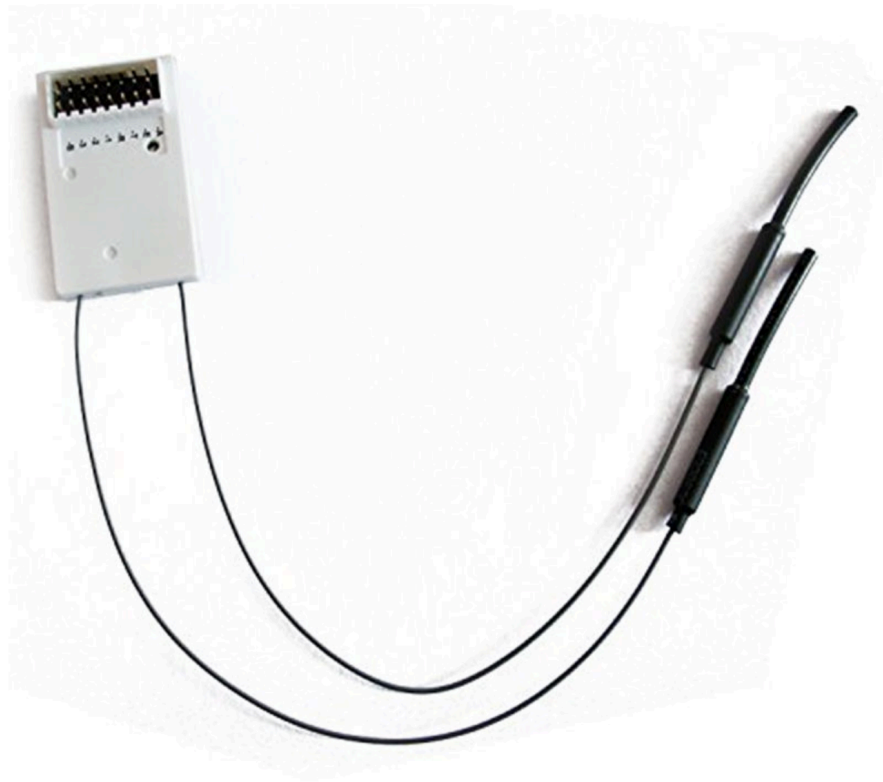


Radio Receiver Signals Characterization

Capstone: FPGA Quadcopter Flight Controller



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Objective:

The purpose of this testing was to characterize the signals coming out of the radio receiver on the Cheerson CX-20 RC Quadcopter. We are interested in what type of signals our FPGA Verilog script is required to receive. The assumption is that the receiver, like the signals that control the electronic motor speed controllers, are Pulse Width Modulated (PWM) signals. We are interested in characterizing the duty cycles at the maximum and minimum points of all the basic controls (throttle, pitch, yaw and roll) that we are interested in from the radio controller.

Pinout:

Figure 1 demonstrates which pins we are interested in on the receiver outputs. These are the pins that will act as the inputs into the FPGA. The goal is to take these signals and map them to produce the proper motor control signals to fly the quadcopter with the remote control. Figure 1 is a diagram with the receiver in the orientation shown in *Figure 2*.

