



Best Practices: Power Quality and Integrated Testing at JSC

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Validate your Design through Qualification Testing, Certify your Workmanship through Acceptance Testing.

- Ideally, Project Developers will first deliver an Engineering Unit to verify the design can pass Power Quality testing.
 - Design changes may be required
- After any necessary design changes, a flight-like Qualification (Qual) Unit is delivered, which is used to validate Power Quality and project requirements.
- Perform Qualification Testing to validate your design at extreme worst-case conditions
 - Thermal Cycling, Random Vibration, Vacuum, Thermal/Vacuum, Radiation, Power Quality, EMI, Functional Testing, etc.
- Once the design passes Qualification Testing, a Flight Unit should be delivered.
- Verify your workmanship through Acceptance Testing on the Flight Unit
 - Electrical Functional Test (EFT), expected temperatures, expected vibration, nominal load
 - Enables the Project Developer's Flight Unit to be verified, without exposing it to extreme conditions experienced during Qualification Testing



Multiple individuals should verify test setup and configurations prior to power-up.

- At least 3 different people should verify test setup and cable configurations
 - Typically Test Director, Tech/Test Assistant, and an Independent Reviewer (IR)
 - Flight Hardware should always be verified by the customer, and requires 2 additional Quality personnel for verification
- Perform a Reverse Polarity Check prior to power-up
 - Complete cable configuration up to Unit Under Test (UUT), without mating UUT connectors
 - Apply power, and use a Digital Multimeter (DMM) to verify polarity of the source
 - If results are as expected, mate UUT connectors, and proceed with testing.



Automate Testing, when possible.

- Standard JSC Power Quality testing includes Impedance & EMI Testing which involves hundreds of measurements at various frequencies.
- We developed an automated software program that will control the test equipment to take measurements while sweeping through all of the required frequencies and test cases
- Automating standard tests will reduce effort, errors, and schedule impacts, and improves test turn-around time.

Perform Integrated Testing in the final flight configuration.

- Newly designed Solid State Lighting Assembly (SSLA) upgraded International Space Station (ISS) internal lighting.
 - New design was retro-fitted into existing light locations
 - System Remote Control Assembly (SRCA) connects to many lights, and controls multiple lights in one module.
- Individual SSLAs successfully passed Power Quality requirements
- However, once SSLAs were installed on ISS, SRCAs did not properly control 5+ SSLAs in parallel.
- New design causes SRCA capacitors that provide a pulse to the control circuit of the SSLA to discharge too rapidly; preventing all SSLAs controlled by that particular switch from receiving the control pulse.
 - Integrated flight-like configuration SRCA/SSLA testing would have identified this problem prior to flight