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for everyone

Connected Nations 2020

Scotland report

Strong, Secure Networks

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Overview

This is Ofcom's annual Connected Nations Scotland report, which measures progress in the availability and capability of broadband and mobile services in Scotland. It also highlights the work we are doing, alongside the UK Government, Scottish Government and communications companies, to improve these services.

Alongside this Scotland report, we publish separate reports on broadband and mobile availability for the UK as a whole and each of its nations. Our interactive dashboard allows people to easily access data for different areas of the UK and specific types of services. We are also releasing the International Broadband Scorecard 2020, which compares the UK's recent position on broadband availability with a number of other European nations.

What we have found:

- Fixed and mobile networks in Scotland have generally coped well with increased demands during the pandemic. A shift to more people being at home drove increased demand on broadband networks during the day, although peak usage remained in the evening. Mobile networks also experienced increases in voice traffic.
- Superfast broadband coverage has increased to 94% of homes in Scotland, up from 92% last year. We now estimate that around 57% of premises who are able to get superfast broadband actually take a superfast or faster service.
- Almost 1.1 million (42%) homes in Scotland have access to a gigabit-capable broadband connection – as well as delivering download speeds of up to 1 Gbit/s, these services offer faster upload speeds and are more reliable than older broadband technologies.
- Over 437,000 (17%) premises in Scotland now have access to full-fibre broadband – an increase of over 238,000 premises and the highest year-on-year increase seen so far.
- The number of premises in Scotland without access to at least decent broadband continues to shrink. Factoring in coverage from both fixed and fixed-wireless networks, we estimate that around 34,000 (1.2%) premises in Scotland are still without a decent broadband connection. These properties may be eligible to receive one under the universal broadband service, with these connections being built without additional customer contributions up to a cost threshold of £3,400.

- 81% of Scotland's landmass has access to good 4G coverage from at least one of the mobile operators (up from 80% in 2019) but only 44% has coverage from all 4 operators. The UK Government's Shared Rural Network programme agreed in March 2020 and the Scottish Government's S4GI programme will extend coverage beyond this in the coming years.
- 81% of homes and businesses in Scotland should be able to get good indoor 4G coverage from all operators (up from 79% in 2019), with 96% of rural premises able to receive a service from at least one operator.
- We estimate that around 10,650 premises in Scotland cannot access either a decent fixed broadband service or get good 4G coverage indoors.
- The number of towns and cities with 5G coverage in Scotland has increased further, with 7% of the 3,000 sites across the UK being in Scotland.

Connectivity has never been more important to people in Scotland

People have been relying on connectivity more and more over recent years – and the Covid-19 pandemic during 2020 has brought this reliance into even sharper relief. In March 2020, life changed suddenly for many people right across the UK. Fast, reliable broadband and mobile connections were essential to allow them to work from home, keep up with schoolwork, access medical appointments and public services, contact their friends and family, order shopping online and keep themselves entertained.

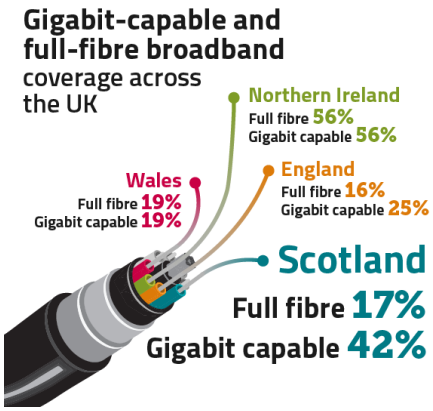
The UK's fixed access networks have seen significantly increased demand from users, with average monthly data usage in Scotland now standing at 433 GB per fixed connection, up from 327 GB last year and 238 GB in 2018. As well as an increase in traffic, the Covid-19 lockdown period has also seen as shift in how people use their services. While peak broadband use is still in the evenings and has continued to grow, daytime traffic has increased significantly. Upload traffic has also increased, driven by more use of video calling for work and to keep in touch with friends and family.

Networks had the capacity to meet these user demands and stayed well within capacity limits. Our research shows average broadband speeds only dipped slightly in March 2020, as much of the nation turned to working, learning and socialising from home.

Mobile networks also successfully coped with the increased demands and changes in network traffic patterns during the lockdown period. The total monthly data use across Scotland over a 4G service now stands at 30,000 TB and we saw how mobile traffic patterns (voice and data) shifted from the city centres (urban areas) to more residential areas (suburbs) during the initial lockdown period and the restrictions that followed, particularly as people began working from home.

Investment in faster, better networks

Full fibre networks are key to delivering gigabit-capable broadband

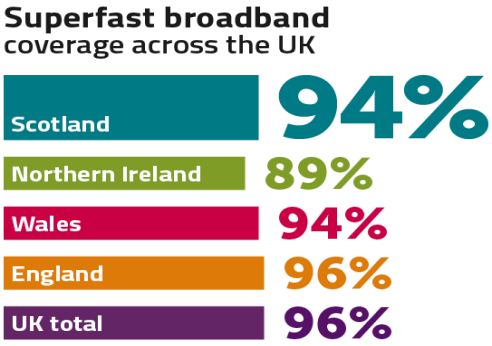


Coverage of faster and more reliable broadband services, especially those that are gigabit-capable (including full fibre), is improving across Scotland. Full fibre and gigabit-capable networks are still at a relatively early stage of rollout and different providers are taking different approaches to their business models for deploying these networks. Gigabit-capable broadband is now available to almost 1.1 million homes (42%), the second highest of the UK nations. This has largely been driven by Virgin Media upgrading its cable network.[1] Around 437,000 (17%) of premises are able to access a full fibre connection, a significant improvement on 8% last year. Openreach, the incumbent wholesale infrastructure provider for almost all of the UK, and other providers like CityFibre and Hyperoptic are also accelerating their full fibre deployment plans.

5G mobile coverage

EE, O2, Three and Vodafone deployed 5G in the UK last year and have continued to roll out services across the UK this year. Many 5G deployments are focused on towns and cities, such as Glasgow, Edinburgh and Stirling, in order to provide enhanced capacity to 3G and 4G services in more populated areas. Around 7% of all 5G deployments across the UK have been in Scotland.

Good connections are available to most people in Scotland



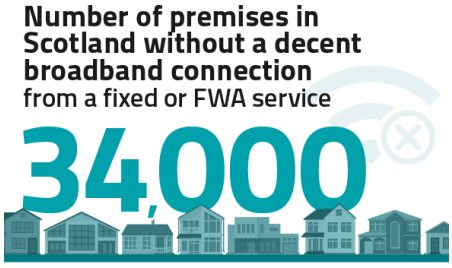
[1] https://www.virginmedia.com/corporate/media-centre/press-releases/virgin-media-to-bring-next-generation-gigabit-internet-to-millions-of-homes-across-the-uk

Ninety-four percent of premises in Scotland have access to a superfast broadband connection with speeds of at least 30Mbit/s. A 30 Mbit/s connection is sufficient to stream a 4K/UHD video or download a one hour long HD TV episode in under 5 minutes, and allows for several devices to work simultaneously. Although most people have superfast broadband available to them, they do not always choose the fastest speeds, even though this might better meet their needs. Despite availability of these services, we estimate that only around 57% of premises who are able to get superfast broadband actually take it.

Mobile operators provide a high level of 4G coverage outside of premises in Scotland, with coverage from each mobile network ranging between 97-99% of premises. Indoor 4G coverage ranges between 89% and 95% of all premises.

Some people are still struggling to get connected

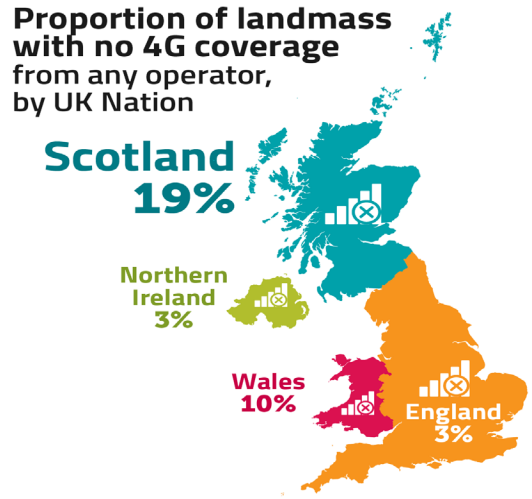
A small – but significant – subset of premises still cannot access decent broadband



Around 34,000 (1.2%) premises in Scotland still cannot get at least a decent broadband service from either fixed or fixed wireless networks. This compares to 113,000 in England; 19,000 in Northern Ireland, and 18,000 in Wales.

