

# Application of Shortwave Communication Technology in Power Emergency Communication System

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**Abstract.** Electric power emergency communication is an important support for power system to deal with all kinds of emergencies and ensure the safe production of power grid. It plays an important role at the critical moment. The choice of power emergency communication mode, to adapt to the characteristics of power systems to meet the needs of power emergency business. Shortwave communication as a traditional radio communication technology, has its unique advantages, suitable for a variety of occasions, the use of emergency communications. This paper introduces the general principle and performance characteristics of shortwave communication technology, and puts forward some schemes of shortwave communication in power system emergency communication, which provides a reference for the construction of power emergency communication system.

**Keywords:** Shortwave, Emergency Communication, Different frequency transfer

## 1. INTRODUCTION

HF communication, also known as high-frequency communications, its frequency range is 3-30MHz, the main use of ionizing reflected sky wave to achieve long-distance communication, and without the establishment of a relay station. HF communications for many years been widely used in government, military, diplomatic, meteorological and other departments, for the transmission of voice, text, images and other information. In addition, short-wave communications in the military command also plays an important role.

Ultrashort wave called UHF communications, frequency range 30-300MHz, due to the ultrashort wavelength between 1-10m, so also known as UHF communications. There are entire VHF band width 270MHz, it is 10 times the shortwave band width. Thus, the meter is widely used in television communication signal transmission, FM radio,

radar, navigation, mobile communications, and other services. Although the current new radio communications systems are emerging, but this ancient shortwave communication, traditional means of communication continue to be widespread worldwide attention.

In recent years, frequent natural disasters and accidents around the world, resulting in traffic congestion or interruption. Due to the lack of on-site emergency communication tools necessary to lead to disaster emergency dispatching field work difficult to carry out. Therefore, the establishment of an emergency communication system is necessary.

Currently, commonly used around the world equipped with wireless emergency communications vehicles, with satellite communication method to establish emergency communication system, but the method is large investment, the actual use of the low rate, high maintenance requirements. Because of HF communication and adaptability, autonomy networking flexibility, low cost, and other prominent advantages, is more suitable for a variety of communications power for emergency situations will be protected.

## 2. BRIEF INTRODUCTION OF SHORTWAVE COMMUNICATION TECHNOLOGY

### 2.1. HF communication

Radio broadcasting, radio communication, satellite radar and so rely on the propagation of radio waves to achieve. Radio waves with a wavelength of electromagnetic waves 100000m-0.75mm. According to the characteristics of electromagnetic wave propagation can be divided into a number of bands long wave, medium wave, short wave, FM and so on. There are basic transmission shortwave Two Ground wave and sky.

### 2.2. ground-wave propagation mode

Radio waves propagate along the surface of the

earth, part of the energy absorbed by the ground and suffered a serious attenuation, the better the conductivity of soil attenuation, the higher the frequency the greater the attenuation. Ground wave propagation characteristics and stability, suitable wavelength wave, medium wave and short wave.

### 2.3. sky-wave propagation mode

Sky-wave is the use of high-altitude ionospheric reflection of radio waves propagation, ionosphere is located 60km-650km from the ground around the area of the upper atmosphere, there are a variety of molecules, atoms and their ions and free electrons, etc., each of which concentrated together to form a layered, so that the sky electron concentration is relatively concentrated, the formation of layers of uneven distribution of electron density.

The electronic density variation with height, ionosphere corresponding conductive layers is divided into four.

#### 1)D layer

Location: 60km-90km above the Earth at a height, the maximum electron density occurs at 80km.

Features: When the sun rises appear, disappear after sunset, low electron density, short-wave will pass through the D layer is not reflected greatly attenuated

#### 2)E layer

Location: 1km-120km above the Earth at a maximum electron density occurs at 110km.

Features: occurs when the sun rises, basic does not affect short-wave communications, may reflect higher than 1.5MHz frequency electromagnetic waves.

#### 3)F layer

Location: F1 layer is located at the 170km-220km above the Earth, F2 layer is located at the 225km-450km above the earth, the height of the lowest in the winter day, while daytime highs in the summer. F2 layer and the other layers of different, not completely disappear after sunset, there remains residual ionization.

A significant impact on the concentration of the ionosphere operating frequency, high frequency high concentrations reflection, low-frequency low concentrations reflection. The concentration of ionized number of free electrons per unit volume to be expressed.

Thus, the sky wave is mainly used for short-distance communications, the ground will not be obstruction. But the use of sky-wave propagation is not stable, because in the process of sky-wave propagation path delay attenuation, atmospheric noise, multipath effects, ionospheric fading and other factors can cause signal weakening and distortion, thus affecting the effect of short-wave communications and quality. This is also not the last one of the main power shortwave communication system used.

### 2.4. shortwave communication

Compared with satellite communications, terrestrial microwave and other means of communication, shortwave communication has many significant advantages:

Shortwave communication does not require the establishment of relay stations to achieve long-distance communications, low construction and maintenance costs and low operating costs.

Equipment is simple, you can use a fixed base station to build equipment, can also be easily carried or loaded into the vehicle to achieve mobile communications. Circuit scheduling easy, temporary networking convenient, flexible and strong;

Resistant to strong, small size, able to adapt to a variety of environmental conditions;

The above advantages are short-wave communication is long-term retention, is still widely used the main reason.