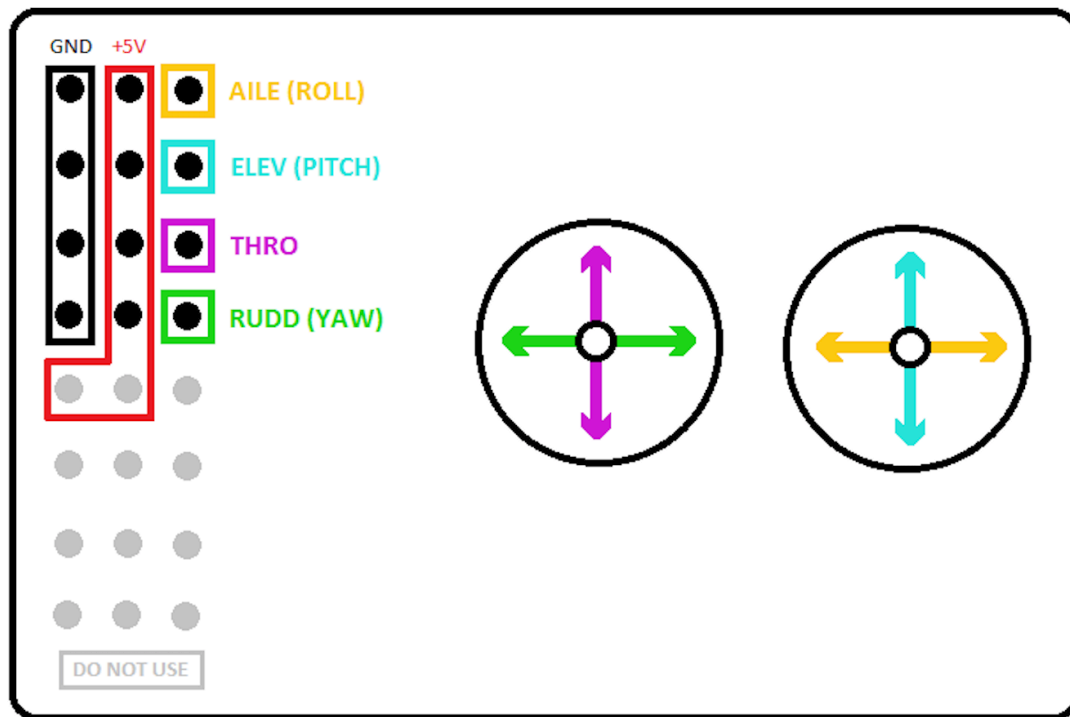


Figure 1: CX-20 Receiver Pinout

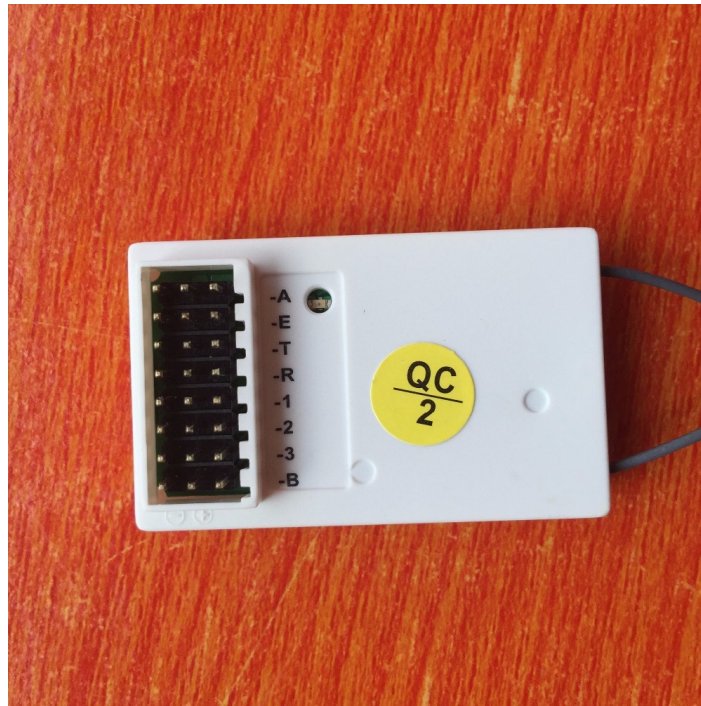
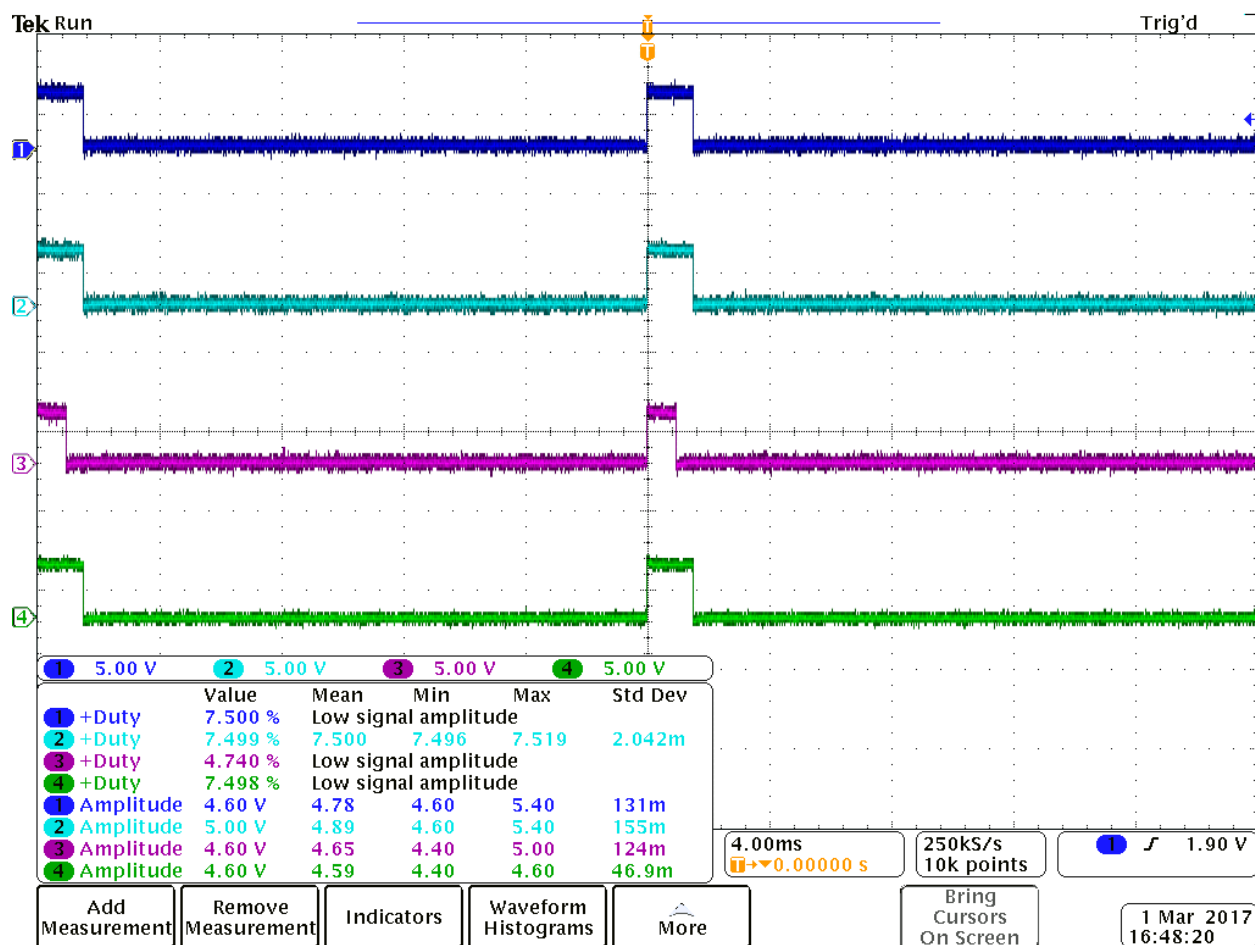


Figure 2: Physical CX-20 Receiver

Data:

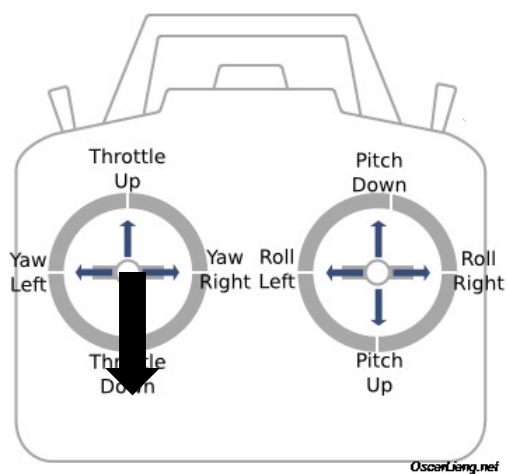
Oscilloscope Key

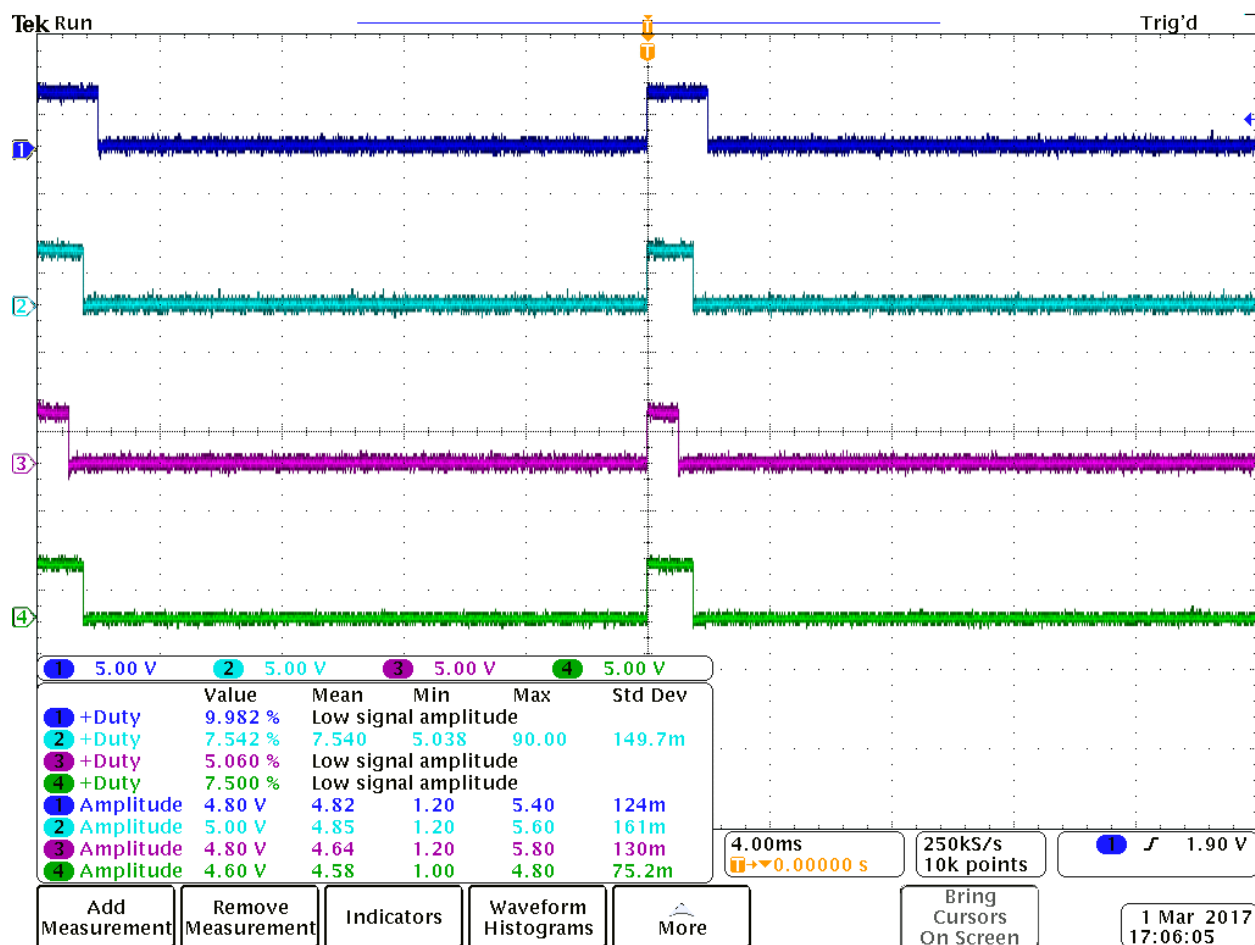
Blue: Roll
Cyan: Pitch
Pink: Throttle
Green: Yaw



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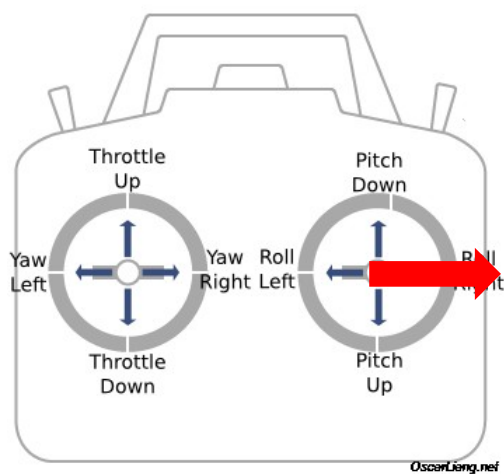
Figure 3: RF Receiver Output Signals - Idle State

