TB 9-6625-1946-50

CHANGE 1

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR SWEEP GENERATOR SG-677/U

Headquarters, Department of the Army, Washington, DC
8 September 1977

TB 9-6625-1946-50, 16 October 1975, is changed as follows:

Page 5, Paragraph 10a(3) is superseded as follows:

(3) Indication on frequency counter will not exceed 500 kHz. At this point a null should be detected on TI RF OUTPUT meter.

Page 6, paragraph 12a(5). In line 1, change "FINE" to read "COARSE."

By Order of the Secretary of the Army:

BERNARD W. ROGERS
General, United States Army
Chief of Staff

Official:

J. C. PENNINGTON
Brigadier General, United States Army
The Adjutant General

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CALIBRATION PROCEDURE FOR SWEEP GENERATOR, SG-677/U

Headquarters, Department of the Army, Washington, DC
16 October 1975

♦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 Aviation and Missile Command, ATTN: AMSAM-TMD-EP, Redstone Arsenal, AL 35898-5000. FAX to DSN 788-2313 (commercial 256-842-2313). A reply will be furnished directly to you.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Sweep Generator, SG-677/U. The manufacturer's manual was used as the prime source data in compiling these instructions. The sweep generator will be referred to as the "TI" (test instrument) throughout this bulletin.

a. Model Variations. Some models are equipped with additional markers.

b. Time and Technique. The time required for this calibration is approximately 4 hours, using the microwave technique.

2. Calibration Data Card, DA Form 2416

a. Forms, records, and reports required for calibration personnel at all levels are prescribed by TM 38-750. DA Form 2416 must be annotated in accordance with TM 38-750 for each calibration performed.

b. Adjustments to be reported on DA Form 2416 are designated (R) at the end of the sentence in which they appear. When adjustments are in tables, the (R) will follow 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 performance	Parameters specification.
RF output	Range: 0 to 0.6 v rms Accuracy: 0.5 v rms into 50 min
Frequency dial	Range: 300 to 1200 MHz (UHF) 0.5 to 300 MHz (VHF) Accuracy: ±1 dial div (10 MHz)
Sweep width: NAR WIDE LINEARITY	Variable from 10kHz to 1MHz Variable from 500kHz to 400 MHz Within ±5% of sweep width
Internal markers	Range: 1 MHz Accuracy: ±0.01%
Attenuation	Range: 0 to 72 db Accuracy: ±2 db

SECTION II
EQUIPMENT REQUIREMENTS

4. Equipment Required. Table 2 identifies the specific equipment used in this calibration procedure. This equipment is issued with secondary transfer calibration standards set 4931-00-621-7877 and is to be used in performing this procedure. 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 accuracy 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 listed in table 3 are issued with secondary transfer calibration standards set 4931-00-621-7877 and are to be used in performing calibration procedure. When necessary, these items may be substituted by equivalent items unless specifically prohibited.

Table 2. Minimum Specifications of Equipment Required.

Item	Common name	Minimum use specifications	Manufacturer, model and part number
A1	AUTOTRANSFORMER	Range: 105 to 125 vac Accuracy: ±3%	General Radio, Model W10MT3AS3 (7910809).
A2	FREQUENCY COUNTER.	Range: 490 kHz to 1210 MHz Accuracy: ±.0025%	Systron-Donner, Model 1037M (7910823) w/Transfer Oscillator Systron-Donner, Model 1292 (7910648) P/O 7910628).
A3	MICROWAVE RECEIVER	Attenuation Range: 0 to 70 db. Accuracy: ±0.5%	PRD, Model 915-S10 (7923103).
A4	OSCILLOSCOPE	Range: 0 to 1 v Accuracy: ±3%	Tektronix, Model RMS561AMOD171 (7910655-4) w/Plug-ins Tektronix, Model 3A6 MOD (7911441-2) and Tektronix, Model 3B4MOD (7912040-2) (P/O 7911440).
A5	POWER METER	Range: 2 to 10 mw Accuracy: ±5%	Hewlett-Packard, Model Y10-431C (7910462-3 w/Thermistor Mount, Hewlett-Packard, Model 478A (7910461).
A6	SIGNAL GENERATOR	Range: 10 to 480 MHz	Hewlett-Packard, Model 608CR (8598927-2).
A7	VOLTMETER	Range: -30 to +200 vdc Accuracy: ±0.25 v	Dana, Model 5703-S-2127 (7912606).

Table 3. Accessories Required

Item	Common name	Description and part number
B1	ADAPTER	N jack to BNC plug (10519458)
B2	ADAPTER	BNC jack to N-plug (10519457)
B3	CABLE ASSEMBLY[1]	36-in., RG-223/U, BNC plug to TNC plug terminations (7923244).
B4	CABLE ASSEMBLY[2]	48-in., RG-58A/U, BNC plug terminations (10519140).
B5	CABLE ASSEMBLY[1]	6-in., RG-58A/U, BNC plug terminations (7907487-1).
B6	CABLE ASSEMBLY	36-in., RG-9A/U, N-plug terminations (10519061)
B7	Connector “T" type	N-type "T" connector, 2 jacks, 1 plug (7907472).

[1]Two required.

[2]Three required.

SECTION III
PRELIMINARY OPERATIONS

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 and item identification number as listed in tables 2 and 3. For the identification of equipment referenced by item numbers prefixed with A, see table 2, and for prefix B, see table 3.

