HEWLETT PACKARD

HP 4934A
Transmission Impairment Measuring Set
Operating and Calibration Manual

CERTIFICATION

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Bureau of Standards, to the extent allowed by the Bureau's calibration facility, and to the calibration facilities of other International Standards Organization members.

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HP 4934A Transmission Impairment Measuring Set

Operating and Calibration Manual

SERIAL NUMBERS

This manual applies directly to instruments
with serial numbers prefixed 2830U.
For additional important information about serial numbers,
see INSTRUMENTS COVERED BY MANUAL in Chapter 3.

HP Part No. 04934-90000
HP Fiche No. 04934-90025
Printed in U.K. September 1988

WARNING

READ THE FOLLOWING NOTES BEFORE INSTALLING OR SERVICING ANY INSTRUMENT.

1. IF THIS INSTRUMENT IS TO BE ENERGISED VIA AN AUTO-TRANSFORMER MAKE SURE THAT THE COMMON TERMINAL OF THE AUTO-TRANSFORMER IS CONNECTED TO THE NEUTRAL POLE OF THE POWER SOURCE.

2. THE INSTRUMENT MUST ONLY BE USED WITH THE MAINS CABLE PROVIDED. IF THIS IS NOT SUITABLE, CONTACT YOUR NEAREST HP SERVICE OFFICE. THE MAINS PLUG SHALL ONLY BE INSERTED IN A SOCKET OUTLET PROVIDED WITH A PROTECTIVE EARTH CONTACT. THE PROTECTIVE ACTION MUST NOT BE NEGATED BY THE USE OF AN EXTENSION CORD (POWER CABLE) WITHOUT A PROTECTIVE CONDUCTOR (GROUNDING).

3. BEFORE SWITCHING ON THIS INSTRUMENT:

   (a) Make sure the instrument input voltage selector is set to the voltage of the power source.

   (b) Ensure that all devices connected to this instrument are connected to the protective (earth) ground.

   (c) Ensure that the line power (mains) plug is connected to a three-conductor line power outlet that has a protective (earth) ground. (Grounding one conductor of a two-conductor outlet is not sufficient).

   (d) Check correct type and rating of the instrument fuse(s).

Contents

HP 4934A Transmission Impairment Measuring Set
and Accessories Suppied

Instrument Description

The HP 4934A is a wideband (20 Hz to 110 kHz) Transmission Impairment Measuring Set (TIMS). The transmission impairment measurements which can be made are listed below.

Level Frequency

Noise

Noise with Tone

Signal to Noise

Impulse Noise

P/AR (Peak to Average Ratio)

Noise to Ground

The HP 4934A can make measurements directly on leased lines or on dial-up lines. It has loop holding capability, a monitor speaker and butt-in connection (useful for talking to the far end of the test line).

There are four permanently stored frequencies 404 Hz, 1004 Hz, 2804 Hz and 2713 Hz. Any other four frequencies may be temporarily assigned and stored by the user.

The HP 4934A can test circuits using single frequency (SF) signaling - use the SF SKIP feature. SF SKIP prevents the HP 4934A from transmitting signaling frequencies in the range 2600 Hz $\pm$150 Hz.

1

Getting Started

Introduction

This chapter aims to get you ready to make measurements. It takes you through switch-on, introduces operating features and provides simple procedures to demonstrate how easy the HP 4934A is to use.

Switch-On

Caution

Before connecting the instrument to the ac power source, ensure that a fuse of the correct rating is installed (refer to INSTALLATION section).

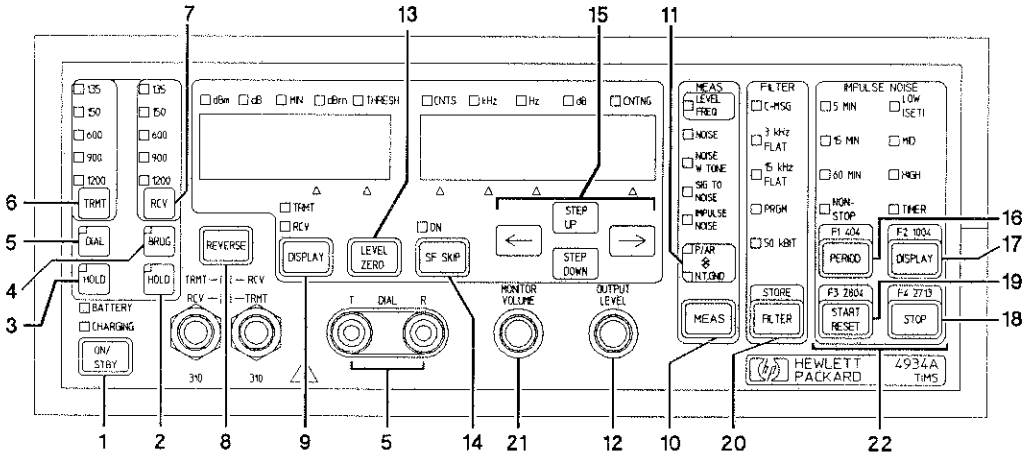
Switch on the HP 4934A by pressing the ON/STBY key.

The instrument automatically does a self-test check at power on (takes approximately 10 seconds). During this time all front panel indicators and displays will light (except for the CHARGING and BATTERY indicators).

When the self-test is complete the instrument starts measuring LEVEL FREQ. Both display windows momentarily blank, then a minus sign "−" and period "." appear in the left window, followed by the transmitter level (in dBm). The right window displays 1004 Hz.

If any of the self tests fail at power-on, an error code (see Page 1-7) is displayed briefly in the right window during self-test.

Front Panel Features



1. ON/STBY powers up the complete instrument. In the STBY (standby) mode, only some circuits have power. When a battery is fitted the ON/STBY key has the following indicators associated with it:

   BATTERY - indicates the instrument is powered from the internal battery. During battery operation, connect the chassis terminal on the side panel to earth ground.

   CHARGING - indicates the instrument is in the STBY (standby) mode with ac power connected and the battery is charging.

2. HOLD (RCV) connects the receive hold circuit to the RCV port when testing dial-up lines.

3. HOLD (TRMT) connects the transmit hold circuit to the TRMT port when testing dial-up lines.

4. BRDG selects a high input impedance (> 50 kΩ), for testing lines that are already terminated. In BRDG (bridged) mode, it is still necessary to use the RCV key to select the terminating impedance for the line you are testing. This ensures that the HP 4934A will display the correct results.

5. DIAL connects the T (tip) and R (ring) DIAL binding posts to the TRMT port (transmitter disconnected). To test a dial-up line or talk over the test line, connect a butt-in to the T and R DIAL binding posts.

6. TRMT selects the transmitter source impedance.

7. RCV selects the receiver terminating impedance or, in bridged mode, selects the impedance of the circuit under test.

8. REVERSE interchanges the TRMT and RCV function of the two 310 ports. The indicators above the ports show the current function.

9. DISPLAY selects either the received or transmitted parameters for display. The TRMT and RCV indicators above the DISPLAY key show which parameters are being displayed.

10. MEAS selects the following measurements:

    LEVEL FREQ
    NOISE
    NOISE W TONE
    SIG TO NOISE
    IMPULSE NOISE
    P/AR N.T. GND

11. P/AR N.T.GND switches between the P/AR and Noise-to-Ground measurement. When this key is used there is about a 10 second delay before the instrument starts measuring; also the stored frequencies F1 to F4 and the SF SKIP center frequency revert to their normal switch-on values.

12. OUTPUT LEVEL sets the transmitter output level.

13. LEVEL ZERO allows relative level measurements in the LEVEL FREQ mode. The displayed received signal becomes the 0 dB reference when you press LEVEL ZERO. All subsequent results are relative to this reference. The displayed results are a measure of loss, that is a higher level than the reference is indicated by a "−" sign. This is standard in the telephone industry.

14. [SF SKIP] prevents the instrument from transmitting signaling frequencies in the range 2600 Hz ±150 Hz. If SF SKIP is enabled the instrument automatically prevents the selection of frequencies in this range. You can also change the SF SKIP center frequency, see Page 2-10.

15. [STEP UP], [STEP DOWN], [→] and [←] change the transmit frequency value in the LEVEL FREQ mode or the low threshold in the IMPULSE NOISE mode.

    Use [→] and [←] to select the digit to change. The selected digit is highlighted by a lit pointer. Change the value of the selected digit using the [STEP UP] and [STEP DOWN] keys.

16. [PERIOD] selects one of the four Impulse Noise measurement periods.

17. [DISPLAY] displays the Impulse Noise measurement time or threshold/count values. Only the LOW (SET) threshold value can be changed, see Page 2-22.

18. [STOP] allows the Impulse Noise measurement to be stopped without affecting the Impulse Noise counter.

19. [START RESET] sets the Impulse Noise counter to zero and starts the Impulse Noise measurement.

20. [FILTER] selects one of the filters in the noise measurement modes.

    C-MSG
    3 kHz FLAT
    15 kHz FLAT
    PRGM
    50 kBIT

21. MONITOR VOLUME controls the volume of the monitor speaker.

22. In the LEVEL FREQ mode, the blue keys F1 to F4 select preset frequencies. At switch-on these frequencies are:

    F1 404 Hz
    F2 1004 Hz
    F3 2804 Hz
    F4 2713 Hz

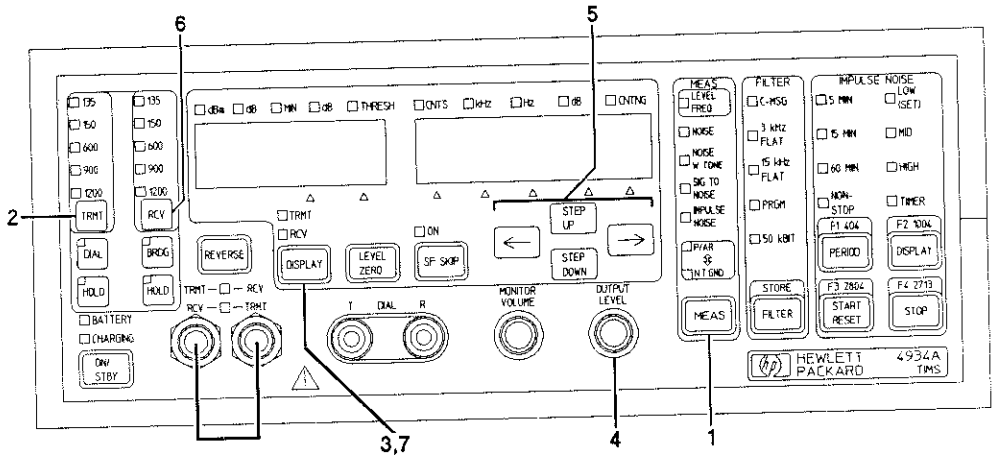
    New frequencies can be assigned to F1 to F4, see Page 2-9.

Demonstrating the HP 4934A

The following demonstrations show how easy the HP 4934A is to use. A detailed explanation of the HP 4934A measurement capability is given in Chapter 2. The HP 4934A TRMT and RCV ports are connected by a looping cable in these demonstrations.

Demonstration 1

A single tone measurement with the transmitter set to −10 dBm and the frequency set to 1804 Hz.



1. Use **MEAS** to select LEVEL FREQ.

   TRANSMITTER

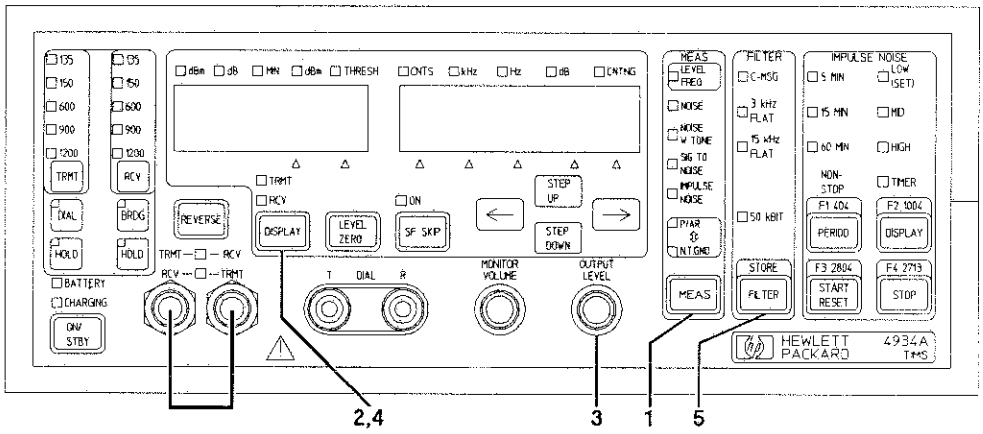
2. Use the **TRMT** key to set the transmitter impedance to 600Ω.
3. Display the transmitted level and frequency using the **DISPLAY** key (TRMT indicator lit).
4. Use the OUTPUT LEVEL control to adjust the transmitted level to −10 dBm.
5. Change the transmitted frequency to 1804 Hz using the →, ←, **STEP UP** and **STEP DOWN** keys.

RECEIVER

6. Use the **RCV** key to set the receiver impedance to 600Ω.
7. Display the received level and frequency using the **DISPLAY** key (RCV indicator lit).

Demonstration 2

A noise-with-tone measurement with the holding tone set to −13 dBm and the C-Message filter selected.



1. Use the **MEAS** key to select NOISE W TONE.

   TRANSMITTER

2. Display the transmitted level and frequency using the **DISPLAY** key (TRMT indicator lit). Level in dBm is in the left window. The frequency (fixed at 1004 Hz) is in the right window.
3. Set the level to −13 dBm using the OUTPUT LEVEL control.

   RECEIVER

4. Display the received noise level using the **DISPLAY** key (RCV indicator lit).
5. Select the C-MSG filter using the **FILTER** key.

6. Read the weighted noise in dBrnC in the left window. The received frequency is in the right window.

Error Codes

The error codes are described in the following table:

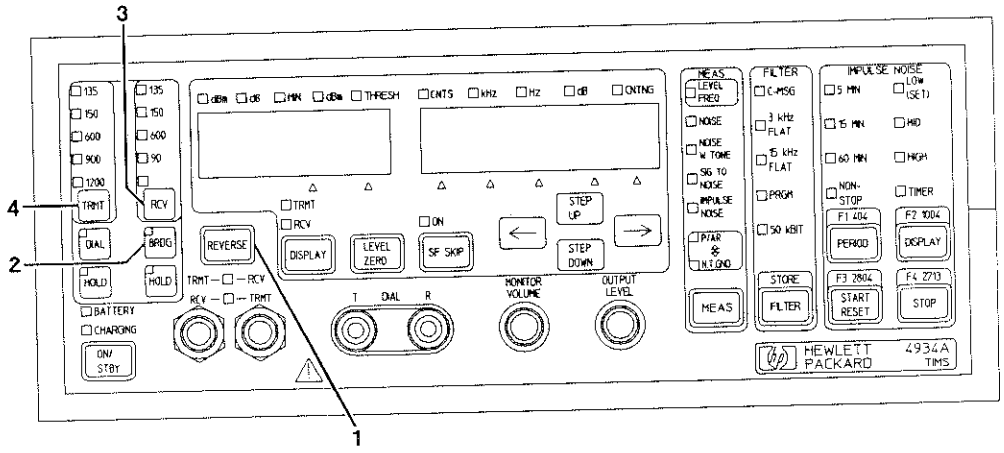
Code	Description
Err 1 to Err 6	Instrument faulty, see Service Manual.
Err 7	Received holding tone level too high or too low - check transmitted level or circuit under test.
Err 8	Impulse Noise threshold set too high - adjust.
"–" sign in right window	Loss of holding tone during Impulse Noise measurement - only a warning, the instrument continues counting.

2

Making Measurements

Preliminary Setup

Connecting the HP 4934A to the Test Circuit



Caution Ensure no more than 200V dc or 10V rms at 60 Hz is connected between tip and ring of the TRMT or RCV jacks.

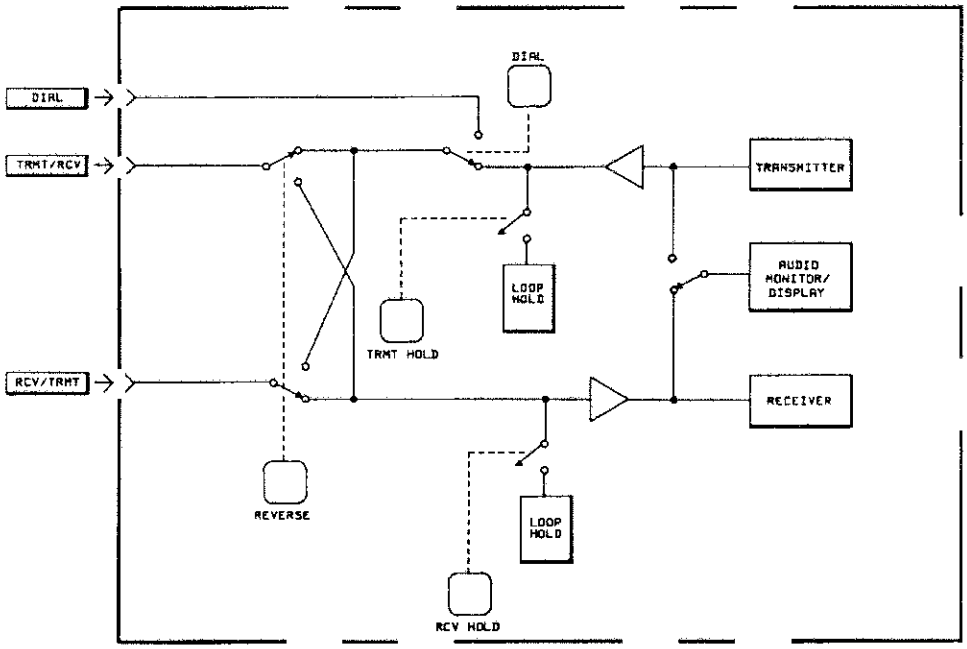
1. The two 310-type jacks of the HP 4934A can function as a Transmitter output or Receiver input. Pressing the **REVERSE** key causes the function of the two 310-type jacks to be reversed. The current function of the ports is indicated by the indicators below the **REVERSE** key.
2. If the line to be tested is already terminated, press **BRDG**.

