

## COM-1019 -> COM-4004 -> COM-3008 -> COM-1418

### Configuration:

IF: 1 MHz

Chip rate: 650Kchips/s

Code: 13-bit Barker code

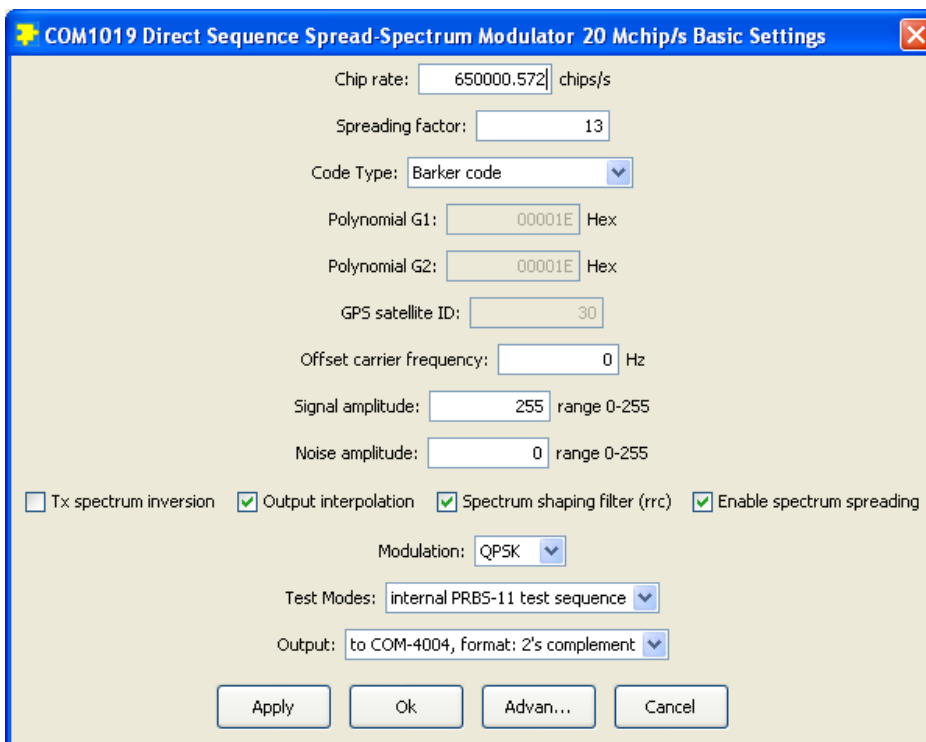
Modulation: QPSK

Data rate: 100 Kbits/s

The setup demonstrates Spread-Spectrum operation at a low intermediate frequency (1 MHz) and highlight some impairments with respect to theory:

- Due to lack of space in the FPGA, the COM-1418 is missing a low-pass filter while decimating the input sampling rate from 40 Msamples/s to  $4 \times \text{chip rate}$ . This missing LPF is letting some aliasing go through. Therefore, not all chip rates/IF frequency combinations are feasible.
- Some saturation is occurring at the COM-3008, causing some intersymbol interference.

