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Standard Test Methods

Document No. TEG-10006

Watkins-Johnson Company
CEI Division
700 Quince Orchard Road
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REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED

Sheet 10	26	27	28	29	30	16A	16B																			
Rev.	A	A	A	A	A	A	A																			
Sheet 10	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
Rev.		A	A	A	A	A	A		A		A	A	A		A		A			A			A	A	A	
Sheet 9-	1	2	3	4	5	6	7	8	9	10	11															
Rev.			A		A																					
Sheet 8-	1	2	3	4	5																					
Rev.																										
Sheet 7-	1	2	3	4	5	6	7																			
Rev.		A	A	A	A	A																				
heet 6-	1	2	3	4	5	6	7	8	9																	
Rev.																										
Sheet 5-	1	2	3	4	5																					
Rev.																										
Sheet 4-	1	2	3	4	5	6	7	8	9	10	11															
Rev.		A	A		A	A	A	A	A	A	A															
Sheet 3-	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15											
Rev.		A		A				A			A	A		A	A											
Sheet 2-	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	14A	14B	18A				
Rev.			A	A	A		A		A	A	A					A	A	A	A	A	A	A				
SHEET 1-	1	2	3	4	5	6	7	8																		
REVISION																										
SHEET	i	ii	iii	iv	v	vi	vii																			
REVISION	A	A	A	A	A	A																				

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SHEET																								
REVISION																								
SHEET	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
REVISION																									

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SIZE	CODE IDENT NO.	DRAWING NO.
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SHEET iii OF

I. Introduction

This manual has been prepared in order to establish standard test methods for the CEI Division.

The test methods are general in nature and do not reflect individual equipment types. Specific equipment types shall be outlined in the test procedure for the device under test.

All specific operating conditions shall be stated in the test procedure for the device under test.

Additional test methods may be added from time to time in order to make the manual as complete as possible. Readers are encouraged to submit suggestions for improvement of the manual or the addition of new test methods.

Tests that are unique to a given piece of equipment and require a specific test set-up procedure with quantitative data shall be detailed in the test procedure for that equipment or on the final test data sheet.

II. Tables of Test Methods

Section 000 - Standard Test Conditions

A. Unless otherwise specified in the equipment test procedure, all tests shall be conducted under the following conditions:

1. Environmental - per prevailing laboratory conditions

2. AC Input

   a. Standard AC power line for equipments operating on 115 Vrms, 60 Hz and 115/220(230)Vrms, 60 Hz

   b. 220(230) ± 3 Vrms, 50 Hz for equipments operating on 220(230)V, 50 Hz only

   c. 115 ± 1.5 Vrms, 400 Hz for equipment operating on 115V, 400 Hz only

3. Termination - all output ports shall be terminated with their characteristic impedance and/or the specified load as stated in the equipment test procedure.

4. Control Settings - all control settings shall be as stated in the equipment test procedure

B. In some equipment set-ups, an oscilloscope is shown but its use is not described. The oscilloscope is used in order that test personnel may verify that the output signal is not highly distorted or that the gain of the unit is not set too high as to drive circuits into saturation.

C. The equipment test procedure shall define the following items.

1. Test equipment by model number
2. Input/Output port designations
3. Input signal characteristics, frequency, level and modulation required
4. Output signal characteristics; level, reference settings, distortion, etc.
5. All test conditions peculiar to the unit under test
6. All load terminations

Section 100 Power Supply Checks

The following tests shall be used for testing of equipment power consumption, power supply regulation and power supply noise or ripple.

Standard test range of AC input voltages for CEI Equipment are defined as follows:

1. 115 ± 12 Vrms, 60 Hz or 400 Hz

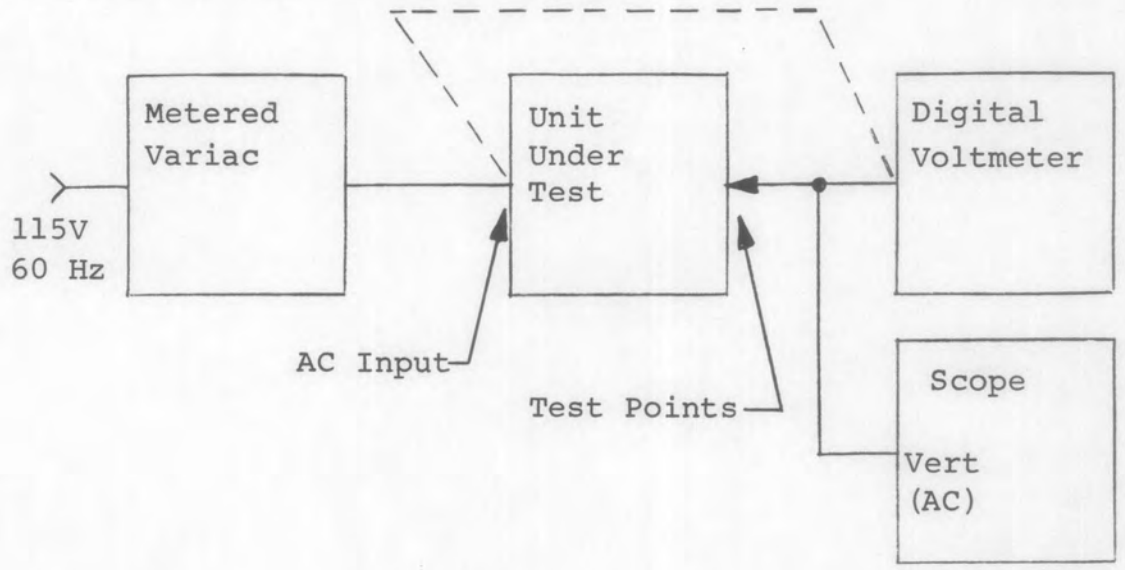
2. 220 ± 22 Vrms, 50 Hz

3. 230 ± 23 Vrms, 50 Hz

METHOD 101

Power Supply Checks for Equipments Operating on 115 Vac, only

1. Equipment Set-up



2. Procedure

1. Set the variac for an AC input voltage of 115 Vrms.[1]
2. Measure/Calculate and record the power consumption.[2]
3. Measure and record the voltage at each test point outlined in the equipment test procedure.
4. Record the peak-to-peak ripple, as observed on the oscilloscope, at each test point.[3]
5. Set the variac for an AC input voltage of 103 Vrms.[1]
6. Repeat step 3.
7. Set the variac for an AC input voltage of 127 Vrms.[1]
8. Repeat step 3.

3. Notes

1. For maximum accuracy, use the digital voltmeter to determine the AC input voltage.

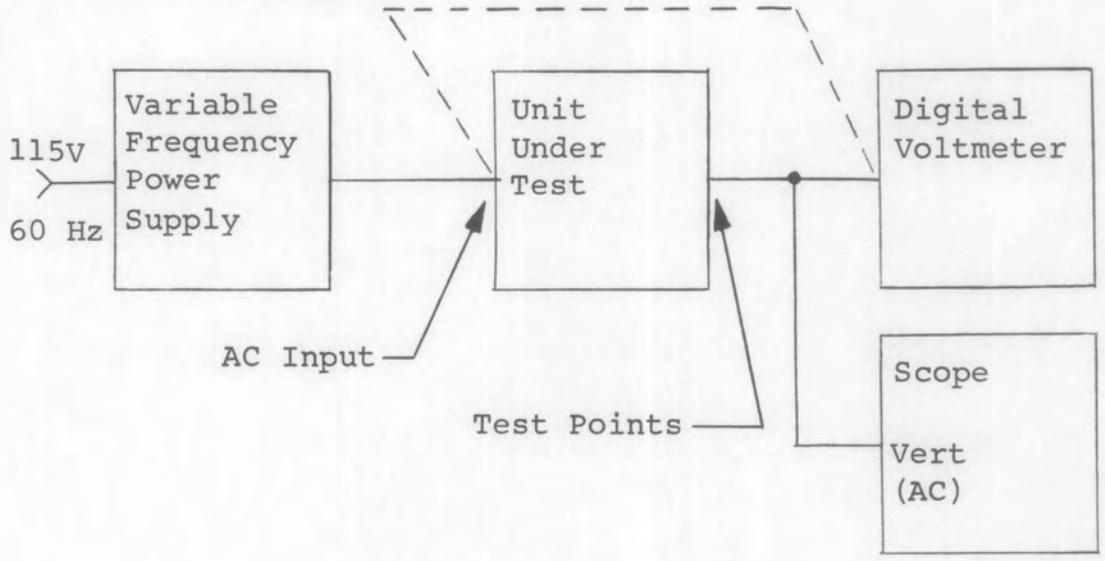
2. If the variac is not metered, an external wattmeter or AC ammeter will be required.

3. Ripple may not be defined for all equipment types.

METHOD 102

Power Supply Checks For Equipments Operating on 220(230)Vac Only

1. Equipment Set-up



2. Procedure

1. Set the variac for an AC input voltage of 220(230) Vrms.[1]

2. Measure/Calculate and record the power consumption.[2]

3. Measure and record the voltage at each test point outlined in the equipment test procedure.

4. Record the peak-to-peak ripple, as observed on the oscilloscope, at each test point.[3]

5. Set the variac for an AC input voltage of 198(207) Vrms.[1]

6. Repeat step 3.

7. Set the variac for an AC input voltage of 242(253) Vrms.[1]

8. Repeat step 3.

3. Notes

1. For maximum accuracy, use the digital voltmeter to determine the AC input voltage.

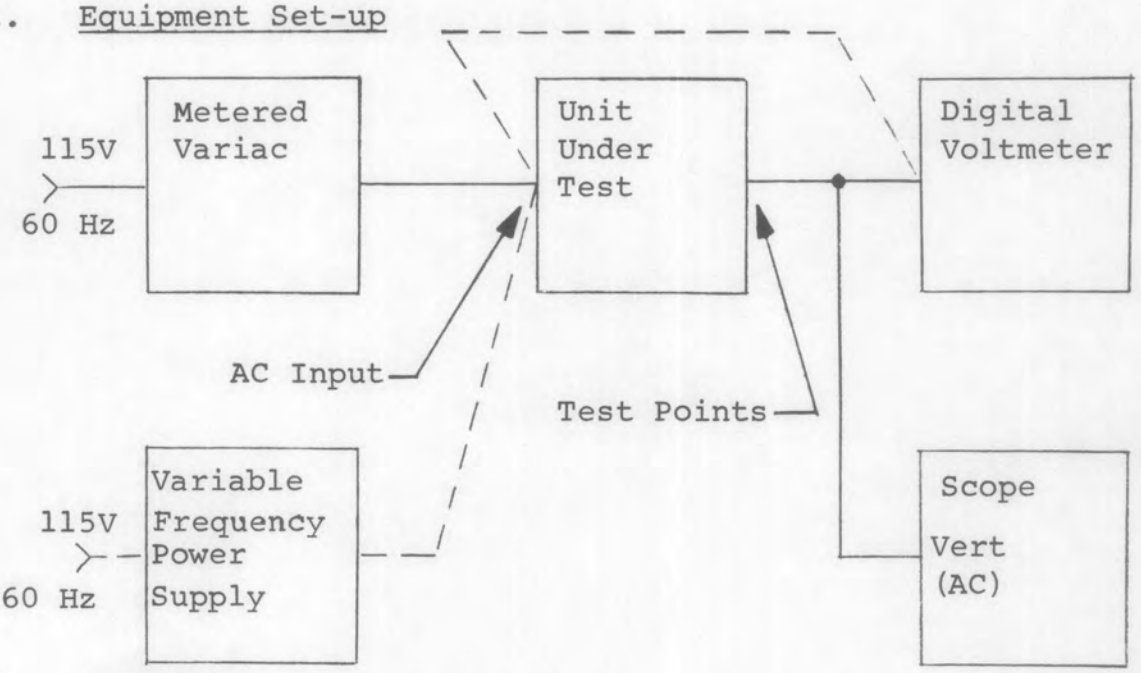
2. If the variac is not metered, an external wattmeter or AC ammeter will be required.

3. Ripple may not be defined for all equipment types.

METHOD 103

Power Supply Checks For Equipments Operating on 115/220/230 Vac

1. Equipment Set-up



2. Procedure

1. Set the unit under test for 115V operation.
2. Set up the equipment as shown by the solid lines.
3. Set the variac for an AC input voltage of 115 Vrms.[1]
4. Measure/Calculate and record the power consumption.[2]
5. Measure and record the voltage at each test point outlined in the equipment test procedure.
6. Record the peak-to-peak ripple, as observed on the oscilloscope, at each test point.[3]
7. Set the variac for an AC input voltage of 103 Vrms.[1]

8. Repeat step 5.

9. Set the variac for an AC input voltage of 127 Vrms.[1]

10. Repeat step 5.

11. Replace the variac with the power amplifier.

12. Set the power amplifier for an AC input voltage of 115 Vrms, 400 Hz.[1]

13. Repeat step 5.

14. Set the unit under test for 220(230)V operation.

15. Set the power amplifier for an AC input voltage of 220(230)Vrms, 50 Hz.[1]

16. Observe the output noise and ripple. Decrease the AC input until spikes start appearing at the test point.[4]

17. Measure and record the AC input voltage. It shall be a maximum of 198(207)Vrms.[1]

18. Repeat steps 16 and 17 at each test point outlined in the equipment test procedure.

19. Turn the unit under test to OFF and reset for 115V operation.

3. Notes

1. For maximum accuracy, use the digital voltmeter to determine the AC input voltage.

2. If the variac is not metered, an external wattmeter or AC ammeter will be required.

3. Ripple may not be defined for all equipment types and the measurement may not be required.

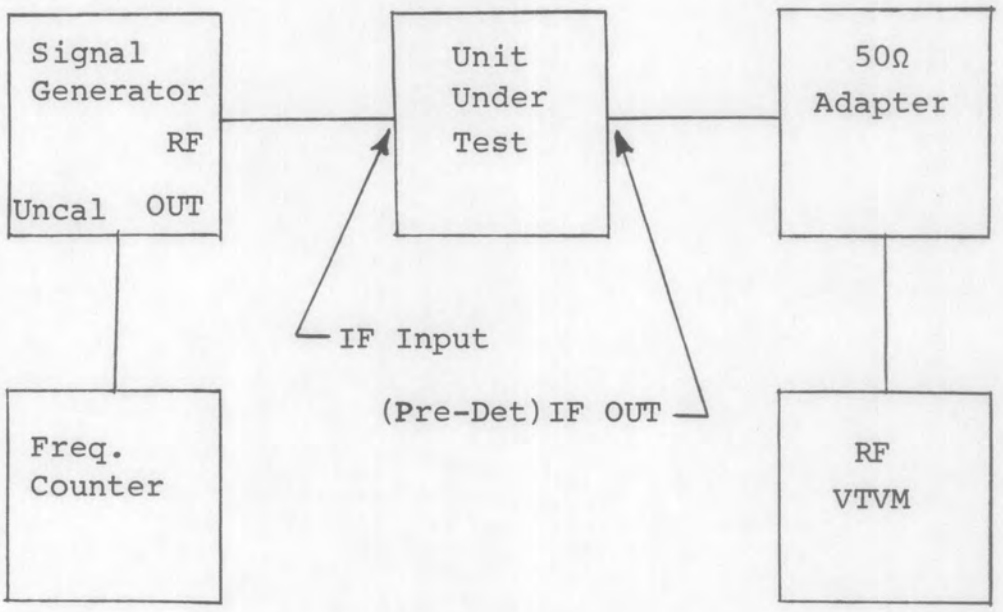
4. A slight increase in the noise or ripple may be observed. This is not a failure.

Section 200 Frequency Response (Bandwidth) Measurements

METHOD 201-1

IF Bandwidth and Center Frequency (Center Frequency Reference)

1. Equipment Set-up



2. Procedure

1. Set the unit under test for maximum gain (Use AM/MAN mode for receivers).

2. Set the signal generator to the specified IF center frequency, CW.

3. Adjust the output level of the signal generator for the reference on the RF VTVM as specified in the test procedure.

4. Increase the frequency of the signal generator, maintaining a constant output level, until the reading on the RF VTVM decreases 3 dB.

5. Record the frequency of the signal generator.

6. Decrease the frequency of the signal generator, passing through the IF center frequency, until the reading on the RF VTVM is again 3 dB less than the reference set in step 3.

7. Record the frequency of the signal generator.

8. Subtract the frequencies of steps 5 and 7 and record the difference. This is the 3 dB bandwidth.

9. Calculate and record the IF center frequency as follows;

$$f_{CF} = f_{LO} + \left(\frac{f_{HI} - f_{LO}}{2}\right) = \frac{f_{HI} + f_{LO}}{2}$$

where

f_{CF} = IF center frequency

f_{LO} = frequency of the lower 3 dB point

f_{HI} = frequency of the upper 3 dB point

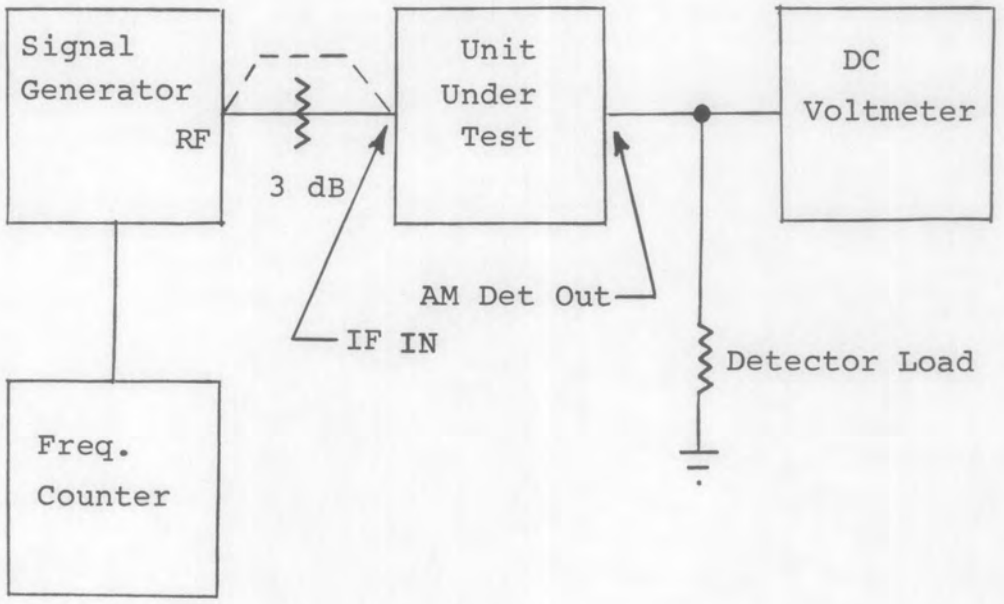
10. Vary the frequency of the signal generator across the pass band. Verify that the deviation from any adjacent peak to valley (ripple) does not exceed the specified limits. Record data as applicable.

3. NOTES:

METHOD 201-2

IF Bandwidth and Center Frequency (Center Frequency Reference)

1. Equipment Set-up



2. Procedure

1. Set the unit under test for maximum gain (Use AM/MAN mode for receivers).

2. Set the signal generator to the specified IF center frequency, CW, at the level specified in the equipment test procedure.

3. Adjust the output level of the signal generator for the specified reference reading on the voltmeter.

4. Remove the 3 dB attenuator.

5. Increase the frequency of the signal generator, maintaining a constant output level, until the reading on the voltmeter decreases to the specified reference.

6. Record the frequency of the signal generator.

7. Decrease the frequency of the signal generator, passing through the IF center frequency, until the reading on the voltmeter is again at the specified reference.

8. Record the frequency of the signal generator.

9. Subtract the frequencies of steps 6 and 8 and record the difference. This is the 3 dB bandwidth.

10. Calculate and record the IF center frequency as follows:

$$f_{CF} = f_{LO} + \frac{(f_{HI} - f_{LO})}{2} = \frac{(f_{HI} + f_{LO})}{2}$$

where

f_{CF} = IF center frequency

f_{LO} = frequency of the lower 3 dB point

f_{HI} = frequency of the upper 3 dB point

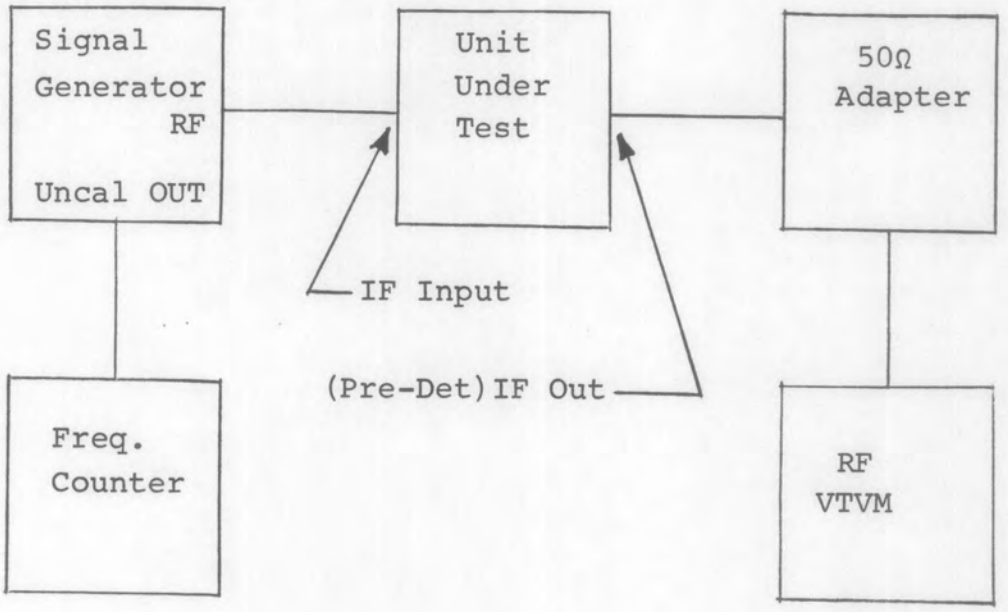
11. Vary the frequency of the signal generator across the pass band. Verify that the deviation from any adjacent peak to valley (ripple) does not exceed the specified limits. Record data as applicable.

3. Notes

METHOD 201-3

IF Bandwidth and Center Frequency (Peak Reference)

1. Equipment Set-up



2. Procedure

1. Set the unit under test for maximum gain (Use AM/MAN mode for receivers).

2. Set the signal generator to obtain the peak within the pass band, CW.

3. Adjust the output level of the signal generator for the specified reference on the RF VTVM.

4. Increase the frequency of the signal generator, maintaining a constant output level, until the reading on the RF VTVM decreases 3 dB.

5. Record the frequency of the signal generator.

6. Decrease the frequency of the signal generator, passing through the peak response, until the reading on the RF VTVM is again 3 dB less than the reference set in step 3.

7. Record the frequency of the signal generator.

8. Subtract the frequencies of steps 5 and 7 and record the difference. This is the 3 dB bandwidth.

9. Calculate and record the IF center frequency as follows;

$$f_{CF} = f_{LO} + \frac{(f_{HI} - f_{LO})}{2} = \frac{f_{HI} + f_{LO}}{2}$$

where

f_{CF} = IF center frequency

f_{LO} = frequency of the lower 3 dB point

f_{HI} = frequency of the upper 3 dB point

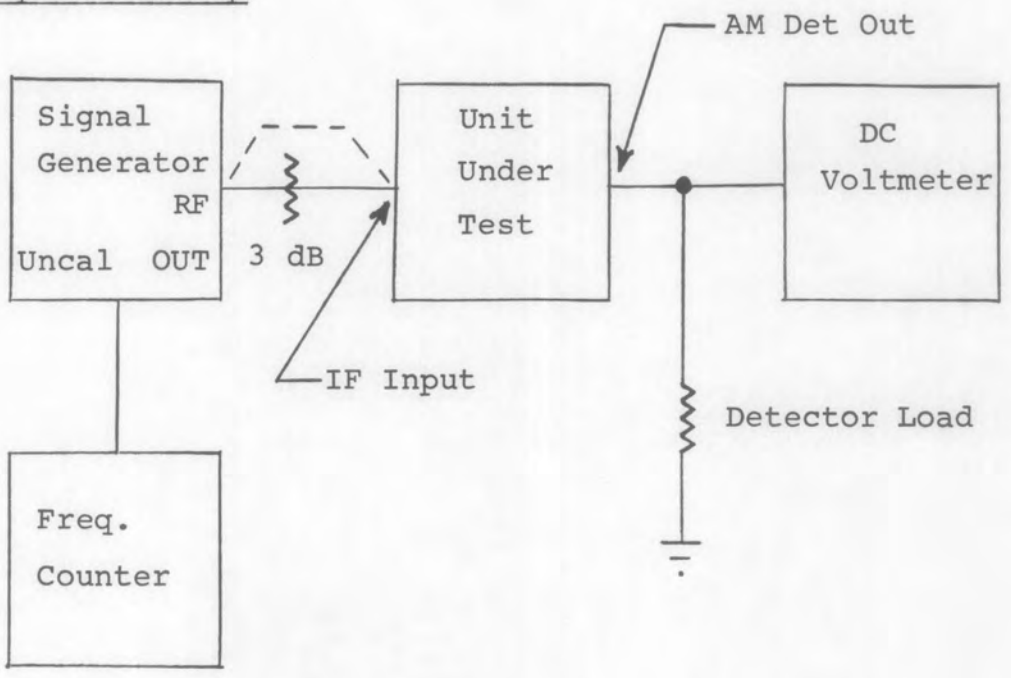
10. Vary the frequency of the signal generator across the pass band. Verify that the deviation from any adjacent peak to valley (ripple) does not exceed the specified limits. Record data as applicable.

3. Notes

METHOD 201-4

IF Bandwidth and Center Frequency (Peak Reference)

1. Equipment Set-up



2. Procedure

1. Set the unit under test for maximum gain (Use AM/MAN mode for receivers).

2. Set the signal generator to obtain the peak within the IF pass band, CW, at the level specified in the equipment test procedure.

3. Adjust the output level of the signal generator for the specified reference reading on the voltmeter.

4. Remove the 3 dB attenuator.

5. Increase the frequency of the signal generator maintaining a constant output level, until the reading on the voltmeter decreases to the specified reference.

6. Record the frequency of the signal generator.

7. Decrease the frequency of the signal generator, passing through the peak response, until the reading on the voltmeter is again at the specified reference.

8. Record the frequency of the signal generator.

9. Subtract the frequencies of steps 6 and 8 and record the difference. This is the 3 dB bandwidth.

10. Calculate and record the IF center frequency as follows;

$$f_{CF} = f_{LO} + \frac{(f_{HI} - f_{LO})}{2}$$

where

f_{CF} = IF center frequency

f_{LO} = frequency of the lower 3 dB point

f_{HI} = frequency of the upper 3 dB point

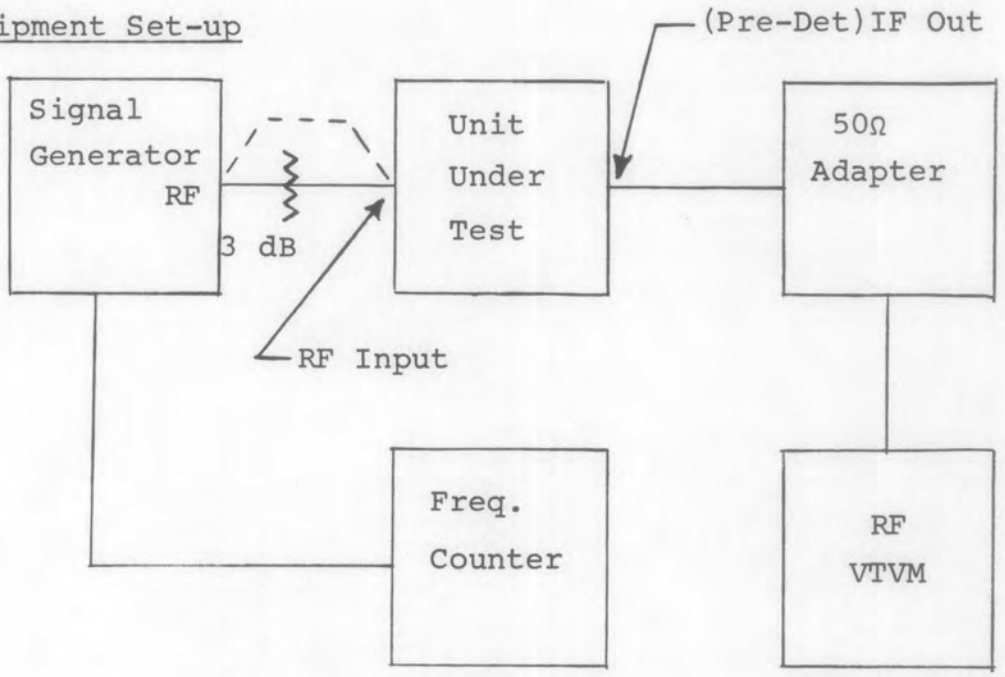
11. Vary the frequency of the signal generator across the pass band. Verify that the deviation from any adjacent peak to valley (ripple) does not exceed the specified limits. Record data as applicable.

