

***TB 9-6625-2224-24**

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR SIGNAL GENERATOR, SG-644/U (HEWLETT-PACKARD, MODEL 8614A) AND HEWLETT-PACKARD, 8616A

Headquarters, Department of the Army, Washington, DC
4 November 2008

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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.

		Paragraph	Page
SECTION	I.	IDENTIFICATION AND DESCRIPTION	
		Test instrument identification	1 2
		Forms, records, and reports	2 2
		Calibration description	3 2
	II.	EQUIPMENT REQUIREMENTS	
		Equipment required	4 3
		Accessories required	5 4
	III.	CALIBRATION PROCESS FOR (SG-644/U HEWLETT-PACKARD, MODEL 8614A) and (HEWLETT-PACKARD, MODEL 8616A)	
		Preliminary instructions	6 4
		Equipment setup	7 5

*This bulletin supersedes TB 9-6625-2224-35, dated 20 April 1992.

	Paragraph	Page
Frequency and stability	8	5
Attenuator accuracy (SG-644/U (Hewlett-Packard, Model 8614A))	9	9
Attenuator accuracy (Hewlett-Packard, Model 8616A)	10	10
RF output power and leveled output (SG-644/A (Hewlett-Packard, Model 8614A))	11	10
RF output power and leveled output (Hewlett-Packard, Model 8616A).....	12	11
Internal square wave	13	12
Power supply	14	13
Final procedure	15	13

SECTION I IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Signal Generator, SG-644/U (Hewlett-Packard, Model 8614A) and Hewlett-Packard, Model 8616A. The manufacturers' manuals 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. Variations among models are described in text.

b. Time and Technique. The time required for this calibration is approximately 4 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	SG-644/U (Hewlett-Packard, Model 8614A)
	Range: 800 to 2400 MHz Accuracy: ± 5 MHz Line stability: $\pm 0.003\%$ for $\pm 10\%$ line voltage change
	Hewlett-Packard, Model 8616A
	Range: 1800 to 4500 MHz Accuracy: ± 10 MHz Stability: $\pm 0.003\%$ for $\pm 10\%$ line voltage change
RF output power	SG-644/U (Hewlett-Packard, Model 8614A)
	Range: +10 to -127 dBm into 50 Ω load Accuracy: ± 0.75 dB + attenuator accuracy (-10 to -127 dBm) ¹ (-15 to -127 dBm SN prefixed 501 and above) ² (0 to -127 dBm SN prefixed 851 and above) ¹
	Hewlett-Packard, Model 8616A
	Range: +10 to -127 dBm (1800 to 3000 MHz) into 50 Ω load +3 to -127 dBm (3000 to 4500 MHz) into 50 Ω load Accuracy: ± 1.0 dB + attenuator accuracy (0 to -127 dBm) ¹
Attenuator	SG-644/U (Hewlett-Packard, Model 8614A)
	Accuracy: +0, -3 dB (0 to -10 dBm) (0 to -15 dBm SN prefixed 501 and above) ± 0.2 dB ± 0.06 dB/10 dB (-10 to -127 dBm) (-15 to -127 dBm SN prefixed 501 and above)
	Hewlett-Packard, Model 8616A
	Accuracy: ± 0.2 dB ± 0.06 dB/10 dB (below -10 to -127 dBm)
Leveled output	SG-644/U (Hewlett-Packard, Model 8614A)
	Range: Attenuator setting below 0 dB Accuracy: ± 0.5 dB (± 0.75 dB SN prefixed 851 and above)
	Hewlett-Packard, Model 8616A
	Range: Attenuator setting below 0 dB Accuracy: ± 1.0 dB
Internal square wave (All models)	Range: 950 to 1050 Hz

¹Verified at -10 dBm only.²Verified at -15 dBm 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 Set 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, 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 this calibration procedure. The following peculiar accessory is also required for this calibration: Semiconductor device (crystal detector), 800 to 1800 MHz range, Hewlett-Packard, Model 423AOPT03 (7923182-2).

