TB 9-6625-1491-35

Change 1

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR INTERFERENCE ANALYZERS AN/URM-178, AND AN/URM-200 (FAIRCHILD/ELECTRO-METRICS MODELS EMC-25 (SERIES))

Headquarters, Department of the Army, Washington, DC
24 December 1990

TB 9-6625-1491-35, 12 June 1989, is changed as follows:

1. Remove old pages and insert new pages as indicated below. New or changed material is indicated by a vertical bar in the margin of the page.

Remove pages	***Insert pages***
21 and 22	21 and 22

2. File this change sheet in front of the publication for reference purposes. **This change incorporates DA Form(s) 2028 dated 28 March 1990.**

By order of the Secretary of the Army:

CARL E. VUONO
General, United States Army
Chief of Staff

Official

THOMAS F. SIKORA
Brigadier General, United States Army
The Adjutant General

Distribution:

To be distributed in accordance with DA Form 12-34C, Block No. 319, requirements for calibration procedures publications.

PIN NO: 052116-001

*TB 9-6625-1491-35

SUPERSEDED COPY DATED 4 SEPTEMBER 1985

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR INTERFERENCE ANALYZERS AN/URM-178, AND AN/URM-200 (FAIRCHILD/ELECTRO-METRICS MODELS EMC-25 (SERIES))

Headquarters, Department of the Army, Washington, DC
12 June 1989

Approved for public release; distribution is unlimited.

REPORTING OF ERRORS

You can help improve this publication by calling attention to errors and by recommending improvements and stating your reasons for the recommendations. Your letter or DA Form 2028, Recommended Changes to Publications, should be mailed directly to Commander, U.S. Army TMDE Support Group, ATTN: AMXTM-LPP, Redstone Arsenal, AL 35898-5400. A reply will be furnished directly to you.

*This bulletin supersedes TB 9-6625-1491-35, 4 September 1985.

SECTION I

IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Interference Analyzers, AN/URM-178, and AN/URM-200, (Fairchild/Electro-Metrics, Models EMC-(25 Series)), The manufacturers' manuals and TM 11-6625-2949-14 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 indicated in the text, tables, and illustrations.

b. Time and Technique. The time required for this calibration is approximately 4 hours, using the dc, low frequency, and 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: 10 kHz to 1.0 GHz (14 kHz to 1.0 GHz on Fairchild Models) Accuracy: ±2% of reading with fine tuning control at midrange
Voltage	Range: 10 µV to 1.0 v Accuracy: ±2 dB (±1.5 dB for Fairchild Models)
Attenuation	Range: 0 to 100 dB Accuracy: ±1 dB
IF rejection	45 dB minimum
Bandwidth (3 dB)	Range: Narrow band: 500 Hz (bands 1 to 7), 5 kHz (band 8 to 10), 50 kHz (bands 11 to 15) Wide band: 4 kHz (bands 1 to 5), 5 kHz (bands 6 and 7), 50 kHz (bands 8 to 10) 500k Hz (bands 11 to 15) Accuracy: ±10%

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-287. Alternate items may be used by the calibrating activity when the equipment listed in table 2 is not available. 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 issued as indicated in paragraph 4 above and must be selected by the calibrator.

Table 2. Minimum Specifications of Equipment Required

Common name	Minimum use specifications	Manufacturer and model (part number)
ATTENUATOR	Range: 0 to 100 dB Accuracy: ±.17 dB with test report	RLC Electronics, Model A2648 (MIS-10263)
DIGITAL VOLTMETER	Range: -12.05 to +98.1 V dc Accuracy: ±0.025%	Hewlett-Packard, Model 3490AOPT060 (3490AOPT060) Dana, Model 5000, or Dana, Model 5000, w/641

Table 2. Minimum Specifications of Equipment Required - Continued

Common name	Minimum use specifications	Manufacturer and model (part number)
FREQUENCY COUNTER	Range: 10 kHz to 1 GHz Accuracy: ±0.5%	Hewlett-Packard, Model 5345A (MIS-28754/1 Type 1) w/5355A
POWER METER	Range: -9 to -5 dBm Accuracy: ±4%	Hewlett-Packard, Model E12-432A (MIS-30525) w/thermistor mount, Hewlett-Packard, Model H75-478A (7915907) or 8478B (8478B)
POWER SPLITTER	Range: 10 kHz to 1 GHz Accuracy: ±0.15%	Weinschel, Model 1870A (1870A)
SIGNAL GENERATOR	Range: 10 MHz to 1 GHz	Hewlett-Packard, Model 8640B-OPTH66 (MIS-28707 Type 1) with frequency doubler Hewlett-Packard, Model 11690A (11690A)
TEST OSCILLATOR	Range: -48 to +20 dBm (10 kHz to 9 MHz) Accuracy: 1	Hewlett-Packard, Model 652A (MIS-10224)

[1] Combined accuracy of test oscillator or power meter and variable attenuator ±.25 dB.

SECTION III

CALIBRATION PROCESS FOR

INTERFERENCE ANALYZER AN/URM-178

(FAIRCHILD, MODEL EMC-25 (SERIES))

6. Preliminary Instructions

a. The instructions outlined in paragraphs 14 and 15 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. Additional maintenance information is contained in the manufacturer's manual for this TI.

d. 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.

a. Insure that **POWER** switch is in off (down) position. Set line switch **(AC INPUT)** on rear panel to **110** or **115-V** position.

b. Connect TI to 115-V ac source.

NOTE

Dummy plug (p/o TI) must be installed on **REMOTE** connector (front panel) of TI during this procedure.

NOTE

The TI is normally supplied with a rechargeable battery pack. Calibration can be accomplished without this pack.

c. Position controls as listed in (1) through (9) below:

(1) **ATTENUATOR** switch to **100** (black value).

(2) Band switch to position **1** and **TUNING** controls for a 14-kHz indication on **FREQUENCY** dial.

(3) **AFC-MAN-SWEEP** switch to **MAN.**

(4) **TUNING AID** switch to off (down).

(5) **DETECTOR** function switch to CARR.

(6) **BANDWIDTH** switch to **NARROW.**

(7) **DUMP** and **THRESHOLD** controls fully ccw.

(8) **FINE TUNING** control to midrange.

(9) **CAL** control to midrange.

d. Set **POWER** switch to on (up) position, and immediately press **BATTERY** pushbutton **(BAT TEST** on some models). Battery test scale of TI meter will indicate in the operate range and charge indicator will be extinguished (on some models, BATT TEST light will glow). If not, set POWER switch to off (down) and allow battery to fully charge.

