



Annual Global Update

Public version

450 MHz Alliance, September 2021

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1 Introduction

This report provides the global status of the use of spectrum in the 410 MHz and 450 MHz bands. The information is gathered from operators and regulators worldwide by 450 MHz Alliance. The 450 MHz Alliance is an interest group fostering deployments in the 380 to 512 MHz band. Primary activities of the 450 MHz Alliance include advocacy for evolution of standards, technical education, advocacy, regulatory affairs, global cooperation’s, system and device availability and cooperation to develop new features and services.

Worldwide, there are currently thirteen LTE operations with commercial traffic and another seven operations performing trials. CDMA networks are still the dominant technology in the 410 MHz and 450 MHz and regulatory work for converting technology specific licenses is an obstacle in the progress of evolving to 4G. Europe is currently leading the evolution from CDMA to LTE with Asia and South America in progress. The aim of this report is to provide operators with a simple introduction to the 450 MHz ecosystem for their business and to show business opportunities to the suppliers who provide equipment to operators and end-users.

2 Technology Overview

LTE in 450 MHz bands is a part of the 3GPP standard for 4G/LTE. With advanced data and voice capabilities, flexibility and a seamless migration path to next generation technologies (typical 5G), LTE has become a leading wireless technology for delivering voice and broadband data to densely populated urban areas as well as rural and remote regions in developed and developing markets. LTE450 – or LTE in the 450 MHz frequency bands – is a mature and robust technology for cost-effective provisioning of both basic and advanced voice and broadband data services across regions with low population densities or difficult terrain due to the favorable propagation characteristics of the lower frequency band combined with a robust and advanced 4G LTE technology. The unique characteristics due to low spectrum give a superior coverage compared to any other spectrum bands standardized by 3GPP and ITU. The typical coverage area for different spectrums can be seen in the figure 1, below.

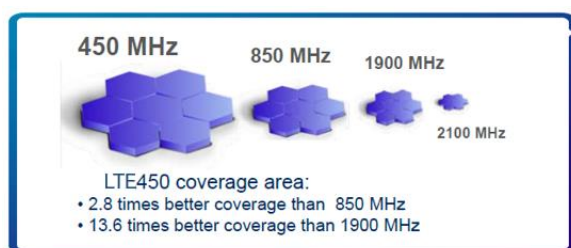


Figure 1. Coverage area for different spectrums

Being part of the 4G/LTE and 3GPP ecosystem brings the advantages of a global technology evolution for connectivity. The fundamental broadband services have evolved to support narrowband and lower power connectivity as well and voice and critical services with access priority and quality of service support. Low power and narrowband support for LTE-M (eMTC) and NB-IoT are available from several suppliers. The path to 5G has started with gathering initial information for the work items for the 3GPP RAN process. Evolution to 5G will follow the general implementation of bandwidth support for 3 MHz and above, since these smaller bandwidths are applicable in the 400 MHz bands. The current view is that both standalone and non-standalone versions are required to be supported and that dynamic spectrum sharing would be essential for some implementations.

3 Market Overview

The major development in the last twelve months has been the spectrum allocation in Germany, which is currently one of the main markets driving LTE progress for the lower bands. The CITC, the regulator of the Kingdom of Saudi Arabia has progressed with a consultation and plan to award spectrum in both 410 MHz and 450 MHz. Most existing allocations of spectrum in the 400 MHz bands are still not technology neutral and require regulatory updates or changes to the allocation and/or licenses to be able to implement LTE by the local operators. The trend is that the 400 MHz spectrum bands are more and more being allocated to private networks typical Utilities, Public Safety and Transport. The advantage is the predictability of the operation, it will be stable and controlled since the network is deployed with a dedicated business as a base and customized to the requirements of the user. Due to the conversion of the business model, the number of operators is likely to decrease temporarily before new allocations have been awarded. There are more than twenty networks actively investing in LTE globally.