WARNING

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

7. Equipment Setup

a. Remove TI from protective case.

b. Connect TI to autotransformer (A1) and adjust autotransformer for 115 vac.

c. Energize equipment and allow approximately 20 minutes for equipment to warm up and stabilize.

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

(1) RANGE switch to VHF.

(2) RF ATTENUATOR to 70.

(3) EXT MARKER SIZE to MID-RANGE.

(4) SWEEP WIDTH to WIDE.

(5) SWEEP WIDTH ADJUST fully clockwise.

(6) INT MARKERS to off (down).

(7) INT MARKERS SIZE to MID-RANGE.

(8) SWEEP RATE to VAR.

(9) SWEEP RATE ADJUST fully clockwise.

SECTION IV
CALIBRATION PROCESS

NOTE

Unless otherwise specified, verify the results of each test and take corrective action whenever the test requirement is not met before continuing with the calibration.

NOTE

When indications specified in paragraphs **9** through **14** are not within tolerance, perform the power supply check prior to making adjustments. After adjustments are made, repeat paragraphs **9** through **14**. Do not perform power supply check if all other parameters are within tolerance.

8. RF Output

a. Performance Check

(1) Connect power meter (A5) to TI RF OUTPUT, using adapter (B1).

(2) Adjust TI FREQUENCY dial to 100 MHz.

(3) Adjust TI RF OUTPUT control fully clockwise and RF ATTENUATOR to 0 dB.

(4) If power meter does not indicate at least 5 milliwatts, perform **b** below.

(5) Set TI RANGE switch to UHF and repeat (2) through (4) above at frequencies of 400, 800, and 1200 MHz.

b. Adjustments

(1) Set TI RANGE switch to UHF TI FREQUENCY dial to 1200 MHz, and the TI SWEEP WIDTH control to NAR position with TI SWEEP WITH ADJUST control counterclockwise.

(2) With TI RF OUTPUT control full clockwise, adjust R410 (fig. 1) (LEVEL MAX) for a 6-milliwatt indication on power meter (R).

(3) Readjust TI RF OUTPUT control for a 5-milliwatt indication on power meter, and adjust R562 (fig. 1) (METER CAL) for 0.5 volt rms as indicated on TI RF OUTPUT meter (R).

(4) Turn TI RF OUTPUT control fully counterclockwise and adjust R411 (fig. 1) (LEVEL MIN) for a power level 10 dB down from (3) above R.

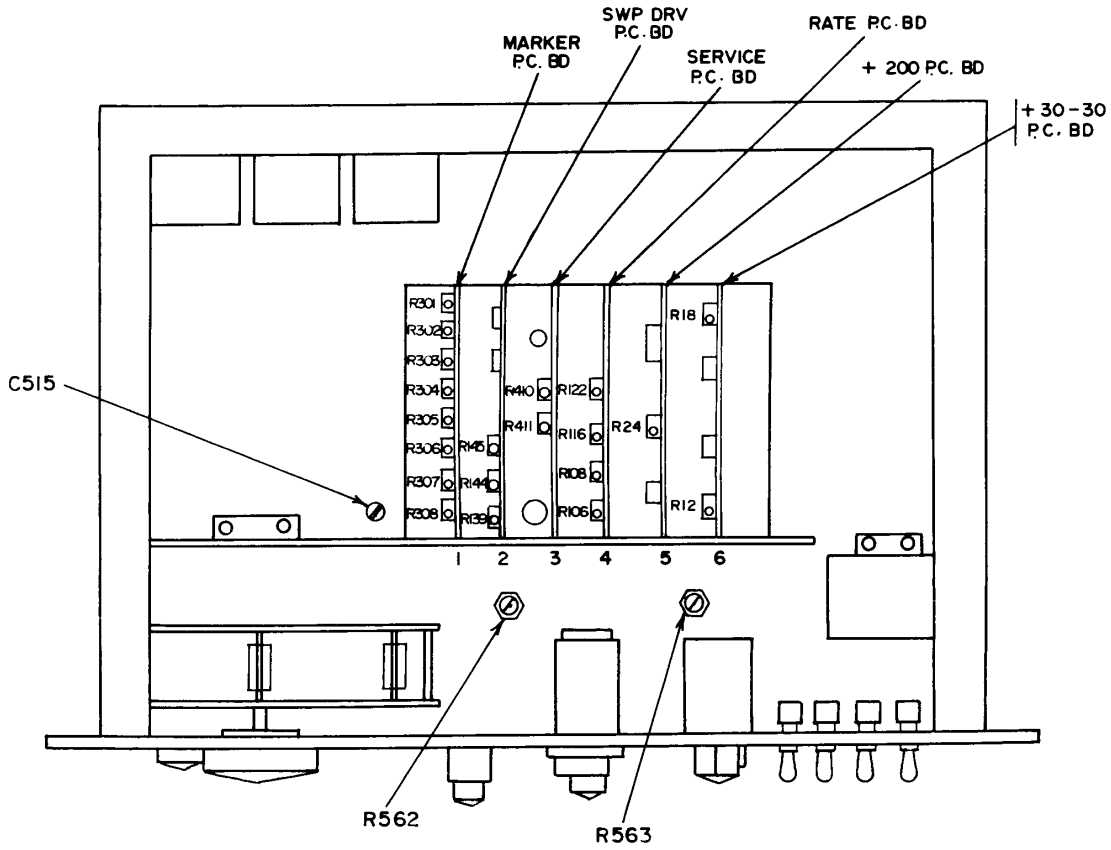

Figure 1. Adjustments locations - (top new).

