Laser Optical Communications for CubeSats

Dual laser inter-satellite FSO communications

The space communications sector is currently booming with the emergence of low cost, short turnaround and high production rate satellites, such as CubeSats being launched into low earth orbit (LEO) constellations. However, available technology doesn't make them currently suitable for data intensive applications.

The dual laser, inter-satellite FSO optical communications device being developed by Northumbria University, provides an alternative option to the existing low-speed radio frequency (RF) high-power transceivers currently used in CubeSat operations, with high-speed, lightweight and lower power free-space optical (FSO) wireless technology. The system offers adaptable data rates that are tunable in orbit to facilitate a range of end-user requirements and can transmit and receive simultaneously increasing the effectiveness of data relay in LEO. The intensity modulation/direct-detection (IM/DD) FSO system that uses an infrared laser source is being prototyped by Durham and Northumbria Universities and in collaboration with UK-based industry partners e2E Group and SMS Electronics Limited.

Item	Specification	Descriptions
Receiver FOV	0.1 degrees	
Data Laser Wavelength	1550 nm	
Beacon Laser Wavelength	830 nm	
Link Length	500 km to 1000 km	
Data Rates Supported	500 Mbps up to 1 Gbps	
Total Power	Up to 34W	
	2.3W when laser is off	
Physical		
Dimensions	96 x 96 x 160 mm	Sized for CubeSats
Weight	2 kg	
Pointing Capability		
Transmitter	70 micro radian beam divergence	Inter-satellite tracking for continuous data
Receiver	+/-10 degrees transmitter tilt range	

Technical Features

Link lengths of 500km to 1000km for LEO inter-satellite communications

Highly miniaturised to be usable with both small satellite constellations and larger spacecraft

Interfaces with Satellite for power, control and data signals

High data rate inter-satellite and satellite-to-ground links for LEO constellations

Delivers wide environmental resilience including temperature, thermal cycling, vibration, shock, acoustic, vacuum, out-gassing and radiation.

Features for Remote Management and Fault Detection Isolation and Recovery (FDIR) including voltage, current and temperature reporting, support for Built-In-Test and for external monitoring and control.

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