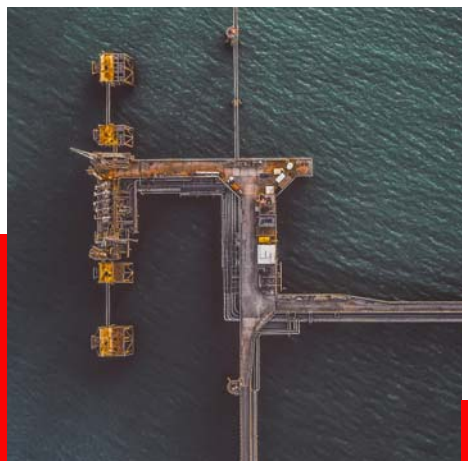
QUECTEL

Build a Smarter World

Whitepaper

Why LTE 450 is the enabler of critical, long-range communications



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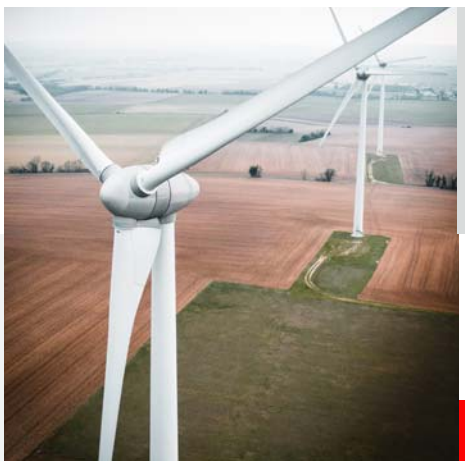


Introduction

LTE 450 connections utilize the 450MHz cellular band to provide robust, long-range connectivity with increased coverage and deeper signal penetration. The 450MHz frequency originated as a low frequency designated to 2G networks which are being retired across the world now. In spite of LTE 450 networks being available in many countries for many years, interest has been reignited as the industry moves into the LTE and 5G era.

The reason for this is that bands around 450MHz are well-suited to the demands of IoT devices and for critical applications ranging from smart grid and smart meter services to public safety applications. The 450MHz band is able to support CAT-M and narrowband-IoT (NB-IoT) technologies and the physics of the band are ideal for large area coverage, which has enabled cellular providers to offer blanket coverage cost effectively. An additional benefit is this reduces the power burden on IoT devices.

Comprehensive coverage demands lower power consumption by IoT devices so they remain connected and the deeper penetration LTE 450MHz means devices can easily connect to a network without energy draining repeated attempts. With national networks already rolled out in some countries, the arrival of CAT-M and NB-IoT have reinvigorated uptake and usage of the 450MHz band with significant support from industry organizations such as the 450MHz Alliance and 450 Connect in Germany.

LTE 450, is sometimes also known as Band 31, and describes networks using a 450MHz frequency, compared to the 900/1800/2100/2600 MHz of a typical public network. It is the band of choice for a number of operators in Western Europe and the US, with the Mobility Development Group reporting it is used by 115 operators in 60 countries across the world. There are a number of mobile devices which are purpose built to support companies in using the LTE 450 network and this vendor list is growing as the opportunities of CAT-M and NB-IoT become clearer.

The benefits of LTE 450

A key differentiator of the 450MHz band is its long range which delivers significantly increased coverage. Most commercial LTE bands are situated somewhere upwards of 1GHz, with 5G networks reaching as far as 39GHz. High frequencies deliver higher data rates thus larger pieces of spectrum are allocated to those bands, but these come at the cost of rapid signal attenuation, which requires dense base station networks.

The 450MHz band sits at the other end of the spectrum. A country the size of The Netherlands, for example, might require thousands of base stations to achieve full geographical coverage of commercial LTE but the increased range of 450MHz signals would only require a few hundred base stations to achieve the same coverage.

