Errata

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Operating Guide

HP 85711A Cable Television Measurements Personality

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If *you are ready to use the cable television capability* of your spectrum analyzer, turn to Chapter 1, "Getting Started," in this manual. This chapter introduces you to the CATV personality, shows you how to load it, and prepares you for making measurements. Chapter 2, "CATV Measurements," describes the tests and functions added by the CATV personality. Chapter 3, "Support Information," provides specifications, characteristics, and verification tests specific to the use of the CATV tests and the HP 8590B, HP 8590D, HP 8591A, HP 8591E, HP 8592B, HP 8592D, HP 8593A, HP 8593E, HP 8594A, HP 8594E, HP 8595A, HP 8595E, or HP 8596E. Chapter 3 also tells you what to do if something goes wrong with the cable television functions.

Notational Conventions Used In This Manual

The display features six **softkeys** at the right-hand side of the display. A softkey executes a function defined by firmware or by software. The name of the function appears on the display next to the activating key.

This manual uses the following conventions:

(FRONT-PANEL KEY)   An function name in a keycap symbol represents a labeled key physically located on the instrument. This key is referred to as either a **key** or a **hardkey**.

SOFTKEY   A function name in screen-font indicates a softkey that either directly executes its function or provides access to a subset menu of softkeys.

CRT Text   Unboxed text in a monospace font indicates any displayed text other than soft keys.

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1

Getting Started

What You'll Find in This Chapter

This chapter describes the HP 85711A cable television measurements personality (CATV), then tells how to load it into and delete it from spectrum analyzer memory, and finally tells how to set up for measurements. The discussion includes the following topics:

■ Introducing the HP 85711A CATV measurements personality

■ How to load the CATV measurements personality

■ How to delete the CATV measurements personality

■ Input setup configurations

■ Tune configurations

■ Accessing CATV tests and functions

Introducing the HP 85711A CATV Measurements Personality

The HP 85711A CATV measurements personality is software permanently stored on a read-only memory (ROM) **measurement card.** A software **personality** is a downloadable program (DLP) consisting of measurement routines especially useful to a particular application.

This CATV measurements personality and an HP 8590 Series spectrum analyzer together have all the capabilities and functions of a standard spectrum analyzer plus an extensive set of specific cable television measurements and functions. In addition, this revision works with the Analog+ display mode for real-time analog emulation capability, available for the HP 8590D, HP 85913, HP 8592D, HP 8593E, HP 85943, HP 8595E, HP 8596E, and some HP 8590B, HP 8591A, HP 8592B, HP 8593A, HP 8594A, and HP 8595A spectrum analyzers (spectrum analyzers with firmware dated 17.7.91 or later). Each CATV measurement typically performs the following tasks:

■ Sets up all spectrum analyzer settings (the analyzer state) required for the measurement.

■ Prompts for any adjustments or values.

■ Performs the measurement.

■ Displays the measurement results.

The CATV measurement tests included in this personality are not the only spectrum analyzer measurement tests performed on CATV systems. The chosen set of CATV measurement tests significantly simplify and shorten common tasks.

Standard spectrum analyzer functions allow other CATV measurements. Refer to your documentation for descriptions of standard analyzer functions.

How to Load the CATV Measurements Personality into the Spectrum Analyzer

1. Locate the arrow printed on the label on the ROM measurements card.

2. Insert the card so that the arrow on the card matches the raised arrow on the bezel around the card-insertion slot.

3. Press the card into the slot. When correctly inserted, 19 mm (0.75 in.) of the card extends from the slot.

4. Press (RECALL). If INTRNL is underlined, press INTRNL CRD to select CRD, which selects the memory card.

5. Press CATALOG CARD, CATALOG ALL, and LOAD FILE. (The CATV measurements personality file name is dCATV_1.) Wait until the file listing disappears-possibly 60 seconds.

6. Press (MODE) and check for the presence of CATV ANALYZER. This softkey indicates that the personality is in memory, and that the CATV ANALYZER mode is available.

Frequency Accuracy Improvement

For HP 8590B, HP 8590D (except Option 013), HP 8592B, and HP 8592D only

When loading the CATV measurements personality into an HP 8590B, HP 8590D, HP 8592B, or HP 8592D spectrum analyzer, a CAL FREQ & CAL STORE should be performed. For these analyzers that are not counter-locked, the CATV measurements personality adds a special calibration routine to the end of the regular frequency calibration (CAL FREQ). This routine records the CATV channel's tuning offset numbers. These numbers are then used by the CATV channel tuning routine to improve frequency accuracy. The specific offset number for each channel is displayed after tuning on the screen in the OFFST position. If a channel is tuned by the CATV measurements personality before a CAL FREQ is performed, the message "PLEASE CAL FREQ & STORE" appears at the bottom of the screen. Until the CAL FREQ is performed, the analyzer may tune to the wrong channel for frequencies above 350 MHz. This applies only to analyzers without counter-lock.

How to Delete the CATV Measurements Personality from the Spectrum Analyzer

The steps outlined below remove the CATV tests and functions added to a spectrum analyzer by the ROM measurements card:

1. Press CATV ANALYZER, More 1 of 3 , More 2 of 3 , and **Misc Menu** .

2. Press DISPOSE CATV . The message IF YOU ARE SURE, PRESS KEY AGAIN TO PURGE DATA appears.

3. Press DISPOSE CATV again.

4. Wait until the CATV ANALYZER disappears from the menu-about 2 seconds.

Input Setup Configurations

The HP 85711A CATV measurements personality operates with several spectrum analyzers. The personality allows you to select input configurations.

HP 8590 Series Option 001 (75 Ω) spectrum analyzers

These analyzers require no input setup configuration.

HP 8590 Series standard (50 Ω) spectrum analyzers

Press the following keys to access the Input Config menu:

MODE CATV ANALYZER More 1 of 3 More 2 of 3 Misc Menu Input Config. See Figure l-l.

NO EXT PAD — Press this softkey if you want to use your own matching pad/dc block or transformer, or if you do not **want** to use an external matching pad/dc block or transformer.

EXT PAD — Press this softkey to set a 5.8 dB reference level offset, which compensates for the external pad (HP 8590 Series Option 711 spectrum analyzer) insertion loss. The 50 Ω to 75 Ω matching pad/dc block at the spectrum analyzer input allows specified measurements on **75 Ω** systems.
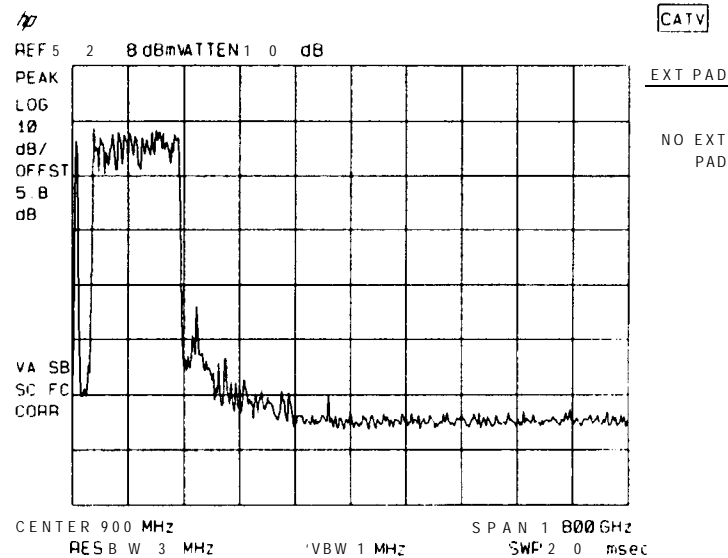
Figure l-l.

Note

1. INPUT CONFIG will not appear for a 75 Ω input spectrum analyzer. It will appear for a 50 Ω input spectrum analyzer, and a configuration must be selected. The input configuration is stored in analyzer memory, so cycling line power does not destroy the set up.

2. The default configuration for a 50 Ω input spectrum analyzer is 75 Ω computational input impedance, dBmV amplitude units, and NO EXT PAD input configuration.

3. The only test result to be significantly affected by the presence or absence of an external pad is the visual carrier level. This is the only *absolute* measurement in the CATV measurements personality. All other measurements are *relative* to the visual carrier and thus are not affected by pad loss. The HP 8590 Series spectrum analyzer is still recommended, however.

Tune Configuration

The Tune Config menu allows you to select channel format (standard, over-the-air, IRC, or HRC) and maximum carrier level (70 dBmV or 40 dBmV). Refer to Figure l-2. Appendix A lists frequency allocations of the various channel formats.
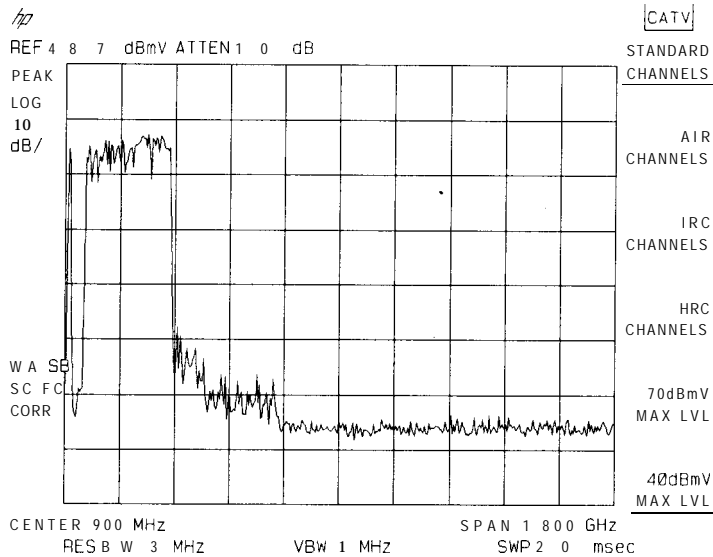
Figure l-2.

1. If the **Misc** Menu menu is displayed, continue at step 2. Otherwise, press the following keys:

   (MODE) CATV ANALYZER More 1 of 3 More 2 of 3 **Misc** Menu.

2. Press Tune **Config**, then select the format that matches your system:
   STANDARD CHANNELS, AIR CHANNELS, IRC CHANNELS, or HRC CHANNELS.

3. Press Tune **Config** again, then select the maximum carrier level: 70 **dBmV** MAX LVL or
   40 **dBmV** MAX LVL . The default value of 40 dBmV is used for most situations.

After selecting a channel, the selected channel format appears between parentheses at the top of the screen in the title line. Refer to Figure l-3.
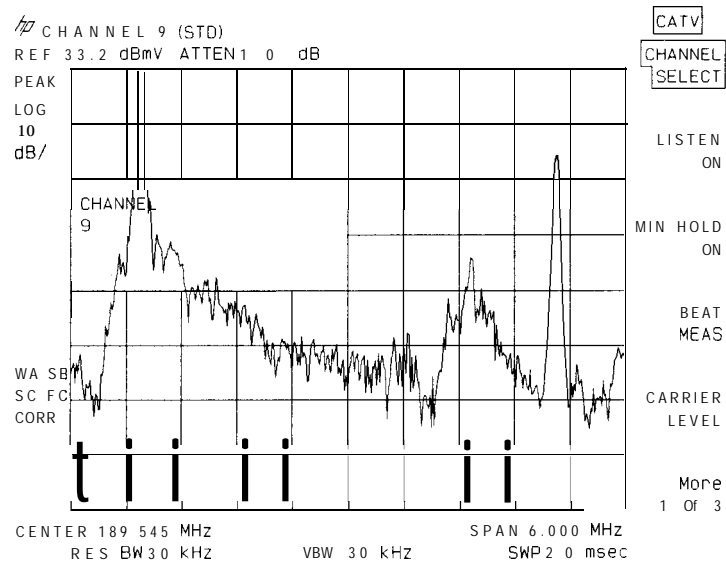
Figure I-3.

Accessing CATV Tests and Functions

The HP 85711A CATV measurements personality adds a CATV ANALYZER mode to the spectrum analyzer.

1. To access the CATV tests and functions, press (MODE) CATV ANALYZER. See Figure l-4.

2. The three sets of CATV softkey menus are shown in Figures 1-5, 1-6, and l-7. Press More 1 of 3 More 2 of 3 More 3 of 3 to cycle through the CATV softkey menus.

