

Telecom Equipment

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COMMENT

5G growth ahead with NOK/ERIC to benefit

- **Wireless equipment to grow 4% in 2019E/2020E.** We have updated our wireless capex analysis post Q219 earnings to assess the spending trends at main operators across key regions, such as US, Korea, Japan, China, EU, Latam and Russia. We now forecast wireless capex to grow 3%/4% yoy in 2019/2020, resulting in 4% pa growth in wireless equipment market (Figure 1). While this is a minor reduction of 1% in our global wireless capex estimates for both 2019/2020, we continue to believe in 4% per annum for the wireless equipment market as we see some early signs of the equipment-to-capex ratio rising in markets such as China. The small reduction in our wireless capex forecasts is being driven mainly by China as we now model lower growth in 2020 (10% now vs. 15% previously) assuming there is some form of network sharing (although not fully confirmed yet).

Figure 1: Wireless equipment market to grow at 4% in both 2019/2020

US\$ bn	2015	2016	2017	2018	CS est. (NEW)		CS est. (OLD)	
					2019E	2020E	2019E	2020E
Wireless capex	195.5	174.6	166.5	169.9	175.9	182.2	177.4	184.5
% change	2%	-11%	-5%	2%	3%	4%	4%	4%
Wireless equipment spend	64.6	59.8	54.9	55.2	57.6	59.7	57.7	60.0
% change	2%	-7%	-8%	1%	4%	4%	4%	4%
Equipment to capex (%)	33.1%	34.3%	33.0%	32.5%	32.8%	32.8%	32.5%	32.5%

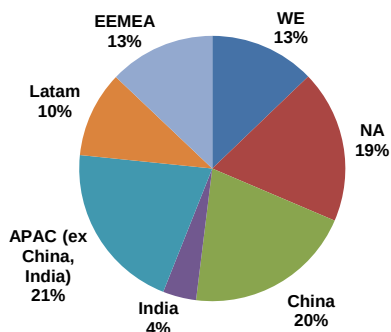
Source: Company data, Credit Suisse estimates

- **5G – key markets have not peaked yet.** Our capex analysis suggests investments in the US, Korea and China have not peaked yet. We estimate 2H19 capex in these 3 markets will be +12%, +64%, +12% hoh and +10%, +38%, -2% yoy respectively. Further, spending levels in China and Japan may continue to rise in 2020 (even US if DISH starts building network). We see signs of continued 5G investments from telcos, further helped by increasing number of 5G smartphone launches, 5G spectrum auctions/allocations and continued 5G positive comments from chip vendors. We view Ericsson and Nokia as key beneficiaries from these trends.
- **Ericsson (OP) – well positioned for 5G with FX tailwinds.** We believe ERIC is well positioned to benefit from 5G portfolio and installed customer base. We expect the top-line to grow 7%/4% in 2019/20 (2%/3% FX adjusted growth despite contract exits) with EBIT margins improving to 12.5% (+340bp yoy) by 2020. Our 2020 sales/EBIT estimates are 3%/15% above consensus. With shares trading at 0.95x EV/sales and 7.6x EV/EBIT on our 2020 estimates, we argue valuation remains cheap.
- **Nokia (OP) – 5G acceptances rising.** We continue to view Nokia as a beneficiary of ongoing 5G investments and expect its revenue to grow 3% in 2019/20, with EBIT margin to expand to 13% in 2020 (from 8.6% in 2019) – also helped by cost-cutting. With stock trading at 1.0x EV/sales and 7.9x EV/EBIT on our 2020 estimates, we see valuation as compelling.

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Key charts – Industry trends

Figure 2: Global wireless capex of \$176bn in 2019E (+3% yoy) broken down by region



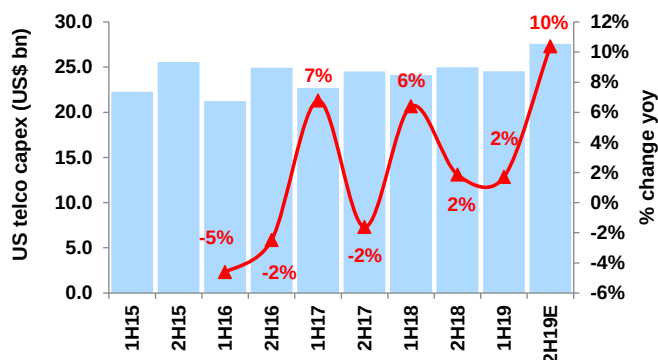
Source: Credit Suisse estimates

Figure 3: We believe US telco capex can still grow in 2020 driven by potential new entrant (DISH)

US telco capex (\$ mn)	2017	2018	2019E	2020E
Verizon	17,247	16,658	17,478	17,720
% change yoy	1%	-3%	5%	1%
AT&T (incl. FirstNet)	21,829	22,680	24,200	23,522
% change yoy	-3%	4%	7%	-3%
T-Mobile US (excl. cap interest)	5,101	5,179	5,700	5,700
% change yoy	12%	2%	10%	0%
Sprint (excl. device leasing)	3,028	4,594	4,738	5,200
% change yoy	41%	52%	3%	10%
US top telcos (excl. DISH)	47,205	49,111	52,116	52,143
% change yoy	2%	4%	6%	0%
DISH Network				2,000
US top telcos (incl. DISH)	47,205	49,111	52,116	54,143
% change yoy	2%	4%	6%	4%

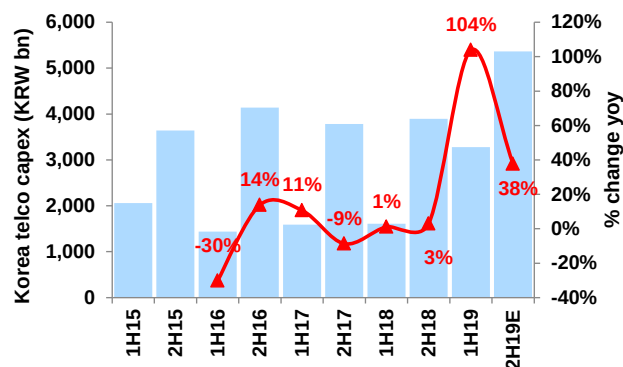
Source: Company data, Credit Suisse estimates, Company guidance (for TMUS/Sprint)

Figure 4: US telco capex: 2H19E could be up 10% yoy (even without DISH capex); also up 12% hoh



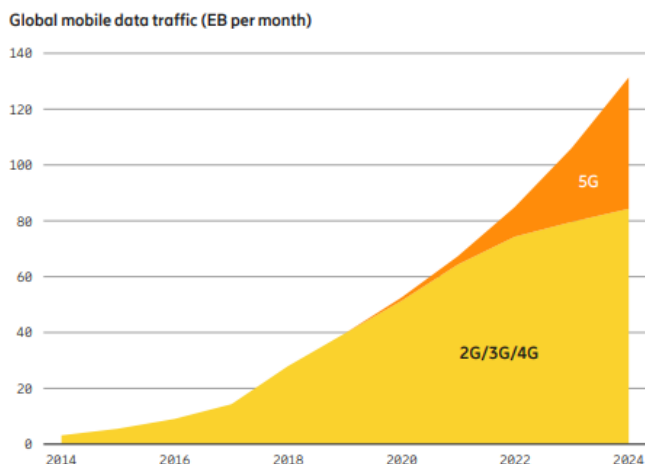
Source: Company data, Credit Suisse estimates

Figure 5: Korea telco capex: 2H19E could be up close to 40% yoy (also up 64% hoh)



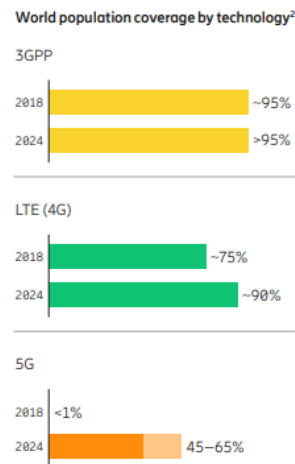
Source: Company data, Credit Suisse estimates

Figure 6: Mobile traffic to grow nearly 4x by 2024...



Source: Ericsson Mobility Report (Jun 2019), Credit Suisse research

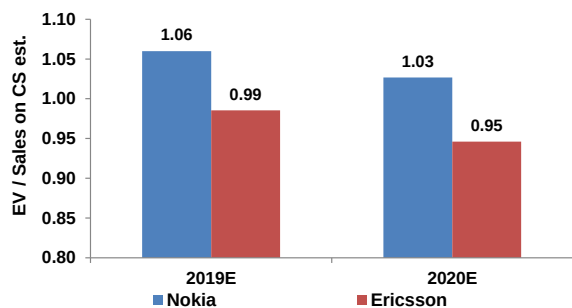
Figure 7: ...as 5G coverage ramps; 4G still got legs



Source: Ericsson Mobility Report (Jun 2019), Credit Suisse research

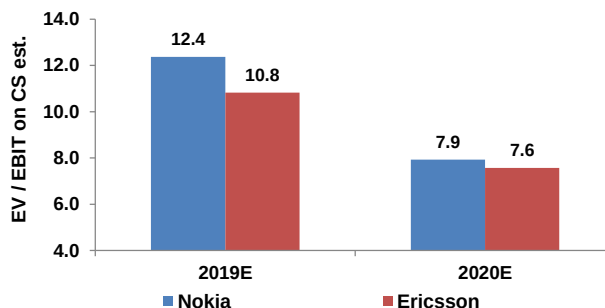
Key charts – Valuation

Figure 8: ERIC shares now trading at 0.95x EV/sales, at a small discount to NOK



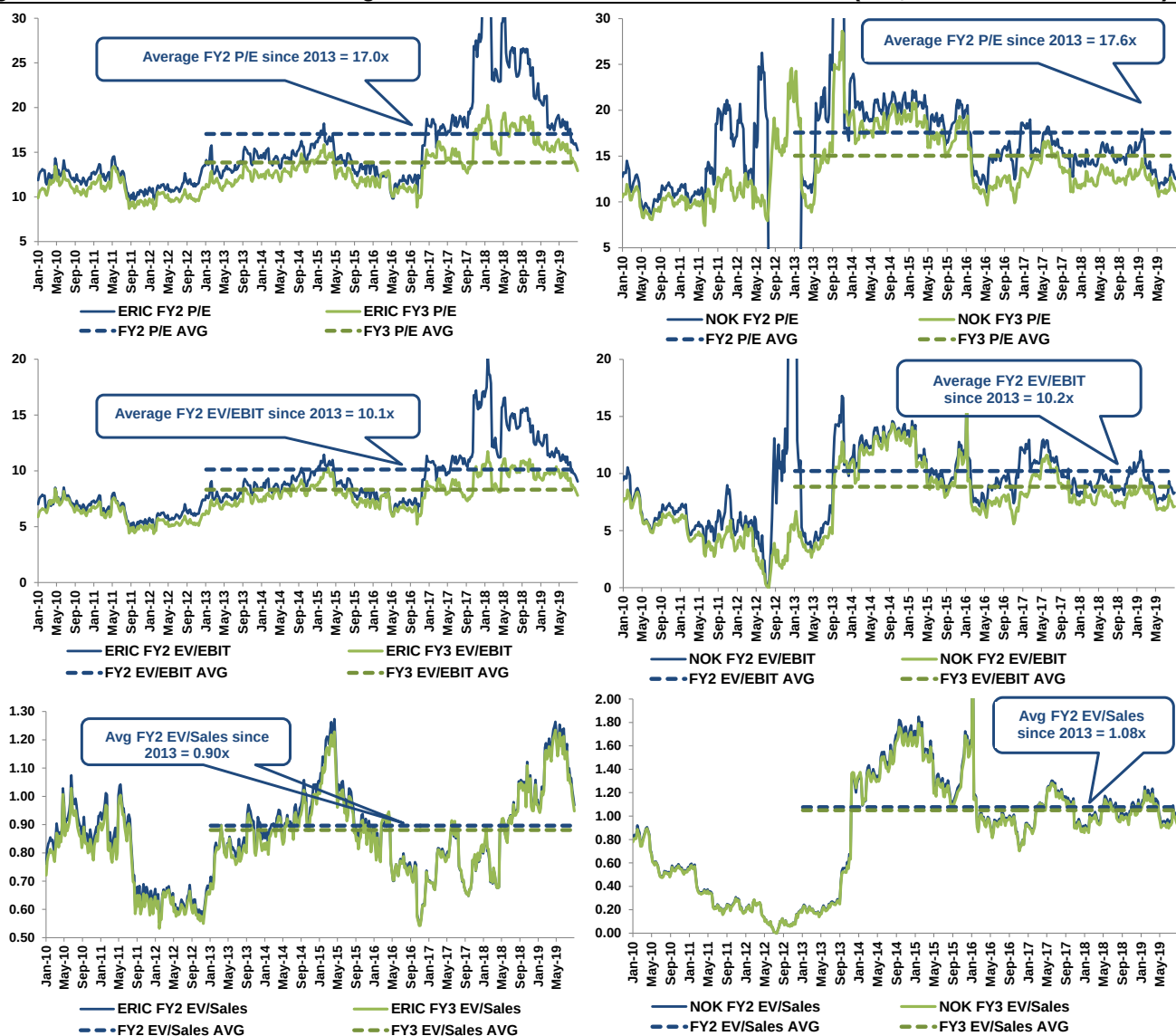
Source: Company data, Credit Suisse estimates

Figure 9: Even small discount to NOK when looking at EV/EBIT for both 2019E and 2020E



Source: Company data, Credit Suisse estimates

Figure 10: Historical valuation ranges for both Nokia and Ericsson over time (P/E, EV/sales and EV/EBIT)



Source: Datastream (for consensus estimates), Credit Suisse research

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5G – telco capex update

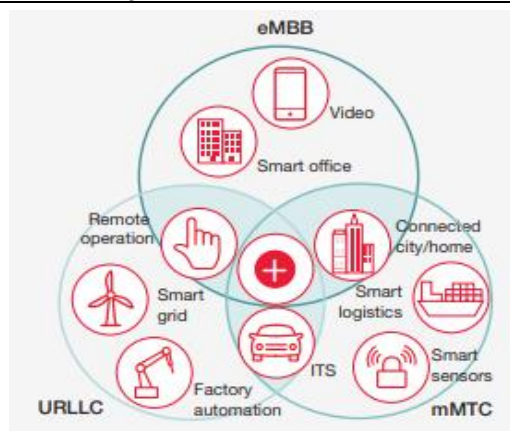
Following on from our detailed 5G report titled ["Telecom Equipment: 5G accelerating, but don't forget about 4G!"](#) in Dec 2018, we have updated our wireless capex analysis post Q219 earnings to assess the spending trends at all the key operators across regions. Here we look at capex spending patterns or intentions from all the key operators in major countries and regions including the US, China, Japan, Korea, Western Europe, Latin America and Russia – tracking around 30 of the largest telcos globally.

Figure 11: 5G can offer speeds in the 1-10Gbps range

Generation	Technology	Real World Download Speed	Theoretical Download Speed	Network Latency
2G	GSM	9.6 Kbps	<114 Kbps	300-1000ms
2.5G	GPRS	32-48 Kbps	114 Kbps	
2.75G	EDGE	175 Kbps	384 Kbps	
3G	HSPA	650 Kbps	7.2 Mbps	100-500ms
	HSPA+	1.4 Mbps	21Mbps	
	DC-HSPA+	6 Mbps	42 Mbps	
4G	LTE	15 Mbps	100 Mbps	50-100ms
4.5G	LTE-A	42 Mbps	300 Mbps	
5G		1 Gbps	10 Gbps	1-10ms

Source: Company data, Credit Suisse research

Figure 12: 3 major use cases in a 5G world



Source: KeySight Technologies

5G – what's different from previous generations

Every new generation of wireless technology brings with it a lot of improvements around network quality, higher network efficiencies and new applications with increasing use cases for consumers. We have seen that with 3G (first real data connectivity on smartphones) when it was launched in early 2000, and then with 4G launch (high speed connectivity enabling growth of apps, video functionalities) from 2011 onwards. So why is there so much hype around 5G. As shown in Figure 12, we note 3 key areas of improvement or differentiation in a 5G world compared to 4G, which are:

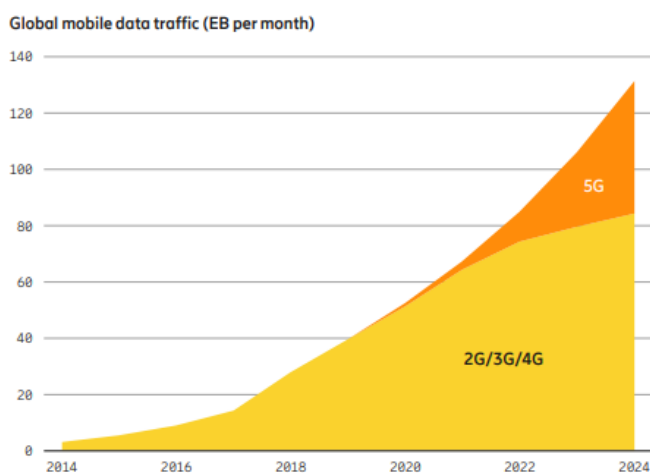
- **Enhanced Mobile Broadband (eMBB).** With 4G already offering high speed data connectivity on our devices today, eMBB can be seen as an evolution of that offering. With strong growth in wireless data traffic along with need for faster speeds, shift to 5G can allow networks to offer both – more capacity and more speed. In Figure 11, we compare the download speeds of different network generations, and how 5G can offer 20-30x higher speed than 4G networks even in real world environment.
- **Massive Machine Type Communications (mMTC).** Another use case for 5G will be machine connectivity. While this is also possible today with 4G networks, most of the IoT or smart devices are still connected via standards such as Wi-Fi, Bluetooth, NFC or RFID, 5G is being seen as a solution to enable more secure connectivity across a vast number of devices/machines.
- **Ultra-Reliable and Low-Latency Communications (URLLC).** Low latency (time it takes to transfer a data packet from one part of network to another, measured in milliseconds or ms) and high reliability are critical elements when we consider connectivity in an industrial or automotive world. Also applications such as gaming, AR/VR, remote surgery are also prime candidates to benefit from such a network offering high reliability and low latency. 5G can offer latency of around 1-10ms on an average compared to around 50ms currently on a typical 4G network.

5G coverage to ramp up, but 4G still has legs

Here we look at certain statistics around network coverage and data traffic, which supports our view that 5G cycle should prove to be a longer and sustainable cycle compared to any of the previous 3G/4G generations.

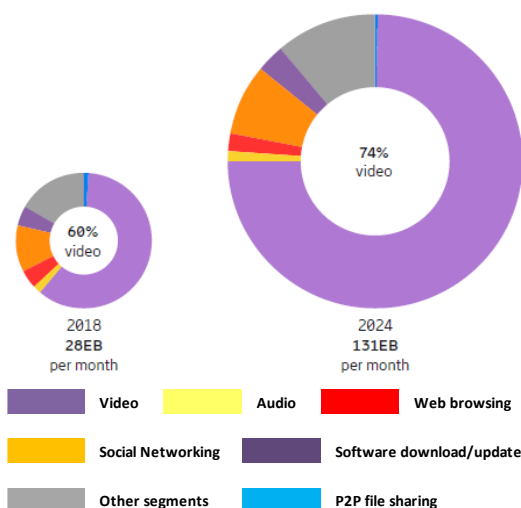
Mobile data traffic can potentially quadruple in the next 5 years. According to Ericsson's Mobility report, total wireless data traffic on networks globally is expected to be around 35 EB (Exabytes) per month, likely to be up 25-30% yoy in 2019. It expects this number to grow to 131 EB per month by 2024, which is around 3.75x higher than current levels (Figure 13). This would imply around 18GB per month of data usage per smartphone user by 2024, which seems not too difficult to get to over time. As a frame of reference, average usage in India has already reached close to 10GB per month by end of 2018 driven by an aggressive push especially from Reliance Jio.

Figure 13: Mobile data traffic to grow nearly 4x over the next 5 years...



Source: Ericsson Mobility Report (Jun 2019), Credit Suisse research

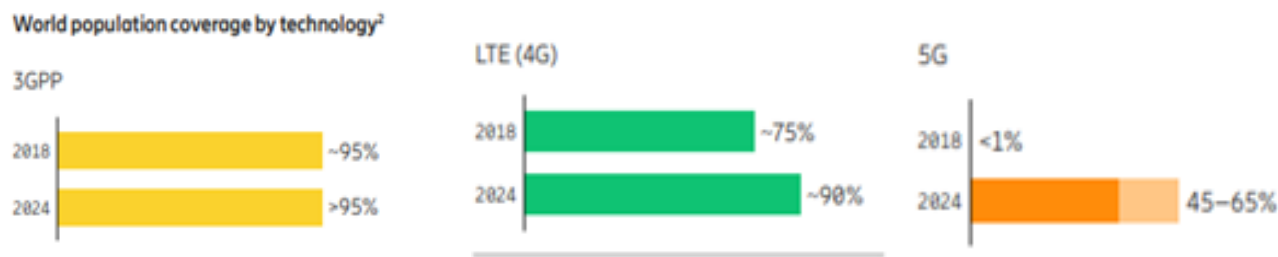
Figure 14: ...driven mainly by video, with video accounting for 3/4th of all mobile traffic over time



Source: Ericsson Mobility Report (Jun 2019), Credit Suisse research

Don't forget about 4G – long tail ahead. During 2018, we saw around 10ppt of increase in LTE coverage reaching ~75% on an average globally. With 3G coverage at ~95%, we can see that 4G could still rise around 20ppt over the next few years. Ericsson expects 4G coverage to reach ~90% by 2024 (Figure 15). Interestingly, there are 720 commercial LTE networks in deployment currently, of which only around 40% have been upgraded to LTE-Advanced. Both these observations would suggest that 4G still should have legs driven by upgrades (both speed and capacity).

Figure 15: Ericsson believes that 5G coverage to reach 45-65% levels by 2024



Source: Ericsson Mobility Report (Jun 2019), Credit Suisse research

What does it mean for wireless capex at telco operators globally?

We have updated our proprietary telco capex model which tracks all major operators in key markets for any changes post Q219 earnings season. In summary, our analysis continues to reaffirm the view that capex trends at telecom operators continue to improve across multiple geographies at the same time (like US, Japan, Korea, Latam and Russia) with a potential recovery in China from 2H19.

As such, we forecast wireless capex to grow 3%/4% yoy in 2019/2020, which leads to 4% pa growth in wireless equipment market (Figure 16). While this is a minor reduction of 1% in our global wireless capex estimates for both 2019/2020, we continue to believe in 4% per annum for the wireless equipment market as we see some early signs of the equipment-to-capex ratio rising in markets such as China. The small reduction in our wireless capex forecasts is being driven mainly by China as we now model lower growth in 2020 (10% now vs. 15% previously) assuming there is some form of network sharing (although it is not fully confirmed yet).

