* TB 11-6625-213-35

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR RADIO TEST SETS TS-538/U, TS-538A/U, TS-538B/U, AND TS-538C/U

Headquarters, Department of the Army, Washington, DC
21 July 1976

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Section I. INTRODUCTION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Radio Test Sets TS-538/U, TS-438A/U, TS-538B/U, and TS-538C/U. TM11-6625-205-35 was used as the primed at a source in compiling these instructions. The equipment being calibrated will be referred to as the TI (test instrumerit) 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 2 hours, using the dc and low frequency technique.

2. Calibration Data Card (DA Form 2416). a. Forms, records, and reports required for calibration

* This bulletin supersedes TB 11-6625-213-35, 3 June 1974.

personnel at all levels are prescribed by TM 38-750. DA Form 2416 must be annotated in accordance with TM 36-750 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. Report only those adjustment 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
Input power requirement	117±12 vac, 50 to 1,600 Hz.
Rf oscillator frequency range	1,630 to 1,730 MHz, CW or interrupted CW.
Duration of interruption	45±5 µ sec.
VSWR *	1.45 to 1.
Output power and accuracy	-107 to -20 dBm. A 1 dBm from -20 to -70 dBm, ±3 dBm from -70 to -107 dBm.
Frequency meter range and accuracy	1,630 to 1,730 MHz ± MHz.
Power monitor[1] sensitivity	150 to 250 mw at 10 in. from source.

* This specification is for information only and is not verified in this bulletin.

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 Standards Calibration Set AN/GSM-256, NSN 4931-00-525-8175 and electronic maintenance shop sets 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.

5. Accessories Required. The accessories listed in table 3 are issued with Secondary Transfer Standards Calibration Set AN/GSM-256, NSN 4931-00-525-8175, and electronic maintenance shop sets and are to be used in this calibration procedure.

Table 2. Minimum Specifications of Equipment Required

Item	Common name	Minimum use specifications	Manufacturer, model and part number*	
			Electronic maintenance shop sets	AN/GSM-246
A1	FREQUENCY CONVERTER	Range: 100 to 200 MHz Accuracy: ± 0.3%	CV-1921/USM-207.	Hewlett-Packard Model 5253B.
A2	FREQUENCY METER	Range: 23 Hz to 1732 MHz Accuracy: ± 0.3%	AN/USM-207	Hewlett-Packard Model 5245L
A3	OSCILLOSCOPE	Range: Dc to 15 MHz Accuracy: ± 3%	AN/USM-281	Hewlett-Packard, Model 180D.
A4	RF POWER TESTS	Range: -40 to 10 dBm Accuracy: ± 2%	AN/USM-161	Hewlett-Packard, Model E12-432A.
A5	TRANSFER OSCILLATOR	Range: Harmonic frequency to 12 GHz. Accuracy: ± 2%	CM-77/USM	N/A.

* The calibration equipment utilized in this procedure was selected from those known to be available at Department of Defense facilities, and the listing by make or model number carries no implication of preference, recommendation, or approval by the Department of Defense for use by other agencies. It is recognized that equivalent equipment produced by other manufacturers maybe capable of equally satisfactory performance in the procedure.

Table 3. Accessories Required

Item	Common name	Description and part number
B1	Adapter	BNC jack to N plug (10519457).
B2	Adapter *	BNC jack to UHF plug (10619439).
B3	Adapter	"T" - N type, 2 jacks, 1 plug (7907472).
B4	Cable **	30-in., RG-58/U; BNC plug termination (7907467).

* Two required.
** 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.* Connect TI to 117-vac power source, set POWER switch to ON, and allow 10 minutes for warmup and stabilization.

b. Operate CRYSTAL CHECK switch to the left position and observe power monitor meter deflection.

c. If power monitor meter does not deflect to the SET POWER line, adjust R17 (fig. 1) for exact SET POWER indication on power monitor meter (R).

