

Local 5G to Accelerate DX

— *NEC UNIVERGE RV1000 Series enables system construction at affordable price range* —



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1. Introduction

With the spread of digital transformation (DX), Local 5G, which enables private use of 5G next-generation wireless technology, has gained wide attention. Radio waves have thus far been allocated for use only by telecommunication carriers with the appropriate technological capabilities. The Japanese government, however, has decided that it is necessary to attract private investments and create social value in order to make effective use of radio resources, and has thus engaged new industry players.

However, due to the complexity of the technology, the system cost has remained high, preventing the widespread use of radio resources. To solve this problem, NEC delved into the fundamental question about what makes a Local 5G system easy for companies and municipalities to use. From this research, it developed a new Local 5G system called the NEC UNIVERGE RV1000 series, which enables system construction at an affordable price range. Here, I will discuss the current state of Local 5G, which is vital in accelerating DX, the features of the new product series, and its potential to promote the uptake of Local 5G.

2. The birth of Local 5G aimed at democratizing radio use

Following the computerization of information, the use of digital data has accelerated since the late 1990s along with the spread of the Internet, and the use of digital data has become commonplace both in corporate activities and in our daily lives. However, apart from the hotspot usage of Wi-Fi and similar technologies, the unrestricted use of data using wireless technology is mainly through public network systems provided by telecommunications carriers via smartphones and other mobile devices. For example, companies and municipalities have been unable to build their own wireless networks to meet their specific needs. The capital investment for mobile phone networks of telecommunication carriers, which had developed as an advanced tool originally intended for mobile communication between people, has been planned based on population density. Therefore, even today, base stations have not been sufficiently installed in uninhabited areas including mountainous and coastal regions. Likewise, radio signals cannot penetrate and be used in large and closed spaces such as factories of private companies, making it practically difficult to use them for business purposes in such locations. Also, even if equipment can be installed, as

long as the network is public, it is provided under technical specifications in accordance with its service stipulations. Thus, it is difficult to provide network functions tailored to use as a private network, for example, in accordance with the needed applications for communication, transmission speed, and type and number of terminals.

In particular, in terms of network characteristics tailored to communication needs, it is imperative to go beyond the technical specifications of 4G/LTE, which has developed as a mobile phone network. We therefore compiled the ITU Vision Recommendations as technical guidelines that ITU-R should aim for in pursuing the standardization of 5G, in accordance with the generational shift that is said to occur once every 10 years (Figure 1). In particular, the three characteristics of 5G; namely, “ultra-high speed,” “ultra-low latency,” and “massive connectivity,” have been defined as three different scenarios, and the story drawn is to achieve the three in parallel. 5G specifications have been formulated through 3GPP in accordance with this story. However, a common misconception is that these three scenarios are achieved at the same time. In reality, instead of providing all the features with one wireless resource, the idea is to create a scenario and allocate wireless resources for each desired service. In other words, the technical scenario for implementing 5G should coincide with the technical specifications in the three directions.

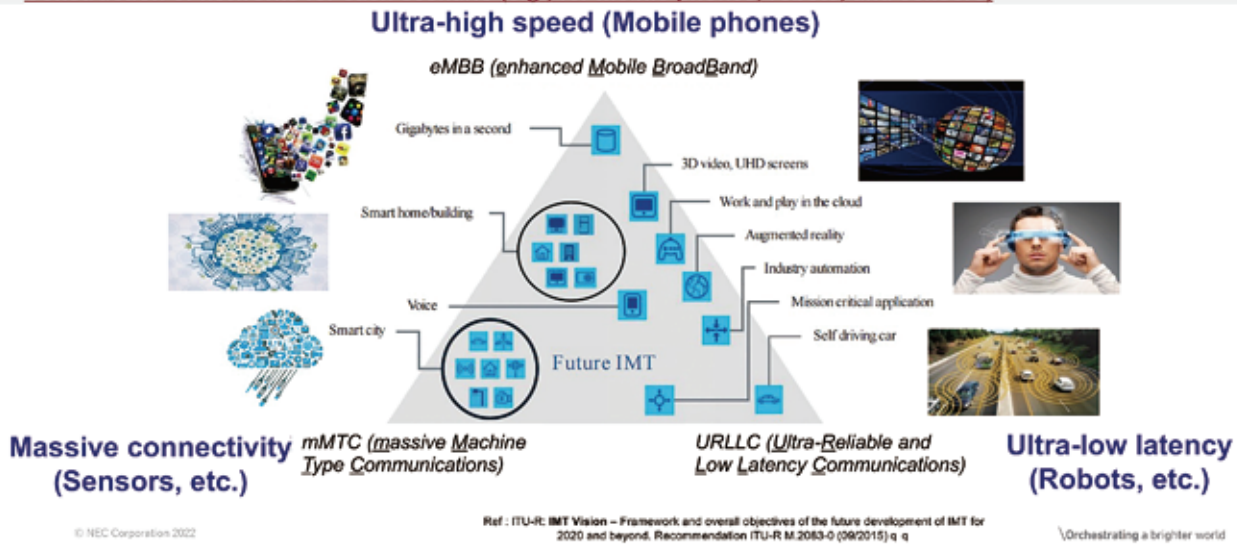
Along with progress in the 3GPP specifications, Japan started 5G field trials in 2017 through the Ministry of Internal Affairs and Communications (MIC) 5G Comprehensive Demonstration Tests. Initially, demonstrations were carried out mainly by telecommunications carriers and related manufacturers with the technical know-how in mobile communications. Later on, the tests developed into problem-solving type demonstrations aimed at social implementation and were carried out under the leadership of players from various industries and municipalities. As a result of the MIC demonstrations and the progress in discussions of 5G use cases by experts from industry, government, and academia, expectations have grown significantly for its use outside of residential areas, including in construction sites, farms, forests, and private factory buildings. Fortunately, as aforementioned, 5G can be applied in multiple technical scenarios, paving the way for discussions of the allocation of wireless resources other than the public networks used for smartphones for general consumers. MIC defined the term “Local 5G” to promote the democratization of radio use. And, in December

