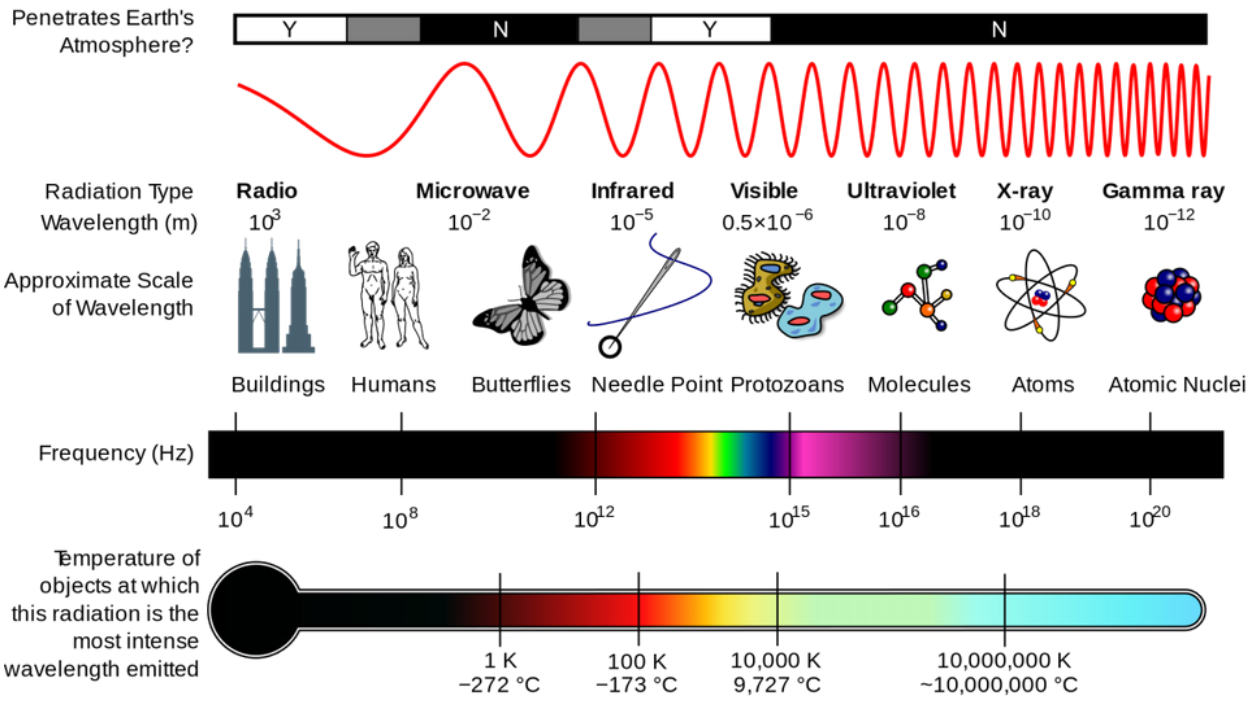
The Science Of Why 5G Is (Almost) Certainly Safe For Humans
Ethan Siegel, Senior Contributor
https://www.forbes.com/sites/startswithabang/2019/11/01/the-science-of-why-5g-is-almost-certainly-safe-for-humans/#4c1810bd70e3

Over the coming few years, a new set of infrastructure will be rolled out across the world: 5G wireless technology. Just as 4G networks are able to provide mobile internet speeds hundreds of times faster than 3G — enabling users worldwide to stream HD TV, browse webpages quickly, and even make high-quality video calls — the advent of 5G will enable speeds of up to 100 Gigabits per second: up to 100 times faster than 4G.

With each new generation of WiFi that comes out, a new wave of fear-mongering health claims emerges. They always come along with the same arguments:

- humans have never been exposed to this much of this type of radiation before,
- scientists have not demonstrated that the proposed new infrastructure won't be harmful to humans,
- the World Health Organization has already declared radio-frequency (WiFi) radiation to be "possibly cancerous,"
- and therefore, we should declare a moratorium on this technology until its safety has been established.

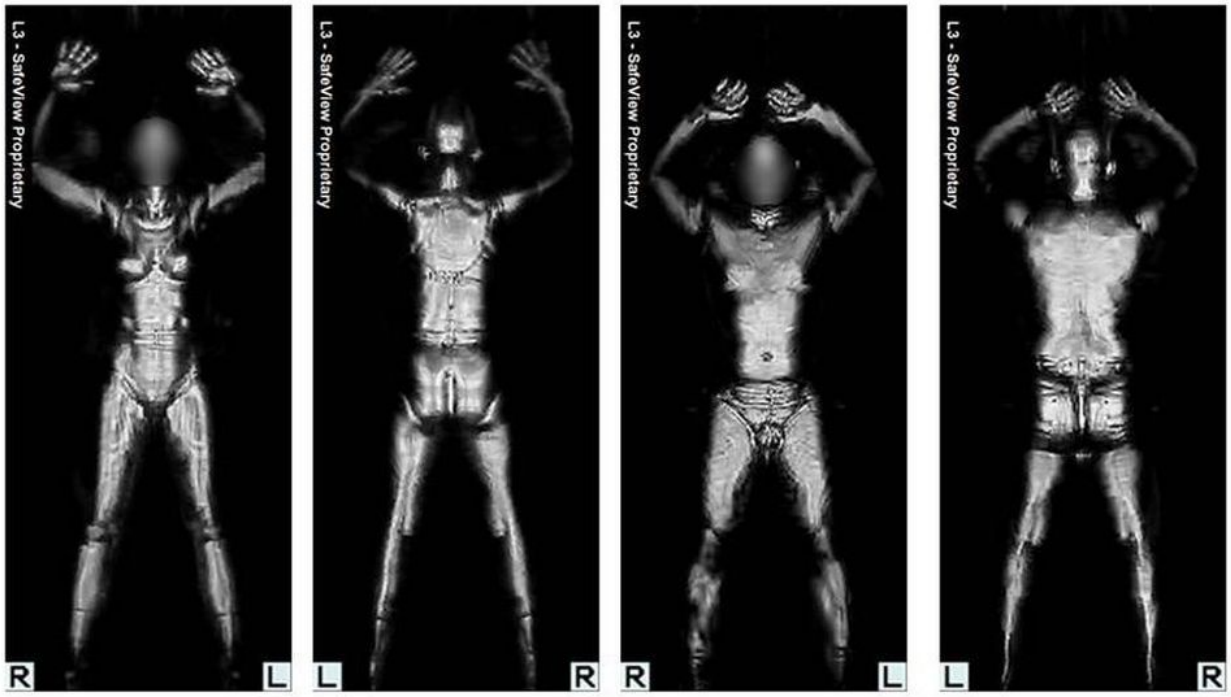
Fortunately, science already tells us that 5G almost certainly poses no danger to humans. Unless you value unfounded conspiracies over bona fide science, here's what you should know.



Above, you can see the electromagnetic spectrum. While you're typically only aware of your interactions with optical (visible) and infrared (heat) radiation, there's much more that's constantly interacting with your body. There are lower-energy signals such as microwaves, with wavelength between a millimeter and a meter, bombard us constantly here on Earth. Microwave radiation includes a mix of natural signals like atmospheric molecules, astronomical signals, and

even the leftover glow from the Big Bang, coupled with human-made radio, radar, satellite, bluetooth, GPS and broadband signals. It also includes all WiFi signals, including 3G, 4G and 5G.

