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2019 Activity Report

of the Federal Communications Commission (ComCom)

Federal Communications Commission (ComCom)

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Contents

Editorial

5G: Making the most of our sound starting position

In February 2019, ComCom auctioned off an extensive bundle of mobile frequencies, creating the licence conditions for the development of 5G mobile radio networks in Switzerland. This makes Switzerland one of the first countries to facilitate the deployment of 5G technology. There are, however, various factors that are hindering an expansion of the network: First, planning permission and operating licences for new mobile communication antennas are currently being granted only hesitantly or not at all in some cantons. Second, the competent authorities and mobile phone operators are still awaiting the definitive recommendations of the Federal Office for the Environment on how to measure the radiation immissions of the new adaptive antennas. The reticence of the licensing authorities can be explained by the fact that claims are still circulating in the public realm that it has yet to be established beyond doubt whether the use of the mobile frequencies allocated in 2019 is safe for human and animal health. Those same misgivings, although unfounded according to the state of knowledge, are also hindering the increase in the strict radiation limits necessary for the expansion of the networks and the maintenance of transmission quality.

While amending the radiation limits does not fall within ComCom's competences, it nonetheless considers itself to have an obligation to ensure that the frequencies it has allocated at considerable cost can actually be utilised to provide the Swiss population and economy with high-quality telecommunications services. ComCom has therefore played an active role in the work of the "Mobile radio and radiation" working group established by DETEC and has submitted its own proposal, which envisages making optimal use of existing antenna installations and increasing the radiation limits moderately, thus largely removing the need to construct new antenna masts. ComCom is strongly committed to ensuring that the legislative and administrative decision-making processes are not paralysed by vague fears and motley protests against technical progress and that our country does not throw away its leading position in the development of mobile radio infrastructure. Switzerland should see 5G as a tremendous opportunity rather than as a threat. This can only be achieved by informing the public and disseminating facts, not through silence and waiting. Both politicians and companies have a responsibility in this regard.

At last year's ITU World Radio Conference, the international community agreed on additional frequencies that could be used for mobile communications in the future, such as the 26 GHz range. These "millimetre bands" are already being employed for mobile communications in several countries, including the USA and Japan. Whether and when these bands will be put to use in Switzerland remains unclear. The EU has instructed its member states to allocate the 26 GHz frequency band for mobile communications in the course of 2020. Whether this goal is realistic remains to be seen, but this band is not expected to be allocated in Switzerland this year.

As part of its international contacts, ComCom is interested in the limited local allocation of mobile frequencies to companies, agricultural enterprises and research institutions, as is currently being undertaken in Germany. Such campus networks are operated by the institutions themselves and are used primarily to network machines and apparatus (Internet of Things) in a secure environment, which users hope will reduce the risk of unauthorised third parties gaining access to confidential data.

Internationally, Switzerland continues to occupy a leading position when it comes to nationwide coverage of the country with high-quality mobile phone services, although the prices for such services remain comparatively high. Switzerland remains a global leader in the provision of broadband Internet connections. From a technical perspective, Switzerland's position is primarily due to high-performance CATV networks and the increased performance of existing copper connections thanks to additional technologies such as vectoring and G.fast. On the other hand, only a third of Swiss households are directly connected by a fibre-optic connection ("Fibre to the

Home"). As we know, Parliament rejected the Federal Council's proposal to introduce technology-neutral regulation of the network infrastructure, which was also supported by ComCom. In particular, this means that regulation of access to fibre-optic networks will continue to be excluded from regulation also in the future. The Federal Council had hoped that this would stimulate competition over the last mile. Last but not least, an attractive range of high-speed broadband services on CATV networks has now prompted Swisscom to push ahead with the expansion of fibre-optic connections to homes with renewed vigour.

The security of communication networks continued to be the subject of intense discussions last year. One of the main issues is ensuring the security of transmitted data and preventing access by unauthorised third parties, while another is securing the infrastructure against operational malfunctions and manipulation. ComCom is not able to influence which suppliers and equipment are selected by the telecommunications services providers and whether technical installations and their operation are outsourced to third companies. Telecommunications service providers are responsible to their customers for the secure operation of their networks. ComCom supports the elaboration and application of security criteria (such as the EU "tool box") that have to be applied by telecommunications service providers when selecting their suppliers.

ComCom has followed with interest the efforts of the telecommunications provider Sunrise to take over the cable network operator UPC (formerly Cablecom). The merger, which would have been welcomed from the competition policy perspective and which the Swiss Competition Commission (COMCO) saw no reason to object to, ultimately collapsed due to opposition from Sunrise shareholders. The failure to complete the takeover resulted in personnel shakeups at the management level of both companies. ComCom has, of course, no influence over entrepreneurial decisions. Nonetheless, ComCom would have welcomed the merger because it could have strengthened competition in the telecoms market.

Pursuant to the amended Telecommunications Act (TCA), ComCom is responsible for the international relations aspects of telecommunications. In the first instance, international cooperation in Europe takes place in the form of membership of the Association of European Regulators (IRG). IRG considers itself to be first and foremost a think tank and a network for training and exchanging experiences among regulatory authorities. The EU member states' regulators meet under the auspices of the Body of European Regulators for Electronic Communications (BEREC), which assists in the implementation of EU legislation in the member states and also performs market analyses and recommends activities to the national regulatory authorities. ComCom's participation in the BEREC working groups and plenary meetings was suspended at the beginning of 2019 as a consequence of the discussions on the institutional framework agreement between Switzerland and the EU. Since then, however, a workaround to revive the important international cooperation with the authorities of the EU member states has been found within the framework of BEREC. In addition, ComCom and OFCOM also maintain contacts with various non-European regulatory authorities to benefit from their experience and observations in the further development of telecom services in Switzerland.

Stephan Netzle, President
March 2020

I. An overview of the telecoms market

When compiling its statistical data, ComCom is largely reliant on the figures published by the major telecommunications providers. In certain cases, it also uses data published by the OECD, the EU, professional bodies and specialised research institutes (Gartner, IDC, etc.). It also uses OFCOM data, which is also based on data from Swiss telecommunications service providers or on OFCOM's own analyses[1]. Further information on the latest developments in the Swiss fixed network and mobile telephony market can be found on ComCom's website under the heading "Facts and figures".

1. Development of mobile networks

The mobile communications market has now reached saturation point and the number of mobile customers fell again in 2019 by a just under 1% to a little over 11,235,000 units.

At the end of 2019 Swisscom had 6,333,000 mobile customers in Switzerland, which was slightly fewer than in the previous year (-0.6%). An increase of 95,000 customers with contracts (postpaid offers) contrasted with a loss of 132,000 prepaid customers. Sunrise, on the other hand, recorded an increase of approximately 0.9% and had 2,821,000 mobile customers at the end of the year. The decline in the number of customers in the prepaid segment (-138,000) was more than offset by the considerable growth in the postpaid segment (+162,000 units). Salt gained some 14,000 new contract customers, but at the same time lost 89,000 in the prepaid segment. Salt's total number of mobile customers fell in the year under review to 1,808,000 (-4%). At the end of 2019 Swisscom's market share was approximately 56.5%, Sunrise had a share of 25% and Salt 16%.

The cable network operators had a total of 275,000 mobile customers at the end of 2019, with UPC (201,000) and Quickline (56,000) accounting for over 93% of this figure. In the longer term, the cable network operators have the potential to become serious competitors in this market. CATV operators had a market share of just under 2.5% at the end of 2019.

With approximately 11.2 million connections for a total population of 8.59 million, mobile penetration in Switzerland was just under 131% at the end of 2019.

Development of the smartphone market

According to the latest Ericsson Mobility Report of November 2019, there were approximately 8 billion mobile connections worldwide in the third quarter of 2019 (up 3% on the same quarter of the previous year). Smartphones account for around 70% of all mobile connections. At the end of 2019, 5.6 billion smartphones were in use worldwide, a figure that is expected to rise to 7.4 billion by 2025.

Following on from several years of steep rises, global smartphone sales are expected to have fallen for the third consecutive year in 2019. According to the latest figures from the International Data Corporation (IDC) from January 2020, 1.37 billion smartphones were sold worldwide in the year under review, 2.3% less than in 2018 (1.41 billion). Sales were thus down on the levels seen in 2015 to 2018.

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[1] All sources used are detailed in the source list at the end of the report.

In this context, it is noteworthy that there is an increasing consumer demand for second-hand equipment: In 2019 almost 207 million used smartphones were sold worldwide, 17.6% more than in the previous year. According to IDC, reconditioned second-hand devices are a worthwhile alternative for many consumers. Sales are expected to rise to 332.9 million units by 2023, representing an annual growth rate of 13.6% between 2018 and 2023. The total revenue from sales is expected to reach USD 67 billion in 2023.