3. Select the receiver input impedance using the RCV key - 135, 150, 600, 900 or 1200Ω. When operating in BRDG (bridged) mode, still ensure the correct impedance is selected.
4. Select the transmitter output impedance using the TRMT key - 135, 150, 600, 900 or 1200Ω.

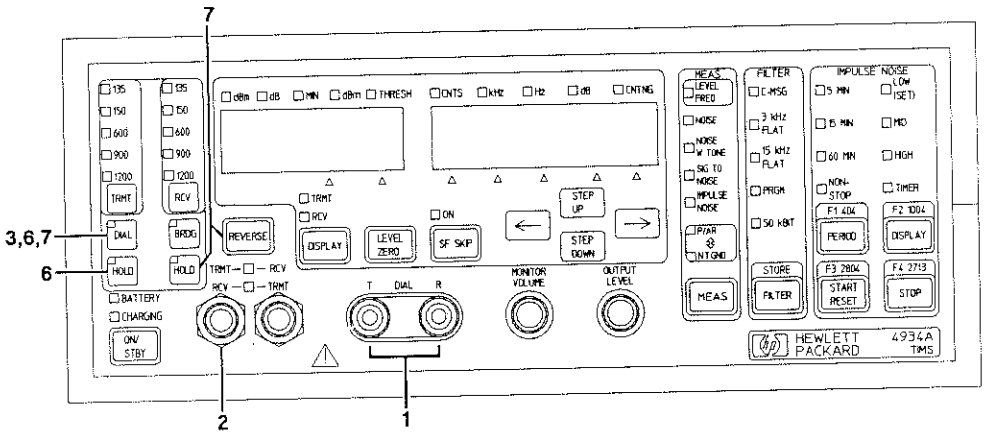
Dial and Hold

The HP 4934A can be used with a butt-in to dial up lines or for talking along a line. The HP 4934A can hold lines which require a DC current to maintain the connection once the butt-in is disconnected.

The diagram below shows how the hold, dial and reverse functions work.

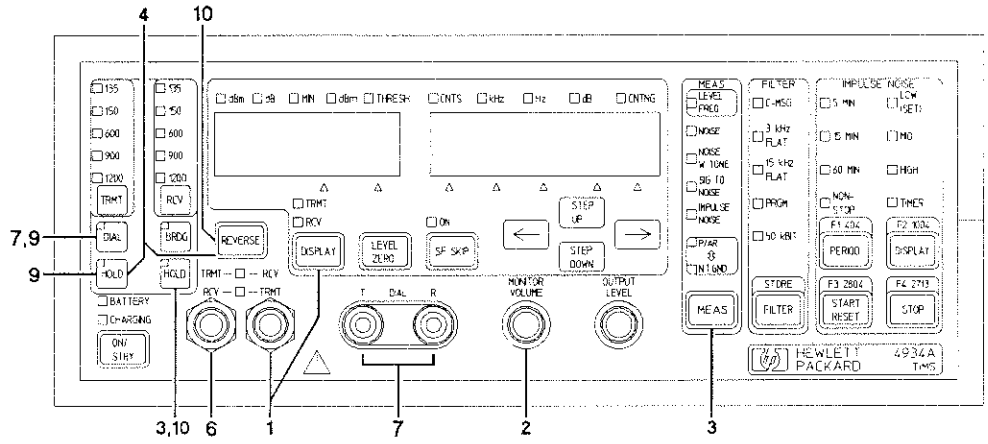


Dialing using the HP 4934A and a Butt-in



1. Connect the butt-in to the T and R DIAL binding posts.
2. Connect the test circuit to the TRMT port.
3. Select DIAL to connect the butt-in through to the TRMT port . The DIAL indicator will light.
4. Dial up the line you want using the butt-in.
5. When the far end goes off-hook you can use the butt-in for voice communication.
6. To continue to hold the line and connect the HP 4934A transmitter to it, select TRMT HOLD then DIAL. You can now transmit test signals along the line. To re-establish the speech path, press **DIAL**. To drop the line, press TRMT **HOLD**.
7. Alternatively, to continue to hold the line and connect the HP 4934A receiver to it, select RCV HOLD then REVERSE. You can now receive test signals from the line. To re-establish the speech path, press **REVERSE** and **DIAL**. To drop the line, press RCV **HOLD**.

Receiving an Incoming Call and Holding the Line



Without a Butt-in

1. Connect the RCV port to the test line. Use the **DISPLAY** key to light the RCV indicator.
2. Adjust the volume of the audio monitor (so that you can hear any received signal) using the MONITOR VOLUME control.
3. When a call comes in, you will hear a *buzzing* on the audio monitor. To seize the line, press RCV **HOLD**. The caller can now speak to you or transmit test signals. To make measurements, use **MEAS** to select the appropriate measurement.
4. To transmit test signals while continuing to hold the line, press TRMT **HOLD** then **REVERSE**.
5. To drop the line, press the appropriate **HOLD** key.

With a Butt-in (if you want to talk)

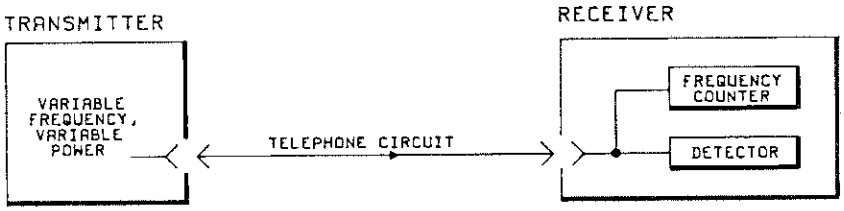
6. Connect the TRMT port to the test line.
7. Connect the butt-in to the T and R DIAL binding posts and press **DIAL** to connect the butt-in through to the TRMT port. The DIAL indicator will light.

8. When you receive a call, the butt-in will ring. Go off-hook to receive the call.
9. To connect the HP 4934A transmitter to the line, select TRMT HOLD then DIAL. You can now transmit test signals along the line. To re-establish the speech path, press [DIAL]. To drop the line, press TRMT [HOLD].
10. Alternatively, to connect the HP 4934A receiver to the line, press RCV [HOLD] then [REVERSE]. You can now receive test signals from the line. To re-establish the speech path, press [REVERSE]. To drop the line, press RCV [HOLD].

Level and Frequency

Principles

LEVEL/FREQUENCY encompasses 4 related measurements: loss, attenuation distortion, gain slope and frequency. All use the same measurement configuration.



1004 Hz Loss

This measurement is used to determine the point-to-point loss (or gain) of a channel at 1004 Hz. 1004 Hz is transmitted instead of 1000 Hz to avoid measurement errors caused by signals which are submultiples of the 8 kHz PCM sample rate.

1. The transmitter sends 1004 Hz at the nominal data level (usually −13 dBm0).
2. The receiver measures the level and frequency of the received signal. The loss is the difference between the transmitted and received levels.

Note

If the channel is already terminated, the receiver can measure the level via a high impedance input (bridging mode).

Attenuation Distortion

Attenuation distortion defines the flatness and usable bandwidth of the circuit.

1. The transmitter usually sends 1004 Hz at the nominal data level. The level received at this frequency is set as the reference level.
2. The transmitter is stepped through a range of spot frequencies over the channel bandwidth. At each frequency, the receiver displays the difference between the level at the reference frequency and the level received.

Gain Slope

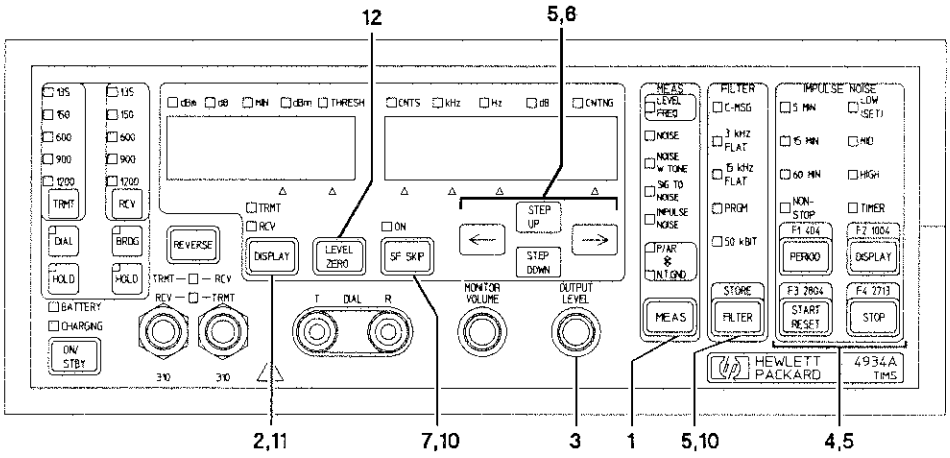
This a quick method for assessing the flatness of a channel using only three frequencies, two of which are close to the edges of the channel bandwidth. The level measured at 1004 Hz is the reference level; then the attenuation is measured at 404 Hz and 2804 Hz relative to the reference level.

Frequency

Frequency shift can occur over facilities such as FDM carrier systems and is measured by comparing the frequency sent into the channel with the frequency received at the far end of the channel.

Note

The calculation of frequency shift may not be valid when measured on looped-around carrier facilities since the frequency shift in one direction may be canceled by frequency shift in the return direction.



1. Use **MEAS** to select LEVEL FREQ.

   TRANSMITTER

2. Display the transmitted level and frequency using the **DISPLAY** key (the TRMT indicator will be lit). A frequency of 1004 Hz is initially transmitted each time LEVEL FREQ is selected.

3. Change the transmitted level if desired, using the OUTPUT LEVEL control (the level in dBm is in the left window).

Note

In some systems it is not desirable to transmit levels above −13 dBm0 as interference with other channels may occur.

Decide whether you want to use a preset frequency or some other frequency.

Preset Frequency

In the LEVEL FREQ mode, the blue keys give single keystroke access to four preset frequencies. The normal preset frequencies are 404 Hz, 1004 Hz, 2804 Hz and 2713 Hz.

4. To select a preset frequency, press the appropriate blue key.

Key	Normal Frequency
F1	404 Hz
F2	1004 Hz
F3	2804 Hz
F4	2713 Hz

5. To store a different preset frequency:

   Set the new frequency in the right window, using the [→], [←], [STEP UP] and [STEP DOWN] keys.

   Enter the new frequency into one of the stores by pressing the blue [STORE] key followed by the appropriate blue F1 to F4 key.

Note

The normal frequency values are re-established when the power is cycled or when the measurement mode is switched between P/AR and N.T.GND.

Some Other Frequency

6. Change the value of the transmitted frequency in the right window using the [→], [←], [STEP UP] and [STEP DOWN] keys.

Single Frequency (SF) Signaling

7. Press [SF SKIP] to prevent the instrument from transmitting signaling frequencies in the range 2600 Hz ±150 Hz.

Changing the SF Skip Center Frequency

8. Disconnect the transmit side of the line from the test set first to avoid dropping the circuit.
9. Set the new frequency in the right window.
10. Press [STORE], followed by [SF SKIP].

Note

The SF SKIP center frequency 2600 Hz is re-established at power on or when the measurement mode is switched between P/AR and N.T. GND.

RECEIVER

11. Display the received level and frequency using the DISPLAY key (RCV indicator will be lit).

Receiver Reference

12. If attenuation relative to a reference is required, press LEVEL ZERO when the reference signal is present and stable (for attenuation distortion measurements this is normally at 1004 Hz). This changes the level reading from an absolute value in dBm (in the left window) to a relative attenuation value in dB. All subsequent received level readings will be relative to this value. A negative reading "–" indicates a level higher than the reference level.

    Pressing LEVEL ZERO a second time changes the level reading back to absolute units in dBm.

    To change the transmitted frequency return to step 2.

Note

Error Codes will be displayed if the input level to the receiver is too high or unstable (see the error codes in Chapter 1).

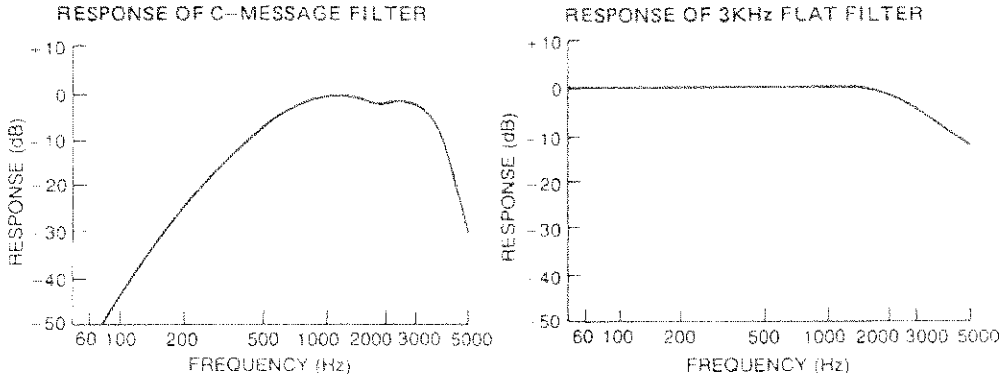
Message Circuit Noise

Principles

The measurement uses no test signal and quantifies background noise with a choice of band limiting filters (C-Message, 3 kHz Flat, 15 kHz Flat, Program and 50 kBit).

C-Message: This filter weights noise in the same way it would be heard by a telephone user. However, it is also used to evaluate the effects of noise on voice-grade data circuits because its response is relatively flat over the frequency range for data transmission.

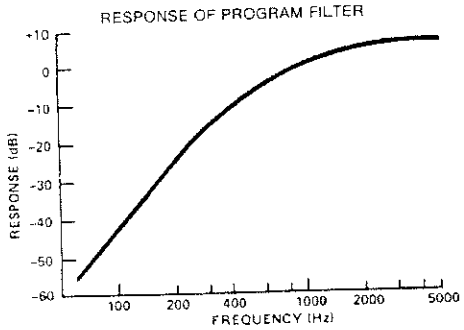
3 kHz Flat: This filter attenuates much less at low frequencies (60 Hz to 500 Hz) than the C-Message filter. By performing a 3 kHz measurement after a C-Message measurement, the effect of low frequency noise (60 Hz commercial power, 20 Hz ringing, etc) can be determined.

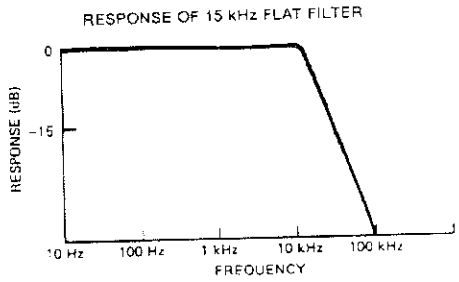


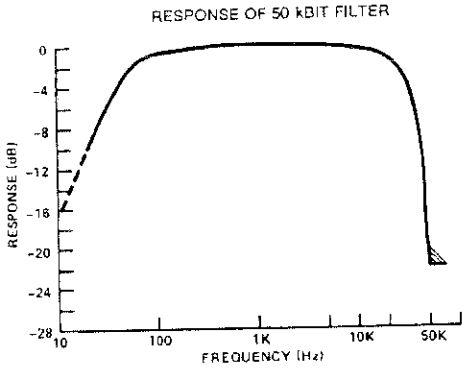
15 kHz Flat: This filter is used when measuring noise on program channels used in the broadcasting industry. Like the 3 kIIz Flat filter, it passes low frequency noise.

Program: This is used when measuring noise on program channels used in the broadcasting industry to communicate between the studio and transmitter site.

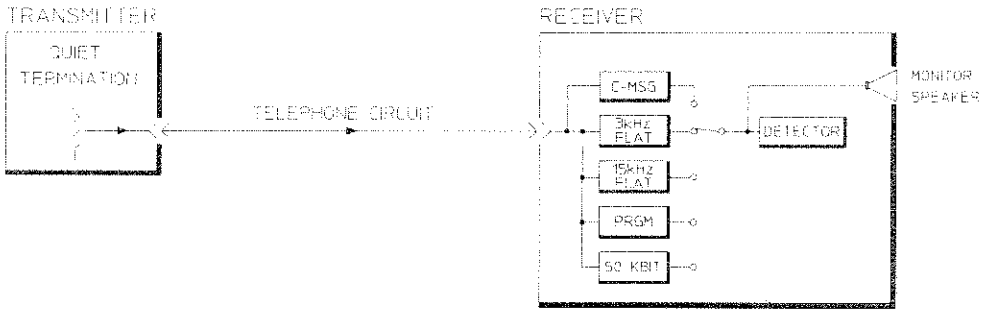
50 kBit: This is a weighted filter used to measure noise on wideband data circuits.



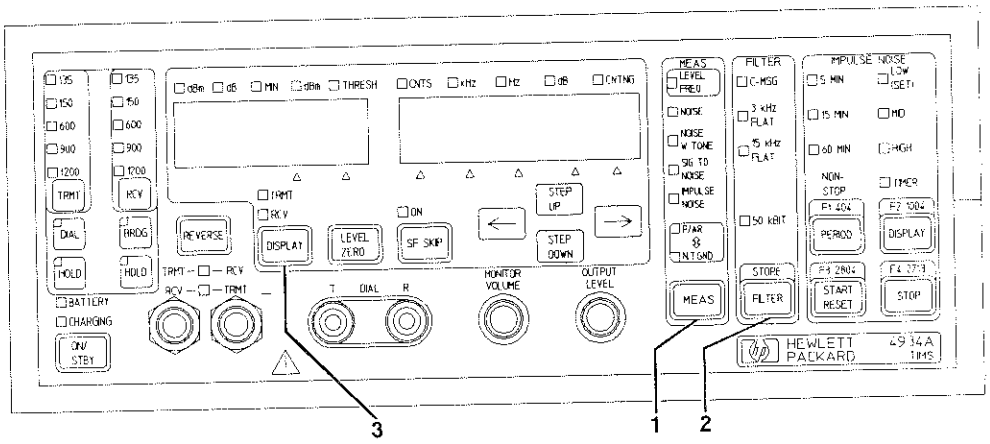




How it is Measured



1. At one end of the line, the transmitter provides a quiet termination of the appropriate impedance.
2. At the other end, the receiver measures the noise via a weighting filter. Noise levels are displayed in dBrn (0dBrn = −90dBm). When the C-Message filter is selected, the noise is in units of dBrnC.



