

5G

In addition to higher throughput compared to previous generations of mobile networks, 5G offers smarter, more powerful, and more energy-efficient connectivity.

For the general public, 5G offers smoother access to services when on the move and richer, more immersive experiences.

For businesses, 5G streamlines industrial processes and improves employees' way of working. Services in smart cities including the management of water, energy, waste, transport and buildings for example will also be redesigned with 5G.

Orange's 5G: key figures

- **3 to 4** times faster than 4G compared to its launch. Speeds up to 10 times faster than 4G in the long term.
- **2 to 3** minutes is the time it takes to download a 4GB HD film in 5G* instead of 13 minutes in 4G.
- **10** times more energy efficient than 4G in 2025.
- **6** Orange countries have already launched 5G.
- **9** Orange 5G Labs to innovate with economic players.
- **300** patent families identified in the 5G environment.

*estimated value according to average download time

Orange's ambitions for 5G

Thanks to its network expertise, research and innovation capacity, ecosystem and international presence, Orange is a leading European operator in 4G and the leading FTTH operator in Europe.

More than ever, Orange differentiates itself through the quality of its networks and the quality of the experience it offers to its consumers and business customers, and aims to maintain its leadership position.

5G is here to complement its existing networks and enable Orange to support everyone as their uses evolve and to develop new services that are useful for people and society.

Orange is considering the development of 5G in three key areas:

1. Improving mobile broadband for new immersive experiences

5G is gradually being deployed on existing 4G sites, in urban areas under heavy demand, in order to avoid any risk of saturation, and in areas of economic activity, in addition to existing networks. It is mainly deployed in the 3.4-3.8 GHz frequency band, which provides average speeds 3 to 4 times faster than those of 4G, and offers real browsing comfort on the move.

5G will enable 360° immersive experiences, combining augmented and virtual reality, for everyday communication, training, entertainment and work. It will also significantly increase the performance of Cloud services.

2. New applications to support the transformation of businesses and society and leverage real-time usage

Companies will be able to exploit data when it is produced, which makes them more agile, more in tune with their customers' needs, and more responsive in their markets. This will be made possible with 5G, combined with the Internet of Things, edge computing and artificial intelligence.

A new world of opportunities opens for different business sectors, such as industrial, media, transportation, smart cities or health. Examples include:

- Developing new capabilities to massively connect objects, collect data, and analyse it in an increasingly relevant way using Artificial Intelligence. In industries, for example, data from valve remote controls, probe readings or HD cameras are leveraged in real time.
- Operating industrial robots and making them co-operate with each other to improve the productivity of production sites or to automate the monitoring of buildings.
- Experiencing events in a fully immersive way, from the pitch or the stadium stands, thanks to this very high-speed connectivity that enables real-time data transmission, virtual reality video streaming and differentiated live audio streams, allowing users to choose what they want to listen to.
- Enabling further developments in the field of mobility: first and foremost, the fluidity and autonomous capability of transport. Offering appropriate service capabilities for the various connected vehicles (cars, trucks, shuttles or trains) by dynamically adapting to the various requirements of road safety, software downloads, information uploads or vehicle-to-vehicle communications.
- Transmitting critical data in near real-time to patients that are hospitalised, or at home, or for remote surgical procedures.
- For Private Mobile Radio (PMR) used for critical communications in industrial environments, airports and Smart Cities, 5G provides the high availability and security expected to enable the use of IoT in near real-time, as well as group video communications and business applications. 5G is key to the digital transformation of activities related to population safety and critical industrial processes.

This is made possible thanks to a 5G core network. From 2023, when these 5G core networks will be deployed, 5G networks will be able to offer low latency, faster uplink throughputs, and enable network slicing, which prioritises certain 'slices' of the network to cover critical uses or specific needs, as well as to allow different levels of security.

In a forthcoming update to the 5G standard, 5G will make it possible to connect millions of sensors and objects across the same area, to improve their battery life and to geolocate them.

3. An alternative solution for fixed broadband access in countries where fiber infrastructure is not widely deployed

5G will use new frequency bands with capabilities similar to those of fiber optics. With 5G, people living in countries or territories where fiber cannot be deployed will benefit from broadband at home. This technology will enable businesses and players in smart cities to wirelessly connect factories and urban infrastructures. It will also provide an easy-to-activate solution to connect pop-up stores or mobile construction sites, in the event of an outage of the company's main network, or for tele-medicine.