CAUTION

Damage to battery may result if **POWER** switch is left in the on (up) position and battery is not fully charged.

e. Allow TI sufficient time for warmup and stabilization.

NOTE

For attenuation values at frequencies below 25 MHz, use black values; above 25 MHz use orange values.

8. Frequency

a. Performance Check

(1) Connect test oscillator 50- **Ω** output to frequency counter input and TI **RF INPUT**

(2) Position test oscillator controls for output frequency of 14 kHz and adjust output level controls for a 10-dB indication on TI meter.

(3) Adjust test oscillator frequency controls for peak indication on TI meter, while readjusting output level controls for a 10-dB indication on TI meter. Frequency counter will indicate between 13.720 and 14.280 kHz.

(4) Repeat technique of (2) and (3) above for **BAND** switch positions, **FREQUENCY** dial indications, and test oscillator/signal generator frequencies listed in table 3. Frequency counter will indicate within limits specified.

b. Adjustments. No adjustments can be made.

Table 3. Frequency Range and Accuracy Check

Test instrument		Test oscillator signal generator frquency (kHz)	Frequency counter indications (kHz)	
BAND switch positions	FREQUENCY dial indications		Min	Max
1	20	20	19.600	20.400
1	28	28	27.440	28.560
2	30	30	29.400	30.600
2	60	60	58.800	61.200
3	60	60	58.800	61.200
3	120	120	117.600	122.400
4	120	120	117.600	122.400
4	240	240	235.200	244.800
5	250	250	245	255
5	500	500	490	510
6	0.5	500	490	510
6	1.1	1100	1078	1122
7	1.2	1200	1176	1224
7	2.4	2400	2352	2448
8	2.5	2500	2450	2550
8	5.0	5000	4900	5100
9	6	6000	5880	6120
9	11	11,000 [1]	10,780	11,220
10	13	13,000	12,740	13,260
10	25	25,000	24,500	25,500
11 [2]	25	25,000	24,500	25,500
11	50	50,000	49,000	51,000
12	50	50,000	49,000	51,000
12	100	100,000	98,000	102,000
13	100	100,000	98,000	102,000
13	200	200,000	196,000	204,000

See footnotes at end of table.

Table 3. Frequency Range and Accuracy Check - Continued

Test instrument		Test oscillator/ signal generator frequency	Frequency counter indications (kHz)	
BAND switch positions	FREQURNCY dial indications		Min	Max
14	200	200,000	196,000	204,000
14	450	450,000	4410,00	459,000
15	490	490,000	480,200	499,800
15	1000 [2]	1,000,000 [3]	980,000	1,020,000

1 Disconnect cable from test oscillator and connect to signal generator output.
2 Set ATTENUATOR switch to 80/100.
3 Disconnect cable from adapter at signal generator output. Connect frequency doubler (Hewlett-Packard, Model 11690A) to adapter at signal generator output. Reconnect cable frequency doubler.

9. Voltage Accuracy and Frequency Response

a. Performance Check

(1) Connect equipment as shown in figure l, connection A.

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

(a) ATTENUATOR switch to CAL (20/40).

(b) Band switch to position **l** and **TUNING** controls for a 14-kHz indication on **FREQUENCY** dial.

(c) BANDWIDTH switch to WIDE.

(3) Set detector function switch to **PEAK.** Press **SHUNT CAL** pushbutton and adjust **CAL** control until meter indicates value shown on left-hand scale of calibration chart (furnished with TI). Release **SHUNT CAL** pushbutton.

(4) Set detector function switch to **CARR.**

(5) Set attenuator to **40 dB.**

(6) Adjust test oscillator frequency to 14 kHz and output for an upper-scale indication on TI meter. Fine tune test oscillator for peak indication.

(7) Adjust oscillator output for a O-dB indication on TI meter. Add test oscillator output attenuator setting and meter indication to test report of attenuator. Computed result will be between -85.5 and -88.5 dB.

(8) Adjust test oscillator output and attenuator for a +20-dB indication on TI meter. Computed result will be between -65.5 and -68.5 dB.

(9) Repeat (3) through (7) above for TI band switch positions, **FREQUENCY** dial indications, and test oscillator frequencies listed in table 4.

(10) Connect equipment as shown in figure 1, connection.

(11) Set attenuator to **80 dB.**

(12) Set band switch to position **9** and adjust **TUNING** controls for a 10-MHZ indication on **FREQUENCY** dial.

(13) Repeat (3) and (4) above.

(14) Adjust signal generator frequency to 10 MHz and output for an upper-scale indication on TI meter. Fine tune signal generator for peak indication.

(15) Adjust signal generator output for a O-dB indication on TI meter. Add power meter indication to test report value of attenuator. Computed result will be between -85.5 and -88.5 dB.

(16) Repeat (12) through (15) above for band switch position 10 and a frequency of 25 MHz.

(17) Set attenuator to **60 dB.** Repeat technique of (12) through (15) above. Set band switch positions, **FREQUENCY** dial indications, and signal generator frequencies listed in table 5. Computed results will be between -65.5 and -68.5 dB.

b. Adjustments. No adjustments can be made.

