TECHNICAL BULLETIN

CALIBRATION PROCEDURE

FOR

SWEEP GENERATORS

AN/USM-308(V), AN/USM-308(V)1,

AN/USM-308(V)2, AND AN/USM-308(V)3,

INCLUDING GENERATOR SUBASSEMBLIES

MX-8333(P)/USM-308(V),

MX-8364(P)/USM-308(V), AND MX-8364A(P)/USM-308(V)

WITH ELECTRONIC TEST EQUIPMENT PLUG-IN UNITS

PL-1239/USM-308(V), PL-1239A/USM-308(V), PL-1240/USM-308(V),

PL-1241\USM-308(V), PL-1241A/USM-308(V),

PL-1242/USM-308(V), PL-1243/USM-308(V), AND PL-1304/USM-308(V)

AND

HEWLETT PACKARD SWEEP OSCILLATORS

MODELS 8690A AND 8690B

INCLUDING

H-P RF PLUG-IN UNITS, MODELS 8691A, 8691A OPT 200, 8692A,

8693A, 8693A OPT 200, 8693B, 8694A. H01-8694A(OPTION 100),

H02-8694A(OPT10N 200), 8694B, H02-8694B, 8695A, 8696A,

8697A, 8698A, 8698B, 8699B, AND 87-07A,

AND

CALIBRATORS

K04-8690A AND 11531A

HEADQUARTERS, DEPARTMENT OF THE ARMY

MAY 1973

THIS IS A REPRINT including Changes 3 and 4.

TB 11-6625-2402-35/1

Change 4

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR
SWEEP GENERATORS
AM/USM-308(V), AN/USM-308(V)l, AN/USM-308(V)2, AND
AN/USM-308(V)3, (NSN 6625-00-283-9766)
INCLUDING GENERATOR SUBASSEMBLIES
MX-8333(P)/USM-308(V) (NSN 6625-00-766-7799)
MX-8364(P)/USM-308(V), AND MX-8364A(P)/USM-308(V)
(NSN 6625-00-442-3470)
WITH ELECTRONIC TEST EQUIPMENT PLUG-IN UNITS
PL-1239/USM-308(V) AND PL-1239A/USM-308(V) (NSN 6625-00450-7594)
PL-1240/USM-308(V) (NSN 6625-00-165-1263)
PL-1241/USM-308(V) AND PL-1241A/USM-308(V) (NSN 6625-00-453-3143)
PL-1242/USM-308(V) (NSN 6625-00-251-5212), PL-1243/USM-308(V)
(NSN 6625-00-422-4311)
AND PL-1304/USM-308(V) (NSN 6625-00-444-2327)
AND HEWLETT PACKARD SWEEP OSCILLATORS MODELS 8690A
(NSN 6625-00-928-0364)
AND 8690B (NSN 6625-00-442-3470)
INCLUDING
RF PLUGIN UNITS, MODELS 8691A AND 8691A OPT 200 (NSN 6625-00-482-1742)
8692A (NSN 6625-00-195-6765), 8693A AND 8693A OPT 200 (NSN 6625-00-118-6728)
8693B (NSN 6625-00-118-6728), 8694A AND 8694B (NSN 6625-00-444-2327)
HO1-8694A OPT 100 (NSN 6625-00-159-2224) HO2-8694A OPT 200 (NSN 6625-00-689-6787)
HO2-8694B (NSN 6625-00-237-4413), 8695A (NSN 6625-00-107-2096),
8696A (NSN 6625-00-137-6794), 8697A (NSN 6625-00-413-5625)
8698A AND 8698B (NSN 6625-00-435-3143) 8699B (NSN 6625-00-251-5212)
AND
8707A (NSN 6625-00-424-4369)
AND CALIBRATORS KO4-8690A (NSN 6625-00-438-9089) AND 11531A
(NSN 6625-00-450-7594)

Headquarters, Department of the Army, Washington, DC
22 April 1987

TB 11-6625-2402-35/1, 8 May 1973, is changed as follows:

Page 12, Table 2-3. In column 2, line 7, add "*" after "zero".

Page 35. Delete tables 6-3 and 6-4. Paragraph 6-4 a (5) through (10) is superseded as follows

(5) Set MANUAL SWEEP control fully ccw. Record electronic counter indication.

(6) Set MANUAL SWEEP control fully CW. Record electronic counter indication.

(7) Subtract value recorded in (5) above from value recorded in (6) above. Sweep width will be between 0.97 and 1.03 MHz.

(8) Set SCALE switch to X1.

(9) Adjust START/CW control for a 50.00-MHz indication on electronic counter.

(10) Repeat (5) through (7) above except sweep width will be between 9.7 and 10.3 MHz.

By Order of the Secretary of the Army:

JOHN A. WICKHAM, JR
General, United States Army
Chief of Staff

Official:

R. L. DILWORTH
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.

TB 11-6625-2402-35/1

*Change 3

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR
SWEEP GENERATORS
AM/USM-308(V), AN/USM-308(V)1, AN/USM-308(V)2, AND
AN/USM-308(V)3, (NSN 6625-00-283-9766)
INCLUDING GENERATOR SUBASSEMBLIES
MX-8333(P)/USM-308(V) (NSN 6625-00-766-7799)
MX-8364(P)/USM-308(V), AND MX-8364A(P)/USM-308(V)
(NSN 6625-00-442-3470)
WITH ELECTRONIC TEST EQUIPMENT PLUG-IN UNITS
PL-1239/USM-308(V) AND PL-1239A/USM-308(V) (NSN 6625-00-450-7594)
PL-1240/USM-308(V) (NSN 6625-00-165-1263)
PL-1241/USM-308(V) AND PL-1241A/USM-308(V) (NSN 6625-00-453-3143)
PL-1242/USM-308(V) (NSN 6625-00-251-5212), PL-1243/USM-308(V)
(NSN 6625-00-422-4311)
AND PL-1304/USM-308(V) (NSN 6625-00-444-2327)
AND HEWLETT PACKARD SWEEP OSCILLATORS MODELS 8690A
(NSN 6625-00-928-0364)
AND 8690B (NSN 6625-00-442-3470)
INCLUDING
RF PLUG-IN UNITS, MODELS 8691A AND 8691A OPT 200 (NSN 6625-00-482-1742)
8692A (NSN 6625-00-195-6765), 8693A AND 8693A OPT 200 (NSN 6625-00-118-6728)
8693B (NSN 6625-00-118-6728), 8694A AND 8694B (NSN 6625-00-444-2327)
HO1-8694A OPT 100 (NSN 6625-00-159-2224) HO2-8694A OPT 200 (NSN 6625-00-689-6787)
HO2-8694B (NSN 6625-00-237-4413), 8695A (NSN 6625-00-107-2096),
8696A (NSN 6625-00-137-6794), 8697A (NSN 6625-00-413-5625)
8698A AND 8698B (NSN 6625-00-435-3143) 8699B (NSN 6625-00-251-5212)
AND
8707A (NSN 6625-00-424-4369)
AND CALIBRATORS KO4-8690A (NSN 6625-00-438-9089) AND 11531A
(NSN 6625-00-450-7594)

Headquarters, Department of the Army, Washington, DC
7 August 1984

*This change supersedes Change 1, 29 July 1975, and Change 2, 7 September 1977.

TB 11-6625-2402-35/1, 8 May 1973, is changed as follows:

The title is superseded as shown above.

Page 3, paragraph 1-2. In lines 7 and 8, change address to read "Commander, US Army TMDE Support Group, ATTN: DRXTM-LPP, Redstone Arsenal, AL 35898."

Paragraph 1-3b, PL-1241A/USM-308(V) (HP 8698B). Make the following changes in the specifications:

Frequency range	4 to 11 MHz, low band; 4 to 110 MHz, high band
Frequency accuracy	Low range: ±1% of frequency ±50 kHz High range: ±1% of Frequency ±500 kHz
Uncalibrated RF output	-15 dBm minimum

Page 11. Paragraph 2-2a(7) is superseded as follows:

(7) Multimeter indication will be greater than indication obtained in (4) above.

Add note after paragraph 2-2a(7) as follows:

NOTE

This circuit contains a diode. When the diode is forward biased, the amount of resistance measured will depend on the sensitivity and range of the meter being used.

Page 12, table 2-2. Lines 1, 2, and 3 are superseded as follows:

SWPREF AM	∞
-300V	9.5 K to 10.5 K
+275V	28 K to 34 K

Table 2-2, footnote. The footnote is deleted entirely.

Table 2-3. Lines 2,3, and 7 are superseded as follows:

-300 V	9.5 K to10.5 K
+275V	28 K to 34 K
HELIX(10:1)/HELIX(1:1AC) . . .	ZERO

Table 2-3. The following footnote added:

*This indication applies to model 8690A only. Also see note following paragraph 2-2a(7) above.

Table 2-5. Delete "SWP REF AM +36 +40 -4" from table.

Paragraph 2-3a(2). In line 5, change "(1. 4)" to read "(1-3)".

Paragraph 2-3a(6) is superseded as follows:

(6) Set sweep oscillator controls as follows:

(a) LINE switch to RF.

(b) START/CW pointer to 38V scribe line.

(C) STOP/ Δ F pointer to 73V scribe line.

(d) SWEEP SELECTOR to CW.

(e) AMPLITUDE MODE pushbutton. all released.

(f) ACL pushbutton released.

(g) SWEEP TIME (SEC) control to .01-.1.

(h) VERNIER control to maximum clockwise (line sync).

(i) FUNCTION pushbutton START/STOP in (remaining 3 released).

(j) UUT FUNCTION SELECTOR switch to SWP REF AM.

Add paragraphs 2-3a(7), (8), and (9) as follows:

(7) Voltmeter (1-2) will indicate between +36 and +40 V dc.

(8) Set UUT SWEEP SELECTOR switch as appropriate and FUNCTION SELECTOR switch to positions listed in table 2-5 and observe that the indications are within prescribed limits.

(9) Set sweep oscillator (1-5) SWEEP SELECTOR control to AUTO. Oscilloscope (1-4) will indicate -4 V pulse as in figure 2-1.

Page 15, paragraph 3-2g(3). In line 1, change "All" to read "All".

Page 16, paragraph 3-4a(3). In line 2, change 'AMP" to read "RMP".

PARAGRAPH 3-6A(7)(b). line 2, change counterclockwise" to read "clockwise".

Page 18 paragraph 3-9(1)e. In line 1, change . "A 11" to read "All".

Page 19, paragraph 3-1 la(l)(c). In line 1, change "STOP/ Δ F" to read "START/CW" and "73 V" to read " 10 V".

Page 29, paragraph 5-3a(2)(a). In line 2, delete "(MANUAL for items listed in table 5-2C)".

Paragraph 5-3a(2)(b). In lines 2 and 3, delete "(FUNCTION ΔF pressed for items listed in table 5-2C)".

Page 33, SECTION VI title. In line 3, change "8690A and 8690B" to read "8698A and 8698B".

Page 35, paragraph 6-6a(2)(d). In line 1, Change "100" to read " 111".

Page 36, paragraph 6-7a(3)(a). In line 1, change "X 1" to read "X. 1".

Paragraph 6-7a(3)(c). In line 1, change "clockwise" to read "counterclockwise".

Paragraph 6-7a(4). In line 1, change "2.23" to read "0.223".

Page 38, paragraph 6-10a(4). In line 2, change "0.3 mw" to read "0.03 row".

Paragraph 6-10a(6). In line 2, change "0.3 mw" to read "0.03 row".

Page 41, table 7-1. In column 3, line 12, change "CN-2171/U" to read "CN-1271/U".

Page 42. Paragraph 7-3a(5) is superseded as follows:

(5) Output power will not be less than +13 dBm and flatness will be less than 7 dB.

Paragraph 7-3a(9) is superseded as follows:

(9) Output power will not be less than +8 dBm and flatness will be less than +3 dB.

Paragraph 7-4a(3). Add at end of sentence "and set stop control to 4 GHz."

By Order of the Secretary of the Army:

JOHN A. WICKHAM, JR.
General, United States Army
Chief of Staff

Official:

ROBERT M. JOYCE
Major 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: 1986-491-885/40049

TECHNICAL BULLETIN

No. 11-6625-2402-35/1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 8 May 1973

CALIBRATION PROCEDURE FOR SWEEP GENERATORS AN/USM-308(V), AN/USM-308(V)1, AN/USM-308(V)2, AND AN/USM-308(V)3, INCLUDING GENERATOR SUBASSEMBLIES MX-8333(P)/USM-308(V), MX-8364(P)/USM-308(V), AND MX-8364A(P)/USM-308(V) WITH ELECTRONIC TEST EQUIPMENT PLUG-IN UNITS PL-1239/USM-308 (V), PL-1239A/USM-308(V), PL-1240/USM-308(V) , PL-1241/USM-308(V), PL-1241A/USM-308(V), PL-1242/USM-308(V), PL-1243/USM-308(V), AND PL-1304/USM-308(V) AND HEWLETT PACKARD SWEEP OSCILLATORS MODELS 8690A AND 8690B INCLUDING H-P RF PLUG-IN UNITS, MODELS 8691A, 8691A OPT 200, 8692A, 8693A, 8693A OPT 200, 8693B, 8694A, HO1-8694A (OPTION 100), H2-8694A (OPTION 200), 8694B, H2-8694B, 8695A, 8696A, 8697A, 8698A, 8698B, 8699B, AND 8707A, AND CALIBRATORS K04-8690A AND 11531A

SECTION I

INTRODUCTION AND DESCRIPTION

1-1. Purpose and Scope

This bulletin provides information, equipment setups, and adjustment locations for the periodic calibration of Sweep Generator Calibrators PL-1239/USM-308(V), PL-1239A/USM-308(V), Sweep Generators AN/USM408(V), AN/USM-308(V)1, AN/USM-308(V)2, and AN/USM-308(V)3, and the associated plug-in units comprising the (V) variable nomenclature. Since it is to be used by personnel trained and qualified in the use of calibration equipment, detailed instructions pertaining to operation and use of the calibration equipment is not included.

1-2. Report of Technical Bulletin Improvements

The reporting of errors, omissions, and recommendations for improving this bulletin by the individual user is encouraged. Reporta should be submitted on DA Form 2028 (Recommended Changes to Publications) and forwarded direct to Commander, US Army Electronics Command, ATTN: AMSEL-MA-CRA, Fort Monmouth, NJ 07708.

1-3. Descriptive Data

Sweep Generators AN/USM-308(V), .AN/USM-308(V)1, AN/USM(V)2, and AN/USM-308(V)3 consist of Generator Subassembly MX-8333(P)/USM-308(V) and Generator Subassembly MX-8364(P)/USM-308(V) or MX-8364A(P)/USM-308 (V) and various plug-in units that govern the frequency range and power output of this broad and narrow band sweep oscillator. Each plug-in unit has a plastic frequency scale that is snapped in the main. frame while being used. The RF plug-in units may be used individually by being inserted into main frame MX-8364 (P)/USM-308(V), or collectively as shown in figure 1 with Plug-In Unit PL-1243/USM-308 (V) inserted into the mainframe. Calibrator PL-1239/USM-308(V) or PL-1239A/USM-308 (V) is also with the configuration and enables checking and adjusting by supplying substitute resistive loads and voltage outlets. Additional data is listed in *a, b,* and *c* as follows:

a.. Identification. The identification and physical description of the sweep generator set is contained in table 1-1.

