{gallery}unichip/title{/gallery}

This project somehow grabbed my imagination. It's a complete 80m transceiver in one chip designed by Mike King G3MY, the CA3086 transistor array. One transistor for crystal oscillator, one for a PA, and three for the audio amplification after direct conversion in a diode mixer. **CLICK HERE** for the original SPRAT article (121K). CLICK PICTURES for the larger images.

Martin Rigby G4FUI sent me this very fine hand-drawn diagram from Mike himself... which Martin thinks followed a QSO some time in the 1980's. **CLICK HERE** for an Adobe PDF of the diagram, which Martin has very kindly cleaned up. Many thanks Martin for sharing this document with us.

{gallery}unichip/mike{/gallery}

I built the unichip + VN66 PA and failed to have any QSO's. The unichip on its own gave only 90mW instead of the 300mW mentioned in the article (something I did wrong?), and the VN66 did not provide any increase in output power, probably due to insufficient drive. I built a new Class-E output stage with an IRF510, which now gives 2W output. After that and using a longwire antenna strung low in some trees, against an "earth" wire just laid out on the ground, I worked G4LAM and G3CWW at distances of 76 and 176 miles respectively (122 and 282 km).

The receiver sounds amazingly nice (particularly considering the simplicity of the circuit) and despite lack of volume control or narrow (CW) filtering it is quite a pleasure to operate. For keying I use a small microswitch and find that it is surprisingly comfortable to use, but the sidetone definitely helps create decent sounding CW! I installed a 1/4-inch jack socket so that a real morse key could be used if desired.

I added a sidetone oscillator at about 600Hz. Another addition to the original unichip circuit was relay switching for the TX/RX, which enabled me to implement semi-QSK by putting a 2,000uF capacitor across the relay coil, which is charged via a diode on key-down. The hang time is just about sufficient to ensure that the relays don't click back to receive on an inter-word spacing at my usual speed of somewhere around 12wpm.

I used separate relay-switched tuning capacitors for receive an transmit, this makes it quite easy to operate: the receiver can be tuned for zero beat, then the transmit tuning moved to

approximately the same position which will get the two stations reasonably close to the same frequency. It is also possible when CQ'ing to move the receive tuning shaft to what you can reasonably guess to be some hundreds of Hz away from the transmit frequency. This all only works because the two tuning capacitors are identical. In practice I'd estimate the crystal can be pulled about 1.5kHz from one end of the tuning scale to the other.

This circuit diagram (below) shows the current state of the transceiver. The photographs (below and above) show the transceiver, but this is BEFORE I replaced the VN66 amp with a Class-E IRF510 amplifier, and BEFORE I added the sidetone oscillator. CLICK THEM for the full size versions. The mixer diagram shown right is hopefully a clearer way of explaining how the bifilar turns should be arranged.

{gallery}unichip/circuit{/gallery}

Unichip goes Stateside!

In September 2005 I took the newly constructed Unichip (with only 2 QSO's to its name) with me on a business trip to Greenwich, Conneticut, USA. Also onboard was my homebrew ATU . I operated on three successive evenings, for 2 - 3 hours each evening. The first evening I had no luck, which I eventually traced to an intermittent connection problem in the variable capacitor of the ATU. As long as I kept squeezing the capacitor, everything worked Ok.

As an earth connection I used a PC power cord plugged into the wall, with the PC end socket cut off and a the earth wired to the rig. For an antenna I used 10m of ordinary twin-core speaker cable (split to make 20m), and a 3m length of 4 twisted pairs network cable dismantled and joined (in pairs) end to end. This gave about 32m wire, which I threw over the low branch of a tree outside my upstairs window, and tied the far end to the top of a bush at about 6 foot off the ground. As a power supply, I used eight D-cell batteries laid in line and wrapped in the front page of the New York Times, with wires taped to each end and stood upright against an armchair. The morse key was just the microswitch on the Unichip board. Headphones were just the dirt-cheap in-ear type.

With this incredibly basic setup and signing as W1/G0UPL, I had continuous QSO's, working 9 stations in total during the course of two evenings. They were: W1GUE, K1ARO, W3MNE, W1CFI, N2EY , AF4K , K4JYS, AE5X/2 and W2LJ . The furthest distant of these stations was Brian AF4K in Florida, at a distance of some 1500 miles! Not bad for 2W to a random bit of wire. The radio activity made otherwise boring evenings highly enjoyable.

My story was featured in George G3RJV's QRP column in December 2005's RadCom, journal of the RSGB .

{gallery}unichip/photos{/gallery}

But there's more to tell! It turned out that John Harper AE5X lived only 5 miles away and worked just over the road. We agreed to meet up for coffee the following morning, and had a very enjoyable chat. I persuaded John to take my rig home with him and have a play. I received the rig back from John a few weeks later in perfect condition and with many more QSO's to its name: he worked 18 states + Bermuda with the rig! Above are some pictures; from left to right:

1: John and I after our coffee meeting
2: John's photo of my Unichip rig (much nicer than my photography!) - notice the sidetone circuit at top right of the picture
3: Spectrum analyser output showing good levels of harmonic suppression: John has access to some nice equipment there!
4: The Unichip with John's Vibroplex bug

John wrote about the rig and our meeting on his website, too.

Performance measurements from John:

Sensitivity:	Better than -106dB i.e. 1uV (limit of measurement in a noisy environmer
Current consumption:	10mA on receive, 750mA on transmit
Tuning range:	3557.3kHz to 3558.4kHz; with the 120uH inductor shorted out, 3559.7kHz

Harmonics output at 2W:

2nd	-46 dB
3rd	-55 dB
4th	-71 dB
5th	-74 dB
6th	-73 dB
7th	-74 dB

John comments: "Hans, I'm amazed at how this rig sounds. It really is easy on the ears, not as fatiguing as some (most) superhets. I'd always read that DC receivers sounded "cleaner" but never could really comprehend what that meant. There is less hash when listening to a freq with no active signals and when there is a signal, it sounds more "there". Sort of like going from AM radio to listening to the same song on a CD - not that drastic of course but a step in the same direction. What really has surprised me is that as good as the receiver sounds, it's so simple! It doesn't seem possible but I guess that is the nature of DC receivers as well. I'd heard horror stories about susceptibility to power supply hum & microphonics but haven't found that to be the case (with exception of the 1-second key-up I mentioned). I've used the rig on 3 power supplies and haven't noticed any AC artifacts at all."

The Future

This rig isn't finished. The following further developments are intended, SOMETIME, EVENTUALLY:

1. Fix the semi-QSK circuit so that it does not make nasty noises on changing between RX and TX
2. Box it up in a nice case along with a 12V sealed lead acid battery, some antenna wire, headphones and an L-match ATU
3. Change the connection between sidetone oscillator and audio amp, to make the sidetone sound "nicer"
4. Correct an error with the PA wiring, which can cause excessive current in the 2K2 bias preset potentiometer
5. Perhaps experiment with a VFO instead of the crystal?