Some of these premises may be eligible for a service under the universal broadband service, which came into force in March 2020. This allows eligible homes and businesses the right to request a broadband connection that delivers a decent speed of at least 10Mbit/s download speed and 1Mbit/s upload speed. Where the costs to provide the connection are below the reasonable cost threshold of £3,400, the customer can be provided a service at standard connection and rental charges with no additional contribution. Where the cost of connection is above the reasonable cost threshold, these premises can still receive a service if the customer pays the additional costs. But for many remote premises in Scotland, these costs could be significant, meaning some premises will continue to be without access to a decent service, even with the universal service in place. We will work continue to work with the Scottish Government, UK Government and industry to explore technology options and possible ways to fund providing connections to these properties so they do not get left behind.

Although most premises now have mobile coverage from at least one operator, there are still significant 4G not-spots



Whilst mobile operators continue to provide a high level of coverage to premises in Scotland (both indoor and outdoor premises), coverage levels remain lower in rural areas and across Scotland's landmass, with individual operator coverage ranging between 56% and 70%.

Eighty-one percent of Scotland's geographic area has access to good 4G coverage from at least one of the mobile operators but only 44% has coverage from all four operators. This leaves around 19% of Scotland without access to a 4G service from any operator.

Working with the UK Government and Scottish Government

Alongside the work we do as a regulator, there will continue to be a role for governments across the UK to help improve access to mobile and broadband, including by investing public money in networks in areas which are unlikely to be covered commercially. We will work closely with the UK Government as it develops plans to invest at least £1.2bn in full fibre and gigabit capable broadband and the Shared Rural Network (SRN) agreement with operators. We will also continue to work closely with the Scottish Government on its digital connectivity ambitions. This includes infrastructure initiatives such the Reaching 100% (R100) programme, which seeks to deliver superfast speeds at 30 Mbit/s to 100% of premises in Scotland, as well as the Scottish 4G mobile Infill (S4GI) programme. We will also continue to provide technical and regulatory advice, as well as data (where appropriate) to help inform the work of stakeholders, including the Scottish Government as it develops its Digital Strategy for Scotland and Draft Infrastructure Investment Plan for 2021/22 to 2025/26.[2] [3]

Our aim is to support investment in gigabit capable networks. From April 2021 we will have in place a longer-term regulatory framework for competition and investment for the five years to March 2026, with the aim of supporting investment in full fibre and other gigabit-capable services. We are

[2] https://consult.gov.scot/digital-directorate/digital-strategy-for-scotland/
[3] https://www.gov.scot/publications/national-mission-local-impact-draft-infrastructure-investment-plan-scotland-202122-202526/

also supporting the rollout of new wireless services – including 5G - for people and industry. This includes making sure a diverse range of companies can access the spectrum they need to develop innovative new services, bringing a better mobile experience to consumers and delivering economic benefits for Scotland the UK.

Ofcom is also working with the Scottish and UK governments to help improve access to mobile and broadband across the UK. Those governments are supporting rollout by investing public money in networks in areas which are unlikely to be covered commercially. In August this year, the Scottish Government announced an important element of its R100 programme; the Scottish Broadband Voucher Scheme (SBVS).[4] The scheme provides grants to people in both residential and business premises to help ensure access to speeds of at least 30 Mbit/s. Premises will be eligible for a voucher where there are no plans to bring superfast broadband to that address by the end of 2021 – either through commercial deployment or the main R100 programme. Premises that are not in scope for R100 deployment will be eligible for a voucher worth up to £8,500 for SMEs and up to £6,500 for residential premises following an announcement of additional funding for the scheme in October. It builds on work by the Scottish and UK governments to link the SBVS to the UK Government's Rural Gigabit Connectivity programme.

Network security and resilience

The network security incidents reported to Ofcom this year do not show that the pandemic resulted in a noticeable increase in telecoms outages, despite the increased demand on the networks. One major incident affecting O2's mobile phone users at the start of the first national lockdown does not appear to have reoccurred. However, it has highlighted some important lessons for the industry about how the latest network technology responded to these unprecedented demand peaks.

The work we started last year with telecoms providers to better understand the most common causes of major outages has identified several themes, and work to tackle them is ongoing. Ofcom has also been working closely with the UK Government and National Cyber Security Centre in preparation for the introduction of the Telecoms Security Bill. The Bill, which has now been introduced to the UK Parliament, will bring new rules and duties for Ofcom on network security.

A more detailed analysis of network security and resilience issues can be found in our Connected Nations UK report.

[4] https://www.scotlandsuperfast.com/how-can-i-get-it/voucher-scheme/

Fixed broadband and voice

Introduction

We want everyone to be able to access fast and reliable voice and broadband services, wherever they live and work. These communications services have never been more important than in 2020. The Covid-19 pandemic has highlighted the importance of connectivity for UK consumers as a vital part of how businesses and people communicate and consume information and entertainment. People have relied more than ever on fast, reliable broadband connections.

Broadband connectivity continues to improve across Scotland, as existing networks are being upgraded and new fixed infrastructure is deployed. We support the investment in superfast, gigabit-capable and full-fibre networks, which give people fast, reliable and future-proofed connections. We report on gigabit-capable coverage for the first time this year.

Most homes and businesses in Scotland now benefit from a choice of broadband connections, which deliver superfast or faster speeds. But there are areas in Scotland (and across the UK) where faster services are not yet available. While the number of homes and businesses without access to decent broadband connections continues to fall, we are concerned that some premises in Scotland still do not have access to decent broadband - given the importance of connectivity to participating in an increasingly digital society.

For this report, we have refined our approach to include data from around 20 additional full fibre communications providers and, for reporting on fixed wireless coverage, we have gathered, and include, data from mobile network operators and a larger number of mobile fixed wireless network operators.

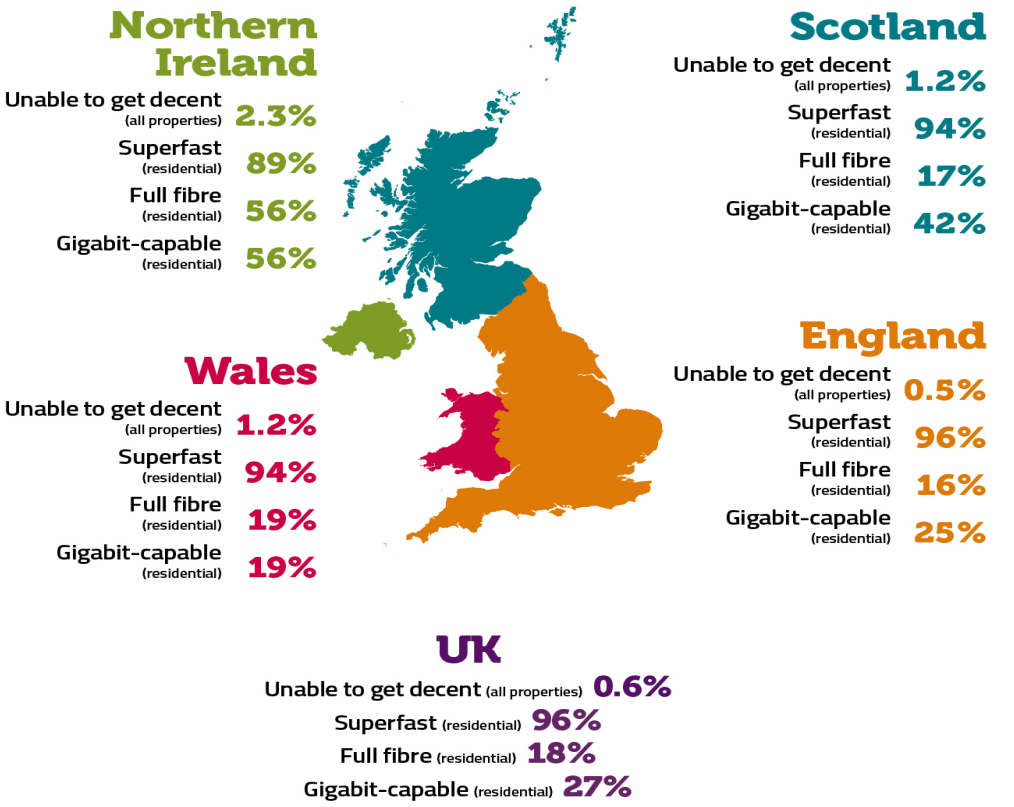
In our Connected Nations UK report, we also highlight some of the developments in progress of upgrading the UK's traditional telephone network.

