Annual Equipment Report

Public version
450 MHz Alliance, May 2025

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1 Introduction

This report provides the global status of the 410 MHz and 450 MHz ecosystem with focus on the devices and network systems currently available. The first LTE system in 410 and 450 MHz were deployed ten years ago, and the ecosystem is growing. The current equipment being released are second generation of chipset and radio base stations. There are currently thirty-two LTE operations and another twenty-three licenses in consultation. There are still CDMA networks in the 410 MHz and 450 MHz bands and the regulatory work for converting the licenses is an obstacle in the progress of evolving to 4G. Europe is at the forefront of transitioning from CDMA to LTE, with Africa, Asia and South America also making progress. The aim with this report is to enable operators a simple entry to the 450 MHz ecosystem for their business and enable market opportunities for the supplier to provide equipment to the operators.

2 Market Overview

The major developments in the past twelve months include deployments in Germany and Poland and procurements in Brazil, Malaysia, South Africa and the Kingdom of Saudi Arabia. These six countries are currently key markets driving LTE progress for the lower bands. Countries where licenses have been awarded or are open for local permits and are expected to make progress this year include the Netherlands, Indonesia, Nigeria and Bolivia. License consultation in several European countries is also a significant step in the global trend of private spectrum allocations.

Most operators with spectrum licenses in the 400 MHz bands are still not technology-neutral and require regulatory changes to implement LTE. The trend is that the 400 MHz spectrum band is allocated to private networks typically for Utilities, Public Safety, and Transport. The advantage of these allocations is the predictability of operation; the network will be stable and controlled since it is deployed with a dedicated business as its base.

Due to the conversion of the business model, the number of operators will temporarily decrease before new allocations are awarded. Currently, more than twenty networks are actively investing in LTE globally.

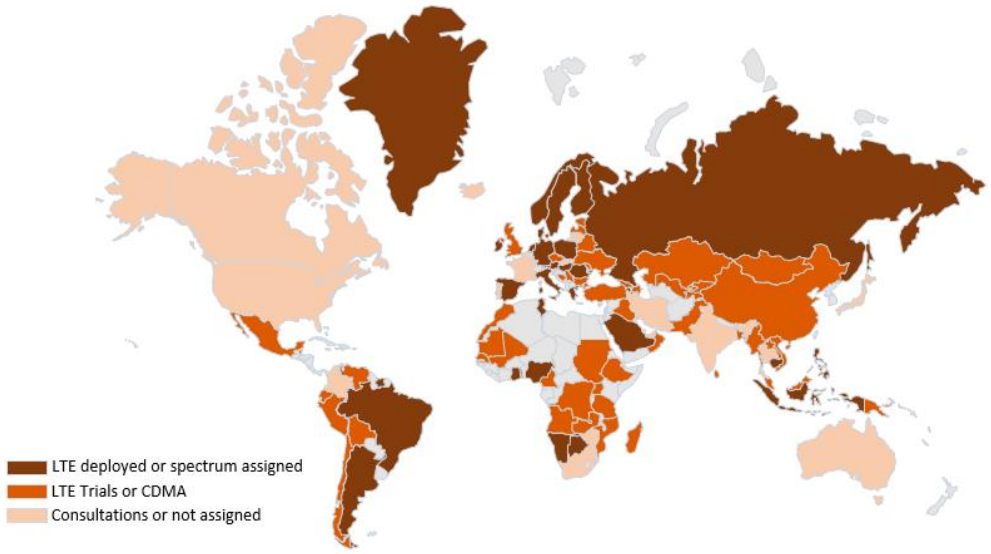

Figure 1. The world map of 380MHz, 410 MHz and 450 MHz deployment.

Region	Deployments	LTE Deployments	Consultation	Not in use
Africa	22	6	3	2
Americas	9	5	7	2
Asia and Oceania	18	5	7	5
Europe	25	16	6	15
Total	74	32	23	24

Table 1. Number of countries per region and globally with 380 MHz, 410 MHz and 450 MHz.

3 Spectrum of overview

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), not in use.
- 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, UTC, UTCAL and other parties in the ecosystem are progressing to identify spectrum allocation in the 380 MHz band.

Spectrum bands allocated for private and dedicated networks globally that are considered as complementary band and to be part of the chipset ecosystem to enable business models for the critical and dedicated business segment.

