

FACTSHEET:

On-Farm Connectivity Technology Options



On-farm connectivity technology types

In the dynamic landscape of modern agriculture, farmers are presented with a plethora of technological options, each offering unique solutions to enhance efficiency, productivity, and sustainability. From the precision of IoT devices to the broad reach of satellite communications, the array of choices can solve a diverse range of on-farm challenges.

The key to harnessing this potential lies in carefully selecting the right technology that aligns with the specific problems they aim to address, ensuring that the solution not only integrates seamlessly with their current operations but also adapts to future advancements in farm management.

Following is a summary of the main technology types and an introduction to the use cases, benefits and limitations. Please contact the **Regional Tech Hub** for free and independent advice on what solutions are right for you.

IoT (Internet of Things)

Description: IoT refers to the interconnection of devices, typically embedding sensors and software, to collect and exchange data.

Use Cases: Smart irrigation systems, precision farming tools, and real-time equipment monitoring.

Benefits: Offers real-time insights into farm operations, allowing for more informed decisions and optimising resource use.

Limitations: can be constrained by inconsistent internet access, device interoperability, data security concerns, and power limitations for remote sensors.

LPWAN (Low Powered Wide Area Network)

Describes a variety of technologies used to connect IoT devices to a network beyond the reach of the traditional networks such as Bluetooth and WiFi.

LPWAN encompasses a range of technologies including LoRaWAN, Sigfox, Category M1 (Cat M1), NB-IoT and others. These have emerged to meet the need for long battery life (several years), low cost, and a long-range reach of signal.

LPWANs are typically used for low data rate transfers, where the ability for sensors to generate, communicate and transmit over long distances is only feasible if infrastructure can be provided affordably, and maintained at low cost over time.



LPWAN Benefits:

- LPWANs enable the use of low power IoT sensors and devices that have very long battery life (up to 10-15 years), i.e. low power users.
- LPWANs typically have a very long connectivity range and can provide coverage for a sizeable area. Range is largely dependent on topography and can be anywhere from 5-50km in regional areas, depending on what natural barriers are between the connection and broadcast points.
- LPWANs can operate at low cost, with low cost sensors and devices and low cost base stations.

LPWAN Limitations:

- LPWANs can only transmit small packets of data at the edge, so are not suitable for applications requiring high bandwidth, such as imaging, voice or video. Farming businesses will need to look to other technologies such as on-farm WiFi to meet high bandwidth use cases.
- Device availability for many LPWAN technologies in Australia is still in an immature stage and finding devices to match the connectivity type can be difficult.

Types of LPWAN technologies:

1. LowRaWan

Description: LowRaWan is a protocol designed for low power consumption and long-range communication. It's ideal for transmitting small amounts of data over vast distances, making it perfect for remote farm applications.

Use Cases: Remote soil moisture monitoring, livestock tracking, and silo level detection.

Benefits: Extremely low power, meaning sensors can operate for years on a single battery. It covers vast distances (several kilometres) and can penetrate dense foliage or even buildings.

Limitations: designed for on-farm connectivity, can face limitations in data rate, real-time response, dense area performance, actual range due to environmental factors, and device power constraints.





2. SigFox

Description: Sigfox offers end-to-end connectivity through LPWAN, which sends small data packets (100bps) from sensors, via the Sigfox network and Cloud to connect sensors to digital third party sites and applications.

Use cases: Ideal for low-power applications that send only small amounts of data infrequently, over large distances.

Benefits: Easy to install, radio modules for Sigfox are generally affordable comparable to other LPWAN technologies, works best for simple devices that infrequently transmit small amounts of data slowly, which has the benefit of prolonging the battery life of sensors, and long-range communication as data transmission capability range of approximately 10km in urban environments and up to 40km in rural areas.

Limitations: Not available across all areas of Australia and potential interference with existing wideband systems. While Sigfox system works well in fixed location, there may be issues, such as interference and frequency inaccuracies, in mobility environments.

3. Cat-M1

Description: Category M1 (Cat M1) is a low-power wide area (LPWAN) cellular technology that is built specifically for IoT projects. Used for On-farm IoT projects covering a wide geographic region, relying on connected sensors that infrequently send small to medium data loads.

Use Cases: Asset trackers, sensor devices, utility metres, monitoring systems.

