D E P A R T M E N T O F T H E A R M Y T E C H N I C A L B U L L E T I N

CALIBRATION PROCEDURE FOR TRANSMITTER DEPOT TEST SET LITCOM MODEL NO. 7400

Headquarters, Department of the Army, Washington, D.C.
23 February 1972

SECTION I

GENERAL

1. Purpose and Scope

a. This bulletin contains calibration instructions for Transmitter Depot Test Set, Litcom Model No. 7400 (transmitter depot test set), and is used by maintenance calibration personnel. Since maintenance calibration personnel are trained and qualified in the use of test and measuring equipment, detailed instructions concerning the operation and use of these equipments is not contained in this bulletin.

b. Integrated within this bulletin is an illustration which shows equipment setup required.

2. Reporting of Technical Bulletin Improvements

The reporting of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended changes to Publications) and forwarded direct to Commanding General, US Army Electronics Command, ATTN: AMSEL-MA-CFA, Fort Monmouth, N.J. 07703.

3. Description

The transmitter depot test set is a depot level maintenance equipment. It provides program matrices, switching functions, indicators, rf signal and operational voltages used for testing, aligning and repairing modules and printed circuit boards of subassemblies contained in Transmitting Set, Radio AN/FRT-76 and Transmitting Set, Radio AN/FRT-77. The transmitter depot test set consists of four major panels: namely; matrix/test indicator panel 1A1, power supply panel 1A2, rf oscillator panel 1A3, and connector panel 1A4. A utility drawer for cable storage is also provided. Additional data is listed in a, b, and c below.

a. Identification.

Nomenclature Transmitter Depot Test Set Litcom Model 7400.
Size .....25 3/4 by 21 1/2 by 69 3/8 in.
Weight .....435 lbs. (approx).
References.....TB 9-6625-961-50.

b. Specifications.

Input requirements ..... 103.5 to 126.5 volts, 54 to 66 Hz, single phase.
Oscillator frequencies ..... 1.75, 2.0, 8.0, 20, 30 MHz (Tolerance: 5 parts per 10^6). 80.875, 131.75, 141.75, 151.75, 153.75 MHz (Tolerance: 20 parts per 10^6).
Power supply output voltages ..... + 24, -24, + 18, and -18 ..... volts dc, ± 3 percent.
VHF, amplifier ..... 14 db gain at 130 to 190 MHz.
Frequency doubler ..... Input, 80 to 90 MHz. output, 160 to 180 MHz.
Multimeter ..... 0 to 1000 volts dc and ac, 0 to 50 microamperes, 0 to 500 milliamperes, 0 to 10 amperes and 0 to 20 megohms.

c. Program Data.

Calibration interval ..... In accordance with TB 750-236.
Time required for calibration .... 1 hour.
Calibration level ..... Depot maintenance.

4. General Instructions

a. Calibration Reporting. During the performance of the calibration procedures included in this manual, annotate DA Form 2416 (Calibration Data) in accordance with TM 38-750.

b. Removal. Do not remove any of the subassemblies to be calibrated from its protective case unless necessitated by equipment connections and/or components to be adjusted which cannot be reached from the external parts on the transmitter depot test set.

c. Unit Under Test. Transmitter depot test set will be referred to as "unit under test" throughout this procedure.

SECTION II
CALIBRATION

5. Equipment Required

Equipment required for calibration performance checks and adjustments is listed in table 1.

a. Authorized Calibration Equipment.

NOTE

Minimum use specifications are the principal parameters required for performance of the calibration and are included to assist in the selection of alternate equipment which may be used at the discretion of the calibrating activity. Satisfactory performance of alternate items shall be verified prior to use. All applicable equipment must bear evidence of current calibration.

Table 1A. Equipment Required

Item	Minimum use specification	Calibration equipment'	Military equivalent
Frequency counter ...	Frequency range, 1.7 to 154 MHz ..... Accuracy, ±1 percent.	Systron-Donner Model 1037.	AN/USM-257A
Vhf signal generator .	Frequency 130 MHz ..... Accuracy, ±0.5 percent.	Hewlett-Packard Model 608E.	AN/UIRM-52B
Sweep signal generator.	Swept frequency range, 0.5 to 460 MHz ..... Sweep width, 200 KHz to 200 MHz. Output voltage; sweep 1 volt peak to peak, cw 0.5 volt peak to peak. ..... Flatness, ±10 db.	Telonic Instruments Model SM-2000 with SH-1 plug-in sweep oscillator.	AN/USM-308(V) or one of the following: AN/USM-219 AN/USM-220 AN/USM-221
Oscilloscope	Frequency range, 0 to 50 MHz ..... Sensitivity, 0.005 volts per division to 20 volts per division Rise time, less than 7 nanoseconds. Sweep range, 0.1 microseconds per division to 2 seconds per division.	Hewlett-Packard 180 series with 1801F vertical amplifier and 1821F time base plug-in accessories.	OS-188/U

See footnote at end of table.