Table 1-1. Component Identification

Nomenclature	Type Number	Mfg. Part Number		Weight (approx)
Generator subassemblies	MX-8333(P)/USM-308(V)	HP 8707A	1 8 X 1 7 X 1 0	28 lbs
	MX-8364(P)/USM-308(V)	HP 8690A	1 8 X 1 7 X 9	36 lbs
	MX-8364A(P)/USM-308(V)	HP 8690B	1 8 X 1 7 X 9	36 lbs
Electric test equlpment plug-in Units.	PL-1239/USM-308(V)	HP K04-S690A	1 7 X 7 X 5	16 lbse
	PL-1239A/USM-308(V)	HP 11531A	1 7 X 7 X 5	16 lbse
	PL-1240/USM-308(V)	HP 8693B	1 7 X 7 X 5	16 lbs
	PL-1241/USM-308(V)	HP 8698A	1 7 X 7 X 5	15 lbs
	PL-1241A/USM-308(V)	HP 8698B	1 7 X 7 X 5	16 lbs
	PL-1242/USM-308(V)	HP 8699B	1 7 X 7 X 5	16 lbs
	PL-1243/USM-308(V)	HP 8706A	1 7 X 7 X 5	16 lbs
	PL-1304/USM-308(V)	HP 8694B	1 7 X 7 X 5	13 lbs
	None applied.	HP 8691A	1 7 X 7 X 5	16 lbs
		HP 8692A	1 7 X 7 X 5	16 lbs
		HP 8695A	1 7 X 7 X 5	16 lbs
		HP 8696A	1 7 X 7 X 5	16 lbs
		HP 8697A	1 7 X 7 X 5	16 lbs

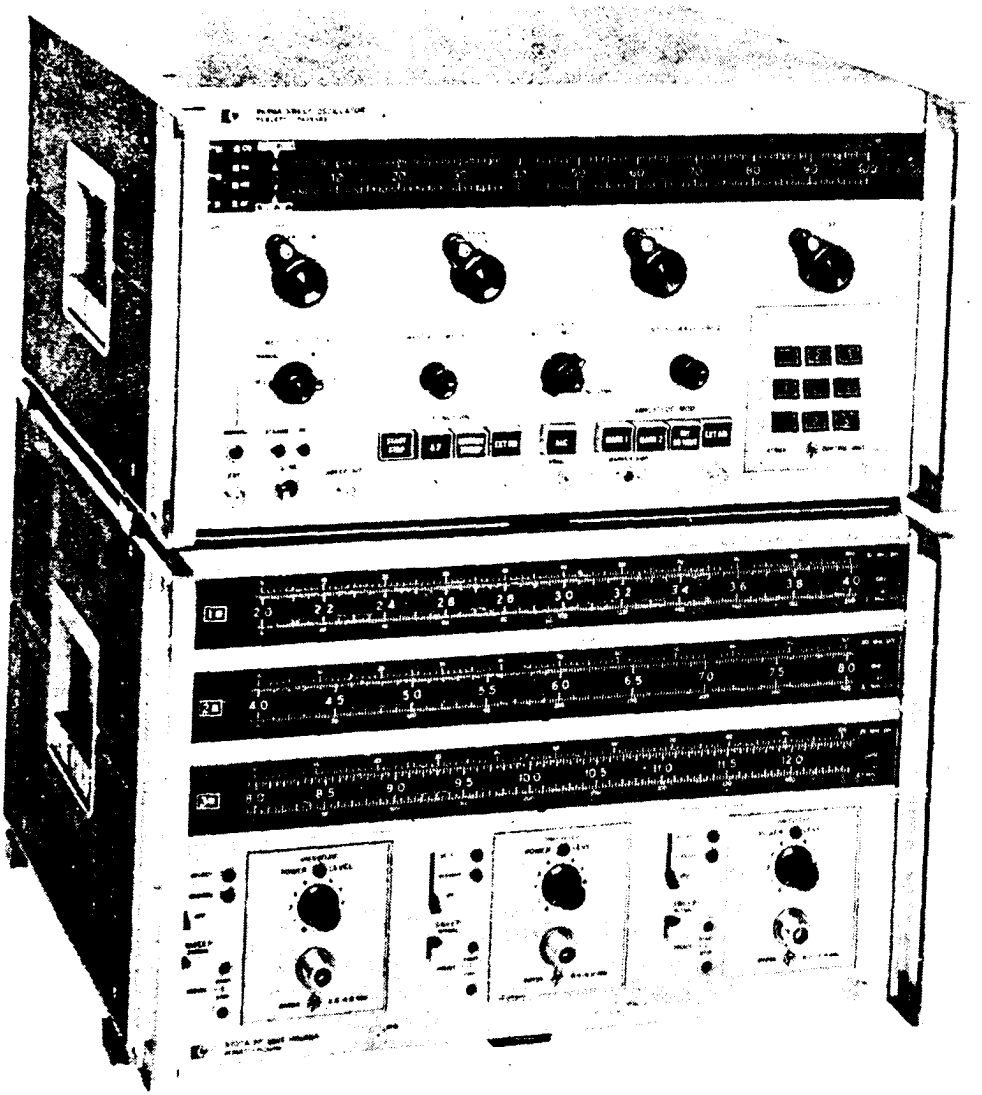


Figure 1-1. Sweep Generator AN/USM-308(V) (top) and RF Unit Holder MX-8333(P)/USM-308(V) (bottom) shown with four various plug-in.

b. Specificatiom. MX-8364(P)/USM-308(V) and MX-8364A(P)/USM-308(V) specifications marked with an asterisk are for information only and are not necessarily verified in this procedure.

*Input requirements	115 or 220 vac ±10%, 50 to 60 Hz. Approximately 350 watts.
Sweep functions:	
Start-stop Sweep . . .	Sweeps from "start" to "stop" frequency setting.
Range	Both settings continuously and independently adjustable over the entire frequency range; can be set to sweep either up or down in frequency.
End-point accuracy	Same as RF unit frequency accuracy.
Marker sweep	Sweeps from "Marker 1" to "Marker 2" frequency setting.
Range	Both settings continuously and independently adjustable over the entire frequency range; can be set to sweep either up or down in frequency.

End-point accuracy	Same as RF unit frequency accuracy.
ΔF sweep	Sweeps upward in frequency, centered on CW setting.
Width	Continuously adjustable from zero to 10% of the frequency band; calibrated directly in MHz.
Width accuracy	±10% of ΔF being awept ±1% of maximum. ΔF (±20%, ±2% respectively with 8691A/B RF unite).
Center-frequency accuracy.	Same as RF unit frequency accuracy.
Frequency markers	Two frequency markers, independently adjustable over the entire frequency range, amplitude modulate the RF output. Amplitude is adjustable from the front panel. The markers are also available for external use.
Accuracy	1% of full scale for all RF units.
Resolution	Better than 0.05% of RF unit bandwidth.
* Marker output	Triangular pulse, typically -6 v peak into 1000-ohm load.
CW operation	Single-frequency RF output selected by START/CW or MARKER 1 control, de pending upon sweep function selected.
Accuracy	Same as RF unit frequency accuracy.
Preset frequencies	Start-stop sweep end pointa and marker frequencies can be used as four preset CW frequencies.
Sweep mode:	
Auto	Sweep recurs automatically.
Manual	Front panel control providea continuous manual adjust ment of frequency between end frequencies act in any of the above sweep functions.
*Triggered	Sweep is actuated by front panel pushbutton or by externally applied signal <-25 v peak, >1 µsec pulse width, and >0.1 v/ µsec rise.
Sweep characteristics:	
Sweep time	Continuously adjustable in four decade ranges, 0.01 to 100 seconds. Can be synchronized with the powerline frequency.
* Sweep indicator . . .	Front panel indicator lights during the sweep to pm- vide indication of sweep duration on slower sweep times.
* Sweep output --------	Direct-coupled sawtooth zero to approx. +15 v, concuryent with swept RF output. Zero at start of sweep, approximately +15 v at end of sweep, approximately +15 v at end of sweep regardless of sweep width or direction. **Source** impedance, 10,000 ohms.
Frequency linearity . . .	(Correlation between frequency and both the sweep and reference output). Same as RF unit frequency accuracy.
* Blanking	RF automatically turned off during retrace, turned on after completion *of* retrace On automatic sweeps, RF is on long enough before eweep starts to stabilize external circuits and equipment whose response is compatible with the selectad sweep rata. Blanking disable switch provided. Blanking automatically disabled for power meter leveling.
* Blanking output	Direct-coupled rectragular pulse approximately -4 v coincident with RF blanking. Source impedance approximately 3000 ohms.
* Pen lift	For uze with X-Y graphic recorderz. Penlift terminals shorted during sweep, open during retrace.
* Power leveling amplifier.	Internal dc-coupled leveling amplifier provided.
Crystal input	Approximately -20 to -350 mv for specified leveling at rated output; for use with negative-polarity detectors.
* Modulation:	
Internal AM.	Square wave modulation continuously adjustable from 950 to 1050 Hz on all sweep times. On/off ratio greater than 20 db at rated output.
External AM:	
Frequency response	DC to 350 kHz unleveled, DC to 50 kHz leveled.
sensitivity	-10 v reduces RF output level at leazt 20 db below mted CW output.
Input impedance . . .	Approximately 1000 ohnm
External FM:	
Frequency reeponze	DC to 3 kHa.
Sensitivity	Deviation from CW setting appmximatily 67c of the frequency band per volt-

Maximum range . . . Full band for modulation frequencies up to 160 Hz (approximately 17 v p-p input), decreases to about 20% of the band for 3 kHz modulation.

Input impedance . Approximately 100,000 ohms.

MX-8333(P)/USM-308 (V) with PL-1243/USM-308 (V):

Compatability -------- Controls up to three RF Units in the holder. Selection of RF unit is by front panel pushbutton and remote contact closure.

*Switching time between RF Unite. 1 second.

Frequency range . . . . 10 kHz to 40 GHz, determined by the RF units installed.

Frequency accuracy . . . Same as RF unit accuracy.

Output . . . . . Same as RF unit.

Sweep functions:

Normal . . . . . .Permits any sweep function available from the sweep generator.

Preset . . . . . .Provides start-stop sweep determined by preset adjustments. Sweep endpoints can be set independently for each RF unit.

*Power requirements. Approximately 385 watts for one system with Sweep Generator MX-8364(P)/USM-206(V), Control Unit PL-1243/USM-308(V), RF Unit Holder MX-6333(P)/USM-308(V), and three RF Unite.

PL-1239/USM-308(V) and PL-1239A/USM-308 (V):

Resistance . . . . . 4.5 ohms to 2 megahms

Voltage dc . . . . . +276 to -300.

Ripple . . . . . Less than 160 RMS mini-Volts.

PL-1240/USM-308(V):

Frequency range . . . . 4 to 8 GHz.

Frequency accuracy . . . . . .20 MHz.

Maximum leveled power. At least 15 mw.

RF power control . . . . . PIN line.

Frequency stability:

With temperature. . . . . ±0.01%/°C.

With 10% change in line voltage. ±1 MHz

'With 10-db power level change. ±1 MHz.

Residual FM ------- <50 kHz peak.

*Output impedance . . 60 ohme.

*Power variation, external leveling (excluding detector and Coupler variation) . ±0.1 db.

Power Variation unleveled. Less than 10 db over the entire band.

Residual AM . .. . . . At least 40 db below CW output.

Spurious signals:

Harmonics . . . . . At least 20 db below CW output.

Nonharmonics. . . . . At least 40 db below CW output.

*Reference output . . . . Direct-coupled voltage proportional to RF frequency, approximately 0 v at the low end of the band, increasing approximately 40 v/octave, output impedance, 30,000 ohms.

PL-1304/USM-308(V):

Frequency range . . . . . 8.0 to 12.4 GHz.

Frequency accuracy .. ±40 MHz.

Maximum leveled power. At least 30 mw.

RF power control . . . . PIN line.

Frequency stability:

With temperature . ±0.01%/°C

With 10% change in line voltage. ±1 MHz.

*With 10-db power level change. ±1 MHz.

Residual FM . . . . . <50 kHz peak.

*Output impedance . . . . . 50Ω.

*Power variation, external leveling (excluding detector and coupler variation). ± 0.1 db.

Power. variation unleveled. Less than 10 db over the entire band.

*Residual AM . . . . . Aat least 40 db below CW output.

*Spurious signals:

Harmonics . . . . . At least 20 db below CW output.

Nonharmonics . . At least 40 db below CW output.

*Reference output . . . Dimet-coupled voltage proportional to RF frequency, approximately 0 v at the low end of the band, increasing approximately 40 v/octave; output impedance. 30,000 Ω.

PL-1241-USM-308(V):

Frequency range . . . . . 0.1 to 11 MHz or 1 to 110 MHz (selected by front panel switch).

Frequency accuracy . 0.1 to 11 MHz, ±1% or ±10 kHz, whichever is greater; 1 to 110 MHz, ±1% or ±100 kHz, whichever is greater.

Linearity. . . . . ±0.5% of sweep width.

* Residual FM . . . . . 0.1 to 11 MHz, <150 Hz peek. 1 to 110 MHz, <500 Hz peak.

Frequency stability:	
*With temperature	0.1-11 MHz, ±0.01%/°C or ±200 Hz/°C, whichever is greater; 1 to 110 MHz, ±0.01%/°C or ±2 KHz/°C, whichever is greater.
With 10% line voltage change.	0.1 to 11 MHz, ±5 kHz 1 to 110 MHz, ±5O kHz.
*Spurious signal:	
Nonharmonics	At least 40 db below CW output.
Harmonics	At least 35 db below CW output from 1 to 110 MHz.
Power output	+20 dbm to -110 dbm adjustable in 10-db steps; 10-db vernier permits continuous adjustment between steps.
Output accuracy (vernier in calibrate position).	+10 to -60 dbm; ±2 db; -70 to -110 dbm; ±3 db.
Attenuator accuracy	±1 db, 10 to 70 db attenuation; ±2 db, 80 to 120 db attenuation.
Output flatness (vernier in calibrate position.	1 to 110 MHz, ±0.25 db.
Output impedance	50 ohms.
Auxiliary outputs:	
Sweep reference	Approx. lV/MHz, 0.1 to 11 MHz range. Approx. 1V/10MHz, 1 to 110 MHz range.
Auxiliary RF output.	CW signal corresponding to front panel output at least -15 dbm.
VTO output	200 to 310 MHz CW ; output level at least -15 dbm.
Modulation:	
Internal square wave.	1 kHz rate.
*External AM	Bandwidth 5 kHz.
*External FM	Linearity ±0.5% ; maximum rate (any deviation) 2 kHz; maximum deviation 110 MHz.

PL-1241A/USM-308(V) (HP 8698B):

Frequency range,	0.1 to 2 GHz, low band; 2 to 4 GHz, high band.
Frequency accuracy	CW: ±10 MHz; all other modes: ±20MHz.
*Frequeticy Linearity	+0.5%, of sweep width.
*Frequency Stability	±600 kHz/10 min; ±750 kHz/°C.
*Residual FM (in Cw).	<3 kHz rms noise in a 10 kHz bandwidth.
With 10% line voltage change.	0.4 to 11 MHz, ±5 kHz; 4 to 110 MHz, ±50 kHz.
*Spurious signal:	
Nonharmonics	At least 35 db below CW output.
Harmonica	at least 30 db below CW output.
Power output	+13 dbm to -110 dbm calibrated in 10-db steps and at +13 dbm. 10-db vernier permits continuous adjustment between steps.
Output accuracy	±1.5 db.
Output flatness	±0.3 db.
Output impedance	50 ohms.
Auxiliary outputs (rear panel):	
Sweep reference	Approx. lV/MHz, 0.4 to 11 MHz range. Approx. lV/10 MHz, 4 to 110 MHz range.
Uncalibrated RF output.	-5 dbm minimum.
VTO output	200.4 to 310 MHz CW ; output level at least -15 dbm.
AUX output	0.4 to 11 MHz, approx. 0 dbm.
Modulation:	
Internal square wave	1 kHz rate.
*External AM	Bandwidth DC to 10 kHz.
*External FM	Deviations to the band edges are possible for rates to 100 Hz. Smaller deviations possible at rates up to 10 kHz.
Crystal calibration	Internal 5-MHz crystal allows frequency calibration to ±0.01% at any 5 MHz multiple using front panel frequency vernier.

PL-1242/USM-308(V) (HP 8699B) :

Frequency range	0.1 to 2 GHz, low band; 2 to 4 GHz, high band.
Frequency accuracy	CW: ±10 MHz; all other modes: ±20 MHz.
*Frequency Linearity	+0.5% of sweep width.
*Frequency Stability	±500 kHz/10 min; ±750 kHz°C.
*Residual FM (in CW).	<3 kHz rms noise in a 10 kHz bandwidth.
*Max. Leveled power	≥+13 dbm (0.1-2 GHz); ≥ + dbm (2-4 GHz).
Flatness	Leveled: ±0.1 db plus coupler l nd detector variation. Unleveled: <+7 db.
*Spurious Signals:	
0.1 to 2 GHz .	Harmonics: >25 db below CW output; nonharmonics: >30 db below CW output, at max. leveled power.
2 to 4 GHz..	Harmonics: 20 db down; nonharmnonics: 30 db down.
*Residual AM .	AM noise modulation index (rms in 10-kHz bandw!dth) lees than -40~ db.

Modulation:	
External FM:	
Frequency response.	DC to 500 kHz ±3O MHz from DC to 100 Hz and ±3 MHz to 200 kHz.
Internal AM.	950 to 1050 Hz.
*External AM	DC to 50 kHz.

Specifications for commercial models HP 8691A, 8692A, 8695A, 8696A, and 8697A are listed in table 1-2.

c. Calibration Program.

Interval of calibration . .	In accordance with TB 236.
Time required for calibration	20 hours (approximately)

1-4. General Instructions

a. Calibration Data Cord. During the performance of this procedure, annotate DA Form 2416 in accordance with TM 38–750.

b. Unit Under Test. The item referred to as the UUT (Unit Under Test) will be the item listed in the title of each section. See table 1-1 for cross index.

c. Equipment Required. Each section throughout this procedure has an equipment required table containing a minimum use specifications column that applies to the item listed in the title of each section.

