Ofcom
making communications work
for everyone

Connected Nations 2018

Scotland report

18 December 2018

Overview

People now rely on being connected through calls and online services more than ever, whether at home or on the move. So, it's important that they have access to reliable, good quality broadband and mobile connections, to help them keep in touch with friends and family, shop and pay bills online, or stream the latest must-see TV series.

This annual report tracks progress in fixed and mobile services in Scotland. It also highlights the work Ofcom is doing, alongside the UK Government, the Scottish Government and communications companies, to improve the availability of fixed and mobile services across Scotland.

Alongside this report, we also publish an interactive dashboard, allowing people to see data at the level and locations they are most interested in.[1] We are also making it even easier for people to access our data on fixed broadband and mobile coverage availability. We have released two Application Programming Interfaces (APIs), a way of sharing data between different systems. These interfaces will allow others to use our data creatively to develop services, such as apps and widgets, to benefit consumers and businesses.

We have also launched the *Boost your broadband* campaign to help people identify the fixed broadband services available to them and get better value from their broadband deal. Despite superfast broadband being available to more than nine in ten Scottish premises and momentum building behind full-fibre broadband, our data shows people are often not on the fastest service in their area. We recognise there is limited competition (and therefore consumer choice) in certain parts of Scotland but we are encouraging people to check what broadband they need, what's available in their area, and to speak to their provider or shop around to make sure they are on the best deal for them.

International comparisons of fixed and mobile coverage are published in our Broadband Scorecard.[2]

[1] https://www.ofcom.org.uk/research-and-data/multi-sector-research/infrastructure-research/connected-nations-2018/interactive-report
[2] https://www.ofcom.org.uk/research-and-data/telecoms-research/broadband-research/eu-bbroadand-scorecard

Key findings for Scotland

Over the past year:

- Superfast broadband coverage has increased to 92% of homes and businesses in Scotland from 87% last year. This refers to the availability of fixed broadband services with a download speed of at least 30 Mbit/s.
- Over the last year the coverage of ultrafast broadband in Scotland has increased from 30% to 44% while almost 4% of premises now have access to a full-fibre connection.
- 4G mobile coverage from at least one operator now reaches 78% of Scotland's landmass.
- Indoor mobile voice coverage from all operators in Scottish homes and businesses has passed 90%.
- Just under half of motorways and A-roads in Scotland have good in-car 4G coverage from all operators.

Despite this progress, there are still large parts of Scotland that remain poorly served by communications services:

- Around 4% of premises in Scotland still cannot access a decent fixed broadband service that delivers a download speed of at least 10 Mbit/s and upload speed of at least 1 Mbit/s. However, this has improved from 6% last year.
- Although 92% of homes and businesses in Scotland are in areas where superfast, or better, broadband is available, only 40% of homes have signed up to these services.
- Around 38% of Scotland's landmass has good 4G coverage from all operators compared to the UK average of 66%.
- Just over half of Scotland's landmass can receive voice services from all operators, up from 39% in June 2017.
- We also estimate that there around 12,000 premises in Scotland are unable to access a decent fixed broadband service or have good 4G coverage.

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Introduction

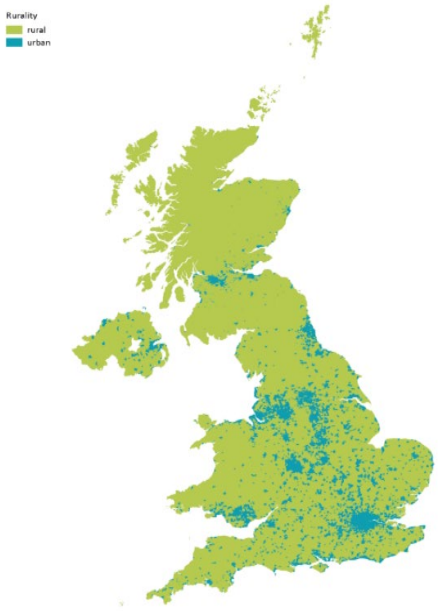
Access to high quality fixed and mobile internet services is vital to our increasingly online social and economic lives. The coverage of communications services across Scotland has increased significantly in recent years but there are still many areas where broadband speeds are inadequate and where mobile coverage is poor.

The areas with limited broadband and mobile coverage in Scotland tend to be sparsely populated rural areas where the commercial incentives to provide coverage are lower.[3] We investigate these issues in more detail in the Economic Geography report published alongside this report.[4]

As we have noted in the past, regulatory solutions alone are unlikely to drive the rollout of infrastructure to the most remote areas of Scotland. In these instances, it may be necessary for governments to take appropriate measures, such providing subsidies to prompt infrastructure investment. But there is also a role for the industry to examine how it approaches these issues and to deliver a step change in service for all consumers in Scotland. We continue to believe that collaboration and constructive dialogue will assist in this.

Ofcom continues to work with the Scottish Government, the UK Government and communications companies to improve communications services for all consumers. We also intend to hold a 'Connected Nations' event in early 2019; all our stakeholders are invited to join us and contribute to the wider policy discussion.

Figure 1: Rural and urban areas of UK according to Connected Nations definitions



[3] Further information on the 'urban' and 'rural' classifications can be found in the methodology section of our main Connected Nations report.