9. Frequency Dial Accuracy

a. Performance Check

(1) Connect frequency counter (A2) to TI RF OUTPUT, using cable assembly (B4) and adapter (B2).

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

(a) RANGE switch to VHF.

(b) FREQUENCY dial to 0.5 MHz (red dial).

(c) RF ATTENUATOR control to 20 db.

(d) SWEEP WIDTH switch to CW.

(e) FINE TUNE to mid range.

(f) RF OUTPUT fully clockwise.

(3) Indication on frequency counter will not exceed 500 kHz. At this point a null should be detected on TI RF OUTPUT meter.

(4) Set TI RANGE switch to UHF, and TI FREQUENCY dial to 300 MHz.

(5) Frequency counter will indicate between 290 and 310 MHz.

(6) Repeat (4) and (5) above for FREQUENCY dial settings listed in table 4.

Table 4. Frequency Dial Accuracy

Test instrument **FREQUENCY** dial setting (MHz).	Frequency counter indications	
	Min	Max
400	390	410
600	590	610
800	790	810
1000	990	1010
1200	1190	1210

b. Adjustments. No adjustments can be made.

10. Rate Check

a. Performance Check

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

(a) FREQUENCY dial to 500 MHz.

(b) RF OUTPUT adjusted for 0.5 volt on TI meter.

(c) SWEEP WIDTH switch to NAR.

(d) SWEEP WIDTH ADJUST fully counterclockwise.

(e) SWEEP RATE to MAN.

(2) Set TI SWEEP RATE ADJUST fully counterclockwise.

(3) Record frequency counter (A2) indications.

(4) Set TI SWEEP RATE ADJUST fully clockwise.

(5) If frequency counter indications exceed 10 kHz from that recorded in (3) above, perform **b** below.

b. Adjustments

(1) Using voltmeter (A7), monitor the voltage (approx. +20 volts dc) at the front panel TI SCOPE HORIZ connector.

(2) Rotate the TI SWEEP RATE ADJUST control counterclockwise and then clockwise. The voltage will vary from 0 (counterclockwise) to 18 (clockwise) +1.8 volts dc.

(3) Connect cable assembly (B4) from the TI SCOPE HORIZ connector to the oscilloscope (A4) EXT HORIZ INPUT connector.

(4) Adjust the oscilloscope controls so that the beam is a dot centered on the extreme left vertical graticule line when the TI SWEEP RATE ADJUST control is counterclockwise, and centered on the extreme right vertical graticule line when the TI SWEEP RATE ADJUST control is clockwise.

NOTE

The oscilloscope is not adjusted to serve as a reference. Do not readjust its controls during calibration of the rate circuit.

(5) Set the TI SWEEP RATE control to the VAR position.

(6) Rotate the TI SWEEP RATE ADJUST control approx. $^3/_4$ clockwise.

(7) Adjust R108 (fig. 1) (UP TRIG POINT) so that the oscilloscope trace extends to the extreme right vertical graticule line (R).

(8) Adjust R116 (fig. 1) (LO TRIG POINT) so that the oscilloscope trace extends to the extreme left vertical graticule line (R).

(9) Alternately adjust R108 and R116 so that the oscilloscope trace extends from the extreme left to the extreme right vertical graticule lines.

(10) Set the SWEEP RATE control to the LINE position.

(11) Alternately adjust R122 (fig. 1) (LINE TRIG AMPL) for trace width and R106 (LINE DC LEVEL) for trace position so that the oscilloscope trace extends from the extreme left to the extreme right vertical graticule line (R).

(12) With the SWEEP RATE control set to the MAN position, note the extreme positions of the oscilloscope beam as the SWEEP RATE ADJUST control is rotated from counterclockwise to clockwise.

(13) Set the SWEEP RATE control to the VAR position and then to the LINE position. The oscilloscope trace extremes obtained from each of these positions will be in coincidence with the trace extremes of the MAN position.

11. Internal Markers

a. Performance Check

(1) Connect equipment as shown in figure 2.