During this measurement the transmitter is quiet terminated (indicated by a decimal point "." in the left window when the display is in TRMT mode).

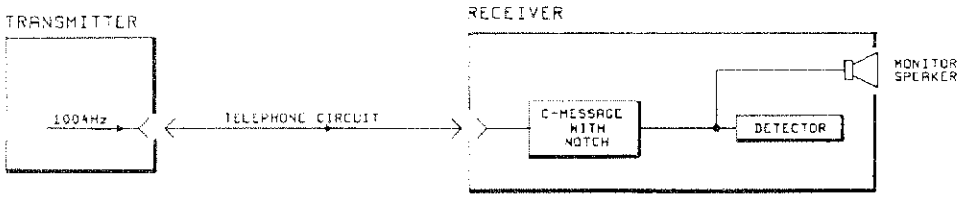
RECEIVER

1. Use **MEAS** to select NOISE.
2. Use **FILTER** to select the required filter.
3. Display the received noise level using the **DISPLAY** key (the RCV indicator will be lit). The noise level, in dBrn, is in the left window. If the C-Message filter is selected the result is in units of dBrnC.

Noise with Tone (Notched Noise)

Principles

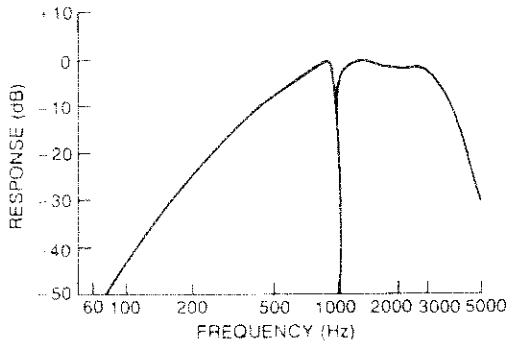
This measurement quantifies total noise which includes background noise and noise generated only when a signal is present, such as when the circuit includes compandors and/or quantizers.

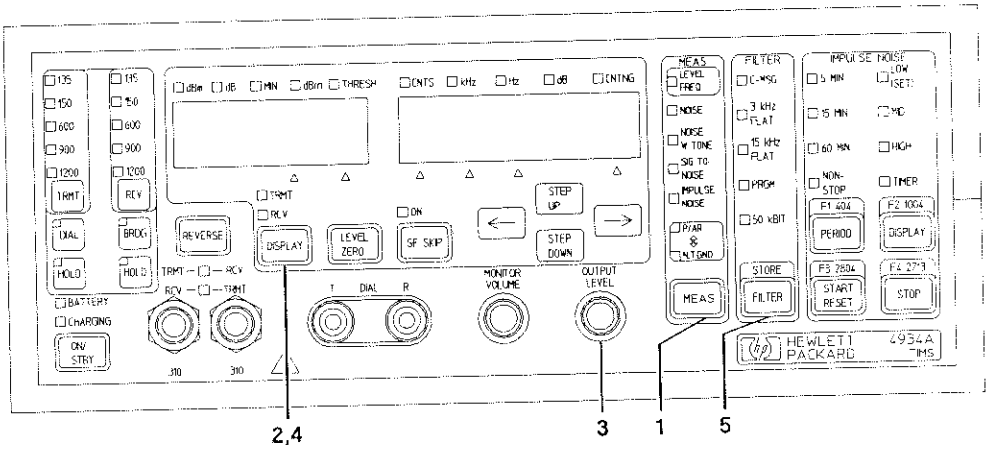


How it is Measured

1. The transmitter sends a 1004 Hz holding tone at the nominal data level.
2. The receiver notches out the 1004 Hz holding tone and what is left is measured via a weighting filter (C-Message, 3 kHz Flat, 15 kHz Flat, Program or 50 kBit). The measured noise level is displayed in dBrn (0 dBrn = − 90 dBm). When the C-Message filter is used, the result is in units of dBrnC. The notch attenuates all frequencies in the range 995 Hz to 1025 Hz by at least 50 dB.

FREQUENCY RESPONSE = C - MESSAGE FILTER WITH 1004Hz NOTCH





1. Use **MEAS** to select NOISE W TONE.

   TRANSMITTER

2. Display the transmitted level and frequency using the **DISPLAY** key (the TRMT indicator will be lit). The level, in dBm, is in the left window. The frequency in the right window is fixed at 1004 Hz.

3. Set the transmitted level to the nominal data level using the OUTPUT LEVEL control.

   RECEIVER

4. Display the received noise level using the **DISPLAY** key (the RCV indicator will be lit).

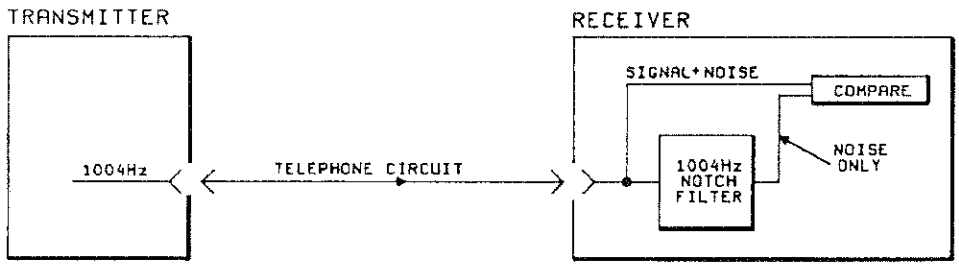
5. Select the required filter using the **FILTER** key.

6. Read the weighted noise in dBrn, in the left window. If the C-Message filter is selected, the result is in dBrnC. The received frequency is displayed in the right window.

Signal to Noise

Principles

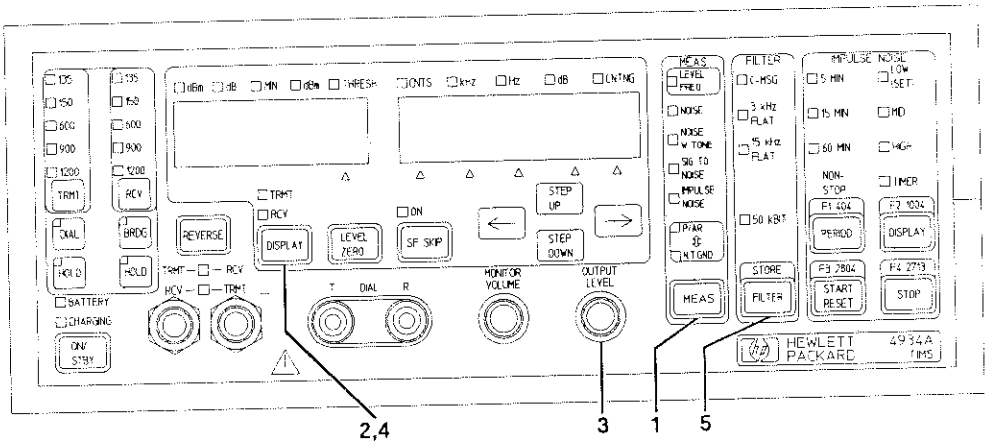
The signal-to-noise measurement determines the ratio of received signal-plus-noise power to noise power and gives a measure of the margin between the data signal and the background noise.



$$\text{SIGNAL-TO-NOISE RATIO} = 10 \log \frac{(\text{SIGNAL POWER} + \text{NOISE POWER})}{\text{NOISE POWER}}$$

How it is Measured

1. The transmitter sends a 1004 Hz holding tone at the nominal data level.
2. The receiver notches out the 1004 Hz holding tone and what is left is measured via a filter (C-Message, 3 kHz Flat, 15 kHz Flat, Program or 50 kBit) then compared with the original signal-plus-noise. The computed ratio is displayed in dB.



1. Use **MEAS** to select SIG TO NOISE.

   TRANSMITTER

2. Display the transmitted level and frequency using the **DISPLAY** key (the TRMT indicator will be lit). Level, in dBm, is in the left window. The frequency (fixed at 1004 Hz) is in the right window.

3. Set the transmitted level to the nominal data level using the OUTPUT LEVEL control.

   RECEIVER

4. Display the received signal-to-noise ratio using the **DISPLAY** key (the RCV indicator will be lit).

5. Select the required filter using the **FILTER** key.

6. Read the signal-to-noise ratio in dB in the right window and the level of the received tone in dBm in the left window.

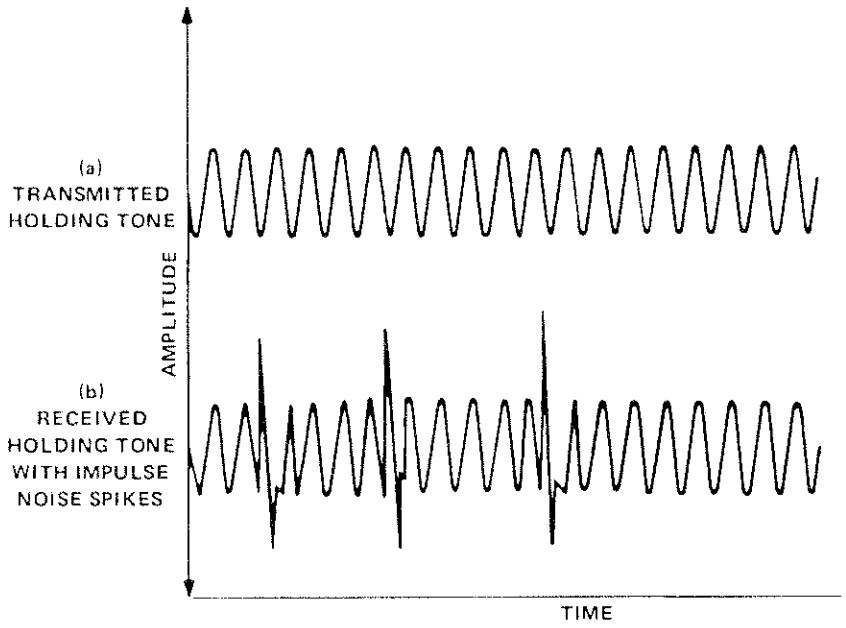
Impulse Noise

Principles

Impulse noise includes noise spikes like the clicks and pops often heard on a telephone line. The spikes are much higher in level than the background noise and, generally, last less than one millisecond.

The impulse noise measurement counts the number of noise spikes against 3 threshold levels simultaneously. The low level threshold is selectable; the medium and high thresholds are fixed at 4 dB and 8 dB above the low threshold.

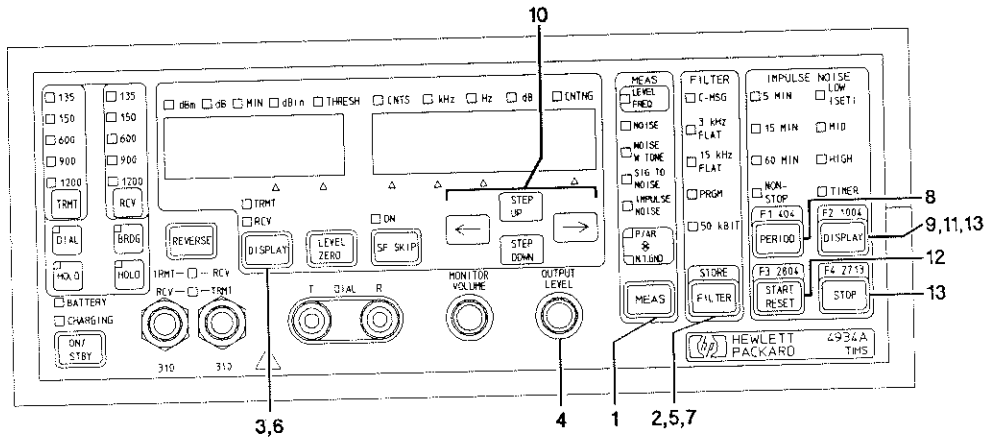
The waveform (b) below illustrates a received holding tone (or test tone) that includes interfering impulse noise spikes.



The HP 4934A measures impulse noise with or without a holding tone. The HP 4934A transmits a holding tone and uses the notch filter in the receiver when either the C-Message or 3 kHz Flat Filter is selected. With the 15 kHz

Flat, Program or 50 kBit Filter selected, the transmitter is quiet terminated and the receiver notch filter is not selected.

Instrument Operation



1. Use **MEAS** to select IMPULSE NOISE.

   TRANSMITTER

   To measure Impulse Noise with a holding tone, go to step 2. To measure Impulse Noise without a holding tone, go to step 5.

   Impulse Noise with a Holding Tone

2. Select either the C-Message or 3 kHz Flat Filter using the **FILTER** key.

3. Display the transmitted level and frequency using the **DISPLAY** key (the TRMT indicator will be lit). Level, in dBm, is in the left window. The frequency (fixed at at 1004 Hz) is in the right window.

4. Set the transmitted level to the nominal data level using the OUTPUT LEVEL control.

   Impulse Noise without a Holding Tone

5. Select either the 15 kHz Flat, PRGM or 50 kBit Filter using the **FILTER** key. The transmitter is quiet terminated (indicated by a decimal point in the left window when the display is in TRMT mode).

RECEIVER

6. Use [DISPLAY] to select the RCV display mode.

7. Select the required filter using the [FILTER] key. If you are doing a loopback test, the filter selection has already been made in the transmitter procedure.

Setting the Impulse Noise Measurement Period

8. Use the [PERIOD] key to select a timed measurement (5, 15 or 60 minutes) or non-stop.

Setting the low Impulse Noise Threshold

9. Use the Impulse Noise [DISPLAY] key to select LOW (SET). The current threshold value will appear in the left window (the THRESH and dBrn indicators will be lit).

10. Use the [→], [←], [STEP UP] and [STEP DOWN] keys to set the threshold value.

Note

If a holding tone exists on the line:

To maintain measurement accuracy, the impulse "low" threshold should be no more than 25 dB below the holding tone level.

---

11. Use the Impulse Noise [DISPLAY] key to display the resulting MID and HIGH threshold values. These are 4 dB and 8 dB greater than the low threshold value up to a limit of 109 dBrn.

Starting/Stopping the Measurement

12. Press [START RESET] to set the impulse noise counters to zero (the CNTS and CNTNG indicators will light) and start the measurement.

13. Use the IMPULSE NOISE [DISPLAY] key to select TIMER.

If you select a timed measurement (5, 15 or 60 minute period) in step 8, when you press [START RESET] the time shown in the left window will decrement in 1 minute intervals to zero - the measurement then automatically stops.

If you select NON-STOP in step 8, when you press START RESET the time starts from zero and increments in one minute intervals. Press STOP to end the measurement.

Note

During a timed measurement you can check the current LOW, MID and HIGH threshold count by using the DISPLAY key. After checking the counts ensure that the instrument is set to TIMER again.

14. When the measurement is complete the impulse noise count is in the right window (the CNTS indicator will be lit). A "–" sign in the right window indicates a loss of received holding tone (impulse noise with holding tone measurement only).

Note

Selecting a new filter during the measurement causes the measurement to stop running.

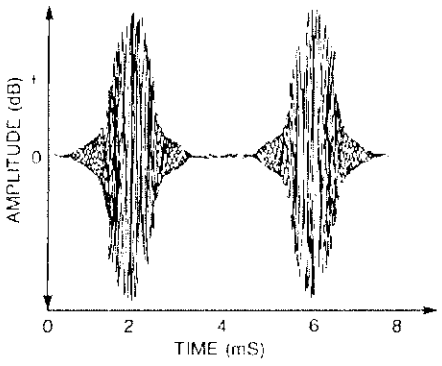
P/AR (Peak to Average Ratio)

Principles

P/AR is a good quick measure of the combined effect of impairments which produce intersymbol interference on a data signal (for example, phase/delay distortion, attenuation distortion, intermodulation distortion and noise).

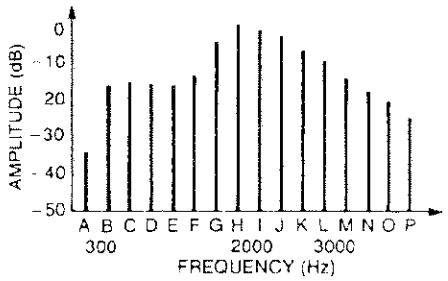
P/AR cannot determine which impairment is causing the problem - its value is primarily as a benchmark measurement to show up degradations with time in the transmission quality of a line.

A deviation of more than 4 P/AR units from the benchmark value usually indicates that some characteristic of the channel has changed significantly.



