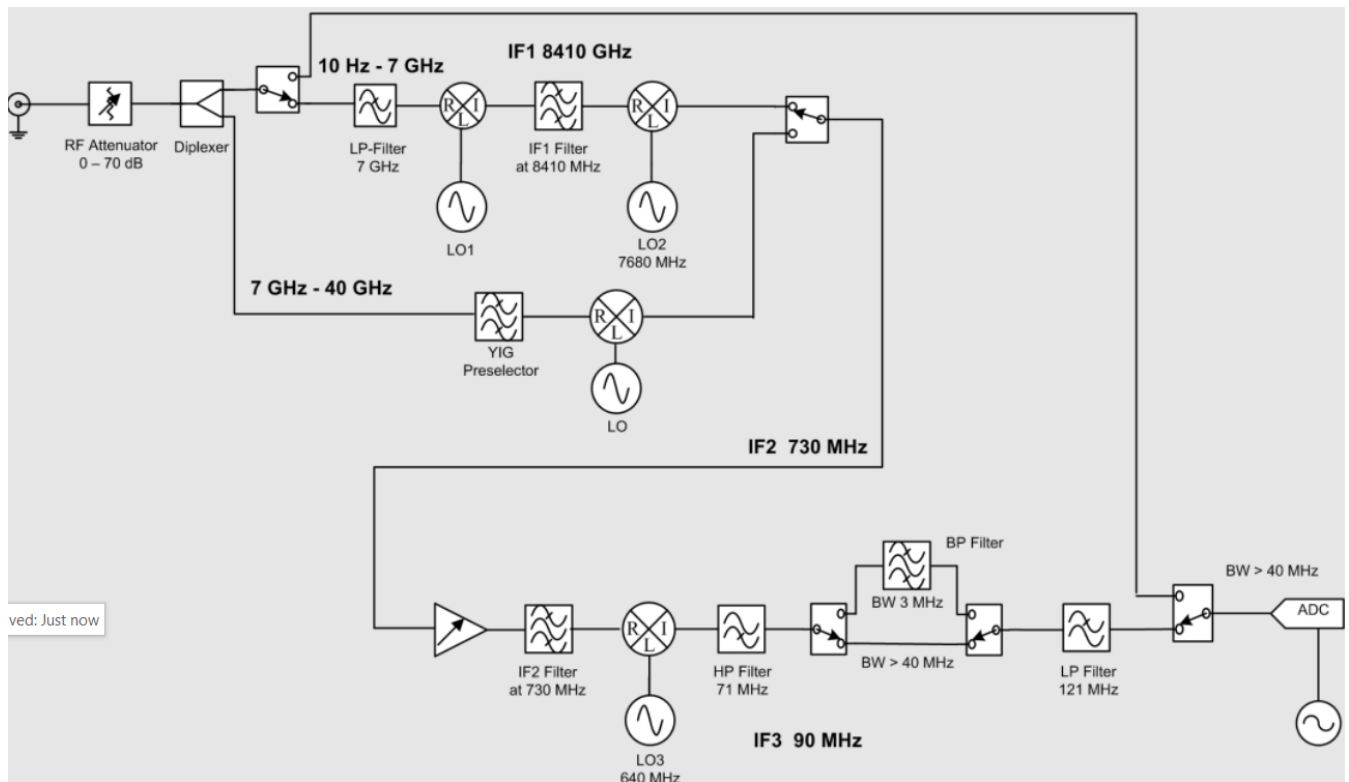
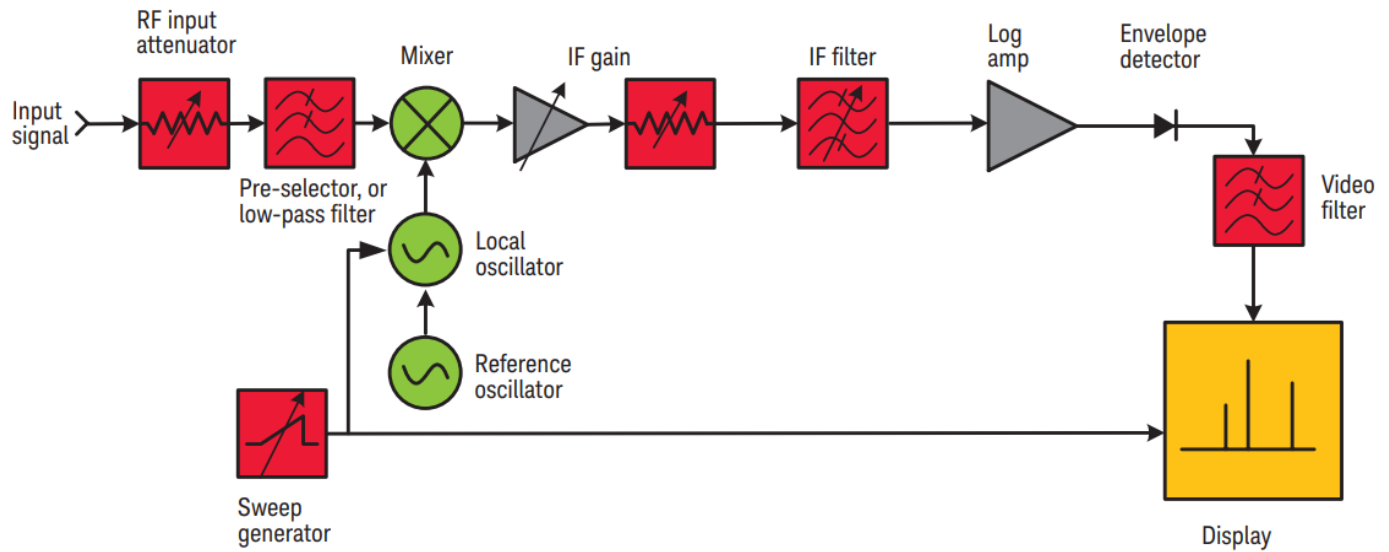
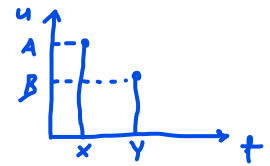
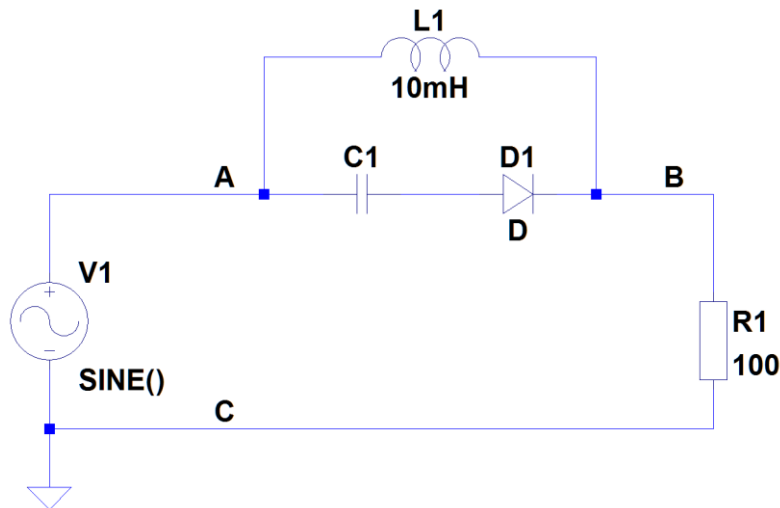


