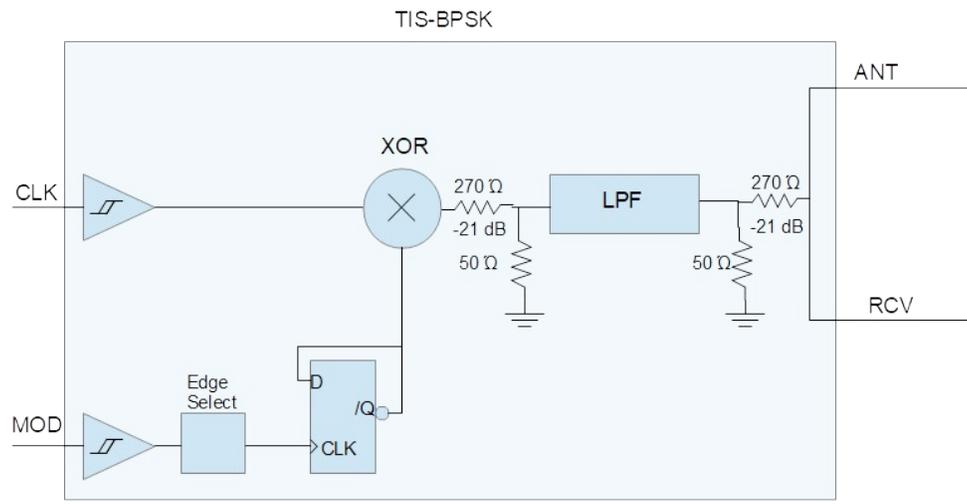
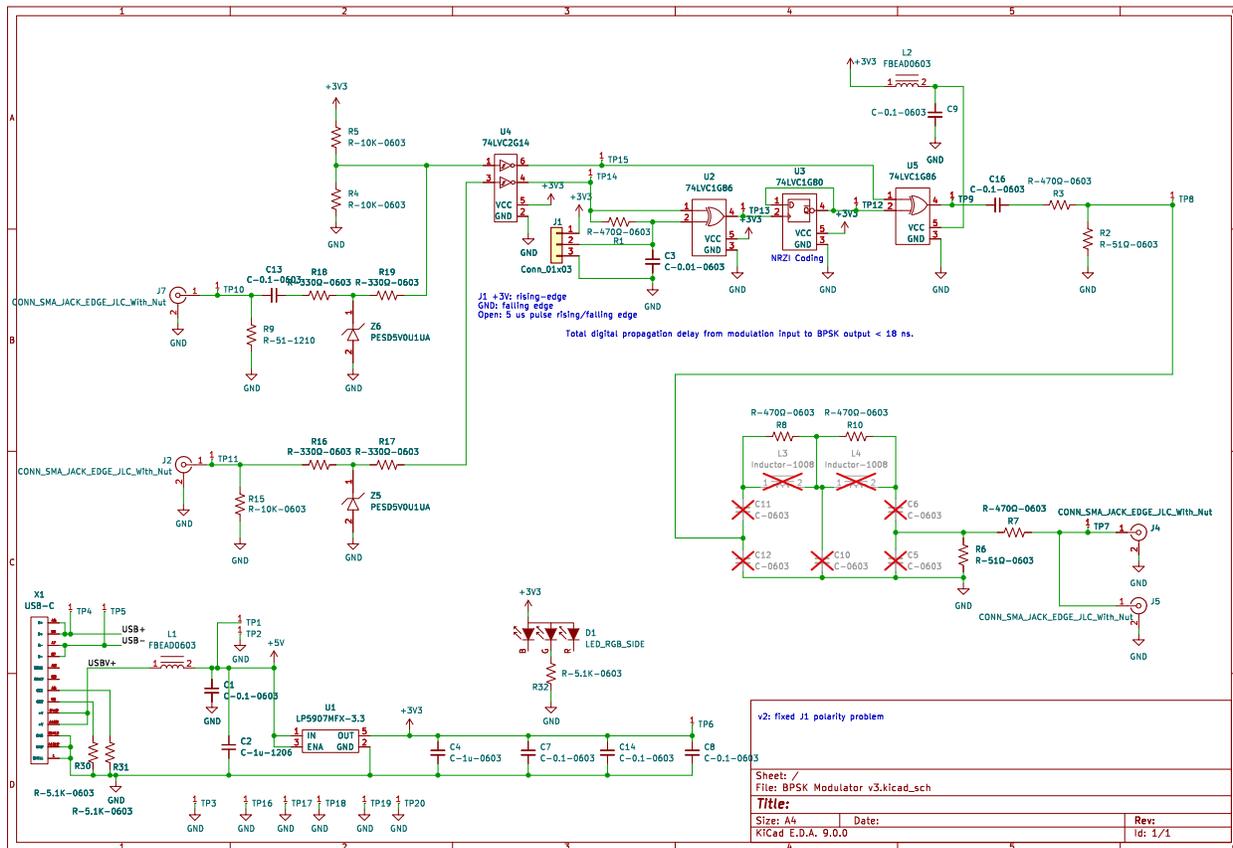
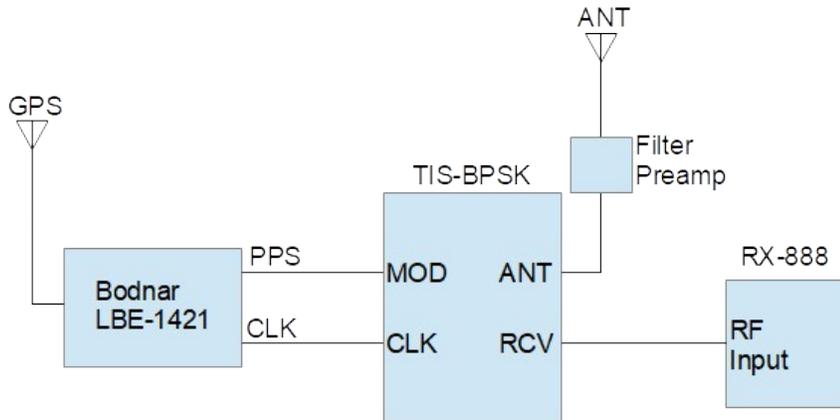