Key highlights:

- Superfast broadband coverage has increased to 94% of homes in Scotland, up from 92% last year. We now estimate that around 57% of premises who are able to get superfast broadband actually take a superfast or faster service.
- Almost 1.1 million (42%) of homes in Scotland have access to a gigabit-capable broadband connection – as well as delivering download speeds of up to 1 Gbit/s, these services offer faster upload speeds and are more reliable than older broadband technologies.
- Over 437,000 (17%) premises in Scotland now have access to full fibre – an increase of over 238,000 premises and the highest year-on-year increase seen so far.
- The number of premises in Scotland without access to at least decent broadband continues to fall. [5] Factoring in coverage from both fixed and fixed-wireless networks, we estimate that around 34,000 (1.2%) premises in Scotland are still without a decent broadband connection and may be eligible to receive one under the broadband Universal Service Obligation (subject to a reasonable cost threshold of £3,400).

[5] Unless otherwise specified, coverage figures for decent broadband count all UK premises (residential and commercial). Coverage for all other speed tiers counts residential premises only, unless otherwise specified.

Summary of broadband coverage across the UK



Increasing demand during Covid-19

During 2020, the UK's fixed access networks have seen significantly increased demand from users, as the lockdown due to the Covid-19 pandemic saw significantly more people using their home broadband connections for work, for keeping in touch with friends and family, for accessing essential services, and for leisure. Networks generally had the capacity to meet user demands.

Data usage during Covid-19

We gathered data (covering the period from February to July) from a range of network operators to understand how traffic on fixed broadband networks from residential and business customers changed during this time before and after lockdown. We are unable to provide nation-specific breakdowns of this data, but a full breakdown of traffic across the UK on weekdays and weekend between February and July this year can be found in the Connected Nations UK report.

Overall, the networks coped well. For major networks, peak traffic increased during the early phase of the first lockdown in late March and April although generally remained below the spikes in peak traffic seen immediately prior to lockdown when major gaming releases coincided with the peak times. After this initial increase, peak traffic remained largely constant on average, meaning traffic levels remained higher than prior to lockdown, though this varied across different networks.

Impact of Covid-19 on availability of services

Telecoms engineers have an important role ensuring the availability of broadband services. Approaches to designating telecoms engineers as 'key workers' varied across the UK which meant that new network build and provisioning of new connections were impacted in some areas more than others. However, as discussed below, coverage of fixed networks has improved since last year, despite the Covid-19 pandemic. The Scottish Government issued a statement to telecoms providers on 30 July confirming the role of telecoms as part of Scotland's critical national infrastructure and confirmed the key worker status of engineers who have been undertaking critical maintenance during this year. [6]

Like other businesses and organisations, restrictions from Covid-19 meant that communications providers needed to change their own working patterns and priorities. On 24 March 2020, in response to restrictions on its engineering workforce, Openreach declared 'Matters Beyond Our Reasonable Control' (MBORC), which meant taking action to prioritise only essential work and minimise work that required engineers to enter customers' homes. Whilst Openreach engineers continued to provide essential in-home service to vulnerable customers, to ensure they stayed connected, this declaration of MBORC particularly impacted the provision of new full-fibre connections on Openreach's network, which requires engineers to enter the customer's premises.

Availability of fixed broadband services

There has been continued investment in fixed networks in Scotland which has resulted in significant improvements in the availability of superfast, ultrafast and full-fibre broadband services in recent years. Consequently, the number of premises that do not receive decent broadband has also declined.

Fixed broadband is available at a variety of speeds and is delivered over different technologies, including copper (ADSL), fibre to the cabinet (FTTC), hybrid fibre coaxial cable (HFC) and full fibre, or 'fibre to the premises' (FTTP). A detailed explanation of these technologies can be found in our Connected Nations UK report.

Broadband to fixed locations can also be delivered wirelessly, providing an alternative to fixed network connections. Some premises may be served by broadband provided over a wireless network (known as fixed wireless access, or FWA), using either a mobile network or a dedicated network. As the capacity in the wireless access network is shared between multiple users, the service needs to be managed appropriately to meet user demand, particularly in areas with capacity constraints. As coverage predications are based on predictive modelling tools, localised issues may mean that some premises may not be able to receive a service despite being predicted to do so. A detailed explanation of these technologies can be found in the methodology annex of the Connected Nations UK report and in technical guidance for WISPs on our website. [7]

[6] https://www.gov.scot/publications/coronavirus-covid-19-statement-to-telecommunications-operators-on-build-and-maintenance-of-networks/

[7] https://www.ofcom.org.uk/__data/assets/pdf_file/0013/204061/technical-guidance-wisps.pdf

Access to a superfast broadband service continues to increase

Ofcom defines superfast broadband as a service which delivers a minimum download speed of at least 30 Mbit/s.[8] A further 180,000 homes in Scotland now have access to a superfast broadband connection. This equates to 94% of residential premises (around 2.44m), up from 92% last year. Taking commercial premises into account, superfast broadband is available to 93% of total premises in Scotland.

Figure 1: **Residential superfast broadband coverage by UK nation (urban/rural split)**

	Superfast	Urban	Rural
Scotland	94%	98%	72%
Wales	94%	98%	78%
Northern Ireland	89%	99%	66%
England	96%	98%	84%
UK	96%	98%	81%

Source: Ofcom analysis of operator data

There are significant differences in the availability of superfast broadband in urban and rural areas of Scotland, with 98% of residential premises in urban areas having access to superfast broadband compared to 72% in rural areas. This is reflected in the superfast coverage data for local authority areas covering some of the more remote and rural parts of Scotland.

Figure 2: Residential superfast broadband coverage by selected Scottish local authority area

Scottish Local Authority	% of premises with speeds ≥ 30 Mbit/s
Orkney Islands	64%
Shetland Islands	70%
Na H-eileanan Siar	75%
Argyll and Bute	79%
Highland	81%
Aberdeenshire	83%
Moray	85%

Source: Ofcom analysis of operator data

[8] The Scottish Government also defines superfast broadband as speeds of at least 30 Mbit/s

Superfast coverage in Orkney Islands and Shetland Islands stands at 64% and 70% respectively, while the more densely populated, urban local authority areas such as Dundee (99%), Glasgow City (98%), City of Edinburgh (98%) enjoy more widespread coverage.

However, residential superfast coverage continues to increase at a faster rate than commercial coverage. Around 83% of commercial premises can access superfast compared to 94% of homes in Scotland. This may in part be the result of lower coverage in business/enterprise park areas, which are generally more expensive to connect and have fewer occupants than in residential areas. The divide between urban and rural coverage is even more pronounced for businesses in Scotland, with only 59% covered by superfast broadband.

Figure 3: Commercial superfast broadband coverage by rurality

	Total	Urban	Rural
Scotland	83%	90%	59%

Source: Ofcom analysis of operator data

Customers in Scotland can increasingly choose ultrafast connections

Figure 4: Residential ultrafast coverage by UK nation

	Total	Urban	Rural
Scotland	52%	60%	15%
Wales	37%	41%	20%
Northern Ireland	64%	82%	17%
England	61%	66%	21%
UK	59%	65%	20%

Source: Ofcom analysis of operator data

Coverage of ultrafast services to homes in Scotland has increased to 52%, which is a significant increase from 45% last year. However, ultrafast coverage remains poor in rural Scotland at only 15%.

The increased coverage of ultrafast broadband has largely been driven by the roll-out of full fibre and gigabit capable networks from Virgin, as well as Openreach's deployment of G.fast. Openreach has now paused its G.fast deployments as it focuses on full fibre build. [9]

[9] ISP Review, Openreach Confirm G.fast Broadband Rollout Paused Until 2021 UPDATE - ISPreview UK

Gigabit-capable broadband is now available to 42% (1.1m) of homes in Scotland, including 17% (437,000) full fibre connections

Figure 5: Residential gigabit-capable and full-fibre coverage by UK nation

	Full fibre	Urban	Rural	Gigabit-capable	Urban	Rural
Scotland	17%	18%	12%	42%	47%	13%
Wales	19%	19%	19%	19%	19%	19%
Northern Ireland	56%	71%	17%	56%	71%	17%
England	16%	16%	17%	25%	26%	18%
UK	18%	18%	17%	27%	29%	17%

Source: Ofcom analysis of operator data

Full fibre (FTTP) and gigabit-capable

Our data shows that 17% (around 437,000) premises in Scotland are now served by a full-fibre connection, a considerable increase from 8% last year. This increase is largely due to the continued investment in the rollout of fibre networks in Scotland from providers included last year, such as Openreach, Virgin Media and CityFibre. However, we are now including coverage data from many more, predominantly smaller, fibre network providers. Whilst these providers do not significantly alter the national figures, they are important in providing full fibre coverage at the local level.

