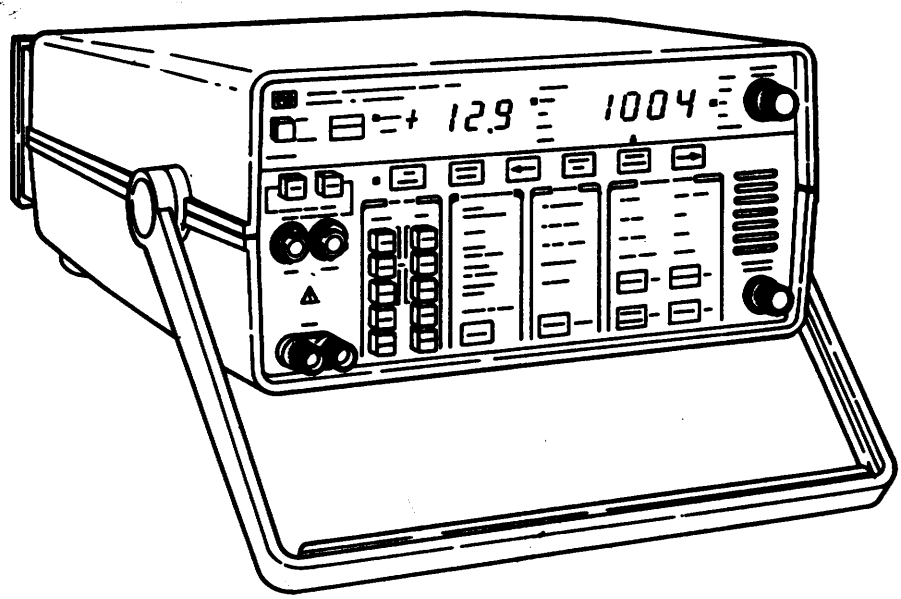
TM 11-6625-3186-24

TECHNICAL MANUAL

UNIT AND INTERMEDIATE DIRECT SUPPORT
AND GENERAL SUPPORT MAINTENANCE
MANUAL



TRANSMISSION TEST SET AN/USM-485 (NSN 6625-01-205-6492)

HEADQUARTERS, DEPARTMENT OF THE ARMY

15 MAY 1988

5 SAFETY STEPS TO FOLLOW IF SOMEONE IS THE VICTIM OF ELECTRICAL SHOCK

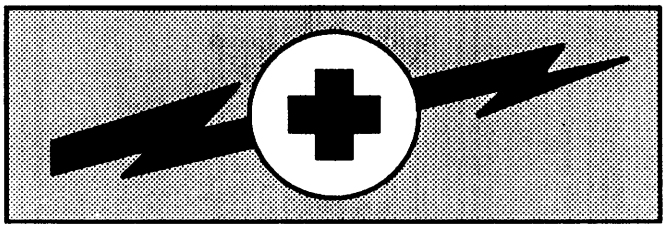
1. DO NOT TRY TO PULL OR GRAB THE INDIVIDUAL

2. IF POSSIBLE, TURN OFF THE ELECTRICAL POWER

3. IF YOU CANNOT TURN OFF THE ELECTRICAL POWER, PULL, PUSH, OR LIFT THE PERSON TO SAFETY USING A DRY WOODEN POLE OR A DRY ROPE OR SOME OTHER INSULATING MATERIAL

4. SEND FOR HELP AS SOON AS POSSIBLE

5. AFTER THE INJURED PERSON IS FREE OF CONTACT WITH THE SOURCE OF ELECTRICAL SHOCK, MOVE THE PERSON A SHORT DISTANCE AWAY AND IMMEDIATELY START ARTIFICIAL RESPIRATION



WARNING

HIGH VOLTAGE

is used in the operation of this equipment

DEATH ON CONTACT

may result if personnel fail to observe safety precautions

Never work on electronic equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment and who is competent in administering first aid. When technicians are aided by operators, they must be warned about dangerous areas.

Be careful not to contact high-voltage connections of 115-volt ac input when installing or operating this equipment.

Whenever the nature of the operation permits, keep one hand away from the equipment to reduce the hazard of current flowing through vital organs of the body.

WARNING

Do not be misled by the term “LOW VOLTAGE.” Potentials as low as 50 volts may cause death under adverse conditions.

For Artificial Respiration refer to FM 21-11.

CAUTION

THIS EQUIPMENT CONTAINS PARTS AND ASSEMBLIES SENSITIVE TO DAMAGE BY ELECTROSTATIC DISCHARGE (ESD). USE ESD PRECAUTIONARY PROCEDURES WHEN TOUCHING, REMOVING OR INSETING PRINTED CIRCUIT BOARDS.

ESD CLASS 1

NOTE

The symbol for static sensitive devices in military inventory is as depicted in the caution block above.

GENERAL HANDLING PROCEDURES FOR ESDS ITEMS

- USE WRIST GROUND STRAPS OR MANUAL GROUNDING PROCEDURES
- KEEP ESDS ITEMS IN PROTECTIVE COVERING WHEN NOT IN USE
- GROUND ALL ELECTRICAL TOOLS AND TEST EQUIPMENT
- PERIODICALLY CHECK CONTINUITY AND RESISTANCE OF GROUNDING SYSTEM
- USE ONLY METALIZED SOLDER SUCKERS
- HANDLING ESDS ITEMS ONLY IN PROTECTED AREAS

MANUAL GROUNDING PROCEDURES

- MAKE CERTAIN EQUIPMENT IS POWERED DOWN
- TOUCH GROUND PRIOR TO REMOVING ESDS ITEMS
- TOUCH PACKAGE OF REPLACEMENT ESDS ITEM TO GROUND BEFORE OPENING
- TOUCH GROUND PRIOR TO INSERTING REPLACEMENT ESDS ITEMS

CAUTION

Devices such as CMOS, NMOS, MNOS, VMOS, HMOS, thin-film resistors PMOS, and MOSFET used in many equipments can be damaged by static voltages present in most repair facilities. Most of the components contain internal gate protection circuits that are partially effective, but sound maintenance practice and the cost of equipment failure in time and money dictate careful handling of all electrostatic sensitive components.

The following precautions should be observed when handling all electrostatic sensitive components and units containing such components.

CAUTION

Failure to observe all of these precautions can cause permanent damage to the electrostatic sensitive device. This damage can cause the device to fail immediately or at a later date when exposed to an adverse environment.

STEP 1 Turn off and/or disconnect all power and signal source and loads used with the unit.

STEP 2 Place the unit on grounded conductive work surfaces.

STEP 3 Ground the repair operator using a conductive wrist strap or other device using a 1-M series resistor to protect the operator.

STEP 4 Ground any tools (including soldering equipment) that will contact the unit. Contact with the operator's hand provides a sufficient ground for tools that are otherwise electrically isolated.

STEP 5 All electrostatic sensitive replacement components are shipped in conductive foam or tubes and must be stored in the original shipping container until installed.

STEP 6 When these devices and assemblies are removed from the unit, they should be placed in the conductive work surface or in conductive containers.

STEP 7 When not being worked on, wrap disconnected circuit boards in aluminum foil or in plastic bags that have been coated or impregnated with a conductive material.

STEP 8 Do not handle these device unnecessarily or remove from their packages until actually used or tested.

TECHNICAL MANUAL
No. 11-6625-3186-24

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 15 May 1988

UNIT AND INTERMEDIATE DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL TRANSMISSION TEST SET AN/USM-485 (NSN 6625-01-205-6492)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or 2028-2 located in back of this manual direct to: Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSEL-ME-MP, Fort Monmouth, New Jersey 07703-5000.

In either case, a reply will be furnished to you.

TABLE OF CONTENTS—Continued

HOW TO USE THIS MANUAL

This manual tells you about your Transmission Test Set AN/USM-485 and contains instructions about how to use it during maintenance on other electronic equipment.

The technical manual for the electronic equipment you are maintaining will tell you where to make certain connections and when to use various accessories which are part of the AN/USM-485.

When you first receive your AN/USM-485, start at the front of the manual and go all the way through to the back. Become familiar with every part of the manual and the AN/USM-485.

This manual has an edge index which will help you find specific information in a hurry. Simply spread the pages on the right edge of the manual until the printed blocks can be seen. Open the manual where the block on the edge of the page lines up with your selected topic printed on the front cover block.

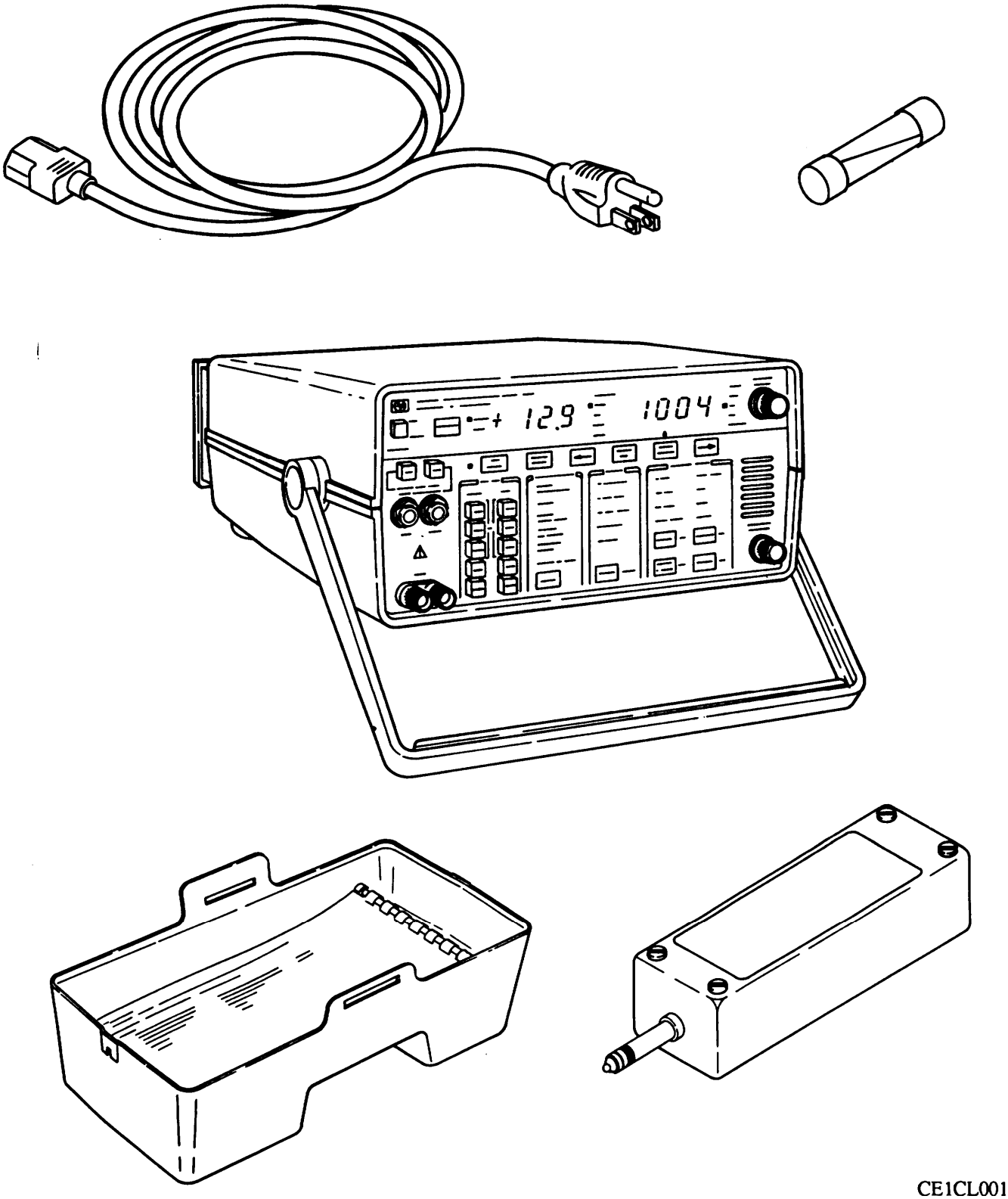


Figure 1-1. Transmission Test Set AN/USM-485.

CHAPTER 1
INTRODUCTION

Section I. GENERAL INFORMATION

1-1. SCOPE.

a Type of Manual: Unit, Intermediate Direct Support and General Support Maintenance Manual.

b. Equipment Name and Model Number: Transmission Test Set AN/USM-485.

c. Purpose of Equipment: The Transmission Test Set AN/USM-485 is designed to measure wideband data and voice impairments on transmission lines.

1-2. CONSOLIDATED INDEX OF ARMY PUBLICATIONS AND BLANK FORMS.

Refer to the latest issue of DA Pam 25-30 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

1-3. MAINTENANCE FORMS, RECORDS, AND REPORTS.

a. Reports of Maintenance and Unsatisfactory Equipment. Department of the *Army* forms and procedures used for equipment maintenance will be those prescribed by DA Pam 738-750 as contained in the Maintenance Management Update.

b. Report of Packaging and Handling Deficiencies. Fill out and forward SF 364 (Report of Discrepancy (ROD)) as prescribed in AR 735-1l-2/DLAR 4140.55/NAVMATINST 4355.73 B/AFR400-54/MCO 4430.3H.

c. Discrepancy in Shipment Report (DISREP)(SF 361). Fill out and forward Discrepancy in Shipment Report (DISREP)(SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33C/AFR 75-18/MCO P4610.19D/DLAR 4500.15.

1-4. DESTRUCTION OF ARMY MATERIEL.

Destruction of Army materiel to prevent enemy use is described in TM 750-244-2.

1-5. PREPARATION FOR STORAGE OR SHIPMENT.

Preparation instructions for storage and shipment are found in Chapter 2, Section V.

1-6. SAFETY, CARE, AND HANDLING.

Observe all WARNINGS, CAUTIONS, and NOTES in this manual. This equipment can be extremely dangerous if these instructions are not followed.

1-7. NOMENCLATURE CROSS-REFERENCE LIST.

Common names will be used when the Transmission Test Set ANA/USM-485 is mentioned in this manual.

NOTE

Official nomenclature must be used when filling out report forms or looking up technical manuals.

Common Name	*Official Nomenclature*
Transmission Test Set	Transmission Test Set AN/USM-485
AN/USM-485	Transmission Test Set AN/USM-485

1-8. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR).

If your Transmission Test Set needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about the design. Put it on an SF 368 (Quality Deficiency Report). Mail it to us at: Commander, US Army Communications Electronics-Command and Fort Monmouth, ATTN: AMSEL-PA-MA-D, Fort Monmouth, New Jersey 07703-5000. We'll send you a reply.

1-9. WARRANTY INFORMATION.

The Transmission Test Set is warranted by Hewlett-Packard Company for 12 months. Warranty starts on the date of shipment to the original buyer. Report all defects in material or workmanship to your supervisor who will take appropriate action.

1-10. LIST OF ABBREVIATIONS.

This list identifies abbreviations and descriptions that are used in this manual.

dBrn	dB relative to noise
MUX	Multiplexer
P/AR	Peak/Average Ratio
QRMS	Quasi Root Mean Square
µP	Microprocessor

Section II. EQUIPMENT DESCRIPTION AND DATA

1-11. EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES.

a. *CHARACTERISTICS.*

- Provides means for test of voice and data lines.
- Allows for:

  Level and frequency measurements.
  Message circuit noise measurements.
  Noise and noise with tone measurements.
  Signal to noise measurements.
  Single frequency interference monitoring.
  Impulse noise measurements.
  Noise to ground measurements.
  Peak to average ratio measurements.

- Designed for bench top use.

b. CAPABILITIES AND FEATURES.

- Battery operation allows for 2.5 hours of portable use.
- Pushbutton control allows for easy operation of equipment
- Annunciator lights on front panel for constant equipment status.
- Four digit LED for frequency and count display.
- Three digit LED for amplitude, time, and threshold display.
- Internal Battery charger with CHG indicator.

1-12. EQUIPMENT DATA.

Refer to TM 11-6625-3186-10, Section I for this information.

Section III. PRINCIPLES OF OPERATION

1-13. GENERAL FUNCTIONAL DESCRIPTION.

(Fig 1-2). The Transmission Test Set provides both the test signals and measurement capabilities required for testing the transmission characteristics of communications lines.

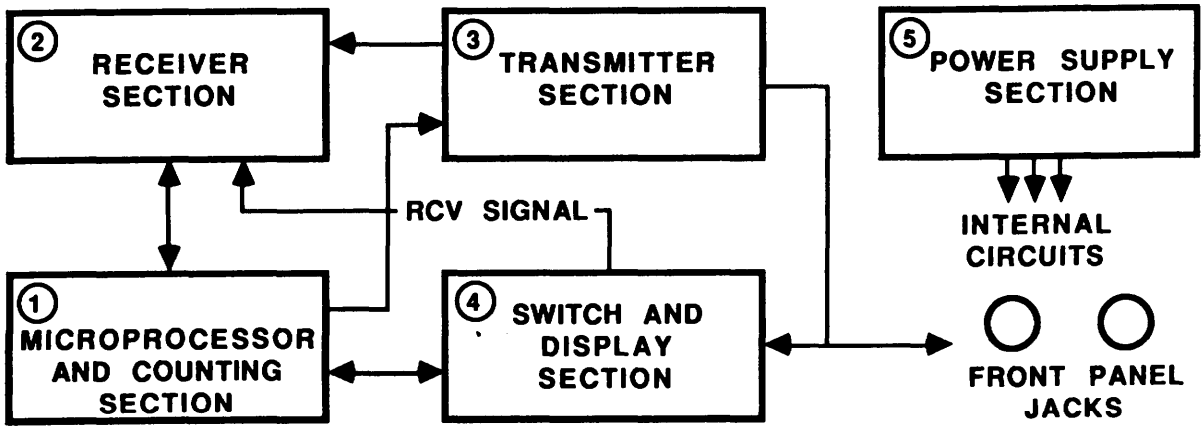


Figure 1-2. Transmission Test Set Simplified Block Diagram.

(1) The Microprocessor and Counting section processes data from the receiver, controls counting functions, and controls general operation of the instrument. This section provides control and sequencing functions for all measurements. The counting circuitry provides impulse noise detector processing, frequency measurement and drop-out detection.

(2) The Receiver section processes signals, monitors frequency levels, and provides signals to the microprocessor and counting circuits. AC input from the switch and display or transmitter is filtered and autoranged by the receiver. It detects full wave average or quasi-rms level of the signal Then a pulse stream with the frequency proportional to the level detected is sent to the microprocessor and counters. It also sends information to the microprocessor if the incoming signal exceeds preset thresholds.

(3) The Transmitter section generates test signals for making measurements. This section receives frequency and signal information from the microprocessor, synthesizes the appropriate waveform, and sends it out through the switch and display which provides a transmit monitor signal to the receiver. In several measurement modes the transmitter has no output signal but is quiet terminated.

(4) The Switch and Display section interfaces with communication lines and the operator. These circuits have four major functions:

- Provide data storage and drive for the segment display and the annunciator LEDs.
- Connect the front panel membrane switches to the microprocessor and counting circuits.
- Provide an audio amplifier and speaker, to monitor the received signal and beep generating circuit signal when a touch button is pressed.
- Connect the front panel jacks to the transmitter and receiver after selection of the proper impedances.

This section also provides dial connections and hold currents as required, and receiver termination selections are routed to the microprocessor and control circuits.

(5) The Power Supply provides power for internal circuitry. +5Vdc at 600mA and ±14Vdc at 200mA are supplied when in LINE SWITCH is in ON position, and the three internal batteries are charged when in STBY. When fully charge batteries provide 2.5 hours of portable operation.

1-14. DETAILED FUNCTIONAL DESCRIPTION (fig. FO-6).

(1) MICROPROCESSOR AND COUNTING (fig. 1-3). This section processes data from the receiver and controls counting functions and general operation of the Transmission Test Set, This section is contained on the following two circuit card assemblies:

- A13 Receiver Circuit Card Assembly (fig. F0-4).
- A14 Transmitter Circuit Card Assembly (fig. FO-5).

The center of the control circuitry is the microprocessor (A14U6). It has 4K bytes of onboard ROM, 128 bytes of RAM, a built in clock circuit, four 8 bit bidirectional I/O ports, and interrupt and timer functions. There are six major flows of information between the operator, the microprocessor, and the rest of the Transmission Test Set.

- Microprocessor to Transmission Test Set
- Transmission Test Set to Microprocessor
- Operator to Microprocessor
- Microprocessor to Operator
- Transmission Test Set to Operator
- Operator to Transmission Test Set

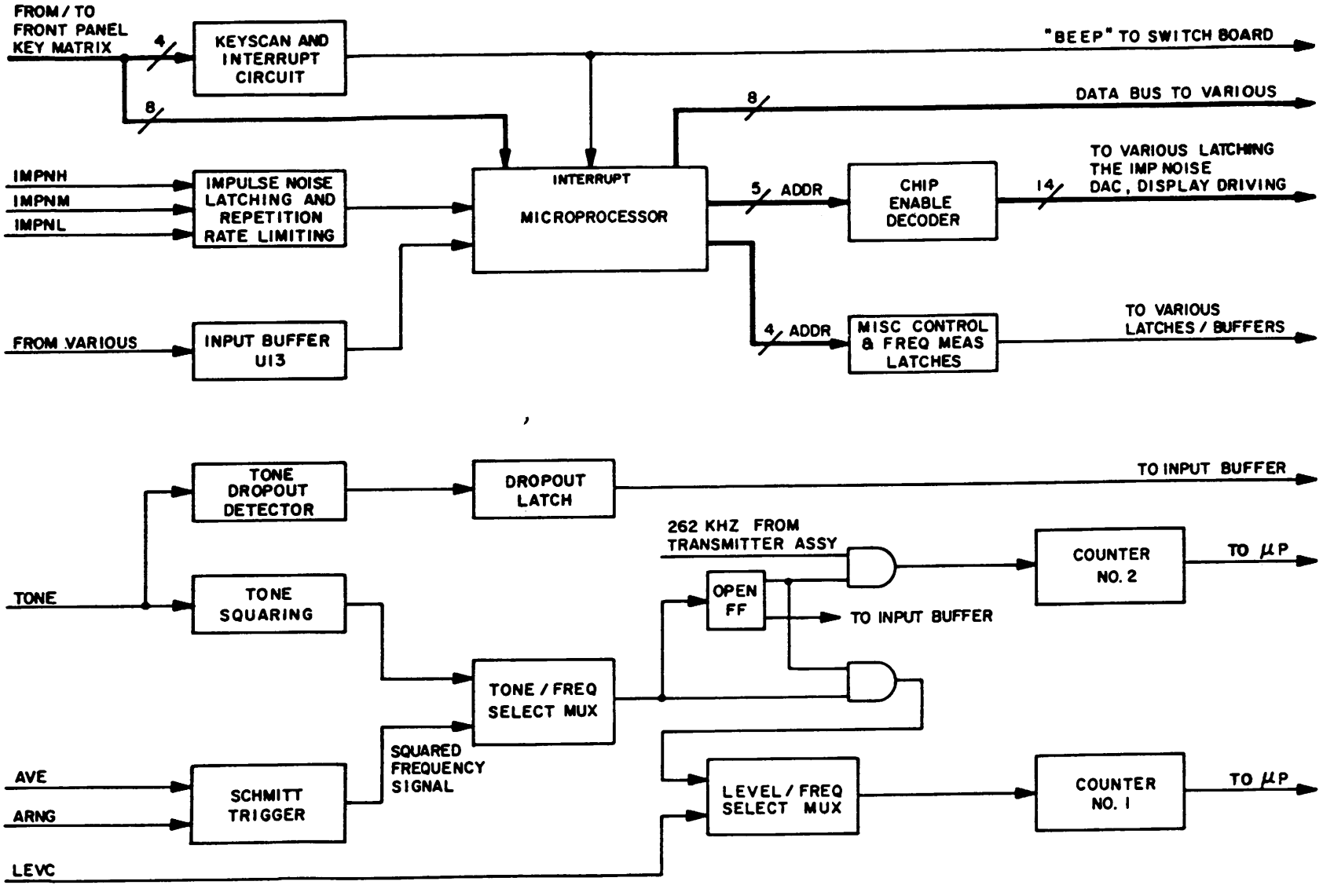
Microprocessor to Transmission Test Set. The microprocessor controls the Transmission Test Set through system latches. System latch data comes on the data bus from the processor I/O. The latch strobes are activated by the chip enable decoder via I/O port 4. Strobes for the latches are provided by the chip enable decoder A14U7 from inputs supplied by the microprocessor through output port 4. There are six system latches:

The phase-step latches (A14U26-A14U30) control the transmitter output frequency. They provide select lines for the output waveform and transmit monitor multiplexer.

The input select latch (A13U7) controls the setup of the input circuitry through analog switches. It selects the input source (balanced input, noise-to-ground, or transmit monitor), determines switching in or out of notch filter, and selects switching in or out of 25dB amp.

The filter select latch (A13U11) controls the filter select MUX which determines which filter is selected.

The autorange latch (A13U17) sets the autorange circuit gain through the autorange multiplexer (A13U39) and analog switch (A13U50).



CE1CL003

Figure 1-3. Microprocessor and Counting Block Diagram.

The detector select latch (A13U8) selects which detector to use for level measurements. It is also used by the diagnostic processor to check the impulse noise detector's digital-to-analog converter.

The impulse noise DAC latch (A13U6) sets the comparison thresholds for impulse noise measurements.

There are two additional latches used in the level and frequency measurement process. They are the miscellaneous control latch (A14U12) and the frequency measurement control latch (A14U11).

Transmission Test Set to Microprocessor. The Microprocessor receives inputs through the following latches and counters:

The option and miscellaneous sense latch provides the microprocessor with the following information:

- D0 reads the state of the open line during frequency measurement.
- D1 reads the state of the tone dropout latch.
- D2 and D3 read the receiver impedance setting from the front panel.
- D4, D5, and D6 read the Transmission Test Set option number.
- D7 is used with the diagnostic processor from the Diagnostic Service kit to enable the signature analysis routines.

The level and frequency measurement counters numbers 1 (A14U9) and 2 (A14U10).

The impulse noise latches perform two functions for each of 3 threshold signals from the receiver. Non-retriggerable monostable one-shots (A14U2 and U3) limit the count rate to 8 per second. Edge triggered latches (A14U4, U5, and U48) hold the count for the microprocessor. The microprocessor reads the latches through I/O port 5 and resets them through I/O port 4.

In addition, the microprocessor has internal circuitry which senses power up and causes a reset. Reset can also be caused by grounding the processor reset line.

Operator to Microprocessor. The operator signals the microprocessor using the following methods:

Keyboard Interrupt. The microprocessor senses operator commands through I/O port O, its own interrupt line, and the keyscan interrupt circuitry. The eight lines of microprocessor I/O port O form a four by four key matrix on the front panel. The four least significant bits of this port feed into NAND gate A14U20. When a hex "OF" is written into the keys, a key closure causes an interrupt via external interrupt of the microprocessor. A 50 millisecond one-shot (A14U3) and a D type flip-flop (A14U5) form the switch debounce circuitry. Bit 2 of I/O Port 5 is programmed by the microprocessor to reset the interrupt latch after the key has been read.

Receiver Impedance Switches. The receiver impedance selected on the front panel setup switches is sensed through the option and miscellaneous sense latch. The microprocessor uses the receiver impedance to compute the power level of the input signal.

When the Transmission Test Set is in BRG receive impedance mode, the receiver has a high impedance input. However, the received level is still computed from the input voltage per the receive impedance selected on the setup switches. For correct level measurement, the proper receive impedance MUST BE SELECTED.

Microprocessor to Operator. The microprocessor signals the Operator using the following methods:

Displays. The microprocessor sends information to the operator through the front panel numeric displays and annunciators (A2). The displays and annunciators are driven by two display decoder/drivers (A2U2 and U3) which provide all multiplexing and drive requirements. The display or the annunciator decoder/drivers are selected by the chip enable decoder (A14U7) outputs DISP (CEO) or ANNUN (CE1) A0 of I/O port 4. If control or data is input to the display chips through the system data bus from 1/0 port 1, the microprocessor writes to the display system chips by sending a control word to the chip (AO = LOGIC O AND CEI OR CEO PULSING).

Transmission Test Set to Operator. There are two lines of communication from the Transmission Test Set to the operator, note that neither is microprocessor controlled.

Monitor Amp. An audio amplifier (A2U6) and speaker A2SP1) are provided to monitor the test signal being measured by the Transmission Test Set receiver. The monitor amplifier (A2U7) takes its input from the output of the receiver autorange circuit.

Beep Generator. The beep circuit located on the switch and display provides audio feedback to alert the the operator when a membrane switch closure has been sensed. Whenever a front panel membrane switch is pressed, the keyboard interrupt circuitry provides both an interrupt for the microprocessor and a pulse causing an audible beep from the monitor amplifier and speaker.

Operator to Transmission Test Set. There are several operator commands which cannot be sensed by the microprocessor including the input NOR and REV buttons, the set up buttons (excluding RCV impedance select), the OUTPUT LEVEL control, and the MONITOR VOLUME control. Front panel, and switch and display contain all operator controls.

Miscellaneous Analog Circuitry: The Schmitt trigger circuit (A14U24 and U25) squares the incoming signal during frequency measurements. Schmitt trigger hysteresis is required for good noise rejection. The amount of hysteresis is proportional to the average detector output to provide wider hysteresis for larger signals.

Tone Squaring and Tone Dropout Circuitry: The 1004 Hz tone dropout and squaring circuitry (A14U25) measures the 1004 Hz frequency tone in noise-with-tone, signal-to-noise, or impulse noise measurements, and detects drops in the tone signal below 45dB. Because the notch filter (A13U40 and U51) removes the 1004 Hz tone before autoranging, the tone signal is intercepted before the notch filter and amplified through a bandpass filter (A13U16).

To measure the hold tone of 1004 Hz in noise-with-tone, a squared 1004 Hz waveform is selected by the microprocessor. The microprocessor determines if the hold tone is present and above –46 ±2dBm as follows:

- The microprocessor sets the dropout latch through the frequency measurement and control latch (A14U11).
- The microprocessor waits for a short time.
- If a tone signal is present and above -46 dBm then the tone dropout detector will reset the tone dropout latch.
- The rnicroprocessor reads the tone dropout latch through the option and miscellaneous sense latches to determine if the tone dropout latch was reset.
- If the tone dropout latch was not reset, the microprocessor writes ERR 7 to the right-hand display (A2).

(2) RECEIVER (fig. 1-4). This section contains all the circuits to do level measurements, background noise measurements and impulse noise measurements. All measurements are done by amplification, filtering and detection of the received signal. This section is contained on the following circuit card assembly:

- Al3 Receiver Circuit Card Assembly (fig. FO-4).

The receiver section can be divided into the following major circuits:

- Input Select/notch filter/25dB amp
- Noise filter
- Autorange amplifier
- Level detectors
- Impulse noise detectors

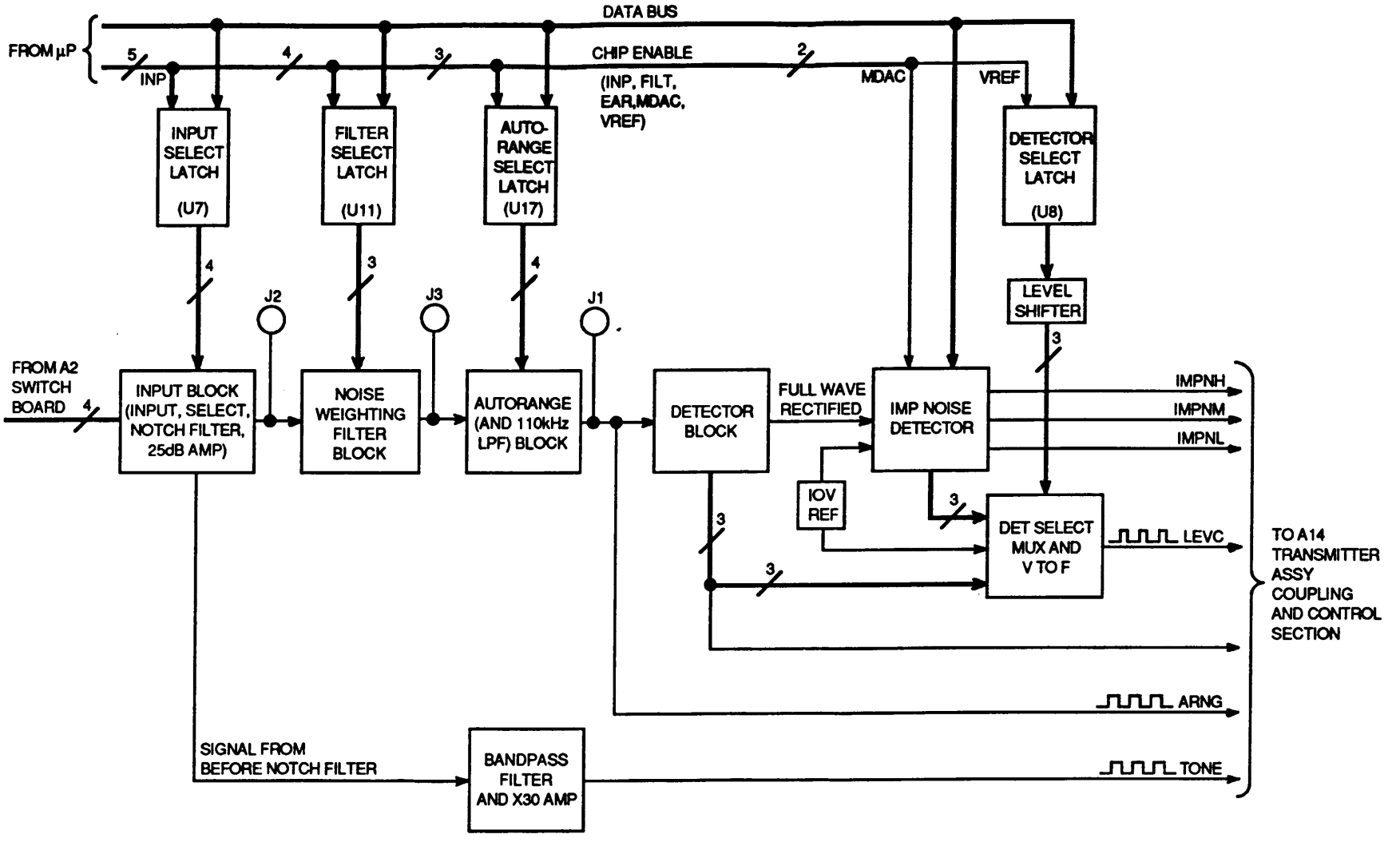


Figure 1-4. Receiver Block Diagram.

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Input Select/Notch Filter/25dB Amp:

Input Filter: The Transmission Test Set receiver can select any of 3 inputs:

- A balanced input through the receiver input transformer (A13T1).
- The noise-to-ground input which senses common mode noise on the input.
- The transmit monitor path which allows the receiver to measure the transmitted signal. Transient protection is provided.

  An analog switch (A13U34) enables selection of either receiver signal or transmitter signal. Each signal can be routed through or by pass the notch filter.

Notch Filter: The notch filter consists of three, second order biquad notch filters. The first has the zero located at 995 Hz. The second has the zero at 1010 Hz. The third has the zero at 1025 Hz.

25dB Amplifier: Amplification (A13U42) is dependent on the amplitude of the received signal, and may be bypassed by the microprocessor. A buffer amplifier delivers the signal to the weighting filters.

Tone Monitor/1010 Bandpass Filter: The tone monitor path detects the holding tone loss in measurements. The signal is bandpass filtered, amplified and sent to the transmitter.

Noise Filter Circuitry. There are 6 noise weighting filters:

- *C-Message Filter:* The C-Message filter consists of five second order networks. The first section is a high-pass network, the second is a band-pass, and the third fourth and fifth are low-pass networks. Filter gain at lKHz is OdB.
- *Program Filter:* This filter has three second order low pass cascaded sections and one, second order high pass.
- *3KHz Filter:* This is a second order Butterworth low pass filter. The 3dB frequency is 3KHz.
- *15KHz Filter:* This filter is a second order Butterworth low pass falter. The 3dB frequency is 15KHz.
- *50KBit Filter:* This filter consists of a high pass network, two low pass networks and a low pass network with a notch. It has a 3.3dB attenuation at 30KHz.
- *P/AR Filter:* The P/AR filter consists of two band pass falters connected in series. The pole and zero frequencies are identical in both stages. The gain, at 1300Hz in the first section, is 5.61dB. In the second stage the gain is 4.78dB.

The microprocessor controls the filter multiplexer's selection of the desired signal from the different filter outputs and routes it through a buffer amplifier (Al3U48) to the autorange circuit

Autorange Amplifier:

The autorange circuit amplifies signals up to 60dB in 10dB steps, or attenuates them by 10dB. The various gain states are software controlled. Selection of the correct state is determined by measuring the detector output voltage and changing the gain in 10dB steps until the detector output falls within the dynamic range of the detector.

150KHz Low Pass Filter The properly amplified signal is routed through the 150KHz filter (3dB). This filter is a sixth order Butterworth low pass filter. It is comprised of three second order stages connected in series.

Level Detectors:

Detector Circuit: The detector circuits convert AC inputs to DC output levels proportional to the input signal level. The Transmission Test Set uses three different detectors: Fullwave average, QRMS, and a P/AR Peak Detector. All of the detectors require a full wave rectified signal.

The full wave rectifier (A13U21) combines the input ac signal with a halfwave rectified signal of twice the peak amplitude to produce a full wave rectified signal.

The average detector (A13U20) takes the full wave rectified signal and low pass filters it to produce a DC level output.

The QRMS detector (A13U23) sums the peak and the average voltage signals. Different scaling factors are used for the peak and average levels, making the output of the Quasi-RMS detector approximately equal to the RMS value of the input waveform.

The P/AR peak detector uses the full wave rectifier (A13CR28-31), a non-inverting buffer and a peak detector (A13U57) to produce a DC level equal to the peak input voltage. The time constant of this detector is approximately one second.

An analog multiplexer (A13U13) selects the desired detector signal and sends it to the voltage-to-frequency converter (A13U3). At this stage the DC level is converted into a frequency measured by the control circuitry associated with the microprocessor. The displayed signal level is computed by the microprocessor according to the receiver impedance selected on the front panel. Although the voltage-to-frequency converter possesses excellent linearity, it lacks absolute accuracy. By measuring the voltage-to-frequency characteristics of the accurate 10 volt reference the required accuracy is obtained.

Impulse Noise Detectors:

The impulse noise detectors compare the full wave rectified signal from the detector circuitry with the preset high mid and low thresholds. When the full wave rectified signal exceeds any preset threshold, that threshold comparator sends a signal to the control and counting section impulse noise latches. The preset thresholds are set as follows:

- The tens digit of all thresholds is set by scaling the input voltage by setting the proper autorange state.
- The ones digit of the low threshold is set by the impulse noise digital to analog convertor and the 10 volt reference.
- The mid and high thresholds are automatically set at +4 and +8dB higher than the low threshold by a voltage divider.

Open collector comparators do the comparisons and send individual signals for high, mid, and low thresholds to the receiver.

(3) TRANSMITTER (fig. 1-5). This section is responsible for digitally synthesizing the Transmission Test Set output signal. It takes inputs from the microprocessor through the data bus I/O port 1 which determines the frequency and type of output waveform. The transmitter circuit supplies outputs through a transformer to the switch and display for the output 310 jacks and to the receiver circuit to internally monitor the transmitted signal through the transmitter monitor loop-around path. This section is contained on the following circuit card assembly:

- A14 Transmitter Circuit Card Assembly (fig. FO-5).

The transmitter section can be divided into the following major circuits:

- Transmit Clock Generator
- Phase Address Generator
- ROM and Latches
- Digital to Analog Conversion
- Filter and Signal Select
- Loop Around Circuit
- Output Amplifier Circuit
- Transmit Impedance/Hold/Dial/Output Routing

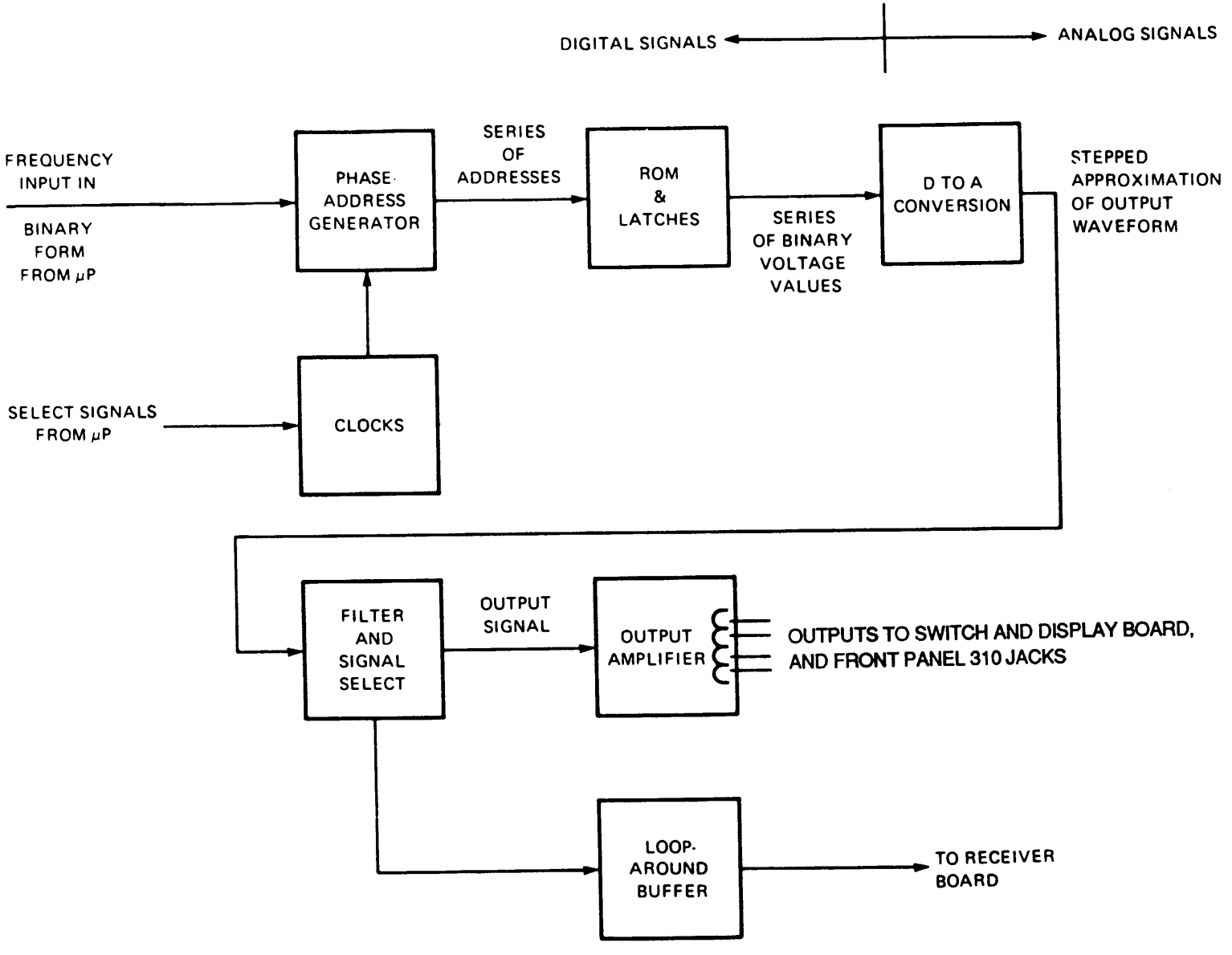


Figure 1-5. Transmitter Block Diagram.

Transmit Clock Generator: The transmit clock generator provides the proper clock frequency to the phase address generator, waveform ROM and ROM latches. It also provides a 262KHz signal to the microprocessor and counting circuit where it is used when measuring frequency.

Sine and P/AR clocks are provided as well as a multiplexer (A14U30). The P/AR sine select signal from A14U26 pin 1 (low = sine clock selected) determines which clock is enabled.

Phase Address Generator: The phase-step latches (A 4U26-30) hold the binary value of the frequency. This value changes only if the frequency is changed The adders (A14U34-38) add the phase-step size (the binary frequency value) to the old phase address to get a new phase address. The new phase address is latched into the phase address latch on the positive going transition of the clock line. The output of the phase address generator is a series of ROM addresses.

ROM and Latches: The ROM (A14U43) and latches convert the series of addresses from the phase address generator and into a series of binary voltage values which represent the output waveform. These values are held in the voltage value latches. This section unpacks the 8 most significant bits and the 2 least significant bits of voltage data so that the Digital to Analog converter can get the entire 10 bits at one time.

Digital to Analog Conversion: The digital-to-analog conversion circuit takes the binary voltages from the voltage value latches and converts them to a series of step voltages approximating the output waveform. Both the Digital to Analog converter (A14U33) and current-to-voltage converter (A14U21) are in this circuit. The current to voltage converter converts the output of the Digital to Analog converter to a series of voltage, not current values.

