# ADVA Optical Networking SE

Germany / Technology
Frankfurt
Bloomberg: ADV GR
ISIN: DE0005103006

Initiating Coverage

| | |
|---|---|
| **RATING** | **BUY** |
| **PRICE TARGET** | **€ 8.50** |
| Return Potential | 30.2% |
| Risk Rating | High |

## POISED TO RIDE THE EDGE NETWORKING BOOM

**The advent of the Internet of Things, 5G mobile telephony and fibre deep initiatives are ending the dominance of centralised cloud computing and driving a wave of investment at the network edge. The rise of edge networking looks set to be the most significant development in telecommunications network architecture over the next decade. By virtue of recent acquisition activity and R&D spending, ADVA is very well placed to participate in the forthcoming boom. Concerns centred on the US-China trade conflict have pushed the share roughly one third off its April high of €9.78, but we think recent tariff rises are now mostly priced in and set a price target of €8.50. Our recommendation is Buy.**

**Shift in sales mix to faster growing, higher margin edge networking businesses** We forecast a sales compound annual growth rate (CAGR) of 9.8% for ADVA over the five year period 2019-2024 driven mainly by the impact of increasing network edge investment on ADVA's carrier / NFV (network functions virtualisation) and network synchronisation technology segments (35% of 2018 sales). We believe that ADVA's margins are higher in these segments than in optical networking (65% of 2018 sales). We expect their faster growth and moderating group R&D costs following the heavy expenditure of recent years to widen ADVA's proforma operating margin from 4.0% in 2019 to 9.6% in 2024. This translates into an EPS CAGR over the same period of 41.8%.

**Prospect of market share gains following launch of FSP 3000 TeraFlex** In Q2/19 ADVA launched the latest generation of its FSP 3000 optical networking terminal - the state-of-the-art FSP 3000 TeraFlex. Management is particularly optimistic that the product will enable ADVA to regain share of the ICP (internet content provider) market. ICPs accounted for ca. 10% of ADVA's revenue in 2018 but this figure was significantly higher as recently as 2016.

### FINANCIAL HISTORY & PROJECTIONS

| | 2016 | 2017 | 2018 | 2019E | 2020E | 2021E |
|---|---|---|---|---|---|---|
| Revenue (€ m) | 566.69 | 514.47 | 501.98 | 540.38 | 591.20 | 649.19 |
| Y-o-y growth | 28.2% | -9.2% | -2.4% | 7.6% | 9.4% | 9.8% |
| EBIT (€ m) | 19.37 | 4.40 | 14.99 | 13.23 | 21.09 | 29.00 |
| EBIT margin | 3.4% | 0.9% | 3.0% | 2.4% | 3.6% | 4.5% |
| Net income (€ m) | 21.35 | -4.23 | 9.68 | 8.25 | 14.02 | 20.36 |
| EPS (diluted) (€) | 0.43 | -0.09 | 0.19 | 0.16 | 0.28 | 0.40 |
| DPS (€) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| FCF (€ m) | 7.14 | -27.44 | 12.09 | -11.30 | -0.26 | 4.36 |
| Net gearing | -8.7% | 19.4% | 13.2% | 32.4% | 32.4% | 30.2% |
| Liquid assets (€ m) | 84.87 | 58.38 | 62.65 | 54.04 | 59.12 | 64.92 |

### RISKS

Risks include but are not limited to: loss of key customers/channel partners, currency risk (particularly USD appreciation/GBP depreciation), the US-China trade conflict, price pressure from Huawei.

### COMPANY PROFILE

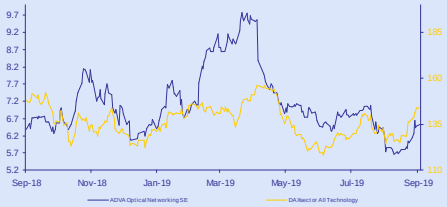
ADVA develops, manufactures, and sells optical networking solutions to deliver data, storage, voice, and video services. To date, the company's networking solutions have been deployed in more than 10,000 enterprises and more than 300 carrier networks around the world. Founded in 1994 and headquartered in Munich, Germany, ADVA had 1,917 employees at the end of June 2019.

### MARKET DATA

| | As of 9/16/2019 |
|---|---|
| Closing Price | € 6.53 |
| Shares outstanding | 50.16m |
| Market Capitalisation | € 327.56m |
| 52-week Range | € 5.66 / 9.78 |
| Avg. Volume (12 Months) | 165,107 |

| Multiples | 2018 | 2019E | 2020E |
|---|---|---|---|
| P/E | 33.9 | 40.4 | 23.7 |
| EV/Sales | 0.8 | 0.7 | 0.7 |
| EV/EBIT | 26.8 | 30.4 | 19.1 |
| Div. Yield | 0.0% | 0.0% | 0.0% |

### STOCK OVERVIEW




### COMPANY DATA

| | As of 30 Jun 2019 |
|---|---|
| Liquid Assets | € 48.28m |
| Current Assets | € 249.16m |
| Intangible Assets | € 193.09m |
| Total Assets | € 519.05m |
| Current Liabilities | € 152.05m |
| Shareholders' Equity | € 247.86m |

### SHAREHOLDERS

| | |
|---|---|
| Teleios Capital Partners GmbH | 20.2% |
| EGORA Group | 14.9% |
| Morgan Stanley | 3.9% |
| Dimensional Fund Advisors LP | 3.2% |
| Free float and other | 57.8% |

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**CONTENTS** **PAGE**

ADVA Optical Networking SE – Executive Summary ..... 1
Investment Case ..... 3
SWOT Analysis ..... 4
Valuation ..... 6
Company Profile ..... 8
*Optical networking growth drivers ..... 8*
*The Internet of Things is a key driver of investment in edge networks ..... 9*
*ADVA's addressable market and product portfolio ..... 9*
*ADVA's customers ..... 11*
Financial History and Outlook ..... 15
*P&L account 2013-H1/19 ..... 15*
*Financial position ..... 16*
*Q2/19 results ..... 16*
*Outlook ..... 17*
Management ..... 18
Shareholders & Stock Information ..... 20
Income Statement ..... 21
Balance Sheet ..... 22
Cash Flow Statement ..... 23

# INVESTMENT CASE

### ADVA IS VERY WELL PREPARED FOR THE EDGE NETWORKING BOOM

The consultant McKinsey has identified over 100 already deployed edge computing use cases across 11 sectors including travel, transportation and logistics, energy, retail, healthcare and utilities. McKinsey expects these use cases to generate USD200bn in hardware revenues by the mid-2020s. This hardware will require networking and the networks will require an operating system. ADVA has been preparing for the forthcoming boom for several years. In 2016 it acquired edge network operating system software capabilities through the acquisition of Overture Networks. In addition, in recent years it has devoted substantial R&D to NFV technology, which enables fast and flexible service implementation at the network edge. ADVA has also expanded its NFV partner programme and now claims the world's largest portfolio of these solutions.

### FSP 3000 TERAFLEX CAPACITY >50% ABOVE LEAD COMPETITOR'S PRODUCT

The new FSP 3000 TeraFlex optical networking terminal uses new fractional quadrature amplitude modulation capabilities to allow increased traffic over existing networks without additional investment. ADVA claims that the product provides 50% more capacity than the leading competitor's current product. The importance of the new TeraFlex product can be gauged from a management statement in the 2018 annual report: "The launch of our new Teraflex terminal has the potential to change market momentum in our favour."

### SALES MIX SHIFT TO EDGE NETWORKING TO DRIVE 2019-24 EPS CAGR OF 41.8%

In 2018 optical networking, carrier / NFV, and network synchronisation respectively accounted for 65%, 30% and 5% of group sales. We forecast a sales CAGR of 9.8% for ADVA over the five year period 2019-2024 driven mainly by the impact of increasing network edge investment on ADVA's carrier / NFV and network synchronisation technology segments. By 2024 we expect the faster growth of the latter two segments to shift these figures to 52%, 42% and 6% respectively. The recent launch of the FSP 3000 TeraFlex terminal notwithstanding, we believe ADVA's competitive position is stronger in the Carrier Ethernet / NFV, network synchronisation segments than in optical networking. The shift in the sales mix towards these segments as well as lower R&D costs following the heavy expenditure of recent years lead us to forecast a widening in ADVA's proforma operating profit margin from 4.0% in 2019 to 9.6% in 2024. This translates to an EPS CAGR of 41.8%.

### US-CHINA TRADE AND CURRENCY WORRIES LOOK TO BE MOSTLY PRICED IN

The ADVA share is down by roughly a third from its April high of €9.78. We think that the decline is attributable to concerns rooted in the US-China trade conflict. First, some of the inputs incorporated in products sold by ADVA in the U.S. are imported from China and have been subject to tariffs since 2018. These tariffs rose from 10% to 25% in May 2019 and management assumes that they will remain unchanged going forward. ADVA is taking steps to shift manufacturing out of China, and guidance given in the Q2 report published in July reflects the latest tariff increase. Second, ca. 75% of ADVA's cost of goods sold and 50% of its revenues are denominated in USD. So ADVA's proforma operating margin changes at one quarter of the rate of the EURUSD rate. If current FX rates are sustained until the end of 2019, the average 2019 EURUSD rate will be 5% below the 2018 figure. This implies EBIT margin compression of around 1.3 percentage points for the full year. The risk associated with this is fully hedged by derivatives which mature in 2020, but longer term currency shifts are not hedged. Third, there are worries that ADVA's competitor Huawei may respond to threatened U.S. sanctions by lowering prices. However, we expect margin lost through price pressure from Huawei to be compensated by increased business volume as Huawei loses market share. Our valuation model indicates to us that trade and currency worries are now mostly discounted by the current share price, but that the potential sales growth and margin expansion stemming from the forthcoming edge networking boom are not. Our recommendation is Buy with a price target of €8.50.

# SWOT ANALYSIS

## STRENGTHS

- **Poised to reap benefits of recent product portfolio investment** Proforma R&D cost during 2017 and 2018 was over 60% above the level of 2012 and 2013. Spending rose because ADVA invested heavily in both the development of NFV technology for edge networking and the new FSP 3000 TeraFlex optical networking terminal. The growth of the IoT, edge network densification stemming from the roll-out of 5G mobile networks, and fibre deep initiatives are leading to rising investment in edge networking solutions. The acquisition of edge networking operating systems technology with Overture Networks in 2016, recent investments in NFV technology and expansion of its NFV partner programme, mean that ADVA is well placed to profit from the coming edge networking boom.
- **Stable, seasoned management** Brian Protiva, co-founded ADVA in 1994 and has been its CEO since 2001. Three out of four of the current management board members have been with the company for over a decade. The fourth joined through the acquisition of MRV Communications in 2017.
- **The CEO's family has substantial skin in the game** The Protiva family control ADVA's second largest shareholder, the EGORA Group, which has a 14.9% stake in the company.

