# On the Convergence of 5G Communication Technology and Broadcasting Technology (Postprint)

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## Abstract

In recent years, communication technologies in China have undergone continuous optimization and innovation; the 4G era has passed, and the new 5G era has arrived. The advent of the 5G era has established 5G communication technology as the mainstream technology in the communications field, with increasingly extensive applications. Beyond basic mobile communication services, it has also been applied to the radio and television broadcasting industry. The broadcasting industry constitutes a key national industry that not only provides valuable information to the public but also safeguards the stable development of society. Based on this, this paper elaborates on the application advantages of 5G communication technology and explores integration and development strategies for 5G communication technology and broadcasting technology, aiming to provide valuable insights.

## Full Text

### Exploring the Integrated Development of 5G Communication Technology and Broadcasting Television Technology

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**Abstract:** In recent years, China' s communication technology has continuously optimized and innovated. The 4G era has passed, and the new 5G era has arrived. The advent of 5G has established 5G communication technology as the mainstream technology in the communications field with increasingly widespread applications. Beyond basic mobile communication services, it has also been applied to the broadcasting and television industry. The broadcasting and television industry represents a major national industry that not only provides useful information to the public but also maintains social stability and development. Based on this context, this paper elaborates on the application

advantages of 5G communication technology and explores integration strategies for 5G communication technology and broadcasting television technology, aiming to provide valuable insights.

**Keywords:** 5G communication technology; broadcasting television technology; live streaming technology; interference handling; broadcasting technology

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In the 5G era, people enjoy greater convenience in acquiring information and benefit from faster search speeds, and their lifestyles have undergone certain changes. The widespread adoption of smartphones has eliminated communication restrictions, transforming both the channels and the speed of information dissemination. The rise of new media has posed development threats to traditional broadcasting media. If broadcasting media fails to innovate technologically, it will struggle to remain competitive in terms of program transmission speed. The integration of 5G communication technology and broadcasting television technology demonstrates advantages of efficiency, speed, and flexibility, driving the development of China' s broadcasting industry. Furthermore, the development of broadcasting television technology is inherently intertwined with communication technology. Only through deeply integrating 5G communication technology and broadcasting television technology can audiences enjoy better experiences and enhance the influence of broadcasting programs.

## 1. Introduction to 5G Communication Technology

5G is the abbreviation for the fifth-generation mobile communication network. 5G communication technology offers extremely fast transmission speeds, with peak rates reaching over 10 Gbps. For example, when downloading 4K ultra-high-definition videos, 4G networks require several minutes, while 5G networks complete the download in just seconds. This is because 5G networks utilize high-frequency bands. With the arrival of the digital age, all types of information have seen explosive growth. Higher data volumes demand higher frequency bands. Currently, China' s three major communication operators have been allocated mid-to-low frequency bands for 5G: China Telecom obtained the 3400-3500 MHz band, China Unicom obtained the 3500-3600 MHz band, and China Mobile obtained the 2515-2575 MHz band. Additionally, China' s broadcasting industry has obtained a 5G commercial license, with the 700 MHz band, known as the "golden frequency band," allocated for broadcasting industry use [1].

## 2. Current Development Status of 5G Communication Technology

5G communication technology represents the mainstream of the current communication industry. Both its practical applications and subsequent research and development bring opportunities and challenges to various industries. To date, China Mobile, China Unicom, and China Telecom operators have all introduced 5G packages. However, for 5G communication technology to be effectively applied, base station construction is essential. Research indicates that 5G base station construction will continue to expand, expected to reach saturation around 2023, after which construction scale will decrease.

## 3. Advantages of 5G Communication Technology

The application of higher frequency resources in 5G communication technology offers several advantages.

First, 5G networks employ network slicing technology. If we compare slicing technology to a traffic lane, it not only extends the lane but also allows more vehicles to pass simultaneously. Moreover, it can divide wide lanes into multiple slices based on attributes, enabling users with different needs to choose their path. This significantly improves transmission rates, prevents signal interference caused by excessive access devices, substantially enhances channel utilization, and achieves rapid transmission.

Second, 5G communication technology operates at higher frequency bands. Generally, the higher the frequency, the shorter the wavelength, which increases radio wave loss. According to China' s existing 5G spectrum resources, the signals operate at millimeter wave wavelengths. Consequently, 5G base station construction mostly adopts a multi-layout, micro-base station approach [2].