"a country the size of the Netherlands would only require a few hundred stations to achieve full geographical coverage"

Deployment status

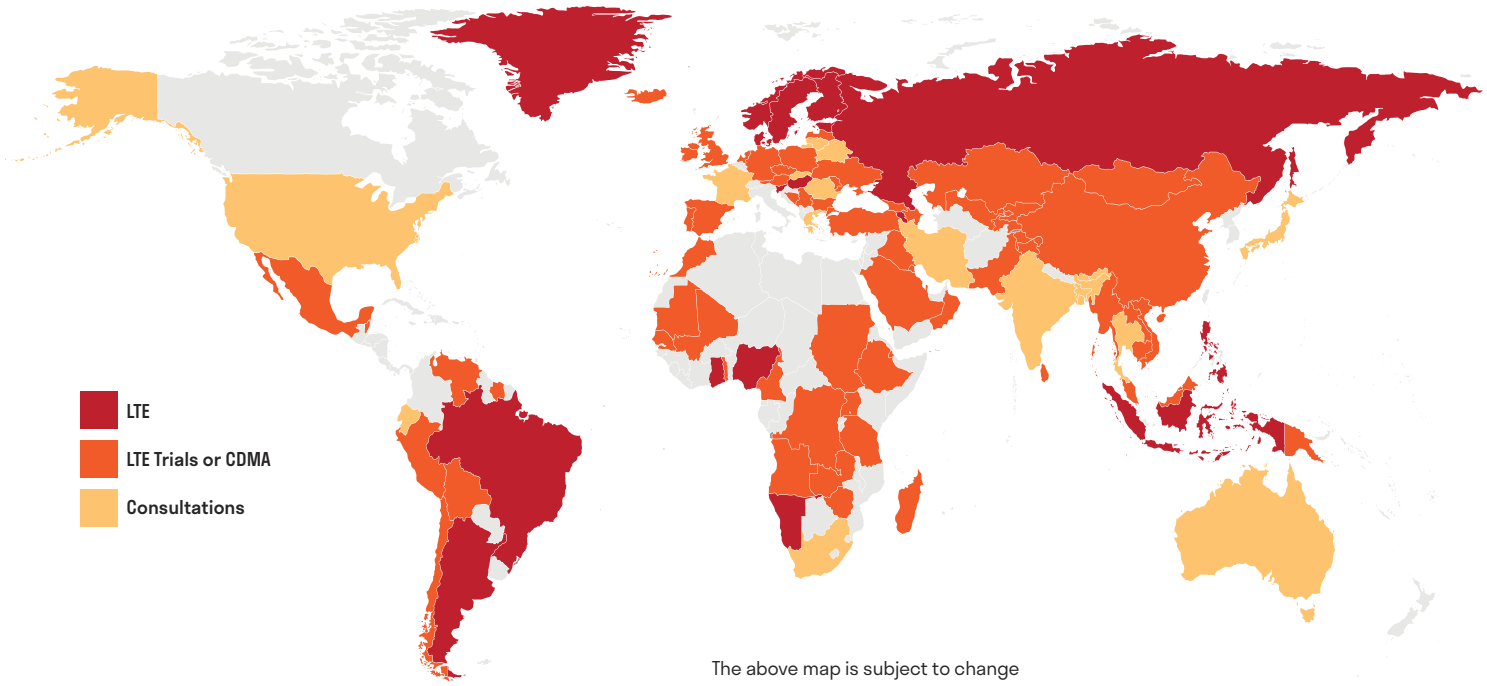
The 400MHz range has been utilized for many years in public and private networks, predominantly in Europe. For example, in Germany CDMA has been used while, in the Nordics, Brazil and Indonesia, LTE has been used. The authorities in Germany have recently awarded the 450MHz spectrum to the energy sector. Increasingly, legislation is making remote control of critical energy network elements mandatory. In Germany alone, millions of network elements are waiting to be connected and 450MHz spectrum is perfectly suited for this. Other countries are about to follow, deploying even more rapidly.