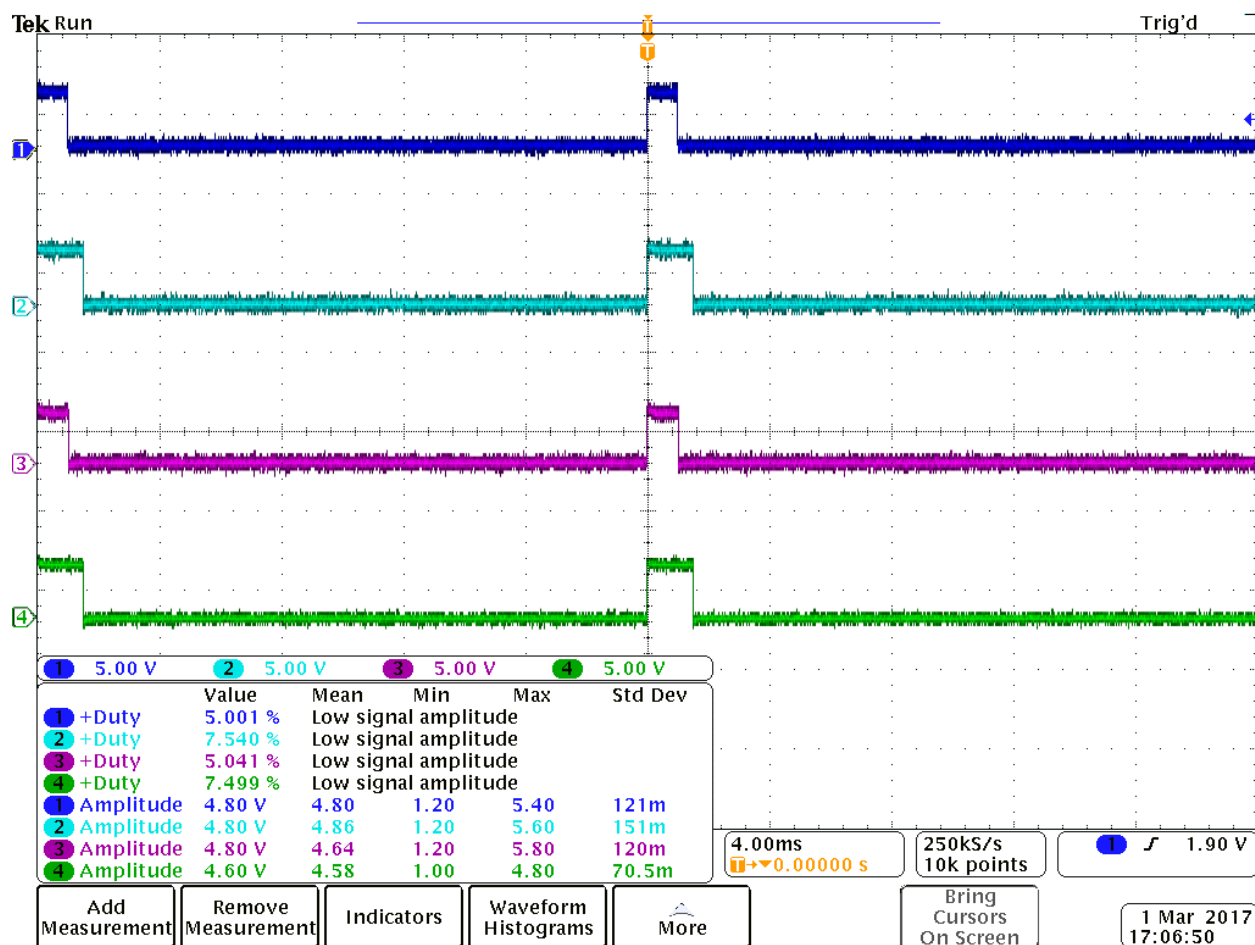




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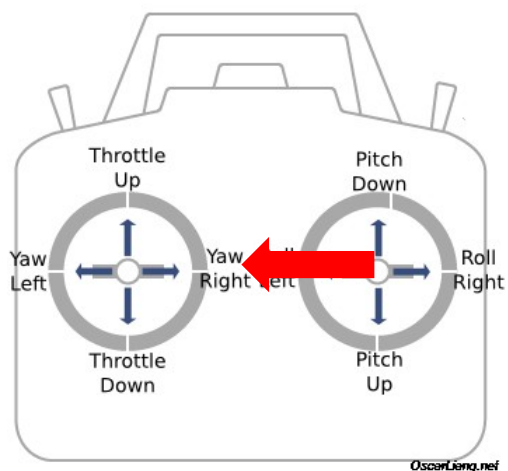
Figure 4: RF Receiver Output Signals – Ch. 1: Roll (Right)