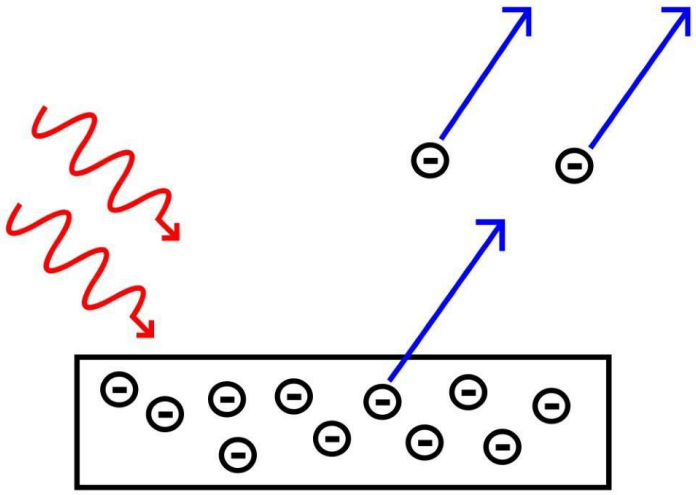
Also invisible to human eyes are higher-energy signals: ultraviolet, X-ray, and gamma-ray light. In large doses, any form of radiation can be dangerous to living things, but in modest doses, only the high-energy signals matter.



The reason for this, believe it or not, has everything to do with the quantum nature of matter and energy. When light interacts with matter, there are three possibilities for what can occur:

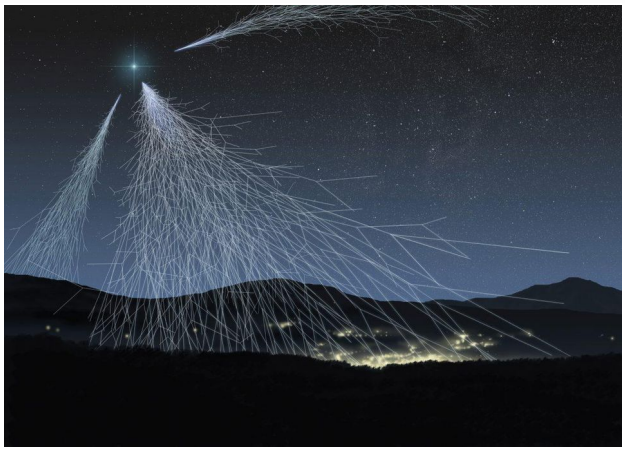
1. The light is of the wrong wavelength to be absorbed by the matter, and therefore gets reflected.
2. The light is of the right wavelength to be absorbed by matter but too low in energy to kick any electrons off of their parent atoms/molecules.
3. Light gets absorbed and each photon is energetic enough to ionize one (or more) electrons.

Plants are green, for example, because they don't absorb green light; instead they reflect it. Food gets cooked in a microwave because liquid water molecules (along with some others) are excellent absorbers of microwave radiation, enabling it to heat up. (Fun fact: ice, which is a lattice of water molecules, isn't a good absorber of microwave radiation, which is why your frozen foods can be simultanously boiling on the outside, where the ice has melted, but remain frozen at the center.)



But the third option, where ionization occurs and electrons get kicked off of atoms, is the type of radiation that truly is damaging at the cellular level to biological organisms. This is why you wear sunscreen when you know your skin is going to be exposed to direct sunlight: because the ultraviolet light will ionize the material in your skin and cause burns that can get quite severe.

That's why you wear a lead shield when you get an X-ray taken, because that even higher-energy radiation can cause extensive damage to your body. And that's why you demand excessive shielding for any nuclear reactors and require humans to stay far away from any nuclear detonations: because gamma-rays, the highest-energy radiation of all, can cause cellular damage so severe it can be fatal to humans in even small, targeted doses.



The ionizing radiation is what causes the most direct, severe damage to not only human but most living things, and that's why there are such tight regulations, all over the world, on how much of these hazardous types of radiation any entity can emit.

But non-ionizing radiation that gets absorbed can still cause damage, provided that there's enough total energy to be damaging. Instead of ionizing individual electrons, this radiation can get absorbed and converted into thermal (heat) energy, and too much heat — just as it can cook plants, animals or fungi — can permanently damage living tissue.

So it seems like a legitimate question: could 5G wireless technology, and the ambient radiation that it will create surrounding each and every one of us, possibly be damaging?

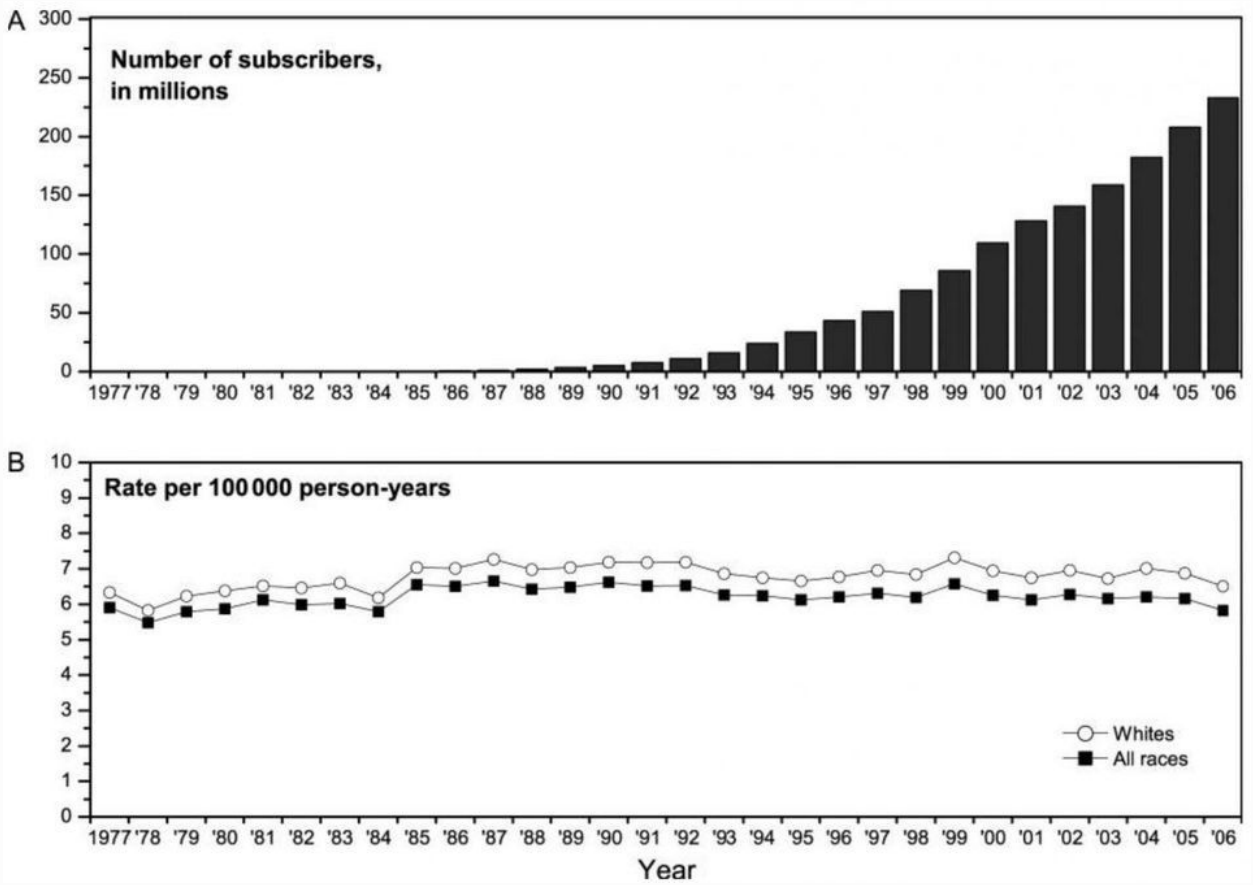
If you ask a WiFi truther, like Berkeley's Joel Moskowitz, they'll insist that it is. That WiFi has already been harming us, that it's the cause of a number of rampant health problems in the human population, that there's an enormous conspiracy to bury it, and that since the World Health Organization has classified 5G (and WiFi radiation in general) as possibly carcinogenic, we should avoid it until it's demonstrated that it's safe, after all.