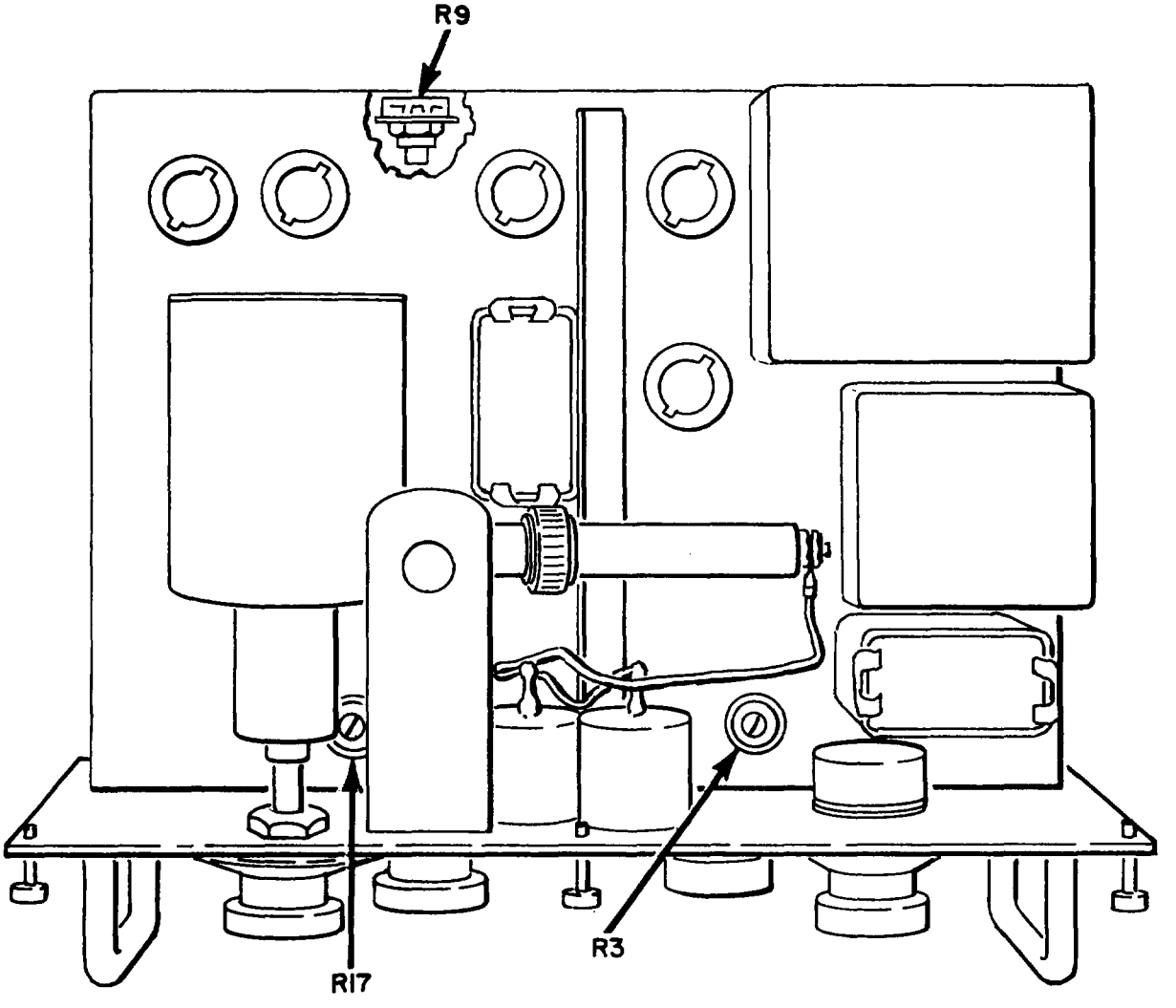

Figure 1. Radio test set - tap view.

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.

8. Repetition Rate. *a. Performance Check.*

(1) Connect TI PULSE connector to input of frequency meter (A2), using cable (B4).

(2) Turn TI RF POWER SET switch to midrange.

(3) Set TI MODULATION switch to ON.

(4) Turn TI REPETITION RATE dial to settings listed in table 4. If frequency meter indications are not within limits specified, perform *b* below.

b. Adjustments. Adjust R3 (fig. 1) for indications specified in table 4 (R).

Table 4. Repetition Rate

Test instrument REPETITION RATE CONTROL settings	Frequency meter indications (Hz or ms)	
	Min	Max
200	170 Hz (5.88 ms)	230 Hz (434 ms)
100	85 Hz (11.76 ms)	115 Hz (8.69 ms)
20	17 Hz (42.5 ms)	23 Hz (57.5 ms)

9. Pulse Width. *a. Performance Check.*

(1) Connect TI PULSE jack to input of ocilloscope (A3), using cable (B4).