Table 2. Minimum Specifications of Equipment Required

Common name	Minimum use specifications	Manufacturer and model (part number)
ATTENUATOR (FIXED)	Range: 20 dB Frequency: 800 to 1800 MHz	Weinschel, Model 9918-20dB
AUTOTRANSFORMER	Range: 105 to 125 V ac	Ridge, Model 9020A (9020A)
MEASURING RECEIVER	Dynamic range: 85 dB Accuracy: ± 0.02 dB/10 dB Frequency: 800 and 1800 MHz	Measuring receiver system N5530S consisting of: Spectrum Analyzer, Agilent Model E4440A (E4440A), Power meter, Agilent Model E4419B (E4419B), and Sensor module, Agilent Model N5543A opt. 504 (504)
MICROWAVE FREQUENCY COUNTER	Range: 950 Hz to 4522.5 MHz Accuracy: ± 0.00075 %	Anritsu, Model MF2414B003 (MF2414B003)
MULTIMETER	Range: -402 to +21 V dc Accuracy: ± 0.125 %	Hewlett-Packard, Model 3458A (3458A)
POWER METER	Range: -8.8 to -15.95 dBm Accuracy: ± 1.25 % Frequency: 800 to 4500 MHz	Hewlett-Packard, Model 437B (13440045) w/power sensor Hewlett-Packard, Model 8481A or 8482A (13440043)

**SECTION III
CALIBRATION PROCESS FOR
HEWLETT-PACKARD, MODEL 8614A AND
HEWLETT-PACKARD, MODEL 8616A**

6. Preliminary Instructions

a. The instructions outlined in paragraphs 6 and 7 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.

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.

f. Unless otherwise specified, all control settings and indications in parenthesis refer to Hewlett-Packard, Model 8616A.

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 minimum after each step within the performance check where applicable.

- a. Remove TI protective cover as required for adjustment.
- b. Connect TI to autotransformer.
- c. Connect autotransformer to a 115 V ac source and adjust for 115 V output.
- d. Position controls as listed in (1) through (5) below:
 - (1) **LINE** pushbutton pressed to in position.
 - (2) All remaining pushbuttons released to out position.
 - (3) ΔF control centered.
 - (4) **FREQUENCY (MC)** control to **0800 (1800)**.
 - (5) **ATTENUATION (DB)** control to **000**.
- e. Observe **DBM** meter pointer is on **ZERO SET mark**. If not, adjust **ZERO SET**.
- f. Allow at least 30 minutes for equipment to warm up and stabilize.

8. Frequency and Stability

a. Performance Check

- (1) Connect microwave frequency counter to **RF POWER OUTPUTS CAL**.

NOTE

Before **INTERNAL ALC** pushbutton is pressed to in position in (2) below, **DBM** meter should indicate approximately +1 dBm.

(2) Press **RF** and **INTERNAL ALC** pushbuttons to in position and adjust **ALC CAL OUTPUT** control for a 0 indication on **DBM** meter. If microwave frequency counter does not indicate between 795 and 805 MHz (1790 and 1820 MHz), perform **b** below. Record microwave frequency counter indication.

(3) Adjust autotransformer to 105 V. Microwave frequency counter will indicate within ± 0.003 percent of indication recorded in (2) above.

(4) Adjust autotransformer to 125 V. Microwave frequency counter will indicate within ± 0.003 percent of indication recorded in (2) above.

(5) Adjust autotransformer to 115 V.

NOTE

Always approach frequency setting in the same direction to eliminate backlash error.

(6) Adjust **FREQUENCY (MC)** control to settings listed in table 3. If microwave frequency counter does not indicate within limits specified, perform **b** below.

Table 3. Frequency and Stability

Test instrument FREQUENCY (MC) settings	Microwave frequency counter indications (MHz)	
	Min	Max
800 (1800)	795 (1790)	805 (1810)
1000 (2000)	995 (1990)	1005 (2010)
1200 (2200)	1195 (2390)	1205 (2210)
1400 (2400)	1395 (2390)	1405 (2410)
1600 (2600)	1595 (2590)	1605 (2610)
1800 (2800)	1795 (2790)	1805 (2810)
2000 (3000)	1995 (2990)	2005 (3010)
2200 (3200)	2195 (3190)	2205 (3210)
2400 (3400)	2395 (3390)	2405 (3410)
(3600)	(3590)	(3610)
(3800)	(3790)	(3810)

Table 3. Frequency and Stability - Continued

Test instrument FREQUENCY (MC) settings	Microwave frequency counter indications (MHz)	
	Min	Max
(4000)	(3990)	(4010)
(4200)	(4190)	(4210)
(4400)	(4390)	(4410)
(4500)	(4490)	(4510)

b. Adjustments

(1) Adjust **FREQUENCY (MC)** control to 1000 (1800). Record microwave frequency counter indication.