1-5. Differences Among Models

Differences are shown in table 1-1, paragraph 1-3b under specifications, and in parentheses in the text where different indications are to be observed. It is also to be noted that this equipment being commercial "off the shelf" and not manufactured to military specifications is subject to changes of any type per any specified Mock of serial numbers. If an indication received in the performance check is other than that specified, consult the yellow change sheets shipped with the commercial operation and service manual before applying a red tag to the instrument. Use the value listed in the change if applicable.

Table 1-2. Commercial Model Specifications

Model number	Frequency range	RF Power control	Maximum leveled power	Power [1] variation external leveling	Frequency accuracy at max leveled power	Frequency stability			Residual FM
						With temperature	With 10% Chg in line voltage	With power level change	
HP 8691A	1.4–2.5 GHz	BWO Grid	100 mw	±0.2 db	±1%	±0.01%/°C	±500 kHz	Less than ±20 MHz (for 6 db).	30 kHz peak.
HP 8692A	2–4 GHz	BWO Grid	70 mw	±0.2 db	±1%	±0.01%/°C	±500 kHz	Less than ±40 MHz (for 6 db).	30 kHz peak.
HP 8695A	10–15.5 GHz	BWO Grid	25 mw	±0.2 db	±1%	±0.01%/°C	±10 MHz	0.25 GHz	150 kHz.
HP 8696A	18–26.5 GHz	BWO Grid	10 mw	±0.2 dB	±1% over a 6 dB range.	±0.01%/°C	±15 MHz	0.36 GHz with 10-db power level change.	200 kHz peak.
HP 8697A	26.5–40 GHz	BWO Grid	5 mw	±0.2 dB	±1% over a 6 dB range.	±0.01%/°C	±20 MHz	0.53 GHz with 10-db power level change.	350 kHz peak.

[1] Excluding coupler and detector

SECTION II

CALIBRATION OF CALIBRATORS PL-1239/USM-308(V), PL-1239A/USM-308(V) (HP MODELS K04-8690A AND 11531A)

2-1. Equipment Required

Equipment required for calibration performance checks and adjustments is listed in table 2-1.

Table 2-1. Equipment and Accessories

Item (Identification No.) (A level Std.)		Minimum use specification [1]	Calibration equipment [2]
1–1	Multimeter (7904729)	4.5 to 2.02 Megohms ±2%	Multimeter ME–333/U (Omega model 217A) or Capacitance Bridge, Inductance and Resistance Test Set AN/URM–90.
1–2	Dc voltmeter (7910448–1)	−300 to +275 volts ±0.05%	ME–202–U (J.Fluke, model 803B or Dana model 5600 or 980411).
1–3	Ac voltmeter (7910902)	−4 to +160 millivolts ±3% of FS	ME–26/U (HP 410B or 410C).
1–4	Oscilloscope	With calibrated sweep	AN/USM–140 (HP 130 or 140 or other available oscilloscopes).
1–5	Sweep oscillator	Mainframe receptical	AN/USM–308(V) (HP 8690A or B).
1–6	Cable assembly	BNC plug to black and red banana plugs.	Radio Frequency Cable Assembly CG–3572/U (Pomona Electronics model 2241–C–36).
1–7	Cable assembly (3 required) (10519140).	BNC plug to BNC plug	Radio Frequency Cable Assembly RG–58A/U. (Pomona Electronics BNC–C–48).
1–8	Connector adapter (MS 35173)	BNC "T" type, 2 jacks one plug	UG–274B/U (Amphenol-Borg IPC 4200).
1–9	Test lead (2 required) (7907498).	24-inch, single banana to signle banana	(Pomona Electronics B–24).
1–10	Probe (2 required)	Test Probe to banana jack	Test Prod MX–8427/U (Pomona Electronics model 1589–2).

[1] Minimum use specifications are the principal paramerters required for performances of the calibration, and are included to assist in the selection of alternate equipment. Satisfactory performance of alternate items shall be verified prior to use. All applicable equipment must bear evidence current calibration.

[2] The instruments utilized in this procedure were selected from those known to ve availiable in Department of Defense Installations, 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 agency. It is recognized that equivalent equipment produced by other manufacturers may be capable of equally satisfactory performance in the procedure.

NOTE

Do not install UUT into sweep oscillator or RF unit holder.

2-2 Resistance

a. Performance Check.

(1) Connect multimeter (1-1) to UUT DC-VM connector with cable assembly (1-6).

(2) Set UUT FUNCTION SELECTOR switch to settings listed in table 2-2. Multimeter indicates within specified limits.

(3) Connect multimeter to UUT SCOPE ACVM connector with cable assembly.

(4) Set UUT FUNCTION SELECTOR switch to settings listed in table 2-3. Multimeter indicates with specified limits.

(5) Set UUT FUNCTION SELECTOR switch to HELIX (10:1) /HELIX (1:1AC).

(6) Reverse banana plugs on multimeter.

(7) Multimeter indicates between 2K ohms and 4K ohms.

(8) Set UUT FUNCTION SELECTOR switch to - 6.3V

(9) Connect multimeter to UUT test points listed in table 2-4, with 2 test leads (1-9) and 2 probes (1-10). Multimeter indicates within specified limits.

b. Adjustments. No adjustments can be made.

Table 2-2. Resistance Check (DCVM Connector)

UUT FUNCTION SELECTOR switch settings	Multimeter indication (ohms)
SWP REF AM	
−300 V	9.5 K ∝ [1] to 10.5 K
+275 V	28.1 K to 31.9 K
+20 V	38 to 42
ANODE/START RMP	∝
HELIX FDBK/STOP RMP	24.7 K to 27.3 K
HELIX (10:1) HELIX (1:1AC)	63.4 K to 69.5 K
COLL (10:1) BLANKING	198 K to 202 K
HELIX (10:1) HELIX OV'LD	63.4 K to 69.5 K

[1] 00 on some instruments.

Table 2-3. Resistance Check (SCOPE ACVM Connector)

UUT FUNCTION SELECTOR switch settings	Multimeter indication (ohms)
SWP REF AM	∞
−300 V	9.5 K to 10.5 K
+275 V	28.1 K to 31.9 K
+20 V	38 to 42
ANODE/START RMP	∝
HELIX FDBK/STOP RMP	∞
HELIX (10:1)/HELIX (1:1AC)	9.5 K to 10.5 K
COLL (10:1)/BLANKING	∞
HELIX (10:1)/HELIX OV'LD	

Table 2-4. Resistance Checks

UUT test points	Multimeter indication (ohms)
P12 pin 13 and DCVM connector	4.5 to 5.5
P12 pin 13 and SCOPE ACVM connector.	4.5 to 5.5
P11 pin M and P11 pin P	9.9 K to 10.1 K
P11 pin N and ground	1.98 M to 2.02 M

NOTE

Install UUT in sweep oscillator (1-5).

2-3. Voltage and Waveforms

a. Performance Check.

(1) Connect voltmeter (1-2) to UUT DC-VM jack with cable assembly (1-7).

(2) Connect UUT SCOPE ACVM jack to oscilloscope channel A input using a connector (1-8) and cable assembly (1-7). Connect cable assembly (1-7) from connector (1-8) to voltmeter (1-4).

(3) Turn sweep oscillator (1-5) LINE switch to STANDBY and allow approximately 1 minute for equipment warmup.

(4) Depress UUT TIME DELAY OVERRIDE pushbutton for about 5 seconds.

(5) Turn sweep oscillator LINE switch to RF.

(6) Set UUT FUNCTION SELECTOR switch to positions listed in table 2-5 and observe that the indications are within the prescribed limits.

b. Adjustments. No adjustments can be made.

Table 2-5. Voltage and Waveform Checks

UUT FUNCTION SELECTOh switch position	Voltmeter indication (volts) minimum	Voltmeter indication (volts) maximum	Oscilloscope and AC voltmeter ripple in RMS millivolts [3] (maximum indication)
SWP REF AM	+36	+40	−4
-300 -300	-280	-320	2
-6.3V-6.3V	-6.1	-6.5	8
+ 276V + 275V	+ 256	+ 294	2
+20V/+20V	+19	+21	1
ANODE/START RMP	+ 104	+ 116	159
HELIX FDBK STOP RMP	+ 33.3	+ 37.3	160
HELIX (10:1) /HELIX (1:1AC)	+112	+124[1]	7
COLL(10:1) BLANKING	+118	+ 136.5[3]	−6

[1] Note this Indication.
[2] Add 12.6 volts to the HELIX (10:1) HELIX (1:1 AC) voltage.
[3] See figure 2-1 for typical oscilloscope presentation.

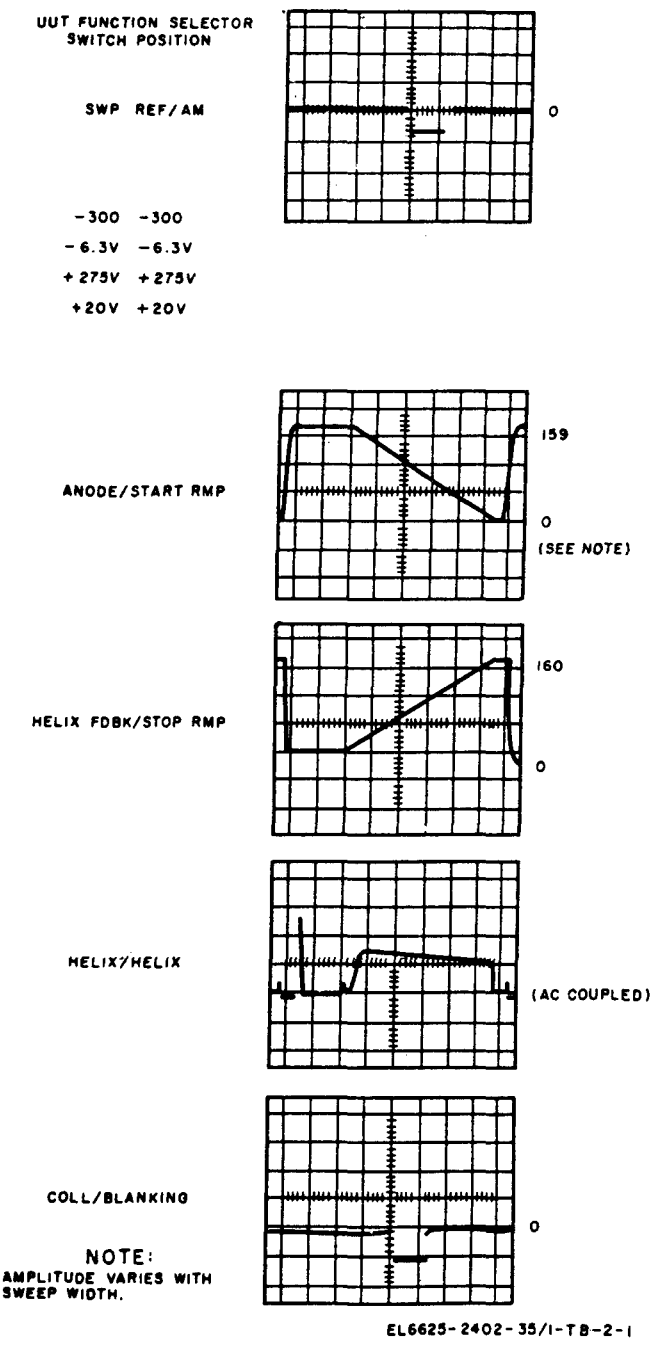


Figure 2-1. Typical oscilloscope waveform.

SECTION III

CALIBRATION OF SWEEP GENERATOR SUBASSEMBLIES MX-8364(P)/USM-308(V) AND MX-8364A(P)/USM-308(V) (HP MODELS 8690A AND 8690B)

3-1. Equipment Required

Equipment required for calibration performance checks and adjustments is listed in table 3-1.

Table 3-1. Equipment and Accessories

Item		Minimun use specification	Calibration equipment
1-1	Autotransformer	105 to 125 vac, ±3%	Variable Power Transformer TF-510/U (General Radio model W10-MT3A).
1-2	Calibrator	UUT plug-in unit	Electrical Teat Equipment Plug-In Unit PL-1239/USM-308(V) (Hewlett-Packard model K04-8690A) Hewlett-Packard model 11531A.
1-3	Multlmeter	0 to ±300 vdc ±0.1%	Multimeter ME-333/U (J-Omega model 217A).
1-4	Oacillascope	0.5v/cmto6 v/cm ±3%	Oscilloscope AN/USM-273 (Tektronix model 463),
1-5	voltmeter	0 to 6 mvac ±1%	Electronic .Voltmeter AN/USM-265 (Hewlett-Packard model 400EL-02).
1-6	Adapter	Tee, BNC plug to 2 BCN jacks.	Connector Adapter UG-274B/U (Amphenol model UG-274B/U).
1-7	Adapter	BNC jack to double banana plug	Connector Adapter UG1887/U (Pomona Electronics model 1289).
1-8	Cable assembly (8 required) . .	36-inch RG58C/U, BNC plug to BNC plug.	Pomona Electronics model BNC-C-36.
1-9	Adapter	Binding poet to BNC plug	Connector Adapter UG-1888/ (Pomona Electronic model 1296).
1-10	Test lead	24 inch, single banana to single banana .	Pomona Electronics model B-24 black.

WARNING

Voltages in excess of 1000 volts are present in UUT and may result in personnel injury or lose of life.

3-2 Preliminary Procedure

a, Install calibrator (1-2) and calibrator scale into UUT.

b. Energise equipment and allow sufficient time for equipment to warmup and stabilise.

c. Adjust autotransformer (1-1) output voltage control to minimum.

d. Connect UUT power cord to autotransformer.

e. Adjust autotransformer output voltage control for a meter indication of 115 vat.

f. Set UUT LINE switch to RF and allow a 15-minute warmup.

g. Position UUT controls as follows:

(1) START/CW, MARKER 1 START/CW, MARKER 2 STOP, and STOP/ Δf controls to 8 v on calibrator scale.

(2) SWEEP SELECTOR switch to CW.

(9) All AMPLITUDE MOD pushbuttons released.

(4) ALC pushbutton released.

(5) MANUAL SWEEP control fully counterclockwise.

(6) SWEEP TIME (SEC) switch to 100-10.

(7) SWEEP TIME (SEC) VENIER control to LINE SYNC.

(8) INT SQ WAVE FREQ control fully counterclockwise.

(11) BLANKING (rear panel) to ON.

(10) FUNCTION START STOP pushbutton pressed.

3-3. Ramp Amplitude

a. Performance Check.

(1) Connect equipment as shown in figure 3-1, without the oscilloscope.

(2) Position UUT controls as follows:

(a) SWEEP' SELECTOR switch to CW.

(b) FUNCTION START-STOP pushbutton pressed.

(c) START/CW control to 73 V on calibrator scale.

(3) Set calibrator FUNCTION SELECTOR switch to SWP REF AM.

(4) Multimeter indicates between 72.9 and 73.1 vdc.

b. Adjustments Adjust UUT 75 V RAMP ADJ R75 (fig. 3-2) for multimeter indication of 73.0 vdc.

3-4. Ramp Zero

a. Perfomance Check.

(1) Position UUT controls as follows:

(a) SWEEP SELECTOR switch to MANUAL.

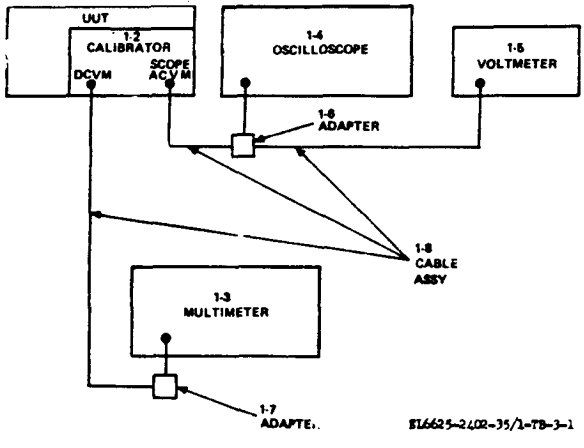


Figure 3-1. Sweep generator calibration, equipment setup

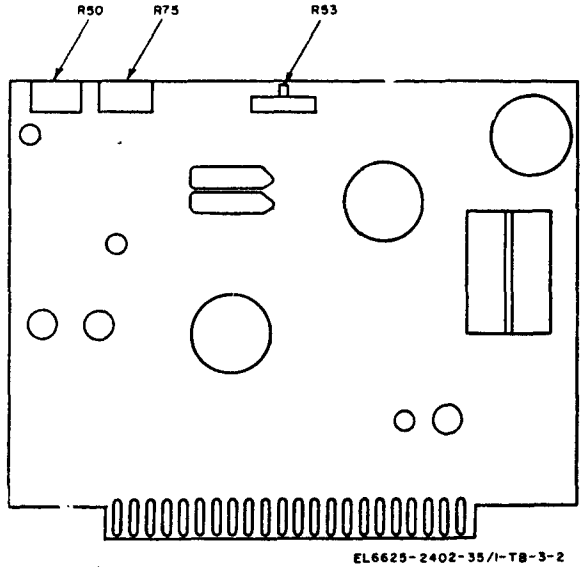


Figure 3-2. Component assembly A3.