Several organisations had been expecting a resumption in growth in the smartphone market, notably due to the launch of 5G networks in many countries and the introduction of 5G-enabled devices in 2020, but the crisis caused by the COVID-19 pandemic is likely to delay this anticipated recovery considerably. IDC now estimates that just over 1.3 billion smartphones will be sold worldwide in 2020, a decrease of 2.3% from the previous year. The downward trend in smartphone sales is likely to continue for at least the first half of 2020. Global smartphone sales are expected to rise again in 2021, driven in particular by the increasing penetration of 5G.

Growth in mobile data traffic

The proliferation of smartphones has not only changed the way we communicate, it has also radically altered our everyday lives. Users are online virtually around the clock and are consuming ever increasing amounts of data, particularly in the form of videos. This is leading to an enormous increase in data traffic on the mobile networks.

Because of this development, data traffic on mobile networks in Switzerland continued to increase in 2019. On Swisscom's network, for example, it has grown 40-fold over the last seven years, while Sunrise's figures show a doubling of data traffic every 16 months.

According to the latest Ericsson Mobility Report, which was updated in February 2020, data traffic on mobile networks worldwide increased by 49% between the end of 2018 and the end of 2019 and is now estimated at 40 exabytes per month (40 billion billion bytes). The reason for this is on the one hand the increasing number of mobile phone contracts associated with smartphones and on the other hand the increase in the volume of data included in these contracts, due mainly to the increasing consumption of video content. According to Ericsson, video already accounted for 63% of mobile data traffic in 2019 and could rise to almost 76% by 2025, which would correspond to a worldwide annual increase of almost 30%.

This growth is driven in particular by the increasing popularity of embedded videos in numerous online applications, by the expansion in the use of video streaming services (VoD), which is reflected both in rising subscriber numbers and longer viewing times, and by ever higher resolutions on smartphone displays.

Moreover, according to Ericsson, the number of broadband mobile phone contracts increased by approximately 10% in one year, reaching 6.27 billion units in September 2019, or 77% of all mobile phone contracts. This figure included some 4.2 billion LTE contracts, representing 52% of all mobile phone contracts. LTE established itself as the most important access technology in 2018 and is likely to remain so until the migration of LTE contracts to 5G is completed at the end of 2025.

Investments

Telecommunications service providers are making substantial investments in their network infrastructures in order to be able to cope with the enormous growth in mobile data traffic.

The network operators spent CHF 380 million acquiring new mobile frequencies in the auction conducted by ComCom at the beginning of 2019, with Swisscom spending CHF 196 million on

this additional frequency allocation. In the year under review, the historic provider invested a further CHF 266 million in the expansion of its mobile network. Although 14% down on 2018, it is a similar amount to that spent in previous years (CHF 231 million in 2016 and CHF 269 million in 2017) and represents 17% of the total amount of CHF 1.565 billion that Swisscom invested in Switzerland in 2019.

In 2019 Sunrise spent CHF 89 million acquiring new frequencies and made further investments totalling CHF 370 million, spending CHF 185 million on fixed and mobile communications infrastructure alone (+17% year-on-year). Finally, Salt invested slightly more in Switzerland in 2019, spending over CHF 268 million on expanding its mobile and fibre-optic network infrastructure. This sum includes more than CHF 94 million to acquire new mobile frequencies.

Network quality

At the beginning of December 2019 the independent German specialist periodical Connect published a test comparing the mobile networks in Germany, Austria and Switzerland. The test confirmed that the quality of all the Swiss mobile phone networks continued to be outstanding, as has been the case for many years. Swisscom again managed a slight improvement and kept its first place, followed by Sunrise just a few points behind. Both Swisscom and Sunrise were again rated as "outstanding", a ranking that is rarely awarded, while Salt was ranked fifth, behind Austria's T-Mobile and A1. Salt's network was rated as "very good". Over the past two years, Salt has managed to continue to improve, both in terms of data and voice connections. In voice traffic in particular, Salt managed to narrow the gap on its powerful competitors thanks to the introduction of VoLTE at the start of the year. Furthermore, all three mobile providers stood out from the competition due to the high stability and quality of their networks.

According to the Connect study, mobile phone coverage on the move is also excellent in Switzerland. This is particularly the case in trains, where coverage is considerably better than in Austria and even more so when compared with Germany. The improvement of mobile provision for travellers across the entire network is a priority for SBB Swiss Railways.

The InTrainCom consortium, an alliance of mobile phone operators and SBB, has already equipped all long-distance trains with the latest generation (3G/4G) repeaters for receiving mobile phone signals. Some 75% of carriages in the regional transport fleet should be equipped with the technology by 2020 and the process should be fully completed by 2024. By the end of 2018, 4G coverage in passenger trains had exceeded 97%. Mobile operators are also improving network coverage by erecting new antennas along rail corridors. From 2022, continuous 4G reception will be guaranteed in all tunnels in Switzerland.

Mobile phone coverage in Switzerland is almost complete.

GSM networks (2G), which were primarily designed for voice telephony and exchanging small amounts of data (SMS texts, e-mail), are more and more being replaced by newer technologies. The vast majority of mobile phone calls are being made over 3G and 4G networks, and 2G now accounts for less than 1% of all traffic.

UMTS/HSPA services (3G), which enable mobile Internet access at a speed of 42 Mbps, are accessible by up to 99% of the Swiss population, depending on the operator. These services are likely to continue to be offered in parallel with the latest generation technologies (4G and 5G) for some years to come.

According to the three Swiss providers Salt, Sunrise and Swisscom, LTE (4G) coverage has reached at least 99% of the population at the end of 2019. All operators report also high network coverage of LTE-A technology (4G+): Swisscom reports that 96% now have access to speeds of up to 300 Mbps and 72% have maximum speeds of 500 Mbps.

Following their acquisition of additional frequencies at the beginning of 2019, the providers began to roll out their 5G mobile networks. Swisscom began to market its 5G network on 17 April 2019, with the aim of extending it to 90% of the population by the end of 2019. Sunrise launched its 5G offering on 4 April 2019 and had extended it to more than 384 cities, towns and communities by December 2019, with the aim of covering 80% of the local population.

The new 5G technology is a further development of 4G. Furthermore, 5G today also utilises frequencies that are very similar to those employed in previous generations of mobile communications and is subject to the same radiation limits.

Compared to 4G, 5G offers data transmission speeds that are up to 100 times faster (1 Gbps and above) and significantly shorter latency. It also permits the transfer of much larger amounts of data and allows many more devices to be operated in parallel (up to one million objects per km^2). 5G is also more efficient in terms of frequency use and energy consumption.

The new technology is of paramount importance for the future of Switzerland, as it makes many new types of applications possible, such as the networking of large numbers of devices and sensors (Internet of Things, IoT), time-critical, reliable remote control (e.g. telemedicine or Industry 4.0) and self-propelled vehicles, that are capable of processing large amounts of data. In future 5G will also play a key role in managing an economy that conserves resources and energy.

4G/LTE technology continued its rapid global expansion in the year under review. The figures compiled by the GSA (Global mobile Suppliers Association) show that there were 4.98 billion LTE/4G customers with contracts around the world in the autumn of 2019, accounting for over 55% of all mobile phone contracts worldwide. According to the GSA, no mobile communications technology has yet established itself as quickly as LTE.

The GSMA (the GSM Association) states that LTE/4G overtook 2G all over the world and become the dominant mobile technology in 2018. More than half of all mobile phone calls and connections (52%) around the world were made using this standard in 2019, a figure that is expected to rise to 56% by 2025. At the same time, 5G is also finding its way into the mainstream, with the launch of the first commercial offerings in numerous countries, Switzerland included. According to GSMA estimates, the number of 5G mobile connections is expected to increase to 1.8 billion units by 2025, which would represent 20% of all mobile connections. This share could grow to a little under 35% in Europe, 48% in North America and to as much as 50% in the developed economies of Asia.

Data transfer rates

Mobile phone users in Switzerland benefit from high data transfer rates.

Switzerland is one of the leading countries in this regard, with average transfer rates of 30 Mbps on the LTE/4G networks. This is the conclusion of the Report on the Digital Economy and Society Index (DESI) on the digitisation of the economy and society published by the European Commission in May 2018. Switzerland is therefore ranked above the European average (26 Mbps). In Europe, average transfer rates range from 20 to 42 Mbps, which is significantly higher than in the USA or Russia (16 Mbps).

The Mobile Network Experience Report for Switzerland, published in December 2019 and produced using the Opensignal network monitoring app, shows that Swiss providers have made further progress in recent months. To be clear, Opensignal measures the real experience of users when accessing their operator's network and makes no claims about geographical network coverage.

When it comes to the availability of 4G networks, Swisscom and Sunrise come in at over 93% and Salt at almost 90%. Opensignal further specifies that users have access to a 4G network on an average of 85% of all cases, regardless of geographical region or topography.

