

1480-nm Cascaded Raman Laser with 50-W Output Power

1. INTRODUCTION

The Erbium-doped fiber amplifier (EDFA) which is commonly used for long-distance optical communication system is capable of amplifying the light signal at high quality and at high efficiency. These features can be achieved effectively by sending a single-mode pumping light into the amplifier which consists of a single-mode fiber. If the signal amplified in the EDFA is a pulse with very short pulse width, as compared with the case of a continuous wave, higher power pumping light is required. We have commercialized a Cascaded Raman Laser of high output pumping laser used in an amplifier for a femtosecond pulsed laser. With this Cascaded Raman Laser, higher than 50W of 1480nm-band output light is gained from the single-mode fiber and it can be made available for a high output power to all EDFA, not only for a femtosecond pulse.

2. BACKGROUND OF THE DEVELOPMENT

OFS Fitel, LLC, a company of our group, has a track record in research, development and commercialization of Cascaded Raman Lasers since the 1990s and now is one of the few companies which sell fiber bragg gratings (FBG) for Cascaded Raman Lasers and fiber for Raman resonators. In undertaking joint research and development with OFS, we have made presentations in conferences, and sold test models of a 40 W output products and mass production models of 20 W output. This time, in response to customers in the US, we have advanced the development of a mass production model for the product of a 50 W output (Figure 1) in cooperation: optical design and reliability validation at OFS Laboratories, and chassis, control board and packaging design at Furukawa Electric.

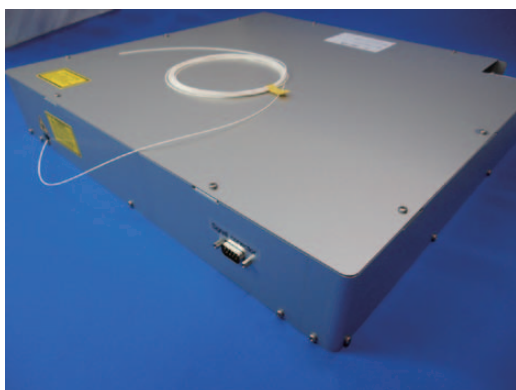


Figure 1 External view of this product.

3. DESCRIPTION OF THE PRODUCT

Figure 2 shows the configuration drawing and Figure 3 shows the mechanical dimensions of the product. This product consists of an output light of ytterbium (Yb) fiber laser oscillating at 1117 nm sent into a cascaded Raman resonator and then oscillated at 1480 nm as the fifth-order of Raman scattering light. The example of the output light spectrum of this product is shown in Figure 4. Pumping light of approx. 150 W is sent into the Yb fiber laser and 1117 nm light of higher than 120 W as maximum outputs. Considering this signal as a fundamental wave and making Raman shift on it, a cascaded Raman laser output of higher than 60 W is available. This product has the spectrum characteristic shown in Figure 4 and the light power at 1480 nm-band accounts for 70-90 percent of the total output power of this product. Power characteristics of total output power and output power at 1480 nm-band of this product are shown in Figure 5. In that figure, you can see that this product achieves higher than 50 W at the 1480 nm-band output power.

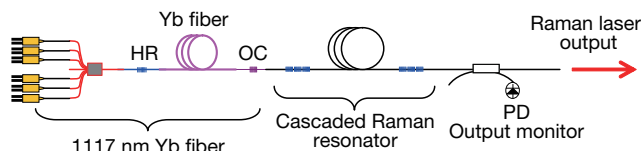


Figure 2 Configuration drawing.

