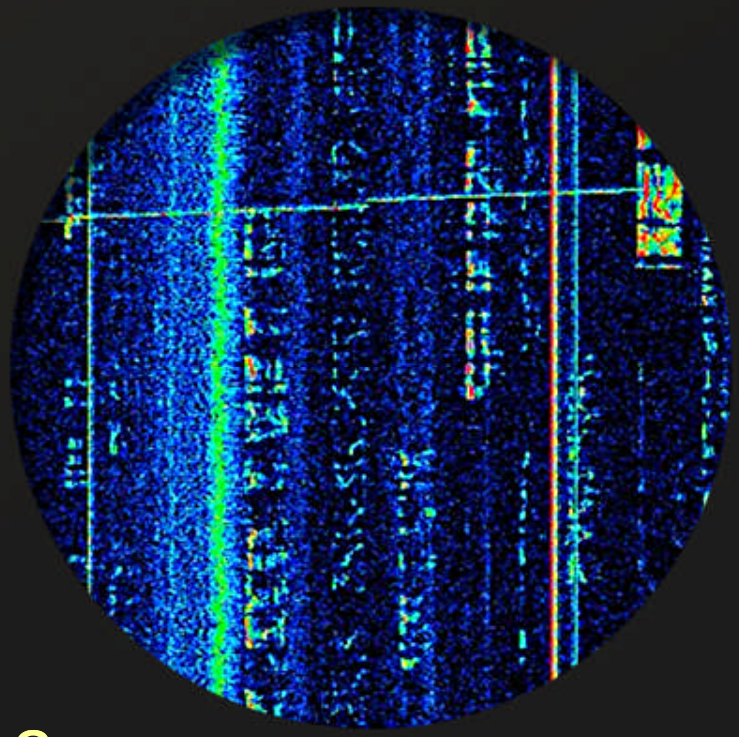
A Blazing Fast Intro to Soft Radio

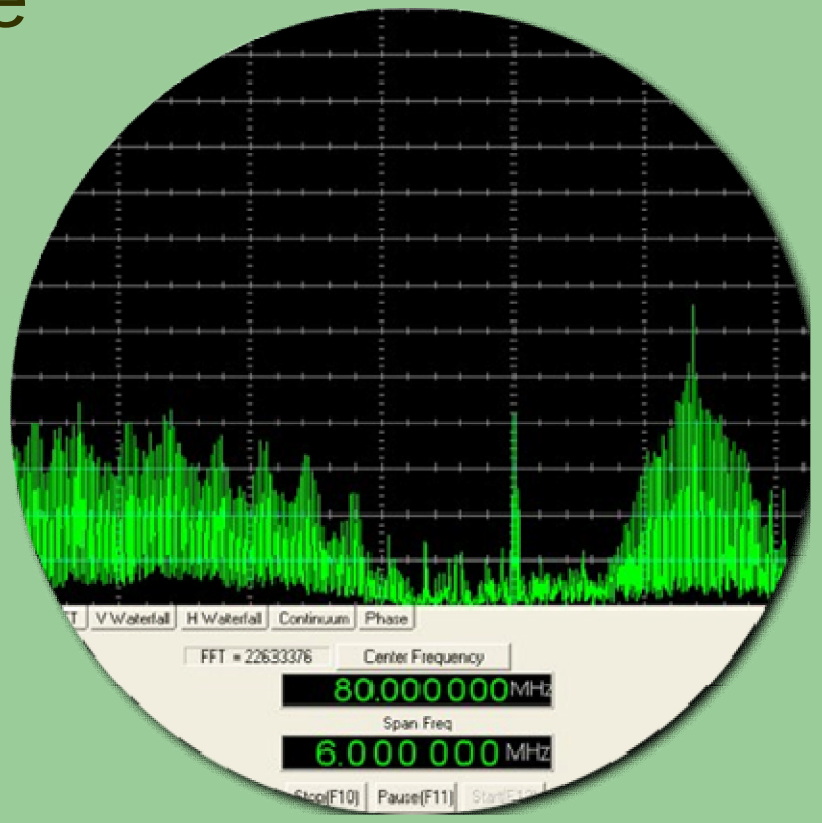


Chapter 2
Principles, Hardware & Software

L. Van Warren *AE5CC*

Blazing Fast SDR: *Overview*

- Principles
- Hardware & Software
- My Research
- Questions
- Acks



- Adapted images & text linked to respective sources.