Third, 5G communication technology incorporates the concept of beamforming, which changes the previous pattern of radio waves emitting in all directions to fixed directional transmission. The direction of radio waves can also be adjusted according to the user' s actual location, thereby enhancing network communication security and quality.

Fourth, 5G communication technology involves D2D (Device-to-Device) technology, which means that during communication between two users, signals are transmitted directly, unlike the limitations in 3G and 4G technologies. This significantly improves communication efficiency and prevents transmission delays.

## 4. Advantages of Integrating 5G Communication Technology and Broadcasting Television Technology

### 4.1 Strong Anti-Interference Capability

In the new era, 5G communication technology has been applied across various industries. The scale of data and signals generated on the Internet every day is enormous, with various frequency bands of electromagnetic waves present in the air. Since electromagnetic waves encounter many limitations during propagation that affect their transmission range and can weaken signals, applying 5G communication technology to the broadcasting industry can prevent signal interference. This significantly improves broadcasting television technology, enabling audiences to receive and watch high-quality programs on their devices without signal stuttering.

### 4.2 High Integration of Technology and Equipment

With the continuous development of digital communication, the focus has shifted to 5G communication technology. The application of 5G communication technology not only enables simultaneous transmission of audio and video data but also significantly improves overall data transmission speed, meeting the needs of the current broadcasting industry' s development. Moreover, 5G communication technology itself includes data encryption capabilities, which not only effectively protects various types of data but also prevents data signals from being intercepted. Simultaneously, 5G communication technology supports voice compression and multiple code division addressing functions, enabling precise broadcasting signal transmission and higher integration [3].

### 4.3 Meeting Personalized User Needs

When Internet media first emerged, broadcasting television was already facing certain development threats. Internet media has captured a share of the highly competitive media market, with its rapid development primarily attributable to its ability to provide personalized services. Meanwhile, the broadcasting industry' s development limitations stem from its service functions, such as failing to provide personalized services based on users' actual needs. The integration of 5G communication technology and broadcasting television technology can provide users with client platforms, allowing them to independently select desired content according to their viewing and listening needs, thereby offering personalized services. For example, users can independently choose client interface pages based on their aesthetic preferences and interests. Furthermore, the broadcasting industry' s application of 5G communication technology enables the development of clients with personalized customization functions, pushing program types that match users' interests and providing audiences with excellent experiences [4].

### 4.4 Meeting Diversified Industry Development Needs

Currently, China' s digital television standards generally employ China' s proprietary encoding formats, with platform setup for digital television using 5G communication technology supported by various network technologies. Driven by 5G communication technology, the broadcasting industry has completed technological and equipment innovation and optimization, bringing ultra-high-definition video into public view and laying a good foundation for subsequent development. For example, during the application of broadcasting two-way communication technology, the integration of hierarchical multiplexing technology can widen the upstream communication channel and improve overall signal transmission quality, providing convenient conditions for the integrated development of broadcasting technology and 5G communication technology.

## 5. Integrated Development of 5G Communication Technology and Broadcasting Television Technology

### 5.1 Integration of 5G + 4K Ultra-High-Definition Television Technology

The broadcasting television industry relies on communication technology, requiring communication technology support during program transmission [5]. Currently, China's broadcasting television and video live streaming applications typically use a resolution of 1920$\times$1080, $commonly known as Full HD. With the rapid development of China's comm$ This ultra-high-definition mode provides audiences with excellent viewing experiences. Broadcasting television technology under 4G networks cannot support these capabilities, and ultra-high-definition modes have not been widely applied.

From the development of some Chinese video platforms, such as iQiyi and Tencent Video, video playback uses 1080P resolution, while some e-sports live streams provide 2K mode for the public. Overall, the gradual popularization of 5G communication technology will increase network bandwidth transmission speed, with rates up to 10 Gbps, laying a good foundation for 4K application and providing broader space for 4K ultra-high-definition video development. Additionally, 5G communication technology' s strong support for various industries has transformed broadcasting engineering equipment and technology, making image data clearer and ensuring smooth signal transmission, serving as a benchmark for integrated development [6]. Through the integration of 5G communication technology and broadcasting television technology, 4K video playback features clear images without screen tearing or stuttering. Moreover, 5G communication technology' s support for the broadcasting industry will optimize equipment, ultimately providing audiences with visual feasts.

