*TB 9-6625-2000-24

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR SIGNAL GENERATOR AN/URM-206 AND POLARAD, MODEL 1608E-Y

Headquarters, Department of the Army, Washington, DC
29 September 2008

REPORTING OF ERRORS AND RECOMMENDING IMPROVEMENTS

You can improve this manual. If you find any mistakes or if you know of a way to improve these procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) directly to: Commander, U.S. Army Aviation and Missile Command, ATTN: AMSAM-MMC-MA-NP, Redstone Arsenal, AL 35898-5000. A reply will be furnished to you. You may also send in your comments electronically to our E-mail address: 2028@redstone.army.mil or by fax 256-842-6546/DSN 788-6546. For the World Wide Web use: https://amcom2028.redstone.army.mil. Instructions for sending an electronic 2028 can be found at the back of this manual.

*This bulletin supersedes TB 9-6625-2000-35, dated 21 June 2007.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Signal Generator AN/URM-206 and Polarad Model 1608E-Y. The manufacturer's manual and TM 11-6625-2948-14&P were used as the prime data sources in compiling these instructions. The equipment being calibrated will be referred to as the TI (test instrument) throughout this bulletin.

a. Model Variations. AN/URM-206 and Polarad Model 1608E-Y consists of Signal Generator SG-1145/URM, Polarad Model 1108E-Y and Modulator MD-1075/URM, Polarad Model 1020A-Y.

b. Time and Technique. The time required for this calibration is approximately 3 hours, using the Microwave technique.

2. Forms, Records, and Reports

a. Forms, records, and reports required for calibration personnel at all levels are prescribed by TB 750-25.

b. Adjustments to be reported are designated (R) at the end of the sentence in which they appear. When adjustments are in tables, the (R) follows the designated adjustment. Report only those adjustments made and designated with (R).

3. Calibration Description. TI parameters and performance specifications which pertain to this calibration are listed in table 1.

Table 1. Calibration Description

Test instrument parameters	Performance specifications
Frequency	Range: 7.0 to 11.0 GHz Accuracy: ± 1% of readout
Power output and attenuation	Range: 0 to -127 dBm[1] Accuracy: 0 to -7 dBm ±3 dB -7 to -127 dBm[1] ±2 dB
Internal square wave modulation[2]	Range: 950 to 1050 Hz continuously variable
Internal pulse modulation	Pulse Rate: 40 to 4000 pps continuously variable Pulse Width: 0.5 to 10 μs continuously variable Rise and Fall: < 0.2 μs
Delayed output	Range: 0.3 to 2000 μs continuously variable

[1] Only calibrated to -110 dBm.
[2] SG1145/URM-1108E-Y only.

SECTION II
EQUIPMENT REQUIREMENTS

4. Equipment Required. Table 2 identifies the specific equipment to be used in this calibration procedure. This equipment is issued with Secondary Transfer Calibration Standards Sets, AN/GSM-286, AN/GSM-287 or AN/GSM-705. Alternate items may be used by the calibrating activity. The items selected must be verified to perform satisfactorily prior to use and must bear evidence of current calibration. The equipment must meet or exceed the minimum use specifications listed in table 2. The accuracies listed in table 2 provide a four-to-

one ratio between the standard and TI. Where the four-to-one ratio cannot be met, the actual accuracy of the equipment selected is shown in parenthesis.

5. Accessories Required. The accessories required for this calibration are common usage accessories, issued as indicated in paragraph **4** above and are not listed in the calibration procedure. The following peculiar accessory is also required for this calibration: SEMICONDUCTOR DEVICE (Coaxial Crystal Detector) Hewlett-Packard, Model 423AOPT03 (423AOPT03).

