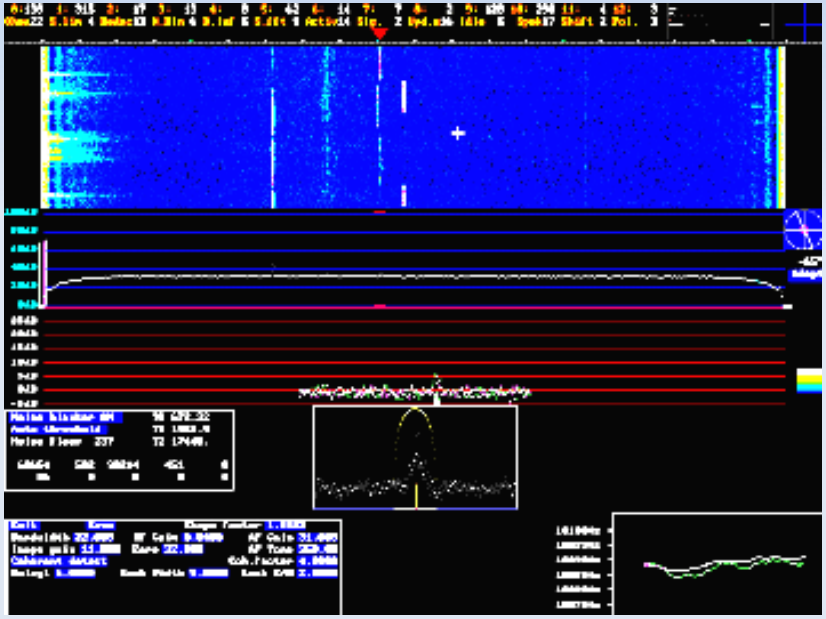
Software Defined Radio – A Closer Look



A Ham Comp Presentation by John Brock ZS6WL

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Software Defined Radio – A Closer Look

- SDR What is it?
- The 'Simplest' Design
- How to put one together
- Receiver / Transceiver
- How easy is it to construct?
- What components MUST I use?
- Can I use a very OLD PC?
- Where can I get more information?
- How do I get the software?

SDR What is it?

- Software Defined Radio – not quite 'self-explanatory'.
- Since 1980's development of the digital signal processing of signals has progressed from Main-Frame/Mini Computers to Personal Computers and dedicated Microprocessor based designs.
- What can it do?

General purpose DSP radio

Modern computers have the processing power to outperform conventional radios in receiving signals with poor S/N. Particularly when the poor S/N is due to interference rather than to white (galactic) noise the computer can remove interference within the narrow bandwidth of the desired signal by use of the information about the interference source retrieved by use of larger bandwidths. The signal processing can be far more clever than what has been possible before. Each interference source can be treated as a signal and the DSP radio can receive AND SEPARATE a large number of signals simultaneously. The DSP radio package is under development with flexibility and generality as important aspects. This page contains links to pages that describe different aspects of digital radio processing in the order they are encountered in the ongoing development. The DSP-radio for LINUX is designed for all narrow band modulation methods for all frequency bands. To start with the following modes will be included:

- Weak signal CW (primarily EME)
- Normal CW
- High speed CW (meteor scatter)
- SSB
- FM

