T-48D

TRANSPONDER/DME RAMP TEST SET

OPERATING AND MAINTENANCE INSTRUCTION MANUAL

SERIAL 191 & UP

(MOD 2)

11 NOV 99
REV. A

WARRANTY

The Tel-Instrument Electronics Corporation warrants each new product manufactured by it to be free from defective material and workmanship and agrees to remedy any such defect of its manufacture which under normal installation, use and service discloses such defect. This warranty requires that the unit be delivered by the owner to Tel intact for examination, with all transportation charges prepaid to the factory, within one year from the date of sale to original purchaser and provided such examination discloses, in Tel's judgment, that it is thus defective. This warranty does not include batteries (NiCad batteries have a 90-day warranty.)

This warranty does not extend to any of Tel products which have been subjected to misuse, neglect, accident, incorrect wiring not our own, improper installation, or to use in violation of instructions furnished by us, nor extend to units which have been repaired or altered outside of our factory, nor to cases where the serial number thereof has been removed, defaced or changed, nor to accessories used herewith not of our own manufacture.

Repair parts will be made available for a minimum period of five (5) years after the manufacture of this equipment has been discontinued.

This warranty is in lieu of all other warranties expressed or implied and no representative or person is authorized to assume for us any other liability in connection with the sale of Tel's products.

ADDITIONAL INFORMATION with regard to the applications and maintenance of this equipment will be available from time to time. Users of our instruments are urged to discuss their problems with us and to suggest such modifications as might make them more adaptable to their special requirements.

MARCH 1, 1995

T-48D (SERIAL # 169 & UP) RECORD OF CHANGES

Date	REV.	ECO	Page	Description
11/9//99	A			Major changes to PCB's to add built in attenuation.

T-48D OPERATING AND MAINTENANCE INSTRUCTION MANUAL

TABLE OF CONTENTS

SECTION 1

GENERAL INFORMATION

1.1 Introduction

The Tel-Instrument T-48D XPDR/DME Ramp Test Sets are battery powered portable units used to test operation of transponder systems antenna to antenna when installed in the aircraft, or connected directly to the UUT.

1.2 Description

The T-48D is self-contained in an aluminum carrying case. Two clamping fasteners secure the hinged case cover in place. All operating controls and the data display are mounted on the test set front panel. All accessories are stored inside the cover. The test set has a rechargeable battery pack and built in battery charger. For antenna-to-antenna operation, the omni antenna is removed from the cover and mounted on the front of the test set.

1.3 Tests Performed

The test set will test transponder modes 1, 2, 3A, C, S, and DME on 3 pre-selected channels. A brief description of Mode S is provided in Appendix A. The test set will also decode the Ident and Emergency codes whenever they are activated.

1.4 Equipment and Accessories Supplied

The following equipment is supplied with the T-48D:

Description	P/N
Test Unit	90 000 043
AC Line Cord	75 010 025
Antenna - OMNI	40 030 009 TSP-1A
Direct Connect Cable	75 010 100
Anti-Radiation Coupler, TAP-126A-10 Lower Antenna	89 000 095
Instruction Manual	
RS 232 Floppy Disk	46 061 019

The following accessory is available:

Description	P/N
Anti-Radiation Coupler, TAP-126A-50 Upper Antenna	89 000 096

SECTION 2

PREPARATION FOR USE AND OPERATION

2.1 Preparation for Use

This test set has been carefully checked and the batteries are fully charged when shipped from the factory. However, before attempting to use the unit, proceed as follows:

1. Carefully unpack the unit and inspect it for obvious signs of damage.
2. Release the two latches and open the cover.
3. Check inside the cover for the AC Line Cord.
4. Check the front panel controls, data display window, and connectors for obvious signs of damage.
5. Select function Mode 3A. Turn the DC on/off Switch to "on". Check the Data Display window for the following message:

   TEL-INSTRUMENT
   T-48D REV. X.X* * *Represents software revision number*

   Immediately followed by:

   Mode 3A
   Press Interrogate

6. If the display indicates the following:

   Low Battery
   Recharge Battery

   The battery must be charged before proceeding.

2.2 Battery Operation

The total operating time for the battery is about 8 hours at 50% duty cycle at a nominal 25° C. Because of self-discharge, it would be a good practice to charge the battery each week for a period of time regardless of the amount of operation the battery has received. A fully discharged battery can be completely charged in 16 hours. A nearly fully charged battery will not be damaged by a 16 hour charge. If the test set has not been used heavily since the last charge, a charge of less than 16 hours may be used. The test set will automatically shut off after 15 minutes of operation unless the Interrogator or Test buttons are pushed.

To charge the battery proceed as follows:

1. Remove the AC line cord from inside the cover and attach it to the AC Input receptacle.
2. Connect the power cord to 120V, 50 to 400 Hz AC outlet.
3. Turn AC Power Switch on. Verify charging by observing that yellow AC Power lamp is lit.
4. Charge battery as required to restore full operation capability

2.3 AC Operation

2.3.1 120 Volt Operation

Caution: CHECK WINDOW ON AC POWER MODULE TO READ $\boxed{120}$

The test set can be operated when the battery is low by following these instructions:

1. Connect the AC line cord and proceed to charge the battery.
2. After 15 to 30 minutes, turn the test set on. If the test set display does not indicate "LOW BATTERY", the test set may be used as long as it is plugged in and the "low battery" indication remains off. It may require a longer period of time to charge the battery to full charge.

2.3.2 220 Volt Operation

Caution: CHECK WINDOW ON AC POWER MODULE TO READ $\boxed{220}$
IMPUT VOLTAGE CAN BE SET BY REMOVING FUSE DRAWER AND SELECTING PROPER VOLTAGE TO SHOW IN WINDOW. CHOICES ARE 120 OR 220 ONLY.

The test set can be operated when the battery is low by following these instructions.

1. Connect the AC line cord and proceed to charge the battery.
2. After 15 to 30 minutes, turn the test set on. If the test set display does not indicate "low battery" indication remains off. It may require a longer period of time to charge the battery to full charge.
3. When the AC switch is switched on, the automatic shut off is disabled.

2.4 Operating Controls

All operating controls and displays for the test set are located on the front panel. Refer to Figure 2-1, and Table 2-1 for the location and description of purpose.

Front Panel

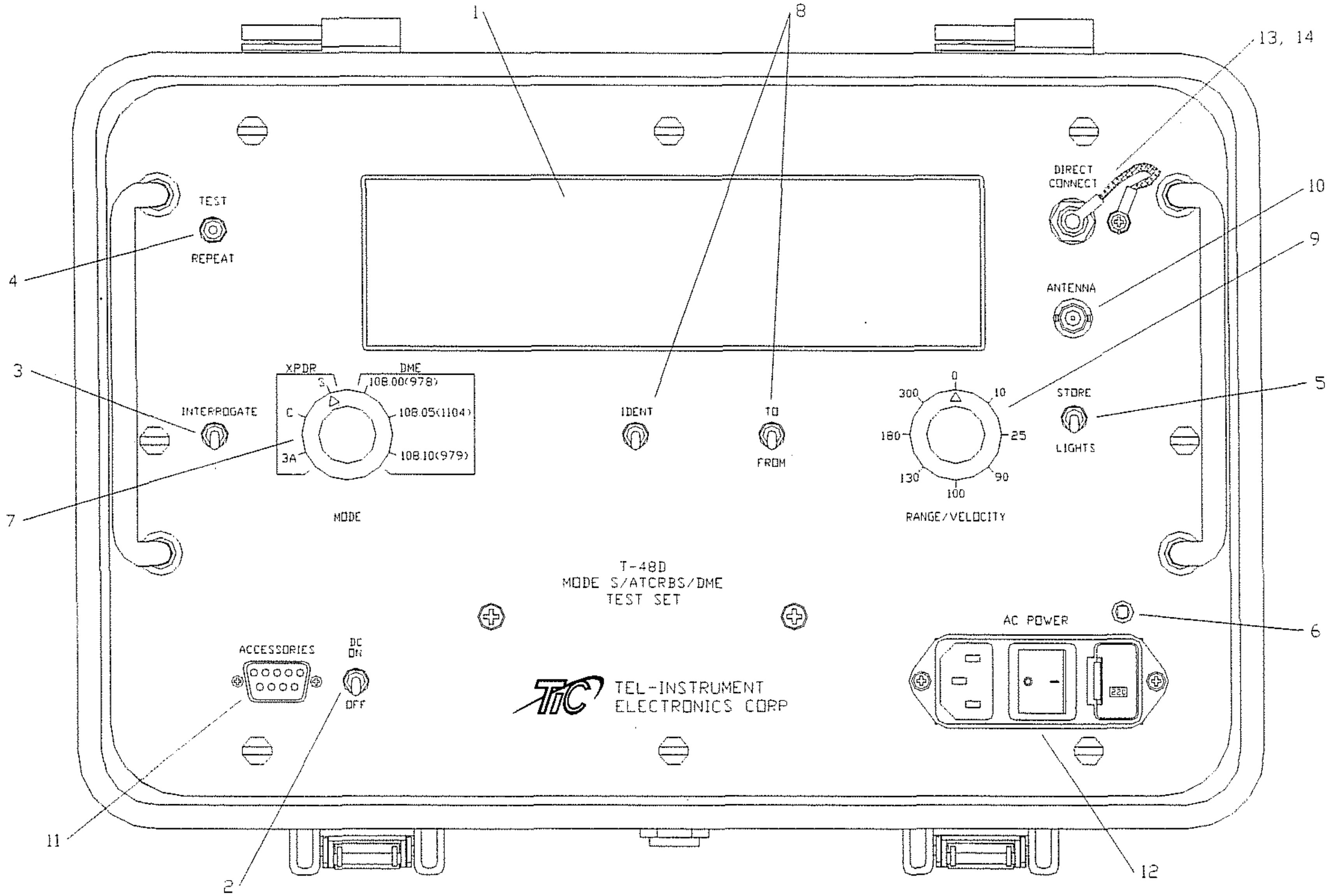


Figure 2-1

TABLE 2-1 OPERATING CONTROLS AND DISPLAYS

Item	Description
1. Data Display	Presents the unit's modes, error messages, and data. The LCD display has 2 lines of 20 characters.
2. DC On/Off Switch	"On" turns the test set on and "Off" turns the test set off. The red DC light will illuminate when on.
3. Interrogate Switch	Select XPDR or DME mode, press to initiate an automatic sequence of tests. The sequence continues until a failure occurs (error message displayed) or the tests are completed successfully (relevant data displayed). After successful completion of interrogate mode, the test data is stored in internal memory. This data can later be sent to a computer for a hard copy.
4. Test Switch	Select XPDR or DME mode, press once to start the first test of the sequence and display relevant data after the completion of the test. The test will repeat continuously and the results displayed until the test switch is pressed again to move to the next test in the sequence.
5. Light Switch	When pressed to MOM or ON, the display back lighting is illuminated.
6. AC Power Switch	Line voltage On/Off switch for battery charging. The yellow AC Power lamp will light when the AC is turned on.
7. Function Rotary Switch	
Mode 3A	Interrogates Mode 3A Transponder
Mode C	Interrogates Mode C Transponder
Mode S	Interrogates Mode S Transponder
DME 978MHz	Performs DME tests on channel 17X, 108.00 MHz
DME 1104MHz	Performs DME tests on channel 17Y, 108.05 MHz
DME 979MHz	Performs DME tests on channel 18X, 108.10 MHz
8. DME Toggle Switches	
IDENT	Add identification tone
To/From	Selects velocity direction

9. Range/Velocity Rotary Switch

DME	
0 miles	0 knots
10 miles	10 knots
25 miles	25 knots
90 miles	90 knots
100 miles	100 knots
130 miles	130 knots
180 miles	180 knots
300 miles	300 knots

10. Antenna Connector — Omni antenna or TAP-126A connects to this TNC connector

11. Accessories Connector — Connect standard 9 pin serial communication cable for downloading stored data to IBM PC or compatible

12. AC Input Connector — AC plug for charging the internal battery

13. Direct Connect — Direct connect cable to UUT.

14. TNC Termination CAP — When placed on TNC connector the RF energy is directed to the antenna.

2.5 Operating Modes

The T-48D test set may be operated in three test modes. The first mode is used by attaching the Omni antenna to the antenna connector. The second mode of operation is to direct connect the test set to the UUT RF output connectors. The third mode of operation requires the TAP-126A to be used to connect the test set to the blade antenna of the UUT.

2.5.1 Operation with the Omni Antenna

Connect the Omni antenna to the antenna connector on the T-48D and operate the test set at a distance of 2 to 30 meters from the active aircraft antenna. Be cautious when operating the test set at a long distance so that the UUT is significantly closer to the test set than other similar units. If the test set is closer to an active transmitter in an adjacent aircraft, the undesired transmitter may reply and cause the test set to receive signals from either the undesired transmitter or from both transmitters possibly causing erroneous indications. In addition, be certain that the test set is illuminating the proper antenna as DME antennas have similar if not identical appearance to transponder antennas. Furthermore, some large aircraft have dual installations, where only one system may operate at any time. Be sure that the active antenna is identified.

Caution: Power, Frequency, and Sensitivity cannot be measured with the Omni antenna.

2.5.2 Direct Connect Operation

For measurements of UUT transmitter power and frequency and receiver sensitivity, connect 10 foot cable to the front panel Direct Connect connector, and to the output RF connectors on the UUT.

2.5.3 Operation with TAP-126A Antenna Coupler

The TAP-126A is required for measurements of UUT transmitter power and frequency and receiver sensitivity. To use the TAP-126A, connect the coax cable to the front panel Antenna connector, and slide the TAP-126A coupler over the blade antenna of the UUT. The TAP-126A is calibrated to be used with the AT-741 Antenna.

2.6 Test Set Functions

The Function rotary switch is used to select one of the following T-48D modes: transponder modes 3A and C, and S, and DME. Each mode status is displayed and testing of each mode can be invoked by pressing interrogate. If, at any time, the function rotary switch is changed, the current mode ends and the new mode is selected. Figure 2-2 thru 2-5 are the flow diagrams for each of the modes listed below.

2.6.1 XPDR Modes 1, 2, 3A, C

The test procedure to test transponder modes 3A and C is similar. If RF power, frequency sensitivity, are to be measured, a TAP is required. Turn the system on and select the desired mode using the function switch and pressing the interrogate switch. The code for that particular mode will be displayed (barometric altitude for Mode C) along with the percent reply. If the TAP is used, power of the UUT in watts, sensitivity of the UUT in dBm, and frequency error from nominal will be displayed. At this point the displayed data can be stored in the T-48D battery backed-up RAM. 50 sets of data can be stored. Once the data is stored, you can then press interrogate or test to continue testing. If the test is to be repeated continuously, press the test switch and the test set will interrogate the UUT and display the code and percent reply continuously until a switch is changed or the test set is turned off. If the test switch is pressed again, the test being conducted will be the power, frequency and sensitivity tests which will run continuously.

2.6.2 XPDR Mode S

The Mode S mode includes all tests outlined in FAR 91.172 for testing mode S transponders. The interrogate switch activates a sequence of tests and, as each test is successfully completed, the test set automatically advances to the next test. The sequence is complete when all the tests are run and the test data are displayed. This test data includes altitude, tail number, and 4096 code. The UUT transmitter power and frequency and receiver sensitivity are displayed only when a TAP is used. If a test fails in the interrogate sequence, the sequence stops and the failed test is flagged with its percent of reply. At this point the displayed data can be stored in the T-48D battery backed-up RAM. 50 sets of data can be stored. Once the data is stored, you can then press interrogate or test to continue testing. When the test switch is pressed, the first test in the sequence is continuously run and the display is updated with the current test data. When the test switch is pressed again, the next test in the sequence is continuously run. Any test in the sequence can be selected and continuously run.

2.6.3 DME

There are three preselected DME channels:

1. 108.00 MHz 17X 978 MHz
2. 108.05 MHz 17Y 1104 MHz
3. 108.10 MHz 18X 979 MHz

Each DME mode can be selected with the function rotary switch and invoked with the interrogate switch. The Range/Velocity rotary switch is used to select one of eight preselected range values. The test set simulates a ground station at the preselected range with no velocity change. The TO/FROM switch can then be used to change velocity from zero to the preselected value of the Range/Velocity rotary switch. For example, if the Range/Velocity rotary switch is set to 10, the test set has a range of 10 nmi with a zero velocity. If TO is pressed, the simulated range will decrease at a velocity of 10kts.

2.6.4 RS232

In any transponder mode, data can be stored into the T-48D battery backed-up RAM by pressing the store switch following an interrogate sequence. For example, if Mode C is selected and interrogate is pressed, at the completion of the tests the data displayed will be the altitude, power, receiver sensitivity and frequency of the UUT. To store this data press store. Up to 50 locations can be stored. To retrieve the stored data, connect the T-48D to an IBM PC or compatible via a standard 9 pin serial communication cable. Insert the supplied RS232 programs floppy disk into the computer and type T48D<RT> at the prompt. Power on the T-48D and it will display, writing to PC. When all the data has been downloaded to the computer, press test to erase the data or turn off the T-48D and remove the cable to save the stored data. The data can be written to the computer screen or to a file for a permanent record. View the READ.ME file on the floppy disk for further details.

