National Institute of Standards and Technology

SPECIFICATIONS
Three Fiber-coupled Low Vpi Broadband Electro Optic Modulators
NB688000-16-04325

BACKGROUND

The National Institute of Standards and Technology (NIST) is developing a compact atom interferometer based on stimulated Raman transitions in cold atoms. To produce the light for Raman transitions, NIST uses an optical phase-lock loop with a master and a slave laser and we apply electrical feedback to the laser current of the slave laser to set the difference frequency between the master and slave to the desired 6.835 GHz. Because of the limited frequency modulation bandwidth of the slave, we only get about 70% of the beat-note power in the coherent carrier with our phase lock-loop, which limits the signal-to-noise in the interferometer. We intend to change our optical source such that we employ an electro-optic phase modulator (EOM) to generate the interrogation spectrum by modulating a single laser at 6.835 GHz. We have already done this in a similar cold-atom clock based on coherent population trapping and have simplified the apparatus while improving the signal to noise ratio by at least a factor of 3. We expect similar improvements with our atom interferometer. The other two EOMs will allow us to make similar improvements to the signal to noise and stability in two of our other NIST on a Chip projects.

PURPOSE

NIST requires three (3) fiber-coupled, broadband EOM phase modulators that can modulate at frequencies up to ~6.8 GHz with low applied voltages (< 10 V). The low applied modulation voltages will enable the devices to operate with low-voltage signal generators with high bandwidth and without high-voltage amplifiers. The devices must able to operate at input optical powers of up to 200 mW such that we can use one of these modulators with a high-power fiber laser system. This requirement sets the ideal choice of waveguide material in the modulator to potassium titanyl phosphate (KTP), since Lithium Niobate modulators can typically only operate up to 50 milliwatts of optical power. One of the modulators is to be built for low RAM without a terminating resistor, and is to include case temperature control.

DELIVERABLES

Three (3) PM fiber-coupled KTP electro-optic phase modulators. Two (2) of the three are to have a bandwidth of at least 6 GHz and insertion loss < 4 dB at 780 nm and 795 nm. One (1) of the modulators is to be built to be optimized for low RAM without a terminating resistor, and is to include case temperature control. The bandwidth of unterminated device is to exceed 100 MHz and the Vpi value for that device will not be specified, but all other specs (wavelength, optical power, connectors, etc.) will be the same.

TECHNICAL SPECIFICATIONS

- Electro-optic phase modulation with operating wavelength of 780 +/- 20 nm
- Maximum optical power of 200 mW
- Insertion Loss: < 4 dB
- Bandwidth:
    - > 6 GHz (DC – 10 GHz) for two of the devices
    - >100 MHz for the third device that is optimized for low RAM
- Modulation Port Vpi (@ 1 GHz): < 6 volts (for the two devices with 50 ohm termination. Vpi not specified for the low-RAM device)
- RF Connector: female SMA
- Input and output PM Fibers with FC/APC connectors

TECHNICAL CONSIDERATIONS
The main considerations for this procurement are that the devices be broadband, operate at high input optical powers, and operate with low applied voltages. Also, the wavelength range for operation should span from 780 to 795 nm with < 4 dB of insertion loss.

GOVERNMENT FURNISHED PROPERTY OR INFORMATION
N/A

DELIVERABLE SCHEDULE
The contractor shall deliver no later than twelve (12) weeks after receipt of order.

INSPECTION AND ACCEPTANCE
There will be no inspection and acceptance period. The acceptable equipment shall meet all technical specifications, as determined by the NIST TPOC.