[4] https://www.ofcom.org.uk/research-and-data/multi-sector-research/availability-of-communication-services/economic-geography-2018

Fixed broadband services in Scotland

Fixed broadband scorecard for 2018

Superfast broadband[5]		Scotland	UK
Coverage	All	92%	94%
	Urban	97%	97%
	Rural	65%	74%
Take up	All	40%	45%
	Urban	43%	46%
	Rural	26%	31%

Unable to access decent broadband[6]		Scotland	UK
Coverage	All	4%	2%
	Urban	0.5%	1%
	Rural	21%	12%

Full fibre		Scotland	UK
Coverage	All	4%	6%
	Urban	4%	6%
	Rural	3%	8%

[5] Superfast broadband is defined as broadband with download speed of at least 30Mbit/s

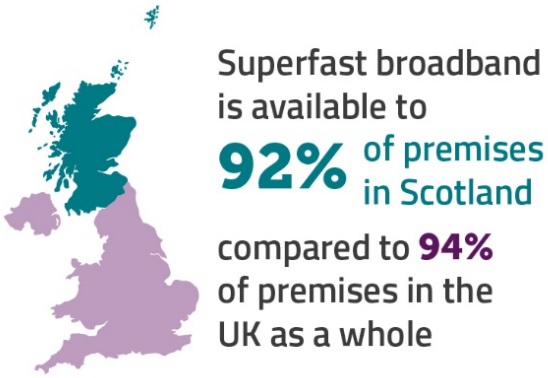
[6] Decent broadband is defined as a minimum download speed of at least 10 Mbit/s and upload speed of 1 Mbit/s)

Fixed broadband in Scotland

The increasing availability of content-rich websites, online streaming services such as Netflix and "cloud" based applications means that people and businesses increasingly expect reliable, resilient and stable broadband connections.

In previous Connected Nations reports we have focused on coverage from the largest companies. This year we have gathered information from some smaller companies to improve our understanding of connectivity across Scotland and the UK, with data from 34 companies included in our analysis. This includes some smaller full-fibre providers and fixed wireless broadband providers who often offer services in more remote areas. We have also collected data from 12 additional full-fibre providers. A full list of the providers who contributed coverage data can be found at Annex A of the main report.[7]

Over the past year the coverage of superfast broadband across Scotland has increased from 87% to 92%



Ofcom defines superfast broadband as a service which delivers a minimum download speed of at least 30 Mbit/s.

Superfast broadband coverage in Scotland continues to increase and is now available to 92% of premises in Scotland from 87% in 2017; the largest increase in the UK.

Scotland has benefited from a combination of government intervention and ongoing commercial investment. Working in partnership with Highlands and Islands Enterprise, local authorities and the UK Government, the Scottish Government's 'Digital Scotland Superfast Broadband' Programme has played an important role in improving superfast broadband coverage. Deployment is expected to continue into 2019.

Figure 2: Premises able to receive a superfast broadband service by nation

Nations	All	Rural	Urban
England	94% (23.1m)	76% (2.3m)	97% (20.8m)
Northern Ireland	89% (685,000)	67% (146,000)	98% (539,000)
Scotland	92% (2.4m)	65% (293,000)	97% (2.1m)
Wales	93% (1.4m)	77% (254,000)	97% (1.1m)

Source: Ofcom analysis of operator data

There is a significant difference between the availability of superfast broadband in urban and rural areas of Scotland, with 97% of premises in urban areas having access to superfast broadband compared to 65% of premises in rural areas.

Local authorities in the highlands and islands of Scotland have seen some of the largest increases in superfast broadband availability in the UK in recent years. However, almost a third of premises in areas such as Orkney and the Outer Hebrides remain unable to access superfast speeds. Figure 2 below shows the

[7] https://www.ofcom.org.uk/research-and-data/multi-sector-research/infrastructure-research/connected-nations-2018

proportion of premises that can access fixed broadband speeds of at least 30 Mbit/s in selected Scottish local authority areas.

Figure 3: Superfast broadband coverage by selected Scottish local authority area

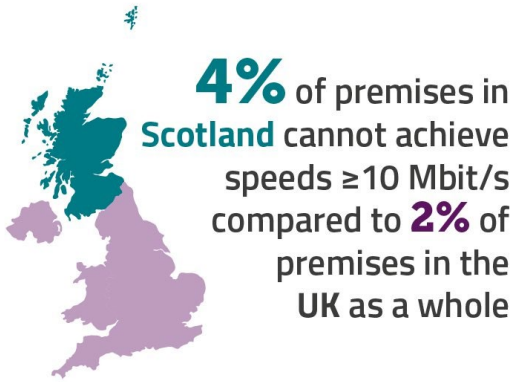
Local authority	% of premises ≥ 30 Mbit/s
Orkney Islands	62%
Comhairle nan Eilean Siar	67%
Shetland Islands	68%
Highland	75%
Argyll and Bute	78%
Aberdeenshire	78%
Dumfries and Galloway	82%
Perth and Kinross	83%
Moray	83%
Scottish Borders	83%

Source: Ofcom analysis of operator data

We expect superfast broadband coverage to continue to increase. The Scottish Government has committed to extending the availability of superfast broadband to 100% of premises in Scotland through its '*Reaching 100% Programme'*. Designed to maximise competition whilst delivering new fibre infrastructure in some of the most challenging geographies in the UK, £600 million has been committed to the first phase of procurement (including £21m from the UK Government) and we expect contracts to be awarded in 2019.