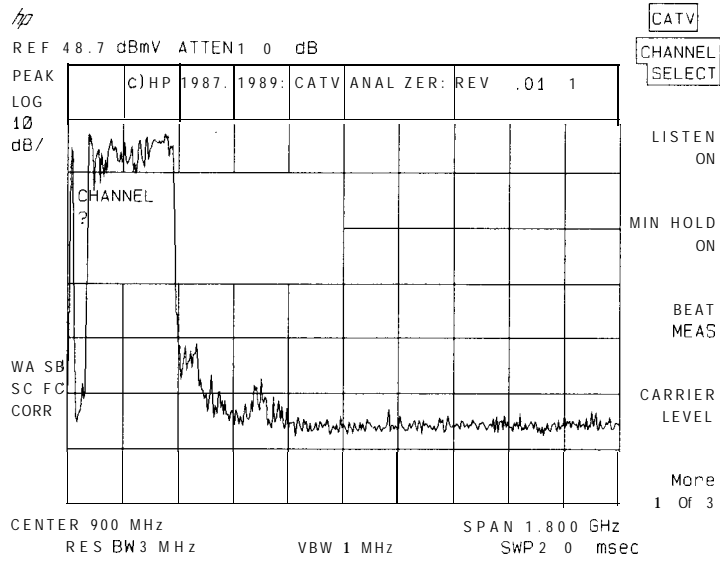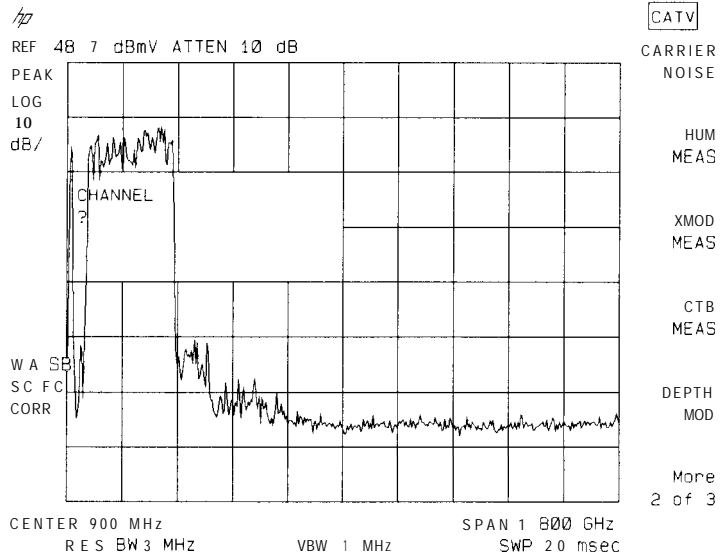| Note	See Figure l-8 for the entire menu map at a glance.
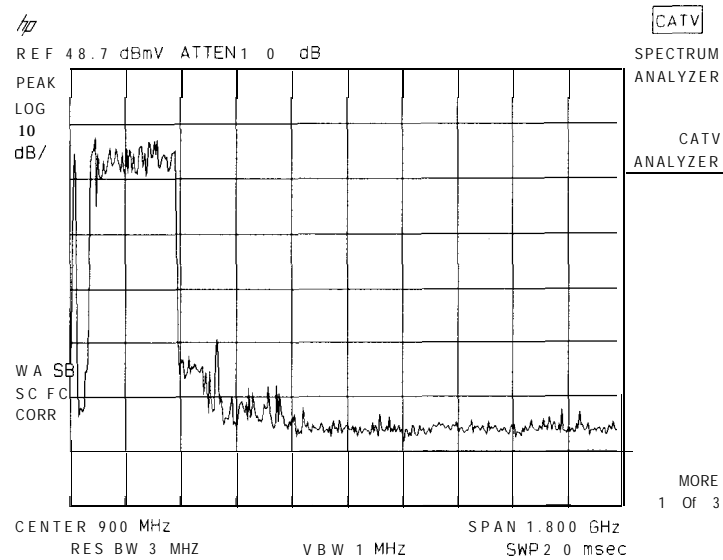
Figure 1-4.

Figure 1-5.

Figure I-6.
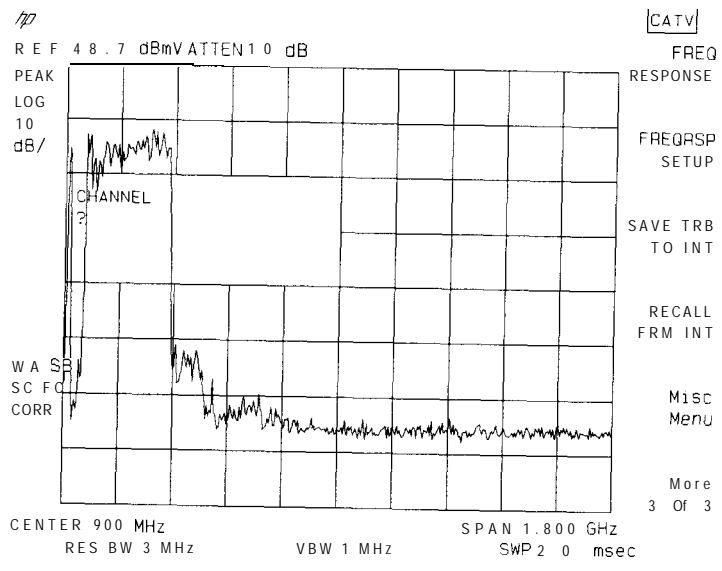
Figure 1-7.

CATV Menus From PRESET, MODE, and DISPLAY
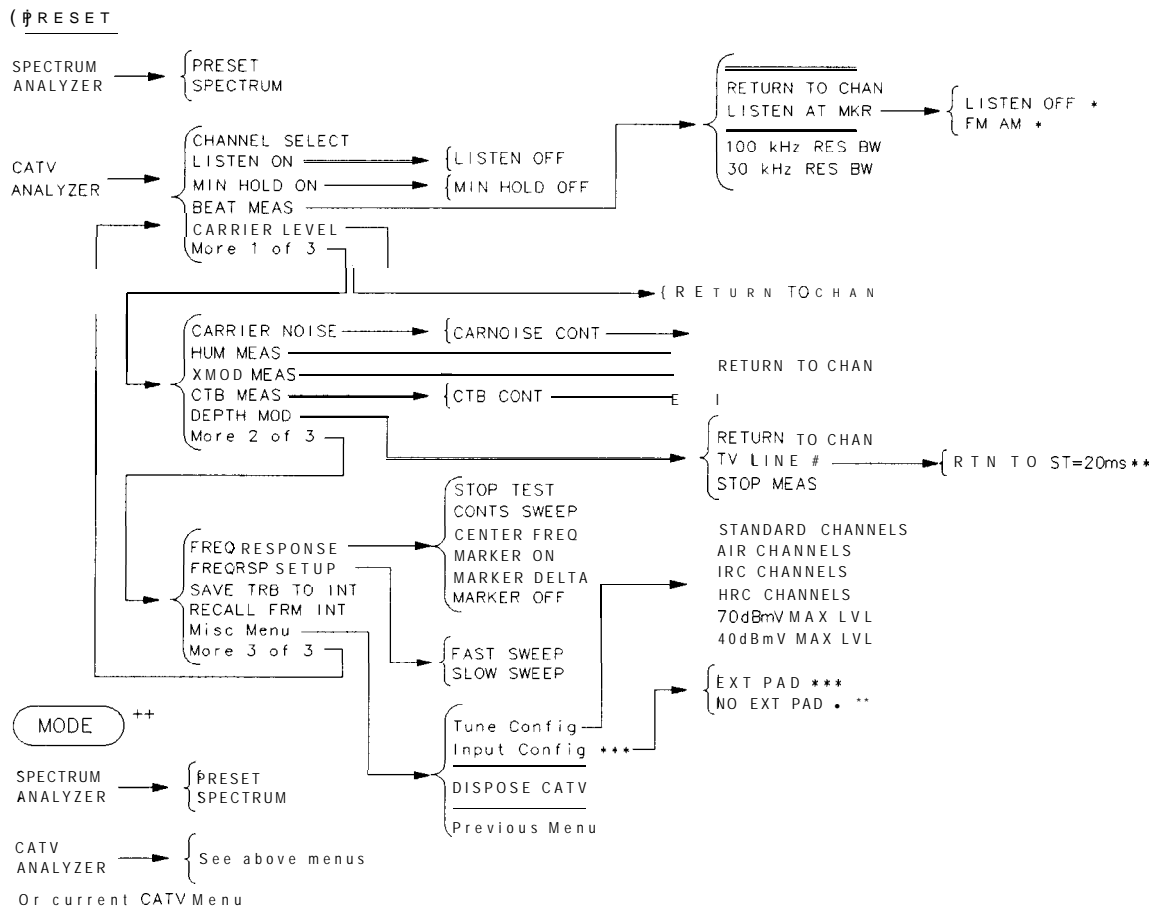
Figure 1-6. CATV Menu Map

NOTES

* Option 102 only.
** Option 101 and 102 only
*** 50 ohm analyzer only
++ First press displays the MODE menu. This is the same as the PRESET menu.
   Second press displays current CATV menu
   Each subsequent press toggles between the MODE menu and current CATV menu.
t This softkey appears after loading and running the HP 85711A

VL22A

2

CATV Measurements

What You'll Find in This Chapter

This chapter describes all CATV tests and functions included in the HP 85711A CATV measurements personality. The following list shows chapter organization.

Notational Conventions in This Manual

The display features six **softkeys** at the right-hand side of the display. A softkey executes a function defined by firmware or by software. The name of the function appears on the display next to the activating key.

This manual uses the following conventions:

FRONT-PANEL KEY A function name in a keycap symbol represents a labeled key physically located on the instrument. This key is referred to as either a **key** or a **hardkey**.

SOFTKEY A function name in screen-font indicates a softkey that either directly executes its function or provides access to a subset menu of softkeys.

CRT Text	Unboxed text in a typewriter font indicates any displayed text other than softkeys.

Note When obtaining hard copy outputs, softkeys are available only when the output is directed to a printer.

Hints

1. If you accidentally use the wrong key sequence, reenter the channel. If CHANNEL SELECT is the active function, enter the channel number, then press (ENTER). Otherwise, press CHANNEL SELECT , enter the channel number, then press (ENTER).

2. If you leave the CATV softkeys (to use markers, for example) or exit a test incorrectly you can return to the last used CATV menu by pressing the mode key twice: (MODE) (MODE).

3. In either of the above cases, or if you are lost in the CATV ANALYZER mode, press (MODE) to reenter the CATV ANALYZER mode, then enter a channel number.

4. If you want to set the spectrum analyzer to the power-on default conditions after using the CATV functions, you can either cycle the power or press [PRESET).

5. After exiting any test, you can step up or down to an adjacent numbered channel by pressing the up (▲) or the down (▼) arrow key.

6. To prevent the analyzer input from being overloaded, the total power at the spectrum-analyzer input mixer must be less than $+39$ dBmV. Use the following formula to find the total power when the visual carriers are equal in level:

   Total Power (dBmv) = Visual Carrier Level (dBmv) +
   10 Log (Number of Channels) $-$ Input Attenuation (dB)

   For systems with unequal carrier levels (system tilt), the total power must be calculated by summing the individual carriers (or use a nomograph available from the Hewlett-Packard CATV seminar).

   Total power at the mixer can be reduced by increasing input attenuation. Press (AMPLITUDE) ATTEN , and make the adjustment. The spectrum analyzer retains a manually selected attenuation until you either select a new value or reset the analyzer power-on default conditions.

CHANNEL SELECT

Channel select is a function used in conjunction with tests. It sets up the spectrum analyzer state for CATV tests, lets you select a specific channel number, and centers the specific channel on the spectrum analyzer screen.

The channel is selected based on the one of the four channel formats available in the tune configuration function as described in Chapter 1: standard, over-the-air, IRC, or HRC.

The channel is displayed on screen in a 6 MHz span to show both the visual and aural carriers. The visual carrier is positioned just below the reference level.

Two ranges for maximum carrier level are available in the tune configuration function as described in Chapter 1: $+70$ dBmV and $+40$ dBmV.

Procedure

1. The channel selection function is always active when you enter the CATV ANALYZER mode. CHANNEL ? appears in the active function block. See Figure 2-l.

   To select a channel after the analyzer is preset or powered on, press (MODE) CATV ANALYZER, wait for the CHANNEL ? prompt, enter the channel number, then press (ENTER] (lower right-hand hardkey). See Figure 2-l.
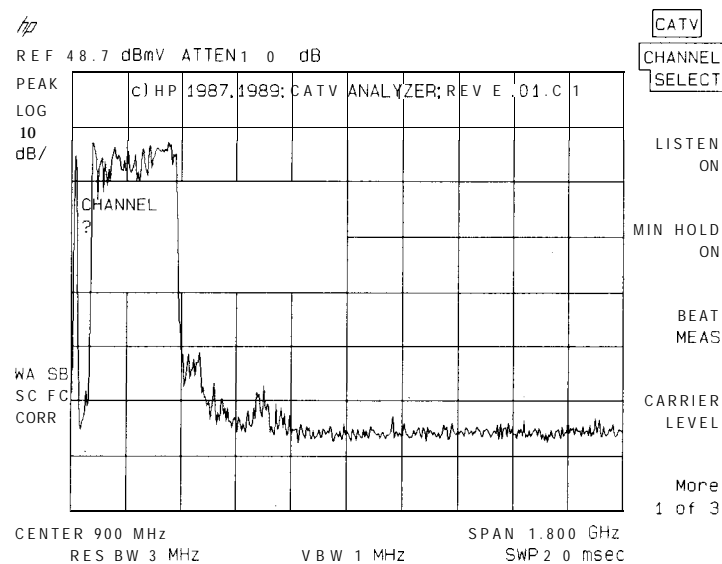

Figure 2-1.

2. Anytime the channel select function is not active (see Figure 2-2), press CHANNEL SELECT, you can enter the channel number, then press (ENTER).
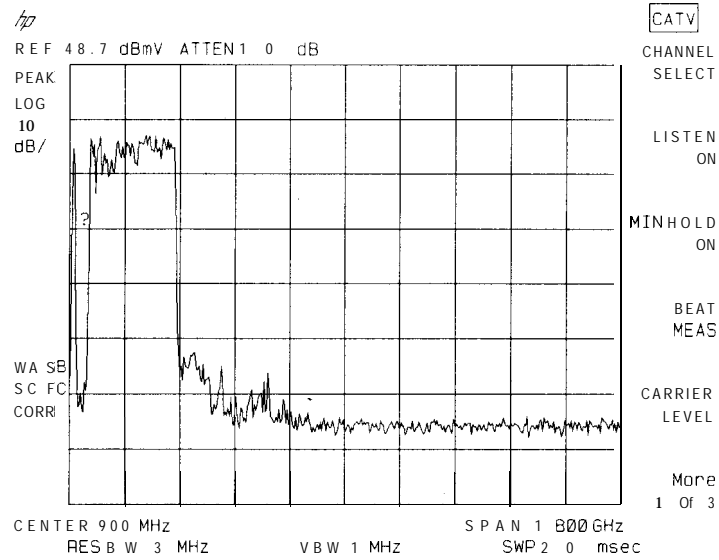
Figure 2-2.