## WEAKNESSES

- **Small size relative to market leader** Industry consolidation has left only three optical networking specialists of significant size: ADVA, Ciena, Infinera. ADVA's 2018 sales were only one fifth of the market leader, Ciena. This is an important consideration in an industry in which size is necessary to cover high R&D costs. We calculate ADVA's average ROCE over the last five years at 7.7% compared with 14.6% for Ciena and -7.7% for Infinera.
- **Limited stickiness of ICP business** In 2017 a significant decrease in orders from a major U.S. ICP customer was mainly responsible for a 30% decline in Q3 revenues in comparison with the prior year quarter.
- **Intense price competition in CSP and ICP business** Communication Service Providers (CSPs) and ICPs currently account for approximately two thirds of ADVA's revenues. Price competition for these customers' business has historically been intense.

## OPPORTUNITIES

- **Very well placed to participate in edge network investment boom** Thanks to the acquisition of Overture Networks in 2016 and subsequent investment in NFV technology, ADVA is very well positioned for the edge network investment boom. We expect increasing investment in this area to contribute to a sales CAGR of 9.8% during 2019-2024 and a widening of the proforma gross margin from 35.4% in 2019 to 39.0% in 2024.
- **FSP 3000 TeraFlex terminal creates opportunity to gain market share with ICPs** ICPs accounted for ca. 10% of ADVA's revenues in 2018 but this figure was significantly higher as recently as 2016. Armed with the new FSP 3000 TeraFlex terminal, ADVA is aiming to rebuild its footprint with this customer group. The product has been successfully trialled by several customers and is currently in commercial ramp-up.
- **Increasing importance of information security and regionalisation** The EU's General Data Protection Regulation, which came into force in 2018, has tightened data protection requirements for all companies operating in Europe. Meanwhile, demand for regional solutions is increasing. ADVA has a large existing footprint with international data centre and network operators and as a European company is very well placed to benefit from these trends.
- **U.S. sanctions against Huawei may create opportunity for ADVA** ADVA's Chinese competitor, Huawei, has a large installed base around the world, particularly in Europe. The U.S. has threatened restrictions on the technologies U.S. companies may sell to Huawei and also pressured its allies not to use Huawei technology. This may create opportunities for ADVA, but could also, as we point out below, damage its business if Huawei responds by aggressively lowering its prices in order to maintain market share.

## THREATS

- **Escalating U.S.-China trade conflict** In 2018 the U.S. imposed a tariff of 10% on switching and routing solutions exported from China to the U.S. This tariff rose to 25% in May 2019. Since early August the USDCNY rate has crossed the psychologically important 7.00 mark. The depreciation of the Yuan has prompted fears of a round of competing currency devaluations.
- **Currency risk** ADVA has significant net cash outflows in USD. The risk associated with these exposures is fully hedged by derivatives which mature in 2020. However, longer term currency shifts are not hedged.
- **Huawei may respond to U.S. sanctions by lowering its prices** U.S. sanctions threaten Huawei with loss of market share. Huawei may respond by reducing its prices, thereby increasing competitive pressures across the optical networking market.

# VALUATION

Our valuation of ADVA is based on a discounted cash flow (DCF) model that discounts future free cash flows back to present value. Our DCF model yields a fair value of €8.5 per share.

In order to determine ADVA's cost of equity, we use a multi-factor risk model, which takes into account company-specific risk factors, such as management strength, balance sheet, financial risk, competitive position, and company size. We assume a cost of equity of 12.0%. Our calculation is based on a risk-free rate of 0.5% and a market risk premium of 5.0%.

For the cost of debt we assume an interest rate of 1.5%. With a terminal effective tax rate of 30%, the financing costs after tax are 1.05%. Our targeted capital structure assumes an equity / debt ratio of 75% / 25%. The WACC (Weighted Average Costs of Capital) thus amounts to 9.26%.

In our DCF model we distinguish three planning periods:

- We have carried out a detailed estimate for the planning period FY 2019E - FY 2024E (six years). We forecast the profit and loss account as well as the balance sheet and the cash flow statement in detail.
- For the planning period FY 2025E - FY 2035E (11 years), parameters relevant to the valuation (profit and loss account, CAPEX, working capital, amongst others) are estimated.
- For the terminal period we assume a constant growth in sales, a constant EBIT margin and a constant tax rate.

Detailed estimates for the fiscal years 2019E - 2024E are shown in the chapter "Financial History and Outlook". For the period FY 2025E - FY 2035E we assume:

- a sales growth rate declining from 7.8% to 3.0%;
- a proforma EBIT margin decreasing from 9.6% to 7.0% as edge networking market growth slows and competition intensifies;
- an effective tax rate of 30%.

For the terminal period we assume a sales growth rate of 3%, a proforma EBIT margin of 7.0% and a tax rate of 30%.

At the end of June 2019, ADVA had a net debt position of €74.3m. During the five calendar years ending 2018, options granted each year to management and employees averaged 1.4% of opening share capital each year. We have adjusted our valuation on the assumption that this share option programme continues. We assume the present value of proceeds from future option exercise is €67m and that the present value of the number of shares issued against future option exercise is 5.6m. Adjusting our valuation model for these numbers, we arrive at a valuation of €8.5 per share (see figure 1 overleaf).

## Figure 1: Valuation model

| DCF valuation model<br>All figures in EUR '000 | 2019E | 2020E | 2021E | 2022E | 2023E | 2024E | 2025E | 2026E |
|---|---|---|---|---|---|---|---|---|
| **Net sales** | **540,376** | **591,199** | **649,187** | **715,532** | **791,632** | **863,569** | **931,091** | **1,003,488** |
| **NOPLAT** | **10,797** | **17,293** | **23,371** | **34,882** | **50,454** | **62,177** | **67,039** | **72,251** |
| + depreciation & amortisation | -59,411 | -64,050 | -67,840 | -74,773 | -74,827 | -80,744 | -87,057 | -93,826 |
| Net operating cash flow | 70,209 | 81,343 | 91,211 | 109,655 | 125,280 | 142,921 | 154,096 | 166,077 |
| - total investments (CAPEX and WC) | -80,757 | -80,298 | -85,999 | -95,265 | -105,933 | -112,918 | -119,357 | -128,485 |
| Capital expenditures | -65,075 | -71,480 | -75,938 | -83,754 | -92,729 | -100,437 | -107,642 | -115,924 |
| Working capital | -15,682 | -8,818 | -10,061 | -11,511 | -13,203 | -12,481 | -11,715 | -12,561 |
| Free cash flows (FCF) | -10,549 | 1,045 | 5,211 | 14,390 | 19,348 | 30,003 | 34,739 | 37,592 |
| **PV of FCF's** | **-10,283** | **932** | **4,255** | **10,754** | **13,233** | **18,782** | **19,903** | **19,712** |

| All figures in thousands | |
|---|---|
| PV of FCFs in explicit period (2019E-2035E) | 214,985 |
| PV of FCFs in terminal period | 268,529 |
| Enterprise value (EV) | 483,514 |
| + Net cash / - net debt | -74,266 |
| + PV cash proceeds of future option exercise | 67,197 |
| Shareholder value | 476,445 |
| Current shares outstanding | 50,163 |
| + PV no shares issued against future option exercise | 5,639 |
| Proforma no shares | 55,802 |
| Fair value per share in EUR | 8.50 |

| WACC | 9.3% |
|---|---|
| Cost of equity | 12.0% |
| Pre-tax cost of debt | 1.5% |
| Tax rate | 30.0% |
| After-tax cost of debt | 1.1% |
| Share of equity capital | 75.0% |
| Share of debt capital | 25.0% |
| Fair value per share in EUR | 8.50 |

| WACC \ Terminal growth rate | 1.5% | 2.0% | 2.5% | 3.0% | 3.5% | 4.0% | 4.5% |
|---|---|---|---|---|---|---|---|
| 5.26% | 20.73 | 22.85 | 25.74 | 29.91 | 36.45 | 48.16 | 75.24 |
| 6.26% | 15.29 | 16.36 | 17.72 | 19.49 | 21.90 | 25.38 | 30.83 |
| 7.26% | 11.83 | 12.43 | 13.15 | 14.05 | 15.18 | 16.66 | 18.67 |
| 8.26% | 9.46 | 9.82 | 10.24 | 10.74 | 11.35 | 12.09 | 13.04 |
| 9.26% | 7.76 | 7.98 | 8.24 | 8.50 | 8.89 | 9.31 | 9.81 |
| 10.26% | 6.48 | 6.62 | 6.79 | 6.98 | 7.19 | 7.44 | 7.74 |
| 11.26% | 5.49 | 5.59 | 5.70 | 5.82 | 5.96 | 6.12 | 6.30 |
| 12.26% | 4.71 | 4.78 | 4.85 | 4.94 | 5.03 | 5.13 | 5.25 |

* for layout purposes the model shows numbers only to 2026, but runs until 2035

*Source: First Berlin Equity Research estimates*

Our valuation is based solely on DCF methodology, but figure 2 compares ADVA's valuation multiples with those of its two main specialist optical networking competitors, the U.S. companies Ciena and Infinera. Five year P&L summaries for all three companies are shown on page 14. Most of Ciena's multiples are above those of ADVA because its average reported EBIT margin over the past five years has been nearly twice as high as those of the German company. One significant contributor to Ciena's superior profitability is its higher revenue base (over 5x the ADVA number in 2018). Infinera reported operating losses in 2016, 2017, 2018 and H1 2019. The higher level of Infinera's EV/EBITDA multiples relative to ADVA is based on the expectation that it will return to profitability in the near term.

