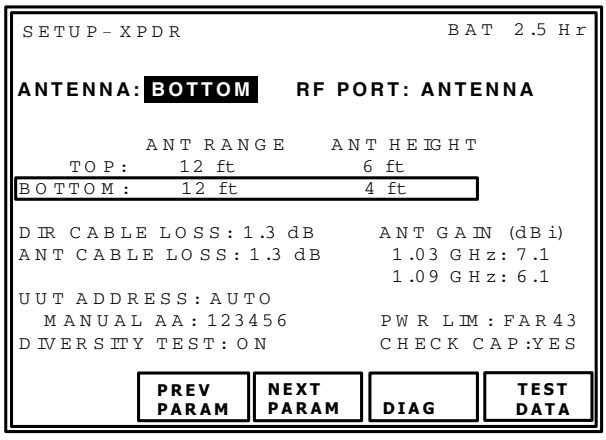
Ramp Testing
Figure 6

5. Refer to 1-1-2, Figure 7. Press SETUP Control Key to display setup screens. Continue pressing SETUP Control Key to cycle to SETUP-XPDR Screen. Use NEXT PARAM and PREV PARAM Soft Keys to select each parameter.



XPDR SETUP Screen
Figure 7

STEP	PROCEDURE

6. Select ANTENNA: Set to TOP or BOTTOM depending on which aircraft antenna Test Set is pointing towards.
7. Select RF PORT: Set to ANTENNA.
8. Select ANT RANGE: Set to setup range from IFR 6000 antenna to UUT Antenna (1-1-2, Figure 6).
9. Select ANT HEIGHT: Set to setup height from IFR 6000 antenna to UUT Antenna (1-1-2, Figure 6).
10. Select ANT CABLE LOSS: Set to cable loss found on cable.
11. Select ANT GAIN (dBi): set 1.03 GHz and 1.09 GHz antenna gain to figures marked on supplied Directional Antenna
12. Select UUT ADDRESS: Set to AUTO.

    NOTE: If aircraft is on the ground set to MANUAL and enter in MANUAL ADDRESS. Mode S all-calls do not work when the aircraft is on the ground.

13. Select DIVERSITY: Set to OFF.

    NOTE: To run diversity test set DIVERSITY to ON and install boot to bottom/top antenna.

14. Select CHECK CAP: Set to YES.
15. Select PWR LIM: Set to FAR 43.

2.4 XPDR SETUP DIRECT CONNECT

STEP	PROCEDURE

1. Connect long RF coaxial cable between the aircraft antenna feeder cable and Test Set RF I/O Connector.
2. Power On Aircraft and configure aircraft for weight off wheels.
3. Power Up: Press the POWER Key to power the Test Set.

   Refer to 1-1-2, Figure 7. Press SETUP Control Key to display setup screens. Continue pressing SETUP Control Key to cycle to SETUP-XPDR Screen. Use NEXT PARAM and PREV PARAM Soft Keys to select each parameter.

5. Select ANTENNA: Set to TOP or BOTTOM depending on which aircraft antenna Test Set is connected with.
6. Select RF PORT: Set to DIRECT CONNECT.
7. Select DIR CABLE LOSS: Set cable loss to cable loss found on cable.
8. Select UUT ADDRESS: Set to AUTO.

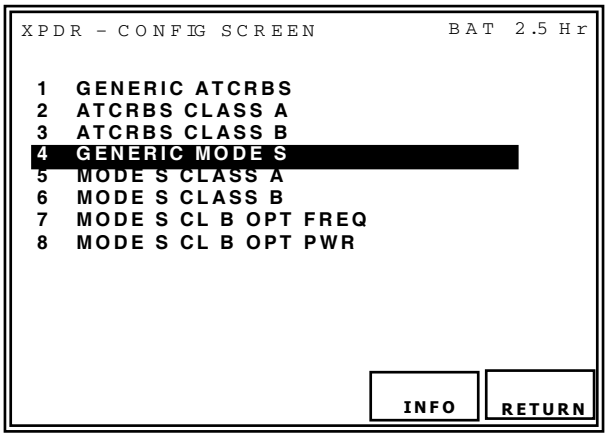
   NOTE: If aircraft is on the ground set to MANUAL and enter in MANUAL ADDRESS. Mode S all-calls do not work when the aircraft is on the ground.

9. Select DIVERSITY: Set to ON.
10. Select CHECK CAP: Set to YES.
11. Select PWR LIM: Set to FAR 43.

2.5 XPDR TESTING

STEP	PROCEDURE

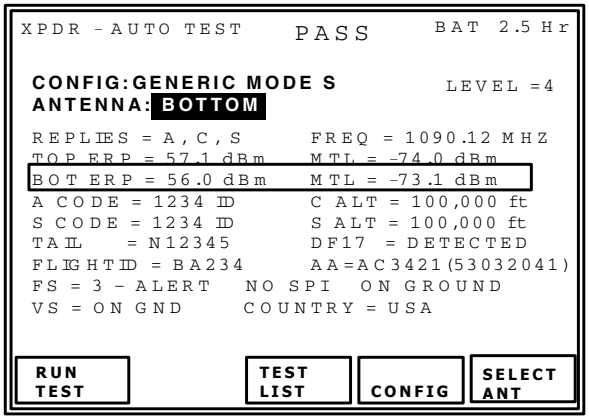
1, Press XPDR Mode Key to return to XPDR Auto Test Screen.



XPDR CONFIG Screen
Figure 6

2. Press CONFIG Soft Key to display XPDR CONFIG Screen (1-1-2, Figure 6). Use Data Keys to select configuration file. Press RETURN Soft Key to confirm selection.

   NOTE: If transponder class is not known, select GENERIC ATCRBS or GENERIC MODE S configuration file.



XPDR AUTO Test Screen
Figure 7

STEP	PROCEDURE

3. To run a complete FAR Part 43 Appendix F Test, press RUN TEST Soft Key to start Auto Test (1-1-2, Figure 7). When Auto Test completes, a PASS or FAIL indication is displayed at the top of the screen.

4. Most UUT parameters requiring user verification are displayed on the Auto Test Screen.

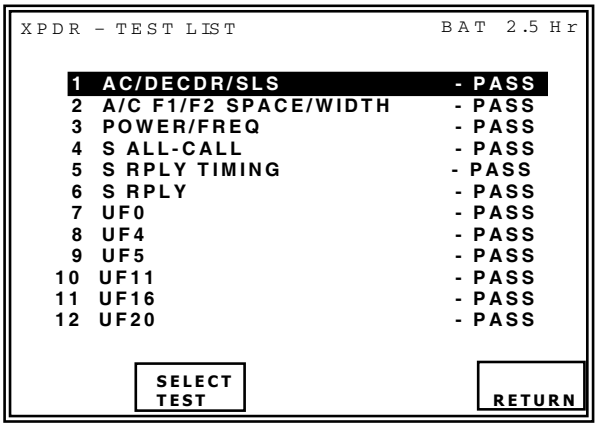
5. VS and FS discretes: To verify status, ensure UUT is in airborne state prior to running test. Run test and confirm that VS and FS fields indicate IN AIR. Place UUT in ground state, repeat test and confirm VS and FS fields indicate ON GROUND.

6. TAIL and COUNTRY: Displays the country decoded from the Mode S discrete address.

   NOTE: If the country selected has not adopted an encoding scheme, only the country is displayed.

7. FLIGHT ID: UUT must have a valid source of Flight ID (internal or external to the UUT) to display data.

8. Press TEST LIST Soft Key to display complete Auto Test List (1-1-2, Figure 8). Use Data Keys to select desired test. Press SELECT Soft Key to display selected test.



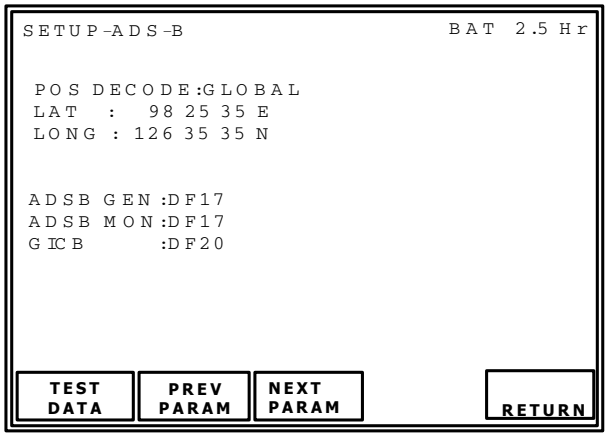
XPDR Test List Screen
Figure 8

9. Press RETURN Soft Key to display Auto Test Screen.

2.5.1 ADS-B/GICB TESTING

STEP	PROCEDURE

1. Perform XPDR SETUP ANTENNA procedure (1-1-2.2.3) or XPDR SETUP DIRECT CONNECT procedure (1-1-2-2.4).
2. Press SETUP Key until SETUP XPDR screen is displayed.
3. Press ADS-B SETUP Soft Key to display ADS-B/GICB Setup Screen (1-1-2, Figure 9). Use NEXT PARAM and PREV PARAM Soft Keys to select each parameter.



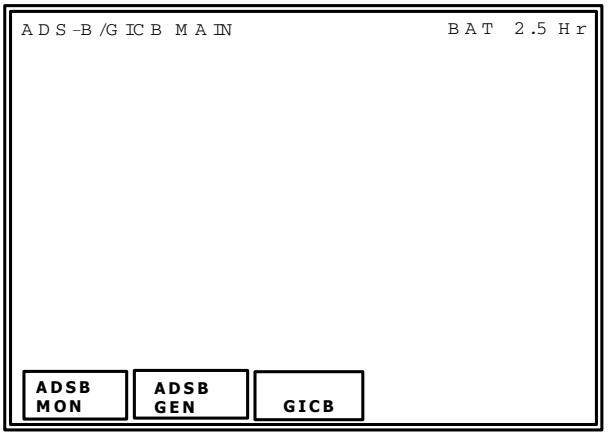
ADS-B/GICB SETUP Screen
Figure 9

4. Select POS DECODE: Set to GLOBAL to use global CPR algorithm for latitude and longitude decoding or simulation. Set to LOCAL to use local CPR algorithm for latitude and longitude decoding or simulation. POS DECODE is for BDS 0,5 and BDS 0,6.
5. Select LAT: Enter local latitude in degrees, minutes and seconds.
6. Select LONG: Enter local latitude in degrees, minutes and seconds.
7. Select ADS-B GEN: Set DF17 or DF18 extended squitters to be generated.
8. Select ADS-B MON: Set DF17 or DF18 extended squitters to be monitored.
9. Select GICB: Set DF20 or DF21 to be requested with GICB protocol.

2.5.1.1 ADS-B MON

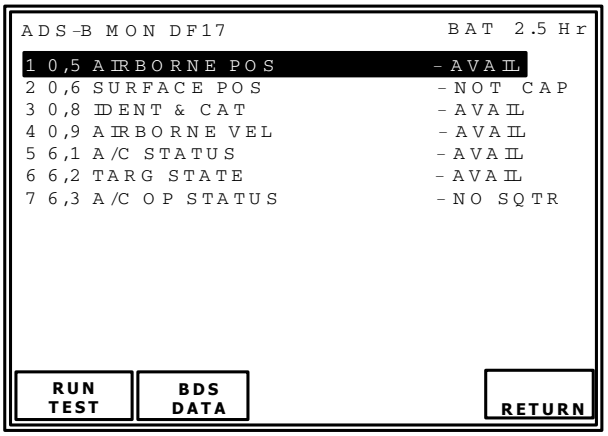
STEP	PROCEDURE

1. Press XPDR Mode Key until ADS-B/GICB MAIN menu is displayed (1-1-2, Figure 10).



ADS-B/GICB MAIN Menu
Figure 10

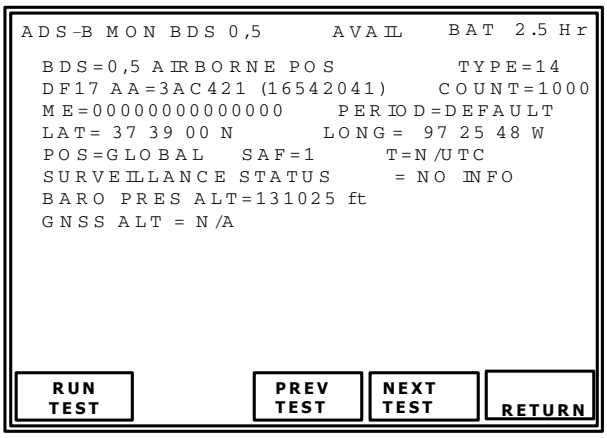
2. Press the ADS-B MON Soft Key to display the ADS-B MON list screen (1-1-2, Figure 11).



ADS-B MON List Screen
Figure 11

3. Press RUN TEST soft key to start test. When a specific extended squitter BDS is captured, AVAIL will be displayed to the right of the BDS name.

STEP	PROCEDURE
4.	Use Data Keys to select specific BDS and press BDS DATA soft key to display selected BDS screen. Refer to ADS-B MON BDS screen example (1-1-2 Figure 12).

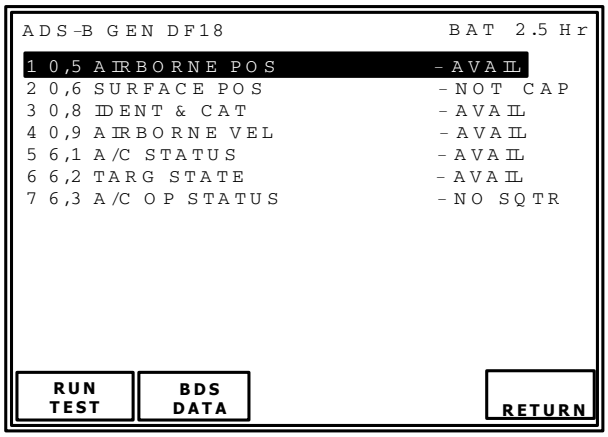


ADS-B MON BDS Screen Example
Figure 12

5.	Press Return soft key to return to ADS-B MON list screen or press PREV TEST or NEXT TEST soft keys to select specific ADS-B MON BDS screens.

2.5.1.2 ADS-B GEN

STEP	PROCEDURE
1.	Press XPDR Mode Key until ADS-B/GICB Main Menu is displayed (1-1-2, Figure 10).
2.	Pres ADSB GEN to display the ADSB GEN List Screen (1-1-2, Figure 13).



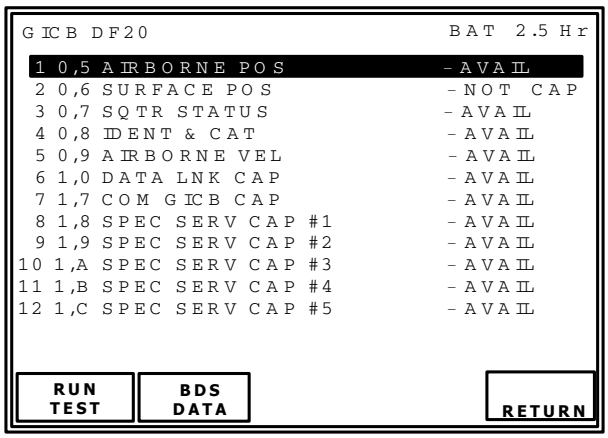
ADS-B GEN List Screen
Figure 13

3.	Press BDS ON Soft Key to enable selected test list items.
4.	Press RUN TEST Soft Key to start test.
5.	Press BDS DATA to enter selected test.

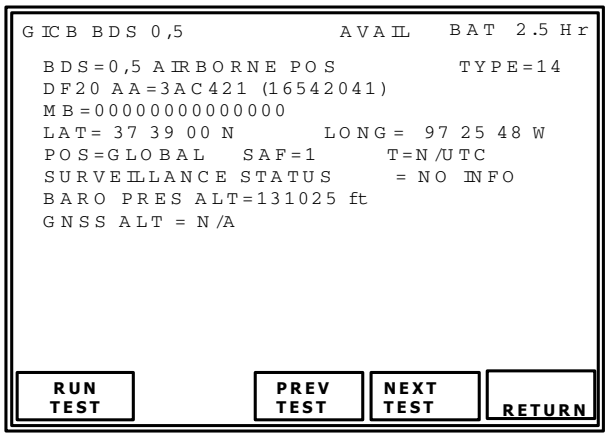
2.5.1.3 GICB

STEP	PROCEDURE

1. Press XPDR Mode Key until ADS-B/GICB Main Menu is displayed (1-1-2, Figure 10).
2. Press GICB Soft Key to display the GICB List Screen (1-1-2, Figure 14).
3. Press RUN TEST soft key to start test. When a BDS is available, AVAIL will be displayed to the right of the BDS name.



GICB List Screen
Figure 14

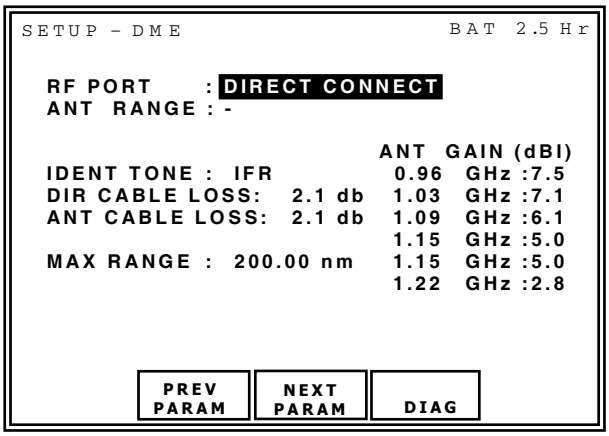


GICB BDS Screen Example
Figure 15

2.6 DME SETUP ANTENNA

STEP	PROCEDURE

1. Refer to 1-1-2, Figure 4. Mount Directional Antenna on Test Set and position friction hinge so Directional Antenna is as shown. Connect short RF coaxial cable between Antenna Connector and Test Set ANT Connector.
2. Position Test Set at ≤50 ft (15.24 m) from and in line of sight with DME antenna.
3. Power Up: Press the POWER Key to power the Test Set On.
4. Refer to 1-1-2, Figure 16. Press SETUP Control Key to display setup screens. Continue pressing SETUP Control Key to cycle to SETUP-DME Screen. Use NEXT PARAM and PREV PARAM Soft Keys to select each parameter.



SETUP DME Screen
Figure 16

5. Select RF PORT: Set to ANTENNA.
6. Select ANT RANGE: Set to line of sight distance from IFR 6000 antenna and UUT antenna (1-2-4, Figure 6).
7. Select ANT CABLE LOSS: Set to cable found on cable.
8. Select ANT GAIN: Set to gains found on supplied antenna.

2.7 DME SETUP DIRECT CONNECT

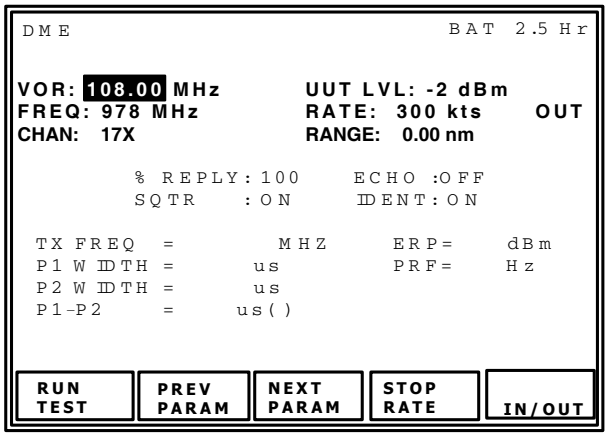
STEP	PROCEDURE

1. Connect long RF coaxial cable between the aircraft DME antenna feeder cable and Test Set RF I/O Connector.
2. Power Up: Press the POWER Key to power the Test Set On.
3. Refer to 1-1-2, Figure 16. Press SETUP Control Key to display setup screens. Continue pressing SETUP Control Key to cycle to SETUP-DME Screen. Use NEXT PARAM and PREV PARAM Soft Keys to select each parameter.
4. Select RF PORT: Set to DIRECT CONNECT.
5. Select DIR CABLE LOSS: Set to cable found on cable.

2.8 DME TESTING

STEP	PROCEDURE

1. Press DME Mode Select Key to display DME ModeTest Screen. All DME test data is displayed on this screen (1-1-2, Figure 17).



DME Test Screen
Figure 17

2. Select VOR/FREQ/CHAN: Set to frequency of DME unit.
3. Select UUT LVL: Set to desired level.
4. Select RATE: Set to 300 kts OUT.
5. Select RANGE: Set to 0.00 nm.
6. Select % REPLY: Set to 100.
7. Select ECHO: Set to OFF.
8. Select SQTR: Set to ON.
9. Select IDENT: Set to ON.
10. Press RUN TEST Soft Key to start test.

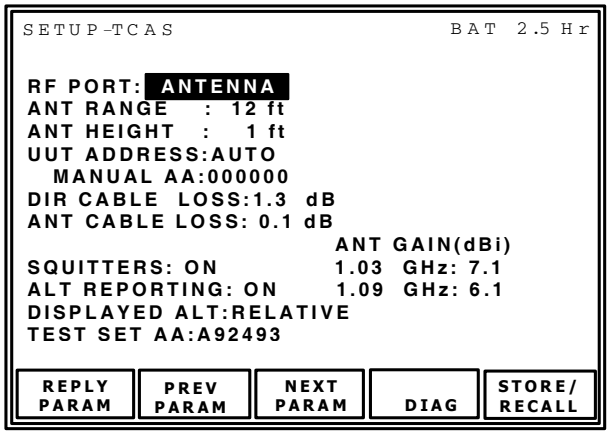
    NOTE: UUT parameters are modifiable while test is running.

11. Press STOP TEST Soft Key to stop test. Last UUT parameters are retained on display.

2.9 TCAS SETUP ANTENNA

STEP	PROCEDURE

1. Refer to 1-1-2, Figure 5. Mount Directional Antenna on Test Set and position friction hinge so Directional Antenna is as shown. Connect short RF coaxial cable between Antenna Connector and Test Set ANT Connector.
2. Position Test Set at Forward Sector Test Location, ≤50 ft (15.24 m) from and in line of sight with TCAS top antenna.
3. Power Up: Press the POWER Key to power the Test Set On.
4. Press SETUP Control Key to display setup screens. Continue pressing SETUP Control Key to cycle to SETUP-TCAS Screen. Use NEXT PARAM and PREV PARAM Soft Keys to select each parameter (1-1-2, Figure 18).



SETUP TCAS Screen
Figure 18

5. Select RF PORT: Set to ANTENNA.
6. Select ANT RANGE: Set to setup range from antenna (1-1-2, Figure 6).
7. Select ANT HEIGHT: Set to setup height from antenna (1-1-2, Figure 6).
8. Select UUT ADDRESS: Set to AUTO.

   NOTE: If aircraft is on the ground, set to MANUAL and enter in MANUAL ADDRESS. Mode S all-calls do not work when the aircraft is on the ground.

STEP	PROCEDURE

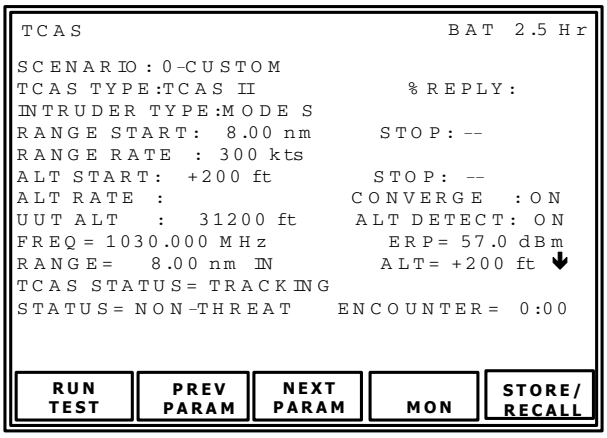
9. Select ANT CABLE LOSS: Set to cable loss found on cable.
10. Select ANT GAIN (dBi): Set 1.03 GHz and 1.09 GHz antenna gain to figures marked on supplied Directional Antenna.
11. Select SQUITTERS: Set to ON.
11. Select ALT REPORTING: Set to ON.
12. Select DISPLAYED ALT: Set to RELATIVE.
13. Select TEST SET AA: Set to A92493.

    NOTE: TEST SET AA needs to be different than the surrounding aircraft.

2.10 TCAS TESTING

STEP	PROCEDURE

1. Press TCAS Mode Select Key to display TCAS Test Screen (1-1-2, Figure 19).



TCAS Test Screen
Figure 19

2. Select SENARIO: Set to CUSTOM.
3. Select TCAS TYPE: Set to TCAS II.

   NOTE: If testing a TCAS I system set to TCAS I.

4. Select % REPLY: Set to 100.
5. Select INTRUDER TYPE: Set to ATCRBS or Mode S.
6. Select RANGE START: Set to 8 nm.
7. Select RANGE RATE: Set to 300 kts.
8. Select ALT START: Set to +200 ft.
9. Select CONVERGE: Set to ON.
10. Select ALT DETECT: Set to ON.
11. Press RUN TEST Soft Key to start test.
12. Verify TCAS STATUS displays AQUIRING and then TRACKING. When TRACKING is annunciated, an intruder should be displayed on the TCAS display.

STEP	PROCEDURE

13. Verify UUT visual and audio operation:

    NOTE: Verify Traffic Advisory at 40 sec until encounter time.

    - Verify Resolution Advisory at 25 sec until encounter time
    - Verify TCAS bearing reads 0° (±15°).

    NOTE: If Radio Altimeter Altitude is below 500 ft, RA's are inhibited.

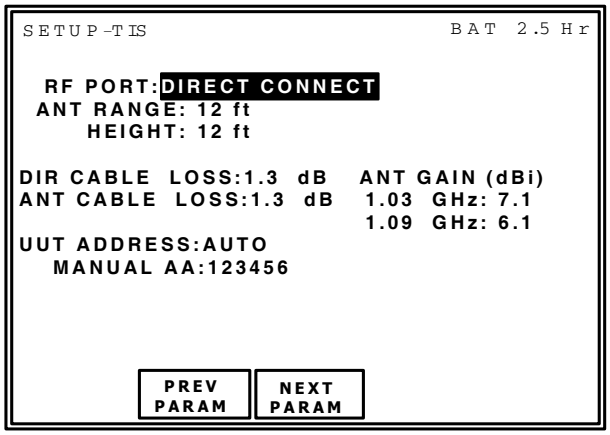
    NOTE: TCAS I systems do not issue RA's.

14. Press STOP TEST Soft Key to stop test

2.11 TIS SETUP ANTENNA

STEP	PROCEDURE

1. Refer to 1-1-2, Figure 5. Mount Directional Antenna on Test Set and position friction hinge so Directional Antenna is as shown. Connect short RF coaxial cable between Antenna Connector and Test Set ANT Connector.
2. Position Test Set ≤50 ft (15.24 m) from and in line of sight with top/bottom antenna. Refer to 1-1-2, Figure 6
3. Power On Aircraft and configure aircraft for weight off wheels.
4. Power Up: Press the POWER Key to power the Test Set On.



SETUP TIS Screen
Figure 20

5. Refer to 1-1-2 figure 20. Press SETUP Control Key to display setup screens. Press SETUP Control Key to display SETUP-TIS Screen. Use NEXT PARAM and PREV PARAM Soft Keys to select each parameter.
6. Select RF PORT: Set to ANTENNA.
7. Select ANT RANGE: Set to setup range from IFR 6000 antenna to UUT Antenna (1-1-2, Figure 6).
8. Select ANT HEIGHT: Set to setup height from IFR 6000 antenna to UUT Antenna (1-1-2, Figure 6).
9. Select ANT CABLE LOSS: Set to cable loss found on cable.

STEP	PROCEDURE

10. Select ANT GAIN (dBi): set 1.03 GHz and 1.09 GHz antenna gain to figures marked on supplied Directional Antenna.
11. Select UUT ADDRESS: Set to AUTO.

    NOTE: If aircraft is on the ground, set to MANUAL and enter MANUAL ADDRESS. Mode S all-calls do not work when the aircraft is on the ground.

2.12 TIS SETUP DIRECT CONNECT

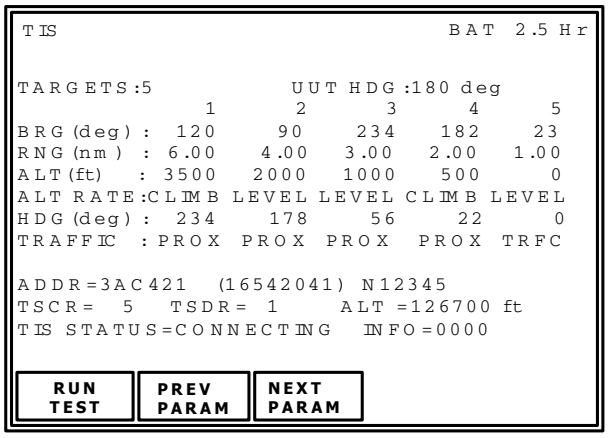
STEP	PROCEDURE

1. Connect long RF coaxial cable between aircraft antenna feeder cable and Test Set RF I/O Connector.
2. Power On Aircraft and configure aircraft for weight off wheels.
3. Power Up: Press POWER Key to power the Test Set.
4. Refer to 1-1-2, Figure 20. Press SETUP Control Key to display setup screens. Press SETUP Control Key until SETUP-TIS Screen is displayed. Use NEXT PARAM and PREV PARAM Soft Keys to select each parameter.
5. Select RF PORT: Set to DIRECT CONNECT.
6. Select DIR CABLE LOSS: Set cable loss to cable loss found on cable.
7. Select UUT ADDRESS: Set to AUTO.

2.13 TIS TESTING

STEP	PROCEDURE

1. Press TCAS Mode Key until TIS Test Screen is displayed (1-1-2, Figure 21).



TIS Test Screen
Figure 21

2. Use NEXT PARAM and PREV PARAM Soft Keys to select each of the following parameters:

   TARGETS: Sets the number of simulated targets 0 to 5.

   UUT HDG: Provides entry for UUT Heading in degrees. This orientates the target bearings with respect to UUT (aircraft) heading.

   BRG: Sets target bearing relative to UUT (aircraft) in degrees

   RNG: Sets targets range relative to UUT (aircraft) in nautical miles.

   ALT: Sets target altitude relative to UUT (aircraft) in feet.

   ALT RATE: Sets Altitude Rate annunciation on TIS display.

   HDG: Sets target Heading in degrees.

   TRAFFIC: Sets target traffic status on TIS display.

3. Press RUN Soft Key to start test.
4. TIS display shows the selected target parameters in accordance with the selections:

   TIS STATUS field indicates TIS connection status.

   ADDR indicates UUT Aircraft Address.

STEP	PROCEDURE
	ALT UUT field displays UUT aircraft altitude.
	TSCR field indicates number of TIS connects requested from UUT.
	TSDR field indicates number of TIS disconnects requested from UUT.

SECTION 2 - OPERATION

1. INSTALLATION

1.1 GENERAL

The IFR 6000 is powered by an internal Lithium Ion battery pack. The Test Set is supplied with an external DC Power Supply that enables the operator to recharge the battery when connected to AC power.

NOTE: The IFR 6000 can operate continuously on AC power via the DC Power Supply, for servicing and/or bench tests.

Refer to 1-2-2, Figure 2 for location of controls, connectors or indicators.

1.2 BATTERY OPERATION

The internal battery is equipped to power the IFR 6000 for six hours of continuous use, after which time, the IFR 6000 battery needs recharging. Battery Operation Time Remaining (in Hours) is displayed on all screens.

The IFR 6000 contains an automatic time-out to conserve power. If a key is not pressed within a 5 to 20 minute time period, the Test Set shuts Off (only when using battery power). The Power Down Time may be set in the Setup Screen.

1.3 BATTERY CHARGING

The battery charger operates whenever DC power (11 to 32 Vdc) is applied to the Test Set with the supplied DC Power Supply or a suitable DC power source. When charging, the battery reaches a 100% charge in approximately four hours. The internal battery charger allows the battery to charge between a temperature range of 5° to 40°C. The IFR 6000 can operate, connected to an external DC source, outside the battery charging temperature range (5° to 40°C).

The battery should be charged every three months (minimum) or disconnected for long term inactive storage periods of more than six months. The Battery must be removed when conditions surrounding the Test Set are <-20°C or >60°C.

1.4 SAFETY PRECAUTIONS

The following safety precautions must be observed during installation and operation. Aeroflex assumes no liability for failure to comply with any safety precaution outlined in this manual.

1.4.1 Complying with Instructions

Installation/operating personnel should not attempt to install or operate the IFR 6000 without reading and complying with instructions contained in this manual. All procedures contained in this manual must be performed in exact sequence and manner described.

1.4.2 Grounding Power Cord

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

For AC operation, the AC Line Cable, connected to the DC Power Supply, is equipped with standard three-prong plug and must be connected to a properly grounded three-prong receptacle that is easily accessible. It is the customer's responsibility to:

- Have a qualified electrician check receptacle(s) for proper grounding.
- Replace any standard two-prong receptacle(s) with properly grounded three-prong receptacle(s).

1.4.3 Operating Safety

Due to potential for electrical shock within the Test Set, the Case Assembly must be closed when the Test Set is connected to an external power source.

Battery replacement, fuse replacement and internal adjustments must only be performed by qualified service technicians.

1.5 AC POWER REQUIREMENTS

The DC Power Supply, supplied with the IFR 6000, operates over a voltage range of 100 to 250 VAC at 47 to 63 Hz.

The battery charger operates whenever DC power (11 to 32 Vdc) is applied to the Test Set with the supplied DC Power Supply or a suitable DC power source. When charging, the battery reaches an 100% charge in approximately four hours. The Battery Charging temperature range is 5° to 40°C, controlled by an internal battery charger.

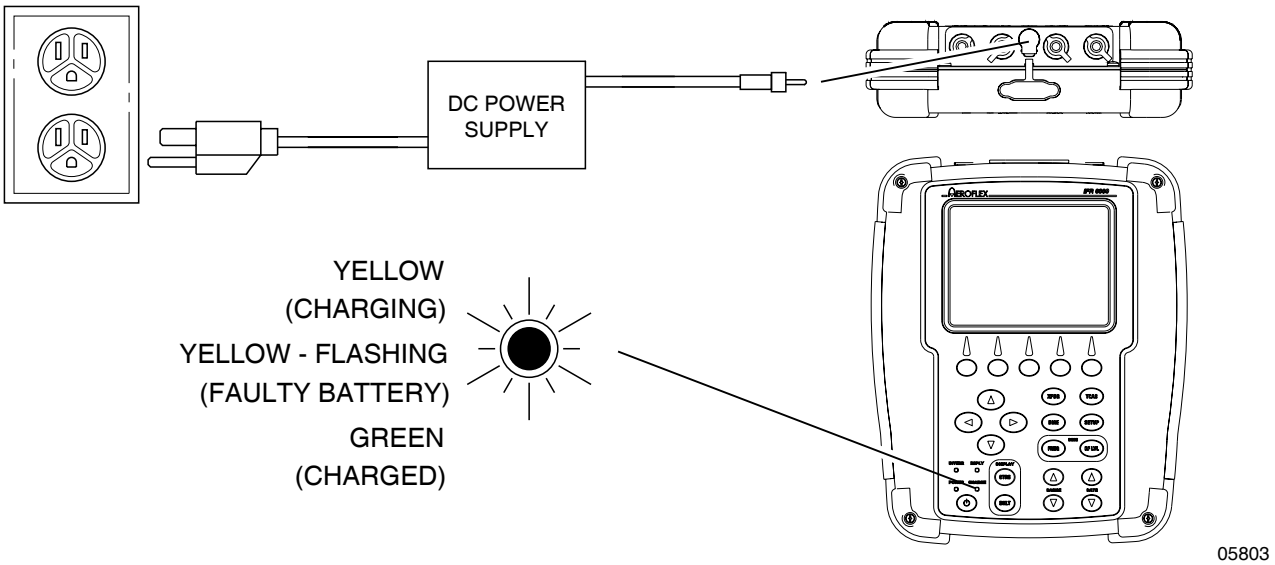
1.6 BATTERY RECHARGING

Refer to 1-2-1, Figure 1.

STEP	PROCEDURE

1. Connect AC Line Cable to either:
   - AC PWR Connector on the DC Power Supply and an appropriate AC power source
   - Suitable DC power source
2. Connect the DC Power Supply to the DC POWER Connector on the IFR 6000.
3. Verify the CHARGE Indicator illuminates yellow.
4. Allow four hours for battery charge or until the CHARGE Indicator illuminates green.

   NOTE: If the CHARGE Indicator flashes yellow and/or the battery fails to accept a charge and the IFR 6000 does not operate on battery power, the battery, serviceable only by a qualified technician, requires replacement. Refer to Battery/Voltage Instructions.



Battery Recharging
Figure 1

1.7 EXTERNAL CLEANING

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

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

STEP	PROCEDURE

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

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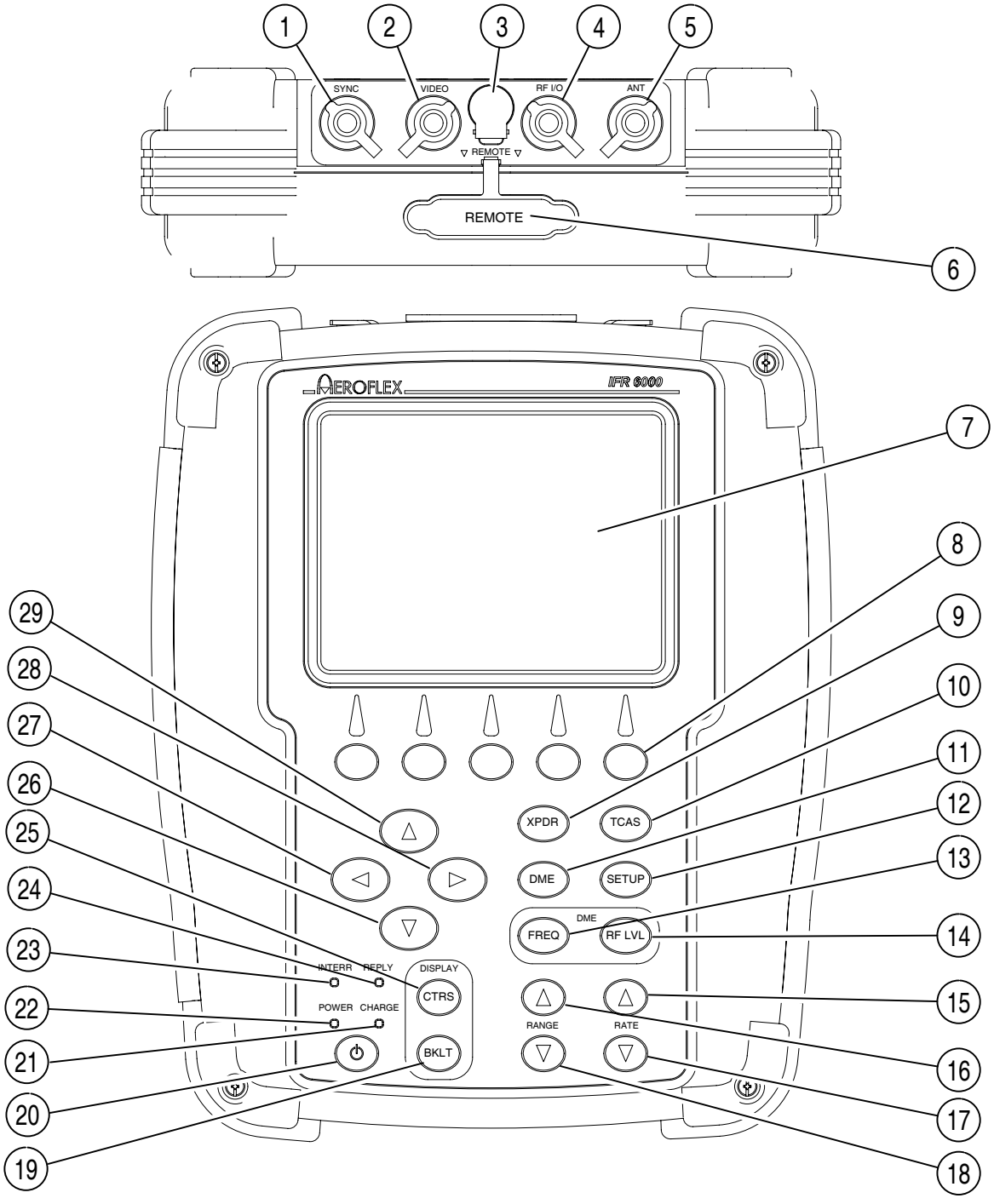
2. CONTROLS, CONNECTORS AND INDICATORS



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IFR 6000 Front Panel
Figure 2

NUMERICAL LOCATION LIST		ALPHABETICAL LOCATION LIST	
1.	SYNC Connector	ALTITUDE ENCODER Connector	37
2.	VIDEO Connector	ANT Connector	30
3.	DC POWER Connector	AUX IN Connector	38
4.	RF I/O Connector	AUX OUT Connector 1	31
5.	Test Set ANT Connector	AUX OUT Connector 2	32
6.	REMOTE Connector	AUX OUT Connector 3	33
7.	Display	AUX OUT Connector 4	34
8.	Multi-Function Soft Keys	BACKLIGHT Key	19
9.	XPDR Mode Select Key	CHARGE Indicator	21
10.	TCAS Mode Select Key	CONTRAST Key	25
11.	DME Mode Select Key	DC POWER Connector	3
12.	SETUP Select Key	DECREMENT/SELECT Data Key	26
13.	FREQ Select Key	RF LEVEL Key	14
14.	RF LVL Key	Display	7
15.	RATE INCREMENT Key	DME Mode Select Key	11
16.	RANGE INCREMENT Key	FREQ Select Key	13
17.	RATE DECREMENT Key	INCREMENT/SELECT Data Key	29
18.	RANGE DECREMENT Key	INTERR Indicator	23
19.	BACKLIGHT Key	Multi-Function Soft Keys	8
20.	POWER Key	POWER Indicator	22
21.	CHARGE Indicator	POWER Key	20
22.	POWER Indicator	RANGE DECREMENT Key	18
23.	INTERR Indicator	RANGE INCREMENT Key	16
24.	REPLY Indicator	RATE DECREMENT Key	17
25.	CONTRAST Key	RATE INCREMENT Key	15
26.	DECREMENT/SELECT Data Key	REMOTE Connector	6
27.	SELECT DATA UNIT MSB Key	REMOTE Connector	40
28.	SELECT DATA UNIT LSB Key	REPLY Indicator	24
29.	INCREMENT/SELECT Data Key	RF I/O Connector	4
30.	ANT Connector	RS-232 Connector	39
31.	AUX OUT Connector 1	SETUP Select Key	12
32.	AUX OUT Connector 2	SELECT DATA UNIT MSB Key	27
33.	AUX OUT Connector 3	SELECT DATA UNIT LSB Key	28
34.	AUX OUT Connector 4	SYNC Connector	1
35.	USB HOST Connector	TCAS Mode Select Key	10
36.	USB DEVICE Connector	Test Set ANT Connector	5
37.	Altitude Encoder Connector	USB DEVICE Connector	36
38.	AUX IN Connector	USB HOST Connector	35
39.	RS-232 Connector	VIDEO Connector	2
40.	REMOTE Connector	XPDR Mode Key	9

ITEM	DESCRIPTION

1. SYNC Connector

   BNC type connector provides oscilloscope SYNC pulse for each interrogation.

2. VIDEO Connector

   BNC type connector provides interrogation and reply pulses.

3. DC POWER Connector

   Circular Type Connector (2.5 mm center, 5.5 mm outer diameter, center positive) used for battery charging or operation of Test Set.

4. RF I/O Connector

   CAUTION: MAXIMUM INPUT TO THE RF I/O CONNECTOR MUST NOT EXCEED 5 KW PEAK OR 30 W AVERAGE.

   TNC Type connector used for direct connection to UUT antenna connector.

5. Test Set ANT Connector

   TNC Type Connector used for connection to the IFR 6000 directional antenna for over the air testing.

6. REMOTE Connector

   Type HD DB44 Connector used for remote operation and software upgrades. Contains RS-232, USB Host and USB Peripheral connections (altitude encoder inputs and SYNC outputs).

7. Display (LCD)

   38 characters by 16 lines for main screen display with Soft Key boxes at the bottom of the screen.

8. Multi-Function Soft Keys

   Legends for the five soft keys are displayed in boxes at the bottom of the Display (LCD) screen.

9. XPDR MODE Select Key

   Selects Transponder Auto Test Screen.

10. TCAS MODE Select Key

    Selects TCAS Auto Test Screen.

ITEM	DESCRIPTION

11. DME MODE Select Key

    Selects DME Test Screen.

12. SETUP Key

    Displays the SETUP Menu.

13. FREQ Select Key

    Selects DME Frequency as VOR Paired, TACAN Channel or MHz.

14. RF LVL Key

    DME mode function only. Selects DME range reply and squitter RF level.

15. RATE INCREMENT Key

    Increments DME or TCAS range rate.

16. RANGE INCREMENT Key

    Increments DME or TCAS range.

17. RATE DECREMENT Key

    Decrements DME or TCAS range rate.

18. RANGE DECREMENT Key

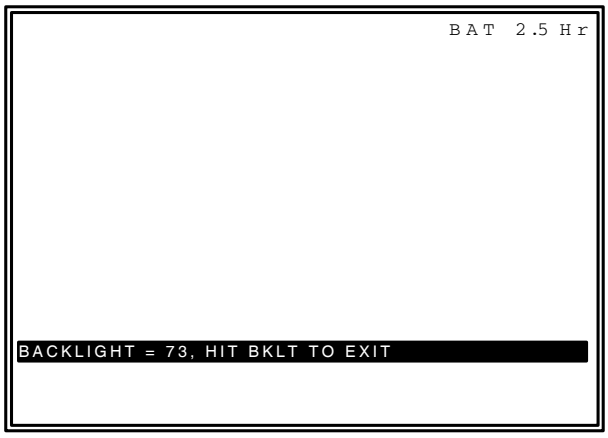
    Decrements DME or TCAS range.

19. BACKLIGHT Key

    Displays/exits the Backlight Adjust Field.

    INCREMENT/SELECT Data Key or DECREMENT/SELECT Data Key may be used to adjust the Backlight Intensity.

    The IFR 6000 powers up with the Backlight set to the setting of the previous session.



ITEM DESCRIPTION

20. POWER Key

    Powers the IFR 6000 ON and OFF.

21. CHARGE Indicator

    Illuminated when external DC power is applied for Bench Operation or Battery charging.

    CHARGE Indicator is yellow when the battery is charging, flashing yellow when the battery needs replacing and green when the battery is fully charged.

22. POWER Indicator

    Illuminated when the IFR 6000 is operational.

23. INTERR Indicator

    Illuminated when Test Set is generating an interrogation signal (XPDR Mode) or receives an Interrogation (TCAS Mode) signal.

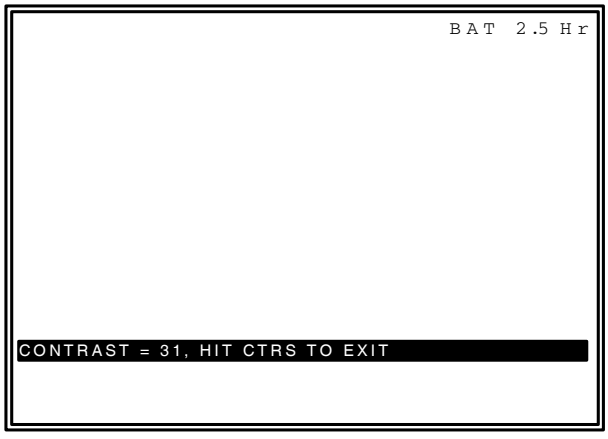
24. REPLY Indicator

    Illuminated when the Test Set receives a valid reply signal (XPDR Mode) or generates a reply (TCAS Mode) signal.

25. CONTRAST Key

    Displays/exits the Contrast Adjust Field.

    The INCREMENT/SELECT Data Key or the DECREMENT/SELECT Data Key may be used to adjust the Contrast.



ITEM DESCRIPTION

26. DECREMENT/SELECT Data Key

    Decrements data in slewable fields, such as RF LVL. This Key also selects data in fields that have fixed functions, such as ECHO and SQUITTER.

27. SELECT DATA UNIT MSB Key

    Moves the slew cursor toward the MSB (Most Significant Bit) of the data field.

    Example: When DME or TCAS range is selected, the slew cursor can be moved from the 1.0 nm unit to the 10 nm, 0.1 nm or 0.01 nm unit.

28. SELECT DATA UNIT LSB Key

    This Key moves the slew cursor toward the LSB (Least Significant Bit) of the data field.

    Example: When DME or TCAS range is selected, the slew cursor can be moved from the 1.0 nm unit to the 10 nm, 0.1 nm or 0.01 nm unit.

29. INCREMENT/SELECT Data Key

    Increments data in slewable fields, such as RF LVL. This Key also selects data in fields that have fixed functions, such as ECHO and SQUITTER.

30. ANT Connector

    TNC Type Connector used for connection to the IFR 6000 for over the air testing.

31. AUX OUT Connector 1

    ATCRBS interrogation trigger used for calibration.

32. AUX OUT Connector 2

    ATCRBS interrogation trigger used for calibration.

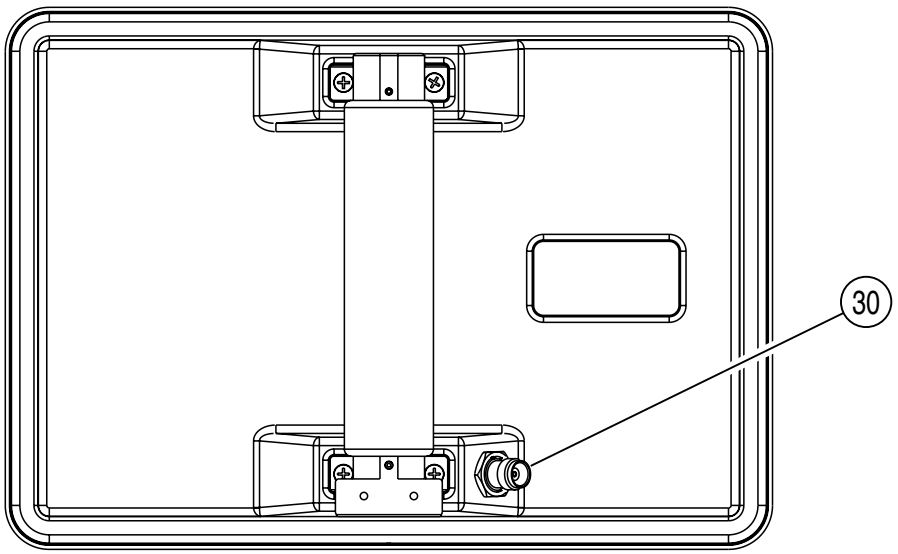
33. AUX OUT Connector 3

    Not Used

34. AUX OUT Connector 4

    Not Used

ITEM	DESCRIPTION
35.	USB HOST Connector USB Jump Drive interface for software update and test data dump (not active in first release).
36.	USB DEVICE Connector Remote Control Interface.
37.	ALTITUDE ENCODER Connector Interface for external encoding altimeter.
38.	AUX IN Connector Not Used
39.	RS-232 Connector Used for remote control interface, software update and test data dump.
40.	REMOTE Connector Used to interface with the IFR 6000.



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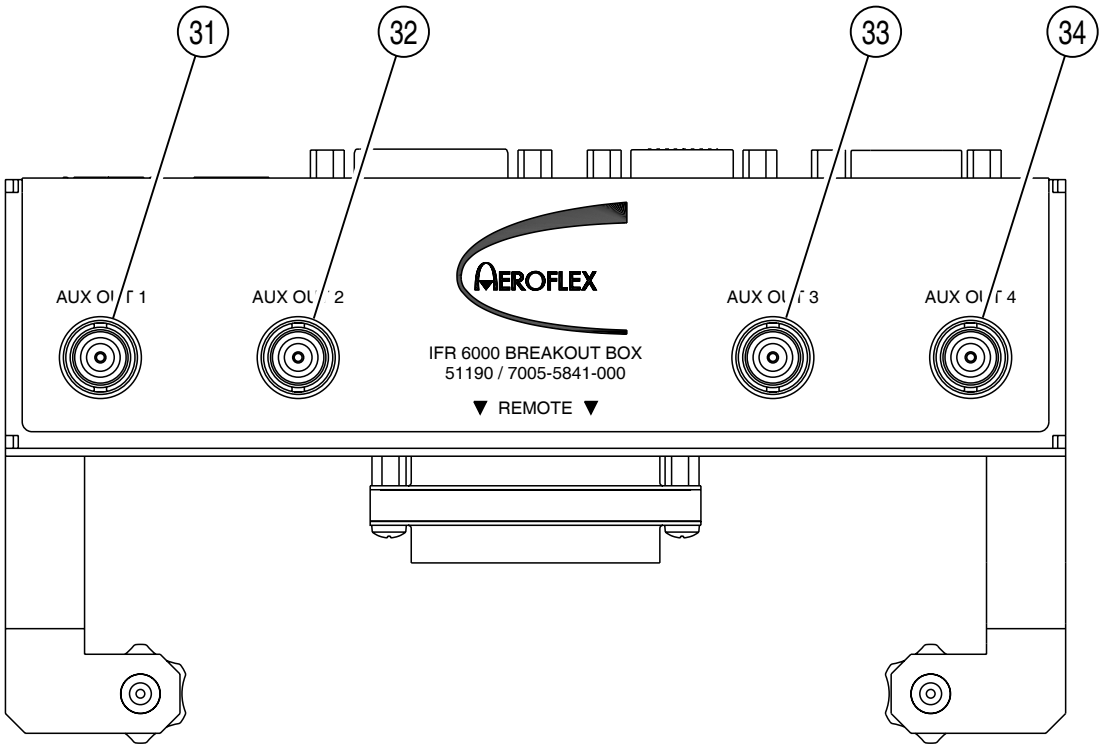
Directional Antenna
Figure 3



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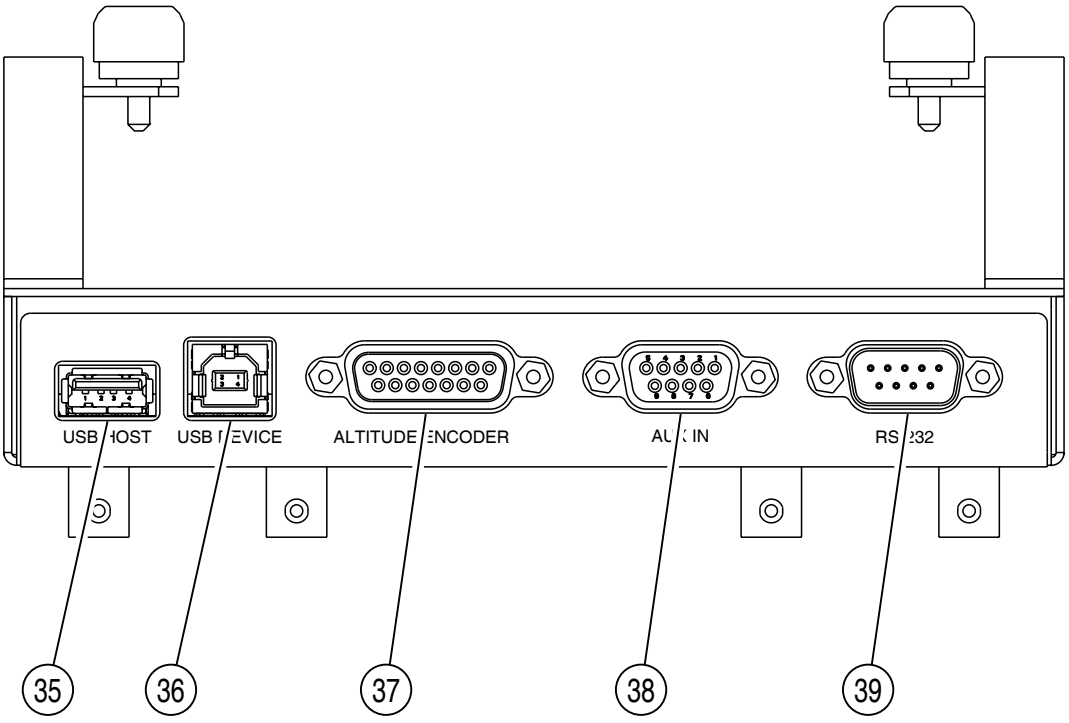
Breakout Box - Front View
Figure 4



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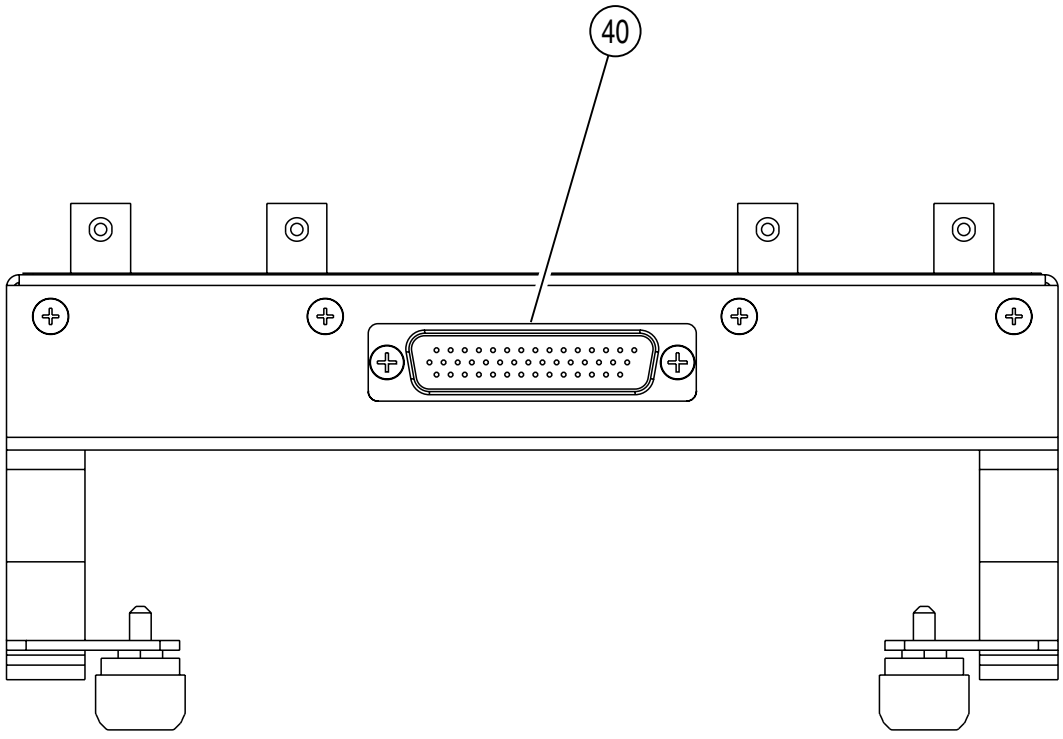
Breakout Box - Top View
Figure 5



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Breakout Box - Bottom View
Figure 6

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3. PERFORMANCE EVALUATION

3.1 GENERAL

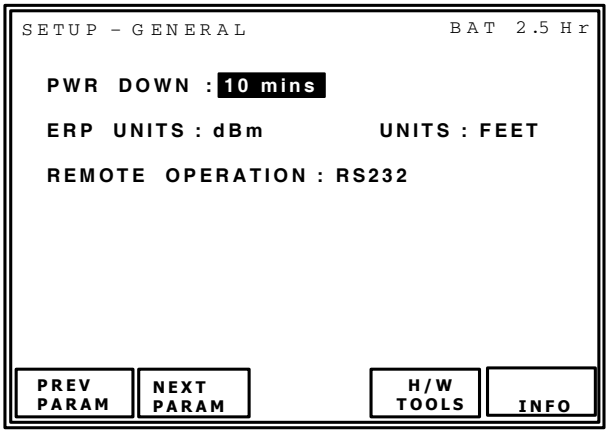
The IFR 6000 is equipped with a Self Test for quick performance evaluation. An abbreviated Self Test is run at Power-Up. The full Self Test is initiated manually.

