DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR SYNTHESIZER DEPOT TEST SET LITCOM MODEL NO. 7900

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 Synthesizer Depot Test Set, Litcom Model No. 7900 (synthesizer 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 are 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 Synthesizer Depot Test Set, Litcom No. 7900 is a depot maintenance test unit used to test, troubleshoot, and maintain the modules and printed circuit boards contained in the Synthesizer, Electrical Frequency 0-1488/FR, which is a component part of Receiving Set, Radio AN/FRR79; Transmitting Set, Radio AN/FAT-76; and Transmitting Set, Radio AN/FAT-77. The synthesizer depot test set contains the necessary switching and patching functions to interconnect the appropriate test circuits that provide simulated test signals, dc operating voltages, and monitoring facilities to the input and output pins of the module or printed circuit board under test. The synthesizer depot test set provides the operator with the capability of fault isolation to a particular printed circuit board of a module or to a particular circuit or component on a printed circuit board. The synthesizer depot test set is a self-contained unit consisting of three major components all housed in an electrical equipment cabinet. The major components constituting the synthesizer depot test set are matrix oscillator 1A1, synthesizer matrix test panel 1A2, and power supply 1A3. A utility drawer for cable storage is also provided. Additional data is listed in a, b, and c below.

a. Identification.

Nomenclature..... Synthesizer Depot Test Set Litcom Model 7900.
Size . ..... 493/8 by 21 1/2 by 25 3/4 in.
Weight ..... 366 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... 1.0, 1.4, 1.5, 1.6, 1.7, 1.75, 1.8, 1.9, 2.0, 2.1, 2.2, 2.3, 2.9, 4.75, 13.0, 14.0, 15.0, 16.0, 17.0, 18.0, 19.0, 20.0, 21.0, 22.0, 23.0,26.75,27.25,27.75, 29.05, 30.0 MHz (Tol erance: 5 parts per 10-;) 34.0, 80.875, 86.0, 86.625, 87.125, 87.375, 92.5, 138.0, 144.25, 147.0, 148.75, 151.75, and 156.75 MHz (Tol erance: 20 parts per 10").
VHF amplifier..... 14 db gain at 130 to 190 MHz.
Multimeter..... 0 to 1000 volts dc and ac, 0-500 milliamperes, 0 to 10 amperes and 0 to 20 megohms.
Frequency doubler ..... input 80.0 to 92.5 MHz. output 160 to 185 MHz.
Power supply output voltages..... +18,-9 volts do, ±3 percent

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 Card) 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 synthesizer depot test set.

c. Unit Under Test. Synthesizer depot test 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.

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 to 157 MHz..... Accuracy, ±1 percent.	Systron-Donner model 1037.	AN/USM-257A
Vhf signal generator.....	Frequency range, 130 MHz..... Accuracy, ±0.5 percent.	Hewlett-Packard model 608E.	AN/URM-52B
Rf voltmeter.....	Voltage range, 0 to 400 microvolts..... Accuracy, ± 3 percent.	Boonton PICA.....	AN/URM-145
Sweep signal generator	Swept frequency range, 0.5 to 460 MHz..... Sweep width, 200 kHz to 200 MHz Output voltage; sweep I volt peak to peak, cw 0.5 volt peak to peak. Flatness, ±1.0 db.	Telonic Instruments. Model SM-2000 with SH-1 plug-in sweep oscillator.	AN/USM-308 (V) or any one of the following: AN/USht-219, AN/USM-220, AN/USM-221.
Oscilloscope.....	Frequency range, 0 to 50 MHz..... Sensitivity, 0.005 volt 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 1801 F vertical amplifier and 1821F time base plt-g-in accessories.	OS- 1 88/U
Detector.....	Input impedance, 50 ohms..... Frequency range, 0.5 to 300 MHz. VSWR, less than 1.2: 1. Type of deflection, half-wave voltage doubler. Output polarity, positive.	Telonic XD-8A.....	RF-235/U
Dc voltmeter	0-24 volts, dc..... Accuracy, + 3 percent.	John Fluke 803B	ME-202/U

[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
Adapter.....	BNC to T. Pomona 3288.
Adapter.....	BNC to T. Pomona 3285.
RF Cable Assembly W118[1], W119, W120, W121, W122, W123.	BNC plug to BNC plug.
Extender Circuit Card.....	Printed circuit card, Litcom part No. 2001721 - 1.

[1]Cables are provided as part of the unit finder test and are stored in the utility drawer. Assure that these cables are returned to the utility drawer after use.

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 (1A3PSI through (A3PS2), RF oscillators (1A1A1 through 1A1A43), vhf amplifier 1A2AR2 and frequency doubler (1A2AR3) 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 power supply panel (1A3) MAINS switch to ON. Observe that MAINS indicator illuminates and blower motor operates. Also observe that-9 VDC and 18 VDC indicators illuminate.

b. Operate RF oscillator (lA1) FREQUENCY IN MHz 1, 2, 3, and 4 switches to OFF.

c. Disregard settings of. remaining controls and switches on unit under test.

d. Operate service strip power switch to on position. Observe that service strip power indicator light illuminates. External test equipment used during the calibration procedure can be connected to the service outlets for primary power.

