

Postprint of Maintenance for Digital Microwave Transmission Systems in Radio and Television Broadcasting

Authors: Yang Wei

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Abstract

During signal transmission, various factors may affect the process. Failed internal components, environmental conditions, and antennas may distort television signals, thereby impacting the visual experience. To ensure broadcast quality of radio and television, improve the quality of radio and television programs, and promote the development of the radio and television industry, this paper primarily conducts a brief analysis of the maintenance of broadcast television digital microwave transmission systems, with the aim of providing reference for relevant technical personnel.

Full Text

Abstract

Signal transmission is subject to various distorting factors, including component failures, environmental conditions, and antenna issues that degrade the viewing experience. To ensure broadcast quality, improve programming standards, and promote the development of the radio and television industry, this paper provides a concise analysis of maintenance practices for digital microwave transmission systems, offering valuable references for technical personnel.

Keywords: radio and television; digital microwave; transmission system; maintenance

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In the current landscape, digital microwave transmission equipment holds a critical position in radio and television engineering. It enables wireless transmission of microwave signals through digital microwave devices. With scientific advancement and the emergence of network technologies, digital microwave transmission equipment is increasingly deployed in broadcasting applications. To better meet industry demands, new maintenance requirements have emerged to fully reflect the performance advantages of these systems.

1.1 Increased Channel Capacity and Broadcast Frequency

Technological progress has propelled rapid development in radio and television services. Simultaneously, evolving audience demands have led to significant increases in both the number of channels and broadcast frequency, with transmission durations extending considerably. Currently, most radio and television programs in China broadcast for approximately 17 hours daily, with some channels operating continuously without interruption.

1.2 Growing Complexity of Signal Transmission Systems

The proliferation of broadcast channels and frequencies, combined with new media technologies, has intensified market competition. Traditional single-channel broadcasting no longer satisfies audience expectations, driving the adoption of integrated broadcast control systems in program production and transmission. Unlike conventional channels, these modern systems offer flexible program control and seamless channel switching, meeting diverse audience needs. Furthermore, they incorporate comprehensive peripheral equipment to enhance viewer experience.

1.3 Solid-State Trends in Transmission Systems

China's radio and television coverage technologies primarily include shortwave, frequency modulation, and digital television wireless broadcasting. As the terminal link in the broadcast chain, the transmission system's reliability is crucial for uninterrupted service. However, China's transmission technology remains relatively underdeveloped, characterized by high power consumption, low efficiency, difficult maintenance, and bulky equipment. These challenges complicate maintenance efforts. Additionally, modern broadcast transmission systems feature high degrees of automation, networking, and digitization, further elevating maintenance requirements.

2.1 Switching Power Supply Maintenance

To ensure reliable operation of switching power supply equipment, technicians must perform routine maintenance. Standard procedures include recording and analyzing operational data, studying alarm information to assess power supply status, and performing necessary maintenance or replacement of batteries and rectifier modules. The monitoring module tracks AC voltage, AC current, DC

voltage, DC current, load current, and battery current. Analysis of this data provides comprehensive insight into the power supply's operational status and integrity, facilitating effective maintenance and repair. Technicians must understand parameter relationships and be capable of performing relevant calculations and analyses.

The monitoring module records operational status and generates alarms when faults occur. Alarm classifications include emergency alarms, general alarms, and normal operation indicators. Emergency alarms indicate critical faults that may severely impact power supply operation, requiring immediate technician intervention. These trigger both audible and visual alerts. General alarms indicate less severe faults that allow continued operation for a period, enabling scheduled maintenance. General alarms utilize only indicator light notifications.

Power supply management relies primarily on the monitoring module to oversee battery float charging processes and capacity, verifying whether batteries can complete power supply and charging cycles. The module also monitors charge-discharge functionality, testing whether batteries can properly discharge and recharge. Normally, charge-discharge testing occurs during commercial power supply operations.