After a long time in the shadows, the 450MHz frequency range is now becoming the backbone to control and manage critical infrastructure such as transformers, transport nodes, and also smart meter gateways for supervision. 450MHz networks are built as private networks protected by firewalls to the outside world and this, by their nature, secures them from cyber attacks. As the 450MHz spectrum is assigned to private operators, it will mainly serve the needs of the critical infrastructure operators such as utilities and distribution network owners. The main uses here will be made by all kinds of routers and gateways to connect the network elements, as well as by smart meter gateways for critical measuring points.

The highest priority for stakeholders in the energy sector is to identify suitable end devices to start the test phase for all kinds of applications that use LTE 450. The focus here is on stable technology from reliable suppliers. Aspects such as the radio performance are of most interest as well as cybersecurity for the new devices.

The map in **Figure 1** clearly shows that 450MHz networks have already been deployed and are operating in South America, Northern Europe, Russia and Hungary, while they are about to be deployed in much of the rest of Europe and in Africa. Around the world, national authorities are auctioning off frequency bands around 400MHz – specifically, bands 31, 72, 73, 87, and 88 – to enable either public or private cellular networks for critical communications, based on LTE or on the legacy CDMA technology that is being replaced by LTE. The Netherlands, Poland, Ireland, the Czech Republic and Estonia plus several South American countries, South Africa and countries in the Middle East have all been early adopters. More European countries are likely to follow.

Figure 1: LTE 450 deployment status September 2020

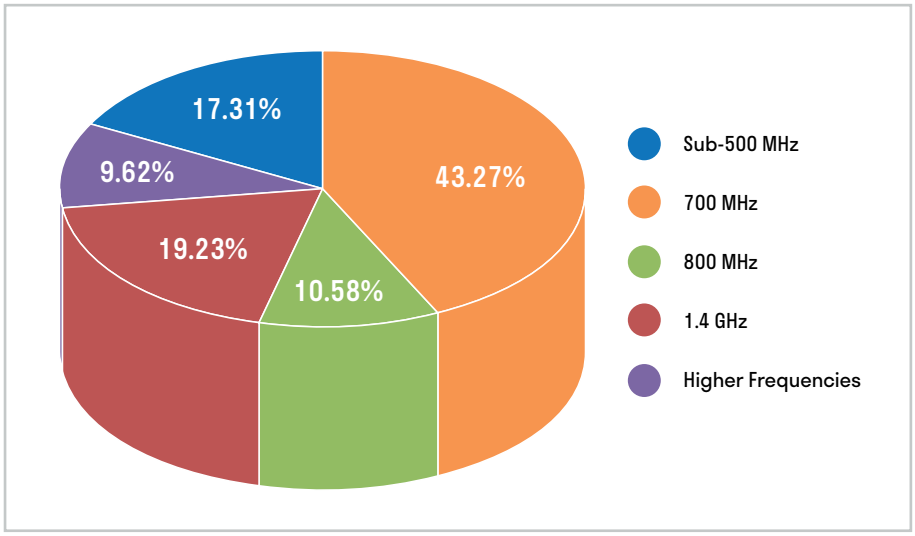


The above map is subject to change

Source: 450 MHz Alliance, September 2020, countries' deployments statuses subject to change

Research firm, SNS Telecom & IT, estimates that annual investments in public safety LTE/5G-ready infrastructure will surpass US$2 billion by the end of 2020, mainly driven by new build-outs and the expansion of existing dedicated and hybrid commercial-private networks in a variety of licensed bands across 420/450MHz, 700MHz, 800MHz, 1.4GHz and higher frequencies. Complemented by a rapidly expanding ecosystem of public safety-grade LTE/5G devices, the market will further grow at a CAGR of approximately 10% between 2020 and 2023, eventually accounting for more than US$3 billion by the end of 2023, the firm says. **Figure 2** details how public safety LTE/5G engagements are being split across the frequency bands and shows adoption of sub-500MHz frequencies accounted for 17.31% of the market in 2020.