Figure 16: Wireless capex – we forecast 3%/4% growth in global wireless capex for 2019/20 (vs. 4% in both years previously), leading to 4% growth for wireless equipment spend in 2019/2020 (unchanged)

Wireless capex (US\$ bn)	2011	2012	2013	2014	2015	2016	2017	2018	CS est. (NEW)		CS est. (OLD)	
									2019E	2020E	2019E	2020E
Western Europe	20.7	21.7	21.9	24.3	25.5	23.5	22.5	22.5	22.5	22.5	22.2	22.2
% change	9%	5%	1%	11%	5%	-8%	-4%	0%	0%	0%	-1%	0%
North America	26.9	30.7	34.5	33.6	32.3	29.7	30.0	30.9	32.7	34.7	34.0	34.7
% change	10%	14%	13%	-3%	-4%	-8%	1%	3%	6%	6%	10%	2%
Asia-Pacific	64.1	71.7	80.9	84.4	92.2	81.5	75.1	76.2	79.5	83.6	79.8	85.6
% change	2%	12%	13%	4%	9%	-12%	-8%	1%	4%	5%	5%	7%
China	31.4	33.3	42.9	47.3	51.5	41.7	35.9	33.7	36.1	39.7	36.5	42.0
% change	2%	6%	29%	10%	9%	-19%	-14%	-6%	7%	10%	8%	15%
India	4.4	4.1	3.6	5.2	8.1	6.9	6.3	7.9	7.1	7.3	7.7	7.6
% change	-38%	-7%	-11%	44%	55%	-15%	-8%	25%	-10%	2%	-3%	-1%
Asia Pacific ex China, India	28.3	34.2	34.4	31.9	32.6	32.9	32.9	34.5	36.3	36.6	35.6	36.0
% change	13%	21%	0%	-7%	2%	1%	0%	5%	5%	1%	3%	1%
Latin America	18.9	20.7	21.2	22.5	20.7	17.8	17.3	17.7	18.4	18.4	18.5	18.7
% change	31%	10%	3%	6%	-8%	-14%	-3%	2%	5%	0%	5%	1%
Emerging EMEA	29.3	25.2	26.0	26.6	24.8	22.0	21.6	22.7	22.7	22.9	22.9	23.4
% change	14%	-14%	3%	2%	-7%	-11%	-2%	5%	0%	1%	1%	2%
Global wireless capex	159.8	169.8	184.6	191.5	195.5	174.6	166.5	169.9	175.9	182.2	177.4	184.5
% change	9%	6%	9%	4%	2%	-11%	-5%	2%	3%	4%	4%	4%

US\$ bn	2011	2012	2013	2014	2015	2016	2017	2018	CS est. (NEW)		CS est. (OLD)	
									2019E	2020E	2019E	2020E
Wireless capex	159.8	169.8	184.6	191.5	195.5	174.6	166.5	169.9	175.9	182.2	177.4	184.5
% change	9%	6%	9%	4%	2%	-11%	-5%	2%	3%	4%	4%	4%
Wireless equipment spend	63.4	59.8	59.8	63.5	64.6	59.8	54.9	55.2	57.6	59.7	57.7	60.0
% change	9%	-6%	0%	6%	2%	-7%	-8%	1%	4%	4%	4%	4%
Equipment to capex (%)	39.7%	35.2%	32.4%	33.1%	33.1%	34.3%	33.0%	32.5%	32.8%	32.8%	32.5%	32.5%

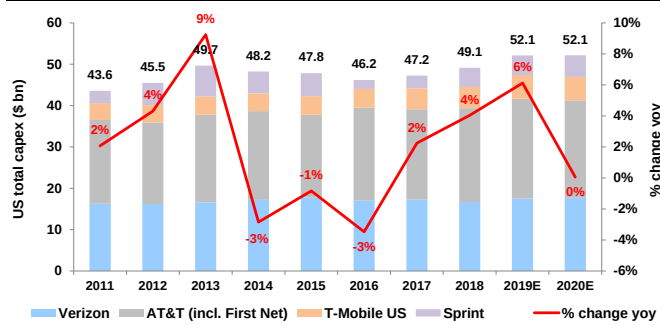
Source: Company data, Credit Suisse estimates

US – not peaking yet, DISH source of upside

With initial 5G rollouts continuing to drive growth in the US over the last 9-12 months, we expect this strength to continue into 2020. Aggregating capex budgets at the top 4 telcos in the US, we believe that total capex in the US may grow by 6%/0% in 2019/2020 (Figure 17), within which wireless part may grow 5%/1% respectively (Figure 18).

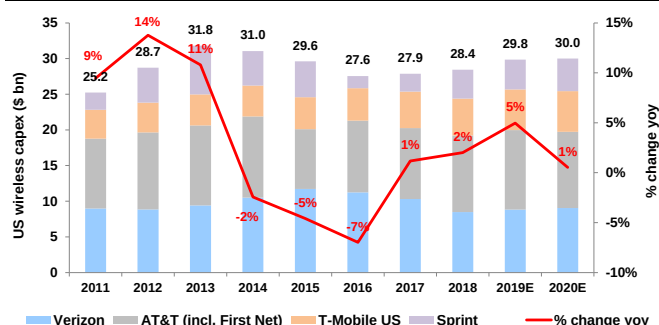
However, what is worth noting is that our capex estimates in Figure 17 do not include DISH Network, which post DoJ settlement recently has agreed to build 70% 5G broadband coverage by June 2023. DISH had also estimated that cumulative investments needed could be in the range of ~\$10bn (capex + opex) between now and mid-2023, or may be slightly lower if it is able to use some of the decommissioned sites and retail stores from Sprint. Given our estimate of \$52bn of total capex (of which \$30bn wireless), an incremental \$2bn of wireless capex per annum could drive ~4% potential upside to total capex (and ~6-7% upside to wireless capex). This may result in US capex growing 4% in 2020 (Figure 19) as opposed to being flatish.

Figure 17: US capex may be flat in 2020 after reaching a peak in 2019...



Source: Company data, Credit Suisse estimates for AT&T and Verizon, Company guidance for T-Mobile US and Sprint

Figure 18: ...we still see some room for growth in wireless (even excluding DISH plans)



Source: Company data, Credit Suisse estimates for AT&T and Verizon, Company guidance for T-Mobile US and Sprint

Figure 19: Our analysis suggests that US telco capex could grow 12% hoh and 10% yoy in 2H19, with another 4% growth in 2020 if we include DISH Network investments

US telco capex (\$ mn)	1H17	2H17	1H18	2H18	1H19	2H19E	2017	2018	2019E	2020E
Verizon	7,011	10,236	7,838	8,820	7,967	9,511	17,247	16,658	17,478	17,720
% change hoh	-28%	46%	-23%	13%	-10%	19%				
% change yoy	-4%	5%	12%	-14%	2%	8%	1%	-3%	5%	1%
AT&T	11,223	10,606	11,528	11,152	10,757	13,443	21,829	22,680	24,200	23,522
% change hoh	-9%	-5%	9%	-3%	-4%	25%				
% change yoy	11%	-14%	3%	5%	-7%	21%	-3%	4%	7%	-3%
T-Mobile US (excl. cap interest)	2,793	2,308	2,850	2,329	3,477	2,223	5,101	5,179	5,700	5,700
% change hoh	45%	-17%	23%	-18%	49%	-36%				
% change yoy	6%	20%	2%	1%	22%	-5%	12%	2%	10%	0%
Sprint (excl. device leasing)	1,650	1,378	1,912	2,682	2,338	2,400	3,028	4,594	4,738	5,200
% change hoh	74%	-16%	39%	40%	-13%	3%				
% change yoy	38%	45%	16%	95%	22%	-11%	41%	52%	3%	10%
US top telcos (excl. DISH)	22,677	24,528	24,128	24,983	24,539	27,577	47,205	49,111	52,116	52,143
% change hoh	-9%	8%	-2%	4%	-2%	12%				
% change yoy	7%	-2%	6%	2%	2%	10%	2%	4%	6%	0%
DISH Network										2,000
US top telcos (incl. DISH)	22,677	24,528	24,128	24,983	24,539	27,577	47,205	49,111	52,116	54,143
% change yoy							2%	4%	6%	4%

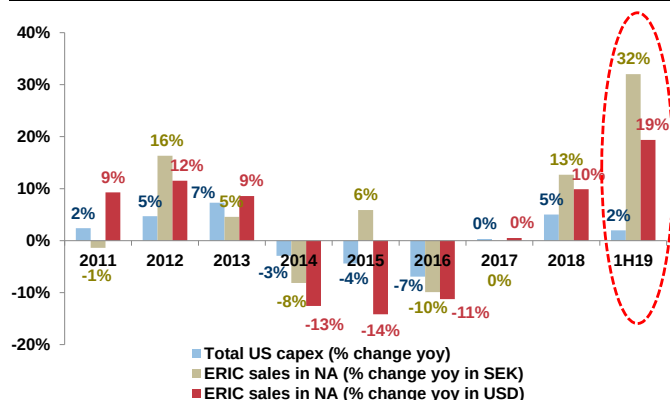
Source: Company data, Credit Suisse estimates, Company guidance (for TMUS/Sprint)

Telcos capex disclosures suggest slower 1H so far, but stronger 2H19 likely. Given both AT&T and VZ have only spent ~45% of their FY capex budgets in 1H19, it would suggest decent growth in 2H19. On the contrary, T-Mobile US has again had a front-end loaded capex similar to the last few years. As such, our analysis suggests that 2H19 capex in aggregate in the US could be up around 12% hoh and up 10% yoy (Figure 19). This would imply that, although we have seen strong growth in NA region sales for both Ericsson and Nokia during 2019 so far, their US revenues should still have room to grow further.

ERIC outgrowing US capex significantly, and so has NOK, but at slower pace.

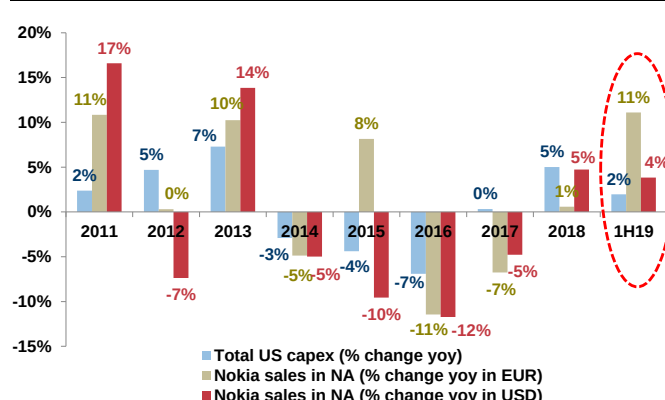
Ericsson has been outgrowing US capex since 2H17, after a long underperformance from 2014 to 1H17. Here we believe that the vendor has benefitted from a combination of factors, including improvement in overall capex environment as telcos are investing in 4G upgrades and initial 5G builds. We see a similar trend at Nokia, although the rate of growth has been slower than Ericsson so far given initial hardware integration challenges at Nokia. This may have also led to more capacity businesses being directed towards Ericsson over the last few quarters. We believe this ongoing trend benefitting Ericsson in the US could potentially continue in the near term (Figure 20).

Figure 20: Similar to 2018, ERIC has continued to outgrow the US capex market in 1H19...



Source: Company data, Credit Suisse research

Figure 21: ...and so has NOK, albeit at much slower pace given initial delays with 5G products



Source: Company data, Credit Suisse research. (Note: from 1H19, Nokia group sales is presented, as opposed to Nokia Networks in prior period)

Looking at Figure 21, it is clear that Nokia was significantly under-growing US capex since the acquisition of Alcatel-Lucent in 2015. For example, over 2014-2017, while the US overall telco capex fell by around 10%, Nokia Networks' NA sales declined by nearly 25% in USD terms. We believe a lot of this is related to Nokia doing large-scale swap outs of older Alcatel-Lucent hardware with Nokia's modern equipment, effectively leading to higher capacity. This in turn has had an impact on its capacity upgrade business in the US, especially at AT&T and Verizon. With headwinds from network swaps now starting to go away and 5G hardware/software delivery getting back on track post initial delays, we believe the vendor can grow at least in-line with the US capex (or even outgrow it, as we have seen in 1H19).

Verizon – capex spend to increase in 2H19. In spite of a slow start to the year in terms of capex spend, Verizon has maintained its 2019 capex guidance of \$17-18bn (+5% yoy at mid-point). After spending \$8.0bn in 1H19 (-10% hoh/+2% yoy), the mid-point of 2019 guidance implies 2H19 capex of \$9.5bn (+20% hoh/+8% yoy). The company has launched 5G in 9 markets so far (with all 3 infrastructure vendors, which we assume are Ericsson, Nokia and Samsung) and is targeting to reach 30 markets by the end of 2019.

"We maintain our 2019 capex guidance range of \$17-18bn...we won some more spectrum in the millimeter wave auction...which means that we have a portfolio for the 5G era where we can build capacity, and we can build coverage...We're also

*very focused on the fiber because, ultimately, if you're going to do 5G, you need fiber...[on 5G] we have basically **now launched 9 markets on the way to get to the 30 for the full year...We have launched with all the 3 infrastructure vendors** we have, which means that we are coming out from sort of just scaling in the beginning, getting all the technology to work and now again start scaling"*

– Hans Vestberg (CEO, Verizon) and Matt Ellis (CFO, Verizon) at Q219 earnings call

AT&T – spending more in 2H19, targeting nationwide 5G coverage by 1H20. AT&T has reported 1H19 capex (incl. FirstNet) of \$10.8bn (-4% hoh/-7% yoy) and reiterated its 2019 capex guidance (incl. FirstNet) in the range of \$24bn (+6% yoy). This implies that 2H19 capex of \$13bn (+23% hoh/+19% yoy), although our estimates are slightly higher as we model 2019 capex of \$24.2bn vs. company guidance of around \$24bn. AT&T recently noted that it is installing hardware equipment that is upgradable to 5G with software release, and is targeting nationwide 5G coverage by 1H20. The company has achieved 60% coverage for its FirstNet plan (this is the public safety network part) and targets 70% completion by end of 2019.

*"FirstNet continues to be the driver of our network performance as well as our 5G leadership. At the end of the quarter, we were about **60% complete with our FirstNet coverage, ahead of plan, and we're now targeting 70% completion by year-end...we're installing hardware that can be upgraded to 5G with a simple software release....we're on track for nationwide 5G coverage by the first half of 2020.**"*

– Randall L. Stephenson (CEO of AT&T) at Q219 earnings

TMUS – expecting capex at very high end of guidance, while Sprint merger ongoing. While the ongoing merger process may lead to some timing uncertainty around capex spending, we note that TMUS has indicated that it plans to spend 15-20% of service revenues for the combined entity on capex over the next 3-4 years post completion of the deal. That would imply capex of around \$10.5bn p.a., taking the mid-point of the company's guidance range, before falling to \$9.6bn levels once 5G is built out.

As a standalone company, T-Mobile has maintained its own 2019 capex guidance of \$5.4-5.7bn (excl. \$0.4bn of capitalized interest), but given high levels of 1H19 spending, it now expects capex to end up at the "very high end of the guidance range", implying about 10% growth over 2018 level. Having spent \$3.5bn in 1H19 (+49% hoh/+22% yoy), the high end of guidance implies 2H19 spend of \$2.2bn (-36% hoh/-5% yoy).

*"We target cash **capex of \$5.4 billion to \$5.7 billion**, excluding capitalized interest, which is expected to be approximately \$400 million in 2019. This is unchanged from our prior guidance range, but we do now expect to be at the **very high end of the guidance range.**"*

– Braxton Carter (CFO of T-Mobile) at Q219 earnings

DISH – potential new entrant to drive incremental capex. After the recent settlement announced by DoJ our US Telecoms & Media Research team (Douglas Mitchelson) noted the following points which DISH and Sprint agreed to. Sprint plans to:

- divest its pre-paid wireless business (9.3mn subs) to DISH for \$1.4bn;
- provide MVNO (mobile virtual network operator) to DISH for 7 years (prepaid, postpaid LTE and 5G);
- allow DISH to choose amongst at least 20k decommissioned tower sites, and 400 decommissioned retail stores;

- allow DISH to purchase Sprint's ~14 MHz of 800MHz spectrum (for \$3.6bn or \$0.79/MHz POP, which is ~30% lower than what DISH paid for 600MHz in 2017);
- extend DISH's build out requirements for its current spectrum to June 2023 giving more time to build out 70% 5G coverage.

Before this settlement, DISH had disclosed that it estimated a full mobile broadband network build out will cost \$10bn, though one can argue that it may now be somewhat cheaper given access to some of Sprint's decommissioned tower sites and retail stores.

Figure 22: Build-out terms for DISH's spectrum holdings

	Original Buildout Terms	Consent Decree's New Buildout Terms	
AWS-4	March 2020 Offer wireless service to 70% of the population in each license area		
Lower 700MHz E Block	March 2020 Offer wireless service to 70% of the population in each license area	June 2022: Offer 5G broadband to at least 20% of the US population and have deployed a core network	June 2023: Offer 5G broadband to at least 70% of the US population
AWS H Block	April 2022 Offer wireless service to 75% of the population in each license area		
600MHz	June 2023 Offer wireless service to 75% of the population in each license area	June 2023 Offer 5G broadband to at least 70% of the US population	June 2025 Offer 5G broadband to 75% of the population in each license area

Source: Company data, Credit Suisse estimates

In terms of enforcement terms from DoJ, DISH has to submit reports twice a year with details of number of sites deployed, spectrum bands in use, subs and traffic data and more. Further, DISH has agreed to pay a \$2.2bn penalty to the US Treasury if the licenses are not perfected by agreed timeline.

"...we still plan on building our network out and spend about \$10 billion to do that. Having said that, with the MVNO deal with T-Mobile, we're able to extend our build-out for some of the less-profitable areas longer term. So our initial cap at least will actually be less than we had envisioned, short term. And as a result, our OpEx will actually be less than we had ultimately envisioned. But the \$10 billion investment is still in the cards."

– Charles Ergen (Co-Founder & Chairman, DISH Network) at Q219 earnings

Wireless service revenue starting to grow again at US telcos. Total wireless service revenues at the top four US telcos have been declining post 2014 due to maturing smartphone subs base and increasing competition. But we now signs of improving trend here as 2H18 saw flattish growth followed by 3% growth in 1H19. We believe this growth trend may prove sustainable in 2H19 with industry likely to see 3% growth in wireless service revenues for 2019 (Figure 23). Once service revenues start to grow, telcos may even start to accelerate 5G spending in an attempt to maintain that growth trend and aim to differentiate vs. each other by offering better 5G network quality.

Figure 23: Wireless service revenues starting to grow again after multi-year declines seen post 2014

Wireless Service revenues	2011	2012	2013	2014	2015	2016	2017	2018	2019E
Verizon	59,157	63,733	69,033	72,630	70,396	66,580	63,121	63,020	65,128
% change yoy	6%	8%	8%	5%	-3%	-5%	-5%	0%	3%
AT&T	56,726	59,186	61,552	61,032	59,837	59,386	57,955	54,933	56,269
% change yoy	6%	4%	4%	-1%	-2%	-1%	-2%	-5%	2%
Sprint	27,390	29,086	29,263	27,964	25,845	24,218	22,736	21,980	
% change yoy	6%	6%	1%	-4%	-8%	-6%	-6%	-3%	
T-Mobile US / MetroPCS	22,909	21,753	20,535	22,375	24,821	27,844	30,160	31,992	
% change yoy	2%	-5%	-6%	9%	11%	12%	8%	6%	
Top 4 US	166,182	173,758	180,383	184,001	180,899	178,028	173,972	171,925	
% change yoy	6%	5%	4%	2%	-2%	-2%	-2%	-1%	

Source: Company data, Credit Suisse estimates

Figure 24: US telco capex: We see signs of sustained growth in the US looking at operators' capex plans especially for the wireless part; DISH Network investments plans could provide further potential upside

Capex (\$ mn)	2011	2012	2013	2014	2015	2016	2017	2018	2019E	2020E
Verizon (wireless)	8,973	8,857	9,425	10,515	11,725	11,240	10,310	8,486	8,821	9,047
% change qoq										
% change yoy	6%	-1%	6%	12%	12%	-4%	-8%	-18%	4%	3%
Verizon (wireline)	6,399	6,342	6,229	5,750	5,049	4,504	5,339	6,255	6,763	6,756
% change qoq										
% change yoy	-12%	-1%	-2%	-8%	-12%	-11%	19%	17%	8%	0%
Verizon (overall - incl. other items)	16,244	16,175	16,604	17,191	17,775	17,059	17,247	16,658	17,478	17,720
% change qoq										
% change yoy	-1%	0%	3%	4%	3%	-4%	1%	-3%	5%	1%
AT&T (wireless) (excl. DirecTV)	9,794	10,795	11,191	11,383	8,383	10,050	9,675	9,300	9,838	9,931
% change qoq										
% change yoy	7%	10%	4%	2%	-26%	20%	-4%	-4%	6%	1%
AT&T (wireline / shared infra) (excl. DirecTV, TWX)	10,387	8,866	9,020	9,081	8,807	8,750	8,000	8,250	9,250	9,250
% change qoq										
% change yoy	-2%	-15%	2%	1%	-3%	-1%	-9%	3%	12%	0%
AT&T (overall - incl. other items, also Mexico, TWX, DirecTV) excl. FirstNet	20,272	19,728	21,228	21,433	20,015	22,408	21,550	21,251	22,883	22,772
% change qoq										
% change yoy	0%	-3%	8%	1%	-7%	12%	-4%	-1%	8%	0%
FirstNet							279	1,429	1,317	750
AT&T (overall - incl. other items, also Mexico, TWX, DirecTV) incl. FirstNet							21,829	22,680	24,200	23,522
% change qoq										
% change yoy								4%	7%	-3%
Sprint (wireless)	2,416	4,884	6,833	4,828	7,193	3,798	4,692	11,710	12,077	13,255
of which Networks & Other				4,682	5,030	1,700	2,510	4,043	4,170	4,576
% change qoq										
% change yoy					7%	-66%	48%	61%	3%	10%
of which Leased Devices				146	2,163	2,098	2,182	7,667	7,907	8,678
Sprint (wireline)	158	242	320	284	275	149	151	204	200	200
% change qoq										
% change yoy					-3%	-46%	1%	35%	-2%	0%
Sprint - cash capex (overall)	3,000	5,370	7,451	5,445	7,729	4,241	5,210	12,261		
Sprint - cash capex (overall) excl. Leased Devices				5,299	5,566	2,143	3,028	4,594	4,738	5,200
% change qoq										
% change yoy					5%	-61%	41%	52%	3%	10%
T-Mobile US (all wireless) excl. Capitalized Interest					4,478	4,560	5,101	5,179	5,700	5,700
% change qoq										
% change yoy						2%	12%	2%	10%	0%
Capitalized Interest					246	142	271	362	400	400
T-Mobile US (all wireless) incl. Capitalized Interest	2,729	2,901	4,241	4,317	4,724	4,702	5,237	5,541	6,100	6,100
% change qoq										
% change yoy	-3%	6%	46%	2%	9%	0%	11%	6%	10%	0%
Total (wireless)*	25,243	28,717	31,820	30,897	29,616	27,550	27,875	28,437	29,847	30,005
% change qoq										
% change yoy	9%	14%	11%	-3%	-4%	-7%	1%	2%	5%	1%
Total (wireline)	16,944	15,450	15,569	15,115	14,131	13,403	13,490	14,709	16,213	16,206
% change qoq										
% change yoy	-7%	-9%	1%	-3%	-7%	-5%	1%	9%	10%	0%
Total (wireless + wireline + others)*	43,576	45,454	49,654	48,240	47,834	46,170	47,205	49,111	52,116	52,143
% change qoq										
% change yoy	2%	4%	9%	-3%	-1%	-3%	2%	4%	6%	0%

* Also includes Leap Wireless and MetroPCS till 2013

Source: Company data, Credit Suisse estimates for AT&T and Verizon, Company guidance for T-Mobile US and Sprint

Wireless capex to sales ratio to start to rise to 2012-2013 levels when 4G started. In a scenario where wireless service revenue starts to grow or even potentially stabilize, telco operators in US should be willing to increase their spending on 5G networks. We believe that during the period of 5G roll outs (end-2018 to 2021), the capex-to-sales ratio could go back up to 17% and remain at that level (Figure 25).

Figure 25: Wireless capex-to-sales at US telcos could rise to 17% in 2019E (similar to what happened with 4G rollouts during 2012-2014), and remain at those levels during 2020E

Wireless Capex	2011	2012	2013	2014	2015	2016	2017	2018	2019E
Verizon	8,973	8,857	9,425	10,515	11,725	11,240	10,310	8,486	8,821
as % of service revenue	15.2%	13.9%	13.7%	14.5%	16.7%	16.9%	16.3%	13.5%	13.5%
AT&T (incl. FirstNet)	9,794	10,795	11,191	11,383	8,383	10,050	9,954	10,729	11,156
as % of service revenue	17.3%	18.2%	18.2%	18.7%	14.0%	16.9%	17.2%	19.5%	19.8%
Sprint	2,416	4,884	6,833	4,682	5,030	1,700	2,510	4,043	4,170
as % of service revenue	8.8%	16.8%	23.4%	16.7%	19.5%	7.0%	11.0%	18.4%	19.6%
T-Mobile US / MetroPCS	3,619	3,747	4,241	4,317	4,478	4,560	5,101	5,179	5,700
as % of service revenue	15.8%	17.2%	20.7%	19.3%	18.0%	16.4%	16.9%	16.2%	17.0%
Top 4 US	24,802	28,283	31,690	30,897	29,616	27,550	27,875	28,437	29,847
% change yoy in wireless capex	9%	14%	12%	-3%	-4%	-7%	1%	2%	5%
as % of service revenue	14.9%	16.3%	17.6%	16.8%	16.4%	15.5%	16.0%	16.5%	16.9%

Source: Company data, Credit Suisse estimates, Company guidance for T-Mobile US and Sprint

Korea off to a quick start, Japan taking time

Korea – capex strength from 1H to continue into 2H19. Since 4G slowed during 2013, telco capex in Korea has been under significant pressure. However, after having fallen 35% in total by 2017 from the peak reached in 2012 (Figure 27), we saw the first signs of growth in 2018 (+2% yoy). We now see this capex growth accelerating across all the three major telcos in the region.