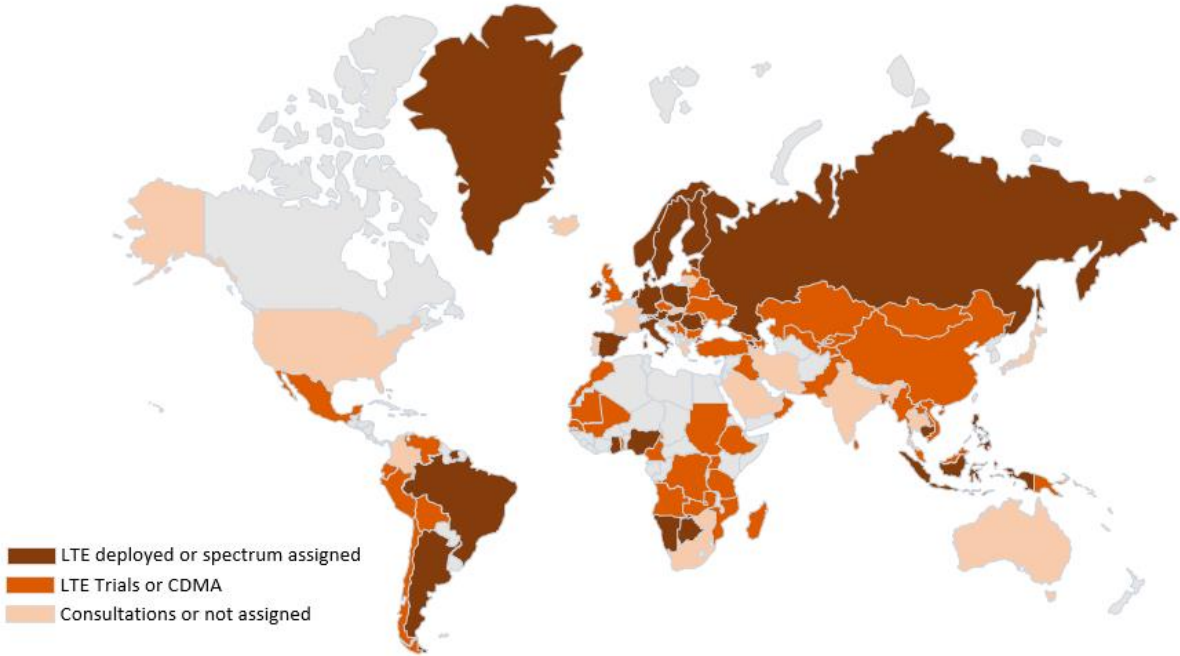


Figure 2. The world map of 380 MHz, 410 MHz and 450 MHz deployment.

Spectrum in the 400 MHz bands is today already allocated or in consultation in countries representing more than 6.6 billion people or 85 percent of the world population. Networks are being or are already deployed or in trial in countries representing more than 4.1 billion people or 52 percent of the world population.

3.1 Applications

Network deployments in the 400 MHz bands are suitable for many applications both as the primary carrier as well as backup solution. The applications could be the same, independent of the continent and country. The applications can be divided into four main segment Utility, Transport, Public Safety networks and Rural connectivity.

Connectivity to support applications and services for **utility** distribution network evolves to require private and dedicated connectivity network due to them supplying critical function in society. This includes connectivity to support smart grid, smart meters, smart city, local production, electrical vehicle charging stations and devices for the staff. Security of the utilities production, distribution, and delivery of services to their customers is the reason to build dedicated networks. The 400 MHz bands fit for providing the coverage required for these applications and can also cater for the capacity need. The organizations UTC (North America), EUTC (Europe), UTCAL (Latin America), UTC Africa and UTC Asia have extensive information regarding Utility application.

Applications for **transport** requires coverage over large range of areas, this includes railways, road service, logistics, mining, shipping, timber industry and agriculture. The solutions can vary from simple monitoring to remote control and assisted automation. The 400 MHz spectrum can provide a secure and continues connectivity for many of the applications and with complementary higher spectrum, today supported by most chipsets, be a seamless part of the overall solution. Like the utility network security of the information and the control of the network drives the requirements for a dedicate and private network.

Public safety would use the 400 MHz bands as part of their connectivity solution either as primary or secondary carriers. Typical service would be broadband and machine to machine, but not limited to these. Networks are likely to have a nationwide coverage but could also be suitable for mobile unit with instant wide range coverage. TCCA provides additional information regarding the requirements for public safety application and services.

Rural connectivity or connectivity for rural school and health care centers and for rural ATMs and bank offices broadband also including services for unconnected or poorly connected consumers. This segment enables services that are critical for a modern society.

The 400 MHz bands provide a service for these applications with an attractive business model. This is due to the capacity and coverage possibilities, which enable the desired traffic pattern with an affordable investment.

3.2 Africa

Listed below is a short status update per country for the most active countries in the last twelve to eighteen months.

- Telecom Namibia have held the band 31 license for several years.
- The band 31 license in Senegal is being evaluated for LTE with several different options of end user scenarios.
- Open Sky Services holds the band 31 in Nigeria and is still working on business models with potential partners.
- The regulator in Uganda is looking at awarding the 380 MHz band for PPDR services.
- The 450 MHz spectrum in Angola is in progress to evolve from CDMA to LTE by Angola Telecom.
- Botswana regulator BORCA has announced auction of the 450 – 470 MHz band for broadband use.

3.3 Americas

Listed below is a short status update per country for the most active countries in the last twelve to eighteen months.

- The utilities in the US are seeking opportunities to obtain their own spectrum, mainly to be independent from third parties and to be in control of the connectivity. Both spectrum in the 410 MHz and in 380 MHz is being evaluated.
- Band 31 in Brazil has been awarded to the four main operators more than five years ago. The progress has been very slow since it is not the core business of the operators. Other industries have been interested in the spectrum but would not like to be dependent of third part not focusing their segment. The utilities and the interest organization UTCAL have started to evaluate the possibility to get access to band 87.
- Colombia initiated a consultation on the 380 MHz band and later a brief consultation regarding the spectrum in the 450 MHz band.
- Alvis is the first former CDMA operator in Argentina evolving to LTE. The deployment includes both band 31 and band 87.
- Suriname has a deployed network in the 450 MHz band for IoT services.
- Telmex holds a 450 MHz license in Mexico currently operational on CDMA.