While superfast broadband speeds have increased for people in Scotland, 86% of small businesses are able to access superfast speeds through these types of connections, compared to 92% of all premises.[8] This may be due in part to coverage being lower in business parks than in residential areas, due to the costs involved in rolling out technology to business parks that have fewer occupants than in residential areas.[9] Just over half (53%) of small businesses in rural areas of Scotland are able to access superfast speeds.

Around 4% of premises in Scotland cannot access a decent fixed broadband service



Ofcom defines decent broadband as a service that delivers a download speed of at least 10 Mbit/s and upload speed of at least 1 Mbit/s. While superfast coverage continues to improve, there remains a significant minority of premises in Scotland (4%) that do not have access to decent broadband services.

This is felt more acutely in rural areas with 94,000 (21%) of premises unable to access decent broadband compared to 11,000 (0.5%) premises in urban areas.

[8] We define a small business as a Small or Medium Enterprise (SME) with at least one employee.
[9] Data for the Connected Nations is gathered from providers offering services over residential broadband technologies and therefore does not include coverage from dedicated business connections, such as leased lines.

Figure 2: Premises unable to access a decent broadband from a fixed line by nation

Nations	All	Rural	Urban
England	2% (484,000)	11% (322,000)	1% (162,000)
Northern Ireland	5% (41,000)	17% (38,000)	0.5% (3,000)
Scotland	4% (105,000)	21% (94,000)	0.5% (11,000)
Wales	3% (48,000)	13% (42,000)	1% (6,000)

Source: Ofcom analysis of operator data

In March 2018, the UK Government introduced legislation for a Broadband Universal Service Obligation (USO), which will give eligible homes and businesses the right to request a broadband connection that delivers a decent broadband service of at least 10 Mbit/s download speed and 1 Mbit/s upload speed. Ofcom is responsible for implementing the USO.

Premises in rural areas are more likely to have poor broadband speeds for several reasons. A significant number of lines with speeds below 10Mbit/s are in areas where there are long distances from exchanges (degrading speeds), and where services from other networks are not available. The longer distances between exchanges and premises reflect the lower population densities and disparate nature of premises in Scotland.

Many premises in rural areas are served by 'Exchange Only' cabinets. These cabinets cannot be easily upgraded to support superfast broadband speeds. Scotland has a higher proportion of these lines (5%) compared with the UK as a whole (3%). BT are installing new cabinets as part of their Copper Rearrangement (CuRE) programme to replace the exchange only lines.

Fixed Wireless Access (FWA) networks provide an alternative solution to traditional fixed broadband services. These networks use a wireless link for the final connection to an end user premises, avoiding the installation of fixed lines.

Ofcom is actively engaging with FWA providers to understand how FWA networks operate and the levels of service people receive. We intend to continue collating and analysing data on FWA networks given the increasingly important role that FWA plays in delivering a broadband service to people, especially in the most remote areas of Scotland. We discuss the potential for FWA networks to deliver decent broadband services in more detail in our main Connected Nations report.[10]

This year we have also seen mobile technologies such as 4G networks begin to be used in greater volumes to deliver home broadband services to people.

There are some areas which are challenging to reach, for both fixed and mobile network coverage. In these areas, satellite broadband is an alternative option for connectivity. We plan to work with satellite broadband providers over the coming year to better understand the broadband services that are delivered to these customers.

Over the last year the coverage of ultrafast broadband in Scotland has increased from 30% to 44%

Almost 1.2 million homes and businesses in Scotland now have access to ultra-fast connections (compared to 795,000 last year).

[10] https://www.ofcom.org.uk/research-and-data/multi-sector-research/infrastructure-research/connected-nations-2018

These connections can deliver higher download speeds of up to 300 Mbit/s.

Figure 3: Percentage of premises which can access ultrafast broadband by nation

Nation	Download speed ≥ 300Mbit/s
England	51%
Northern Ireland	38%
Scotland	44%
Wales	29%

Source: Ofcom analysis of operator data

Virgin Media has continued to upgrade its network, increasing their fastest residential broadband service to 300 Mbit/s for most of its network. Rollout continues in areas such as the Glasgow and Edinburgh City Regions, Fife, and Ayrshire, and will move into new areas in 2019.

We also expect ultrafast coverage to grow as a result of the increased interest in full-fibre networks.

Almost 4% of premises now have access to a full-fibre connection

In a 'Full-fibre' or Fibre to the Premises (FTTP) network, fibre optic cables are connected all the way from the local exchange to the home or small business, and can deliver reliability and speeds of 1 Gbit/s or more.[11] This contrasts with technologies that are a combination of fibre and copper like Fibre to the Cabinet (FTTC), where the quality and distance of the copper to the premises can impact on both the reliability and speed of the service

The number of premises in Scotland that have access to full fibre services has increased to 4% (96,000) from 1% last year.

Figure 4: Percentage of premises which can access full fibre services

Nation	Full fibre coverage
England	6%
Northern Ireland	12%
Scotland	4%
Wales	7%

Source: Ofcom analysis of operator data

Investment in full-fibre networks continues to grow and we expect deployment to continue to increase over the coming years with established and alternative providers announcing plans to expand their full-fibre networks.