Filter and Signal Select: The output of the digital to analog conversion circuit is an approximation of the desired output. Unwanted high frequency components introduced by the step nature of the waveform must be filtered. The P/AR waveform is filtered by the 5KHz low pass filter (A14U51). The output select multiplexer (A14U40) selects the appropriate filter (or a ground input for “quiet termination”) as the input to the power amplifier (A14U42, Q5/6).

Loop Around Circuit: The loop-around circuit provides the signal path used by the Transmission Test Set receiver to monitor the transmitted signal in the display transmit mode. The circuit has two signal paths.

- The first is from the power amplifier output stage, through the loop adjust amplifier (A14U52), and the loop select MUX to the receiver.
- The second comes from the wideband low pass filter and goes directly through the MUX (A14U40) to A14J1 and the receiver. This path is used when the output is quiet terminated and the Transmission Test Set monitoring the fixed level sinewave being generated.

To suppress the loop-around signal, the transmit line is grounded through the loop select MUX. The loop select lines are the same as the output select MUX address lines. With quiet termination, the noise should be below 20mV.

Output Amplifier Circuit: The output power amplifier is an OP AMP driven complementary-symmetry output stage which provides the amplification necessary for a + 13dBm output level. The OUTPUT LEVEL control provides a full dynamic range of -40dBm to + 13dBm. The display blanks to a “+” sign to indicate the signal level is too high (overrange). When generating a P/AR waveform, the P/AR signal crest factor causes the output to overrange at +3dBm.

Transmit Impedance/Hold/Dial/Output Routing: The output amplifier circuit drives a transformer (A14T1) with balanced outputs at each of the 3 impedances. The proper transmitter impedance is set from the front panel TRMT impedance set up switches.

If selected, a transmit hold circuit is connected across the transmit output lines. Transmit dial and hold circuits are selected by the front panel TRMT set up switches (A2). Transmitter signal is routed to whichever front panel 310 jack is selected by the front panel NOR and REV switches (A2).

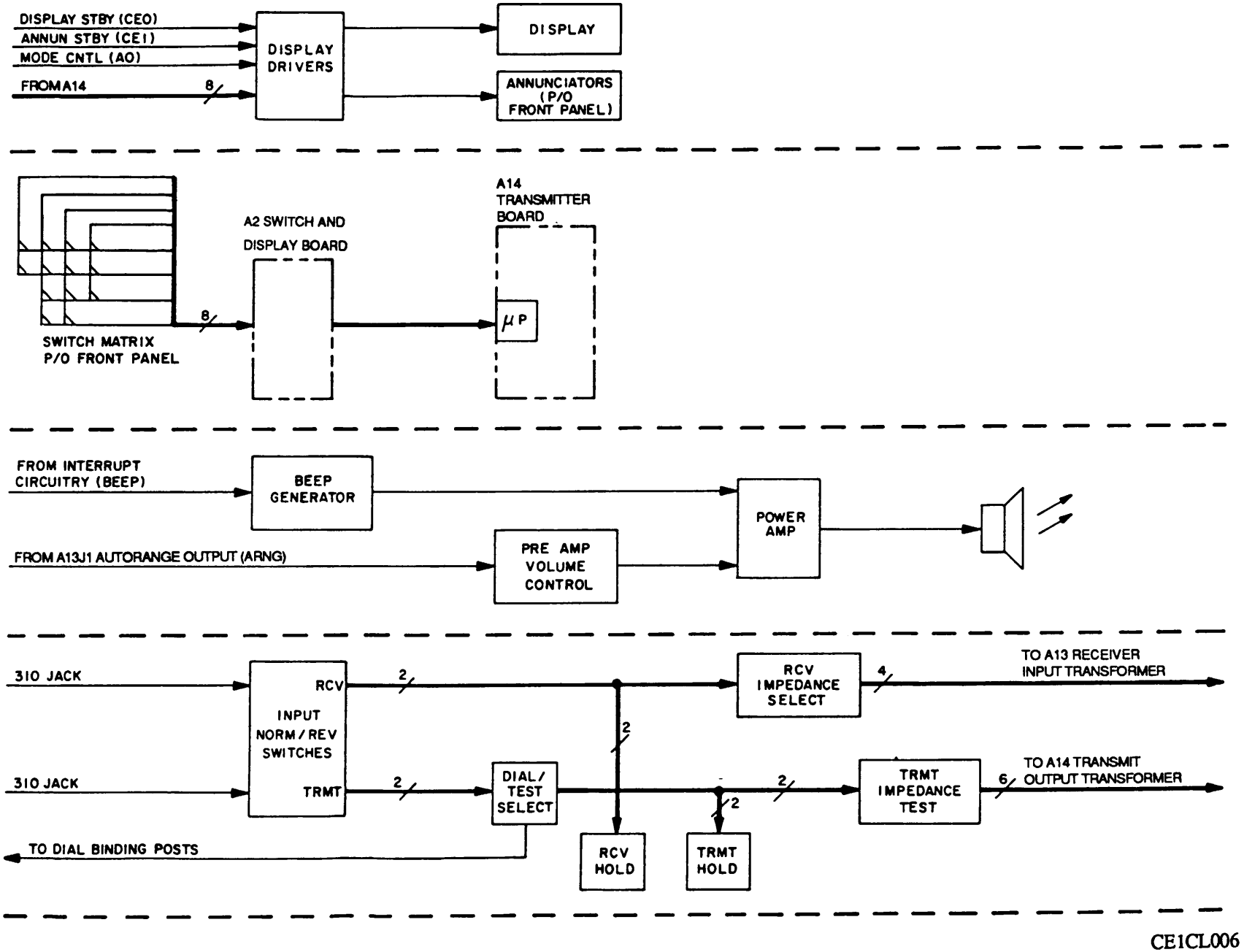


Figure 1-6. Switch and Display Block Diagram.

(4) SWITCH AND DISPLAY (fig. 1-6). This section is responsible for interfacing the operator with the internal circuits. This section is contained on the following circuit card assembly:

- A2 Switch and Display Circuit Card Assembly (fig. FO-2).

The switch and display section can be divided into the following major circuits:

- I/O Switching
- Hold Circuits

Input-Output Switching: The Transmission Test Set and telephone line to be tested are connected through the RCV/TRMT 310 jacks (A2J3/4). The NOR and REV buttons (A2W3) select switches select either the transmit or the receive function for the left 310 connectors, and the other function for the right 310 jack. In normal operation, only one of these ganged switches is in use at any one time. Engaging or disengaging both switches simultaneously creates a non-standard situation resulting in the transmitter being connected internally to the receiver (only at reversing switches, not through transmit monitor path).

Dial and Test With Hold: The Transmission Test Set has two hold coil circuits and a dial connector made up of two binding posts. The hold coil circuits sink 23 mA between tip and ring of a "wet" (dial-up) line to hold or "latch the line during testing. Failure to engage the hold coil circuit on a "wet" line indicates an "on-hook condition" causing the telephone switching equipment to drop the line under test. The dial terminals are accessed by engaging the TRMT DIAL button in the setup section. Engaging TRMT DIAL connects the DIAL posts directly to the tip and ring of the transmit 310 jack and to the circuit under test. After dialing the number for the circuit to be tested and engaging the TRMT HOLD switch, the dialed line is connected to the Transmission Test Set by disengaging the TRMT DIAL switch. The line can be transferred to the receive input by depressing the RCV HOLD switch and transferring the line using the NOR and REV switches.

Hold Circuit: The hold circuit sinks a constant current of 23 mA or greater under DC bias voltages of either polarity. This current is maintained with 46V into 1700 and draws less than 40mA with 53V into 400 Ω.

(5) POWER SUPPLIES. This section is responsible for supplying power for operation of the Transmission Test Set by AC line or internal batteries. This section is contained on the following circuit card assembly:

- AS Charger Circuit Card Assembly (fig. FO-3).
- A6 Rear Panel Assembly.
- A14 Transmitter Circuit Card Assembly (fig. FO-5).

The Power Supply section can be divided into the following major circuits:

- AC Power Supply Circuit (fig. 1-7)
- Battery Charger Circuit (fig. 1-8)

AC Power Supply Circuit: The AC power supplies provide +5V at 600mA and ±14V at ±200 mA to the rest of the Transmissicm Test set There are 3 major functional sections of the AC Power Supply:

- The AC power line supplies.
- The regulator sections.
- The overvoltage protection circuitry.

AC Line Supplies: The line module filters noise, has protective fuses, and sets the line voltage as ac line power is brought into the power supply. From the line module (A6FL1) AC power goes to the transformer (A6T1) which provides 10Vac (9-11) for the +5V supply and 35Vac (33-39) center tapped for positive and negative 14V supplies.

The 9-11 Vac secondary is full wave bridge rectified and is capacitively filtered to provide 10-14Vdc unregulated to the +5 volt regulator (A14Q4). The 35V C-T is full wave rectified and capacitively filtered to provide both ±19 to 27Vdc unregulated for the ±14Vdc supplies.

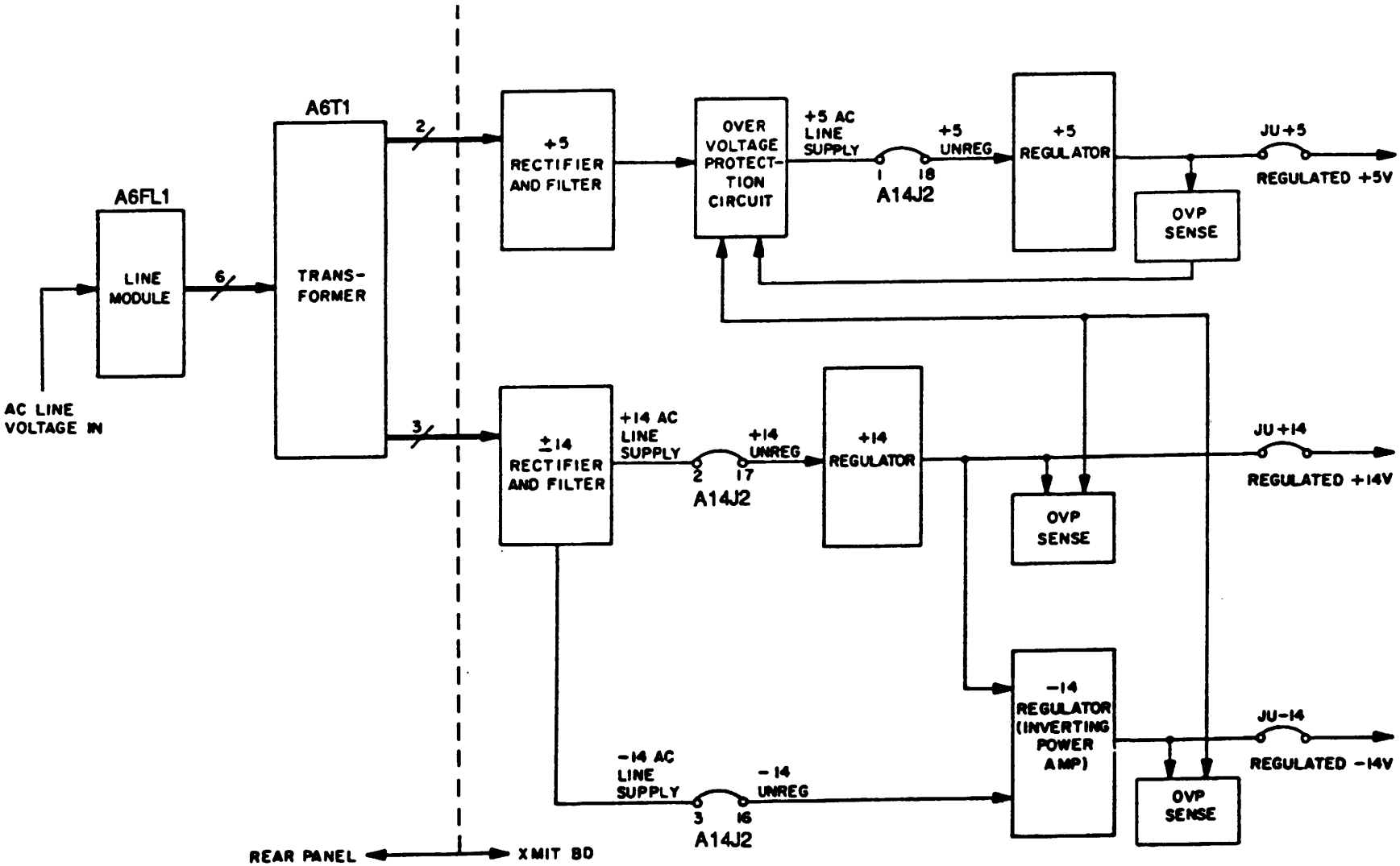


Figure 1-7. AC Power Supply Block Diagram.

Regulators: Separate regulator circuits are provided for +5V and ±14V supplies. The +5V and +14V regulators are similar in form. The -14V regulator tracks the +14V supply; it resembles a power amplifier with a gain of-1 with input from the +14 regulated supply.

+5 Regulators: The +5V supply is series regulated with a pass transistor (A14Q4) mounted on the rear panel. A regulator chip provides the reference voltage, an error amplifier, shut down circuitry, and base drive for the pass transistor. When the error amplifier senses that the output voltage is low it sinks current through the base of the pass transistor turning it on until the output voltage rises to an acceptable level.

+14V Regulator: The +14V regulator (A14Q3) has a +14 output voltage but otherwise is the same as the +5V regulator circuit.

–14V Regulator: The -14V regulator (A14Q1) resembles a unity gain inverting amplifier with drive in only the negative direction. Input comes from the +14V supply, so any malfunction in the +14V regulator supply will affect in the –14V regulated supply.

There are 2 unusual features in this power supply. First, a (local) zener voltage regulator provides the +Vcc supply for the OP AMP to avoid excessive supply voltage since the ±14Vac line supplies provide more than 36V between them. Second, a diode helps the OP AMP output to swing as close to the negative Vcc supply rail as possible.

Overvoltage Protection Circuit: The overvoltage protection circuit (A14CR24) checks the voltage at 4 points in the power supply and shorts the +14Vac line supply if any of these voltages exceed normal levels. The +5V regulated output, the +14V regulated output and the unregulated +5Vac line supply voltages are checked with simple zener diode-series resistor sense circuits. The -14V regulated output sense circuit (A14Q2) is more complex although it performs the same function. When any abnormally high voltage is sensed a triac shorts the +14Vac line supply and the inline fuse blows shutting the Transmission Test Set down.

Jumpers: There are two sets of jumpers in the power supply.

One set (A14JU+5, JU+14 and JU-14) isolates the regulated supply outputs from the rest of the Transmission Test Set. This allows troubleshooting the power supply, under no load conditions, without endangering the rest of the Transmission Test Set.

The other set of jumpers goes into the first 3 pins of A14J2. These isolate the AC line supplies from the regulators to allow troubleshooting the AC line supplies and the OVP circuit. In battery units A14J2 connects the batteries and charger to the AC line supplies and the regulators.

Charger Circuit: There are 3 primary functions of the Charger Circuit:

- It connects the charging current to the batteries.
- It connects the batteries to the unregulated side of the power supply. The Transmission Test Set must be unplugged to operate from the batteries.
- If any battery voltage goes too low or if the AC power cable is plugged in, the batteries are disconnected from the unregulated side of the power supply and the AC line supplies are connected.

Battery Charging: There are three battery packs to charge. The AC line supply provides the necessary current to charge the batteries when the unit is plugged in and turned to STBY. The batteries are regulated at approximately the C/10 rate for each battery so overcharge poses no problem. When the power switch is turned on, the charge current is reduced to a trickle charge. Thus, full charging of the batteries takes place only in STBY.

The +14V current source circuit is an example of the Transmission Test Set charging circuits. The full charge current is supplied by A5Q1 through R20. A5CR20-21 hold the voltage across A5R20 nearly constant which keeps the charge current nearly constant. When the Transmission Test Set is on, no base current flows through A5R23 so A5Q1 is off, and therefore A5R22 provides a trickle charge.

Power Source Selection: Battery power or AC line power to the unregulated power supplies is selected through a relay (A5K1). The battery supplies are selected by the relay whenever the batteries are charged the power switch is on, and the Transmission Test Set is unplugged. STBY mode switches the power to AC line power which sits at zero volts. If the battery voltages drop below ±15V and/or +5.75V, the relay will switch to AC line power, effectively shutting the Transmission Test Set off. Plugging in the Transmission Test Set automatically selects the AC line power independent of the power switch setting.

Relay Drive Circuitry: The relay drive circuitry controls the operation of the relay. A5Q2 energizes the relay when the battery option is selected. In this state A5Q3, R2, CR2, and R4 form a feedback loop keeping A5Q2 latched. The power switch input provides a transient to latch A5Q2(R5, Cl). This transient is the transition switch between +5V battery and ground. When the power switch is on, the latch latches. Turn the power switch off, the feedback loop is broken, and A5Q2 is turned off. The only input to the drive circuit is the inhibit signal (through A5Q4) that turns A5Q2 off and then turns on transient.

Inhibit Circuit: When the Transmission Test Set is connected to line voltage or if any battery voltage drops too low, the inhibit signal is activated.

To check the battery voltages, the 3 unregulated voltages are compared to reference voltages with open collector comparators. In battery mode these unregulated voltages will be battery voltages. The reference voltages are generated from the +14V regulated supplies.

Any of the comparators tripping will turn on the inhibit transistor A5Q5. Note that if the –14Vac line voltage is present, A5Q5 will be turned on through A5CR3. Note that the Low Battery Sense Circuit has a regulator for the power supplies formed by A5Q11 and Q9 because of the wide range of voltages seen at the ±14 volt unregulated supplies.

When the power switch is turned on, A5Q12 turns off. Current flow to A5R23 stops and the charging current turns off. A5Q12 is turned on by A5R21 and A5R24 in the STBY mode. In the on mode Q1O turns A5Q12 off. A5Q14 inverts the base current enabling the -14V battery to turn off.

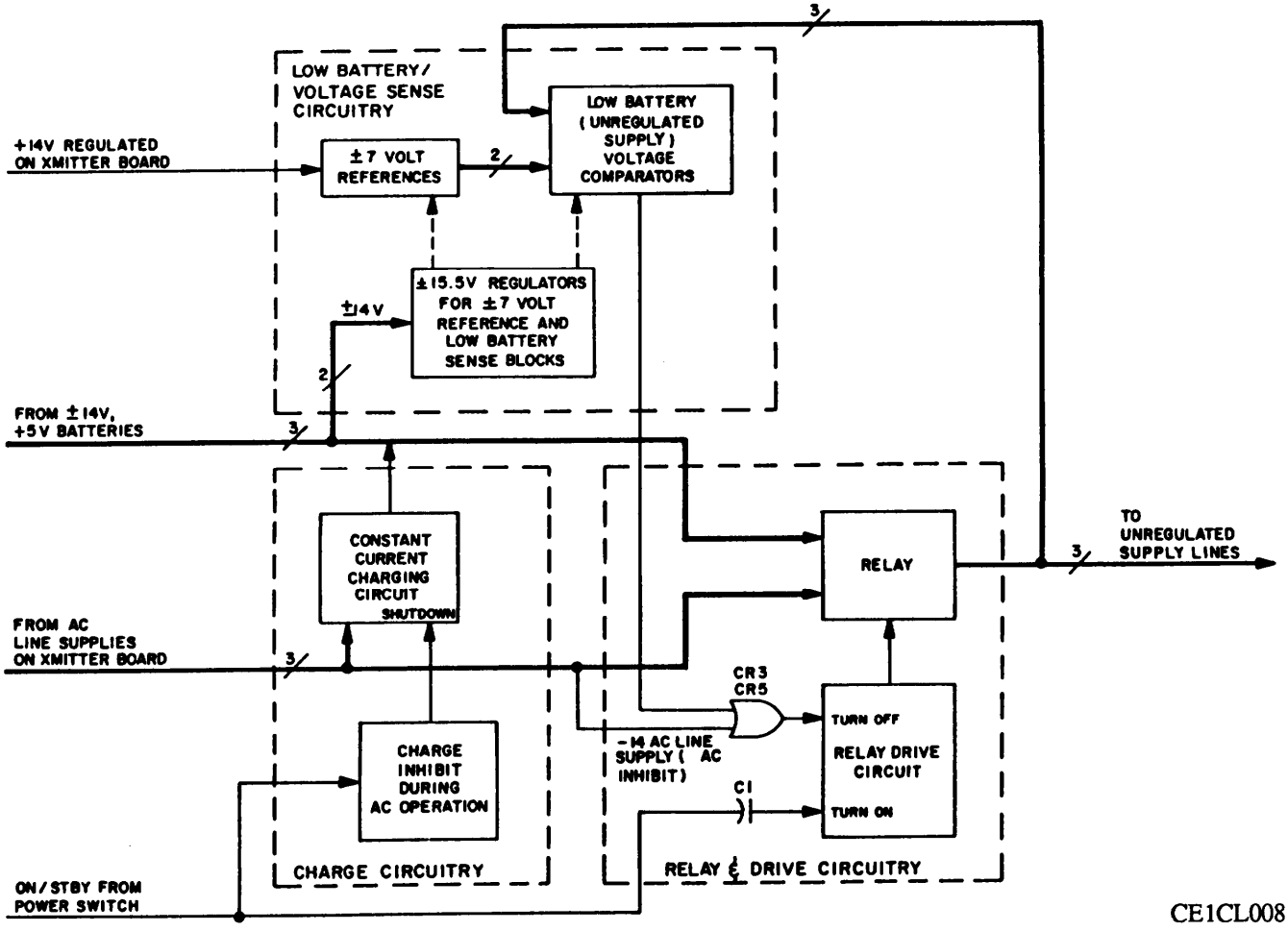


Figure 1-8. Battery Charger Block Diagram.

CHAPTER 2
UNIT MAINTENANCE INSTRUCTIONS

Section I. REPAIR PARTS, SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

2-1. COMMON TOOLS AND EQUIPMENT.

Common tools and equipment required for unit maintenance of Transmission Test Set are listed in the Maintenance Allocation Chart (MAC) (Appendix B).

2-2. SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT.

There are no special tools, TMDE, or support equipment required for unit maintenance.

2-3. REPAIR PARTS.

Repair parts are listed and illustrated in the Repair Parts and Special Tools List, TM 11-6625-3186-24P.

Section II. SERVICE UPON RECEIPT

2-4. SERVICE UPON RECEIPT OF MATERIAL.

a. *Unpacking.* Special design reusable packing material inside this shipping carton provides maximum protection for Transmission Test Set. Avoid damaging carton and packing material during equipment unpacking. Use the following steps for unpacking Transmission Test Set

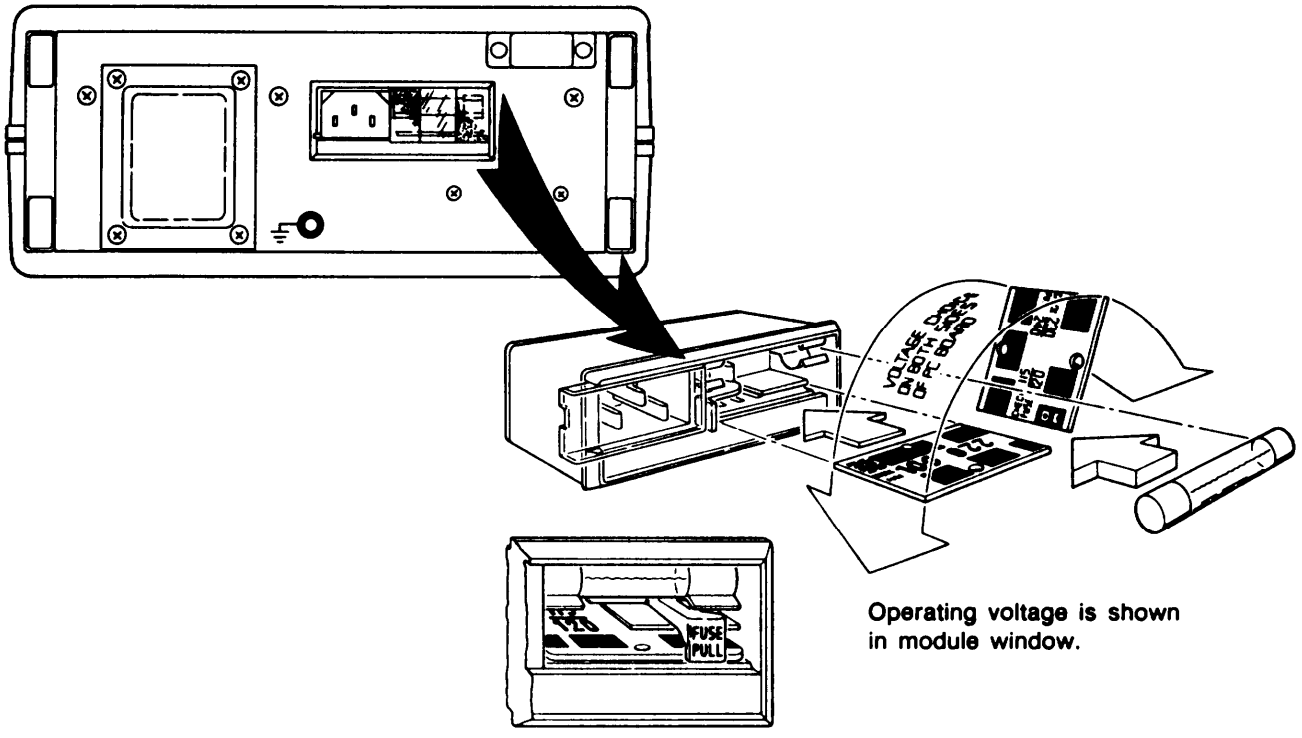
- Cut and remove paper sealing tape on carton top and open carton.
- Grasp Transmission Test Set firmly while restraining shipping carton and lift equipment and packing material vertically.
- Place Transmission Test Set and end cap packing material on a suitable flat clean and dry surface.
- Remove end cap packing material while firmly supporting Transmission Test Set.
- Remove protective plastic bag from Transmission Test Set. Place desiccant bags back inside protective plastic bag.
- Place protective plastic bag and end cap packing material inside shipping carton.
- Return shipping carton to supply system.

b. Checking Unpacked Equipment.

- Inspect the equipment for damage incurred during shipment. If the equipment has been damaged report the damage, on SF 364, Report of Discrepancy (ROD).
- Check the equipment against the packing slip to see if the shipment is complete. Report all discrepancies in accordance with the instructions of DA Pam 738-750.
- Check to see whether the equipment has been modified.

2-5. PRELIMINARY SERVICING AND ADJUSTMENT OF EQUIPMENT.

a. Remove Fuse (para 2-7). Check that fuse and voltage selection card are correct for the line voltage available in your area.



Input Voltage	PC Board Position	Fuse
90 to 105	100	0.5 amp
108 to 126	115/120	0.5 amp
198 to 231	220	0.25 amp
216 to 252	230/240	0.25 amp

b. Perform the turn on procedures in TM 11-6625-3186-10, Section IV.

c. After successful turn on, set POWER SWITCH to STBY. Verify power cable connected to rear panel power module. Verify front panel CHG indicator is on. Allow 17 hours to charge batteries. If battery fails to acceptor hold a charge, notify next higher level maintenance.

Section III. TROUBLESHOOTING

SYMPTOM INDEX

2-6. TROUBLESHOOTING TABLE.

Table 2-1 lists common malfunctions which you may find during operation or maintenance of the Transmission Test Set. You should perform the test/inspections and corrective actions in the order listed.

NOTE

This manual cannot list all malfunctions that may occur, nor all tests or inspections and corrective actions. If a malfunction is not listed or is not corrected by listed corrective actions, notify next higher level of maintenance.

Table 2-1. Troubleshooting.

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1. TRANSMISSION TEST SET DISPLAYS ERRORS.
Error message number O.
• Notify next higher level maintenance.
Error message number 1.
• Notify next higher level maintenance.
Error message number 2.
• Notify next higher level maintenance.
Error message number 3.
• Notify next higher level maintenance.
Error message number 4.
• Notify next higher level maintenance.
Error message number 5.
• Notify next higher level maintenance.
Error message number 6.
• Notify next higher level maintenance.
Error message number 7.
• Verify proper operating procedure (TM 11-6625-3186-10).
• Notify next higher level maintenance.

Table 2-1. Troubleshooting–Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1. TRANSMISSION TEST SET DISPLAYS ERRORS-Continued.
Error message number 8.
• Verify proper operating procedure (TM 11-6625-3186-10).
• Notify next higher level maintenance.
Any error message combination from numbers 6 to 0.
• Notify next higher level maintenance.
2. TRANSMISSION TEST SET NOT OPERATING ON BATTERY POWER.
Step 1. Set POWER SWITCH to STBY.
Plug in power cable.
Step 2. Check to see that CHG indicator is on.
• If CHG indicator is on, allow 17 hours to charge battery. If after 17 hours Transmission Test Set is still inoperable or will not operate 2.5 hours, notify next higher level maintenance.
• If CHG indicator is not on, proceed with step 3.
Step 3. Check to see if fuse is blown or broken.
• Replace fuse (para 2-7).
• If fuse checks good, notify next higher level maintenance.
Step 4. Observe display. Display contains error message.
• Go to malfunction number 1.
Display frozen or characters locked up.
• Notify next higher level maintenance.
Display completely dark.
• Notify next higher level maintenance.
3. TRANSMISSION TEST SET NOT OPERATING ON AC POWER.
Step 1. Check to see if fuse is blown or broken.
• Replace fuse (para 2-7).
• If fuse checks good, notify next higher level maintenance.
Step 2. Observe display. Display contains error message.
• Go to malfunction number 1.
Display frozen or characters locked up.
• Notify next higher level maintenance.
Display completely dark.
• Notify next higher level maintenance.

Section IV. MAINTENANCE PROCEDURES

2-7. REPLACE FUSE.

DESCRIPTION

This procedure covers: Remove. Install.

REMOVE

1. Working from the front panel, set POWER switch (1) to STBY.

2. Working from rear, unplug power cable (2).

3. Slide plastic window (3) overpower connector.

4. Pull fuse (4) out of fuseholder (5) using extractor (6).

5. Verify voltage selection card (7) and fuse (4) are related for line voltage being used (para 2-5).

INSTALL

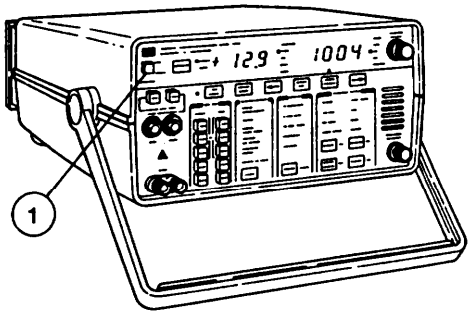
1. Working from rear, insert the fuse (4) into the fuseholder (5) and press into place.

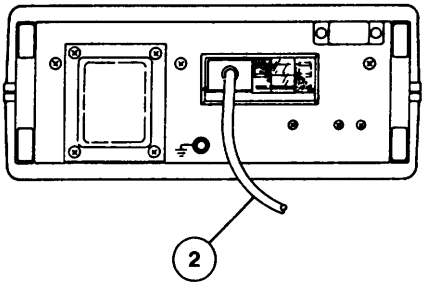
2. Position extractor (6) into place.

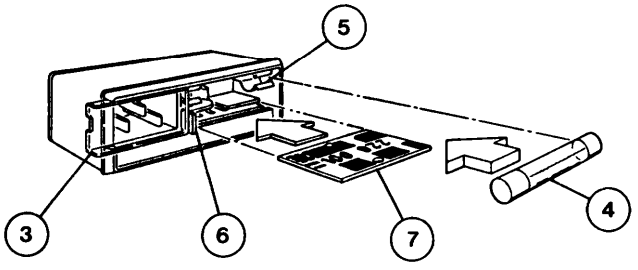
3. Slide plastic window (3) over fuseholder (5).

4. Replace power cable (2).

5. Working from front, set POWER switch (1) to ON.







END OF TASK

2-8. REPLACE FRONT PANEL CONTROL KNOBS.

DESCRIPTION

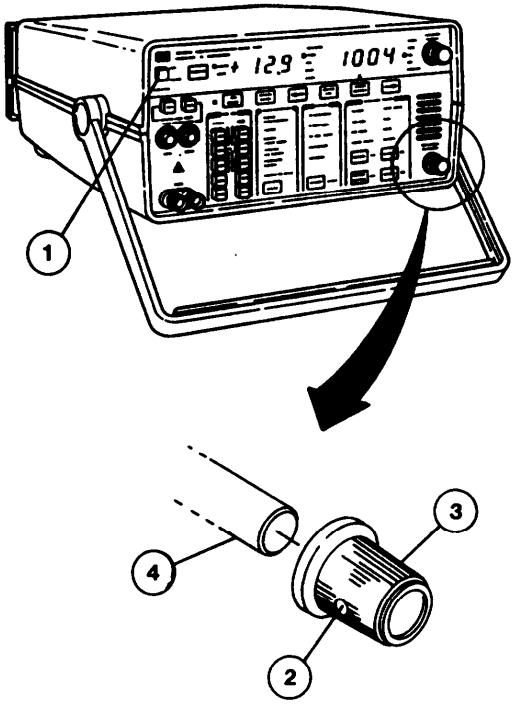
This procedure covers: Remove. Install.

REMOVE

1. Set POWER switch (1) to STBY.
2. Loosen two setscrews (2).
3. Pull knob (3) Off shaft (4).

INSTALL

1. Push knob (3) onto shaft (4).
2. Tighten two setscrews (2).
3. Set POWER switch (1) to on.



END OF TASK

Section V. PREPARATION FOR STORAGE OR SHIPMENT

2-9. PACKAGING.

Package Transmission Test Set in original shipping container. Refer to SB 38-100 for preservation, packaging, packing and marking materials. When using packing materials other than the original, use the following guidelines:

- Wrap Transmission Test Set in plastic packing material.
- Use double-wall cardboard shipping container.
- Protect all sides with shock-absorbing material to prevent Transmission Test Set from movement within the container.
- Seal the shipping container with approved sealing tape.
- Mark “FRAGILE’ on all sides, top, and bottom of shipping container.

2-10. TYPES OF STORAGE.

- Short-Term (administrative)=l to 45 days. Refer to TM 740-90-1 for administrative storage procedures.
- Intermediate=46 to 180 days.
- Long term=over 180 days. Before long term storage, operate in battery mode until completely discharged. After long term storage, perform Preliminary Servicing and Adjustment of Equipment (para 2-5). If battery fails to acceptor hold a charge, notify next higher level maintenance.

2-11. ENVIRONMENT.

The Transmission Test Set should be stored in a clean, dry environment. In high humidity environments, protect the Transmission Test Set from temperature variations that could cause internal condensation. The following environmental conditions apply to both shipping and storage:

Temperature	-40° C to +75° C (-40° F to +167° F)
Relative Humidity	less than 95%
Altitude	less than 15,300 meters (50,000 feet)

CHAPTER 3
INTERMEDIATE DIRECT SUPPORT MAINTENANCE INSTRUCTIONS

Direct Support Maintenance Not Authorized for Transmission Test Set AN/USM-485.

CHAPTER 4
INTERMEDIATE GENERAL SUPPORT MAINTENANCE INSTRUCTIONS

Section I. REPAIR PARTS, SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

4-1. COMMON TOOLS AND EQUIPMENT.

Common tools and equipment required for general support maintenance of Transmission Test Set AN/USM-485 are listed in the Maintenance Allocation Chart (MAC), Appendix B.

4-2. SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT.

Special tools, TMDE, and support equipment required for general support maintenance of Transmission Test Set ANAJSM-485 are listed in the Maintenance Allocation Chart (MAC), Appendix B. Special tools are listed and illustrated in Repair Parts and Special Tools List, TM 11-6625-3186-24P.

4-3. REPAIR PARTS.

Repair parts are listed and illustrated in the Repair Parts and Special Tools List, TM 11-6625-3186-24P.

Section II. SERVICE UPON RECEIPT

4-4. SERVICE UPON RECEIPT OF MATERIAL.

a. Unpacking. The Transmission Test Set is packed in its own shipping carton. Unpack the equipment as follows:

- Open shipping carton and remove equipment.
- Place equipment on a suitable clean and dry surface for inspection.
- Keep all shipping materials for use in repacking and reshipping.

b. Checking Unpacked Equipment.

- Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, report the damage on SF 364, Report of Discrepancy (ROD).
- Check the equipment against the packing slip to see if the shipment is complete. Report all discrepancies in accordance with the instructions of DA Pam 738-750.
- Check to see whether the equipment has been modified.

4-5. PRELIMINARY SERVICING AND ADJUSTMENT OF EQUIPMENT.

a. Perform Preliminary Servicing and Adjusting of Equipment (para 2-5) for Unit Maintenance.

b. Complete performance tests (para 4-18).

Section III. TROUBLESHOOTING

SYMPTOM INDEX

Transmission Test Set

4-6. GENERAL.

Troubleshooting at the intermediate general support maintenance level requires you to locate any malfunction as quickly as possible. The amount of troubleshooting you can do is based on what the Maintenance Allocation Chart says you can fix. Because of this, the only trouble symptoms you will find here are those that could be caused by faulty items you can fix.

NOTE

Before using the troubleshooting table, check your work order and talk to unit maintenance, if possible, for a description of the symptoms and the steps that have been taken to correct them.

Check all forms and tags attached to, or accompanying, the equipment to determine the reason for removal from service.

4-7. TROUBLESHOOTING GUIDELINES.

The following is a list of aids that you can use when troubleshooting the Transmission Test Set:

a. The Transmission Test Set has built-in self tests and diagnostics that are used in troubleshooting. The self testis performed at power up. Procedures for diagnostic tests are specified in troubleshooting procedures.

b. Refer to the principles of operation, Chapter 1, Section III as required. This provides circuit theory of the assembly or section you are troubleshooting with references to the schematic diagrams. Functional Block diagrams are located in figures 1-2 thru 1-8. Schematic diagrams and component locators are located on figures FO-1 thru FO-5. Assembly and Cable location diagram and an instrument level Signal Flow Block diagram is located on figure FO-6.

c. Circuit cooler spray (Appendix C, item 4) can be used in isolating problems. The most generally used method is to spray suspected components to see if the malfunction can be temporarily fixed. This can be used to isolate a bad component. This method will not work all the time, but it can be a great timesaver. It is especially helpful on intermittent problems that get worse with arise in temperature.

d. Use signature analysis. The Signature Analyzer is a good troubleshooting tool when testing digital circuits to give a go/no-go test.

e. Diagnostic Service Kit. The Diagnostic Service Kit allows test diagnostics to be accessed and certain test conditions to be set up for troubleshooting purposes. The Diagnostic Service Kit consists of:

- +20dB Amplifier Circuit Card Assembly.
- Jumper Circuit Card Assembly.
- Cable Assembly, Radio Frequency.
- Test Processor consisting of Socket, Diagnostic EPROM, and Diagnostic Microprocessor.
- Eight position DIP Switch.
- Six Removable Jumpers.

f. Many problems on Transmission Test Sets that have been in service for awhile are caused by corrosion. Sometimes removing and reseating the affected plug-in assemblies will correct a malfunction. Cleaning connector pins and/or switch contacts with alcohol (Appendix C, item 1) will repair many types of digital and analog circuit malfunctions.

g. For microcircuit orientation, pin one is identified by a square pad on printed circuit board or socket. For transistor orientation. emitter is identified by a square pad on printed circuit board.

4-8. EQUIPMENT INSPECTION.

The following inspection procedures shall be used to locate obvious malfunctions with the Transmission Test Set.

a. Inspect all external surfaces of Transmission Test Set for physical damage, breakage, loose or dirty contacts, and missing components.

b. Remove top and bottom case as required to access components (para 4-28).

WARNING

Transmission Test Set contains high voltages. After power is removed, discharge capacitors to ground before working inside Transmission Test Set to prevent electrical shock.

CAUTION

Do not disconnector remove any board assemblies in the Transmission Test Set unless the instrument is unplugged. Some board assemblies contain devices that can be damaged if the board is removed when the power is on. Several components, including MOS devices, can be damaged by electrostatic discharge. Use conductive foam and grounding straps when servicing is required around sensitive components. Use care when unplugging ICS from high-grip sockets.

c. Inspect printed circuit board surfaces for discoloration, cracks, breaks, and warping.

d. Inspect printed circuit board conductors for breaks, cracks, cuts, erosion, or looseness.

e. Inspect all assemblies for burnt or loose components.

f. Inspect all chassis-mounted components for looseness, breakage, loose contacts or conductors.

g. Inspect Transmission Test Set for disconnected, broken, cut, loose, or frayed cables or wires.

4-9. TROUBLESHOOTING TABLE.

The Troubleshooting table (table 4-1) lists common malfunctions which may be found during normal operation or maintenance of the Transmission Test Set or its components. You should perform the tests or inspections and corrective actions in the order listed.

NOTE

- After repair of AN/USM-485 verify malfunction is cleared. If not, perform the proper adjustment (table 4-2).
- All voltage readings referenced to ground unless otherwise specified.
- See figure FO-6, sheet 1 for assembly and cable location diagram.

Table 4-1. Troubleshooting.

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1. Transmission Test Set Displays Errors.
Only error message number O.
• Perform Measurement Test-Noise Filter Test-C Message Filter Check (para 4-17c).
Only error message number 1.
• Perform Measurement Test-Noise Filter Test-3 KHz Flat Filter Check (para 4-17d).
Only error message number 2.
• Perform Measurement Test-Noise Filter Test-15KHz Flat Filter Check (para 4-17e).
Only error message number 3.
• Perform Measurement Test-Noise Filter Test-Program FiIter Check (para 4-170.
Only error message number 4.
• Perform Measurement Test-Noise Filter Test-50K BIT Filter Check (para 4-17g).
Only error message number 5.
• Perform Measurement Test-P/AR Filter Check (para 4-17j).
Only error message number 6.
• Perform malfunction number 15.
Error message numbers 0-6.
• Perform malfunction number 15.
2. Transmitter Flatness at +l0dBm Test Failure.
Step 1. Adjust Output Level and Transmitter Monitor Loop (para 4-22).
Step 2. Perform Transmitter Test (para 4-14).
• Replace faulty component/assembly.
3. Transmitter Flatness at -40dBm Test Failure.
Step 1. Adjust Output Level and Transmitter Monitor Loop (para 4-22).
Step 2. Perform Transmitter Test (para 4-14).
• Replace faulty component/assembly.
4. Receiver Accuracy Test Failure.
Step 1. Adjust Receiver (para 4-23).
Step 2. Perform Receiver Test (para 4-15).
• Replace faulty component/assembly.

Table 4-1. Troubleshooting-Continued.

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
5. Autorange Test Failure. Perform Receiver Test-Autorange Check (pm 4-15f). • Replace faulty component/assembly.
6. Filter Test Failure. Step 1. Adjust Notch Filter (para 4-24). Step 2. Adjust P/AR Filter and Latch (para 4-25). Step 3. Perform Receiver Test (para 4-15). • Replace faulty component/assembly.
7. Impulse Noise DAC Test Failure. Perform Measurement Test-Impulse Noise Digital to Analog Converter Check (para 4-17i). • Replace faulty component/assembly.
8. Count Limit Test Failure. Perform Control and Counting Test (para 4-13). • Replace faulty component/assembly.
9. Termination Impedance Test Failure. Step 1. For transmit impedance problem, troubleshoot around A14T1 (fig. FO-5, sheet 5). Step 2. For receive impedance problem, troubleshoot around A13T1 (fig. FO-4, sheet 1). • Replace faulty component/assembly.
10. Hold Tone Dropout Detector Test Failure. Troubleshoot around Hold Tone Dropout Detector A14U25C (fig. FO-5, sheet 1). • Replace faulty component/assembly.
11. Hold Circuit Test Failure. Step 1. Adjust Hold Circuit (para 4-26). Step 2. Troubleshoot around Transmit Hold Circuit or Receive Hold Circuit (fig. FO-2, sheet 2). • Replace faulty component/assembly.
12. Distortion Test Failure. Troubleshoot using fig. FO-4 and fig FO-5. • Replace faulty component/assembly.

