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U-BLOX HOLDING SA

Les Diablons

Sector:	Technology	Stock Exchange:	SIX Swiss	Valuation Date:	29/11/2019
Industry:	Semiconductor	Ticker:	UBXN	Analysts:	Les Diablons
Share Price:	CHF 91	Downside:	35%	Recommendation:	SELL
Target Price:	CHF 59				

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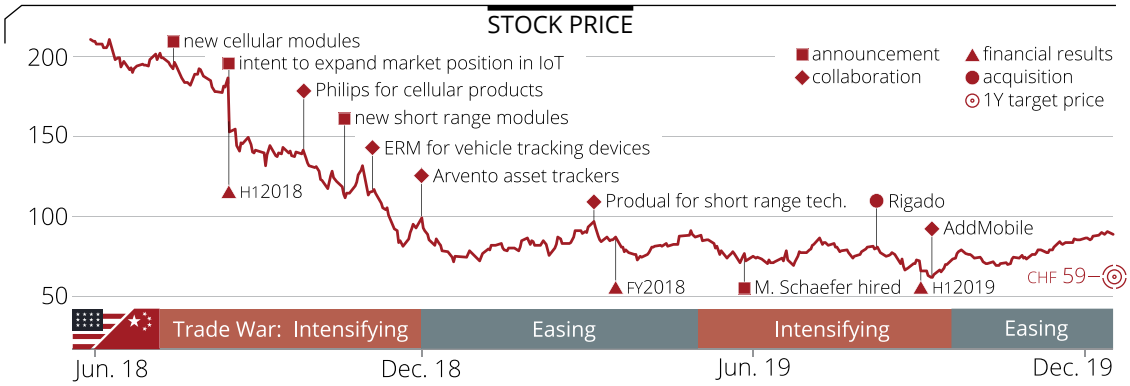


ISIN	CH003361673
REVENUE (CHF)	393M
FOUNDED	1997
HEADQUARTER	Thalwil, CH
CEO	Thomas Seiler
MSCI ESG SCORE	A
EMPLOYEES	1020

From technology leaders to technology bleeders

We issue a **SELL** recommendation for u-blox. The target price of CHF 59, representing a downside of 35%, is based on a DCF and multiples valuation weighted 75%/25%. We believe that the recent guidance misses and negative growth of u-blox are not results of a temporary setback, but of larger structural changes in the industry that will continue to frustrate u-blox for years to come. While management's outlook for 2023 revenues is CHF 700-800M (~14% CAGR), we are expecting CHF 555M (7% CAGR). Our negative outlook is driven by the following factors:

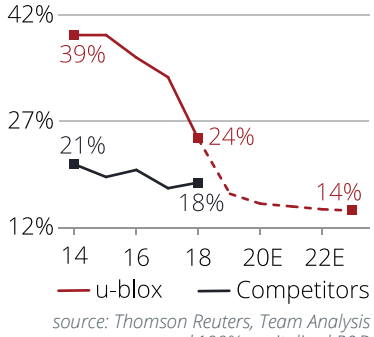
The R&D machine is consuming all the free cash flow in sight - With Average Sales Price (ASP) declines of 10% per year on existing products *(ref 1)*, u-blox will suffer a negative price effect on revenue of CHF 223M (40% of 2023 revenue) over the next 5 years. To combat this, u-blox is obliged to constantly release new generation products to enjoy a positive mix effect on revenue of CHF 374M (67% of 2023 revenue) ***(fig 34)***. With its recent pivot from the Blue Ocean Global Navigation Satellite System (GNSS) module market into the Red Ocean cellular and short-range module markets, u-blox will be forced to compete in an intensifying R&D arms race, spending CHF 611M on R&D over the next 5 years. Increased competition not only means more R&D, but also pressure on gross margins with a contraction from 45% to 41.4% expected in the next 5 years ***(fig 2)***. With lower gross margins, u-blox must sell higher volumes of each product to recover development costs, pushing more projects into negative NPV territory.

Gambling on risky products that have no market yet - After missing their own guidance 4 years in a row, u-blox management is taking increasingly risky bets on technologies that are 5-10 years ahead of their markets. Nobody disputes that the F9 GNSS chipset released in April 2018 is excellent technology, but it is unclear whether customers outside of small niche markets are willing to pay 10x more for centimeter level precision. With the V2X chipset that u-blox released in June 2018, management is envisioning a futuristic universe where all of the cars on the road wirelessly communicate with each other, road signs, and traffic lights. Management claims that these products are designed for autonomous driving, which might be coming, but with 2-3 year development cycles, current generation technology will be obsolete before this market materializes. In another risky macro-bet, this time on Internet of Things (IoT), u-blox released the UBX-R5 NB-IoT chipset in June 2019. Given that global cellular networks by and large do not yet support this technology, we expect this product to have a negative NPV of CHF 12.6M. With development costs of USD 20-35M per chip *(ref 1)*, shareholders are out of pocket some USD 90M for these 3 chips with no major sales in sight. These bad investments have driven Return on Invested Capital (ROIC) from 39% in 2014 to 24% in 2018, and we expect it to fall to 14% by 2023 ***(fig 1)***.

Critical markets are under siege - To quote Martin Friedl, a semiconductor researcher at the Swiss Federal Institute of Technology in Lausanne (EPFL): *"In this industry the Chinese are known for producing 80% of the quality at 50% of the price, and it is easy to imagine that they will soon produce 100% of the quality at 50% of the price." (ref 2)*. After the announcement of the *"Made in China 2025"* plan in 2015, Chinese semiconductor firms identified u-blox's primary markets as the ideal basecamp for their ultimate ascent up to the markets of the American semiconductor giants, due to the relative simplicity of u-blox's products. With state funded R&D, these firms are coming in with gross margins that are half that of u-blox (21.8% vs. 45%) and aggressively taking market share. With 25% of u-blox's 2018 sales coming from China, a quarter of its customers will be among the first to jump ship.

KEY FIGURES	
SHARES OUT.	6.94M
MARKET CAP (CHF)	633M
52 WEEK RANGE (CHF)	61.3 - 96.3
BETA	1.44
WACC	7.8%
DIVIDEND YIELD	1.7%
P/E RATIO	28.3
FREE FLOAT	96.3%
1Y AVG. DAILY VOLUME	44.7K
VALUATION - TARGET PRICE	
DCF - 75% (CHF)	58
MULTIPLES - 25% (CHF)	63
MAJOR SHAREHOLDERS	
BAILLIE GIFFORD & CO.	5.7%
CRÉDIT SUISSE FUND	5.3%
CRÉDIT SUISSE IB	5.1%

FIG 1 ADJ.* ROIC



source: Thomson Reuters, Team Analysis
*100% capitalized R&D

FIG 2 KEY FINANCIALS

	2018	2019E	2020E	2021E	2022E	2023E
REVENUE (CHF M)	393	379	417	465	514	555
REVENUE GROWTH (%)	-2.6	-3.7	10.2	11.4	10.6	8.0
R&D SPENDING (CHF M)	109.8	113.5	117.9	123.4	127.7	128.3
GROSS MARGIN (%)	45.0	44.6	44.0	43.4	42.5	41.4
EBITDA MARGIN (%)	18.2	14.7	15.6	15.9	16.0	15.9
DEBT TO ASSET (%)	26.2	24.1	23.6	23.0	22.5	21.9
EPS (CHF)	5.6	1.6	1.8	1.8	2.0	2.3

source: Company Data, Team Analysis

Business Description

History shows limited success outside niche GNSS markets - In 1997 u-blox was founded as a lab spinoff from ETH Zurich, one of the world's top engineering and technology schools. The company got its start from a contract with the Swiss government to provide GPS tracking modules for the heavy vehicle road pricing system. Over the next 12 years u-blox organically grew its GNSS business into a leading position in the automotive market, and some niche markets with an overall market share of 63% ***(fig 3, 26)***. In 2009 u-blox started an acquisition strategy to buy its way into the cellular module market with the EUR 9.3M acquisition of Neonseven, and in 2014 it expanded its acquisition strategy to short range wireless technologies with the USD 28M acquisition of connectBlue, and the EUR 5.2M acquisition of Antcor *(app 5)*. To date u-blox has not been able to replicate its GNSS success in the cellular and short-range module markets, where they have market shares of 21% and less than 2% respectively ***(fig 4, 27)***. Both of these markets are larger in size than GNSS, but much more competitive.

Leading edge innovation strategy turning more and more bleeding edge - With intangible assets comprising 59% of non-cash assets, Intellectual Property (IP) is a primary concern to u-blox investors. Indeed, analysis of intangibles uncovers big concerns: 65% of u-blox R&D assets are currently in cellular and short-range segments which produce only 39% of revenue and 27% of gross profit ***(fig 5)***. u-blox does not extensively use patents to protect its IP. Its strategy is instead to keep ahead of copiers with constant innovation in product design, but design IP is only valuable for 2-3 years before the products become obsolete. u-blox is currently trying to break the ice by investing in the early stage tech before the markets are in place, however with only CHF 633M in market cap and 2018 free cash flow of negative CHF 25M, u-blox does not have adequate size or cash flow to successfully pursue this strategy ***(fig 44)***. Given the 2-3 year R&D cycles of these products *(app 25)*, recently released products will be obsolete before markets arrive, and better capitalized competitors such as Broadcom (USD 125B market capitalization) or Qualcomm (USD 100B market capitalization) will swoop in and grab market share after u-blox has bled itself dry developing these markets.

Fabless model allows little differentiation from competitors and limits control of COGS - u-blox does not manufacture its products, which is normal for modern semiconductor companies. Leading semiconductor manufacturers TSMC (Taiwan) and GlobalFoundries (Singapore) are u-blox's primary suppliers for silicon wafer processing (17% of module COGS), and AMKOR (Philippines) is the preferred chip packager (3% of module COGS) ***(fig 13, 14)***. Finished chips are then sent to Flextronics in Austria for assembly into modules (77% of module COGS). Flextronics provides full-service inventory management and order fulfillment to u-blox *(app 10)*. This model is highly concentrated and does not allow u-blox much opportunity to improve COGS which is 55% of revenue, however it does eliminate manufacturing fixed costs, is low risk, is scalable, and enables u-blox to focus on product innovation *(app 18)*.

Headquartered in the world's most expensive engineering labour market - u-blox conducts most central R&D activities at headquarters in a suburb of Zurich, where ~300 of its total ~700 engineers are stationed. The next biggest R&D center is in Finland, where most cellular R&D is done. The 28 other offices across 18 countries serve mainly as sales and support offices, or ancillary product development centers resulting from acquisitions *(app 5, 6)*. Concentrating R&D activities in Switzerland, the world's most expensive engineering labour market where even new grad engineers demand a salary of USD 79K, means that with a global median salary of USD 42.5K, competitors are able to hire two engineers for the money that u-blox pays one ***(fig 6)***. Making matters worse, significant local competition for top talent from Google and IBM who both have European headquarters in Zurich, and restrictive immigration policies reduce management's ability to respond to business cycles by adjusting workforce *(app 19)*. Indeed, when asked why costs continued to rise while revenues declined in 2018, CFO Jud stated that their talent pool is very specialized, and if they let them go they will not get them back *(ref 1)*.

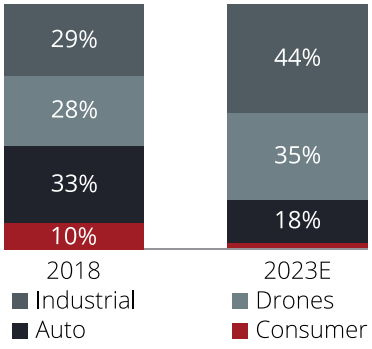
¼ of revenues in grave danger from formidable new Chinese competitors - u-blox has roughly equal split of revenues with 32% Americas, 33% EMEA, and 35% APAC with 25% from China ***(fig 7)***. We expect this split to change by 2023 to 38% Americas, 41% EMEA, and 21% APAC driven by formidable new Chinese competitors who have been taking substantial market share in APAC. With 6,700 customers, management claims strong diversification of revenue streams, however having 25% of their eggs in the China basket given the uncertainty in the Chinese semiconductor market is worrying. Indeed, switching costs are moderate as customers can easily change suppliers when designing new products *(app 18)*.

Corporate Governance

One co-founder and one long-standing director recently exited the company - In 2019 Dr. Paul Van Iseghem and Dr. Gerhard Tröster (co-founder) retired from the board of directors, and Daniel Ammann (co-founder) left the executive committee. Dr. Van Iseghem and Dr. Trösters' retirements were expected given their ages, and Mr. Ammann started a new venture in the consulting industry.

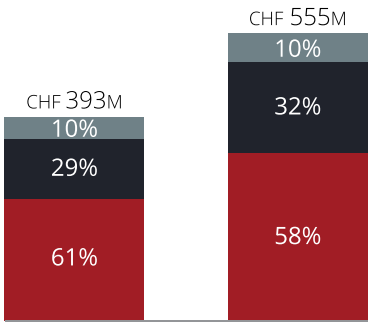
Skilled executive committee might be prone to tech enthusiasm - The executive committee comprises highly skilled professionals, however is heavy on electrical engineers ***(fig 10)*** *(app 11)*. It is easy to imagine that this executive committee is prone to tech enthusiasm, which would explain why strategy is focused on developing interesting new technologies before markets are ready. In 2018, u-blox CEO compensation was 20% lower than the average for Swiss small cap counterparts (CHF 1.1M vs. 1.4M) due to a smaller bonus resulting from u-blox's poor revenue growth and EBIT margin performance (-2.6% and 12.3% respectively), while the compensation of the other executives was in line with counterparts (CHF 0.7M vs. 0.7M) *(app 12)*.

FIG 3 REVENUE BY MARKET



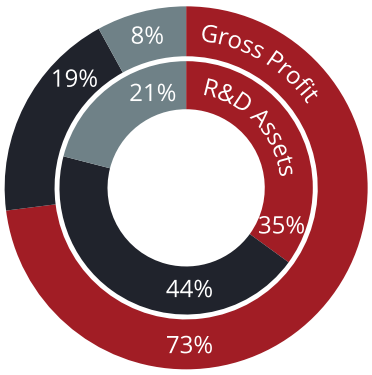
source: Company Data, Team Analysis

FIG 4 REVENUE BY SEGMENT



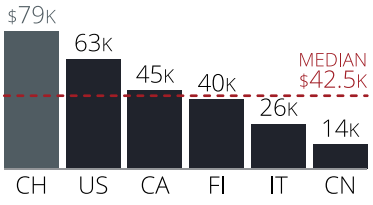
source: Company Data, Team Analysis

FIG 5 R&D ASSETS VS PROFIT



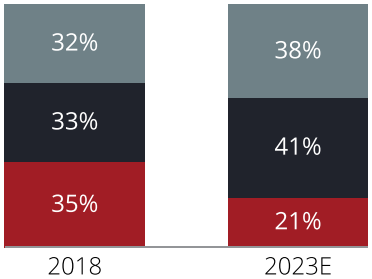
source: Company Data, Team Analysis

FIG 6 JR. ENGINEER SALARY



source: Universum

FIG 7 REGIONAL REVENUE



source: Company Data, Team Analysis

Only outsiders on the board seem quite busy - The 7 member board has two new members starting from April 2019, following the exit of Dr. Van Iseghem and Dr. Tröster: Annette Rinck and Markus Borchert *(app 13)*. These two new directors and Ms. Domanig are the only ones that are not engineers from ETH, making the three of them the only real outsiders. These outsiders are however quite busy, as Ms. Domanig is on 8 other boards, while Mr. Borchert is on 3 other boards and is currently the CEO of Nokia Shanghai Belt. Dr. Rinck is less busy than the other two, however her background in IoT suggests that she is likely also a tech enthusiast ***(fig 8)***.

u-blox Board vs. Swiss counterparts - The board is more diverse than the Swiss average in terms of gender, nationality, and backgrounds ***(fig 9)*** *(app 14)*; components that academics have shown positively relate to firm's operating performance *(ref 3, 4, 5)*. 5 out of 7 directors are non-executive, making the board less independent than the Swiss average.

Highly diversified shareholder base keeps power in the hands of management - As of April 2019, u-blox had 6,937,156 common shares outstanding (CSO), and a free float of 96.3% *(app 16)*. Share structure is simple with no preferred shares, one vote per share, and no governance provisions restricting shareholder rights *(ref 6)*. u-blox shareholder base is well-diversified, as are those of most firms in the semiconductor industry *(ref 7)*. Currently the investment management firm Baillie Gifford & Co. is the largest shareholder owning 5.7% of the CSO. However, when considering indirect and direct shareholdings, Credit Suisse Group AG, that underwrote u-blox's IPO in 2007 and led their 2015 and 2017 bond issuances, owns 12.2% of the CSO *(app 15)*.

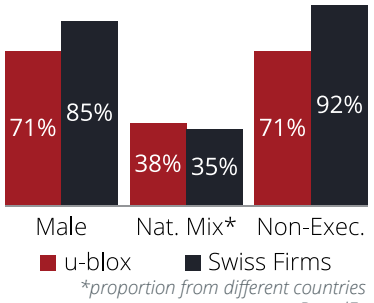
u-blox has strong ESG practices but can always do better - u-blox is ESG A rated (AAA being the highest) by MSCI ESG Research, positioning the company in the top 30% of the industry ***(fig 11)*** *(app 17)*. u-blox has a sustainable supplier program consisting of a supplier self-assessment. The assessment might be followed by an audit, but not on an automatic basis, which is the best practice in the industry. u-blox's two main suppliers, Flextronics and TSMC, are both listed on Russell FTSE4Good indices suggesting they have strong ESG practices, alleviating concerns of controversial sourcing.

FIG 8 BOARD OF DIRECTORS

Members	Other boards
ANDRÉ MÜLLER (CHM.)	3
GINA DOMANIG (VP)	8
THOMAS SEILER (CEO)	1
JP. WYSS (FOUNDER)	1
ULRICH LOOSER	9
ANNETTE RINCK	1
MARKUS BORCHERT	3

source: BoardEx, Company Data, LinkedIn

FIG 9 BOARD MEMBERS



**proportion from different countries*
source: BoardEx

FIG 10 EXECUTIVE COMMITTEE MEMBERS

	Position	Background
THOMAS SEILER	Chief Executive Officier	Electrical Engineering
ANDREAS THIEL	Head of Product Centers & co-founder	Electrical Engineering
JEAN-PIERRE WYSS	Head of Production and Logics & co-founder	Electrical Engineering
ROLAND JUD	Chief Financial Officier	Economics
MARKUS SCHAEFER	Executive Director of Global Marketing & Sales	Electrical Engineering

source: Company Data

FIG 11 MSCI ESG SCORE

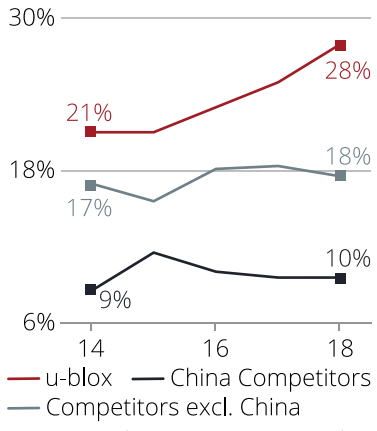
	Weight	Score
ENVIRONMENT	28%	4.3
SOCIAL	42%	5.3
GOVERNANCE	30%	7
INDUSTRY ADJ.		5.8
ESG GRADE		A

source: MSCI

Industry Overview

Industry key value drivers are margins and R&D efficiency - The key value driver in the semiconductor industry is how much revenue a business generates for each dollar invested to develop a new chipset, multiplied by its margin on that chipset. If a business is low in both of these measures it will not survive. In general, there is a trade-off between margins and R&D spending. High margins come from having useful technology that others do not have. In order to develop such technology, companies must spend significantly on R&D. The strategy of Chinese firms in this industry has been to come in with low innovation, low margin, and high-volume products. This results in Chinese firms having the lowest R&D TO Sales ratio of 10% compared to the 18% of other competitors, and 28% of u-blox ***(fig 12)***. The recent entrance of these products with *"80 percent of the performance at 50% of the price"* has put pressure on the entire industry. Businesses that attempt to keep their prices high in spite of this competition will lose market share, and businesses that lower their prices to compete will lose gross margin. In the last 3 years u-blox has taken the first path and has thus seen R&D TO Sales rising from 21% in 2014 to 28% in 2018 with the peak of 30% expected in 2019, as it tries to reinvent its product portfolio while sales growth plunges from 23% in 2014 to -4% in 2019. While R&D investments have been focused on chips, primarily to increase margins on modules by integrating u-blox's own chip, analysis of COGS on modules reveals that only 13.6% of module price is driven by chip cost, and thus margin gains will be limited ***(fig 13, 14)***.

FIG 12 R&D TO SALES



source: Thomson Reuters, Team Analysis

Semiconductor industry is a game of thrones - Simon Gray, the head of marketing and sales at the Swiss Center for Electronics and Microtechnology (CSEM), stated in a private interview that: *"The semiconductor industry is permanently renewing itself, if you look at the market leaders today compared to 10 years ago it's not the same top 10, and 10 years previously is again a different top 10." (ref 9)*. This dynamic is a threat for u-blox. In order to maintain its market shares in GNSS and cellular u-blox must continue to cost effectively out-innovate its competitors.

With 2% the R&D budget of Qualcomm, u-blox products are relatively simple - u-blox products have line sizes of 28nm, while cutting edge integrated circuits are now using 7nm. This simplicity makes these products relatively easy for new entrants to replicate. u-blox might be protected from this if they had process technology, explains David Mele, director of procurement in IBM's semiconductor business *(ref 8)*:

FIG 13 CHIP COSTS

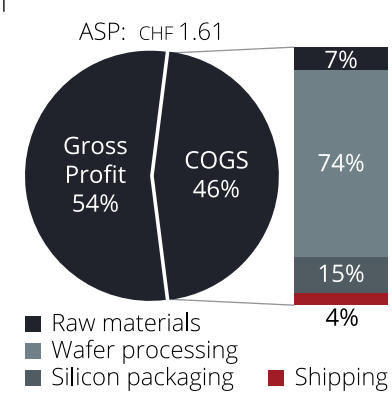
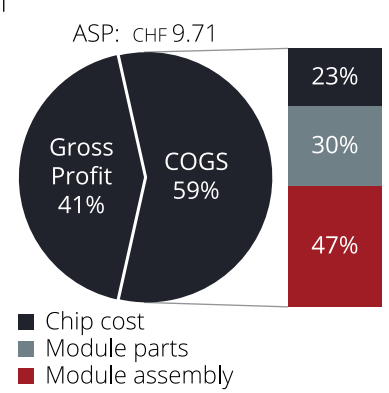


FIG 14 MODULE COSTS



source: Company Data, Industry Expert (ref 9), Team Analysis

"A unique semiconductor process is patentable and will provide an entry barrier against competition. A company without process IP is competing solely on design, and there is nothing stopping others from coming out with a new design that takes your business. This means that they need to constantly keep spending on R&D in order to stay ahead of the competition."

When asked if u-blox had any process technology, CFO Jud responded that u-blox does not, and that it competes only on design *(ref 1)*. This lack of process technology means that u-blox has no real structural advantage over its competitors, but only temporary design advantages that last for a short period of time. This confirms that u-blox's R&D process is a hamster wheel which it must keep spinning, or else quickly fall behind competitors.

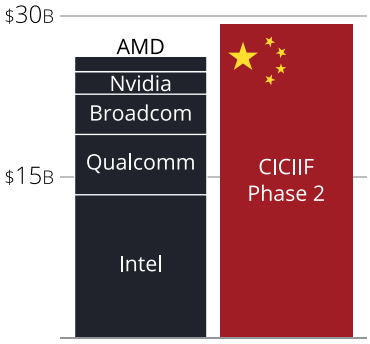
Nascent Chinese competitors are laying siege on u-blox's critical markets - The Chinese government began investing in "National Champions" through the 2014 China Integrated Circuit Industry Investment Fund (CICIIF). With USD 22B raised, the 1st round of CICIIF invested in 23 semiconductor companies, and the 2nd round of USD 29B started investments in Nov 2019 ***(fig 15)*** *(ref 10, 11)*. These investments have been successful, launching direct competitors to u-blox such as BDStar Navigation who received CICIIF funding in 2016 and has since grown revenues from USD 233M to 444M *(app 22) (ref 12)*. With President Xi's *"Made in China 2025"* initiative targeting semiconductor independence by 2025, China has both the political will and financial resources to close the gap between its domestic technology and that of u-blox. Given converging technical performance, nationalistic and state-influenced Chinese customers will switch to Chinese products. In addition, many customers that u-blox counts as American and European currently drop-ship their orders to contract manufacturers in China. Thus, possible tariffs or import restrictions at the Chinese border will make Chinese products not only lower cost, but also less risky for these customers. In our forecasts, this translates to 5-year market share declines of 18PPTS in APAC, 9PPTS in Americas and 9PPTS in EMEA with the most severe market share losses in lower sophistication products ***(fig 16)***.

Growth opportunities concentrated in APAC - The European GNSS Agency expects the positioning and cellular markets across all applications to grow from 329M to 677M units over the next 5 years, representing a 16% CAGR, however most of this growth is expected in APAC ***(fig 17)***. With increasing competition from Chinese companies leading to the already observed market share declines of u-blox in APAC of 5.7PPTS in GNSS and 5.6PPTS in cellular, we do not expect u-blox to fully participate in this growth. Gradual market share declines in APAC are expected to offset the market growth, resulting in relatively stable u-blox revenue from APAC of CHF 138M in 2018 and 114M in 2023 ***(fig 18)***.

Growth opportunities concentrated in low innovation products - u-blox's main GNSS markets are: consumer devices, automotive in-vehicle-systems (IVS), consumer drones, professional drones, geomatics, agriculture, and timing and synchronization. Cellular key markets are: in-vehicle emergency call systems (eCall), asset tracking, insurance telematics, connected health, bike/e-scooter sharing, and fleet management. These markets can be divided into: **i)** growth markets comprising: consumer devices, consumer drones, asset tracking, bike/e-scooter sharing, and insurance telematics; and **ii)** non-growth markets comprising: all others ***(fig 21)***. The growth markets will grow at a CAGR of 18% from 2018 to 2023, compared to the 7% CAGR of non-growth markets. The growth markets use low sophistication products, and thus will be where u-blox loses the most market share (from 15% in 2018 to 6% in 2023) to low cost, low innovation competitors.