P/AR WAVEFORM

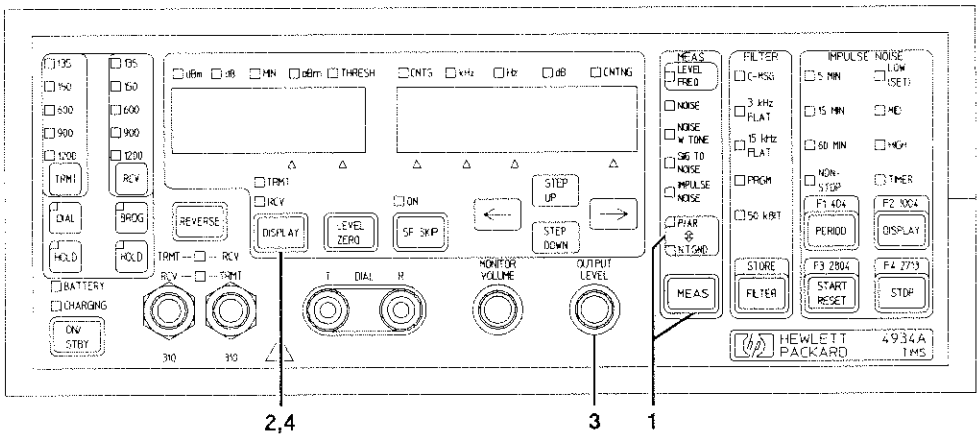
KEY	FREQUENCY	KEY	FREQUENCY
A	140.625 Hz	I	2140.625 Hz
B	390.625	J	2390.625
C	640.625	K	2640.625
D	890.625	L	2890.625
E	1140.625	M	3140.625
F	1390.625	N	3390.625
G	1640.625	O	3640.625
H	1890.625	P	3890.625



P/AR SPECTRUM

How it is Measured

1. The transmitter sends a complex signal which approximates a modem signal (16 frequencies with a known envelope shape).
2. From the received signal envelope, the receiver calculates the peak-to-average ratio. This is compared with the known peak-to-average ratio of the transmitted signal. A scaling factor ensures that a P/AR of 100 indicates no signal degradation.



1. Use **MEAS** to select P/AR or N.T. GND. If the instrument is currently in N.T.GND mode, use the **P/AR N.T.GND** key to select P/AR - there will be a 10 second delay before the HP 4934A starts measuring.

Note

The SF SKIP center frequency and the F1 to F4 stored frequencies revert to their normal values if the **P/AR N.T. GND** key is used. Therefore, in a sequence of tests, it is better to do P/AR and N.T. GND last.

TRANSMITTER

2. Display the transmitted P/AR signal level (in dBm) in the left window using the **DISPLAY** key (the TRMT indicator will be lit).

3. Set the transmitted level to the nominal data level using the OUTPUT LEVEL control.

RECEIVER

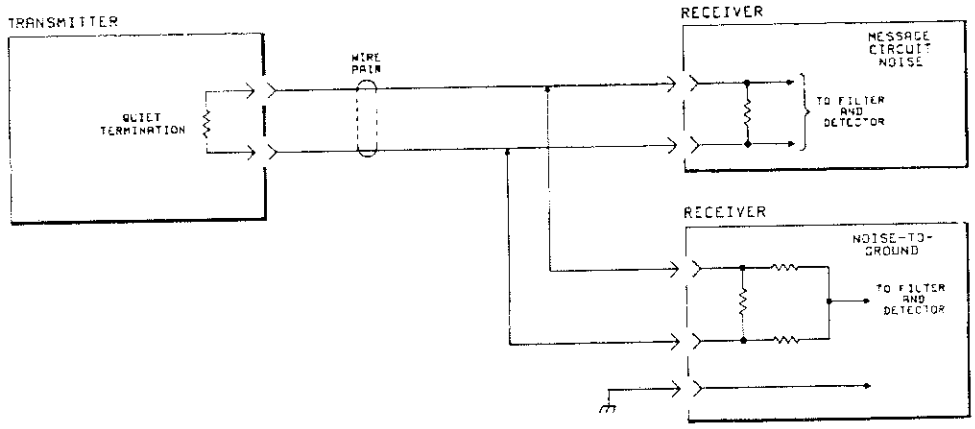
4. Display the received signal level in the left window and the P/AR reading in the right window using the **DISPLAY** key (the RCV indicator will be lit).

Noise to Ground

Principles

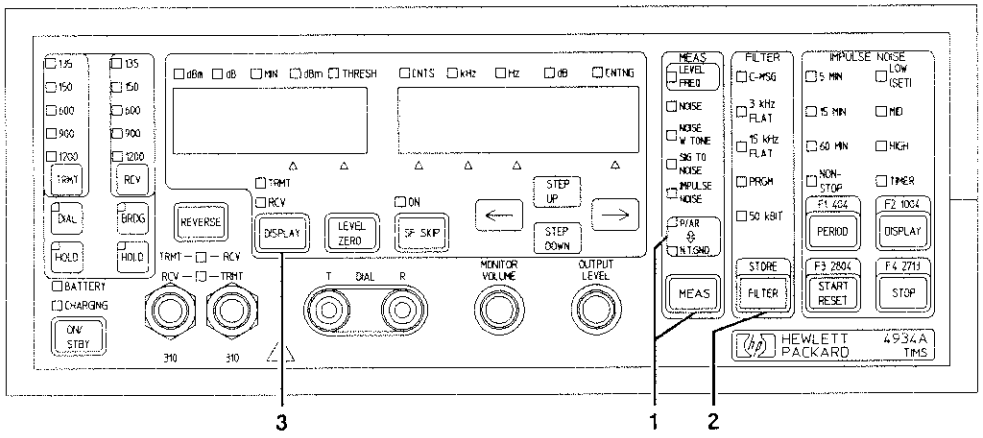
This measurement determines the longitudinal (common mode) noise present on a circuit (with reference to ground) and is a measure of the susceptibility of the circuit to electrical coupling from external interference. Often this interference is power-line related and so is best measured using the 3 kHz Flat filter.

Common mode noise can be converted to transverse noise in the circuit by line imbalance.



How it is Measured

The measurement technique is similar to the message circuit noise measurement but the input configuration is designed to respond to longitudinal signals. The ground used as the signal reference is the sleeve of the test cord, which is also connected to the instrument chassis and the power line ground.



During this measurement the transmitter is quiet terminated (indicated by a decimal point "." in the left window when the display is in the TRMT mode).

RECEIVER

1. Use the **MEAS** key to select N.T. GND or P/AR. If the instrument is in the P/AR mode use the **P/AR N.T.GND** key to select N.T. GND - there will be a 10 second delay before the HP 4934A starts measuring.

Note

The SF SKIP center frequency and the F1 to F4 stored frequencies revert to their normal values if the **P/AR N.T. GND** key is used. Therefore, in a sequence of tests, it is better to do P/AR and N.T. GND last.

---

2. Select the required filter using the **FILTER** key.
3. Display the received noise level using the **DISPLAY** key (the RCV indicator will be lit). The noise level, in dBrn, is in left window. If you select the C-Message filter, the result is in dBrnC.

3

General Information

Introduction

This manual contains information which allows the user to operate and calibrate the Hewlett-Packard Model 4934A Transmission Impairment Measuring Set. An HP 4934A and the accessories supplied are shown at the front of this manual (opposite the instrument description).

On the title page of this manual is a Microfiche Part Number. This number can be used to order 4 X 6 inch microfilm transparencies of the manual. Each microfiche contains up to 96 photo duplicates of the manual pages.

Specification

Instrument specifications are listed on Page 3-4. These specifications are the performance standards or limits against which the instrument is tested.

Safety Considerations

This product is a Safety Class 1 instrument (provided with a protective earth terminal). The instrument and manual should be reviewed for safety markings and instructions before operation. Also read the Warning page at the front of this manual.

Instruments Covered by Manual

Attached to the instrument is a serial number plate. This serial number is in the form XXXXUXXXXX. It is in two parts; the first four digits and the letter are the serial prefix and the last five are the suffix. The prefix is the same for all identical instruments, it changes only when a change is made to the instrument. The suffix however, is assigned sequentially and is different for each instrument. The contents of this manual apply to instruments with the serial number prefix(es) listed under SERIAL NUMBERS on the title page.

An instrument manufactured after the printing of this manual may have a number prefix that is not listed on the title page. The unlisted serial number prefix indicates the instrument is different from those described in this manual. The manual for this new instrument is accompanied by a Manual Changes supplement. This supplement contains "change information" that explains how to adapt the manual to the new instrument.

In addition to change information, the supplement may contain information for correcting errors in the manual. To keep this manual as current and accurate as possible, Hewlett-Packard recommends that you periodically request the latest Manual Changes supplement. The supplement for this manual is identified with the manual print date and part number, both of which appear on the manual title page. Complementary copies of the supplement are available from Hewlett-Packard. For information concerning a serial number prefix that is not listed on the manual title page or in the Manual Changes supplement, contact your nearest Hewlett-Packard office.

Options Available

The following options are available and may have been ordered with the HP 4934A:

Option 001	Rechargeable Ni-Cd battery and charger.
Option 010	Delete Test Cords (two HP 15513A 1m WECO 310-to-WECO 310 cables).

Option 910	Provides an additional copy of the Operating and Calibration Manual and two copies of the Service Manual.
Option 915	Used for ordering a copy of the Service Manual to enable a service trained person to troubleshoot and repair the instrument.
Option W30	3-year Extended Support. W30 is an extended hardware support agreement. It provides 2-year extended hardware support beyond the standard 1-year return to bench warranty.
Option 1A3	For Bell Operating Companies:Provides Bellcore Common Language Equipment Identification (CLEI) compliance (Product and Shipping carton labeling).

Accessories Supplied

The accessories supplied with the HP 4934A are:

Accessories Supplied	*Part Number*
Power Cord	HP 8120-1378
Operating and Calibration Manual	HP 04934-90000
Test Cords - Two 1m WECO 310-to-WECO 310 cables	HP 15513A
Instruction Label	HP 04934-90002

The Instruction Label is primarily intended to be fixed to the inside of the front cover. However, it is supplied loose so that you can fix it to a location of your choice. The location should be a flat clean dry surface. To fix the label, remove the protective backing, then carefully position the label on the flat surface.

Accessories Available

The following accessories are available and may have been ordered with the HP 4934A:

HP 18182A	1.5m (60-inch) test cord with a 310 male connector and alligator clips.
HP 15678A	19-inch rack mount kit.
HP 15677A	Ladder bracket.
HP 18134A	Soft vinyl carrying case with handles and shoulder strap and space for manuals and test cords.

Specification

Except where otherwise stated the following parameters are warranted performance specifications. Parameters described as "typical" or "normal" are supplemental characteristics which provide a useful indication of the typical, but non-warranted, performance characteristics.

Measurement methods meet IEEE Std 743-1984

Transmitter Frequency

Range	Resolution	Accuracy
20 to 99999 Hz	1 Hz	± 50 ppm
100 to 110 kHz	10 Hz	± 120 ppm

Receiver Frequency

Range	Resolution	Accuracy
20 to 9999 Hz	1 Hz	± 0.5 Hz
10 to 110 kHz	10 Hz	± 5 Hz

Additional Transmitter Functions

SF Skip: Transmitter skips 2600 ± 150 Hz.
Four Pre-set Frequencies: Normally 404, 1004, 2804 and 2713 Hz.
User can temporarily change these and the SF Skip center frequency.

Transmitter Level

Range: -40 to +13 dBm.
Resolution: 0.1 dB.
Accuracy at 1004 Hz, 0 to -19 dBm: Typically ± 0.1 dB.
Flatness (dB relative to 1004 Hz):

Level (dBm)	Frequency (Hz)				
	20	200	15k	60k	85k 110k
+10 to +13	+1 - 2.5*	± 0.2*	± 0.5*	± 0.7*	± 1.5*
-40 to +10	± 1.0	± 0.2	± 0.5	± 0.5	± 1.5*

Typical

Distortion (dB down from fundamental):

Level (dBm)	Frequency (Hz)		
	30	100	4k 110k
< +13	20 typ	45 typ	40 typ
< +10	20 typ	55	40
< 0	40 typ	50	40
< -30	40 typ	50	40 typ

At 1004 Hz, 0 dBm: THD typically >65 dB down from fundamental.

Receiver Level

Range: -60 to +13 dBm.
Resolution: 0.1 dB.
Detector type: Average.
Accuracy (dB):

Level (dBm)	Frequency (Hz)					
	20	50	200	15k	60k	85k 110k
+13 to -40	± 1.0	± 0.5	± 0.2	± 0.5	± 0.5	± 2.0*
-40 to -60	± 1.0*	± 0.6*	± 0.4*	± 0.8*	± 1.0*	± 2.0*

Typical

At 1004 Hz, -20 to +10 dBm: ± 0.1 dB.
Receiver accuracy is specified from 500 Hz when using the 135 or 150Ω terminations.

Message Circuit Noise

RECEIVER (Transmitter: off and terminated).
Range: 0 to 100 dBrn (135 & 150Ω: 7 to 100 dBrn).
Resolution: 1 dB.
Detector Type: Quasi-RMS.
Accuracy: ± 1 dB from 10 to 100 dBrn, ± 3 dB from 0 to 10 dBrn.
Filters: C-Message, 3 kHz Flat, 15 kHz Flat, Program, 50 kbit.

Noise-with-Tone

RECEIVER (Transmitter: 1004 Hz tone).
Notch Filter: >50 dB rejection from 995 to 1025 Hz.
Range (at 600,900 and 1200Ω): 10 to 100 dBrn.
Resolution: 1 dB.
Accuracy: ± 1 dB from 20 to 100 dBrn, ± 3 dB from 10 to 20 dBrn.
Detector Types (noise): Quasi-RMS; (tone): Average.
Filters: C-Message, 3 kHz Flat, 15 kHz Flat, Program, 50kbit.

Signal-to-Noise Ratio

RECEIVER (Transmitter: 1004 Hz tone).
Signal Level Range (600, 900 and 1200Ω): -40 to +10 dBm.
Ratio Range: 10 to 45 dB.
Ratio Resolution: 1 dB.
Accuracy (signal > -30 dBm), S/N 10 to 40 dB: ± 1 dB; S/N 40 to 45 dB: ± 2 dB.
Detector Types (noise): Quasi-RMS; (tone): Average.

3-Level Impulse Noise

TRANSMITTER C-Msg or 3 kHz Flat receive filter selected: 1004 Hz tone. Any other receive filter: off and terminated.
RECEIVER
Level Range: -40 to +10 dBm.
Notch Filter: >50 dB rejection from 995 to 1025 Hz.
Threshold Ranges (at 600Ω): Low 30 to 109 dBrn, Mid and High 4 and 8 dB higher respectively, up to 109 dBrn.
Threshold Accuracy for Threshold Above 40 dBrn (threshold above 60 dBrn for program filter): ± 1 dB.
Loss of Holding Tone: "-" sign in right display, latching.
Count Timer: Nominally 5, 15, 60 minutes or non-stop.
Count Range: 0 to 9999.
Max Count Rate: Nominally 8 per second.

Noise-to-Ground

RECEIVER (Transmitter: off and terminated)
Range (600, 900 and 1200Ω): 50 to 130 dBrn.
Resolution: 1 dB.
Accuracy: ± 1.5 dB.
Filters & Detector: See message circuit noise.

P/AR

TRANSMITTER
Signal: 16 frequencies in range 140 to 3890 Hz.
Level Range: -40 to 0 dBm.
Resolution: 1 dB.
RECEIVER
P/AR Range: 0 to 120 units.
Resolution: 1 unit.
Accuracy (30 to 110 units): ± 2 units.
Level Range: -40 to +3 dBm RMS. (135 & 150Ω: -30 to +3 dBm RMS).
Resolution: 1 dB.

General

Maximum DC Blocking: 200V nominal.
Impedances: Nominally 135, 150, 600, 900 and 1200Ω. Transmit and receive impedances are independently selectable.
Receiver Return Loss (600, 900 and 1200Ω; 50 Hz to 4 kHz): typically >30 dB.
Bridging Loss (up to 20 kHz): Typically <0.2 dB.
Longitudinal Balance: (typical) >80 dB at 60 Hz, >70 dB at 540 Hz, >60 dB up to 4 kHz, decreasing at 6 dB per octave up to 20 kHz.
Hold Circuits: 2, each drawing 23 mA nominal.
AC Power Requirement: Nominally 90 to 126 V RMS, 48 to 66 Hz, 20VA max.
Battery Supply (Option 001): Nominally 6 hours (4 hours minimum) operation at 25°C. Complete recharge typically in 14 hours with unit in standby mode.
Temperature Range (without batteries)
Operating: 0°C to +50°C;
Storage: -40°C to +75°C.
Temperature Range (with batteries),
Operating: 0°C to +40°C;
Storage: -20°C to +55°C.
Dimensions (including handle): 105 mm high, 280 mm wide, 355 mm deep (4.1 in x 11.0 in x 14.0 in).
Weight (without batteries): 3.7 kg (8.2 lb).
Weight (with batteries): 5.0 kg (11.0 lb).

4

Installation

Introduction

This section provides installation instructions for the Hewlett-Packard Model 4934A Transmission Impairment Measuring Set and its accessories. This section also includes information about initial inspection, preparation for use, packaging, storage and shipment.

Initial Inspection

Warning

To avoid hazardous electrical shock, do not perform electrical tests when there are signs of shipping damage to any portion of the outer enclosure (covers, panels, meters and so on).

Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the instrument has been checked mechanically and electrically. Procedures for checking electrical performance are given in Chapter 5 of this manual. If the contents are incomplete, if there is mechanical damage or defect or if the HP 4934A does not pass the Performance Tests, notify the nearest Hewlett-Packard office. If the shipping container is damaged or the cushioning material shows signs of stress, notify the carrier as well as the Hewlett-Packard office. Keep the shipping materials for the carrier's inspection. The HP office will arrange for repair or replacement at HP option without waiting for claim settlement.

Preparation for Use

Warning

To avoid the possibility of injury or death, the following precautions must be followed before the instrument is switched on.

A. Note that the protection provided by grounding the instrument cabinet may be lost if any power cable other than the three-pronged type supplied is used to couple the ac line voltage to the instrument.

B. If this instrument is to be energized via an auto-transformer to reduce or increase the line voltage, make sure that the common terminal is connected to the neutral pole of the power source.

C. The power cable plug shall only be inserted into a socket outlet provided with a protective earth contact. The protective action must not be negated by the use of an extension cord without a protective conductor (grounding).

Power Requirements

The instrument requires a power source of 90 to 126V ac, 48 to 66 Hz single phase. The power consumption is less than 20 VA.

Line Fuse

The line fuse is located on the side panel. The correct rating is 120V, 250 mA slow blow (HP 2110 - 0235).

