

Analysis of Key Technical Issues in Radio and Television Wireless Transmission in the Digital Age: Post-print

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Abstract

Broadcast television wireless transmission technology is characterized by fundamental features including digitization, real-time performance, and accuracy. Contemporary broadcast television wireless transmission and reception systems must be built upon the foundation of digital methodologies. The digital era has transformed and innovated the conventional data signal transmission paradigms of broadcast television systems by leveraging digital network technology platforms for signal conversion, thereby ensuring the complete and secure delivery of broadcast television data. Consequently, this paper concentrates on examining the essential technical implementation strategies for broadcast television wireless transmission, with the aim of rationally enhancing the wireless transmission systems for broadcast television data.

Full Text

Preamble

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Title: Analysis of Key Issues in Radio and Television Wireless Transmission Technology in the Digital Era

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Abstract: Wireless transmission technology for radio and television broadcasting is characterized by digitalization, real-time performance, and accuracy. Current radio and television wireless transmission and reception systems must be built upon a foundation of digital means. The digital era has transformed the traditional data signal transmission modes of broadcasting systems, relying on digital network technology platforms to convert broadcasting signals and ensuring the complete and secure delivery of radio and television data. Therefore,

this paper focuses on discussing the key practical approaches for radio and television wireless transmission technology and rationally improving the wireless transmission systems for broadcasting data.

Keywords: digital era; radio and television broadcasting; wireless transmission technology; basic characteristics; system architecture

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1.1 System Reliability

The reliability of radio and television transmission systems fundamentally determines the clarity of broadcasting signals and data. Compared with traditional transmission platforms, wireless transmission technology can better ensure reliable and stable delivery of broadcasting data signals [1]. This is because wireless transmission technology does not rely on physical media for data conversion and transmission, but instead utilizes digital platforms to control the entire signal transmission process. Digital means can prevent interference from natural factors, particularly protecting against severe weather conditions such as lightning, storms, and frost. From this perspective, the integration of digital methods in broadcasting practice enhances system reliability and fully safeguards users' rights to access broadcasting data resources [2].

1.2 Signal Transmission Security

Digital platforms in signal transmission practice enhance data delivery security, enable accurate detection of potential signal distortion risks, and effectively conserve data transmission resources and costs for broadcasting organizations. To ensure stable and secure transmission of television and radio programs, the key practical approach at present involves actively adopting digital means. Network information systems can help broadcasting technicians comprehensively collect transmission data and implement intelligent monitoring of system operation. In recent years, digital telemetry, remote sensing, and remote control technologies have been fully integrated into broadcasting transmission, demonstrating the practical value of digital methods in maintaining data transmission reliability [3].

1.3 Automated Control Characteristics

Automated control must be thoroughly implemented throughout broadcasting transmission operations, employing intelligent monitoring instruments to en-

sure stable data transmission and accurately identify both human-induced and natural interference factors [4]. Automated control technology enables broadcasting personnel to save program backup information in network databases, maintaining safe and efficient data transmission even when unexpected system failures occur. Therefore, wireless transmission systems with automated control characteristics can replace traditional broadcasting data processing models, significantly reducing resource costs in broadcasting transmission.

2. Composition of Digital Broadcasting Wireless Transmission Systems

2.1 Digital Encoding Circuits

Analog and digital signals constitute key transmission elements in wireless transmission systems. Digital encoding circuits accurately convert original broadcasting data signals through automated converter devices. Supported by automated instrumentation, digital encoding circuits can adjust the processing length of broadcasting data, generating more precise and comprehensive audiovisual signal data sources through conversion. Typically, broadcasting audiovisual data must be obtained via wireless transmission conversion to ensure it remains within specified byte lengths. Digital encoding circuits primarily handle the transmission and conversion of real-time broadcasting data streams, with technicians relying on audio encoders to perform these operations and ensure wireless transmission data meets optimal quality standards [5].