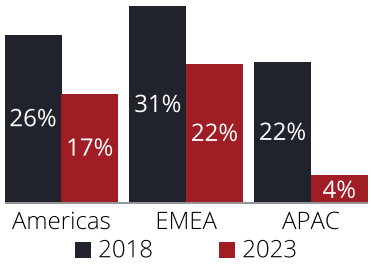
IoT deployment not as easy as we thought - Google Trends reveals that people started talking about IoT around the start of 2014. Around the same time, u-blox stock started its meteoric rise as investors piled in, viewing u-blox as a thematic investment on the future of IoT with its new focus on cellular and short range IoT products ***(fig 20)***. IoT has been a poster boy for Gartner's Hype Cycle where a technological advancement leads to boundless inflated expectations of the nascent technology ***(fig 19)*** *(app 4)*. At the peak of these expectations, the realities of the technical and economic hurdles set in and expectations deflate. In the case of IoT, these hurdles have been high: collecting, interpreting, and acting on data from thousands or millions of distributed nodes requires major business process innovation; significant risky capex is required to purchase and integrate this equipment; global cellular networks are not ready; data security and privacy issues are concerning and unresolved; regulation has been slow to react; lack of standardization has created compatibility nightmares; and tangible economic benefits are not clear. u-blox management plays up this hype aspect of their valuation, with substantial use of buzzwords such as "Mega Trends" appearing in all investor presentations since 2015. These IoT headwinds will affect revenue growth in u-blox's cellular and short-range segments which are both expected to grow at a CAGR of 9%, versus management expectations of 30% for cellular and 17% for short-range.

FIG 15 R&D BUDGETS VS CICIIF



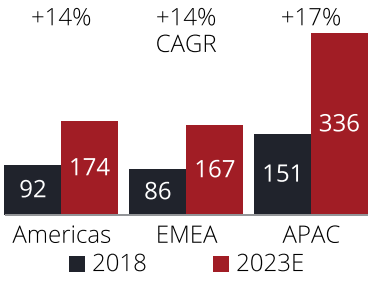
source: Thomson Reuters, SCMP

FIG 16 MARKET SHARES



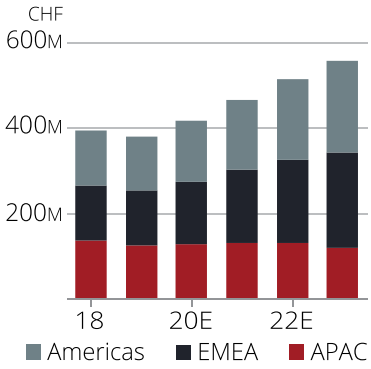
source: Team Analysis

FIG 17 MARKET SIZE IN UNITS (M)



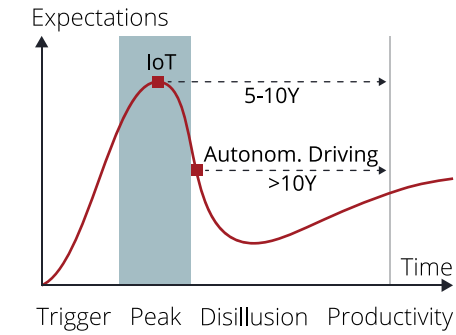
source: European GNSS Agency

FIG 18 REVENUE BY REGION



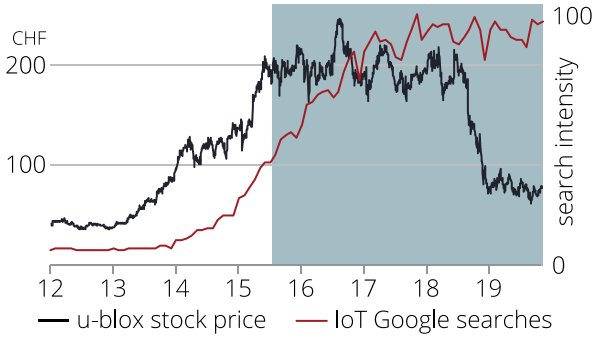
source: Company Data, Team Analysis

FIG 19 GARTNER'S HYPE CYCLE



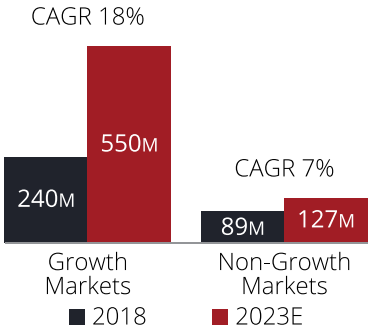
source: Gartner

FIG 20 STOCK PRICE & IOT WEB SEARCHES



source: Google

FIG 21 MARKET UNIT GROWTH

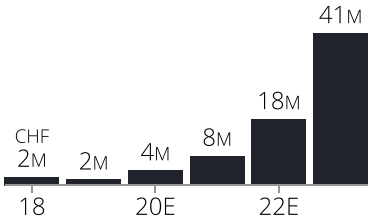


source: European GNSS Agency

The US-China trade war is directly impacting NB-IoT rollout worldwide - The success of u-blox's new NB-IoT & Cat-M1 platform is heavily dependent on the support of cellular network operators, since this new technology requires substantial hardware upgrades to current networks. With forthcoming 5G technology, network operators are currently dragging their feet on incremental network upgrades. The situation has been further complicated by geopolitical events such as the US government's move to ban network equipment from Huawei in May 2019 on cybersecurity grounds *(ref 13)*. Seeing that the NB-IoT rollout is taking place more slowly than expected, especially in Europe *(ref 14)*, we expect that the u-blox NB-IoT platform will not start selling in volume until 2022 ***(fig 22)***.

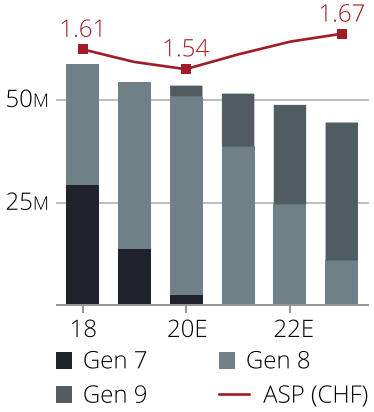
With the global economy cooling, u-blox is highly exposed to recession risk - The arrival of recession bellwethers including a deteriorating European Purchasing Managers' index, inverted yield curve, and plummeting OECD Business Confidence Index is especially concerning for u-blox investors *(app 20)*. u-blox is highly exposed in the event of a recession given that it sells inputs to automobiles (CHF 130M, 2018), manufacturing tools (CHF 114M, 2018), drones (CHF 110M, 2018), and consumer devices (CHF 39M, 2018); all segments that depend heavily on consumer, government, and corporate spending. Our base-case forecasts do not model the effects of a recession, but we do look at these effects in the scenario analysis, where we find that a recession would drive the target price to CHF 28/share ***(fig 48)***.

FIG 22 U-BLOX NB-IOT SALES



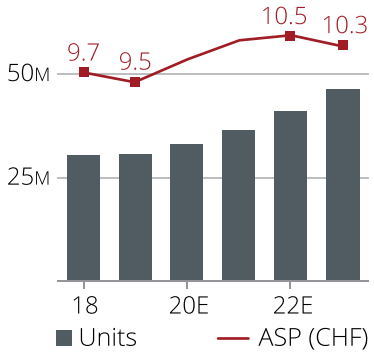
source: Team Analysis

FIG 23 GNSS CHIPS VOL. & ASP



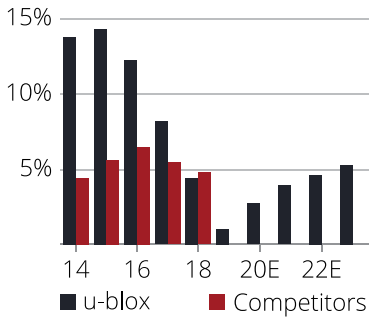
source: Company Data, Team Analysis

FIG 24 MODULE VOL. & ASP



source: Company Data, Team Analysis

FIG 25 ADJ.* EBITDA MARGIN



source: Thomson Reuters, Team Analysis
*100% expensed R&D

Competitive Positioning

ETH Zürich Tech Wizzes thrived as first movers in a Blue Ocean - When Bill Clinton declared the US military's GPS system available for worldwide public use in 1996, u-blox got its start by being first movers. The GPS system had already been operational for over a decade, so the infrastructure was already in place and working. With early support from the Swiss government in the form of a sales contract, u-blox even had a customer waiting for their first devices. As the market for GPS enabled devices evolved over the next 10 years, u-blox found a niche by selling modules that provide core GPS functionality while being relatively easy to integrate into a range of electronic devices. In niche markets including **i)** automotive IVS; **ii)** drones; **iii)** geomatics; **iv)** emergency response; **v)** agriculture; **vi)** marine and trains; and **vii)** timing and synchronization they currently have a weighted average market share of 63% in a total market of 72.4M units ***(fig 26)***. u-blox's module products (ASP of CHF 9.7) are suited to businesses that do not have the engineering horsepower necessary to integrate the much cheaper chips (ASP of CHF 1.61) into their devices ***(fig 23, 24)***. This has generally meant that u-blox services companies selling low volume products, explaining why they have so many (6,700) customers.

After saturating niche GNSS module market in 2009, u-blox started exploring more competitive waters - Unlike US competitors such as Trimble who increase the value of their target markets by turning the USD 9 module into a device worth USD 10,000, u-blox decided to stick to the modules business and instead grow their market by moving into cellular. This time u-blox was entering an arena with established competitors such as Sierra Wireless and Telit, nonetheless it found its niche in applications that require both GNSS and cellular functionality ***(fig 27)***. With this strategy, u-blox leveraged its dominant position in the GNSS market to double the value of customers in some market segments by selling them both cellular and GNSS functionality. Growth since this move into cellular in 2009 has mostly been driven by the emergence of in-vehicle navigation (IVS) devices and eCall systems, and drones. These markets have grown from 12.5M (IVS), 1.4M (eCall), and 45K (drones) devices in 2009 to 43.6M (IVS), 15M (eCall), and 11.4M (drones) devices in 2018, and are expected to reach 60.4M (IVS), 16.8M (eCall), and 18.1M (drones) devices in 2023 *(app 23.1, 23.2)*. In these applications that require both cellular and GNSS functionality, u-blox has market shares of 78% (IVS), 57% (eCall), and 78% (drones) in 2018, and we expect these market shares to decline to 60% (IVS), 36% (eCall), and 54% (drones) driven by increasing competition from Chinese firms given the simplicity of devices needed in these applications. These niche markets have been perfect for u-blox because the products are not sophisticated enough to require the enormous R&D budgets found in applications such as cell phones (USD 5.6B for Qualcomm and 3.8B for Broadcom), and the markets are not large enough to attract these big players who process orders with volumes of tens of millions rather than hundreds or thousands.

No competitor is exactly like them… but many are pretty close - While there are no exact replicates of u-blox, there are a myriad of companies that directly compete with at least one of u-blox's products *(app 9)*. u-blox is more unique in the GNSS space than it is in the cellular space, and unsurprisingly, the cellular niche markets that u-blox dominates are those which require both GNSS and cellular functionality, while it has struggled in standalone cellular markets. In the past, u-blox has shown strong

FIG 26 U-BLOX GNSS NICHE MARKETS 2018

(millions of units)	Market Size	u-blox Sales	u-blox Mkt. Share
AUTO IVS	43.6	34.0	78%
TRANSPORTATION	14.0	2.4	17%
DRONES	11.4	8.9	78%
OTHER NICHES	3.4	0.6	19%
NICHE MARKET TOTAL	**72.4**	**45.9**	**63%**
CONSUMER GNSS	193.8	25.2	13%
GNSS TOTAL	**266.2**	**71.1**	**27%**

source: European GNSS Agency, Team Analysis

FIG 27 U-BLOX CELLULAR NICHE MARKETS 2018

(millions of units)	Market Size	u-blox Sales	u-blox Mkt. Share
ASSET TRACKING	18.3	1.7	9%
ECALL	15.0	8.6	57%
BIKE SHARING	6.9	1.7	25%
INSURANCE TELEMATICS	11.3	0.6	5%
CONNECTED HEALTH	6.2	0.3	5%
OTHER	4.7	0.3	7%
CELLULAR TOTAL	**62.3**	**13.1**	**21%**

source: European GNSS Agency, Team Analysis

performance with an adjusted EBITDA margin (100% expensed R&D) of 14.0% compared to the 4.6% of competitors in 2014 ***(fig 25)***, however, the margin decreased sharply to 4.6% vs. the 4.9% of competitors in 2018 due to increasing R&D spending and SG&A. After reaching a low of 1.2% in 2019, we expect the adjusted EBITDA margin to reach only 5.5% in 2023 as R&D spending intensifies and gross margins continue to wither ***(fig 2)***.

u-blox's niche markets are the perfect launchpad for young Chinese firms aspiring to compete with US giants - When compared to the latest devices coming from companies such as Intel or Qualcomm, u-blox products are less sophisticated, utilizing larger line size architectures and fewer mask layers. This is to be expected considering that the R&D budgets of Intel and Qualcomm are USD 13.5B and 5.6B compared to the 0.1B of u-blox. A semiconductor business must learn to walk before it can fly, and simpler devices using older process technologies such as those of u-blox are the low hanging fruit for Chinese new entrants *(app 18)*. u-blox has started feeling the heat from Chinese competitors including BDStar Navigation, Quectel, Fibocom, and Sunsea *(app 20)*. These young companies have all seen very high growth in recent years and are expected to see 2018-2020 revenue CAGRs of: 6.3% (BDStar), 46.8% (Quectel), 48.1% (Fibocom), and 7.9% (Sunsea) vs. 2.7% (u-blox) ***(fig 28)***. In addition, these firms sell their products at much lower gross margins than u-blox (21.8% vs. 45%). The coalescent timing of the expansion of these companies with the announcement of the "*Made in China 2025"* program in 2015 is not a coincidence. These companies are making the same products as u-blox: BDStar Navigation is targeting u-blox's niche GNSS positioning markets, Fibocom u-blox cellular niches, Sunsea cellular and short-range niches, while Quectel seems to be on a mission to replicate u-blox's entire product catalogue ***(fig 29)*** *(app 8, 9)*. While these companies are generally offering lower quality products than u-blox, they are often "good enough" and substantially less expensive *(ref 2)*.

Ratio analysis against competitors shows how u-blox has gone from darling to dud - An extended analysis of financial performance metrics of u-blox against a group of 16 peers shows that in 2014 u-blox was better than the peer group average in: revenue growth; gross margin; EBITDA margin (if R&D expensed OR capitalized); EBIT margin; ROE; ROA; ROIC; and current ratio. Since then, almost all of these performance indicators have been getting worse and are expected to continue deteriorating in the forecast period *(app 21, 22, 24)*.

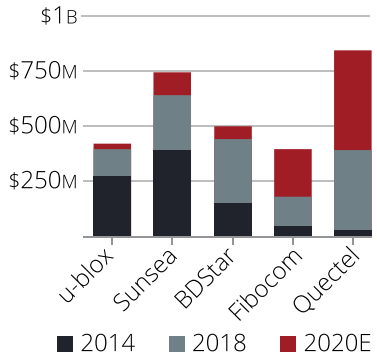
With its bread and butter niches under siege, u-blox is gambling on futuristic markets - u-blox management knows that their pot is on the burner and the R&D to Sales increase from 21% to 28% over the last 4 years is evidence of their attempt to reinvent themselves before the water starts to boil ***(fig 12)***. They have been investing heavily in products for IoT and autonomous driving markets in hopes to replicate the recipe that brought them success back in 1997. The problem is that this time the infrastructure is not already in place, customers are not lined up, and small contracts are no longer enough given the USD 20-35M investment required to develop each of these short-lived technologies. Making matters worse, competitors active in the cellular and short-range markets are also investing in IoT and most of them are either state-subsidized or have much larger R&D budgets than u-blox *(app 21)*.

Financial Analysis

Forecasting revenues in an uncertain industry, a data driven approach - Given the complex industry dynamics discussed earlier, forecasting revenues required a bottom up, data driven approach to eliminate sources of uncertainty. The European GNSS Agency's 2019 GSA GNSS Market Report was used as a starting point, as it contains detailed 10-year unit market size projections per region for 71 different GNSS applications. The 20 applications that apply to u-blox were then separated by technology and revenue generating segment. u-blox market share in each application was then estimated using information disclosed by u-blox, competitors, customers, and market research reports. Using a product matrix built from u-blox's product catalogue and retail prices, it was possible to estimate ASPs and infer revenues for each application, accounting for new product integration and the 10% annual ASP decline *(app 8)*. Market shares were adjusted from initial estimates until the model balanced with u-blox's 2018 and H12019 financial statements. This model forecasts u-blox's revenue by region ***(fig 18)***, revenue-generating segment ***(fig 30)***, product, platform, and application ***(fig 32, 33)*** *(app 23)*. Revenue is estimated to reach CHF 555M in 2023, far below management guidance of CHF 700-800M.

Quickly losing ground in main GNSS niches - We expect u-blox GNSS unit sales to decline 4% annually ***(fig 31)***, resulting from overall market share falling from 27% to 12% by 2023. The unit sales re-

FIG 28 REVENUE OVER TIME



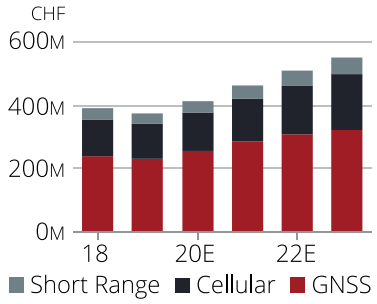
source: Bloomberg, Thomson Reuters

FIG 29 CHINESE COMPETITORS

	P	C	SR
BDSTAR	■		
FIBOCOM		■	
SUNSEA		■	■
QUECTEL	■	■	■

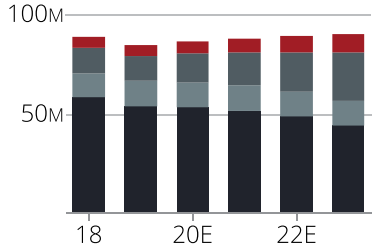
P = positioning C = cellular SR = short-range
source: Company Websites

FIG 30 REVENUE BY SEGMENT



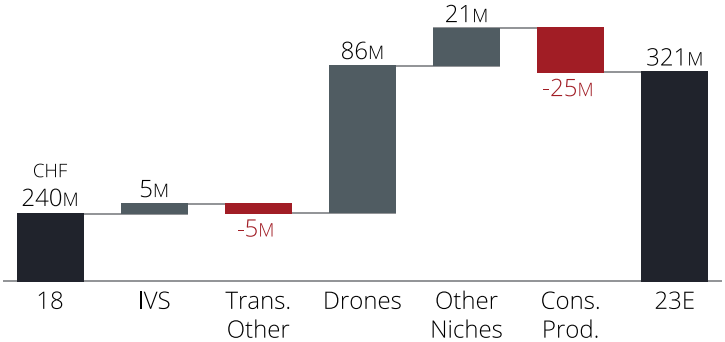
source: Team Analysis

FIG 31 VOL. BY SEGMENT



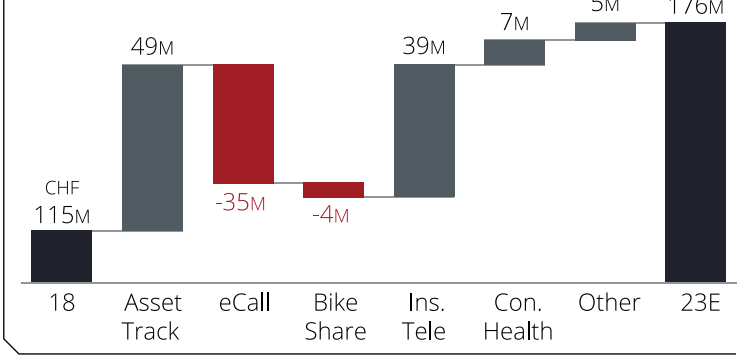
source: Team Analysis

FIG 32 GNSS REVENUE BY APPLICATION (CAGR 6%)



source: Team Analysis

FIG 33 CELLULAR REVENUE BY APPLICATION (CAGR 9%)



source: Team Analysis

duction is driven by losses in consumer GNSS as basic consumer application chips are relatively simple and replicable, giving the advantage to low-cost Chinese producers. In automotive IVS, u-blox market share is forecast to fall from 78% to 60%. u-blox will see its automotive IVS customers in APAC switching to local providers like Quectel, BDStar and Mediatek. In EMEA and America intensifying competition will be spearheaded by Qualcomm compensating for its sales lost in APAC. For the same reason, consumer drone market share is forecast to decrease from 77% to 50%. The professional drone segment will have a smaller decline from 80% to 69% due to the sophisticated F9 module used in this application. u-blox's positions in smaller GNSS segments such as geomatics, agriculture, emergency response, and timing are expected to decline between 3 and 5PPTS given the lack of price sensitivity and high performance expectations of customers in these applications. The European GNSS Agency expects the GNSS market to grow at a 12% CAGR in unit terms, meaning that market share losses are compensated by overall market growth. u-blox will benefit from product mix effect as sales shift towards more expensive premium products, resulting in an overall revenue CAGR of 6% in the GNSS segment despite declining volumes ***(fig 32)***.

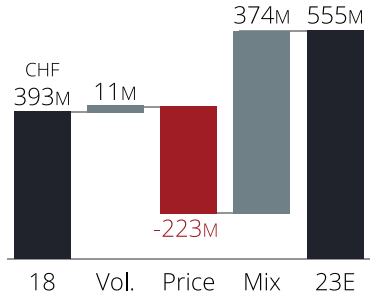
Cellular and short-range modules expansion to compensate losses in GNSS - u-blox's cellular target market is expected to grow in unit terms at a 27% CAGR over the forecast period. We expect u-blox to only participate in a fraction of this growth due to overall market share falling from 21% to 12% because of intensifying competition *(app 23.2)*. New and expanded collaborations with Arvento, Xirgo and addMobile in EMEA and Americas set the stage for increasing market shares in fleet management and insurance telematics from 5% in 2018 to 16% in 2023. These gains will be partially offset by market share losses in APAC for the key segments of eCall (57% in 2018 to 36% in 2023), and bike/e-scooter sharing (25% in 2018 to 11% in 2023), due to low complexity of products in these applications. The net effect is that cellular revenues will climb at a 9% CAGR ***(fig 33)***. Following the recent acquisition of Rigado's Bluetooth module business, short-range technology sales are expected to show a 9% revenue CAGR over the forecast period, in line with the growth of u-blox's cellular business.

Organic revenue growth is rooted in product mix shift - Given the decrease in GNSS unit sales and the increase in wireless module unit sales, the combined volume effect is expected to have a small positive impact of CHF 11M on u-blox's revenue over the next 5 years ***(fig 34)***. Product ASPs will continue to decline 10% annually, resulting in a negative price effect of CHF 223M. A richer product mix will generate CHF 374M, leading to a 7% revenue CAGR in the forecast period. In GNSS, the product mix effect is driven by: **i)** a shift in the Chips/Modules ratio from the 83/17 to 78/22 by 2023; **ii)** a gradual replacement of aging UBX-7 chips by M8s and further by new M9s ***(fig 23)***; and **iii)** a progressive transition from M8-HP to the new generation F9 modules. In cellular, the product mix effect is driven by customer migration from 2G networks to more modern solutions such as 3G, 4G, NB-IoT and Cat-M1. Ultimately, revenue growth comes from a transition from lower priced products (GNSS chips) to higher priced products (cellular modules and F9 GNSS modules) ***(fig 24)***. While increasing revenues, this shift will negatively affect margins, due to lower gross margin in cellular (30%) and short range (40%) segments VS. GNSS (54%).

Battling commoditization and price declines with costly innovations - To continue enjoying a positive mix effect, u-blox is compelled to constantly release new products. In early 2019, the company released V2X, NB-IoT, F9 and M9 products. u-blox is currently capitalizing 6 new platforms including new generation V2X and NB-IoT chips, pouring cash into futuristic products that will not generate substantial revenues in the foreseeable future. u-blox management view R&D spending as a fixed cost, as it is driven by engineer salaries and u-blox is very reluctant to cut workforce. Consistent with management indications, we forecast R&D spending to increase in absolute terms from CHF 110M in 2018 to CHF 128M in 2023 ***(fig 35)***. After the forecast period, R&D TO Sales ratio is expected to go back to its historical 10-year average of 21.4%. Management has indicated that they will continue to capitalize 45% of R&D spending in the future and we assume amortization of R&D assets with a 2-year lag over the average useful life of 5 years. R&D assets currently represent 32% of the balance sheet. Given the fabless business model of u-blox, PP&E comprises only 2.7% of the balance sheet. 72% of PP&E is testing and IT infrastructure, which we expect to grow along with R&D spending, while the rest (furniture, equipment, and vehicles) is forecast to stay stable. This requires capex to increase from USD 10.1M to 12.3M in the forecast period.

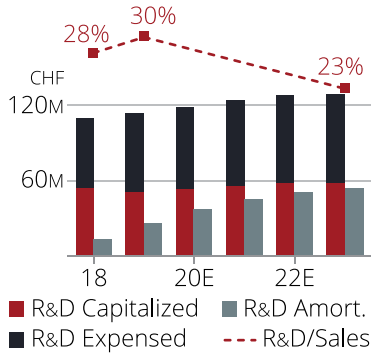
Inevitable margin erosion will make profitability harder and harder - We expect u-blox gross margin to fall from 45% to 41.4% in the forecast period due to the shift in relative weights of u-blox's sales to lower margin products. Margin improvements on cellular/short-range modules from integrating u-blox's own chip will be limited given that only about a quarter of module COGS is the chip ***(fig 13, 14)***. We expect management to miss their 2023 guidance of 20-25% EBITDA margin and 10-13% EBIT margin.

FIG 34 REVENUE DRIVERS



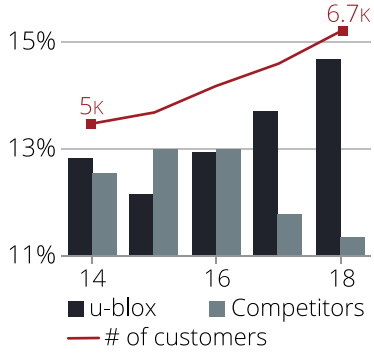
source: Team Analysis

FIG 35 R&D SPENDING



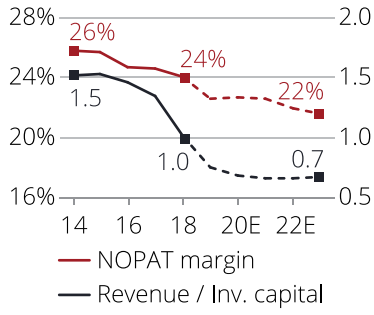
source: Company Data, Team Analysis

FIG 36 SG&A TO SALES



source: Thomson Reuters, Company Data

FIG 37 ADJ.* ROIC DECOMP.