Openreach's Fibre First program aims to roll-out full-fibre broadband to 3 million UK homes and small businesses by the end of 2020, with a target of covering 10 million homes by 2025. Several cities across the UK, including Edinburgh, will be involved in the initial deployment phase.

Cityfibre and Vodafone have announced plans to roll out full-fibre to 5 million homes and businesses by 2025, including in Aberdeen, Stirling and Edinburgh.

To encourage investment in building full-fibre networks and to provide investors and companies with long term regulatory certainty, Ofcom has proposed several changes in our regulatory and policy approach.[12] They include:

- Allowing competing companies to use Openreach's ducts and poles for both people and businesses. Currently, duct and pole access is restricted to networks focusing primarily on the residential market, but we are proposing that the restriction now be

[11]We define full fibre coverage as where the network has been rolled out to a "lead-in" that will serve the consumer end premise and where the customer would expect to pay a standard installation charge for that connection.

[12]https://www.ofcom.org.uk/__data/assets/pdf_file/0025/116539/investment-full-fibre-broadband.pdf

removed to allow it to also be used for business customers;
- A flexible approach to regulation by deregulating in areas where there are competing fibre providers; and
- Increasing the period for telecom competition assessments from 3 to 5 years.

We are also working with the UK Government and Scottish Government to overcome barriers to network deployment (including on wayleaves and gaining access to existing infrastructure).

Although 92% of premises have access to superfast broadband, 40% of premises have signed up to them

Although the terms 'coverage' and 'take up' are often interchangeable in the context of broadband speeds, they have very different meanings. Coverage is used to refer to the maximum broadband speed available at a premise. Take up is defined based on the package the consumer subscribes to and the measured speed that is delivered on that line.

Many consumers in Scotland, particularly in rural areas, could be receiving faster speeds now by upgrading their broadband service. While superfast broadband services are available to 65% of rural premises, 26% have signed up to faster services.

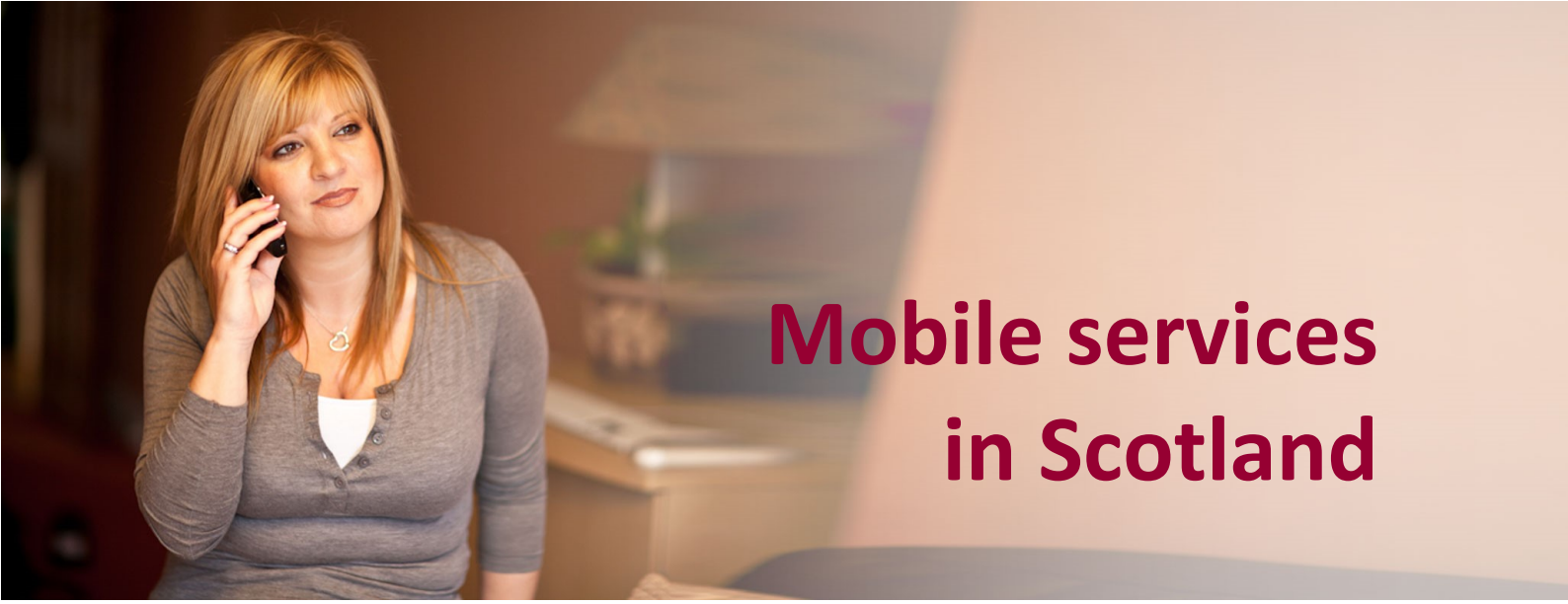
Figure 5: Percentage of premises taking up superfast broadband services

