

Qualification and Reliability Testing of a Microchip Laser System for Space Applications

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Abstract

A compact microchip laser pumped by a single fiber coupled diode laser was developed for a scanning laser radar instrument called Laser Mapper (LAMP) to be used as a guidance and control sensor in future JPL/NASA missions. The system involved commercial-off-the-shelf technology that was packaged and qualified for limited budget space applications. In particular, the system had to meet a 5000 hour minimum life requirement on a LEO platform. This paper discusses the process used and the results of the selection and qualification of a low cost prepackaged diode laser with a custom packaged microchip laser crystal. The environmental testing would be applicable to a variety of photonic systems.

The topics to be discussed include:

- The selection of the diode pump laser and manufacturer
- Packaging requirements for the laser crystal
- Upscreening of commercial parts
- Qualification sampling tests including temperature cycling, vibration, outgassing
- Physical construction analysis

The testing requirements and screening flow to ensure the lifetime reliability will be presented. This was determined based on input from Telcordia standards that apply to optoelectronic systems used in the telecommunications industry but upgraded to account for the unique aspects of the devices, such as the high optical power. The key elements in packaging high power optoelectronic devices for harsh environments include managing the thermal loading through the expected spacecraft temperature extremes and addressing the die mounting, optical fiber coupling and jacket assembly. Each of these aspects will be discussed and testing results presented.