

# Utilizing Microwave Technology in Radio and Television Transmitters

Rui Zheng \*

Cardiff University, Cardiff CF24 3AA, United Kingdom

\* *Corresponding author:* Rui Zheng, 18652109927@163.com

**Copyright:** © 2023 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), permitting distribution and reproduction in any medium, provided the original work is cited.

**Abstract:** In order to improve the performance and reliability of the radio and television transmission system and provide users with a better audiovisual experience, this paper first analyzes the advantages of microwave in radio and television transmitters, and further elaborates the radio and television transmission system. Through the reasonable configuration and application of microwave equipment, the performance and reliability of radio and television transmission system can be improved, and the stable transmission of radio and television signals can be ensured.

**Keywords:** Microwave; Launch pad; Television broadcast

**Online publication:** August 29, 2023

## 1. Introduction

Due to the rapid advancement of information technology, radio and television have become crucial means of disseminating information, leading to increased demands for transmission quality and reliability. As an advanced medium of communication, microwave technology plays an increasingly important role in the radio and television transmission system. Microwave refers to electromagnetic waves with a frequency of 300 MHz to 300 GHz, which has high frequency, short wavelength, and strong penetration. Microwave can realize long-distance transmission and wireless reception of signals in radios and television, thereby improving the coverage and transmission quality of signals<sup>[1]</sup>. Microwave has many advantages, such as improving the quality of the transmitted signal, reducing the production and maintenance costs of the transmitter, facilitating the switching of multiple transmission methods, and improving the security and confidentiality of the signals. Through the rational use of microwave technology, efficient transmission, remote monitoring, equipment debugging, and emergency communication of radio and television signals can be achieved<sup>[2-3]</sup>. Moreover, microwave technology is continually evolving and innovating, and it is poised to play an even more extensive and vital role in the realm of broadcast and television in the future.

## 2. Advantages of microwave in radio and television transmitters

### 2.1. Improves the quality of the transmitted signal

Microwave technology can effectively improve the transmission quality of radio and television signals. Compared to the traditional radio wave transmission method, microwave technology has higher signal

stability and anti-interference ability, which can effectively reduce the bit error rate and noise of the signal. This helps to improve the broadcast quality and clarity of broadcast and television, and provide users with a better audiovisual experience.

## **2. 2. Reduces the construction and maintenance costs of the launch pad**

Microwave can reduce the construction and maintenance costs of radio and television transmitters. Primarily, it is worth noting that microwave equipment demonstrates superior signal transmission efficiency and significantly reduced transmission loss in comparison to conventional radio wave transmission equipment. Microwave equipment can reduce the energy consumption and transmission power requirements of the transmitting equipment, thereby reducing the operating costs of the transmitter. Secondly, microwave can reduce the number and scale of antennas of the transmitter, the construction area of the transmitter, and thus the production cost of the transmitter.

## **2. 3. Makes switching of multiple transmission modes more convenient**

Microwave makes switching between multiple transmission modes easier, which helps improve the reliability and flexibility of broadcast and television systems. For instance, in the event of a natural disaster or emergencies, microwave technology can be utilized by seamlessly switching between different microwave stations. Microwave technology allows stable transmission of signals and emergency communication and ensures that radio and television can still function under special circumstances.

## **2. 4. Improve the security and confidentiality of signals**

Microwave technology can improve the security and confidentiality of broadcast television signals. Microwave signals can be encrypted during transmission to safeguard the confidentiality and security of the signal. In addition, microwave technology can also realize the digital encryption of signals to them from being eavesdropped or tampered with during transmission.

## **3. Application of microwave in radio and television transmitters**

### **3. 1. Radio and television transmission system**

Radio and television transmission systems are mainly composed of the following parts (Figures 1 & 2):

#### **(1) Radio and television transmitter**

As the core of a radio and television transmission system, the transmitter is responsible for converting signals and transmitting them through antennas. The transmitter generally includes a signal source, a transmitting equipment, an antenna feeder system, cooling system, and other components.

##### **(i) Signal source**

The signal source is the starting point of the radio and television transmission system and is responsible for generating signals. The signal source can be from a program production center, satellite, etc.