(b) MANUAL SWEEP control fully clockwise.

(2) Connect multimeter to calibrator SCOPE ACVM connector with cable assembly (1-8) and adapter (1, 7).

(3) Set calibrator FUNCTION SELECTOR switch to ANODE/START AMP.

(4) Multimetor indicates between -0.010 and +0.010 vdc (8690A), or -0.100 and 0+.100 vdc (8690B) .

b. Adjustments. Adjust UUT RAMP ZERO ADJ R53 (fig. 3-2) for multimeter indication of 0.00 vdc.

3-5. Reciprocal Zero

a. Performance Check.

(1) Turn UUT MANUAL SWEEP control fully counterclockwise.

(2) Set calibrator FUNCTION SELECTOR switch to HELIX FDBK STOP RMP.

(3) Multimeter indicates between -0.010 and +0.010 vdc (8690A). or -0.400 and +0.400 vdc 8690B) .

b. Adjustments. Adjust UUT R50 (fig. 3-2) for multimeter indication of 0.00 vdc.

3-6. Frequency Control (Low End)

a. Performance Check.

(1) Connect equipment as shown in figure 3-1.

(2) Position UUT controls as follows:

(a) START/CW, MARKER 1 START/CW, MARKER 2 STOP, and STOP/ΔF controls to 3 v on calibrator scale.

(b) FUNCTION START STOP pushbutton pressed.

(c) SWEEP SELECTOR switch to CW.

(3) Set calibrator FUNCTION SELECTOR to SWP REF AM.

(4) Multimeter indicates between 2.9 and 3.1 vdc.

(5) Press UUT FUNCTION MARKER SWEEP pushbutton.

(6) Multimeter indicates between 2.9 and 3.1 vdc.

(7) Position UUT controls as follows:

(a) SWEEP SELECTOR switch to MANUAL.

(b) MANUAL SWEEP control fully counterclockwise.

(8) Multimeter indicates between 2.9 and 3.1 vdc.

(9) Press UUT FUNCTION START STOP pushbutton.

(10) Multimeter indicates between +2.9 and +3.1 vdc (8690A), or +2.6 to +3.4 vdc (8690B).

b. Adjustments.

(1) Repeat performance check steps a(2) and (3). Adjust UUT START LF ADJ R1 (fig. 3-3) for multimeter indication of 3.0 vdc.

(2) Press UUT FUNCTION MARKER SWEEP pushbutton. Adjust UUT MS START LF ADJ R2 (fig. 3–3) for multimeter indication of 3.0 vdc.

(3) Repeat performance check step a(7). Adjust UUT MS STOP LF ADJ R3 (fig. 3-3) for multimeter indication of 3.0 vdc.

(4) Press UUT FUNCTION START STOP pushbutton. Adjust UUT STOP LF ADJ R4 (fig. 3-3) for multimeter indication of 3.0 vdc.

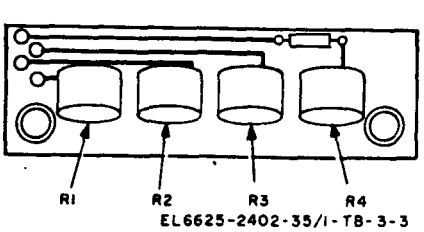


Figure 3–3. Component assembly A1.

(5) Repeat performance check.

3-7. Helix Feedback Amplifier Gain

a. Performance Check.

(1) Position UUT controls as follows:

(a) SWEEP SELECTOR switch to MANUAL.

(b) MANUAL SWEEP control fully clockwise.

(C) FUNCTION START STOP pushbutton pressed.

(2) Set calibrator FUNCTION SELECTOR switch to HELIX FDBK STOP RMP.

(3) Multimeter indicates between -0.1 and +0.1 vdc.

b. Adjustments. Adjust UUT R32 (fig. 3-4) for multimeter indication of 0.00 vdc.

3-8. Marker (Low End)

a. Performance Check.

(1) Position UUT conltrols as follovs:

(a) SWEEP SELECTOR switch to MANUAL.

(b) MANUAL SWEEP control fully counterclockwise.

(c) MARKER 1 START/CW and MARKER 2 STOP controls to 3 v calibrator scale.

(d) AMPLITUDE MOD MARK 1 pushbutton pressed.

(e) AMPLITUDE MOD MARK 2 pushbutton released.

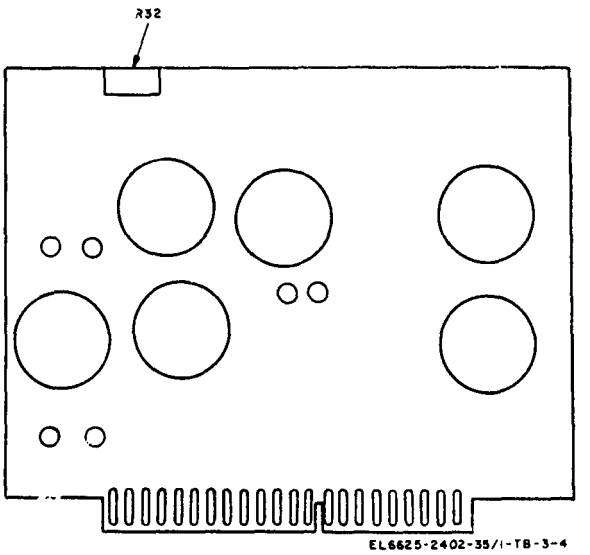


Figure 3–4. Component assembly A4.

(f) MARKER AMP adjustment fully clockwise.

(2) Set calibrator FUNCTION SELECTOR switch to SWP REF AM.

(3) Adjust UUT MARKER 1 START/CW control for maximum dc deflection on oscilloscope (l-4), UUT M1 pointer indicates 3 V on calibrator scale.

(4) Position UUT controls as follows:

(a) AMPLITUDE MOD MARK 1 pushbutton released.

(b) AMPLITUDE MOD MARK 2 pushbutton pressed.

(5) Adjust UUT MARKER 2 STOP control for maximum dc deflection on oscilloscope. UUT M2 pointer indicates 3 V on calibrator scale.

b. Adjustments.

(1) Repeat performance check steps (1) and (2) .

(2) Adjust UUT R18 (fig. 3-5) for maximum dc deflection on oscilloscope.

(3) Repeat performance check step (4).

(4) Adjust UUT R2 (fig. 3-5) for maximum dc deflection on oscilloscope.

(5) Repeat performance check.

3-9. Frequency Control (High End)

a. Performance Check.

(1) Position UUT controls as follows:

(a) START/CW, MARKER 1 START/CW, MARKER 2 STOP and STOP/ΔF controls to 73 V on calibrator scale.

(b) SWEEP SELECTOR switch to MANUAL.

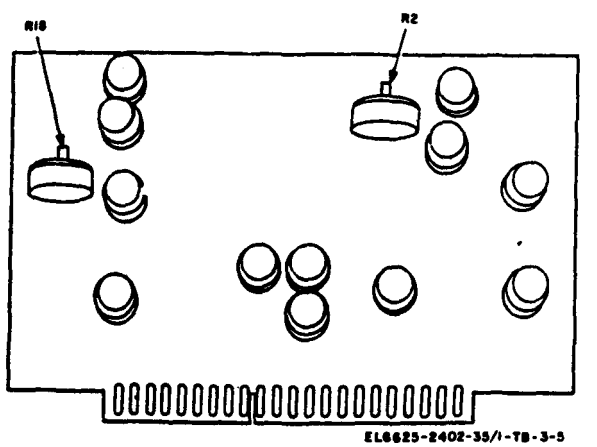


Figure 3-5. Component assembly A11.

(c) MANUAL SWEEP control fully clockwise.

(d) FUNCTION START STOP pushbutton pressed,

(e) All AMPLITUDE MOD pushbuttons released.

(2) Set calibrator FUNCTION SELECTOR switch to SWP REF AM.

(3) Short UUT EXT FM connector with adapter (l-9) and test lead (1-10).

(4) Multimeter indicates between 72.9 and 73.1 vdc.

(5) Press UUT FUNCTION MARKER SWEEP pushbutton.

(6) Multimeter indicates between 72.9 and 73.1 Vdc.

(7) Set UUT SWEEP SELECTOR switch to Cw.

(8) Multimeter indicates between 72.9 and 73.1 vdc.

(9) Press UUT FUNCTION AF pushbutton.

(10) Multimeter indicates between 72.9 and 73.1 vdc.

(11) Press UUT FUNCTION EXT FM pushbutton.

(12) Allow 3 minutes for circuit to stabilize. Multimeter indicates between 72.9 and 73.1 vdc.

(13) Remove adapter (1-9) and cable (l-10) from EX.T FM connector.

b. Adjustments.

(1) Repeat performance check steps (1) through (3).

(2) Adjust UUT STOP HF R24 (fig. 3-6) for multimeter indication of 73.0 vdc.

(3) Press UUT FUNCTION MARKER SWEEP pushbutton.

(4) Adjust UUT MARKER STOP HF R30 (fig. 3-6) for multimeter indication of 73.0 vdc.

(5) Set UUT SWEEP SELECTOR switch to Cw.

(6) Adjust UUT MARK START HF R22 (fig. .3-6) for multimeter indication of 73.0 vdc,

(7) Press UUT FUNCTION Δ F pushbutton. ton.

(8) Adjust UUT Δ F CW R19 (fig. 3-6) for multimeter indication of 73.0 vdc.

(9) Press UUT FUNCTION EXT FM pushbutton Allow 3 minutes for circuit to stabilize.

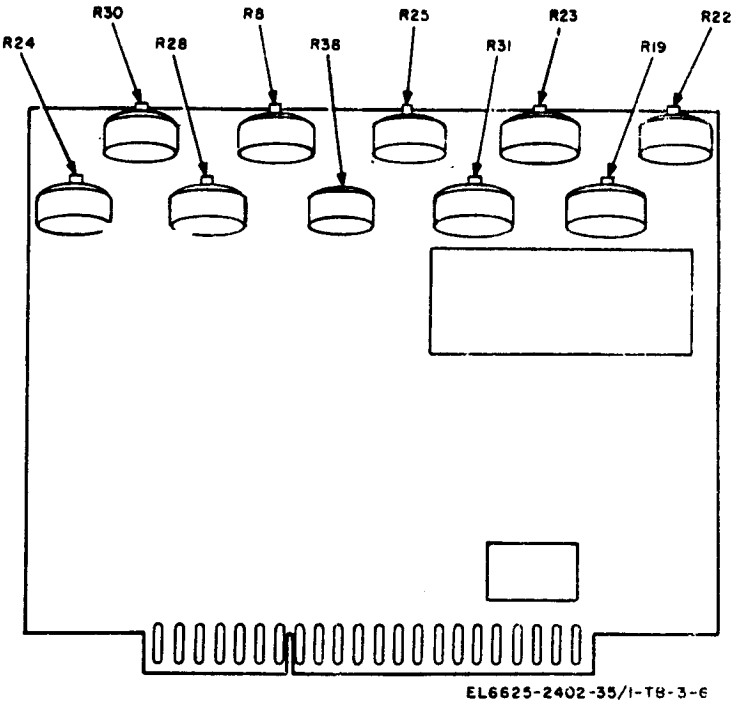


Figure 3-6. Component assembly A2.

(10) Adjust UUT EXT FM ZERO R38 (fig. 3-6) for multimeter indication of 73.0 vdc.

(11) Repeat performance check.

3-10. Marker (High End)

a. Performance Check.

(1) Position UUT controls as follows:

(a) FUNCTION START-STOP pushbutton pressed.

(b) SWEEP SELECTOR switch to CW

(c) AMPLITUDE MOD MARK 1 push. button pressed.

(d) AMPLITUDE MOD MARK 2 pushbutton released.

(2) Set calibrator FUNCTION SELECTOR switch to SWP REF AM.

(3) Adjust UUT MARKER 1 START/CW control for maximum dc deflection on oscilloscope. UUT Ml pointer indicates 73 V on calibrator scale.

(4) Position UUT controls as follows;

(a) AMPLITUDE MOD MARK 1 pushbutton released.

(b) AMPLITUDE MOD MARK 2 pushbutton pressed.

(5) Adjust UUT MARKER 2 STOP control for maximum dc deflection on oscilloscope. UUT M2 pointer indicates 73 V on calibrator scale.

b. Adjustments.

(1) Repeat performance check steps (1) and (2).

(2) Adjust UUT MARK 1 HF R23 (fig, 3-6) for maximum dc deflection on oscilloscope.

(3) Repeat performance check step (4)

(4) Adjust UUT MARK 2 HF R31 (fig. 3-6) for maximum dc deflection on oscilloscope. oscilloscope.

(5) Repeat performance check.

3-11. ΔF Bandwidth

a. Performance Check.

(1) Position UUT controls as follows:

(a) FUNCTION AF pushbutton pressed.

(b) SWEEP SELECTOR switch to MANUAL.

(c) STOP/ΔF control to 73 V on calibrator scale.

(d) STOP/ΔF control to 73 V on calibrator scale.

(e) MANUAL SWEEP control fully counterclockwise.

(f) A11 AMPLITUDE MOD pushbuttons released.

(2) Set calibrator FUNCTION SELECTOR switch to SWP REF AM. Record multimeter indication.

(3) Turn UUT MANUAL SWEEP control fully clockwise. Record multimeter indication.

(4) Difference in recorded multimeter indications is between.6.8 and 7.2 vdc,

b. Adjustments. Adjust UUT ΔF BW AD - JUST R25 (fig. 3-6) for 7.0 vdc difference in multimeter indications as UUT MANUAL SWEEP control is turned from one limit to the other.

3-12. ΔF Center Frequency

a. Performance Check.

(1) Position UUT controls as follows:

((z) FUNCTION START-STOP pushbutton pressed.

(b) SWEEP SELECTOR switch to MANUAL.

(c) START/CW control to 3 V on calibra. tor scale.

(d) STOP/ΔF control to 73 V on calibrator scale.

(2) Set calibrator FUNCTION SELECTOR switch to SWP REF AM.

(3) Adjust UUT MANUAL SWEEP control for multimeter indication of 38.0 vdc.

(4) Press UUT FUNCTION AF pushbutton. Multimeter indicates between 2.9 and 3.1 vdc.

b. Adjustments. Adjust UUT ΔF CENT R28 (fig. 3-6) for multimeter indication of 3.0 vdc.

3-13. ΔF Zero

a. Performance Check.

(1) Position UUT controls as follows:

(a) FUNCTION AF pushbutton pressed.

(b) SWEEP SELECTOR switch to MANUAL.

(c) START/CW and STOP/ΔF controls to 3 V on calibrator scale.

(2) Set calibrator FUNCTION SELECTOR switch to SWP REF AM.

(3) Slowly turn UUT MANUAL SWEEP control from fully counterclockwise to fully clockwise. Multimeter indicates between 2.9 and 3.1 wdc throughout range of MANUAL SWEEP control.

b. Adjustments. Adjust UUT ΔF ZERO R8 (fig. 3-6) for multimeter indication of 3.0 vdc throughout range of MANUAL SWEEP control.

3-14. Power Supply

a. Performance Check. Set calibrator FUNCTION SELECTOR switch to settings listed in table 3-2. At each setting, adjust autotransformer output voltage control for a meter indication of 105, 1.25, and 115 vat. Multimeter (1-3) and voltmeter (1-5) indicate within specified limits.

b. Adjustments.

(1) Set calibrator FUNCTION SELECTOR selector switch to positions listed in table 3-3. Adjust UUT adjustment listed for multimeter indication.

(2) Repeat the performance check.

Table 3-2. Power Supply

Calibrator FUNCTION SELECTOR switch setting	Voltmeter indication (mvac)	Multimeter indication (vdc)
−300 V	< 2	−299.5 to −300.5
+275 V	< 2	274.7 to 275.3
−6.3 V	< 5	− 6.25 to −6.35
+20 V	< 1	19.8 to 20.2

Table 3–3. Power Supply Adjustments

Calibrator FUNCTION SELECTOR switch setting	UUT Adjustment	Multimeter indication (vdc)
−300 V	R7 (fig. 3–7)	−300
+275 V	R27 (fig. 3–7)	+275
−6.3 V	R16 (fig. 3–8)	−6.3
+ 20 V	R21 (fig. 3–8)	+20

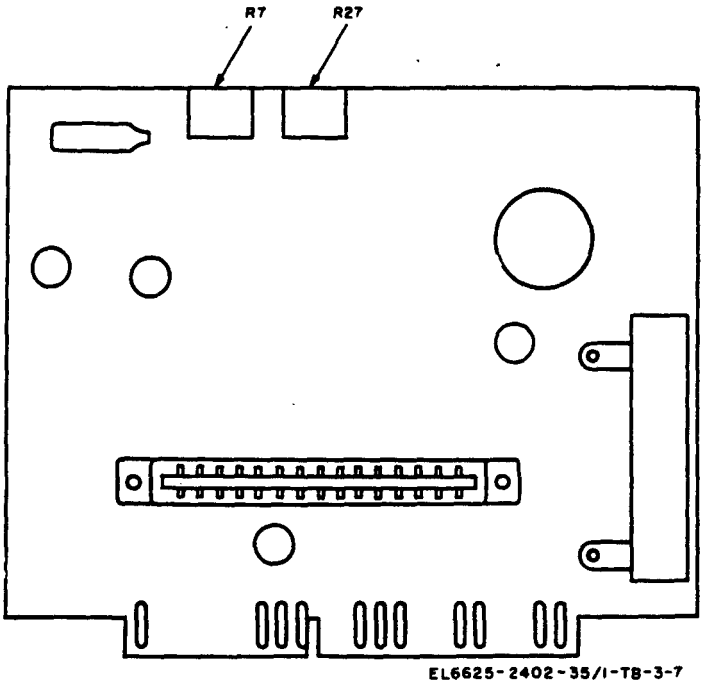


Figure 3-7. Component assembly A5.