Refer to 1-2-2, Figure 2 for location of controls, connectors and indicators.

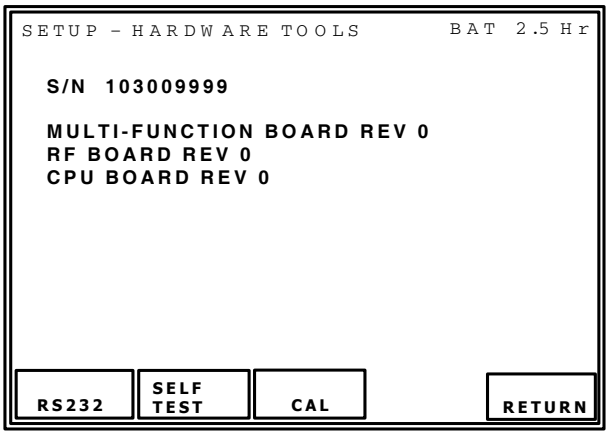
3.2 SELF TEST

STEP	PROCEDURE

1. Press SETUP Key to display the Setup Menu.

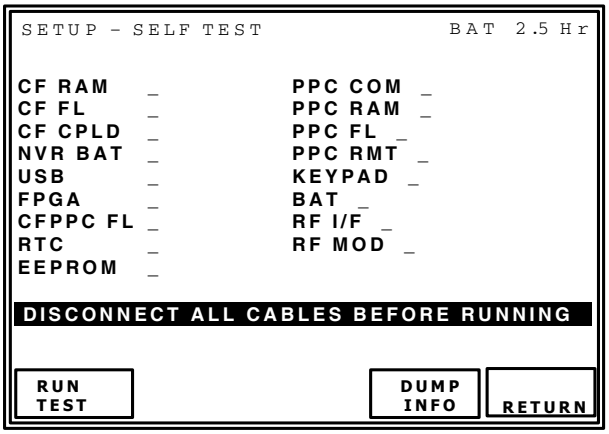


2. Press H/W TOOLS Soft Key to display the Hardware Tools Screen.



STEP	PROCEDURE

3. Press SELF TEST Soft Key to display the Self Test Screen.



4. Press RUN TEST Soft Key to initiate the Self Test.

5. Verify that all the modules/assemblies pass the Self Test. If the Self Test indicates a failure, contact Aeroflex for additional information:

AEROFLEX
10200 West York
Wichita, KS 67215 U.S.A.

Phone: (800) 835-2350
FAX: (316) 524-2623
EMAIL: service@aeroflex.com

AEROFLEX INTL LTD
Units 14/15 Monks Brook Industrial Park,
School Close
Chandlers Ford, Hampshire
England A053 4RA

Phone: 44-2380-273722
FAX: 44-2380-254015

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4. OPERATING PROCEDURES

4.1 GENERAL

This section contains operating instructions for the IFR 6000. The IFR 6000 tests ATCRBS/MODE S Transponders, DME, TCAS, ADS-B, TIS and TIS-B. The IFR 6000 replaces the IFR ATC-600A, ATC-601 and TCAS-201.

General procedures identify the controls, connectors, indicators and display screens used in individual test modes. For specific Unit Under Test (UUT) Procedures, refer to the UUT Manual.

Refer to 1-2-2, Figure 2 for location of controls, connectors and indicators.

The IFR 6000 Test Set provides ATCRBS/Mode S Transponder and DME Test capability as standard modes.

Software options available are:

- TCAS I, II, TIS (Traffic Information Service) and TIS-B (Traffic Information Service Broadcast).
- ADS-B (DO-260/A) and GICB extracted DAP's (Downlinked Aircraft Parameters).

The IFR 6000 uses four functional modes:

XPDR MODE

XPDR Mode provides flight line test capability for ATCRBS and Mode S transponders using an Auto Test, a series of tests displayed over several screens. All data normally required to verify transponder operation in accordance with FAR 91.413, Part 43, Appendix F, is displayed on one main Auto Test Screen.

Different classes of transponders are tested to built-in test limits by selection of configuration files. If the class of transponder is unknown, generic configuration files are provided for ATCRBS and Mode S transponders that apply the widest system limits.

Mode S Transponder level is automatically determined. European Enhanced Surveillance test capability allows decode and display of GICB derived BDS register contents (primary parameters only).

ADS-B provides flight line test capability for receiving, decoding and displaying full DO-260/A DF17 extended squitter transmissions from Mode S transponders or DF18 extended squitters from 1090 MHz emitters. Capability to generate full DO-260/A DF17/18 extended squitter transmissions for testing ADS-B receivers is provided. A GICB mode decodes and displays all Enhanced Surveillance BDS register contents.

NOTE: ADS-B operates as an XPDR submode.

DME MODE

DME Mode provides flight line test capability for Distance Measuring Equipment Interrogators. All parameters normally required for DME testing are displayed on one main screen. UUT interrogation parameters are clearly displayed in conjunction with Test Set reply parameters.

TCAS MODE

TCAS Mode provides flight line test capability for TCAS I and II. ATCRBS and Mode S intruders are simulated, allowing the generation of proximity, TA and RA flight deck annunciations. TCAS Interrogator parametric measurements are displayed.

TIS Provides a five aircraft static flight simulation, using the Comm A protocol, to test the TIS (Traffic Information Service).

TIS-B provides a five aircraft static flight simulation, using DF18 extended squitter broadcasts, for testing TIS-B (Traffic Information Service Broadcast) systems.

NOTE: TIS and TIS-B operate as TCAS sub modes.

NOTE: TIS-B is not provided in the second release of the TCAS option.

SETUP MODE

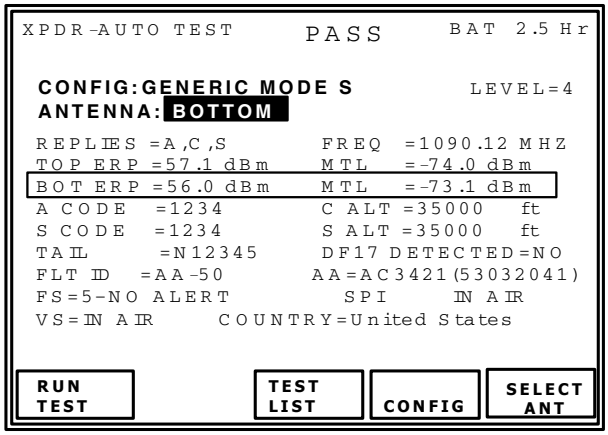
SETUP Mode function sets various parameters used in testing, configuration and memory storage for each functional mode.

4.2 START-UP

Press POWER Key. Start-Up Screen appears on the DISPLAY. XPDR-Auto Test Screen with blank data fields always displays on Power-up.

4.3 XPDR (TRANSPONDER)

Press XPDR Mode Key to select XPDR Functional Mode (1-2-4, Figure 7). XPDR Auto Test Screen is displayed

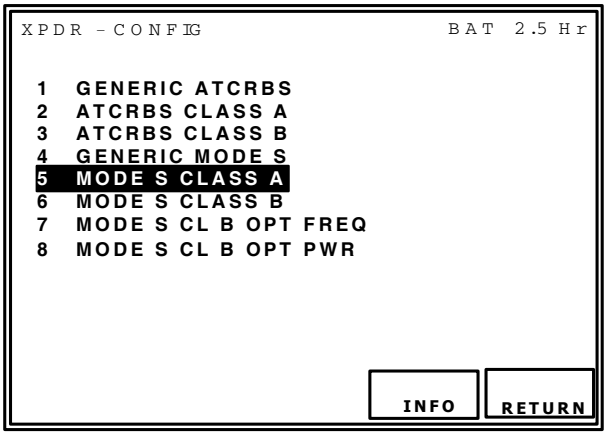


XPDR Auto Test Screen
Figure 7

There are two versions of the Auto Test Screen, one for ATCRBS transponders and one for Mode S transponders. The number of additional screens displayed by the Test List feature depends on the configuration selected.

4.3.1 CONFIGURATIONS

Press CONFIG Soft Key to display CONFIG List (1-2-4, Figure 8). Use DATA Keys to select the desired configuration. Press RETURN Soft Key to display XPDR Auto Test Screen.



XPDR Configuration Screen
Figure 8

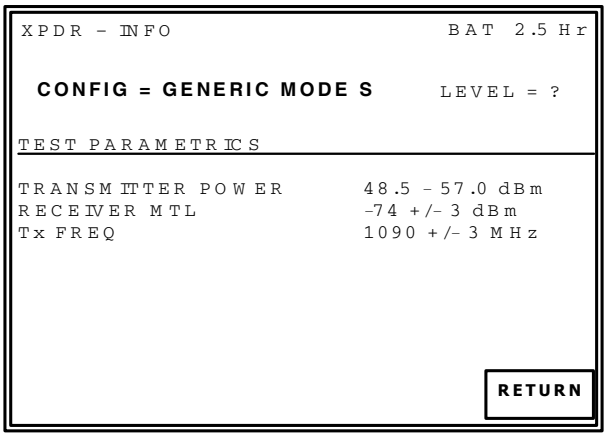
Eight predefined Configurations are provided to determine the PASS/FAIL limits applied to ERP, Frequency and MTL measurements. Configurations are named by class and option. Refer to Appendix F for predefined Configuration details

NOTE: Transponder class and option identification are found on the transponder's TSO label.

1. GENERIC ATCRBS: Tests ATCRBS transponders, specifically when the class of the transponder is unknown.
2. ATCRBS CLASS A: Tests ATCRBS Class A transponders.
3. ATCRBS CLASS B: Tests ATCRBS Class B transponders.
4. GENERIC MODE S: Tests Mode S transponders, specifically when the class of the transponder is unknown.
5. MODE S CLASS A: Tests Mode S Class A transponders.
6. MODE S CLASS B: Tests Mode S Class B transponders.
7. MODE S CL B OPT FREQ: Tests Mode S Class B transponders equipped with Class A frequency tolerance option.
8. MODE S CL B OPT PWR: Tests Mode S Class B transponders equipped with Class A power option.

NOTE: Level detection is automatic when running a test.

Press INFO Soft Key to display XPDR INFO Screen. XPDR INFO Screen displays the PASS/FAIL limits for selected Configuration (1-2-4, Figure 9).



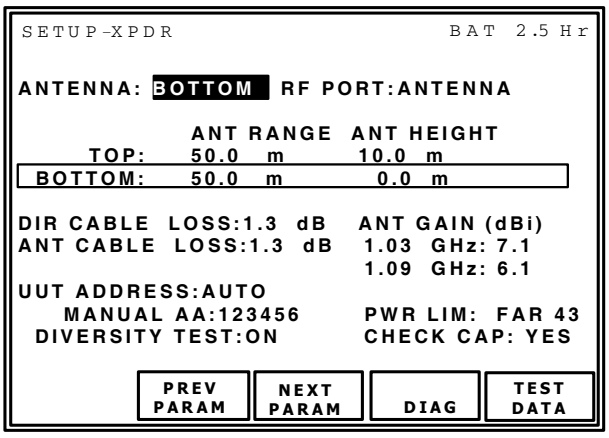
XPDR Configuration Info Screen
Figure 9

4.3.2 SETUP

SETUP XPDR

Setup XPDR Screen contains parameters which determine operational characteristics of the XPDR Functional Mode. Unless otherwise stated, last used values are retained on Power-up.

NOTE: Enter Setup Screen information before conducting test operations.



Setup XPDR Screen
Figure 10

STEP	PROCEDURE

1. Press SETUP Soft Key to display SETUP-XPDR Screen (1-2-4, Figure 10).
2. Set the parameters by pressing NEXT PARAM. Press PREV PARAM to select the field. Use DATA Keys to slew the data. Parameters are:

   - ANTENNA:

     TOP or BOTTOM

   - RF PORT:

     Selects ANTENNA (ANT CONNECTOR) or DIRECT CONNECT via RF I/O Connector.

   - DIRECT CABLE LOSS:

     Entered in dB, figure (at 1090 MHz) marked on supplied RF coaxial cable.

     NOTE: Cable loss range 0.0 to 9.9 dB.

   - ANT CABLE LOSS:

     Entered in dB, figure (at 1090 MHz) marked on supplied RF coaxial cable.

     NOTE: Cable loss range 0.0 to 9.9 dB.

   - ANT GAIN:

     Entered in dBi, gain figures for 1030 and 1090 MHz marked on supplied Directional Antenna.

     NOTE: Cable loss range 0.0 to 20.9 dB.

   - ANT RANGE:

     Test Set Antenna to transponder antenna horizontal range. Enter parameters for BOTTOM and TOP antenna if installation has diversity capability.

     NOTE: Antenna Range is 6 to 250 ft or 2.0 to 75.0 m. UNITS parameter on SETUP-GENERAL Screen determines feet or meters (1-2-4, Figure 11).

STEP PROCEDURE

- ANT HEIGHT:

  Test Set Antenna Range to transponder antenna height range. Enter parameters for BOTTOM and TOP antenna if installation has diversity capability.

NOTE: Antenna Range is 1 to 99 ft or .50 to 30.0 m. UNITS parameter on SETUP-GENERAL Screen determines feet or meters (1-2-4, Figure 11).

- PWR LIM:

  FAR 43 OR MOD43.
  FAR 43 uses limits in accordance with FAR 91.413, Part 43, Appendix F. MOD 43 removes upper ERP limits and lower MTL limits.

- CHECK CAP:

  YES or NO. If YES (default) is selected, BDS 1,7/1,8/1,9 is verified to confirm availability of:

  BDS 0,5
  BDS 0,6
  BDS 0,7
  BDS 0,8
  BDS 0,9
  BDS 1,D
  BDS 1,E
  BDS 1,F
  BDS 2,0
  BDS 2,1
  BDS 3,0
  BDS 4,0
  BDS 4,1
  BDS 4,2
  BDS 4,3
  BDS 5,0
  BDS 6,0
  BDS 6,1
  BDS 6,2
  BDS 6,3

  If BDS 1,7/1,8/1,9 reports a particular BDS is not available, the data is blanked alongside the respective BDS in the Enhanced Surveillance Screen, or GICB screens.

  If NO is selected, BDS 1,7/1,8/1,9 is not verified and the Test Set will extract the BDS and display content.

STEP PROCEDURE

NOTE: Some transponders reply to BDS requests even though BDS 1,7/1,8/1,9 reports they are not available.

- UUT ADDRESS:

  MANUAL or AUTO (defaults to AUTO on power-up). AUTO selection Mode S address is obtained via ATCRBS/Mode S All Call (FAR Part 43, Appendix F approved method).

  On loss of ATCRBS/Mode S All Call reply (i.e., UUT placed in ground state) tests already running continue to use last ATCRBS/ Mode S All Call obtained address. AUTO uses manually entered address if no reply is received.

  NOTE: ICAO amendment 77 transponders only replies to Mode S discrete interrogations when installation is in ground state.

- MANUAL ADDRESS:

  A six digit HEX address is entered if UUT ADDRESS: MANUAL is selected.

- DIVERSITY TEST:

  ON or OFF. If testing transponders with single antenna systems, select OFF.

  NOTE: If Diversity Isolation Test is enabled, ensure Antenna Shield is fitted to top or bottom UUT antenna prior to running test. Refer to Appendix J for Antenna Shield mounting procedure.

3. Press XPDR Mode Key to return to XPDR Auto Test Screen.

Software Update Procedure Via USB:

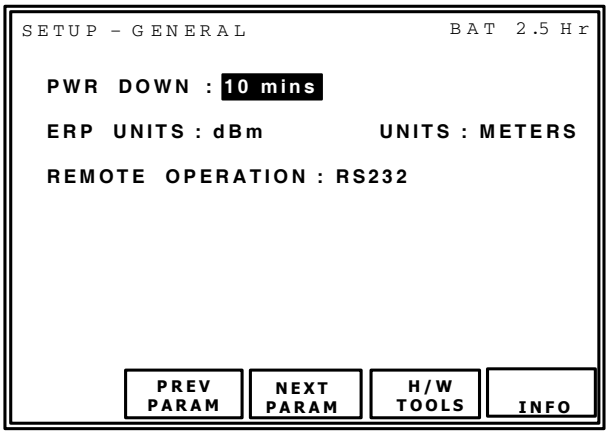
1. Software must be loaded onto a FAT 16 USB Flash Memory stick. Software updates may be downloaded from product data section on the www.aeroflex.com website.
   Note: only one version of software may reside on the root directory of the Flash Memory stick.

STEP	PROCEDURE

2. Connect IFR 6000 breakout box to IFR 6000. Insert Flash Memory stick in USB port and Press Power key to power unit. Software load process is automatic.
3. When software load is complete, remove Flash Memory stick.

SETUP GENERAL

The Setup General Screen contains parameters that determine the common operational characteristics of each functional mode of the Test Set.



Setup General Screen
Figure 11

STEP	PROCEDURE

1. Press SETUP Select Key until SETUP-GENERAL Screen is displayed (1-2-4, Figure 11).
2. Set following parameters by pressing NEXT PARAM and PREV PARAM to select the field. Use DATA Keys to slew data.
   - PWR DWN:

     Selects battery saving power down time in minutes, ranging from 5 to 20 min or OFF.
   - ERP UNITS:

     Selects ERP units in dBm, dBW or WATTS (peak).
   - UNITS:

     Selects Setup XPDR Screen distance units in feet or meters.

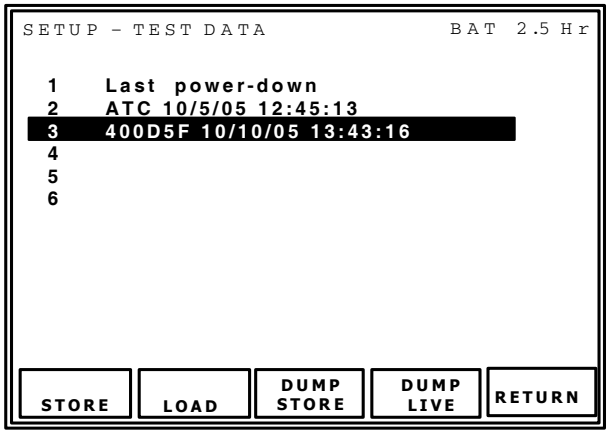
STEP	PROCEDURE

   - REMOTE OPERATION:

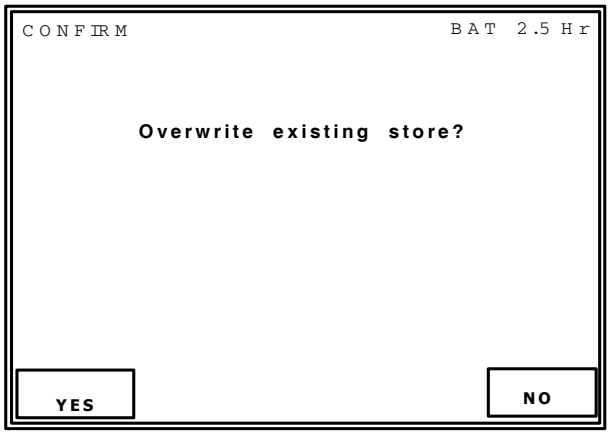
     Selects Remote Operation type of RS-232, USB or OFF.
3. Press XPDR Mode Key to return to XPDR Auto Test Screen.

SETUP TEST DATA

The Setup Test Data Screen allows storage and recall of all transponder test screens, including measurement data (1-2-4, Figure 12). There are six storage memories. The first storage memory retains the last power down data and cannot be overwritten. The last five may be defined by the Test Set operator. If the operator does not enter a name the Mode S Transponder Address, Date & Time are automatically entered on storage, i.e. 400D5F 10/10/05 13:43:16.



Setup Test Data Screen
Figure 12



Confirm Screen
Figure13

Setup Store Name Screen
Figure 14

Data Storage Procedure:

STEP	PROCEDURE

1. Press SETUP Select Key to display SETUP - XPDR Screen (1-2-4, Figure 10). Press TEST DATA Soft Key to display SETUP TEST DATA Screen (1-2-4, Figure 12).
2. Use DATA Keys to select the required store.
3. Press STORE Soft Key. A confirm Screen is displayed (1-2-4, Figure 13). Press YES Soft Key to confirm overwrite. SETUP STORE NAME Screen is displayed (1-2-4, Figure 14) Software always prompts for overwrite. Store name can be blank.
4. Use DATA Keys to select the character line (1-2-4, Figure 14). Use DATA Keys to select desired character.
5. Press CHAR SELECT Soft Key to add selected character to the end of name string. Press BACK SPACE Soft Key to delete the selected character.
6. When name is complete, press ENTER Soft Key to store name and display SETUP TEST DATA Screen.
7. Press XPDR Mode Key to return to XPDR-Auto Test Screen.

Data Recall Procedure:

STEP	PROCEDURE

1. Press SETUP Select Key until SETUP - XPDR Screen is displayed (1-2-4, Figure 10). Press TEST DATA Soft Key to display SETUP TEST DATA Screen (1-2-4, Figure 12).
2. Use DATA Keys to select required store.
3. Press RECALL Soft Key to recall test data.
4. Press XPDR Mode Key to return to XPDR Auto Test Screen.

RS232 Data Dump Procedure:

1. Press SETUP Select Key until SETUP - XPDR Screen is displayed (1-2-4, Figure 10). Press TEST DATA Soft Key to display SETUP TEST DATA Screen (1-2-4, Figure 12).
2. Use DATA Keys (Increment/Select, Decrement/Select), to select and slew data.
3. Ensure that RS-232 interface parameters are set correctly for communication with printer or PC (1-2-4, Figure 11).
4. Press DUMP STORE Soft Key to send selected stored test data to the printer or PC via the RS-232 interface.
5. Press DUMP LIVE Soft Key to send current or live test data to the printer or PC via the RS-232 interface.
6. Press XPDR Mode Key to return to XPDR Auto Test Screen.

4.3.3 AUTO TEST

Introduction:

XPDR Auto Test contains one main screen (the Auto Test Screen) and up to 17 additional test screens. Auto Test completes a full FAR Part 43, Appendix F Test, providing decode and display of Elementary and Enhanced surveillance GICB extracted DAP's (Downlinked Aircraft Parameters).

When first powered-up the Test Set displays blank data fields. The last test results are displayed while Test Set remains powered on. The last test results are stored upon power- down.

Auto Test only displays items needed to visually confirm a FAR Part 43 Test. For detailed test explanations, refer to TEST DETAILS for individual test list screens.

General Description:

Mode Test

Mode Test Identifies modes of operation. Mode Test interrogates with Mode A, Mode C and ATCRBS (Mode C)/Mode S All-Call to determine reply modes of the transponder. Mode A, Mode C and ATCRBS (Mode C)/Mode S All-Call modes are tested during Auto Test sequence.

NOTE: Internal to software. No screen is displayed.

Transponder Level

Transponder Level is automatically determined by requesting a BDS 1,0 Data Link Capability Report. Transponder level is displayed on Auto Test Screen.

Mode S UF Tests Run, based on XPDR Level:

Level 1: UF0,4,5,11,16,20,21

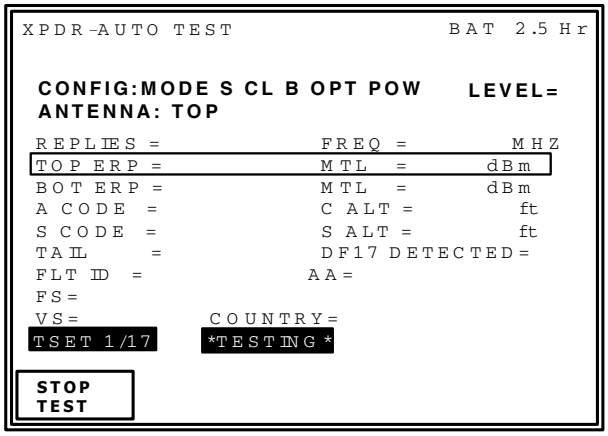
Level 2: UF0,4,5,11,16,20,21

Level 3: UF0,4,5,11,16,20,21,(24 UELM)

Level 4: UF0,4,5,11,16,20,21,(24 UELM)

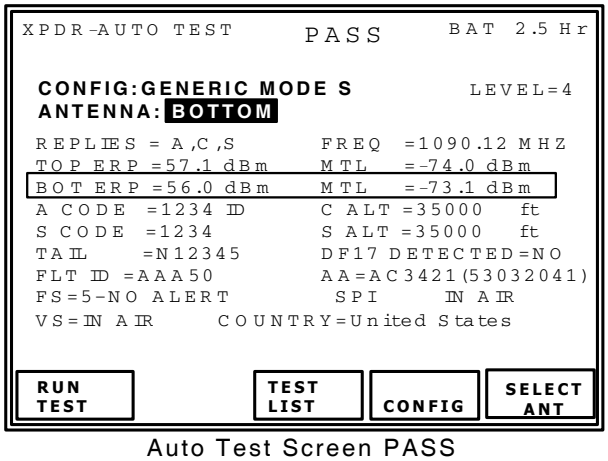
STEP	PROCEDURE

1. Follow CONFIG selection procedure (1-2-4.3.1).
2. Press SELECT ANTENNA Soft Key to select TOP or BOTTOM antenna to be tested. Antenna selected in XPDR Setup Screen is displayed by default.



Auto Test Screen Test Running
Figure 15

3. Press RUN TEST Soft Key to start Auto Test (1-2-4, Figure 15). TEST RUNNING is displayed at top of screen.



Auto Test Screen PASS
Figure 16

STEP	PROCEDURE

4. Auto Test completes and displays Parameters tested (1-2-4, Figure 16). Warnings/Errors are identified by an arrow symbol to left of the item.

The Parameters displayed are:

Regulatory Test Requirements

TESTS IDENTIFIER SYMBOLS	
♦	FAA FAR 91.413, Part 43, Appendix F
•	Other Civil Aviation Authority Requirement
♣	Eurocontrol/JAA (Proposed

Test Identifier Symbols
Table 1

Auto Test Details:

♦REPLIES: Transponder Modes replied to A,C,S

♦FREQ: Transponder TX frequency in MHz

♦TOP ERP: Top transponder antenna Effective Radiated Power in dBm, dBW or peak

NOTE: Units selected in SETUP-GENERAL Screen.

♦TOP MTL: Top transponder antenna Minimum Trigger Level

♦BOT ERP: Bottom transponder antenna Effective Radiated Power in dBm, dBW or peak.

NOTE: Units selected in SETUP-GENERAL Screen.

♦BOTTOM MTL: Bottom transponder antenna Minimum Trigger Level

♦A CODE: Mode A 4096 squawk code. Presence of Ident (SPI) pulse indicated by display of 'ID' after the squawk code.

♦S CODE: Mode S 4096 Identity Code. Presence of Ident (SPI) pulse indicated by display of 'ID' after the squawk code (obtained from DF5)

NOTE: The Mode A code is compared with Mode S code. Modes A and S codes Pass when in agreement.

♦C ALT: Mode C altitude displayed (100 ft resolution)

♦S ALT: Mode S altitude displayed (25 or 100 feet resolution, obtained from DF4)

NOTE: Mode C altitude is compared to Mode S altitude. Modes C and S altitudes Pass when in agreement of 100 ft.

♦TAIL: Aircraft tail number decoded from Mode S discrete address (obtained from Mode S All Call DF11)

NOTE: Some countries have encoded the aircraft tail number into the Mode S discrete address. Refer to Appendix G for list of countries supported. If not supported only the country is displayed.

COUNTRY: Decoded from the Mode S discrete address (obtained from Mode S All Call DF11).

DF17 DETECTED: Indicates the presence of DF17 extended squitter.

NOTE: ADS-B option is required to decode and display DF17 squitter content.

♣FLT ID: Eight Character ICAO Flight ID

♦AA: Aircraft Address (Mode S discrete address) displayed in HEX and (OCTAL)

♣FS: Flight Status. The number preceding the text identifies the RTCA DO-181C FS code assignment. Indications are:

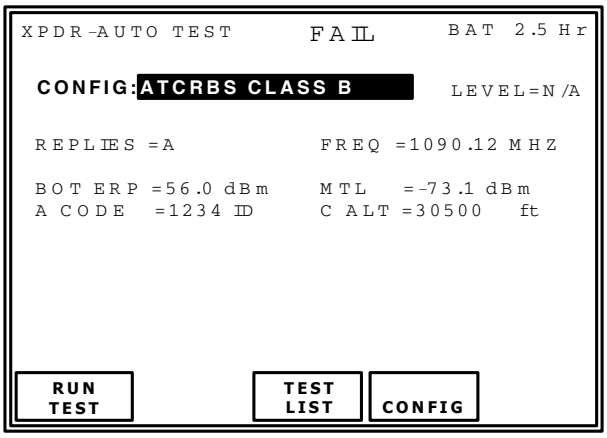
ALERT, NO ALERT, SPI, NO SPI, AIRBORNE, ON GROUND (obtained from DF0).

♣VS: Vertical Status either ON GND or IN AIR (obtained from DF0)

Testing FS (Flight Status) and VS (Vertical Status):

ICAO Amendment 77 transponders only reply to Mode S discrete interrogations when installation is in ground state. Refer to Setup for UUT ADDRESS settings (para 1-2-4.3.2).

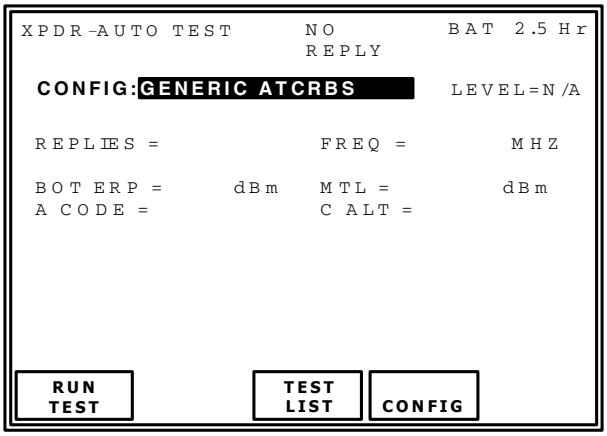
Auto Test Screen examples



Auto Test Screen FAIL
Figure 17

Refer to 1-2-4, Figure 17. ATCRBS CLASS B configuration selected with FAIL indication.

NOTE: Only ATCRBS parameters displayed.



Auto Test Screen NO REPLY
Figure 18

Refer to 1-2-4, Figure 18. GENERIC ATCRBS configuration selected with NO REPLY indication (No Reply From Transponder).

4.3.4 TEST LIST

Introduction:

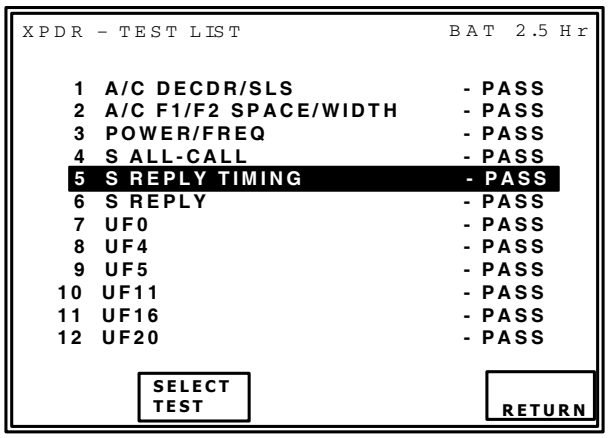
Auto Test Screen is the primary test screen. The complete Auto Test contains up to 17 additional test screens.

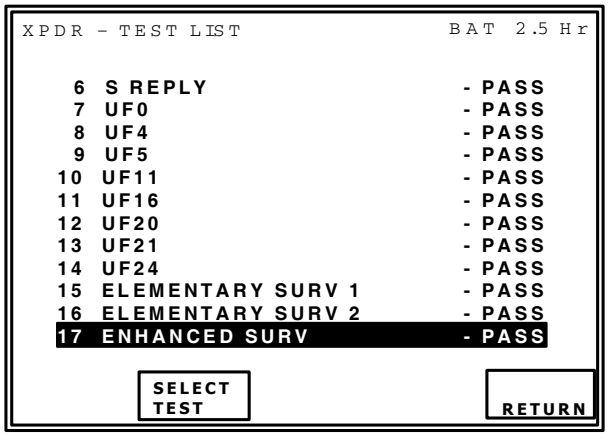
The Test Set displays blank data fields when first powered-up. While the Test Set remains powered the last test results are displayed.

STEP	PROCEDURE

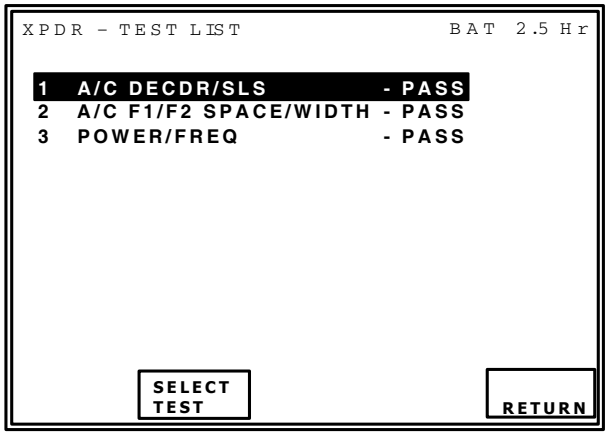
1. Press TEST LIST Soft Key to display Test List. When a Mode S configuration is selected the test list is displayed over two screens (1-2-4, Figure 19). When an ATCRBS configuration is selected the test list is displayed on one screen (1-2-4, Figure 20).
2. Use DATA Keys to select desired test. Press SELECT TEST Soft Key to display selected test.
3. Press RETURN Soft Key to display XPDR Auto Test Screen.
4. Press RUN TEST Soft Key to start test.
5. Press STOP TEST Soft Key to stop test.
6. Press NEXT TEST Soft Key to display the next test.
7. Press PREV TEST Soft Key to display the previous test.
8. Press RETURN Soft Key to display the test list and choose desired test.

   NOTE: The test runs until stopped. Each pass through the test sequence updates the PASS/FAIL indication.

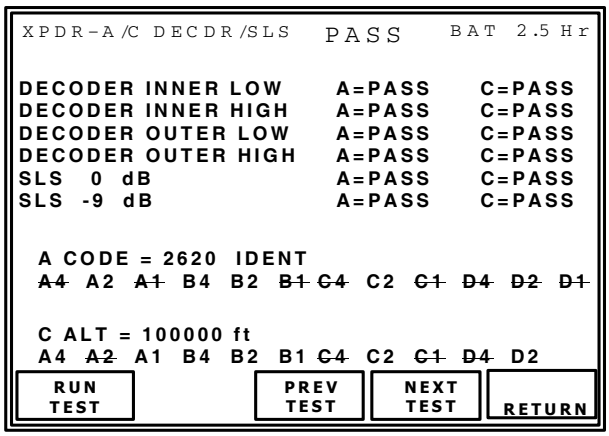




XPDR Test List Mode S
Figure 19



XPDR Test List ATCRBS
Figure 20



XPDR A/C Decoder/SLS Test Screen
Figure 21

XPDR A/C Decoder/SLS Test

XPDR A/C Decoder/SLS Test (1-2-4, Figure 21) performs these functions:

♦Verifies inner and outer windows for Mode A and C interrogations

♦Verifies the SLS performance for Mode A and C interrogations

♦Displays Mode A Squawk Code, Ident (SPI) and code binary bits.

♦Decodes and displays the Mode C altitude in feet and code binary bits.

NOTE: Binary bits verify if specific control lines are correct.

Decoder

The Test Set interrogates with valid Mode A and C interrogations, +6 dB above MTL.

Nominal spacing, P_1 to P_3, 8 μs for Mode A and 21 μs for Mode C. The test deviates the pulse spacings as follows:

Sets P_1 to P_3 pulse spacing to inner high "must reply" values (8.2 μs for Mode A and 21.2 μs for Mode C). The test indicates PASS if percent replies are ≥90% or FAIL if percent replies are <90%. An arrow identifies FAIL.

Sets P_1 to P_3 pulse spacing to inner low "must reply" values (7.8 μs for Mode A and 20.8 μs for Mode C). The test indicates PASS if percent replies are ≥90% or FAIL if percent replies are <90%. An arrow identifies FAIL.

Sets P_1 to P_3 pulse spacing to outer high "must not reply" values (9.0 μs for Mode A and 22 μs for Mode C). The test indicates PASS if percent replies are <10% or FAIL if percent replies are ≥10%. An arrow identifies FAIL.

Sets P_1 to P_3 pulse spacing to outer low "must not reply" values (7.0 μs for Mode A and 20 μs for Mode C). The test indicates PASS if percent replies are <10% or FAIL if percent replies are ≥10%. An arrow identifies FAIL.

SLS

The Test Set interrogates with Mode A and C interrogations including the P_2 SLS pulse. When P_2 level is set at -9 dB and replies are ≥90%, the test indicates PASS. If replies are <90%, the test indicates FAIL.

When P_2 level is set at 0 dB and replies are ≥1%, the test indicates FAIL. If replies are <1%, the test indicates PASS.

NOTE: Because interrogation with SLS at -9 dB is sent at MTL + 12 dB, the test must be run within 95 ft (28.96 m) of UUT antenna being tested.

A Code

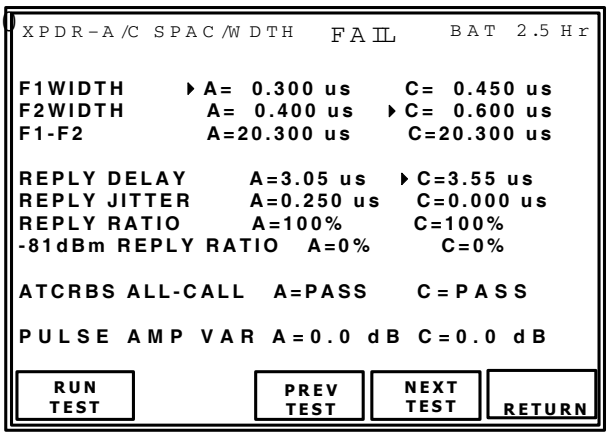
The Test Set interrogates with Mode A interrogations, +6 dB above MTL. Replies are monitored and transponder Squawk code is displayed in four digit octal and binary.

If Ident (SPI) is present in the reply, IDENT is displayed after the octal code.

C Altitude

The Test Set interrogates with Mode C interrogations, +6 dB above MTL. The replies are monitored and transponder altitude code is displayed in feet to a resolution of
100 ft. Receiving an invalid input (no C bit or C_1 and C_4 are on at the same time) blanks out the altitude field. Regardless of validity, the Mode C information is shown in binary format (MSD to LSD):

A4, A2, A1, A, B4, B2, B1,B, C4, C2, C1, C, D4, D2.



XPDR A/C Spacing Width Test Screen
Figure 22

XPDR A/C Spacing Width Test

XPDR A/C Spacing Width Test (1-2-4, Figure 22) performs these functions:

♦Verifies and displays F_1/F_2 pulse width and spacing for Mode A and C replies.

♦Verifies and displays reply delay for Mode A and C replies.

♦Verifies and displays reply jitter for Mode A and C replies.

♣Verifies reply ratio for Mode A and C interrogations.

♦Verifies replies to ATCRBS all call Mode A and C interrogations.

♣Verifies Mode A and C reply pulse droop.

F_1/F_2 Pulse Width and Spacing

The IFR 6000 interrogates with Mode A and C interrogations, +6 dB above MTL. The test indicates F_1 to F_2 spacing, F_1 width and F_2 width values on the DISPLAY for Mode A and C replies. Measurements outside the following tolerances result in a FAIL and are identified by an arrow.

F_1 to F_2 spacing is 20.30 μs (±0.10 μs).

F_1/F_2 pulse widths are 0.45 μs (±0.10 μs).

Reply Delay

The Test Set interrogates UUT with Modes A and C. The test verifies reply delay minus range delay is 3.00 µs (±0.50 µs).

Measurements outside the above tolerance result in a FAIL and are identified by an arrow.

Reply Jitter

The Test Set interrogates UUT with Modes A and C. The test verifies reply jitter values (difference between shortest and longest reply delay) using the best that are ≤0.1 µs.

Measurements outside the above tolerance result in a FAIL and are identified by an arrow.

Reply Ratio

The Test Set interrogates UUT with Modes A and C. The test verifies replies are ≥90% between MTL +6 dBm and not more than ≤10% for -81 dBm. Replies outside this tolerance results in a FAIL and are identified by an arrow.

NOTE: Above paragraph only applicable to direct connect testing.

NOTE: Transponder occupancy in 'over the air testing' prevents reliable Reply Ratio measurements. When Antenna is selected, Reply Ratio Mode A and C Test displays percent replies however, PASS/FAIL test limits are not applied.

ATCRBS All Call

The Test Set interrogates with ATCRBS (Mode A and C) only All-Call interrogations, 6 dB above MTL. Test verifies the following:

ATCRBS transponder must reply.

Mode S transponder - FAIL if reply Mode S.

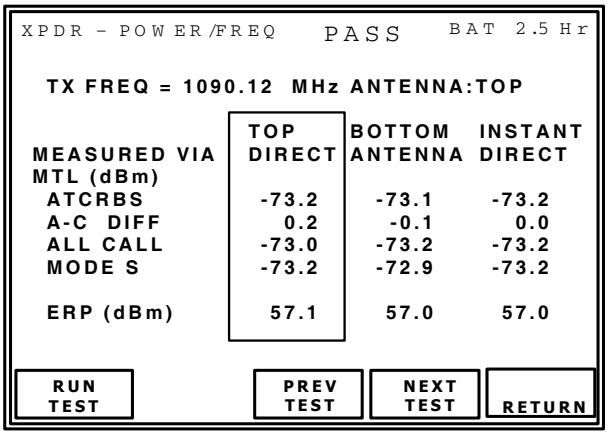
Mode S transponder - FAIL if reply ATCRBS.

Reply criteria is ≥90%. No Reply criteria is ≤10%. A FAIL is identified by an arrow.

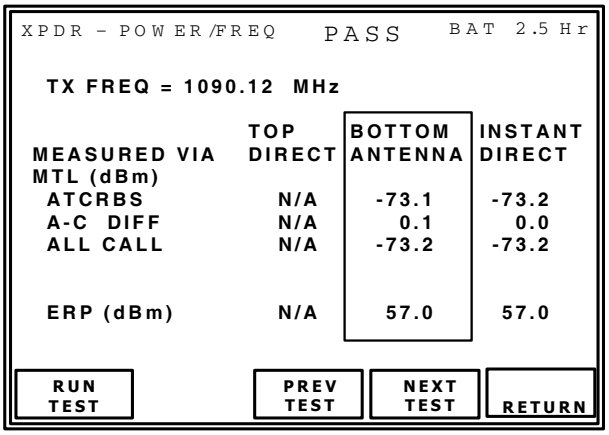
NOTE: The selected configuration file determines if an ATCRBS or Mode S transponder is being tested.

Pulse Amplitude Variation

The Test Set interrogates with Mode A and C interrogations, +6 dB above MTL. The test verifies all pulses in the Mode A and C replies are within a 2 dB amplitude window (minimum to maximum). Replies outside the 2 dB window result in a FAIL indication and are identified by an arrow.



Power and Frequency (Mode S) Test Screen
Figure 23



Power and Frequency (ATCRBS) Test Screen
Figure 24

XPDR Power and Frequency Test: Refer to 1-2-4, Figure 23. The XPDR Power and Frequency Test performs these functions:

♦ Measures, verifies and displays TX Frequency in MHz.

♦ Measures, verifies and displays TX ERP for top and bottom antennas in dBm, dBW or W.

♦Measures, verifies and displays MTL for top and bottom antennas, for ATCRBS, ATCRBS All-Call and Mode S (P_6) interrogation types in dBm.

Top or Bottom antenna measurement is selected with DATA Keys. Top and Bottom measurements are averaged and values are displayed (1-2-4, Figure 24).

NOTE: When an ATCRBS configuration is selected (non diversity transponder) only the Bottom antenna measurement fields are used.

Frequency

When a Mode S configuration is selected, the Test Set interrogates with UF4, +6 dB above MTL, verifying a DF4 reply is received.

With an ATCRBS configuration selected, the Test Set interrogates with Mode A, (or Mode C if no reply is received to a Mode A), +6 dB above MTL.

Test averages Frequency measurement over 40 replies. The value is updated every 40 replies. PASS/FAIL limits are applied.

NOTE: Frequency PASS/FAIL limits are determined by selected configuration. Refer to Appendix F.

ERP (Effective Radiated Power)

When a Mode S configuration is selected, the Test Set interrogates with UF4, +6 dB above MTL, verifying a DF4 reply is received.

When an ATCRBS configuration is selected, the Test Set interrogates with Mode A (or Mode C if no reply is received to a Mode A) +6 dB above MTL.

When the (peak) ERP is measured, two values for each measurement are displayed. INSTANT values are obtained from the average power measurement over five replies and updated every five replies.

TOP and BOTTOM values are obtained from the average power measurement over 40 replies. PASS/FAIL limits are applied and updated every 40 replies.

NOTE: ERP PASS/FAIL limits are determined by selected configuration. Refer to Appendix F.

NOTE: ERP and MTL Upper limits specified in selected configuration file are not applied during radiated test. The configuration file upper limits are in accordance with RTCA-DO181C, which are based on maximum feeder cable loss of 3 dB and measurement at the antenna port. ERP and MTL Upper limits are only applied when directly connected to UUT or end of feeder cable. In practice, many installations have feeder losses of 1 dB (minimum feeder loss) and antennas that exhibit gain.

MTL (Minimum Trigger Level)

When a Mode S configuration is selected the Test Set interrogates in sequence with UF4, Mode A (or Mode C if no reply is received to a Mode A) and an ATCRBS/Mode S All-Call, verifying MTL for each interrogation type.

When an ATCRBS configuration is selected the Test Set interrogates with Mode A (or Mode C if no reply is received to a Mode A) and an ATCRBS/Mode S All-Call, verifying MTL for each interrogation type.

To determine MTL the test adjusts RF interrogation level for 90% replies. Two values for each measurement are displayed. INSTANT values are obtained from the MTL readings. The 50% reply point is determined by sending 100 interrogations. The 90% reply point is calculated from the 50% reply point.

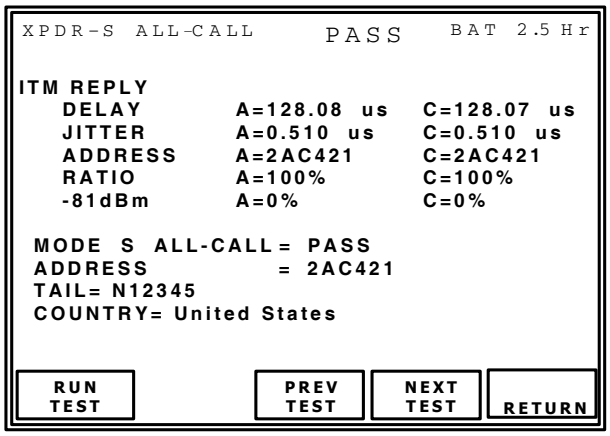
TOP and BOTTOM values are obtained from the average MTL readings of all replies received during the MTL Test sequence. PASS/FAIL limits are applied.

NOTE: MTL PASS/FAIL limits are determined by the selected configuration. Refer to Appendix F.

A-C Difference

The Test Set interrogates with Mode A (or Mode C if no reply is received to a Mode A), verifying MTL for each interrogation type.

The test compares MTL measurements between Mode A and C. PASS is displayed when difference is <1 dB. FAIL is displayed when difference is >1 dB.



XPDR - S All Call Test Screen
Figure 25

XPDR - S All Call Test

Refer to 1-2-4, Figure 25. The XPDR - S All Call Test performs these functions:

•Verifies and displays ITM Reply Delay Mode A and C

♣Verifies and displays ITM Reply Jitter Mode A and C

♣Verifies ITM Reply Ratio Mode A and C

♦Verifies ITM All Call Address

♦Verifies Mode S All Call.

♦Verifies and displays Mode S All Call Address

•Verifies Country and Tail Number

ITM Reply Delay

The Test Set interrogates UUT with an ATCRBS/Mode S All-Call, +6 dB above MTL, verifying DF11 replies are received. The test verifies reply delay minus range delay is:

128.00 μs (±0.50 μs) for ITM Mode A and C.

Measurements outside this tolerance result in a FAIL and are identified by an arrow.

NOTE: Range delay is 2.03 ns/ft (6.67 ns/m), calculated from the range values in the Setup Menu.

ITM Reply Jitter

The Test Set interrogates UUT with a Mode S All-Call, +6 dB above MTL, verifying DF11 replies are received.

The test verifies reply jitter values (difference between shortest and longest reply delay). Reply jitter (changes in reply delay) is:

≤0.08 μs for ITM Mode A and C

Measurements outside this tolerance result in a FAIL and are identified by an arrow.

ITM Reply Ratio

The Test Set interrogates UUT with a Mode S All-Call, +6 dB above MTL, verifying DF11 replies are received. The test verifies that ITM Mode A and C replies are ≥90% between MTL +6 dB and <10% for -81 dBm. Replies outside these tolerances result in a FAIL and are identified by an arrow.

NOTE: Above paragraph only applicable to direct connect testing.

NOTE: Transponder occupancy in 'over the air testing' prevents reliable Reply Ratio measurements. When Antenna is selected, Reply Ratio ITM Mode A and C Test displays percent replies however, PASS/FAIL test limits are not applied.

ITM Address

The Test Set interrogates UUT with a Mode S All-Call, +6 dB above MTL, verifying DF11 replies are received.

The test decodes and displays the discrete address reported in the DF11 replies.

Mode S All-Call

The Test Set interrogates UUT with a Mode S All-Call UF11, AA=FFFFFF, +6 dB above MTL, verifying DF11 replies are received.

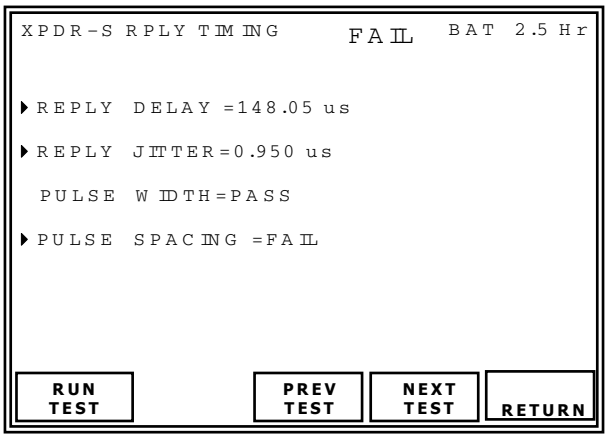
The test interrogates with a UF4 using the discrete address obtained in the DF11 reply and confirms the DF4 reply contains the same address and displays a PASS. If an incorrect address is received the address and FAIL are displayed. A FAIL is identified by an arrow.

Address, Tail and Country

The Test Set interrogates UUT with a Mode S All-Call UF11, AA=FFFFFF, +6 dB above MTL, verifying DF11 replies are received.

The test decodes and displays discrete address reported in the DF11 replies, country and tail number.

NOTE: Some countries have encoded the aircraft tail number into the Mode S discrete address. Refer to Appendix G for list of countries supported. If not supported only the country is displayed.



XPDR - S Reply Timing Test Screen
Figure 26

XPDR - S Reply Timing Test:

Refer to 1-2-4, Figure 26. XPDR - S Reply Timing Test performs these functions:

♦Verifies Mode S Reply Delay

♣Verifies Mode S Reply Jitter

♣Verifies Mode S Reply Pulse Width (all pulses)

♣Verifies Mode S Reply Pulse Spacing (all pulses)

Reply Delay

The Test Set interrogates UUT with UF4, 6 dB above MTL, verifying reply is received with the same address and correct format. The test verifies if reply delay minus range delay is:

128.00 μs (±0.25 μs) for Mode S

Measurements outside this tolerance result in a FAIL and are identified by an arrow.

NOTE: Range delay is 2.03 ns/ft (6.67 ns/m), calculated from the values in the Setup Menu.

Reply Jitter

The Test Set interrogates UUT with UF4, 6 dB above MTL, verifying reply is received with the same address and correct format.

The test verifies reply jitter values (difference between shortest and longest reply delay). Reply jitter (changes in reply delay) is:

≤0.08 μs

Measurements outside this tolerance result in a FAIL and are identified by an arrow.

Pulse Width

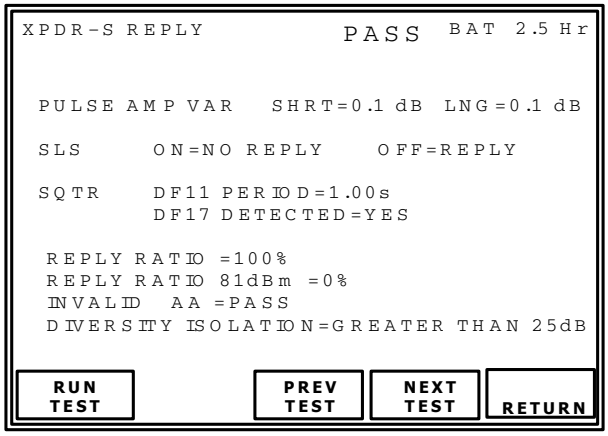
The Test Set interrogates UUT with UF4, +6 dB above MTL, verifying reply is received with the same address and correct format. Test verifies that the widths are:

0.5 μs (±0.05 μs) or 1.0 μs (±0.05 μs)

Pulse Spacing

The Test Set interrogates UUT with UF4, 6 dB above MTL. Verifying reply is received with the same address and correct format. The test verifies that the pulse spacing are within ±0.05 μs of nominal values.

NOTE: Pulse width spacing measured on preamble only (first release).



XPDR - S Reply Test Screen
Figure 27

XPDR - S REPLY Test:

Refer to 1-2-4, Figure 27. The XPDR - S Reply Test performs these functions:

♣Verifies Mode S Pulse Amplitude Variation Short Reply

♣Verifies Mode S Pulse Amplitude Variation Long Reply

♣Verifies Mode S SLS Level

♣Verifies Mode S Reply Ratio

♦Verifies and displays Mode S DF11 Squitter Period

♣Verifies Mode S DF11 Squitter Distribution.

♦Verifies Mode S Invalid AA

•Verifies S DF17 Detect

♦Verifies and displays Mode S Diversity Isolation

Pulse Amplitude Variation Short

The Test Set interrogates with UF4 (reply length short) interrogations, +6 dB above MTL. The test verifies all pulses in the DF4 replies are within a 2 dB amplitude window. Replies outside the 2 dB window result in a FAIL indication and are identified by an arrow. The measured variation is displayed.

Pulse Amplitude Variation Long

The Test Set interrogates with UF4 (reply length long) interrogations, +6 dB above MTL. The test verifies all pulses in the DF20 replies are within a 2 dB amplitude window. Replies outside the 2 dB window result in a FAIL indication and are identified by an arrow. The measured variation is displayed.

SLS Level

The Test Set interrogates with UF4 interrogations including the P_5 SLS pulse. For Direct Connect, when P_5 level is set at -12 dB and replies are ≥99%, the test indicates PASS.

For Antenna Connect, when PS level is set at -12 dB and replies are ≥90%, the test indicates a PASS. When P5 level is set at +3 dB and replies are ≥90%, the test indicates PASS.

NOTE: Because interrogation with SLS at -12 dB is sent at MTL + 12 dB, SLS Test must be run within 95 feet (28.96 meters) of UUT antenna being tested.

Reply Ratio

The Test Set interrogates UUT with UF4. The test verifies that replies are ≥99% between MTL +6 dB and ≤10% for -81 dBm. Replies outside this tolerance result in a FAIL and are identified by an arrow.

NOTE: Above paragraph only applicable to direct connect testing.

NOTE: Transponder occupancy in 'over the air testing' prevents reliable Reply Ratio measurements. When Antenna is selected, Reply Ratio Mode S Test displays percent replies however, PASS/FAIL test limits are not applied.

Squitter Period

The Test Set monitors the UUT DF11 acquisition squitters and verifies that the period is 0.6 to 2.4 s. A Squitter period outside this tolerance results in a fail and is identified by an arrow.

DF17 Detected

The Test Set monitors the UUT DF17 extended squitters and confirms detection by displaying YES. Test displays NO if DF17's are not detected.