3. Up and down arrow keys (▲ and ▼) select the next higher or lower channel number, respectively.

4. The current channel number appears next to the channel format at the top of the screen in the title line. See Figure 2-3.
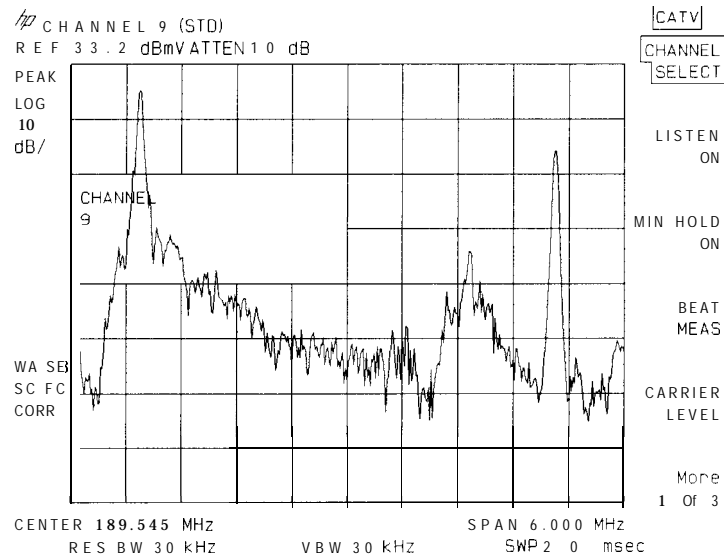

Figure 2-3.

Note   When entering channels, always reenter the number before pressing (<u>ENTER</u>).
Just pressing (ENTER) will tune the analyzer to channel 1.

Hints   1. The visual carrier of a channel must be "on" before the CHANNEL SELECT
function can correctly center the channel.

2. If the selected channel is not present and if its aural carrier appears in
the measurement window, then CHANNEL SELECT may locate the aural
carrier of the next lower channel (for HP 8590B, HP 8590D, HP 8592B, or
HP 8592D only).

3. Do not use the data knob for selecting channels.

BEAT MEAS

The beats measurement test places a reference marker at the peak carrier level and activates the delta marker so that you can position it on the beat or intermodulation product.

Procedure

1. Select a channel, then press BEAT MEAS. A marker is placed on the peak of the carrier, and the delta marker is activated.

2. After the displayed modulation and noise are reduced, use the knob to position the delta marker on the beat. The frequency and amplitude differences between the peak carrier level and the beat appears in the active function block. See Figure 2-4.
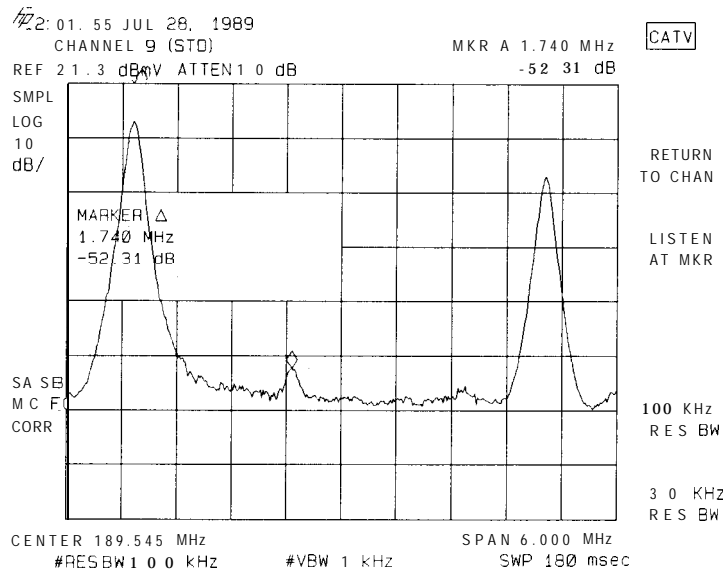

Figure 2-4.

3. During the test, you can change the default 100 Khz resolution bandwidth (RBW). For example, you might select 30 kHz RES BW to improve resolution of beats close to the visual carrier. Return to 100 kHz RBW by selecting 100 Khz RES BW .

4. Selecting either 100 Khz RES BW or 30 kHz RES BW resets the modulation and noise reduction part of the beats function. This reset can improve the beat clarity during the measurement.

5. Option 102 allows you to demodulate the beat in AM or FM by pressing the LISTEN AT MKR . Press LISTEN OFF to return to the previous menu.

6. Press RETURN TO CHAN to exit the test.

Note Because of the minimum hold function used in this measurement, the delta marker display is approximately 3 dB lower than the actual beat level. For example, if the marker displays -50 dBc, the actual beat level is closer to -47 dBc.

CARRIER LEVEL

The carrier level test measures the peak visual carrier level and the visual-to-aural carrier ratio of a channel.

Procedure

1. Select a channel, then press CARRIER LEVEL . The peak visual carrier level and visual-to-aural carrier ratio appear on the screen as shown in Figure 2-5.
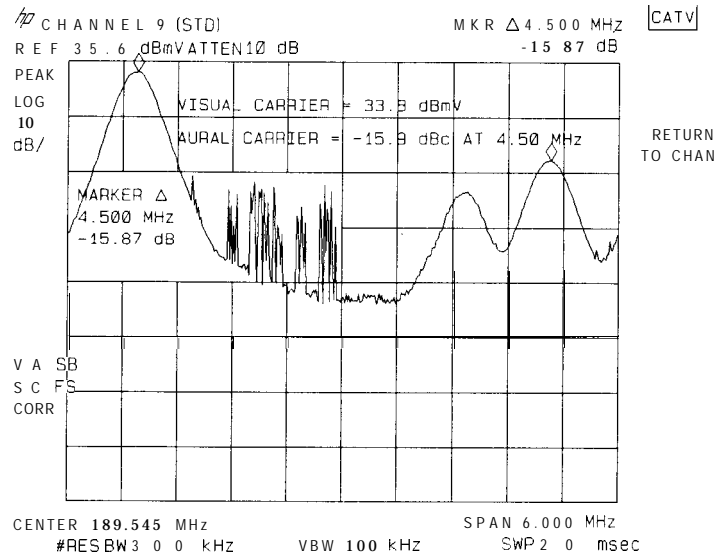

Figure 2-5.

2. Press RETURN TO CHAN to exit the test.

Hint   For best results, the carrier-to-noise ratio (in 4 Mhz SW) of the system should be 40 dB or greater, and the measured signal level should be 30 dB or greater above the displayed noise during the test.

CARRIER NOISE

The carrier-to-noise test measures the carrier-to-noise ratio of a channel (modulated or unmodulated carrier), normalized to a 4 MHz noise bandwidth.

Procedure

1. Select a channel, then press *More* `1 of 3` `CARRIER NOISE`.

2. The prompt `MAKE ADJUSTMENTS AS NECESSARY` appears as shown in Figure 2-6. A reference noise level appears on the screen. Three options follow for proceeding with the test:

   Option 1   Turn off the carrier or the modulation at the headend.

   Option 2   Press [FREQUENCY] to tune to a nearby unoccupied channel, then either enter the channel frequency or press a step key. Get back to the appropriate CATV menu by pressing the MODE key twice: (MODE) [MODE].

   Option 3   Change nothing. In this case, the spectrum analyzer will find the minimum noise level between the visual carrier and the aural carrier of the next lower channel when the test is continued.
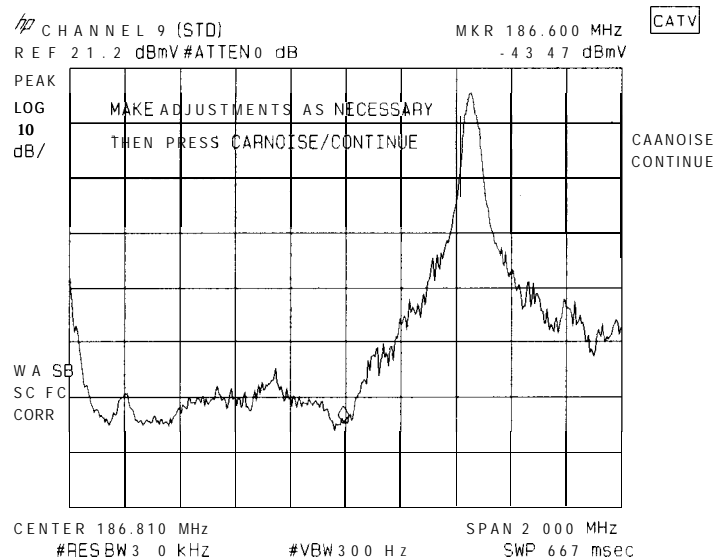

Figure 2-6.

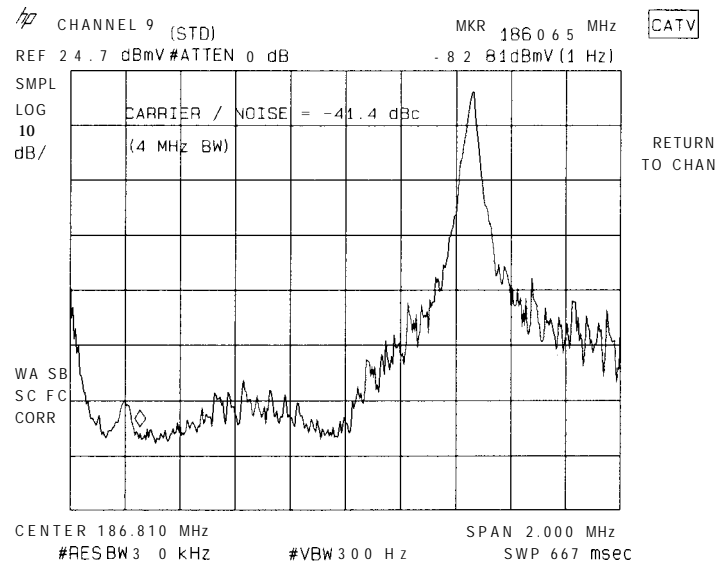3. `Press CARNOISE CONTINUE`. The result appears as shown in Figure 2-7.

Figure 2-7.

4. Ensure the carrier is on before pressing RETURN TO CHAN .

Hints

1. For best results, the visual carrier signal level at the spectrum-analyzer input should be +38 dBmV or higher. For lower signal levels: use a preamplifier and a bandpass filter.

2. Before pressing CARNOISE CONTINUE the reference level should be adjusted so the noise floor is at least two divisions from the bottom graticule line. The noise floor can also be raised by widening the resolution bandwidth.

3. For best carrier-to-noise measurement accuracy, the system noise must be 10 dB or greater than the spectrum analyzer noise. To check this, disconnect the signal input to the spectrum analyzer and compare its noise with the system noise. If the two noise levels are less than 10 dB apart, you can use a preamplifier and bandpass filter.

HUM MEAS

The hum test measures the percentage of amplitude modulation for low frequency disturbances (hum) in two ways, peak-to-peak variation for total hum and Fast Fourier Transform (FFT) for 60 Hz and 120 Hz hum.

Total hum is measured by reading the peak-to-peak variation in the visual signal level caused by low frequency disturbances (hum or repetitive transients). Two values are reported, %AM for broadband local area networks, and National Cable Television Association (NCTA) for cable television systems. These values are explained more fully in the hints following the hum test procedure.

60 Hz hum and 120 Hz hum are calculated using the spectrum analyzer's FFT capability. These values appear in the %AM column and are intended to be used as a troubleshooting aid. A relatively high 60 Hz level implies inadequate grounding or stray power utility neutral currents. A relatively high 120 Hz level implies poor filtering of a full-wave rectifier in a power supply.

The relationship between the two test methods (peak-to-peak and FFT) is a function of the wave shape of the disturbance. A pure 60 Hz or 120 Hz sine wave is the only wave shape for which the results from the peak-to-peak and FFT tests converge. For all other wave shapes, results diverge. Therefore, use the total hum results for meeting standards and use the FFT 60 Hz and 120 Hz hum results for troubleshooting.

The hum test automatically configures the spectrum analyzer for measuring with or without video modulation on the carrier. This is necessary because spectrum analyzer settings used to match the *NCTA Recommended Practices* cannot be used when video modulation is present. Other spectrum analyzer settings can be used to compensate for the presence of video modulation, then the measurement can be made.

When video modulation is on, the video bandwidth is set to 1 Mhz to allow the spectrum analyzer to measure only the values of the sync tips. When the video bandwidth is set to 1 MHz, significant noise is also present. This noise is digitally minimized, then several peak-to-peak measurements are taken and averaged. Using the average of these measurements gives the best consistency with visual oscilloscope measurements. However, the effects of noise cannot be completely eliminated and the results reported have slightly more uncertainty (usually less than 1% larger) than when video modulation is off. The reverse, however, is not true. That is, when adding modulation to a carrier wave signal, results will increase, not decrease. For example, if the results are less than 3% with modulation on, FCC rule 76.605(a)(10) is satisfied. If a channel does exceed 3%, it may still pass by testing again without video modulation.

When video modulation is not present, the test sets the spectrum analyzer to the conditions set forth in the *NCTA Recommended Practices.* A setting of zero span with a sweep time of 5 ms/div acts as a signal level meter and oscilloscope display, and a video bandwidth of 1 kHz functions as a 1 kHz low pass filter. Several peak-to-peak measurements are taken, then the average measurement is reported. This result is reported in the NCTA column and can be used to satisfy the FCC 76.605(a)(10) test for low frequency disturbances.

