Discussion on Maintenance and Fault Handling of 1kW Medium-Wave Broadcast Transmitter (Postprint)

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Abstract

With the continuous acceleration of domestic economic development, the radio and television industry has entered a period of prosperous development. At the present stage, broadcast transmitters have become widely adopted, featuring relatively simple operation and robust functionality, which can effectively satisfy the actual requirements of broadcasting activities. Compared with electron tube plate-modulated transmitters, 1kW medium-wave broadcast transmitters offer more pronounced advantages, exhibiting excellent stability, compact size, and light weight. Although this type of transmitter possesses significant advantages, various issues may arise during application, necessitating that technicians fulfill their respective duties and diligently execute maintenance tasks. This paper primarily conducts an in-depth investigation and analysis of various faults occurring during the operation of 1kW medium-wave transmitters, seeks practical and viable solutions on this basis, and ensures that maintenance work is properly executed.

Full Text

Maintenance and Fault Handling of 1kW Medium-Wave Broadcast Transmitters

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Abstract: With the continuous acceleration of domestic economic development, the radio and television industry has entered a period of prosperous growth. At present, broadcast transmitters are widely used, offering relatively simple operation and strong functionality that can effectively meet the practical needs of

broadcasting activities. Compared with electron tube plate-modulated transmitters, the 1kW medium-wave broadcast transmitter offers more obvious advantages, including good stability, compact size, and light weight. Although this type of transmitter has significant strengths, numerous problems arise during application, requiring technicians to fulfill their responsibilities and perform maintenance work effectively. This paper provides an in-depth analysis of various faults that occur during the use of 1kW medium-wave transmitters, identifies practical and feasible solutions, and ensures that maintenance work is properly implemented.

Keywords: 1kW medium-wave broadcast transmitter; carrier output; digital circuit; fuse; medium-wave broadcasting

2. Composition and Principle of 1kW Medium-Wave Broadcast Transmitters

Analysis of the 1kW medium-wave broadcast transmitter reveals that it consists of three components: power supply, audio, and high-frequency sections. During operation, the carrier frequency must be effectively controlled within the range of 531 to 1602 kHz, while ensuring the response frequency remains below 1 dB, thereby guaranteeing efficient carrier operation. In terms of working principle, after the 1kW medium-wave broadcast transmitter emits an audio signal, it must be immediately processed using a subcarrier signal to achieve audio modulation, enabling the pulse width modulation to meet expectations. Specifically, the pulse-width-modulated signal must be amplified before being input to the modulator, where the pulse power and amplitude are appropriately adjusted according to actual broadcast transmission requirements. Subsequently, the audio signal undergoes further amplification while the tuning filter is adjusted, after which the signal is transmitted. The power supply is a critical component of the 1kW medium-wave broadcast transmitter, as it delivers stable power that enables orderly transmitter operation.

3. Analysis of Fault Types in 1kW Medium-Wave Broadcast Transmitters

3.1 Key Indicator Light Faults Numerous faults occur when starting up the 1kW medium-wave broadcast transmitter, with key indicator light faults being the most common. When equipment is operating, key indicator light failures prevent mechanical equipment from functioning effectively. Typically, to ensure adequate protection of the transmitter during startup, internal equipment must achieve automatic protection and blocking functionality. Additionally, relevant signal reception devices must be properly adjusted to significantly reduce impact. During startup, it is essential to ensure that the signal power supply voltage and waveform between the modulator and exciter do not deviate from normal states. The equipment block can only be released after charging is complete,

which ensures continuous current increase to the mechanical equipment and enables power to reach required levels—this is critical for successful transmitter startup. The most direct manifestation of key indicator light faults is flashing or non-illumination of indicator lights, which prevents understanding of actual equipment operating conditions.

3.2 Normal Operation with Intermittent Carrier Output Intermittent carrier output indicates faults in either the power supply or high-frequency sections. In such cases, the sixth pin of the side terminal block in the PA box must be tested, typically revealing that the fundamental amplitude is not particularly stable—when amplitude decreases, power similarly becomes lower. After checking the driver power supply and finding no abnormalities, the exciter pre-stage should be examined, often showing that the 15V voltage fluctuates between high and low states, with the voltage regulator exhibiting high temperature and inadequate thermal stability. In the voltage regulator circuit, a large voltage difference exists between the DC 25VDC, 7815, and 7818 components, significantly increasing power loss and causing abnormal temperature, which ultimately prevents the voltage regulator from maintaining good stability.