Benefits: Cat M1 pricing is very competitive compared to other providers in the market. This is because, unlike LoRaWAN, Cat M1 connectivity uses LTE, saving the cost of buying new antennas and other equipment to build the IoT system. Cat M1's low power consumption decreases maintenance costs drastically compared to other connectivity options like 3G and satellite.

Limitations: Limited bandwidth.

4. Narrowband-IoT

Description: a communication method that uses a narrow bandwidth to transmit data, often ideal for low data-intensive applications like certain IoT devices.

Use cases: gathering insights from IoT devices like soil moisture detectors, tank meters, and weather monitoring stations and straightforward functions like toggling pumps on or off.





Benefits: can be highly effective for specific farm-related tasks. In particular at handling tasks that aren't data-heavy, such as gathering insights from IoT devices.

Limitations: In areas with mobile connectivity, technologies like Cat1 LTE and NB-IoT come into play for narrowband functions. However, some agricultural zones lack this connectivity and therefore LoRaWAN becomes the better option. However, narrowband can be supplemented by unique wireless systems and satellite alternatives to ensure comprehensive farm coverage.

5. Satellite-IoT

Description: Uses satellite technology to provide internet connectivity. It's especially useful in areas where ground-based internet solutions are not viable. [Click here to learn more about Low Earth Orbit, Medium Earth Orbit and Geostationary Orbit Satellites.](#)

Use Cases: Remote farm monitoring in areas without traditional internet infrastructure, GPS-based machinery guidance, and weather monitoring.

Benefits: Covers extremely remote areas where other connectivity options might not be feasible.

Limitations: can experience high latency, weather-related disruptions, higher costs, and data bandwidth limitations.

Technologies to support greater bandwidth

1. Broadband

Description: Broadband provides high-speed internet access via various forms, including DSL, fibre-optic, satellite, and more.

Use Cases: High-speed data transfer, video conferencing, online research, accessing cloud-based farm management software, and real-time streaming of surveillance cameras.

Benefits: Provides rapid data transfer rates suitable for various online activities, both operational and managerial.

Limitations: can face challenges in coverage gaps in rural areas, inconsistent speeds, higher costs, and susceptibility to environmental disruptions.





2. Mobile Broadband (4G/5G)

Description: Cellular connectivity, using 4G or the newer 5G networks, provides internet access through mobile phone towers.

Use Cases: Mobile machinery monitoring, quick data checks in the field, and using smartphones/ tablets for farm management apps on the go.

Benefits: Allows for mobility across the farm without losing connection, especially if the farm is covered well by cellular towers. 5G, in particular, can offer very high speeds and low latencies.

Limitations: Can be constrained by inconsistent signal strength in remote areas, limited data allowances, and vulnerability to tower infrastructure issues or a lack of towers in the area.

3. Mesh Networks

Description: Provides farmers with internet coverage across their property and helps eliminate black spots using repeaters to extend an existing connection (whether this exists on their property or somewhere nearby).

Use Cases: Extending connectivity in challenging terrains, ensuring continuous monitoring even if one point fails. Voice over WiFi and video (e.g. for surveillance or facial recognition).

Benefits: Provides redundancy, ensuring that the network remains up even if certain parts fail. It's also scalable – you can add more nodes as needed.

Limitations: Can face challenges in scalability, complexity in setup, potential signal interference, and reduced performance over extended distances. Whilst it is possible to use wireless mesh for IoT use cases, it is not generally practical due to its power consumption impacting sensor battery life and its lower range, as compared to LPWANs.

The Regional Tech Hub is here to help with free and independent on-farm connectivity advice:

- Book an appointment by clicking the link to speak with one of our friendly team - [Book an appointment • Regional Tech Hub](#)
- Call us on 1300 081 029
- Fill out an [simple form](#) and we can get back to you with further information.
- Visit our website for more resources: www.regionaltechhub.org.au





About the Regional Tech Hub

The Regional Tech Hub (RTH) is an Australian Government initiative run by the National Farmers' Federation. Since late 2020, we have helped more than 160,000 people across rural, regional and remote Australia to get connected and stay connected to internet and voice services.

The RTH is proud to work alongside the Australian Government to offer free and independent advice to farmers, fishers and foresters, on their connectivity options as part of the Government's new [On-Farm Connectivity Program](#).

Information in this Factsheet has been sourced, in part, from KMPG's report for Meat and Livestock Australia, titled [Agri 4.0 – Connectivity at our fingertips: A deep dive into the most important enabler for digital innovation on Australia's farms](#).