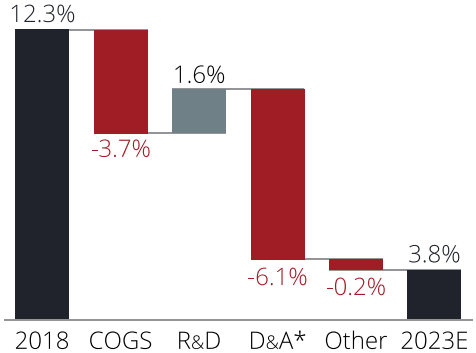
source: Company Data, Team Analysis
*100% capitalized R&D

FIG 38 DUPONT DECOMPOSITION OF ROE AND ROA

	2018	2019E	2020E	2021E	2022E	2023E
EBIT MARGIN	12.3%	5.2%	4.3%	3.8%	3.8%	3.8%
TOTAL ASSET T.O.	0.73	0.67	0.72	0.78	0.84	0.89
FINANCIAL LEVERAGE	1.61	1.62	1.65	1.65	1.65	1.65
INTEREST BURDEN	99.6%	69.6%	88.4%	88.5%	89.5%	90.4%
TAX BURDEN	80.0%	78.9%	78.9%	80.3%	80.3%	81.8%
NET PROFIT MARGIN	9.8%	2.8%	3.0%	2.7%	2.7%	2.8%
ROE	11.5%	3.1%	3.5%	3.5%	3.8%	4.1%
ROA	7.1%	1.9%	2.1%	2.1%	2.3%	2.5%

source: Company Data

FIG 39 EBIT MARGIN



source: Team Analysis *Depreciation & Amortization

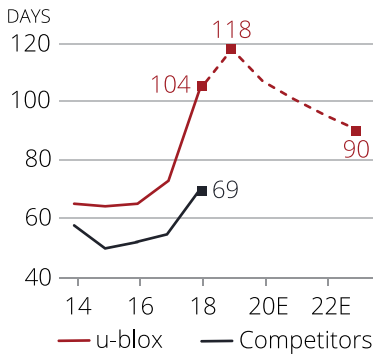
EBITDA margin (as reported) is expected to decrease from 18.2% to 15.9% while EBIT margin is estimated to drop from 12.3% to 3.8% ***(fig 2, 39)***. This margin erosion is driven by a 6.3PPTS increase in Amortization TO Sales due to previously capitalized R&D expenditures.

Horde of low-value clients sapping resources, dragging down efficiency - u-blox currently serves 6,700 customers and 99% of them generate only 20% of the revenues. Since the average customer from this group brings only CHF 11,000 of sales while still requiring administrative resources, we question how these low-value clients are impacting efficiency. SG&A expenses have been growing with the number of customers over the last 3 years, while competitors show falling SG&A relative to revenues ***(fig 36)***. An equivalent decrease would improve u-blox's EBIT margin by 2.7PPTS, however management has no plans to improve efficiency, thus SG&A Expense TO Sales is expected to stay constant.

Plummeting value generation for shareholders expected to continue - In the past, u-blox Return on Invested Capital (ROIC) was almost double the industry average (39% VS. 21%), however, ROIC has fallen to 24% in 2018, and we expect it to decline to 14% by 2023 ***(fig 1)***. DuPont decomposition of the ratio shows that further ROIC reduction will be driven by both capital turnover slowdown and shrinking margins caused by persistent investment into products that are not selling, and expansion to cellular markets ***(fig 37)***. Given low profitability and insufficient operational efficiency ***(fig 38)***, it is doubtful that free cash flow will meet management's highly optimistic 2023 guidance of CHF 49-80M. We are expecting a more reasonable figure of CHF 11M in 2023 ***(fig 44)***. A dramatic decrease in EPS from CHF 5.58 in 2018 to CHF 1.60 in 2019 with a subsequent recovery up to CHF 2.30 by 2023 ***(fig 2)*** will negatively impact dividend payouts and fall far below the CHF 8.00-12.10 implied by management guidance.

Fat cash pile is unprofitable, but at least there are no liquidity or solvency concerns - u-blox management are risk-averse when it comes to solvency and liquidity. Enjoying the security of a cash pile from low-cost debt issued in 2015 and 2017, they are expected to roll over these bonds after maturity, implying constant debt in nominal terms. Cash currently comprises 21% of assets, equivalent to 1 year of R&D spending, and provides u-blox with a safety cushion in case of hard times. Probability of bankruptcy remains low, with Z-score expected to stay above the 2.99 threshold *(app 27)*. The cash conversion cycle has historically been 10-20 days longer than the industry average ***(fig 40)***, however, days in inventories on hand (DOH) increased in 2018 and H12019 due to unanticipated network upgrade delays. We expect DOH to gradually decrease to the historical average in the future.

FIG 40 CASH CONV. CYCLE



source: Thomson Reuters, Team Analysis

FIG 41 WACC CALCULATION

RISK-FREE RATE	0.5%
EQUITY RISK PREMIUM	6%
BETA - LEVERED	1.44
COST OF EQUITY	**9.2%**
TAX RATE	21.2%
PRE-TAX COST OF DEBT	1.7%
AFTER-TAX COST OF DEBT	1.4%
DEBT TO MARKET CAP	0.19
BETA - UNLEVERED	1.25
UNLEV. COST OF CAPITAL	**8.1%**
DEBT TO EV	0.16
WACC	**7.8%**

source: Thomson Reuters, Team Analysis

VALUATION

Our one-year target price of CHF 59/share, with a 35% downside from the November 29 closing price, was derived assigning a weight of 75% to the CHF 58/share Discounted Free Cash flow (DCF) valuation and 25% to the CHF 63/share Multiples Valuation.

Intrinsic valuation methodology - The non-standard Modigliani-Miller WACC was used to discount the free cash flow to the firm (FCFF), following CFO Jud's suggestion that u-blox bonds will be rolled over, and thus that debt will remain constant in CHF over the forecasted period *(app 29)*. Revenues were forecast using a three-stage growth model. The first stage uses the bottom-up revenue forecasts explained in the Financial Analysis section, with revenues expected to grow from CHF 393M in 2018 to CHF 555M in 2023. The second stage uses a linear growth decline from 8% to 4.6% between 2023-2028, and the third a stable growth of 3.9% *(app 28)*. This results in a one-year forward value of CHF 58/share.

WACC assumptions - A WACC of 7.8% ***(fig 41)*** based on the Capital Asset Pricing Model was derived from the following inputs: **i)** a risk-free rate of 0.5% inferred from the 10-year average of the 10Y Swiss government bonds, which assumes that the negative Swiss risk-free rates will eventually converge to positive historical levels; **ii)** an equity beta of 1.44 derived by regressing weekly USD returns of u-blox on returns of the MSCI World index over a 5-year period, leading to an unlevered beta of 1.25; **iii)** an equity risk premium (ERP) of 6% calculated by applying a geographical revenue-based weighted average of regional risk premium (RRP) ***(fig 42)*** (determined using Damodaran's GDP based methodology *(app 30)*); **iv)** Canton of Zurich corporate tax rate which will decrease from 21.15% to 19.70% in January 2021 and 18.19% in January 2023 due to the recent Swiss tax reform; **v)** a 1.7% pre-tax cost of debt computed from the average yield to maturity of the two bonds at issuance due to illiquidity of the bonds.

Terminal growth rate derivation - Terminal growth is derived from the OECD 2060 regional real GDP growth forecasts weighted by the expected future geographical revenues, resulting in a 2% real GDP growth rate. The IMF expected 1.9% long-term inflation was then added, generating a 3.9% nominal growth rate ***(fig 43)***.

Sensitivity analysis shows that recommendation changes only under extreme circumstances - It is interesting to further comment on the following four sensitivities: **i)** The risk-free rate sensitivity quickly evaluates the effects of prolonged negative interest rates or an increase towards more ordinary rates. It is worth noting that the recommendation would remain unchanged even if negative interest rates persist *(app 31.1)*. **ii)** The terminal value and the unlevered cost of capital are two of the principal assumptions of the model. Sensitivity analysis reveals that our recommendation would change only in the top left quadrant ***(fig 45)***. However, the probability for the unlevered cost of capital to fall below 7% and the terminal growth rate to be greater than the already optimistic 3.9% is low. **iii)** The trade-off between R&D spending and revenue growth is crucial when valuing capital intensive firms. As discussed in the Financial Anal-

FIG 42 EQUITY RISK PREMIUM

Region	Weight (2018)	RRP	ERP
AMERICA	32%	0%	5.4%
EMEA	33%	0.9%	6.3%
APAC	35%	0.9%	6.3%
WEIGHTED ERP			**6.0%**

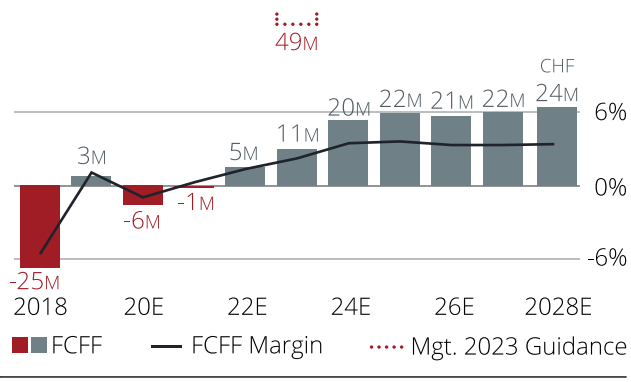
source: Damodaran

FIG 43 TERMINAL GROWTH

Region	Weight (2023)	LT. Real GDP
AMERICA	38%	1.9%
EMEA	41%	1.7%
APAC	21%	2.5%
WEIGHTED REAL GDP		**2.0%**
LT. INFLATION		1.9%
TERMINAL GROWTH		**3.9%**

source: IMF, OECD

FIG 44 FCFF & FCFF MANAGEMENT GUIDANCE



source: Company Data, Team Analysis

FIG 45 DCF SHARE-PRICE SENSITIVITY ANALYSIS

TERM. GROWTH \ WACC	6.8%	7.3%	**7.8%**	8.3%	8.8%
4.5%	CHF 99	CHF 80	**CHF 66**	CHF 57	CHF 49
4.3%	CHF 92	CHF 75	**CHF 63**	CHF 54	CHF 47
4.1%	CHF 86	CHF 71	**CHF 61**	CHF 52	CHF 46
3.9%	**CHF 81**	**CHF 68**	**CHF 58**	**CHF 51**	**CHF 45**
3.7%	CHF 77	CHF 65	**CHF 56**	CHF 49	CHF 43
3.5%	CHF 73	CHF 62	**CHF 54**	CHF 47	CHF 42
3.3%	CHF 69	CHF 60	**CHF 52**	CHF 46	CHF 41

source: Team Analysis

FIG 46 PEERS MATRIX

	Line of Business	Size	Growth	Margin	Credit Profile
LANTRONIX	■	■	■	■	
NORDIC SC.	■	■	■	■	
SEQUANS	■	■	■		
SIERRA W.	■	■	■		
STM			■	■	■
TELIT	■	■	■		■
WISTRON	■	■	■		

source: Team Analysis, Bloomberg, Thomson Reuters

ysis section, R&D TO Sales ratio is expected to converge to the 21.4% historical average within 5 years. Our recommendation would change only if u-blox is able to decrease R&D TO Sales below 20%, showing that the recommendation is robust to the R&D spending assumption *(app 31.2)*. Improvement over historical levels is unlikely given u-blox's talent pool costs, constant innovation strategy, and increasing competition. iv) The sensitivity analysis on ASP decline and gross margin reveals that our recommendation would change only if the gross margin remains unaffected by the product shift and the ASP decline decreases *(app 31.3)*. This is a very unlikely event due to price pressure from Chinese competition and u-blox's increasing reliance on lower margin products.

Multiples Valuation: an overvalued company in an increasingly competitive market - The most appropriate multiple to compare u-blox to its peers is the selected Enterprise Value (EV) TO Sales. This ratio is preferred to the frequently used multiples EV TO FCFF and EV TO EBITDA because these multiples would be misleading due to high industry volatility, low/negative FCFF, and arbitrary impacts on EBITDA resulting from different R&D accounting policies. The peers were selected based on their business model similarity, size, growth, margin, and credit profile ***(fig 46)***. The 7 selected comparables are a mix of GNSS and wireless solutions companies. The estimated price from the median of the peers' 2020E forward looking EV TO Sales is CHF 63/share ***(fig 47)*** *(app 34)*. The lower weight attributed to the multiples valuation is driven by the lack of good comparables to u-blox particularly in the pure play GNSS market. The most comparable GNSS companies such as BDstar Navigation and Quectel cannot be used because they are trading at high multiples due to their exceptional growth prospects.

FIG 47 EV TO SALES MULTIPLE

	18	19E	20E
LANTRONIX	1.0	1.2	1.1
NORDIC SC.	1.8	2.7	2.6
SEQUANS	2.1	3.0	1.7
SIERRA W.	0.5	0.4	0.4
STM	1.3	2.3	2.2
TELIT	0.6	0.6	0.6
WISTRON	0.5	0.5	0.4
MEDIAN	**1.0**	**1.2**	**1.1**
U-BLOX	**1.4**	**1.6**	**1.0**

source: Bloomberg, T. Reuters, Team Analysis

Scenario Analysis: u-blox intrinsic value if - Certain events could materially change u-blox's fundamental value, and thus affect our recommendation. Scenario analyses on these events were conducted by fluctuating variables of interest in the DCF model while holding others constant ***(fig 48)***. We arrive at the following fundamental target prices:

Recession (CHF 28) - A repression factor was applied to all market sizes so that the unit CAGR 2019-2023 was cut in half. We additionally assumed that u-blox would implement a hiring freeze, thus keeping R&D spending stable at 2018 levels.

Communist Party of China restricts semiconductor imports (CHF 34) - This scenario assumes that the Chinese government prohibits domestic firms from buying non-Chinese semiconductor products in mid 2022. Market shares in China drop to half of the expected value in 2022, and drop to 0 from 2023 forward.

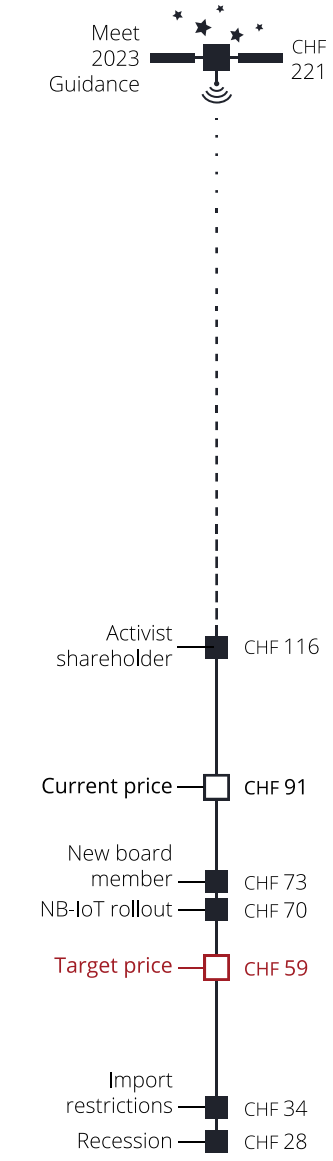
Network providers rush to adopt NB-IoT standards (CHF 70) - Cellular networks are upgraded to support NB-IoT hardware a year faster than expected. This is forecast by inflating the NB-IoT market size by 20% from 2021 to 2023.

Chinese relations improve thanks to new board member (CHF 73) - The newly appointed Director Markus Borchert has extensive experience in the cellular industry and a developed network in Asia. During his time at Nokia Greater China, Mr. Borchert helped establish the company as the main non-Chinese supplier. His efforts could help u-blox maintain its position in the Chinese market. This scenario is assuming that Mr. Borchert is able to slow down the market share losses in China so that APAC market share losses transpire at half the pace expected in the base scenario.

Activist investor puts a stop to wishful R&D programs (CHF 116) - u-blox is investing in futuristic products such as V2X which are not expected to pay off within the next ten years. An activist shareholder could acquire a stake in u-blox and force management to pivot away from this strategy. The new investor could cut the V2X programs and lay off the workforce focused on that project, which would allow the company to generate some meaningful free cash flow. The scenario assumes that an activist investor targets u-blox in 2020 and forces management to cut two products from the development cycle, resulting in an annual reduction in R&D spending of CHF 25M driven by layoffs of engineering staff.

Management meets their 2023 guidance (CHF 221) - We decided to see what it would take for management to reach the lower bound of their optimistic 2023 guidance of: i) CHF 700M in revenue; ii) CHF 140M in EBITDA; iii) CHF 70M in EBIT; and iv) CHF 49M in free cash flow. Model assumptions relating to income statement were changed until the targets were reached. According to our model, management is expecting: i) no loss of GNSS market shares in any market; ii) increase tracking-devices market share from 7% to 13%; and iii) R&D TO Sales to linearly decline from 30% in 2019 to 16% by 2023 (about 5PPTS lower than historical average). We consider these assumptions implicit in the guidance to be utopian, and thus the long-term guidance incredible *(app 32, 33)*.

FIG 48 SCENARIO ANALYSIS



source: Team Analysis

Investment Risks

Investors should be aware of the following risks. The occurrence of these events would have a negative impact on the value of u-blox. *(fig 49)*

Market risks

Economic slowdown (MR1) - The US Federal Reserve Bank is currently forecasting a 40% probability of recession in 2020 *(app 20)*. Such a shock would negatively impact u-blox's revenues in two ways: i) most of u-blox customers are in cyclical industries which are the first to be impacted by an economic slowdown; ii) product mix forecast would be substantially affected, as customers would be more reluctant to switch to higher-cost new generation products. In the scenario analysis it was found that such an event would cause the fundamental value of u-blox to drop to CHF 28/share ***(fig 48)***.

Currency risk (MR2) - u-blox mitigates currency risk by matching the currencies of revenues and COGS, however most of their revenues are in USD while they report and pay salaries in CHF, so they have significant exposure to the CHF/USD rate. A 10% appreciation of the CHF/USD would cause a 9% decrease in revenues, a 16% decrease in EBITDA, and a 22% decrease in EBIT. u-blox occasionally limits this risk by entering forward contracts to purchase CHF. While we expect changes in the CHF/USD to be unbiased, annualized volatility of this rate is 10.6% over the last 5 years.

Strategic risks

Blue chips come after u-blox's customers (SR1) - Continued in-house chip design from tech giants such as Apple and Samsung, and the increasing domestic chip use of Chinese manufacturers such as Huawei, will cause Broadcom and Qualcomm to start to see their most lucrative customer base dry up. This could cause them to come after u-blox's niche markets that they have mostly ignored up to this point.

Unsuccessful M&A (SR2) - u-blox often conducts cross-border M&A to quickly access new customers and markets. Cross-border M&A is risky, with academics showing failure rate falling between 70% and 90% *(ref 15)*. Common issues such as a disinterested target or poor integration can destroy investment value. Similarly, deal withdrawal can affect the bidding company's reputation and incur costs, as u-blox learned with the failed USD 53M acquisition of SIMCom in 2017 which caused a 2.3% drop in the stock price, destroying CHF 31.7M of corporate value.

Financial risks

History of missing financial guidance (FR1) - u-blox has missed its revenue guidance every year since 2016 and is expected to barely reach the lower bound of its revised 2019 guidance of USD 380M to 400M *(app 2, 32)*. The 2018 guidance miss resulted in a 7.3% drop in the stock price, destroying CHF 43.1M of corporate value. Yet another miss will cause a drop in u-blox's stock price, and management credibility to further deteriorate. To avoid this, management could change their habit of issuing overly ambitious guidance, or simply stop issuing guidance; an operation that can be costly and does not necessarily improve market value *(ref 16)*.

Impairment of intangible assets (FR2) - In 2018 intangible assets and goodwill represented 90% of u-blox's non-current assets. Even though the company has seldom impaired intangibles or goodwill, with sales of new products not arriving, u-blox's auditors (KPMG) could force impairments to R&D assets which would have severe negative effects on earnings. An impairment of 1% of intangible assets in 2018 would have caused a 1% decrease in EBIT margin.

Credit risk (FR3) - u-blox almost went bankrupt in 1999 because a large customer became insolvent. Nowadays, credit risk is mitigated through the use of accounts receivable insurance by AXA, covering 90% of each customer's credit line. AXA also estimates creditworthiness of customers and helps set credit limits.

Lack of transparency, a driver for risk (FR4) - u-blox's financials lack transparency in both financial information and investment disclosure. Operational segments could be better defined given the meaningless partition of 99.94% of revenue for the product segment and 0.06% for the service segment. Management claims this lack of disclosure prevents competitors from learning business secrets, however analysts will note that it makes it very difficult to understand the business activities of u-blox, and how these activities change from period to period. In terms of investment disclosure, it is unclear how the privately-held Sapcorda Joint Venture, which has incurred consistent losses since its founding in 2016, is allocating u-blox's investment of CHF 11.1M.

Earnings manipulation risk (FR5) - u-blox's Beneish M-score has been increasing over the last three years and reached the -2.22 threshold in 2018, implying that the conditions are ripe for earnings manipulation *(app 26)*. The fact that management bonuses are based on revenue growth and EBIT margin further increases the incentives for earnings manipulation. According to our revenue growth and EBIT estimates, management bonuses will decrease by 26% for the CEO and 33% for other executives by 2023 *(app 12)*.

Operational risks

Talent poaching and retention (OR1) - u-blox headquarters and main engineering center is in Switzerland's biggest tech hub, where giants including Google and IBM are constantly hunting for the country's best talent. Because of its high dependence on R&D, failing to develop and retain its talent pool would put u-blox's growth at risk. Recruiting from abroad provides limited mitigation of this problem due to Switzerland's strict work permit policies.

Supply chain risk (OR2) - Low supply chain burden comes with a high dependence cost. If critical suppliers such as Flextronics suffer business interruptions or substantially increase prices u-blox will be severely impacted. Analysis of COGS shows that if Flextronics were to increase prices by 10%, gross margins on modules would drop from 41% to 36.5%. u-blox does not disclose whether long-term pricing contracts that would prevent such an event are in-place.

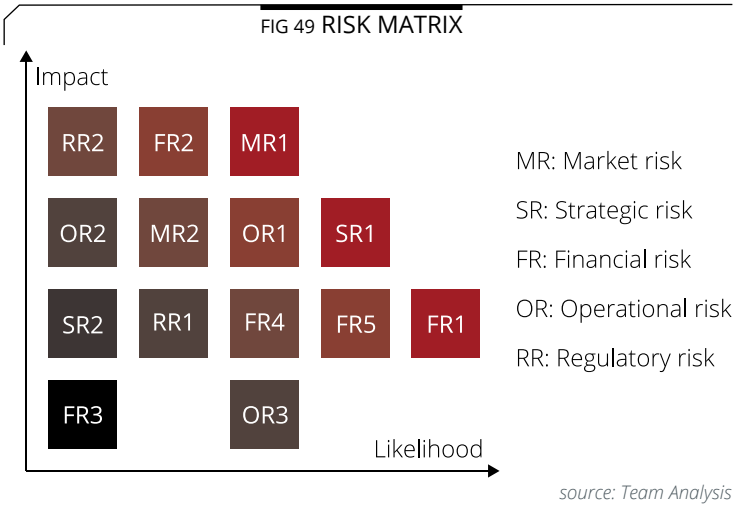
Inventory obsolescence risk (OR3) - u-blox inventory increased from 11% to 15% of sales in 2018 in anticipation of cellular network upgrades. However, delays in the upgrades postponed customer orders. Even though management claims this increase to be only short-term, inventories did not decrease in H12019. If delays continue and u-blox is not able to sell these products they will become obsolete, forcing a CHF 13.3M write-off. If such a write-off had occurred in 2018, EBIT margin would have dropped from 12.3% to 8.9%.

Regulatory risks

Shared economy regulatory risk (RR1) - Regulations can easily bring sales activities in a location to a standstill. In 2017, several Chinese cities, including Beijing, banned deliveries of new shared bikes for safety concerns. This regulation caused u-blox's sales to drop by CHF 5.3M in 2017 and CHF 8.0M in 2018 *(ref 17)*. With the growing shared transportation trend and all of the problems that come along with it, more regulations can be expected worldwide.

Chinese import restrictions (RR2) - China is aiming to achieve semiconductor self-sufficiency by creating a closed loop integrated circuit manufacturing ecosystem. The country could go one step further and restrict imports in favor of domestic suppliers. Such a policy is unlikely given current trade agreements, but would severely impact u-blox's prospects. Scenario analysis indicates that the fundamental value of u-blox would drop to CHF 34/share in such an event ***(fig 48)***.

