Avionics

TS-4530/UPM Interrogator/Transponder Test Set

NSN: 6625-01-483-7194

- Transponder Test Set Modes 1, 2, 3/A, C, 4, S
- Interrogator Test Set Modes 1, 2, 3/A, C, 4, S, TCAS, ETCAS
- Can be upgraded to Mode 5 testing capability (planned)
- Hand-held, Battery Powered and Lightweight (under 11 lb)
- One piece, 3-button point and shoot Go/No-Go Operation
- Self-diagnostic with extended calibration cycle
- Automated MTL measurement
- Parametric test results can be stored for immediate viewing or downloaded to PC for review or maintenance logging

The new AIMS certified TS-4530/UPM Test Set is a performance and capability upgrade to the popular AN/APM-424(V)2 "Star Wars" Test Set. The TS-4530/UPM is ruggedized and has passed all military environmental testing as specified in the MIL-STD.

Northrop Grumman licensed Aeroflex, to redesign the electronics inside the AN/APM-424(V)2 with the result being the new TS-4530/UPM. The TS-4530/UPM provides Interrogator and Transponder testing capability in a one-box test set, as well as growth to Mode 5.

The Mode S Interrogator/TCAS testing can provide as many as (8) different scenarios for testing TCAS systems.

The new TS-4530/UPM has the same point-and-shoot, easy-to-use operation as the 424(V)2. The small hand-held unit consists of an integrated mono-pulse antenna, electronics package and display unit. The antenna employs dual end-fire planar array elements mounted on the upper surface. The electronics package contains a transmitter, a two-channel digital receiver, DSP and FPGA based processing and control circuitry, power regulators and rechargeable battery stick. All modulation and demodulation is done in the digital domain and results in a highly accurate and flexible ramp or bench test platform. The display unit consists of an LED alphanumeric display and an optical sight. The unit automatically adjusts both transmitter power and receiver sensitivity to the test environment. This permits the operator to set a distance of 10 to 150 feet for transponder testing and 30 to 70 feet for interrogator testing according to the unit being tested.
SPECIFICATIONS

USER INTERFACE

Display
16 character by 2 line alpha-numeric LED, 0.18" character height with green Accept, red Reject and yellow Battery indicators

Controls
3 buttons: test sequence advance, test sequence repeat and test result data

MODES OF OPERATION

TRANSPONDER TESTING

Test Range
10 to 150 ft.
1,2,3A - displays code, identification and emergency status
C - displays altitude
4 - stand alone operation, but must be filled with challenge video patterns from COMSEC, displays code A or B and verification bit status
S - Interrogates with: UF0, UF11 (all call), UF4(altitude), UF4 asking for DF20 containing AIS, UF5(Identity), UF5 asking for DF21 containing Datalink capability report, DF16(long TCAS surveillance)

Capable of upgrade to add IFF mode 5.

INTERROGATOR TESTING (INCLUDING TCAS)

Test Range
30 to 70 ft.

Static Targets
1 - responds with 12
2 - responds with 1202
3/A - responds with 1203 (4096 code)
C - responds with configurable altitude
4 - requires KIT or KIV to operate
S - Replies to: UF11(all call),UF0 (short TCAS surveillance), UF16 (long TCAS surveillance), UF4 (altitude), UF5 (Identity), UF20 (long altitude), UF21 (long identity)

Measures interrogation rate
Capable of upgrade to add IFF mode 5.

Dynamic Target Scenarios

Level - Intruder closing level at configured altitude
Above - Intruder closing level 2000 ft. above configured altitude
Dive - Intruder closing from 5000 ft. above descending to configured altitude
Climb - Intruder closing from 5000 ft. below climbing to configured altitude
Intruder starts at 15 nmi distance from UUT, ends at approx. 0 nmi
Closing speed fixed at 720 knots
Configured altitude is 0-20,000 ft.