The operators have also improved the capacity of their networks, allowing users to benefit from ever higher speeds. Swisscom is the first provider to achieve average transfer speeds of slightly under 50 Mbps, 9 Mbps more than indicated in the measurements in June 2019, while Sunrise and Salt offer average transfer speeds of 36.5 and 34 Mbps respectively. While significantly less than Swisscom's rates, these are 3 Mbps more than in June 2019.

The continuing disparity between these values and the theoretical transfer speeds touted by the operators shows that the networks are coming up against their capacity limits as a result of the growing number of users and the ever-larger volumes of data being transferred. Thanks to the rapid expansion of 5G networks in Switzerland, operators should soon be able to offer their customers even higher transfer rates.

Prices of mobile communications

Following a tangible fall in mobile communications prices in 2018, 2019 saw a further drop in prices for all customer types. The prices of the cheapest offers from the three largest Swiss service providers fell by an average of 7.8% for customers with high usage requirements, by 8.4% for those with medium usage requirements and by 5.5% for the low-usage customer segment. A differentiation must, however, be made according to market segment (contract or prepaid).

According to OFCOM's statistics, only customers with contracts benefited from falling prices. In this segment, prices for those whose usage requirements were low fell by 6.9%, for customers with medium usage requirements by 13.1% and for those with high usage requirements by 18.5%. Prices in the prepaid market remained stable in 2019.

According to OFCOM, these significant price reductions are due to the launch of cheaper contract products that are better adapted to the actual amount of data the customer requires. This is particularly the case for Swisscom and Salt.

Compared with the other OECD countries, mobile telephony prices in Switzerland continue to be among the highest.

This is confirmed by the Teligen price baskets published by the market research company Strategy Analytics, which are based on OECD methods and which take into account the most competitive products offered by the largest operators in each country. These include products and options from both the prepaid and contract segments. The price basket for Switzerland includes only the products of the three operators Salt, Sunrise and Swisscom. For an average basket of voice and data connections, a medium user (100 calls and 500 MB of data) in Switzerland still paid EUR 19 more per month than the OECD-wide average (EUR 36 versus EUR 17, as at August 2019). The difference is less pronounced for high users (900 calls and 2 GB of data), but in Switzerland they still paid EUR 11 more per month than the average for OECD countries (EUR 36 versus EUR 25).

2. Development of fixed networks

Switzerland has several backbone networks as well as high-quality access networks in the fixed-network sector. Swisscom's access network is available nationwide. The well-developed cable television networks (CATV) – in particular the UPC and Quickline networks – also offer fixed-network connections in much of the country. In addition, there is also a large number of small cable network operators offering broadband and telephone services in geographically limited areas. Approximately 80% of Swiss households have a CATV network connection.

A look at the market shares in the fixed-line market shows clearly that the cable network operators have helped shape the development of fixed-line telephony in recent years. According to OFCOM statistics, Swisscom's market share, which was for a long time over 60%, continued to decline and amounted to 52.8% at the end of 2018. Nonetheless, the historic provider remains far ahead of its two main competitors, UPC and Sunrise, which held market shares of 16.1% and 13.9% respectively at the end of 2018. Swisscom's market share has shrunk by 15 percentage points over the past ten years (from 68.2% to 52.8%), while UPC's market share has doubled from 7.6% to 16.1% during the same period. Some smaller cable network operators have also achieved significant expansion over the past ten years, despite having only relatively modest market shares – with the exception of Finecom/Quickline, which claimed a 3.5% share at the end of 2018.

Meanwhile, the downward trend in the number of fixed-network telephone connections in Switzerland continues as a result of the continued boom in mobile telephony. The figures available for 2019 show that most providers have lost subscribers. In the course of 2019, the cable network operators lost around 9,000 customers, with UPC losing 14,000. Sunrise gained 34,000 new customers in the year under review. By way of contrast, Swisscom lost 194,000 fixed-network connections between 2018 and 2019, a decrease of almost 11%. At the end of 2019, Swisscom had a total of 1,594,000 active fixed-network connections.

The gradual transition to IP telephony, as well as the growth of cable network operators in this area and the increase in the number of fibre-optic connections show that the fixed network in Switzerland is still very significant and indicate that fixed network and mobile telephony will complement each other in the future.

Voice telephony via Internet (VoIP) firmly established

Fixed-network telephone services using VoIP technology have been available from alternative providers of telecommunications services and cable network operators for the past ten years. The replacement of analogue by IP telephony (telephony via Internet protocol) is also promoting the advance of VoIP.

According to OFCOM's statistics, the number of customers who make telephone calls via the fixed network using a VoIP connection from a telecommunication services provider (DSL, cable, etc.) has increased more than sevenfold over the last ten years and exceeded the 3 million mark by the end of 2018 (3,130,209). More than 9 out of 10 fixed-network subscribers now make calls via a VoIP connection.

Migration of analogue telephony to IP

In spring 2014 Swisscom announced that it would convert all fixed-network connections to digital IP telephony over the coming years and phase out outdated analogue telephony and ISDN telephony, which dates from the 1980s. The gradual migration from traditional fixed-line telephony to IP technology is a global trend. Almost all data (music, images, videos and voice

communications) is now transmitted digitally via IP-based networks. Unlike analogue, IP telephony does not supply power to devices via the subscriber line, but instead offers a variety of advantages, including lower costs and better speech quality.

It will still be possible to use most telephones after the migration, with the exception of telephones with rotary dials.

By the end of 2017, Swisscom had already migrated approximately 90% of its private customers to All-IP. In 2018 the company increased its focus on its business customers, 99.8% of whom had already migrated by the end of 2019. The transition to IP telephony is therefore largely complete and should be concluded by the end of the first quarter of 2020.

3. Broadband market on the fixed network

Switzerland has a high-performance broadband infrastructure. The economy as a whole benefits from competition between different infrastructures and services as it gives consumers a wider range of products and services to choose from.

Penetration rates

At the end of June 2019 more than 46.1% of the Swiss population had a broadband Internet connection. Switzerland therefore consolidated its top-ranking position in an OECD-wide comparison. It remains ahead of France (43.7%), Denmark (43.4%) and the Netherlands (43.1%). The average for the OECD countries is 31.4%, while that of EU countries is 34.7% (July 2018).

Switzerland is not, however, currently a world leader in terms of fibre-optic connections to homes (FTTH); approximately 30% of Swiss households have a FTTH connection, but according to an IDATE study for 2018, the uptake in Swiss households is only around 8%. According to IDATE, the penetration rate in the European Union in September 2018 was 13.9%.

Data transfer rates

By international standards, Switzerland remains one of the best networked countries, with both a high broadband penetration rate and ever higher data transfer rates for its users. The performance measurements carried out by Measurement Lab (M-Lab) between May 2018 and May 2019 on the broadband networks of 207 countries, the results of which were published by Cable.co.uk at the beginning of July 2019, show that Switzerland ranked 9th with an average transfer rate of just under 40 Mbps. Switzerland had thus moved up two places compared with its previous ranking. The top positions were held by Taiwan and Singapore, whose average transfer rates are 85 and 70 Mbps respectively, followed by Jersey, Sweden and Denmark with average speeds of between 49 and 67 Mbps. The average transfer rate worldwide is approximately 11 Mbps. Compared to the previous measurement period, the average transfer rate in Switzerland had increased by 10 Mbps, an increase of almost 30%.

Prices

OFCOM's statistical data showed that the increase in transfer rates in 2019 was accompanied by slightly higher prices for two user profiles. The prices paid for broadband services by

customers with low and medium usage requirements increased by 2.5% and 1.2% respectively between 2018 and 2019. Those with high usage requirements saw a reduction of 7.2%, which was largely down to UPC launching a more cost-effective product for this user profile. Compared by transfer speed, the products offered by the cable operators are generally cheaper. OFCOM also noted that the average transfer rate of the medium-use products examined was 61 Mbps (compared with 44 Mbps in 2018) and that all providers now offered products with downstream transfer rates of at least 100 Mbps, with some even offering transfer rates of up to 1 Gbps and above.

An international comparison of prices for broadband services shows that these are still considerably more expensive in Switzerland than the OECD-wide average. According to the Teligen price baskets published by Strategy Analytics, which take into account only Swisscom, Sunrise, UPC and Quickline for Switzerland, the cheapest product offers a transfer rate of at least 100 Mbps for EUR 45 per month for medium usage.

A user in Switzerland paid the equivalent of EUR 45 for an average basket with 60 GB of data and a transfer rate of at least 25 Mbps in September 2019 (compared to the OECD-wide average of approximately EUR 25). A basket with 120 GB and a transfer rate of at least 100 Mbps costs only slightly more in the OECD at EUR 30, whereas in Switzerland the cost equates to EUR 45.