Invalid AA

The Test Set interrogates with UF4 interrogations, +6 dB above MTL. Test uses default addresses that are 1 and 256 greater than the correct address. Test displays PASS if no replies are received and FAIL if replies are received.

Diversity Isolation

The Test Set monitors the UUT DF11 acquisition squitters. The test verifies UUT diversity isolation (difference between "On" antenna squitters and "Off" antenna squitters) is ≥20 dB. Values <20 dB result in a FAIL and are identified with an arrow.

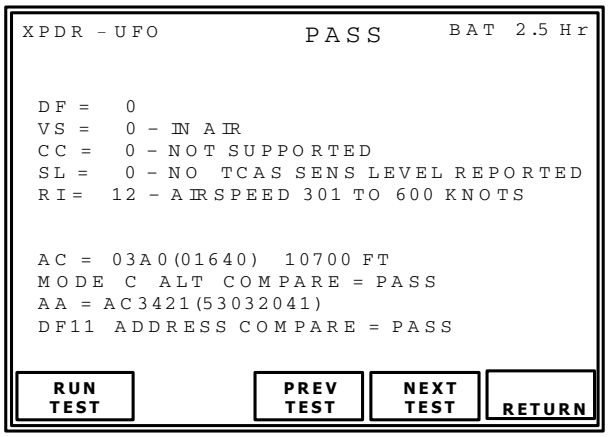
Indications:

- OFF is displayed if diversity isolation is not selected in Setup Screen.
- >25 dB.
- Value in dB.

NOTE: For >20 dB dynamic range, test must be run within 50 ft (15.24 m) of UUT antenna being tested.

NOTE: When Diversity Isolation Test is enabled, make sure Antenna Shield is fitted to top or bottom UUT antenna prior to running test. It is important that only one UUT antenna is seen during the Diversity Test. Make sure Test Set Directional Antenna is pointed at unshielded antenna. Refer to Appendix J for Antenna Shield mounting procedure.

NOTE: This test must be enabled on the XPDR Setup Screen to display diversity isolation parameter.



UF0 Test Screen
Figure 28

UF0 Test

Refer to 1-2-4, Figure 28. The UF0 (Short Air to Air Surveillance) Test performs these functions:

♦Verifies replies to Mode S UF0 interrogations and compares discrete address with DF11.

♦Decodes and displays DF0 data fields.

♦Compares Mode S altitude to Mode C altitude.

The Test Set interrogates with UF0, +6 dB above MTL, verifying a UF0 reply is received.

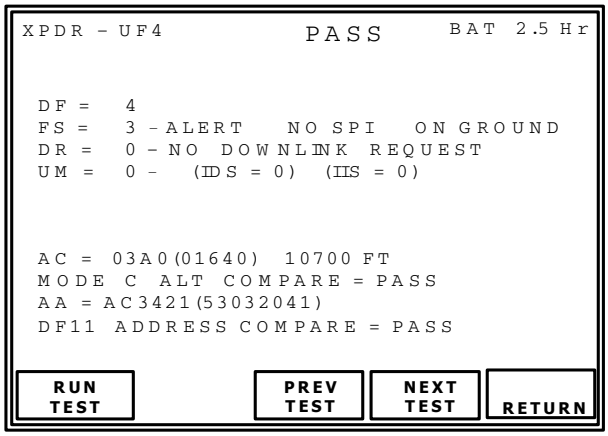
Altitude reported in DF0 is compared with altitude reported during Mode Test in valid ATCRBS Mode C reply. Altitudes must agree within 100 ft.

Address is compared with address reported during Mode Test in DF11 reply. DISPLAY indicates the Downlink Format Fields. If test fails due to incorrect altitude, Mode C altitude is displayed. If test fails due to wrong address, DF11 address is displayed. UF0 AQ bit is "1" for requesting airspeed information in DF0 RI field.

NOTE: AC field blanks out if invalid data is received for that field.

Testing VS (Vertical Status)

ICAO amendment 77 transponders only replies to Mode S discrete interrogations when installation is in ground state. Refer to para 1-2-4.3.2 for UUT ADDRESS and MANUAL AA settings.



UF4 Test Screen
Figure 29

UF4 Test

Refer to 1-2-4, Figure 29. UF4 (Short Surveillance Altitude) Test performs these functions:

♦Verifies replies to Mode S UF4 interrogations and compares discrete address with DF11.

♦Decodes and displays DF4 data fields.

♦Compares Mode S altitude to Mode C altitude.

The Test Set interrogates with UF4, +6 dB above MTL, verifying a DF4 reply is received.

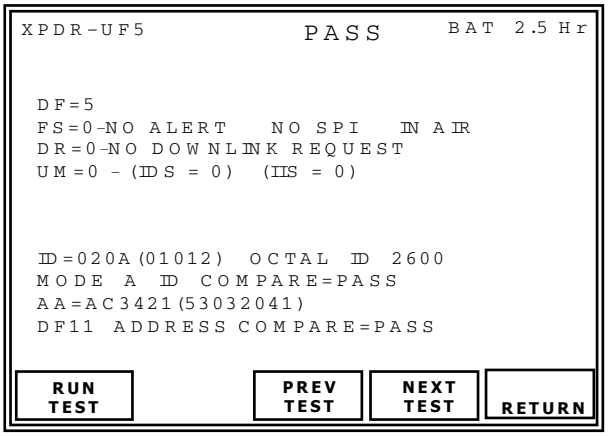
Altitude reported in DF4 is compared with altitude reported during Mode Test in valid ATCRBS Mode C reply. Altitudes must agree within 100 ft.

Address is compared with address reported during Mode Test.

NOTE: AC field blanks out if invalid data is received for that field.

Testing FS (Flight Status)

ICAO amendment 77 transponders only reply to Mode S discrete interrogations when installation is in ground state. Refer to para 1-2-4.3.2 for UUT ADDRESS and MANUAL AA settings.



UF5 Test Screen
Figure 30

UF5 Test

Refer to 1-2-4, Figure 30. The UF5 Test (Short Surveillance Identity) performs these functions:

♦Verifies replies to Mode S UF5 interrogations and compares discrete address with DF11.

♦Decodes and displays DF5 data fields.

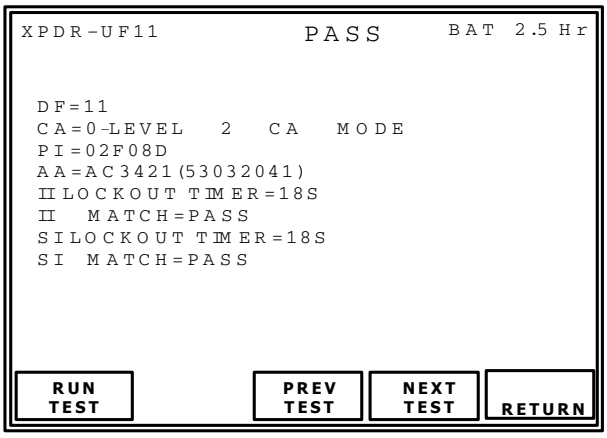
♦Compares Mode S Identity Code to Mode A Squawk Code.

The Test Set interrogates with UF5, +6 dB above MTL, verifying a DF5 reply is received.

ID code reported in DF5 is compared with ID code reported during Mode Test in valid ATCRBS Mode A reply. Address is compared with address reported during Mode Test.

Testing FS (Flight Status)

ICAO amendment 77 transponders only reply to Mode S discrete interrogations when installation is in ground state. Refer to para 1-2-4.3.2 for UUT ADDRESS and MANUAL AA settings.



UF11 Test Screen
Figure 31

UF11 Test

Refer to 1-2-4, Figure 31. UF11 Test performs these functions:

♦Interrogates with Mode S UF11, AP set FFFFFF. Decodes and displays DF11 replies.

♣Performs comprehensive II and SI Match Test.

•Performs II and SI lockout Timer Test.

The Test Set interrogates with UF11, +6 dB above MTL, verifying a DF11 reply is received.

Address is compared with address reported during Mode Test in DF11 reply (1-2-4, Figure 31). Test interrogates with a UF11, using the 15 II codes, in sequence from 1 to 15. If all codes are correct PASS is displayed. If the transponder supports SI (Surveillance Identifier) each of the 63 SI codes from 1 to 63 are tested. When all codes are correct PASS is displayed. BDS 1,0 is verified to determine SI support.

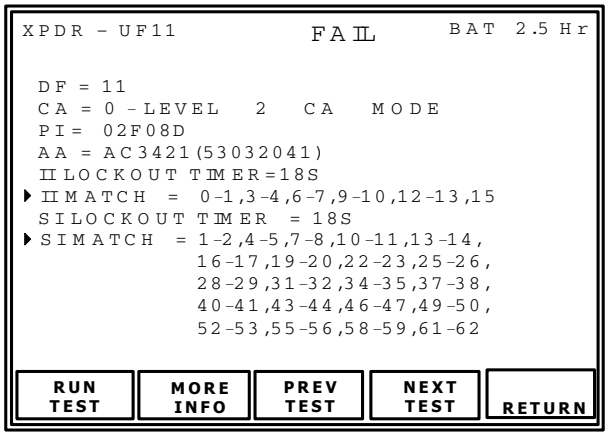
NOTE: When a single code fails the code is displayed. When more than one code fails, the range of codes are displayed. An arrow identifies a FAIL (1-2-4, Figure 32).

The multi-site lockout protocol is utilized in conjunction with an II code to verify lockout (not accept any Mode S only All-Call) time. If lockout time is 18 sec (±1 sec), PASS is displayed. FAIL is displayed if lockout time is outside this window.

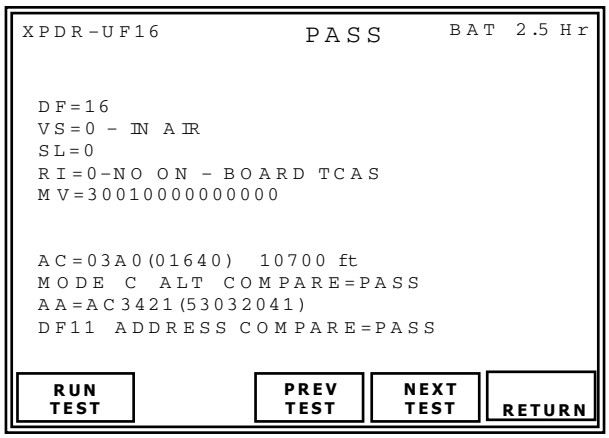
The multi-site lockout protocol is utilized in conjunction with an SI code to verify lockout (not accept any Mode S only All-Call) time. If lockout time is 18 sec (±1 sec), PASS is displayed. FAIL is displayed if lockout time is outside this window.

The test interrogates during the lockout period with a different SI code to confirm interrogation acceptance.

NOTE: Due to long test time required, lockout timer test is not run as part of Auto Test. Test is run only if UF11 Test is performed separately.



UF11 FAIL Test Screen
Figure 32



UF16 Test Screen
Figure 33

UF16 Test

Refer to 1-2-4, Figure 33. UF16 Test (Long Air to Air Surveillance) performs these functions:

♦Verifies replies to Mode S UF16 interrogations and compares discrete address with DF11.

♦Decodes and displays DF16 data fields.

♦Compares Mode S Altitude to Mode C Altitude.

The Test Set interrogates with UF16, +6 dB above MTL, verifying a DF16 reply is received.

Altitude reported in DF16 is compared with altitude reported during Mode Test in valid ATCRBS Mode C reply. Altitudes must agree within 100 ft.

Address is compared with address reported during Mode Test in DF11 reply. The DISPLAY indicates the Downlink Format Fields. If test fails because of incorrect altitude, Mode C altitude is displayed. If test fails due to wrong address, DF11 address is displayed.

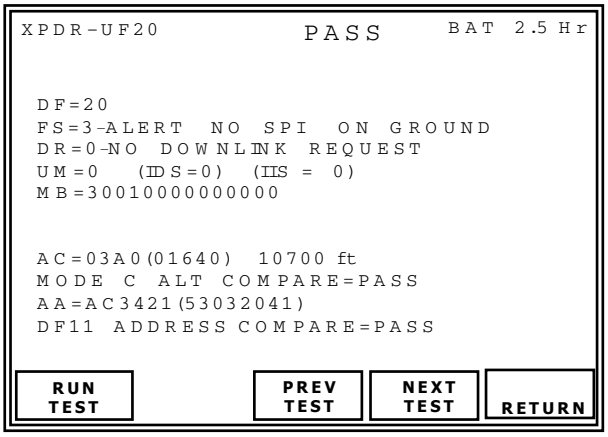
NOTE: AC field blanks out if invalid data is received for that field.

NOTE: No reply to UF16 results in Mode S pass in Auto Test.

NOTE: Replies to UF16 are received only if an active TCAS II system is installed.

Testing VS (Vertical Status)

ICAO amendment 77 transponders only replies to Mode S discrete interrogations when installation is in ground state. Refer to para 1-2-4.3.2 for UUT ADDRESS and MANUAL AA settings.



F20 Test Screen
Figure 34

UF20 Test

Refer to 1-2-4, Figure 34. UF20 (Long Surveillance Altitude) Test performs these functions:

♦Verifies replies to Mode S UF20 interrogations and compares discrete address with DF11.

♦Decodes and displays DF20 data fields. Displays MB message field in HEX.

♦Compares Mode S altitude to Mode C altitude.

The Test Set interrogates with UF20 (Comm A, altitude request), RR=17 (long reply), DI=7, RRS=0, requesting a BDS 1,0 data link capability report, +6 dB above MTL, verifying a DF20 reply is received. If reply is not received, the test interrogates for BDS 3,0 TCAS sensitivity status message.

Altitude reported in DF20 is compared with altitude reported during Mode Test in valid ATCRBS Mode C reply. Altitudes must agree within 100 ft.

Address is compared with address reported during Mode Test in DF11 reply.

NOTE: The BDS 3,0 TCAS sensitivity status message interrogates with Mode S UF20 (Comm A, altitude request), RR=19 (long reply), DI=7, RRS=0, MA=05000000000000, verifying DF20 reply received has correct altitude (compared with Mode C altitude), address (compared with Mode Test address) and format.

NOTE: Data displayed in MB message field is not decoded.

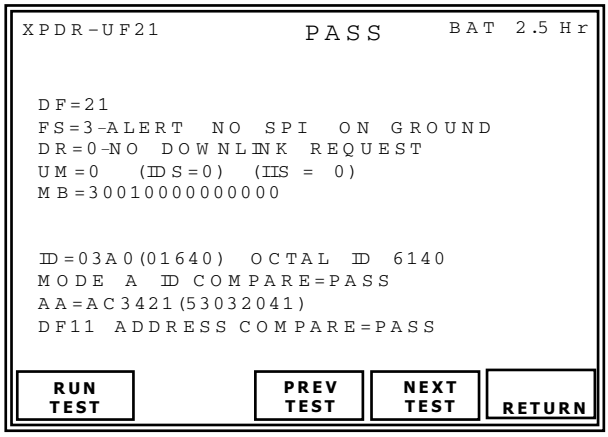
NOTE: The Datalink Capability Report determines the level of transponder under test.

NOTE: AC field blanks out if invalid data is received for that field.

NOTE: Transponders without active subsystems capable of accepting Comm A data do not reply to UF20 interrogations.

Testing FS (Flight Status)

ICAO amendment 77 transponders only reply to Mode S discrete interrogations when installation is in ground state. Refer to para 1-2-4.3.2 for UUT ADDRESS and MANUAL AA settings.



UF21 Test Screen PASS
Figure 35

UF21 Test

Refer to 1-2-4, Figure 35. UF21 (Long Surveillance Identity) Test performs these functions:

♦Verifies replies to Mode S UF21 interrogations and compares discrete address with DF11.

♦Decodes and displays DF21 data fields. Displays MB message field in HEX.

♦Compares Mode S Identity Code to Mode A Squawk Code.

The Test Set interrogates with UF21 (Comm A, altitude request), RR=17 (long reply), DI=7, RRS=0, requesting a BDS 1,0 data link capability report, +6 dB above MTL, verifying a DF21 reply is received. If reply is not received test interrogates for BDS 3,0 TCAS sensitivity status message.

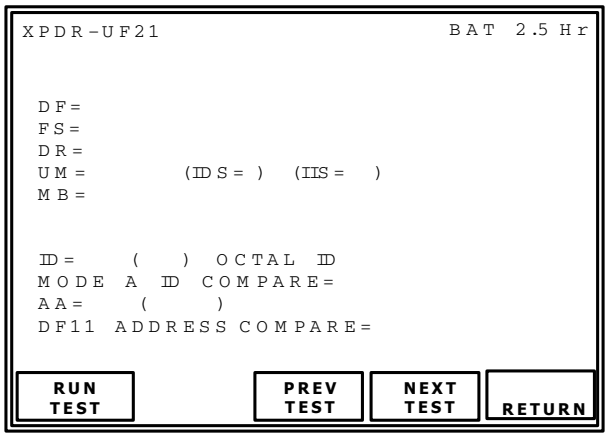
ID code reported in DF21 is compared with ID code reported during Mode Test in valid ATCRBS Mode A reply.

Address is compared with address reported during Mode Test in DF11 reply.

NOTE: The BDS 3,0 TCAS sensitivity status message interrogates with Mode S UF20 (Comm A, altitude request), RR=19 (long reply), DI=7, RRS=0, MA=05000000000000, verifying DF20 reply received has correct altitude (compared with Mode C altitude), address (compared with Mode Test address) and format.

NOTE: Data displayed in MB message field is not decoded.

NOTE: BDS 1,0 Datalink Capability Report determines the level of transponder under test.

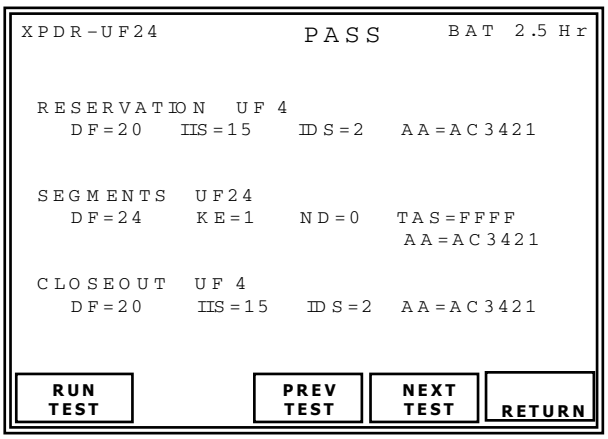


UF21 Test Screen NOT RUN
Figure 36

NOTE: Transponders without active subsystems capable of accepting Comm A data does not reply to UF21 interrogations.

Testing FS (Flight Status)

ICAO amendment 77 transponders only reply to Mode S discrete interrogations when installation is in ground state. Refer to para 1-2-4.3.2 for UUT ADDRESS and MANUAL AA settings.



UF24 Test Screen
Figure 37

UF24 Test

The UF24 Test (1-2-4, Figure 37) completes the 16 segment data transfer (UELM protocol) verifying UF24.

Interrogates with Mode S UF4 UELM reservation, verifying reply received is a DF20 UELM Reservation (Comm-B). Interrogates with Mode S UF24 (Comm-C) UELM segments, one initial, 14 intermediate and one final interrogation. Verifies reply received is a Mode S DF24 (Comm-D) acknowledgment.

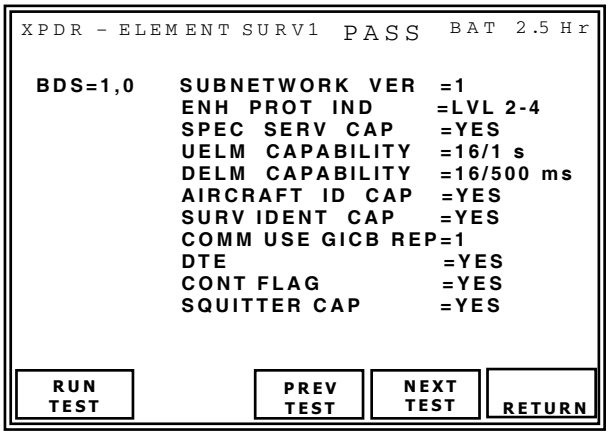
When the close-out is completed the IIS displayed equals the IIS displayed in the reservation.

Interrogates with Mode S UF4, +6 dB above MTL, UELM close-out and verifies reply received is a DF20 UELM close-out (Comm-B).

TAS Field displays the number of transferred segments. TAS data consists of 16 bits, each bit representing a segment, displayed as four hex digits.

No reply to the UELM Test sequence does not fail Mode S in Auto Test.

NOTE: BDS 1,0 Datalink Capability Report determines the level of transponder under test. If level <3 is reported, test is not run and NOT CAPABLE is displayed.



XPDR Elementary Surveillance 1 Test Screen
Figure 38

XPDR Elementary Surveillance 1 Test

Refer to 1-2-4, Figure 38. XPDR Elementary Surveillance Test performs these functions:

♣Verifies, decodes and displays BDS 1,0 Data Link Capability Report.

NOTE: Only the primary data fields are displayed. For full decode and display of GICB extracted BDS registers, the ADS-B option is required.

Data Link Capability Report BDS 1,0

The Test Set Interrogates with UF4 RR=17 DI=7 RRS=0, decodes DF20 reply and displays data link capability report comprising the following fields:

SUBNETWORK VER:

(Mode S Subnetwork Version Number)
0 to *127*

ENH PROT IND:
(Enhanced Protocol Indicator)
2-4 (Transponder Level 2-4) or *5*
(Transponder Level 5 Enhanced Protocol)

SPEC SER CAP:
(Mode S Specific Services Capability Report):
YES or *NO*

UELM SEG CAP:
(Uplink Extended Length Message Segment Capability)
NO UELM, *16/1 S*, *16/500 mS*, *16/250 mS*, *16/125 mS*, *16/60 mS* or *16/30 mS*
(Ex: 16 segments transferred in 500 ms.)

DELM SEG CAP:
(Downlink Extended Length Message Segment Capability)
NO DELM, *4/1 S*, *8/1 S*, *16/1 S*, *16/500 mS*, *16/250 mS*, *16/125 mS* or *7* to *15* (unassigned)
(Ex: Eight segments transferred in 1 sec.)

AIRCRAFT ID CAP:
(Aircraft Identification Capability)
YES or *NO*

SURV IDENT CAP:
(Surveillance Identifier Code Capability)
YES or *NO*

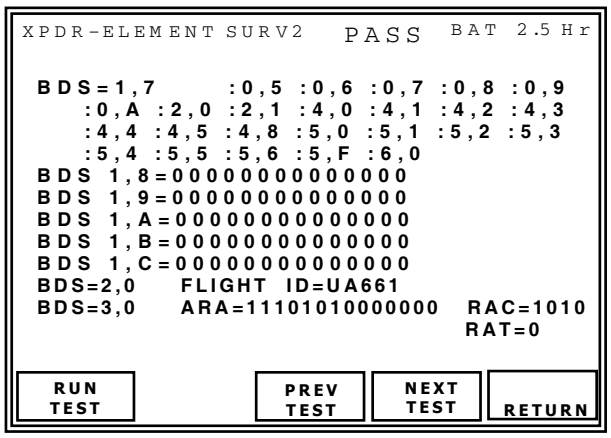
COMM/USE GICB CAP REP:
(Common Usage [Ground Initiated Comm B] Capability Report)
1 or *0*
This bit changes when the common usage GICB capability report BDS 1,7 content changes.

DTE:
(Data Terminal Equipment)
YES or *NO*

CONT FLAG:
(Continuation Flag).
YES (Yes means that a continuation report may be found in registers BDS 1,1 up to BDS 1,6 which are not implemented in this revision)
NO

SQUITTER CAP:
(Capability Subfield)
YES (Surveillance code identifier capability),
NO (No surveillance code identifier capability)

NOTE: If CHECK CAP is enabled in Setup Menu, capability of test is determined from BDS 1,0



XPDR Elementary Surveillance 2 Test Screen
Figure 39

XPDR Elementary Surveillance 2 Test

Refer to 1-2-4, Figure 39. XPDR Elementary Surveillance Test performs these functions:

♣Verifies, decodes and displays BDS 1,7 Common Usage GICB Capability Report.

♣Verifies, decodes and displays BDS 1,8 to BDS 1,C Specific Services Capability Report.

♣Verifies, decodes and displays BDS 2,0 Aircraft Identification (Flight ID).

♣Verifies, decodes and displays BDS 3,0 ACAS Resolution Advisory.

NOTE: Only primary data fields are displayed. For full decode and display of GICB extracted BDS registers, the ADS-B option is required.

GICB Common Usage Capabilities Report:

Interrogates with UF4 RR=16 DI=7 RRS=7, decodes DF20 reply and displays common usage GICB capability report.

The Screen displays BDS Numbers for the common usage GICB services currently supported by the transponder and decodable by the Test Set.

BDS	DESCRIPTION
0.5	Ext Squitter Airborne Position
0,6	Ext Squitter Surface Position
0,7	Ext Squitter Status
0,8	Ext Squitter Type and Identification
0,9	Ext Squitter Airborne Velocity Information
0,A	Ext Squitter Event Driven Information
1,0	Data Link Capability Report
1,7	Common Usage GICB Capability Report
2,0	Aircraft Identification (Flight ID)
2,1	Aircraft Registration Number
3.0	ACAS Resolution Advisory
4,0	Aircraft Vertical Intention
4,1	Next Way Point Identifier
4,2	Next Way Point Position
4,3	Next Way Point Information
4,4	Meteorological Routine Report
4,5	Meteorological Hazard Report
4,8	VHF Channel Report
5,0	Track and Turn Report
5,1	Position Coarse
5,2	Position Fine
5,3	Air Referenced State Vector
5,4	Way Point 1
5,5	Way Point 2
5,6	Way Point 3
5,F	Quasi-Static Parameter Monitoring
6,0	Heading and Speed Report

Common Usage GICB BDS
Table 2

NOTE: Refer to 1-2-4, Table 2. Dark Shaded BDS are not supported by current IFR 6000 software. Light shaded BDS are supported by ADS-B option.

Specific Services GICB Capability Report BDS 1,8

BDS 1,8 Interrogates with UF4 RR=17 DI=7 and RRS=8. DF20 reply BDS register content displayed as 14 HEX digits. Each bit set indicates capability supported for BDS 0,1 to 3,8.

Specific Services GICB Capability Report BDS 1,9

BDS 1,9 Interrogates with UF4 RR=17 DI=7 and RRS=9. DF20 reply BDS register content displayed as 14 HEX digits. Each bit set indicates capability supported for BDS 3,9 to 7,0.

Specific Services GICB Capability Report BDS 1,A

BDS 1,A Interrogates with UF4 RR=17 DI=7 and RRS=10. DF20 reply BDS register content displayed as 14 HEX digits. Each bit set indicates capability supported for BDS 7,1 to A,8.

Specific Services GICB Capability Report BDS 1,B

BDS 1,B Interrogates with UF4 RR=17 DI=7 and RRS=11. DF20 reply BDS register content displayed as 14 HEX digits. Each bit set indicates capability supported for BDS A,9 to E,0.

Specific Services GICB Capability Report BDS 1,C

BDS 1,C Interrogates with UF4 RR=17 DI=7 and RRS=12. DF20 reply BDS register content displayed as 14 HEX digits. Each bit set indicates capability supported for BDS E,1 to F,F.

Aircraft Identification (Flight ID) BDS 2,0

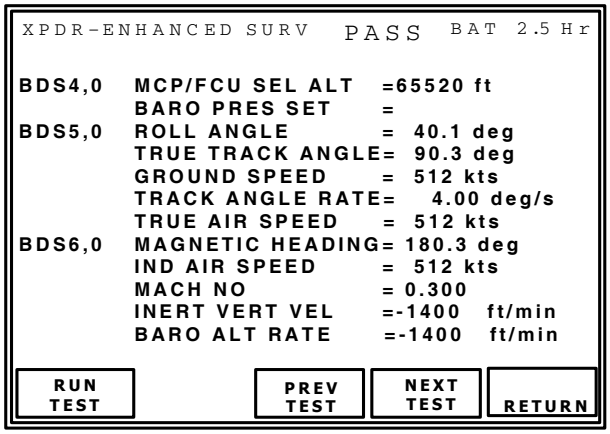
The Test Set Interrogates with Mode S UF4 (Comm A Identity request), RR=18 (long reply) to request DF20 with AIS reply. Verifies reply received is a DF20 (Comm-B) with an AIS field containing valid characters.

NOTE: If Flight ID is not entered into transponder or linked subsystem, AIS is zero (0).

ACAS Resolution Advisory BDS 3,0

Test Set Interrogates with UF4, +6 dB above MTL, RR=19 DI=7 RRS=0, decodes DF20 reply and displays active resolution advisory data, including RAT (Resolution Advisory Terminated) bit.

NOTE: TCAS II must be installed and a resolution advisory must be in progress for data to be displayed on this Screen. RA may be stimulated by Test Set or a TCAS-201 Test Set running a collision scenario



Enhanced Surveillance Test Screen
Figure 40

XPDR Enhanced Surveillance Test

Refer to 1-2-4, Figure 40. XPDR Enhanced Surveillance Test performs these functions:

♣Verifies, decodes and displays BDS 4,0 Aircraft Vertical Intention.

♣Verifies, decodes and displays BDS 5.0 Track and Turn Report.

♣Verifies, decodes and displays BDS 6,0 Heading and Speed Report.

NOTE: Only primary data fields are displayed. For full decode and display of GICB extracted BDS registers, the ADS-B option is required.

NOTE: BDS Data Items not available are identified by displaying N/A in the data field.

NOTE: If Check Cap is enabled, BDS 1,7 is verified to confirm availability of:

BDS 4,0
BDS 5,0
BDS 6,0

Aircraft Vertical Intention BDS 4,0

The Test Set Interrogates with UF4 RR=20 DI=7 RRS=0, decodes DF20 reply and displays vertical intent report data.

NOTE: ADLP (Air Data Link Processor) must be installed or transponder must have embedded ADLP to receive data from subsystem (in this case the FMS [Flight Management System]).

MCP/FCU SEL ALT:

(Mode Control Panel/Flight Control Unit Selected Altitude) displayed in feet.

Track and Turn Report BDS 5,0

The Test Set Interrogates with UF4 RR=21 DI=7 RRS=0, decodes DF20 reply and displays Track and Turn Report data.

NOTE: ADLP (Air Data Link Processor) must be installed or transponder must have embedded ADLP to receive data from subsystem (in this case the FMS [Flight Management System]).

ROLL ANGLE:

±90.0 deg

TRUE TRACK ANGLE:

(True Track Angle)
0 to *359* deg

GROUND SPEED:

(Ground Speed)
0 to *2048* kts (2 kt resolution)

TRUE TRACK ANGLE RATE:

(True Track Angle Rate)
±16.0 deg/sec

TRUE AIR SPEED:

(True Air Speed)
0 to *2046* kts (2 kt resolution)

Heading and Speed Report BDS 6, 0

The Test Set Interrogates with UF4 RR=22 DI=7 RRS=0, decodes DF20 reply and displays Heading and Speed Report data.

MAG HDG:

(Magnetic Heading)
0 to *360* deg

IND AIR SPEED:

(Indicated Air Speed)
0 to *1023* kts (1 kt resolution)

MACH NO:

(Mach Number)
0 to *4.096* (Mach Number)

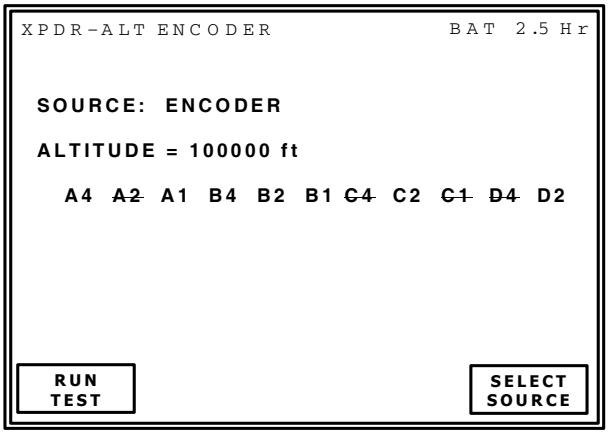
INERT VERT VEL:

(Inertial Vertical Velocity)
-16384 to *+16352* ft/min
(32 ft/min resolution)

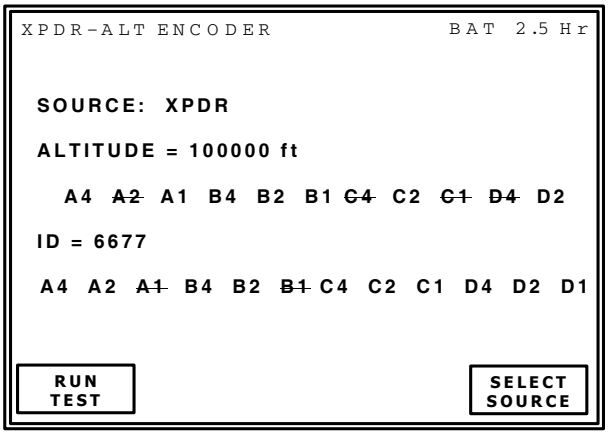
BARO ALT RATE:

(Barometric Altitude Rate)
-16384 to *+16352* ft/ min (32 ft/min resolution)

4.3.5 ALTITUDE ENCODER



Altitude Encoder Test Screen
Source Encoder
Figure 41



Altitude Encoder Test Screen
Source XPDR
Figure 42

Altitude Encoder

Refer to 1-2-4, Figure 41. Altitude Encoder performs these functions:

Decodes and displays altitude in feet and binary code (grey code) from encoding altimeters.

Altitude

Encoding altimeter is connected via user manufactured cable to Remote Connector. Altitude is decoded and displayed in feet and binary lines are monitored and displayed as A4, A2, A1, B4, B2, B1 C4, C2, C1, D4, D2. A logic 0 is displayed by a strike through (~~A4~~).

STEP	PROCEDURE
1.	Press XPDR Mode Key until the XPDR ENCODER Screen is displayed (1-2-4, Figure 41).
2.	Use DATA Keys or SELECT SOURCE Soft Key to select ENCODER.
3.	Connect Test Set. Remote Connector, Altitude Encoder inputs to UUT Encoding Altimeter via user provided cable. Refer to Appendix A for remote connector pinouts.
4.	Press RUN TEST Soft Key.
5.	Use Barometric Test Set to pump up UUT Encoding Altimeter to desired test altitudes and confirm altitude on display.

STEP	PROCEDURE
1.	Press XPDR Mode Key until the XPDR ENCODER Screen is displayed (1-2-4, Figure 42).
2.	Use DATA Keys or SELECT SOURCE Soft Key to select XPDR.
3.	Connect Test Set. Refer to 1-1-2, for Antenna Setup. Refer to 1-1-2, for Direct Connect Setup.
4.	Press RUN TEST Soft Key.

4.3.6 DIRECT CONNECT PROCEDURE

STEP	PROCEDURE

1. Connect UUT to Test Set RF I/O Connector via coaxial cable.

   CAUTION: TO PREVENT DAMAGE TO TEST SET, DO NOT CONNECT UUT TO TEST SET ANT CONNECTOR.

2. Press XPDR Mode Key to display XPDR Auto Test Screen. The Test Set displays the results of last XPDR Auto Test if run since last Power-up.
3. Perform XPDR Setup Screen procedure, setting RF I/O Connector to DIRECT CONNECT (para 1-2-4.3.2).
4. Perform CONFIG selection procedure (para 1-2-4.3.1).
5. Press RUN/STOP Soft Key to run XPDR Auto Test. **TESTING** in the line above the soft keys indicates test is running.
6. Press RUN/STOP Soft Key at any time to stop test (non-resumable).
7. Verify XPDR Auto Test indicates PASS or FAIL on DISPLAY. Verify squawk codes, altitudes, Mode S address, VS and FS status, country and tail number.

4.3.7 "OVER THE AIR" GROUND TEST PROCEDURE (UUT Aircraft Altitude Reporting System ≤Airfield Altitude)

STEP	PROCEDURE

1. Press XPDR Mode Key to display XPDR Auto Test Screen. The Test Set shows displays the results of the last XPDR Auto Test if run since last Power-up.
2. Perform XPDR Setup Screen procedure (para 1-2-4.3.2) setting RF Port to ANTENNA.
3. Perform CONFIG selection procedure (para 1-2-4.3.1).
4. Perform Directional Antenna Use procedure (para 1-2-4.5). Position Test Set Antenna facing UUT antenna at XPDR Setup Screen ANT RANGE.
5. Shield with Antenna Shield or disconnect and terminate UUT antenna not being tested. Refer to Appendix J. Deactivate other area transponders or position transponders at least three times the XPDR Setup Screen ANT RANGE from the Test Set Antenna.
6. Press RUN/STOP Soft Key to run XPDR Auto Test. **TESTING** in the line above the soft keys indicates test is running.
7. Press RUN/STOP Soft Key at any time to stop test (non-resumable).
8. Verify XPDR Auto Test indicates PASS or FAIL on DISPLAY. Verify squawk codes, altitudes, Mode S address, VS and FS status, country and tail number.
9. Verify squawk codes, altitudes, Mode S address, VS and FS status, country and tail number.

NOTE: The Antenna Shield provides at least 20 dB of isolation, ensuring airborne TCAS equipped aircraft do not detect UUT at altitude, causing false RA's and TA's. The 20 dB isolation of the antenna shield may cause various tests to fail, which is normal.

4.3.8 "OVER THE AIR" SIMULATED ALTITUDE TEST PROCEDURE (UUT Aircraft Altitude Reporting System >Airfield Altitude ["Pumped Up"])

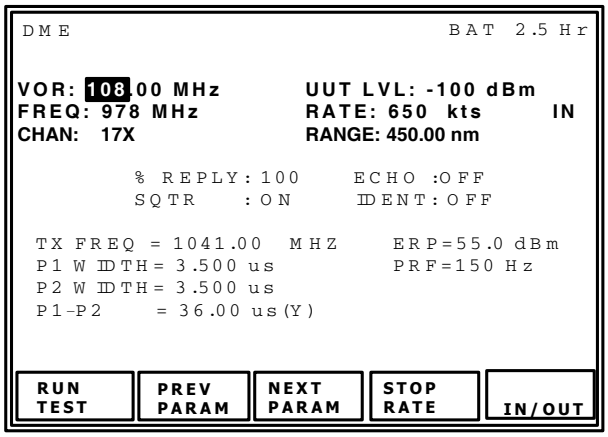
STEP	PROCEDURE

1. Press XPDR Mode Key to display XPDR Auto Test Screen. Test Set displays results of last XPDR Auto Test if run since last Power-up.
2. Perform XPDR Setup Screen procedure, setting RF I/O Connector to ANTENNA (para 1-2-4.3.2). Set ANT RANGE to ≤20 ft (6.1 m).
3. Perform CONFIG selection procedure (para 1-2-4.3.1).
4. Perform Directional Antenna procedure (para 1-2-4.5). Position Test Set Antenna facing UUT antenna at XPDR Setup Screen ANT RANGE.
5. Shield both UUT antenna's with Antenna Shields or disconnect and terminate UUT Antenna not being tested. Deactivate other area transponders or position transponders >50 ft (15.24 m) from the Test Set antenna.
6. Press RUN/STOP Key to run XPDR Auto Test. **TESTING** in the line above the soft keys indicates test is running.
7. Press RUN/STOP Key at any time to stop test (non-resumable). Otherwise, Auto Test runs until all tests are complete.
8. XPDR Auto Test will indicate a FAIL on DISPLAY.
9. Verify squawk codes, altitudes, Mode S address, VS and FS status, country and tail number.

NOTE: The Antenna Shield provides at least 20 dB of isolation, ensuring airborne TCAS equipped aircraft do not detect UUT at altitude, causing false RA's and TA's. The 20 dB isolation of the antenna shield may cause various tests to fail, which is normal.

4.4 DME

Press DME Mode Key to select DME functional mode. DME Test Screen is displayed (1-2-4, Figure 42).



DME Screen
Figure 42

DME functional mode has a single test screen that provides all required control functions and measurement display. A Setup DME Screen allows user parameters to be entered.

User Controls:

Soft Keys:

RUN TEST:

Starts the DME Test. TEST RUNNING is displayed at the top of Screen.

NEXT PARAM:

Selects next control field. Includes selection of fields that have dedicated Keys.

PREV PARAM:

Selects previous control field. Includes selection of fields that have dedicated Keys.

STOP(START) RATE:

Stops or starts Range Rate.

IN/OUT:

Reverses simulated direction of aircraft.

Dedicated Keys and Control Fields:

FREQ Key:

Test Set reply Frequency is displayed in three linked units.

VOR (paired frequency MHz)

FREQ (ground to air frequency MHz)

CHAN (DME channel number)

Press Frequency Key to select each unit in sequence. Press DATA Key to select X or Y channel.

RF LVL (UUT LVL) Key:

Selects UUT LVL field.

UUT LVL defaults to maximum on RF Port selected.

RANGE Key:

Selects Range field.

RATE Key:

Selects Rate field.

Control Fields Selected with NEXT/PREV PARAM Soft Keys:

% REPLY:

Selectable in 1% steps. Range is 0% to 100%.

SQTR:

Selectable ON or OFF. Squitter must be on for DME to search and acquire track.

ECHO:

Selectable ON or OFF. Multi-path Reply Echo simulation at Fixed 30 nm, RF level -11 dB relative to RF LVL selected (Main Reply).

IDENT:

Selectable ON or OFF. Sends 1350 Hz tone with three letter station Identification. Defined in Setup DME Screen (1-2-4, Figure 43).

Measurement Parameters:

TX FREQ:

Measures and displays Interrogation Frequency in MHz.

ERP:

Measures and displays Interrogator ERP (Effective Radiated Power) in dBm, dBW or W peak. Units are selected in SETUP-GENERAL Screen (1-2-4, Figure 11).

PRF:

Measures and displays interrogator Pulse Repetition Frequency.

P_1 WIDTH:

Measures and displays Interrogator P_1 width in us.

P_2 WIDTH:

Measures and displays Interrogator P_2 width in us.

P_1/P_2:

Measures and displays interrogator P_1 to P_2 spacing and displays Mode X or Y, depending on spacing.

Control Field Power Up Defaults:

FREQ: 978 MHz.

RF LVL: Maximum

RATE: 0 kts IN

RANGE: 0 nm

% REPLY: 100

ECHO: OFF

SQTR: ON

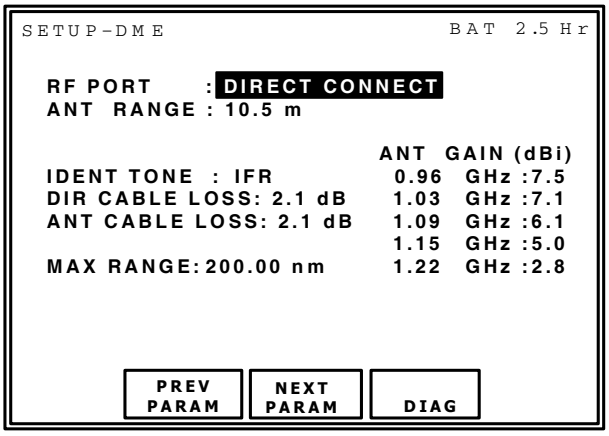
IDENT: ON

4.4.1 SETUP

Setup DME

Setup DME Screen contains parameters which determine the operational characteristics of each functional mode of the Test Set.

NOTE: Setup Screen information is entered before conducting test operations.



Setup DME Screen
Figure 43

STEP	PROCEDURE

1. Press SETUP Select Key to display SETUP-DME Control Screen (1-2-4, Figure 43).
2. Set following parameters by pressing NEXT PARAM and PREV PARAM to select field. Use DATA Keys to slew the data.

   - RF I/O CONNECTOR:

     Selects ANTENNA (ANT CONNECTOR) or DIRECT CONNECT via RF I/O Connector.

   - DIRECT CABLE LOSS:

     Entered in dB, normally this is set once, figure marked on supplied RF coaxial cable (0.0 to 9.9 dB).

   - ANT CABLE LOSS:

     Entered in dB, normally this is set once, figure marked on supplied RF coaxial cable (0.0 to 9.9 dB).

STEP	PROCEDURE

   - ANT RANGE:

     Test Set Antenna to transponder antenna range (6 to 250 ft or 2.0 to 75.0 m).

     NOTE: SETUP GENERAL Screen UNITS parameter determines feet or meters (1-2-4, Figure 11).

   - ANT GAIN:

     Entered in dBi and normally set once, the five gain figures (0.0 to 20.9) for frequencies are:

     0.96 GHz 1.15 GHz
     1.03 GHz 1.21 GHz
     1.09 GHz

     Gain figures are also marked on the Directional Antenna.

   - IDENT TONE:

     Sets the three letter IDENT tone. Default is IFR.

   - MAX RANGE:

     Limits the maximum simulated range (10.00 to 450.00) Default is 400 nm.

3. Press DME Mode Key to return to DME Test Screen.

DME Test Guidelines:

1. Press DME Mode Key to display DME Test Screen (1-2-4, Figure 42).
2. Set Test Set controls as follows:

   UUT LVL: Maximum Output

   RF FREQ: To desired channel

   RANGE: 0.00 nm

   RATE: STOP

   IN/OUT: OUT

   ECHO: OFF

   SQTR: OFF

   % REPLY: 70

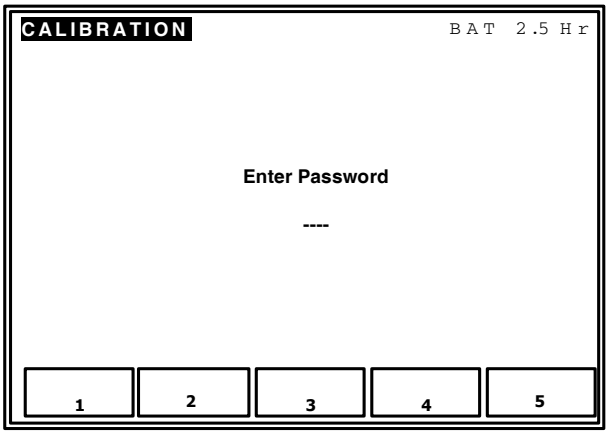
   IDENT: ON

STEP	PROCEDURE
3.	Set SQTR to ON and verify UUT DME searches and locks on within 1.5 sec.
4.	Verify Range displayed on UUT DME distance indicator is 0 nm (±0.5 nm).
5.	Verify Track PRF is ≤30 Hz.
6.	Verify TX Frequency is within ±0.07 MHz of assigned channel.
7.	Verify P_1 to P_2 Pulse Widths are 3.5 μs (±0.5 μs).
8.	Verify P_1 to P_2 Pulse Spacing is: X channel 12.0 us (±0.5 μs) Y Channel 36.0 us (±0.5 μs)
9.	Verify ERP is for: TSO'd DME >18,000 ft ≥250 W (+54 dBm) TSO'd DME <18,000 ft ≥50 W (+47 dBm)
10.	Set RATE to 600 kts and verify UUT DME distance indicator displays an outbound track, without breaking lock.
11.	Set IN/OUT to IN and verify UUT DME distance indicator displays an inbound track, without breaking lock. Set RATE to 0 kts.
12.	Set %REPLY to 0. Verify distance continues to be displayed and flag remains out of view for 8 s (±4 sec). After memory times out, verify on UUT DME distance indicator that distance is not displayed and flag is in view. Verify Search PRF is ≤150 Hz.
13.	Set %REPLY to 70 and RF LVL to -79 dBm, verify UUT DME locks on. Set IDENT tone to ON. Verify 1350 Hz Ident morse is present on UUT DME audio. Set IDENT to OFF.
14.	Set RANGE to 40 nm. Set ECHO to ON. Verify UUT DME does not break lock and range displayed on UUT DME indicator is 40 nm (±0.5 nm). Set ECHO to OFF.
15.	Set UUT LVL to -79 dBm and %REPLY to 70. Verify UUT DME is locked on. Adjust UUT LVL in -1 dB steps, allowing 15 sec between steps until UUT DME breaks lock. Verify UUT LVL is ≥-83 dBm.

STEP	PROCEDURE
	NOTE: OEM Test procedures should be followed.
	NOTE: For Radiated Testing, Maximum UUT LVL settable depends on distance of Test Set from UUT and Setup DME Screen settings.

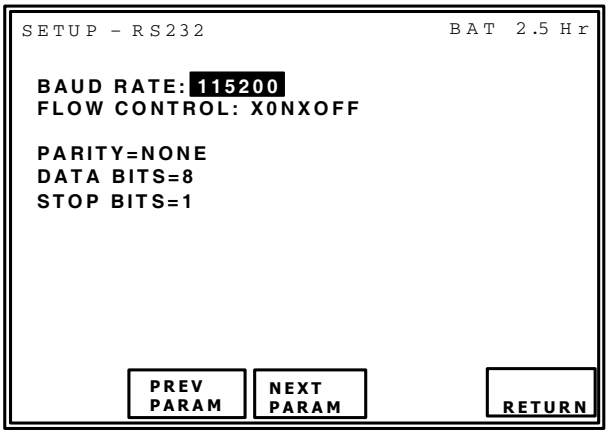
Calibration:

1. Press CAL Soft Key to display the Calibration Screen. Consult maintenance manual for required password.



Calibration Screen
Figure 44

2. Press RS232 Soft Key to display the RS-232 Screen.



Setup RS232 Screen
Figure 45

4.5 TCAS

The IFR 6000 fully tests ATCRBS and Mode S, ACAS, TCAS I and II (Traffic Alert Collision Avoidance System).

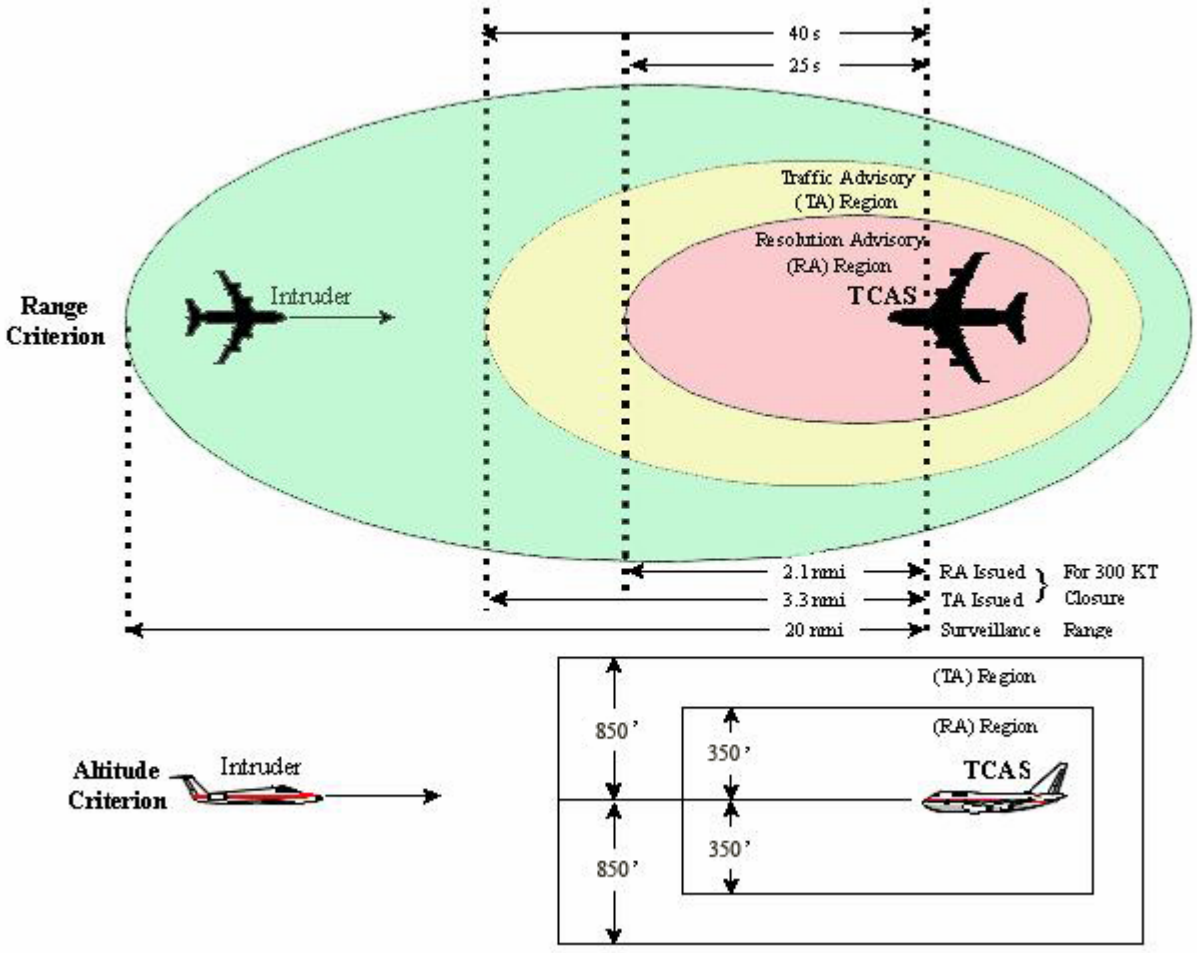
The test set simulates an Intruder Aircraft converging on the position of the TCAS UUT. By manually defining a scenario or utilizing the factory default scenarios in test set memory, the Test Set operator can verify the correct TA's (Traffic Advisory) and RA's (Resolution Advisory) have occurred on the TCAS display.

The IFR 6000 is used with the directional antenna attached, allowing the user to move the test set to different locations and headings from the Aircraft UUT.

4.5.1 TCAS OPERATION CONCEPT

TCAS is a system which provides situational awareness of the surrounding airspace of an aircraft to the pilot and crew. TCAS establishes a volume of airspace around the aircraft based upon range, speed and altitude. Refer to 1-2-4, Figure 46.

By working in-conjunction with the aircraft Transponder system, TCAS can determine the relative threat of an aircraft and issue visual and audible advisories to assist the crew in taking action that prevents a collision. Refer to 1-2-4, Table 3.



TCAS Protection Volume Example
5,000 ft to 10,000 ft
Figure 46

Your Altitude (ft)	SL	Tau (sec)		DMOD (nmi)		Altitude Threshold (ft)	
		TA	RA	TA	RA	TA	RA (ALIM)
<1000	2	20	N/A	0.30	N/A	850	N/A
1000 - 2350	3	25	15	0.33	0.20	850	300
2350 - 5000	4	30	20	0.48	0.35	850	300
5000 - 10,000	5	40	25	0.75	0.55	850	350
10,000 - 20,000	6	45	30	1.00	0.80	850	400
20,000 - 42,000	7	48	35	1.30	1.10	850	600
>42,000	7	48	35	1.30	1.10	1200	700

Protection Volume Parameters Versus Altitude
Table 3

Typical TCAS II Display
Figure 47

◇	**Non-Threat Traffic:** An open white diamond indicates that an intruder's relative altitude is ±1200 ft vertically or distance is beyond 6 nm range and not yet considered a threat.
◆	**Proximity Intruder Traffic:** A filled white diamond indicates that the intruding aircraft is ±1200 ft vertically and within 6 nm range, and still not considered a threat.
●	**Traffic Advisory:** A symbol change to a filled yellow circle indicates that the intruding aircraft is considered to be potentially hazardous. Depending on altitude TCAS II displays a TA when the time to CPA is between 20 and 48 sec.

■	**Resolution Advisory:** A solid red square indicates that the intruding aircraft is projected to be a collision threat. TCAS II calculates that the intruder has reached the point where a Resolution Advisory is necessary. The time to closest approach with the intruder is now between 15 and 35 sec depending on altitude. The symbol appears together with an appropriate audio warning and a vertical maneuver indication on the RA/VSI.
-05	**Numbers:** Represents the intruder aircraft relative altitude ±100 ft levels from aircraft.
↑	**Arrows:** Indicate if the intruder aircraft is ascending or descending from relative position.

4.5.2 TCAS TESTING

The IFR 6000 provides three basic TCAS test functions.

TCAS Screen

Provides simulated encounters with intruding Mode S or Mode C aircraft. Measures Peak Pulse Power or ERP (Effective Radiated Power) and TX Frequency of the interrogator.

Monitor Screens

Surveillance Monitor:

Displays surveillance interrogations UF0 and UF16 field content, surveillance interval and count.

Broadcast Monitor:

Displays TCAS broadcast interrogations UF16 field content, broadcast interval and count.

Displays RA broadcast interrogations UF16 field content, broadcast interval and count.

Whisper-Shout Monitor:

Displays whisper-shout sequence interval, count of interrogations with no suppression, S1, P2 or both S1 and P2. Interrogation spacing is also displayed.

Setup Screens

Sets operational range and height from test set antenna to UUT antenna, cable loss, antenna gain parameters simulated and transponder Mode S address.

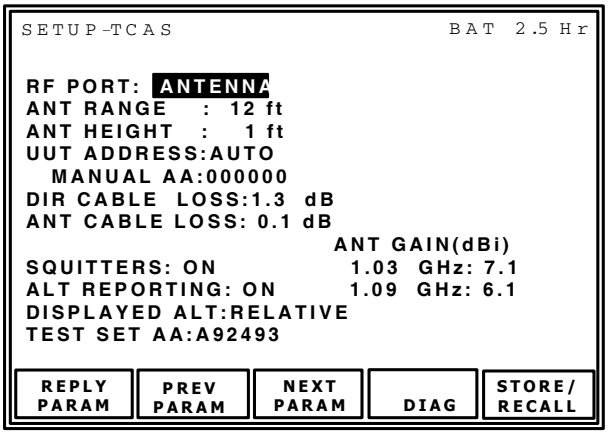
Reply Parameters Screen allows control over Mode S DF0, DF11 and DF16 field content.

4.5.3 SETUP

SETUP-TCAS SCREEN:

SETUP-TCAS Screen contains parameters which determine operational characteristics of the TCAS Functional Mode. Unless otherwise stated, last used values are retained on Power-Up.

NOTE: Enter Setup Screen information before conducting test operations.



SETUP-TCAS Screen
Figure 48

STEP	PROCEDURE

1. Press SETUP Select Key to display SETUP TCAS Screen (1-2-4, Figure 48).
2. Set following parameters by pressing NEXT PARAM and PREV PARAM to select field. Use DATA Keys to slew the data.