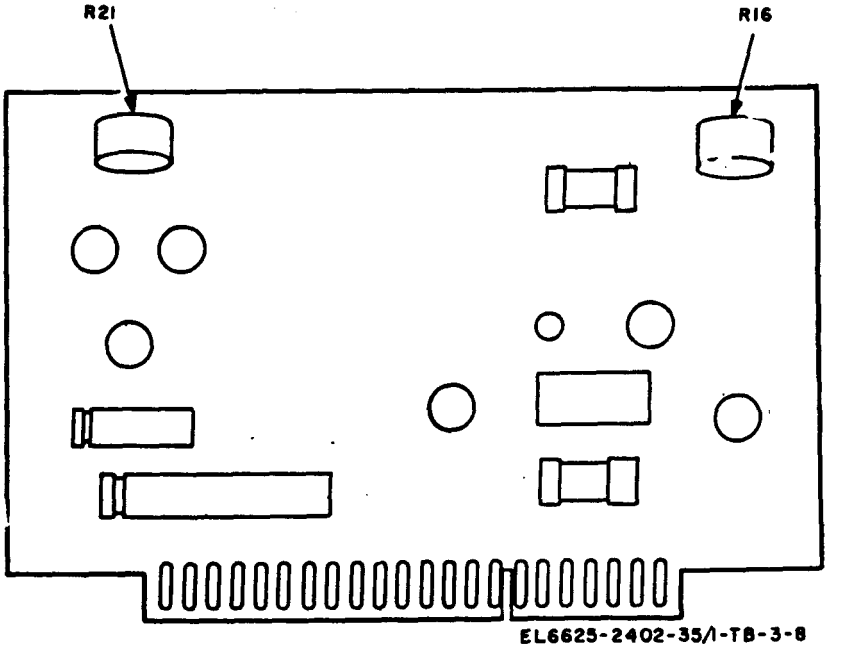


Figure 3-8. Component assembly A14.

SECTION IV

CALIBRATION OF CONTROL UNIT PL-1243/USM-308(V) AND RF UNIT HOLDER MX-8333(P)/USM-308(V) (HP MODELS 8706A AND 8707A)

4-1. Equipment Required

Equipment required for calibration performance checks and adjustments is listed in table 4-1.

Table 4-1. Equipment and Accessories

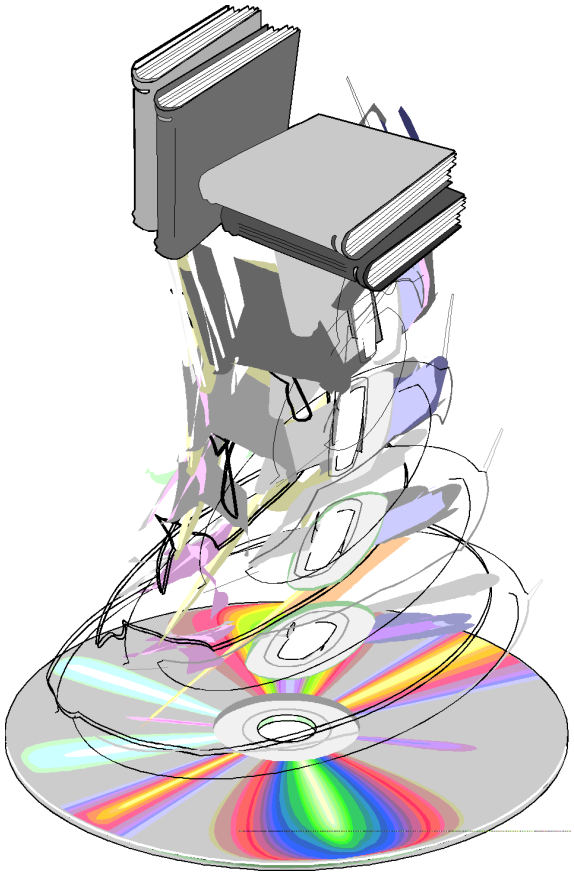
Item		Minimum use specification	Calibration equipment
1-1	Autotransformer (2 required)..	105 to 125 vac, ± 3%	Variable Power Transformer TF--510/U (General Radio model W10MT3A).
1-2	Sweep oscillator	Accepts UUT control unit	Sweep Generator AN/USM-308(V) (Hewlett-Packard model 8690A/B).
1-3	Calibrator	UT RF unit holder plug-in unit	Electrical Test Equipment Plug-In Unit PL-1239/U (Hewlett-Packard model K04-8690A) or Hewlett-Packard model 11531A, Calibrator.
1-4	Multimeter	0to±;300vdc, ±1%	Multimeter ME-333/U (J-Omega model 217A).
1-6	Cable assembly	36 inch, double banana plug to black and red alligator clips.	Pomona Electronics model 2BC-AL-36.
1-6	Voltmeter	0 to 10 mvrms±1%.....	Electronic Voltmeter AN/USM-265 (Hewlett-Packard model 400EL-02).
1-7	Adapter	indingpost to BNC plug....	Connector Adapter UG-1888/U (Pomona Electronics model 1296).
1-8	Oscilloscope	DC ot 1 kHz, 0 to 20 v p-p, +3 Ye.....	oscilloscope AN/USM-273 (Tektronix Type 453).
1-9	Adapter	ee, BNC plug to 2 BNC jacks	Connector Adapter UG-274B/U (Amphenol model UG-274B/U).
1-10	Adapter	NC jack to double banana plug ...	Connector Adapter UG-1887/U (Pomona Electronics model 1269).
1-11	Cable assembly (3 required) ..	36 inch, BNC plug to BNC plug ..	Pomona Electronics model BNC-C-36.
1-12	RF unit	2 to4 GHz, =10 MHz	Electrical Test Equipment Plug-In Test Unit PL-1242/U (Hewiett-Packard model 8699 B).
1-13	Attenuator	) db, N plug to N jack, 2 to 4 GHz ..	Fixed Attenuator CN-1271/U (Weinschel model 210-20).
1-14	Cable assembly	36 inch, RG-213/U, N plug to N plug..	Pomona Electronics model 1658-S-36.
1-15	Electronic counter	2 to 4 GHz, ±0.1%	Digital Readout Electronics Counter AN/USM-257A (Systron-Donner model 1037 B4-F-H) with Frequency Converter CV-2350/U (Systron Donner model 1292).

WARNING

Voltages hazardous to life are present inside UUT. Use extreme care when making connections or taking measurements inside UUT cabinets.

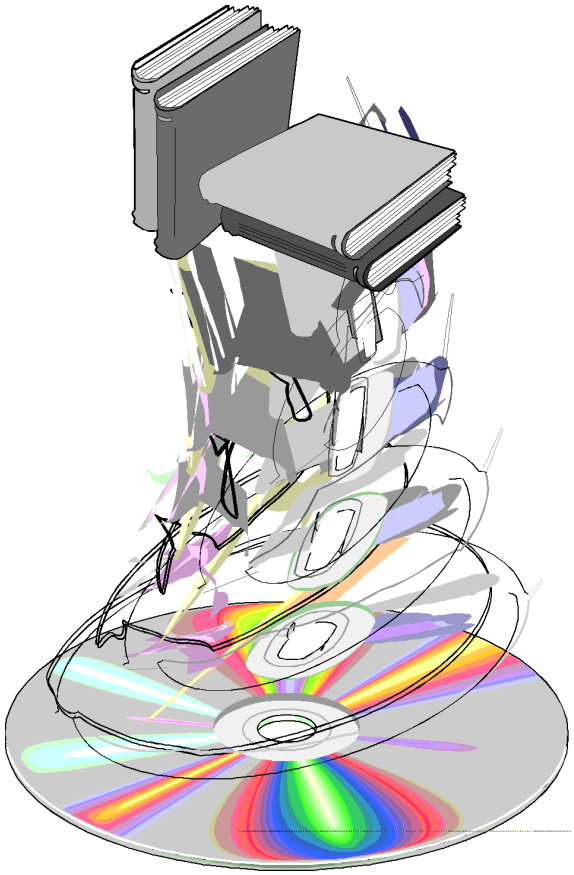
The figure you asked
for has not yet been digitized.
Please refer to your paper or
microfiche copy as appropriate.

NOT DIGITIZED



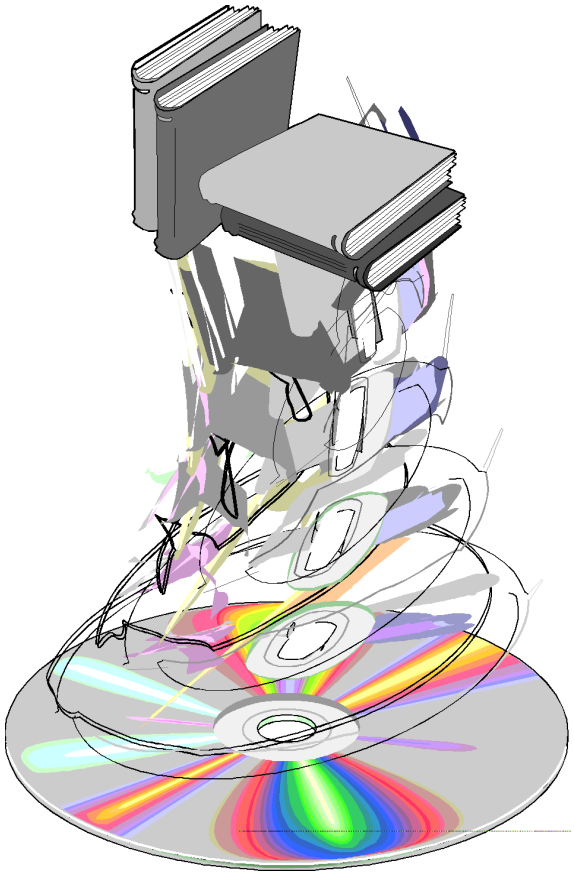
The figure you asked
for has not yet been digitized.
Please refer to your paper or
microfiche copy as appropriate.

NOT DIGITIZED



The figure you asked
for has not yet been digitized.
Please refer to your paper or
microfiche copy as appropriate.

NOT DIGITIZED



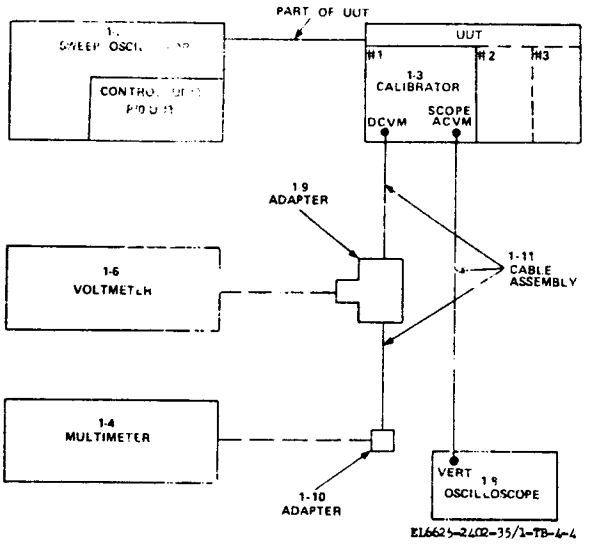


Figure 4-4. Relay circuit, equipment setup.

(11) Oscilloscope (l-8) displays square wave.

(12) Release sweep oscillator INT SQ WAVE pushbutton.

b. Adjustments. No adjustments can be made.

4-6. Preset Sweep

a. Performance Check.

(1) Position sweep oscillator controls as follows :

(a) LINE switch to RF.

(b) All AMPLITUPE MOD pushbuttons released.

(c) ALC pushbutton released.

(d) FUNCTION START-STOP pushbutton pressed.

(e) SWEEP SELECTOR switch to MANUAL.

(f) MANUAL SWEEP control fully counterclockwise.

(2) Position UUT #1 controls as follows:

(a) SWEEP switch to PRESET.

(b) SELECT-STANDBY-OFF switch to SELECT and release.

(c) START and STOP adjustments fully counterclockwise.

(3) Multimeter indicates less than 3.0 vdc.

(4) Turn sweep oscillator MANUAL SWEEP control fully clockwise.

(5) Multimeter indicates less than 3.0 vdc.

(6) Turn UUT #1 START and STOP adjustments fully clockwise.

(7) Multi meter indicates greater than 73.0 vdc.

(8) Turn sweep oscillator MANUAL SWEEP control fully counterclockwise.

(9) Multimeter indicates greater than 73.0 vdc.

(10) Remove calibrator from UUT cavity #1 and install in cavity #2.

(11) Repeat steps (1) through (9) above with UUT #2 controls.

(12) Remover. calibrator from UUT cavity #2 and install in cavity #3.

(13) Repeat steps (1) through (9) above with UUT #3 controls.

b. Adjustments. No adjustments can be made.

4-7. Frequency Accuracy

a. Performance check.

(1) Connect equipment as shown in figure *4-5.*

Table 4-2. Relay Circuit Check

Calibrator FUNCTION SELECTOR switch setting	Multimeter indication (vdc)	Voltmeter indication (mvrms)
−300 V	−299.5 to −300.5	≤ 2
+275 V	+274.7 to +275.3	≤ 2
+20 V	+ 19.8 to + 20.3	≤ 1
ANODE/START AMP*	100 to 120	–
HELIX (10:1)/HELIX (1.1 AC)*	+10 to +20 (record indication)	≤ 2
HELIX (10:1)/HELIX (1:1 AC)**	200 to 240	≤ 10
COL (10:1)/BLANKING*	10 to 12.5 greater than helix indication recorded.	–

*Sweep oscillator START/CW control set to 0 on logging scale.

**Sweep oscillator START/CW control set to 100 on logging scale.

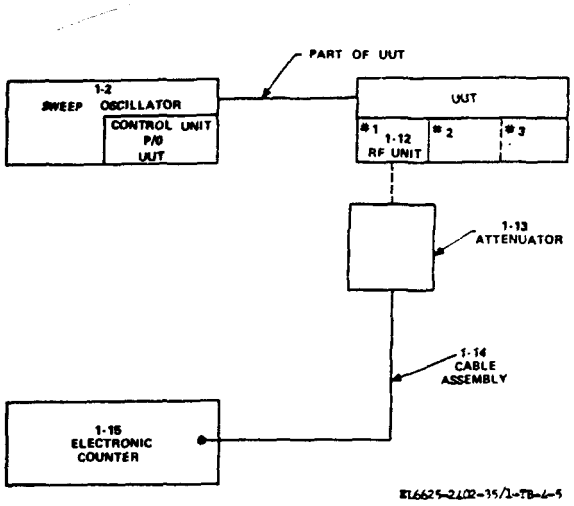


Figure 4-5. Frequency accuracy, equipment setup.

(2) Position sweep oscillator controls as follows:

(a) LINE switch to RF.

(b) AMPLITUDE MOD pushbuttons all released.

(c) ALC pushbutton released.

(d) FUNCTION START-STOP pushbutton pressed.

(e) SWEEP SELECTOR switch to CW.

(f) START/CW control to 0 on logging scale.

(8) Set RF unit (1-12) selector switch to 2-4 GHz.

(4) Set UUT #l SWEEP switch to NORMAL.

(5) Set and release UUT #1 SELECT-STANDBY-OFF switch to SELECT.

(6) Turn RF unit POWER LEVEL control fully clockwise.

(7) Set sweep oscillator START/CW control to logging scale settings listed in table 4-3. Electronic counter (1-15) indicates within specified limits.

(8) Position sweep oscillator controls as follows:

(a) FUNCTION START-STOP pushbutton pressed.

(b) SWEEP SELECTOR switch to MANUAL.

(c) MANUAL SWEEP control fully clockwise.

(9) Turn sweep oscillator STOP/AF control to logging scale settings listed in table 4-3. Electronic counter indicates within specified limits.

