Subsystem/ Function Name: Strain Measurement system/ Telemetry System

Date Completed: __1/29/16__

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Tested By: Thomas Klaben, David Halle, Adam Johnson

S3, S5, S6, S7, S8, S14 TEST PLAN

Concluded Condition of meeting Engineering Specifications S3	O
Concluded Condition of meeting Engineering Specifications S5	O
Concluded Condition of meeting Engineering Specifications S6	O
Concluded Condition of meeting Engineering Specifications S7	O
Concluded Condition of meeting Engineering Specifications S8	O
Concluded Condition of meeting Engineering Specifications S14	Δ

I. TESTING SPECIFICATION

Specification Number	Importance	Source	Function	Specification (Metric)	Unit of Measure	Marginal Value	Ideal Value	Comments/Status
S3	9	PRP	Strain Meas	Waterproofing	conductivity/failures	>1MΩ/zero failures	∞Ω/no failures	All connections should have infinite resistance with no failures by testing conductivity from plug couplers outside of wire to the sidewall of the tank
S5	9	PRP	Telem	Frequency Range	GHZ transmitter	.-	.1-100	Transmit in this range to avoid interference, product specs
S6	9	PRP	Telem	Battery Life	Hours	8	12	
S7	3	PRP	Telem	Transmission Range	Meters	10	100	
S8	3	PRP	Telem	Data Sampling Rate	Hz	100	150	
S14	9	PRP	Misc.	CSV File and Size	Yes and MB	.-	yes/5MB	5MB CSV file made at end of 20 min test

II. EQUIPMENT REQUIRED

Specification Number	Equipment or Instrumentation required
S3	Current Limited Power Supply, Tank, Water, Salt, Multimeter, Strain Gauge set up
S5	Product Specifications
S6	Tank, Transmitter, Receiver, Tank, Water, Strain Gauge set up, Motor and controller, Telemetry System
S7	Telemetry System, Laptop
S8	Telemetry System, Computer, Strain Measurement system
S14	Telemetry System, Computer, Strain Measurement system

III. DATA COLLECTION STRATEGY

Specification Number	Data acquisition strategy
S3	Use a multimeter and salt water to ring out every electrical connection from top of plug coupler to the metal tank, there should be no measurable resistances or "rings" week one, repeat test every week to check for endurance. Test checks for conductivity between gauge wires and tank side wall by using salt water, gauge should be insulated so infinite resistance. To be done after connections rung out.
S5	Check within the product specifications for the telemetry system to make sure within range. Run drop packet test from computer with transmitter in case and tank and confirm positive transmission with less than 1% dropped packets
S6	Charge the telemetry system the night before, Step up on the telemetry system and start generic data gathering at various blade speeds. Time the amount of active transmission time and minimize downtime between samples with the transmitter on. Keep testing until Telemetry system battery is depleted. If testing must be paused for more than 5 minutes turn the transmitter off and stop all timers
S7	Set up the telemetry system in the operating position and hook the base station to a laptop with data software. Take laptop and start range ping test. Walk away from test setup with laptop until first dropped ping is received and measure distance.
S8	Set up the telemetry system. In software settings set sampling rate to 128Hz on all 4 channels, start sampling and see if system can sample. Change to 256Hz and test system again, continue increasing sampling rate until system error.
S14	Step up the telemetry system. Start the system on a triggered sampling for 20 minutes and sampling to 128Hz and all four channels(customers long test time). Trigger test and wait for test to end. When ended save data and confirm CSV file is selected and save, open folder with file and check to see if its under 5Mb

