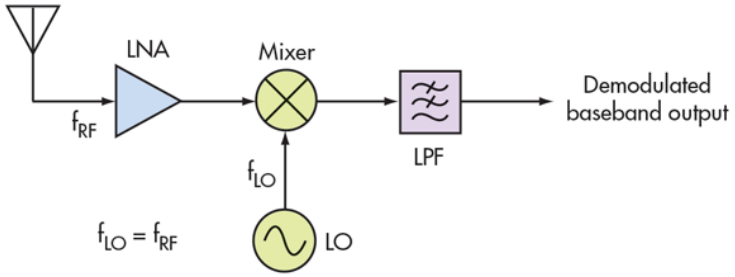
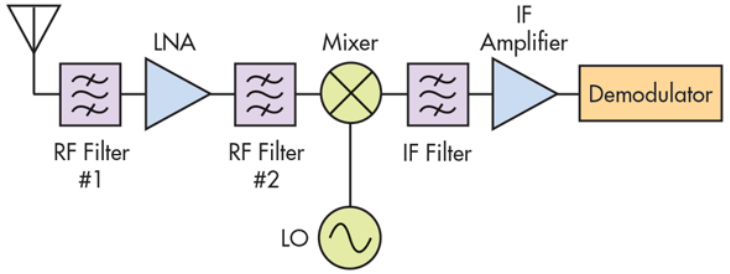
Types of radio receivers

Direct Conversion



- converts in one step down to AF
- local oscillator at same frequency as input signal
- only one mixer needed, LPF takes care of upconverted frequency component
- Poorer selectivity, dc offset issues

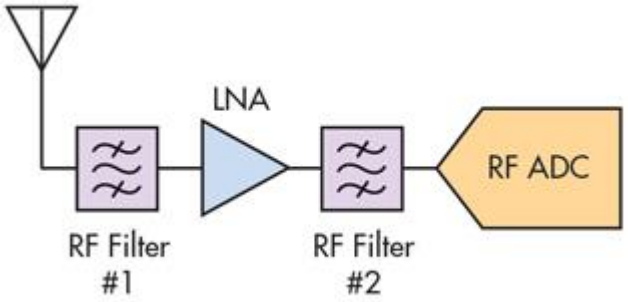
Super Heterodyne



- converts in two steps
- first conversion to IF, filtering and down-convertion with 2nd mixer to AF
- crystal filter (IF filter) for good selectivity
- high IF frequency prevents image frequency challenges: $f_{rf} - f_{lo} = f_{if} = f_{image} - f_{lo}$
- even better image rejection in two stage super heterodyne (two IF stages)

Types of radio receivers

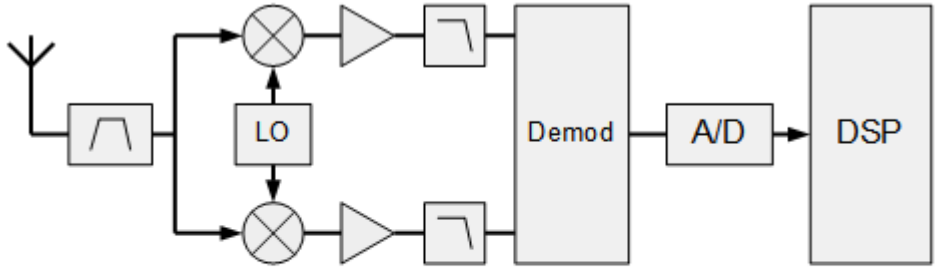
Direct Sampling



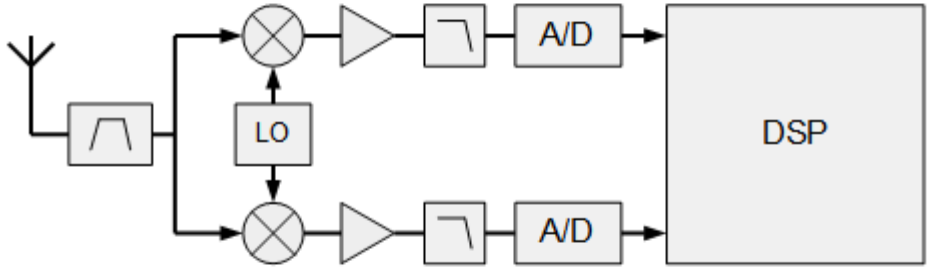
- Often also seen as hybrid designs (ADC after IF stage)
- IC-7300, Flexradio
- DC offset, 50Hz/60Hz to be addressed
- Output ADC: f(n)