Unfortunately for Moskowitz, and fortunately for society, possibly carcinogenic is one of the lowest danger levels that can be ascribed to a risk factor. If any study at all finds that any dose of a substance causes any spike in cancer in any creature — even in mice, even with a small sample size, even with marginal or dubious significance — this is the classification it gets. If you're not afraid of coffee or thyme, or getting a nickel with your change, you shouldn't be afraid of 5G, or WiFi radiation in general.

The reason for this is simple: the only way this radiation can harm you is through the total energy your body (or a part of your body) absorbs. Whenever a device sends or receives a wireless signal, it emits or searches for radiation of the appropriate frequency. The devices all use power, and the energy they emit spreads out in a sphere: falling off as the inverse of the distance squared as you leave the source.

If you ever held a portable radio or boombox close to you, you received far more radiation of similar frequencies than you do from a 5G device that sits in your pocket. At the end-user, consumer level, even dozens of devices surrounding you — similar to the situation you'd experience in an office, classroom, or airport — impart a level of radiation that, based on energy concerns, ought to pose no threat at all.

As Dr. Alex Berezow of the American Council on Science and Health states, the assumption that 5G is safe is already backed by the full suite of scientific studies. Only, he contends, "[i]f sufficient evidence shows something to the contrary, then we should reconsider the status quo."



One of the most ubiquitous conspiracies about WiFi radiation is that it's responsible for the growth... [+] P. D. INSKIP, R. N. HOOVER, AND S. S. DEVESA, NEURO ONCOL. 2010 NOV; 12(11): 1147–1151

From a theoretical point of view, there's absolutely no reason to fear 5G technology, or WiFi radiation in any form.

But if you were really curious about the potential hazards to humans, you'd take a look at the people who get the highest levels of 5G radiation exposure: the electrical and construction workers who build and install the wireless communication towers that provide the necessary infrastructure for 5G. In the UK, the National Register of RF workers is the body that looks after the health and safety of that group of people, and it's composed entirely of RF workers themselves.

What might be a dangerous dose of radiation when you're four inches (about 10 centimeters) away from it goes down by a factor of 10,000 when you move to be about 33 feet (10 meters) from it.

The first Brandenburger transmission tower that meets the new 5G standard for cellphone and internet... [+] GETTY

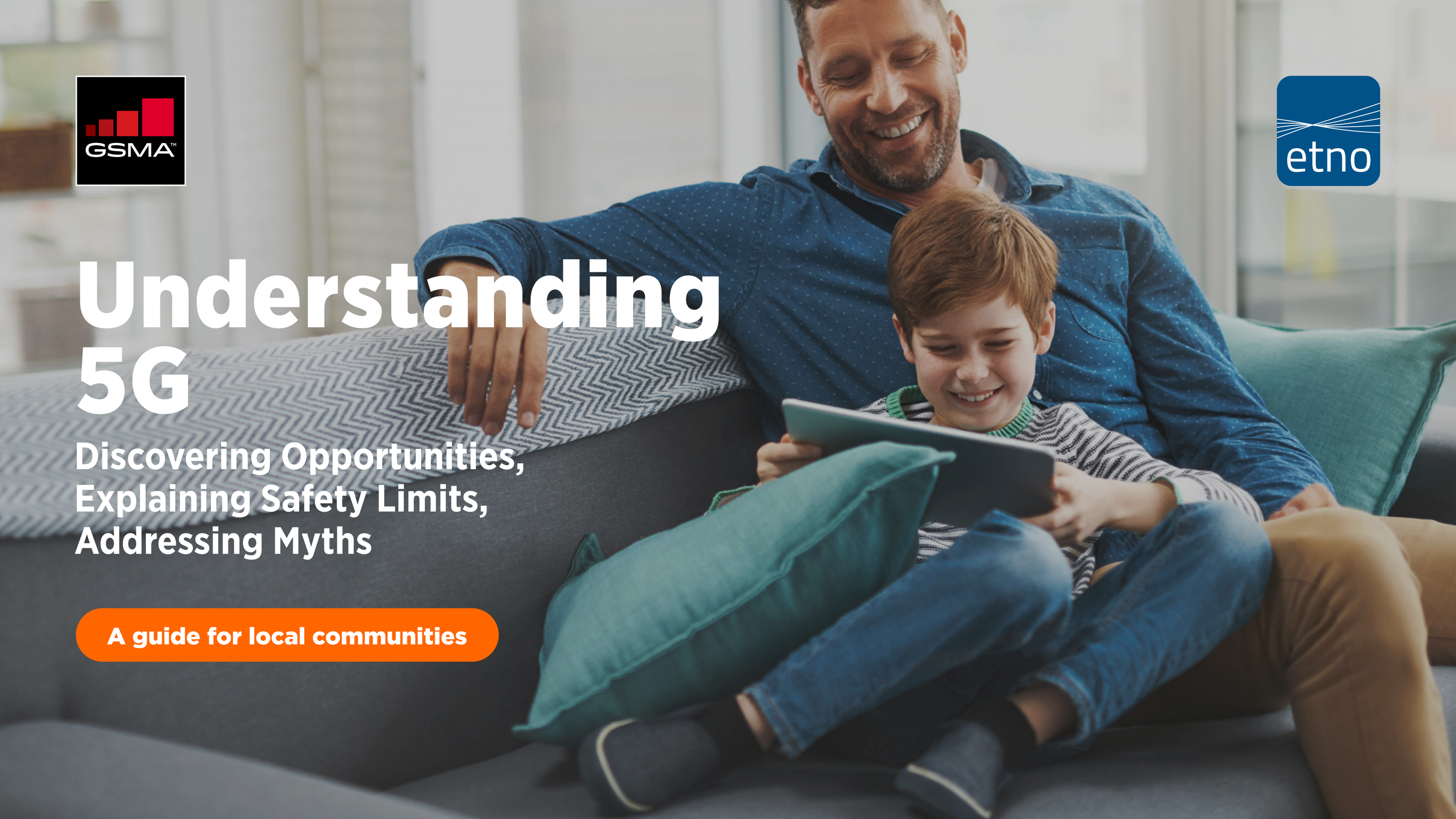
As reported by Simon Rockman here on Forbes, there are 4,500 people in the UK who work in close proximity to radiofrequency (RF) radiation. The RF exposure they're allowed to receive is five times that of the general population, and there is no evidence that they have higher rates of cancer or any other health problems that could possibly be attributable to WiFi radiation than any other population of humans.

