Bundeskartellamt

Case Summary **6 February 2020**

Bundeskartellamt clears merger between Cisco Systems and Acacia Communications following extensive investigations

Sector:	Information technology, communication networks
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On 11 November 2019 the Bundeskartellamt cleared the acquisition of Acacia Communications, Inc., Maynard (MA, USA) by Cisco Systems, Inc., San Jose (CA, USA) in the first phase of examination following extensive investigations. The merger was initially notified on 5 August 2019, but the notification was withdrawn on 3 September because the product markets and their vertical links had to be clarified. It was notified again on 11 October 2019.

Cisco Systems (hereinafter referred to as "**Cisco**") develops and distributes network products worldwide. Its customers include web scale companies, communication network operators and service providers, private companies and public sector organisations. Its product portfolio comprises in particular products for infrastructure platforms like switches and routers, applications, security solutions, cloud and system management products as well as services and support. **Acacia Communications** (hereinafter referred to as "**Acacia**") supplies optical interconnects for high-speed transmission in communication networks, i.e. semiconductor products like coherent digital signal processors ("**DSPs**"), optical semiconductors referred to as silicon photonic integrated circuits ("**PICs**") and embedded and pluggable coherent optical interconnects, so-called transceivers, into which DSPs and PICs are incorporated, to operators of cloud infrastructures, content providers and communication network operators service providers.

The **merger** has also been cleared by the Austrian competition authority and the US Department of Justice.

Based on Acacia's product portfolio the **relevant product markets** were the markets for coherent digital signal processors/DSPs and optical semiconductors/PICs and the markets for embedded and pluggable coherent optical interconnects/transceivers. However, as far as PICs are concerned, there were neither horizontal overlaps between the parties, as Cisco does not produce this kind of optical semiconductors, nor vertical links.

DSPs are used in information technology devices and the telecommunications and music industries. Their application as components in optical transceiver modules was of particular relevance in assessing the merger. DSPs are high-speed chips that process digital signals in real-time and perform repetitive high-precision numerical calculations. The third generation is currently the leading DSP technology, achieving transmission rates of 400+ GB/s. However, even if legacy DSPs for coherent optical data transmission as produced and used by Cisco in its embedded optical transceiver modules do not achieve the same bandwidth, space and energy efficiency as the DSPs produced by Acacia, the market definition should not differentiate by DSP generation because the various DSP generations for coherent optical data transmission have identical customers and applications in long-haul data transmission.

Optical transceiver modules are embedded or pluggable modules that enable network devices like switches or routers to communicate between system components or systems based on fibre optic technology via an optic network. They can basically be classified by performance/bandwidth, colour/wavelength and range in three major categories:

(1) Low-cost **static transceiver modules** are cheap, mass-produced products for a fixed bandwidth, wavelength and range and mostly used for customer routers with low performance requirements.

(2) **Direct detection ("DD") transceiver modules** are considerably more expensive and automatically detect the optimum bandwidth, wavelength and distance (<10km, thus normally used in data centres) for their application and adjust accordingly.

(3) **Coherent optical transceiver modules** are five to ten times more expensive than direct detection transceiver modules. Their data transmission rate is higher and they are more resistant to signal degradation as a result of the amplitude and phase modulation of light. However, they require complex algorithms and have a higher energy consumption compared to DD transceivers Coherent technology is used for communications within the optical transport networks, for signal transmission between data centres and for long-haul transmission from data centres to users.

The three different types of transceiver modules can therefore only be used for specific applications and are not substitutes from the customers' perspective. The transceiver markets are separated accordingly, not least because of various customer groups ranging from private companies

with small company computer centres and network operators with large backbone networks to internet service providers with large data centres. However, it is necessary to differentiate the types of transceivers also with regard to the technological progress of the coherent technology, which in the future are likely to supersede optical network components by directly joining a coherent module to a router.

Downstream **markets for optical networks** and switches/routers also had to be considered due to potential vertical implications of the merger. While Acacia is not active on these markets, Cisco has a high market share in the switches and routers market. **Switches and routers** are a combination of software and hardware devices and an essential part of telecommunication networks. They are the "nodes" of a network connecting the different network parts, in particular to exchange data packets between sub-networks. While switches are generally used to direct data traffic within a local area network, routers are used to direct data traffic between local area networks, for example between two data centres that are 10-50km apart. For this reason, routers are primarily used for wide area connectivity, both at the edge and the core of a wide area network.

The **geographic markets** had to be defined as worldwide because the relevant products are produced and distributed worldwide, transport costs and price differences are low and there are no regulatory barriers.