Types of radio receivers

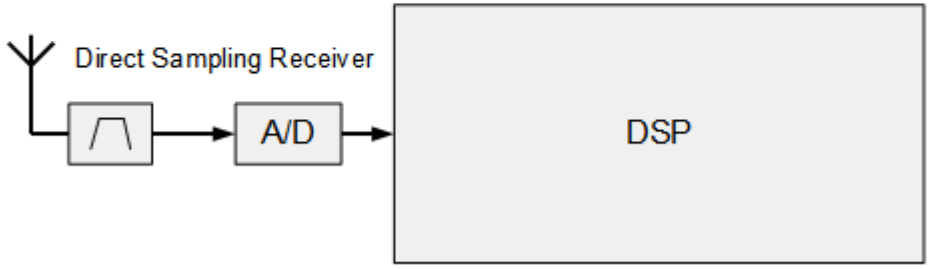
IQ demodulation / quadrature mixer



- Once the signal got digitized, it is prone to further degradation



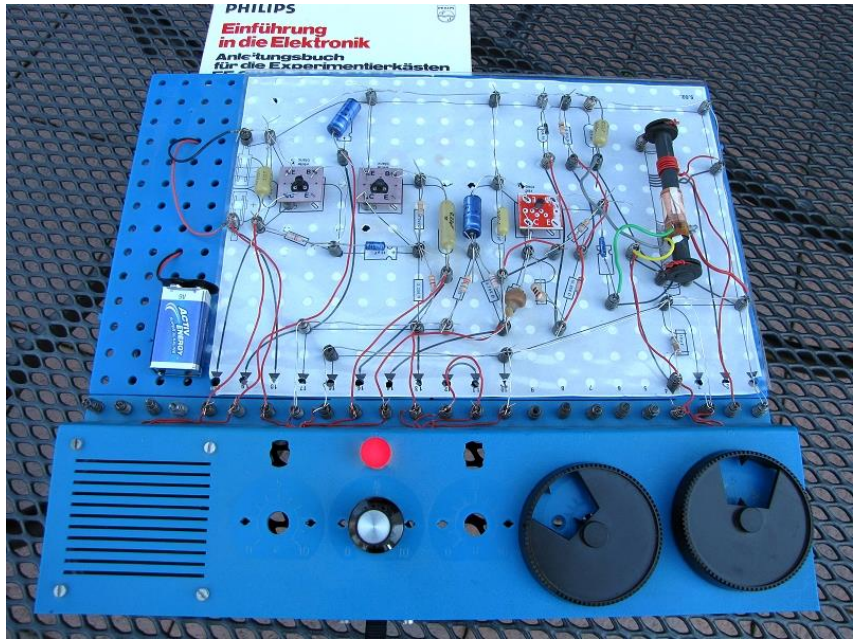
- Low clock jitter and SNR is needed
- Output ADC: I(n) + Q(n)

