News Release

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Nippon Telegraph and Telephone Corporation (NTT)
NTT Electronics Corporation (NEL)

Three High-Performance Semiconductor Laser Emission Sources Commercialized

as Effective Light Sources for Smaller, Less Expensive and Higher Performance of Next-Generation Communication/ Medical and Environmental Sensing Systems

Nippon Telegraph and Telephone Corporation (hereinafter "NTT," with headquarters in Chiyoda-ku, Tokyo; Norio Wada, President) and NTT Electronics Corporation (hereinafter "NEL," with headquarters in Dogenzaka, Shibuya-ku, Tokyo; Tomoyuki Toshima, President) have endeavored to commercialize new laser emission sources that are optimum for next-generation communication systems and applications in non-communication fields such as medicine and the environment. They intend to launch three new products soon via the sales channels of NEL.

- 2.5 Gbps (*1) direct-modulation laser emission source for long-distance transmission, which is operable without temperature control
- Variable-wavelength laser emission source, for which emission wavelength can be arbitrarily set using only one element in a specific wavelength range
- Laser emission source with oscillation wavelengths in excess of 2.0 μm, which is applicable to measuring instruments in the medical and environmental fields

These new products are the result of the successful commercialization of NTT Photonics Laboratories' long-accumulated design and manufacturing technologies for the light sources of backbone optical communication systems. Jointly with NEL, NTT has focused on the commercialization of such systems based on the Comprehensive Commercialization Functions (*2) introduced by NTT in July 2003.

1. Background

To supply high-speed, large-capacity communication services to households of individual subscribers via FTTH (fiber to the house), an optical-fiber communication network to connect the core system with the subscriber (access) systems is indispensable. The required systems for networking must not only ensure high speed and large capacity but also meet the requirement of being economical to supply less expensive communication services.
To that end, especially for the light sources of subscriber (access) and metro systems, it is considered necessary to dispense with the temperature adjustment function, which requires a complicated device control and high power consumption. NTT's 2.5 Gbps direct-modulation laser emission source for long-distance transmission, which is operable without temperature control, was developed to address this need.
Previously, it was necessary to prepare several light sources with different wavelengths for the WDM (*3), an economical networking technology used for communications to effectively connect metro and core systems. NTT's variable-wavelength laser emission source for which emission wavelength can be arbitrarily set to a specified wavelength range was developed to eliminate complexity and increase the number of light source inventories.
Meanwhile, these semiconductor lasers for communication have features in non-communication fields such as excellent wavelength controllability, compact size and

low cost compared with solid-state lasers. Accordingly, some recent approaches have extended their application to light sources for optical sensors (*4). However, until recently there were no semiconductor lasers that could oscillate around 2.0 μm wavelength despite strong demand in the medical and environmental fields, therefore expensive and large-scale, solid-state lasers were used instead. NEL showed its presence in these application fields by commercializing a semiconductor laser with oscillation wavelengths at 2.0 μm in 2004. NEL has also developed a DFB laser (*5) with oscillation wavelength in excess of 2.0 μm in response to requests such as the extended lineup of measurable substance types, the extensible optimum absorption wavelength range depending on measured items by each substance and simultaneous measurements for several wavelengths.
NTT and NEL have endeavored to realize higher performance of semiconductor laser emission sources for optical communications and accumulated sophisticated design and manufacturing technologies to meet the stringent requirement of higher capacity for backbone optical communication systems. Applying the accumulated technologies led to the development of these new products.

2. Features of New Products
The new products have the following technical features.

2-1. 2.5 Gbps direct-modulation laser emission source
This product has the following technical features.

(1) Operating temperature
Long-distance transmission for more than 80 km becomes possible at an environmental temperature between -30°C and 90°C without any temperature control. We can make our communication systems smaller and more economical, thereby making communication systems increasingly effective.

(2) Transmission distance
If the environmental temperature is set at 0 to 85 °C, which corresponds to that for conventional similar products, long-distance transmissions up to 120 km are possible.

(3) CWDM (*6)-compliant
The DFB laser structure, which excels in wavelength precision, ensures stable single wavelength oscillations of laser emissions. In addition, our varied eight wavelengths with a 20-nm interval within a wavelength band of 1470-1610 nm allow large-capacity transmissions via CWDM without requiring wavelength alignment functionality.

2-2. Variable-wavelength laser emission source
This product will be sold as a butterfly module equipped with a variable-wavelength function.

(1) Oscillation wavelength
Oscillation wavelength can be arbitrarily set in the communication wavelength band, that is, for the whole region at the C-band (1.53-1.565 μm) and for a region of about 30 nm at the L-band (1.565-1.625μm). Moreover, particular wavelengths of approximately 16 ch to a maximum 80 ch can be set with a wavelength interval of 50-200 GHz by the customized adaptation to a user application. Please consult us for your customization to any user applications.

(2) Optical output
Optical outputs of 10-13 dBm are available, depending on user specifications.

