

Case study

# Mission-critical 5G in the skies

Trialing 5G-ready air-ground-air connectivity  
for mission-critical airborne operations



**ERICSSON**

In  
partnership  
with

**TERACOM**  
SAMHÄLLSNÄT

# Expand 5G coverage into the skies for airborne critical communications

**Case study:**  
Teracom  
**Industry:**  
Telecommunications

## Executive summary

On Sweden's eastern coast, the scenic Mälaren Valley is a perfect picture of the wild and heterogenous Nordic landscape. Here you can find mile upon mile of thick, impenetrable forest – pierced by densely populated urban sprawls and carved up by vast waterways which filter through the nearby coastal archipelago where they are swallowed up by the waiting Baltic Sea.

Throughout 2021, this untamed valley provided the setting for an innovative 4G and 5G air-ground-air (AGA) connectivity

trial using a 5G-ready mission-critical cellular network and tested by several local and national agencies in need of critical communication. The trial, which was performed by Sweden-based communication service provider Teracom in partnership with Ericsson and other technology providers marks a new era of critical connectivity in the skies – demonstrating resilient and high-performance 5G-ready mobile connectivity for airborne use cases up to several thousand meters in altitude.

## Quick facts: The mission-critical 5G-ready air-ground-air (AGA) trial

**Altitude coverage target (but not limited to):** 0 to 5000+ meters

**Area coverage (approximate):** 3000+ km<sup>2</sup> - Mälaren Valley (Västerås to Stockholm archipelago)

**Targeted applications:** Airborne operations (unmanned aerial vehicles, helicopters, propeller airplanes)

**Network infrastructure:** Teracom's 300+ meter high-mast infrastructure

**Spectrum:** Wide-area and high capacity 5G-ready 2.3 GHz spectrum with a bandwidth of 80 MHz

**Ericsson solutions:** Ericsson Radio 4418 and AIR 3239 with Massive MIMO in 4x4 and 32x32 formation, Ericsson Evolved Packet Core with Service Capability Exposure Function.

## The challenge: A demand for more data in the sky

Above the treetops and beyond the shoreline, the Mälaren Valley's skyscape serves as working space for an abundance of air traffic activity – with dozens of helicopters, light aircraft and unmanned aerial vehicles (UAVs) performing high-speed airborne operations across a wide geographical area and between altitudes of 0 to several thousands of meters.

The nature of the operations range from blue-light missions and healthcare transport to various forms of situational awareness for critical communications, such as mission-

critical push-to-talk, remote search and rescue using high-definition real-time video, infrared heat camera, as well as the continual monitoring of air quality, fire, smoke and weather developments based on live data feeds.

### Extending cellular coverage higher and further than ever before

Reliable and resilient connectivity is critical to the success of public safety operations, ensuring both operational efficiency and real-time access to critical information. Traditionally, this has been served through specialized voice-centric land mobile radio (LMR) systems for push-to-talk (PTT), such as terrestrial trunked radio (TETRA), as well as other satellite-based communication systems. While such narrowband networks provide high reliability, their limited data load capacity and range restrict them to supporting use cases such as voice-only and short messaging services.

The introduction of 3GPP LTE/5G mission-critical broadband networks – offering higher data throughput and low latency – has removed traditional connectivity limitations set by legacy narrowband networks. Today, it is already widely transforming the nature of many public safety use cases in areas of good cellular coverage, enabling the integration of advanced digital technologies such as real-time video, augmented reality and remote

## About Teracom

The Swedish state-owned Teracom Group delivers nationwide communications services to public and private national critical infrastructure enterprises.

With more than 45 antenna sites of 300 meters or more across Sweden, combined with an extremely robust set up ensuring high availability and redundancy, Teracom delivers a network that is designed to be extremely reliable in all situations.

command and control, as well as daily office activities such as file transfer, e-mail transmission and video conferencing.

