

**UK
5G**

**Innovation
Network**



A STRAIGHTFORWARD GUIDE TO 5G:

MANUFACTURING

MAY 2022



INTRODUCTION

From the Industrial Revolution to Industry 4.0, manufacturing has always been a cornerstone of the UK economy. Continuous innovation has been the driving force behind this, but today—more than ever—manufacturers are under constant pressure from shrinking margins and increasing demands to boost factory efficiency while enhancing safety and security.

Spurred by shorter product lifecycles and the impact of COVID-19, these longstanding challenges are made even more complex by rising energy prices, the need for agility and emerging skills gaps. Not forgetting obligations to operate more sustainably for the good of the planet, and business. All of which means, things have got to change.

5G could play an important role in tackling these challenges. Research from Vodafone indicates that the application of new digital technologies such as 5G and IoT in manufacturing could add £3.6bn to the sector's GVA in 2025, rising to £6.3bn in 2030.

This guide has been designed to demystify 5G, helping businesses and organisations understand exactly what 5G is, what it does and why it's important.

We've tried to keep it as jargon-free as possible but if you find yourself confused, we've included a handy glossary.

MANUFACTURING

How is 5G different from other Gs?

5G is not just “4G but a bit quicker”. Instead, it is a total remodelling of the mobile system: 5G is completely digital, bringing greater flexibility and new opportunities. The network’s extra bandwidth also facilitates the capability to use larger amounts of data—reliably, with almost zero lag, at a rate that is up to 20 times faster than 4G.

Don’t believe it can be that much better? Ultimately, 5G will be able to deliver:

- Handles up to 1,000 times higher data volumes than 4G
- Supports 10-100 times more connected devices per km² than 4G
- Enables data speeds 10-100 times higher than 4G
- Reduces latency by around 5x compared to 4G technology
- Enables up to 10 years of battery life for low power, machine-type devices

These numbers are based on an optimised stand-alone 5G network (basically, the all-singing, all-dancing 5G) and that isn’t available for all instances and uses quite yet. We’re at the start of the 5G journey but understanding what it’s building to can help organisations understand exactly how it might be able to help them.

A better performance, however, is not all it offers: 5G networks’ systems and power are also based on standard computer chips, which because of economies of scale makes it cheaper than custom equipment.

How is 5G different from Wi-Fi?

5G and Wi-Fi complement each other but there are several advantages to 5G, some of which are listed below:

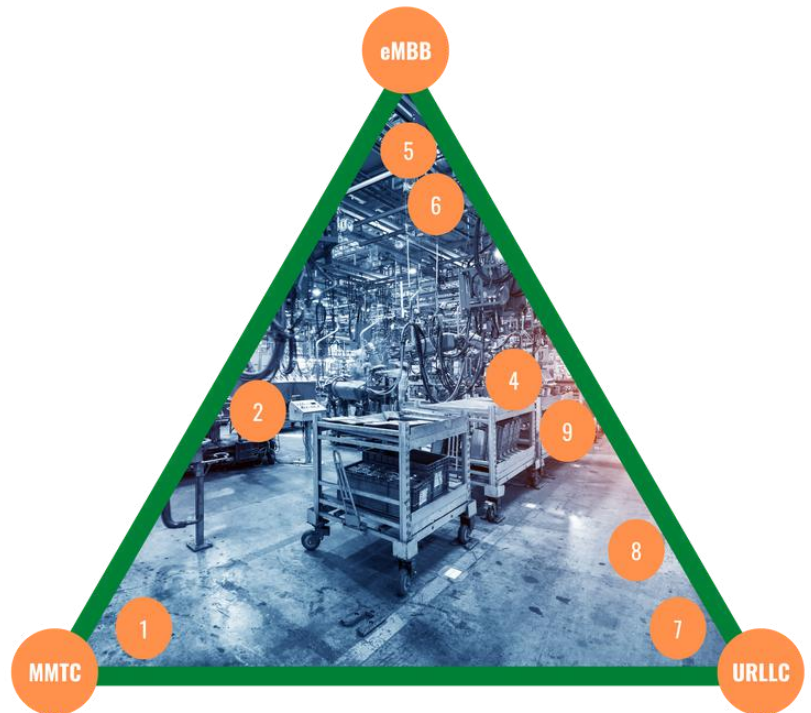
- 5G will be the designated choice for outdoor networks: the early business cases include tracking of goods outside the factory and remote operation of HGVs.