(2) Adjust **FREQUENCY (MC)** control to 2400 (4000). Record microwave frequency counter indication.

(3) Subtract indication recorded in **b** (1) above from indication recorded in **b** (2) above. If difference is not between 1397 and 1403 (2194 and 2206), refer to frequency dial correction chart (fig. 1) and determine correction value as in example below:

EXAMPLE: If difference is 1354 MHz, the corrective dial setting in 990 MHz.

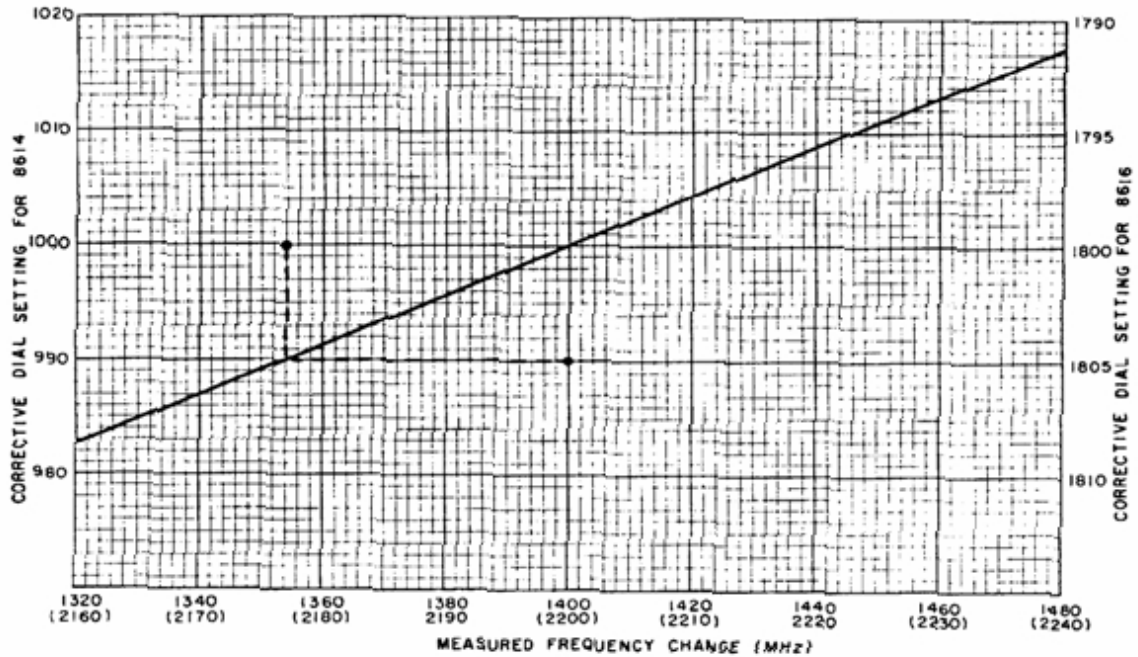
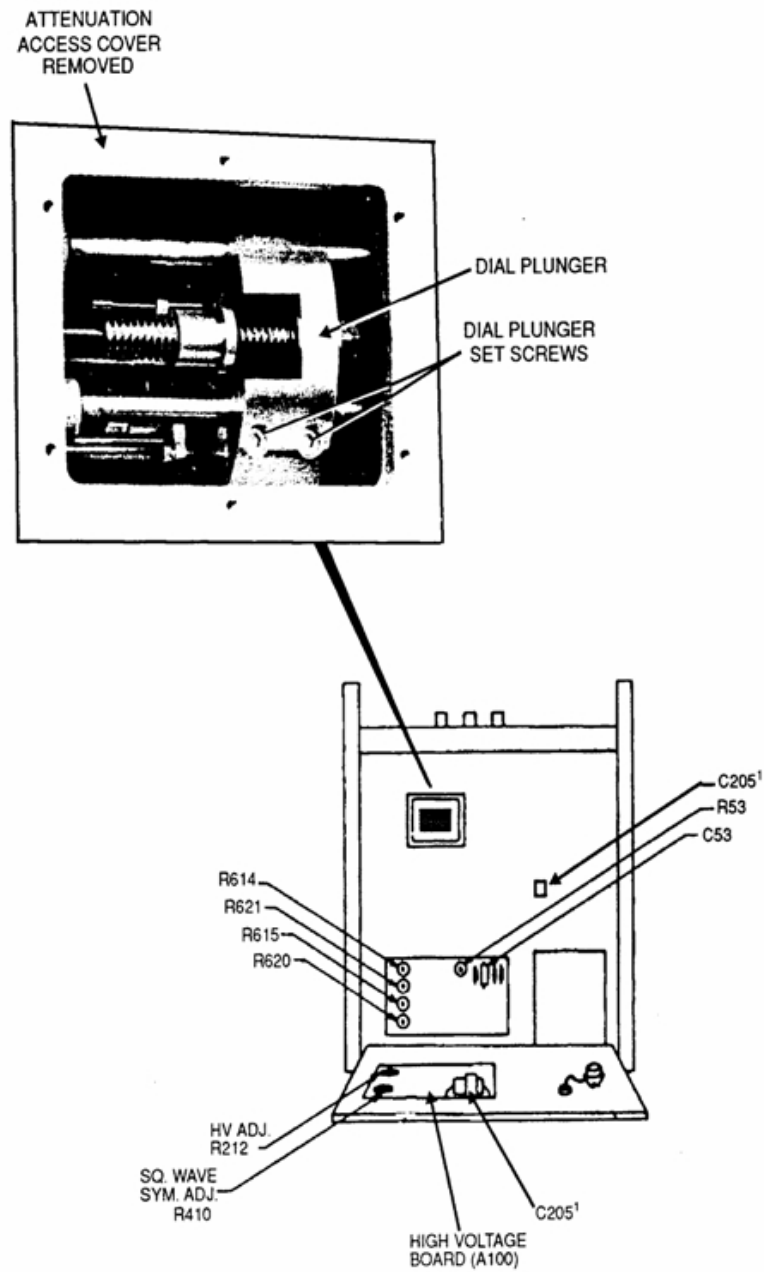