Table 2. Minimum Specifications of Equipment Required

Common name	Minimum use specifications	Manufacturer and model (part number)
ATTENUATOR	Range: DC to 18 GHz Accuracy: ± 0.5dB	Weinschel, Model 9918-10dB (9918)
AUTOTRANSFORMER	Range: 105 to 125 V ac Accuracy: ±1%	Ridge, Model 9020A (9020A) W10MT3AS3
FREQUENCY COUNTER	Range: 6.5 to 11.5 GHz Accuracy: ± 0.125%	Fluke, Model PM6681/656 (PM6681/656)
MEASURING RECEIVER	Frequency measurement: Range: 10 MHz to 26.5 GHz Accuracy: ±0.5% Power measurement: Frequency: 250 kHz to 26.5 MHz Range: +10 dB to -113 dB Accuracy: ±0.125 dB	Measuring receiver system N5530S consisting of: Spectrum Analyzer Agilent, Model E4440A (E4440A), Power meter Agilent, Model E4419B (E4419B), and Sensor module, Agilent Model N5532A opt. 518 (518)
MULTIMETER	Range: -1850 to +10 V dc Accuracy: ±0.5%	Fluke, Model 8840A/AF05 (AN/GSM-64D)
OSCILLOSCOPE	Range: 0 to 15 V pk 800 to 1200 Hz Accuracy: ±3%	(OS303/G)

SECTION III
CALIBRATION PROCESS

6. Preliminary Instructions

a. The instructions outlined in this section are preparatory to the calibration process. Personnel should become familiar with the entire bulletin before beginning the calibration.

b. Items of equipment used in this procedure are referenced within the text by common name as listed in table 2.

c. Unless otherwise specified, verify the result of each test and, whenever the test requirement is not met, take corrective action before continuing with the calibration. Adjustments required to calibrate the TI are included in this procedure. Additional maintenance information is contained in the manufacturer's manual for this TI and TM 11-6625-2948-14&P.

d. When indications specified in paragraphs **8** through **13** are not within tolerance, perform the power supply check prior to making adjustments. After adjustments are made, repeat paragraphs **8** through **13**. Do not perform power supply check if all other parameters are within tolerance.

e. Unless otherwise specified, all controls and control settings refer to the TI.

7. Equipment Setup

WARNING

HIGH VOLTAGE is used or exposed during the performance of this calibration. DEATH ON CONTACT may result if personnel fail to observe safety precautions. REDUCE OUTPUT(S) to the minimum after each step within the performance check where applicable.

a. Position TI controls as listed in (1) through (3) below:

(1) **VOLT SET** switch (rear panel) to appropriate position (115 V ac).

(2) **FREQ SET** switch (rear panel) to **50/60**.

(3) **SELECTOR** switch (rear panel) to **115 V** ac.

b. Connect power cord from modulator **AC OUTPUT** (rear panel) to signal generator **AC INPUT** (rear panel), using power cord supplied with TI.

c. Connect modulator **AC INPUT** to autotransformer.

d. Connect autotransformer to 115 V ac source and adjust for 115 V ac output.

e. Set both power switches to **ON** and allow approximately 30 minutes for equipment to warm-up and stabilize.

NOTE

Remove protective cover only when necessary to perform required adjustments.

8. Frequency Accuracy and Stability

a. Performance Check

(1) Connect frequency counter to TI **RF OUTPUT** connector.

(2) Adjust **FREQUENCY GHz** control to **7.00 GHz**.

(3) Set **MODULATION SELECTOR** switch to **CW**.

(4) Set a **ΔF** control to central “0” position.

(5) Adjust **POWER SET** control for **CAL** on the power monitor meter.

(6) Adjust **ATTENUATOR** control for a 0 dBm indication on **–DBM/MICROVOLTS** dial.

NOTE

Maintain this indication throughout remainder of this performance check.

(5) If frequency counter does not indicate within limits listed in first row of table 4, perform **b** below. Record indication.

(8) Adjust **FREQUENCY GHz** control to indications listed in table 3. If frequency counter indications are not within limits specified, perform **b** below.

Table 3. Frequency Accuracy

TI **FREQUENCY GHz** dial settings	Frequency counter indications (GHz)	
	Min	Max
7.00	6.93	7.07
7.50	7.425	7.575
8.00	7.920	8.080
8.50	8.415	8.585
9.00	8.910	9.090
9.50	9.405	9.595
10.00	9.900	10.100
10.50	10.395	10.605
11.00	10.890	11.110

b. Adjustments

(1) Adjust **FREQUENCY GHz** control to position the CAM FOLLOWER at fixed point on tuning cam (fig. 1). Readjust **FREQUENCY GHz** dial to nearest cardinal point (approximately 9 GHz).