We are reporting on gigabit capable broadband for the first time in this report. The UK Government has set a target of at least 85% gigabit coverage by 2025, alongside an ambition to get as close to 100% as possible.

When all technologies are combined, our data shows that 42% of homes (around 1.1m) in Scotland now have access to gigabit-capable broadband. This is the second-highest figure of the UK nations and is 15% higher than the UK total. This can largely be attributed to upgrades in the HFC network to the latest standard of cable technology, DOCSIS 3.1, which is capable of delivering download speeds of up to 10Gbit/s and upload speeds of up to 1Gbit/s. [10]

Full fibre can boost business productivity. It enables faster services and better access to cloud-based computing services. Commercial full-fibre coverage continues to be lower than residential coverage and stands at 8%, which is an increase of 4% from last year. Twenty-two percent of commercial premises have access to a gigabit-capable service, but this drops to just 6% for rural businesses.

[10] Although in practice speeds average out significantly below this – and since capacity is shared among users, it may not be the case that each user can simultaneously receive gigabit speeds

Figure 6: **Commercial gigabit-capable and full-fibre coverage in Scotland by rurality**

	Total	Urban	Rural
Gigabit-capable	22%	27%	6%
Full fibre	8%	8%	6%

Source: Ofcom analysis of operator data

Commercial deployment in rural areas is improving. Openreach has announced plans to build gigabit-capable and full-fibre broadband to homes and businesses in over 80 small and rural towns in Scotland, including Aviemore and Thurso.

Local authorities in Scotland can play a key role in driving improved digital connectivity. The Scottish Government (in conjunction with COSLA) has set out plans for a refreshed Digital Strategy for Scotland that will build on the work between central and local government during the Covid-19 pandemic. Other organisations, such as the Digital Office for Scottish Local Government, work directly in partnership with local authorities to help drive 'digital transformation.' [11] Some local authorities, such as Glasgow City Council, have developed their own digital strategies to help deliver better public services. [12]

Broadband coverage will be a critical element in supporting the development and growth of Scotland's economy, especially in more remote and rural areas. Earlier this year, the Scottish Government's Advisory Group on Economic Recovery noted that *"greater utilisation of digital and virtual infrastructure can lock in beneficial changes...and deliver better for rural areas."* [13]

Building on the work of the Digital Scotland Superfast Broadband Programme, the Scottish Government has committed to ensuring every home and business in Scotland can access superfast broadband. This commitment will be delivered through the Reaching 100% (R100) programme via three key strands of activity – the £600 million R100 contracts (North, Central and South), the Scottish Broadband Voucher Scheme (SBVS) and ongoing commercial deployment.

Contracts for R100 in the Central and South lots were signed with BT last year and will go beyond the original commitment to provide superfast broadband of 30 Mbit/s by providing a significant amount of gigabit-capable and full fibre connections. Work is already underway in both the South and Central lots and the Scottish Government is working with Openreach to identify opportunities to accelerate this where and when possible. On 14 December, the Scottish Government also announced that it had signed a contract with BT for the North of Scotland. [14]

Earlier this year, the Infrastructure Commission for Scotland also published its Phase 1 and Phase 2 Reports. [15] The Commission made twenty-three recommendations, including that the Scottish

[11] https://www.digitaloffice.scot/
[12] https://www.glasgow.gov.uk/councillorsandcommittees/viewSelectedDocument.asp?c=P62AFQDNDX0G2U812U
[13] https://www.gov.scot/publications/towards-robust-resilient-wellbeing-economy-scotland-report-advisory-group-economic-recovery/
[14] https://www.gov.scot/news/superfast-broadband-for-homes-and-businesses-in-the-north/
[15] https://infrastructurecommission.scot/

Government ensure the delivery of a full fibre network for Scotland by 2027. Ofcom understands the ambition for the R100 deployment is to include full fibre in many areas.

Some premises still cannot access decent broadband

Taking into account all fixed line connections, 97% of homes and businesses in Scotland have access to at least decent broadband. Around 95,000 do not have access to decent broadband via a fixed connection, the majority of these in rural areas.

Figure 7: Homes unable to receive decent broadband from a fixed line

	Total	Rural	Urban
Scotland	3% (95,000)	17% (85,000)	<1% (10,000)
Wales	3% (52,000)	13% (45,000)	1% (8,000)
Northern Ireland	6% (49,000)	19% (43,000)	1% (6,000)
England	1% (387,000)	7% (240,000)	1% (146,000)
UK	2% (583,000)	10% (413,000)	1% (170,000)

Source: Ofcom analysis of operator data

Broadband delivered wirelessly to fixed locations can meet the needs of some people, including those in areas without access to decent broadband over wired connections

As discussed above, some premises can access broadband provided over a wireless network, known as Fixed Wireless Access (FWA), using either a mobile network or a dedicated operated by a Wireless Internet Service Provider (WISP).

Fixed Wireless Access on mobile networks

Of the four MNOs in the UK, only Telefonica does not currently offer FWA services. For areas with poor indoor coverage, EE offers an external antenna for its FWA services. Based on the MNOs' claimed coverage, we estimate that 94% premises in Scotland have access to an MNO FWA service.

Across the UK, EE claims its product has an average download speed of 31Mbit/s for customers on its 4G FWA service [16] and 150Mbit/s on its 5G FWA service. [17] However, this average speed will likely vary by nation. Vodafone claims to have made their FWA product available at all properties where a mobile signal is available. [18] However, the end users' experience of the service could be affected by several factors, including router placement, indoor mobile coverage and the capacity available in the wireless access network and/or backhaul.

[16] https://shop.ee.co.uk/dongles/pay-monthly-mobile-broadband/4gee-home-router-2/details
[17] https://shop.ee.co.uk/dongles/pay-monthly-mobile-broadband/huawei-5g-cpe-pro/details
[18] Although we do not have data on what performance can be delivered on their network.

Fixed Wireless Access from WISPs

We have adopted a new approach to collecting WISP coverage data this year, asking operators to provide an estimate of their coverage based on network capacity constraints, interference and other external factors. [19] Based on these estimates, around 1.3% (36,000) homes and businesses in Scotland could have coverage from a WISP network.

There are many more WISPs who have not given us their coverage data, so coverage from these providers could be higher. We intend to continue to collate and analyse data from these providers and monitor changes to the sector. [20]

Figure 8: Coverage of MNO and WISP FWA networks

	MNO FWA	WISP FWA
Scotland	94%	1%
Wales	91%	33%
Northern Ireland	83%	3%
England	95%	3%
UK	95%	5%

Source: Ofcom analysis of operator data

Fixed Wireless Access and the impact on the availability of broadband

If the networks are managed well, both MNO and WISPs can deliver a decent broadband service and are an alternative network technology for consumers who cannot receive a decent broadband connection from their fixed network.

Based on the coverage estimates provided by FWA providers, we estimate that 60,000 premises in Scotland that do not have access to a decent broadband service from a fixed network could have access via an FWA network. This provides an additional 2% of decent broadband service coverage to Scotland. Around 4,000 premises have access to a decent broadband service from a WISP network. A further 56,000 premises in Scotland have access to a decent broadband service from an MNO FWA service. Some premises that can get decent broadband on a WISP network may also be covered by an MNO FWA service. Over the next year, we plan to work with FWA providers to understand how they manage the capacity of their network to ensure that a reliable service can be provided to their customers.