Still, the best measure that they can take is to simply have a small exclusion zone around the radio masts (or towers) that emit the most powerful signals for this type of radiation. So long as that exclusion zone is about 10 meters in all directions, any humans outside of the zone will undoubtedly be safe. A receiver/transmitter that's perched very high above the ground or a tall building will automatically be safe for any humans directly beneath it, so long as they're more than 10 meters below the active device.

Warning sign on the side of a cellular phone tower indicating that the tower emits strong radio,... [+] GETTY

Finally, the benefits that 5G will bring to society in the coming decade are truly revolutionary. In addition to the accelerated speeds that regular consumers will see, laying the infrastructure for 5G will enable civilization-changing smart technologies and a virtually unlimited number of device connections. 5G will enable blossoming technologies that rely on connectivity to the internet to go widespread, from connected self-driving cars to smart plugs, lights, cameras, toothbrushes, thermostats, healthcare monitoring devices and more. The Internet of Things is coming, and 5G is the technology that will take it mainstream.

There are lots of real hazards out there in the world, but 5G — much like vaccines, fluoridated drinking water, and the vapor trails left by airplanes — aren't among them. In the search for truth, society should rely on the full suite of scientific evidence, rather than fear or ideology, to guide us. When we do, all of us can reap the benefits of a safe, connected world.



Understanding 5G

Discovering Opportunities, Explaining Safety Limits, Addressing Myths

A guide for local communities

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01

Introduction

Today connectivity is essential to accomplish many of our daily activities. Telecommunications infrastructure is the backbone for digitalisation and will power an economic recovery that is smarter, greener and more inclusive. As our local and national economies recover, digital connectivity will be a central pillar to accelerate e-learning, e-health, cleaner cities, manufacturing and transport, and economic resilience.

This guide provides an overview of 5G mobile technology, including fact-based answers to frequent questions posed by decision-makers and the public alike. It also provides a variety of innovative examples across Europe that show how 5G is already helping solve some of the most pressing challenges for citizens and businesses.

Technological innovation, in turn, has raised questions about rapid 5G deployment for national politicians, regional authorities, local governments, and of course citizens and businesses. Many are keen to understand both the benefits of the latest generation of mobile technology and the safety measures that protect our health and environment.

Public health concerns about mobile technologies have circulated since the introduction of 2G networks 30 years ago, but they have never been supported by accredited public agencies or by scientific consensus.

Meanwhile, the spread of disinformation and misinformation, particularly through social media platforms during the COVID-19 pandemic, raised alarm and in some cases resulted in criminal damage to the very networks sustaining society and businesses.

This guide also addresses how existing international safety guidelines protect the public, with limits for exposure to electromagnetic fields (EMF) substantially below the level of any established health risk. In addition, it dispels some of the more common myths circulating in print, online and social media.

Trust is key to dispelling 5G misinformation, and this guide references independent scientific studies, international public health organisations, as well as government and public authorities.

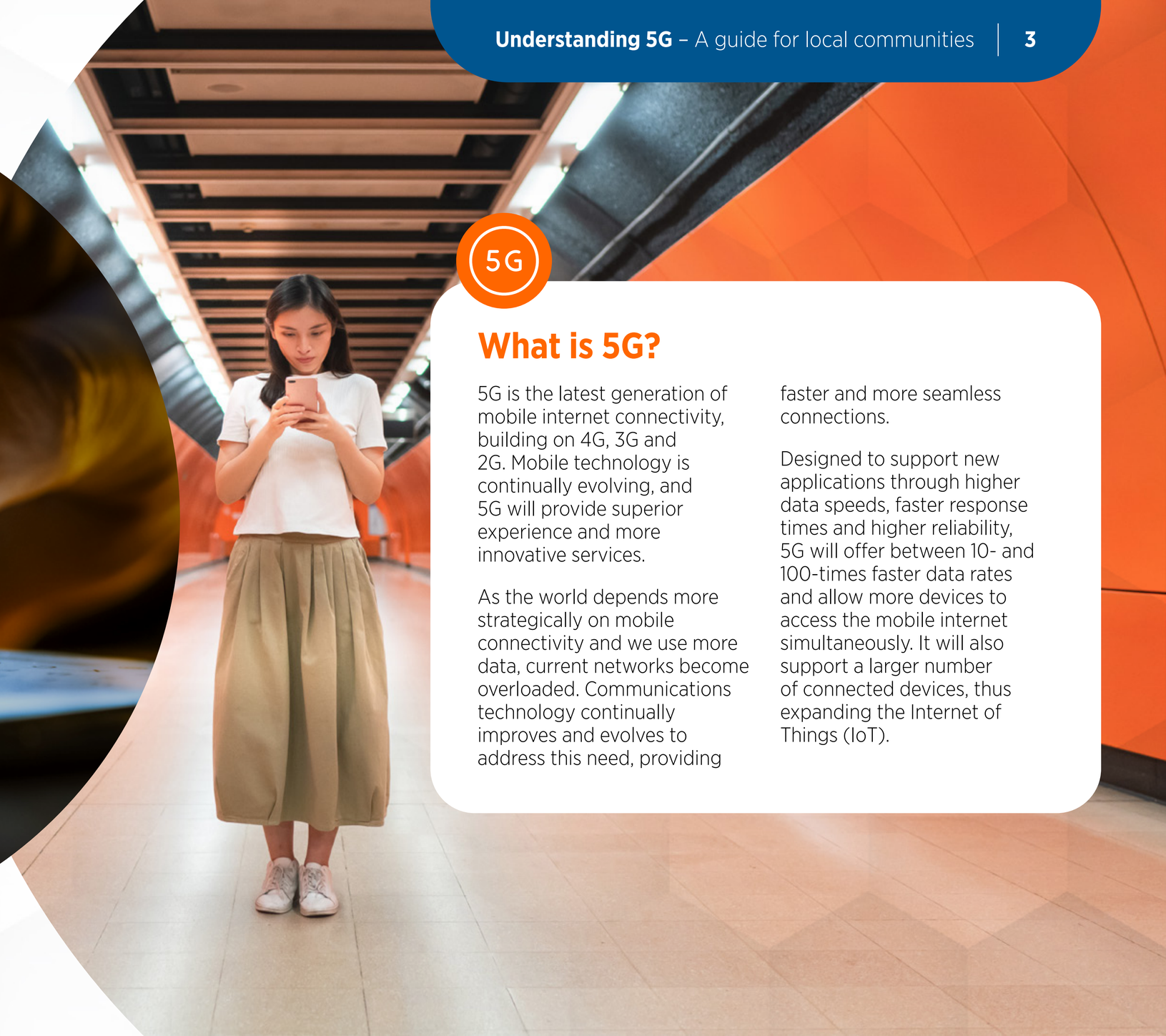
5G will accelerate digital transformation across countries and industries so they can achieve their climate goals and build more resilient economies and supply chains[1].