Table 1A. Equipment Required-Continued

Item	*Minimum use specification*	*Calibration equipment'*	*Military equivalent*
Detector	Input impedance, 50 ohms Frequency range, 0.5 to 300 MHz. VSWR, less than 1.2:1. Type of deflection, halfwave voltage doubler. Output polarity, positive.	Telonic XD-8A.	RF-235/U
Dc voltmeter	Ranges, 0-24 volts, dc Accuracy, ±2 percent.	John Fluke 803B	ME-202/U
Rf voltmeter	Range 0 to 400 millivolts Accuracy, ±3 percent.	Boonton Model 91CA	AN/URM-145

[1]The calibration equipment utilized in this procedure was selected from those known to be available at Department of Defense facilities, and the listing by make or model number carries no implication of preference, recommendation, or approval by the Department of Defense for use by other agencies. It is recognized that equivalent equipment produced by other manufacturers may be capable of equally satisfactory performance in the procedure.

Table 1B. Authorized Accessories

Nomenclature	Description
Rf cable assemblies W97, W98, W99, W100, W101, W102.1	BNC plug to BNC plug.
Adapter	N to BNC, Pomona 3288.
Adapter	Boonton 91-8B 50 ohm BNC.
Rf probe	Boonton 91-12F.
Circuit card assy extender	Litton Part No. 2001721-2.

[1]Rf cables and circuit card assy extender are provided as part of the unit under test and are stored in the utility drawer.

NOTE

It is recommended that personnel familiarize themselves with the entire procedure before performing calibration.

6. Preliminary Procedure

This section includes instructions to prepare the unit under test for the calibration procedures outlined in paragraphs 7, 8, 9, and 10. These preliminary operating procedures place the power supplies (1A2PS1 through PS4), rf oscillators (1A3A1 through 1A3A10), vhf amplifier 1A1AR2, and frequency doubler (1A1AR3) in the unit under test in a turned-on condition.

NOTE

Unless otherwise specified, verify the results of each step and take corrective action whenever the requirement is not met, before proceeding.

a. Operate unit under test oscillator panel (1A3) FREQUENCY IN MHZ switch to OFF.

b. Operate power supply panel 1A2 MAINS switch to ON. Observe that MAINS indicator illuminates and blower motor operates.

c. Operate -18, +18, -24, and +24 VDC switches to ON and observe that the corresponding indicators illuminate.

d. Operate electrical equipment cabinet service outlets circuit breaker to the on position. Observe that service outlets pilot light illuminates. External test equipment used during the calibration procedure can be connected to the service outlets for primary power.

e. Disregard settings of remaining controls and switches.

NOTE

The following paragraphs are divided into subparagraph a, performance check, and subparagraph b, adjustments. When the performance check is within tolerance do not perform the corresponding adjustment. When the performance check is not within tolerance, perform the corresponding adjustment before continuing with the calibration procedure. When the performance check is not within tolerance and the adjustment cannot bring it into tolerance, the deficiency must be corrected before continuing with the procedure.

7. Power Supplies 1A2PS1 Through 1A2PS4 Calibration

a. Performance Check.

(1) Connect dc voltmeter to unit under test power supply panel (1A2) test points as noted in table 2.

(2) Observe that dc voltmeter indicates within the limits specified in table 2.

b. Adjustments.

(1) Set the MAINS switch on the power supply panel to off position.

(2) Remove screws securing power supply panel 1A2 to cabinet frame.

(3) Pull out panel until it locks into open position.

(4) Set interlock safety switch (located at upper right-hand section of power supply drawer) to closed position by pulling out plunger until detent action causes plunger to remain in outward position.

(5) Set power supply panel MAINS switch to ON.

(6) Insure that power supply panel 1A2, + 18 VDC, -18 VDC, +24 VDC, and -24 VDC switches are set to ON.

(7) Locate voltage adjustments on power supplies 1A2PS1 through 1A2PS4.

(8) Connect dc voltmeter to test points on power supply panel (1A2) and adjust the corresponding voltage adjustment to obtain indications within the limits specified in table 2.

Table 2. Power Supply Output Voltages

Unit under test		Dc voltmeter indication (volts, dc)	
Power supply	Front panel	Minimum	Maximum
1A2PS1	GND and +18 VDC	+17	+19
1A2PS2	GND and -18 VDC	-17	-19
1A2PS3	GND and +24 VDC	+23	+25
1A2PS4	GND and -24 VDC	-23	-25

(9) Reinstall power supply panel (1A2) in cabinet frame and secure with holding screws.