T-48D Flow Charts

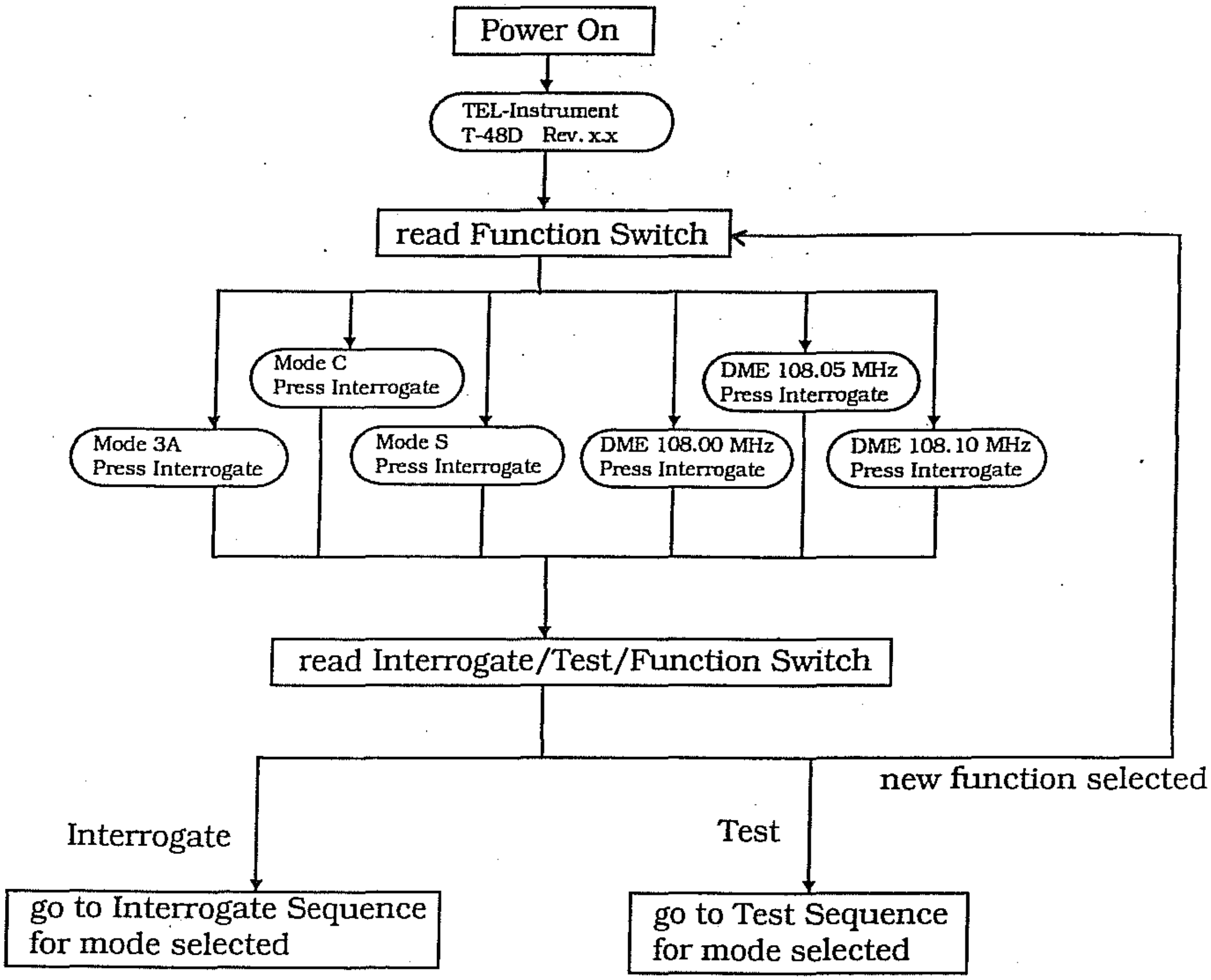
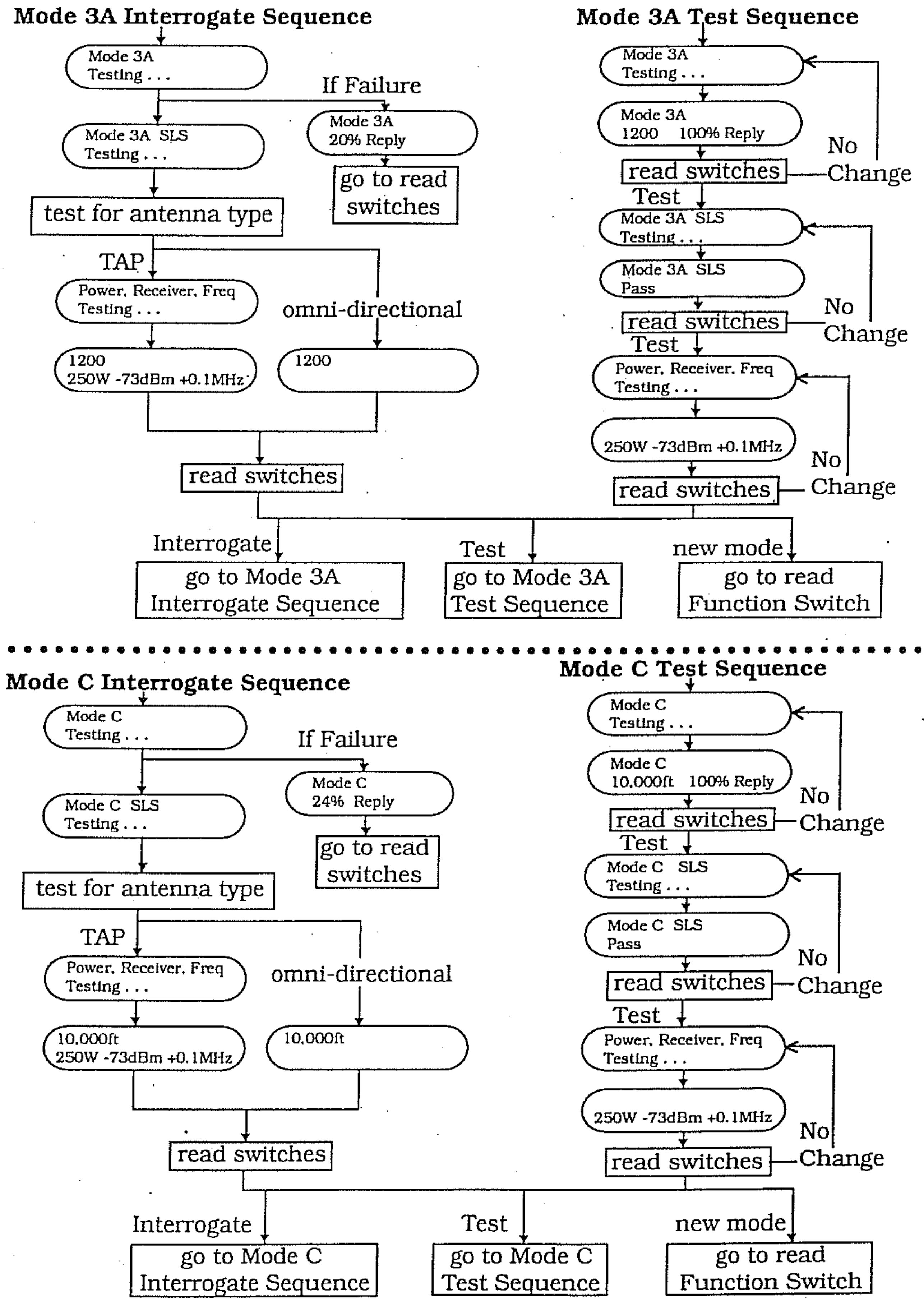


Figure 2-2



Mode 3A Interrogate Sequence
Mode 3A Testing . . .
If Failure
Mode 3A 20% Reply
go to read switches
Mode 3A SLS Testing . . .
test for antenna type
TAP
omni-directional
Power, Receiver, Freq Testing . . .
1200 250W -73dBm +0.1MHz
1200
read switches
Interrogate
go to Mode 3A Interrogate Sequence
Test
go to Mode 3A Test Sequence
new mode
go to read Function Switch
Mode 3A Test Sequence
Mode 3A Testing . . .
Mode 3A 1200 100% Reply
read switches
No Change
Test
Mode 3A SLS Testing . . .
Mode 3A SLS Pass
read switches
No Change
Test
Power, Receiver, Freq Testing . . .
250W -73dBm +0.1MHz
read switches
No Change
Mode C Interrogate Sequence
Mode C Testing . . .
If Failure
Mode C 24% Reply
go to read switches
Mode C SLS Testing . . .
test for antenna type
TAP
omni-directional
Power, Receiver, Freq Testing . . .
10,000ft 250W -73dBm +0.1MHz
10,000ft
read switches
Interrogate
go to Mode C Interrogate Sequence
Test
go to Mode C Test Sequence
new mode
go to read Function Switch
Mode C Test Sequence
Mode C Testing . . .
Mode C 10,000ft 100% Reply
read switches
No Change
Test
Mode C SLS Testing . . .
Mode C SLS Pass
read switches
No Change
Test
Power, Receiver, Freq Testing . . .
250W -73dBm +0.1MHz
read switches
No Change

Figure 2-3

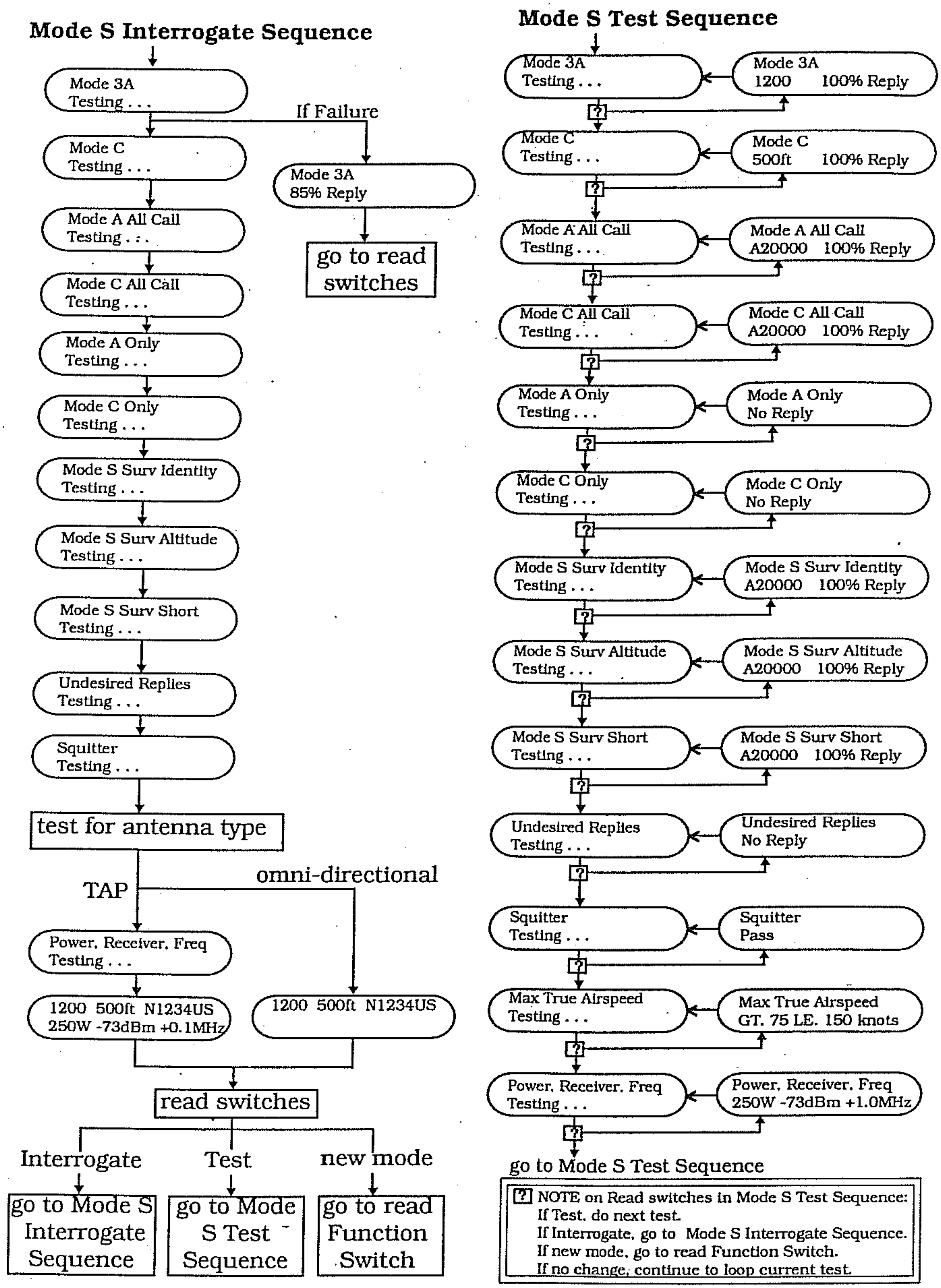

Mode S Interrogate Sequence
Mode 3A Testing . . .
If Failure
Mode 3A 85% Reply
go to read switches
Mode C Testing . . .
Mode A All Call Testing . . .
Mode C All Call Testing . . .
Mode A Only Testing . . .
Mode C Only Testing . . .
Mode S Surv Identity Testing . . .
Mode S Surv Altitude Testing . . .
Mode S Surv Short Testing . . .
Undesired Replies Testing . . .
Squitter Testing . . .
test for antenna type
TAP
omni-directional
Power, Receiver, Freq Testing . . .
1200 500ft N1234US 250W -73dBm +0.1MHz
1200 500ft N1234US
read switches
Interrogate
Test
new mode
go to Mode S Interrogate Sequence
go to Mode S Test Sequence
go to read Function Switch
Mode S Test Sequence
Mode 3A Testing . . .
Mode 3A 1200 100% Reply
Mode C Testing . . .
Mode C 500ft 100% Reply
Mode A All Call Testing . . .
Mode A All Call A20000 100% Reply
Mode C All Call Testing . . .
Mode C All Call A20000 100% Reply
Mode A Only Testing . . .
Mode A Only No Reply
Mode C Only Testing . . .
Mode C Only No Reply
Mode S Surv Identity Testing . . .
Mode S Surv Identity A20000 100% Reply
Mode S Surv Altitude Testing . . .
Mode S Surv Altitude A20000 100% Reply
Mode S Surv Short Testing . . .
Mode S Surv Short A20000 100% Reply
Undesired Replies Testing . . .
Undesired Replies No Reply
Squitter Testing . . .
Squitter Pass
Max True Airspeed Testing . . .
Max True Airspeed GT. 75 LE. 150 knots
Power, Receiver, Freq Testing . . .
Power, Receiver, Freq 250W -73dBm +1.0MHz
go to Mode S Test Sequence
? NOTE on Read switches in Mode S Test Sequence:
If Test, do next test.
If Interrogate, go to Mode S Interrogate Sequence.
If new mode, go to read Function Switch.
If no change, continue to loop current test.

Figure 2-4

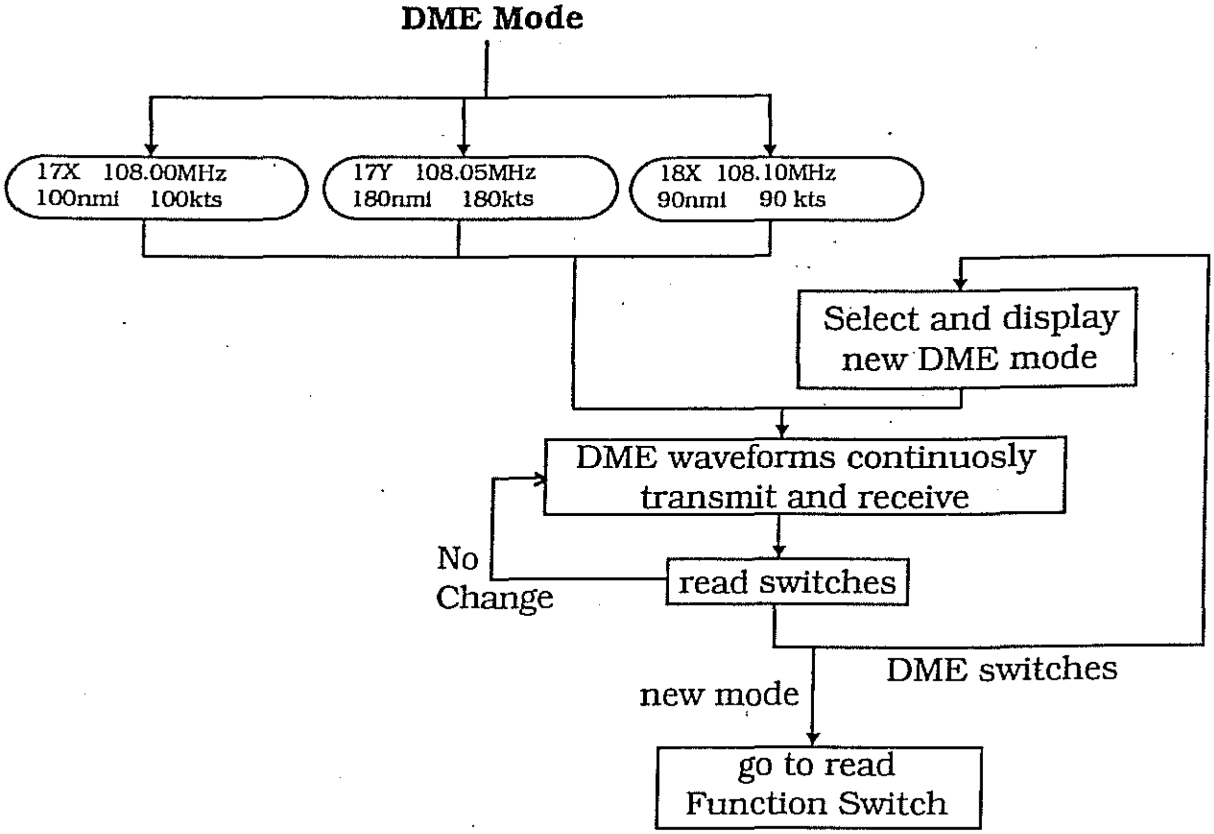

DME Mode
17X 108.00MHz
100nmi 100kts
17Y 108.05MHz
180nmi 180kts
18X 108.10MHz
90nmi 90 kts
Select and display new DME mode
DME waveforms continuosly transmit and receive
No Change
read switches
DME switches
new mode
go to read Function Switch

Figure 2-5

SECTION 3

THEORY OF OPERATION

3.1 General

The T-48D XPDR/DME test set is comprised of three circuit boards. The digital PCB interfaces with the switching PCB, the RF PCB, and with the panel switches, connectors, and LCD display. An 8-bit microprocessor is used to control the digital logic to perform the UUT XPDR test functions. The RF output/input is directed through an internal attenuator to the TNC connector on the front panel. By placing the cap attached to the front panel on the TNC connector, the energy is directed to the antenna connection.

The AC connector on the front panel provides the AC power used to run the test set, in a bench operating mode, and charges the internal +12V battery used for ramp testing. Additional connectors are also used to interface the test set with a computer to generate a hard copy.

The switching PCB serves as a bridge between the front panel switches and the digital PCB, reducing the internal wiring and assuring a reliable interface. The LCD front panel display also connects to the switching PCB, to power the indicator light, while displaying the information generated on the digital board.

The RF PCB generates the UUT stimulus signals and receives the UUT responses for measurement. The RF transmissions are modulated by signals produced on the digital PCB and are passed through the Antenna TNC panel connector to the omni antenna, or the TAP-126A coupler, or the direct connect TNC using the 10 ft. coaxial cable. The reply signals are demodulated and passed to the digital board for decoding and evaluation. Refer to fig. 3.1, 3.2, and 3.3.

3.2 Power Supply

The test set can be powered either by an external 110/220VAC, which gets stepped down and rectified to produce +12 VDC for charging the battery, or by the internal +12 VDC NiCad battery. The AC signal runs through switch S13 and fuses F1 and F2, are located on the front panel. When this AC switch is thrown to the "ON" position, LED CR1 will light to indicate the presence of the AC signal. The AC signal will then travel from the switch to the primary of a step down transformer T1. The secondary of the transformer will go through a bridge rectifier, CR19-CR22, on the digital board, and into relay K1, and is also available to charge the battery. A fuse, F4, located internal to the test set is placed in series with the battery when charging.

For 110V operation the outputs of fuses F1 and F2 are connected to J2-A and J2-B which power the KIR computer. If the test set is wired for 220 volts, the connections to J2-A and J2-B must be disconnected and terminated, and the transformer must be wired so that the primary windings are in series, per figure 5-1.

Power is applied to the unit through relay K1. Pressing the momentary DC ON switch S12 on the front panel to the "ON" position energizes this relay. When energized, the output of U52 lights a LED, CR2, on the front panel to indicate the presence of the +12 VDC in the unit. Plus 5 VDC is regulated using U50 and regulator U53 delivers +10VDC. By viewing output 5 of U53, pot R80 can be adjusted to bring the +10VDC within ± 0.5V. Minus 5 VDC is obtained from regulator U46 and minus 10 VDC from regulator U51.

The + 12 VDC is supplied to the RF board via pin P1-18. Regulator U19 generates +5VDC, regulator U17 generates +6VDC and regulator U20 generates -5VDC. An adjustable regulator, U18, is used to obtain the +10 VDC. Pot R102 (factory set) is used to fine-tune the +10VDC voltage. Also, a +23VDC voltage is obtained from a step up regulator U14 to control the VCO. The +12VDC is applied to the panel PCB to supply power to the backlight inverter.

The test set is de-energized by one of three methods. First, the time-out counter, U54 which is controlled by C64, R69, and R82, will turn off after 15 minutes when operating in the ramp test mode. Each time the interrogate switch is pressed, the time-out counter is reset by U47 pin 1. When operating on the bench, plugged directly into an external AC source, U17 inhibits the power down counter and the unit will not automatically turn off. Second, the momentary activation of S12, on the front panel, to the "OFF" position of the DC switch will remove power from the unit. Finally, a low battery condition, with a battery voltage of less than +9 volts, as sensed by the comparator, U47 pin 7, will shut the unit down. The display will indicate that the battery needs charging.

3.3 Microprocessor Control Logic

The microprocessor U10 is an 8-bit CPU used to read and write instructions through hardware and software addressing. Special features of the 80C31 processor include extensive Boolean processing, 64K bites programming memory address space, 64K bites data memory address space, 32 bi-directional and individual addressable I/O lines, and two 16-bit timer/counters. A 12 MHz crystal clock, Y1, is used to synchronize the timing of the processing. A high-speed 64K bite UV erasable and electrically reprogrammable CMOS EPROM, U7, is used because of its fast turn around and low power consumption. Assembly language programming generates instructions, in the form of machine language, to the processor. A battery backed up 8K bite RAM, U6, is used to store accessible memory for the CPU operation.

In order for the microprocessor to control the input/output signals, a 4-to-16 line decoder with latch, U11, is utilized for memory address decoding and data routing applications. When the latch enable input, LE, is high, the outputs will change with the inputs. When LE goes low, the data on the select inputs are stored in the latches. The four select inputs determine which output will go high when the inhibit input is low.