By extending mission-critical broadband coverage further and higher than ever before, Teracom's and Ericsson's innovative cellular AGA trial provides a launchpad to similar levels of digital transformation across even the most demanding and remote public safety and first responder use cases – today and tomorrow.





## The solution: A uniquely resilient high-mast AGA cellular network

The success behind the landmark mission-critical 5G-ready AGA trial is based on a culmination of Teracom's extremely resilient network infrastructure – combining high-mast infrastructure with high network redundancy – as well as its unique spectrum portfolio.

### Robust and resilient network infrastructure

As one of the leading radio and television operators in the Nordics, Teracom's networks have traditionally served an important function for emergency preparedness, with a condition that it must be able to broadcast under most circumstances. This unique broadcasting heritage, along with its demanding criteria, has had a significant impact on Teracom's network design.

Not only does Teracom have more than fortyfive high-mast antenna sites across Sweden each measuring more than 300 meters – with the ability to transmit unhindered above the tree line, but it also has a network profile that is markedly less dense than most other commercial communication service providers – leading to a higher average spend across each of its transmission sites. This unique high-mast infrastructure is also complemented by a strategy that has ensured extremely high levels of resilience throughout the

network, such as through the deployment of microwave links and diesel generators among other factors.

The combination of these factors delivers a network that is extremely reliable in all situations and delivers a foundation for Teracom to provide secure and robust communication services to public safety societal actors including emergency services and other government agencies.

### Coverage and capacity through a unique spectrum strategy

In early 2021, Sweden auctioned its mid-band 5G spectrum. Yet, while many of the commercial entities were lining up to take a share of the 3.5 GHz band with a focus on high-capacity services in dense areas, Teracom had other ideas – bidding on and ultimately securing 80 MHz of spectrum in the low-mid 2.3 GHz band to complement its already strong offering in the 450 MHz band.

This decision was another step in Teracom's wider strategy to deliver wide-area AGA coverage for mission-critical operations, enabling Teracom to create unmatched connectivity solutions for public safety actors based on a unique spectral combination and its robust high-mast infrastructure.

As part of the trial, Teracom and Ericsson deployed services in both the low-band 450 MHz range – ensuring wider reach, better propagation and more suitable coverage for remote location sites; as well as the 2.3 GHz range, ensuring

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“The future need of public safety operations is cellular coverage to or more than 5000 meters with speeds of 450 km/h or beyond. To deliver that, our ambition is to build a completely different kind of network, one that can both meet these criteria and serve completely different use cases.”

**Roland Svensson,**  
Chief Technology Officer at Teracom

high-performance 5G-ready capacity for data-heavy and latency-sensitive operational services.

In future, Teracom intends to share its unique spectral portfolio to support not only mission-critical airborne use cases, but also temporary mission-critical cellular coverage areas on the ground – otherwise known as ‘tactical bubbles’. By using the AGA network [to support the backhaul for tactical bubbles on the ground](#), Teracom intends to provide its public safety customers with coverage anywhere in Sweden – exactly when they need it.

**Network technologies: Sweden’s first AGA built for quality of service**

The trial uses the award-winning Ericsson Massive MIMO, a future-proof antenna solution which delivers unparalleled capacity and coverage for high-mobility environments such as a high-speed, wide-area airspace.

Throughout the trial, Ericsson and Teracom have been meticulous in optimizing and tuning the hardware to achieve optimal performance, making it Sweden’s first AGA network developed specifically for quality of service.