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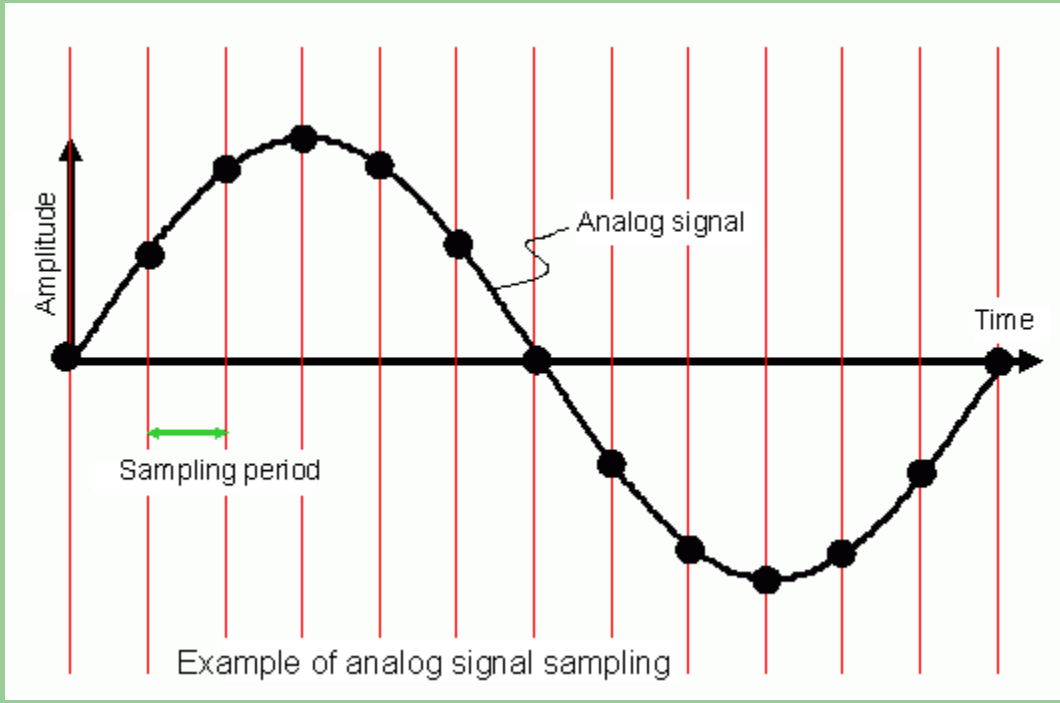
What is Software Defined Radio?

A soft radio samples RF and performs modulation, mixing and conversion using digital software rather than analog hardware.

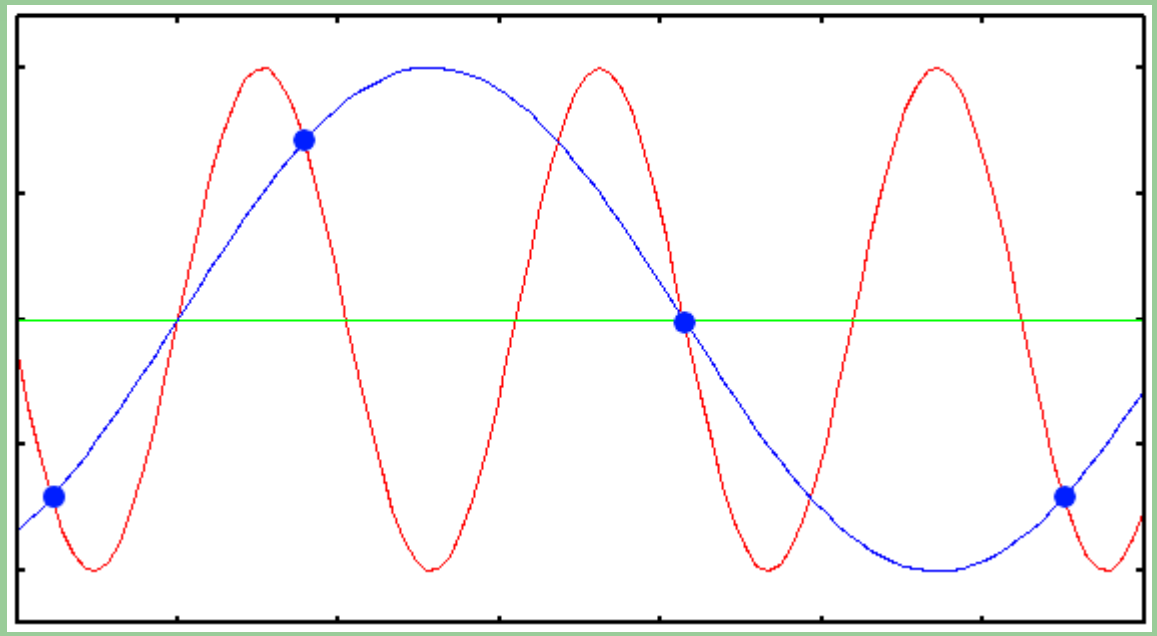
Sampling:

Recording a continuous analog waveform as a set of discrete digital measurements.



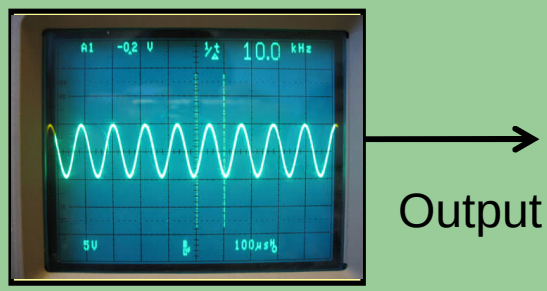
Nyquist:

Sample more often than twice the frequency of the signal to reconstruct it. If you don't, an alias will appear.