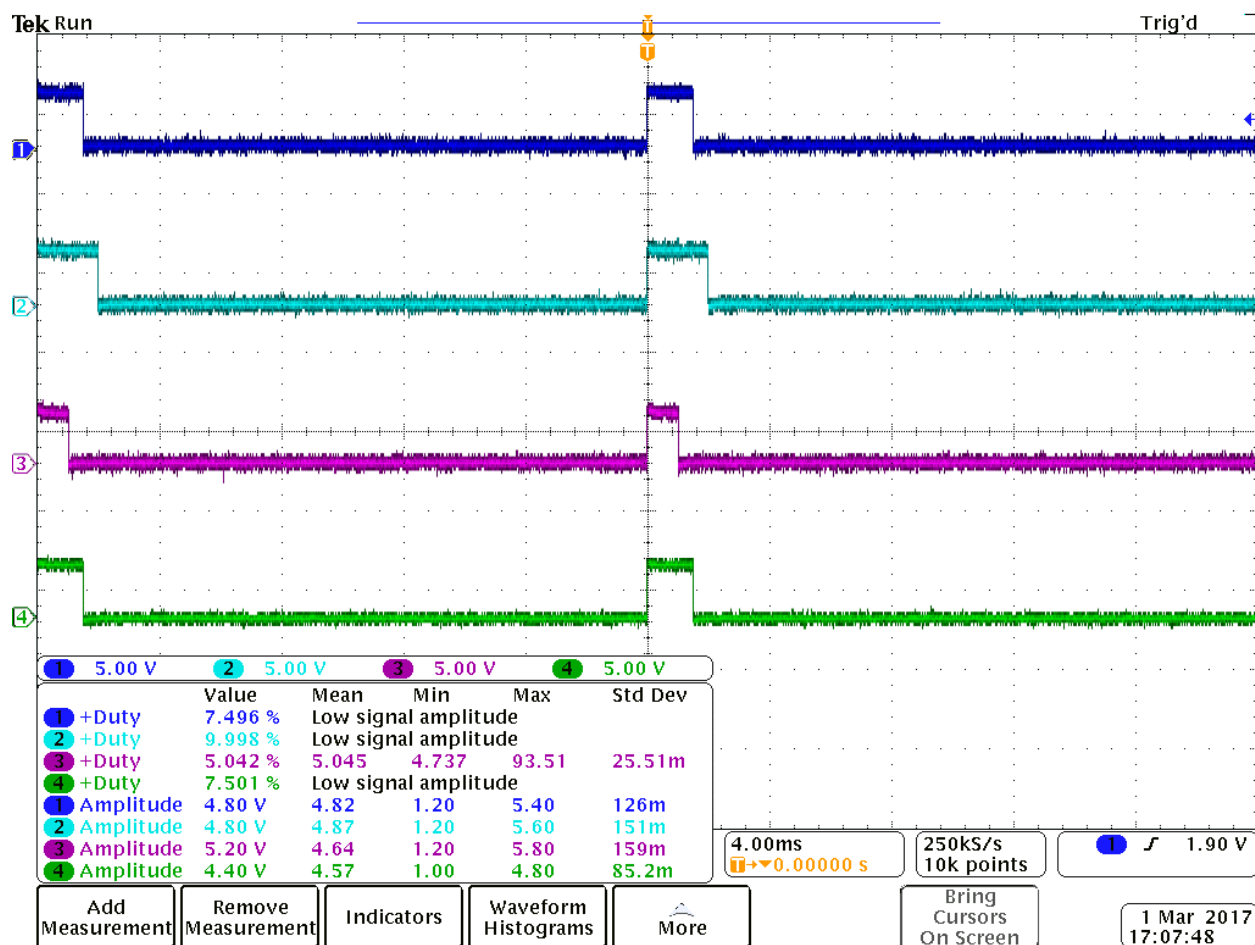




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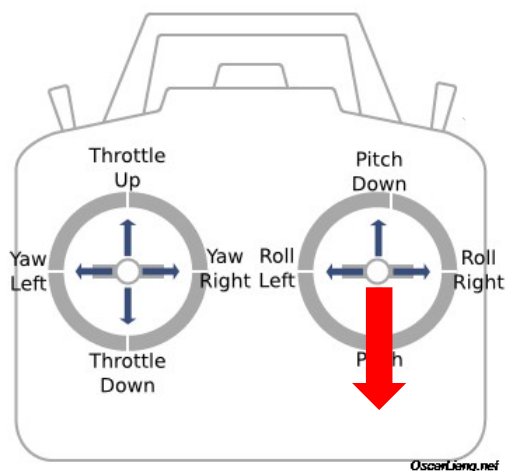
Figure 5: RF Receiver Output Signals – **Ch. 1: Roll (Left)**