The outputs of the line decoders are used to drive the octal D-type flip flops U1, U2, U4, U5, and U35-U38, and to generate triggers for such outputs as the reply KIR trigger, Digital/Analog converter, and other logic applications. For example, the front panel LCD display is programmed from data inputs derived from the processor. I/O port P1 on the CPU registers a word into the octal D-type flip-flop, U5, and then gets latched with the line decoder, U11. The output of the D-flip flops are sent to the LCD display via lines DBO-DB7

The RS-232 interface uses the 9-pin D-Sub connector, part of the KIR cable, to transmit the serial communication signals necessary to handshake with the computer. The interacting signals include request to send and data transmit ready. The integrated circuit, U33, provides interfacing for the RS-232 connector, including a negative voltage for 9 VDC for this serial interface. The serial clock, SRLCLK, is used to transmit the data bits necessary to transfer the signals between the computer RS-232 and the test set.

3.4 Clock Frequencies

The XPDR/IFF signals are generated with a hybrid analog/digital system. All clock frequencies are crystal derived from a 20 MHz crystal, Y2, and used to generate all the clock frequencies needed for the output waveforms. D-flip flop, U26, is clocked by the 20 MHz signal to produce a 10 MHz signal. A binary counter, U27, divides the clock pulse input by 5 in order to achieve a 4 MHz clock signal. Both inputs and outputs of D-flip flop U57 are used to divide the 4 MHz clock by four to generate a 1 MHz clock.

3.5 First-In/First-Out (FIFO)

Two FIFO's are used to transmit and receive data at slow and fast rates. The transmit FIFO, U19, is used to load data from the microprocessor using DATA 1-4 at a slow rate. Once the data are loaded, it can be transmitted at a 4 MHz rate. The slow rate (SRLCLK) and 4 MHz rate (4 MHz CLK) selector is U8. The receive FIFO, U22, is used to receive data from RX-CHAL at a 4 MHz rate. Once the data are received, it can be clocked out of the FIFO and into the microprocessor for analyses.

3.6 Panel Controls

The CPU monitors the front panel switches. Octal D-flip flop U38 sequences a series of pulses, via KEYPAD 1-5, through the switching matrix and back, via KEYPAD 6-10 and latched to the processor through U35. Pull down resistors R53-R57 are used on KEYPAD 6-10 inputs so that the signals into the D-flip flop are never in a floating status.

3.7 RF Gain Control

The microprocessor reads a signal into an 8-bit digital to ananlog converter (DAC), U9, to produce the desired analog output. The output of the DAC goes through the operational amplifier U13 to the RF board through Q3 via D/A-PWR. The operational amplifier is also used to convert the output current from the DAC to a voltage via a feedback resistor included in the DAC (RFB). The analog level of D/A-PWR is used to control the gain of the RF board attenuator Q6 to vary the output power level in 1db steps. Course control, 10 db steps, is provided be relays K1, K2 and K3 on the RF PCB.

3.8 RF Transmitter

The transmitter RF is generated by a single chip serial imput phase lock loop frequency synthesizer, U9. The programming data is provided from the digital board logic circuitry via connector P1-15, SYN-DATA. P1-17, STROB-TX, is used to latch the synthesizer. The SYN-CLK signal provides a latching clock, via P1-22, into the synthesizer to pulse in the SYN-DATA data bits from the microprocessor.

The output of the transmitter synthesizer is passed through the loop filter U36 to achieve the DC voltage required to set the frequency of the voltage controlled oscillator (VCO), Q3, and to set the bandwidth of the phase lock loop. The output stage of the VCO feeds amplifiers U5 and U30 before the RF signal is fed back to the synthesizer phase detector. The phase detector compares the RF signal with the 10 MHz reference P1-2 signal to generate an error signal to the loop filter. A second output from U5 is amplified by U3 before being passed to the modulator U4.

DPSK-MOD input, derived from the digital board, is also fed into mixer, U4, via P1-5. The DPSK -MOD imput is a pulse modulated signal required for TACAN and XPDR. Resistor pot R107 (factory set) is used to balance the level of RF carrier of the pulse modulated signal. The pulse modulated signal and RF frequency are combined together using mixer U4.

Once the signals are mixed, they are passed on to three (10,20,20 dB) attenuator stages having a combined output attenuation range of 50 dB. The digital pcb processor controls the attenuators through inputs P1-25, P1-26, and P1-20 which control switching transistors Q11, Q12, and Q13, which switches the relays K1-K3 when activated. All three relays use normally closed, thus providing no attenuation if the relay is not selected.

The transmitter frequency is then fed into two stages of a 25dB linear amplifier, U1, U37, and RF-switch U38. The system is configured so that when not transmitting, the linear amplifier shuts down and a switching transistor activates the receiver circuitry.

3.9 RF Receiver

A second serial input phase lock loop frequency synthesizer, U22, is used as a receiver local oscillator. The programming data is provided from SYN-DATA via the digital board. The same 10MHz clock used in the transmitter phase locked loop is also used here to drive the receiver serial synthesizer. P1-19, STROB-RX, is used to latch the synthesizer. The synthesizer uses handshaking to transfer serial data bits into the IC. SYN-CLK is used to clock the serial data bits for the input SYN-DATA. The same two signals are also used in the transmitting phase lock looped synthesizer circuitry. STROB-RX and STROB-TX are the transmitting phase lock looped synthesizer circuitry. STROB-RX and STROB-TX are used interactively to designate the correct frequency synthesizer with the proper data bit pulses. The microprocessor on the digital board is set up to select the correct configuration required.

The output of the receiver synthesizer is passed through two low pass filters, U39, to remove unwanted higher frequencies to control the VCO frequency range from 980 to 1105 MHz. The VCO must be factory tuned to achieve proper operation. The VCO output feed amplifiers U23, U24 and U35 to lock the desired frequency into the synthesizer to prevent any frequency pulling of the VCO from the mixer U6.

The RF signal from the front panel connector, & RF-switch U38, is fed into mixer, U6, and combined with the VCO frequency to produce the IF signal. This signal goes through IF amplifier U7 and a 45MHz filter consisting of a LC network. Variable inductors L2 and L3 are used to fine tune the LC network. Once the signal is filtered, the signal is then passed through an IF logarithmic amplifier, U10-U13, to generate the video. The received detected video is passed through an analog threshold circuit consisting of Q4, U43 and U15. The string of pulses received are complimented and sent to the microprocessor via connector P1-9, DATA-RX. TP1 is used to view the detected signal for trouble shooting purposes.

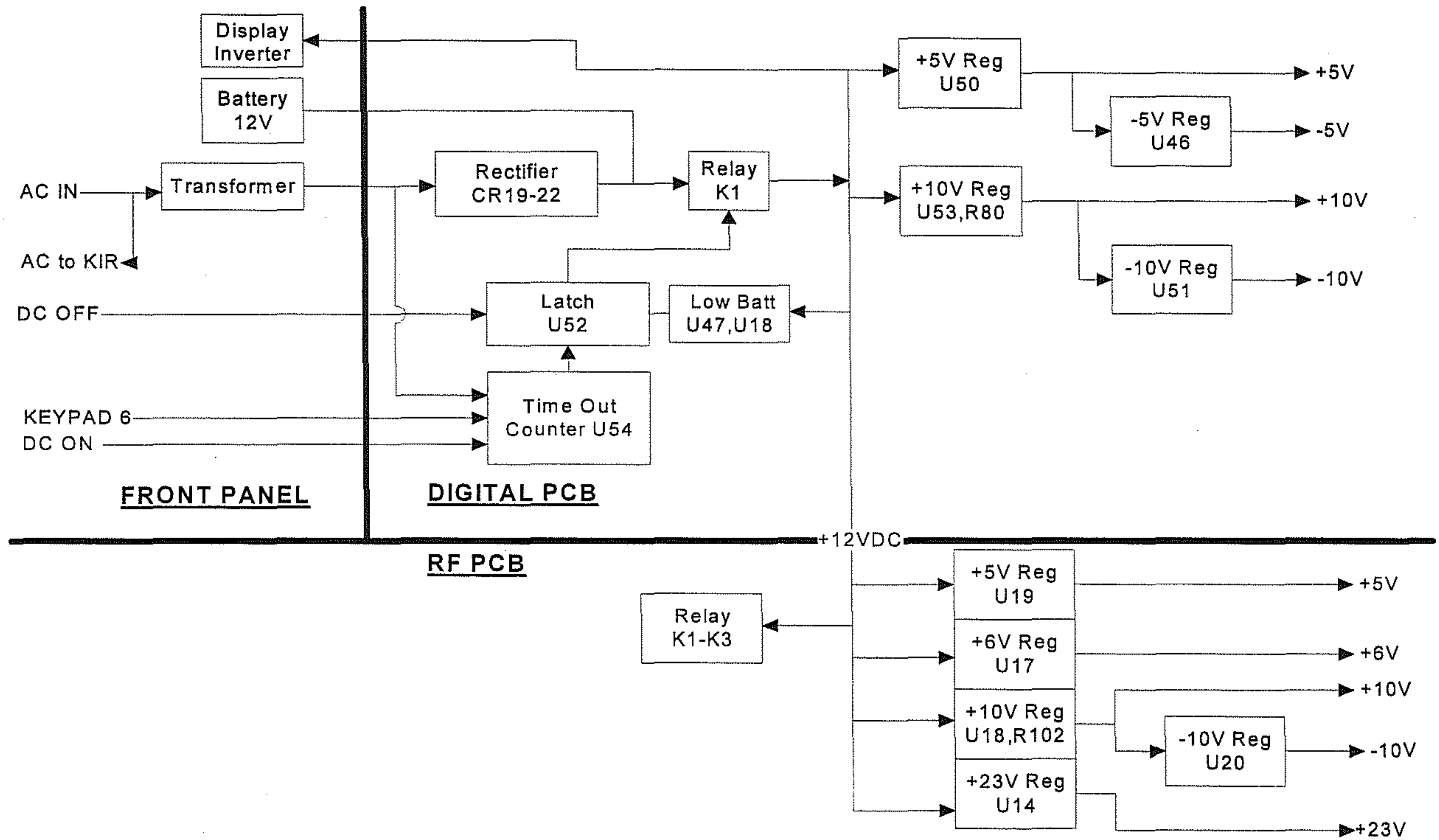
3.10 Power, Frequency and Sensitivity Measurement

The 45MHz output of the log amplifier is passed to a 45 MHz discriminator, U25, for frequency measurement purposes. The discriminator measures the phase of the 45 MHz signal, as compared to the delayed, U16, output. Variable capacitor, C29, is used to set the proper phase differential into the discriminator and comparator, U29, is used to sample the signal via a D-Flip Flop U34. The local oscillator is slewed in 0.1MHz steps until the discriminator crossover is reached. The offset frequency of the local oscillator is translated to the UUT frequency. The clock pulse into the D-Flip Flop comes from the DATA RX circuit for synchronization purposes. P1-23, FREQ DATA, is used to transfer the sampling rate of the DATA-RX signal to the microprocessor. P1-24, HI FREQ, the output of the D-Flip Flop, is also used in the sampling process to indicate to the processor to take a reading.

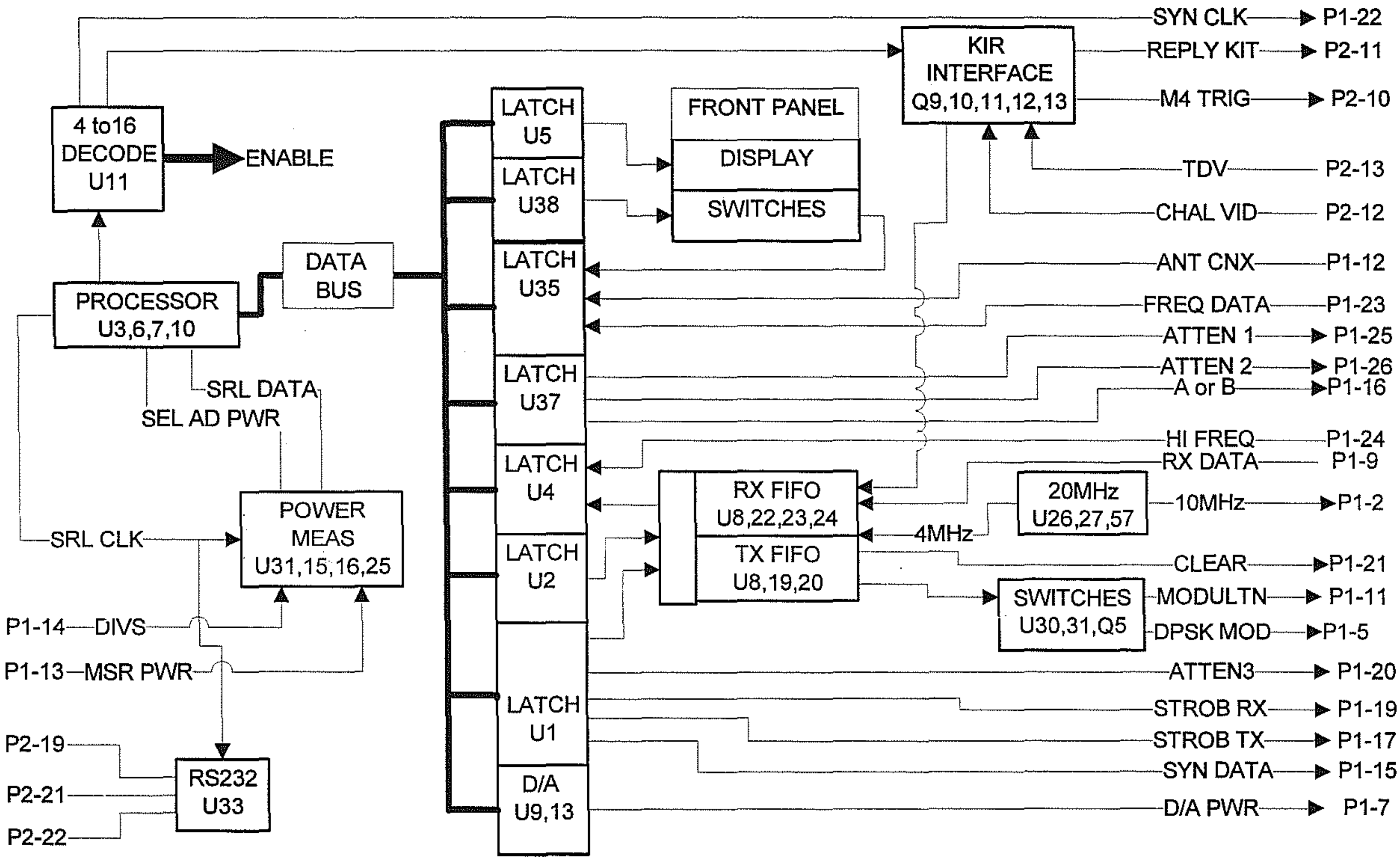
The RF power signal is passed through a diode detector, CR2, to provide power measurement information to the digital board. P1-13, MSR-PWR, is used to transfer the signal back. Pot R17 on the digital PCB is provided for power calibration. For diversity testing the analog video output from the log amplifiers is fed to the digital PCB via P1-14.

The detected video signals from the RF PCB are switched by U31 and peak detected by U15 on the digital PCB. Buffer U16 provides isolation between the peak detector and the A/D converter, U25. The output of the A/D converter is clocked out to the processor for evaluation. For power measurement, signal at U31-5 is a "1" and for the diversity low level, signal U31-6 is a "1".

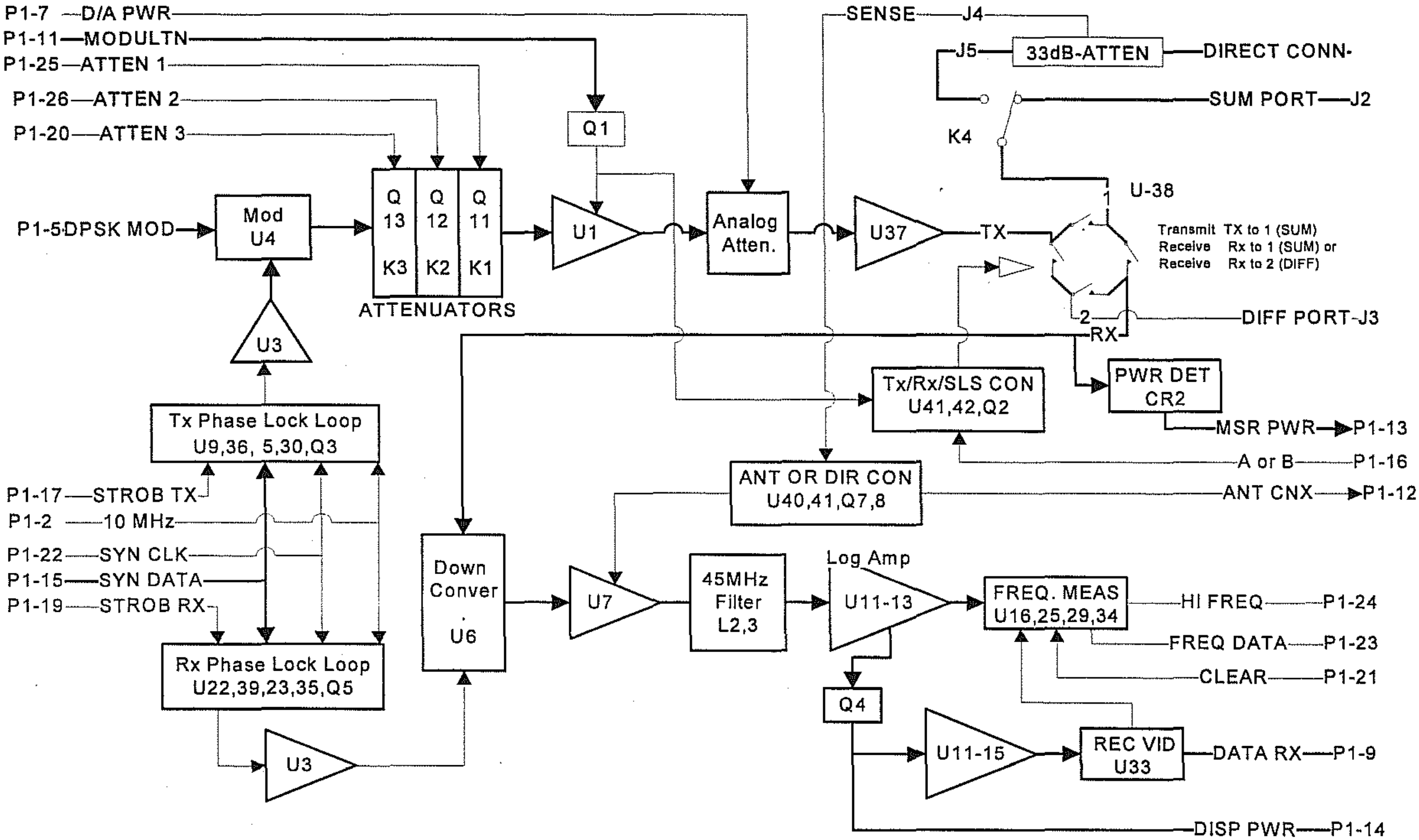
Power, frequency and sensitivity can only be measured in the direct connect mode of operation.



T-48D
Power Distribution Function Flow
Figure 3-1



T-48D
Digital PCB Function Flow
Figure 3-2



T-48D
RF PCB Function Flow
Figure 3-3

SECTION 4

TEST, CALIBRATION, AND MAINTENANCE

4.1 General

The use of the current generation of electronic components has dramatically increased avionic test customer cost saving changes to traditional industry acceptance-test / annual calibration procedures. Accordingly, the recommended test, calibration, and maintenance procedures for the T-48D will be as follows:

4.1.1 Final Assembly Acceptance & Annual Calibration Tests

These will be performed on an unopened test set by measuring inputs/outputs; if these tests are not within spec, the test set should be opened for alignment (see Appendix B for test report documentation format.)

4.1.2 Sub Assembly Alignment Tests

Opening the test set will make accessible the RF and Digital printed circuit boards, and their test points and alignment controls; if these adjustments do not return the test set to specified function, the unit requires maintenance; (see Appendix B for test report documentation format.)

4.1.3 Maintenance

Depending upon customer maintenance policy, the unit is either trouble-shot, using the information from Sections 3, 5, & 6, which will permit a qualified technician to diagnose the fault and make the necessary repair, or SRU replacement, or is returned to the manufacturer for repair; it is suggested that this policy be discussed at the time of the initial unit delivery.

4.2 Final Assembly Acceptance and Annual Calibration Tests

4.2.1 Equipment Needed

1. Oscilloscope	Tektronix 2235	or equivalent
2. RF Power Meter	HP 432A	or equivalent
3. Spectrum Analyzer	HP 8558B/182T	or equivalent
4. Mode S Transponder		
5. DME Transponder		

4.2.2 Procedure

1) Data Display and Switches

Plug AC line cord into front panel receptor and switch to on. Verify red LED charging light illuminates. Power on. Select all modes and verify that display shows correct current mode. Select a DME mode. Press interrogate. Verify data display is displaying correct mode. Verify all the DME rotary and toggle switches. Press Light switch.

