Change 1

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURES FOR ENVELOPE DELAY DISTORTION MEASURING SETS TS-2669/GCM (NSN 6625-00-880-1578) AND TS-2669A/GCM (NSN 6625-00-126-0217)

Headquarters, Department of the Army, Washington, DC
21 June 1988

TB 11-6625-922-35, 24 September 1976, is changed as follows:

Page 1. Reporting of Errors is changed as follows:

REPORTING OF ERRORS

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Page 4, paragraph 9a(1). In line 1 change "TRANSMIT LEVEL DEM control" to read "TRANSMIT LEVEL DEM -10 DB/ODB control."

Paragraph 9a(3). In line 2 change "measurement of 2.28 to 2.32 volts" to read "measurement of 2.43 to 2.47 volts."

Paragraph 9b(1). In line 2 change "for 2.30 volts ac" to read "for 2.45 volts ac."

Page 5, paragraph 12a2). In line 2 change "CARRIER FREQUENCY control fully counterclockwise" to read "CARRIER FREQUENCY control for a 00000 indication on TI FREQUENCY display."

Paragraph 12a(4). In line 3 change "control fully counterclockwise" to read "control for a 00000 indication on TI FREQUENCY display."

Paragraph 12a(6). In line 3 change "fully counterclockwise" to read "for a 00000 indication on TI FREQUENCY display."

By Order of the Secretary of the Army:

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*This bulletin supersedes TB 11-6625-922-35/1, 20 August 1973.

SECTION I
INTRODUCTION AND DESCRIPTION

1. Test Instrument Identification.

This bulletin provides instructions for the calibration of Envelope Delay Distortion Measuring Sets TS2669/GCM (Action Model 490A) and TS-2669A/GCM (Acton Model 490B). TM 11-6625-922-15 and manufacturers instruction manual were used as the prime data source in compiling these instructions. The envelope delay distortion measuring set will be referred to as the TI (test instrument) throughout this bulletin.

a. Model Variations. The difference among models that may be noted during calibration is that some may have the wraparound case and some may have a top and bottom cover plate. Some printed circuit boards may be made by different manufacturers and may vary slightly. The TS-2669A/GCM FREQUENCY switch is marked KHz, Hz, Hz which otherwise is identical with the TS-2669/GCM COUNTING TIME switch calibrated as 0.1 SEC, Hz I Sec, and 10 SEC. BAL RECEIVE and BAL TRANSMIT connections on the front panel of TS-2669/GCM are jacks and will accept telephone-type plugs. TS-2669A/GCM connections will accept the General Radio double plug arrangement. TheTS-2669A/GCM has a linear recorder output which works directly to an XY recorder; TS-2669/GCM has nonlinear output which requires a converter when used with an XY recorder. TS-2669A/GCM has a decimal t 1w point before the last digit on frequency readout for easier readability; TS-2669/GCM does not. Calibration procedures described in this bulletin apply to both models unless otherwise indicated.

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

2. DA Form 2416 (Calibration Data).

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.

Test instrument parameters and performance specifications which pertain to this calibration are listed in table 1.

Table 1. Calibration Description

Test instrument parameters	Performance specifications
Power supply voltages	With input power at 115 or 230 vac + 10%, 47 to 63 Hz single phase, the test instrument will perform satisfactorily when power supply outputs are adjusted to + and - 12.0 volts dc.
Output amplifier level	Transmitter output is adjustable from --20 dBm to + 10 dBm into loads of 900, 600, 150, and 130/135 ohms + 10 % balanced; 75 ohms +10% unbalanced.
Percent modulation	Adjustable from 0 to 50%, with provision for adjusting front panel meter to correspond to applied modulation rate.
Sweep drive base line	A sweep rate of 1 sweep/sec. to 0.5 sweeps/minute is provided in band widths of 300 Hz to 12.5 kHz (in the 0.1 to 50 kHz carrier range) and 3 kHz to 125 kHz (in the 50 to 552 kHz range). (100 Hz to 600 kHz on some models).
Vfo frequency	The variable frequency oscillator operates in conjunction with sweep controls to produce frequency limits specified for the sweep drive base line.
Input amplifier gain	The dBm/% modulation meter is scaled to indicate input level.
Delay meter scaling	The test instrument provides delays of 0-40 ms at 25 Hz, 0-12 ms at 83 1/3 Hz, and 0-4 ms at 250 Hz modulation frequencies.
Receive level variation	Delay circuitry may be adjusted for minimal change with variations in input signal level.

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 sets AN/GSM-256 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 ant TI.

5. Accessories Required.

The accessories listed in table 3 are issued as indicated in paragraph 4 above and are to be used in this calibration procedure. When necessary, these items may be substituted by equivalent items unless specifically prohibited.

Table 2. Minimum Specifications of Equipment Required

Item No *Common name*	*Minimum use specifications*	*Manufacturer, Model., and Part NO.*
A1 Digital voltmeter	Range: 0 to 15 volts dc positive and negative	Dana Model 5000-S-2351 or ME -2021U
A2 Electronic counter	Range: 202,000 Hz Accuracy: + -1	Hewlett-Packard Model 5245M or AN/USM-207
A3 Electronic voltmeter	Range: 0 to 3 volts ac Accuracy: + 1 % (50 to 500 kHz)	Hewlett-Packard Model 410C 7910102) or ME-30(*) U*
A4 Oscilloscope	Sensitivity: 5 mv/cm Accuracy: ± 3%	Hewlett-Packard Model 180D or AN/USM-281
A5 Signal generator	Range: 1 kHz Output: 0.775 volts Accuracy: ±2%	Hewlett-Packard Model 652A (MIS 10224)or AN/URM-127

*(*) Any model.

Table 3. Required Accessories

Item No.	*Common name*	*Description*
B1	Adapter, connector	Double banana jack to phone plug
B2	Adapter, connector	BNC jack to double banana jack
B3	Load resistor	600 ohm ± 1 %, 1 ,2 watt

SECTION III
PRELIMINARY OPERATION

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 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. Verify that all power switches are off, and set all calibration equipment controls as necessary prior to applying power.

b. Remove TI from its case to make internal measurements.

c. Connect calibration equipment to the appropriate power sources.

d. Set TI front panel controls as follows:

(1) RECEIVER IMPEDANCE Q and TRANSMIT IMPEDANCE Q switches to 600.

(2) MODULATION FREQUENCY HZ switch to 25.

(3) RECEIVE LEVEL DBM switch to 0.

(4) Adjust both TRANSMIT LEVEL DBM controls to 0 DB.

(5) REF RETURN/END TO END switch to END TO END.

(6) RANGE KIIZ switch to .1-50.

(7) SWEEP/CARRIER/REFERENCE switch to CARRIER.

(8) Adjust CARRIER FREQULENCY control to approximately 10 kHz.

(9) COUNTING TIME switch to I SEC on TS2669/GCM; FREQUENCY switch to center position marked HZ on TS-2669A/GCM.

(10) TRANSMIT FREQUENCY/RECEIVE FREQUENCY switch to TRANSMIT FREQUENCY.

(11) Disregard settings of all other switches and controls at this time.

e. Turn TI and calibration equipment power switches on and allow approximately 20 minutes for equipment warmup.

SECTION IV
CALIBRATION PROCESS

NOTE

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

8. Power Supply Voltages.

a. Performance Check.

(1) Connect digital voltmeter (Al) to pin Y on regulator assembly board All, and chassis ground.

(2) Digital voltmeter will read between 11.6 and 12.4 volts positive. If not, perform b(l) below.

(3) Disconnect the lead from pin Y and connect it to pin D.

(4) Digital voltmeter will read between 11.6 and 12.4 volts negative. If not, perform b(2) below.

(5) Disconnect lead from pin D and connect it to pin Y on the regulator assembly board A5.

(6) Digital voltmeter will read between 4.85 and 5.15 positive. If not, perform b(3) below.

b. Adjustments.

(1) Adjust R37 so that the voltage is + 12 volts dc between pin Y and chassis ground on regulator assembly board All. (R)

(2) Adjust R34 so that the voltage is - 12 volts de between pin D and chassis ground on regulator assembly board All. (R)

(3) Adjust R21 so that the voltage is + 5 volts dc between pin Y and chassis ground on regulator assembly board All. (R)

9. Output Amplifier Level.

a. Performance Check.

(1) Adjust TRANSMIT LEVEL DEM control full) clockwise.

(2) Connect 600-) ohm + 1 percent resistor across the tip an(d ring terminals of BAL TRANSMIT jack on the TS-2669/CCM (double plug terminals on TS2669A/GCM).

(3) With electronic voltmeter (A3), check for a measurement of 2.28 to 2.32 volts ac between TP1 and chassis ground on output amplifier and meter amplifier assembly A 1 2. If not, perform b(1) below.

(4) Using electronic voltmeter (A3), the voltage across the 600-ohm resistor at the BAL TRANSMIT jack (terminal) will measure 0.767 to 0.783 volt ac, and the front panel dBm/% MODULATION meter will indicate 0 dBm when the % NIOD/RECEIVE LEVEL/TRANSMIT LEVEL switch is in the TRANSMIT LEVEL position. If not, perform b(2) and (3) below.

b. Adjustments.

(1) Adjust resistor R9 on output amplifier and meter amplifier assembly board A12 for 2.30 volts ac between TP 1 and chassis ground. (R)

(2) Adjust R36 on output amplifier and meter amplifier assembly board A12 to obtain 0.775 volt ac across the 600-ohm resistor at the BAL TRANSMIT jack (terminals). (R)

(3) With % MOD/RECEIVE LEVEL,TRANSMIT LEVEL switch in TRANSMIT LEVEL position, adjust R16 on the output amplifier and meter amplifier assembly board A 12 to obtain a level reading of 0 dBm on front panel dBm/% MODULATION meter. (R)

10. Percent Modulation Calibration.

a. Performance Check.

(1) Set % MOD/RECEIVE LEVEL/TRANSMIT LEVEL switch to % MOD position.

(2) Monitor output signal at BAL TRANSMIIT jack (terminals) using oscilloscope (A4).

(3) Adjust % MOD ADJ control for 50 percent modulated waveform on oscilloscope. If not, perform adjustment b below.

b. Adjustment. Adjust R4 on modulation meter adjust assembly board A20 to obtain a reading of 50 per- w cent on front panel dBh/% MODULATION meter. (R).

Oscilloscope display will be three positive-going peaks

covering two major vertical divisions smoothly rounded at the top with two equally spaced proportioned valleys between. The pattern will be repeated in the negative-going direction with 2 vertical divisions between, covering a total of 6 vertical divisions and approximately10 horizontal divisions.

11. Sweep Drive Base Line.

a. Performance Check.

(1) Adjust SWEEP TIME control counterclockwise toward the 1 SEC position.

(2) Set SWEEP CALIBRATE switch to LOW CAL.

(3) Connect oscilloscope probe (part of A4) to TPI on sweep drive assembly board A 16.

(4) Adjust SWEEP WIDTH control from fully counterclockwise to fully clockwise and note that the voltage at TP1 does not vary around ground potential by more than + 2 millivolts. If more than + 2 millivolts, perform b( ) below.

(5) Set SWEEP CALIBRATE switch to SWEEP, and observe triangular waveform between TP1 and chassis ground. Note that the most positive excursion of triangular waveform is at ground level. If not, perform b(2) below. Note level of most negative excursion of triangular waveform

(6) Set SWEEP CALIBRATE switch to HIGH CAL.

(7) Dc level between TPI and chassis ground will be within + 3 millivolts of the position noted for the most negative excursion of triangular waveform as noted in (5) above when SWEEP CALIBRATE switch was in SWEEP position. If not, perform b(3) below.

b. Adjustments.

(1) With SWEEP CALIBRATE switch in LOW CAI position, adjust R4 on sweep drive assembly board A16 so that the voltage at TPI does not vary around ground potential by more than + 2 millivolts while adjusting SWEEP WIDTH control from fully counterclockwise to clockwise position. (R)

(2) Adjust R5 1 on sweep drive assembly board A 16 so that the most positive excursion of the triangular waveform is at ground. (R)

(3) Adjust R52 on sweep drive assembly board A 16 so that de level between TP 1 and chassis ground is within + 2 millivolts of that noted for the most negative excursion of the triangular waveform in (5) above. (R)

12. Vfo Frequency Calibration.

a. Performance Check.

(1) Connect electronic counter (A2) to connector XA 16 between pin T (located on sweep drive assembly board A 16) and ground of variable frequency oscillator assembly board A2 (accessable b)y removing bottom cover of unit).

(2) Set SWEEP/CARRIER/REFERENCE switch to CARRIER and adjust CARRIER FREQUENCY control fully counterclockwise.

(3) Electronic counter will indicate between 198,000 and 202,000 Hertz. If not, perform b(l) and (2) below.

(4) Set SWEEP/CARRIER/REFERENCE switch to REFERENCE and adjust REFERENCE FREQUENCY control full)y counterclockwise.

(5) Electronic counter will indicate between 198,000 and 202,000 Hertz. If not, perform b(l) and (3) below.

(6) Set SWEEP/CARRIER/REFERENCE switch to SWEEP and adjust CARRIER FREQUENCY control fully counterclockwise.

(7) Adjust SWEEP WIDTH control fully counterclockwise and set SWEEP CALIBRATE switch to LOW CAL.

(8) Electronic counter will indicate between 198,000 and 202,000 Hertz. If not, perform b(I) and (4) below.

b. Adjustments.

(1) Remove bottom cover of unit if not already removed and locate respective capacitor curves.

NOTE

Use a nonmetalic adjustment tool for best results

(2) Remove the cover to C7 on A2 housing. Adjust C7 for 200,000 Hertz and replace cover. (R)

(3) Remove cover to C9 on A2 housing. Adjust C9 for 200,000 Hertz and replace cover. (R)

(4) Remove cover to C1 on A2 housing. Adjust C1 for 200,000 Hertz and replace cover. (R)

(5) No further adjustments can be made.

13. Input Amplifier Gain.

a. Performance Check.

(1) Connect signal generator (A5) to the tip and ring of TI BAL RECEIVER jack (terminals).

(2) Connect electronic *voltmeter (A3) across signal generator output.

(3) Adjust signal generator for an output of 0.775 volts at 1 kHz.

(4) Set % MOD/RECEIVE LEVEL,TRANSMIT LEVEL switch to RECEIVE LEVEL.

(5) DBm/% MODULATION meter will indicate O. If not, perform adjustment b below.

b. Adjustment. Adjust R9 on input amplifier and demodulator assembly board A6 until an indication of O on the dBm/% MODULATION meter is obtained. (R)

14. Delay Meter Scaling.

a. Performance Check.

(1) Set SWEEP/CARRIER/REFERENCE switch to CARRIER, and adjust CARRIER FREQUENCY control to approximately 10 kHz.

(2) Connect a jumper cable between BAL TRANSMIT and BAL RECEIVE jacks (terminals).

(3) Set MODULATION FREQUENCY HZ switch to 25 and % MOD/RECEIVE LEVEL/TRANSMIT LEVEL switch to % MOD.

(4) Adjust '% MOD ADJ control to obtain an indication of 45-50 on the dBm/% MODULATION meter.

(5) Set % MOD/RECEIVE LEVEL/TRANSMIT LEVAL switch to RECEIVE LEVEL and RECEIVE I,E. DBM switch to obtain a dBm/%, MODULATION meter indication bet--10 and 0.

(6) Set DET.IAY METER RANGE MS switch to 3-10 and COURSE DELAY MS switch to 0-10.

(7) Adjust DELAY ZERO ADJ control until DELAY meter indicates O (black 0-10 scale).

(8) Set COURSE DEL.AY switch to 30-40. DELAY meter will indicate © 10 (full scale). If not, perform b(1) below.

(9) Set DELAY- RANGE MS switch to .15-.5, COURSE DELAY NIS switch to 0-10, and FINE DELA'Y NIS switch to 0.5.

(10) Adjust DEI.AY- ZERO ADJ control until DELIAY meter indicates O (black 0-.5 scale).

(11) Set FINE DEI.AL- MS switch to 0. DELAY meter will indicate 0.5 (full scale). If not, perform b(2) below.

b. Adjustments.

(1) Adjust R55 on delay output assembly board A8 until DEI..Y meter indicates 10 (full scale). (R)

(2) Adjust R52 on De(la) Output Assembly board A8 until DELAY meter indicates 0.5 (full scale). (R)

15. Receive Level Variation.

a. Performance Check.

(1) Perform steps outlined in paragraph 13a(1) through (4).

(2) Perform steps outlined in paragraph 14a(l) through (5).

(3) Adjust TRANSMIT LEVEL DBM control fully clockwise.

(4) Set MODULATION FREQUENCY HZ switch to 250.

(5) Set DELAY METER RANGE MS switch to 15-.5.

(6) Operate COURSE DELAY MS switch, FINE DELAY MS switch, and DELAY ZERO ADJ control until DELAY meter indicates near center scale. Note this position.

(7) Operate TRANSMIT LEVEL DBM control (and, if needed, TRANSMIT LEVEL DBM switch) until there is an indication of -6 on dBm/% MODLUATION meter.

(8) Note the indication on the DELAY meter. It should be within a half division of indication noted in (6) above. If not, perform b(1) below.

(9) Repeat (1) through (8) above for MODULATION FREQUENCY HZ switch in the 83 1/3 and 25 positions. Perform applicable adjustments b(2) or (3) below if required.

b. Adjustments.

(1) Adjust R68 on delay output assembly board A8 so that a difference of 6 dB in the receive level will cause less than a one-half division change in DEI,LAY meter indication. (R) (2) Adjust R59 for the 83-1/3 Hz frequency in the same was as in (1) above.

(3) Adjust R58 for the 25 Hz frequency the same as in (I) above.

16. Final Procedure.

a. Deenergize and disconnect all equipment.

b. In accordance with TM 38-750, annotate and affix calibration DA Label 80 (US Arm)y Calibration S)stem). When the TI cannot be adjusted within tolerance, annotate and affix red tag DA Form 2417 (Unserviceable or Limited Use) tag.

By Order of the Secretary of the Army:

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