- KT Corp recently reported Q2 capex of KRW0.80tn (+45% qoq/+97% yoy). The company also reiterated 2019 guidance of KRW3.3tn (+67% yoy), implying 2H capex of KRW1.9tn (+44% hoh/+46% yoy).
- LG Uplus reported significant increase in capex with Q2 level at KRW0.73tn (+164% qoq/+181% yoy). We expect around 75-80% yoy increase in 2019 capex.
- Cumulative capex in Korea in 1H19 was KRW3.3bn (+104% yoy) and we expect 2H capex to be around KRW5.4bn (+64% hoh/+38% yoy) as we show in Figure 28. This should result in 2019 cumulative capex of KRW8.6bn (+57% yoy), of which wireless capex should be around KRW5.20bn (+79% yoy) (Figure 26).

Figure 26: We expect Korea telco capex to start recovering from 2H18 with further improvement in 2019

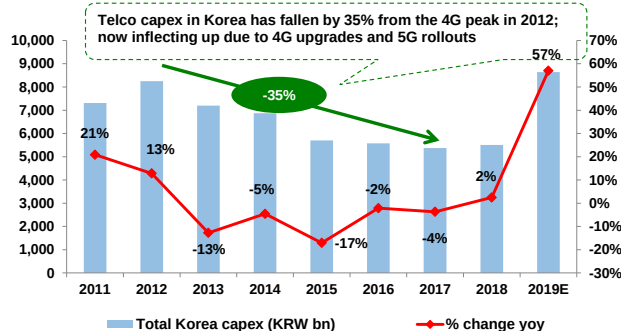
Total Capex (KRW bn)	2011	2012	2013	2014	2015	2016	2017	2018	2019E
SK Telecom	2,277	2,858	2,318	2,144	1,891	1,963	1,984	2,130	2,876
KT Corp	3,319	3,711	3,313	2,514	2,397	2,359	2,250	1,977	3,300
LG U+	1,716	1,680	1,568	2,212	1,410	1,256	1,138	1,397	2,467
Total	7,311	8,248	7,198	6,870	5,698	5,578	5,372	5,504	8,642
% yoy change	21%	13%	-13%	-5%	-17%	-2%	-4%	2%	57%
Wireless Capex (KRW bn)	2011	2012	2013	2014	2015	2016	2017	2018	2019E
SK Telecom	1,842	2,554	1,903	1,733	1,444	1,507	1,600	1,743	2,353
as % of wireless service revenues	17.1%	23.7%	17.1%	15.5%	13.2%	13.9%	14.7%	17.4%	24.3%
KT Corp	1,608	2,105	1,294	901	800	849	897	827	1,380
as % of wireless service revenues	23.1%	30.5%	18.5%	12.3%	10.9%	11.5%	12.5%	11.9%	19.7%
LG U+	846	1,198	970	1,254	338	371	262	340	1,462
as % of wireless service revenues	24.8%	30.1%	20.3%	24.0%	6.3%	6.8%	4.7%	6.3%	26.5%
Total Wireless Capex	4,296	5,857	4,166	3,887	2,582	2,728	2,759	2,910	5,195
as % of wireless service revenues	20.3%	27.1%	18.2%	16.4%	10.9%	11.5%	11.7%	13.0%	23.4%
% yoy change	49%	36%	-29%	-7%	-34%	6%	1%	5%	79%

Source: Company data, Credit Suisse estimates, Company guidance

"2019 capex guidance is at KRW 3.3 tn. Up to 1H19, the actual execution against the guidance was around 40%. We will be expanding within the KRW 3.3 tn guidance, but however it may be subject to a slight change depending on the 5G competition-related landscape as well as expansion of the coverage"

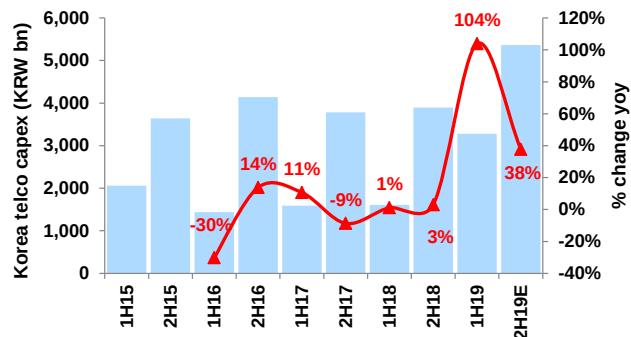
– KT Corp management comments at Q219 earnings call.

Figure 27: Strong uplift in 2019 capex due to combination of 4G upgrades and 5G rollouts



Source: Company data, Credit Suisse estimates

Figure 28: 2019 guidance suggests 2H19 capex should see strong growth (both hoh and yoy)



Source: Company data, Credit Suisse estimates

Japan – surprisingly off to a slow start with 5G. In Japan, cumulative Jun-Q capex at 3 major telcos was ¥416bn (-23% qoq/+5% yoy) due higher spend at KDDI but offset by slow start to the new fiscal year at Docomo. Both companies have maintained their FY19 (end Mar 2020) capex guidance unchanged, with KDDI at ¥610bn (+1% yoy) and Docomo at ¥570bn (-4% yoy).

We see cautious investments in 5G from Japan telco carriers, which prefer to start with 5G pre-commercial services, as opposed to full commercial rollouts. Here, KDDI plans to deploy 5G (on NSA basis) next Spring, while Softbank aims to roll out 5G within the 3 year period. Interestingly, Softbank and KDDI have agreed for a mutual use of each other's assets (base stations) in rural areas to realize capex efficiencies and accelerate on 5G build up. With 2020 Summer Olympics in Tokyo approaching, the question remains whether the Japan telco carriers will accelerate their capex spending to have the commercial 5G ready before the event.

*"We are **now working to build out the 5G network**. And with -- taking the opportunity for **Rugby World Cup 2019 in September, we will launch pre-commercial service for 5G**. For the consumers to various events, such as Rugby World Cup, we would like to have these users experience the world of 5G."*

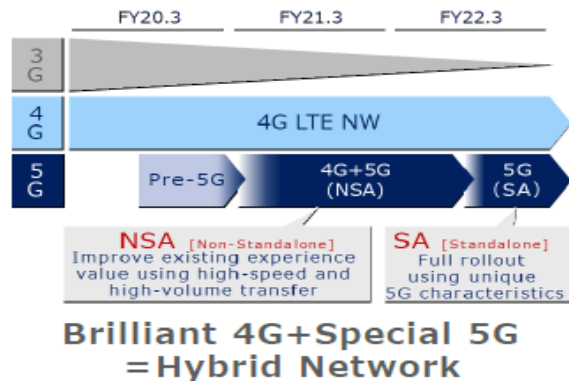
– NTT DoCoMo management comments at C2Q19 earnings call.

*"As we push for open innovation, leveraging 5G that would generate new values of experiences, we **will make steady efforts developing new generation services** that would lead to new platforms and regional regeneration...**Our 5G network is scheduled to be deployed on an NSA, or a non-standalone basis next spring**. Our brilliant, superb **4G that we have brushed up on over the years will be combined with a special 5G and will be implemented as a hybrid network**. On top of that, in July this year, in order to accelerate our effort to set up 5G networks, **we agreed with SOFTBANK on working together to jointly promoting early development of 5G networks in local [rural] areas**"*

– KDDI management comments at C2Q19 earnings call.

*"We have **rolled out our 5G pre-commercial service at the music festival in Japan called Fuji Rock Festival '19**...With regards to 5G network, **at least within 3 years, as quickly as possible, we want to roll out 5G network**...For the **base stations in rural areas**, we have decided that we will **tie up with KDDI for the mutual use of other assets** so that we **can realize efficiency in capex**. And there are many plants in the rural areas and regions."*

– Softbank management comments at C2Q19 earnings call.

Figure 29: 5G roadmap at KDDI over the next 3 years with commercial rollouts from CY2020

Source: KDDI (C2Q19 earnings presentation)

Figure 30: 5G rollout plans at Japan telcos; cumulative capex for 5G over the next 5 years

5G cumulative capex	JPY bn	US\$ bn	Coverage target
Docomo	795	7.6	90%
Softbank	206	2.0	64%
KDDI	466	4.4	90%
Rakuten	194	1.8	56%
Total Japan	1,661	15.8	

Source: Company data, Credit Suisse research

Aggregate capex in Japan fell by 25% over FY14-17. Once 4G investments reached peak levels in FY14, cumulative capex at Japan telcos fell by a cumulative 25% over Mar-14 to Mar-17 year end period. This was followed by 5%/8% of capex growth in years ending Mar-18/Mar-19, which we believe would have been driven by 4G upgrades. As shown in Figure 31, while we currently model FY19 (year ending Mar 2020) capex in total to be flattish yoy, mainly driven by slowdown at NTT Docomo. However, looking at wireless capex, we believe FY19 could see 5% yoy increase (mainly driven by KDDI plans to invest more in wireless vs. fixed). Note these estimates do not include Rakuten (as there are limited disclosures on its wireless capex spending so far), which is the new entrant (4th mobile operator) in Japan from this year.

Figure 31: Japan telco capex plans suggest a slow start to 5G especially when compared to Korea

Total Capex (JPY bn)	Mar 2012	Mar 2013	Mar 2014	Mar 2015	Mar 2016	Mar 2017	Mar 2018	Mar 2019	Mar 2020E
NTT DoCoMo	727	754	703	662	595	597	577	594	570
Softbank	516	698	781	655	491	446	503	572	595
KDDI	422	467	572	668	531	519	561	602	610
Total	1,665	1,919	2,056	1,984	1,618	1,562	1,640	1,768	1,775
% yoy change	9%	15%	7%	-3%	-18%	-3%	5%	8%	0%

Wireless Capex (JPY bn)	Mar 2012	Mar 2013	Mar 2014	Mar 2015	Mar 2016	Mar 2017	Mar 2018	Mar 2019	Mar 2020E
NTT DoCoMo	727	754	703	662	595	597	577	594	570
Wireless capex as % of wireless service revenues	21.8%	23.8%	23.8%	24.1%	21.1%	20.0%	18.7%	19.0%	19.0%
Softbank	463	635	739	599	413	321	370	409	425
Wireless capex as % of wireless service revenues	21.6%	27.1%	23.4%	19.8%	13.1%	10.0%	11.5%	10.9%	11.3%
KDDI	304	338	344	479	338	325	351	352	427
Wireless capex as % of wireless service revenues	19.1%	21.6%	20.5%	27.3%	19.3%	18.3%	19.9%	20.3%	24.7%
Total Wireless Capex	1,494	1,726	1,787	1,740	1,346	1,243	1,298	1,354	1,422
Wireless capex as % of wireless service revenues	21.1%	24.4%	22.9%	23.1%	17.4%	15.6%	16.1%	15.7%	16.8%
% yoy change	7%	16%	4%	-3%	-23%	-8%	4%	4%	5%

Source: Company data, Credit Suisse estimates

New entrant Rakuten on track to launch services; disruptive approach to Networks.

In addition to looking at capex plans from the three established wireless players in Japan, we note that Rakuten is on track to launch its mobile service from Oct 2019. The company is aiming to start offering 4G mobile services from Oct 2019. Given it was awarded 3.8GHz and 28GHz spectrum earlier this year, it is now aiming to start offering 5G services from 2020 onwards. Although the company has not disclosed a lot of details around its capex plans recently, it has been focusing on building a cloud-native end to end network, fully virtualized and automated, which is aimed at lowering both capex and opex costs significantly vs. any other traditional mobile operator.

5G cumulative capex of ¥1.7 tn over the next few years. As per applications submitted by all the 4 operators to Japan's Communications Ministry in April this year, we note that telcos plan to invest cumulative ¥1.66 tn (or \$15.8bn) specifically for 5G over the next 5

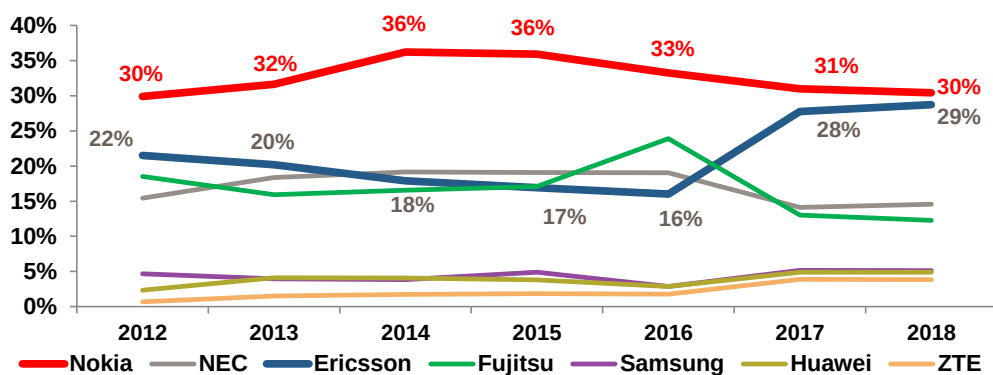
years (Figure 30). Given last year's total capex in Japan was ¥1.77 tn, we would argue it does not look like an aggressive capex budget so far.

Figure 32: List of 4G and 5G RAN suppliers into Korea and Japan telecom operators

Operator	3G equipment supplier	4G equipment supplier	5G equipment supplier
SK Telecom	Samsung, LG	Nokia, Samsung, Ericsson	Samsung, Ericsson, Nokia
KT Corp	Samsung, LG, Nortel	Nokia, Samsung, Ericsson	Nokia, Samsung, Ericsson
LG U+	Samsung, LG, Nortel	Samsung, Nokia, Ericsson, Huawei	Samsung, Nokia, Ericsson, Huawei
Operator	3G equipment supplier	4G equipment supplier	5G equipment supplier
DoCoMo	Fujitsu, NEC, Alcatel-Lucent, Motorola	Nokia, NEC, Panasonic	Nokia, NEC, Fujitsu, Panasonic
KDDI	Samsung, Hitachi, Motorola, Alcatel-Lucent	Samsung, Nokia, Ericsson	Samsung, Nokia, Ericsson
Softbank	Ericsson, Nokia-Siemens	Ericsson, Nokia, Huawei, ZTE	Ericsson, Nokia
Rakuten		Nokia, Altiostar, Fujitsu, Cisco	

Source: Company data, Credit Suisse research

Figure 33: Japan RAN market share: Nokia still holding on to its #1 position; Ericsson taking significant share over the last 2 years



Source: IHS, Credit Suisse research

China – faster off the blocks in 5G vs. 4G

China was a couple of years behind the US, Japan and Korea when 4G rollouts began earlier this decade. Given its later start with 4G deployments, capex at China telcos continued to grow until early 2016, before starting to significantly come under pressure from mid-2016. Both Ericsson's and Nokia's China sales are down around 25-30% from the high levels seen in 2015/2016. However, with 5G it is clear that China does not want to be seen as a follower anymore, which is evident from the 2019 capex budgets of all the 3 telcos in the region. On aggregate, capex of China Mobile, China Telecom and China Unicom in 1H19 was Rmb142bn (+15% yoy), with combined FY19 capex guidance of Rmb302bn (+5% yoy). This follows 3 consecutive years of decline when capex fell by 20%/15%/7% yoy in 2016/2017/2018. For 2020 capex, we model +8% yoy, driven by the start of commercial rollouts for 5G. Within that, we believe wireless capex will grow 7%/10% in 2019/2020 (Figure 41).

China Mobile – gradual increases in capex ahead. China Mobile, the largest telco in the region, reported 1H19 capex of RMB85bn (-3% hoh/+7% yoy) and guided for 2019 capex not to exceed RMB 166bn (vs. 167.1bn in 2018) implying 2H capex below RMB81bn (-5% hoh/-8% yoy). In addition, we flag the following key observations from the company's recent earnings call:

- 5G capex budget increased to Rmb24bn in 2019 vs. Rmb17bn previously – of this Rmb24bn, 70% is for 5G Radio, 10% for Transmission and 20% for Core network;
- Plan to build over 50k 5G sites (also up from earlier plan of 30-50k sites) across 50 cities for initial 5G commercial launch;
- During 'peak' years of 2020-2022, capex would not rise substantially (maybe less than 10%) above 2019 level as CM realizes the benefits of same 2.6GHz spectrum for 4G and 5G;
- Cost of a 5G base station is 2.5x to 3x level of 4G, but it should decline with scale.

Figure 34: China Mobile capex split over last few years: Equipment related capex to start to grow in 2019 after 4 consecutive years of decline

China Mobile listco								% change yoy						
Capex (Rmb bn)	2013	2014	2015	2016	2017	2018	2019E	2013	2014	2015	2016	2017	2018	2019E
Mobile Communication Networks (A)	74.0	103.2	91.9	87.3	69.6	68.5	79.0	32%	40%	-11%	-5%	-20%	-2%	15%
Transmission (B)	68.4	73.1	68.5	62.4	68.2	55.5	49.0	92%	7%	-6%	-9%	9%	-19%	-12%
Business Networks (C)	9.2	8.6	7.8	9.7	13.3	17.4	24.2	21%	-7%	-9%	24%	37%	31%	-6%
Support Systems (D)	9.2	8.6	7.8	8.1	7.6	8.4		-9%	-7%	-9%	3%	-5%	9%	
Buildings & Infrastructure (E)	16.6	17.2	17.6	14.6	15.3	14.5	11.8	19%	3%	2%	-17%	4%	-5%	-19%
Others (F)	7.4	4.3	2.0	5.2	3.6	2.8	2.0	94%	-42%	-55%	168%	-32%	-20%	-30%
Total	184.9	215.1	195.6	187.3	177.5	167.1	166.0	45%	16%	-9%	-4%	-5%	-6%	-1%
Equipment related capex (A + B)	142.4	176.4	160.4	149.7	137.7	124.0	128.0	55%	24%	-9%	-7%	-8%	-10%	3%
of which 4G/LTE		80.6	79.1	83.0	65.7	68.5	55.0			-2%	5%	-21%	4%	-20%
of which 5G capex (G)							24.0							
% change yoy for equipment related capex	55%	24%	-9%	-7%	-8%	-10%	3%							

Source: Company data, Credit Suisse estimates (2019E is based on company guidance). Note these capex numbers exclude TD-SCDMA capex spent at the parent company level till 2016

China Unicom – advocating 5G network sharing. China Unicom reiterated its 2019 capex guidance of Rmb58bn (+29% yoy) while it is now targeting to build over 40k 5G base stations (vs. 20-30k previously) by 2019-end. More importantly, the company is in discussion with other players regarding co-building and co-sharing 5G capex. Specifically, it is looking at 2 possible options on network sharing:

- **Roaming arrangement with China Mobile (CM)** to improve coverage and lower initial capex, in exchange for roaming fee payment. CU would focus on building 5G starting with key cities only while roaming onto CM's 5G network in other areas. This would allow major capex savings in the initial stages of 5G buildout, but over the long term, CU would still have to spend similar amount of aggregate capex as it expands its 5G network to smaller areas.

- **Agreement with China Telecom (CT) allowing spectrum aggregation** to enhance network quality and reducing its potential capex by half compared to the level required to roll-out 5G fully on its own. CU believes that both CU and CT together will have to build 5G network at a scale similar to CM. This could lead to capex levels at roughly half of CM's budget (around Rmb100bn on 5G in 2020), meaning CU and CT would each spend Rmb50bn on 5G next year. Overall, CU estimates that a "co-build, co-share" model could save Rmb200bn in capex each for CU and CT over a 5-yr period (vs. building its own network). While it acknowledges technical difficulties that could arise in network co-operation model, around 60 engineers from each company are already discussing these issues with sharing plans to focus on transmission equipment (wireless access and mobile backhaul), but not core network.

Figure 35: Split of CU capex over time: 5G has started to drive growth in overall capex from 2019

China Unicom capex split	2013	2014	2015	2016	2017	2018	2019E	2013	2014	2015	2016	2017	2018	2019E
GSM	34%	44%	21%	3%	2%	0%	0%	24.7	37.0	27.5	1.9	0.8	0.0	0.0
WCDMA														
LTE (4G)			25%	36%	36%	42%	34%			33.5	25.9	15.2	18.9	19.8
5G							14%							8.0
2G + 3G + 4G (A)	34%	44%	46%	39%	38%	42%	48%	24.7	37.0	61.0	27.8	16.0	18.9	27.8
Broadband & Data (B)	24%	22%	25%	23%	21%	20%	18%	17.5	19.0	33.8	16.8	8.8	9.0	10.4
Transport Networks (C)	32%	27%	23%	38%	41%	38%	34%	23.8	22.9	31.2	27.5	17.3	17.1	19.7
IT Systems & Others (D)	10%	7%	6%	0%	0%	0%	0%	7.6	6.0	7.9	0.0	0.0	0.0	0.0
Total capex split (%)	100%	100%	100%	100%	100%	100%	100%	73.5	84.9	133.9	72.1	42.1	44.9	58.0
% change yoy								-26%	16%	58%	-46%	-42%	7%	29%

Source: Company data, Credit Suisse estimates (2019E is based on company guidance)

While we still await to see which path CU chooses to go ahead with, and whether it gets the regulatory/government approval for that plan, we note the following observations from its recent earnings call:

- Even if it is allowed to go ahead with its network sharing plan with CT, CU still believes its capex for 2020 can rise by 10-15% from the elevated base budgeted for 2019;
- CU expects that CM would have to spend Rmb100bn on 5G specifically in 2020. This is well above Rmb24bn that CM is planning to spend on 5G during 2019, and also above the Rmb80-85bn of peak spending seen for 4G at CM during 2014-2016;
- CU noted that overall 5G capex requirement depends on scale – Rmb400bn if 5G is built on a smaller scale; and Rmb600bn if it is built on a larger scale similar to current 4G rollout;
- 4G network utilization on CU network was 67% (+2ppt yoy);
- We note that CM has invested Rmb430bn in 4G capex in total over 2014-2019, with CU + CT together likely to spend around Rmb300bn on 4G over that period

China Telecom – also supports 5G network sharing. China Telecom reported 1H19 capex of RMB35bn (-17% hoh/+6% yoy) and reiterated 2019 capex guidance of RMB78bn (+4% yoy). This implies 2H19 capex of RMB43bn (+23% hoh/+2% yoy). CT also plans to build 40k 5G sites by year end (vs. 20k previously) to cover ~50 cities.

Similarly to CU, CT confirmed its intention to adopt "co-build co-share" approach to 5G. At the moment, CT is considering network cooperation predominantly with CU given their complimentary resources (eg. each have 100MHz spectrum at 3.5GHz located next to each other and around 50MHz of contiguous spectrum at 2.1GHz; and complimentary fibre, with CU strong in the north and CT in south of China). CT believes that ~80% of 5G capex can be shared, leading to capex savings but also opex savings in long-term. In fact, CT is already in progress with CU on 4G sharing in rural areas (note, CT has 20-30% of 4G bts in rural areas). CT also said it is open to cooperation with other operators, such as CM. CT also considers three-way sharing (with CU and CM) in rural areas, with 2 approaches:

- one player builds network and makes roaming agreements with others
- all 3 telcos build network in different geographies – this approach leads to network completeness and autonomy

However, CT said rural network buildout is not urgent (likely wait till 2021). CT also confirms that companies would share access network for wireless transmissions, while core network independence would be maintained.