3.3 Normal Key Lights but Transmitter Fails to Start If the transmitter' s key lights show no abnormalities during startup but the unit fails to start properly, technicians must immediately identify the specific cause and select feasible techniques to eliminate the fault. When external power supply is not problematic, the transmitter' s transformer can ensure voltage remains within specified ranges during operation, with indicator lights illuminating, though startup remains unsuccessful. Failure to promptly address this fault will inevitably require greater financial investment in later repairs, more importantly, it directly impacts transmitter operational efficiency and reduces equipment lifespan. When handling such faults, personnel must analyze the voltage output of the power board to ensure existing faults are effectively eliminated and voltage output remains within reasonable ranges. During fault processing, maintenance personnel should connect a voltage indicator to the fuse tube; if the indicator extinguishes after power-on, the fuse has likely failed, requiring direct replacement. All fuse tubes should be inspected using this method, with faulty fuses directly replaced to effectively eliminate faults. If resistance values do not exceed 40Ω, measurements are normal, indicating no external damage has occurred, at which point abnormal components and circuits must be carefully examined. To effectively eliminate the above faults, external circuits must be inspected, with any looseness or short circuits immediately reinforced. It should be noted that during this process, short-circuited positions must be replaced, while analyzing the actual condition of transmitter switches and ensuring they are in a closed state during repairs.

3.4 No Current in PA Box When the PA box has no current, the fault light illuminates and there is no power output. While this fault is not difficult

to handle, ensuring complete resolution requires personnel to thoroughly understand transmitter operation principles and conduct troubleshooting for RF and modulation faults. For modulation path inspection, the control board pins, modulator output terminals, and relay control input terminals must be checked to understand their operating status. For RF fault inspection, the focus should be on the exciter output square wave, driver output voltage, and PA box sine wave to determine whether they are in normal condition. If all test results are normal, this indicates the relay control board has failed. Maintenance personnel must then conduct comprehensive testing throughout the entire operation period, adjust modulation output, identify the root cause, replace faulty components, and restart the equipment to verify the fault point.

3.5 Abnormal Noise from Transmitter After preliminary judgment determines that transmitter vibration is caused by poor contact, the D4 to D6 indicator lights are illuminated but no current exists. Technicians must conduct comprehensive testing of contact conditions in relevant areas to clearly identify fault locations. Generally, switches, components, plugs, and potentiometers have a high probability of poor contact. During inspection, the elimination method can be used to significantly improve inspection efficiency. Specifically, exciter faults must first be accurately diagnosed by blocking the exciter switch to ensure it is disconnected during switching, enabling more precise detection. If the fault is not eliminated after testing, this indicates the blocking switch is normal. Next, the power control board should be tested to determine whether the multi-turn potentiometer is abnormal, with plugs, relays, and tank circuits inspected individually for faults using professional instruments to test the exciter. If no abnormalities persist, technicians should conduct tapping tests while carefully observing whether the relay produces sound, which can reveal faults in the relay' s KA node.

4. Fault Handling Measures for 1kW Medium-Wave Broadcast Transmitters

4.1 Heat Point Inspection and Fuse Troubleshooting If indicator light faults occur during startup accompanied by a burning smell, this typically indicates excessive voltage or current causing component overheating. To resolve such faults, first shut down the equipment, then identify heat sources by locating overheating points. After completing this inspection, restart the equipment to ensure normal mechanical operation. When testing circuits, effectively utilize relays—if resistance values do not exceed 40Ω, measurements are normal, indicating no external damage has occurred, at which point abnormal areas and circuits must be carefully examined. To effectively eliminate the above faults, external circuits must be inspected, with any looseness or short circuits immediately reinforced. It should be noted that during this process, short-circuited positions must be replaced, while analyzing the actual condition of transmitter switches and ensuring they are in a closed state during repairs.

4.2 Enhanced Fuse Quality Monitoring If the transmitter exhibits automatic switching on/off, maintenance personnel must inspect the power supply to effectively reduce the probability of irreversible equipment damage. Subsequently, machine foot voltage should be checked to ensure operation remains abnormal-free, typically maintained between 4.7V and 5V. If machine foot voltage is lower than the minimum voltage, the mechanical display screen will fail. When this fault occurs, the display becomes chaotic with problematic chrominance and brightness, preventing the transmitter from achieving automatic adjustment. To effectively eliminate transmitter faults, fuse selection must be prioritized. When the transmitter is operating, fuses play a crucial role in maintaining normal mechanical equipment operation, thereby stabilizing control board voltage. When handling automatic switching faults, adjusting only the power control motherboard yields unsatisfactory results. During fault elimination, control board voltage must be tested, and if results confirm compliance with standard values, this indicates the fault has been eliminated.