■ Figure 1: ITU Vision Recommendations: Objectives and Framework for 5G Development

ITU Vision Recommendations: Objectives and Framework for 5G Development

Definition of performance requirements (technical standards) in three different scenarios for 5G (only high-speed performance for 4G)

Construction of networks for each scenario (e.g., for mobile phones, robots, and sensors)



2018, the Local 5G Study Group of the New-generation Mobile Communications System Subcommittee under the Information and Communications Council started discussions on its standardization. In December 2019, millimeter-wave (28 GHz band) Local 5G was institutionalized, and a new wireless field called “Local 5G” was officially established. Further, in December 2020, Local 5G (4.6 GHz to 4.9 GHz) in the Sub-6 band, a user-friendly, low frequency band, was institutionalized and launched into full-scale use, leading to its applications in a wider range of use cases.

3. The challenge of utilizing technology designed for telecommunication carriers for the general public

As mentioned in the preceding paragraph, Local 5G was institutionalized in Japan as 5G that can be used not only by telecommunications carriers but also by companies and municipalities to meet various needs. For example, Local 5G radio waves can be used in factories within buildings as a private, wireless on-premises network. In addition, unlike for Wi-Fi and other wireless signals that do not require a license as an exception for weak radio waves, by allocating 5G radio waves as a licensing station, Local 5G enables emitting stable radio waves that cover a large area of the premises.

However, using wireless technologies in Japan requires operating them in accordance with the rules established by MIC. Even for Local 5G, a license is needed after technical verification based on the purpose of use. Also, emission of radio waves for

operations must be performed by licensed radio engineers, and each user entity must assign nationally certified radio engineers within the organization to obtain a Local 5G license.

Moreover, 5G systems are equipped with mechanisms for terminal authentication as intended originally for mobile communications, as well as mechanisms to enable mobility over a wide area. Therefore, the systems are relatively large, thereby requiring significant capital investments.

NEC has developed a Local 5G system that uses the technologies it has developed for base stations designed for telecommunications carriers, an area for which it has an accumulation of technical strengths and know-how. Leveraging this technology as an innovator, NEC has been promoting value creation through Local 5G via co-creation with companies carrying out advanced initiatives in major construction and manufacturing industries. Even in the early stages, these companies were able to make relatively large investments to secure human resources, improve efficiency, and solve pressing safety and environmental issues. These initiatives have been going on for more than five years, and significant progress has been made toward practical use of the system.

4. Changes in use cases and breakthroughs in Local 5G adoption

In FY2020, MIC conducted Development Demonstrations for Realizing Local 5G Services to Solve Local Issues. In the following year, dropping the “local” in “local issues,” it continued the initiative as Development Demonstrations for Realizing

Local 5G Services to Solve Issues to promote the utilization of Local 5G as a social implementation aimed at solving “issues” in various companies and municipalities. Local 5G is anticipated to be used in many areas of society, including in primary industries, medical care, disaster prevention, sports, and local communities. However, as mentioned in the preceding section, Local 5G systems are still admittedly expensive and technically difficult to deploy. Meanwhile, along with a growing understanding of its features and benefits in comparison with Wi-Fi and other wireless technologies, corporate use cases for relatively general IT applications, such as use in offices and business activities, must be expanded also for general businesses. We have received much feedback that there is a need for a system that is easy to deploy and widely affordable in order to expand use cases and make Local 5G a viable option for those companies. It has become clear that there is a need for transformation, including the characteristics of the equipment used and the cost aspects, to make a breakthrough in achieving changes in use cases and for the uptake of Local 5G in a wide range of new applications.

