Validation by Test:

To validate that our device can supply $10A$ at $24V$, we will connect the output of the $24V$ rail to a $10A$ load. We will have two digital multimeters (DMM), one in parallel to the load to measure the voltage across it and one in series to measure the current. If we get $24V$ and $10A$ on the respective DMMs then we have met the specification.

To validate that our device can supply $5A$ at $12V$, we will connect the output of the $12V$ rail to a $5A$ load. We will have two DMMs, one in parallel to the load to measure the voltage across it and one in series to measure the current. If we get $12V$ and $5A$ on the respective DMMs then we have met the specification.

To validate that our device can operate on a single charge for the duration of one race. We will discharge the device for 30 minutes, the longest time of a race, by applying a $5A$ load to the $12V$ rail and a $10A$ load to the $24V$ rail. After 30 minutes have elapsed, we will measure the voltage of the battery pack using a DMM in parallel. If the voltage of the two rails is still $12V$ and $24V$, then this specification is validated.

To validate the short circuit protection feature, we will probe the gate and source of the discharge power field effect transistor (FET), using a DMM. We will short the $pack +$ and $pack -$ connections together. If we see V_{GS} of the discharge FET drop below V_{TH}, the specification is validated.

To validate the over-charge protection feature, we will begin charging the batteries of the device, via the AC wall power adapter. We will monitor the voltage of each cell by having a DMM in parallel. Using a DMM, we will probe the gate and source of the charge power FET. Once the voltage of the cells reaches $4.2V$, if V_{GS} of the charge FET is less than the V_{TH}, the specification is validated.

To validate the over-discharge protection feature, we will begin discharging the batteries of the device, by applying a load across $pack+$ and $pack-$. We will monitor the voltage of each cell by having a DMM in parallel. Using a DMM, we will probe the gate and source of the discharge power FET. Once the voltage of the cells reaches $3V$, if V_{GS} of the discharge FET is less than the V_{TH}, the specification is validated.

To validate the high-temperature protection feature, we will begin discharging the batteries of the device, by applying a load across $pack+$ and $pack-$. Using a DMM, we will probe the gate and source of the discharge power FET. We will apply hot air to the thermistor attached to the battery pack. Once $60\ °C$ is achieved, if V_{GS} of the discharge FET drops below V_{TH}, the specification is validated.

To validate logging info to the onboard SD card, we will request the system to log the battery temperature, battery voltage, and current output. We will then apply various loads across the $24V$ rail and the $12V$ rail. We will then request the system to stop logging. We will remove the SD card from the device and read the contents using a PC. If the contents are not NULL and seem to be feasible values, the specification is validated.

Validation by Inspection:

We will look at the display to see if it is displaying battery temperature, battery voltage, and current output. If it is, then the spec is validated.

We will look at the device to see that rechargeable batteries are powering it. If it is, then the spec is validated.

We will look at the device and ensure that its method of recharging the batteries is via the use of an external AC wall power adapter. If it is, then the spec is validated.