8. Oscillators 1A3A1 Through 1A3A10 Calibration

a. Performance Check.

(1)Connect unit under test OUTPUT connector on the rf oscillator panel (1A3) to A INPUT of the frequency counter, using rf cable assembly W97.

(2) Insure that power supply panel (1A2) MAINS, +18 VDC switches and service outlets circuit breaker are set to ON.

(3) Set oscillator panel (1A3) FREQUENCY IN MHZ switch to positions noted in table 3.

(4) that frequency indications are within the limits specified in table 3.

(5) FREQUENCY IN MHZ switch to OFF.

(6) Remove rf cable assembly W97 from unit under test.

b. Adjustments.

(1) Remove screws securing oscillator panel (1A3) to cabinet frame.

(2) Pull out panel until it locks in open position.

(3) oscillator holddown cover plate to expose oscillator and adjustments.

Table 3. Rf Oscillator Panel (1IA3) Output Frequencies

Unit under test		Frequency counter indication (MHz)	
Oscillator	FREQUENCY IN MHz switch position	Minimum	Maximum
A1.....	1.750....	1,749,991.	1,750,009
A2.....	2.000....	1,999,990.	2,000,010
A3.....	8.000....	7,999,960.	8,000,040
A4.....	20.000..	19,999,900	20,000,100
A5.....	30.000..	30,000,850	30,000,150
A6.....	131.750..	131,747,365	131,752,635
A7.....	141.750..	141,746,456	141,752,835
A8.....	151.750..	151,746,965	151,753,035
A9.....	153.750..	153,746,925	153,753,075
A10.....	80.875..	80,873,382	80,876,618

(4) Rotate the frequency adjust of each oscillator to obtain indications within the limits specified in table 3. Use circuit card assembly extender (table 1B) for oscillator Al, if it is necessary to adjust its frequency.

(5) Reinstall oscillator holddown cover plate.

(6) Release slide latches and position rf oscillator panel into cabinet. Secure panel to cabinet frame with holding screws.

9. Frequency Doubler 1A1AR3 Calibration

a. Performance Check.

1) Connect N to BNC adapter to vhf signal generator RF OUTPUT.

(2) Connect RF OUTPUT connector of vhf signal generator to unit under test 2F INPUT connector of matrix/test indicator panel (1A1) using rf cable W97.

(3) Connect 2F OUTPUT connector of matrix/test indicator panel (1A1) to D INPUT connector of frequency counter using rf cable W98.

(4) Insure that power supply panel (1A2) MAINS and + 18 VDC switches are set to ON.

(5) Set vhf signal generator for 86 MHz at 100 millivolts operation.

(6) Observe that the frequency counter indicates between 171 and 173 MHz.

(7) Remove rf cables from unit under test.

b. Adjustments.

(1) Loosen captive screws screwing matrix/test indicator panel (1A1) to cabinet frame and open.

(2) Locate the frequency doubler adjustment cap (opposite 2F INPUT/OUTPUT) connectors on front panel) and remove.

(3) Adjust frequency doubler trim capacitor C5 until frequency counter indicates between 171 and 173 MHz.

(4) Replace frequency doubler adjustment cap. Do not secure matrix/test indicator panel (1A1) to cabinet frame until the procedures in paragraph 10 have been completed.

10. Vhf Amplifier 1A1AR2 Calibration.

a. Performance Check.

(1) Interconnect unit under test and calibration equipment as shown in figure 1, CONNECTION A.