Structure of the broadband market

DSL/FTTx providers are still way ahead of the cable network operators when it comes to Internet access. At the end of 2019, just over 71% of users were connected via a telecoms operator (2,838,000 connections), while 29% were connected via a cable operator (1,157,000 connections).

Looking at broadband providers as a whole (CATV, DSL and FTTx), Swisscom remains far ahead of its closest competitors with a market share of 50.9% at the end of 2019.

The alternative telecoms providers had a combined market share of 20.2% at the end of 2019, with Sunrise accounting for 12.4%. As far as the cable network operators are concerned, UPC has a market share of 16.5%, while the other CATV operators together account for 12.4%.

By way of comparison, the average market share of the historic providers in the EU countries is steadily declining and amounted to 39.7% in 2018.

The above figures for broadband connections in Switzerland include Swisscom subscribers who are supplied via a FTTH/B connection and hybrid fibre-optic and copper technologies (FTTC and FTTS), as well as customers of alternative providers who use the historic provider's network or a utility provider's infrastructure.

The number of fibre-optic connections (FTTH/B) is growing less rapidly than in previous years. With around four million connections, the broadband market is almost saturated. Growth in the fibre segment is primarily the result of DSL and CATV subscribers migrating to fibre-optic technology, with considerable number of users switching to fibre contracts in previous years. This trend has now declined somewhat. At the end of 2019, around 850,000 or just over 21% of all broadband subscribers in Switzerland were using a fibre-optic connection. Switzerland is therefore still somewhat behind by international standards, as the fibre penetration rate in the OECD countries had reached 27% at the end of 2019.

Unbundling

Unbundling local loops allows alternative providers to offer their customers their own telecommunications services by leasing the copper subscriber lines from Swisscom and operating them themselves as far as the end customers.

After its introduction in 2007, unbundling initially led to a stimulation of competition in the market for DSL connections. There has been a decline in the number of unbundled lines for some years now: a peak was reached in mid-2012 with approximately 315,000 (just under 10% of all broadband lines), but only 70,000 remained by the end of 2019. Fully unbundled (full access) lines therefore now represent less than 2% of all broadband lines in Switzerland.

On the one hand, this is due to the offerings from cable network operators and the increasing use of fibre-optic connections, which is further intensify infrastructure competition, while on the other, the increasing interest of customers in bundled products for telephony, Internet and digital television is working against unbundling technology, since the latter does not allow high data transfer rates.

Development of ultra-broadband networks

As previously mentioned, Switzerland has for some years occupied a leading position in the provision of fixed-network broadband. Switzerland is, however, not currently a world leaders when it comes to fibre-optic connections, the technology of the future in the fixed network. Nonetheless, various players have continued to invest considerable sums in the expansion of the network for over ten years.

The drivers of these investments are the rapidly growing volume of data traffic and, looking ahead, the need to invest in a future-proof network. Infrastructure competition also works as an incentive. The municipalities and regions who are investing in fibre are mostly doing so as a way of making their locations more attractive to businesses.

The trajectory of technological development is clear: in both the telecoms and CATV networks, optical fibre, which has long been used in the core networks, is being brought ever closer to the end customers. The conventional copper or coaxial cables are either being replaced entirely by fibre (FTTH) or the fibres are being brought at least as far as a cabinet in the locality (FTTC), a manhole in the street (FTTS) or to the basements of buildings (FTTB).

For many years, Swisscom and local utility providers have worked together to construct FTTH networks in numerous cities and regions. The collaboration partners build a local FTTH network together that gives each of them at least one optical fibre to each household. In some locations, individual local authorities are also investing in their own FTTH.

Collaborations with local utility companies have brought fibre to around one million households (FTTH) and several such fibre networks have been completed to date. In 2019, for instance, the St. Gallen public utilities announced that after almost ten years of construction, its comprehensive fibre-optic network had been completed. Other networks, such as the one in Yverdon or those in the major cities of Basel (IWB) and Zurich (EWZ) have also been successfully set up. In Zurich, considerably more connections were achieved than originally planned. Other collaboration agreements are to be concluded in the near future, e.g. between Swisscom and AMB (Bellinzona) and EWB (Berne).

New projects are also being commenced in many areas: partners are collaborating on new projects (e.g. connecting the town of Kriens) and previous collaborations are being resumed (e.g. between ftth fr and Swisscom in the Canton of Fribourg).

Fibre-optic networks are being expanded not only in the large conurbations but also in many rural areas (e.g. in the Canton of Fribourg, the Upper Valais and the Lower Engadin). In addition, cantonal projects have been launched in Grisons and Ticino to promote the development of ultra-broadband (100 Mbps and above), particularly in peripheral areas. These cantons wish to assume an active role in provisioning to ensure that their peripheral regions remain competitive with Switzerland's urban areas.

In addition to these collaborations, Swisscom is also investing in the modernisation of the fixed network without partners in many locations. For some years, however, it has primarily been opting for a hybrid technology consisting of copper cable and fibre optics (FTTC, FTTS, FTTB), with the old copper cable continuing to be used on the last 50 to 200 metres to the socket in the household. This avoids the high costs of renewing this final section as far as the customer. This is possible because the complementary technologies of "vectoring" and "G.fast", which enable high bandwidths of 100 to 500 Mbps over short copper cables, were developed some years ago. However, this technology mix and "vectoring" have an adverse effect on the alternative service providers, in that unbundling the copper connection, which was only introduced in 2007 as an instrument to stimulate competition, is no longer competitive and is continuing to decline in significance *(cf. "Unbundling" above)*.

By the end of 2019, Swisscom was supplying 74% of homes and businesses with bandwidths of more than 80 Mbps, 47% with more than 200 Mbps and 29% with bandwidths of up to 1 Gbps. Swisscom's investment in fibre-optic expansion in 2019 amounted to CHF 494 million (+0.8%).

The investments will continue – Swisscom has long set itself the goal of modernising the fixed network in all municipalities in Switzerland by the end of 2021 to ensure that 90% of homes and businesses are supplied with at least 80 Mbps. In the meantime, Swisscom has turned again to investing in fibre to the home. The aim is that 50-60% of all homes and businesses should be connected to FTTH by the end of 2025.

Since the market was opened up 20 years ago, a key driver for the expansion of broadband networks has been the infrastructure competition between Swisscom and the numerous CATV operators, the latter of which have continuously invested in fibre expansion and in the DOCSIS 3.0 transmission standard for coaxial cables. Approximately 80% of Swiss households have a cable network connection and 95% of these have the option of being able to take up an ultra-broadband offer. Since 2016, a new technology – DOCSIS 3.1 – that enables even faster data transfer (1 Gbps and above), has been introduced in Switzerland. In September 2019, for example, UPC announced that it would offer transfer speeds of 1 Gbps throughout its entire distribution area with immediate effect.

The new player in the market, Swiss Fibre Net (SFN), has also been fostering the competition since 2013. SFN is a network consortium consisting of numerous energy suppliers that have constructed local fibre-optic networks. SFN consists of five shareholders – the utility providers of the cities of Bern, Lucerne and St. Gallen plus the network companies Danet (Upper Valais) and Didico (Meilen-Herrliberg). Fourteen 14 partner networks also belong to the consortium.

SFN offers service providers who do not have their own access network (e.g. Init7, 1tv, iWay.ch, GGA Maur, Salt, Sunrise and VTX) the opportunity to source uniform FTTH products throughout Switzerland for resale via a common platform.

In 2018 Sunrise renewed its cooperation with SFN and Salt has also entered into a partnership with SFN since it entered the fixed-line market in March 2018. Both have also announced that they will make upfront investments in the infrastructure of the SFN partners in return for long-term, non-retractable usage rights.

Not all local utility companies market their connections via SFN. Some offer telecom services to both business and retail customers (e.g. Industrielle Werke Basel), while others limit their

activities to operating their network and leave the provision of services to third parties (e.g. in the cities of Zurich and Geneva). In French-speaking Switzerland, several network operators market their connections via the company netplus.ch.

There is also a considerable divergence in pricing: Internet access with 1 Gbps download speed costs between CHF 50 and CHF 110 per month.

Digital television in Switzerland

The Swiss digital television market is characterised by intensifying competition and a rapidly expanding number of streaming platforms, as well as changes in consumer habits (time-shifted television, use of multiple and, in particular, mobile end devices, etc.). The cable network operators were able to maintain their leading position, but their core business continues to lose customers year on year. Their customer base contracted by more than 112,000 TV subscribers (-5%) to approximately 2.12 million units in 2019. The cable network operators' market share, which fell below the 60% mark for the first time in 2017, amounted to 53.6% at the end of 2019.

Although UPC managed to stem the massive outflow of customers it had experienced in recent years, it lost almost 71,000 subscribers from its digital television service (-6.6%) in the year under review. The largest cable network operator sees its market share decline to 25.6% at the end of 2019.

