Discussion on 5G-Based Radio and Television Transmission Technology Postprint

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Abstract

To clarify the future development direction of broadcast television transmission technology, this study proposes an investigation into 5G-based broadcast television transmission technology. Initially, 5G technology is analyzed, upon which basis the transformations it brings to broadcast television transmission technology are examined, and the development requirements for broadcast television transmission technology within the 5G era context are analyzed. Based on the analytical results, a development strategy centered on multi-technology integration, 5G network construction, and rational resource allocation is proposed, along with corresponding development pathways. Through this research, it aims to provide references for the future development of broadcast television transmission technology.

Full Text

A Discussion on 5G-Based Radio and Television Transmission Technology

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Abstract: To clarify the future development direction of radio and television transmission technology, this paper presents a discussion on 5G-based radio and television transmission technology. First, 5G technology is analyzed, and based on this analysis, the changes it brings to radio and television transmission technology are examined, along with an analysis of the development requirements for radio and television transmission technology in the 5G era. According to the analysis results, development strategies focusing on multi-technology integration, 5G network construction, and rational resource allocation are proposed, with corresponding development paths outlined. Through this research, we aim

to provide a reference for the future development of radio and television transmission technology.

Keywords: Radio and television transmission technology; 5G technology; Content optimization; Business expansion; Resource allocation

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1. Analysis of 5G Technology

The emergence of radio technology and corresponding transmitting and receiving equipment in 1895 gradually gained widespread practical application through continuous optimization [1]. This environment sparked tremendous enthusiasm worldwide for the production and construction of radio stations and receivers, marking the rise of the broadcasting industry. In the subsequent period, the use of shortwave frequencies significantly increased the power of transmitting equipment, substantially extending the transmission distance of radio waves to enable transnational broadcasting and diversifying the content and forms of wireless broadcasting [2]. In recent years, computer technology has developed rapidly, network communication methods have been continuously optimized and innovated, and the world has entered the 5G era [3]. While 5G brings enormous opportunities, it also presents new challenges for radio and television transmission technology. In this context, actively exploring the development of radio and television technology is both a result of the times' advancement and a necessary path for the development of radio and television technology itself [4].

Numerous scholars have conducted research on the development of radio and television transmission technology. Among them, Li Limin proposed research on the transformation and upgrading of radio and television transmission technology in the 5G era [5]. Against the backdrop of 5G, taking radio and television transmission technology as the research object, he analyzed the characteristics of 5G network technology, examined the features of radio and television transmission technology, studied its application in different fields in the 5G era, and proposed development trends for radio and television transmission technology based on 5G to provide development ideas for its transformation and upgrading. Additionally, Chen Xiaojin analyzed the impact and role of satellite communication on radio and television transmission and broadcasting [6]. As an important communication method in radio and television transmission and broadcasting, satellite communication plays a significant role in the development of radio and television transmission. The author provided a detailed introduction to satellite communication methods, compared them with traditional transmission meth-

ods, analyzed their advantages and disadvantages, and proposed corresponding development recommendations.

In this environment, this paper proposes a discussion on 5G-based radio and television transmission technology. Based on an analysis of the basic characteristics of 5G technology, it examines the progress achieved in radio and television technology, analyzes the new requirements that 5G imposes on radio and television transmission technology, and proposes future development strategies and paths for 5G-based radio and television transmission technology. Through this research, we aim to provide valuable references for the development planning of television transmission technology.