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 1A3PS1 and 1A3PS2 Calibration

a. Performance Check.

(1) Connect dc voltmeter to test points on power supply panel (1A3) as noted in table 2.

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

Table 2. Power Supply Output Voltages

Unit under test		Dc voltmeter indication	
Power supply	Front panel test points	Minimum	Maximum
1A3PS1	GND and 18	+17	+19
A3PS2	GND and - 9	-8	-10

b. Adjustments.

(1) Remove screws securing power supply panel (IA3) to cabinet frame.

(2) Pull out panel until it docks into open position.

(3) Remove popover supply panel (1A3) cover screen.

(4) Locate voltage adjust potentiometers on power supplies 1A3PS1 and 1A3PS2.

(5) Rotate the voltage adjust associated with each power supply to obtain indications with the limits specified in table 2.

(6) Disconnect dc voltmeter from power supply panel 1A3 test points.

(7) Replace cover screen on power subassembly!'

(8) Secure power supply panel (1A3) to cabinet frame with holding screws.

8. Oscillators 1A1A1 Through 1A1A43 Calibration

a. Performance Check.

(1) Connect unit under test oscillator panel (1A1) OUTPUT 1 connector to A INPUT of the frequency counter using RF cable assembly W118.

(2) Insure that MAINS switch is set to ON and that service strip power switch is set to on position.

(3) Set oscillator panel (1A1) FREQUENCY IN MHz 1 switch to positions noted in table 3.

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

(5) Return FREQUENCY IN MHz 1 switch to OFF.

(6) Remove RF cable assembly W118 from OUTPUT 1 connector and connect it to OUTPUT 2 connector.

(7) Set FREQUENCY IN MHz 2 switch to positions noted in table 4.

Table 3. Oscillator Panel 1A1 OUTPUT 1 Frequencies

Unit under test		Frequency counter indication (Hz)	
Oscillator	FREQUENCY IN MHz 1 switch position	Minimum	Maximum
A22	2.300	22,999,885	23,000,115
A23	26.750	26,749,866	26,750,134
A24	27.250	27,249,864	27,250,136
A25	27.750	27,749,861	27,750,139
A26	147.000	146,997,060	147,002,940
A27	151.750	151,746,965	151,753,035
A28	80.875	80,873,382	80,876,618
A29	86.000	85,998,280	86,001,720
A30	86.625	86,623,267	86,626,733
A31	87.125	87,123,257	87,126,743
A32	87.375	87,373,252	87,376,748

(8) Observe that frequency counter indications are within the limits specified in table 4.

(9) Return FREQUENCY IN MHZ 2 switch to OFF.

(10) Remove RF cable assembly W118 from OUTPUT 2 connector and connect it to OUTPUT 3 connector.

(11) Set FREQUENCY IN MHZ 3 switch to positions noted in table 5.

(12) Observe that frequency counter indications are within the limits specified in table 5.

(13) Return FREQUENCY IN MHZ 3 switch to OFF.

(14) Remove RF cable assembly W118 from OUTPUT 3 connector and connect it to OUTPUT 4 connector.

(15) Set FREQUENCY IN MHZ 4 switch to positions noted in table 6.

(16) Observe that frequency counter indications are lecithin the limits specified in table 6.

(17) Return FREQUENCY IN MHZ switch to OFF.

(18) Remove RF cable assembly W118 from **OUTPUT** 4 connector on oscillator (lA1) panel.

Table 4. Oscillator Panel 1A1 OUTPUT 2 Frequencies

Unit under test		Frequency counter indication (Hz)	
Oscillator	FREQUENCY IN MHZ 2 switch position	Minimum	Maximum
A1	1.000	999,995	1,000,005
A2	1.400	1,399,993	1,400,007
A3	1.500	1,499,992	1,500,008
A4	1.600	1,599,992	1,600,008
AS	1.700	1,699,991	1,700,009
A6	1.800	1,799,991	1,800,009
A7	1.900	1,899,990	1,900,010
AS	2.100	27099,989	2,100,011
A9	2.200	2,199,989	2,200,011
A10	148.750	148,747,025	148,752,975
A33	92.50	92,498,150	92,501,850

Table 5. Oscillator Panel 1A1 OUTPUT 3 Frequencies

Unit under test		Frequency counter indication (Hz)	
Oscillator	FREQUENCY IN MHZ 3 switch position	Minimum	Maximum
A11	1.750	1,749,991	1,750,009
A12	2.900	2,999,985	2,900,015
A13	13.000	12,999,935	13,000,035
A14	14.000	13,999,930	14,000,070
A15	16.000	15,999,820	16,000,080
A16	22.000	21,999,890	22,000,110
A17	23.000	22,999,885	23,000,115
A18	29.050	29,049,855	29,050,145
A19	30.000	29,999,850	30,000,150
A20	34.000	33,999,320	34,000,680
A21	138.000	137,997,240	138,002,760