Main achievements

Since 2012, Orange has actively contributed to **research activities** as part of the **5G PPP European Public Private Partnership** and in collaboration with the ANR (*Agence Nationale de la Recherche Française* - the French National Research Agency). On the basis of its 5G research works, Orange counts about 300 patent families related to 5G including 80 patents at the heart of the 5G technology (mobile phones and infrastructures).

Orange is also heavily involved in the standardization of 5G through **3GPP**, the global mobile standardization body, to which it is the first European contributing operator (and 5th worldwide operator).

In addition to research and standardization, **several major European initiatives have been carried out since 2017 with technological and innovation partners to test and prepare for the future evolutions of 5G:**

- In February 2017, Orange announced a partnership with UTAC CERAM, the world leader in vehicle testing and certification, including autonomous vehicles, to provide 4G/5G connectivity on the Linas-Monthléry site. Orange, together with Ericsson, has rolled out 4G public connectivity on the

test track and provided experimental private 4G/5G connectivity to test the 5G functionalities necessary to autonomous vehicles. Field experiments are continuing, notably with tests as part of the European research project 5GCroCo, which focuses on the implementation of communication services between vehicles and with their environment that are harmonized and seamless from one country to another via 5G.

- Orange sees 5G as a supplementary technology to fiber to bring broadband to more remote or less accessible territories that cannot have fiber. Orange conducted real-world testing in Romania, in partnership with Samsung and Cisco, between June and mid-July 2018.
- In April 2019, Orange made the first fully 5G data call in Valencia, Spain, using 5G Standalone (5G SA) technology. A new step was taken in November 2020 with a first data call demonstrating interoperability between 5G SA equipment from different partners, at Orange Labs in Lannion, France.

Orange is also conducting several initiatives as part of an **open innovation approach**, including:

- The opening of a network of nine Orange 5G Lab sites in France and abroad in 2021. This initiative aims to help economic players to better understand the opportunities, value and utility of 5G. There, they will be able to test their current solutions and services and think about new uses while taking advantage of an ecosystem to co-innovate and already start changing their business model and processes. Five Orange 5G Lab are already opened including four in France and one in Romania.
- The possibility for start-ups selected as part of challenges or the Orange Fab acceleration programme to receive the support of experts and to test their offerings and services on Orange's 5G network.
- The launch of two open 5G experimentation platforms in France, in the 26 GHz band, to test uses requiring ultra-high speed in areas with very high traffic (stations, airports, stadiums, concert venues, for example).

In addition, since 2019, Orange has been engaged in a process of co-developing future uses of 5G with major companies in Europe.

In France, co-innovation experiments have been conducted with French leading companies:

- Schneider Electric, on the indoor 5G coverage of their industrial campus, the testing of 5G-connected augmented reality solutions for real-time maintenance operations and the possibility of remote factory visits thanks to a remotely controlled telepresence robot.
- The Olympique de Marseille football club, to anticipate and respond to the needs and future 5G uses of spectators and businesses in the Orange Vélodrome.
- SNCF and Nokia, on new in-station services, with a fast download test of high definition video content in Rennes.

In the French port of Le Havre, Orange has opened up 5G for companies in the industrial port area. Thanks to 5G, these companies will benefit from real-time data, and will be able to use connected robotics, augmented reality maintenance and even make remote interventions possible.

In Belgium, Orange opened an Industry 4.0 innovation campus at the end of 2019. This is based on a 100% 5G test network (5G Stand Alone network) deployed in the port area of Antwerp. The first innovations based on this 5G network were demonstrated in October 2020 with its partners:

- The Port of Antwerp, around the efficiency and safety of towing ships in the port thanks to tugs connected in 5G that transmit information (images, radar, sonar) in real time to the control room.
- Covestro, to facilitate the work of technicians during the inspection operations of its chemical plants with access to information on the installation and the possibility of remote assistance in 5G.
- Borealis, for quality control in production, with plant equipment data being securely transmitted via 5G connectivity to AI-based quality control systems hosted in the cloud.
- BASF, to increase its critical communications capabilities and modernize its network for emergency and group calls with 5G connectivity, multi-functional 5G smartphones and location-based security applications and high-quality real-time images.