##### **(ii) Transmitting equipment**

Transmitting equipment is the key equipment for converting radio and television signals into radio waves. Transmitting equipment includes modulators, power amplifiers, transmitting antennas, etc. The modulator modulates the broadcast television signal to a specified frequency band, the amplifier amplifies the signal, and the transmitting antenna converts the signals into radio waves and sends them out.

##### **(iii) Antenna feed system**

The antenna feeder system is an important part of the radio and television transmission system that is responsible for sending the transmitted radio waves to the receiving end. The antenna feed system includes

an antenna and a feeder, the antenna converts the radio waves into a wireless signal, and the feeder transmits the signal received by the antenna to the receiving end.

(iv) Cooling system

The cooling system is responsible for reducing the temperature and ensuring the normal operation of the transmitting equipment. The cooling system includes components such as radiators and air conditioners, which can effectively reduce the temperature of the transmitting equipment and ensure the stability of the transmission system.

(2) Receiving port

The receiving port is the terminal of the radio and television transmission system, which is responsible for receiving and restoring radio and television signals. The receiving end includes receiving antennas, feeders, demodulators, and other equipment, which converts the radio waves to radio and television signals for users to listen and watch.

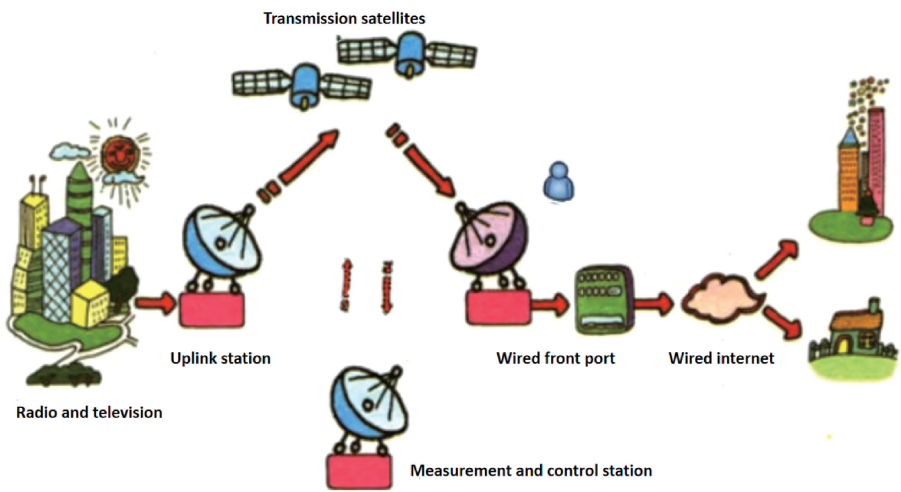


Figure. 1 Radio and television satellite transmission system

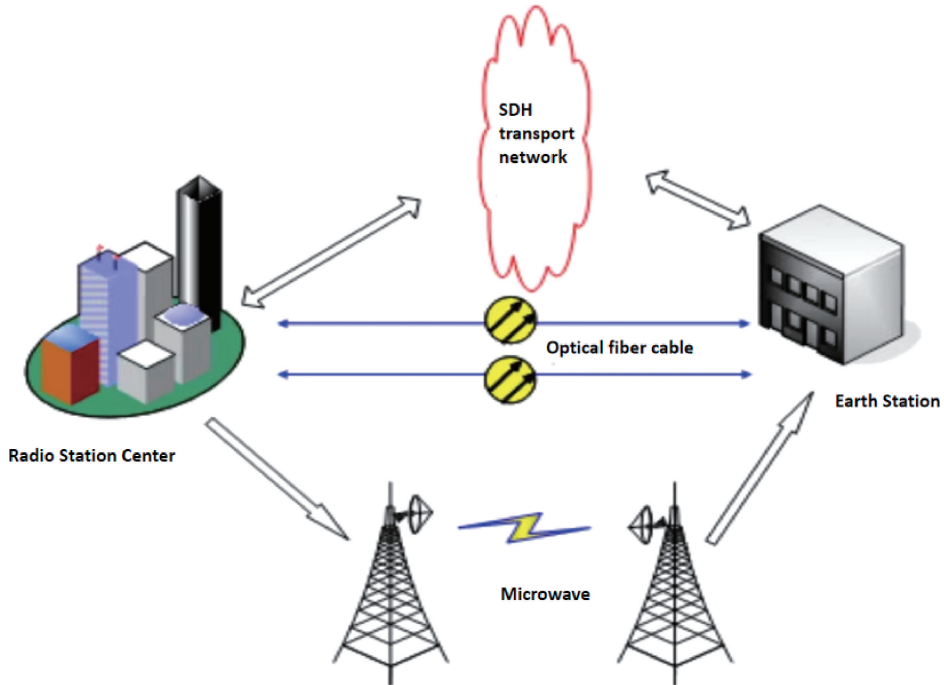


Figure. 2 Basic structure of radio and television transmission system

### 3. 2. Specific application

#### 3. 2. 1. Signal transmission

Microwave can be used for the transmission of radio and television signals. Microwave transmitting equipment converts radio and television signals into microwaves and transmits them through antennas. The receiving port restores the received microwave signal to radio and television signals, which will be received by the users (Figure 3).

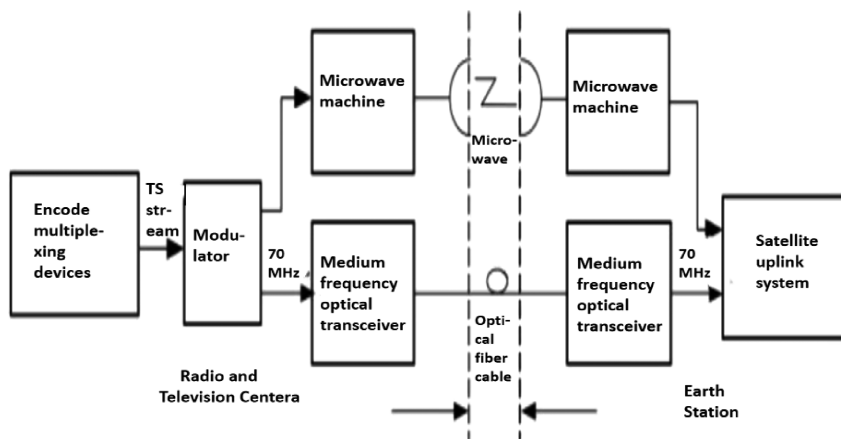


Figure. 3 Intermediate frequency transmission mode

#### 3. 2. 2. Remote monitoring

Microwave can be used for remote monitoring of radio and television transmitters. The parameters and status of the transmitter can be transmitted to the remote monitoring center through a microwave transmission equipment. Then, the working status of the transmitter can be monitored and adjusted at the monitoring center in real time to ensure the stable transmission of radio and television signals (Figure 4).

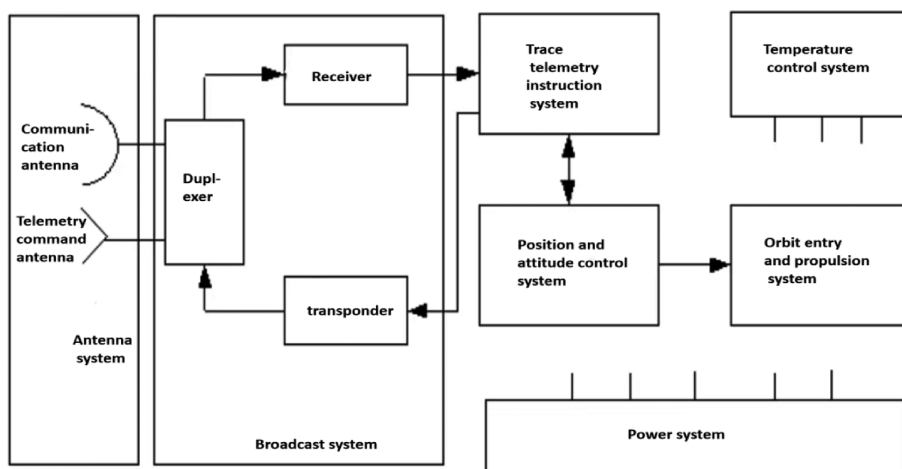


Figure. 4 System monitoring

#### 3. 2. 3. Equipment debugging

Microwave technology finds application in the equipment commissioning of radio and television transmitters. With microwave test equipment, various devices can be commissioned and tested on the launch pad site. For example, parameter adjustment of microwave transmitting equipment, calibration of

antenna systems, etc.