Target Simulation
Multiple 4, 8, 16, 32, 64, 128, and 256 nmi

Single 4 nmi, IDENT On/Off, EMERG On/Off

ANTENNA

(End-fire antenna with sum and difference feeds)

Interrogation Beamwidth
Approximately ±5 degrees

Polarization
Vertical

DIRECT CONNECTION PORT

Impedance
50 Ω

SWR
1.3:1 maximum

Connector
TNC

POWER SUPPLY

Operating Modes
Unit operates either from external DC input power or internal batteries

External DC Input
11.5 to 28 V DC input, 25 W maximum

Surge Protection
MIL-STD-704E figure 9 (50 volts peak for 12.5 ms, then reducing linearly to 29 V over 70 ms)

Reverse Polarity
-30 volts maximum

Battery Compatibility
Replaceable internal batteries, disassembly of unit is not required.
Reverse polarity protected
NICAD re-chargeable battery assy, 7.2 volt DC nominal
Compatible with commercial C size NICAD, NiMH or alkaline batteries

Int. Battery Charger
Operates from external DC input
Full re-charge time within 8 hours from fully discharged state (actual charge time depends on level of discharge). Battery will charge with unit operating unless an external COMSEC is connected.
Automatic charge termination when fully charged
Automatic charge restriction to 0 to +40ºC nominal battery temperature range
Safety charge termination at +85ºC nominal battery temperature range

Low Battery Indication
Display indicates “BATTERY” when less than 20 % capacity remains, flashes “BATTERY” at slow rate when less than 5% capacity remains, flashes at high rate when battery is too low to run tests.

Discharge Protection
Test set automatically shuts off to prevent excessive battery discharge.
**SIGNAL GENERATOR**

**Generator Frequency**
1030 or 1090 ±0.01 MHz

**Generator Power**
+4 to -44 dBm, 1 dB resolution, ±1.5 dB accuracy at antenna connector, +/- 2 dB radiated antenna field strength -40 to -88 dBm, 1 dB resolution, ±1.5 dB accuracy at direct port

**Pulse Shape and Timing**
Modes 3/A, C, S comply with RTCA/DO-181C, mode 1, 2, 4 comply with DOD AIMS 97-1000

**ISLS Amplitude**
Equal to P1 on difference or sum ports when enabled

**Interrogation Rate**
Modes 1, 2, 3/A, 4: 235 +/- 5 Hz
Mode S: 50 +/- 5 Hz

**Harmonics**
2nd and 3rd harmonic >30 dBc

**Spurious**
Applies at greater than 60 MHz from TX center frequency, -50 dBm maximum in standby / 50 dBc or -50 dBm max in transmit when measured at the antenna connection

**MEASUREMENT RECEIVER**

**GENERAL**

**Frequency Range**
1090 or 1030 MHz

**Amplitude Range**
+68 to +20 dBm at direct port, +24 to -24 dBm at antenna port

**Input Protection**
(1 µs pulse width, 1% max duty cycle)

**Direct Input**
+68 dBm

**Antenna Input**
+30 dBm at antenna connection

**RECEIVER MEASUREMENTS**

**Received Power**
1 dB resolution, ±1.5 dB accuracy at antenna port, ±1.5 dB at direct port, +/- 2 dB antenna field strength

**Method**
Peak power of pulse obtained using 100 ns averaging period

**Frequency**
0.01 MHz resolution +/-0.10 MHz accuracy with >400 ns pulse width (transponder mode)
+/-0.05 MHz accuracy with >750 ns pulse width (interrogator mode)

**Method**
Average frequency between 90% points

**Frequency Range**
Within ±5 MHz of nominal for specified accuracy of amplitude and frequency measurements

**Pulse Spacing**
±25 ns measured between leading edges for pulses with rise times <100 ns

**Pulse Width**
±25 ns for pulses with rise times of 50 to 100 ns, fall times of 50 to 200 ns

**Receiver Bandwidth**
>10 MHz at 3 dB points

**Oscillator Leakage**
-50 dBm maximum at antenna connection

**Image Rejection**
>40 dBc

**COMSEC INTERFACE**

**Connector**
Accessory interface cable or adapter provides the required interface connector.

**Compatibility**
KIR-1A /1C, KIT-1A/1C, KIV-3 /6 with appropriate cable or adapter

**Power for COMSEC**
KIT-1A / KIR-1A External 115 V AC provided through KIT/KIR-1A interface cable (JPN: 55-1045-16)
KIT-1C / KIR-1C 22 to 29 V DC at 3 watts max. (provided by the test set)
KIV-6 15 +/- 0.75 V DC at 200 mA max. (provided by the test set)