Table 4-1. Troubleshooting-Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
13. P/AR Test Failure.
Step 1. Adjust P/AR filter and Latch (para 4-25).
Step 2. Troubleshoot around P/AR Circuits A13U37, A13U53, and A13U54 (fig. FO-4, sheet 2), and A14U51 (fig FO-5, sheet 4).
• Replace faulty component/assembly.
14. Noise to Ground Test Failure.
Step 1. Perform Receiver Test-Noise Filter Check (para 4-15e).
• Replace faulty component/assembly.
Step 2. Troubleshoot around A13T1 (fig. FO-4, sheet 1).
• Replace faulty component/assembly.
15. All other AN/USM-485 Failures.
Step 1. Set LINE switch to STBY.
• Disconnect all external cables including power cable.
Step 2. Set LINE switch to ON. Verify front panel lights turn on.
• If indications are correct, proceed with step 5.
Step 3. Set LINE switch to STBY.
• Connect rear panel power cable.
Step 4. Verify front panel CHG indicator turns on.
• If indications are correct, allow sufficient charge time and repeat step 1.
• If indications are incorrect, perform Charger Test (para 4-16).
Step 5. Set LINE switch to STBY.
• Connect rear panel power cable.
Step 6. Set LINE switch to ON. Verify front panel lights turn on.
• If indications are correct, proceed with step 8.
Step 7. Perform Power Supply Test (para 4-10).
• Replace faulty component/assembly.
• If Power Supply Test passes, proceed with step 9.
Step 8. Verify instrument performs self test.
• If self test not performed, proceed with step 9.
• If self test fails, proceed with step 11.
• If self test passes, complete performance test (para 4-18).

Table 4-1. Troubleshooting-Continued.

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
15. Another AN/USM-485 Failures–Continued.
Step 9. Perform Minimum Core Test (para 4-11).
• Replace faulty component/assembly.
• If test passes, proceed with step 10.
Step 10. Perform Display Test (para 4-12).
• Replace faulty component/assembly.
Step 11. Verify number of self check error codes displayed.
• If Err 5 to 0 (one or more but not all) are displayed, perform malfunction number 1.
• If Err 6 is displayed, proceed with step 12.
• If Err 6 to 0 (all) are displayed, proceed with step 13.
• If Err 7 or 8 are displayed, verify proper operation (TM 11-6625 -3186-10).
Step 12. Perform Measurement Test (para 4-17).
• Replace faulty component/assembly.
Step 13. Perform Power Supply Test (para 4-10).
• Replace faulty component/assembly.
• If Power Supply Test passes, proceed with step 14.
Step 14. Perform Transmitter Test (para 4-14).
• Replace faulty component/assembly.
• If Transmitter Test passes, proceed with step 15.
Step 15. Perform Measurement Test-Frequency Response Test-Internal Loop Around Check (para 4-17a) and Measurement Test-Frequency Response Test-External Loop Around Check (para 4-17 b).
• If loop around test passes, proceed with step 16.
• If loop around test fails, proceed with step 17.
Step 16. Perform Control and Counting Test (para 4-13).
• Replace faulty component/assembly.
Step 17. Perform Receiver Test (para 4-15).
• Replace faulty component/assembly.

4-10. POWER SUPPLY TEST.

DESCRIPTION

This test is used to correct a malfunction in the Power Supply Circuits (fig. FO-5).

1. Place ANAJSM-485 into troubleshooting position (para 4-39).
2. Disconnect ribbon cable A5W1 (fig. FO-3) from A14 Transmitter Circuit Card. Disconnect jumpers A14JU+5, A14JU+14, and A14JU-14 (fig. FO-5, sheet 5).

WARNING

AC voltages are present whenever plugged in whether power switch is in ON or STBY.

3. On AN/USM-485, connect power cable, set power switch to ON, and verify the following voltages:

NOTE

Front panel indicators will not light.

A14C15 ..... +12.0 to +14.0V
A14C11 ..... +23.5 to +32.0V
A14C5 ..... -23.5 to -32.0V

- If fuse blows as unit is plugged in, proceed with step 4.
- If all voltages are incorrect troubleshoot A6LF1 and A6T1 using fig. FO-5, sheet 5. Replace faulty component.
- If only 1 or 2 voltages are incorrect, troubleshoot appropriate rectifiers and filters using fig. FO-5, sheet 5. Replace faulty component.
- If voltages are correct, proceed with step 6.

4. Unsolder and remove A14CR24.

CAUTION

Verify jumpers A14JU+5, A14JU+14, and A14JU-14 are removed whenever overvoltage protection is disabled

NOTE

Tripping Over Voltage Protection shorts only +14V line. Avoid shorting regulated outputs (brief shorts cause no damage).

5. Repeat step 3.
   - If voltages are now correct, replace A14CR24, then proceed with step 6.
   - If voltages are incorrect, troubleshoot using fig. FO-5, sheet 5. Replace faulty component
6. Remove power. Jumper A14J2 pin 1 to pin 18. Reapply power.
   - If fuse blows, troubleshoot around A14CR25 using fig. FO-5, sheet 5. Replace faulty component.
7. Verify A14JU+5 is +5V ±20mV.
   - If correct, proceed to step 12.
   - If incorrect, perform Adjust Power Supply (para 4-21). If adjustment does not correct problem, proceed with step 8.

4-10. POWER SUPPLY TEST—Continued.

8. Verify voltage at A14U14 pin 6 is approximately 2.5V.
   - If incorrect, replace A14U14.
9. Check A14R33, A14R37, and A14R42.
   - If incorrect, replace faulty component.
10. Remove A14Q4, and verify following voltages:

NOTE

Removing A14Q4 may require pressing on line module retaining springs and sliding line module out of its hole. When reinstalling A14Q4, remember to install insulating shoulder washer.

A14U14 pin 7 ..... GND
A14U14 pin 10 ..... ~1.6v
A14U14 pin 11 ..... -pin 10 + 0.6v
A14U14 pin 12 ..... +8 to +14v

- If pin 10 is >2.0V or <1.2V, troubleshoot A14CR19 and A14CR20 using fig. FO-5, sheet 5. Replace faulty component.
- If pin 12 is incorrect, troubleshoot around A6LF1, A6T1, and A14J2 using fig. FO-5, sheet 5. Replace faulty component
- If any other voltages are incorrect, replace A14U14.

11. Reinstall A14Q4.
12. Remove power. Jumper A14J2 pin 2 to pin 17. Reapply power
    - If fuse blows, troubleshoot around A14CR23 using fig. FO-5, sheet 5. Replace faulty component.
13. Verify A14JU+14 is +14V ±20mV.
    - If correct. proceed to step 18.
    - If incorrect, perform Adjust Power Supply (para 4-21). If adjustment does not correct problem, proceed with step 14.
14. Verify voltage at A14U8 pin 6 is approximately 2.5V.
    - If incorrect replace A14U8.
15. Check A14R19, A14R23, and A14R31.
    - If incorrect, replace faulty component.
16. Remove A14Q3, and verify following voltages:

A14U8 pin 7 ..... GND
A14U8 pin 10 ..... 1.6v
A14U8 pin 11 ..... ~pin 10 + 0.6v
A14U8 pin 12 ..... +21 to +25v

- If pin 10 is >2.0V or <1.2V, troubleshoot A14CR14 and A14CR13 using fig. FO-5, sheet 5. Replace faulty component.
- If pin 12 is incorrect, troubleshoot around A6LF1, A6T1, and A14J2 using fig. FO-5, sheet 5. Replace faulty component
- If any other voltages are incorrect, replace A14U8.

4-10. POWER SUPPLY TEST—Continued.

NOTE

When reinstalling A14Q3, remember to install insulating shoulder washer.

17. Reinstall A14Q3.
18. Remove power. Leave A14J2 pin 2-17 connected. Jumper A14J2 pin 3 to pin 16. Reapply power.
    - If fuse blows, troubleshoot around A14CR7, R4, R16, R94, R95, R96, Q2 and Q7 using fig. FO-5, sheet 5. Replace faulty component.
19. Verify A14JU-14V is -14 ±20mV.
    - If incorrect, troubleshoot around A14CR4, Ul, Q1, R3, and CR1 using fig. FO-5, sheet 5. Replace faulty. component.
    - If correct power supply is functioning normal.

NOTE

- Any ripple on +14V supply will appear on -14V supply, even though -14V supply is operating properly.
- When replacing A14U1, check A14CR4 and also replace if needed

20. Troubleshoot all other malfunctions using fig. FO-5, sheet 5.
21. Remove power, disconnect test equipment, reinstall circuit card assemblies, and reconnect all cables.

4-11. MINIMUM CORE TEST.

DESCRIPTION

This test is used to correct a malfunction in' the Minimum Core Circuit (fig. FO-5).

1. Place AN/USM-485 into troubleshooting position (para 4-39).

CAUTION

When checking microprocessor socket pins, use a small probe to avoid spreading socket pins. Microprocessor socket pins are connected to STATIC SENSITIVE devices which can be easily damaged.

4-11. MINIMUM CORE TEST—Continued.

2. On AN/USM-485, apply power and verify following voltages:

   A14U6 pin 40 .....+5V ±0. 1V
   A14U6 pin 39 .....+5V ±0.1V
   A14U6 pin 20 .....GND (<0.1V)
   A14U6 pins 7—15, 22—25, 29, 30, and 33—37 ..... toggling

   A14U6 pin 38 logic high (check with a logic probe) then pulse low when PERIOD key is pressed.

   After self-check is completed, A14U6 pins 3-6 should be logic high and pins 16-21 should be logic low.

   - If pin 38 does not work, troubleshoot key scan circuitry (A14U20) and front panel key matrix (Al) using fig. FO-1 and FO-5. Replace faulty component/assembly.
   - If any other pins are incorrect, replace A14U6.
   - If correct and display does not respond, troubleshoot control latches using fig. FO-5. Replace faulty component.

NOTE

Signal lines are generally checked at IC pin but a defective socket may stop signal from getting to its destination.

3. Troubleshoot all other malfunctions using fig. FO-5.
4. Remove power, disconnect test equipment, reinstall circuit card assemblies, and reconnect all cables.

4-12. DISPLAY TEST.

DESCRIPTION

This test is used to correct a malfunction in the Display Circuits (fig. FO-1 and FO-2).

1. Place AN/USM-485 into troubleshooting position (para 4-39).
2. On AN/USM-485, set power switch to ON and working from rear of A2, verify the following voltages (fig. FO-2, sheet 1):

   A2U2 pin 19 ..... +5V ±0.lV
   A2U2 pin 28 ..... GND
   A2U3 pin 19 ..... +5V ±0.lV
   A2U3 pin 28 ..... GND

   - If incorrect, perform Power Supply Test (para 4-10).

3. Using a Logic Probe, verify A2U2 pins 5—14 and A2U3 pins 5—14 are toggling.

   - If correct and display is frozen or shows meaningless numbers, replace A2U2 and/or A2U3.

4. Install Test Processor (para 4-38).
5. On AN/USM-485,

   - Set power switch to STBY for approximately 1 second, then to ON.
   - Press DISPLAY—TRMT/RCV button.

4-12. DISPLAY TEST—Continued.

6. Verify all indicators on front panel light.
7. Press DISPLAY—TRMT/RCV button.

   The same segment on all displays will light for 1/2 second, then step to next segment. It will take a total of eight steps for one full cycle. Decimal points are always turned on except during one step when front panel display is blanked.

   • If incorrect, troubleshoot appropriate line using fig. FO-1 and FO-2. Replace faulty component.
8. Press DISPLAY—TRMT/RCV button.

   A single digit or group of annunciators is turned on for 1/2 second then turned off. Each digit or set of annunciators is then turned on in succession. The process repeats fifteen times until all digits and annunciator groups have turned on. The display blanks for 1/2 second to indicate end of test sequence, then repeats. The decimal points are turned on except when digit to right of decimal point is lit.

   • If incorrect, troubleshoot appropriate line using fig. FO-1 and FO-2. Replace faulty component.
9. On AN/USM-485,
   - Press DISPLAY—TRMT/RCV button.
   - Press RCV 135 Ω, 600 Ω, and 900 Ω in sequence.

NOTE

If two buttons are pressed simultaneously, either higher value, or FAIL will appear on display.

10. Verify that value of impedance selected appears in right display.

    • If incorrect, troubleshoot using fig. FO-1 and FO-2. Replace faulty component.
11. Troubleshoot all other malfunctions using fig. FO-1 and fig. FO-2.
12. Remove power. Remove Test Processor (para 4-38). Disconnect test equipment, reinstall circuit card assemblies, and reconnect all cables.

4-13. CONTROL AND COUNTING TEST.

DESCRIPTION

This test is used to correct a malfunction in the Control and Counting Circuits (fig. FO-5).

a. Control and Counting Test—Keyscan/Interrupt Circuit Check.

1. Place AN/USM-485 into troubleshooting position (para 4-39). Set power to ON.
2. Using Logic Probe, verify A14U6 pins 3-6 are high and pins 16–19 are low (fig. FO-5, sheet 5).
   - If correct, proceed with step 4.
   - If A14U6 pins 3—6 are low and pins 16-19 are high, proceed with Control and Counting Test-Control Circuit Signature Analysis Check (para 4-13b).

4-13a. Control and Counting Test—Keyscan/interrupt Circuit Check—Continued.

3. Remove Al Front Panel Assembly (para 4-29) and repeat step 2.
   - If now correct, replace Al Front Panel Assembly (para 4-29).
   - If only a single pin of A14U6 (3, 4, 5, 6) is low, then replace A14U20.
4. Verify A14U20 pin 1 is low and goes high when any front panel membrane switch is pressed.
   - If correct, proceed with step 6.
5. Verify A14U20 pins 2, 3, 4, and 5 goes low when correct front panel membrane switch is pressed. 2= MEAS and DISPLAY TRMT/RCV. 3= STEP UP,<—, —>, and SF SKIP. 4= STEP DOWN, FILTER, LEVEL ZERO, and PERIOD. 5= IMPULSE NOISE DISPLAY, STOP, and START RESET.
   - If correct, replace A14U20.
   - If incorrect, troubleshoot using fig. FO-1 and FO-2. Replace faulty component.
6. Verify A14U3 pin 9 pulses low when any front panel membrane switch is pressed.
   - If incorrect, replace A14U3.
7. Verify A14U5 pin 12 pulses low when any front panel membrane switch is pressed.
   - If incorrect, replace A14U5.
8. Verify A14U5 pin 10 pulses high when any front panel membrane switch is pressed.
   - If incorrect, replace A14U6.
9. Verify line monitor circuit beeps when any front panel membrane switch is pressed.
   - If incorrect, troubleshoot beep generator circuit using fig. FO-2, sheet 1. Replace faulty component.
10. On AN/USM-485, set power to STBY.

b. Control and Counting Test—Control Circuit Signature Analysis Check.

CAUTION

Microprocessor is static sensitive.

1. Install Test Processor (para 4-38). Set power to ON.
2. Move jumper from A14JU6 to A14JU1 (SA).
3. Place a jumper between A14TP3(SA) and CSA2 contact (fig. FO-5, sheet 5).
4. Connect Signature Analyzer as follows:

   CLOCK A14TP2
   STOP A14TPS/S
   START ..... A14TPS/S (same as stop)
   GND ..... negative side of A14C15

5. Remove ribbon cable (W2) (fig. FO-6, sheet 1) from A13P1 (fig. FO-4, sheet 4) and connect to Jumper Board from Diagnostic Service Kit

4-13b. Control and Counting Test—Control Circuit Signature Analysis Check—Continued.

6. Set up Signature Analyzer as follows:

   START ..... on falling edge
   STOP ..... on falling edge
   CLOCK ..... on rising edge
   HOLD ..... button OUT
   SELF TEST ..... button OUT

7. On AN/USM-485, apply power and verify right display reads “SA”.

8. Momentarily touch probe to any +5V supply line and verify signature is 0FU0.

   • If incorrect, test setup is incorrect, or circuitry associated with reference signature needs repair.

9. Verify A14U13 signatures are as shown below.

NOTE

Signatures are dependent on receiver impedance selected on front panel.

PIN	CONDITION	SIGNATURES
3		A73U
7		UU2C
9		922F
12	RCV impedance of 135 or 600	C0C0
	RCV impedance of 900	UA15
14	RCV impedance of 135 or 900	U17F
	RCV impedance of 600	CCH9
16		UU1H
18		8F15

   • If incorrect, troubleshoot using fig. FO-5, sheet 2. Replace faulty component.

10. Verify signatures are as shown below.

IC	PIN NO	SIGNATURE	IC	PIN NO	SIGNATURE
	1	882A		1	71P4
U12	2	UHPH	U11	2	4AA5
	4	33U7		4	33U7
	5	3U6A		5	H263
	6	0000		6	0000
	7	HH19		7	HH19
	8	0000		8	0000
	10	2665		10	HF12
	11	5C41		11	P289
	13	52AA		13	52AA
	14	F0FP		14	F0FP
	16	0FU0		16	0FU0

   • If incorrect, troubleshoot using fig. FO-5, sheet 1. Replace faulty component.

4-13b. Control and Counting Test—Control Circuit Signature Analysis Check—Continued.

11. Verify signature at A14U18 pin 13 is UHF3.
    - If correct, proceed with step 14.
12. Verify signature at A14U18 pin 8 is UHF3 and pin 10 is U133.
    - If both correct replace A14U18.
13. Verify a 1.5KHz pulse train is present at A14U25 pin 6 using Oscilloscope.
    - If correct, troubleshoot A14U24, A14U25, and associated circuitry. Replace faulty component.
14. Verify signature at A14U19 pin 9 is 2A0F.
    - If incorrect, troubleshoot A14U25, A14R56, A14R57, A14R62, and A14R63. Replace faulty component.
15. Verify signature at A14U15 pin 5 is PP79.
    - If incorrect, troubleshoot A14U25, A14R58, and A14R60. Replace faulty component.
16. Verify signature at A14U17 pin 6 is P881.
    - If incorrect, troubleshoot Jumper Board (from Diagnostic Service Kit) or A14U7. Replace faulty component.
17. Verify signatures at A14U9 pin 3 is C28H, A14U1O pin 3 is 1246, and A14U18 pin 2 is 1246.
    - If correct, proceed with step 19.
    - If incorrect, proceed with step 18.
18. Verify signatures are as shown below.

IC	PIN NO	SIGNATURE	IC	PIN NO	SIGNATURE
U9	1	0000	U10	1	0000
	2	H3HF		2	H3HF
	3	C28H		3	1246
	6	0FU0		6	0FU0
	7	CCP5		7	CCP5
	8	0000		8	0000
	9	33U7		9	33U7
	10	HH19		10	HH19
	11	52AA		11	52AA
	12	F0FP		12	F0FP
	13	20AH		13	C5U3
	14	0000		14	0000
	15	0000		15	0000
	16	0FU0		16	0FU0

- If incorrect, troubleshoot using fig. FO-5, sheet 1. Replace faulty component.

4-13b. Control and Counting Test—Control Circuit Signature Analysis Check—Continued.

19. Verify signatures are as shown below.

IC	PIN NO	SIGNATURE	IC	PIN NO	SIGNATURE
U15	1	P289	U16	1	0FU0
	2	0000		2	H7FU
	3	PP79		3	HC3U
	4	0000		4	C28H
	5	PP79		5	1PC6
	6	2A0F		6	H7FU
	7	0000		7	0000
	8	4AA5		8	3AA7
	9	4AA5		9	882A
	10	4655		10	C28H
	11	0FU0		11	H7FU
	12	0000		12	0FU0
	13	0000		13	HC3U
	14	0FU0		14	0FU0

IC	PIN NO	SIGNATURE	IC	PIN NO	SIGNATURE	IC	PIN NO	SIGNATURE
U17	1	882A	U18	1	1PC6	U19	1	71P4
	2	882A		2	1246		2	UHF3
	3	84HA		3	HC3U		3	8F27
	4	882A		4	5C41		4	7H14
	5	84HA		5	HF12		5	0FU0
	6	P881		6	0000		6	71P4
	7	0000		7	0000		7	0000
	9	1PC6		8	UHF3		8	7H14
	10	0FU0		9	0000		9	2A0F
	11	3AA7		10	U133		10	5718
	12	882A		11	0000		11	HC3U
	13	C28H		12	U133		12	5718
	14	0FU0		13	UHF3		13	8F27
				14	0FU0		14	0FU0

- If incorrect, troubleshoot using fig. FO-5, sheet 1. Replace faulty component.

4-13b. Control and Counting Test—Control Circuit Signature Analysis Check—Continued.

20. A14U9, U10, U15A, and U15B are not completely checked by diagnostic signature analysis.
    - If AN/USM-485 successfully measures level but not frequency, first replace A14U10 and if malfunction still exists, replace A14U9.

c. Control and Counting Test—Touch Panel Check.

1. Verify AN/USM-485 is set up as described in Control and Counting Test-Control Circuit Signature Analysis Check (para 4-13b).
2. Without removing power, move jumper from A14JU1 (SA) to A14JU6.
3. Verify a "O" appears in right display.
4. Press each of buttons on front panel and compare with corresponding number as shown below.

DISPLAY BUTTON	DECIMAL NUMBER	DISPLAY BUTTON	DECIMAL NUMBER
Display RCV/TRMT	33	MEAS	17
SF SKIP	18	FILTER	36
LEVEL ZERO	68	PERIOD	132
<—	66	DISPLAY	24
STEP UP	34	START/RESET	72
STEP DOWN	20	STOP	40
—>	130		

    - If incorrect, troubleshoot appropriate line using fig. FO-1 and FO-2. Replace faulty component.
5. On AN/USM-485,
    - Remove power.
    - Remove jumper between A14TP3(SA) and CSA2.
    - Remove Jumper Board (from Diagnostic Service Kit) and reconnect ribbon cable (W2) to A13P1.
6. Troubleshoot all other malfunctions using fig. FO-1, fig. FO-2, and fig. FO-5.
7. Remove Test Processor (para 4-38).
8. Remove power, disconnect test equipment, reinstall circuit card assemblies, and reconnect all cables.

4-14. TRANSMITTER TEST.

DESCRIPTION

This test is used to correct a malfunction in the Transmitter Circuits (fig. FO-5).

a. Transmitter Test—Transmit Clock Generator Check.

NOTE

Multiplexer A14U39 selects proper clock according to state of P/AR-SINE select signal from A14U26 pin 1 (low = sine clock selected high = P/AR clock selected).

1. Place AN/USM-485 into troubleshooting position (para 4-39). Set power to ON.
2. Verify the following conditions/frequencies for proper operation of the Sine Oscillator circuitry:

   A14U39 pin 4 (fig. FO-5, sheet 5) ..... Low
   A14U23 pin 12 ..... 4.194MHZ
   A14U32 pin 9 .....1.049MHz
   A14U32 pin 11 ..... 262.lKHz

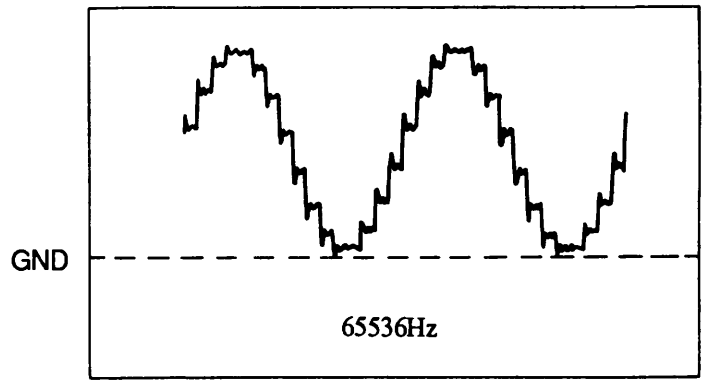
   • If incorrect, troubleshoot using fig. FO-5, sheet 3. Replace faulty component.
3. On AN/USM-485, press P/AR measurement pushbutton.
4. Verify the following conditions/frequencies for proper operation of the P/AR Oscillator circuitry:

   A14U39 pin 4 .....High
   A14U23 pin 8 ..... 6.144MHz
   A14U31 pin 8 .....512KHz
   A14U32 pin 9 .....128 KHz
   A14U32 pin 11 ..... 32KHz

   • If incorrect, troubleshoot using fig. FO-5, sheet 3. Replace faulty component.

b. Transmitter Test—Digital to Analog Converter Circuitry Check.

1. Place AN/USM-485 into troubleshooting position (para 4-39). Set power from STBY to ON.
2. On AN/USM-485,
   • Set DISPLAY to TRMT.
   • Set frequency to 65,536Hz.
3. Verify waveform at A14JU2 is as shown. Steps must be exactly as shown.
   • If waveform is not present, check A14U21 pin 2 for 0V ±20mV. If voltage incorrect, replace A14U21.
   • If waveform is incorrect, perform Transmitter Test—Transmitter Signature Analysis Check (para 4-14h) for A14U33. If A14U33 checks good, perform Transmitter Test—Phase Address Generator Check (para 4-14i).



4-14c. Transmitter Test—Filter and Signal Select Circuitry Check.

1. Place AN/USM-485 into troubleshooting position (para 4-39). On AN/USM-485, remove A14JU2. Set power to ON.
2. Connect Signal Generator output to negative end of A14C36. Set Signal Generator output to 10KHz at 0.707Vrms sinewave.
3. Connect Oscilloscope to A14TP5 and verify the following output for each Signal Generator frequency shown.

FREQUENCY IN HZ	VOLTAGE AT TP5 (P-P)
10000	~3.5
40000	~3.5
80000	~3.6
120000	~3.5
160000	~3.1
200000	~2.4

   - If incorrect, troubleshoot Wideband Filter circuit using fig. FO-5, sheet 4. Replace faulty component.

4. Connect Oscilloscope to A14TP11 and verify the following output for each Signal Generator frequency shown.

FREQUENCY IN HZ	VOLTAGE AT TP11 (P-P)
500	~7.0
1000	~7.0
7500	~2.0
10000	~0.9

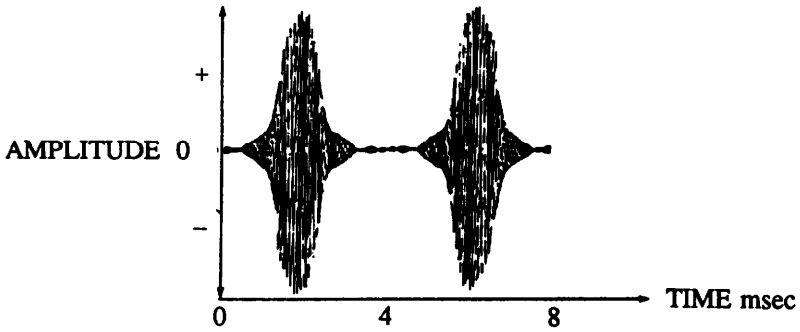
   - If incorrect, troubleshoot 5KHz Low Pass Filter circuit using fig. FO-5, sheet 4. Replace faulty component.

5. Disconnect Signal Generator and reconnect A14JU2.
6. Connect Oscilloscope to left front panel 310 jack and press NOR pushbutton.
7. Set AN/USM-485 Measurement mode to Level Frequency and Display to TRMT. Set Output Level to 0.0dBm. Verify 1004Hz sinewave.

   Set Measurement mode to Level Frequency and Display to RCV. Verify 1004Hz sinewave.

   Set Measurement mode to Noise and Display to RCV. Verify DC at approximately 0V.

   Set Measurement mode to P/AR and Display to RCV. Verify waveform is as shown below.



   - If incorrect, troubleshoot MUX circuit using fig. FO-5, sheet 4. Replace faulty component.

4-14d. Transmitter Test—Power Amplifier Check.

1. Place AN/USM-485 into troubleshooting position (para 4-39). Set power to ON.
2. On AN/USM-485,
   - Set DISPLAY to TRMT.
   - Adjust OUTPUT LEVEL control for OdBm reading.
   - Set MEASUREMENT to LEVEL FREQUENCY.
3. Connect Oscilloscope to negative side of A14C72. Verify oscilloscope displays ~8Vp-p signal.

   Connect Oscilloscope to A14CR29 cathode. Verify oscilloscope displays 4 to 5Vp-p signal.

   - If signals are incorrect, troubleshoot Power Amplifier circuit using fig. FO-5, sheet 4. Replace faulty component.

NOTE

- When troubleshooting at low frequencies and high output levels the transmit output has considerable distortion introduced in output transformer A14T1. All signals to the input of A14T1 should be clean sinewaves except in P/AR mode or quiet termination. In P/AR mode characteristic P/AR signal should be present as shown above in Filter And Signal Select Circuitry Check.
- The P/AR signal crest-factor prevents valid signals greater than +3dBm. When signal level is too high display blanks out. At this point AN/USM-485 is over-ranged.

e. Transmitter Test—Transmit Monitor Check.

1. Place AN/USM-485 into troubleshooting position (para 4-39). Set power to ON.
2. Connect Oscilloscope to A13TP9.
3. Set AN/USM-485 Measurement mode to Level Frequency and Display to TRMT. Verify 1004Hz sinewave.

   Set Measurement mode to Level Frequency and Display to RCV. Verify DC at approximately 0V.

   Set Measurement mode to Noise and Display to RCV. Verify DC at approximately 0V.

   Set Measurement mode to P/AR and Display to RCV. Verify waveform is as shown above in Filter and Signal Select Circuitry Check above.

   - If incorrect, troubleshoot Transmit Monitor circuit using fig. FO-5, sheet 4. Replace faulty component.

f. Transmitter Test—Chip Enable Decoder Check.

1. Install Test Processor (para 4-38).
2. On AN/USM-485,
   - Turn power switch to STBY, then to ON.
   - Press DISPLAY—TRMT/RCV button.
   - Press LEVEL ZERO button.
   - Verify all indicators go blank.

4-14f. Transmitter Test—Chip Enable Decoder Check—Continued.

3. Connect oscilloscope as follows:
   - Connect channel A to A14U7 pin 1.
   - Trigger channel A (negative slope).
   - Set oscilloscope at 2V/division and 50µsec/division.
4. Check A14U7 pins 2—11 and 13-17 on channel B using same oscilloscope setup as channel A. As each pin is checked verify pulse waveshape appears about 1/2 of a division away from previous waveshape.
   - If incorrect replace A14U7.

g. Transmitter Test—Transmitter Phase Step Latch Check.

1. Install Test Processor (para 4-38).
2. On AN/USM-485,
   - Turn power switch to STBY, then to ON.
   - Press DISPLAY-TRMT/RCV button.
   - Press PERIOD button.
   - Verify a "1" appears in right-hand display and all other indicators go blank.
3. Press STEP UP or STEP DOWN buttons to change state of A14U26 pin 1 (PAR/sine select line) as shown and measure using a Logic Probe.

RIGHT DISPLAY	LOGIC HIGH IC	PIN	U26 PIN 1
1	U28	2	Low
2	U28	10	Low
4	U28	11	Low
8	U28	1	Low
16	U30	2	Low
32	U30	10	Low
64	U30	11	Low
128	U30	1	Low
256	U27	2	Low
512	U27	10	Low
1024	U27	11	Low
2048	U27	1	Low
4096	U29	2	Low
8192	U29	10	Low
16.384	U29	11	Low
32.768	U29	1	Low
65.536	U26	2	Low
128	U30	1	Low
128P	U30	1	High

   - If incorrect, troubleshoot Phase Step Latch circuit using fig. FO-5, sheet 3. Replace faulty component.
4. If you do not desire to continue using Test Processor (from Diagnostic Service Kit), return standard processor A14U6 to its socket.

4-14h. Transmitter Test—Transmitter Signature Analysis Check.

1. Place AN/USM-485 into troubleshooting position (para 4-39). Set power to ON. Perform the following:
   - If standard processor A14U6 is used, set MEASUREMENT to LEVEL FREQUENCY and set frequency to 128Hz.
   - If Test Processor (from Diagnostic Service Kit) is used, press IMPULSE NOISE DISPLAY, then PERIOD. Press STEP UP and STEP DOWN buttons until 128Hz appears in right display.
2. Connect Signature Analyzer as follows:

   CLOCK A14TP7
   STOP A14TP6
   START A14TP6
   GND ..... GND
3. Set up Signature Analyzer as follows:

   START .....on rising edge
   STOP .....on rising edge
   CLOCK .....on falling edge
   HOLD ..... button OUT
   SELF TEST ..... button OUT
4. Momentarily touch probe to any +5V supply line and verify signature is P254.
   - If incorrect, perform Transmitter Test—Phase Address Generator Check(para 4-14i).
5. Verify A14U33/34/35/37/43/44/45/46/48 signatures are as shown below.

IC	PIN NO	SIGNATURE	IC	PIN NO	SIGNATURE	IC	PIN NO	SIGNATURE
	1	0000		1	55CU		1	7CU5
U33	2	don't check	U34	2	AAHU	U35	2	3HUA
	3	don't check		3	0000		3	0000
	4	A294		4	3PCH		4	9422
	5	320P		5	0000		5	0000
	6	UC56		6	1U5P		6	FA11
	7	25CP		7	21P3		7	5P33
	8	5919		8	0000		8	0000
	9	7P6P		9	86C3		9	FC6F
	10	34FH		10	P688		10	6U4A
	11	38F3		11	603A		11	C7A5
	12	AA85		12	0000		12	0000
	13	2C12		13	PFFA		13	25P1
	14	P254 (+5V)		14	0000		14	0000
	15	don't check		15	U665		15	12U0
	16	don't check		16	P254 (+5V)		16	P254 (+5V)

4-14h. Transmitter Test—Transmitter Signature Analysis Check—Continued.

IC	PIN NO	SIGNATURE	IC	PIN NO	SIGNATURE	IC	PIN NO	SIGNATURE
	1	FC75		1	AAHU		1	P254 (+5V)
U37	2	65CA	U43	2	1U5P	U44	2	UC56
	3	0000		3	9241		3	619H
	4	8HC7		4	8AUC		4	4P69
	5	0000		5	65CA		5	25CP
	6	46HC		6	46HC		6	5919
	7	FC6F		7	C7A5		7	9C3U
	8	0000		8	12U0		8	2350
	9	21P3		9	619H		9	7P6P
	10	2482		10	4P69		10	0000
	11	9241		11	9C3U		11	P254
	12	0000		12	0000		12	34FH
	13	15U7		13	2350		13	H679
	14	0000		14	H679		14	803A
	15	8AUC		15	803A		15	38F3
	16	P254 (+5V)		16	63H5		16	AA85
				17	42P0		17	63H5
				18	0000		18	42P0
				19	P254		19	2C12
				20	0000		20	P254 (+5V)
				21	P254 (+5V)			
				22	603A			
				23	U665			
				24	P254 (+5V)			
	1	P254 (+5V)		1	P254 (+5V)		1	P254 (+5V)
U45	2	1U5P	U46	2	FA11	U48	2	320P
	3	UHOA		3	9422		3	P254
	4	3PCH		4	7CU5		4	P254 (+5V)
	5	55CU		5	3HUA		5	320P
	6	488C		6	12U0		6	H05A
	7	AAHU		7	25P1		7	0000
	8	0000		8	6U4A		8	40F0
	9	P254		9	C7A5		9	A294
	10	U665		10	0000		10	P254 (+5V)
	11	1431		11	P254		11	P254
	12	PFFA		12	46HC		12	A294
	13	P688		13	8HC7		13	P254 (+5V)
	14	826P		14	FC75		14	P254 (+5V)
	15	603A		15	65CA			
	16	P254 (+5V)		16	8AUC			
				17	15U7			
				18	2482			
				19	9241			
				20	P254 (+5V)			

• If incorrect, troubleshoot Adder and Phase Address Latch circuit using fig. FO-5, sheet 3. Replace faulty component.

i. Transmitter Test—Phase Address Generator Check.

1. Install Test Processor (para 4-38). Set power to ON.

2. Connect Signature Analyzer as follows:

CLOCK A14TP7
STOP A14TP6
START A14TP6
GND ..... GND

4-14i. Transmitter Test—Phase Address Generator Check—Continued.

3. Set up Signature Analyzer as follows:

   START ..... on rising edge
   STOP ..... on rising edge
   CLOCK ..... on falling edge
   HOLD ..... button OUT
   SELF TEST ..... button OUT

4. On AN/USM-485,

   - Press DISPLAY-TRMT/RCV button.
   - Press PERIOD button.
   - Set frequency to lHz.

5. Momentarily touch probe to any +5V supply line and verify signature is UP73.

   - If incorrect, check setup.

6. Verify A14U36/38/47 signatures areas shown below.

NOTE

Signatures may take as long as 2 seconds to stabilize. Incorrect signatures will transfer through the circuit so parts earliest in signal flow should be replaced first.

IC	PIN NO	SIGNATURE	IC	PIN NO	SIGNATURE	IC	PIN NO	SIGNATURE
U36	1	669P	U38	1	69F1	U47	1	UP73 (+5V)
	2	334U		2	34P0		2	55H1
	3	0000		3	0000		3	ACA2
	4	ACA2		4	UUUP		4	669P
	5	UP73 (+5V)		5	0000		5	334U
	6	55H1		6	UUUU		6	0U16
	7	0000		7	0001		7	1P2F
	8	0000		8	0000		8	01UH
	9	0001		9	6U28		9	00UP
	10	01UH		10	916H		10	0000
	11	00UP		11	48C6		11	UP73
	12	0000		12	0000		12	UUUU
	13	1P2F		13	1PA5		13	UUUP
	14	0000		14	0000		14	69F1
	15	0U16		15	0U52		15	34P0
	16	UP73 (+5V)		16	UP73 (+5V)		16	0U52
							17	1PA5
							18	916H
							19	48C6
							20	UP73 (+5V)

   - If incorrect, troubleshoot appropriate line using fig. FO-5, sheet 3. Replace faulty component.

7. Troubleshoot all other malfunctions using fig. FO-5.
8. Remove Test Processor (para 4-38).
9. Remove power, disconnect test equipment, reinstall circuit card assemblies, and reconnect all cables.

4-15. RECEIVER TEST.

DESCRIPTION

This test is used to correct a malfunction in the Receiver Circuits (fig. FO-4).

a. Receiver Test—Initial Set-up.

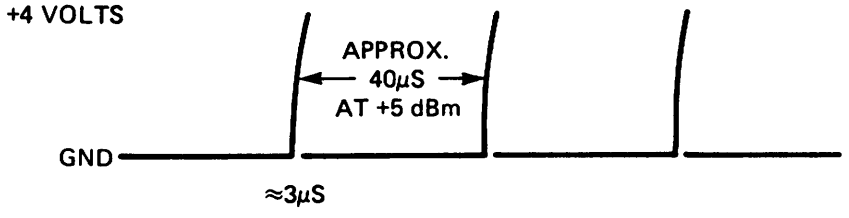
1. Remove Top Case (para 4-28).
2. On AN/USM-485,
   - Set power to ON.
   - Set MEASUREMENT to LEVEL FREQUENCY.
   - Set DISPLAY to TRMT.
   - Press in TRMT and RCV 600 Ω pushbuttons.
   - Set frequency to 1004Hz.
   - Adjust output level to +5dBm using OUTPUT LEVEL control.

NOTE

- When troubleshooting this section, it is important to check DC offsets in the signal along with amplitude and frequency. Offset can be checked by switching Oscilloscope connected to signal from AC to DC input. Any noticeable jump in position of waveform indicates a failure.
- When measuring voltage at front panel 310 jacks, Oscilloscope should be terminated with 600 Ω. If no termination is used, voltage will be 7.8Vp-p. If using a Digital Voltmeter with no termination, voltage will be 2.8Vac.

b. Receiver Test—Overall Transmit Monitor Check.

1. Perform Receiver Test—Initial Set-up (para 4-15a).
2. Connect Oscilloscope to Al3U3 pin 7 (fig. FO-4, sheet 4). Verify is signal 15 KHz at approximately 4Vp-p. Using OUTPUT LEVEL control, vary output level and verify that as output level rises, signal frequency should increase and vise versa.



- If this signal is present, varies with output level, and left hand display indicates approximately 5.0dBm, then perform Inputs From Front Panel/Notch Filter/25dB AMP/Tone Dropout Signal Path Check (para 4-15h).

4-15c. Receiver Test—Transmit Monitor Signal Check.

1. Perform Receiver Test—Initial Set-up (para 4-15a).
2. Connect Oscilloscope to A13TP9. Verify 1004Hz sinewave at approximately 3.9Vp-p.
   - If incorrect, perform Transmitter Test (para 4-14).

d. Receiver Test—Input Check.

1. Perform Receiver Test—Initial Set-up (para 4-15a).
2. Connect Oscilloscope to A13JU6. Verify 1004Hz sinewave at 3.9Vp-p.
   - If signal is present, perform Receiver Test—Noise Filter Check (para 4-15e).
3. Using a Logic Probe, check A13JU3 for proper latch contents as shown below:

   pin 15 .....logic 0
   pin 14 .... logic 1
   pin 13 .... logic 0

   - If incorrect, troubleshoot A13U7, A14U6 and data bus circuits using fig. FO-4, sheet 1, and FO-5, sheet 2. Replace faulty component then repeat step 1.
4. Connect Oscilloscope to A13TP14. Verify 1004Hz sinewave at approximately 3.9Vp-p.
   - If signal is present, replace A13U35.
5. Connect Oscilloscope to A13U34 pin 5. Verify 1004Hz sinewave at approximately 3.9Vp-p.
   - If signal is present, replace A13U34 then repeat step 1.
   - If no signal is present, then troubleshoot Low Pass Filter circuit (Al3U14) using fig. FO-4, sheet 1. Replace faulty component then repeat step 1.

e. Receiver Test—Noise Filter Check.

1. Perform Receiver Test—Initial Set-up (para 4-15a).
2. Connect Oscilloscope to A13U48 pin 6. Verify 1004Hz sinewave at approximately 3.9Vp-p.
   - If signal is present, perform Receiver Test—Autorange Check (para 4-15f).
3. Using a Logic Probe check A13U11 for proper address contents as shown below:

   pin 2 .....logic 0
   pin 10 .... logic 1
   pin 11 .....logic 1

   - If incorrect, verify jumper A13JU1 is installed. If A13JU1 installed, troubleshoot A14U6, A13U11, A14U7, and data bus circuits using fig. FO-4, sheet 2, and FO-5, sheet 2. Replace faulty component.
4. Connect Oscilloscope to A13TP15-2. Verify 1004Hz sinewave at approximately 3.9Vp-p.
   - If signal is present, troubleshoot A13U37 and A13U48 using fig. FO-4, sheet 2. Replace faulty component.
   - If no signal is present, replace A13U52.
5. Perform Measurement Test (para 4-17) if malfunction still exists.

4-15f. Receiver Test—Auforange Check.

1. Perform Receiver Test—Initial Set-up (para 4-15a).
2. Connect Oscilloscope to A13TP25. Verify 1004Hz sinewave at approximately 3.9Vp-p.
   - If signal is present, perform Receiver Test—Detector Select Check (para 4-15g).

NOTE

The housing of A13J1 is not connected to ground and another signal ground must be provided.

3. Using a Logic Probe, check Al3JU4 for proper address contents as shown below:

   pin 16 .....logic 0
   pin 15 .....logic 0
   pin 14 .....logic 1
   pin 13 .....logic 0

   - If incorrect, troubleshoot A13U17, A14U7, A14U6, and data bus circuits using fig. FO-4, sheet 3, and FO-5, sheet 2. Replace faulty component and repeat step 1.
4. Connect Oscilloscope to microcircuit pin shown below and check if signal is 1004Hz sinewave at approximately 0.39Vp-p. If signal is present, replace microcircuit listed.

Microcircuit	Pin Number	Replace
A13U26	6	A13U25
A13U28	6	A13U26
A13U33	6	A13U28
A13U29	6	A13U33
A13U39	8	A13U29
A13U39	5	A13U39

5. If all microcircuits above have incorrect signal, there is a jumper or trace problem, or bad resistors A13R129/146/147.
   - Troubleshoot by tracing backwards from A13U39 pin 6 to A13J1 iusing fig. FO-4, sheet 3. Replace faulty component.
6. If malfunction still exists, perform Receiver Test—Autorange Troubleshooting Check (para 4-15i).

g. Receiver Test—Detector Select Check.

1. Perform Receiver Test—Initial Set-up (para 4-15a).
2. Connect Oscilloscope to A13U13 pin 15. Verify 10V DC level.
   - If incorrect, verify Al3U5 is not being loaded down. If not, replace Al3U5.
3. Connect Oscilloscope to A13TP6. Verify 2.5V DC level.
   - If a DC level is present (1 to 4.5V), but is not proper value and level changes with small input signal changes, perform Adjust Receiver (para 4-23). Check signal at A13TP23 for <5% difference in alternate peak heights.
   - If DC level incorrect, proceed with step 5.
   - If DC level correct, proceed with step 4.

4-15g. Receiver Test—Detector Select Check—Continued.

4. Verify A13U3 pin 7 is toggling.
   - If correct, perform Receiver Test—Inputs from Front Panel/Notch Filter/25dB AMP/Tone Dropout Signal Path Check (pm 4-15h).
   - If incorrect, troubleshoot A13U3 circuit using fig. FO-4, sheet 3. Replace faulty component.
5. Connect Oscilloscope to A13U13 pin 3. Verify approximate 2.5V DC level.
   - If DC level is missing, troubleshoot A13U4 circuit using fig. FO-4, sheet 3. Replace faulty component.
6. Using an Oscilloscope, check A13U13 for proper address contents as shown below:

   pin 11 ..... +14V
   pin 10 ..... 0V
   pin 9 ..... +14V

   - If incorrect, troubleshoot A13U12, A13U8, A14U7, A14U6, and data bus circuits using fig. FO-4, sheet 3, and FO-5, sheet 2. Replace faulty component..
7. Connect Oscilloscope to A13U13 pin 5. Verify approximate 2.5V DC level.
   - If a DC level is present, replace A13U13.
8. Perform Receiver Test-Detector Troubleshooting Check (para 4-15j) if malfunction still exists.

h. Receiver Test—Inputs from Front Panel/Notch Filter/25dB AMP/Tone Dropout Signal Path Check.