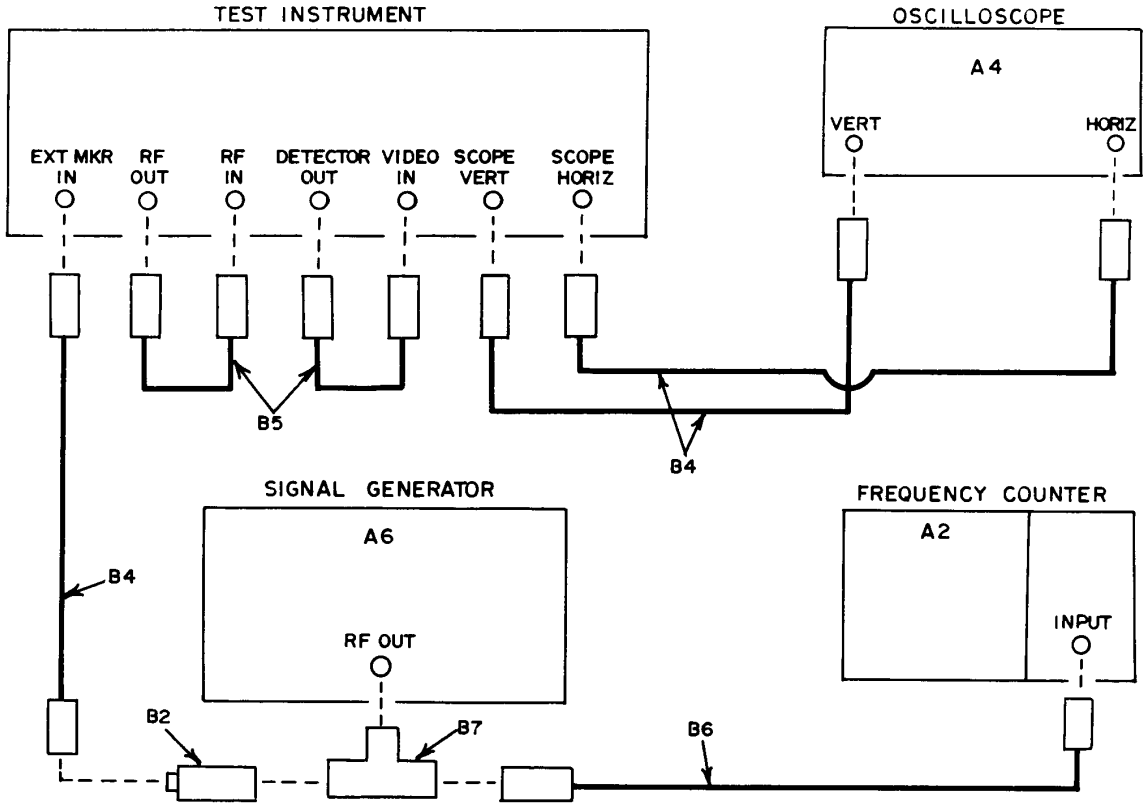

Figure 2. Internal markers - equipment setup.

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

(a) RANGE switch to VHF.

(b) EXT MARKER SIZE to mid range.

(c) SWEEP WIDTH switch to NAR.

(d) SWEEP WIDTH ADJUST approximately 1/3 clockwise.

(e) FREQUENCY control to 50 MHz.

(f) SWEEP RATE to VAR.

(g) SWEEP RATE ADJUST to fully clockwise.

(h) RF ATTENUATOR to 0 dB.

(i) RF OUTPUT to 0.5 volt.

(3) Adjust oscilloscope (A4) for 4 x 10-centimeter box pattern horizontal display in external sweep position.

(4) Adjust signal generator (A6) for 10 MHz as indicated on frequency counter (A2).

(5) Adjust the TI COARSE TUNING control to position the external marker near the center of the scope presentation.

(6) Set TI HM-1 INT MARKER (1 MHz) switch to ON. Adjust SWEEP WIDTH ADJUST for 3 or 4 markers. If markers are not 30 millivolts peak-to-peak, perform **b**(1) below.

(7) Slowly adjust the signal generator frequency control for a zero beat with the 50th marker on oscilloscope.

(8) Divide the frequency counter indication by 10. The quotient will be between 0.999 and 1.001 MHz.

(9) Set the HM-1 INT MARKER switch to off (down) and set the HM-10 INT MARKER 10 MHz switch to ON. Readjust TI SWEEP WIDTH ADJUST for 3 or 4 markers. If a 100-millivolt peak-to-peak marker cannot be obtained after adjusting INT MARKER SIZE, perform **b**(2) below.

(10) Repeat (7) above.

(11) The frequency counter will indicate between 9.9990 and 10.0010 MHz.

(12) Set TI HM-10 INT MARKER switch to off and set the HM-50 INT MARK (50 MHz) switch to ON. Readjust SWEEP WIDTH ADJUST for 3 or 4 markers. If a 100-millivolt peak-to-peak marker cannot be obtained by adjusting INT MARKER SIZE, perform **b**(3) below.

(13) Repeat (7) above.

(14) Multiply frequency counter indication by 5. The quotient will be between 49.995 and 50.005 MHz.

(15) Use above technique for units equipped with additional markers, using equivalent adjustments.

b. Adjustments

(1) Adjust R301 (fig. 1) for a 30-millivolt peak-to-peak 1 MHz marker.

(2) Adjust R302 (fig. 2) for a 100-millivolt peak-to-peak 50 MHz marker (R).

(3) Adjust R303 (fig. 1) for a 100-millivolt peak-to-peak 50 MHz marker (R).

12. Sweep Drive

a. Performance Check

(1) Connect equipment as shown in figure 3.