Obtaining meaningful results even in the presence of video modulation is a great benefit. No one needs to be present at the headend to temporarily insert a carrier wave signal, and subscribers are not deprived of service. On a properly operating system, results with video modulation present will usually be under the 3% limit. Low frequency disturbances on channels above the limit are often a combination of video field time distortion on the received

signal and cable system hum. The dominant contributor may be identified by removing the signal input to the headend, inserting a clean carrier wave signal on that input, and retesting. More than 3% field time distortion on off-air signals has been observed, but it also has been seen to be caused by multi-path interference between the transmitter and the headend antenna. Field time distortion on the signal can also be qualitatively separated from cable hum by observing whether the distortions vary with time or picture level since cable hum won't change with picture level.
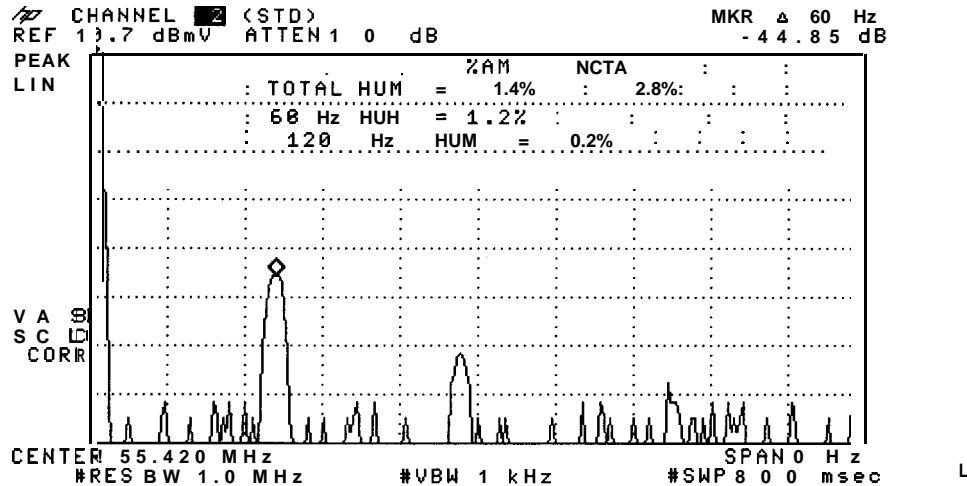
Figure 2-8.

Procedure

1. Select a channel or tune directly to the carrier to be measured. Make sure that the desired carrier is the highest on screen by adjusting the center frequency and/or span as needed. Turn off modulation (optional), then press More 1 of 3 , HUM MEAS . The results appear as shown in Figure 2-8. The FFT calculated trace is left on the screen and the delta marker is active at the 60 Hz responses.

2. To observe the real time signal, press (TRACE), CLEAR WRITE A, (SWEEP), 50 ms. To get the RETURN TO CHAN softkey back, press Mode twice.

3. Press RETURN TO CHAN to exit the test.

Hints
    . For best results, the channel carrier-to-noise ratio should be 35 dBc or greater (in a 4 MHz noise bandwidth).

2. %AM hum is defined in *IEEE Std 802. 7-1989 Recommended Practices for Broadband Local Area Networks* in section 2.8, "Incidental Modulation" (hum). It is described as the "percentage of peak-to-average level of the amplitude modulation with respect to the average level of the desired carrier wave signal." The recommended limit is 2%.

NCTA hum is described in the *Code of Federal Regulations,* Title 47, part 76.605(a)(10) as the "peak-to peak variation in visual signal level" (see part

76.5[y]). This definition is in agreement with the procedure "Modulation Distortion at Power Frequencies" in Part I(A) of the *National Cable Television Association Recommended Practices for Measurements on Cable Televisions Systems,* Second Edition, 1989. The FCC limit for NCTA hum is 3%. Because %AM hum uses "peak-to-average" and NCTA hum uses "peak-to-peak"values, NCTA hum will be twice that of %AM hum.

3. The hum test requires a carrier wave or NTSC signal. It cannot give meaningful results when a channel uses sync suppression scrambling (unless the measurement is made at the subscriber terminal output of a descrambler). Measuring hum with video modulation present requires that all sync tips have the same general level in order to measure their variation.

    When the hum test is performed on channels with sync suppression scrambling, it gives completely meaningless numbers.

XMOD MEAS

The cross modulation test measures the 15.7 kHz cross modulation relative to the unmodulated visual carrier of the channel.

Procedure

1. Select a channel, turn off modulation, then press More 1 of 3 XMOD **MEAS** . The results appear as shown in Figure 2-9.
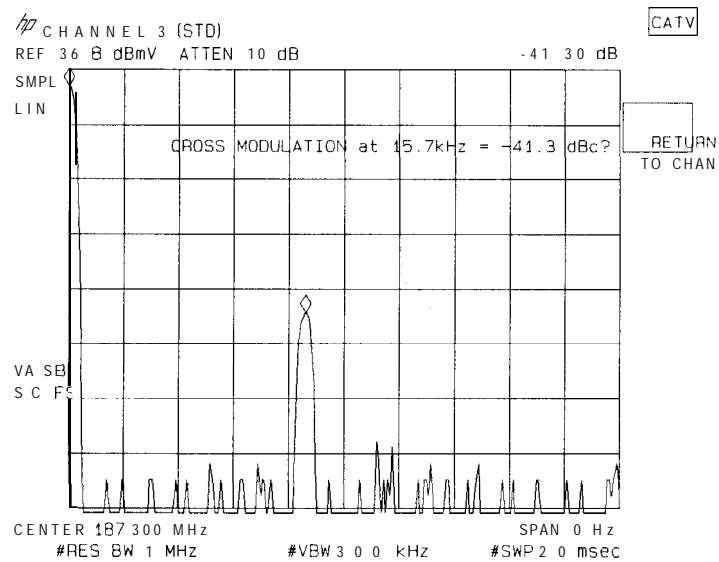
Figure 2-9.
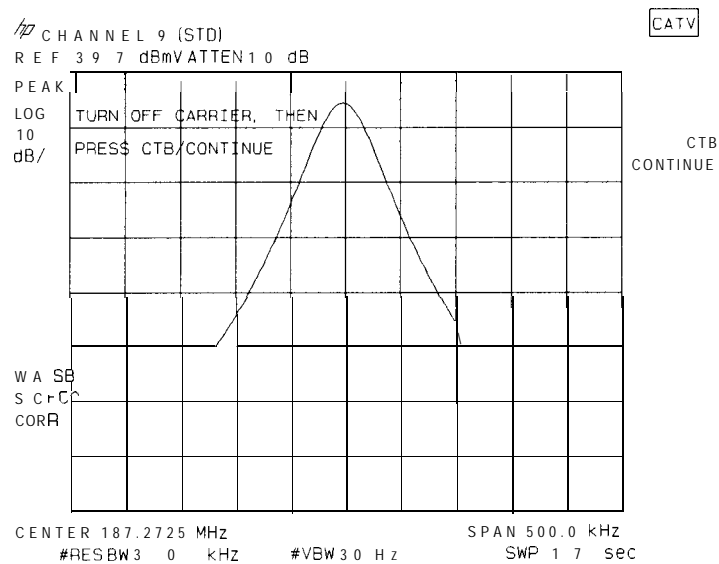
2. Press RETURN TO CHAN to exit the test.

Hints   1. To ensure an accurate measurement, the channel must be unmodulated.

2. For best results, the carrier-to-noise ratio of the system should be 40 dBc or greater (in a 4 MHz noise bandwidth).

CTB MEAS

The composite triple beat (CTB) test measures the composite third order distortion beneath the visual carrier of a channel (modulated or unmodulated).

Procedure

1. Select a channel, then press More 1 of 3 CTB MEAS .

2. When the prompt TURN OFF CARRIER appears (see Figure 2-10), turn the carrier off at the headend.

Figure 2-10.

3. Press CTB CONTINUE . The result appears as shown in Figure 2-11.

```
 hp   CHANNEL 9 (STD)                    MKR 187 2563 MHz    CATV
    REF 9.7 dBmV   ATTEN 10 dB                  -34.77 dBmV
    PEAK
    LOG      COMPOSITE TRIPLEBEAT = -57.8 dBc
    10
    dB/      TURN ON CARRIER BEFORE PRESSING                   RETURN
             RETURN TO CHAN                                    TO CHAN




    WA SB
    SC FC
    CORR



    CENTER 187 2550 MHz                  SPAN 500 0 kHz
       #RES B W 30 kHz        #VBW 30 Hz     SWP 1.7 sec
```
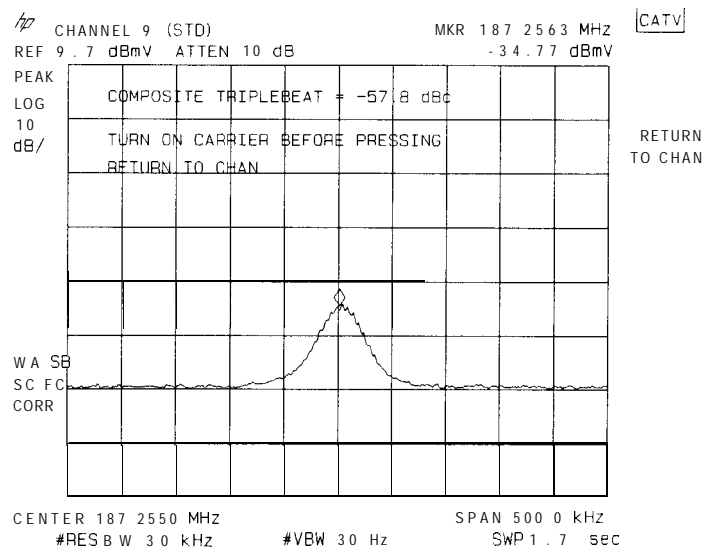
Figure 2-11.

4. Turn the carrier back on.

5. Press RETURN TO CHAN to exit the test.

Hints

1. Before pressing **CTB** CONTINUE , the reference level should be adjusted so the CTB signal is at least two divisions from the bottom graticule line.

2. Maximum CTB range occurs for a $+40$ dBmV or greater signal at the signal analyzer input. Use an external preamplifier to increase signal level. Also, use an external preselector filter in front of the preamplifier to prevent intermodulation in the amplifier or analyzer.

3. For best accuracy, the CTB level must be 10 dB or greater than the spectrum analyzer noise. To check this, disconnect the signal input to the spectrum analyzer and compare its noise with the CTB signal. Also for best CTB measurement accuracy, use an external preselector filter.

DEPTH MOD

The depth of modulation test measures the modulation depth of a channel. Modulation depth is the ratio of the "white" level of a channel carrier relative to the peak sync pulse level.

Procedure

1. Select a channel, then press More 1 of 3 DEPTH MOD.

2. The result is displayed at the bottom of the screen as shown in Figure 2-12. This result is updated every 10 spectrum analyzer sweeps (approximately every 3 seconds) and continues until you stop the test.
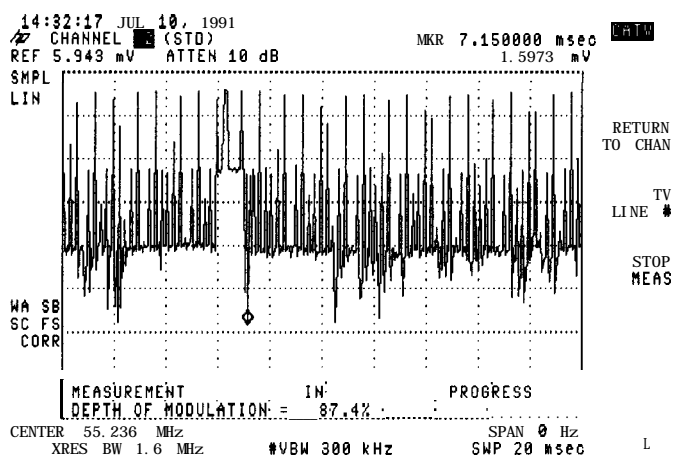

Figure 2-12.

3. For spectrum analyzers with TV Sync (Option 102) and Fast Time-Domain Sweeps (Option 101), the test can also be performed on an individual TV line.

4. Press TV LINE # . Line 17 appears as in shown in Figure 2-13.
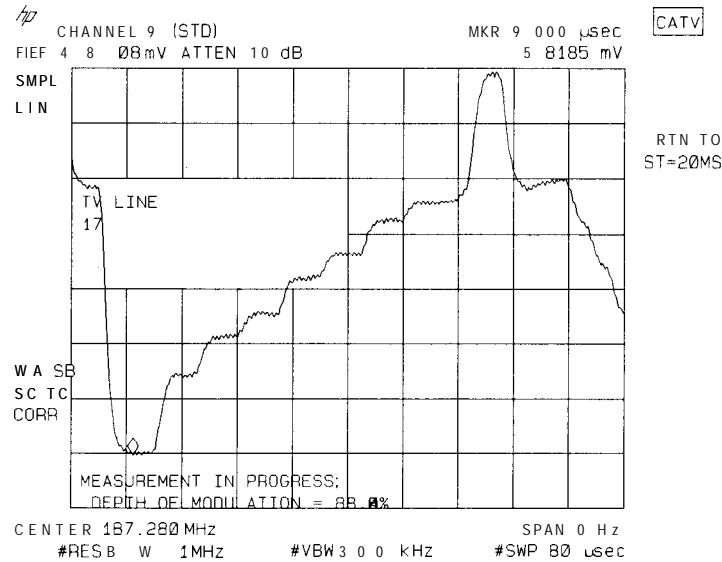
Figure 2-13.

5. To change the TV line number, either enter the new number and press (ENTER) or use the up and down arrow keys ((▲) and (▼)) to increment and decrement, respectively, the current line number by one. For other functions press (TRIG) and TV TRIG. Press the mode key twice ((MODE) (MODE)) to return to the CATV menu.