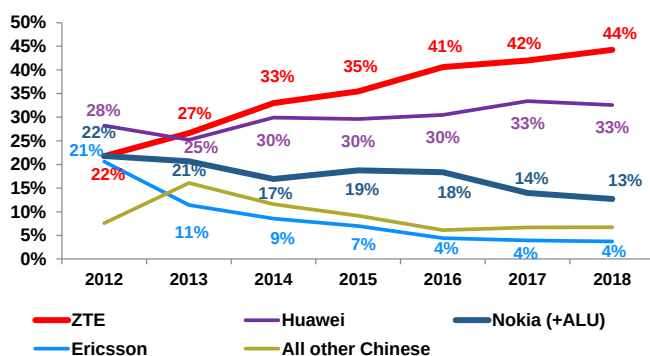
Figure 36: Split of CT capex over time: 5G driving growth in overall capex from 2019

China Telecom capex split	2013	2014	2015	2016	2017	2018	2019E	2013	2014	2015	2016	2017	2018	2019E
LTE / 4G (A)	36.7%	38.4%	46.9%	42.5%	40.6%	39.5%	35.9%	29.4	29.5	51.2	41.1	36.0	29.6	28.0
5G (B)							11.5%							9.0
Broadband & Internet (C)	41.2%	34.2%	34.3%	37.9%	35.8%	32.6%	23.1%	33.0	26.3	37.4	36.7	31.8	24.4	18.0
VAS & Integrated Information (D)	8.3%	8.3%	5.7%	7.5%	9.6%	11.6%	13.5%	6.6	6.4	6.2	7.3	8.5	8.7	10.5
IT Support (E)	4.0%	4.5%	3.3%	4.1%	4.0%	4.3%	3.6%	3.2	3.5	3.6	4.0	3.5	3.2	2.8
Infra & Others (F)	9.8%	14.6%	9.8%	8.0%	10.0%	12.0%	12.4%	7.8	11.2	10.7	7.7	8.9	9.0	9.7
Total	100%	100%	100%	100%	100%	100%	100%	80.0	76.9	109.1	96.8	88.7	74.9	78.0
% change yoy									-4%	42%	-11%	-8%	-16%	4%
Equipment related capex (A + B + C)	77.9%	72.6%	81.2%	80.4%	76.4%	72.1%	70.5%	62.3	55.8	88.6	77.8	67.8	54.0	55.0
% change yoy									-10%	59%	-12%	-13%	-20%	2%

Source: Company data, Credit Suisse estimates (2019E is based on company guidance)

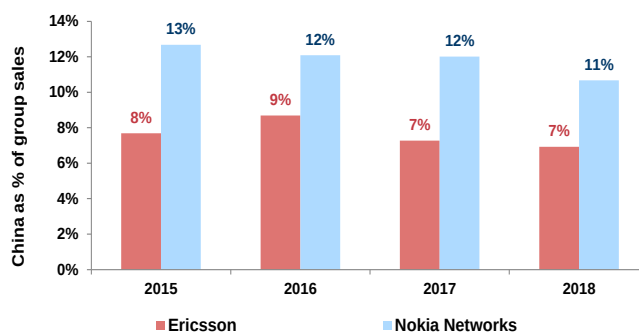
Our view on China 5G network sharing – headline reads negative, but underlying numbers may be fine. While intention to actively share 5G network looks a negative from headline perspective, we believe that the impact may be limited for both European equipment vendors, Nokia and Ericsson. As such, we make 3 observations: 1) Combined capex levels at CU + CT have always been well below CM (last 6 years' capex at CU + CT has been RMB0.96tn vs. CM at RMB1.15tn, so still 15% below even on combined basis); 2) Even with CT sharing, CU believes its capex can rise by 10-15% in 2020 (we model total China capex to grow 5%/15% in 2019/20 in our global capex model); and 3) China accounted for 7-9% of sales for ERIC and 11-12% for NOK over the last 3 years (Figure 38) with their market share in China falling as local vendors (Huawei and ZTE) have gained share (Figure 37).

Figure 37: RAN unit share in China; NOK/ERIC have only 13%/4% market share



Source: IHS (Infonetics), Credit Suisse research

Figure 38: China exposure for both NOK/ERIC has been falling

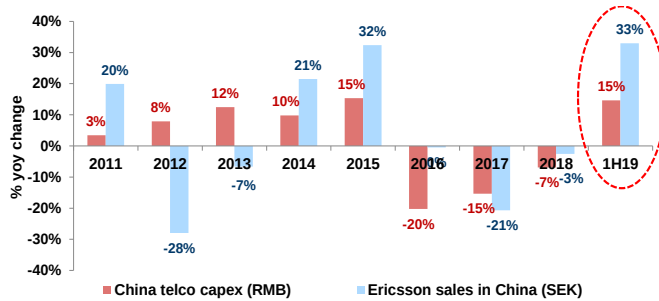


Source: Company data, Credit Suisse research

ERIC sales in China have been improving, while NOK continued to decline. Looking at overall sales in China for both Nokia and Ericsson, we can see that after a strong performance in 2014/2015, sales trends have been mixed in 2016. While both vendors recorded sales declines in 2017, Ericsson's sales in the region moderated in 2018, as opposed to Nokia, which noted further decline. For 1H19, Ericsson sales in China were up 33% yoy (Figure 39), while Nokia revenues continue to decline in the region (Figure 40). We believe that while Ericsson might be striving to gain market share in China, Nokia

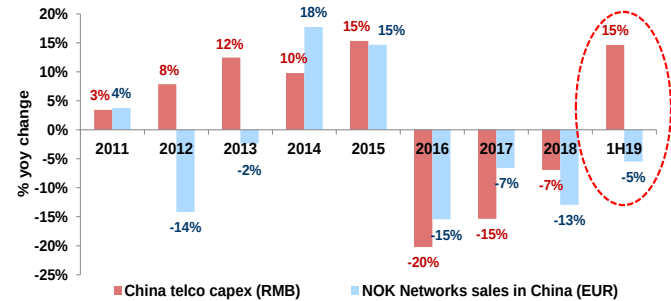
takes an easier stance on its positioning in this market, which has been characterized by preference for local vendors (Huawei/ZTE) and high pricing competition (limiting profits).

Figure 39: ERIC sales vs. telco capex in China – ERIC sales have been improving in the region



Source: Company data, Credit Suisse research

Figure 40: NOK sales in China under-grew telco capex in China



Source: Company data, Credit Suisse research, (Note: from 1H19, Nokia group sales is presented, as opposed to Nokia Networks in prior period)

Figure 41: China telco capex over time broken down by the three operators (CM, CT and CU)

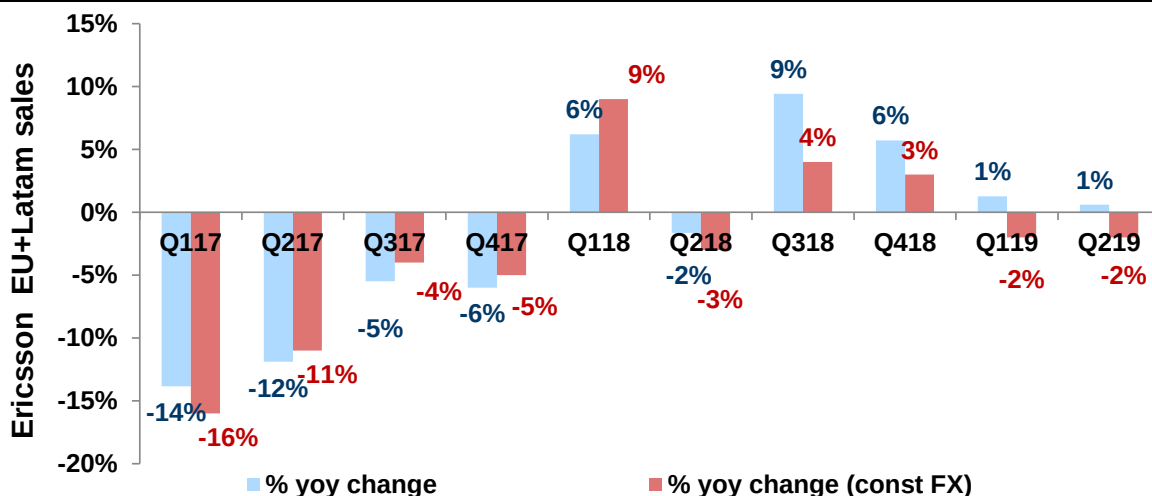
2019 capex comments based on conf call in Aug 2019									
Regarding this year's 5G capex, we had previously expected to spend Rmb17 bn. We are now expecting to spend Rmb24 bn....However, we would control FY19 total capex to within Rmb166 bn. We have compressed our legacy capex by around Rmb7-8 bn in order to accommodate the accelerated 5G spend...the peak capex would be over the 2020-22 period - even in the 2020-22 period, total capex would not increase substantially versus the Rmb166 bn expenditure we expect for FY19...Maybe an increase of less than 10% would not be considered 'substantial'....On average, the cost of a 5G base station is 2.5-3x that of a 4G base station. We hope this declines over time, as scale improves.									
China Mobile capex (Rmb bn)	2012	2013	2014	2015	2016	2017	2018	2019E	2020E
GSM, TD-LTE and Others	127.4	184.9	215.1	195.6	187.3	177.5	167.1	166.0	180.9
% change yoy	-1%	45%							
of which TD-LTE (4G)			80.6	79.1	83.0	65.7	68.5	55.0	10.0
% change yoy				-2%	5%	-21%	4%	-20%	-82%
of which 5G								24.0	100.0
% change yoy									317%
TD-SCDMA (3G)	20.9	22.2	19.0	18.0					
% change yoy	0%	6%	-14%	-5%					
China Mobile (total, all wireless)	148.3	207.1	234.1	213.6	195.3	177.5	167.1	166.0	180.9
% change yoy	-1%	40%	13%	-9%	-9%	-9%	-6%	-1%	9%
China Unicom capex (Rmb bn)	2012	2013	2014	2015	2016	2017	2018	2019E	2020E
Wireless	53.7	50.0	48.4	76.6	41.6	24.6	27.4	37.7	45.1
% change yoy	59%	-7%	-3%	58%	-46%	-41%	11%	38%	20%
of which LTE (4G)				33.5	25.9	15.2	18.9	19.8	5.0
% change yoy					-23%	-41%	24%	5%	-75%
of which 5G								8.0	30.0
% change yoy									275%
Wireline & Others	46.1	23.5	36.5	57.3	30.6	17.5	17.5	20.3	20.1
% change yoy	7%	-49%	55%	57%	-47%	-43%	0%	16%	-1%
China Unicom (total)	99.8	73.5	84.9	133.9	72.1	42.1	44.9	58.0	65.3
% change yoy	30%	-26%	16%	58%	-46%	-42%	7%	29%	13%
China Telecom capex (Rmb bn)	2012	2013	2014	2015	2016	2017	2018	2019E	2020E
Wireless	18.8	29.4	29.6	51.2	41.1	36.0	29.6	37.0	39.0
% change yoy	-13%	56%	1%	73%	-20%	-12%	-18%	25%	5%
of which LTE (4G)				49.3	41.1	36.0	29.6	28.0	9.0
% change yoy					-16%	-12%	-18%	-5%	-68%
of which 5G								9.0	30.0
% change yoy									233%
Wireline & Others	53.7	50.6	47.3	57.9	55.7	52.7	45.4	41.0	41.0
% change yoy	8%	-6%	-7%	22%	-4%	-5%	-14%	-10%	0%
China Telecom (total)	72.5	80.0	76.9	109.1	96.8	88.7	74.9	78.0	80.0
% change yoy	2%	10%	-4%	42%	-11%	-8%	-16%	4%	3%
China total capex (Rmb bn)	2012	2013	2014	2015	2016	2017	2018	2019E	2020E
Wireless capex	220.8	286.5	312.1	341.4	278.0	238.1	224.1	240.7	265.1
% change yoy	8%	30%	9%	9%	-19%	-14%	-6%	7%	10%
of which LTE (4G)			80.6	161.9	150.0	116.9	116.9	102.9	24.0
% change yoy				101%	-7%	-22%	0%	-12%	-77%
of which 5G								41.0	160.0
% change yoy									290%
Wireline & Other capex	99.8	74.1	83.8	115.2	86.2	70.2	62.9	61.3	61.1
% change yoy	8%	-26%	13%	37%	-25%	-19%	-10%	-3%	0%
Total capex	320.6	360.6	395.9	456.6	364.2	308.3	286.9	302.0	326.2
% change yoy	8%	12%	10%	15%	-20%	-15%	-7%	5%	8%

Source: Company data, Credit Suisse estimates

EU still lagging well behind on 5G

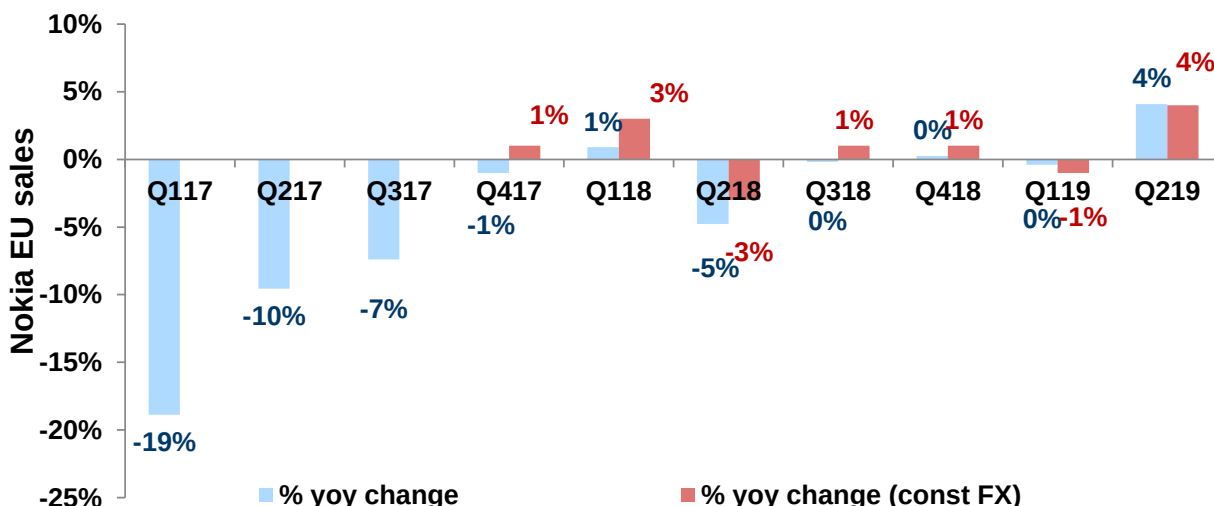
Europe continues to be a challenging market for telco equipment vendors, due to a combination of factors, such as: i) continued pressures on service revenues due to competition, ii) high 5G spectrum costs, iii) delay in 5G spectrum auctions, iv) shift in the capex mix more towards fiber due to the EU Commission's reforms around FTTH. This is evident from declining revenue in EU + Latam sales for Ericsson this year (Figure 42) and limited growth in EU sales for Nokia (Figure 43).

Figure 42: ERIC sales in EU+Latam (FX adjusted) declining again this year after a brief recovery in 2018



Source: Company data, Credit Suisse research

Figure 43: Nokia Networks sales in EU has started to improve in 2018, following weak 2017. 2019 saw some growth (Note: from Q119, Nokia group sales is presented, as opposed to Nokia Networks in prior quarters)



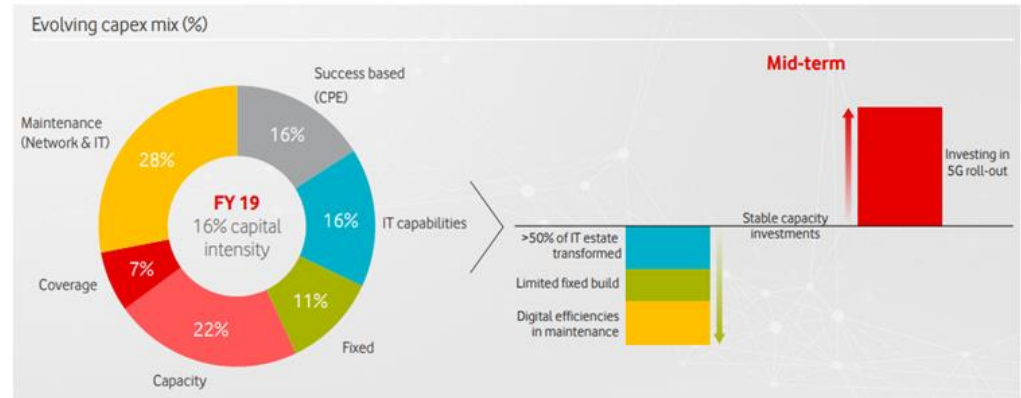
Source: Company data, Credit Suisse research. Note from Q119 onwards, yoy growth in Nokia group sales is presented (as opposed to Nokia Networks in prior quarters)

- Vodafone.** FY18/19 capital intensity stood at 16.0% (+0.3ppt yoy) and Vodafone expects capital intensity to remain at mid-teens for FY19/20 (Figure 44). Note this excludes the Gigabit Plan for fiber investment in Germany. In absolute terms, overall capex at Vodafone was down 1% yoy in FY18/19, and we expect flattish trend for FY19/20 (including €500mn of Gigabit investment). In the mid-term, the company plans

to invest in 5G roll-out at the expense of lower investments in IT, limited fixed build and efficiencies in network maintenance.

Figure 44: Vodafone is guiding for mid-teens capital intensity for FY19/20

Mid-teens capital intensity guidance re-iterated



Source: Vodafone 2H FY18/19 earnings presentation

Figure 45: VOD is guiding for mid-teens capex-to-sales ratio (excl. Gigabit fiber investment in Germany); we model €500mn of Gigabit investment in FY19/20 which drives overall capex of €7.2bn (flat yoy)

Vodafone capex (€ mn) (year ending Mar)	Mar 16 FY 15/16	Mar 17 FY 16/17	Mar 18 FY 17/18	Mar 19 FY 18/19	Mar 20 FY 19/20E
Germany	2,362	1,671	1,673	1,816	
% change yoy		▼ -29%	0%	▼ 9%	
UK	1,210	950	889	804	
% change yoy		▼ -21%	-6%	▼ -10%	
Italy	1,516	793	797	784	
% change yoy		▼ -48%	1%	▼ -2%	
Spain	1,178	746	863	813	
% change yoy		▼ -37%	16%	▼ -6%	
Rest of Europe	1,372	1,069	710	775	
% change yoy		-22%	-34%	9%	
Total Vodafone Europe	7,638	5,229	4,932	4,992	
% change yoy		-32%	-6%	1%	
India	1,102	1,139	952		
% change yoy		3%	-16%		
Africa (Vodacom)	847	736	763	810	
% change yoy		-13%	4%	6%	
Other AMAP	1,173	795	729	626	
% change yoy		-32%	-8%	-14%	
Total Vodafone AMAP	3,122	2,670	1,492	1,436	
% change yoy		-14%	-44%	-4%	
Non-controlled interest / Common Functions	903	915	897	799	
Total Vodafone Group (EUR mn)	11,663	8,814	7,321	7,227	7,229
% change yoy		-24%	-17%	-1%	0%
Revenues	55,930	53,484	46,571	45,066	43,292
% change yoy		-4%	-13%	-3%	-4%
Capex as % of sales	20.9%	16.5%	15.7%	16.0%	16.7%

Source: Company data, Credit Suisse estimates

- **Deutsche Telekom.** We expect group cash capex (excl. US and spectrum) to grow from €7.8bn in 2018 to around €7.9bn in 2019 (+1% yoy), in-line with the company guidance. Out of this €7.9bn guidance for 2019, it has already spent €3.9bn in 1H, implying nearly even split of capex between 1H and 2H. The company continues to guide for flattish capex (excl. US) for the period 2017-2021.

In Germany, we see 2 potential drivers for capex upside – entry of 4th operator in the country (Drillisch) which is planning to build its own network, and steep rollout conditions for 5G from the regulator post spectrum auctions (this may force incumbents like DT to spend more in German mobile, and even cut capex in other areas like shared services. On the flip side, any potential for network sharing could offset these positives (although details are limited at this stage on network sharing).

Figure 46: DT's capex excl. US has been rising, but potentially peaking in 2019

DT cash capex (€ mn)	2011	2012	2013	2014	2015	2016	2017	2018	2019E
Germany	3,627	3,418	3,411	3,807	5,609	4,161	4,214	4,240	
% change yoy	5%	-6%	0%	12%	47%	-26%	1%	1%	
Europe	1,870	1,722	3,653	2,101	1,656	2,764	1,874	1,887	
% change yoy	-7%	-8%	112%	-42%	-21%	67%	-32%	1%	
US	1,963	2,560	3,279	5,072	6,381	5,855	11,932	4,661	
% change yoy	-7%	30%	28%	55%	26%	-8%	104%	-61%	
Others	946	732	725	864	971	860	1,474	1,704	
% change yoy	-1%	-23%	-1%	19%	12%	-11%	71%	16%	
Systems Solutions	1,166	1,187	1,073	1,171	1,169	1,058	673	733	
% change yoy	61%	2%	-10%	9%	0%	-9%	-36%	9%	
Group HQ & Shared Services	378	380	411	381	342	268	1,005	1,078	
% change yoy	-7%	1%	8%	-7%	-10%	-22%	275%	7%	
Reconciliation	-598	-835	-759	-688	-540	-466	-204	-107	
Total capex (incl Spectrum)	8,406	8,432	11,068	11,844	14,617	13,640	19,494	12,492	
% change yoy	-2%	0%	31%	7%	23%	-7%	43%	-36%	
of which Spectrum related investment	146	411	2,207	2,310	3,795	2,682	7,395	269	
Total capex (excl Spectrum)	8,260	8,021	8,861	9,534	10,822	10,958	12,099	12,223	12,700
% change yoy	-3%	-3%	10%	8%	14%	1%	10%	1%	4%
Total capex (excl US and Spectrum)	6,297	5,461	5,582	6,211	6,655	6,759	7,475	7,835	7,900
% change yoy	-2%	-13%	2%	11%	7%	2%	11%	5%	1%

Source: Company data, Credit Suisse estimates

- **Orange.** At Orange, we believe capex peaked at €7.4bn in 2018 (+3% yoy) and will see moderate declines from 2019 onwards (CSe at -1% yoy in both 2019/2020). Out of total of €7.3bn capex we expect for 2019, Orange has spent €3.5bn in 1H, implying around €3.8bn to be spent in 2H19.
- **Telefonica.** TEF has maintained its capex guidance of around 15% capex-to-sales ratio (excl. any spectrum spend) for 2019, with revenue growth of 2%. We model capex of €7.4bn (+2% yoy) in 2019, of which €3.4bn has already been spent in 1H so far, with the remaining €4.0bn to come in 2H19.