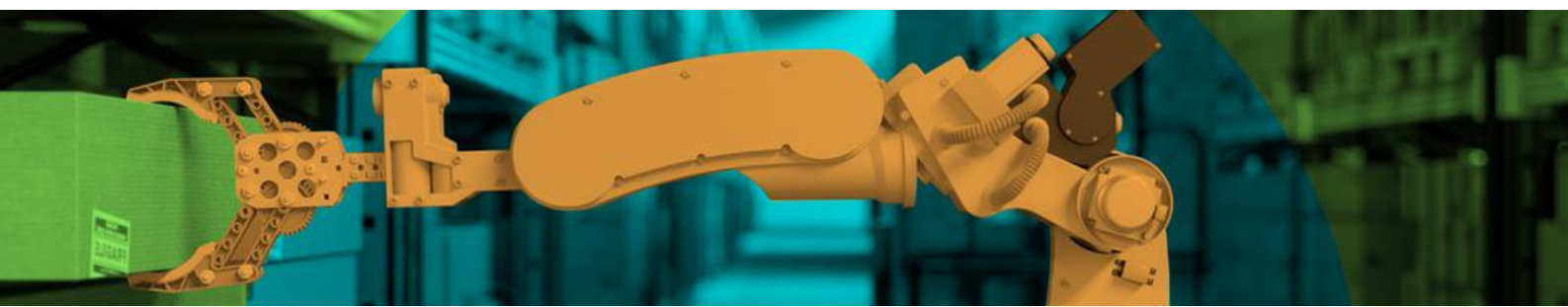
WHAT IS 5G?


- 5G is optimised for coverage: since the licensed spectrum allows higher transmit power, the coverage of 5G Small Cells is usually 100 to 300 metres, which is larger than the coverage of indoor Wi-Fi (usually within 50 metres).
- 5G can be deployed using the original 2/3/4G sites, making the deployment costs can be lower than Wi-Fi.
- 5G has more advantages in anti-jamming, reliability, low latency, and multiple connections. Ideal for manufacturers needing optimised security and safety of workers around cobots.

When thinking about 5G, there are three key pillars that people tend to speak about: Extended Mobile Broadband, Massive Internet of Things and Ultra-reliable, Low Latency Communications. Head to our glossary for definitions or read the diagram (right), which explains by way of use cases.



1. Pervasive sensors & monitoring
2. Predictive Maintenance
3. Augmented/Virtual Reality for training & remote assistance
4. Ultra Hi-Def Video: Machine Vision - Security/Production Quality Control
5. AI & Machine Learning for intelligent analytics of large volumes of data
6. Remote Collaboration / Transferring data & designs between sites
7. Autonomous vehicles with remote operation
8. Industrial automation - robots and cobots
9. Asset management



A person wearing a white hard hat, a VR headset, and work gloves is shown in a factory environment. They are gesturing with their hands as if interacting with a virtual interface. The background is a blurred industrial setting with blue and green lighting.

AR & VR BEING UTILISED BY
MANUFACTURERS TO CHANGE
THE WAY WE WORK &
INTERACT WITH MACHINES

What can you use 5G for?

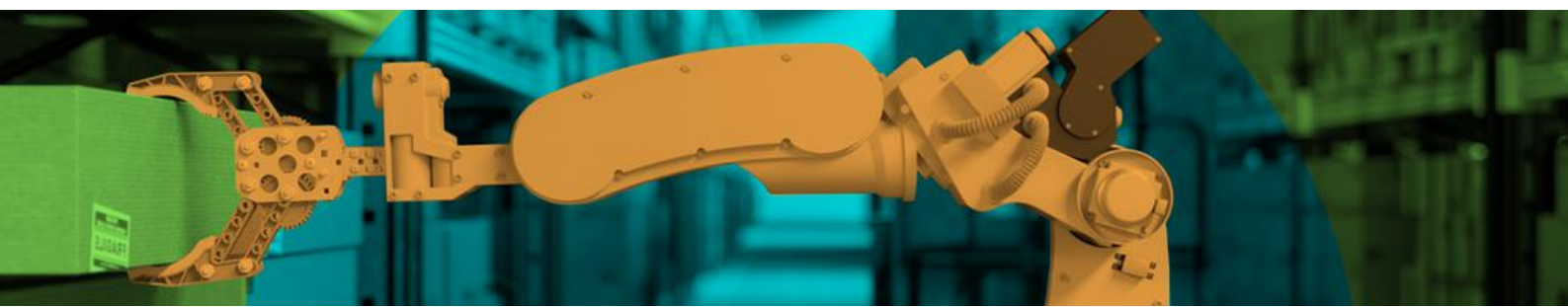
Hopefully, now you know a little bit more about what makes 5G tick, but why is that important to manufacturers? With its impressive capabilities, 5G provides an opportunity for the sector to unlock greater productivity, flexibility, security and sustainability by way of new industrial digital technologies.

Control operations in real-time: The higher bandwidth and low latency of 5G can be used to connect goods, assets, the manufacturing line and even the factory as a whole. This allows for less downtime, fewer 'lost' assets and greater productivity.