- » Broadband spectrum bands
  - » 4G bands 3, 25, 26, 31, 38, 40, 42, 43, 48, 50, 68, 72, 87, 88, 106 (US8), 111
  - » 5G bands 3, 25, 31, 38, 40, 48, 68, 71, 72, 77, 79, 87, 88, 258
- » IoT spectrum bands
  - » 4G bands 3, 25, 26, 31, 68, 72, 87, 88, 106 (US8), 111
  - » 5G bands 3, 25, 31, 38, 40, 48, 68, 71, 72, 77, 79, 87, 88, 258

450 MHz Alliance is continuously monitoring new spectrums allocated for dedicated networks and are updating the requirements for the ecosystem.

4 The 400 MHz Ecosystem

The range of devices in the 410 MHz and 450 MHz bands is good relative to the number of commercial operations, but it is limited compared to the overall global mobile industry. The main volumes are in various router devices and electric meters. Other types of devices, such as sensors, meters, wearables, and handheld mobiles, have increased in availability over the past twelve months. The available routers range from simple consumer products to advanced

specialized industrial routers. The handheld devices are predominantly rugged and robust smartphones. Most devices support multiple spectrum bands.

To provide a complete view of the ecosystem, this report also includes eNBs, chipsets, modules, and antennas for both networks and devices. Modules are the enablers of many devices, and device suppliers often source these from third parties. Currently, NB-IoT and LTE-M are the dominant technologies for chipsets and modules, and thus for narrowband devices. However, router and handheld devices are still mainly based on Cat.4 modules.

4.1 Device supplier ecosystem

The range of devices focuses on industrial solutions many with advanced device management platform. The most active suppliers are Advantech, Alait, Andra, Baeris, Cavli wireless, Cisco, Cybertel, Cyrus, Digi, Etic Telecom, Garderos, GE Verona, Hitachi Energy, Huawei, Hytera, INSYS, Intelliport, MC-Technologies, Meazon, Nokia, Quectel, Robustel, RugGear, Sierra Wireless, SIMCOM, STUV, TDTech, Telit, Unitac, Westermo, WMsystems and ZTE. Supported by chipset providers like Qualcomm and GCT semiconductors.

4.2 Network and systems supplier ecosystem

Contributors and supporters to the ecosystem includes the big network vendors and niche suppliers in specific. The macro eNB suppliers Alait, Airbus, Anktion, Airspan, Ericsson, Etelm, Huawei, Hytera, Katela Networks, Nokia and ZTE with the complement of small cells from Anktion and Ubiik provides the fundament for the 400 MHz ecosystem. Core network supplier, Druid Software, Ericsson, Huawei, Nokia and ZTE supported by software and connectivity from operators and service providers like Elisa and Monogoto or a supplier such as Telit. In addition, OneLayer and Comarch support the ecosystem with business solutions, intelligent monitoring and security solutions.

4.3 Approach to 5G and RedCap

The 5G bands for n31, n72, n87 and n88 have been progressed in 3GPP and chipset suppliers GCT and Qualcomm have released a roadmap for 5G in the 400 MHz bands to be available during this year. The focus is RedCap which is a good fit for the bandwidth available in the 400 MHz bands.

4.4 GSA alignment private networks (the Global mobile Suppliers Association)

The GSA provides reports for Sub 1 GHz Spectrum for LTE and 5G, listing the spectrum allocations and the number of devices in each spectrum. For this report, 450 MHz Alliance have reviewed the information in the GSA reports and can conclude that data is aligned. 450 MHz Alliance can conclude that the 400 MHz bands are well utilized in the private and dedicated networks around the world and are part of driving the development of this segment.

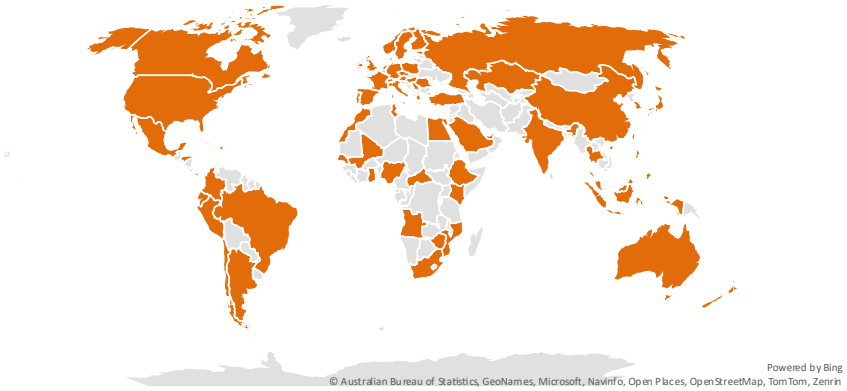

Figure 2. GSA the world map of private and dedicated network deployments.