Table 4-3. Frequency Accuracy

Sweep oscillator START/CW or STOP/ΔF settings	Electronic counter indication (GHz)
0	1.99 to 2.01
50	2.99 to 3.01
100	3.99 to 4.01

b. Adjustments. No adjustments can be made.

4-8. Frequency Resettability

a. Performance Check.

(1) Connect equipment as shown in figure 4-5.

(2) Position sweep oscillator controls as follows:

(a) LINE switch to RF.

(b) START/CW control to 50 on logging scale.

(c) All AMPLITUDE MOD pushbuttons released.

(d) ALC pushbutton released.

(e) FUNCTION START-STOP pushbut. ton pressed.

(f) SWEEP SELECTOR switch to CW.

(3) Set and release UUT #l SELECT-STANDBY-OFF switch to SELECT.

(4) Record electronic counter indication.

(5) Press UUT control unit #2 pushbutton (top row).

(6) Press UUT control unit #1 pushbutton (top row).

(7) Electronic counter indicates between -10 and +10 MHz of frequency recorded in step (4) above.

b. Adjustments. No adjustments can be made.

SECTION V

CALIBRATION OF ELECTRONIC TEST EQUIPMENT PLUG-IN UNITS PI-1240/USM-308(V) AND PL-1304/USM-308 (V) AND HP MODELS 8691A, 8691A OPT 200, 8692A, 8693A, 8693A OPT 200, 8693B,8694A, HOI-8694A, HO2-8694A, 8694B,8695A, 8696A, AND 8697A

5-1. Equipment Required

Equipment required for calibration performance checks and adjustments is listed in table 5-1.

Table 5-1. Equipment and Accessories

	Item	Minimum use specifIcation	Calibration equipment
1-1	Autotransformer	105t0125vac, ±3%	Variable Power Transformer TF-510/U (General Radio model W10MT3A).
1-2	Sweep oscillator	Accepts UUT	Sweep Generator AN/USM-308(V) (Hewlett-Packard model 8690 B).
1-3	Electronic counter with plug-in converter.	4.0 to 40.0 GHz, ±0.01% . . . . . 18.00 to 40.00 GHz ±0.01%.	Digital Readout Electronic Counter AN/USM-257A (Systron Dormer model 1037B4-F-H) with Frequency Converter CV-2350/U (Systron Donner model 1292) and (model 129 S).
1-4	Power meter...	1 to 10 mw, ±3%	Radio Frequency Power Test Set AN/USM-260 (Hewlett-Packard model 431C) with Thermistor Mount MX-7772/U (Hewlett-Packard model 478A) and (models P486A, K486A, and R486A).
1-5	Attenuator	4.0to12.4 GHz,20db.	Fixed Attenuator CN-1271/U (Weinschel model'. 210-20).
1-6	Cable assembly	36 inch, RG-213/U, N plug to N plug	Radio Frequency Cable Assembly CG 3544/U (Pomona Electronics model 1658-S-36).

Sec footnote for column 9 of table 5-2C.

CAUTION

During this procedure, if more than 10 mw is applied to power meter (1-4), damage could result that would produce an unsatisfactory calibration performante.

NOTE

Perform paragraphs 5-2 through 5-5 consecutively with each RF unit to be calibrated.

5-2 Preliminary Procedure

a. Install UUT in sweep oscillator (1-2). Install UUT scale in sweep oscillator.

b. Adjust autotransformer (1-1) output voltage control to minimum.

c. Connect sweep oscillator power cord to autotransformer.

d. Adjust autotransformer output voltage control for a meter indication of 115 vac.

e. Energize equipment and allow sufficient time for equipment to warm up and stabilize.

f. Turn UUT POWER LEVEL control to the low end of the range.

5-3. Frequency Accuracy

a. Performance Check.

(1) Connect UUT output connector to electronic counter (1-3) mixer input with cable assembly (1-6).

(2) Position sweep oscillator controls as follows:

(a) SWEEP SELECTOR switch to CW (MANUAL for items listed in table 5-2C).

(b) FUNCTION START-STOP pushbutton pressed. (FUNCTION ΔF pressed for items listed in table 5-2C.)

(c) All AMPLITUDE MOD pushbutton released.

(d) ALC pushbutton released.

(e) STOP/AF control to maximum clockwise.

NOTE

Refer to the power indication in table 5-3 and use an attenuator between the UUT and the frequency counter for those units above 30 mw.

(3) Turn UUT POWER LEVEL control to midrange.

(4) Turn sweep oscillator START/CW control to settings listed in table 5-2. Electronic counter indicates within specified limits.

b. Adjustments.

(1) Turn sweep oscillator START/CW control to settinge listed in table 5-2. Adjust UUT adjustment listed (fig. 5-1) for specified electronic counter indication.

(2) Adjustments interact. Repeat adjustment step (1) until no further adjustment is required.

(3) Repeat performance check.

5-4. Frequency Stability

a. Performance Check.

(1) Adjust sweep oscillator START/CW control for electronic counter indication that corresponds with the middle frequency of each plug-in listed in tables 5-2 A, B, and C.

(2) Adjust autotransformer for 105, 125, and 115 vac output.

(3) Electronic counter indicates between the limits specified on that line of the tables.

Table 5-2A. Frequency Accuracy for Plug-In Unit PL-1240/USM-so8 (v)

Sweep oscillator START/CW control (GHz)	Electronic counter indication (GHz)		UUT Adjustment (fig. 5-1)
	Minimum	Maximum	
4.0	3.98	4.02	A2R13 [1]
4.4	4.38	4.42	–
4.8	4.78	4.82	–
5.2	5.18	5.22	–
5.6	5.58	5.62	–
6.0	5.98	6.02	A2R12 [1]
6.4	6.38	6.42	–
6.8	6.78	6.82	–
7.2	7.18	7.22	–
7.6	7.58	7.62	–
8.0	7.98	8.02	A1R24

[1] These two resistors are reversed on some models.

Table 5–2B. Frequency Accuracy for Plug-In PL–1304/USM–808(V).

Sweep oscillator START/CW control (GHz)	Electronic counter indication (GHz)		UUT Adjustment (fig. 5–1)
	Minimum	Maximum	
8.0	7.96	8.04	A2R12 [1]
8.4	8.36	8.44	–
8.8	8.76	8.84	–
9.2	9.16	9.24	–
9.6	9.56	9.64	–
10.0	9.96	10.04	–
10.4	10.36	10.44	A2R13 [1]
10.8	10.76	10.84	–
11.2	11.16	11.24	–
11.6	11.56	11.64	–
12.0	11.96	12.04	–
12.4	12.36	12.44	A1R24

[1] These two resistors are reversed on some models.

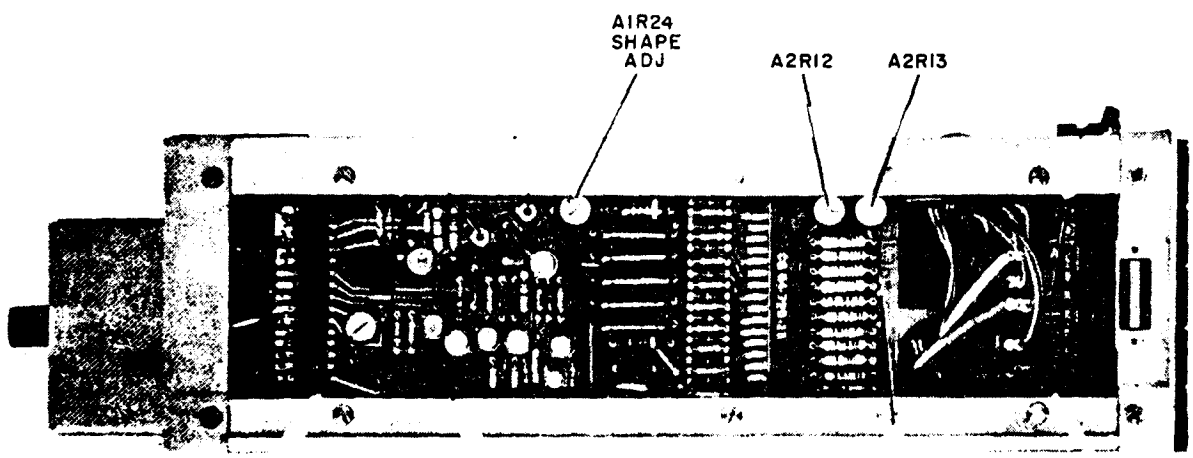


Figure 5-1. Typical RF plug-in unit, adjustment locations.

Table 5-2C. Frequency Accuracy for Other RF Plug-In Units

Model number 8691A	8691A Opt. 200	8692A	8693A	8693A Opt. 200	8664A	H01-8694A	H02-8694A	8695A	8696A	8697A
Frequency (GHz)										
2.000	2.50	4.000	8.000	6.750	12.40	12.40	- E l m -	18.00	26.90	40.00
1.900	2.39	3.800	7.600	6.425	11.96	11.86	10.60	17.44	25.65	38.65
1.800	2.28	3.600	7.200	6.100	11.52	11.32	10.20	16.88	24.80	37.30
1.700	2.17	3.400	6.800	5.775	11.08	10.78	9.800	16.32	23.95	35.95
1.600	2.06	3.200	6.400	5.450	10.64	10.24	9.400	15.76	23.10	34.60
1.500	1.95	3.000	6.000	5.125	10.20	9.700	9.000	15.20	22.25	33.25
1.400	1.84	2.800	5.600	4.800	9.760	9.160	8.600	14.64	21.40	31.90
1.300	1.73	2.600	5.200	4.475	9.320	8.620	8.200	14.08	20.55	30.55
1.200	1.62	2.400	4.800	4.150	8.880	8.080	7.800	13.52	19.70	29.20
1.100	1.51	2.200	4.400	3.825	8.440	7.540	7.400	12.96	18.85	27.85
1.000	1.40	2.000	4.000	3.500	8.000	7.000	7.000	12.40	18.00	26.50

[1] Tolerance for each indication is ±0.8%.

[2] Refer to paragraph 26, section III, including table 68 and figure 60 in TM 9-4931-294-15/1 for the calibration test setup for 8695A, 8696A and 8897A RF plug-in units.

b. Adjustments. No adjustments can be made.

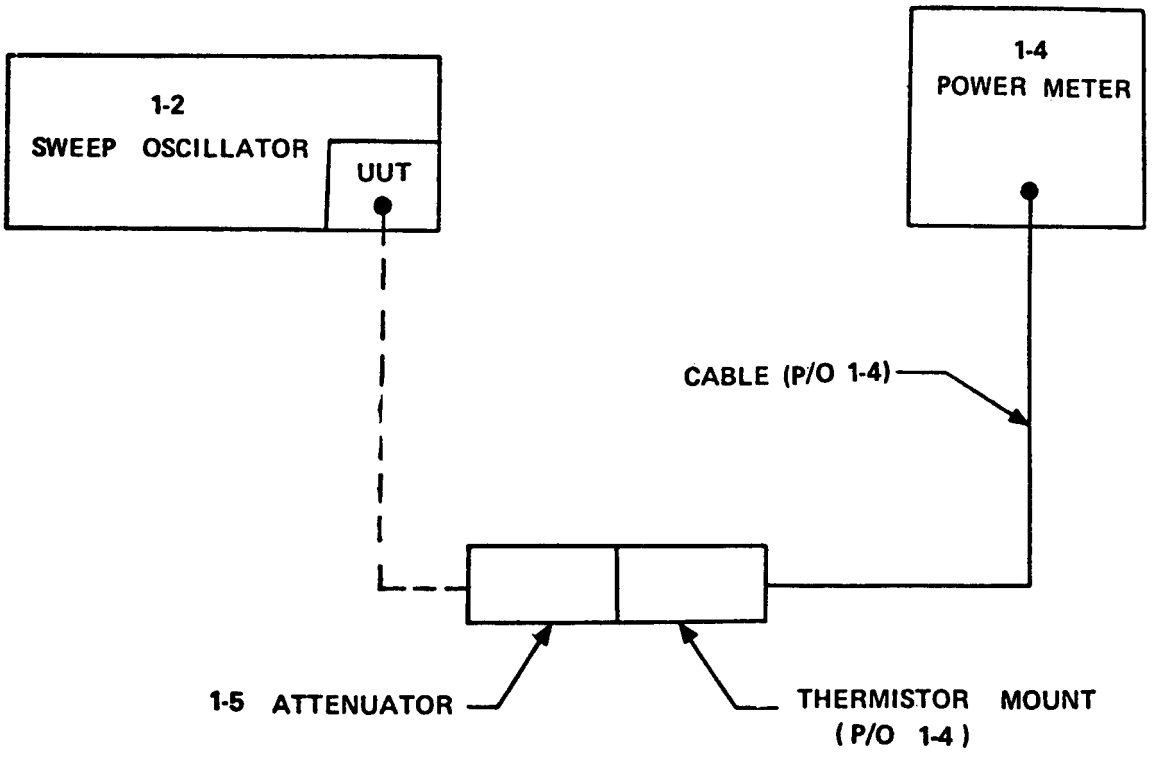
5-5. RF Output

a. Performance Check.

(1) Connect equipment as shown in figure

(2) Turn UUT POWER LEVEL control fully clockwise.

(3) Slowly turn sweep oscillator START/CW control across the entire frequency range. Record the minimum and maximum power meter (1-4) indications.



EL6625-2402-35/1-TB-5-2

Figure 5-2. RF output calibration, equipment setup.

(4) Minimum power meter indication is listed in table 5-3.

(5) Repeat steps (1) through (4) above for all the plug-in units listed in table 5-3.

(6) Maximum power meter indication is not greater than 10 db above minimum indication (for all units).

b. Adjustments. No adjustments can be made.

Table 5-3. RF Power Output

Model number	Minimum power meter indication (milliwatts)
8691A	100
8691A Opt. 200	100
8692A	70
PL-1240/USM-308(V)	15
8693A	30
8693A Opt. 200	40
H01-8694A	25
H02-6694A	25
8694A	50
PL-1304/USM-308(V)	30
8694B	30
6695A	40
8696A	10
8697A	5

SECTION VI

CALIBRATION OF ELECTRONIC TEST EQUIPMENT PLUG-IN UNITS PL-1241/USM-308(V) AND PL-1241A/USM-308(V) (HP MODELS 8690A AND 8690B)

6-1. Equipment Required

Equipment required for calibration performance checks and adjustments is listed in table 6-1.

Table 6-1. Equipment and Accessories

		Minimum use specification	Calibration equipment
1-1	Autotransformer	105 to 125 vac ±3%	Variable Power Transformer TF-510/U (General Radio model W10MT3A).
1-2	Sweep oscillator	Accepts UUT	Sweep Generator AN/USM-308 (V) (Hewlett-Packard model 8690A/B).
1-3	Electronic counter	100 kHz to 110 MHz ±0.05%	Digital Readout Electronic Counter AN/USM-257A (Systron Dormer model 1037 B4-F-H) with Frequency Converter CV-2350/U (Systron Don. ner model 1292).
1-4	Adapter (2 req'd) . . .	BNC jack to N plug	Connector Adapter UG-201A/U (Amphenol model UG201A/U),
1-6	Cable assembly (5 req'd)	36 inch, RG-58C/U, BNC plug to BNC plug.	Pomona Electronics model BNC-C-36.
1-6	Signal generator . .	1.0 to 10 MHz.	Signal Generator AN/USM-264 (Hewlett-Packard model 652A).
1-7	Power divider	50-ohm N plugto2N jacks	Radio Frequency Power Divider MX-7776/U (Weinschel model 1506).
1-8	Adapter .	BNC plu. to N jack.	Connector Adapter UG-349/U (Amphenol model UG-349/U).
1-9	Detector	BNC jack to BNC jack..	Radio Frequency Detector RF-235/U (Telonic model XD-3A).
1-10	Adapter (2 req'd)	BNC jack to double banana plug	Connector Adapter UG1887/U (Pomona Electronics model 1269).
1-11	Oscilloscope	DC to1 kHz ±3%....	Oscilloscope AN/USM-254 (Hewlett-Packard model 130 C).
1-12	Voltmeter	0 to 3 vrms ±1%	Electronic Voltmeter AN/USM-265 (Hewlett-Packard model 400EL-02).
1-13	Termination . . .	50-ohm, BNC jack to BNC plug	Electrical Dummy Load DA-471/U (Hewlett-Packard model 11048B).
1-14	Step attenuator	0 to1 db ±0.25db	Variable Attenuator CN-970/A (Hewlett-Packard model 355C).
1-16	Multimeter	0 to 11 vdc ±3%.	Multimeter ME-333/U (J-Omega model 217A).
1-16	Power meter	0 to 10 mw ±3%	Radio Frequency Power Test Set AN/USM-260 (Hewlett-Packard model 431C) with Thermistor Mount MX-7772/U (Hewlett-Packard model 478A).
1-17	Adapter	BNC plug to BNC plug...	Connector Adapter UG-491B/U (Amphenol model UG-491B/U).