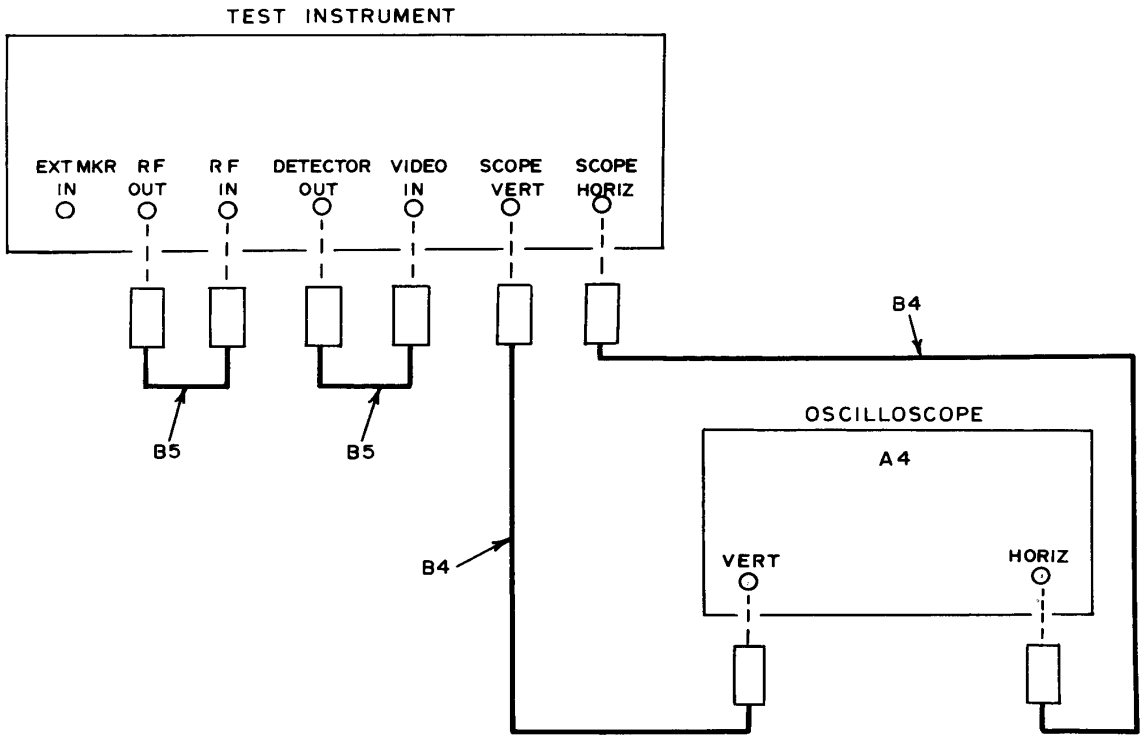

Figure 3. Sweep drive - equipment setup.

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

(a) RANGE switch to UHF.

(b) FREQUENCY control to 1000 MHz.

(c) FINE TUNING control to mid range.

(d) SWEEP WIDTH switch to WIDE.

(e) SWEEP WIDTH ADJUST clockwise.

(f) RF OUTPUT control for 0.5 volt rms on TI RF OUTPUT meter.

(3) Adjust oscilloscope (A4) to obtain a display as shown in figure 4.

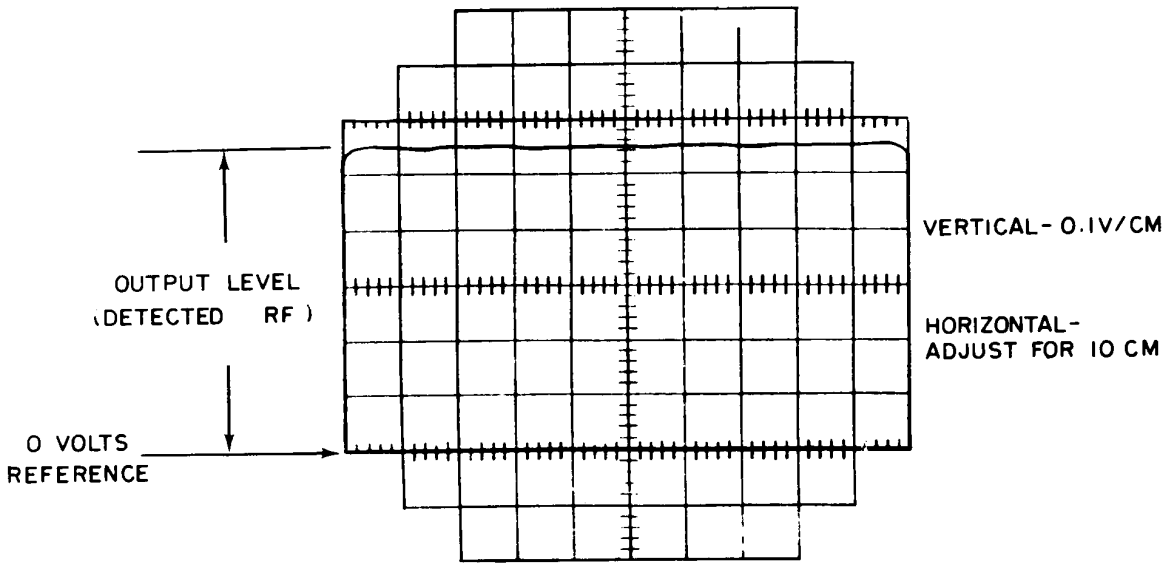

Figure 4. Oscilloscope display (typical).

(4) Set the HM-50 INT MARKER (50 MHz) switch to ON.

(5) Slowly rotate the SWEEP WIDTH ADJUST control counterclockwise until only one internal frequency marker remains on the oscilloscope trace. (The marker represents a frequency of 1000 MHz.)

(6) Simultaneously continue to slowly rotate the SWEEP WIDTH ADJUST control counterclockwise and adjust the FINE TUNING CAL control to maintain the marker near the center of the oscilloscope trace.

(7) While observing the 1000-MHz marker, slowly rotate the SWEEP WIDTH ADJUST control clockwise and note the position of this marker when the control is at the maximum clockwise position.

NOTE

When the SWEEP WIDTH ADJUST control reaches the maximum clockwise position the 1000-MHz marker will usually be to the right of the center vertical graticule line.

(8) Rotate the SWEEP WIDTH ADJUST control approximately $^1/_3$ clockwise.

(9) Adjust R139 (fig. 1) (MED SWCF) so that the 1000-MHz marker position coincides with the 1000 MHz marker position when the SWEEP WIDTH ADJUST control is clockwise (7) above.

