Introduction

Digital broadcasting in the world

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What "digital broadcasting" is

- High visual and sound quality
- Large number of channels

Global trends in digital broadcasting

[Europe]

- Advanced functions (data broadcasting / two-way capability)
- Large number of channels
[USA]

In the USA, the regulations for the operation of radio transmitters are quite different from those in Japan. In the USA, the Federal Communications Commission (FCC) is responsible for setting the rules for radio communication, including the operation of AM and FM radio receivers.

AM bands

The AM bands in the USA are divided into several categories, each with its own frequency range. The most common AM band is the 530-1710 kHz band, which is used for local radio stations. Other AM bands include the 150-530 kHz band for medium-wave broadcasts and the 600-1000 kHz band for long-wave broadcasts.

FM bands

The FM bands in the USA are also divided into several categories, each with its own frequency range. The most common FM band is the 88-108 MHz band, which is used for AM broadcast stations. Other FM bands include the 102-108 MHz band for FM broadcast stations and the 87.5-90 MHz band for FM broadcast stations.

[Japan]

Japan has a different set of rules for the operation of radio transmitters. The Ministry of Internal Affairs and Communications (MIC) is responsible for setting the rules for radio communication, including the operation of AM and FM radio receivers.

AM bands

The AM bands in Japan are divided into several categories, each with its own frequency range. The most common AM band is the 760-1200 kHz band, which is used for local radio stations. Other AM bands include the 1400-2000 kHz band for medium-wave broadcasts and the 2800-3000 kHz band for long-wave broadcasts.

FM bands

The FM bands in Japan are also divided into several categories, each with its own frequency range. The most common FM band is the 87.5-108 MHz band, which is used for AM broadcast stations. Other FM bands include the 107.9-120 MHz band for FM broadcast stations and the 87.5-90 MHz band for FM broadcast stations.
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4.1 Data source encoding technology

4.2 Multiplexing technology

4.3 Transmission path encoding technology (modulation and error correction)

4.3.1 Error correction technology

Viterbi algorithm

Reed-Solomon code

4.3.2 Digital modulation technology
5.1 Problems of antenna

Problems for reception by mobiles
Digital broadcasting in the world

5.2 Doppler shift due to high-speed travel

The Doppler shift due to high-speed travel is a phenomenon that occurs when an object is moving relative to the source of a wave. In the context of digital broadcasting, this can affect the reception of signals. The shift is caused by the change in the frequency of the wave as the distance between the source and the receiver changes. The Doppler shift can be calculated using the formula:

\[ f' = \frac{f}{1 + \frac{v}{c}} \]

where:
- \( f' \) is the observed frequency,
- \( f \) is the emitted frequency,
- \( v \) is the velocity of the object, and
- \( c \) is the speed of light.

This formula applies to objects moving towards or away from the source at a constant velocity. In cases of accelerating or decelerating motion, more complex formulas are required.

In practice, the Doppler shift can lead to signal distortion and can be compensated for by adjusting the receiver's tuning frequency. Techniques such as frequency modulation and time division multiple access (TDMA) are used to mitigate the effects of Doppler shift in digital broadcasting systems.

![Diagram showing Doppler shift due to high-speed travel](image)
Conclusion

In conclusion, it is essential to focus on improving the performance of vehicle-mounted digital broadcast reception equipment. The development of high-quality, user-friendly devices that can effectively handle various broadcast signals is crucial. Through continuous research and development, we can enhance the technology and create more satisfying products for our customers.

Profiles of Writers

Hidenori Gohara
Entered the company in 1999. Since then, has pursued vehicle-mounted digital broadcast reception equipment. Currently in the Research and Development Department.

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Entered the company in 1976. Since then, has pursued development of reception engineering for devices such as electronic tuners, diversity antennas, antenna amps, and FM multi-receivers. Currently Department General Manager of the Antenna System Engineering Department in the Component Division, A.V.C. Products Group, as well as Department General Manager of the Research and Development Department.