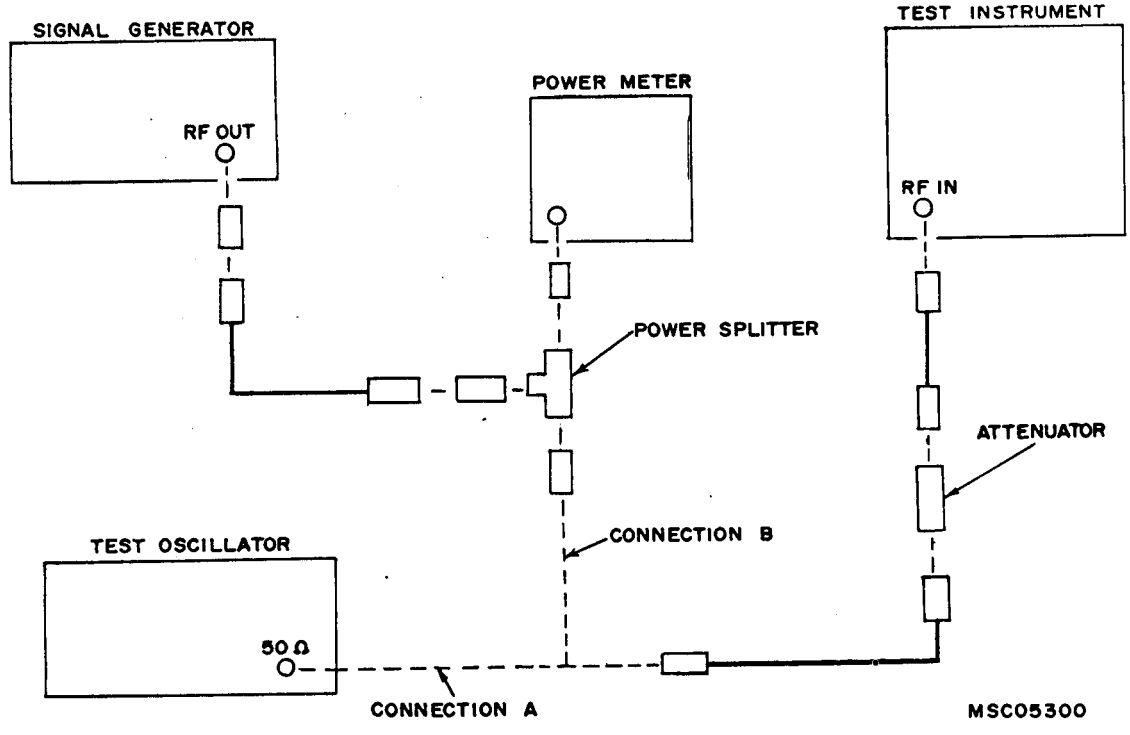

Figure 1. Voltage and attenuation - equipment setup.

Table 4. Low Frequent Voltage Accuracy

Test instrument		Test oscillator frequency
BAND switch positions	FREQUENCY dial indications	
1	28 kHz	28 kHz
2	59 kHz	59 kH Z
3	120 kHz	120 kHz
4	240 kHz	240 kHz
5	480 kHz	480 kHz
6	1.0 MHz	1.0 MHz
7	2.3 MHz	2.3 MHz
8	5.0 MHz	5.0 MHz

Table 5. High Frequency Voltage Accuracy

Test instrument		Signal generator frequency (MHz)
BAND switch positions	FREQUENCY dial indications (MHz)	
11	49	49
12	98	98
13	210	210
14	490	490
15[1]	1000	1000

[1]Connect frequency doubler (Hewlett-Packard, Model 11690A) to signal generator output.

10. Attenuation

a. Performance Check

(1) Connect equipment as shown in figure 1, connection A.

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

(a) **ATTENUATOR** switch to **CAL (20/40).**

(b) **BANDWIDTH** switch to **NARROW.**

(c) Band switch to position 6 and **TUNING** controls for an 0.8-MHz indication on **FREQUENCY** dial.

(d) Detector function switch to CARR.

(3) Set attenuator to **40 dB.**

(4) Adjust test oscillator frequency to 800 kHz and output for an upper-scale indication on TI meter. Fine tune test oscillator for peak indication.

(5) Adjust test oscillator output for a -87 dB input to TI (test report value of attenuator must be added to test oscillator output indications).

(6) Adjust **CAL** level control for a 0-dB indication on TI meter.

NOTE

Change setting of attenuator as required to obtain 0-dB indication on TI meter in (7) through (9) and (18) through (20) below.

(7) Set **ATTENUATOR** switch to **(40/60)** and adjust test oscillator output for a 0-dB indication on TI meter.

(8) Add test oscillator output attenuator setting and meter indication to test report value of attenuator. Computed result will be between -66 and -68 dB.

(9) Repeat technique of (7) and (8) above for **ATTENUATOR** switch settings listed in table 6. Computed results will be within limits specified for frequency being applied.

(10) Set **BAND** switch to position 8 and **TUNING** control for a 4-MHz indication on **FREQUENCY** dial. Set **ATTENUATOR** switch to **CAL (20/40).**

(11) Repeat (3) through (9) above with test oscillator frequency adjusted to 4 MHz.

(12) Connect equipment as shown in figure 1, connection B.

(13) Position controls as listed in (a) and **(b)** below:

(a) **ATTENUATOR** switch to **CAL (20/40).**

(b) **BAND** switch to position 11 and **TUNING** control for a 35-MHz indication on **FREQUENCY** dial.

(14) Set attenuator to **60 dB.**

(15) Adjust signal generator frequency to 35 MHz and output for an upper-scale indication on TI meter. Fine tune signal generator for peak indication.

(16) Adjust signal generator output for a -67 -dB input to TI (test report value of attenuator must be added to power meter indication).

(17) Repeat (6) above.

(18) Set **ATTENUATOR** switch to **40/60** and adjust signal generator output for a 0-dB indication on TI meter.

(19) Add power meter indication to test report value of attenuator. Computed results will be between -46 and -48 dB.

(20 Repeat technique of (18) and (19) above for **ATTENUATOR** switch settings listed in table 6. Computed results will be within limits specified for frequency being applied.

(21) Connect frequency doubler (Hewlett-Packard, Model 11690A) between power splitter and signal generator output.

(22) Position controls as listed in (a) and (b) below:

(a) **ATTENUATOR** switch to **CAL (20/40).**

(b) Band switch to position **15** and **TUNING** control for a 1000-MHz indication on **FREQUENCY** dial.

(23) Repeat (14) through (20) above with signal generator frequency adjusted to 1000 MHz.

b. Adjustments. No adjustments can be made.

Table 6. Attenuator Accuracy

Test instrument **ATTENUATOR** switch settings (dB)	Computed results (dB)			
	0.8 and 4 MHz		35 and 1000 MHz	
	Min	Max	Min	Max
60/80	-48	-46	-28	-26
80/100	-28	-26	-8	-6
100	-8	-6	- - -	- - -
0/20	-108	-106	-88	-86

11. Bandwidth

a. Performance Check

(1) Connect test oscillator 50- **Ω** output to frequency counter input and TI **RF INPUT.**

(2) Position controls as listed in **(a)** through **(e)** below:

(a) ATTENUATOR switch to **100** (black value).

(b) Band switch to position 6 and **TUNING** control for a 0.8-MHz indication on **FREQUENCY** dial.

(c) Detector function switch to **CARR.**

(d) **CAL** control fully ccw.