Quickline, an association of several cable network operators, also saw a slight decline in its TV customers of some 10,000 units year on year (-2.9%). With almost 339,000 TV customers at the end of 2019, Quickline's market share remained virtually unchanged at 8.6%.

In parallel, the telecoms providers were able to gain additional digital TV customers in 2019 and represent serious competition for cable network operators in this market segment.

Considering the telecom providers individually, Swisscom has been able to expand the leading position that it assumed from UPC in 2015, gaining 36,000 new customers in the year under review and posting moderate growth of 2.4% compared to 2018. The historic provider currently has 1.56 million digital TV subscribers and an increased market share of 39.3%.

Sunrise, which was the last to enter this market in 2012, recorded an increase in new customers over the same period of slightly over 35,000 or 14.6%, with an increased market share of 7.1%.

II. Commission and Secretariat

1. Commission

ComCom is an independent, extra-parliamentary commission tasked with licensing and market regulation in the telecommunications sector.

Under the Swiss Telecommunications Act, ComCom's main tasks are:

- Granting licences for the use of the radiocommunication frequencies (Art. 24a TCA),

- Awarding universal service licences (Art. 14 TCA),

- Laying down access prices and conditions when service providers fail to agree among themselves (Art. 11 and 11a TCA),

- Approving national numbering plans (Art. 28 TCA),

- Regulating the arrangements for number portability and carrier selection (Art. 28 TCA),

- Imposing measures and sanctions in the event of violations of the conditions of a licence granted by ComCom (Art. 58 TCA).

The Commission consists of seven independent experts appointed by the Federal Council.

In 2019 the Commission was composed of the following members:

- **Stephan Netzle, President,** Dr. iur., LL.M., Attorney

- **Adrienne Corboud Fumagalli, Deputy President,** Doctor of Economics and Social Sciences, Chairman of the Board of Directors of Deeption SA

- **Andreas Bühlmann**, Dr. rer. pol., Chief of the Office of Finance of the Canton of Solothurn

- **Jean-Pierre Hubaux**, Electrical Engineer, Professor at the Swiss Federal Institute of Technology in Lausanne

- **Christian Martin**, Electrical Engineer HTL, General Manager of Cisco Switzerland

- **Stephanie Teufel**, Professor of Management in Information and Communication Technology and Director of the international institute of management in technology (iimt) at the University of Fribourg

- **Flavia Verzasconi**, Lawyer and Notary, President of the Administrative Court of the Canton of Ticino

Having served for the maximum statutory term of office of 12 years, Jean-Pierre Hubaux resigned as a member of the Commission at the end of 2019. With his outstanding expertise in the field of telecommunications, Professor Hubaux has played a decisive role in shaping the work of the Commission. ComCom would like to take this opportunity to thank Jean-Pierre Hubaux for his enormous dedication.

On 29 November 2019, the Federal Council appointed Matthias Grossglauser to succeed Jean-Pierre Hubaux. Matthias Grossglauser is Associate Professor at the Faculty of Computer and Communication Sciences at the Swiss Federal Institute of Technology in Lausanne and Co-Director of the Information and Network Dynamics Laboratory. His current research topics are machine learning and data analysis for large social systems. Matthias Grossglauser had already made a name for himself as a telecommunications expert with his previous research work.

All the other members of ComCom were reappointed on 27 November 2019 as part of the appointment of extra-parliamentary bodies for the 2020-2023 term of office and reconfirmed in their respective offices.

The Commission met almost every month in 2019. However, its members also spent much time in preparing the meetings and in taking decisions by way of circulation. The Commissioners were able to learn about the latest developments in the field of information and communication technologies during a study trip to Sweden and Estonia in August 2019. The trip provided an opportunity to exchange views on the latest developments in fibre and 5G mobile networks with counterparts from other countries and representatives of the telecommunications industry.

When Estonia became independent in the 1990s, it was quick to identify the opportunities offered by digitising the country. Estonia introduced a self-developed digital infrastructure for official data (X-Road) in 2001, digital signatures and the eID card in 2002 and e-voting in 2005. ComCom therefore found it very instructive to obtain an overview of "eEstonia".

2. Secretariat

The Commission is assisted by a Secretariat, which is responsible for management and public relations. The Secretariat coordinates the Commission's activities with OFCOM, which prepares ComCom's business and generally implements its decisions.

The Secretariat consists of a secretary (90%), a scientific collaborator and webmaster (80%) and an administrative secretary (70%).

The **Members of the Secretariat** will be happy to provide you with any information you might require:

- Peter Baer, Secretary of the Commission

- Pierre Zinck, Scientific Collaborator and Webmaster

- Jacqueline Fischer Pulfer, Administrative Secretary

III. Activities of the Commission

The following sections provide an overview of ComCom's activities in 2019.

1. Access procedures

In order to promote competition in the telecoms market, the Telecommunications Act (Art. 11 TCA) specifies that market-dominant companies (such as the former monopolist Swisscom in certain areas of the market) must offer other providers access in various forms to the existing infrastructure or services. In areas where it has a market-dominant position, this access must be offered in a non-discriminatory manner and at cost-based prices.

The areas in which a market-dominant provider must grant access to infrastructure are definitively set out in the Act, in contrast, for instance, to the technology-neutral access regime in the EU. Specifically, the TCA currently specifies the following six forms of access (Art. 11):

1. Full unbundling of the local loop
2. Fast bitstream access (for a period of four years)
3. Charging for subscriber connections on the fixed network
4. Interconnection
5. Leased lines
6. Access to cable ducts, insofar as these have sufficient capacity.

Another feature of Swiss telecommunications legislation is the primacy of negotiation, which means that alternative providers must first negotiate the conditions of access to the infrastructure with the market-dominant provider. Only if these negotiations do not result in an agreement can a request be made to ComCom to determine the access conditions and prices. This procedure is known as *ex-post* regulation.

In all other respects access in the access network is limited to conventional copper technology. In Switzerland, connections based on fibre or coaxial cable are currently not subject to any access obligation or regulation.

Amended TCA

Parliament adopted some amendments to the TCA on 22 March 2019. These amendments include a provision on net neutrality (new Art. 12e) and various improvements with regard to consumer protection. The introduction of regulatory instruments for fibre-optic lines in the access network was also discussed. However, Parliament decided against the option of regulating network access in a technology-neutral manner in the event of market dominance, a move which had been put forward by the Federal Council and supported by ComCom.

Parliament introduced only the following innovation in this area (Art. 3a TCA): The Federal Council shall be required to submit an evaluation report on developments within the telecoms market every three years and, where necessary, to request measures to promote competition.

There have been two small changes to ComCom's responsibilities relating to the introduction of the shared use of installations inside buildings (new Art. 35b) and the allocation of radio licences (Art. 24d).

Pending proceedings

At the end of 2019, a total of two access cases were pending with ComCom, but these are currently suspended. Five appeals against ComCom decisions from 2018 and 2019 were pending before the Federal Administrative Court (FAC) at the end of 2019.

1.1. Interconnection and other forms of access pursuant to Art. 11 TCA

At the end of 2019, two access cases were pending before ComCom in which the prices for various forms of access such as interconnection, unbundling, leased lines and access to cable ducts are to be determined.

These cases are particularly important as the following innovations are being included in the calculation of prices for the first time:

A) Fibre as a "Modern Equivalent Asset" (MEA)

- Pursuant to a ruling by the FAC (A-549/2014 of 18 January 2016), fibre-optic technology is the reference technology for the calculation of cost-based prices from the beginning of 2013 (see the 2016 Activity Report for more details).

- Conventional transmission technology and copper technology were applied as the established technology (MEA) for the purpose of defining regulated access prices until 2013, in order to derive the costs of a new, efficient telecoms network in the form of a model. However, a company constructing a new telecoms network now would use fibre-optic technology. Fibre was therefore used as the reference technology from 2013 onwards.

B) First application of new regulatory provisions

Regulatory provisions in the Ordinance on Telecommunications Services (TSO) introduced by the Federal Council in March 2014 are being applied for the first time in the current proceedings:

- **Unbundling of the copper local loop:** Since a modern network would now be constructed with fibre and would be much more efficient than the old copper network, the **difference in value between the old and the new technology** must be determined in order to calculate the regulated price of the unbundled copper access line. The Federal Council set out how this should be done in Art. 58 TSO.

- **Cable ducts:** In future, the price calculations for the use of cable ducts will no longer be based on model costs, but on the **actual costs for the long-term maintenance and development of cable ducts** (Art. 54a TSO). ComCom will take into account the actual expenditure of the telecommunications service provider concerned in its price calculations.

- **Glide path for the transition to fibre technology:** As far as interconnection and leased lines are concerned, the TSO (Articles 61 and 62) provides for a staggered transition to the fibre network as MEA over a period of three years.