Design



(Stage by stage circuit description to follow, eventually)

Use



(Discussion of preferred carrier frequencies and aliasing to come)

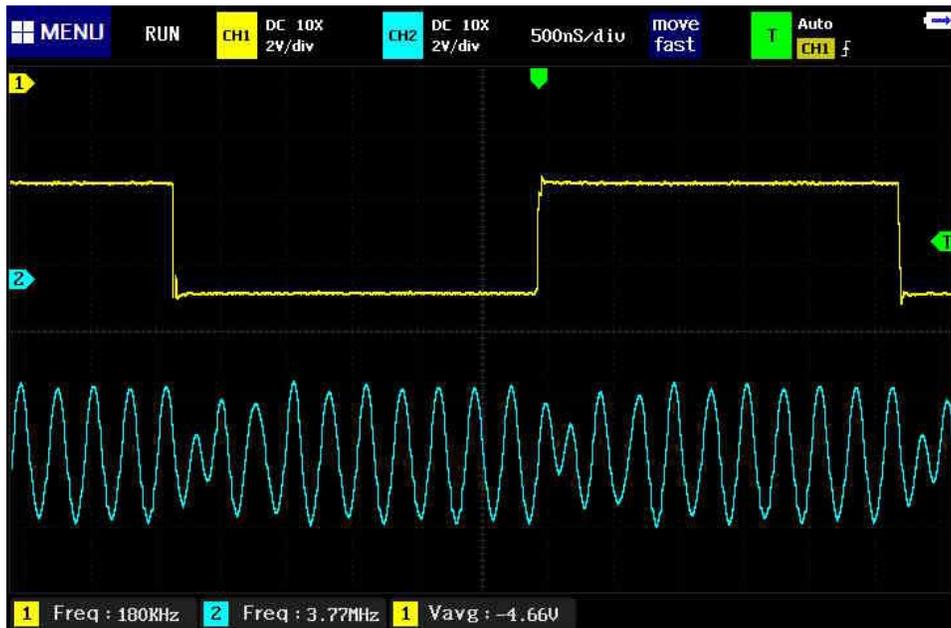
Performance

The essential function of the Turn Island Systems BPSK Modulator (TIS-BPSK) is to invert the phase of the carrier input on either the rising edge, or both the rising and falling edges of the modulation input. This is jumper-selectable. In the case of pps modulation we use only the rising-edge. For data applications we use both edges, obtaining a NRZI line coding.