(3) High reliability
The laser emission source, which consists primarily of semiconductor components around the DFB laser for communication, does not require any complicated movable parts in the variable-wavelength mechanism or a complicated feedback circuit for stabilizing wavelengths. As a result, stable light sources can be supplied without causing wavelengths to skip during the operation of wavelength variation.

2-3 Laser emission source with oscillation wavelengths in excess of 2.0 µm
(1) Oscillation wavelength
This product has realized oscillations with wavelengths of 2.0 µm-2.1 µm. Strong light absorption by CO_2, NO_x and glucose, which are important substances in the medical and environmental fields, occurs in this wavelength band. Although light absorption by these substances is also detectable in the communication wavelength band, intensity is weak and detection is difficult. Light absorption by these substances at a wavelength of around 2.0 µm is strong, and the newly developed laser emission source with oscillation wavelengths in excess of 2.0 µm has considerably improved sensibility against these substances. For example, two-digit sensitivity improvement has been achieved for CO_2, compared with the use of the communication wavelength band. This outstanding sensitivity improvement allows real-time monitoring of CO_2 or other substances, and expected applications include use in exhaust control systems for combustion equipment such as vehicle engines.

(2) Compact size and inexpensive price
Previously, solid-state lasers were principally adopted as the light source at a 2.0 µm wavelength band. This had several weaknesses such as large equipment size and high price. NTT's new product eliminates these conventional shortcomings by radically reducing body size to 1/100th and lowering unit price to 1/5th. In addition, direct modulation on the optical output intensity is possible with semiconductor lasers, and simplified equipment configuration will allow us to develop portable-type devices in the near future.

3. Major Applications
The expected application fields for these products are shown below. (See Fig. 1 and Fig. 2 in the attached sheets.)

3-1. 2.5 Gbps direct-modulation laser emission source
(1) Intermediate-distance transmission transceivers for metro/access systems
(2) WANs (Wide Area Networks)

3-2. Variable-wavelength laser emission source
(1) Light source for the WDM communication system of core metro systems (e.g., light source for transceivers)
(2) Light source for instrumentation

3-3. Laser emission source with oscillation wavelengths in excess of 2.0 µm
(1) Helicobacter pylori sensors and blood sugar sensors (*7) in the medical field
(2) CO_2/NO_x monitoring and exhaust control systems in the environmental field

4. Release Timing
These products will be launched sequentially from March 16, 2005.

5. Prospects
We intend to improve these new products to reduce prices and raise performance, and

also endeavor to enhance the lineup of applicable wavelength bands. Furthermore, we will exploit potential seeds and create new promising markets by making the most of the Comprehensive Commercialization Functions.

The latest research results on the 2.5 Gbps direct-modulation laser emission source and the variable-wavelength laser emission source will be presented and exhibited at OFC 2005 (*8), North America's largest international convention on optical communication technologies, which will be held March 6-11 at the Anaheim Convention Center in California, the United States.

<Glossary>

*1 Gbps (Giga bit per second)
Gbps is used to count the number of information units (bits) that can be transmitted per second. Giga means one billion.

*2 Comprehensive Commercialization Functions
The special producer for commercialization will promote the research results of NTT laboratories in cooperation with NTT Group companies and other outside companies. NTT plans to promote the application of a wide range of R&D results through the Comprehensive Commercialization Functions introduced in July 2003.

*3 WDM (Wavelength Division Multiplexing)
This communication system can send a variety of information at once by transmitting on several different wavelengths simultaneously in a single communication line. Adopting the WDM without modifying existing network communication lines such as optical fibers can therefore expand the communication capacity.

*4 Optical sensors
Molecules and gases usually show a peak light absorption at particular wavelengths. Optical sensors adopt this principle to measure the concentration or temperature of a target substance by monitoring the light absorption. As the light absorption of important substances used in the medical and environmental fields, such as CO_2, NO_x and glucose, occurs around a wavelength of 2.0 μm, a light source that oscillates at this wavelength band is sought.

*5 DFB (Distributed Feedback) laser
In general, DFB lasers are laser diodes through which oscillating spectrums are shaped into a single mode (single wavelength component) by setting a fine cycling structure (diffraction grating) inside laser diode elements.

*6 CWDM (Coarse Wavelength Division Multiplexing)
CWDM refers to a transmission technology that enables sending different 4- or 8-wavelength information simultaneously in a single communication line due to the wider intervals between wavelengths.

*7 Blood sugar sensor
It is necessary to periodically measure the blood sugar level of diabetic patients, of which the number is increasing yearly in Japan. The blood sugar sensor is a priority biosensor on which our development efforts are focused. For measurements by conventional blood sugar sensors, blood is taken directly from a fingertip, thus causing patients to feel pain (invasive). To the contrary, optical blood sugar sensors do not injure a blood vessel or any other organs and can measure the blood sugar level by only applying a sensing unit onto the skin of patients (noninvasive).

*8 OFC (Optical Fiber Communication Conference and Exposition)
The annual OFC is North America's largest international optical-fiber communication technology convention. Featuring diverse conferences, many persons from around the world visit exhibitions by the world's carriers and other communication-related companies. OFC 2005 will be held March 6-11 this year in Anaheim, California.

- Attached Sheets

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