Figure 47: Orange capex peaked at €7.4bn in 2018, now likely to see small declines in 2019/2020

Orange capex (€ mn)	2011	2012	2013	2014	2015	2016	2017	2018	2019E	2020E
France	2,619	2,712	2,832	2,799	3,097	3,421	3,451			
Spain	405	473	562	585	864	1,086	1,115			
Poland	627	558	457	418	463	455	443			
Rest of World	1,409	1,237	1,163	1,223	1,376	1,396	1,536			
Enterprise	343	347	311	325	325	336	382			
International Carrier & Shared Services	367	415	305	286	361	277	282			
Total Orange group	5,770	5,743	5,631	5,636	6,486	6,971	7,209	7,442	7,350	7,300
% change yoy	3%	0%	-2%	0%	15%	7%	3%	3%	-1%	-1%
Group revenue	44,703	43,515	40,981	39,445	40,236	40,918	41,096	41,379	41,972	42,157
Capex to sales ratio (excl. spectrum)	12.8%	13.2%	13.7%	14.3%	16.1%	17.0%	17.5%	18.0%	17.5%	17.3%

Source: Company data, Credit Suisse estimates

Figure 48: Telefonica is guiding for 15% capex-to-sales ratio (excl. spectrum) in 2019 (similar to 2018); we estimate this should result in flat to low single digit growth in capex for 2019

Telefonica capex excl license and spectrum (€ mn)	2011	2012	2013	2014	2015	2016	2017	2018	2019E
Brazil	2,120	2,025	1,939	2,044	2,105	2,091	2,225	1,908	
Argentina	449	519	574	509	742	577	602	1,140	
Chile	529	606	488	429	427	406	356	0	
Peru	302	379	359	422	491	433	392	0	
Colombia	368	351	348	385	342	330	264	533	
Mexico	472	427	242	251	257	218	216	0	
Venezuela & Central America	371	556	739	309	316	231	313	0	
Ecuador	59	85	93	103	114	99	0	0	
Uruguay	22	27	23	32	33	34	0	0	
Others	115	23	5	-4	1	0	-1	0	
Central & Latin America	4,807	4,998	4,810	4,480	4,828	4,419	4,367	3,581	
% change yoy	14%	4%	-4%	-7%	8%	-8%	-1%	-18%	
Spain	2,069	1,692	1,460	1,733	1,779	1,840	1,682	1,597	
UK	731	748	667	754	882	931	827	877	
Germany	557	608	666	849	1,032	1,103	949	967	
Ireland	60	64	57	27	0	0	0	0	
Czech Republic	229	248	218	0	0	0	0	0	
Others	24	26	17	-1	1	-1	1	-2	
Europe	3,670	3,386	3,085	3,362	3,694	3,873	3,459	3,439	
% change yoy	-3%	-8%	-9%	9%	10%	5%	-11%	-1%	
Others	452	490	272	311	355	291	334	275	
% change yoy	108%	8%	-44%	14%	14%	-18%	15%	-18%	
Total Telefonica group	8,929	8,874	8,167	8,153	8,877	8,583	8,160	7,295	7,429
% change yoy	9%	-1%	-8%	0%	9%	-3%	-5%	-11%	2%
Spectrum (check)									
Group revenues	62,837	62,356	57,061	50,377	46,757	52,036	52,008	48,693	49,178
Capex as % of sales (excl spectrum)	14.2%	14.1%	14.5%	15.9%	16.8%	17.0%	15.7%	15.0%	15.1%

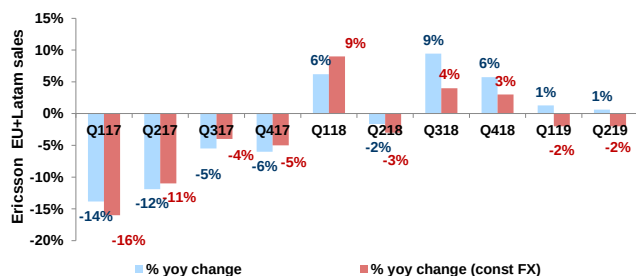
Source: Company data, Credit Suisse estimates

LATAM – recovery from 2018 continues

Latin America as a region had been quite challenging for telecom equipment vendors over the period 2015-2017 given issues around spectrum auctions, currency fluctuations and Oi coming back from bankruptcy. All these meant that capex remained under significant pressure in the region over that period. In 2018, we started to see some early signs of recovery, which has continued into 1H19 and we expect this trend to stabilize into 2020.

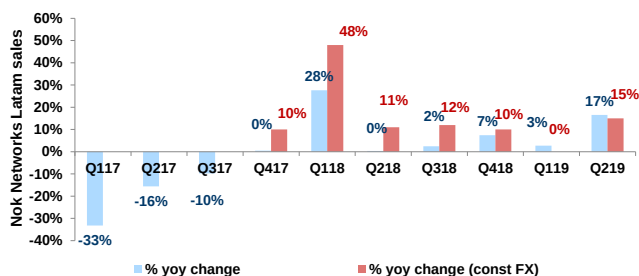
- In 2019 so far, we have seen that cumulative capex across 4 key telcos (Vivo, TIM Brasil, Oi, America Movil) has increased by 10%/55% yoy in Q1/Q219 (in USD terms). This aggregate capex number had declined by around 25% in total over the period 2013 to 2017, and then saw recovery with 1% growth in 2018.
- Nokia's sales in Latam grew 8% in reported terms and 18% on FX adjusted basis in 2018. In 1H19, sales have continued to grow at 10% and 8% yoy respectively (Figure 50, note as Nokia stopped providing Networks sales by region post the recent change in reporting structure, so we have used Nokia group sales from Q119 onwards).
- While Ericsson does not disclose Latam sales separately (they are combined with EU sales), the vendor reported its EU+Latam sales up 5% yoy (reported) and up 4% yoy (FX adjusted) in 2018 after being down nearly 10% in 2017. Contrary to Nokia, Ericsson has seen a slow start to 2019 in its EU + Latam business with revenues up 1% yoy (reported) but down 2% yoy (FX adjusted) as we show in Figure 49.

Figure 49: ERIC sales in EU+Latam after showing a recovery in 2018 has again been weak in 1H19



Source: Company data, Credit Suisse estimates

Figure 50: Robust recovery in Nokia's Latam sales has continued into 2019



Source: Company data, Credit Suisse estimates, (Note: from Q119, Nokia group sales is presented, as opposed to Nokia Networks in prior quarters)

What are telco operators saying? We also look at capex related commentary from the key telco operators in the Latam region, which suggest that capex at some carriers have been front-end loaded during 2019 (like Telefonica Brasil and America Movil) which may result in some level of normalization in 2H19. But equally their commentary and/or mid-term capex guidance suggests that capex may sustain at these levels in the mid-term.

Specifically, Telefonica Brasil is indicating normalization of capex in 2H19, after high capex in 1H due to front-loaded LTE rollout and network diversification. TIM Brasil does not see disruptive approach for 5G capex ("huge" amount upfront) but rather gradual development. Oi presented its new strategic plan in Jun 2019, which will focus on leadership in fiber and infrastructure, which should drive increase in overall capex in 2019 (Figure 51), but its wireless related capex may decline (Figure 52).

"We reiterate our guidance of growing revenues and OIBDA by around 2% in the full year with capex to sales standing at levels of 15%...capex strongly increased by 16.9% year-on-year in the first half, mainly due to the front-loaded LTE rollout and network densification, a trend we expect to normalize over the year."

– Vivo (TEF Brasil) management comments at Q219 earnings call.

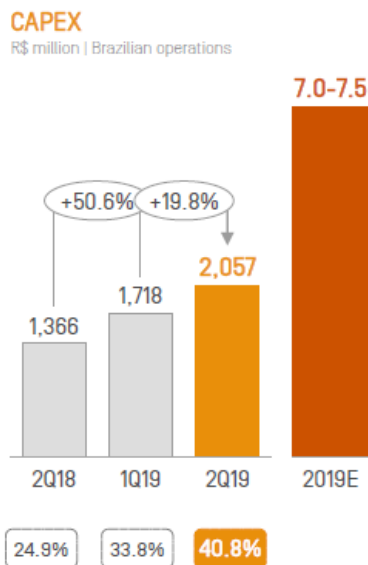
"Related to the **capex in the 5G, we do not image a disruptive approach, but it's more a gradual approach in the development**. It's clear that it's too early to try to understand better the level of capex and all this kind of stuff because it's important to understand better from what will be published by Anatel with the public hearing that will allow us to have a better understanding about what can be done. But what they told you is exactly the position of TIM Telebrasil, the **position of all the operators that don't want an approach that could drive a huge amount of capex upfront, and with a gradual development of that.**"

– TIM Brasil management comments at Q219 earnings call

"We will rationally invest in 1.8GHz spectrum refarming to descend our postpaid base using our ample spectrum available. We will capture market share in high-value segments using the excess capacity we have in 1.8GHz and maintaining the successful commercial strategy in postpaid. **This strategy will lead to lower levels of capex in the Mobile segment...**With this, we will capitalize on the postpaid momentum, leverage our infrastructure in preparation for 5G deployment while we keep exploring all the strategic options to maximize shareholder value"

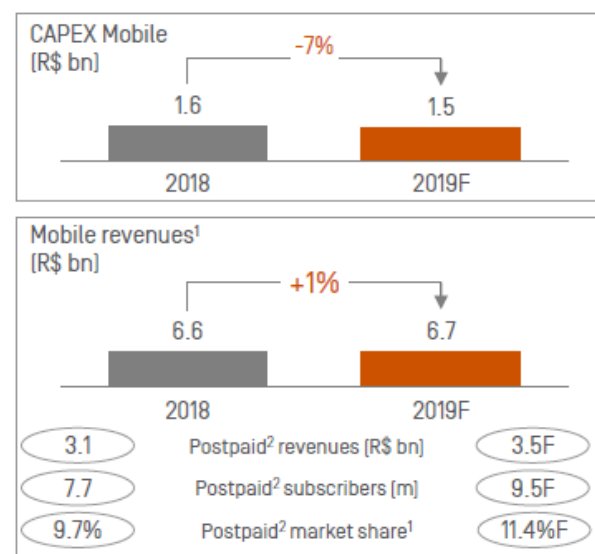
– Oi management comments at Strategic plan presentation in Jul 2019

Figure 51: Oi expects total capex to grow to R\$ 7-7.5bn in 2019 (+20% yoy)...



Source: Company data, Credit Suisse research, Oi Q219 ppt

Figure 52: ...however, mobile capex is expected to decrease 7% yoy as it focuses on fiber



Source: Company data, Credit Suisse research, Oi Strategic plan ppt (Jul 2019)

"In Telcel, what we want is, **we're putting more 4.5G quality and we want to connect more cities and more locations in the south of Mexico**. So we're putting more money to invest and to have more connectivity in the South, all Mexico and specifically more in the south of Mexico."

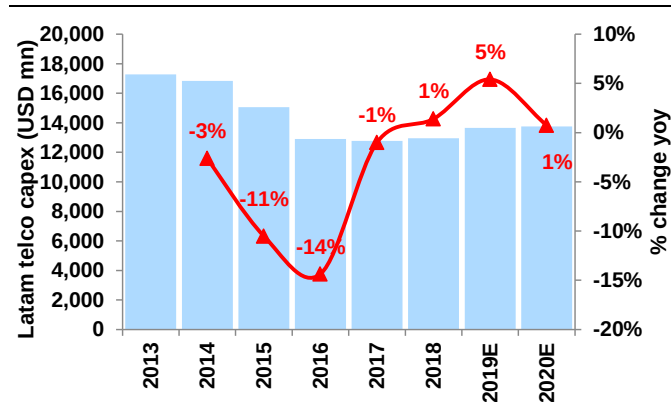
– America Movil management comments at Q219 earnings call

Figure 53: Latam telco capex: Following capex recovery in 2018, we model 5% growth in 2019, followed by 1% growth in 2020

LATAM Capex	Q118	Q218	Q318	Q418	Q119	Q219	2015	2016	2017	2018	2019E	2020E
Vivo (Telefônica Brasil)												
Capex excl license/spectrum (US\$ mn)	466	646	612	525	438	610	2,500	2,410	2,493	2,250	2,315	2,319
% change qoq	-44%	38%	-5%	-14%	-17%	39%						
% change yoy	14%	11%	-8%	-37%	-6%	-6%	-30%	-4%	3%	-10%	3%	0%
TIM Brasil (Telecom Italia)												
Capex (US\$ mn)	195	307	231	359	144	332	1,424	1,331	1,293	1,092	1,042	1,067
% change qoq	-63%	58%	-25%	55%	-60%	130%						
% change yoy	-5%	18%	-24%	-31%	-26%	8%	-15%	-7%	-3%	-16%	-5%	2%
Oi												
Capex (US\$ mn)	340	413	390	535	445	533	1,229	1,378	1,772	1,678	1,872	1,811
% change qoq	-41%	22%	-6%	37%	-17%	20%						
% change yoy	-13%	4%	-4%	-8%	31%	29%	-43%	12%	29%	-5%	11.6%	-3.3%
America Movil (Claro)												
Capex excl Spectrum (US\$ mn)	1,227	1,807	1,720	3,177	1,422	3,450	9,910	7,783	7,215	7,931	8,422	8,556
% change qoq	-56%	47%	-5%	85%	-55%	143%						
% change yoy	-12%	51%	-6%	13%	16%	91%	5%	-21%	-7%	10%	6%	2%
Top 4 telcos in Latam												
Capex (US\$ mn)	2,228	3,173	2,954	4,596	2,449	4,926	15,063	12,901	12,772	12,951	13,651	13,753
% change qoq	-53%	42%	-7%	56%	-47%	101%						
% change yoy	-7%	30%	-8%	-3%	10%	55%	-10.5%	-14.4%	-1.0%	1.4%	5.4%	0.7%
Revenues (US\$ mn)	19,173	20,221	17,610	18,925	17,710	18,243	82,343	76,745	79,713	75,929	73,290	76,480
% change qoq	-9%	5%	-13%	7%	-6%	3%						
% change yoy	0%	2%	-11%	-10%	-8%	-10%	-20.6%	-6.8%	3.9%	-4.7%	-3.5%	4.4%
Capex to sales ratio (%)	11.6%	15.7%	16.8%	24.3%	13.8%	27.0%	18.3%	16.8%	16.0%	17.1%	18.6%	18.0%

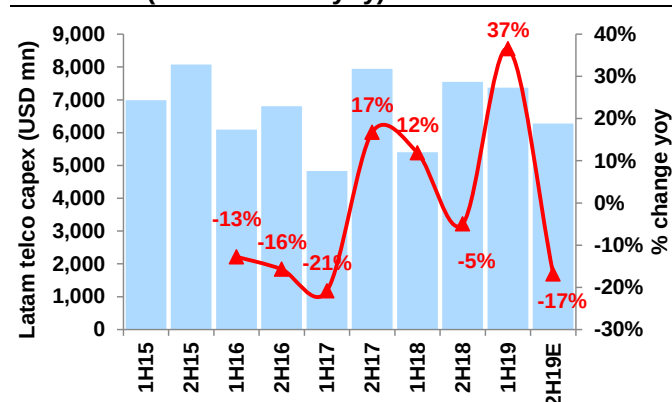
Source: Company data, Credit Suisse estimates

Figure 54: Latam capex to increase 5%/1% in 2019/20...



Source: Company data, Credit Suisse estimates

Figure 55: ...with 2H19 capex potentially seeing slowdown (both hoh and yoy)



Source: Company data, Credit Suisse estimates

Russia capex – moderate increase expected

Russia – capex expected to moderately increase in USD terms. Capex at telcos in Russia had been challenging with the region seeing 12% declines (in RUB) both in 2016 and 2017, which in USD terms was -20%/flat for 2016/2017. 2018 saw significant increase with capex growing 17% (in RUB) or 13% (in USD). This year, we observe that growth continued in Q119, with capex of +28% yoy (in RUB)/+6% yoy (in USD), with Q219 also being +26% yoy (in RUB)/+11% yoy (in USD). For 2019, consensus is modeling for +11% (in RUB), followed by 2020 being flat (in RUB). In USD terms, this translates to +1% yoy/+3% yoy in 2019/2020 (Figure 56).

Figure 56: Russia: Telco capex is expected to increase 1%/3% in 2019/2020 (in USD terms)

RUSSIA CAPEX	Q118	Q218	Q318	Q418	Q119	Q219	2015	2016	2017	2018	2019E	2020E
MegaFon	Q118	Q218	Q318	Q418	Q119	Q219	2015	2016	2017	2018	2019E	2020E
Capex (RUB mn)	8,491	16,227	18,478	38,260	7,963	16,424	70,164	65,577	55,985	81,456	81,456	81,456
% change yoy	4%	24%	47%	73%	-6%	1%	24%	-7%	-15%	45%	0%	0%
as % of group revenues	11.1%	19.8%	20.8%	43.3%	9.9%	19.2%	22.4%	20.7%	17.4%	24.3%	24.3%	24.3%
Capex (US\$ mn)	147	282	292	614	115	251	1,146	979	954	1,335	1,209	1,245
% change yoy	11%	21%	38%	63%	-22%	-11%	-22%	-15%	-3%	40%	-9%	3%
Rostelekom	Q118	Q218	Q318	Q418	Q119	Q219	2015	2016	2017	2018	2019E	2020E
Capex (RUB mn)	15,125	14,442	16,325	27,287	22,343	15,242	62,726	61,857	60,752	73,179	67,500	73,402
% change yoy	-15%	16%	35%	48%	48%	6%	9%	-1%	-2%	20%	-8%	9%
as % of group revenues	19.8%	18.7%	20.6%	31.3%	28.4%	19.0%	21.1%	20.8%	19.9%	22.9%	20.5%	21.3%
Capex (US\$ mn)	263	251	258	428	322	233	1,024	920	1,035	1,200	1,002	1,122
% change yoy	-9%	14%	26%	34%	23%	-7%	-31%	-10%	13%	16%	-17%	12%
MTS	Q118	Q218	Q318	Q418	Q119	Q219	2015	2016	2017	2018	2019E	2020E
Capex excl. spectrum/license (RUB mn)	16,670	17,566	21,180	31,064	16,614	22,704	96,112	83,543	76,432	86,480	88,769	97,964
% change yoy	50%	15%	-5%	12%	0%	29%	5%	-13%	-9%	13%	3%	10%
as % of group revenues	15.4%	15.4%	16.6%	23.9%	14.1%	18.1%	22.3%	19.0%	17.3%	18.0%	17.5%	18.9%
Capex excl. spectrum/license (US\$ mn)	290	305	334	474	239	347	1,599	1,263	1,303	1,418	1,317	1,498
% change yoy	59%	12%	-11%	0%	-17%	14%	-31%	-21%	3%	9%	-7%	14%
Total revenues	107,925	114,346	127,958	130,064	118,025	125,149	431,233	440,000	442,911	480,293	505,897	518,531
FX (USD to RUB)	57.6	57.6	63.3	65.5	69.4	65.4	61.03	66.87	58.68	61.00	67.39	65.41
Vimpelcom (VEON)	Q118	Q218	Q318	Q418	Q119	Q219	2015	2016	2017	2018	2019E	2020E
Capex (RUB mn)	44,560	28,615	20,204	26,125	31,079	36,170	147,533	116,151	105,096	119,504	126,963	113,417
Capex excl. licenses (RUB mn)	20,438	23,146	19,698	23,038	30,801	35,778	132,034	106,522	85,614	86,319	126,963	113,417
% change yoy	27%	24%	-17%	-15%	51%	55%	-12%	-19%	-20%	1%	47%	-11%
as % of group revenues	15.8%	17.7%	13.4%	15.4%	20.9%	24.2%	18.0%	17.9%	15.4%	15.6%	21.0%	19.2%
Capex (US\$ mn)	774	497	319	369	448	553	2,418	1,737	1,791	1,959	1,884	1,734
Capex excl. licenses (US\$ mn)	355	402	311	347	444	547	2,164	1,593	1,459	1,415	1,884	1,734
% change yoy	35%	21%	-22%	-26%	25%	36%	-45%	-26%	-8%	-3%	33%	-8%
Total operating revenue (\$ mn)	2,250	2,270	2,317	2,249	2,124	2,261	12,017	8,905	9,474	9,086	8,989	9,054
as % of group revenues	15.8%	17.7%	13.4%	15.4%	20.9%	24.2%	18.0%	17.9%	15.4%	15.6%	21.0%	19.2%
Top 4 telcos in Russia	Q118	Q218	Q318	Q418	Q119	Q219	2015	2016	2017	2018	2019E	2020E
Capex (RUB mn)	60,724	71,381	75,681	119,649	77,721	90,148	361,036	317,499	278,783	327,434	364,688	366,239
% change yoy	15%	20%	7%	25%	28%	26%	1%	-12%	-12%	17%	11%	0%
Capex (US\$ mn)	1,055	1,240	1,195	1,864	1,120	1,378	5,933	4,754	4,751	5,368	5,412	5,599
% change yoy	21%	17%	1%	14%	6%	11%	-35%	-20%	0%	13%	1%	3%
Revenues (US\$ mn)	6,780	7,021	6,991	7,021	6,119	6,709	29,058	24,635	27,709	27,693	26,354	27,377
% change yoy	6%	0%	1%	-5%	-10%	-4%	-37%	-15%	12%	0%	-5%	4%
Capex to sales ratio (%)	15.6%	17.7%	17.1%	26.5%	18.3%	20.5%	20.4%	19.3%	17.1%	19.4%	20.5%	20.5%

Source: Company data, Credit Suisse estimates, Thomson Reuters consensus (2019/20 estimates)

"In terms of cash CapEx, the guidance there is RUB 65 billion to RUB 70 billion in that range... In terms of our CapEx priorities, that is fully in line with our strategy objectives. ... We believe it is important to develop our base infrastructure, if you will, the telephone infrastructure, the connectivity infrastructure. And we develop the backbone and we continue tapping international markets... We are doing a lot of new construction and at the same time providing comprehensive range of services in each apartment or community or neighborhood. At the same time, each year our focus is shifting each sequence year to the products that's become the new growth drivers such as data centers, investments in software, investments in IT security and all of that is reflected in our CapEx structure."

– Rostelekom management comments at Q219 earnings call

"As far as 5G is concerned, we don't see any changes towards our estimates, which have no material impact on our CapEx in 2019 and 2020."

– MTS management comments at Q219 earnings call

Figure 57: MTS expects up to RUB90bn of capex in 2019 (incl. Yarovaya law investments)

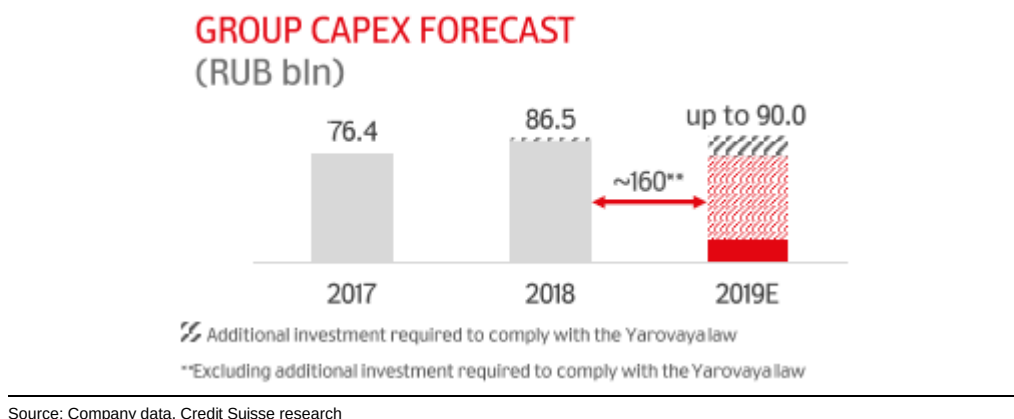
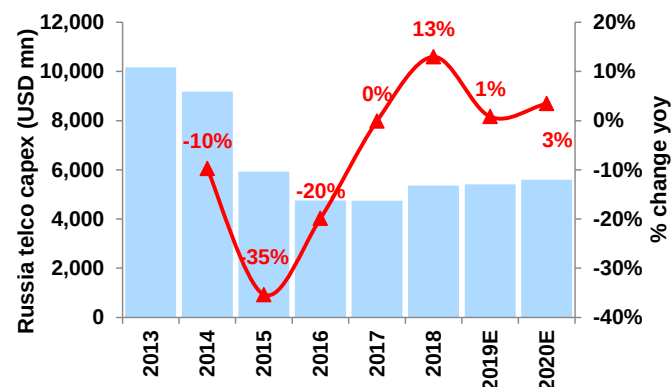
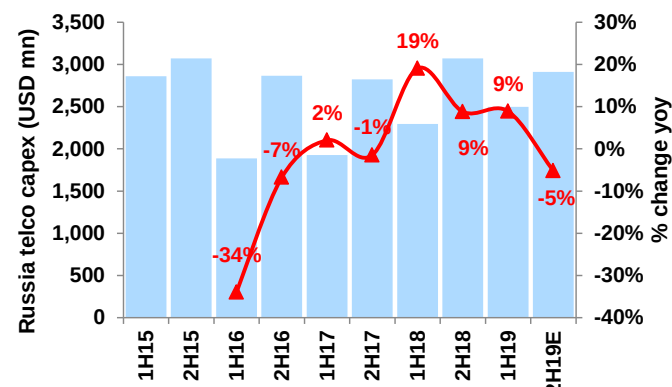


Figure 58: Russia capex to increase 1%/3% in 2019/20...



Source: Company data, Credit Suisse estimates, Thomson Reuters consensus

Figure 59: ...with 2H19 capex of +17% hoh/-5% yoy



Source: Company data, Credit Suisse estimates, Thomson Reuters consensus

5G development so far

The development of 5G ecosystem is important, as it offers potentials for further revenue growth for 5G providers, whether these are smartphone vendors, network equipment manufacturers, chip makers, telco carriers or enterprises. Even governments can generate revenues from 5G spectrum auctions. With the ongoing shift towards data-driven analytics and high automation trends in multiple industries, factors such as high speed, low latency and reliability of the network are becoming increasingly important – these can be offered by 5G, which we discussed earlier in the report (Figure 11).

