

Building the Soldersmoke Direct Conversion Receiver

40m Double-Sideband, homebrewed with all discrete components

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The "Soldersmoke Challenge"

... issued by Bill N2CQR and Dean KK4DAS of the SolderSmoke podcast

- Build the 40m direct-conversion receiver they designed for a high school class
 - Homebrew: Source the parts, put them together, make it work!
- Meant as an entry-level, accessible project
 - "We do this not because it is easy, but because we thought it would be easy"
- Bill and Dean published schematics and notes on a <u>hackaday.io</u> page, and later updates on their own Discord messaging group and supporting videos on YouTube
- Over 50 builds now complete and documented online!

"As simple as possible... ... but no simpler"

- All components are discrete and "only" ~60 to assemble by hand
- Receiver design is direct-conversion: radio to audio frequency in a single step
- Just four modules:
 - Variable Frequency Oscillator
 - Band-Pass Filter
 - Diode-Ring Mixer
 - Audio Amplifier



A Block Diagram of our Receiver

Diagram from "SolderSmoke DCR Challenge 1 - Overview.pdf", source: hackaday.io

Just Four Modules

Variable Frequency Oscillator

(Permeability-Tuned Colpitts design)





Band Pass Filter

Suppress Out-of-Band Noise







Diode Ring Mixer

(and audio diplexer)







Audio Amplifier

(Really Three in a Row)







Demo (if possible)

Lessons Learned

"Manhattan" Construction

- Build modules on copper-covered circuit board
- Board area provides ground plane
- Connections between components on raised pads
- Board layout can mirror schematic
- If you can glue and solder, you can do this!











Lessons Learned - Andy

#1 - This was a fun project!

- Be sure to connect all of the boards together for good ground
 - I used solder braid
- When connecting signals between boards, I used twisted pair wires, with one of the wires connected to ground at both ends
 - I suspect this avoided a LOT of problems
- The audio amp is less than perfect if you turn it up too high, it oscillates
 - Will drive a speaker reasonably, but be careful with headphones due to lack of AGC
- There were too many CW signals for my brain to parse (no filter except audio diplexer)
 - I connected the audio to my SCAF filter and tuned it to hear one signal at a time MUCH BETTER!
- I cut off the head of the tuning screw and attached a big knob, making tuning easier
 - (Another Discord user suggested a toilet bolt, with a flat flange/head Adam)

Winding Toroids

Not Hard, Just Tedious?

- Mostly just wrapping enameled wires onto toroid
- Make turns tight and spacing even
- Keep count each pass through the center is a "turn"
- For mixer, the wires are coiled before winding on toroid
- Multi-colored wires help (I didn't have any for these examples)



>>> Not an exact science - tweak turns, spacing to achieve needed value

Full Schematic

Soldersmoke Direct-Conversion Double-Sideband Receiver

4 Modules - ~60 discrete components - untold amounts of fun!



Schematic from SolderSmoke Discord - Credit: Bill N2CQR and Dean KK4DAS

Completed Build by Adam - AA1N