As the fifth-generation mobile network communication technology, 5G can achieve data transmission speeds of up to 10 Gb/s. At present, the formulation of 5G technology-related indicators and its practical application have gained recognition in most countries [7]. Simultaneously, with the development of 5G technology, the Internet economy has also experienced rapid growth, effectively solving wireless communication problems in other industries. Consequently, 5G technology has gradually become an important support for the further development of wireless communication technology [8]. The advancement and superiority of 5G technology are mainly manifested in two aspects: wireless air interface technology and networking technology [9]. Relying on existing high-tech technologies, 5G technology has effectively increased air interface traffic, reduced link operation overhead, and optimized communication transmission. Currently, this technology has been applied in numerous fields, including high-frequency band information communication and new multi-carrier data transmission. Compared with wireless air interface technology, the development direction of networking technology tends more toward reducing transmission delay, improving intelligence levels, strengthening digital applications, increasing coverage, and enhancing operational robustness. Among these, the Option3 non-standalone networking series, as a primary representative, is widely applied in the field of secondary station diversion, enabling data to enter the diversion phase from the GNR side and providing reliable guarantees for stable data transmission. Meanwhile, the Option2 standalone networking series and Option4 standalone networking series are continuously being optimized, their theoretical systems are becoming increasingly mature, and relying on the LTE side, they can provide secure and reliable carrier flow for the signaling plane in NAS networking [10].

2. New Developments in 5G-Based Radio and Television Transmission Technology

2.1 Optimizing Radio and Television Content Transmission Paths

As discussed in the overview of 5G technology above, compared with 4G network communication speeds, 5G network communication speed has achieved substantial improvement, with theoretical transmission speeds reaching 10 Gb/s. Therefore, with 5G technology support, ultra-high-definition video materials can be downloaded within a short time. In radio and television information data transmission, given that 5G network communication possesses extremely high transmission speeds, its optimization calculations for actual paths are also smoother, providing guarantees for the safe and reliable transmission of radio and television signals. Meanwhile, supported by 5G technology, real-time recording and broadcasting of radio and television programs have been realized, effectively solving signal compression problems in traditional radio and television transmission modes and preventing damage to original materials of radio and television transmission content during real-time backhaul.

2.2 Expanding Radio and Television Business Experience

In traditional 4G network communication, data transmission delay typically ranges from 15 ms to 25 ms. With the arrival of the 5G era, end-to-end delay has achieved a major breakthrough. Under normal conditions, 5G network communication can complete data transmission within 1 ms, greatly reducing experience quality issues caused by information transmission delay and meeting the requirements for real-time interactive experiences on-site. Leveraging the low transmission delay characteristic of 5G network communication, multimedia interactive application scenarios can be constructed based on user-customized information content combined with immersive integrated media, thereby broadening radio and television business experiences.

2.3 Extending Radio and Television Terminal Platforms

In 5G network technology, connection density has achieved substantial improvement, with a maximum capacity of up to 1,000 connections, achieving the goal of meeting self-connection or mutual connection needs between people and objects without time and space limitations—so-called "Internet of Everything." In traditional radio and television transmission modes, limited by the number of output ports, receiving terminals for transmission content were typically limited to radios, televisions, and mobile phones. However, with 5G technology support, the expansion of information transmission scope based on the Internet of Things has been realized, and data information receiving and input ends are no longer restricted. Intelligent devices can be developed for media purposes, and in this model of widespread media and platforms, the development platform for radio and television is no longer confined to traditional scopes. Radio and television programs are gradually becoming novel, and content collection and

data transmission are diversifying.

3. Development Requirements for Television Transmission Technology in the 5G Environment

3.1 Triple Network Convergence Trend

The implementation of the DTMB standard signifies that China' s digital television technology is already in an advanced position worldwide. At present, the DTMB standard has been deployed on a large scale, marking the maturity of digital television technology. However, it is worth noting that mobile digital television technology and wireless network digital transmission technology remain relatively backward. As they are still in the initial development stage, certain difficulties remain in their application. In this environment, the development trend requirement that 5G imposes on television transmission technology is the integration of wireless networks, mobile networks, and the Internet to ultimately solve the problems of digital television transmission technology.

3.2 Application of High-Order Modulation Technology

Low spectrum utilization efficiency is a common problem in the traditional radio and television industry. High-order modulation technology can effectively solve this problem and improve spectrum utilization efficiency. However, this technology has the disadvantage of small coverage range in its application process. When coverage range is increased, interference also increases, which has a significant negative impact on the reception of radio and television programs. Therefore, research efforts must be intensified to develop radio frequency devices with better performance, promote the further development of high-order modulation technology, improve spectrum utilization rates, ensure coverage, and create favorable conditions for the development of radio and television transmission technology.