## Figure 2: Peer group multiple comparison

| Company | EV/sales (x) | | | EV/EBITDA (x) | | | EV/EBIT (x) | | | PER (x) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2019E | 2020E | 2021E | 2019E | 2020E | 2021E | 2019E | 2020E | 2021E | 2019E | 2020E | 2021E |
| ADVA | 0.74 | 0.68 | 0.62 | 5.53 | 4.72 | 4.15 | 30.36 | 19.05 | 13.85 | 40.38 | 23.70 | 16.33 |
| Ciena | 1.77 | 1.66 | 1.57 | 11.06 | 9.58 | 9.06 | 13.09 | 10.99 | 10.67 | 26.38 | 21.12 | 20.51 |
| Infinera | 0.93 | 0.85 | 0.78 | 73.76 | 9.91 | 8.00 | -12.95 | 62.07 | 17.29 | -4.02 | -15.58 | -71.55 |

*Source: First Berlin Equity Research estimates, Bloomberg*

# COMPANY PROFILE

ADVA (ADd VAlue) was founded in Meiningen, Germany, in 1994 at the dawn of mass adoption of the internet. During the decade to end 2018 internet traffic grew at a CAGR of 31% to 156 exabytes per month. The optical networking technology supplied by ADVA and its competitors has enabled this growth. Optical networking uses signals encoded onto light to transmit information across fibre-optic cables. Transmission capacity is multiplied by wavelength division multiplexing (WDM) which uses multiple wavelengths (colours of light). Each wavelength carries an individual signal that does not interfere with the others. The bandwidth-over-distance capabilities of fibre by far exceed those of other media such as copper or wireless technologies and so fibre-optic transport is the technology of choice for high-speed communications networks. More recently Internet traffic grew at a CAGR of 25.0% between 2013 and 2018*. This growth is set to accelerate slightly to 26.2% during the period 2018-2022* and is being driven by the increasing service demands placed on communications networks discussed below.

## OPTICAL NETWORKING GROWTH DRIVERS

**Cloud-based services** - Enterprises and consumers continue to replace locally-housed computing and storage with cloud-based models such as Software as a Service (SaaS) and Infrastructure as a Service (IaaS) and deploy cloud-based services to host key applications and store data.

**Over-the-Top (OTT) Services** - Content providers distribute streaming media directly to viewers over the public internet, bypassing telecommunications, multichannel television, and broadcast television platforms that traditionally act as a controller or distributor of such content. Netflix and Amazon Video are well-known providers of OTT Services. OTT Services are typically accessed via websites on personal computers, via apps on mobile devices (such as smartphones and tablets), through digital media players (including video game consoles), or televisions with integrated smart TV platforms.

**Mobile Devices and Applications** - The proliferation of smartphones, tablets and other wireless devices has generated expanded traffic from mobile applications. Much of this wireless traffic also travels across wireline networks emanating from cell sites.

**Network Densification** - Fifth-Generation wireless broadband technology (5G) is designed to enable significant increases in data consumption by a growing number of users and devices, thereby better supporting the IoT and other emerging applications. Densification of infrastructure will be necessary to enable 5G infrastructure, particularly at the network edge. According to the June 2019 Ericsson Mobility Report, 5G network deployments are expected to ramp up during 2020. Ericsson forecasts 1.9 billion 5G subscriptions globally by the end of 2024.This is an increase on the 1.5bn end 2024 subscriptions Ericsson predicted in its November 2018 report.

**“Fibre deep” initiatives** - These are designed to push digital fibre-based communications closer to the end-user, increasing potential bandwidth to homes and enterprises and increasing data speeds.

**Ultra-High Definition TV and Virtual and Augmented Reality** - Ultra-high definition TV and immersive technologies such as 360° video, virtual reality and augmented reality are likely to place substantial technical and capacity demands on networks as their adoption grows.

** source: Cisco Systems*

**Internet of Things** - Machine-to-machine-related traffic will account for an increasing portion of traffic as the IoT evolves. According to the June 2019 Ericsson Mobility Report, the number of IoT connections is set to rise from 8.6bn in 2018 to 22.3bn in 2024 i.e. at a CAGR of 17%. These connections generate data which can be monitored and processed to create value.

## THE INTERNET OF THINGS IS A KEY DRIVER OF INVESTMENT IN EDGE NETWORKS

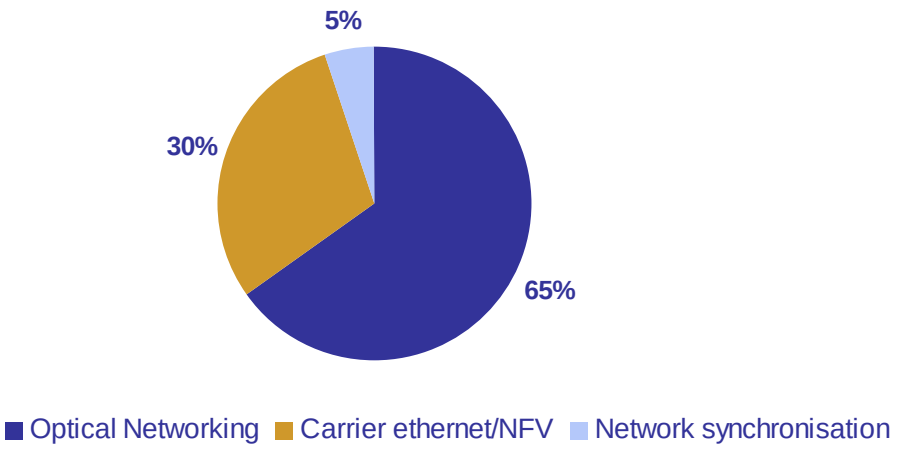
There are several reasons why the architecture of centralised cloud computing cannot fully meet IoT needs. First, IoT devices need to make real-time decisions. This process is slowed if centralised cloud computing resources have to be accessed through a series of networks. Second, the transmission of IoT data to the cloud and back heightens security risks. Third, processing of IoT data in the cloud may entail high storage and IT integration costs. For these reasons computing capacity is rising at the edge of the network. According to the consultant Gartner, around 10% of enterprise-generated data is currently processed outside a traditional data centre or cloud. Gartner expects this figure to rise to 75% by 2025. In an article published in October 2018, “New demand, new markets: What edge computing means for hardware companies”, McKinsey & Company identified over 100 already deployed edge computing use cases across 11 sectors. These sectors include travel, transportation and logistics, energy, retail, healthcare and utilities. McKinsey expects these use cases to generate USD200bn in hardware revenues by the middle of the next decade.

## ADVA’S ADDRESSABLE MARKET AND PRODUCT PORTFOLIO

Industry analysts estimated the total addressable market (TAM) for ADVA to be USD14bn in 2018 rising to USD21bn by 2023 (i.e. at a CAGR of 8.4%). ADVA’s 2018 sales total of €502m indicated that it had a ca. 4% share of its addressable market.

ADVA’s product portfolio is based on three technologies which are strategically important for the future evolution of communications networks. These are: optical networking, carrier and NFV, network synchronisation. ADVA’s 2018 sales split among these technologies as shown in figure 3 below.

**Figure 3: 2018 sales split by technology**




*Source: ADVA Optical Networking SE*

### Optical networking

As we have seen above, fibre is the optimum physical medium for the transmission of large amounts of data over long distances. ADVA supplies communications service providers (CSPs), internet content providers (ICPs) and enterprise customers. Figure 4 shows the overall TAM growth rate forecast for ADVA's Optical Networking and the growth rates forecast for its customer subsegments.

**Figure 4: Optical networking TAM by customer group**

| | CSP | ICP | Enterprise | Total |
|---|---|---|---|---|
| TAM (USD bn) | 11.6 | 1 | 0.3 | 12.9 |
| CAGR (5 year) | 4% | 17% | 4% | 5% |

*Source: Ovum*

Adva's flagship optical networking product is the FSP (fibre service platform) 3000 family. The FSP 3000 was first introduced at the turn of the millennium but has since been upgraded several times. The latest version of the product, the FSP 3000 TeraFlex, was launched in May 2019. Development of the FSP 3000 TeraFlex was a significant driver of the rise in R&D costs as a percentage of sales at ADVA during 2016-2018. The new product enables CSPs to boost capacity without major upgrades to the optical line system (OLS). Using the FSP 3000 TeraFlex, CSPs can transmit 300 Gbit/s across 50GHz metro links without upgrading the OLS and 600 Gbit/s is possible over 100 GHz grids. Today the majority of all wavelengths in metro and long haul networks use a bitrate of 100Gbit/s.

### Carrier Ethernet/NFV

The advent of the IoT, edge network densification and fibre deep initiatives are all creating increased demand for edge networking solutions. ADVA's flagship edge networking solution is the FSP 150 product family which is based on carrier technology. At the network edge the priority for carriers is not maximisation of data transmission volume, but simplification of logistical processes. NFV plays a key role in this. ADVA greatly strengthened its capability in NFV technology through the acquisition of the U.S. company, Overture Networks (2016). The rapid emergence of 5G and IoT means that CSPs will need to support a variety of new features at the edge of their networks within a short space of time. Relying on multiple purpose-built colocated hardware appliances will not allow them to move fast enough. Virtualised network functions (VNFs) are software implementations of network functions deployed on infrastructure which typically consists of industry standard high volume servers. VNF's advantages include:

- reduced equipment costs and power consumption through consolidation of equipment
- Economies of scale required to cover investments in purpose-built hardware do not apply to software-based development. This increases speed of Time to Market and means that services can be rapidly scaled up/down as required.
- opening the virtual appliance market to independent software players, encouraging more innovation and rapid development of new revenue streams at much lower risk

With regard to the last point, in February Adva announced that the multivendor NFV ecosystem surrounding its Ensemble product suite now includes 50 partners, 50 commercial VNFs and 25 white box servers. ADVA has a growing list of NFV infrastructure customer wins including Verizon, Colt, Masergy and IBM. In March ADVA announced that its Ensemble Activator (part of the Ensemble product suite) had been selected for trials with several major mobile network operators (MNOs) that are members of the Telecom Infra Project (TIP) community, including Vodafone and TIM Brasil.

Use of FSP 150 products in conjunction with the Ensemble software framework means that for the first time functions from higher network levels can be mapped onto the ADVA portfolio, thereby expanding the addressable application space for the company. The consultant Ovum estimates the TAM for ADVA's carrier ethernet/NFV business at USD1.3bn with a 2018-2023 CAGR of 18%.

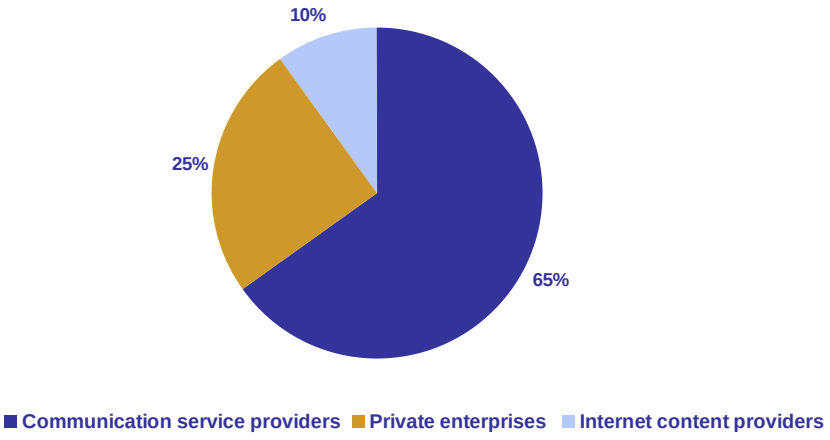
**Network synchronisation**

ADVA acquired the Swiss company Oscilloquartz in April 2014. Founded in 1949, Oscilloquartz designs, manufactures and installs precise frequency sources and synchronisation systems which are crucial to the effective transmission of digital signals for communications networks. The company's proforma full year 2014 sales were €11.4m. In 2018 it contributed 5% or ca. €25m of ADVA's total sales. This implies a CAGR in sales of 22% - substantially higher than the figure for the group as a whole over the same period. ADVA's synchronisation solutions portfolio is used by many of the world's leading network operators and management claims that it is technologically ahead of the competition. We also believe that it is the most profitable part of the group. The strategic importance of the business is likely to increase as the rollout of 5G technology will require much more precise time and frequency synchronisation throughout the network. We assume a sales CAGR of 15% for ADVA's network synchronisation business over the next five years.

