THE EVOLVING TUNEABLE OPTICS MARKET

There is an evolving market for tuneable optics/lasers supporting data centre connectivity, metropolitan connections and links to the edge, **Antony Savvas** takes a look.

Tuneable lasers offer the ability to remotely provision wavelengths, deploy all-optical switching and regeneration and provide restoration to failed optical layers. And compared to fixed-wavelength lasers that rely on an intelligent network to switch their signals to termination, tuneable lasers ensure that the criteria for switching is inherent in the wavelengths.

The tuneables market is a growing one as a result of rapidly increasing network traffic and surging bandwidth demand, driven by cloud computing, video on demand services, data analytics processing, the Internet of Things, the move to 5G mobile and the feverish building of hyperscale data centres. The "tunability" offered when easily and cost effectively adding or deleting/reducing bandwidth remotely is in turn supporting the growth of more on-demand services around the technology.

GROWING MARKET

The global tuneable laser market was valued at $10.12 billion in 2020 and is expected to reach 16.79 billion by 2026, at a compound annual growth rate (CAGR) of 8.7% over the forecast period, according to Mordor Intelligence. Those figures include the use of tuneables in not only telecoms/optical networking, but also in the manufacturing/industrial, healthcare markets and other sectors. The major players in the market include the likes of Coherent, HÜBNER, Newport Corporation, Santec, Agilent Technologies, Daylight Solutions, EMCORE, Continuum, II-VI, Fujitsu Optical Components, NEC, JDS Uniphase, NeoPhotonics, Yenista Optics, Santur, Lumentum, Thorlabs, Sacher Lasertechnik, Nexus Photonics, NKTPhotonics and Acacia Communications (recently acquired by Cisco Systems). The overlapping optical transceiver market, according to MarketsandMarkets, is expected to grow from $5.7 billion in 2020 to $9.2 billion by 2025 globally, at a CAGR of 10%.

The optical transceiver market for data centres is expected to grow at the highest CAGR, said MarketsandMarkets, due to the growth of cloud storage and increased applications around machine learning and artificial intelligence, for instance.

Optical transceivers are used in interconnect networks for connecting two or more data centres over short, medium or long distances, and also for intra-connectivity in data centres for connecting networks within facilities.

The potential value in the whole tuneable laser market is perhaps illustrated by the three-way race to acquire leading player Coherent, which began at the beginning of 2021. Lumentum, MKS Instruments and II-VI all put in bids for the company. As of mid-March 2021, the industry was still waiting to see who would win out, but at the last count Coherent was

being valued at almost $7bn, which is impressive for a player specialising in a relatively new market.

FLEXIBLE ADVANTAGES

Joe Mocerino, packet optical solutions lead at Fujitsu Network Communications, outlines why the tuneables market is growing rapidly. He says, "Tunability provides flexibility of system configuration and ease of inventory management compared to fixed wavelength lasers for reduced Opex.

"Legacy DWDM systems using fixed wavelength lasers previously had to assign a spare fixed wavelength laser in the C-band and keep it in their inventory in case of failure of an operating fixed laser."

Smart tuneable optical transceivers automatically self-tune to the correct wavelength without intervention by the host system or a field technician, simplifying operations to ensure fast system turn ups, higher performance and SLA compliance - while reducing the total cost of ownership over the life of the network.

INDUSTRY PARTNERSHIPS

To serve the needs of customers, partnerships are forming across the industry. HFR Networks and Fujitsu Network Communications, for instance, recently introduced 25G smart tuneable optics for 5G xHaul deployments. The technology is integrated with HFR's intelligent xHaul RAN transport and edge access solutions.

The offering reduces deployment and operational costs while simultaneously supporting 4G LTE, 5G and Ethernet services. "These self-tuning optical transceivers enable 5G applications, automate fast service turn-up and include full operational visibility on xHaul transport links for proactive management of active or passive remote sites," said Mocerino.

Mocerino said intelligent self-tuning optics in this market enable network operators to maximise valuable fibre capacity while saving on space and power at remote sites by using only passive components. "This is critical for operators around the world as they continue deploying additional LTE capacity in parallel with quickly ramping up new 5G services," he said.

Paul Crann, CEO at HFR Networks, confirmed, "By enabling converged 4G/5G services across RAN vendors and overcoming constraints due to limited fibre we are able to simplify operations."

The 5G space for tuneables is a particularly active one. II-VI's 25 Gbps wavelength-tuneable transceivers, for instance, meet the CPRI 10 standard for 25 Gbps front-haul links in a standard SFP28 pluggable form factor.

II-VI's Flextune embedded configuration protocol enables transceiver pairs across a given link to self-configure to a common wavelength channel. The 25 Gbps system supports an "optical budget" of up to 18 dB with a link reach of up to 15 km, said II-VI.

Matthias Berger, vice president for II-VI's coherent optics business unit, said, "This differentiated product combines a monolithically integrated indium phosphide tuneable laser and modulator with software intelligence in a standard pluggable transceiver module. It offers a vastly more cost-effective alternative to pulling fibre, with a product that's just as easy to deploy as any standard pluggable transceiver."

SERVICE PROVIDERS AT THE EDGE

Ciena says service providers in various markets are helping to expand the tuneables market as services need to be supported across different and evolving network footprints.

Patricia Bower, senior manager for portfolio marketing at Ciena, says, "There are various drivers for business and network transformation for service providers and one key trend is the need to provide real-time services at higher bandwidth and low latency closer to the user (enterprise or broadband or mobile subscriber) at the network edge."

She says, "These services will be driven by emerging applications such as IoT, edge-compute, AR/VR (augmented reality/virtual reality) and high-definition video streaming that require higher bandwidth for the best user experience."

She said network edge connectivity is currently supported by transport optics based on 10 or 25Gb/s capacities which, in turn, are based on direct detect technologies. In order to support the higher bandwidths needed for new edge services (at 100Gb/s and higher), the transport optics will migrate to coherent technology, said Bower.

"100+Gb/s coherent optics at the edge will pave the way for higher capacity over existing fibre networks, lower overall link engineering costs - through greater ease of use - and a multi-vendor ecosystem thanks to the focus on generating interoperable standards through global communications standards bodies," Bower says.

EVOLUTION

Evolving form factors to address changing markets are taking shape too. CompoundTEK and Nanyang Technological University (NTU) in Singapore are combining different technologies to address market needs.

KS Ang, chief operating officer at CompoundTek, says, "There are many ways to build a tuneable laser. What sets our technology apart is the ability to integrate with Silicon Photonics (SiPh) devices which offers low propagation loss and high integration densities. In our co-developed solution, the tuneable laser consists of a III-V gain section and a silicon-based photonic integrated circuit. It is a solid-state laser diode based on integrated optics and will be compact and resistant to environmental vibrations."

Professor Wang Hong, principal investigator for the Silicon Photonics Programme at NTU, adds, "The type of lasers we are developing will be a critical technology in transceivers and co-packaged optics. As with all technologies, miniaturisation and scalability are key. Our III-V/SiPH hybrid wavelength tuneable laser technology places us in a good position alongside future trends. Of interest to our customers is the possibility of smaller form factors without sacrificing performance and we look forward to delivering on their needs in 2023."

It is clear that a combination of more established and newer tuneable optics players is steadily moving forwards to satisfy the evolving deployment, configuration and operational management needs of telcos, service providers and data centre operators in this growing market.

Joe Mocerino, Fujitsu Network Communications

Matthias Berger, II-VI

Patricia Bower, Ciena