3.3 Meeting 3D Visual Effect Requirements

In today' s rapidly developing technological environment, people' s demands continue to increase, and their visual experience requirements have become more stringent. In this context, 3D movies have emerged. Although 3D technology has made certain progress, shortcomings remain, and naked-eye 3D technology is still imperfect. Watching 3D videos with glasses satisfies people' s visual needs but poses certain risks to eye health. To effectively solve this problem, radio and television transmission technology needs to enhance research on 3D visual effects to achieve true naked-eye 3D.

4. Development Strategies for 5G-Based Radio and Television Technology

4.1 Integrating Terrestrial Digital Television with 5G

In the field of terrestrial radio and television transmission, it is essential to actively promote the integration of radio and television transmission technology with 5G to achieve transformation and upgrading. We should advance the integration model of "terrestrial digital television broadcasting + 5G communication" and "large radio and television towers + small 5G base station towers." Terrestrial digital television broadcasting primarily serves traditional large screens, enabling high-quality live content transmission, while 5G mainly serves intelligent small screens, using mobile terminals as the foundation to achieve the upgrading of radio and television. Additionally, beyond television live broadcasting, various forms of content can be introduced, including video and audio on-demand, self-produced content uploading, and social media content.

4.2 Planning the Development of Radio and Television 5G Networks

The advantage of radio and television is its possession of the 700 MHz frequency band. Therefore, when constructing 5G for radio and television transmission technology, it integrates frequency, technology, and industry advantages. Combined with its experience in content resources and cultural creativity, this offers certain advantages in reducing networking costs, expanding coverage, and increasing service content. At present, the main challenges are insufficient customers, experience, and hardware infrastructure, requiring substantial capital and resource investment. Therefore, in the 5G construction of radio and television technology, cooperation with multiple parties is necessary to achieve balanced development across the industry and create favorable conditions for improving public radio and television services.

4.3 Rational Allocation of Resources for 5G TV Broadcasting Networks

At the end of 2019, China proposed a new plan for terrestrial digital television broadcasting frequencies, and radio and television frequencies face a new round of reform. Existing terrestrial digital television will undergo large-scale transformation, and transmission hardware systems will also be upgraded accordingly. Under the premise of smooth frequency and network resource integration, building a 5G TV broadcasting network for radio and television transmission will still require a long development process. However, once the 5G TV broadcasting network is established, it will bring enormous economic value to radio and television operators while also promoting business integration and development. Therefore, at this stage, it is essential to actively promote cooperation between radio and television and third-party operators to achieve flexible resource allocation and complementary advantages, providing a foundation for the extensive coverage and application of 5G TV broadcasting networks across all general

frequency bands.

5. Development Path for 5G-Based Radio and Television Transmission Technology

5.1 Building an Ecosystem Through 5G

In the development process of radio and television transmission technology, an important role of 5G technology is to build a platform that provides a good carrier for high-quality content and constructs a sound transmission ecosystem. In the 5G era, the operation of video websites and self-media platforms is based on the principle of content as the core and platform as the foundation. Therefore, we should use professional platforms as the basis, leverage the advantages of 5G network communication to aggregate high-quality content to attract audiences, and combine AR technology' s "seamless" integration function of real-world information and computer network virtual information to overlay real and virtual environments and arrange images and spaces in parallel, enhancing viewers' sensory impact and providing deeper immersion. Meanwhile, based on traditional radio and television transmission modes, we should upgrade cable television, satellite, and terrestrial wireless radio and television transmission and reception modes, integrate 5G technology, gradually expand into related fields, not be limited to existing production and broadcasting fields, gradually develop toward 4K resolution, actively promote research in data collection, imaging, display, and transmission technologies, and build an ecosystem for radio and television business.