The various innovations have led to an extensive and detailed exchange of correspondence and a very complex set of instructions. ComCom has therefore decided to issue a partial decision for each of the two cases for the years up to 2016 (see the media release dated 12 February 2019). The two ComCom decisions of February 2019 were each challenged before the Federal Administrative Court of Switzerland (FAC) by both parties to the case.

1.2. Interconnect peering

In Init7's access proceedings against Swisscom concerning free peering, ComCom rejected Init7's application in July 2018 (for more details see the 2018 Activity Report). Init7 appealed to the FAC against this decision in 2018. The FAC's ruling is pending.

2. Licences

In accordance with the Telecommunications Act (TCA), ComCom grants radio licences and awards the universal service licence.

ComCom has permanently delegated to OFCOM the granting of those radio licences which are not the subject of a public tender procedure (e.g. licences for amateur radio operators or private companies' radio networks) and which are wholly or primarily intended for the broadcasting of access-authorised radio and television programme services (Art. 1 ComCom ordinance; SR 784.101.112). Information concerning radio licences award by OFCOM can be found on the www.bakom.admin.ch website.

The following overview deals only with those licences awarded by ComCom itself.

2.1. Universal service

The universal service includes a basic range of telecom services which must be offered throughout the country to all sections of the population in good quality and at affordable price. These services are intended to enable the population in every part of Switzerland to participate in social and economic life. The universal service also includes special services that offer increased communication possibilities to those with disabilities.

The scope of the universal service is defined in the Telecommunications Act (Art. 16 TCA). The Federal Council periodically adapts the universal service to social and economic needs and to the state of technology.

It is ComCom's task to grant the universal service licence and, together with OFCOM, to ensure compliance with it. The universal service licence granted to Swisscom in May 2017 came into force on 1 January 2018 and runs until 31 December 2022.

Which services form part of the universal service?

The Federal Council amended the scope of the universal service licence in the Ordinance on Telecommunications Services (Art. 15 and 16 TSO) one year prior to the granting of the new universal service licence, which came into force at the beginning of 2018. Price ceilings were again also set for individual services (Art. 22 TSO).

Since 1 January 2018 the following services have been included in the universal service:

- A multifunctional broadband connection, based on the Internet Protocol (IP), replaces both the previous analogue and ISDN connections. Until the end of 2021, Swisscom must provide, free of charge, an interface for analogue and ISDN equipment at the network termination point to allow sufficient time for the replacement of the terminal equipment.

- The minimum download data speed for Internet access under the basic supply was 3000 kbps by the end of 2019. Following a motion (16.3336) submitted by National Councillor M. Candinas, which was adopted by Parliament in 2018, the Federal Council has raised this minimum speed to 10 Mbps (and 1 Mbps for uploads). This licence amendment will enter into force on 1 January 2020.
- Each household can request a second directory listing free of charge.
- Services for the disabled:
  - For the hearing impaired, a round-the-clock transcription service, which also covers emergency calls, and an SMS service. At certain times there is now also a sign language service via video telephony.
  - For the visually impaired and those with reduced mobility, there is a round-the-clock directory enquiries and operator service which ensures access to the directory data of customers of all providers, using the 1145 number.

Some services for which there are affordable alternatives thanks to technological developments or which in the view of the Federal Council are no longer essential for the population's ability to communicate have ceased to be included in the universal service since 2018 (e.g. fax connections, telephone kiosks in every municipality, bars on outgoing calls). Providers may, of course, continue to offer these services at market conditions.

In order to ensure the universal service, the Federal Council has laid down quality criteria for the services forming part of the universal service (Art. 21 TSO). Universal service licensees must report annually to OFCOM on how these criteria have been met. Swisscom once again met these quality criteria in full in 2019.

A historic side note: the end of the telephone kiosk

In November 2019, the last Swisscom telephone kiosk, which had formed part of the universal service, was dismantled and donated to the Museum of Communication in Bern.

When the telecom market was opened up in 1998, there were still some 10,000 public telephones that were subject to the universal service. At that time there was at least one telephone kiosk in each of Switzerland's communities. The rapid spread of mobile telephony led to a 95% decline in usage between 2004 and 2016. As maintaining kiosks was expensive, those that were barely used were gradually dismantled.

Following the Federal Council's decision to remove public telephones from the universal service as of 2018, the remaining kiosks, numbering almost 3,000, were removed. However, commercially operated public telephones can still be found in highly frequented locations.

2.2. Mobile radio licences

2012 frequency allocation

In February 2012, all mobile frequencies available at that time in Switzerland were awarded anew. All mobile frequencies in the 800 MHz, 900 MHz, 1800 MHz, 2100 MHz and 2600 MHz bands at that time were sold off at auction for approximately CHF 1 billion. The new licences were awarded in June 2012, with a term extending to 2028.

All three mobile network operators – Salt, Sunrise and Swisscom – acquired a wider range of frequency allocations in the 2012 auction, allowing them to quickly introduce 4G technology.

Thanks to massive investments by all three mobile operators, it was possible to roll out very good 4G coverage within a very few years (reaching at least 99% of the population).

The rapid increase in data traffic, combined with customers' high expectations of good service quality – throughout Switzerland, where possible – means that Swiss mobile network operators are early adopters of new technologies compared with other countries. It is why operators invest large sums of money every year to introduce more efficient network technology. This trend is also confirmed by the introduction of LTE Advanced (or 4G+) and 5G.

2019 frequency allocation

In November 2017, the Federal Council released various frequency bands for mobile radio use (see table below). After several consultations with interested parties and the mobile telephony operators, ComCom launched the invitation to tender for the allocation of these mobile frequencies at the beginning of July 2018 (further information on the history of the award procedure can be found in ComCom's 2017 and 2018 Activity Reports and at *www.comcom.admin.ch*). These frequencies were sold off at the auction in February 2019. In April 2019, ComCom granted the three existing mobile telephony operators one further technology-neutral licence each.

Consultations ahead of the tender procedure

The consultation conducted in summer 2017 showed that there was enormous interest in the new frequencies. The mobile operators and other participants pointed out that the strict limit values in the Ordinance relating to Protection against Non-Ionising Radiation (ONIR) could obstruct the introduction of the new 5G technology at existing sites. Environmental protection groups were for their part of the opinion that the allocation of new mobile frequencies should not result in an increase in exposure to non-ionising radiation.

In spring 2018, the interested companies were given the opportunity to comment on a specific ComCom proposal concerning the award procedure (including the auction rules and a specimen licence). Several companies submitted numerous proposals, some of which took very different approaches. ComCom examined all the proposals thoroughly. Before coming to a final decision on the tender procedure and the procedural rules, ComCom also consulted with the network operators and various network equipment providers.

Frequencies put out to tender in 2018

Frequency band	Frequencies to be awarded	Number of blocks	Uses and term of licence
700 MHz	**Frequency Division Duplex FDD:**- A: 703-733 MHz/758-788 MHz ⇨ 60 MHz **Supplemental downlink only:** - B: 738-753 MHz ⇨ 15 MHz	6 blocks of 2x5 MHz 3 blocks of 5 MHz	formerly: digital terrestrial television (DVB-T) in future: 4G, 5G Duration: 15 years from the award of the licence
1400 MHz	**Supplemental downlink only:** - C1: 1427-1452 MHz ⇨ 25 MHz - C2: 1452-1492 MHz ⇨ 40 MHz - C3 1492-1517 MHz ⇨ 25 MHz Total: 90 MHz	5 blocks of 5 MHz 8 blocks of 5 MHz 5 blocks of 5 MHz Total: 18 blocks of 5 MHz	formerly: digital broadcasting (DAB) in future: 4G, 5G Duration: 15 years
2600 MHz	**Frequency Division Duplex FDD:** - D: 2565-2570/2685-2690 MHz ⇨ 10 MHz FDD	1 block of 2x5 MHz	currently: 4G in future: 4G, 5G Duration: until the end of 2028
3500-3800 MHz	**Time Division Duplex TDD:** - E: 3500-3800 MHz ⇨ 300 MHz	15 blocks of 20 MHz	currently: wireless broadband connections (BWA), wireless cameras (PMSE), satellite services in future: 5G, satellite services Duration: 15 years

Tendering and auctioning

On 6 July 2018, ComCom launched the tender procedure for the award of all newly available mobile frequencies in the 700 MHz, 1400 MHz, 2600 MHz and 3500 MHz frequency bands by auction.