2) Power and Frequency Output

Reset power. Select Mode 3A. Press test. Connect antenna output to a peak power meter or spectrum analyzer. Verify 0.0 dBm ± 2 dB output. Connect antenna output to a spectrum analyzer or frequency counter and verify frequency of 1030 +/-1MHz.

3) DME

Test the DME antenna-to-antenna. Set DME to 108.00 MHz. Connect DME antenna coax to blade antenna and the tone coax to DME speaker. Connect dipole to T-48D antenna output. See Figure 4-1. Select DME mode. Press interrogate. Select 17X 108.00 MHz 180 nmi. Verify DME displays 180 +/- 0.1 nmi. Press TO switch. Verify DME range decreases at a rate of 180 +/-5 KTS. Press IDENT switch. Verify tone on DME speaker.

4) Mode S Transponder

Connect T-48D antenna output to high powered 30 dB pad. Connect other end of 30dB pad to a Mode S transponder. Power on. Select Mode S. Press interrogate. Verify passes all test and displays proper power/receiver sensitivity/frequency as per calibrated transponder.

5) TAP-126A

Connect the Mode S transponder to a blade antenna. Connect TAP-126A to T-48D antenna output and place over blade antenna. See Figure 4.1 on page 4-6. Power on. Select Mode C. Press interrogate. Verify passes all tests and displays proper power/receiver sensitivity/frequency for the transponder.

4.3 Sub-Assembly Adjustment Tests

4.3.1 Equipment Needed

1. Oscilloscope	Tektronix 2235	or equivalent
2. RF Power Meter	HP 432A	or equivalent
3. Spectrum Analyzer	HP 8558B/182T	or equivalent
4. Digital Voltmeter	Fluke 8000A	or equivalent
5. RF Signal Generator	Wavetek 2520	or equivalent
6. Pulse Generator	Tektronix 2235	or equivalent

4.3.2 RF PCB Procedure

1) Voltage and Clocks

Power on and use a DVM to verify within ± 0.5V:

+5 V at U19 pin 1
-5 V at U 20 pin 5
+10 V at U18 pin 5 (use R102 pot to set)
+6 V at U17 pin 1
21 V at R121 ± 3V

Verify 10 MHz ± 300 Hz at U22 pin 1 and U9 pin 1.

2) Voltage Controlled Oscillators

Power on. Use a spectrum analyzer with a pick up loop to verify the following frequencies:

Select Mode 3A. Press interrogate.	Transmitter = 1030 ± 1MHz Receiver = 1045 ± 1MHz
Select DME 108.00. Press interrogate.	Transmitter = 978 ± 1MHz Receiver = 996 ± 1MHz
Select DME 108.05. Press interrogate.	Transmitter = 1104 ± 1MHz Receiver = 996 ± 1MHz
Select DME 108.10. Press interrogate.	Transmitter = 979 ± 1MHz Receiver = 997 ± 1MHz

3) SLS and DPSK Modulation

Select a DME mode and reset power holding TEST. Connect antenna connector to spectrum analyzer. Monitor vertical output from spectrum analyzer. Adjust R107 so on-to-off ratio is a maximum and pulses are symmetrical. Verify P2 is 9 ± 1dB below P1. Reset power. Select Mode S. Use test switch to select Mode S Surv. Use oscilloscope to verify that the DPSK modulation at the mixer side of R74 has a baseline of 0.0 V ± 100 mV.

4) Power Output and Relays

Select a DME mode and reset power holding TEST. Connect antenna connector to a peak power meter or calibrated spectrum analyzer and oscilloscope to verify a power output of 0.0 dBm ± 1 dB at antenna. Use R17 pot on DIG. PCB to calibrate power. Select 0 nmi on velocity/bearing rotary switch. To/From will toggle on and off K1 relay. Switch K1 on (K1=1) and verify power output is -18 dBm ± 2 dB. Switch K1 off (K1=0). Select 10 nmi on velocity/bearing rotary switch. To/From will toggle on and off K2 relay. Switch K2 on (K2=1) and verify power output is -18 dBm ± 2 dB. Switch K2 off (K2=0). Select 25 nmi on range/velocity/bearing rotary switch. To/From will toggle on and off K3 relay. Switch K3 on (K3=1) and verify power output is -18 dBm ± 2 dB. Switch K3 off (K3=0).

5) Receiver Sensitivity

Reset power. Input 1us pulses, at a 50 KHz rate, at a level of +13 dBm and a frequency of 1090 MHz into antenna. Monitor DATA-RX at TP1. Measure receiver sensitivity to better than -23dBm. Tune L2 and L3 if necessary.

6) Frequency and Power Measurement

Reset power holding interrogate switch. Input 1us pulses, at a 200 KHz rate, at a level of +13 dBm and a frequency of 1090 MHz into antenna. Adjust variable cap until frequency reads within ± 0.1 MHz. Vary input frequency ± 4.5 MHz and frequency should track ± 0.2 MHz. Input a 1us pulses, at a 200 KHz rate, into antenna port. Use oscilloscope to probe antenna and adjust pulse generator for a 2.7V level. Adjust R17 pot so the power reads 250 W ± 25 W. Increase pulsed signal to a 5.0 V level. Verify 500 W ± 50 W. Decrease pulsed signal to a 1.4 V level. Verify 125 W ± 20 W.

4.3.3 Digital PCB Procedure

1) Voltage and Clocks

Power on. Use DVM to verify within ± 0.5 V:

+5V at U50 pin 3
-5V at U46 pin 5
+10 V at U53 pin 5 (adjust pot R80)
-10V at U51 pin 5
+9V at TP5
-9V ± 1.5V at TP4

Use frequency counter or oscilloscope to verify:

12 MHz ± 2 KHz at C5
20 MHz ± 200 KHz at R33
10 MHz ± 100 KHz at R37
4 MHz ± 100 KHz at U28 pin 2

2) Display and Switches

Select all modes. Verify display for each mode selected. Select Mode 3A, press interrogate. Verify No Reply. Press test. Verify looping No Reply. Select a DME mode. Press interrogate. Toggle all switches. Verify activity on the display. Use rotary switches to select different ranges. Verify activity on the display.

3) D/A Converter

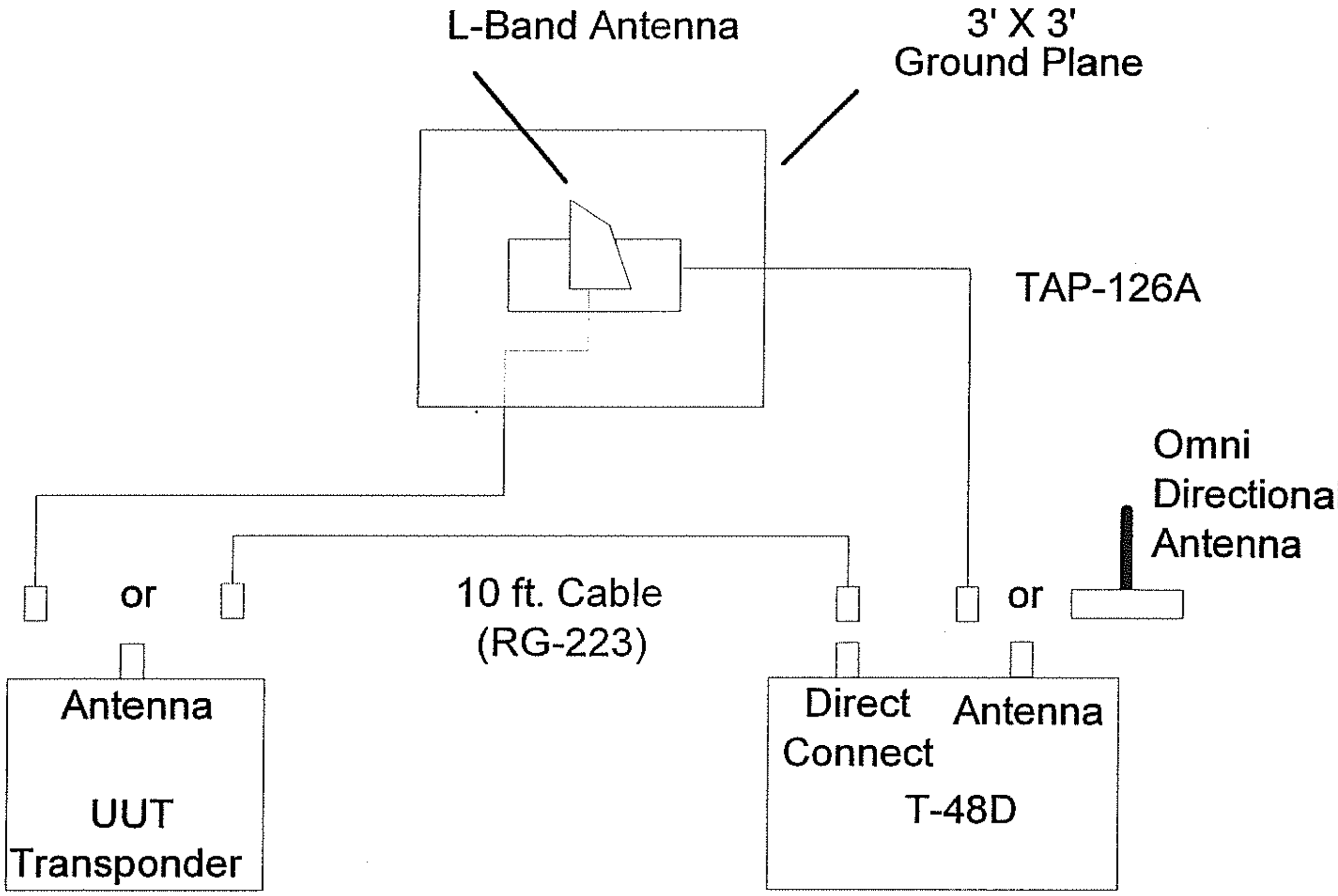
Select DME power measurement mode. Verify at R17 a maximum negative voltage of -8.0 ± 1.0V.

4) RF Board Interface

Select Mode 3A. Power on. Press test. Verify the mode 3A interrogation at R44 is 0.7 ± 0.25V with a lower level, P2. Verify R45 is 10V with inverse 2 ± 0.5V interrogation. Verify 5 ± 0.5V interrogation at TP9. Select DME, 108.0, chan 17X and 0 nmi. Use a pulse generator to generate a 1us, 5V pulse with a 10ms period. Feed this into signal generator at 1041 MHz, 13 dBm. Input RF generated signal into antenna connector. Sync oscilloscope pulse generator output. Probe TP9 (sum interrogation). Verify that delay is 50 ± 2us. Select 100 nmi. Verify delay is 1.28 ± 0.1 ms. Probe R62 and verify 4.0 ± 0.5V, 3.5 ± 0.5us at 50% amplitude, gaussian pulse. Select Mode 3A. Press test. Connect antenna connector to spectrum analyzer and set to 1030 MHz, +0 dBm. Probe the vertical output from spectrum analyzer and set SLS pulse to -9 ±1dB from P1 by adjusting R40.

5) Time Out

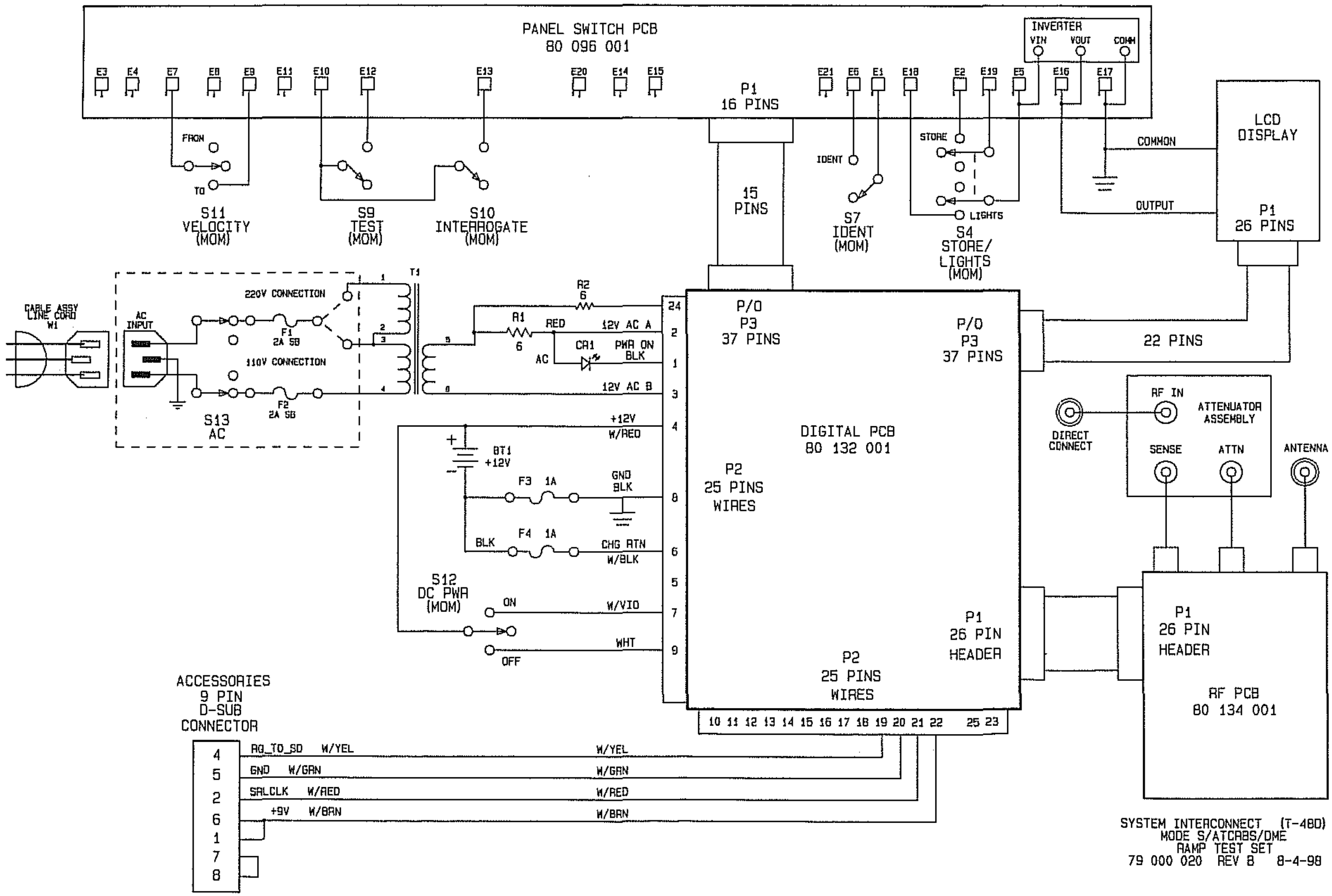
Power on. Verify that unit times-off after approx. 15 minutes.



