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:

- a) 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*chip rate. This missing LPF is letting some aliasing go through. Therefore, not all chip rates/IF frequency combinations are feasible.
- b) Some saturation is occurring at the COM-3008, causing some intersymbol interference.

Configuration:

😓 COM1019 Direct Sequence Spread-Spectrum Modulator 20 Mchip/s Basic Settings 💦 🔀	
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 😪	
Apply Ok Advan Cancel	

COM4004 70 MHz IF Modulator Basic Settings	
IF Center Frequency: 9999999 Hz	🗧 COM3008 Dual Analog to Digital Converter Basic S 🔀
Gain Control: 180	ADC Sampling Frequency: 40000000 Hz
10 MHz External Frequency Reference	
Unmodulated Test Mode	✓ Internal ADC Sampling Clock
✓ Output On	DDR Output Interface
Apply Ok Advan Cancel	Apply Ok Advan Cancel

🔁 COM1418 Direct Sequence Spread-Spectrum D 🔀		
Chip rate: 649999.995		
Spreading factor: 13		
Code Type: Barker code		
Polynomial G1: 000001E Hex		
Polynomial G2: 00001E Hex		
GPS satellite ID: 30		
Nominal center frequency: 1000000.003 Hz		
Spectrum inversion		
AFC enable: Automatic AFC selection 💌		
Symbol decoding: QPSK 💌		
AGC response time: 15 0 - 22		
Code sweep period: 32 💌		
Software reset		
Output: 38 connector I/Q serialized 💌		
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.