6. To view multiple horizontal lines, change the sweep time, press (SWEEP), enter the new number and press (sec) (ms) or (μs). Press the mode key twice ((MODE) (MODE)) to return to the CATV menu.

7. Return to the full-field display by pressing RTN TO **ST=20ms** .

8. To stop all measurement activity, press STOP **MEAS** .

Note   You cannot re-start the depth of modulation measurement after pressing STOP **MEAS**. You must press RETURN TO CHAN , then DEPTH MOD to re-start the measurement.

At this point, the analog display could be activated by pressing ANALOG+ ON OFF in the Display menu. The sweep time can be adjusted, using the knob, to obtain the desired display. In addition, the delta display line can be activated by pressing DL DELTA ON OFF . For further information about the delta display line, refer to the DL DELTA function description in this chapter.

9. To stop the test, press RETURN TO CHAN .

Hints   1. For best results, the carrier-to-noise ratio of the system should be 40 dBc or greater (in a 4 MHz noise bandwidth).

2. For this measurement to work correctly, the Vertical Interval Test Signals (VITS) must include a white signal level. In addition, you may need to turn off channel scrambling.

System Frequency Response

The system frequency response test measures system flatness without the need for a sweep generator or other signal source. This measurement technique does not require shutting down the system, does not interfere with any signals on the system, and works on systems with or without horizontal-sync suppression scrambling. If channels are scrambled, any time-varying scrambling must be disabled. The measurement is done in a two-step process. First, a reference spectrum is obtained and stored during the frequency response setup. Second, the system frequency response is measured by comparing the reference trace to the spectrum measured at another point in the system. FREQRSP SETUP stores the reference trace, and FREQ RESPONSE measures system frequency response and then compares it with the reference trace.

FREQRSP SETUP

Procedure for Reference Trace Measurement

In the frequency response setup, a reference trace measurement is made at any point in the system that you want to use as the "reference." For example, typical reference spectrums can be set up at the headend for a trunk-line amplifier output, a bridger output, or a customer tap. Thirty-two or more reference traces can be stored.

1. Set the start and stop frequencies of the CATV spectrum analyzer to include all channels being tested in the system.

   a. While in the CATV ANALYZER mode, press (FREQUENCY) START FREQ , then enter the lowest channel frequency. Press STOP FREQ , then enter the highest channel frequency. See Figure 2-14.
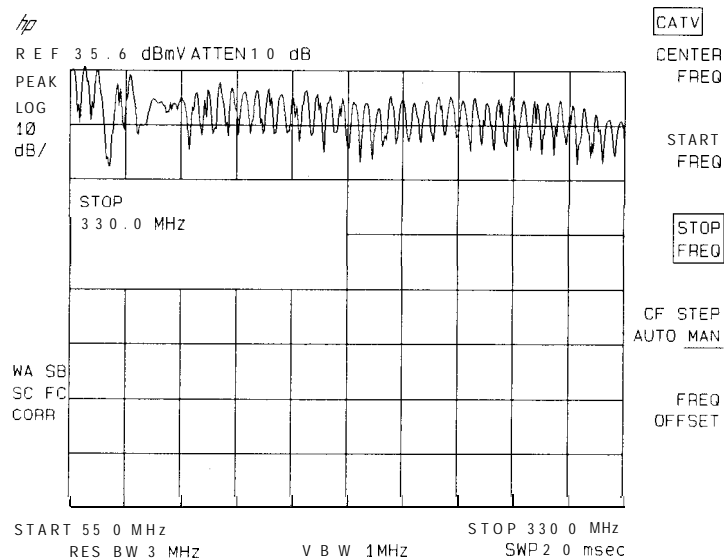
Figure 2-14.

   b. To fine tune the frequency alignment, press (FREQUENCY) START FREQ , then use the knob. Then press STOP FREQ and use the knob.

   c. For your convenience when repeating this setup, save this analyzer state for later recall.

2. Press the mode key twice ((MODE) (MODE)) to return to the CATV menu. Then press More 1 of 3 More 2 of 3 FREQRSP SETUP.

   The message, MAKE ADJUSTMENTS AS NECESSARY THEN SELECT FAST OR SLOW SWEEP appears, and a new menu shows FAST SWEEP and SLOW SWEEP. See Figure 2-15.
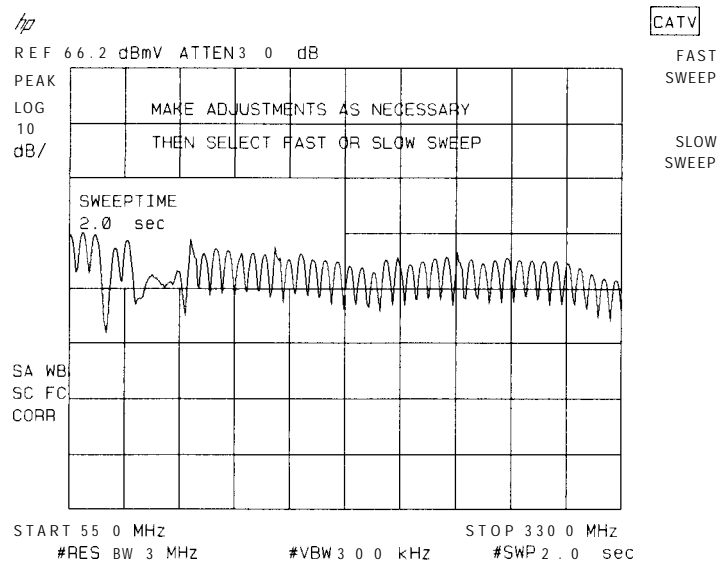
Figure 2-15.

3. Because sweep time is now the active function, you can adjust sweep time before continuing the frequency response setup. If sweep time is not changed, the analyzer use default values. Continue the frequency response setup by selecting FAST SWEEP or SLOW SWEEP .

4. If FAST SWEEP is pressed, the analyzer sweeps at the selected sweep time, or at the 2-second default value. For SLOW SWEEP the default is 8 seconds. During this setup step, the analyzer converts the reference spectrum into a reference trace, which connects the carrier peaks into a continuous line. When the setup is finished, the conditioned reference spectrum appears, as shown in Figure 2-16, along with the message SETUP FINISHED SAVE THIS TRACE.

Hints   A less accurate, but more real-time, response can be obtained by entering a faster sweep time such as 0.1 seconds at the point where you are requested to SELECT FAST OR SLOW SWEEP. This response is more variable for scrambled channels, but still is useful for a quick look. Experiment to find your own optimum setup.
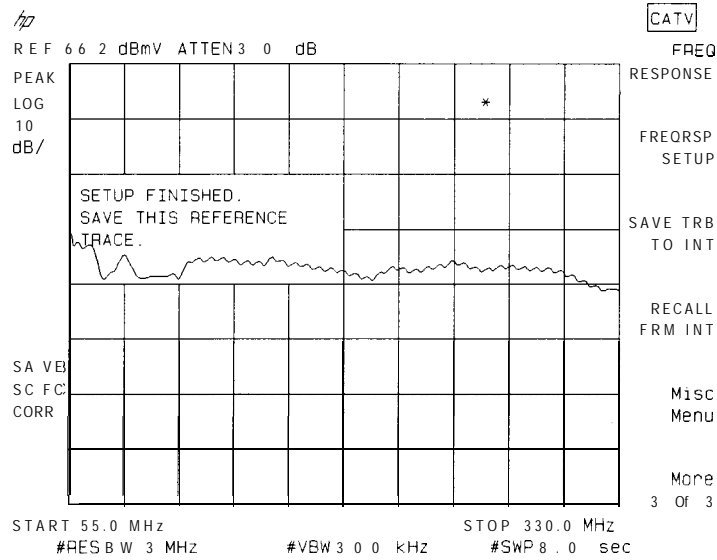
Figure 2-16.

5. Press SAVE TRB TO **INT** , enter a trace register number, then press (<u>ENTER</u>) to store
the reference spectrum and spectrum analyzer state in nonvolatile memory. See the
SAVE TRB TO **INT** function for more information about saving trace B. Wait until the
message TRACE B SAVED appears before proceeding. See Figure 2-17.
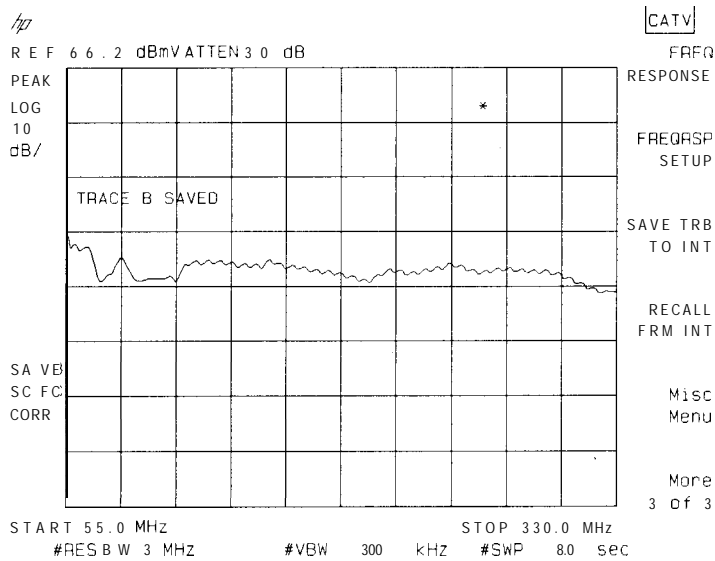
Figure 2-17.

Hints

1. FAST SWEEP is used for systems that do not have scrambled channels. However, the fast sweep is useful in making rough measurements and adjustments on systems with scrambled channels. More accurate results can be obtained in a following test with the slow sweep.

2. SLOW SWEEP allows the analyzer to measure the vertical sync pulse level when the horizontal sync pulse has been suppressed. An 8-second sweep normally is optimum for this measurement, but for analyzer spans greater than 300 MHz, a slower sweep time may be necessary to reduce trace fluctuations caused by the scrambling.

FREQ RESPONSE

Procedure for Frequency Response Measurement

The frequency response measurement compares a spectrum stored at a reference point to a spectrum at any other point in the system where you want to evaluate the frequency response. The signal level and amplitude slope should be approximately the same as the reference trace.

1. Recall the reference trace saved in the FREQRSP SETUP function. See the RECALL FRM INT function for more information about recalling traces.

2. Press CATV ANALYZER More 1 of 3 More 2 of 3 RECALL FRM INT . Enter the trace register number that corresponds to the desired reference trace. This puts the reference trace into trace B of the spectrum analyzer and recalls the state that the spectrum analyzer was in at the time it stored the trace. See Figure 2-18.
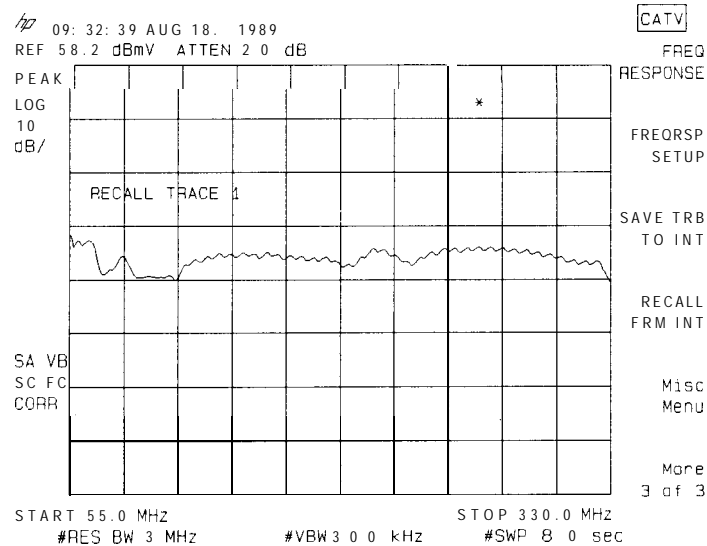
Figure 2-18.

3. After the reference trace appears on screen, press FREQ RESPONSE.

4. To align the frequency of the measurement trace with that of the reference trace, press (FREQUENCY), and use the up (▲) and down (▼) arrow keys (do not use the data knob) to minimize amplitude ripple that may occur over the entire trace (small variations spaced by 6 MHz). Best results occur when the keys are pressed when the sweep is in the last division to the right. This adjustment is not necessary unless the ripple is annoying or your measurement must be very precise. See Figure 2-19. At this point, you can use the marker functions to evaluate the data while the measurement is in progress. See Figure 2-20.
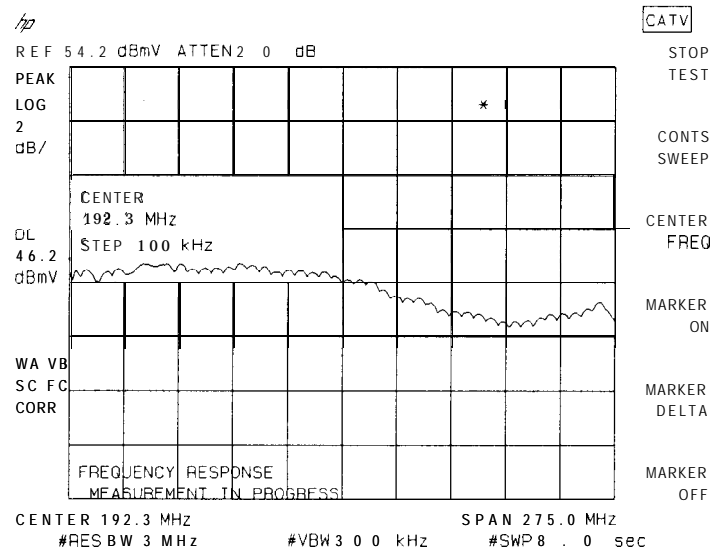
Figure 2-19.
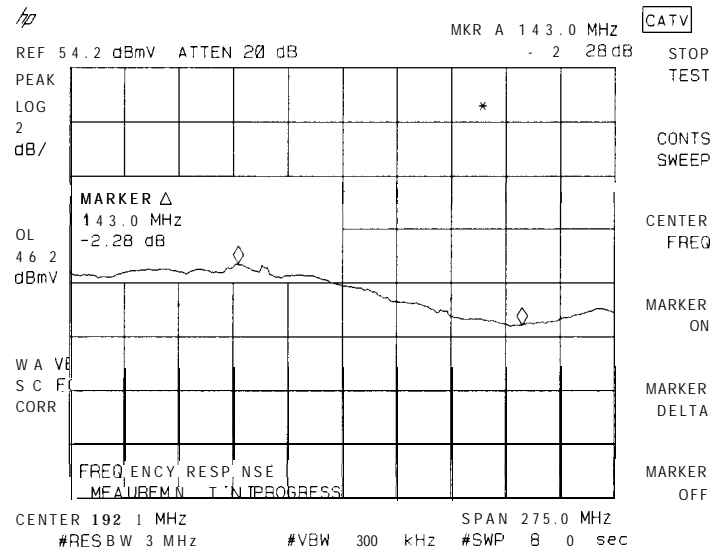
Figure 2-20.

