

## Specific Communications and DSP Experience / Expertise

### Applications

- ◆ Military communications (air to ground, air to air, satellite, telemetry, 1553)
- ◆ Wireless networking
- ◆ Cellular / Telecom
- ◆ Modulators / demodulator
- ◆ Transmitters / receivers
- ◆ Wireless internet digital transceivers
- ◆ Error Control Coding / FEC
- ◆ Networks: Ethernet, Fiber Channel, 1553, USB
- ◆ Satellite

### Specific Experience includes:

#### Modulation

Modulators, demodulators, OFDM, QPSK, GMSK, DQPSK, OQPSK, SOQPSK, PCM/FM, Multi-H CPM, QAM, AM, FM, PM, Costas Loops, carrier synchronization / recovery, bit synchronization, clock recovery, NCOs, VCOs, PLL, DPLL, ADPLL, DDS, base-band/passband signaling, transcendental function generation (sin, cos, atan, atan2, etc.), spectral efficiency, bit-error-rate testing

#### Tools

Mathworks Matlab, Signal processing toolbox, Image processing toolbox, Communications toolbox, Simulink, Communication blockset, Signal Processing Workshop (SPW), QEDesign Filter design, spectrum analyzers, bit error rate testing

#### Error Control Coding

FEC, Viterbi, Reed Solomon, BCH, CRC, convolutional codes, turbo codes, block codes, cyclic codes, interleaving, scrambling, encryption, LFSR, etc.

#### Networking

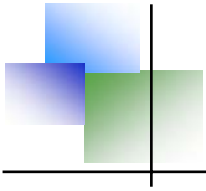
1553, IEEE802.3, IEEE802.11, HDLC, USB, Fiber-Channel, TokenBus, USB, I2C, custom

#### DSP

Sampling, quantization, transcendental function generation, multi-rate, spectral analysis, correlation, convolution, fixed point, RSSI, linear interpolation, FIR, IIR, frequency domain filtering, convolution, time domain filtering, notch, comb, bandpass, lowpass, highpass, multi-rate, decimating, interpolating filters, polyphase, averaging, adaptive filters, active noise cancellation, DFT, IDFT, FFT, IFFT, DCT, IDCT, etc.

#### Telecom/Cellular

HDLC, T1, CHI, A/u-law, DSL, ADSL, DS0, DS1, DS2, DS3, carrier/frame synchronization, framing, protocols, link budget analysis, baseband signaling, bandpass signaling, TDMA, CDMA, GSM, PCS, 3G, RSSI, T1/E1, DQPSK, GMSK, FM, IS-41, IS-54, IS-95, CHI



## Communications and DSP Experience / Expertise cont.

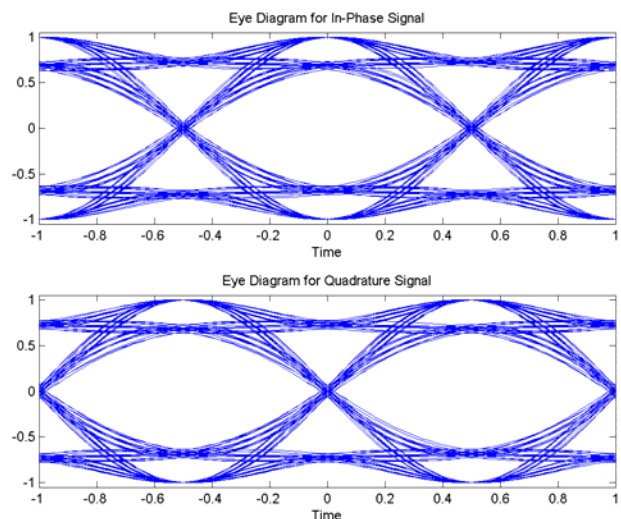
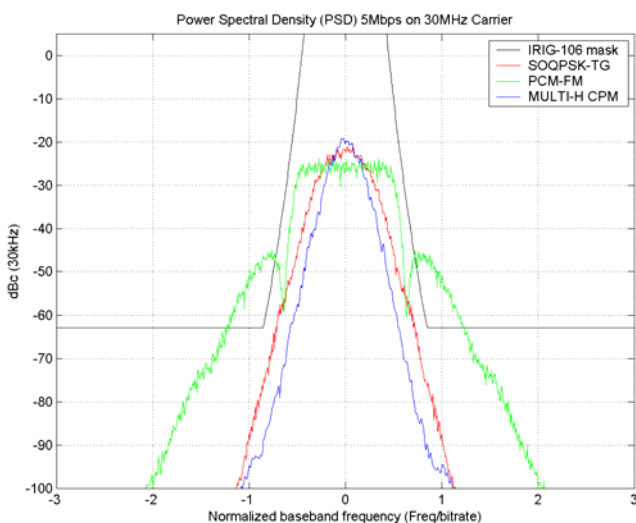
DDC has a wide breadth of communications talent and experience. DDC works at the high end of complexity and algorithmic sophistication, and we ultimately culminate our experience in the most advanced applications and highest levels of integration, using SoC (System On a Chip) technologies. DDC has extensive modeling experience and tools with which to research and design communication systems. Our communications applications expertise loosely falls into two general categories, as outlined below.

### Military Communications & Signal Processing

DDC has assisted in the research, architecture, development, implementation, and testing of actual hardware, for communications / signal processing elements in several different systems (airborne, telemetry, satellite, and terrestrial). These were products used by the NRO (National Reconnaissance Office), Edwards AFB, Quasonix, and Motorola Applied Tech Government Division. We have developed transmitters and receivers around several different modulation schemes (SOQPSK, BPSK, PCM/FM, Multi-H CPM, OFDM, AM, FM), used under varying conditions (low power, buried-in-noise signals, Rayleigh fading, high Doppler, satellite, terrestrial, intersymbol interference, bursty channels, etc.).

### Consumer / Industrial Communications and Signal Processing

DDC has developed several ASICs, FPGAs, and SoCs for consumer / industrial communications. In particular, DDC has many personnel with extensive backgrounds in cellular communications, both in handset, and in infrastructure. They have worked extensively with TDMA, CDMA, GSM, and 3G networks and enabling technologies, with modulations schemes of  $\pi/4$  shifted DQPSK, GMSK, FM, etc. Particularly, many have developed baseband chips and chip sets for both transmitters and receivers and have worked specifically with the modulators, demodulators, diversity, filtering, signal recovery, and FEC. DDC personnel have also developed a wireless internet digital transceiver which included a Coldfire processor packet based interface, Reed Solomon/convolutional coding, OFDM modulator/demodulator, timing acquisition, and filtering. The design was prototyped using an FPGA prior to conversion to ASIC.



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