Shortwave communication also has some obvious shortcomings: the available frequency band is narrow, the communication capacity is small, only suitable for voice, low speed data and picture transmission, shortwave wave channel is the variable channel, the signal transmission stability is poor, the radio operation needs Some experience and skills; atmospheric and industrial radio noise interference.

## 3.POWER EMERGENCY COMMUNICATION SYSTEM

### 3.1. Power Emergency Communication System

Power system is a huge energy delivery network consists of power generation, power transmission, electricity distribution and other aspects of the composition. Constituted by a variety of power facilities, urban and rural areas throughout the country. However, in the power production process will inevitably be some incidents. Therefore, we must build a complete power system emergency support to cope with the impact of various incidents and disasters, improve security of electricity production, operation.

Power emergency communication refers to the power system when the accident or disaster and other emergencies, for all levels of power production operation and management agencies to provide the scene of the audio data and image services, communication security, to ensure that the repair site and the emergency command center between the contact communication system.

The construction of a power emergency communication system can obtain relevant information in the shortest time in the event of an emergency event in the power system, the disruption of the power communication or the need for rapid communication, the development of a realistic contingency plan and the notification of all

emergency personnel with a fast and convenient means of communication, and communication tools to help commanders quickly and efficiently deploy and communicate instructions to notify emergency department coordinated command and control, in order to minimize the impact and damage caused by the accident.

Selection of power emergency communication system should have the following characteristics:

- By geographical and climatic conditions with minimal impact, and does not limit the transmission distance;
- Self-contained, it has a strong independent, strong flexibility, availability and reliability, ease of operation;
- In the field under consideration no special power communication network and public network situation, to quickly establish a temporary communication services.

#### 4.APPLICATION OF SHORTWAVE COMMUNICATION IN POWER EMERGENCY COMMUNICATION SYSTEM

HF communication applications in power emergency communication include the following:

##### 4.1. long-distance communications.

Optional shortwave communication station in three ways: a fixed base station - fixed station; fixed base stations - mobile vehicle; mobile vehicle - moving vehicle.

##### 4.2. 4.1.2 Communication within the region.

Optional shortwave communication station, there are two: a fixed base station - mobile vehicle; mobile vehicle - moving vehicle. The selection of the fixed base station and the vehicle station is the same as that of the above scheme. It is suitable for long distance communication coverage between the central station and the mobile station in the field, which can meet the short-range communication demand in the province.

##### 4.3. 4.1.3 Field Communication.

Optional shortwave communication station in two ways: by moving vehicles - portable radios; portable radios - Portable radio station.

In recent years, shortwave communication technology in the world has made great progress, there have been many used in new radio, new equipment and new technology. Short-wave single-side radio station smaller and smaller, more and more features. Has introduced a variety of new base station antenna and car antenna. Short-wave communication in the frequency selection has launched a short-wave full-band real-time adaptive frequency selection system, to further improve the stability and reliability of short-wave communications.

##### 4.4. 4.2 HF communication network in power emergency communication system

In the short-wave radio emergency communications

still irreplaceable means of communication. The VHF equipment is also wide range of applications. Organize emergency use short-wave radio communication network can be a center for the selective call, group call and other networking communication, covering a large area of communication, communication distance of up to 2000km. Conventional short-wave radio communication with a communication distance without repeaters, using the advantages of flexibility, however, after all, a certain weight and volume, and therefore not easy to carry. FM radio, although widely used, but only a few kilometers to tens of kilometers of communication distance, and through the mountains or city high-rise will occur affects the communication signal blocking effect.

With the rapid development of communication technology, the market has now developed a new device called different frequency adapter, it can be short-wave radio and VHF radio combine together to complete the transfer of different voice frequency equipment. Automatic or manual changeover between VHF handset poor transfer, call transfer between handsets VHF and shortwave radio. Short-wave radio station also can install different frequency adapter consisting of local short-wave command and communications network, to achieve a few hundred kilometers of liaison between the two FM radio calls, the working principle is shown in Figure 1.

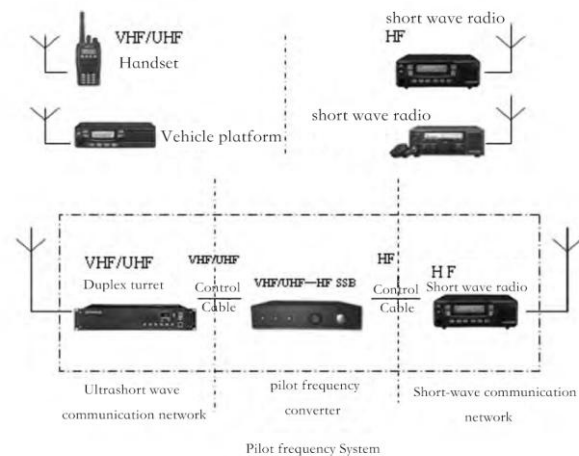


Figure 1 working principle

#### 5.CONCLUSIONS

In recent years, the construction of the national emergency system attaches great importance to many industries, and all levels of government has increased the construction of emergency communication system. At present, the government, public security, civil defense, earthquakes, weather, traffic, forestry and other sectors has assigned short-wave communications as an important means

of emergency communication. Computers, mobile communications and the rapid development of microelectronics technology to promote the upgrading of HF communication technologies. Use modern shortwave equipment modification and enrichment of all important areas of the radio communication network can make it more effective and advanced to meet the electricity needs of emergency communications.

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