3. Notes

METHOD 201-5

Overall Bandwidth and Center Frequency (IF Center Frequency Reference)

1. Equipment Set-up



2. Procedure

1. Set the signal generator to obtain the IF center frequency at the IF output port, CW, at the level specified in the equipment test procedure.

2. Set the unit under test gain control as specified in the equipment test procedure. (Use AM/MAN mode for receivers)

3. Adjust the output level of the signal generator for the specified reference on the RF VTVM.

4. Remove the 3 dB attenuator.

5. Increase the frequency of the signal generator, maintaining a constant output level, until the reading on the RF VTVM is at the specified reference.

6. Record the frequency of the signal generator.

7. Decrease the frequency of the signal generator, passing through the IF center frequency, until the reading on the RF VTVM is again at the reference set in step 3.

8. Record the frequency of the signal generator.

9. Subtract the frequencies of steps 6 and 8 and record the difference. This is the 3 dB bandwidth.

10. Calculate and record the IF center frequency as follows;

$$f_{CF} = f_{LO} + \frac{(f_{HI} - f_{LO})}{2} = \frac{f_{HI} + f_{LO}}{2}$$

where

f_{CF} = IF center frequency

f_{LO} = frequency of the lower 3 dB point

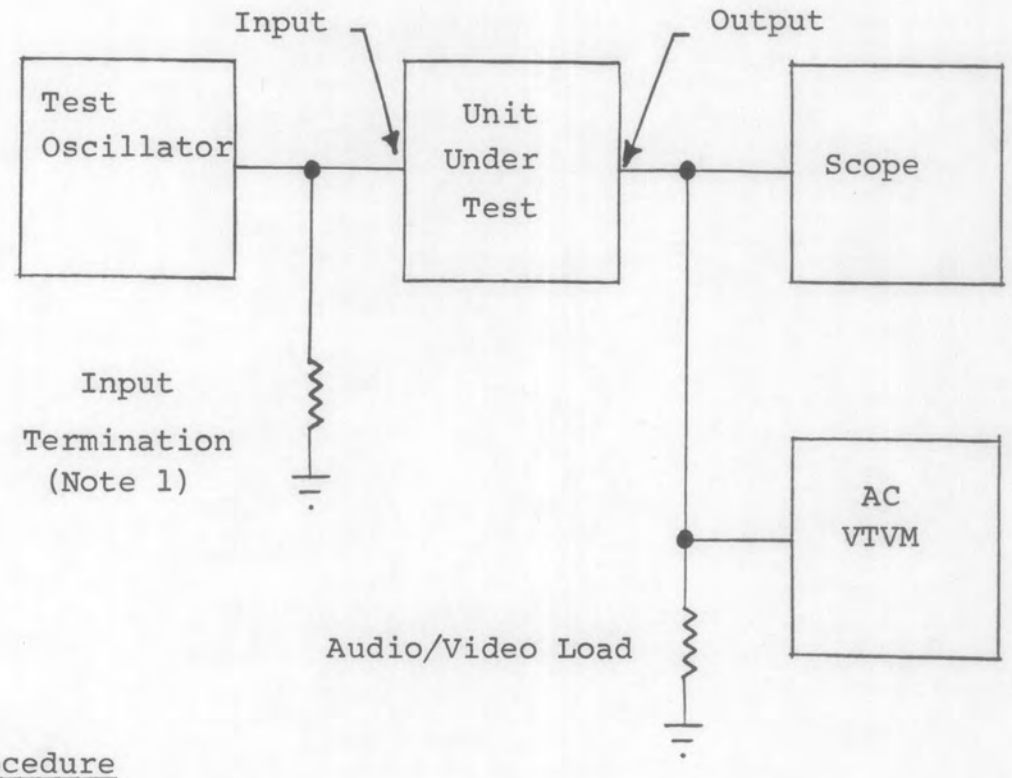
f_{HI} = frequency of the upper 3 dB point

11. Vary the frequency of the signal generator across the pass band. Verify that the deviation from any adjacent peak to valley (ripple) does not exceed the specified limits. Record data as applicable.

METHOD 202-1

Audio/Video Frequency Response - Circuit Test

1. Equipment Set-up



2. Procedure

1. Set the unit under test for maximum gain.

2. Set the test oscillator for 1 kHz (unless otherwise specified) at the level specified in the test procedure for the unit under test or to obtain the specified output signal level.

3. Adjust the gain of the unit under test to obtain the specified reference on the AC VTVM.

4. Increase the frequency of the test oscillator until the output signal level decreases 3 dB.

5. Record the frequency of the test oscillator.

6. Decrease the frequency of the test oscillator, passing through 1 kHz, until the output signal level is again 3 dB less than the reference set in step 3.

7. Repeat step 5.

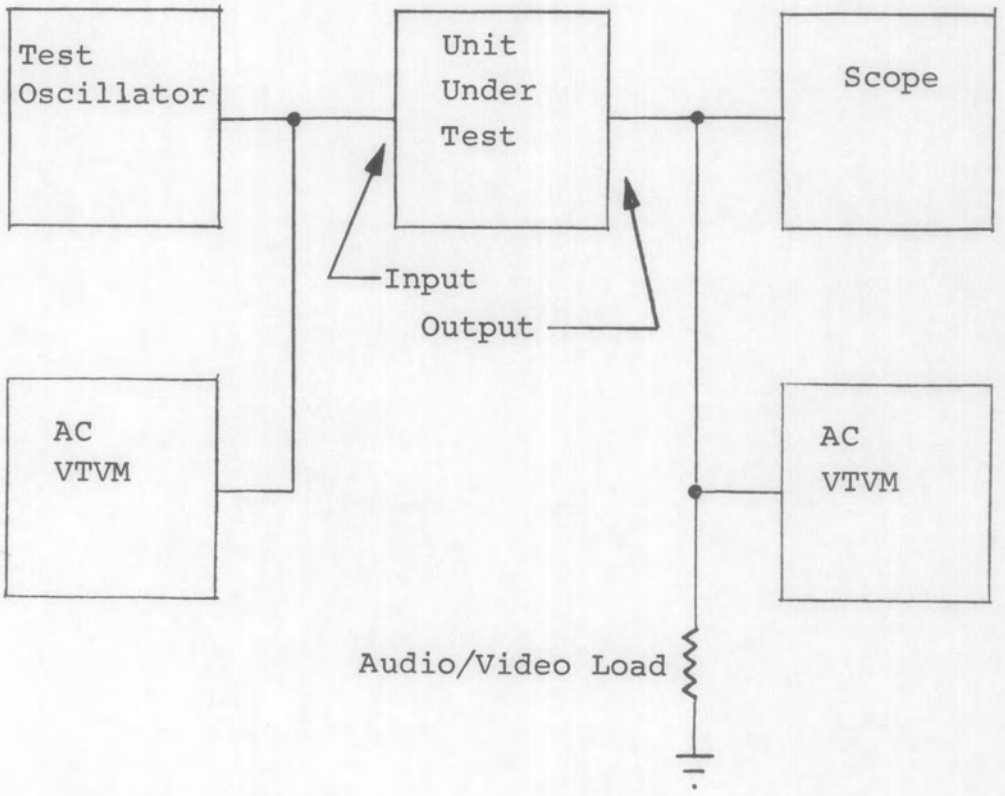
3. Notes

1. Input termination is matched to the output impedance of the test oscillator.

METHOD 202-2

Audio/Video Frequency Response - Circuit Test

1. Equipment Set-up



2. Procedure

Same as 202-1.

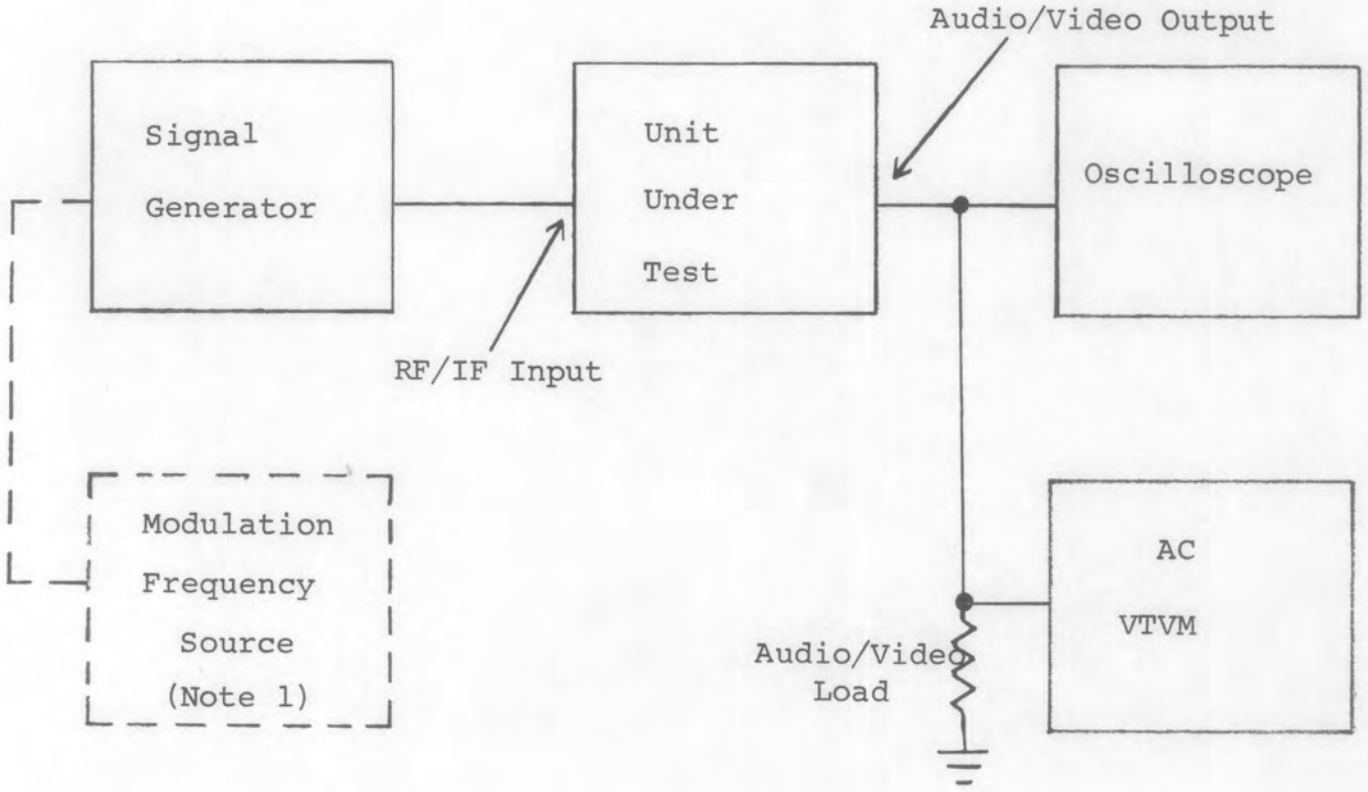
3. Notes

1. Input signal level must be monitored to insure a constant level over the frequency range of the test.

METHOD 202-3

Audio/Video Frequency Response - System Test, AM or FM

1. Equipment Set-up



1. Set UUT to either AM/MAN, AM/AGC or FM/AGC reception/Detection mode. In AM/MAN mode, set RF/IF gain to maximum gain. Adjust tuned frequency of UUT to RF Test Frequency as called out in unit/equipment test procedure.

2. Select the IF Bandwidth desired or as specified.

3. Set the signal generator to the specified RF Test Frequency as called out in the test procedure. Select appropriate modulation mode on signal generator and set generator RF output level to correct UUT input level per IF bandwidth selected or as called out in test procedure.

4. Set the modulation frequency source to 1kHz (unless otherwise specified) at a percentage modulation amplitude of 30% (unless otherwise specified) for the AM detection mode. For FM detection mode, set deviation peak at output of signal generator to 5% of IF Bandwidth (to ensure a low modulation index) or as specified in test procedure.

5. Adjust audio/or video gain to obtain a reference level on AC VTVM, typically 0.5 volt rms (or as specified). Using oscilloscope, verify that audio/or video output signal is not distorted or clipped.

6. Increase modulation frequency until the output signal level decreases 3dB from reference level set in para 5. (Note 2) Record the upper 3dB roll-off modulation frequency. Using oscilloscope, verify that audio/or video output is still sinusoidal and not overly visibly distorted.

7. Decrease modulation frequency passing through reference frequency point until the output signal level is again 3dB less than the reference set in para 5. (Note 2). Record the lower 3dB roll-off modulation frequency.

8. Record the frequency of the upper and lower 3dB points. Limits shall be specified in the equipment test procedure.

9. Repeat steps 1 thru 8 for other IF Bandwidths and/or RF input test frequencies as specified.

3. Notes:

1. External Modulation Source is required only if the signal generator does not have the proper internal modulation characteristics.

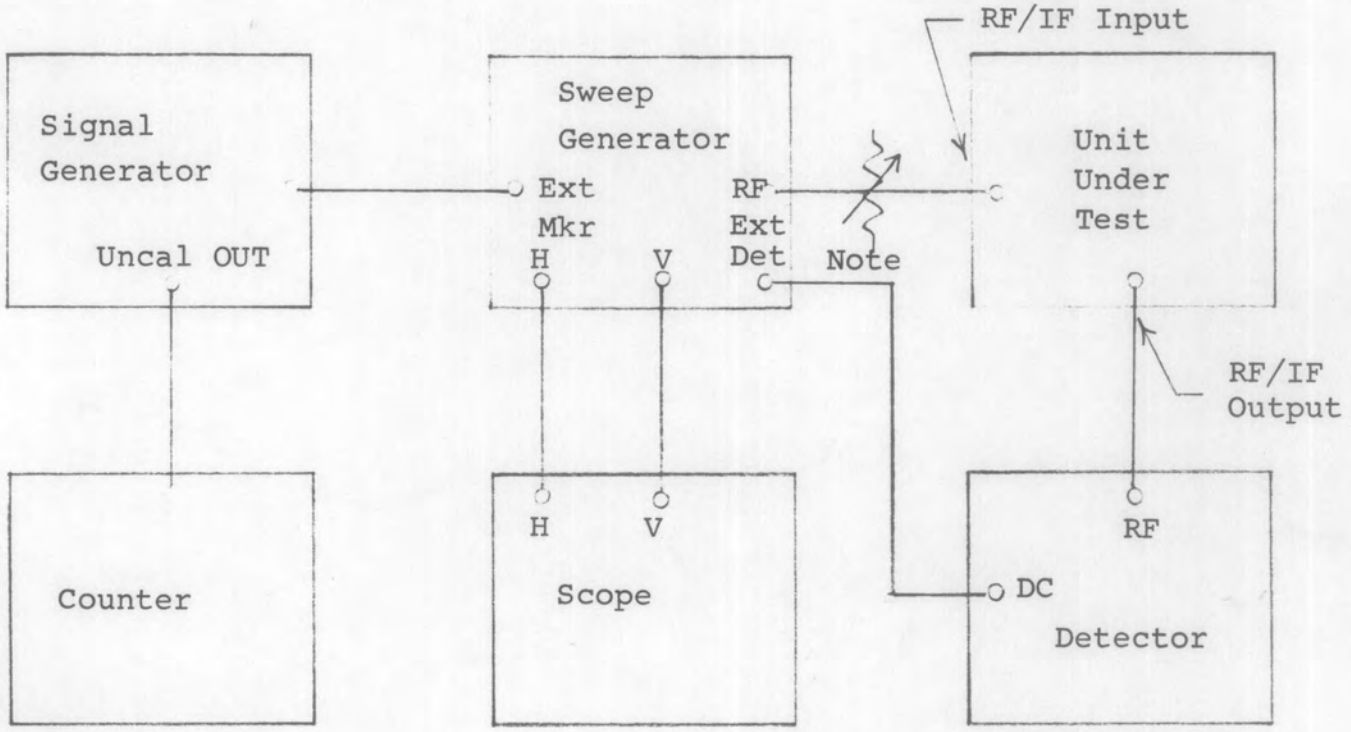
2. Ensure percentage modulation and/or peak deviation output levels from signal generator are kept constant as modulation frequency is varied.

3. If this method is used to measure the overall frequency response of an audio/video subassembly, care must be exercised since the RF and/or IF bandwidths of the unit under test can introduce errors. The combination of RF and IF bandwidths must be greater than 3.0 times the anticipated audio/video response.

METHOD 203-1

Swept Frequency Response (Fixed Center Frequency)

1. Equipment Set-up



NOTE: Use an external attenuator if sweep generator output is not calibrated in dBm.

2. Procedure

1. Set the oscilloscope: DC coupled mode, horizontal sweep disabled, horizontal sensitivity as required to present a 10 CM wide trace, vertical sensitivity as specified.

2. Set marker generator to center frequency of the unit under test.

3. Adjust the sweep generator to produce a response centered around the test frequency at the specified sweep rate. Adjust the sweep generator and signal generator amplitude as specified so that the marker is displayed on the response.

4. Add 3 dB of attenuation using the internal attenuator and note the level of the response(i.e. 3 dB points). Remove the 3 dB of attenuation.

5. Increase signal generator frequency until the marker is at the level noted in 2.4 on the upper skirt of the response. Record the signal generator frequency.

6. Decrease signal generator frequency until the marker is at the level noted in 2.4 on the lower skirt of the response. Record signal generator frequency.

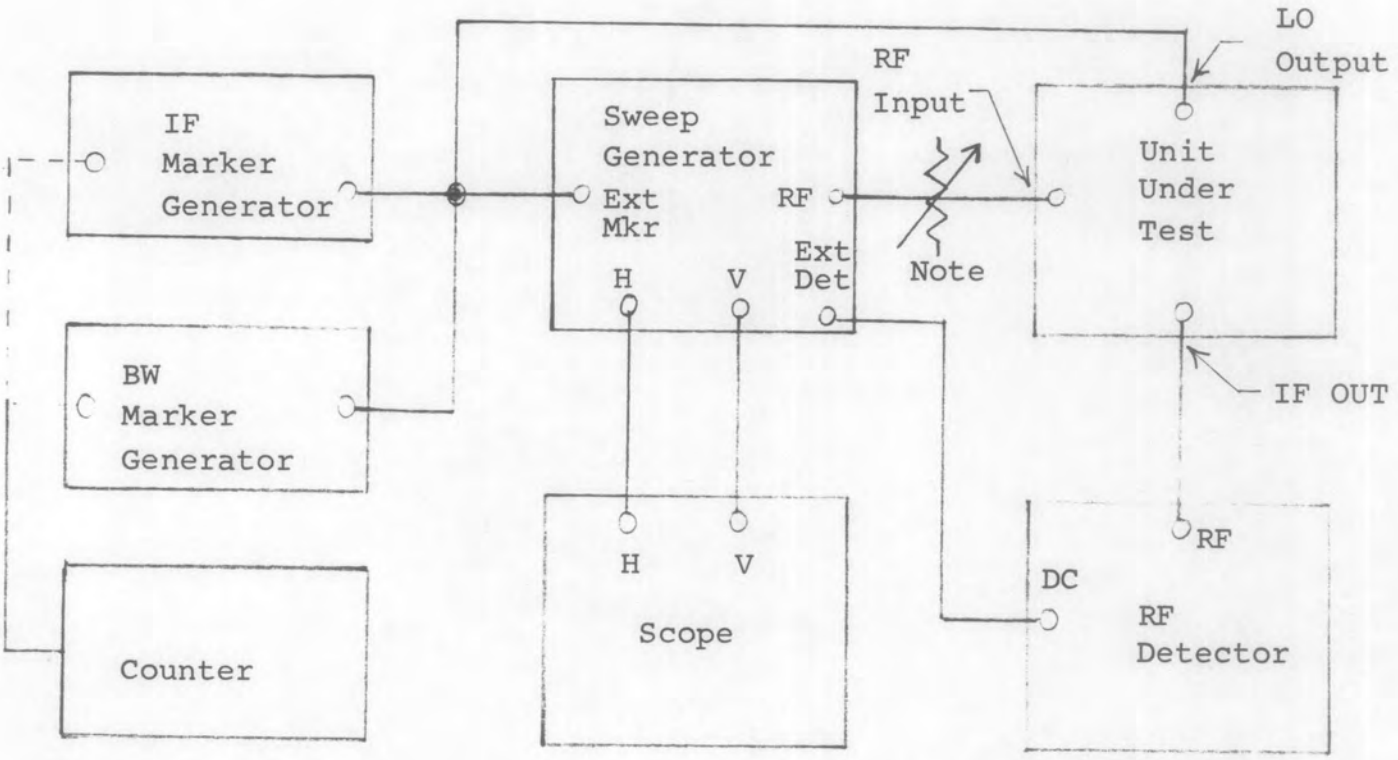
7. Compute Frequency Response (Bandwidth) by subtracting frequency recorded in 2.6 from that recorded in 2.5.

8. Verify that the variation between any adjacent peak to valley (ripple) does not exceed the specified limit (Use the variable attenuator to determine the variation).

METHOD 203-2

Swept Frequency Response (Tuners)

1. Equipment Set-up



NOTE: Use an external attenuator if sweep generator output is not calibrated in dBm.

2. Procedure

1. Set the oscilloscope: DC coupled mode, horizontal sweep disabled, horizontal sensitivity as required to present a 10 CM wide trace, vertical sensitivity to 5 mV/CM. Set sweep generator RF output level as specified.
2. Set IF marker generator to the 1st IF frequency of the tuner under test.

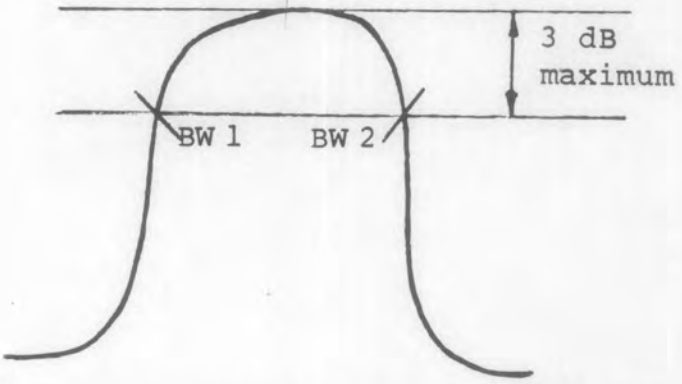
3. Set BW marker generator to 1/2 of minimum RF Bandwidth of the tuner under test.

4. Adjust the sweep generator to produce an undistorted response centered around test frequency. Adjust the BW generator and IF generator amplitude so that the bandwidth markers are displayed on the response.

5. Add 3 dB of attenuation using the internal attenuator and note the level of the response (i.e. 3 dB points). Remove the 3 dB of attenuation.

6. Tune the sweep generator and tuner slowly across the tuner's frequency range. Note that the bandwidth markers do not fall below the 3 dB point set in 2.5. If any doubt exists, set a new reference at that point and recheck.

7. Between the RF bandwidth markers, the variation between the maximum point and the minimum point shall be a maximum of 3 dB. Refer to figures below for typical examples:
   Ideal Response

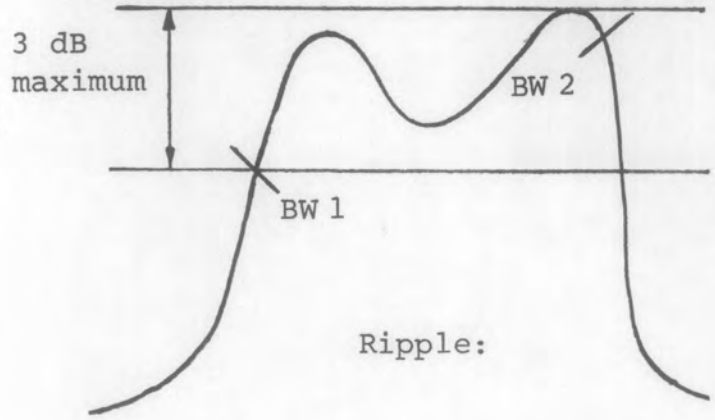


8. For an RF Tuner swept frequency response, where the RF passband ripple and tilt is to be within a specified RF bandwidth:
   1) Bandwidth frequency markers BW1 and BW2 are defined as:

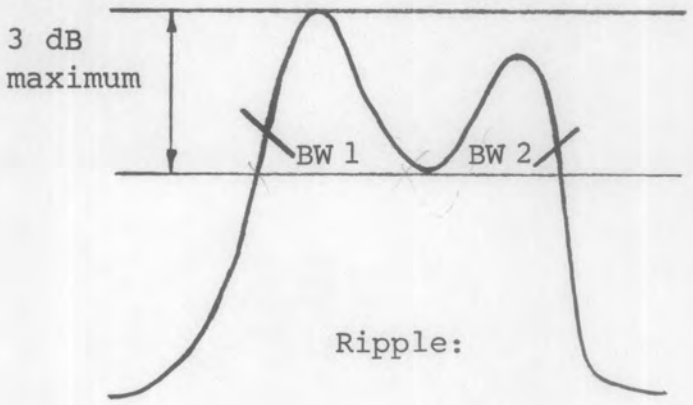
$$BW\,1 \text{ or } BW\,2 = (\text{Frequency}_{LO} \pm \text{Frequency}_{IF}) \pm \frac{\text{Specified Tuner Bandwidth}}{2}$$

   2) The maximum limit for passband amplitude or shape variation within the bandwidth frequency markers is 3 dB.