(2) If frequency counter indication is not within ± 1 percent of **FREQUENCY GHz** dial indication, loosen CAM FOLLOWER SET SCREW (fig. 1) and adjust pushrod yoke in or out as needed until frequency counter indication is the same as **FREQUENCY GHz** dial setting (R).

(3) Tighten CAM FOLLOWER SET SCREW and observe that frequency counter indication remains within ± 1 percent of **FREQUENCY GHz** dial setting.

(4) Loosen four hex nuts on underside of TUNING CAM for ADJUSTMENTS 4, 5, and 6 (fig. 1).

(5) Adjust **FREQUENCY GHz** control to position the eccentric ADJUSTMENT 4 (fig. 1) opposite the CAM FOLLOWER. Note **FREQUENCY GHz** dial indication; readjust **FREQUENCY GHz** dial to nearest cardinal point. Adjust hex nut 4 until frequency counter indication is same as test instrument **FREQUENCY GHz** dial indication. Hold hex nut 4 with a wrench and tighten nut on underside of tuning cam with another wrench while observing that frequency counter indication remains within ± 1 percent of **FREQUENCY GHz** dial setting (R).

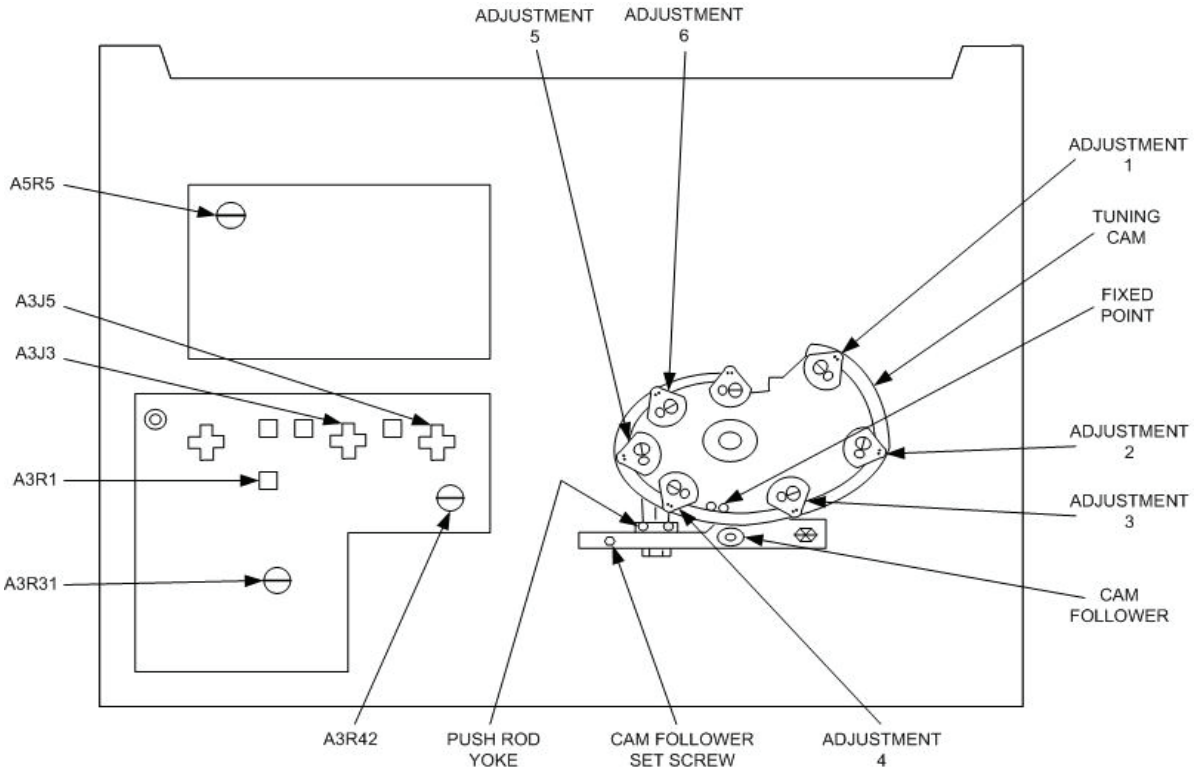

Figure 1. Signal generator - top view.

CAUTION

Make adjustments carefully to avoid distorting tuning cam.