Figure 2: Distribution of public safety LTE/5G engagements by frequency band Q2 2020



Source: SNS Telecom & IT (https://www.snstelecom.com/public-safety-lte)

Critical communications

"critical communications networks are continuously utilized infrastructure and need the attributes of LTE 450"

Critical communications are a growing market that is increasingly mandated by law as nations battle to improve their environmental footprints, secure their energy supplies and protect the safety of their citizens. Authorities need to be able to manage critical infrastructure, emergency responders need to co-ordinate their activities and power utilities need to be able to control the electricity grid. In addition, growth in smart city applications requires resilient networks to support large numbers of important applications. These are no longer just about emergency response, critical communications networks are routine, continuously utilized infrastructure and this needs the attributes of LTE 450 in terms of low power demand, comprehensive coverage and the throughput of LTE that supports audio and video streaming.

The capability of LTE 450 is well understood in Europe where the energy industry has successfully won privileged access to the 450MHz frequency band for low power wide area (LPWA) LTE communication in 3GPP Release 16 using voice communication, standard LTE, and LTE-M and NB-IoT.

IoT modules enable LTE 450 devices

YE0039BA

The device ecosystem around LTE 450 is growing rapidly with increasing numbers of devices, modules and antennas becoming available. Quectel Wireless Solutions has been developing IoT modules for more than a decade and these include its BG95-M4 multi-mode LPWA module which supports LTE Cat M1/Cat NB1/Cat NB2 and integrated GNSS and which meets the 3GPP Release 14 specification.

The BG95-M4 achieves maximum downlink rates of 588Kbps and uplink rates of 1119Kbps under LTE Cat M1. The module's integrated RAM and flash memory enables ultra-low power consumption, and the ARM Cortex A7 processor, which supports ThreadX, enables up to 70% reduction in power saving mode (PSM) leakage and 85% reduction in extended discontinuous reception (eDRX) current consumption compared to its predecessor. The BG95-M4's highly integrated, cost-effective and compact SMT form factor of 23.6mm × 19.9mm × 2.2mm allows integrators and developers to benefit from its mechanical intensity and low power consumption and design their applications with ease, and its advanced LGA package enables fully automated manufacturing for high-volume applications.

The module offers the 450MHz bands as well as supporting frequency bands for all global public LTE networks. Its flexible interfaces makes it easy to connect to all kinds of devices via USB or UART.

Quectel also produces the CAT 1 LTE module EC200S-EN which provides support for medium data rates up to 10/5Mbps in downlink and uplink at a competitive price. The module is designed for routers, gateways and concentrators that need to offer sustainable data throughput. The Quectel LTE 450 offering is completed by its range of antennas, including the YE0039BA, which help optimize connection efficiency and aid ease of installation of devices. These can be supplied pre-integrated with Quectel IoT modules to accelerate time to market and help eliminate integration issues commonly found.

Conclusion

The 450MHz band has been a sleeping giant, set aside for utilization in critical communications during the 2G and 3G eras. Now, however, interest has re-ignited because the bands around 450MHz support LTE CAT-M and NB-IoT, making these ideal for IoT applications.

The relative ease of achieving national coverage because of the physics of the 450 band adds to the attractiveness of LTE 450 solutions. This is further augmented by a strong vendor sector that offers optimized devices, modules and systems to enable rapid roll out and simplified operation of critical communication networks. It is clear that the message about LTE 450 is getting through and this is show by the growing adoption of the band in nations across the world.

As these roll-outs continue, more IoT applications and use cases will be served by LTE 450 networks. With infrastructure already familiar and often in place it presents an ideal network for critical communications today but also aligns with 5G for the future and this is what makes 450MHz such a compelling frequency to deploy networks and operate solutions on today.

To learn more about how Quectel modules and antennas can support your LTE 450 deployment, visit:
www.quectel.com