[19] Ofcom, September 2020, https://www.ofcom.org.uk/__data/assets/pdf_file/0013/204061/technical-guidance-wisps.pdf
[20] If WISPs would like to provide information as per the technical guidance, they can get in touch via the mailbox connectednationsreport@ofcom.org.uk

Figure 9: Access to a decent broadband service by technology type

	Has no access to decent broadband from a fixed network	Has access to decent broadband from a FWA network	Remaining premises without access to decent broadband
Scotland	95,000	60,000	34,000
Wales	52,000	35,000	18,000
Northern Ireland	49,000	30,000	19,000
England	387,000	268,000	119,000
UK	583,000	393,000	190,000

Source: Ofcom analysis of operator data

Our latest estimate is that 34,000 (1.2%) of premises in Scotland still do not have access to a decent broadband service via either a fixed or fixed wireless network. This figure has reduced slightly from our estimate of 40,000 last year. This is due in part to the rollout of more fibre and fixed wireless networks but also because we have gathered data from more operators this year.

Some of these premises may be able to get a service under the broadband Universal Service Obligation (USO), which provides the right to request a broadband connection at a download speed of at least 10 Mbit/s and upload speed of at least 1 Mbit/s, subject to a reasonable cost threshold of £3,400 and not being covered by a publicly funded scheme within the next 12 months. However, these costs could be significant in more remote parts of Scotland.

We are concerned that BT may not be complying with the regulatory conditions correctly where it assesses excess costs for a given connection. This could result in some customers' quote for a connection being higher than necessary. This could in turn lead to fewer people taking advantage of the USO. As such, we have opened an investigation into BT's approach to calculating quotes for excess costs.[21] Despite this, the costs could still be significant for many rural premises in Scotland, meaning they are unlikely to benefit from the USO.

Geostationary satellites can also be an alternative to a fixed broadband connection, particularly in the most remote and rural parts of Scotland. Performance can be limited by its high latency and the data caps on usage. As such, we do not consider that geostationary satellites can currently provide a service that meets the broadband USO specification. In future, we will likely see Low Earth Orbit (LEO) satellite constellations beginning to offer residential and business broadband to UK consumers, at the earliest during 2021. These services will have lower latency, because the satellites are closer to earth, so they are more likely to provide decent broadband services.

[21] Ofcom, Investigation into BT's compliance with its obligations as a broadband universal service provider

Data usage over fixed networks continues to grow

Data gathered during the Covid-19 pandemic shows that consumers in Scotland are using increasing amounts of data over their fixed connections, with more people using broadband for data-heavy activities such as streaming. The average monthly data usage now stands at 433 GB per connection, up from 327 GB last year and 238 GB in 2018.

More consumers could be upgrading to higher speeds

Our data shows that people do not always choose the fastest, or one of the fastest, speeds available to them. We now estimate that around 57% of premises who are able to take superfast broadband actually do so. And we estimate that the take up of full fibre services in Scotland, where they are available, is around 25% (in line with the UK average).

Mobile

Introduction

Mobile services are an important part of people's daily lives and business. The experiences of the Covid-19 pandemic over the course of this year have further emphasised the reliance society and business place on access to good mobile services, and the key role such services play in helping people communicate and stay in touch.

In this chapter, we provide an update on mobile coverage both outside and inside premises, across Scotland's landmass and on major roads. We also report on the impact of Covid-19 restrictions on the use of mobile services.

Mobile operators successfully coped with increased traffic demands and changes in consumption trends while Covid-19 restrictions lasted. There was an increase in call volumes and average call duration particularly in the week the restrictions were introduced. Mobile data consumption fell during this period as people offloaded their data traffic onto home Wi-Fi networks as they began working from home and schools were shut. This also meant that mobile hotspots shifted from the city centres to the suburbs and residential areas.

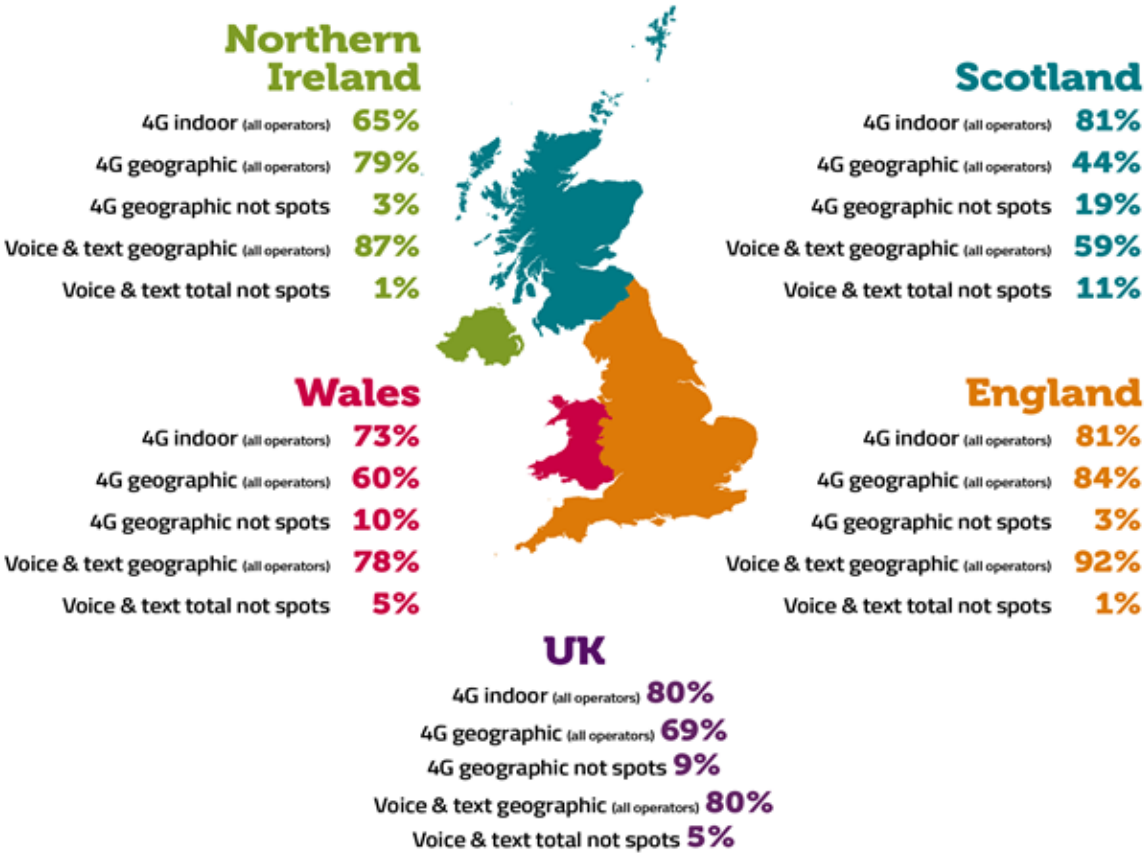
This year, mobile data traffic across the UK increased by 45% compared with last year. Around 10% of this traffic was in Scotland, compared with 83% in England, 4% in Wales and 3% in Northern Ireland. This is broadly consistent with the share of population across the nations of the UK. There was also significant increase in voice and data traffic across all mobile network operators during the Covid-19 spring lockdown compared with periods before.

The availability and use of 'Internet of Things' devices and services have continued to increase, and we discuss this in more detail in our Connected Nations UK report.

Key highlights:

- Mobile network operators (MNOs) successfully coped with increased traffic demands and changes in consumption trends as more people began working from home and schools were shut during the Covid-19 spring lockdown.
- 81% of Scotland's landmass has access to good 4G coverage from at least one of the mobile operators (up from 80% in 2019) but only 44% has coverage from all 4 operators.
- 81% of homes and businesses in Scotland should be able to get good indoor 4G coverage from all operators (up from 79% in 2019), with 96% of rural premises able to receive a service from at least one operator.
- We estimate that around 10,650 premises in Scotland cannot access either a decent fixed broadband service or get good 4G coverage indoors.
- The number of towns and cities with 5G coverage in Scotland has increased further, with 7% of the 3,000 sites across the UK being in Scotland.

Summary of mobile coverage across the UK



Mobile networks in Scotland successfully coped with increased traffic demands and changes in consumption patterns during Covid-19

Data usage during Covid-19

Mobile operators in the UK successfully coped with the increased demands and changes in data and voice traffic as many people began working from home and schools were shut during the Covid-19 spring lockdown. New peaks were reached for most of the network metrics reported by MNOs just before or during the week lockdown measures were first introduced across the UK in March 2020.[22, 23] Although these peaks generally reduced with the gradual easing of lockdown, they have remained higher than periods before (in line with the historical trend for incremental growth in data consumption).