## ADVA'S CUSTOMERS

2018 sales split by three main customer groups: communication service providers, private enterprises, internet content providers as shown in figure 5 below.

**Figure 5: 2018 sales split by customer group**




*Source: ADVA Optical Networking SE*

**Communication service providers** ADVA's communication service provider (CSP) clients include 17 of the top 25 global CSPs as well as 5 of the top 6 global (the dominant optical networking data link protocol) service providers. Clients include both fixed line and wireless service providers as well as multiservice (cable) operators. This customer group is characterised by long sales cycles, high volume and longevity of relationships (stickiness). Selected ADVA CSP customers are shown in figure 6 below.

**Figure 6: Selected ADVA CSP customers**


*Source: ADVA Optical Networking SE*

**Private enterprises** The private enterprise customer group includes 30 of the world's top 50 banks as well as research, education and healthcare institutions, and media and utility companies. ADVA's most important business with this customer group is the provision of data centre interconnect (DCI) infrastructure. Project volume tends to be limited but the strategic importance of data centres requires premium quality and generates customer loyalty and trust.

**Figure 7: Selected ADVA private enterprise customers**

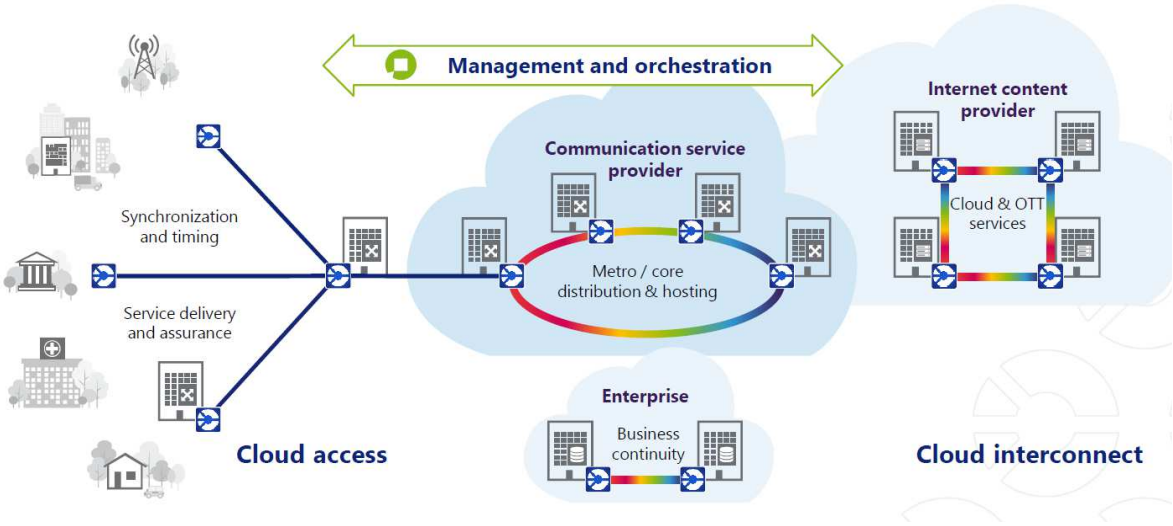

*Source: ADVA Optical Networking SE*

**Internet content providers** Four of the top five global internet content providers are ADVA customers. ADVA's DCI business has won substantial orders from hyperscale ICPs in recent years. This customer group offers volume and growth potential but pricing is aggressive and business is also characterised by limited visibility and stickiness. In 2017 a significant decrease in orders from a major U.S. ICP customer was partly responsible for a 30% decline in Q3 revenues in comparison with the prior year quarter. In previous years the revenue contribution from ICPs was significantly higher than the 2018 figure of 10%.

**Figure 8: Selected ADVA ICP customers**


*Source: ADVA Optical Networking SE*

**Figure 9: Overview of ADVA's offering by technology and customer group**




*Source: ADVA Optical Networking SE*

Figure 10 below shows the development of ADVA's sales by geographic region over the past five years. Figure 10 documents the boom in ADVA's sales in 2015 (+30.3%) and 2016 (+28.2%). ADVA's sales grew significantly faster than the market during this period mainly because of orders from a large U.S. ICP. The near doubling of Asia Pacific's share of sales between 2017 and 2018 was a function of the August 2017 acquisition of the Californian company MRV Communications Inc. (2016 sales: USD80.3m) with a strong customer base in this region. In 2017 and 2018 sales in the Americas fell by 19.8% and 14.4% respectively due in large measure to a reduction in spending on ADVA equipment by the U.S. ICP and lower investment by Level 3 Communications following its merger with CenturyLink.

**Figure 10: Sales by geographic region**

| € 000's | FY 13 | FY 14 | FY 15 | FY 16 | FY 17 | FY 18 |
|---|---|---|---|---|---|---|
| **Revenue** | **310,702** | **339,168** | **441,938** | **566,686** | **514,471** | **501,981** |
| ***change (%)*** | ***-5.9%*** | ***9.2%*** | ***30.3%*** | ***28.2%*** | ***-9.2%*** | ***-2.4%*** |
| **Revenue by geographic region** | | | | | | |
| Europe, Middle East and Africa | 205,162 | 203,413 | 262,420 | 251,626 | 257,747 | 249,191 |
| *change (%)* | *n.a.* | *-0.9%* | *29.0%* | *-4.1%* | *2.4%* | *-3.3%* |
| Americas | 88,325 | 110,203 | 143,937 | 279,637 | 224,362 | 192,087 |
| *change (%)* | *n.a.* | *24.8%* | *30.6%* | *94.3%* | *-19.8%* | *-14.4%* |
| Asia Pacific | 17,215 | 25,552 | 35,581 | 35,423 | 32,262 | 60,703 |
| *change (%)* | *n.a.* | *48.4%* | *39.2%* | *-0.4%* | *-8.9%* | *88.2%* |
| | | | | | | |
| ***Revenue split by geographic region*** | | | | | | |
| Europe, Middle East and Africa | *66.0%* | *60.0%* | *59.4%* | *44.4%* | *50.1%* | *49.6%* |
| Americas | *28.4%* | *32.5%* | *32.6%* | *49.3%* | *43.6%* | *38.3%* |
| Asia Pacific | *5.5%* | *7.5%* | *8.1%* | *6.3%* | *6.3%* | *12.1%* |

*Source: ADVA Optical Networking SE*

### Consolidation of the optical networking business

The optical networking business has seen a wave of consolidation in recent years. Companies unable to bear the R&D expenditure necessary to remain competitive have been absorbed by the more profitable players. In 2015 Ciena bought Cyan. In 2014 Tellabs' packet optical and mobile backhaul businesses were integrated with Coriant. In 2015 Infinera acquired Transmode and three years later Coriant. As mentioned above, ADVA acquired MRV in 2017. Other former players such as Ericsson and Juniper have discontinued in-house optical networking operations.

Industry consolidation means that there are only three optical networking specialists of significant size left:- ADVA, Ciena and Infinera. As figure 11 below shows, Ciena's 2018

sales were ca. 5x higher than ADVA while its trailing five-year average return on capital employed (ROCE) at 14.6% is almost twice ADVA's figure of 7.7%. Infinera meanwhile is struggling to survive in its current form. Its trailing five-year average ROCE is -7.7%.

**Figure 11: Comparison of ADVA, Ciena and Infinera 2014-2018**

| ADVA (€ 000's)<br>Year to 31.12. | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|
| Revenue | 339,168 | 441,938 | 566,686 | 514,471 | 501,981 |
| Change (%) | 9.2% | 30.3% | 28.2% | -9.2% | -2.4% |
| Gross profit | 118,076 | 156,911 | 166,289 | 166,220 | 181,728 |
| margin (%) | 34.8% | 35.5% | 29.3% | 32.3% | 36.2% |
| EBIT | 8,352 | 26,755 | 19,367 | 4,403 | 14,989 |
| margin (%) | 2.5% | 6.1% | 3.4% | 0.9% | 3.0% |
| ROCE | 6.0% | 16.5% | 9.4% | 1.7% | 5.1% |

| Ciena (USD 000's)<br>Year to 31.10. | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|
| Revenue | 2,288,289 | 2,445,669 | 2,600,573 | 2,801,687 | 3,094,286 |
| Change (%) | 9.9% | 6.9% | 6.3% | 7.7% | 10.4% |
| split by geographic region: | | | | | |
| North America | 64.6% | 65.4% | 65.0% | 62.0% | 61.0% |
| EMEA | 18.2% | 16.4% | 15.1% | 14.4% | 15.0% |
| Central and Latin America | 9.3% | 8.2% | 7.5% | 5.9% | 4.5% |
| Asia Pacific | 7.9% | 10.0% | 12.4% | 17.7% | 19.5% |
| Gross profit | 948,352 | 1,075,563 | 1,161,576 | 1,245,786 | 1,314,690 |
| margin (%) | 41.4% | 44.0% | 44.7% | 44.5% | 42.5% |
| EBIT | 45,704 | 199,448 | 156,169 | 214,772 | 229,946 |
| margin (%) | 2.0% | 8.2% | 6.0% | 7.7% | 7.4% |
| ROCE | 6.9% | 24.4% | 16.1% | 13.8% | 11.8% |

| Infinera (USD 000's)<br>Year to 31.12. | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|
| Revenue | 668,079 | 886,714 | 870,135 | 740,739 | 943,379 |
| Change (%) | 22.8% | 32.7% | -1.9% | -14.9% | 27.4% |
| split by geographic region | | | | | |
| United States | 71.3% | 67.9% | 62.3% | 57.9% | 50.5% |
| Other Americas | 5.1% | 7.3% | 4.6% | 2.7% | 4.7% |
| EMEA | 19.8% | 19.7% | 28.0% | 31.7% | 32.9% |
| Asia Pacific | 3.8% | 5.1% | 5.1% | 7.7% | 11.9% |
| Gross profit | 288,304 | 403,477 | 393,718 | 244,000 | 321,156 |
| margin (%) | 43.2% | 45.5% | 45.2% | 32.9% | 34.0% |
| EBIT | 27,342 | 59,736 | -25,774 | -183,087 | -185,679 |
| margin (%) | 4.1% | 6.7% | -3.0% | -24.7% | -19.7% |
| ROCE | 11.1% | 13.5% | -4.3% | -32.8% | -25.8% |

*Source: Companies*

ADVA is also subject to competition from the multi-technology giants: Cisco, Huawei and Nokia, who also have optical networking businesses.