### 5.2 5G Visual Live Streaming Technology

Currently, China Mobile, China Unicom, China Telecom, and the broadcasting industry have all embarked on 5G network construction. By 2020, 5G communication technology had achieved significant progress with numerous research results, and many cities have completed 5G network coverage. With this technology' s support, Internet information acquisition speeds have increased, and its application has become the dominant development trend with promising prospects [7]. Furthermore, the integrated development of 5G communication technology and broadcasting technology will enable stable development of the video production industry, driving industrial development through various live streams and making live streaming technology mainstream. In this fast-paced era, people' s pressures are increasing, and they hope to relieve stress by watching videos. Against this background, broadcasting television should transform its original development concepts and provide audiences with 5G visual live streaming content according to their actual needs. For example, during music festival live broadcasts, 5G visual live streaming technology can be applied with multiple 5G-enabled cameras simultaneously to ensure more stable signal transmission and guarantee live streaming quality.

### 5.3 Interference Handling Between 5G Spectrum and Broadcasting C-Band

The continuous development and application of 5G communication technology do not always yield good results. Currently, the 5G spectrum used by various Chinese communication operators is similar to the C-band used by the broadcasting industry. During integration, interference from various factors occurs, primarily manifested as unstable broadcasting program signals or video screen tearing [8]. Additionally, since China' s 5G terminal construction scale is not yet large, such interference is not severe. However, as 5G communication technology becomes more popular, terminal construction scale will expand, and technical integration will suffer more interference. The main solution to this situation is installing filters on broadcasting satellite receivers. Through comparative analysis, equipment systems with filters have certain anti-interference capabilities and can improve signal stability to some extent. With the future rapid development of broadcasting technology and 5G technology, if filters still cannot solve the interference problem, adding shielding nets should be considered, with parameters adjusted according to base stations' actual operating conditions to make broadcasting television signal transmission and reception more stable.

### 5.4 5G Intelligent Mobile Broadcasting Technology

Nowadays, various media industries are seeking technological innovation and breakthroughs to enhance competitiveness and adapt to the pace of development. In the integration of 5G communication technology and broadcasting television technology, the addition of intelligent mobile broadcasting has become an inevitable trend. 5G technology enables stable development of intelli-

gent technology, can carry more sensors, and offers powerful capabilities [9]. For the intelligent mobile broadcasting field, the utilization of 5G technology can create a media editing system, making information acquisition more convenient for broadcasting industry news editors and allowing them to process information on smartphones. Smartphones equipped with 5G communication technology make background system functions more powerful, enabling rapid manuscript production and providing convenient conditions for subsequent media editing work. Finally, after broadcasting industry staff complete resource integration, they can leverage system advantages to expand news resources and significantly improve overall work efficiency. The realization of news resource sharing also enriches broadcasting television program presentation forms. Broadcasting television program relay technology must also be innovated, applying 5G communication technology to guarantee relay program quality. When applied to actual programs, audio-visual signals should first be transmitted to cable network rooms, where they undergo frequency conversion and decoding technologies to restore the original digital signals. Although signal transmission distances are relatively large, the application of 5G communication technology ensures stable audio-visual content signals and enhances overall relay efficiency [10]. The integrated development of 5G communication technology and broadcasting television technology has also fostered the development of micro-films, web dramas, cinema chains, and smart home industries, achieving business expansion and innovation.

In conclusion, as the leader of traditional media, broadcasting television must keep pace with technological development and complete technological innovation according to its specific conditions to secure a position in the highly competitive market. Moreover, broadcasting television technology is closely linked to the communication field. Only by applying the latest communication technology to actual broadcasting work can broadcasting program quality be improved. Additionally, utilizing the integration of "5G + 4K" ultra-high-definition television technology can provide broadcasting audiences with more realistic viewing and listening experiences. Broadcasting television can adopt 5G visual live streaming technology according to users' actual needs, allowing everyone to watch high-quality live programs and fully demonstrating the value of 5G communication technology.

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*Note: Figure translations are in progress. See original paper for figures.*