5G enables a level of insight and control not yet seen: whether tracking and monitoring assets and supplies, moving to a predictive maintenance model, linking bespoke customer requests to a dynamic supply chain or having the flexibility to easily reconfigure production lines. Real-time, high-quality images, video and data can also be shared and processed by Artificial Intelligence and Machine Learning systems, optimising the output of your factory, improving efficiency, quality control and reducing waste.

Reduce risks with digital twins: The speed and reliability of 5G allows for the creation of live digital twins, which can digitally replicate the manufacturing environment. This enables more thorough, accurate and rapid testing in a virtual dimension before production hits the factory floor, minimising the need for downtime, disruption or costly mistakes. Processes can also be analysed in greater detail and maximised for both the efficiency and sustainability of the factory floor.

Improve the security and resilience of networks: Network security and a stable connection are critical for manufacturers: a dropped connection might jeopardise worker safety, hold up production, or affect the quality of the final product. 5G has security and resilience built-in as part of the standard. Artificial Intelligence and automated tools can then be layered over the top for greatly enhanced security. This means manufacturers can migrate to wireless connectivity with confidence and unlock added agility, as well as flexibility.

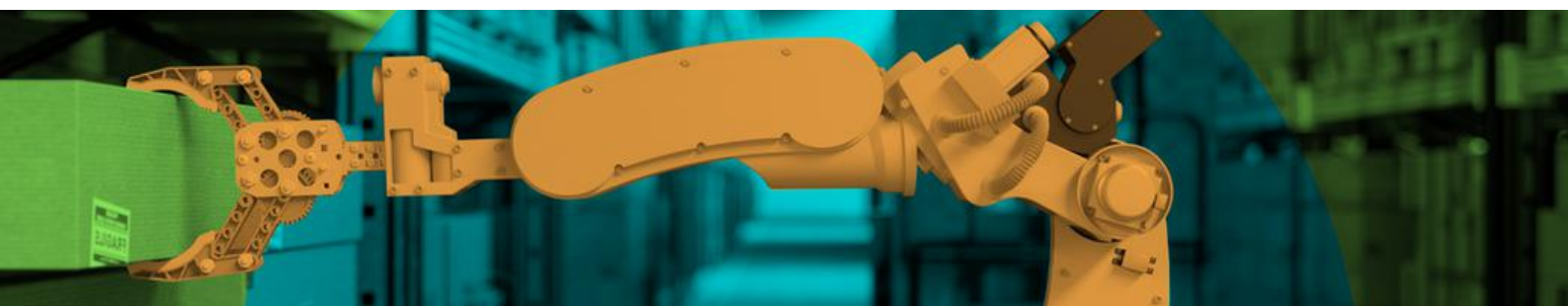


Replicate connectivity over multiple sites to enable great innovation: With a 5G network, businesses can create a ubiquitous, flexible network across multiple sites, granting seamless access for third parties to carry out remote maintenance, training or security. This is simpler to manage than multiple wireless networks and makes data sharing and collaboration across multiple sites and organisations much easier. This fosters greater innovation and collaboration between teams, partners and suppliers, levelling up the UK's manufacturing sector across the board.

Future-proof factories from future skills challenges: Training and remote support can be implemented in real-time using augmented or virtual reality and addressing the sector's skills gap. An estimated 60% of UK engineers are over the age of 50, meaning the sector is likely to face a dramatic drop off in technical knowledge over the next 10-15 years.

5G enables technologies like AR/VR on the shop floor, so you can decentralise expertise and ensure all workers are armed with the insights and support they need, across multiple sites. This also results in less travel and costs, speeding up response times and supporting sustainability initiatives.

Enable next-level automation: 5G will enable new levels of automation for manufacturing, from logistics and warehousing to the production line. Owing to its high bandwidth and low latency, 5G allows robots to undertake more complex tasks and facilitates closer collaborative working with humans. Not only will this drive efficiency, but the ability for remote control means they can be deployed in hazardous environments and stopped or redirected in an emergency, all of which helps to boost worker safety.





WEST MIDLANDS 5G (WM5G)

As part of the West Midlands 5G programme, AE Aerospace, a leading SME manufacturing business, is using high-quality wireless 5G and a range of sensors installed across the factory floor to enable high volume data capture. Machines can communicate with one another in real-time, enabling live updates and changes to achieve greater operational efficiency on the production line.