CAUTION

A13U7 is static sensitive.

1. On AN/USM-485,
   - Set power to STBY.
   - Remove A13U7.
   - Set DIP Switch (from Diagnostic Service Kit) positions to open. Install DIP Switch in A13JU3.
   - Connect TRMT 310 jack to RCV 310 jack using 310 adapters.
   - Set power to ON.
   - Set MEASUREMENT to LEVEL FREQUENCY.
   - Set DISPLAY to RCV.
   - Press TRMT and RCV 600 Ω pushbuttons. Verify BRG, DIAL, and both HOLD pushbuttons are out.
   - Set frequency to 1004Hz.

4-15h. Receiver Test—Inputs from Front Panel/Notch Filter/25dB AMP/Tone Dropout Signal Path Check.

2. Set Dip switch in A13JU3 as follows:

1-16 ..... open
2-15 ..... open
3-14 ..... open
4-13 ..... closed

Set output level to +5dBm using OUTPUT LEVEL control.

Using an Oscilloscope, verify A13TP14 has 3.9Vp-p signal.

NOTE

The DIP Switch installed in A13JU3 can be selected for troubleshooting purposes follows (fig. FO-4, sheet 1):

- 1-16: Open = Balanced input from transformer.
  Closed = Noise to Ground input.
- 2-15: Open = Front panel input (balanced or noise to ground).
  Closed = Transmit monitor loop around.
- 3-14: Open = Notch filter circuit in.
  Closed = Notch filter circuit out
- 4-13: Open = 25dB Amplifier circuit in.
  Closed = 25dB Amplifier circuit out.

INPUT TRANSFORMER CHECK

1. Look for a 1004Hz signal at transformer output A13TP11.
   - If signal is correct, perform Tone Dropout Signal Path Check below.
2. Remove cable connected to A13J4. Connect A13TP9 to A13J4 pin 3. Connect Al3J4 pin 6 to orange wire on four conductor cable.
   - If A13TP11 now has a signal, troubleshoot Switch and Display input and impedance selection circuits using fig. FO-2. Replace faulty component.
   - If A13TP11 signal still incorrect, troubleshoot Al3T1 circuit using fig. FO-4, sheet 1. Replace faulty component.
3. Reconnect cable to A13J4.

4-15h. Receiver Test—Inputs from Front Panel/Notch Filter/25dB AMP/Tone Dropout Signal Path Check—Continued.

TONE DROPOUT SIGNAL PATH CHECK

1. On AN/USM-485,
   - Set frequency to 2004Hz.
   - Adjust output level to approximately +5dBm using OUTPUT LEVEL control.
2. Verify signal at A13TP13 is approximately 3.9Vp-p. Verify signal at A13TP12 is approximately 0.42Vp-p. Verify signal at A13U15 pin 6 is approximately 12.6Vp-p, at 2004Hz.
   - If incorrect, troubleshoot A13U15 circuit using fig. FO-4, sheet 1. Replace faulty component.
3. On AN/USM-485, set frequency 1004Hz. Verify voltage at A13TP12 is approximately 7.8Vp-p
   - If incorrect, troubleshoot A13U16 circuit using fig. FO-4, sheet 1. Replace faulty component.
4. Verify signal at both sides of A13C159 is 1004Hz squarewave at approximately 25Vp-p.
   - If incorrect, troubleshoot A13U15 circuit using fig. FO-4, sheet 1. Replace faulty component.

NOTCH FILTER CHECK

1. Verify signal at A13TP14 is 1004Hz at approximately 3.9Vp-p. Set DIP Switch in A13JU3 as follows:

   pins 1-16 ..... open
   pins 2-15 ..... open
   pins 3-14 ..... closed
   pins 4-13 ..... closed

   Verify signal at A13TP14 drops to l/300th or less than its original level.
   - If not, troubleshoot A13U34 and notch filter circuit using fig. FO-4, sheet 1. Replace faulty component.
2. Open DIP Switch in A13JU3 between pins 3-14.
3. Connect Oscilloscope to A13TP14. Reduce OUTPUT LEVEL control until signal is approximately 0.2Vp-p as viewed on Oscilloscope. Set DIP Switch in Al3JU3 as follows:

   pins 1-16 ..... open
   pins 2-15 ..... open
   pins 3-14 ..... open
   pins 4-13 ..... open

   Verify signal at A13JU6 is approximately 3.5Vp-p.
   - If incorrect, troubleshoot 25dB Amplifier circuit using fig. FO-4, sheet 1. Replace faulty component.
4. Set power to STBY.
5. Remove DIP Switch in A13JU3.
6. Reinstall A13U7.
7. If malfunction still exists, perform Measurement Test—Notch Filter Check (para 4-17h).

4-15i. Receiver Test—Autorange Troubleshooting Check.

1. Connect left 310 jack to Attenuator input using 600-50 Ω mismatch. Connect right 310 jack to Attenuator output. Leave attenuator inputs and outputs floating and ground attenuator case to AN/USM-485.
2. Set attenuation to OdB.
3. On AN/USM-485,
   - Set power to ON.
   - Set MEASUREMENT to LEVEL FREQUENCY.
   - Set DISPLAY to RCV.
   - Press TRMT and RCV 600 Ω pushbuttons. Verify BRG, DIAL, and both HOLD pushbuttons are out.
   - Set frequency to 1004Hz.
   - Set output level to +5dBm using OUTPUT LEVEL control.
4. Connect Oscilloscope to A13TP25.

NOTE

A13J1 case is not grounded, so some other signal ground must be used (A13TP2).

5. Step attenuator from 0 to 60dB attenuation in steps of 10 dB. Verify with each step, autorange output will drop and then stabilize at approximately its original amplitude. As greater attenuation is switched in, noise on signal will rise.
   - If incorrect, check latch outputs vs values shown in A13U39 truth table on FO-4, sheet 3. If select address is correct troubleshoot A13U38, A13U55, and A13U50 circuits using fig. FO-4, sheet 3. If required, proceed with step 6 to select a desired gain in the autorange circuit. Replace faulty component.

NOTE

To avoid crosstalk in A13U39 do input grounding as follows: A13U55 input is grounded -10 to +20dB gain. A13U38 input is grounded -10 to +40dB gain.

6. Use this step to select a specific gain in the autorange circuit for troubleshooting purposes only.

CAUTION

A13U17 is static sensitive.

- Remove power.
- Remove A13U17.
- Set DIP Switch (from Diagnostic Service Kit) positions to open. Install DIP Switch in A13JU4.
- Apply power.
- Set DIP Switch in A13JU4 to desired gain as shown.

4-15i. Receiver Test—Autorange Troubleshooting Check.

GAIN WANTED	SWITCH SETTINGS S1-PINS 1–16	S2-PINS 2–15	S3-PINS 3–14	S4-PINS 4–13	D7	D6	D5	D4
–10 dB	Closed	Closed	Closed	Closed	0	0	0	0
0 dB	Closed	Closed	Open	Closed	0	0	1	0
10 dB	Closed	Open	Closed	Closed	0	1	0	0
20 dB	Closed	Open	Open	Closed	0	1	1	0
30 dB	Open	Closed	Closed	Closed	1	0	0	0
40 dB	Open	Closed	Open	Closed	1	0	1	0
50 dB	Open	Open	Closed	Open	1	1	0	1
60 dB	Open	Open	Open	Open	1	1	1	1

- Troubleshoot Autorange Circuit using fig. FO-4, sheet 3.

7. Remove power. Remove DIP switch and reinstall A13U17.
8. Remove power, disconnect test equipment, reinstall circuit card assemblies, and reconnect all cables.

j. Receiver Test—Detector Troubleshooting Check.

1. On AN/USM-485,
   - Set power to ON.
   - Set MEASUREMENT to LEVEL FREQUENCY.
   - Set DISPLAY to RCV.
   - Press TRMT and RCV 600 Ω pushbuttons. Verify BRG, DIAL, and both HOLD pushbuttons are out.
   - Set frequency to l004Hz.
   - Set output level to +5dBm using OUTPUT LEVEL control.
2. Using an Oscilloscope, verify positive side of A13C34, C35, and C36 is 3.9Vp-p 1004Hz.
   - If incorrect perform Adjust Output Level and Transmit Monitor Loop (para 4-22).
3. Troubleshoot Detector Circuit as follows:
   - Use waveform diagrams provided on fig. FO-4, sheet 3.
   - The output of A13U22 must be correct for remainder of Detector circuit to work. Both A13TP10 and TP21 signals must be correct.
   - If Average Detector malfunction, troubleshoot A13U22, U21, and U20A circuits. Replace faulty component.
   - If QRMS Detector malfunction, troubleshoot Al3U22, U23, and U24B circuits. Replace faulty component.
4. Remove power, disconnect test equipment, reinstall circuit card assemblies, and reconnect all cables.

4-15k. Receiver Test—Impulse Noise Circuitry Check.

1. Perform Receiver Test—Initial Set-up (para 4-15a).
2. Check for a +10 volt reference voltage at A13U13 pin 15.
   - If incorrect, verify circuit is not loaded down. If not, replace A13U5.
3. On AN/USM-485,
   - Set MEASUREMENT to IMPULSE NOISE.
   - Set DISPLAY to RCV.
   - Select IMPULSE LOW (SET).
   - Set threshold to 60dBm.
4. Verify the following voltages:

   A13TP5 (LO) ..... from 0.762 to 0.794V
   A13TP4 (MID) ..... from 1.207 to 1.257V
   A13TP3 (HI) ..... from 1.914 to 1.992V

   - If incorrect, perform Measurement Test—Impulse Noise Digital to Analog Converter Check (para 4-17i).
5. Using Digital Voltmeter, verify voltages at A13U1 pin 1 and pin 7 are equal but of opposite sign (±20mV).
   - If incorrect, replace A13U1.
6. Using Digital Voltmeter, verify the following DC voltage on A13TP3 (HI) for each DB of low threshold setting. The 10's digit can be set to any value.

THRESHOLD (dB)	NOMINAL VOLTAGE	ACCEPTABLE RANGE
X1	2.188	2.144 - 2.232
X2	2.461	2.412 - 2.510
X3	2.734	2.679 - 2.789
X4	3.086	3.024 - 3.148
X5	3.477	3.407 - 3.547
X6	3.867	3.790 - 3.944
X7	4.336	4.249 - 4.423
X8	4.883	4.785 - 4.981
X9	5.469	5.360 - 5.578

   - If incorrect, troubleshoot Impulse Noise Detector circuit using fig. FO-4, sheet 4. Replace faulty component.
7. Connect Signal Generator output to AN/USM-485 RCV 310 jack. Set Signal Generator output to 2.0V at lKHz.
8. On AN/USM-485,
   - Press NOR pushbutton.
   - Select 15 KHz filter.
   - Set threshold to 90dBrn.

4-15k. Receiver Test—Impulse Noise Circuitry Check—Continued.

NOTE

Transmitter will not work because its signal path is grounded in Impulse Noise using 15KHz filter.

9. Using an Oscilloscope, verify output of A13U2 pins 1, 2, and 13 is a pulse with a voltage swing from +5V to -14V.
   - If incorrect, replace A13U2.
10. Troubleshoot all other malfunctions using fig. FO-4.
11. Remove power, disconnect test equipment, reinstall circuit card assemblies, and reconnect all cables.

4-16. CHARGER TEST.

DESCRIPTION

This test is used to correct a malfunction in the Battery Charger Circuits (fig. FO-3).

a. Charger Test—Inital Set-up.

1. Place AN/USM-485 into troubleshooting position (para 4-39).
2. On AN/USM-485, connect AC power cable; set power switch to ON then STBY, and check for following voltages on A5J1 (fig. FO-3).

   pin 1 ..... 9to14vdc
   pin 2 ..... 23.5 to 29.5 Vdc
   pin 3 ..... -29.5 to -23.5 Vdc

   - If these voltages are not present, troubleshoot AC power supply and power cable using fig. FO-5, sheet 5. Replace faulty component.

b. Charger Test—Charge Circuitry/Charge Inhibit Circuitry.

1. Perform Charger Test—Initial Set-up (para 4-16a).
2. Remove battery cables from A5J2, A5J3, and A5J4. Place a 900-1000 Ω load in parallel with Digital Voltmeter.
3. On AN/USM-485, set power switch to STBY and check the following voltages:

   A5J2 ..... 23.5 to 29.5 Vdc
   A5J3 ..... -29.5 to -23.5 Vdc
   A5J4 ..... 9.0 to 13.0 Vdc

4-16b. Charger Test—Charge Circuitry/Charge Inhibit Circuitry.

4. On AN/USM-485, set power switch ON and check the following voltages:

   A5J2 ..... 9V ±3V
   A5J3 ..... -9V ±3v
   A5J4 ..... 6V ±3V

   • If voltage readings are at ground, check A5F1, F2, F3. Replace faulty component. If fuses check good, replace A5 Charger Circuit Card Assembly (para 4-31).

   • If there is no change in voltage between steps 2 and 3 for all connectors, check A2S1 using fig. FO-2, sheet 1. Replace faulty component. If A2S1 checks good, replace A5 Charger Circuit Card Assembly (para 4-31).

   • For incorrect voltages or no change in voltage between steps 2 and 3, on only one or two connectors, troubleshoot charge circuitry A5Q1/Ql3/Q15 using fig. FO-3. Replace faulty component. If transistors check good, replace AS Charger Circuit Card Assembly (para 4-31).

5. On AN/USM-485, disconnect AC power cable and reconnect battery cables to A5J2, A5J3, A5J4. Remove load from Digital Voltmeter.

6. On AN/USM-485, set power switch to STBY and verify voltages areas follows:

   A5J4 ..... >6Vdc
   A5J2 and A5J3 ..... >16Vdc (absolute value)

   • If voltages are low, charge batteries by connecting AN/USM-485 to an AC power source. Turn power switch to STBY and let AN/USM-485 charge overnight. If battery voltages do not reach acceptable values after overnight charging and AN/USM-485 passes tests 1-5 above, replace batteries (para 4-37). Allow 17 hours for battery to fully charge.

c. Charger Test—Relay Drive Circuitry, Low Voltage Inhibit Circuitry Check.

NOTE

Batteries must be functional and fully charged for this test to work.

1. Perform Charger Test—Initial Set-up (para 4-16a).
2. On AN/USM-485, disconnect AC power cable. Set power switch from STBY to ON.

   • If AN/USM-485 comes on, perform Charger Test—Inhibit Circuitry AC and Low Voltage Check (para 4-16d).

3. On AN/USM-485, set power switch to STBY and jumper across A5C3.
4. On AN/USM-485, set power switch from STBY to ON.

   • If AN/USM-485 does not start, perform Charger Test—Delay and Relay Drive Circuitry Check (para 4-16e).

5. Remove jumper.

d. Charger Test—Inhibit Circuitry AC Low Voltage Check.

CAUTION

Do not short A5U1 pins in steps 1 to 3 below for longer than 2 seconds or permanent damage may result.

4-16d. Charger Test—Inhibit Circuitry AC Low Voltage Check—Continued.

NOTE

Batteries must be functional and fully charged for this test to work.

1. On AN/USM-485, verify AC power cable is disconnect. Set power switch to ON. Momentarily short A5U1 pin 5 to A5TF2 and verify AN/USM-485 shuts down.
2. Wait 2 sec and turn power switch to STBY then ON. Momentarily short A5U1 pin 6 to A5TP2 and verify AN/USM-485 shuts down.
3. Wait 2 sec and turn power switch to STBY then ON. Momentarily short A5U1 pins 7 and 9 and verify AN/USM-485 shuts down.
4. Wait *2* sec and turn power switch to STBY then ON.
5. When self-check has been completed, connect AC power cable and and verify AN/USM-485 resets.
6. Wait *2* seconds and disconnect AC power cable and verify AN/USM-485 shuts down.
   - If any of these steps fail, perform Charger Test—AC and Low Voltage Inhibit Troubleshooting Check (para 4-16f).
   - If AN/USM-485 passed all tests to this point, A5 Charger Circuit Card Assembly is not malfunctioning.

e. Charger Test—Delay and Relay Drive Circuitry Check.

NOTE

Batteries must be functional and fully charged for this test to work.

1. On AN/USM-485, connect AC power cable and set power switch to ON.
2. Without setting power switch to STBY, disconnect AC power cable.
3. Jumper across A5C3.
4. Momentarily short collector and emitter of A5Q2 and verify day clicks and AN/USM-485 turns on.
   - If incorrect, troubleshoot A5K1, A5F1, A5F3, Batteries using fig. FO-3. Replace faulty component. If components check good, replace A5 Charger Circuit Card Assembly (para 4-31).
5. Remove jumper from A5C3. Turn power switch from ON to STBY.
6. On AN/USM-485, connect AC power cable and set power switch to ON.
7. Without setting power switch to STBY, disconnect AC power cable.
8. Momentarily short collector of A5Q3 to A5TP2 and verify AN/USM-485 turns on and remains on.
   - If AN/USM-485 does not turn on, replace A5 Charger Circuit Card Assembly (para 4-31).
   - If AN/USM-485 comes on but does not stay on, replace A5 Charger Circuit Card Assembly (para 4-31).
   - If AN/USM-485 turns on and stays on but will not turn on when power switch is recycled, then troubleshoot A5F2 and wiring using fig. FO-3. Replace faulty components. If good, replace A5 Charger Circuit Card Assembly (para 4-31).

4-16f. Charger Test—AC and Low Voltage Inhibit Troubleshooting Check.

1. Perform Charger Test-Initial Set-up (para 4-16a).
2. On AN/USM-485, connect AC power cable and set power switch to ON.

NOTE

When AN/USM-485 is operated on AC power, low voltage and AC inhibit sense circuits take power and sense inputs from transmitter. Circuits are not affected by battery or charge circuitry.

3. Verify A5U2 pin 3 is 7.0V ±0.lV.
   - If correct, proceed with step 5.
4. Verify A5TP1 is approximately +14V.
   - If incorrect, perform Power Supply Test (para 4-10).
   - If correct, replace A5 CCA (para 4-31).
5. Check the following voltages at points listed below and replace A5 CCA (para 4-31) if incorrect.

Test Point	Correct Reading
A5U1 pin 1	~0V
A5U1 pin 2	~0V
A5U1 pin 3	+14V to +16.5V
A5U1 pin 5	>+7V
A5U1 pin 6	<–7V
A5U1 pin 9	>0V
A5U1 pin 12	–14V to –16.5 V
A5U1 pin 14	~0V
A5U2 pin 1	7.0V ±20mV
A5U2 pin 2	7.0V ±20mV
A5U2 pin 4	–14V to –16.5 V
A5U2 pin 7	–7.0V ±20mV
A5U2 pin 8	+14V to +16.5V

4-16f. Charger Test—AC and Low Voltage Inhibit Troubleshooting Check.

6. Verify voltage at the anode of A5CR3 or CR5 is more negative than -17V.
   - If incorrect, and A5J1 pin 3 is -29.5 to -23.5 Vdc, replace A5 Charger Circuit Card Assembly (para 4-31).

CAUTION

Do not ground either side of A5C3.

7. Measure and record each side of A5C3. Subtract each value and verify difference is approximately 0.7 volts.
   - If incorrect, replace A5 Charger Circuit Card Assembly (para 4-31).
8. Disconnect AC power cable. Turn power switch from ON to STBY to ON and wait 10 seconds. Measure and record each side of A5C3. Subtract each value and verify difference is approximately 0 volts (no more than +0.5 volts).
   - If incorrect, replace A5 Charger Circuit Card Assembly (para 4-31).
9. Troubleshoot all other malfunctions using fig. FO-3.
10. Remove power, disconnect test equipment, reinstall circuit card assemblies, and reconnect all cables.

4-17. MEASUREMENT TEST.

DESCRIPTION

This test is used to correct a malfunction in the Measurement Circuits (fig. FO-4).

a. Measurement Test—Frequency Response Test—Internal Loop Around Check.

1. Install Test Processor (para 4-38).
2. On AN/USM-485, set power switch to ON.
3. Verify all indicators light for approximately one second. Test starts automatically, checking transmitter amplitude at frequencies listed below. Use volume control to adjust level of test tone. Press STOP to halt test, press IMPULSE NOISE DISPLAY to continue test, and press START/RESET to restart test.

FREQUENCY (Hz)	REF in dB	LEVEL TOLERANCE
20	0.0	±1.5
200	0.0	±0.3
1000	0.0	±0.2
10000	0.0	±0.2
60000	0.0	±0.7
85000	0.0	±0.7
110000	–0.9	±3.4

- If level is incorrect, AN/USM-485 beeps and displays “Err”. Troubleshoot using fig. FO-4. Replace faulty component.
- If level is correct, AN/USM-485 displays “PASS”.

4-17b. Measurement Test—Frequency Response Test—External Loop Around Check.

1. Install Test Processor (para 4-38). Set power to ON.
2. On AN/USM-485,
   - Press both TRMT and RCV Impedance pushbuttons to 600 Ω or 900 Ω.
   - Press NOR pushbutton.
   - Press SF SKIP and verify SF SKIP indicator lights.
   - Verify "Err LOOP message flashes on and off in display.
   - Connect TRMT 310 jack to RCV 310 jack.
   - Verify "Err LOOP' message stops.
   - Adjust OUTPUT LEVEL control to display any desired reference level.
3. Press START/RESET button to set reference to displayed level. Left display blanks and right display indicates "LOOP' momentarily. After approximately one second, left display will show the reference level.

NOTE

Each time reference level is changed, press START/RESET button and continue test.

4. Press IMPULSE NOISE DISPLAY button to start test. Test starts automatically, checking transmitter amplitude at frequencies listed below. Press STOP to halt test, press IMPULSE NOISE DISPLAY to continue test, and press START/RESET to restart test.

FREQUENCY (Hz)	REF in dB	LEVEL TOLERANCE
20	0.0	±1.5
200	0.0	±0.3
1000	0.0	±0.2
10000	0.0	±0.2
60000	0.0	±0.8
85000	0.0	±0.8
110000	–0.9	±3.4

- If level is incorrect, AN/USM-485 beeps and displays "Err". Troubleshoot using fig. FO-4. Replace faulty component.
- If level is correct, AN/USM-485 displays "PASS".

c. Measurement Test—Noise Filter Test—C Message Filter Check.

1. Install Test Processor (para 4-38).
2. On AN/USM-485,
   - Set power switch to STBY then to ON.
   - Set MEASUREMENT to NOISE.
   - Press PERIOD button to start test.

4-17c. Measurement Test—Noise Filter Test—C Message Filter Check-Continued.

FREQUENCY (Hz)	REF in dB	LEVEL TOLERANCE
300	–16.5	±1.0
900	–0.6	±1.0
1000	0.0	±0.2
2500	1.4	±1.0
3000	–2.5	±1.0
4500	–21.5	±3.0

- If level is correct, AN/USM-485 displays “PASS”. Perform Measurement Test—Noise Filter Test—3KHz Flat Filter Check (para 4-17d).
- If level is incorrect, AN/USM-485 beeps and displays “FAIL”. Proceed with step 3.

3. Remove power. Remove Test Processor (para 4-38).
4. Remove Shorting Bar from A13JU1 (fig. FO-4, sheet 4). Insert DIP Switch from Diagnostic Service Kit into A13JU1. Set all DIP Switch positions to open. Change following DIP Switch positions (address 000):

   5-12 ..... closed
   6-11 ..... closed
   7-10 ..... closed

5. Connect Signal Generator to RCV 310 jack.
6. On AN/USM-485,
   - Set MEASUREMENT to LEVEL FREQUENCY.
   - Set DISPLAY to RCV.

NOTE

Disregard error message.

7. Adjust Signal Generator output level to obtain filter input level as shown below. Adjust Signal Generator frequency to values shown below. Measure response using Digital Voltmeter or reading AN/USM-485 display as indicated. Troubleshoot filter using fig. FO-4, sheet 2. Replace faulty component.

Filter Input = 1.000 volts AC at TP15-2. Output in mV on Voltmeter (approx.).

FREQUENCY	U31-1 STAGE 1	U31-8 STAGE 2	U32-1 STAGE 3	U32-7 STAGE 4	TP15-1 STAGE 5
300	583	145	146	147	148
900	960	789	848	917	946
1000	968	790	863	952	988
2500	995	295	320	665	852
3000	997	241	201	512	734
4500	999	156	55	45	85

4-17c. Measurement Test—Noise Filter Test—C Message Filter Check—Continued.

Filter Input = 0.775Vac at TP15-2	Read Acceptable Level in dBm on AN/USM-485 Display	
	ACCEPTABLE	OUTPUT LEVEL
FREQUENCY	minimum	maximum
60	-57.7	-53.7
100	-44.5	-40.5
200	-27.0	-23.0
300	-17.5	-15.5
400	-12.4	-10.4
500	- 8.5	- 6.5
600	- 5.7	- 3.7
700	- 3.7	- 1.7
800	- 2.5	- .5
900	- 1.6	+ .4
1000	- .2	+ .2
1200	- 1.2	+ .8
1300	- 1.5	+ .5
1500	- 2.0	0.0
1800	- 2.3	- .3
2000	- 2.3	- .3
2500	- 2.4	- .4
2800	- 2.9	- .9
3000	- 3.5	- 1.5
3300	- 7.2	- 3.2
3500	- 9.6	- 5.6
4000	-17.5	-11.5
4500	-24.5	-18.5
5000	-31.5	-25.5

8. Disconnect Signal Generator. Remove Dip Switch and install Shorting Bar in A13JU1 pins 1-4.

d. Measurement Test—Noise Filter Test-3KHz Flat Filter Check.

1. Install Test Processor (para 4-38).
2. On AN/USM-485,
   - Set power switch to STBY then to ON.
   - Set MEASUREMENT to NOISE.
   - Select 3KHz FLAT Filter.
   - Press PERIOD button to start test.

4-17d. Measurement Test—Noise Filter Test—3KHz Flat Filter Check—Continued.

FREQUENCY (Hz)	REF in dB	LEVEL TOLERANCE
3000	–3.0	±0.5

- If level is correct, AN/USM-485 displays “PASS”. Perform Measurement Test—Noise Filter Test—15KHz Flat Filter Check (para 4-17e).
- If level is incorrect, AN/USM-485 beeps and displays “FAIL”. Proceed with step 3.

3. Remove power. Remove Test Processor (para 4-38).
4. Remove Shorting Bar from A13JU1. Insert DIP Switch from Diagnostic Service Kit into A13JU1. Set all DIP Switch positions to open. Change following DIP Switch positions (address 001):

   5-12 ..... open
   6-11 ..... closed
   7-10 ..... closed

5. Connect Signal Generator to RCV 310 jack.
6. On AN/USM-485,
   - Set MEASUREMENT to LEVEL FREQUENCY.
   - Set DISPLAY to RCV.
7. Adjust Signal Generator output level to obtain filter input level as shown below. Adjust Signal Generator frequency to values shown below. Measure response using Digital Voltmeter or reading AN/USM-485 display as indicated. Troubleshoot filter using fig. FO4, sheet 2. Replace faulty component.

Filter Input = 0.775Vac at TP15-2	Read Acceptable Level in dBm on AN/USM-485 Display	
	ACCEPTABLE	OUTPUT LEVEL
FREQUENCY	minimum	maximum
30	– 2.5	+ 2.5
60	– 1.7	+ 1.7
400	– .5	+ .5
1000	– .2	+ .2
2000	– 1.8	+ .2
3000	– 4.8	– 1.2
6000	–15.3	– 9.3

Filter Input = 1.000 volts AC at TP15-2. Output in mV on Voltmeter (approx.).

FREQUENCY	U36-1 STAGE 1	U36-7 STAGE 2	U36-8 STAGE 3	TP15-3 STAGE 4
100	1000	1000	1000	40.2
500	1004	1004	1000	490.0
1000	1015	1015	1000	1007.0
2000	1063	1060	998	1712.0
5000	1512	1386	989	2398.0
10000	1040	516	193	504.0

8. Disconnect Signal Generator. Remove Dip Switch and install Shorting Bar in A13JU1 pins 1-4.

4-17e. Measurement Test—Noise Filter Test—15KHz Flat Filter Check.

1. Install Test Processor (para 4-38).
2. on AN/USM-485,
   - Set power switch to STBY then to ON.
   - Set MEASUREMENT to NOISE.
   - Select 15KHz FLAT Filter.
   - Press PERIOD button to start test.

FREQUENCY (Hz)	REF in dB	LEVEL TOLERANCE
15000	–3.0	±0.5

   - If level is correct, AN/USM-485 displays “PASS”. Perform Measurement Test-Noise Filter Test-Program Filter Check (para 4-17f).
   - If level is incorrect, AN/USM-485 beeps and displays “FAIL”. Proceed with step 3.
3. Remove power. Remove Test Processor (para 4-38).
4. Remove Shorting Bar from A13JU1. Insert DIP Switch from Diagnostic Service Kit into A13JU1. Set all DIP Switch positions to open. Change following DIP Switch positions (address 010):

   5-12 ..... closed
   6-11 ..... open
   7-10 ..... closed
5. Connect Signal Generator to RCV 310 jack.
6. On AN/USM-485,
   - Set MEASUREMENT to LEVEL FREQUENCY.
   - Set DISPLAY to RCV.
7. Adjust Signal Generator output level to obtain filter input level as shown below. Adjust Signal Generator frequency to values shown below. Measure response using Digital Voltmeter or reading AN/USM-485 display as indicated. Troubleshoot filter using fig. FO-4, sheet 2. Replace faulty component.

Filter Input = 0.775Vac at TP15-2 at given frequencies	Read Acceptable Level in dBm on AN/USM-485 Display	
	ACCEPTABLE OUTPUT LEVEL	
FREQUENCY	minimum	maximum
30	– 2.5	+ 2.5
60	– 1.7	+ 1.7
400	– .5	+ .5
1000	– .2	+ .2
10K	– 1.8	+ .2
15K	– 4.8	– 1.2
30K	–15.3	– 9.3

4-17e. Measurement Test—Noise Filter Test—15KHz Flat Filter Check—Continued.

Filter Input = 1.000 volts AC at TP15-2. Output in MV on Voltmeter (approx.).	
FREQUENCY	TP15-5
1K	1000
15K	714
30K	247

8. Disconnect Signal Generator. Remove Dip Switch and install Shorting Bar in A13JU1 pins 1-4.

f. Measurement Test—Noise Filter Test—Program Filter Check.

1. Install Test Processor (para 4-38).
2. On AN/USM-485,
   - Set power switch to STBY then to ON.
   - Set MEASUREMENT to NOISE.
   - Select PROGRAM Filter.
   - Press PERIOD button to start test.

FREQUENCY (Hz)	REF in dB	LEVEL TOLERANCE
100	–26.5	±2.0
500	–6.6	±1.0
1000	0.0	±0.2
2000	+4.8	±1.0
5000	+6.5	±2.0
10000	–8.5	±4.0

   - If level is correct, AN/USM-485 displays “PASS”. Perform Measurement Test—Noise Filter Test—50K BIT Filter Check (para 4-17g).
   - If level is incorrect, AN/USM-485 beeps and displays “FAIL”. Proceed with step 3.
3. Remove power. Remove Test Processor (para 4-38).
4. Remove Shorting Bar from A13JU1. Insert DIP Switch from Diagnostic Service Kit into A13JU1. Set all DIP Switch positions to open. Change following DIP Switch positions (address 100):

   5-12 .....open
   6-11 .....open
   7-10 .....closed

5. Connect Signal Generator to RCV 310 jack.
6. On AN/USM-485,
   - Set MEASUREMENT to LEVEL FREQUENCY.
   - Set DISPLAY to RCV.

4-17f. Measurement Test—Noise Filter Test—Program Filter Check—Continued.

7. Adjust Signal Generator output level to obtain filter input level as shown below. Adjust Signal Generator frequency to values shown below. Measure response using Digital Voltmeter or reading AN/USM-485 display as indicated. Troubleshoot filter using fig. FO-4, sheet 2. Replace faulty component.

Filter Input = 0.775Vac at TP15-2	Read Acceptable Level in dBm on AN/USM-485 Display	
	ACCEPTABLE	OUTPUT LEVEL
FREQUENCY	minimum	maximum
100	-28.3	-24.3
200	-19.3	-15.3
300	-14.3	-10.3
400	-11.0	- 7.0
500	- 7.6	- 5.6
600	- 5.7	- 3.7
700	- 4.2	- 2.2
800	- 3.0	- 1.0
900	- 1.8	+ .2
1000	- .2	+ .2
1500	+ 2.2	+ 4.2
2000	+ 3.8	+ 5.8
2500	+ 3.6	+ 7.6
3000	+ 4.0	+ 8.0
4000	+ 4.5	+ 8.5
5000	+ 4.5	8.5
6000	+ 3.4	+ 9.4
7000	+ 2.8	+ 8.8
8000	+ 1.0	+ 7.0
9000	- 5.5	+ 2.5
1000	-12.5	- 4.5

Filter Input = 1.000 volts AC at TP15-2. Output in MV on Voltmeter (approx.).	
FREQUENCY	TP15-5
1K	994
3K Hz	707
6K Hz	243

8. Disconnect Signal Generator. Remove Dip Switch and install Shorting Bar in A13JU1 pins 1-4.

g. Measurement Test—Noise Filter Test—50K BIT Filter Check.

1. Install Test Processor (para 4-38).
2. On AN/USM-485,
   - Set power switch to STBY then to ON.
   - Set MEASUREMENT to NOISE.
   - Select 50K Bit Filter.
   - Press PERIOD button to start test.

4-17g. Measurement Test—Noise Filter Test—50K BIT Filter Check—Continued.

FREQUENCY (Hz)	REF in dB	LEVEL TOLERANCE
1000	0.0	±0.4
15000	–1.0	±1.0
25000	–2.0	±1.0
35000	–5.0	±1.7
45000	–14.0	±3.0

- If level is correct, AN/USM-485 displays "PASS". Perform Measurement Test—Notch Filter Check (para 4-17h).
- If level is incorrect, AN/USM-485 beeps and displays "FAIL". Proceed with step 3.

3. Remove power. Remove Test Processor (para 4-38).
4. Remove Shorting Bar from A13JU1. Insert DIP Switch from Diagnostic Service Kit into A13JU1. Set all DIP Switch positions to open. Change following DIP Switch positions (address 011):

   5-12 ..... closed
   6-11 ..... closed
   7-10 ..... open

5. Connect Signal Generator to RCV310 jack.
6. On AN/USM-485,
   - Set MEASUREMENT to LEVEL FREQUENCY.
   - Set DISPLAY to RCV.
7. Adjust Signal Generator output level to obtain filter input level as shown below. Adjust Signal Generator frequency to values shown below. Measure response using Digital Voltmeter or reading AN/USM-485 display as indicated. Troubleshoot filter using fig. FO-4, sheet 2. Replace faulty component.

Filter Input = 0.775Vac at TP15-2	Read Acceptable Level in dBm on AN/USM-485 Display	
	ACCEPTABLE	OUTPUT LEVEL
FREQUENCY	minimum	maximum
20	-13.0	- 7.0
50	- 4.2	- 1.2
200	- .7	+ .3
1k	- .2	+ .2
5k	- .6	+ .4
10k	- .8	+ .2
15k	- 1.7	+ .3
20k	- 2.3	- .3
25k	- 3.1	- 1.1
30k	- 4.8	- 1.8
35k	- 6.7	- 3.3
40k	- 9.8	- 5.8
45k	-17.0	-11.0
50k		<- 22.0
55k		<- 30.0

4-17g. Measurement Test—Noise Filter Test—50K BIT Filter Check—Continued.

Filter Input = 1.000 volts AC at TP15-2. Output in mV on Voltmeter (approx.).				
FREQUENCY	U46-1 STAGE 1	U46-7 STAGE 2	U47-1 STAGE 3	TP15-6 STAGE 4
1000	999	998	998	998.0
15K	1000	896	889	944.0
25K	1000	694	656	787.0
35K	1000	485	401	560.0
50K	1000	281	164	74.3

8. Disconnect Signal Generator. Remove Dip Switch and install Shorting Bar in A13JU1 pins 1-4.

h. Measurement Test—Notch Filter Check.

1. Install Test Processor (para 4-38).
2. On AN/USM-485,
   - Set power switch to STBY then to ON.
   - Set MEASUREMENT to NOISE WITH TONE.
   - Press PERIOD button to start test.

FREQUENCY (Hz)	REF in dB	LEVEL TOLERANCE
400	–0.0	+0.5
860	–1.2	–1.2
1000	—	—
1020	—	—
1180	–1.2	+1.7
1700	–0.0	+0.5

   - If level is correct, AN/USM-485 displays “PASS”. Perform Impulse Noise Digital to Analog Converter Check (para 17i).
   - If level is incorrect, AN/USM-485 beeps and displays “FAIL”. Proceed with step 3.
3. Remove power. Remove Test Processor (para 4-38).
4. Remove Shorting Bar from A13JU1. Insert DIP Switch from Diagnostic Service Kit into A13JU1. Set all DIP Switch positions to open. Change following DIP Switch positions (address 010):

   5-12 .....closed
   6-11 ..... open
   7-10 .....closed

5. Connect Signal Generator to RCV 310 jack.

4-17h. Measurement Test—Notch Filter Check-Continued.

6. On AN/USM-485,
   - Set MEASUREMENT to LEVEL FREQUENCY.
   - Set DISPLAY to RCV.
7. Adjust Signal Generator output level to obtain filter input level as shown below. Adjust Signal Generator frequency to values shown below. Measure response using Digital Voltmeter or reading AN/USM-485 display as indicated. Troubleshoot filter using fig. FO-4, sheet 1. Replace faulty component.

Filter Input = 0.775Vac at TP15-2 (with 15KHz flat)	Read Acceptable Level in dBm on AN/USM-485 Display	
	ACCEPTABLE	OUTPUT LEVEL
FREQUENCY	minimum	maximum
=< 400 Hz	- .5	+ .5
400 <f=< 862 Hz	-3.0	+ .5
862 <f=< 995		<+ .5
995=<f=<1025		<-50.0
1025 <f< 1182		<+ .5
1182=<f< 1700	-3.0	+ .5
1700=<f	- .5	+ .5

Filter Input = 1.000 volts AC at TP15-2. Output in mV on Voltmeter (approx.).

FREQUENCY	U40-7 STAGE 1	U51-7 STAGE 2	U51-14 STAGE 3
400	1058	1034	993
862	2476	1411	901
1182	493	280	894
1700	691	637	979

8. Disconnect Signal Generator. Remove Dip Switch and install Shorting Bar in A13JU1 pins 1-4.

i. Measurement Test—impulse Noise Digits/-to-Analog Converter Check.

1. Install Test Processor (para 4-38).
2. On AN/USM-485,
   - Set power switch to STBY then to ON.
   - Set MEASUREMENT to IMPULSE NOISE.

4-17i. Measurement Test—impulse Noise Digital-to-Analog Converter Check—Continued.

3. Impulse noise DAC is tested at points listed as shown below.

dB	VOLTAGE	VOLTAGE TOLERANCE
0	0.78	±0.04
1	0.87	±0.04
2	0.98	±0.05
3	1.09	±0.05
4	1.23	±0.06
5	1.37	±0.07
6	1.54	±0.08
7	1.73	±0.09
8	1.94	±0.10
9	2.18	±0.11

- If level is correct, AN/USM-485 displays “PASS”. Perform PAR Filter Check (para 4-17j).
- If level is incorrect, AN/USM-485 beeps and displays “FAIL”. Troubleshoot Impulse Noise Circuit using fig. FO-4, sheet 4. Replace faulty component.

j. Measurement Test—P/AR Filter Check.

NOTE

Perform this check only if P/AR Filter malfunction is suspect. Do not deviate from steps as instructed.

1. If installed, remove Test Processor (para 4-38).
2. On AN/USM-485, set power switch to STBY then to ON.
3. Remove Shorting Bar from A13JU1. Insert DIP Switch from Diagnostic Service Kit into A13JU1. Set all DIP Switch positions to open. Change following DIP Switch positions (address 101):

   5-12 .....open
   6-11 .....closed
   7-10 .....open

4. Connect Signal Generator to RCV 310 jack.
5. On AN/USM-485,
   - Set MEASUREMENT to LEVEL FREQUENCY.
   - Set DISPLAY to RCV.
6. Adjust Signal Generator output level to obtain filter input level as shown below. Adjust Signal Generator frequency to values shown below. Measure response using Digital Voltmeter or reading AN/USM-485 display as indicated. Troubleshoot filter using fig. FO-4, sheet 2. Replace faulty component.

4-17j. Measurement Test—P/AR Filter Check—Continued.

Filter Input = 1.000 volts AC at TP15-2. Output in mV on Voltmeter (approx.).			
FREQUENCY	TP15-7 STAGE 1	TP15-8 STAGE 2	
300	232	49.1	
1000	1312	1566.0	
2300	736	492.0	

7. Disconnect Signal Generator. Remove Dip Switch and install Shorting Bar in A13JU1 pins 1-4.

k. Measurement Test—150KHz Low Pass Filter Check.

NOTE

Perform this check only if 150KHz Low Pass Filter malfunction is suspect.

1. If installed, remove Test Processor (para 4-38).
2. On AN/USM-485, set power switch to STBY then to ON.
3. Connect Signal Generator to RCV 310 jack.
4. On AN/USM-485,
   - Set MEASUREMENT to LEVEL FREQUENCY.
   - Set DISPLAY to RCV.
5. Adjust Signal Generator output level to obtain filter input level as shown below. Adjust Signal Generator frequency to values shown below. Measure response using Digital Voltmeter. Troubleshoot filter using fig. FO-4, sheet 3. Replace faulty component.

Filter Input = 0.20 volts AC at TP15-2. Output in MV on Voltmeter (approx.).			
FREQUENCY	U33 PIN 6 STAGE 1	U28 PIN 6 STAGE 2	U26 PIN 6 STAGE 3
1	200	200	200
60 K	231	204	201
85 K	269	212	203
100 K	305	221	203
110 K	333	228	202
135 K	402	235	184

6. Disconnect Signal Generator.

l. Measurement Test—Filter Select

NOTE

Use this procedure to select between Flat Filter (no filter) or ground for troubleshooting purposes only.

1. If installed, remove Test Processor (para 4-38).
2. On AN/USM-485, set power switch to STBY then to ON.
3. Remove Shorting Bar from A13JU1. Insert DIP Switch from Diagnostic Service Kit into A13JU1. Set all DIP Switch positions to open.

   For FLAT Filter (no filter selected), change following DIP Switch positions (address 110):

   5-12 .....closed
   6-11 .....open
   7-10 .....open

   For Ground, change following DIP Switch positions (address 111):

   5-12 ..... open
   6-11 .... open
   7-10 .....open
4. Remove Dip Switch and install Shorting Bar in A13JU1 pins 1-4.
5. Troubleshoot all other malfunctions using fig. FO-1 and fig. FO-4.
6. Remove power, disconnect test equipment, reinstall circuit card assemblies, and reconnect all cables.

Section IV. MAINTENANCE PROCEDURES

4-18. PERFORMANCE TEST.

DESCRIPTION

This procedure covers:

- Transmitter Flatness at +l0dBm Test.
- Receiver Accuracy Test.
- Filter Test.
- Count Limit Test.
- Hold Tone Dropout Detector Test.
- Distortion Test.
- Noise to Ground Test.
- Transmitter Flatness at -40dBm Test.
- Autorange Test
- Impulse Noise DAC Test.
- Termination Impedance Test
- Hold Circuit Test.
- P/AR Circuit Test.

NOTE

- Performance test procedure steps should be done in the order given.
- Keep test equipment interconnecting cables as short as possible.
- A performance test checklist is provided at the end of the performance test procedures. Use the checklist while doing the test procedures.
- Allow an initial 10 minute warm-up period when performing the first performance test to allow the Transmission Test Set to stabilize.
- Allow Transmission Test Set 3 minutes to stabilize if turned off during performance tests.
- The initialized setup of Transmission Test Set controls and indicators is to be performed prior to each performance test.

INITIALIZED SETUP.

1. Initialization of Transmission Test Set controls and indicators is accomplished automatically by pressing LINE switch to STBY then to ON.