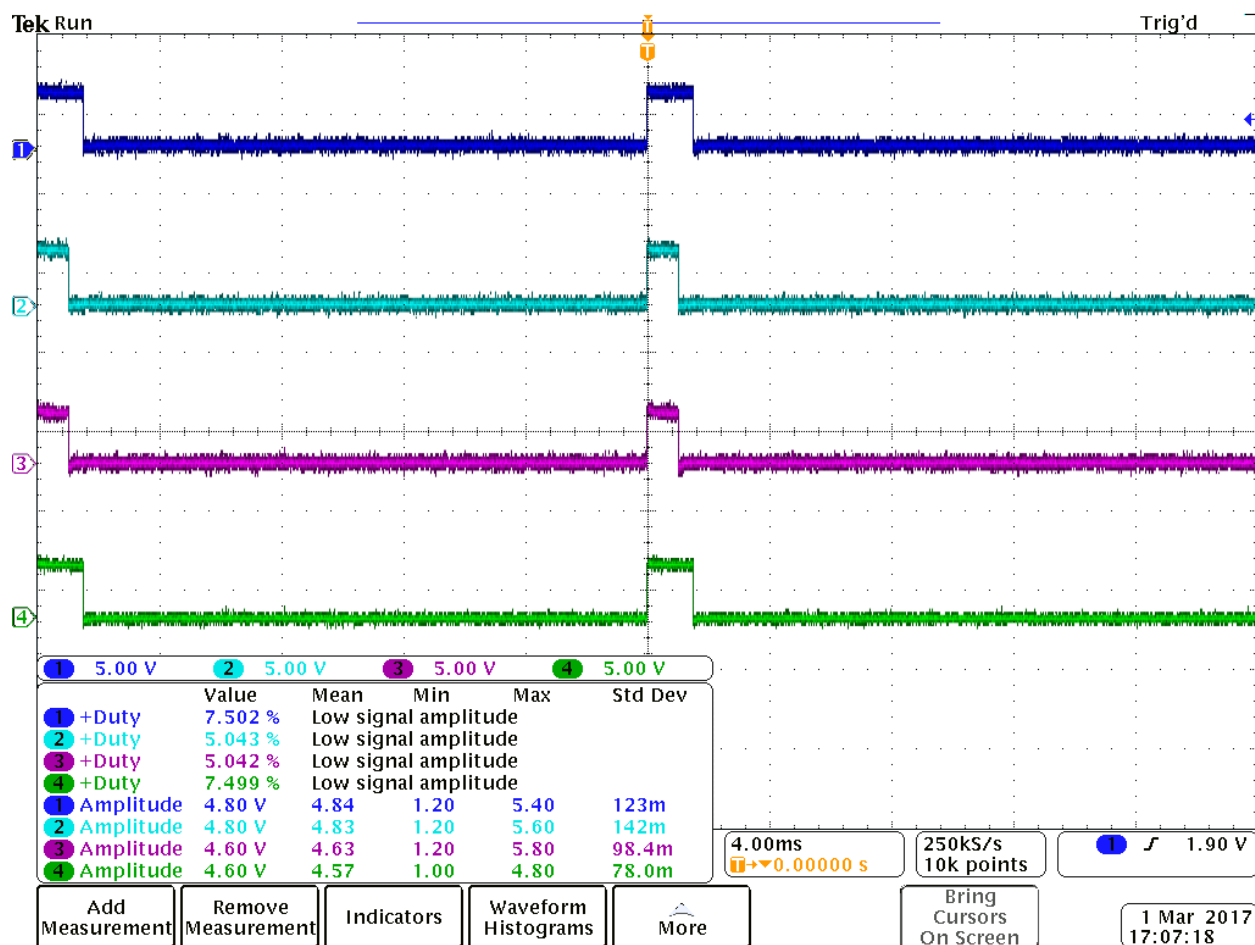




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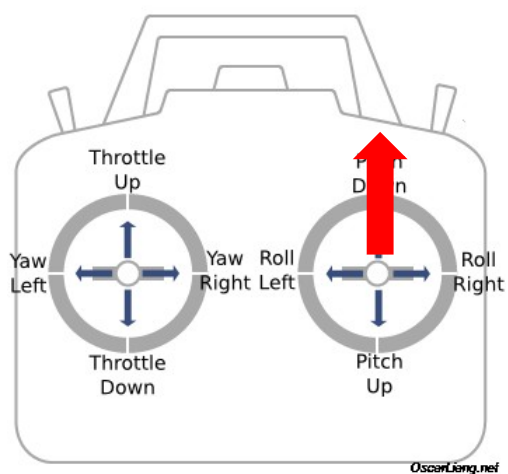
Figure 6: RF Receiver Output Signals – Ch. 2: Pitch (Down)