CAUTION

During this procedure, if more than 10 mw is applied to power meter (1-16), damage could result that would produce an unsatisfactory calibration performance.

6-2. Preliminary Procedure

a. Install UUT and scale into sweep oscillator (1-2).

b. Set autotransformer (1-1) to ON and adjust autotransformer output voltage control to minimum.

c. Connect sweep oscillator power cord to autotransformer.

d. Adjust autotransformer output voltage control for a meter indication of 115 vac.

e. Energize equipment and allow sufficient time for equipment to warm up and stabilize.

f. Set sweep oscillator LINE switch to RF and allow a 15 minute warmup.

6-3. Frequency Range *and Accuracy*

a. Performance Check.

(1) Connect equipment as ahown in figure 6-1.

(2) Position sweep oscillator controls as follows:

(a) SWEEP SELECTOR to MANUAL.

(b) FUNCTION START-STOP pushbutton pressed.

(c) All AMPLITUDE MOD pushbuttons released.

(d) ALC pushbutton released.

(e) START/CW control to 1 (4 for 8698B).

(f) STOP/ Δ F control to 110.

(3) Position UUT controls as follows.

(a) POWER LEVEL switch to +10 DBM.

(b) VERNIER control to fully clockwise (CAL for 8698B Plus the following two control settinga).

(c) 5 MHz CRYSTAL switch to OFF.

(d) FREQ CAL adjustment fully clockwise.

(4) Turn sweep oscillator MANUAL SWEEP control as listed in table 6-2. Set UUT SCALE switch as listed. Electronic counter (l-3) indicates within specified limits.

b. Adjustments. No adjustments can be made.

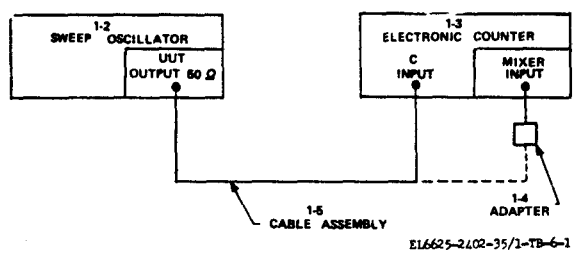


Figure 6–1. Frequency measurement, equipment setup.

Table 6-2A. Plug-In Unit PL-1241/USM308(V) Frequency Range and Accuracy

UUT SCALE switch setting	Sweep oscillator MANUAL SWEEP control	Electronic counter indication (MHz)	
		Minimum	Maximum
X.1	Fully counterclockwise	0.090	0.110
X.1	Fully clockwise	10.89	11.11
X1	Fully clockwise	108.9	111.1
X1	Fully counterclockwise	0.9	1.1

Table 6–2B. Plug-In Unit PL–1241A/USM–308(V) Frequency Range and Accuracy

UUT SCALE switch setting	Sweep oscillator MANUAL SWEEP control	Electronic counter indication (MHz)	
		Minimum	Maximum
X.1	Fully counterclockwise	0.346	0.454
X.1	Fully clockwise	10.39	11.61
X1	Fully counterclockwise	3.46	4.54
X1	Fully clockwise	103.9	116.1

6–4. ΔF Accuracy

a. Performance Check,

(1) Position sweep oscillator controls as follows:

(a) FUNCTION ΔF pushbutton pressed.

(b) All AMPLITUDE MOD pushbuttons released.

(c) SWEEP SELECTOR switch to CW

(d) STOP/ ΔF to 10 on ΔF scale.

(2) Position UUT controls as follows:

(a) SCALE switch to X1.

(b) POWER LEVEL switch to +10DBM.

(c) VERNIER control to fully clockwise (CAL on PL-1241A,USM-308(V).)

(3) Adjust sweep oscillator START/CW control for 5.000 MHz on electronic counter.

(4) Set sweep oscillator SWEEP SELECTOR switch to MANUAL.

(5) Turn sweep oscillator. MANUAL SWEEP control as listed in table 6-3. Electronic counter indicates within specified limits,

(6)' Repeat step (1) above.

(7) Set UUT SCALE switch to X1,

(8) Adjust sweep oscillator START/CW control for 50.00 MHz on electronic counter.

(9) Repeat step (4) above.

(10) Turn sweep oscillator MANUAL SWEEP control as listed in table 6-4. Electronic counter indicates within specified limits.

Table 6-3. AF Accuracy (X.1) .

Sweep oscillator MANUAL SWEEP control	Electronic counter indication (MHz)
Fully counterclockwise	4.47 to 4.63
Fully clockwise	5.47 to 5.53

Table 6-4. AF Accuracy (X.1)

Sweep oscillator MANUAL SWEEP control	Electronic counter indication (MHz)
Fully counterclockwise	44.7 to 45.3
Fully clockwise	64.7 to 55.3

b. Adjustments. No adjustments can be made.

6-5. Frequency Stability

a. Performance Check.

(1) Position sweep oscillator controls as follows:

(a) SWEEP SELECTOR switch to CW.

(b) START/CW control to 50.

(c) FUNCTION START-STOP pushbutton pressed.

(d) All AMPLITUDE MOD pushbuttons released.

(2) Position UUT controls as follows:

(a) SCALE switch to X.1.

(b) POWER LEVEL control to +10 DBM.

(c) VERNIER control to CAL.

(3) Adjust sweep oscillator START/CW control for 5.000 MHz on electronic counter.

(4) Adjust autotransformer output voltage control for a meter indication of 105, 125, and 115 vac.

(5) Electronic counter indicates between 4.995 and 5.005 MHz at each setting,

(6) Set UUT SCALE switch to X1.

(7) Adjust sweep oscillator START/CW control for 50.00 MHz on electronic counter.

(8) Adjust autotransformer output voltage control for a meter indication of 105, 125, and 115 vac.

(9) Electronic counter indicates between 49.95 and 50.05 MHz at each setting.

(10) Disconnect equipment.

b. Adjustments. No adjustments can be made.

6-6. Linearity

a. Performance Check.

(1) Connect equipment as shown in figure 6-2.

(2) Position sweep oscillator controls as follows:

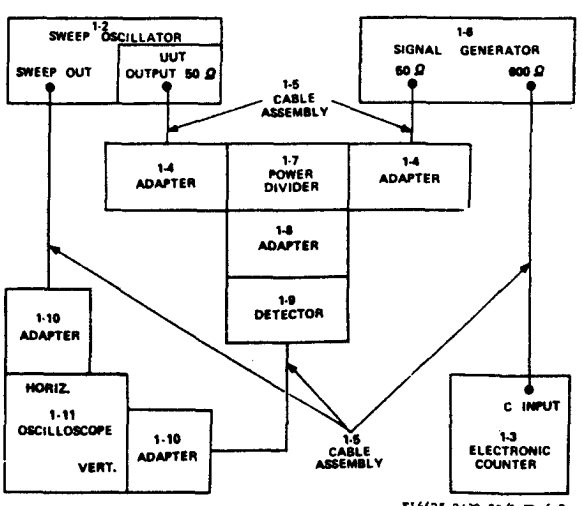


Figure 6-2. Linearity measurement, equipment setup.

(a) FUNCTION START-STOP pushbutton pressed.

(b) SWEEP SELECTOR switch to AUTO.

(c) START/CW control to 1 (4 on PL-1241A/USM-308(V)).

(d) STOPΔF control to 100.

(e) SWEEP TIME (SEC) switch to .1-.01.

(3) Position UUT controls as follows:

(a) SCALE switch to X1.

(b) POWER LEVEL switch to 0DBM,

(c) VERNIER control to CAL.

(4) Adjust signal generator (1-6) controls for output meter indication of 1.0 vrms and electronic counter indication of 1.0000 MHz.

(5) Adjust oscilloscope (1-11) controls for horizontal display of first marker on extreme left graticule line and last marker on extreme right graticule line.

(6) .Markers occur within -0.5 and +0.5 mm of every 1 cm calibration line on horizontal axis.

(7) Set UUT SCALE switch to X1

(8) Adjust signal generator controls for output meter indication of 1.0 vrms (3.0 vrms on PL-1241A/USM-308(V)) and electronic counter indication of 10.000 MHz.

(9) Repeat steps (5) and (6) above.

(10) Disconnect equipment.

b. Adjustments. No adjustments can be made.

6-7. Power Output

a. Performance Check.

(1) Connect UUT OUTPUT 50Ω (ohm) connector to voltmeter (1-12) with cable assembly (1-5) and termination (1-13).

(2) Position sweep oscillator controls as follows:

(a) FUNCTION START-STOP pushbutton pressed.

(b) SWEEP SELECTOR switch to CW.

(c) START/CW control to 40.

(3) Position UUT controls as follows:

(a) SCALE switch to X1.

(b) POWER LEVEL switch to + 10DBM.

(c) VERNIER control fully clockwise.

(4) Voltmeter indicates greater than 2.23 vrms (between 0.19 and 0.26 vac on PL-1241A/USM-308(V)).

(5) Turn UUT VERNIER control to CAL.

(6) Set UUT POWER LEVEL switch to settings listed in table 6-5. Voltmeter indicates within specified limits.

(7) Disconnect equipment.

b. Adjustments.

(1) Position UUT controls as follows:

(a) POWER LEVEL switch to +10 dbm.

(b) VERNIER control fully counterclockwise.

(2) Adjust UUT RANGE adjustment, A8-R24 (fig. 6-3) for voltmeter indication of 0.223 vat.

NOTE

Earlier models may not have this adjustment.

(3) Turn UUT VERNIER control to CAL

(4) Adjust UUT LEVEL adjustment, A8-R23 (fig. 6-3) for voltmeter indication of 0.707 vat.

EL6625-2402-35/1-TB-6-3

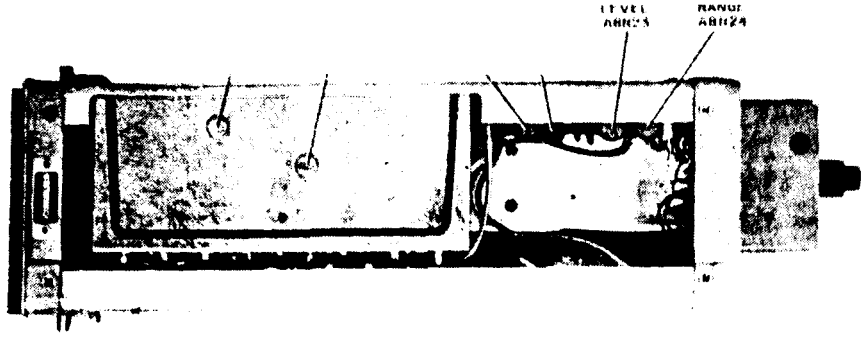


Figure 6-3. Plug-In Unit PL-1241A/USM-308(V), top view.

Table 6-5A. Plug-In Unit PL-1241/USM308(V) Power Output

UUT POWER LEVEL switch settings (DBM)	Voltmeter indication (vrms)	
	Minimum	Maximum
+10	0.56	0.89
0	0.178	0.28
−10	0.056	0.089
−20	0.0178	0.028
−30	0.0056	0.0089
−40	0.00178	0.0028
−50	0.00056	0.00089

Table 6-5B. Plug-In Unit PL-1241A/USM-308(V) Power Output

UUT POWER LEVEL switch setting (dBm)	Voltmeter indication (vrms)	
	Minimum	Maximum
+13	0.84	1.19
+10	0.60	0.84
0	0.19	0.26
−10	0.060	0.084
−20	0.019	0.026
−30	0.0060	0.0084
−40	0.0019	0.0026
−50	0.00060	0.00084

(5) Repeat (1) through (4) above until no further adjustment is required.

(6) Repeat performance check,

6-8. Flatness

a. Performance Check.

(1) Connect equipment as shown in figure 6-4.

(2) Position sweep oscillator controls as follows:

(a) START/CW control to 40.

(b) STOP/ΔF control to 110.

(C) FUNCTION START-STOP pushbutton pressed.

(d) SWEEP TIME (SEC) switch to .1-.01.

(e) SWEEP SELECTOR switch to CW.

(3) Position UUT controls as follows:

(a) SCALE switch to X1.

(b) POWER LEVEL switch to +10 dbm (0 dbm on PL-1241A/USM-308 (V).

(c) VERNIER control to CAL.

(4) Adjust oscilloscope controls for display of free running sweep.

(5) Alternately set step attenuator (1-14) switch from 10 to 1.1 db (3 to 4 db for PL-1241A/USM-308(V)) and adjust oscilloscope vertical controls for 4 centimeter deflection between the

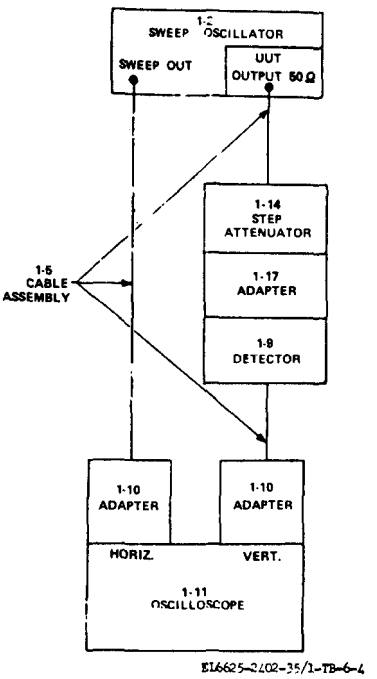


Figure 6-4. Flatness measurement, equipment eetup.

two step attenuator settings. This calibrates oscilloscope for 0.25 db/cm vertical deflection. Do not move oscilloscope vertical controls for remainder of check.

(6) Set step attenuator switch to 10 db (3 db for PL-1241A/USM-308 (V))

(7) Position sweep oscillator controls as follows:

(a) SWEEP SELECTOR switch to AUTO.

(b) START/CW control to 10.

(8) Adjust oscilloscope horizontal gain controls for 10 cm trace. Difference between maximum and minimum vertical deflection points is less than 2.4 cm peak-to-peak.

(9) Set UUT SCALE switch to X1.

(10) Repeat step (8) above.

(11) Disconnect equipment.

b. Adjustments. No adjustments can be made.

6-9. Sweep Reference

a: Performance Check.

(1) Connect multimeter (1-15) to UUT SWEEP REF connector (rear panel) with cable assembly (1-5) and adapter (1-10).

(2) Position sweep oscillator controls as follows.

(a) FUNCTION START-STOP pushbutton pressed.

(b) SWEEP SELECTOR switch to MANUAL.

(c) START/CW control to 10.

(d) STOP/AF control to 110,

(3) Set UUT SCALE switch to X.1.

(4) Turn sweep oscillator MANUAL SWEEP control fully counterclockwise.

(5) Multimeter indicates between 0.8 and 1.2 vdc.

(6) Turn sweep oscillator MANUAL SWEEP control fully clockwise.

(7) Multimeter indicates between 10. and 12 vdc.

(8) Set UUT SCALE switch to X1.

(9) Repeat steps (4) through (7) above.

b. Adjustments. No adjustments can be made.

6-10. Auxiliary (Uncalibrated) RF Output

a. Performance Check.

(1) Connect power meter (1-16) thermistor mount to UUT AUX OUTPUT connector (rear panel) with adapter (1-8).

(2) Position sweep oscillator controls as follows:

(a) START/CW control to 100.

(b) FUNCTION START-STOP pushbutton pressed.

(c) SWEEP SELECTOR switch to CW.

(d) All AMPLITUDE MOD pushbuttons released.

(3) Set UUT SCALE switch to X.1.

(4) Power meter indicates greater than -15 dbm (0.3 mw for PL-1241A/USM-308(V)).

(5) Set UUT SCALE switch to X1.

(6) Power meter indicates greater than -15 dbm (0.3 mw for PL-1241A/USM-308-(V)).

(7) Disconnect equipment .

b. Adjustments. No adjustments can be made.

6-11. VTO Output

a. Performance Check.

(1) Connect power meter thermistor mount to UUT V.T.O. OUTPUT connector (rear panel) with adapter (1-8).

(2) Position sweep oscillator controls as follows:

(a) FUNCTION START-STOP pushbutton pressed,

(b) SWEEP SELECTOR switch to MANUAL.

(c) START/CW control to 1 (4 on PL-1241A/USM-308(V)).

(d) STOP/AF control to 110.

(3) Set UUT SCALE switch to X.1.

(4) Turn sweep oscillator MANUAL SWEEP control from limit to limit. Power meter indicates greater than -15 dbm (0.03 mw for PL--1241A/USM-308(V)).

(5) Set UUT SCALE switch to X1 and re. peat step (4) above.

b. Adjustments. No adjustments can be made.

6-12. Internal Square Wave

a. Performance Check,

(1) Connect equipment as shown in figure 6-5.

(2) Position sweep oscillator controls as follows:

(a) SWEEP SELECTOR switch to CW.