In this guide, decision-makers and citizens can learn how 5G can close the digital divide while posing no known health risks.

1. https://digital-strategy.ec.europa.eu/en/policies/5g-qa

02

About 5G



5G

What is 5G?

5G is the latest generation of mobile internet connectivity, building on 4G, 3G and 2G. Mobile technology is continually evolving, and 5G will provide superior experience and more innovative services.

As the world depends more strategically on mobile connectivity and we use more data, current networks become overloaded. Communications technology continually improves and evolves to address this need, providing faster and more seamless connections.

Designed to support new applications through higher data speeds, faster response times and higher reliability, 5G will offer between 10- and 100-times faster data rates and allow more devices to access the mobile internet simultaneously. It will also support a larger number of connected devices, thus expanding the Internet of Things (IoT).

02

About 5G

What makes 5G different to previous generations of mobile technology?

5G's superior speed, capacity, flexibility and reliability will support an array of existing and new uses above and beyond 4G. This guide provides concrete examples.

5G offers significant energy-efficiency improvement per gigabyte over previous mobile technology. Researchers[2] estimate that 5G-supported applications can significantly reduce carbon emissions in areas, including flexible working, smart power grids, automated driving and precision agriculture.

New or improved 5G capabilities will provide better ways to connect schools, hospitals, businesses, governments, transportation and citizens.

Improved performance will come from increased investment by telecom operators in advanced core networks, and by using more efficient radio technologies and spectrum bandwidth.

2. Next generation mobile networks: Problem or opportunity for climate protection? University of Zurich and Empa, October 2020

Where is 5G currently deployed?

At the end of 2020, 5G was commercially available in 52 countries from 135 telecommunications companies.

In Europe, 5G is up and running in 38 countries from almost 50 operators, with more than 20 new launches planned in 2021. By 2025, it is expected that 5G will cover one-third of Europe and account for 236 million connections.

However, Europe remains behind North America and China, where half of all connections will be 5G by 2025.

What are the opportunities for society?

Achieving full 5G deployment in Europe could lead to 2.4 new million jobs by 2025 and generate €113 billion per year in gross domestic production, according to a new report by BCG[3]. In addition, widespread adoption of 5G digital solutions can reduce total carbon emissions by up to 15%, BCG estimates.

Recognising these opportunities, the European Union and most member countries have made 5G a top strategic priority. A recent IPSOS poll also showed solid public support, with 55% of Europeans positive about 5G and 85% thinking that 5G will be very important for businesses[4].

3. Connectivity & Beyond: How Telcos Can Accelerate a Digital Future for All, BCG for ETNO, March 2021

4. IPSOS, European 5G Survey, October 2020, https://www.ipsos.com/en/european-5g-survey-2020

Case Study

Improved waste collection in difficult areas thanks to 5G

IADYS' Jellyfishbot is a small robot that collects waste and hydrocarbons on the water's surface. It can help clean marine areas that areless extensive and difficult to access in ports, marinas, lakes, canals and industrial areas.

Although previously available on the market without 5G, IADYS' Jellyfishbot is more effective with5G's almost non-existent latency and high-definition images, real-time feedback and reduced risk of interference from boats.

The French port of Marseille is testing the water decontamination robot, following on IADYS' success in the port of Le Havre.

Learn More

03

What Leaders' Say

Margrethe Vestager, Executive Vice President for the European Commission, July 2020:

"The timely rollout of 5G networks is strategically important for all Member States as it can open new opportunities for businesses, transform our critical sectors and benefit European citizens[5]."

5. Ref: https://ec.europa.eu/commission/presscorner/detail/en/IP_20_1378

Charles Michel, President of the European Council, September 2020:

The development of 5G is (...) crucial to closing the digital gap, an unacceptable obstacle to social integration and, as we have seen during the pandemic, to education[6]".

6. Ref: https://www.consilium.europa.eu/en/press/press-releases/2020/09/29/the-digital-in-a-fractious-world-europe-s-way-speech-by-president-charles-michel-at-the-ft-etno-forum/

Doreen Bogdan-Martin, Director of the Telecommunication Development Bureau of the International Telecommunications Union:

"5G can be a cornerstone of post-COVID recovery, and digitally-led development, but we need everyone to benefit equally. We need a strong, shared focus on bridging the digital divide, so that we can put affordable, accessible 5G mobile broadband within reach of all[7].'

7. Ref: https://www.itu.int/en/ITU-D/bdt-director/Pages/News.aspx?ItemID=272

04

Health and Safety

What about safety?

Just like other things in everyday use like TVs, home Wi-Fi routers, radios or microwave ovens, mobile technology and 5G are covered by international and national exposure guidelines and regulations.

Scientists have been studying mobile frequencies for decades, including those for 5G. This cumulative research is the basis for the international safety guidelines for radio signals. The consistent conclusion of public health agencies and expert groups is that compliance with the international guidelines protects all persons, including pregnant women and children.

04

Health and Safety

Could 5G be detrimental to my health?

A large number of studies into radio frequencies are relevant to 5G and many 5G specific studies show the new technology complies with international safety guidelines.[8] High-quality scientific research aligned with WHO priorities should continue to be our lighthouse on health and safety. The international public safety guidelines were updated in early 2020 and confirmed that existing safety guidelines retain a high level of protection, with limits well below the thresholds for established hazards for all radio frequencies for' 2G to 5G.

The WHO[9] says about 5G:

"As the frequency increases, there is less penetration into the body tissues and absorption of the energy becomes more confined to the surface of the body (skin and eye). Provided that the overall exposure remains below international guidelines, no consequences for public health are anticipated."

The WHO continues to monitor research.

What radio frequencies are used for 5G?

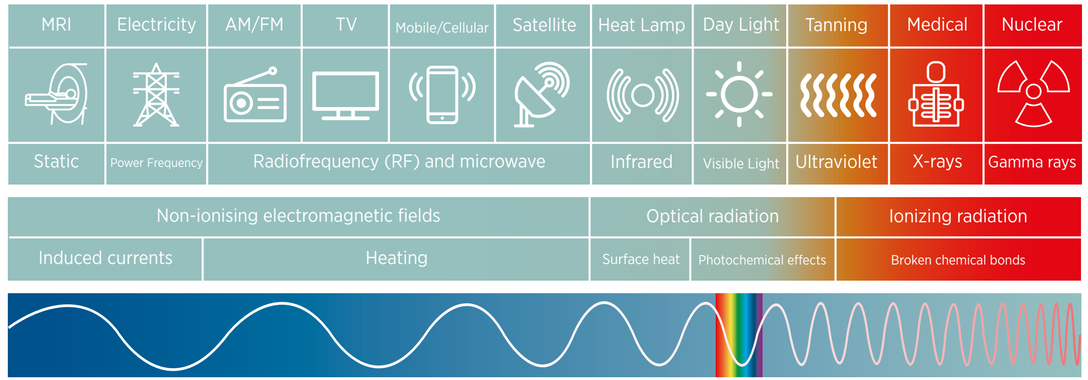
5G uses radio waves to send and receive data from mobile devices, connecting them to each other and the internet, similar to 4G and 3G before that.