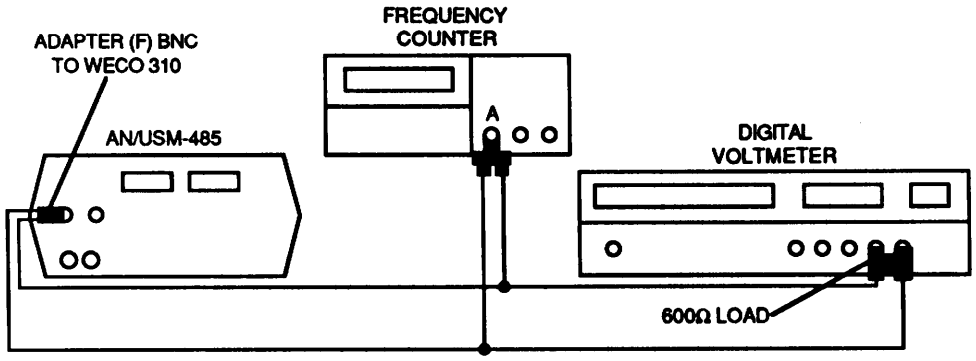
2. Initialized state of Transmission Test Set should be as follows:

DISPLAY	TRMT
LEFT DISPLAY	-65 to +13dBm*
RIGHT DISPLAY	1004Hz
MEASUREMENT	LEVEL FREQUENCY
F1	404Hz**
F2	1004Hz**
F3	2804Hz**
F4	2713Hz**

* Dependent upon OUTPUT LEVEL control knob position.
** Initialized value. To verify, press key.

TRANSMITTER FLATNESS +10dBm TEST.

1. Connect test equipment as shown.



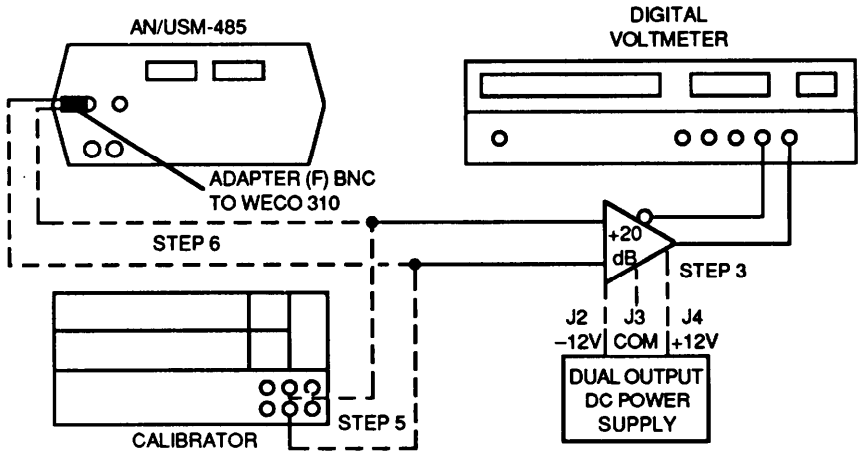
2. On AN/USM-485,
   - Set POWER to ON.
   - Press NOR pushbutton.
   - Set DISPLAY to TRMT.
   - On SETUP press in TRMT 600 Ω pushbutton.
   - Set MEASUREMENT to LEVEL FREQUENCY.
   - Set frequency to 1004HZ.
   - Adjust AN/USM-485 OUTPUT LEVEL until 2.435Vrms appears on Digital Voltmeter.
3. Use STEP UP or STEP DOWN buttons in conjunction with <—or—> buttons to set AN/USM-485 TRMT frequency to frequencies listed below. Verify Digital Voltmeter readings are within specified limits. At 85KHz verify that AN/USM-485 frequency when measured with Frequency Counter is between 84.996KHz and 85.(M)4KHz.

FREQUENCY	ACCEPTABLE VOLTAGE RANGE
20 Hz	2.17 to 2.73 Vrms
200 Hz	2.38 to 2.49 Vrms
5 kHz	2.38 to 2.49 Vrms
15 kHz	2.38 to 2.49 Vrms
30 kHz	2.30 to 2.58 Vrms
60 kHz	2.30 to 2.58 Vrms
85 kHz	2.25 to 2.64 Vrms

4. On AN/USM-485, set power to STBY and disconnect test equipment.

TRANSMITTER FLATNESS -40dBm TEST.

1. Connect test equipment as shown.



2. On AN/U3M-45%
   - Set POWER to ON.
   - Press NOR pushbutton.
   - Set DISPLAY to TRMT.
   - On SETUP press in TRMT 600 Ω pushbutton. Verify BRG, DIAL, and both HOLD pushbuttons are out.
   - Set MEASUREMENT to LEVEL FREQUENCY.
   - Set IMPULSE NOISE to Display (F2 1004Hz).
3. Adjust Power Supply for + and- 12V output and connect to +20dB Amplifier from Diagnostic Service Kit. Set +20dB Amplifier to 20dB gain and 4KHz Low Pass Filter to FLAT.
4. Set Calibrator to 7.746mV at 1004Hz with output floating.
5. Connect Calibrator to +20dB Amplifier input. Record amplifier output voltage.
6. Connect +20dB Amplifier input to AN/USM-485 jack as shown. Monitor +20 amplifier output with Digital Voltmeter.
7. Adjust AN/USM-485 OUTPUT LEVEL control until Digital Voltmeter reading is same as +20dB Amplifier output voltage in step 5.

NOTE

Do not change 40dBm setting on Calibrator or AN/USM-485 OUTPUT LEVEL control settings during rest of this test.

8. Connect Calibrator to +20dB Amplifier input. Set Calibrator to 20Hz. Record amplifier output voltage.

TRANSMITTER FLATNESS -40dBm TEST-Continued.

9. Locate horizontal Vout line closest to recorded voltage reading from below. Use this voltage line for acceptable voltage readings.

   EXAMPLE: If Digital Voltmeter reading is 71.lmV, locate 71.0mV line from Vout column below. Locate 20Hz frequency column. Allowable voltage reading, when Calibrator is substituted by AN/USM-485, is 79.7 to 63.3mV as displayed on Digital Voltmeter.

10. Connect AN/USM-485 TRMT output in place of Calibrator. Use STEP UP or STEP DOWN buttons in conjunction with <-or-> buttons to set AN/USM-485 TRMT frequency to 20Hz.

11. Locate voltage line identified in Step 9. Identify allowable voltage range in frequency column as shown below. Verify that +20dB Amplifier output is in this range as displayed on Digital Voltmeter.

12. Repeat Steps 10 to 11 for each frequency column as shown below (50Hz through 85KHz).

13. On AN/USM-485, set power to STBY and disconnect test equipment.

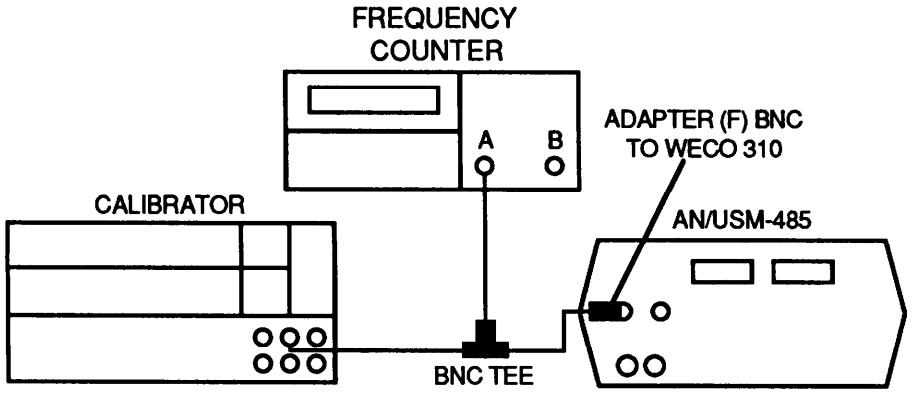
Vout (in mV)	±1.0 dB 20 Hz	±0.5 dB 50 Hz	±0.2 dB 200 Hz & ±0.2 dB 15 kHz	±0.5 dB 60 kHz	±0.5 dB 85 kHz
65.0	72.9 to 57.9	68.9 to 61.4	66.5 to 63.5	68.9 to 61.4	68.9 to 61.4
65.4	73.4 to 58.3	69.3 to 61.7	66.9 to 63.9	69.3 to 61.7	69.3 to 61.7
65.8	73.8 to 58.6	69.7 to 62.1	67.3 to 64.3	69.7 to 62.1	69.7 to 62.1
66.2	74.3 to 59.0	70.1 to 62.5	67.7 to 64.7	70.1 to 62.5	70.1 to 62.5
66.6	74.7 to 59.4	70.5 to 62.9	68.2 to 65.1	70.5 to 62.9	70.5 to 62.9
67.0	75.2 to 59.7	71.0 to 63.3	68.6 to 65.5	71.0 to 63.3	71.0 to 63.3
67.4	75.6 to 60.1	71.4 to 63.6	69.0 to 65.9	71.4 to 63.6	71.4 to 63.6
67.8	76.1 to 60.4	71.8 to 64.0	69.4 to 66.3	71.8 to 64.0	71.8 to 64.0
68.2	76.5 to 60.8	72.2 to 64.4	69.8 to 66.6	72.2 to 64.4	72.2 to 64.4
68.6	77.0 to 61.1	72.7 to 64.8	70.2 to 67.0	72.7 to 64.8	72.7 to 64.8
69.0	77.4 to 61.5	73.1 to 65.1	70.6 to 67.4	73.1 to 65.1	73.1 to 65.1
69.4	77.9 to 61.9	73.5 to 65.5	71.0 to 67.8	73.5 to 65.5	73.5 to 65.5
69.8	78.3 to 62.2	73.9 to 65.9	71.4 to 68.2	73.9 to 65.9	73.9 to 65.9
70.2	78.8 to 62.6	74.4 to 66.3	71.8 to 68.6	74.4 to 66.3	74.4 to 66.3
70.6	79.2 to 62.9	74.8 to 66.7	72.2 to 69.0	74.8 to 66.7	74.8 to 66.7
71.0	79.7 to 63.3	75.2 to 67.0	72.7 to 69.4	75.2 to 67.0	75.2 to 67.0
71.4	80.1 to 63.6	75.6 to 67.4	73.1 to 69.8	75.6 to 67.4	75.6 to 67.4
71.8	80.6 to 64.0	76.1 to 67.8	73.5 to 70.2	76.1 to 67.8	76.1 to 67.8
72.2	81.0 to 64.3	76.5 to 68.2	73.9 to 70.6	76.5 to 68.2	76.5 to 68.2
72.6	81.5 to 64.7	76.9 to 68.5	74.3 to 70.9	76.9 to 68.5	76.9 to 68.5
73.0	81.9 to 65.1	77.3 to 68.9	74.7 to 71.3	77.3 to 68.9	77.3 to 68.9
73.4	82.4 to 65.4	77.7 to 69.3	75.1 to 71.7	77.7 to 69.3	77.7 to 69.3
73.8	82.8 to 65.8	78.2 to 69.7	75.5 to 72.1	78.2 to 69.7	78.2 to 69.7
74.2	83.3 to 66.1	78.6 to 70.0	75.9 to 72.5	78.6 to 70.0	78.6 to 70.0
74.6	83.7 to 66.5	79.0 to 70.4	76.3 to 72.9	79.0 to 70.4	79.0 to 70.4

TRANSMITTER FLATNESS -40dBm TEST-Continued.

Vout (in mV)	±1.0 dB 20 Hz	±0.5 dB 50 Hz	±0.2 dB 200 Hz & ±0.2 dB 15 kHz	±0.5 dB 60 kHz	±0.5 dB 85 kHz
75.0	84.2 to 66.8	79.4 to 70.8	76.7 to 73.3	79.4 to 70.8	79.4 to 70.8
75.4	84.6 to 67.2	79.9 to 71.2	77.2 to 73.7	79.9 to 71.2	79.9 to 71.2
75.8	85.0 to 67.6	80.3 to 71.6	77.6 to 74.1	80.3 to 71.6	80.3 to 71.6
76.2	85.5 to 67.9	80.7 to 71.9	78.0 to 74.5	80.7 to 71.9	80.7 to 71.9
76.6	85.9 to 68.3	81.1 to 72.3	78.4 to 74.9	81.1 to 72.3	81.1 to 72.3
77.0	86.4 to 68.6	81.6 to 72.7	78.8 to 75.2	81.6 to 72.7	81.6 to 72.7
77.4	86.8 to 69.0	82.0 to 73.1	79.2 to 75.6	82.0 to 73.1	82.0 to 73.1
77.8	87.3 to 69.3	82.4 to 73.4	79.6 to 76.0	82.4 to 73.4	82.4 to 73.4
78.2	87.7 to 69.7	82.8 to 73.8	80.0 to 76.4	82.8 to 73.8	82.8 to 73.8
78.6	88.2 to 70.1	83.3 to 74.2	80.4 to 76.8	83.3 to 74.2	83.3 to 74.2
79.0	88.6 to 70.4	83.7 to 74.6	80.8 to 77.2	83.7 to 74.6	83.7 to 74.6
79.4	89.1 to 70.8	84.1 to 75.0	81.2 to 77.6	84.1 to 75.0	84.1 to 75.0
79.8	89.5 to 71.1	84.5 to 75.3	81.7 to 78.0	84.5 to 75.3	84.5 to 75.3
80.2	90.0 to 71.5	85.0 to 75.7	82.1 to 78.4	85.0 to 75.7	85.0 to 75.7
80.6	90.4 to 71.8	85.4 to 76.1	82.5 to 78.8	85.4 to 76.1	85.4 to 76.1
81.0	90.9 to 72.2	86.8 to 76.5	82.9 to 79.2	85.8 to 76.5	85.8 to 76.5
81.4	91.3 to 72.5	86.2 to 76.8	83.3 to 79.5	86.2 to 76.8	86.2 to 76.8
81.8	91.8 to 72.9	86.6 to 77.2	83.7 to 79.9	86.6 to 77.2	86.6 to 77.2
82.2	92.2 to 73.3	87.1 to 77.6	84.1 to 80.3	87.1 to 77.6	87.1 to 77.6
82.6	92.7 to 73.6	87.5 to 78.0	84.5 to 80.7	87.5 to 78.0	87.5 to 78.0
83.0	93.1 to 74.0	87.9 to 78.4	84.9 to 81.1	87.9 to 78.4	87.9 to 78.4
83.4	93.6 to 74.3	88.3 to 78.7	85.3 to 81.5	88.3 to 78.7	88.3 to 78.7
83.8	94.0 to 74.7	88.8 to 79.1	85.8 to 81.9	88.8 to 79.1	88.8 to 79.1
84.2	94.5 to 75.0	89.2 to 79.5	86.2 to 82.3	89.2 to 79.5	89.2 to 79.5
84.6	94.9 to 75.4	89.6 to 79.9	86.6 to 82.7	89.6 to 79.9	89.6 to 79.9
85.0	95.4 to 75.8	90.0 to 80.2	87.0 to 83.1	90.0 to 80.2	90.0 to 80.2
85.4	95.8 to 76.1	90.5 to 80.6	87.4 to 83.5	90.5 to 80.6	90.5 to 80.6
85.8	96.3 to 76.5	90.9 to 81.0	87.8 to 83.8	90.9 to 81.0	90.9 to 81.0
86.2	96.7 to 76.8	91.3 to 81.4	88.2 to 84.2	91.3 to 81.4	91.3 to 81.4
86.6	97.2 to 77.2	91.7 to 81.8	88.6 to 84.6	91.7 to 81.8	91.7 to 81.8
87.0	97.6 to 77.5	92.2 to 82.1	89.0 to 85.0	92.2 to 82.1	92.2 to 82.1
87.4	98.1 to 77.9	92.6 to 82.5	89.4 to 85.4	92.6 to 82.5	92.6 to 82.5
87.8	98.5 to 78.3	93.0 to 82.9	89.8 to 85.8	93.0 to 82.9	93.0 to 82.9
88.2	99.0 to 78.6	93.4 to 83.3	90.3 to 86.2	93.4 to 83.3	93.4 to 83.3
88.6	99.4 to 79.0	93.8 to 83.6	90.7 to 86.6	93.8 to 83.6	93.8 to 83.6
89.0	99.9 to 79.3	94.3 to 84.0	91.1 to 87.0	94.3 to 84.0	94.3 to 84.0
89.4	100.3 to 79.7	94.7 to 84.4	91.5 to 87.4	94.7 to 84.4	94.7 to 84.4
89.8	100.8 to 80.0	95.1 to 84.8	91.9 to 87.8	95.1 to 84.8	95.1 to 84.8
90.2	101.2 to 80.4	95.5 to 85.2	92.3 to 88.1	95.5 to 85.2	95.5 to 85.2
90.6	101.7 to 80.7	96.0 to 85.5	92.7 to 88.5	96.0 to 85.5	96.0 to 85.5
91.0	102.1 to 81.1	96.4 to 85.9	93.1 to 88.9	96.4 to 85.9	96.4 to 85.9
FACTOR	1.12202 to .89125	1.05925 to .94406	1.02329 to .97724	1.05925 to .94406	1.05925 to .94406

RECEIVER ACCURACY TEST.

1. Connect test equipment as shown.



2. On AN/USM-485,
   - Set POWER to ON.
   - Press REV pushbutton.
   - Set DISPLAY to RCV.
   - On SETUP press in RCV 600 Ω and BRG pushbuttons. Verify DIAL, and both HOLD pushbuttons are out.
   - Set MEASUREMENT to LEVEL FREQUENCY.
3. Set Calibrator output to 2.733V at 20Hz. Verify AN/USM-485 level and frequency displays are within specified limits of under +1ldBm for 20Hz.
4. Repeat step 3 setting Calibrator to all frequencies shown below. Verify AN/USM-485 level and frequency displays are within specified limits as shown below under +11dBm.
5. Set Calibrator output to 7.702mV at 20Hz. Verify AN/USM-485 level and frequency displays are within specified limits as shown below under -41dBm for 20Hz.
6. Repeat step 5 setting Calibrator to all frequencies shown below. Verify AN/USM-485 level and frequency displays are within specified limits as shown below under -40dBm.

FREQUENCY (MONITOR AT COUNTER)	AN/USM-485 DISPLAY +11 DBM	AN/USM-485 DISPLAY –40 DBM	FREQUENCY TOLERENCE
50 Hz	10.5 to 11.4	-40.5 to -39.6	±1 Hz
200 Hz	10.8 to 11.1	-40.2 to -39.9	±1 Hz
500 Hz	10.8 to 11.1	-40.2 to -39.9	±1 Hz
1000 Hz	10.9 to 11.0	-40.2 to -39.9	±1 Hz
5000 Hz	10.8 to 11.1	-40.2 to -39.9	±1 Hz
15000 Hz	10.8 to 11.1	-40.2 to -39.9	±0.01 kHz
30000 Hz	10.5 to 11.4	-40.5 to -39.6	±0.01 kHz
50000 Hz	10.5 to 11.4	-40.5 to -39.6	±0.01 kHz
85000 Hz	10.5 to 11.4	-40.5 to -39.6	±0.01 kHz
110000 Hz	9.0 to 12.9	-42.0 to -38.1	±0.01 kHz

RECEIVER ACCURACY TEST—Continued.

7. On AN/USM-485, set power to STBY and disconnect test equipment.

AUTORANGE TEST.

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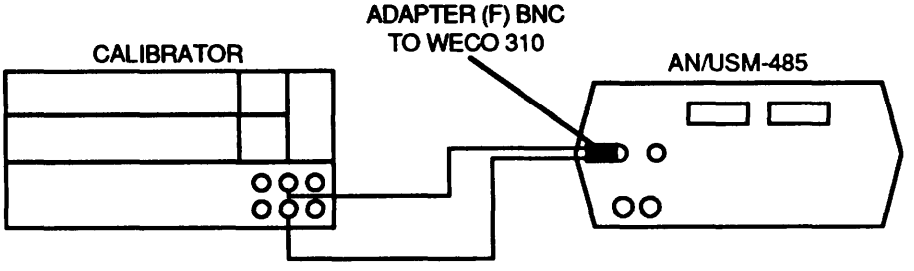
1. Connect test equipment as shown.

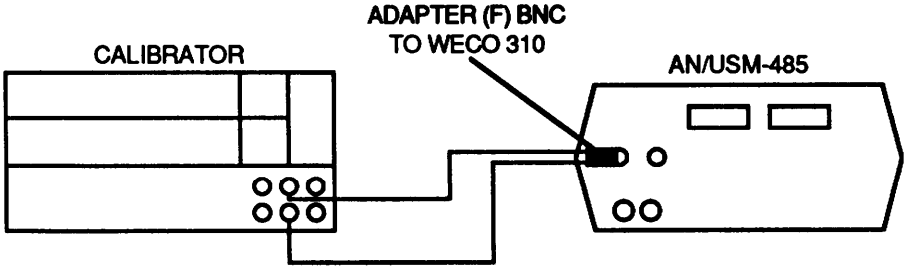


2. On AN/USM-485,
   - Set POWER to ON.
   - Press REV pushbutton.
   - Set DISPLAY to RCV.
   - On SETUP press in RCV 600 Ω pushbutton. Verify BRG, DIAL, and both HOLD pushbuttons are out.
   - Set MEASUREMENT to LEVEL FREQUENCY.
3. Set Calibrator to 1000Hz.
4. Set Calibrator voltage and range as shown below and verify that AN/USM-485 display is within specified limits.

AC CALIBRATOR VOLTAGE	AN/USM-485 DISPLAY
.86911 V	+0.9 to +1.1
.086911 V	−19.1 to −18.9
.0086911 V	−39.2 to −38.8
.00086911 V	−59.4 to −58.6
2.7484 V	+10.9 to +11.1
0.27484 V	− 9.1 to − 8.9
0.027484 V	−29.2 to −28.8
0.0027484 V	−49.4 to −48.6

FILTER TEST.

1. Connect test equipment as shown.



2. On AN/USM-485,
   - Set POWER to ON.
   - Press REV pushbutton.
   - Set DISPLAY to RCV.
   - On SETUP press in RCV 600 Ω pushbutton. Verify BRG, DIAL, and both HOLD pushbuttons are out.
   - Set MEASUREMENT to NOISE.
3. Set Calibrator to 0.775V.
4. On AN/USM-485, select C-MESSAGE filter
5. Set Calibrator to frequencies shown below. Verify AN/USM-485 display is within specified limits (dBrn).

FREQUENCY (in Hz)	RECEIVED LEVEL (dBrn) ACCEPTABLE READINGS
300	73-74
900	89-90
1000	90
2500	88-89
3000	87-88
4500	66-71

6. On AN/USM-485, select 3KHz flat filter
7. Set Calibrator to frequencies shown below. Verify AN/USM-485 display is within specified limits (dBm).

FREQUENCY (in Hz)	RECEIVED LEVEL (dBrn) ACCEPTABLE READINGS
1000	90
3000	86-88
6000	75-80

FILTER TEST—Continued.

8. On AN/USM-485, select 15KHz flat filter
9. Set Calibrator to frequencies shown below. Verify AN/USM-485 display is within specified limits (dBrn).

FREQUENCY (in Hz)	RECEIVED LEVEL (dBrn) ACCEPTABLE READINGS
1000	90
15000	86-88
30000	75-80

10. On AN/USM-485, select PROGRAM filter
11. Set Calibrator to frequencies shown below. Verify AN/USM-485 display is within specified limits (dBrn).

FREQUENCY (in Hz)	RECEIVED LEVEL (dBrn) ACCEPTABLE READINGS
100	62-65
500	83-84
1000	90
2000	94-95
5000	95-98
10000	78-85

12. On AN/USM-485, select 50KBIT filter.
13. Set Calibrator to frequencies shown below. Verify AN/USM-485 display is within specified limits (dBrn).

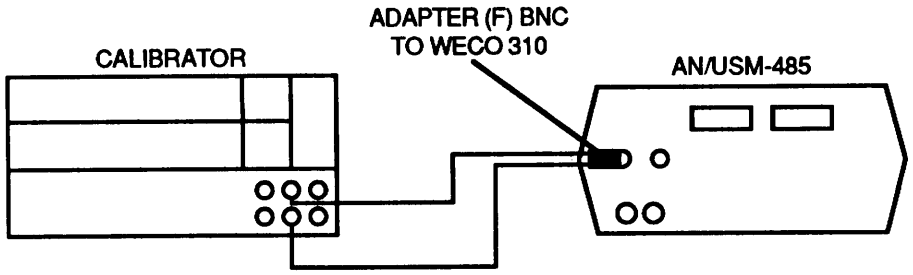
FREQUENCY (in Hz)	RECEIVED LEVEL (dBrn) ACCEPTABLE READINGS
1000	90
15000	89-90
25000	87-88
35000	84-86
50000	62-67

14. On AN/USM-485, select 15KHz filter and NOISE WITH TONE measurement.
15. Set Calibrator to frequencies shown below. Verify AN/USM-485 display is within specified limits (dBrn).

FREQUENCY (in Hz)	RECEIVED LEVEL (dBrn) ACCEPTABLE READINGS
400	90
862	≥88
1000	<40
1020	<40
1182	≥88
1700	90

IMPULSE NOISE DAC TEST.

1. Connect test equipment as shown.



2. On AN/USM-485,
   - Set POWER to ON.
   - Press REV pushbutton.
   - Set DISPLAY to RCV.
   - On SETUP press in RCV and TRMT 600 Ω pushbutton. Verify BRG, DIAL, and both HOLD pushbuttons are out.
   - Set MEASUREMENT to IMPULSE NOISE.
   - Set FILTER to 15 KHz Flat.
   - On IMPULSE NOISE, press PERIOD to select NON-STOP, press DISPLAY to select LOW(SET), and press START/RESET button.
   - Adjust left display threshold to 90dBrn using STEP UP/DOWN buttons.
3. Set Calibrator to 2KHz at 0.580V. Verify the AN/USM-485 counts.
4. On AN/USM-485, increase LOW(SET) threshold on left display by ldBrn using STEP UP button. Verify AN/USM-485 display stops counting.
5. Repeat steps 3 and 4 setting Calibrator Voltage as shown below. Verify AN/USM-485 threshold limits are as specified.

CALIBRATOR VOLTAGE	COUNTING THRESHOLD	NOT COUNTING THRESHOLD
0.580	90	91
0.651	91	92
0.730	92	93
0.820	93	94
0.920	94	95
1.032	95	96
1.158	96	97
1.299	97	98
1.457	98	99
1.635	99	100

IMPULSE NOISE DAC TEST-Continued.

6. On AN/USM-485,
   - Adjust Left display threshold to 90dBrn using STEP UP/DOWN buttons.
   - On IMPULSE NOISE, press DISPLAY button to select MID.
7. Set Calibrator to 0.820V and verify AN/USM-485 display does not count.
8. Set Calibrator to 0.920V and verify AN/USM-485 display does count.
9. On AN/USM-485, on IMPULSE NOISE, press DISPLAY button to select HIGH.
10. Set Calibrator to 1.299V and verify AN/USM-485 display does not count.
11. Set Calibrator to 1.457V and verify AN/USM-485 display does count.

COUNT LIMIT TEST.

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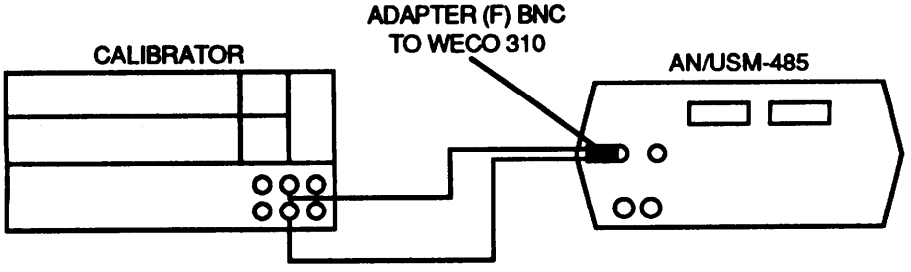
1. Connect test equipment as shown.



2. On AN/USM-485,
   - Set POWER to ON.
   - Press REV pushbutton.
   - Set DISPLAY to RCV.
   - On SETUP press in RCV and TRMT 600 Ω pushbuttons. Verify BRG, DIAL, and both HOLD pushbuttons are out.
   - Set MEASUREMENT to IMPULSE NOISE.
   - Set FILTER to 3KHz Flat.
   - On IMPULSE NOISE, press DISPLAY to select LOW(SET).
3. Set Calibrator to 2000Hz at 0.775V.
4. On AN/USM-485, adjust Left display threshold to 75dBrn using STEP UP/DOWN buttons.
5. Read entire step before proceeding.
   - Press IMPULSE NOISE START/RESET button. Wait 60 seconds. Press IMPULSE NOISE STOP button.
   - Verify AN/USM-485 right display indicates 480 ±48 counts.
6. On AN/USM-485, press IMPULSE NOISE DISPLAY button to select MID. Verify AN/USM-485 right display indicates 480 ±48 counts.

COUNT LIMIT TEST-Continued.

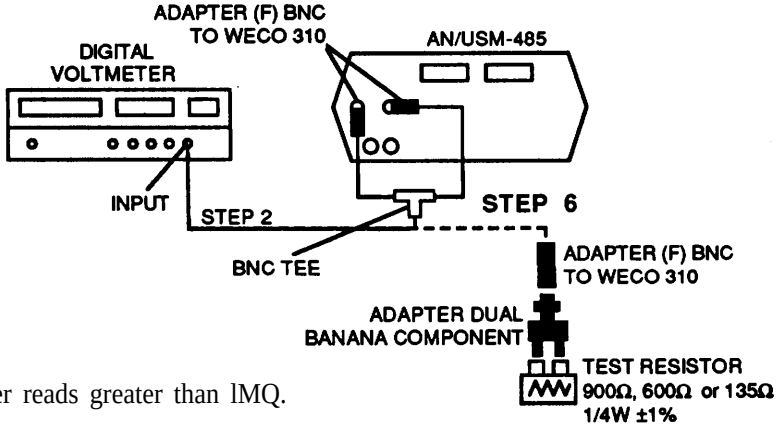
7. On AN/USM-485, press IMPULSE NOISE DISPLAY button to select HIGH. Verify AN/USM-485 right display indicates 480 ±48 counts.
8. On AN/USM-485, set power to STBY and disconnect test equipment.

TERMINATION IMPEDANCE TEST.

1. On AN/USM-485,
   - Set POWER to STBY.
   - Disconnect AC Power Cable.
   - Press NOR pushbutton.
   - On SETUP press in RCV and TRMT 900 Ω pushbuttons. Verify BRG, DIAL, and both HOLD pushbuttons are out.
2. Connect test equipment as shown.

NOTE

As DC blocking capacitors charge, measured resistance may slowly rise. Set Digital Voltmeter to lowest resistance and increase resistance as meter over-ranges.



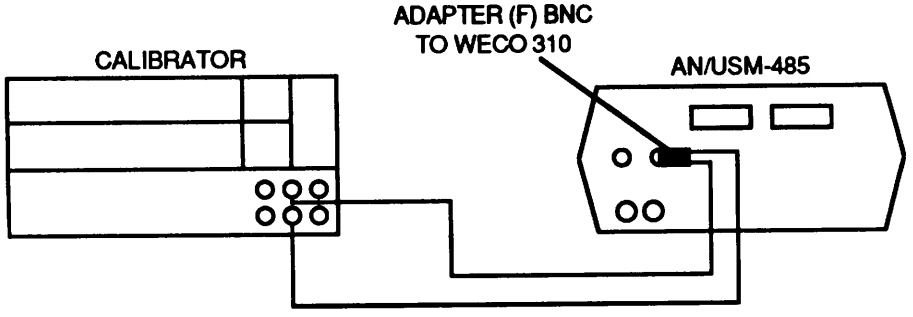
   - Verify Digital Voltmeter reads greater than lMQ.
3. Disconnect Digital Voltmeter.
4. On AN/USM-485,
   - Reconnect AC Power Cable.
   - Set POWER to ON.
   - Set DISPLAY to RCV.
   - On SETUP verify BRG, DIAL and both HOLD pushbuttons are out.
   - Set MEASUREMENT to LEVEL FREQUENCY.
   - Adjust OUTPUT LEVEL control to O.OdBm as shown in left Display.

TERMINATION IMPEDANCE TEST—Continued.

5. On AN/USM-485,
   - On SETUP press TRMT and RCV 900 Ω pushbuttons.
   - Verify left Display reads 0.0dBm.
   - On SETUP press in BRG pushbutton.
   - Verify left display reads 6.ldBm ±0.ldBm.
6. Connect test equipment as shown above. Use 900 Ω resistor.
7. On AN/USM-485,
   - Verify left Display reads 0.0dBm ±0.ldBm.
   - On SETUP set BRG pushbutton to out position.
   - Remove resistor.
8. Repeat technique in steps 5 thru 7 for 600 Ω and then 135 Ω.
9. On AN/USM485, set power to STBY and disconnect test equipment.

HOLD TONE DROPOUT DETECTOR TEST.

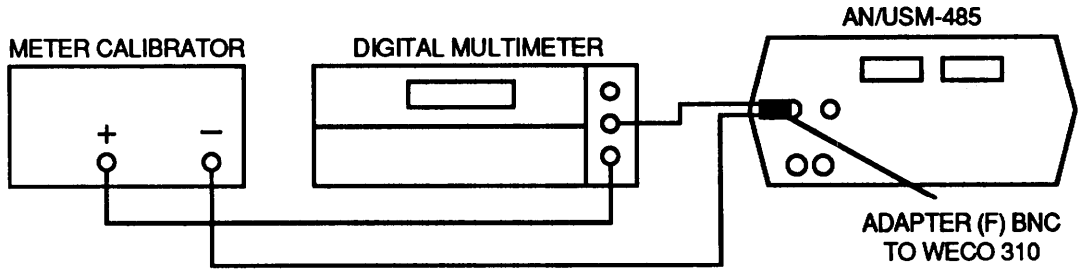
1. Connect test equipment as shown.



2. On AN/USM-485,
   - Set POWER to ON.
   - Press NOR pushbutton.
   - Set DISPLAY to RCV.
   - On SETUP press in RCV 600 Ω pushbutton. Verify BRG, DIAL, and both HOLD pushbuttons are out.
   - Set MEASUREMENT to NOISE WITH TONE.
   - Set FILTER to C-MESSAGE.
3. Set Calibrator to 10mV at 1004Hz.
4. Lower Calibrator level until Err 7 appears on AN/USM-485 display.
5. On AN/USM-485 select LEVEL FREQUENCY and verify signal level on display is -46dB ±2dBm.
6. On AN/USM-485, set power to STBY and disconnect test equipment.

HOLD CIRCUIT TEST.

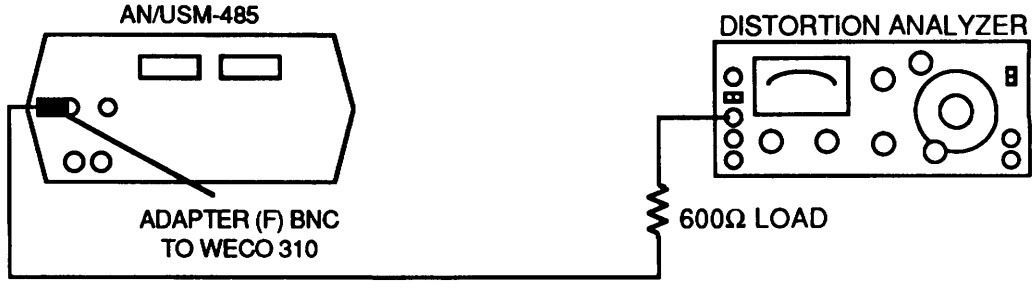
1. Connect test equipment as shown.



2. On Meter Calibrator, set output to 6.9V ±0.2Vdc.
3. On AN/USM-485,
   - Press NOR pushbutton.
   - Set DISPLAY to TRMT.
   - On SETUP press in both HOLD pushbuttons.
4. Verify DC current reading as shown on Digital Multimeter is 24.0mA ±0.5mA.
5. On AN/USM-485, press in REV pushbutton.
6. Reverse Meter Calibrator leads. Verify DC current reading is 24.0mA ±0.5mA. Return Meter Calibrator leads to normal polarity.
7. Adjust Meter Calibrator for 50Vdc. Verify DC current reading is less than 26mA.
8. On AN/USM-485, press in NOR pushbutton. Verify DC current reading is less than 26mA.
9. On AN/USM-485, set power to STBY and disconnect test equipment.

DISTORTION TEST.

1. Connect test equipment as shown.



DISTORTION TEST—Continued.

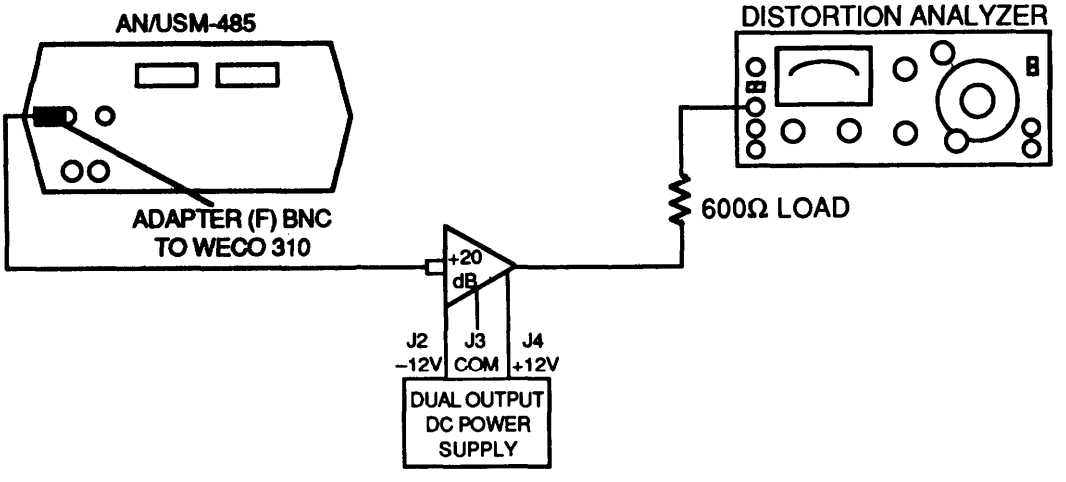
2. On AN/USM-485,
   - Set POWER to ON.
   - Press NOR pushbutton.
   - Set DISPLAY to TRMT.
   - On SETUP press in TRMT 600 Ω pushbutton. Verify BRG, DIAL and both HOLD pushbuttons are out.
   - Set MEASUREMENT to LEVEL FREQUENCY.
3. Set Distortion Analyzer to measure distortion in dB. Input should be floating.
4. Set AN/USM-485 to frequencies and output levels as shown. Verify distortion readings are within specified limits.

FREQUENCY	OUTPUT LEVEL	DISTORTION
100 Hz	+10 dBm 0 dBm	≤–55dB
4000 Hz	+10 dBm 0 dBm	≤–55dB

5. Remove 30KHz Low Pass Filter and connect cable directly to Distortion Analyzer.
6. Set AN/USM-485 to frequencies and output levels as shown. Verify distortion readings are within specified limits.

FREQUENCY	OUTPUT LEVEL	DISTORTION
110 kHz	+ 9 dBm 0 dBm –20 dBm	≤–50dB

7. Connect test equipment as shown:



8. Set Power Supply to + and – 12V output.
9. Set +20dB Amplifier to 20dB gain and 4KHz Low Pass Filter to OFF.

DISTORTION TEST—Continued.

10. Set AN/USM-485 to frequencies and output levels as shown. Verify distortion readings are within specified limits.

FREQUENCY	OUTPUT LEVEL	DISTORTION
100 Hz	−40 dBm	≤−50dB
4000 Hz	−40 dBm	≤−50dB

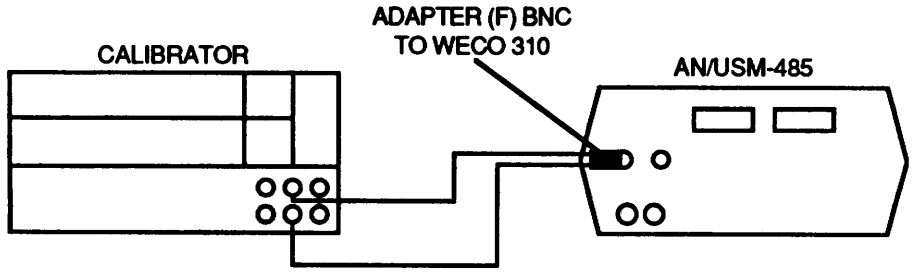
11. Set +20dB Amplfler to unity gain and 4KHz Low Pass Filter to ON.
12. Set AN/USM-485 to frequencies and output levels as shown. Verify distortion readings are within specified limits.

FREQUENCY	OUTPUT LEVEL	DISTORTION
1004 Hz	0 dBm	≤−65dB

13. On AN/USM-485, set power to STBY and disconnect test equipment.

P/AR TEST.

1. Connect test equipment as shown.



2. On AN/USM-485,
   - Set POWER to ON.
   - Press REV pushbutton.
   - Set DISPLAY to RCV.
   - On SETUP press in RCV and TRMT 600 Ω pushbutton. Verify BRG, DIAL, and both HOLD pushbuttons are out.
   - Set MEASUREMENT to P/AR.
3. Set Calibrator to 300Hz at 0.495V.

P/AR TEST—Continued.

4. Set Calibrator to frequency as shown below and verify that AN/USM-485 left display is within specified limits.

FREQUENCY	ACCEPTABLE LEVEL
300 Hz	-30 dBm
1000 Hz	0 dBm
2300 Hz	-10 dBm

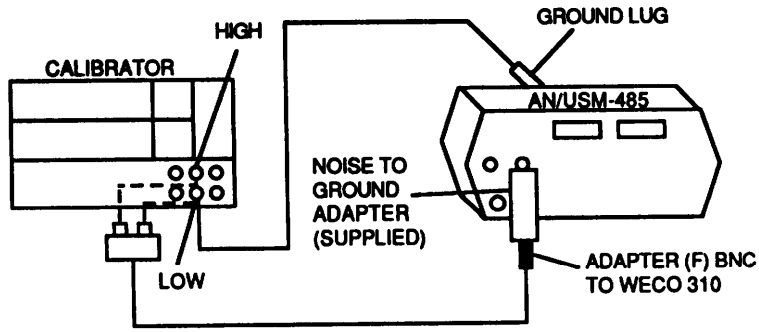
5. On AN/USM-485,
   - Set DISPLAY to TRMT and verify right display reads 100±1.
   - Vary OUTPUT LEVEL control to obtain a left display reading between -12dBm and -1dBm. Verify reading in right display reads 100 ±1.
6. On AN/USM-485, set power to STBY and disconnect test equipment.

NOISE TO GROUND TEST.

1. Connect test equipment as shown. Use Noise to Ground Adapter (supplied).

NOTE

Calibrator low is connected to ground lug on AN/USM-485 rear panel.



2. On AN/USM-485,
   - Set POWER to ON.
   - Press NOR pushbutton.
   - Set DISPLAY to RCV.
   - On SETUP press in RCV and TRMT 600 Ω and BRG pushbuttons. Verify DIAL and both HOLD pushbottons are out.
   - Set MEASUREMENT to NOISE.
   - Set FILTER to 15KHz FLAT.
3. Set Calibrator output to 0.775V ±lmV and frequency to 1000Hz. Verify AN/USM-485 display reads 54 ±ldBrn.

NOISE TO GROUND TEST—Continued.

4. Set Calibrator output to 0.775V ±lmV and frequency to 50Hz. Verify AN/USM-485 display reads 54 ±2dBrn.
5. On AN/USM-485, set FILTER to 50KBIT.
6. Set Calibrator output to 0.775V ±lmV and frequency to 20KHz. Verify AN/USM-485 display reads 54 ±2dBrn.
7. On AN/USM-485, set FILTER to 15KHz FLAT and reverse input leads, and repeat steps 3 thru 6.
8. On AN/USM-485, set power to STBY and disconnect test equipment.

PERFORMANCE TEST CHECKLIST.