Caution

Before connecting the instrument to a power outlet ensure that a fuse of the correct rating is fitted.

Power Cable

This instrument is equipped with a three-wire power cable. When connected to a properly grounded power outlet, this cable grounds the instrument case. The power cable part number is HP 8120-1378.

Battery (Option 001 or Retrofit)

Warning

Do not short circuit the battery terminals, it may cause serious personal injury. The battery should only be changed by service trained personnel.

Do not incinerate or otherwise mutilate the battery. It might burst or release toxic materials causing personal injury.

For operator protection during battery operation, connect the chassis terminal on the side panel to earth ground.

The instrument will run with a fully charged battery for nominally 6 hours at 25 degrees centigrade. Full charge is ensured by charging for 14 hours at 25 degrees centigrade.

To change the battery, see the Service Manual or contact your nearest HP Service Office.

Mating Connectors (Front Panel)

The TRMT and RCV front panel jacks are 310-type connectors. The mating plug for the jacks is part number HP 1251-0695.

Operating Environment

Temperature	The instrument may be operated in temperatures from 0 degrees centigrade to +50 degrees centigrade. The temperature for battery operation is 0 degrees centigrade to +40 degrees centigrade.
Humidity	The instrument may be operated in environments with humidity up to 95% at 40 degrees centigrade. However, the instrument should also be protected from temperature extremes which may cause condensation within the instrument.
Altitude	The instrument may be operated at altitudes up to 4,600m (15,000 ft).
Air Flow	To provide adequate cooling, an air gap of approximately 3-inches should be maintained around the instrument.

Storage and Shipment

Environment

The instrument may be stored or shipped in environments within the following limits:

Temperature	−40 degrees centigrade to +75 degrees centigrade without a battery and −20 degrees centigrade to +55 degrees centigrade with a battery.
Humidity	90%
Altitude	15,300m (50,000 ft)

The instrument should also be protected from temperature extremes which may cause condensation within the instrument.

Packaging

Tagging for Service

If the instrument is being returned to Hewlett-Packard for service, please complete one of the blue repair tags located at the front of the service manual (if you have one) or give details on a label then attach the tag or label to the instrument.

Original Packaging

Containers and material identical to those used in the factory packaging are available through Hewlett-Packard offices. If the instrument is being returned to Hewlett-Packard for servicing, attach a tag indicating the type of service required, return address, model number and full serial number. Also mark the container "FRAGILE" to ensure careful handling.

Other Packaging

The following general instructions should be used for re-packing with commercially available materials:

a. Wrap instrument in heavy paper or plastic. (If shipping to Hewlett-Packard office or service center, attach a tag indicating type of service required, return address, model number and full serial number.)

b. Use strong shipping container. A double-walled carton of 35-pound test material is adequate.

c. Use a layer of shock absorbing material 70 to 100 mm (3 to 4 inch) thick around all sides of the instrument to provide firm cushioning and prevent movement inside the container. Protect the control panel with the front cover provided or with cardboard.

d. Seal shipping container securely.

e. Mark the shipping container clearly.

f. In any correspondence, refer to instrument by model number and full serial number.

5

Performance Tests

Introduction

This chapter contains procedures which test the HP 4934A electrical performance to the specifications in Chapter 3.

There are two levels of performance testing contained in this chapter:

Operational Verification	Provides >90% confidence that the instrument is operating to its full warranted specification.
Full Performance Test	Ensures that the instrument is operating to its full warranted specification.

Results of the Performance Test may be recorded on the Test Record at the end of Chapter 5, or on the Abbreviated Test Record at the end of the Operational Verification procedures.

Calibration Cycle

Results recorded on the Test Record at incoming inspection can be used for comparison in yearly maintenance and calibration or after repairs or adjustments.

Recommended Test Equipment

The test equipment required is listed in the following table. Equipment which meets or exceeds the critical specifications may be substituted for the recommended model.

Recommended Test Equipment

Instrument	Critical Specification	Recommended Model
AC Calibrator	Frequency range 20 Hz to 110 kHz. Voltage range 1.5 mV to 80V.	DATRON 4707A
Synthesizer	Balanced 600Ω output	HP 3336B
DMM	6 1/2 digit resolution	HP 3456A
DC Power Supply	Dual output, range 0 to 48V	HP 6234A
Frequency Counter	Range 20 Hz to 10 MHz, .001 Hz resolution at 20 Hz.	HP 5315A
Distortion Analyzer	Input level range 77.46 mV to 2.5V. Selectable 30 kHz low pass filter.	HP 8903B
Decade Transformer	Attenuation 0 to 85 dB.	Model DT72A DEKATRAN
600Ω Resistor	0.01% 0.25W	HP 0811 - 3502
100Ω Resistor	1% 0.25W	HP 0757 - 0178
20 dB Amplifier and 4 kHz low pass filter	Details of the specification and construction are in Appendix A which is at the rear of this manual.	SA1
Power Adder	Details of the specification and construction are in Appendix B which is at the rear of this manual.	SA2
WECO 310 type connector		HP 1251 - 0695

Operational Verification

The Operational Verification tests quickly establish with >90% confidence that the HP 4934A meets the specifications listed in Chapter 3. If any test fails to meet specification, refer to the Adjustments in Chapter 5 of the Service Manual. If after adjustment the specification still cannot be met, refer to the troubleshooting in Chapter 8 of the Service Manual.

The following table lists all the Operational Verification Tests.

Operational Verification	What to Do
Transmitter Frequency	Carry out the Performance Test on Page 5-18 at the following frequencies: 20 Hz, 1000 Hz, 50 kHz and 110 kHz.
Transmitter Level	Carry out the Performance Test on Page 5-19.
Receiver Frequency	Carry out the procedure on Page 5-4.
Receiver Level	Carry out the procedure on Page 5-5.
Weighting Filters	Carry out the procedure on Page 5-6.
Message Circuit Noise	Carry out the Performance Test on Page 5-35.
Impulse Noise	Carry out steps 1 to 17 in the Performance Test on Page 5-41.
Impulse Noise Count	Carry out the procedure on Page 5-9.
Noise to Ground	Carry out the Performance Test on Page 5-43.
Peak to Average Ratio (P/AR)	Carry out the Performance Test on Page 5-45.
Loss of Holding Tone	Carry out the procedure on Page 5-10.
Hold Circuits	Carry out the procedure on Page 5-11.

Receiver Frequency

1. Connect the HP 4934A TRMT port to the RCV port.
2. Set the HP 4934A as follows:

Measurement	: LEVEL FREQ
Transmitter (TRMT) Impedance	: 600Ω
Receiver (RCV) Impedance	: 600Ω
Display Mode	: TRMT
Transmitter Level/Frequency	: 0 dBm/20 Hz

3. Set the Display Mode to RCV. Check the displayed frequency is between 19 and 21 Hz.
4. Set the transmitter frequency (Display Mode - TRMT) to each of the values in the following table and check that the displayed receiver frequency (Display Mode - RCV) is within limits.

Transmitter Frequency	Receiver Frequency
1,000 Hz	998 to 1002 Hz
50,000 Hz	49.99 to 50.01 kHz
110,000 Hz	109.99 to 110.01 kHz

Receiver Level

1. Connect the HP 4934A TRMT port to the RCV port.
2. Set the HP 4934A as follows:

Measurement	: LEVEL FREQ
Transmitter (TRMT) Impedance	: 600Ω
Receiver (RCV) Impedance	: 600Ω
Display Mode	: TRMT
Transmitter Level/Frequency	: 0 dBm/1004 Hz

3. Set the Display Mode to RCV. Check the displayed level is between −0.2 and +0.2 dBm.
4. Set the transmitter level to −19 dBm (Display Mode - TRMT).
5. Check that the received level (Display Mode - RCV) reading is between −19.2 and −18.8 dBm.

Weighting Filters

EQUIPMENT

AC Calibrator : DATRON 4707A

Caution 

Ensure that the AC Calibrator OUTPUT is switched off or set to the minimum level before proceeding with the following procedure.

1. Connect the AC Calibrator output to the HP 4934A RCV port.

   C-Message Filter

2. Set the HP 4934A as follows:

Measurement	: NOISE
Transmitter (TRMT) Impedance	: 600Ω
Receiver (RCV) Impedance	: 600Ω
Display Mode	: RCV
Filter	: C-MSG

3. Set the AC Calibrator output level to 0.7746V then switch on the OUTPUT.

Note 

Do not adjust the AC Calibrator output level during the remainder of this test.

4. Set the AC Calibrator to each of the frequencies listed in the following table and check the HP 4934A noise readings.

AC Calibrator Frequency	HP 4934A Noise Reading
300 Hz	71 to 77 dBrn
600 Hz	83 to 87 dBrn
1,000 Hz	89 to 91 dBrn
2,500 Hz	87 to 91 dBrn
5,000 Hz	57 to 65 dBrn

3 kHz Flat Filter

5. Select the 3 kHz FLAT filter.
6. Set the AC Calibrator to each of the frequencies in the following table and check the HP 4934A noise readings.

AC Calibrator Frequency	HP 4934A Noise Reading
400 Hz	88 to 92 dBrn
1,000 Hz	89 to 91 dBrn
3,000 Hz	84 to 90 dBrn
6,000 Hz	74 to 82 dBrn

15 kHz Flat Filter

7. Select the 15 kHz FLAT filter.
8. Set the AC Calibrator to each of the frequencies in the following table and check the HP 4934A noise readings.

AC Calibrator Frequency	HP 4934A Noise Reading
400 Hz	88 to 92 dBrn
1,000 Hz	89 to 91 dBrn
15,000 Hz	84 to 90 dBrn
30,000 Hz	74 to 82 dBrn

Program Filter

9. Select the PRGM filter.
10. Set the AC Calibrator to each of the frequencies in the following table and check the HP 4934A noise readings.

AC Calibrator Frequency	HP 4934A Noise Reading
100 Hz	61 to 67 dBrn
500 Hz	81 to 85 dBrn
1,000 Hz	88 to 92 dBrn
2,000 Hz	92 to 98 dBrn
7,000 Hz	92 to 100 dBrn
10,000 Hz	76 to 86 dBrn

50 kBIT Filter

11. Select the 50 kBIT filter.
12. Set the AC Calibrator to each of the frequencies in the following table and check the HP 4934A noise readings.

AC Calibrator Frequency	HP 4934A Noise Reading
50 Hz	85 to 90 dBrn
1,000 Hz	89 to 91 dBrn
15,000 Hz	87 to 91 dBrn
25,000 Hz	86 to 90 dBrn
50,000 Hz	<69 dBrn

Impulse Noise Count

Caution

Ensure that the AC Calibrator OUTPUT is switched off or set to the minimum level before proceeding with the following procedure.

1. Connect the AC Calibrator output to the HP 4934A RCV port.
2. Set the HP 4934A as follows:

Measurement	: IMPULSE NOISE
Transmitter (TRMT) Impedance	: 600Ω
Receiver (RCV) Impedance	: 600Ω
Display Mode	: RCV
Filter	: 15 kHz FLAT
Period	: NON-STOP
Impulse Noise Display	: LOW (SET)

3. Set the AC Calibrator output level to 0.7746V at 2,000 Hz then switch on the OUTPUT.
4. Set the LOW (SET) threshold to 75 dBrn.
5. Press START RESET to start the measurement.
6. Wait 60 seconds then press STOP.
7. Check the reading on the HP 4934A display is 480 ± 48 counts.
8. Select the MID threshold. Check the reading on the display is 480 ±48 counts.
9. Select the HIGH threshold. Check the reading on the display is 480 ±48 counts.

Loss of Holding Tone

1. Connect the HP 4934A TRMT port to the RCV port.
2. Set the HP 4934A as follows:

Measurement	: NOISE W TONE
Filter	: C-MSG
Transmitter (TRMT) Impedance	: 600Ω
Receiver (RCV) Impedance	: 600Ω
Display Mode	: TRMT
Transmitter Level	: 0 dBm

3. Set the Display Mode to RCV and remove the cable from the RCV port.
4. Err 7 should be displayed in the right window.

Hold Circuit

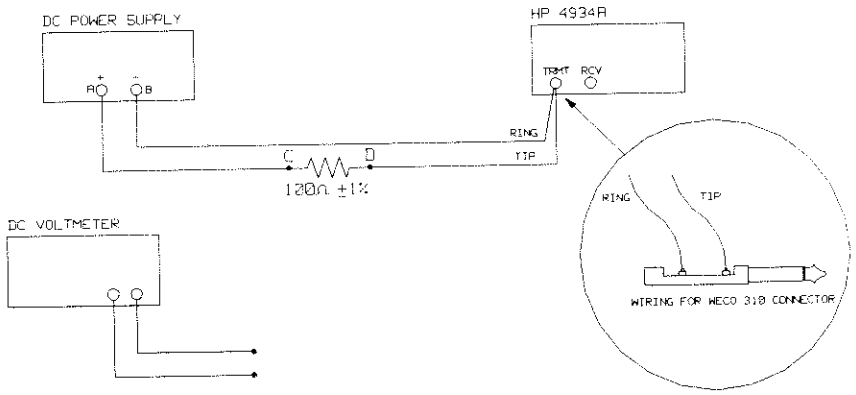
Warning **Hazardous voltages are present during this procedure - only service trained personnel, aware of the hazards involved, should perform the test.**

EQUIPMENT

DC Voltmeter	: HP 3456A
DC Power Supply	: HP 6234A
100Ω ±1% Resistor	: HP 0757-0178
WECO 310 Connector	: HP 1251-0695

PROCEDURE

1. Connect the equipment as shown in the following figure.



2. Set the HP 4934A as follows:

Measurement	: LEVEL FREQ
Transmitter (TRMT) Impedance	: 600Ω
Receiver (RCV) Impedance	: 600Ω
Transmit Hold Select	: TRMT HOLD
Receive Hold Select	: RCV HOLD

Transmitter Hold Circuit

3. Connect the DC Voltmeter across points A and B shown in the previous figure.
4. Adjust the DC Power Supply output level until a 48V reading is obtained on the DC Voltmeter.
5. Connect the DC Voltmeter across points C and D shown in the previous figure and note the reading.
6. Calculate the hold current as follows:

   Hold Current = (Voltage noted in step 5)÷100

   The specification of the hold current is nominally 26 mA.
7. Switch off the DC Power Supply.
8. Reverse the polarity of the connections to the DC Power Supply.
9. Switch on the DC Power Supply.
10. Repeat steps 5 to 7.

    Receiver Hold Circuit
11. Press REVERSE
12. Repeat steps 5 to 10.

Hewlett-Packard	*Tested by:*
Model 4934A	*Date:*
Transmission Impairment Measuring Set	*Serial No.:*

Operational Verification Test Record

Page No.	Test Description	Result		
	Transmitter Frequency Accuracy	*Min*	*Actual*	*Max*
5-18	Step 3: 20 Hz	19.999 Hz		20.001 Hz
	Step 4: 1000 Hz	999.95 Hz		1000.05 Hz
	50,000 Hz	49,997.5 Hz		50,002.5 Hz
	110,000 Hz	109,986.8 Hz		110,013.2 Hz
	Transmitter Level Accuracy			
5-20	Step 4: 0 dBm	0.7657V		0.7836V
	Step 5: −5 dBm	0.4306V		0.4406V
	−10 dBm	0.2421V		0.2478V
	−19 dBm	0.0859V		0.0879V
	Receiver Frequency			
5-4	Step 3: 20 Hz	19 Hz		21 Hz

Operational Verification Test Record
Continued

Page No.	Test Description	Result		
		Min	*Actual*	*Max*
5-4	Step 4: 1000 Hz	998 Hz		1002 Hz
	50,000 Hz	49.99 kHz		50.01 kHz
	110,000 Hz	109.99 kHz		110.01 kHz
	Receiver Level			
5-5	Step 3: 0 dBm	−0.2 dBm		0.2 dBm
	Step 5: −19 dBm	−19.2 dBm		−18.8 dBm
	Weighting Filters			
	C-Message Filter			
5-6	Step 4: 300 Hz	71 dBrn		77 dBrn
	600 Hz	83 dBrn		87 dBrn
	1000 Hz	89 dBrn		91 dBrn
	2500 Hz	87 dBrn		91 dBrn
	5000 Hz	57 dBrn		65 dBrn
	3 kHz Flat Filter			
5-7	Step 6: 400 Hz	88 dBrn		92 dBrn
	1000 Hz	89 dBrn		91 dBrn
	3000 Hz	84 dBrn		90 dBrn
	6000 Hz	74 dBrn		82 dBrn
	15 kHz Flat Filter			
5-7	Step 8: 400 Hz	88 dBrn		92 dBrn
	1000 Hz	89 dBrn		91 dBrn
	15,000 Hz	84 dBrn		90 dBrn
	30,000 Hz	74 dBrn		82 dBrn

Operational Verification Test Record
Continued

Page No.	Test Description		Result		
		Program Filter	*Min*	*Actual*	*Max*
5-8	Step 10:	100 Hz	61 dBrn		67 dBrn
		500 Hz	81 dBrn		85 dBrn
		1000 Hz	88 dBrn		92 dBrn
		2000 Hz	92 dBrn		98 dBrn
		7000 Hz	92 dBrn		100 dBrn
		10000 Hz	76 dBrn		86 dBrn
		50 kBit Filter			
5-8	Step 12:	50 Hz	85 dBrn		90 dBrn
		1000 Hz	89 dBrn		91 dBrn
		15000 Hz	87 dBrn		91 dBrn
		25000 Hz	86 dBrn		90 dBrn
		50000 Hz			69 dBrn
		Impulse Noise			
5-9	Step 7:	Low Count	432		528
	Step 8:	Mid Count	432		528
	Step 9:	High Count	432		528
	Noise to Ground Accuracy				
5-45	Step 4:	65.17V	127 dBrn		130 dBrn
	Step 5:	8.2049V	109 dBrn		112 dBrn
		0.8205V	89 dBrn		92 dBrn
		82.049 mV	69 dBrn		72 dBrn
		9.2061 mV	50 dBrn		53 dBrn

Operational Verification Test Record
Continued

Page No.	Test Description	Result		
	Peak to Average Ratio	*Min*	*Actual*	*Max*
5-46	Step 3: −23 dBm	98		102
	Step 4: −20 dBm	98		102
	−40 dBm	98		102
	Loss of Holding Tone			
5-10	Step 4: Err 7 displayed			
	Hold Current			
5-12	Step 6: Current nominally 26 mA			

Performance Tests

The following procedures check the electrical performance of the HP 4934A to the specifications listed in Chapter 3.