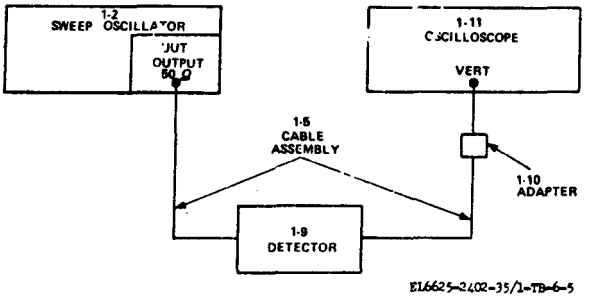


Figure 6–5. Internal square wave, equipment setup.

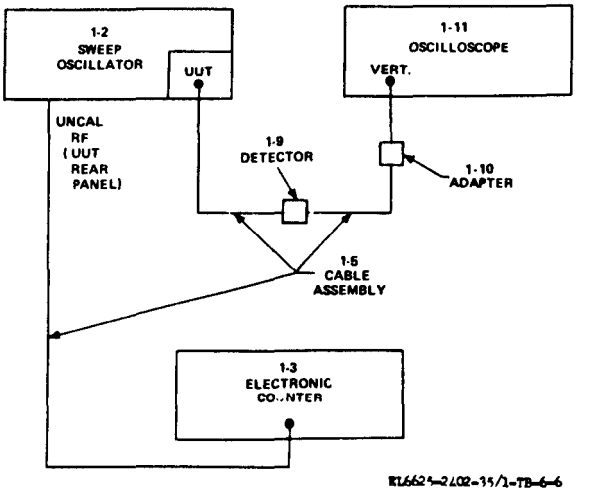


Figure 6-6. Crystal oscillator, equipment setup.

(b) START/CW control to 50.

(c) INT SQ WAVE pushbutton pressed.

(3) Set UUT SCALE switch to X1.

(4) Oscilloscope displays square wave.

b. Adjustments. No adjustments can be made.

6-13 Crystal Oscillator

a. Performance Check.

(1) Connect equipment as shown in figure 6-6.

(2) Position sweep oscillator controls as follows:

(a) SWEEP SELECTOR to MANUAL.

(b) START/CW control to 100.

(c) STOP/ΔF control to 10 (1 on ΔF scale),

(d) FUNCTION Δ F pushbutton pressed.

(e) All AMPLITUDE MOD pushbuttons released.

(3) Position UUT controls as follows:

(a) SCALE switch to X.1.

(b) 5-MHz CRYSTAL switch to ON.

(4) Adjust sweep oscillator MANUAL SWEEP control for oscilloscope display of zero beat.

(5) Electronic counter indicates between 9.999 and 10.001 MHz.

b. Adjustments. No adjustments can be made.

SECTION VII

CALIBRATION OF ELECTRONIC TEST EQUIPMENT PLUG-IN UNIT PL-1242/USM-308(V) (HP MODEL 8699B)

7-1 Equipment Required

Equipment required for calibration performance checks and adjustments is listed in table 7-1.

Table 7-1. Equipment and Accessories

ITEM		Minimum use specification	Calibration equipment
1-1	Autotransformer	105 to 126 vac =3%	Variable Power Transformer TF-510/U (General Radio model W10MT3A).
1-2	Sweep oscillator	Accepts UUT	Sweep Generator AN/USM-308 (V) (Hewlett-Packard model 8690A/B),
1-3	Power meter	.0 to 10 mw ±3%	Radio Frequency Power Test Set AN/USM-260 (Hewlett-Packard model 431C) with Thermistor Mount MX-7772/U (Hewlett-Packard model 478A).
1-4	Attenuator	20 db, N plug to N jack	Fixed Attenuator CN-1201-U (Weinschel model 60-20).
1-6	Attenuator	20 db, N plug to N jack	Fixed Attenuator CN-2171/U (Weinschel model 210-20).
1-6	Cable assembly	36 inch, RG-213/U, N plug to N plug	Radio Frequency Cable Assembly CG 3544/U (Pomona Electronics model 1658-S-36).
1-7	Electronic counter	0.1 to 4.0 GHz, ±0.03%	Digital Readout Electronic Counter AN/USM-257A (Systron-Dormer model 1037B4-F-H) with Frequency Converter CV-2350/U (Systron-Donner model 1292).
1-8	Multimeter	0 to73 vdc ± 0.5%	Multimeter ME-333/U (J-Omega model 217A).
1-9	Cable assembly	36 inch, double banana plug to black and red alligator clips.	Pomona Electronics model 2BC-AL-36.
1-10	Crystal detector	0.1 to 4.0 GHz	Radio Frequency Deteetor RF-210/U (Hewlett-Packard model 423A-02).
1-11	Cable assembly	36 inch, RG 58C/U, BNC plug to BNC plug.	Pomona. Electronics model BNC-C-36.
1-12	Oscilloscope	DC to 1 kHz+3%	Oscilloscope AN/USM-273 (Tektronix model 462).

CAUTION

Do not apply greater than 10 mv to power meter (1-3) or unsatisfactory performance may result.

7-2. Preliminary Proredure

a. Install UUT and UUT scale into sweep oscillator (1-2).

b. Set autotransformer (1-1) to ON and adjust output voltage control to minimum.

c. Connect sweep oscillator power cord to autotransformer,

d. Adjust autotransformer output voltage control for a meter indication of 115 vac.

e. Energize equipment.

f. Set sweep oscillator LINE switch to RF and allow a 15-minute warmup.

7-3. Output Power and Flatness

a. Performance Check.

(1) Connect equipment as shown in figure 7-1.

(2) Position sweep oscillator controls as follows:

(a) SWEEP SELECTOR switch to CW.
(b) ALC pushbutton released.
(c) FUNCTION START STOP pushbutton pressed.
(d) All AMPLITUDE MOD pushbuttons released.

(3) Position UUT controls as follows:

(a) Frequency range switch to .1-2 GHz.
(b) POWER LEVEL control fully clockwise.

(4) Slowly turn sweep oscillator START/CW control from 0.1 to 2.0 GHz. Record power meter minimum and maximum indications.

(5) Minimum power meter indication is greater than -7 dbm. Maximum indication does not exceed minimum by more than 14 db.

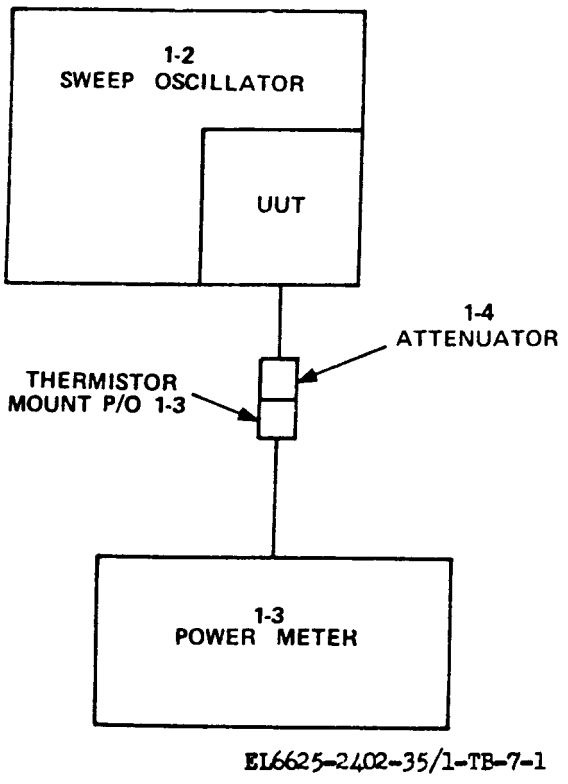


Figure 7-1. Power output and flatness, equipment setup

(6) Set UUT frequency range switch to 2-4 GHz.

(7) Replace attenuator (1-4) with attenuator (1-5).

(8) Slowly turn sweep oscillator START/CW control from 2.0 to 4.0 GHz. Record power meter minimum and maximum indications.

(9) Minimum power meter indication is greater than -12 dbm. Maximum indication does not exceed minimum by more than 14 db.

b. Adjustments.

(1) Repeat performance check steps (1) through (3).

(2) Adjust sweep oscillator START/CW control for minimum indication on power meter.

(3) Adjust UUT POWER ADJ AIR40 (fig. 7-2) for power meter indication of -7 dbm.

7-4. Frequency Range and Accuracy Check

a. Performance Check.

(1) Connect equipment as shown in figure 7-3.

(2) Position sweep oscillator controls as follows:

(a) SWEEP SELECTOR switch to CW.
(b) FUNCTION START STOP pushbutton pressed.
(C) All AMPLITUDE MOD pushbuttons released.
(d) ALC pushbutton released.

(3) Turn UUT POWER LEVEL control fully clockwise.

(4) Turn sweep oscillator START/CW control to settings listed in table 7-2. Set UUT frequency range switch as listed. Electronic counter (1-7) indicates within specified limits.

b. Adjustments.

(1) Connect equipment as shown in figure 7-3.

(2) Connect multimeter (1-8) between UUT A1TP5 (fig. 7-2) and chassis ground with cable assembly (1-9).

(3) Set UUT frequency range switch to 2-4 GHz.

(4) Adjust sweep oscillator START CW control for multimeter indication of 3.00 wit.

(5) Adjust UUT 2.0 GHz ADJ AIR28 (fig. 7-2) for electronic counter indication of 1.997 GHz.

(6) Adjust sweep oscillator START CW control for multimeter indication of 73.00 vdc.

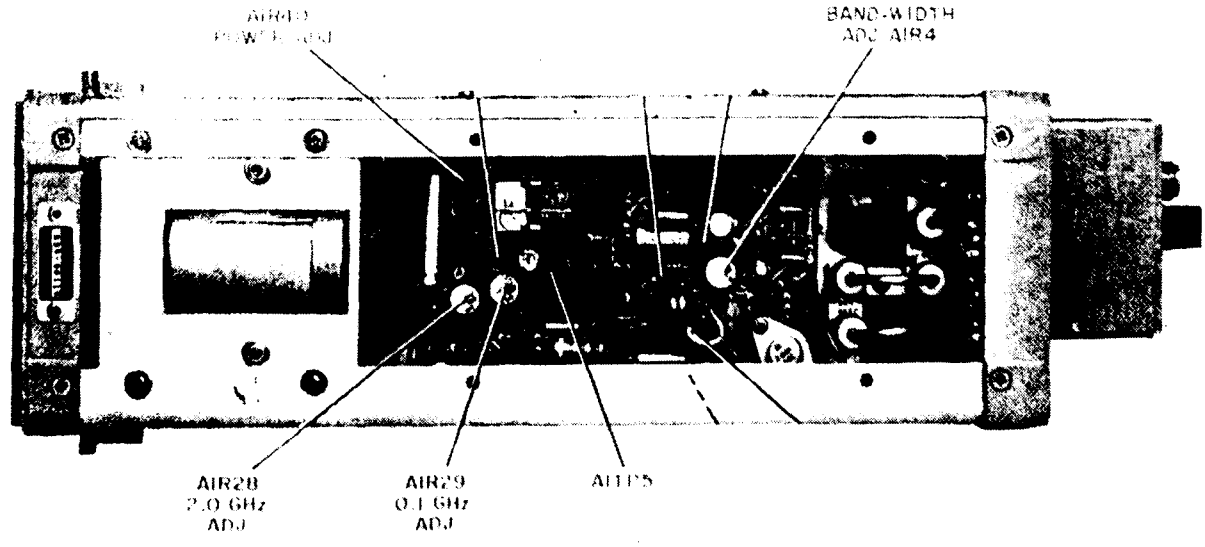


Figure 7-2. Plug-In Unit PL-1242/USM-308(V), top view showing adjustment locations.

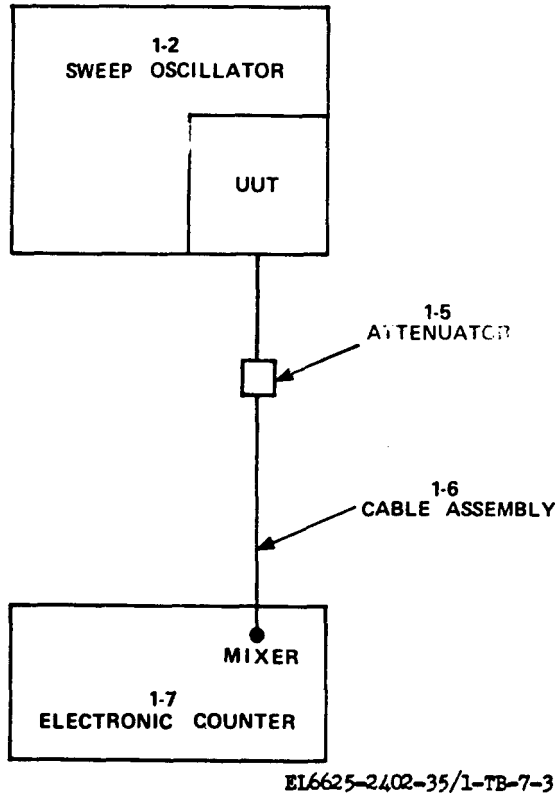


Figure 7-3. Frequency range and accuracy, equipment setup.

(7) Adjust UUT BAND-WIDTH ADJ A1-R4 (fig. 7-2) for electronic counter indication of 4.003 GHz.

(8) Replace attenuator (1-5) with attenuator (1-4).

(9) Set UUT frequency range switch to .1–2 GHz.

(10) Adjust sweep oscillator START/CW control for multimeter indication of 6,50 vdc.

(11) Adjust UUT 0.1 GHz ADJ A1R29 (fig, 7-2) for electronic counter indication of 0.097 GHz.

(12) Disconnect multimeter.

(13) Repeat performance check.

7-5. Internal Square Wave

a. *Performance Check.*

(1) Connect equipment as shown in figure 7-4.

(2) Position sweep oscillator controls as follows:

(a) INT SQ WAVE pushbutton pressed.
(b) START/CW control to 3.0 GHz.

(3) Position UUT controls as follows:

(a) POWER LEVEL control fully clockwise.

(b) Frequency range switch to 2-4 GHz.

(4) Oscilloscope (1-12) displays square wave.

b. Adjusments: No adjustments can be made.

Table 7-2. Frequency Range and Accuracy

UUT	Sweep oscillator		
Frequency range switch setting	START/CW control setting	Electronic counter indication (GHz)	
		Minimum	Maximum
2-4 GHz	2.0 GHz on high scale	1.99	2.01
2-4 GHz	4.0 GHz on high scale	3.99	4.01
.1-2 GHz	0.1 GHz on low scale	0.09	0.11
.1-2 GHz	2.0 GHz on low scale	1.99	2.01

*Replace attenuator (1-5) with attenuator (1-4).

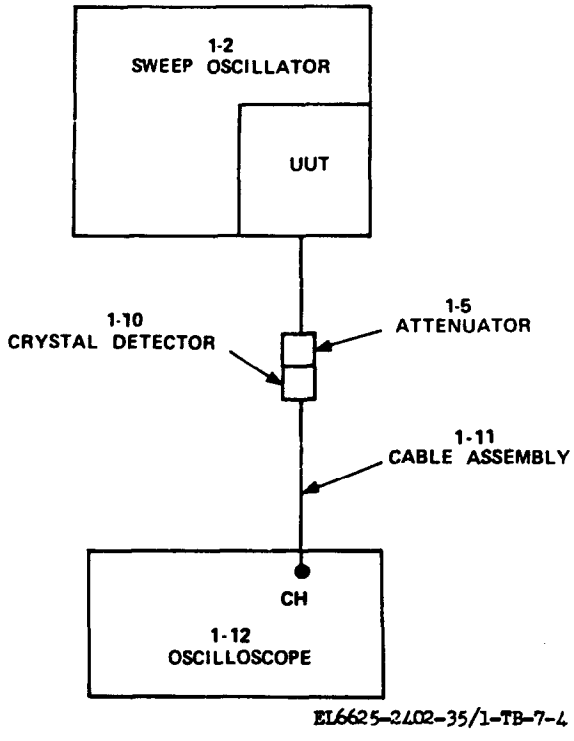


Figure 7-4. Internal square wave, equipment setup.

7-6. Final Procedure

a. Deenergize and disconnect all equipment.

b. In accordance with TM 38-750, annotate and affix calibration label (DA Label 80). When the unit under test cannot be adjusted within tolerance or utilized with an appropriate correction chart, annotate and affix red tag (DA Form 2417).

By Order of the Secretary of the Army:

CREIGHTON W. ABRAMS
General, United States Army
Chief of Staff

Official:

VERNE L. BOWERS
Major General, United States Army
The Adjutant General

Distribution:

To be distributed in accordance with DA Form 12-34 (qty rqr block No. 75) Requirements for Calibration Procedure Publications.

* U.S. GOVERNMENT PRINTING OFFICE: 1985-546-652/19352 Reqion 4.

PIN NO: 010660-000