FIG 49 RISK MATRIX



source: Team Analysis

APPENDICES - TABLE OF CONTENTS & ANALYSTS

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APPENDIX 1 PROJECTED BALANCE SHEET

source: Company Data, Team Analysis

(mln CHF)	2017	2018	2019E	2020E	2021E	2022E	2023E
Cash and cash equivalents	169.6	136.3	114.9	104.0	96.2	95.1	98.3
Marketable securities	2.8	1.4	1.4	1.4	1.4	1.4	1.4
Trade accounts receivables	50.4	60.8	56.6	60.3	64.9	69.2	73.6
Other receivables	9.6	11.2	10.4	11.0	11.8	12.6	13.2
Current tax assets	3.3	1.6	1.6	1.6	1.6	1.6	1.6
Inventories	44.2	57.5	55.3	58.9	63.3	67.4	70.0
Prepaid expenses and accrues income	3.2	7.7	7.0	7.3	7.7	8.0	8.5
Derivative financial assets	0.2	0.5	0.5	0.5	0.5	0.5	0.5
Total current assets	283.3	276.9	247.7	245.0	247.4	255.8	267.2
Property, plant and equipment	17.5	14.8	15.3	15.8	16.3	16.7	16.8
Right-of-use assets	-	-	19.5	19.5	19.5	19.5	19.5
Goodwill	57.6	55.2	58.9	58.9	58.9	58.9	58.9
Intangible assets	154.0	193.4	221.8	237.7	248.1	254.7	257.9
Financial assets	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Equity-accounted investees	7.2	8.0	8.1	8.1	8.1	8.1	8.1
Deferred tax assets	3.7	3.6	3.6	3.6	3.6	3.6	3.6
Total non-current assets	241.2	276.1	328.3	344.7	355.6	362.7	365.9
Total assets	524.5	553.0	576.1	589.7	603.0	618.4	633.1
Trade accounts payables	20.3	21.6	20.5	22.8	25.7	28.9	31.8
Other payables	6.6	7.2	7.8	8.2	8.8	9.4	9.8
Current tax liabilities	5.8	3.2	3.2	3.2	3.2	3.2	3.2
Accrued expenses	26.3	23.5	27.7	29.0	31.3	33.4	34.8
Total current liabilities	58.9	55.5	59.1	63.2	69.0	74.9	79.5
Financial liabiltiies	118.9	119.2	119.4	119.7	119.1	119.4	118.9
Other payables	0.5	0.1	0.1	0.1	0.1	0.1	0.1
Provisions	8.2	6.9	6.9	6.9	6.9	6.9	6.9
Pension liability	15.9	18.0	18.0	18.0	18.0	18.0	18.0
Lease liabilities	-	-	19.5	19.5	19.5	19.5	19.5
Deferred tax liabilities	3.5	4.6	4.6	4.6	4.6	4.6	4.6
Total non-current liabilities	147.1	148.7	168.4	168.7	168.1	168.4	167.9
Share capital	6.3	6.4	6.4	6.4	6.4	6.4	6.4
Share premium	66.6	66.3	55.2	49.1	44.5	39.7	34.4
Treasury shares	-24.4	-32.0	-32.0	-29.1	-29.1	-29.1	-29.1
Cumulative translation differences	-10.2	-14.2	-14.2	-14.2	-14.2	-14.2	-14.2
Retained earnings	280.3	322.4	333.2	345.6	358.3	372.4	388.1
Total equity	318.5	348.9	348.5	357.8	365.9	375.2	385.6
Total liabilities and equity	524.5	553.0	576.1	589.7	603.0	618.4	633.1

APPENDIX 2 — PROJECTED INCOME STATEMENT

source: Company Data, Team Analysis

(mln CHF)	2017	2018	2019E	2020E	2021E	2022E	2023E
Revenue	403.7	393.3	378.5	417.3	465.0	514.1	555.2
COGS	(219.7)	(216.2)	(209.7)	(233.5)	(263.3)	(295.8)	(325.4)
Gross profit	184.0	177.1	168.8	183.8	201.7	218.3	229.8
Distribution & Marketing expenses (D&M)	(36.2)	(37.0)	(37.0)	(39.3)	(43.8)	(48.4)	(52.2)
Research & Development expenses (R&D)	(65.6)	(74.9)	(94.3)	(107.7)	(118.9)	(127.0)	(131.1)
General & Administrative expenses (G&A)	(19.1)	(20.8)	(20.8)	(22.0)	(24.5)	(27.1)	(29.2)
Other income	1.9	3.8	2.7	3.0	3.4	3.7	4.0
EBIT	65.1	48.3	19.5	17.8	17.9	19.6	21.3
Net financial cost	(0.4)	(0.2)	(5.9)	(2.1)	(2.1)	(2.1)	(2.1)
EBT	64.7	48.1	13.6	15.8	15.8	17.5	19.2
Income tax	(13.4)	(9.6)	(2.9)	(3.3)	(3.1)	(3.4)	(3.5)
Net profit	51.3	38.5	10.7	12.4	12.7	14.1	15.7
EPS	7.3	5.6	1.6	1.8	1.8	2.0	2.3
EBITDA	87.3	71.6	55.6	65.1	74.0	82.0	88.0

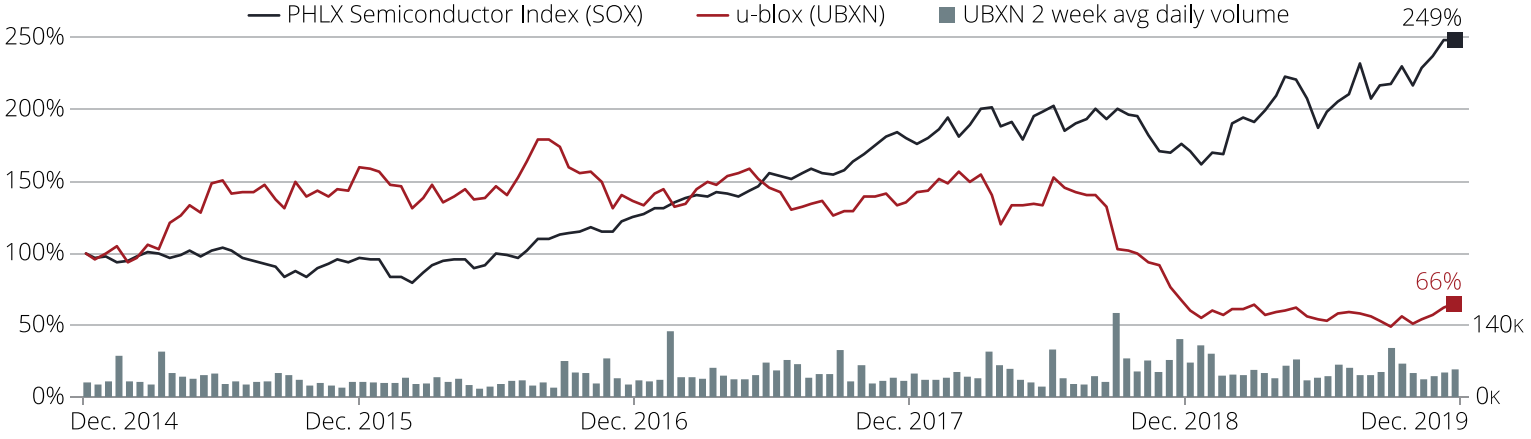
APPENDIX 3 — PROJECTED CASH FLOW STATEMENT

source: Company Data, Team Analysis

(mln CHF)	2017	2018	2019E	2020E	2021E	2022E	2023E
Net profit	51.3	38.5	10.7	12.4	12.7	14.1	15.7
Adjustments for:							
Depreciation	9.3	9.3	9.6	10.1	10.9	11.7	12.2
Amortization	12.9	14.1	26.4	37.2	45.2	50.8	54.5
Share-based payment transactions	8.0	8.4	-	-	-	-	-
Other non-cash transactions	2.7	2.4	-	-	-	-	-
Net Financial costs	0.4	0.2	5.9	2.1	2.1	2.1	2.1
Income tax expense	13.4	9.6	2.9	3.3	3.1	3.4	3.5
Change in trade and other receivables	-12.9	-16.6	5.6	-4.7	-5.7	-5.3	-5.6
Change in investories	-12.6	-13.3	2.2	-3.6	-4.4	-4.1	-2.6
Change in trade and other payables	4.9	-0.9	3.7	4.0	5.8	5.9	4.7
Change in provisions	2.6	-1.5	-	-	-	-	-
Income tax paid	-19.4	-12.9	-2.9	-3.3	-3.1	-3.4	-3.5
Net cash from operating activites	60.5	36.3	64.1	57.6	66.5	75.0	81.0
Acquisition of PP&E	-10.6	-7.3	-10.1	-10.5	-11.4	-12.1	-12.3
Acquisition of intangible assets	-54.5	-54.1	-51.1	-53.1	-55.5	-57.4	-57.7
Proceeds from disposal	0.1	0.1	-	-	-	-	-
Proceeds from sale of securities	4.7	1.4	-	-	-	-	-
Acquisition of business / subsidiaries	-	-	-7.4	-	-	-	-
Capital increase in an associate	-3.6	-4.1	-4.1	-	-	-	-
Interest received	0.3	0.6	-	-	-	-	-
Net cash used in inv. activities	-63.5	-63.4	-72.6	-63.6	-67.0	-69.5	-70.0
Proceeds from exercise of options	6.8	15.3	-	0.9	-	-	-
Dividends paid to owners	-14.5	-15.4	-11.1	-4.0	-4.7	-4.8	-5.3
Repayments of financial liabilities	-	-	-	-	-60.0	-	-60.0
Proceed from financial liabilities	59.3	-	-	-	59.2	-	59.3
Purchase of treasury shares	-24.4	-7.6	-	-	-	-	-
Interest paid	-1.2	-1.9	-1.8	-1.8	-1.8	-1.8	-1.8
Net cash from fin. activities	26.0	-9.7	-12.9	-4.9	-7.3	-6.6	-7.8
Net increase in cash	23.0	-36.7	-21.4	-10.9	-7.8	-1.1	3.2
Cash at beginning of year	149.5	169.6	136.3	114.9	104.0	96.2	95.1
Exchange gains / (losses)	-2.9	3.4	-	-	-	-	-
Cash at end of the year	169.6	136.3	114.9	104.0	96.2	95.1	98.3

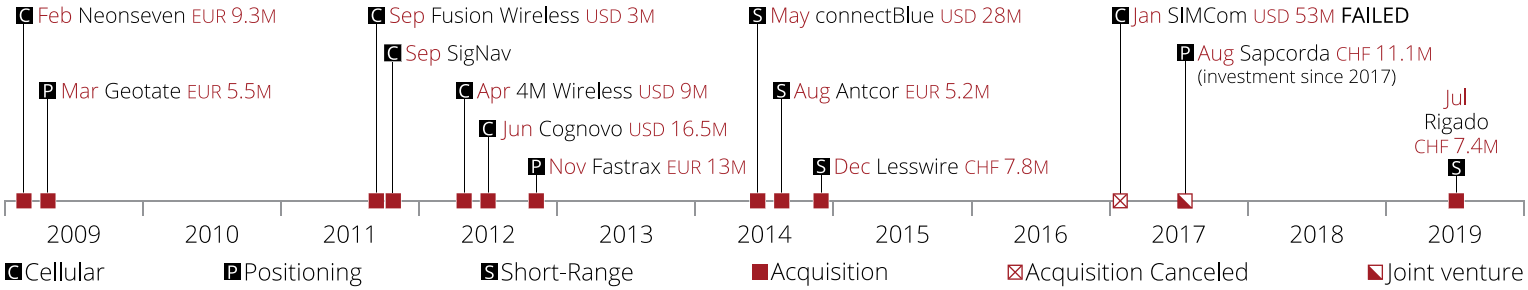
APPENDIX 4 — U-BLOX vs SEMICONDUCTOR INDEX

source: Thomson Reuters



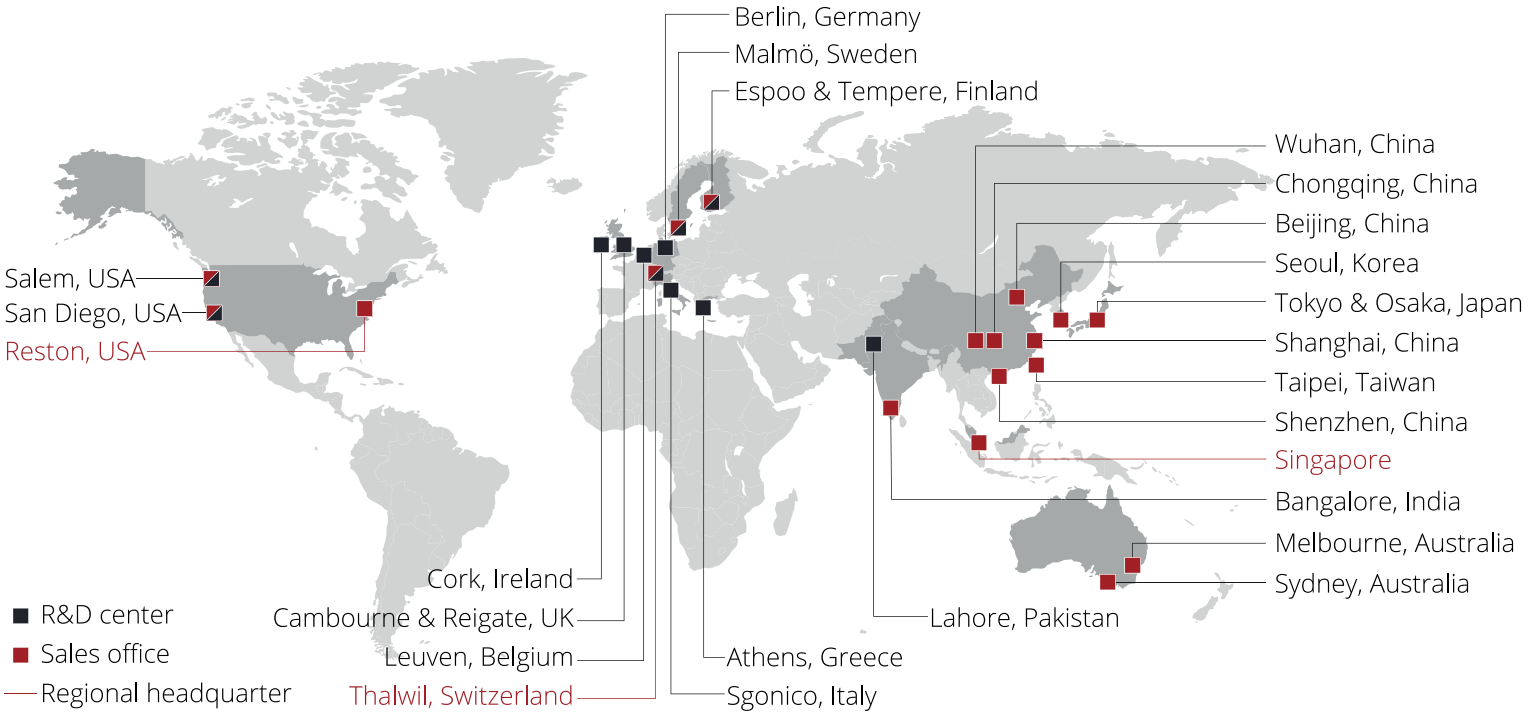
APPENDIX 5 — ACQUISITION TIMELINE

source: Company Data



APPENDIX 6 — SUBSIDIARIES MAP

source: Company Data



APPENDIX 7 — PARTNERSHIPS

source: Company Data

Partner	Description	Start year
arm MBED	The building of the new operating system, software components, tools and ecosystem to deploy commercial, standards-based **Internet of Things**. The design principles focus on Connectivity, Efficiency, Security, Productivity. The ecosystem is open source and implements open standard.	2015
IBM Blueprint	The combination of u-blox cellular, short-range and positioning products and solutions with IBM's deep data analytics and management capabilities in the IBM Bluemix cloud platform to allow companies to get business benefits from **IoT**.	2015
accenture	The deployment of end-to-end solutions, in which u-blox has provided the devices and device technology, while Accenture has integrated their cloud analytics platform, allowing customers to analyze the data captured by **IoT devices** and gain business insights that streamline operations, reduce manpower and lower maintenance costs.	2016
JT	u-blox is collaborating with JT to provide 'out-of-the-box' connectivity for the u-blox C030 range of **IoT Application** Development boards. JT is also a u-blox partner for customers wishing to take advantage of JT's global connectivity solutions.	2016
verizon	u-blox and Verizon have collaborated closely to introduce the u-blox SARA-R410M LTE Cat M1 module as a device for ThingSpace Ready platform of connectivity services for the **IoT**.	2016
WIREPAS Things connected – Naturally	Wirepas has partnered with u-blox to offer an advanced decentralized radio communications solution for industrial **IoT applications**. The NINA-B1 in combination with the Wirepas Connectivity software enables short time to market for **IoT applications** in segments such as lighting, sensor, asset tracking and beacons.	2016
NAGRA KUDELSKI	The provision of **IoT device security**, data security, access management and active security to create trust and integrity between devices and applications.	2018
T-Mobile	The migration of customers from 2G to LTE to embrace the **IoT revolution**.	2018
TE connectivity	Embedded or multi-element external antennas provide high-clarity transmissions in wireless devices in a wide variety of frequencies including: Cellular any sub 6GHz, 2G/3G/4G/5G single and multiple antenna assemblies, positioning GNSS, non cellular and ISM band, Bluetooth, Wi-Fi, NBIoT, ZigBee, Sigfox etc.	2018
swisscom	The combination of different access technologies, platforms and a large ecosystem. In addition, Swisscom provides access to an established **IoT ecosystem** and other modules, such as the cloud or Data Analytics.	2019

APPENDIX 8 — U-BLOX PRODUCT MATRIX — *source: Company Data*

GNSS

Group	Class	App.	SP-GNSS	HP-GNSS	Dead-Rec	Timing	Raw Data	V2X
CAM	Ant	C-Drone Transp	M8					
LEA	Module	Transp	M8S			M8F/T	M8T	
MAX	Module	C-Drone	8, M8					
NEO	Module	P-Drone Transp Emerg	8Q, M8Q/U	M8P	M8L/U	M8T	M8P/T	M9N
SAM	Ant	G&A	M8Q					
UBX	Chip	Cons IVS Transp	G82, M83 /823 /914					M914, P3
ZED	Module	P-Dro G&A Time		F9H/P		F9T		
ZOE	SiP	Time	M8B					

Cellular

Group	Class	App.	2G	3G	4G	Cat-1	Cat-M	NB-IoT
LARA	Module	eCall C-Health Ins-Tele	R2	R2	R2, R3121	R2, R3121		
LISA	Module	eCall A-Track	U2	U2				
SARA	Module	Agri 4.0 S-Meter eBike	G3/45, R4, U2	U2	N2 R4/5		R4/5	N2/3, R4/5
TOBY	Module	A-Track Ins-Tele	R2	R2	R2	R2		
UBX	Chip	Other						R5

Short range

Group	Class	App.	V2X	BT-LE	BT-BR	Wi-Fi	NFC
ANNA	SiP	Other		B112			B112
BMD	Module	Other		33/34x			34x
ELLA	Module	IVS Other			W1	W1	
EMMY	Module	IVS Cons		W1	W1	W1	
JODY	Module	IVS		W1		W1	
LILY	Module	Other				W1	
NINA	Module	Ins-Tele C-Health S-Meter		B1/2/3, W1/15	B2, W1/15	W1/13 /15	B1/3
ODIN	Module	Other		W2	W2	W2	
R	Module	S-Meter		41Z			
VERA	Module	Fleet eCall A-Track	P1				

C-Health:	*Connect Health*	*Cons:*	*Consumer Application*
Ins-Tele:	*Insurance Telematics*	*Time:*	*Timing*
A-Track:	*Asset Tracking*	*SiP:*	*System in Package*
Agri 4.0:	*Agriculture 4.0*	*Ant:*	*Antenna Module*
S-Meter:	*Smart Meters*	*SP-GNSS:*	*Standard Precision GNSS*
C-Drone:	*Consumer Drones*	*HP-GNSS:*	*High Precision GNSS*
P-Drone:	*Professional Drones*	*Dead-Rec:*	*Dead Reckoning*
Transp:	*Transport*	*Fleet:*	*Fleet Management*
Emerg:	*Emergency*	*BT-LE:*	*Bluetooth Low Energy*
G&A:	*Geomatics & Agriculture*	*BT-BR:*	*Bluetooth Basic Rate*
IVS:	*In Vehicle System*	*V2X:*	*Vehicle to Everything*

APPENDIX 9 — CHINESE COMPETITORS PRODUCTS — *source: Company Data, Competitors Data*

	HP-GNSS	SP-GNSS	Low Power - GNSS	2G	3G	4G	5G	Cat 1	Cat M	NB-IoT	V2X	Bluetooth	Wi-Fi
u-blox	ZED-F9H	NEO-M9N	ZOE-M8B	SARA-G4	SARA-U201	NINA R2	SARA-R5	TOBY-R2	SARA-R4	SARA-N2	VERA-P1	NINA W15	NINA W10
Quectel	LC79D	L76		M95	UC20	EG18 -XX	RG500 Q	BC66 -NA	BG95	BC68	AG15	FC20	FC10
SIMCom				SIM808	SIM 5320	SIM 7600NA	SIM 8200G	SIM 7500A	SIM 7090G	SIM 7020G	SIM 8100	W59	W58
Fibocom				G510	H350	NL668 -EU	FG150	L610	MA510	N700			
BDStar	UM482	UM220-INS	UM220 -IV M0	UC6226									

APPENDIX 10 VALUE CHAIN

source: Industry Expert (ref 9), Company Data, Team Analysis

Activities	Support activities: Firm Infrastructure	Support activities: Design & Engineering	Support activities: Procurement	Primary activities: Chip Wafer Processing	Primary activities: Chip Packaging	Primary activities: Assembly & Distribution	Primary activities: Sales & Marketing
Owners	u-blox	u-blox	u-blox Flextronics	TSMC Global Foundries	AMKOR	Flextronics	u-blox
Costs	CHF 21m	CHF 110m	CHF 52m	CHF 62m	CHF 16 m	CHF 82m	CHF 37m
% of costs	6%	29%	14%	16%	4%	22%	10%
Importance	low	high	medium	high	high	high	medium
Cost control	full	full	moderate	limited	limited	limited	full
Cost drivers	Compensation, amenities	Frequency & sales of new models, R&D center location	Order size, supplier location & avg. purchase	Chip complexity, wafer yield	Chip complexity, order size	Order size & destination, module complexity	Account no. & value, ad. budget, reputation
Cost reduction opportunities	• R&D portfolio optimization • Pricing discipline and value communication improvement • Efficiency of sales forces • Key accounts investing • General and administrative costs optimization						

APPENDIX 11 EXECUTIVE COMMITTEE

source: Company Data

Member	Position	Background
Thomas Seiler	CEO	MSc in Electrical Engineering from ETH MBA from INSEAD Previously CEO of Melcher Holdings AG and Kitsler Holdings AG
Andreas Thiel	Head of Product Centers & co-founder	MSc in Electrical Engineering from Aachen University Research assistant at ETH
Jean-Pierre Wyss	Head of Production and Logics & co-founder	MSc in Electrical Engineering from ETH Diploma in Finance from INSEAD Research assistant & project manager at ETH
Roland Jud	CFO	MSc in Economics from University of St. Gallen Previously head of accounting in at Ascom Holdings AG Previously CFO at Nexgen
Markus Schaefer	Executive Director of Global Marketing & Sales	MSc in Electrical Engineering from Aachen RWTH MBA in Leadership from Tiffin University Head of Sales EMEA and India at MACOM Head of Global Sales at NXP

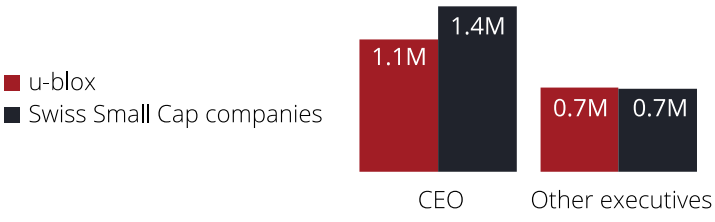
APPENDIX 12 EXECUTIVE COMMITTEE - COMPENSATION

source: Company Data, Team Analysis

Compensation includes: Base salary, Bonus, Value of options, Pension insurance, and other benefits.

Base salaries are regularly adjusted. In the forecast period, they have been adjusted with the IMF long term inflation.
Bonus rates are computed based on the EBIT margin and revenue growth as given by the formulas below:

CEO: *(3 + 0.7 x ((rev.growth - 1) - 0.15)) x exp((EBIT margin - 0.4) x 5))*
Other executives: *(1 + 0.4 x ((rev.growth - 1) - 0.15) + 2.1 x (EBIT margin - 0.4))*



Member	Base salary 2018 (CHF)	Base salary 2023E (CHF)	% Change	Bonus 2018 (CHF)	Bonus 2023E (CHF)	% Change
Thomas Seiler	466,752	512,811	10%	335,783	248,018	-26%
Andreas Thiel	318,240	349,644	10%	110,593	74,248	-33%
Jean-Pierre Wyss	318,240	349,644	10%	110,593	74,248	-33%
Roland Jud	310,284	340,903	10%	107,828	72,392	-33%
Markus Schaefer	-	340,903	-	-	72,392	-

Assumptions	
EBIT Margin 2023	4%
Revenue Growth 2023	8%
Base salary CAGR 18-23 (IMF exp. inf.)	1.9%
R. Jud and M. Schaefer Working Time	98%

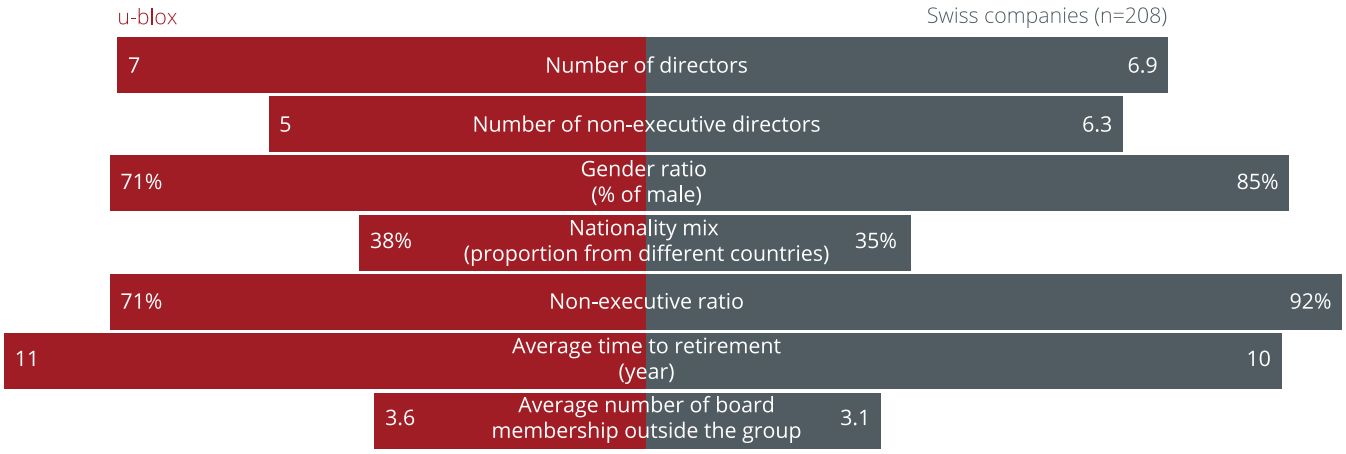
APPENDIX 13 BOARD OF DIRECTORS

source: Company Data, BoardEx, LinkedIn

Board Member	Background	Board membership (excl. u-blox)
André Müller (Chairman)	MSc in Electrical Engineering from ETH Previously CEO of Cicorel AG and HCT Shaping Systems SA Various positions in R&D in the aerospace industry	3
Gina Domanig (Vice-president)	BSc in Finance & Economics from ASU, MBAs from Thunderbird School (USA) and ESADE (Spain) Founder and partner of Emerald Technology Ventures AG 25 years of international business experience incl. banking, M&A and strategic development	8
Thomas Seiler (CEO)	MSc in Electrical Engineering from ETH MBA from INSEAD Previously CEO of Melcher Holdings AG and Kitsler Holdings AG	1
Jean-Pierre Wyss (co-founder)	MSc in Electrical Engineering from ETH Diploma in Finance from INSEAD Research assistant & project manager at ETH	1
Ulrich Looser	MSc in Physics from ETH and MSc in Economics from University of St. Gallen Career in McKinsey, Managing director at Accenture Experience in private equity investments and consulting	9
Annette Rinck	PhD in Applied Economics & Communication Science from Leipzig University Currently general manager of Honeywell brands Previously in boards of leading industry associations focused on futuristic IoT	1
Markus Borchert	MSc in Electrical Engineering from TU Munich and MBA from MIT 25 years of international experience in telecom Received the China Friendship Award CEO of Nokia Shanghai Belt and President of Nokia Greater China	3

APPENDIX 14 BOARD OF DIRECTORS - CHARACTERISTICS

source: BoardEx, Company Data, LinkedIn



APPENDIX 15 MAIN SHAREHOLDERS

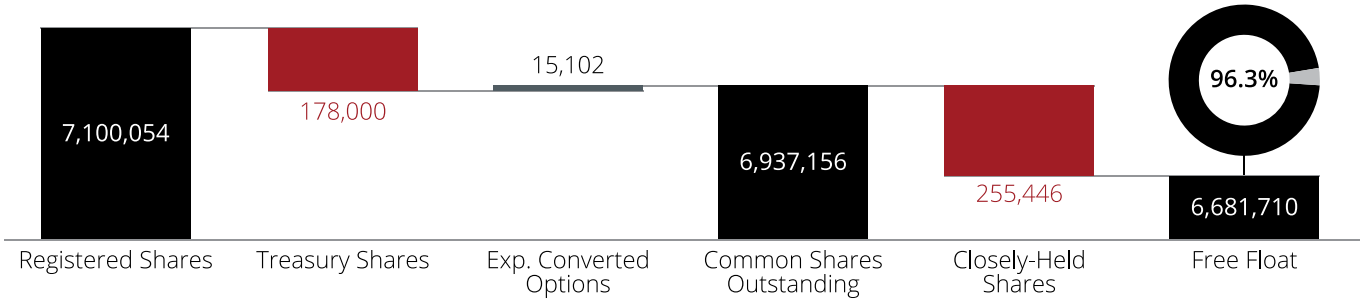
source: Company Data, S&P Capital IQ

Company	Type	% CSO
BAILLIE GIFFORD	British growth-oriented investment management firm	5.67%
CREDIT SUISSE Fund Management S.A.	Swiss investment bank	5.29%
CREDIT SUISSE Investment Banking & Securities Investments	Swiss investment bank	5.13%
MONDRIAN INVESTMENT PARTNERS LIMITED	British value-oriented investment management firm	4.85%
NORGES BANK Investment Bank	Asset Management unit from the Norwegian central bank	2.92%