   - RF PORT:

     Selects ANTENNA or DIRECT CONNECT via RF I/O Connector.

   - DIR CABLE LOSS:

     Entered in dB, figure (at 1090 MHz) marked on supplied long RF coaxial cable.

     NOTE: Cable loss range is 0.0 to 9.9 dB.

   - ANT CABLE LOSS:

     Entered in dB, figure (at 1090 MHz) marked on supplied short RF coaxial cable.

     NOTE: Cable loss range is 0.0 to 9.9 dB.

STEP PROCEDURE

- ANT GAIN:

  Entered in dBi, gain figures (0.0 to 20.9) for 1.03 and 1.096 GHz marked on supplied Directional Antenna.

- ANT RANGE:

  Test Set Antenna to TCAS antenna horizontal range (6 to 250 ft or 2.0 to 75.0 m).

  NOTE: UNITS parameter determines feet or meters (1-2-4, Figure 11).

- ANT HEIGHT:

  Test Set Antenna to TCAS antenna height difference (1 to 99 ft or 0.5 to 30.0 m).

  NOTE: UNITS parameter determines feet or meters (1-2-4, Figure 11).

- UUT ADDRESS:

  If AUTO is selected the test set interrogates the TCAS UUT Transponder with an ATCRBS All Call, to obtain the Mode S address, which is used in subsequent Transponder interrogations to obtain the TCAS UUT altitude.

  If MANUAL is selected, the UUT address is obtained from the MANUAL AA field.

- MANUAL AA:

  User entered Transponder address for TCAS UUT Transponder.

- SQUITTERS:

  Used to turn ON or OFF Simulated Mode S Transponder DF11 squitters containing address specified in TEST SET AA: field. Squitters are transmitted once per second and should be set to ON for normal interrogation/reply operation.

- ALT REPORTING:

  Used to turn ON or OFF Simulated Transponder ATCRBS Mode C or Mode S altitude information.

STEP PROCEDURE

- DISPLAYED ALT:

  With RELATIVE selected, simulated altitude displayed in ALT field of TCAS screen is relative to UUT Altitude (i.e., ± UUT altitude). With ABSOLUTE selected, simulated altitude displayed in ALT field of TCAS screen is actual altitude.

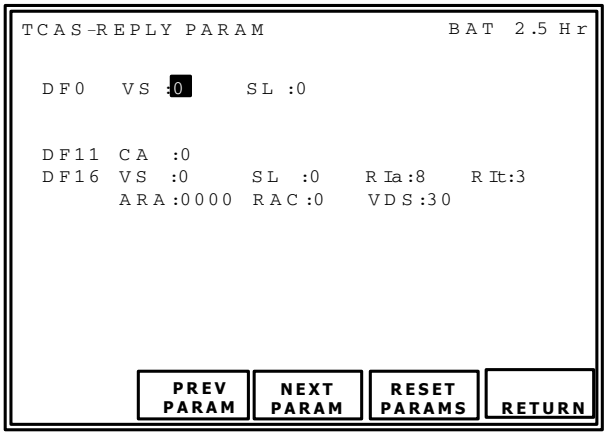
- TEST SET AA:

  Enter test set simulated Mode S Transponder address in HEX.

3. Press TCAS Mode Key to return to TCAS Test Screen.

TCAS REPLY PARAMETERS SCREEN:

Press SETUP SELECT Key until TCAS-SETUP screen is displayed. Press REPLY PARAM Soft Key to display TCAS Reply Param Screen (1-2-4, Figure 49).



TCAS Reply Parameters Screen
Figure 49

The reply parameters screen controls the content of the Mode S Replies DF0, DF11 and DF16 used in the TCAS test. The message fields allow the user to program capability information and various advisories to the TCAS interrogator.

NOTE: Refer to Appendix I for detailed descriptions of the following displayed Downlink Format (DF) fields and subfields. All fields are displayed in hexadecimal. Unless otherwise specified, both single and continuous SLEW key depressions change values by 1.

USER CONTROL SOFT KEYS

NEXT PARAM:

Selects next control field, including selection of fields that have dedicated keys.

PREV PARAM:

Selects previous control field, including selection of fields that have dedicated keys.

RESET PARAMS:

Resets all parameters to factory default.

RETURN:

Displays the SETUP-TCAS screen.

CONTROL FIELD SOFT KEYS

VS:

Enter vertical status. VS: field indicates intruding aircraft is airborne when '0' or on the ground when '1'. The VS: field is transmitted in DF0 and DF16.

SL:

Enter simulated IFR 6000 Sensitivity Level (1-2-4, Table 4)

NOTE: The SL: field contains simulated sensitivity level information and does not actually set the IFR 6000 to a particular Sensitivity Level.

INPUT DATA	DEFINITION
0	No Sensitivity Level reported
1	Operates at Sensitivity Level 1
2	Operates at Sensitivity Level 2
3	Operates at Sensitivity Level 3
4	Operates at Sensitivity Level 4
5	Operates at Sensitivity Level 5
6	Operates at Sensitivity Level 6
7	Operates at Sensitivity Level 7

SL: Field Valid Data
Table 4

CA:

Enter transponder Capability (1-2-4, Table 5). The Test Set transmits the CA: field in DF11 (squitter transmissions).

INPUT DATA	DEFINITION
0	No communications capability (surveillance only)
1	Comm-A and Comm-B capability
2	Comm-A, Comm-B and Comm-C capability
3	Comm-A, Comm-B, Comm-C and Comm-D capability

CA: Field Valid Data
Table 5

RIa:

Enter air-to-air Reply Information for an acquisition report. The RIa: field contains airspeed data. The field can be set from '0' to 'F' but only '8' to 'E' is valid (1-2-4, Table 6). The Test Set transmits the RIa: field in DF0 and DF16 when interrogator requests an acquisition report.

RIa: FIELD INPUT DATA	DEFINITION (AIRSPEED)
8	No data available
9	≤75 kts
A	>75 kts and ≤150 kts
B	>150 kts and ≤300 kts
C	>300 kts and ≤600 kts
D	>600 kts and ≤1200 kts
E	>1200 kts

RI: Field (Acquisition) Valid Data
Table 6

RIt:

Enter air-to-air Reply Information for a tracking report. The RIt: field contains TCAS capability data. The field can be set from '0' to 'F' but only '0' '3' and '4' are valid (1-2-4, Table 7).

RIt: FIELD INPUT DATA	DEFINITION (TCAS CAPABILITY)
0	No on-board TCAS
3	On-board TCAS has vertical-only resolution ability.
4	On-board TCAS has vertical and horizontal resolution ability.

RI: Field (Tracking) Valid Data
Table 7

RAC:

Enter simulated TCAS Resolution Advisory Complements. The RAC: field indicates current active Resolution Advisory Complements being received from all other TCAS aircraft with on-board resolution capability (1-2-4, Table 8). The test set transmits the RAC: field in DF16 (part of MV field).

INPUT DATA	DEFINITION
0	No resolution advisory complements
1	Don't turn right.
2	Don't turn left.
4	Don't climb.
8	Don't descend.
NOTE: The sum of the Input Data codes indicates multiple active resolution advisories are being received.	

RAC: Field Valid Data
Table 8

ARA:

Enter simulated TCAS resolution advisory report. The ARA: field indicates all current Active Resolution Advisories being transmitted by the intruding aircraft (IFR 6000) (1-2-4, Table 9). The Test Set transmits the ARA: field in DF16 (part of MV field).

INPUT DATA	DEFINITION
0001	Don't turn right.
0002	Don't turn left.
0004	Turn right.
0008	Turn left.
0010	Don't climb faster than 2000 fpm.
0020	Don't climb faster than 1000 fpm.
0040	Don't climb faster than 500 fpm.
0080	Don't climb.
0100	Descend.
0200	Don't descend faster than 2000 fpm.
0400	Don't descend faster than 1000 fpm.
0800	Don't descend faster than 500 fpm.
1000	Don't descend.
2000	Climb.
NOTE: Data codes are added together to indicate multiple active resolution advisories are being transmitted.	

ARA: Field Valid Data
Table 9

VDS:

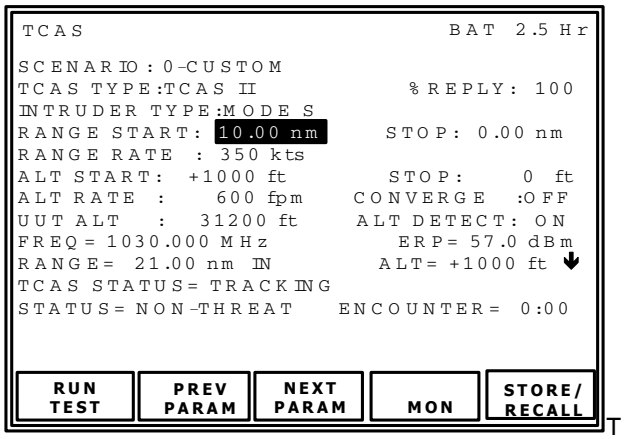
Enter MV message field content definition. Set the VDS: field to '30' for coordination reply messages (default value). The test set transmits the VDS: field in DF16 (part of MV field).

CLI:

Enter Coordination Lock Indicator ('0' is Off, '1' is On). The test set transmits the CLI: field in DF16 (part of MV field).

4.5.4 TCAS SCREEN

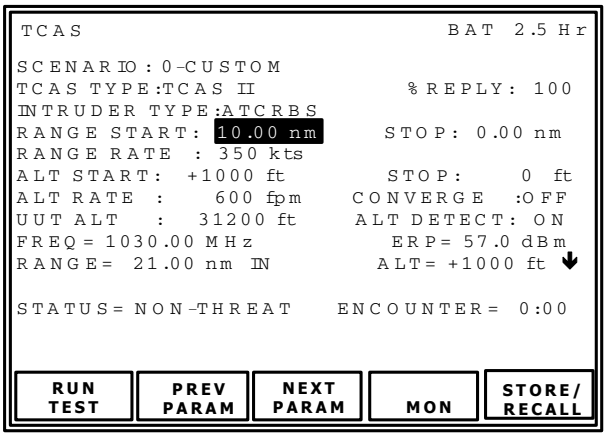
Press TCAS Mode Key until TCAS Test Screen is displayed (1-2-4, Figure 50).



TCAS Screen (Mode S)
Figure 50

The TCAS screen provides simulated planned encounters with ATCRBS Mode C or Mode S intruders. The TCAS screen is used to verify audio and visual TCAS operation (Traffic and Resolution Advisories). Intruding flight patterns are programmed from the TCAS screen and stored in one of sixteen user named scenario data storage locations.

Eight factory pre-defined scenarios are provided which may be recalled, modified and stored under a user named scenario.



TCAS Screen (ATCRBS)
Figure 51

Calculation of Scenarios:

Ex: Assume intruder at 10,000 ft above UUT altitude. Intruder velocity is 600 kts and intruder distance is 20 nm.

Manual calculation of altitude rate to ensure convergence:

Select CONVERGE: OFF

STOP ALT= 0 ft, STOP RANGE= 0 nm.

$$\text{ALT RATE} = \frac{\text{ALT START} \times \text{RANGE RATE}}{\text{START RANGE} \times 60}$$

$$\text{ALT RATE} = \frac{10{,}000 \times 600}{20 \times 60}$$

ALT RATE = 5000 fpm

Auto calculation of altitude rate to ensure convergence:

Set the following:

RANGE START: 20 nm

RANGE RATE: 600 kts

ALT START: +10,000 ft

Select CONVERGE: ON. Altitude rate is automatically determined to achieve collision. STOP (Range) and STOP (Alt) fields is cleared, allowing easy programming of random but converging scenarios.

STEP	PROCEDURE
1.	Refer to para 1-2-4.7 for Directional Antenna use and setup procedure.
2.	Press TCAS Mode Key to display TCAS Test Screen (1-2-4, Figure 50).
3.	Set following parameters by pressing NEXT PARAM and PREV PARAM to select field. Use DATA Keys to slew the data.

STEP PROCEDURE

USER CONTROLS SOFT KEYS

RUN TEST:

Starts the TCAS Test.

NEXT PARAM:

Selects next control field. Includes selection of fields that have dedicated Keys.

PREV PARAM:

Selects previous control field. Includes selection of fields that have dedicated Keys.

MON:

Selects the Surveillance or Broadcast Monitor Screens.

STORE/RECALL:

Selects the Setup-Scenario Data Screen.

DEDICATED KEYS AND CONTROL FIELDS

RANGE:

RANGE Keys change RANGE.

RATE:

RATE Keys change RATE in 1kt steps (0 to 1200 kts).

CONTROL FIELDS SOFT KEYS

STORE/RECALL:

Selects Custom, Predefined or User defined scenarios.

TCAS TYPE:

Selections are TCAS I or TCAS II.

% REPLY:

Selects simulated transponder % reply. Selectable in 1% steps. Range is 0 to 100%.

STEP PROCEDURE

INTRUDER TYPE:

Selects intruder type MODE S or ATCRBS.

RANGE START:

Selects start range of scenario in nm. Range is Mode S, 0.00 to 260.00 nm or ATCRBS, 0.35 to 260.00.

RANGE STOP:

Selects stop range of scenario in nm. Range is Mode S, 0.00 to 260.00 nm or ATCRBS, 0.35 to 260.00.

RANGE RATE:

Selects range rate of scenario (0 to 1200 kts).

ALT START:

Selects start altitude of scenario in ft. Range is $\pm$127,700 ft.

NOTE: In all IFR 6000 TCAS scenarios, altitude START and STOP parameters are Relative to UUT altitude, enabling scenarios to be used at any altitude without reprogramming.

ALT STOP:

Selects stop altitude of scenario in ft. Range is $\pm$127,700 ft.

NOTE: In all IFR 6000 TCAS scenarios, altitude START and STOP parameters are relative to UUT altitude, enabling scenarios to be used at any altitude without reprogramming.

ALT RATE:

Selects altitude rate of scenario in fpm. Range is 0 to 10000 fpm.

CONVERGE:

When converge is ON, altitude rate is automatically calculated to achieve collision at 0 nm and 0 ft (relative to UUT). Range STOP and Alt STOP fields are blanked when converge is ON.

STEP PROCEDURE

UUT ALT:

Displays simulated intruder altitude in ft. This is either entered via the TCAS Screen or is obtained automatically from the TCAS UUT transponder when ALT DETECT is set to ON.

ALT DETECT:

When set to ON, UUT altitude is obtained automatically from TCAS UUT transponder.

FREQ:

Displays TCAS UUT transmitter frequency in MHz.

ERP:

Displays TCAS UUT transmitter ERP (Effective Radiated Power) in dBm, dBW or W peak.

RANGE:

Displays simulated range in nm.

ALT:

Displays simulated altitude. Depending on setup TCAS menu DISPLAYED ALT setting, altitude displayed is either relative to UUT ALT or actual altitude.

NOTE: In all IFR 6000 TCAS scenarios, altitude START and STOP parameters are relative to UUT altitude, enabling scenarios to be used at any altitude without reprogramming.

TCAS STATUS:

Displays TCAS status either ACQUIRING or TRACKING. When TRACKING is annunciated, an intruder should be displayed on the TCAS display (Mode S feature).

NOTE: ACQUIRING or TRACKING is determined from UF0 or UF16 discrete interrogations AQ field.

STEP PROCEDURE

STATUS:

Displays simulated test set status in relationship to TCAS UUT. Four different status messages may be displayed.

"NON THREAT"

Range is >4 nm and time until encounter is >40 s.

"PROXIMITY"

Range is ≤4 nm and time until encounter is >40 sec.

"TRAFFIC"

Time until encounter is ≤40 sec and >25 sec.

"RESOLUTION"

Time until encounter is ≤25 sec.

ENCOUNTER:

Displays time in minutes and seconds to encounter.

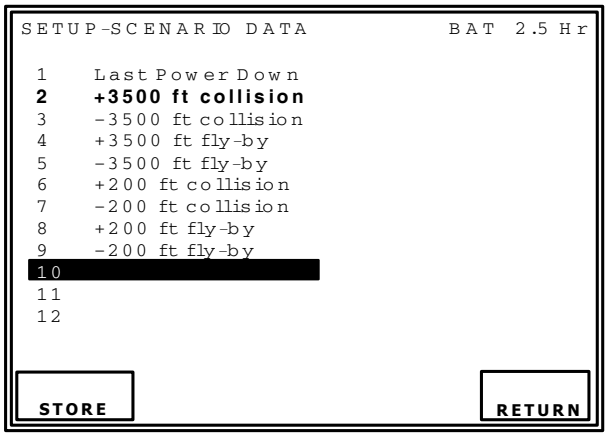
NOTE: There are usually two to three seconds of delay (target acquisition time) between the start of TCAS operation and when the UUT acquires the test set as a target.

When any UUT antenna is being tested the target acquisition time increases. Refer to Appendix K for target acquisition time probabilities.

5. Press RUN Soft Key to start test.

4.5.5 SETUP-SCENARIO DATA SCREEN

The SETUP-SCENARIO DATA Screen may be accessed from either the TCAS Screen or SETUP-TCAS Screen by pressing the STORE/RECALL Soft Key (1-2-4, Figure 52).



Setup Scenario Data Screen
Figure 52

Setup Store Name Screen
Figure 53

The Setup Scenario Screen allows the recall of nine factory predetermined scenarios and the Storage and Recall of up to 16 user defined and named scenarios.

USER CONTROL SOFT KEYS

STORE:

To store a specific scenario, use the Data Select Keys to highlight user storage locations 10 to 25 (1-2-4, Figure 52). Press STORE Soft Key to display SETUP-STORE NAME. Use the Data Select Keys to highlight desired character.

CHAR SELECT:

Press CHAR SELECT Soft Key to select character. Repeat until all characters have been selected.

ENTER:

Press ENTER Soft Key to store name and data. Use backspace key to change any previous character selection.

CANCEL:

Press CANCEL Soft Key to cancel storage operation.

RECALL:

To recall a specific scenario use the Data Select Keys to select a specific scenario. Press the RECALL Soft Key.

RETURN:

Press the RETURN Soft Key to display the previous screen.

NOTE: Scenarios are also selected by using the DATA KEYS when in the scenario field of the TCAS screen.

4.5.6 MONITOR SCREENS

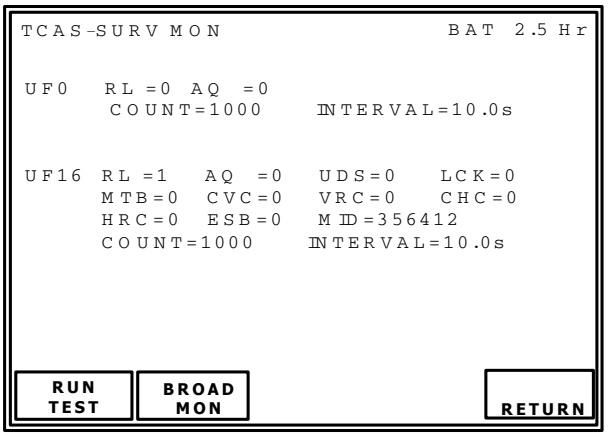
Monitor Screens are accessed from the TCAS Screen by pressing the MON Soft Key.

When INTRUDER TYPE selected is Mode S, the Test Set monitors for Uplink Formats (UF) 0 or 16. Mode S monitoring consists of two different Monitor screens; the surveillance monitor and the broadcast monitor.

When INTRUDER TYPE selected is ATCRBS, the Test Set monitors the Whisper-Shout sequence.

4.5.6.1 Surveillance Monitor

The Surveillance Monitor is a general monitoring screen displaying the contents of the major interrogation fields incorporated in UF0 and UF16. Information is displayed in hexadecimal and can be used to verify interrogator bit accuracy (1-2-4, Figure 54).



TCAS Surveillance Monitor Screen
Figure 54

STEP	PROCEDURE

1. Connect UUT to IFR 6000 RF I/O Connector or IFR 6000 Directional Antenna (facing towards UUT Antenna) to Antenna Connector.
2. Perform the Setup Procedure (para 1-2-4.5.3). Set INTRUDER TYPE: to **MODE S**.

STEP	PROCEDURE

3. If UUT simulates altitude and direct connection is not used, shield UUT Antenna being tested with Antenna Shield. Refer to para 1-2-4.6. Position Directional Antenna ≤20 ft (6.1 m) from UUT Antenna being tested.
4. Press MON Soft Key to enter Surveillance Monitor screen. (Test Set displays information from the last received or recalled Mode S interrogation.)
5. Press RUN Soft Key to initiate Monitor Mode. (Test Set displays information for the latest received interrogation.)

   The bottom line indicates running Monitor by displaying: ****Testing****.

   Refer to Appendix F for detailed description of the following displayed Uplink Format fields and subfields.

   - UF:

     Uplink Format number, as received in the Mode S interrogation, is displayed in decimal form.

   - RL:

     Reply Length field, sent in UF0 and UF16, indicates request for transponder (IFR 6000) to reply with DF0 if set to 0 or DF16 if set to 1.

   - AQ:

     Acquisition field, sent in UF0 and UF16, indicates request for transponder (IFR 6000) to reply with capability (tracking) report if set to 0 or airspeed (acquisition) report if set to 1.

   - UDS:

     The UDS: field, sent in UF16 (part of MU field), defines the content of the MU message field. The UDS: field indicates TCAS Resolution Advisories Lock Requests or Resolution Messages if set to 30 or TCAS Broadcast Messages if set to 32.

STEP PROCEDURE

- LCK:

  If set to 1, the Lock field indicates request for the transponder (IFR 6000) to send information for TCAS Resolution Advisory (transponder is a collision threat to the interrogator) and is received in UF16 (part of MU field).

- MTB:

  If set to 1 the Multiple Threat Bit received in UF16 (part of MU field) indicates the interrogator is receiving more than one collision threat.

- CVC:

  The Cancel Vertical Resolution Advisory Complement is received in UF16 (part of MU field) (1-2-4, Table 10).

CVC: FIELD	DEFINITION
0	No cancellation
1	Cancel, don't descend.
2	Cancel, don't climb.

CVC: Field Display Data
Table 10

- VRC:

  The Vertical Resolution Advisory Complement is received in UF16 (part of MU field) (1-2-4, Table 11).

VRC: FIELD	DEFINITION
0	No complement sent
1	Don't descend.
2	Don't climb.

VRC: Field Display Data
Table 11

STEP PROCEDURE

- CHC:

  The Cancel Horizontal Resolution Advisory Complement is received in UF16 (part of MU field) (1-2-4, Table 12).

CHC: FIELD	DEFINITION
0	No cancellation
1	Cancel, don't turn left.
2	Cancel, don't turn right.

CHC: Field Display Data
Table 12

- HRC:

  Refer to 1-2-4, Table 13 for the Horizontal Resolution Advisory Complement received in UF16 (part of MU field).

HRC: FIELD	DEFINITION
0	No complement sent
1	Intruder TCAS sense is turn left/Don't turn left.
2	Intruder TCAS sense is turn left/Don't turn right.
5	Intruder TCAS sense is turn right/Don't turn left.
6	Intruder TCAS sense is turn right/Don't turn right.

HRC: Field Display Data
Table 13

STEP PROCEDURE

- ESB:

  Refer to 1-2-4, Table 14 for the Encoded/Vertical Sense Bits received in UF16 (now VSB, part of MU field) to verify Vertical Resolution Advisory Complements.

CVC: FIELD	VRC: FIELD	VALID ESB: FIELD
0	0	0
0	1	E
0	2	7
0	3	9
1	0	B
1	1	5
1	2	C
1	3	2
2	0	D
2	1	3
2	2	A
2	3	4
3	0	6
3	1	8
3	2	1
3	3	F

ESB: Field Display Data
Table 14

- MID:

  The MID: field, received in UF16 (part of MU field) displays the discrete Mode S address of the TCAS interrogator.

STEP PROCEDURE

- INTERVAL:

  The IFR 6000 displays time from the start of one interrogation to the start of the next interrogation. The IFR 6000 looks for the interval between 0.53 sec (time to display information) and 1.27 sec (1.0 sec is nominal).

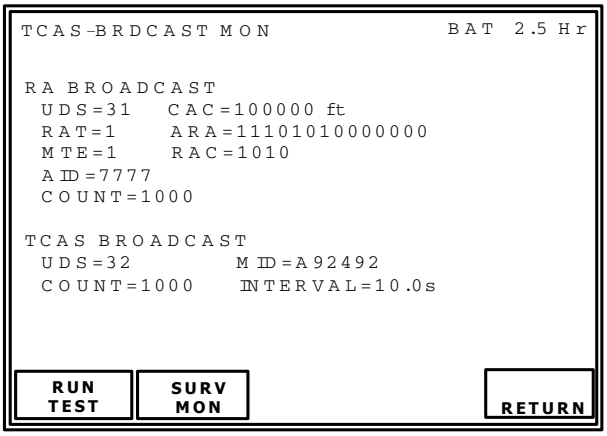
- COUNT:

  The COUNT: field displays the number of TCAS Surveillance Interrogations received during the test operation.

6. Press STOP Soft Key to terminate test operation.

4.5.6.2 BROADCAST MONITOR

The Broadcast Monitor verifies the TCAS Broadcast is transmitted in UF16 approximately every ten seconds. The Test Set detects a TCAS Broadcast when the AA address field decoded from the AP field in UF16 has all ones. The Broadcast Monitor also verifies the RA Broadcast content (1-2-4, Figure 55).



TCAS Broadcast Monitor Screen
Figure 55

STEP PROCEDURE

1. Press BROAD MON Soft Key to enter Broadcast Monitor. The Test Set displays information from last received TCAS Broadcast or RA Broadcast.
2. Press RUN Soft Key to initiate Monitor mode. The Test Set displays information for the latest received interrogation.

   The bottom line indicates running Monitor by displaying: ***Testing***.

   NOTE: UDS and MID field descriptions are the same as the TCAS Surveillance Monitor.

   - CAC:

     The CAC= field, received in UF16 (part of MU field), displays the Mode C altitude code of the reporting aircraft.

   - RAT:

     The RAT= field received in UF16 (part of MU field) indicates that an RA has been terminated. If set to 0, the RA indicated by the ARA subfield is currently active. If set to 1, the RA indicated by the ARA subfield has been terminated. The one is set for 18 sec ±1 sec.

   - ARA:

     The ARA= field indicates all current Active Resolution Advisories being transmitted by the UUT (1-2-4, Table 15).

DEFINITION
BINARY DATA
Don't turn right.
0000 0000 0000 0001
Don't turn left.
0000 0000 0000 0010
Turn right.
0000 0000 0000 0100
Turn left.
0000 0000 0000 1000
Don't climb faster than 2000 fpm.
0000 0000 0001 0000
Don't climb faster than 1000 fpm.
0000 0000 0010 0000
Don't climb faster than 500 fpm.
0000 0000 0100 0000
Don't climb.
0000 0000 1000 0000
Descend.
0000 0001 0000 0000
Don't descend faster than 2000 fpm.
0000 0010 0000 0000
Don't descend faster than 1000 fpm.
0000 0100 0000 0000
Don't descend faster than 500 fpm.
0000 1000 0000 0000
Don't descend.
0001 0000 0000 0000
Climb.
0010 0000 0000 0001
NOTE: Data codes are added together to indicate multiple active resolution advisories are being transmitted.

ARA= Field Valid Data
Table 15

STEP PROCEDURE

- RAC:

  The RAC= field indicates current active Resolution Advisory Complements being received from all other TCAS aircraft with on-board resolution capability (1-2-4, Table 16).

DATA	DEFINITION
0	No resolution advisory complements
1	Don't turn right.
2	Don't turn left.
4	Don't climb.
8	Don't descend.
NOTE:	The sum of the Input Data codes indicates multiple active resolution advisories are being received.

RAC= Field Valid Data
Table 16

- MTE:

  The MTE= field, received in UF16 (part of MU field), indicates if two or more simultaneous threats are currently being processed by the TCAS threat resolution logic. 0= One threat is being processed by the resolution logic (when ARA bit 41=1); or no threat is being processed by the resolution logic (when ARA bit 41=0). 1= Two or more simultaneous threats are being processed by the resolution logic.

- AID:

  The AID= field, received in UF16 (part of MU field), displays the Mode A identity code of the reporting aircraft.

- INTERVAL:

  The INTERVAL= field displays the time interval, in seconds, between the latest two TCAS Broadcast Messages received (nominally 10 sec for each interrogator).

STEP PROCEDURE

NOTE: TCAS Broadcast Messages are jittered ±0.2 sec off the nominal 10 sec interval time. The TCAS Broadcast Message may also be staggered between the directional antennas causing shorter intervals, if detected.

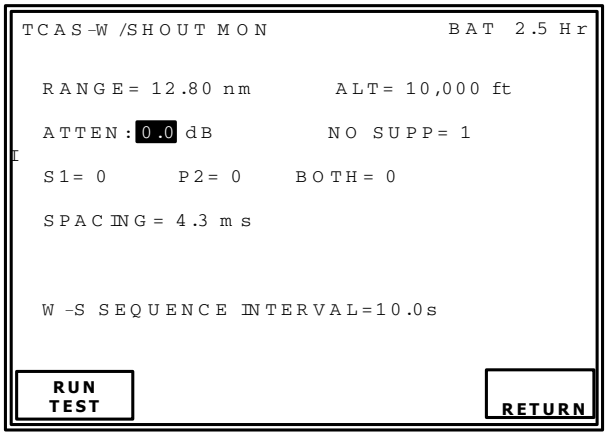
- COUNT:

  The COUNT: field displays the number of TCAS Broadcast Messages received during the test operation.

3. Press STOP Soft Key to terminate test operation.

4.5.6.3 ATCRBS (WHISPER-SHOUT)

The Whisper-Shout Monitor screen provides information used to verify whisper-shout steps and Side Lobe Suppression (SLS). By conducting several tests from different points around the aircraft (para 1-2-4.5.7), the capabilities of the TCAS interrogator concerning coverage (directional and/or omni-directional), whisper-shout sequence operation and interrogation timing are effectively evaluated (para 1-2-4, Figure 56).



Whisper-Shout Monitor Screen
Figure 56

STEP PROCEDURE

1. Connect UUT to IFR 6000 RF I/O Connector or IFR 6000 Directional Antenna (facing towards UUT Antenna) to ANT Connector.
2. Perform the Setup Procedure (para 1-2-4.5.3). Set INTRUDER TYPE: to ***ATCRBS***.
3. If UUT simulates altitude and direct connection is not used, shield UUT Antenna being tested with Antenna Shield. Refer to para 1-2-4.6. Position Directional Antenna ≤20 ft (6.1 m) from UUT Antenna being tested.
4. Press MON Key to enter Whisper-Shout Monitor Screen. The IFR 6000 displays information from the last received or recalled whisper-shout sequence. The latest sequence is displayed if the Test Set is already in the running mode.
4. Set following parameters by pressing NEXT PARAM and PREV PARAM to select field. Use DATA Keys to slew data.

   - RANGE:

     The RANGE: field is the same as in TCAS Test (para 1-2-4.5.4).

   - ALT:

     The ALT: field is the same as the ALT: field in TCAS Test (para 1-2-4.5.4).

   - ATTEN:

     Set attenuation of incoming signals (UUT interrogations). (The same attenuation is set for outgoing signals [IFR 6000 replies] when Scenario Test or Reply Test functions have been initiated. The IFR 6000 sets a default value internally based upon the UUT distance information entered in XPDR Setup Menu.)

   NOTE: Attenuation may be changed using the Whisper-Shout Monitor screen. Default value is restored upon exit from the screen.

STEP PROCEDURE

6. Press RUN Soft Key to initiate Monitor mode. (The IFR 6000 displays latest whisper-shout sequence information.)

   The bottom line indicates running Monitor by displaying ****Testing****.

   - NO SUPP:

     The IFR 6000 displays the number of processed interrogations, received in latest sequence, without detected S_1 (whisper-shout suppression) and P_2 (SLS) pulses. These interrogations solicit replies.

   NOTE: If a TCAS Test has been activated, the IFR 6000 sends the number of replies indicated in the NO SUPP: field.

   - S1:

     The IFR 6000 displays the number of processed interrogations, received in latest sequence, containing a detected S_1 pulse, but without a detected P_2 pulse.

   NOTE: S1: field added with NO SUPP: field provides the number of whisper-shout steps received in latest sequence from the UUT Antenna directed towards the Test Set.

   - P2:

     The IFR 6000 displays the number of interrogations, received in latest sequence containing a detected P_2 pulse, but without a detected S_1 pulse. This information can be used to verify correct SLS operation when the IFR 6000 is positioned between the directional antenna lobes. The P2: field indicates interrogations not directed towards the Test Set.

   - BOTH:

     The IFR 6000 displays the number of processed interrogations, received in latest sequence containing both detected S_1 and P_2 pulses. The BOTH: field added to the P2: field indicates the number of total interrogations not directed towards the Test Set (from the other UUT Antennas).

STEP PROCEDURE

- SPACING:

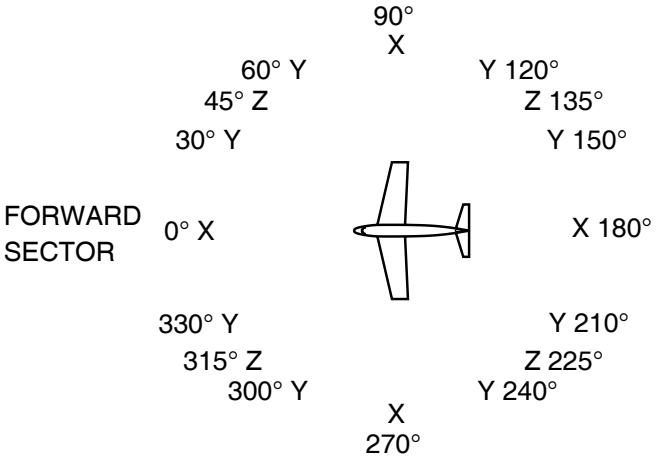
  The IFR 6000 displays the minimum time spacing in ms between any two successive interrogations received in latest sequence.

- W-S SEQUENCE INTERVAL:

  The IFR 6000 displays time from the start of one whisper-shout sequence to the start of the next whisper-shout sequence. The IFR 6000 looks for the interval between 0.53 sec (time to display information) and 1.27 sec (1.0 sec is nominal).

7. Press STOP Soft Key to terminate test operation.
8. Press RETURN Soft Key to exit Whisper-Shout Monitor Screen.

4.5.7 RECOMMENDED TEST PROCEDURE



NOTE: X, Y AND Z REPRESENT TEST LOCATIONS. (NUMBER)° IS BEARING.

Recommended Test Locations
Figure 57

STEP	PROCEDURE
	INITIAL SETUP
1.	Position Test Set at Forward Sector Test Location ((1-2-4, Figure 57) ≤50 ft (15.24 m) from and in line of sight with TCAS top antenna.
2.	Press SETUP Key. Use NEXT PARAM and PREV PARAM Keys to enter UUT Antenna Range Height and Test Set Directional Antenna information.
3.	Press TCAS Mode key to display TCAS Screen.
4.	Set INTRUDER TYPE: field to MODE S
5.	Select SCENARIO: field and slew to (6 +200 ft Collision).
6.	Set ALT DETECT field to ON.
	TCAS ADVISORY OPERATION AND BEARING ACCURACY
7.	Press RUN Soft Key to initiate test operation.
8.	Verify UUT visual and audio operation:
	● Verify Traffic Advisory at 40 sec until encounter time.
	● Verify Resolution Advisory at 25 sec until encounter time.
	● Verify TCAS bearing reads 0° (±15°).

STEP	PROCEDURE
9.	Press STOP Soft Key to terminate test operation.
	TCAS SURVEILLANCE OPERATION
10.	Press MON Key to display TCAS Surveillance Monitor Screen.
11.	Press RUN Soft Key to initiate test operation.
12.	Verify TCAS Surveillance Interval. INTERVAL: 0.53 to 1.27 sec.
13.	Press STOP Soft Key to terminate test operation.
	TCAS BROADCAST OPERATION
14.	Press BROAD MON Soft Key to display TCAS Broadcast Monitor screen.
15.	Press RUN Soft Key to initiate test operation.
16.	Verify TCAS Broadcast Interval. INTERVAL: 10 sec (±0.2 sec) and MID: field contains correct UUT address.
17.	Press STOP Soft Key to terminate test operation.

STEP	PROCEDURE

TCAS OPERATES AT EVERY STEP IN W-S SEQUENCE (Not available in V1.01)

18. Press TCAS Mode Key to display TCAS Screen.
19. Set INTRUDER TYPE: field to ATCRBS.
20. Press MON Key to enter Whisper-Shout Monitor Screen.
21. Press RUN Soft Key to initiate test operation.
22. Starting at ***0.0***, slew ATTEN: field up in 1.0 dB steps, verifying NO SUPP: field is ≥1 at each step. Continue until S1: field is 0.
23. Press STOP Soft Key to terminate test.

UUT POWER (ERP) AND FREQUENCY

24. Press TCAS Mode Key to display TCAS screen.
25. Press RUN Soft Key to initiate test operation. Run test for >30 sec.
26. Verify power (ERP) = 49.0 dBm (±2 dBm) and frequency (FREQ) = 1030 MHz (±0.01 MHz).
27. Press STOP Soft Key to terminate test operation.
28. Reposition Test Set To a "Y" Test Location (1-2-4, Figure 59). Stay at same distance from UUT as established in Steps 1 through 2.

TCAS BEARING ACCURACY

29. Press TCAS Mode Key to display TCAS Screen.
30. Set INTRUDER TYPE: field to ***ATCRBS.***
31. Press RUN Soft Key to initiate test operation.
32. Verify TCAS bearing is correct (±15°).
33. Press STOP Soft Key to terminate test operation.
34. Reposition Test Set to a "Z" Test Location (1-2-4, Figure 59). Stay at same distance from UUT as established in Steps 1 through 2.

STEP	PROCEDURE

SLS PATTERN AT CROSSOVER

35. Press MON Soft Key to enter Whisper Shout Monitor Screen.
36. Press RUN Soft Key to initiate test operation.
37. Verify NO SUPP: field is ≥2.
38. Press STOP Soft Key to terminate test operation.

UUT ANTENNA PATTERN AT CROSSOVER

39. Press TCAS Mode Key to display TCAS Screen.
40. Press RUN Soft Key to initiate test operation. Run test for >30 sec.
41. Verify power (ERP) is ≤3 dB below the greater ERP of the two adjacent "X" Test Locations.
42. Press STOP Soft Key to end test operation.
43. Perform Steps 24 through 27 and 29 through 33 from all "X" Test Locations shown in 1-2-4, Figure 59. Stay at same distance from UUT as established in Steps 1 through 5.
44. Perform Steps 28 through 33 from all "Y" Test Locations shown in 1-2-4, Figure 20.
45. Perform Steps 34 through 42 from all "Z" Test Locations shown in 1-2-4, Figure 20.

NOTE: TCAS II systems do not display RA's unless Radio Altitude is above 500 ft.

NOTE: Ensure aircraft installation is in airborne state.

NOTE: Refer to para 1-2-4.5.1 regarding TCAS II control panels. When simulating an intruder above the aircraft select ABOVE.

4.6 ADS-B GENERAL

Automatic Dependent Surveillance Broadcast (ADS-B) is a technology where aircraft avionics broadcasts the aircraft position, altitude, velocity and other parameters completely autonomously.
The system is automatic because the pilot is not involved in initiating broadcasts.
The service is dependent on the aircraft position determination system.
The application is surveillance, both air-ground and air-air.

When ADS-B is used, aircraft and other vehicles continuously broadcast a message including position, heading, velocity and intent. Other uses may include obstacles transmitting a position message. Aircraft, ground-based stations and other users monitoring the channels can receive the information and use it in a wide variety of applications. Because of this potential for broad utilization, a system using ADS-B is most often discussed as a replacement for or an augmentation to current methods of monitoring aeronautical traffic.

To understand the full capability of ADS-B, consider how the current Air Traffic Control system creates information. The radar measures the range and bearing of an aircraft. Bearing is measured by the position of the rotating radar antenna when it receives a response to its interrogation from the aircraft, and range is measured by the time it takes for the radar to receive the interrogation response. The antenna beam becomes wider as the aircraft get farther away, making the position information less accurate. Additionally, detecting changes in aircraft velocity requires several radar sweeps that are spaced several seconds apart.

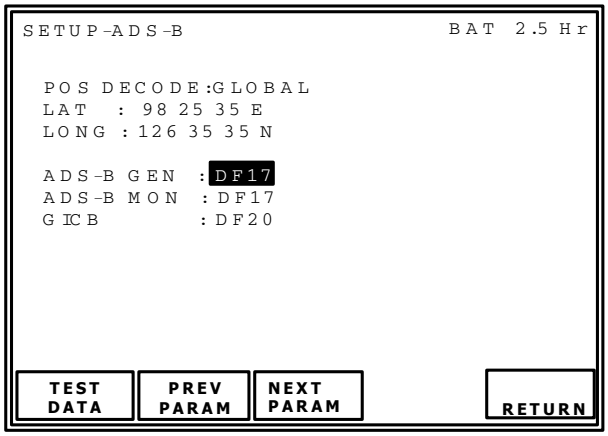
In contrast, a system using ADS-B creates and listens for periodic position and intent reports from aircraft. These reports are generated and distributed using precise instruments, such as the global positioning system (GPS) and Mode S transponders, meaning integrity of the data is no longer susceptible to the range of the aircraft or the length of time between radar sweeps. The enhanced accuracy of the information will be used to improve safety, support a wide variety of applications and increase airport and airspace capacity.

4.6.1 ADS-B/GICB MODES

The IFR 6000 provides flight line test capability for receiving (ADS-B MON mode), decoding and displaying full ADS-B DO-260/A DF17/DF18 extended squitter transmissions from Mode S transponders or DF18 extended squitters from 1090 MHz emitters. Capability to generate (ADS-B GEN mode) full DO-260/A DF17/DF18 extended squitter transmissions for testing ADS-B receivers is provided. A GICB mode fully decodes and displays all Enhanced Surveillance BDS register contents. The ADS-B/GICB is a Sub-Mode of XPDR Mode.

4.6.2 ADS-B SETUP

The SETUP-ADS-B screen is accessed from the SETUP-XPDR screen and allows the setting of operational parameters for the ADS-B/GICB functional Mode.



Setup ADS-B Screen
Figure 58

NOTE: Enter Setup Screen information before conducting test operations.

STEP	PROCEDURE
1.	Press SETUP Key until the SETUP-XPDR Screen is displayed
2.	Press ADSB SETUP Soft Key.
3.	Set the parameters by pressing NEXT PARAM (1-2-4, Figure 58). Press PREV PARAM to select the field. Use DATA Keys to slew the data. Parameters are:

STEP PROCEDURE

- POS DECODE:

  With GLOBAL selected simulated or decoded Latitude and Longitude will use the Global algorithm. BDS 0,6 requires a local LAT and LONG to resolve CPB positional algorithm ambiguity.

  With LOCAL selected, simulated or decoded Latitude and Longitude (BDS 0,5 and BDS 0,6) will use the local algorithm which requires a local LAT and LONG to be entered to resolve CPR positional algorithm ambiguity.

- LAT:

  Local Latitude of UUT in Degrees, Minutes and Seconds, East or West.

- LONG:

  Local Longitude of UUT in Degrees, Minutes and Seconds, North or South.

- ADS-B GEN:

  Select Extended squitter type that test set will transmit, DF17 or DF18.

- ADS-B MON:

  Select Extended squitter type that test set will receive DF17 or DF18.

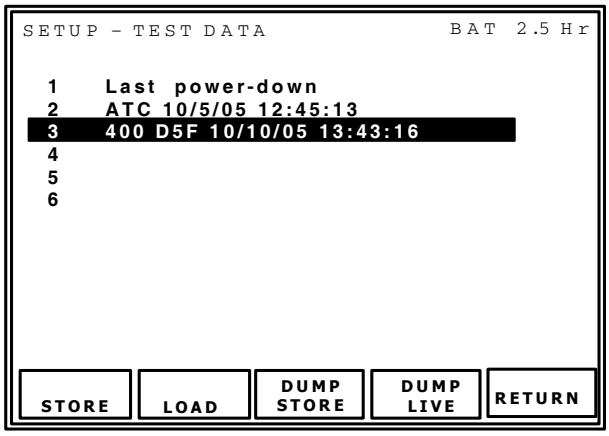
- GICB:

  Select DF20 or DF21 for GICB BDS transfer.

4. Press the RETURN softkey to display the previous screen.

SETUP TEST DATA

The SETUP-ADS-B Screen allows storage and recall of all SETUP-ADS-B test screens, including measurement data (1-2-4, Figure 59). There are six storage memories. The first storage memory retains the last power down data and cannot be overwritten. The last five are defined by the Test Set operator.



Setup Test Data Screen
Figure 59

Confirm Screen
Figure 60

Setup Store Name Screen
Figure 61

Data Storage Procedure:

STEP	PROCEDURE

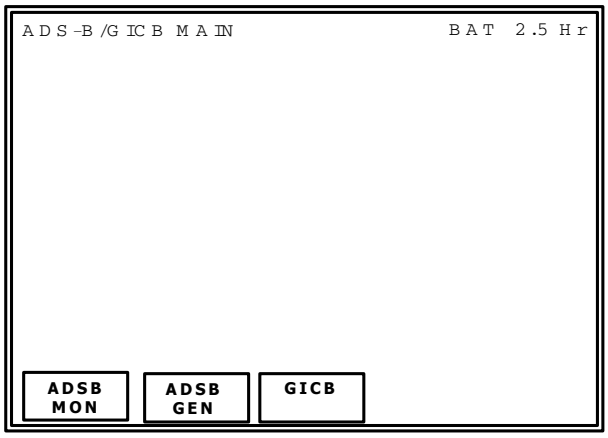
1. Press SETUP Select Key until SETUP – XPDR Screen is displayed. Press ADSB SETUP Soft Key to display SETUP ADS-B Screen (1-2-4, Figure 58).
2. Press TEST DATA Soft Key to display SETUP-ADSB Test Data Screen (1-2-4, Figure 59).
3. Use DATA Keys to select the required store. Press STORE Soft Key to display CONFIRM Screen (1-2-4, Figure 60).
4. Press YES Soft Key to confirm overwrite. SETUP STORE NAME Screen is displayed (1-2-4, Figure 61). Store name can be blank.
5. Use DATA Keys to select the character line (1-2-4, Figure 61). Use DATA Keys to select desired character.
6. Press CHAR SELECT Soft Key to add selected character to the end of name string. Press BACK SPACE Soft Key to delete the selected character.
7. Press ENTER Soft Key to store name and display SETUP-ADSB TEST DATA Screen.
8. Press XPDR Mode Key until ADS-B MAIN menu is displayed.

Data Recall Procedure:

1. Press SETUP Select Key until SETUP – XPDR Screen is displayed. Press ADSB SETUP Soft Key to display SETUP ADS-B Screen (1-2-4, Figure 58).
2. Press TEST DATA Soft Key to display SETUP-ADSB Test Data Screen (1-2-4, Figure 59).
3. Press RECALL Soft Key to recall test data. Press XPDR Mode Key until ADSB MAIN menu is displayed.

4.6.3 ADS-B/GICB MAIN

Press the XPDR mode key twice to display the ADS-B/GICB Main Menu (1-2-4 figure 62).

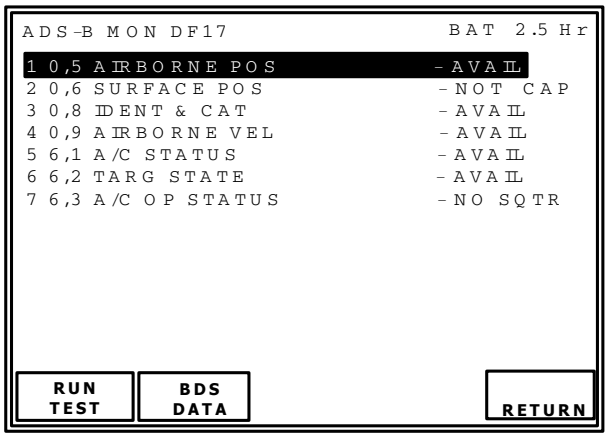


ADS-B/GICB Main Menu
Figure 62

Press the ADS-B MON softkey to display the ADS-B MON list screen. Press the GICB softkey to display the GICB list screen.

4.6.4 ADS-B MON

The ADS-B MON mode of operation receives Transponder DF17 or Ground Emitter DF18 extended squitters, either via the Antenna port or RF I/O port. The squitters are captured in a buffer, decoded and displayed.

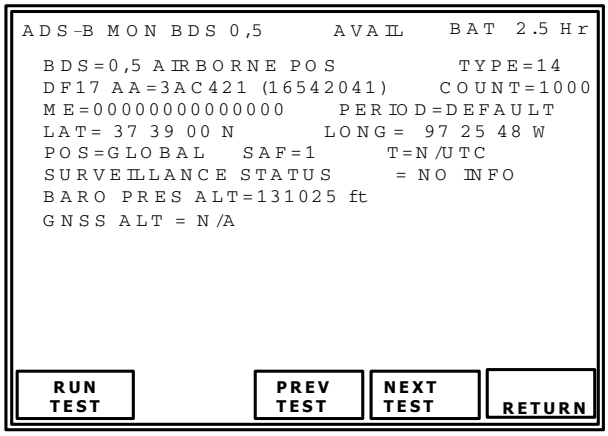


ADS-B MON List Screen
Figure 63

The ADS-B MON screen displays supported squitters that are identified by BDS register number and an abbreviated name (1-2-4 figure 63). Status of the received squitter is displayed to the right of the squitter name. Indications are AVAIL (squitter has been captured), NO SQTR (Squitter available but not captured), NOT CAP (transponder has identified squitter is not supported by transponder/subsystem).

TEST SCREEN DESCRIPTIONS

ADS-B MON BDS 0,5



ADS-B MON BDS 0,5 Screen
Figure 64

DF17/18: Receives extended squitter decodes and displays airborne position

NOTE: ADLP (Air Data Link Processor) must be installed or transponder must have embedded ADLP, to receive data from subsystem.

NOTE: Installation must be in the airborne state to transmit airborne position.

AA (Aircraft Address) in HEX and (OCTAL)
COUNT
Indications: Displays total squitters received since test was run, range 0 to 9999.

ME message field displayed in 14 digit HEX format.

PERIOD
Indications: Displays DF17/18 squitter period in seconds.

LAT (Encoded latitude) and LONG (Encoded longitude) decoded CPR format in degrees, minutes and seconds.

BARO PRESS ALT (Barometric Pressure Altitude)
Indications:
N/A
Displayed for types 9 to 18, range –1000 to 126700 ft.

GNSS ALTITUDE.
Indications:
N/A
Displayed for types 20 to 22, RANGE -1000 TO 126700 ft.

POS (Position Decode)
Indications:
GLOBAL (if Global LAT/LONG not entered in ADS-B/GICB setup menu).
LOCAL (if Local LAT/LONG is entered in ADS-B/GICB setup menu).

SURVEILLANCE STATUS
Indications:
NO INFO (No Information),
SPI (Special Position Identification),
PERM ALERT (Permanent Alert (Emergency),
TEMP ALERT (Temporary Alert (change in Mode identity code).

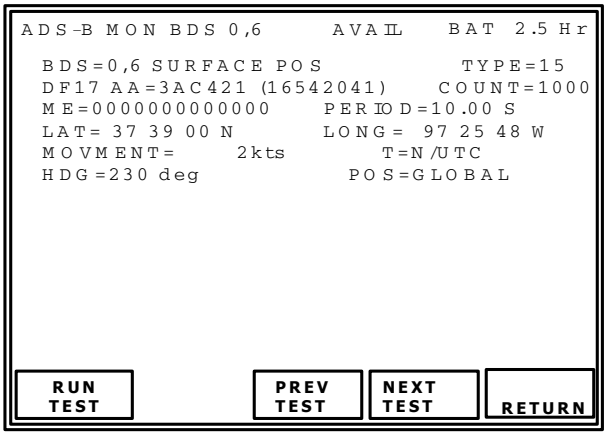
SAF (Single Antenna Flag)
Indications:
0 (single antenna),
1 (dual antenna).

T (Time Sync to UTC)
Indications:
N/UTC (not UTC),
UTC.

TYPE Specifies class and accuracy of data. Refer to table A-2 RTCA DO-260A V2.

NOTE: Refer to ICAO Annex 10, Vol III, Part 1, Chapter 5 and RTCA-DO-260 for detailed description of data fields

ADS-B MON BDS 0,6



ADS-B MON BDS 0,6 Screen
Figure 65

DF17/18: Receives extended squitter decodes and displays surface position.

NOTE: ADLP (Air Data Link Processor) must be installed or transponder must have embedded ADLP, to receive data from subsystem.

NOTE: Installation must be in the ground state to transmit surface position.

AA (Aircraft Address) in HEX and (OCTAL)

COUNT
Indications: Displays total squitters received since test was run

ME message field displayed in 14 digit HEX format.

PERIOD
Indications: Displays DF17/18 squitter period in seconds.

LAT (Encoded Latitude) and LONG (Encoded Longitude) decoded Local unambiguous CPR format in degrees, minutes and seconds.

MOVEMENT
Indications:
NO INFO (No Information Available),
STOPPED
0.125-<1 Kt,
1-<2 Kt,
2-<15 Kt,
15-<70 Kt,
70-<100 Kt,
100-<175 Kt,
>175 Kt,
DECELERATING,
ACCELERATING,
BACKING UP

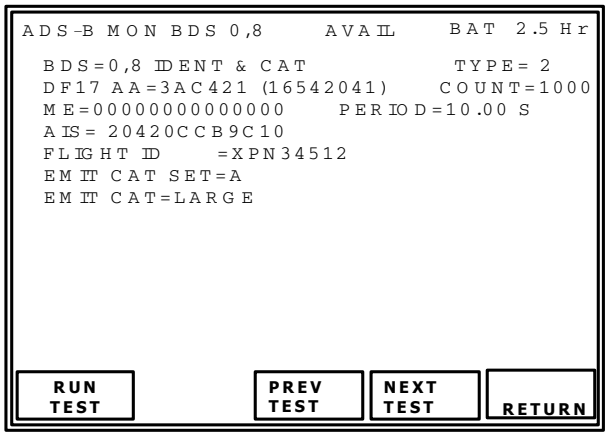
HDG (Heading)
Indications: 0 to 357 Degrees or N/A if HDG Status not valid.

T (Time Sync to UTC)
Indications:
N/UTC (Not UTC),
UTC

TYPE Specifies class and accuracy of data. Refer to table A-2 RTCA DO-260A V2.

NOTE: Refer to ICAO Annex 10, Vol III, Part 1, Chapter 5 and RTCA-DO-260 for detailed description of data fields.

ADS-B MON BDS 0,8



ADS-B MON BDS 0,8 Screen
Figure 66

DF17,18: Receives extended squitter decodes and displays identification and category.

NOTE: ADLP (Air Data Link Processor) must be installed or transponder must have embedded ADLP, to receive data from subsystem.

AA (Aircraft Address) in HEX and (OCTAL)

COUNT
Indications: Displays total squitters received since test was run.

ME message field displayed in 14 digit HEX format.

PERIOD
Indications: Displays DF17/18 squitter period in seconds.

EMIT CAT SET (ADS-B Emitter Category Set).
Indications: D,C,B,A.

EMIT CAT (ADS-B Emitter Category).
Indications:

EMIT CAT A:

NO ADS-B EMITTER INFO,
LIGHT,
SMALL,
LARGE,
HIGH VORTEX,
HEAVY,
HIGH PERFORMANCE,
ROTOCRAFT,

EMIT CAT B:

NO ADS-B EMITTER INFO,
GLIDER/SAILPLANE,
LIGHTER-THAN-AIR,
PARACHUTIST/SKYDIVER,
ULTRALIGHT/HANG-GLIDER,
RESERVED,
UNMANNED AERIAL VEHICLE,
SPACE VEHICLE.

EMIT CAT C:
NO ADS-B EMITTER INFO,
SURFACE EMERGENCY VEHICLE,
SURFACE SERVICE VEHICLE,
FIXED GND/TETHERED OBSTR,
CLUSTER OBSTR,
LINE OBSTR,
RESERVED,
RESERVED

EMIT CAT D:

RESERVED,
RESERVED,
RESERVED,
RESERVED,
RESERVED,
RESERVED,
RESERVED

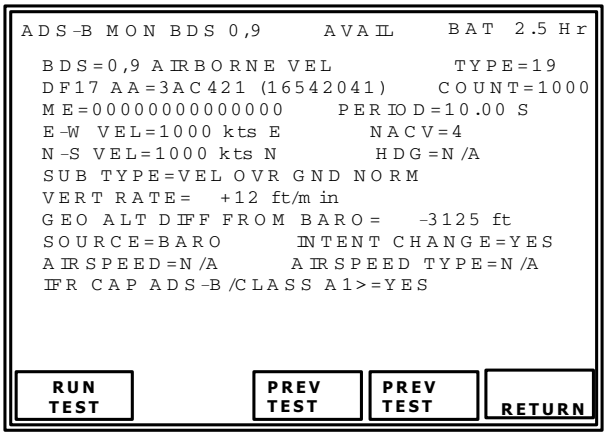
AIS (Aircraft Identity Subfield) HEX field containing BDS plus flight ID.

FLIGHT ID Indications: 8 ICAO character field.

TYPE Specifies class and accuracy of data. Refer to table A-2 RTCA DO-260A V2.

NOTE: Refer to ICAO Annex 10, Vol III, Part 1, Chapter 5 and RTCA-DO-260 for detailed description of data fields.

ADS-B MON BDS 0,9



ADS-B MON BDS 0,9 Screen
Figure 67

DF17,18: Receives extended squitter decodes and displays Airborne Velocity.

AA (Aircraft Address) in HEX and (OCTAL)

COUNT
Indications: Displays total squitters received since test was run.

ME message field displayed in 14 digit HEX format.

PERIOD
Indications: Displays DF17/18 squitter period in seconds.

NOTE: ADLP (Air Data Link Processor) must be installed or transponder must have embedded ADLP, to receive data from subsystem.

NOTE: Installation must be in the airborne state to transmit airborne velocity.

