Peak Envelope Detection

An ideal peak envelope detector is a device which samples the peak of each positive (or negative) carrier cycle and holds the peak value until the next carrier cycle occurs. Figure 10.1–12 illustrates a typical set of input and output waveforms for an ideal peak envelope detector. It is apparent from Fig. 10.1–12 that a considerable amount of ripple appears on the output signal $v_o(t)$ unless the carrier frequency greatly exceeds the maximum frequency component ω_m of $g(t)$. Consequently, unless subsequent filtering is employed, the use of the envelope detector is restricted to situations where a very wide separation exists between ω_m and ω_0. However, when a wide separation between ω_m and ω_0 exists, it is apparent that $v_o(t)$ closely approaches $g(t)$ for $g(t) \geq 0$.

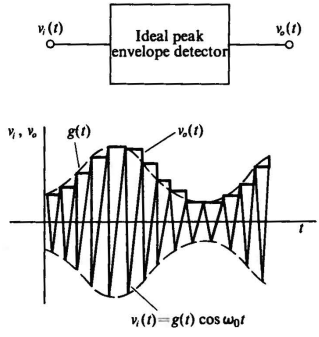

Fig. 10.1–12 Ideal peak envelope detector.

Most practical peak envelope detectors employ a diode to drive the holding network (usually a resistor in parallel with a capacitor) to the peak value of each carrier cycle, as shown in Fig. 10.1–13. Once $v_o(t)$ has reached the peak value of $v_i(t)$, the diode becomes reverse biased and $v_o(t)$ decays slowly toward zero with a time constant $\tau = RC$ until, near the peak of the cycle, $v_i = v_o$, which again turns the diode on and brings $v_o(t)$ to the peak value of $v_i(t)$. The resistor R in the holding network obviously has the effect of increasing the ripple; however, it is required in most practical detectors to ensure that $v_o(t)$ decays more rapidly during every holding period than the envelope of $v_i(t)$. If the decay in $v_o(t)$ is insufficient, the diode does not turn on at the peak of every cycle of $v_i(t)$, and "failure-to-follow" distortion results. Clearly the time constant τ must be chosen to meet a compromise between ripple and "failure-to-follow" distortion.

It is apparent that the peak envelope detector, like the average envelope detector, produces an output proportional to $|g(t)|$ which results in distortion if $g(t)$ is not always positive; hence suppressed carrier AM demodulation and SSB demodulation are