Update on 5G spectrum – starting to pick up

Having started with initial 5G rollouts from 2H18, the US and South Korea became the first two countries to have launched commercial 5G network with some scale. While US so far has auctioned 28GHz and 24GHz (mmWave) spectrum so far with more to follow later this year, Korea chose to auction 3.5GHz and 28GHz in the middle of 2018.

With Japan and China also having seen 5G spectrum being issued recently, we expect 5G build out momentum to continue to accelerate as we move into 2H19 and 2020. In Figure 60, we look at some of the key countries and what are the different timelines for 5G spectrum issuance or auctions.

Figure 60: Timeline for 5G spectrum auctions/allocations around the world

Region	Country	Frequency	Auction timeline
Europe	Germany	2.0 GHz, 3.6 GHz	Q219
	Italy	700 MHz, 3.6-3.8 GHz, 26.5-27.5 GHz	Q418
	Switzerland	700 MHz, 1.4 GHz, 2.6 GHz, 3.5 GHz	Q119
	UK	2.3 GHz, 3.4 GHz	Q219
	Austria	3.4-3.8 GHz	Q119
	Spain	700 MHz (Q120), 3.4-3.6 GHz (Q318)	Q318 & Q120
	Ireland	3.6 GHz	Q217
	Denmark	700 MHz, 900 MHz, 2.3 GHz	Q119
	France	3.6-3.8 GHz, 26 GHz	Q319
	Finland	700 MHz (Q416), 3.4-3.8 GHz (Q319)	Q416 & Q319
	Sweden	700 MHz (Q418), 2.3 GHz, 3.5 GHz (Q120)	Q418 & Q120
	Greece	700 MHz, 1.5 GHz, 2.1 GHz, 3.6 GHz, 24-28 GHz	Q319
	Netherlands	700 MHz, 1.4 GHz, 2.1 GHz (Q419/Q120), 3.5 GHz (Q421/Q122)	Q419/Q120 & Q421/Q122
	Portugal	700 MHz	Q220
	Russia	3.4-3.8 GHz, 25.25 GHz, 24.25 GHz and 29.5 GHz	Q418
Asia Pacific	China	2.5-2.6 GHz, 3.4-3.6 GHz, 4.8-4.9 GHz	Q418, Q219
	South Korea	3.5 GHz, 28 GHz	Q218
	Japan	3.7 GHz, 4.5 GHz, 28 GHz	Q219
	India	700 MHz, 800 MHz, 1.8 GHz, 2.3 GHz, 2.5 GHz, 3.4-3.6 GHz	Q419
	Taiwan	1.8 GHz, 3.5 GHz, 28 GHz	Q419
	Thailand	700 MHz	Q319
	Australia	3.6 GHz	Q418
	Hong Kong	3.3 GHz, 3.5 GHz, 4.9 GHz (Q319), 26 GHz, 28 GHz (Q119)	Q119 & Q319
Middle East	Qatar	3.5-3.8 GHz	Q119
	Saudi Arabia	3.5 GHz	Q119
North America	USA	28 GHz (Q418), 24 GHz (Q219), 37 GHz, 39 GHz, 47 GHz (Q419)	Q418, Q219, Q419
	Canada	600 MHz (Q119), 3.5 GHz (2020)	Q119, 2020
	Mexico	600 MHz, 700 MHz, 3.5 GHz	2020
South America	Colombia	700 MHz, 1.9 GHz, 2.5 GHz	Q219
	Brazil	700 MHz, 2.3 GHz, 3.5 GHz, 26 GHz	Q120
Africa	South Africa	700 MHz, 3.4-3.6 GHz, 26 GHz	2021

Source: Credit Suisse research

5G smartphones launches – still limited choice

With 5G spectrum already available and initial networks being built in certain regions, handset vendors have started to launch a few of their flagship smartphone models with 5G network compatibility. A look at Figure 61 shows the list of all 5G smartphones launched so far which are from Asian vendors such as Samsung, Huawei, LG, Xiaomi, Lenovo, OPPO, Vivo, ZTE and OnePlus. Obviously Apple is conspicuous here by its absence from this list with market expectations that the first 5G iPhone model is likely to be launched only in Sep 2020.

Figure 61: 5G smartphone launches so far: Still limited choices for a consumer

Vendor	Samsung	Samsung	Samsung	Huawei	LG	OnePlus
Image						
Model	Galaxy Note10 5G	Galaxy Note10+ 5G	Galaxy S10 5G	Mate 20 X (5G)	V50 ThinQ 5G	7 Pro 5G
Announced	Aug-19	Aug-19	May-19	Feb-19	Jun-19	May-19
5G details	5G NSA / Sub-6	5G NSA / Sub-6 / mmWave	5G NSA / Sub-6 / mmWave; 3.5GHz	5G SA / NSA / Sub-6 / mmWave; 3.5, 3.7, 4.7GHz	5G NSA / Sub-6 / mmWave	5G NSA / Sub-6 / mmWave
4G speed	150 Mbps	150 Mbps	150 Mbps	200 Mbps	75 Mbps	150 Mbps
5G speed	5G (2+ Gbps DL)	5G (2+ Gbps DL)	5G (2+ Gbps DL)	(2+ Gbps DL)	5G (2+ Gbps DL)	5G (2+ Gbps DL)
Chipset	Exynos 9825 (7nm) - EMEA/LATAM	Exynos 9825 (7nm) - EMEA/LATAM	Exynos 9820 (8 nm) - Global	HiSilicon Kirin 980 (7nm)	QCOM SDM 855 (7nm)	QCOM SDM 855 (7nm)
	QCOM SDM 855 (7nm) - USA/China	QCOM SDM 855 (7nm) - USA/China	QCOM SDM 855 (7nm) - USA			

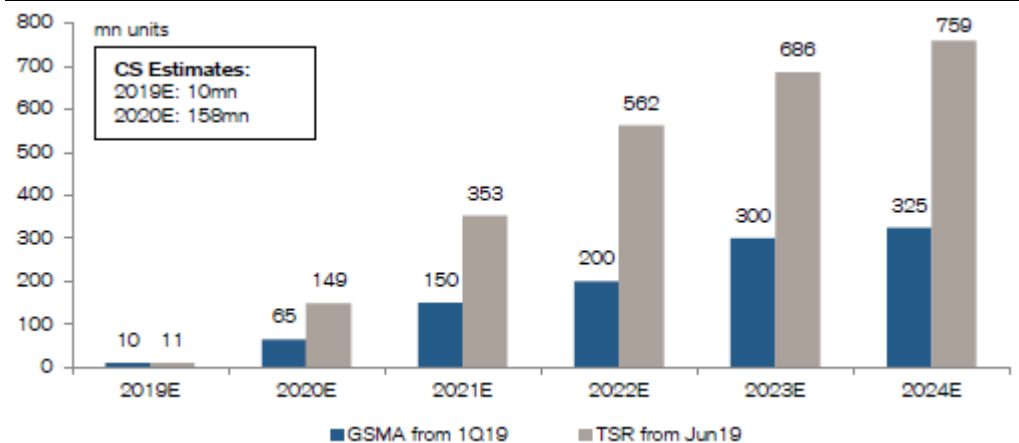
Vendor	Oppo	Xiaomi	Lenovo	ZTE	ZTE	vivo
Image						
Model	Reno 5G	Mi Mix 3 5G	Z6 Pro 5G	nubia X 5G	Axon 10 Pro 5G	iQOO Pro 5G
Announced	Apr-19	Feb-19	Jun-19	Jul-19	Feb-19	Jul-19
5G details	5G NSA / Sub-6 / mmWave; 3.5GHz	5G NSA / Sub-6 / mmWave; 3.5GHz	5G NSA / Sub-6 / mmWave; 2.5, 3.5GHz	5G NSA / Sub-6 / mmWave	5G NSA / Sub-6 / mmWave; 2.5, 3.5GHz	5G NSA / Sub-6 / mmWave
4G speed	150 Mbps	150 Mbps	150 Mbps	150 Mbps	150 Mbps	150 Mbps
5G speed	5G (2+ Gbps DL)	5G (2+ Gbps DL)	5G (2+ Gbps DL)	5G (2+ Gbps DL)	5G (2+ Gbps DL)	5G (2+ Gbps DL)
Chipset	QCOM SDM 855 (7nm)	QCOM SDM 855 (7nm)	QCOM SDM 855 (7nm)	QCOM SDM 855 (7nm)	QCOM SDM 855 (7nm)	QCOM SDM 855+ (7nm)

Source: Company data, Credit Suisse estimates, gsmarena.com

5G smartphone units to ramp in 2020. In the recent report ("[5G: Tech ecosystem ready for 2020 ramp](#)") our Asia Tech Team estimated approximately 10mn 5G units in 2019, most of them shipping in Korea, followed by 158mn units of 5G smartphones in 2020, driven by a rapid ramp in China, Japan, Korea, Europe and the US and availability of mainstream 5G models (based on integrated chipsets) by 3Q20 and the launch of 5G-enabled iPhones in late 3Q20. As 5G has become a reality, the market (third party research) has upgraded its view on the pace of the ramp—a 1Q19 estimate from GSMA

for 65 mn/150 mn units in 2020/21 vs. a more recent estimate of 149 mn/353 mn units from TSR (Figure 62).

Figure 62: 5G smartphone units forecast from third-parties (mn)



Source: TSR, GSMA, Credit Suisse estimates, CS Asia Tech Team

Chipset roadmap

Alongside the release of 5G spectrum in a number of countries, mobile chip makers have been striving to launch a few modem chips which can support 5G connectivity. Although Qualcomm had been the first vendor to announce its X50 modem suited for 5G phones back in Oct 2016, we still are waiting for the full product range and availability of 5G modems from different vendors.

For 5G modems, only 4 solutions available in the market currently... As we show in Figure 63, Qualcomm (with 2 chips), Samsung and Huawei are the only companies that have a 5G modem available in the market. Out of those, X55 from Qualcomm is still in the sampling stage as we wait for its introduction in a 5G smartphone (most likely in 2020). Samsung and Huawei have recently used their internal 5G modems in their recent 5G smartphone launches.

...with 2 more vendors joining the band hopefully next year. We note that MediaTek and UniSOC (formerly Spreadtrum) are talking about their 5G modems to be seen in phone launches starting from 2020. However, both these vendors are currently only sampling these chips which can support sub-6GHz frequency (no mmWave support for now). Given China is currently rolling out 5G using sub-6GHz spectrum only, this may explain this decision from both MediaTek and UniSOC.

Figure 63: Range of 5G modems announced so far – still early days

	Qualcomm		Huawei		Mediatek	UniSOC (Spreadtrum)	Samsung
Modem	X50	X55	Balong 5000	Balong 5G (Kirin 990 5G)*	M70	Makalu Iy510	Exynos 5100
Foundry	Samsung 10nm	TSMC 7nm	TSMC 7nm	TSMC 7nm	TSMC 7nm	TSMC 12nm	Samsung 10nm
Announced	2016	Feb-19	Jan-19	Sep-19	Jun-18	Feb-19	Aug-18
Availability	end of 2018	2019	2019	2019	2019-2020	N/A	end of 2018
Shipment status	Multiple designs	Sampling	Huawei Mate X	Huawei Mate 30	1Q20 devices	Sampling	Galaxy S10 5G
Spectrum (bands)	Sub-6GHz, mmWave	Sub-6GHz, mmWave	Sub-6GHz, mmWave	Sub-6 GHz	Sub-6GHz	Sub-6GHz	Sub-6GHz, mmWave
Support (5G standard)	NSA	SA, NSA	SA, NSA	SA, NSA	SA, NSA	SA, NSA	SA, NSA
Downlink / Upload speed Sub-6GHz	N/A	N/A	4.6 Gbps / 2.5 Gbps	2.3 Gbps / 1.25 Gbps	4.7 Gbps / 2.5 Gbps	2 Gbps (downlink)	2 Gbps (downlink)
Downlink / Upload speed mmWave	4.5 Gbps (downlink)	7 Gbps / 3 Gbps	6.5 Gbps / 3.5 Gbps	N/A	No support	No support	6 Gbps (downlink)

*Huawei's Kirin 990 5G is an integrated SoC (basedband + apps processor)

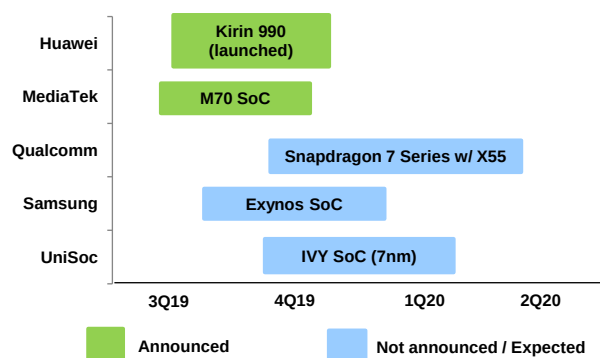
Source: Company data, Credit Suisse research

Intel out now, Apple trying for internal solution in the future. Intel's XMM 8160 modem announced in late 2018 (with intention to release in 2H19) was already running behind the plans. With Intel now having exited the smartphone modem business and Apple acquiring that asset for \$1bn (announcement made in July 2019), we may have to

wait for the deal to get completed (Apple expects deal to close in Q4'19) and then see how quickly Apple moves with its R&D efforts to bring its internal 5G modem into the iPhone.

First 5G SoC launched from Huawei, now waiting for more. Chip vendors are also in a race to launch integrated 5G chipsets before mass 5G roll out takes place globally. While various companies indicated plans on launching integrated chips, only few have announced planned launches. MediaTek has announced its M70 SoC (in May 2019). Huawei recently launched Kirin 990, its 5G SoC (first to be compatible with standalone and non-standalone networks), which will integrate baseband and application processor. Huawei also made a 4G version of Kirin 990 with 5G modem component swapped-out available. Kirin 990 will be used in its forthcoming smartphone, Mate 30, to be unveiled in Munich in mid-Sep. Qualcomm has also recently announced plans to expand its 5G mobile platforms across 8 Series, 7 Series and 6 Series. Of these, Snapdragon 7 Series will be based on 7nm process technology and have 5G integrated into an SoC and support all key regions and frequency bands. There are already 12 leading global smartphone OEMs (incl. OPPO, realme, Redmi, Vivo, Motorola, HMD Global, the home of Nokia smartphones, and LG Electronics) that plan to use this. The readiness of the platform is expected at Q4'19. Other two series (8 and 6) are application chips compatible with 5G modem. 8 Series already powers 5G mobile devices introduced in 2019, while 6 Series is expected to be available in devices in 2H20. Integrated chipsets will aim to bring the price-points down for end devices and improve 5G handset's power efficiency.

Figure 64: Anticipated launch of 5G integrated chipsets



Source: Company data, Credit Suisse estimates, CS Asia Tech Team

Figure 65: MediaTek SoC (5G-1) integrating its M70 modem the only announced SoC so far



Source: Company data, CS Asia Tech Team

5G related comments from semis

Looking at comments from semiconductor chip vendors, we observe that Massive MIMO and 5G both have been key growth drivers for a number of companies. Although some vendors were impacted by Huawei ban in recent quarters, companies have remained positive on future opportunities that 5G can bring. Specifically, Marvell indicated that 5G content is roughly 4x higher than 4G, while Broadcom sees 5-10% content growth as transition into 5G takes place. Intel believes that service provider demand is still in the early phase of a meaningful 5G-related build-out and expects growth to materialize more in 2020 (Figure 66).

Figure 66: Commentaries from semiconductor companies on 5G demand so far and opportunities ahead

Company	C1Q19 earnings call	C2Q19 earnings call
Intel	25 Apr 2019: "We see customers becoming more cautious in their buying patterns , with the most acute deceleration happening in China . Demand pressure is particularly evident in our data center business, where we are seeing a continuing inventory correction in enterprise and comms and capacity digestion among cloud service providers who ramped consumption strongly in 2018... comms service provider revenue declined 4% year-over-year in the first quarter as both enterprise and comms customers worked through inventory and China demand weakened...the relationships we've built for 5G is going to be important going forward"	25 Jul 2019: " Two large telecom equipment manufacturers have committed to this architecture (Snow Ridge- Intel's 10-nanometer system-on-chip technology for 5G base stations) and we're on track to 40% share in this market segments by 2022 . Network infrastructure... is growing at a 40% CAGR since 2014 from just over \$1 billion in revenue to more than \$4 billion last year... we have seen a weaker first half in our data center business, we expect a better second half as demand from cloud and comms service providers, improves.. We see comms service provider demand still in the early phase of a meaningful 5G-related build-out... comms has been low single-digits as our customers begin to build up for the transition to 5G, so we expect that growth to probably materialize .. more in 2020... comms will get a little bit stronger in the context of our overall full year guide."
Texas Instruments	23 Apr 2019: "... communications equipment grew about 30% year on year , and as we mentioned earlier, benefiting both from 5G shipments as well as an easy compare due to weakness in the year-ago period. History would suggest that we should expect this market to be choppy in the future. "	23 July 2019: " In communications equipment, revenue declined sequentially , but was about even from a year ago versus a weak compare... Huawei is about 3% to 4% of our revenue overall . It's a mix of comms equipment and some handset in there and some other products. If you look at comms equipment overall, it's 11% of our revenue . We had seen some nice growth in our 5G products"
Xilinx	24 Apr 2019: "I want to also clarify we're far from peaking... Because this is just the very early stage of 5G. 5G is going to continue on for quite some time because 5G is very ambitious. I mean, we see 5G being factors larger than 4G over its entirety. We think we have higher market share now. We think that's actually going to expand . It's still early days in 5G."	24 July 2019: "Wired and Wireless Group: Continued 5G build out drove growth, with revenue expanding 66% yoy and 2% qoq...Huawei is important for us. So it's not like it had no impact . But if just speaking to the strength of the 5G deployment, it's really happening. Korea started last year, but that's not as though that's over, and I think I'll remind everybody that Huawei is a key customer as is ZTE. And we continue to ship to ZTE and as well as all the other ones , right? We ship to all the big players in wireless"
Broadcom	14 Mar 2019: "I think it's 5G actually that impacts content in components in handsets, high-end smartphones , I might add, will only really impact in a big way, I think, beyond 2020. "	13 June 2019: " Secured next two generations of RF front end [at large] North American OEM, which positions Co. well for transition into 5G...we probably see in the 5% to 10% range content growth (as we transition into 5G) and with -- in terms of the products we ship. Now for the entire, I guess, served available market or -- yes, served available market, it's probably a smaller growth percentage. "
Marvell	7 Mar 2019: "when we talk about our long-term growth rate , what we outlined at the last Analyst Day was in the range of 6% to 8% on a year-over-year basis... I think we feel pretty good about the balance that we have for the rest of the year, but certainly, with all the 5G opportunities that continue to ramp and the design wins that we continue to have , our team literally is, as every quarter goes, they win more designs...We like our position in 5G and the ability to transition from 4G successfully"	30 May 2019: " 5G is rapidly emerging as one of the most exciting growth catalyst for Co...5G content is up roughly 4x versus 4G "
Analog Devices	22 May 2019: "Revenue \$1.53b, came in at high end of guidance(and B2B revenue increased approx. 3% yoy) led by strong yoy growth from communications' applications across multiple segments...Comms: Represented 24% of sales. Experienced strong double-digit yoy growth, led by ongoing strength in wireless , while wireline franchise continued to grow nicely. Results reflect Co.'s higher content and share in 5G."	21 Aug 2019: " Communications represented 21% of sales during the quarter and grew 7% year-over-year. While both wireless and wired results were impacted by Huawei, our wireless sales still increased double digits year-over-year driven by record revenue across multiple customers, a testament to our balanced and market-leading position in advanced radio systems used in the 5G infrastructure...5G is one of the most exciting new platforms to be introduced in the world of information and communications technology for several years... I believe it'll be very pervasive. It's in the early stages of deployment. We're looking at a multiyear cycle here.
Keysight	29 May 2019: " In 5G , we achieved another record quarter of orders . The entire mobile communications ecosystem is now investing in solutions to support the early ramp of commercial 5G networks and devices...In Q2, Commercial Communications delivered double-digit order growth and revenue of \$431 million driven by increased 5G R&D demand across the wireless ecosystem and growth in data center-related next-generation 400 Gigabit Ethernet and higher digital tests.. the strong software content in our solutions is enabling our improved gross margin performance... if you were to take Huawei out of our orders, 5G still grew 198% in the quarter . The second point that I'll add is 5G relative to legacy cellular technologies, our 5G orders have surpassed all of our legacy cellular technologies for the second quarter in a row."	21 Aug 2019: " Commercial communications drove considerable upside in the quarter with double-digit order and revenue growth . This growth was driven by another exceptional quarter of 5G orders where we believe we have strong technology leadership over the competition....5G deployments pose complex challenges across devices, base stations and core networks on an accelerated time frame... This organizational alignment will further enhance our ability to accelerate innovation in 5G . Additionally, we see future opportunities to expand their footprint within enterprises deploying dedicated networks as our network visibility solutions provide increased actionable insight and security from mission-critical applications running on these networks."

Source: Company data, Credit Suisse research

Ericsson (ERICb.ST / ERIC)

Rating	OUTPERFORM
Price (05 Sep 19, Skr)	76.94
Target price (Skr)	107.00
Market Cap (Skr m)	251,778.1
Enterprise value (Skr m)	213,657.6
Secondary RIC	ERIC
Rating	OUTPERFORM
Price (05 Sep 19, US\$)	7.94
Target price (US\$)	11.38
Target price is for 12 months.	

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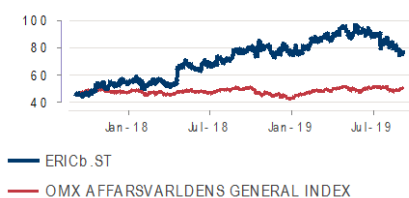
US/KOR not peaking yet, GM concerns overdone

■ **Maintain above consensus estimates, reiterate OP.** Our capex analysis update continues to support our thesis that 5G may prove to be a longer, more profitable cycle than previous generations. With Ericsson well positioned to benefit from 5G portfolio and installed customer base, we expect top-line to grow 7%/4% in 2019/20 (2%/3% FX adjusted growth despite contract exits) with EBIT margins improving to 12.5% (+340bp yoy) by 2020. Our 2020 sales/EBIT estimates are 3%/15% above consensus. Hence, we reiterate OP rating (TP of SKr107).

■ **5G momentum to continue; key markets not peaking yet.** FX adjusted growth in Networks sales has accelerated from 2% yoy in Q218 to 11% in Q219 driven by US, Korea and China. However, none of these markets have yet peaked – our analysis suggests that 2H19 capex in these 3 markets may be +12%, +64%, +12% hoh and +10%, +38%, -2% yoy respectively. Further, spending levels in China and Japan could continue to rise in 2020 (even US if DISH starts building network). Hence, we model 5% sales growth (4% FX adjusted) for Networks in 2020 (following +12% in 2019 or +7% FX adjusted).

■ **GM debate continues.** Even with Networks GMs potentially peaking in Q219 (41.4% adjusted or 42.4% if we excl. royalty paid off), we make 2 points: i) 2H headwinds from China 5G ramp and strategic contracts should be offset by continued US and Korea strength and higher sales leverage; ii) Services and Media GMs should improve after a weak Q2 print. This should allow group GMs to remain at around 37.5% levels in 2H19, with improvement to 39% in 2020 helped by robust mix and further exits from loss making contracts.

■ **Valuation looks attractive; FX tailwinds increasing.** With shares trading at 0.95x EV/sales and 7.6x EV/EBIT on our 2020 estimates, we argue valuation remains cheap. In addition to 5G momentum, FX also remains a tailwind with current USD/SEK rate of 9.75 suggesting 2020 targets of SKr223-233bn sales and 11-14% EBIT margins implying EBIT of SKr29.0bn (vs. co. guidance of SKr25bn, consensus at SKr25.6bn and CS at SKr29.3bn).