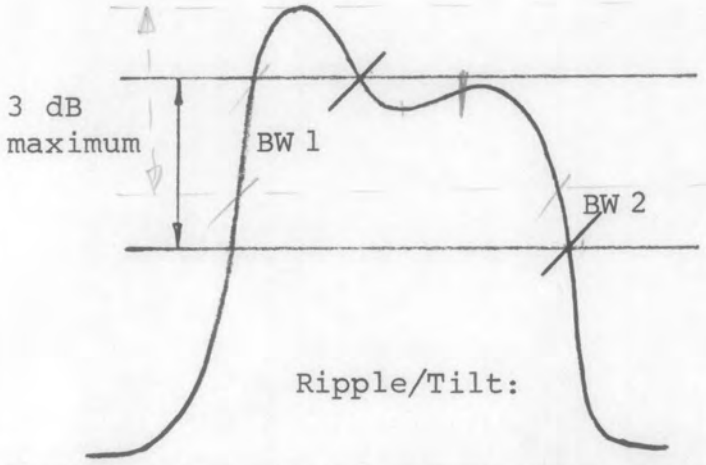
Acceptable Response



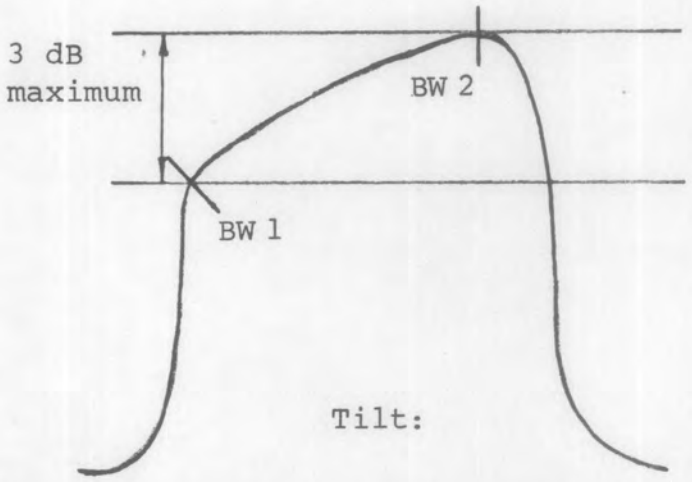
Ripple:



Ripple:

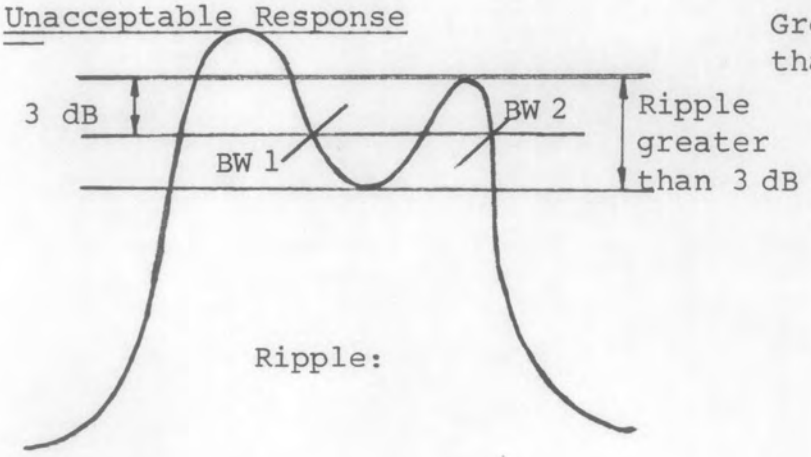


Ripple/Tilt:

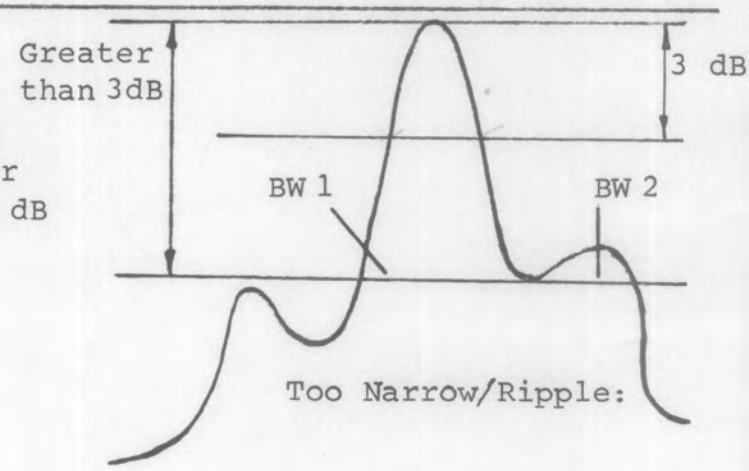


Tilt:

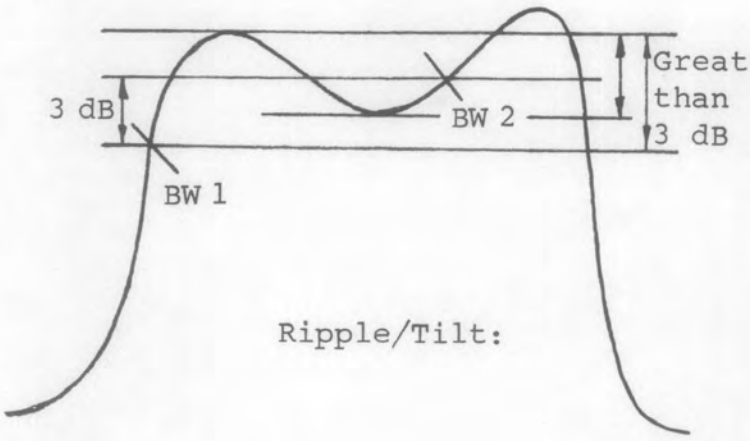
Unacceptable Response



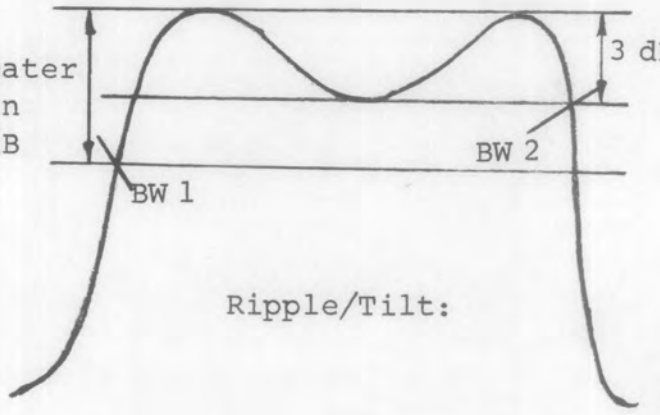
Ripple:



Too Narrow/Ripple:



Ripple/Tilt:

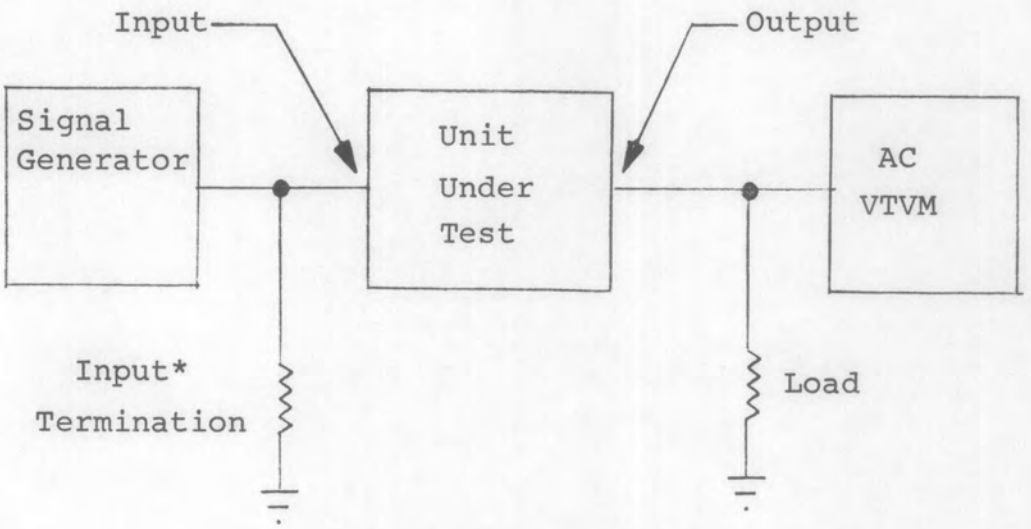


Ripple/Tilt:

METHOD 204-1

Bandpass Variation - Telephone Equipment

1. Equipment Set-up



2. Procedure

1. Set the signal generator for the specified frequency and output level.

2. Set the UUT for maximum gain, if variable.

3. Slowly vary the input frequency over the specified frequency range. Note the variation from the reference, on the AC VTVM, across the bandpass.

4. The ripple is the difference between any adjacent peak and valley dip. Record the result.

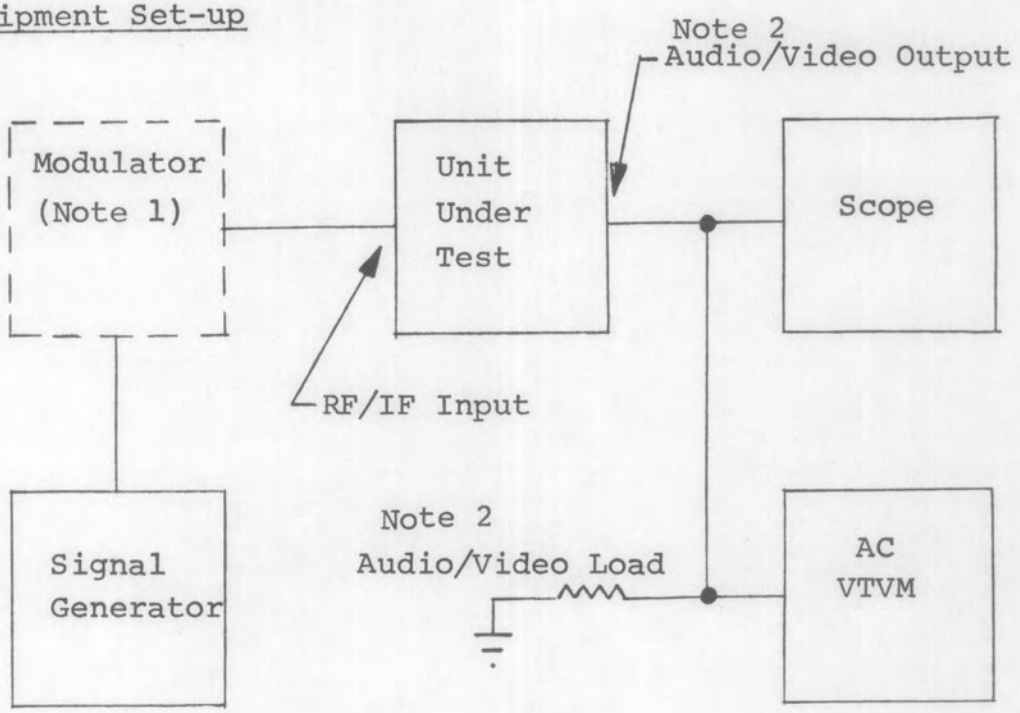
*To match the Output Impedance of the Signal Generator.

Section 300 Receiver Sensitivity Measurements

METHOD 301

AM Sensitivity, (S+N)/N

1. Equipment Set-up



2. Procedure

1. Set the unit under test for AM/AGC mode, or maximum RF/IF gain; select the bandwidth as desired or as specified in the equipment test procedure.

2. Set the signal generator for the test frequency and level specified in the equipment test procedure.

3. Modulate the signal generator 50% with the frequency specified in the equipment test procedure.

4. Adjust the Video (Audio) gain of the unit under test for the specified reference on the AC VTVM (Do not overdrive the amplifier).

5. Remove the modulation from the signal generator.

6. Record the decrease in the reading on the AC VTVM. This is the AM (S+N)/N and shall be as stated in the equipment test procedure.

7. Repeat the procedure for all other bandwidth settings specified in the equipment test procedure.

3. Notes

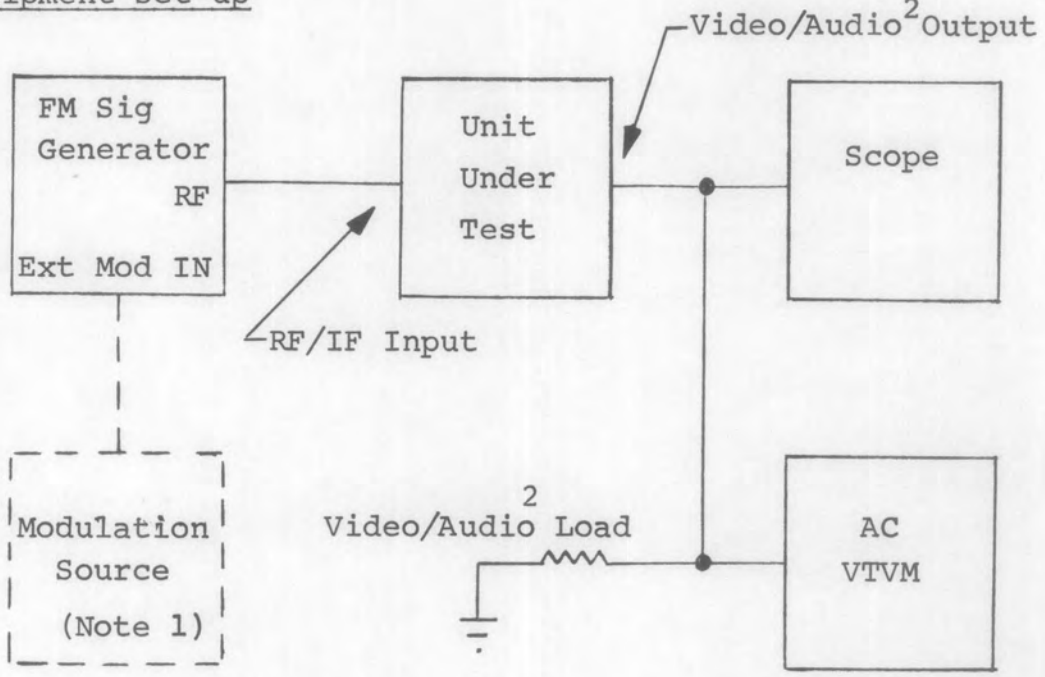
1. External modulator is required only if the signal generator being used does not have the proper modulation characteristics.

2. For equipments that have both a video and audio output, use the video port for the measurement.

METHOD 302-1

FM Sensitivity, (S+N)/N - Direct Deviation

1. Equipment Set-up



2. Procedure

1. Set the unit under FM mode; select the bandwidth as desired or as specified in the equipment test procedure.

2. Set the FM generator; the test frequency, level, rate and peak deviation specified in the equipment test procedure.

3. Adjust the video (audio) gain of the unit under test for a convenient reference on the AC VTVM. (Do not overdrive the amplifier)

4. Remove the modulation from the input signal.

5. Record the decrease in the reading on the AC VTVM. This is the FM (S+N)/N and shall be as specified in the test procedure for the unit under test.

6. Repeat the procedure for all other bandwidth settings specified in the equipment test procedure.

3. Notes

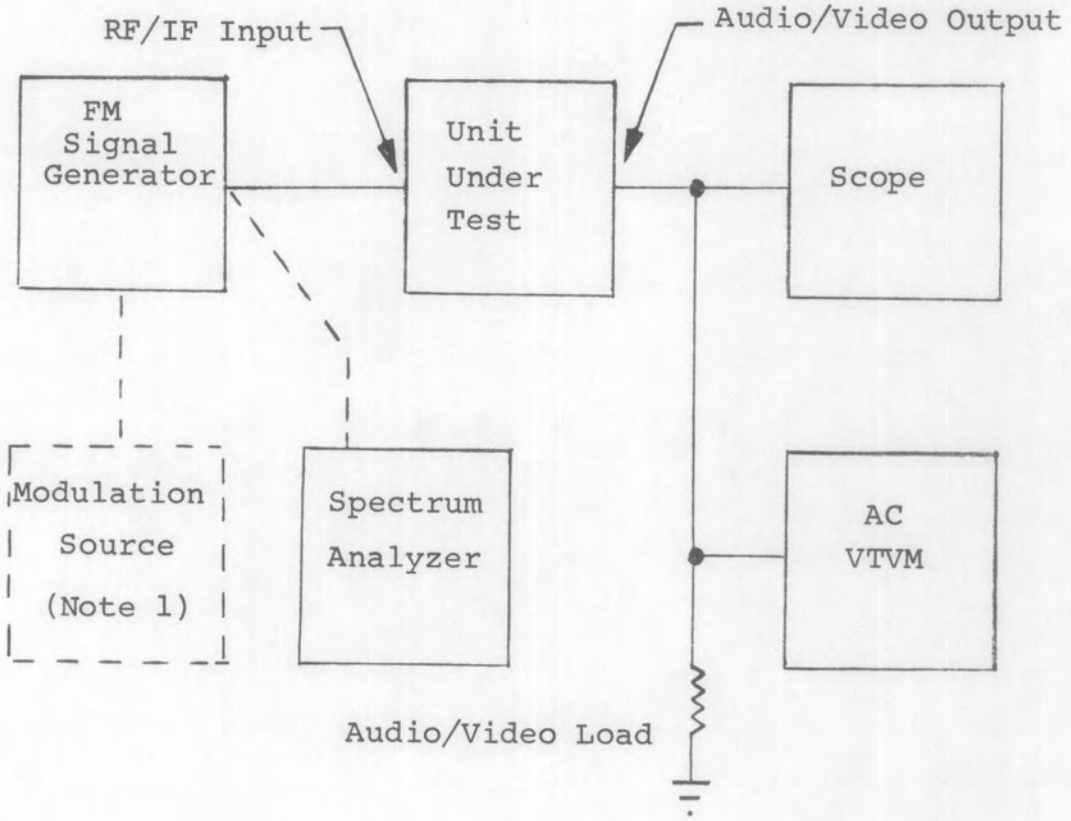
1. An external modulation source is required only if the signal generator being used does not have the proper modulation characteristics.

2. For equipments that have both a video and audio output, use the video port for the measurement.

METHOD 302-2

FM Sensitivity, (S+N)/N - Harmonic Techniques

1. Equipment Set-up



2. Procedure

A. Reference Set-up

1. Connect the FM Signal Generator to the spectrum analyzer.

2. Set the FM generator for the specified test frequency.

3. Set the output level of the FM generator for a CW signal as specified in the test procedure for the unit under test.

4. Adjust the spectrum analyzer controls for a reasonable presentation of the signal in the linear mode.

5. Decrease the frequency of the signal generator as specified.

6. Increase the output level of the signal generator until the signal presentation on the spectrum analyzer is the same as that of step 4.

B. Measurements

1. Connect the FM generator to the unit under test.

2. Set the unit under test for FM mode, bandwidth and test frequency as specified.

3. Set the peak deviation and modulation rate as given in the test procedure for the unit under test.

4. Adjust the video (audio) gain of the unit under test for the specified reference on the AC VTVM.

5. Remove the modulation from the input signal.

6. Record the decrease in the reading on the AC VTVM. This is the FM (S+N)/N and shall be as specified in the test procedure for the unit under test.

7. Repeat the procedure for all other bandwidth settings specified in the test procedure.

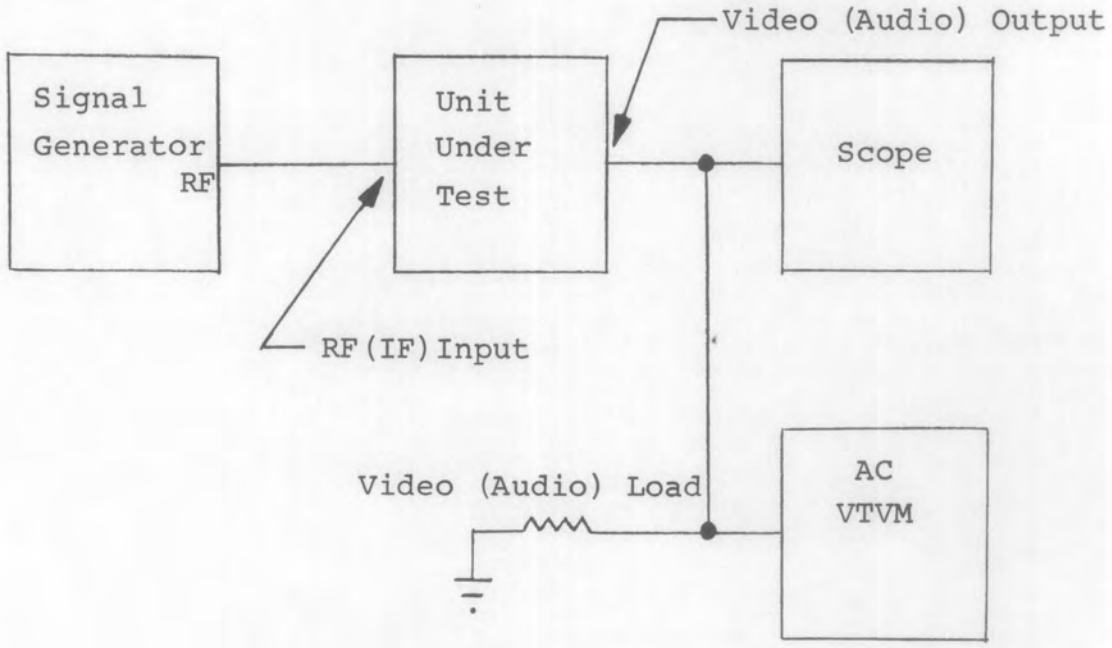
3. Notes

1. The external modulation source is required only if the signal generator being used does not have the proper internal modulation characteristics.

METHOD 303

CW Sensitivity

1. Equipment Set-up



2. Procedure

1. Set unit under test for CW mode; select bandwidth as desired or as specified in the equipment test procedure; maximum RF/IF gain.

2. Set the signal generator for CW operation at the frequency and power level specified in the equipment test procedure.

3. Adjust the BFO control on the unit under test for the specified output signal. If the BFO is fixed, vary the signal generator frequency to obtain the specified output signal. Adjust RF/IF gain, if required, to minimize compression or expansion.

4. Adjust the VIDEO (AUDIO) gain of the unit under test for a specified reference on the AC VTVM (Do not overdrive the amplifiers).

5. Remove the input signal from the unit under test.

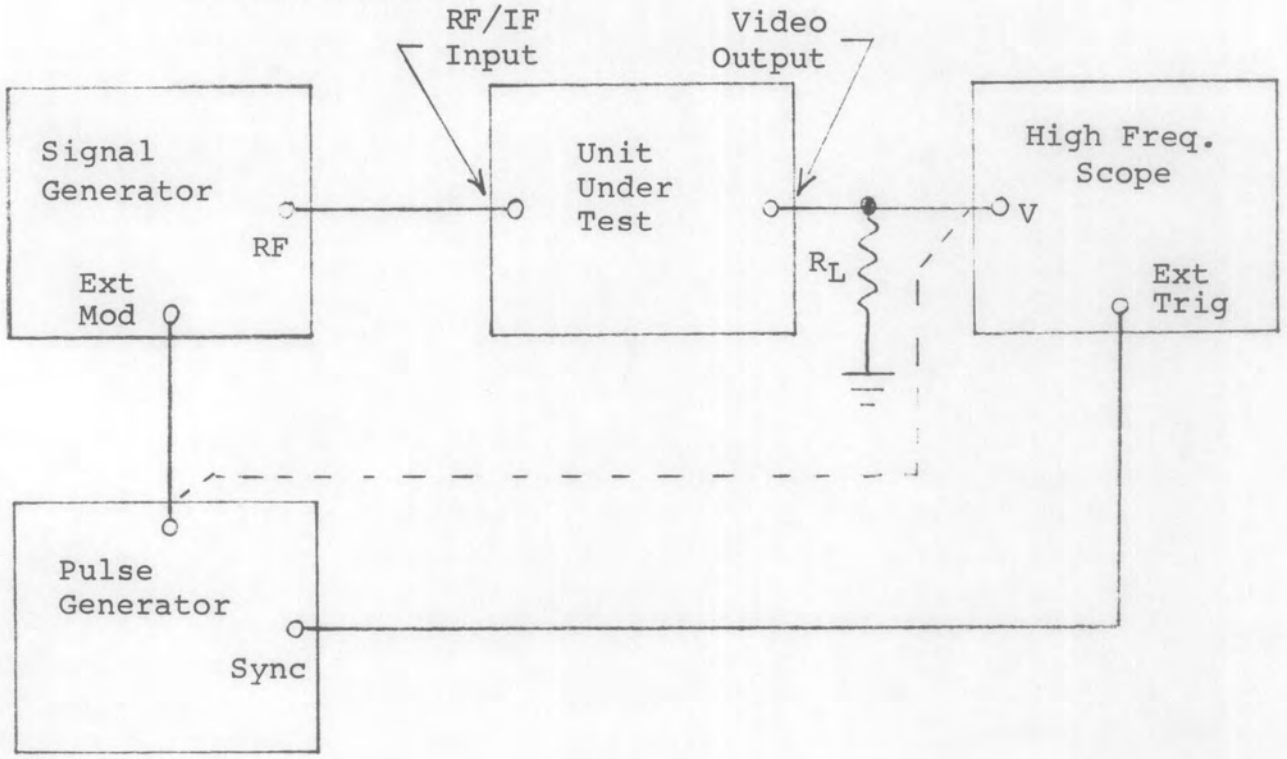
6. Record the decrease in the reading on the AC VTVM. The minimum limit shall be as specified in the equipment test procedure.

7. Repeat the procedure for all other bandwidths specified in the equipment.

METHOD 304-1

Tangential Sensitivity (Minimum Pulse Width 10 μS)

1. Equipment Set-up



2. Procedure

1. Set repetition rate and pulse width on pulse generator as specified in procedure for unit under test.

2. Connect pulse generator as indicated by dotted line and set output level for a positive pulse at the specified level.

3. Adjust oscilloscope sweep time for a reasonable display of the pulse length.

4. Adjust pulse delay control on pulse generator to center pulse on oscilloscope display.

5. Connect pulse generator as indicated by solid line and set the output level as specified.

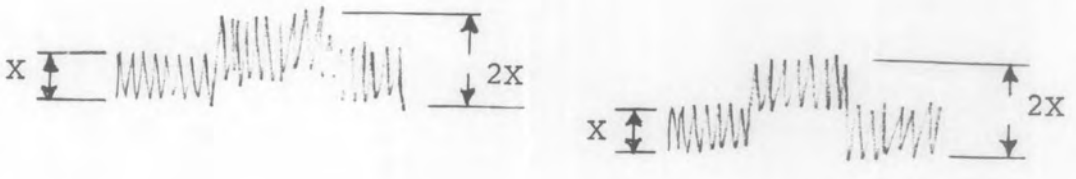
6. Set signal generator to EXT PULSE modulation at the frequency and level specified in the procedure for unit under test.

7. Set video gain of unit under test at mid range and reception mode to PULSE.

8. Adjust oscilloscope vertical sensitivity for a useable display of noise.

9. Increase signal generator output level until the pulse displayed on the scope has a magnitude equal to twice the noise magnitude. (See Figure)

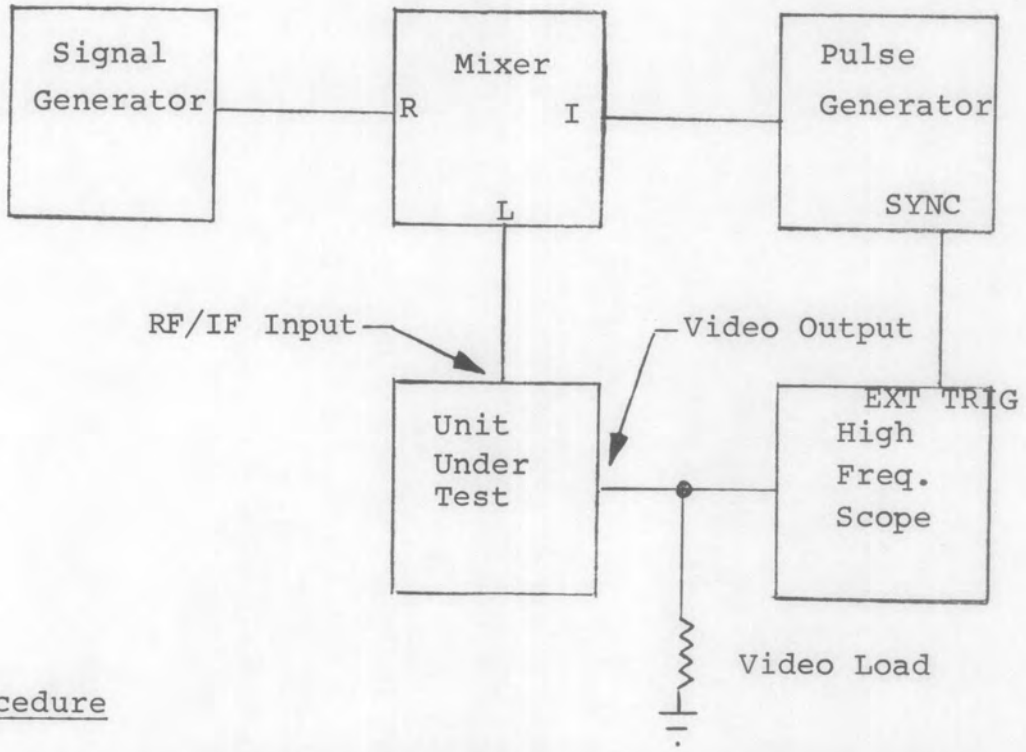
10. Record the value of the signal generator output level. The level should not exceed the limit specified in the procedure for the unit under test.



METHOD 304-2

Tangential Sensitivity (For Narrow Pulse Widths, < 10 μS)

1. Equipment Set-up



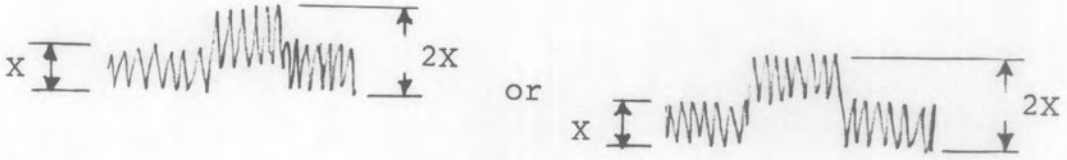
2. Procedure

1. Set pulse generator controls as specified in the equipment test procedure.

2. Set the signal generator to the specified frequency.

3. Set the UUT to PULSE mode, maximum video gain.

4. Adjust the output level of the signal generator until the video output signal is as shown below.

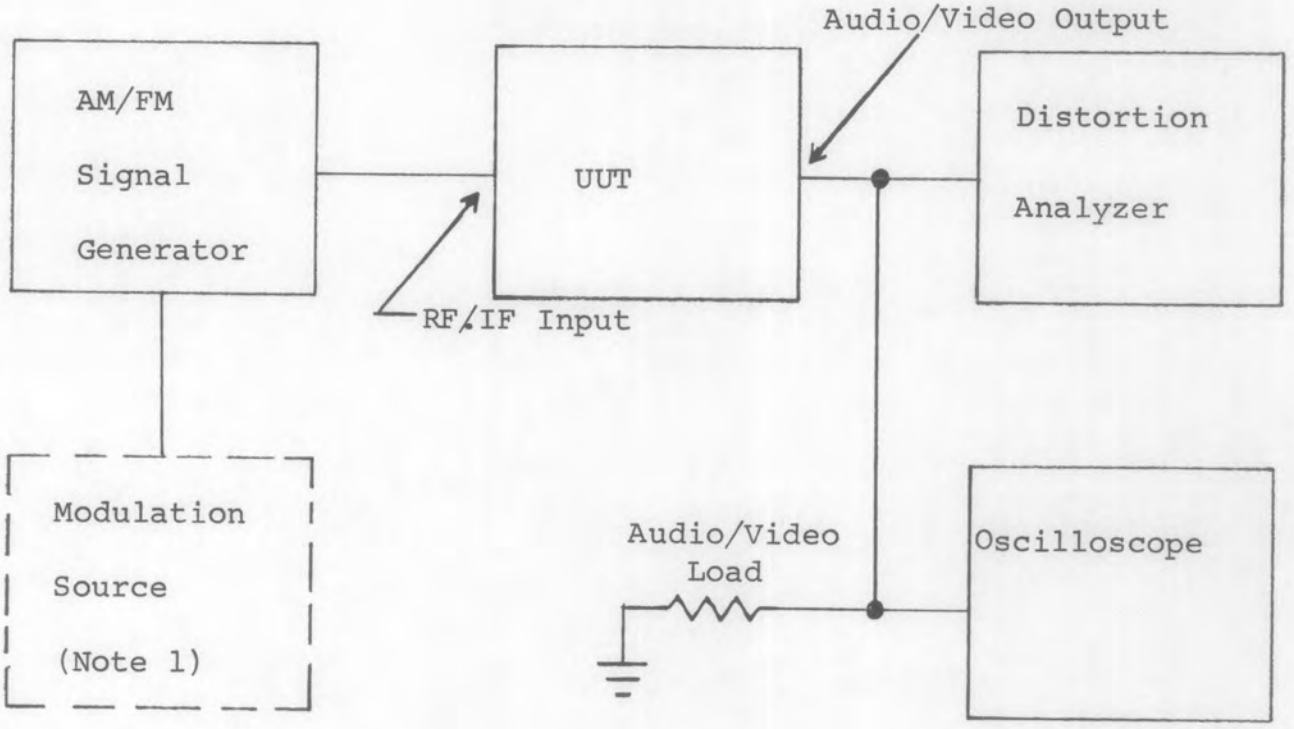


5. Record the input level to the UUT, i.e., (signal generator level) - (insertion loss of mixer). The maximum acceptable level shall be as stated in the equipment test procedure.

