SERVICE NOTE

382A-1A

#8

℗ MODELS G382A, C382A, J382A, H382A, X382A AND P382A BROADBAND PRECISION WAVEGUIDE VARIABLE ATTENUATOR

CALIBRATION AND ALIGNMENT PROCEDURES

This Service Note describes an improved method for calibration and alignment of your ℗ Model 382A Broadband Precision Waveguide Variable Attenuator. The procedure incorporates swept frequency techniques to arrive at more accurate and more complete calibration.

The swept frequency technique provides rapid "complete frequency range" testing. If possible errors exist in your attenuator*, this technique will easily spot them. The point-by-point method (spot checking across the frequency band) may overlook these errors such as resonances, holes, or other deviations from normal. Using the swept frequency technique eliminates any chance of missing these deviations.

These procedures cover measurement of attenuator standing wave ratio, measurement of insertion loss, and dial calibration.

Equipment required varies with the test desired. See figures 1 through 3 which show setups for individual tests.

* The attenuation, in decibels, of your ℗ Model 382A is directly proportional to the angle to which the resistive metal film card in the center section is rotated with respect to the end section cards. Since the attenuator obeys a precise mathematical law, the position of the dial with respect to the angular rotation of the center section is the controlling factor of calibration accuracy. Precise methods for achieving this alignment are outlined in these Service Notes.

