

- 1) Customer Requirement: System must operate a long time.  
Engineering Requirement: The system must log and transmit data for at least 12 hours on a single charge.
  - a) To test this requirement for our system we will keep both the alpha and beta transceivers on for 12 hours. The alpha transceiver will keep a log file that will check whether the beta transceiver is still running. If the log file consists of data that is consistent and the data entries correspond to 12 hours of operations, the test will be completed and passed.
- 2) Customer Requirement: The system must be accurate.  
Engineering Requirement: The system must log GPS data with at least a 10 meter accuracy and 2 analog voltages from 0.2 - 4.5V within 5% or 0.1V of real values, whichever is larger.
  - a) For testing the GPS accuracy we will use 3 known locations and their GPS coordinates. The system will gather gps data at the known location for 5 minutes. If the average of all the GPS data is within 10 metres of the known GPS coordinates, the test passes.
  - b) For the 2 analog voltage test the system will read in a voltage from 0.2V to 4.5 V by placing an input voltage to the onboard voltage dividers which will be sent to the alpha transceiver and stored onto a log file using MATLAB. If the values that are stored onto MATLAB are within 5% or 0.1V of the real value (whichever is larger), then the test passes.
- 3) Customer Requirement: The system needs to be robust:  
Engineering Requirement: The system will function to all other requirements while: Being submerged to 1 cm of depth for one second, operating at -10°C, operating above 85°C, and after being dropped on concrete from 3 feet at least 5 times
  - a) Testing the Water Blocking Ability of the Enclosure
    - i) For this test we would need to fill a sink of water, then line the enclosure with paper towels so that it will be visible if water leaks into the enclosure.
    - ii) Next we will fully submerged (1 cm depth) into water for one second then take it out. If the paper towels inside are not stained from submerging the enclosure in the water then this part of the test is passed.
  - b) Temperature Operation Range of the Enclosure: Checking if the enclosure can operate in -10°C or Lower temperature (Cold Extreme).
    - i) First place the system into a freezer that is -10 degrees. Next, start a timer for 5 minutes and check back on the system enclosure when the time is up. If the system is still operational and data is being sent to the alpha-transceiver for the duration of the five minutes then this test passes.

- c) Checking if the enclosure can operate and 85°C or Higher (Heat Extreme)
  - i) First preheat the oven to 87 degrees celsius, and place the system in it. Set a timer for 10 minutes and check the enclosure when the time is up. Immediately check for structural weaknesses, if there are not any then the enclosure passed the heat extreme verification test.
- d) Drop Shock Robustness
  - i) For this test we need to drop that enclosure which will be in the dog harness 5 times from a height of 3 feet on concrete. This test will be conducted when the when both beta and the alpha transceivers are running to show that the system will survive and continue to operate. If the system is still transmitting data after the series of 5 drops then this test is passed.
- 4) Customer Requirement: The system must transmit data.  
Engineering Requirements: The system must transmit its measurements at least 0.5 miles with at least 95% of the packets being received by the the alpha-transceiver over an hour.
  - a) For this test we will be sending the packet numbers from the beta to alpha transceiver. On both transceivers we will be keeping running totals of the amount of packets during operation which will be over the hour for this test. Once the hour has passed, we will take that ratio of the packets received by the alpha transceiver over the packets sent by that beta transceiver; if that ratio is at least 95 percent that this part of the test is passed.
- 5) Customer Requirement: The system must present data.  
Engineering Requirement: The system must display data in Matlab, with a professional looking overlay of a satellite map image.
  - a) To test this engineering requirement, we will show that the data retrieved from the beta transceiver can be displayed on the MATLAB GUI with the temperature, battery voltage, the two analog voltage readings, and the GPS data.
- 6) Customer Requirement: The system must be lightweight.  
Engineering Requirement: The beta side of the system must be light enough to be wearable by a dog. Hence, the beta system can weigh up to 7 pounds or 12% of the dog's body weight, whichever is less.
  - a) To test this requirement we will just weigh the system on a balanced and accurate scale and if the system is less than 7 pounds this test is passed.

7) Customer Requirement: The user can remotely trigger a bell sound on the beta-transceiver.

Engineering Requirement: The system has two way communication. A button press by the user on the alpha side must trigger a buzzer on the beta side of the system.

- a) For this test, to show that the system has two way communication, the alpha-transceiver will trigger a response on the beta-transceiver side of the system. A mechanical switch will trigger the beta-side buzzer running at 4699 Hz. If a buzzer sound is triggered when the mechanical switch on the alpha side is pressed then this test passes.