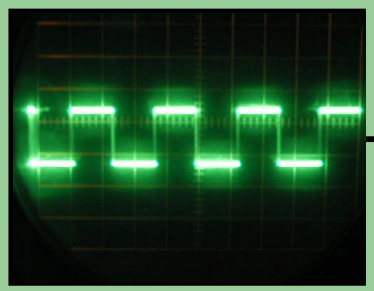


Oscillator:

A functional block that generates a single frequency. The wave form can be sinusoidal or square.



Output



Output

"Oscillators amplify
and
amplifiers oscillate."

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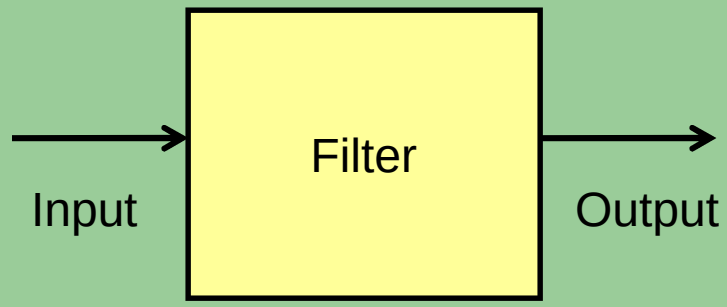
Generalized Filter:

A functional block that performs signal processing.

A filter may be analog or digital.

A filter may operate in time or frequency domain.



"Filters amplify
and
amplifiers filter."

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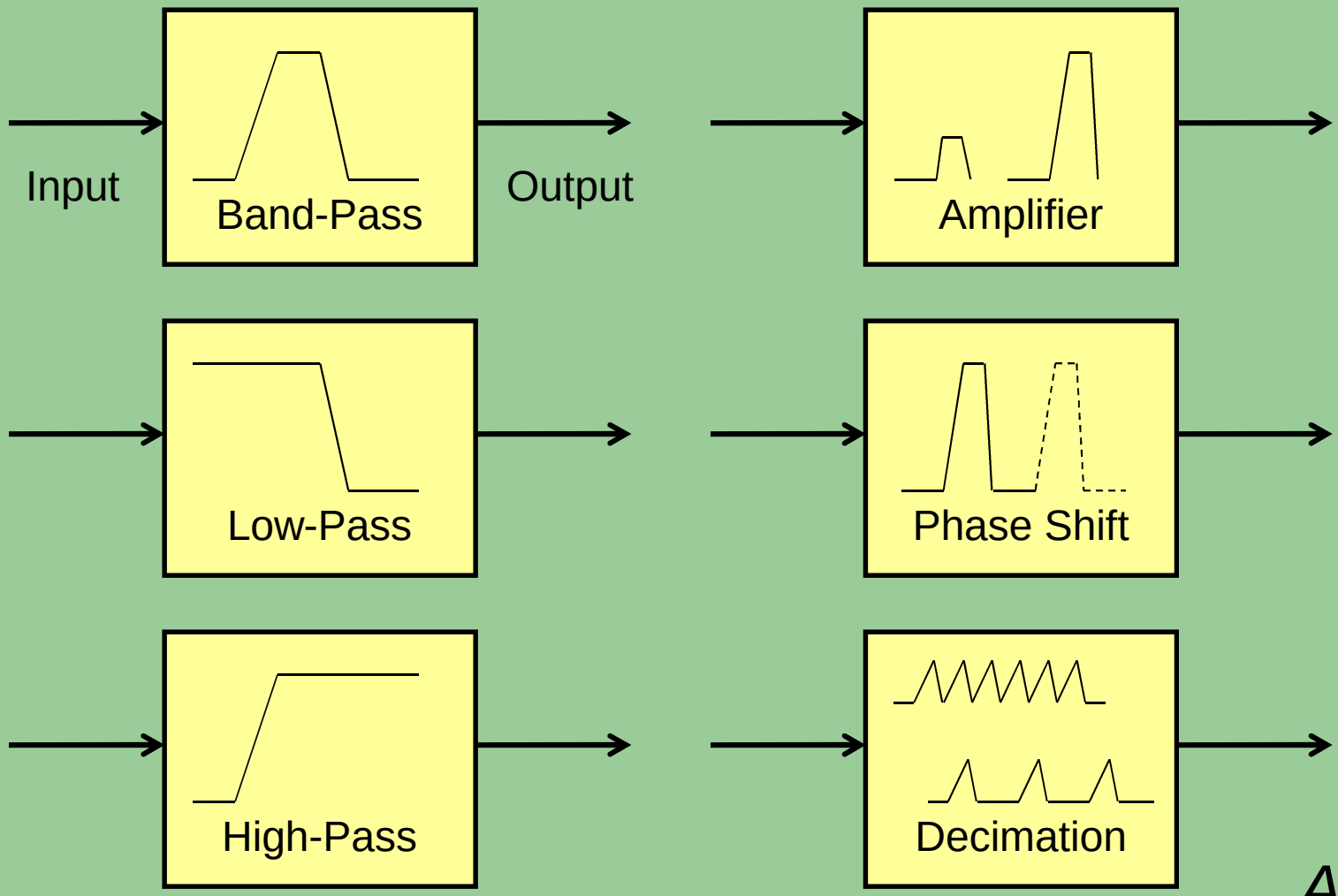
Blazing Fast SDR: *Principles*