(e) **BANDWIDTH** switch to **WIDE.**

(3) Adjust test oscillator frequency to 800 kHz and output for an upper-scale indication on TI meter. Fine tune test oscillator for peak indication.

(4) Adjust test oscillator output for 0-dB indication on TI meter.

(5) Increase test oscillator frequency until TI meter indicates -3 dB. Record frequency counter indication.

(6) Decrease test oscillator frequency until TI meter returns to 0 dB; then continue to decrease test oscillator frequency until TI meter indicates -3 dB. Record frequency counter indication. Difference between frequencies recorded in (5) and (6) above will be between 4.5 and 5.5 kHz.

(7) Set BANDWIDTH switch to NARROW.

(8) Repeat (3) through (6) above. Difference between frequencies recorded in (5) and (6) above will be between 450 and 550 Hz.

(9) Set **BANDWIDTH** switch to **WIDE.**

(10) Repeat technique of (3) through (9) above for TI band switch positions, **FREQUENCY** dial indications and test oscillator/signal generator frequencies listed in table 7. Bandwidth will be between limits specified.

b. Adjustments. No adjustments can be made.

Table 7. Bandwidth

Test instrument			Test oscillator/ signal generator frequency (MHz)	Test instrument bandwidth indications (kHz)	
BAND switch positions	**FREQUENCY** dial Indications	**BANDWIDTH** settings		Min	Max
8	4.0	WIDE	4	**45**	**55**
8	4.0	NARROW	4	**4.5**	**5.5**
11 [1]	40	WIDE	40	**450**	**550**
11	40	NARROW	40	**45**	**55**

[1] Set **ATTENUATOR** switch to **80/100** and replace test osicillator with signal generator.

12. IF Rejection

a. Performance Check

(1) Connect test oscillator 50- Ω output to TI **RF INPUT.**

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

(a) **ATTENUATOR** switch to **40/60.**

(b) **BANDWIDTH** switch to NARROW.

(c) Band switch to position 1 and **TUNING CONTROL** for a 22-kHz indication on **FREQUENCY** dial.

(3) Adjust test oscillator frequency to 22 kHz and fine-tune for peak indication on TI meter. Adjust test oscillator output as required.

(4) Adjust test oscillator output to 1 mV.

(5) Adjust **CAL** control for a full-scale indication on TI meter.

(6) Adjust test oscillator frequency to 175 kHz and increase output by 30 dB.

(7) Fine-tune test oscillator frequency for peak indication on TI meter. Meter indication will not exceed +5 dB.

(8) Set band switch to position 9 and **TUNING** control for an 8-MHz indication on **FREQUENCY** dial.

(9) Repeat (3) through (5) above, with test oscillator frequency adjusted to 8 MHz.

(10) Adjust test oscillator frequency to 1.6 MHz, and increase output by 30 dB.

(11) Repeat (7) above.

(12) Replace test oscillator with signal generator.

(13) Set band switch to position 11 and **TUNING** control for a 40-MHz indication on **FREQUENCY** dial.

(14) Adjust signal generator frequency to 40 MHz and fine-tune for peak indication on TI meter. Adjust signal generator output as required.

(15) Adjust signal generator output to 10 mV.

(16) Repeat (5) above.

(17) Replace signal generator with test oscillator.

(18) Adjust test oscillator frequency to 8.7 MHz and output to +3 dBm.

(19) Fine-tune test oscillator frequency for peak indication on TI meter. Meter indication will not exceed +5 dB.

b. Adjustments. No adjustments can be made.

13. Final Procedure

a. Deenergize and disconnect all equipment.

b. Annotate and affix DA Label/Form in accordance with TB 750-25.

SECTION IV

CALIBRATION PROCESS FOR

INTERFERENCE ANALYZER AN/URM-200,

(ELECTRO-METRICS, MODEL EMC-25 (SERIES))

14. Preliminary Instructions

a. The instructions outlined in paragraphs **14** and **15** 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 and TM 11-6625-2949-14 for this TI.

d. When indications specified in paragraphs 16 through 20 are not within tolerance, perform the power supply check prior to making adjustments. After adjustments are made, repeat paragraphs **16** through **20.** 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.

15. Equipment Setup

WARNING

HIGH VOLTAGE is used or exposed during the perform ante of this calibration. DEATH ON CONTACT may result if personnel fail to observe safety precautions.

a. Insure that **POWER** switch is in off (down) position. Set line switch **(AC INPUT)** on rear panel to 110 or 115-V position.

b. Connect TI to 115-V ac source.

NOTE

The TI is normally supplied with a rechargeable battery pack. Calibration can be accomplished without this pack.

c. Position controls as listed in (1) through (12) below:

(1) **ATTENUATOR** switch to **40/60.**

(2) **BANDWIDTH** switch to **WIDE.**

(3) **CONTROL LOCAL-REMOTE** switch to **LOCAL.**

(4) **BAND STEP** switch to **1** and **TUNING (COARSE and FINE)** controls for a 10-kHz indication on frequency dial.

(5) **TUNING MANUAL-START** switch to **MANUAL.**

(6) **DETECTION** switch to **CARRIER.**

(7) **DWELL** and **THRESHOLD** controls fully CCW.

(8) **CAL** pushbutton released and **CAL** level control to midrange.

(9) **AFC** switch to **OFF.**

(10) **VOL** control fully CCW.

(11) **AM-FM** switch to **AM.**

(12) **AUTO-SWEEP** slide switch less than 1, **AUTO-SWEEP START** pushbutton released (out).

d. Set **POWER** switch to **ON** and allow sufficient time for warmup.

16. Frequency

a. Performance Check

(1) Connect test oscillator 50- **Ω** output to frequency counter input and TI **RF INPUT.**

(2) Adjust test oscillator controls for an output frequency of 10 kHz and adjust output level controls for a 10-dB indication on TI meter.

(3) Adjust test oscillator frequency controls for peak indication on TI meter. While readjusting output level controls for a 10-dB indication on TI meter.

(4) Set **BANDWIDTH** switch to **NARROW** and repeat (3) above. Frequency counter will indicate between 9.8 and 10.2 kHz.

(5) Set **BANDWIDTH** switch to **WIDE** and repeat technique of (2) through (4) above for **BAND STEP** switch positions, **FREQUENCY** dial indications, and test oscillator/signal generator frequencies listed in table 8. Frequency counter will indicate within limits specified.

b. No adjustments can be made.