Take up of superfast broadband	
Scotland	40%
Urban	43%
Rural	26%

Source: Ofcom analysis of operator data

People should be given the choice to sign up to a fast broadband service but may not choose to do so for different reasons. For example, where the slower service is sufficient for their needs or because the faster service is too expensive. However, people should have access to information that helps them to make the most suitable choice for their situation. Therefore, we have launched a campaign to help people to identify the fixed broadband services that are available to them in their area and advice on how to get the service most suitable for their needs.[13]

[13] https://www.boostyourbroadband.com/



Mobile services in Scotland

Mobile scorecard for 2018

		Scotland	UK
4G	Good 4G indoor coverage from all operators	75%	77%
	Good 4G geographic coverage from all operators	38%	66%
	Good 4G indoor coverage from at least one operator	99%	99%
	Good 4G geographic coverage from at least at least one operator	78%	91%
Voice	Indoor voice coverage from all operators	91%	92%
	Geographic voice coverage from all operators	54%	78%
	Indoor voice coverage from at least one operator	100%	100%
	Geographic voice coverage from at least one operator	87%	95%

Mobile services in Scotland

Mobile services are an increasingly important part of people's lives and how business is conducted, and people increasingly want access to a good mobile connection wherever they are.

Our approach to reporting on mobile coverage

The levels of mobile coverage included in this report relate to where a sufficiently strong mobile signal is available to deliver a good experience to smartphone users.[14] [15] This is where:

- Nearly all 90-second telephone calls are very likely to complete without interruption;
- Nearly all 4G connections will deliver a connection speed of at least 2 Mbit/s. This is fast enough to browse the internet and watch glitch-free mobile video.

How you measure coverage is important, but so is *where* you measure it. To reflect the places in which people are likely to use their mobile, we look at coverage in three main ways:

a) *Outdoor:* The percentage of geographic area where someone can use their phone while outdoors. This measurement is useful for assessing the likelihood of successfully using a phone while out and about.

b) *Indoor:* The percentage of premises in which someone can use their phone. This measurement is useful for assessing the likelihood of successfully using a phone while at home or at work. This is estimated using the average reduction buildings cause to mobile signal levels. In next year's report we intend to provide more details on how signals are reduced by different types of building and the materials used in their construction.

c) *Roads:* The percentage of roads on which someone can use their phone while inside a vehicle. This measurement is useful for assessing the likelihood of successfully receiving coverage whilst on the road.

Finally, we report on whether coverage is available from all four operators. This reflects the level of choice of provider available to people. It is often much lower than the coverage available from a single operator. Given this, we also report on the highest and lowest coverage available from operators, noting that there are often significant differences between the coverage provided by mobile operators.

38% of Scotland's landmass has good 4G coverage from all operators compared to the UK average of 66%

While the ongoing roll-out of 4G services has led to improvements, geographic coverage in Scotland still lags behind the rest of the UK. More needs to be done to improve 4G

[14] We have used crowdsourced data from consumer handsets and drive testing to identify the signal levels needed to meet these targets at least 95% of the time.

[15] We also report on the availability of lower speed earlier generation 3G data services. These are reported in combination with lower speed 4G data services (based on a lower target signal threshold) where they are likely to provide a connection speed of at least 200 kbit/s for nearly all connections. These connections are likely to be sufficient to support lower speed data services such as basic web-browsing as opposed to higher resolution video.

coverage, particularly in rural areas of Scotland.

Figure 6: Geographic 4G coverage from all operators across the UK

Nations	All	Rural	Urban
England	82%	79%	98%
Northern Ireland	79%	78%	93%
Scotland	38%	37%	96%
Wales	57%	53%	89%

Source: Ofcom analysis of operator data, September 2018

4G mobile coverage from at least one operator now reaches 78% of Scotland's landmass

Despite these challenges, consumers can access 4G services from at least one operator across 78% of Scotland. This still leaves almost a fifth of Scotland's landmass without access to a good 4G mobile service but represents a significant improvement from 51% in 2017.

Figure 7: Geographic 4G coverage from at least one operator

	% of landmass covered by at least one operator
Scotland	78%
Urban	100%
Rural	77%

Source: Ofcom analysis of operator data, September 2018

Figure 8 highlights the spread of complete (served by no operator) and partial (served by at least one operator) 4G 'not-spots' across the UK.

Figure 8: Complete and partial 4G not-spots

Source: Ofcom analysis of operator data - September 2018

Consumers in urban areas of Scotland are relatively well served by 4G networks but those in rural areas, more focused in the highlands and islands, continue to experience poor levels of 4G coverage. This reflects the difficulties involved in building mobile networks in areas of challenging terrain and with lower population density.

Just over half of Scotland can receive voice services from all four operators, up from 39% in June 2017

The geographic area of Scotland covered by all operators for telephone calls has increased to 54% but remains behind the UK average, which now stands at 78%.

Figure 9: Geographic voice coverage from all operators across the UK

Nations	All	Rural	Urban
England	91%	90%	99%
Northern Ireland	88%	87%	96%
Scotland	54%	53%	99%
Wales	75%	73%	96%

Source: Ofcom analysis of operator data September 2018

However, geographic voice coverage in Scotland increases to 87% when we consider geographic voice coverage from at least one operator.

Indoor voice coverage from all networks in Scottish homes and businesses passes 90%

Some 91% of Scottish premises have indoor telephone call coverage from all four mobile networks, up from 86% in June 2017. We welcome these improvements, but more must be done to increase indoor coverage in rural areas of Scotland, which now stands at 66%.