METHOD 305

SINAD Sensitivity, (S+N+D)/(N+D)

1. Equipment Set-up



2. Procedure

1. Select the AM/AGC, AM MAN or FM/AGC mode on the UUT. If the AM MAN mode is selected, set the RF/IF gain for maximum output from the UUT.

2. Select the IF bandwidth desired or specified.

3. Set the signal generator output to the frequency and level specified.

4. Modulate the signal generator output as specified.

5. Set the distortion analyzer to its VOLTMETER function and adjust the video (audio) gain control of the UUT to the output level specified. (Do not overdrive the amplifier).

6. Set the distortion analyzer to its SET LEVEL function and adjust the sensitivity of the analyzer for a reading of 0dB on the SET LEVEL range.

7. Set the analyzer to the DISTORTION mode and, employing the FREQUENCY and BALANCE controls, minimize the meter indication.

8. Record the decrease in the meter reading. This is the SINAD sensitivity of the UUT and shall be as stated in the UUT test procedure.

9. Repeat the procedure for all other UUT settings as specified in the UUT test procedure.

3. Notes

1. External modulation is required only if the signal generator in use does not have the required modulation capabilities.

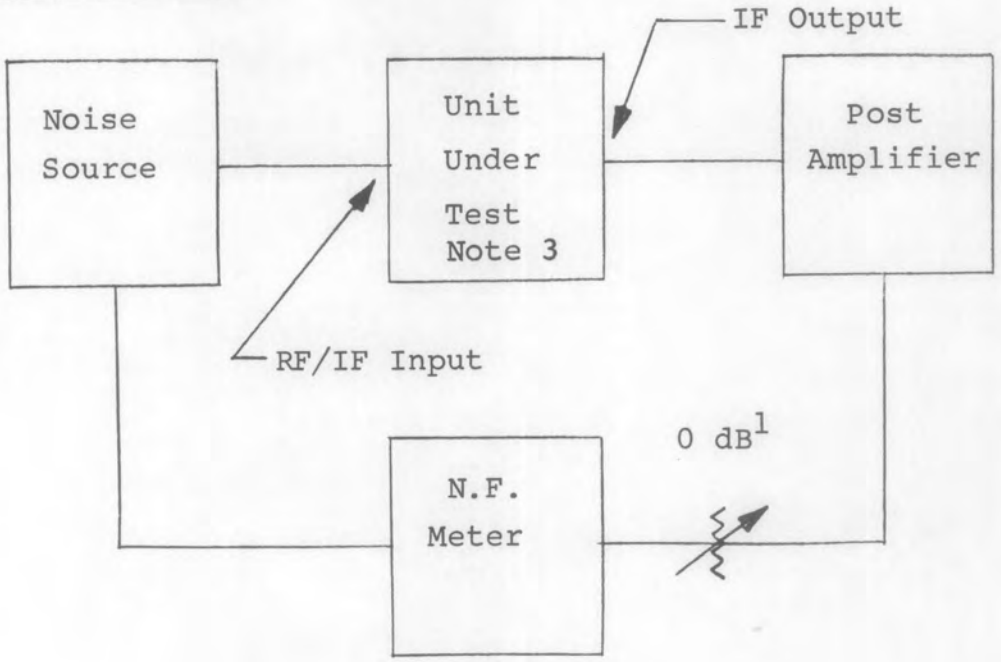
2. For equipments which have both video and audio outputs, use the video output port for this measurement.

Section 400 Noise Figure Measurements

METHOD 401-1

Noise Figure - HP Automatic Noise Figure Meter - No Conversion

1. Equipment Set-up



2. Procedure

1. Set noise figure meter IF selector to the appropriate IF frequency.

2. Set unit under test to the desired test frequency.

3. Adjust the post-amplifier gain such that the post-amplifier is not saturated by the noise generated by the unit under test.[1]

4. Perform the CURRENT, ZERO, and INF calibration adjustments as required. (See instruction manual for the noise figure meter. Adjust Noise Source current as specified for the source in use)

5. Add the correction factor of Figure 4.1 to the reading on the noise figure meter.

6. Record the corrected noise figure value. Limits shall be as stated in the equipment test procedure.

7. Repeat the procedure for all other test frequencies given in the test procedure for the unit under test.

8. Tune through the frequency range of the unit under test to determine the maximum noise figure.

9. Record the maximum noise figure, corrected in accordance with Figure 4.1, and the frequency at which the unit under test is operating.

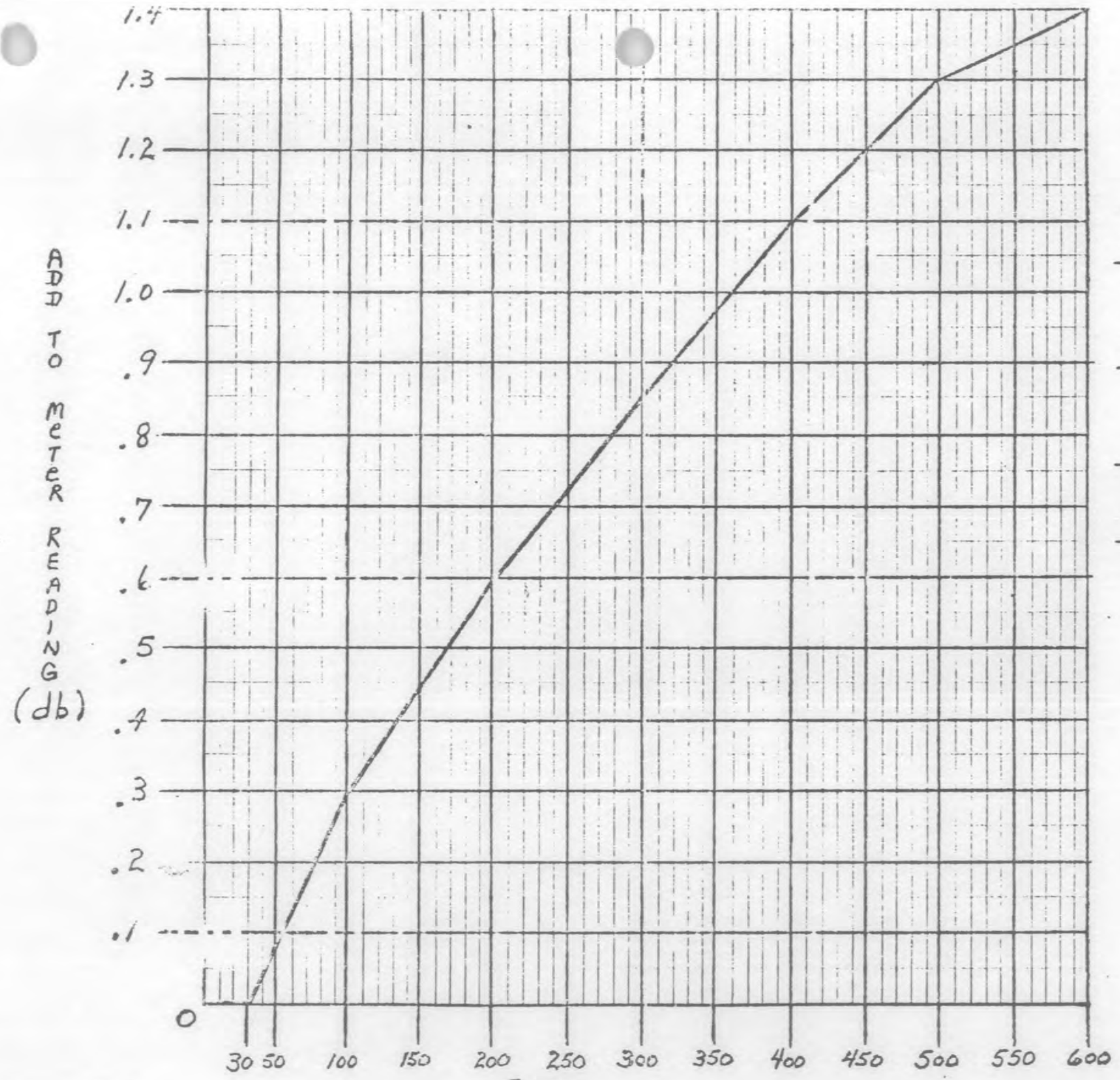
3. Notes

1. In order to determine if the post-amplifier is saturated, reduce the amplifier gain to see if the reading on the noise figure meter increases to a peak then falls off. The point at which the meter reading peaks is the setting for the post-amplifier gain. In order to determine that the gain between the noise source and noise figure meter is sufficient, one should be able to change the attenuator 10 to 20 dB without changing the noise figure reading more than a few tenths of a dB.

2. Step 8 of the procedure may be used instead of discrete frequencies. Also step 8 may be deleted if discrete frequency points are used.

3. Gain N.F. product of the UUT must be 15 dB greater than the noise figure of the post-amplifier.

4. A bandpass filter may be required for those units having excessive spurious output. If used, insert in front of the post-amplifier.



CORRECTION (db) FOR:

HP 349 A

500 - 1000 MHZ	+.4
1000 - 4000 MHZ	+.5

S 347 A

2000 - 4000 MHZ	-.1

H 347A

7000 - 10,000 MHZ	+.5

X 347A

8000 - 12,000 MHZ	+.7

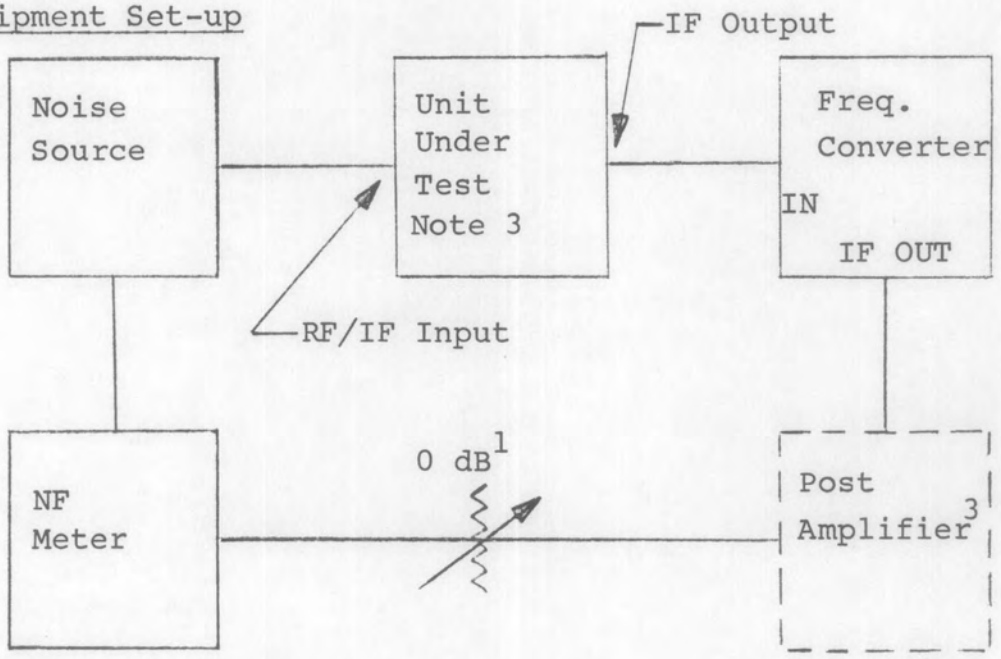
Figure 4.1

CORRECTION FACTOR FOR HP 343A NOISE DIODE

METHOD 401-2

Noise Figure - HP Automatic Noise Figure Meter - Conversion Required

1. Equipment Set-up



2. Procedure

Same as 401-1

3. Notes

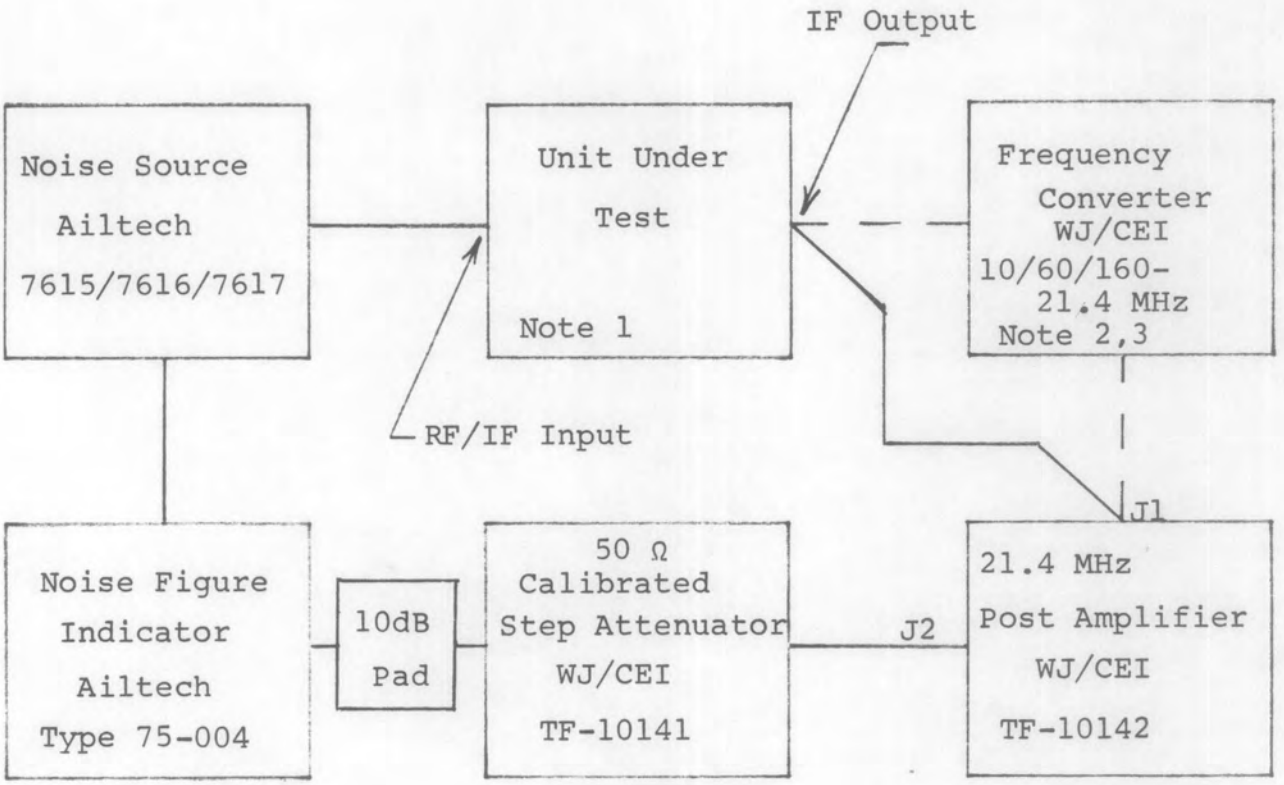
1, 2, 3 and 4 same as 401-1.

5. Post-amplifier may not be required if the frequency converter has sufficient gain.

METHOD 402

Noise Figure - AILTECH - Manual Noise Figure Measurement
(Y Factor)

1. Equipment Set-up



2. Procedure

1. Set the step attenuator to 0dB attenuation.

2. Depress the CAL button on the noise figure meter and adjust the CAL ADJ knob for a 15.5 reading on the CALIBRATE scale of the meter.

3. Increase the attenuation of the step attenuator until the AGC light on the noise figure meter extinguishes. The attenuation of the step attenuator shall be between the limits of 5 dB minimum and 55dB maximum minus insertion loss of bandpass filter, if used.

4. Re-set the step attenuator to 0dB attenuation.

5. Depress the AUTO button on the noise figure meter and adjust the ADD to NOISE FIGURE control for an on-scale reading of the meter.[4]

6. Tune the unit under test slowly through it's entire range while observing the noise figure meter for the point of highest noise figure reading.[4] (AGC light should be on for all auto tests).

7. Depress the MANUAL-OFF button on the noise figure meter and adjust the GAIN control for a convenient reference on the meter.

8. Depress the MANUAL-ON button on the noise figure meter and increase the attenuation of the step attenuator to restore the reference reading set in Step 7. Note the step attenuator setting and determine the <u>exact attenuation</u> from the calibration chart on the attenuator. This is the Y Factor.

9. Refer to the noise source calibration chart and determine the Correction Factor of the noise source at the frequency at which the unit under test is operating.

10. Using the Y Factor from Step 8 and the Correction Factor from Step 9, determine the noise figure of the unit under test from the Y Factor Vs Noise Figure graphs, Figure 402.

11. Record the maximum noise figure from Step 10 and the frequency at which the unit under test is operating. Limits shall be stated in the equipment test procedure.

3. Notes

1. The gain N.F. product of the UUT must be at least 15 dB greater than the noise figure of the post amplifier. TF-10142 N.F.= 6 dB.

2. A frequency converter with bandwidth and noise figure characteristics similar to TF-10142 is required if the UUT IF output frequency is other than 21.4 MHz.

3. The post amplifier may not be required if the frequency converter has sufficient gain. TF-10142 gain = 30dB.

4. Steps 5 and 6 are not required on fixed frequency UUT's.

5. A bandpass filter TF-10150 may be required for those units having excessive spurious outputs. If used, insert in front of the post-amplifier.

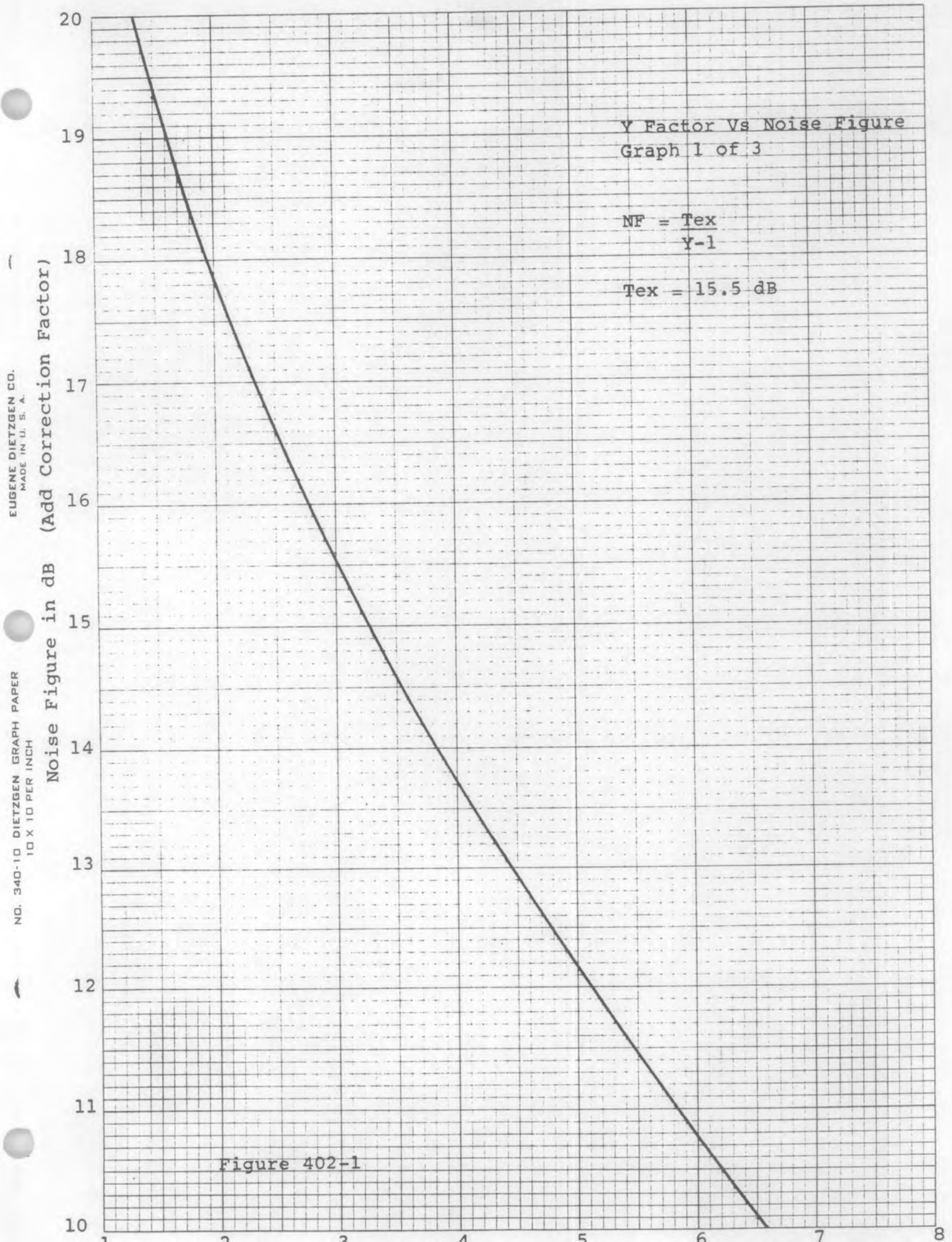

Y Factor Vs Noise Figure
Graph 1 of 3
NF = Tex / Y-1
Tex = 15.5 dB
Noise Figure in dB (Add Correction Factor)
20
19
18
17
16
15
14
13
12
11
10
1
2
3
4
5
6
7
8
EUGENE DIETZGEN CO.
MADE IN U. S. A.
NO. 340-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

Figure 402-1

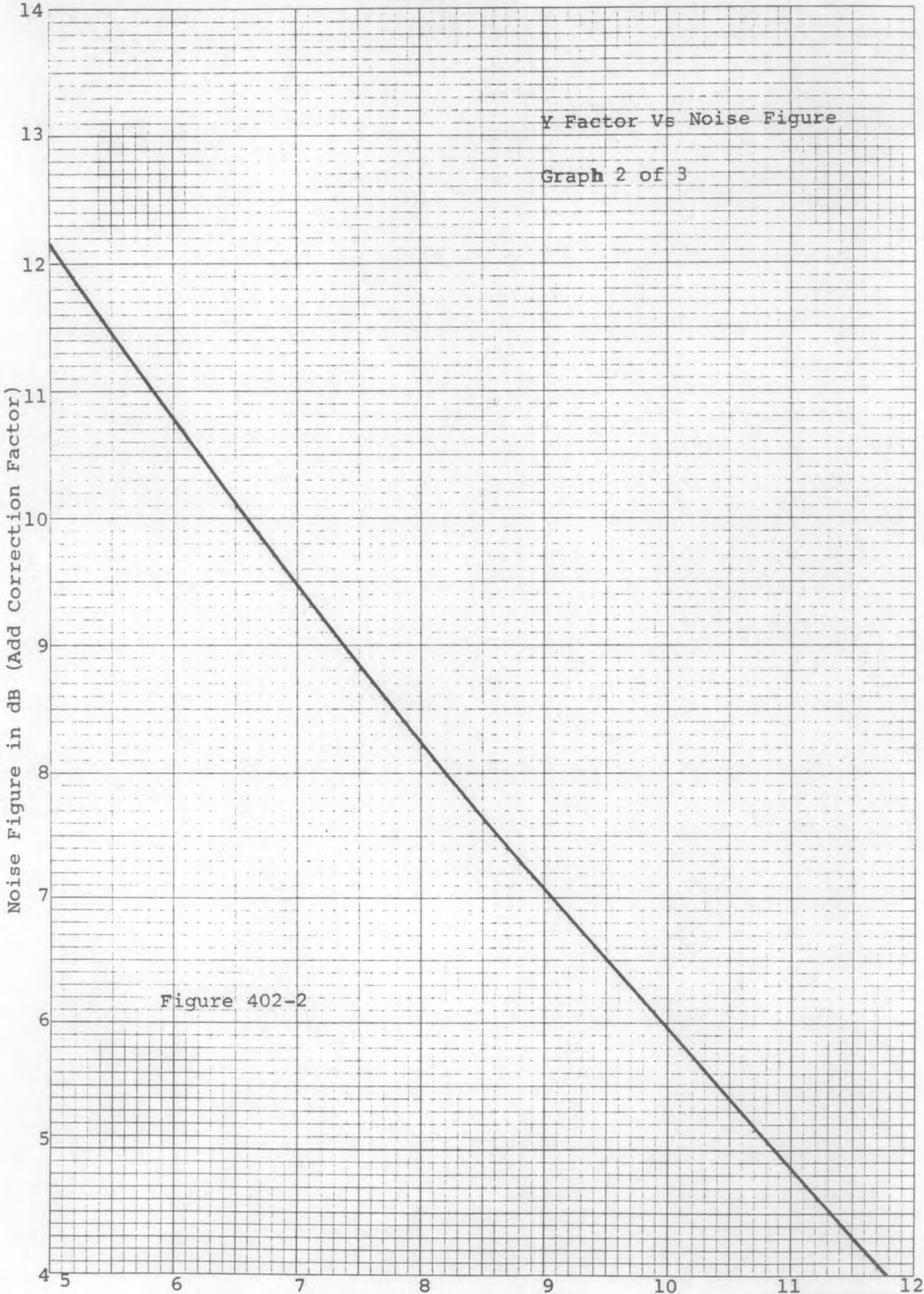

Y Factor Vs Noise Figure
Graph 2 of 3
Noise Figure in dB (Add Correction Factor)
14
13
12
11
10
9
8
7
6
5
4
5
6
7
8
9
10
11
12
EUGENE DIETZGEN CO.
MADE IN U. S. A.
NO. 340-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

Figure 402-2

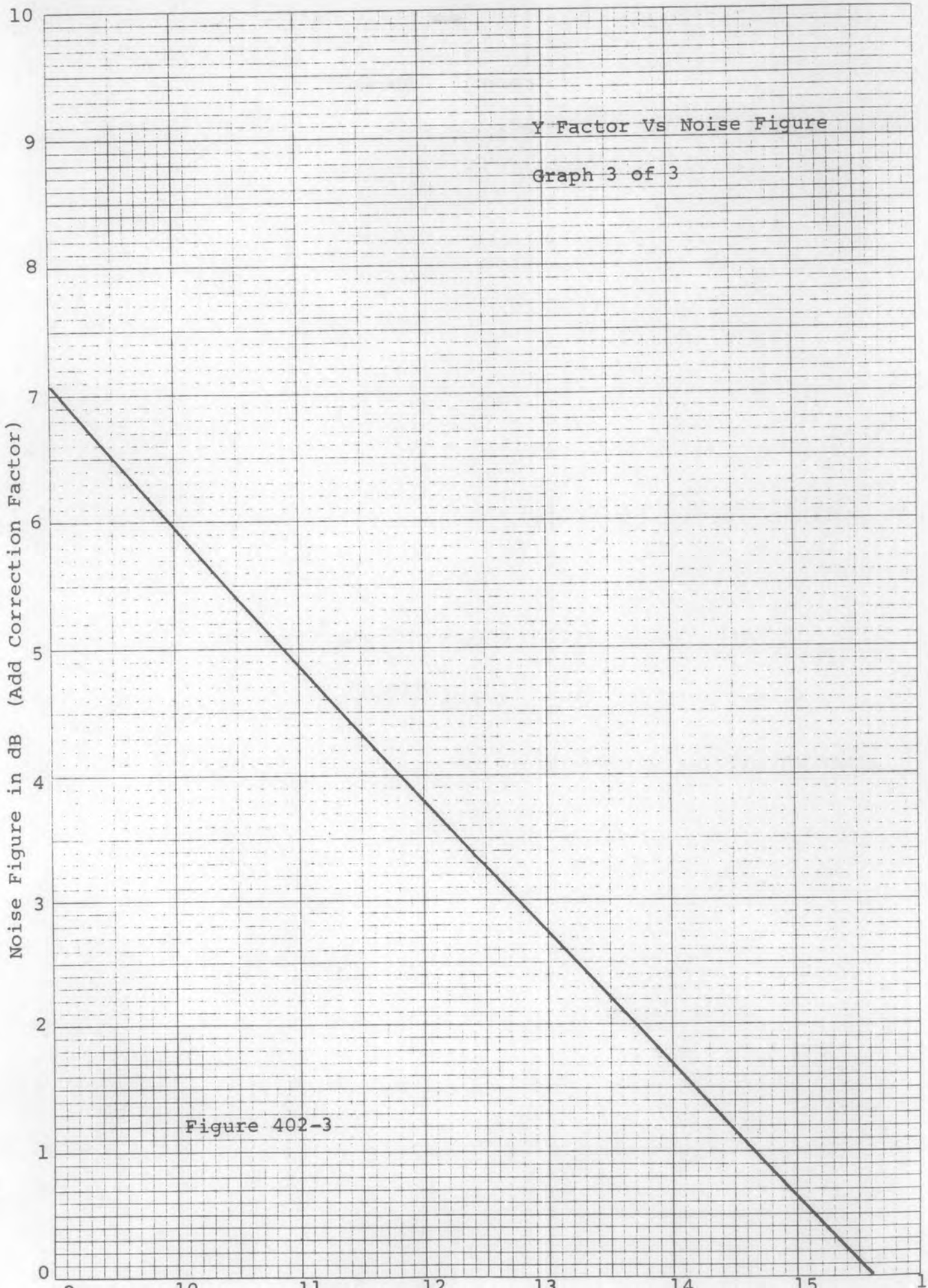

Y Factor Vs Noise Figure
Graph 3 of 3
Noise Figure in dB (Add Correction Factor)
10
9
8
7
6
5
4
3
2
1
0
11
12
13
14
15
16
EUGENE DIETZGEN CO.
MADE IN U. S. A.
NO. 340-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

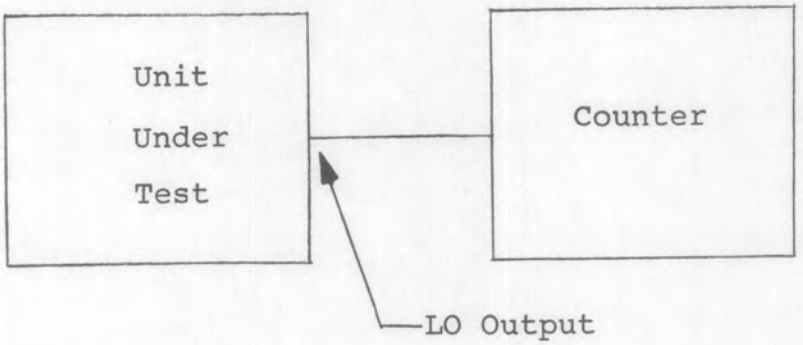
Figure 402-3

Section 500 Tuning Accuracy and Fine Tuning Range

METHOD 501

Dial Accuracy and Fine Tuning Range for Equipments with LO Output Port - Mechanically Tuned

1. Equipment Set-up



2. Procedure

1. Set the UUT to the specified test frequency. Set Fine Tuning range to mid-range.

2. Set counter preset for first IF frequency of unit under test. (If the counter does not have presets, it will be necessary to adjust the counter reading accordingly, i.e., subtract the IF frequency if the LO is above the tuned frequency or add the IF frequency if the LO is below the tuned frequency).