Credit Suisse Group AG as Shareholder	Number of shares	% CSO
Credit Suisse Asset Management (Switzerland)	125,092	1.81%
Credit Suisse Fund Management S.A.	366,353	5.29%
Credit Suisse Investment Banking and Securities Investments	355,071	5.13%
Total	846,516	12.23%

APPENDIX 16 — COMMON SHARES OUTSTANDING & FREE FLOAT

source: Company Data, S&P Capital IQ



APPENDIX 17 — MSCI ESG SCORECARD

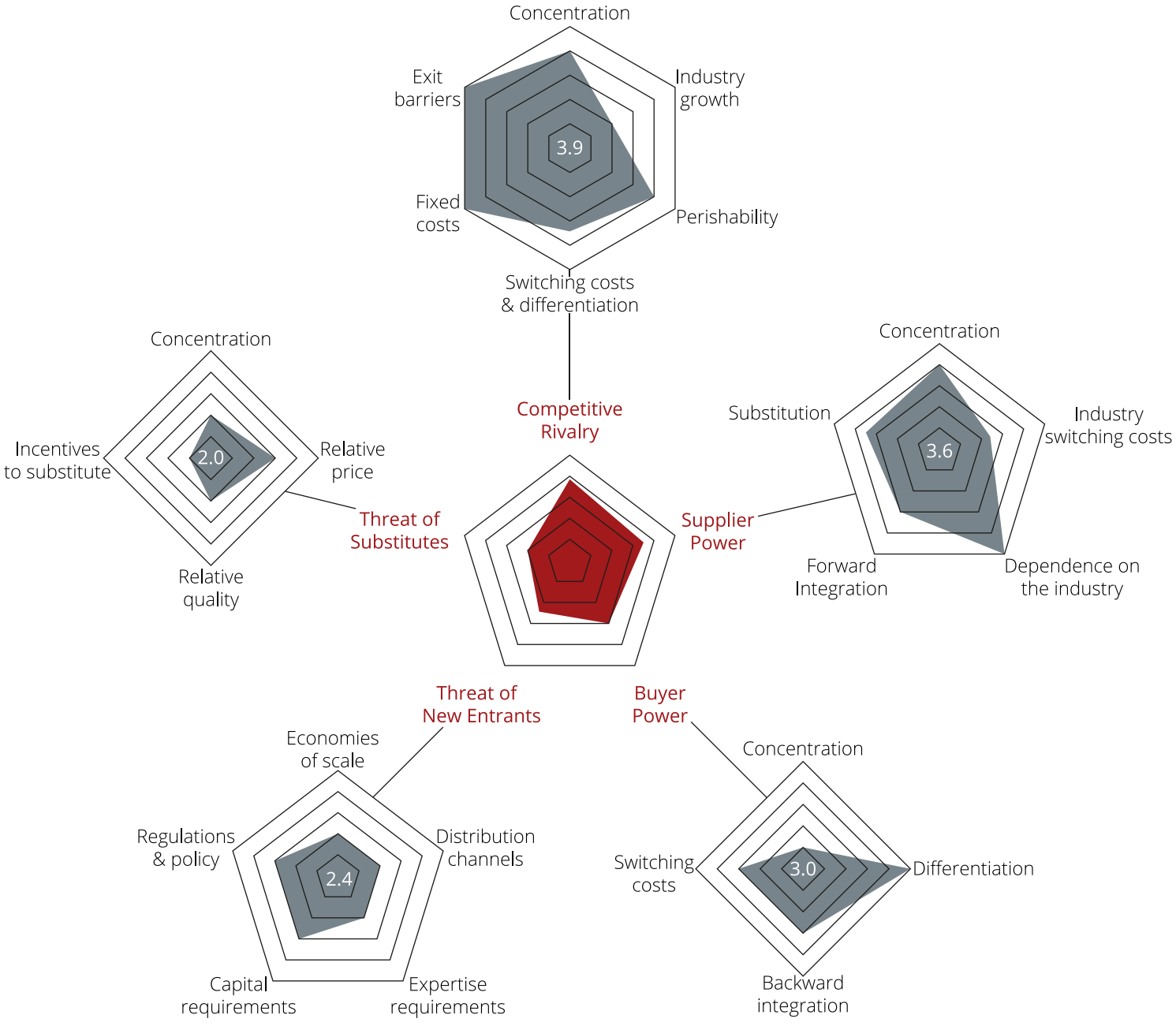
source: MSCI

Criteria	Weight	Score
Environment	28%	4.3
CleanTech Innovation	28%	4.3
Social	42%	5.3
Human Capital Development	28%	5.1
Controversial Sourcing	14%	5.8
Governance	30%	7.0
Corporate Governance	30%	7.0

	Score
Weighted Average	5.5
Industry Highest	7
Industry Lowest	3.9
Industry-Adjusted	5.8
ESG Grade	A

APPENDIX 18 — PORTER'S 5 FORCES (1/2)

source: Team Analysis



Competitive Rivalry		**3.9**
Concentration	GNSS market is concentrated with u-blox currently being the market leader. In the cellular market there are many different size competitors from Qualcomm with a market cap of USD 100B to numerous small competitors.	4
Industry growth	GNSS unit sales are expected to grow at a 12% growth annually between 2019 and 2023 whereas the cellular market is expected to grow in unit terms at a 27% CAGR over the same period.	2
Perishability	The semiconductor industry is heavily R&D focused therefore companies constantly need to release new generations of products to out-innovate their competitors.	4
Switching costs & Differentiation	Many competitors offer similar products and switching costs are moderate as customers can easily change suppliers when releasing new generations of products.	3.5
Fixed costs	The industry is fixed-cost oriented as it needs to support R&D and the associated wages, which cannot be cut because of talent competition. New entrants are currently putting pressure on margins.	5
Exit barriers	As launching a new product requires significant upfront R&D investment, companies in the industry are prone to sunk cost fallacy and less likely to exit.	5
Supplier Power		**3.6**
Concentration	u-blox has three different types of suppliers: silicon wafer processors (2 suppliers), chip packaging firms (1 supplier), and assembly and distribution services firms (1 supplier). Suppliers for u-blox are concentrated and the same can be said for the industry as a whole.	4
Switching costs for the industry	In the industry, companies generally own their encrypted-design masks and tooling. Therefore, switching costs between wafer processors would be relatively small. However, switching costs would be higher for services firms as they manage the inventory and product distribution.	2.5
Substitution	No substitute exists for the processing of wafers. However, firms in the industry could very well backward-integrate the services firms activities.	3.5
Forward integration	Processors are specialized in semiconductor production. It is very unlikely that they forward intergrate design creation. On the contrary, services firms are already offering design development to their customers.	3
Dependence on the industry	GNSS and cellular are niche markets and represent a relatively small portion of the entire semiconductor industry. Therefore, suppliers do not highly depend on them.	5
Buyer Power		**3.0**
Concentration	GNSS and cellular products have a wide range of applications. Therefore, customers are from different industries and can require large or small volumes. u-blox has 6700 customers with 99% representing only 20% of revenues.	1
Differentiation	GNSS and cellular module manufacturers offer similar products.	5
Switching costs	Switching costs are moderate as customers can easily change suppliers when they release new generations of products every two to six years.	3
Backward integration	On the module side, customers are specialized in specific products and have little incentives to produce GNSS or cellular modules, as it requires significant upfront investment in R&D and expertise. On the chip side, customers may have incentives to produce their own chips, as they buy larger volumes.	3
Threat of New Entrants		**2.4**
Economies of scale	Suppliers offer lower prices for high volume orders thus there are economies of scale for large companies. There are also R&D economies of scope from a reduction in the cost of development for new generations.	2
Capital requirements	Developing advanced chips requires large upfront R&D investments, causing an important barrier to entry for newly-established companies.	3
Expertise requirements	Heavily dependent on R&D, the already-existing companies have many years of expertise in chip manufacturing processes and employ highly-skilled engineers. Module development requires less expertise than chip design.	2
Distribution channels	u-blox has 22 years of experience in the industry and has managed to create strong relationship with customers and distributors. New entrants will need time and investment to create reliable distribution channels.	2
Regulations & Policy	The ongoing trade tensions between China and US is negatively impacting the semiconductor companies. Regulations on IoT, especially in Europe, might prevent the entry of new participants.	3
Threat of Substitutes		**2.0**
Concentration	There are numerous wireless technologies available on the market such as NB-IoT, LTE-M, Sigfox, LoRa or Win-Sun. NB-IoT and LTE-M technology - for which u-blox designs modules - are licensed meaning that they can be used only by operators and for independent usage. Unlicensed technology - that can be used by anyone - includes Sigfox, LoRa and Win-Sun and are u-blox's main substitutes.	2
Relative price	NB-IoT and LTE-M networks - necessary to use u-blox's products - are costly and their complexity makes modules more expensive (~USD 9 and ~USD 13 respectively) than the ones necessary to Sigfox, LoRa and Win-Sun networks (~USD 3, ~USD 9 and ~USD 8.5 respectively).	3
Relative quality	The quality of each technology depends on the use case. For example, LoRa, NB-IoT and LTE-M provide equal quality for asset tracking or smart-metering.	2
Incentives to substitute	If a customer has applied a specific design, switching to another technology would incure significant costs as the entire set-up would have to be reconfigured.	1

Strengths	
Qualified workforce	With the proximity and common history with the ETH, u-blox has access to highly skilled and educated young workforce.
New board member with expertise on Asian market	The newly appointed Director Markus Borchert has extensive experience in the cellular industry and an important network in Asia. During his time at Nokia Greater China, he helped establish the company as the main non-Chinese supplier.
New executive in global sales	The recent appointment of Markus Schaefer could add value to u-blox management team given his previous track record of growing market share in semiconductor companies such as NXP. Moreover, the creation of this new position should enable the CEO to focus more on corporate strategy and key account management.
Key locations	Based in Thalwil (CH), u-blox is geographically close to key companies in the semiconductor industry (e.g. IBM, AMS) and to ETH, a highly respected university of engineering and science.
Good liquidity situation	Currently, u-blox has a cash balance of CHF 136.3M representing about 25% of total assets.
Good reputation	With 20 years of experience, u-blox has a good reputation in the industry *(ref 8)*.

Weaknesses	
Employee compensation and skills development	u-blox being active in a higly innovative industry, its employees need to be up-to-date regarding the last technological breakthrough. There is lack of diclosure about support for degree programs and certifications.
R&D hamsterwheel	u-blox's future revenues highly depend on their R&D investments. However, the ROI might end up being negative in case the infrastructure is not ready or the technology is changing too fast.
Sapcorda Joint Venture investment	Initially founded in 2016, Sapcorda Joint Venture (JV) required several upfront investments (CHF 4.1M only in 2018). As of today the JV is still showing negative profits (CHF 3.3M in 2018 and CHF 2M in H12019 accounted for u-blox holdings).
Stock price drop and volatility	In June 2018, u-blox's stock price started to plummet due to the 25% tariffs on automobiles in both China and the US. This impacted u-blox because of its high reliance on the automotive sector. u-blox stock price is sensitive to trade war news.
Supply chain dependency	As Flextronics drop-ship most products to end-customers, u-blox is highly dependent on the Austrian company. If Flextronics' business is interrupted or decides to unexpectedly increase prices, u-blox's activities might be severely impacted.
Bet on IoT	u-blox is diverting capital to R&D activities for products that have no market yet. This includes the the NB-IoT and V2X chips.
Bet on autonomous vehicles	u-blox is currently betting on AV with its V2X and F9 platform. AV market is not expected to contribute before 10 years.
Missed guidance	u-blox has an history of missing guidance since 2016. In 2018, the company missed its initial revenue guidance of CHF 460M-475M, with CHF 393M.
Replicability of GNSS natural market products	u-blox has high market shares in automobile GNSS, professional drone market and timing and synchronisation. Despite overall market growth, market shares are expected to decrease as u-blox's products are relatively simple and replicable.
Costly broad customer base	In 2019, u-blox had a customer base of more than 6700 firms and 99% of them generated only 20% of the revenues, while requiring substantial administrative resources.
Failed acquisition of SIMCom	In 2017, u-blox failed to acquire Chinese wireless solution supplier SIMCom. The target finally signed a deal with SunSea, a Chinese direct competitor of u-blox.
Busy outsider board members	There are only three independent board members that are not ETH alumni: Gina Domanig, Markus Brochert and Annette Rinck. They however are quite busy. Mrs. Domanig seats at 8 other boards while Mr. Borchert seats at 2 others and is currently the CEO of Nokia Shanghai Belt.

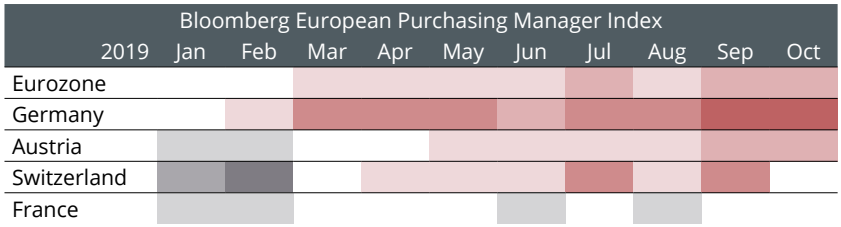
Opportunities	
CNY appreciation	With a potential US-China trade deal in sight, we could expect an appreciation of the CNY, translating into slightly pricier Chinese products.
Rising demand for high precison positionning	The demand for increased positioning accuracy in mass market applications might grow. u-blox would be able to meet this demand with its F9 module.
Growing GNSS market	Global annual GNSS receiver shipments is expected to grow in the next decade from 1.8B units in 2019 to 2.8B units in 2029, with drones becoming a significant market segment.
Business model innovation	As services segments are providing higher gross margins than manufacturing segments, there is an opportunity for u-blox to adapt and develop its services business model to third parties, as some competitors such as Sierra Wireless have done.
NB-IoT rollout	We are expecting NB-IoT rollout between 2022 and 2023. There is a first mover opportunity for u-blox, although it will be a very competitive market.
Switzerland's strong ties with China	In April 2019, Switzerland and China signed a declaration of intending to increase cooperation in trade and investment under the Belt and Road Initiative. This will improve the condition and facilitate business cooperation between the two countries. Plus Switzerland is the first and only European country so far to have an FTA with China *(ref 18)*.

Threats	
Economic slowdown	Recession bellwethers including a deteriorating European Purchasing Managers' index, inverted yield curve, and plummeting OECD Business Confidence Index are evidence of global economy cooling.
Increasing Chinese competition	The CICIIF, "Made in China 2025" program and, Belt and Road initiative are aiming to create a closed-loop semiconductor manufacturing ecosystem and to increase Chinese-based companies' international competitiveness. These policies have the potential to restrict the market access to foreign semiconductor companies like u-blox as they are directly competing with domestic companies and put pressure on prices.
Talent poaching	Heavily R&D-focused, the semiconductor industry is lacking highly-skilled engineers, creating fierce competition between companies and putting talent risk at the top of the most dramatic risks for companies' growth.
Shared economy regulation	Regulations can easily bring activities in a country to a standstill. In 2017, several Chinese cities banned deliveries of new shared bikes for safety concerns. With the ongoing shared transportation trend, more regulations could arise worldwide.
Intensifying trade war	Since June 2018, u-blox's stock price has been fluctuating according to the trade war key events. At the same time, the share of revenues coming from China decreased from 32.8% to 25.2% between 2017 and 2018. If the tensions continue to worsen, u-blox will suffer from losses of industrial and auto sales.
Semiconductor industry game of thrones dynamic	The semiconductor industry is constantly renewing itself and the leaders of today can be the losers of tomorrow if they are not able to out-innovate their direct competitors.

APPENDIX 20 — MACROECONOMIC OVERVIEW

source: OECD, US Fed, Bloomberg

The global economy is cooling. Over the past months, the European Purchasing Managers' Index has been deteriorating, especially in Germany. Last March the US Treasury bond yield curve inverted for the first time since the financial crisis. Since 2018, the probability of recession has been increasing from 4% to 17% and is expected to reach 40% in 2020. Following these warning signs of an economic slowdown, the OECD Business Confidence Index has reached its lowest level since 2010.



10Y - 3 Month US Treasury Spread

US Fed. Probability of Recession

OECD Business Confidence Index

APPENDIX 21 — COMPETITORS DESCRIPTION

source: Company Data, Thomson Reuters, Bloomberg

Ticker	Comp. Name	Mkt Cap*	P	C	SR	Business description	R&D budget*
2151	Beijing BDStar Navigation Co. Ltd	1,562	■			Main products are Global Navigation Satellite System (GNSS) chips, modules and board cards, navigation positioning antennas & microwave communication devices.	53
AVGO	Broadcom Inc.	125,118	■	■	■	Designer, developer and global supplier of a range of semiconductor devices with a focus on digital and mixed signal complementary metal oxide semiconductor based devices and analog III-V based products.	3,768
300638	Fibocom Wireless Inc.	1,248		■		Main business is primarily engaged in the sales of wireless modules which have been applied in machine to machine (M2M) and MI (Multi-intelligent) consumer electronics, provision of solution plans, sales of parts and components.	19
6814	Furuno Electric Co. Ltd	395	■			Engaged in the manufacture & sale of marine electronic equipment & industrial electronic equipment that utilize ultrasound & electromagnetic wave sensor technologies.	42
4906	Gemtek Technology Co. Ltd	288		■	■	Primary products include wireless gateways & wireless local area network cards. Products are mainly used in the manufacturing of office computers & computer wireless transmission equipment, as well as wireless & wired network transmission equipment.	28
LTRX	Lantronix Inc.	74	■	■	■	Provider of secure data access and management solutions for Internet of things and information technology assets. Its connectivity solutions serves a range of industries, including data center, medical, security, environmental and government.	8
2454	Mediatek Inc.	22,740	■	■	■	Principal products include mobile communication chipsets, Bluetooth chips, wireless local area network (WLAN) chips, global positioning system (GPS) chips, optical storage chipsets, DVD player system-on-chips (SOCs), high integrated digital television control chips and television decoding chipsets, among others.	2,033
NOD	Nordic Semiconductor Asa	1,084		■	■	Engaged in the development and sell of integrated circuits and related solutions for short-range wireless communication. Its solutions are applied to a range of end products, such as PC and tablet accessories, mobile and wearable devices, home electronic devices, sports and health monitors, toys, as well as installed sensor networks.	49
QCOM	Qualcomm Inc.	100,288	■	■	■	Engaged in the development and commercialization of a digital communication technology called code division multiple access. The products principally: integrated circuits and system software used in mobile devices and in wireless networks.	5,619
603236	Quectel Wireless Solutions Co. Ltd	2,008	■	■	■	Main products include GSM/GPRS (2G category), WCDMA/HSPA (3G category), LTE (4G category) and NB-IoT cellular communication modules, as well as GNSS t module and EVB tool. The Company's products are mainly used in the fields of wireless payment, vehicle transportation, smart energy, smart city, intelligent security, wireless gateway, industrial applications, medical health and agricultural.	33
SQNS	Sequans Communications S.A.	75		■		The Company offers semiconductor solutions for wireless broadband applications, with a specific focus on the single-mode device market. The solutions integrate baseband processor and radio frequency (RF) transceiver integrated circuits (ICs) along with its signal processing techniques, algorithms and software stacks.	36
SWIR	Sierra Wireless Inc.	344	■	■	■	Offers a portfolio of second, third, & fourth generation cellular embedded wireless modules & gateways, integrated with its secure cloud & connectivity services.	94
STM	STMicroelectronics N.V.	22,397	■		■	Range of products, including discrete and standard commodity components, & application-specific integrated circuits (ASICs) for analog, digital & mixed-signal applications.	1,684
2313	Sunsea AIoT Technology Co. Ltd	882		■	■	Design and research & development of wireless communication modules. In 2017, after u-blox failed the acquisition of SiMCom, Sunsea AIoT acquired SiMCom.	30
TELT	Telit Communications PLC	290	■	■	■	Modules are integrated in a range of applications, including asset tracking, remote industrial monitoring, automated utility meter reading, insurance telematics, consumer electronics and mobile health devices.	77
6285	Wistron NeWeb Corp.	959		■	■	Main products include satellite communications products, mobile and home communications products and other wireless communications products	83
UBXN	u-box Holding SA	633	■	■	■	u-blox is a supplier of chipsets and modules that provide Global Navigation Satellite System (GNSS), cellular, Wi-Fi, and Bluetooth functionality to industrial devices.	111

*USD million | P: Positioning | C: Cellular | SR: Short-Range

	Revenue (USD million)					Gross margin					R&D spending TO Sales				
	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018
BDStar	154	171	233	339	444	30%	32%	32%	31%	30%	11%	12%	10%	16%	12%
Broadcom	4269	6824	13240	17636	20848	44%	52%	45%	48%	52%	16%	15%	20%	19%	18%
Fibocom	47	50	50	87	182	26%	28%	28%	27%	23%	6%	11%	10%	11%	11%
Furuno	719	794	703	740	738	32%	33%	34%	36%	39%	5%	5%	5%	6%	6%
Gemtek	562	537	450	457	566	10%	12%	16%	13%	9%	6%	6%	7%	7%	5%
Lantronix	43	41	45	46	47	50%	47%	48%	53%	56%	15%	16%	17%	18%	17%
Mediatek	6742	6491	8552	8005	7749	49%	43%	36%	36%	39%	25%	28%	23%	26%	26%
Nordic Semi	167	193	198	236	271	49%	50%	47%	47%	50%	20%	15%	20%	17%	18%
Qualcomm	26487	25281	23554	22291	22732	61%	60%	60%	58%	57%	21%	22%	22%	25%	25%
Quectel	29	47	82	255	393	28%	25%	23%	18%	20%	18%	13%	11%	8%	8%
Sequans	23	33	46	48	40	30%	40%	44%	44%	39%	146%	92%	66%	75%	90%
Sierra W.	549	608	615	691	794	33%	32%	35%	34%	33%	15%	12%	12%	12%	12%
STM	7404	6897	6973	8347	9664	34%	34%	35%	39%	40%	26%	25%	23%	19%	17%
Sunsea AIoT	392	442	389	460	644	26%	22%	21%	20%	18%	6%	6%	4%	3%	5%
Telit	294	334	370	375	428	40%	40%	40%	35%	33%	18%	18%	14%	20%	18%
Wistron	1275	1590	1638	1914	1824	13%	13%	14%	13%	13%	5%	5%	5%	4%	5%
Median						**33%**	**34%**	**35%**	**36%**	**36%**	**16%**	**14%**	**13%**	**17%**	**14%**
u-blox	272	338	354	414	399	45%	46%	46%	46%	45%	21%	21%	23%	25%	28%

	EBITDA margin (R&D AS Reported)					EBITDA margin (R&D Capitalized)					EBITDA margin (R&D Expensed)				
	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018
BDStar	11%	8%	11%	13%	11%	12%	9%	12%	12%	11%	1%	-3%	2%	-4%	-1%
Broadcom	28%	40%	28%	42%	45%	44%	55%	48%	61%	63%	28%	40%	28%	42%	45%
Fibocom	10%	11%	12%	9%	9%	16%	19%	21%	18%	17%	9%	8%	11%	7%	6%
Furuno	5%	5%	6%	6%	7%	10%	10%	11%	12%	13%	5%	5%	6%	6%	7%
Gemtek	2%	3%	5%	2%	2%	8%	9%	12%	9%	7%	2%	3%	5%	2%	2%
Lantronix	0%	-4%	-1%	2%	4%	15%	12%	15%	19%	21%	0%	-4%	-1%	2%	4%
Mediatek	24%	15%	11%	7%	10%	44%	38%	31%	31%	34%	19%	10%	8%	5%	8%
Nordic Semi	16%	23%	11%	10%	10%	35%	34%	28%	24%	23%	15%	18%	8%	6%	5%
Qualcomm	34%	30%	34%	29%	19%	55%	52%	56%	54%	44%	34%	30%	34%	29%	19%
Quectel	6%	9%	4%	5%	7%	20%	20%	12%	11%	13%	2%	7%	1%	3%	5%
Sequans	-127%	-56%	-32%	-29%	-59%	19%	34%	34%	40%	29%	-127%	-58%	-32%	-35%	-61%
Sierra W.	5%	6%	8%	6%	4%	20%	18%	20%	18%	16%	5%	6%	8%	6%	4%
STM	14%	13%	15%	21%	23%	35%	33%	34%	36%	37%	9%	8%	11%	17%	20%
Sunsea AIoT	6%	5%	6%	6%	6%	10%	9%	9%	8%	9%	4%	3%	5%	5%	4%
Telit	10%	12%	12%	6%	6%	19%	22%	18%	18%	18%	1%	4%	4%	-2%	0%
Wistron	7%	7%	8%	7%	6%	11%	11%	12%	10%	10%	6%	6%	7%	6%	5%
Median	8%	9%	9%	6%	7%	**19%**	**19%**	**19%**	**18%**	**18%**	**5%**	**6%**	**7%**	**6%**	**5%**
u-blox	22%	22%	23%	22%	18%	35%	35%	35%	33%	33%	14%	14%	12%	8%	5%

	EBIT margin (R&D AS Reported)					EBIT margin (R&D Capitalized)					EBIT margin (R&D Expensed)				
	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018
BDStar	3%	1%	5%	6%	-10%	6%	2%	6%	9%	-6%	-1%	-5%	1%	-5%	-2%
Broadcom	10%	24%	-4%	13%	24%	22%	35%	21%	28%	36%	10%	24%	-4%	13%	24%
Fibocom	9%	10%	11%	8%	8%	15%	18%	18%	16%	14%	9%	7%	8%	5%	3%
Furuno	2%	-1%	2%	2%	2%	3%	4%	4%	5%	6%	2%	-1%	2%	2%	2%
Gemtek	-1%	1%	2%	-1%	0%	2%	3%	3%	-2%	-2%	-1%	1%	2%	-1%	0%
Lantronix	-2%	-6%	-5%	0%	2%	0%	-5%	-2%	3%	5%	-2%	-6%	-5%	0%	2%
Mediatek	22%	12%	8%	4%	7%	32%	23%	17%	12%	11%	18%	9%	7%	4%	6%
Nordic Semi	12%	18%	5%	4%	5%	24%	20%	12%	8%	8%	13%	16%	5%	3%	4%
Qualcomm	28%	22%	27%	11%	3%	38%	32%	30%	25%	14%	28%	22%	27%	11%	3%
Quectel	5%	9%	3%	6%	7%	18%	17%	9%	9%	11%	2%	7%	1%	3%	4%
Sequans	-151%	-73%	-43%	-41%	-79%	-122%	-75%	-47%	-38%	-66%	-143%	-68%	-39%	-41%	-69%
Sierra W.	-1%	2%	4%	0%	-2%	3%	3%	4%	3%	2%	-1%	2%	4%	0%	-2%
STM	2%	2%	3%	12%	15%	-7%	-8%	-4%	8%	13%	-1%	-1%	2%	10%	12%
Sunsea AIoT	2%	-1%	3%	3%	2%	6%	5%	4%	3%	6%	2%	1%	3%	3%	3%
Telit	5%	6%	5%	-13%	-8%	8%	10%	5%	0%	4%	0%	2%	2%	-4%	-2%
Wistron	4%	5%	5%	5%	4%	5%	6%	6%	5%	5%	4%	4%	4%	4%	3%
Median	**4%**	**3%**	**3%**	**4%**	**3%**	**6%**	**5%**	**5%**	**7%**	**6%**	**2%**	**2%**	**2%**	**3%**	**3%**
u-blox	14%	15%	16%	16%	12%	21%	21%	21%	19%	17%	12%	12%	10%	6%	2%