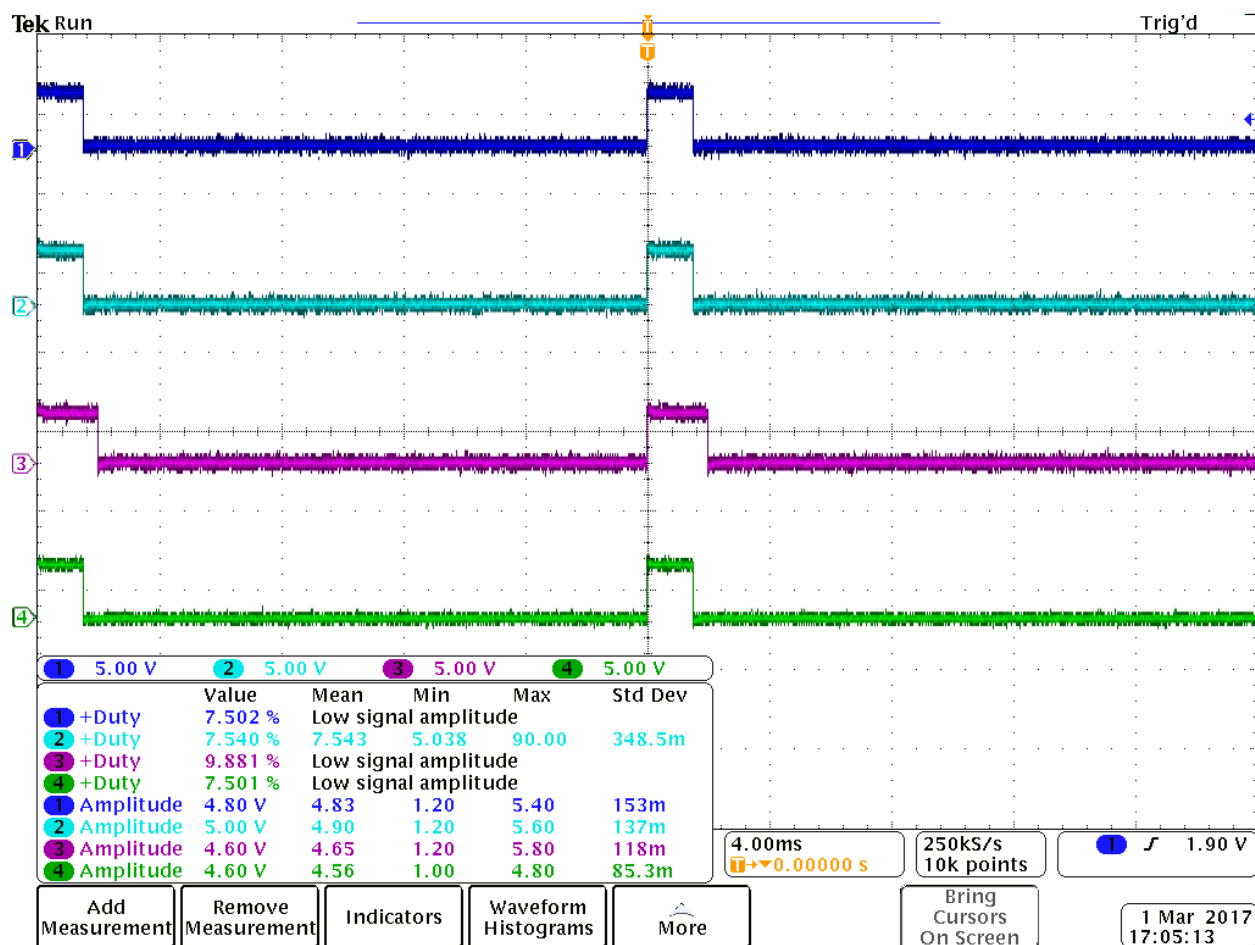




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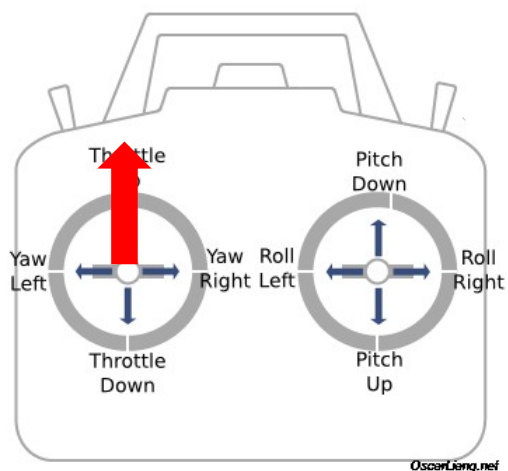
Figure 7: RF Receiver Output Signals – Ch. 2: Pitch (Up)

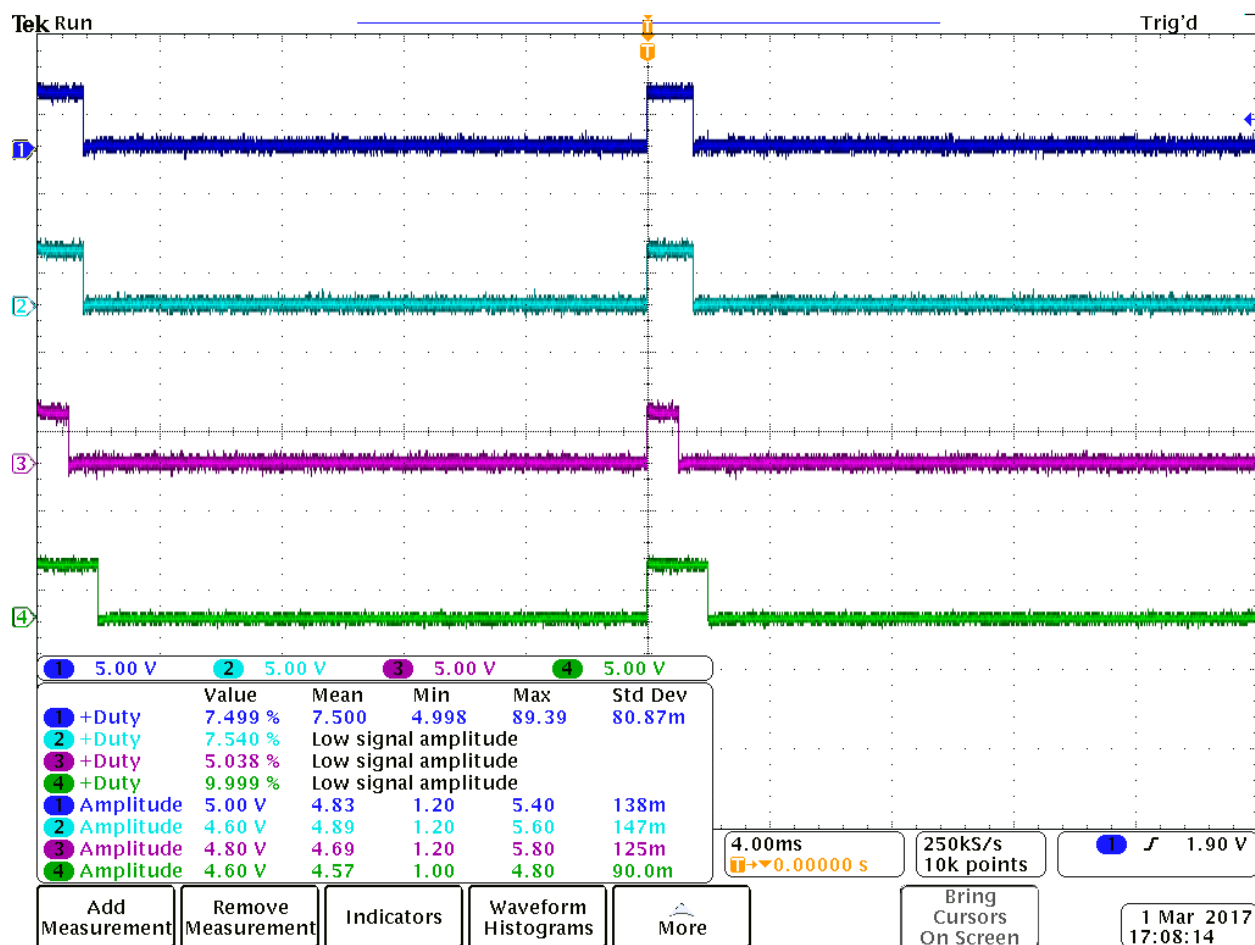




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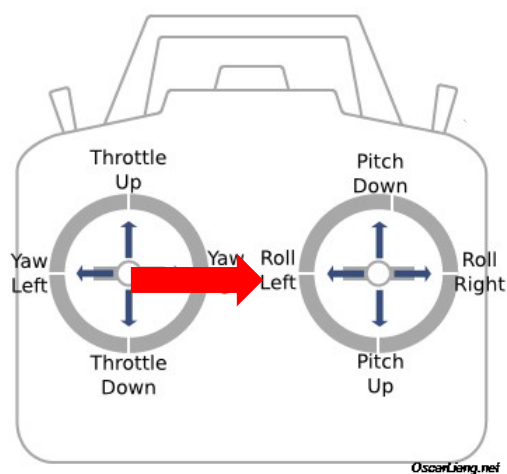
Figure 8: RF Receiver Output Signals – **Ch. 3: Throttle (Max)**