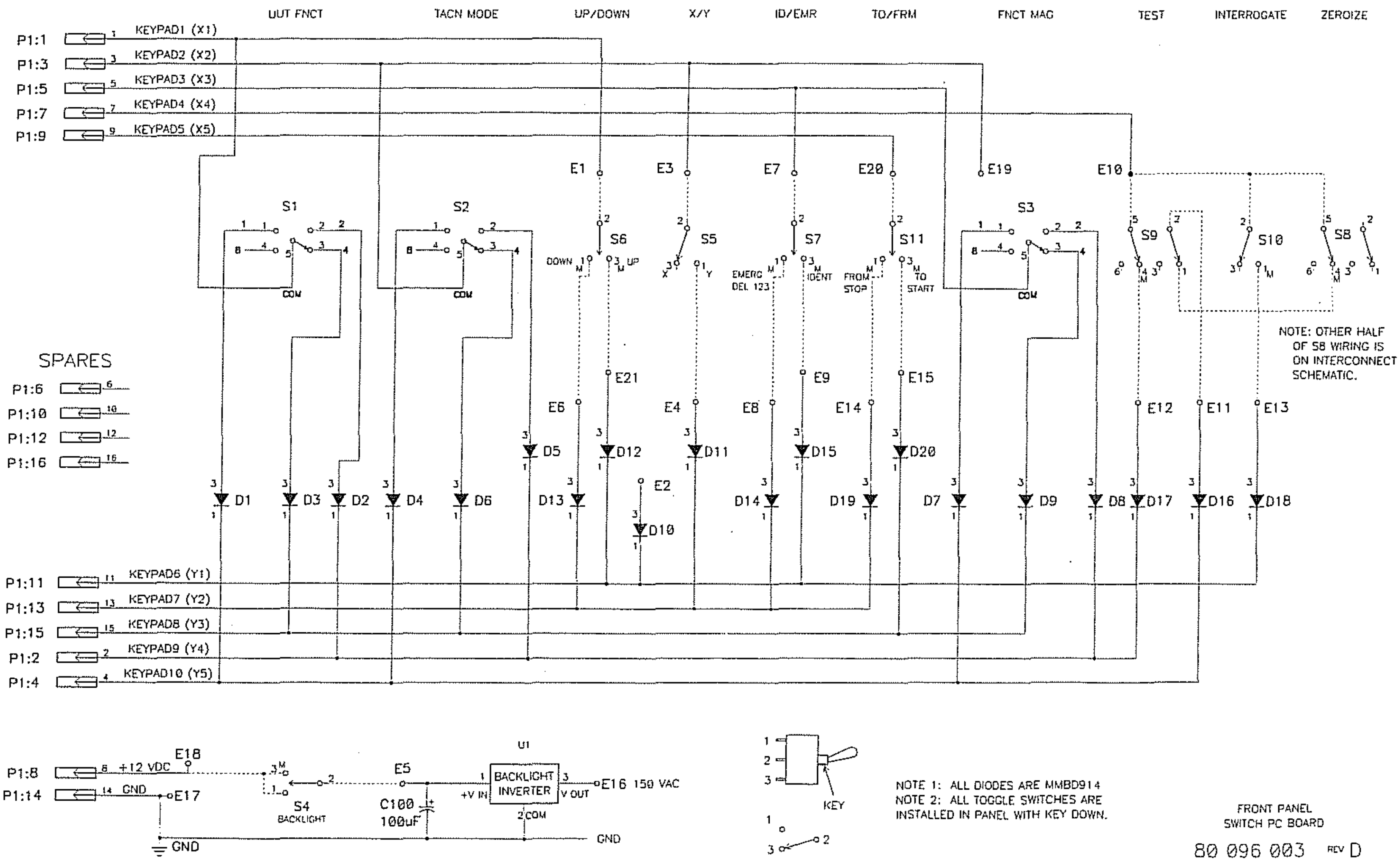
Transponder/T-48D Setup
Figure 4-1

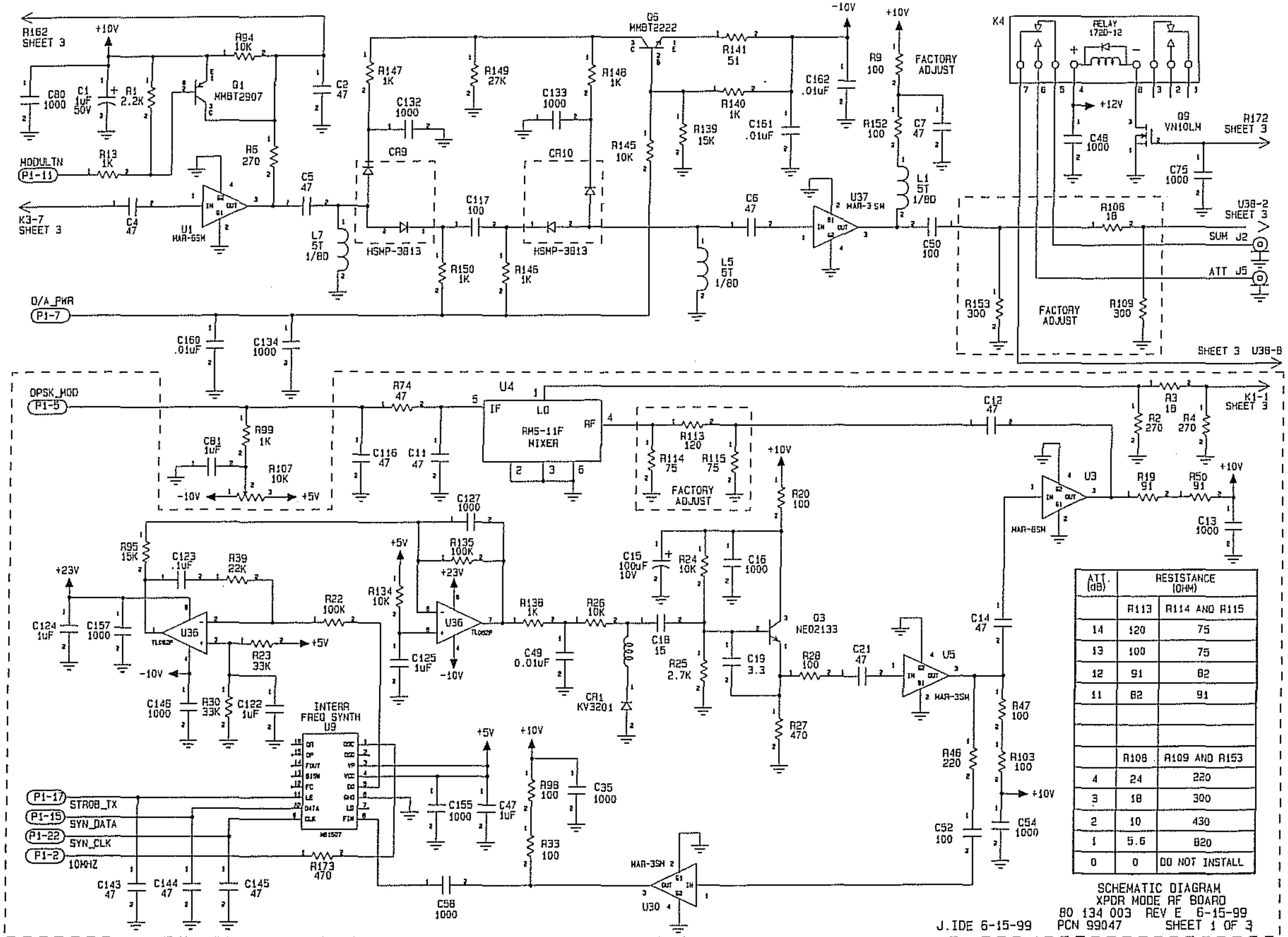
Section 5

SCHEMATICS



SYSTEM INTERCONNECT (T-48D)
MODE S/ATCRBS/DME
RAMP TEST SET
79 000 020 REV B 8-4-98

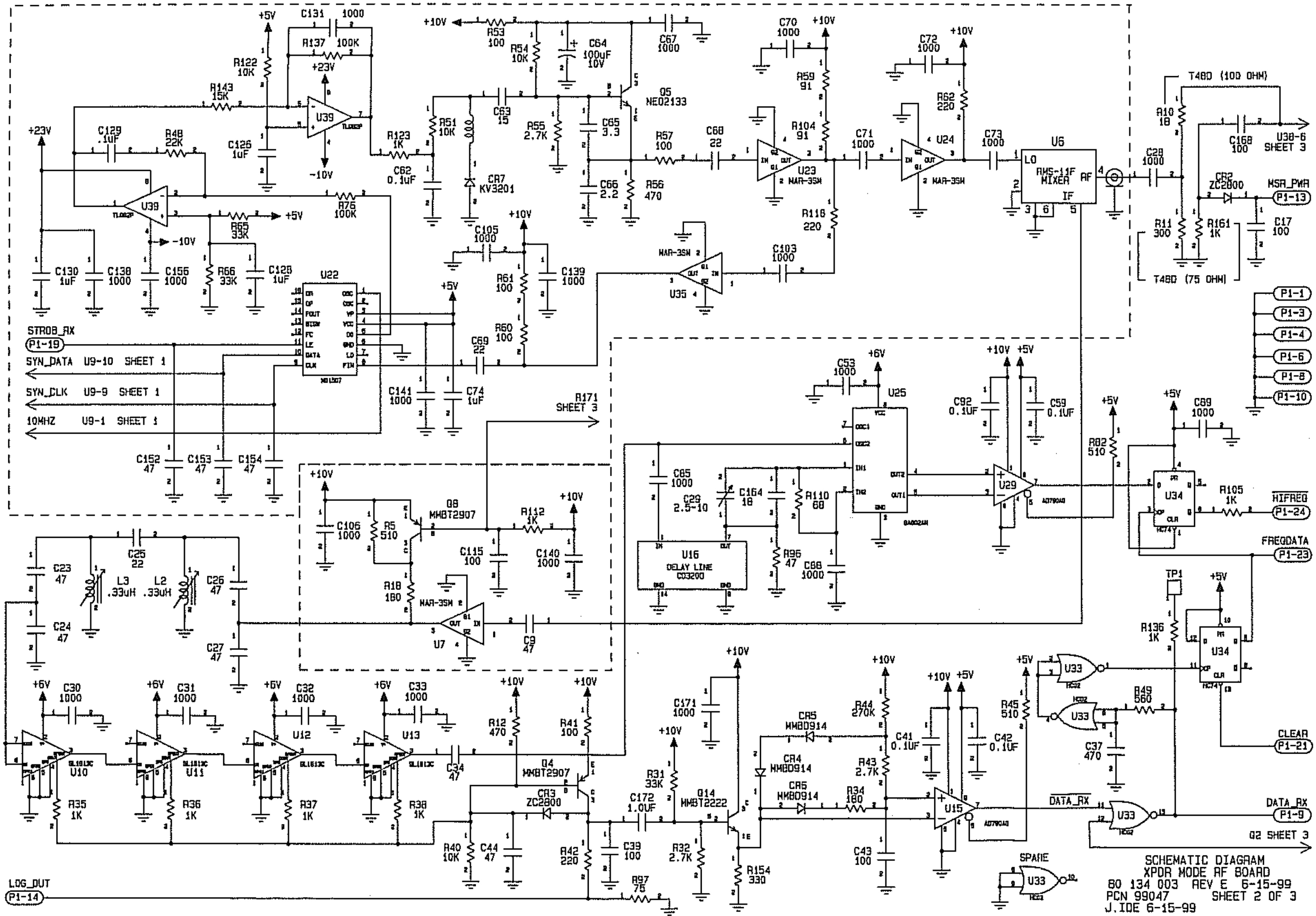

UUT FNCT
TACN MODE
UP/DOWN
X/Y
ID/EMR
TO/FRM
FNCT MAG
TEST
INTERROGATE
ZEROIZE
P1:1
P1:3
P1:5
P1:7
P1:9
KEYPAD1 (X1)
KEYPAD2 (X2)
KEYPAD3 (X3)
KEYPAD4 (X4)
KEYPAD5 (X5)
SPARES
P1:6
P1:10
P1:12
P1:16
P1:11
P1:13
P1:15
P1:2
P1:4
KEYPAD6 (Y1)
KEYPAD7 (Y2)
KEYPAD8 (Y3)
KEYPAD9 (Y4)
KEYPAD10 (Y5)
NOTE: OTHER HALF OF S8 WIRING IS ON INTERCONNECT SCHEMATIC.
P1:8
P1:14
+12 VDC
GND
E18
E17
S4
BACKLIGHT
E5
C100
100uF
U1
BACKLIGHT INVERTER
+V IN
V OUT
COM
E16 150 VAC
GND
KEY
NOTE 1: ALL DIODES ARE MMBD914
NOTE 2: ALL TOGGLE SWITCHES ARE INSTALLED IN PANEL WITH KEY DOWN.
FRONT PANEL
SWITCH PC BOARD
80 096 003 REV D



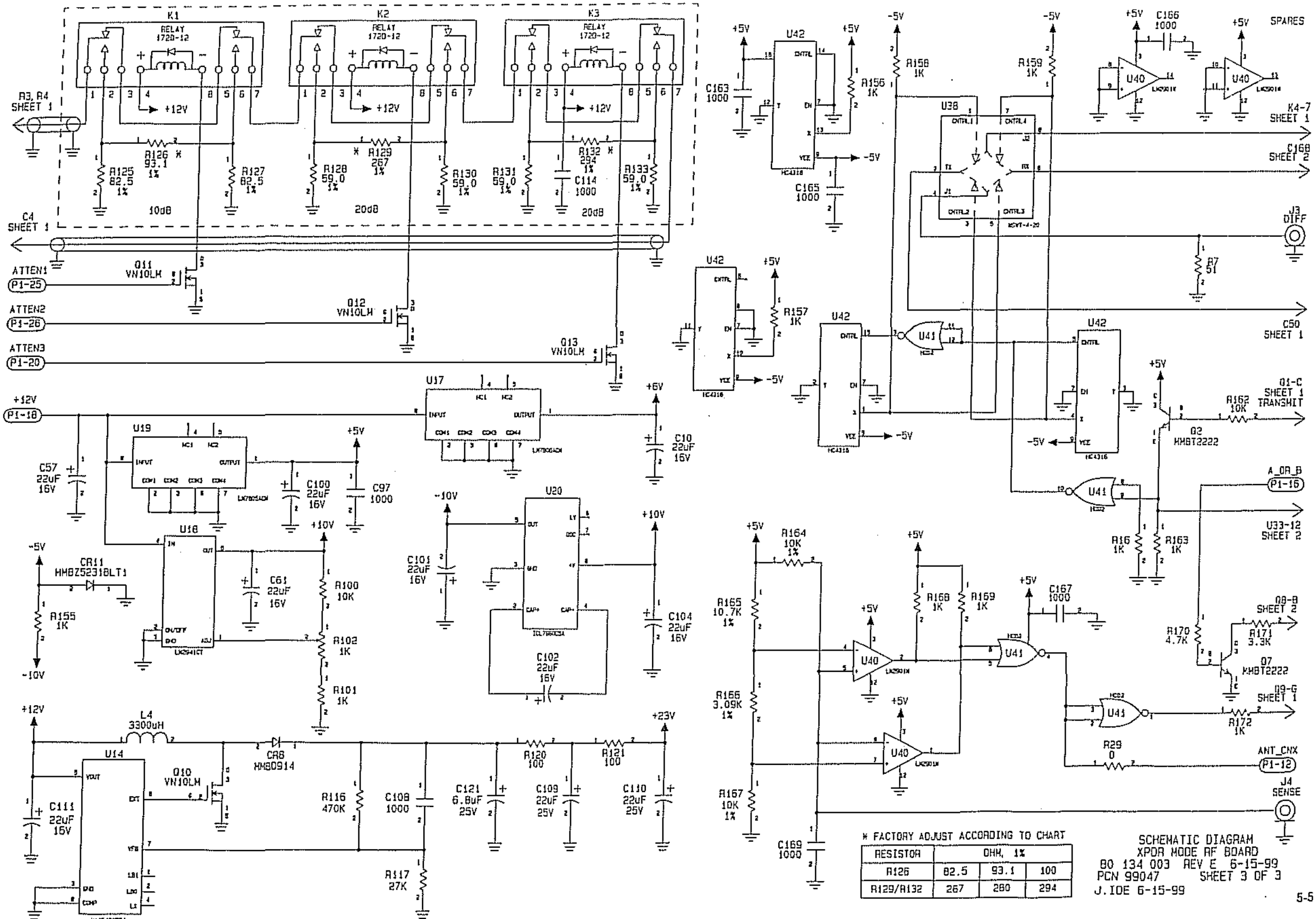
ATT. (dB)	RESISTANCE (OHM)	
	R113	R114 AND R115
14	120	75
13	100	75
12	91	82
11	82	91
	R108	R109 AND R153
4	24	220
3	18	300
2	10	430
1	5.6	820
0	0	DO NOT INSTALL

SCHEMATIC DIAGRAM
XPDR MODE RF BOARD
80 134 003 REV E 6-15-99
PCN 99047 SHEET 1 OF 3

J.IDE 6-15-99



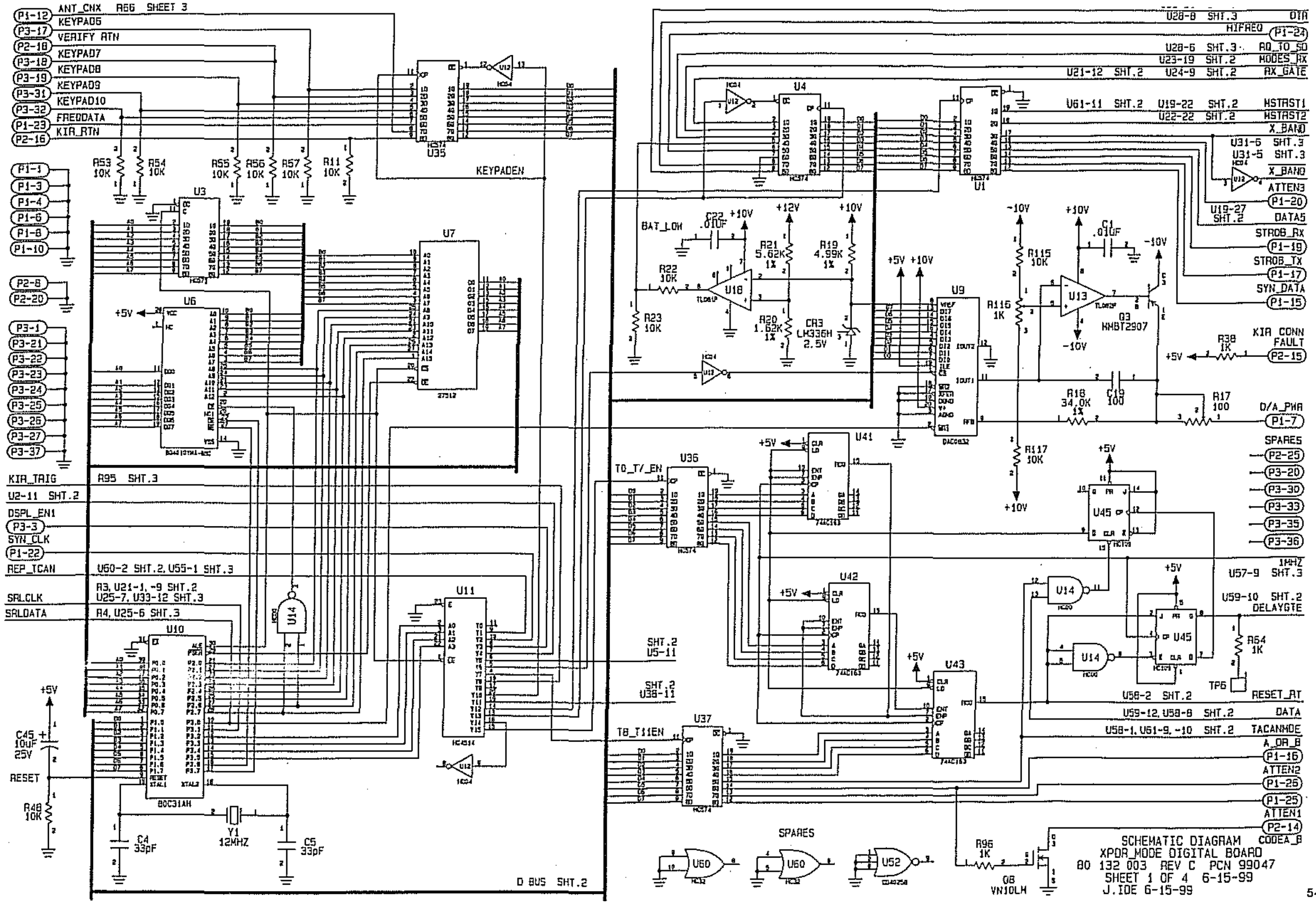
SCHEMATIC DIAGRAM
XPDR MODE RF BOARD
80 134 003 REV E 6-15-99
PCN 99047 SHEET 2 OF 3
J.IDE 6-15-99