**TEST PARAMETERS**

**Correct Reply Code**
Indicates reply code

**Correct Pulse Timing**
Displays pulse spacing error or pulse width error

**Percent Reply**
Indicates % reply

**Receiver Sensitivity**
Displays MTL in dBm

**Transmitter Power**
Displays dBm

**Transmitter Frequency**
Displays frequency

**Mode 4 Word**
Indicates presence of A or B word

**VER BIT 1 Word**
Indicates presence of A1 or B1 word

**Reply Delay**
Displays in µs

**ISLS Operation**
Indicates % reply
Identify Response
Indicates presence

Emergency Response
Indicates presence

Angle Reflection
Indicates unacceptable levels of multi-path interference

Umbilical Testing
Connector provided for direct connection to transponder

Mode S Testing
Supports the RF link portion of the installed equipment performance requirements of DO-181C and ED-73A (Additional equipment is required to simulate aircraft pressure altitude for the altitude reporting verification.)

ENVIRONMENTAL

Physical Dimensions: (Test set without accessories)
- Length 14.1 inches / 358 mm
- Height 7.5 inches / 190 mm
- Width 11.5 inches / 292 mm
- Weight 10 lbs. / 4.55 kg (with battery)

Temperature
- -40 °C to +55 °C operating, -55°C to + 85°C storage

Humidity
- To 100%, rain exposure acceptable

Altitude
- Less than 15,000 ft operating, 50,000 ft storage

Shock
- 12-inch drop without protection, 1-m drop in transit case

Vibration
- 5 g, 5 Hz to 55 Hz in transit case

EMI / RFI MIL-STD-461E
- CE101 Power Leads, 30 Hz to 10 kHz
- CE102 Power Leads, 10 kHz to 10 MHz
- CS101 Power Leads, 30 Hz to 150 kHz
- CS114 Bulk Cable Injection, 10 kHz to 200 MHz
- CS115 Bulk Cable Injection, Impulse
- CS116 Cables & Power Leads, Damped Sinusoidal Transients
- RE101 Magnetic, 30 Hz to 100 kHz
- RE102 Electric, 10 kHz to 18 GHz (RX and TX standby)
- RE103 Antenna Spurious and Harmonics, 10 kHz to 40 GHz (TX active)

EXCEPTION: -50 dBc spurious limit, transmit harmonic levels are not required to be lower than 10 dB above the RE102 transmit standby limits.
- RS101 Magnetic, 30 Hz to 100 kHz
- RS103 Electric, 2 MHz to 18 GHz, 50 V/m

EXCEPTION: does not apply within 10% of RX and TX operating frequency

ACCESSORY SPECIFICATIONS

EXTERNAL POWER SUPPLY

Temperature
- 0 to +40 C

Altitude
- Less than 2,000 m operating

Humidity
- 10 to 80% non-condensing, indoor operation only

Weight
- 1 lbs. / 0.45 kg

Input Voltage
- 100 to 240 V AC +/- 10%

Input Current
- 1.0 A AC Max

Frequency
- 47 to 63 Hz

Input Connector
- IEC 320 3 pin receptacle, 6' (USA standard line cord provided)

Output Connector
- 6 ft / 1.8 meter cable with 5.5 x 2.5 x 9.5 mm barrel connector

Output Voltage
- +12 V DC nominal

Output Current
- 2.0 ADC nominal

EMC
- FCC class B, CISPR 22 class B

Approvals
- UL, CE

EXTERNAL BATTERY CHARGER

Temperature
- 0 to +40°C

Altitude
- Less than 2,000 m operating

Humidity
- 10 to 80% non-condensing, indoor operation only

Weight
- 1 lbs. / 0.45 kg

Size
- 12.2” L x 2” H x 3.3” W

Functions
- Charges or discharges one battery stick

Power Source
- Requires connection to supplied AC Adapter, 12 V DC ±0.5 V, 2 A min, 4 A max.
### Input Connector
- Accepts 5.5 x 2.5 x 9.5 mm barrel connector

### Charge Time
- 3 hours maximum for 3 AH battery, dependent on battery charge state
- Automatic shut off when fully charged