	FCF margin					SG&A TO Sales					Asset turnover (R&D Capitalized)				
	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018
BDStar	-5%	1%	-9%	-13%	1%	18%	23%	20%	18%	19%	0.52	0.38	0.34	0.35	0.44
Broadcom	18%	25%	20%	31%	40%	10%	7%	6%	4%	5%	0.51	0.54	0.38	0.30	0.34
Fibocom	16%	12%	13%	-24%	-3%	11%	9%	8%	10%	7%	1.74	1.52	1.16	1.04	1.27
Furuno	0%	-2%	3%	2%	3%	24%	23%	25%	26%	26%	0.89	0.94	0.87	0.88	0.90
Gemtek	-4%	8%	12%	-3%	-7%	5%	5%	6%	6%	5%	0.86	0.89	0.81	0.77	0.93
Lantronix	2%	-5%	-1%	4%	1%	29%	30%	33%	34%	35%	0.89	0.86	0.83	0.89	0.84
Mediatek	16%	7%	9%	7%	7%	6%	8%	7%	8%	8%	0.54	0.46	0.55	0.44	0.42
Nordic Semi	8%	-8%	-8%	7%	0%	14%	14%	18%	22%	23%	0.95	0.93	0.81	0.88	0.84
Qualcomm	29%	18%	30%	19%	14%	9%	9%	9%	11%	12%	0.44	0.39	0.35	0.30	0.35
Quectel	-16%	6%	-12%	-1%	0%	9%	6%	11%	8%	8%	1.59	1.78	1.85	2.31	2.04
Sequans	-136%	-67%	-46%	-73%	-80%	54%	35%	29%	32%	44%	0.14	0.23	0.30	0.31	0.25
Sierra W.	6%	0%	5%	-2%	3%	16%	16%	17%	17%	19%	0.75	0.81	0.78	0.80	0.85
STM	2%	4%	6%	4%	6%	13%	13%	13%	12%	11%	0.50	0.50	0.55	0.64	0.67
Sunsea AIoT	8%	11%	10%	2%	-20%	18%	16%	14%	13%	9%	0.55	0.61	0.61	0.64	0.71
Telit	3%	1%	2%	-13%	-2%	26%	25%	25%	25%	20%	1.06	1.05	1.04	0.89	0.96
Wistron	1%	-1%	3%	2%	-2%	5%	5%	5%	5%	5%	1.46	1.68	1.54	1.59	1.48
Median	**2%**	**3%**	**4%**	**2%**	**1%**	**13%**	**13%**	**13%**	**12%**	**11%**	**0.81**	**0.83**	**0.79**	**0.79**	**0.84**
u-blox	7%	9%	12%	-1%	-6%	13%	12%	13%	14%	15%	0.79	0.76	0.69	0.67	0.57

APPENDIX 22 COMPETITORS FINANCIAL PERFORMANCE METRICS (2/2)

source: Thomson Reuters, Team Analysis

	ROA (R&D Capitalized)					ROE (R&D Capitalized)					ROIC (R&D Capitalized)				
	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018
BDStar	4%	2%	2%	3%	3%	7%	3%	2%	4%	4%	9%	6%	9%	15%	13%
Broadcom	8%	16%	9%	7%	13%	15%	33%	20%	15%	25%	27%	40%	91%	73%	69%
Fibocom	23%	26%	20%	14%	16%	37%	40%	32%	22%	27%	49%	51%	51%	30%	31%
Furuno	-1%	3%	1%	1%	4%	-2%	5%	2%	2%	8%	10%	4%	2%	2%	7%
Gemtek	2%	3%	4%	1%	1%	3%	5%	6%	1%	1%	4%	8%	11%	7%	6%
Lantronix	-2%	-5%	-3%	3%	3%	-2%	-7%	-3%	4%	4%	-2%	-8%	-4%	5%	5%
Mediatek	16%	10%	9%	7%	5%	20%	13%	12%	10%	7%	57%	43%	35%	26%	27%
Nordic Semi	17%	13%	7%	5%	5%	22%	16%	9%	6%	5%	36%	28%	19%	16%	15%
Qualcomm	15%	10%	9%	7%	-4%	18%	13%	13%	10%	-7%	36%	27%	27%	22%	26%
Quectel	30%	30%	17%	20%	21%	38%	39%	27%	31%	34%	47%	45%	30%	38%	47%
Sequans	-17%	-20%	-18%	-16%	-21%	-20%	-26%	-28%	-24%	-34%	-24%	-23%	-21%	-16%	-23%
Sierra W.	-1%	1%	2%	1%	-1%	-1%	1%	3%	2%	-1%	7%	3%	5%	3%	-1%
STM	-5%	-5%	-2%	3%	8%	-7%	-7%	-3%	5%	12%	20%	20%	15%	22%	28%
Sunsea AIoT	2%	1%	2%	2%	2%	4%	2%	4%	4%	5%	7%	7%	8%	9%	10%
Telit	7%	8%	4%	-8%	-4%	13%	13%	7%	-16%	-7%	25%	26%	18%	6%	12%
Wistron	6%	8%	7%	7%	6%	11%	14%	13%	12%	10%	27%	28%	26%	24%	22%
Median	**5%**	**6%**	**4%**	**3%**	**4%**	**9%**	**9%**	**7%**	**5%**	**5%**	**21%**	**19%**	**20%**	**18%**	**18%**
u-blox	14%	12%	11%	10%	8%	17%	16%	15%	14%	11%	39%	39%	36%	33%	24%

	LT. Debt TO Assets					Current ratio					Cash conversion cycle, days				
	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018
BDStar	2%	5%	2%	10%	19%	2.61	1.95	3.14	1.80	2.10	138	215	171	165	147
Broadcom	44%	37%	27%	32%	35%	3.77	3.36	2.31	6.26	3.90	58	43	50	58	61
Fibocom	9%	15%	10%	13%	23%	2.33	2.19	2.05	2.31	1.66	57	40	4	49	43
Furuno	16%	21%	20%	18%	16%	1.83	2.08	2.17	2.49	2.32	172	164	184	185	193
Gemtek	24%	24%	10%	13%	18%	1.18	1.40	2.01	1.64	1.52	53	51	54	62	81
Lantronix	0%	1%	1%	0%	0%	1.85	1.79	2.19	2.16	2.39	105	108	101	98	114
Mediatek	13%	14%	15%	16%	13%	2.45	2.12	1.85	1.88	1.93	32	49	44	40	57
Nordic Semi	0%	2%	6%	7%	3%	3.31	2.70	3.55	3.43	4.53	134	175	224	176	152
Qualcomm	0%	22%	22%	33%	50%	3.73	3.62	3.14	4.00	1.53	15	22	30	46	46
Quectel	14%	6%	26%	0%	12%	2.36	2.42	1.51	2.23	1.86	58	50	74	33	36
Sequans	5%	32%	37%	43%	68%	1.91	1.15	1.59	1.42	1.59	106	-2	50	24	122
Sierra W.	0%	0%	0%	0%	0%	2.62	1.95	1.70	1.64	1.70	9	22	18	36	46
STM	20%	20%	18%	18%	18%	2.86	3.00	2.76	2.52	2.76	43	62	82	72	70
Sunsea AIoT	14%	18%	6%	18%	29%	1.64	1.67	1.97	1.45	1.23	337	236	204	208	181
Telit	13%	12%	14%	21%	22%	1.24	1.30	1.11	1.11	0.88	-3	-23	-25	-28	-23
Wistron	8%	7%	13%	13%	8%	1.47	1.39	1.55	1.69	1.51	34	38	46	51	68
Median	**13%**	**15%**	**14%**	**16%**	**18%**	**2.35**	**2.02**	**2.03**	**2.02**	**1.78**	**58**	**50**	**52**	**55**	**69**
u-blox	12%	19%	17%	26%	26%	2.16	3.97	4.05	4.81	4.99	65	64	65	73	104

The competitors report in accordance with US GAAP, Chinese GAAP, Taiwanese GAAP, Japanese GAAP and IFRS, implying different R&D cost accounting. Given these differences, the ratios can be presented in 3 forms:

- R&D as reported – financial results as presented in the financial statements;
- R&D Expensed – financial results if 100% of R&D spending was expensed;
- R&D Capitalized* – financial results if 100% of R&D spending was capitalized as the costs represent long-term investment.

* R&D expenses have been consistently capitalized starting from 2009 and amortized over 5 year useful life. The difference between capitalized R&D expenses and additional amortization increases the operating income. R&D expenses treated like capital expenditures augment the value of R&D assets on the balance sheet as well as equity and capital.

APPENDIX 23.0 REVENUE FORECAST - SUMMARY

source: Thomson Reuters, Team Analysis

	2018	2019E	2020E	2021E	2022E	2023E
GNSS (CHF M)	240	232	257	285	308	321
segment growth		*-3.2%*	*10.4%*	*11.1%*	*8.1%*	*4.3%*
Cellular (CHF M)	115	110	121	135	155	176
segment growth		*-4.6%*	*9.9%*	*12.0%*	*14.5%*	*13.6%*
Short-Range (CHF M)	35	34	37	41	47	54
segment growth		*-4.6%*	*9.9%*	*12.0%*	*14.5%*	*13.6%*
Other (CHF M)	3	3	3	4	4	4
segment growth		*-3.7%*	*10.3%*	*11.4%*	*10.2%*	*7.4%*
Tot. Revenue (CHF M)	**393**	**379**	**417**	**465**	**514**	**555**
growth		*-3.7%*	*10.2%*	*11.4%*	*10.6%*	*8.0%*
Revenue by region						
America (CHF M)	127	126	142	164	189	214
EMEA (CHF M)	129	128	146	170	198	227
APAC (CHF M)	138	125	129	131	127	114
America	32%	33%	34%	35%	37%	38%
EMEA	33%	34%	35%	37%	39%	41%
APAC	35%	33%	31%	28%	25%	21%
Chips & Modules Summary						
ASP Chip (CHF)	1.61	1.56	1.54	1.59	1.64	1.67
ASP Module (CHF)	9.71	9.50	9.99	10.40	10.52	10.28
# of Chips sold (M)	58.84	54.39	53.59	51.88	48.94	44.46
# of Modules sold (M)	30.45	30.60	33.19	36.44	40.86	46.39

	Market size in units (million)						u-blox market share						u-blox GNSS revenue (CHF million)					
	2018	2019E	2020E	2021E	2022E	2023E	2018	2019E	2020E	2021E	2022E	2023E	2018	2019E	2020E	2021E	2022E	2023E
Consumer GNSS	**1642**	**1709**	**1780**	**1857**	**1940**	**2031**	**2%**	**1%**	**1%**	**1%**	**1%**	**0%**	**39.6**	**33.0**	**30.1**	**27.2**	**22.2**	**14.2**
America																		
Phones	373	381	388	396	404	412	0%	0%	0%	0%	0%	0%	0.0	0.0	0.0	0.0	0.0	0.0
Other	50	57	64	73	83	94	10%	9%	8%	7%	6%	5%	8.0	8.0	7.9	8.1	8.2	7.9
EMEA																		
Phones	287	295	304	312	321	330	0%	0%	0%	0%	0%	0%	0.0	0.0	0.0	0.0	0.0	0.0
Other	38	44	50	58	66	76	10%	9%	8%	7%	6%	5%	6.2	6.2	6.2	6.4	6.5	6.3
APAC																		
Phones	788	811	835	859	884	910	0%	0%	0%	0%	0%	0%	0.0	0.0	0.0	0.0	0.0	0.0
Other	105	121	138	159	182	208	15%	10%	8%	5%	3%	0%	25.4	18.8	16.0	12.6	7.5	0.0
In Veh. Syst. (IVS)	**43.6**	**45.2**	**48.5**	**52.2**	**56.1**	**60.4**	**78%**	**74%**	**70%**	**67%**	**63%**	**60%**	**54.9**	**51.9**	**52.3**	**55.3**	**58.2**	**60.0**
America	13.8	14.0	14.4	14.8	15.3	15.8	80%	77%	74%	71%	68%	65%	17.8	16.8	16.3	16.8	17.1	17.1
EMEA	16.5	17.1	18.3	19.6	21.0	22.5	80%	78%	76%	74%	72%	70%	21.2	20.8	21.4	23.1	24.9	26.3
APAC	13.3	14.1	15.8	17.7	19.8	22.1	75%	65%	60%	55%	50%	45%	16.0	14.3	14.6	15.5	16.2	16.6
Transport. other	**14.0**	**14.4**	**14.4**	**13.9**	**12.6**	**10.2**	**17%**	**17%**	**18%**	**18%**	**18%**	**17%**	**15.0**	**14.0**	**12.7**	**13.0**	**12.1**	**9.7**
America	4.5	4.4	4.3	3.9	3.4	2.7	17%	18%	18%	19%	20%	23%	4.8	4.4	3.9	4.0	3.8	3.3
EMEA	5.3	5.5	5.4	5.2	4.7	3.8	17%	18%	18%	19%	20%	23%	5.7	5.4	5.0	5.3	5.2	4.8
APAC	4.2	4.5	4.7	4.7	4.4	3.7	17%	17%	16%	15%	13%	7%	4.5	4.2	3.8	3.7	3.1	1.6
Prof. Drones	**1.9**	**2.4**	**2.6**	**2.9**	**3.2**	**3.5**	**80%**	**78%**	**77%**	**75%**	**72%**	**69%**	**56.1**	**61.5**	**86.5**	**110.2**	**130.0**	**147.5**
America	0.6	0.8	0.8	0.9	1.0	1.1	80%	80%	80%	80%	78%	76%	18.2	20.1	28.8	37.2	44.2	50.7
EMEA	0.7	0.9	1.0	1.1	1.2	1.3	80%	80%	80%	80%	78%	76%	21.2	23.4	33.3	42.9	50.9	58.1
APAC	0.6	0.7	0.8	0.9	1.0	1.2	80%	75%	70%	65%	60%	55%	16.7	17.9	24.5	30.2	34.9	38.7
Cons. Drones	**9.5**	**11.1**	**11.9**	**12.8**	**13.6**	**14.6**	**77%**	**67%**	**63%**	**59%**	**54%**	**50%**	**54.5**	**49.9**	**48.2**	**47.6**	**48.8**	**48.8**
America	3.1	3.6	3.8	4.0	4.3	4.6	80%	70%	68%	65%	63%	60%	18.3	16.8	16.5	16.7	17.6	18.3
EMEA	3.6	4.2	4.4	4.7	4.9	5.2	80%	70%	68%	65%	63%	60%	21.4	19.5	19.2	19.3	20.3	20.9
APAC	2.8	3.4	3.7	4.0	4.4	4.8	70%	60%	53%	45%	38%	30%	14.8	13.6	12.5	11.6	10.9	9.6
Marine	**1.7**	**1.8**	**1.9**	**2.0**	**2.0**	**2.1**	**5%**	**5%**	**5%**	**5%**	**5%**	**5%**	**0.5**	**0.5**	**0.5**	**0.5**	**0.6**	**0.6**
America	1.0	1.0	1.0	1.0	1.0	1.0	0%	0%	0%	0%	0%	0%	0.0	0.0	0.0	0.0	0.0	0.0
EMEA	0.4	0.4	0.5	0.5	0.5	0.6	20%	20%	20%	20%	20%	20%	0.5	0.5	0.5	0.5	0.6	0.6
APAC	0.4	0.4	0.4	0.5	0.5	0.6	0%	0%	0%	0%	0%	0%	0.0	0.0	0.0	0.0	0.0	0.0
Trains	**0.1**	**0.1**	**0.2**	**0.2**	**0.2**	**0.3**	**33%**	**32%**	**32%**	**31%**	**31%**	**30%**	**0.2**	**0.2**	**0.3**	**0.3**	**0.4**	**0.5**
America	0.0	0.1	0.1	0.1	0.1	0.1	40%	40%	40%	40%	40%	40%	0.1	0.1	0.1	0.2	0.2	0.3
EMEA	0.0	0.0	0.0	0.1	0.1	0.1	20%	20%	20%	20%	20%	20%	0.0	0.0	0.0	0.1	0.1	0.1
APAC	0.0	0.0	0.0	0.1	0.1	0.1	35%	33%	31%	29%	27%	25%	0.1	0.1	0.1	0.1	0.1	0.1
Geomatics	**0.5**	**0.5**	**0.6**	**0.6**	**0.6**	**0.7**	**36%**	**34%**	**33%**	**32%**	**31%**	**30%**	**7.8**	**8.4**	**9.8**	**11.0**	**12.5**	**13.6**
America	0.1	0.1	0.1	0.1	0.1	0.1	30%	30%	30%	30%	30%	30%	1.2	1.4	1.7	2.0	2.3	2.6
EMEA	0.1	0.2	0.2	0.2	0.2	0.2	40%	40%	40%	40%	40%	40%	2.6	2.8	3.3	3.8	4.3	4.8
APAC	0.3	0.3	0.3	0.3	0.3	0.4	35%	33%	31%	29%	27%	25%	4.0	4.2	4.8	5.3	5.8	6.1
Emergency	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**43%**	**43%**	**42%**	**41%**	**41%**	**40%**	**0.8**	**0.7**	**0.8**	**0.8**	**0.9**	**0.9**
America	0.1	0.1	0.1	0.1	0.1	0.1	50%	50%	50%	50%	50%	50%	0.3	0.3	0.3	0.3	0.4	0.4
EMEA	0.1	0.1	0.1	0.1	0.1	0.1	50%	50%	50%	50%	50%	50%	0.3	0.3	0.3	0.3	0.4	0.4
APAC	0.1	0.1	0.1	0.1	0.1	0.1	30%	28%	26%	24%	22%	20%	0.2	0.2	0.2	0.2	0.2	0.2
Agriculture	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**	**1.1**	**34%**	**33%**	**32%**	**32%**	**31%**	**30%**	**7.8**	**9.1**	**11.7**	**14.4**	**17.8**	**21.3**
America	0.2	0.3	0.3	0.4	0.4	0.5	40%	40%	40%	40%	40%	40%	4.4	5.1	6.7	8.3	10.3	12.5
EMEA	0.1	0.1	0.2	0.2	0.3	0.3	25%	25%	25%	25%	25%	25%	1.4	1.7	2.3	3.0	3.9	5.0
APAC	0.2	0.2	0.2	0.2	0.3	0.3	30%	28%	26%	24%	22%	20%	2.1	2.3	2.7	3.1	3.5	3.8
Timing	**0.3**	**0.3**	**0.3**	**0.3**	**0.4**	**0.4**	**25%**	**25%**	**24%**	**24%**	**24%**	**23%**	**2.6**	**3.1**	**3.6**	**4.5**	**4.7**	**4.3**
America	0.1	0.1	0.1	0.1	0.1	0.1	25%	25%	25%	25%	25%	25%	0.8	1.0	1.1	1.4	1.5	1.4
EMEA	0.1	0.1	0.1	0.1	0.1	0.1	25%	25%	25%	25%	25%	25%	1.0	1.2	1.4	1.7	1.8	1.6
APAC	0.1	0.1	0.1	0.1	0.1	0.1	25%	24%	23%	22%	21%	20%	0.8	1.0	1.1	1.4	1.4	1.3
Total GNSS without phones	266	298	334	375	421	472	27%	22%	20%	17%	15%	12%	240	232	257	285	308	321
Total America	73	81	89	99	109	120	27%	25%	22%	20%	18%	16%	74	74	83	95	106	114
Total EMEA	65	73	81	89	99	110	33%	30%	29%	27%	25%	23%	81	82	93	106	119	129
Total APAC	127	145	165	187	213	242	23%	17%	14%	11%	8%	5%	85	77	80	84	84	78

Summary by application without phones																		
Consumer GNSS	193.8	221.5	253.2	289.5	330.9	378.2	13%	10%	8%	6%	4%	2%	39.6	33.0	30.1	27.2	22.2	14.2
In Veh. Syst. (IVS)	43.6	45.2	48.5	52.2	56.1	60.4	78%	74%	70%	67%	63%	60%	54.9	51.9	52.3	55.3	58.2	60.0
Transport. Other	14.0	14.4	14.4	13.9	12.6	10.2	17%	17%	18%	18%	18%	17%	15.0	14.0	12.7	13.0	12.1	9.7
Prof. Drones	1.9	2.4	2.6	2.9	3.2	3.5	80%	78%	77%	75%	72%	69%	56.1	61.5	86.5	110.2	130.0	147.5
Cons. Drones	9.5	11.1	11.9	12.8	13.6	14.6	77%	67%	63%	59%	54%	50%	54.5	49.9	48.2	47.6	48.8	48.8
Marine	1.7	1.8	1.9	2.0	2.0	2.1	5%	5%	5%	5%	5%	5%	0.5	0.5	0.5	0.5	0.6	0.6
Trains	0.1	0.1	0.2	0.2	0.2	0.3	33%	32%	32%	31%	31%	30%	0.2	0.2	0.3	0.3	0.4	0.5
Geomatics	0.5	0.5	0.6	0.6	0.6	0.7	36%	34%	33%	32%	31%	30%	7.8	8.4	9.8	11.0	12.5	13.6
Emergency	0.2	0.2	0.2	0.2	0.2	0.2	43%	43%	42%	41%	41%	40%	0.8	0.7	0.8	0.8	0.9	0.9
Agriculture	0.5	0.6	0.7	0.8	0.9	1.1	34%	33%	32%	32%	31%	30%	7.8	9.1	11.7	14.4	17.8	21.3
Timing	0.3	0.3	0.3	0.3	0.4	0.4	25%	25%	24%	24%	24%	23%	2.6	3.1	3.6	4.5	4.7	4.3