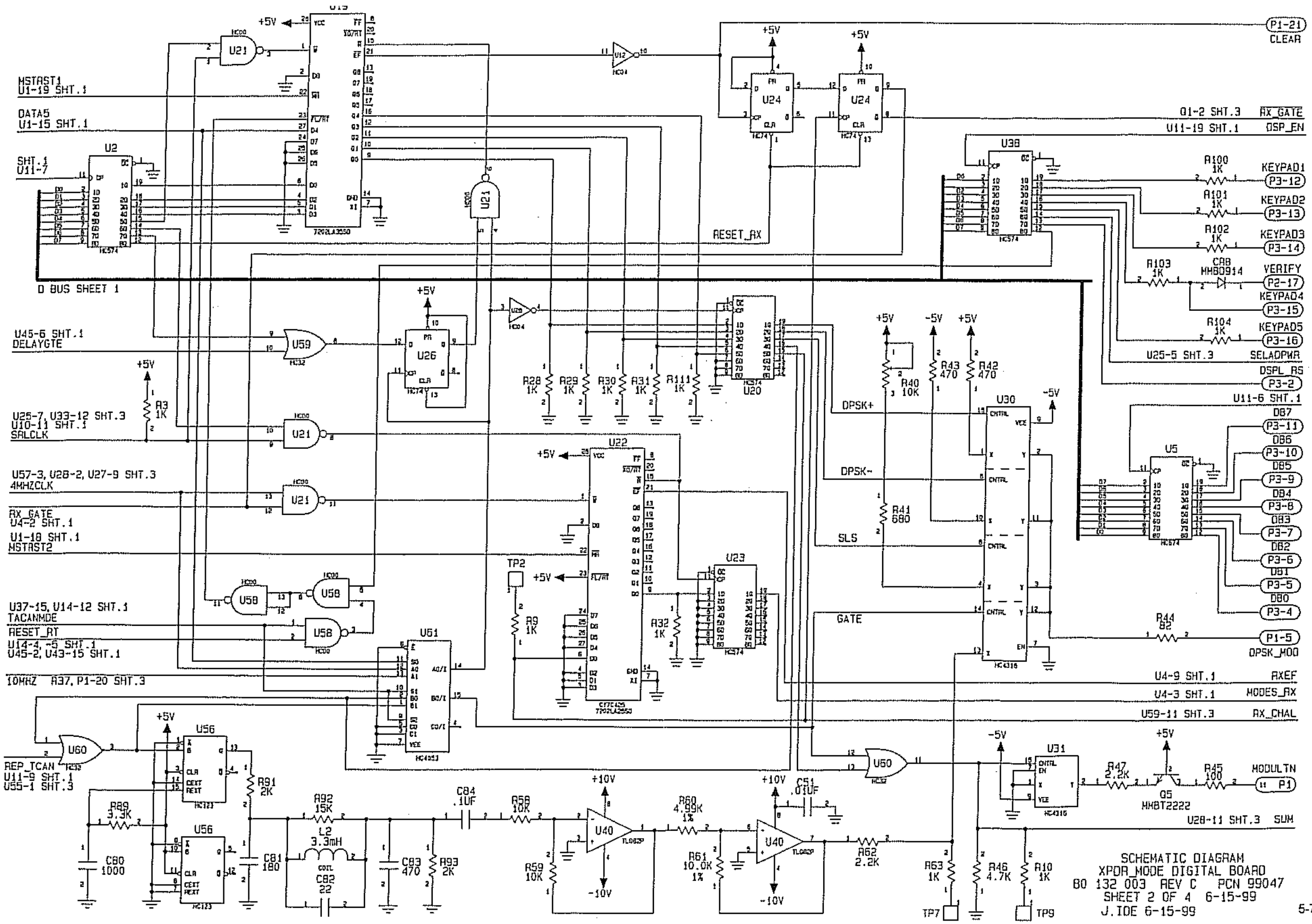


* FACTORY ADJUST ACCORDING TO CHART

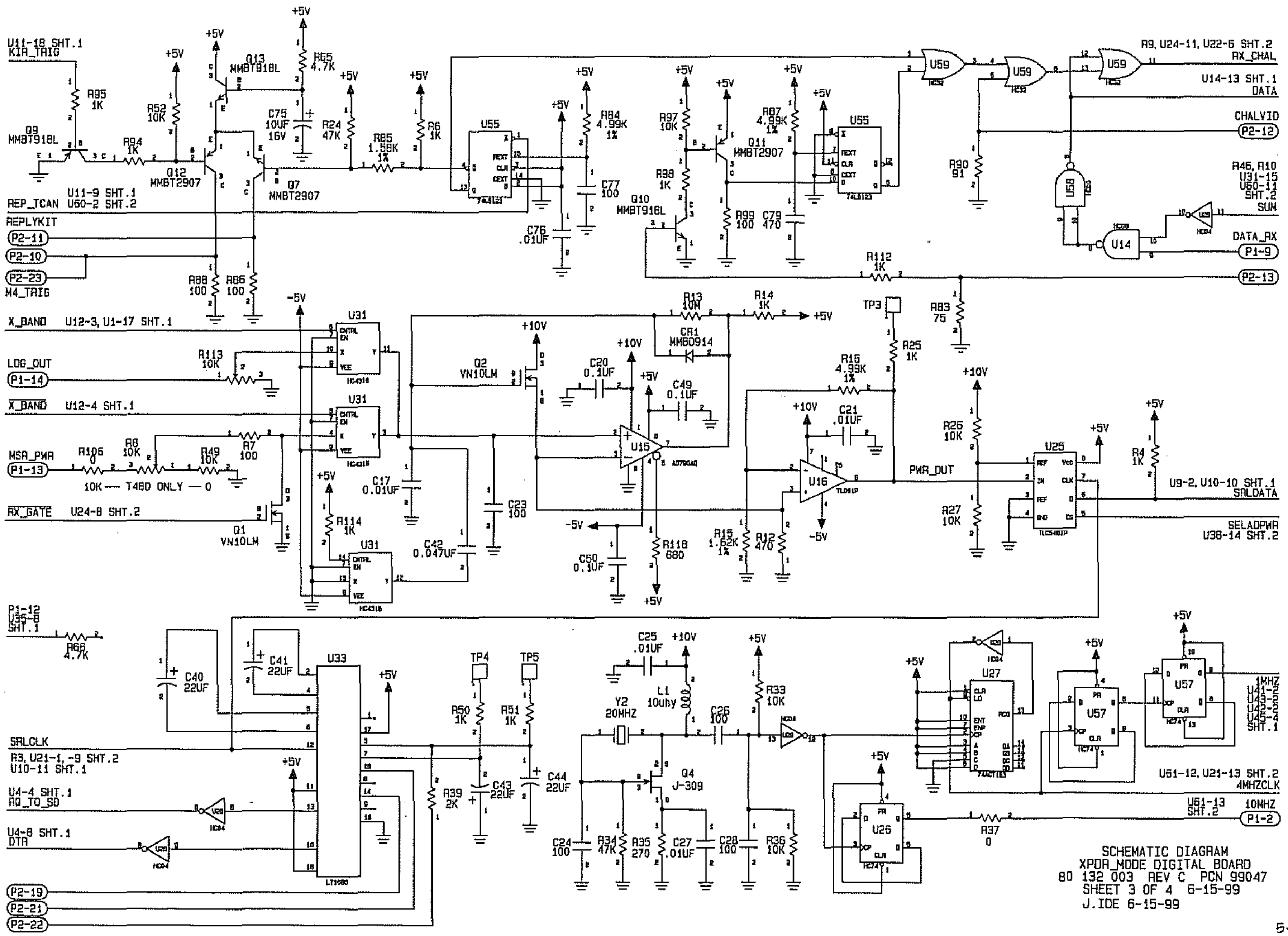
RESISTOR	OHM, 1%		
R126	82.5	93.1	100
R129/R132	267	280	294

SCHEMATIC DIAGRAM
XPDR MODE RF BOARD
80 134 003 REV E 6-15-99
PCN 99047 SHEET 3 OF 3
J.IDE 6-15-99

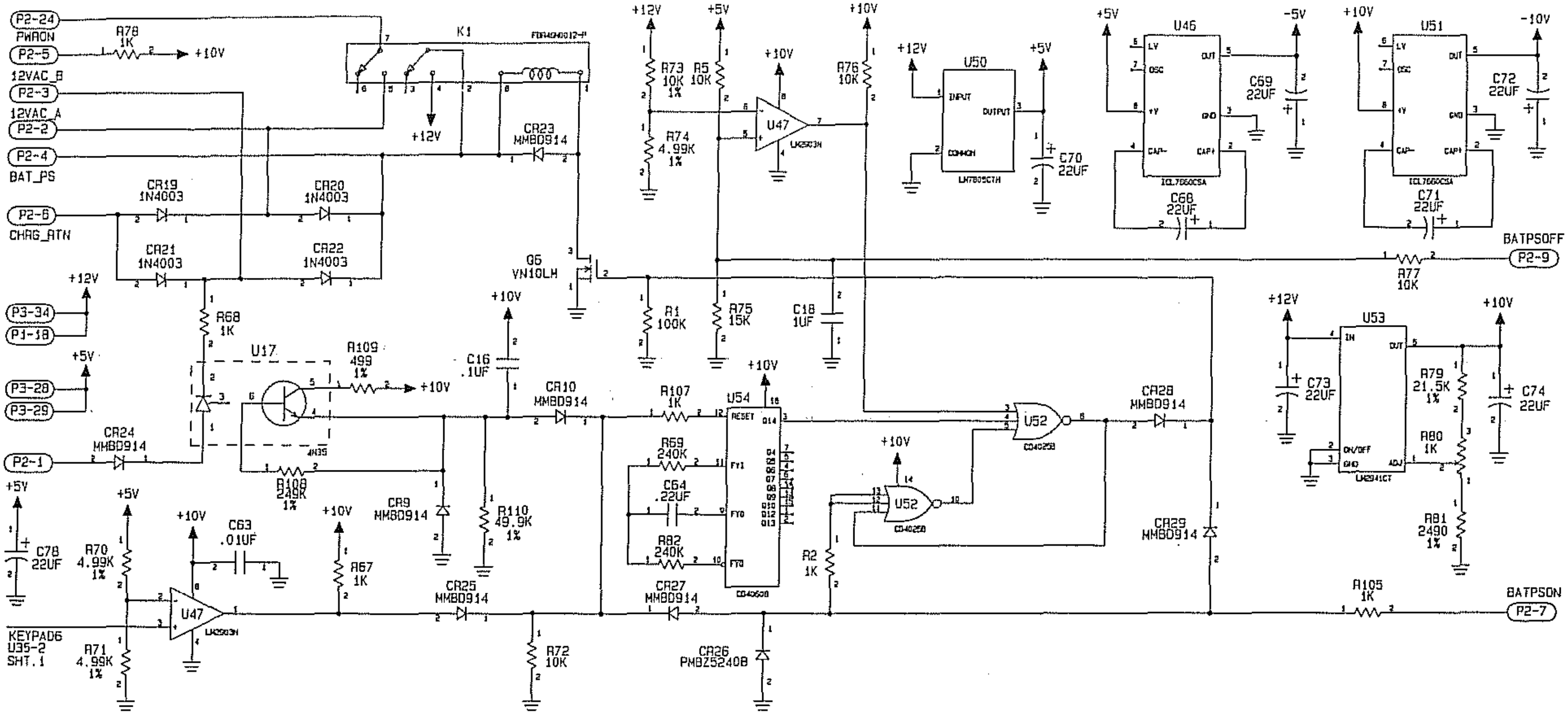

SCHEMATIC DIAGRAM
XPDR_MODE DIGITAL BOARD
80 132 003 REV C PCN 99047
SHEET 1 OF 4 6-15-99
J.IDE 6-15-99
ANT_CNX R66 SHEET 3
KEYPAD6
VERIFY RTN
KEYPAD7
KEYPAD8
KEYPAD9
KEYPAD10
FREQDATA
KIR_RTN
KEYPADEN
BAT_LOW
KIR_TRIG R95 SHT.3
U2-11 SHT.2
DSPL_EN1
SYN_CLK
REP_TCAN U60-2 SHT.2, U55-1 SHT.3
SRLCLK R3, U21-1, -9 SHT.2 U25-7, U33-12 SHT.3
SRLDATA R4, U25-6 SHT.3
RESET
D BUS SHT.2
SHT.2 U5-11
SHT.2 U39-11
T0_T7_EN
T8_T11EN
SPARES
U28-8 SHT.3 DIR
HIFREQ
U28-6 SHT.3 AQ_TO_SQ
U23-19 SHT.2 MODES_RX
U21-12 SHT.2 U24-9 SHT.2 RX_GATE
U61-11 SHT.2 U19-22 SHT.2 HSTRST1
U22-22 SHT.2 HSTRST2
X_BAND
U31-6 SHT.3
U31-5 SHT.3
X_BAND
ATTEN3
U19-27 SHT.2 DATA5
STROB_RX
STROB_TX
SYN_DATA
KIR CONN FAULT
D/A_PHA
SPARES
1MHZ
U57-9 SHT.3
U59-10 SHT.2
DELAYGTE
RESET_RT
U58-2 SHT.2
U59-12, U58-8 SHT.2 DATA
U58-1, U61-9, -10 SHT.2 TACANMODE
A_OR_B
ATTEN2
ATTEN1
CODEA_B
U3 U6 U7 U9 U10 U11 U13 U14 U18 U35 U36 U37 U41 U42 U43 U45 U4 U1 U12 U60 U52
80C31AH 27512 DAC0832 LM336H 2.5V MMBT2907 VN10LM 12MHZ



SCHEMATIC DIAGRAM
XPDR_MODE DIGITAL BOARD
80 132 003 REV C PCN 99047
SHEET 2 OF 4 6-15-99
J.IDE 6-15-99



SCHEMATIC DIAGRAM
XPDR_MODE DIGITAL BOARD
80 132 003 REV C PCN 99047
SHEET 3 OF 4 6-15-99
J.IDE 6-15-99



IC	VENDOR NO.	GND	+5V +10V *	CAP .01UF
U1	MM74HC574WM	PIN 10	PIN 20	C7
U2	MM74HC574WM	PIN 10	PIN 20	C8
U4	MM74HC574WM	PIN 10	PIN 20	C9
U5	MM74HC574WM	PIN 10	PIN 20	C10
U20	MM74HC574WM	PIN 10	PIN 20	C35
U23	MM74HC574WM	PIN 10	PIN 20	C36
U35	MM74HC574WM	PIN 10	PIN 20	C52
U36	MM74HC574WM	PIN 10	PIN 20	C55
U37	MM74HC574WM	PIN 10	PIN 20	C53
U38	MM74HC574WM	PIN 10	PIN 20	C54
U11	MM74HC4514	PIN 12	PIN 24	C12
U12	MC74HC04D	PIN 7	PIN 14	C33
U24	MC74HC74AM	PIN 7	PIN 14	C37
U26	MC74HC74AM	PIN 7	PIN 14	C30

IC	VENDOR NO.	GND	+5V +10V *	CAP .01UF
U57	MC74HC74AM	PIN 7	PIN 14	C31
U14	MC74HC00D	PIN 7	PIN 14	C38
U21	MC74HC00D	PIN 7	PIN 14	C31
U58	MC74HC00D	PIN 7	PIN 14	C88
U41	MC74AC163D	PIN 8	PIN 16	C56
U42	MC74AC163D	PIN 8	PIN 16	C57
U43	MC74AC163D	PIN 8	PIN 16	C58
U19	7202LA35SO	PIN 14	PIN 28	C91
U22	CY7C425-40VC 7202LA25SO	PIN 14	PIN 28	C34
U30	MM74HC4316WM	PIN 8	PIN 16	C47
U31	MM74HC4316WM	PIN 8	PIN 16	C48
U59	MM74HC32M	PIN 7	PIN 14	C89
U60	MM74HC32M	PIN 7	PIN 14	C90

IC	VENDOR NO.	GND	+5V +10V *	CAP .01UF
U3	MM74HC573WM	PIN 10	PIN 20	C13
U6	BQ4010YMA-85C	PIN 14	PIN 28	C14
U7	NM27C512Q	PIN 14	PIN 28	C15
U9	DAC0832LCN	PIN 10	PIN 20 *	C3
U10	80C31BH	PIN 20	PIN 40	C11
U27	MC74ACT163D	PIN 8	PIN 16	C38
U28	MC74HC04D	PIN 7	PIN 14	C29
U25	TLC548IP	PIN 4	PIN 8	C32
U45	MC74HC109D	PIN 8	PIN 16	C60 C59
U52	CD4025BCM	PIN 7	PIN 14 *	C65
U54	CD4060BCM	PIN 8	PIN 14 *	C66
U55	DM74LS123M	PIN 8	PIN 16	C76
U56	MM74HC123AM	PIN 8	PIN 16	C86
U61	CD4053BCM	PIN 8	PIN 16	C87

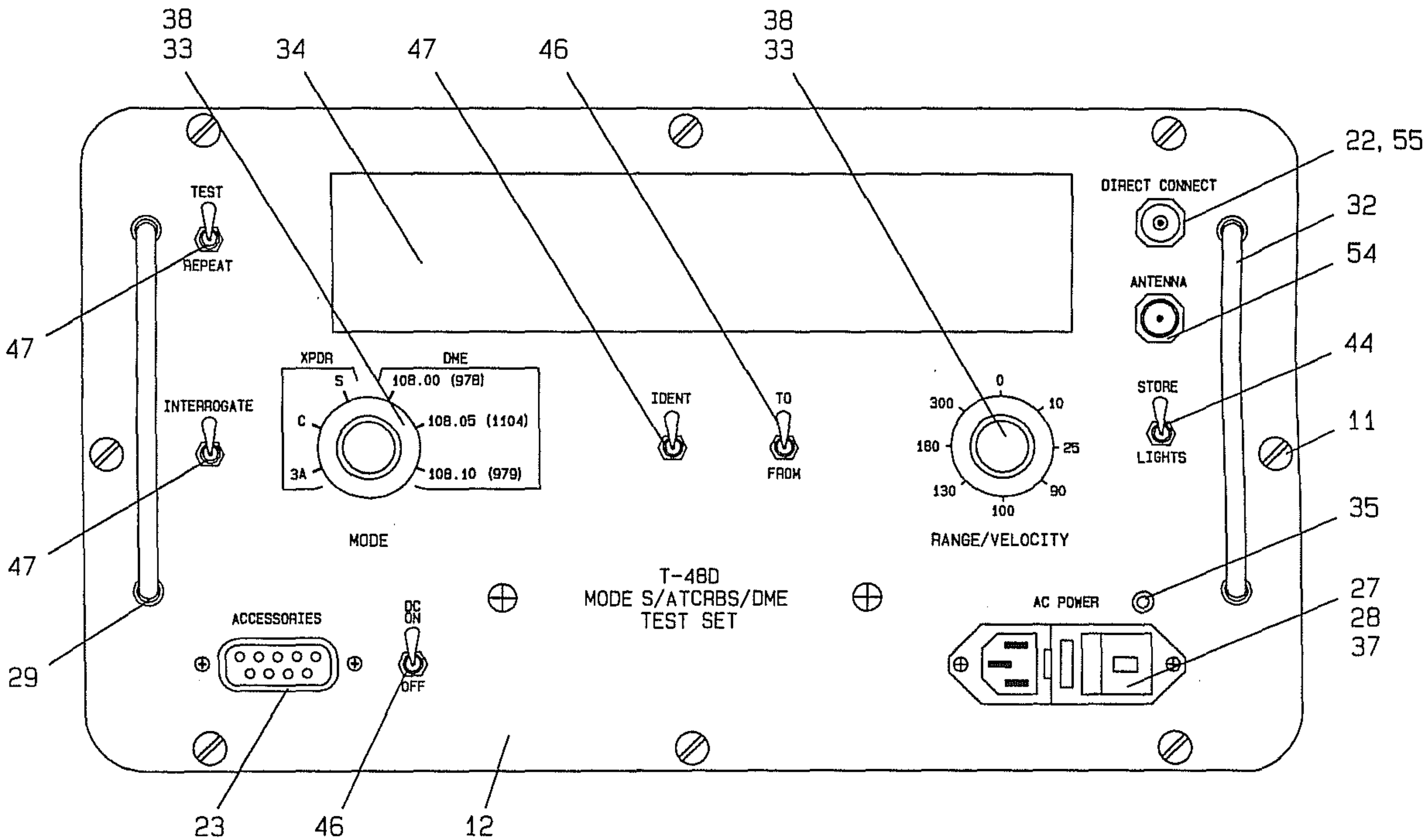
HIGHEST REF. DESIG. USED			REF. DESIG. NOT USED					
U61	R118	Q13	U29	U32	U34	U44	U8	U48
CR29	P3	C91	U49	U39	C6		C39	C85
TP9	L2	Y2		C61	C67	C46	C2	
K1				CR2	CR4-CR7		CR11-CR18	
			TP1	TP8	Q14			C62