(10) Rotate the SWEEP WIDTH ADJUST control clockwise.

(11) Adjust R144 (fig. 1)(WIDE SW LIMIT) counterclockwise until the oscilloscope trace stops shifting (approximately two turns).

(12) Determine the position of the 1000-MHz marker on the oscilloscope trace, (i.e., rotate the SWEEP WIDTH ADJUST control counterclockwise until only one marker remains on the oscilloscope trace then return the control to the clockwise position).

(13) Using the 1000-MHz marker as a reference, determine the position of the 750-MHz marker (5th marker to left of 1000 MHz marker).

(14) Adjust R145 (fig. 1) (WIDE SWCF) counterclockwise until the 750 MHz marker is at the extreme left of the horizontal trace.

(15) Determine the position of the 1000 MHz marker on the oscilloscope trace (step 12).

(16) Using the 1000 MHz marker as a reference, determine the position of the 1150 MHz marker (3rd marker to right of the 1000-MHz marker).

NOTE

Both the 750-MHz marker (extreme left) and the 1150-MHz marker are now present on the oscilloscope display. It is essential to note the positions of these markers now and during the adjustments performed in the nod step of this procedure.

(17) Alternately adjust R145 and R144 clockwise until the 750 and 1150-MHz markers are positioned at the extreme ends of the horizontal trace as shown in figure 5.

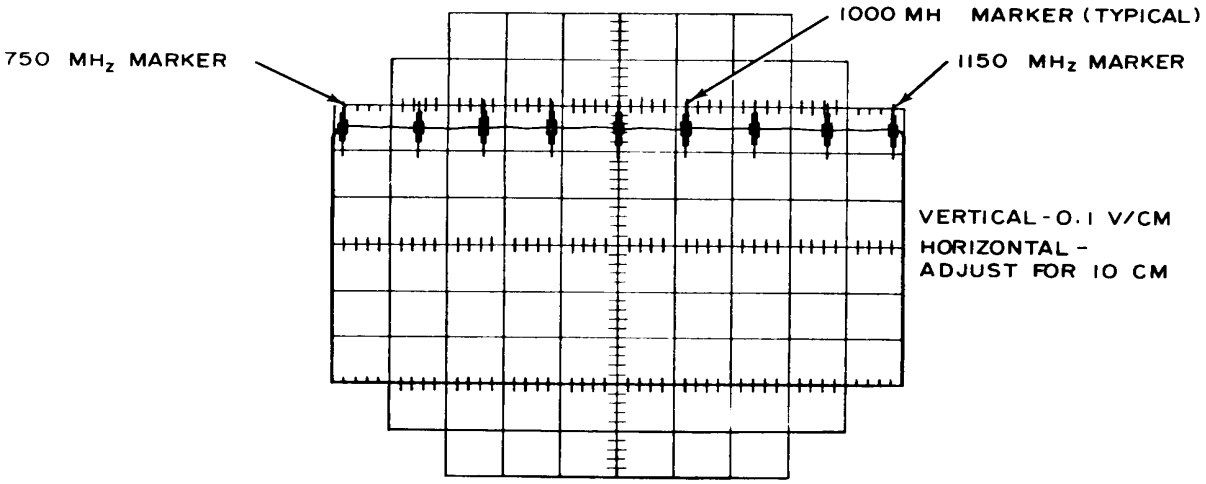

Figure 5. Oscilloscope display (typical).

(18) Set the SWEEP WIDTH control to the NAR position.

(19) Rotate the SWEEP WIDTH ADJUST control counterclockwise until the 1000-MHz marker approximates that shown in figure 6.

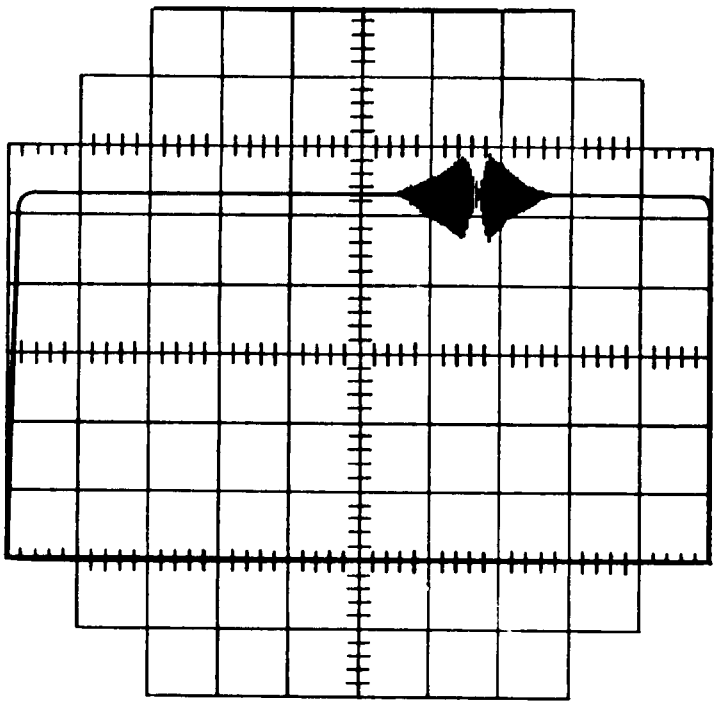

Figure 6. Internal frequency marker.

(20) Slowly adjust the FREQUENCY dial to about the 700-MHz point to position the 700-MHz marker near the center of the oscilloscope trace.