These frequencies are in a similar range to those used for years for mobile communications purposes in Switzerland (800 MHz, 900 MHz, 1800 MHz, 2100 MHz and 2600 MHz) and WLAN (2400 MHz and 5000 MHz). These are therefore frequencies whose properties we are familiar with and which have been in use around the world for many years:

The 700 MHz frequencies have long been used in mobile networks in the USA and the Asia-Pacific region, and for digital terrestrial television (DVB-T) around the world. The frequencies in the 3500-3800 MHz range are used worldwide for wireless broadband access (BWA and WiMAX) and also with wireless cameras and at sporting events. These 3500 MHz frequencies lie between the frequencies (2400 MHz and 5000 MHz), which are used everywhere in countless private WLANs.

None of these frequencies are what are colloquially called "millimetre waves", which are 24 GHz and above and are often the subject of criticism with regard to 5G. Such millimetre waves have not been allocated in Switzerland and can therefore not be used in conjunction with 5G.

ComCom chose a comparatively simple, two-stage auction format (what is known as a "clock auction") for the frequency award. This auction format makes it possible for bidders to bid simultaneously for multiple blocks in all the frequency bands to be awarded.

In accordance with legal requirements, the minimum prices for the frequency blocks were specified in such a way that the auction was guaranteed to produce adequate proceeds. Maximising the auction proceeds was not, however, the objective of the award.

ComCom employed bidding restrictions ("spectrum caps") to ensure that no bidder was able to buy up the majority of frequencies. All network operators therefore had a fair chance of acquiring a broad range of frequency allocations to meet their needs. New entrants to the market were also able to take part in the award procedure under the same conditions.

All interested parties had the opportunity to submit any questions concerning the procedure by 27 July 2018. The answers were published online by OFCOM in anonymised form on 5 September 2018.

By 5 October 2018, four companies, Dense Air, Salt, Sunrise and Swisscom had submitted applications, which involved applying for a desired amount of frequency allocation and providing a bank guarantee. As more frequency blocks were requested than were offered, ComCom decided to hold the auction at the beginning of 2019. All applicants fulfilled the conditions for participation and were allowed to participate in the auction process.

In January 2019, each applicant received training in the use of the auction software and a test auction was then conducted.

The auction itself took place from 29 January to 7 February 2019. The 29 bidding rounds were managed via an electronic auction system supplied by the British company DotEcon Ltd. This system had already been used successfully for a frequency award by ComCom in 2012 as well as in numerous other countries. The system is specially secured and offers a reliable Internet-based bidding process.

All four applicants took part in the auction. The existing mobile network operators were each able to acquire a broad range of additional frequencies; the fourth applicant, Dense Air, came away empty-handed (see table below). The total revenue generated by the auction amounted to almost CHF 380 million.

Five 5 MHz frequency blocks in the 700 MHz, 1400 MHz and 2600 MHz bands remained unsold. The Confederation will retain ownership of these non-assigned frequencies and can put them out to tender again at a later date.

Result of the mobile phone auction in January/February 2019

Frequency band	Dense Air Ltd.	Salt	Sunrise	Swisscom
700 MHz FDD	0	20 MHz	10 MHz	30 MHz
700 MHz SDL	0	0	10 MHz	0
1400 MHz SDL	0	10 MHz	15 MHz	50 MHz
2600 MHz TDD	0	0	0	0
3500-3800 GHz TDD	0	80 MHz	100 MHz	120 MHz
Adjudication price in CHF	**0**	**94,500,625**	**89,238,101**	**195,554,002**

Key:

FDD: Frequency Division Duplex => two radio channels are needed for a connection

TDD: Time Division Duplex => only one radio channel is needed for a connection

SDL: Supplemental Downlink => three radio channels are needed for one connection

Efficient frequency allocation thanks to auctioning

The licences with the newly acquired frequencies were awarded to Salt, Sunrise and Swisscom in April 2019. The licences came into effect in May 2019 and the operators paid the adjudication price to the federal treasury in good time.

The auction achieved both the goal of generating an appropriate amount of revenue pursuant to Art. 23 of the Ordinance on Frequency Management and Radiocommunication Licences (OFMRL) and also of efficient frequency distribution.

The early allocation of frequencies and a 15-year licence term for the frequencies allows the licensees to plan their investments in new technologies such as LTE-A and 5G over the long term.

2.3. "Mobile radio and radiation" working group

ComCom took part in the "Mobile radio and radiation" working group set up by DETEC in autumn 2018. Its mandate was to analyse the requirements and risks involved in establishing 5G networks and come up with recommendations.

Headed by the Federal Office for the Environment (FOEN), the working group published its report on 28 November 2019 (see the FOEN website for details: *www.bafu.admin.ch*). This report provides a broad overview of the research on the possible health effects of mobile phone radiation, discusses different options for the expansion of 5G and proposes important accompanying measures.

After 20 years of extensive research, it is clear that the end devices (rather than the antennas) are responsible for by far the largest proportion of mobile phone radiation and that there is no evidence of any impact on health if the radiation is kept below the immission limits.

Under the auspices of the "Mobile radio and radiation" working group, ComCom submitted a proposal for the introduction of the efficient, modern 5G mobile radio technology in Switzerland. This is of the utmost importance for Switzerland's future and for ensuring that our country remains a place of work and innovation in the face of global competition.

The concept underlying ComCom's proposal is an increase in the joint use of existing antenna sites. This is the only way to avoid having to erect thousands more new antennas to meet the rapidly growing customer demand for data. ComCom therefore firstly proposes that the installation limit values be applied to each user of an antenna installation rather than to the entire antenna installation as has been the case to date, and secondly, it supports a moderate increase in the installation limit values, which were set very restrictively and with no scientific basis 20 years ago *(see ComCom website for details of the proposal: www.comcom.admin.ch)*.

Although this could increase the field strength at sensitive locations, the radiation levels would remain well below the immission limits and the population would continue to be protected, in keeping with the precautionary principle.

2.4. New DAB frequency block for French-speaking Switzerland

In October 2017, the Federal Council decided that DAB+ (Digital Audio Broadcasting) should replace the analogue FM system as the main broadcasting technology for radio programmes from 2020. In collaboration with OFCOM, the radio industry itself is drawing up a timetable for the orderly switchover from FM to DAB+. The migration should be completed by 2024 at the latest.

On 20 December 2017, the Federal Department of the Environment, Transport, Energy and Communications (DETEC) released three additional frequency blocks, one each for the provision of DAB+ in German-, French- and Italian-speaking Switzerland.

OFCOM had previously conducted a survey of interested parties. In French-speaking Switzerland, several companies had expressed an interest in additional DAB+ coverage. DETEC therefore decided to award the new frequency block for French-speaking Switzerland within the framework of a public tender procedure. In this case, ComCom is responsible for the award of the radiocommunication licence. There was only one interested party in German-speaking Switzerland and also only one in the Italian-speaking Ticino, which meant that an award could be made without a tender process.

Against this background, in December 2017 DETEC instructed ComCom to conduct an award of frequencies. ComCom prepared and launched the tender procedure for a DAB+ licence in French-speaking Switzerland in spring 2018.

This radio licence must be awarded by means of a competition based on specific criteria. The tender documents explained in detail the criteria on which the applications would be assessed. The most important selection criteria were the strengthening of media diversity, the extent of coverage of DAB+ in French-speaking Switzerland and the economic feasibility of the project *(cf. tender documents on the ComCom website)*.

By the end of July 2018, two companies had applied for the DAB+ licence for French-speaking Switzerland: Romandie Médias and DABCOM. Both companies had the required experience to set up and operate a DAB+ platform.

Following a detailed evaluation of the comprehensive applications and consultations with the two candidates, ComCom granted the licence to DABCOM AG in May 2019. ComCom therefore selected the applicant which attained the best evaluations, particularly with regard to the criteria of media diversity and economic feasibility.

DABCOM AG had undertaken to expand the transmission network in stages and cover the whole of French-speaking Switzerland by mid-2024. The licensee wishes to produce a broad range of commercial and alternative programmes.

In the interests of diversity, ComCom has limited the number of company radio stations to six. When allocating the other twelve available broadcasting slots, the licensee must ensure that it offers a varied schedule that includes informative, cultural, educational and entertainment elements. The licensee also undertakes to give priority to broadcasters from French-speaking Switzerland. It also ensures that there are always slots for short-term programming, e.g. in connection with cultural events.

As the losing candidate lodged an appeal with a suspensory effect with the Federal Administrative Court (FAC) against ComCom's licence award decision, DABCOM cannot yet put its licence to use.

3. Number porting

Since 2000, it has been possible to keep your existing telephone number and port it to a new provider.

After a slight decline in 2018, the number of numbers being ported again increased significantly in 2019. According to the company Teldas, which is in charge of the central porting database in Switzerland, more than 646,000 numbers were ported in 2019. This corresponds to an increase of 20% over the previous year.

Mobile telephony accounts for the bulk of ported numbers,

with almost 508,000 mobile numbers ported in 2019. This corresponds to a little under 5% of all mobile connections. Number porting affects both the contract segment (+21%) and the prepaid segment (+36%).

