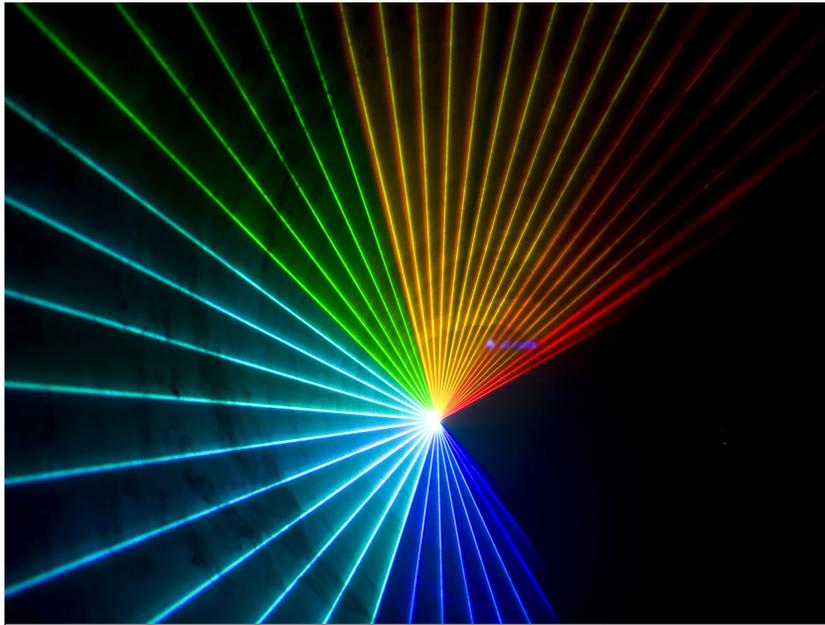




TECHNOLOGY SOLUTION

Communications



Optical Tunable-Based Transmitter for Multiple High- Frequency Bands

Eliminates the need to have separate transmitters for each frequency

As the demand grows for more radio frequency (RF) carrier bands in space communication systems, so does the need for a cost-effective compact optical transmitter that is capable of efficiently transmitting multiple RF bands. Traditionally, when a satellite transmits to another satellite or a ground station, a separate terminal with a corresponding antenna is needed for each radio frequency band. Equipment becomes more complex as frequencies get higher. At the higher bands, large heat sinks are needed to dissipate the waste heat. Now, however, innovators at NASA's Glenn Research Center have successfully developed a method using a single laser beam to combine and transmit - all in one unit - multiple microwave bands with different modulation formats and bandwidths. This breakthrough benefits space communication systems in important ways, including reduced size, weight, and complexity, with consequent savings in cost. With additional development, the technology could be extended to fiber optic systems for terrestrial applications.

BENEFITS

- Reduced size and weight: Allows several multiple RF bands to be transmitted using the same number of components as a single-band transmitter
- Increased efficiency: Drastically reduces the system's power consumption and boosts the upper limits of data throughput
- Reduced cost: Creates savings by lowering the number of transceivers and antennas needed per system and payload weight for launch; ultimately, could reduce the number of satellites needed to handle future communications loads
- Increased flexibility: Allows additional RF carriers to be added to the system at any time with minimal configuration



THE TECHNOLOGY

NASA Glenn's researchers have developed a means of transporting multiple radio frequency carriers through a common optical beam. In contrast to RF infrastructure systems alone, this type of hybrid RF/optical system can provide a very high data-capacity signal communication and significantly reduce power, volume, and complexity. Based on an optical wavelength division multiplexing (WDM) technique, in which optical wavelengths are generated by a tunable diode laser (TDL), the system enables multiple microwave bands to be combined and transmitted all in one unit. The WDM technique uses a different optical wavelength to carry each separate and independent high-frequency microwave band (e.g., L, C, X, Ku, Ka, Q, or higher bands). Since each RF carrier operates at a different optical wavelength, the tunable diode laser can, with the use of an electronic tunable laser controller unit, adjust the spacing wavelength and thereby minimize any crosstalk effect.

Glenn's novel design features a tunable laser, configured to generate multiple optical wavelengths, along with an optical transmitter. The optical transmitter modulates each of the optical wavelengths with a corresponding RF band and then encodes each of the modulated optical wavelengths onto a single laser beam. In this way, the system can transmit multiple radio frequency bands using a single laser beam. Glenn's groundbreaking concept can greatly improve the system flexibility and scalability - not to mention the cost of - both ground and space communications.



Glenn's tunable laser and optical transmitter will dramatically improve both ground and space communications.



Glenn's innovative technology holds great promise not only for satellite-to-satellite communications but also for military vessels and land-based equipment.

APPLICATIONS

The technology has several potential applications:

- Commercial satellites
- Communications for military vehicles, vessels, and aircraft
- Aircraft/aerospace
- Anywhere that multiple bands for high frequency communications are needed in small spaces

PUBLICATIONS

Patent No: 9,490,899

technology.nasa.gov

More Information

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