(6) Repeat (5) above for cam ADJUSTMENT 5 and 6 (fig. 1).

(7) Loosen three nuts on underside of cam for ADJUSTMENTS 3, 2, and 1 (fig.1).

(8) Adjust **FREQUENCY GHz** control to position eccentric ADJUSTMENT 3 (fig. 1) opposite the CAM FOLLOWER. Note **FREQUENCY GHz** dial indication; readjust **FREQUENCY GHz** dial to nearest cardinal point. Adjust hex nut 3 until frequency counter is same as **FREQUENCY GHz** dial indication. Hold nut 3 with a wrench and tighten nut on underside of tuning cam with another wrench while observing that frequency counter indication remains within ± 1 percent of **FREQUENCY GHz** dial setting (R).

(9) Repeat (8) above for cam ADJUSTMENTS 1 and 2 (fig. 1).

(10) Repeat **a** (1) through (9) above.

9. Power Output and Level Accuracy

a. Performance Check

NOTE

Verify the proper Cal Factors are loaded into the controller for the power sensor module being utilized and perform sensor zero and calibration.

(1) Connect measuring receiver to TI **RF OUTPUT** connector.

(2) Adjust **FREQUENCY GHz** control to **7.0 GHz**.

(3) Adjust the **ΔF** control to 0.

(4) Adjust **POWER SET** control until **POWER SET** meter pointer is on **CAL** mark.

(5) Set **ATTENUATOR** control for 0 dBm indication on **–DBM/MICROVOLTS** dial.

(6) Set the **MODULATION SELECTOR** switch to **RF OFF**.

(7) Set the **MODULATION SELECTOR** switch to **CW**.

(8) Configure measuring receiver for tuned RF level measurements in the ratio mode and manually enter carrier frequency into measuring receiver.

(9) If measuring receiver does not indicate within limits listed in the first row of table 4, perform **b** below.

(10) Adjust **ATTENUATOR** control for **–DBM/MICROVOLTS** dial indications listed in table 4.

(11) Repeat (2) through (10) above for **FREQUENCY GHz** control set to 11.0 GHz.

Table 4. Attenuation Accuracy

ATTENUATOR dial indications	Measuring receiver indications	
	Min	Max
0	-3	+3
-10	-8	-12
-20	-18	-22
-30	-28	-32
-40	-38	-42
-50	-48	-52
-60	-58	-62
-70	-68	-72
-80	-78	-82
-90	-88	-92
-100	-98	-102
-110	-108	-112

b. Adjustments

(1) Configure measuring receiver to measure power in the linear mode.

(2) Adjust **ATTENUATOR** and **POWER SET** controls for 1-mW indication on measuring receiver with 0-dBm indication on **–DBM/MICROVOLTS** dial.

(3) Adjust A3R31 (fig. 1) until TI power monitor meter indicates **CAL** (R).

10. Internal Square Wave

a. Performance Check

(1) Connect TI **RF OUTPUT** to crystal detector input then connect crystal detector output to oscilloscope channel 1.

(2) Set **FREQUENCY GHz** to **7.0 GHz**.

(3) Press **MODULATION SELECTOR** switch to **CW** and Δ **F** control to 0. Adjust the **POWER SET** control for an indication of **CAL** on the power monitor meter.

(4) Adjust **ATTENUATOR** control for a reading of **0 dBm** on the attenuator dial.

(5) Configure oscilloscope for a square wave display.

(6) Rotate **INT SQ WAVE** control throughout its range. Waveform as displayed on oscilloscope will be a symmetrical square wave and variable from 950 to 1050 Hz, or greater.

b. Adjustments.

No adjustments can be made.

11. Repetition Rate (Model 1020A-Y Modulator)

a. Performance Check

(1) Connect frequency counter to TI **OUT**.

CAUTION
Output from TI may be 40 V.

(2) Position TI controls as listed in (a) through (c) below:

(a) **FUNCTION** switch to **EXT**  **/INT**  .

(b) **RATE** control fully cw and **X1-X10-X1000** switch to **X100**.

(c) **SELECTOR** switch to **INT**.

(3) Adjust frequency counter to indicate frequency. If frequency counter does not indicate 10 kHz or more, perform **b** (1) below.

(4) Turn **RATE** control fully ccw. If frequency counter does not indicate 1000 Hz or less, perform **b** (2) below.