5. To stop the test, press STOP TEST. This will stop the measurement and display the frequency response trace as shown in Figure 2-21.

```
 hp                                                      CATV
REF 62.3 dBmV ATTEN 3 0  dB                              FREQ
PEAK                                                    RESPONSE
LOG
 2                                                      FREQRSP
dB/                                                      SETUP

     TEST COMPLETE
     SAVE RESULT                                       SAVE TRB
                                                        TO INT

                                                        RECALL
                                                       FRM INT

SA VB
SC FC                                                     Misc
CORR                                                     Menu

                                                         More
                                                        3 Of 3
START 54.9 MHz                     STOP 329 9 MHz
    #RES BW 3 MHz      #VBW 3 0 0 kHz    #SWP 8 0  sec
```
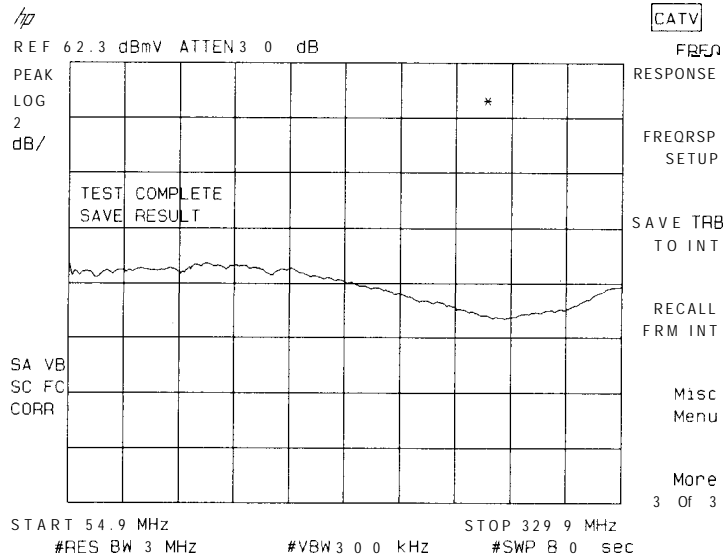
Figure 2-2 1.

6. The results can now be stored to internal memory, memory card, or printed. The frequency response is frozen on the display until you recall the instrument state saved in step lc of the "Procedure for Reference Trace Measurement" under the FREQRSP SETUP , or until you select a channel by pressing More **3** of 3 and either enter a channel or reenter the CATV ANALYZER mode.

Notes   1. Do not press FREQ RESPONSE without first recalling the reference to trace B. Using RECALL FRM INT automatically puts the trace into trace B.

2. Always press STOP TEST to exit the FREQ RESPONSE function, otherwise the display will be left in 2 dB per division and the traces most probably are off the bottom of the screen.

Hints   1. To minimize unwanted amplitude responses in unoccupied frequency bands due to system noise floor variations, you can increase the spectrum analyzer input-attenuation until its noise level is greater than the system noise level. This adjustment should be made when you are setting up the reference trace. (See step 1 under "Reference Trace Measurement Procedure".)

2. While the frequency response measurement is in progress, the REF LEVEL or amplitude scale (LOG dB/DIV) can be adjusted to facilitate viewing the data. (See step 3 under "Frequency Response Measurement.")

3. In the Frequency Response test, screen titles are limited to 30
    characters because a time/date stamp is added to any existing
    title when a trace is stored. Entering more than 30 characters
    into the title causes the time/date stamp not to be added.
    In tests other than Frequency Response, the title line is used to display the
    channel number. This complicates using the title line.

    Four situations are discussed; 1) What is seen on the screen; 2) What is
    saved in a trace; 3) What appears on a printer; 4) What appears on a
    plotter.

    a. The channel number appears in the title area of the screen, but it is not
        a true title. Entering a title from the front panel causes the channel
        number to be erased from the screen.

    b. A trace saves the user-entered title line. However, it does not save
        the extra annotation that is placed on the screen by the CATV
        measurements personality, such as test results. Channel number is in
        this category, so it is not saved in a trace.

    c. Pressing COPY to a printer prints the channel number as long as it
        is viewed on the screen. Entering a title erases the channel number;
        therefore, if a title is desired with the channel number on a printed
        screen copy, the channel number must be included as part of the
        user-entered title. For more space in the title line, the backspace key can
        be pressed up to 18 times before beginning the title.

    d. Pressing COPY to a plotter will plot the channel number with or
        without a title. If a title is desired on a plotted screen, it begins at the
        end of the channel number.

LISTEN ON/OFF

The listen on function is available in spectrum analyzers with demodulation capability (Option 102). The listen-on function demodulates the aural carrier so that it is audible through the built-in speaker.

Procedure

1. Select a channel, then press LISTEN ON.

2. Adjust volume with the front-panel volume knob.

3. Press LISTEN OFF to exit the function.

MIN HOLD ON/OFF

The minimum hold function puts the spectrum analyzer into the sample detection mode and continuously places the minimum level at each trace point of trace A into trace B. Once activated, the function continues until turned off with MIN HOLD OFF .

Procedure

1. To use the minimum hold function, press CATV ANALYZER MIN HOLD ON . The result will be updated as shown in Figure 2-22.
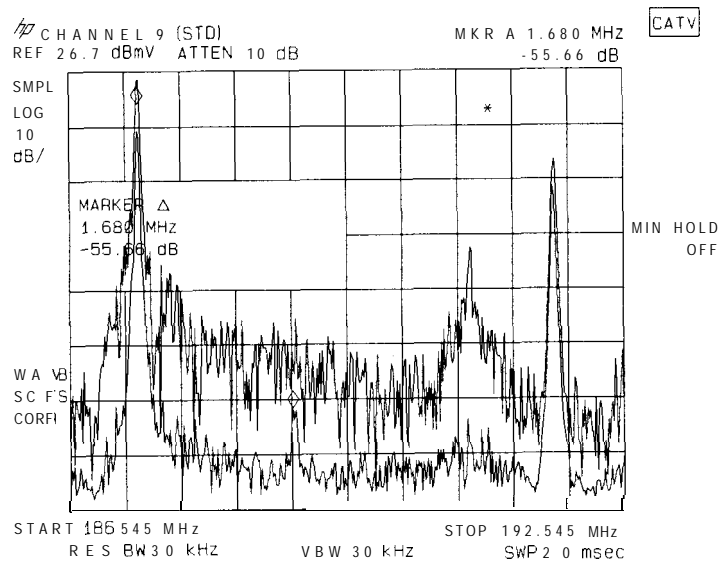
Figure 2-22.

2. To turn off this function, press MIN HOLD OFF . Trace A will remain active and trace B will be blanked, but not updated. To view the minimum hold data on the screen again, press (TRACE) TRACE A B C so that B is underlined, and VIEW B . See Figure 2-23. (To view only trace B as in Figure 2-23, press BLANK A)
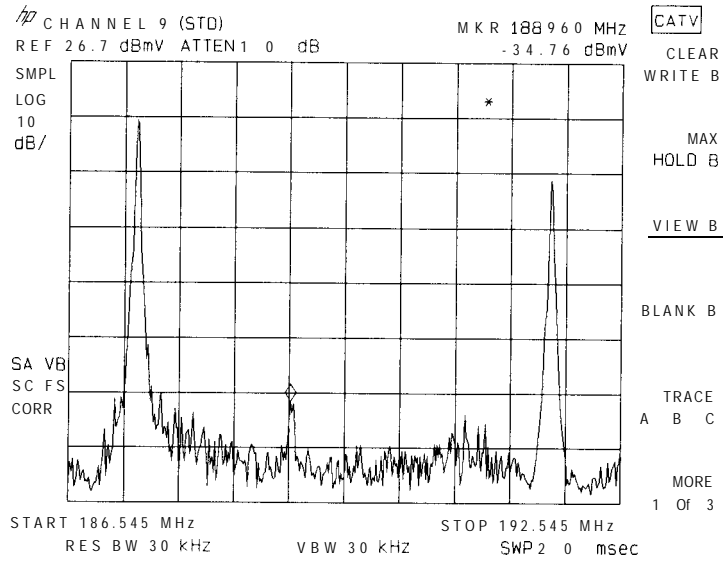
Figure 2-23.

Hint	Intermodulation products, commonly referred to as beats, and other spurious signals are generally hidden within the visual carrier modulation. Thus beats can often be resolved by using the minimum hold function. As shown in Figure 2-23, the beat is clearly visible in the lower trace (the minimum hold trace).

SAVE TRB TO INT

The save trace B to internal memory function stores trace B in internal memory for use with
FREQRSP SETUP.

Procedure

1. After setting up to display the desired trace, press SAVE **TRB** TO INT .

2. The message (REG'S 0 THRU MAX **#** ARE AVAILABLE) appears. Enter a trace register number between 0 and the MAX REG #, then press (ENTER).

3. Trace B is saved internally when the message TRACE B SAVED appears as shown in Figure 2-24.
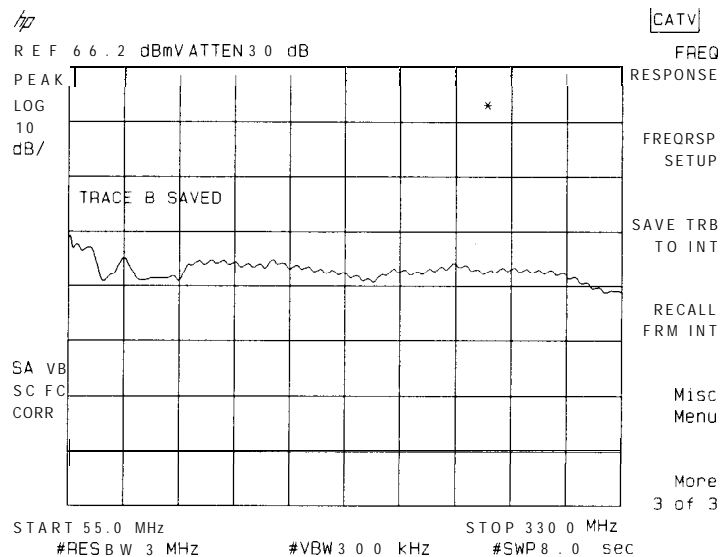
Figure 2-24.

Note	Another method of saving traces, internally or to a memory card, utilizes the functions under the (SAVE) key. Refer to the spectrum analyzer operation manual for a description.

Hint	When using this function to save reference traces, be sure to record the trace register that each reference trace was saved under. This precaution helps prevent re-storing over useful reference traces and recalling the wrong register when using FREQ RESPONSE.

RECALL FRM INT

The recall from internal memory function recalls a trace into trace B for use with
FREQ RESPONSE.

Procedure

1. To recall a trace into trace B, press RECALL FRM INT .

2. After the message REGISTER # appears, enter the trace number the trace was stored under in SAVE TRB TO INT , then press (ENTER).

3. The trace is recalled to trace B in view mode. It is complete when the message RECALL TRACE n (where n is the trace number you entered) as shown in Figure 2-25.
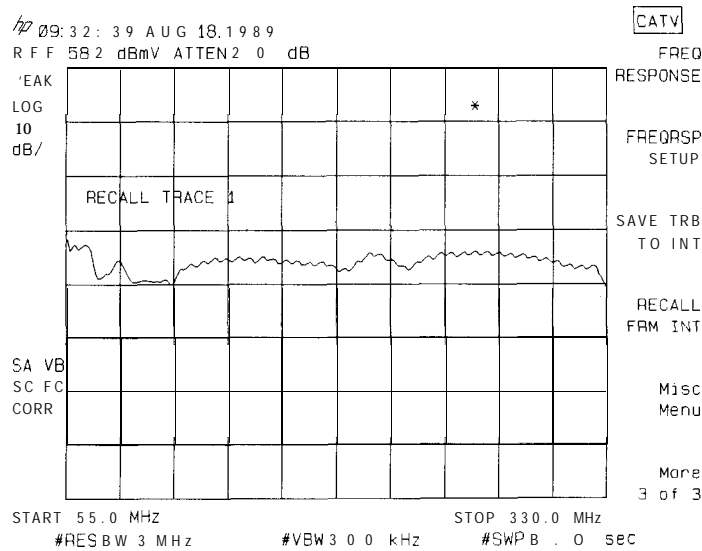
Figure 2-25.