Test and step		Measured value		Desired value
TRANSMITTER FLATNESS +l0dBm TEST				
20Hz	Step 3	_____	Vrms	2.17 to 2.73Vrms
200Hz	Step 3	_____	Vrms	2.38 to 2.49Vrms
5KHz	Step 3	_____	Vrms	2.38 to 2.49Vrms
15KHz	Step 3	_____	Vrms	2.38 to 2.49Vrms
30KHz	Step 3	_____	Vrms	2.30 to 2.58Vrms
60KHz	Step 3	_____	Vrms	2.30 to 2.58Vrms
85KHz	Step 3	_____	Vrms	2.25 to 2.64Vrms
85KHz	Step 3	_____	KHz	84.996 to 85.004KHz
TRANSMITTER FLATNESS -40dBm TEST				
20Hz	Step 11	_____	mV	57.9 to 102.1mV
50Hz	Step 12	_____	mV	61.4 to 96.4mV
200Hz	Step 12	_____	mV	63.5 to 93.1mV
15KHz	Step 12	_____	mV	63.5 to 93.1mV
60KHz	Step 12	_____	mV	61.4 to 96.4mV
85KHz	Step 12	_____	mV	61.4 to 96.4mV
RECEIVER ACCURACY TEST				
20Hz +11dBm	Step 3	_____	dBm	10.0 to 11 .9dBm
20Hz +11dBm	Step 3	_____	Hz	19Hz to 21Hz
50Hz +11dBm	Step 4	_____	dBm	10.5 to 11.4dBm
50Hz +11dBm	Step 4	_____	Hz	49Hz to 51Hz
200Hz +11dBm	Step 4	_____	dBm	10.8 to 11.1dBm
200Hz +11dBm	Step 4	_____	Hz	l99Hz to 201Hz
500Hz +11dBm	Step 4	_____	dBm	10.8 to 11.1dBm
500Hz +11dBm	Step 4	_____	Hz	499Hz to 501Hz
1KHz +11dBm	Step 4	_____	dBm	10.9 to 11.0dBm
1KHz +11dBm	Step 4	_____	Hz	999Hz to 1001HZ
5KHz +11dBm	Step 4	_____	dBm	10.8 to 11.1dBm
5KHz +11dBm	Step 4	_____	Hz	4999Hz to 5001Hz
15KHz +11dBm	Step 4	_____	dBm	10.8 to 11.ldBm
15KHz +11dBm	Step 4	_____	Hz	14999Hz to 15001Hz
30KHz +11dBm	Step 4	_____	dBm	10.5 to 11.4dBm
30KHz +11dBm	Step 4	_____	Hz	29990Hz to 30010HZ
50KHz +11dBm	Step 4	_____	dBm	10.5 to 11.4dBm
50KHz +11dBm	Step 4	_____	Hz	49990Hz to 50010HZ
85 KHz +11dBm	Step 4	_____	dBm	10.5 to 11.4dBm
85KHz +11dBm	Step 4	_____	Hz	84990Hz to 85010HZ
110KHz +11dBm	Step 4	_____	dBm	9.0 to 12.9dBm
110K.Hz +11dBm	Step 4	_____	Hz	109990HZ to 110010HZ
20Hz -40dBm	Step 5	_____	dBm	+4.0 to -39.ldBm
20Hz -40dBm	Step 5	_____	Hz	19Hz to 21Hz
50Hz -40dBm	Step 6	_____	dBm	-40.5 to -39.6dBm
50Hz -40dBm	Step 6	_____	Hz	49Hz to 51Hz

PERFORMANCE TEST CHECKLIST—Continued.

Test and step		Measured value		Desired value
RECEIVER ACCURACY TEST—Continued				
200Hz -40dBm	Step 6	_____	dBm	-40.2 to -39.9dBm
200Hz -40dBm	Step 6	_____	Hz	199Hz to 201Hz
500Hz -40dBm	Step 6	_____	dBm	-40.2 to -39.9dBm
500Hz-4dBm	Step 6	_____	Hz	499Hz to 501Hz
1KHz-40dBm	Step 6	_____	dBm	-40.2 to -39.9dBm
1KHz -40dBm	Step 6	_____	Hz	999Hz to 1001Hz
5KHz -4kiBm	Step 6	_____	dBm	-40.2 to –39.9dBm
5KHz -40dBm	Step 6	_____	Hz	4999Hz to 5001Hz
15KHz -40dBm	Step 6	_____	dBm	-40.2 to -39.9dBm
15KHz -40dBm	Step 6	_____	Hz	14999Hz to 15001Hz
30KHz -40dBm	Step 6	_____	dBm	-40.5 to -39.6dBm
30KHz -40dBm	Step 6	_____	Hz	29990Hz to 30010HZ
50KHz -40dBm	Step 6	_____	dBm	-40.5 to -39.6dBm
50KHz -40dBm	Step 6	_____	Hz	49990Hz to 50010HZ
85KHz -40dBm	Step 6	_____	dBm	-40.5 to –39.6dBm
85KHz -40dBm	Step 6	_____	Hz	84990Hz to 85010HZ
110KHz -40dBm	Step 6	_____	dBm	-42.0 to -38.ldBm
110KHz -40dBm	Step 6	_____	Hz	109990Hz to 110010Hz
AUTORANGE TEST				
+ldBm	Step 4	_____	dBm	+0.9 to +1.1dBm
-19dBm	Step 4	_____	dBm	-19.1 to –18.9dBm
-39dBm	Step 4	_____	dBm	-39.2 to -38.8dBm
-59dBm	Step 4	_____	dBm	-59.4 to -58.6dBm
+l0dBm	Step 4	_____	dBm	+10.9 to +11.1dBm
-9dBm	Step 4	_____	dBm	-9.1 to -8.9dBm
-29dBm	Step 4	_____	dBm	-29.2 to -28.8dBm
-49dBm	Step 4	_____	dBm	-49.4 to -48.6dBm
FILTER TEST				
C-Message 300Hz	Step 5	_____	dBm	73 to 74dBrn
C-Message 900Hz	Step 5	_____	dBm	89 to 90dBrn
C-Message lKHz	Step 5	_____	dBm	90dBrn
C-Message 2.5KHz	Step 5	_____	dBm	88 to 89dBrn
C-Message 3KHz	Step 5	_____	dBm	87 to 88dBrn
C-Message 4.5 KHz	Step 5	_____	dBm	66 to 71dBrn
3KHz Flat lKHz	Step 7	_____	dBrn	90dBrn
3KHz Flat 3KHz	Step 7	_____	dBrn	86 to 88dBrn
3KHz Flat 6KHz	Step 7	_____	dBrn	75 to 80dBrn
15KHz Flat 1KHz	Step 9	_____	dBrn	90dBrn
15 KHz Flat 15KHz	Step 9	_____	dBrn	86 to 88dBrn
15KHz Flat 30KHz	Step 9	_____	dBrn	75 to 80dBrn

PERFORMANCE TEST CHECKLIST—Continued.

Test and step		Measured value	Desired value
FILTER TEST—Continued			
Program 100Hz	Step 11	_____ dBrn	62 to 65dBrn
Program 500Hz	Step 11	_____ dBrn	83 to 84dBrn
Program lKHz	Step 11	_____ dBrn	90dBrn
Program 2KHz	Step 11	_____ dBrn	94 to 95dBrn
Program 5KHz	Step 11	_____ dBrn	95 to 98dBrn
Program 10KHz	Step 11	_____ dBrn	78 to 85dBrn
50KBIT KHz	Step 13	_____ dBrn	90dBrn
50KBIT 15KHz	Step 13	_____ dBrn	89 to 90dBrn
50KBIT 25KHz	Step 13	_____ dBrn	87 to 88dBrn
50KBIT 35KHz	Step 13	_____ dBrn	84 to 86dBrn
50KBIT 50KI-Iz	Step 13	_____ dBrn	62 to 67dBrn
Notch 400Hz	Step 15	_____ dBrn	90dBrn
Notch 862Hz	Step 15	_____ dBrn	≥88dBrn
Notch 1000Hz	Step 15	_____ dBrn	<40dBrn
Notch 102OHz	Step 15	_____ dBrn	<40dBrn
Notch 1182Hz	Step 15	_____ dBrn	≥88dBrn
Notch 1700Hz	Step 15	_____ dBrn	90dBrn
IMPULSE NOISE DAC TEST			
2KHz 0.5dBm	Step 3	_____ Display Counts	90dBrn
2KHz 0.5dBm	Step 4	_____ Display Not Count	91dBrn
2KHz 1.5dBm	Step 5	_____ Display Counts	91dBrn
2KHz 1.5dBm	Step 5	_____ Display Not Count	92dBrn
2KHz 2.5dBm	Step 5	_____ Display Counts	92dBrn
2KHz 2.5dBm	Step 5	_____ Display Not Count	93dBrn
2KHz 3.5dBm	Step 5	_____ Display Counts	93dBrn
2KHz 3.5dBm	Step 5	_____ Display Not Count	94dBrn
2KHz 4.5dBm	Step 5	_____ Display Counts	94dBrn
2KHz 4.5dBm	Step 5	_____ Display Not Count	95dBrn
2KHz 5.5dBm	Step 5	_____ Display Counts	95dBrn
2KHz 5.5dBm	Step 5	_____ Display Not Count	96dBrn
2KHz 6.5dBm	Step 5	_____ Display Counts	96dBrn
2KHz 6.5dBm	Step 5	_____ Display Not Count	97dBrn
2KHz 7.5dBm	Step 5	_____ Display Counts	97dBrn
2KHz 7.5dBm	Step 5	_____ Display Not Count	98dBrn
2KHz 8.5dBm	Step 5	_____ Display Counts	98dBrn
2KHz 8.5dBm	Step 5	_____ Display Not Count	99dBrn
2KHz 9.5dBm	Step 5	_____ Display Counts	99dBrn
2KHz 9.5dBm	Step 5	_____ Display Not Count	100dBrn

PERFORMANCE TEST CHECKLIST—Continued.

Test and step		Measured value		Desired value
IMPULSE NOISE DAC TEST—Continued				
2KHz 3.5dBm	Step 7	_____	Display Not Count	94dBrn
2KHz 4.5dBm	Step 8	_____	Display Counts	94dBrn
2KHz 7.5dBm	Step 10	_____	Display Not Count	98dBrn
2KHz 8.5dBm	Step 11	_____	Display Counts	98dBrn
COUNT TEST				
2KHz 75dBrn 60sec	Step 5	_____	counts	432 to 528
2KHz 79dBrn	Step 6	_____	counts	432 to 528
2KHz 83dBrn	Step 7	_____	counts	432 to 528
TERMINATION IMPEDANCE TEST				
	Step 2	_____	W	>lM Ω
900 Ω	Step 5	_____	dBm	6.0 to 6.2dBm
900 Ω with Resistor	Step 7	_____	dBm	-0.1 to +0.ldBm
600 Ω	Step 8	_____	dBm	6.0 to 6.2dBm
600 Ω with Resistor	Step 8	_____	dBm	-0.1 to +0.ldBm
135 Ω	Step 8	_____	dBm	6.0 to 6.2dBm
135 Ω with Resistor	Step 8	_____	dBm	-0.1 to +0.ldBm
HOLD TONE DROPOUT DETECTOR TEST				
Err 7	Step 5	_____	dBm	-48 to -44dBm
HOLD CIRCUIT TEST				
7V TRMT Hold	Step 4	_____	mA	23.5 to 24.5mA
7V RCV Hold	Step 6	_____	mA	23.5 to 24.5mA
50V TRMT Hold	Step 7	_____	mA	<26mA
50V RCV Hold	Step 8	_____	mA	<26mA
DISTORTION TEST				
100Hz +l0dBm	Step 4	_____	dB	≤ - 55dB
100Hz 0dBm	Step 4	_____	dB	≤ -55dB
4000Hz +l0dBm	Step 4	_____	dB	≤ -55dB
4000Hz 0dBm	Step 4	_____	dB	≤ -55dB
110KHz +9dBm	Step 6	_____	dB	≤ -50db
110KHz 0dBm	Step 6	_____	dB	≤ -50dB
110KHz –20dBm	Step 6	_____	dB	≤ -50dB

PERFORMANCE TEST CHECKLIST—Continued.

Test and step		Measured value		Desired value
DISTORTION TEST—Continued				
100Hz -40dBm	Step 10	_____	dB	**≤–50dBm**
4000Hz -40dBm	Step 10	_____	dB	**≤–50dBm**
1004Hz 0dBm	Step 12	_____	dB	**≤–65dB**
P/AR TEST				
300Hz	Step 4	_____	dB	-30dBm
1000Hz	Step 4	_____	dB	OdBm
2300Hz	Step 4	_____	dB	–l0dBm
TRMT	Step 5	_____	P/AR unit	99 to 101
TRMT -12 to -ldBm	Step 5	_____	P/AR unit	99 to 101
NOISE TO GROUND TEST				
1000Hz	Step 3	_____	dBrn	53 to 55dBrn
50Hz	Step 4	_____	dBrn	52 to 56dBrn
20KHz	Step 6	_____	dBrn	52 to 56dBrn
1000Hz	Step 7	_____	dBrn	53 to 55dBrn
50Hz	Step 7	_____	dBrn	52 to 56dBrn
20KHz	Step 7	_____	dBrn	52 to 56dBrn

4-19. ADJUSTMENTS.

DESCRIPTION

The adjustment procedures cover:

Adjust Power Supply (para 4-21).

Adjust Output Level and Transmit Monitor Loop (para 4-22).

Adjust Receiver (para 4-23).

Adjust Notch Filter (para 4-24).

Adjust P/AR Filter and Latch (para 4-25).

Adjust Hold Circuit (para 4-26).

Hand Selection of A13C57 and A13C160 (para 4-27).

NOTE

- Specific adjustments may be necessary after repair/replacement of specific assemblies in the Transmission Test Set or failure of a performance test. Adjustment is not required if malfunction has been cleared after repair.
- Never perform all adjustments from para 4-21 thru 4-27 at one time.
- The adjustment needed after repair/replacement of specific assemblies are as shown in table 4-2.
- Use rear panel for all ground connections unless otherwise specified.
- All indications and waveforms are referenced to chassis ground unless otherwise specified.
- Assembly and cable location diagram is fig. FO-6. Individual circuit card component locator diagrams are fig. FO-1 thru FO-5.
- After adjust procedure is completed remove power and install top case (para 4-28).

Table 4-2. Post Repair/Replace Adjustments.

Repaire & Replaced Assembly	Adjust
A1 Assembly	None.
A2 Assembly	Hold Circuit (para 4-26).
A5 Assembly	None.
Al3 Assembly	Adjust Receiver (para 4-23).
	Adjust Notch Filter (para 4-24).
	Adjust P/AR Filter and Latch (para 4-25).
	Hand Selection of A13C57 and A13C160 (para 4-27).
A14 Assembly	Adjust Power Supply (para 4-21).
	Adjust Output Level and Transmit Monitor Loop (para 4-22).

4-20. INITIAL SETUP

1. Remove top case (para 4-28).

WARNING

Dangerous voltages are present with the covers removed. Where maintenance can be performed without power applied, the power should be removed. Battery voltages are present even with AC power cable removed.

NOTE

If performing adjustment or making connections to the A14 Transmitter Circuit Card Assembly, it may be necessary to place AN/USM-485 into troubleshooting position (para 4-39).

2. Perform turn-on procedures, TM 11-6625-3186-10, paragraph 4-2.

NOTE

Allow a 10 minute warm-up before performing adjustments.

4-21. ADJUST POWER SUPPLY.

1. On AN/USM-485, set POWER to ON.
2. Connect Digital Voltmeter to A14JU+5 (fig. FO-5, sheet 5). Verify Digital Voltmeter reads +5Vdc ±20mV.
   - If not, adjust A14R42 (+5V ADJ).
3. Connect Digital Voltmeter to A14JU+14. Verify Digital Voltmeter reads +14Vdc ±20mV.
   - If not, adjust A14R31 (+14V ADJ).
4. Connect Digital Voltmeter to A14JU-14. Verify Digital Voltmeter reads –14Vdc ±25mV.
5. Remove Digital Voltmeter and connect Oscilloscope to A14JU–14. Ripple should not exceed 100mVp-p.
6. Use Oscilloscope to verify ripple does not exceed 100mVp-p at A14JU+5 and JU+14.
7. Remove power and disconnect test equipment. Install top case (para 4-28).

4-22. ADJUST OUTPUT LEVEL AND TRANSMIT MONITOR.

1. Connect Digital Voltmeter through 600 Ω matching pad to AN/USM-485 TRMT 310 jack using WECO 310 adapter.
2. On AN/USM-485,
   - Set POWER to ON.
   - Press NOR pushbutton.
   - Set DISPLAY to TRMT.
   - On SETUP press in TRMT and RCV 600 Ω pushbuttons. Verify BRG, DIAL, and both HOLD pushbuttons are out.
   - Set MEASUREMENT to LEVEL FREQUENCY.
   - Set OUTPUT LEVEL control fully clockwise.
3. Adjust A14R74 (OUTPUT ADJ) (fig. FO-5, sheet 5) for a Digital Voltmeter reading of 3.42 to 3.43Vac.
4. Adjust OUTPUT LEVEL control for a Digital Voltmeter reading of 775mVrms ±l0mV.
5. Connect Digital Voltmeter to A13TP25 (fig. FO-4, sheet 4).
   - Adjust A14R72 (LOOP ADJ) for a Digital Voltmeter reading of 775mVrms ±10mV.
6. Connect Digital Voltmeter through 600 Ω matching pad to TRMT jack.
   - If Digital Voltmeter does not read 775mVrms ±10mV, repeat steps 3 thru 5.
7. Remove power and disconnect test equipment. Install top case (para 4-28).

4-23. ADJUST RECEIVER.

1. On AN/USM-485,
   - Set POWER to ON.
   - Press NOR pushbutton.
   - Set DISPLAY to TRMT.
   - Set MEASUREMENT to NOISE.
   - Jumper A13TP10 to A13TP21 (fig. FO-4, sheet 4).
   - Jumper A13TP22 to A13TP23.
2. Connect Digital Voltmeter to A13TP24.
   - Adjust A13R33 (OFFSET ADJ) for a Digital Voltmeter reading of 0 ±0.3mVdc.
3. Remove jumpers.
4. On AN/USM-485,
   - Press NOR pushbutton.
   - Set DISPLAY to RCV.
   - On SETUP press in RCV 600 Ω and BRG pushbuttons. Verify DIAL and both HOLD pushbuttons are out.
   - Set MEASUREMENT to LEVEL FREQUENCY.

4-23. ADJUST RECEIVER—Continued.

5. Connect Calibrator output to AN/USM-485 RCV 310 jack. Set Calibrator to 816mVac ±0.5mV at 1000Hz.
6. Connect Digital Voltmeter to A13TP25.
   - Adjust A13R77 (RCV GAIN) for a Digital Voltmeter reading of 816mVac ±0.5mV.
   - Adjust A13R23 (AVG DET) until AN/USM-485 left display least significant digit flickers between XX.4 and XX.5dBm.
7. On AN/USM-485,
   - Set MEASUREMENT to NOISE.
   - Set FILTER to 15 KHz FLAT.
8. Verify Digital Voltmeter still reads 816mVac ±0.5mV.
   - Adjust A13R65 (QRMS DET) until display flickers between 90 and 91dBrn.
9. Remove power and disconnect test equipment. Install top case (para 4-28).

4-24. ADJUST NOTCH FILTER.

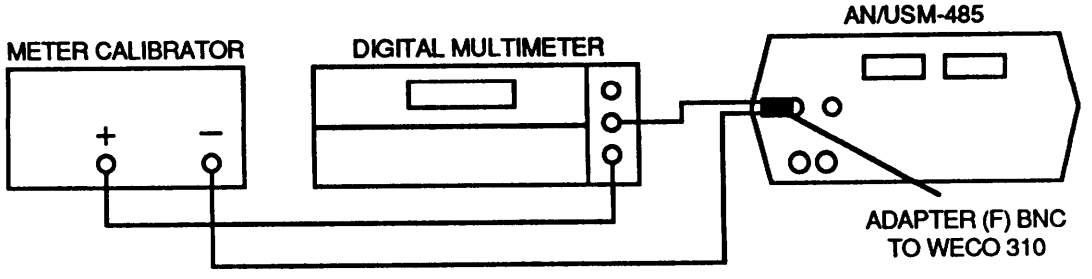
1. On AN/USM-485,
   - Set POWER to ON.
   - Connect RCV 310 jack to TRMT 310 jack using WECO 310 adapters.
   - Press NOR pushbutton.
   - Set DISPLAY to TRMT.
   - Set MEASUREMENT to LEVEL FREQUENCY.
   - Set displayed frequency on right display to 995Hz using STEP UP/DOWN buttons.
   - Adjust OUTPUT LEVEL control until left display reads approximately 0.0dBm.
   - Press DISPLAY TRMT/RCV button.
   - Move A13JU5 (fig. FO-4, sheet 4) shorting bars to right (short pin 5 to 12, 6 to 11,7 to 10, and 8 to 9).
2. Connect an Oscilloscope to A13JU5 pin 1.
   - Adjust A13R102 (995Hz) for minimum AC signal on Oscilloscope.
3. On AN/USM-485, change frequency to 1010HZ using STEP UP button.
4. Connect Oscilloscope to A13JU5 pin 4.
   - Adjust A13R132 (1010HZ) for minimum AC signal on Oscilloscope.
5. On AN/USM-485, change frequency to 1025Hz using STEP UP button.
6. Connect Oscilloscope to A13TP7.
   - Adjust A13R180 (1025Hz) for minimum AC signal on Oscilloscope.
7. Remove power and disconnect test equipment. Move A13JU5 shorting bars to original positions (shorting pins 1 to 16, 2 to 15, 3 to 14, and 4 to 13). Install top case (para 4-28).

4-25. ADJUST P/AR FILTER.

1. On AN/USM-485,
   - Set POWER to ON.
   - Connect RCV 310 jack to TRMT 310 jack using WECO 310 adapters.
   - Press NOR pushbutton.
   - Set DISPLAY to TRMT.
   - Set MEASUREMENT to LEVEL FREQUENCY.
   - Set displayed frequency on right display to 1300Hz using STEP UP/DOWN buttons.
   - Adjust OUTPUT LEVEL control until left display reads approximately 0.0dBm.
3. Set Dual Trace Oscilloscope to 0.2 volts per division. Set mode to X-Y. Connect channel A to Al3TP15 pin 2 (fig. FO-4, sheet 4) and external horizontal input to A13TP15 pin 7.
   - Adjust A13R153 (PAR PHASE 1) to obtain a 0 degree phase (closed loop waveshape).
4. Move Dual Trace Oscilloscope channel A probe to A13TP15 pin 8.
   - Adjust A13R175 (PAR PHASE 2) to obtain a 0 degree phase (closed loop waveshape).
5. On AN/USM-485, select MEASUREMENT to P/AR.
   - Adjust A13R186 (PAR DET) until AN/USM-485 display reads 100.
6. Remove power and disconnect test equipment. Install top case (para 4-28).

4-26. ADJUST HOLD CIRCUIT.

1. Connect Test Equipment as shown.



2. Set Meter Calibrator output to 6.9V ±0.2Vdc.

4-26. ADJUST HOLD CIRCUIT—Continued.

3. On AN/USM-485,
   - Set POWER to ON.
   - Set DISPLAY to TRMT.
   - On SETUP press in both HOLD pushbuttons. Verify BRG and DIAL pushbuttons are out.
   - Set MEASUREMENT to LEVEL FREQUENCY.
4. On AN/USM-485, press NOR pushbutton.
   - Adjust A2R53 (fig. FO-2, sheet 1) (TRMT HOLD) to a DC current reading on Digital Multimeter of 24.0mA ±0.lmA.
5. On AN/USM-485, press in REV button.
   - Adjust A2R73 (RCV HOLD) to a DC current reading of 24.OmAb ±0.lmA.
6. Reverse Meter Calibrator leads.
   - Verify DC current reading is 24.0mA ±0.5mA.
7. On AN/USM-485, press NOR button.
   - Verify DC current reading is 24.0mA ±0.5mA.
8. Return Meter Calibrator leads to normal polarity.
9. Adjust Meter Calibrator for 50Vdc.
   - Verify DC current reading is less than 26mA.
10. On AN/USM-485, press in REV button.
    - Verify DC current reading is less than 26mA.
11. Remove power and disconnect test equipment Install top case (para 4-28).

4-27. SELECTION OF A13C57 AND A13C160.

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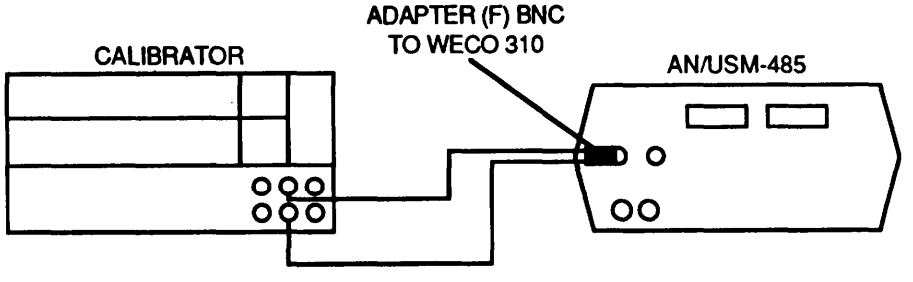
1. Connect test equipment as shown.

NOTE

Perform this adjustment only after Receiver Accuracy Test failure.



4-27. SELECTION OF A13C57 AND A13C160—Continued.

2. On AN/USM-485,
   - Set POWER to ON.
   - Press REV pushbutton.
   - Set DISPLAY to RCV.
   - On SETUP press in RCV 600 Ω and BRG pushbuttons. Verify DIAL, and both HOLD pushbuttons are out.
   - Set MEASUREMENT to LEVEL FREQUENCY.
3. Set Calibrator output to 2.733V (+1l.0dBm) at 30KHz. Record AN/USM-485 level display for 30KHz. Set Calibrator to frequencies shown below and record AN/USM-485 level display.

Frequency	AN/USM-485 Level
30KHz	_____dBm
40KHz	_____dBm
50KHz	_____dBm
60KHz	_____dBm
70KHz	_____dBm
80KHz	_____dBm
85KHz	_____dBm

4. Verify all AN/USM-485 levels are +11.0dBm±0.4dB.
   - If readings are correct correct values for A13C57 and A13C160 are installed.
   - If readings are incorrect, proceed with step 5.
5. Select a capacitance value from the table shown below that will change the problemed measured values to within specified limits. Example;

   Level for 60KHz is 10.5dB and 70KHz is 11.2dB (60KHz not within specification). Select 1300pf capacitor to raise 60KHz to 10.67 and 70KHz to 11.4 (both now within specification).

CAPACITOR	FREQUENCY RESPONSE						
	30 kHz	40 kHz	50 kHz	60 kHz	70 kHz	80 kHz	85 kHz
1200 pF	+.09	+.14	+.20	+.25	+.30	+.33	+.35
1300 pF	+.06	+.10	+.14	+.17	+.20	+.22	+.23
1400 pF	+.03	+.05	+.07	+.08	+.10	+.11	+.11
1500 pF	0 (ref)	0 (ref)	0 (ref)	0 (ref)	0 (ref)	0 (ref)	0 (ref)
1600 pF	−.03	−.05	−.07	−.08	−.10	−.11	−.11
1700 pF	−.07	−.10	−.14	−.17	−.19	−.21	−.21
1800 pF	−.10	−.16	−.21	−.25	−.28	−.30	−.31
Others: (approximately)	N.03 per 100 pF	.05 / 100 pF	.07 / 100 pF	.08 / 100 pF	.10 / 100 pF	.11 / 100 pF	.11 / 100 pF

6. Install new A13C57 and A13C160, and repeat steps 1 to 4.

4-28. REPLACE TOP/BOTTOM CASES.

DESCRIPTION

This procedure covers: Remove. Install.

INITIAL SETUP

WARNING

Dangerous voltages are present with covers removed. Battery voltage is present even with AC power cable disconnected.

NOTE

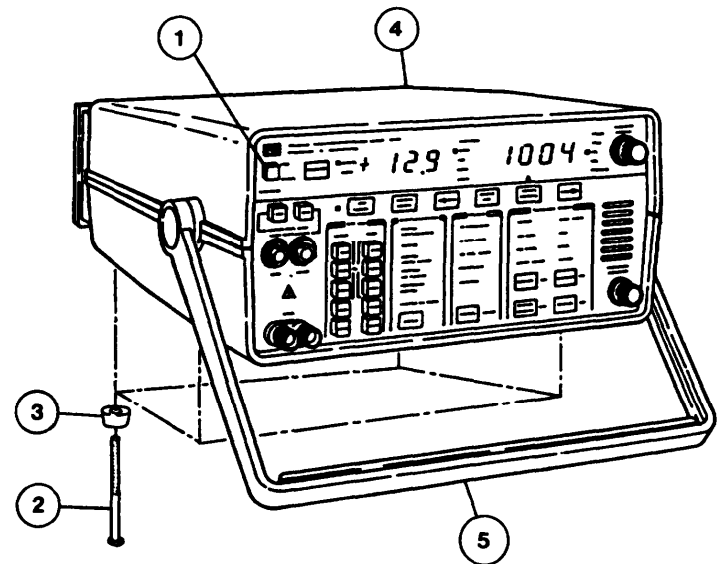
Task same for top and bottom case. Only top case shown.

REMOVE

1. Set power switch (1) to off and remove AC power cable.
2. Working from bottom, remove four screws (2) and bumpers (3).
3. Remove top case (4) and handle (5).

INSTALL

1. Install handle (5) into bottom case. Install top case (4) until seated to bottom case.
2. Install four bumpers (3) and screws (2).



END OF TASK

4-29. REPLACE A1 FRONT PANEL ASSEMBLY.

DESCRIPTION

This procedure covers: Remove. Install.

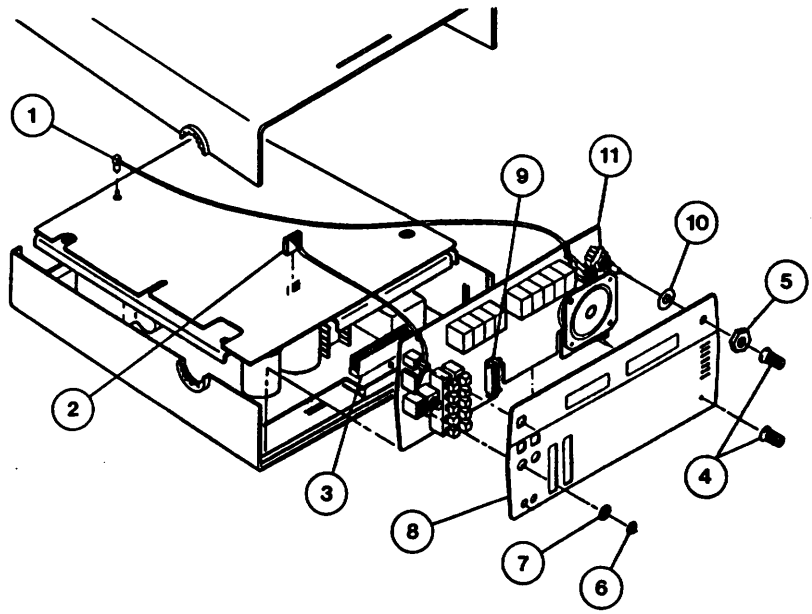
INITIAL SETUP

NOTE

PRELIMINARY PROCEDURES:

- Remove top case (para 4-28).

REMOVE



1. Disconnect black coaxial cable W5 (1) and four conductor cable (2).
2. Remove combination A1/A2 assembly from bottom case and A14J3 (3).
3. Remove two knobs (4), one nut (5), two nuts (6), and two flat washers (7).
4. Remove Al Front Panel Assembly (8) by pulling from connector A2J6/7 (9). Remove insulator washer (10).
5. Reinstall A2 Switch and Display Circuit Card Assembly (11) into A14J3 (3) and bottom case. Reconnect black coaxial cable W5 (1) and four conductor cable (2).

INSTALL

1. Disconnect black coaxial cable W5 (1) and four conductor cable (2). Remove A2 Switch and Display Circuit Card Assembly (10) from bottom case and A14J3 (3).
2. Install insulator washer (10). Install Al Front Panel Assembly (8) on connector A2J6/7 (9).
3. Install one nut (5), two flat washers (7), two nuts (6), and two knobs (4).
4. Install combination A1/A2 assembly into A14J3 (3) and bottom case.
5. Reconnect black coaxial cable W5 (1) and four conductor cable (2).

NOTE

FOLLOW-ON MAINTENANCE:

- Install top case (para 4-28).

END OF TASK

4-30. REPLACE A2 SWITCH AND DISPLAY CIRCUIT CARD ASSEMBLY.

DESCRIPTION

This procedure covers: Remove. Install.

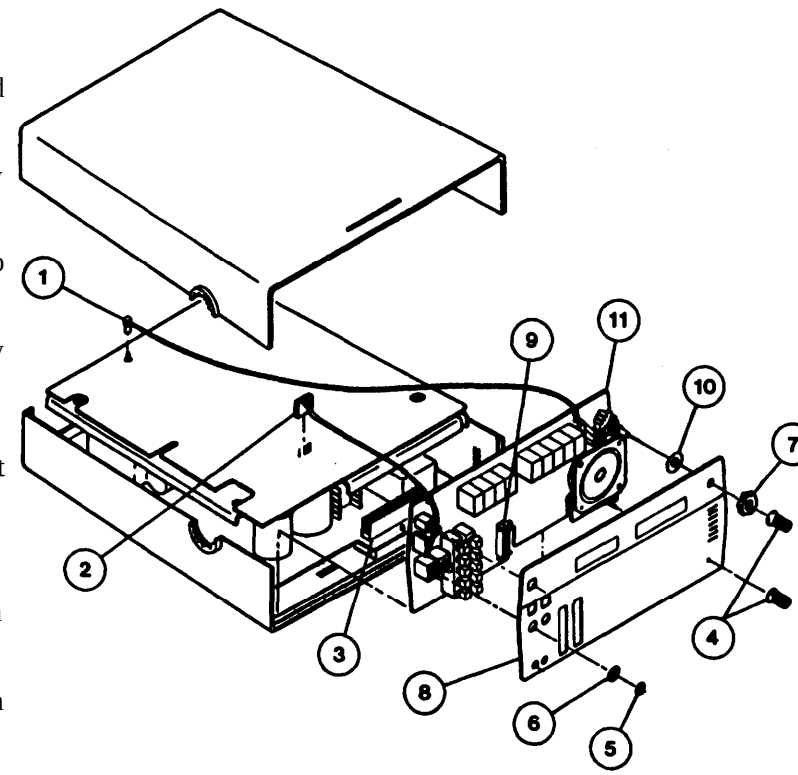
INITIAL SETUP

NOTE

PRELIMINARY PROCEDURES:

- Remove top case (para 4-28).

REMOVE



1. Disconnect black coaxial cable W5 (1) and four conductor cable (2).
2. Remove combination A1/A2 assembly from bottom case and A14J3 (3).
3. Remove two knobs (4), two nuts (5), two flat washers (6), and one nut (7).
4. Remove Al Front Panel Assembly (8) by pulling from connector A2J6/7 (9). Remove insulator washer (10).
5. Remove A2 Switch and Display Circuit Card Assembly (11).

INSTALL

1. Install insulator washer (10) on A2 Switch and Display Circuit Card Assembly (11).
2. Install A1 Front Panel Assembly (8) on connector A2Jd7 (9).
3. Install one nut (7), two flat washers (6), two nuts (5), and two knobs (4).
4. Install combination A1/A2 assembly into A14J3 (3) and bottom case.
5. Reconnect black coaxial cable W5 (1) and four conductor cable (2).

NOTE

FOLLOW-ON MAINTENANCE:

- Install top case (para 4-28).

END OF TASK

4-31. REPLACE A5 CHARGER CIRCUIT CARD ASSEMBLY.

DESCRIPTION

This procedure covers: Remove. Install.

INITIAL SETUP

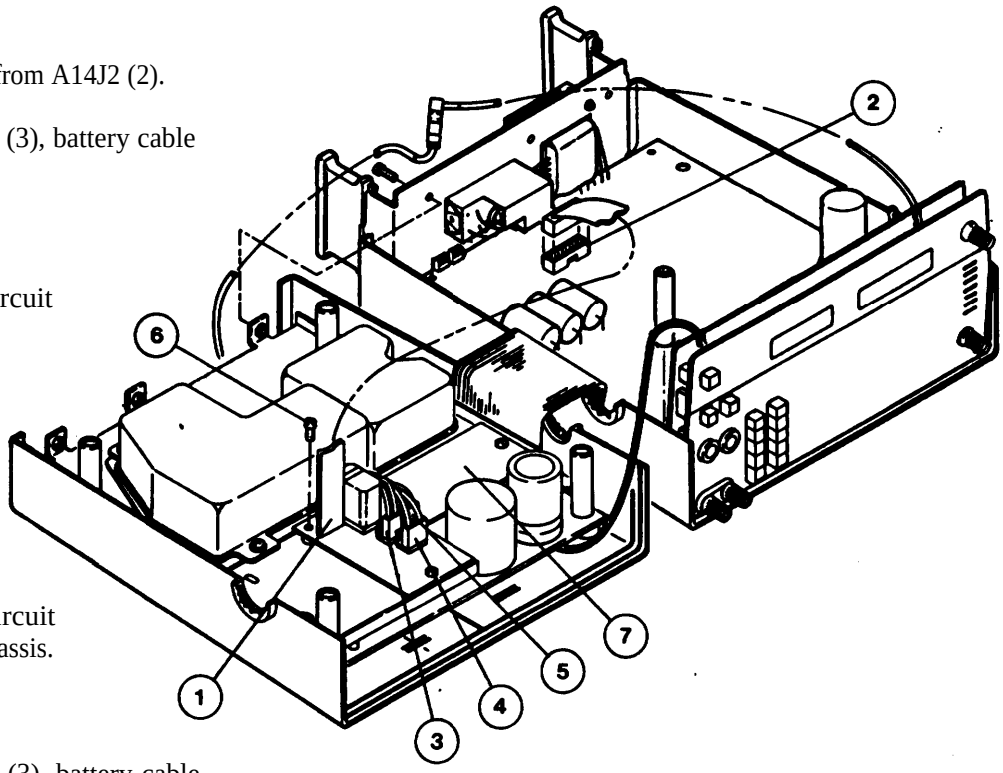
NOTE

PRELIMINARY PROCEDURES:

- Place AN/USM-485 into troubleshooting position (para 4-39).

REMOVE

1. Disconnect flat cable (1) from A14J2 (2).
2. Disconnect battery cable (3), battery cable (4), and battery cable (5).
3. Remove three screws (6).
4. Remove A5 Charger Circuit Card Assembly (7).



INSTALL

1. Install A5 Charger Circuit Card Assembly (7) on chassis.
2. Install three screws (6).
3. Reconnect battery cable (3), battery cable (4), and battery cable (5).
4. Reconnect flat cable (1) from A14J2 (2).

NOTE

FOLLOW-ON MAINTENANCE:

- Place AN/USM-485 into normal position (para 4-39).

END OF TASK

4-32. REPLACE A6 REAR PANEL ASSEMBLY.

DESCRIPTION

This procedure covers: Remove. Install.

INITIAL SETUP

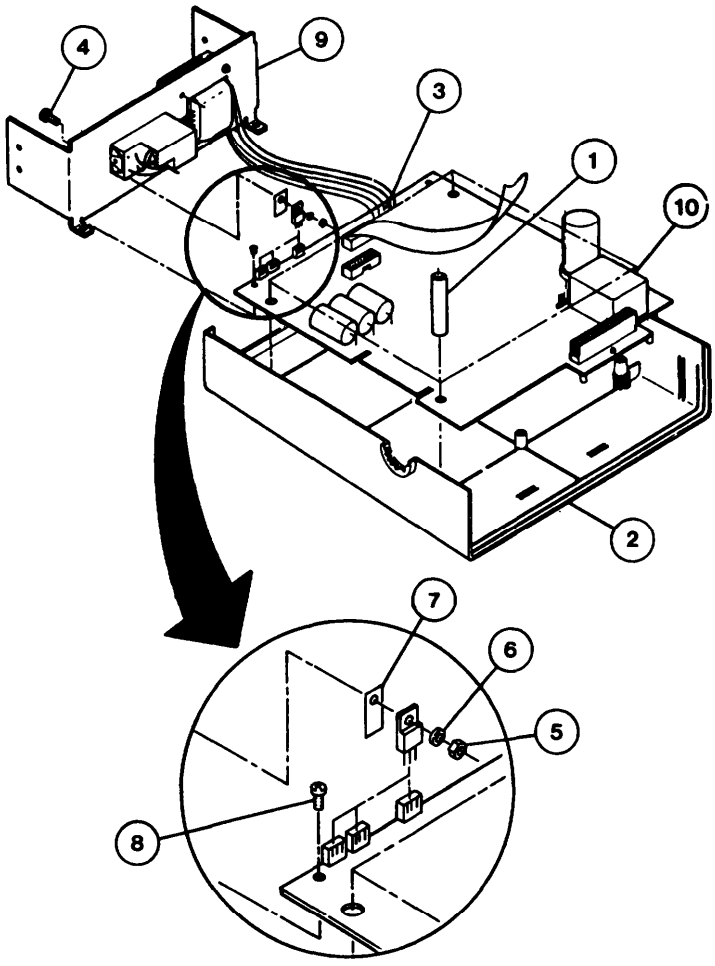
NOTE

PRELIMINARY PROCEDURES:

- Place AN/USM-485 into troubleshooting position (para 4-39).

REMOVE

1. Remove four plastic spacers (l).
2. Remove bottom case (2).
3. Working from bottom, tag and unsolder five wires (3).
4. Remove three screws (4), three nuts (5), three insulator washers (6), and three insulator plates (7).
5. Remove two screws (8).
6. Remove A6 Rear Panel Assembly (9).



INSTALL

1. Install A6 Rear Panel Assembly (9) onto A14 Transmitter Circuit Card Assembly (10).
2. Install two screws (8).
3. Install three insulator plates (7), three screws (4), three insulator washers (6), and three nuts (5).
4. Working from bottom, resolder five wires (3).
5. Install bottom case (2).
6. Install four plastic spacers (l).

NOTE

FOLLOW-ON MAINTENANE:

- Place AN/USM-485 into normal position (para 4-39).

END OF TASK

4-33. REPLACE A6FL1 LINE MODULE.

DESCRIPTION

This procedure covers: Remove. Install.

INITIAL SETUP

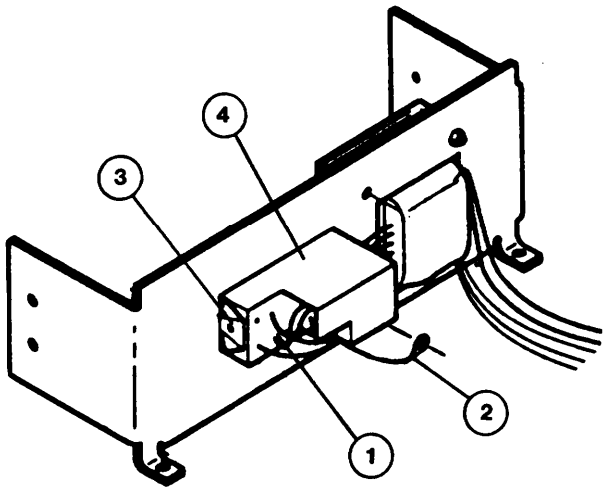
NOTE

PRELIMINARY PROCEDURES:

- Place AN/USM-485 into troubleshooting position (para 4-39).

REMOVE

1. Tag and disconnect five wires (1).
2. Tag and unsolder one wire (2).
3. Pinch close retainers (3) and remove A6FL1 Line Module (4).



INSTALL

1. Install A6FL1 Line Module (4) into hole on rear panel. Press until retainers (3) release.
2. Resolder one wire (2).
3. Reconnect five wires (l).

NOTE

FOLLOW-ON MAINTENANCE:

- Place AN/USM-485 into normal position (para 4-39).

END OF TASK

4-34. REPLACE A6T1 TRANSFORMER.

DESCRIPTION

This procedure covers: Remove. Install.

INITIAL SETUP

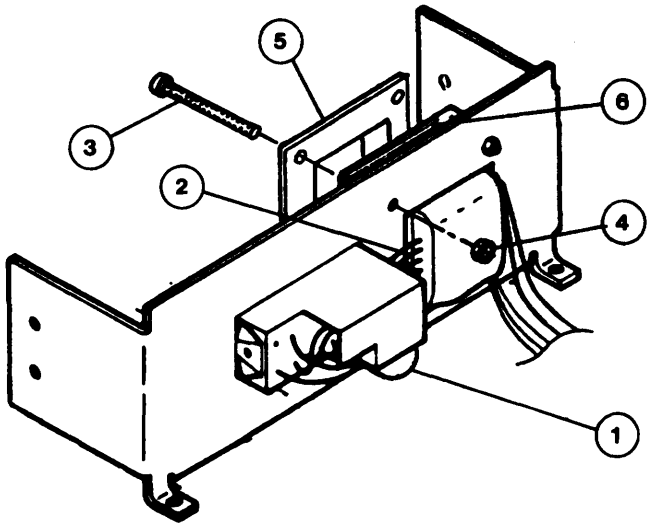
NOTE

PRELIMINARY PROCEDURES:

- Remove A6 Rear Panel Assembly (para 4-32).

REMOVE

1. Tag and unsolder one wire (l). Tag and disconnect five wires (2).
2. Remove four screws (3) and four nuts (4). Remove cover (5).
3. Remove A6T1 Transformer (6).



INSTALL

1. Install A6T1 Transformer(6) into rear panel.
2. Install cover (5). Install four screws (3) and four nuts (4).
3. Resolder one wire (l). Tag and reconnect five wires

NOTE

FOLLOW-ON MAINTENANCE:

- Install A6 Rear Panel Assembly (para 4-32).

END OF TASK

4-35. REPLACE A13 RECEIVER CIRCUIT CARD ASSEMBLY.

DESCRIPTION

This procedure covers: Remove. Install.

