DX FT8: A Software Defined Radio QRP Odyssey By Charles Hill, W5BAA

After moving to Central Texas around 2009, I met a great QRP Group known as the Austin QRP Radio Group (AQRP) who encourages radio amateurs to build a wide range of electronic projects ranging from code practice oscillators to state of the art Digital Signal Processing projects such as SDR and PSK Transceivers. I certainly learned a lot from this group.

In addition, being located in the Austin, Tx Area we have had great technical support from major electronic manufacturers such Silicon Labs, Texas Instruments, STM and others. In particular, STM holds regular seminars to introduce their line of microprocessors developed for embedded processor applications. One of these seminars held in 2015 even included a free development board in addition to Lunch! The board that I and other AQRP members received is the STM32F746 Disco Board. Although this board is almost ten years old, they are stocked by parts suppliers such as Mouser and Digikey in the hundreds for less than $60 each. In our times of parts shortages this longevity is remarkable.

Over the years I have had a great deal of pleasure in building transceiver projects and writing DSP applications for SDRs. These projects included interfacing with popular SDR Boards such as the Softrock , UHF SDR and other boards which interfaced signals at the audio, I2C and discrete signal level. A common thread among these projects has been the versatile clock chip the Si5351 developed by Silicon Labs.

During the last ten years we have seem another significant amateur radio development, low power signal communications protocols using Forward Error Correction (FEC) techniques. FEC is not a new technology in itself having been developed during the 1950's. FEC does require a lot of digital processing which makes it an ideal candidate for embedded processor projects. The most popular of these amateur radio FEC protocols is FT8.

I am not really a programmer. I am more of a "Hacker" and I am great at plagiarizing. When I realized that FT8 was very popular I searched this protocol to see what others were doing. This lead me to the work done by Karlis Goba, **YL3JG**. Here is a link to his website: https://github.com/kgoba/ft8_lib. The algorithms developed by Karlis use 3.125 Hz spaced FFT bins which are screened in both frequency and time so that errors in symbol frequency and time reception can be overcome to provide really great FT8 decoding. This led to developing a standalone FT8 Transceiver entitled "Pocket FT8". This project used a Teensy 3.6 processor and a small touch screen. This unit worked well and I used it on a trip to London where I worked FT8 stations from Hyde Park. Unfortunately, the Teensy 3.6 processor is no longer available.

Further, on the hardware side there has been an explosion of projects using the Si5351 along with Class E amplifiers to generate SSB, FSK, CW and FT8 signals. While the generation of SSB directly with a Si5351 has not proven to be all that successful, the generation of CW, FSK and FT8 and other FEC protocols has been quite successful.

Enter the DX FT8 project. Combining the features of a great codec for receive audio processing, a robust DSP processor, the Si5351 plus a final amplifier based on an Octal TTL Line Driver has resulted in a compact project board. This board has the same outline as the Disco Board and provides switching power supplies which provide a solid 700 mW output using a single 5 volt power input. Further, a filter system has been realized which provides for operation on five bands, 20 M thru 10M without the need for a band switch or plug in filters.! The project kit includes the circuit board, front and back plates plus spacers, nuts and bolts and power connector. No case required.