NOTE

The 700-MHz marker may not be present on the oscilloscope trace when the FREQUENCY dial is set exactly on 700, but will appear when the dial is slowly rotated within one dial division of the 700-MHz point.

(21) Note the extent of deviation between this FREQUENCY dial setting and the 700-MHz mark and adjust the FREQUENCY dial to the midpoint of this deviation.

(22) Slowly adjust the FINE TUNING control to position the 700-MHz marker near the center of the oscilloscope trace.

(23) Set the RANGE switch to the VHF position.

(24) Set the FREQUENCY dial to 300 MHz (red).

(25) Slowly adjust C515 (fig. 1) (CW OSC FREQ ADJ) to position the 300 MHz marker near the center of the oscilloscope trace (R).

(26) Slowly adjust the FREQUENCY dial to about the 0.5-MHz point to position the slope of the beat frequency notch near the center of the oscilloscope trace as shown in figure 7.

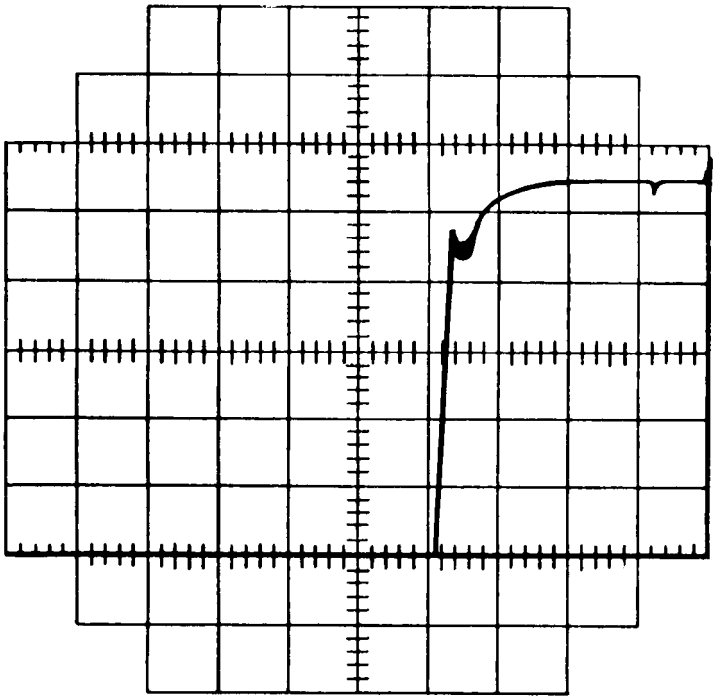

Figure 7. Slope of beat frequency.

(27) Note the extent of deviation between this FREQUENCY dial setting and the 0.5 MHz mark and adjust the FREQUENCY dial to the mid point of this deviation.

(28) Slowly readjust C515 to reposition the slope of the beat frequency notch near the center of the oscilloscope trace.

(29) Set the SWEEP WIDTH control to the WIDE position and rotate the SWEEP WIDTH control clockwise.

(30) Adjust the FREQUENCY dial to position the beat frequency notch at the extreme left of the horizontal trace as shown in figure 8.

(31) Simultaneously adjust the FREQUENCY dial to maintain the beat frequency notch at this position and adjust R563 (fig. 1) (VHF SW LIMIT) to obtain a 300-MHz bandwidth as shown in figure 8.

b. Adjustments. No further adjustments can be made.

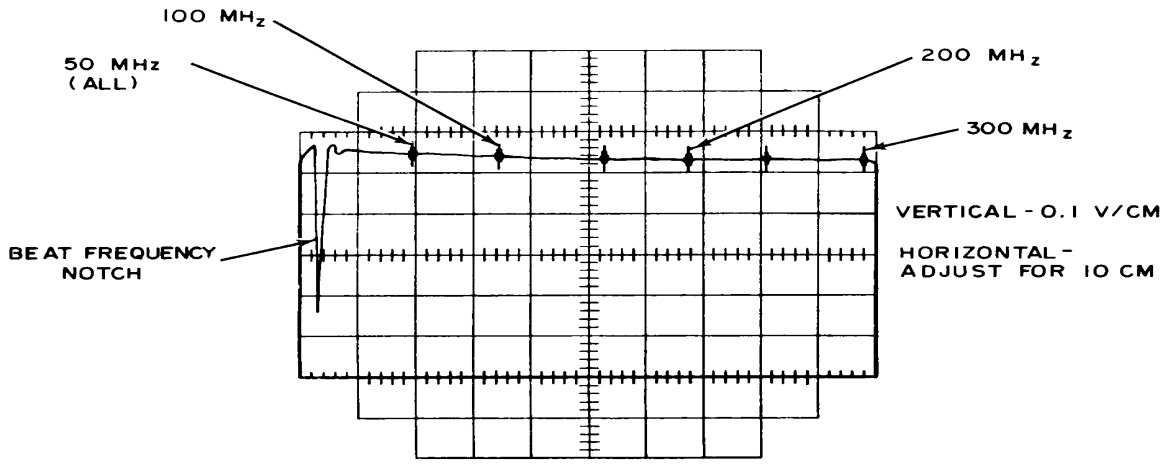

Figure 8. Frequency response at maximum sweep width (VHF).

13. Attenuation

a. Performance Check

(1) Connect equipment as shown in figure 9.

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

(a) FREQUENCY dial to 30 MHz.