Figure 1. Frequency dial correction chart.

(4) Adjust **FREQUENCY (MC)** control to 1000 (1800). Loosen the two **DIAL PLUNGER SET SCREWS** (fig. 2), hold the **DIAL PLUNGER** (fig. 2) stationary, and set dial to correction value determined in **b** (3) above. Tighten **DIAL PLUNGER SET SCREWS** (R).

(5) Repeat **b** (1) through (4) above as necessary.



¹Physical location of C205 differs among models.

Figure 2. Test instrument top view.

9. Attenuator Accuracy SG-644/U (Hewlett-Packard, Model 8614A)

a. Performance Check

NOTE

Settings and indications in parenthesis are for SN prefixed 501 and above.

- (1) Position controls as listed in (a) through (d) below:
 - (a) **RF** pushbutton released to out position.
 - (b) **INTERNAL ALC** pushbutton released to out position.
 - (c) **FREQUENCY (MC)** control to **0800**.
 - (d) **ATTENUATION (DB)** control to **000**.

NOTE

Verify that the proper CAL FACTORS are loaded for the measuring receiver power sensor module.

- (2) Zero and calibrate the measuring receiver power sensor module.
- (3) Set up measuring receiver to measure tuned level RF power in dB.
- (4) Connect measuring receiver power sensor module to **RF POWER OUTPUTS CAL**.
- (5) Press **RF** pushbutton and establish a 0 dB reference on the measuring receiver at 800 MHz.
- (6) Adjust **ATTENUATION (DB)** control to each setting in table 4. Measuring receiver will indicate within limits specified.

Table 4. Attenuator Accuracy

Test instrument ATTENUATION (DB) dial indications	Measuring receiver indications (dB)			
	Min		Max	
010 (015)	10.0	(15.0)	13.0	(18.0)
020 (025)	19.68	(24.68)	20.32	(25.32)
030 (035)	29.62	(34.62)	30.38	(35.38)
040 (045)	39.56	(44.56)	40.44	(45.44)
050 (055)	49.50	(54.50)	50.50	(55.50)
060 (065)	59.44	(64.44)	60.56	(65.56)
070 (075)	69.38	(74.38)	70.62	(75.62)
080 (085)	79.32	(84.32)	80.68	(85.68)
090 (095)	89.26	(94.26)	90.74	(95.74)
100 (105)	99.20	(104.20)	100.80	(105.80)
110 (115)	109.14	(114.14)	110.86	(115.86)
120 (125)	119.08	(124.08)	120.92	(125.92)

b. Adjustments. No adjustments can be made.