	Market size in units (million)						u-blox market share						u-blox Cellular revenue (CHF million)					
	2018	2019E	2020E	2021E	2022E	2023E	2018	2019E	2020E	2021E	2022E	2023E	2018	2019E	2020E	2021E	2022E	2023E
2G	**32.8**	**34.2**	**34.8**	**34.1**	**31.2**	**24.1**	**24%**	**20%**	**19%**	**18%**	**17%**	**17%**	**40.1**	**30.9**	**26.6**	**22.2**	**17.6**	**12.3**
Asset Tracking	**7.0**	**7.9**	**8.6**	**8.7**	**7.9**	**5.3**	**9%**	**8%**	**8%**	**8%**	**8%**	**8%**	**3.2**	**2.8**	**2.8**	**2.5**	**2.1**	**1.3**
Americas	1.8	2.0	2.2	2.2	2.0	1.3	10%	10%	12%	14%	16%	18%	0.9	0.9	1.1	1.1	1.0	0.7
EMEA	1.4	1.6	1.7	1.7	1.6	1.1	5%	5%	8%	11%	14%	17%	0.3	0.4	0.6	0.7	0.7	0.5
APAC	3.8	4.3	4.7	4.8	4.3	2.9	10%	8%	6%	4%	2%	0%	1.9	1.6	1.1	0.7	0.3	0.0
eCall	**9.0**	**8.4**	**7.9**	**7.2**	**6.6**	**5.9**	**57%**	**50%**	**47%**	**43%**	**40%**	**36%**	**25.9**	**19.3**	**15.0**	**11.5**	**8.6**	**6.3**
Americas	2.9	2.6	2.3	2.1	1.8	1.5	60%	55%	53%	50%	48%	45%	8.7	6.5	5.0	3.8	2.8	2.1
EMEA	3.4	3.2	3.0	2.7	2.5	2.2	60%	55%	53%	50%	48%	45%	10.3	8.0	6.4	5.0	3.9	2.9
APAC	2.7	2.6	2.6	2.5	2.3	2.2	50%	40%	35%	30%	25%	20%	6.8	4.8	3.7	2.7	1.9	1.3
Bike/e-scooter	**6.7**	**7.5**	**8.2**	**8.8**	**8.9**	**8.1**	**25%**	**17%**	**16%**	**14%**	**12%**	**11%**	**8.5**	**5.9**	**5.3**	**4.4**	**3.6**	**2.6**
Americas	2.2	2.3	2.4	2.5	2.4	2.1	25%	23%	21%	19%	17%	15%	2.7	2.4	2.1	1.7	1.4	0.9
EMEA	2.6	2.8	3.1	3.3	3.4	3.0	25%	23%	21%	19%	17%	15%	3.2	3.0	2.7	2.3	1.9	1.3
APAC	2.0	2.4	2.7	3.0	3.1	3.0	25%	5%	5%	3%	3%	3%	2.5	0.5	0.5	0.3	0.3	0.3
Fleet Mgt.	**2.4**	**2.1**	**1.8**	**1.4**	**1.0**	**0.5**	**5%**	**6%**	**9%**	**12%**	**14%**	**16%**	**0.6**	**0.6**	**0.7**	**0.6**	**0.5**	**0.3**
Americas	0.8	0.6	0.5	0.4	0.3	0.1	5%	7%	11%	15%	19%	23%	0.2	0.2	0.2	0.2	0.2	0.1
EMEA	0.9	0.8	0.7	0.5	0.4	0.2	5%	7%	11%	15%	19%	23%	0.2	0.3	0.3	0.3	0.2	0.1
APAC	0.7	0.7	0.6	0.5	0.3	0.2	5%	5%	5%	5%	5%	5%	0.2	0.1	0.1	0.1	0.1	0.0
Connect. Health	**0.9**	**1.0**	**1.0**	**1.0**	**0.9**	**0.6**	**5%**	**5%**	**5%**	**5%**	**5%**	**5%**	**0.2**	**0.2**	**0.2**	**0.2**	**0.1**	**0.1**
America	0.3	0.3	0.3	0.3	0.3	0.2	5%	5%	5%	5%	5%	5%	0.1	0.1	0.1	0.1	0.0	0.0
EMEA	0.3	0.3	0.3	0.3	0.3	0.2	5%	5%	5%	5%	5%	5%	0.1	0.1	0.1	0.1	0.0	0.0
APAC	0.3	0.3	0.3	0.3	0.3	0.2	5%	5%	5%	5%	5%	5%	0.1	0.1	0.1	0.1	0.0	0.0
Ins. Telematics	**6.8**	**7.2**	**7.3**	**6.9**	**5.9**	**3.7**	**5%**	**6%**	**9%**	**12%**	**14%**	**16%**	**1.7**	**2.1**	**2.7**	**3.0**	**2.7**	**1.8**
Americas	2.2	2.2	2.2	2.0	1.6	1.0	5%	7%	11%	15%	19%	23%	0.5	0.7	1.0	1.1	1.0	0.7
EMEA	2.6	2.7	2.8	2.6	2.2	1.4	5%	7%	11%	15%	19%	23%	0.6	0.9	1.2	1.4	1.4	1.0
APAC	2.0	2.2	2.4	2.4	2.1	1.4	5%	5%	5%	5%	5%	5%	0.5	0.5	0.5	0.4	0.3	0.2
3G	**18.4**	**24.8**	**32.8**	**42.8**	**54.7**	**67.0**	**23%**	**19%**	**17%**	**16%**	**16%**	**15%**	**58.2**	**58.2**	**63.8**	**70.8**	**78.6**	**83.9**
Asset Tracking	**3.5**	**5.1**	**7.5**	**10.9**	**15.7**	**22.7**	**9%**	**8%**	**8%**	**8%**	**8%**	**8%**	**4.4**	**5.1**	**6.7**	**8.8**	**11.4**	**14.7**
Americas	0.9	1.3	1.9	2.8	3.9	5.6	10%	10%	12%	14%	16%	18%	1.3	1.6	2.6	3.9	5.8	8.4
EMEA	0.7	1.0	1.5	2.2	3.1	4.5	5%	5%	8%	11%	14%	17%	0.5	0.6	1.3	2.4	4.0	6.3
APAC	1.9	2.8	4.1	6.0	8.6	12.5	10%	8%	6%	4%	2%	0%	2.7	2.8	2.8	2.4	1.6	0.0
eCall	**6.0**	**6.9**	**7.9**	**8.8**	**9.9**	**10.9**	**57%**	**50%**	**47%**	**43%**	**40%**	**36%**	**47.6**	**43.6**	**41.5**	**38.8**	**35.7**	**32.3**
Americas	1.9	2.1	2.3	2.5	2.7	2.9	60%	55%	53%	50%	48%	45%	16.1	14.7	13.8	12.8	11.7	10.6
EMEA	2.3	2.6	3.0	3.3	3.7	4.1	60%	55%	53%	50%	48%	45%	19.0	18.0	17.6	16.9	16.1	15.1
APAC	1.8	2.2	2.6	3.0	3.5	4.0	50%	40%	35%	30%	25%	20%	12.5	10.8	10.1	9.1	7.9	6.6
Fleet Mgt.	**1.5**	**2.0**	**2.5**	**2.9**	**3.2**	**3.0**	**5%**	**6%**	**9%**	**12%**	**14%**	**16%**	**1.1**	**1.6**	**2.5**	**3.4**	**4.1**	**4.1**
Americas	0.5	0.6	0.7	0.8	0.9	0.8	5%	7%	11%	15%	19%	23%	0.3	0.5	0.9	1.3	1.5	1.5
EMEA	0.6	0.8	0.9	1.1	1.2	1.1	5%	7%	11%	15%	19%	23%	0.4	0.7	1.2	1.7	2.1	2.1
APAC	0.5	0.6	0.8	1.0	1.1	1.1	5%	5%	5%	5%	5%	5%	0.3	0.4	0.5	0.5	0.5	0.5
Connect. Health	**3.1**	**3.8**	**4.7**	**5.8**	**7.1**	**8.7**	**5%**	**5%**	**5%**	**5%**	**5%**	**5%**	**2.1**	**2.4**	**2.7**	**2.9**	**3.2**	**3.6**
America	1.0	1.3	1.6	1.9	2.4	2.9	5%	5%	5%	5%	5%	5%	0.7	0.8	0.9	1.0	1.1	1.2
EMEA	1.0	1.3	1.6	1.9	2.4	2.9	5%	5%	5%	5%	5%	5%	0.7	0.8	0.9	1.0	1.1	1.2
APAC	1.0	1.3	1.6	1.9	2.4	2.9	5%	5%	5%	5%	5%	5%	0.7	0.8	0.9	1.0	1.1	1.2
Ins. Telematics	**4.3**	**6.9**	**10.2**	**14.4**	**18.8**	**21.7**	**5%**	**6%**	**9%**	**12%**	**14%**	**16%**	**3.0**	**5.5**	**10.4**	**16.9**	**24.2**	**29.3**
Americas	1.4	2.1	3.0	4.1	5.1	5.7	5%	7%	11%	15%	19%	23%	1.0	1.9	3.8	6.2	8.9	10.7
EMEA	1.6	2.6	3.9	5.4	7.1	8.1	5%	7%	11%	15%	19%	23%	1.1	2.3	4.8	8.2	12.3	15.3
APAC	1.3	2.2	3.3	4.9	6.6	7.9	5%	5%	5%	5%	5%	5%	0.9	1.4	1.9	2.5	3.0	3.3
NB-IoT	**1.5**	**1.5**	**4.1**	**9.6**	**24.4**	**63.3**	**14%**	**11%**	**11%**	**11%**	**10%**	**10%**	**2.2**	**1.6**	**4.0**	**7.9**	**17.7**	**40.6**
Bike/e-scooter	**0.1**	**0.2**	**0.3**	**0.8**	**1.7**	**3.8**	**25%**	**17%**	**16%**	**14%**	**12%**	**11%**	**0.4**	**0.3**	**0.5**	**0.8**	**1.4**	**2.6**
Americas	0.0	0.0	0.1	0.2	0.5	1.0	25%	23%	21%	19%	17%	15%	0.1	0.1	0.2	0.3	0.6	0.9
EMEA	0.1	0.1	0.1	0.3	0.6	1.4	25%	23%	21%	19%	17%	15%	0.1	0.1	0.2	0.4	0.8	1.3
APAC	0.0	0.0	0.1	0.3	0.6	1.4	25%	5%	5%	3%	3%	3%	0.1	0.0	0.0	0.1	0.1	0.3
Smart Meters	**0.6**	**0.3**	**1.0**	**1.5**	**2.3**	**2.4**	**20%**	**19%**	**18%**	**16%**	**15%**	**14%**	**1.2**	**0.6**	**1.6**	**1.9**	**2.4**	**2.1**
Americas	0.1	0.1	0.2	0.2	0.4	0.4	20%	20%	20%	20%	20%	20%	0.2	0.1	0.3	0.4	0.5	0.5
EMEA	0.3	0.1	0.4	0.6	1.0	1.0	20%	20%	20%	20%	20%	20%	0.6	0.3	0.8	1.0	1.4	1.3
APAC	0.2	0.1	0.4	0.6	0.9	1.0	20%	17%	14%	11%	8%	5%	0.5	0.2	0.5	0.5	0.5	0.3
Asset tracking	**0.2**	**0.3**	**0.9**	**2.3**	**6.3**	**17.1**	**9%**	**8%**	**8%**	**8%**	**8%**	**8%**	**0.2**	**0.2**	**0.6**	**1.4**	**3.5**	**8.5**
Americas	0.1	0.1	0.2	0.6	1.6	4.3	10%	10%	12%	14%	16%	18%	0.1	0.1	0.2	0.6	1.8	4.9
EMEA	0.0	0.1	0.2	0.5	1.3	3.4	5%	5%	8%	11%	14%	17%	0.0	0.0	0.1	0.4	1.2	3.7
APAC	0.1	0.2	0.5	1.3	3.5	9.4	10%	8%	6%	4%	2%	0%	0.1	0.1	0.2	0.4	0.5	0.0
LP Asset Tracking	**0.2**	**0.3**	**0.9**	**2.8**	**8.7**	**26.4**	**9%**	**8%**	**8%**	**8%**	**8%**	**8%**	**0.2**	**0.2**	**0.6**	**1.8**	**4.8**	**13.2**
Americas	0.1	0.1	0.2	0.7	2.2	6.6	10%	10%	12%	14%	16%	18%	0.1	0.1	0.2	0.8	2.4	7.5
EMEA	0.0	0.1	0.2	0.6	1.7	5.3	5%	5%	8%	11%	14%	17%	0.0	0.0	0.1	0.5	1.7	5.7
APAC	0.1	0.2	0.5	1.6	4.8	14.5	10%	8%	6%	4%	2%	0%	0.1	0.1	0.3	0.5	0.7	0.0
Fleet Mgt.	**0.1**	**0.1**	**0.2**	**0.4**	**0.8**	**1.7**	**5%**	**6%**	**9%**	**12%**	**14%**	**16%**	**0.0**	**0.1**	**0.1**	**0.3**	**0.8**	**1.7**
Americas	0.0	0.0	0.1	0.1	0.2	0.4	5%	7%	11%	15%	19%	23%	0.0	0.0	0.1	0.1	0.3	0.6
EMEA	0.0	0.0	0.1	0.1	0.3	0.6	5%	7%	11%	15%	19%	23%	0.0	0.0	0.1	0.2	0.4	0.9
APAC	0.0	0.0	0.1	0.1	0.3	0.6	5%	5%	5%	5%	5%	5%	0.0	0.0	0.0	0.0	0.1	0.2

APPENDIX 23.2 REVENUE FORECAST - CELLULAR

source: European GNSS Agency, Team Analysis

	Market size in units (million)						u-blox market share						u-blox Cellular revenue (CHF million)					
	2018	2019E	2020E	2021E	2022E	2023E	2018	2019E	2020E	2021E	2022E	2023E	2018	2019E	2020E	2021E	2022E	2023E
Ins. Telematics	0.2	0.3	0.7	1.9	4.7	12.0	5%	6%	9%	12%	14%	16%	0.1	0.2	0.6	1.7	4.7	12.5
Americas	0.1	0.1	0.2	0.5	1.3	3.1	5%	7%	11%	15%	19%	23%	0.0	0.1	0.2	0.6	1.7	4.6
EMEA	0.1	0.1	0.3	0.7	1.8	4.5	5%	7%	11%	15%	19%	23%	0.0	0.1	0.3	0.8	2.4	6.5
APAC	0.1	0.1	0.2	0.6	1.7	4.4	5%	5%	5%	5%	5%	5%	0.0	0.0	0.1	0.2	0.6	1.4
Cat-M1 & 4G	**9.6**	**15.6**	**23.9**	**34.9**	**46.8**	**50.9**	**8%**	**7%**	**7%**	**7%**	**7%**	**7%**	**14.7**	**19.2**	**26.3**	**34.4**	**41.1**	**39.2**
Connect. Health	2.2	3.2	4.7	6.8	9.8	13.9	5%	5%	5%	5%	5%	5%	1.9	2.6	3.4	4.5	5.8	7.4
Americas	0.7	1.1	1.6	2.3	3.3	4.6	5%	5%	5%	5%	5%	5%	0.6	0.9	1.1	1.5	1.9	2.5
EMEA	0.7	1.1	1.6	2.3	3.3	4.6	5%	5%	5%	5%	5%	5%	0.6	0.9	1.1	1.5	1.9	2.5
APAC	0.7	1.1	1.6	2.3	3.3	4.6	5%	5%	5%	5%	5%	5%	0.6	0.9	1.1	1.5	1.9	2.5
Asset Tracking	0.9	2.5	4.5	7.1	9.4	8.3	9%	8%	8%	8%	8%	8%	1.5	3.1	5.2	7.4	8.8	6.9
Americas	0.2	0.6	1.1	1.8	2.4	2.1	10%	10%	12%	14%	16%	18%	0.4	1.0	2.0	3.3	4.5	3.9
EMEA	0.2	0.5	0.9	1.4	1.9	1.7	5%	5%	8%	11%	14%	17%	0.2	0.4	1.0	2.0	3.1	3.0
APAC	0.5	1.3	2.5	3.9	5.2	4.6	10%	8%	6%	4%	2%	0%	0.9	1.7	2.1	2.0	1.2	0.0
LP Asset Tracking	6.5	9.9	14.6	20.8	27.4	28.6	9%	8%	8%	8%	8%	8%	10.5	12.6	16.8	21.6	25.6	23.9
Americas	1.7	2.5	3.7	5.3	6.9	7.1	10%	10%	12%	14%	16%	18%	3.0	4.1	6.5	9.6	13.0	13.6
EMEA	1.3	2.0	2.9	4.1	5.5	5.7	5%	5%	8%	11%	14%	17%	1.2	1.6	3.4	6.0	9.0	10.3
APAC	3.5	5.4	8.0	11.4	15.1	15.8	10%	8%	6%	4%	2%	0%	6.3	7.0	7.0	6.0	3.6	0.0
Agriculture 4.0	0.1	0.1	0.1	0.1	0.2	0.2	34%	32%	30%	29%	28%	26%	0.8	0.8	0.9	0.9	1.0	1.0
Americas	0.0	0.0	0.1	0.1	0.1	0.1	40%	40%	40%	40%	40%	40%	0.4	0.5	0.5	0.6	0.6	0.7
EMEA	0.0	0.0	0.0	0.0	0.0	0.1	25%	25%	25%	25%	25%	25%	0.1	0.2	0.2	0.2	0.2	0.3
APAC	0.0	0.0	0.0	0.0	0.0	0.1	30%	25%	20%	15%	10%	5%	0.2	0.2	0.2	0.1	0.1	0.1
Total Cellular	**62.3**	**76.0**	**95.5**	**121.4**	**157.1**	**205.4**	**21%**	**17%**	**15%**	**14%**	**13%**	**12%**	**115.2**	**109.9**	**120.7**	**135.2**	**154.9**	**175.9**
Total America	18.8	22.2	27.0	33.4	42.1	53.8	23%	20%	19%	18%	19%	19%	37.5	37.2	42.7	51.0	62.7	76.5
Total EMEA	20.1	23.8	29.1	35.8	45.1	57.1	23%	20%	19%	19%	19%	20%	39.5	38.5	44.3	53.0	65.8	81.5
Total APAC	23.4	30.0	39.4	52.2	70.0	94.5	18%	12%	10%	7%	5%	3%	38.2	34.1	33.7	31.2	26.4	17.9
Summary by application																		
Asset Tracking	11.7	15.8	21.4	29.0	39.4	53.3	9%	8%	8%	8%	8%	8%	9.3	11.3	15.3	20.1	25.7	31.4
eCall	15.0	15.4	15.7	16.1	16.4	16.8	57%	50%	47%	43%	40%	36%	73.5	62.8	56.5	50.3	44.3	38.5
Bike/e-scooter	6.9	7.7	8.6	9.5	10.6	11.9	25%	17%	16%	14%	12%	11%	8.9	6.2	5.8	5.2	5.0	5.1
Fleet Mgt.	4.0	4.2	4.4	4.7	4.9	5.2	5%	6%	9%	12%	14%	16%	1.7	2.3	3.3	4.4	5.3	6.1
Connect. Health	6.2	8.0	10.5	13.6	17.8	23.1	5%	5%	5%	5%	5%	5%	4.3	5.2	6.3	7.6	9.2	11.0
Ins. Telematics	11.3	14.4	18.2	23.2	29.4	37.4	5%	6%	9%	12%	14%	16%	4.8	7.8	13.7	21.6	31.6	43.6
Agriculture 4.0	0.1	0.1	0.1	0.1	0.2	0.2	34%	32%	30%	29%	28%	26%	0.8	0.8	0.9	0.9	1.0	1.0
LP Asset Tracking	6.7	10.2	15.5	23.7	36.1	55.0	9%	8%	8%	8%	8%	8%	10.7	12.9	17.5	23.4	30.4	37.1
Smart Meters	0.6	0.3	1.0	1.5	2.3	2.4	20%	19%	18%	16%	15%	14%	1.2	0.6	1.6	1.9	2.4	2.1

APPENDIX 23.3 REVENUE FORECAST - SHORT RANGE

source: Company Data, Team Analysis

	Summary GNSS						Summary Cellular						Summary GNSS & Cellular					
	2018	2019E	2020E	2021E	2022E	2023E	2018	2019E	2020E	2021E	2022E	2023E	2018	2019E	2020E	2021E	2022E	2023E
Revenue (CHF M)	240	232	257	285	308	321	115	110	121	135	155	176	355	342	377	420	463	497
growth (%)		*-3.2*	*10.4*	*11.1*	*8.1*	*4.3*		*-4.6*	*9.9*	*12.0*	*14.5*	*13.6*		*-3.7*	*10.3*	*11.4*	*10.2*	*7.4*
America	74	74	83	95	106	114	37	37	43	51	63	77	111	111	126	146	168	191
EMEA	81	82	93	106	119	129	40	38	44	53	66	81	121	120	137	159	185	210
APAC	85	77	80	84	84	78	38	34	34	31	26	18	123	111	114	115	110	96
America	31%	32%	33%	33%	34%	36%	33%	34%	35%	38%	40%	44%	31%	33%	33%	35%	36%	38%
EMEA	34%	35%	36%	37%	39%	40%	34%	35%	37%	39%	42%	46%	34%	35%	36%	38%	40%	42%
APAC	35%	33%	31%	29%	27%	24%	33%	31%	28%	23%	17%	10%	35%	32%	30%	27%	24%	19%
ASP Chip (CHF)	1.61	1.56	1.54	1.59	1.64	1.67	-	-	-	-	-	-	1.61	1.56	1.54	1.59	1.64	1.67
ASP Module (CHF)	12.20	11.79	13.65	15.71	17.81	19.92	8.77	8.59	8.37	8.14	7.79	7.22	10.40	10.17	10.85	11.45	11.72	11.50
# of modules (M)	11.91	12.50	12.76	12.89	12.78	12.41	13.14	12.79	14.42	16.61	19.87	24.38	25.05	25.29	27.18	29.49	32.65	36.78
# of chips (M)	58.84	54.39	53.59	51.88	48.94	44.46	-	-	-	-	-	-	58.84	54.39	53.59	51.88	48.94	44.46

u-blox data	
(CHF)	2018
Revenue	393M
Sale of Goods	390M
Other Rev.	3M
Chips Rev.	94M
Modlues Rev.	291M
Chips sold (units)	58.8M
Chip ASP	1.61
Modules sold (units)	30.5M
Module ASP	9.56

	Short Range and Other Revenue					
(CHF)	2018	2019E	2020E	2021E	2022E	2023E
Revenue (M)	35	34	37	41	47	54
growth (%)		-4.6	9.9	12.0	14.5	13.6
# of Modules	5.40	5.31	6.02	6.95	8.20	9.61
Other Rev. (M)	3	3	3	4	4	4
growth (%)		-3.7	10.3	11.4	10.2	7.4

Revenues from the short-range segment were derived as follows:

- For 2018, by taking the difference between the 2018 sales of goods and the revenues from the GNSS and cellular segments.
- From 2019 forward, by applying the cellular revenue growth rate as the two segments follow similar market dynamics.

APPENDIX 23.4 REVENUE FORECAST - ASP DERIVATIONS

source: Company Data, Team Analysis

	GNSS Prices					
	2018	2019E	2020E	2021E	2022E	2023E
Annual ASP decline	10%	10%	10%	10%	10%	10%
ASP factor (2012)	0.53	0.48	0.43	0.39	0.35	0.31
ASP factor (2015)	0.73	0.66	0.59	0.53	0.48	0.43
ASP factor (2018)	1.00	0.90	0.81	0.73	0.66	0.59
ASP factor (2020)			1.00	0.90	0.81	0.73
Consumer GNSS						
ASP of 7 Chip (2012) (CHF)	2.55					
ASP of M8 chip (2015) (CHF)	2.55					
ASP of M9 chip (2020) (CHF)	2.55					
% u-blox 7	50%	25%	5%	0%	0%	0%
% M8	50%	75%	90%	75%	50%	25%
% M9	0%	0%	5%	25%	50%	75%
Derived ASP (CHF)	1.61	1.56	1.54	1.59	1.64	1.67
IVS						
Same as Consumer GNSS						
Derived ASP (CHF)	1.61	1.56	1.54	1.59	1.64	1.67
Transportation Other						
ASP of M8 module (2015) (CHF)	8.5					
ASP of M9 module (2020) (CHF)	8.5					
% M8	100%	100%	100%	75%	50%	25%
% M9	0%	0%	0%	25%	50%	75%
Derived ASP (CHF)	6.20	5.58	5.02	5.30	5.48	5.56
Professional Drones						
ASP of M8 HP (2015) (CHF)	50.4					
ASP Drones F9 (2018) (CHF)	102					
% M8 HP	100%	100%	75%	50%	25%	0%
% F9	0%	0%	25%	50%	75%	100%
Derived ASP (CHF)	36.74	33.07	42.98	50.57	56.22	60.23

	GNSS Prices					
	2018	2019E	2020E	2021E	2022E	2023E
Cons.Drones						
ASP of M8 module (2015) (CHF)	10.20					
ASP of M9 module (2020) (CHF)	10.20					
% M8	100%	100%	90%	75%	50%	25%
% M9	0%	0%	10%	25%	50%	75%
Derived ASP (CHF)	7.44	6.69	6.44	6.36	6.57	6.67
Marine & Trains						
Same as Transportation other						
Derived ASP (CHF)	6.20	5.58	5.02	5.30	5.48	5.56
Geomatics						
ASP Geom M8 HP (CHF)	60.48					
ASP Geom F9 (CHF)	112.2					
% M8 HP	100%	90%	70%	50%	25%	0%
% F9	0%	10%	30%	50%	75%	100%
Derived ASP (CHF)	44.09	45.81	52.26	56.97	62.44	66.25
Emergency						
ASP Emergency M8 (CHF)	12.75					
ASP Emergency M9 (CHF)	12.75					
% M8	100%	100%	70%	50%	25%	0%
% M9	0%	0%	30%	50%	75%	100%
Derived ASP (CHF)	9.29	8.37	9.10	9.13	9.27	9.29
Agriculture						
Same as Geomatics						
Derived ASP (CHF)	44.09	45.81	52.26	56.97	62.44	66.25
Timing						
ASP CI M8 timing (2015) (CHF)	45					
ASP CI F9 timing (2018) (CHF)	136					
% M8	100%	90%	80%	60%	50%	50%
% F9	0%	10%	20%	40%	50%	50%
Derived ASP (CHF)	32.81	38.81	43.29	54.01	55.38	49.84

		Cellular Prices					
		2018	2019E	2020E	2021E	2022E	2023E
ASP decline			10%	10%	10%	10%	10%
ASP factor		1	0.90	0.81	0.73	0.66	0.59
ASP modules	Retail	Wholesale					
2G	8.40	5.04	4.54	4.08	3.67	3.31	2.98
3G	27.85	13.93	12.53	11.28	10.15	9.14	8.22
4G	63.54	31.77	28.59	25.73	23.16	20.84	18.76
NB-IoT	11.93	10.74	9.66	8.70	7.83	7.04	6.34
Cat -M1	35.95	17.98	16.18	14.56	13.10	11.79	10.61

	Short Range Price Assumptions					
	2018	2019E	2020E	2021E	2022E	2023E
New Prod.Effect	7%	7%	7%	7%	7%	7%
ASP Decline	10%	10%	10%	10%	10%	10%
ASP SR Retail (CHF)	9.43					
Wholesale discount	31%					
ASP SR Wholesale (CHF)	6.50	6.31	6.12	5.94	5.76	5.58

APPENDIX 24 U-BLOX FINANCIAL PERFORMANCE METRICS (1/2)

source: Company Data, Team Analysis

COMMON SIZE INCOME STATEMENT	2014	2015	2016	2017	2018	2019E	2020E	2021E	2022E	2023E
COGS (w/o D&A)	-53.3%	-52.9%	-52.7%	-53.7%	-54.1%	-54.7%	-55.2%	-55.9%	-56.8%	-57.8%
Distribution & Marketing (w/o D&A)	-8.9%	-8.0%	-8.7%	-8.8%	-9.2%	-9.6%	-9.2%	-9.2%	-9.2%	-9.2%
R&D (incl. impairment) (w/o D&A)	-12.9%	-13.7%	-12.6%	-11.8%	-14.3%	-16.5%	-15.5%	-14.6%	-13.7%	-12.7%
G&A expenses (w/o D&A)	-3.6%	-3.7%	-3.8%	-4.5%	-5.1%	-5.3%	-5.1%	-5.1%	-5.1%	-5.1%
Depreciation	-2.3%	-2.5%	-2.3%	-2.3%	-2.4%	-2.5%	-2.4%	-2.3%	-2.3%	-2.2%
Amortization	-4.9%	-4.8%	-4.0%	-3.2%	-3.6%	-7.0%	-8.9%	-9.7%	-9.9%	-9.8%
Other income	0.3%	0.7%	0.6%	0.5%	1.0%	0.7%	0.7%	0.7%	0.7%	0.7%
Net financial cost	1.4%	-1.1%	0.7%	-0.1%	0.0%	-1.6%	-0.5%	-0.4%	-0.4%	-0.4%
Income tax	-3.2%	-3.1%	-4.3%	-3.3%	-2.4%	-0.8%	-0.8%	-0.7%	-0.7%	-0.6%
Net profit	12.7%	11.0%	12.8%	12.7%	9.8%	2.8%	3.0%	2.7%	2.7%	2.8%

PROFITABILITY RATIOS	2014	2015	2016	2017	2018	2019E	2020E	2021E	2022E	2023E
Gross margin	45.4%	45.8%	46.4%	45.6%	45.0%	44.6%	44.0%	43.4%	42.5%	41.4%
EBITDA margin	21.7%	22.4%	22.7%	21.6%	18.2%	14.7%	15.6%	15.9%	16.0%	15.9%
EBIT margin	14.5%	15.2%	16.4%	16.1%	12.3%	5.2%	4.3%	3.8%	3.8%	3.8%
Net margin	12.7%	11.0%	12.8%	12.7%	9.8%	2.8%	3.0%	2.7%	2.7%	2.8%
FCFF margin	7.4%	9.4%	12.2%	-1.1%	-6.4%	0.8%	-1.4%	-0.1%	1.1%	2.0%
ROA	13.0%	10.8%	11.4%	10.8%	7.1%	1.9%	2.1%	2.1%	2.3%	2.5%
ROE	17.5%	16.1%	17.3%	17.0%	11.5%	3.1%	3.5%	3.5%	3.8%	4.1%
ROIC adjusted (100% Capitalized)	39.2%	39.3%	36.1%	33.3%	24.5%	16.8%	15.4%	14.9%	14.5%	14.4%

APPENDIX 24 — U-BLOX FINANCIAL PERFORMANCE METRICS (2/2)

source: Company Data, Team Analysis

ROIC DECOMPOSITION	2014	2015	2016	2017	2018	2019E	2020E	2021E	2022E	2023E
ROIC adjusted (100% Capitalized)	39.2%	39.3%	36.1%	33.3%	24.5%	16.8%	15.4%	14.9%	14.5%	14.4%
EBITA margin	25.9%	25.7%	24.7%	24.6%	24.1%	22.6%	22.7%	22.6%	22.0%	21.6%
Revenue / Invested capital	1.52	1.53	1.46	1.35	1.02	0.74	0.68	0.66	0.66	0.67