### **3.2.4. Emergency communications**

Microwave technology can be used for emergency communication on radio and television transmitters. In the event of natural disasters or other emergencies, microwave technology can provide a reliable means of communication. The use of microwaves allows signal transmission and communication during emergencies, and the normal function of radio and television in special circumstances can be guaranteed.

### **3.3. Optimization strategies**

#### **(1) Choosing the right microwave equipment**

The microwave equipment should be chosen according to the actual needs of the radio and television transmitter, including the transmitter, the receiver, the antenna, etc. Besides, the quality and performance of the selected equipment should meet the relevant standards and technical requirements.

#### **(2) Determining the microwave transmission scheme**

A suitable microwave transmission scheme, including the frequency, bandwidth, route, etc. of microwave transmission should be designed according to the specifications of the radio and television transmitter. At the same time, the influence of topography, climate, electromagnetic environment and other factors on microwave transmission should be considered to ensure the feasibility and reliability of the scheme.

#### **(3) Constructing the microwave network**

According to the microwave transmission plan, we build microwave network, including: microwave transmission tower, microwave receiving station, microwave signal relay station, etc. At the same time, we must consider the security, reliability and scalability of the network to ensure the normal operation and management and maintenance of the network.

#### **(4) Optimizing microwave network management**

Aspects of microwave network management should include monitoring network operation status, collecting user feedback, and handling faults and abnormalities in a timely manner. Moreover, the network should be adjusted and optimized according to the actual situation to improve the performance and efficiency of the network.

#### **(5) Strengthening technical training**

To enhance the technical expertise and operational proficiency of radio and television staff, it is essential to provide them with specialized training in microwave technology. Our training includes basics of microwave, equipment operation, maintenance skills, network management, optimization skills, and more. Through training, proficiency in the application and management of microwave technology can be ensured among the staff, thus ensuring the stable operation of radio and television transmitters.

#### **(6) Establishing an emergency plan**

A comprehensive emergency plan should be developed to address microwave transmission failures, enabling timely implementation of effective measures to restore signal transmission in case of any failure. The emergency plan should include equipment backup, routing backup, emergency repair, etc., to improve the stability and reliability of the radio and television transmitter.

#### **(7) Joint other means of communication**

In radio and television transmitters, limited means of communication may be risky. Therefore, we can consider combining microwaves with other communication methods (such as optical fiber, satellite, etc.) to form a multi-channel, multi-backup signal transmission system. By doing so, we can enhance the safety and reliability of the entire system while ensuring the stability of signal transmission.

#### 4. Summary

In summary, the application of microwave technology in radio and television transmitters offers numerous advantages and holds significant practical significance. Microwave technology in radio and television transmitters allows signal transmission, remote monitoring, equipment debugging, and emergency communication. By utilizing microwave technology effectively, we can enhance the quality and reliability of broadcast television transmissions. This ensures the stable transmission of broadcast and television signals, providing users with a high-quality audiovisual experience. Through the selection of suitable equipment, designing appropriate solutions, building well-structured networks, optimizing management, and reinforcing technical training, we can ensure the effective utilization of microwave technology in radio and television transmitters, thus delivering high-quality radio and television services to audiences. At the same time, microwave technology is constantly developing, and it will play a more extensive and important role in the field of radio and television in the future.

#### Disclosure statement

The author declares no conflict of interest.

#### References

- [1] Dang H, 2020, Exploring the Application of IP Microwave in Radio and Television Transmitter. *Electronic World*, 2020(18): 156–157.
- [2] Wang X, 2020, Prospect of Construction of Intelligent Network for Radio and Television Wireless Transmission at Provincial Level. *Radio & Television Technology*, 47(05): 134–137.
- [3] Fan Y, 2017, Application Analysis of Digital Microwave Transmission in Radio and Television. *Electronic Test*, 2017(24): 114–115.

#### Publisher's note

Bio-Byword Scientific Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations