*TB 9-6695-263-24

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR MODULATION ANALYZER, HEWLETT-PACKARD, MODEL 8901A W/OPTION 002 AND 010

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

REPORTING OF ERRORS AND RECOMMENDING IMPROVEMENTS

You can improve this manual. If you find any mistakes or if you know of a way to improve these procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) directly to: Commander, U.S. Army Aviation and Missile Command, ATTN: AMSAM-MMC-MA-NP, Redstone Arsenal, AL 35898-5000. A reply will be furnished to you. You may also send in your comments electronically to our E-mail address: 2028@redstone.army.mil or by fax 256-842-6546/DSN 788-6546. For the World Wide Web use: https://amcom2028.redstone.army.mil. Instructions for sending an electronic 2028 can be found at the back of this manual.

*This bulletin supersedes TB 9-6695-263-35, 13 April 2004.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Modulation Analyzer, Hewlett-Packard, Model 8901A w/Options 002 and 010. The manufacturer's manual was used as the prime data source in compiling these instructions. The equipment being calibrated will be referred to as the TI (test instrument) throughout this bulletin.

a. Model Variations. Variations among models are described in text, tables, and figures.

b. Time and Technique. The time required for this calibration is approximately 4 hours, using the dc and low frequency 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 modulation:	Specifications	Carrier frequency range
Rates	20 Hz to 10 kHz 20 Hz to 200 kHz 20 Hz to 20 kHz (w/750 μs filter)	150 kHz to 10 MHz 10 to 1300 MHz 10 to 1300 MHz
Deviation	40 kHz pk max 400 kHz pk max 40 kHz pk max (w/750 μs filter)	150 kHz to 10 MHz 10 to 1300 MHz 10 to 1300 MHz

Table 1. Calibration Description - Continued

Test instrument parameters	Performance specifications	
Frequency modulation:	Specifications	Carrier frequency range
Accuracy	±2% reading ± 1 digit for 20 Hz to 10 kHz rates	250 kHz to 10 MHz
	±1% reading ± 1 digit for 50 Hz to 100 kHz rates	10 to 1300 MHz
	±5% reading ± 1 digit for 20 Hz to 200 kHz rates	10 to 1300 MHz
Demodulated output distortion	<0.1% THD for deviations	400 kHz to 10 MHz
	<0.1% THD for deviations <100 kHz	10 to 1300 MHz
	(THD: Total harmonic distortion)	
AM rejection (50% AM at 400 Hz and 1 kHz)	<20 Hz pk deviation	50 Hz to 3 kHz BW
FM calibrator:		
Deviation	34 kHz pk nominal	- - -
Accuracy	±0.1%	
Amplitude modulation:		
Rates	20 Hz to 10 kHz	150 Hz to 10 MHz
	20 Hz to 100 kHz	10 to 1300 MHz
Depth	to 99%	
Accuracy	±2% reading ±1 digit for 50 Hz to 10 kHz rates and depth >5%	150 kHz to 10 MHz
	±3% reading ±1 digit for 20 Hz to 10 kHz rates	150 kHz to 10 MHz
	±1% reading ±1 digit for 50 Hz to 50 kHz rates and depth >5%	10 to 1300 MHz
	±3% reading ±1 digit for 20 Hz to 100 kHz rates	10 to 1300 MHz
Flatness	±0.3% reading ±1 digit for 90 Hz to 10 kHz rates and depth 20 to 80%	10 to 1300 MHz
FM rejection	<0.2% AM at 5 kHz pk deviation at 400 Hz and 1 kHz rates	250 kHz to 10 MHz and 50 Hz to 3 kHz BW
	<0.2% AM at 50 kHz pk deviation at 400 Hz and 1 kHz rates	10 to 1300 MHz and 50 Hz to 3 kHz BW
Distortion	<0.3% THD	≤50% depth
	<0.6% THD	≤95% depth
Residual	0.01% rms	50 Hz to 3 kHz BW
AM calibration:		
Depth	33.33% nominal	- - -
Calibration factor accuracy	±0.1%	

Table 1. Calibration Description - Continued

Test instrument parameters	Performance specifications
AM calibration: Internal reference Stability	 Frequency: 10 MHz <1 x 10^{-9} per day after 30-day warm-up
Audio filters: 50 Hz high pass (2 pole) 3 dB cutoff frequency Flatness	 50 Hz nominal <1% at ≥200 Hz rates
300 Hz high pass (2 pole) 3 dB cutoff frequency Flatness	 300 Hz nominal <1%≥kHz at rates
3 kHz low pass (5 pole) 3 dB cutoff frequency Flatness	 3 kHz nominal <1% at ≤ kHz rates
15 kHz low pass (5 pole) 3 dB cutoff frequency Flatness	 15 kHz nominal <1% at ≤10 kHz rates
20 kHz low pass (9 pole bessel) 3 dB cutoff frequency Flatness	 >20 kHz <1% at ≤ kHz rates
Dc-emphasis filters (1 pole high pass)	25 µs nominal 50 µs nominal 75 µs nominal 750 µs nominal
Phase modulation: Carrier frequency Rates Accuracy Demodulated output distortion	 10 MHz to 1300 MHz 200 Hz to 20 kHz ±3% of reading ±1 digit ≤0.1% THD
RF level: Range Accuracy SWR	 1 mW to 1W ±2 dB (150 kHz to 650 MHz), ±3 dB (650 MHz to 1300 MHz) ≤1.5 (50 ohm system)

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 Reference Calibration Standards Set, NSN 4931-00-621-7878 and Secondary Transfer Calibration Standards Set AN/GSM-287 or AN/GSM-705. Alternate items may be used by the calibrating activity. The items selected must be verified to perform satisfactorily prior to use and must bear

evidence of current calibration. The equipment must meet or exceed the minimum use specifications listed in table 2. The accuracies listed in table 2 provide a four-to-one ratio between the standard and TI. Where the four-to-one ratio cannot be met, the actual accuracy of the equipment selected is shown in parenthesis.

5. Accessories Required. The accessories required for this calibration are common usage accessories, issued as indicated in paragraph **4** above, and are not listed in this calibration procedure.

Table 2. Minimum Specifications of Equipment Required

Common name	Minimum use specifications	Manufacturer and model (part number)
AUDIO ANALYZER	Range: 20 Hz to 100 kHz Distortion: -70 dB min Accuracy: ±2 dB	Boonton, Model 1121 (1121)
CALIBRATION FIXTURE	Range: 12.5 MHz to 100 MHz Modulation rate: 1 and 4 kHz	Agilent, Model 11715A (11715A)
CALIBRATOR	Range: 20 Hz to 100 kHz Accuracy: ±0.1%	Fluke, Model 5720A (5720A) (p/o MIS-35947)
FREQUENCY DIFFERENCE METER	Measuring capacity of 1×10^{-9}	Tracor, Model 527E
MULTIMETER	Range: 0 to 50 V dc Accuracy: ±0.01%	Hewlett-Packard, Model 3458A (3458A)
POWER METER	Range: 150 kHz to 1300 MHz Accuracy: ±1%	Hewlett Packard, Model 437B (13440045) w/power sensor Hewlett Packard, Model 8482A (13440043)
POWER SPLITTER	Range: 150 kHz to 1300 MHz	Weinschel, Model 1870A (7916839)
SIGNAL GENERATOR	Range: 0.5 to 1100 MHz Accuracy: ±1%	Aeroflex, Model 2023B (2023B) or (SG-1207/U)
SWR BRIDGE	Range: 10 MHz to 1300 MHz	Wiltron, Model 60NF50
TIME/FREQUENCY WORKSTATION	Output: 100 kHz; 1, 5, or 10 MHz Accuracy: ±0.1 ppm	Datum, Model ET6000-75 (13589305)

SECTION III
CALIBRATION PROCESS

6. Preliminary Instructions

a. The instructions outlined in paragraphs **6** and **7** are preparatory to the calibration process. Personnel should become familiar with the entire bulletin before beginning the calibration.

b. Items of equipment used in this procedure are referenced within the text by common name as listed in table 2.

c. Unless otherwise specified, verify the result of each test and, whenever the test requirement is not met, take corrective action before continuing with the calibration. Adjustments required to calibrate the TI are included in this procedure. Additional maintenance information is contained in the manufacturer's manual for this TI.

d. 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. REDUCE OUTPUT(S) to minimum after each step within the performance check where applicable.

a. Connect TI to 115 V ac power source.

b. Press power key to on and allow at least 30 minutes for TI to warm-up and stabilize.

8. Internal Reference Frequency Stability

a. Performance Check

(1) Connect frequency difference meter signal input to TI **INT 10 MHz OUT** or rear panel time base **10 MHz OUTPUT** (OPTION 002).

(2) Connect time/frequency workstation output to frequency difference meter reference input. If TI frequency stability is not >1 x 10^{-9}, perform **b** below.

b. Adjustments. Adjust Y1 **COARSE** and **FINE** controls (fig. 1) for a frequency stability of >1 x 10^{-9}.

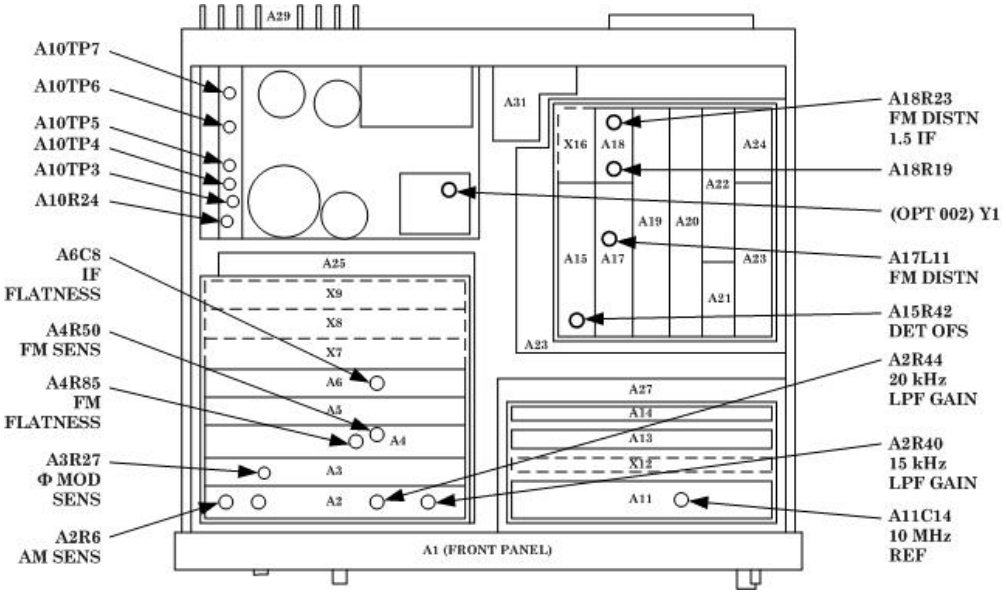

Figure 1. Modulation analyzer - top view.

9. AM Accuracy at 10 kHz

a. Performance Check

(1) Connect TI **CALIBRATION OUTPUT** to TI **INPUT**.

(2) Press **MEASUREMENT AM** and **CALIBRATION** pushbuttons and allow time for at least two readings. TI indication will be between 99 and 101 percent.

(3) Press **2.2 SPCL** pushbuttons and allow time for at least two readings. If TI does not indicate between 99 and 101 percent, perform **b** below. Record indication for use in paragraph **13**.

b. Adjustments. Adjust A2R6 AM SENS (fig. 1) for 100 percent indication on TI display (R).

10. Residual AM

a. Performance Check

(1) Connect calibration fixture **AM** output to TI **INPUT**.

(2) Set calibration fixture test mode switch to **AM**.

(3) Press TI **MEASUREMENT FREQ** pushbutton.

(4) Adjust calibration fixture frequency to 12.5 MHz.

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

(a) **MEASUREMENT AM** pushbutton pressed.
(b) **2.0 SPCL** pushbuttons pressed.
(c) **HP FILTER 50 Hz** pushbutton pressed.
(d) **LP FILTER 3 kHz** pushbutton pressed.
(e) **DETECTOR AVG** pushbutton pressed.

(6) TI display will indicate 0.01 percent or less**.**

b. Adjustments. No adjustments can be made.

11. AM Distortion

a. Performance Check

(1) Connect equipment as shown in figure 2.

(2) Set calibrator for a wideband output of 20 kHz at an amplitude of 175 mV.

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

(a) All **HP FILTER** pushbuttons released (off).
(b) All **LP FILTER** pushbuttons released (off).
(c) **DETECTOR PEAK +** (positive) pushbutton pressed.

(4) Adjust calibrator wideband output for a 50 percent AM indication on TI display.

(5) Set audio analyzer to measure signal distortion with 80 kHz low-pass filtering. Distortion will be 0.3 percent or less.

(6) Increase calibrator wideband output for a 95 percent AM indication on TI display. Measured distortion will be 0.6 percent or less.

(7) Adjust calibrator frequency to 20 Hz and adjust wideband output to maintain 95 percent AM indication on TI display. Measured distortion will be 0.6 percent or less.

(8) Decrease calibrator wideband output for a 50 percent AM indication on TI display. Measured distortion will be 0.3 percent or less.

(9) Remove cable from TI **MODULATION OUTPUT**.

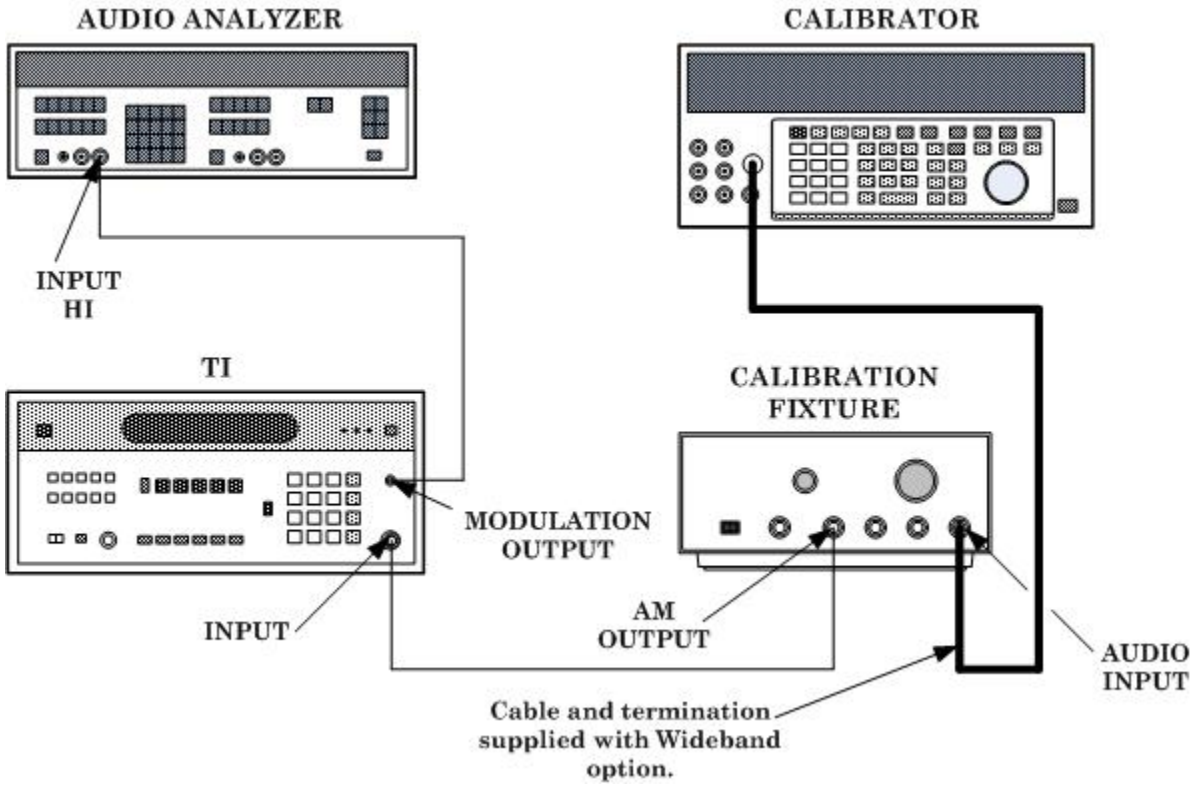

Figure 2. AM distortion - equipment setup.

b. Adjustments. No adjustments can be made.

12. AM Flatness

a. Performance Check

(1) Set calibrator for a wideband output of 1 kHz at an amplitude of 280 mV.

(2) Adjust calibrator output for an 80 percent AM indication on TI display.

(3) Press **DETECTOR AVG.** and **RATIO %** pushbuttons.

(4) Adjust calibrator frequency to 10 kHz, 150 Hz, and 90 Hz, and note TI display at each frequency. TI will display less than 0.8 percent REL difference between any two indications.

b. Adjustments. No adjustments can be made.

13. AM Accuracy

a. Performance Check

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

(a) **RATIO %** pushbutton released (off).
(b) **DETECTOR PEAK +** (positive) pushbutton pressed.
(c) **5.1 SPCL** pushbuttons pressed.

(2) Set calibrator for a wideband output of 1 kHz at an amplitude of 280 mV.

(3) Adjust calibrator output amplitude for a TI indication of 80 percent of value recorded in paragraph **9 a** (3).

(4) Press TI **80**, **RATIO %** pushbuttons.

(5) Adjust calibrator to frequencies listed in table 3 without changing output level. TI will indicate within limits specified.

Table 3. AM Accuracy

Calibrator frequencies (Hz)	Test instrument AM limits (% REL)	
	Min	Max
50,000	98.9	101.1
100,000	96.9	103.1
50	98.9	101.1
20	96.9	103.1
20[1]	96.9	103.1
50	97.9	102.1
10,000	97.9	102.1

[1]Press 3.1 SPCL pushbuttons.

b. Adjustments. No adjustments can be made.

14. AM Rejection

a. Performance Check

(1) Set TI controls as listed in (a) through (c) below:

(a) **RATIO %** pushbutton off.
(b) **HP FILTER 50 Hz** pushbutton on.
(c) **LP FILTER 3 kHz** pushbutton on.

(2) Set calibrator for a wideband output of 1 kHz at an amplitude of 175 mV.

(3) Adjust calibrator output amplitude for a 50 percent AM indication on TI display.

(4) Press TI **MEASUREMENT FM** pushbutton.

(5) Momentarily disconnect calibration fixture audio input. Record TI residual FM indication.

(6) Reconnect calibration fixture audio input. Record TI FM indication. Displayed FM indication minus one-half residual FM value recorded in (4) above will be 20 Hz peak or less.

(7) Press **3.0 SPCL** pushbuttons. Repeat (4) through (6) above.

b. Adjustments. No adjustments can be made.

15. FM Accuracy at 10 kHz

a. Performance Check

(1) Connect TI **CALIBRATION OUTPUT** to TI **INPUT**.

(2) Press **FM** and **CALIBRATION** pushbuttons and allow time for at least two readings. TI indication will be between 99 and 101 percent. Record TI indication.

(3) Press **2.3 SPCL** pushbuttons and allow time for two readings. If TI does not indicate between 99 and 101 percent, perform **b** below.

(4) Disconnect cable connected in (1) above.

(5) Connect calibration fixture **FM ÷ 4** output to TI **INPUT**.

(6) Set calibration fixture test mode switch to **FM**.

(7) Set calibrator for a wideband output frequency of 10 kHz at an amplitude of 0.5 V.

(8) Press **MEASUREMENT FREQ** pushbutton.

(9) Adjust calibration fixture frequency to 100 MHz.

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

(a) **MEASUREMENT FM** pushbutton pressed.
(b) **LP FILTER 15 kHz** pushbutton pressed.
(c) **2.0 SPCL** pushbuttons pressed.
(d) **DETECTOR AVG.** pushbutton pressed.

(11) Adjust calibrator output for a 20 kHz average deviation as displayed on TI.

(12) Press **TI RATIO %** pushbutton.

(13) Move connection to **FM ÷ 32 OUTPUT** without disturbing calibration fixture controls. Multiply displayed ratio by value recorded in (2) above. Result will be between 12.35 and 12.65 percent REL.

b. Adjustments. Adjust A4R50 FN SENS (fig. 1) for a 100 percent indication on TI display (R).

16. FM Distortion, Accuracy, and Rejection at 1.5 MHz IF

a. Performance Check

(1) Connect equipment as shown in figure 2, except connect calibration fixture **FM ÷ 4 OUTPUT** to TI **INPUT**.

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

(a) **HP** and **LP FILTER** pushbuttons pressed to off.
(b) **DETECTOR PEAK +** (positive) pushbutton pressed
(c) **RATIO** pushbuttons pressed to off.

(3) Set calibrator for a wideband output frequency of 100 kHz at an amplitude of 370 mV.

(4) Adjust calibrator output for a 100 kHz indication on TI display.

(5) Measure distortion on audio analyzer with all filters off. If audio analyzer does not indicate 0.1 percent or less distortion, perform **b** below.

(6) Adjust calibrator frequency to 10 kHz and output level for TI display equal to 100 kHz times calibration factor recorded in a **15 a** (2). (For example, if calibration factor in **15 a** (2) is 100.4 percent, set output level for display of 100.4 kHz.).

(7) Adjust calibrator to frequencies listed in table 4. TI display will indicate within limits specified.

Table 4. FM Accuracy

Calibrator frequencies (Hz)	Test instrument FM limits (kHz)	
	Min	Max
100,000	98.9	101.1
200,000	94.9	105.1
50	98.9	101.1
20	94.9	105.1

(8) Press **HP FILTER 50 Hz** and **LP FILTER 3 kHz** pushbuttons.

(9) Set calibrator for a wideband output frequency of 1 kHz and output level for a 50 kHz indication on TI display.

(10) Press **MEASUREMENT AM** pushbutton.

(11) Momentarily disconnect cable from calibration fixture **AUDIO INPUT**. Record TI display.

(12) Reconnect cable to **AUDIO INPUT** and record TI display.

(13) Subtract one-half of value recorded in (11) above from value recorded in (12) above. If result is not 0.2 percent or less, perform **b** below.

b. Adjustments

(1) Adjust calibrator frequency for 100 kHz.

(2) Set calibration fixture test mode switch to **FM**.

(3) Connect TI **INPUT** to calibration fixture **FM OUTPUT**.

(4) Press **HP FILTER 50 Hz** and **41.0 SPCL** pushbuttons.

(5) Adjust calibration fixture carrier frequency to 400 MHz.

(6) Press **INPUT FREQ MHz** and **MEASUREMENT FM** pushbuttons.

(7) Adjust calibrator output level for a 400-kHz peak deviation on TI display.

(8) Alternately press **DETECTOR PEAK +** (positive) and **PEAK -** (negative) pushbuttons while observing TI display. If indications are not equal in both positions, adjust A18R23 FM DISTN 1.5 IF (fig. 1) for an equal indication on TI (R).

(9) Press **3000 kHz** and **+** (down) pushbuttons.

(10) Alternately press **DETECTOR PEAK +** (positive) and **PEAK -** (negative) pushbuttons while observing TI display. If difference between the two indications is not less than 1.6 kHz, adjust A18R23 again to diminish difference by one-half.

(11) Press ↑ **kHz** pushbutton. TI is properly adjusted when pk1+ = pk2- and pk1 = pk2+.

(12) Connect calibration fixture **FM ÷ 4** output to TI **INPUT**.

(13) Press **LP FILTER** pushbutton to **3 kHz** and press **AUTOMATIC OPERATION** pushbutton.

(14) Adjust calibrator to 1 kHz and adjust amplitude level for 50 kHz peak deviation on TI.

(15) Press **AM** pushbutton and adjust A18R19 (fig. 1) for a minimum display less than 0.2 percent.

NOTE

The specification for incidental AM requires 0.5 times residual AM be subtracted. Residual AM, requires 0.5 times residual AM be subtracted. Residual AM can be measured by momentarily disconnecting audio - input to calibration fixture and noting displayed AM; - Subtracting 0.5 times displayed AM from AM measured in (15) above gives actual incidental AM.

17. FM Distortion, Accuracy, and Rejection at 455 kHz IF

a. Performance Check

(1) Connect equipment as shown in figure 2, except connect calibration fixture **FM ÷ 32 OUTPUT** to TI **INPUT**.

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

(a) Press **3.1 SPCL** and **MEASUREMENT FM** pushbuttons.
(b) Press **RATIO %** pushbutton to off.
(c) Press **PEAK +** pushbutton to on.

(3) Adjust calibrator wideband frequency to 1 kHz and output level for a 5 kHz peak deviation as displayed on TI.

(4) Press **MEASUREMENT AM** pushbutton.

(5) Momentarily disconnect cable from calibration fixture audio input and record residual AM displayed on TI.

(6) Reconnect cable to calibration fixture and record AM displayed on TI.

(7) Subtract one-half of value recorded in (5) above from value recorded in (6) above. Result will be 0.2 percent or less.

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

(a) **MEASUREMENT FM** pushbutton pressed.
(b) All **HP FILTER** pushbuttons pressed to off.
(c) **LP FILTER >20 kHz** pushbutton pressed.

(9) Adjust calibrator frequency to 1 kHz and output level for 10 kHz peak deviation times calibration factor value recorded in paragraph **15 a** (2).

(10) Adjust calibrator frequency to 20 Hz and 10 kHz. TI will indicate FM between 9.79 and 10.21 kHz at each frequency.

(11) Adjust calibrator frequency to 10 kHz and output level to 10 kHz peak deviation.

(12) Measure distortion on audio analyzer with 30 kHz low-pass and 400 Hz high-pass filtering. If measured distortion does not indicate 0.1 percent or less, perform **b** below.

b. Adjustments

(1) Disconnect cable from TI **INPUT**.

(2) Connect signal generator RF output to TI **INPUT**.

(3) Adjust signal generator frequency to 2.45 MHz at 0 dBm with 10 kHz peak FM deviation at a 1 kHz rate.

(4) Press **41.1 SPCL** and **10.0 SPCL** pushbuttons.

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

(a) **MEASUREMENT AM** pushbutton pressed.
(b) **HP FILTER 50 Hz** pushbutton pressed.
(c) **LP FILTER 3 kHz** pushbutton pressed.
(d) **DETECTOR AVG** pushbutton pressed.

(6) Adjust A6C8 IF FLATNESS (fig. 1) until TI indicates a minimum but less than 0.2 percent (R).

(7) Disconnect signal generator and reconnect cable disconnected in (1) above.

(8) Adjust calibrator to 10 kHz frequency and output level for 2 V ac.

(9) Set calibration fixture test mode switch to **FM**.

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

(a) **MEASUREMENT FM** pushbutton pressed.
(b) All **LP FILTER** pushbuttons pressed to off.
(c) **DETECTOR PEAK +** (positive) pushbutton pressed.

(11) Adjust calibration fixture carrier frequency to 12.5 MHz.

(12) Press **3.1 SPCL** and **MEASUREMENT FM** pushbuttons.

(13) Adjust calibrator output level to 10 kHz peak deviation as indicated on TI.

(14) Adjust A17L11 FM DISTN (fig. 1) for less than 0.1 percent distortion indication on audio analyzer (R).

18. Audio Filters

a. Performance Check

(1) Connect equipment as shown in figure 2, except connect calibration fixture **FM ÷ 4 OUTPUT** to TI **INPUT**.

(2) Set calibration fixture test mode switch to **FM**.

(3) Set calibrator for a wideband output frequency of 200 Hz at a level of 130 mV.

(4) Press **41.0 SPCL** pushbuttons.

(5) Adjust calibration fixture carrier frequency to 100 MHz.

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

(a) **INPUT FREQ MHz** pushbutton pressed.
(b) **MEASUREMENT FM** pushbutton pressed.
(c) **DETECTOR AVG** pushbutton pressed.

(7) Adjust calibrator output level for a 25 kHz average deviation as indicated on TI.

(8) Adjust calibrator to frequencies listed in table 5. At each frequency, press all **RATIO**, **HP** and **LP FILTER** pushbuttons to off. Then press **RATIO** % and **FILTER** pushbuttons as listed in table 5. If TI does not indicate between 98.99 and 101.01 percent, at each setting, perform **b** below.

Table 5. Audio Filter

Calibrator frequencies (Hz)	Test instrument **FILTER** pushbuttons
200	50 Hz HP FILTER
2,000	50 Hz HP FILTER
1,000	300 Hz HP FILTER
10,000	300 Hz HP FILTER
1,000	3 kHz LP FILTER
100	3 kHz LP FILTER
10,000	15 kHz LP FILTER
1,000	15 kHz LP FILTER
10,000	>20 kHz LP FILTER
1,000	>20 kHz LP FILTER

b. Adjustments

(1) Disconnect cable from TI **INPUT**.

(2) Connect signal generator RF output to TI **INPUT**.

(3) Adjust signal generator frequency for 11 MHz at 0 dBm with 30 percent AM at a 1 kHz rate.

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

(a) **41.0 SPCL** pushbuttons pressed.
(b) **MEASUREMENT AM** pushbutton pressed.

(5) Press **RATIO %** pushbutton button.

(6) Press **LP FILTER >20 kHz** pushbutton.

(7) Adjust A2R44 20 kHz LPF GAIN (fig. 1) until TI indicates 100 percent (R).

(8) Press **LP FILTER 15 kHz** pushbutton.

(9) Adjust A2R40 15 kHz LPF GAIN (fig. 1) until TI indicates 100 percent (R).

19. Phase modulation

a. Performance Check

(1) Connect equipment as shown in figure 2, except connect calibration fixture **FM OUTPUT** to TI **INPUT**.

(2) Set calibration fixture test mode switch to **FM**.

(3) Set calibrator for a wideband output frequency of 200 Hz at a level of 0 dBm.

(4) Press **41.0**, **SPCL** pushbuttons.

(5) Adjust calibration fixture carrier frequency to 400 MHz.

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

(a) **INPUT FREQ MHz** pushbutton pressed.
(b) **MEASUREMENT FM** pushbutton pressed.
(c) **HP FILTER 50 Hz** pushbutton pressed.
(d) **LP FILTER >20 kHz** pushbutton pressed.
(e) **DETECTOR AVG** pushbutton pressed.

(7) Adjust calibrator output level for a TI FM deviation indication of 50 kHz.

(8) Press TI **ΦM** pushbutton. If TI indication is not within limits specified in first row of table 6, perform **b** below.

(9) Repeat technique of (3), (6) (b), (7) and (8) above for calibrator frequencies, levels and TI indications as listed in table 6. If TI indications are not within limits specified in table 6, perform **b** below.

Table 6. Phase Modulation Accuracy

Calibrator		Test instrument		
Frequency	Initial level	FM deviation indication	ΦM indication limits (Radians)	
			Min	Max
200 Hz	0 dBm	50 kHz	242.4	257.6
1 kHz	0 dBm	250 kHz	242.4	257.6
20 kHz	0 dBm	250 kHz	12.1	13.0
20 kHz	0 dBm	4 kHz[1]	0.193	0.207

[1]Move connection from calibration fixture **FM** to **FM÷32** output. If the resolution is not 0.001 radians, press **ΦM** again. Press TI **AUTOMATIC OPERATION**, then **MHz** to retune TI.

(10) Connect calibration fixture **FM OUTPUT** to TI **INPUT**.

(11) Disconnect calibrator from calibration fixture **AUDIO INPUT** and connect audio analyzer **OUTPUT HIGH** to calibration fixture **AUDIO INPUT**.

(12) Press TI **ΦM** and **DETECTOR PEAK +** pushbuttons.

(13) Set audio analyzer output frequency to 1 kHz and output level for a 400 radians display on TI.

(14) Connect TI **MODULATION OUTPUT** to audio analyzer **INPUT HIGH** turn all audio analyzer filters off and set for distortion measurement.

(15) Audio analyzer displayed distortion will be ≤ 0.1%.

b. Adjustments

(1) Connect calibration fixture **FM ÷ 4 OUTPUT** to TI **INPUT** and calibrator **WIDEBAND** output to calibration fixture **AUDIO INPUT**.

(2) Set calibrator for a 1 kHz output frequency at a level of 4 dBm.

(3) Set calibration fixture test mode switch to **FM**.

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

(a) **41.0 SPCL** pushbuttons pressed.
(b) **HP FILTER 300 Hz** pushbutton pressed.
(c) **LP FILTER 3 kHz** pushbutton pressed.

(5) Adjust calibration fixture carrier frequency to 100 MHz.

(6) Press TI **INPUT FREQ MHz** pushbutton then **MEASUREMENT FM** pushbutton.

(7) Adjust calibrator output level for a TI display as close as possible to 100 kHz peak deviation (record displayed value).

(8) Press TI **ΦM** pushbutton and adjust A3R27 Φ MOD SENS (fig. 1) for a display in radians equal to value recorded in (7) above ±0.02 radian.

20. RF level

a. Performance Check

(1) Zero and calibrate power meter and power sensor.

(2) Connect equipment as shown in figure 3.

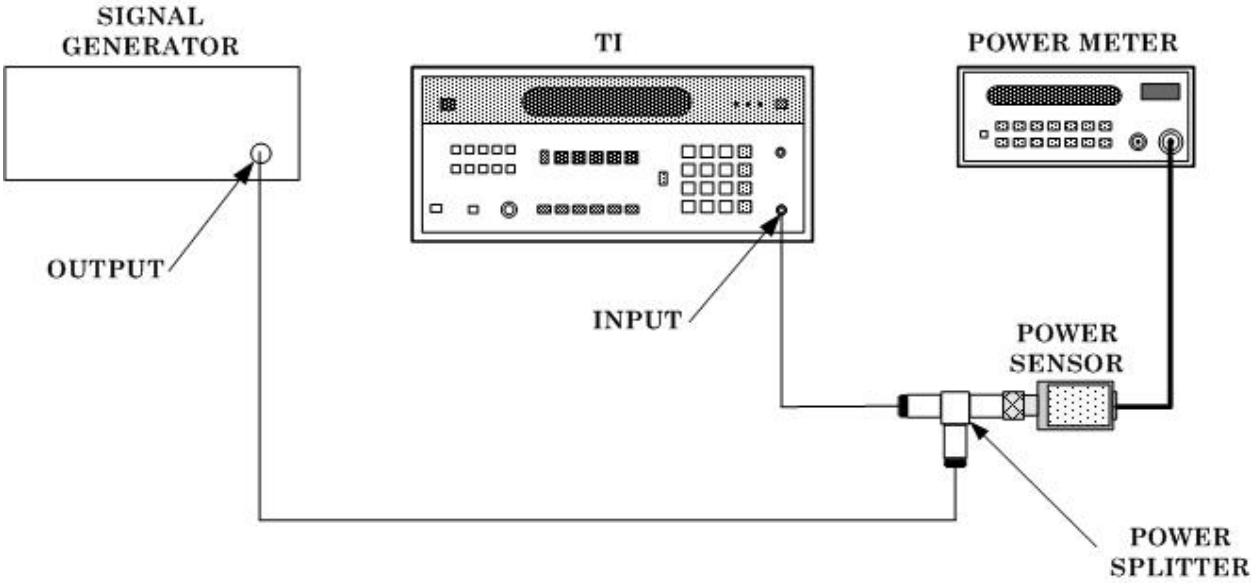

Figure 3. RF level equipment set-up.

(3) Set signal generator for 50 MHz output frequency and output level to indicate 10 mW on power meter.

(4) Press TI **RF LEVEL** pushbutton. If TI does not indicate within limits specified in first row of table 7, perform **b** below.

(5) Repeat technique of (3) above for signal generator levels and power meter indications listed in table 7. If TI does not indicate within limits specified in table 7, perform **b** below.

Table 7. RF Level Accuracy

Signal generator	Power meter	Test instrument	
Frequency	Indication (mW)	**RF LEVEL** indication (mW)	
		Min	Max
50 MHz	10	6.31	15.8
50 MHz	3	1.89	4.75
50 MHz	1	0.631	1.58

(6) Set signal generator for a 1000 MHz output frequency and output level to indicate 3 mW on power meter. If TI does not indicate within limits specified in first row of table 8, perform **b** below.

(7) Repeat technique of (6) above for signal generator frequencies and power meter indications listed in table 7. If TI does not indicate within limits specified in table 8, perform **b** below.

Table 8. RF Level Accuracy

Signal generator	Power meter	Test instrument	
Frequency	Indication (mW)	**RF LEVEL** indication (mW)	
		Min	Max
1000 MHz	3	1.50	5.99
650 MHz	3	1.89	4.75
100 MHz	3	1.89	4.75
10 MHz	3	1.89	4.75
0.5 MHz	3	1.89	4.75

(8) Connect equipment as shown in figure 4.

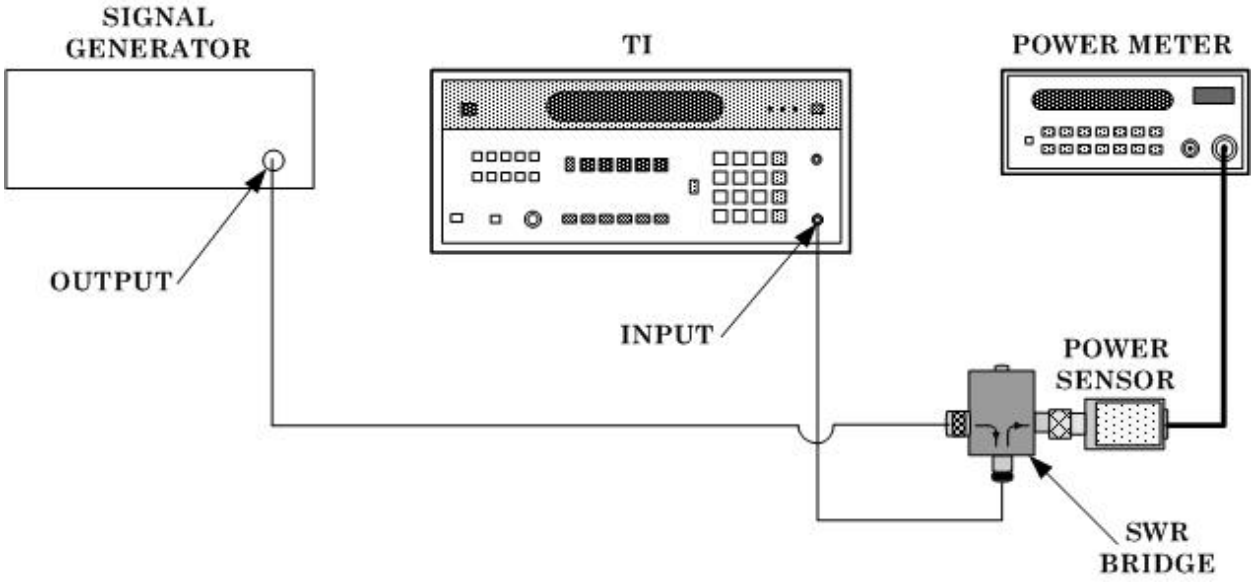

Figure 4. SWR equipment set up.

(9) Set signal generator for an output frequency of 1000 MHz.

(10) Disconnect load from test port of SWR bridge and adjust output level of signal generator for a power meter indication of –5 dBm.

(11) Reconnect test port of SWR bridge directly to TI **INPUT**. Power meter will indicate within limits specified in first row of table 9.

(12) Repeat technique of (9) through (11) above for signal generator frequencies and power meter indications specified in table 9. Power meter will indicate within limits specified in table 9.

Table 9. SWR

Signal generator frequency (MHz)	Power meter indication (dBm)
1000	≤–19
300	≤–19
100	≤–19
30	≤–19
10	≤–19

b. Adjustments

(1) Disconnect equipment setup.

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

(a) Press **RF LEVEL**.

(b) Press **0.024 SPCL**.

(c) Press **49.31 SPCL**.

(3) Adjust A15R42 DET OFS (fig. 1) for a TI indication between -0.001 and 0.001.

21. Power Supply

a. Performance Check

NOTE

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

(1) Connect multimeter input between A10TP3 (fig. 1) and ground. If multimeter does not indicate between 14.9 and 15.1 V dc, perform **b** below.

(2) Connect multimeter input between test points listed in table 10 and ground. Multimeter will indicate within limits specified.

Table 10. Power Supply

Test instrument test points (fig. 1)	Multimeter indications (V dc)	
	Min	Max
A10TP7	-15.2	-14.8
A10TP5	+5.1	+5.3
A10TP4	-5.3	-5.1
A10TP6	+40.5	+42.5

b. Adjustments. Adjust A10R24 (+15 V ADJ) (fig. 1) for a 15.0 V dc indication on multimeter (R).

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:

GEORGE W. CASEY, JR.
General, United States Army
Chief of Staff

Official:

JOYCE E. MORROW
Administrative Assistant to the
Secretary of the Army

0827404

Distribution:

To be distributed in accordance with the initial distribution number (IDN) 343116, requirements for calibration procedure TB 9-6695-263-24.

Instructions for Submitting an Electronic 2028

The following format must be used if submitting an electronic 2028. The subject line must be exactly the same and all fields must be included; however, only the following fields are mandatory: 1, 3, 4, 5, 6, 7, 8, 9, 10, 13, 15, 16, 17, and 27.

From: "Whomever" whomever@redstone.army.mil
To: <2028@redstone.army.mil

Subject: DA Form 2028

1. **From**: Joe Smith
2. Unit: home
3. **Address**: 4300 Park
4. **City**: Hometown
5. **St**: MO
6. **Zip**: 77777
7. **Date Sent**: 19-OCT –93
8. **Pub no:** 55-2840-229-23
9. **Pub Title**: TM
10. **Publication Date**: 04-JUL-85
11. Change Number: 7
12. Submitter Rank: MSG
13. **Submitter FName**: Joe
14. Submitter MName: T
15. **Submitter LName**: Smith
16. **Submitter Phone**: 123-123-1234
17. **Problem**: 1
18. Page: 2
19. Paragraph: 3
20. Line: 4
21. NSN: 5
22. Reference: 6
23. Figure: 7
24. Table: 8
25. Item: 9
26. Total: 123
27. **Text**

This is the text for the problem below line 27.