Filter Examples:



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Mixer:

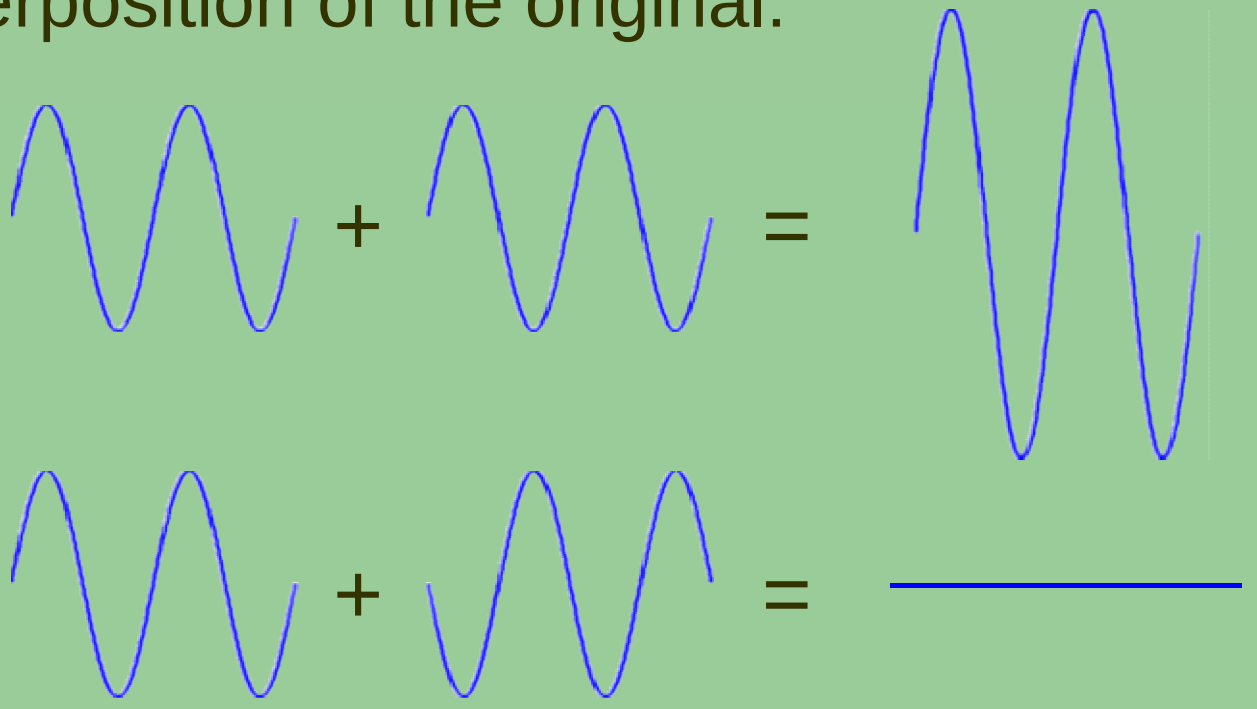
An Audio mixer sums two signals.

An RF mixer multiplies two signals.

The results are not the same!

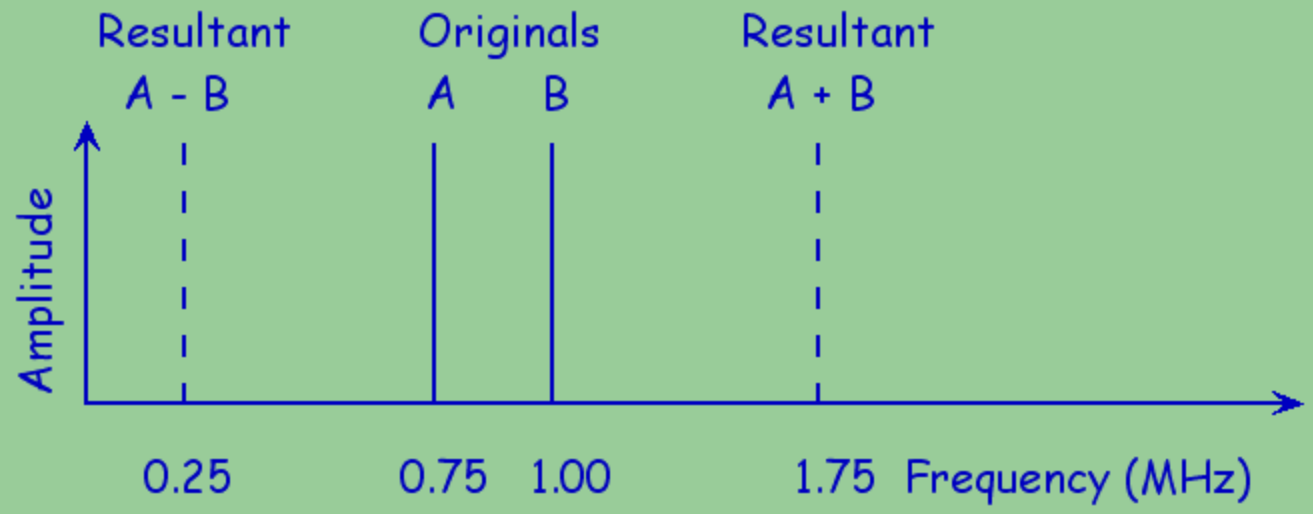
Audio Mixer:

An Audio mixer adds two signals, creating a superposition of the original:



RF Mixer:

An RF mixer multiplies two signals creating two completely new signals at stations A – B and A + B.