# FINANCIAL HISTORY AND OUTLOOK

## P&L ACCOUNT 2013-H1/19

ADVA's reported P&L numbers include amortisation of intangible assets arising from acquisitions, stock compensation programme expenses and restructuring expenses. These costs are allocated among the various P&L items. As these costs fluctuate more strongly than other P&L items, ADVA publishes a proforma P&L excluding them. The company also publishes a reconciliation between the proforma and the reported numbers. Figure 12 shows ADVA's proforma P&L from 2014 to end H1/19 as well as the proforma/reported EBIT reconcilation.

**Figure 12: Full ADVA P&L and reconciliation between proforma and reported EBIT**

| € 000's | FY 14 | FY 15 | FY 16 | FY 17 | Q1 18 | Q2 18 | H1 18 | FY 18 | Q1 19 | Q2 19A | H1 19 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Revenue** | **339,168** | **441,938** | **566,686** | **514,471** | **120,538** | **123,752** | **244,290** | **501,981** | **128,160** | **133,216** | **261,376** |
| ***change (%)*** | ***9.2%*** | ***30.3%*** | ***28.2%*** | ***-9.2%*** | ***-15.0%*** | ***-14.2%*** | ***-14.6%*** | ***-2.4%*** | ***6.3%*** | ***7.6%*** | ***7.0%*** |
| **Revenue by geographic region** | | | | | | | | | | | |
| Europe, Middle East and Africa | 203,413 | 262,420 | 251,626 | 257,747 | 64,700 | 57,100 | 121,800 | 249,191 | 68,300 | 71,400 | 139,700 |
| *change (%)* | *-0.9%* | *29.0%* | *-4.1%* | *2.4%* | *-9.1%* | *-16.5%* | *-12.8%* | *-3.3%* | 5.6% | 25.0% | 14.7% |
| Americas | 110,203 | 143,937 | 279,637 | 224,362 | 41,300 | 51,900 | 93,200 | 192,087 | 48,300 | 52,100 | 100,400 |
| *change (%)* | *24.8%* | *30.6%* | *94.3%* | *-19.8%* | *-34.2%* | *-26.5%* | *-30.1%* | *-14.4%* | 16.9% | 0.4% | 7.7% |
| Asia Pacific | 25,552 | 35,581 | 35,423 | 32,262 | 14,600 | 14,700 | 29,300 | 60,703 | 11,600 | 9,700 | 21,300 |
| *change (%)* | *48.4%* | *39.2%* | *-0.4%* | *-8.9%* | *87.2%* | *182.7%* | *125.4%* | *88.2%* | -20.5% | -34.0% | -27.3% |
| Proforma gross profit | 118,760 | 157,417 | 168,525 | 174,377 | 44,263 | 45,389 | 89,652 | 185,621 | 45,132 | 46,513 | 91,645 |
| *margin (%)* | *35.0%* | *35.6%* | *29.7%* | *33.9%* | *36.7%* | *36.7%* | *36.7%* | *37.0%* | *35.2%* | *34.9%* | *35.1%* |
| Proforma sales & marketing costs | -48,003 | -55,296 | -58,969 | -60,513 | -15,348 | -15,375 | -30,723 | -61,010 | -16,589 | -17,407 | -33,996 |
| *% revenue* | *-14.2%* | *-12.5%* | *-10.4%* | *-11.8%* | *-12.7%* | *-12.4%* | *-12.6%* | *-12.2%* | *-12.9%* | *-13.1%* | *-13.0%* |
| Proforma general & admin. costs | -27,151 | -30,114 | -31,974 | -33,998 | -8,853 | -9,414 | -18,267 | -34,494 | -8,617 | -8,661 | -17,278 |
| *% revenue* | *-8.0%* | *-6.8%* | *-5.6%* | *-6.6%* | *-7.3%* | *-7.6%* | *-7.5%* | *-6.9%* | *-6.7%* | *-6.5%* | *-6.6%* |
| Proforma R&D costs | -67,461 | -78,493 | -99,261 | -105,746 | -27,882 | -26,420 | -54,302 | -107,165 | -29,886 | -29,011 | -58,897 |
| *% revenue* | *-19.9%* | *-17.8%* | *-17.5%* | *-20.6%* | *-23.1%* | *-21.3%* | *-22.2%* | *-21.3%* | *-23.3%* | *-21.8%* | *-22.5%* |
| Capitalisation of development expenses | 27,108 | 32,071 | 39,282 | 39,033 | 7,973 | 7,865 | 15,838 | 31,872 | 11,472 | 11,085 | 22,557 |
| *% revenue* | *8.0%* | *7.3%* | *6.9%* | *7.6%* | *6.6%* | *6.4%* | *6.5%* | *6.3%* | *9.0%* | *8.3%* | *8.6%* |
| Other operating income and expenses | 6,214 | 4,392 | 5,812 | 6,369 | 2,086 | 4,100 | 6,186 | 8,442 | 1,236 | 1,818 | 3,054 |
| *% revenue* | *1.8%* | *1.0%* | *1.0%* | *1.2%* | *1.7%* | *3.3%* | *2.5%* | *1.7%* | *1.0%* | *1.4%* | *1.2%* |
| **Proforma operating income** | **9,467** | **29,977** | **23,415** | **19,522** | **2,239** | **6,145** | **8,384** | **23,266** | **2,748** | **4,337** | **7,085** |
| ***margin (%)*** | ***2.8%*** | ***6.8%*** | ***4.1%*** | ***3.8%*** | ***1.9%*** | ***5.0%*** | ***3.4%*** | ***4.6%*** | ***2.1%*** | ***3.3%*** | ***2.7%*** |
| Amort. of intang. assets from acquisitions | -733 | -346 | -2,997 | -4,426 | -1,347 | -1,373 | -2,720 | -5,526 | -1,415 | -1,409 | -2,824 |
| *% revenue* | *-0.2%* | *-0.1%* | *-0.5%* | *-0.9%* | *-1.1%* | *-1.1%* | *-1.1%* | *-1.1%* | *-1.1%* | *-1.1%* | *-1.1%* |
| Stock compensation expenses | -382 | -2,876 | -1,051 | -1,259 | -348 | -354 | -702 | -1,413 | -465 | -431 | -896 |
| *% revenue* | *-0.1%* | *-0.7%* | *-0.2%* | *-0.2%* | *-0.3%* | *-0.3%* | *-0.3%* | *-0.3%* | *-0.4%* | *-0.3%* | *-0.3%* |
| Restructuring expenses | 0 | 0 | 0 | -9,434 | -968 | -331 | -1,299 | -1,338 | 0 | 0 | 0 |
| *% revenue* | *0.0%* | *0.0%* | *0.0%* | *-1.8%* | *-0.8%* | *-0.3%* | *-0.5%* | *-0.3%* | *0.0%* | *0.0%* | *0.0%* |
| **Reported EBIT** | **8,352** | **26,755** | **19,367** | **4,403** | **-424** | **4,087** | **3,663** | **14,989** | **868** | **2,497** | **3,365** |
| ***margin (%)*** | ***2.5%*** | ***6.1%*** | ***3.4%*** | ***0.9%*** | ***-0.4%*** | ***3.3%*** | ***1.5%*** | ***3.0%*** | ***0.7%*** | ***1.9%*** | ***1.3%*** |

*Source: ADVA Optical Networking SE*

ADVA's operating profitability is impacted by variations in regional revenue distribution, product and customer mix as well as by the EURUSD exchange rate because ADVA buys a large proportion of the components used in its products in US Dollars. During 2016 ADVA's gross margin narrowed due to aggressive pricing of older technology for a large U.S. ICP. In recent years the weakening EURUSD exchange rate has also exerted pressure on profitability. In 2013 EURUSD averaged 1.33 but only 1.18 in 2018. The H1/19 figure was 1.13.

## FINANCIAL POSITION

**Figure 13: Key cashflow and balance sheet data 2014-H1/19**

| € 000s | 2014 | 2015 | 2016 | 2017 | 2018 | H1 2019 |
|---|---|---|---|---|---|---|
| Total cashflow from operations | 46,186 | 39,415 | 61,350 | 27,134 | 60,360 | 28,330 |
| Consideration for acquisitions | -3,009 | 0 | -42,114 | -57,879 | 0 | 0 |
| Other cashflow from investing | -35,733 | -41,311 | -44,259 | -32,659 | -48,061 | -30,153 |
| Total cashflow from investing | -38,742 | -41,311 | -86,373 | -90,538 | -48,061 | -30,153 |
| Cashflow before financing | 7,444 | -1,896 | -25,023 | -63,404 | 12,299 | -1,823 |
| | | | | | | |
| Cash and cash equivalents | 83,877 | 93,850 | 84,871 | 58,376 | 62,652 | 48,275 |
| Short term financial liabilities | 7,293 | 18,220 | 18,648 | 79,061 | 19,400 | 19,264 |
| Short term leasing liabilities | 9 | 0 | 0 | 0 | 0 | 5,347 |
| Long term financial liabilities | 27,690 | 24,449 | 40,717 | 17,500 | 70,084 | 60,879 |
| Pension liabilities | 5,684 | 4,048 | 4,705 | 5,822 | 5,531 | 6,149 |
| Long term leasing liabilities | 0 | 0 | 0 | 0 | 0 | 30,902 |
| Net debt (cash) | -43,201 | -47,133 | -20,801 | 44,007 | 32,363 | 74,266 |
| | | | | | | |
| Consolidated equity | 177,114 | 215,921 | 238,947 | 227,021 | 244,641 | 247,861 |
| Net gearing | -24.4% | -21.8% | -8.7% | 19.4% | 13.2% | 30.0% |

*Source: ADVA Optical Networking SE*

Figure 13 shows the development in ADVA's financial position from end 2014 to end June 2019. The two major acquisitions made during this period were Overture Networks in 2016 (consideration: €42.1m) and MRV in 2017 (consideration: €57.9m). The balance sheet moved from a net cash to a net debt position in 2017 as ADVA took out a short term bridging loan of €55m to finance the MRV acquisition. In 2018 ADVA refinanced this loan with a syndicated loan of €65m with a total maturity of five years. At end 2018 the average interest rate on financial liabilities was 1.4% to 1.5%. Reported net debt jumped by over €40m to €74.3m in H1/19 because of the inclusion on the balance sheet of leasing liabilities under IFRS16.