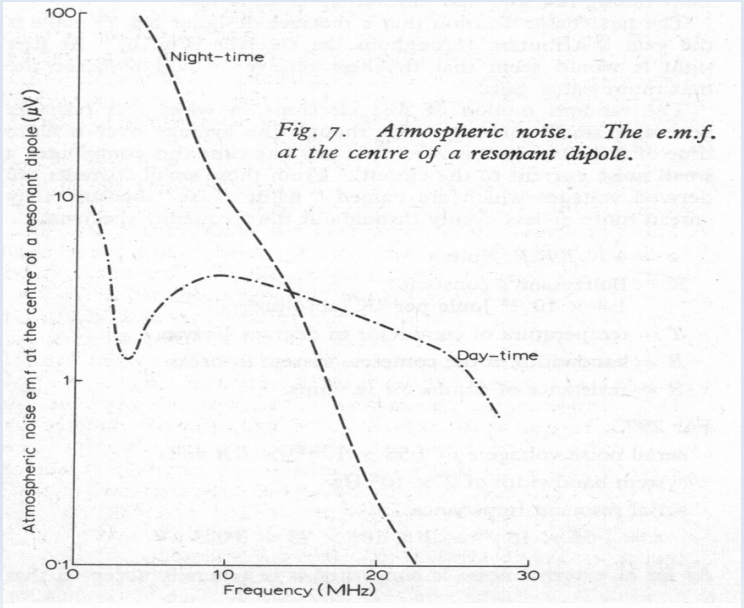
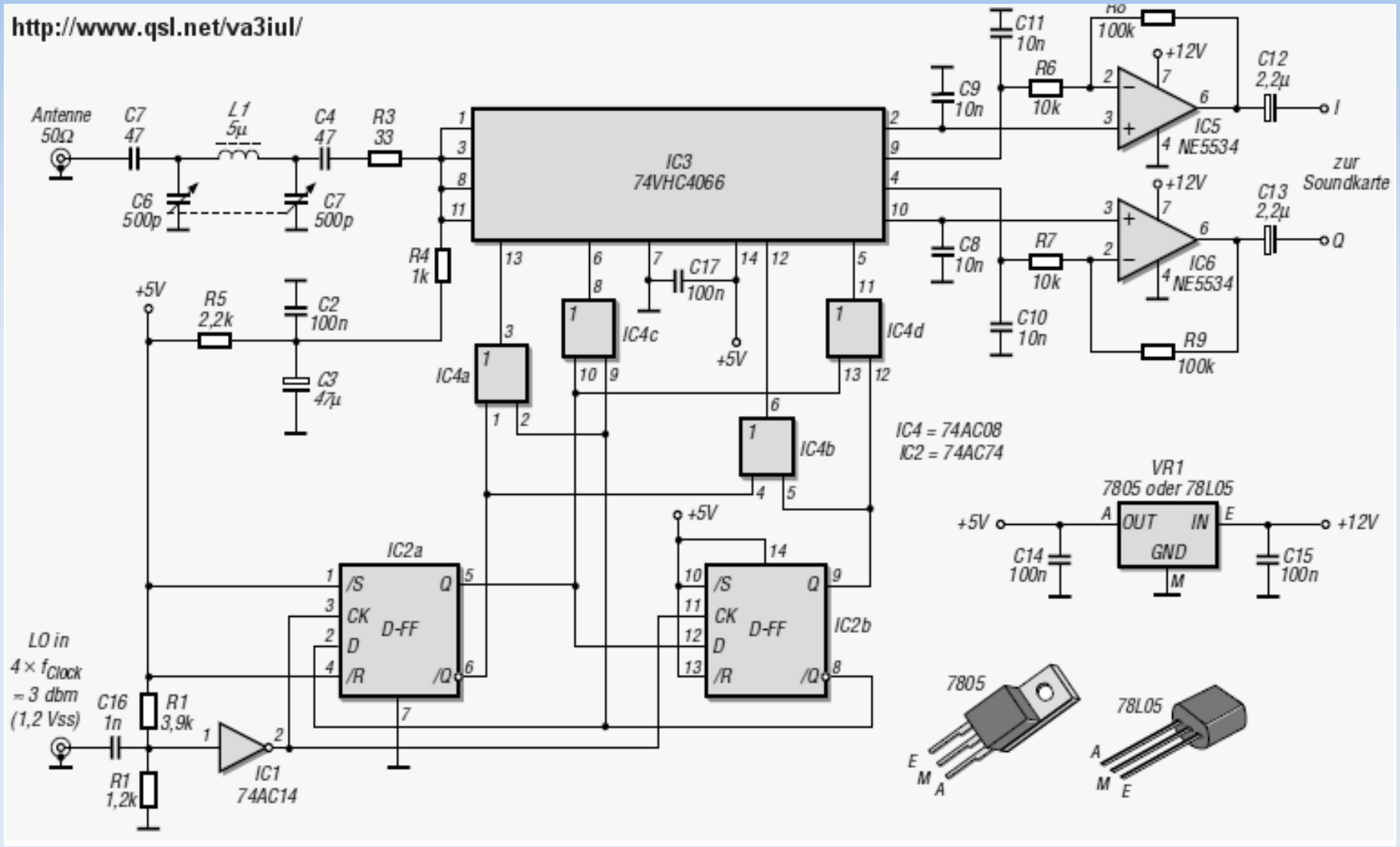


Fig. 7. Atmospheric noise. The e.m.f. at the centre of a resonant dipole.