(5) Set **RATE X1-X10-X100** control to **X10**. If frequency counter does not indicate 100 Hz or less, perform **b** (2) below.

(6) Set **RATE X1-X10-X100** control to **X1**. If frequency counter does not indicate 10 Hz or less, perform **b** (2) below.

b. Adjustments

(1) Adjust R6 (fig. 2) until frequency counter indicates 10 kHz (R).

(2) If required, readjust R6 for best in-tolerance condition while performing **a** (2) through (6) above.

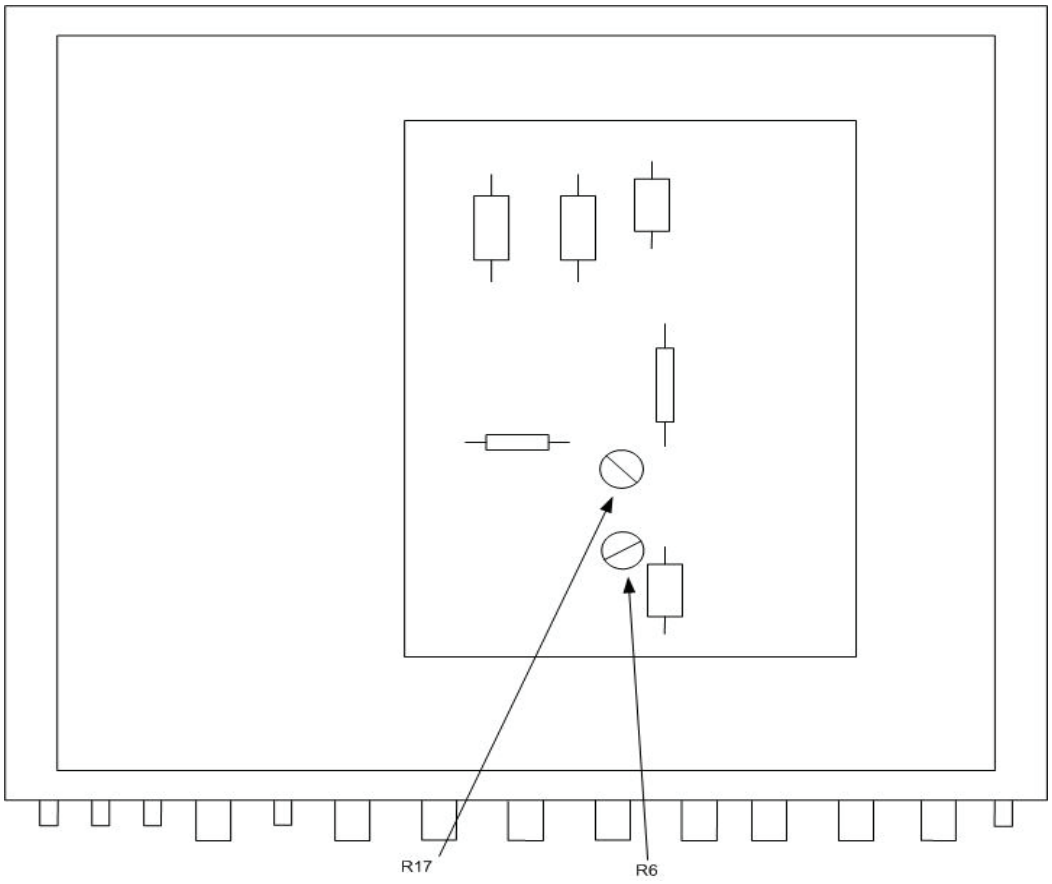

Figure 2. Model 1020A-Y - adjustment locations (top view).

12. Waveforms

a. Performance Check

(1) Connect oscilloscope to TI ⎍ ⎓ **OUT**.

(2) Set **RATE** control fully cw, and **X1-X10-X100** switch to **X100**. Oscilloscope will indicate a square wave.

(3) Set **FUNCTION** switch to **INT** ⎍ and **PULSE WIDTH** control fully ccw and **X1-X10-X200-X1000** switch to **X1**. Oscilloscope will indicate a pulse width (pip) less than 0.2 μs.

(4) Set **PULSE WIDTH** control fully cw. Oscilloscope will indicate a pulse width 2 μs or more.