Table 8. Frequency Range and Accuracy Check

Test instrument		Test oscillator/ signal generator frequency	Frequency counter Indications	
BAND STEP switch positions	**FREQUENCY** dial indications		Min	Max
1	34 kHz	34 kHz	33.320 kHz	34.680 kHz
2	55 kHz	55 kHz	53.900 kHz	56.100 kHz
2	75 kHz	75 kHz	73.500 kHz	76.500 kHz
3	110 kHz	110 kHz	107.800 kHz	112.200 kHz
3	150 kHz	150 kHz	147.000 kHz	1530000 kHz
4	200 kHz	200 kHz	196.000 kHz	204.000 kHz
4	240 kHz	240 kHz	235.200 kHz	244.800 kHz
5	400 kHz	400 kHz	392.000 kHz	408.000 kHz
5	500 kHz	500 kHz	490.000 kHz	510.000 kHz
6	.8 MHz	800 kHz	784.000 kHz	816.000 kHz
6	1.1 MHz	1100 kHz	1078.000 kHz	1122.000 kHz
7	1.8 MHz	1.8 MHz	1764.000 kHz	1836.000 kHz
7	2.4 MHz	2.4 MHz	2352.000 kHz	2448.000 kHz
8	4.0 MHz	4.0 MHz	3920.000 kHz	4080.000 kHz
8	5.5 MHz	5.5 MHz	5390.000 kHz	5610.000 kHz
9	9.0 MHz	900 MHz	8820.000 kHz	9180.000 kHz
9 [1]	12 MHz	12 MHz	11.760 MHz	12.240 MHz
10	22 MHz	22 MHz	21.560 MHz	22.440 MHz
10	30 MHz	30 MHZ	29.400 MHz	30.600 MHz
11	35 MHz	35 MHz	34.300 MHz	35.700 MHz
11	45 MHz	45 MHz	44.100 MHz	45.900 MHz
12	80 MHz	80 MHz	78.400 MHz	81.600 MHz
12	100 MHz	100 MHz	98.000 MHz	102.000 MHz
13	160 MHz	160 MHz	156.800 MHz	163.200 MHz
13	200 MHz	200 MHz	196.000 MHz	204.000 MHz

See footnotes at end of table.

Table 8. Frequency Range and Accuracy Check - Continued

Test instrument		Test oscillator signal generator frequency	Frequency counter indications	
BAND STEP switch positions	FREQUENCY dial indications		Min	Max
14	350 MHz	350 MHz	343.000 MHz	357.000 MHz
14	500 MHz	500 MHz	490.000 MHz	5100000 MHz
15 [2]	700 MHz	700 MHz	686.000 MHz	714.000 MHz
15	1000 MHz	1000 MHz	980.000 MHz	1020.000 MHz

[1] Replace test oscillator with signal generator.
[2] Connect frequency doubler (Hewlett-Packard, Model 11690A) to signal generator output.

17. Voltage Accuracy and Frequency Response

a. Performance Check

(1) Connect equipment as shown in figure 1, connection A.
(2) Position controls as listed in (a) through (c)below:

(a) ATTENUATOR switch to 40/60.

(b) BANDWIDTH switch to WIDE

(c)BAND STEP switches to position 1 and TUNING (COARSE and FINE) controls for a 10-kHz indication on FREQUENCY dial.

(3) Set attenuator to 40 dB.
(4) Press CAL pushbutton and adjust CAL level control for a 0-dB indication on TI meter. Release CAL pushbutton.
(5) Adjust test oscillator frequency to 10 kHz and output for an upper-scale indication on TI. Fine tune test oscillator for peak indication.
(6) Adjust test oscillator output for a 0-dB indication on TI meter. Add test oscillator output attenuator setting and meter indication to test report value of attenuator. Computed result will be between -65 and -69 dB if not, perform b below.

(7) Adjust test oscillator output and attenuator for a +20-dB indication on TI meter. Add test oscillator output attenuator setting and meter indication to test report value of attenuator. Computed result will be between -45 and -49 dB.

(8) Repeat technique of (7) above for a -20 dB TI meter indication. Computed result will be between -85 and -89 dB.
(9) Repeat technique of (4) through (6) above for BAND STEP switch positions, FREQUENCY dial indications and test oscillator frequencies listed in table 9.
(10) Connect equipment as shown in figure 1, connection B. Set attenuator to 60 dB.
(11) Set BAND STEP switches to position 10 and adjust TUNING, (COARSE and FINE) controls for a 22-MHz indication on FREQUENCY dial. Repeat (4) above.
(12) Adjust signal generator frequency to 22 MHz and output for an upper-scale indication on TI meter. Fine-tune signal generator for peak indication.
(13) Adjust signal generator output for a 0-dB indication on TI meter. Add power meter indication to test report value of attenuator. Computed result will be between -65 and -69 dB, if not perform b below.

(14) Set **BAND STEP** switches to position 11 and adjust **TUNING, (COARSE** and **FINE)** controls for a 35-MHz indication on **FREQUENCY** dial.

(15) Set attenuator to 40 dB.

(16) Repeat (4) above.

(17) Adjust signal generator frequency to 35 MHz and output for an upper-scale indication on TI meter. Fine tune signal generator for peak indication.

(18) Adjust signal generator output for a 0-dB indication on TI meter. Add power meter indication to test repeat value of attenuator. Computed result will be between -45 and -49 dB, if not perform b below.

(19) Repeat technique of (14) and (16) through (18) above for **BAND STEP** switch positions, **FREQUENCY** dial indications, and signal generator frequencies listed in table 10.

b. Adjustments

NOTE

Place TI in its normal operating position with front section overhanging test bench to allow access to adjustments.

(1) Remove TI bottom cover.

(2) Connect equipment as shown in figure 1, connection A. Set attenuator to 40 dB.

(3) Set **BAND STEP** switch to position 3 and **TUNING (COARSE** and **FINE)** controls for a 100-kHz indication on **FREQUENCY** dial. Set **ATTENUATOR** switch to **40/60.**

(4) Adjust test oscillator frequency to 100 kHz and output for an upper-scale indication on TI meter. Fine tune oscillator for peak indication.

(5) Adjust test oscillator output for a -67 -dB input to TI. (Test report value of attenuator must be added to test oscillator output indications).

(6) Adjust **CAL** level control for a 0-dB indication on TI meter.

(7) Press **CAL** pushbutton and adjust R27 (fig. 2) for a 0-dB indication on TI meter (R).