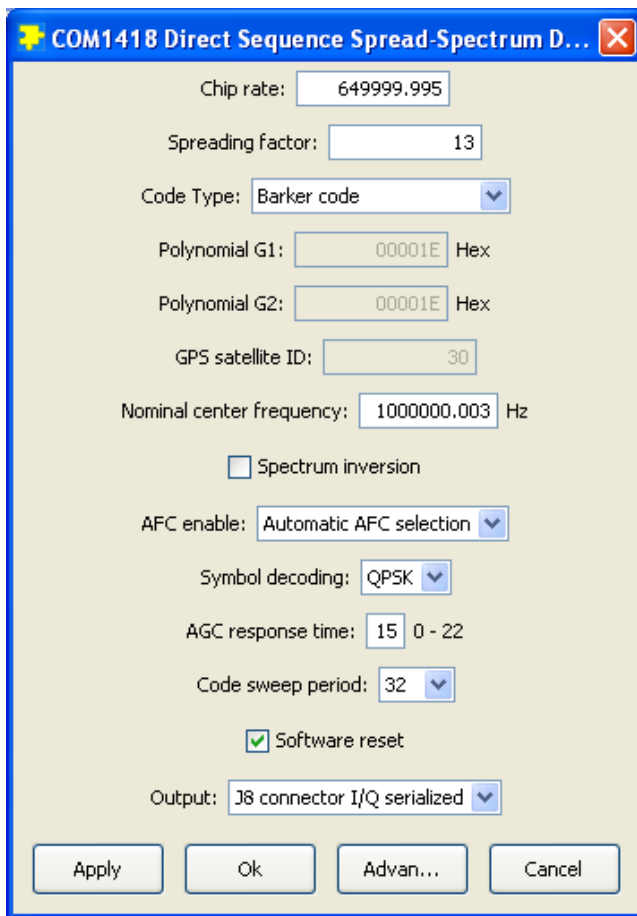
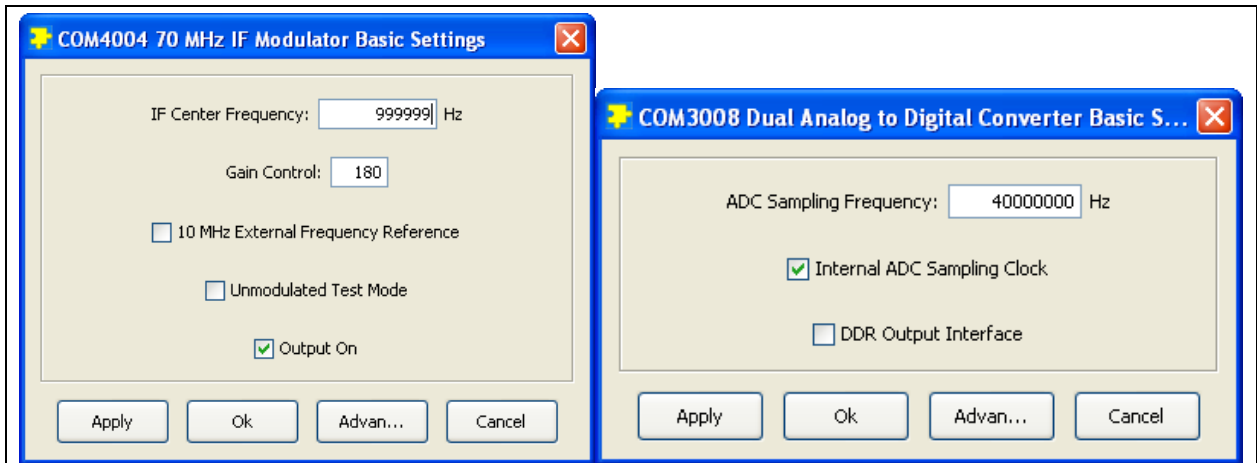
### Configuration:



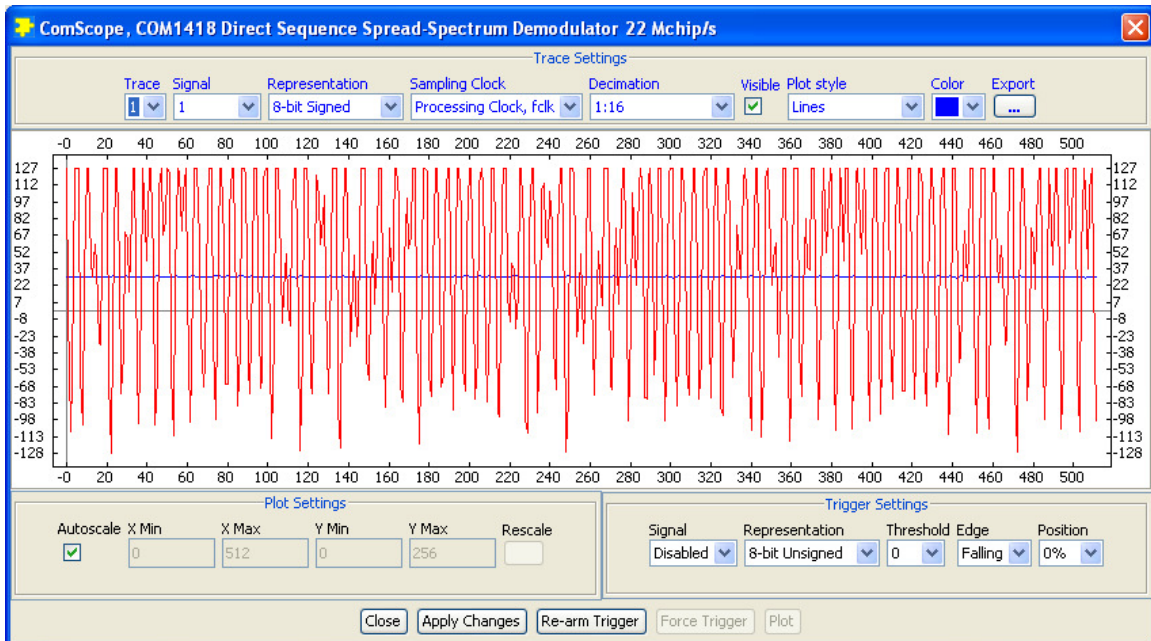
The screenshot shows the 'COM1019 Direct Sequence Spread-Spectrum Modulator 20 Mchip/s Basic Settings' dialog box. The settings are as follows:

- Chip rate: 650000.572 chips/s
- Spreading factor: 13
- Code Type: Barker code
- Polynomial G1: 00001E Hex
- Polynomial G2: 00001E Hex
- GPS satellite ID: 30
- Offset carrier frequency: 0 Hz
- Signal amplitude: 255 range 0-255
- Noise amplitude: 0 range 0-255
- Tx spectrum inversion
- Output interpolation
- Spectrum shaping filter (rrc)
- Enable spectrum spreading
- Modulation: QPSK
- Test Modes: internal PRBS-11 test sequence
- Output: to COM-4004, format: 2's complement

Buttons at the bottom: Apply, Ok, Advan..., Cancel



Key demodulator waveforms:

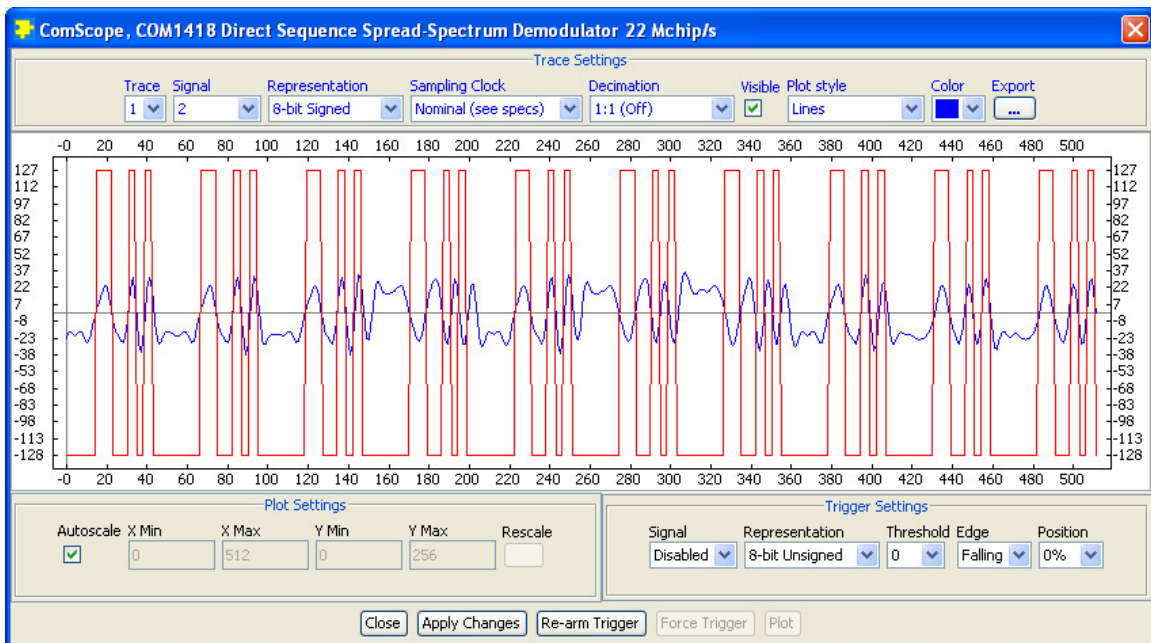


COM-1418 demodulator:

Blue trace = I-channel input

Red trace = Q-channel input

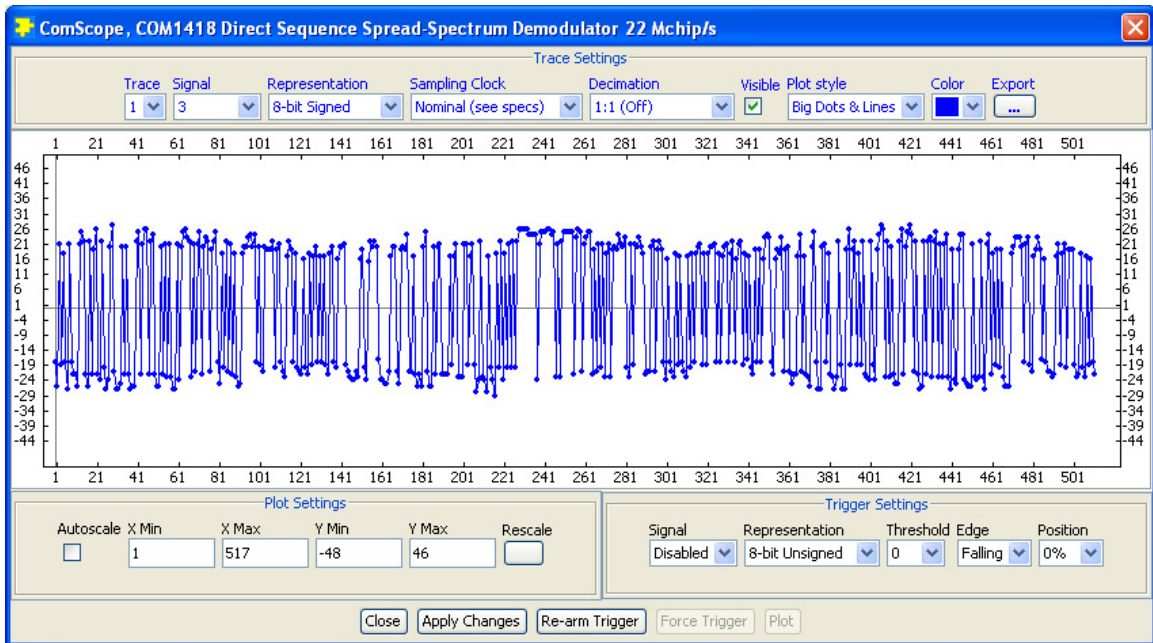
Note: the demodulator is designed to remove the strong input DC offset.



COM-1418 demodulator:

Blue trace = I-channel spread-signal after frequency translation to baseband and root raised cosine filter

Red trace = demodulator code replica  
The demodulator is clearly locked onto the code and carrier.



COM-1418 demodulator:

Demodulated symbols after despreading and integrate and dump. Although no bit errors are seen, some noise is apparent, very likely due to saturation at the front-end and poor aliasing rejection during the decimation.