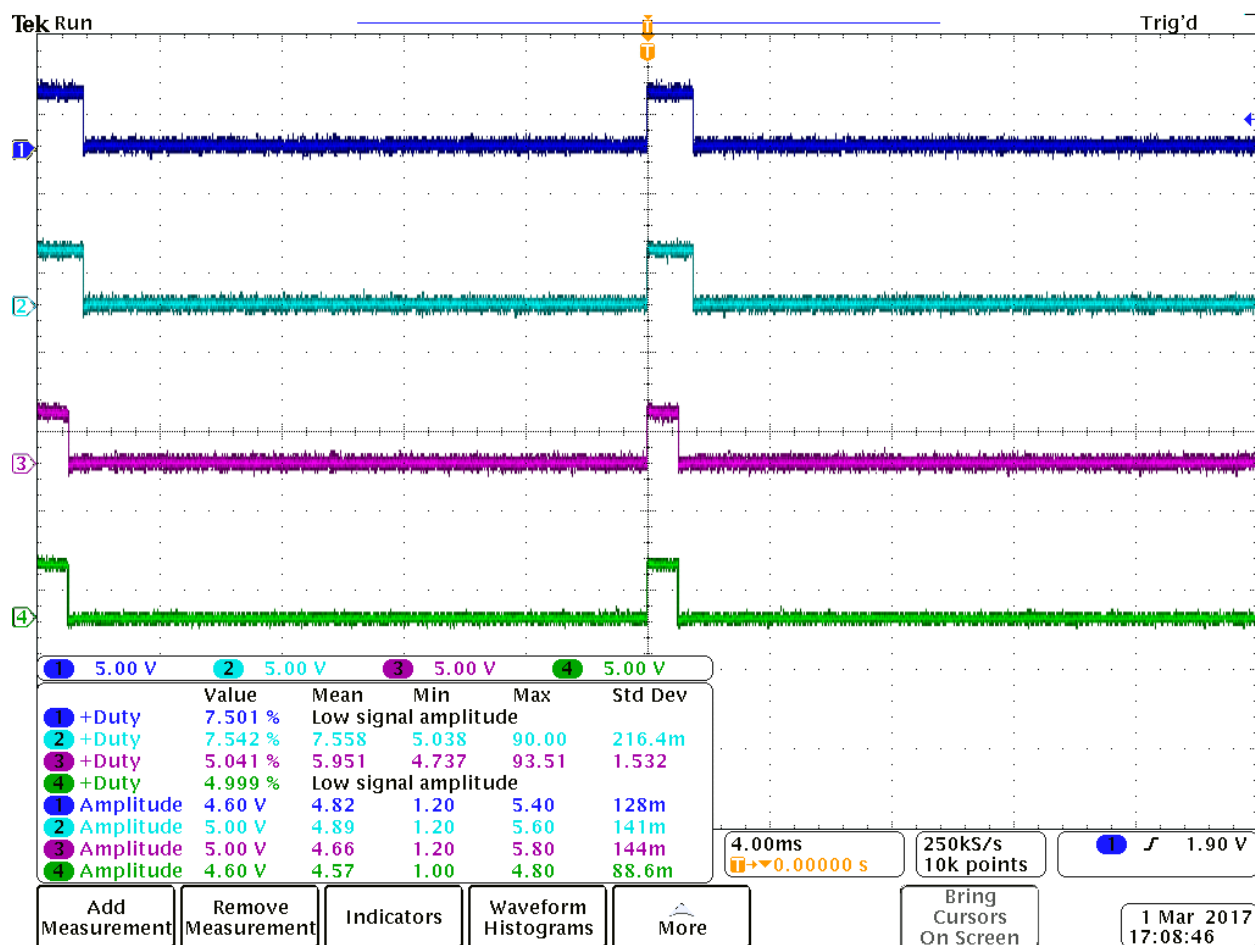




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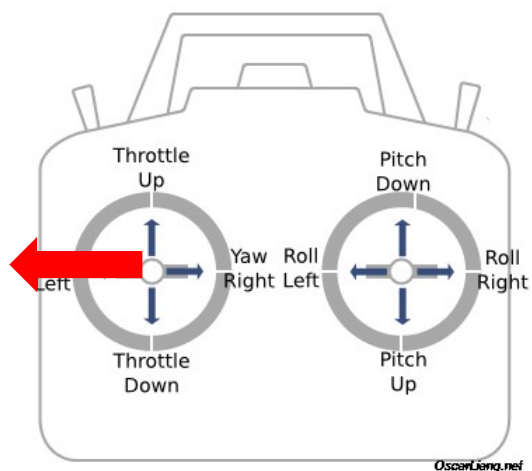
Figure 9: RF Receiver Output Signals – Ch. 4: Yaw (Right)





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Figure 10: RF Receiver Output Signals – Ch. 4: Yaw (Left)



Notes:

The signals seen from the receiver are PWM signals. The duty cycles can be seen on the measurement box on the oscilloscope screen shots. The frequency of the pulses displayed was around 50 Hz with an amplitude of around 5V.