(5) Set **PULSE WIDTH X1-X10-X200-X1000** switch to **X10**. Oscilloscope will indicate a pulse width 20 μs or more.

(6) Set **PULSE WIDTH X1-X10-X200-X1000** switch to **X200** and **RATE X1-X10-X100** switch to **X1**. Oscilloscope will indicate a pulse width 400 μs or more.

(7) Set **PULSE WIDTH X1-X10-X200-X1000** switch to **X1000**. Oscilloscope will indicate a pulse width 2,000 μs or more.

(8) Disconnect cable from TI ⎍ ⎓ **OUT** and connect to **FM OUT**.

(9) Turn **FM DEV AMPLITUDE** control fully cw and **FUNCTION** switch to **FM**. If oscilloscope does not indicate a symmetrical saw tooth wave (no flat bottom), perform **b** below.

b. Adjustments. Adjust R17 (fig. 2) for a saw tooth wave with no flat bottom (R).

13. Delayed and Undelayed

a. Performance Check

(1) Connect **UNDELAYED** output to oscilloscope CH 1 input and **DELAYED** output to CH 2 input of oscilloscope.

(2) Set **FUNCTION** switch to **INT** ⎍.

(3) Set **SYNC DELAY** control fully ccw and **LOW-X1-X10-X100** switch to **LOW**.

(4) Adjust oscilloscope to display both pulses. Delayed pulse will be delayed 0.2 μs or less from undelayed pulse.

(5) Set **SYNC DELAY** control fully cw. Oscilloscope will indicate delayed pulse 2 μs or more from undelayed pulse.

(6) Set **SYNC DELAY** control fully ccw and **LOW-X1-X10-X100** switch to **X1**. Oscilloscope will show delayed pulse 2 μs or less.

(7) Set **SYNC DELAY LOW-X1-X10-X100** switch to **X10**. Oscilloscope will indicate delayed pulse 20 μs or less.

(8) Set **SYNC DELAY LOW-X1-X10-X100** switch to **X100**. Oscilloscope will indicate delayed pulse 200 μs or less.

(9) Disconnect cable from **DELAYED** output and connect to ⎍ ⊓ **OUT** connector. Oscilloscope will indicate delayed pulse 200 μs or less.

b. Adjustments. No adjustments can be made.

14. Power Supply

a. Performance Check

NOTE

Do not perform power supply check if all other parameters are within tolerance.

(1) Connect multimeter between pin 4 and pin 2 (common) of connector 1A4TPI (fig. 3). If multimeter does not indicate between 2.07 and 2.53 V dc, perform **b** (1) below.