DL DELTA

The display line delta function displays the change, in percent, between a reference display line and the display line activated by pressing DL DELTA ON OFF . The percentage is displayed in the active function block. Note that this function is available only if your spectrum analyzer has firmware revision 17.7.91 or later and has run the HP 85711A at least once.

Procedure

1. Set up the desired measurement.

2. Press (DISPLAY), then DSP LINE ON OFF to activate the display line to be used as the reference.

3. Use the knob to position the display line.

4. Press MORE 1 of 2 , then DL DELTA ON OFF to activate the display line delta function.

5. Position the display line delta using the knob.

6. Read the percent change in the active function block.

Figure 2-26 shows the reference display line at the top of the signal and the display line delta at the bottom of the signal. The measurement shown was performed in Analog+ display mode.

Note	The following figure shows the softkey configuration for firmware revision 17.9.91. Other firmware revisions will have slightly varying softkey configurations. Refer to the CATV menu map at the end of Chapter 1 for specific softkey configuration information regarding a particular firmware revision.
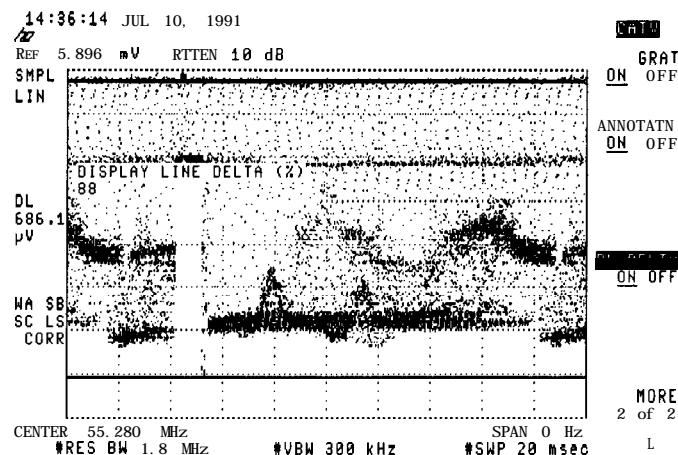
Figure 2-26.

To increase the ability to view the DISPLAY LINE DELTA (%) value when it is obscured by a video signal (as in Figure 2-26), momentarily blank the active trace. For example, press

DL DELTA

Trace and then **Blank** A to view the value. Then press `Clear Write A to reactivate` the trace.

When using the delta display line function, if the active function control is transferred to some other function (for example, Amplitude) or turned off with `Hold,` the display line and delta display line must be set up again to reactivate the delta display line control.

Press (MODE) twice to return to the CATV analyzer menu.

3

Support Information

What You'll Find in This Chapter

This chapter outlines the specifications of the HP 85711A CATV measurements personality with related verification information and it tells you what to do if you experience a problem.

Specifications and Characteristics

Specifications describe the warranted analyzer performance over the temperature range of 0 to 55" C, unless stated otherwise. All specifications apply after the unit has reached a stable operating temperature as defined by the temperature stability specification, when functions are coupled (AUTO COUPLE key), and after any required calibration routines have been run.

For best amplitude accuracy, the analyzer's input attenuation must be set to a constant value, and the measured signal level must be greater than 10 dB above the displayed analyzer noise (S/N >10 dB). Unl ess otherwise stated, signals must be unscrambled. They may be modulated or unmodulated.

The specifications listed in Table 3-l are based on HP 85711A usage with an HP 8590B, HP 8590D, HP 8591A or HP 8591E Option 001, or an HP 8590B, HP 8590D, HP 8591A, HP 8591E, HP 8592B, HP 8592D, HP 8593A, HP 8593E, HP 8594A, HP 8594E, HP 8595A, HP 8595E, or an HP 8596E Option 711. Option 001 is 75 ohm input impedance. Option 711 is a 50 to 75 ohm matching pad with a 100 V dc blocking capacitor. With the Option 711 on the input of the analyzer, the following amplitude specifications are warranted over a 5 MHz to 500 MHz frequency range. However, the Option 711 is functional over a 1 MHz to 1.8 GHz frequency range.

Characteristics provide useful, but non-warranted, information in the form of typical, nominal, or approximate values for analyzer performance.

Table 3-1. HP 85711A CATV Measurement Personality Specifications

Numbers in {braces} refer to notes following the specification section	
Input Configuration Select input conditions of analyzer.	
75Ω Analyzer	No selection required
50Ω Analyzer	Measurements converted to 75Ω values
50 Ω Analyzer Selections:	
HP 8590 Series Option 711 Ext Pad	Amplitude offset set to 5.8 dB
No Ext Pad	Amplitude offset set to zero
Channel Selection Visual and aural carriers displayed when channel number is entered or when ⊞ or ⊟ softkeys are pressed (channels may be scrambled).	
Tune Configuration{ 1}	Standard, Off the Air, HRC, and IRC
Channel Range	1 to 99
Amplitude Range (selectable)	-30 to +40 dBmV (default) for S/N >30 dB 0.0 to $70 dBmV for S/N >30 dB
Frequency Range	54 to 648 MHz 54 to 500 MHz with Option 711 {2}
Listen (characteristic) {3} When both the visual and aural carriers are displayed, the aural carrier is demodulated.	
output	Speaker with volume control
Demodulation Type	FM (default)
Demodulation Time	3 seconds (default)
Sweep Refresh Time	75 ms (default)
Trace Minimum Hold (characteristic) Displayed modulation and noise peaks are minimized, so spurious signals can be identified.	
Trace A	Active and sample detector used
Trace B	Updated minimum value of trace A

Table 3-1.
HP 85711A CATV Measurement Personality Specifications (continued)

Beat Measurement *(characteristic)*	
Distortion-product (beat) level and frequency measured relative to visual-carrier peak.	
Amplitude Range {4}	>50 dB for input >+30 dBmV
Amplitude Accuracy	±1.25 dB for single beat without modulation +1.25 dB, −4.25 dB for composite beats or beat with modulation {5}
Marker Delta Frequency Accuracy	±2% of span setting
Resolution BW	30 kHz or 100 kHz selectable
Listen {3}	AM or FM selectable (used to identify ingressing signals)

Visual-Carrier Peak Level {6}	
Absolute peak amplitude of visual carrier measured (part of carrier level test).	
Amplitude Range	−24 to +70 dBmV
Absolute Accuracy	±2.0 dB for S/N >30 dB {7}
Accuracy Relative to Adjacent Channels	±1.0 dB
Accuracy Relative to All Channels	±1.5 dB {7}

Visual/Aural Carrier	
Aural-carrier level measured relative to the visual carrier (part of Carrier-Level test).	
Range	>25 dB
Relative Accuracy	±0.75 dB for S/N >30 dB

Visual Carrier/Noise Ratio	
Noise floor in a 4 MHz BW measured relative to the visual-carrier peak.	
Range {4}	>60 dB for input >+38 dBmV, and total power at mixer <+39 dBmV
Accuracy {7}	<±1.25 dB for measured noise >10 dB above analyzer noise and adjusted <−60 dB from reference level

Table 3-1.
HP 85711A CATV Measurement Personality Specifications (continued)

Hum Interference NCTA hum (low frequency disturbances) measured on an unmodulated visual carrier for C/N >35 dB.		
	Range	0.5 to 10% in 0.1% steps
	Accuracy	±0.4% for hum ≤3% ±0.7% for hum ≤5% ±1.3% for hum ≤10%
Percent AM *(characteristic)*		
	Range	0.5 to 10.0% in 0.1% steps
	Accuracy	±0.25% for hum ≤2% ±0.7% for hum ≤5% ±1.3% for hum ≤10%
60 Hz* and 120 *Hz Hum (characteristic)		
	Range	0.5 to 10.0% in 0.1% steps
	Accuracy	±0.3% for hum ≤1% ±1.1% for hum ≤5% ±2.1% for hum ≤10%
Cross Modulation *(characteristic)* 15.7 kHz AM measured on unmodulated visual carrier for C/N >40 dB		
	Range	60 dB, usable to 65 dB
	Accuracy	±2.0 dB for crossmodulation <40 dB ±2.6 dB for crossmodulation <50 dB f4.6 dB for crossmodulation <60 dB
Composite Triple Beat (CTB) Distortion Composite third-order intermodulation distortion measured relative to visual-carrier peak.		
	Range {4}	>74 dB for input >+40 dBmV
	Accuracy	<±1.25 dB {7} for CTB signals >10 dB above analyzer noise, <-60 dB from reference level, and constant attenuation setting
Video Modulation Depth *(characteristic)* Percent AM measured from sync tip to lowest white level found in 10 sweeps.		
	Range	50 to 93%
	Accuracy	±2.0% for C/N >40 dB

IV Line Selection *(characteristic)* {8}
During the video modulation depth function, an individual horizontal line is displayed when its number is entered.

Line Format	NTSC
Line Range	1 to 525 (default line 17)
Sweep Time	20 μs to 20 ms (default 80 μs)

System Frequency Response
For fixed-amplitude scrambling {9} or no scrambling, system amplitude variations (flatness) are measured relative to a reference trace (stored during the frequency-response setup).

Sweep Type (selectable)	Fast (2 s) or slow (8 s)
Reference-Trace Storage (non-volatile)	up to 50 traces with analyzer states
Range	1.0 dB to 20 dB/Div (2 dB default)
Resolution	<0.05 dB
Trace Flatness Accuracy	<±0.1 dB for every dB that the trace deviates from an ideal flat response (horizontal line) ±0.75 dB maximum cumulative error
Trace Position Accuracy	The entire frequency response trace may have an amplitude offset caused by different ambient temperatures at the two measurement locations. 0.0 dB for no temperature difference, and ±0.4 dB maximum for any temperature difference over the 0" C to +55° C range

Notes

1. Channel frequencies are defined in FCC Vol. 47, Part 73.603 and EIA Interim Standard No. 6 (CP).

2. The CAL FREQ routine must be run for the HP 8590B, HP 8590D, HP 8592B, and HP 8592D.

3. Available only when Option 102 is installed in the HP 8591A, HP 8591E, HP 8593A, HP 8593E, HP 8594A, HP 8594E, HP 8595A, HP 8595E, or HP 8596E.

4. If the input signal is lower than the maximum specified, the maximum range is reduced by the same amount. A preselector filter and preamplifier may be required to achieve maximum range.

5. In this case, the beat level is approximately 3 dB higher than the display indicates.

6. Absolute level accuracy is traceable to the National Institute of Standards and Technology. Relative levels result from comparison of absolute levels.

7. This specification is dependent on other independent specifications, and its tolerance has been derived from the root-sum-square (RSS) of the other tolerances.

8. Available only when Options 101 and 102 are installed in the HP 8591A, HP 8591E, HP 8593A, HP 8593E, HP 8594A, HP 8594E, HP 8595A, HP 8595E, or HP 8596E.

9. For best results with scrambling, use horizontal-sync suppression, disable time variations for scrambling, and select slow sweep for the analyzer.

Verifying Specified Operation

(For HP 8590B, HP 85900, HP 8592B, and HP 8592D only)

All HP 85711A CATV measurements personality specifications, except Channel Selection, can be verified by referring to the standard HP 8590B, HP 8590D, HP 8591A, HP 8591E, HP 8592B, HP 8592D, HP 8593A, HP 8593E, HP 8594A, HP 8594E, HP 8595A, HP 8595E, and HP 8596E verification procedures. This information is contained in the documentation for your spectrum analyzer, and should be used in conjunction with this manual. The verification test for channel selection is provided in this section.

Before You Start Verification

Switch on the analyzer and allow the specified warm up time. See the temperature stability specification in the documentation for your spectrum analyzer. Next complete a full frequency and amplitude calibration. Refer to the documentation for your spectrum analyzer.

Verifying Channel Select

This test will verify that the channel select feature finds and displays the correct channel number. Although there are four channel formats (STD, AIR, IRC, HRC) and up to 99 channel numbers, the verification can be achieved using one format and two channel numbers.