NOTE

The **CAL** pushbutton must be pressed and **CAL** level control adjusted for a 0-dB indication on TI meter after band switches and **TUNING, (COURSE** and **FINE)** controls are changed in (8), (10), and (13) below.

Table 9. Voltage Accuracy and Low Frequency Response

Test oscillator frequency	Test instrument		
	BAND STEP switch positions	**FREQUENCY** dial indications	Adjustments (fig. 2)
800 kHz	6	800 kHz	R26 (R)
55 kHz	2	55 kH Z	R261
400 kHz	5	400 kHz	R261
1.8 MHz	7	1.8 MHz	R261
4.0 MHz	8	4.0 MHz	R25 (R)
9.0 MHz	9	9.0 MHz	R24 (R)

[1]Repeat these checks while adjusting R26 for best in-tolerance condition.

Table 10. Voltage Accuracy and High Frequency Response

Signal generator frequency (MHz)	Test instrument		
	BAND STEP switch positions	FREQUENCY dial indications (MHz)	Adjustments (fig. 2) (R)
80	12	80	R20
160	13	160	R21
350	14	350	R22
700 [1]	15	700	A1P2R23

[1] Connect frequency doubler (Hewlett-Packard, Model 11690 A) to signal generator output.

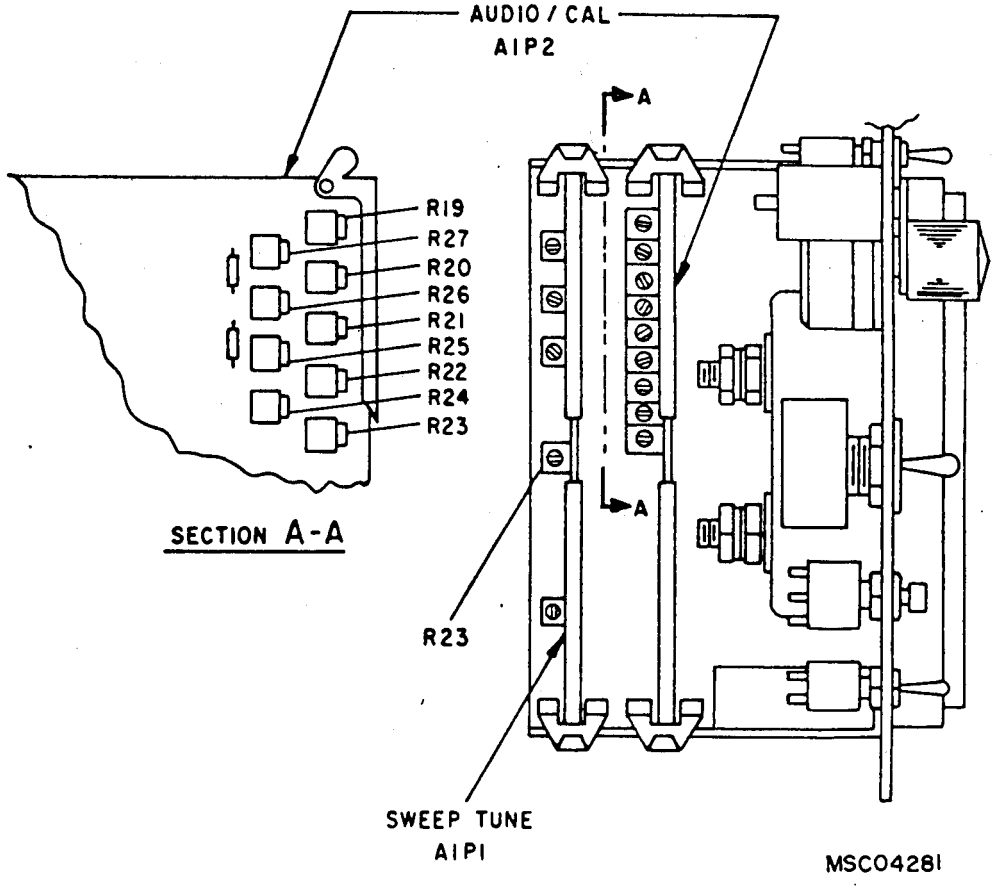

Figure 2. Adjustment locations.

(8) Set **BAND STEP** switches to position 1 and adjust **TUNING, (COARSE** and **FINE)** controls for a 20 kHz **FREQUENCY** dial indication.

(9) Repeat technique of (4) and (5) above for test oscillator output frequency of 20 kHz. If TI meter does not indicate 0. dB, record the error.

(10) Set **BAND STEP** switches to position 4 and adjust TUNING, **(COARSE** and **FINE** controls for a 200 kHz **FREQUENCY** dial indication.

(11) Repeat technique of (4) and (5) above for test oscillator output frequency of 200 kHz. Of TI meter does not indicate 0 dB, record the error.

(12) If error recorded in (9) and (11) above exceeds ±l dB. Repeat (3) through (11) above and readjust R27 (fig. 2) for best in-tolerance condition.

(13) Repeat technique of (3) through (5) above for TI **BAND STEP** switch positions, FREQUENCY dial indications, and test oscillator frequencies listed in table 9 while adjusting corresponding adjustment in table 9 for a 0 ±l dB indication on TI meter.

(14) Connect equipment as shown in figure 1, connection B. Set attenuator to 60 dB.

(15) Set **BAND STEP** switches to position 10 and **TUNING, (COARSE** and **FINE)** controls for a 22 MHz indication on **FREQUENCY** dial.

(16) Press **CAL** pushbutton and adjust **CAL** level control for a 0-dB indication on TI meter. Release **CAL** pushbutton.

(17) Adjust signal generator frequency to 22 MHz and output for an upper-scale indication on TI meter. Fine tune signal generator for peak indication.

(18) Adjust signal generator output for a -67 dB input to TI (power meter indication must be added to test report value of attenuator).

NOTE

If an out-of-tolerance condition is noted in (19) below, perform adjustment and then repeat the 9-MHz check in (13) above while readjusting R24 (fig. 2) for best in-toleranee results.

(19) If TI meter does not indicate 0 ±2 dB adjust R24 (fig. 2) until TI meter indicates within tolerance.

(20) Set **BAND STEP** switches to position 11 and adjust **TUNING, (COARSE** and **FINE)** controls for a 35-MHz indication on **FREQUENCY** dial.

(21) Set attenuator to 40 dB and. repeat (16) above.