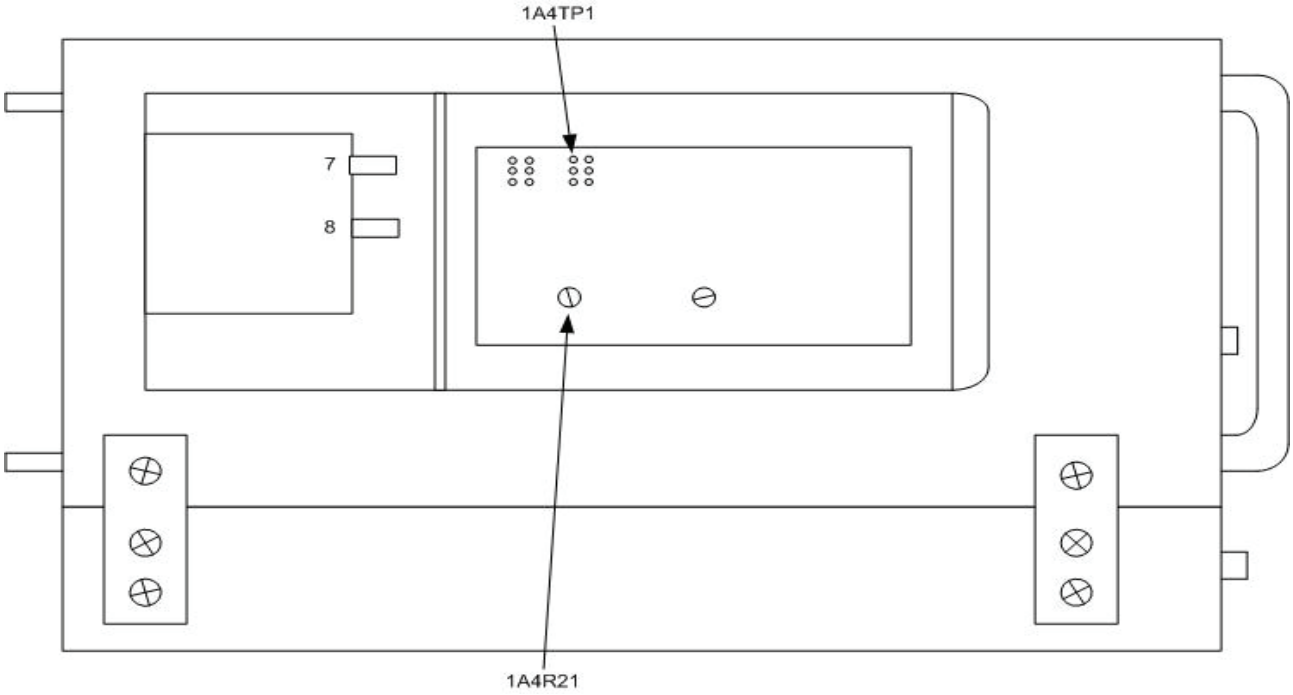

Figure 3. Signal generator - left view.

(2) Connect multimeter between chassis ground and pin 2 of A3J3 (fig. 1), using high-voltage probe. If multimeter does not indicate between -1237.5 and -1262.5 V dc, perform **b** (2) below.

(3) Press **CW** pushbutton and turn **ΔF** control fully cw.

(4) Connect multimeter between chassis ground and pin 3 of connector A3J5 (fig. 1), using high-voltage probe. If multimeter does not indicate between -1831.5 and -1868.5, perform **b** (3) below.

(5) Set **ΔF** control to 0 position.

(6) Connect multimeter between pin 2 and pin 3 (common) of A3J3 (fig. 1). If multimeter does not indicate between 6.237 and 6.363, perform **b** (4) below.

b. Adjustments

(1) Adjust A5R5 (fig. 1) until multimeter indicates 2.30 V dc (R).

(2) Adjust 1A4R21 (fig. 3) until multimeter indicates -1250 V dc (R).

(3) Adjust A3R42 (fig. 1) until multimeter indicates -1850 V dc (R).

(4) Adjust A3R1 (fig. 1) until multimeter indicates 6.30 V dc (R).

15. Final Procedure

a. Deenergize and disconnect all equipment.

b. Annotate and affix DA label/form in accordance with TB 750-25.

By Order of the Secretary of the Army:

GEORGE W. CASEY, JR.
General, United States Army
Chief of Staff

Official:

JOYCE E. MORROW
Administrative Assistant to the
Secretary of the Army

0719011

Distribution:

To be distributed in accordance with the initial distribution number (IDN) 343050, requirements for calibration procedure TB 9-6625-2000-24.

Instructions for Submitting an Electronic 2028

The following format must be used if submitting an electronic 2028. The subject line must be exactly the same and all fields must be included; however, only the following fields are mandatory: 1, 3, 4, 5, 6, 7, 8, 9, 10, 13, 15, 16, 17, and 27.

From: "Whomever" whomever@redstone.army.mil
To: <2028@redstone.army.mil

Subject: DA Form 2028
1. **From**: Joe Smith
2. Unit: home
3. **Address**: 4300 Park
4. **City**: Hometown
5. **St**: MO
6. **Zip**: 77777
7. **Date Sent**: 19-OCT –93
8. **Pub no:** 55-2840-229-23
9. **Pub Title**: TM
10. **Publication Date**: 04-JUL-85
11. Change Number: 7
12. Submitter Rank: MSG
13. **Submitter FName**: Joe
14. Submitter MName: T
15. **Submitter LName**: Smith
16. **Submitter Phone**: 123-123-1234
17. **Problem**: 1
18. Page: 2
19. Paragraph: 3
20. Line: 4
21. NSN: 5
22. Reference: 6
23. Figure: 7
24. Table: 8
25. Item: 9
26. Total: 123
27. **Text**

This is the text for the problem below line 27.