Study on Performance Improvement of ISDB-T Receiver in Fast Fading

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Presentation Outline

- What is ISDB-T?
- Problem of ISDB-T in Fast Fading
- The Conventional research
- Dummy Elements add on both sides of Monopole Array
- Dipole Array Doppler Spread Compensator
- Conclusion
- Future Work

What is ISDB-T?
(Integrated Services Digital Broadcasting for Terrestrial)

- Digital Terrestrial Television Broadcasting
  ISDB-T has been started on December, 2003
  Stationary Reception->12 segments (64QAM)
  Cellular Phone Reception->1 segment (QPSK)
- OFDM (Orthogonal Frequency Division Multiplexing)
  robust multi-path delay
   奀 Narrow bandwidth among sub-carriers
  weak in Doppler spread
  (It can cause problem when high speed mobile reception)

Problem of ISDB-T in Fast Fading

- Multi-path Environment
  Several incoming waves affect the different Doppler shift
  ISDB-T has narrow bandwidth among sub-carriers
  (eg. Mode 3: 1kHz)

The Conventional Research

- Space Domain Interpolator
- OFDM Receiver

The Reception Point is fixed with respect to the Ground

Problems of Conventional Research

- Mutual Coupling Effect
  Dummy Elements add on both sides of Monopole Array
- Polarization
  By using Dipole Array
- Multi-Path Fading Problem
  Making use of MRC (Maximum Ratio Combining) Diversity
Mutual Coupling Effect Cancel Method

Dummy Elements add on both sides of Monopole Array

Mutual Coupling Cancel Method

The space domain interpolator severely affected the mutual coupling because the conventional monopole array has narrow antenna spacing between array elements.

Adding the dummy elements on both sides of monopole array, the mutual coupling effect has been reduced.

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Radiation Pattern(2-element)

Radiation Pattern(4-element)

BER Performance against fT_s

(Em/N_0 = 20dB, d = 0.15 \lambda)

Conclusion

- Adding the Dummy Elements on both sides of Monopole Array
  - Reduction of Mutual Coupling effect among Array Elements
  - Wide Operating Bandwidth
  - The BER performance of Doppler spread compensator is improved due to reduction of Mutual Coupling effect
Polarization & Multi-Path Fading Problem

Making use of Dipole Array with MRC (Maximum Ratio Combining) Diversity

Concept of Dipole Array

- Dipole Array System Model
  Proposed Horizontal Polarization Antenna
  Making efficiency use of MRC Diversity

  Degradation of Doppler Spread effect and Multi-path Fading

Conclusion

- Making use of Dipole Array assisted Doppler Spread Compensator with MRC Diversity
  - A Horizontally polarized Dipole Array mitigate BER Performance due to polarization mismatch between Base Station and Receiver.
  - MRC Diversity reduced BER Performance degradation in Multi-Path Environment.

The Performance of Doppler Spread Compensator improved in Fast Multi-Path Fading Environment