(2) Turn TI REPETITION RATE control to 200. If oscillocope waveform is not a positive going square wave with a width between 40 and 50 microseconds, perform *b* below.

b. *Adjustments.* Adjust R9 (fig. 1) for indication as specified in (2) above (R).

10. Oscillator and Wavemeter, Using Electronic Maintenance Shop Sets. *a. Performance Check.*

(1) Connect equipment as shown in figure 2.

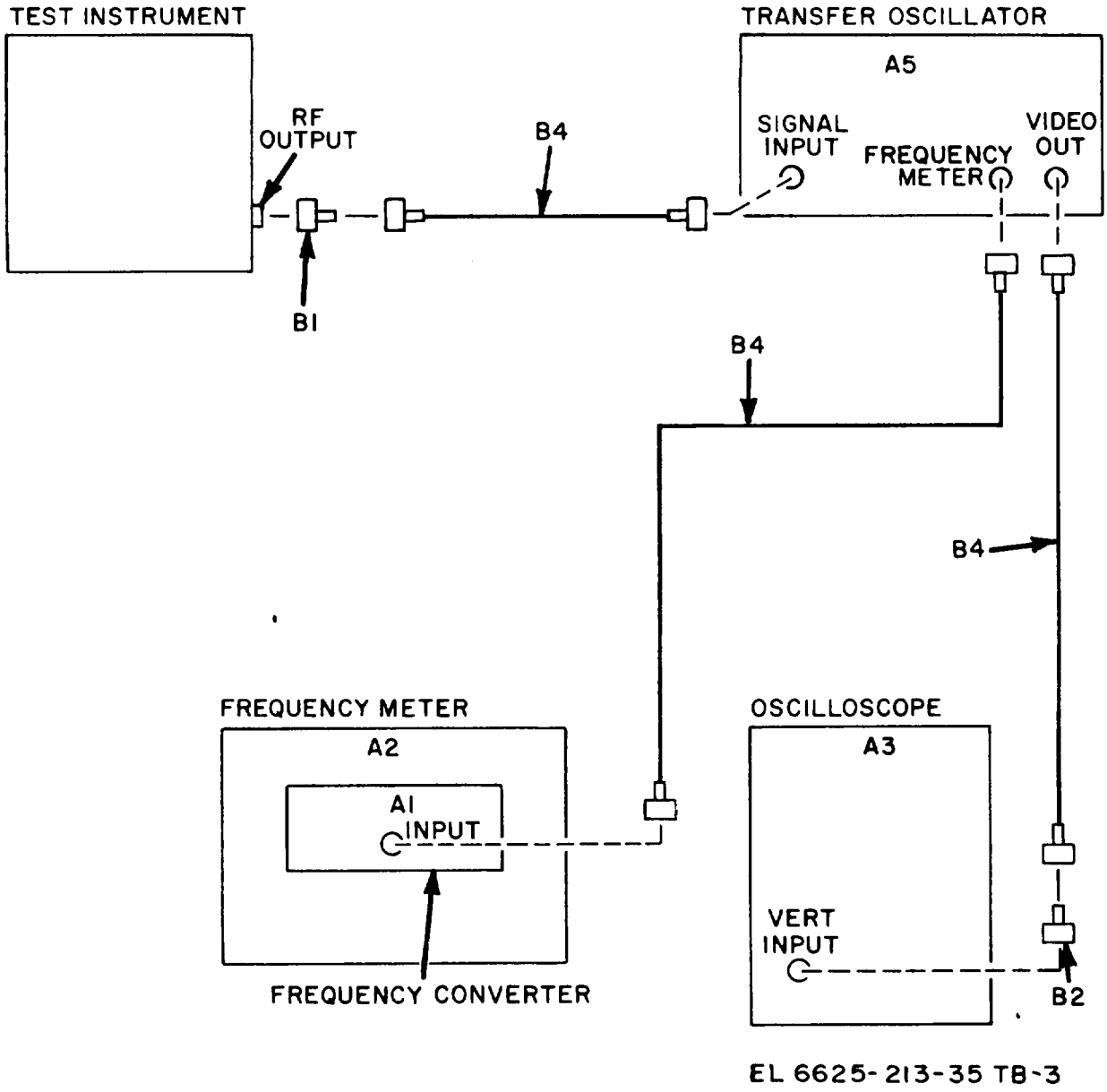

Figure 2. Oscillator and wavemeter - equipment setup.