2.2 Broadcasting Signal Sources

Wired interfaces, satellite transmission, and wireless signal delivery are all critical media for broadcasting data transmission, with current wireless transmission and data processing methods primarily depending on broadcasting signal sources. Wireless broadcasting signal sources can effectively eliminate transmission interference caused by external factors during information transfer and conversion, safeguarding optimal transmission quality. These signal sources are generally influenced by multiple factors including data coverage range, transmission intensity, and digital encoding circuit performance. Consequently, broadcasting management and technical personnel should implement real-time control and monitoring of signal transmission effects, employing systematic data monitoring techniques to identify signal distortion risks and enhance accuracy throughout the data transmission process [6].

2.3 Digital Transmitters

Digital transmitters occupy a core position in radio and television transmission systems, with fundamental functions of accurately delivering broadcasting data and enabling real-time release of news content. The key to implementing digital audio technology lies in converting original audio signals using processing devices, combining simulation methods to transform audio pulse data into

discrete-format audio processing results. Current digital transmitters feature real-time analog signal conversion systems, effectively ensuring optimal transmission performance of wireless transmission systems. In this process, broadcasting technicians must comprehensively consider key indicators including antenna matching characteristics, antenna effective gain, and transmission energy loss to rationally control and adjust the system transmission frequency of digital transmitters.

Modern network-intelligent processing technologies have permeated broadcasting transmission practice, with corresponding digital audio conversion technologies optimized and improved [7]. Digital audio processing methods constitute core elements of broadcasting technology, and technicians should emphasize signal data conversion methods while actively exploring technological innovation approaches. Digital audio technology essentially involves necessary storage, recording, compression, and editing conversion of original data signals to form highly integrated audio processing results. Broadcasting technicians primarily utilize audio conversion devices, combining pulse signals with specialized data conversion techniques to generate clear audio information adjusted to specific playback formats. Current digital audio technology relies on network processing, signal conversion, and multimedia recording and storage technologies, demonstrating the necessity of audio processing methods in broadcasting practice. Digital audio conversion technology offers standardization, accuracy, and efficiency advantages, effectively preventing distortion in broadcasting data transmission.

3. Key Application Points of Wireless Transmission Technology in the Digital Era

Broadcasting departments must address digital era challenges by employing rational and proactive methods to improve signal transmission quality. Current wireless transmission processing technologies are being comprehensively refined and updated. In practice, broadcasting management and technical personnel should focus on the following improvement strategies for wireless transmission technology.

3.1 Rational Control of System Loss Energy in Transmission Signals

Wireless transmission of television and radio data signals must be fully incorporated into transmission security management, employing more scientific and flexible wireless transmission methods to reduce system loss ratios and strictly control real-time transmission energy loss. In most cases, television and radio signals during transmission cannot completely avoid energy consumption, making flexible reduction of total system loss the fundamental optimization approach. Due to ground resistance effects, dispersed system energy cannot be recollected, requiring broadcasting technicians to closely monitor loss energy ratios. Wireless transmission and emission technologies rely on complete data conversion devices, which broadcasting technicians must ensure meet safety and

reliability indicators to fully support comprehensive broadcasting signal transmission. Technicians should intensify monitoring and control of real-time data conversion processes to promptly identify erroneous television and radio signal transmission links. For example, in recent years broadcasting technicians have been actively optimizing digital encoder systems, employing more sensitive digital encoders to control comprehensive data transmission operations and rationally optimize regulatory control mechanisms for wireless transmission networks [8].

3.2 Expansion of Transmission Range and Distance

Broadcasting departments bear important responsibilities for disseminating current affairs and promoting mainstream values, objectively requiring wireless transmission network architectures to cover broader areas and reasonably extend the coverage distance of television and radio data signals. Only in this way can urban and rural audiences truly enjoy real-time access to news programs, preventing broadcasting effectiveness degradation due to limited wireless transmission coverage. Broadcasting technicians should closely monitor whether system impedance reaches optimal levels; if poor impedance matching is identified, immediate changes to existing wireless transmission modes are required to flexibly adjust system matching impedance. Supported by vertical polarization digital technology, management personnel should focus more on reducing and controlling return loss magnitude. Broadcasting departments should implement comprehensive routine maintenance of wireless transmission devices to ensure stable and secure optimal operation of wireless transmission network systems.