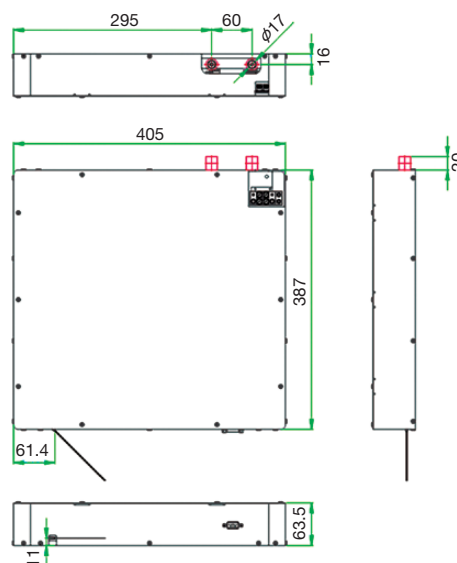


Figure 3 Mechanical dimensions.

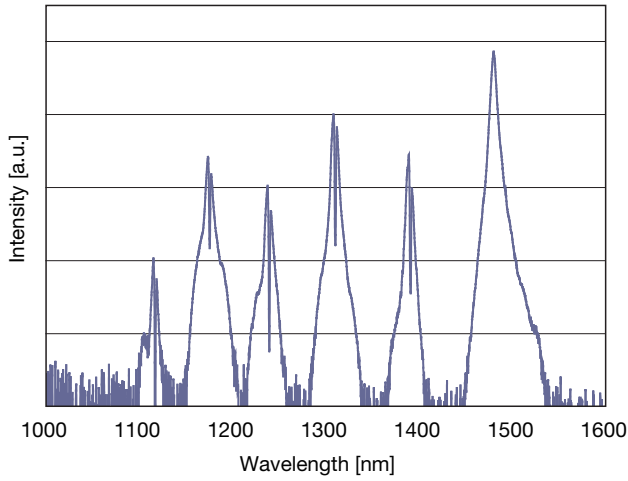


Figure 4 Example of output spectrum.

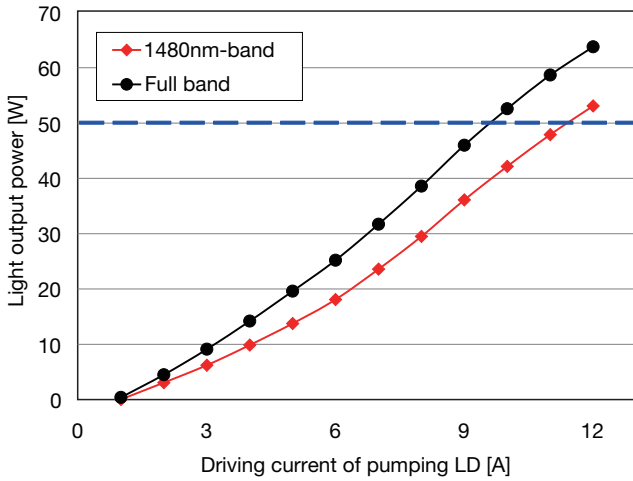


Figure 5 Output power in total and 1480 nm-band.

4. CONCLUSION

As the pumping light source used in an EDFA for a femto-second pulsed laser, we have commercialized high output power Cascaded Raman Laser with higher than 50 W at 1480 nm-band, made by joint development with OFS. As a summary of this product, we illustrate the key specifications and environmental conditions in Table 1.

Table 1 Specifications of this product.

Specifications.

	Unit	Min.	Max.
Oscillation mode		c.w.	
Polarization		Random	
1480 nm-band output		50 W	
Output power variable range	%	10	100
1480 nm-band center wavelength	nm	1478	1482
1480 nm-band wavelength linewidth	nm		6

Environmental conditions.

	Unit	Min.	Max.
Storage environmental temperature	°C	-20	70
Storage environmental humidity	%	20	85
Operating environmental temperature	°C	10	40
Operating environmental humidity	%	20	85
Supply voltage	DCV	33	40

For more information, please contact:
 Administrative Department,
 Telecommunications Company
 Tel: +81-3-3286-3768 Fax: +81-3-3286-3708
 E-mail: fiberlaser_bsgr@furukawa.co.jp