The electrical fluctuations which we refer to as noise form a very complex signal which does not lend itself to straightforward amplitude measurements. A number of special techniques have therefore been developed for measuring noise. A comprehensive discussion of noise measurement is outside the scope of this publication. However, some of the methods that apply to television systems are presented in this section.

Special filters are generally required for noise measurements. These filters are used to separate the noise into its various frequency components for analysis. Each measurement standard typically calls for three or four measurements made with various combinations of the filters. Note that specifications for the filters vary from standard to standard.

The tangential method of noise measurement, useful for making operational measurements of random noise, is the only method discussed in detail in this publication. While not the most accurate technique, the tangential method can provide a quick way of keeping track of system noise performance over time. Tangential noise measurements are made with a specially equipped waveform monitor. This feature is standard in the 1780R.

Specialized equipment is required to completely characterize the noise performance of a system. Until recently, these capabilities were available only in dedicated noise measurement instruments. The VM700T, however, makes highly accurate noise measurements using filters implemented in software. The noise measurement features of the VM700T are reviewed briefly in this section.

DEFINITION

Noise refers to the fluctuations that are present in any electrical system. Noise can be either random or coherent and comes from a variety of natural and man-made sources. Although there is always some noise present, an excessive amount is undesirable since it tends to degrade or obscure the signal.

Signal amplitudes do not always remain constant as the video signal is processed and transmitted. An absolute measurement of noise is therefore not particularly relevant - a certain amount of noise will have very different effects on signals of different amplitudes.

Since it is the amount of noise relative to the signal amplitude (rather than the absolute amount of noise) that tends to cause problems, measurement of signal-to-noise ratio, expressed in dB, is made.

PICTURE EFFECTS

Noisy pictures often appear grainy or snowy and sparkles of color may be noticeable. Extremely noisy signals may be difficult for equipment to lock to causing horizontal tearing and vertical roll.

TEST SIGNALS

Tangential noise measurement may be made on any portion of the video signal with a constant luminance level without chrominance. The measurement can be made on a line in the vertical interval although full-field measurements are more accurate and somewhat easier to make.

Any line with a constant pedestal level can be used to make VM700T NOISE SPECTRUM measurements. A quiet line in the vertical interval is typically used. The VM700T CHROMA NOISE measurement requires a red field test signal (see Figure 98).

MEASUREMENT METHODS

Tangential Method. Tangential noise measurements may be made with a 1780R with measurement results repeatable to within 1 or 2 dB, down to noise levels of about 60 dB. Filters can be inserted in the AUX OUT/AUX IN path to separate noise components of different frequencies.

Make sure the waveform monitor filter selection is set to FLAT (unless using the auxiliary filter capability) and DC restorer to OFF or FAST. Select NOISE in the 1780R MEASURE menu. In the 1480, use the WAVEFORM COMPARISON mode to split the luminance levels of interest in half and overlay the two parts.

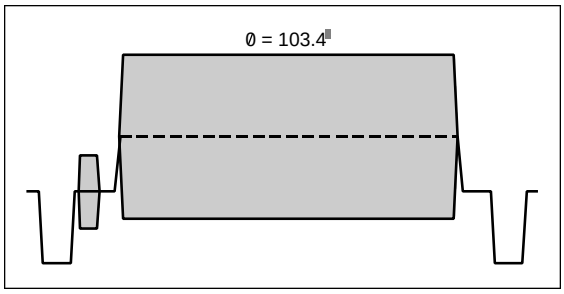

Figure 98. A red field test signal.

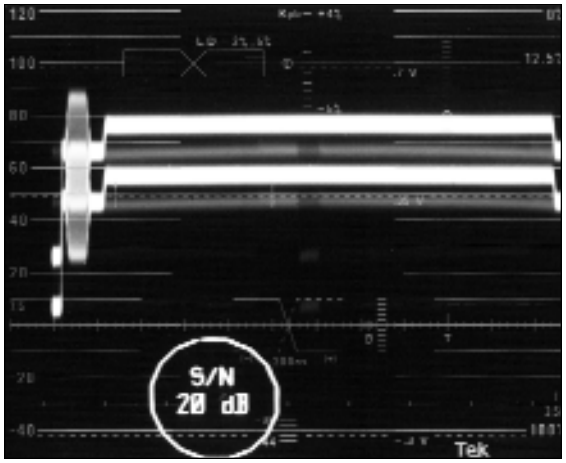

Figure 99. The 1780R tangential noise measurement mode showing excessive trace separation.