The merger project was **not expected to significantly impede effective competition** pursuant to Section 36(1) sentence 1 of the German Competition Act, GWB. In particular, the merger was not expected to create or strengthen a dominant market position.

Compared to its few competitors NEL, Inphi and the vertically integrated company Ciena as well as some smaller start-up companies, Acacia's **horizontal** position on the market for DSPs for coherent optical data transmission, which could even fall under the minor market clause, will not be strengthened as the merger will not lead to a gain in market share since, so far, Cisco itself has not sold the DSPs or coherent transceiver modules externally.

Any possible **vertical** competition concerns are eliminated by the large number of competitors at different market levels and customers' regular procurement of individual compatible network components from different manufacturers and their at least dual vendor strategy. Three types of market situations had to be examined:

(1) coherent DSPs and coherent optical transceiver modules
(2) coherent optical transceiver modules and optical networks and
(3) coherent optical transceiver modules and routers.

Acacia's strong position on a market for DSPs for coherent optical data transmission and possibly also on a market for coherent optical transceiver modules could have led to considerably impeded effective competition when combined with Cisco's strong position on the router market due to new opportunities and incentives for the parties to implement a foreclosure strategy.

Foreclosure of upstream services is subject to the following three conditions: Opportunity and incentive for foreclosure and appreciable negative effects on downstream competition.

While it is generally possible that competitors will no longer have access to **DSPs** as indispensable components of **coherent optical transceiver modules**, the Bundeskartellamt assesses that the parties to the merger do not have the incentive to deny them access and does not expect any negative effects on competition on the market for coherent optical transceiver modules. There are no incentives for market foreclosure because the profit margins for DSPs are high compared to coherent transceivers and because of the large number of existing competitors, including the start-ups, and vertically integrated companies as potential competitors (e.g. Huawei, Nokia, Infinera). Furthermore, there is a sufficiently large number of credible downstream competitors who would not face cost increases even if the parties were to implement a foreclosure strategy, as they are vertically integrated or can switch to equivalent alternative products. Appreciable effects on competition on the downstream market level are therefore not expected.

There is also a potential for the parties to foreclose competitors active on the market for **optical networks** from the **procurement of coherent optical transceiver modules.** However, there is no reason to assume that the parties will have an incentive to foreclose competitors or that there will be negative effects on the market for optical network products. Considering the parties' low market shares in the market for optical networks, the large number of small and large competitors on this market, alternative transceiver manufacturers and the tendency to buy components, the Bundeskartellamt sees no potential incentives for the parties to foreclose the markets for downstream companies depending on optical networks of Acacia transceiver modules. With a sufficiently large number of credible competitors on the transceiver market, the costs for competitors on the optical market are not expected to increase, since they are either vertically integrated or equivalent alternative transceivers are available.

The parties' open letters confirm their intention to continue to supply Acacia's customers with DSPs and transceiver modules and to refrain from market foreclosure.

Lastly, there is a possibility of foreclosure towards other manufacturers of routers with regard to **coherent optical transceiver modules for routers and switches** due to Acacia's technological edge, but the parties neither have an incentive to do so nor would there be negative effects on the markets for switches and routers.

As the increasingly pluggable coherent transceiver modules have not been indispensable components so far, there were doubts about whether coherent optical transceiver modules were important components of routers and switches at all, which would have been a precondition for foreclosure. The industry increasingly uses pluggable coherent transceiver modules in routers. The gradual displacement of optical network components could lead to coherent transceiver modules becoming important router components within the forecast period under merger control law.

It was also doubtful whether the parties have market power on the transceiver market, which would be a precondition for an appreciable influence on the competitive conditions in the market and thus possibly on prices and terms and conditions of supply in the downstream market. However, vertical concerns can also arise where a party to a merger is likely to grow considerably in the near future, e.g. because of recent innovations.

While Acacia's new generation of coherent optical transceivers gave reasons to assume such issues, the fact that there are competitors active on the market for coherent optical transceiver modules like Fujitsu, NeoPhotonics, Lumentum and new market entrants like Ciena and potentially Nokia and Huawei as vertically integrated suppliers contradicts this assumption. What is more, pluggable coherent transceiver modules, especially the new generation of 400 G ZR modules, will be compatible with various routers by different manufacturers due to "multi-source agreements" and standardised interfaces in future. The risk of negative effects on competition on the downstream router market thus only exists, if at all, while Acacia's developments are still ahead of its competitors. However, Acacia's edge is purely technological and not a consequence of the merger. Any short-term effects it may have on competition were not to be considered.

In the final analysis the merger was not expected to significantly impede effective competition within the meaning of Section 36(1), sentence 1 GWB.