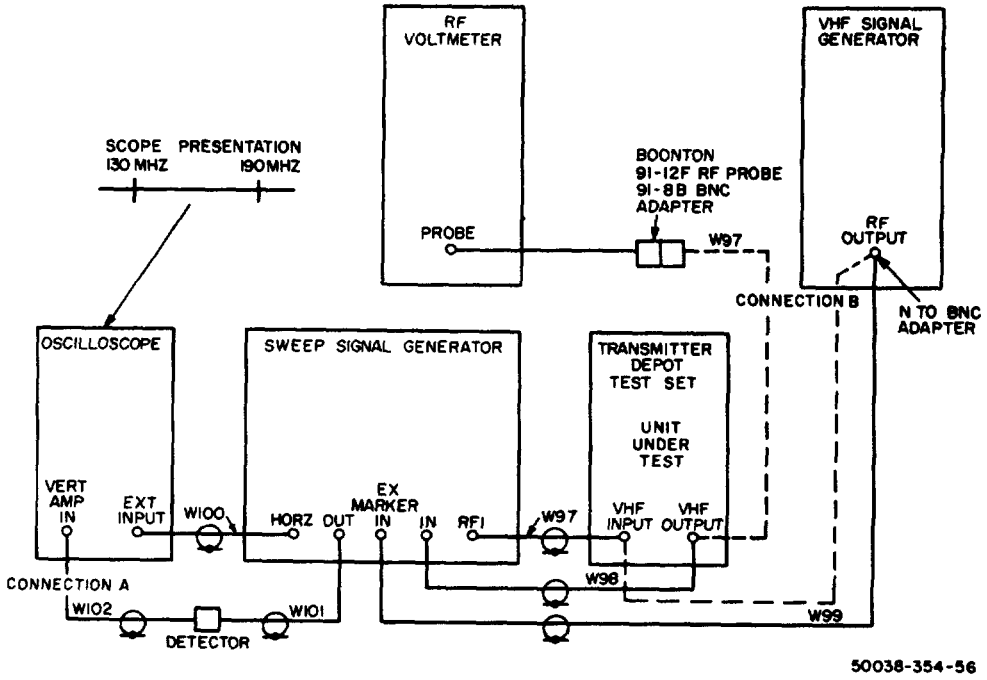

Figure 1. Vhf amplifier 1A1A2 calibration interconnection diagram.

(2) Insure that power supply panel (1A2) MAINS and + 18 VDC switches are set to ON.

(3) Set sweep generator controls and switches as follows:

(a) POWER switch to ON.
(b) MARKERS switches to OFF.
(c) SWEEP setting to 170.
(d) MARKER setting to 170.
(e) MARKER WIDTH (SIZE) to midposition.
(f) RF FUNCTION to SWEEP.
(g) SWEEP RATIO to left position.
(h) RF ATTENUATOR to 0.
(i) SWEEP WIDTH to maximum.
(i) SWEEP RATE to LINE.
(k) MONITOR to RF1.
(l) MONITOR LEVEL to midposition.

(4) Set oscilloscope controls and switches as follows:

(a) Power switch to ON.

(b) VOLT/DIV control initial setting .005; thereafter adjust as required.

(5) Set vhf signal generator for 130 MHz operation.

NOTE

Vary vhf generator rf output level and frequency output (from 130 to 190 MHz) as required to achieve proper oscilloscope presentation in step (6) below.

(6) Observe that oscilloscope trace is flat and symmetrical for sweep from 130 to 190 MHz as illustrated in figure 1.

(7) Remove rf cables from unit under test VHF INPUT/OUTPUT connectors.

(8) Connect vhf signal generator RF OUTPUT connector to unit under test VHF INPUT connector (fig. 1, CONNECTION B).

(9) Connect rf voltmeter to unit under test VHF OUTPUT connector.

(10) Set vhf signal generator for 130 MHz at 75 millivolt operation.

(11) Set rf voltmeter to 1000 millivolt scale.

12) (Increase vhf generator frequency in 10 MHz steps (each setting at 75 millivolts) from 130 MHz to 190 MHz.

(13) Observe that rf voltmeter indicates 400 millivolts minimum for each setting.

b. Adjustments.

(1) Operate unit under test power supply panel (1A2) MAINS switch to off position.

(2) Loosen captive screws securing test/ matrix indication panel (1Al) to cabinet frame and open.

(3) Remove vhf amplifier subassembly from panel by removing the two retaining screws.

(4) Locate adjustment cap on bottom of vhf amplifier subassembly and remove.

(5) Operate unit under test power supply panel (1A2) MAINS switch to ON.

(6) Adjust capacitor C13 to give flat symmetrical response as noted in a (6) above, with the required level noted in a (13) above.

(7) Operate power supply panel (1A2) MAINS switch to off position.

(8) Reinstall adjustment cap into vhf amplifier subassembly.

(9) Reinstall vhf amplifier subassembly on panel.

(10) Remove all rf cables from unit under test.

(11) Secure matrix/test indicator panel (1A1) to cabinet frame with captive screws.

11. Multimeter Calibration

The multimeter is to be calibrated according to procedures contained in TB 9-6625-961-50.

12. Final Procedure

a. Deenergize and disconnect all equipment.

b. In accordance with TM 38-750, annotate and affix calibration DA label 80 (US Army Calibration System). When the unit under test cannot be adjusted to within tolerance, annotate and affix DA Form 2417 (Unserviceable or Limited Use).

By the Order of the Secretary of the Army:

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The Adjutant General.

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The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .035 ounce
1 decagram = 10 grams = .35 ounce
1 hectogram = 10 decagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*	*To change*	*To*	*Multiply by*
inches	centimeters	2.540	ounce-inches	Newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29,573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	Newton-meters	1.356	metric tons	short tons	1.102
pound-inches	Newton-meters	.11296			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

PIN: 012898-000