10. Attenuator Accuracy Hewlett-Packard, Model 8616A

a. Performance Check

- (1) Position controls as listed in (a) through (c) below:
 - (a) **RF** pushbutton released to out position.
 - (b) **FREQUENCY (MC)** control to **1800**.
 - (c) **ATTENUATION (DB)** control to **010**.

NOTE

Verify that the proper CAL FACTORS are loaded for the measuring receiver power sensor module.

- (2) Zero and calibrate the measuring receiver power sensor module.
- (3) Set up measuring receiver to measure tuned level RF power in dB.
- (4) Connect measuring receiver power sensor module to **RF POWER OUTPUTS CAL**.
- (5) Press **RF** pushbutton to in position and establish a 0 dB reference on the measuring receiver at 1800 MHz.
- (6) Adjust **ATTENUATION (DB)** control to each setting in table 5. Measuring receiver will indicate within limits specified.

Table 5. Attenuator Accuracy

Test instrument ATTENUATION (DB) dial indications	Measuring receiver indications (dB)	
	Min	Max
020	9.75	10.26
030	19.68	20.32
040	29.62	30.38
050	39.56	40.44
060	49.50	50.50
070	59.44	60.56
080	69.38	70.62
090	79.32	80.68
100	89.26	90.74
110	99.20	100.80
120	109.14	110.86

b. Adjustments. No adjustments can be made.

11. RF Output Power and Leveled Output SG-644/U (Hewlett-Packard, Model 8614A)

NOTE

Settings and indications in parenthesis are for SN prefixed 501 and above.

- (1) Press **RF** pushbutton to out position.

- (2) Connect power meter to **RF POWER OUTPUTS CAL.**
- (3) Position controls as listed in (a) through (d) below:
 - (a) **FREQUENCY (MC)** control to **0800**.
 - (b) **ATTENUATION (DB)** control to **010 (015)**.
 - (c) **ALC CAL OUTPUT** control fully ccw.
 - (d) **RF** pushbutton pressed to in position.

NOTE

Before **INTERNAL ALC** pushbutton is pressed to in position in (4) below, **DBM** meter should indicate approximately +1 dBm.

(4) Press **INTERNAL ALC** pushbutton to in position and adjust **ALC CAL OUTPUT** control for a **0** indication on **DBM** meter. Power meter will indicate between -9.05 and -10.95 dBm(-14.05 and -15.95 dBm). Record power meter indication.

(5) Adjust **FREQUENCY (MC)** control from **0800** to **2400**. If power meter indication does not remain within ± 0.5 dB (± 0.75 dB) of indication recorded in (4) above, perform **b** below.

b. Adjustments. Adjust **FREQUENCY (MC)** control to settings listed in table 6 below and perform corresponding adjustment for a -10 dBm (-15 dBm) power meter indication.

NOTE

R614 and R621 interact as do R615 and R620. To simplify the adjustment, overcorrect when adjusting R614 or R615; then back off with interacting adjustment R621 or R620.

Table 6. Leveled Output Adjustments

Test instrument	
FREQUENCY (MC) dial settings	Adjustments (fig. 2)
0800	R614
1600 below switch	R621
1600 above switch	R615
2400	R620

12. RF Output Power and Leveled Output Hewlett-Packard, Model 8616A

a. Performance Check

- (1) Press **RF** pushbutton to out position.
- (2) Connect power meter to **RF POWER OUTPUTS CAL.**
- (3) Position controls as listed in (a) through (d) below:
 - (a) **FREQUENCY (MC)** control to **1800**.
 - (b) **ATTENUATION (DB)** control to **010**.
 - (c) **ALC CAL OUTPUT** control fully ccw.
 - (d) **RF** pushbutton pressed to in position.

NOTE

Before **INTERNAL ALC** pushbutton is pressed to in position in (4) below, **DBM** meter should indicate approximately +1 dBm.

(4) Press **INTERNAL ALC** pushbutton to in position and adjust **ALC CAL OUTPUT** control for a 0 indication on **DBM** meter. Power meter will indicate between -8.8 and -11.2 dBm. Record power meter indication.