Share price performance

The price relative chart measures performance against the OMX AFFARSVARLDENS GENERAL INDEX which closed at 590.5 on 05/09/19
On 05/09/19 the spot exchange rate was SKr10.69/Eu 1.-
Eu.91/US\$1

Performance	1M	3M	12M
Absolute (%)	-5.9	-17.8	-2.5
Relative (%)	-9.4	-20.5	-4.0

Financial and valuation metrics

Year	12/17A	12/18A	12/19E	12/20E
Revenue (Skr m)	205,378.0	210,838.0	225,545.3	234,894.7
EBITDA (Skr m)	33,009.0	20,550.0	29,919.0	36,167.0
Adjusted net income (Skr m)	-1,781.99	1,967.80	11,988.15	18,638.39
CS EPS (adj.) (Skr)	-0.54	0.59	3.60	5.60
Prev. EPS (Skr)	-	-	-	-
ROIC (%)	-1.6	-12.2	28.9	44.6
P/E (adj.) (x)	-143.2	129.7	21.4	13.7
P/E rel. (%)		794.6	136.5	92.3
EV/EBITDA (x)	6.6	10.5	7.1	5.6
Dividend (12/19E, Skr)	1.15	Net debt/equity (12/19E, %)		-44.7
Dividend yield (12/19E, %)	1.5	Net debt (12/19E, Skr m)		-38,120.6
BV/share (12/19E, Skr)	25.6	IC (12/19E, Skr m)		47,169.4
Current WACC (%)		EV/IC (12/19E, (x)		4.5
Free float (%)	97.9	Number of shares (m)		3,272.4

Source: Company data, Refinitiv, Credit Suisse estimates

Ericsson (ERICb.ST)

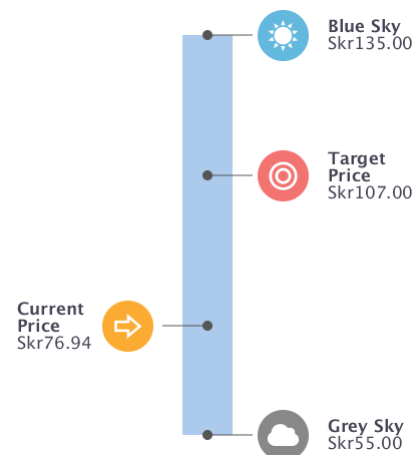
Price (05 Sep 2019): **Skr76.94**; Rating: **OUTPERFORM**; Target Price: **107.00**; Analyst: **Achal Sultania**

Income statement (Skr m)	12/17A	12/18A	12/19E	12/20E
Revenue	205,378	210,838	225,545	234,895
EBITDA	33,009	20,550	29,919	36,167
Depr. & amort.	(27,892)	(8,318)	(9,395)	(6,820)
EBIT	5,117	12,232	20,524	29,347
Net interest exp.	(1,215)	(2,705)	(1,726)	(1,592)
Associates	24	58	(175)	(100)
PBT	3,926	9,585	18,624	27,655
Income taxes	3,525	(4,813)	(5,895)	(7,726)
Profit after tax	7,451	4,772	12,728	19,928
Minorities	(143)	(254)	(335)	(250)
Preferred dividends	-	-	-	-
Associates & other	(9,090)	(2,550)	(405)	(1,040)
Net profit	(1,782)	1,968	11,988	18,638
Other NPAT adjustments	(30,794)	(8,498)	(354)	(860)
Reported net income	(32,576)	(6,530)	11,634	17,778
Cash flow (Skr m)	12/17A	12/18A	12/19E	12/20E
EBIT	5,117	12,232	20,524	29,347
Net interest	(1,215)	(2,705)	(1,726)	(1,592)
Cash taxes paid	(9,805)	(1,897)	(1,500)	(1,500)
Change in working capital	8,586	(3,333)	(136)	295
Other cash and non-cash items	9,548	5,045	(1,764)	(4,781)
Cash flow from operations	12,231	9,342	15,399	21,769
CAPEX	(3,877)	(3,975)	(4,736)	(4,698)
Free cashflow to the firm	8,354	5,367	10,663	17,071
Acquisitions	-	-	-	-
Divestments	-	-	-	-
Other investment/(outflows)	(12,193)	(157)	(800)	(800)
Cash flow from investments	(16,070)	(4,132)	(5,536)	(5,498)
Net share issue/(repurchase)	-	-	-	-
Dividends paid	(3,424)	(3,425)	(4,296)	(3,797)
Issuance (retirement) of debt	-	-	-	-
Other financing	8,902	(652)	(811)	(1,705)
Cashflow from financing	5,478	(4,077)	(5,106)	(5,502)
Changes in net cash/debt	3,466	1,214	2,250	10,769
Net debt at start	(31,191)	(34,657)	(35,871)	(38,121)
Change in net debt	(3,466)	(1,214)	(2,250)	(10,769)
Net debt at end	(34,657)	(35,871)	(38,121)	(48,889)
Balance sheet (Skr m)	12/17A	12/18A	12/19E	12/20E
Assets				
Total current assets	154,820	161,167	162,750	173,922
Total assets	260,544	268,761	282,327	290,971
Liabilities				
Total current liabilities	97,586	110,914	116,377	114,954
Total liabilities	160,368	180,991	197,037	195,168
Total equity and liabilities	260,544	268,761	282,327	290,971
Per share	12/17A	12/18A	12/19E	12/20E
No. of shares (wtd avg.) (mn)	3,317	3,318	3,327	3,330
CS EPS (adj.) (Skr)	(0.54)	0.59	3.60	5.60
Prev. EPS (Skr)	-	-	-	-
Dividend (Skr)	1.00	1.00	1.15	1.25
Free cash flow per share (Skr)	2.52	1.62	3.20	5.13
Key ratios and valuation	12/17A	12/18A	12/19E	12/20E
Growth/Margin (%)				
Sales growth (%)	(6.8)	2.7	7.0	4.1
EBIT growth (%)	(59.9)	139.0	67.8	43.0
Net income growth (%)	(161.0)	210.4	509.2	55.5
EPS growth (%)	(160.8)	210.4	507.6	55.3
EBITDA margin (%)	16.1	9.7	13.3	15.4
EBIT margin (%)	2.5	5.8	9.1	12.5
Pretax profit margin (%)	1.9	4.5	8.3	11.8
Net income margin (%)	(0.9)	0.9	5.3	7.9
Valuation	12/17A	12/18A	12/19E	12/20E
EV/Sales (x)	1.1	1.0	0.9	0.9
EV/EBITDA (x)	6.6	10.5	7.1	5.6
EV/EBIT (x)	42.4	17.7	10.4	6.9
Dividend yield (%)	1.30	1.30	1.49	1.62
P/E (x)	(143.2)	129.7	21.4	13.7
Credit ratios (%)	12/17A	12/18A	12/19E	12/20E
Net debt/equity (%)	(34.6)	(40.9)	(44.7)	(51.0)
Net debt to EBITDA (x)	(1.0)	(1.7)	(1.3)	(1.4)
Interest coverage ratio (x)	4.2	4.5	11.9	18.4

Source: FTI, Company data, Refinitiv, Credit Suisse Securities (EUROPE) LTD. Estimates

Company Background
Ericsson is a supplier of equipment, integrated solutions, multimedia applications and services to operators worldwide. The Company is a provider of communications networks, related services and multimedia solutions.

Blue/Grey Sky Scenario



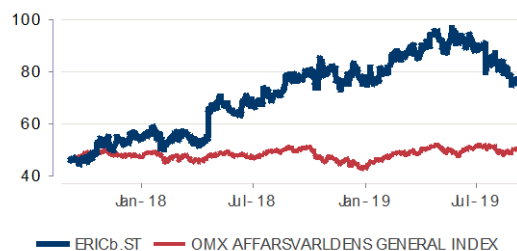
Our Blue Sky Scenario (Skr) 135.00

Our blue sky scenario assumes Ericsson's loss making assets will return to profitable growth which will result in higher margins. This can potentially drive EBIT margins (excl rest.) of ~15% by 2020 driving EPS to around SKr6.7. Based on average of 1.60x EV/sales and 20x P/E on 2020 estimates, and adding current net cash would imply blue sky valuation of SKr135. (\$14.4).

Our Grey Sky Scenario (Skr) 55.00

Our grey sky scenario assumes Ericsson will continue with its ongoing cost cutting as top-line remains under pressure and GM improvement is below company's target. This can potentially drive EBIT margins (excl rest.) of 9% by 2020 driving EPS of around SKr3.5. Based on an average of 0.90x EV/sales and 12x P/E on 2020 estimates, adjusting for net cash and assuming SKr10bn of cash used for restructuring, implies grey sky valuation of SKr55 (\$5.9).

Share price performance



The price relative chart measures performance against the OMX AFFARSVARLDENS GENERAL INDEX which closed at 590.5 on 05/09/19. On 05/09/19 the spot exchange rate was Skr10.69/Eu 1.- Eu.91/US\$1

Key charts – Ericsson

Figure 67: Our sales/EBIT estimates for Ericsson are 3%/15% above consensus for 2020; FX continues to act as a tailwind with current rates implying upside to existing EBIT target in 2020

Ericsson (SEK mn)	Actual			CS est.		Consensus		Co. target at USD / SEK FX of 8.70	Co. target assuming current FX rate	Co. target
	2016	2017	2018	2019E	2020E	2019E	2020E	2020E	2020E	by 2022
Networks sales	138,865	132,285	138,570	154,959	163,275	152,617	157,415	141 - 145 bn		
% change yoy		-5%	5%	12%	5%	10%	3%			
Networks EBIT (adjusted)	19,974	19,975	21,202	25,026	29,145	24,535	25,877	22,880		
EBIT margin (%)	14.4%	15.1%	15.3%	16.2%	17.9%	16.1%	16.4%	15 - 17%		15 - 17%
Digital Services sales	45,214	38,752	38,089	38,478	39,632	38,429	39,409	41 - 43 bn		
% change yoy		-14%	-2%	1%	3%	1%	3%			
Digital Services EBIT (adjusted)	(3,730)	(9,167)	(5,511)	(3,463)	(198)	(3,978)	(596)	420		
EBIT margin (%)	-8.2%	-23.7%	-14.5%	-9.0%	-0.5%	-10.4%	-1.5%	low single digit		10 - 12%
Managed Services sales	27,551	26,472	25,770	25,255	25,065	25,295	25,296	23 - 25 bn		
% change yoy		-4%	-3%	-2%	-1%	-2%	0%			
Managed Services EBIT (adjusted)	(76)	(853)	1,369	1,566	2,131	2,374	1,859	1,560		
EBIT margin (%)	-0.3%	-3.2%	5.3%	6.2%	8.5%	9.4%	7.4%	5 - 8%		8 - 10%
Emerging Business & Other sales	8,686	7,869	8,409	6,853	6,922	6,985	6,984	5 - 7 bn		
% change yoy		-9%	7%	-19%	1%	-17%	0%			
Emerging Business & Other EBIT (adjusted)	(3,414)	(4,838)	(4,828)	(2,604)	(1,730)	(1,669)	(1,088)	0		
EBIT margin (%)	-39.3%	-61.5%	-57.4%	-38.0%	-25.0%	-23.9%	-15.6%	break even		no guidance
Ericsson group sales	220,316	205,378	210,838	225,545	234,895	223,325	229,105	210 - 220 bn	223 - 233 bn	
% change yoy		-7%	3%	7%	4%	6%	3%			
Gross Profits	68,729	64,258	76,888	84,794	91,907	83,407	87,351	81,700		
GM (%)	31.2%	31.3%	36.5%	37.6%	39.1%	37.3%	38.1%	37 - 39%		
Ericsson group EBIT	12,754	5,117	12,232	20,524	29,347	20,880	25,614	24,860	29,048	
EBIT margin (%)	5.8%	2.5%	5.8%	9.1%	12.5%	9.3%	11.2%	10 - 13%	11.2 - 14.2%	12 - 14%
FX rate (USD / SEK)	8.68	8.53	8.74	9.50	9.50			8.70	9.75	8.70

Source: Company data, Credit Suisse estimates, Consensus (Infront Data)

Figure 68: We believe Networks can grow 4% (FX adjusted) in 2020 following 7% growth we model in 2019

Sales (\$K mn)	Q118	Q218	Q318	Q418	Q119	Q219	Q319E	Q419E	2016	2017	2018	2019E	2020E
Networks	28,602	32,393	35,934	41,641	33,481	37,819	39,315	44,344	138,865	132,285	138,570	154,959	163,275
% change yoy (reported)	-10%	2%	13%	12%	17%	17%	9%	6%		-5%	5%	12%	5%
% change yoy (organic FX adjusted)	-2%	2%	5%	6%	10%	11%	6%	3%			3%	7%	4%
Digital Services	7,262	8,833	8,987	13,007	7,817	8,991	9,260	12,410	45,214	38,752	38,089	38,478	39,632
% change yoy (reported)	-10%	-11%	1%	10%	8%	2%	3%	-5%		-14%	-2%	1%	3%
% change yoy (organic FX adjusted)	-3%	-12%	-6%	5%	0%	-3%	0%	-8%			-4%	-4%	2%
Managed Services	5,896	6,528	6,465	6,881	5,856	6,323	6,271	6,805	27,551	26,472	25,770	25,255	25,065
% change yoy (reported)	-6%	-2%	-2%	0%	-1%	-3%	-3%	-1%		-4%	-3%	-2%	-1%
% change yoy (organic FX adjusted)	-4%	-3%	-8%	-5%	-5%	-6%	-6%	-5%			-5%	-7%	-2%
Emerging & Others	1,651	2,054	2,424	2,280	1,752	1,677	1,685	1,740	8,686	7,869	8,409	6,853	6,922
% change yoy (reported)	-7%	2%	22%	9%	6%	-18%	-31%	-24%		-9%	3%	-19%	1%
% change yoy (organic FX adjusted)	-2%	1%	11%	1%	38%	24%							
Ericsson group	43,411	49,808	53,810	63,809	48,906	54,810	56,531	65,298	220,316	205,378	210,838	225,545	234,895
% change yoy (reported)	-9%	-1%	9%	10%	13%	10%	5%	2%		-7%	3%	7%	4%
% change yoy (organic FX adjusted)	-2%	-1%	1%	4%	7%	7%	2%	-1%		-10%	1%	2%	3%
FX tailwind yoy	-7%	0%	8%	6%	6%	3%	3%	4%		3%	2%	5%	1%

Source: Company data, Credit Suisse estimates

Figure 69: GM and EBIT margins both should continue to see improvement as we go into 2020

GROUP	Q118	Q218	Q318	Q418	Q119	Q219	Q319E	Q419E	2017	2018	2019E	2020E
Sales	43,411	49,808	53,810	63,809	48,906	54,810	56,531	65,298	205,378	210,838	225,545	234,895
GP (ex rest.)	15,601	18,270	19,834	20,433	18,844	20,097	21,320	24,533	53,170	74,138	84,794	91,907
Other charges (COGS)	0	0	0	(2,750)	0	0	0	0	(11,088)	(2,750)	0	0
GP (ex all charges)	15,601	18,270	19,834	23,183	18,844	20,097	21,320	24,533	64,258	76,888	84,794	91,907
GM clean (%)	35.9%	36.7%	36.9%	36.3%	38.5%	36.7%	37.7%	37.6%	31.3%	36.5%	37.6%	39.1%
OPEX (ex rest.)	(14,741)	(16,225)	(16,041)	(17,874)	(13,742)	(16,240)	(15,893)	(16,829)	(79,412)	(64,881)	(62,703)	(62,561)
Other charges (OPEX)	0	0	0	(225)	750	0	0	0	(20,271)	(225)	750	0
OPEX (ex all charges)	(14,741)	(16,225)	(16,041)	(17,649)	(15,308)	(16,240)	(15,893)	(16,829)	(59,141)	(64,656)	(64,269)	(62,561)
as % of sales	34.0%	32.6%	29.8%	27.7%	31.3%	29.6%	28.1%	25.8%	28.8%	30.7%	28.5%	26.6%
EBIT (ex rest.)	860	2,045	3,793	2,559	5,102	3,857	5,427	7,704	(26,242)	9,257	22,090	29,347
Other charges (COGS + OPEX)	0	0	0	(2,975)	750	0	0	0	(31,359)	(2,975)	750	0
EBIT (ex all charges)	860	2,045	3,793	5,534	3,536	3,857	5,427	7,704	5,117	12,232	20,524	29,347
EBIT margin clean (%)	2.0%	4.1%	7.0%	8.7%	7.2%	7.0%	9.6%	11.8%	2.5%	5.8%	9.1%	12.5%

Source: Company data, Credit Suisse estimates

Nokia (NOKIA.HE / NOK.N)

Rating	OUTPERFORM
Price (05 Sep 19, €)	4.49
Target price (€)	5.70
Market Cap (€ m)	25,320.4
Enterprise value (€ m)	23,829.5
Secondary RIC	NOK.N
Rating	OUTPERFORM
Price (05 Sep 19, US\$)	4.97
Target price (US\$)	6.38
Target price is for 12 months.	

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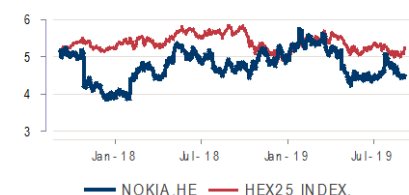
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5G acceptance rising, cost cutting benefits to come

- **Maintain OP rating.** We continue to view Nokia as a beneficiary of ongoing 5G investments, which we believe could be a longer and more profitable cycle than previous 2G/3G/4G. As such, we expect Nokia's revenue to grow 3% in 2019/20, with EBIT margin to expand to 13% in 2020 (from 8.6% in 2019) – also helped by cost cutting program. As such, we maintain our OP rating (TP of €5.70). While our 2019/20 sales estimates are in-line with consensus, our 2019 EBIT is 6% lower (due to lower gross margin) but our 2020 EBIT is 3% higher than street (driven by lower opex).
- **5G to drive growth, as spending in key markets not peaking yet.** According to our analysis, capex investments in US, Korea and China have not peaked yet and should continue to grow in the near future. We believe capex in these markets can continue to rise in 2H19, with increasing investments from China and Japan to continue to grow in 2020. Nokia reported Networks+Software sales growth in Q1/Q2 of 4%/8% yoy (-1%/+5% yoy FX adjusted). Going forward, we model Networks+Software sales of 4% growth in 2019, followed by 4% in 2020 driven by 5G investments and further 5G kit acceptances from telcos following recent success in the US.
- **Margins helped by cost cutting and end-demand growth.** Nokia has a €700mn cost savings plan over 2019-2020 (€500mn in opex and €200mn in COGS). With 2019 likely to see only partial benefit from cost savings plan (€200mn out of €700mn plan) and end demand likely to grow from 2H19, we believe Nokia can deliver a meaningful improvement in EBIT margins in 2020. As such, we assume that the company could deliver EBIT margin of 13% in 2020 (up from 8.6% in 2019).
- **Valuation compelling.** Nokia shares are trading at 1.0x EV/sales and 7.9x EV/EBIT on our 2020 estimates. With on-going 5G investments continuing to benefit Nokia and potential to reach 13% EBIT margin that we model for 2020, we see the valuation as compelling.

Share price performance



The price relative chart measures performance against the HEX25 INDEX, which closed at 3937.9 on 05/09/19. On 05/09/19 the spot exchange rate was €1/Eu 1.- Eu.91/US\$1

Performance	1M	3M	12M
Absolute (%)	-4.6	1.0	-3.5
Relative (%)	-8.2	-1.1	2.7

Financial and valuation metrics

Year	12/17A	12/18A	12/19E	12/20E
Revenue (€ m)	23,222.6	22,580.2	23,339.8	24,093.7
EBITDA (€ m)	3,155.8	2,706.5	2,721.2	3,842.7
Adjusted net income (€ m)	1,868.80	1,265.90	1,182.87	2,045.00
CS EPS (adj.) (€)	0.33	0.23	0.21	0.36
Prev. EPS (€)	-	-	-	-
ROIC (%)	17.9	12.3	12.1	19.7
P/E (adj.) (x)	13.6	19.9	21.4	12.4
P/E rel. (%)		133.8	137.6	89.4
EV/EBITDA (x)	6.6	8.2	8.8	6.2
Dividend (12/19E, €)	0.20	Net debt/equity (12/19E, %)		-11.1
Dividend yield (12/19E, %)	4.5	Net debt (12/19E, € m)		-1,490.9
BV/share (12/19E, €)	2.5	IC (12/19E, € m)		11,919.5
Current WACC (%)	10.0	EV/IC (12/19E, (x))		2.0
Free float (%)	94.7	Number of shares (m)		5,640.5

Source: Company data, Refinitiv, Credit Suisse estimates

Nokia (NOKIA.HE)

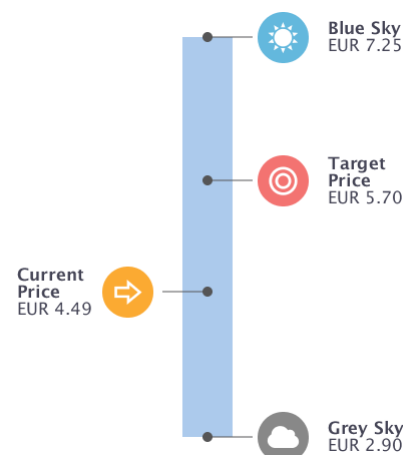
Price (05 Sep 2019): **€4.489**; Rating: **OUTPERFORM**; Target Price: **5.70**; Analyst: **Achal Sultania**

Income statement (€ m)	12/17A	12/18A	12/19E	12/20E
Revenue	23,223	22,580	23,340	24,094
EBITDA	3,156	2,707	2,721	3,843
Depr. & amort.	(558)	(515)	(721)	(722)
EBIT	2,587	2,180	2,000	3,120
Net interest exp.	(280)	(358)	(350)	(350)
Associates	11	12	0	0
PBT	2,318	1,834	1,650	2,770
Income taxes	(443)	(563)	(462)	(720)
Profit after tax	1,875	1,271	1,188	2,050
Minorities	(6)	(5)	(5)	(5)
Preferred dividends	-	-	-	-
Associates & other	0	(0)	0	0
Net profit	1,869	1,266	1,183	2,045
Other NPAT adjustments	(3,362)	(1,608)	(1,140)	(592)
Reported net income	(1,493)	(342)	43	1,453
Cash flow (€ m)	12/17A	12/18A	12/19E	12/20E
EBIT	2,587	2,180	2,000	3,120
Net interest	(356)	(91)	(84)	(100)
Cash taxes paid	(555)	(364)	(454)	(486)
Change in working capital	598	(943)	(1,101)	(1,165)
Other cash and non-cash items	(462)	(422)	(395)	(119)
Cash flow from operations	1,812	360	(34)	1,249
CAPEX	(601)	(672)	(700)	(608)
Free cashflow to the firm	1,211	(312)	(734)	641
Acquisitions	(394)	(31)	0	0
Divestments	51	70	0	0
Other investment/(outflows)	953	318	803	542
Cash flow from investments	9	(315)	103	(66)
Net share issue/(repurchase)	-	-	-	-
Dividends paid	(970)	(1,081)	(1,119)	(1,178)
Issuance (retirement) of debt	43	110	0	0
Other financing	(822)	2	0	0
Cashflow from financing	(1,749)	(969)	(1,119)	(1,178)
Changes in net cash/debt	(785)	(1,461)	(1,562)	5
Net debt at start	(5,299)	(4,514)	(3,053)	(1,491)
Change in net debt	785	1,461	1,562	(5)
Net debt at end	(4,514)	(3,053)	(1,491)	(1,496)
Balance sheet (€ m)	12/17A	12/18A	12/19E	12/20E
Assets				
Total current assets	19,841	18,266	17,278	17,605
Total assets	41,024	39,517	38,405	37,698
Liabilities				
Total current liabilities	12,809	14,104	14,244	13,870
Total liabilities	24,806	24,146	24,994	24,501
Total equity and liabilities	41,024	39,517	38,405	37,698
Per share	12/17A	12/18A	12/19E	12/20E
No. of shares (wtd avg.) (mn)	5,671	5,612	5,627	5,635
CS EPS (adj.) (€)	0.33	0.23	0.21	0.36
Prev. EPS (€)	-	-	-	-
Dividend (€)	0.17	0.19	0.20	0.21
Free cash flow per share (€)	0.21	(0.06)	(0.13)	0.11
Key ratios and valuation	12/17A	12/18A	12/19E	12/20E
Growth/Margin (%)				
Sales growth (%)	(3.1)	(2.8)	3.4	3.2
EBIT growth (%)	19.1	(15.7)	(8.2)	56.0
Net income growth (%)	46.6	(32.3)	(6.6)	72.9
EPS growth (%)	48.8	(31.5)	(6.8)	72.6
EBITDA margin (%)	13.6	12.0	11.7	15.9
EBIT margin (%)	11.1	9.7	8.6	13.0
Pretax profit margin (%)	10.0	8.1	7.1	11.5
Net income margin (%)	8.0	5.6	5.1	8.5
Valuation	12/17A	12/18A	12/19E	12/20E
EV/Sales (x)	0.9	1.0	1.0	1.0
EV/EBITDA (x)	6.6	8.2	8.8	6.2
EV/EBIT (x)	8.0	10.2	11.9	7.6
Dividend yield (%)	3.79	4.23	4.46	4.68
P/E (x)	13.6	19.9	21.4	12.4
Credit ratios (%)	12/17A	12/18A	12/19E	12/20E
Net debt/equity (%)	(27.8)	(19.9)	(11.1)	(11.3)
Net debt to EBITDA (x)	(1.4)	(1.1)	(0.5)	(0.4)
Interest coverage ratio (x)	9.2	6.1	5.7	8.9

Source: FTI, Company data, Refinitiv, Credit Suisse Securities (EUROPE) LTD. Estimates

Company Background
Nokia has 3 business segments: Networks, Software and Technologies (licensing). Its main activities include supplying telecom equipment/services to carriers globally, and collecting royalties for use of patents in phones.