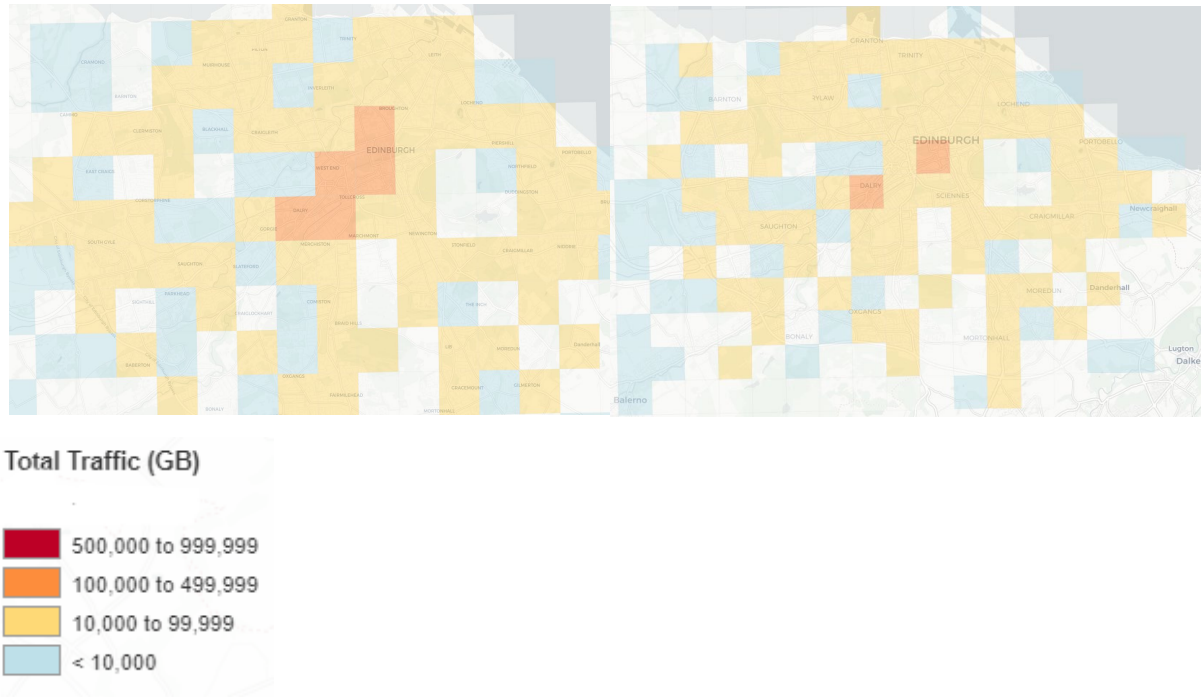
Mobile hotspots shifted from urban areas to suburban areas during lockdown

Mobile traffic patterns (voice and data) shifted from the city centres (urban areas) to more residential areas (suburbs) during the period, particularly as many people began working from home. Figure 10 below shows the shift in all traffic from Edinburgh city centre to more residential areas by comparing periods before and after the Covid-19 spring lockdown. On the left we show data from February 2020, before restrictions were introduced. On the right we show data reported to us for June 2020, when the heaviest restrictions had been lifted but social distancing measures, with associated changes in people's behavioural patterns, were on-going.

[22] We have assessed the impact of Covid-19 on mobile networks by comparing MNO data for the second week of March 2020 (as a baseline) with those collected in the week lockdown measures were introduced in the UK and the periods after these measures were eased. We collected relevant data from MNOs between February 1- July 31, 2020. We have also clarified where we have considered data from other sources.

[23] This analysis does not include data from one operator.

Figure 10: Variations in MNO data traffic distribution in Edinburgh (February 2020 and June 2020)



Source: Ofcom analysis of operator data

MNO Base Stations were attacked due to Covid-19 related concerns

Across the UK, mobile operators reported attacks on 159 base stations associated with anti-5G or similar campaigns. Over this year, a number of unsubstantiated claims have circulated, often through social media, alleging a link between new 5G services and Covid-19 (notwithstanding that 5G deployments are at a relatively early stage in the UK, and have not taken place in many of the countries impacted by the pandemic). Prior to this, there were also concerns expressed about claims of the Electromagnetic Field (EMF) emissions of a 5G base stations posing an increased risk to people's health.

Earlier this year, we published our findings on Electromagnetic Field (EMFP) measurements we carried out around 22 locations near 5G mobile phone stations across 10 cities in the UK including Belfast, Cardiff, Edinburgh and London. [24]

We found that in all cases, the measured EMF levels from 5G-enabled mobile phone base stations are at small fractions of the levels identified in the International Commission on Non-Ionizing Radiation Protection (ICNIRP) Guidelines, the highest level recorded being approximately 1.5% of the relevant level. [25]

Our findings are also consistent with those of Public Health England (PHE) which states that overall exposure due to 5G is expected to remain low relative to guidelines (ICNIRP) and, as such, there

[24] Ofcom, Electromagnetic Field (EMF) measurements near 5G mobile phone base stations: Summary of results, 21 February 2020 (updated 17 April 2020)

[25] Guidelines for limiting EMF exposure that will provide protection against known adverse health effects are published by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). ICNIRP is formally recognised by the World Health Organization (WHO).

should be no consequences for public health. The Scottish Government has also confirmed it follows PHE's advice on these issues.

Progress with 5G continues despite the pandemic

Since the initial roll out of 5G networks last year, UK mobile operators have continued to deploy 5G services. As noted above, the main focus of this activity has been urban areas where such deployments provide additional capacity in areas of high demand.

We also expect MNOs to leverage other benefits of 5G as they continue to rollout their networks and to provide connectivity solutions for both consumers and businesses. This includes private networks for businesses, which will facilitate greater control and privacy in addition to connectivity.

The Scottish Government has published a national Strategy and established the Scotland 5G Centre to facilitate investment in, and deployment of, 5G in Scotland. The Scotland 5G Centre is the national hub for 5G, with a key role in delivering the Scottish Government's 5G strategy**.**

In September 2020, the Scottish Government confirmed additional funding of £4m to support the establishment of a network of 5G Innovation Hubs. These Hubs will work with SMEs to help develop skills needed to use 5G technology as a business enabler. The first Hub will be located in the Forth Valley and is expected to be operational in early 2021.

Availability of 2G, 3G and 4G mobile services

Methodology

In this section we report on coverage both outside and inside premises, on geographic coverage and on coverage along major roads in Scotland. We report on the availability of voice services, via either 2G, 3G or 4G, and on the availability of 4G data connections. Our definition of 4G coverage reflects a level of service that can deliver a connection speed of at least 2 Mbit/s (fast enough to browse the internet and watch glitch-free mobile video).

The mobile coverage figures provided in this report are based on predictions which the MNOs supply to Ofcom, with Ofcom undertaking regular testing to ensure the predictions provided are suitable for national and regional reporting. We take the accuracy of the data supplied to us seriously and we continue to monitor, through drive testing, the accuracy of all operators' coverage predictions. We note that operators continue to update and improve their prediction models, and we welcome this. The data used in the report includes predictions provided to us by O2 using a newly developed coverage prediction model, and which are still subject to Ofcom's validation process. In light of our own drive testing, we are continuing further discussions and work with O2.

Indoor coverage

The coverage people receive indoors will depend on a range of factors including: the thickness of walls, building materials used in construction and where in a building people are using their phone. Due to these factors, in some premises there may be differences between our predicted indoor coverage data and the actual coverage available. Our online coverage checker provides additional information on the likelihood of there being indoor coverage in buildings at different locations, which takes into account some of the factors that can affect a mobile signal.

Mobile operators provide several alternative options to improve indoor mobile coverage at locations without reliable coverage. Examples of these include broadband-based calls on services such as Skype/WhatsApp, femtocells and mobile repeaters. Additionally, all the operators in the UK make Wi-Fi calling services (the ability to make and receive a call over a Wi-Fi network) available to consumers (although not all mobile handsets support this feature). We note that the percentage of calls across the UK made using voice over Wi-Fi [26] by MNOs has increased substantially to between 2% and 18% from between 0.2% and 12% last year. [27] Other examples of available tools include broadband-based calls on services such as Skype/WhatsApp, and femtocells. In 2018 Ofcom also introduced regulations that allow the licence exempt use of certain types of mobile repeaters, which can amplify the signal received outside a building and thus improve consumer experience indoors (devices not meeting these specifications remain unlawful). [28, 29]

4G services (Indoor)

As can be seen from figure 11 below, 81% of premises in Scotland can receive 4G coverage indoors from all four operators, broadly in line with a UK average of 80%. However, indoor coverage from all four operators falls to just 51% for premises in rural Scotland.