The 'Simplest' Design

- A 'down converter' using a 2 or 4 phase local oscillator.
- Feeds a 'switching mixer'
- Which provides a 'stereo I/Q' input to a 'sound card'
- Inside a Personal Computer.
- Software installed on PC does all the 'Digital Signal Processing'.
- Outputs Audio to speakers or
- Data to screen [psk31].

How to put one together

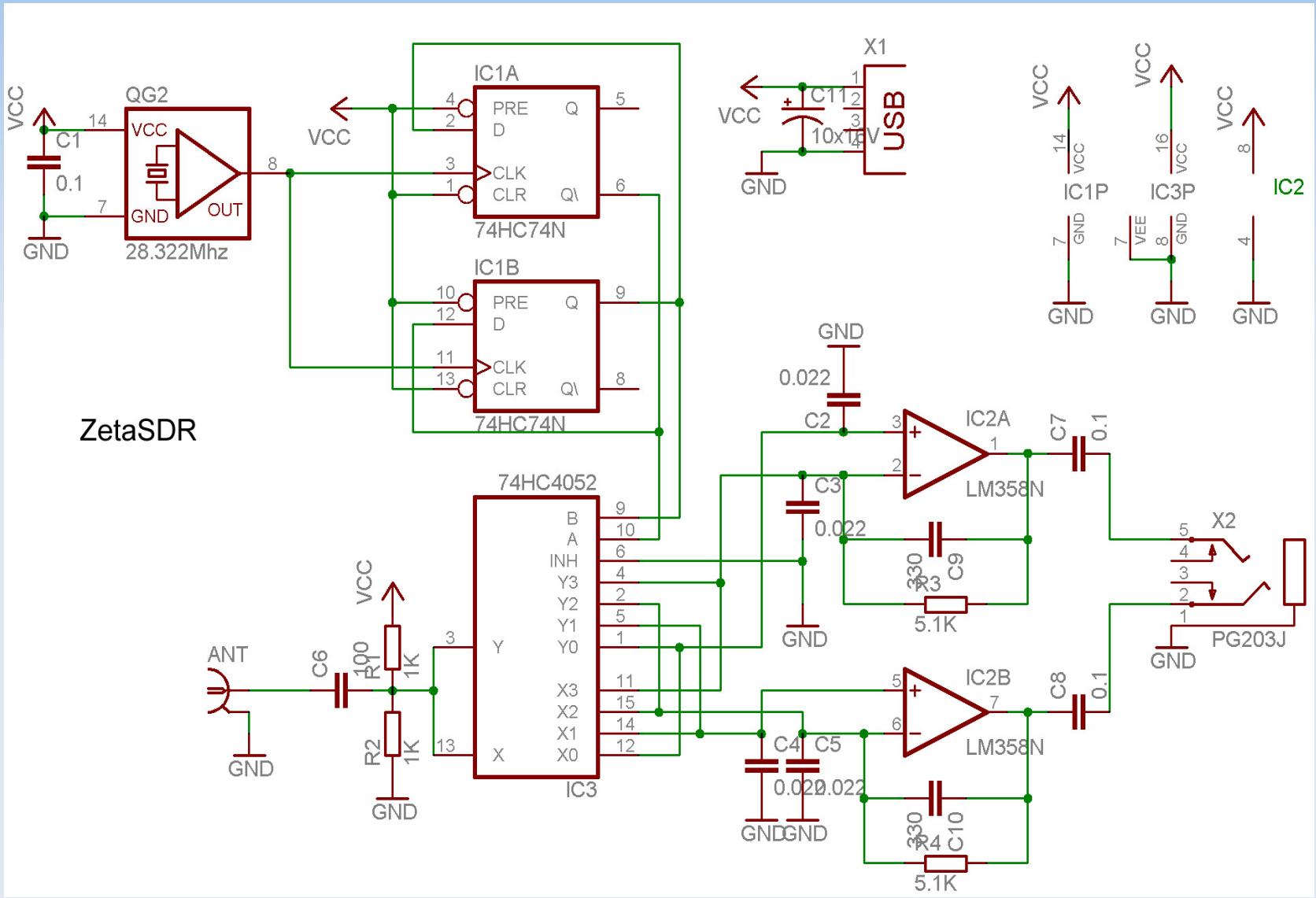


- A really 'nice' and 'simple' design - [80-49-40m]

How to put one together (2)

- 4066 is originally a CMOS quad switch.
- 7474 is originally a TTL D type Flip-Flop.
- Op Amps ?? Who's never heard of an OpAmp?
- A voltage regulator.
- Buffer chips are Logic Gates.

Another Circuit



- Simpler design? Uses 74HC series chips.