Orange Belgium is also a partner of Helicus, a drone supplier, in the framework of a research project called HAI-SCS (Helicus Aero Initiative - Scheduling, Connectivity and Security). This project aims to

enable automated drone services when shipping medical supplies or human samples through 5G connectivity.

In Spain, Orange, in collaboration with other players (local authorities, companies, universities, public bodies, etc.), is playing a leading role in the trials projects funded by the Spanish government, through the public entity Red.es, that will be developed in 2021 in Valencia (15 use cases), Galicia (13 use cases) and Basque Country (3 use cases):

- In Valencia, use cases will focus on the following fields: Safety, Health, Industry, Tourism, Agriculture, Gaming, TV broadcasting and smart cities. The 5G network will also serve as a backup network for critical communications.
- In Galicia, various applications will be explored in the fields of Safety, Health, Industry, Tourism, Agriculture, Education and Research, Gaming and events broadcasting. A 5G fixed-wireless solution will also be implemented.
- In the Basque Country, Orange is part of a temporary joint venture, providing its 5G network and taking part in use cases in the cybersecurity domain, MNVO (Mobile Network Virtual Operator) and national roaming, and 5G deployment in the electricity sector.

Additionally, Orange Spain has tested a "5G Anti Collision" pilot in the Mercabarna fresh produce wholesale market in Barcelona. This project aims to prevent accidents at work involving commercial vehicles. A trial of an alert system has already demonstrated the relevance of using 5G in conjunction with other communication and geolocation technologies to provide warning and avoid collisions.

Furthermore, Mercamadrid, one of Europe's largest food distribution platforms, has entrusted Orange Spain with the deployment of a fiber-optic infrastructure and a 5G network to accelerate the digital transformation of the food sector and businesses located on the site (business planning, optimising the use of resources, traceability, customer information, etc.).

It is worth noting also that in previous times Orange Spain has also developed several experiences regarding the possibilities of 5G in other fields as urgent health assistance, tourism, automotive, robotic or entertainment.

In Romania, Orange is conducting several co-innovation projects, including one with Continental aimed at equipping trucks travelling in convoys in order to optimize and secure road transport. Another use case focuses on video broadcast and is underway with several media outlets in Romania.

In Poland, Orange signed an agreement at the end of 2020 with the Lodz Special Economic Zone (ŁSSE) for the deployment in 2021 of a 5G indoor network at ŁSSE 5G Lab, a venue dedicated to start-ups and innovation around 5G. Partner companies at ŁSSE 5G Lab will be able to test their innovative solutions and benefit from Orange's expertise. Selected start-ups will be able to test and develop their solutions, among others as part of the Orange Fab acceleration program.

Orange has also been selected by Miele for the deployment of a 5G network within Miele's domestic appliances factory, in Ksawerów near Łódź. The network will digitize and automate the quality control process for the manufactured products, as well as facilitate large-scale employee training programs using virtual reality (VR).

Orange's roadmap for 5G

On 5th November 2019, Orange Romania was the first Orange Group country to open a 5G commercial network in 3 main cities. Since 29th October 2020, the 5G network is available in Bucharest (100% coverage) and in 14 other cities.

On 1st July 2020, Orange Poland has launched 5G services that are available to 6 million customers in almost 400 cities and towns across the country. This is a first step before 5G frequencies allocation in Poland.

On 7th of September 2020, Orange Spain launched a 5G commercial network in 5 main cities: Madrid, Barcelona, Valencia, Sevilla and Malaga. In April 2021, Orange announced that its 5G network in Spain reached 442 cities in 38 provinces, with 28% population coverage. The company works to offer this service to more than half of the Spanish population in 2021 and to more than 90% in 2022. Additionally, Orange is currently the operator in Spain with the largest amount of spectrum in the frequencies band 3,5 GHz (3,4-3,8 GHz), the priority one to offer 5G services, reaching a total amount of 110 MHz after the last public auction.

In France, after launching its first 5G-compatible rate plans on October 8, 2020, Orange commercially launched its 5G network on December 3, 2020. As of the 7th of April 2021, 5G was already available in 286 French cities and in 1,300 economic areas.