SUB TYPES (Subtype Coding).
Indications:
0 (ICAO DOC 9688 (First edition of ICAO Mode S Specific Service manual) not supported,
VEL OVR GND NORM (Velocity Over Ground Normal),
VEL OVER GND SUPER (Velocity Over Ground Supersonic),
AIR SPD NORM (Airspeed Normal),
AIR SPD SUPER (Airspeed Supersonic),
NOT ASSIGNED,
NOT ASSIGNED,
NOT ASSIGNED

EAST-WEST VEL (East-West Velocity).
Indications:
N/A (Not Available),
0 to >1021 Kts (subtype 1),
0 to >4086 Kts (subtype 2),

NOTE: Followed by E (East) or W (West) direction identifier.

NORTH-SOUTH VEL (North-South Velocity)
Indications:
N/A (Not Available),
0 to >1021 Kts
(subtype 1),
0 to >4086 Kts (subtype 2),

NOTE: Followed by N (North) or S (South) direction identifier.

VERT RATE (Vertical Rate).
Indications:
N/A (Not Available),
<-32608 to >32608 ft/min (subtypes 1 and 2).

SOURCE (Source of Vertical rate).
Indications:
N/A (Not Available),
BARO (Barometric Source),
GEO (i.e. GPS Source)

GEO ALT DIFF FROM BARO (Geo Altitude Difference from Barometric Altitude).
Indications:
<-3137 to ft >3137 ft

HDG (Heading).
Indications:
N/A (Not Available),
0.0 to 359.6 Degrees.

INTENT CHANGE (Intent Change Flag)
Indications:
Yes,
No

IFR CAP ADS-B/CLASS A1> (IFR Capability Flag).
Indications:
NO (No ADS-B capability class A1 and above),
YES (ADS-B Capability Class A1 and above)

AIRSPEED.
Indications:
N/A (Not Available),
0 to >1021 Kts (subtype 3)
0 to >4086 Kts (subtype 4)

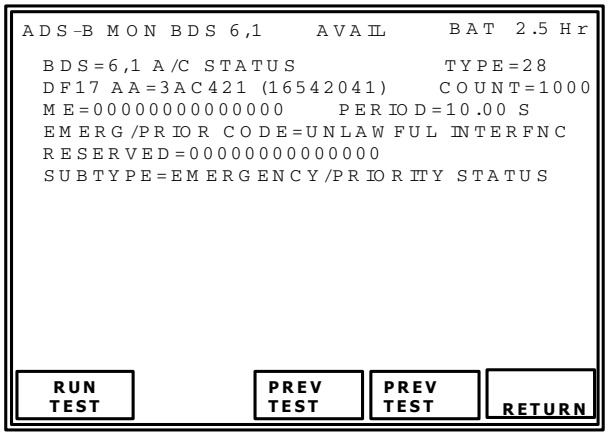
AIR SPEED TYPE.
Indications:
IAS (Indicated Airspeed),
TAS (True Airspeed).

NACV (Navigation Accuracy Category for Velocity)
Indications:
0 to 4, reference tables A5-A7 RTCA DO-260.

TYPE Specifies class and accuracy of data. Refer to table A-2 RTCA DO-260A V2.

NOTE: Refer to ICAO Annex 10, Vol III, Part 1, Chapter 5 and RTCA-DO-260A for detailed description of data fields.

ADS-B MON BDS 6,1



ADS-B MON BDS 6,1 Screen
Figure 68

DF17,18: Receives extended squitter decodes and displays Aircraft Status.

AA (Aircraft Address) in HEX and (OCTAL)

COUNT
Indications: Displays total squitters received since test was run.

ME message field displayed in 14 digit HEX format.

PERIOD
Indications: Displays DF17/18 squitter period in seconds.

NOTE: ADLP (Air Data Link Processor) must be installed or transponder must have embedded ADLP, to receive data from subsystem.

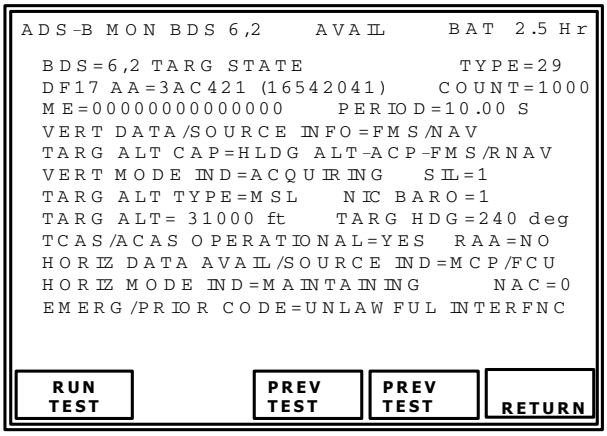
SUB TYPE (Subtype Coding).
Indications:
NO INFO,
EMERGENCY/PRIORITY STATUS,
RESERVED

EMERG/PRIOR CODE (Emergency/Priority Status Coding).
Indications:
NO EMERGENCY,
GENERAL EMERGENCY,
LIFEGUARD/MEDICAL,
MINIMUM FUEL,
NO COMM,
UNLAWFUL INTERFNC,
DOWNED AIRCRAFT,
RESERVED.

RESERVED subfield, 12 digit HEX field containing contents of bits 9 to 56.

TYPE Specifies class and accuracy of data. Refer to table A-2 DO-260A V2.

ADS-B MON BDS 6,2



ADS-B MON BDS 6,2 Screen
Figure 69

DF17,18: Receives extended squitter decodes and displays Aircraft Status.

AA (Aircraft Address) in HEX and (OCTAL)

COUNT
Indications: Displays total squitters received since test was run.

ME message field displayed in 14 digit HEX format.

PERIOD
Indications: Displays DF17/18 squitter in seconds.

NOTE: ADLP (Air Data Link Processor) must be installed or transponder must have embedded ADLP, to receive data from subsystem.

NOTE Installation must be in the airborne state to transmit target state and status.

NOTE: Autopilot must be engaged and stimulated by sensor data for some fields to display data.

SUBTYPE= 0

VERT DATA/SOURCE INFO (Vertical Data Available/Source Indicator)
Indications:

MCP/FCU (Mode Control Panel/Flight Control Unit),
HLD ALT (Holding Altitude),
FMS/RNAV (FMS/RNAV System).

VERT MODE IND (Vertical Mode Indicator)
Indications:
UNKNOWN, (Unknown Mode or Information unavailable),
ACQUIRING (Acquiring Mode),
MAINTAINING (Capturing or Maintaining Mode).
RESERVED

TARGET ALT CAP (Target Altitude Capability)
Indications:
HLDG ALT (Capability for reporting Holding altitude only),
HLDG ALT-ACP (Capability for reporting either Holding altitude or Autopilot control panel selected altitude),
HLDG ALT-ACP-FMS/RNAV (Capability for reporting either Holding altitude or Autopilot control panel selected altitude, or any FMS/RNAV level off altitude).
RESERVED

H DATA AVAIL/SOURCE IND (Horizontal Data Available/Source Indicator)
Indications:
NOT VALID (No Valid Horizontal Target State Data is available),
MCP/FCU (Mode Control Panel/Flight Control Unit selected track angle),
MAINTAIN (Maintain Current Heading or Track angle),
FMS/RNAV (FMS/RNAV System)

TARGET HDG (Target Heading Angle)
Indications: 0 to 359 degrees.
INVALID

HORIZ MODE IND (Horizontal Mode Indicator)
Indications:
UNKNOWN (Unknown Mode or Information unavailable),
ACQUIRING (Acquiring Mode),
MAINTAINING (Capturing or Maintaining Mode),
RESERVED.

NIC BARO (Navigation Integrity Baro)
Indications:
0 (Gillum Cross Checked)
1 (Gillum Not Cross Checked)

SIL (Surveillance Integrity Level) Indications:
0 (Unknown),
1 (1x10(-3) per flight),
2 (1x10(-5) per flight),
3 (1x10(-7) per flight)

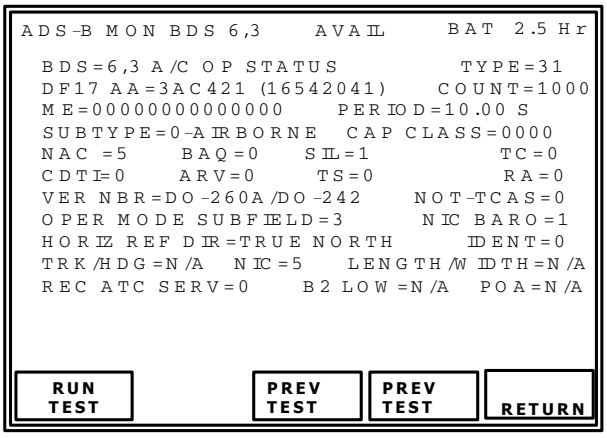
TCAS/ACAS OPERATIONAL (TCAS/ACAS Operational)
Indications:
YES,
NO.

RAA (TCAS/ACAS Resolution Advisory Active)
Indications:
YES,
NO.

TYPE Specifies class and accuracy of data. Refer to table A-2 RTCA DO-260A V2.

NOTE: Refer to ICAO Annex 10 Vol III Chapter 5 and RTCA-DO-260A for detailed description of data fields.

ADS-B MON BDS 6,3



ADS-B MON BDS 6,3 Screen
Figure 70

DF17,18: Receives extended squitter decodes and displays Aircraft Operational Status.

AA (Aircraft Address) in HEX and (OCTAL)

COUNT
Indications: Displays total squitters received since test was run.

ME message field displayed in 14 digit HEX format.

PERIOD
Indications: Displays DF17/18 squitter period in seconds.

NOTE: ADLP (Air Data Link Processor) must be installed or transponder must have embedded ADLP, to receive data from subsystem.

NOTE Data is displayed over three screens Part 1, Part 2 and Part 3.

SUBTYPE
Indications:
AIRBORNE (Airborne Status message),
SURFACE (Surface Status message),
RESERVED,
RESERVED,
RESERVED,
RESERVED,
RESERVED,
RESERVED,

VER NBR (Reports formats and protocols supported)
Indications:
260/242 (RTCA DO-260 and DO-242),
260A/242A (RTCA DO-260A and DO-242A),
RESERVED,
RESERVED,
RESERVED,
RESERVED,
RESERVED,
RESERVED,

CDTI (Cockpit Display of Traffic Information)
Indications:
1 (Traffic Display operational),
0 (Traffic Display not operational)

ARV (Air Referenced Velocity Report) Only Available when Subtype= Airborne.
Indications:
N/A (Surface)
1 (Capability of sending messages to support Air-Reference velocity),
0 (No Capability of sending messages to support Air-Reference velocity).

TS (Target State Report Capability) Only Available when Subtype= Airborne
Indications:
N/A (Surface)
1 (Capability of sending messages to support Target State Reports),
0 (No Capability of sending messages to support Target State Reports).

TC (Target Change Report Capability) Only Available when Subtype= Airborne.
Indications:
N/A (Surface)
0 (No capability for sending messages to support trajectory change reports) ,
1 TC+0 (Capability of sending messages to support TC+0 report only),
2 MTC (Capability of sending information for multiple TC reports).
3 (Reserved)

TRK ANGLE/HDG (Used for surface ADS-B participants, surface position message heading or ground track determination bit)
Indications:
N/A (Airborne)
0 (Target Heading Angle Reported)
1 (Target Angle Reported)

IDENT (Ident Switch)
Indications
YES (Ident switch active),
NO (Ident switch not active).

REC ATC SER (Receiving ATC Services)
Indications:
1 (Aircraft receiving ATC services),
0 (Aircraft not receiving ATC services).

A/V LENGTH (Aircraft or Vehicle Length)
Indications:
N/A (Airborne)
<15m,
<25m,
<35m,
<45m,
<55m,
<65m,
<75m,
<=200m.

A/V WIDTH (Aircraft or Vehicle Width)
Indications:
N/A (Airborne)
<11.5m,
<23m,
<28.5m,
<34m,
<33m,
<38m,
<39.5m,
<45m,
<52m,
<59.5m,
<67m,
<72m,
<80m,
=>80m.

SIL (Surveillance Integrity Level)
Indications:
0 (Unknown),
1 (1x10(-3) per flight),
2 (1x10(-5) per flight),
3 (1x10(-7) per flight)

NIC BARO (Navigation Integrity Baro)
Indications:
N/A (Surface)
0 (Gillum Cross Checked)
1 (Gillum Not Cross Checked)

NAC
Indications:
0 (EPU ≥18.52 km)
1 (EPU <18.52 km)
2 (EPU <7.408 km)
3 (EPU <3.704 km)
4 (EPU <1852 m)
5 (EPU <926 m)
6 (EPU <555.6 m)
7 (EPU <185.2 m)
8 (EPU <92.6 m)
9 (EPU <30 m and VEPU <45 m)
A (EPU <30 m and VEPU <15 m)
B (EPU <3 m and VEPU <4 m)
C (reserved)
D (reserved)
E (reserved)
F (reserved)

BAQ
Indications:
N/A (Surface)
0 (always 0 for airborne message)
1 (not specified)
2 (not specified)
3 (not specified)

NOT TCAS
Indications:
N/A (Surface)
0 (TCAS operations or unknown)
1 (TCAS not installed or not operational)

OPER MODE Subfield
Indications:
0 (TCAS RA Active, IDENT Switch Active, Receiving ATC Services)
1 (Reserved)
2 (Reserved)
3 (Reserved)

NIC
Indications:
0 (Rc unknown)
1 (Rc < 20 NM)

B2low
Indications:
N/A (Airborne)
0 (≥70 W)
1 (<70 W)

POA
Indications:
N/A (Airborne)
0 (Position transmitted is not the ADS-B position reference point)
1 (Position transmitted is the ADS-B position reference point)

CAPABILITY CLASS
ME BITS 9-24(airborne)
ME BITS 9-20 (surface)
0000-FFFF (airborne)
000-FFF (surface)

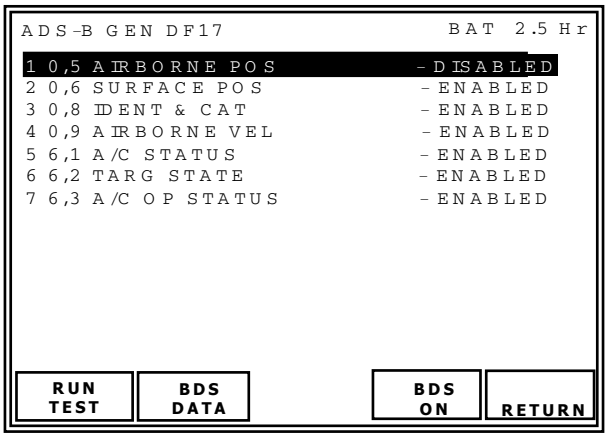
HORIZ
REF DIR (Horizontal Reference Direction)
Indications:
TRUE NORTH,
MAGNETIC NORTH

TYPE Specifies class and accuracy of data. Refer to table A-2 RTCA DO-260A V2.

NOTE: Refer to ICAO Annex 10 Vol III Chapter 5 and RTCA-DO-260A for detailed description of data fields

4.6.5 ADS-B GEN

The ADS-B GEN mode of operation generates Transponder DF17 or Ground Emitter DF18 extended squitters, either via the Antenna port or RF I/O port. The squitters are encoded via data entered in individual data screens.

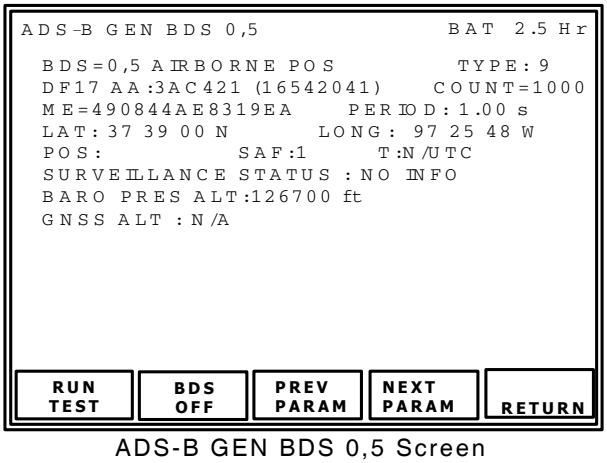


ADS-B GEN List Screen
Figure 71

The ADS-B GEN screen displays supported squitters that are identified by BDS register number and an abbreviated name (1-2-4 figure 71). Status of the generated squitter is displayed to the right of the squitter name. Selections are ENABLED (squitter will be generated) or DISABLED (Squitter will not be generated)

TEST SCREEN DESCRIPTIONS

ADS-B GEN BDS 0,5



ADS-B GEN BDS 0,5 Screen
Figure 72

DF17/18: Encodes Airborne Position and generates extended squitter.

AA (Aircraft Address) in HEX.

COUNT
Indications: Displays total squitters generated since test was run. Range 0 to 9999.

ME message field displayed in 14 digit HEX format.

PERIOD
Selection: DF17/18 squitter period in seconds. Range: 0.5 to 20.00 seconds with 0.2 sec distrubution.

LAT (Encoded latitude) and LONG (Encoded longitude) CPR format in degrees, minutes and seconds.

BARO PRESS ALT (Barometric Pressure Altitude)
Selection:
- NA (Not available)
Selectable for types 9 to 18, range –1000 to 126700 ft in 25ft increments.

GNSS ALTITUDE.
Selection:
- NA (Not available)
Selectable for types 20 to 22, RANGE -1000 to 126700 ft in 25ft increments.

POS (Position Decode)

SURVEILLANCE STATUS
Selections:
NO INFO (No Information),
SPI (Special Position Identification),
PERM ALERT (Permanent Alert (Emergency),
TEMP ALERT (Temporary Alert (change in Mode identity code).

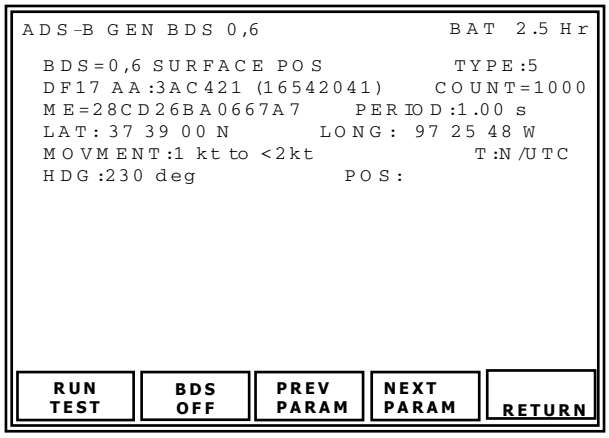
SAF (Single Antenna Flag)
Selections:
0 (single antenna),
1 (dual antenna).

T (Time Sync to UTC)
Selections:
N/UTC (not UTC),
UTC.

TYPE Specifies class and accuracy of data. Refer to table A-2 RTCA DO-260A V2.

NOTE: Refer to ICAO Annex 10, Vol III, Part 1, Chapter 5 and RTCA-DO-260A for detailed description of data fields

ADS-B GEN BDS 0,6



ADS-B GEN BDS 0,6 Screen
Figure 73

DF17/18: Encodes surface position and generates extended squitter.

AA (Aircraft Address) in HEX and (OCTAL).

COUNT
Indications: Displays total squitters generated since test was run. Range 0 to 9999.

ME message field displayed in 14 digit HEX format.

PERIOD
Selection: DF17/18 squitter period in seconds. Range: 0.5 to 20.00 seconds with 0.2 sec distribution.

LAT (Encoded latitude) and LONG (Encoded longitude) CPR format in degrees, minutes and seconds.

MOVEMENT.
Selections:
NO INFO (No Information Available),
STOPPED
0.125 to <1 Kt,
1 to <2 Kt,
2 to <15 Kt,
15 to <70 Kt,
70 to <100 Kt,
100 to<175 Kt,
>175 Kt,
DECELERATING,
ACCELERATING,
BACKING UP

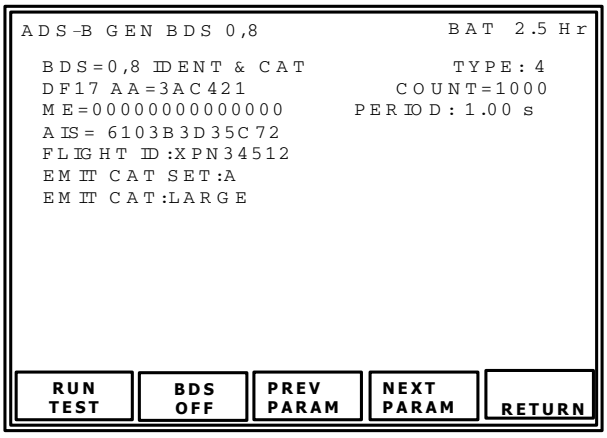
HDG (Heading)
Selection: 0 to 359 Degrees or N/A if HDG Status not valid.

T (Time Sync to UTC)
Selections:
N/UTC (Not UTC),
UTC

TYPE Specifies class and accuracy of data. Refer to table A-2 RTCA DO-260A V2.

NOTE: Refer to ICAO Annex 10, Vol III, Part 1, Chapter 5 and RTCA-DO-260A for detailed description of data fields.

ADS-B GEN BDS 0,8



ADS-B GEN BDS 0,8 Screen
Figure 74

DF17,18: Encodes Identification and Category and generates extended squitter.

AA (Aircraft Address) in HEX.

COUNT
Indications: Displays total squitters generated since test was run. Range 0 to 9999.

ME message field displayed in 14 digit HEX format.

PERIOD
Selection: DF17/18 squitter period in seconds. Range: 0.5 to 20.00 seconds with 0.2 sec distribution.

EMIT CAT SET (ADS-B Emitter Category Set).
Selections: D,C,B,A.

EMIT CAT (ADS-B Emitter Category).
Selections:

EMIT CAT A:

NO ADS-B EMITTER INFO,
LIGHT,
SMALL,
LARGE,
HIGH VORTEX,
HEAVY,
HIGH PERFORMANCE,
ROTOCRAFT,

EMIT CAT B:
NO ADS-B EMITTER INFO,
GLIDER/SAILPLANE,
LIGHTER-THAN-AIR,
PARACHUTIST/SKYDIVER,
ULTRALIGHT/HANG-GLIDER,
RESERVED,
UNMANNED AERIAL VEHICLE,
SPACE VEHICLE.

EMIT CAT C:
NO ADS-B EMITTER INFO,
SURFACE EMERGENCY VEHICLE,
SURFACE SERVICE VEHICLE,
FIXED GND/TETHERED OBSTR,
CLUSTER OBSTR,
LINE OBSTR,
RESERVED,
RESERVED

EMIT CAT D:

RESERVED,
RESERVED,
RESERVED,
RESERVED,
RESERVED,
RESERVED,
RESERVED

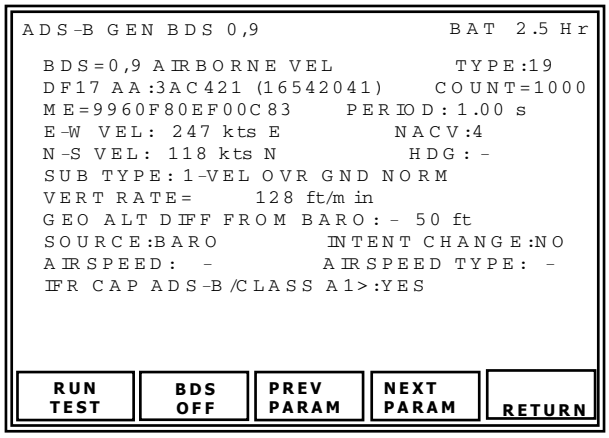
AIS (Aircraft Identity Subfield)
Indication: HEX field containing BDS plus flight ID.

FLIGHT ID
Selection: 8 ICAO character field.

TYPE Specifies class and accuracy of data. Refer to table A-2 RTCA DO-260A V2.

NOTE: Refer to ICAO Annex 10, Vol III, Part 1, Chapter 5 and RTCA-DO-260A for detailed description of data fields.

ADS-B GEN BDS 0,9



ADS-B GEN BDS 0,9 Screen
Figure 75

DF17,18: Encodes Airborne Velocity and generates extended squitter.

AA (Aircraft Address) in HEX and OCTAL.

COUNT
Indications: Displays total squitters generated since test was run.

ME message field displayed in 14 digit HEX format.

PERIOD
Selection: DF17/18 squitter period in seconds. Range: 0.5 to 20.00 seconds with 0.2 sec distribution.

SUB TYPES (Subtype Coding).
Selections:
0 (ICAO DOC 9688 (First edition of ICAO Mode S Specific Service manual) not supported,
VEL OVR GND NORM (Velocity Over Ground Normal),
VEL OVER GND SUPER (Velocity Over Ground Supersonic),
AIR SPD NORM (Airspeed Normal),
AIR SPD SUPER (Airspeed Supersonic),
NOT ASSIGNED,
NOT ASSIGNED,
NOT ASSIGNED

EAST-WEST VEL (East-West Velocity).
Indications:
- (Not Applicable),
- NA (Not Available),
0 to >1021 Kts (subtype 1),
0 to >4086 Kts (subtype 2),

NOTE: Followed by E (East) or W (West) direction identifier.

NORTH-SOUTH VEL (North-South Velocity)
Indications:
- (Not Applicable),
- NA (Not Available),
0 to >1021 Kts
(subtype 1),
0 to >4086 Kts (subtype 2),

NOTE: Followed by N (North) or S (South) direction identifier.

VERT RATE (Vertical Rate).
Selections:
- (Not Applicable),
- NA (Not Available),
<-32608 to >32608 ft/min (subtypes 1 and 2).

SOURCE (Source of Vertical rate).
Selections:
- N/A (Not Available),
BARO (Barometric Source),
GEO (i.e. GPS Source)

GEO ALT DIFF FROM BARO (Geo Altitude Difference from Barometric Altitude).
Selections:
- NA (Not Available),
- (Not Applicable),
<-3137 to ft >3137 ft

HDG (Heading).
Selections:
- (Not Applicable),
- (Not Available),
0.0 to 359.0 Degrees.

INTENT CHANGE (Intent Change Flag)
Selections:
- (Not Applicable),
YES,
NO

IFR CAP ADS-B/CLASS A1> (IFR Capability Flag).
Selections:
NO (No ADS-B capability class A1 and above),
YES (ADS-B Capability Class A1 and above)

AIRSPEED.
Selections:
- (Not Applicable),
- (Not Available),
0 to >1021 Kts (subtype 3)
0 to >4086 Kts (subtype 4)

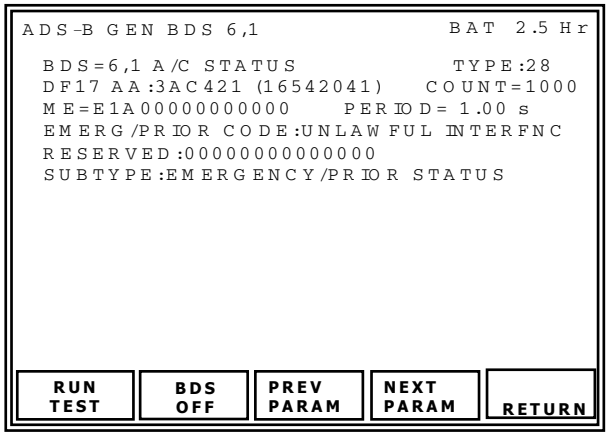
AIR SPEED TYPE.
Selections:
- (Not Applicable),
IAS (Indicated Airspeed),
TAS (True Airspeed).

NACV (Navigation Accuracy Category for Velocity)
Selections:
- (Not Applicable),
0 to 4, reference tables A5-A7 RTCA DO-260A.

TYPE Specifies class and accuracy of data. Refer to table A-2 RTCA DO-260A V2.

NOTE: Refer to ICAO Annex 10, Vol III, Part 1, Chapter 5 and RTCA-DO-260 for detailed description of data fields.

ADS-B GEN BDS 6,1



ADS-B GEN BDS 6,1 Screen
Figure 76

DF17,18: Encodes Aircraft Status and generates extended squitter.

AA (Aircraft Address) in HEX.

COUNT
Indications: Displays total squitters generated since test was run. Range 0 to 9999.

ME message field displayed in 14 digit HEX format.

PERIOD
Indications: Displays DF17/18 squitter period in seconds. Range: 0.5 to 20.00 seconds with 0.2 sec distribution.

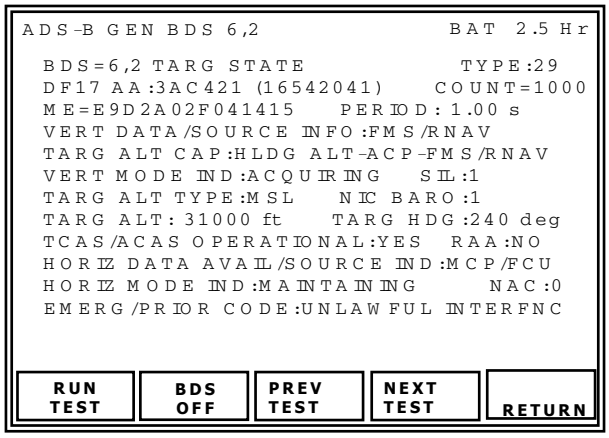
SUB TYPE (Subtype Coding).
Selections:
NO INFO,
EMERGENCY/PRIORITY STATUS,
RESERVED

EMERG/PRIOR CODE (Emergency/Priority Status Coding).
Selections:
- (Not Applicable),
NO EMERGENCY,
GENERAL EMERGENCY,
LIFEGUARD/MEDICAL,
MINIMUM FUEL,
NO COMM,
UNLAWFUL INTERFNC,
DOWNED AIRCRAFT,
RESERVED.

RESERVED subfield, 12 digit HEX field containing contents of bits 9 to 56.

TYPE Specifies class and accuracy of data. Refer to table A-2 DO-260A V2.

ADS-B GEN BDS 6,2



ADS-B GEN BDS 6,2 Screen
Figure 77

DF17,18: Target State and generates extended squitter.

AA (Aircraft Address) in HEX and (OCTAL).

COUNT
Indications: Displays total squitters generated since test was run.

ME message field displayed in 14 digit HEX format.

PERIOD
Indications: Displays DF17/18 squitter in seconds. Range: 0.5 to 20.00 seconds with 0.2 sec distribution.

SUBTYPE= 29

VERT DATA/SOURCE INFO (Vertical Data Available/Source Indicator)
Selections:

MCP/FCU (Mode Control Panel/Flight Control Unit),
HLD ALT (Holding Altitude),
FMS/RNAV (FMS/RNAV System).

VERT MODE IND (Vertical Mode Indicator)
Selections:
NOT AVAIL (no valid Vertical Target state data available)
UNKNOWN, (Unknown Mode or Information unavailable),
ACQUIRING (Acquiring Mode),
MAINTAINING (Capturing or Maintaining Mode).
RESERVED

TARGET ALT CAP (Target Altitude Capability)
Selections:
HLDG ALT (Capability for reporting Holding altitude only),
HLDG ALT-ACP (Capability for reporting either Holding altitude or Autopilot control panel selected altitude),
HLDG ALT-ACP-FMS/RNAV (Capability for reporting either Holding altitude or Autopilot control panel selected altitude, or any FMS/RNAV level off altitude).
RESERVED

HORIZ DATA AVAL/SOURCE IND (Horizontal Data Available/Source Indicator)
Selections:
NOT VALID (No Valid Horizontal Target State Data is available),
MCP/FCU (Mode Control Panel/Flight Control Unit selected track angle),
MAINTAIN (Maintain Current Heading or Track angle),
FMS/RNAV (FMS/RNAV System)

TARGET HDG (Target Heading Angle)
Selections: 0 to 359 degrees and INVALID

HORIZ MODE IND (Horizontal Mode Indicator)
Selections:
UNKOWN (Unknown Mode or Information unavailable),
ACQUIRING (Acquiring Mode),
MAINTAINING (Capturing or Maintaining Mode),
RESERVED.

NIC BARO (Navigation Integrity Baro)
Selections:
0 (Gillum Cross Checked)
1 (Gillum Not Cross Checked)

SIL (Surveillance Integrity Level) Selections:
0 (Unknown),
1 (1x10(-3) per flight),
2 (1x10(-5) per flight),
3 (1x10(-7) per flight)

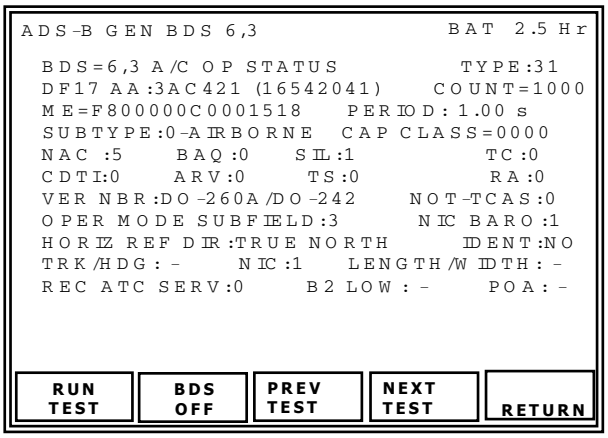
TCAS/ACAS OPERATIONAL (TCAS/ACAS Operational)
Selections:
YES,
NO.

RAA (TCAS/ACAS Resolution Advisory Active)
Selections:
YES,
NO.

TYPE Specifies class and accuracy of data. Refer to table A-2 RTCA DO-260A V2.

NOTE: Refer to ICAO Annex 10 Vol III Chapter 5 and RTCA-DO-260A for detailed description of data fields.

ADS-B GEN BDS 6,3



ADS-B GEN BDS 6,3 Screen
Figure 78

DF17,18: Encodes Aircraft Operational Status and generates extended squitter.

AA (Aircraft Address) in HEX.

COUNT
Indications: Displays total squitters generated since test was run. Range 0 to 9999.

ME message field displayed in 14 digit HEX format.

PERIOD
Selection: DF17/18 squitter period in seconds. Range: 0.5 to 20.00 seconds with 0.2 sec distribution.

SUBTYPE
Selections:
0 - AIRBORNE (Airborne Status message),
1 - SURFACE (Surface Status message),

VER NBR (Reports formats and protocols supported)
Selections:
260/242 (RTCA DO-260 and DO-242),
260A/242A (RTCA DO-260A and DO-242A),
RESERVED,

CDTI (Cockpit Display of Traffic Information)
Selections:
1 (Traffic Display operational),
0 (Traffic Display not operational)

ARV (Air Referenced Velocity Report) Only Available when Subtype= Airborne.
Selections:
N/A (Surface)
1 (Capability of sending messages to support Air-Reference velocity),
0 (No Capability of sending messages to support Air-Reference velocity).

TS (Target State Report Capability) Only Available when Subtype= Airborne
Selections:
N/A (Surface)
1 (Capability of sending messages to support Target State Reports),
0 (No Capability of sending messages to support Target State Reports).

TC (Target Change Report Capability) Only Available when Subtype= Airborne.
Selections:
N/A (Surface)
0 (No capability for sending messages to support trajectory change reports) ,
1TC+0 (Capability of sending messages to support TC+0 report only),
MTC (Capability of sending information for multiple TC reports).

TRK/HDG (Used for surface ADS-B participants, surface position message heading or ground track determination bit)
Selections:
- (Airborne)
0 (Target Heading Angle Reported
1 (Target Angle Reported)

IDENT (Ident Switch)
Selections:
YES (Ident switch active),
NO (Ident switch not active).

REC ATC SER (Receiving ATC Services)
Selections:
1 (Aircraft receiving ATC services),
0 (Aircraft not receiving ATC services).

A/V LENGTH (Aircraft or Vehicle Length)
Selections:
- (Airborne)
<15m,
<25m,
<35m,
<45m,
<55m,
<65m,
<75m,
<=200m.

A/V WIDTH (Aircraft or Vehicle Width)
Selections:
- (Airborne)
<11.5m,
<23m,
<28.5m,
<34m,
<33m,
<38m,
<39.5m,
<45m,
<52m,
<59.5m,
<67m,
<72m,
<80m,
=>80m.

SIL (Surveillance Integrity Level)
Selections:
0 (Unknown),
1 (1x10(-3) per flight),
2 (1x10(-5) per flight),
3 (1x10(-7) per flight)

NIC BARO (Navigation Integrity Baro)
Selections:
N/A (Surface)
0 (Gillum Cross Checked)
1 (Gillum Not Cross Checked)

NAC
Selections:
0 (EPU ≥18.52 km)
1 (EPU <18.52 km)
2 (EPU <7.408 km)
3 (EPU <3.704 km)
4 (EPU <1852 m)
5 (EPU <926 m)
6 (EPU <555.6 m)
7 (EPU <185.2 m)
8 (EPU <92.6 m)
9 (EPU <30 m and VEPU <45 m)
A (EPU <30 m and VEPU <15 m)
B (EPU <3 m and VEPU <4 m)
C (reserved)
D (reserved)
E (reserved)
F (reserved)

BAQ
Selections:
- (Surface)
0 (always 0 for airborne message)
1 (not specified)
2 (not specified)
3 (not specified)

NOT TCAS
Selections:
- (Surface)
0 (TCAS operations or unknown)
1 (TCAS not installed or not operational)

OPER MODE Subfield
Selections:
0 (TCAS RA Active, IDENT Switch Active, Receiving ATC Services)
2 (Reserved)
3 (Reserved)

NIC
Selections:
0 (Rc unknown)
1 (Rc < 20 NM)

B2low
Indications:
- (Airborne)
0 (≥70 W)
1 (<70 W)

POA
Selections:
- (Airborne)
0 (Position transmitted is not the ADS-B position reference point)
1 (Position transmitted is the ADS-B position reference point)

CAPABILITY CLASS
ME BITS 9-24(airborne)
ME BITS 9-20 (surface)
0000-FFFF (airborne)
000-FFF (surface)

HORIZ REF DIR (Horizontal Reference Direction)
Selections:
TRUE NORTH,
MAGNETIC NORTH

TYPE Specifies class and accuracy of data. Refer to table A-2 RTCA DO-260A V2.

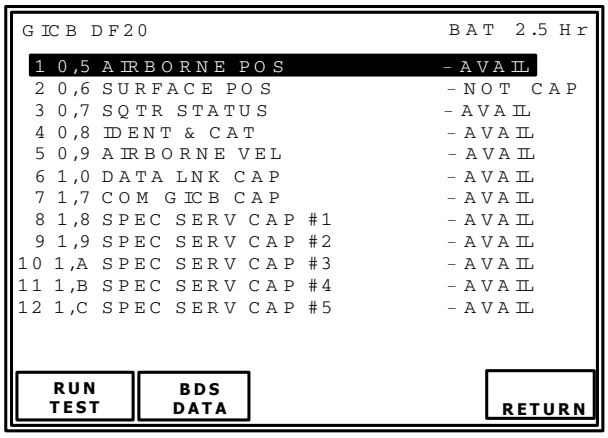
NOTE: Refer to ICAO Annex 10 Vol III Chapter 5 and RTCA-DO-260A for detailed description of data fields

4.6.6 GICB GENERAL

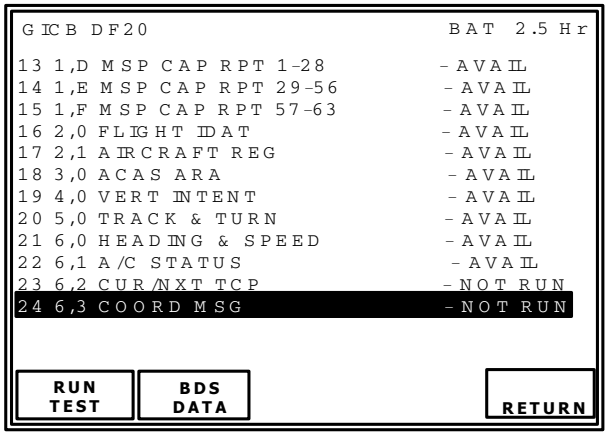
GICB (Ground Intiated Comm B) is a protocol used by Mode S ground stations to extract DAP's (Downlinked Aircraft Parameters) from Mode S transponder equipped aircraft. DAP's are utilized by Air Traffic Control equipment, to provide the air traffic controller with accurate and predictive tracks i.e. anticipated altitude changes. DAP'S are obtained from various sub-systems via a separate or transponder integral ADLP (Air Data Link Processor). DAP's are stored in the transponder BDS (B-Definition Subfield) registers. There are 255 BDS registers, not all defined at this time.

4.6.7 GICB MODE

GICB mode of operation uses UF4 or UF5 interrogations with reply length set to long, to request DF20 or DF21 replies with MB message field containing transponder BDS register contents, which are decoded and displayed.



GICB List Screen, 1-12
Figure 71



GICB List Screen, 13-24
Figure 72

The GICB screen displays the supported BDS registers (determined by test set software version), identified by BDS register number and an abbreviated name. The Status of the received BDS is displayed to the right of the BDS name. Indications are NOT RUN (Test has not retrieved this BDS yet), AVAIL (BDS is available), NO DATA (BDS available but not reporting data), NOT CAP (transponder has identified that this BDS is not supported by transponder/subsystem).

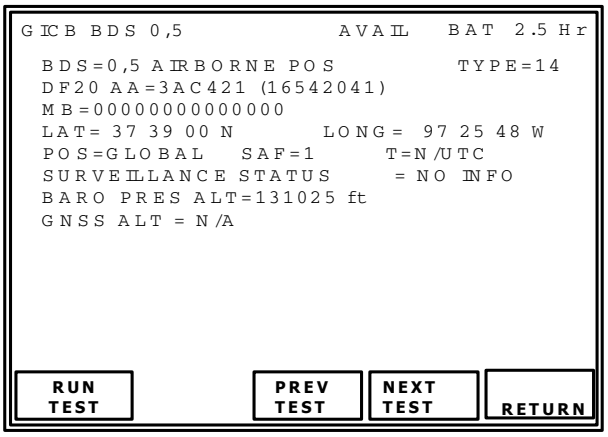
BDS registers supported by software version 1.1.2 and above, are listed in 1-2-4 Table 17.

BDS	DESCRIPTION
0.5	Ext Squitter Airborne Position
0,6	Ext Squitter Surface Position
0,7	Ext Squitter Status
0,8	Ext Squitter Type and Identification
0,9	Ext Squitter Airborne Velocity Information
1,0	Data Link Capability Report
1,7	Common Usage GICB Capability Report
1,8	Mode S Specific Services #1
1,9	Mode S Specific Services #2
1,A	Mode S Specific Services #3
1,B	Mode S Specific Services #4
1,C	Mode S Specific Services #5
1,D	Mode S Specific Service Capability Report 1-28
1,E	Mode S Specific Service Capability Report 29-56
1,F	Mode S Specific Service Capability Report 57-63
2,0	Aircraft Identification (Flight ID)
2,1	Aircraft Registration Number
3.0	ACAS Resolution Advisory
4,0	Aircraft Vertical Intention
4,1	Waypoint Name
4,2	Waypoint Position
4,3	Waypoint Details
5,0	Track and Turn Report
6,0	Heading and Speed Report
6,1	Aircraft Status
6,2	Current/Next TCP
6,3	Coordination Message

GICB Supported BDS Registers
Table 17

TEST SCREEN DESCRIPTIONS

GICB BDS 0,5



GICB BDS 0,5 Screen
Figure 73

Uses UF4/5 Reply Length Long, BDS 0,5 register request: Receives DF20/21 reply and decodes MB message field containing BDS register contents and displays airborne position.

NOTE: ADLP (Air Data Link Processor) must be installed or transponder must have embedded ADLP to receive data from subsystem.

NOTE: Installation must be in the airborne state to transmit airborne position.

AA (Aircraft Address) in HEX and (OCTAL)

MB message field displayed in 14 digit HEX format.

LAT (Encoded latitude) and LONG (Encoded longitude) decoded CPR format in degrees, minutes and seconds.

BARO PRESS ALT (Barometric Pressure Altitude)
Indications:
N/A
In feet. Displayed for types 9 to 18, range –1000 to 126700 ft.

GNSS ALT (Global positioning system derived altitude)
Indications:
N/A
In feet. Displayed for types 20 to 22, range -1000 to 126700 ft.

POS (Position Decode)
Indications:
GLOBAL (if Global LAT/LONG not entered in ADS-B/GICB setup menu).
LOCAL (if Local LAT/LONG is entered in ADS-B/GICB setup menu).

SURVEILLANCE STATUS
Indications:
NO INFO (No Information),
SPI (Special Position Identification),
PERM ALERT (Permanent Alert (Emergency),
TEMP ALERT (Temporary Alert (change in Mode identity code).

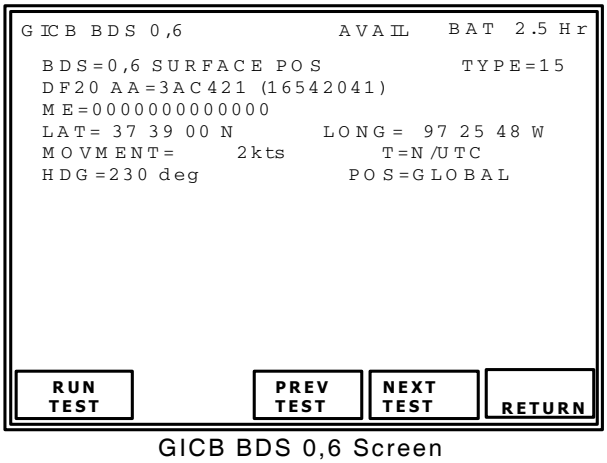
SAF (Single Antenna Flag)
Indications:
0 (single antenna),
1 (dual antenna).

T (Time Sync to UTC)
Indications:
N/UTC (not UTC),
UTC.

TYPE Specifies class and accuracy of data. Refer to table A-2 RTCA DO-260A V2.

NOTE: Refer to ICAO manual on Mode S specific services DOC 9688-AN/952 and RTCA DO-260A V2 for detailed description of data fields

GICB BDS 0,6



GICB BDS 0,6 Screen
Figure 74

Uses UF4/5 Reply Length Long, BDS 0,6 register request: Receives DF20/21 reply and decodes MB message field containing BDS register contents and displays surface position.

NOTE: ADLP (Air Data Link Processor) must be installed or transponder must have embedded ADLP to receive data from subsystem.

NOTE: Installation must be in the ground state to transmit surface position.

AA (Aircraft Address) in HEX and (OCTAL)

MB message field displayed in 14 digit HEX format.

LAT (Encoded latitude) and LONG (Encoded longitude) decoded Local unambiguous CPR format in degrees, minutes and seconds.

MOVEMENT
Indications:
NO INFO (No Information Available),
STOPPED
0.125-<1 Kt,
1-<2 Kt,
2-<15 Kt,
15-<70 Kt,
70-<100 Kt,
100-<175 Kt,
>175 Kt,
DECELERATING,
ACCELERATING,
BACKING UP

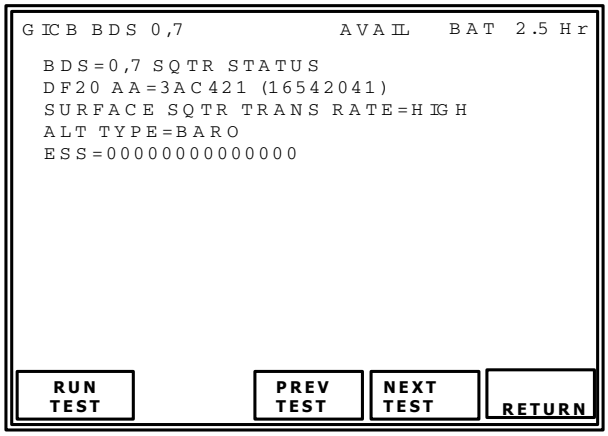
HDG (Heading)
Indications:
0 to 357 Degrees or N/A if HDG Status not valid.

T (Time Sync to UTC)
Indications:
N/UTC (Not UTC),
UTC

TYPE Specifies class and accuracy of data. Refer to table A-2 RTCA DO-260A V2.

NOTE: Refer to ICAO manual on Mode S specific services DOC 9688-AN/952 and RTCA DO-260A V2, for detailed description of data fields

GICB BDS 0,7



GICB BDS 0,7 Screen
Figure 75

Uses UF20/21 BDS 0,5 register request: Receives DF20/21 reply and decodes MB message field containing BDS register contents and displays Squitter Status.

NOTE: ADLP (Air Data Link Processor) must be installed or transponder must have embedded ADLP to receive data from subsystem.

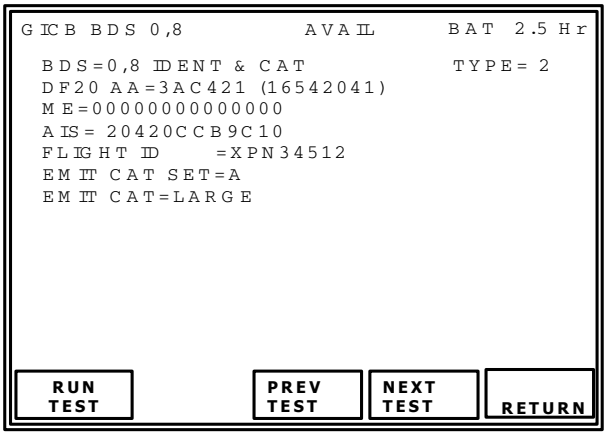
SURF SQTR TRAN RATE
Indications:
NOT CAP (No Capability to determine surface squitter rate),
HIGH (High surface squitter rate selected),
LOW (Low surface squitter rate selected).

ALT TYPE
Indications:
BARO,
GNSS

ESS (Extended Squitter Status)
Indications:
14 digit hex field, bits 1 to 56

NOTE: Refer to ICAO manual on Mode S specific services DOC 9688-AN/952 and RTCA DO-260A V2 for detailed description of data fields.

GICB BDS 0,8



GICB BDS 0,8 Screen
Figure 76

Uses UF4/5 Reply Length Long, BDS 0,8 register request: Receives DF20/21 reply and decodes MB message field containing BDS register contents and displays Squitter Ident and Category.

NOTE: ADLP (Air Data Link Processor) must be installed or transponder must have embedded ADLP to receive data from subsystem.

AA (Aircraft Address) in HEX and (OCTAL)

MB message field displayed in 14 digit HEX format.

EMIT CAT SET (ADS-B Emitter Category Set)
Indications: D,C,B,A.

EMIT CAT (ADS-B Emitter Category).
Indications:

EMIT CAT A:

NO ADS-B EMITTER INFO,
LIGHT,
SMALL,
LARGE,
HIGH VORTEX,
HEAVY,
HIGH PERFORMANCE,
ROTOCRAFT,

EMIT CAT B:
NO ADS-B EMITTER INFO,
GLIDER/SAILPLANE,
LIGHTER-THAN-AIR,
PARACHUTIST/SKYDIVER,
ULTRALIGHT/HANG-GLIDER,
RESERVED,
UNMANNED AERIAL VEHICLE,
SPACE VEHICLE.

EMIT CAT C:
NO ADS-B EMITTER INFO,
SURFACE EMERGENCY VEHICLE,
SURFACE SERVICE VEHICLE,
FIXED GND/TETHERED OBSTR,
CLUSTER OBSTR,
LINE OBSTR,
RESERVED,
RESERVED

EMIT CAT D:
RESERVED,
RESERVED,
RESERVED,
RESERVED,
RESERVED,
RESERVED,
RESERVED

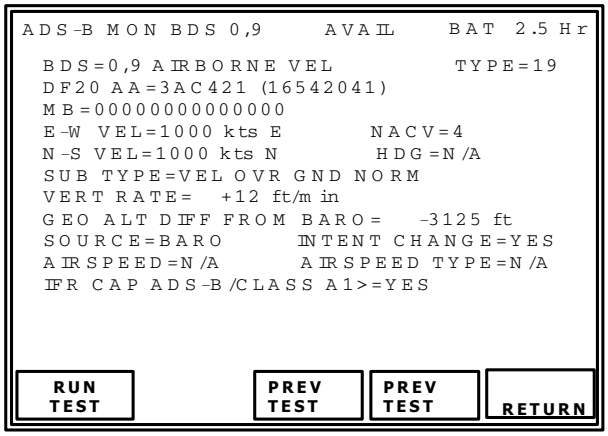
AIS (Aircraft Identity Subfield) HEX field containing BDS plus flight ID.

FLIGHT ID
Indications:
8 ICAO character field.

TYPE Specifies class and accuracy of data. Refer to table A-2 RTCA DO-260A V2.

NOTE: Refer to ICAO manual on Mode S specific services DOC 9688-AN/952 and RTCA DO-260A V2 for detailed description of data fields

GICB BDS 0,9



GICB BDS 0,9 Screen
Figure 77

Uses UF4/5 Reply Length Long, BDS 0,9 register request: Receives DF20/21 reply and decodes MB message field containing BDS register contents and displays Airborne Velocity.

AA (Aircraft Address) in HEX and (OCTAL)

MB message field displayed in 14 digit HEX format.

NOTE: ADLP (Air Data Link Processor) must be installed or transponder must have embedded ADLP to receive data from subsystem.

NOTE: Installation must be in the airborne state to transmit airborne velocity.

SUB TYPES (Subtype Coding).
Indications:
0 (ICAO DOC 9688 (First edition of ICAO Mode S Specific Service manual) not supported,
VEL OVR GND NORM (Velocity Over Ground Normal),
VEL OVER GND SUPER (Velocity Over Ground Supersonic),
AIR SPD NORM (Airspeed Normal),
AIR SPD SUPER (Airspeed Supersonic),
NOT ASSIGNED,
NOT ASSIGNED,
NOT ASSIGNED

EAST-WEST VEL (East-West Velocity)
Indications:
N/A (Not Available)
NO INFO (No Information),
0 to >1021 Kts (subtype 1),
0 to >4086 Kts (subtype 2),

NOTE: Followed by E (East) or W (West) direction identifier.

NORTH-SOUTH VEL (North-South Velocity)
Indications:
N/A (Not Available)
(subtype 1),
(subtype 2)

NOTE: Followed by N (North) or S (South) direction identifier.

VERT RATE (Vertical Rate).
Indications:
N/A (Not Available)
<-32608 to >32608 ft/min

SOURCE (Source of Vertical rate).
Indications:
BARO (Barometric Source),
GEO (i.e. GPS Source)

GEO ALT DIFF FROM BARO (Geo Altitude Difference from Barometric Altitude).
Indications:
N/A
<-3137 to ft >3137 ft

HDG (Heading)
Indications:
N/A (Not Available),
0.0 to 359.6 Degrees.

INTENT CHANGE (Intent Change Flag)
Indications:
YES,
NO

IFR CAP ADS-B/CLASS A1> (IFR Capability Flag)
Indications:
NO (No ADS-B capability class A1 and above),
YES (ADS-B Capability Class A1 and above)

AIRSPEED
Indications:
N/A (Not Available)
0 to >1021 Kts.(subtype 3)
0 to >4086 Kts.(subtype 4)

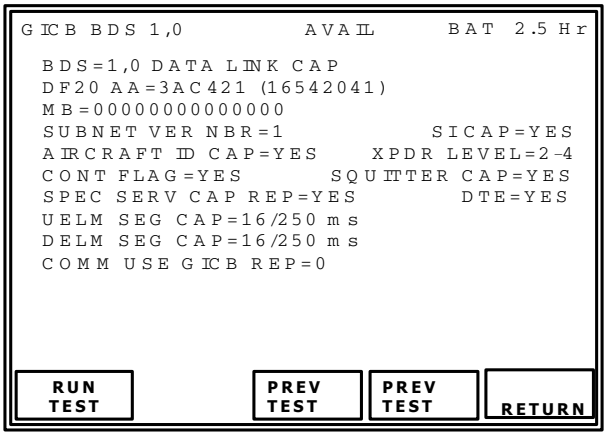
AIR SPEED TYPE
Indications:
IAS (Indicated Airspeed),
TAS (True Airspeed).

NACV (Navigation Accuracy Category for Velocity)
Indications:
0 to 4, reference tables A5-A7 RTCA DO-260.

TYPE Specifies class and accuracy of data. Refer to table A-2 RTCA DO-260A V2.

NOTE: Refer to ICAO manual on Mode S specific services DOC 9688-AN/952 and RTCA DO-260A V2 for detailed description of data fields

GICB BDS 1,0



GICB BDS 1,0 Screen
Figure 78

Uses UF4/5 Reply Length Long, BDS 1,0 register request: Receives DF20/21 reply and decodes MB message field containing BDS register contents and displays Data Link Capability Report.

AA (Aircraft Address) in HEX and (OCTAL)

MB message field displayed in 14 digit HEX format.

NOTE: ADLP (Air Data Link Processor) must be installed or transponder must have embedded ADLP to receive data from subsystem.

SUBNET VER NBR
Indications:
0-127

SI CAP
Indications:
YES (surveillance identifier code capability)
NO (no surveillance identifier code capability)

CONT FLAG
Indications:
YES (a continuation report may be found in registers BDS 1,1 up to BDS 1,6 which are not implemented in this revision)
NO

XPDR LEVEL
Indications:
2-4 OR 5

AIRCRAFT ID CAP
Indications:
Yes
NO

SQUITTER CAP
Indications:
YES (squitter registers are being updated)
NO (squitter registers are not being updated)

SPEC SERV CAP REP
Indications:
YES (at least one MODE S specific service is supported and the particular capability report will be checked)
NO (no MODE S specific service is supported and the particular capability report will not be checked)

DTE
Indications:
YES (DTE supported)
NO (DTE not supported)

COMM USE GICB REP
Indications:
0 = (Capabilities reported in BDS code 1,7 have not changed)
1 (Capabilities reported in BDS code 1,7 has changed)

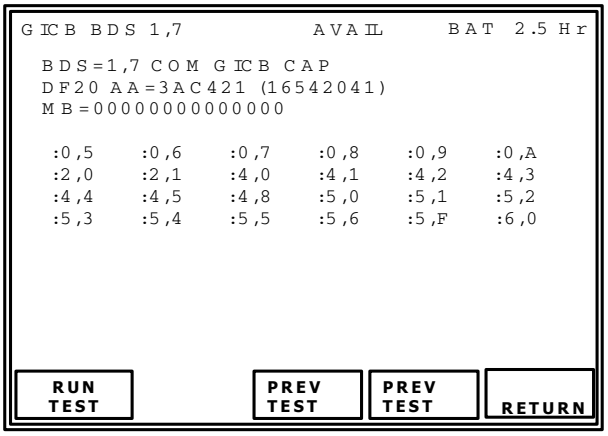
DELM
Indications:
NO DELM
4/15
8/15
16/15
16/500 ms
16/250 ms
16/125 ms
unassigned
unassigned
unassigned
unassigned
unassigned
unassigned
unassigned
unassigned
unassigned

UELM
Indications:
NO UELM
16/5
16/500 MS
16/250 MS
16/128 MS
16/60 MS
16/30 MS
unassigned
unassigned
unassigned
unassigned
unassigned
unassigned
unassigned
unassigned
unassigned

TYPE Specifies class and accuracy of data. Refer to table A-2 DO-260A V2.

