# The Application of LTE Technology in Vehicle-ground Communication of Urban Railway System

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**Abstract:** At present, urban railway system has developed rapidly meanwhile train safety has become one of the most important issues. The vehicle-ground communication system is evidently one of the important systems to ensure the safety and stability of urban railway system. However, the current mainstream WLAN technology is difficult to meet the technical requirements for vehicle-ground communication of current urban railway system due to the influence of bandwidth, speed, external environment and other factors, so it is necessary to explore a new technology to better meet the vehicle-ground communication system. Therefore, this paper analyzes the advantages of LTE technology and its application in urban railway system by comparing LTE technology with WLAN technology.

## 1. Introduction

With the development of urbanization, urban railway system, as an important transportation hub, has a very important significance for the construction of urbanization. In the management process of urban railway system, safety management is the most important. The current society is an information society. For urban railway system, vehicle-ground wireless communication system is the key to ensure the normal operation of vehicles. However, the safety management of urban railway system needs to face many difficulties [1] due to the influence of complex lines. In order to ensure the safety of urban railway system and provide better service for passengers, the urban railway transport system must constantly improve the current vehicle-ground communication system.

## 2. Analysis of advantages of LTE technology

At present, WLAN technology is adopted in most urban railway transport system to support the work of various communication systems. WLAN technology has great advantages in the transport efficiency, security, automation degree, so it has become one of the more widely used technologies. However, its shortcomings are gradually exposed with the development of modern communication technology. The biggest disadvantage is that its working frequency will overlap with the civil WIFI devices to some extent, and there will be some interference between them, which brings hidden dangers to the sTable operation of urban railway system. In addition, with the development of urban railway system, WLAN technology, which does not support high-speed movement originally, is prone to emergency braking facing gradual acceleration of urban railway system.

In order to effectively solve the above problems, domestic scholars and urban rail transit departments have been committed to the research and development of more advanced urban rail transit communication system, hoping to establish a set of wireless transmission technology with stronger anti-interference ability, less influence from high-speed movement, and more sTable and reliable performance. In such a context, LTE technology has gradually attracted the attention of rail transit departments. LET technology, mainly supported by 3GP technology, which has great advantages in anti-interference ability, interval coverage and maintenance, is the most suiTable communication system for the operation of urban railway system at present. At the beginning of design, LTE technology was expected to provide higher bandwidth for the vehicle-ground communication system of urban rail transit. With the support of MIMO and HARQ technologies,

LTE technology greatly improves the transmission rate and anti-interference ability, which are as follows:

### 2.1 lighter anti-interference ability

The traditional WLAN technology selected the frequency band of 2.4g / 5.8g, which leads to the coincidence with the civil WiFi frequency band. In the process of operation, LTE network technology uses dedicated frequency band, avoiding the problem of overlapping with civil frequency band [2], thus greatly improving the anti-interference ability of the whole system. In the face of the system internal interference, the system can give full play to the scheduling function by applying IRC, ICIC technology, greatly improve the cell throughput rate, and greatly avoid the edge interference.

### 2.2 Better mobile connectivity

Urban railway system has high mobility, and its internal communication system must be able to run stably in high-speed movement. The original WLAN communication technology, at the initial stage of research and development, only supports relatively fixed working environments such as office places and shopping malls. Relevant protocol standards also determine that WLAN technology can only support relatively low-speed mobile working environment. This means that WLAN technology has a big problem in urban railway system, while LTE technology is locally anti-frequency offset algorithm in algorithm, so it is more suiTable for high-speed mobile environment [3].

### 2.3 More extensive coverage

By using a specific band and more advanced technology in signal processing, LTE devices can greatly improve the transmitting power when working. This means that LTE-based communications technologies can achieve a greater range of network coverage. In addition, since the vehicle-ground wireless communication system can be designed based on LTE technology, signals can be transmitted through leakage cables. This means that the number of signal devices around the track will be greatly reduced. The coverage of traditional WLAN technology is only 200m, while the coverage of RRU based on LTE technology can reach 1KM, which is more convenient for the later maintenance of equipment [4].

### 2.4 More matching with the actual demand of rail transit

In rail transit, safety is the primary prerequisite for all kinds of system applications. In the process of operation, vehicle-ground communication system must match the development speed of urban railway system. WLAN technology is excellent in security and data transmission, but it is no longer suiTable for vehicle-ground communication system because it does not match the development speed of urban railway system in China. While LTE technology itself has a strong redevelopment ability, which can greatly match the development speed of urban railway system. Therefore, in terms of technology matching, it is more advantageous for WLAN technology and other technologies.

## 3. Application of LTE technology in the vehicle-ground communication of urban railway system

To sum up, LTE technology has the advantages of large bandwidth, low delay and high performance, so it can be fully applied in many aspects in the current vehicle-ground communication, thus helping the better operation of urban railway system.

### 3.1 Application of tunnel coverage

In the vehicle-ground communication system of urban rail transit, due to the interference of the internal environment of the tunnel, the setting of BBU and RRU is required to achieve the wireless signal coverage inside the tunnel. Usually, BBU will be set in the communication equipment of the

station, while RRU will be mainly set in the tunnel wall. The application of LTE technology can fully transmit wireless signals to RRU, thus effectively completing the signal coverage function inside the tunnel. In addition, LTE technology can be widely used in viaduct, signal coverage on the ground as well as in parking garage [5].

### 3.2 Application in wireless link computing

As mentioned above, LTE vehicle-ground wireless communication system has a proprietary communication channel. At present, the dual network structure is mainly adopted, that is, 5MHz+15MHz communication structure. Wireless link computing can effectively plan the RRU layout scheme, and then complete the control of coverage requirements, which is the main method for effective computing equipment. Since LTE technology has a relatively flexible spectrum, it is able to allocate the spectrum according to the actual situation of urban rail system and take it as the condition for specific equipment deployment. In vehicle-ground wireless communication technology, the use of RRU equipment determines the stability of the whole system and the cost of the project. Since a single RRU can cover the area signal stably, if multiple RRU devices are adopted, the signal will be lost. Therefore, wireless link computing using LTE technology plays an important role in signal stability of tunnels.

### 3.3 Application in QoS assurance

LTE technology can allocate the priority level of QoS through analyzing the importance of different services, mainly through the processing of different data from different content sources, so as to complete the mapping and carrying of different services. Through the use of LTE technology, CTBC, PIS, CCTV and other businesses can be registered and allocated, thus greatly reducing the service delay rate and packet loss rate. At present, with the development of urban rail transit services, the vehicle-ground wireless services must be able to cope with different business needs, which requires the classification of different services. The application of LTE technology provides sufficient technical support for QoS. After the priority level is classified, the service quality can be further improved to provide the different data required by different businesses, so as to reduce the delay and ensure the sTable operation of various businesses.

## 4. Conclusion

Through the analysis in this paper, it can be found that compared with WLAN technology, LTE technology has great advantages in guaranteeing anti-interference ability, stability, maintenance efficiency, service quality and other aspects, and its application in the vehicle-ground communication system of urban rail transit will be more extensive in the future. At present, the vehicle-ground communication technology based on LTE technology has been able to meet the requirements of CBTC, CCTV and other information systems. Through the analysis in this paper, it is found that LTE technology has made remarkable achievements in the application of tunnel coverage, wireless link computing and QoS guarantee. It can be predicted that LET will be more widely used in urban rail transit communication system in the near future.

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