Existing 4G signals generally sit between 800 MHz and 2.6 GHz, while Wi-Fi operates in the 2.4 and 5.8 GHz bands. In Europe, the main band for current 5G deployments is around 3.5 GHz (previously used in some countries for wireless internet connections). Future 5G deployments will use 700 MHz (formerly used for TV) and 26 GHz (close to some satellite services).

These signals are far below the frequencies of visible light (430- 770 THz), another form of electromagnetic energy.

World Health Organization (WHO)[10] maintains,

"To date, and after much research performed, no adverse health effect has been causally linked with exposure to wireless technologies."



8. https://www.emf-portal.org/en/article/overview/mobile-communications-5g

9. https://www.who.int/news-room/q-a-detail/radiation-5g-mobile-networks-and-health

10. https://www.who.int/news-room/q-a-detail/radiation-5g-mobile-networks-and-health

04

Health and Safety

Why are some people concerned that 5G could cause cancer?

Many people who are concerned about 5G and cancer cite the International Agency for Research on Cancer (IARC) classification of radio signals as "possibly carcinogenic" in 2011[11]. The IARC placed radio signals in the same group as eating pickled vegetables because there was limited evidence that they could cause cancer in humans. Processed meats have a higher classification than radio signals because there is stronger evidence that eating them might cause cancer in humans.

The IARC classification separated out the sources of radiofrequency between personal (such as phones used close to the head), environmental (such as antennas) and occupational (for those who install and maintain telecom equipment).

It is important to note that following the classification, the WHO has not recommended any changes to the exposure limits for wireless networks and devices. Further research is underway to address uncertainties.

11. https://www.who.int/news-room/fact-sheets/detail/electromagnetic-fields-and-public-health-mobile-phones

What about 5G base stations, are these dangerous?

Strong consensus from public health agencies, including the European Commission's Scientific Committee (SCHEER) and the WHO[12] maintains there is no established health risk from exposure to the low-level radio signals used for mobile networks, including 5G. The WHO[13] says:

"Studies to date provide no indication that environmental exposure to RF fields, such as from base stations, increases the risk of cancer or any other disease."

Base stations transmit and receive radio waves to connect users of mobile phones and other devices to the internet. The strength of those radio waves is very low in public areas.

Mobile phones are designed to automatically reduce power to the lowest level needed for a quality connection. When there is a good connection to a base station, a mobile phone will operate at lower transmit power.

12. https://www.who.int/news-room/q-a-detail/radiation-5g-mobile-networks-and-health

13. https://www.who.int/news-room/q-a-detail/what-are-the-health-risks-associated-with-mobile-phones-and-their-base-stations

04

Health and Safety

Are some people more sensitive to electromagnetic fields?

No. The WHO[14] concluded that while self-reported headaches and other symptoms are real, there is no scientific basis to link the symptoms to exposure from radio signals. Furthermore, the WHO says that treatment should focus on medical management of the health symptoms and not on reducing exposure to radio signals.

The international guidelines[15] include a reduction factor of 50 for environmental limits to ensure protection of the public. The guidelines are even more conservative for children.

14. https://www.who.int/teams/environment-climate-change-and-health/radiation-and-health/electromagnetic-fields-and-public-health--electromagnetic-hypersensitivity
15. https://www.icnirp.org/en/activities/news/news-article/rf-guidelines-2020-published.html

Why do I see so many social media posts claiming 5G harms health and the environment?

For decades, there have been unfounded claims and deliberate disinformation spread about telecommunications technology. The transmission of false and misleading information accelerated with the reach of social media platforms and went viral during the COVID-19 pandemic.

Conspiracy theories linking 5G technology to the origin, spread and risk of catching COVID-19 led the WHO to add 5G to its “Myth Busters” list of false claims about the new coronavirus in early 2020. Also, unfounded claims that 5G caused the mass death of birds or harmed trees have also been declared false by fact-checking groups[16].

Authorities state that there are no established health or environmental harms from 5G. Measurements of 5G and existing mobile technologies show overall levels of radio signals in the community remain low and well below international safety guidelines.

16. https://fullfact.org/online/5g-and-coronavirus-conspiracy-theories-came/

Case Study

Ambulances deliver real-time emergency care in the UK

In healthcare emergencies, lost seconds can reduce the chance of survival.

In Birmingham, ambulances with 5G-empowered equipment save lives daily, as well as reduce CO2 emission by reducing the number of trips to hospitals.

5G allows for real-time clinical expertise: paramedics traveling the streets in an ambulance wear virtual reality headsets. Video footage of wounds or injuries seen by the paramedic is broadcast to the right clinician or surgeon.

The time lapse between what they both see is almost real-time. Moreover, the hospital clinician can direct the paramedic to perform necessary scans using a joystick that sends signals to a robotic glove worn by the paramedic. In addition, a camera transmits a high-definition view of the interior of the ambulance, capturing vital details of the patient's interaction with the paramedic.

With live feeds of the patient's ultrasound scan, the clinician can recognise vital signs and view medical records in real-time via the virtual reality headset.

Learn More

Watch Video

Case Study

A German hospital handles a surge in urgent patients

The University Hospital Bonn has been upgraded with 5G technology providing patients in crowded emergency rooms with the best treatments. With 5G, the diagnostic processes can be optimised to handle high volumes and save lives.

5G technology enables seamless communications among different specialists. Data travels faster and more securely, protecting sensitive patient data. Even heavy data files generated by computer tomography (CT), magnetic resonance imaging (MRI) or other imaging systems can cope with more input. In emergencies, CT scans can be sent directly to the tablet of the right expert in another geographical location.

Learn More

05

5G and the Environment

What are the energy savings of 5G?

5G is designed to transfer data more energy efficiently than 4G. The potential increase in network energy consumption of mobile communications and network density will be quickly compensated by efficiency features of 5G, antenna optimization, putting transmitters on standby when not in use and replacing less efficient infrastructure equipment.

The use of mobile technology alone avoided emissions of about 2,135 million tons of CO_2 in 2018 thanks to energy savings in other industries. The use of this technology across all sectors including transportation, manufacturing, agriculture and energy has the potential to reduce global CO_2 emissions by 20% by 2030[17].

17. https://data.gsmaintelligence.com/research/research/research-2020/5g-energy-efficiencies-green-is-the-new-black

Is 5G dangerous for the environment?

The same exposure limits that protect people also protect the environment. The German government agency (Bundesamt für Strahlenschutz[18]), for example, recently concluded that there is no scientifically reliable evidence of risk to animals and plants exposed to radio signals at or below the international guidelines.