Here is the digital output showing rising-edge modulation of a 20.048 MHz carrier.

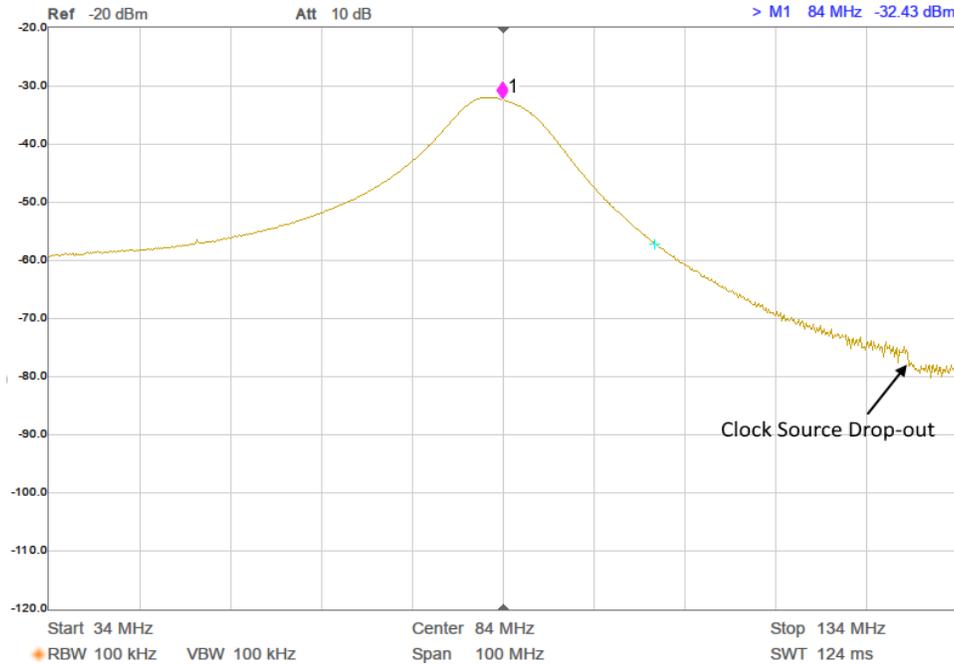


When this digital signal is passed through a wide bandpass filter the abrupt transitions are slightly filtered. In the example below the carrier is at 3.7 MHz, and we are using rising/falling-edge modulation::