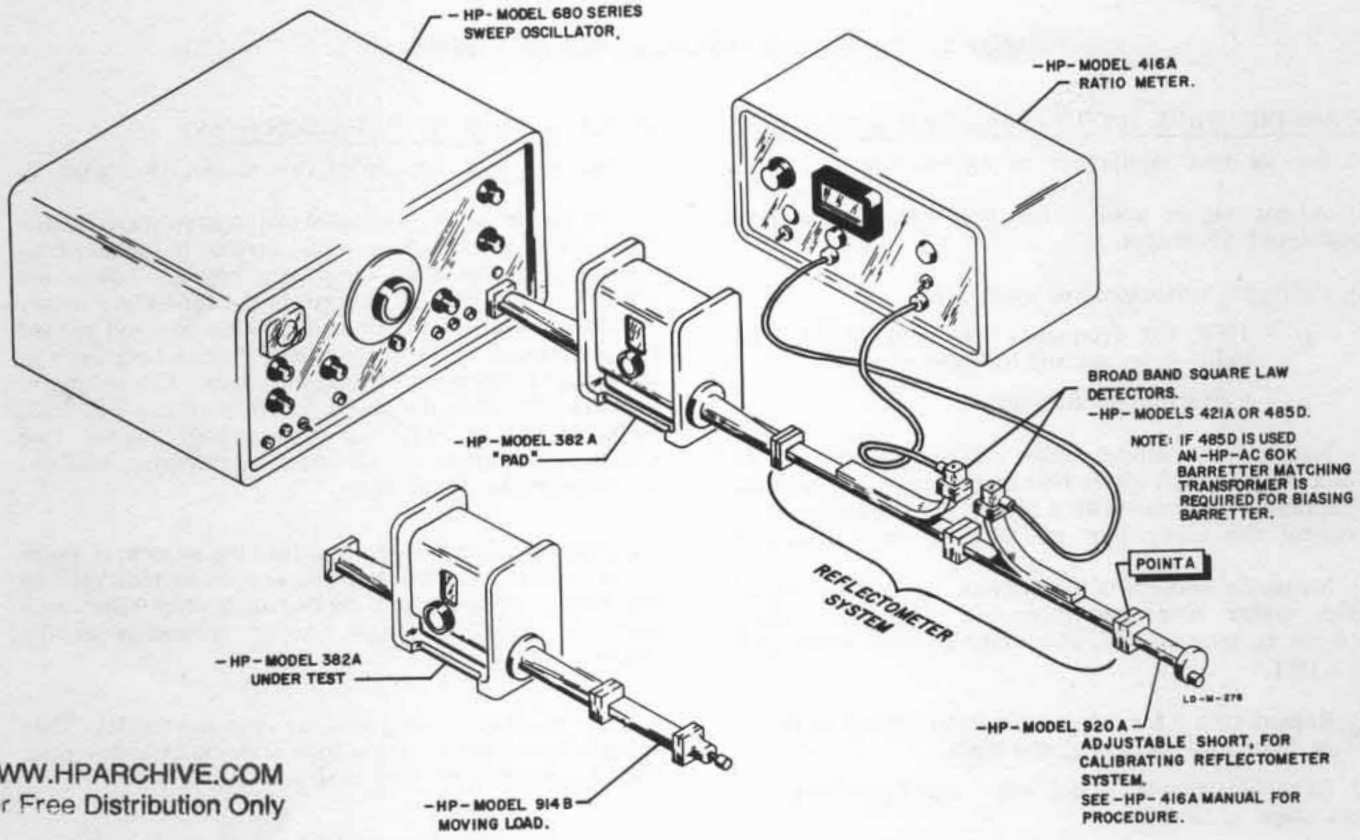

Figure 1. Test Setup for Measuring Standing Wave Ratio

distribution abcefg$_3$
01074-2

HEWLETT-PACKARD COMPANY
1501 PAGE MILL ROAD
PALO ALTO, CALIFORNIA, U.S.A.
CABLE: "HEWPACK" DAVENPORT 6-7000
RUE DU VIEUX BILLARD NO. 1
GENEVA, SWITZERLAND
CABLE: "HEWPACKSA" TEL. NO. (022) 26.43.36

PRINTED IN U.S.A.