18. https://www.bfs.de/SharedDocs/Pressemitteilungen/BfS/EN/2019/022.html

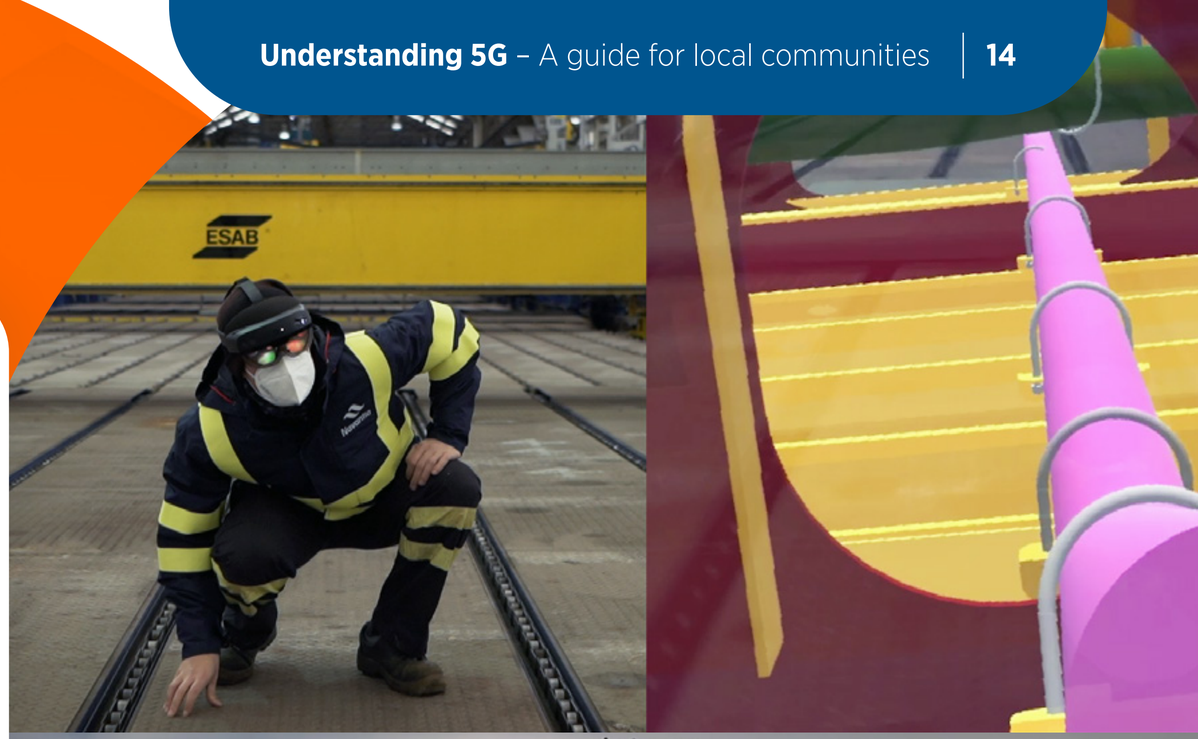
Case Study

Precision ship construction in Spain

Shipbuilding is a complex and often dangerous job for highly skilled workers operating specialized assembly lines. In factories with 5G augmented reality, complex tasks can be performed remotely by qualified specialists, improving worker safety, productivity and precision.

With 5G powered augmented reality technology, the physical assembly of heavy parts can be done at a safe distance. In shipbuilding, millimetre accuracy matters and 5G technology can instantly spot inconsistencies before physical assembly, improving the entire process and saving time and money. This is now possible in the Ferrol shipyard on the northern coast of Spain.

Read More



Case Study

Connecting communities with digital highways

5G “travel corridors” are digital highways connecting logistical centres across Europe. Everyone benefits from reduced CO_2 emissions, fewer road fatalities, increased productivity and strategic industrial zones.

First, air quality: 30% of the EU’s total CO_2 emissions comes from the transport sector. 5G corridors will improve fuel efficiency, reducing CO_2 emissions.

Second, road safety: 64 people die daily in road accidents in the EU. 5G-enabled automation will lsave lives thanks to technology that reduces human error and driver fatigue.

Third, productivity: The EU loses an estimated 1% of the region’s gross domestic because of traffic jams – a waste of every driver’s time and energy.

Fourth, industrial zones: With digital infrastructure being deployed along pan-European corridors, local communities can take advantage of new locations and develop new business clusters in areas empowered by enhanced connectivity.

Total investment in the project is estimated to be in excess of €9 million with a completion date set for April 2022.

Learn More

Case Study

Supporting tourism and culture in Italy

Culture and art are essential for Europeans and the tourism sector and 5G offers immersive, virtual reality experiences of historical sites.

In Matera, Italy's iconic white-stone city and UNESCO site, visitors worldwide can have an immersive experience of archaeological sites and the museum.

Visitors can explore the city's breath-taking sights virtually, including the 1,300-year-old "Crypt of the Original sin", known as "the Sistine Chapel of Rupestrian Art". Or, they can take a "virtual walk" through the local MUSMA museum.

If you want to visit St. Rocco Church in Venice, you can transform your smartphone into an augmented reality portal with multimedia content.

Learn More

06

International Safety Guidelines

Who sets the international safety guidelines and are they independent?

The International Commission on Non-Ionizing Radiation Protection (ICNIRP) reviews published science and produces guidelines to protect people and the environment.

In March 2020, ICNIRP updated guidelines that ensure the protection of people against all established health hazards when they are exposed to radiofrequency electromagnetic fields (RF-EMF) in the range 100 kHz to 300 GHz[19].

ICNIRP is independent from commercial, national and vested interests. Its members do not represent their country of origin or their institute. They cannot hold a position of employment or have other interests that compromise their scientific independence. ICNIRP is funded by national and international public institutions and does not receive funding from the telecommunications or any other industry.

ICNIRP works with the WHO and the International Labour Organization. All European countries follow the ICNIRP guidelines or adhere to even stricter limits. In March 2020, ICNIRP stated: *"The degree of protection in the exposure levels is thus greater than may be suggested by considering only the reduction factors, which represent only one conservative element of the guidelines. There is no evidence that additional precautionary measures will result in a benefit to the health of the population."*

19. https://www.icnirp.org/en/activities/news/news-article/rf-guidelines-2020-published.html

06

International Protective Guidelines

Do the updated safety guidelines include 5G?

Yes, the guidelines concern all the frequencies in use by and planned for 5G. The mobile communications industry already has the international technical standards and test methods to ensure 5G networks and devices comply with the 2020 updated ICNIRP guidelines.

Why are millimeter wave frequencies important for 5G?

Millimeter wave (mmWave) frequencies are typically in the 24-86 GHz range and are used today for satellite and point-to-point radio links. They can also be used for providing very fast links for network deployments in specific locations such as busy urban areas, stadiums and airports.

This frequency range will be critical for 5G to provide the fastestdata speeds and lowest latency services.

As of early 2021, 15 countries worldwide have assigned mmWave bands for 5G, four of which are in Europe. Some operators in the United States are currently pioneering mmWave 5G with gigabit speeds in localised areas.

What are small cells?

Small cells have been used for decades to improve mobile connectivity in localised areas such as city centres, train stations and office buildings. As mmWaves do not travel as far as lower frequencies, small cells increase the ability of 5G to deliver higher data speeds.

Recent measurements on 4G small cells by the French spectrum agency[20] found that levels in nearby areas did not change significantly and remained well below safety guidelines.