3. At each specified point record the reading on the counter.

4. Set the tuner to low end of band.

5. Set the FINE TUNING control fully CCW and record the frequency indicated on the counter.

6. Set the FINE TUNING control fully CW and record the frequency indicated on the counter.

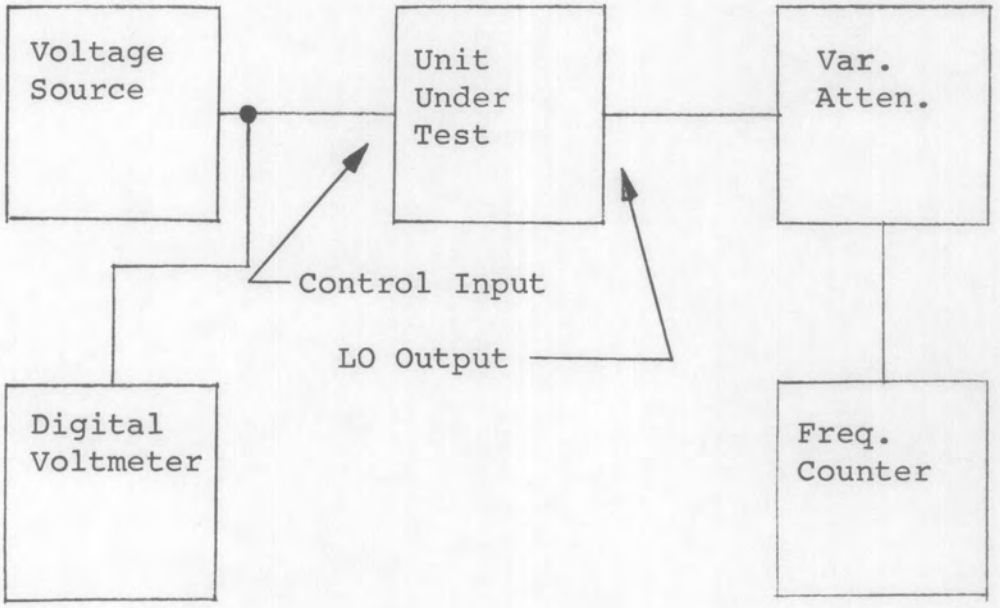
7. Determine the range by subtracting the frequencies recorded in 2.5 and 2.6.

8. Repeat 2.5 to 2.7 with the tuner set to high end of band.

METHOD 502

For Equipments with an LO Output Port - Voltage Controlled

1. Equipment Set-up



2. Procedure

1. Set the power supply for the voltage specified in the test procedure for the unit under test.
2. Measure and record the LO output frequency.
3. Repeat for all other specified voltages.

3. Notes

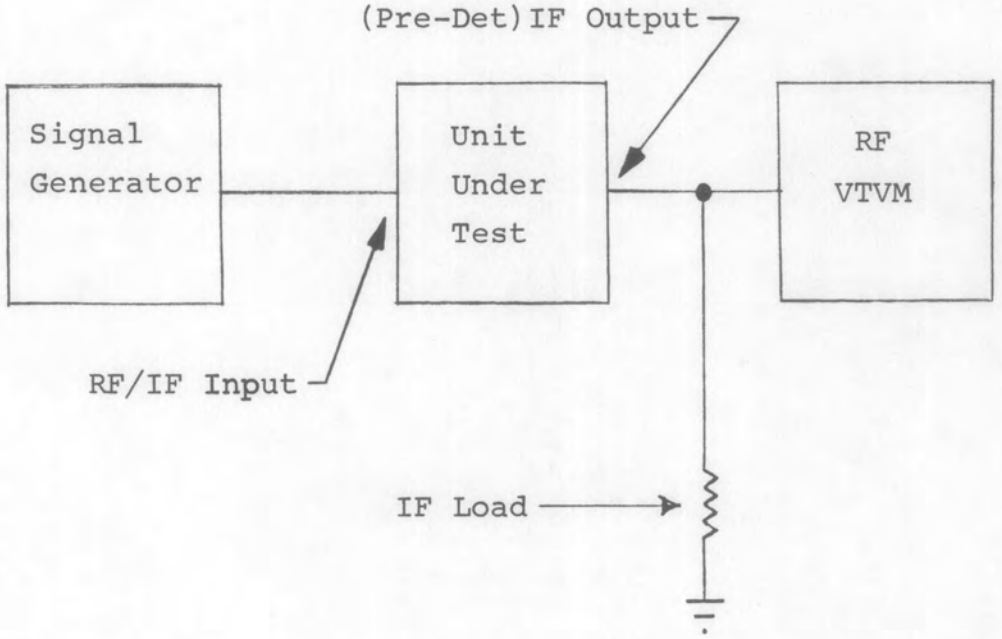
1. The attenuator is an optional item. It will be required only if the LO output level is greater than the specified maximum input level of the counter.

Section 600 Output Level Measurements

METHOD 601

RF/IF Output Level

1. Equipment Set-up



2. Procedure

1. Set the signal generator for a CW signal at the frequency and level specified in the test procedure for the unit under test.

2. Set the gain of the Unit Under Test as specified in the test procedure.

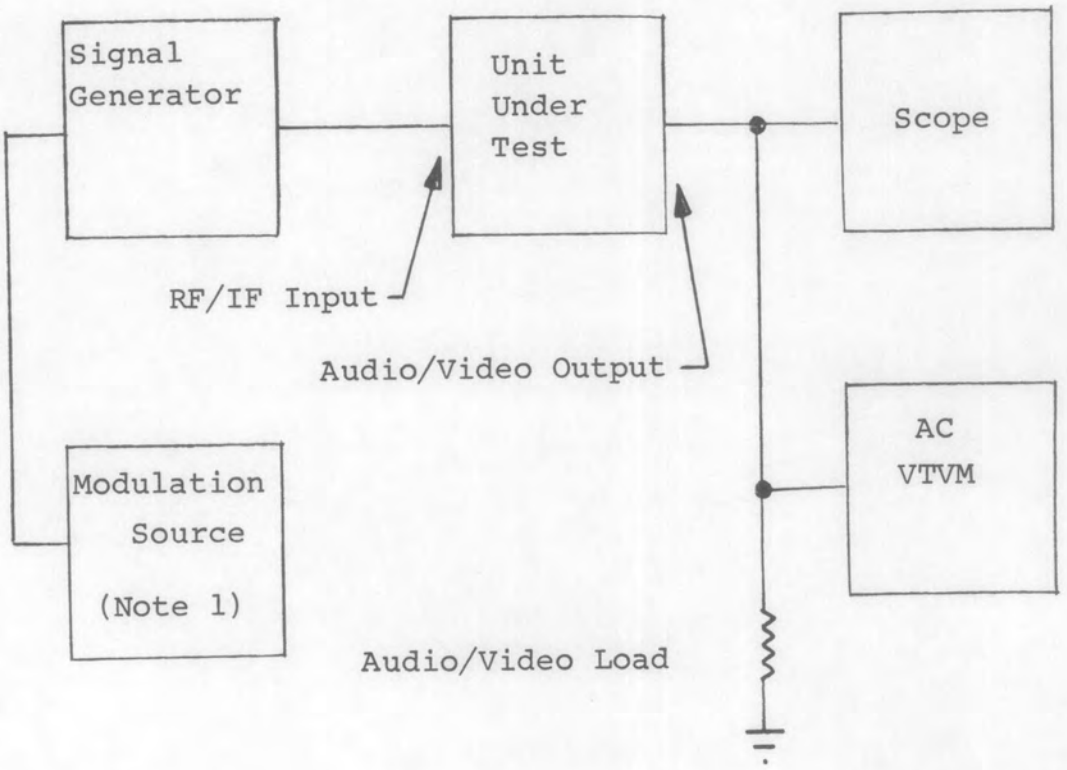
3. Record the reading on the RF VTVM.

4. Repeat for all other specified test frequencies.

METHOD 602-1

Audio/Video Level - System Test

1. Equipment Set-up



2. Procedure

1. Set the unit under test for maximum RF/IF gain (use AM/AGC mode for receivers) at the specified test frequency and bandwidth.

2. Set the signal generator for a 50% modulated signal at the specified rate at the specified test frequency and output level.

3. Adjust the audio/video gain of the unit under test for maximum undistorted output.

4. Record the output level.

5. Repeat for all other specified bandwidths.

6. Set the UUT for the FM mode at the specified bandwidth.

7. Set the signal generator for the specified peak deviation and rate.

8. Repeat steps 3, 4 and 5.

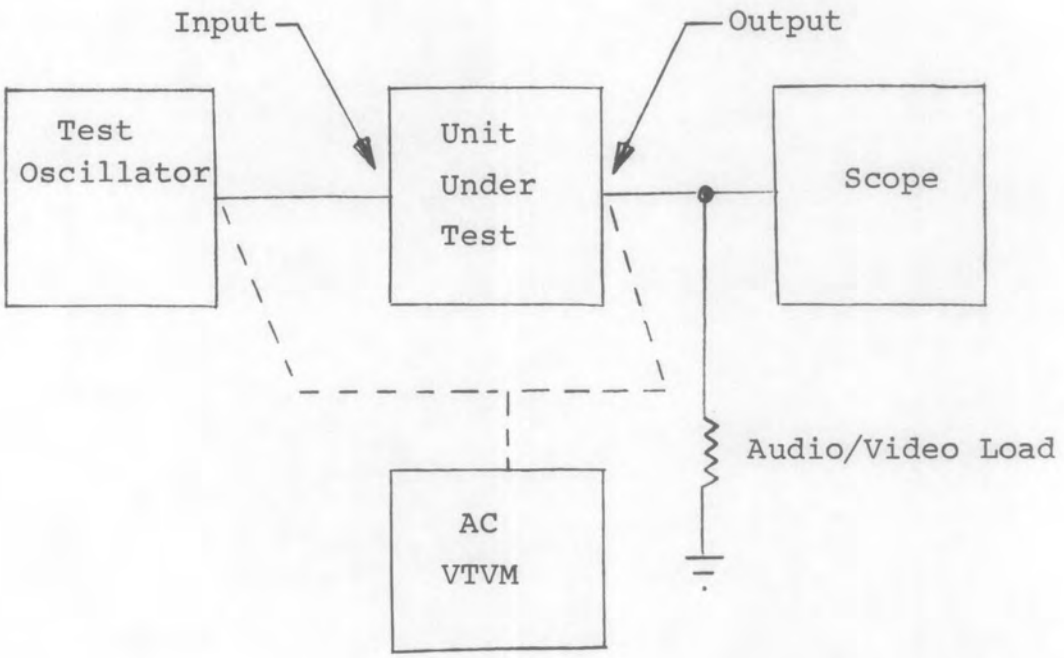
3. Notes

1. Modulation source is required only if the signal generator does not have the proper internal modulation characteristics.

METHOD 602-2

Audio/Video Output Level - Circuit Test

1. Equipment Set-up



2. Procedure

1. Set the test oscillator for the specified frequency and output level.

2. Set the gain of the unit under test for maximum undistorted output, if variable.

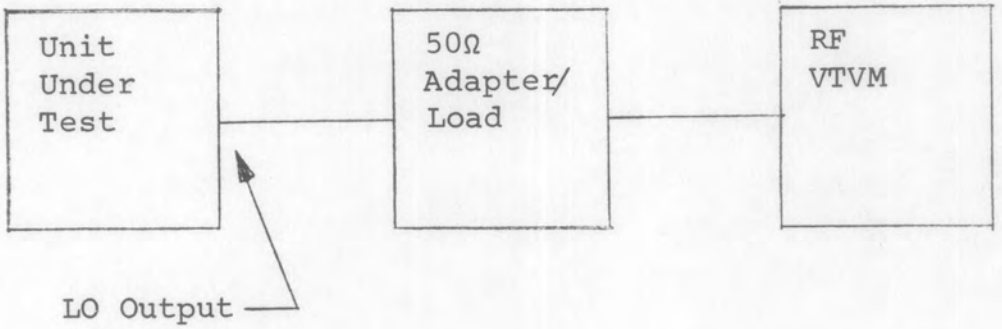
3. Measure and record the output level. The minimum acceptable output level shall be as specified in the equipment test procedure.

4. Repeat for all other specified test frequencies.

METHOD 603-1

Local Oscillator Output Level (Maximum Frequency 500 MHz)

1. Equipment Set-up



2. Procedure

1. Set RF VTVM range as required (typical range is 50-250 mV).

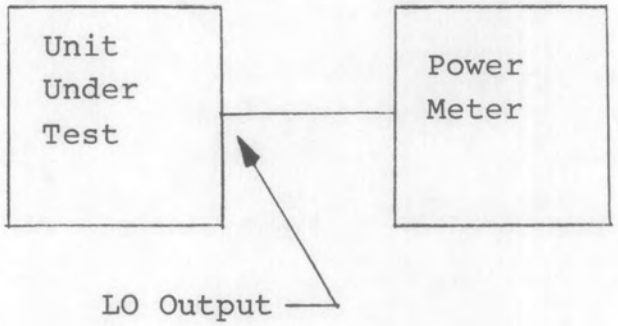
2. Tune through the full frequency range of the unit under test to determine the maximum and minimum output levels.

3. Record the maximum and minimum output levels and the frequencies at which each occurs.

METHOD 603-2

Local Oscillator Output Level

1. Equipment Set-up



2. Procedure

1. Set power meter range as required (typical range is -13 to +1 dBm)

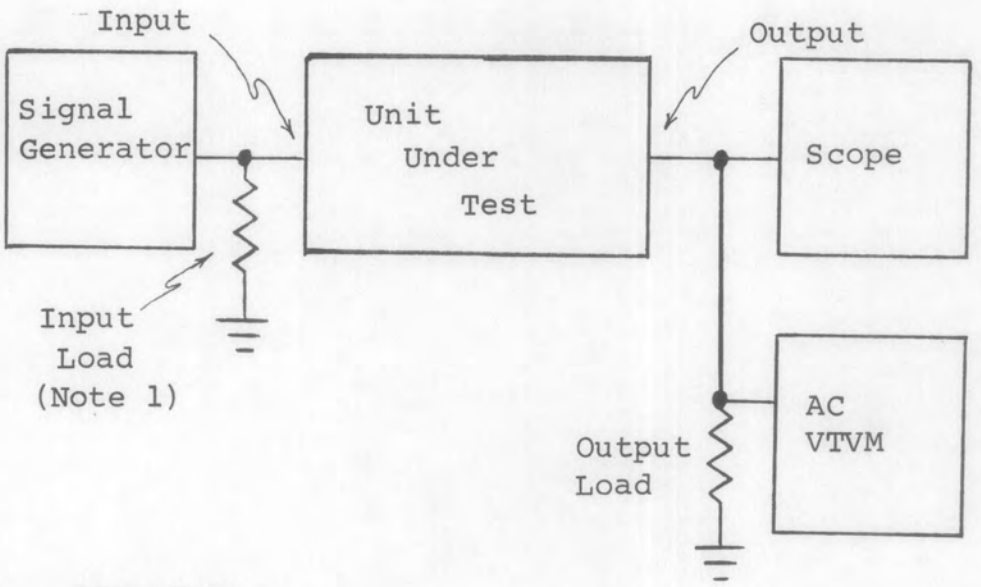
2. Tune through the full frequency range of the unit under test to determine the maximum and minimum output levels.

3. Record the maximum and minimum output levels and the frequencies at which each occurs.

METHOD 604

Output Level (Telephone Equipment)

1. Equipment Set-up



2. Procedure

1. Set the unit under test for maximum output (if variable).

2. Set the signal generator for a CW signal, at the center frequency of the unit under test, at the level specified in the equipment test procedure.

3. Record the output level.

3. Notes

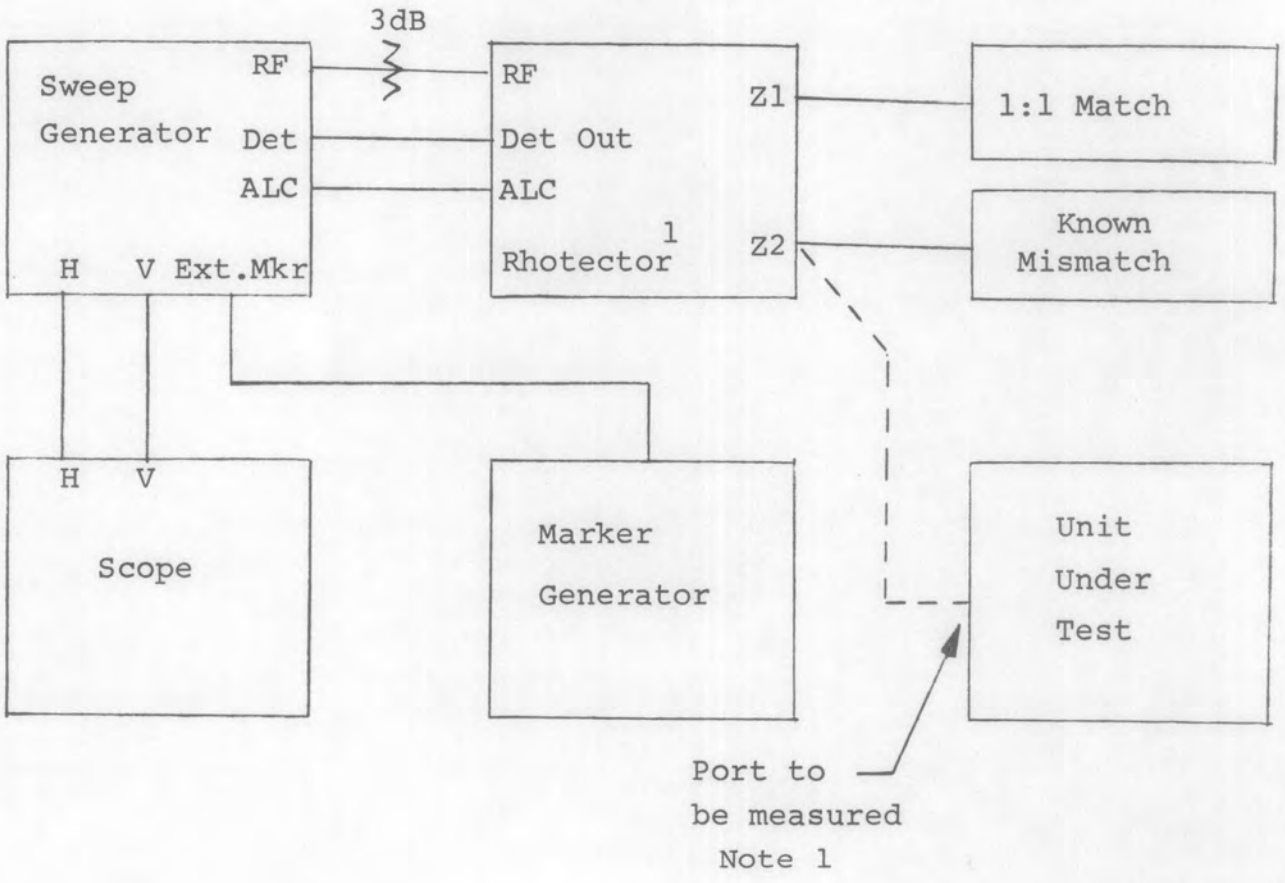
1. To match the Output Impedance of the Signal Generator. Will be specified in the equipment test procedure.

Section 700 VSWR Measurements

METHOD 701-1

Swept VSWR Measurement Using a Rhotector (Fixed Center Frequency)

1. Equipment Set-up



2. Procedure

1. Set marker generator to center frequency of unit under test.

2. Set sweep generator and scope controls for a reference display at the center frequency of the unit under test[1] using the specified RF level and the known mismatch. Check sweep generator leveling by changing generator output several dB. Display amplitude should not change.

(This insures correct ALC operation)

3. Connect the unit under test to the Z2 connector of the rhotector.

4. The response amplitude shall not exceed the reference level at any point within the limits specified in the test procedure for the unit under test. Use the marker generator to determine maximum VSWR in the bandpass.

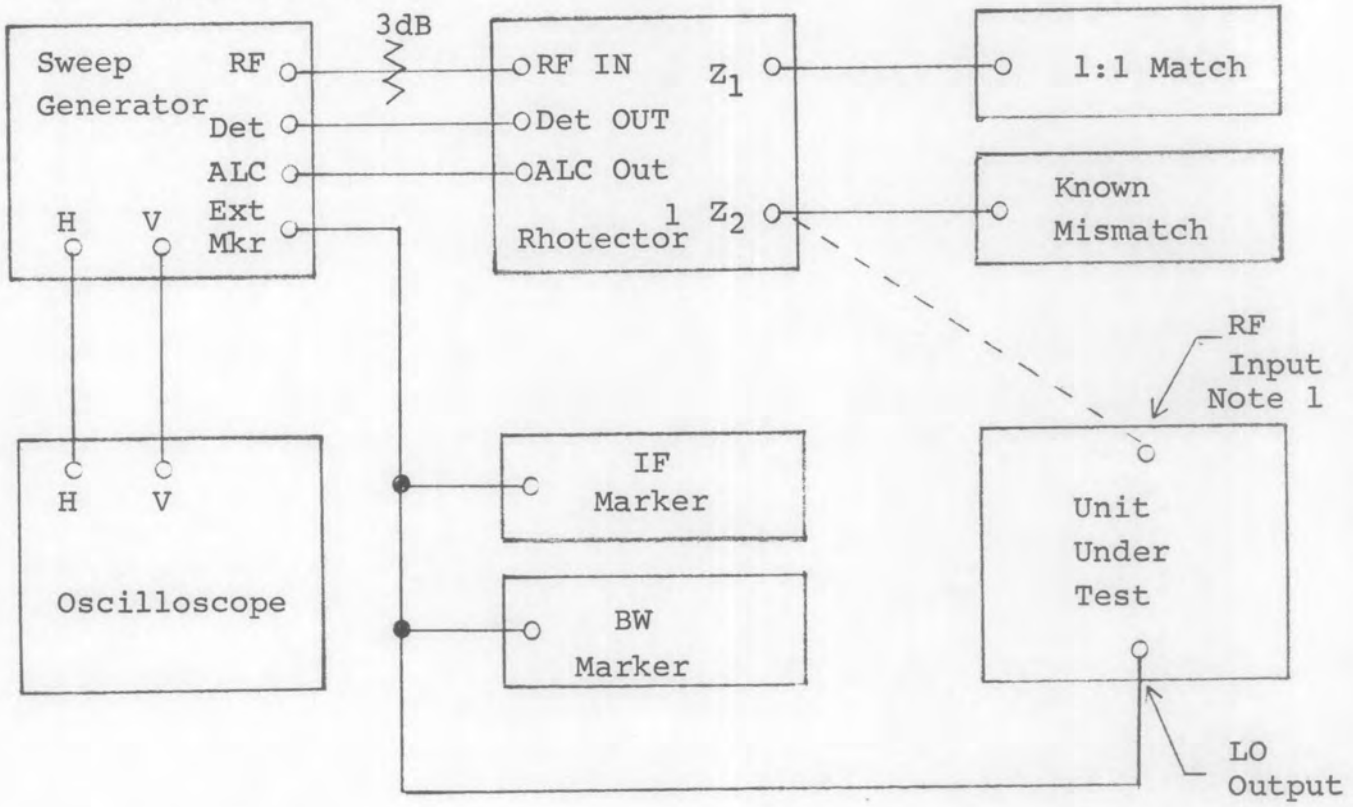
3. Notes

1. If the sweep generator does not have a calibrated output, an RF VTVM will be required to set the RF level into the known mismatch. Level is as specified in the equipment test procedure and/or shall not exceed the maximum input level for the UUT.

METHOD 701-2

Swept VSWR Measurement Using a Rhotector
(Tuners)

1. Equipment Set-up



2. Procedure

1. Set IF marker to first IF frequency of the tuner under test or as specified in test procedure.

2. Set BW marker to 1/2 the minimum RF Bandwidth specification of the Tuner under test.

3. Set the sweep generator and scope controls for a reference display centered at the tuned frequency of the tuner under test so that the IF and BW markers are visible on the display. Check sweep generator leveling by changing generator output several dB. The display amplitude should not change. (This insures correct ALC operation).

4. Connect the tuner under test to the Z2 connector of the rhotector.

5. Tune the sweep generator and the tuner slowly across the frequency range of the tuner while observing the VSWR display. The response amplitude shall not exceed the reference level at any point between the BW markers. Re-check the reference level at any frequency where the measurement might be marginal.