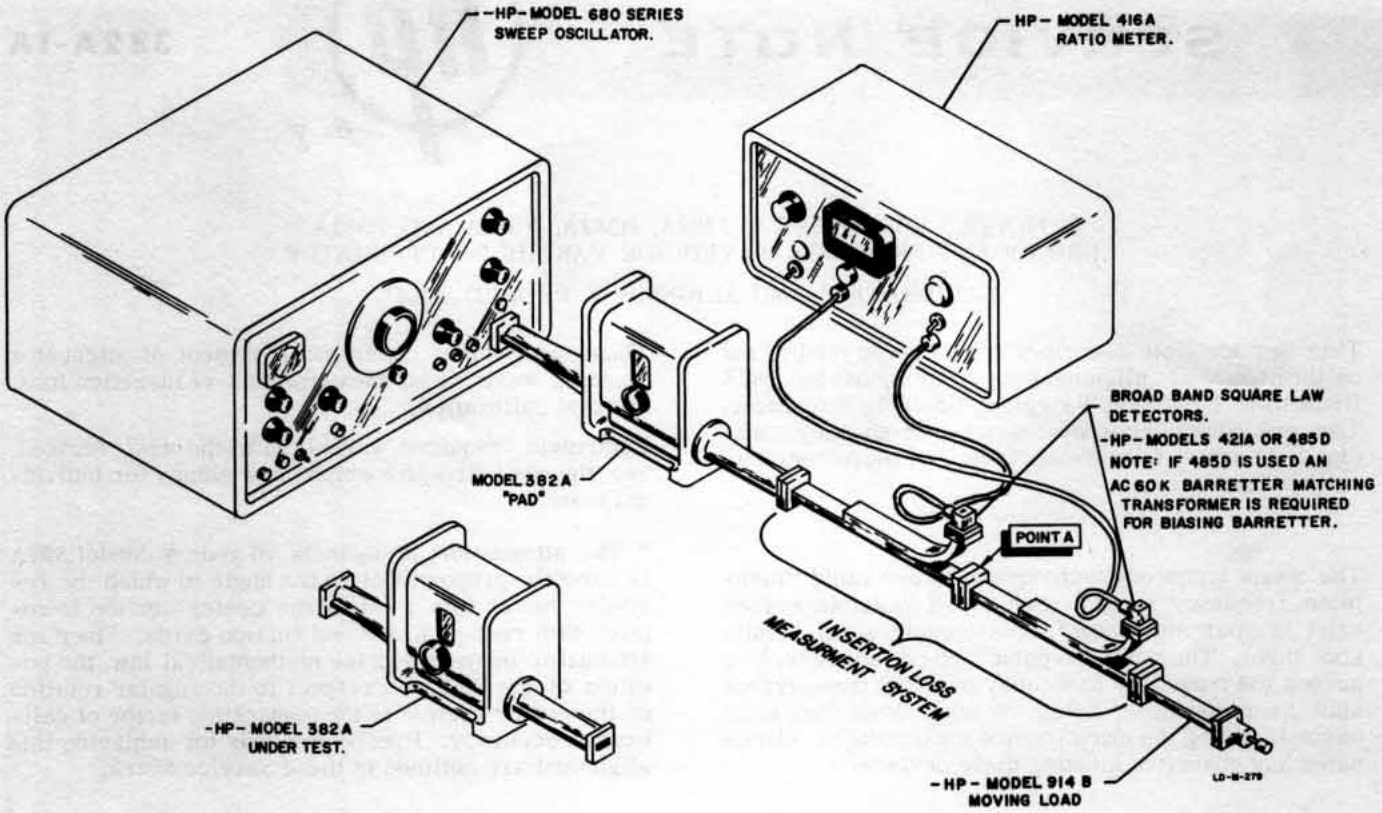

Figure 2. Test Setup for Measuring Insertion (Fixed) Loss

STANDING WAVE RATIO (SWR) TEST PROCEDURE

1) Set up test equipment to agree with figure 1.

2) Adjust signal source for 1000 cps square wave modulated RF output.

3) Calibrate reflectometer system to:

ρ = 100% for frequency range of Model 382A (with short applied to Point A).

ρ = Reflection coefficient

4) Remove the Model 920A Adjustable Short from Point A. Set 382A under test to minimum attenuation. Terminate one port with a Model 914A Moving Load. Connect the other port to Point A. (see figure 1.)

5) Measure Reflection Coefficient, ρ, of the Model 382A under test throughout its frequency range. ρ must be less than 7% which corresponds to an SWR of 1.15:1.

6) Repeat step 5 for attenuator dial readings of 10 db, 20 db, 30 db, 40 db, 50 db, and MAX.

7) Reverse ends of Model 382A under test and repeat steps 4, 5, and 6.

NOTE: If SWR is out of specification, check for warped, broken, burned, or wrinkled resistive cards. Check for silver paint on cards or foreign material in rotary choke joints.

MEASUREMENT OF INSERTION LOSS

8) Set up test equipment as shown in figure 2.

9) Set signal source for 1000 cps square wave modulated RF output. Adjust signal source to highest frequency of Model 382A frequency range. Adjust the SET TO FULL SCALE control of the 416A for a meter reading of "2" on the db scale. Measure and record the variations in 416A readings versus frequency at the quarter points of the frequency band. For example: For the "X" band the check points would be 8.2, 9.25, 10.3, 11.35, and 12.4 gc (gigacycles). Note: Use minus (-) notation for up-scale variations., and (+) for down scale variations.

10) Insert the 382A under test into the system at Point A and set it to minimum attenuation as indicated by the 416A. Measure and record as in step 9 the variation in 416A readings versus frequency at the quarter points.

11) Add the data in step 9 to the data in step 10. This value will be the insertion loss of the 382A under test. This figure must be less than 1.0 db.

NOTE: If insertion loss is high, check card alignment. The three cards should be in the same plane. Also, check the rotary choke joints for leakage, as a common cause for high insertion loss is poorly painted joints on the ends of the center barrel.

DIAL CALIBRATION

12) Set up test equipment as shown in figure 3.

13) Set signal source to mid-band point of Model 382A frequency range. Adjust for 1000 cps square wave modulated RF output.

14) Tune the 485B to obtain maximum indication on the 415B/C. Set 382A under test to the dot which appears at approximately 48 db on the attenuator dial. Adjust the Model 382A padding attenuator for a reference of 1 db on the 50 db range of the Model 415B/C.

NOTE: If a double peak in maximum attenuation occurs the resistive center card has been installed with the emulsion side reversed. Refer to Service Note 382A-2, steps 1 through 21 for correct installation procedure.

15) Check the variation from 1 db of the corresponding dot on the other side of MAX.

16) If adjustment is necessary, loosen the setscrews and the dial hub clamping screw in the dial hub. Adjust the dial so the difference in power level between the two dots is less than 0.2 db as indicated by the 415B/C. This aligns the dial to the angular position of the center section. Tighten cap screw and allen setscrews and recheck.

17) Check for backlash at a dial reading of 50 db on the ℗ Model 382A.

NOTE: When backlash is in excess of 0.2 db, refer to figure 4 and make the following adjustments. Check backlash after each adjustment.