Another 'Front End' from QEX

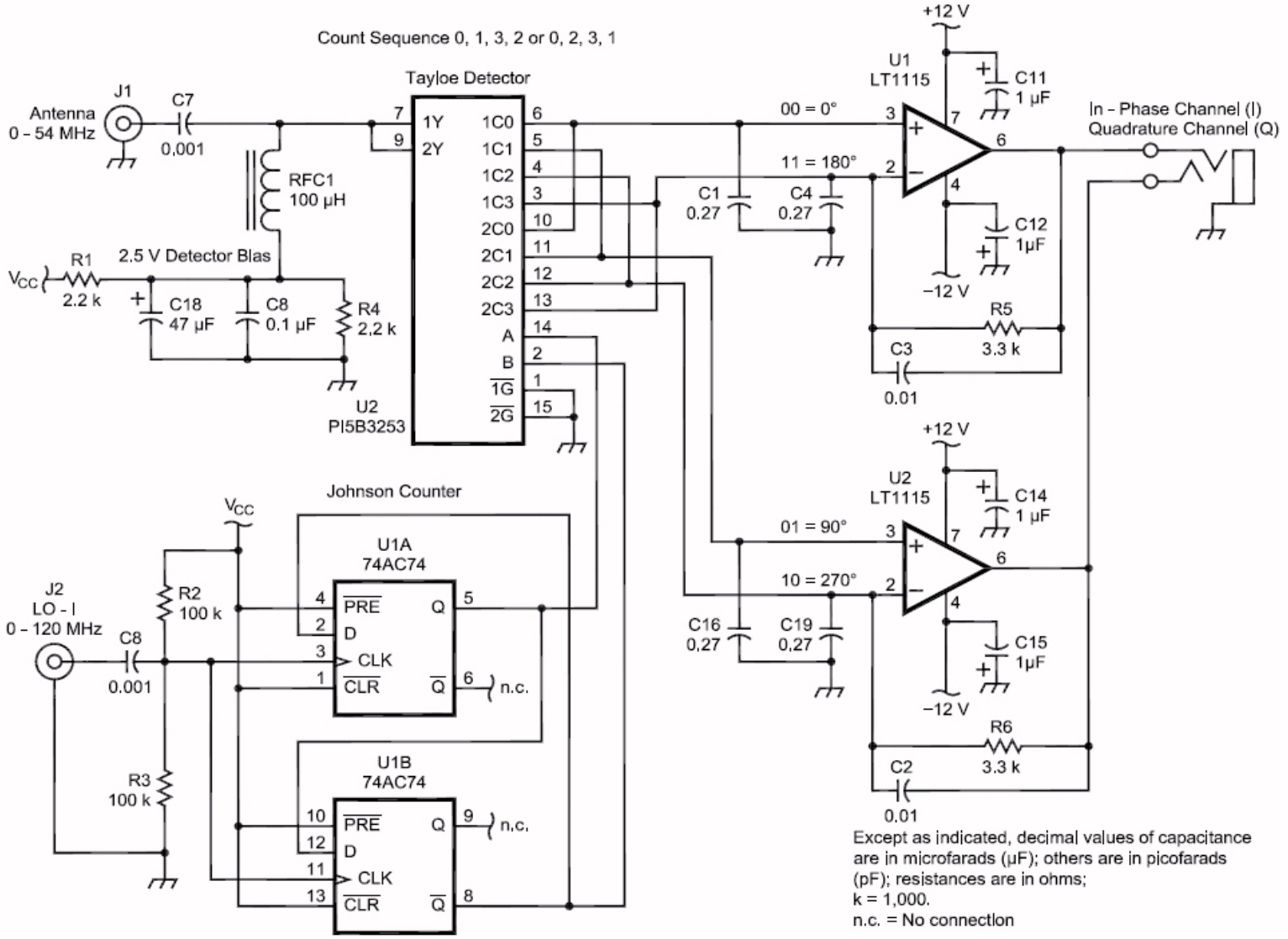