Figure 10: Indoor voice coverage from all operators across the UK

Nations	All	Rural	Urban
England	93%	67%	97%
Northern Ireland	80%	59%	89%
Scotland	91%	66%	97%
Wales	88%	66%	95%

Source: Ofcom analysis of operator data, September 2018

There are 12,000 premises in Scotland that do not have coverage from either decent fixed or good 4G mobile

Premises are considered to have access to a decent fixed connection if the broadband speed is a download speed of at least 10 Mbit/s and an upload speed of at least 1 Mbit/s and to have good mobile coverage if indoor 4G mobile coverage is available. Using this approach, we estimate that 95% of premises in Scotland can receive both decent fixed and good mobile services.[16] Premises in the highlands and islands of Scotland are most likely to have neither a decent fixed or good mobile service available; 3% of rural premises in Scotland are unable to receive either a decent fixed or good mobile service.

Just under half of motorways and A-roads in Scotland do not have good in-car 4G coverage from all operators

Good mobile coverage is important for road users. The need for connectivity to be available to all roads is continuing to increase, with requirements including vehicle occupant communications, navigation, infotainment, and safety aids.

Around 46% of Motorway and A roads in Scotland have good in-car 4G coverage from all four operators, up from 24% in June 2017. Eight percent of Motorways and A roads do not have good in-car 4G coverage from any operator, compared with 3% across the UK.

Ensuring the accuracy of the mobile coverage data

The mobile coverage figures provided in this report relies on the accuracy of coverage prediction data supplied by the mobile operators.

In our last Connected Nations report update, published in October 2018, we noted that Ofcom's drive testing measurements had identified a potential overprediction in EE's 2100 MHz 3G signal level data. More recent drive testing by EE has found a similar level of overprediction. Given this, EE has resubmitted signal level predictions for their 2100 MHz 3G services to generate the mobile coverage data

[16] This consists of 0.7% of premises that can receive decent fixed, good mobile and FWA services and 94.7% that can receive decent fixed and good mobile.

for this report. This resubmitted data reduces EE's reported 3G coverage.

Separately, we identified a potential underprediction of the signal levels for Vodafone's 4G services. This has been confirmed by Vodafone and corrected for this report. This correction factor increases Vodafone's reported 4G coverage.[17]

We provide re-stated historic mobile coverage levels taking into account these adjustments in the interactive dashboard.

We take the accuracy of the data supplied to us seriously given its importance to policy making and the information provided to people on coverage. Considering these corrections, we decided to formally investigate these matters further.[18] [19] We have been reviewing the evidence and plan to publish an update in the new year.

In addition, we will continue to monitor, through drive testing, the accuracy of all of the operators' coverage predictions.

Initiatives to improve mobile communications

Coverage is improving, but expectations are also increasing and more must be done. We continue to work with the UK Government, the Scottish Government and companies to improve mobile communications in the Scotland. We discuss some of the key initiatives below.

Making more spectrum available for coverage

As set out in our Strategic Review of Digital Communications, the award of the mobile airwaves in the 700 MHz band provides an important opportunity to improve coverage.

To ensure mobile operators provide good quality coverage to more of the UK, we are consulting on including two coverage obligations in the award of 700 MHz and 3.6 GHz spectrum. Our proposed obligations would require the licence holders to improve geographic coverage for at least 90% of the UK's landmass (including improving coverage in each of the nations), as well as delivering additional outdoor coverage and deploying a minimum of 500 new sites. [20]

We have made more spectrum available for capacity and performance with both 4G and 5G

This year we auctioned and released 40MHz of 2.3 GHz spectrum, ideal for providing extra speed and capacity to 4G mobile services. This spectrum is supported by many mobile devices today and has already been put into service to improve performance across large areas.

We also auctioned and released 150 MHz of spectrum at 3.4 GHz that may be used for 5G services in the future.

Innovative spectrum uses

To enable opportunities for innovation, we are proposing to enable new users shared access to spectrum bands supporting mobile technology in locations not used by other licensed users. [21] This includes the 3.8-4.2 GHz

[17] A correction factor of 6dB has been applied.
[18] https://www.ofcom.org.uk/about-ofcom/latest/bulletins/competition-bulletins/open-cases/cw_01232
[19] https://www.ofcom.org.uk/about-ofcom/latest/bulletins/competition-bulletins/open-cases/cw_01231
[20] https://www.ofcom.org.uk/consultations-and-statements/category-1/award-700mhz-3.6-3.8ghz-spectrum
[21] https://www.ofcom.org.uk/consultations-and-statements/category-1/enabling-opportunities-for-innovation

band which is covered by 5G technology standard. This could enable new users to access spectrum for new business models and services, including 5G applications and high capacity wireless solutions that may address rural broadband coverage.

5G Rural First, a co-innovation project involving the University of Strathclyde, is currently trialling 5G services in some of the most challenging areas of the UK, including Orkney.[22]

Improving coverage in buildings and in vehicles

This year we introduced new regulations that allow people to use some types of mobile phone repeaters without the need for a licence.[23] These repeaters can be an effective low-cost solution to help to boost mobile signal indoors and in vehicles.