For example:

Use Air Channels	2	69
Frequency	55.25 MHz	801.25 MHz

Equipment

Test Equipment   **HP Model/HP Part Number**

Synthesized Source A and B . . . . HP 8340A, HP 8642A, HP 8656B

Power Splitter . . . . HP 11667A

Output Adapters for HP 8642A/HP 8656B:

Type N (m) to BNC (f) . . . . HP part number 1250-00780

Output Adapter for HP 8340A:

Type N (f) to SMA (f) . . . . HP part number 86290-60005

Type N (m) to BNC (f) . . . . HP part number 1250-0780

Adapters for HP 11667A:

Type N (m) to BNC (f) (three *required)* . . . . HP part number 1250-0780

Cables

BNC cable (three *required)* . . . . HP part number 8120-1839

Procedure

1. Connect the equipment as shown in Figure 3-l.
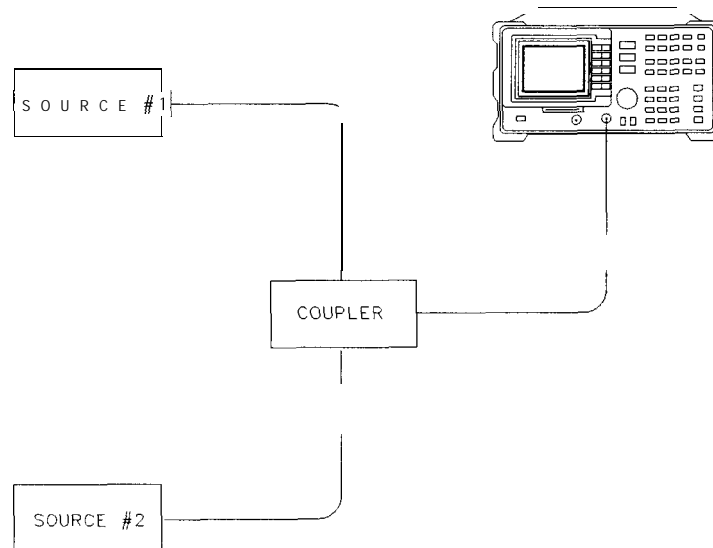
Figure 3-1. Test Setup

2. Preset all instruments.

3. Set source A to 55.25 MHz, -4 dBm.

4. Set source B to 59.75 MHz, -19 dBm.

5. Press the following spectrum analyzer softkeys:

   CATV ANALYZER
   More 1 of 3 More 2 of 3 Misc Menu
   Tune Config AIR CHANNELS
   Previous Menu More 3 of 3 ② (ENTER)

6. Confirm the analyzer display is similar to Figure 3-2.
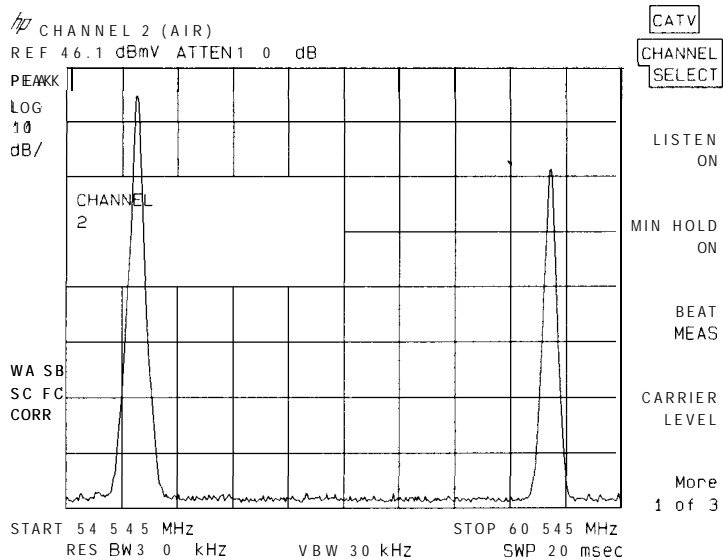
Figure 3-2.

7. Repeat the measurement with Source A set to 801.25 MHz, -4 dBm, Source B set to 805.75 MHz, -19 dBm, and select channel 69 rather than channel 2.

8. Confirm the analyzer display is similar to Figure 3-3.
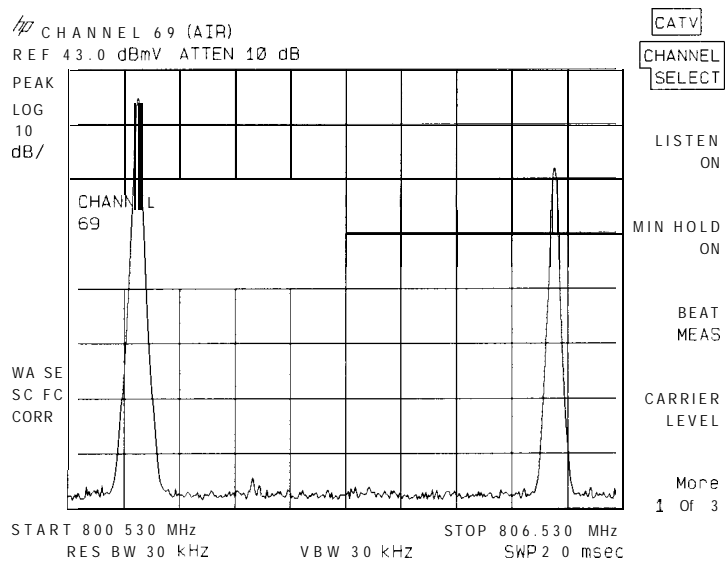
Figure 3-3.

If Something Goes Wrong

In the event that something goes wrong, refer to the documentation for your spectrum analyzer. It is important that you complete basic checks of the analyzer before calling Hewlett-Packard or returning the analyzer. This will help avoid unnecessary repair work and waiting time. If the problem is still unresolved after some simple checks, call your nearest Hewlett-Packard Sales and Support Office, as listed in Table 3-2.

Table 3-2. Hewlett-Packard Sales and Service Offices

US FIELD OPERATIONS

Headquarters
Hewlett-Packard Co.
19320 Pruneridge Avenue
Cupertino, CA 95014
(800) 752-0900

California, Northern
Hewlett-Packard Co.
301 E. Evelyn
Mountain View, CA 94041
(415) 694-2000

California, Southern
Hewlett-Packard Co.
1421 South Manhattan Ave.
Fullerton, CA 92631
(714) 999-6700

Colorado
Hewlett-Packard Co.
24 Inverness Place, East
Englewood, CO 80112
(303) 649-5512

Georgia
Hewlett-Packard Co.
2000 South Park Place
Atlanta, GA 30339
(404) 955-1500

Illinois
Hewlett-Packard Co.
5201 Tollview Drive
Rolling Meadows, IL 60008
(708) 255-9800

New Jersey
Hewlett-Packard Co.
150 Green Pond Rd.
Rockaway, NJ 07866
(201) 586-5400

Texas
Hewlett-Packard Co.
930 E. Campbell Rd.
Richardson, TX 75081
(214) 231-6101

EUROPEAN FIELD OPERATIONS

Headquarters
Hewlett-Packard S.A.
150, Route du Nant-d'Avril
1217 Meyrin 2/Geneva
Switzerland
(41 22) 780.8111

France
Hewlett-Packard France
1 Avenue Du Canada
Zone D'Activite De Courtaboeuf
F-91947 Les Ulis Cedex
France
(33 1) 69 82 60 60

Germany
Hewlett-Packard GmbH
Hewlett-Packard Strasse
61352 Bad Homburg v.d.H
Germany
(49 6172) 16-O

Great Britain
Hewlett-Packard Ltd.
Eskdale Road, Winnersh Triangle
Wokingham, Berkshire RG41 5DZ
England
(44 734) 696622

INTERCON FIELD OPERATIONS

Headquarters
Hewlett-Packard Company
3495 Deer Creek Road
Palo Alto, California, USA
94304-1316
(415) 857-5027

Australia
Hewlett-Packard Australia Ltd.
31-41 Joseph Street
Blackburn, Victoria 3130
(61 3) 895.2895

Canada
Hewlett-Packard (Canada) Ltd.
17500 South Service Road
Trans.Canada Highway
Kirkland, Quebec H9J 2X8
Canada
(514) 697-4232

China
China Hewlett-Packard Company
38 Bei San Huan Xl Road
Shuang Yu Shu
Hai Dian District
Beijing, China
(86 1) 256-6888

Japan
Hewlett-Packard Japan, Ltd.
1-27-15 Yabe, Sagamihara
Kanagawa 229, Japan
(81 427) 59-1311

Singapore
Hewlett-Packard Singapore (Pte.) Ltd.
150 Beach Road
#29-00 Gateway West
Singapore 0718
(65) 291-9088

Taiwan
Hewlett-Packard Taiwan
8th Floor, H-P Building
337 Fu Hsing North Road
Taipei, Taiwan
(886 2) 712-0404

A

Television Broadcast Station Identification

Table A-l.
FCC Numerical Designation of Television Channels
(Section 73.603)

Channel Number	Frequency Band (MHz)
2	54-60
3	60-66
4	66-72
5	76-82
6	82-88
7	174-180
8	180-186
9	186-192
10	192-198
11	196-204
12	204-210
13	210-216
14	470-476
15	476-482
16	482-488
17	488-494
18	494-500
19	500-506
20	506-512
21	512-518
22	518-524
23	524-530
24	530-536
25	536-542
26	542-548
27	548-554
28	554-560
29	560-566
30	566-572

Table A-I.
FCC Numerical Designation of Television Channels
(Section 73.603) (continued)

Channel Number	Frequency Band (MHz)
31	572-578
32	578-584
33	584-590
34	590-596
35	596-602
36	602-608
37	608-614
38	614-620
39	620-626
40	626-632
41	632-638
42	638-644
43	644-650
44	650-656
45	656-662
46	662-668
47	668-674
48	674-680
49	680-686
50	686-692
51	692-698
52	698-704
53	704-710
54	710-716
55	716-722
56	722-728
57	726-734
58	734-740
59	740-746
60	746-752
61	752-758
62	758-764
63	764-770
64	770-776
65	776-782
66	782-788
67	788-794
68	794-800
69	800-806

Table A-2.
Channel Identification Plan
EIA Interim Standard No. 6 (CP) and FCC Part 76.612

Channel Designation	Picture Carrier Frequency (MHz)			Historical Reference
	STD	HRC	IRC	
1	N/A	72.0036	73.2625	4+, A-8
2	55.25	54.0027	55.2625	
3	61.25	60.0030	61.2625	
4	67.25	66.0033	67.2625	
5	77.25	78.0039	79.2625	A-7(HRC,IRC)
6	83.25	84.0042	85.2625	A-6(HRC,IRC)
7	175.25	174.0087	175.2625	
8	181.25	180.0090	181.2625	
9	187.25	186.0093	187.2625	
10	193.25	192.0096	193.2625	
11	199.25	198.0099	199.2625	
12	205.25	204.0102	205.2625	
13	211.25	210.0105	211.2625	
14	121.2625	120.0060	121.2625	A
15	127.2625	126.0063	127.2625	B
16	133.2625	132.0066	133.2625	C
17	139.25	138.0069	139.2625	D
18	145.25	144.0072	145.2625	E
19	151.25	150.0075	151.2625	F
20	157.25	156.0078	157.2625	G
21	163.25	162.0081	163.2625	H
22	169.25	168.0084	169.2625	I
23	217.25	216.0108	217.2625	J
24	223.25	222.0111	223.2625	K
25	229.2625	228.0114	229.2625	L
26	235.2625	234.0117	235.2625	M
27	241.2625	240.0120	241.2625	N
28	247.2625	246.0123	247.2625	0
29	253.2625	252.0126	253.2625	P
30	259.2625	258.0129	259.2625	Q
31	265.2625	264.0132	265.2625	R
32	271.2625	270.0135	271.2625	S
33	277.2625	276.0138	277.2625	T

Table A-2.
Channel Identification Plan
EIA Interim Standard No. 6 (CP) and FCC Part 76.612 (continued)

Channel Designation	Picture Carrier Frequency (MHz)			Historical Reference
	STD	HRC	IRC	
34	283.2625	282.0141	283.2625	U
35	289.2625	288.0144	289.2625	V
36	295.2625	294.0147	295.2625	W
37	301.2625	300.0150	301.2625	X
38	307.2625	306.0153	307.2625	Y
39	313.2625	312.0156	313.2625	Z
40	319.2625	318.0159	319.2625	DD
41	325.2625	324.0162	325.2625	EE
42	331.2750*	330.0165	331.2750*	FF
43	337.2625	336.0168	337.2625	GG
44	343.2625	342.0171	343.2625	HH
45	349.2625	348.0174	349.2625	II
46	355.2625	354.0177	355.2625	JJ
47	361.2625	360.0180	361.2625	KK
48	367.2625	366.0183	367.2625	LL
49	373.2625	372.0186	373.2625	MM
50	379.2625	378.0189	379.2625	NN
51	385.2625	384.0192	385.2625	0 0
52	391.2625	390.0195	391.2625	PP
53	397.2625	396.0198	397.2625	QQ
54	403.25	402.0201	403.2625	RR
55	409.25	408.0204	409.2625	s s
56	415.25	414.0207	415.2625	TT
57	421.25	420.0210	421.2625	u u
58	427.25	426.0213	427.2625	v v
59	433.25	432.0216	433.2625	WW
60	439.25	438.0219	439.2625	x x
61	445.25	444.0222	445.2625	YY
62	451.25	450.0225	451.2625	ZZ
63	457.25	456.0228	457.2625	
64	463.25	462.0231	463.2625	
65	469.25	468.0234	469.2625	
66	475.25	474.0237	475.2625	

'This frequency deviates from the pattern

Table A-2.
Channel Identification Plan
EIA Interim Standard No. 6 (CP) and FCC Part 76.612 (continued)

Channel Designation	Picture Carrier Frequency (MHz)			Historical Reference
	STD	HRC	IRC	
67	481.25	480.0240	481.2625	
68	487.25	486.0243	487.2625	
69	493.25	492.0246	493.2625	
70	499.25	498.0249	499.2625	
71	505.25	504.0252	505.2625	
72	511.25	510.0255	511.2625	
73	517.25	516.0258	517.2625	
74	523.25	522.0261	523.2625	
75	529.25	528.0264	529.2625	
76	535.25	534.0267	535.2625	
77	541.25	540.0270	541.2625	
78	547.25	546.0273	547.2625	
79	553.25	552.0276	553.2625	
80	559.25	558.0279	559.2625	
81	565.25	564.0282	565.2625	
82	571.25	570.0285	571.2625	
83	577.25	576.0288	577.2625	
84	583.25	582.0291	583.2625	
85	589.25	588.0294	589.2625	
86	595.25	594.0297	595.2625	
87	601.25	600.0300	601.2625	
88	607.25	606.0303	607.2625	
89	613.25	612.0306	613.2625	
90	619.25	618.0309	619.2625	
91	625.25	624.0312	625.2625	
92	631.25	630.0315	631.2625	
93	637.25	636.0318	637.2625	
94	643.25	642.0321	643.2625	
95	91.25	90.0045	91.2625	A-5
96	97.25	96.0048	97.2625	A-4
97	103.25	102.0051	103.2625	A-3
98	109.2750*	108.0054	109.2750*	A-2
99	115.2750*	114.0057	115.2750*	A-1

*This frequency deviates from the pattern.

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