Figure 11: Indoor premise 4G coverage by UK nation (all operators)

Nation	Total
Scotland	81%
Wales	73%
Northern Ireland	65%
England	81%
UK	80%

Source: Ofcom analysis of operator data

The picture improves if we consider indoor coverage from at least one operator, with around 96% of rural premises in Scotland having the option of taking a 4G service from at least one operator.

Figure 12 and figure 13 below, highlights indoor 4G premise coverage by individual operator across urban and rural Scotland. It shows that 02 (82%) and Vodafone (81%) have some of the best coverage for premises in rural areas of Scotland.

[26] There are two types of Wi-Fi calling solutions: "cellular preferred", where the devices use Wi-Fi calling only if there is poor cellular coverage, and "Wi-Fi preferred" where all the calls are made via Wi-Fi, when Wi-Fi is available. All UK MNOs use the Cellular-preferred solution.

[27] Ofcom has also committed to improving indoor mobile coverage by making regulations which allow consumers to operate mobile phone repeaters on a licence-exempt basis. Ofcom keeps under active review whether further changes can be made to improve access to and function of these devices for consumers.

[28] Mobile phone repeaters – what you need to know, 12 April 2018.

Figure 12: Indoor premise 4G coverage in urban Scotland (by operator)

Urban	% of premises with indoor 4G coverage (2019)	% of premises with indoor 4G coverage (2020)
EE	95%	96%
02	99%	98%
Three	92%	93%
Vodafone	98%	99%

Source: Ofcom analysis of operator data

Figure 13: Indoor premise 4G coverage in rural Scotland (by operator)

Rural	% of premises with indoor 4G coverage (2019)	% of premises with indoor 4G coverage (2020)
EE	77%	78%
02	78%	82%
Three	70%	70%
Vodafone	81%	81%

Source: Ofcom analysis of operator data

Voice and data services (Indoor)

Mobile voice services from all four operators are available to 93% of premises in Scotland, up 1% from last year. Again, urban areas of Scotland are better served with 98% indoor coverage compared to 72% in rural areas. This is illustrated by the difference in all-operator coverage between North Lanarkshire (99%) and Orkney Islands (42%). However, almost every premise in Scotland (whether urban or rural) has indoor voice coverage from at least one operator.

Mobile data services from all four operators are available to 97% of premises in Scotland. This drops to 87% for premises in rural Scotland.

Coverage outside premises

4G services (outdoor premise)

People expect good mobile coverage inside and outside their home. Coverage that is only present outside a home does not provide consumers with a comprehensive experience (although other workarounds, such as Wi-Fi calling, can mitigate this impact). Coverage outside premises, however, provides a good indication of the availability in places where people typically live, work and travel.

As can be seen from figure 14 below, 4G outdoor premise coverage from all operators in Scotland stands at 96%, the second highest of the UK nations. This coverage falls to 82% for rural areas of

Scotland. This still represents a considerable increase in rural outdoor premise coverage from 70% in January 2018.

Figure 14: Outdoor premise 4G coverage by UK nation (all operators)

Nation	Total
Scotland	96%
Wales	93%
Northern Ireland	94%
England	98%
UK	98%

Source: Ofcom analysis of operator data

Outdoor premise coverage from at least one operator stands at 99% for rural Scotland, providing consumers with alternative options. Figure 15 and figure 16 below highlights outdoor premise coverage by individual operator across urban and rural Scotland.

Figure 15: Outdoor premise 4G coverage in urban Scotland (by operator)

Urban	% of premises with outdoor 4G coverage (2019)	% of premises with outdoor 4G coverage (2020)
EE	100%	100%
02	100%	100%
Three	99%	99%
Vodafone	100%	100%

Source: Ofcom analysis of operator data

Figure 16: Outdoor premise 4G coverage in rural Scotland (by operator)

Rural	% of premises with outdoor 4G coverage (2019)	% of premises with outdoor 4G coverage (2020)
EE	95%	96%
02	92%	93%
Three	88%	88%
Vodafone	93%	94%

Source: Ofcom analysis of operator data

Voice and data services (Outdoor premise)

As with last year, around 98% of premises in Scotland have voice coverage outside from all four operators. This drops to 92% for premises in rural Scotland. Again, almost every premise in Scotland (whether urban or rural) has outdoor voice coverage from at least one operator.

Mobile data services from all four operators are available to 99% of premises in Scotland area. This drops to 95% for premises in rural Scotland. Almost all premises in Scotland have outdoor coverage from at least one operator.

Geographic coverage

4G services (Geographic)

The growth in 4G geographic coverage has begun to plateau in recent years, with small increases in individual operator coverage and national coverage recorded. There are still considerable gaps between the coverage available from at least one operator compared to the coverage from all operators, and these trends are reflected across the whole of the UK. Figure 17 below shows the change in 4G geographic coverage from all operators by UK nation. It highlights an increase of 2% points in coverage across Scotland (up from 42% in 2019) compared to a 3% point increase across the UK as a whole.

Figure 17: Change in 4G Geographic coverage from all operators by UK nation

	% of landmass served by all operators (2019)	% of landmass served by all operators (2020)	% change
Scotland	42%	44%	+2%
Wales	58%	60%	+2%
Northern Ireland	75%	79%	+4%
England	81%	84%	+3%
UK	66%	69%	+3%

Source: Ofcom analysis of operator data

Geographic coverage varies considerably among mobile operators and remains poor in many places. As can be seen from figure 18 below, only 43% of rural Scotland has 4G coverage from all operators.

Figure 18: 4G Geographic coverage from all operators by UK nation and rurality

Nation	Total	Urban	Rural
Scotland	44%	96%	43%

Source: Ofcom analysis of operator data

4G geographic coverage across Scotland from at least one operator increased by 1% this year to 81%, up from 80% in 2019. Complete not spots are down 1% to 19% this year, from 20% last year. There remain significant differences in coverage across the nations of the UK, with Wales (60%), Northern Ireland (79%) and England (84%) having geographic coverage from all four operators.

Whilst the trend for differences in coverage between the nations of the UK is also reflected in the coverage provided by individual MNOs, these overall coverage levels from operators tend to be higher and reflect the actual coverage available to a consumer on a given network in each nation.

Figure 19: Complete and partial 4G not-spots across the UK

Source: Ofcom analysis of operator data

Urban areas of Scotland are relatively well served by 4G networks but those in rural areas, particularly in the western Highlands and Islands, continue to experience poor levels of 4G geographic coverage. This compares to 9% of the overall UK geographic area which has no coverage from any operator.

Figure 20: Complete 4G not-spots by UK nation

Complete 4G not spots	
Scotland	19%
Wales	10%
Northern Ireland	3%
England	3%
UK	9%

Source: Ofcom analysis of operator data

It should be noted that some areas in Scotland without coverage are very remote, for example, 20% of Scotland is considered 'wild' by Scottish National Heritage.[30] This challenging terrain presents challenges for mobile operators who must consider a range of factors when deploying infrastructure, such as proximity to power sources and backhaul or radio links to connect masts to the main network. It can also be difficult to obtain the relevant permissions to access private land and the low population density in rural areas can limit the commercial attractiveness of some of these more remote areas.

Figure 21 below highlights 4G geographic coverage across the UK from at least one operator by rurality.

Figure 21: 4G Geographic coverage from at least one operator by UK nation and rurality

Nation	Total	Urban	Rural
Scotland	81%	100%	81%
Wales	90%	99%	88%
Northern Ireland	97%	99%	97%
England	97%	100%	97%
UK	91%	100%	90%

Source: Ofcom analysis of operator data

Figures 22 and 23 below highlight the extent of 4G geographic coverage across urban and rural Scotland by individual operator.