If any of the following tests fail, carry out the adjustments described in Chapter 5 of the Service Manual. If this fails to correct the problem, refer to the troubleshooting section in Chapter 8 of the Service Manual or return the instrument to the nearest HP Service Office.

Transmitter Frequency Accuracy

SPECIFICATION

Frequency Range	: 20 Hz to 110 kHz
Frequency Accuracy	: 20 Hz to 99.999 kHz ±0.005%
	: 100 kHz to 110 kHz ± 0.012%

DESCRIPTION

A Frequency Counter is used to check the accuracy and range of the HP 4934A transmitter.

EQUIPMENT

Frequency Counter : HP 5315A

PROCEDURE

1. Set the HP 4934A as follows:

Measurement	: LEVEL·FREQ
Transmitter (TRMT) Impedance	: 600Ω
Display Mode	: TRMT
Transmitter Output Level/Frequency	: 0 dBm/20 Hz

2. Connect the HP 4934A TRMT port to the Frequency Counter input.
3. Check the reading on the Frequency Counter is between 19.999 and 20.001 Hz.
4. Set the HP 4934A transmitter frequency to each of the values in the following table and check the Frequency Counter reading.

Transmitter Frequency	Frequency Counter Reading
1000 Hz	999.95 to 1000.05 Hz
10,000 Hz	9,999.5 to 10000.5 Hz
50,000 Hz	49,997.5 to 50002.5 Hz
99,999 Hz	99,994 to 100,004 Hz
110,000 Hz	109,986.8 to 110,013.2 Hz

Transmitter Level Range

SPECIFICATION

Level Range: −40 dBm to +13 dBm

DESCRIPTION

An AC Voltmeter and a 600Ω resistor are used to check the level range of the HP 4934A transmitter.

EQUIPMENT

AC Voltmeter	: HP 3456A
600Ω ±0.01% Resistor	: HP 0811-3502

PROCEDURE

1. Connect the 600Ω resistor across the AC Voltmeter input.
2. Connect the HP 4934A TRMT port to the AC Voltmeter input.
3. Set the HP 4934A as follows:

Measurement	: LEVEL FREQ
Transmitter (TRMT) Impedance	: 600Ω
Display Mode	: TRMT
Transmitter Frequency	: 1004 Hz

4. Set the HP 4934A transmitter output level to a maximum by turning the OUTPUT LEVEL control fully clockwise. The reading on the AC Voltmeter should be greater than 3.42V.
5. Set the HP 4934A transmitter output level to a minimum by turning the OUTPUT LEVEL control fully counter-clockwise. The reading on the AC Voltmeter should be less than 0.00775 V.

Transmitter Level Accuracy

SPECIFICATION

Level Accuracy (at 1004 Hz) : −19 dBm to 0 dBm ±0.1 dB (typical)

DESCRIPTION

An AC Voltmeter and 600Ω resistor are used to check the HP 4934A transmitter output level accuracy at 1004 Hz.

EQUIPMENT

AC Voltmeter	: HP 3456A
600Ω ±0.01% Resistor	: HP 0811-3502

PROCEDURE

1. Connect the 600Ω resistor across the AC Voltmeter input.
2. Connect the HP 4934A TRMT port to the AC Voltmeter input.
3. Set the HP 4934A as follows:

Measurement	: LEVEL FREQ
Transmitter (TRMT) Impedance	: 600Ω
Display Mode	: TRMT
Transmitter Level/Frequency	: 0 dBm/1004 Hz

4. Check the reading on the AC Voltmeter is between 0.7657 and 0.7836V.
5. Set the HP 4934A transmitter output level to each of the values in the following table and check the AC Voltmeter readings.

HP 4934A Output Level	AC Voltmeter Reading
−5 dBm	0.4306 to 0.4406V
−10 dBm	0.2421 to 0.2478V
−19 dBm	0.0859 to 0.0879V

Transmitter Flatness at +10 dBm

SPECIFICATION

Transmitter Flatness	20 Hz to 200 Hz	: ±1.0 dB
	200 Hz to 15 kHz	: ±0.2 dB
	15 kHz to 85 kHz	: ±0.5 dB

DESCRIPTION

An AC Voltmeter and 600Ω resistor are used to check the HP 4934A transmitter flatness at +10 dBm over the frequency range 20 Hz to 85 kHz.

EQUIPMENT

AC Voltmeter	: HP 3456A
600Ω ±0.01% Resistor	: HP 0811-3502

PROCEDURE

1. Connect the 600 ohm resistor across the AC Voltmeter input.
2. Connect the HP 4934A TRMT port to the AC Voltmeter input.
3. Set the HP 4934A as follows:

Measurement	: LEVEL FREQ
Transmitter (TRMT) Impedance	: 600Ω
Display Mode	: TRMT
Transmitter Frequency	: 1004 Hz

4. Adjust the HP 4934A transmitter output level until a reading of 2.4495V is obtained on the AC Voltmeter.
5. Set the HP 4934A transmitter frequency to each of the values in the following table and check the AC Voltmeter readings.

HP 4934A Transmitter Frequency	AC Voltmeter Reading
20 Hz	2.1831 to 2.7484V
200 Hz	2.3937 to 2.5065V
5 kHz	2.3937 to 2.5065V
15 kHz	2.3937 to 2.5065V
30 kHz	2.3125 to 2.5946V
85 kHz	2.3125 to 2.5946V

Transmitter Flatness at −40 dBm

SPECIFICATION

Transmitter Flatness 20 Hz to 200 Hz : ±1.0 dB
200 Hz to 15 kHz : ±0.2 dB
15 kHz to 85 kHz : ±0.5 dB

DESCRIPTION

An AC Voltmeter, AC Calibrator and 20 dB Amplifier are used to check the HP 4934A transmitter flatness at −40 dBm over the frequency range 20 Hz to 85 kHz.

The 20 dB Amplifier is required to increase the −40 dBm level to within the specified range of the AC Voltmeter. The amplifier provides a 600Ω termination and is powered from a separate DC Power Supply.

If a high input impedance amplifier is used, a 600Ω termination is required.

Variations in the gain of the 20 dB Amplifier are compensated for at each of the test frequencies in the following procedure.

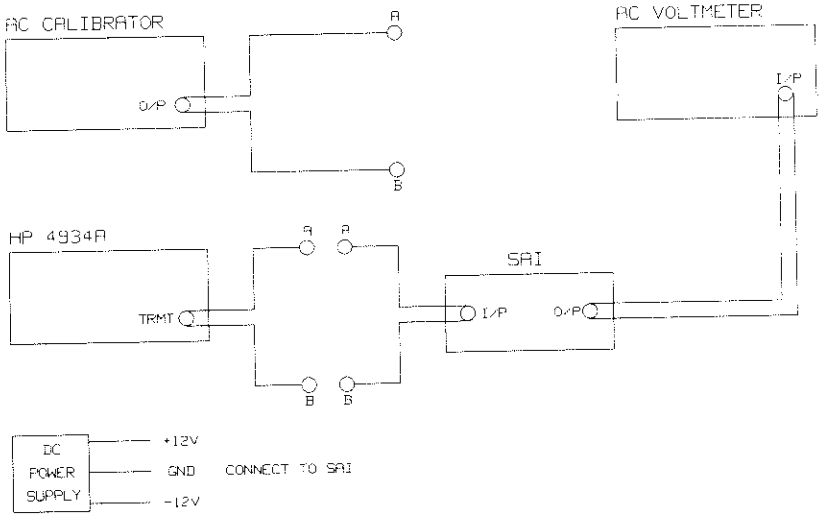
EQUIPMENT

AC Voltmeter	: HP 3456A
AC Calibrator	: DATRON 4707A
20 dB Amplifier	: SA1 (see Appendix A)
Dual Output DC Power Supply	: HP 6234A

PROCEDURE

Caution Ensure that the AC Calibrator OUTPUT is switched off or set to the minimum level before proceeding with the following procedure.

1. Connect the equipment as shown in the following figure:



2. Set the SA1 gain to 20 dB and filter to 4 kHz L. P.
3. Set the AC Calibrator to 7.746 mV at 1000 Hz then switch on the OUTPUT.

4. Connect the AC Calibrator output to the input of SA1 and the SA1 output to the AC Voltmeter input.
5. Note the reading on the AC Voltmeter.
6. Set the HP 4934A as follows:

Measurement	: LEVEL FREQ
Transmitter (TRMT) Impedance	: 600Ω
Display Mode	: TRMT
Transmitter Frequency	: 1000 Hz

7. Disconnect the AC Calibrator from the input of SA1.
8. Connect the HP 4934A TRMT port to the input of SA1.
9. Adjust the HP 4934A transmitter output level until the reading on the AC Voltmeter is the same as that noted in step 5.

Note

Do not change the HP 4934A transmitter output level or the AC Calibrator output level during the remainder of this procedure.

10. Adjust the HP 4934A transmitter frequency to each of the values in the table on Pages 5-25 to 5-27. Note the reading on the AC Voltmeter at each frequency.
11. Reconnect the AC Calibrator to SA1.
12. Adjust the AC Calibrator frequency to each of the values in the table on Pages 5-25 to 5-27. Note the reading on the AC Voltmeter at each frequency.
13. Use the AC Voltmeter readings and the table on Pages 5-25 to 5-27 to check the flatness. This is best explained by the following example:

    If the frequency is 20 Hz, and the AC Voltmeter reading in step 12 were 71.0 mV - Look up 71 mV in the V_{out} column, then check the 20 Hz column for the allowable voltage range when the HP 4934A is connected to the AC Voltmeter. If the reading in step 10 is within the 79.7 to 63.3 mV range, the 20 Hz check would be good.

V_{out} (in mV)	±1 dB at 20 Hz and 50 Hz	±0.2 dB at 200 Hz and 15 kHz	±0.5 dB at 60 kHz and 85 kHz
65.0	72.9 to 57.9	66.5 to 63.5	68.9 to 61.4
65.4	73.4 to 58.3	66.9 to 63.9	69.3 to 61.7
65.8	73.8 to 58.6	67.3 to 64.3	69.7 to 62.1
66.2	74.3 to 59.0	67.7 to 64.7	70.1 to 62.5
66.6	74.7 to 59.4	68.2 to 65.1	70.5 to 62.9
67.0	75.2 to 59.7	68.6 to 65.5	71.0 to 63.3
67.4	75.6 to 60.1	69.0 to 65.9	71.4 to 63.6
67.8	76.1 to 60.4	69.4 to 66.3	71.8 to 64.0
68.2	76.5 to 60.8	69.8 to 66.6	72.2 to 64.4
68.6	77.0 to 61.1	70.2 to 67.0	72.7 to 64.8
69.0	77.4 to 61.5	70.6 to 67.4	73.1 to 65.1
69.4	77.9 to 61.9	71.0 to 67.8	73.5 to 65.5
69.8	78.3 to 62.2	71.4 to 68.2	73.9 to 65.9
70.2	78.8 to 62.6	71.8 to 68.6	74.4 to 66.3
70.6	79.2 to 62.9	72.2 to 69.0	74.8 to 66.7
71.0	79.7 to 63.3	72.7 to 69.4	75.2 to 67.0
71.4	80.1 to 63.6	73.1 to 69.8	75.6 to 67.4
71.8	80.6 to 64.0	73.5 to 70.2	76.1 to 67.8
72.2	81.0 to 64.3	73.9 to 70.6	76.5 to 68.2
72.6	81.5 to 64.7	74.3 to 70.9	76.9 to 68.5
73.0	81.9 to 65.1	74.7 to 71.3	77.3 to 68.9
73.4	82.4 to 65.4	75.1 to 71.7	77.7 to 69.3
73.8	82.8 to 65.8	75.5 to 72.1	78.2 to 69.7
74.2	83.3 to 66.1	75.9 to 72.5	78.6 to 70.0
74.6	83.7 to 66.5	76.3 to 72.9	79.0 to 70.4

V_{out} (in mV)	±1 dB at 20 Hz and 50 Hz	±0.2 dB at 200 Hz and 15 kHz	±0.5 dB at 60 kHz and 85 kHz
75.0	84.2 to 66.8	76.7 to 73.3	79.4 to 70.8
75.4	84.6 to 67.2	77.2 to 73.7	79.9 to 71.2
75.8	85.0 to 67.6	77.6 to 74.1	80.3 to 71.6
76.2	85.5 to 67.9	78.0 to 74.5	80.7 to 71.9
76.6	85.9 to 68.3	78.4 to 74.9	81.1 to 72.3
77.0	86.4 to 68.6	78.8 to 75.2	81.6 to 72.7
77.4	86.8 to 69.0	79.2 to 75.6	82.0 to 73.1
77.8	87.3 to 69.3	79.6 to 76.0	82.4 to 73.4
78.2	87.7 to 69.7	80.0 to 76.4	82.8 to 73.8
78.6	88.2 to 70.1	80.4 to 76.8	83.3 to 74.2
79.0	88.6 to 70.4	80.8 to 77.2	83.7 to 74.6
79.4	89.1 to 70.8	81.2 to 77.6	84.1 to 75.0
79.8	89.5 to 71.1	81.7 to 78.0	84.5 to 75.3
80.2	90.0 to 71.5	82.1 to 78.4	85.0 to 75.7
80.6	90.4 to 71.8	82.5 to 78.8	85.4 to 76.1
81.0	90.9 to 72.2	82.9 to 79.2	85.8 to 76.5
81.4	91.3 to 72.5	83.3 to 79.5	86.2 to 76.8
81.8	91.8 to 72.9	83.7 to 79.9	86.6 to 77.2
82.2	92.2 to 73.3	84.1 to 80.3	87.1 to 77.6
82.6	92.7 to 73.6	84.5 to 80.7	87.5 to 78.0
83.0	93.1 to 74.0	84.9 to 81.1	87.9 to 78.4
83.4	93.6 to 74.3	85.3 to 81.5	88.3 to 78.7
83.8	94.0 to 74.7	85.8 to 81.9	88.8 to 79.1
84.2	94.5 to 75.0	86.2 to 82.3	89.2 to 79.5
84.6	94.9 to 75.4	86.6 to 82.7	89.6 to 79.9

V_{out} (in mV)	±1 dB at 20 Hz and 50 Hz	±0.2 dB at 200 Hz and 15 kHz	±0.5 dB at 60 kHz and 85 kHz
85.0	95.4 to 75.8	87.0 to 83.1	90.0 to 80.2
85.4	95.8 to 76.1	87.4 to 83.5	90.5 to 80.6
85.8	96.3 to 76.5	87.8 to 83.8	90.9 to 81.0
86.2	96.7 to 76.8	88.2 to 84.2	91.3 to 81.4
86.6	97.2 to 77.2	88.6 to 84.6	91.7 to 81.8
87.0	97.6 to 77.5	89.0 to 85.0	92.2 to 82.1
87.4	98.1 to 77.9	89.4 to 85.4	92.6 to 82.5
87.8	98.5 to 78.3	89.8 to 85.8	93.0 to 82.9
88.2	99.0 to 78.6	90.3 to 86.2	93.4 to 83.3
88.6	99.4 to 79.0	90.7 to 86.6	93.8 to 83.6
89.0	99.9 to 79.3	91.1 to 87.0	94.3 to 84.0
89.4	100.3 to 79.7	91.5 to 87.4	94.7 to 84.4
89.8	100.8 to 80.0	91.9 to 87.8	95.1 to 84.8
90.2	101.2 to 80.4	92.3 to 88.1	95.5 to 85.2
90.6	101.7 to 80.7	92.7 to 88.5	96.0 to 85.5
91.0	102.1 to 81.1	93.1 to 88.9	96.4 to 85.9
FACTOR	1.12202 to .89125	1.02329 to .97724	1.05925 to .94406

Transmitter Distortion

SPECIFICATION

Transmitter Frequency (Fo)	Output Level	Distortion
100 Hz to 4 kHz	+10 dBm to 0 dBm	< −55 dB
100 Hz to 4 kHz	0 dBm to −40 dBm	< −50 dB
4 kHz to 110 kHz	+10 dBm to 0 dBm	< −40 dB
4 kHz to 110 kHz	0 dBm to −30 dBm	< −40 dB

Note

Includes harmonics, spurious and background noise within a filter with a 3 dB bandwidth of 4 kIIz or 4 x Fo, whichever is the greater.

DESCRIPTION

A Distortion Analyzer and 20 dB Amplifier, with a 4 kHz Low Pass Filter (SA1) are used to check the HP 4934A transmitter distortion.

The 20 dB Amplifier is required to increase the −40 dBm level to within the specified range of the Distortion Analyzer. The amplifier provides a 600Ω termination and is powered from a separate DC Power Supply.

If a high input impedance amplifier is used, a 600Ω termination is required.