5. Development of base stations to make the benefits of Local 5G more accessible

In response to these changes in usage scenes and market needs, from around the second half of FY2019, NEC has concluded that it is crucial to plan and develop a widely affordable Local 5G system that meets market needs, starting with the

concept creation, in order to enable many users to enjoy the benefits of Local 5G in anticipation of its uptake. To fully leverage the strengths of wireless technology, NEC carried out studies by tapping members who have technical expertise in the development of equipment designed for telecommunications carriers, as well as engineers who have experience and knowledge on networks of user companies and municipalities.

Discussions were held on a wide range of topics, including the identification of the functions necessary to construct closed private networks from the vast functions of 5G standard technologies and the proposal of the optimal system size and architecture. In addition, communication performance, quality, size, ease of installation, cost, environmental performance, maintenance and operation, and the selection of detailed components were also tackled. These comprehensive studies resulted in the development of the NEC UNIVERGE RV1000 series (Figure 2), which enables the construction of a Local 5G system at an affordable price range. Both RV1200 for the Sub6 band and RV1300 for the millimeter-wave band were commercialized and announced in January 2022 and were widely welcomed by various quarters.

The RV1000 series includes all-in-one compact base stations that house the Local 5G base station radio unit (RU) and control units (CU/DU) in a single enclosure. In addition to reducing unit cost, it reduces the overall system implementation cost, as well as the period and labor needed for construction and installation. Its compact size and light weight also improve flexibility of

■ Figure 2: Widely Affordable Local 5G System: NEC UNIVERGE RV1000 Series

Announced
in January
2022

Widely Affordable Local 5G System

NEC UNIVERGE RV1000 series

Goals


- Reduce the cost of deploying Local 5G system
- Reduce the labor required for implementation, and simplify the implementation through integration of functions

Targets

- Customers who want to deploy Local 5G by starting small
- Customers who want to take advantage of 5G benefits even for small and medium-scale deployments
- Customers who want to expand their systems incrementally

(*) UNIVERGE RV1200 is the first integrated Sub6 base station in Japan that supports 4.6 to 4.9 GHz (according to NEC research).

Provision of equipment with integrated base station functions for both Sub6 and millimeter wave bands



Sub6 Integrated Base Station UNIVERGE RV1200(*) Millimeter-wave Integrated Base Station UNIVERGE RV1300

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installation in various locations and significantly reduce power consumption. In particular, RV1200, which supports the Sub6 band, is compatible with all standardized frequencies (4.6 GHz to 4.9 GHz). While equipped with all functions as a base station, it is housed in a small case weighing only 3 kg and downsized to A4 paper-size. Its IP66-compliant high dustproof and waterproof performance enables installation both indoors and outdoors. In addition, it can cater to users who want to start small. After verifying the possibility of Local 5G use with a single base station, users can then scale out seamlessly to a large-scale system with more than 100 units simply by adding base stations. These features make it possible to take advantage of the high-quality communication properties of Local 5G in a wide range of environments while enabling installation with similar ease as Wi-Fi access points. Thus, the RV1000 series models have enabled us to meet the recent market needs while proactively developing and proposing practical use cases that take advantage of the benefits of Local 5G going forward.

6. Expectations for the spread of Local 5G

Modern society is facing various social issues such as the declining birthrate and aging population, environmental issues,

and the COVID-19 pandemic that started three years ago in 2020. In particular, COVID-19 has brought about the need for remote communication and contactless business activities, which highlighted the delay in the use of digital technology in Japan. Therefore, accelerating DX is imperative, and there is high anticipation for the spread of Local 5G as the infrastructure for DX. Japan has established a Digital Agency. Further, under the “Digital Garden City” Initiative launched in 2021, the Japanese government has listed “early deployment of 5G” as an important goal for digital infrastructure development. As a digital infrastructure to realize a sustainable society and solve local issues, the implementation of Local 5G is a top priority as one of the most important issues the government is aiming to address.

At NEC, we believe that it is of considerable significance to be able to respond to these social issues. We will thus aim to implement a variety of use cases by providing a Local 5G system under a new concept at the right timing in response to the need for establishing the relevant social infrastructure in the future. As a social value innovator, our goal is to contribute to the utilization of DX in all sectors to create a prosperous society by continuing our activities in collaboration with relevant stakeholders.

Cover Art



Yuigahama, from Famous Views of Tokaido Road

Ikkaisai Yoshitoshi (1839-1892)

Source: National Diet Library,
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