In the fixed-link network, number porting only takes place between companies operating their own connections (e.g., a switch to a cable network operator, a VoIP provider or another provider in the course of unbundling). In 2019, slightly over 133,000 numbers were ported to another operator, which corresponds to approximately 8% of fixed-network connections and represents an increase of almost 8% over the previous year.

Since 2002, fixed-network providers have been able to offer "geographical number portability" throughout Switzerland – when moving home, customers can take their telephone number with them if their operator provides this service, even if they are moving to another area code.

4. International Relations

ComCom is a founding member of the association of European telecom regulators, the Independent Regulatory Group (IRG), which the independent regulatory authorities of every European country belong to. The member states of the European Union are also members of the Body of European Regulators for Electronic Communications (BEREC). While the IRG considers itself to be a platform for exchanging experiences at a European and interdisciplinary level, BEREC is a body with close links to the European Commission that primarily engages in the harmonisation of telecommunications law and the implementation of European directives in the member states. BEREC maintains numerous expert groups that perform the groundwork for regulatory decisions and legislative projects, which is something that is also of interest to Switzerland.

Switzerland has been granted observer status in BEREC. This status had been temporarily suspended at the beginning of 2019 as a result of Switzerland's failure to approve until then the institutional framework agreement with the EU. However, ComCom succeeded in finding a solution with BEREC in the first quarter of 2019, which will enable ComCom and OFCOM to continue to participate in the expert groups that are of importance to Switzerland and to participate in the plenary sessions.

5. Outlook for 2020

In the interests of consumers, ComCom will continue to uphold its commitment in 2020 to ensuring that the universal service obligation of providing telecommunications services is fulfilled, competition in the telecom market is promoted and the frequency spectrum is used efficiently. ComCom will also continue to strive for investment-friendly framework conditions and technological innovation in the telecoms market.

ComCom will focus on the following activities in 2020:

1. **Universal service:** Since January 2020, universal service licensees have had to provide Internet access at a minimum bandwidth of 10 Mbps as part of their universal service obligations (see universal service section above). Together with OFCOM, ComCom will ensure that the services specified in the universal service obligations are provided in accordance with the quality criteria laid down by the Federal Council.

2. **Radio frequencies:** The World Radio Conference (WRC) took place in Sharm el-Sheikh in November 2019. New frequencies in the millimetre wave bands were identified for mobile communications to facilitate the development of fifth-generation (5G) mobile communications networks. Bandwidth amounting to 17.25 GHz was reserved for International Mobile Telecommunications (IMT), of which 14.75 GHz is harmonised globally. By way of comparison, only 1.9 GHz of bandwidth was available before WRC-19. In particular, the ranges 24.25-27.5 GHz, 37-43.5 GHz and 66-71 GHz will be available for IMT worldwide. Although these bands are reserved for IMT in Switzerland, they have yet to be released for use, as the Federal Council would first need to issue a decision to authorise this. These "millimetre bands" are already being employed for mobile communications in several countries, including the USA and Japan. The EU has instructed its member states to allocate the 24.25-27.5 GHz frequency band for mobile communications in 2020. ComCom will analyse the conclusions of the WRC and prepare for future challenges in the radio spectrum. In addition, ComCom expects that the DAB+ licence in French-speaking Switzerland that has been blocked by an appeal will be able to be put to use. ComCom will continue its efforts to improve the legal framework conditions for the optimum use of the mobile communications licences it granted with regard to the development and use of 5G networks.

3. **Access procedures:** In 2018 and 2019, ComCom reached decisions in several access cases, all of which were challenged before the Federal Administrative Court (FAC). ComCom is contesting these pending appeals and expects an adjudication by the FAC in the near future. OFCOM will provide guidance in any new access procedures.

4. **Revision of the Telecommunications Act (TCA):** Parliament completed its partial revision of the TCA in its 2019 spring session. The consultation on amendments to the regulations is scheduled for the beginning of 2020 and ComCom will actively follow the work of the administration on enacting the TCA revision. ComCom is also keeping a close eye on market developments in fibre-optic networks.

5. **International relations:** Following a brief suspension, ComCom and OFCOM are again attending the meetings of the EU's Body of European Regulators for Electronic Communications (BEREC) as observers.

IV. Finances

Regulators from various infrastructure sectors are administratively affiliated to the Federal Department of the Environment, Transport, Energy and Communications (DETEC). Together with the Federal Electricity Commission (ElCom), the Postal Commission (PostCom), the Railway Arbitration Commission (RACO) and the Independent Complaints Authority for Radio and Television (ICA), ComCom was included in the "Regulatory Authorities for Infrastructure" (RegInfra) administrative unit in 2012. DETEC's general secretariat provides services to the RegInfra administrative unit in various administrative areas; in particular, it also supports ComCom with regard to budget and accounting. This does not compromise ComCom's abilities to conduct its activities independently.

In terms of content, it collaborates very closely with OFCOM, which prepares most of ComCom's business and issues instructions on legal procedures. OFCOM's outgoings and income must also be included in any general picture of the income and expenditure of the telecommunications regulator as a whole.

Within the framework of its activities for ComCom, OFCOM incurred total costs of CHF 2.56 million in 2019. A large proportion of these costs are attributable to the intensive preparation of the invitation to tender and the auctioning of new mobile frequencies. Other important activities performed by OFCOM for ComCom in 2019 also included awarding a DAB+ licence, briefings for access procedures and overseeing the universal service licence.

On the revenue side, OFCOM collected administration fees amounting to CHF 3.34 million in 2019, which included fees on behalf of ComCom. As a result of the mobile phone auction, the cost recovery ratio was at a very high 131%. Where ongoing legal proceedings and invitations to tender are concerned, the administrative fees for several years can only be billed once the transactions have been legally concluded.

In addition, OFCOM also collected radiocommunication licence fees amounting to CHF 54,217 and, as a result of ComCom auctioning off mobile frequencies, the federal treasury was boosted by extraordinary revenue of CHF 379,292,728 in 2019.

The costs of the Commission and its administrative secretariat amounted to CHF 1.05 million in 2019. The 2019 outgoings are consequently some CHF 150,000 lower than was envisaged in the preliminary estimate *(more detailed information on RegInfra is published in the estimates and state accounts of the Confederation; see www.efv.admin.ch*).

Abbreviations

5G = Fifth generation mobile radio

ADSL = Asymmetric Digital Subscriber Line

BBCS = Broadband Connectivity Service (commercial wholesale offers of Swisscom)

BEREC = Body of European Regulators for Electronic Communications

CATV = Cable television

COMCO = Competition Commission

ComCom = Federal Communications Commission

DETEC = Federal Department of the Environment, Transport, Energy and Communications

DOCSIS = Data Over Cable Service Interface Specification (technology for high bandwidths on coaxial cable)

DSL = Digital Subscriber Line

EDGE = Enhanced Data rates for GSM Evolution (GSM technology)

ESC = Energy supply companies

FAC = Federal Administrative Court

FDD = Frequency Division Duplex (two radio channels are needed for one connection)

FTTB = Fibre to the Building

FTTC = Fibre to the Cabinet

FTTH = Fibre to the Home

FTTS = Fibre to the Street

G.fast = Gigabit fast access to subscriber terminals (technology for bandwidths up to 500 Mbit/s on copper cable)

GPRS = General Packet Radio Services (GSM technology)

GSM = Global System for Mobile Communications (standard for second-generation mobile radio networks)

HDTV = High-definition television

HFC = Hybrid Fibre Coaxial

HSDPA = High Speed Downlink Packet Access (UMTS technology)

IC = Interconnection

ICT = Information and communication technologies

IP = Internet Protocol

IPTV = Internet Protocol Television

IRG = Independent Regulatory Group

ISDN = Integrated Services Digital Network

ISP = Internet Service Provider

LRIC = Long Run Incremental Costs (model for calculation of interconnection prices)

LTE = Long Term Evolution (standard for fourth-generation mobile radio networks/3.9G standard)

LTE-A = LTE-Advanced (standard for fourth-generation mobile radio networks)

MEA = Modern Equivalent Asset

NFC = Near Field Communication

NGA = Next Generation Access Network

OFCOM = Federal Office of Communications

PSTN = Public Switched Telephone Network (traditional telephone network)

SMS = Short Message System

SVOD = Subscription Video on Demand

TCA = Telecommunications Act (CC 784.10)

TDD = Time Division Duplex (bidirectional communication on only one radio channel)

TSO = Telecommunications Services Ordinance (CC 784.101.1)

TSP = Telecommunication Services provider

UMTS = Universal Mobile Telecommunications System

VDSL = Very-high-bit-rate DSL

VoD = Video on Demand

VoIP = Voice over IP

VoLTE = Voice over LTE

Wi-Fi = Wireless Fidelity (wireless local networks)

WLAN = Wireless Local Area Network

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