(22) Adjust signal generator frequency to 35 MHz and output for an upper-scale indication on T1 meter. Fine tune signal generator for peak indication.

(23) Adjust signal generator output for a -47 dB input to TI (power meter indication must be added to test report value of attenuator).

(24) Adjust R19 (fig. 2) for a 0-dB indication on TI meter (R).

(25) Repeat technique of (20) through (24) above for **BAND STEP** switch positions, **FREQUENCY** dial indications, and signal generator frequencies listed in table 10. While adjusting corresponding adjustment as listed in table 10.

18. Attenuation

a. Performance Check

(1) Connect equipment as shown in figure 1, connection A.

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

(a) **ATTENUATOR** switch to **40/60.**

(b) **BANDWIDTH** switch to **NARROW.**

(c) **BAND STEP** switches to position 6 and **TUNING, (COARSE** and **FINE)** controls for a 0.8-MHz indication on **FREQUENCY** dial.

(3) Set attenuator to 60 dB.

(4) Adjust test oscillator frequency to 800 kHz and and output for an upper-scale indication on TI meter. Fine tune test oscillator for peak indication.

(5) Adjust test oscillator output for a -67 dB input to TI (test repeat value of attenuator must be added to test oscillator output indications).

(6) Adjust CAL level control for a 0-dB reference indication on TI meter.

NOTE

Change setting of attenuator as required to obtain 0 dB indication on TI meter in (7) through (9) and (18) through (20) below.

(7) Set **ATTENUATOR** switch (to **60/80** and adjust test oscillator output for a 0 dB indication on TI meter.

(8) Add test oscillator output attenuator setting and meter indication to test report value of attenuator. Computed result will be between -46 and -48 dB.

(9) Repeat technique of (7) and (8) above for **ATTENUATOR** switch settings listed in table 11. Computed results will be within limits specified for frequency being applied.

(10) Set **BAND STEP** switches to position 8 and adjust **TUNING (COARSE** and **FINE)** controls for a 4-MHz indication on **FREQUENCY** dial. Set **ATTENUATOR** switch to **40/60.**

(11) Repeat (3) through (9) above with test oscillator frequency adjust to 4 MHz.

(12) Connect equipment as shown in figure 1, connection B.

(13) Position control as listed in **(a)** and **(b)** below:

(a) **ATTENUATOR** switch to **40/60.**

(b) **BAND STEP** switches and **TUNING, (COARSE and FINE)** controls for a 35 MHz indication on **FREQUENCY** dial.

(14) Set attenuator to 40 dB.

(15) Adjust signal generator frequency to 35 MHz and output for an upper-scale indication on TI meter. Fine tune signal generator for peak indication.

(16) Adjust signal generator output for a -47 dB input to TI (test report value of attenuator must be added to power meter indication).

(17) Repeat (6) above.

(18) Set **ATTENUATOR** switch to 60/80 and adjust signal generator output for a 0-dB indication on TI meter

(19) Add power meter indication to test report value of attenuator. Computed result will be between -26 and -28 dB.

(20) Repeat technique of (18) and (19) above for **ATTENUATOR** switch settings listed in table 11. Computed results will be within limits specified for frequency being applied.

(21) Connect frequency doubler (Hewlett-Packard, Model 11690A) between power splitter and signal generator output.

(22) Position controls as listed in **(a)** and **(b)** below:

(a) **ATTENUATOR** switch to **40/60.**

(b) **BAND STEP** switches to position 15 and **TUNING, (COARSE** and **FINE)** controls for a 1000-MHZ indication on **FREQUENCY** dial.

(23) Repeat (14) through (20) above with signal generator frequency adjusted to 1000 MHz.

b. Adjustments. No adjustments can be made.

Table 11. Attenuator Accuracy

Test instrument ATTENUATOR switch settings (dB)	Computed results (dB)			
	0.8 and 4 MHz		35 and 1000 MHz	
	Min	Max	Min	Max
80/1 00	-28	-26	-8	-6
100	-8	-6	---	---
20/40	-88	-86	-68	-66
0/20	-108	-106	-88	-86

19. Bandwidth

a. Performance Check

(1) Connect test oscillator 50- Ωoutput to frequency counter input and TI RF INPUT.

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

(a) ATTENUATOR switch to 100 (black value).

(b) BAND STEP switches to position 6 and TUNING, (COURSE and FINE) controls for a 0.8-MHz indication on FREQUENCY dial.

(c) DETECTION switch to CARRIER.

(d) CAL control fully ccw.

(e) BANDWIDTH switch to WIDE.

(3) Adjust test oscillator frequency to 800 kHz and output for an upper-scale indication on TI meter. Fine tune test "oscillator for peak indication.

(4) Adjust test oscillator output for 0-dB indication on TI meter.

(5) Increase test oscillator frequency until TI meter indicates -3 dB. Record frequency counter indication.

(6) Decrease test oscillator frequency until TI meter returns to 0 dB; then continue to decrease frequency until meter indicates -3 dB. Record frequency counter indication. Difference between frequencies recorded in (5) and (6) above will be between 4.5 and 5.5 kHz.

(7) Set BANDWIDTH switch to NARROW.

(8) Repeat (3) through (6) above. Difference between frequencies recorded in (5) and (6) above will be between 450 and 550 Hz.

(9) Set BANDWIDTH switch to WIDE.

(1 0) Repeat technique of (3) through (9) above for BAND STEP switch positions, FREQUENCY dial indications, and test oscillator/ signal generator frequencies listed in table 12. Bandwidth will be within limits specified.

b. Adjustments. No adjustments can be made.

Table 12. Bandwidth

Test instrument			Test oscillator/ signal generator frquency (MHz)	Test instrument bandwidth indications (kHz)	
BAND switch positions	FREQUENCY dial Indications	BANDWIDTH settings		Min	Max
8	4.0	WIDE	4	45	55
8	4.0	NARROW	4	4.5	5.5
11 [1]	40	WIDE	40	450	550
11	40	NARROW	40	45	55

[1] See ATTENUATOR switch 80/100 and replace test oscillator with signal generator.

20. IF Rejection

a. Performance Check

(1) Connect test oscillator to TI **RF INPUT.**

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

(a) **ATTENUATOR** switch to 40/60.

(b) **BANDWIDTH** switch to **NARROW.**

(c)**BAND STEP** switches to position 1 and **TUNING, (COARSE.** and **FINE)** controls for a 22-kHz indication on **FREQUENCY** dial.