## Q2/19 RESULTS

Q2/19 results showed a 7.6% rise in sales to €133.2m (Q2/18: €123.8m). However, the proforma gross margin narrowed to 34.9% (Q2/18: 36.7%). EMEA sales growth at 25.0% was clearly higher than sales growth in the Americas of 0.4%. The link between faster sales growth in Europe and higher gross margin was thus broken in Q2/19. The strength of the US Dollar, additional costs due to rising tariffs in consequence of the trade conflict between the U.S. and China, as well as an adverse shift in the product mix contributed to this. ADVA buys a large proportion of the components used in its products in US Dollars. The 5.8% decline in the average EURUSD exchange rate in Q2/19 vs. Q2/18 thus raised cost of goods sold. During the analysts' conference call following the Q2/19 results management quantified the impacts of EURUSD weakness and tariffs in the quarter at €0.5m and €0.3-€0.4m respectively. Their combined impact was thus 0.6-0.7% of sales. Proforma EBIT (excluding depreciation on intangible assets from acquisitions, employee stock compensation programme expenses and restructuring charges) came in at €4.3m (Q2/18: €6.2m) equivalent to a margin of 3.3% (Q2/18: 5.0%). The results were in line with guidance given at the time of the Q1 results in April, which was for sales of €130-€140m and a proforma EBIT margin of 2-5%. Full year guidance for an upper single-digit increase in revenues, an increase in proforma EBIT at a margin in the mid single-digit range is unchanged on the Q1 report. However, in the Q1 report the company lowered EBIT guidance in comparison with the annual report (published in February) from an increase in the EBIT margin to an absolute rise in EBIT.

## OUTLOOK

### Figure 14: P&L forecast to 2024

| € 000's | 2018 | 2019E | 2020E | 2021E | 2022E | 2023E | 2024E | 2019-24 CAGR |
|---|---|---|---|---|---|---|---|---|
| **Revenue** | **501,981** | **540,376** | **591,199** | **649,187** | **715,532** | **791,632** | **863,569** | **9.8%** |
| *% change* | *-2.4%* | *7.6%* | *9.4%* | *9.8%* | *10.2%* | *10.6%* | *9.1%* | |
| of which: | | | | | | | | |
| Optical networking | 326,288 | 351,244 | 368,834 | 387,729 | 408,083 | 430,076 | 449,196 | **5.0%** |
| *% change* | *n.a.* | *7.6%* | *5.0%* | *5.1%* | *5.2%* | *5.4%* | *4.4%* | |
| *% revenue* | *65.0%* | *65.0%* | *62.4%* | *59.7%* | *57.0%* | *54.3%* | *52.0%* | |
| Carrier ethernet/NFV | 150,594 | 162,113 | 191,293 | 225,726 | 266,357 | 314,301 | 361,446 | **17.4%** |
| *% change* | *n.a.* | *7.6%* | *18.0%* | *18.0%* | *18.0%* | *18.0%* | *15.0%* | |
| *% revenue* | *30.0%* | *30.0%* | *32.4%* | *34.8%* | *37.2%* | *39.7%* | *41.9%* | |
| Network synchronisation | 25,099 | 27,019 | 31,072 | 35,732 | 41,092 | 47,256 | 52,927 | **14.4%** |
| *% change* | *n.a.* | *7.6%* | *15.0%* | *15.0%* | *15.0%* | *15.0%* | *12.0%* | |
| *% revenue* | *5.0%* | *5.0%* | *5.3%* | *5.5%* | *5.7%* | *6.0%* | *6.1%* | |
| | | | | | | | | |
| **Proforma gross profit** | **185,621** | **191,023** | **211,649** | **236,953** | **268,324** | **300,820** | **336,792** | |
| *margin (%)* | *37.0%* | *35.4%* | *35.8%* | *36.5%* | *37.5%* | *38.0%* | *39.0%* | |
| Proforma sales & marketing expenses | -61,010 | -68,151 | -74,491 | -81,798 | -90,157 | -99,746 | -108,810 | |
| *margin (%)* | *-12.2%* | *-12.6%* | *-12.6%* | *-12.6%* | *-12.6%* | *-12.6%* | *-12.6%* | |
| Proforma G&A expenses | -34,494 | -34,990 | -38,428 | -42,197 | -46,510 | -51,456 | -56,132 | |
| *margin (%)* | *-6.9%* | *-6.5%* | *-6.5%* | *-6.5%* | *-6.5%* | *-6.5%* | *-6.5%* | |
| Proforma R&D expense | -107,165 | -115,372 | -122,969 | -131,136 | -139,529 | -150,410 | -164,078 | |
| *margin (%)* | *-21.3%* | *-21.4%* | *-20.8%* | *-20.2%* | *-19.5%* | *-19.0%* | *-19.0%* | |
| Income from capitalisation of development expenses | 31,872 | 42,762 | 46,705 | 48,689 | 53,665 | 59,372 | 64,768 | |
| *margin (%)* | *6.3%* | *7.9%* | *7.9%* | *7.5%* | *7.5%* | *7.5%* | *7.5%* | |
| Net other operating income and expense | 8,442 | 6,402 | 7,094 | 7,790 | 8,586 | 9,500 | 10,363 | |
| *margin (%)* | *1.7%* | *1.2%* | *1.2%* | *1.2%* | *1.2%* | *1.2%* | *1.2%* | |
| **Proforma operating income** | **23,266** | **21,674** | **29,560** | **38,302** | **54,380** | **68,080** | **82,903** | |
| *margin (%)* | *4.6%* | *4.0%* | *5.0%* | *5.9%* | *7.6%* | *8.6%* | *9.6%* | |
| Amortisation of intangible assets and goodwill | -5,526 | -5,644 | -6,503 | -7,141 | -7,871 | -809 | 0 | |
| Stock compensation expenses | -1,413 | -1,796 | -1,965 | -2,158 | -2,378 | -2,631 | -2,870 | |
| Restructuring expenses | -1,338 | -1,000 | 0 | 0 | 0 | 0 | 0 | |
| **Reported operating income** | **14,989** | **13,234** | **21,092** | **29,003** | **44,131** | **64,640** | **80,032** | **43.3%** |
| *margin (%)* | *3.0%* | *2.4%* | *3.6%* | *4.5%* | *6.2%* | *8.2%* | *9.3%* | |

*Source: First Berlin Equity Research estimates, ADVA Optical Networking SE*

As figure 14 shows, we forecast a sales CAGR of 9.8% for ADVA over the five year period 2019-2024 driven mainly by the impact of increasing network edge investment on ADVA's carrier/NFV and network synchronisation technology segments. Optical networking, Carrier Ethernet/NFV, network synchronisation respectively accounted for 65%, 30% and 5% of group sales in 2018. By 2024 we expect the faster growth of the latter two technology business segments to shift these figures to 52%, 42% and 6%.

Adva has created a leading position for itself within the Carrier Ethernet/NFV space through the integration of Overture Networks since 2016 and subsequent R&D spending on this technology. Indeed, the company claims the industry's most comprehensive NFV partner programme with more than 50 members and over 100 components. Meanwhile, within the synchronisation space, we gather that ADVA is gaining market share from its main competitor, the Microchip subsidiary Symmetricom. We believe that going forward the profitability of both these segments will be higher than for Optical Networking.

Given that we expect the product mix to shift towards more profitable businesses, we forecast a rise in ADVA's proforma gross margin from 35.4% in 2019 to 39% by 2024. Proforma R&D costs climbed from the 17-18% range in 2015 and 2016 to 22.5% during H1/19. The increase was a function of the R&D integration of the Overture acquisition, heavy R&D spending on NFV technology and development of the latest generation of the FSP 3000 technology, the FSP 3000 TeraFlex. Given that the investment in NFV technology has been made to accommodate a once-in-a decade shift in networking architecture, and that the FSP 3000 Teraflex has just been introduced, we think it reasonable to assume a decline in proforma R&D costs to below 20% of sales over the next few years. These are the drivers of our forecast increase in the proforma operating margin from 4.0% in 2019 to 9.6% in 2024.

# MANAGEMENT

### CEO

Brian Protiva (born 1964) co-founded ADVA in 1994 and has been CEO since 2001. Prior to ADVA Mr Protiva was Managing Director at AMS Technologies (now the EGORA Group), which he joined in 1987 and where he focused on co-managing its subsidiaries. Mr. Protiva is currently also Chairman of INNOBASE AG, Munich, Germany and a Member of the Board at AMS Technologies AG, Munich, Germany. Mr Protiva holds a B.S. in electrical engineering from Stanford University.

### CFO

Ulrich Dopfer (born 1973) joined ADVA in March 2004 after working in financial management positions at ESCADA AG and FJH AG. Prior to his appointment as CFO in 2015, he was vice president of financial planning & analysis and corporate services. Mr Dopfer is also president of the company's North American subsidiary with full legal responsibilities for the region. He is a Graduate in Business Administration from the Verwaltungs- und Wirtschaftsakademie Munich, Germany.

### Chief Technology Officer (CTO)

Dr. Christoph Glingener (born 1968) joined ADVA in 2006 and was appointed CTO the following year. He has responsibility for all global research and development activities at sites in Europe, the United States, China and, more recently, the Middle East. Dr Glingener also leads ADVA's product management and advanced technology teams and has focused on streamlining the product portfolio, defining the product strategy and building the company's standing as an innovator in optical networking. Strategic partnerships and mergers & acquisitions are part of this strategy. Before joining ADVA, Dr Glingener held leading positions at Marconi Communications (now Ericsson) and Siemens Communications (now Coriant). He holds a Ph.D. in Electrical Engineering from the University of Dortmund, Germany.

### Chief Marketing and Sales Officer (CMSO)

Scott St. John (born 1969) joined ADVA in 2017 as part of the acquisition of MRV Communications, and was appointed CMSO and a member of the management board. At MRV Mr St. John was SVP of global sales and service, re-structuring the sales and service teams and driving adoption of new packet and optical platforms by over 175 customers globally. From 2004 to 2013, he held senior sales and service leadership roles at Overture Networks (acquired by ADVA in 2016). He has also held sales leadership positions at Saisei, Larscom and VINA Technologies, as well as sales, marketing and finance roles at Lucent Technologies and AT&T. Mr St. John holds a Bachelor of Arts degree in Economics from Syracuse University, USA.