3.4 Asia and Oceania

Listed below is a short status update per country for the most active countries in the last twelve to eighteen months.

- India has had several investigations for dedicated spectrum for different segments and verticals. 450 MHz has been included in proposals for railway and critical communication.
- China Unicom holds the band 31 license in China. No official statement has been made with regard to services to be delivered using the spectrum at this time. It has been evaluated for power grid and meters as well as railway communication.
- The license holder of band 31 in the Philippines has changed ownership. The new owner has not officially stated the plans for the operation.
- Net1 holds a license covering both band 31 and 72 in Indonesia. The operation is live in large areas focusing on rural connectivity and governmental solution.
- Band 31 is available in Vietnam. Previous license holder was EVN Telecom.
- Malaysia Telecom has held the band 31 license for many years with limited progress. With the growing need for connectivity, the utilities in Malaysia have been reviewing the possibility to use the spectrum.
- The Telecom Regulator in Pakistan has had consulted in order to evaluate the interest in evolving the current CDMA license to a technology neutral or LTE license.
- The Telekom Regulator in Bahrain has initiated a process for band 87.
- The 410 MHz and 450 MHz bands are part of the Saudi Arabia extensive spectrum plan and will hopefully become available during 2022 for deployments.

- The Cambodia regulator has awarded 60 MHz from 390-450 MHz, so far, no public announcements regarding the operation have been made.
- Singapore has awarded 450 MHz spectrum.
- Dialog holds the 450 MHz license in Sri Lanka and are looking to evolve to LTE.
- Thailand is reviewing the use of 450 MHz to 470 MHz-band.
- VEON holds the 450 MHz license in Armenia and provides a broadband service.

3.5 Europe

Listed below is a short status update per country for the most active countries in the last twelve to eighteen months.

- Elisa holds the band 31 license in Finland, but there is no official target segment stated at this time.
- ice holds the band 31 license in Norway which is mainly used for consumer broadband in rural areas typical second homes. A license for band 87 has been out for consultation with limited interest from the main operators, other industries were not included in the consultation.
- Teracom holds the band 31 license in Sweden. It serves broadband for consumers, utilities and mix of business solutions for typical rural areas.
- Cibicom holds the band 31 license in Denmark with the initial focus for the IoT, but no official product launch has been registered at this time. The Danish police holds the license in band 87 and are evaluating the options to progress.
- ESB holds the band 87 license in Ireland and is currently in the procurement process for network infrastructure and devices. The main initial use case is to deploy connectivity for smart grid.
- PGE holds the band 31 license in Poland and are in the planning phase for their deployment. Polkomtel holds the 410 MHz license and is evaluating their options as to how evolve the business.
- Utility Connect holds the band 31 license in the Netherlands which is mainly used for smart meters and smart grid connectivity.
- 450connect holds the band 72 license in Germany. The operator is currently in the procurement phase for network infrastructure and auxiliary services. The network will be deployed with a focus on emergency voice communication, smart meters, smart grid and communication of other critical infrastructures.
- SIRDEE holds the band 31 license in Spain and have given Telefonica the task to build and operate a public safety network.
- EDP have had trial network in Portugal. EDP has been offered the license. However, the commercial terms have not been at a level enabling the benefits of the deployment, so the process to award the license is ongoing.
- Tele2 Russia, part of Rostelecom, holds the band 31 license in Russia. The network provides services for Public safety staff, industries and transport.
- MVM NET holds the band 31 license in Hungary with primary service for smart city, smart grid and smart meters.

- In Czech Republic, both band 31 and band 87 license are under evaluation. Earlier license holder's business in the public safety domain was halted due to delays in the decision process within the government.
- Consultations in Slovenia (band 31 and 87), UK (band 87), Greece (band 87) and Ukraine (band 31) are in progress.

4 Overview of Spectrum

The LTE bands available in the 380 MHz to 512 MHz are currently:

- Band 31 (450 MHz)
- Band 72 (450 MHz)
- Band 73 (450 MHz)
- Band 87 (410 MHz)
- Band 88 (410 MHz)

All bands are standardized to support LTE, LTE-M and LTE-NB (NB-IoT). Ongoing strategic work with TCCA, EUTC, UTCAL, UTC and other parties in the ecosystem are progressing to identify spectrum allocation in the 380 MHz and 470 MHz bands.

5 General outlook

The evolution towards LTE of the spectrum in 380 MHz to 512 MHz is expected to increase. Bandwidth and coverage requirements for private and closed networks as well as public networks for rural communication are getting more interest and with this also an increased interest for the lower spectrum bands. With only twenty active operation and spectrum allocated in over seventy countries the expansion can be very fast. The ongoing consultations and the interest from government and companies are likely to drive the ecosystem even faster.