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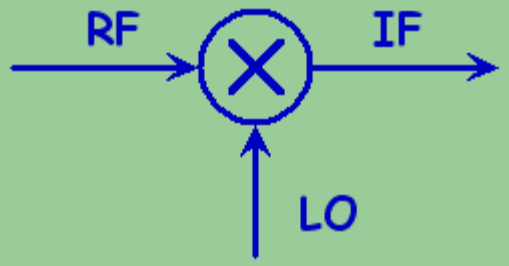
Mixer:

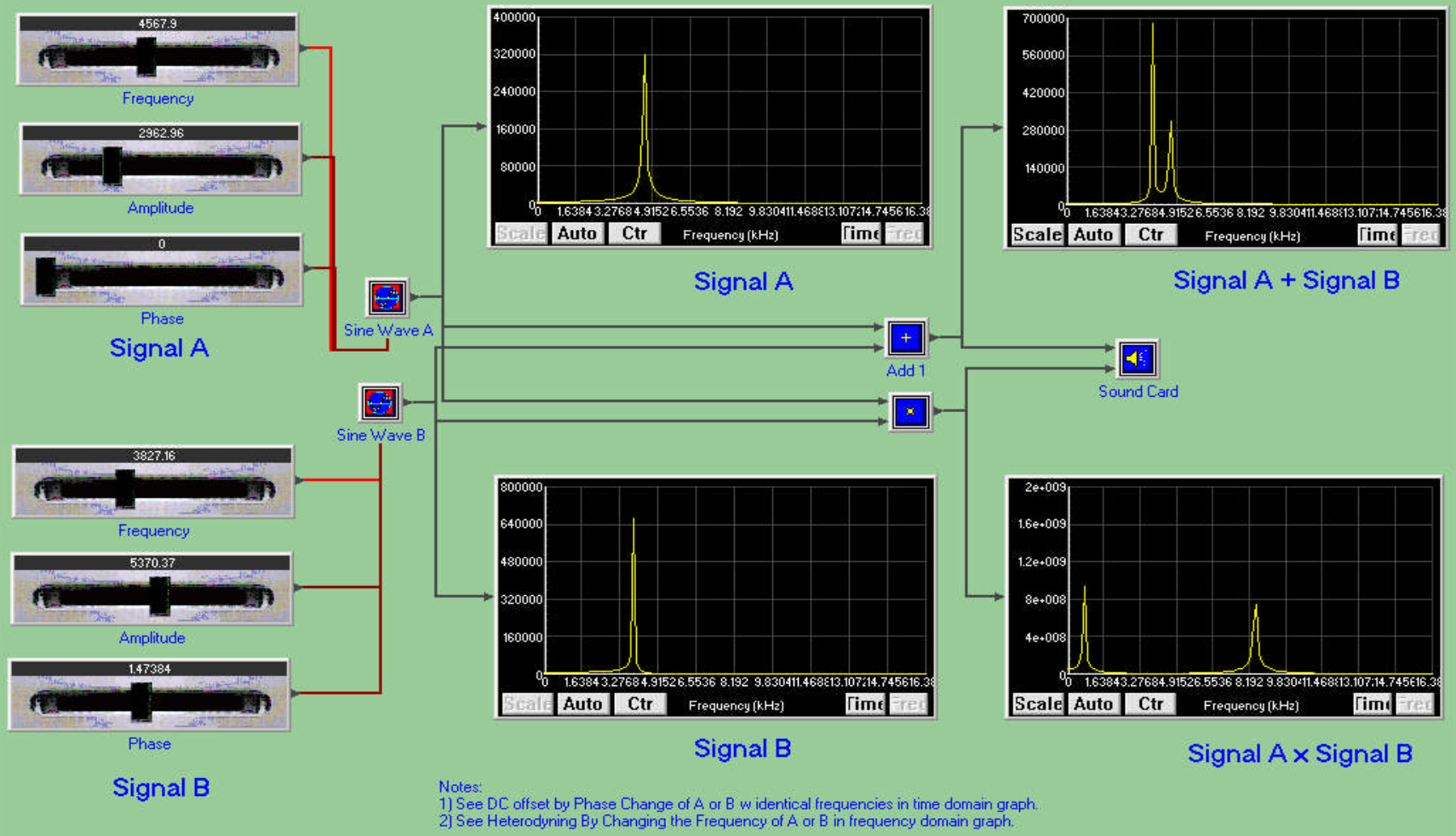
When referring to RF the term

product mixer

may reduce confusion.



Blazing Fast SDR: *Principles*



Notes:
1) See DC offset by Phase Change of A or B w identical frequencies in time domain graph.
2) See Heterodyning By Changing the Frequency of A or B in frequency domain graph.