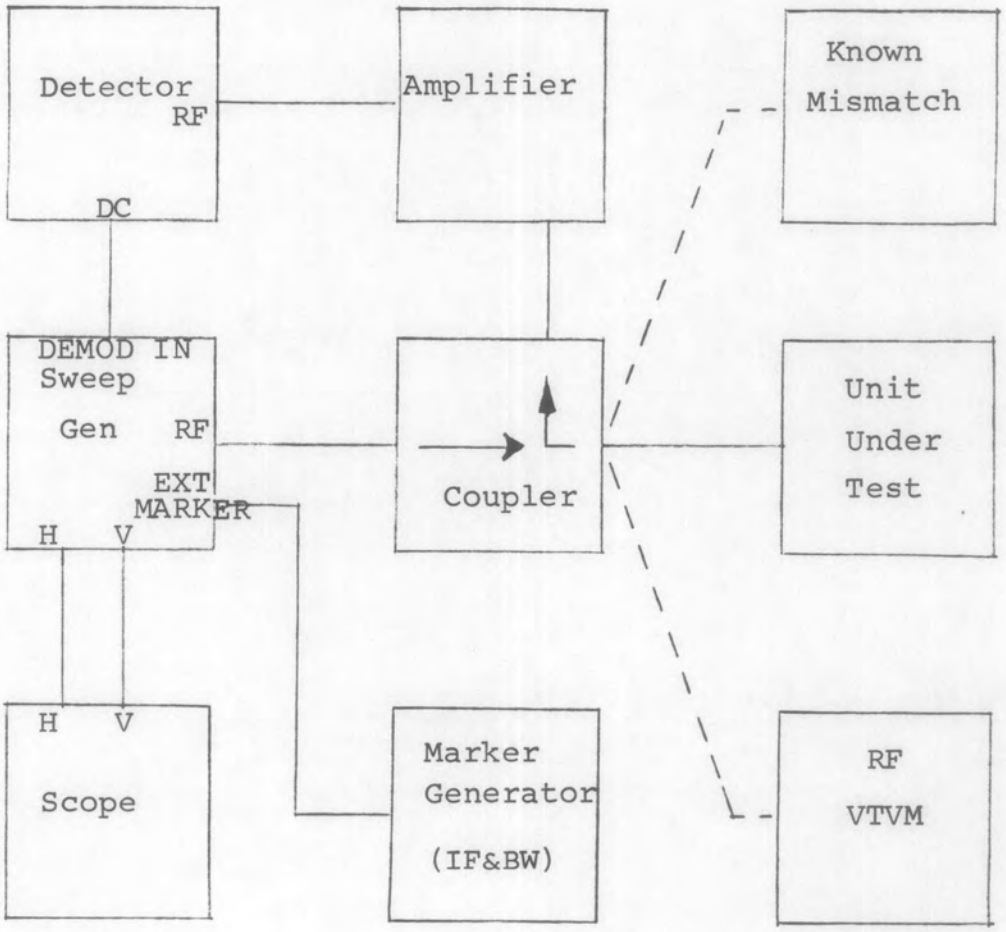
3. Notes

1. Same as 701-1.

METHOD 702

Swept VSWR Measurements Using a Directional Coupler

1. Equipment Set-up



2. Procedure

1. Set IF marker to the first IF frequency of the unit under test or as specified in the equipment test procedure.

2. Set bandwidth markers to display the specified bandwidth.

3. Set the sweep generator and oscilloscope controls for a reference display centered at the tuned frequency of the UUT using the specified signal level and known mismatch.

4. Connect the UUT to the coupler.

5. Tune the sweep generator and the UUT slowly across the specified frequency range. Verify that the response amplitude does not exceed the reference level at any point between the bandwidth markers.

3. Notes

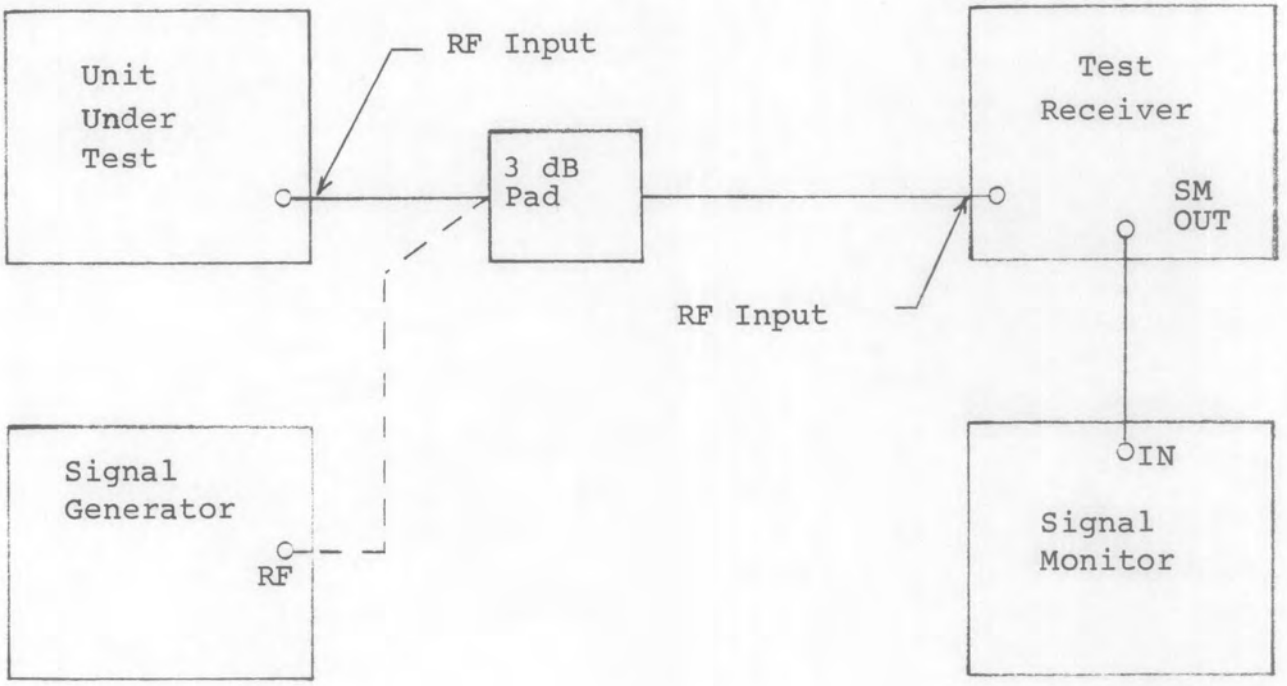
1. If the sweep generator does not have a calibrated output, an RF VTVM will be required to set the RF level into the known mismatch. Level is as specified in the equipment test procedure and/or shall not exceed the maximum input level for the UUT.

Section 800 Local Oscillator to Antenna Radiation

METHOD 801-1

Local Oscillator to Antenna Radiation

1. Equipment Set-up



2. Procedure

1. Set the unit under test for the specified test frequency.

2. Tune the test receiver to the specified test frequency ± the IF frequency (L.O. frequency) of the unit under test.[1,2]

3. Adjust the Signal Monitor gain for a full scale response reference on the CRT.

4. Connect the signal generator to the test receiver through the 3 dB pad.

5. Set the signal generator frequency to the frequency of the test receiver.

6. Adjust the signal generator output level until the signal monitor display is equal to that set in step 3.

7. Record the signal generator output level.

8. Repeat for all other test frequencies.

3. Notes

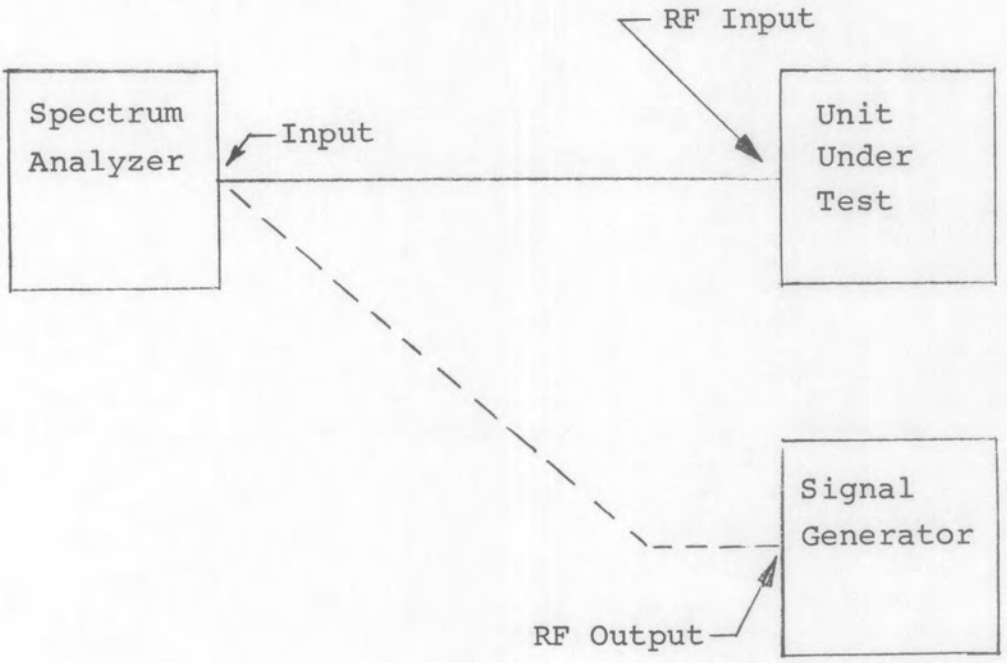
1. For double conversion units, the IF center frequency refers to the first IF.

2. First L.O. is generally high-beat, however those tuners having low-beat L.O. will be specified in test procedure.

METHOD 801-2

Local Oscillator to Antenna Radiation

1. Equipment Set-up



2. Procedure

1. Set the unit under test for the specified test frequency.

2. Adjust the spectrum analyzer controls for a reasonable presentation of the signal which is equal to (specified test frequency ± IF center frequency).[1]

3. Connect the signal generator to the spectrum analyzer.

4. Set the signal generator frequency to (specified test frequency ± IF center frequency)[1]

5. Adjust the signal generator output level until the spectrum analyzer display is equal to that set in step 2.

6. Record the signal generator output level.

7. Repeat for all other test frequencies.

3. Notes

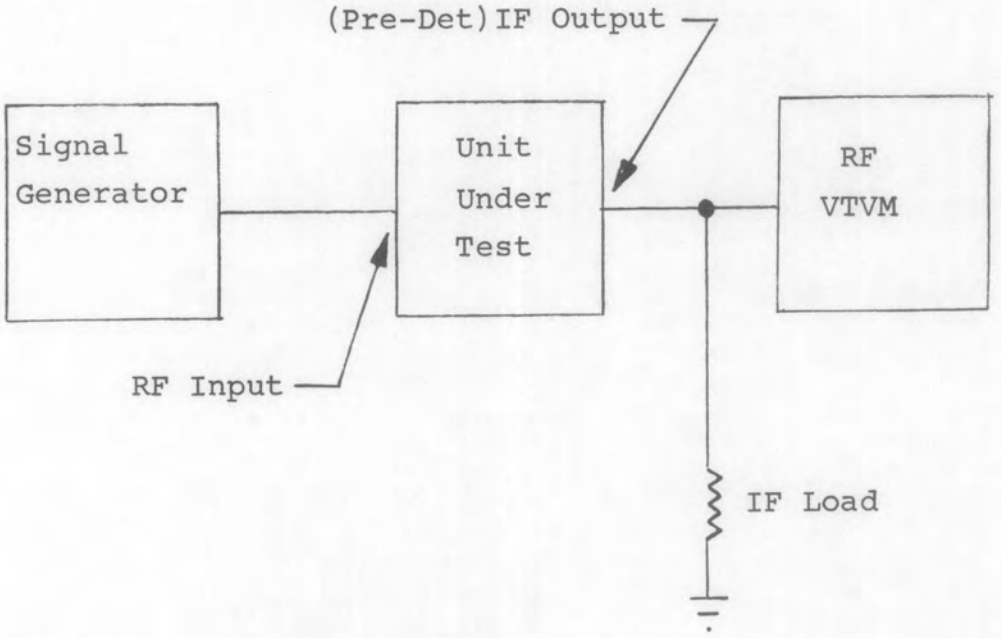
1. For double conversion units, the IF center frequency refers to the first IF.

Section 900 Image and IF Rejection

METHOD 901-1

IF Rejection - Receivers with Pre-Detection IF Outputs

1. Equipment Set-ups



2. Procedure

1. Set the unit under test to the test frequency specified in the equipment test procedure, AM/MAN mode for receivers, maximum RF/IF gain.

2. Set the signal generator to the desired test frequency at the level specified in the test procedure for the unit under test.

3. Note the reading on the RF VTVM (reference). Unit gain or signal level may be varied slightly to obtain a convenient reference on the RF VTVM.

4. Retune the signal generator frequency to the IF center frequency of the unit under test as specified in the equipment test procedure.

5. Increase the signal generator output level until the reference reading of step 3 is obtained on the RF VTVM.

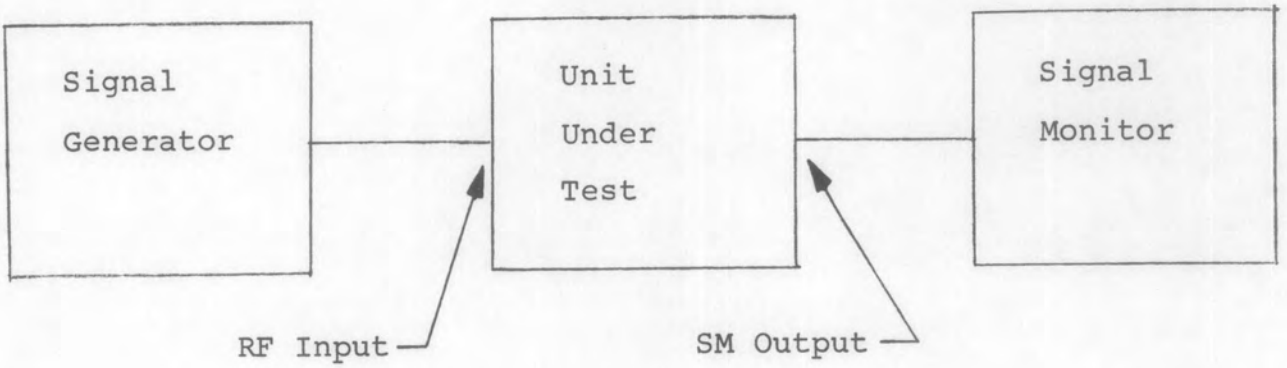
6. Record the change in the signal generator output level (step 5 - step 2). This is the IF rejection. Minimum acceptable limits shall be as stated in the test procedure for the unit under test.

7. Repeat the procedure for all other IF and/or test frequencies specified in the Test Procedure for the unit under test.

METHOD 901-2

IF Rejection - Receivers with Signal Monitor Output

1. Equipment Set-up



2. Procedure

1. Set the unit under test to the test frequency specified in the equipment test procedure, AM/MAN mode for receivers, maximum RF/IF gain.

2. Set the signal generator to the desired test frequency at the level specified in the test procedure for the unit under test.

3. Note the response amplitude on the signal monitor. Adjust SM gain to obtain a convenient reference on the CRT.

4. Retune the signal generator frequency to the IF center frequency of the unit under test as specified in the equipment test procedure.

5. Increase the signal generator output level until the reference reading of step 3 is obtained on the CRT.

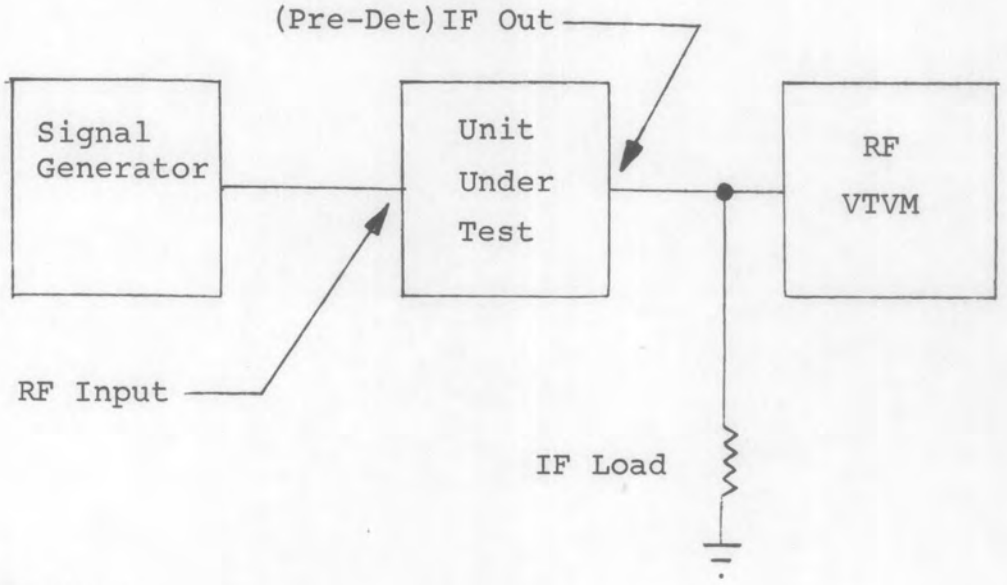
6. Record the change in the signal generator output level (step 5 - step 2). This is the IF rejection. Minimum acceptable limits shall be as stated in the test procedure for the unit under test.

7. Repeat the procedure for all other IF and/or test frequencies specified in the Test Procedure for the unit under test.

METHOD 902-1

Image Rejection - Receivers with Pre-Detection IF Outputs

1. Equipment Set-up



2. Procedure

1. Set the unit under test to the test frequency specified in the equipment test procedure, AM/MAN mode for receivers, maximum RF/IF gain.

2. Set the signal generator to the specified test frequency at the level specified in the test procedure for the unit under test.

3. Note the reading on the RF VTVM (reference). Unit gain or signal level may be varied slightly to obtain a convenient reference on the RF VTVM.

4. Retune the signal generator frequency to the specified image frequency of the unit under test.

5. Increase the signal generator output level until the reference reading of step 3 is obtained on the RF VTVM.

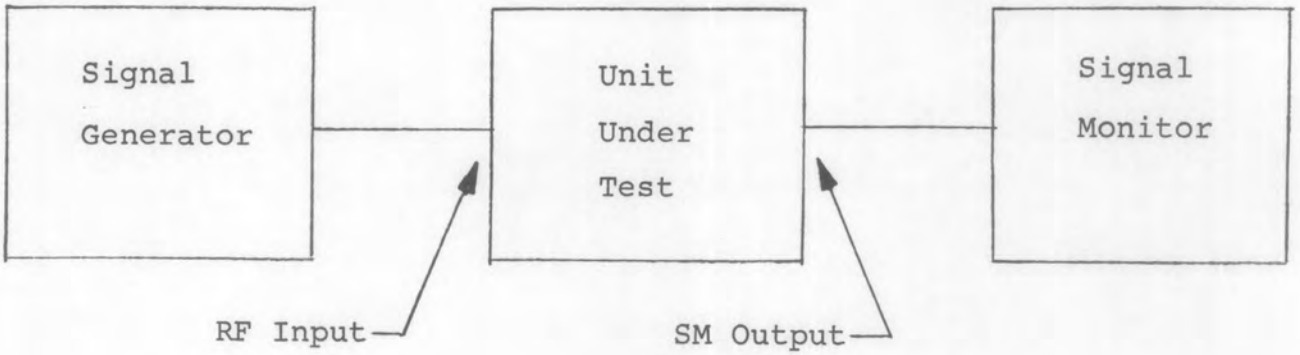
6. Record the change in the signal generator output level (step 5 - step 2). This is the image rejection. Minimum acceptable limits shall be as stated in the test procedure for the unit under test.

7. Repeat the procedure for all other test frequencies specified in the test procedure for the unit under test.

METHOD 902-2

Image Rejection - Units with Signal Monitor Output

1. Equipment Set-up



2. Procedure

1. Set the unit under test to the test frequency specified in the equipment test procedure, AM/MAN mode for receivers, maximum RF/IF gain.

2. Set the signal generator to the specified test frequency at the level specified in the test procedure for the unit under test.

3. Note the response amplitude on the signal monitor. Adjust SM gain to obtain a convenient reference on the CRT.

4. Retune the signal generator frequency to the specified image frequency of the unit under test.

5. Increase the signal generator output level until the reference reading of step 3 is obtained on the SM.

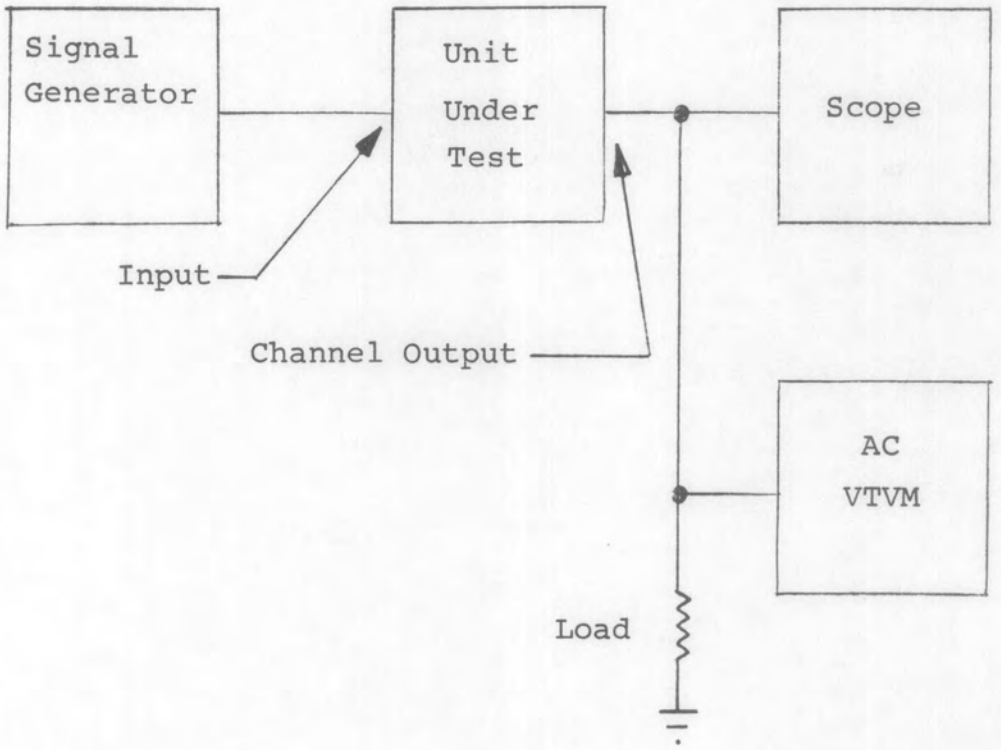
6. Record the change in the signal generator output level (step 5 - step 2). This is the image rejection. Minimum acceptable limits shall be as stated in the test procedure for the unit under test.

7. Repeat the procedure for all other test frequencies specified in the test procedure for the unit under test.

METHOD 903

Image and IF Rejection - Telephone Equipment

1. Equipment Set-up



2. Procedure

1. Set the signal generator to the specified channel center frequency at the specified input level.

2. Adjust the level control for a specified reference on the AC VTVM.

3. Set the signal generator to the IF center frequency at the specified input level.

4. Record the decrease in the output level. This is the rejection and shall be as specified in the test procedure for the unit under test.

5. Retune the signal generator to the image frequency as specified in the equipment test procedure at the specified input level.

6. Repeat step 4.

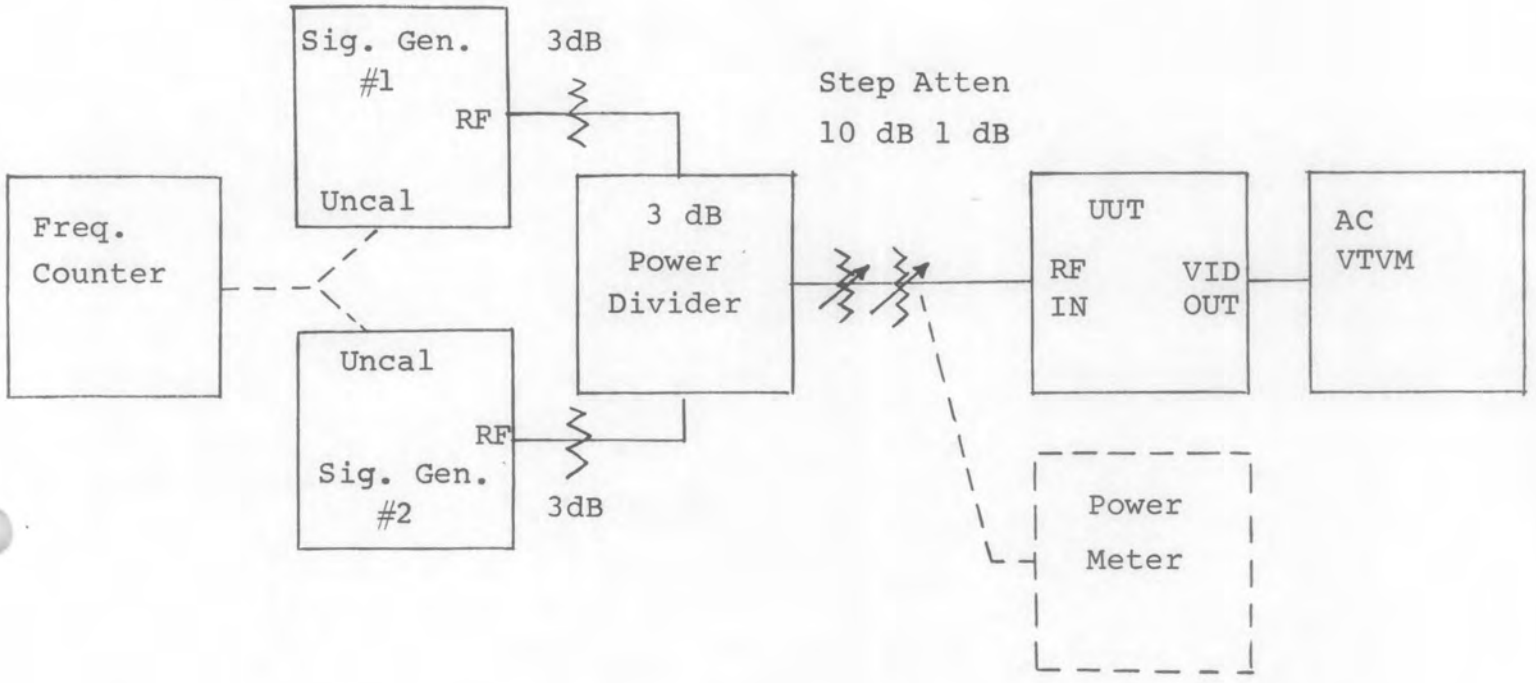
7. Repeat the procedure for all channels.

Section 1000 Miscellaneous Tests

METHOD 1001-1

Intercept Point - Receiver Test

1. Equipment Set-up



2. Procedure

1. Set receiver to AM/MAN mode, maximum RF/IF gain; tuned to desired test frequency, bandwidth as specified in the equipment test procedure.

2. Set step attenuators for minimum insertion loss.

3. Set signal generator #2 at its minimum output level, CW.

4. Set signal generator #1 for the test frequency at the reference level specified in the equipment test procedure. Modulate 50% at a 1 kHz rate.

5. Adjust the video gain for the output reference given in the equipment test procedure.

6. Set the step attenuators for maximum insertion loss.

7. Set signal generator 1 for the specified test frequency and level, modulated 50% at 1 kHz.

8. Set signal generator #2 for the specified test frequency and level, CW.

9. Decrease the step attenuators values until the AC VTVM again indicates the output reference.

10. Calculate the intercept point as follows:

$$IP = P_{IN} + \left(\frac{P_{IN} - P_{REF}}{2}\right)$$

where P_{IN} = (Generator #1 output level) - (value of step Attenuators)

P_{REF} = (input level of step 4) - 3 dB

3. Notes

1. Input cables shall be as short as possible to minimize power loss. If long cables are used, modify equation of step 2.10 to read

P_{IN} = (Gen Level - cable I.L.) - (value of step atten.)

P_{ref} = (input level of step 4) - (cable I.L.)