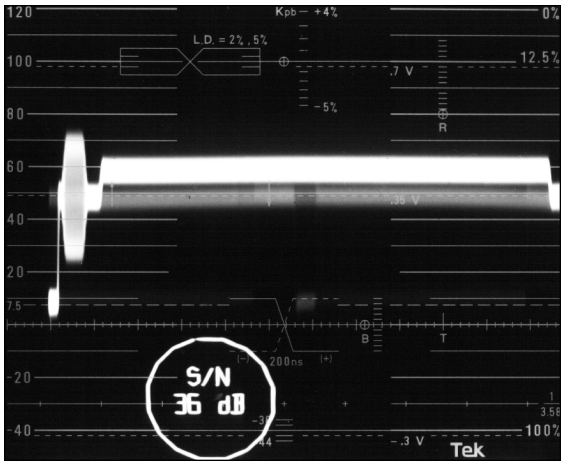

Figure 100. The 1780R tangential noise measurement mode with trace separation properly adjusted. This signal has a signal-to-noise ratio of 36 dB.

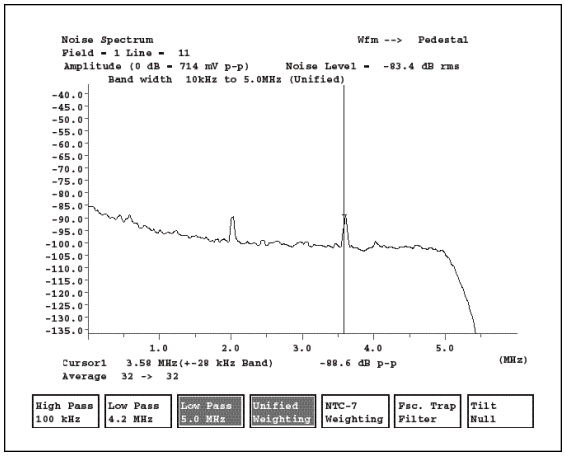

Figure 101. The VM700T Noise Spectrum display.

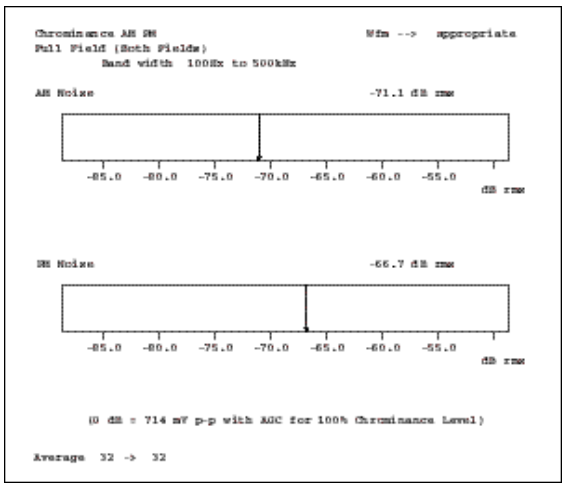

Figure 102. The VM700T Chrominance AM PM Noise display.

The measurement is made by adjusting the separation between the two traces until the dark area between them just disappears. When there is no perceptible dip in brightness between the two traces, the calibrated offset level (in dB) is the amount of noise (see Figures 99 and 100). In the 1780R, the large knob is used to control the offset and the on screen readout provides the dB reading. In the 1480, the offset function is performed by the two dB NOISE controls in the lower right hand corner. The dB reading is obtained from the knob settings.

VM700T Automatic Measurement. Select NOISE SPECTRUM in the VM700T MEASURE menu to make signal-to-noise measurements. A spectral display as well as numeric results is provided in this mode (see Figure 101).

There are four filters available in this mode: 4.2 MHz lowpass, 5 MHz lowpass, a unified weighting filter, and a 3.58 MHz trap. Measurement standards typically require three or four measurements made with various combinations of these filters.

The rms signal-to-noise ratio of the entire spectrum is always displayed in the upper right hand corner of the display.

A cursor can be used to select a certain frequency for a peak-to-peak noise measurement. The cursors can also be used to define a narrow range of frequencies for S/N measurements.

The CHROMINANCE AM PM selection in the VM700T MEASURE menu provides information about the noise that affects the chrominance portion of the signal. Since the chrominance signal is sensitive to both the amplitude (AM) and phase (PM) components of noise, separate measurements are provided. A selection of filters is available in this mode as well. Be sure to use the red field test signal for this measurement (see Figure 102). Noise measurements are also available in the AUTO mode.

NOTES

30. Quiet Lines. "Quiet lines" in the vertical interval are sometimes used to determine the amount of noise introduced in a certain part of the transmission path. A line is reinserted (and is therefore relatively noise free) at one end of the transmission path of interest. This ensures that any noise measured on that line at the other end was introduced in that part of the path.