## Supervisory Board

### Chairman

Nikos Theodosopoulos (born 1962) has been Chairman of the Supervisory Board since January 2015. He is the managing member of NT Advisors LLC, a consulting firm for the technology industry. Prior to founding NT Advisors LLC in September of 2012, Mr Theodosopoulos was an equity research analyst for 18 years, covering the technology sector, primarily at UBS Investment Bank. As an equity research analyst, Institutional Investor Magazine selected him to the All-American Research Team in 15 different years. Mr Theodosopoulos was also the global technology strategist and the head of US technology sector research at UBS Investment Bank. Prior to his career on Wall Street, he spent 10 years at AT&T Network Systems and Bell Laboratories. He holds an MBA from New York University, a master of science from Stanford University and a bachelor of science from Columbia University. Mr Theodosopoulos also serves as a member of the Columbia Engineering Entrepreneurship Advisory Board.

### Vice Chairwoman

Professor Johanna Hey (born 1970) has been Vice Chairwoman of the Supervisory Board since June 2013. Professor Hey is head of the Institute for Tax Law at the University of Cologne and belongs to several committees, including the Scientific Advisory Board of the Federal Ministry of Finance. Since the end of 2002, she has held the chair of corporate law at the Heinrich Heine University in Düsseldorf. In October 2006, she became director of the Institute of Tax Law at the University of Cologne. From 2004 to 2012, Johanna was a member of the committee and first VP of the German Association of University Professors. Since 2006, she has been a member of the Scientific Advisory Board of the Federal Ministry of Finance. In 2010, she was announced scientific head of the Berlin Finance and Taxation Institute and, in the same year, was elected to the Permanent Deputation of the Association of German Jurists. From 2011 to 2016, she was head of the Scientific Advisory Board of German Tax Lawyers and since 2011 has been a member of the Scientific Advisory Board of the Centre for European Economic Research (ZEW). Between 2015 and 2018 Professor Hey was a member of the Global Faculty of the New York University Law School.

### Member of the Supervisory Board

Michael Aquino (born 1956) has been a Member of the Supervisory Board since June 2018. Prior to joining the Supervisory Board Mr Aquino was Chief Strategy Officer of ADVA. Before that, he was president, CEO, and board member of Overture Networks (acquired by ADVA in 2016). Mr Aquino has extensive global market experience with communications service provider (wireline, wireless, MSO, content) and enterprise market segments (government, research & education, financial services, healthcare). He has also worked with global and regional integrators and VARs to drive solutions into those various market segments. He spent 11 years working for Ciena, initially starting their enterprise and government business, and developing it into a material portion of their revenue stream.

# SHAREHOLDERS & STOCK INFORMATION

| Stock Information | |
|---|---|
| ISIN | DE0005103006 |
| WKN | 510300 |
| Bloomberg ticker | ADV GR |
| No. of issued shares | 50,162,966 |
| Transparency Standard | Prime Standard |
| Country | Germany |
| Sector | Technology |
| Subsector | Communications Technology |

*Source: Börse Frankfurt, First Berlin Equity Research*

| Shareholder Structure | |
|---|---|
| Teleios Capital Partners GmbH | 20.2% |
| EGORA Group | 14.9% |
| Morgan Stanley | 3.9% |
| Dimensional Fund Advisors LP | 3.2% |
| Free float and other | 57.8% |

*Source: ADVA Optical Networking SE*

# INCOME STATEMENT

| All figures in EUR '000 | 2016A | 2017A | 2018A | 2019E | 2020E | 2021E |
|---|---|---|---|---|---|---|
| **Revenues** | **566,686** | **514,471** | **501,981** | **540,376** | **591,199** | **649,187** |
| Cost of goods sold | -400,397 | -348,251 | -320,253 | -353,045 | -383,799 | -416,900 |
| **Gross profit** | **166,289** | **166,220** | **181,728** | **187,331** | **207,400** | **232,287** |
| Sales and marketing expenses | -60,014 | -62,889 | -63,569 | -70,844 | -77,555 | -85,163 |
| General and administrative expenses | -32,252 | -36,260 | -35,024 | -35,357 | -38,829 | -42,638 |
| Research and development expenses | -60,468 | -69,037 | -76,588 | -73,298 | -77,017 | -83,273 |
| Net other operating income | 5,812 | 6,369 | 8,442 | 5,402 | 7,094 | 7,790 |
| **Operating income (EBIT)** | **19,367** | **4,403** | **14,989** | **13,234** | **21,092** | **29,003** |
| Net interest income/(expense) | -60 | -785 | -1,408 | -2,486 | -1,740 | -1,137 |
| Other financial gains and losses,net | -292 | -3,809 | -1,096 | 740 | 0 | 0 |
| **Pre-tax income (EBT)** | 19,015 | -191 | 12,485 | 11,488 | 19,351 | 27,866 |
| Income taxes | 2,517 | -4,037 | -2,807 | -3,235 | -5,329 | -7,506 |
| Minority interests | 0 | 0 | 0 | 0 | 0 | 0 |
| **Net income / loss** | 21,352 | -4,228 | 9,678 | 8,253 | 14,022 | 20,360 |
| **Diluted EPS (in €)** | 0.43 | -0.09 | 0.19 | 0.16 | 0.28 | 0.40 |
| | | | | | | |
| **EBITDA** | **58,942** | **51,267** | **64,356** | **72,645** | **85,142** | **96,843** |
| | | | | | | |
| **Ratios** | | | | | | |
| Gross margin | 29.3% | 32.3% | 36.2% | 34.7% | 35.1% | 35.8% |
| EBITDA margin on revenues | 10.4% | 10.0% | 12.8% | 13.4% | 14.4% | 14.9% |
| EBIT margin on revenues | 3.4% | 0.9% | 3.0% | 2.4% | 3.6% | 4.5% |
| Net margin on revenues | 3.8% | -0.8% | 1.9% | 1.5% | 2.4% | 3.1% |
| Tax rate | 13.2% | 2113.6% | -22.5% | -28.2% | -27.5% | -26.9% |
| **Expenses as % of revenues** | | | | | | |
| Sales and marketing expenses | 10.6% | 12.2% | 12.7% | 13.1% | 13.1% | 13.1% |
| General and administrative expenses | 5.7% | 7.0% | 7.0% | 6.5% | 6.6% | 6.6% |
| Research and development expenses | 10.7% | 13.4% | 15.3% | 13.6% | 13.0% | 12.8% |
| **Y-Y Growth** | | | | | | |
| Revenues | 28.2% | -9.2% | -2.4% | 7.6% | 9.4% | 9.8% |
| Operating income | -27.6% | -77.3% | 240.4% | -11.7% | 59.4% | 37.5% |
| Net income/ loss | -20.5% | n.m. | n.m. | -14.7% | 69.9% | 45.2% |

# BALANCE SHEET

| All figures in EUR '000 | 2016A | 2017A | 2018A | 2019E | 2020E | 2021E |
|---|---|---|---|---|---|---|
| **Assets** | | | | | | |
| **Current assets, total** | **268,361** | **232,639** | **257,216** | **264,784** | **289,687** | **318,102** |
| Cash and cash equivalents | 84,871 | 58,376 | 62,652 | 54,038 | 59,120 | 64,919 |
| Receivables | 78,474 | 81,327 | 97,936 | 105,373 | 115,284 | 126,591 |
| Contract assets | 0 | 0 | 320 | 270 | 296 | 325 |
| Inventories | 92,800 | 81,694 | 85,734 | 92,404 | 101,095 | 111,011 |
| Tax assets | 1,474 | 1,438 | 1,675 | 2,432 | 2,660 | 2,921 |
| Other current assets | 10,742 | 9,804 | 8,899 | 10,267 | 11,233 | 12,335 |
| **Non-current assets, total** | **176,191** | **231,249** | **229,322** | **272,214** | **284,238** | **297,461** |
| Right of use assets | 0 | 0 | 0 | 36,300 | 39,828 | 43,734 |
| Property, plant & equipment | 25,126 | 26,898 | 29,052 | 31,342 | 34,290 | 37,653 |
| Goodwill | 41,538 | 68,036 | 70,400 | 71,240 | 72,080 | 72,920 |
| Capitalised development projects | 76,263 | 85,175 | 87,926 | 99,346 | 111,761 | 122,798 |
| Intangible assets from acquistions | 14,284 | 30,505 | 26,012 | 20,368 | 13,865 | 6,724 |
| Other intangible assets | 2,145 | 6,280 | 5,512 | 2,270 | 0 | 0 |
| Deferred tax assets | 12,659 | 10,614 | 7,315 | 8,106 | 8,868 | 9,738 |
| Other non-current assets | 4,176 | 3,741 | 3,105 | 3,242 | 3,547 | 3,895 |
| **Total assets** | **444,552** | **463,888** | **486,538** | **536,998** | **573,925** | **615,562** |
| **Shareholders' equity & debt** | | | | | | |
| **Current liabilities, total** | **141,526** | **188,985** | **145,576** | **159,322** | **175,382** | **192,494** |
| Lease liabilities | 0 | 0 | 0 | 5,300 | 5,912 | 6,492 |
| Financial liabilities | 18,648 | 79,061 | 19,400 | 19,833 | 20,865 | 21,033 |
| Accounts payable | 73,290 | 39,193 | 63,195 | 68,087 | 74,491 | 81,798 |
| Advance payments received | 352 | 93 | 0 | 0 | 0 | 0 |
| Current provisions | 11,789 | 21,994 | 15,005 | 21,790 | 25,635 | 29,938 |
| Tax liabilities | 2,957 | 6,446 | 5,067 | 5,404 | 5,912 | 6,492 |
| Contract liabilities | 0 | 0 | 14,061 | 15,131 | 16,554 | 18,177 |
| Refund liabilities | 0 | 0 | 511 | 1,081 | 1,182 | 1,298 |
| Deferred revenues | 11,347 | 15,062 | 0 | 0 | 0 | 0 |
| Other current liabilities | 23,143 | 27,136 | 28,337 | 22,696 | 24,830 | 27,266 |
| **Long-term liabilities, total** | **64,079** | **47,882** | **96,321** | **130,750** | **140,034** | **146,982** |
| Lease liabilities | 0 | 0 | 0 | 31,000 | 33,916 | 37,242 |
| Financial liabilities | 40,717 | 17,500 | 70,084 | 71,650 | 75,376 | 75,982 |
| Provisions for pensions | 4,705 | 5,822 | 5,531 | 6,214 | 6,799 | 7,466 |
| Other provisions | 1,507 | 1,478 | 1,453 | 1,621 | 1,774 | 1,948 |
| Deferred tax liabilities | 6,916 | 12,502 | 10,828 | 12,429 | 13,598 | 14,931 |
| Contract liabilities | 0 | 0 | 6,469 | 6,485 | 7,094 | 7,790 |
| Deferred revenues | 6,971 | 7,402 | 0 | 0 | 0 | 0 |
| Other non-current liabilities | 3,263 | 3,178 | 1,956 | 1,351 | 1,478 | 1,623 |
| **Shareholders' equity** | **238,947** | **227,021** | **244,641** | **246,927** | **258,510** | **276,086** |
| **Total consolidated equity and debt** | **444,552** | **463,888** | **486,538** | **536,998** | **573,925** | **615,562** |
| **Ratios** | | | | | | |
| Current ratio (x) | 1.90 | 1.23 | 1.77 | 1.66 | 1.65 | 1.65 |
| Quick ratio (x) | 1.24 | 0.80 | 1.18 | 1.08 | 1.08 | 1.08 |
| Net debt | -20,801 | 44,007 | 32,363 | 79,960 | 83,748 | 83,296 |
| Net gearing | -8.7% | 19.4% | 13.2% | 32.4% | 32.4% | 30.2% |
| Book value per share (in €) | 4.83 | 4.56 | 4.90 | 4.92 | 5.15 | 5.50 |
| Return on equity (ROE) | 9.4% | -1.8% | 4.1% | 3.4% | 5.5% | 7.6% |