### Discharge Rate
- 700 mA typical, automatic shut off when discharged

### EXTERNAL DC CABLE
#### Supply Connector
- Banana Plugs

#### Unit Connector
- 5.5 x 2.5 x 9.5 mm barrel connector

#### Length
- 6 ft / 1.8 meter

#### Weight
- 0.22 lb / 0.1 kg

### UMBILICAL RF CABLE
#### Length
- 12 ft / 3.6 meters

#### Connectors
- TNC male right angle, TNC male straight
- TNC female to N male adapter included

#### Weight
- 0.5 lb. / 0.25 kg

### KIT/KIR-1C CABLE (UPN: 55-1045-10)
#### Supported COMSEC
- KIT-1C / TSEC, KIR-1C / TSEC

#### Length
- 4 ft / 1.2 meters

#### Weight
- 2 lbs. / 0.9 kg

#### RS-232 Connector
- 9 pin D sub female

#### External DC Connector
- Accepts 5.5 x 2.5 x 9.5 mm barrel connector

### KIT/KIR Power
- 28 volt nominal at 3 watts max supplied from test set

### AUTOMOTIVE DC ADAPTER CABLE
#### Length
- 10 ft / 3 meters

### KIV-6 ADAPTER (OPTIONAL)
#### Mounting
- Attaches to handle and circular connector

#### Size
- 7in. L x 5in. H x 5in. W / 175 x 125 x 125 mm maximum

#### Weight
- 1.5 lb. / 0.7 kg max without KIV-6

#### Humidity
- To 100% , Rain Exposure Acceptable

#### RS-232 Connector
- 9 pin D sub female

#### External DC Connector
- Accepts 5.5 x 2.5 x 9.5 mm barrel connector

### BATTERY STICK
#### Type
- High Capacity Rapid Charge NiCad

#### Voltage
- 7.2 volts DC nominal

#### Capacity
- 3 amp hour at +25ºC nominal

#### Temperature
- Operating -20 to +55ºC recommended. Will operate at -40ºC with 25% of +25ºC capacity and degraded cycle lifetime
- Storage -55 to +85ºC
- Re-charging 0 to +40ºC

#### Weight
- 1.5 lbs.

### TRANSIT CASE
#### Type
- Watertight sealed enclosure with pressure release valve

#### Size
- Length 26.8 inches / 681 mm
- Height 12.25 inches / 312 mm
- Width 13.25 inches / 337 mm

#### Weight
- Empty: 16 lbs./ 7.3 kg
- Full: 36 lbs. / 16.4 kg
**Bench Utility Software**

**Function**
Allows download, viewing, and saving test data from test set.

**Compatibility**
Microsoft Windows 95, 98, 2000, XP, NT 4.x

**Format**
CD ROM

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**KIV-6 Adapter**

The KIV-6 adapter can be used with a KIV-6 crypto appliqué to test both transponders and interrogators. For transponder testing with the TS-4530/UPM Radar Test Set, the KIV-6 adapter is used to connect the KIV-6 COMSEC to the test set during code load programming. The adapter provides the following:

- Interface between the test set and KIV-6 during Mode 4 interrogator testing
- 15Vdc to power the KIV-6
- A connector for external DC power to operate the test set and charge the batteries
- An RS-232 connector to allow an external PC to be connected to the test set

The TS-4530/UPM Test Set supplies power through the KIV-6 adapter to the COMSEC for code loading. This eliminates the need for a 15VDC or 115VAC source during code loading. The power supply is enabled by the test set during code loading and supplies 15VDC at up to 5 watts. In addition, the supply provides power to the KIV-6 COMSEC when attached during interrogator testing.

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**Versions, Options and Accessories**

When ordering please quote the full ordering number information.

**Ordering Numbers**

TS-4530/UPM-70 Interrogator/Transp. Test Kit, JPN 50-1045-70

Included with kit:

- TS-4530/UPM Test Set, NSN: 6625-01-483-7194
- COMSEC cable for KIT/KIR-1C
- Transit case with pressure release valve
- External battery charger
- AC Power adapter - 115V to 230V, 50Hz to 400Hz
- (2) Battery Sticks
- Operator Training CD-ROM, Bench Utility CD-ROM
- r-f Direct connect cable
- r-f adapter
- Calibration Certificate - Calibration interval (5) years
- DC Power Cable
- RS-232 cable

**Optional Accessories**

- AC55104516 COMSEC cable w/ power adptr for KIT-1A or KIR-1A
- AC55104513 COMSEC adapter for KIV-6
- AC55104518 Cable, Automotive DC adapter
- AC600694C0 TIBS (Trans/Inter Bench Software) CD-ROM

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This product is controlled for export under the International Traffic in Arms Regulations (ITAR). A license from the U.S. Department of State is required prior to the export of this product from the United States.

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