Table 6. Oscillator Panel 1A1 OUTPUT 4 Frequencies

Unit under test		Frequency counter indication (Hz)	
Oscillator	FREQUENCY IN MHZ 4 switch position	Minimum	Maximum
A34	2.000	1,999,990	2,000,010
A35	4.750	4,749,976	4,750,024
A36	15.000	14,999,925	15,000,075
A37	17.000	16,999,915	17,000,085
A38	18.000	17,999,910	18,000,090
A39	19.000	18,999,905	19,000,095
A40	20.000	19,999,900	20,000,100
A41	21.000	20,999,895	21,000,105
A42	144.250	144,247,115	144,252,885
A43	156.750	156,746,856	156,753,135

b. Adjustments

(1) Remove holding screws securing oscillator panel (1A1) to unit under test cabinet f came.

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

(3) Release the two slide latches on oscillator (1A1) panel and tilt panel to vertical position.

(4) Remove oscillator holddown cover plate to expose oscillators and adjustments.

(5) Rotate the frequency adjustment of each oscillator to obtain indications within the limits specified in tables 3, 4, 5, and 6.

NOTE

To permit access to the frequency calibration adjustment of oscillators A1 through A11 use extender card assembly (table 1B).

(6) Reinstall oscillator holddown cover plate.

(7) Release slide latches and position oscillator (1A1) panel into cabinet. Secure panel to cabinet frame with holding screws.

9. Frequency Doubler 1A2AR3 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 panel (1A2) using RF cable W118.

(3) Connect 2F OUTPUT terminal of matrix test panel (1A2) to D INPUT connector terminal of frequency counter using RF cable W119.

(4) Insure that power supply panel (1A3) MAINS switch is set to ON.

(5) Set vhf signal generator for an output of 86 MHz at a level of 100 millivolts.

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

(7) Remove cables from unit under test.

b. Adjustments.

(1) Loosen captive screws securing matrix/ test indicator panel (1A2) 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 panel (1A2) to cabinet frame until the procedures in paragraph 10 have been completed.

10. Vhf Amplifier 1A2AR2 Calibration

a. Performance Check.

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

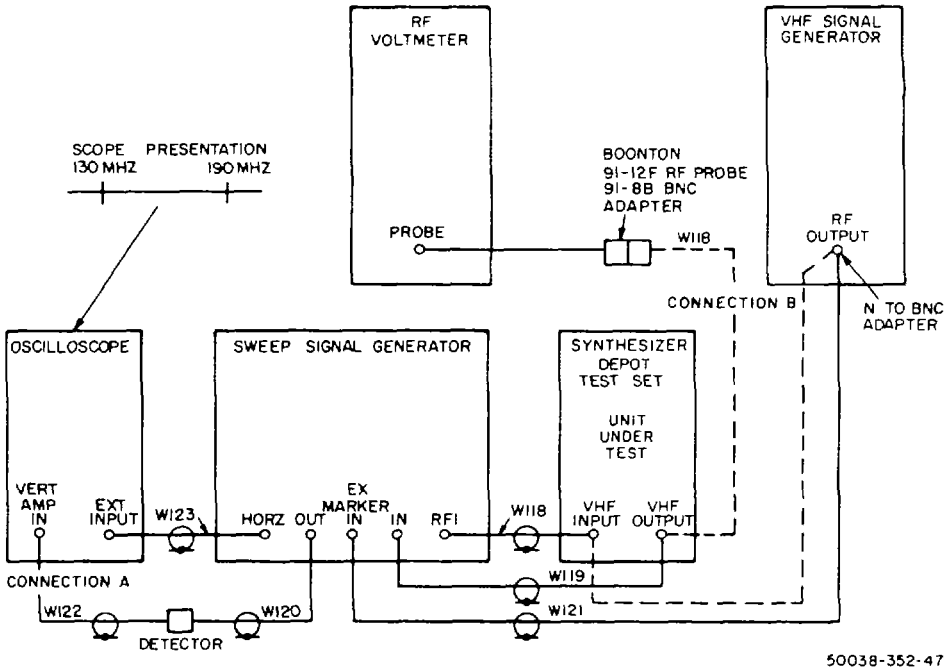

Figure 1. Vhf amplifier 1A2AR2 calibration interconnection diagram.

(2) Insure that power supply panel (1A3) MAINS switch is 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 10MHz 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 (1A3) MAINS switch to off position.

(2) Loosen captive screws securing test matrix panel (1A2) 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 (1A3) MAINS switch to ON.

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

NOTE

If capacitor C13 is readjusted In step b (6) above, repeat steps a (3) to (13)

(7) Operate power supply panel (1A3) 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 panel (1A2) 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. Deeneigize and disconnect all equipment

b. In accordance ,with TM 38-750, annotate and affix calibrated DA Label 80 (U S Army Calibration System). When the unit under test cannot be adjusted to within tolerance, annotate and affix DA Form 2417 (Unserviceable Test Instrument or Limited Use Tag)

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