III. TESTING FLOWCHART
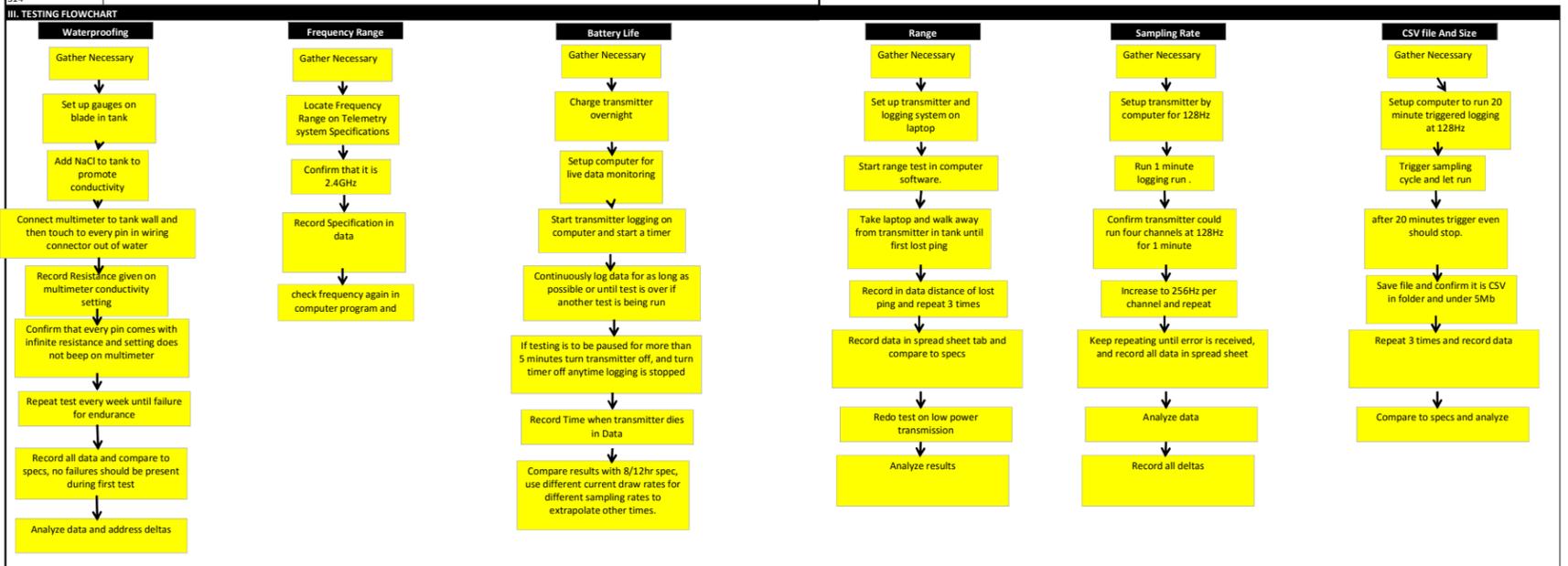
IV. RAW DATA ACQUISITION

For data of waterproofing see :Gauge Waterproofing

For S5 data see: Frequency range data

For S6 data see: BATTERY LIFE DATA

FOR S7 DATA SEE: TRANSMISSION RAW DATA

FOR S8 SEE: DATA SAMPLING RATE DATA

FOR S14 SEE: CSV FILE AND SIZE DATA

V. RESULTS

Spec S5 is satisfied based off of Specifications from Lord Micro strain and signed Conformity sheets

Spec S6 is met at 565Hz battery life was over 8 hours at 8.665. No sampling rate above 100Hz would meet 12 hours based on extrapolated data but 128 would make approximatly 11hrs. Also, this is with high power transission. If low can be used could be extended by more.

Spec S7 is satisfied marginally for now at 50m and low power at 20m line of sight

Spec S8 is satisfied based off of data, using synchronized streaming we can achieve 256Hz which is well above our 100-150Hz goal, 512 does not work but if continuous streaming is used it samples at ~560Hz

Spec S14 is marginally satisfied. All files are CSV file, but the minimum file size is ~2.75 times our specification derivate maximum file size. This is acceptable because only the transmitter has limited memory internally, but when streaming or sampling to the computer none is stored on the transmitter only on the computer. when in streaming mode the file size is 9 times the marginal value but again this doesn't effect the computers limitations and provides higher resolution to the customer. Also, larger because other values were also logged using more data.

VI. CONCLUSION

Spec S5 is satisfied based off of Specifications from Lord Micro strain and signed Conformity sheets.

Spec S6 is marginally satisfied. We made over 8 hours of testing (8.665) at 565Hz sampling even though only 128Hz was required. The ideal value was 12 straight hours of testing. using Extrapolated data based off of manufacturer information the 128Hz rate would have made approximately 11.06 hours so still less than 12. However, this is still much more testing than will be done in any single day and with the Devices Ultra low power standby multiple days of testing without turning off the device could be accomplished. Therefore this requirement is fully satisfied. Full data can be found on the Battery life Testing tab.

Spec S7 is satisfied marginally for now at 50m and low power at 20m line of sight

Spec S8 is easily met with 256Hz being well above 150Hz, but if continuous streaming is used then the spec is well beaten at about ~560Hz sampling

Spec S14 is marginally satisfied. All files are CSV file, but the minimum file size is ~2.75 times our specification derivate maximum file size. This is acceptable because only the transmitter has limited memory internally, but when streaming or sampling to the computer none is stored on the transmitter only on the computer. when in streaming mode the file size is 9 times the marginal value but again this doesn't effect the computers limitations and provides higher resolution to the customer