Rectifier modules frequently experience overheating during operation, affecting component efficiency and performance parameters. Therefore, routine maintenance requires technicians to inspect module operating temperatures and internal heat sink functionality. When temperatures consistently exceed 40°C, heat sinks should be checked for dust accumulation. Additionally, high ambient temperatures in equipment rooms can elevate rectifier module temperatures, necessitating regular ventilation to maintain constant temperature.

2.2 Transmission Equipment Maintenance

2.2.1 Fault Analysis During inspection and maintenance of digital microwave transmission equipment, personnel can identify faults through measurement data and analyze fault points and causes to understand their logical relationships. For example, when checking power supplies, technicians should first detect any abnormalities, then inspect internal components. Fault diagnosis should not focus solely on a single point. Instead, technicians must examine all relevant cable connections to ensure comprehensive and complete fault diagnosis of digital microwave transmission equipment.

2.2.2 Rectifier Module Maintenance The rectifier module represents the core component in switching power supplies and a primary focus of maintenance efforts. Its indicator lights signal normal operation. Maintenance professionals should regularly measure internal heat sink temperatures, cleaning dust from filters when temperatures exceed 40°C. During summer, when higher ambient temperatures raise module temperatures, professionals should maintain temperatures around 20°C.

2.2.3 Enhanced Maintenance in Special Environments For large-scale events, the broadcast industry typically deploys digital microwave transmission equipment on-site. Maintenance personnel must intensify maintenance efforts to enhance service performance and prevent equipment failures from disrupting events. Technicians should apply appropriate maintenance techniques to monitor transmission equipment operation in real-time, adapting waterproofing or insulation measures based on weather and temperature conditions to strengthen cable maintenance and ensure event success.

2.3 Component-Level Maintenance

Documentation specifies requirements for inspecting and maintaining different components of digital microwave transmission equipment. Technicians must strictly adhere to these specifications to ensure accuracy. Maintenance typically begins by verifying that equipment indicator lights display normal status, then confirming that indicator displays match actual operational information. Different indicator lights reflect different functional statuses. When abnormal indicators are detected, technicians should first check for connection issues. If connections are normal, further observation and analysis are required.

3.1 Enhancing Maintenance Personnel Competence

To improve maintenance capabilities, radio and television organizations should establish dedicated training departments. Instructors develop specialized curricula to deliver professional maintenance knowledge. Maintenance personnel must deepen their understanding of this knowledge and enhance their technical skills. Beyond regular working hours, staff should utilize available time to improve their comprehension of microwave transmission equipment, continuously reinforcing maintenance knowledge acquired during training to elevate their professional expertise and practical equipment maintenance capabilities.

3.2 Improving Maintenance Management Systems

Organizations should establish dedicated management departments for unified, professional supervision of maintenance personnel. Managers must oversee maintenance activities and develop comprehensive work standards. Additionally, reasonable labor quotas should be established and used as management benchmarks, with regular performance evaluations of maintenance staff. To improve efficiency and ensure smooth operations, maintenance personnel must understand their responsibilities and recognize areas for improvement.

3.3 Mitigating Lightning and Extreme Weather Impacts

Due to operational requirements, microwave stations are typically constructed at elevated locations, increasing lightning strike probability for antennas—particularly in mountainous regions. Lightning affects normal antenna

operation, necessitating appropriate protective measures during design and implementation. Standard practice involves lightning protection through grounding and grounding grid systems for antennas. Currently, lightning protection implementation prioritizes optimization of grounding systems for broadcast transmission equipment.

The application of digital microwave transmission equipment has become essential for radio and television industry development. Proper utilization enhances transmission efficiency and flexibility. However, maintenance personnel must properly maintain these systems, paying attention to switch and power supply maintenance, regularly inspecting cables to improve safety performance and extend equipment lifespan. Appropriate maintenance techniques must be employed to enhance safety and stability, thereby strengthening the market competitiveness of China's radio and television industry.

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(Author Affiliation: Chongqing Changshou District Radio and Television Station)

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

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