

EE430 Lab #2 (Week 4)

Amplitude Modulation

This is an informal lab. It has not been tested, so prepare for surprises!

1. Equipment

- Agilent spectrum analyzer
- Digital oscilloscope
- Analog oscilloscope
- Tektronix function generator, with AM. (hereafter referred to as "transmitter")
- Philips or HP (preferred) function generator. (hereafter referred to as "modulating signal")
- 2 1N4148 diodes
- 10k resistor
- 1 nf capacitor

2. Setting up

Connect the equipment according to Fig. 1.

Note that the AM input of the Tektronix function generator is on the back.

- Set the transmitter to sine wave, 1 mHz, 4 volts p-p output.
- Set the modulating signal to sine wave, 1 kHz, sweep off, DC offset off, but disconnect the cable for now.

Set up the spectrum analyzer to view the spectrum near 1 mHz. As a starting point

- Measure -- Analyzer type -- Spectrum -- R.
- Start -- 990 kHz.
- Stop -- 1010 kHz.
- Scale Ref -- 30 dBm, 10 dB per division.
- Bandwidth -- 100 Hz.

3. Unmodulated carrier

Observe on both scopes that the unmodulated carrier is as expected.

4. AM with envelope detector

- Connect the cable to the modulating signal.
- Set the level for a modulation index of 1.
- Observe the waveforms on both scopes. See the difference? Sketch them.
- Observe the spectrum.
- Connect the envelope detector (Fig. 2) to the output of the transmitter.
-
- Disconnect the RF (Channel 1) from the digital scope, and connect that input to the output of the detector.
- Vary the modulation.
- Observe that for modulation index of less than 1, the output is a good replica of the modulating signal, but for modulation index greater than 1, it is distorted. Sketch what you see.
- Observe that the spectrum analyzer still shows that distortion is not significant.
-
- Turn on the DC offset on the modulating signal.
- Adjust the DC offset for minimum carrier amplitude, as seen on the spectrum analyzer.
- Observe the modulated carrier waveform. Sketch it.
- Observe the output of the detector. It should look like a full-wave rectified sine wave.
- Observe that the spectrum analyzer still shows that distortion is not significant.
-

5. DSB-SC with product detector

- Disconnect the envelope detector, and connect the product detector (Fig. 3) in its place.
- Connect the "sync out" output of the transmitter to the "BFO in" input of the product detector. This is an unmodulated square wave, in sync with the transmitter output.
- Adjust the transmitter output level to about half of the level of the "BFO" signal.
- Observe that the output of the detector is now a good reproduction of the modulating signal.

6. The report

For the report, give a quick summary of your observations, and your observations in the experiments.

Fig. 1

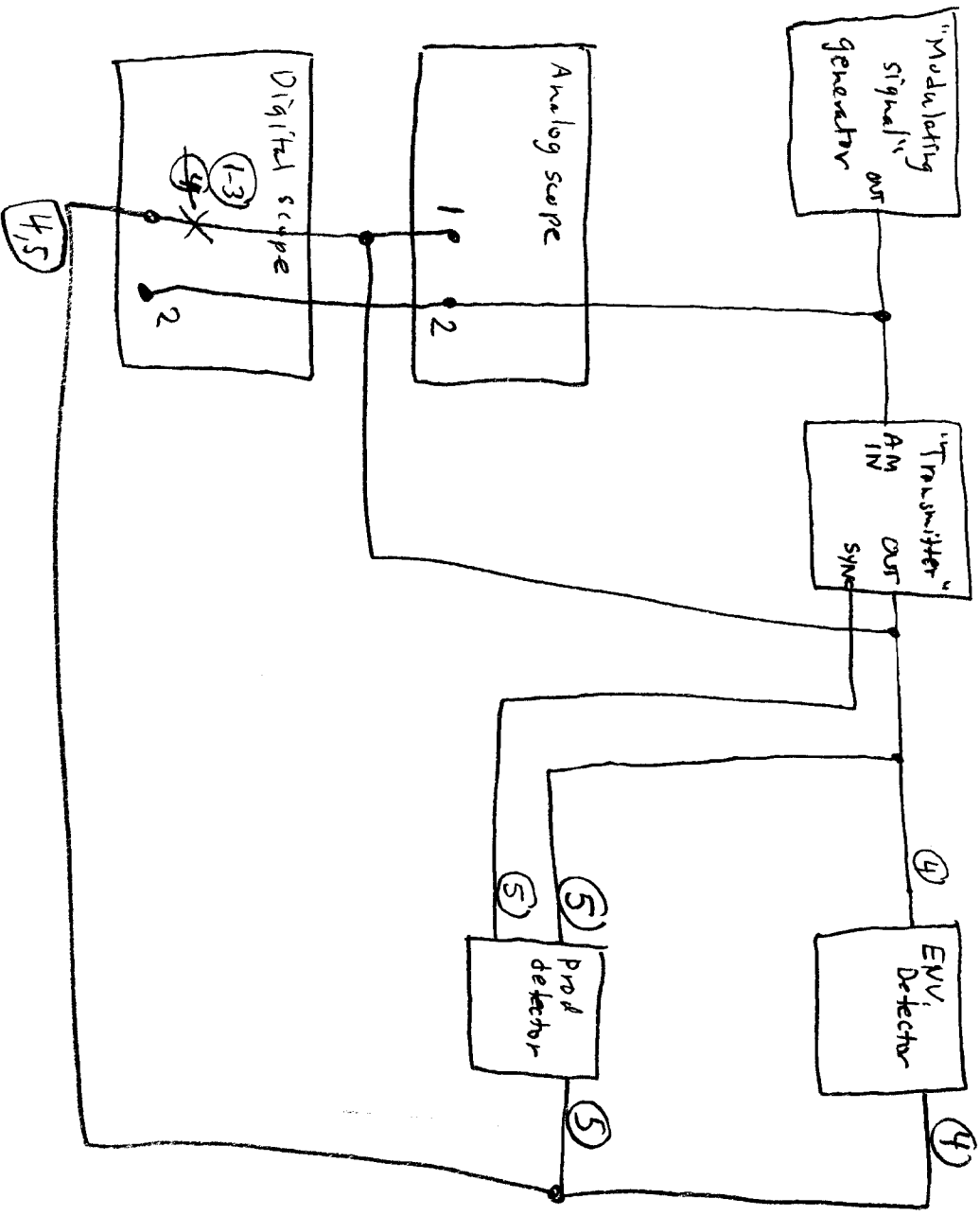


Fig. 2

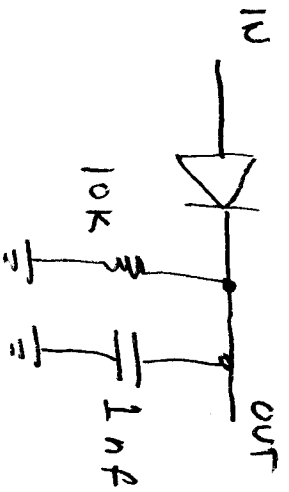


Fig 3