[30] Scottish Natural Heritage (now NatureScot), Scottish Natural Heritage's Advice to Government, 16 June 2014

Figure 22: Geographic 4G coverage in urban Scotland (by operator)

Urban	Geographic 4G coverage across Scotland (2019)	Geographic 4G coverage across Scotland (2020)
EE	99%	99%
02	98%	98%
Three	98%	98%
Vodafone	99%	99%

Source: Ofcom analysis of operator data

Figure 23: Geographic 4G coverage in rural Scotland (by operator)

Rural	Geographic 4G coverage across Scotland (2019)	Geographic 4G coverage across Scotland (2020)
EE	69%	70%
02	56%	62%
Three	56%	56%
Vodafone	62%	65%

Source: Ofcom analysis of operator data

Voice and data services (Geographic)

Mobile voice services from all four operators are available across 59% of Scotland's geographic area, up 1% from last year. The difference between urban coverage (99%) and rural coverage (58%) is striking and consistent with broader trends and gaps in coverage between urban and rural areas. However, 89% of Scotland's geographic area can get voice coverage from at least one operator, covering 100% of urban and 88% of rural Scotland.

Mobile data services from all four operators are available across 69% of Scotland's geographic area with significant difference between coverage in urban Scotland (99%) and rural Scotland (68%). Around 92% of Scotland's geographic area has data coverage from at least one operator.

Improving geographic coverage

Both the UK Government and Scottish Government have introduced initiatives which should see significant investment in networks and therefore improved geographic coverage over the coming years.

The announcement of the Shared Rural Network (SRN) agreement between the UK Government and mobile network operators in March 2020 should see around £1billion of public and private funds invested in addressing these problems and improving rural coverage for the UK. However, there has

only been limited coverage gains over the course of this year, as the SRN completes detailed planning work before shifting focus to delivery.

Ofcom is committed to reporting on progress made by the operators towards the legally binding commitments entered into their licences as part of the SRN. Under the agreement, each operator is committed to reaching 88% coverage of UK landmass by 2024, and 90% of landmass within 6 years from 2020 (subject to certain conditions), with an expectation that this will see the 'at least one operator' (i.e. the area where there is mobile coverage but not necessarily from the same MNO) reach 95% of UK landmass by 2025. Coverage in Scotland is expected rise by 10% to 91% from at least one operator and reach 74% from all four operators. [31]

The Scottish Government is also investing up to £25 million to deliver 4G mobile infrastructure to up to 40 mobile 'not-spots' through the Scottish 4G Infill programme (S4GI). The first site in the programme – at New Luce in Wigtownshire – went live in February 2020 and is now delivering 4G services. Two further sites at Ettrick in the Scottish Borders and at Strathconon in the Highlands went live in October 2020. Updates – including timescales for 4G service availability – are being published on the Scottish Government's website. [32]

Premises that do not have a decent fixed or a 4G mobile network connection

As with last year, this report continues to examine those premises unable to get a decent fixed or 4G mobile broadband service. Premises are considered to have access to a decent fixed connection if the broadband speed is above a download speed of at least 10 Mbit/s and an upload speed of at least 1 Mbit/s and to have access to an indoor 4G mobile service if a connection speed of at least 2 Mbit/s is available.

We estimate that 95% of premises in Scotland can receive both decent fixed and 4G mobile broadband services, while about 10,650 (0.4%) of premises in Scotland are unable to access either. [33] Aside from a handful of exceptions, all these premises are in rural Scotland. This means just over 2% of rural Scotland has no coverage from a decent fixed or 4G mobile network.

Coverage on roads

The road network in Scotland is hugely diverse, spanning the ten-lane M8 in Glasgow city centre to single carriageway sections in the Highlands. Good coverage is important along this road network to assist with vehicle communications, navigation, infotainment and safety aids. This section focuses on coverage along Scotland's major roads but a detailed breakdown of coverage along A&B roads can be found via our interactive dashboard.

In-vehicle 4G coverage from all operators along major roads in Scotland now stands at 50%. Whilst this represents a small increase of 2% from last year, coverage has risen from 41% in January 2018. Five percent of Scotland's roads are unable to receive in-vehicle 4G coverage. Figure 24 below highlights the range of in-vehicle 4G coverage along major roads in Scotland, by individual operator.

[31] https://www.gov.uk/government/news/shared-rural-network
[32] https://www.gov.scot/publications/scottish-4g-infill-programme-progress-update/
[33] This includes premises that are unable to receive services from other providers such as Wireless Internet Providers (WISPs)

Figure 24: In-vehicle 4G and voice coverage on major roads in Scotland, by operator

Rural	4G	Voice
EE	78%	82%
02	79%	92%
Three	66%	82%
Vodafone	80%	91%
All operators	50%	69%
At least one operator	95%	98%

Source: Ofcom analysis of operator data

There has also been a small increase for in-vehicle voice coverage from all operators on major roads in Scotland, which now stands at 69%. Around 2% of major roads are without voice coverage from any operator.

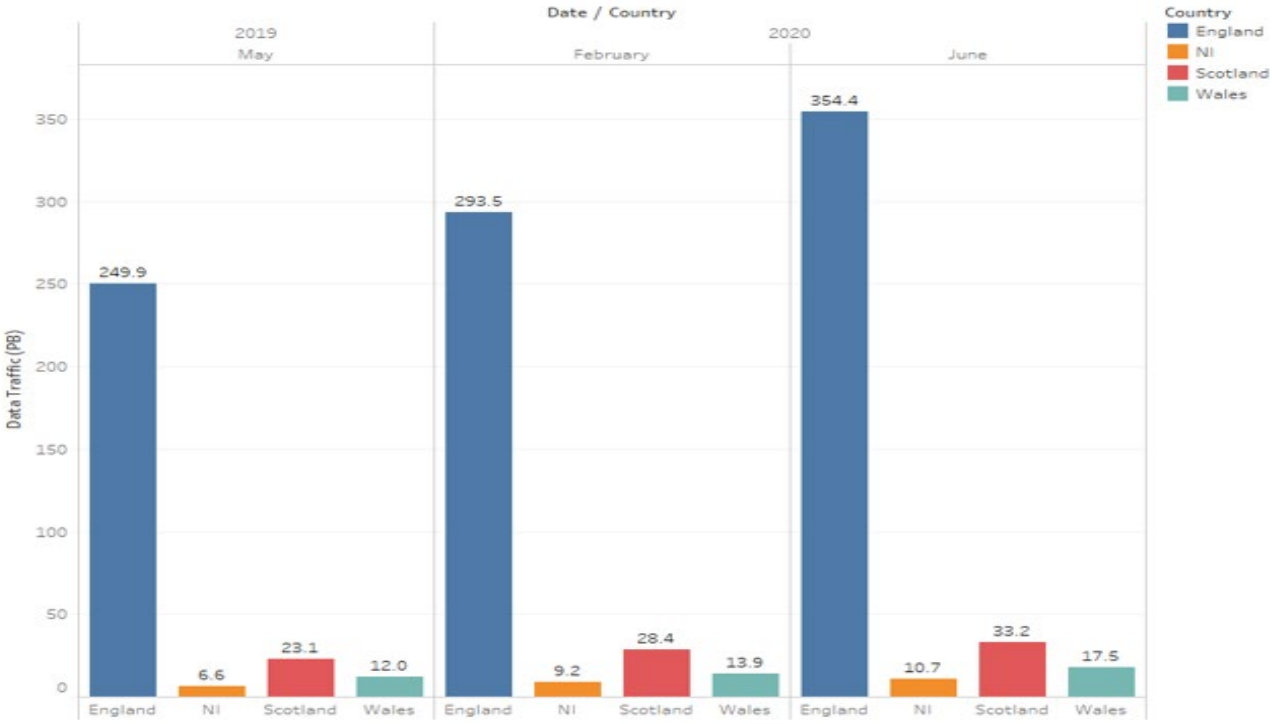
Mobile network performance and capacity

4G continues to carry most of the data traffic

Mobile data traffic in Scotland continues to grow significantly year-on-year. Our monthly sample indicates data growth increased to c33,000 TB from c23,000 TB in 2019. Most of this data is from 4G traffic, which accounts for c30,000 TB of this year's total data traffic in Scotland. Year-on-year data traffic continues to fall on 3G and 2G compared with 4G. Most of the traffic is concentrated in urban areas of Scotland, with Glasgow City local authority area generating around 2,800 GB/km sq. of data traffic, compared to just under 40 GB/km sq. in the Highland Council area.

England continues to generate the vast majority of the data traffic across the nations of the UK, with it accounting for 355,000 TB of the 415,000 TB UK total. Figure 25 below highlights the distribution of data across the nations of the UK. This distribution of traffic between England and Scotland largely reflects differences in population, rather than substantial differences in per head data consumption.

Figure 25: Mobile data traffic distribution across the UK nations (in PB)



Source: Ofcom analysis of operator data