NOTE: Refer to ICAO manual on Mode S specific services DOC 9688-AN/952 and RTCA DO-260A V2 for detailed description of data fields

GICB BDS 1,7



GICB BDS 1,7 Screen
Figure 79

Uses UF4/5 Reply Length Long, BDS 1,7 register request: Receives DF20/21 reply and decodes MB message field containing BDS register contents and displays Common GICB Capability Report.

AA (Aircraft Address) in HEX and (OCTAL)

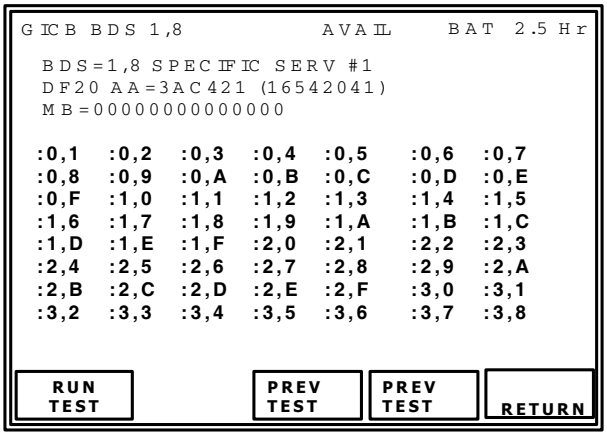
MB message field displayed in 14 digit HEX format.

Refer to 1-2-4, Table 17. Each BDS register supported by the transponder is displayed.

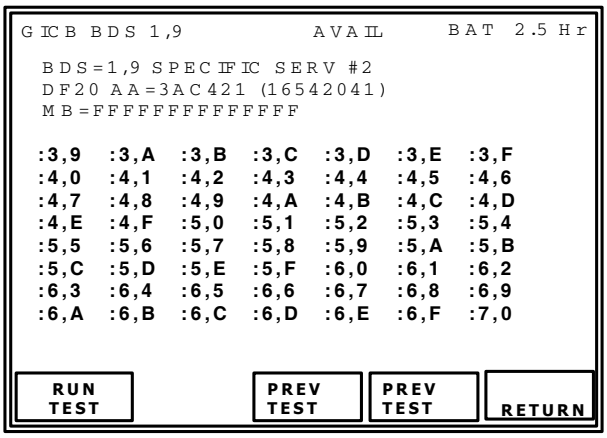
NOTE: ADLP (Air Data Link Processor) must be installed or transponder must have embedded ADLP to receive data from subsystem.

NOTE: Refer to ICAO manual on Mode S specific services DOC 9688-AN/952 and RTCA DO-260A V2 for detailed description of data fields

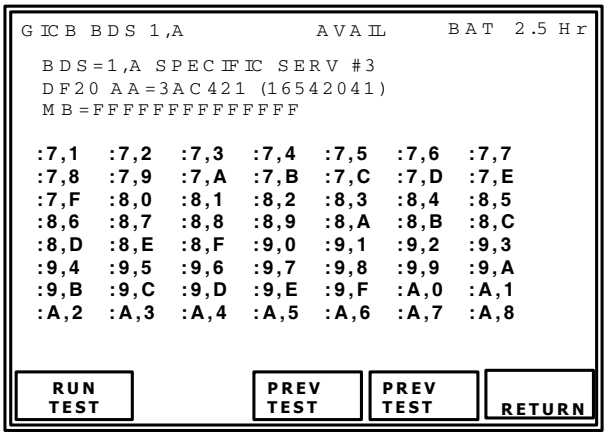
GICB BDS 1,8 – 1,C



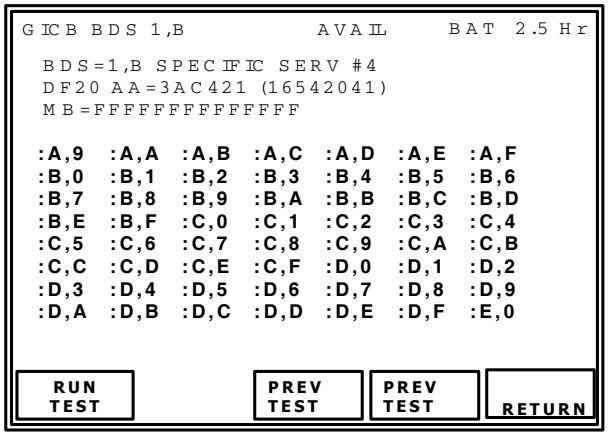
GICB BDS 1,8 Screen
Figure 80



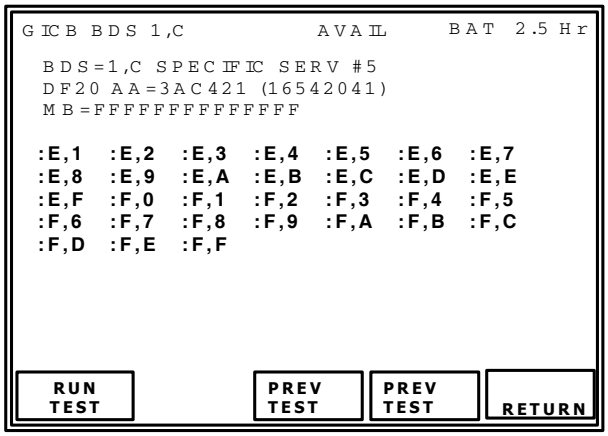
GICB BDS 1,9 Screen
Figure 81



GICB BDS 1,A Screen
Figure 82



GICB BDS 1,B Screen
Figure 83



GICB BDS 1,C Screen
Figure 84

AA (Aircraft Address) in HEX and (OCTAL)

Uses UF4/5 Reply Length Long, BDS 1,8 through 1,C register requests: Receives DF20/21 reply and decodes MB message field containing BDS register contents and displays Mode S Specific Service GICB Capability Reports #1 through #5.

AA (Aircraft Address) in HEX and (OCTAL)

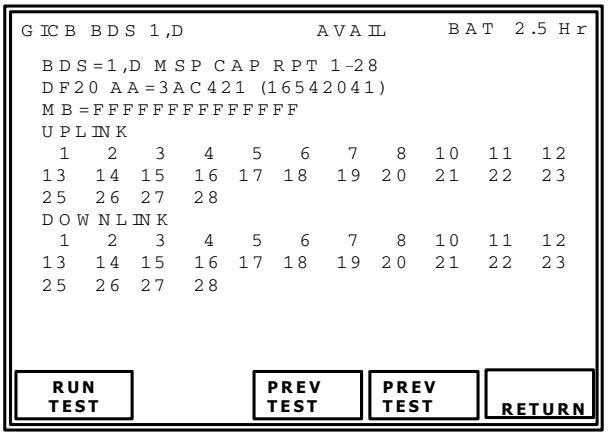
MB message field displayed in 14 digit HEX format.

Mode S Specific Service GICB Capability Reports advise which BDS registers are currently available from the transponder for data download via GICB protocol.

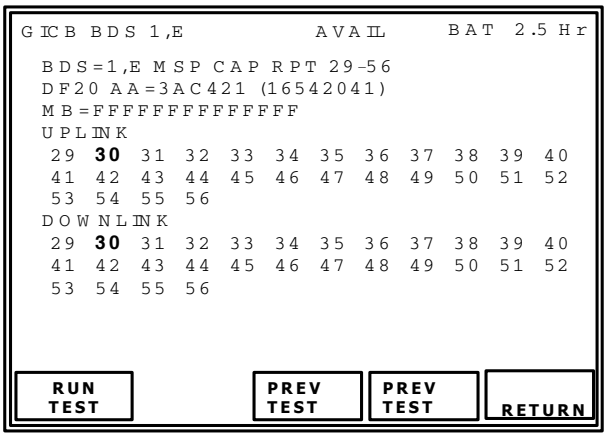
GICB BDS 1,D – 1,F

NOTE: ADLP (Air Data Link Processor) must be installed or transponder must have embedded ADLP to receive data from subsystem.

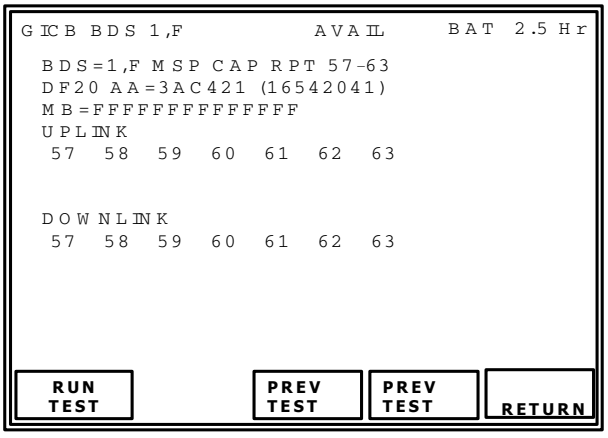
NOTE: Refer to ICAO manual on Mode S specific services DOC 9688-AN/952 and RTCA DO-260A V2 for detailed description of data fields



GICB BDS 1,D Screen
Figure 85



GICB BDS 1,E Screen
Figure 86



GICB BDS 1,F Screen
Figure 87

AA (Aircraft Address) in HEX and (OCTAL)

Uses UF4/5 Reply Length Long, BDS 1,D through 1,F register requests: Receives DF20/21 reply and decodes MB message field containing BDS register contents and displays Mode S Specific Protocol Capability Reports 1,D MSP channels 1-28, 1,E MSP Channels 29-56, 1,F MSP channels 57-63.

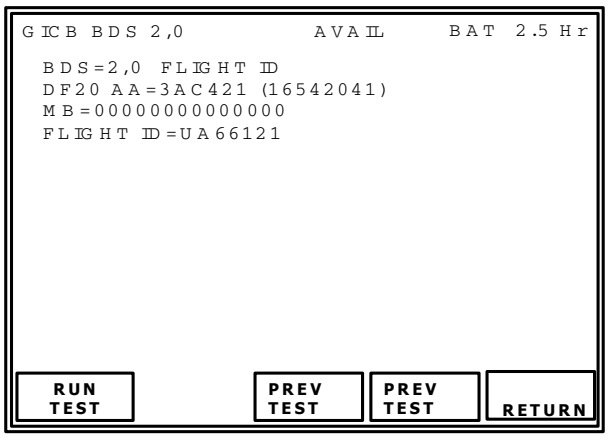
AA (Aircraft Address) in HEX and (OCTAL)

MB message field displayed in 14 digit HEX format.

Mode S Specific Protocols (MSPs) utilize one or more of the 63 uplink or downlink channels provide by this protocol to transfer data in either short or long form MSP packets from the GDLP (Ground Data Link Processor) to the ADLP (Airborne Data Link Processor) or vice versa. The available channels are displayed over three screens BDS 1,D BDS 1,E and BDS 1,F.

NOTE: Refer to ICAO manual on Mode S specific services DOC 9688-AN/952 and RTCA DO-260A V2 for detailed description of data fields

GICB BDS 2,0



GICB BDS 2,0 Screen
Figure 88

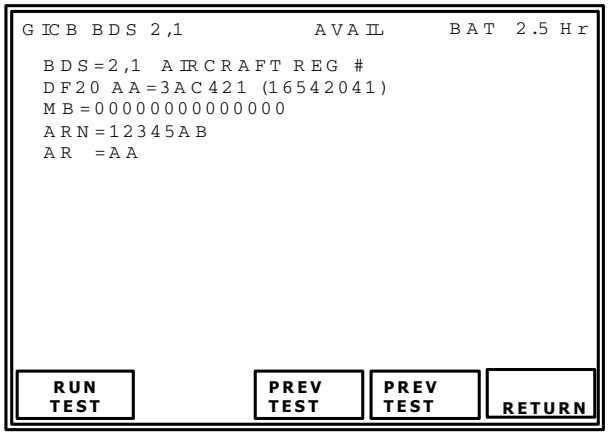
Uses UF4/5 Reply Length Long, BDS 2,0 register request: Receives DF20/21 reply and decodes MB message field containing BDS register contents and displays AIS Flight ID.

AA (Aircraft Address) in HEX and (OCTAL)

MB message field displayed in 14 digit HEX format.

Flight Id is seven characters.

GICB BDS 2,1



GICB BDS 2,1 Screen
Figure 89

Uses UF20/21 BDS 2,1 register request: Receives DF20/21 reply and decodes MB message field containing BDS register contents and displays Aircraft Registration Number.

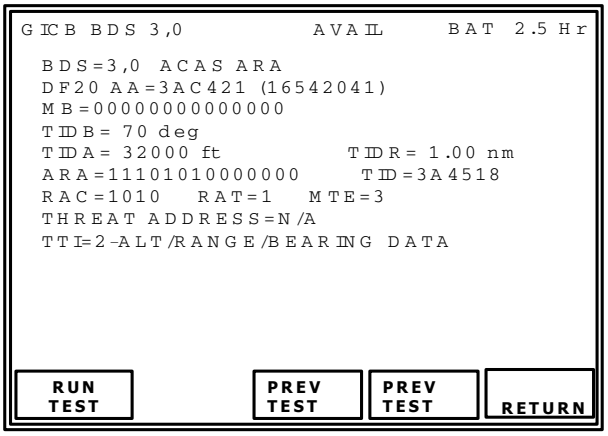
AA (Aircraft Address) in HEX and (OCTAL)

MB message field displayed in 14 digit HEX format.

ARN (Aircraft Registration Number) up to seven characters.

AR (Airline Registration) two characters.

GICB BDS 3,0



GICB BDS 3,0 Screen
Figure 90

Uses UF4/5 Reply Length Long, BDS 3,0 register request: Receives DF20/21 reply and decodes MB message field containing BDS register contents and displays ACAS Active Resolution Advisory data.

AA (Aircraft Address) in HEX and (OCTAL)

MB message field displayed in 14 digit HEX format.

ARA (Active Resolution Advisories) bits 41-54 displayed in binary.

RAC (Resolution Advisory Compliment) bit 55-58 displayed in binary.

RAT (RA Terminated) indicator bit 59 displayed in binary. Note: Normally 0 until an RA is terminated, then will be 1 for 18 seconds.

TIDA (Threat Identity Data Altitude) displayed in feet.
N/A (Not Available)
Note: Only displayed when TTI = 2, Intruder Not Mode S Equipped.

TID (Threat Identity Data) Mode S address (HEX) of the threat. Note: Only displayed when TTI = 1.

TIDR (Threat Identity Data Range) in nm.
N/A (Not Available)
Note: Only displayed when TTI = 2, Intruder Not Mode S Equipped.

TIDB (Threat Identity Data Bearing) in degrees.
N/A (Not Available)
Note: Only displayed when TTI = 2, Intruder Not Mode S Equipped.

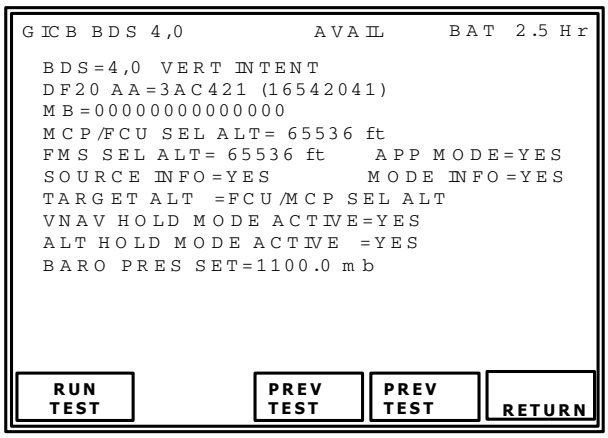
THREAT ADDRESS (Mode S threat address) displayed in 6 HEX digits
N/A (Not Available)
Note: Only displayed when TTI = 1.

MTE (Multiple Threat Encounter) displayed in 1 bit binary.

TTI (Threat Type Indicator)
Indications:
0-NO DATA
1-MODE S ADDRESS
2-ALT/RANGE/BEARING DATA
3-NOT ASSIGNED

NOTE: Refer to ICAO Annex 10, Vol III, Part 1, Chapter 5 and RTCA-DO-260A V2 for detailed description of data fields. Also refer to RTCA D0-185A para 2.2.3.9.3.2.3 MB fields used by TCASII

GICB BDS 4,0



GICB BDS 4,0 Screen
Figure 91

Uses UF4/5 Reply Length Long, BDS 4,0 register request: Receives DF20/21 reply and decodes MB message field containing BDS register contents and displays Vertical Intent.

AA (Aircraft Address) in HEX and (OCTAL)

MB message field displayed in 14 digit HEX format.

NOTE: ADLP (Air Data Link Processor) must be installed or transponder must have embedded ADLP to receive data from subsystem.

MCP/FCU SEL ALT (Mode Control Panel/Flight Control Unit Selected Altitude)
Indications in feet.
N/A (Not Available)

FMS SEL ALT (Flight management System)
Indications in feet.
N/A (Not Available)

TARGET ALT (Target Altitude)
Indications:
N/A (Not Available)
UNKNOWN,
AIRCRAFT ALT,
FCU/MCP SEL ALT,
FMS SEL ALT

SOURCE INFO (Target Altitude Source Information)
Indications:
YES (Source information Provided),
NO (No Source Information Provided)

BARO PRES SET (Barometric Pressure set)
Indications:
N/A (Not Available)
800 to 1209.5 in mb.

VNAV HOLD MODE (Vertical Navigation Mode)
Indications:
YES,
NO (Not Active)

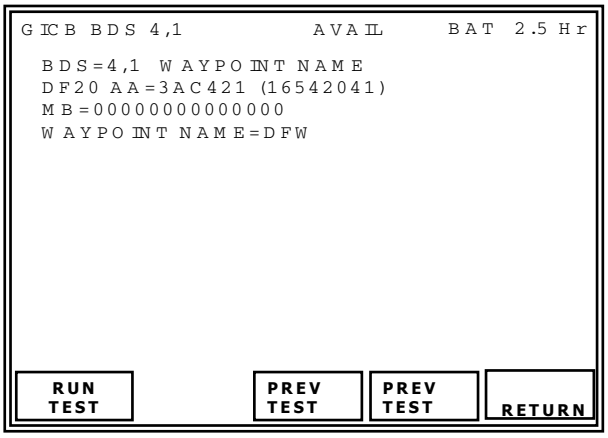
ALT HOLD MODE (Altitude Hold Mode)
Indications:
YES,
NO (Not Active)

APP MODE (Approach Mode)
Indications:
YES,
NO (Not Active)

MODE INFO (Mode Information)
Indications
YES (Mode Information Provided),
NO (No Mode Information Provided).

NOTE: Refer to ICAO manual on Mode S specific services DOC 9688-AN/952 and RTCA DO-260A V2 for detailed description of data fields.

GICB BDS 4,1



GICB BDS 4,1 Screen
Figure 92

Uses UF4/5 Reply Length Long, BDS 4,0 register request: Receives DF20/21 reply and decodes MB message field containing BDS register contents and displays Vertical Intent.

AA (Aircraft Address) in HEX and (OCTAL)

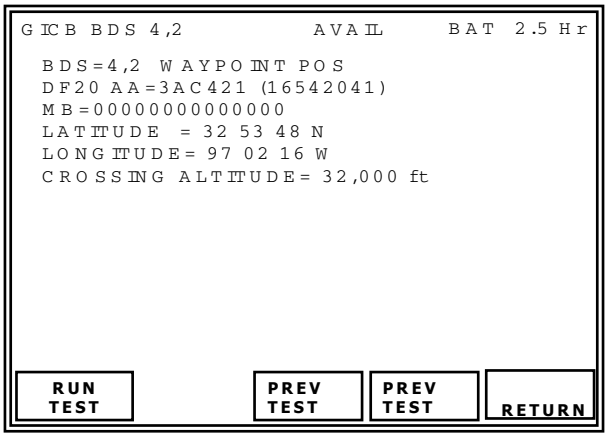
MB message field displayed in 14 digit HEX format.

NOTE: ADLP (Air Data Link Processor) must be installed or transponder must have embedded ADLP to receive data from subsystem.

WAYPOINT NAME 9 ICAO character name

NOTE: Refer to ICAO manual on Mode S specific services DOC 9688-AN/952 for detailed description of data fields.

GICB BDS 4,2



GICB BDS 4,2 Screen
Figure 93

Uses UF4/5 Reply Length Long, BDS 4,0 register request: Receives DF20/21 reply and decodes MB message field containing BDS register contents and displays Vertical Intent.

AA (Aircraft Address) in HEX and (OCTAL)

MB message field displayed in 14 digit HEX format.

NOTE: ADLP (Air Data Link Processor) must be installed or transponder must have embedded ADLP to receive data from subsystem.

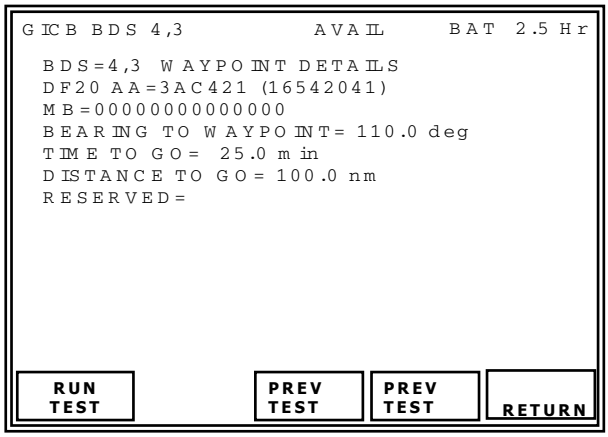
LATITUDE decoded format in degrees, minutes and seconds North or South.

LONGITUDE decoded format in degrees, minutes and seconds East or West.

CROSSING ALTITUDE range
0 to 131068 ft.

NOTE: Refer to ICAO manual on Mode S specific services DOC 9688-AN/952 for detailed description of data fields.

GICB BDS 4,3



GICB BDS 4,3 Screen
Figure 94

Uses UF4/5 Reply Length Long, BDS 4,0 register request: Receives DF20/21 reply and decodes MB message field containing BDS register contents and displays Vertical Intent.

AA (Aircraft Address) in HEX and (OCTAL)

MB message field displayed in 14 digit HEX format.

NOTE: ADLP (Air Data Link Processor) must be installed or transponder must have embedded ADLP to receive data from subsystem.

BEARING TO WAYPOINT
Indications: +/-180 degrees (1 decimal place)

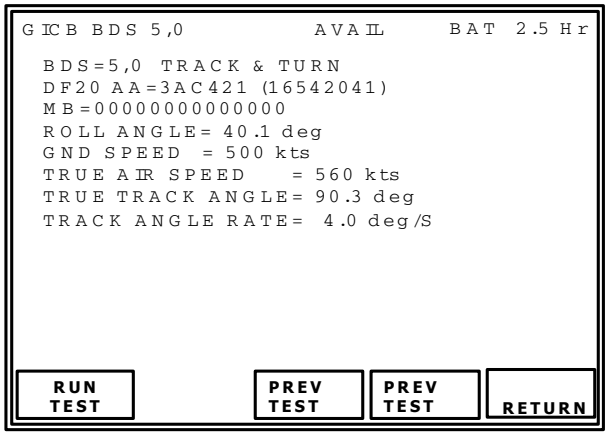
TIME TO GO
Indications: 0 to 409.6 mins

DISTANCE TO GO
Indications: 0 to 6553.6 nm

RESERVED

NOTE: Refer to ICAO manual on Mode S specific services DOC 9688-AN/952 for detailed description of data fields.

GICB BDS 5,0



GICB BDS 5,0 Screen
Figure 92

Uses UF4/5 Reply Length Long, BDS 5,0 register request: Receives DF20/21 reply and decodes MB message field containing BDS register contents and displays Track and Turn Report.

AA (Aircraft Address) in HEX and (OCTAL)

MB message field displayed in 14 digit HEX format.

NOTE: ADLP (Air Data Link Processor) must be installed or transponder must have embedded ADLP to receive data from subsystem.

ROLL ANGLE.
Indications:
+/-90 degrees (1 decimal place)

TRUE TRACK ANGLE (True Track Angle)
Indications:
+/-180 degrees (1 decimal place).

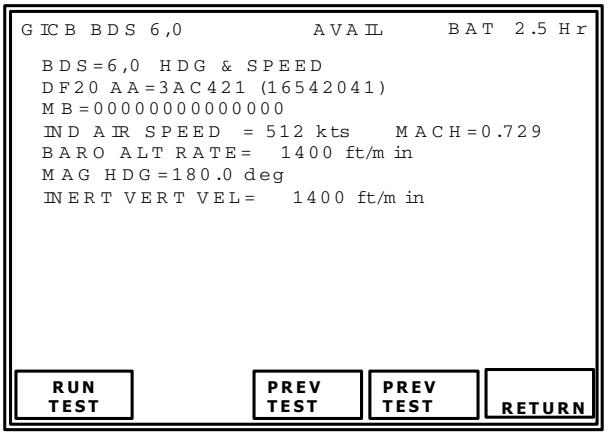
RATE (True Track Angle Rate)
Indications:
+/- 0 to 16 degrees/second (1 decimal place)

GND SPEED (Ground Speed)
Indications:
0 to 2048 Kts, 2kt resolution.

TRUE AIR SPEED (True Air Speed)
Indications:
0 to 2048 Kts, 2kt resolution.

NOTE: Refer to ICAO manual on Mode S specific services DOC 9688-AN/952 and RTCA DO-260A V2 for detailed description of data fields.

GICB BDS 6,0



GICB BDS 6,0 Screen
Figure 93

Uses UF4/5 Reply Length Long, BDS 6,0 register request: Receives DF20/21 reply and decodes MB message field containing BDS register contents and displays Heading and Speed Report.

AA (Aircraft Address) in HEX and (OCTAL)

MB message field displayed in 14 digit HEX format.

NOTE: ADLP (Air Data Link Processor) must be installed or transponder must have embedded ADLP to receive data from subsystem.

IND AIR SPEED (Indicated Air Speed)
Indications:
N/A (Not Available)
0 to 1023 Kts, 1 kt resolution.

MACH (Mach Number)
Indications:
N/A (Not Available)
0 to 4.096 mach number, resolution to three decimal places.

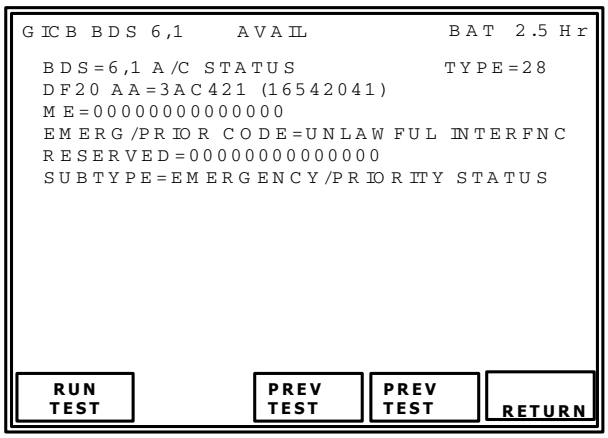
BARO ALT RATE (Barometric Altitude Rate)
Indications:
N/A (Not Available)
-16384 to +16352 ft/ minute, resolution 32 ft/min.

MAG HDG (Magnetic Heading)
Indications:
N/A (Not Available)
0 to 359 degrees.

INERT VERT VEL (Inertial Vertical Velocity)
Indications:
N/A (Not Available)
-16384 to +16352 ft/ minute, resolution 32 ft/min.

NOTE: Refer to ICAO manual on Mode S specific services DOC 9688-AN/952 and RTCA DO-260A V2 for detailed description of data fields.

GICB BDS 6,1



GICB BDS 6,1 Screen
Figure 94

DF20,21: Receives extended squitter decodes and displays Aircraft Status.

AA (Aircraft Address) in HEX and (OCTAL)

ME message field displayed in 14 digit HEX format.

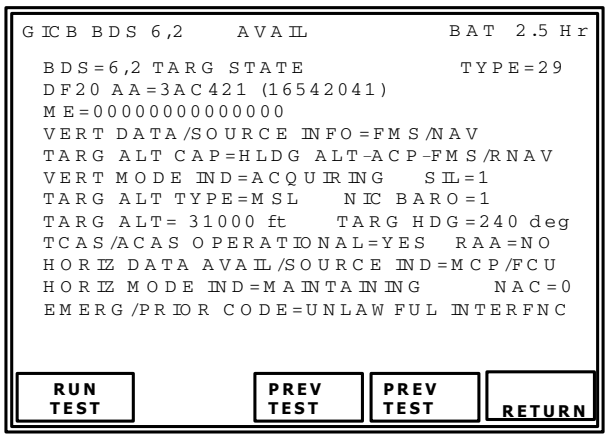
NOTE: ADLP (Air Data Link Processor) must be installed or transponder must have embedded ADLP, to receive data from subsystem.

SUB TYPE (Subtype Coding).
Indications:
NO INFO,
EMERGENCY/PRIORITY STATUS,
RESERVED
EMERG/PRIOR CODE (Emergency/Priority Status Coding).
Indications:
NO EMERGENCY,
GENERAL EMERGENCY,
LIFEGUARD/MEDICAL,
MINIMUM FUEL,
NO COMM,
UNLAWFUL INTERFNC,
DOWNED AIRCRAFT,
RESERVED.

RESERVED subfield, 12 digit HEX field containing contents of bits 9 to 56.

TYPE Specifies class and accuracy of data. Refer to table A-2 DO-260A V2.

GICB BDS 6,2



GICB BDS 6,2 Screen
Figure 95

DF20,21: Receives extended squitter decodes and displays Aircraft Status.

AA (Aircraft Address) in HEX and (OCTAL)

ME message field displayed in 14 digit HEX format.

NOTE: ADLP (Air Data Link Processor) must be installed or transponder must have embedded ADLP, to receive data from subsystem.

NOTE Installation must be in the airborne state to transmit target state and status.

NOTE: Autopilot must be engaged and stimulated by sensor data for some fields to display data.

SUBTYPE= 0

VERT DATA/SOURCE INFO (Vertical Data Available/Source Indicator)
Indications:

MCP/FCU (Mode Control Panel/Flight Control Unit),
HLD ALT (Holding Altitude),
FMS/RNAV (FMS/RNAV System).

VERT MODE IND (Vertical Mode Indicator)
Indications:
UNKNOWN, (Unknown Mode or Information unavailable),
ACQUIRING (Acquiring Mode),
MAINTAINING (Capturing or Maintaining Mode).
RESERVED

TARGET ALT CAP (Target Altitude Capability)
Indications:
HLD-ALT (Capability for reporting Holding altitude only),
HOLD+AUTOPILOT (Capability for reporting either Holding altitude or Autopilot control panel selected altitude),
HOLD+AUTOPILOT+FMS/RNAV (Capability for reporting either Holding altitude or Autopilot control panel selected altitude, or any FMS/RNAV level off altitude).
RESERVED

H DATA AVAIL/SOURCE IND (Horizontal Data Available/Source Indicator)
Indications:
NOT VALID (No Valid Horizontal Target State Data is available),
MCP/FCU (Mode Control Panel/Flight Control Unit selected track angle),
MAINTAIN (Maintain Current Heading or Track angle),
FMS/RNAV (FMS/RNAV System)

TARGET HDG (Target Heading Angle)
Indications: 0 to 359 degrees.
INVALID

HORIZ MODE IND (Horizontal Mode Indicator)
Indications:
UNKNOWN (Unknown Mode or Information unavailable),
ACQUIRING (Acquiring Mode),
MAINTAINING (Capturing or Maintaining Mode),
RESERVED.

NIC BARO (Navigation Integrity Baro)
Indications:
0 (Gillum Cross Checked)
1 (Gillum Not Cross Checked)

SIL (Surveillance Integrity Level) Indications:
0 (Unknown),
1 (1x10(-3) per flight),
2 (1x10(-5) per flight),
3 (1x10(-7) per flight)

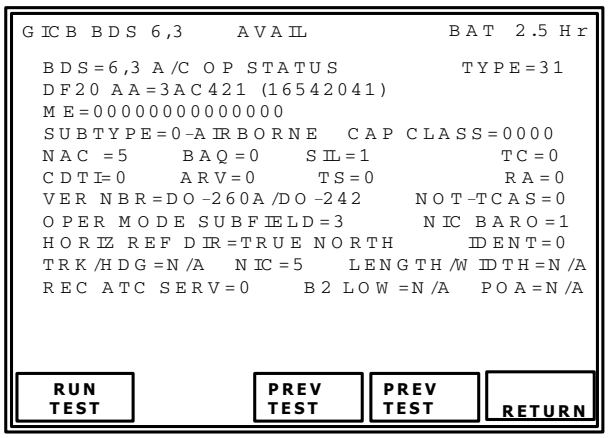
TCAS/ACAS OPERATIONAL (TCAS/ACAS Operational)
Indications:
YES,
NO.

RAA (TCAS/ACAS Resolution Advisory Active)
Indications:
YES,
NO.

TYPE Specifies class and accuracy of data. Refer to table A-2 RTCA DO-260A V2.

NOTE: Refer to ICAO Annex 10 Vol III Chapter 5 and RTCA-DO-260A for detailed description of data fields.

GICB BDS 6,3



GICB 6,3 Screen
Figure 96

DF20,21: Receives extended squitter decodes and displays Aircraft Operational Status.

AA (Aircraft Address) in HEX and (OCTAL)

ME message field displayed in 14 digit HEX format.

NOTE: ADLP (Air Data Link Processor) must be installed or transponder must have embedded ADLP, to receive data from subsystem.

NOTE Data is displayed over three screens Part 1, Part 2 and Part 3.

SUBTYPE
Indications:
AIRBORNE (Airborne Status message),
SURFACE (Surface Status message),
RESERVED,
RESERVED,
RESERVED,
RESERVED,
RESERVED,
RESERVED,

VER NBR (Reports formats and protocols supported)
Indications:
260/242 (RTCA DO-260 and DO-242),
260A/242A (RTCA DO-260A and DO-242A),
RESERVED,
RESERVED,
RESERVED,
RESERVED,
RESERVED,
RESERVED,

CDTI (Cockpit Display of Traffic Information)
Indications:
1 (Traffic Display operational),
0 (Traffic Display not operational)

ARV (Air Referenced Velocity Report) Only Available when Subtype= Airborne.
Indications:
N/A (Surface)
1 (Capability of sending messages to support Air-Reference velocity),
0 (No Capability of sending messages to support Air-Reference velocity).

TS (Target State Report Capability) Only Available when Subtype= Airborne
Indications:
N/A (Surface)
1 (Capability of sending messages to support Target State Reports),
0 (No Capability of sending messages to support Target State Reports).

TC (Target Change Report Capability) Only Available when Subtype= Airborne.
Indications:
N/A (Surface)
0 (No capability for sending messages to support trajectory change reports) ,
1TC+0 (Capability of sending messages to support TC+0 report only),
2 MTC (Capability of sending information for multiple TC reports)
3 (Reserved)

TRK ANGLE/HDG (Used for surface ADS-B participants, surface position message heading or ground track determination bit)
Indications:
N/A (Airborne)
0 (Target Heading Angle Reported
1 (Target Angle Reported)

IDENT (Ident Switch)
Indications
YES (Ident switch active),
NO (Ident switch not active).

REC ATC SER (Receiving ATC Services)
Indications:
1 (Aircraft receiving ATC services),
0 (Aircraft not receiving ATC services).

A/V LENGTH (Aircraft or Vehicle Length)
Indications:
N/A (Airborne)
<15m,
<25m,
<35m,
<45m,
<55m,
<65m,
<75m,
<=200m.

A/V WIDTH (Aircraft or Vehicle Width)
Indications:
N/A (Airborne)
<11.5m,
<23m,
<28.5m,
<34m,
<33m,
<38m,
<39.5m,
<45m,
<52m,
<59.5m,
<67m,
<72m,
<80m,
=>80m.

SIL (Surveillance Integrity Level)
Indications:
0 (Unknown),
1 (1x10(-3) per flight),
2 (1x10(-5) per flight),
3 (1x10(-7) per flight)

NIC BARO (Navigation Integrity Baro)
Indications:
N/A (Surface)
0 (Gillum Cross Checked)
1 (Gillum Not Cross Checked)

NAC
Indications:
0 (EPU $\geq$18.52 km)
1 (EPU <18.52 km)
2 (EPU <7.408 km)
3 (EPU <3.704 km)
4 (EPU <1852 m)
5 (EPU <926 m)
6 (EPU <555.6 m)
7 (EPU <185.2 m)
8 (EPU <92.6 m)
9 (EPU <30 m and VEPU <45 m)
A (EPU <30 m and VEPU <15 m)
B (EPU <3 m and VEPU <4 m)
C (reserved)
D (reserved)
E (reserved)
F (reserved)

BAQ
Indications:
N/A (Surface)
0 (always 0 for airborne message)
1 (not specified)
2 (not specified)
3 (not specified)

NOT TCAS
Indications:
N/A (Surface)
0 (TCAS operations or unknown)
1 (TCAS not installed or not operational)

OPER MODE Subfield
Indications:
0 (TCAS RA Active, IDENT Switch Active, Receiving ATC Services)
2 (Reserved)
3 (Reserved)

NIC
Indications:
0 (Rc unknown)
1 (Rc < 20 NM)

B2low
Indications:
N/A (Airborne)
0 (≥70 W)
1 (<70 W)

POA
Indications:
N/A (Airborne)
0 (Position transmitted is not the ADS-B position reference point)
1 (Position transmitted is the ADS-B position reference point)

CAPABILITY CLASS
ME BITS 9-24(airborne)
ME BITS 9-20 (surface)
0000-FFFF (airborne)
000-FFF (surface)

HORIZ
REF DIR (Horizontal Reference Direction)
Indications:
TRUE NORTH,
MAGNETIC NORTH

TYPE Specifies class and accuracy of data. Refer to table A-2 RTCA DO-260A V2.

NOTE: Refer to ICAO Annex 10 Vol III Chapter 5 and RTCA-DO-260A for detailed description of data fields.

4.7 TIS GENERAL DESCRIPTION

Primarily a U.S. deployed system, the Traffic Information Service (TIS) data link provides automatic display of nearby traffic and warns the pilot of potentially threatening traffic conditions. Using the Mode-S data link, a TIS ground processor uplinks surveillance information generated by Mode S sensors to equipped aircraft. The aircraft TIS processor receives the data and displays the data on the TIS display, providing increased situational awareness and an enhanced “see-and-avoid” capability for pilots.

TIS data is obtained from the ground Mode S sensor that acquires and maintains aircraft tracks within its coverage area.
TIS can only provide traffic information to aircraft equipped with Mode S, although the system acquires and maintains track information on all aircraft equipped with an ATC Radar Beacon System (ATCRBS). TIS can also integrate primary radar coverage to maintain tracks of non-transponder equipped aircraft. Because it is available to all Mode S transponders, TIS is inexpensive and its availability makes collision avoidance technology more accessible to the price-sensitive general aviation community.

TIS software and Mode S sensors are fielded at a number of terminals nationwide (U.S.) Terminal Mode S installations currently provide 60 nautical mile coverage, including a 5-mile buffer required for TIS coverage.

A Mode S equipped aircraft requests TIS data via a downlink message at 1090 MHz. The ground station sends TIS data to the aircraft via a datalink that operates at 1030 MHz. Data formats for TIS are described in the Minimum Operational Performance Standards for Traffic Information Service (TIS) Data Link Communications RTCA DO-239. The TIS cockpit display provides at least 5 miles of display range and TIS encoding provides values up to seven miles in 1/8-mile intervals. Relative altitudes from –3,000 to +3,500 feet are also accommodated.

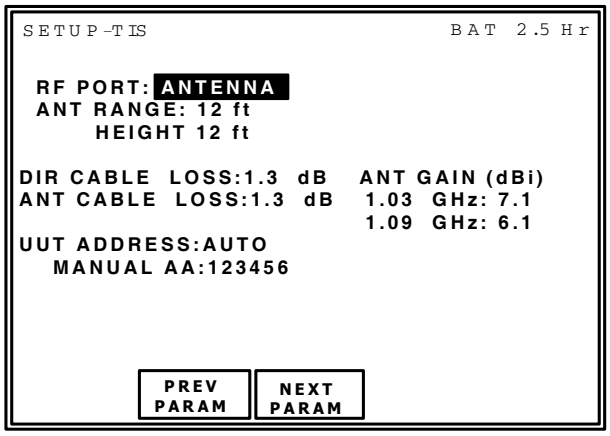
4.7.1 TIS MODE

Press the TCAS mode key twice to display the TIS screen (1-2-4 figure 100).

4.7.2 TIS SETUP

Setup TIS Screen contains parameters which determine operational characteristics of the TIS Functional Mode. Unless otherwise stated, last used values are retained on Power-up.

NOTE: Enter Setup Screen information before conducting test operations.



Setup TIS Screen
Figure 100

STEP	PROCEDURE

1. Press SETUP Soft Key to display SETUP TIS Screen (1-2-4, Figure 100).
2. Set the parameters by pressing NEXT PARAM. Press PREV PARAM to select the field. Use DATA Keys to slew the data. Parameters are:

   - RF PORT:

     Selects ANTENNA (ANT CONNECTOR) or DIRECT CONNECT via RF I/O Connector.

   - DIRECT CABLE LOSS:

     Entered in dB, figure (at 1090 MHz) marked on supplied RF coaxial cable.

     NOTE: Cable loss range 0.0 to 9.9 dB.

   - ANT CABLE LOSS:

     Entered in dB, figure (at 1090 MHz) marked on supplied RF coaxial cable.

     NOTE: Cable loss range 0.0 to 9.9 dB.

   - ANT GAIN:

     Entered in dBi, gain figures for 1030 and 1090 MHz marked on supplied Directional Antenna.

     NOTE: Cable loss range 0.0 to 20.9 dB.

   - ANT RANGE:

     Test Set Antenna to transponder antenna horizontal range (6 to 250). Enter parameters for BOTTOM and TOP antenna if installation has diversity capability.

     NOTE: UNITS parameter determines feet or meters (1-2-4, Figure 11).

   - ANT HEIGHT:

     Test Set Antenna Range to transponder antenna height difference (1 to 99).

     NOTE: UNITS parameter determines feet or meters (1-2-4, Figure 11).

   - UUT ADDRESS:

     MANUAL or AUTO (defaults to AUTO on power-up). AUTO selection Mode S address is obtained via ATCRBS/Mode S All Call (FAR Part 43, Appendix F approved method).

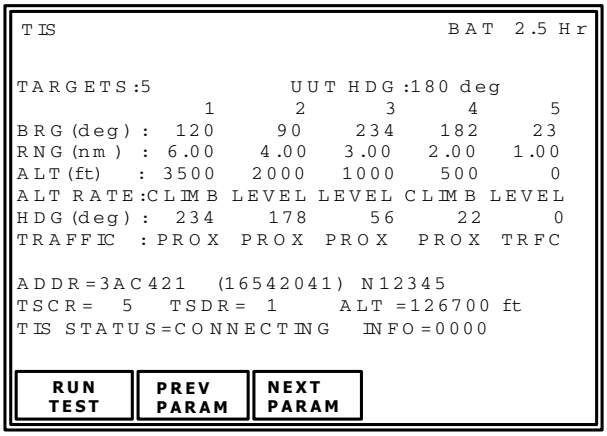
     On loss of ATCRBS/Mode S All Call reply (i.e., UUT placed in ground state) tests already running continue to use last ATCRBS/ Mode S All Call obtained address. AUTO uses manually entered address if no reply is received.

     NOTE: ICAO amendment 77 transponders only replies to Mode S discrete interrogations when installation is in ground state.

   - MANUAL ADDRESS:

     A six digit HEX address is entered if UUT ADDRESS: MANUAL is selected.

TIS TEST SCREEN



TIS Operation Screen
Figure 101

Test Screen Description:

TARGETS: Sets the number of simulated targets 0 to 5.

UUT HDG: Provides entry for UUT Heading in degrees range 0 to 354. This orientates the target bearings with respect to UUT (aircraft) heading.

BRG: Sets target bearing relative to UUT (aircraft) range 0 to 354 degrees

RNG: Sets targets range relative to UUT (aircraft) range 0 to 7 nm

ALT: Sets target altitude relative to UUT (aircraft) range +/- 3500 ft

ALT RATE: Sets Altitude Rate annunciation on TIS display indications: CLIMB, LEVEL, DESCEND, UNUSED.

HDG: Sets target Heading

TRAFFIC: Sets target traffic status on TIS display. PROX (Proximity), TRFC (Traffic)

ADDR= (UUT Aircraft Address) in HEX and (OCTAL)

TSCR= Number of TIS connect requests received

TSDR= Number of TIS disconnect requests received

ALT UUT= UUT Altitude in ft

TIS STATUS: Indications
CONNECTED (Up-linking data to UUTTSCR but not up-linking data to UUT)

INFO= (Debug output of IFR 6000)

0x0001 - Reply to Datalink Cap Report
0x0002 - No reply to Datalink Cap Report
0x0004 - Reply to MSP Cap Report
0x0008 - No reply to MSP Cap Report
0x0010 - Reply to Broadcast Cap Report
0x0020 - No reply to Broadcast Cap Report
0x0040 - Reply to keep alive uplink
0x0080 - No reply to keep alive uplink
0x0100 - Reply to TIS uplink
0x0200 - No reply to TIS uplink Reply
0x0400 - Reply to lockout
0x0800 - No reply to lockout

TIS DISPLAY

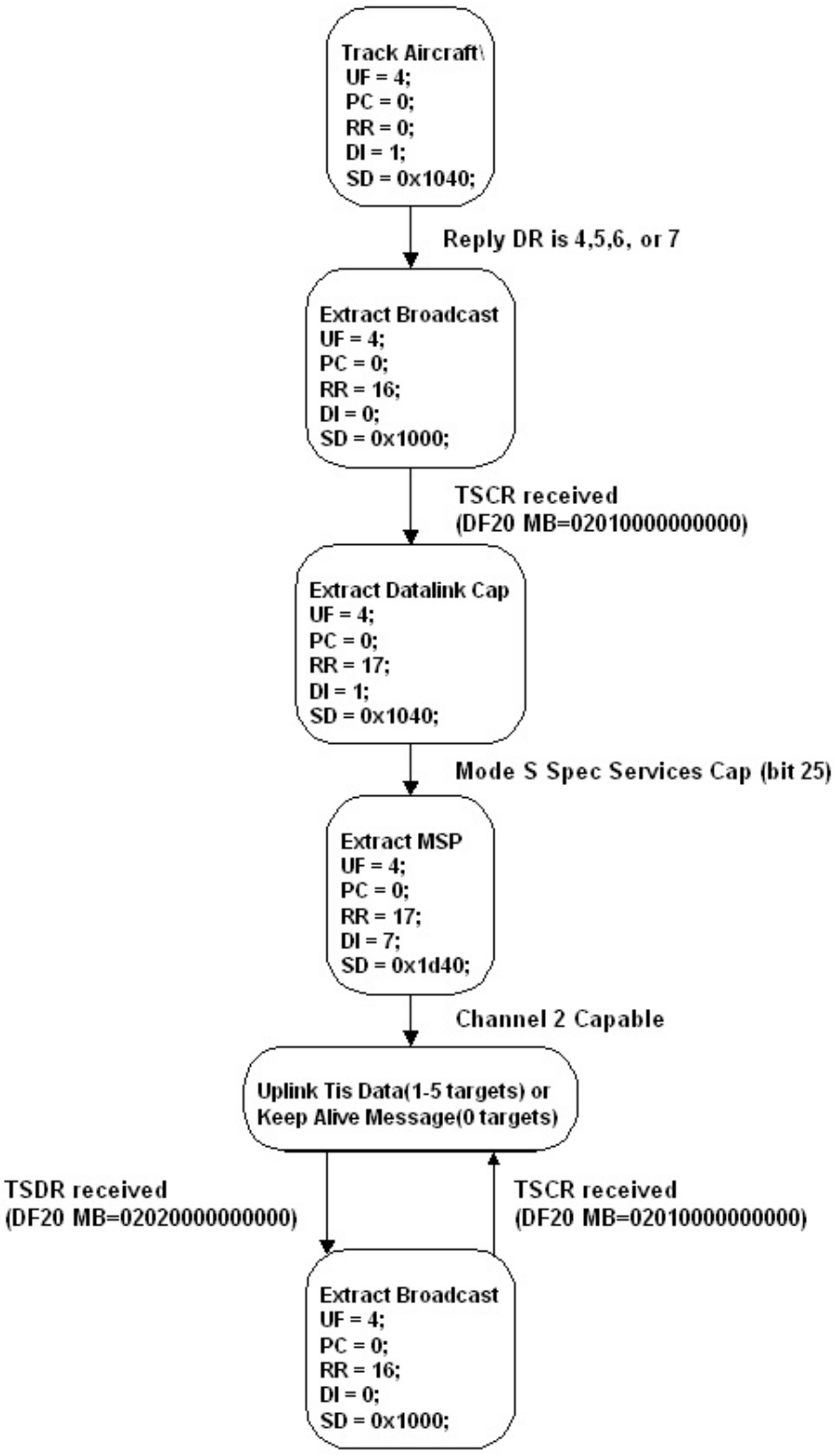
Refer to 1-2-4, Figure 102. The Aircraft heading is shown at the top of the display and the target headings are shown as lines radiating from the target symbols.

TIS Display Example
Figure 102

Target status:

White symbol	Proximity
Yellow symbol	Traffic

Relative altitudes are displayed alongside the targets with arrow symbols indicating climbing or descending. The blue cross (bottom center), is the UUT Aircraft.



TIS Operation Flow Chart
Figure 10

4.7 DIRECTIONAL ANTENNA USE

The Directional Antenna is used three ways.

Directional Antenna Mounted on Test Set
Figure 104

Mount Directional Antenna on friction hinge and connect Directional Antenna ANT Connector to Test Set ANT Connector via 12 in coaxial cable (1-2-4, Figure 104).

Hand Held Directional Antenna
Figure 105

Connect Directional Antenna ANT Connector to Test Set ANT Connector via 72 in coaxial cable. Point Directional Antenna at UUT antenna (1-2-4, Figure 105).

Tripod Mounted Directional Antenna
Figure 106

Connect Directional Antenna ANT Connector to Test Set ANT Connector via 72 in coaxial cable. Mount Directional Antenna on tripod and point at UUT antenna (1-2-4, Figure 106).

XPDR:

XPDR antennas are top and bottom mounted on airframe. Verify which antenna(s) is transponder antenna(s) as the DME antenna(s) look similar.

Position Directional Antenna in direct sight of UUT antenna, avoiding close obstructions (such as gantries, ladders and tool chests etc.), to minimize multi-path reflections which cause random test failures.

Distance for testing top UUT antenna should be sufficient so UUT antenna is visible (1-2-4, Figures 109 and 110).

Shield with Antenna Shield (Appendix J) or disconnect and terminate UUT Antenna not being tested. Deactivate other area transponders or position transponders at least three times the XPDR Setup Menu Range from Directional Antenna.

Procedure to Avoid False TCAS RA's on Overflying Aircraft or Altitude:

If the aircraft barometric system is at altitude, shield UUT Antenna being tested with Antenna Shield (Appendix J). Shield with another Antenna Shield or disconnect and terminate UUT Antenna(s) not being tested. Deactivate other area transponders or position transponder >50 ft (15.24 m) from the Directional Antenna. Position Directional Antenna ≤20 ft (6.1 m) from UUT Antenna being tested.

DME:

DME Antennas are bottom mounted on airframe. Verify which antenna(s) is DME Antenna(s) as the transponder lower antenna(s) look similar.

Position Directional Antenna in direct sight of UUT antenna, avoiding close obstructions (such as gantries, ladders and tool chests etc.), to minimize multipath reflections which cause random test failures. Usual distance from UUT antenna is approximately 10 to 20 feet.

NOTE: Directional Antenna should not be positioned closer than 6 feet, to ensure that the antenna far field is tested

TCAS:

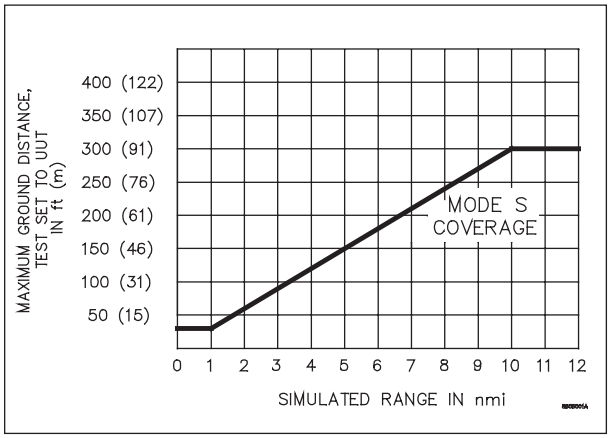
Most TCAS installations have top and bottom directional antennas. Some aircraft are fitted with an omni-directional bottom antenna.

Follow Avoid False TCAS RA's on Overflying Aircraft or Altitude procedure.

Position the Test Set Directional Antenna in direct sight of UUT antenna. To minimize intruder bearing error, Test Set antenna should be at the same height as the UUT antenna. Refer to 1-2-4, Figure 104 to ensure Test Set Directional Antenna is within effective coverage area for either ATCRBS or Mode S.

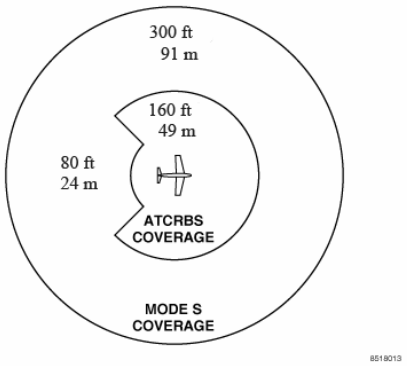
Avoid close obstructions (such as gantries, ladders and tool chests) to minimize multipath reflections which cause erroneous intruder bearings.

Testing in aircraft hangers may result in erratic bearing of simulated intruder. Changing bearing may result in a more reliable track. When testing top antenna in a hanger use a gantry at the same height as the top antenna.

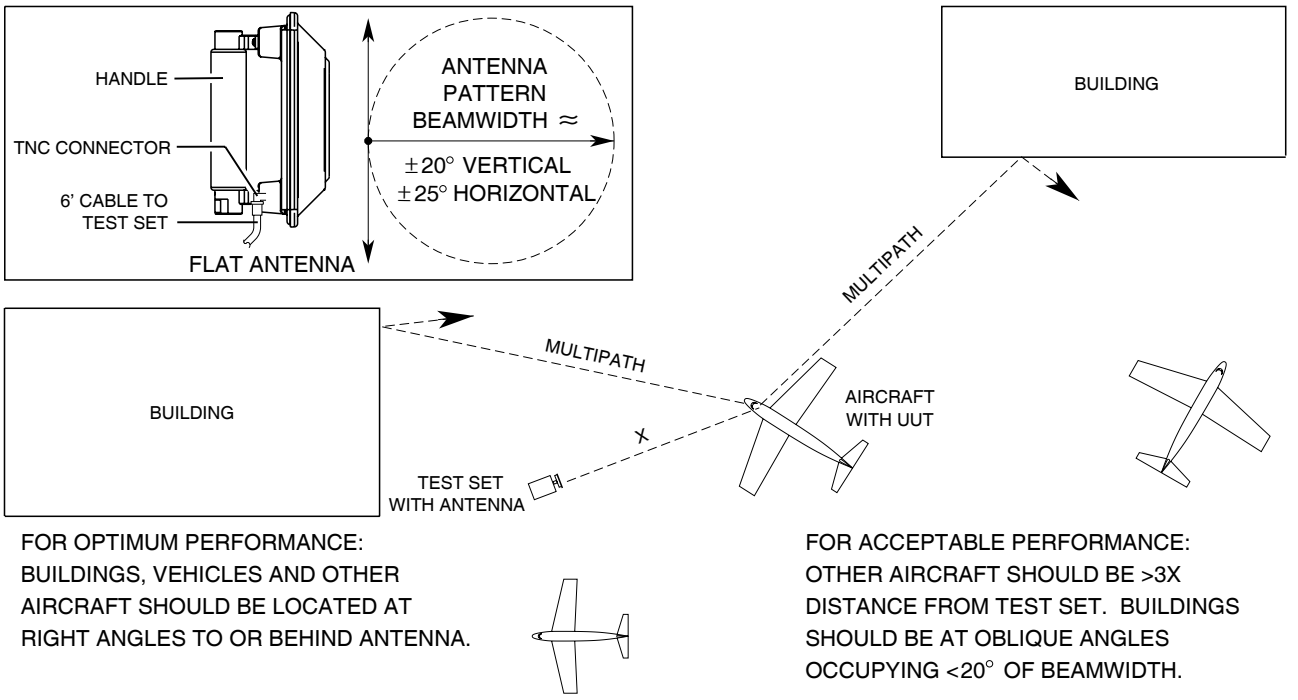


Mode S Coverage
Within 12 nmi Simulated Range
Figure 107

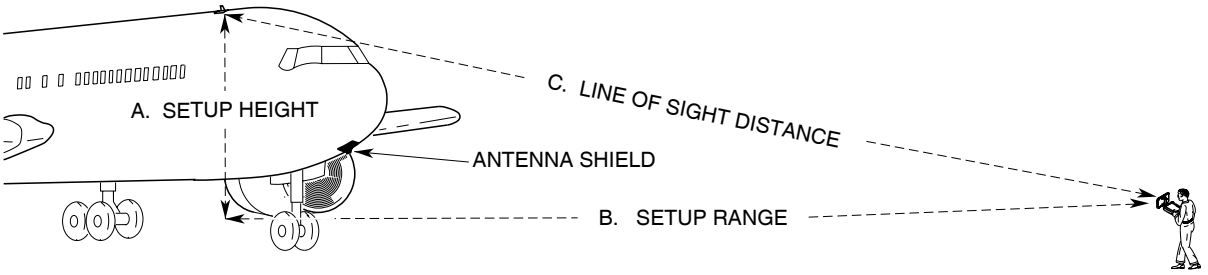
Refer to 1-2-4, Figure 107. Due to high power density reduction in some TCAS interrogators, Mode S effective coverage distance may be dependent on the Test Set simulated range. For those units place Test Set according to 1-2-4, Figure 108. For simulated ranges within 1 nm, position test set within 30 ft (9.0 m) of UUT antenna.