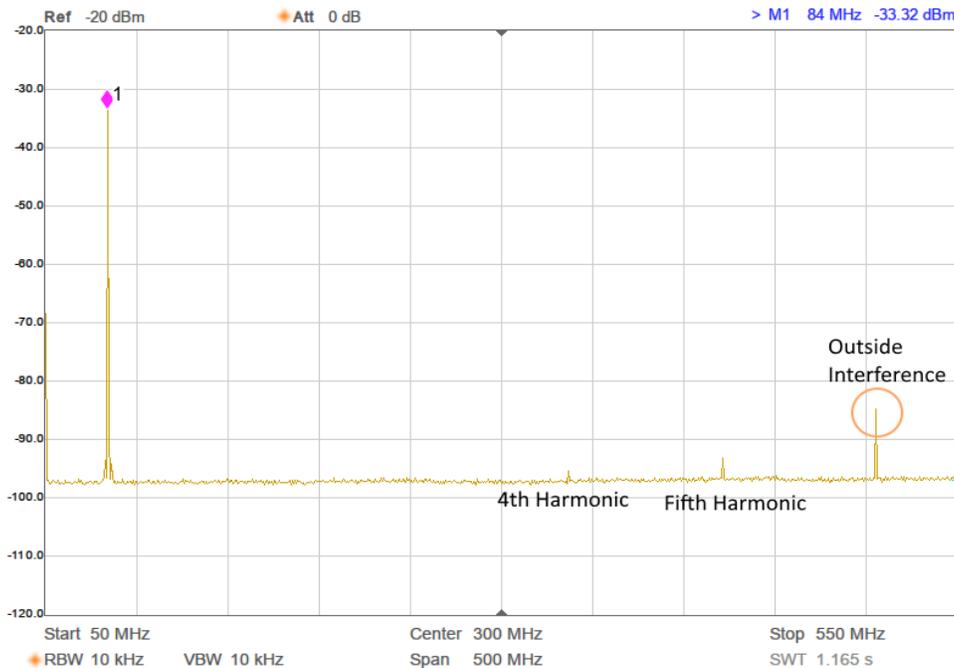


A wide bandpass filter as is used here does not filter out much of the modulation sideband spectral peaks, and BPSK has plenty of those. Most BPSK systems use a form of baseband filtering, which filters the modulating waveform before applying that to a linear mixer. Other techniques are commonly used in other PSK and QAM modulation. The TIS-BPSK includes a bandpass filter (actually a peaked low-pass filter), but this is used for harmonic suppression, not modulation shaping.

Below is the filter passband, components selected for an 84 MHz center-frequency:

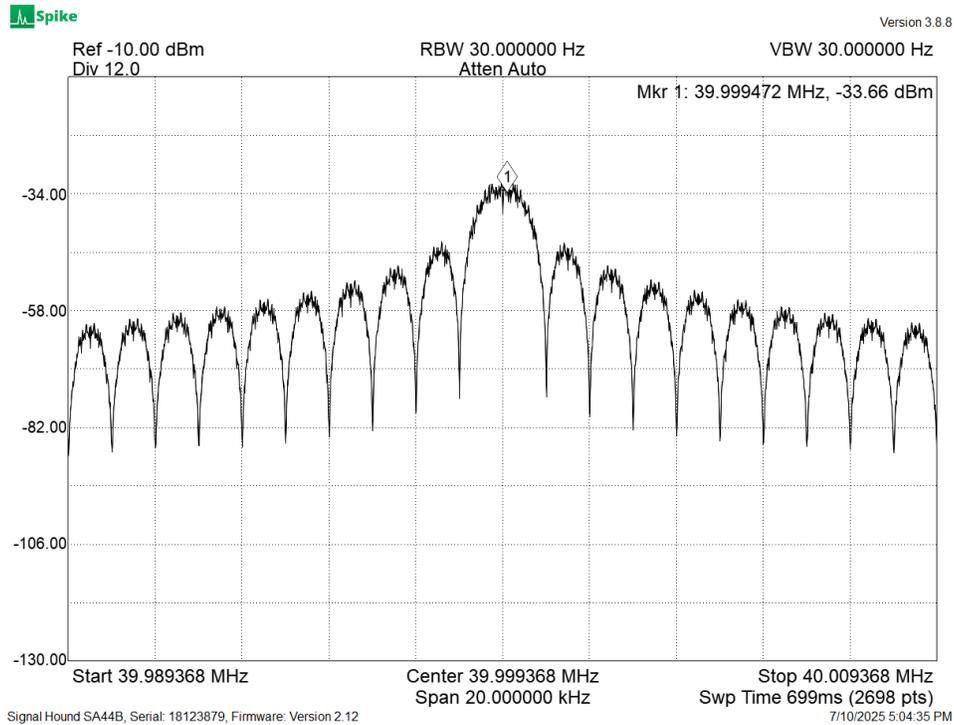


In addition to the filtering, attenuation is added to the signal path, to reduce the output signal to about -33 dBm:



As you can see, this filter does a good job of harmonic suppression, better than -60 dBc.

Here is an example of a BPSK spectrum (modulated with 100 quasi-random bits / second):



Initial Test Conditions

- Freq: 84.225 MHz
- Encroachment on “ham-interesting” bands: no closer than 0.475 MHz (including first five harmonic aliasing)
- Alias (fSample 64.800 MHz) : 19.425 MHz
- Alias (fSample 129.600 MHz) : 45.375 MHz

Seeing the good performance of the low-pass filter, perhaps we don't need to consider the harmonics. In this case there are many other usable frequencies within the range of the existing filter such as:

- Freq: 82.000 MHz
- Encroachment: 0.800 MHz
- Alias (fSample 64.800 MHz) : 17.200 MHz
- Alias (fSample 129.600 MHz) : 47.600 MHz