Taking steps to improve coverage in rural areas by addressing barriers and reducing costs

We continue to work with the UK Government, Scottish Government and communications companies to improve rural coverage in other ways. We have also supported changes to the Electronic Communications Code and to planning laws, to make it easier and cheaper to deploy mobile infrastructure.

We have provided advice to the UK Government following technical analysis of a variety of options to improve mobile coverage.[24] The advice focused on public subsidy, rural wholesale access (commonly known as rural roaming), infrastructure sharing and planning reform.

In June 2016, the Scottish Government published a Mobile Action Plan aimed at delivering improved investment in mobile infrastructure – and increased coverage – in Scotland. The Action Plan also seeks to introduce planning reforms and the trialling of non-domestic rates relief.[25]

The Scottish Government has also announced WHP Telecoms Ltd as its chosen supplier for the Scottish 4G Infill (S4GI) Programme, which aims to extend 4G coverage to areas not covered by commercial rollout. Up to £25 million of public funding, including funding from the European Union, will be invested to deliver 4G mobile infrastructure to serve selected mobile 'not-spots' throughout Scotland. The Scottish Government's 2018/19 Programme for Government sets out their commitment to publishing a 5G strategy for Scotland.

We discuss the potential impact of innovation and 5G services in more detail in the main Connected Nations Report.[26]

Making mobile coverage data more widely available

This report is accompanied by an interactive dashboard to provide readers with the ability to explore the data in greater depth and allow them to create customised views.[27]

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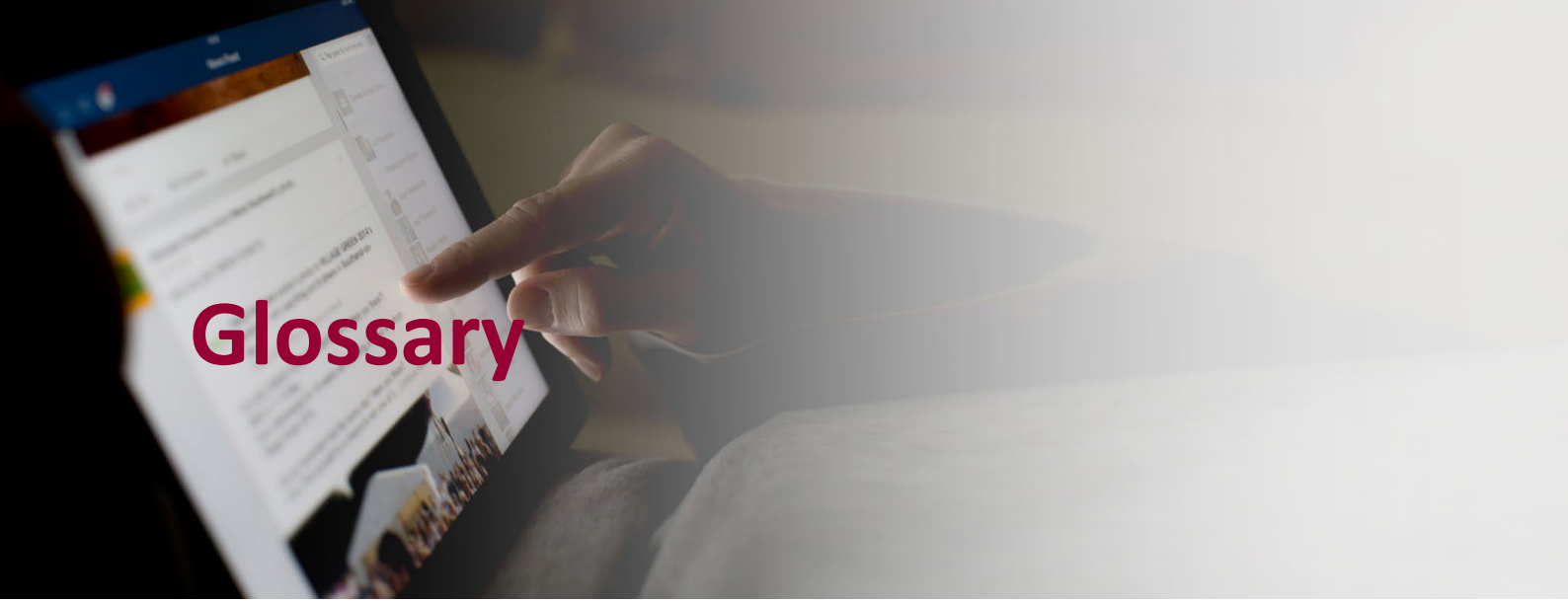
[22] https://www.5gruralfirst.org/what-is-5gruralfirst/
[23] https://www.ofcom.org.uk/consultations-and-statements/category-2/mobile-phone-repeaters
[24] https://www.ofcom.org.uk/phones-telecoms-and-internet/coverage/advice-government-improving-mobile-coverage
[25] https://www.gov.scot/publications/mobile-action-plan/
[26] https://www.ofcom.org.uk/research-and-data/multi-sector-research/infrastructure-research/connected-nations-2018/main-report
[27] https://www.ofcom.org.uk/research-and-data/multi-sector-research/infrastructure-research/connected-nations-2018/interactive-report

Additionally, Ofcom makes data available at an aggregate level for anyone to access use and share.[28]

The data that supports this report has also been used to update our coverage checker app for smartphones and tablets, which helps people check the availability of fixed broadband and mobile services in their area.[29]

We are making an API available for the first time, allowing users and organisations access to Ofcom coverage data on a premise by premise basis, which they can use in services such as apps and widgets. This will make it easier for third party websites to integrate the mobile coverage information available on our coverage checker.