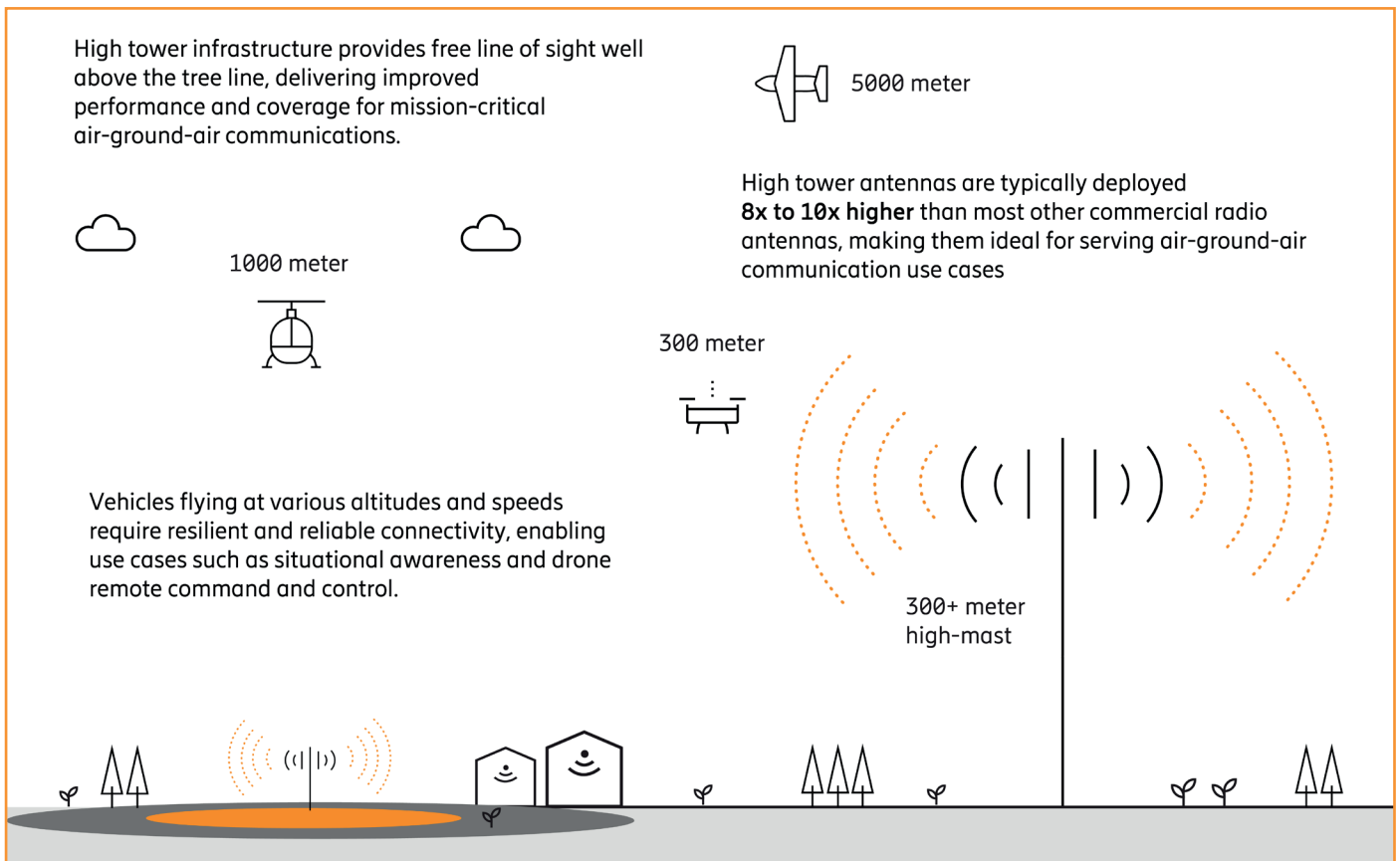
This resolute approach has been supported by Ericsson Massive MIMO’s built-in capability to enable ad-hoc hardware reconfiguration. This dynamic and versatile solution has even enabled Teracom to use the same radio hardware to meet the coverage requirements of both ground-based and airborne use cases at zero plane positioning – unlike traditional AGA deployments where the hardware is typically pivoted skywards.

The deployment of leading, standards-based technologies such as this is key to Teracom delivering on its strategic objectives in coming years. It’s also part of the reason why the partnership between Teracom and Ericsson works so well:

“Ericsson’s technologies are extremely mature, not least of all because of 3GPP standardization,” says Roland Svensson. “We want to deploy these various standards-based technologies in the way that our specific customers want to use them, deploying resilient and high-performance cellular networks that are built exclusively for mission-critical operations in the sky. It’s thanks to our partnership with Ericsson, and their extremely dedicated support, that we have now taken a significant step to accomplishing that objective.”