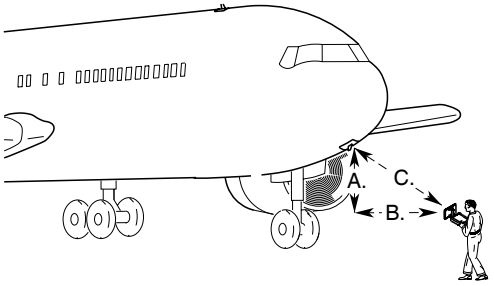
TCAS 6000 Effective Test Coverage
Figure108



Suggested Layout to Reduce Multipath Errors
Figure 109



TESTING TOP ANTENNA



WHEN DESELECTING, TERMINATING OR SHIELDING TOP ANTENNA IS NOT POSSIBLE OR PRACTICAL, USE SETUP POSITION THAT HAS AIRCRAFT BLOCKING LINE OF SIGHT TO TOP ANTENNA.

TESTING BOTTOM ANTENNA

05818A

Ramp Testing
Figure 110

4.8 BREAKOUT BOX

The Breakout Box accessory provides access to individual user interfaces via standard connectors (1-2-4, Figure 111). The Test Set REMOTE Connector provides the main user signal interface for the Breakout Box.

IFR 6000 with Breakout Box
Figure 111

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SECTION 3 - SPECIFICATIONS

NOTE: A 5 minute warm-up period is required for all specifications.

NOTE: Specifications are subject to change without notice.

DME MODE SIGNAL GENERATOR

Output Frequency:

Reply Frequency:	
Range:	962 to 1213 MHz
Accuracy:	±10 kHz

Output Level:

ANT Connector:	
Range:	-67 to -2 dBm at ANT Connector
Resolution:	1 dB
Accuracy:	±2 dB
Distance to UUT Antenna:	6 to 300 ft with supplied antenna
RF I/O Connector:	
Range:	-115 to -47 dBm
Resolution:	1 dB
Accuracy:	
-95 to -47 dBm:	±1 dB
-115 to <-95 dBm:	±2 dB

Reply Pulse Spacing:

P_1 to P_2:	12 μs (±100 ns) (X Channel) at 50% peak
P_1 to P_2:	30 μs (±100 ns) (Y Channel) at 50% peak

Reply Pulse Width:

P_1/P_2:	3.5 μs (±0.5 μs)

Echo Reply:

Control:	On/Off
Position:	30 nmi (±1 nmi)
Amplitude:	-11 dB (±1 dB) relative to reply level

DME MODE SIGNAL GENERATOR (cont)

Reply Pulse Rise and Fall Times:

All Pulses:	
Rise Time:	2.5 μs (±0.25 μs) (10% to 90%)
Fall Time:	2.5 μs (±0.25 μs) (90% to 10%)

Reply Delay:

X Channel:	
Fixed Reply Delay:	50 μs (±100 ns)
Y Channel:	
Fixed Reply Delay:	56 μs (±100 ns)

Range Delay:

X and Y Channel:	
Range:	0 to 450.00 nmi
Resolution:	0.01 nmi
Accuracy:	±0.01 nmi

Range Rate:

X and Y Channel:	
Range:	10 to 6500 kts
Resolution:	1 kts
Accuracy:	±0.01 % typical, tested to ±0.5%

Squitter:

PRF:	2700 Hz
Accuracy:	±2%
Distribution:	Per ARINC 568

Reply Efficiency:

Range:	0 to 100%
Resolution:	1% increments
Accuracy:	±0.5%

Ident Tone:

Selection:	Selectable three letter code
Frequency:	1350 Hz
Accuracy:	±2 Hz

DME MODE UUT MEASUREMENTS

ERP:

Range:	+47 to +64 dBm
Resolution:	0.1 dB
Accuracy:	±2 dB

Direct Connection Peak Pulse Power:

Range:	+47 to +64 dBm
Resolution:	0.1 dB
Accuracy:	±1 dB

Frequency:

Range:	1025.00 to 1150.00 MHz
Resolution:	10 kHz
Accuracy:	±20 kHz

Interrogation Pulse Width:

P_1 and P_2 Pulse Widths:

Range:	2.00 to 5.00 μs
Resolution:	1 ns
Accuracy:	±50 ns

Interrogation Pulse Spacing:

P_1 to P_2 Spacing:	10 to 14 μs (X Channel) 34 to 38 μs (Y Channel)
Resolution:	10 ns
Accuracy:	±20 ns

Interrogation PRF:

Range:	1 to 300 Hz
Resolution:	1 Hz
Accuracy:	±2 Hz

TRANSPONDER MODE SIGNAL GENERATOR

RF Output Frequency:

Interrogation Frequency:	1030 MHz
Accuracy:	±10 kHz

RF Output Level:

Ant Connector:	MTL +6 dB typical, automatically controlled for a MTL range of -83 to -68 dBm
Range:	-67 to -2 dBm at ANT Connector
Resolution:	0.5 dB
Accuracy:	±2 dB
Distance to UUT Antenna:	6 to 200 ft with supplied antenna
RF I/O Connector:	MTL + 6 dB typical, automatically controlled
Range:	-115 to -47 dBm
Resolution:	0.5 dB
Accuracy:	
-95 to -47 dBm:	±1 dB
-115 to <-95 dBm:	±2 dB

ATCRBS/Mode S Interrogation Pulse Spacing:

Mode A:	
P_1 to P_2:	2.00 µs (±25 ns)
P_1 to P_3:	8.00 µs (±25 ns)
Mode C:	
P_1 to P_2:	2.00 µs (±25 ns)
P_1 to P_3:	21.00 µs (±25 ns)
Mode S:	
P_1 to P_2:	2.00 µs (±25 ns)
P_1 to P_6:	3.50 µs (±25 ns)
P_1 to SPR:	4.75 µs (±25 ns)
P_5 to SPR:	0.40 µs (±50 ns)

Intermode Interrogation Pulse Spacing:

Mode A:	
P_1 to P_3:	8.00 µs (±25 ns)
P_1 to P_4:	10.00 µs (±25 ns)

TRANSPONDER MODE SIGNAL GENERATOR (cont)

Intermode Interrogation Pulse Spacing (cont):

Mode C:

P_1 to P_3:	21.00 µs (±25 ns)
P_1 to P_4:	23.00 µs (±25 ns)

Interrogation Pulse Widths:

Mode A, C, S, Intermode:

P_1, P_2, P_3:	0.80 µs (±50 ns)

Mode S:

P_6 (Short DPSK Block):	16.25 µs (±50 ns)
P_6 (Long DPSK Block):	30.25 µs (±50 ns)
P_5	0.80 µs (±50 ns)

Intermode:

P_4 (Short):	0.80 µs (±50 ns)
P_4 (Long):	1.60 µs (±50 ns)

Interrogation Pulse Rise and Fall Times:

All Modes:

Rise Time:	50 to 100 ns
Fall Time:	50 to 200 ns

Phase Modulation:

All Modes:

Transition Time:	≤80 ns
Phase Shift:	180° (±10°)

SLS Levels:

ATCRBS:

SLS Level (P_2):	-9 dB, -1 to +0 dB relative to P_1 level
	0 dB, -0 to +1 dB relative to P_1 level
	Off

Mode S:

SLS Level (P_5): NOTE 1	-12 dB, -1 to +0 dB relative to P_6 level
	+3 dB, -0 to +1 dB relative to P_6 level
	Off

TRANSPONDER MODE SIGNAL GENERATOR (cont)

Interrogation Test Signals:

Mode S:

PRF:	50 Hz (±5 Hz)

ATCRBS:

PRF:	235 Hz (±5 Hz)

TRANSPONDER MODE UUT MEASUREMENTS

ERP (at 1090 MHz):

Range:	+45.5 to +59 dBm (35.5 to 800 W)
Resolution:	0.1 dB
Accuracy:	±2 dB

Direct Connection Peak Pulse Power (at 1090 MHz) :

Range:	+46.5 to +59 dBm (45 to 800 W)
Resolution:	0.1 dB
Accuracy:	±1 dB

Transmitter Frequency:

Range:	1087.000 to 1093.000 MHz
Resolution:	10 kHz
Accuracy:	±50 kHz

Receiver Sensitivity, Radiated MTL:

Range:	-79 to -67 dBm into 0 dBi antenna
Resolution:	0.1 dB
Accuracy:	±2 dB, typical

Receiver Sensitivity, Direct Connection MTL:

Range:	-79 to -67 dBm
Resolution:	0.1 dB
Accuracy:	±2 dB

Reply Delay:

ATCRBS:

Range:	1.80 to 7.00 μs
Resolution:	10 ns
Accuracy:	±50 ns

Mode S and ATCRBS Mode S All-Call:

Range:	125.00 to 131.00 μs
Resolution:	10 ns
Accuracy:	±50 ns

TRANSPONDER MODE UUT MEASUREMENTS (cont)

Reply Delay Jitter:

ATCRBS:

Range:	0.00 to 2.30 μs
Resolution:	1 ns
Accuracy:	±20 ns

Mode S and ATCRBS Mode S All-Call:

Range:	0.00 to 6.00 μs
Resolution:	1 ns
Accuracy:	±20 ns

Pulse Spacing:

F_1 to F_2:

Range:	19.70 to 21.60 μs
Resolution:	1 ns
Accuracy:	±20 ns

Mode S Preamble:

Range:	
P_1 to P_2:	0.8 to 1.2 μs
P_1 to P_3:	3.3 to 3.7 μs
P_1 to P_4:	4.3 to 4.7 μs
Resolution:	1 ns
Accuracy:	±20 ns

Pulse Widths:

F_1 and F_2:

Range:	0.25 to 0.75 μs
Resolution:	1 ns
Accuracy:	±20 ns

Mode S Preamble:

Range:	0.25 to 0.75 μs
Resolution:	1 ns
Accuracy:	±20 ns

TRANSPONDER MODE UUT MEASUREMENTS (cont)

Pulse Amplitude Variation:

Range:	
Mode S (Relative to P_1):	-3 to +3 dB
ATCRBS (Relative to F_1):	-3 to +3 dB
Resolution:	0.1 dB, (0.01 dB via RCI)
Accuracy:	±0.5 dB

DF 11 Squitter Period:

Range:	0.10 to 4.88 sec
Resolution:	10 ms
Accuracy:	±10 ms

Diversity Isolation:

Range:	0 to >20 dB (Depending on Test Distance)
	Test Distance is 1.83 m (6 ft) to 28.96 m (95 ft)
Resolution:	0.1 dB
Accuracy:	±3 dB

TCAS MODE SIGNAL GENERATOR

Output Frequency:

Reply Frequency:	1090 MHz
Accuracy:	±10 kHz

Output Level (Simulated ERP) :

ANT Connector:	Simulates a 50.5 dBm XPDR ERP at 10 nmi range.
Radiated pwr at 0dBi UUT ant:	-68 dBm typical at 10 nmi range, automatically controlled
Range:	-67 to -2 dBm at ANT Connector
Resolution:	0.5 dB
Accuracy:	±2 dB
Distance to UUT Antenna:	6 to 300 ft with supplied antenna
RF I/O Connector:	
Automatic mode:	-68 dBm at 10 nmi range, automatically controlled
Manual Mode Range	-115 to -47 dBm
Resolution:	0.5 dB
Accuracy:	
-95 to -47 dBm:	±1 dB
-115 to <-95 dBm:	±2 dB

Reply Pulse Spacing:

Mode C:	
F_1 to F_2:	20.30 µs (±25 ns)
F_1 to C_1:	1.45 µs (±25 ns)
F_1 to A_1:	2.90 µs (±25 ns)
F_1 to C_2:	4.35 µs (±25 ns)
F_1 to A_2:	5.80 µs (±25 ns)
F_1 to C_4:	7.25 µs (±25 ns)
F_1 to A_4:	8.70 µs (±25 ns)
F_1 to B_1:	11.60 µs (±25 ns)
F_1 to D_1:	13.05 µs (±25 ns)
F_1 to B_2:	14.50 µs (±25 ns)
F_1 to D_2:	15.95 µs (±25 ns)
F_1 to B_4:	17.40 µs (±25 ns)
F_1 to D_4:	18.85 µs (±25 ns)

TCAS MODE SIGNAL GENERATOR (cont)

Reply Pulse Spacing (cont):

Mode S:

P_1 to P_2:	1.00 μs (±25 ns)
P_1 to P_3:	3.50 μs (±25 ns)
P_1 to P_4:	4.50 μs (±25 ns)
P_1 to D_1:	8.00 μs (±25 ns)
D_1 to Dn (n = 2 to 112):	1.00 μs times (n-1) (±25 ns)

Reply Pulse Widths:

Mode C:

All Pulses:	0.45 μs (±50 ns)

Mode S:

P_1 through P_4:	0.50 μs (±50 ns)
D_1 through D_{112}:	0.50 μs (±50 ns), 1 μs chip width

Reply Modes

TCAS I / II Mode C (with altitude reporting)

TCAS II Mode S formats 0, 11, 16

Reply Pulse Amplitudes:

ATCRBS:	±1 dB relative to F_1
Mode S:	±1 dB relative to P_1

Reply Pulse Rise and Fall Times:

All Modes:

Rise Time:	50 to 100 ns
Fall Time:	50 to 200 ns

Percent Reply:

Range:	0 to 100%
Resolution:	10%
Accuracy:	±1%

Reply Delay

ATCRBS:	3.0 μs (±50 ns)
Mode S:	128 μs (±50 ns)

Range Delay:

Range:	0 to 260 nmi
Resolution:	0.1 nmi
Accuracy:	±0.02 nmi

TCAS MODE SIGNAL GENERATOR (cont)

Range Rate:

Range:	-1200 to +1200 kts
Resolution:	10 kts
Accuracy:	10%

Altitude Range:

Range:	-1000 to 126,000 ft
Resolution:	
Mode C:	100 ft
Mode S:	25 ft

Altitude Rate:

Range:	-10,000 to +10,000 fpm
Resolution:	100 fpm
Accuracy:	10%

Squitter:

Control:	On/Off
Rate:	0.8 to 1.2 sec, randomly distributed

TCAS MODE UUT MEASUREMENTS

Pulse Spacing:

ATCRBS (Mode C AllCall):

S1 to P1:	2.0 us
Accepts:	≤ ±200 ns
Rejects:	≥ ±1.0 us
P1 to P3:	21.0 us
Accepts:	≤ ±200 ns
Rejects: (<10% Replies)	≥ ±1.0 us
P1 to P4:	23.0 us
Accepts:	≤ ±200 ns
Rejects: (<10% Replies)	≥ ±1.0 us

Mode S:

P1 to P2:	2.0 us
Accepts:	≤ ±200 ns
Rejects: (<10% Replies)	≥ ±1.0 us
P1 to SPR:	4.75 us
Accepts:	≤ ±200 ns
Rejects: (<10% Replies)	≥ ±1.5 us

Suppresion

ATCRBS (P2 or S1):

>0.5dB above level of P1	<10% Replies

ERP (at 1030 MHz):

ATCRBS:

Range:	+43 to +58 dBm (20 to 631 W)
Resolution:	0.1 dB
Accuracy:	±2 dB

Mode S:

Range:	+43 to +58 dBm (20 to 631 W)
Resolution:	0.1 dB
Accuracy:	±2 dB

Direct Connection Peak Pulse Power (at 1030 MHz):

ATCRBS:

Range:	+43 to +58 dBm (20 to 631 W)
Resolution:	0.1 dB
Accuracy:	±1 dB

TCAS MODE UUT MEASUREMENTS (cont)

Direct Connection Peak Pulse Power (at 1030 MHz) (cont):

Mode S:

Range:	+43 to +58 dBm (20 to 631 W)
Resolution:	0.1 dB
Accuracy:	±1 dB

Frequency:

Range: 1029.900 to 1030.100 MHz

Resolution:	1 kHz
Accuracy:	±10 kHz

TCAS Broadcast Interval:

Range:	1.0 to 12.0 sec
Resolution:	0.1 sec
Accuracy:	±0.2 sec

MISCELLANEOUS

Inputs/Outputs:

RF I/O:

Type:	Input/Output
Impedance:	50 Ω typical
Maximum Input Level:	4 kW peak
	10 W average
VSWR:	<1.3:1

Antenna:

Type:	Input/Output
Impedance:	50 Ω typical
Maximum Input Level:	10 W peak
	1/2 W average

Video

Type:	Output
Impedance:	50 Ω typical
Generate Video Level:	1.1 ± 0.4V peak into 50 Ω
Receive Video Level:	Proportional to IF level

Test Antenna:

VSWR:	<1.5:1
Gain:	6 dB, Typical

Time Base (TCXO):

Temperature Stability:	±1 ppm
Aging:	±1 ppm per year
Accuracy:	±1 ppm
Test Limit:	±0.3 ppm

Battery:

Type:	Li Ion
Duration:	>4 hrs continuous operation
	>6 hrs, Typical

Input Power (Test Set):

Input Range:	11 to 32 Vdc
Power Consumption:	55 W Maximum
	16 W Nominal at 18 Vdc with charged battery
Fuse Requirements:	5 A, 32 Vdc, Type F

MISCELLANEOUS (cont)

Input Power (Supplied External AC to DC Converter):

Input Range:	100 to 250 VAC, 1.5 A Max, 47 to 63 Hz
Mains Supply Voltage Fluctuations:	≤10% of the nominal voltage
Transient Overvoltages:	According to Installation Category II

Environmental (Test Set):

Use:	Pollution Degree 2
Altitude:	≤4800 m
Operating Temperature:	-20°C to 55°C NOTE 2
Storage Temperature:	-30°C to 71°C NOTE 3
Relative Humidity:	95% (±5%) from 5°C to 30°C 75% (±5%) from 30°C to 40°C 45% (±5%) from 40°C to 55°C

Environmental (Supplied External AC to DC Converter):

Use:	Indoors
Altitude:	≤10,000 m
Operating Temperature:	0°C to 40°C
Storage Temperature:	-20°C to 71°C

Physical Characteristics:

Dimensions:	
Height:	11.2 in (28.5 cm)
Width:	9.1 in (23.1 cm)
Depth:	2.7 in (6.9 cm)
Weight (Test Set only):	<8 lbs. (3.6 kg)

SUPPLEMENTAL INFORMATION:

Test Set Certifications:

Altitude, Operating:	MIL-PRF-28800F, Class 2
Altitude, Non-Operating:	MIL-PRF-28800F, Class 2
Bench Handling:	MIL-PRF-28800F, Class 2
Blowing Dust	MIL STD -810F, Method 510.4, Procedure 1
Drip Proof:	MIL-PRF-28800F, Class 2
Explosive Atmosphere:	MIL-STD-810F, Method 511.4, Procedure 1
Relative Humidity:	MIL-PRF-28800F, Class 2
Shock, Functional:	MIL-PRF-28800F, Class 2
Vibration Limits:	MIL-PRF-28800F, Class 2
Temperature, Operating:	MIL-PRF-28800F, Class 2 NOTE 4
Temp, Non-Operating:	MIL-PRF-28800F, Class 2 NOTE 5
Transit Drop:	MIL-PRF-28800F, Class 2
Safety Compliance:	UL-61010B-1 EN 61010-1 CSA 22.2 No 61010-1
EMC:	EN 61326

External AC-DC Converter Certifications:

Safety Compliance:	UL 1950 DS
	CSA 22.2 No. 234
	VDE EN 60 950
EMI/RFI Compliance:	FCC Docket 20780, Curve “B”
EMC:	EN 61326

Transit Case Certifications:

Drop Test:	FED-STD-101C, Method 5007.1, Paragraph 6.3, Procedure A, Level A
Falling Dart Impact:	ATA 300, Category I
Vibration, Loose Cargo:	FED-STD-101C, Method 5019
Vibration, Sweep:	ATA 300, Category I
Simulated Rainfall:	MIL-STD-810F, Method 506.4, Procedure II of 4.1.2
	FED-STD-101C, Method 5009.1, Sec 6.7.1
Immersion:	MIL-STD-810F, Method 512.4

NOTES

NOTE 1 SLS level is automatically controlled in the SLS LEVEL test.

NOTE 2 Battery charging temperature range is 5° to 40°C (controlled by internal charger).

NOTE 3 Li Ion Battery must be removed below -20° C and above 60° C.

NOTE 4 Temperature range extended to -20°C to 55°C.

NOTE 5 Temperature range reduced to -30°C to 71°C.

SECTION 4 - SHIPPING

1. SHIPPING TEST SETS

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

Authorization

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

CONTACT: Aeroflex
Customer Service Dept.

Telephone: (800) 835-2350
FAX: (316) 524-2623

E-Mail: *service@aeroflex.com*

Tagging Test Sets

All Test Sets must be tagged with:

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

Shipping Containers

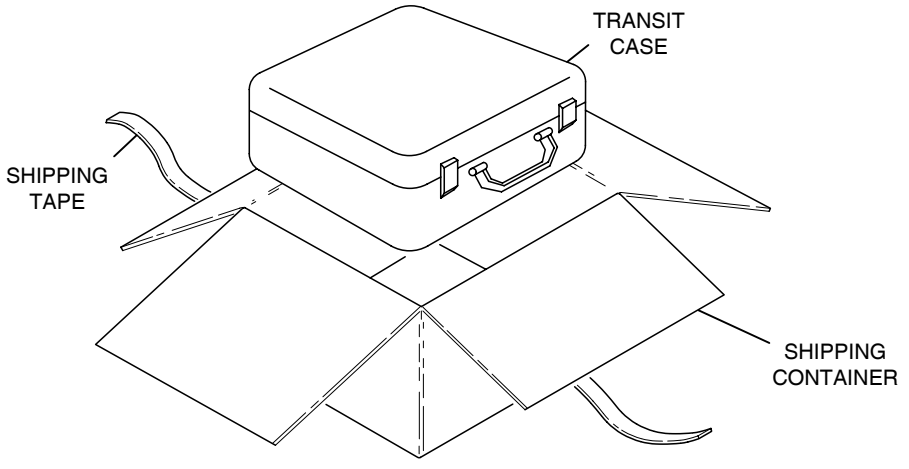
Test Sets must be repackaged in original shipping containers using Aeroflex packing molds. If original shipping containers and materials are not available, contact Aeroflex Customer Service for shipping instructions.

Freight Costs

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

1.2 REPACKING PROCEDURE

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



Repacking Procedure
Figure 1

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SECTION 5 - STORAGE

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

- Disconnect Test Set from any electrical power source.
- Disconnect the wire harness connecting the battery to the Test Set and remove the battery. Refer to the Battery/Voltage Instructions.
- Disconnect and store ac power cable and other accessories with Test Set.
- Cover Test Set to prevent dust and debris from covering and entering Test Set.

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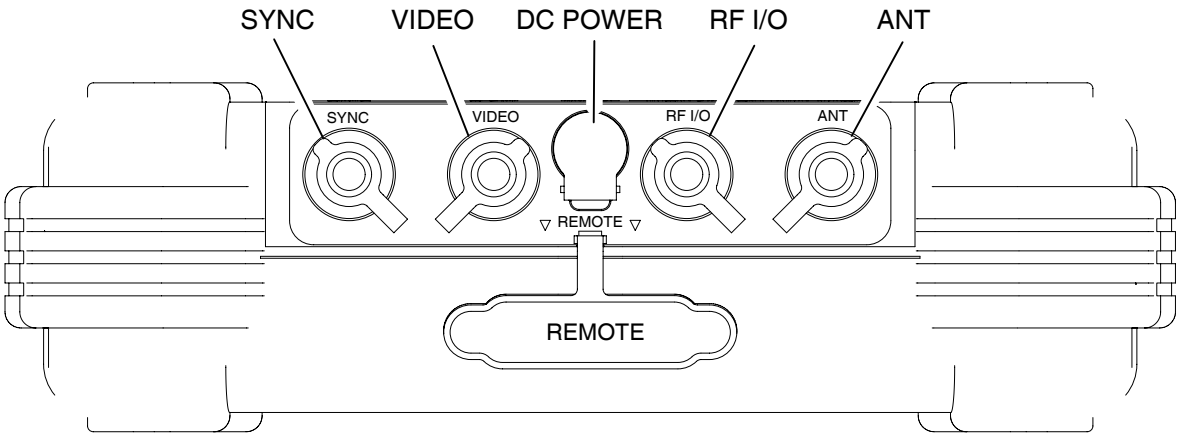
APPENDIX A - CONNECTOR PIN-OUT TABLES

1. I/O CONNECTORS

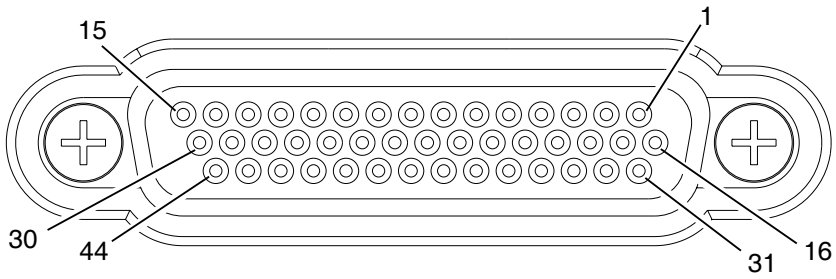


05806

CONNECTOR	TYPE	SIGNAL TYPE	INPUT/OUTPUT
SYNC	BNC	TTL	OUTPUT
VIDEO	BNC	TTL	OUTPUT
DC POWER	2.5 mm CIRCULAR (2.5 mm center, 5.5 mm outer diameter, center positive)	11 to 32 Vdc	INPUT
RF I/O	TNC	RF, 30 W CW MAX	INPUT/OUTPUT
ANT	TNC	RF, 0.5 W CW MAX	INPUT/OUTPUT
REMOTE	44-Pin Female	MIXED	INPUT/OUTPUT
	Refer to Appendix A, Table 2 for REMOTE Connector description.		

I/O Connectors
Table 1

2. REMOTE CONNECTOR PIN-OUT TABLE



05807

PIN NO.	SIGNAL NAME	SIGNAL TYPE	DESCRIPTION
1	VBUS_DN1	Supply	+5V supply for USB device port
2	GND_DN1	Ground	Ground for USB device port
3	VBUS_UP	Supply	+5V supply input from USB host
4	GND_UP	Ground	Ground for USB host port
5	GND	Ground	System Ground
6	HOST-RTS	Output	RS-232 Request to send
7	A2	Input	Altitude Encode Input
8	A4	Input	Altitude Encode Input
9	C2	Input	Altitude Encode Input
10	C4	Input	Altitude Encode Input
11	GND	Ground	System Ground
12	REM_IN1	Input	General Purpose Input
13	REM_OUT2	Output	General Purpose Output
14	GND	Ground	System Ground
15	GND	Ground	System Ground
16	H_D-	In/Out	USB Host Data Compliment
17	H_D+	In/Out	USB Host Data True
18	D_D-	In/Out	USB Host Data Compliment
19	D_D+	In/Out	USB Host Data True
20	GND	Ground	System Ground
21	HOST_TXD	Output	RS-232 Data Output
22	HOST_CTS	Input	RS-232 Clear to send
23	B1	Input	Altitude Encode Input
24	B2	Input	Altitude Encode Input
25	D2	Input	Altitude Encode Input

REMOTE Connector Pin-Out Table
Table 2

2. REMOTE CONNECTOR PIN-OUT TABLE (cont)

PIN NO.	SIGNAL NAME	SIGNAL TYPE	DESCRIPTION
26	GND	Ground	System Ground
27	REM_IN2	Input	General Purpose Input
28	REM_IN3	Input	General Purpose Input
29	REM_OUT4	Output	General Purpose Output
30	GND	Ground	System Ground
31	VBUS_DN1	Supply	+5V supply for USB device port
32	VBUS_DN1	Supply	+5V supply for USB device port
33	VBUS_UP	Supply	+5V supply input from USB host
34	GND_UP	Ground	Ground for USB host port
35	GND	Ground	System Ground
36	HOST_RXD	Input	RS-232 Data Input
37	A1	Input	Altitude Encode Input
38	B4	Input	Altitude Encode Input
39	C1	Input	Altitude Encode Input
40	REM_SP1		Spare Pin
41	D4	Input	Altitude Encode Input
42	REM_IN4	Input	General Purpose Input
43	REM_OUT1	Output	General Purpose Output
44	REM_OUT3	Output	General Purpose Output

REMOTE Connector Pin-Out Table (cont)
Table 2

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APPENDIX B - METRIC/BRITISH IMPERIAL CONVERSION TABLE WITH NAUTICAL DISTANCE CONVERSIONS

TO CONVERT:	INTO:	MULTIPLY BY:	TO CONVERT:	INTO:	MULTIPLY BY:
cm	feet	0.03281	meters	feet	3.281
cm	inches	0.3937	meters	inches	39.37
feet	cm	30.48	m/sec	ft/sec	3.281
feet	meters	0.3048	m/sec	km/hr	3.6
ft/sec	km/hr	1.097	m/sec	miles/hr	2.237
ft/sec	knots	0.5921	miles	feet	5280
ft/sec	miles/hr	0.6818	miles	km	1.609
ft/sec^2	cm/sec^2	30.48	miles	meters	1609
ft/sec^2	m/sec^2	0.3048	miles	nmi	0.8684
grams	ounces	0.03527	miles/hr	ft/sec	1.467
inches	cm	2.54	miles/hr	km/hr	1.609
kg	pounds	2.205	miles/hr	knots	0.8684
kg/cm^2	psi	0.0703	nmi	feet	6080.27
km	feet	3281	nmi	km	1.8532
km	miles	0.6214	nmi	meters	1853.2
km	nmi	0.5396	nmi	miles	1.1516
km/hr	ft/sec	0.9113	ounces	grams	28.34953
km/hr	knots	0.5396	pounds	kg	0.4536
km/hr	miles/hr	0.6214	psi	kg/cm^2	0.0703
knots	ft/sec	1.689	100 ft	km	3.048
knots	km/hr	1.8532	100 ft	miles	1.894
knots	miles/hr	1.1516	100 ft	nmi	1.645

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APPENDIX C - FACTORY/POWER UP PRESETS

Setup General

CONTROL	FACTORY	POWER UP
Power Down	10 mins	Last Used
ERP Units	dBm	Last Used
Units	Feet	Last Used
Remote Operation	RS-232	Last Used

Setup XPDR Screen

FIELD	FACTORY	POWER UP
Antenna Selection	Bottom	Last Used
RF Port	Antenna	Last Used
Antenna Range	12 feet	Last Used
Antenna Height	1 foot	Last Used
Cable Loss	1.3 dB	Last Used
Ant Gain 1.03 GHz	7.1 dB	Last Used
Ant Gain 1.09 GHz	6.1 dB	Last Used
UUT Address	AUTO	AUTO
Manual AA	000000	Last Used
Diversity Test	ON	Last Used
Config Type	GENERIC MODE S	Last Used

Setup DME Screen

FIELD	FACTORY	POWER UP
RF Port	Antenna	Last Used
Antenna Range	12 feet	Last Used
Ident Tone	IFR	Last Used
Cable Loss	1.3dB	Last Used
Ant Gain 0.96 GHz	7.5 dB	Last Used
Ant Gain 1.03 GHz	7.1 dB	Last Used
Ant Gain 1.09 GHz	6.1 dB	Last Used
Ant Gain 1.15 GHz	5.0 dB	Last Used
Ant Gain 1.22 GHz	2.8 dB	Last Used
Max Range	400 nm	Last Used

DME Screen

FIELD	FACTORY	POWER UP
VOR / Freq / Chan	978/108.00/17X	978/108.00/17X
RF LVL	Maximum	Maximum
Range	0 nm	0 nm
Rate	10 kts	10 kts
Rate Direction	OUT	OUT
% Reply	100%	100%
Echo	OFF	OFF
Ident	ON	ON
SQTR	ON	ON

XPDR Auto Test Screen

FIELD	FACTORY	POWER UP
Config	GENERIC MODE S	Last Used
Antenna	Bottom	Last used
Level	Blank	Blank
Replies	Blank	Blank
FREQ	Blank	Blank
TOP ERP	Blank	Blank
TOP MTL	Blank	Blank
BOT ERP	Blank	Blank
BOT MTL	Blank	Blank
A Code	Blank	Blank
C Alt	Blank	Blank
S Code	Blank	Blank
S Alt	Blank	Blank
Tail	Blank	Blank
DF17	Blank	Blank
Flight ID	Blank	Blank
AA	Blank	Blank
FS	Blank	Blank
VS	Blank	Blank
Country	Blank	Blank

APPENDIX D - ABBREVIATIONS

A

A	Amperes
AA	Address Announced
AC	Altitude Code
AC	Alternating Current
ac	Alternating Current
ACAS	Airborne Collision Avoidance System
ACS	Comm-A Capabilitiy Subfield
A/D	Analog to Digital
ADC	Analog to Digital Converter
ADDR	Address
ADLP	Airborne Data Link Processor
ADS	A-Definition Subfield
AIS	Comm-A Capability Subfield
ALT	Altitude
AP	Address Parity
AQ	Acquisition Special
ASCII	American National Standard Code for Information Interchange
ATC	Air Traffic Control
ATC	ATCRBS (screen abbreviation)
ATCRBS	Air Traffic Control Radar Beacon System
ATE	Automatic Test Equipment
ATTEN	Attenuation
AUTO	Automatic
AVG	Average

B

BAT	Battery
BCS	Comm-B Capability Subfield
BD	Comm-B Data
BDS	B-Definition Subfield
BIT	Built In Test
BOT	Bottom
bps	Bits per Second
BR	Bridge Rectifier
BT	Battery

C

C	Celsius or Centigrade
CA	Transponder Capability
CC	Crosslink Capability
ccw	Counterclockwise
CFS	Continuation Subfield
CHAN	Channel
CHC	Cancel Horizontal Resolution Advisory
CLOS	Closeout
cm	Centimeter (10^{-2} Meters)
Cont	Continued
CPU	Central Processing Unit
CrLf	Carriage Return and Line Feed
CTRL	Control
CTS	Clear to Send/(One-way hardware)
CTS/DTR	Two-way hardware
CVC	Cancel Vertical Resolution Advisory Complement
CW	Continuous Wave
cw	Clockwise

D

D/A	Digital to Analog
DABS	Discrete Address Beacon System
DAC	Digital to Analog Converter
dB	Decibel
dBi	Decibels above isotropic
dBm	Decibels above one milliwatt
dB W/m^2	Decibels above one watt per square meter
DCD	Data Carrier Detect
DCXO	Digitally Compensated Crystal Oscillator
DELM	Downlink Extended Length Message
DF	Downlink Format
DI	Designator Identification
DMM	Digital Multimeter
DPSK	Differential Phase Shift Keying
DR	Downlink Request
DSP	Digital Signal Processor
DSR	Data Set Ready
DTR	Data Terminal Ready

E

ECS	Extended Capability Subfield
ELM	Extended Length Message
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EOL	End of Line
ERP	Effective Radiated Power
ESB	Encoded Sense Bits
ESD	Electrostatic Discharge
EXT	External

F

FCC	Federal Communications Commission
FPM	Feet Per Minute
FREQ	Frequency
FS	Flight Status
FT	Foot/Feet
Ft	Foot/Feet

G

GEN	Generator
GND	Ground

H

h	Hexadecimal
Hz	Hertz
HRC	Horizontal Resolution Advisory Complement

I

ID	Identification
IDS	Identifier Designators Subfield
IFF	Identification Friend or Foe
II	Interrogator Identification
IIS	Interrogator Identification Subfield
IN	Input
INTERR	Interrogation
I/O	Input/Output
ITM	Intermode

K

KE	Control, ELM
kg	Kilogram (10^3 Grams)
kHz	Kilohertz (10^3 Hertz)
km	Kilometer (10^3 meters)
Kts	Knots (Velocity)

L

LCA	Logic Cell Array
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LF	Line Feed
LO	Local Oscillator
LOS	Lockout Subfield
LSB	Least Significant Bit
LSD	Least Significant Digit

M

m	Meters
MA	Message, COMM-A
MAX	Maximum
MB	Message, COMM-B
MBS	Multisite COMM-B Subfield
MC	Message, COMM-C
MD	Message, COMM-D
ME	Message, COMM-E
MEAS	Measuring
MES	Multisite ELM Subfield
MHz	Megahertz (10^6 Hertz)
μs	Microsecond (10^{-6} Seconds)
MID	Mode S Address
MIN	Minimum
MPU	Microprocessing Unit
ms	Millisecond (10^{-3} Seconds)
MTB	Multiple Threat Bit
MTE	Multiple Threat Encounter
MTL	Minimum Threshold Level
MU	Message, COMM-U
MV	Message, COMM-V

N

N/A	Not Applicable
NC	C-Segment Number
ND	D-Segment Number
nmi	Nautical Miles
No	Number
ns	Nanosecond (10^{-9} Seconds)

O

o	Octal
OUT	Output
Ω	Ohm

P

PC	Personal Computer
PC	Printed Circuit
PC	Protocol
PI	Parity/Interrogator Identity
PLCS	Places
PN	Part Number
PPM	Pulse Position Modulation
ppm	Parts per Million
PR	Probability of Reply
PRF	Pulse Repetition Frequency
PROM	Programmable Read Only Memory
psi	Pounds per Square Inch
PWM	Pulse Width Modulation
PWR	Power

R

RAM	Random Access Memory
RAC	Resolution Advisory Complement
RAT	Resolution Advisory Termination
RC	Reply Control
RCI	Remote Control Interface
RCVD	Received
RCVR	Receiver
Ref	Reference
RF	Radio Frequency
RI	Reply Information Air-to-Air
RL	Reply Length
RMS	Root Mean Square
ROM	Read Only Memory
RR	Reply Request
RRS	Reply Request Subfield
RSS	Reservation Status Subfield
RTCA	Requirements and Technical Concepts for Aviation organization
RTS	Request to Sent
RX	Receive
RXD	Receive Data

S

SCOPE	Oscilloscope
SCPI	Standard Commands for Programmable Instruments organization
SD	Special Designator
Sec	Second
SL	Sensitivity Level
SLM	Standard Length Message
SLS	Side-Lobe Suppression
SPI	Special Identifier Pulse
SQTR	Squitter
SRQ	Service Request
SRS	Segment Request Subfield
SSR	Secondary Surveillance Radar
SYNC	Synchronous

T

TAS	Transmission Acknowledgment Subfield
TCAS	Traffic Alert and Collision Avoidance System
TID	Threat Identity Data
TMS	Tactical Message Subfield
Trig	Trigger
TTI	Threat Type Indicator
TTL	Transistor-Transistor Logic
TX	Transmit
TXD	Transmit Data

U

UDS	U-Definition Subfield
UELM	Uplink Extended Length Message
UF	Uplink Format
UM	Utility Message
UUT	Unit Under Test

V

V	Volt
VAC	Volts, Alternating Current
VCO	Voltage Controlled Oscillator
Vdc	Volts, Direct Current
VDS	V-Definition Subfield
VERS	Version
VRAM	Video Random Access Memory
VRC	Vertical Resolution Advisory Complement
Vrms	Volts Root Mean Square
VS	Vertical Status
VSB	Vertical Sense Bits
VSWR	Voltage Standing Wave Ratio

W

W	Watt

X

XMTR	Transmitter
Xon/Xoff	Software Handshake
XPDR	Transponder

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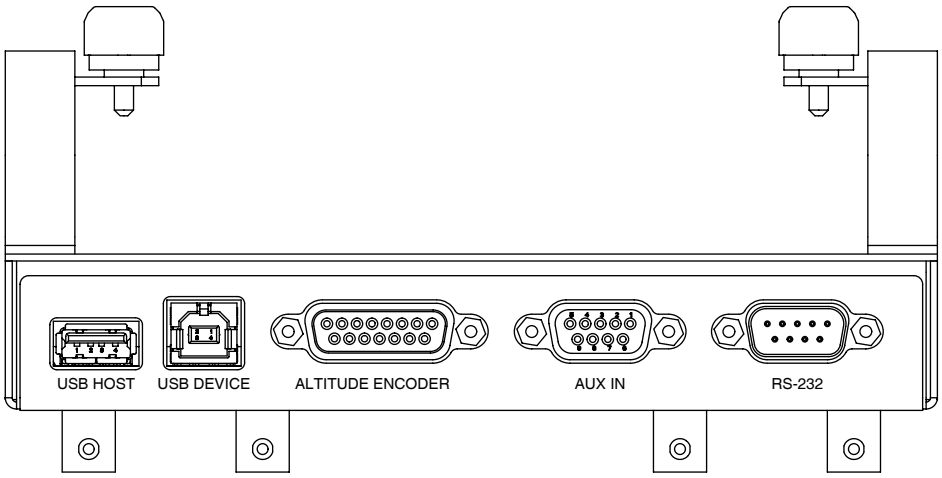
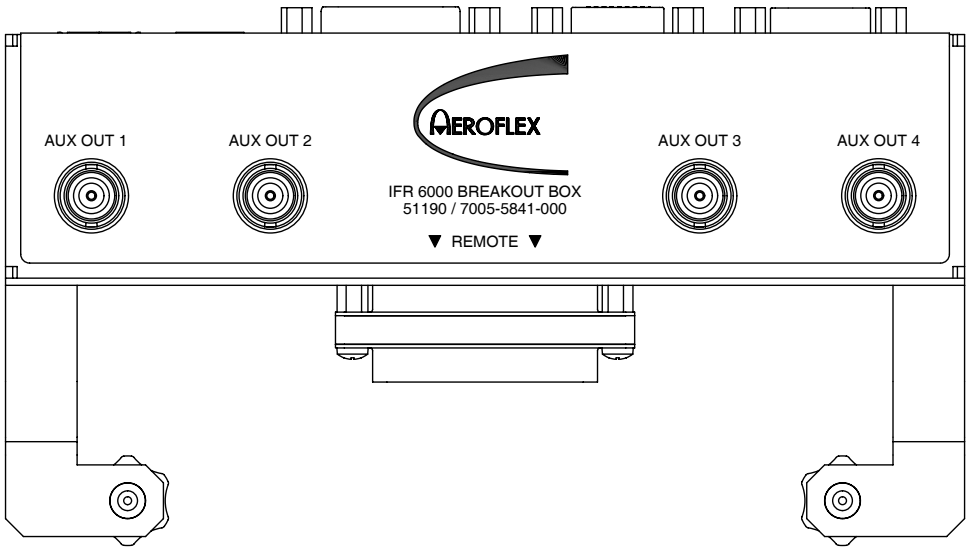
APPENDIX E - BREAKOUT BOX

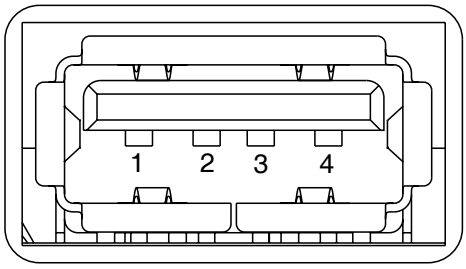


Breakout Box - Top View
Figure 1



Breakout Box - Front View
Figure 2

1. USB HOST CONNECTOR

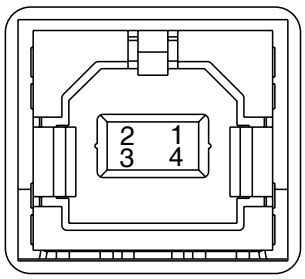


05810

PIN NO.	SIGNAL NAME	SIGNAL TYPE	DESCRIPTION
1	VBUS_DN1	Supply	+5 V supply for USB device port
2	H_D-	In/Out	USB Host Data Compliment
3	H_D+	In/Out	USB Host Data True
4	GND_DN1	Ground	Ground for USB device port

USB HOST Connector Table
Table 1

2. USB DEVICE CONNECTOR

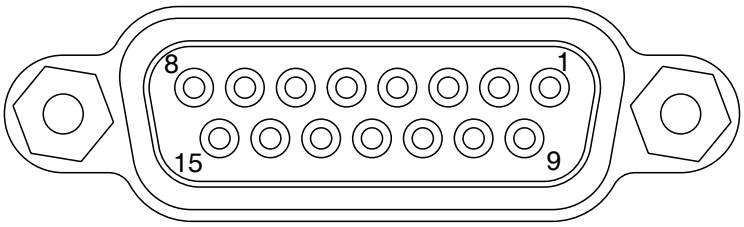


05811

PIN NO.	SIGNAL NAME	SIGNAL TYPE	DESCRIPTION
1	VBUS_UP	Supply	+5 V supply input from USB host
2	D_D-	In/Out	USB Host Data Compliment
3	D_D+	In/Out	USB Host Data True
4	GND_UP	Ground	Ground for USB host port

USB DEVICE Connector Table
Table 2

3. ALTITUDE ENCODER CONNECTOR

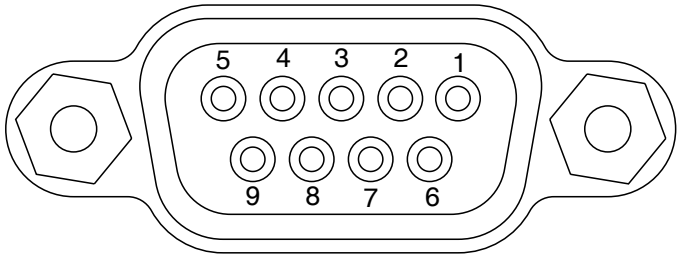


05814

PIN NO.	SIGNAL NAME	SIGNAL TYPE	DESCRIPTION
1	A1	Input	Altitude Encode Input
2	A2	Input	Altitude Encode Input
3	A4	Input	Altitude Encode Input
4	B1	Input	Altitude Encode Input
5	B2	Input	Altitude Encode Input
6	B4	Input	Altitude Encode Input
7	C1	Input	Altitude Encode Input
8	C2	Input	Altitude Encode Input
9	C4	Input	Altitude Encode Input
10			
11	D2	Input	Altitude Encode Input
12	D4	Input	Altitude Encode Input
13	GND	Ground	System Ground
14			
15			

ALTITUDE ENCODER Connector Table
Table 3

4. AUX IN CONNECTOR

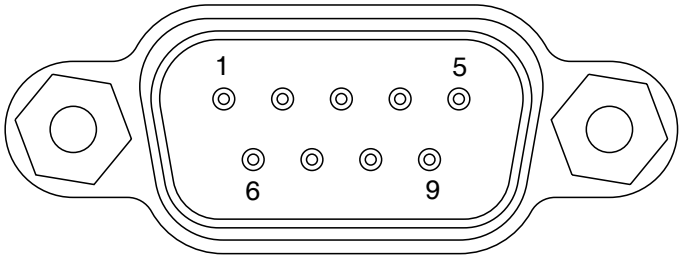


05813

PIN NO.	SIGNAL NAME	SIGNAL TYPE	DESCRIPTION
1	REM_IN1	Input	General Purpose Input
2	REM_IN2	Input	General Purpose Input
3	REM_IN3	Input	General Purpose Input
4	REM_IN4	Input	General Purpose Input
5	GND	Ground	System Ground
6	GND	Ground	System Ground
7	GND	Ground	System Ground
8	GND	Ground	System Ground
9	DNU	Supply	Do Not Use, Reserved

AUX IN Connector Table
Table 4

5. RS-232 CONNECTOR

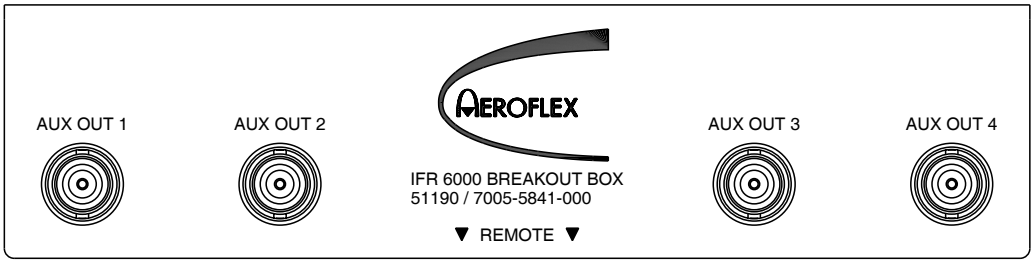


05812

PIN NO.	SIGNAL NAME	SIGNAL TYPE	DESCRIPTION
1			
2	HOST_TXD	BIPOLAR	RS-232 Data Output
3	HOST_RXD	BIPOLAR	RS-232 Data Input
4			
5	GND	Ground	System Ground
6			
7	HOST_CTS	BIPOLAR	RS-232 Clear to Send (Input)
8	HOST_RTS	BIPOLAR	RS-232 Clear to Send (Output)
9			

RS-232 Connector Table
Table 5

6. AUX OUT CONNECTORS

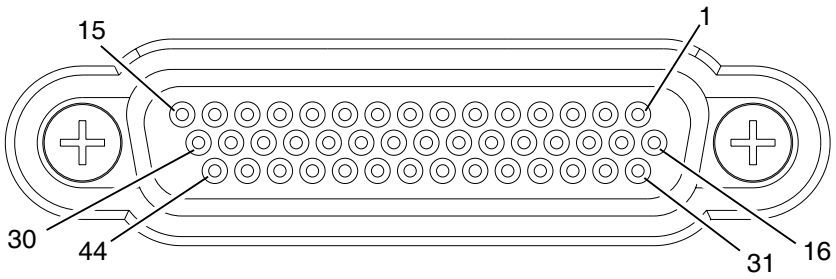


05816

CONNECTOR	SIGNAL TYPE	DESCRIPTION
AUX OUT 1	Output	Mode S Interrogation Trigger
AUX OUT 2	Output	ATCRBS Interrogation Trigger
AUX OUT 3	Output	Not Used
AUX OUT 4	Output	Not Used

Remote OUT Connector Table
Table 6

7. REMOTE CONNECTOR



05807

PIN NO.	SIGNAL NAME	SIGNAL TYPE	DESCRIPTION
1	VBUS_DN1	Supply	+5 V supply for USB device port
2	GND_DN1	Ground	Ground for USB device port
3	VBUS_UP	Supply	+5 V supply input from USB host
4	GND_UP	Ground	Ground for USB host port
5	GND	Ground	System Ground
6	HOST-RTS	Output	RS-232 Request to send
7	A2	Input	Altitude Encode Input
8	A4	Input	Altitude Encode Input
9	C2	Input	Altitude Encode Input
10	C4	Input	Altitude Encode Input
11	GND	Ground	System Ground
12	REM_IN1	Input	General Purpose Input
13	REM_OUT2	Output	General Purpose Output
14	GND	Ground	System Ground
15	GND	Ground	System Ground
16	H_D-	In/Out	USB Host Data Compliment
17	H_D+	In/Out	USB Host Data True
18	D_D-	In/Out	USB Host Data Compliment
19	D_D+	In/Out	USB Host Data True
20	GND	Ground	System Ground
21	HOST_TXD	Output	RS-232 Data Output
22	HOST_CTS	Input	RS-232 Clear to send
23	B1	Input	Altitude Encode Input
24	B2	Input	Altitude Encode Input
25	D2	Input	Altitude Encode Input

REMOTE Connector Pin-Out Table
Table 2

7. REMOTE CONNECTOR (cont)

PIN NO.	SIGNAL NAME	SIGNAL TYPE	DESCRIPTION
26	GND	Ground	System Ground
27	REM_IN2	Input	General Purpose Input
28	REM_IN3	Input	General Purpose Input
29	REM_OUT4	Output	General Purpose Output
30	GND	Ground	System Ground
31	VBUS_DN1	Supply	+5 V supply for USB device port
32	VBUS_DN1	Supply	+5 V supply for USB device port
33	VBUS_UP	Supply	+5 V supply input from USB host
34	GND_UP	Ground	Ground for USB host port
35	GND	Ground	System Ground
36	HOST_RXD	Input	RS-232 Data Input
37	A1	Input	Altitude Encode Input
38	B4	Input	Altitude Encode Input
39	C1	Input	Altitude Encode Input
40	REM_SP1		Spare Pin
41	D4	Input	Altitude Encode Input
42	REM_IN4	Input	General Purpose Input
43	REM_OUT1	Output	General Purpose Output
44	REM_OUT3	Output	General Purpose Output

REMOTE Connector Pin-Out Table (cont)
Table 2

APPENDIX F - CONFIGURATIONS

Configuration	TX Power (dBm)	RX MTL (dBm)	TX Freq (MHz)
GENERIC ATCRBS	48.5 to 57.0	-73 (±4)	1090 (±3)
ATCRBS CLASS A	51.0 to 57.0	-73 (±4)	1090 (±3)
ATCRBS CLASS B	48.5 to 57.0	-73 (±4)	1090 (±3)
GENERIC MODE S	48.5 to 57.0	-74 (±3)	1090 (±3)
MODE S CLASS A	51.0 to 57.0	-74 (±3)	1090 (±3)
MODE S CLASS B	48.5 to 57.0	-74 (±3)	1090 (±3)
MODE S CL B OPT FRQ	48.5 to 57.0	-74 (±3)	1090 (±3)
MODE S CL B OPT POW	51.0 to 57.0	-74 (±3)	1090 (±3)

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APPENDIX G - MODE S ADDRESS BLOCKS

This table contains Mode S address blocks for countries whose tail numbers are decoded by the IFR 6000. For an expanded list of Mode S codes, refer to Appendix H.

COUNTRY	ADDRESS BLOCK
Belgium	448000 - 448FFF
Canada	C00000 - C3FFFF
Denmark	458000 - 45FFFF
France	380000 - 3AFFFF
Germany	3C0000 - 3FFFFF
Poland	488000 - 48FFFF
Switzerland	4B0000 - 4B7FFF
USA	A00000 - AFFFFF

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APPENDIX H - MODE S ADDRESS BLOCKS

This table contains a complete list of Mode S address blocks. For countries whose tail numbers are decoded by the IFR 6000, refer to Appendix G.