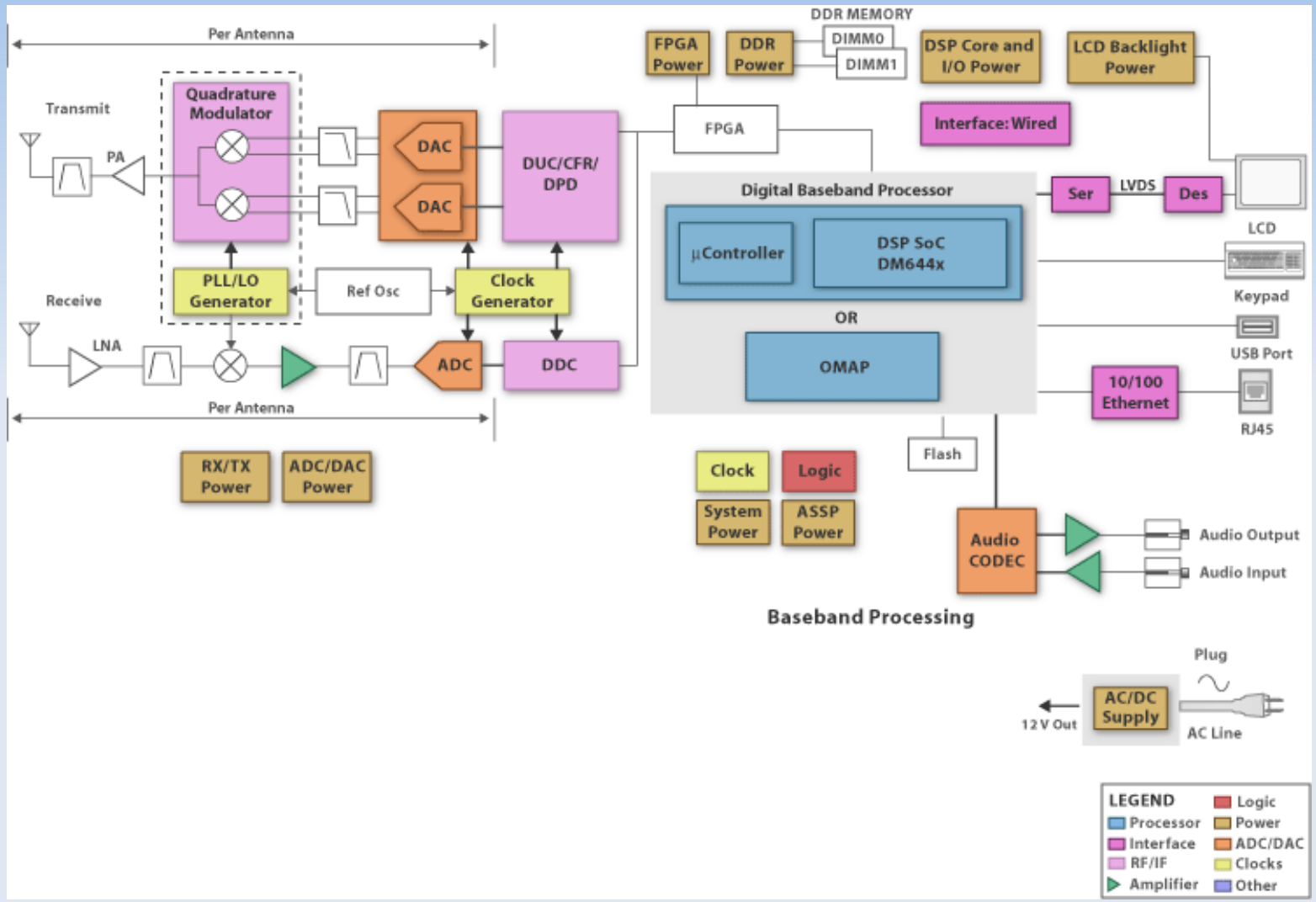