“Together with Ericsson, we have designed and built a network that can deliver both wide-area coverage, as well as an excellent downlink channel for high-capacity data at altitude. The results have surpassed all expectations in the field tests.”

**Roland Svensson,**  
Chief Technology Officer at Teracom





## The result: A flight path towards future airborne innovation

### A sandbox for wide-area AGA coverage

The 5G-ready AGA trial has been deployed to cover a wide area in Sweden's Mälaren Valley, leveraging three of Teracom's high-mast antennas located in Västerås, Enköping and Nacka.

The feedback from the wide range of public safety actors involved in the trial has been extremely positive, regarding both the network coverage and data capacity performance.

Many of these actors operate in remote spaces, with little or no cell coverage even on the ground. However, to perform their mission they also rely on high uplink and downlink throughput to feed and receive data reliably from the ground. This trial successfully demonstrates that, by deploying robust, high-mast infrastructure, cellular AGA connectivity can provide the necessary coverage and data capacity to support future advanced digital technologies for public safety operations both on the ground and in the air.

### A gateway for future UAV development

Unmanned aerial vehicles (UAVs), such as drones that journey beyond visual line of sight (BVLOS) and can be controlled in real time, is a technology area that - although is advancing rapidly - is hugely dependent on AGA cellular trials such as this.

Throughout the trial, Teracom and Ericsson have been working jointly with Katla Aero, a Sweden-based developer of electric drones and aircraft, to explore how drones can be used both as a relay station and

a sensor platform for various missions in the field.

The advent of wide-area, high-altitude and high-bandwidth cellular networks are likely to have a profound impact on the future of UAV deployments and could give flight to all manner of innovative BVLOS applications across the areas of real-time data collection and electric aviation and logistics.

Katla Aero, for example, are already running their video equipment on 4G, enabling real-time data transmission from their drone application to the ground station. For public safety operators, in future, that essentially means that they can have an eye in the sky anywhere in the world, while sitting somewhere else.

Gustav Wiberg, Co-Founder and Chief Technology Officer at Katla Aero, says: "A lot of the development today on the sensor side is to do with communication, to be able to relay data from the drone to the ground - in real time.

This is also part of the exploratory work

we are doing with Teracom and Ericsson today, using the drone as a sensor platform to collect data from the air. We then add an application layer with analytics software that can process the data, either in real time or afterwards on the ground. Beyond the obvious societal benefits, it also opens all kinds of new business opportunities. This could be a very exciting decade for telecommunication and UAV industries."

Teracom plan to launch Sweden's first fully commercial 5G-ready AGA network later in 2022.

Roland Svensson, Chief Technology Officer at Teracom, says: "This has been a sandbox project to give us a critical base for a real deployment serving real missions. What we are doing is wholly unprecedented. It has been extremely important for us to deeply engage with public safety agencies so that we can build a network based on facts and real requirements. It's clear, now that we have concluded the trial, that we have achieved what we set out to do."



## About Teracom

Teracom develops and offers communications solutions based on an infrastructure built specifically to meet Sweden's emergency preparedness requirements, to operators of socially important functions. As a wholly state-owned company, Teracom gets its mission from the Swedish parliament and the corporate governance is carried out by the Ministry of Enterprise.

## About Ericsson

Ericsson enables communications service providers to capture the full value of connectivity. The company's portfolio spans Networks, Digital Services, Managed Services, and Emerging Business and is designed to help our customers go digital, increase efficiency and find new revenue streams. Ericsson's investments in innovation have delivered the benefits of telephony and mobile broadband to billions of people around the world. The Ericsson stock is listed on Nasdaq Stockholm and on Nasdaq New York. [www.ericsson.com](http://www.ericsson.com)

