Ultra-Low Noise Fiber Laser

The product description

Single Frequency Fiber laser with low Relative Intensity Noise (RIN) have wide application in quantum optics, pumping lasers, lidar, coherent optical communications, high-precision optical sensing, optical measurement, and precision spectroscopy. For example, the laser for trapping atoms in optical lattice demands not only high output power, but also low RIN to reduce the resonance between the lattice and atoms and low frequency noise (FN) to reduce the spatial vibration, which is quite important for the atoms lifetime in the lattice. In the atomic interferometer and atomic clock application, high power laser could lead to more atoms, uniform interaction area and high measurement SNR.

![Image of low noise fiber laser scheme]

Fig. 1, Schematic of the low noise fiber laser.
*The doubler module is equipped with SHG model, for example, LN-YFA-D & LN-EFA-D

Erbium group offers high power low noise 1064 nm and 1550 nm fiber laser with low FN and low RIN seed + low noise fiber amplifier shown in Fig. 1. In Fig. 2, the amplifier will not introduce the extra frequency noise and the linewidth broadening is measured to be less than 1 Hz. The RIN of the amplifier is ultra-low (RIN<140 dBc/Hz (>5 kHz), RIN integration from 10 Hz-10 MHz <0.03%). Also, the wavelength could extend to be 1020-1120 nm for Ytterbium-doped fiber amplifier and 1530-1596 nm for Er-doped fiber amplifier. With stable single pass frequency doubling module, the low noise fiber laser wavelength could extend to be 510-556 nm and 765-798 nm. In the process of frequency doubling, the linewidth of the laser is doubled, and the intensity noise (RIN) is only increased by 6 dB, thus inheriting the low noise characteristics of the fundamental frequency light.

![Image of linewidth broadening test result]

Fig. 2, Linewidth broadening test and result
PreciLasers offers a high-power (up to 130 W), low intensity noise, narrow linewidth highly-reliable 1064 nm fiber laser solution for the optical lattice application.

**Key Features:**
- Low Intensity Noise (-140 dBc/Hz @100 kHz)
- Narrow Linewidth(<10 kHz)
- Good Beam quality (M² <1.2)
- High Output Power (up to 100 W)
- Operation in harsh conditions
- Full Protection System

**Applications:**
- Optica Lattice
- Optical Tweezers
- Optical Traps
- Pump laser for OPO

**Technical Indicators**

<table>
<thead>
<tr>
<th>Model</th>
<th>LN-YFA-1064-130</th>
<th>LN-YFA-1064-100</th>
<th>LN-YFA-1064-50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Wavelength, nm</td>
<td>1064</td>
<td>1064</td>
<td>1064</td>
</tr>
<tr>
<td>Linewidth, kHz</td>
<td>&lt; 10</td>
<td>&lt; 10</td>
<td>&lt; 10</td>
</tr>
<tr>
<td>Tuning Range, GHz</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Power after ISO, W</td>
<td>&gt;130</td>
<td>&gt;100</td>
<td>&gt;50</td>
</tr>
<tr>
<td>RIN</td>
<td>RIN: -140 dBc/Hz (100 kHz) RMS Integration: &lt;0.0(10Hz-10 MHz)</td>
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</tr>
<tr>
<td>Beam Quality</td>
<td>TEM₀₀, M² &lt;1.15</td>
<td>TEM₀₀, M² &lt;1.15</td>
<td>TEM₀₀, M² &lt;1.15</td>
</tr>
<tr>
<td>Polarization</td>
<td>Linearly Polarized, &gt; 300: 1</td>
<td>Linearly Polarized, &gt; 300: 1</td>
<td>Linearly Polarized, &gt; 300: 1</td>
</tr>
<tr>
<td>P-P, RMS Power Stability</td>
<td>&lt;0.5 %@3hrs</td>
<td>&lt;0.5 %@3hrs</td>
<td>&lt;0.5 %@3hrs</td>
</tr>
<tr>
<td>Cooling</td>
<td>Water Cooling</td>
<td>Water Cooling</td>
<td>Air Cooling/Water Cooling</td>
</tr>
<tr>
<td>Output Connector</td>
<td>Space (300*240 mm²)</td>
<td>Space (300*240 mm²)</td>
<td>Fiber</td>
</tr>
</tbody>
</table>

1: Wavelength could be selected from 1020-1112nm

With single pass and resonant cavity SHG module, low noise 532 nm laser could be generated with output power up to 30 W, which has been applied in optical lattice application.

**Key Features:**
- Narrow Linewidth<20 kHz
- Low Intensity Noise (-130 dBC/ Hz @ 100 kHz)
- High Power (up to 30W @ LNYFA-SHG)
- Good Beam Quality ($M^2 < 1.2$)
- Linearly Polarize
- Active Power Stability

**Applications:**
- Optica Lattice
- Optical Tweezers
- Pump laser for Ti: Saphir laser

**Technical indicators**

<table>
<thead>
<tr>
<th>Model</th>
<th>LN-YFA-D-532-10 (Single Pass SHG)</th>
<th>LN-YFA-D-532-30 (Resonant Cavity SHG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Wavelength, nm</td>
<td>532</td>
<td>532</td>
</tr>
<tr>
<td>Linewidth, kHz</td>
<td>&lt; 20</td>
<td>&lt; 20</td>
</tr>
<tr>
<td>Tuning Range, GHz</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Output Power, W</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>RIN</td>
<td>RIN: -130 dBC/Hz (100 kHz) &lt; 0.05(10Hz-10 MHz)</td>
<td>RIN: -130 dBC/Hz (100 kHz) &lt; 0.05(10Hz-10 MHz)</td>
</tr>
<tr>
<td>Beam Quality</td>
<td>TEM$_{00}$, $M^2 &lt; 1.2$</td>
<td>TEM$_{00}$, $M^2 &lt; 1.1$</td>
</tr>
<tr>
<td>Polarization</td>
<td>Linearly Polarized, &gt; 100: 1</td>
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<td>P-P, RMS Power Stability</td>
<td>&lt;0.5 %@3hrs</td>
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</tr>
</tbody>
</table>

1 Central Wavelength could be selected from 510-540 nm