Broadcasting technicians can innovatively apply information-based editing business models throughout the entire process of editing digital signals and audio materials, performing necessary processing on operating system devices that output digital images. Through these technical conversion operations, technicians can strictly ensure optimal picture processing, special effects insertion, and video recording effects while reducing potential security risks of signal distortion. Wireless transmission networks are achieving universal coverage across urban and rural areas, with existing wireless transmission processing technologies being comprehensively improved and updated. When recording various types of image materials, broadcasting technicians should mobilize current digital processing technologies, combining them with information-based simulation conversion measures for processing operations. To ensure delicate and smooth program audio quality, key audio technologies should actively adopt information-based sound quality conversion techniques. During comprehensive program recording operations, broadcasting personnel typically need to edit large volumes of original audio data, a process that consumes considerable resources and necessitates optimized and innovative editing techniques.

3.3 Reduction of System Return Loss Magnitude

Return loss constitutes a significant proportion in broadcasting wireless systems, and technicians should accurately monitor and regulate return loss intensity indicators to effectively reduce the overall ratio. Under current conditions, broadcasting technicians should actively optimize and improve antenna system effective gain to substantially reduce and control vertical lobe loss energy intensity. For wireless transmission networks, technicians must focus on expanding coverage areas and distances to ensure strict control over overall return loss magnitude. For broadcast audio signals, for instance, an important technical approach to reducing audio loss involves converting original information flows and using wireless conversion processing of data streams to differentiate data frames. Through comprehensive implementation of these data frame conversion and processing procedures, technicians can achieve superior applicability and accuracy standards for wireless transmission data suitable for various transmission scenarios.

The fundamental operational points of mixing processing technology involve controlling pulse audio effects to achieve optimal results when processing audio signals of different frequencies. In recent years, broadcasting technicians have been able to accurately identify negative pulse transmission impacts, ensuring filtered audio effects reach the most complete and clear level possible. Mixing processing technology can integrate short-wave television and digital audio methods, and broadcasting technicians should focus on updating wireless processing systems by actively adopting mixing processing techniques.

4. Evolution Trends of Wireless Transmission Technology in the Digital Era

Against the backdrop of comprehensive digital construction of broadcasting wireless transmission networks, broadcasting personnel must accurately understand the overall evolution trends of wireless transmission technology. In recent years, broadcasting departments in many regions have been actively accelerating the construction of “optical cable to mountain stations” systems to improve digital hardware network architectures for wireless transmission. Technical operators should promptly establish digital signal source systems with broader coverage, strictly ensuring transmitted broadcasting signal data meets good clarity indicators to safeguard audience interests [10].

Additionally, the digital era objectively requires broadcasting personnel to actively focus on deploying lightning protection systems, correctly utilizing lightning protection networks to monitor broadcasting signal data transmission processes. When constructing transmission antenna systems, broadcasting departments should add lightning protection ground networks while emphasizing strict protection of signal transmission towers. Critical structural components of grounding resistance should be coated with anti-corrosion protection, primarily using corrosion inhibitors, electrochemical protection methods, and coating

protection measures. Comprehensive maintenance of wireless transmission devices should be implemented to maintain and ensure reliable and secure system performance. During rainy seasons, maintenance personnel must frequently test the grounding safety performance of broadcasting transmission devices to avoid missing key grounding system line detection areas.

Through analysis, it is evident that wireless transmission processing technology for radio and television system signals can achieve precision and automated control effects, enabling real-time playback and transmission of reliable and complete broadcasting program content data. The digital wireless transmission system for radio and television primarily includes digital encoding circuits, broadcasting signal sources, and digital transmitters, all of which must be incorporated into intelligent control scopes. In practice, technical optimization measures for broadcasting wireless transmission should focus on controlling system loss energy in transmission signals, expanding transmission range and distance, and reducing system return loss magnitude.

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