INITIAL SETUP

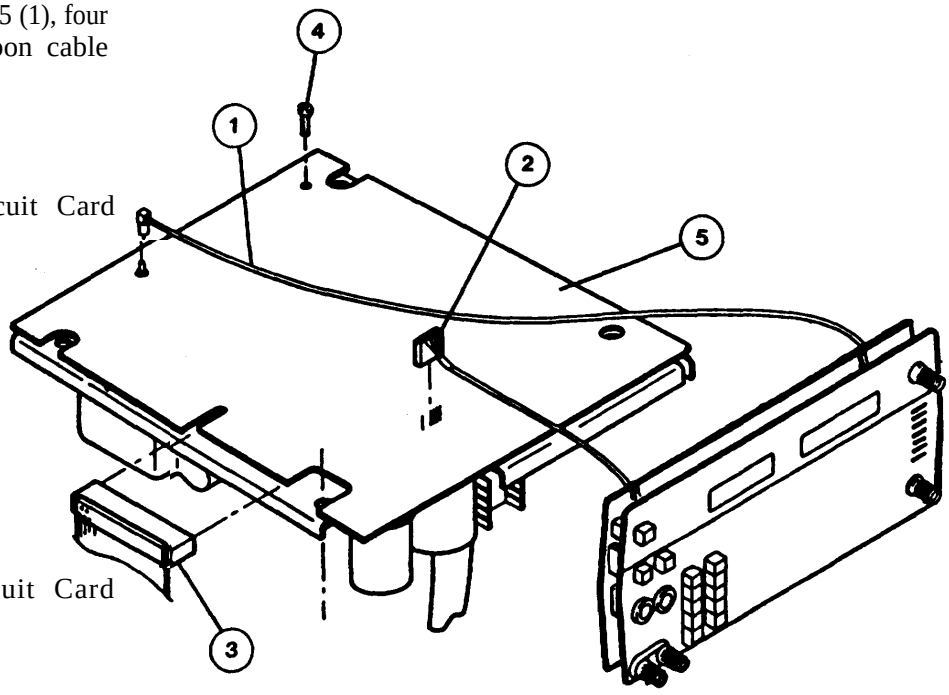
NOTE

PRELIMINARY PROCEDURES:

- Remove top case (para 4-28).

REMOVE

1. Disconnect black coaxial cable W5 (1), four conductor cable (2), and ribbon cable W2 (3).
2. Remove six screws (4).
3. Remove A13 Receiver Circuit Card Assembly (5).



INSTALL

1. Install A13 Receiver Circuit Card Assembly (5) onto chassis.
2. Install six screws (4).
3. Reconnect black coaxial cable W5 (l), four conductor cable (2), and ribbon cable W2 (3).

NOTE

FOLLOW-ON MAINTENANCE;

- Install top case (para 4-28).

END OF TASK

4-36. REPLACE A14 TRANSMITTER CIRCUIT CARD ASSEMBLY.

DESCRIPTION

This procedure covers: Remove. Install.

INITIAL SETUP

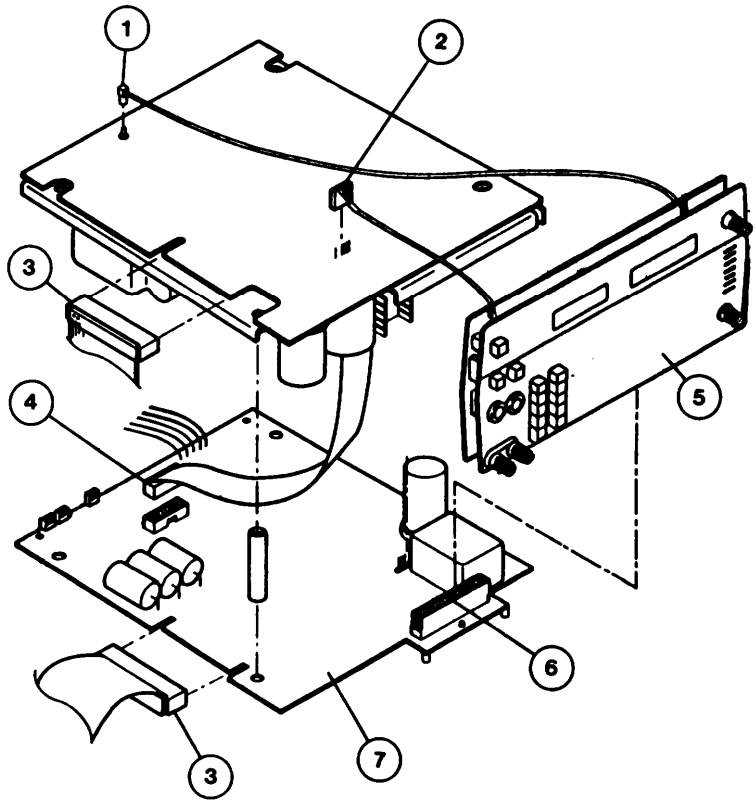
NOTE

PRELIMINARY PROCEDURES:

- Remove A6 Rear Panel Assembly (para 4-32).

REMOVE

1. Disconnect black coaxial cable W5 (l), four conductor cable (2), ribbon cable W2 (3), and flat cable (4).
2. Remove combination A1/A2 assembly (5) from A14J3 (6).
3. Remove A14 Transmitter Circuit Card Assembly (7).



INSTALL

1. Install A14 Transmitter Circuit Card Assembly (7).
2. Install combination A1/A2 assembly (5) on A14J3 (6).
3. Reconnect black coaxial cable W5 (1), four conductor cable (2), ribbon cable W2 (3), and flat cable (4).

NOTE

FOLLOW-ON MAINTENANCE:

- Install A6 Rear Panel Assembly (para 4-32).

END OF TASK

4-37. REPLACE BATTERY ASSEMBLY.

DESCRIPTION

This procedure covers: Remove. Install.

INITIAL SETUP

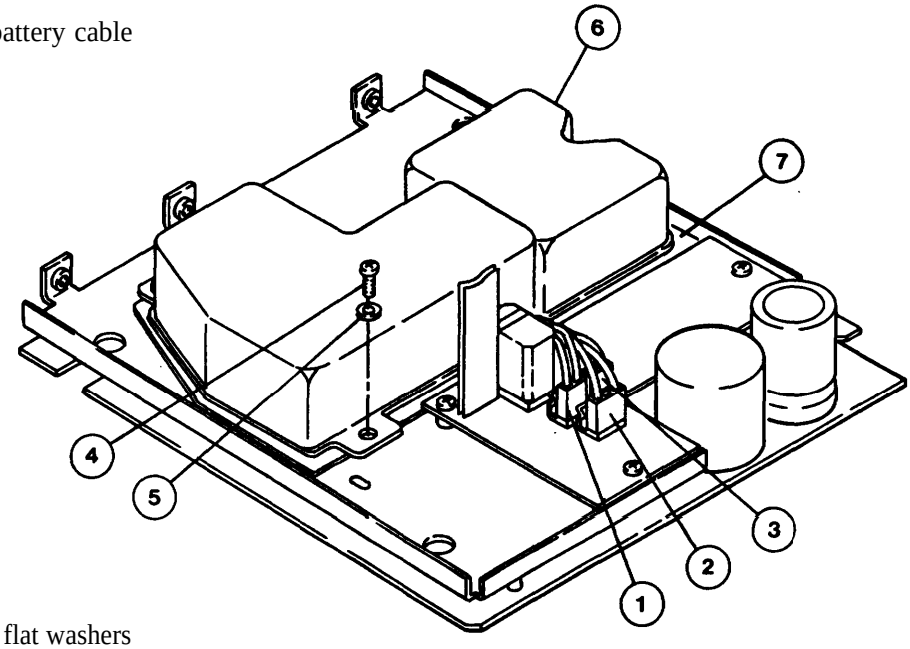
NOTE

PRELIMINARY PROCEDURES:

- Place AN/USM-485 into troubleshooting position (para 4-39).

REMOVE

1. Disconnect battery cable (l), battery cable (2), and battery cable (3).
2. Remove four screws (4) and four flat washers (5).
3. Remove Battery (6).



INSTALL

1. Install insulator (7) and Battery (6) on chassis.
2. Install four screws (4) and four flat washers (5).
3. Reconnect battery cable (l), battery cable (2), and battery cable (3).

NOTE

FOLLOW-ON MAINTENANCE:

- Place AN/USM-485 into normal position (para 4-39).

END OF TASK

4-38. INSTALL TEST PROCESSOR.

DESCRIPTION

This procedure covers: Install. Remove.

INITIAL SETUP

NOTE

Test Processor consists of 40 pin socket, Diagnostic Processor, and Diagnostic EPROM from Diagnostic Service Kit.

CAUTION

Always remove power before removing or installing Test Processor or A14U6 Microprocessor.

Both A14U6 (Processor), Diagnostic Processor and Programmed EPROM are static sensitive.

Make sure pins align correctly when installing Diagnostic EPROM on Diagnostic Processor.

NOTE

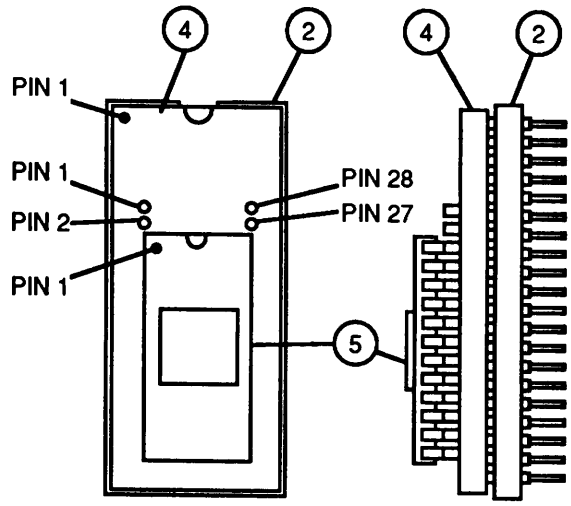
PRELIMINARY PROCEDURES:

- Place AN/USM-485 into troubleshooting position (para 4-39).

4-38. INSTALL TEST PROCESSOR—Continued.

INSTALL

1. CAREFULLY remove A14U6 (1) (fig. FO-5, sheet 5).
2. Install 40 pin socket (2) to A14U6 socket (3).
3. Taking care to line pins correctly, install Diagnostic EPROM (4) on 40 pin socket (2).
4. Taking care to line pins correctly, install Diagnostic Processor (5) on Diagnostic EPROM (4).



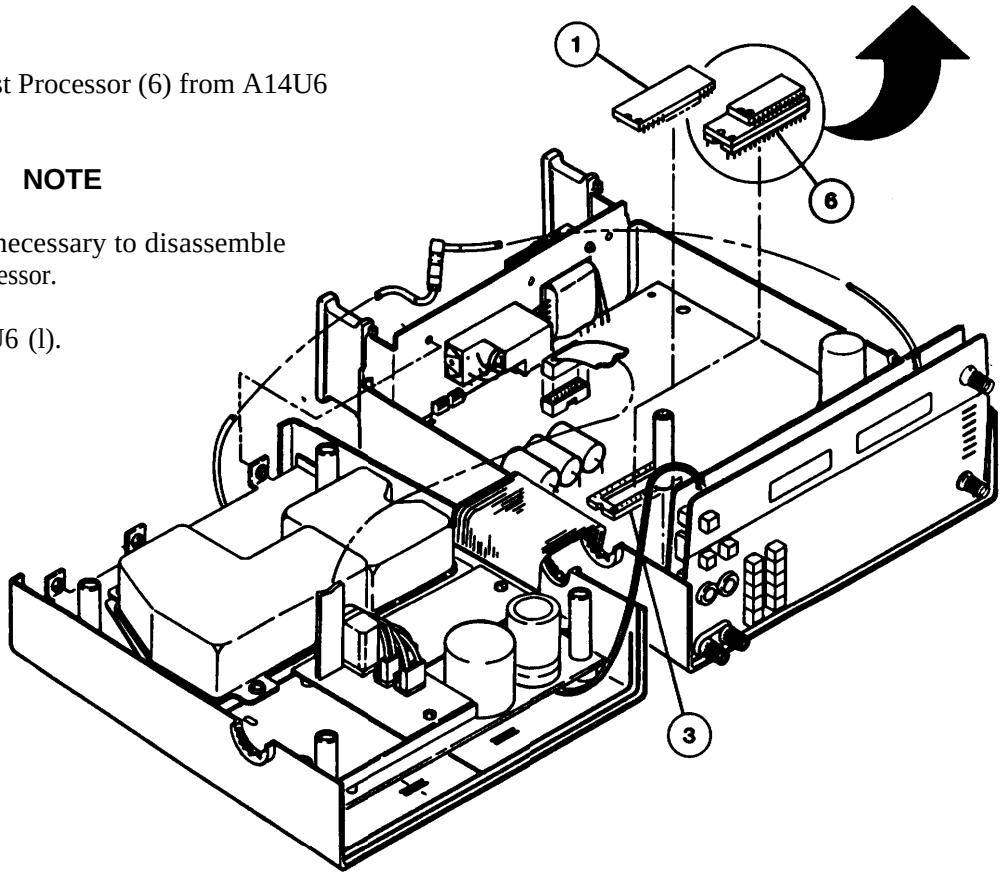
REMOVE

1. Remove Test Processor (6) from A14U6 socket (3).

NOTE

It is not necessary to disassemble Test Processor.

2. Install A14U6 (l).



NOTE

FOLLOW-ON MAINTENANCE:

- Place AN/USM-485 into normal position (para 4-39).

END OF TASK

4-39. PLACE AN/USM-485 INTO TROUBLESHOOTING POSITION.

DESCRIPTION

This procedure covers: Install. Remove.

INITIAL SETUP

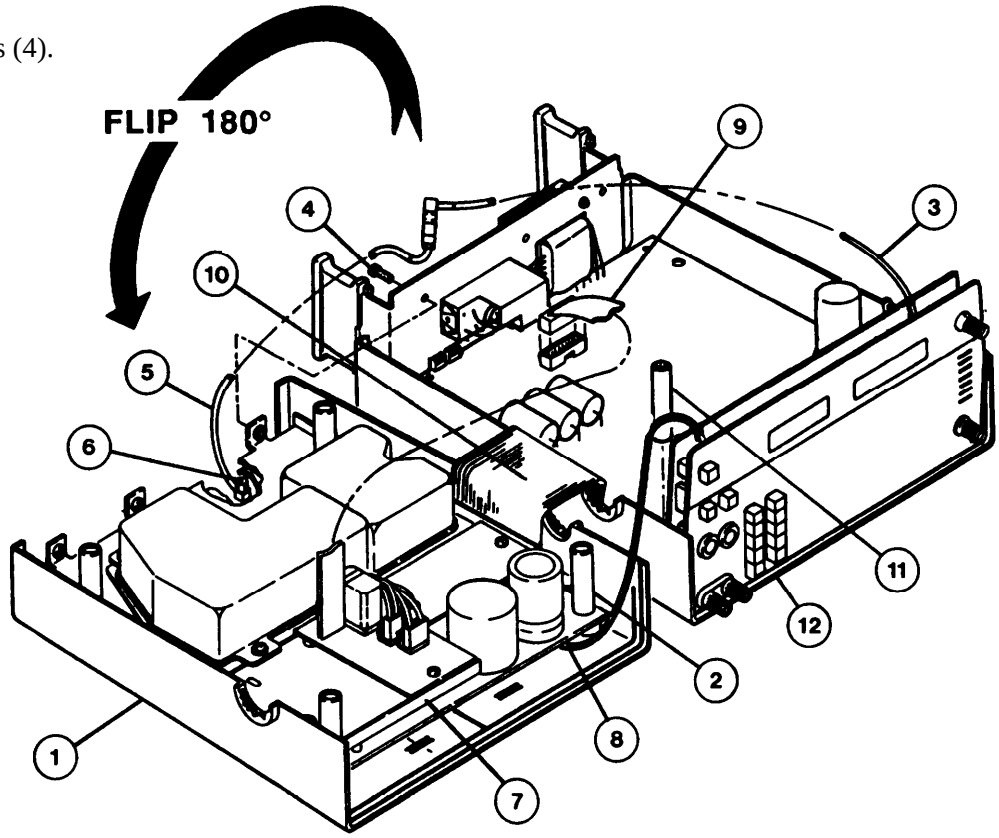
NOTE

PRELIMINARY PROCEDURES:

- Remove top case (para 4-28).

INSTALL

1. Place top case (1) on left side of AN/USM-485.
2. Remove four plastic posts (2) and place on top case (1) posts.
3. Disconnect black coaxial cable W5 (3).
4. Remove three screws (4).



4-39. PLACE AN/USM-485 INTO TROUBLESHOOTING POSITION—Continued.

5. Connect black coaxial extender cable (5) from Diagnostic Service Kit to A13J1 (6).

CAUTION

A13 Receiver Circuit Card Assembly contains static sensitive devices. When handling combination assembly, make sure you do not touch static sensitive devices.

6. Gently lift combination A5/A13 assembly (7) out of case, rotate 180°, and match holes on chassis onto plastic posts (2) installed on top case (1). Take care to position four conductor cable (8), flat cable (9), and ribbon cable W2 (10) when moving. Allow combination A5/A13 assembly (7) to slide down into top case (l).

7. Connect black coaxial cable W5 (3) to black coaxial extender cable (5).

REMOVE

1. Disconnect black coaxial cable W5 (3) from black coaxial extender cable (5).

2. Verify four plastic spacers (11) are in position on bottom cover (12).

3. Gently lift combination A5/A13 assembly (7) out of top case (l), flip 180°, and match holes on chassis onto plastic spacers (11) installed on bottom case (12). Take care to position four conductor cable (8), flat cable (9), and ribbon cable W2 (10) when moving.

4. Install three screws (4).

5. Disconnect black coaxial extender cable (5) from Diagnostic service kit. Reconnect black coaxial cable W5 (3) to A13J1 (6).

6. Install four plastic posts (2) into plastic spacers (11).

NOTE

FOLLOW-ON MAINTENANCE:

- Install top case (para 4-28).

END OF TASK

Section V. PREPARATION FOR STORAGE OR SHIPMENT

4-40. PACKAGING.

Package Transmission Test set in original shipping container. When using packing materials other than the original, use the following guidelines:

- Wrap Transmission Test Set in plastic packing material.
- Use double-wall cardboard shipping container.
- Protect all sides with shock-absorbing material to prevent Transmission Test Set from movement within the container.
- Seal the shipping container with approved sealing tape.
- Mark “FRAGILE on all sides, top, and bottom of shipping container.

4-41. TYPES OF STORAGE.

- Short-Term (administrative)=l to 45 days. Refer to TM 740-90-1 for administrative storage procedures.
- Intermediate=46 to 180 days.
- Long term=over 180 days. Before long term storage, operate in battery mode until completely discharged. After long term storage, perform Preliminary Servicing and Adjustment of Equipment (para 2-5). If battery fails to accept or hold a charge, perform Charger Test (para 4-16).

4-42. ENVIRONMENT.

The Transmission Test Set should be stored in a clean, dry environment. In high humidity environments, protect the Transmission Test Set from temperature variations that could cause internal condensation. The following environmental conditions apply to both shipping and storage:

Temperature	-40° C to +75° C (-40° F to +167° F)
Relative Humidity	less than 95%
Altitude	less than 15,300 meters (50,000 feet)

APPENDIX A
REFERENCES

A-1. SCOPE.

This appendix lists all forms, field manuals, technical manuals, and miscellaneous publications referenced in this manual.

A-2. FORMS.

Recommended Changes to Publications and Blank Forms ..... DA Form 2028

Recommended Changes to Equipment Technical Manuals .....DA Form 2028-2

Discrepancy in Shipment Report (DISREP) ..... Form SF 361

Report of Discrepancy (ROD) ..... Form SF 364

Quality Deficiency Report ..... Form SF 368

A-3. TECHNICAL MANUALS.

The Army Maintenance Management System (TAMMS) .....DA Pam 738-750

Operator's Manual, Transmission Test Set AN/USM-485 .....TM 11-6625-3186-10

Unit and Intermediate Direct Support and General Support Repair Parts and Special Tools List, for Transmission Test Set AN/USM-485 .....TM 11-6625-3186-24P

Procedures for Destruction of Electronics Materiel to Prevent Enemy Use (Electronics Command) . . . . . TM 750-244-2

Administrative Storage Procedure .....TM 740-90-1

A-4. MISCELLANEOUS.

Common Table of Allowances .....CTA 50-970

Consolidated Index of Army Publications and Blank Forms ..... DA Pam 25-30

First Aid for Soldiers .....FM 21-11

Safety Precautions for Maintenance of Electrical/Electronic Equipment .....TB 385-4

Abbreviations for Use on Drawings, Specifications, Standards and in Technical Documents ..... MIL-STD- 12

APPENDIX B
MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

B-1. GENERAL.

a. This appendix provides a general explanation of all maintenance and repair functions authorized at various maintenance levels for the AN/USM-485.

b. The Maintenance Allocation Chart (MAC) in Section II designates overall authority and responsibility for the performance of maintenance functions on the identified end item or component. The application of the maintenance functions to the end item or component will be consistent with the capacities and capabilities of the designated maintenance levels.

c. Section III lists the tools and test equipment (both special tools and common tool sets) required for each maintenance function as referenced from section II.

d. Section IV contains supplemental instructions and explanatory notes for a particular maintenance function.

B-2. MAINTENANCE FUNCTIONS.

Maintenance functions will be limited to and defined as follows:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination.

b. Test. To verify serviceability and to detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition, i. e., to clean (includes decontaminate, when required), preserve, drain, paint, or to replenish fuel, lubricants, chemical fluids, or gases.

d. Adjust. Maintain or regulate within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to the specified parameters.

e. Align. To adjust specified variable elements of an item to bring about optimum or desired performance.

f. Calibrate. To determine the cause and corrections to be made or adjusted on instruments or test measuring and diagnostic equipment used in precision measurement. This consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Remove/Install. To remove and install the same item when required to perform service on other maintenance functions. Install may be the act of emplacing, seating, of fixing into position an item, part, module (component or assembly) in a manner to allow the proper functioning of the equipment or system.

h. Replace. To remove an unserviceable item and install a serviceable counterpart in its place. Replace is authorized by the MAC and is shown as the 3d position code of the SMR code.

i. Repair. The application of maintenance services (inspect, test, service, adjust, align, calibrate, and/or replace) including fault location/troubleshooting, removal/installation, and disassembly/assembly procedures, and maintenance actions (welding, grinding, riveting, straightening, facing, remachining, or resurfacing) to identify troubles restore serviceable to an item by correcting specific damage, fault malfunction, or failure in a part, subassembly, module (component or assembly), and item or system.

j. Overhaul. That periodic maintenance effort (service/ action) prescribed to restore an item to a completely semiceable/operational condition as required by maintenance standards in appropriate technical publications (i.e., DMWR). Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. Rebuild. Consists of those services/ actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of material maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours, miles, etc.) considered in classifying Army equipment components.

B-3. EXPLANATIONS OF COLUMNS IN THE MAC, SECTION II.

a. Column 1, Group Number. Column 1 lists functional group code numbers, the purpose of which is to identify maintenance significant components, assemblies, subassemblies and modules with the next higher assembly. End item group number shall be "00".

b. Column 2, Component/ Assembly. Column 2 contains the noun names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. Column 3, Maintenance Function. Column 3 lists the functions to be performed on the item listed in column 2.

d. Column 4, Maintenance Level. Column 4 specifies, by the listing of a work time figure in the appropriate subcolumn (s), the level of maintenance authorized to perform the function listed in column 3. This figure represents the active time required to perform that maintenance function at the indicated level of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different levels, appropriate work time figures will be shown for each level. The work time figure represents the average time required to restore an item (assembly, subassembly, component, module, end item or system) to a serviceable condition under typical field operating conditions. This time includes preparation time (including any necessary disassembly/assembly time), troubleshooting/fault location time and quality assurance/ quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. The symbol designations for the various maintenance levels are as follows:

UNIT
C — Operator/ Crew
O — Organizational Maintenance

INTERMEDIATE
F — Direct Support Maintenance
H — General Support Maintenance
L — Specialized Repair Activity

DEPOT
D — Depot Maintenance

e. Column 5, Tools and Equipment. Column 5 specifies by code, those common tool sets (not individual tools) and special tools, TMDE, and support equipment required to perform the designated function.

f. Column 6, Remarks. This colum shall, when applicable, contain a letter code, in alphabetic order, which shall be keyed to the remarks contained in Section IV.

B-4. EXPLANATIONS OF COLUMNS IN THE TEST EQUIPMENT REQUIREMENTS, SECTION III.

a. Column 1, Reference Code. The tool and test equipment code correlates with a code used in the MAC, Section II, column 5.

b. Column 2, Maintenance Level. The lowest level of maintenance authorized to use the tool or test equipment.

c. Column 3, Nomenclature. Name or identification of the tool or test equipment.

d. Column 4, National Stock Number. The National Stock Number of the tool or test equipment.

e. Column 5, Tool Number. The manufacturer's part number.

B-5. EXPLANATIONS OF COLUMNS IN REMARKS, SECTION IV.

a Column 1, Reference Code. The code recorded in column 6, Section II.

b. Column 2, Remarks. This column lists information pertinent to the maintenance function being performed as indicated in the MAC, Section II.

SECTION II. MAINTENANCE ALLOCATION CHART FOR

TRANSMISSION TEST SET AN/USM-485

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQPT.	(6) REMARKS
			UNIT		INTERMEDIATE		DEPOT		
			C	O	F	H	D		
00	Transmission Test Set AN/USM-485	Inspect		0.1				1	A
		Inspect				0.1		2	B
		Test		0.1					C
		Test				3.0		2-25	D
		Calibrate				1.0		2-7,9-12, 15,16,18, 19-25	E
		Repair		0.5				1	F
		Repair				5.0		2-25	G
01	Switchboard CCA A2	Inspect				0.1		2	
		Test				0.5		2-6,9,14, 17,25	
		Repair				1.0		2	
02	BAT CHG CCA A5	Inspect				0.1		2	
		Test				0.1		2,9	
		Repair				0.5		2	H
03	Rear Panel ASSY A6	Inspect				0.1		2	
		Test				0.1		2,9	
		Repair				0.5		2	J
04	Receiver CCA A13	Inspect				0.1		2	
		Test				1.0		2-6,8,9, 11,13,14, 17,23,25	
		Repair				2.0		2	
05	Transmitter CCA A14	Inspect				0.1		2	
		Test				0.5		2-6,8,9, 11,14,17, 25	
		Repair				1.0		2	

SECTION III. TOOL AND TEST EQUIPMENT REQUIREMENTS FOR TRANSMISSION TEST SET AN/USM-485

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE LEVEL	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NUMBER
1	O	Tool Kit, ELEC EQPT TK-101/G	5180-00-064-5178	
2	H	Tool Kit, JTK-17	4931-01-073-3845	
3	H	Oscilloscope Mainframe MIS28706/1TYPE1	6625-01-046-3712	TEK 5440
4	H	Plug-In Oscilloscope MIS28706/3	6625-01-008-1480	TEK 5A48
5	H	Plug-In Oscilloscope MIS28706/4	6625-01-008-1479	TEK 5B42
6	H	Probe,10:1 010-6056-03 (2 EA)	6625-00-434-0605	TEK P6056
7	H	Calibrator	4931-01-012-2884	HP 745AC93
8	H	Signal Generator	6625-00-113-2943	HP 652A
9	H	Voltmeter, Digital	6625-00-557-8305	HP 3490A
10	H	Digital Multimeter (or equivalent)	6625-00-500-6640	TEK DM501
11	H	Frequency Counter MIS28754TYPE1	4931-01-040-0121	HP 5345A System
12	H	Distortion Analyzer 7911957	4931-00-987-9002	HP 334A
13	H	Attenuator,Variable 10519457	5985-00-957-1860	HP 355D
14	H	Logic Probe	6625-01-047-7309	HP 545A
15	H	Dual Output DC Power Supply	6130-01-004-6705	PS-503A
16	H	Meter Calibrator	6625-00-935-7002	JF 760A
17	H	Signature Analyzer TS-3791/U (or equivalent)	6625-01-068-8641	HP 5004A
18	H	BNC Tee UG-274	5935-00-926-7523	
19	H	Adapter, BNC to Dual Banana 7907592	5935-00-053-9454	POM 1269
20	H	Oscilloscope, Dual Trace	6695-01-074-7954	TEK SC504

SECTION III. TOOL AND TEST REQUIPMENT REQUIREMENTS FOR TRANSMISSION TEST SET AN/USM-485

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE LEVEL	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NUMBER
21	H	Adapter (f) BNC to WECO 310 (2 each) (or equivalent)	6625-00-107-8287	POM 2798
22	H	Adapter Dual Banana Component Carrier (or equivalent)		POM 1330ST
23	H	600-50Ω Matching Pad 2 each (or equivalent)		POM 1656-1 YELLOW
24	H	600Ω Load BNC-BNC (or equivalent)	5935-00-454-9945	HP 11095A
		****SPECIAL TOOLS****		
25	H	Diagnostic Service Kit (consists of) +20 dB Amplifier CCA Jumper CCA Cable Assembly, Radio FREQ Test Processor (consists of) Diagnostic Processor Diagnostic EPROM 40 Pin Socket Six Jumpers Eight position DIP Switch		HP 04935-60030

SECTION IV. REMARKS FOR TRANSMISSION TEST SET AN/USM-485

REFERENCE CODE	REMARKS
A	External visual inspection.
B	Visual external and internal inspection for signs of damage, loose parts, or cables, ETC.
C	Operational tests and observation of error messages.
D	Fault isolate to major assembly or cables.
E	Calibration procedures described in TB 43-180.
F	Repair by replacement of fuse, knobs, and power cable which are nonrepairable items.
G	Repair includes replacement of A1 Front Panel Assembly, A5 Battery Charger Assembly (see note H), Battery Pack Assembly, W2, W5, and four conductor inter-assembly cable assemblies, and panel mounted connectors which are nonrepairable items.
H	Repair limited to replacement of fuses A5F1, A5F2, and A5F3, Relay A5K1, transistors A5Q1, A5Q13, and A5Q15, and one cable assembly.
J	Repair limited to replacement of A6FL1 Line Filter Module and A6T1 Transformer.

APPENDIX C

EXPENDABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

C-1. SCOPE.

This appendix lists expendable supplies you will need for maintenance on Transmission Test Set AN/USM-485. These items are authorized to you by CTA 50-970, Expendable items (Except Medical, Class V, Repair Parts, and Heraldic Items).

C-2. EXPLANATION OF COLUMNS.

a. Column (1)-Item Number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g., "Use cleaning compound, item 5, App. D").

b. Column (2)-Level. This column identifies the lowest level of maintenance that requires the listed item.

O - Organizational Maintenance.

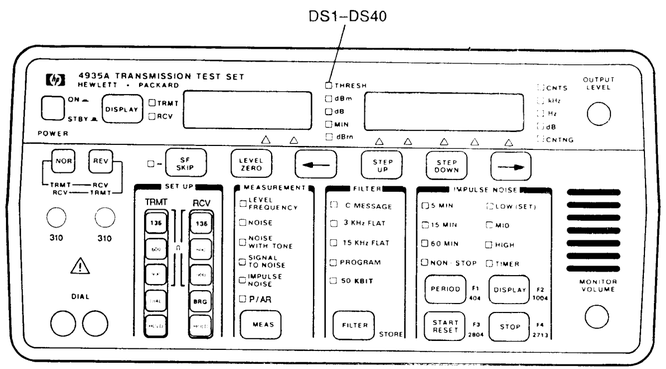
c. Column (3)-National Stock Number. This column indicates the national stock number assigned to the item and will be used for requisitioning purposes.

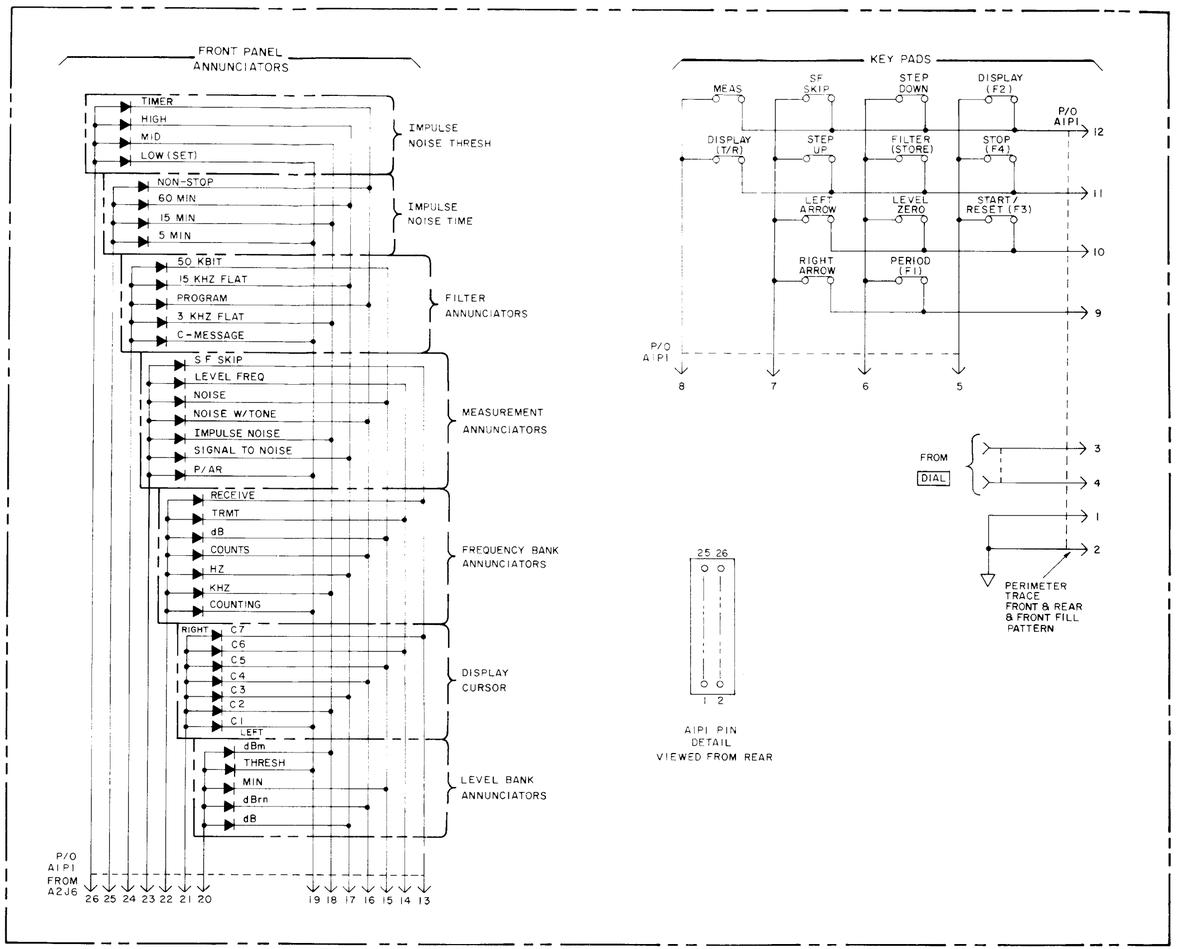
d. Column (4)-Description. This column indicates the federal item name and if required, a minimum description to identify the item. The last line for each item indicates the FSCM (in parentheses) followed by the part number.

e. Column (5)-Unit of Measure (U/M). This column indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., EA, IN, PR). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

Section II. EXPENDABLE SUPPLIES AND MATERIALS LIST

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
1	O,H	6810-00-753-4993	Alcohol, Isopropyl, 8OZ Can, MIL-A-10428, Grade A (81349)	CN
2	C	8305-00-267-3015	Cloth, Cheesecloth, Cotton, Lintless, CCC-C-440, Type II, Class 2 (81349)	YD
3	C		Detergent, Mild, Liquid	OZ
4	H	6850-00-405-9385	Circuit Cooler, Freon 12 Base MS240 (18598)	CN
5	H		Cable Ties TY23M-8 (59730)	EA



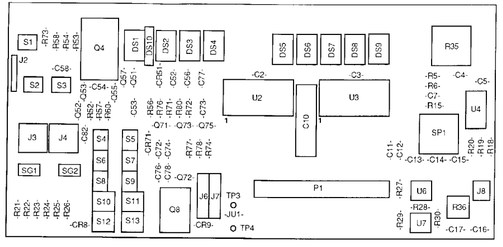


CE1CL009

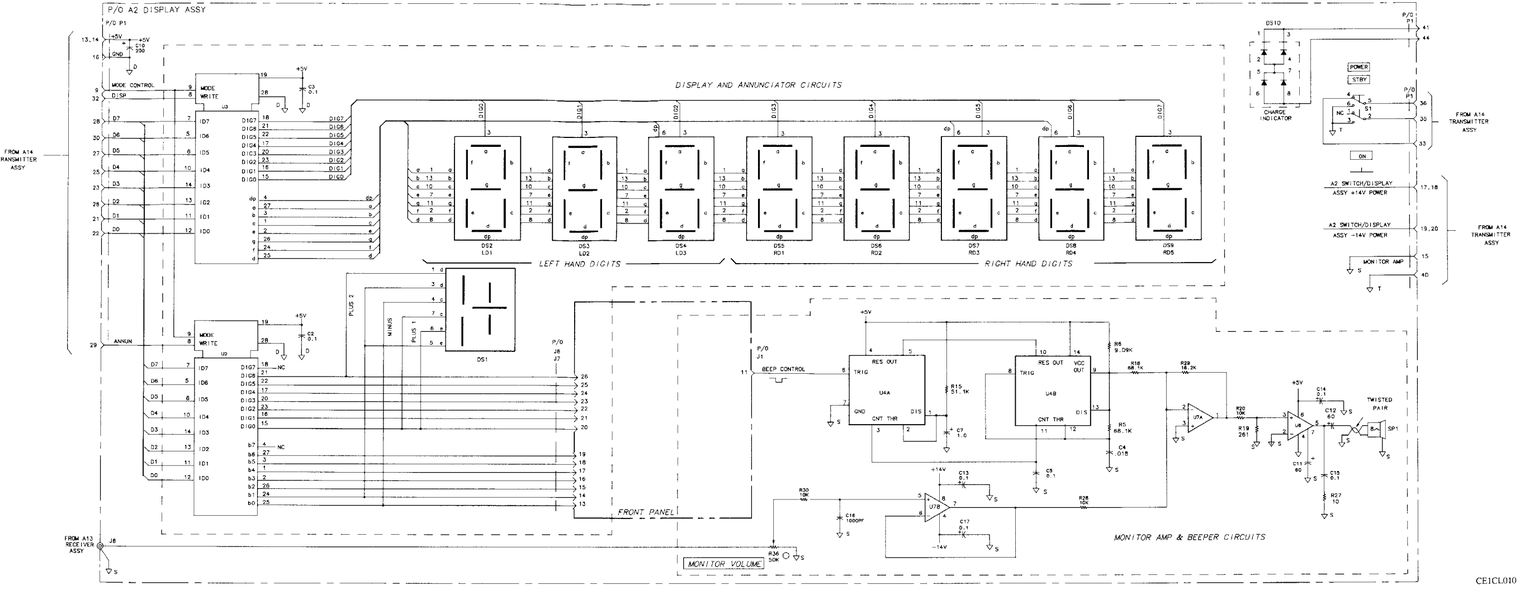
Figure FO-1. A1 Front Panel Assembly Component Locator and Schematic Diagram.

NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD A2 TO ABBREVIATION FOR COMPLETE REFERENCE DESIGNATOR.
2. UNLESS OTHERWISE SPECIFIED:
   RESISTANCE IS IN OHMS
   CAPACITANCE IS IN MICROFARADS
   INDUCTANCE IS IN MICROHENRIES
3. ASTERISK (*) INDICATES FACTORY SELECTED PART, AVERAGE VALUE SHOWN.
4. UNLESS OTHERWISE SPECIFIED:
   S = SIGNAL GROUND
   D = DIGITAL GROUND
   T = TRANSMITTER GROUND

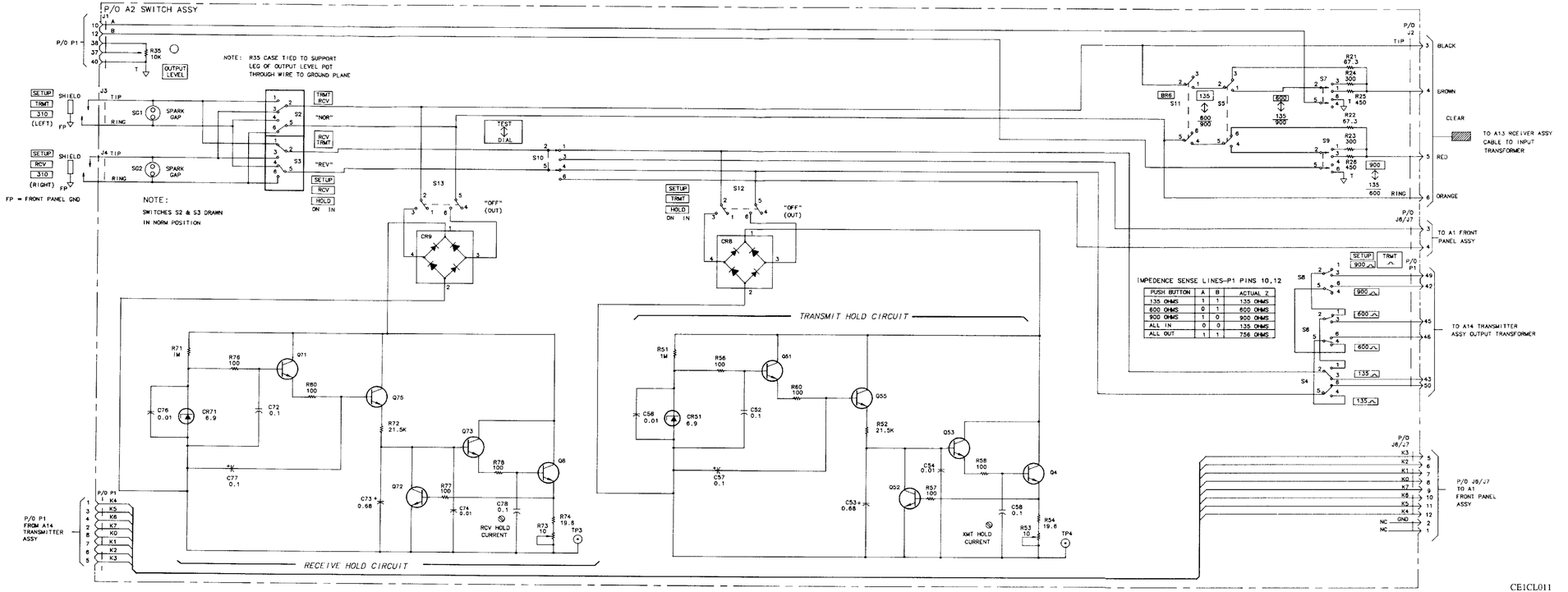


A2



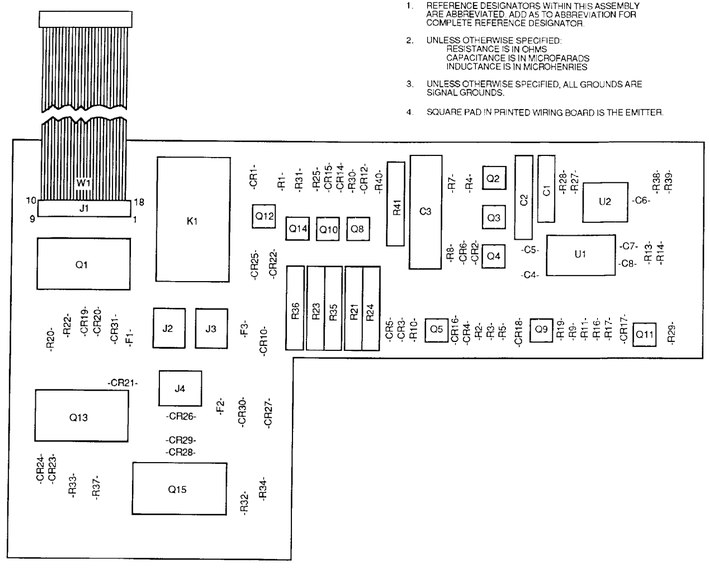
CE1CL010

Figure FO-2. A2 Switch and Display Assembly Component Locator and Schematic Diagram (Sheet 1 of 2).