(5) Adjust **FREQUENCY (MC)** control from **1800** to **4500**. If power meter indication does not remain within ± 1.0 dB of indication recorded in (4) above, perform **b** below.

b. Adjustments. Adjust **FREQUENCY (MC)** control settings listed in table 7 below and perform corresponding adjustment for a -10 dBm power meter indication.

NOTE

R614 and R621 interact as do R615 and R620. To simplify the adjustment, overcorrect when adjusting R614 or R615, then back off with interacting adjustment R621 or R620.

Table 7. Leveled Output Adjustments

Test instrument	
FREQUENCY(MC) dial settings	Adjustments (fig. 2)
1800	R614
3200 below switch	R621
3200 above switch	R615
4500	R620

13. Internal Square Wave

a. Performance Check

(1) Position controls as listed in (a) through (d) below:

- (a) **RF** pushbutton released to out position.
- (b) **INTERNAL ALC** pushbutton released to out position.
- (c) **FREQUENCY (MC)** control to **0800 (1800)**.
- (d) **ATTENUATION (DB)** control to **000**.

(2) Connect microwave frequency counter to **RF POWER OUTPUTS CAL**, using crystal detector.

(3) Press **RF** and **INTERNAL SQ WAVE** pushbuttons to in position. Adjust **SQ WAVE** control fully ccw. If microwave frequency counter does not indicate 950 Hz or less, perform **b** below.

(4) Adjust **SQ WAVE** control fully cw. If microwave frequency counter does not indicate 1050 Hz or greater, perform **b** below.

b. Adjustments. Adjust **SQ WAVE** control to center position. Adjust **SQ WAVE SYM. ADJ.** R410 (fig. 2) for 1000 Hz indication on microwave frequency counter (R).

14. Power Supply

a. Performance Check

NOTE

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

NOTE

C205 may either be chassis mounted or located on HIGH VOLTAGE (A100) board.

(1) Connect multimeter negative to positive side of C205 (fig. 2) (white-violet wire), and multimeter positive to negative side of C205 (fig. 2) (violet wire). If multimeter does not indicate between -348 and -352 V dc (-398 and -402 V dc), perform **b** (1) below.

(2) Connect multimeter negative to top of R4 (fig. 3) and multimeter positive to V203 PIN 5 TRACE (fig. 3). If multimeter does not indicate between -6.05 and -6.25 V dc, perform **b** (2) below.

(3) Connect multimeter negative to chassis ground and multimeter positive to positive side of C53 (fig. 3). If multimeter does not indicate between +19 and +21 V dc, perform **b** (3) below.

b. Adjustments

(1) Adjust HV ADJ. R212 (fig. 2) for a -350 V dc (400 V dc) indication on multimeter (R).

(2) Adjust DC FIL. ADJ. R5 (fig. 3) for a -6.15 V dc indication on multimeter (R).

(3) Adjust R53 (fig. 2) for a +20 V dc indication on multimeter (R).

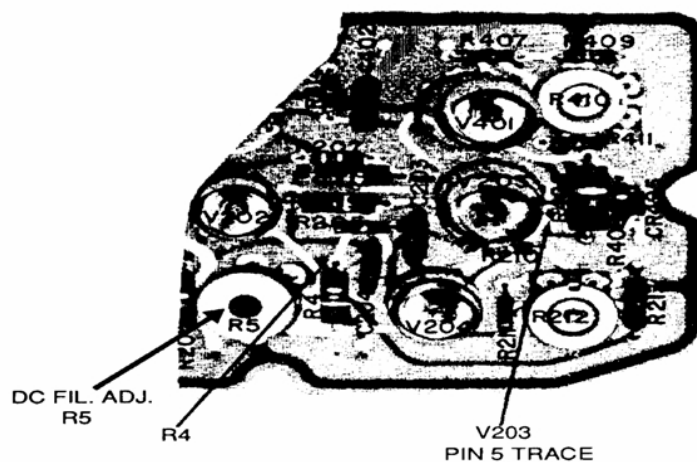


Figure 3. High voltage board (A100) - partial view.


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

0719017

Distribution:

To be distributed in accordance with the initial distribution number (IDN) 343119 requirements for calibration procedure TB 9-6625-2224-35.

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.