# CASH FLOW STATEMENT

| All figures in EUR '000 | 2016A | 2017A | 2018A | 2019E | 2020E | 2021E |
|---|---|---|---|---|---|---|
| **Income before tax** | **19,015** | **-191** | **12,485** | **11,488** | **19,351** | **27,866** |
| Depreciation and amortisation | 39,575 | 46,864 | 49,367 | 59,411 | 64,050 | 67,840 |
| Changes in working capital | 2,571 | -16,551 | -2,207 | -15,682 | -8,818 | -10,061 |
| Income tax paid | -599 | -1,666 | -2,351 | -3,235 | -5,329 | -7,506 |
| Other adjustments | 788 | -1,322 | 3,066 | 1,796 | 1,965 | 2,158 |
| **Operating cash flow** | **61,350** | **27,134** | **60,360** | **53,778** | **71,220** | **80,297** |
| Investments in PP&E | -12,889 | -10,559 | -14,029 | -21,473 | -23,935 | -26,409 |
| Investments in intangibles | -41,325 | -44,014 | -34,239 | -43,602 | -47,545 | -49,529 |
| **Free cash flow** | **7,136** | **-27,439** | **12,092** | **-11,297** | **-260** | **4,358** |
| Acquisitions & disposals, net | -32,509 | -36,213 | 0 | 0 | 0 | 0 |
| Other | 350 | 248 | 207 | 0 | 0 | 0 |
| **Investment cash flow** | **-86,373** | **-90,538** | **-48,061** | **-65,075** | **-71,480** | **-75,938** |
| Debt financing, net | 16,676 | 37,184 | -7,083 | 2,683 | 5,342 | 1,440 |
| Equity financing, exercise of stock options | 421 | 1,029 | 810 | 0 | 0 | 0 |
| Dividends paid | 0 | 0 | 0 | 0 | 0 | 0 |
| Other | -1,318 | -1,291 | -1,953 | 0 | 0 | 0 |
| **Financing cash flow** | **15,779** | **36,922** | **-8,226** | **2,683** | **5,342** | **1,440** |
| FOREX & other effects | 265 | -13 | 203 | 0 | 0 | 0 |
| **Net cash flows** | **-8,979** | **-26,495** | **4,276** | **-8,614** | **5,082** | **5,799** |
| Cash, start of the year | 93,850 | 84,871 | 58,376 | 62,652 | 54,038 | 59,120 |
| **Cash, end of the year** | **84,871** | **58,376** | **62,652** | **54,038** | **59,120** | **64,919** |
| **EBITDA/share (in €)** | **1.18** | **1.02** | **1.28** | **1.42** | **1.67** | **1.90** |
| | | | | | | |
| **Y-Y Growth** | | | | | | |
| Operating cash flow | 55.7% | -55.8% | 122.5% | -10.9% | 32.4% | 12.7% |
| Free cash flow | n.m. | n.m. | n.m. | n.m. | n.m. | n.m. |
| EBITDA/share | -10.8% | -13.2% | 25.4% | 11.1% | 17.5% | 13.7% |

## FIRST BERLIN RECOMMENDATION & PRICE TARGET HISTORY

| Report No.: | Date of publication | Previous day closing price | Recommendation | Price target |
|---|---|---|---|---|
| Initial Report | Today | € 6.53 | Buy | € 8.50 |

**Authored by: Simon Scholes, Analyst**

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**Person responsible for forwarding or distributing this financial analysis: Martin Bailey**



### INFORMATION PURSUANT TO SECTION 34B OF THE GERMAN SECURITIES TRADING ACT [WPHG], TO REGULATION (EU) NO 596/2014 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL OF APRIL 16, 2014, ON MARKET ABUSE (MARKET ABUSE REGULATION) AND TO THE GERMAN ORDINANCE ON THE ANALYSIS OF FINANCIAL INSTRUMENTS [FINANV]

First Berlin Equity Research GmbH (hereinafter referred to as: "First Berlin") prepares financial analyses while taking the relevant regulatory provisions, in particular the German Securities Trading Act [WpHG], Regulation (EU) No 596/2014 of the European Parliament and of the Council of April 16, 2014, on market abuse (market abuse regulation) and the German Ordinance on the Analysis of Financial Instruments [FinAnV] into consideration. In the following First Berlin provides investors with information about the statutory provisions that are to be observed in the preparation of financial analyses.

### CONFLICTS OF INTEREST

In accordance with Section 34b Paragraph 1 of the German Securities Trading Act [WpHG] and Regulation (EU) No 596/2014 of the European Parliament and of the Council of April 16, 2014, on market abuse (market abuse regulation) financial analyses may only be passed on or publicly distributed if circumstances or relations which may cause conflicts of interest among the authors, the legal entities responsible for such preparation or companies associated with them are disclosed along with the financial analysis.

First Berlin offers a range of services that go beyond the preparation of financial analyses. Although First Berlin strives to avoid conflicts of interest wherever possible, First Berlin may maintain the following relations with the analysed company, which in particular may constitute a potential conflict of interest (further information and data may be provided on request):

- The author, First Berlin, or a company associated with First Berlin holds an interest of more than five percent in the share capital of the analysed company;
- The author, First Berlin, or a company associated with First Berlin provided investment banking or consulting services for the analysed company within the past twelve months for which remuneration was or was to be paid;
- The author, First Berlin, or a company associated with First Berlin reached an agreement with the analysed company for preparation of a financial analysis for which remuneration is owed;
- The author, First Berlin, or a company associated with First Berlin has other significant financial interests in the analysed company;

First Berlin F.S.B. Investment-Beratungsgesellschaft mbH (hereafter FBIB), a company of the First Berlin Group, holds a stake of under 0.1% of the shares in the company which has been covered in this analysis. The analyst is not subject to any restrictions with regard to his recommendation and is therefore independent, so that we believe there is no conflict of interest.

In order to avoid and, if necessary, manage possible conflicts of interest both the author of the financial analysis and First Berlin shall be obliged to neither hold nor in any way trade the securities of the company analyzed. The remuneration of the author of the financial analysis stands in no direct or indirect connection with the recommendations or opinions represented in the financial analysis. Furthermore, the remuneration of the author of the financial analysis is neither coupled directly to financial transactions nor to stock exchange trading volume or asset management fees.

If despite these measures one or more of the aforementioned conflicts of interest cannot be avoided on the part of the author or First Berlin, then reference shall be made to such conflict of interest.

### INFORMATION PURSUANT TO SECTION 64 OF THE GERMAN SECURITIES TRADING ACT [WPHG] (2ND FIMANOG) OF 23 JUNE 2017, DIRECTIVE 2014/65/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL OF 15 MAY 2014 ON MARKETS IN FINANCIAL INSTRUMENTS AND AMENDING DIRECTIVE 2002/92/EC AND DIRECTIVE 2011/61/EU, ACCOMPANIED BY THE MARKETS IN FINANCIAL INSTRUMENTS REGULATION (MIFIR, REG. EU NO. 600/2014)

First Berlin notes that is has concluded a contract with the issuer to prepare financial analyses and is paid for that by the issuer. First Berlin makes the financial analysis simultaneously available for all interested security financial services companies. First Berlin thus believes that it fulfils the requirements of section 64 WpHG for minor non-monetary benefits.

### PRICE TARGET DATES

Unless otherwise indicated, current prices refer to the closing prices of the previous trading day.

### AGREEMENT WITH THE ANALYSED COMPANY AND MAINTENANCE OF OBJECTIVITY

The present financial analysis is based on the author's own knowledge and research. The author prepared this study without any direct or indirect influence exerted on the part of the analysed company. Parts of the financial analysis were possibly provided to the analysed company prior to publication in order to avoid inaccuracies in the representation of facts. However, no substantial changes were made at the request of the analysed company following any such provision.

## ASSET VALUATION SYSTEM

First Berlin's system for asset valuation is divided into an asset recommendation and a risk assessment.

### ASSET RECOMMENDATION

The recommendations determined in accordance with the share price trend anticipated by First Berlin in the respectively indicated investment period are as follows:

| Category | | 1 | 2 |
|---|---|---|---|
| Current market capitalisation (in €) | | 0 - 2 billion | > 2 billion |
| Strong Buy[1] | An expected favourable price trend of: | > 50% | > 30% |
| Buy | An expected favourable price trend of: | > 25% | > 15% |
| Add | An expected favourable price trend of: | 0% to 25% | 0% to 15% |
| Reduce | An expected negative price trend of: | 0% to -15% | 0% to -10% |
| Sell | An expected negative price trend of: | < -15% | < -10% |

*[1] The expected price trend is in combination with sizable confidence in the quality and forecast security of management.*

Our recommendation system places each company into one of two market capitalisation categories. Category 1 companies have a market capitalisation of €0 – €2 billion, and Category 2 companies have a market capitalisation of > €2 billion. The expected return thresholds underlying our recommendation system are lower for Category 2 companies than for Category 1 companies. This reflects the generally lower level of risk associated with higher market capitalisation companies.

### RISK ASSESSMENT

The First Berlin categories for risk assessment are low, average, high and speculative. They are determined by ten factors: Corporate governance, quality of earnings, management strength, balance sheet and financial risk, competitive position, standard of financial disclosure, regulatory and political uncertainty, strength of brandname, market capitalisation and free float. These risk factors are incorporated into the First Berlin valuation models and are thus included in the target prices. First Berlin customers may request the models.

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