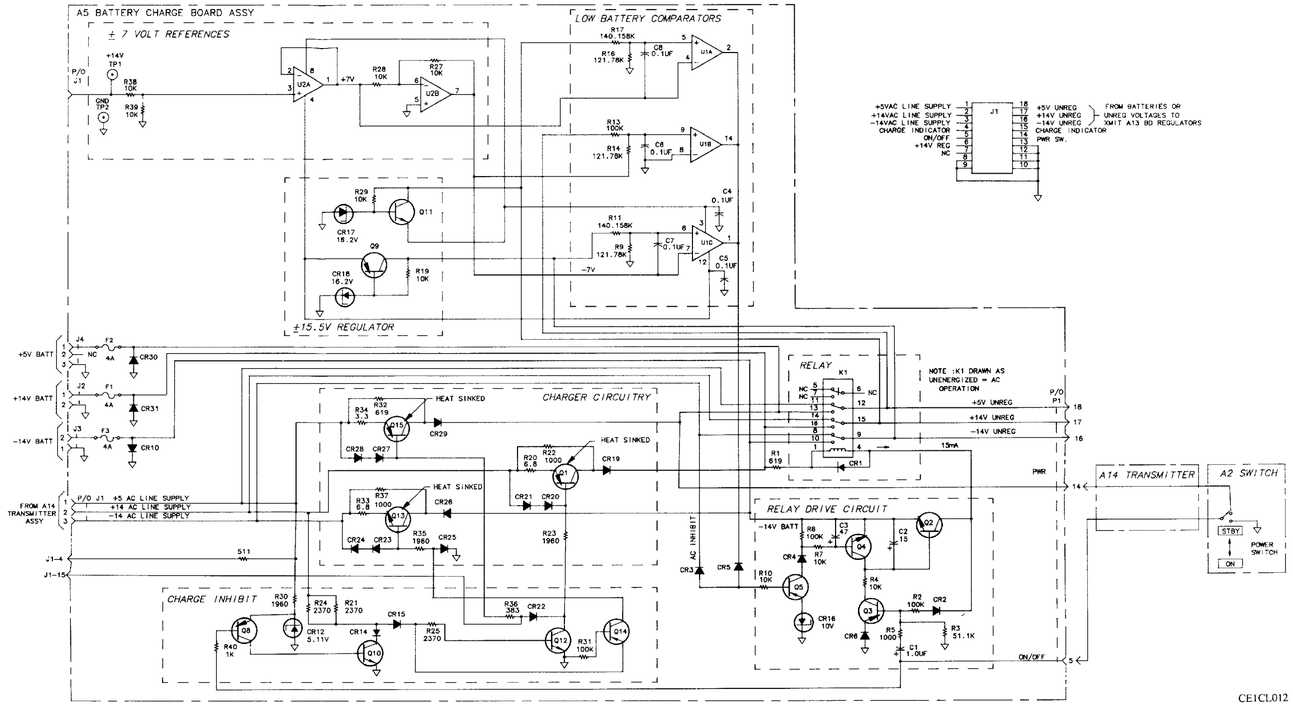


CE1CL011

Figure FO-2. A2 Switch and Display Assembly Component Locator and Schematic Diagram (Sheet 2 of 2).



A5



CE1CL012

Figure FO-3. A5 Charger Assembly Component Locator and Schematic Diagram.

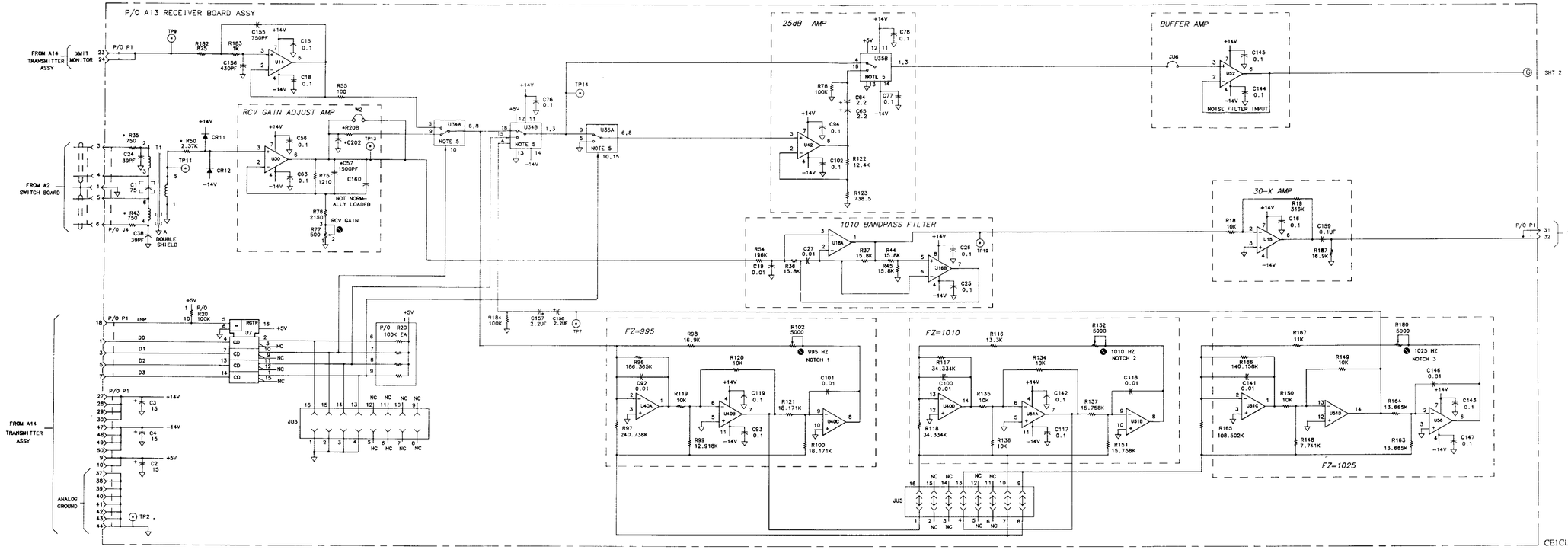


Figure FO-4. A13 Receiver Assembly Component Locator and Schematic Diagram (Sheet 1 of 4).

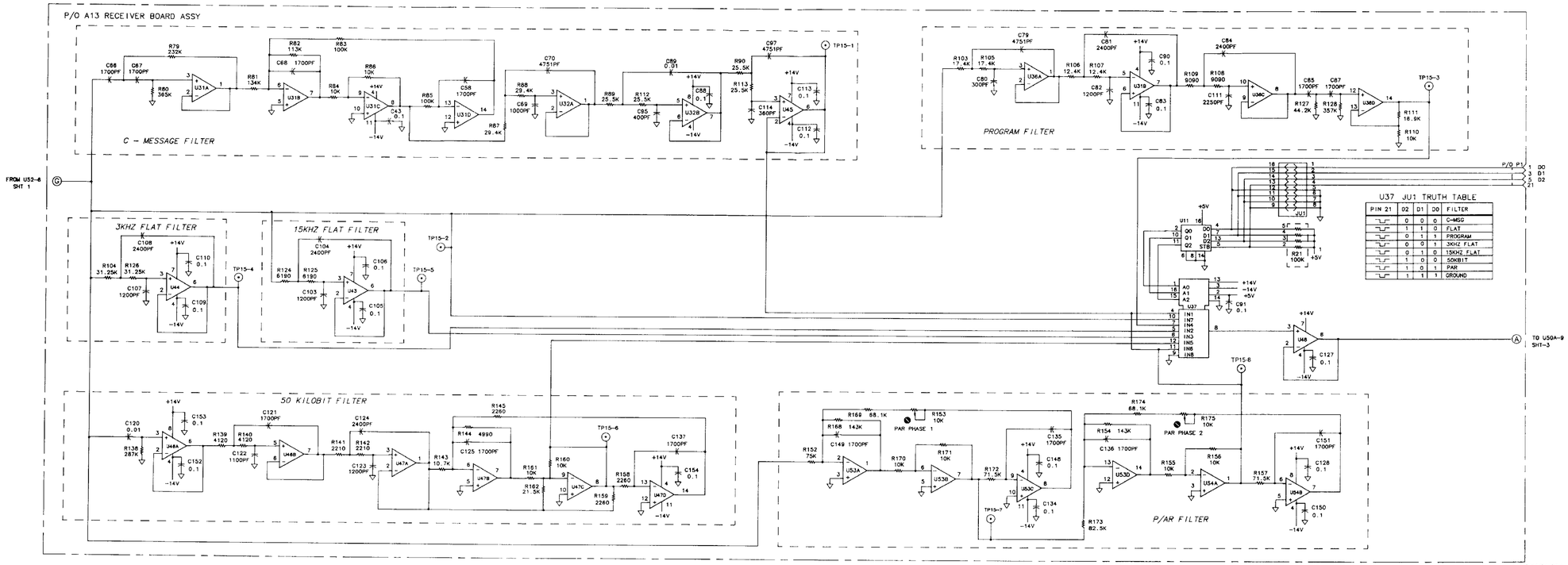
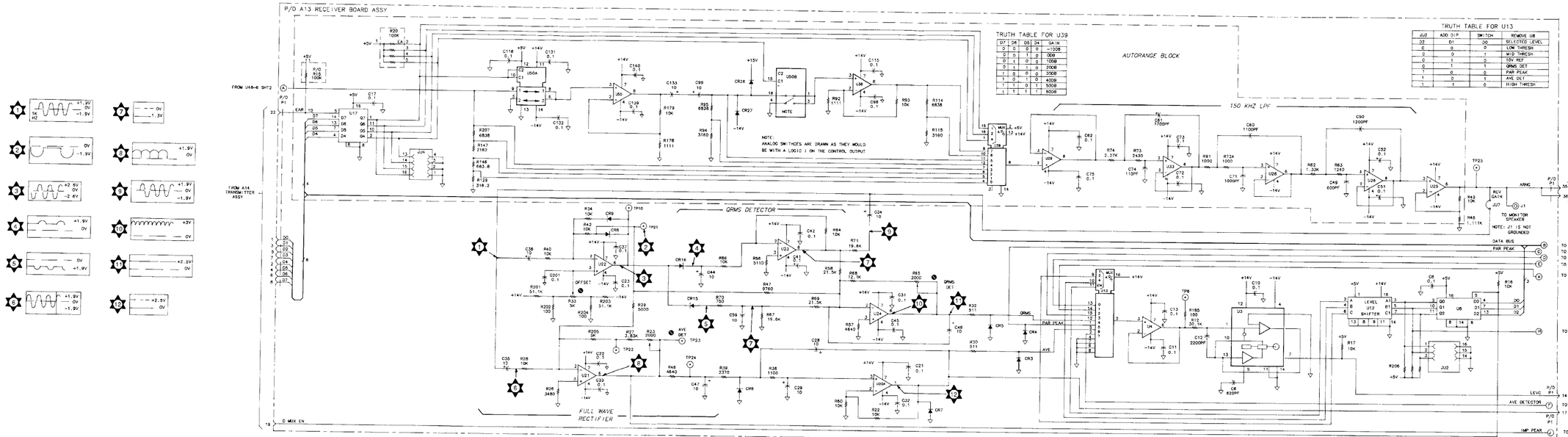
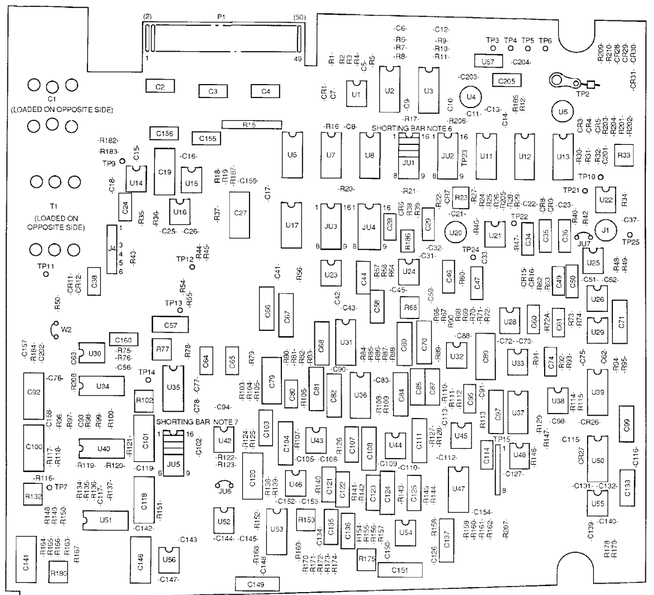


Figure FO-4. A13 Receiver Assembly Component Locator and Schematic Diagram (Sheet 2 of 4).



CE1CL015

Figure FO-4. A13 Receiver Assembly Component Locator and Schematic Diagram (Sheet 3 of 4).



NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD A13 TO ABBREVIATION FOR COMPLETE REFERENCE DESIGNATOR.
2. UNLESS OTHERWISE SPECIFIED:
   RESISTANCE IS IN OHMS
   CAPACITANCE IS IN MICROFARADS
   INDUCTANCE IS IN MICROHENRIES
3. ASTERISK (*) INDICATES FACTORY SELECTED PART, AVERAGE VALUE SHOWN.
4. UNLESS OTHERWISE SPECIFIED, ALL GROUNDS ARE DIGITAL GROUNDS.
5. ANALOG SWITCHES ARE DRAWN AS THEY WOULD BE WITH A LOGIC 1 ON THE CONTROL INPUT.
6. SHORTING BAR NORMALLY INSTALLED IN POS 1-16, 2-15, 3-14, 4-13.
7. SHORTING BAR NORMALLY INSTALLED IN POS 1-16, 2-13, 3-14, 4-13

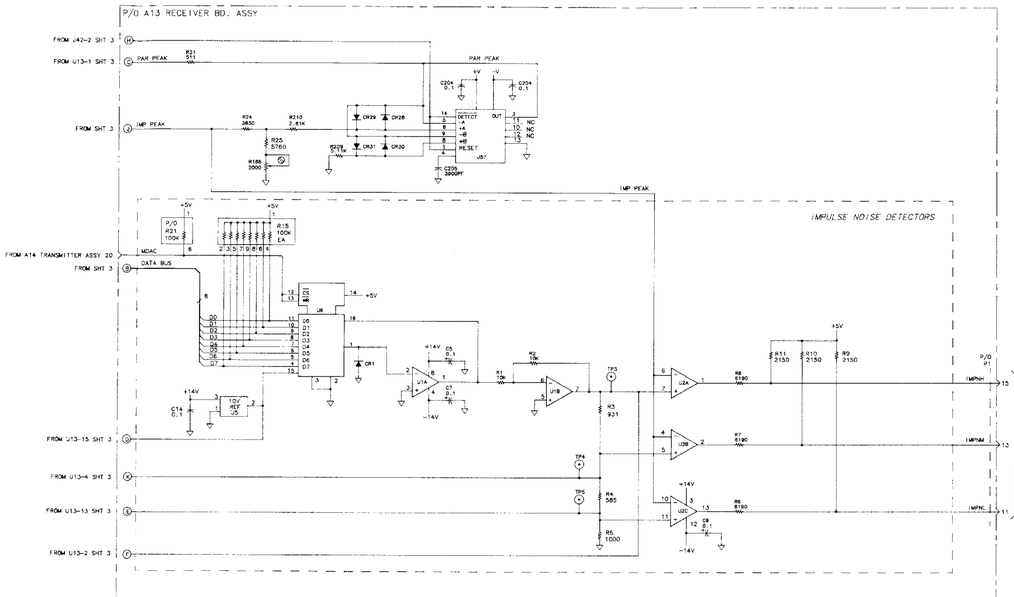
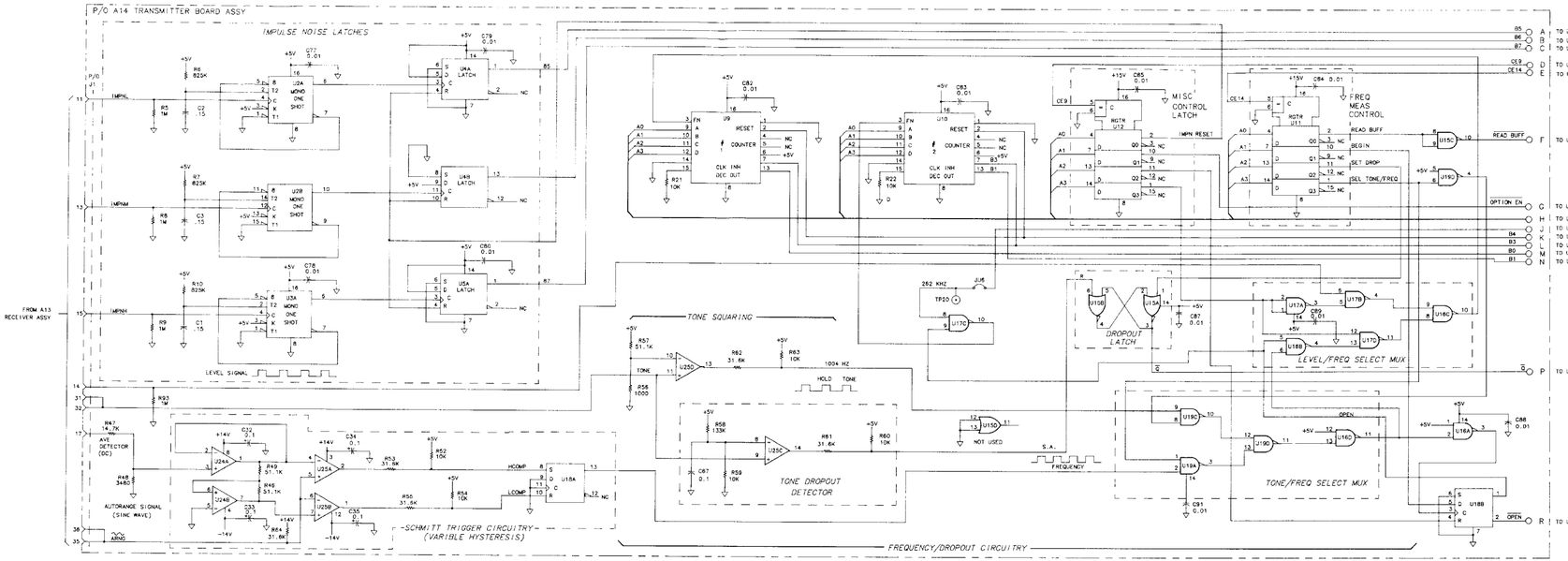


Figure FO-4. A13 Receiver Assembly Component Locator and Schematic Diagram (Sheet 4 of 4).

CE-14				FREQUENCY MEASUREMENT CONTROL
A13	A2	A1	A0	FUNCTION
1	X	X	X	FREQUENCY SELECT
0	X	X	X	1004 TONE SELECT
X	1	X	X	SET DROP
X	X	1	X	BEGIN
X	X	X	1	READ ENABLE/IMPED STATUS ENABLE
X	X	X	0	READ DISABLE/ IMPED STATUS DISABLE

CE-9				MISC CONTROL
A13	A2	A1	A0	FUNCTION
X	X	X	1	RESET IMPULSE NOISE LATCH
X	X	0	X	ENABLE OPTION SELECT BUFFER
X	X	1	X	DISABLE OPTION BUFFER
X	1	X	X	RESET OPEN (FREQ MEASUREMENT)
0	X	X	X	SELECT LEVEL TO COUNTER #1
1	X	X	X	SELECT EVENTS TO COUNTER #1



CE1CL017

Figure FO-5. A14 Transmitter Assembly Component Locator and Schematic Diagram (Sheet 1 of 5).

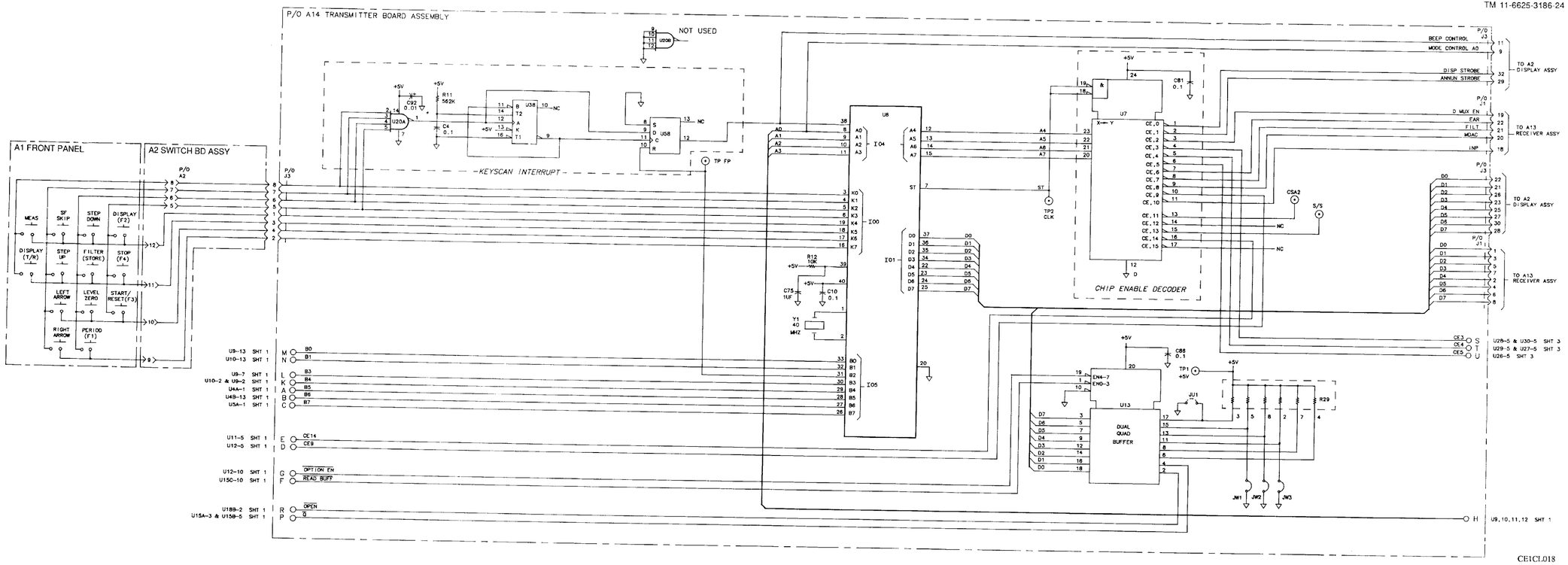
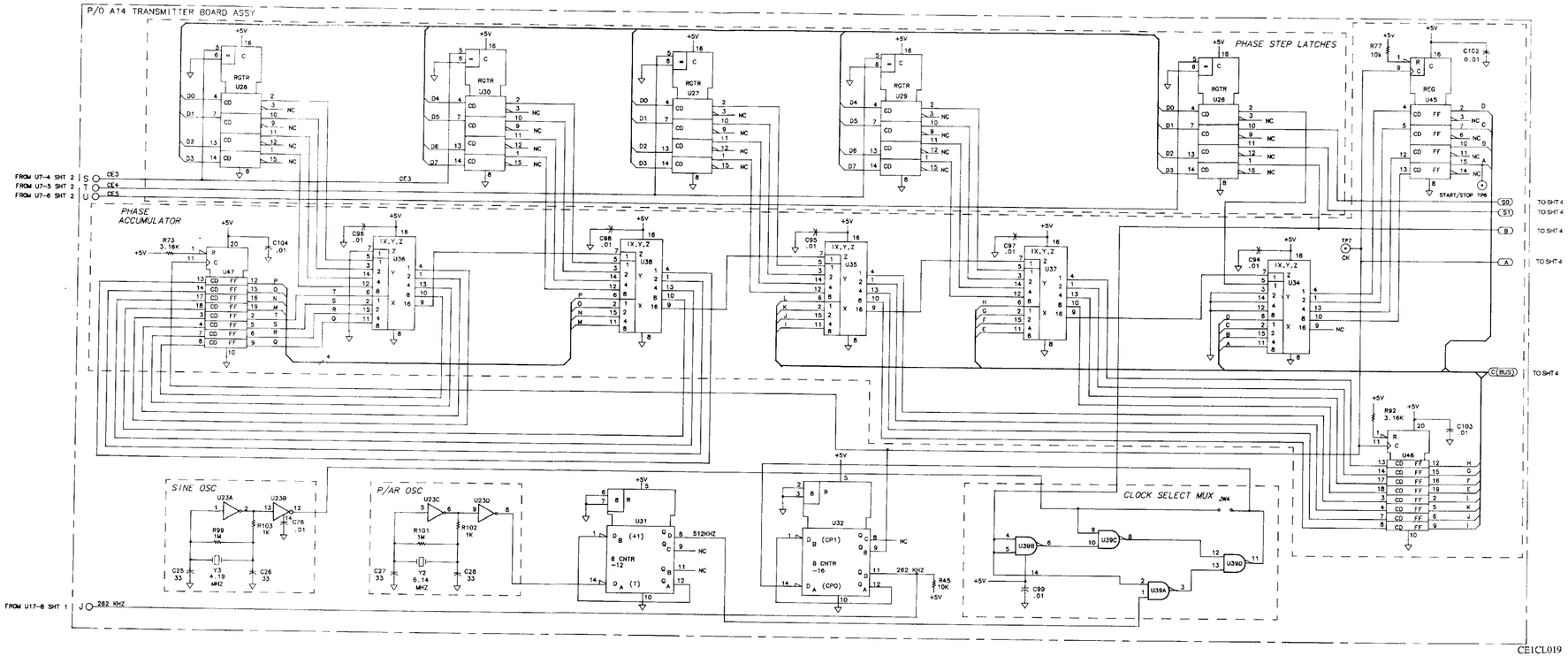
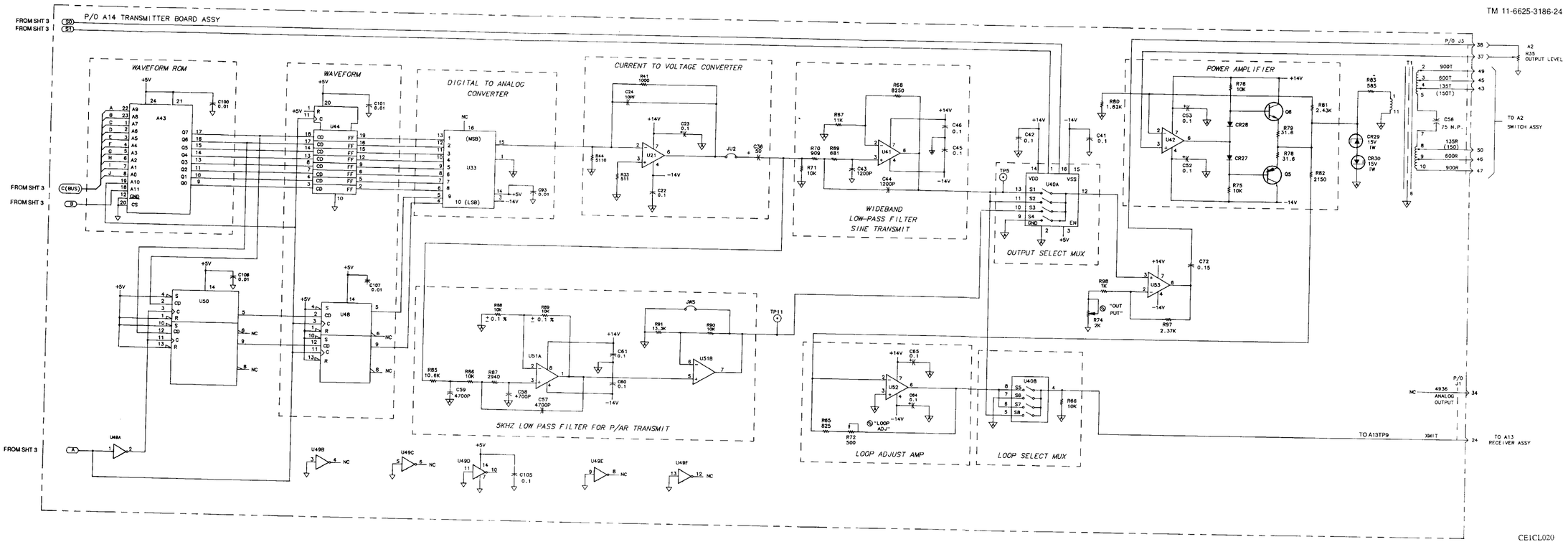


Figure FO-5. A14 Transmitter Assembly Component Locator and Schematic Diagram (Sheet 2 of 5).



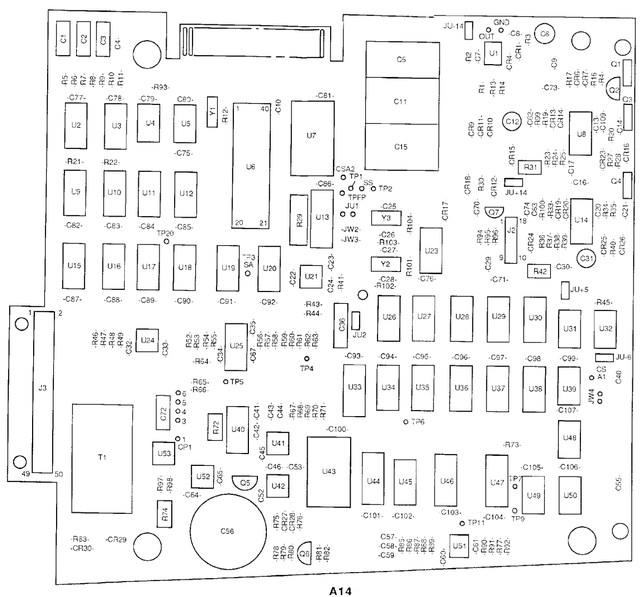
CEICL019

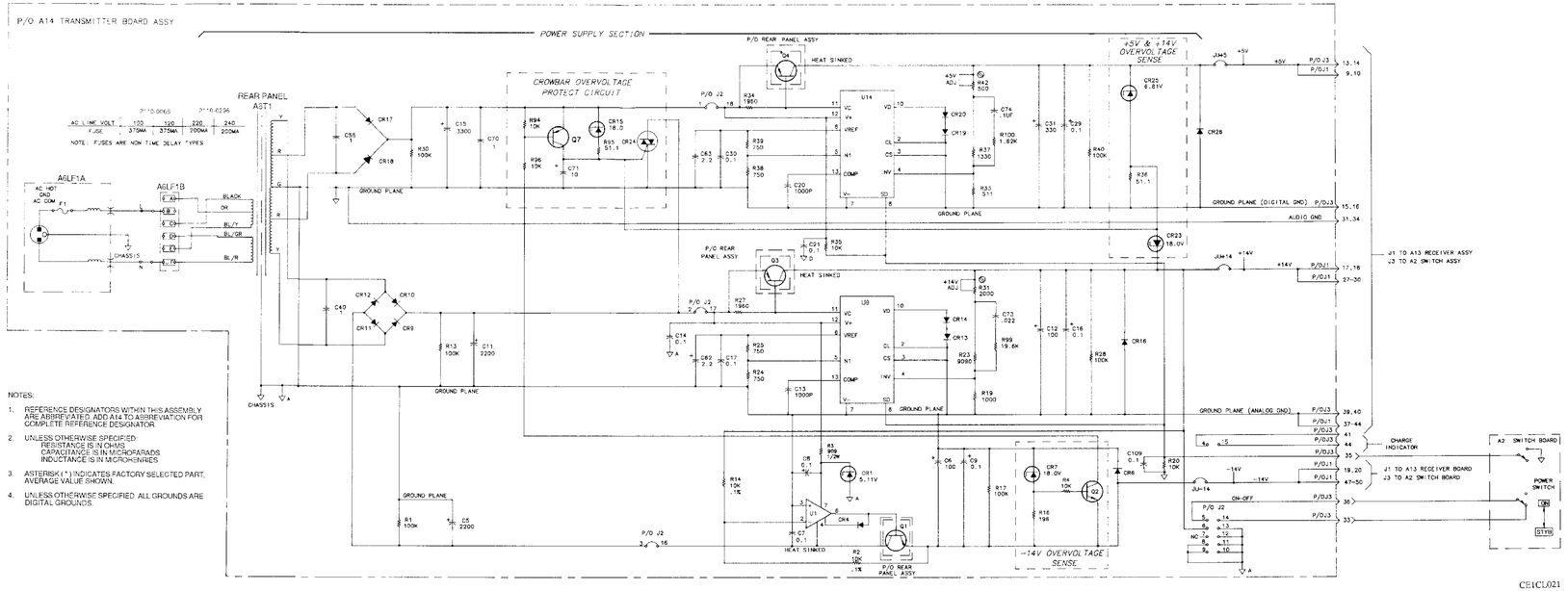
Figure FO-5. A14 Transmitter Assembly Component Locator and Schematic Diagram (Sheet 3 of 5).



CE1CL020

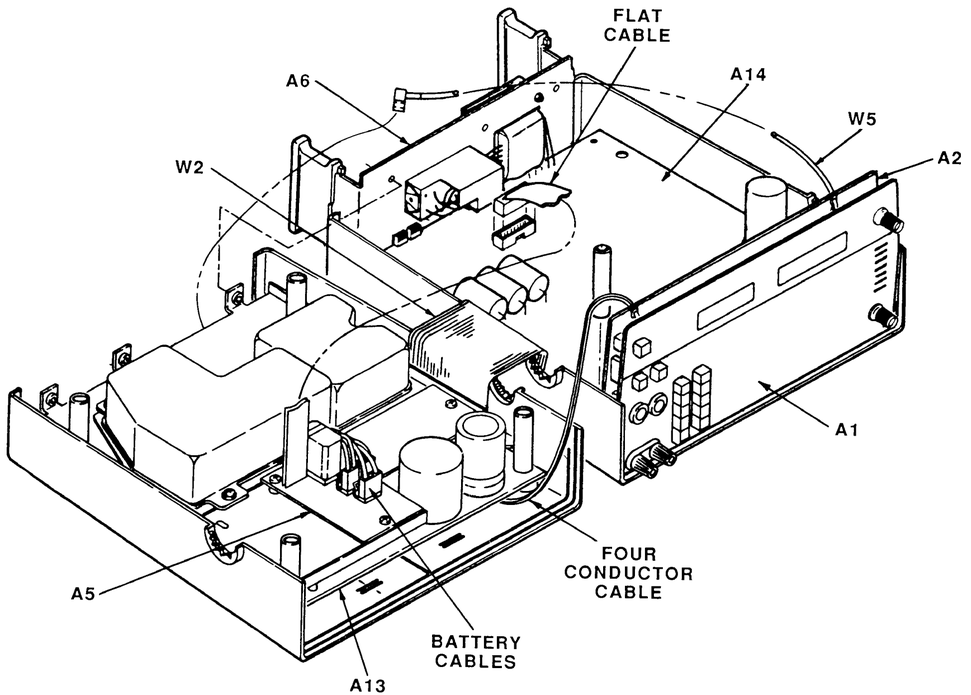
Figure FO-5. A14 Transmitter Assembly Component Locator and Schematic Diagram (Sheet 4 of 5).





CE1CL021

Figure FO-5. A14 Transmitter Assembly Component Locator and Schematic Diagram (Sheet 5 of 5).



COMPONENT LOCATOR

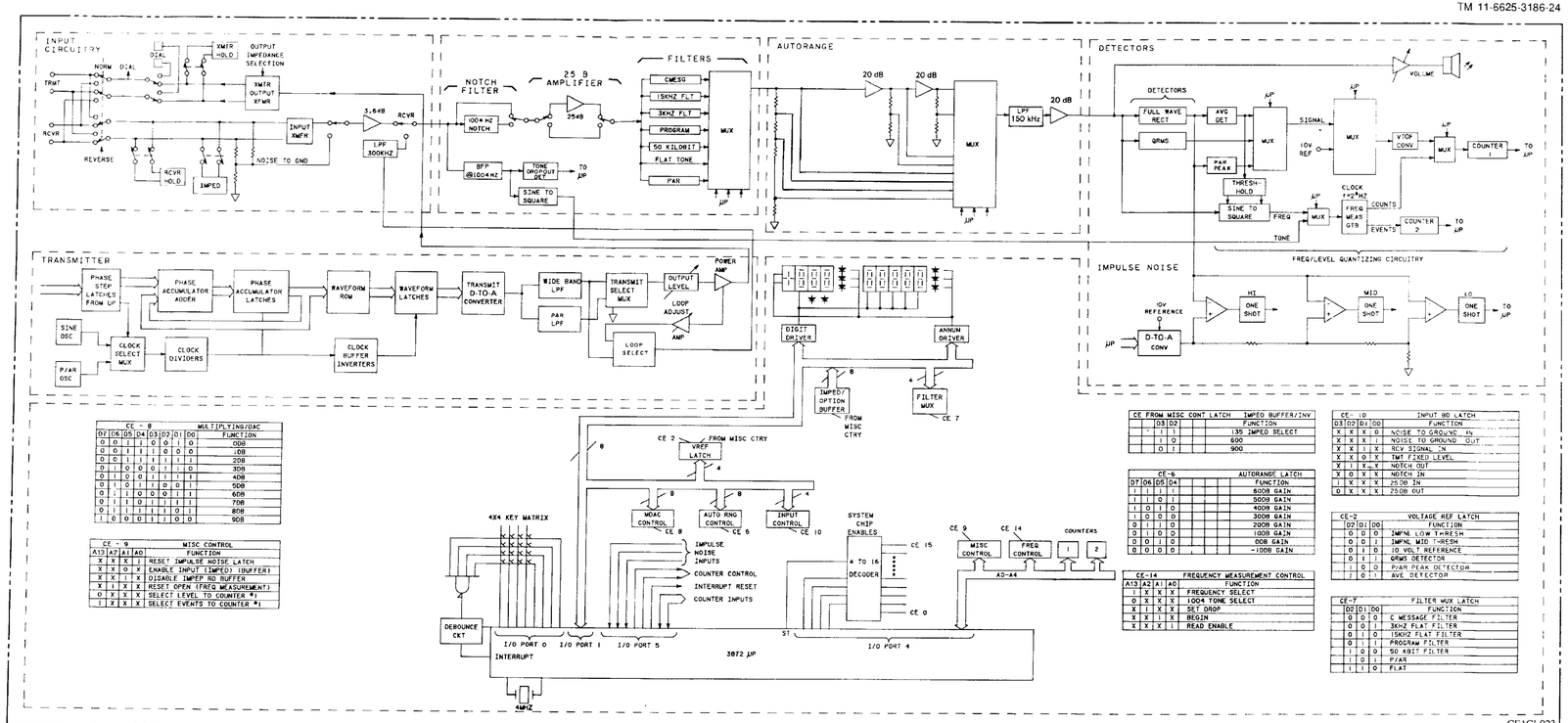
MEASUREMENTS SUMMARY

MEASUREMENT	INPUT SOURCE SELECTED A13JU3 PIN			NOTCH FILTER A13JU3		DETECTORS USED A3U8				TRANSMIT FILTER	XMIT MONITOR SOURCE	S1	S0
		16	15	IN/ OUT	PIN 14		Q2 PIN 11	Q1 PIN 10	Q0 PIN 2			A14 U40 (1)	A14 U40 (16)
Level and Frequency													
TRMT Display	Xmit Monitor	1	0	Out	1	AVG	1	0	T	Wideband LPF	Power Amp Output	0	0
RCV Display	Input Transformer	1	1	Out	1	AVG	1	0	T	Wideband LPF	Gnd	0	1
Noise													
TRMT Display	Xmit Monitor	1	0	Out	1	AVG	1	0	T	Gnd	Wideband LPF	1	1
RCV Display	Input Transformer	1	1	Out	1	QRMS	0	1	T	Gnd	Wideband LPF	1	1
Noise w/Tone													
TRMT Display	Xmit Monitor	1	0	Out	1	Avg	1	0	T	Wideband LPF	Power Amp Output	0	0
RCV Display	Input Transformer	1	1	In	0	QRMS	0	1	T	Wideband LPF	Gnd	0	1
Signal to Noise													
TRMT Display	Xmit Monitor	1	0	Out	1	Avg	1	0	T	Wideband LPF	Power Amp Output	0	0
RCV Display Signal	Input Transformer	1	1	In	0	Avg	Toggling at ≈ 1 Hz			Wideband LPF	Gnd	0	1
Noise	Input Transformer	1	1	Out	1	QRMS				Wideband LPF	Gnd	0	1
Impulse Noise													
TRMT Display	Xmit Monitor	1	0	Out	1	Avg	1	0	1	Wideband LPF	Power Amp Output	0	0
RCV Display	Input Transformer	1	1	In	0	Avg	1	0	1	Wideband LPF	Gnd	0	1
Noise to Ground													
TRMT	Xmit Monitor	1	0	Out	1	Avg	1	0	T	Gnd	Wideband LPF	1	1
RCV	Signal to Gnd	0	1	Out	1	QRMS	0	1	T	Gnd	Wideband LPF	1	1
P/AR													
TRMT Display	Xmit Monitor	1	0	Out	1	Avg	1	0	T	Wideband LPF	Power Amp Output	1	0
RCV Display	Input Transformer	1	1	Out	1	Avg QRMS P/AR Peak	Toggling at ≈ 1 Hz			5 kHz LPF	Power Amp Output	1	0

T = toggling

CE1CL022

Figure FO-6. AN/USM-485 Assembly and Cable Locator, and Signal Flow Block Diagram (Sheet 1 of 2).



CE - 8								MULTIPLYING/DAC
D7	D6	D5	D4	D3	D2	D1	D0	FUNCTION
0	0	1	1	0	0	1	0	00B
0	0	1	1	1	0	0	0	10B
0	0	1	1	1	1	1	1	20B
0	1	0	0	0	1	1	0	30B
0	1	0	0	1	1	1	1	40B
0	1	0	1	0	0	0	1	50B
0	1	1	0	0	0	1	1	60B
0	1	1	1	0	1	1	1	70B
0	1	1	1	1	1	0	1	80B
1	0	0	0	1	1	0	0	90B

CE - 9				MISC CONTROL
A13	A2	A1	A0	FUNCTION
X	X	X	1	RESET IMPULSE NOISE LATCH
X	X	0	X	ENABLE INPUT (IMPED) (BUFFER)
X	X	1	X	DISABLE IMPED BO BUFFER
X	1	X	X	RESET OPEN (FREQ MEASUREMENT)
0	X	X	X	SELECT LEVEL TO COUNTER #1
1	X	X	X	SELECT EVENTS TO COUNTER #1

CE FROM MISC CONT LATCH				IMPED BUFFER/INV
	D3	D2		FUNCTION
	1	1		135 IMPED SELECT
	1	0		600
	0	1		900

CE-6				AUTORANGE LATCH
D7	D6	D5	D4	FUNCTION
1	1	1	1	80DB GAIN
1	1	0	1	50DB GAIN
1	0	1	0	40DB GAIN
1	0	0	0	30DB GAIN
0	1	1	0	20DB GAIN
0	1	0	0	10DB GAIN
0	0	1	0	0DB GAIN
0	0	0	0	-10DB GAIN

CE-14				FREQUENCY MEASUREMENT CONTROL
A13	A2	A1	A0	FUNCTION
1	X	X	X	FREQUENCY SELECT
0	X	X	X	1004 TONE SELECT
X	1	X	X	SET DROP
X	X	1	X	BEGIN
X	X	X	1	READ ENABLE

CE - 10				INPUT BO LATCH
D3	D2	D1	D0	FUNCTION
X	X	X	0	NOISE TO GROUND IN
X	X	X	1	NOISE TO GROUND OUT
X	X	1	X	RCV SIGNAL IN
X	X	0	X	INT FIXED LEVEL
X	1	X	X	NOTCH OUT
X	0	X	X	NOTCH IN
1	X	X	X	25DB IN
0	X	X	X	25DB OUT

CE-2			VOLTAGE REF LATCH
D2	D1	D0	FUNCTION
0	0	0	IMPNL LOW THRESH
0	0	1	IMPNL MID THRESH
0	1	0	10 VOLT REFERENCE
0	1	1	QRMS DETECTOR
1	0	0	P/AR PEAK DETECTOR
1	0	1	AVG DETECTOR

CE-7			FILTER MUX LATCH
D2	D1	D0	FUNCTION
0	0	0	C MESSAGE FILTER
0	0	1	3KHZ FLAT FILTER
0	1	0	1SKHZ FLAT FILTER
0	1	1	PROGRAM FILTER
1	0	0	50 KBIT FILTER
1	0	1	P/AR
1	1	0	FLAT

CE1CL023

Figure FO-6. AN/USM-465 Assembly and Cable Locator, and Signal Flow Block Diagram (Sheet 2 of 2).

INDEX

INDEX (Continued)

INDEX (Continued)

INDEX (Continued)

INDEX (Continued)

INDEX (Continued)

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2-25	2-28		
3-10	3-3		3-1
5-6	5-8		
		F03	

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

Recommend that the installation antenna alignment procedure be changed throughout to specify a 2^{o} IFF antenna lag rather than 1^{o}.

REASON: Experience has shown that with only a 1^{o} lag, the antenna servo system is too sensitive to wind gusting in excess of 25 knots, and has a tendency to rapidly accelerate and decelerate as it hunts, causing strain to the drive train. Hunting is minimized by adjusting the lag to 2^{o} without degradation of operation.

Item 5, Function column. Change "2 db" to "3db."

REASON: The adjustment procedure for the TRANS POWER FAULT indicator calls for a 3 db (500 watts) adjustment to light the TRANS POWER FAULT indicator.

Add new step f.1 to read, "Replace cover plate removed in step e.1, above."

REASON: To replace the cover plate.

Zone C 3. On J1-2, change "+24 VDC to "+5 VDC."

REASON: This is the output line of the 5 VDC power supply. +24 VDC is the input voltage.

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