Mixer Demonstration

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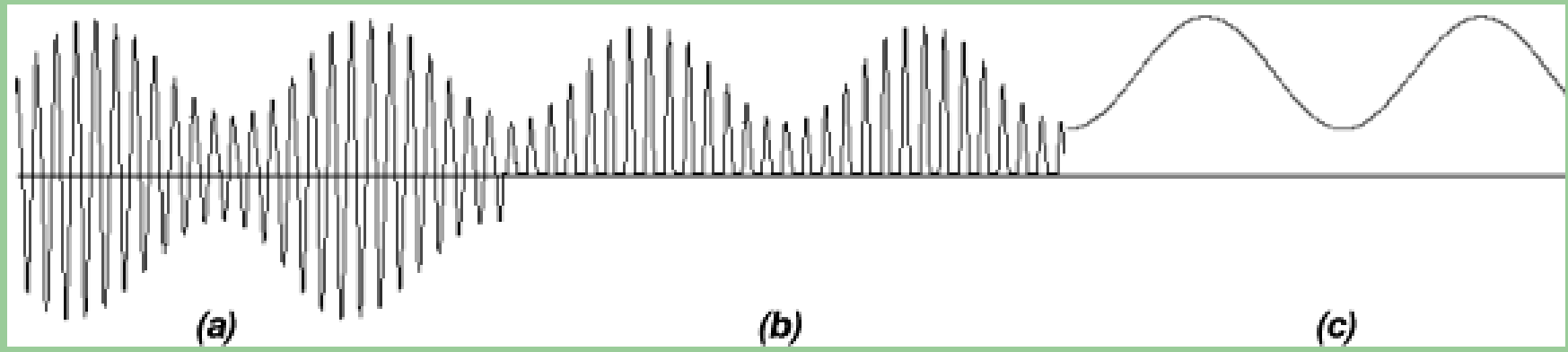
Detector/Demodulator:

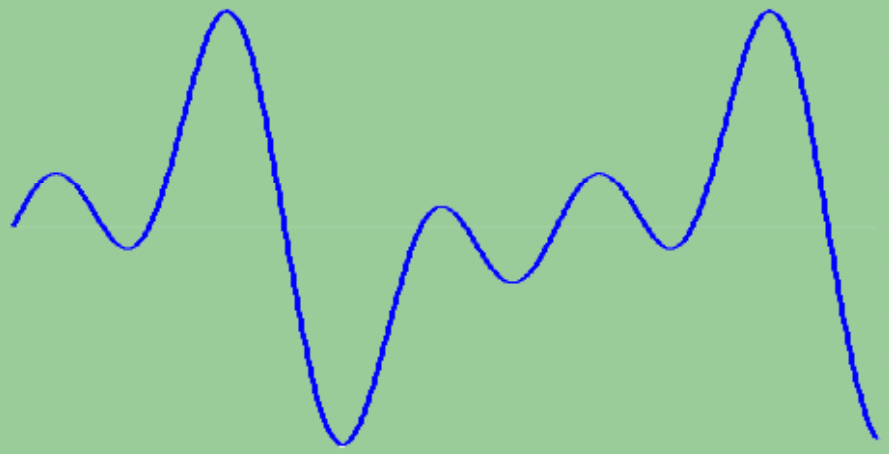
Separates the original signal from the RF carrier on which it was modulated.



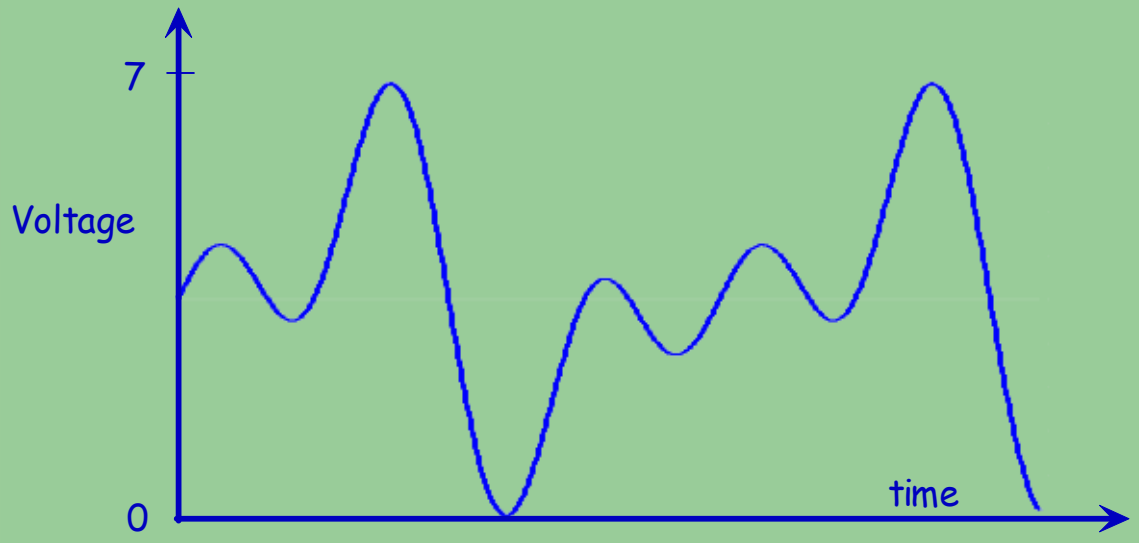
ADC: Analog to Digital Converter

Samples a continuous analog signal and converts it to a set of digital numbers:

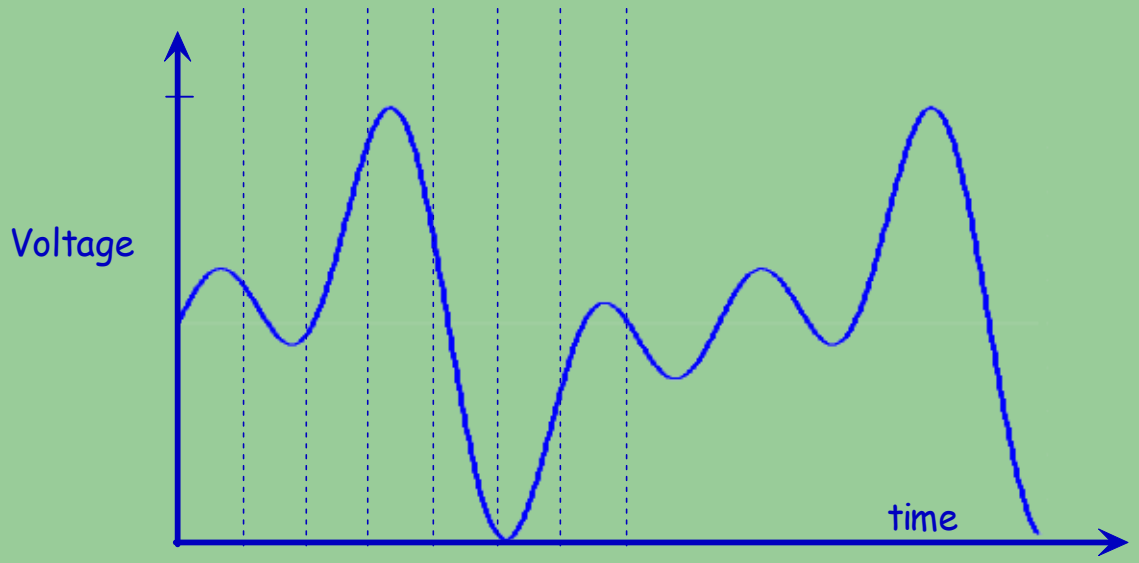
ADC: Signal Exists in World



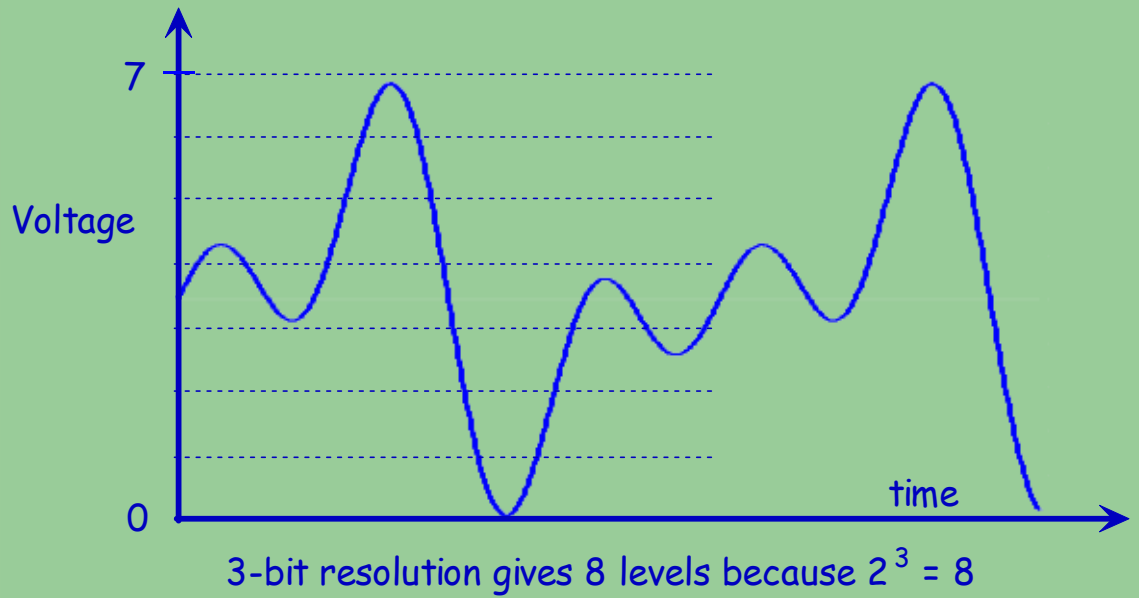
ADC: Given As Voltage over Time



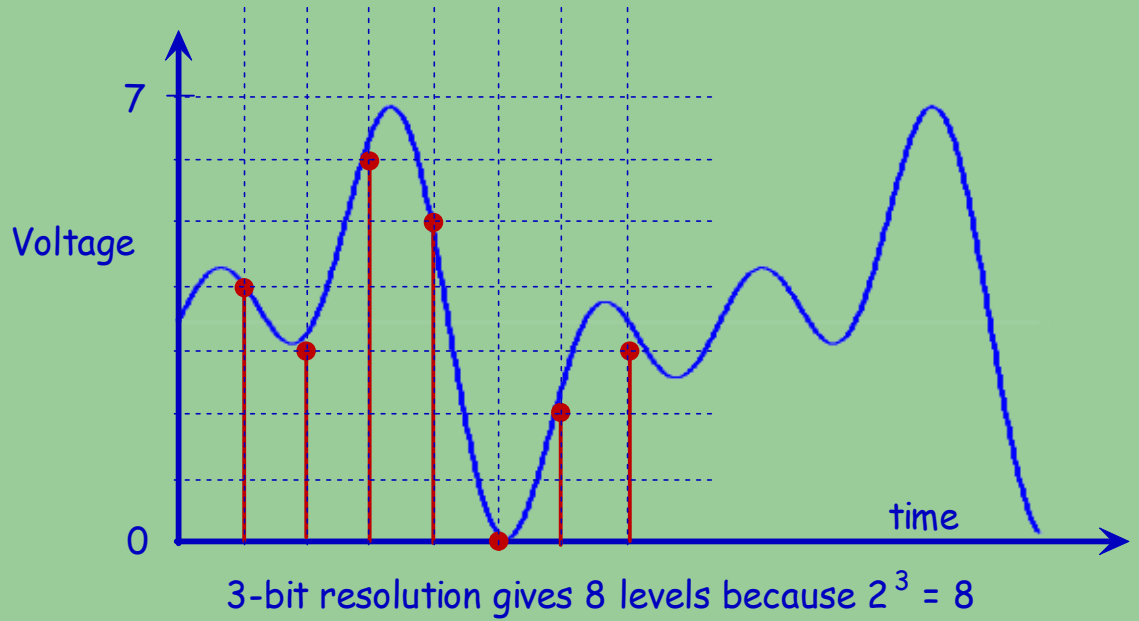
ADC: Choose sampling frequency.