A. Check the position of the Ring nut. It should be backed off approximately 1/4 turn from snug against the bearing.

B. Adjust the worm gear tension adjustment screw to minimize backlash.

C. Adjust the worm gear thrust adjustment screw to minimize backlash.

18) Set the 382A padding attenuator to MAX. Set the 382A under test to "0" (zero). Adjust the padding attenuator for a reference of 1 db on the 40 db range of the 415B/C.

19) Set the 382A under test to 10 db. Switch the 415B/C to the 50 db range. Read and record indication on the 415B/C. The difference between this reading and the reference set in step 18 is the actual attenuation that results when 10 db is set on the 382A under test.

20) Switch the 415B/C to 40 db range. Adjust the 382A padding attenuator to return to the deviation from the reference obtained in step 19.

21) Repeat steps 19 and 20 for dial calibrations of 20 db, 30 db, 40 db and 50 db. The error recorded will be total error and must not exceed 2.0% or 0.1 db whichever is greater.

22) Repeat steps 18 through 21 at the quarter points of the band.

NOTE: The detector mount must be retuned at each frequency.

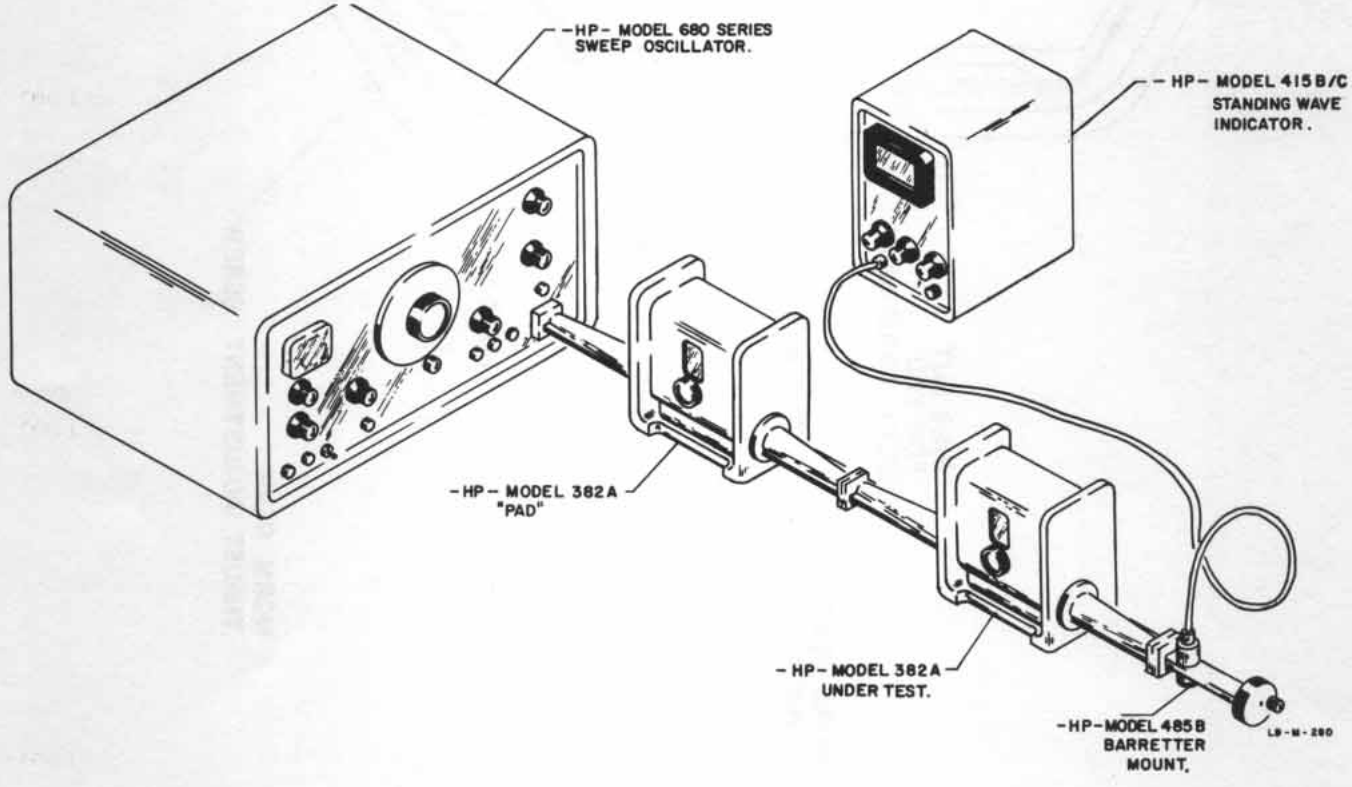

Figure 3. Test Setup for Calibrating ℗ Model 382A

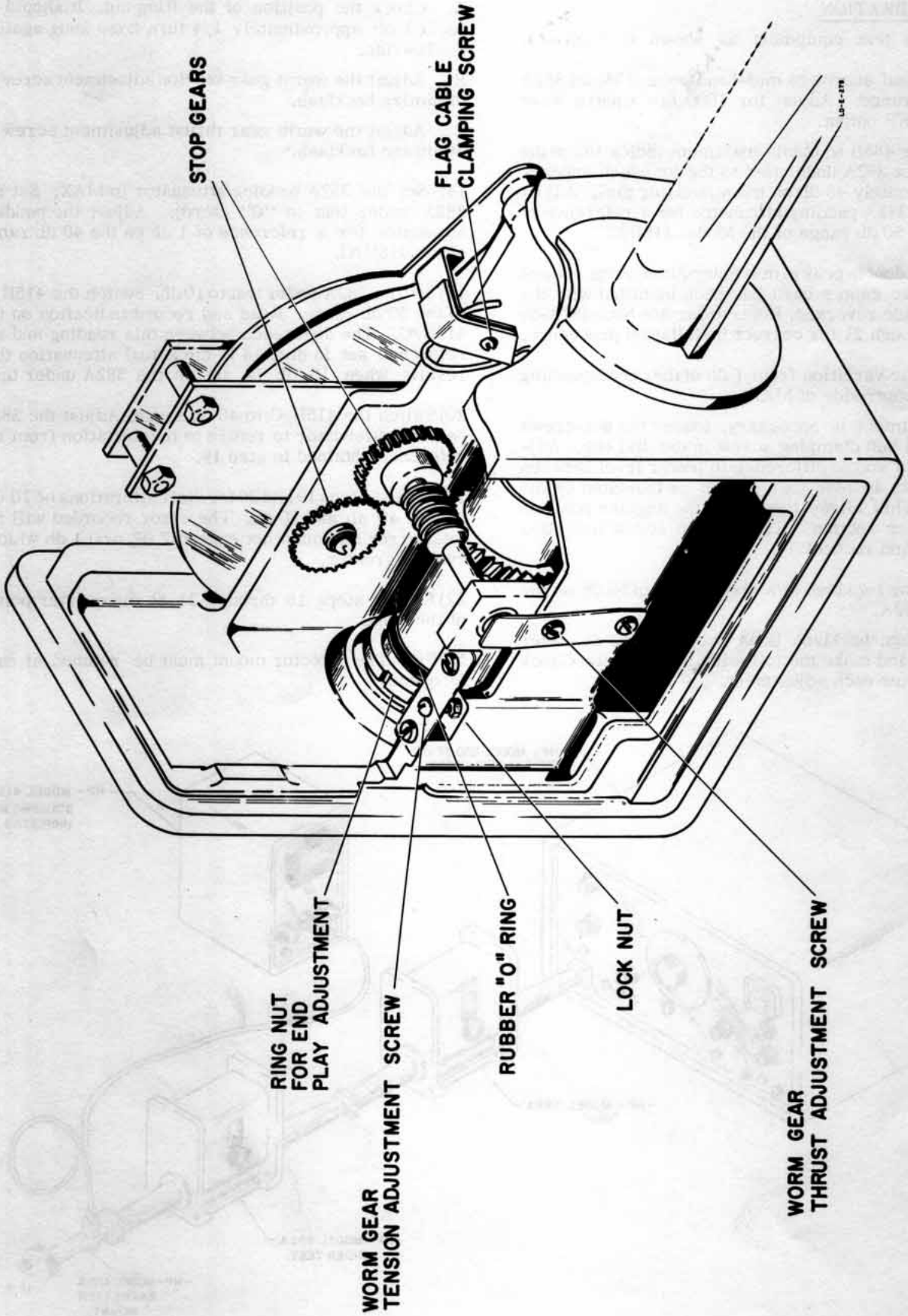

Figure 4. Backlash Adjustments