(3) Adjust test oscillator frequency to 22 kHz and fine-tune for peak indication on TI meter. Adjust test oscillator output as required.

(4) Adjust test oscillator output to 1 mV.

(5) Adjust **CAL** control for a full-scale indication on TI meter.

(6) Adjust test oscillator frequency to 175 kHz and increase output by 30 dB.

(7) Fine-tune test oscillator frequency for peak indication on TI meter. Meter indication will not exceed +5 dB.

(8) Set **BAND STEP** switches to position 9 and adjust **TUNING, (COARSE** and **FINE)** controls for a 8-MHz indication on **FREQUENCY** dial.

(9) Repeat (3) through (5) above, with test oscillator frequency adjusted to 8 MHz.

(10) Adjust test oscillator frequency to 1.6 MHz, and increase output by 30 dB.

(11) Repeat (7) above.

(12) Replace test oscillator with signal generator.

(13) Set **BAND STEP** switches to position 11 and adjust **TUNING, (COARSE** and **FINE)** controls for a 40-MHz **FREQUENCY** dial indication.

(14) Adjust signal generator frequency to 40 MHz, and fine-tune for peak indication on TI meter. Adjust signal generator output as required.

(15) Adjust signal generator out put to 10 mV.

(16) Repeat (5) above.

(17) Replace signal generator with test oscillator.

(18) Adjust test oscillator frequency to 8.7 MHz and amplitude to +3 dBm.

(19) Fine-tune test oscillator frequency for peak indication on TI meter. Meter indication will not exceed +5 dB.

b. Adjustments. No adjustments can be made.

*U.S. GOVERNMENT PRINTING OFFICE: 1991-531-038/40051

21. Power Supply

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

a. Performance Check

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

(a) DETECTION switch to CARRIER.

(b) ATTENUATOR switch to 0/20.

(c) BAND STEP switches to position 7.

(d) COARSE TUNING control as required.

(e) FINE TUNING control to mechanical zero.

(f) TUNING MANUAL-START switch to MANUAL.

(g) AFC switch to OFF.

(h) DWELL and THRESHOLD controls fully CCW.

(i) CAL level control fully CCW.

(j) CONTROL switch to LOCAL.

(2) Remove bottom cover from TI.

(3) Connect digital voltmeter positive lead to A5TB1-10 and negative lead to A5TB1 (GND) -15 (fig. 3). If digital voltmeter does not indicate between +11.95 and +12.05 V dc, perform b(1) below.

(4) Move digital voltmeter positive lead to A5TB1-11 (fig. 3). If digital voltmeter does not indicate between -5.95 and -6.05 V dc, perform b(2) below.

(5) Adjust COARSE TUNING control to low frequency end of band 7.

(6) Connect digital voltmeter negative lead to A5TB1 (GND) -15 (fig. 3) and positive lead to tuning voltage test point (labeled "TV" on tuner cover). If digital voltmeter does not indicate between -0.05 and +0.05 V dc, perform b(3) below.

(7) Adjust COARSE TUNING control to high end of band 7. If digital voltmeter does not indicate between +97.9 and +98.1 V dc, perform b(4) below.

b. Adjustments

(1) Adjust RI (+12 V) (fig. 3) for +12.00-V dc indication on digital voltmeter (R).

(2) Adjust R2 (-6 V) (fig. 3) for -6.00-V dc indication on digital voltmeter (R).

(3) Adjust TUNING REGULATOR ZERO VOLTAGE ADJUST R36 (fig. 3) for 0.00-V dc indication on digital voltmeter (R).

(4) Adjust (AIP1) R23 (fig. 2) for +98.0-V dc indication on digital voltmeter (R).

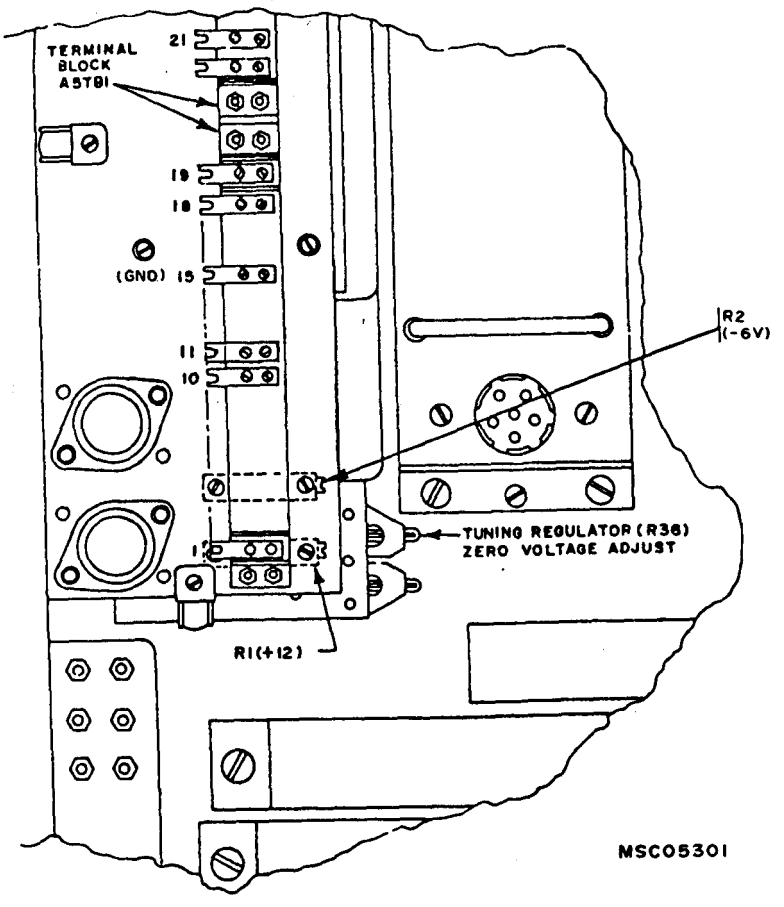

Figure 3. Power supply - adjustment locations.

22. 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:

CARL E. VUONO
General, United States Army
Chief of Staff

Official:
WILLIAM J. MEEHAN II
Brigadier General, United States Army
The Adjutant General

Distribution:
To be distributed in accordance with DA Form 12-34C, Block No. 319, requirements for calibration procedures publications.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1989—631-164/000167

PIN NO: 052116-000