What's more, the SME is using 5G for real-time ultra-high-definition image comparisons and calibration tracking to ensure product quality assurance. The network is increasing the manufacturer's accuracy of measurements by tagging production units' gauges so that their location can be tracked in real-time, increasing the accuracy of measurement. Operational and productivity gains here are significant, in addition to less product wastage, which will have a positive impact on the environment

In addition, in partnership with West Midlands 5G, the Manufacturing Technology Centre (MTC) has launched a 5G private network. The network is used to facilitate automated logistics, robotics and vision inspection, providing production lines with varied inspection requirements; for example, autonomous mobile robots are being used to rapidly transport components across the factory to an inspection cell where products are checked against design specifications.

5G CASE
STUDY

Glossary of useful technical terms

Technical terms used in and around the world of 5G, listed alphabetically.

Augmented Reality / Virtual Reality:

Augmented reality is an interactive experience of a real-world environment where the objects that reside in the real world are enhanced by computer-generated perceptual information, sometimes across multiple sensory modalities. Virtual Reality goes one step further, seemingly taking the viewer into a different world or environment in an immersive way. 5G networks will facilitate greater use of this through expanded network bandwidth and low latency, meaning more immersive experiences and no more feeling sick when you wear a headset.

Cell tower: A cell tower or cell site is a cellular-enabled mobile device site where antennae and electronic communications equipment are placed—typically on a radio mast, tower, or other raised structure—to create a cell in a cellular network

Cloud: IT parlance, a data centre where applications are hosted.

Devices and Sensors: These are the next step in the data or signal journey, developed to handle the new loads required by faster and increased data signals.

Enhanced Mobile Broadband: eMBB is, in simple terms, an extension of services first enabled by 4G networks that allow for a high data rate across a wide coverage area. Basically, allowing more data to be transferred. eMBB provides the greater capacity necessary to support peak data rates both for large crowds and for end-users who are on the move.

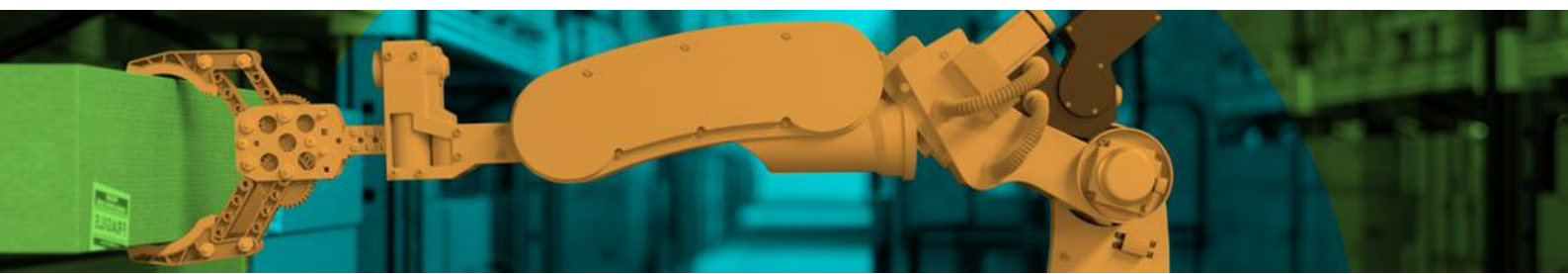
IoT: The Internet of Things describes physical objects that are embedded with sensors, processing ability, software, and other technologies, and that connect and exchange data with other devices and systems over the Internet or other communications networks. This could be anything from a smart fridge in your home to a temperature monitor on a factory production line.

Non-standalone network: Non-Standalone (NSA) 5G is the model of deployment where 5G services are provided without an end-to-end 5G network. This means that the network will rely on some previous generation (4G LTE) infrastructure.

Massive Internet of Things: communications between different machines, deployed at a large scale. This capability enables Internet of Things deployments and rollouts of sensors across sites, including large distributed sites. Also sometimes referred to as massive machine type communications.

Network Latencies: Used to indicate any kind of delay that happens in data communication over a network. The longer the latency, the more “laggy” an experience, such as Augmented Reality or mobile gaming will feel, and the more the user has a disconnect between taking an action and seeing the result of that action.

Private Networks: A private network is a restricted, personal network that can be deployed in a particular location or across multiple connected locations. This type of network can be configured in such a way that devices outside the network cannot access it, meaning you can set up the network exactly how you want it and can always guarantee bandwidth. Imagine, for instance, a manufacturer might want to set up a private network to cover its site and surrounding local suppliers.



Glossary of useful technical terms continued

Standalone network: A network where the 5G radio connects directly to a 5G core providing full end-to-end 5G architecture with no reliance on 4G infrastructure. These networks will deliver the full 5G experience.

User device: A UE is a piece of end-user hardware such as a smartphone or modem that can connect to the cellular network.

Ultra-Reliable Low Latency Communications: URLLC is a set of features that provide low latency (high refresh rate) and ultra-high reliability for mission-critical applications such as industrial internet, smart grids, remote surgery and intelligent transportation systems.



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