[28] https://www.ofcom.org.uk/research-and-data/multi-sector-research/infrastructure-research/connected-nations-2018/data-downloads
[29] http://www.ofcom.org.uk/checker



Glossary

2G Second generation of mobile telephony systems. Uses digital transmission to deliver: voice, text services and very low-speed data services.

3G Third generation of mobile systems. It can be used to deliver: voice, text and lower speed data services. It supports multi-media applications such as video, audio and internet access, alongside conventional voice services.

4G Fourth generation of mobile systems. It can provide download speeds of over 10 Mbit/s, and is used to deliver: voice, text and higher speed data services.

5G will be the fifth generation of mobile technology. It is expected to deliver faster, lower latency mobile broadband, and to enable more revolutionary uses in sectors such as manufacturing, transport and healthcare.

Access network An electronic communications network which connects end-users to a service provider; running from the end-user's premises to a local access node and supporting the provision of access-based services. It is sometimes referred to as the 'local loop' or the 'last mile'.

ADSL Asymmetric Digital Subscriber Line. A digital technology that allows the use of a standard telephone line to provide high-speed data communications. Allows higher speeds in one direction ('downstream' towards the customer) than the other.

Backhaul The part of the communications network which connects the local exchange to the ISP's core network

Base station This is the active equipment installed at a mobile transmitter site. The equipment installed determines the types of access technology that are used at that site.

Decent Broadband A data service that provides download speeds of at least 10 Mbit/s and upload speeds of at least 1 Mbit/s.

Broadband A data service or connection generally defined as being 'always on' and providing a bandwidth greater than narrowband connections.

Broadband USO Broadband Universal Service Obligation. This will give consumers and businesses the right to request a broadband connection capable of delivering a download sync speed of 10Mbit/s and an upload sync speed of 1Mbit/s.

Core network The central part of any network aggregating traffic from multiple backhaul and access networks.

DOCSIS Data Over Cable Service Interface Specification. It is a standard for the high speed transmission of data over cable networks.

DSL Digital Subscriber Line. A family of technologies generally referred to as DSL, or xDSL, capable of transforming ordinary phone lines (also known as 'twisted copper pairs') into high-speed digital lines, capable of supporting advanced services such as fast internet access and video on demand. ADSL and VDSL (very high speed digital subscriber line) are variants of xDSL).

FTTC Fibre to the Cabinet. Access network consisting of optical fibre extending from the access node to the street cabinet. The street cabinet is usually located only a few hundred metres from the subscribers' premises. The remaining segment of the access network from the cabinet to the customer is usually a copper pair.

FTTP Fibre to the Premises. A form of fibre optic communication delivery in which the optical signal reaches the end user's home or office. Also known as full fibre broadband.

FTIR Future Telecoms Infrastructure Review. This document sets out the government's ambition for digital connectivity published in July 2018.

Full fibre coverage Where the network has been rolled out to a "lead-in" that will serve the consumer end premise and where the customer would expect to pay a standard installation charge for that connection

HD or **HDTV** High-definition television. A technology that provides viewers with better quality, high resolution pictures.

IP Internet Protocol. This is the packet data protocol used for routing and carrying data across the internet and similar networks.

IoT Internet of Things. Embedded connectivity in everyday things, enabling them to send and receive data.

LTE Long Term Evolution. This is 4G technology which is designed to provide faster upload and download speeds for data on mobile networks.

M2M Machine to Machine. Wired and wireless technologies that allow systems to communicate with each other.

MNO Mobile Network Operator, a provider who owns a cellular mobile network.

Not-spot An area which is not covered by fixed or mobile networks.

PSTN Public Switched Telephone Network. The network that manages circuit switched fixed line telephone systems.

SIM Subscriber Identity Module. A SIM is a small flat electronic chip that identifies a mobile customer and the mobile operator. A mobile phone must have a SIM before it can be used.

Smartphone A mobile phone that offers more advanced computing ability and connectivity than a contemporary basic 'feature' phone.

Superfast broadband A data service that delivers download speeds of at least 30 Mbit/s.

UHD Ultra High Definition television, providing a resolution of 3840 x 2160 pixels (4K).

Ultrafast broadband A data service that delivers download speeds of greater than 300 Mbit/s.

Usage cap Monthly limit on the amount of data that users can download, imposed by fixed and mobile operators for some of their packages.

VDSL Very High Speed DSL. A high speed variant of DSL technology, which provides a high headline speed through reducing the length of the access line copper by connecting to fibre at the cabinet.

VoIP Voice over Internet Protocol. A technology that allows users to send calls using internet protocol, using either the public internet or private IP networks.

wifi A short range wireless access technology that allows devices to connect to a network through using any of the 802.11 standards. These technologies allow an over-the-air connection between a wireless client and a base station or between two wireless clients.

xDSL The generic term for the Digital Subscriber Line (DSL) family of technologies used to provide broadband services over a copper telephone line.