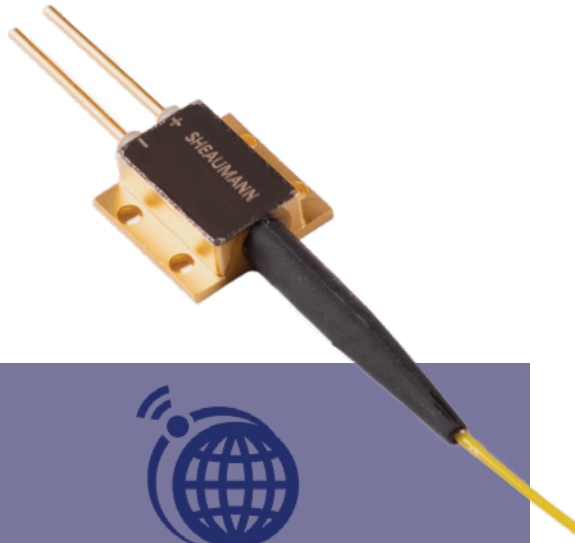
Case Study

SHEAUMANN

PROJECT Space-Qualified, Fiber-coupled Module
PARTNER TESAT

Sheaumann teamed with Tesat-Spacecom in 2015 to develop a space-qualified laser module which is now used in LEO and GEO satellites. This intensive three-year project required an enhancement of Sheaumann's flagship 2-Pin "SheauPac" module to perform continuously in the extreme environment of space for over 20 years without repair or recalibration. Some of the customizations of the module involved overcoming obstacles where an off-the-shelf product would have performed unsatisfactorily.



"Sheaumann Laser is proud to be an OEM supplier of laser modules to Tesat for its satellite communications applications. Such business relationships are founded on product quality/performance, support, transparency, and mutual respect." -Jim Hsieh, CEO, Sheaumann Laser, Inc.

Challenges and Solutions

Extreme temps

In Earth orbit, temperatures are far more extreme than any conditions experienced on Earth when the satellite moves from darkness to sun. This may cause the shifts in the positioning of the chip and fiber, leading to a reduction in power and possible failure.
SOLUTION We revised the processes for attaching the laser diode and fiber to the package to make it able to withstand 100,000 cycles from -55°C to +85°C.

Noise in the signal

When the laser is sending optical data to Earth, the quality of each individual photon is critical for an accurate signal transmission. Laser light in the fiber cladding can result in an unacceptable, "noisy" output.
SOLUTION We designed a proprietary fiber preparation and alignment process that greatly reduced the cladded light and improved the beam quality. We also redesigned the epitaxial structure of the diode and created an additional processing step for the facet, further improving the output.

Gamma radiation

Exposure to radiation in space will degrade standard fiber over time.
SOLUTION We procured a custom batch of radiation-tolerant fiber while adjusting our other processes to ensure its compatibility.

Launch g-forces

Conditions during the launch of the satellite can result in high mechanical stresses, including severe shock and vibration, which could damage the laser.
SOLUTION We employed our proprietary component dampening technology that we developed previously for a military application.

Tin whiskers

"Whiskers" formed from tin have caused system failures in space-based applications.
Tin is commonly used in solder.
SOLUTION We reformulated our solder to reduce the tin content while ensuring proper thermal conductivity and matching.

Offgassing

Standard adhesives such as epoxy will offgas over time and could cause laser failure if deposited on the facet.
SOLUTION We procured a unique space-grade epoxy and added a component inside the module to absorb any detrimental emissions.

Minimal payload

Due to space and power constraints on a satellite, the size, weight, and power consumption of the laser module must be minimal.
SOLUTION The compact size of the 2-Pin "SheauPac" package made it an ideal candidate for this project.

Redundancy

Redundant laser modules must be employed to ensure continuous operation in case of failure, but they must be automatically switched on without additional circuitry or complexity.
SOLUTION We designed a simple passive component that enabled uninterrupted operation of the system in the event of a module failure.