DSBSC - GENERATION

modules

basic: MULTIPLIER

optional basic: AUDIO OSCILLATOR, ADDER

preparation

A double sideband suppressed carrier (DSBSC) signal is defined as:

$$DSBSC = a(t).\cos\omega t$$ 1

where typically the frequency components in a(t), the message, all lie well below the frequency of ω. The DSBSC occupies a band of frequencies either side of ω, by amounts equal to the bandwidth of a(t).

This is easy to show, for the simple case where $a(t) = \cos\mu t$, by making the substitution and expanding eqn(1) to eqn(2)

$$DSBSC = \tfrac{1}{2}.\cos(\omega-\mu)t + \tfrac{1}{2}.\cos(\omega+\mu)t$$ 2

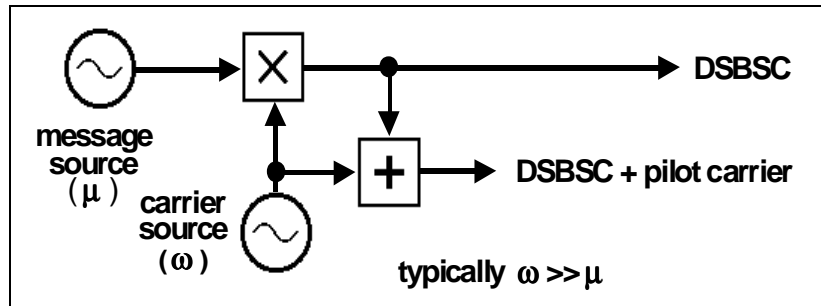Equation (2) is very simply generated by the arrangement of Figure 1.

Figure 1: a DSBSC generator

Here the message source a(t) is shown as a single sinusoid. Its frequency (μ) would typically be much less than that of the carrier source (ω).

A snap-shot of the waveform of a DSBSC is shown in Figure 2, together with the message from which it was derived..
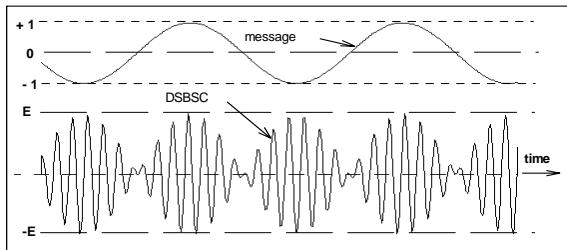

Figure 2: a DSBSC - seen in the time domain

experiment

Model the block diagram of Figure 1 as shown in Figure 3. If an AUDIO OSCILLATOR is not available, the 2 kHz MESSAGE from MASTER SIGNALS can be substituted. But this would be a special case, since this message is synchronous with the carrier frequency. Note also the *optional* ADDER in Figure 3; this makes provision for a 'pilot' carrier - see ***pilot carrier*** below.
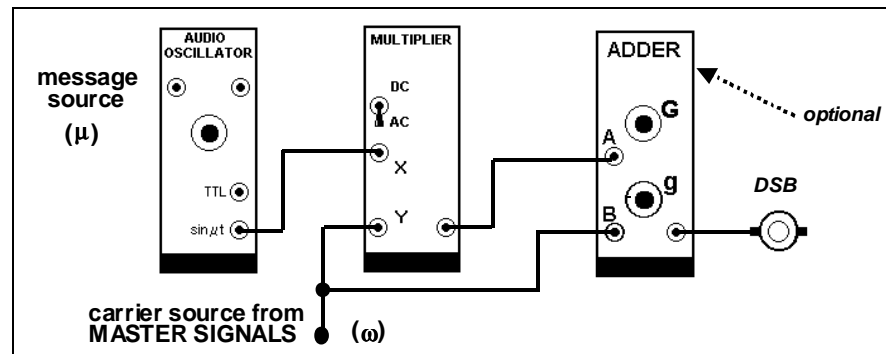

Figure 3: the TIMS model of Figure 1

There should be no trouble in viewing the output of the above generator, and displaying it as shown in Figure 4. Ideally the oscilloscope should be synchronised to the message waveform.
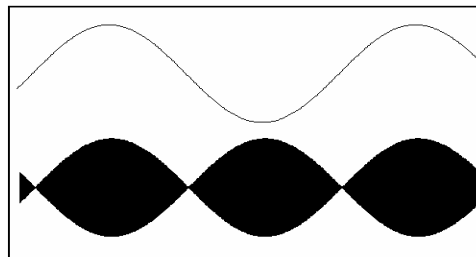

Figure 4: typical display of a DSBSC and the message.

This is not the same as the snap-shot illustrated in Figure 2. An oscilloscope with the ability to capture and display the signal over a few message periods could reproduce the display of Figure 2.

You can obtain the snap-shot-like display with a 'standard' oscilloscope, provided the frequency ratio of the message is a sub multiple of that of the carrier. This can be achieved with difficulty by manual adjustment of the message frequency.   A better solution is to use the 2 kHz MESSAGE from MASTER SIGNALS. The frequency of this signal is exactly 1/48 of the carrier.

If an AUDIO OSCILLATOR is not available (the 2 kHz MESSAGE from MASTER SIGNALS being used as the message) then the display of Figure 4 will not be possible.

pilot carrier

For synchronous demodulators a local, synchronous carrier is required. See the Lab Sheet entitled ***Product demodulation***, for example. As an aid to the carrier acquisition circuitry at the receiver a small amount of 'pilot' carrier is often inserted into the DSBSC at the transmitter (see Figure 1). Provision for this is made in the model of Figure 3.