4.5 410 MHz and 450 MHz devices listed by 450 MHz Alliance

The annual inventory by the 450 MHz Alliance gathers information from all operators and suppliers who wish to contribute to the organization and this report. This year, more than fifty companies have contributed with their input. The categories used to structure this report are listed below:

- Handheld mobiles
- Routers and MiFi's
- Utility meters (Electricity, gas, water, others)
- Modules
- Chipsets
- eNB/NR
- eNB/NR antennas
- Device antennas
- Other (including wearables, cameras, dongles, etc.)

The products and devices reported to the 450 MHz Alliance can be seen in **Figure 3** and include both the commercially available, engineering samples availability, and the devices in the road map.

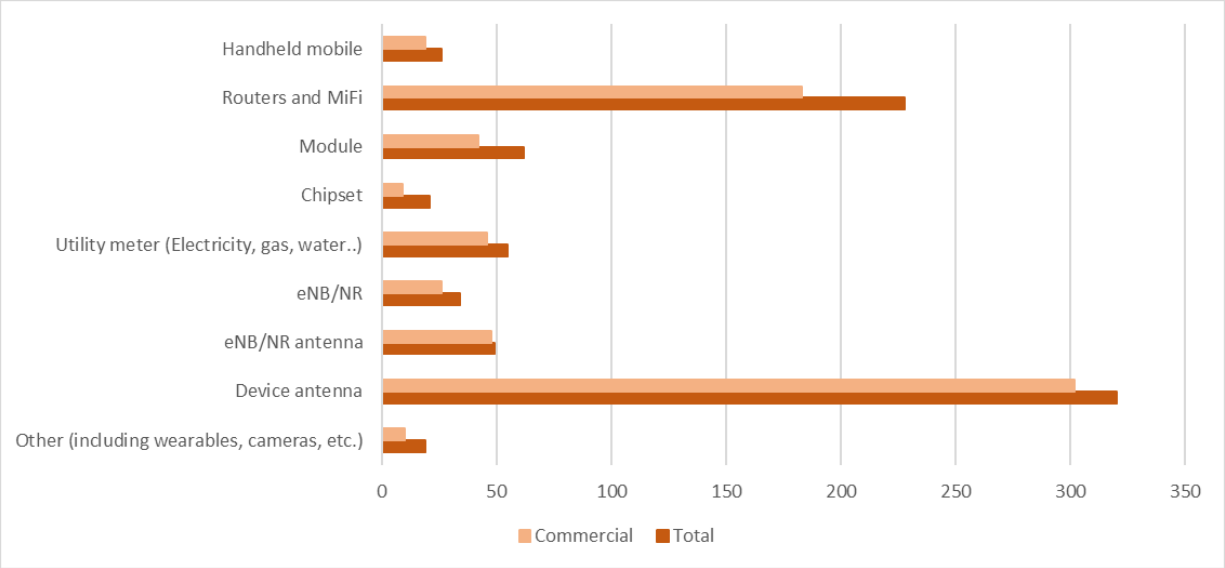

Figure 3. Global 450 MHz device status.

There are more device antenna manufacturers that have provided input to this year's report compared to earlier reports. This has resulted in a significant increase in data, not due to actual growth, but because the information was previously missing.

The first generation of LTE450 devices are mostly replaced with new versions or terminated, but the number of devices still increases year over year. The variety of devices is increasing as well as the number of use cases that can be supported by the devices.

With ongoing deployments and more procurements there has been an increasing number of eNB available on the market.

5 General outlook

The evolution toward LTE and 5G in the 380 MHz to 512 MHz spectrum is expected to increase. Bandwidth and coverage requirements for private and dedicated networks, as well as public networks for rural communication, are gaining more interest, leading to increased interest in the lower spectrum bands. With thirty active operations and spectrum allocated in over seventy countries, the expansion can be very fast. Ongoing consultations and interest from governments and companies are likely to drive the ecosystem even faster. Utilities are greatly interested in evolving smart grids, smart meters, and smart cities, including charging poles, especially with more local energy production via solar power and windmills.
In 2023, about one million devices were ordered and delivered globally, mainly utility meters. The annual volume of connections is expected to grow to about ten million within the next three years. The number of base stations delivered per year is expected to be a couple of thousand.

Services provided in the networks cover the full range of LTE technologies, for CAT-4 and higher to LTE-M, Cat-1 and NB-IoT. This trend is already a reality in the 400 MHz networks that have been in service for more than four to five years and up to ten years. For long-term broadband service delivery, support for RedCap will be important

within the 400 MHz bands. The work for 3GPP standardization of 5G bands in the 400 MHz spectrum is progressing, with the first tests expected by the end of 2025 or the beginning of 2026.