SCHEMATIC DIAGRAM
XPDR_MODE DIGITAL BOARD
80 132 003 REV C PCN 99047
SHEET 4 OF 4 6-15-99
J.IDE 6-15-99

Section 6

PARTS BREAKDOWN

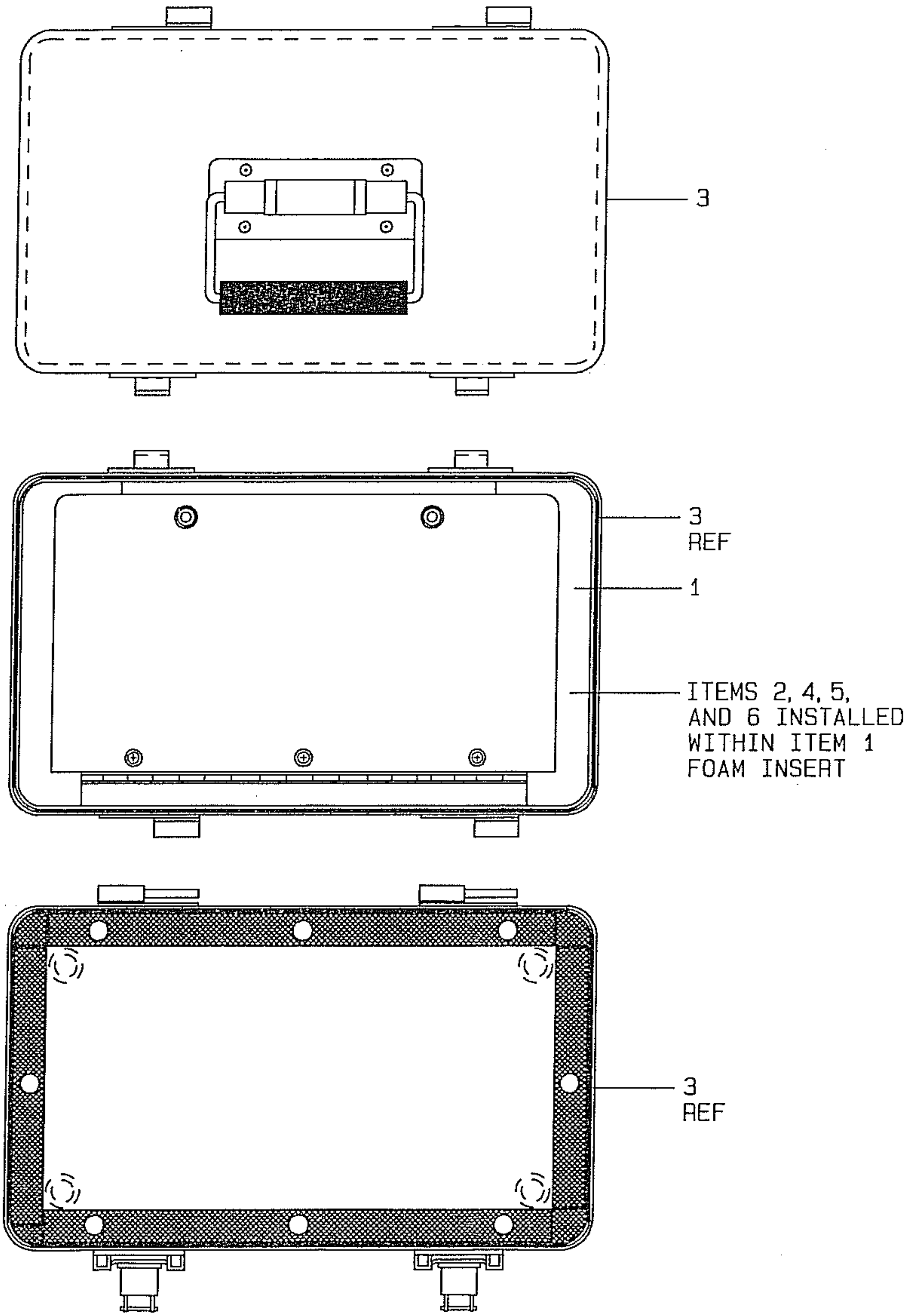
FRONT PANEL ASSEMBLY



T-48D FRONT PANEL ASSEMBLY

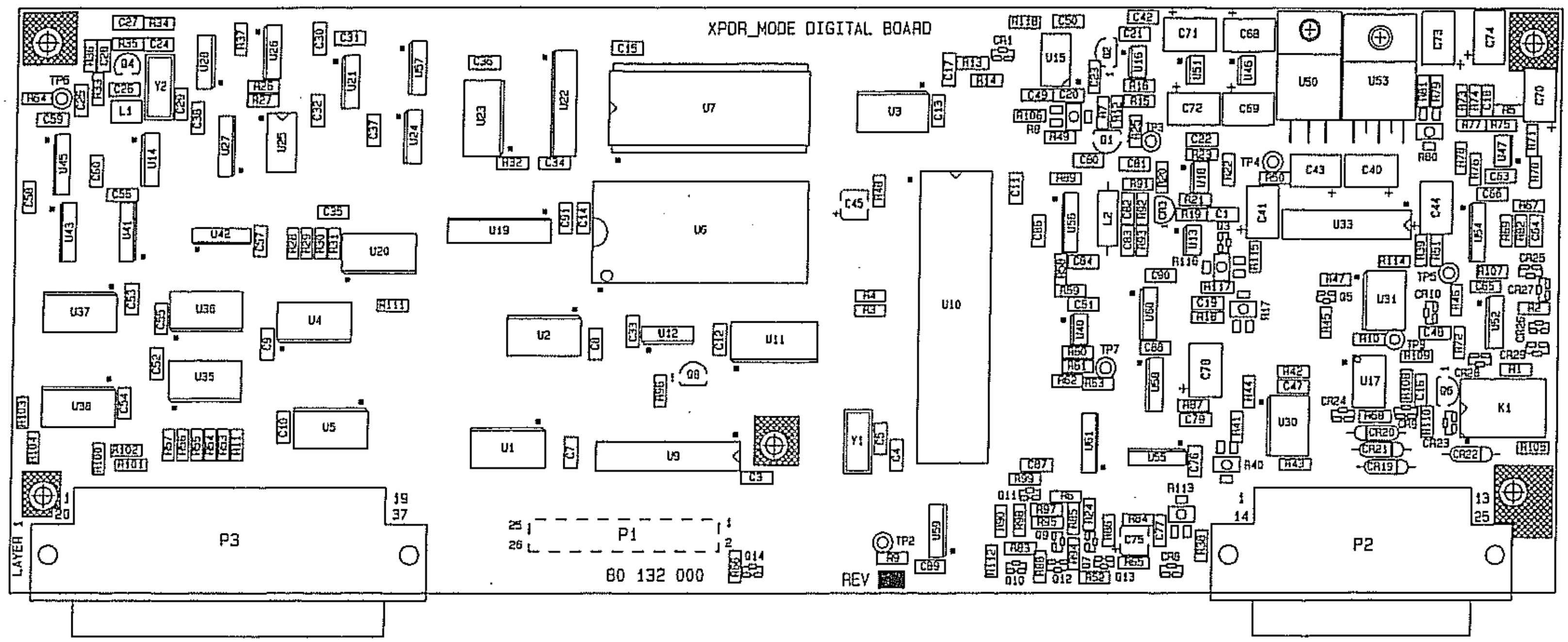
ITEM	P/N	STOCK #	DESCRIPTION	UNIT	QTY
1	62020028	Z-611	Bracket,Fuse/Res Mtg,Rev A	ea	1
2	75010060		Cable Assy,Antenna to RF,W3	ea	1
3	75010066		Cable Assy,Dig to LCD & Sw Bd	ea	1
4	75000015		Cable,Rib,40Cond,ScotchFex #3302-40	ft	A/R
5	62000030		Chassis,RF/Digital, Rev. A	ea	1
6	71110002		Coax, RG-316	ft	1
7	62040026		Cover,Digital,Rev. A	ea	1
8	62040027		Cover,RF,Rev. A	ea	1
9	62040024	Z-405	Cover,RF Shield,Rev A	ea	2
10	62040025	Z-406	Cover,RF Shield,Rev A	ea	1
11	56020001		Fastener,Panel,PEM# PFC2-832-94	ea	8
12	61060024		Panel,Front,Rev. A	ea	1
13	52400018	S-48-T	Standoff,Chassis,2.25lg.,RAF# 2197-832-SS-20	ea	4
14	52400019		Standoff,Dig Cov,.69lg,RAF#4537-440-SS-20	ea	5
15	48063001	B-11-A1	Fuse Block,Double,Littlefuse# 357002	ea	1
16	48071001	B-700	Battery Pack,TNR# 10TNR4D, FULL-D	ea	1
17	48000039	C-242-H	Conn,37P,F,T&B #622-37SM	ea	1
18	48000016	C-376	Connector,26P,F,T&B #622-2630	ea	1
19	46052001	C-377-1	Contact,Amp# 66569-3	ea	9
20	46052001	C-377-1	Contact,Amp# 66569-3	ea	25
21	48063003	C-595	Cover,Fuse,Richco# 840836	ea	2
22	48040029	C-800-F	Conn,TNC,Amphenol# 31-2318	ea	1
23	48000061	C-800-K	Connector,9Pin,Amp #205203-1	ea	1
24	48040026	C-899	Conn,SMA,EFJ# 142-0321-001	ea	1
25	48000077	C-905	Conn,25Pin,Rect,Amp# 205207-1	ea	1
26	45100004	F-21-B	Fuse,1 Amp,Bussman# AGC-1	ea	2
27	45100005	F-22-A1	Fuse,2A,S/B,MDL-2	ea	2
28	48035002	F-700	Fusedrawer,Schurter #4303.2714.01	ea	1
29	31020035	F-800	Ferrule,Promptus #288-09-ALC	ea	4
30	55082006	G-551	Gasket,37Pin,SC# 572019-00103-70	ea	1
31	55082016	G-552	Gasket,25Pin,SC# 572019-00102-70	ea	1
32	56025006	H-700	Handle,Vemaline #BZ-130-1	ea	2
33	57025019	K-15-I	Knob,Skirted W/Line,Rogan #RB67-1-SK-7-M	ea	2
34	45010001	L-5-C	LCD,IEE# 3857-03-040	ea	1
35	45001002	L-700	Light,LED,DIALIGHT# 559-0101-007,Red	ea	1
36	41400002	R-353	Res,5W,6ohm,Dale# RH-5-6	ea	2
37	48035001	R-700	Fuse Casing,Schurter #KD14.4101.151	ea	1
38	46020019	S-176	Switch,Rot,Grayhill #26ASD40-01-1-AJS	ea	2
39	52400001	S-47-N	Standoff,Battery,RAF# 2132-832-SS,2.5"	ea	2
40	52400008	S-47-R	Standoff,LCD,RAF #2101-440-SS-20	ea	4
41	52400015	S-49-B	Standoff,RF Cov,.5lg,RAF#4534-440-SS-20	ea	5
42	52400003	S-526	Standoff,SW PCB,.38lg,RAF#2102-440-SS-20	ea	6
43	52400006	S-55-1	Standoff,Fuse Mtg,1.56lg,RAF#2121-632-SS-20	ea	2
44	46027507	S-701	Switch,Toggle,3Pos,C&K #7205SWZQE	ea	1
45	55060001	S-750	Shield,Spiral,Spira #SS-06	ft	5
46	46027515	S-77	Switch,Toggle,3Pos,C&K #7105SWZQE	ea	2
47	46027530	S-78	Switch,Toggle,SPDT,C&K #7108SWZQE	ea	3
48	43000001	T-550	Transformer,Signal #DP-241-5-16	ea	1
49	62020033	Z-245	Bracket,Batt ,Btm,Rev C	ea	1
50	48000059		Connector,Socket,Female,16Pin,T&B#622-1600	ea	1
51	55082012		Gasket,LCD	ea	1
52	62070030	Z-627	Plate,RF/Digital Chassis	ea	1
53	62070031		Plate,RF/Digital Chassis	ea	1
54	75010060		Cable Assy/Antenna RF Output	ea	1
55	43003001		Termination Cap	ea	1
56	89000075		Attenuator Assembly	ea	1

CASE ASSEMBLY



T-48D CASE ASSEMBLY

ITEM#	P/N	STOCK #	DESCRIPTION	U	UNITS
1	31000007	I-900	Insert,Case	ea	1
2	89000094		Direct Connect Assy,TAP-122A	ea	1
3	64030026	C-700-A	Case	ea	1
4	89000095		Coupler,Antenna,Anti-radition,TAP-126A	ea	1
5	75010025	L-6-A	Line Cord,Belden# 17250	ea	1
6	40030009	TSP-1A	Antenna	ea	1

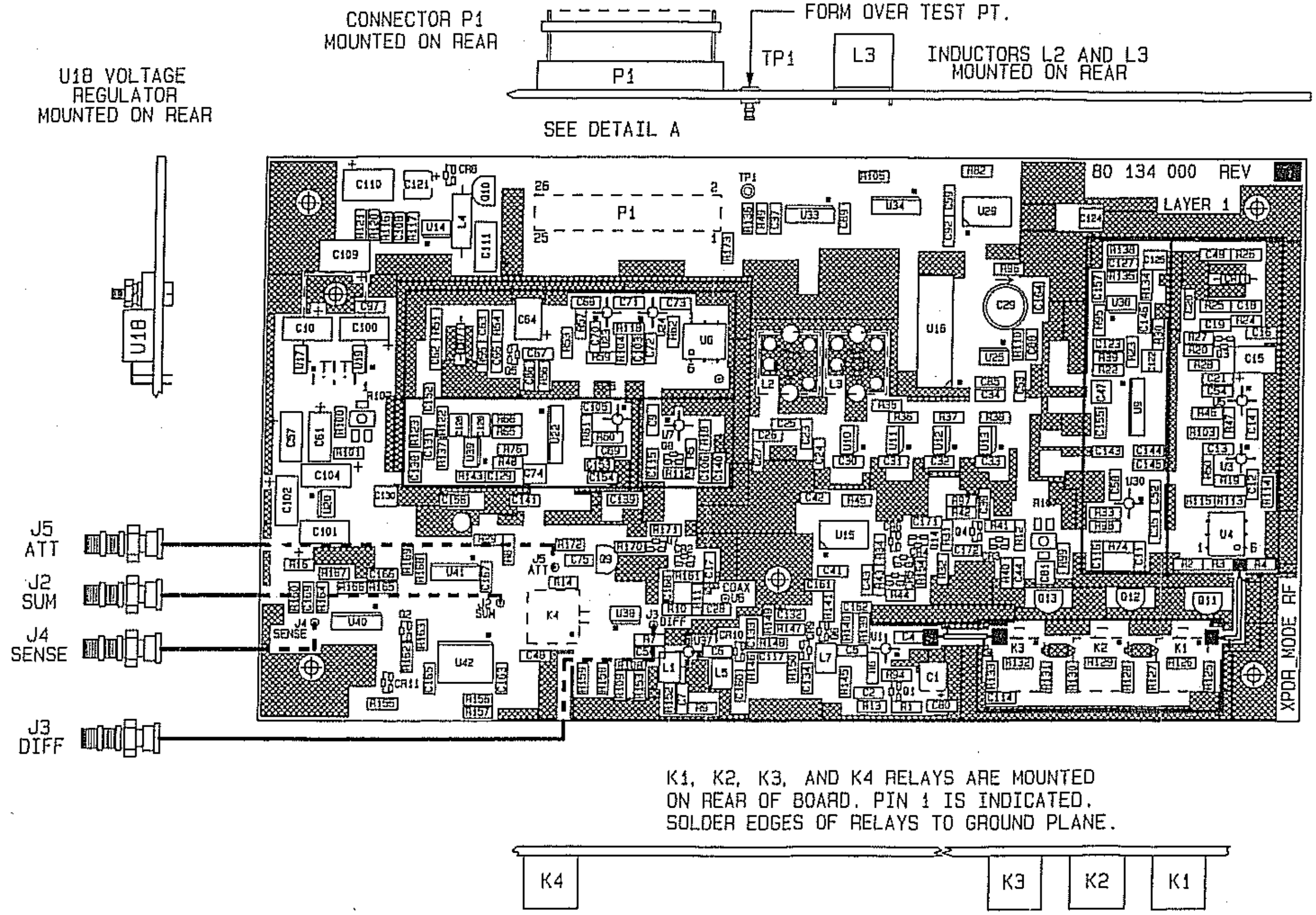


XPDR MODE DIGITAL BOARD
80 132 001 rev. B

31	40200025		RS232, I10, LT1080	1	U33
32	40200052		A/D Converter, TLC5481	1	U25
33	40201015		3 Input NOR,Triple,SM,CD4025	1	U52
34	40201020		Counter,Binary,SM,CD4060	1	U54
35	40201039		FIFO,SM,CY7C425	1	U22
36	40201079		One-Shot,Dual,SM,74LS123	1	U55
37	40201012		Voltage Inverter,SM,7660	2	U46, U51
38	40201023		Op Amp,Dual,SM,LM2903	1	U47
39	40201036		Flip-Flop,JK,Dual,SM,74HC109	1	U45
40	40201056		Counter,Binary,SM,74AC163	3	U41-U43
41	40201037		Counter,Binary,SM,74ACT163	1	U27
42	40201038		NAND,2 Input,Quad,SM,74HC00	3	U14, U21, U58
43	40201019		Buffer Amp,Inverting,Hex,SM,74HC04	2	U12, U28
44	40201155		FIFO,SM,7202	1	U19
45	40201021		Flip-Flop,D,Dual,SM,74HC74	3	U24, U26, U57
46	40201074		One-shot,Dual,SM,74H123	1	U56
47	40201151		FIFO,SM,7202	1	U22
48	40201078		Or,Dual-Input,Quad,SM,74HC32	2	U59, U60
49	40201080		Switch,Analog,SM,74HC4053	1	U61
50	40201011		Switch,Analog,SM,74HC4316	2	U30, U31
51	40201018		4-16 LineDecoder,SM,74HC4514	1	U11
52	40201014		Latch,D,Octal,SM,74HC573	1	U3
53	40201013		Flip-Flop,D,Octal,SM,74HC574	10	U1, U2, U4, U5, U20, U23, U35-U38
54	40201007		Op Amp,SM,TL081	2	U16, U18
55	40201008		Op Amp,Dual,SM,TL082	2	U13, U40
56	53010001		Nut Hex No. 4	2	N/A
57	41050010		Pot,SM,10k	3	R8, R40, R113
58	41050007		Pot,SM,1K	2	R80, R116
59	80132002	A	PCB Drilling and Fabrication	1	N/A
60	40200104		Prom,27C512	1	U7
61	46050001		Relay, DPDT	1	K1
62	41160011		Res,Chip,RC1206,100ohm	5	R7, R45, R86, R88, R99
63	41160015		Res,Chip,RC1206,10K	24	R5, R11, R22, R23, R26, R27, R33, R36, R48, R52-R59, R72, R76, R77, R97, R115,R117, R106

64	41160033		Res,Chip,RC1206,10M	1	R13
65	41160041		Res,Chip,5%,15K,RC1206	2	R75, R92
66	41160003		Res,Chip,RC1206,1K	35	R2-R4, R6, R9, R10, R14, R25, R28-R32, R38, R50, R51, R63, R64, R67, R68, R78, R94-R96, R98, R100-R105, R107, R111, R112, R114
67	41160035		Res,Chip,RC1206,240K	2	R69, R82
68	41160001		Res,Chip,RC1206,270ohm	1	R35
69	41160030		Res,Chip,5%,2K,RC1206	3	R39, R91, R93
70	41160008		Res,Chip,5%,2.2K,RC1206	2	R47, R62
71	41160029		Res,Chip,RC1206,3.3K	1	R89
72	41160021		Res,Chip,RC1206,470ohm	3	R12, R42, R43
73	41160031		Res,Chip,RC1206,47K	2	R24, R34
74	41160013		Res,Chip,RC1206,4.7K	3	R46, R65, R66
75	41160027		Res,Chip,RC1206,680ohm	2	R41, R118
76	41050004		Potentiometer,SM,100ohm	1	R17
77	41160040		Res,Chip,RC1206,75ohm	1	R83
78	41160032		Res,Chip,RC1206,82ohm	1	R44
79	41160019		Res,Chip,5%,91ohm,RC1206	1	R90
80	41160025		Res,Chip,5%,100K,RC1206	1	R1
81	41101289		Res,Chip,MF,1%,10.0K,RC1206	2	R61, R73
82	41101212		Res,Chip,MF,1%,1.58K,RC1206	1	R85
83	41101213		Res,Chip,MF,1%,1.62K,RC1206	2	R15, R20
84	41101321		Res,Chip,RC1206,MF,21.5K,1%	1	R79
85	41101423		Res,Chip,MF,1%,249K,RC1206	1	R108
86	41101231		Res,Chip,MF,1%,2.49K,RC1206	1	R81
87	41101340		Res,Chip,MF,1%,34.0K,RC1206	1	R18
88	41101164		Res,Chip,MF,1%,499ohm,RC1206	1	R109
89	41101356		Res,Chip,MF,1%,49.9K,RC1206	1	R110
90	41101260		Res,Chip,RC1206,MF,4.99K,1%	8	R16, R19, R60, R70, R71, R74, R84, R87
91	41101265		Res,Chip,MF,1%,5.62K,RC1206	1	R21
92	50110009		Screw,PH,S/S,#4-40X5/16	2	N/A
93	48064001		Socket,28Pin	1	XU7
94	55025002		Terminal,Double Turret	7	TP2-TP7, TP9
95	40001005		Transistor	1	Q4
96	40001011		Transistor,SM, MMBT2222	1	Q5
97	40001014		Transistor,SM, MMBT2907	4	Q3, Q7, Q11, Q12

98	40001017		Transistor,SM, MMBT918	3	Q9, Q10, Q13
99	40001012		Transistor,VN10LM	4	Q1, Q2, Q6, Q8
100	52010002		Washer,Flat,S/S,#4	2	N/A
101	52020002		Washer,Lock,S/S,#4	2	N/A
102	55080002		Crystal Mount	2	XY1, XY2
103					
104	41160145		Res,Chip, RC1206; 0ohms	2	R37, R49
105					
106					
107					
108					
109					
110	42026001		Cap Chip; Z5U CC1210; 1uF	1	C18



XPDR MODE RF PCB ASSEMBLY
80 134 001 rev. C

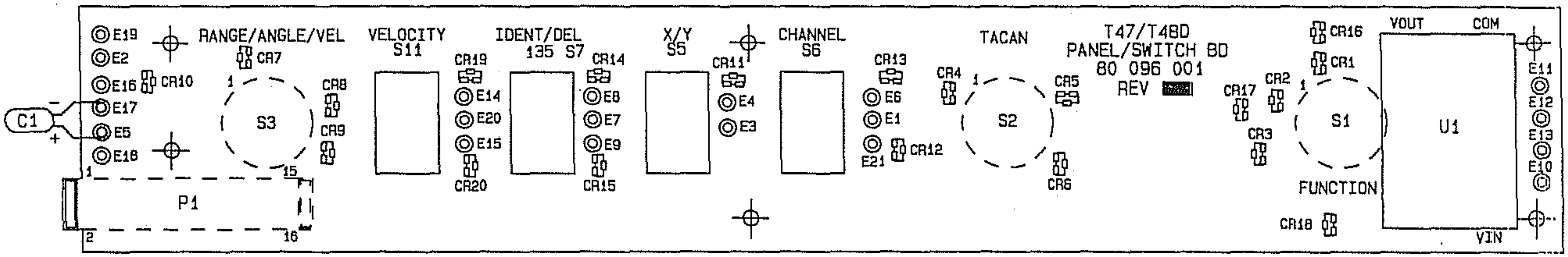
					Eff. Date: 6/15/99; REV E; PCN#99047
ITEM NO.	PART NUMBER	REV	DESCRIPTION	QTY.	REF. DESIG.
1	80134002	A	PCB DRILLING AND FABRICATION	1	
2	31020092		Shield Isolation	1	N/A
3	31020091		Shield Isolation	1	N/A
4	31020090		Shield Isolation	1	N/A
5	48040012		Connector,Blkhd,Jack	4	J2-J5
6	48000049		Connector Shrouded Term.	1	P1
7	71110002		Coax Semi-Rigid	A/R	
8	53010002		Nut,Hex,#4	1	N/A
9	50110009		Screw,PH,#4-40X5/16	1	N/A
10	52010002		Washer,Flat,#4	1	N/A
11	52020002		Washer,Lock,#4	1	N/A
12					
13					
14					
15	42260008		Capacitor Trimmer,2.5-10pf,	1	C29
16	42480008		Cap Tant-Elect-SM,100uf/10V	2	C15, C64
17	42185045		Cap,SM,Alum,1uf/50V	1	C1
18	42480009		Cap Tant-Elect-SM,22uf/25V	2	C109, C110
19	42185007		Cap,SM,Alum,6.8uf/25V	1	C121
20	42480001		Capacitor,SM,Tant,22uf/16V	8	C10, C57, C61, C100, C101, C102, C104, C111
21	42025037		Capacitor,Chip,NPO,CC1206,1000pf	47	C13, C16, C28, C30-C33, C35,C48, C53, C54, C58, C67, C70-C73, C75, C85, C88, C89, C97, C103, C105, C106, C108, C114, C127, C131-C134, C138-C141, C146, C155-C157, C163, C165-C167, C169, C171, C80
22	42026001		Capacitor,Chip,NPO,CC1210,1uf	10	C47, C74, C122, C124-C126, C128, C130, C81, C172
23	42025025		Capacitor,Chip,NPO,CC1206,100pf	8	C17, C39, C43, C50, C52, C115, C117, C168
24	42025015		Capacitor,Chip,NPO,CC1206,15pf	2	C18, C63