4.3 Comprehensive Equipment Quality Management During fault detection and handling, personnel must thoroughly understand actual power supply voltage conditions to effectively eliminate related faults and ensure voltage input/output remains within specified ranges. During practical operations, place a small voltage indicator at both ends of the fuse tube and check the indicator status after power-on. If the indicator extinguishes, immediately replace the fuse to improve quality, then restart the equipment for verification, significantly enhancing maintenance effectiveness.

5. Maintenance Measures for 1kW Medium-Wave Broadcast Transmitters

5.1 Daily Maintenance Implementation The maintenance measures adopted for the 1kW medium-wave broadcast transmitter significantly impact its operation. Personnel must recognize the importance of maintenance work, as effective daily maintenance substantially reduces the probability of major faults and ensures potential hazards are eliminated. To achieve optimal periodic maintenance results, dedicated personnel should be assigned to this task, with appropriate maintenance strategies selected based on actual conditions. Inspection results must be documented in detail for direct reference during subsequent checks. During daily maintenance, particular attention should be paid to the following points: First, implement dust prevention and cleaning to ensure all components remain clean, typically using air filters for dust prevention. It should be noted that metal wool in air filters must be cleaned regularly and replaced when necessary. Second, conduct detailed inspections of electronic components for rust, detachment, or fracture, addressing any issues promptly through treatment or direct replacement. Third, perform careful inspections of key points with detailed and complete records to obtain necessary references for later maintenance.

5.2 Improving Technician Skill Levels Currently, broadcast information technology is developing rapidly. If traditional maintenance techniques continue to be used for 1kW medium-wave broadcast transmitter repairs, results will fall short of expectations. To change this situation, maintenance personnel must effectively improve their technical capabilities through various channels. First, organize relevant personnel to participate in specialized training to ensure clear understanding of transmitter construction and working principles, while developing proficiency in more advanced maintenance techniques to guarantee successful, quality maintenance work. Second, effectively apply conventional maintenance techniques while mastering special maintenance techniques to ensure more stable transmitter operation. Third, incentivize maintenance personnel to study during their spare time, providing both spiritual motivation and appropriate material rewards based on learning outcomes. Effective implementation of these measures can significantly improve maintenance personnel capabilities, enabling them to successfully complete maintenance work and effectively prevent potential risks during 1kW medium-wave broadcast transmitter operation.

5.3 Digital Circuit Maintenance Digital circuits have become one of the primary components for stable operation of 1kW medium-wave broadcast transmitters, making proper digital circuit maintenance essential. During operation, digital circuits typically exhibit only two states: “1” and “0” . Maintenance personnel must master the operational patterns of these states, organize their internal logic relationships, and regularly inspect each connector in the digital circuit. If connectors exhibit poor contact, looseness, or other adverse phenomena, they must be addressed and resolved immediately. Additionally, when digital circuit faults occur during operation, power should be promptly cut off to prevent subsequent, more severe faults. It should be noted that digital circuit maintenance often requires high standards—in many cases, after eliminating a series of fault suspects, the root cause remains undiscovered. In such situations, maintenance personnel must demonstrate innovative thinking and continuously summarize experiences, examining problems from the internal construction of the 1kW medium-wave broadcast transmitter while avoiding safety hazards such as electric shock to ensure both timely fault resolution and the physical and mental health and work safety of maintenance personnel.

Conclusion

With continuous scientific and technological development, broadcast transmission signal quality has greatly improved, and advancements in technical innovation and management have achieved comprehensive upgrading of broadcast transmitters. In radio station operations, PDM 1kW medium-wave broadcast transmitters play a crucial role in news program relay transmission, requiring continuous normal operation to ensure good program broadcasting. The importance of 1kW medium-wave broadcast transmitters is self-evident. During specific operations, influenced by various internal and external factors, transmitters experience various startup faults. This paper analyzes specific fault causes,

explores solutions for particular faults, and hopes to identify reasonable resolution methods to ensure transmitters can operate in a healthy state, which not only reduces maintenance costs but also effectively extends equipment lifespan.

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