5.2 Accessing New Platforms for Radio and Television Through 5G

In the integration process of radio and television transmission technology and 5G technology, the continuous deepening of IoT practical applications is an important way to demonstrate integration results. In line with China' s urban construction strategy, radio and television programs should gradually extend to the 5G Internet, using the Internet of Things as the foundation to develop smart home appliances and smart home construction. In this process, mMTC (massive Machine Type Communications) can be adopted to further strengthen home scenarios. Based on low-power wide-area IoT, the integration effect of radio and television transmission technology and mMTC can be improved, the intelligence level of home services can be enhanced, and comprehensive smart home development can be achieved. Meanwhile, as an important scenario for expanding 5G technology applications, the vehicle networking system also has broad development prospects. Radio and television transmission technology can be introduced into vehicle networking and organically combined with it to provide a foundation for adding functions to future driverless cars.

5.3 Application of Artificial Intelligence in Radio and Television

As the most powerful competitive core in the radio and television market, radio and television transmission technology has natural advantages in security, reliability, and political nature. Therefore, in the process of advancing radio and television technology to mobile terminals, the security and political nature of mobile terminals must be verified. Traditional radio and television transmission technology mainly achieves multi-screen interaction and on-demand viewing functions through trigger mode activation. However, with the accelerated pace of social life, this can no longer meet people' s needs. Therefore, artificial intelligence technology must be organically integrated with radio and television transmission technology, using edge computing technology to connect the network to the cloud, complete matching of edge requirements, and achieve convenient use of AI front-end algorithms. With the help of artificial intelligence technology, users' viewing habits can be collected and organized, and based on data collection, analysis, and processing results, precise resource push can be realized.

The rapid development of 5G technology enables faster, more complete, and more secure data transmission. In this environment, higher requirements are placed on radio and television transmission. Facing the highly information-developed 5G era, radio and television transmission technology faces both opportunities and challenges. How to rationally and effectively utilize 5G technology to optimize and innovate existing radio and television transmission technology and improve transmission effects has become an important issue affecting the future development of radio and television. Through this paper, we hope to provide references for the development of radio and television transmission technology.

References

[1] Yang Jun. Research on Inventory Cost Management in State-owned Radio and Television Transmission and Broadcasting Institutions [J]. China Collective Economy, 2019(2): 45-47.
[2] Lv Wenyi. Research on Radio and Television Technology Development Based on 5G Technology [J]. Satellite TV & IP Multimedia, 2020(5): 44-45.
[3] Zhou Qiang, Zhu Liyue, Tang Xinkun, Yang Baoyi, et al. Research on a "Frequency Division Multiplexing-IF" Technology for Deep 5G Signal Coverage Based on Cable TV Coaxial Networks [J]. Radio & TV Broadcast Engineering, 2020(4): 20-23.
[4] Zhao Weitao. Terrestrial Digital Television Transmission Technology in Radio and Television Technology Development [J]. China Media Technology, 2019(12): 120-122.
[5] Li Limin. Research on Transformation and Upgrading of Radio and Television Transmission Technology in the 5G Era [J]. Communications World,

2020(1): 54-55.
[6] Chen Xiaojin. Analysis of the Impact and Role of Satellite Communication on Radio and Television Transmission and Broadcasting [J]. Radio & TV Information, 2020(11): 79-80.
[7] Yang Dehai. Discussion on the Construction of Radio and Television Transmission Coverage Technology System [J]. Video Engineering, 2020(1): 56-57.
[8] Wang Hao. Analysis of Terrestrial Digital Television Transmission Technology in Radio and Television Technology Development [J]. Satellite TV & IP Multimedia, 2020(10): 14-16.
[9] Lu Guangbin. Discussion on How to Ensure the Accuracy and Stability of Signals in Radio and Television Transmission [J]. West China Broadcasting TV, 2020(7): 228-229.
[10] Tian Shijun. Building a Self-healing Radio and Television Transmission Network Using Digital Microwave and Fiber Optic Technology [J]. Digital Media Research, 2019(10): 65-67.

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