(b) RF OUTPUT to 0.5 volt.

(c) RANGE switch to VHF.

(d) RF ATTENUATOR to 0.

(e) INT MARKER switch to OFF.

(f) SWEEP WIDTH switch to CW.

(3) Adjust microwave receiver (A3) and TI controls for a null on microwave receiver NULL meter.

(4) Position RF ATTENUATOR DB switch to 10.

(5) Readjust microwave receiver for a null.

(6) Measured attenuation will be between 8 and 12 db.

(7) Repeat (2) through (6) above for each RF ATTENUATOR setting listed in table 5. Measured attenuation will be within limits specified.

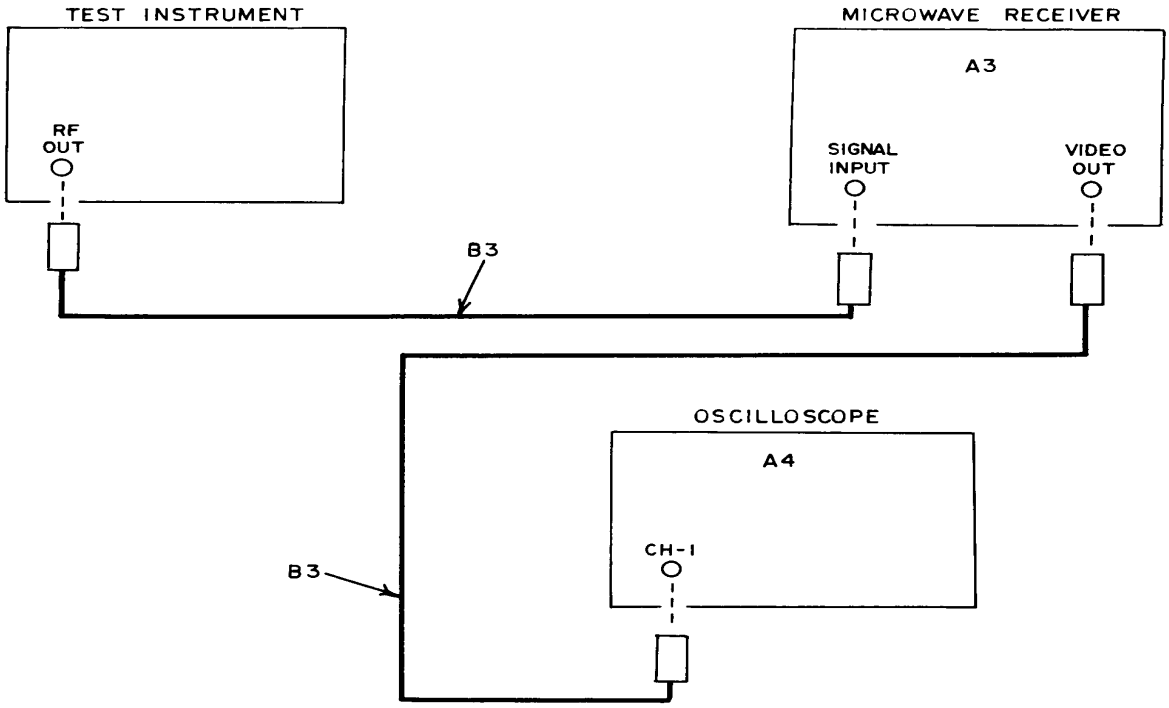

Figure 9. Attenuation - equipment setup.

Table 5. Attenuation

Test instrument **RF ATTENUATOR** switch settings (dB).	Measured attenuation (dB)	
	Min	Max
20	18	22
30	28	32
40	38	42
50	48	52
60	58	62
70	68	72

b. Adjustments. No adjustments can be made.

14. Power Supply

a. Performance Check

NOTE

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

(1) Connect voltmeter (A7) to TP3 and chassis ground.

(2) If voltmeter does not indicate +30, ±0.6 volts dc, perform **b**(1) below. Using oscilloscope (A4), observe that ac ripple at TP3 does not exceed 6 millivolts.

(3) Connect voltmeter to TP7 and chassis ground.

(4) If voltmeter does not indicate -30, ±0.6 volts dc, perform **b**(2) below. Using oscilloscope, observe that ac ripple at TP7 does not exceed 4 millivolts.

(5) Connect voltmeter to TP11 and chassis ground.

(6) If voltmeter does not indicate +200, ±4 volts dc, perform **b**(3) below. Using oscilloscope, observe that ac ripple at TP11 does not exceed 6 millivolts.

(7) Connect voltmeter to TP12 and chassis ground.

(8) Voltmeter will indicate between +45 and +62 volts dc. Using oscilloscope, observe that ripple at TP12 does not exceed 500 millivolts.

b. Adjustments

(1) Adjust R12 (fig. 1) for +30 volts dc.

(2) Adjust R18 (fig. 1) for -30 volts dc.

(3) Adjust R24 (fig. 1) for +200 volts dc.

15. Final Procedure

a. Deenergize and disconnect all equipment and replace TI within protective cover.

b. In accordance with TM 38-750, annotate and affix DA Label 80 (U.S. Army Calibration System). When the TI cannot be adjusted within tolerance, annotate and affix DA Form 2417 (Unserviceable or Limited Use) tag.

By Order of the Secretary of the Army:

FRED C. WEYAND
General, United States Army
Chief Of Staff

Official:

PAUL T. SMITH
Major General, United States Army
The Adjutant General

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