ACTIVITY RATIOS	2014	2015	2016	2017	2018	2019E	2020E	2021E	2022E	2023E
Inventory turnover	5.3	5.2	5.6	5.8	4.3	3.7	4.1	4.3	4.5	4.7
# of days of inventory on hand	69.4	70.4	65.1	62.9	85.9	98.2	89.3	84.7	80.7	77.1
Receivables turnover	7.9	8.2	8.6	9.0	7.1	6.4	7.1	7.4	7.7	7.8
# of days of sales outstanding	46.0	44.6	42.3	40.8	51.6	56.6	51.2	49.2	47.6	47.0
Payables turnover	7.2	7.1	8.6	11.7	11.0	9.9	11.0	11.0	11.0	10.8
# of days of payables	50.8	51.5	42.5	31.2	33.3	37.0	33.3	33.1	33.2	33.7
Working capital turnover	8.2	8.8	10.0	9.0	5.6	4.8	5.5	5.8	6.1	6.4
Asset turnover	1.0	1.0	0.9	0.9	0.7	0.7	0.7	0.8	0.8	0.9
Intangibles turnover	4.7	4.3	3.6	3.0	2.3	1.8	1.8	1.9	2.0	2.2

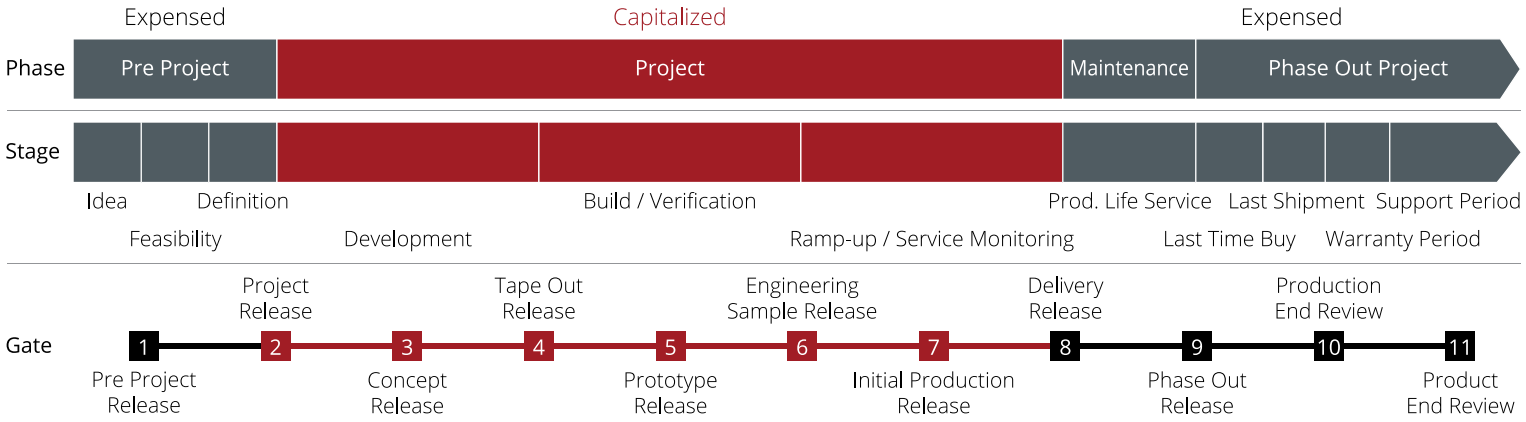
LIQUIDITY RATIOS	2014	2015	2016	2017	2018	2019E	2020E	2021E	2022E	2023E
Current ratio	2.2	4.0	4.1	4.8	5.0	4.2	3.9	3.6	3.4	3.4
Quick ratio	1.5	3.2	3.5	3.9	3.8	3.1	2.8	2.5	2.4	2.3
Cash ratio	0.8	2.2	2.7	2.9	2.5	2.0	1.7	1.4	1.3	1.3
Defensive interval ratio	173.1	192.5	246.9	250.7	247.9	220.2	185.0	162.5	147.7	141.3
Cash conversion cycle	64.6	63.5	65.0	72.5	104.2	117.8	107.2	100.8	95.1	90.3

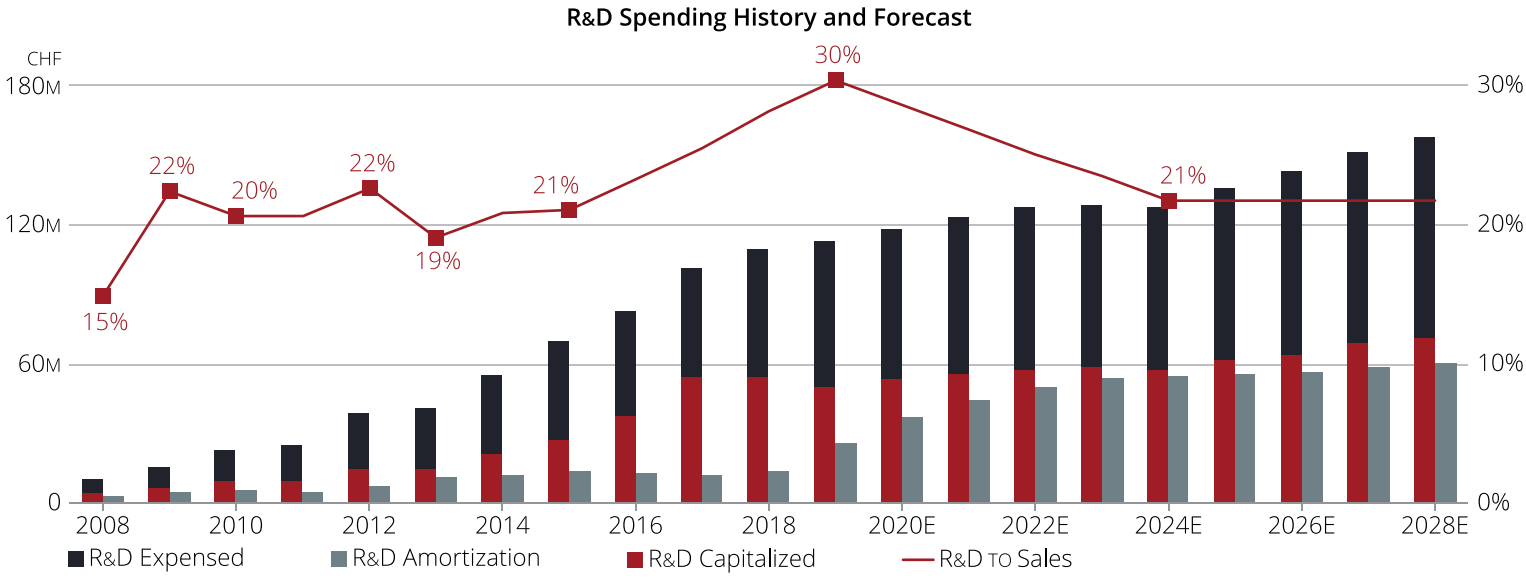
SOLVENCY RATIOS	2014	2015	2016	2017	2018	2019E	2020E	2021E	2022E	2023E
Debt-to-asset ratio	11.9%	18.5%	16.6%	25.7%	26.2%	24.1%	23.6%	23.0%	22.5%	21.9%
Financial leverage ratio	1.3	1.5	1.5	1.6	1.6	1.6	1.7	1.6	1.6	1.6
Interest coverage	59.4	11.0	35.7	11.5	22.4	10.8	9.9	9.9	10.8	11.8

R&D RATIOS	2014	2015	2016	2017	2018	2019E	2020E	2021E	2022E	2023E
Cash R&D spending / Revenue	20.7%	20.8%	22.9%	25.1%	27.9%	30.0%	28.3%	26.5%	24.8%	23.1%
Cash R&D expensed / Revenue	12.9%	12.9%	12.6%	11.8%	14.3%	16.5%	15.5%	14.6%	13.7%	12.7%
Cash R&D capitalized / Revenue	7.7%	8.0%	10.3%	13.4%	13.7%	13.5%	12.7%	11.9%	11.2%	10.4%
Operating CF / Capitalized R&D	2.6	2.8	2.5	1.1	0.7	1.3	1.1	1.2	1.3	1.4

APPENDIX 25 — R&D CAPITALIZATION MODEL & R&D SPENDING

source: Company Data, Team Analysis





APPENDIX 26 M-SCORE

source: Company Data, Team Analysis

Input variables, mln CHF	2014	2015	2016	2017	2018
Revenue	270	338	360	404	393
Net receivables	39	44	40	50	61
Gross profit	122	155	167	184	177
Current assets	153	220	240	283	277
PP&E	15	15	16	18	15
Total assets	302	387	425	525	553
Depreciation	6	8	8	9	9
SG&A	35	41	47	55	58
Current liabilities	71	55	59	59	56
Long-term debt	18	83	81	147	149
Net income	34	37	46	51	39
Cash flow from operations	54	75	94	61	36
M-score variables	**Weight**	**2015**	**2016**	**2017**	**2018**
Days Sales in Receivables Index (M_1)	0.9	0.9	0.9	1.1	1.2
Gross Margin Index (M_2)	0.5	1.0	1.0	1.0	1.0
Asset Quality Index (M_3)	0.4	0.9	1.0	1.1	1.1
Sales growth index (M_4)	0.9	1.3	1.1	1.1	1.0
Depreciation index (M_5)	0.1	0.8	1.0	1.0	0.9
SG&A Expenses Index (M_6)	-0.2	0.9	1.1	1.1	1.1
Leverage index (M_7)	-0.3	1.2	0.9	1.2	0.9
Total Accruals to Total Assets (M_8)	4.7	-0.1	-0.1	0.0	0.0
M-SCORE		-2.9	-3.1	-2.4	**-2.2**

M-SCORE = - 4.84 + 0.92 x M_1 + 0.528 x M_2 + 0.404 x M_3 + 0.892 x M_4 + 0.115 x M_5 - 0.172 x M_6 - 0.327 x M_7 + 4.679 x M_8

Beneish's M-score assesses the likelihood that the reported earnings of a company have been manipulated.

If the M-score is higher than **-2.22**, the company is likely to be a manipulator.

APPENDIX 27 Z-SCORE

source: Company Data, Team Analysis

Input variables, mln CHF	2014	2015	2016	2017	2018
Working capital	82	164	181	224	221
Total assets (TA)	302	387	425	525	553
Retained earnings	122	169	219	280	322
EBIT	39	51	59	65	48
Market value of equity	905	1442	1305	1333	560
Total liabilities (TL)	89	139	140	206	204
Sales	270	339	360	404	393
Z-score variables					
Working capital / TA (Z_1)	0.3	0.4	0.4	0.4	0.4
Retained earnings / TA (Z_2)	0.4	0.4	0.5	0.5	0.6
EBIT / TA (Z_3)	0.1	0.1	0.1	0.1	0.1
MC / TL (Z_4)	10.2	10.4	9.3	6.5	2.7
Sales / TA (Z_5)	0.9	0.9	0.8	0.8	0.7
Z-SCORE	8.3	8.7	8.1	6.3	3.9

Z-SCORE = 1.2 x Z_1 + 1.4 x Z_2 + 3.3 x Z_3 + 0.6 x Z_4 + 0.99 x Z_5

Altman's Z-score indicates the likelihood that the business will go bankrupt within the coming years.

If the Z-Score is:

- higher than 2.99: The company is less likely to experience bankruptcy.
- lower than 1.81: The company is heading for bankruptcy.

APPENDIX 28 VALUATION ASSUMPTIONS

source: Team Analysis

		2018	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E	2028E
Revenue growth		-2.6%	-3.7%	10.2%	11.4%	10.6%	8.0%	7.3%	6.6%	5.9%	5.2%	4.6%
Gross Margin (w/o D&A)	% sales	45.9%	45.3%	44.8%	44.1%	43.2%	42.2%	42.2%	42.2%	42.2%	42.2%	42.2%
D&M expenses (w/o D&A)	% sales	9.2%	9.6%	9.2%	9.2%	9.2%	9.2%	9.2%	9.2%	9.2%	9.2%	9.2%
G&A expenses (w/o D&A)	% sales	5.1%	5.1%	5.1%	5.1%	5.1%	5.1%	5.1%	5.1%	5.1%	5.1%	5.1%
R&D cash expenditure	% sales	27.9%	30.0%	28.3%	26.5%	24.8%	23.1%	21.4%	21.4%	21.4%	21.4%	21.4%
R&D expensed (w/o D&A)	% sales	14.3%	16.5%	15.5%	14.6%	13.7%	12.7%	11.8%	11.8%	11.8%	11.8%	11.8%
R&D capitalized	% sales	13.7%	13.5%	12.7%	11.9%	11.2%	10.4%	9.6%	9.6%	9.6%	9.6%	9.6%
Depreciation	% sales	2.4%	2.5%	2.4%	2.3%	2.3%	2.2%	2.1%	2.1%	2.1%	2.1%	2.1%
Amortization	% sales	3.6%	7.0%	8.9%	9.7%	9.9%	9.8%	9.3%	8.8%	8.5%	8.4%	8.2%
Tax rate		20.0%	21.2%	21.2%	19.7%	19.7%	18.2%	18.2%	18.2%	18.2%	18.2%	18.2%
Trade accounts receivables	% sales	15.5%	15.0%	14.5%	14.0%	13.5%	13.3%	13.3%	13.3%	13.3%	13.3%	13.3%
Other receivables	% sales	2.8%	2.7%	2.6%	2.5%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%
Inventories	% sales	14.6%	14.6%	14.1%	13.6%	13.1%	12.6%	12.1%	11.6%	11.5%	11.5%	11.5%
Prepaid expenses and accrued income	% sales	2.0%	1.9%	1.8%	1.7%	1.6%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%
Trade accounts payables	% COGS	10.0%	9.8%	9.8%	9.8%	9.8%	9.8%	9.8%	9.8%	9.8%	9.8%	9.8%
Other payables	% COGS	6.6%	6.7%	6.7%	6.7%	6.7%	6.7%	6.7%	6.7%	6.7%	6.7%	6.7%
Accrued expenses	% COGS	21.5%	23.9%	23.9%	23.9%	23.9%	23.9%	23.9%	23.9%	23.9%	23.9%	23.9%
Capex	% sales	15.6%	16.2%	15.2%	14.4%	13.5%	12.6%	11.7%	11.8%	11.8%	11.8%	11.8%
Capex PP&E	% sales	2.0%	2.7%	2.5%	2.5%	2.3%	2.2%	2.1%	2.2%	2.2%	2.2%	2.2%
FCF	% sales	-6.4%	0.8%	-1.4%	-0.1%	1.1%	2.0%	3.3%	3.5%	3.1%	3.1%	3.2%
Dividend payout ratio	% net inc.	30%	29%	38%	38%	38%	38%	38%	38%	38%	38%	38%

APPENDIX 29 FREE CASH FLOW TO THE FIRM - DERIVATION

source: Team Analysis

(mln CHF)	2018	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E	2028E
Net profit	38.5	10.7	12.4	12.7	14.1	15.7	24.8	28.8	32.2	35.1	37.4
Depreciation	9.3	9.6	10.1	10.9	11.7	12.2	12.4	13.2	14.0	14.8	15.5
Amortization	14.1	26.4	37.2	45.2	50.8	54.5	55.3	56.2	57.5	59.2	61.1
Finance costs	1.9	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
Other non-cash adjustments	3.2	3.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Change in NWC	30.7	-11.4	4.2	4.4	3.6	3.5	5.2	3.1	5.3	5.4	4.9
Capex	61.4	61.2	63.6	67.0	69.5	70.0	69.7	75.2	79.6	83.7	87.4
FCFF	-25.1	2.9	-6.0	-0.5	5.5	11.0	19.6	22.0	20.9	22.0	23.7
Terminal value											628.1
Total FCFF		**2.9**	**-6.0**	**-0.5**	**5.5**	**11.0**	**19.6**	**22.0**	**20.9**	**22.0**	**651.8**
Value of levered firm	391.2										
Cash & Marketable Securities*	121.0										
Debt and leases*	139.5										
Value of equity	372.6										
Number of shares out. (mln)	6.94										
Price per share - today	54										
Price per share - 1y horizon	58										

**as of 30.06.2019*

APPENDIX 30 — REGIONAL RISK PREMIUM

source: Damodaran, Team Analysis

Country	GDP (in billions)	Moody's rating	CRP	GDP Weight (W)	(W*CRP)
Austria	417	Aa1	0.45%	2.33%	0.01%
Belgium	493	Aa3	0.68%	2.75%	0.02%
Denmark	325	Aaa	0.00%	1.81%	0.00%
Finland	252	Aa1	0.45%	1.41%	0.01%
France	2583	Aa2	0.56%	14.42%	0.08%
Germany	3677	Aaa	0.00%	20.54%	0.00%
Greece	200	B1	5.08%	1.12%	0.06%
Italy	1935	Baa3	2.48%	10.81%	0.27%
Liechtenstein	7	Aaa	0.00%	0.04%	0.00%
Luxembourg	62	Aaa	0.00%	0.35%	0.00%
Netherlands	826	Aaa	0.00%	4.61%	0.00%
Norway	399	Aaa	0.00%	2.23%	0.00%
Spain	1311	Baa1	1.80%	7.32%	0.13%

Country	GDP (in billions)	Moody's rating	CRP	GDP Weight (W)	(W*CRP)
Sweden	538	Aaa	0.00%	3.01%	0.00%
Switzerland	679	Aaa	0.00%	3.79%	0.00%
United K.	2622	Aa2	0.56%	14.65%	0.08%
Russia	1578	Baa3	2.48%	8.81%	0.22%
West. Europe	17903				0.87%
Australia	1323.4	Aaa	0.00%	5.81%	0.00%
India	2597.5	Baa2	2.15%	11.41%	0.24%
New Zealand	205.9	Aaa	0.00%	0.90%	0.00%
Japan	4872.1	A1	0.79%	21.40%	0.17%
Korea	1530.8	Aa2	0.56%	6.72%	0.04%
China	12237.7	A1	0.79%	53.75%	0.43%
APAC	22767.4				0.88%

APPENDIX 31.1 — SENSITIVITY - RISK FREE RATE & BETA

source: Team Analysis

RISK FREE RATE	-0.50%	-0.25%	0.00%	0.25%	**0.50%**	0.75%	1.00%	1.25%
	CHF 79	CHF 73	CHF 67	CHF 62	**CHF 58**	CHF 54	CHF 50	CHF 47

LEVERED BETA	1.24	1.34	**1.44**	1.49	1.54
	CHF 81	CHF 68	**CHF 58**	CHF 54	CHF 50

APP. 31.2 — SENSITIVITY - R&D ASSUMPTION

source: T.A.

R&D TO SALES CONVERGENCE VALUE \ # OF YEARS TO GO BACK TO CONVERGENCE VALUE	2	3	4	**5**	6	7	8
19.4%	100	97	95	**93**	91	89	87
19.9%	91	89	86	**84**	82	80	78
20.4%	82	80	77	**75**	73	72	70
20.9%	73	71	69	**67**	65	63	61
21.4%	**64**	**62**	**60**	**58**	**56**	**54**	**53**
21.9%	55	53	51	**49**	47	46	44
22.4%	46	44	42	**40**	39	37	36
22.9%	37	35	33	**32**	30	29	27
23.4%	27	26	24	**23**	22	20	19

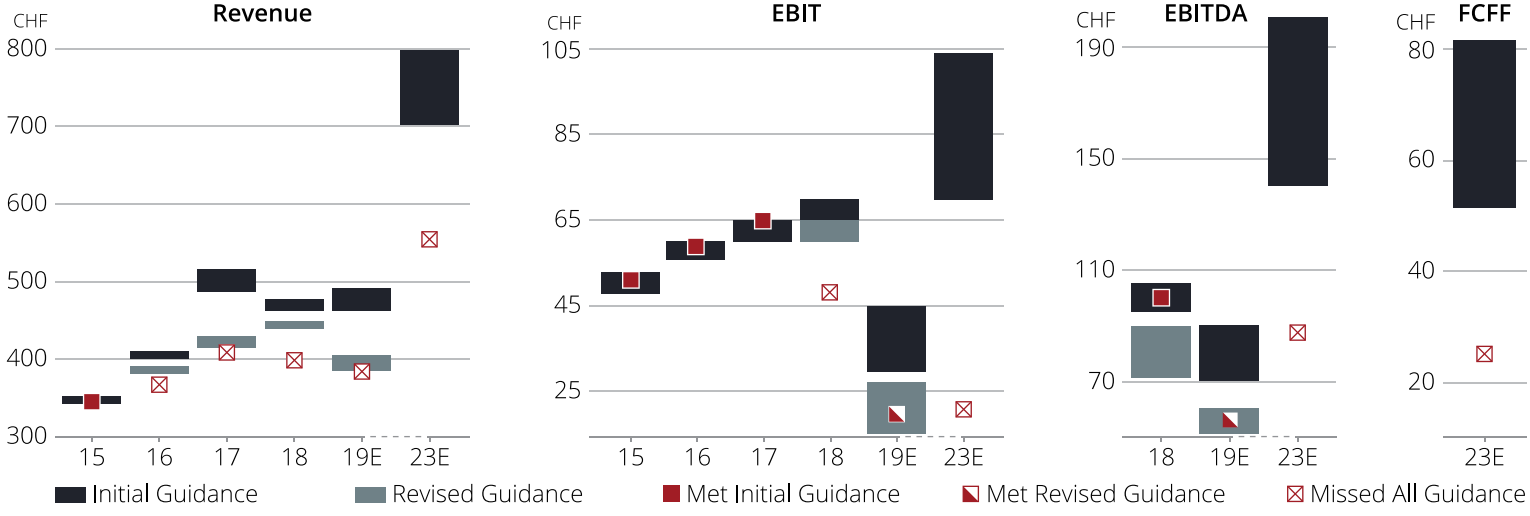
APP. 31.3 — GROSS MARGIN vs ASP DECLINE

source: T.A.

GROSS MARGIN BY 2023 \ ASP DECLINE PER YEAR	8.5%	9.0%	9.5%	**10.0%**	10.5%	11.0%	11.5%
44.2%	99	96	94	**91**	89	86	84
43.7%	90	87	85	**83**	81	79	77
43.2%	81	79	77	**75**	73	71	69
42.7%	72	70	68	**66**	65	63	61
42.2%	**62**	**61**	**59**	**58**	**56**	**55**	**54**
41.7%	53	52	51	**50**	48	47	46
41.2%	46	45	44	**43**	42	41	40
40.7%	35	34	33	**33**	32	32	31
40.2%	26	25	25	**24**	24	24	23

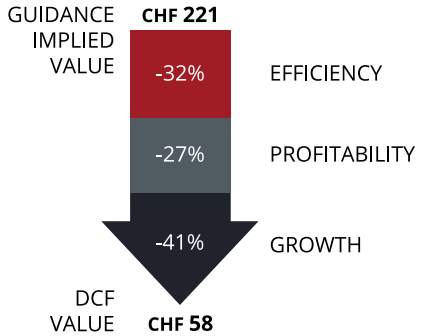
APPENDIX 32 — MANAGEMENT GUIDANCES

source: Company Data, Team Analysis



APPENDIX 33 — VALUATION DRIVERS

source: Team Analysis



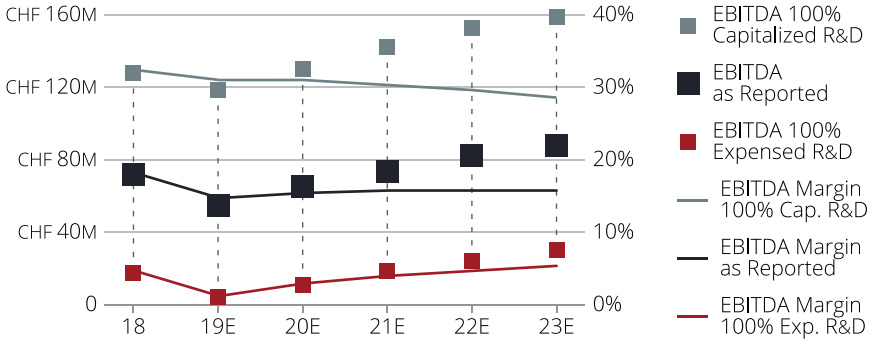
The three main drivers behind our sell recommendation are efficiency, profitability, and growth. The relative impact of these drivers on the recommendation was assessed by comparing our R&D efficiency, gross margin, and revenue expectations with those implicitly embedded in the 2023 management guidance shown in Appendix 28. In order to isolate the effect of each of these factors the management value for each variable was independently input in the DCF model while holding other variables constant, and the resulting change in the enterprise value was observed. The relative weight of each of the factors was determined to be the following: R&D efficiency 32%, Gross margin 27%, and Revenue 41%.

Selected Peers	EV TO SALES					EV TO EBITDA				
Company Name	2016	2017	2018	2019E	2020E	2016	2017	2018	2019E	2020E
Lantronix	0.57	0.63	0.97	1.20	1.10	9.06	23.11	21.05	11.33	9.20
Nordic Semiconductors	3.37	3.70	1.83	2.70	2.60	9.30	-	-	6.45	5.72
Sequans Communications SA	3.19	3.26	2.09	2.96	1.74	-	-	-	-	-
Sierra Wireless Inc	0.65	0.98	0.54	0.36	0.35	14.93	11.09	12.00	9.10	7.63
STMicroelectronics NV	1.47	2.52	1.30	2.31	2.16	10.56	11.65	5.44	11.04	9.34
Telit Communications PLC	1.23	0.73	0.61	0.64	0.60	22.01	22.95	18.69	15.51	14.71
Wistron NeWeb Corp	0.53	0.55	0.52	0.48	0.43	6.89	7.93	9.04	8.07	6.75
Median	1.23	0.98	0.97	1.20	1.10	9.93	11.65	12.00	10.07	8.42
u-blox	3.36	3.17	1.38	1.63	1.01	14.79	14.68	7.56	11.53	6.31

Revenue (CHF M)				379	417				379	417
EBITDA (CHF M)				56	65				56	65
EV (CHF M)				454	459				559	548
Cash (CHF M)				121	121				121	121
Debt and Leases (CHF M)				140	140				140	140
Value of equity (CHF M)				436	440				541	530
Price per share (CHF)				63	63				78	76

Chinese Competitors	EV TO Sales Peers					EV TO EBITDA				
Company Name	2016	2017	2018	2019E	2020E	2016	2017	2018	2019E	2020E
Quectel	-	-	-	3.12	2.12	-	67.58	31.08	43.48	30.79
Fibocom	-	6.22	2.63	3.94	2.61	-	69.58	33.95	59.85	52.59
BDStar Navigation	10.22	7.26	3.52	3.91	-	135.14	130.54	52.28	-	-
Sunsea AIoT	2.65	3.42	1.86	1.45	-	71.38	73.56	37.35	-	-
Median	2.65	6.22	2.63	3.52	2.37	103.26	71.57	35.65	51.66	41.69

EV TO Sales multiple was used in place of the more common EV TO EBITDA due to the large effects of R&D capitalization policy on EBITDA. As can be seen in the graph to the right, if u-blox were to 100% expense its R&D, as all competitors who report under US GAAP must do, its EBITDA in 2018 would have gone from CHF 72M to 18M. On the other hand, if R&D had been 100% capitalized, EBITDA would have been CHF 128M. This wide range in EBITDA that results from a somewhat arbitrary accounting choice frustrates attempts to use any multiple involving EBITDA.



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