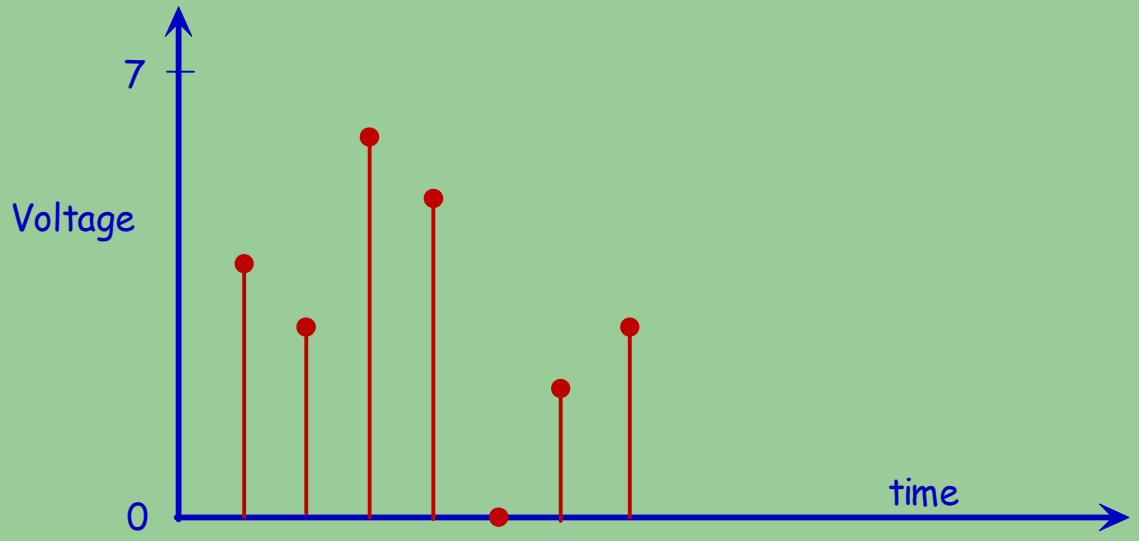
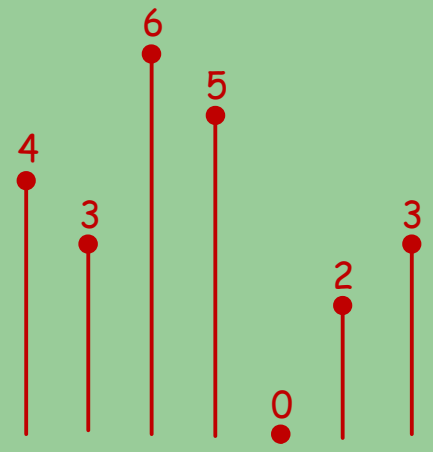
ADC: Choose number of voltage levels.



ADC: Sample signal to nearest level.



ADC: a small error occurs.



ADC: “quantization” error.