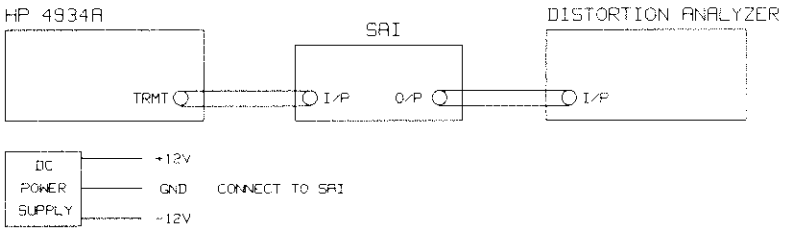
EQUIPMENT

Distortion Analyzer	: HP 8903B
20 dB Amplifier	: SA1 (see Appendix A)
Dual Output DC Power Supply	: HP 6234A
600Ω ±0.01% Resistor	: HP 0811-3502

PROCEDURE

Distortion at 0 dBm to −40 dBm

1. Connect the equipment as shown in the following figure:



2. Set the HP 4934A as follows:

Measurement	: LEVEL FREQ
Transmitter (TRMT) Impedance	: 600Ω
Display Mode	: TRMT
Transmitter Level/Frequency	: 0 dBm/100 Hz

3. Set the SA1 gain to Unity and filter to 4 kHz Low Pass.
4. Set the Distortion Analyzer as follows:

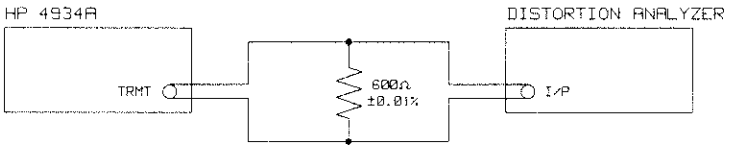
Measurement	: Distortion (dB)
Impedance	: High
Input	: Float
30 kHz Filter	: Disabled

5. Check that the Distortion Analyzer reading is < -55 dB.
6. Check the distortion for each combination of settings listed in the following table.

HP 4934A		SA1 Settings		Distortion Analyzer	
Frequency	*Level*	*Gain*	*Filter*	*30 kHz Filter*	*Distortion*
1004 IIz	0 dBm	Unity	4 kHz L.P.	Disabled	< −55 dB
4 kHz	− 40 dBm	20 dB	Flat	Disabled	<−50 dB
110 kHz	− 30 dBm	20 dB	Flat	Disabled	<−40 dB

Distortion at 0 dBm to +10 dBm

7. Connect the equipment as shown in the following figure:



8. Set the HP 4934A as follows:

Measurement	: LEVEL FREQ
Transmitter (TRMT) Impedance	: 600Ω
Display Mode	: TRMT
Transmitter Level/Frequency	: +10 dBm/4 kHz

9. Select the Distortion Analyzer 30 kHz Filter.
10. Check that the Distortion Analyzer reading is <−55 dB.
11. Set the equipment for the settings listed in the following table and check the Distortion Analyzer readings.

HP 4934A		Distortion Analyzer	
Frequency	*Level*	*30 kHz Filter*	*Distortion*
4 kIIz	0 dBm	Enabled	<−55 dB
110 kHz	+10 dBm	Disabled	<−40 dB

Receiver Frequency Range/Accuracy

SPECIFICATION

Frequency Range	: 20 Hz to 110 kHz
Frequency Accuracy	: 20 Hz to 9.999 kHz ±0.5 Hz
	: 10 kHz to 110 kHz ±5 Hz

DESCRIPTION

An AC Calibrator and Frequency Counter are used to check the HP 4934A receiver range and accuracy.

EQUIPMENT

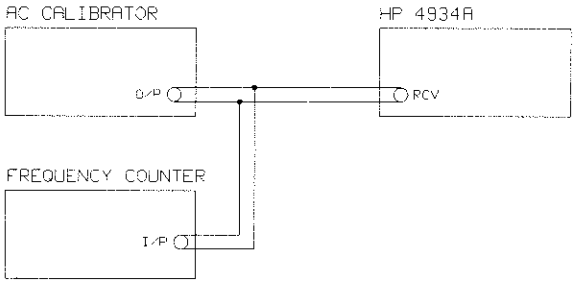
AC Calibrator	: DATRON 4707A
Frequency Counter	: HP 5315A

PROCEDURE

Caution 

Ensure that the AC Calibrator OUTPUT is switched off or set to the minimum level before proceeding with the following procedure.

1. Connect the equipment as shown in the following figure:



2. Set the AC Calibrator output level to 0.7746V then switch on the OUTPUT. Set the AC Calibrator frequency to 20 Hz as observed on the Frequency Counter.

3. Set the HP 4934A as follows:

Measurement	: LEVEL FREQ
Receiver (RCV) Impedance	: 600Ω
Display Mode	: RCV

4. Check the HP 4934A receiver frequency reading is between 19 Hz and 21 Hz.

5. Set the AC Calibrator frequency to each of the values given in the following table (as observed on the Frequency Counter) and check the HP 4934A receiver frequency reading.

AC Calibrator Frequency	HP 4934A Receiver Reading
1,000 Hz	999 to 1001 Hz
10,000 Hz	9,995 to 10,005 Hz
50,000 Hz	49.99 to 50.01 kHz
100,000 Hz	99.99 to 100.01 kHz
110,000 Hz	109.99 to 110.01 kHz

Receiver Level Accuracy

SPECIFICATION

Input Level: −40 dBm to +13 dBm

Frequency Range	20 Hz to 50 Hz	: ±1 dB
	50 Hz to 200 Hz	: ±0.5 dB
	200 Hz to 15 kHz	: ±0.2 dB
	15 kHz to 85 kHz	: ±0.5 dB

Level Accuracy (at 1004 Hz): −20 to +10 dBm ±0.1 dB

DESCRIPTION

An AC Calibrator is used to check the HP 4934A receiver level accuracy.

EQUIPMENT

AC Calibrator : DATRON 4707A

PROCEDURE

Caution 

Ensure that the AC Calibrator OUTPUT is switched off or set to the minimum level before proceeding with the following procedure.

1. Connect the AC Calibrator output to the HP 4934A RCV port.
2. Set the HP 4934A as follows:

Measurement	: LEVEL FREQ
Receiver (RCV) Impedance	: 600Ω
Display Mode	: RCV

3. Set the AC Calibrator output level to 2.4495V at 1000 Hz then switch on the OUTPUT.

4. Check the HP 4934A receiver level reading is between 9.9 and 10.1 dBm.
5. Set the AC Calibrator output level to 77.46 mV.
6. Check the HP 4934A receiver level reading is between −20.1 and −19.9 dBm.
7. Set the AC Calibrator output level to 2.748V at 20 Hz.
8. Check the HP 4934A receiver level reading is between 10 and 12 dBm.
9. Set the AC Calibrator to each of the frequencies in the following table and check the HP 4934A receiver level readings.

AC Calibrator Frequency	HP4934A Receiver Level
50 Hz	10.5 to 11.5 dBm
200 Hz	10.8 to 11.2 dBm
15,000 Hz	10.8 to 11.2 dBm
85,000 Hz	10.5 to 11.5 dBm

10. Set the AC Calibrator output level to 7.746 mV at 20 Hz.
11. Check the HP 4934A receiver level reading is between −41 and −39 dBm.
12. Set the AC Calibrator to each of the frequencies in the following table and check the HP 4934A receiver level readings.

AC Calibrator Frequency	HP 4934A Receiver Level
50 Hz	−40.5 to −39.5 dBm
200 Hz	−40.2 to −39.8 dBm
15,000 Hz	−40.2 to −39.8 dBm
85,000 Hz	−40.5 to −39.5 dBm

Message Circuit Noise Accuracy

SPECIFICATION

TRANSMITTER: Quiet Terminated

RECEIVER

Filters: C-Message, 3 kHz Flat, 15 kHz Flat, Program and 50 kBit

Range 600, 900 and 1200Ω : 0 to 100 dBrn

135 and 150Ω : 7 to 100 dBrn

Accuracy : 10 dBrn to 100 dBrn ±1 dBrn

: 0 dBrn to 10 dBrn ±3 dBrn

DESCRIPTION

The Message Circuit Noise accuracy is checked using an AC Calibrator and Decade Transformer. The Decade Transformer attenuates a test signal from the AC Calibrator.

EQUIPMENT

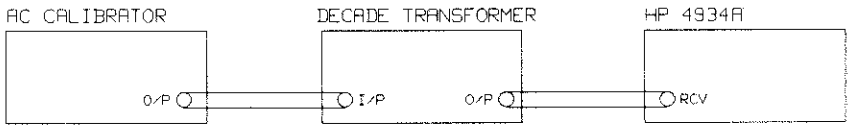
AC Calibrator	: DATRON 4707A
Decade Transformer	: Model DT72A DEKATRAN

PROCEDURE

Caution

Ensure that the AC Calibrator OUTPUT is switched off or set to the minimum level before proceeding with the following procedure.

1. Connect the equipment as shown in the following figure:



2. Set the HP 4934A as follows:

Measurement	: NOISE
Filter	: C-MSG
Display Mode	: RCV
Receiver (RCV) Impedance	: 600Ω

3. Set the AC Calibrator output level to 2.1831 V at 1000 Hz then switch on the OUTPUT.
4. Set the Decade Transformer to 1.0000000.
5. Check the message circuit noise reading on the HP 4934A is between 98 and 100 dBrn.
6. Set the AC Calibrator output level to 0.7746V.
7. Check the reading on the HP 4934A is between 89 and 91 dBrn.
8. Set the Decade Transformer to each of the settings listed in the following table and check the HP 4934A noise reading.

Decade Transformer Settings	(dB)	HP 4934A Noise Reading
0.3162278	(−10)	79 to 81 dBrn
0.1000000	(−20)	69 to 71 dBrn
0.0316228	(−30)	59 to 61 dBrn
0.0100000	(−40)	49 to 51 dBrn
0.0031623	(−50)	39 to 41 dBrn
0.0010000	(−60)	29 to 31 dBrn
0.0003162	(−70)	19 to 21 dBrn
0.0001000	(−80)	9 to 11 dBrn
0.0000562	(−85)	2 to 8 dBrn

Notch Filter Rejection

SPECIFICATION

Rejection (995 Hz to 1025 Hz) : >50 dB

DESCRIPTION

An AC Calibrator is used to check the HP 4934A Notch Filter rejection.

EQUIPMENT

AC Calibrator : DATRON 4707A

PROCEDURE

Caution Ensure that the AC Calibrator OUTPUT is switched off or set to the minimum level before proceeding with the following procedure.

1. Connect the AC Calibrator output to the HP 4934A RCV port.
2. Set the HP 4934A as follows:

Measurement	: NOISE W TONE
Filter	: C-MSG
Receiver (RCV) Impedance	: 600Ω
Display Mode	: RCV

3. Set the AC Calibrator output level to 0.7746V at 995 Hz then switch on the OUTPUT.
4. Check the reading on the HP 4934A is less than 40 dBrn.
5. Set the AC Calibrator to each of the frequencies in the following table and check the HP 4934A noise readings.

AC Calibrator Frequency	HP 4934A Noise Reading
1004 Hz	<40 dBrn
1015 Hz	<40 dBrn
1025 Hz	<40 dBrn

Signal to Noise Ratio Accuracy

SPECIFICATION

TRANSMITTER

Holding Tone Frequency	: 1004 Hz fixed tone
Other Specifications	: See LEVEL FREQ in the Specifications in Chapter 3.

RECEIVER

Filter: C-Message, 3 kHz Flat, 15 kHz Flat, Program and 50 kBit (all + Notch Filter)

Signal Level Range 600, 900 and 1200Ω	: −40 to +10 dBm
Signal to Noise Ratio Range (Signal Level > −30 dBm)	: 10 to 45 dB
Signal to Noise Ratio Accuracy	: 10 to 40 dB ±1 dB
	: 40 to 45 dB ±2 dB

DESCRIPTION

A Synthesizer and Power Adder (SA2) are used to check the Signal to Noise Ratio accuracy. Signal to Noise Ratio is the amplitude ratio of the holding tone to the background noise. An 1800 Hz tone is used to simulate the noise and is added to the HP 4934A 1004 Hz holding tone using the Power Adder.

EQUIPMENT

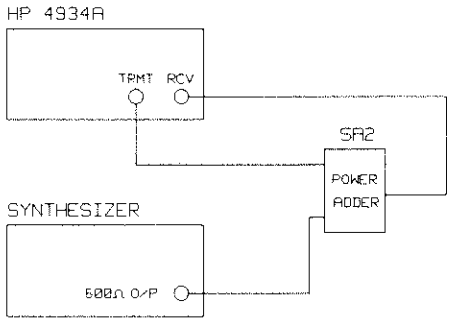
Synthesizer	: HP 3336B
Power Adder	: SA2 (see Appendix B)

Note

Do not use an AC Calibrator in place of a Synthesizer with a 600Ω balanced output or errors will occur.

PROCEDURE

1. Connect the equipment as shown in the following figure:



2. Set the HP 4934A as follows:

Measurement	: SIG TO NOISE
Filter	: 15 kHz FLAT
Transmitter (TRMT) Impedance	: 600Ω
Receiver (RCV) Impedance	: 600Ω
Display Mode	: TRMT
Transmitter Level	: +10 dBm

3. Set the Synthesizer output level to 0 dBm at 1800 Hz.
4. Set the HP 4934A Display Mode to RCV, then check the signal to noise ratio reading on the display is 10 dB ±1 dB.
5. Set the Synthesizer output level to each of the values in the following table and check the noise reading on the HP 4934A.

Synthesizer Level	HP 4934A Noise Reading
−10 dBm	20 dB ±1 dB
−20 dBm	30 dB ±1 dB
−30 dBm	40 dB ±1 dB
−35 dBm	45 dB ±2 dB

Impulse Noise Threshold Accuracy

SPECIFICATION

RECEIVER

Level Range	: −40 to +10 dBm
Range - Low Threshold	: 30 to 109 dBrn
Mid Threshold	: 34 to 109 dBrn
High Threshold	: 38 to 109 dBrn
Threshold Accuracy	: >40 dBrn ±1 dB

DESCRIPTION

An AC Calibrator is used to verify the Low, Mid and High impulse noise thresholds.

EQUIPMENT

AC Calibrator : DATRON 4707A

Caution

Ensure that the AC Calibrator OUTPUT is switched off or set to the minimum level before proceeding with the following procedure.

PROCEDURE

1. Connect the AC Calibrator output to the HP 4934A RCV input.
2. Set the AC Calibrator output level to 1.7341 mV at 1000 Hz then switch on the OUTPUT.

Low Threshold Check

3. Set the HP 4934A as follows:

Measurement	: IMPULSE NOISE
Receiver (RCV) Impedance	: 600Ω
Display Mode	: RCV
Filter	: 15 kHz FLAT
Period	: NON-STOP

4. Set the Impulse Noise LOW(SET) threshold to 41 dBrn.
5. Start the measurement by pressing START RESET; the displayed count should remain at zero.
6. Slowly increase the AC Calibrator output level until the HP 4934A starts counting; the AC Calibrator level should be less than 2.1831 mV.
7. Press STOP to stop the low threshold check.

Mid Threshold Check

8. Set the AC Calibrator output level to 2.7484 mV.
9. Select the Mid threshold using the HP 4934A Impulse Noise DISPLAY key.
10. Press START RESET to start the measurement; the displayed count should remain at zero.
11. Slowly increase the AC Calibrator output level until the HP 4934A starts counting; the AC Calibrator level should be less than 3.46 mV.
12. Press STOP to stop the Mid threshold check.

High Threshold Check

13. Set the AC Calibrator output level to 4.3559 mV.
14. Select the HIGH threshold using the HP 4934A Impulse Noise DISPLAY key.
15. Press the START RESET key; the displayed count should remain at zero.

16. Slowly increase the AC Calibrator output level until the HP 4934A starts counting; the AC Calibrator level should be less than 5.4837 mV.
17. Press [STOP] to stop the high threshold check.
18. Repeat the above procedure for each of the LOW (SET) threshold settings listed in the following table:

HP 4934A Settings	Low Check		Mid Check		High Check	
Low (SET) Threshold	*Min*	*Max*	*Min*	*Max*	*Min*	*Max*
60 dBrn	15.455 mV	19.457 mV	24.495 mV	30.837 mV	38.822 mV	48.874 mV
80 dBrn	0.1546V	0.1946V	0.2449V	0.3084V	0.3882V	0.4887V
100 dBrn	1.5455V	1.9457V	2.4495V	3.0837V	3.8822V	4.8874V

Noise to Ground Accuracy

SPECIFICATION

TRANSMITTER: Quiet terminated

RECEIVER

Filters : C-Message, 3 kHz Flat, 15 kIIz Flat, Program and 50 kBit

Range 600, 900 and 1200Ω: 50 to 130 dBrn

Accuracy: ±1.5 dB

DESCRIPTION

A common mode signal from an AC Calibrator is used to check the Noise to Ground accuracy.

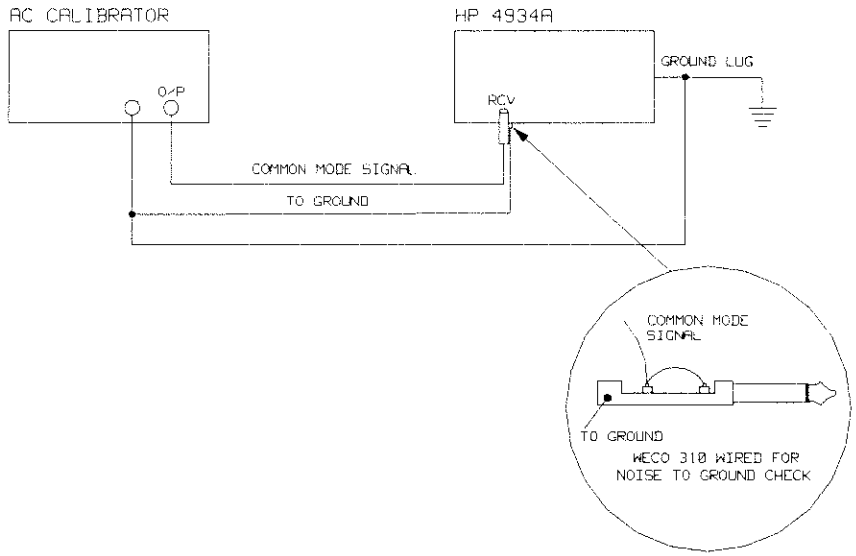
EQUIPMENT

AC Calibrator : DATRON 4707A
WECO 310 Connector : HP 1251-0695

Warning **Hazardous voltages are present during this procedure - only service trained personnel, aware of the hazards involved, should perform the test.**

Caution Ensure that the AC Calibrator OUTPUT is switched off or set to the minimum level before proceeding with the following procedure.