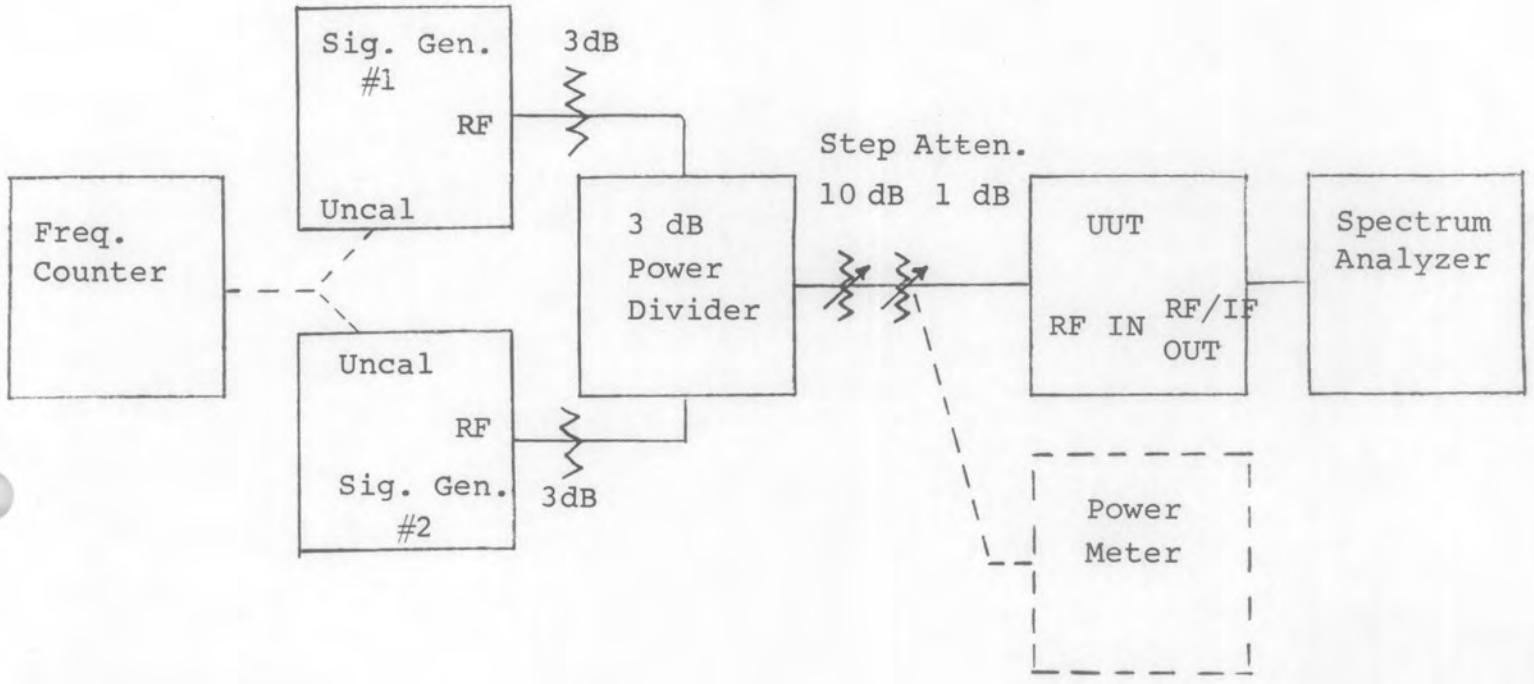
2. When generating intermodulation product (step 2.9), both signal generators must be at the same power level into the unit under test. If in doubt, use the power meter to set the levels in steps 2.7 and 2.8 with 0 dB attenuation in the external attenuators.

3. To verify that the output signal is an intermodulation product and not a spurious signal, disconnect one of the signal generators and verify that the output signal is gone. Then repeat for the other signal generator.

METHOD 1001-2

Intercept Point - In Band

1. Equipment Set-up



2. Procedure

1. Set the unit under test for maximum gain, when applicable AM/MAN mode, bandwidth and test frequency as specified in the equipment test procedure.

2. Set the step attenuators for 0 dB.

3. Set signal generator #2 to its minimum output level, CW.

4. Set signal generator #1 for the specified test frequency, CW, at the specified reference level.

5. Set the spectrum analyzer controls for a reasonable presentation of the output signal (output reference).

6. Set the step attenuators for maximum insertion loss.

7. Set signal generator #1 for a CW signal at the specified frequency and level.

8. Set signal generator #2 for a CW signal at the specified frequency and level.

9. Decrease the insertion loss of the step attenuators until the response on the spectrum analyzer is the same as established in step 2.5.

10. Calculate the intercept point as follows:

$$IP = P_{IN} + \left(\frac{P_{IN} - P_{Ref}}{2}\right)$$

where P_{IN} = (Generator #1 output level) - (value of step attenuators)
P_{ref} = (input level of step 4) - 3 dB

3. Notes

1. Input cables shall be as short as possible to minimize power loss. If long cables are used, modify equation of step 2.10 to read

P_{IN} =(Gen level- cable I.L.) - (value of step atten.)

P_{ref} = (input level of step 4) - (cable I.L.)

2. When generating intermodulation product (step 2.9), both signal generators must be at the same power level into the unit under test. If in doubt, use the power meter to set the levels in steps 2.7 and 2.8 with 0 dB attenuation in the external attenuators.

3. To verify that the output signal is an intermodulation product and not a spurious signal, disconnect one of the signal generators and verify that the output signal is gone. Then repeat for the other signal generator.

4. Care must be exercised when using the spectrum analyzer since intermodulation products can be generated within the spectrum analyzer. By changing the input attenuator on the spectrum analyzer, all signals should change accordingly, i.e. one for one. If the intermodulation product is created in the spectrum analyzer, the display will change 2 times the change in the input attenuator.

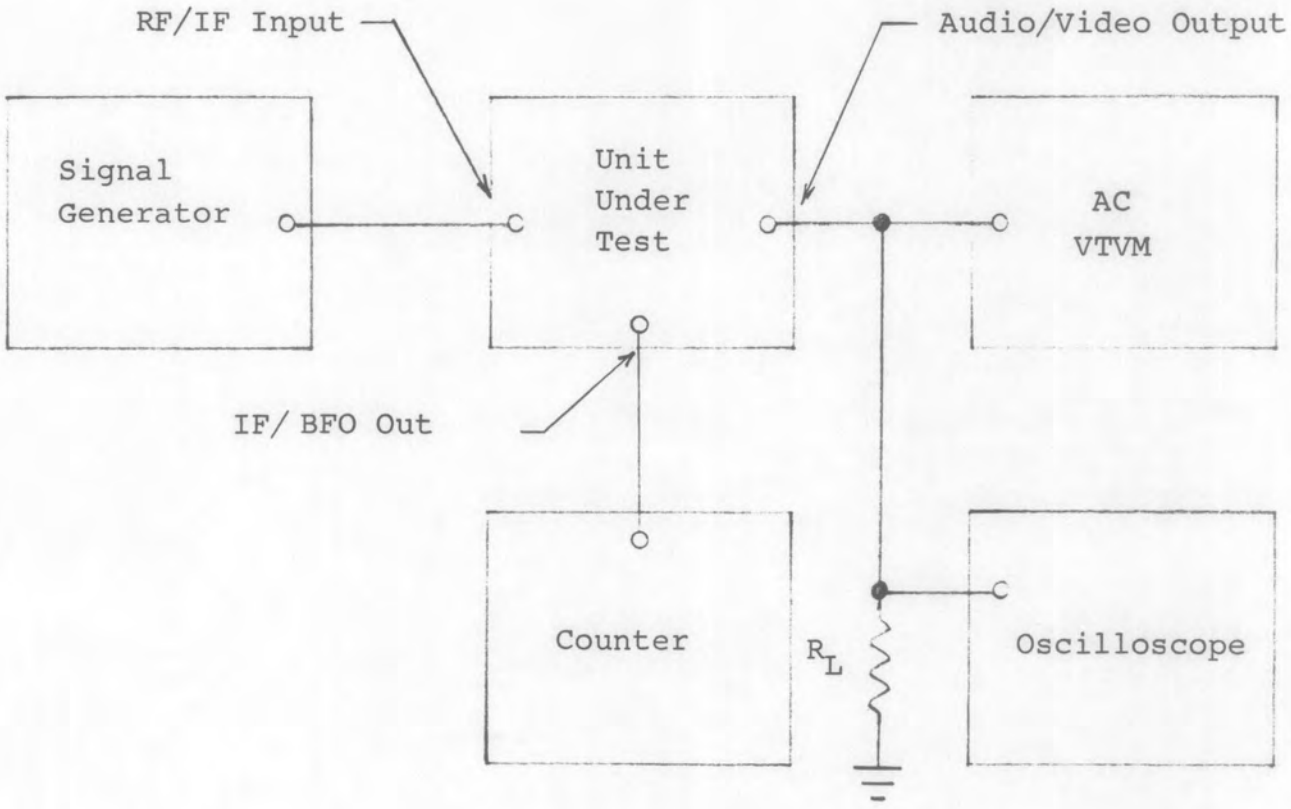
5. It is also possible to observe in-band spurious signals on the spectrum analyzer, particularly if the UUT is a receiver. In addition to the cross-check of step 3.3, vary the external 1 dB step attenuator. The true intermodulation product will change 3 times the change in the step attenuator. The spurious signal will change at the same rate.

6. When testing wide band devices, such as tuners, the intermodulation products will appear at $(f_1 - \triangle f)$ and $(f_2 + \triangle f)$ where Δf is the difference between the frequencies of the two signal generators.

METHOD 1002

Fixed BFO Checks

1. Equipment Set-up



2. Procedure

1. Set unit under test to CW mode; RF/IF gain to maximum; IF bandwidth to narrowest BW; audio/video gain as required.

2. Set signal generator frequency and output level to produce approximately a 10 dB S+N/N 1 kHz signal at the audio/video output of the unit under test.

3. Increase the signal generator output level until a maximum undistorted audio/video output is indicated on the AC voltmeter. Do not readjust RF/IF gain.

4. Set audio/video gain of the unit under test for a convenient reference on the AC voltmeter.

5. Further increase the signal generator output level until the maximum input level for AM Stability of the unit under test is reached.

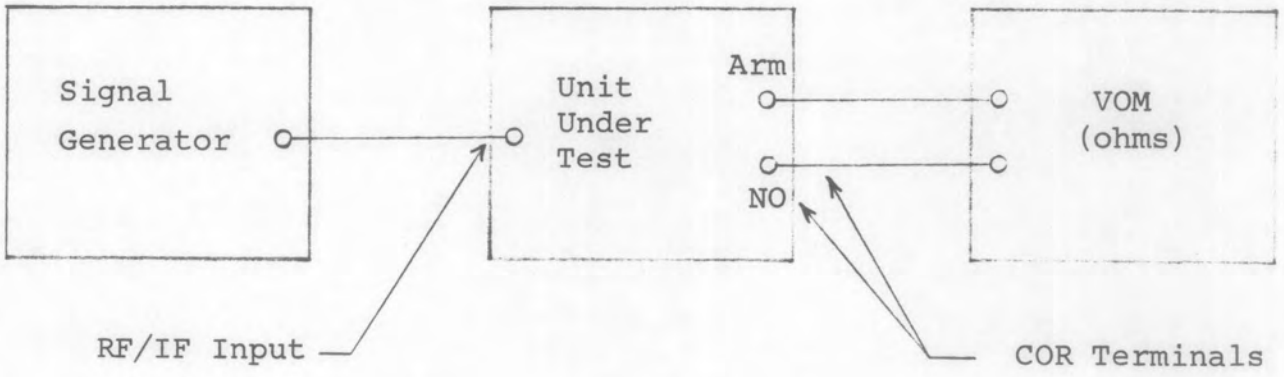
6. Note the audio/video output level. It shall not decrease more than 6 dB from the level set in Step 4.

7. Set the RF/IF gain of the unit under test to minimum. Record the BFO frequency as indicated on the frequency counter.

METHOD 1003

COR Sensitivity

1. Equipment Set-up



NOTE: The COR indicator may be used if the COR terminal wiring has been previously checked with continuity tests.

2. Procedure

1. Set unit under test to AM/AGC; COR sensitivity control to maximum CW; RF frequency and I.F. bandwidth as specified in the test procedure.

2. Set the signal generator to the specified test frequency and set output to minimum. Adjust the COR sensitivity control of the unit under test to the point just above COR operation on noise.

3. Increase the signal generator output level until the COR operates. This is the maximum COR sensitivity. Record the signal generator output level.

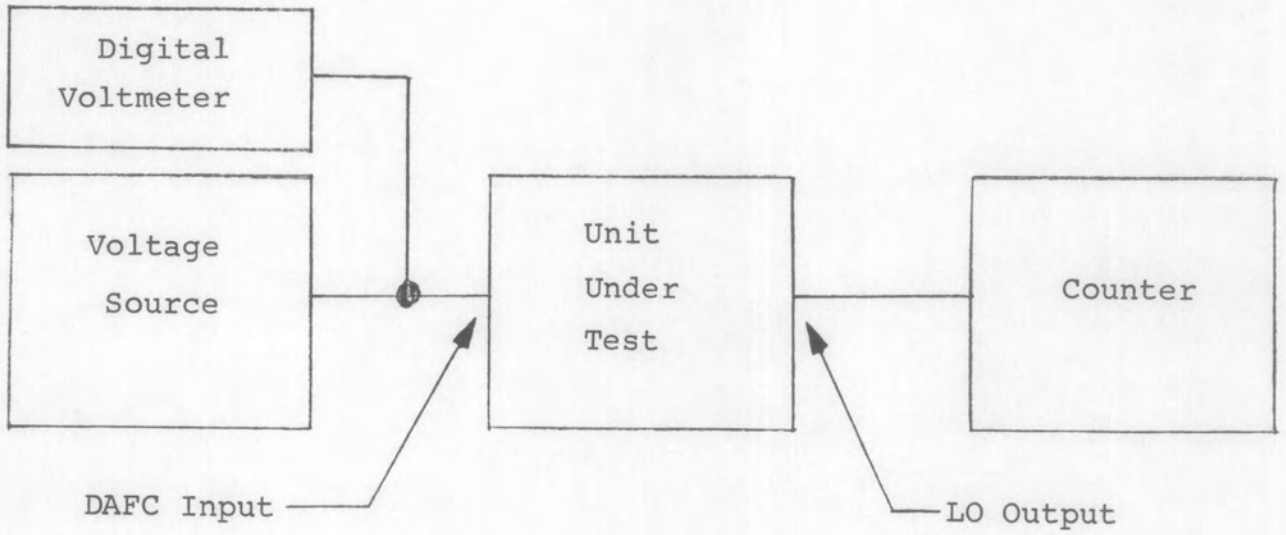
4. Set the COR sensitivity control of the unit under test to maximum CCW and increase the signal generator output level until the COR operates. This is the COR minimum sensitivity. Record the signal generator output level.

5. Connect the VOM to the COR normally closed contacts and repeat Step 2 to verify contact opening when COR operates.

METHOD 1004

DAFC Range

1. Equipment Set-up



2. Procedure

1. Set tuner to low end of band.

2. Set power supply to voltages specified for unit under test.

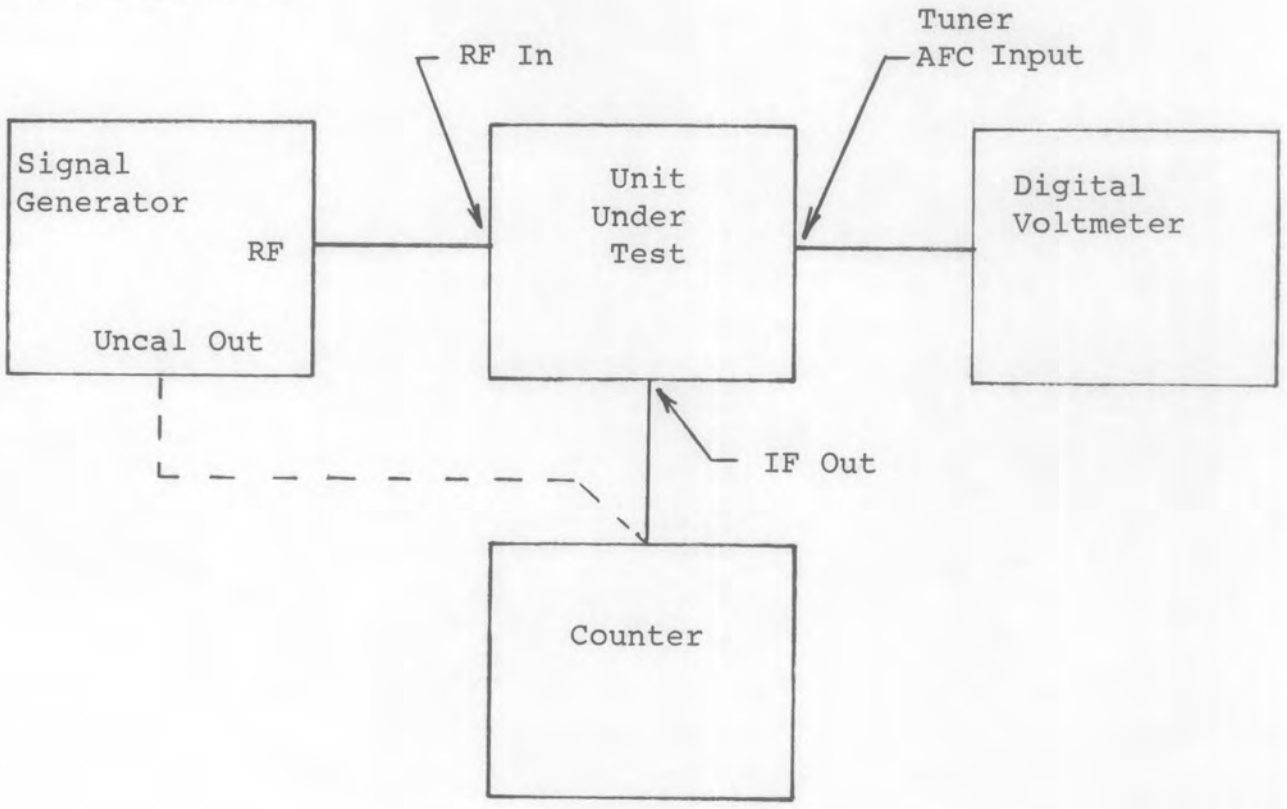
3. Record LO frequency at each test voltage.

4. Calculate the DAFC range by computing the difference of the two frequencies recorded in 2.3.

METHOD 1005

AFC Hold-In Ratio

1. Equipment Set-up



2. Procedure

1. Turn unit under test AFC control off.

2. Adjust signal generator to obtain exact IF frequency of unit under test on counter at the IF output port.

3. Turn unit under test to AFC mode and note the IF frequency change on counter. This change is the offset and should not exceed 5% of the IF Bandwidth of the unit under test.

4. Adjust signal generator frequency to obtain exactly +4.0 Vdc[1] on the voltmeter.

5. Connect counter to signal generator as indicated by dotted line and record the RF frequency.

6. Reconnect the counter as shown by solid line and record the IF frequency of the unit under test.

7. Adjust signal generator frequency to obtain exactly -4.0 Vdc[1] on the voltmeter. Compute the IF frequency change from that recorded in step 6.

8. Reconnect the counter to the signal generator and compute the RF frequency change from that recorded in step 5.

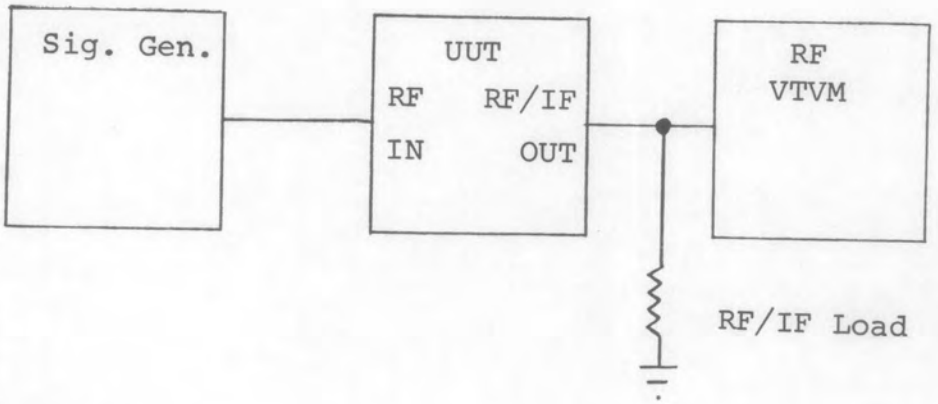
9. Compute the AFC Hold-in Ratio by dividing the IF frequency change (step 7) into the RF frequency change (step 8).

NOTE[1] Units having other closed loop AFC voltages will be so indicated in the test procedure for the unit under test.

METHOD 1006

Compression Point

1. Equipment Set-up



2. Procedure

1. Set the signal generator for a CW signal at the level and frequency specified in the equipment test procedure.

2. Set the unit under test for maximum gain, no AGC (if applicable).

3. Note the reading on the RF VTVM.

4. Increase the input level in 3 dB steps and verify that the output level increases in 3 dB steps.

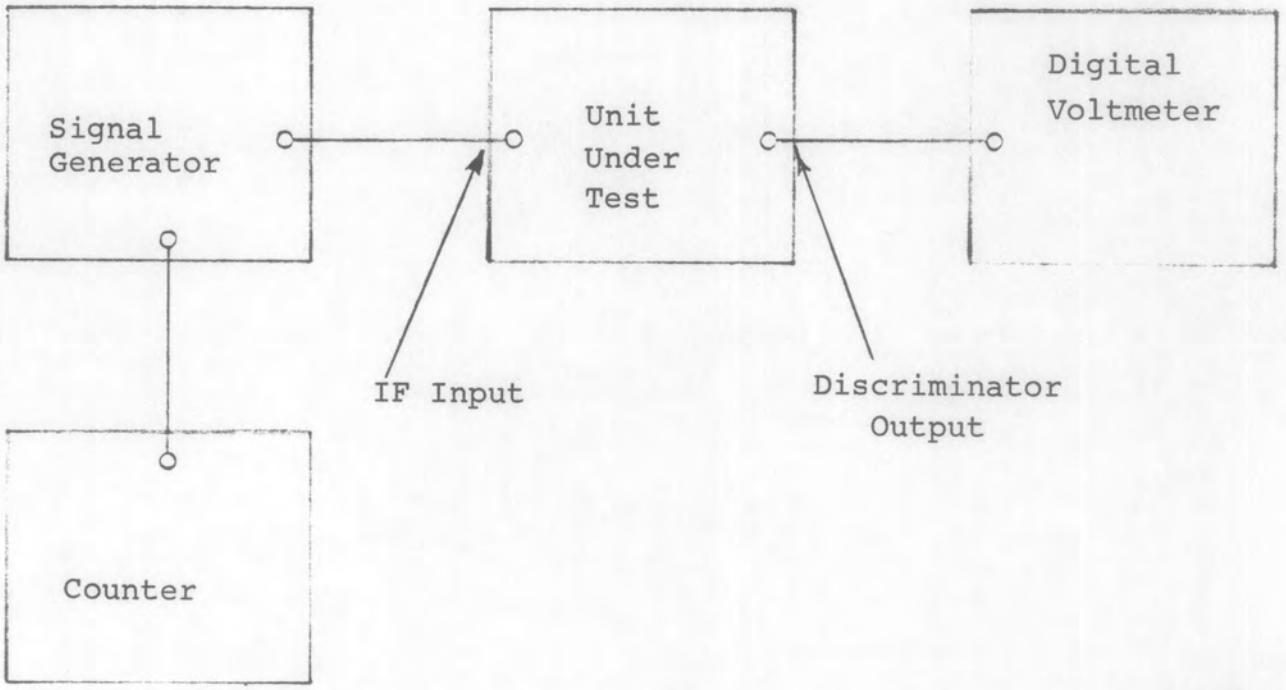
5. Continue increasing the input level in 3 dB steps until the output level increases 2 dB.

6. Record the input level.

METHOD 1007-1

Discriminator Center Frequency CW Method

1. Equipment Set-up



2. Procedure

1. Set unit under test to AM/MAN minimum IF gain.

2. Record DC voltage on VTVM. On units having a DC balance control adjust this control for 0 Vdc on the DVM. This is the offset voltage and shall not exceed the limits specified in the equipment test procedure.

3. Set unit under test to FM.

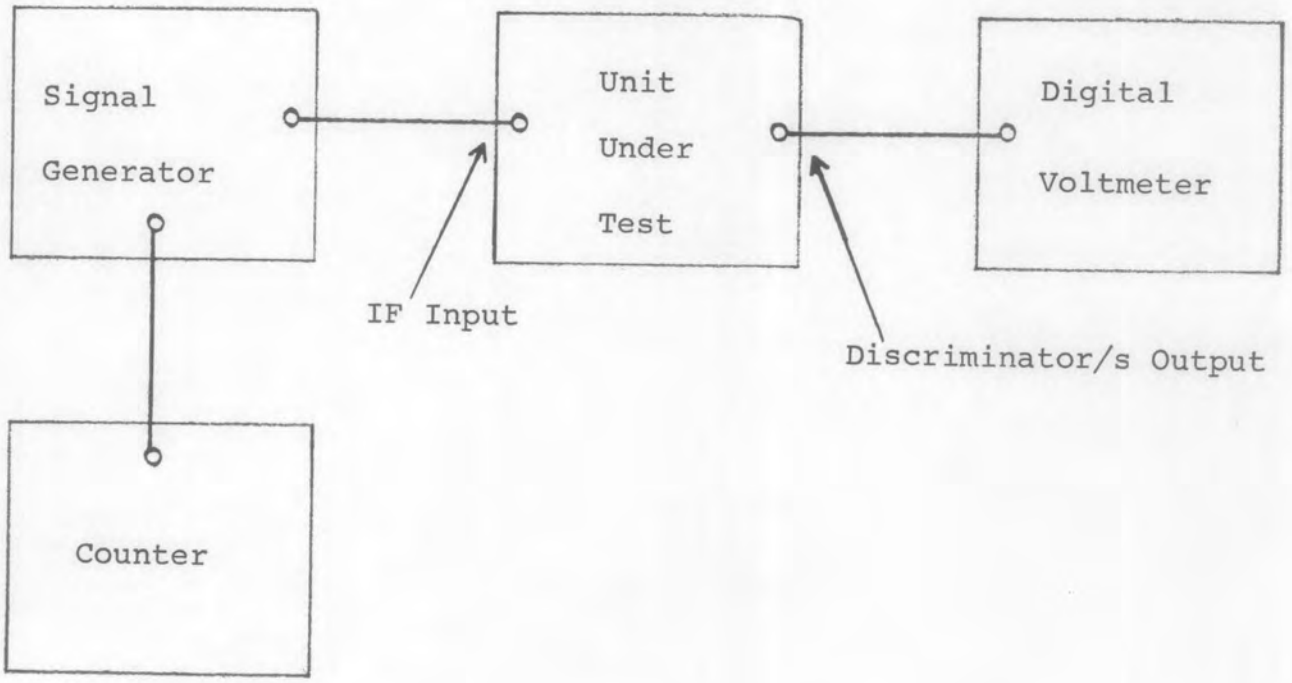
4. Set signal generator output to 10 μV (-87 dBm) and adjust frequency to IF frequency of unit under test.

5. Adjust frequency of signal generator for a DVM reading noted in step 2.2 and record frequency indicated on counter. This is the discriminator center frequency or zero crossover.

METHOD 1007-2

Discriminator Center Frequency, CW Method; (for Receiver sub-assemblies where IF threshold limiting level is related to bandwidth selected.)

1. Equipment Setup



2. Procedure

1. Set unit under test to IF Bandwidth #1.

2. Set unit under test to "FM Mode".

3. Connect test equipment and UUT as shown above. The IF input connection, center frequency, input level and related FM Discriminator Output connections per IF bandwidth selected will be called out in the unit/equipment test procedure.

4. Set signal generator to IF Center Frequency of UUT and set output level to minimum. The digital voltmeter will indicate a DC voltage. This is the FM Discriminator Offset voltage and should be typically within plus or minus 50 milli volts from zero volts DC or as specified in the test procedure.

Note this reference voltage. On units having a DC balance control, do not now readjust this control for zero volts DC (See Note 1).

5. Set signal generator output level to level per IF bandwidth as specified in test procedure for IF center frequency of UUT.

6. Trim adjust the frequency of the signal generator for a DVM reading as noted in step 4. Record input frequency as indicated on counter. This is the FM Discriminator center frequency or zero crossing point. It should be within the limits as specified in the equipment test procedure.

7. Repeat para 3 thru 6 for all other IF Bandwidths/FM Discriminators as called out in unit/equipment test procedure.

3. Notes:

1. If the offset voltage is out of the specified limit, refer to the appropriate Pretest/alignment Procedure for setting instructions. Setting of the offset balance control for a zero volt discriminator output when the discriminator itself is not hard-limited on overall receiver noise can give an erroneous DC offset voltage.