For its part, Orange Luxembourg made all its mobile plans 5G compatible on 16 October 2020 without any price increase. On November 23, 2020, Orange Luxembourg announced the gradual deployment of 5G, starting with Luxembourg City and surrounding areas. On December 2020, Orange launched a support program for Orange customers with survey and content marketing, and the Orange team also organized a digital round table dedicated on 5G for gamers.

On 12th May 2021, Orange Slovakia launched a 5G network in Slovakia, accessible to residents of the Bratislava district of Petržalka and residents of a selected part of Banská Bystrica.

Recent news:

20 April 2021: Orange and the CAMPUS Research Institute of UPB open the first 5G laboratory in Romania (in Romanian)

22 March 2021: Orange launches 5G in its first French port, Le Havre

18 March 2021: Orange Poland will build a 5G campus network at Miele plant (in Polish)

3 February 2021: Orange announces the opening of nine Orange 5G Labs to enable economic players to bring 5G uses to life

14 December 2020: The connected car crossed national borders

9 December 2020: Orange launches the challenge of developing new 5G applications with the collaboration of Google (in Spanish)

8 December 2020: Orange Poland will build a 5G network in the Łódź Special Economic Zone (ŁSSE) (in Polish)

3 December 2020: Mercabarna chooses 5G technology to prevent industrial vehicle accidents (in Spanish)

26 November 2020: Orange launches its 5G network in France by making quality of service its priority

25 November 2020: 5 startups win the 5G Online Challenge launched by Orange Romania and enter the Orange Fab accelerator (in Romanian)

24 November 2020: Orange Luxembourg launches its 5G network and deploys a support program for its customers (in French)

9 November 2020: Orange supports LACROIX Group prepare for the arrival of 5G in its Industry 4.0 electronics plant

9 November 2020: A multi-vendor ecosystem to prepare for the 5G of tomorrow

3 November 2020: Mercamadrid moves towards a smart city with the Orange 5G network (in Spanish)

22 October 2020: Orange Belgium partners with Helicus to support use of drones for shipping medical samples and supplies

22 October 2020: First 5G innovations proposed by Orange Belgium and its industrial partners in the Port of Antwerp: from augmented field operators to connected tugboats

9 October 2020: Orange Belgium selects Nokia for its future mobile radio network

8 October 2020: Orange is launching new mobile offers enriched with data and compatible with the future 5G network rolled out from December 2020

1^{er} October 2020: Orange wins the broadest range of frequencies in France's 5G auction

28 September 2020: Orange and Schneider Electric Run Industrial 5G trials in French Factory

28 September 2020: Orange, official supplier of Roland-Garros 2020 (in French)

7 September 2020: Orange launches 5G network in Madrid, Barcelona, Valencia, Sevilla and Malaga (in Spanish)

24 August 2020: Bucharest becomes the first city in Romania with 100% 5G coverage in the Orange network (in Romanian)

10 August 2020: Orange Spain, the national operator with the largest presence in the development of 5G technology based pilots (in Spanish)

3 July 2020: The 6 winning start-ups of the Orange Fab France acceleration program dedicated to 5G

1 July 2020: Say #hello5G with Orange today (in Polish)

24 July 2020: Orange Luxembourg obtains an attractive spectrum package at Luxembourg's 5G auction (in French)

18 February 2020: 5G technology will allow municipal police to provide emergency health care in real time (in Spanish)

22 January 2020: Orange Industry 4.0 Campus welcomes co-innovation of Port of Antwerp, Borealis, Covestro and other industrial partners, maximizing 5G potential in the port of Antwerp

20 December 2019: The mayors of Malaga and Seville make the first 100% 5G video call between two European cities (in Spanish)

12 December 2019: Orange Belgium is the first to launch a 5G testing hub for business in Belgium: the Orange Industry 4.0 Campus in the port of Antwerp

11 December 2019: Orange Luxembourg in the starting blocks for the launch of 5G (in French)

5 December 2019: Orange presents its new strategic plan Engage 2025

18 November 2019: Barcelona advances in the integration of immersive tourism in the city thanks to 5G technology (in Spanish)

7 November 2019: The Orange Vélodrome enriches its connectivity with an experimental 5G antenna (in French)

5 November 2019: Orange's first commercial 5G network launched in Romania

7 October 2019: Orange launches two open 5G experimentation platforms in the 26 GHz band