1. Connect the equipment as shown in the following figure:



2. Set the HP 4934A as follows:

Measurement	: N.T. GND
Transmitter (TRMT) Impedance	: 600Ω
Receiver (RCV) Impedance	: 600Ω
Display Mode	: RCV
Filter	: C-MSG

3. Set the AC Calibrator output level to 65.17V at 1000 Hz then switch on the OUTPUT.
4. Check the reading on the HP 4934A display is between 127 and 130 dBrn.
5. Set the AC Calibrator output level to each of the values in the following table and check the N.T. GND reading on the HP 4934A display.

AC Calibrator Setting	N.T. GND Reading
8.2049V	109 dBrn to 112 dBrn
0.8205V	89 dBrn to 92 dBrn
82.049 mV	69 dBrn to 72 dBrn
9.2061 mV	50 dBrn to 53 dBrn

Peak to Average Ratio (P/AR) Accuracy

SPECIFICATION

TRANSMITTER

Signal Spectrum : 16 Frequencies 140 Hz to 3890 Hz

Level : −40 to 0 dBm

Level Resolution : 1 dB

RECEIVER

P/AR Range : 0 to 120 P/AR Units

Resolution : 1 P/AR Unit

Accuracy : 30 to 110 P/AR Units ±2 P/AR Units

PROCEDURE

1. Connect the HP 4934A TRMT port to the RCV port using a short cable.
2. Set the HP 4934A as follows:

Measurement	: P/AR
Transmitter (TRMT) Impedance	: 600Ω
Receiver (RCV) Impedance	: 600Ω
Display Mode	: TRMT
Transmitter Level	: −23 dBm

3. Set the Display Mode to RCV. Check the reading on the HP 4934A display is between 98 and 102 P/AR Units.
4. Set the transmitter level to each of the values in the following table and check the P/AR readings in the RCV display mode.

Output Level	P/AR Reading
−20 dBm	98 to 102 P/AR Units
−40 dBm	98 to 102 P/AR Units

Hewlett-Packard Model 4934A Transmission Impairment Measuring Set	
Location:	*Serial No.:*
	Tested by:
Temperature:	*Certified by:*
Humidity:	*Date:*

Performance Test Record

Page No.	Test Description	Result		
	Transmitter Frequency Accuracy	*Min*	*Actual*	*Max*
5-18	Step 3: 20 Hz	19.999 Hz		20.001 Hz
	Step 4: 1000 Hz	999.95 Hz		1000.05 Hz
	10,000 Hz	9,999.5 Hz		10,000.5 Hz
	50,000 Hz	49,997.5 Hz		50,002.5 Hz
	100,000 Hz	99,994 Hz		100,004 Hz
	110,000 Hz	109,986.8 Hz		110,013.2 Hz
	Transmitter Level Range			
5-20	Step 4: Fully clockwise	3.42V		
	Step 5: Fully anti-clockwise			0.00775V
	Transmitter Level Accuracy			
5-20	Step 4: 0 dBm	0.7657V		0.7836V
	Step 5: −5 dBm	0.4306V		0.4406V
	−10 dBm	0.2421V		0.2478V
	−19 dBm	0.0859V		0.0879V

Performance Test Record
Continued

Page No.	Test Description	Result		
	Transmitter Flatness at 10 dBm	*Min*	*Actual*	*Max*
5-22	Step 5: 20 Hz	2.1831V		2.7484V
	200 Hz	2.3937V		2.5065V
	5,000 Hz	2.3937V		2.5065V
	15,000 Hz	2.3937V		2.5065V
	30,000 Hz	2.3125V		2.5946V
	85,000 Hz	2.3125V		2.5946V
	Transmitter Flatness at −40 dBm			
5-22	20 Hz to 200 Hz: ±1.0 dB			
	200 Hz to 15 kHz: ±0.2 dB			
	15 kHz to 85 kHz: ±0.5 dB			
	Transmitter Distortion			
5-29	Step 5: 0 dBm at 1000 Hz			−55 dB
	Step 6: 0 dBm at 1004 Hz			−55 dB
	−40 dBm at 4 kHz			−50 dB
	−30 dBm at 110 kHz			−40 dB
5-30	Step 10: 10 dBm at 4 kHz			−55 dB
	Step 11 0 dBm at 4 kHz			−55 dB
	10 dBm at 110 kHz			−40 dB

Performance Test Record
Continued

Page No.	Test Description	Result		
	Receiver Frequency Range and Accuracy	*Min*	*Actual*	*Max*
5-32	Step 4: 20 Hz	19 Hz		21 Hz
	Step 5: 1000 Hz	999 Hz		1001 Hz
	10,000 Hz	9,995 Hz		10,005 Hz
	50,000 Hz	49.99 kHz		50.01 kHz
	100,000 Hz	99.99 kHz		100.01 kHz
	110,000 Hz	109.99 kHz		110.01 kHz
	Receiver Level Accuracy			
5-34	Step 4: 1000 Hz	9.9 dBm		10.1 dBm
	Step 6:	−20.1 dBm		−19.9 dBm
	Step 8: 20 Hz	10 dBm		12 dBm
	Step 9: 50 Hz	10.5 dBm		11.5 dBm
	200 Hz	10.8 dBm		11.2 dBm
	15,000 Hz	10.8 dBm		11.2 dBm
	85,000 Hz	10.5 dBm		11.5 dBm
	Step 11: 20 Hz	−41 dBm		−39 dBm
	Step 12: 50 Hz	−40.5 dBm		−39.5 dBm
	200 Hz	−40.2 dBm		−39.8 dBm
	15,000 Hz	−40.2 dBm		−39.8 dBm
	85,000 Hz	−40.5 dBm		−39.5 dBm

Performance Test Record
Continued

Page No.	Test Description	Result		
	Message Circuit Noise Accuracy	*Min*	*Actual*	*Max*
5-36	Step 5:	98 dBrn		100 dBrn
	Step 7:	89 dBrn		91 dBrn
	Step 8:	79 dBrn		81 dBrn
		69 dBrn		71 dBrn
		59 dBrn		61 dBrn
		49 dBrn		51 dBrn
		39 dBrn		41 dBrn
		29 dBrn		31 dBrn
		19 dBrn		21 dBrn
		9 dBrn		11 dBrn
		2 dBrn		8 dBrn
	Notch Filter Rejection			
5-38	Step 4: 995 Hz			40 dBrn
	Step 5: 1004 Hz			40 dBrn
	1015 Hz			40 dBrn
	1025 Hz			40 dBrn

Performance Test Record
Continued

Page No.	Test Description	Result		
	Signal to Noise Ratio Accuracy	*Min*	*Actual*	*Max*
5-40	Step 4:	9 dB		11 dB
	Step 5:	19 dB		21 dB
		29 dB		31 dB
		39 dB		41 dB
		43 dB		47 dB
	Impulse Noise Threshold Accuracy			
5-42	Step 6: Count starts at			2.1831 mV
	Step 11: Count starts at			3.46 mV
5-43	Step 16: Count starts at			5.4837 mV
	Step 18: *60 dBrn*			
	Low	15.455 mV		19.457 mV
	Mid	24.495 mV		30.837 mV
	High	38.822 mV		48.874 mV
	80 dBrn			
	Low	0.1546V		0.1946V
	Mid	0.2449V		0.3084V
	High	0.3882V		0.4887V
	100 dBrn			
	Low	1.5455V		1.9457V
	Mid	2.4495V		3.0837V
	High	3.8822V		4.8874V

Performance Test Record
Continued

Page No.	Test Description		Result		
	Noise to Ground Accuracy		*Min*	*Actual*	*Max*
5-45	Step 4:	65.17V	127 dBrn		130 dBrn
	Step 5:	8.2049V	109 dBrn		112 dBrn
		0.8205V	89 dBrn		92 dBrn
		82.049 mV	69 dBrn		72 dBrn
		9.2061 mV	50 dBrn		53 dBrn
	P/AR Accuracy				
5-46	Step 3:	−23 dBm	98		102
	Step 4:	−20 dBm	98		102
		−40 dBm	98		102

A

Service Accessory 1 (SA1)
20 dB Amplifier/4 kHz Filter

Performance Test

SPECIFICATION

Unity Gain with Flat Filter	: 0 dB ±1.5 dB from 20 Hz to 85 kHz
20 dB Gain with Flat Filter	: 20 dB ±1.5 dB from 20 Hz to 85 kHz
4 kHz Filter	: Rejection at 10 kHz is greater than 10 dB

EQUIPMENT

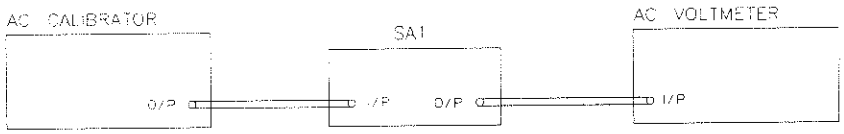
AC Calibrator	: DATRON 4707A
AC Voltmeter	: HP 3456A
Dual Output DC Power Supply	: HP 6234A

PROCEDURE

Caution 

Ensure that the AC Calibrator OUTPUT is switched off or set to the minimum level before proceeding with the following procedure.

1. Connect the equipment as shown in the following figure.



Unity Gain and Flatness Check

2. Set SA1 as follows:

   Gain : Unity
   Filter : Flat

3. Set the AC Calibrator output level to 0.7746V at 20 Hz then switch on the OUTPUT.
4. Check that the AC Voltmeter is between 0.6517V and 0.9206V.
5. Set the AC Calibrator to each frequency listed in the following table and check the corresponding AC Voltmeter reading.

AC Calibrator Frequency	AC Voltmeter Reading
50 Hz	0.6517V to 0.9206V
200 Hz	0.6517V to 0.9206V
1000 Hz	0.6517V to 0.9206V
15 kHz	0.6517V to 0.9206V
60 kHz	0.6517V to 0.9206V
85 kHz	0.6517V to 0.9206V

20 dB Gain and Flatness Check

6. Set SA1 as follows:

   Gain : 20 dB
   Filter : Flat

7. Set the AC Calibrator output level to 7.746 mV at 20 Hz.
8. Check that the AC Voltmeter reading is between 65.17 mV and 92.06 mV.
9. Set the AC Calibrator to each frequency listed in the following table and check the corresponding AC Voltmeter reading.

A-2 Service Accessory 1 (SA1) 20 dB Amplifier/4 kHz Filter

AC Calibrator Frequency	AC Voltmeter Reading
50 Hz	65.17 mV to 92.06 mV
200 Hz	65.17 mV to 92.06 mV
1000 Hz	65.17 mV to 92.06 mV
15 kHz	65.17 mV to 92.06 mV
60 kHz	65.17 mV to 92.06 mV
85 kHz	65.17 mV to 92.06 mV

4 kHz Filter Check

10. Set SA1 as follows:

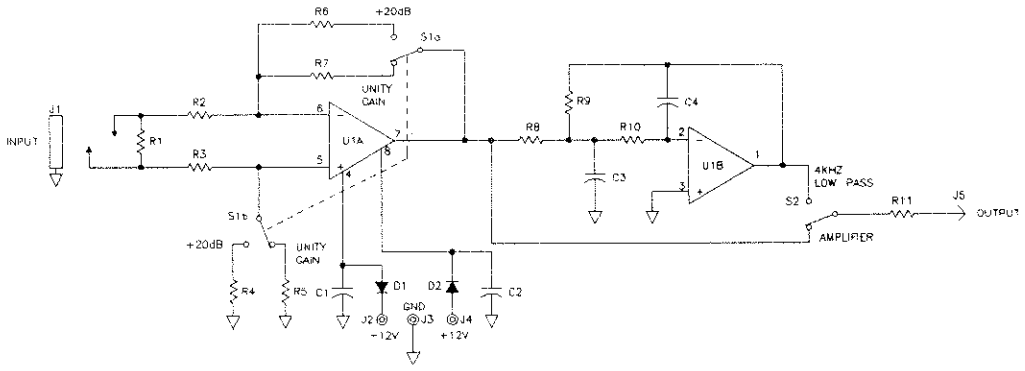
    Gain : Unity
    Filter : 4 kHz L. P.

11. Set the AC Calibrator frequency to 100 Hz.
12. Adjust the AC Calibrator output level until the reading on the AC Voltmeter is 0.7746V.

Note

Do not adjust the AC Calibrator output level for the remainder of the test.

13. Set the AC Calibrator frequency to 10 kHz.
14. Check that the reading on the AC Voltmeter is Less than 0.2450V.



SA1 Schematic

Replaceable Parts

Ref. Designator	Description	Qty.	HP Part No.
SA1	Amplifier/Filter Assembly	1	04935-60018
C1	Capacitor 0.12μF ±5%	2	0160-3468
C2	Capacitor 0.12μF ±5%		0160-3468
C3	Capacitor 10k pF ±1%	1	0160-3548
C4	Capacitor 1k pF ±1%	1	0160-2387
D1	Diode	2	1901-0040
D2	Diode		1901-0040
R1	Resistor 600Ω ±0.1%	2	0698-7408
R2	Resistor 10 kΩ ±1%	4	0757-0442
R3	Resistor 10 kΩ ±1%		0757-0442
R4	Resistor 100 kΩ ±1%	2	0757-0465
R5	Resistor 10 kΩ ±2%		0757-0442
R6	Resistor 100 kΩ ±1%		0757-0465
R7	Resistor 10 kΩ ±1%		0757-0442
R8	Resistor 42.2 kΩ ±1%	2	0698-3450
R9	Resistor 42.2 kΩ ±1%		0698-3450

A-4 Service Accessory 1 (SA1)
20 dB Amplifier/4 kHz Filter

Replaceable Parts
Continued

Ref. Designator	Description	Qty.	HP Part No.
R10	Resistor 2.87 kΩ ±1%	1	0698-3151
R11	Resistor 600Ω ±0.1%		0698-7408
U1	MC3400L	1	1826-0712
S1	Switch	2	3101-0973
S2	Switch		3101-0973
J1	Connector	1	1251-3677
J2	Binding Post	3	1510-0076
J3	Binding Post		1510-0076
J4	Binding Post		1510-0076
J5	BNC Connector	1	1250-1780

B

Service Accessory 2 (SA2) Power Splitter/Adder

Performance Test

SPECIFICATION

Characteristic Impedance: 600Ω
Attenuation between any two ports: 6.02 dB ±0.05 dB at 40 Hz to 40 kHz

EQUIPMENT

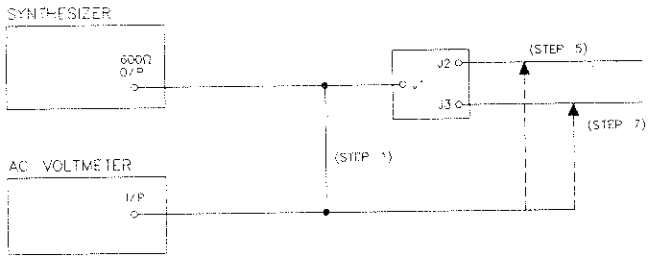
AC Voltmeter	: HP 3456A
Synthesizer	: HP 3336B
Resistor 600Ω ±0.01%	: HP 0811-3502

Note

Do not use an AC Calibrator in place of a Synthesizer with a 600Ω balanced output or errors will occur.

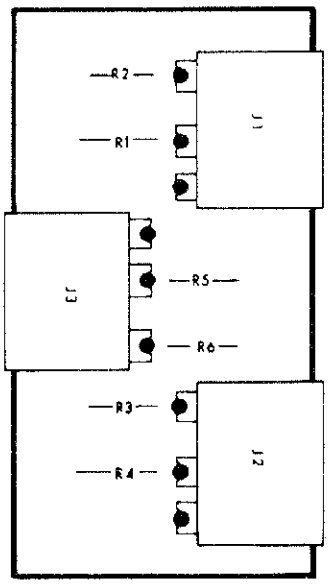
PROCEDURE

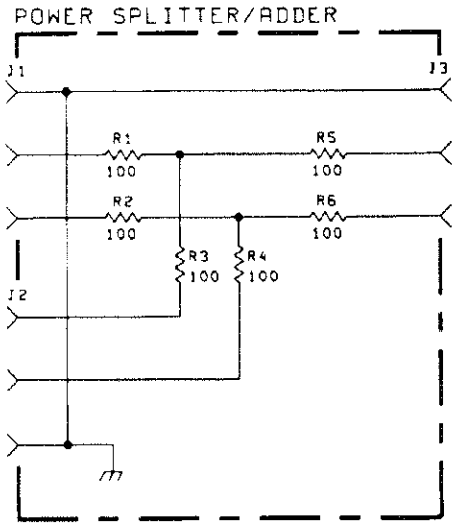
1. Connect the equipment as shown in the following figure.



2. Set the Synthesizer output level to 0 dBm at 200 Hz.

3. Adjust the Synthesizer output level until the reading on the AC Voltmeter is between 1.5420V and 15491V
4. Connect the 600Ω resistor across J2 and the AC Voltmeter across J3.
5. Check the AC Voltmeter reading is between 0.7702V and 0.7791V.
6. Connect the AC Voltmeter across J2 and the resistor across J3 then repeat step 5.
7. Repeat steps 2 to 6 with the Synthesizer frequency at 40 kHz.





Replaceable Parts

Ref. Designator	Description	Qty.	HP Part No.
R1 to R6	Resistor Fxd 100Ω 0.1% 1/8 W	6	0698-6323
J1 to J3	Connector 3-pin	3	1251-2533
MSC	Connector single pin	9	1251-0600
MSC	Blank Printed Circuit Board	1	03779-20045

B-2 Service Accessory 2 (SA2) Power Splitter/Adder

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M

S

T

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