Medical Devices

Remote Patient Monitoring

Led software design for Guidant (later Boston Scientific) first In-Home implantable pacemaker-defibrillator remote monitor. Coded the DSP radio link. Managed platform requirements and the software team.

In-Body Ultrasonic Communication Link

Intra-body communication system design

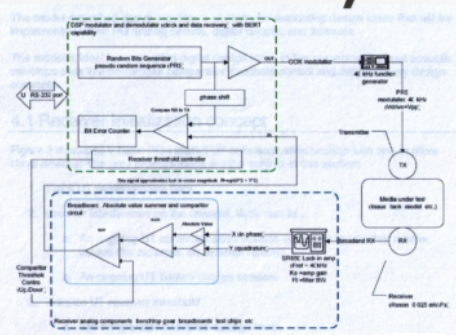

Figure 1: Ultrasonic Receiver Model, with Transmit engine for bit error checking.

The model (Figure 1) permits demonstration of the following aspects of the receiver sub-system…

- Hydrophone (PZT transducer equivalent) input to…
- Receiver input Amplifier
- Phase-sensitive detector
  - Produces I and Q output channels
- Low pass filter I and Q
- Rectify and sum I and Q for input to…
- A comparator
  - with a digitally controlled threshold voltage.
- Digitally sample 1-bit comparator output at design rate of 160kHz.
- Digitally filter comparator output.
- Clock recovery: edge detection.
- Bit decision logic
  - Is a one or zero bit detected.
- Comparator threshold control feedback
  - Based on digitally determined characteristics of received pulses

Designed and demonstrated ultrasonic data channel demodulator intended for ASIC. Equipped ASIC designer with base model and analytical tools for his mixed-signal receiver channel design.

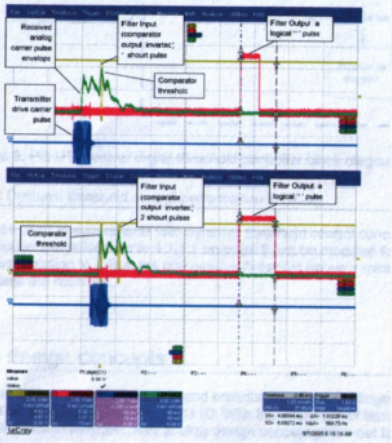

Figure 7: digital filter performance example

4.2.2.1 Filter performance in water tank model

The filter described above is implemented in a DSP on the lab model. Figure 7 illustrates filter output for two cases: one short input pulse and two short input pulses per carrier burst. In this example, N, the filter sample history length, is set to 80 within the DSP. This is illustrated by the roughly 500us output pulse for a very short input pulse (top traces of Figure 7). 500us is 80 samples acquired at 160kHz. The bottom traces of Figure 6 illustrate smoothing of two short input pulses into one, long filter output pulse.

In both examples, the short input pulses are the result of a high comparator threshold voltage, relative to the received carrier burst envelope signal.

GUIDANT

Patent Granted: System and method for addressing implantable devices US 7908334 B2