Fig 12—Singly balanced Tayloe detector.

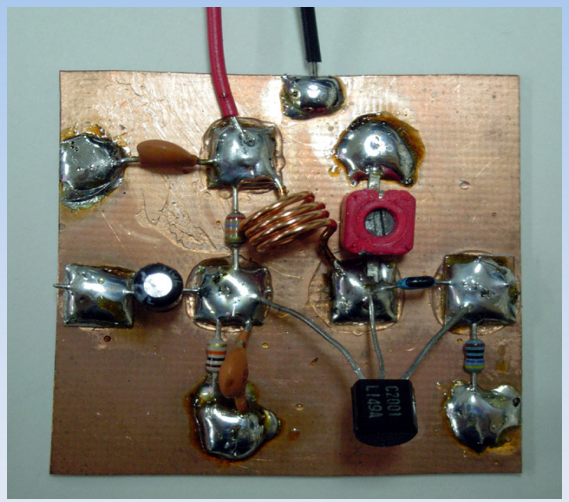
Receiver / Transceiver



- Block diagram of Transceiver.

  (Transmitter & Receiver)

How easy is it to construct?



- No special construction method required or needed.
- If you are using smd components, you will need glasses and magnifying glass with light.
- Methods of soldering vary from 'blobbing' and removing excess with solder braid to heat gun / hair dryer on overload.

What components MUST I use?

- The only real MUST is to use a high performance processor and good quality sound card. [24 bit]
- Actually a Pentium II will do. So long as it isn’t doing anything else [like Windwoes]
- Not much else...