(2) Position TI controls as indicated in *(a)*, *(b)*, and *(c)* below.

(a) RF POWER SET to SET POWER line on power monitor.

(b) OUTPUT POWER dial to -20 dBm.

(c) MODULATION switch to OFF.

(3) Turn FREQUENCY METER dial to settings listed in table 5. With OSCILLATOR FREQUENCY dial tuned for maximum dip on power monitor meter and FREQUENCY METER dial 1/4 turn in either direction away from test settings, obtain a zero beat indication on oscilloscope (A3) with transfer oscillator (A5) frequency tuned to the tenth harmonic of the TI FREQUENCY METER dial setting. If frequency meter (A2) indications are not within limits specified in table 5, perform *b* below.

Table 5. Oscillator and Wavemeter Accuracy

Teat instrument FREQUENCY METER dial settings	Frequency meter indications (MHz)	
	Min	Max
1630	162.80	163.23
1690	167.80	166.20
1715	171.30	171.70

b. Adjustments.

(1) Adjust transfer oscillator for 168 MHz as indicated on frequency meter.

(2) Adjust OSCILLATOR FREQUENCY dial for a zero beat indication on oscilloscope.

(3) Adjust FREQUENCY METER dial for maximum dip on power monitor meter.

(4) Loosen setscrews of FREQUENCY METER dial and slip dial until the dial indicates 1680 MHz. Tighten setscrews (R).

11. Oscillator and Wavemeter, Using AN/GSM-256 Standards. *a. Performance Check.*

(1) Connect frequency meter (A2) to TI RF output connector, using cable and two adapters (B4 and B2).

(2) Position TI controls as indicated in (a) through (e) below.

(a) RF POWER SET to SET POWER line on power monitor meter.

(b) FREQUENCY METER dial to 1630 (1615 for Model TS-53WU).

(c) OSCILLATOR FREQUENCY dial for maximum dip on power monitor meter.

(d) OUTPUT POWER dial to -20 dBm.

(e) MODULATION switch to OFF.

(3) Turn FREQUENCY METER dial 1/4 turn in either direction away from test frequency. If frequency meter does not indicate between 1628 and 1632 (1613 and 1617 for Model TS-538C/U) MHz, perform b below.

(4) Repeat (2) *(b)* through (3) above at FREQUENCY METER dial setting listed in table 6.

b. Adjustments.

(1) Adjust FREQUENCY METER dial for maximum dip on power monitor meter.

(2) Loosen setscrews of FREQUENCY METER dial and slip dial until the dial indicates 1630 (1615 for Model TS-538C/U) MHz. Tighten setscrews (R).

Table 6. Oscillator and Wavemeter Accuracy

Test Instrument FREQUENCY METER dial settings	Frequency meter indications (MHz)	
	Min.	Max.
1715 *	1713	1717
1730 **	1728	1732

* Perform for Model TS-538C/U only.
** perform for all models except TS-538C/U.

12. Output Power. *a. Performance Check.*

(1) Connect rF power test set (A4) to OUTPUT POWER connector (Jl) on side of TI, using cable CG-171A/AP (supplied with TI) and adapter (B3).

(2) Position TI controls as indicated in *(a), (b),* and (c) below.

(a) MODULATION switch to OFF.

(b) RF POWER SET to SET POWER line on power monitor meter.

(c) OUTPUT POWER to -20 dBm.

(3) If rF power test set does not indicate between -19 and -21 dBm, perform *b* below.

b. Adjustments.

(1) Turn OUTPUT POWER control for a -20 dBm indication on rF power test set.

(2) Loosen setscrews of OUTPUT POWER knob and slip knob until pointer is aligned with 20. Tighten setscrews (R).

13. Final Procedure. *a.* Reenergize and disconnect all equipment and replace TI 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.

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To be distributed in accordance with DA Form 12-34A requirements for Calibration Procedures Publications,

U.S. GOVERNMENT PRINTING OFFICE: 1976-665668/704

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ST. LOUIS, MISSOURI 63114

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