20. https://www.anfr.fr/toutes-les-actualites/actualites/lanfr-publie-un-rapport-sur-le-deploiement-de-petites-antennes-dans-du-mobilier-urbain-pour-tester-de-nouvelles-solutions-de-connectivite-au-tres-haut-debit-mobile/

Case Study

An even smarter university in Estonia

Estonia's Tallin University of Technology (TalTech) is inventing new 5G products and services in its Smart Campus. This testing environment for start-ups and companies allows TalTech students, scientists and researchers to identify opportunities for new products and services. Their inventions rely on 5G's fast and high-quality data connectivity and, to date, have focused on connected and automated mobility, drones, and smart manufacturing.

Over the next 5 years, the Smart Campus aims to develop a prototype of a city or urban district that would focus on the needs and expectations of a future, more digital society. Naturally, early applications focus on smart houses and smart-traffic infrastructure and self-driving cars.

Learn More

Case Study

Going to a concert in the Netherlands in half the time

Amsterdam is testing 5G-enabled sensors and data analysis to minimize traffic, accidents and wait times for people attending concerts, festivals and sports events.

Instead of using the same busy routes, public transportation and access points into the stadium, crowds can be efficiently and wisely guided to the venue by an app.

The app directs people through the best routes, reducing accidents and transit times to and from the venue.

But that's not all: 5G allows tens of thousands of people to send and share HD videos, live broadcast or make video calls from the event or browse their smartphones. Moreover, a separate "slice" of the 5G network is reserved for emergency services.

Learn More

07

Public Agency Statements on 5G Safety

The European Union

"The strict and safe exposure limits for electromagnetic fields recommend at EU level apply for all frequency bands currently envisaged for 5G".

Australia

"Although the 5G mobile network is new, limits set in safety standards, our understanding of the evidence of health effects and the need for more research has not changed".

Norway

"Measurements show that the total exposure from mobile and radio transmitters that we are exposed to today is weak and is far below the limits for what is harmful to health. We have no reason to believe that the introduction of 5G will change this".

ICNIRP

"The ICNIRP RF EMF guidelines have taken the above considerations into account and protect against all potential adverse health effects relating to exposure to RF EMFs from 5G technologies. This includes potential differences in the effect of RF EMFs as a function of age, health status, and depth of penetration, the effect of both acute and chronic exposures, and it includes all substantiated effects regardless of mechanism."

Body of European Regulators for Electronic Communications

"Compliance of 5G technology with the new ICNIRP guidelines will continue to provide the highest level of protection to date".

Case Study

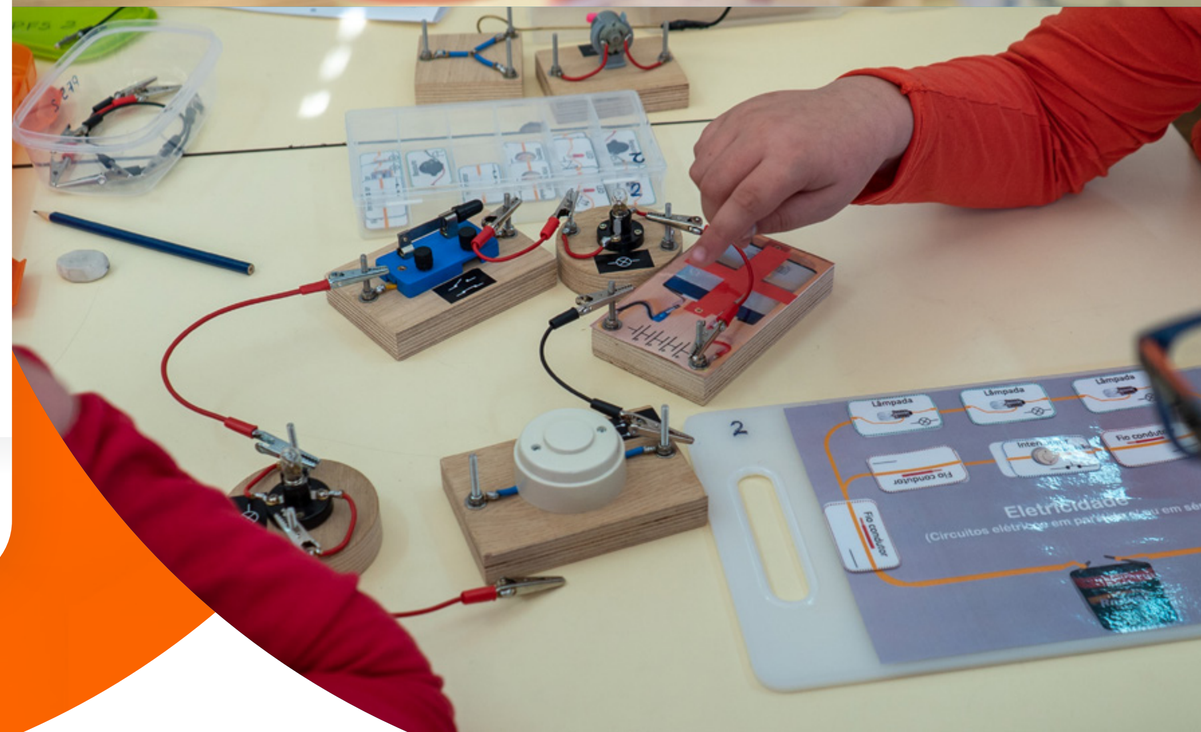
Creating high-tech jobs in Portugal

The city of Aveiro, has embraced 5G to attract and retain highly skilled workers. The city of about 80,000 residents is building a state-of-the-art ICT infrastructure - including tech sensors, devices, and urban data platforms - to better understand citizens' behaviours and needs.

Innovative urban mobility services will be driven by an IoT infrastructure, empowered by artificial intelligence and algorithms. The ICT infrastructure is supported by more than 13 km of fibre links, 25 radio units and has benefited from nearly €5 million of European Regional Development Funds.

The project has attracted 34 ICT companies to the region and 1,300 jobs.

In addition, Aveiro's TechLab will offer education programmes for 3,000 students, starting at primary school, that will train them for jobs of the future. Graduated trainees can also enroll in tech city "boot camps" for 28 weeks, divided between training and internships in local communities.



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The GSMA represents the interests of mobile operators worldwide, uniting more than 750 operators with almost 400 companies in the broader mobile ecosystem, including handset and device makers, software companies, equipment providers and internet companies, as well as organisations in adjacent industry sectors. The GSMA also produces the industry-leading MWC events held annually in Barcelona, Los Angeles and Shanghai, as well as the Mobile 360 Series of regional conferences.

For more information, please visit the GSMA corporate website at www.gsma.com

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ETNO has been the voice of Europe's telecommunication network operators since 1992 and has become the principal policy group for European electronic communications network operators. Its 40 members and observers from Europe and beyond are the backbone of Europe's digital progress. They are the main drivers of broadband and are committed to its continual growth in Europe.

ETNO members are pan-European operators that also hold new entrant positions outside their national markets. ETNO brings together the main investors in innovative and high-quality e-communications platforms and services, representing 70% of total sector investment.

ETNO closely contributes to shaping the best regulatory and commercial environment for its members to continue rolling out innovative and high quality services and platforms for the benefit of European consumers and businesses.

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