Blue/Grey Sky Scenario



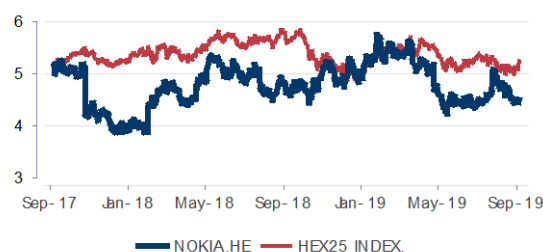
Our Blue Sky Scenario (€) 7.25

Our blue sky scenario assumes 25-30% increase in FY20 adjusted EPS (driven by Networks sales returning to mid- to high- single digit growth after declines in 2016/17/18) along with EV/sales re-rating to 1.50x and P/E re-rating to 16.0x along with net cash adjustments. This results in a blue sky valuation of €7.25 (\$8.12).

Our Grey Sky Scenario (€) 2.90

Our grey sky scenario assumes about 40% reduction to FY20 adjusted EPS (driven by further decline in Networks sales due to telco capex weakness) along with EV/sales de-rating to 0.90x and P/E de-rating to 10x. This results in a grey sky valuation of €2.90 (\$3.25).

Share price performance



The price relative chart measures performance against the HEX25 INDEX, which closed at 3937.9 on 05/09/19. On 05/09/19 the spot exchange rate was €1/Eu 1.- Eu.91/US\$1

Key charts – Nokia

Figure 70: Nokia: While our 2019/20 sales estimates are in-line with consensus, our 2019 EBIT is 6% lower (due to lower gross margin) but our 2020 EBIT is 3% higher than street (driven by lower opex)

				CS est.		Consensus		Guidance	
Nokia P&L (in € mn)	2016	2017	2018	2019E	2020E	2019E	2020E	2019E	2020E
Net Sales	23,973	23,223	22,580	23,340	24,094	23,412	24,156		
% growth yoy	-9.9%	-3.1%	-2.8%	3.4%	3.2%	3.7%	3.2%		
Networks	21,831	20,523	17,404	18,158	18,852	18,174	18,774	TAM to slightly grow	TAM to grow
% growth yoy	-11.4%	-6.0%	nm	1.5%	3.3%	4.4%	3.3%		
Software			2,713	2,815	2,928	2,829	2,915		
Technologies	1,053	1,654	1,501	1,454	1,400	1,489	1,538		
Group Common & Others	1,142	1,115	1,024	983	983	919	928		
Eliminations	(53)	(69)	(63)	(71)	(70)				
Gross Profit (proforma)	9,656	9,673	9,035	8,744	9,544	8,842	9,713	€50mn savings	€150mn savings
% margin	40.3%	41.7%	40.0%	37.5%	39.6%	37.8%	40.2%		
Total opex (excl. all charges)	(7,397)	(7,249)	(6,911)	(6,725)	(6,413)	(6,702)	(6,668)	€150mn savings	€350mn savings
% of sales	30.9%	31.2%	30.6%	28.8%	26.6%	28.6%	27.6%		
Other income & expenses	(88)	163	55	(19)	(11)				
EBIT (proforma)	2,172	2,587	2,180	2,000	3,120	2,129	3,026		
% margin	9.1%	11.1%	9.7%	8.6%	13.0%	9.1%	12.5%	9 - 12%	12 - 16%
Networks	1,943	1,711	773	681	1,692	774	1,476		
Networks margin (%)	8.9%	8.3%	4.4%	3.8%	9.0%	4.3%	7.9%		
Software			450	562	672	537	583		
Software margin (%)			16.6%	20.0%	23.0%	19.0%	20.0%		
Technologies	579	1,124	1,203	1,202	1,150	1,227	1,263		
Technologies margin (%)	54.9%	67.9%	80.2%	82.7%	82.1%	82.4%	82.1%		
Group Common & Others	(350)	(248)	(246)	(445)	(393)	(411)	(329)		
Net Income (proforma)	1,275	1,869	1,266	1,183	2,045				
EPS (proforma) (€)	0.22	0.33	0.23	0.21	0.36	0.23	0.36	0.25 - 0.29	0.37 - 0.42

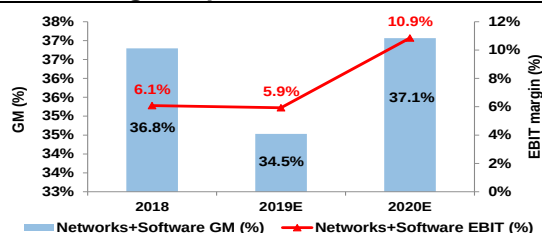
Source: Company data, Credit Suisse estimates

Figure 71: We believe Nokia Networks sales can grow 4% in 2020, following 4% growth in 2019, with group EBIT margin expanding to 13% in 2020 from 9% in 2019

	Revenue (€ mn)							GP and EBIT (€ mn)					
	Q119	Q219	Q319E	Q419E	2019E	2020E		Q119	Q219	Q319E	Q419E	2019E	2020E
Networks sales	3,944	4,393	4,425	5,397	18,158	18,852	Networks gross profits	1,061	1,367	1,372	1,993	5,792	6,551
% qoq change	-25.2%	11.4%	0.7%	22.0%			Gross margin (%)	26.9%	31.1%	31.0%	36.9%	31.9%	34.8%
% yoy change	4.3%	7.7%	3.7%	2.3%	4.3%	3.8%	Networks EBIT	(254)	119	142	674	681	1,692
% yoy change (constant FX)	0%	5%					EBIT margin (%)	-6.4%	2.7%	3.2%	12.5%	3.8%	9.0%
Software sales	543	678	635	959	2,815	2,928	Software gross profits	219	357	311	562	1,450	1,522
% qoq change	-42.1%	24.9%	-6.3%	50.8%			Gross margin (%)	40.3%	52.7%	49.0%	58.7%	51.5%	52.0%
% yoy change	0.4%	10.8%	2.0%	2.2%	3.8%	4.0%	Software EBIT	(7)	137	94	338	562	672
% yoy change (constant FX)	-4%	8%					EBIT margin (%)	-1.3%	20.2%	14.8%	35.3%	20.0%	23.0%
Technologies sales	370	383	351	350	1,454	1,400	Technologies gross profits	357	378	346	344	1,425	1,372
% qoq change	-12.6%	3.5%	-8.3%	-0.5%			Gross margin (%)	96.5%	98.7%	98.5%	98.3%	98.0%	98.0%
% yoy change	1.4%	6.1%	0.0%	-17.4%	-3.1%	-3.7%	Technologies EBIT	302	324	290	287	1,202	1,150
% yoy change (constant FX)	0%	4%					EBIT margin (%)	81.6%	84.5%	82.5%	81.9%	82.7%	82.1%
Group Common & Others	220	263	240	260	983	983	Group Common & Others EBIT	(100)	(129)	(111)	(105)	(445)	(393)
Eliminations	(20)	(21)	(15)	(15)	(71)	(70)	Eliminations EBIT	0	0	0	0	0	0
Nokia group sales	5,057	5,696	5,636	6,950	23,340	24,094	Nokia group gross profits	1,641	2,117	2,054	2,931	8,744	9,544
% qoq change	-26.4%	12.6%	-1.0%	23.3%			Gross margin (%)	32.5%	37.2%	36.4%	42.2%	37.5%	39.6%
% yoy change	2.6%	7.1%	3.2%	1.1%	3.4%	3.2%	Nokia group EBIT	(59)	451	414	1,194	2,000	3,120
% yoy change (constant FX)	-1%	5%					EBIT margin (%)	-1.2%	7.9%	7.3%	17.2%	8.6%	13.0%

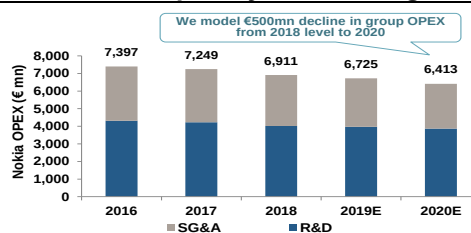
Source: Company data, Credit Suisse estimates

Figure 72: Margin improvement to come...



Source: Company data, Credit Suisse estimates

Figure 73: ...also helped by cost cutting



Source: Company data, Credit Suisse estimates

Companies Mentioned *(Price as of 05-Sep-2019)*

AT&T (T.N, \$35.89)
America Movil (AMX.N, \$14.5)
China Mobile Limited (0941.HK, HK\$66.05)
China Telecom (0728.HK, HK\$3.51)
China Unicom Hong Kong Ltd (0762.HK, HK\$7.94)
Cisco Systems (CSCO.OQ, \$48.42)
Deutsche Telekom (DTGn.F, €15.134)
Dish Network (DISH.OQ, \$34.85)
Ericsson (ERIC.OQ, \$7.94, OUTPERFORM, TP \$11.38)
Ericsson (ERICb.ST, Skr76.94, OUTPERFORM, TP Skr107.0)
Fujitsu (6702.T, ¥8,545)
KDDI (9433.T, ¥2,870)
KT Corp (030200.KS, W27,100)
LG Electronics Inc (066570.KS, W62,300)
LG Uplus (032640.KS, W13,250)
MegaFon (MFON.MM, Rbl650.6)
Mob TeleSystems (MTSS.MM, Rbl275.1)
NEC (6701.T, ¥4,650)
NTT DOCOMO (9437.T, ¥2,708)
Nokia (NOK.N, \$4.97, OUTPERFORM, TP \$6.38)
Nokia (NOKIA.HE, €4.49, OUTPERFORM, TP €5.7)
Nortel Networks (NRTLQ.PK, \$0.0025)
Oi SA (OIBR3.SA, R\$1.17)
Orange (ORAN.PA, €13.71)
Panasonic (6752.T, ¥835)
Rakuten (4755.T, ¥1,038)
Rostelecom (RTKM.MM, Rbl80.3)
SK Telecom (017670.KS, W236,500)
Samsung Electronics (005930.KS, W45,700)
SoftBank Group (9984.T, ¥4,795)
Sprint Corp (S.N, \$6.76)
T-MOBILE (TMUS.OQ, \$77.83)
TIM Participacoes (TIMP3.SA, R\$11.95)
Telefonica (TEF.MC, €6.507)
Telefonica Brasil (VIVT4.SA, R\$55.64)
Verizon Communications (VZ.N, \$58.59)
Vodafone Group (VOD.L, 153.72p)
ZTE Corporation (000063.SZ, Rmb30.65)
ZTE Corporation (0763.HK, HK\$19.58)

Disclosure Appendix

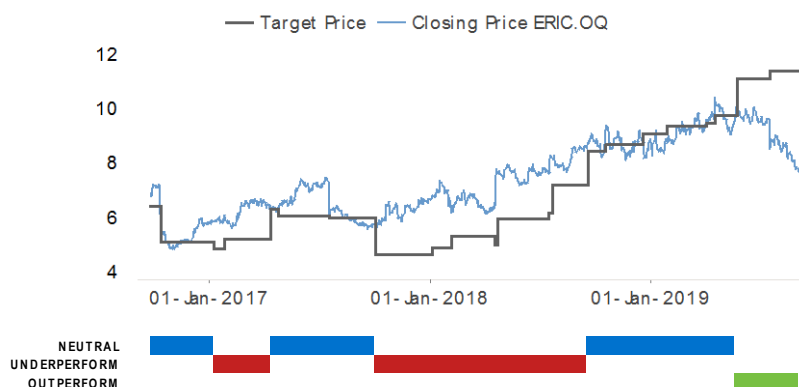
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3-Year Price and Rating History for Ericsson (ERIC.OQ)

ERIC.OQ	Closing Price	Target Price	
Date	(US\$)	(US\$)	Rating
26-Sep-16	6.90	6.40	N
13-Oct-16	5.44	5.10	
09-Jan-17	5.87	4.85	U
27-Jan-17	5.92	5.20	
12-Apr-17	6.42	6.30	N
26-Apr-17	6.38	6.05	
19-Jul-17	6.14	6.00	
03-Oct-17	5.63	4.65	U
05-Jan-18	6.81	4.90	
05-Feb-18	6.20	5.32	
18-Apr-18	6.37	5.00	
23-Apr-18	7.65	5.95	
16-Jul-18	7.65	6.18	
23-Jul-18	8.15	7.19	
19-Sep-18	8.74	8.44	N
19-Oct-18	9.36	8.67	
19-Dec-18	8.75	9.06	
28-Jan-19	8.74	9.37	
03-Apr-19	9.59	9.46	
18-Apr-19	10.11	9.73	
24-May-19	10.03	11.09	O
18-Jul-19	8.84	11.38	

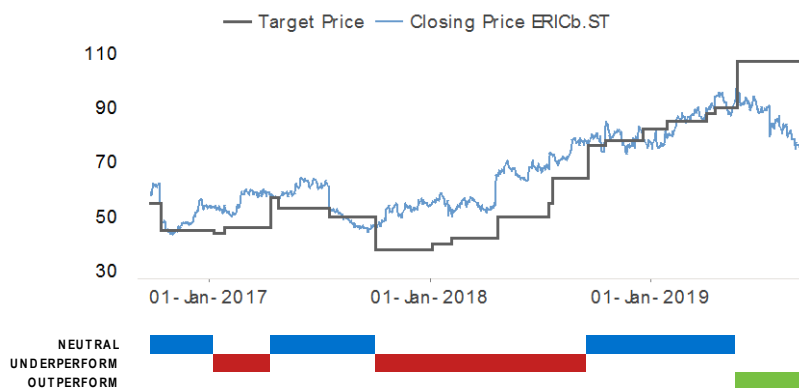
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3-Year Price and Rating History for Ericsson (ERICb.ST)

ERICb.ST	Closing Price	Target Price	
Date	(Skr)	(Skr)	Rating
26-Sep-16	58.85	55.00	N
13-Oct-16	48.30	45.00	
09-Jan-17	53.55	44.00	U
27-Jan-17	52.50	46.00	
12-Apr-17	58.25	57.00	N
26-Apr-17	56.15	53.00	
19-Jul-17	51.70	50.00	
03-Oct-17	45.75	38.00	U
05-Jan-18	55.46	40.00	
05-Feb-18	51.60	42.00	
23-Apr-18	65.00	50.00	
16-Jul-18	67.74	55.00	
23-Jul-18	72.42	64.00	
19-Sep-18	77.86	76.00	N
19-Oct-18	84.94	78.00	
19-Dec-18	80.46	82.00	
28-Jan-19	79.02	85.00	
03-Apr-19	89.82	88.00	
18-Apr-19	94.10	90.00	
24-May-19	94.90	107.00	O

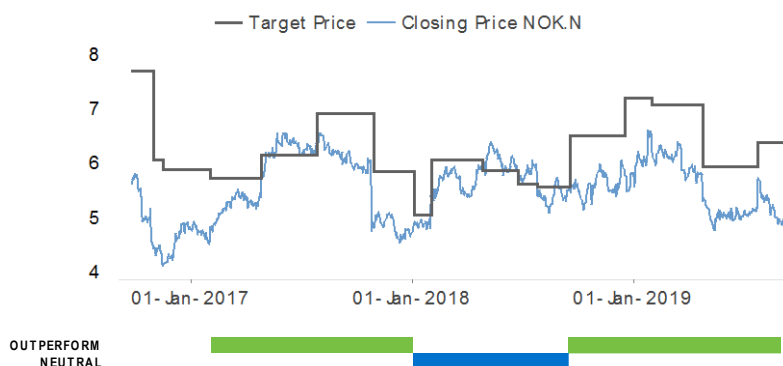
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3-Year Price and Rating History for Nokia (NOK.N)

NOK.N	Closing Price	Target Price	
Date	(US\$)	(US\$)	Rating
26-Sep-16	5.62	7.70	
01-Nov-16	4.44	6.05	
16-Nov-16	4.12	5.89	
03-Feb-17	4.83	5.72	O
28-Apr-17	5.73	6.15	
28-Jul-17	6.40	6.90	
30-Oct-17	4.82	5.85	
05-Jan-18	4.92	5.04	N
02-Feb-18	5.40	6.06	
27-Apr-18	5.96	5.86	
25-Jun-18	5.83	5.62	
27-Jul-18	5.40	5.56	
19-Sep-18	5.46	6.50	O
19-Dec-18	5.77	7.19	
01-Feb-19	6.13	7.07	
26-Apr-19	5.36	5.94	
26-Jul-19	5.72	6.38	

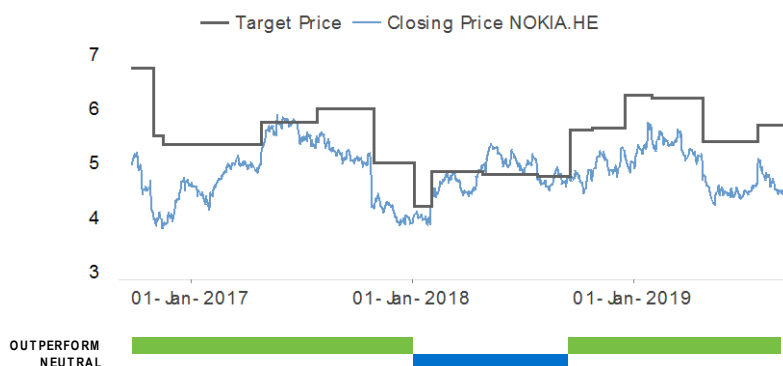
* Asterisk signifies initiation or assumption of coverage.



3-Year Price and Rating History for Nokia (NOKIA.HE)

NOKIA.HE	Closing Price	Target Price	
Date	(€)	(€)	Rating
26-Sep-16	4.98	6.75	O
01-Nov-16	3.97	5.50	
16-Nov-16	3.84	5.35	
28-Apr-17	5.25	5.75	
28-Jul-17	5.39	6.00	
30-Oct-17	4.17	5.00	
05-Jan-18	4.06	4.20	N
02-Feb-18	4.40	4.85	
27-Apr-18	4.95	4.80	
27-Jul-18	4.70	4.75	
19-Sep-18	4.67	5.60	O
26-Oct-18	4.86	5.65	
19-Dec-18	5.13	6.25	
01-Feb-19	5.40	6.20	
26-Apr-19	4.77	5.40	
26-Jul-19	5.07	5.70	

* Asterisk signifies initiation or assumption of coverage.



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Outperform (O) : The stock's total return is expected to outperform the relevant benchmark* over the next 12 months.

Neutral (N) : The stock's total return is expected to be in line with the relevant benchmark* over the next 12 months.

Underperform (U) : The stock's total return is expected to underperform the relevant benchmark* over the next 12 months.

*Relevant benchmark by region: As of 10th December 2012, Japanese ratings are based on a stock's total return relative to the analyst's coverage universe which consists of all companies covered by the analyst within the relevant sector, with Outperforms representing the most attractive, Neutrals the less attractive, and Underperforms the least attractive investment opportunities. As of 2nd October 2012, U.S. and Canadian as well as European ratings are based on a stock's total return relative to the analyst's coverage universe which consists of all companies covered by the analyst within the relevant sector, with Outperforms representing the most attractive, Neutrals the less attractive, and Underperforms the least attractive investment opportunities. For Latin American and Asia stocks (excluding Japan and Australia), ratings are based on a stock's total return relative to the average total return of the relevant country or regional benchmark (India - S&P BSE Sensex Index); prior to 2nd October 2012 U.S. and Canadian ratings were based on (1) a stock's absolute total return potential to its current share price and (2) the relative attractiveness of a stock's total return potential within an analyst's coverage universe. For Australian and New Zealand stocks, the expected total return (ETR) calculation includes 12-month rolling dividend yield. An Outperform rating is assigned where an ETR is greater than or equal to 7.5%; Underperform where an ETR less than or equal to 5%. A Neutral may be assigned where the ETR is between -5% and 15%. The overlapping rating range allows analysts to assign a rating that puts ETR in the context of associated risks. Prior to 18 May 2015, ETR ranges for Outperform and Underperform ratings did not overlap with Neutral thresholds between 15% and 7.5%, which was in operation from 7 July 2011.

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Restricted	2%	

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Target Price and Rating

Valuation Methodology and Risks: (12 months) for Ericsson (ERIC.OQ)

Method: Our TP of SKr107 (\$11.4) and Outperform rating is based on the assumption that ongoing cost cutting plan can potentially drive EBIT margins (excl restructuring) of 12.5% by 2020 driving EPS of SKr5.6. Based on average of 1.4x EV/sales and 17.0x P/E on 2020 estimates and adding back current net cash would imply TP of SKr107. Given potential upside from current levels, we rate shares as Outperform.

Risk: Risks to our TP of SKr107 (\$11.4) and Outperform rating for Ericsson include i) lower levels of capex spending in Ericsson's key markets such as US, Europe and China, ii) FX headwinds (weak USD vs. SEK), and iii) worse pricing environment in the industry. Given Ericsson's business is highly linked to wireless capex spending environment, any deterioration in spending trends at telecom operators or material move in FX (weak USD vs. SEK) could negatively impact overall valuation and impact our PT and/or rating.

Target Price and Rating

Valuation Methodology and Risks: (12 months) for Ericsson (ERICb.ST)

Method: Our TP of SKr107 (\$11.4) and Outperform rating is based on the assumption that ongoing cost cutting plan can potentially drive EBIT margins (excl restructuring) of 12.5% by 2020 driving EPS of SKr5.6. Based on average of 1.4x EV/sales and 17.0x P/E on 2020

estimates and adding back current net cash would imply TP of SKr107. Given potential upside from current levels, we rate shares as Outperform.

Risk: Risks to our TP of SKr107 (\$11.4) and Outperform rating for Ericsson include i) lower levels of capex spending in Ericsson's key markets such as US, Europe and China, ii) FX headwinds (weak USD vs. SEK), and iii) worse pricing environment in the industry. Given Ericsson's business is highly linked to wireless capex spending environment, any deterioration in spending trends at telecom operators or material move in FX (weak USD vs. SEK) could negatively impact overall valuation and impact our PT and/or rating.

Target Price and Rating

Valuation Methodology and Risks: (12 months) for Nokia (NOK.N)

Method: Our TP of €5.70 (or \$6.38) is based on average of 1.35x EV/Sales and 15.0x P/E on our 2020 EPS of about €0.35, adjusted for net cash. We rate the stock Outperform as we see Nokia benefiting from teclo capex returning back to growth driven by 4G upgrades and initial 5G projects.

Risk: Key risks to our €5.70 (or \$6.38) TP and Outperform rating for Nokia include i) challenging environment for networks business resulting in decline in top-line and margin levels, ii) slowdown in licensing activities, and iii) pricing pressure in the industry.

Target Price and Rating

Valuation Methodology and Risks: (12 months) for Nokia (NOKIA.HE)

Method: Our TP of €5.70 (or \$6.38) is based on average of 1.35x EV/Sales and 15.0x P/E on our 2020 EPS of about €0.35, adjusted for net cash. We rate the stock Outperform as we see Nokia benefiting from teclo capex returning back to growth driven by 4G upgrades and initial 5G projects.

Risk: Key risks to our €5.70 (or \$6.38) TP and Outperform rating for Nokia include i) challenging environment for networks business resulting in decline in top-line and margin levels, ii) slowdown in licensing activities, and iii) pricing pressure in the industry.

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This research report is authored by:

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