1. The signal voltage is $u(t)=A*\sin(2\pi X t)+B*\cos(2\pi Y t)$ (in V). Draw its amplitude spectrum.
2. The structure of what device is in the picture below? Explain the purpose of all blocks.



3. Propose a system structure for:
 - a. Impedance measurement of a DUT over given temperature range
 - b. Impedance measurement of a DUT over given magnetic field strength (H, B) range
 - c. Magnetic field measurement over given surface
 - d. A drone position determination
 - e. Etc..

4. How to measure power [W] in such a circuit:



5. What is the best way to estimate (i.e., the maximum utilization of the signal-to-noise ratio) the amplitude U_m of the harmonic oscillation, if the frequency is known? Mark all the answers you think are correct.

- a) 4 parameter (U_m , U_0 , ϕ , f) sinusoid function fit.
- b) Sine wave correlation (SWC).
- c) Discrete time Fourier transform (DTFT), using 1 frequency.
- d) By measuring the difference between minima and maxima (U_{pp}), and then $U_m = U_{pp}/2$.
- e) By measuring the difference between zero and maxima (U_m).

6. What is the most accurate technique (i.e., maximum utilization of the signal-to-noise ratio) to determine the frequency of the harmonic oscillation f ? Mark all the answers you think are correct.

- a) 4 parameter (U_m , U_0 , ϕ , f) sinusoid function fit.
- b) Sine wave correlation (SWC).
- c) By using Discrete time Fourier transform (DTFT).
- d) By using Discrete Fourier transform (DFT/FFT).
- e) By using Fourier transform (FT).

7. What is the most accurate technique (i.e., the maximum utilization of the signal-to-noise ratio) to determine the delay ToF of a bandlimited (i.e., occupying a limited frequency band) signal s_{RX} if the transmitted signal s_{TX} (reference) is known? Mark all the answers you think are correct.

- a) By finding the temporal position of the maxima of the cross correlation (between s_{RX} and s_{TX}) function.
- b) By finding the temporal position of the threshold crossing.
- c) By finding the temporal position of the zero crossing.
- d) By finding the temporal position of the minima of the absolute difference (between s_{RX} and s_{TX}) sum.
- e) By finding the temporal position of the minima of the energy of the difference (between s_{RX} and s_{TX}).
- f) By using Fourier transform (FT).

8. What is the fastest way (i.e. requires minimal computational resources) to determine the delay ToF of a bandlimited signal s_{RX} (i.e., occupying a limited frequency band) if the transmitted signal s_{TX} (reference) is known? Mark all the answers you think are correct.

- a) By finding the temporal position of the maxima of the cross correlation (between s_{RX} and s_{TX}) function.
- b) By finding the temporal position of the threshold crossing.
- c) By finding the temporal position of the zero crossing.
- d) By finding the temporal position of the minima of the absolute difference (between s_{RX} and s_{TX}) sum.
- e) By finding the temporal position of the minima of the energy of the difference (between s_{RX} and s_{TX}).
- f) By using Fourier transform (FT).

9. Which of the systems listed below is raster (scanning) measurements system? Mark all the answers you think are correct.

- a) Scanning electron microscope.
- b) Atomic forces microscope.
- c) Ultrasonic imaging system.
- d) Radar.
- e) Thermometer.
- f) Voltmeter.

10. Which of the received signal parameters influence the random errors of signal delay time ToF estimation?

- a) Signal energy.
- b) Signal effective bandwidth.
- c) Signal center frequency (spectral center of gravity).
- d) Signal envelope bandwidth.
- e) Signal phase.