25	42025017		Capacitor,Chip,NPO,CC1206,22pf	3	C25, C68, C69
26	42025005		Capacitor,Chip,NPO,CC1206,2.2pf	1	C66
27	42025007		Capacitor,Chip,NPO,CC1206,3.3pf	2	C19, C65
28	42025033		Capacitor,Chip,NPO,CC1206,470pf	1	C37
29	42025021		Capacitor,Chip,NPO,CC1206,47pf	23	C2, C4-C7, C9, C11, C12, C14, C21, C23, C24, C26, C27, C34, C44, C116, C143-C145, C152-C154
30	42020013		Capacitor,Chip,X7R,CC1206,.1uf	6	C41, C42, C59, C92, C123, C129
31	42020001		Capacitor,Chip,X7R,CC1206,.01uf	5	C49, C62, C160-C162
32	42026001		Capacitor, Chip, NPO, CC1206, 18pf	1	C164
33					
34					
35	56060005		I/C-Voltage Regulator, LM2941CT	1	U18
36	46002004		Relay; DPDT; 172D-12	4	K1, K2, K3, K4
37	40201115		I/C-SM; TRANSFER SWITCH, MSWT-4-20	1	U38
38	40200113		I/C-miniDIP; PREC. COMPARATOR, AD790AQ	2	U15, U29
39	40201086		I/C-SM; Frequency Mixer, RMS-11F	2	U4, U6
40	40201058		I/C-SM; Delay Line, CD320D-104	1	U16
41	40201021		I/C-SM; Dual D Flip-Flop, MM74HC74AM	1	U34
42	40201012		I/C-SM; Switched Capacitor Voltage Converter ICL7660CSA	1	U20
43	40201008		I/C-SM; OP-AMP, Dual, TL082CD	2	U36, U39
44	40201060		I/C-SM; Voltage Regulator, LM7805ACM	1	U19
45	40201061		I/C-SM; Voltage Regulator, LM7806ACM	1	U17
46	40201087		I/C-SM; RF AMP, MAR-3SM	7	U5, U7, U23, U24, U30, U35, U37
47	40201085		I/C-SM; Step-Up Switching Regulator, MAX643XCSA	1	U14
48	40201084		I/C-SM; Freq. SYNTH., MB1507PF	2	U9, U22
49	40201034		I/C-SM; Quad 2-INPUT NOR GATE, MM74HC02M	2	U33, U41
50	40201145		I/C-SM; Double-balanced mixer, SA602AM	1	U25
51	40201006		I/C-SM; LOG IF-STRIP AMP, SL1613C/MP	4	U10-U13
52	40201116		I/C-SM; QUAD COMPARATOR, LM2901M	1	U40
53	40201011		I/C-SM; QUAD ANALOG SWITCH, MM74HC4316WM	1	U42
54	40201090		I/C-SM; RF AMP, MAR-6SM	2	U1, U3
55					
56					
57					
58	40010011		Diode, Tuning Varactor, KV3201	2	CR1, CR7
59	40010014		Diode,SM MMBD914LT1	4	CR4-CR6, CR8
60	40010016		Diode,SM Schottky ZC2800	2	CR2, CR3

61	40010039		Diode, SM ZENER MMBZ5231BLT1	1	CR11
62	40010026		Diode,SM, PIN-Diode, HSMP-3813	2	CR9, CR10
63					
64					
65	40001014		Transistor,SM; P-N-P; MMBT2907ALT1	3	Q1, Q4, Q8
66	40001013		Transistor,SM, High Freq., NE02133	2	Q3, Q5
67	40001011		Transistor,SM; N-P-N; MMBT2222ALT1	4	Q2, Q6, Q7, Q14
68	40001012		Transistor; FET; VN10LM	5	Q9-Q13
69					
70					
71	43011029		Inductor,SM,3300uHy	1	L4
72	43011009		Inductor Variable; 33uHy	2	L2, L3
73	43025037		Coil, .125ID X .25Lg, 5TURNS	3	L1, L5, L7
74					
75					
76	41050010		TrimPot,SM,10kohm	1	R107
77	41050007		TrimPot,SM,1kohm	1	R102
78	41101289		Res. Chip, RC1206, 1%; 10K	2	R164, R167
79	41101292		Res. Chip, RC1206, 1%; 10.7K	1	R165
80	41101240		Res. Chip, RC1206, 1%; 3.09K	1	R166
81	41101138		Res. Chip, RC1206, 1%; 267 Ohm	1	R129
82					
83	41160046		Res. Chip, RC1206, 5%; 510 Ohms	3	R5, R45, R82
84	41160013		Res. Chip, RC1206, 5%; 4.7K	1	R170
85					
86	41160029		Res. Chip, RC1206, 5%; 3.3K	1	R171
87	41160064		Res. Chip, RC1206, 5%, 120 Ohm	1	R113
88	41160026		Res. Chip, RC1206, 5%; 270K	1	R44
89	41160040		Res,Chip,RC1206,5%,75ohm	5	R97, R114, R115, R11, R161
90	41160047		Res,Chip,RC1206,5%,22kohm	2	R39, R48
91	41160041		Res,Chip,RC1206,5%,15kohm	3	R95, R139, R143
92	41160025		Res,Chip,RC1206,5%,100kohm	4	R22, R76, R135, R137
93	41160011		Res,Chip,RC1206,5%,100ohm	16	R9, R20, R28, R33, R41, R47, R53, R57, R60, R61, R98, R103, R120, R121, R152, R10
94	41160015		Res,Chip,RC1206,5%,10kohm	11	R24, R26, R40, R51, R54, R94, R100, R122, R134, R145, R162
95	41160145		Res,Chip,RC1206,5%,0ohm	2	R29, R16

96	41160006		Res,Chip,RC1206,5%,180ohm	2	R18, R34
97	41160038		Res,Chip,RC1206,5%,18ohm	2	R3, R108
98	41160003		Res,Chip,RC1206,5%,1kohm	26	R13, R35-R38, R99, R101, R105, R112, R123, R136, R138, R140, R146-R148, R150,, R155-R159, R163, R168, R169, R172
99	41160020		Res,Chip,RC1206,5%,220ohm	4	R42, R46, R62, R118
100	41101142		Res,Chip,RC1206,1%,294ohm	1	R132
101	41160001		Res,Chip,RC1206,5%,270ohm	3	R2, R4, R6
102	41160024		Res,Chip,RC1206,5%,27kohm	2	R117, R149
103	41160008		Res,Chip,RC1206,5%,2.2kohm	1	R1
104	41160004		Res,Chip,RC1206,5%,2.7kohm	4	R25, R32, R43, R55
105	41160023		Res,Chip,RC1206,5%,330ohm	1	R154
106	41160042		Res,Chip,RC1206,5%,33kohm	5	R23, R30, R31, R65, R66
107	41160036		Res,Chip,RC1206,5%,470kohm	1	R116
108	41160021		Res,Chip,RC1206,5%,470ohm	4	R12, R27, R56, R173
109	41160062		Res,Chip,RC1206,5%,47ohm	2	R74, R96
110	41160043		Res,Chip,RC1206,5%,51ohm	2	R141, R7
111	41160017		Res,Chip,RC1206,5%,560ohm	1	R49
112	41101075		Res,Chip,RC1206,1%,59.0ohm,	4	R128, R130, R131, R133
113	41160016		Res,Chip,RC1206,5%,68ohm	1	R110
114	41160019		Res,Chip,RC1206,5%,91ohm	4	R19, R50, R59, R104
115	41160068		Res,Chip, RC1206, 5%, 300Ohms	2	R109, R153
116					
117					
118	62040024		Cover Shield Isolation	2	N/A
119	62040025		Cover Shield Isolation	1	N/A
120	41101094		Res. Chip RC1206 1% 93.1 Ohms	1	R126
121	41101089		Res. Chip RC1206 1% 82.5 Ohms	2	R125, R127

PCB ASSEMBLY
PANEL SWITCH



PANEL/SWITCHING PCB PARTS LIST
80 096 004 REV D 2-25-99

ITEM NO.	PART NO.	DESCRIPTION		QTY	REF. DESIG.
1	80096002	PCB DRILLING AND FAB.	REV C	1	
2	48000058	CONNECTOR-HEADER T & B NO.609-1624	16 PIN	1	P1
3	40010014	DIODE-SM	MMBD914	20	CR1-CR20
4	48072002	INVERTER-12V	IEE NO.46713-01	1	U1
5	55025002	TERMINAL-DOUBLE TURRET CAMBION NO.160-2043-02-01		21	E1-E21
6	42470021	CAPACITOR-TANT SPRAGUE NO.199D107X9020RF2	100UF/20V 10%	1	C1

APPENDIX A

MODE S BACKGROUND INFORMATION

The Mode S transponder system was developed to alleviate problems associated with the overloading of the ATCRBS transponder system. The overloading mechanism is garbling, or the corruption of replies due to multiple aircraft within the radar antenna beam. The Mode S system has the capability to Selectively interrogate an airborne transponder, the significance of the S in Mode S, and elicit a reply from only one transponder and thus prevent multiple replies.

The Mode S transponder will respond to all ATCRBS interrogations as if it were a standard ATCRBS transponder. This is required so that during the phase-in period when ATCRBS and Mode S transponders and interrogators will co-exist, the Mode S transponders will interoperate with the older ATCRBS interrogators.

There are two basic categories of Mode S interrogations; the all-call and the select. All-call interrogations cause all Mode S transponders to reply. This is used to periodically check for transponders that have not been previously identified. As an example, when an aircraft enters the coverage area of a ground interrogator, the presence of the aircraft is not known until an all-call interrogation is transmitted. The new aircraft responds with it's address and is added to the roll-call. Further interrogations will address the new interrogator selectively.

There are also hybrid Mode S/ATCRBS interrogations which are used to separate ATCRBS and Mode S transponders. A hybrid interrogation is made and the ground interrogator will then know the location of all Mode S ant ATCRBS transponders. A Mode S all-call will allow all of the Mode-S transponders to be identified while the ATCRBS transponders remain silent and reduce the chance of garble.

The ATCRBS system is capable of receiving altitude data from the transponder by initiating a Mode C interrogation. In the case of the Mode S transponder, there are several types of data that may be retrieved from the transponder, one of which is altitude.

The transponder test set is a dual-function ATCRBS and Mode S transponder test set that performs the test outlined in FAR 91.172. There are nine interrogation modes and one "listen only" mode on the test set.

DEFINITION OF TERMS

TERM	DEFINITION
ADDRESS	The unique code to which a Mode S transponder replies. This is not to be confused with the "4096" code used for identifying ATCRBS transponders. The address of a Mode S transponder is not alterable by the pilot or crew.
ALTITUDE	The pressure altitude of the aircraft as transmitted by an ATCRBS or Mode S transponder. This information is obtained from an external sensor and transmitted to the transponder.
ATCRBS	Air Traffic Control Radar Beacon System. The original non-selective secondary radar beacon system using the usual two-pulse interrogation and an auxiliary SLS pulse.
DPSK	Differential phase shift keying. The method of modulation used for the selective Mode S uplink interrogations.
DF	Downlink format. The format included in a Mode S transponder to an interrogation or squitter message that indicates the type of message.
MODE S	A secondary radar system where transponders can be individually interrogated or selected (the S in Mode S), so that the amount of interference or garble can be reduced to a minimum.
MODE S ALL-CALL	An interrogation that causes all Mode S transponders to reply.
REPLY	A transmitted response from the airborne transponder to an interrogation.
SLS	Side load suppression. A pulse transmitted from an omni-directional antenna used as a reference level to prevent replies to interrogations received from the main antenna sidelobes.

DEFINITION OF TERMS CONTINUED...

TERM	DEFINITION
SQUITTER	The transmissions made by a Mode S transponder not in reply to an interrogation for the use of collision avoidance systems.
SURVEILLANCE, ID	An interrogation that causes only the addressed Mode S transponder to reply with its 4096 code.
UF	Uplink format. The format in a Mode S interrogation that indicates the type of reply expected.
"4096" CODE	This refers to the octal number dialed into either a ATCRBS or Mode S transponder by the pilot or other crew member. This is to be distinguished from the address of a Mode S transponder which cannot be changed by front panel switches.
COMM	Refers to the communication and data-link capability of a Mode S transponder. There are four capabilities: No Comm, Comm A/B, Comm A/B/C, and Comm A/B/C/D. The Comm capability is displayed when the transponder is determined to be Mode S.

Further definitions may be found in the following reference documents: (1) RTCA Document DO-181, Minimum Operational Performance Standards for Air Traffic Control Beacon System/Mode Select Airborne Equipment. March 1983; (2) Modern Aviation Electronics, A.D. Helfrick, Englewood Cliffs, N.J. Prentice Hall, Inc., and (3) Federal Register, Fed 3, 1987 FAA rules part 91.

APPENDIX B

T-48D Final Assembly Acceptance and Two Year Calibration Test Report

SERIAL # ____________
TECHNICIAN ____________
DATE ____________

FINAL PROCEDURE

	TEST DESCRIPTION	ACTUAL	INITIAL	FINAL
1)	AC CHARGE LED		________	________
	DISPLAY AND SWITCHES		________	________
	BACK LIGHT OPERATION		________	________
2)	POWER AND FREQUENCY OUTPUT		________	________
	POWER 0.0 ± 2 dB	________		
	FREQUENCY 1030 ± 1MHz	________		
3)	DME		________	________
	RANGE 180 ± 0.1 NMI	________		
	VELOCITY 180 ± 5 KTS	________		
	TONE (YES/NO)	________		
4)	MODE S TRANSPONDER		________	________
	POWER ± 100W	________		
	FREQUENCY ± 0.1MHZ	________		
	RCVR SENSITIVITY ±2DB	________		
5)	TAP-126A		________	________
	POWER ± 100W	________		
	FREQUENCY ± 0.1MHZ	________		
	RCVR SENSITIVITY ±2DB	________		

T-48D Sub-Assembly Adjustment Test Report

SERIAL # ____________
TECHNICIAN ____________
DATE ____________

RF PCB PROCEDURE

	TEST DESCRIPTION		ACTUAL	INITIAL	FINAL
1)	VOLTAGE AND CLOCKS			________	________
	+5 ± 0.5V		________		
	-5 ± 0.5V		________		
	+10 ± 0.5V		________		
	+6 ± 0.5V		________		
	+21 ± 0.5V		________		
	10MHZ ± 300HZ		________		
2)	VOLTAGE CONTROLLED OSCILLATORS			________	________
	MODE 3A	TX=1030 ± 1MHZ	________		
		RX=1045 ± 1MHZ	________		
	DME 108.00	TX= 978 ± 1MHZ	________		
		RX=996 ± 1MHZ	________		
	DME 108.05	TX=1104 ± 1MHZ	________		
		RX=996 ± 1MHZ	________		
	DME 108.10	TX= 979 ± 1MHZ	________		
		RX=997 ± 1MHZ	________		
3)	SLS AND DPSK MODULATION			________	________
	SLS -9 ± 1DB		________		
	DPSK 0.0V ± 100MV		________		
4)	POWER OUTPUT AND RELAYS			________	________
	POWER 0.0 ± 2DB		________		
	K1 RELAY 18 ± 2DB		________		
	K2 RELAY 18 ± 2DB		________		
	K3 RELAY 18 ± 2DB		________		
5)	RECEIVER SENSITIVITY			________	________
	BETTER THAN -23DBM		________		
6)	FREQUENCY AND POWER MEASUREMENT			________	________
	250 ± 25W		________		
	500± 50W		________		
	125 ± 20W			________	

DIGITAL PCB PROCEDURE

TEST DESCRIPTION		ACTUAL	INITIAL	FINAL
1)	VOLTAGE AND CLOCKS		________	________
	+5 ± 0.5V	________		
	-5 ± 0.5V	________		
	+10 ± 0.5V	________		
	-10 ± 0.5V	________		
	+9 ± 0.5V	________		
	-9 ± 1.5V	________		
	12MHZ ± 2K	________		
	20MHZ ± 200HZ	________		
	10MHZ ± 100HZ	________		
	4MHZ ± 100HZ	________		
2)	DISPLAY AND SWITCHES		________	________
3)	D/A CONVERTER		________	________
	MAXIMUM NEGATIVE 8±1.0V	________		
3)	RF BOARD INTERFACE		________	________
	R44 0.7 ± 0.25V	________		
	R45 10V W/ INVERSE 2 ± 0.5V	________		
	TP9 5 ± 0.5V	________		
	0 NMI RANGE 50 ± 2US	________		
	100 NMI RANGE 1.28 ± 0.1MS	________		
	R62 GAUSSIAN PULSE	________		
	R62 4 ± 0.5V	________		
	R62 3.5 ± 0.5us			
	SLS -9 ± 1DB	________		
3)	TIME OUT		________	________
	15 ± 3 MINUTES	________		

APPENDIX C

TAP-126A

Operation Procedure

1. Place the anti-radiation coupler, TAP-126A, over both transponder antennas by pulling the 'ring' to separate the spring loaded jaws. The TAP-126A must be centered over the antenna base and placed such that the EMI gasket material is compressed against the skin of the aircraft. Connect one of the TAP-126A cables to the test set. The TAP-126A cable not connected does not have to be terminated.

2. Conduct all transponder tests as before.

3. Diversity test - Mode S transponders only. After completing step 2 above, press 'test.' Continue to press 'test' until the diversity test shows in the display. After a short period of time, the display will show 'Diversity Pass' indicating a successful test or the display will show 'Diversity Fail' indicating the leakage from the active antenna to the tested antenna is greater than -20dB.

   Note: If the test shows 'Diversity Fail' repeat the test since this may be the result of an interrogation from a near-by secondary surveillance radar or other interference at the time the gate is open to receive the leakage signal.

4. Remove the TAP-126A cable from the test set and connect the other TAP-126A cable and repeat tests 2 and 3 above.

APPENDIX D

SERVICE AND TRAINING INFORMATION

Service

Repair, calibration and certification of TIC products is available at our facility at 728 Garden Street, Carlstadt, New Jersey 07072. Turn-around time varies but is generally within three weeks. Expedited quick turn-around is available on an individual basis, but the customer must contact TIC prior to returning the test equipment.

TIC charges an hourly rate for labor plus any parts necessary to repair the unit. Estimates will be provided prior to completing the repair if requested. TIC will also provide the customer with an estimate of average repair cost upon request.

TIC maintains a stock of repair parts for a minimum of five years after discontinuing a product. Generally, the parts that commonly fail are stocked until there is very little demand for them. Part numbers and descriptions are in the instruction manual. Price, availability, and placement of orders may be obtained by calling our Parts Department at (201) 933-1600 or by faxing (201) 933-7340. Parts shipments of stocked items are within 24 hours.

Training

TIC does not generally provide operator training. We feel there is more than adequate information in the instruction manual for a qualified technician to perform aircraft testing without special training. This is particularly true of the newer "smart" boxes which have automatic test sequences designed into the unit. Telephone assistance is available when necessary.

TIC does not generally provide service training. Experienced and trained avionic electronic technicians should be able to test, calibrate, and repair our instruments with the aid of the instruction book and, on occasion, telephone instructions from our technicians. TIC will quote on providing in-plant training for customers with special requirements.