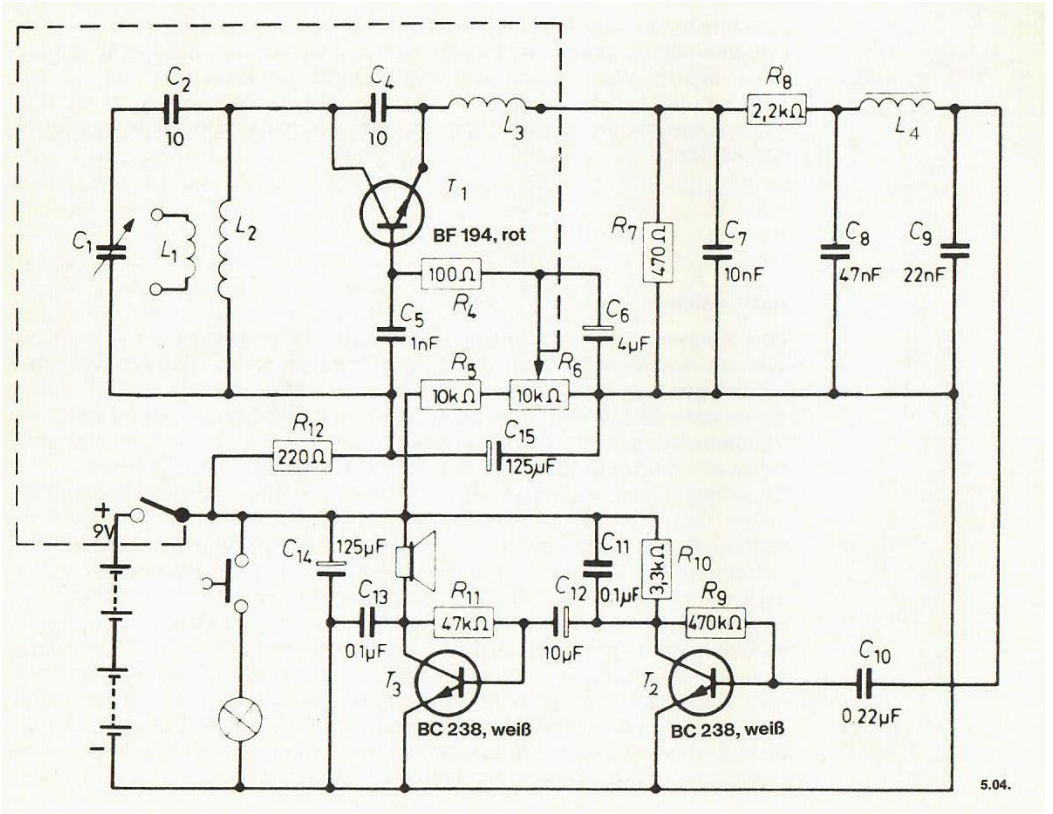


- Very high data rate like 16bit x 250MHz resulting in internal data rate of up to 10 Gbit/s

That’s how all started…

Super regenerative receiver, Philipps EE2003, 1976

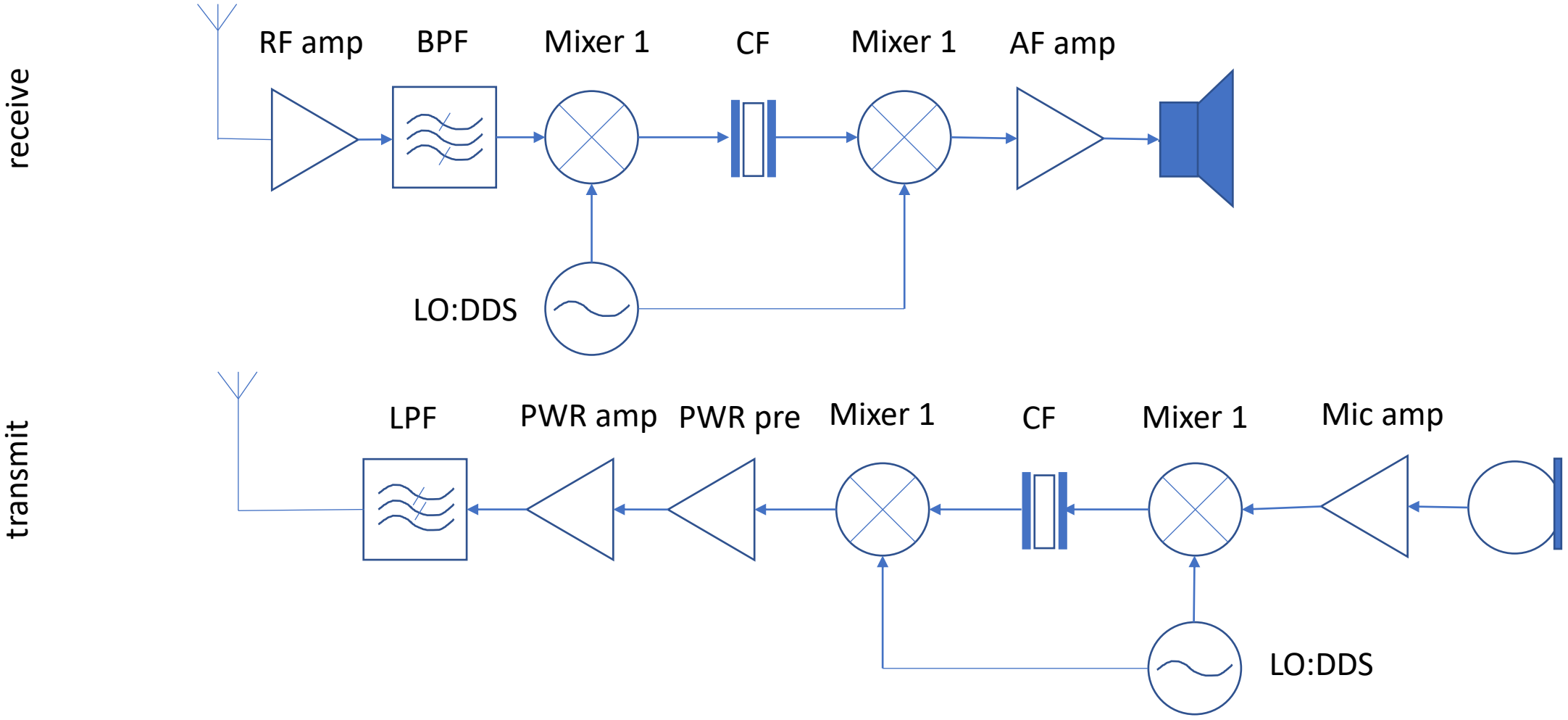




- good for AM, FM only with large freq. swing / high modulation index
- generates HF distortion that affects other radios close by
- Poor selectivity, high AF noise level

Microwaves & RF, Chris DeMartino, Feb 22, 2016
Analog Devices, Peter Delos,

The DIY super-het transceiver



DDS: direct digital synthesis, Si5351