COUNTRY	ADDRESS BLOCK
Afghanistan	70000 - 700FFF
Albania	501000 - 5013FF
Algeria	0A0000 - 0A7FFF
Angola	090000 - 090FFF
Antigua and Barbuda	0CA000 - 0CA3FF
Argentina	E00000 - E3FFFF
Armenia	600000 - 6003FF
Australia	7C0000 - 7FFFFF
Austria	440000 - 447FFF
Azerbaijan	600800 - 600BFF
Bahamas	0A8000 - 0A8FFF
Bahrain	894000 - 894FFF
Bangladesh	702000 - 702FFF
Barbados	0AA000 - 0AA3FF
Belarus	510000 - 5103FF
Belgium	448000 - 448FFF
Belize	0AB000 - 0AB3FF
Benin	094000 - 0943FF
Bhutan	680000 - 6803FF
Bolivia	E94000 - E94FFF
Bosnia and Herzegovina	513000 - 5133FF
Botswana	030000 - 0303FF

COUNTRY	ADDRESS BLOCK
Brazil	E40000 - E4FFFF
Brunei Darassalam	895000 - 8953FF
Bulgaria	450000 - 457FFF
Burkin Faso	09C000 - 09CFFF
Burundi	032000 - 032FFF
Cambodia	70E000 - 70EFFF
Cameroon	034000 - 034FFF
Canada	C00000 - C3FFFF
Cape Verde	096000 - 096FF
Central African Republic	06C000 - 06CFFF
Chad	084000 - 084FFF
Chile	E80000 - E80FFF
China	780000 - 78BFFF
Colombia	0AC000 - 0ACFFF
Comoros	035000 - 0353FF
Congo	036000 - 036FFF
Cook Islands	901000 - 9013FF
Costa Rica	0AE000 - 0AEFFF
Côte d/Ivoire	038000 - 038FFF
Croatia	501C00 - 501FFF
Cuba	0B0000 - 0B0FFF
Cyprus	4C8000 - 4C83FF

COUNTRY	ADDRESS BLOCK
Czech Rep	498000 - 49FFFF
Dem Republic Korea	72000 - 727FFF
Dem Republic Congo	08C000 - 08CFFF
Denmark	458000 - 45FFFF
Djibouti	098000 - 0983FF
Dominican Rep	0C4000 - 0C4FFF
Ecuador	E84000 - E84FFF
Egypt	010000 - 017FFF
El Salvador	0B2000 - 0B2FFF
Equatorial Guinea	042000 - 042FFF
Eritrea	202000 - 2023FF
Estonia	511000 - 5113FF
Ethiopia	040000 - 040FFF
Fiji	C88000 - C88FFF
Finland	460000 - 467FFF
France	380000 - 3AFFFF
Gabon	03E000 - 03EFFF
Gambia	09A000 - 09AFFF
Georgia	514000 - 5143FF
Germany	3C0000 - 3FFFFF
Ghana	044000 - 044FFF
Greece	468000 - 46FFFF
Grenada	0C000 - 0CC3FF
Guatemala	0B4000 - 0B4FFF
Guinea	046000 - 046FFF

COUNTRY	ADDRESS BLOCK
Guinea-Bissau	048000 - 0483FF
Guyana	0B6000 - 0B6FFF
Haiti	0B800 - 0B8FFF
Honduras	0BA000 - 0BAFFF
Hungary	470000 - 477FFF
Iceland	4CC000 - 4CCFFF
India	800000 - 83FFFF
Indonesia	8A0000 - 8A7FFF
Iran, Islamic Rep	730000 - 737FFF
Iraq	728000 - 72FFFF
Ireland	4CA000 - 4CAFFF
Israel	738000 - 73FFFF
Italy	300000 - 33FFFF
Jamaica	0BE000 - 0BEFFF
Japan	840000 - 87FFFF
Jordan	740000 - 747FFF
Kazakhstan	683000 - 6733FF
Kenya	04C000 - 04CFFF
Kiribati	C8E000 - C8E3FF
Kuwait	706000 - 706FFF
Kyrgyzstan	601000 - 6013FF
Lao Dem Rep	708000 - 708FFF
Latvia	502C0 - 502FFF
Lebanon	748000 - 74FFFF
Lesotho	04A000 - 04A3FF

COUNTRY	ADDRESS BLOCK
Liberia	050000 - 050FFF
Libyan Arab Jam	018000 - 01FFFF
Lithuania	503C00 - 503FFF
Luxembourg	4D0000 - 4D03FF
Madagascar	054000 - 054FFF
Malawi	057000 - 058FFF
Malaysia	75000 - 757FFF
Maldives	05A000 - 05A3FF
Mali	05C000 - 05CFFF
Malta	4D2000 - 4D23FF
Marshall Islands	900000 - 9003FF
Mauritania	05E000 - 05D3FF
Mauritius	060000 - 0603FF
Mexico	0D0000 - 0D7FFF
Micronesia, Federal States	681000 - 6813FF
Monaco	4D4000 - 4D43FF
Mongolia	682000 - 6823FF
Morocco	020000 - 027FFF
Mozambique	006000 - 006FFF
Myanmar	704000 - 704FFF
Namibia	201000 - 2013FF
Nauru	C8A000 - C8A3FF
Nepal	70A000 - 70AFFF
Netherlands, Kingdom	480000 - 487FFF

COUNTRY	ADDRESS BLOCK
New Zealand	C80000 - C87FFF
Nicaragua	0C0000 - 0C0FFF
Niger	062000 - 062FFF
Nigeria	064000 - 064FFF
Norway	478000 - 47FFFF
Oman	70C000 - 70C3FF
Pakistan	760000 - 767FFF
Palau	684000 - 6843FF
Panama	0C2000 - 0C2FFF
Papua New Guinea	898000 - 898FFF
Paraguay	E88000 - E88FFF
Peru	E8C000 - E8CFFF
Philippines	758000 - 75FFFF
Poland	488000 - 48FFFF
Portugal	490000 - 497FFF
Qatar	06A000 - 06A3FF
Rep of Korea	718000 - 71FFFF
Rep of Moldova	504C00 - 504FFF
Romania	4A0000 - 4A7FFF
Russian Fed	100000 - 1FFFFF
Rwanda	06E000 - 06EFFF
Saint Lucia	C8C000 - C8C3FF
St Vincent and Grenadines	0BC000 - 0BC3FF
Samoa	902000 - 9023FF

COUNTRY	ADDRESS BLOCK
San Marino	500000 - 5003FF
Sao Tome and Principe	09E000 - 09E3FF
Saudi Arabia	710000 - 717FFF
Senegal	070000 - 070FFF
Seychelles	074000 - 0743FF
Sierra Leone	076000 - 0763FF
Singapore	768000 - 76FFFF
Slovakia	505C00 - 505FFF
Slovenia	506C00 - 506FFF
Solomon Islands	897000 - 8973FF
Somalia	078000 - 078FFF
South Africa	008000 - 00FFFF
Spain	340000 - 37FFFF
Sri Lanka	770000 - 777FFF
Sudan	07C000 - 07CFFF
Suriname	0C80000 - 0C8FFF
Swaziland	07A000 - 07A3FF
Sweden	4A8000 - 4AFFFF
Switzerland	4B0000 - 4B7FFF
Syrian Arab Rep	778000 - 77FFFF
Tajikistan	515000 - 5153FF
Thailand	880000 - 887FFF

COUNTRY	ADDRESS BLOCK
The Former Yugoslav Republic of Macedonia	512000 - 5123FF
Togo	08800 - 088FFF
Tonga	C8D000 - C8D3FF
Trinidad and Tobago	0C6000 - 0C6FFF
Tunisia	028000 - 02FFFF
Turkey	4B8000 - 4BFFFF
Turkmenistan	601800 - 601BFF
Uganda	068000 - 068FFF
Ukraine	508000 - 50FFFF
United Arab Emirates	896000 - 896FFF
United Kingdom	400000 - 423FFFF
United Rep of Tanzania	080000 - 080FFF
United States	A00000 - AFFFFF
Uruguay	E90000 - E00FFF
Uzbekistan	507C00 - 507FFF
Vanuatu	C90000 - C903FF
Venezuela	0D8000 - 0DFFFF
Viet Nam	888000 - 88FFFF
Yemen	890000 - 890FFF
Zambia	08A000 - 08AFFF
Zimbabwe	004000 - 0043FF

COUNTRY	ADDRESS BLOCK
Non-Contracting States	
Yugoslavia	4C0000 - 4C7FFF
Other Allocations	
ICAO (1)	F00000 - F07FFF
ICAO (2)	899000 - 8993FF
ICAO (2)	F09000 - F093FF

(1) ICAO or its designate administers this block for assigning temporary aircraft addresses if and when an immediate action is to be taken to avoid the assignment of an unauthorized 24-bit aircraft address.

It is intended that the temporary address is to be relinquished as soon as practicable when the 24-bit aircraft address is assigned by a Stat of Registry or common mark registering authority in conformance with the provisions in 4, 5 and 6 of the ICAO Annex 10 Vol. III.

The State concerned is then expected to inform ICAO or its designate regarding the release of the temporary address.

(2) Block allocated for special use in the interest of flight safety

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APPENDIX I - SIGNAL FORMATS

1. OPERATING GOALS

Mode S combines secondary surveillance radar and a ground-air-ground data link system to provide aircraft surveillance and communications necessary for supporting automated ATC in dense traffic environments. Mode S provides common-channel interoperation with the ATC beacon system and may be implemented over an extended ATCRBS-to-Mode S transition period. In supporting ATC automation, Mode S provides the reliable communications necessary for data link services.

2. MODE S MESSAGE CONTENT

2.1 ADDRESS/PARITY (FIELD AP)

All discrete Mode S interrogations (56-bit or 112-bit) and replies (except the All Call reply) contain the 24-bit discrete address of the Mode S transponder upon which 24 error-detecting parity check bits are overlaid. In the All Call reply, the 24 parity check bits are overlaid on the address of the Mode S interrogator. The text of the reply includes the discrete address of the transponder.

2.2 SURVEILLANCE

The primary function of Mode S is surveillance. For the Mode S transponder, this function is accomplished by using short (56-bit) transmissions in both directions. In these transmissions, the aircraft reports altitude (DF04) or ATCRBS 4096 code as well as flight status (airborne, on the ground, alert, Special Position Identification [SPI], etc.).

2.3 DATA LINK COMMUNICATIONS

The discrete addressing and digital encoding allow Mode S transmissions to be used as digital data links. Interrogation and reply formats of the Mode S system contain sufficient coding space to transmit data. Most Mode S data link transmissions are handled as one 56-bit message included as part of long 112-bit interrogations or replies. The transmissions include the message in addition to surveillance data, and is generally used in place of a surveillance interrogation and/or reply.

An efficient transmission of longer messages is accomplished by the extended length message (ELM) capability (UF24 and DF24). Using this capability, a sequence of up to sixteen 80-bit message segments (each with a 112-bit transmission) is transmitted, either ground-to-air or air-to-ground and is acknowledged with a single reply/interrogation. ELMs do not contain surveillance data and thus cannot substitute for a surveillance interrogation-reply cycle.

3. SIGNAL FORMATS

Signal formats for uplink and downlink messages are outlined in Chapter 2, RTCA DO-181 and Chapter 2, Volume I of RTCA DO-185. Tables 1, 2, 3, 4 and 5 in Appendix B contain the signal formats and definitions. Data is expressed in decimal unless otherwise specified. Refer to Appendix B, Table 6 for conversion to hexadecimal, octal or binary. Appendix B, Table 7 shows the ATC-601-2 fixed formats for Mode S using Front Panel operation.

NOTE: TCAS operates in Mode S and many signals pertain only to TCAS.

FORMAT NO.	UF						
0	(0 0000)	— 3 —(RL:1)— 4 —(AQ:1)	(BD:8)— 10 —			(AP:24)	..... Short Air-Air Surveillance
1	(0 0001)	——— 27 or 83 ———				(AP:24)	
2	(0 0010)	——— 27 or 83 ———				(AP:24)	
3	(0 0011)	——— 27 or 83 ———				(AP:24)	
4	(0 0100)	(PC:3)	(RR:5)	(DI:3)	(SD:16)	(AP:24)	. Surveillance, Altitude Request
5	(0 0101)	(PC:3)	(RR:5)	(DI:3)	(SD:16)	(AP-24)	. Surveillance, Identity Request
6	(0 0110)	——— 27 or 83 ———				(AP:24)	
7	(0 0111)	——— 27 or 83 ———				(AP:24)	
8	(0 1000)	——— 27 or 83 ———				(AP:24)	
9	(0 1001)	——— 27 or 83 ———				(AP:24)	
10	(0 1010)	——— 27 or 83 ———				(AP:24)	
11	(0 1011)	(PR:4) (II:4)———	19 ———			(AP:24)	..... Mode S Only All Call
12	(0 1100)	——— 27 or 83 ———				(AP:24)	
13	(0 1101)	——— 27 or 83 ———				(AP:24)	
14	(0 1110)	——— 27 or 83 ———				(AP:24)	
15	(0 1111)	——— 27 or 83 ———				(AP:24)	
16	(1 0000)	— 3 —(RL:1)— 4 —(AQ:1)—	18 —(MU:56)			(AP:24)	..... Long Air-Air Surveillance
17	(1 0001)	——— 27 or 83 ———				(AP:24)	
18	(1 0010)	——— 27 or 83 ———				(AP:24)	
19	(1 0011)	——— 27 or 83 ———				(AP:24)	
20	(1 0100)	(PC:3)	(RR:5)	(DI:3)	(SD:16) (MA:56)	(AP:24)	..... Comm-A, Altitude Request
21	(1 0101)	(PC:3)	(RR:5)	(DI:3)	(SD:16) (MA:56)	(AP:24)	..... Comm-A, Identity Request
22	(1 0110)	——— 27 or 83 ———				(AP:24)	
23	(1 0111)	——— 27 or 83 ———				(AP:24)	
24	(1 1xxx)	(RC:2)	(NC:4)	(MC:80)		(AP:24)	..... Comm-C (ELM)

NOTE: (XX:M) represents a field designated XX containing M number of assigned bits.

NOTE: —N— represents free coding space with N available bits, coded as Zeros for transmission.

NOTE: For Uplink Formats (UF) 0 through 23, the format number corresponds to the binary code in the first 5 bits of the interrogation. Format number 24 is arbitrarily defined as the format beginning with Ones in the first two bit positions. The following three bits (xxx) vary with the interrogation content.

NOTE: All formats are shown for completeness, although a number of them are unused.

Overview of Mode S Interrogation Formats
Table 1

FORMAT NO.	DF		
0	(0 0000)	(VS:1) (CC:1)-1-(SL:3)-2-(RI:4)-2-(AC:13) (AP:24)	..... Short Air-Air Surveillance
1	(0 0001)	—— 27 or 83 —— (P:24)	
2	(0 0010)	—— 27 or 83 —— (P:24)	
3	(0 0011)	—— 27 or 83 —— (P:24)	
4	(0 0100)	(FS:3) (DR:5) (UM:6) (AC:13) (AP:24)	..... Surveillance, Altitude Reply
5	(0 0101)	(FS:3) (DR:5) (UM:6) (ID:13) (AP-24)	..... Surveillance, Identity Reply
6	(0 0110)	—— 27 or 83 —— (P:24)	
7	(0 0111)	—— 27 or 83 —— (P:24)	
8	(0 1000)	—— 27 or 83 —— (P:24)	
9	(0 1001)	—— 27 or 83 —— (P:24)	
10	(0 1010)	—— 27 or 83 —— (P:24)	
11	(0 1011)	(CA:3) (AA:24) (PI:24)	..... All Call Reply/Squitter
12	(0 1100)	—— 27 or 83 —— (P:24)	
13	(0 1101)	—— 27 or 83 —— (P:24)	
14	(0 1110)	—— 27 or 83 —— (P:24)	
15	(0 1111)	—— 27 or 83 —— (P:24)	
16	(1 0000)	(VS:1)-2-(SL:3)-2-(RI:4)-2-(AC:13)(MV:56)(AP:24)	..... Long Air-Air Surveillance
17	(1 0001)	(CA:3) (AA:24) (ME:56) (PI:24)	..... Extended Squitter
18	(1 0010)	—— 27 or 83 —— (P:24)	
19	(1 0011)	—— 27 or 83 —— (P:24)	
20	(1 0100)	(FS:3) (DR:5) (UM:6) (AC:13) (MB:56) (AP:24)	..... Comm-B, Altitude Reply
21	(1 0101)	(FS:3) (DR:5) (UM:6) (ID:13) (MB:56) (AP:24)	..... Comm-B, Identity Reply
22	(1 0110)	—— 27 or 83 —— (P:24)	
23	(1 0111)	—— 27 or 83 —— (P:24)	
24	(1 1xxx)	(KE:1) (ND:4) (MD:80) (AP:24)	..... Comm-D (ELM)

NOTE: (XX:M) represents a field designated XX containing M number of assigned bits.

NOTE: (P:24) represents a 24-bit field reserved for parity information.

NOTE: —N— represents free coding space with N available bits, coded as Zeros for transmission.

NOTE: For Downlink Formats (DF) 0 through 23, the format number corresponds to the binary code in the first 5 bits of the reply. Format number 24 is arbitrarily defined as the format beginning with Ones in the first two bit positions. The following three bits (xxx) vary with the reply content.

NOTE: All formats are shown for completeness, although a number of them are unused.

Overview Of Mode S Reply Formats
Table 2

FIELD	SUB FIELD	NO. OF BITS	BITS POSITION	FORMATS UP DOWN	CONTENT
AA		24	9-32	X	The aircraft address announced in the clear, used in DF=11, 17.
AC		13	20-32	X	The altitude code used in formats DF=0, 4, 16 and 20. All bits are Zeros if altitude information is not available. Contains metric altitude if M-bit (26) is One.
AP		24 24	33-56 89-112	X	Parity overlaid on the Address appears at the end of all transmissions, uplink and downlink, with the exception of format DF=11.
AQ		1	14	X	Designates formats UF=0, 16 as acquisition transmissions. Bit 14 (RI, DF=0, 16), repeats AQ as received by transponder.
BD		8	15-22	X	Contains the identity of the ground-initiated Comm-B register contents to appear in the MV field of the corresponding reply, used in UF=0.
CA		3	6-8	X	Used in DF=11, Acquisition Squitter & DF17 Extended Squitter or All Call reply, to report transponder capability. Codes are: 0 = Signifies no communications capability (surveillance only,) no ability to set CA code 7, either on the ground or airborne. 1 = Not Used 2 = Not Used 3 = Not Used 4 = Level 2, 3 or 4; ability to set code 7, and is on the ground. 5 = Level 2, 3 or 4; ability to set code 7, and is airborne. 6 = Level 2,3 or 4; ability to set code 7. 7 = DR≠0 or FS=3,4 or 5. **NOTE:** Codes 1 to 3 were used by earlier Mode S transponders that did not use CA code 7.
CC		1	7	X	Indicates transponder has ability to support crosslink capability (decode the contents of the UF=0 BD field and respond with the contents of the specified ground-initiated Comm-B register in the MV field of the corresponding DF=16 reply. Used in DF=0. 0= Aircraft Cannot Support 1= Aircraft Can Support

Overview of Format Definitions
Table 3

FIELD	SUB FIELD	NO. OF BITS	BITS POSITION	FORMATS UP DOWN	CONTENT
CL		3	14-16	X	Coding in Binary 000=IC Field contains the II code 001=IC Field contains SI codes 1 to 15 010=IC Field contains SI codes 16 to 31 011=IC Field contains SI codes 32 to 47 100=IC Field contains SI codes 48 to 63
DF		5	1-5	X	The first field in all downlink formats is the transmission descriptor.
DI		3	14-16	X	Identifies coding contained in the SD codes are: 0 = SD has Interrogator Identifier (IIS). 1 = SD contains (IIS, MBS, MES, LOS, RSS, TMS). 2 = SD used for extended squitter surface control 3 = SD contains SIS, LSS, RRS 4-6 = Not assigned. 7 = SD contains IIS, RRS, LOS, TMS
DR		5	9-13	X	Requests extraction of downlink messages from the transponder by the interrogator and appears in formats DF=4, 5, 20, 21. The codes are: 0 = No downlink request. 1 = Request to send Comm-B message (B bit set), 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 = Request to send n-segments, signified by 15 + n. Codes 1-15 take priority over codes 16-31.

Overview of Format Definitions (cont)
Table 3

<table>
<tr><th>FIELD</th><th>SUB FIELD</th><th>NO. OF BITS</th><th>BITS POSITION</th><th>FORMATS UP DOWN</th><th>CONTENT</th></tr>
<tr><td>FS</td><td></td><td>3</td><td>6-8</td><td>X</td><td>Reports flight status of aircraft and is used in formats DF=4, 5, 20, 21. Codes are:
<table>
<tr><th>CODE</th><th>ALERT</th><th>SPI</th><th>AIRBORNE</th><th>ON THE GROUND</th></tr>
<tr><td>0</td><td>no</td><td>no</td><td>yes</td><td>no</td></tr>
<tr><td>1</td><td>no</td><td>no</td><td>no</td><td>yes</td></tr>
<tr><td>2</td><td>yes</td><td>no</td><td>yes</td><td>no</td></tr>
<tr><td>3</td><td>yes</td><td>no</td><td>no</td><td>yes</td></tr>
<tr><td>4</td><td>yes</td><td>yes</td><td colspan="2">either</td></tr>
<tr><td>5</td><td>no</td><td>yes</td><td colspan="2">either</td></tr>
<tr><td colspan="5">6 -Reserved</td></tr>
<tr><td colspan="5">7- Not assigned.</td></tr>
</table></td></tr>
<tr><td>ID</td><td></td><td>13</td><td>2-32</td><td>X</td><td>The 4096 identification code, numbers , as, set by the pilot, in DF=5, 21.</td></tr>
<tr><td>IC</td><td></td><td>4</td><td>10-13</td><td>X</td><td>Contains II or SI depending on value of CL field.
II: Identifies the interrogator and appears in UF=11, the Mode S Only All Call.
NOTE: The same information may also appear in the IIS subfields.
SI: Surveillance Identifer (lower 4 bits of 6 bit SI code)
NOTE: Surveillance Identifier is derived from CL and IC fields of UF11, or directly in the SIS subfield of SD field value of CL field in formats UF4,5,20 and 21</td></tr>
<tr><td>KE</td><td></td><td>1</td><td>4</td><td>X</td><td>Defines the content of the ND and MD fields in Comm-D replies, DF=24.</td></tr>
<tr><td>MA</td><td></td><td>56</td><td>33-88</td><td>X</td><td>Messages directed to the aircraft, part of Comm-A interrogations, UF=20, 21.</td></tr>
<tr><td></td><td>ADS</td><td>8</td><td>33-40</td><td>X</td><td>Defines the content of the MA message field in Comm-A requests and is expressed in two groups of 4 bits each, ADS1 (33-36) and ADS2 (37-40).</td></tr>
<tr><td></td><td>ADS1</td><td>4</td><td>33-36</td><td>X</td><td>Part of the A-Definition Subfield and is set to 0 for TCAS Sensitivity Level Commands.</td></tr>
<tr><td></td><td>ADS2</td><td>4</td><td>37-40</td><td>X</td><td>Part of the A-Definition Subfield and is set to 5 for TCAS Sensitivity Level Commands.</td></tr>
</table>

Overview of Format Definitions (cont)
Table 3

FIELD	SUB FIELD	NO. OF BITS	BITS POSITION	FORMATS UP DOWN	CONTENT
MA	SLC	4	41-44	X	Sensitivity Level Command for the TCAS aircraft. The codes are: 0 = No command. 1 = Not Assigned. 2 = Select TA_ONLY mode of operation. 3 = Set TCAS Sensitivity Level to 3. 4 = Set TCAS Sensitivity Level to 4. 5 = Set TCAS Sensitivity Level to 5. 6 = Set TCAS Sensitivity Level to 6. 7 = Set TCAS Sensitivity Level to 7. 8-14 = Not Assigned. 15 = Cancel previous Sensitivity Level.
MB		56	33-88	X	Messages to be transmitted to interrogator, part of the Comm-B replies, DF=20, 21. The field contains Data Link, Capability Reports or Aircraft Identification Reports or TCAS Resolution Advisory Reports.
	ACS	20	45-64	X	Comm-A capability subfield reports data link service(s) supported by the installation. If all bits are Zeros, no Comm-A data link services are supported.
	AIS	48	41-88	X	Aircraft Identification, reported when a surveillance or Comm-A interrogation (UF=4, 5, 20, 21) contains RR=18 and DI=anything but 7. AIS contains up to eight 6-bit characters as defined in Table 4.
MB	ARA	14	41-54	X	TCAS Resolution Advisory Report indicating current Active Resolution Advisories (if any) generated by own TCAS unit against one or more threat aircraft. Each bit indicates a specific resolution advisory with One being active and Zero being inactive. Bit indications are: 41-Climb. 42-Don't descend. 43-Don't descend faster than 500 FPM. 44-Don't descend faster than 1000 FPM. 45-Don't descend faster than 2000 FPM. 46-Descend. 47-Don't climb. 48-Don't climb faster than 500 FPM. 49-Don't climb faster than 1000 FPM. 50-Don't climb faster than 2000 FPM. 51-Turn left. 52-Turn right. 53-Don't turn left. 54-Don't turn right.

Overview of Format Definitions (cont)
Table 3

FIELD	SUB FIELD	NO. OF BITS	BITS POSITION	FORMATS UP DOWN	CONTENT
MB	BCS	16	65-80	X	Comm-B capability subfield reports installed data sources that can be accessed by the ground for transmission via a ground-initiated Comm-B. If all bits are Zeros, no data is accessible by a ground-initiated Comm-B.
	BDS	8	33-40	X	Defines the content of the MB message field in reply to ground-initiated Comm-B and is expressed in two groups of 4 bits each, BDS1 (33-36) and BDS2 (37-40).
	BDS1	4	33-36	X	Corresponds with RR in UF=4, 5, 20, 21. The codes are: 0 = MB contains Air-initiated Comm-B. 1 = MB contains Data Link Capability Report. 2 = MB contains Aircraft Identification. 3 = MB contains TCAS Resolution Advisory. 4-15 = Not assigned.
	BDS2	4	37-40	X	Basic report uses BDS2=0. More complex Mode S installations report additional capabilities in various formats assigned to BDS2 codes other than 0 as requested by interrogator, specified in the RRS subfield of SD.
	CFS	4	41-44	X	Continuation subfield contains the BDS2 value of the next additional capability report available from the installation.
MB	ECS	8	81-88	X	Data Link Capability subfield reports ELM capability of installation. No ELM data link services are supported if all bits are Zeros.
	MTE	1	60	X	Multiple Threat Encounter bit indicates ≥2 simultaneous TCAS threats.
	RAC	4	55-58	X	Resolution Advisory Complements subfield indicates currently active resolution, advisory complements (if any) received from all other TCAS aircraft with on-board resolution capability. Bits are set to One when active and Zero when inactive. Bit indications are: 55-Don't descend. 56-Don't climb. 57-Don't turn left. 58-Don't turn right.
	RAT	1	59	X	Resolution Advisory Terminated indicator is set to One for 18 seconds (±1 second) following termination of a previously reported resolution advisory.

Overview of Format Definitions (cont)
Table 3

FIELD	SUB FIELD	NO. OF BITS	BITS POSITION	FORMATS UP DOWN	CONTENT
MB	TID	26	33-88	X	Threat Identity Data subfield contains data according to TTI field. If TTI=1, TID contains Mode S address of threat in bits 63-85 (bits 87-88 are Zero). If TTI=2, TID contains altitude, range and bearing data.
	TIDA	13	63-75	X	Threat Identity Data, Altitude subfield reports Mode C altitude code of the threat.
	TIDB	6	83-88	X	Threat Identity, Bearing subfield reports most recent bearing of the threat.
	TIDR	7	76-82	X	Threat Identity, Range subfield reports most recent range of the threat.
	TTI	2	61-62	X	Threat Type Indicator subfield defines type of data in TID field.
MC		80	9-88	X	Comm-C field contains one segment of a sequence of segments transmitted to the transponder in the ELM mode. MC is part of UF=24.
	IIS	4	9-12 (if RC=0 to 2) or 25-28 (if RC=3)	X	Interrogator Identifier subfield reports the identity of the interrogator (See SD and UM fields).
	SRS	16	9-24	X	If a Comm-C interrogation (UF=24) contains RC=3, the SRS subfield contains a list of segment request-authorizations for DELMs in the 16-bit (9-24) SRS subfield. Starting with bit 9, denoting the first segment, each of the following bits is set to One if the transmission of the corresponding segment is requested. Refer to Table 5.
MD		80	9-88	X	Comm-D field, part of DF=24, contains one segment of a sequence of segments transmitted by the transponder in the ELM mode. It may contain a summary of received MC segments of an uplink ELM.
	TAS	16	17-32	X	Reports segments received in a Comm-C sequence. Starting with bit 17 denoting the first segment, each successive bit is One if the corresponding segment was received. TAS appears if KE=1 in the same reply. Refer to Table 5 for values.
ME		56	33-88	X	Extended squitter message, part of DF=17, contains broadcast messages.
MU		56	33-88	X	Field, part of the long air-air surveillance interrogation UF=16, contains information used in air-to-air exchanges (TCAS, Resolution Messages and TCAS Broadcast Messages).

Overview of Format Definitions (cont)
Table 3

FIELD	SUB FIELD	NO. OF BITS	BITS POSITION	FORMATS UP DOWN	CONTENT
MU	CHC	3	47-49	X	Cancel Horizontal Resolution Advisory Complement. In TCAS Resolution Messages transmitted by TCAS without horizontal resolution capability, CHC is set to 0. The codes are: 0 = No cancellation. 1 = Cancel, don't turn left. 2 = Cancel, don't turn right. 3-7 = Not assigned.
	CVC	2	43-44	X	Cancel Vertical Resolution Advisory Complement. The codes are: 0 = No cancellation. 1 = Cancel, don't descend. 2 = Cancel, don't climb. 3 = Not assigned.
	HRC	3	50-52	X	Horizontal Resolution Advisory Complement. In TCAS Resolution Messages transmitted by TCAS without horizontal resolution capability, HRC is set to 0. The codes are: 0 = No horizontal resolution advisory complement sent. 1 = Intruder TCAS sense is turn left/do not turn left. 2 = Intruder TCAS sense is turn left/do not turn right. 3-4 = Not assigned. 5 = Intruder TCAS sense is turn right/do not turn left. 6 = Intruder TCAS sense is turn right/do not turn right. 7 = Not assigned.
	HSB	5	56-60	X	Encoded Sense Bits for Horizontal Resolution Complements provide a parity coding field protecting the six horizontal sense bits (CHC and HRC) and are used in TCAS III Resolution Messages.
	MID	24	65-88	X	Contains discrete address of interrogating aircraft and is in TCAS Resolution Advisories Lock Requests, TCAS Resolution Messages and TCAS Broadcast Messages. **NOTE:** TCAS Broadcast Message is sent at 10-second intervals.

Overview of Format Definitions (cont)
Table 3

FIELD	SUB FIELD	NO. OF BITS	BITS POSITION	FORMATS UP DOWN	CONTENT
MU	MTB	1	42	X	Multiple Threat Bit indicates more than one TCAS threat when set to One and no more than one threat when set to Zero.
	UDS	8	33-40	X	Defines the content of the MU message field and is expressed in two 4-bit groups, UDS1 (33-36) and UDS2 (37-40).
	UDS1	4	33-36	X	Is set to 3 for TCAS Resolution Messages and TCAS Broadcast Messages.
	UDS2	4	37-40	X	Is set to 0 for TCAS Resolution Messages or set to 2 for TCAS Broadcast Messages.
	VRC	2	45-46	X	Vertical Resolution Advisory, Complement. The codes are: 0 = No vertical resolution advisory complement sent. 1 = Don't descend. 2 = Don't climb. 3 = Not assigned.
	VSB	4	61-64	X	Encoded Sense Bits for Vertical Resolution Complements provide a parity coding field to protect four vertical sense bits (CVC and VRC) in all TCAS Resolution Messages. If bits 43-46 do not agree with bits 61-64, the TCAS receiver assumes an error and disregards message. Bits are as follows:

43	44	45	46	61	62	63	64
0	0	0	0	0	0	0	0
0	0	0	1	1	1	1	0
0	0	1	0	0	1	1	1
0	0	1	1	1	0	0	1
0	1	0	0	1	0	1	1
0	1	0	1	0	1	0	1
0	1	1	0	1	1	0	0
0	1	1	1	0	0	1	0
1	0	0	0	1	1	0	1
1	0	0	1	0	0	1	1
1	0	1	0	1	0	1	0
1	0	1	1	0	1	0	0
1	1	0	0	0	1	1	0
1	1	0	1	1	0	0	0
1	1	1	0	0	0	0	1
1	1	1	1	1	1	1	1

Overview of Format Definitions (cont)
Table 3

FIELD	SUB FIELD	NO. OF BITS	BITS POSITION	FORMATS UP DOWN	CONTENT
MV		56	33-88	X	Field, part of the long air-air surveillance reply DF=16, contains information used in air-to-air exchanges (Coordination Reply Message).
	ARA	14	41-54	X	Same as in MB field.
	MTE	1	60	X	Same as in MB field.
	RAC	4	55-58	X	Same as in MB field.
	RAT	1	59	X	Same as in MB field.
MV	VDS	8	33-40	X	Defines the content of the MV message field and is expressed in two 4-bit groups, VDS1 (33-36) and VDS2 (37-40).
	VDS1	4	33-36	X	Is set to 3 for Coordination Reply Message.
	VDS2	4	37-40	X	Is set to 0 for Coordination Reply Message.
NC		4	5-8	X	Provides the segment number transmitted in an uplink ELM and is part of a Comm-C interrogation, UF=24.
ND		4	5-8	X	Provides the segment number transmitted in a downlink ELM and is part of a Comm-D reply, DF=24.
PC		3	6-8	X	Contains operating commands to the transponder and is part of surveillance and Comm-A interrogations UF=4, 5, 20, 21. The codes are: 0 = No changes in transponder state. 1 = Non-selective All Call lockout. 2 = Not assigned. 3 = Not assigned. 4 = Cancel B. 5 = Cancel C. 6 = Cancel D. 7 = Not assigned.
PI		24	33-56	X	Contains the parity overlaid on the interrogator identity code. PI is part of the reply, DF=11, to the Mode S Only All Call.

Overview of Format Definitions (cont)
Table 3

FIELD	SUB FIELD	NO. OF BITS	BITS POSITION	FORMATS UP DOWN	CONTENT
PR		4	6-9	X	Field contains commands to the transponder specifying the reply probability to the Mode S Only All Call interrogation, UF=11 containing the PR. A command to disregard any lockout state can also be given. The assigned codes are: 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. 5,6,7 = 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, 14, 15 = Do not reply. **NOTE:** On receipt of a Mode S Only All Call containing a PR code other than 0 or 8, transponder executes a random process and makes a reply decision for the interrogation in accordance with the commanded probability. Random occurrence of replies enables interrogator to acquire closely spaced aircraft when replies would otherwise synchronously garble each other.
RC		2	3-4	X	Designates transmitted segment as initial, intermediate or final if coded 0, 1 or 2 respectively. RC=3 is used to request Comm-D DELMs by the transponder. RC is part of Comm-C interrogation, UF=24.

Overview of Format Definitions (cont)
Table 3

FIELD	SUB FIELD	NO. OF BITS	BITS POSITION	FORMATS UP DOWN	CONTENT
RI		4	14-17	X	Information in DF=0, 16. The codes are: 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. 4 = On-board TCAS with vertical and horizontal resolution capability. 5-7 = Not assigned. 8 = No maximum airspeed data available. 9 = Airspeed is ≤75 kts. 10 = Airspeed is >75 kts and ≤150 kts. 11 = Airspeed is >150 kts and ≤300 kts. 12 = Airspeed is >300 kts and ≤600 kts. 13 = Airspeed is >600 kts and ≤1200 kts. 14 = Airspeed is >1200 kts. 15 = Not assigned.
RL		1	9	X	Command, sent in UF=0, 16; solicits DF=0 reply if Zero and DF=16 reply if One (only if transponder is associated with Airborne Collision Avoidance System [ACAS] equipment). Otherwise, in UF=0, Zero solicits DF=0 reply and One solicits no reply. In UF=16, Zero solicits DF=16 reply and One solicits no reply.
RR		5	9-13	X	Contains length and content of interrogator requested reply. RR is part of surveillance and Comm-A interrogations UF=4, 5, 20, 21.

RR CODE	REPLY LENGTH	MB CONTENT
0-15	Short	N/A
16	Long	Air initiated Comm-B
17	Long	Data link capability
18	Long	Aircraft Identification
19	Long	Resolution Advisories
20-31	Long	Not Assigned

NOTE: If first bit of RR code is One, decimal equivalent of last four bits of RR code designates code for BDS1 in reply (ground initiated). BDS2 is assumed to be Zero if not specified by DI=7 and RRS.

Overview of Format Definitions (cont)
Table 3

FIELD	SUB FIELD	NO. OF BITS	BITS POSITION	FORMATS UP DOWN	CONTENT
SD		16	17-32	X	Contains control codes, as specified by the DI field affecting transponder protocol and is part of surveillance and Comm-A interrogations UF=4, 5, 20, 21.
	IIS	4	17-20	X	Interrogator Identifier subfield contains the self-identification code of the interrogator and is numerically identical to the II code transmitted by the interrogator in Mode S Only All Calls. IIS codes are 0 through 15; IIS=0 is not a valid interrogator identifier for multisite purposes. IIS is sent only when DI=0, 1 or 7.
	LOS	1	26	X	Lockout subfield, if set to One, initiates a multisite All Call lockout to Mode S Only All Calls (UF=11) from the Interrogator indicated in IIS of the interrogation. If LOS is set to Zero, no change in lockout state is commanded. LOS is sent only if DI=1 or 7.
	LSS	1	23	X	Lockout surveillance subfield, if set to One, shall signify a multisite lockout command from the interrogator indicated in SIS. LSS set to zero shall be used to signify that no change in lockout state is commanded.
	MBS	2	21-22	X	Multisite Comm-B subfield, sent when DI=1, is assigned the following codes: 0 = No Comm-B action. 1 = Comm-B reservation. 2 = Comm-B closeout.
	MES	3	23-25	X	Multisite ELM subfield, sent when DI=1, contains reservation and closeout commands for ELM as follows: 0 = No ELM action. 1 = Comm-C reservation. 2 = Comm-C closeout. 3 = Comm-D reservation. 4 = Comm-D closeout. 5 = Comm-C reservation and Comm-D closeout. 6 = Comm-C closeout and Comm-D reservation. 7 = Comm-C and Comm-D closeouts.

Overview of Format Definitions (cont)
Table 3

FIELD	SUB FIELD	NO. OF BITS	BITS POSITION	FORMATS UP DOWN	CONTENT
SD	RCS	3	24-26	X	Rate control subfield shall control the squitter rate of the transponder when it is reporting the surface format. The codes are: 0 = No squitter rate command 1 = Report high surface squitter rate for 60 seconds 2 = Report low surface squitter rate for 60 seconds 3 = Suppress all surface squitters for 60 seconds 4 = Suppress all surface squitters for 120 seconds 5-7 Not assigned
	RRS	4	21-24	X	Reply Request subfield, sent when DI=7, contains coding corresponding to the requested BDS2 code.
	RRS	4	24-27	X	Reply Request subfield, sent when DI=3, contains coding corresponding to the requested BDS2 code.
	RSS	2	27-28	X	Reservation Status subfield, sent when DI=1, requests transponder to report reservation status in the UM field. The codes are: 0 = No request. 1 = Report Comm-B reservation status. 2 = Report Comm-C reservation status. 3 = Report Comm-D reservation status.
	SAS	2	27-28	X	Surface Antenna Subfield, shall control the diversity antenna that is used for the acquisition and extended squitters when the aircraft is reporting the surface format. The codes are: 0 = No antenna command, use the top antenna 1 = Alternate top and bottom antennas for 120 seconds 2 = Use bottom antenna for 120 seconds 3 = Return to the default
	SIS	6	17-22	X	Surveillance Identifier Subfield, shall contain an assigned SI code of the interrogator.

Overview of Format Definitions (cont)
Table 3

FIELD	SUB FIELD	NO. OF BITS	BITS POSITION	FORMATS UP DOWN	CONTENT
SD	TCS	3	21-23	X	Type Control Subfield, shall control the position type reported by the transponder. The codes are: 0 = No position type command 1 = Use surface position type for the next 15 seconds 2 = Use surface position type for the next 60 seconds 3 = Cancel surface type command 4-7 = Not assigned.
	TMS	4	29-32	X	Tactical Message subfield, sent when DI=1 or 7, contains coding for linking the Comm-A message segments. The codes are: 0 = No Action. 1 = Unlinked, Priority. 2 = Unlinked, Acknowledge. 3 = Unlinked, Priority, Acknowledge. 4 = Linked 1st Segment, Single ADS. 5 = Linked 1st Segment, Single ADS Priority. 6 = Linked 1st Segment, Single ADS Acknowledge. 7 = Linked 1st Segment, Single ADS, Priority, Acknowledge. 8 = Linked 1st Segment, Multiple ADS. 9 = Linked 1st Segment, Multiple ADS, Priority. 10 = Linked 1st Segment, Multiple ADS, Acknowledge. 11 = Linked 1st Segment, Multiple ADS, Priority, Acknowledge. 12 = Second Segment. 13 = Third Segment. 14 = Final Segment. 15 = Not Assigned.

Overview of Format Definitions (cont)
Table 3

FIELD	SUB FIELD	NO. OF BITS	BITS POSITION	FORMATS UP DOWN	CONTENT
SL		3	9-11	X	Reports the current operating sensitivity level of the TCAS unit and is a part of air-air surveillance replies, DF=0, 16. The codes are: 0 = No TCAS sensitivity level reported. 1 = TCAS operates at sensitivity level 1. 2 = TCAS operates at sensitivity level 2. 3 = TCAS operates at sensitivity level 3. 4 = TCAS operates at sensitivity level 4. 5 = TCAS operates at sensitivity level 5. 6 = TCAS operates at sensitivity level 6. 7 = TCAS operates at sensitivity level 7. **NOTE:** The SL field has no meaning for aircraft with RI=0 (no on-board capability to generate resolution, advisories).
UF		5	1-5	X	The first field in all uplink formats is the transmission descriptor in all interrogations.
UM		6	14-19	X	Contains transponder status readouts in replies DF=4, 5, 20, 21.
	IDS	2	18-19	X	Identifier Designator subfield reports the type of reservation made by the interrogator identified in IIS and corresponds with the RSS subfield of SD. Assigned coding is: 0 = No information available. 1 = Comm-B reservation active. 2 = Comm-C reservation active. 3 = Comm-D reservation active.
	IIS	4	14-17	X	Interrogator Identifier subfield reports the identity of the interrogator that has made a multisite reservation.
VS		1	6	X	Indicates aircraft is airborne when Zero or aircraft is on the ground when One. VS is a part of DF=0, 16.

Overview of Format Definitions (cont)
Table 3

				B5	0	0	1	1
				B6	0	1	0	1
B4	B3	B2	B1					
0	0	0	0			P	SP	0
0	0	0	1		A	Q		1
0	0	1	0		B	R		2
0	0	1	1		C	S		3
0	1	0	0		D	T		4
0	1	0	1		E	U		5
0	1	1	0		F	V		6
0	1	1	1		G	W		7
1	0	0	0		H	X		8
1	0	0	1		I	Y		9
1	0	1	0		J	Z		
1	0	1	1		K			
1	1	0	0		L			
1	1	0	1		M			
1	1	1	0		N			
1	1	1	1		O			
SP=SPACE code								

6-Bit Character Set for AIS Subfield
Table 4

SRS OR TAS SUBFIELD VALUE		NUMBER OF SEGMENTS
OCTAL	HEXADECIMAL	
100000	8000	1
140000	C000	2
160000	E000	3
170000	F000	4
174000	F800	5
176000	FC00	6
177000	FE00	7
177400	FF00	8
177600	FF80	9
177700	FFC0	10
177740	FFE0	11
177760	FFF0	12
177770	FFF8	13
177774	FFFC	14
177776	FFFE	15
177777	FFFF	16

Valid Values for SRS and TAS Subfields
Table 5

BINARY	OCTAL	DECIMAL	HEXADECIMAL
000	0	0	0
001	1	1	1
010	2	2	2
011	3	3	3
100	4	4	4
101	5	5	5
110	6	6	6
111	7	7	7
1000	10	8	8
1001	11	9	9
1010	12	10	A
1011	13	11	B
1100	14	12	C
1101	15	13	D
1110	16	14	E
1111	17	15	F
10000	20	16	10

Number Systems Conversion
Table 6

UF#	FIELDS							
0	VS(b)	CC(b)	SL(d)	RI(d)			AC(h&o)	AA(h&o)
4	FS(d)	DR(d)	UM(h)	IDS(d)	IIS(d)		AC(h&o)	AA(h&o)
5	FS(d)	DR(d)	UM(h)	IDS(d)	IIS(d)		ID(h&o)	AA(h&o)
11	CA(d)	PI(h)						AA(h&o)
16	VS(b)		SL(d)	RI(d)	MV(h)		AC(h&o)	AA(h&o)
20	FS(d)	DR(d)	UM(h)	IDS(d)	IIS(d)	MB(h)	AC(h&o)	AA(h&o)
21	FS(d)	DR(d)	UM(h)	IDS(d)	IIS(d)	MB(h)	ID(h&o)	AA(h&o)
24	KE(b)	ND(d)		IDS(d)	IIS(d)			AA(h&o)
	h=hex b=binary d=decimal							

IFR 6000 Mode S UF Fields Numeric Units
Table 7

APPENDIX J - STANDARD ACCESSORIES

1. AUXILIARY EQUIPMENT

Refer to Appendix J, Figure 1.

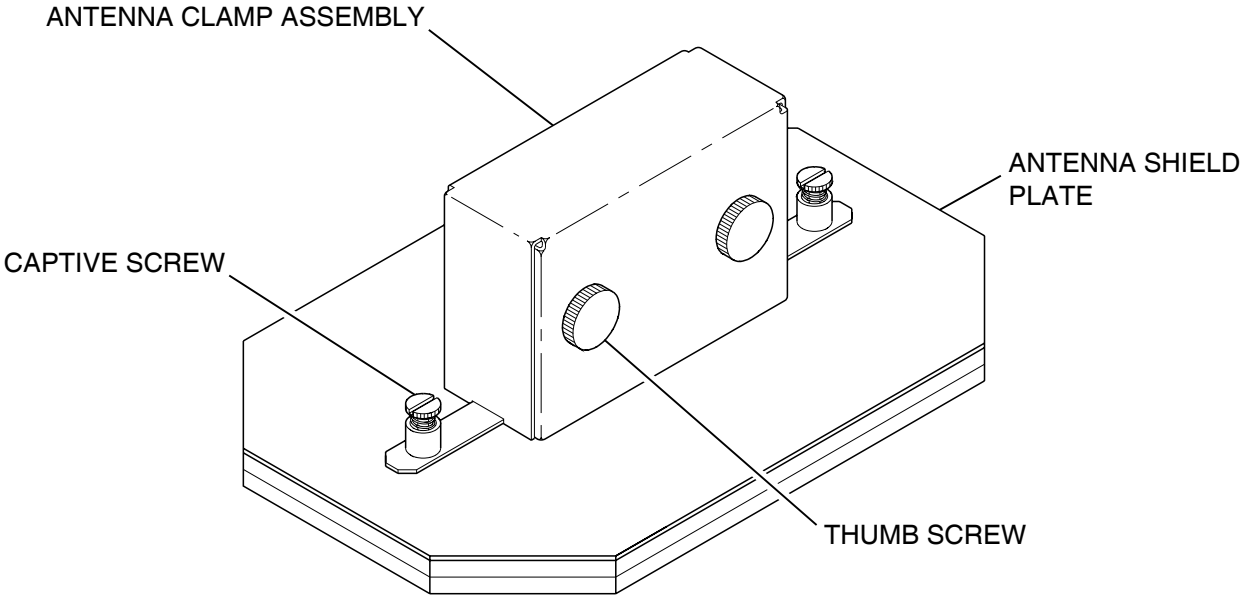
ITEM	DESCRIPTION
● DC Power Supply	Used to power the Test Set.
● Antenna	RF antenna used with Test Set when power accuracy is most critical.
● Breakout Box	Provides means of accessing individual user interfaces via standard connectors
● Antenna Shield	Used with Antenna Clamp Assembly to cover UUT Antenna not being tested.
● 12 in. Coaxial Cable	Used to connect Test Set ANT Connector to Directional Antenna ANT Connector.
● 72 in. Coaxial Cable	Used to connect the Test Set to the UUT.
● 5 A Fuse	Spare Fuse
● Power Cord (US Only)	Used to connect AC power from an external AC power source to AC PWR Connector.
● Power Cord (European)	Used to connect AC power from an external AC power source to AC PWR Connector.

Auxiliary Equipment
Figure 1

2. ANTENNA SHIELD PROCEDURE

Refer to Appendix J, Figure 2.

STEP	PROCEDURE
1.	Position Antenna Clamp Assembly inside the slot in the Antenna Shield Plate, aligning captive screws into the respective screw holes.
2.	Tighten captive screws.
3.	Cover UUT Antenna with Antenna Shield. Loosen Thumbscrews if necessary.
	NOTE: It may be necessary to remove UUT Antenna Guard if access to UUT Antenna is restricted.
4.	Secure Antenna Shield by tightening thumbscrews.



Antenna Shield
Figure 2

APPENDIX K - TARGET ACQUISITION TIME PROBABILITY TABLE

The following table shows the probability of target acquisition time increasing by more than a specified time (in addition to the normal two to three sec). The table indicates, for example, there is a 10% probability the target acquisition time increases by more than ten sec.

NOTE: The table only applies when testing one UUT Antenna. Other UUT Antennas are shielded, disabled or out of the line of sight path with the IFR 6000 TCAS.

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INCREASE IN TARGET ACQUISITION TIME	PROBABILITY PERCENTAGE
>3 sec	91%
>4 sec	76%
>5 sec	59%
>6 sec	44%
>7 sec	31%
>8 sec	22%
>9 sec	15%
>10 sec	10%
>11 sec	7%
>12 sec	4%
>13 sec	3%
>14 sec	2%
>15 sec	1%
>16 sec	0.7%
>17 sec	0.4%
>18 sec	0.3%
>19 sec	0.2%
>20 sec	0.1%

Target Acquisition Time Probability
Table 1

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INDEX

FOR QUALIFIED SERVICE PERSONNEL ONLY

BATTERY/FUSE INSTRUCTIONS

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SAFETY FIRST: TO ALL SERVICE PERSONNEL

REFER ALL SERVICING OF UNIT TO QUALIFIED TECHNICAL PERSONNEL.

WARNING: USING THIS EQUIPMENT IN A MANNER NOT SPECIFIED BY THE ACCOMPANYING DOCUMENTATION MAY IMPAIR THE SAFETY PROTECTION PROVIDED BY THE EQUIPMENT.

CASE, COVER OR PANEL REMOVAL

Opening the Case Assembly exposes the technician to electrical hazards that can result in electrical shock or equipment damage.

SAFETY IDENTIFICATION IN TECHNICAL MANUAL

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

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

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

SAFETY SYMBOLS IN MANUALS AND ON UNITS

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

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

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

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

EQUIPMENT GROUNDING PRECAUTION

Improper grounding of equipment can result in electrical shock.

USE OF PROBES

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

POWER CORDS

Power cords must not be frayed, broken nor expose bare wiring when operating this equipment.

USE RECOMMENDED FUSES ONLY

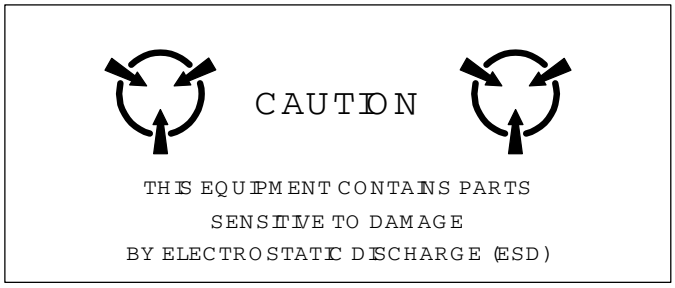
Use only fuses specifically recommended for the equipment at the specified current and voltage ratings.

WARNING: THE IFR 6000 USES A LITHIUM ION BATTERY PACK. THE FOLLOWING WARNINGS CONCERNING LITHIUM ION BATTERIES MUST BE HEEDED:

- **DO NOT RECHARGE OUTSIDE THE IFR 6000.**
- **DO NOT CRUSH, INCINERATE OR DISPOSE OF IN NORMAL WASTE.**
- **DO NOT SHORT CIRCUIT OR FORCE DISCHARGE AS THIS MIGHT CAUSE THE BATTERY TO VENT, OVERHEAT OR EXPLODE.**

CAUTION: INTEGRATED CIRCUITS AND SOLID STATE DEVICES SUCH AS MOS FETS, ESPECIALLY CMOS TYPES, ARE SUSCEPTIBLE TO DAMAGE BY ELECTROSTATIC DISCHARGES RECEIVED FROM IMPROPER HANDLING, THE USE OF UNGROUNDED TOOLS AND IMPROPER STORAGE AND PACKAGING. ANY MAINTENANCE TO THIS UNIT MUST BE PERFORMED WITH THE FOLLOWING PRECAUTIONS:

- BEFORE USE IN A CIRCUIT, KEEP ALL LEADS SHORTED TOGETHER EITHER BY THE USE OF VENDOR-SUPPLIED SHORTING SPRINGS OR BY INSERTING LEADS INTO A CONDUCTIVE MATERIAL.
- WHEN REMOVING DEVICES FROM THEIR CONTAINERS, GROUND THE HAND BEING USED WITH A CONDUCTIVE WRISTBAND.
- TIPS OF SOLDERING IRONS AND/OR ANY TOOLS USED MUST BE GROUNDED.
- DEVICES MUST NEVER BE INSERTED INTO NOR REMOVED FROM CIRCUITS WITH POWER ON.
- PC BOARDS, WHEN TAKEN OUT OF THE SET, MUST BE LAID ON A GROUNDED CONDUCTIVE MAT OR STORED IN A CONDUCTIVE STORAGE BAG. REMOVE ANY BUILT-IN POWER SOURCE, SUCH AS A BATTERY, BEFORE LAYING PC BOARDS ON A CONDUCTIVE MAT OR STORING IN A CONDUCTIVE BAG.
- PC BOARDS, IF BEING SHIPPED TO THE FACTORY FOR REPAIR, MUST BE PACKAGED IN A CONDUCTIVE BAG AND PLACED IN A WELL-CUSHIONED SHIPPING CONTAINER.



CAUTION: SIGNAL GENERATORS CAN BE A SOURCE OF ELECTROMAGNETIC INTERFERENCE (EMI) TO COMMUNICATION RECEIVERS. SOME TRANSMITTED SIGNALS CAN CAUSE DISRUPTION AND INTERFERENCE TO COMMUNICATION SERVICES OUT TO A DISTANCE OF SEVERAL MILES. USERS OF THIS EQUIPMENT SHOULD SCRUTINIZE ANY OPERATION THAT RESULTS IN RADIATION OF A SIGNAL (DIRECTLY OR INDIRECTLY) AND ENSURE COMPLIANCE WITH INSTRUCTIONS IN FAA CIRCULAR AC 170-6C, DATED FEBRUARY 19, 1981.

FOR QUALIFIED SERVICE PERSONNEL ONLY

FUSE REPLACEMENT

Refer to Figure 1.

STEP	PROCEDURE

1. Verify the IFR 6000 is OFF and not connected to AC power.
2. Fully loosen two captive screws in the two lower bumpers and remove the bumpers.
3. Fully loosen five captive screws and lift the Battery Cover from the Case Assembly.
4. Replace fuse:

   5 A, 32 Vdc, Type F
   (Mini Blade Fuse)
   (Aeroflex PN: 5106-0000-057)

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

5. Install the Battery Cover on the Case Assembly and tighten the five captive screws (8 in/lbs.).
6. Install the two lower bumpers and tighten the two captive screws in each bumper (8 in/lbs.).

BATTERY REPLACEMENT

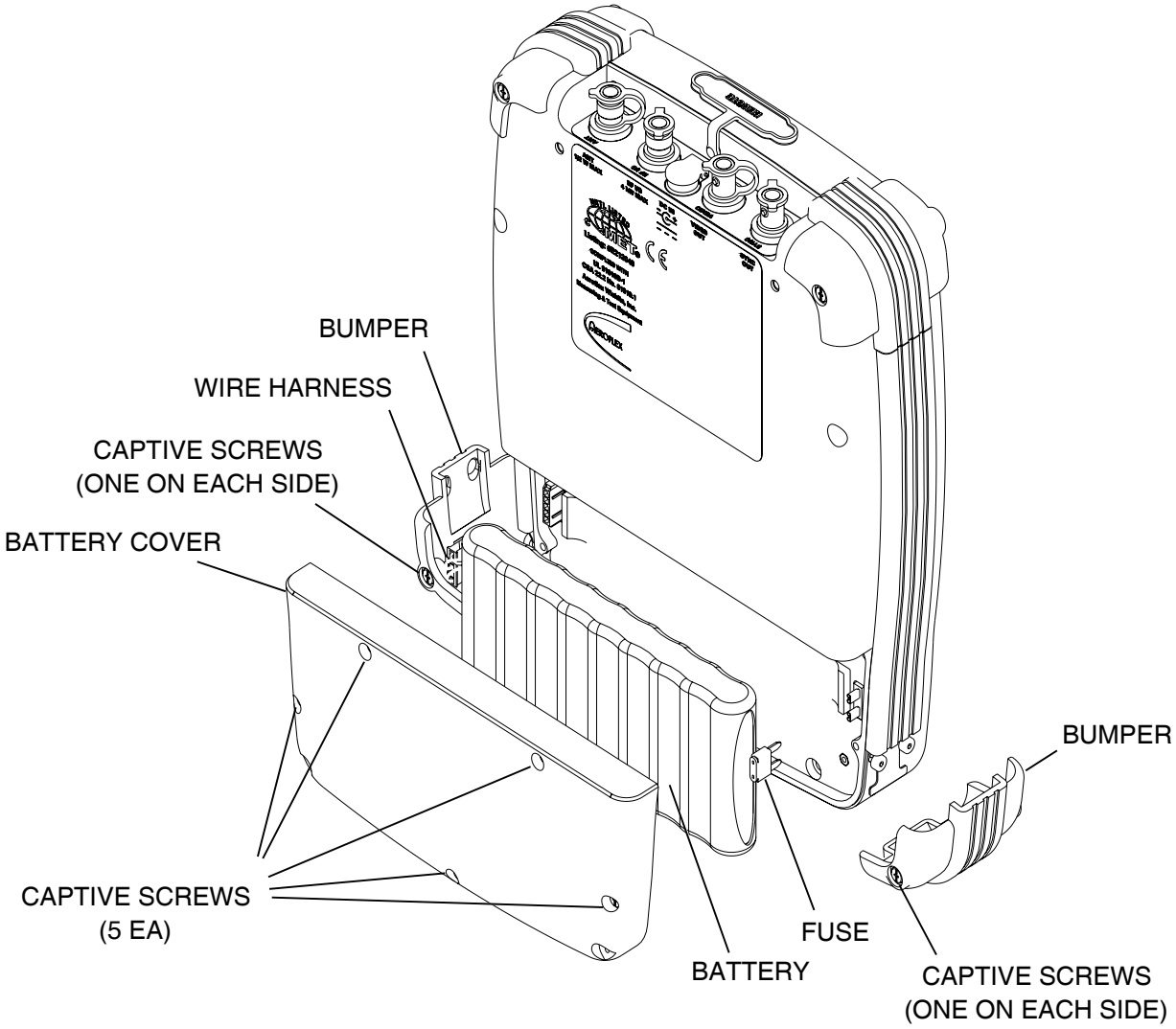
Refer to Figure 1.

STEP	PROCEDURE

1. Verify the IFR 6000 is OFF and not connected to AC power.
2. Fully loosen two captive screws in the two lower bumpers and remove the bumpers.
3. Fully loosen five captive screws and lift the Battery Cover from the Case Assembly.
4. Disconnect the wire harness connecting the battery to the Test Set and remove the battery.
5. Install new battery and reconnect the wire harness.
6. Install the Battery Cover on the Case Assembly and tighten the five captive screws (8 in/lbs.).
7. Install the two lower bumpers and tighten the two captive screws in each bumper (8 in/lbs.).

   WARNING: DISPOSE OF OLD BATTERY ACCORDING TO LOCAL STANDARD SAFETY PROCEDURES.

   ⚠ **CAUTION:** REPLACE ONLY WITH THE BATTERY SPECIFIED BY AEROFLEX. DO NOT ATTEMPT TO INSTALL A NON-RECHARGEABLE BATTERY.



Battery and Fuse Replacement
Figure 1

As we are always seeking to improve our products, the information in this document gives only a general indication of the product capacity, performance and suitability, none of which shall form part of any contract. We reserve the right to make design changes without notice.

CHINA	Tel: [+86] (10) 6467 2716	Fax: [+86] (10) 6467 2821
FRANCE	Tel: [+33] 1 60 79 96 00	Fax: [+33] 1 60 0177 69 22
HONG KONG	Tel: [+852] 2832 7988	Fax: [+852] 2834 5364
SCANDINAVIA	Tel: [+45] 9614 0045	Fax: [+45] 9614 0047
SPAIN	Tel: [+34] (91) 640 11 34	Fax: [+34] (91) 640 06 40
UNITED KINGDOM	Tel: [+44] (0) 1438 742200	Fax: [+44] (0) 1438 7276
	Toll Free: 0800 282388 (UK only)	
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