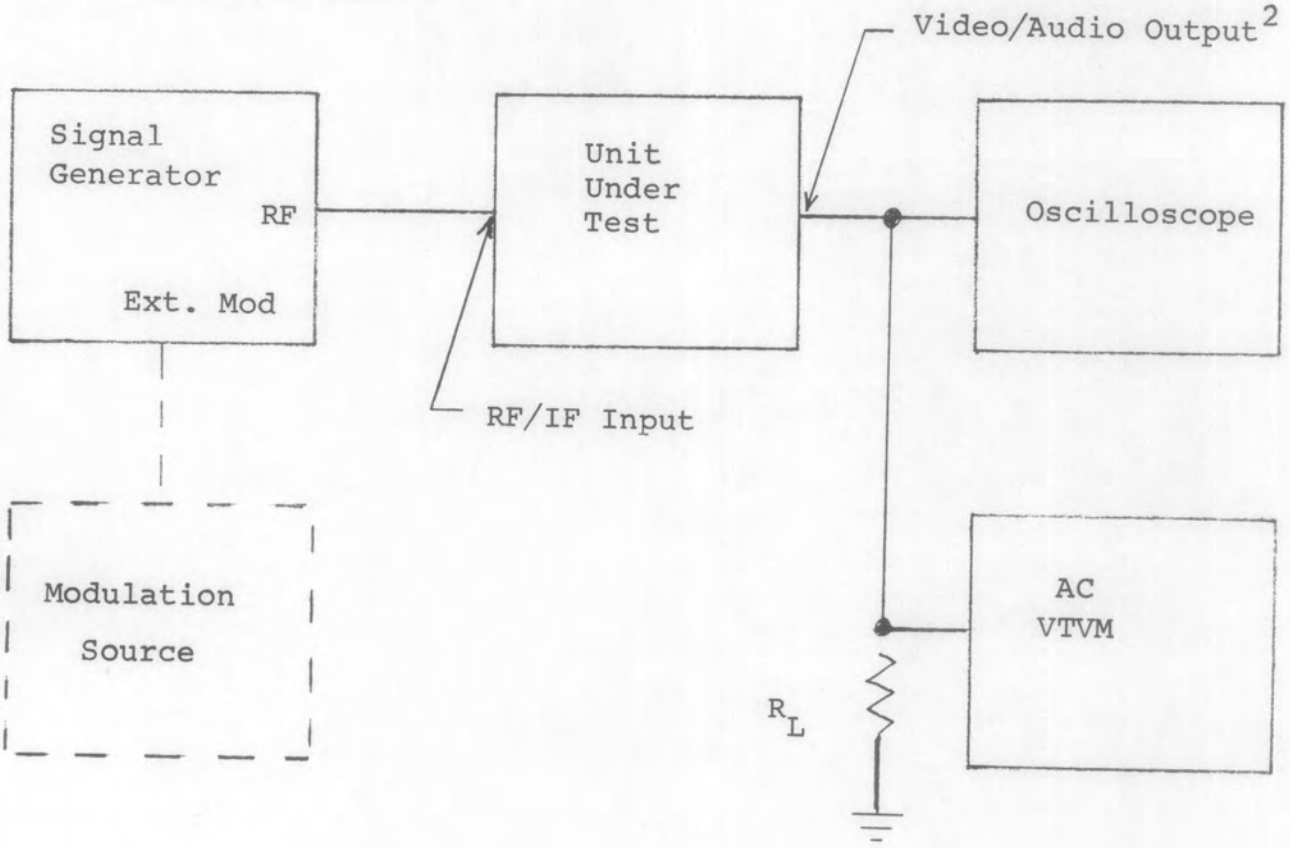
   The DC offset voltage will be affected by the "limited output level" versus frequency response of the discriminator circuits plus the symmetry, with respect to the IF center frequency, of the noise pedestal as determined by the IF preselector filter.

   For optimum FM reception, and determination of "quieting point" the overall receiver would require the addition of tuner gain/noise figure product to the IF noise to assure that the discriminator is hard-limited on the actual receiver threshold noise level.

METHOD 1008

Output Stability

1. Equipment Set-up



2. Procedure

1. Set the unit under test for AM/AGC or FM mode, select the bandwidth as desired or as specified in the equipment test procedure.

2. Set the signal generator for the test frequency and level specified in the equipment test procedure.

3. Modulate the signal generator as specified.

4. Adjust the Video (Audio) gain of the unit under test for a reference on the AC VTVM (Do not overdrive the amplifier).

5. Slowly increase the signal generator output level to the level specified in the equipment test procedure while observing the AC VTVM reading and oscilloscope response. (Do not overdrive the amplifier)

6. Record the increase/decrease in the reading on the AC VTVM. This is the output stability and shall not exceed the limits specified in the equipment test procedure.[2]

7. Repeat the procedure for all other bandwidth settings specified in the equipment test procedure.

3. Notes

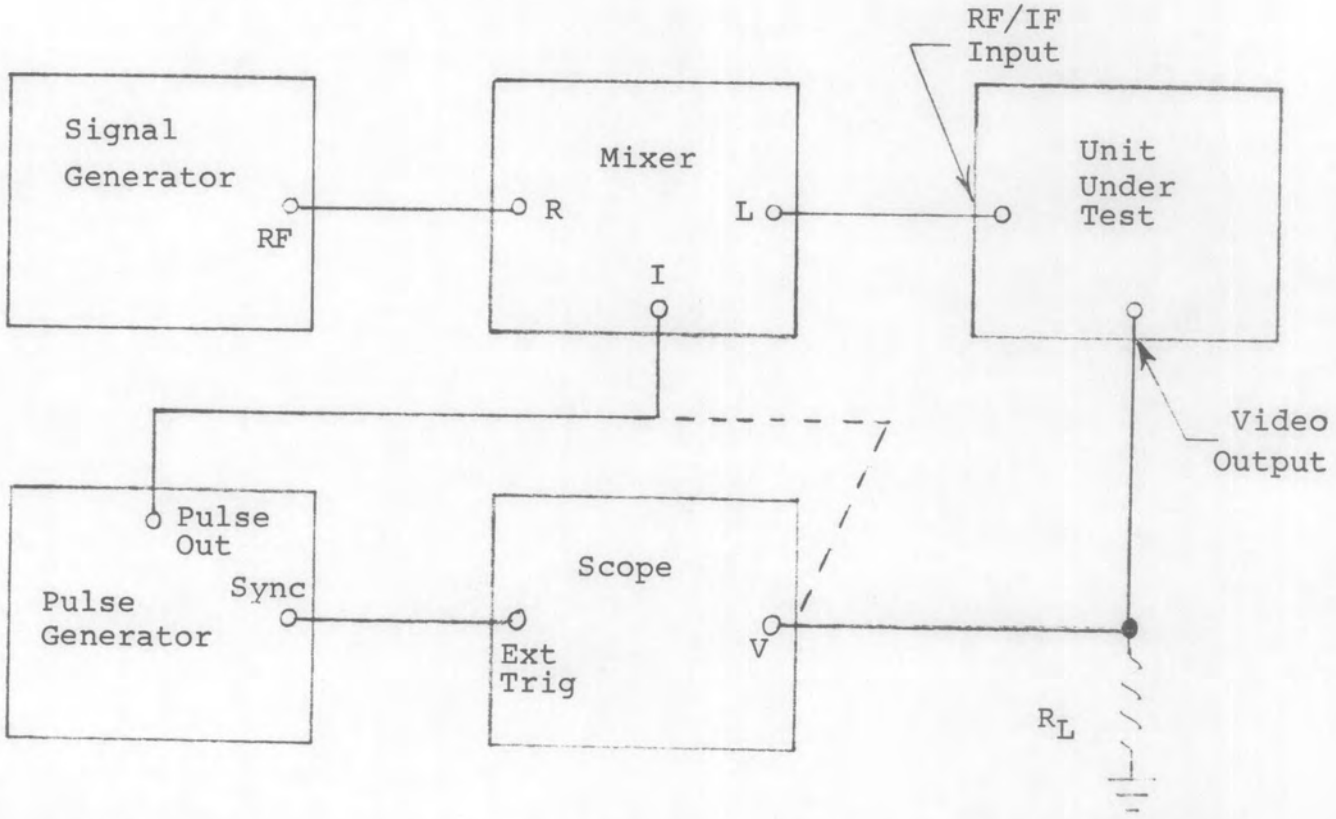
1. External modulation source is required only if the signal generator being used does not have the proper modulation characteristics.

2. Unless otherwise stated in the equipment test procedure do not allow a change in output level due to compression or expansion in excess of 1 dB.

METHOD 1009

Pulse AGC Measurements

1. Equipment Set-up



NOTE: For pulse lengths greater than 5 μSec equipment may be connected as shown in Standard Method 304-1.

2. Procedure

1. Set pulse generator repetition rate and pulse width as specified in test procedure for unit under test.

2. Connect pulse generator as indicated by dotted line and set output level for a 1.0V positive pulse. (10V positive pulse when set-up as in Standard Method 304-1)

3. Adjust oscilloscope sweep time for a 3 CM pulse length.

4. Adjust pulse delay control on pulse generator to center pulse on oscilloscope display.

5. Connect pulse generator as indicated by solid line.

6. Set the signal generator output level to the AGC threshold point or as specified in the procedure for the unit under test.

7. Set AGC mode of unit under test to PULSE and video gain for a reference display on the oscilloscope.

8. Increase the signal generator output level as specified in the procedure for the unit under test and record the change in dB of the video output signal. (Refer to Voltage Ratio Table.) The change should not exceed specified limits.

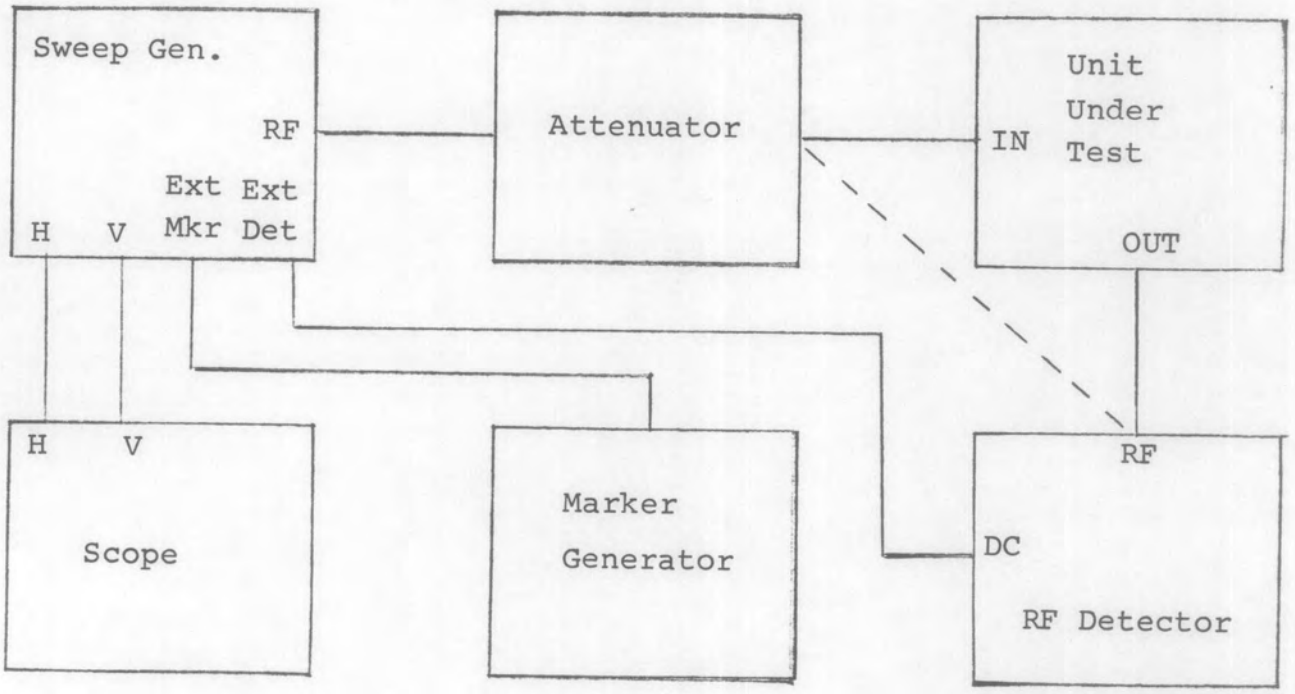
3. Notes

1. Correct test level into UUT must take into account the insertion loss of the mixer.

METHOD 1010-1

Swept Frequency Gain Measurement

1. Equipment Set-up



2. Procedure

1. Set marker generator to center frequency of unit under test.

2. Set sweep generator, attenuator and scope controls for a useable display. Sweep generator output level shall be as specified in the equipment test procedure.[1]

3. Note response amplitude at the marker and the attenuator setting.

4. Connect RF detector to attenuator and decrease attenuation until deflection on scope equals that noted in Step 3.

5. Compute gain by subtracting attenuator setting in Step 4 from Step 3.

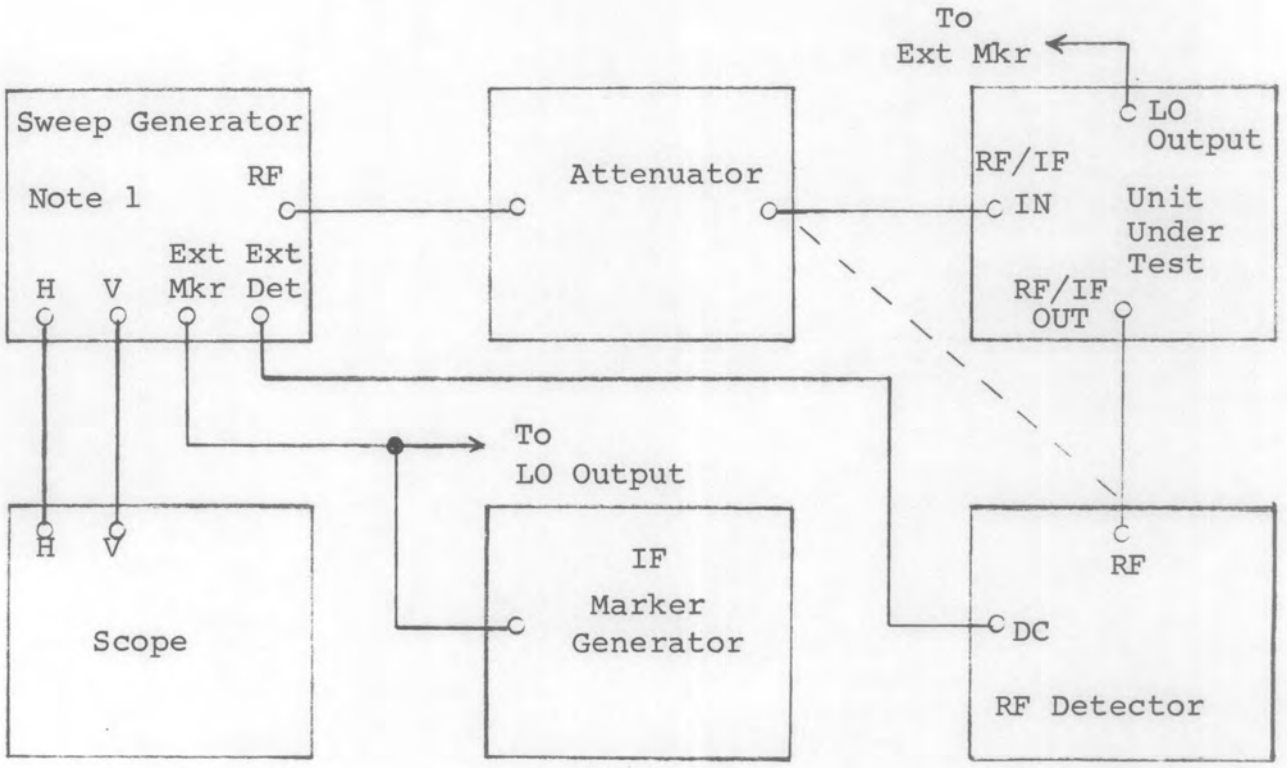
3. Notes

1. If the sweep generator does not have a calibrated output, it will be necessary to use an RF VTVM to set the level.

METHOD 1010-2

Swept Frequency Gain Variation Measurement (Tuners)

1. Equipment Set-up



2. Procedure

1. Set the oscilloscope: DC coupled mode, horizontal sweep disabled, horizontal sensitivity as required to present a 10 CM wide trace, vertical sensitivity to 1 mV/CM.

2. Set IF marker generator to the 1st IF frequency of the tuner under test.

3. Adjust the sweep generator and attenuator to produce an undistorted response centered around the test frequency. Adjust the IF marker generator so that the marker is displayed on the response.

4. Note the response amplitude at the marker while tuning the sweep generator and tuner slowly across the tuner's frequency range until the lowest amplitude point is found. Note the attenuator setting at this point.

5. Connect the RF detector to the attenuator and decrease attenuation until the scope deflection equals that noted in Step 4.

6. Compute the minimum gain by subtracting attenuator setting in Step 5 from Step 4.

7. Repeat Steps 3 through 6 at the highest amplitude point of the response.

8. Compute gain variation by subtracting the lowest gain measurement from the highest gain measurement.

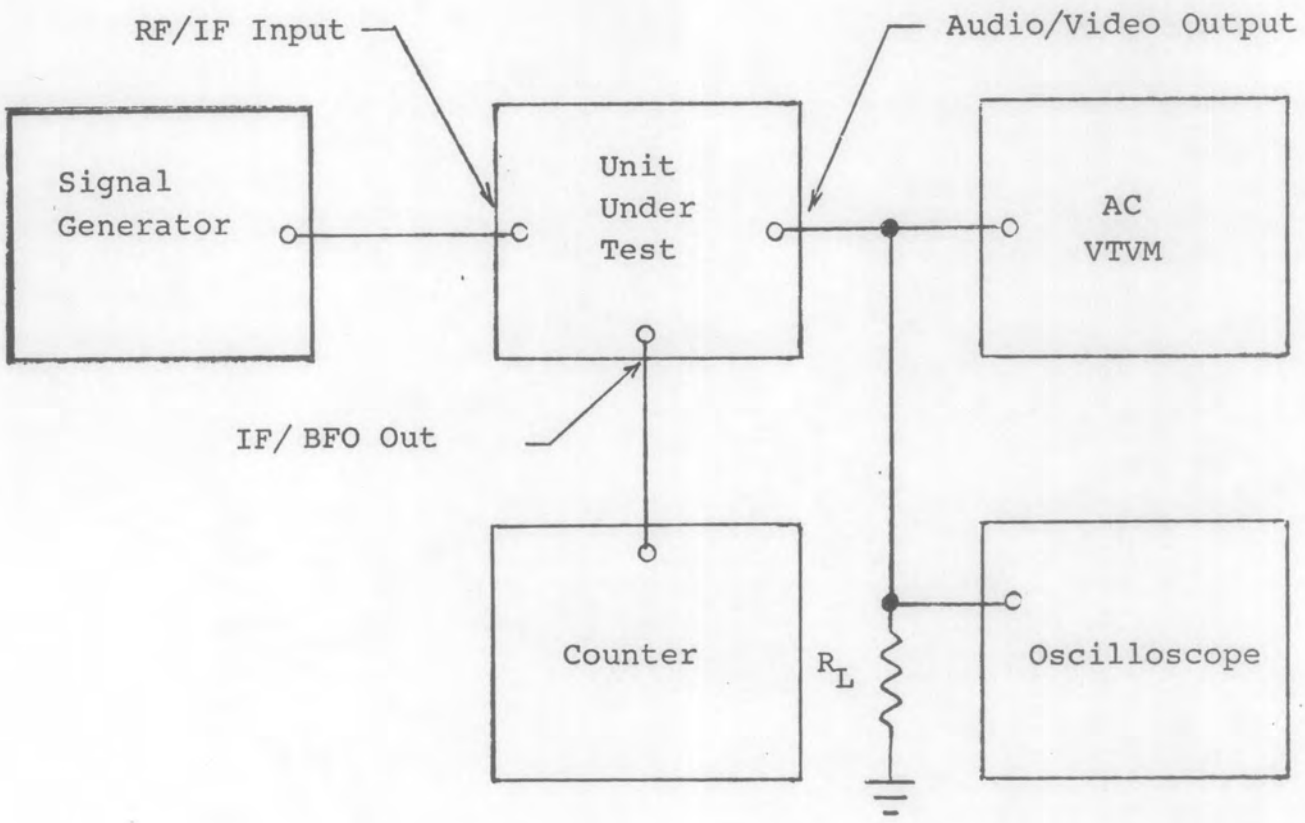
3. Notes

1. If the sweep generator does not have a calibrated output, it will be necessary to use an RF VTVM to set the level.

METHOD 1011

Variable BFO Checks

1. Equipment Set-up



2. Procedure

1. Set unit under test to CW mode; RF/IF gain to maximum; IF bandwidth to narrowest BW; audio/video gain as required.

2. Set signal generator frequency and output level to produce approximately a 10 dB S+N/N 1 kHz signal at the audio/video output of the unit under test.

3. Increase the signal generator output level until a maximum undistored audio/video output is indicated on the AC voltmeter Do not adjust RF/IF gain.

4. Set audio/video gain of the unit under test for a convenient reference on the AC voltmeter.

5. Further increase the signal generator output level until the maximum input level for AM Stability of the unit under test is reached.

6. Note the audio/video output level. It shall not decrease more than 6 dB from the level set in Step 4.

7. Set the RF/IF gain of the unit under test to minimum.

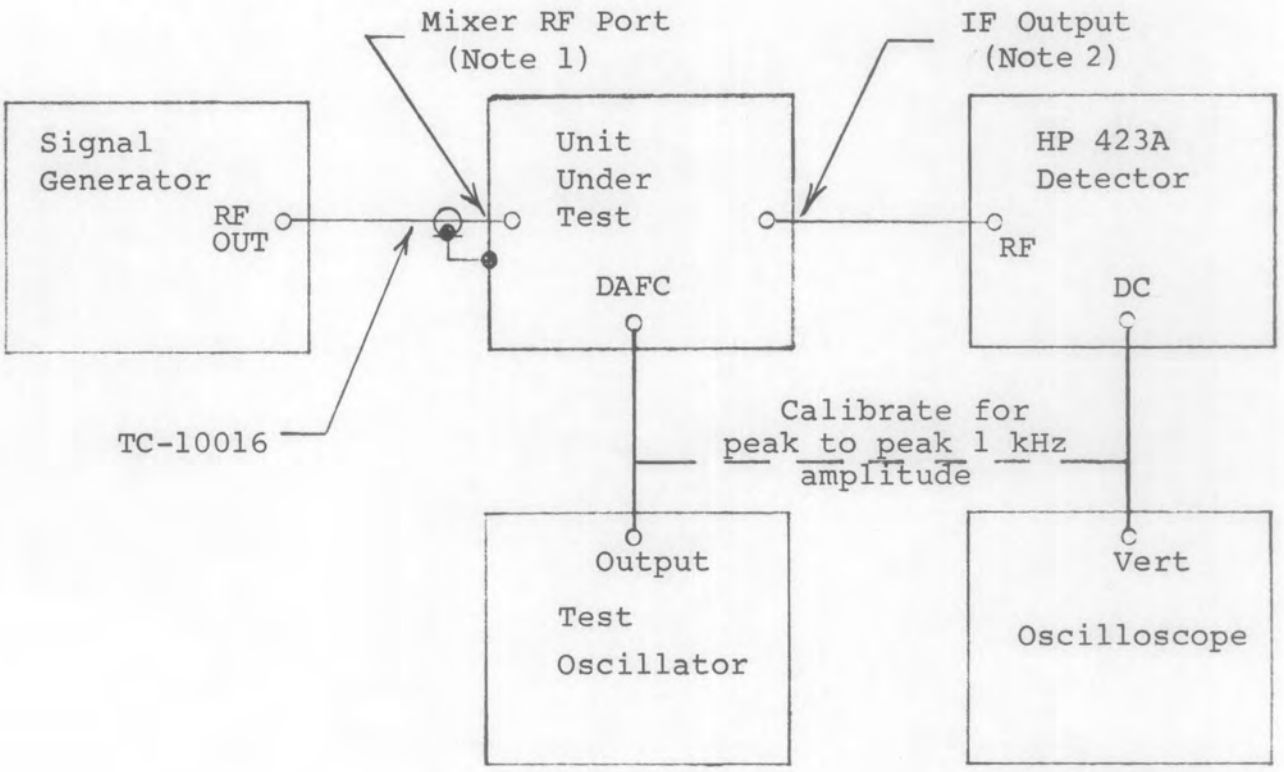
8. Set the BFO control to maximum CCW. Record the BFO frequency as indicated on the frequency counter.

9. Set the BFO control to maximum CW. Record and calculate the difference in the BFO frequency from that in step 8. This is the BFO range and shall be as specified in the test procedure for the unit under test.

METHOD 1012

Unidirectional DAFC/Fine Tuning

1. Equipment Set-up



2. Procedure

1. Complete oscillator alignment of the unit under test as specified in the equipment alignment procedure. (Note 2)

2. Set fine tuning control of the unit under test to maximum CCW or as specified in the equipment test procedure.

3. Set the signal generator for CW operation at the low band-edge frequency of the unit under test at an output level of 0 dBm. (Note 1)

4. Set the oscilloscope controls for Normal Sweep - .2 mSec/CM, Vertical Sensitivity - 5 mV/CM, Input - DC. Position the trace at top of oscilloscope graticule.

5. Tune the unit under test to the signal generator frequency and readjust signal generator output level for a full scale deflection on the oscilloscope.

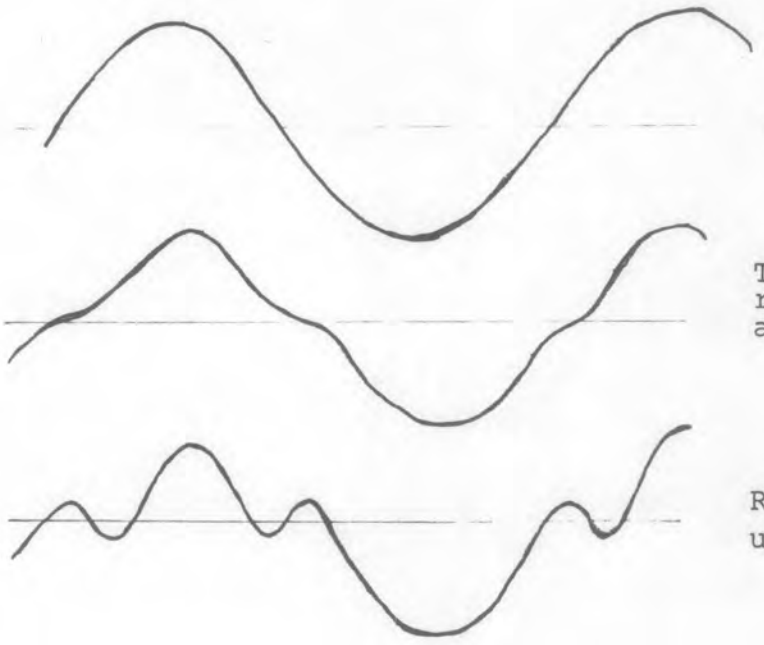
6. Adjust the signal generator <u>frequency</u> until the oscilloscope deflection is at 1/2 scale.

7. Set the test oscillator for a 1 kHz 8 Vp-p sine wave at the DAFC input to the unit under test or as otherwise specified in the equipment test procedure.

8. An IF Slope detected sine wave of the frequency modulated LO should be displayed on the oscilloscope.

9. Slowly tune the signal generator and unit under test through the entire band while observing the slope detected response at 1/2 scale deflection on the oscilloscope. (Adjust the signal generator output level as necessary to maintain full scale deflection at the IF center frequency)

10. The waveshape should remain nearly sinusoidal throughout the tuning range of the unit under test with no reversal as indicated below.



3. Notes

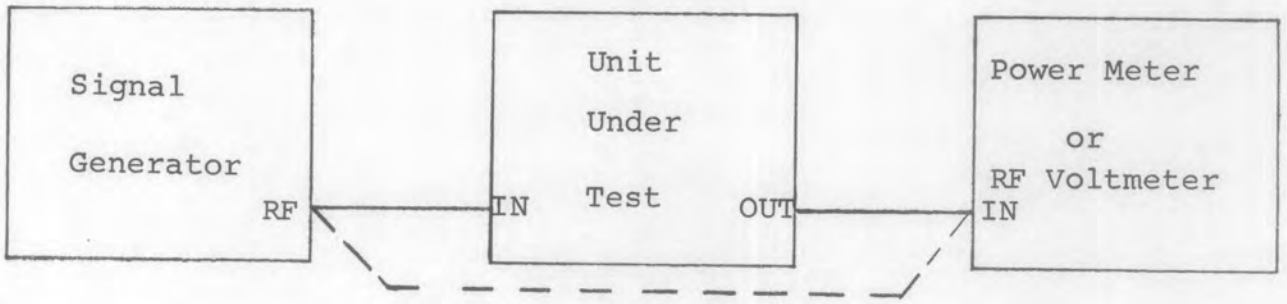
1. RF input to tuner can be used at lower power levels where RF alignment has been completed.

2. IF alignment must be completed prior to performing test.

METHOD 1013

Insertion Loss Measurement - CW Method

1. Equipment Setup



2. Procedure

1. Connect equipment as shown by the dashed lines above, i.e., the signal source output directly to the indicator input. Use the same cables as will be used for the test, substituting a "barrel" connector for the unit under test.

2. Set the signal source output frequency and level as specified in the equipment test procedure.

3. Note the level indicated on the meter. [1]

4. Remove the "barrel" connector and connect the equipment to the unit under test as shown by the solid lines above.

5. The decrease in meter reading is the insertion loss of the unit under test. In some cases it may be necessary to change scales on the indicator or increase the source output level, but in any case, the decrease in meter reading plus the increase in source output level is the insertion loss.

3. Notes

1. Assuming that the output and input impedances of the test equipments are equal, the meter indication should be equal to the source output level. Because of equipment calibration tolerances this will seldom be true. It is permissable to slightly adjust the source output level so as to obtain a convenient reference on the meter.