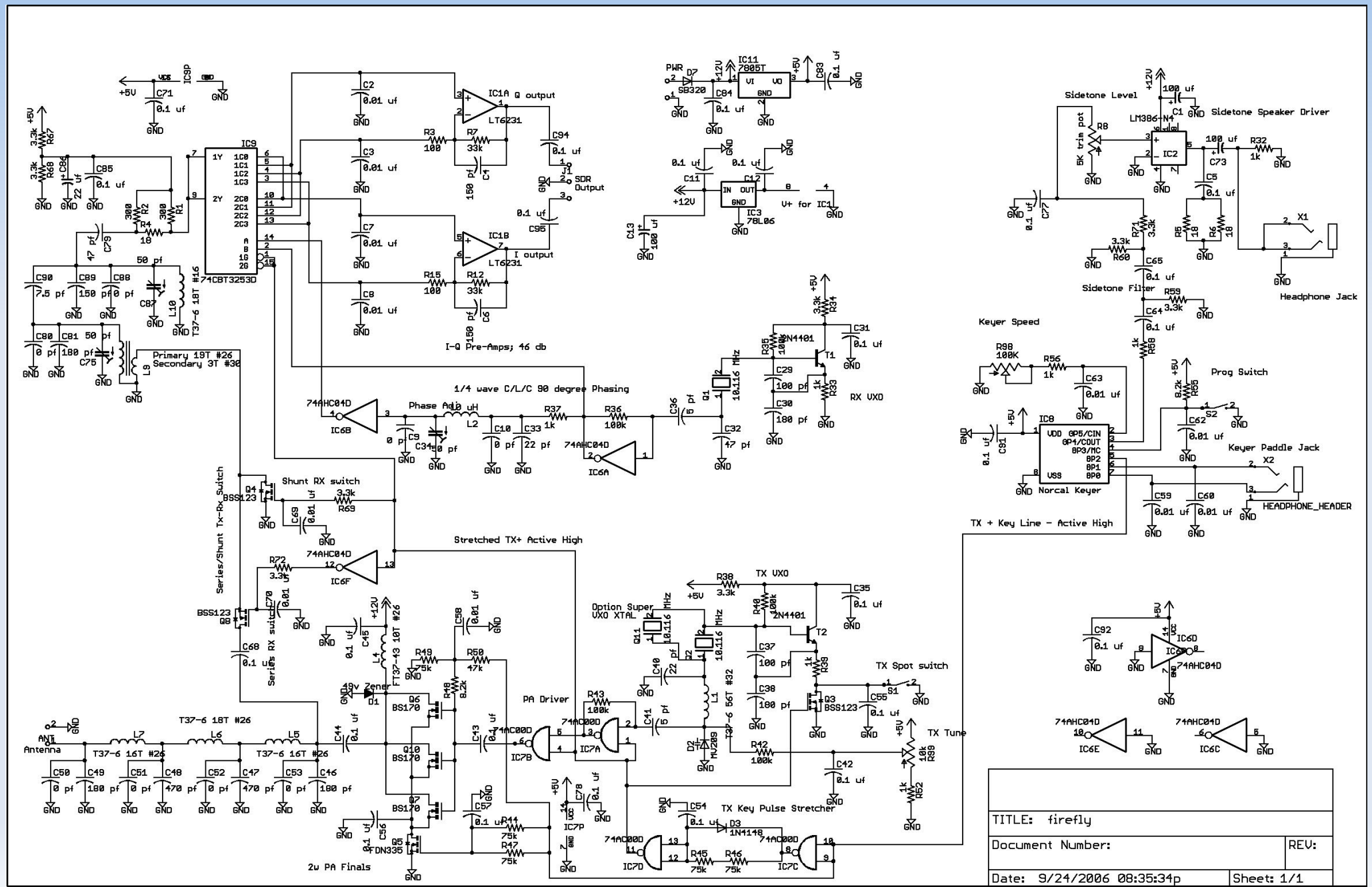
Can I use a very OLD PC?

”For SSB bandwidth, using a conventional SSB receiver and a single antenna, **a 486 computer and almost any conventional audio board will do**. Of course the limited bandwidth will limit the performance; obviously the FM mode will not work at all. The interference rejection routines will have limited information about the interference sources and will have reduced capacity. If the SSB receiver has adequate noise blanking and the S/N of the desired signal is essentially determined by white noise the weak signal performance will be without degradation. Under the development phase I used a **TS520 as the SSB radio together with a Pentium 66MHz (16MB RAM) and a Soundblaster 16** to check performance both on HF and VHF.”

Where can I get more info?

- A list of links...
- http://www.funcubedongle.com/
- http://www.amrad.org/projects/sdrhwinfo/
- http://www.sm5bsz.com/linuxdsp/linrad.htm
- http://en.wikipedia.org/wiki/Software-defined_radio
- http://gnuradio.org/redmine/projects/gnuradio/wiki/Hardware

An SDR Transceiver kit



How do I get the software?

- Linrad – open source & free software. Available for both Linux, Mac and Windwoes.
- Winradio – free download from the Internet.
- Remember most of the circuitry is at audio frequencies. Very easy to handle/test/measure.
- Also for easy testing, you do not have to have a quad-phase VFO. You can then use an audio band-pass filter [in software]
- A very long list of links...

Linrad

- Linux and X Windowing system based software
- ”Open Source” - fiddle with it to your heart's content.
- Does NOT require 'Todays Hardware'!
- Can cope with multiple signals at the same time. ”Real Time” system
- Is available for Windows systems. Note performance degrades with system load.