

Reactance-Domain Modulation Scheme for Burst Error Reduction of ISDB-T in Slow Fading Environment

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Presentation Outline

- Introduction of ISDB-T
- Problems of ISDB-T in Fading Environment
- Solution for Fast Fading
 - Array Antenna Scheme
 - Dummy Elements Scheme for Reduction of Mutual Coupling
- Solution for Slow Fading
 - Reactance-Domain Modulation Scheme
- Conclusion



ISDB-T

(Integrated Services Digital Broadcasting for Terrestrial)

- Japanese Digital TV Standard
 - Stationary reception service has been started on December, 2003.
 - 1-segment service (for Mobile reception) has been started on April, 2006.
- Adopts OFDM (Orthogonal Frequency Division Multiplexing) Scheme
 - robust Multi-Path delay
 - (narrow bandwidth among sub-carriers)
 - weak in Doppler Spread

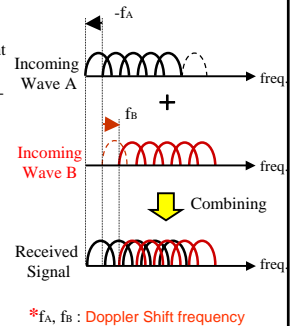
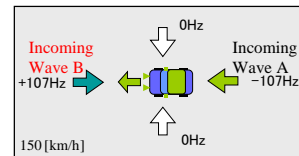


Problems of ISDB-T in Fading Environment

Fast Fading Environment

• Multi-path Environment

- Several incoming waves affect the different Doppler shift
- ISDB-T has narrow bandwidth among sub-carriers (eg. Mode3: 1kHz)



* f_A, f_B : Doppler Shift frequency



Problems of ISDB-T in Fading Environment

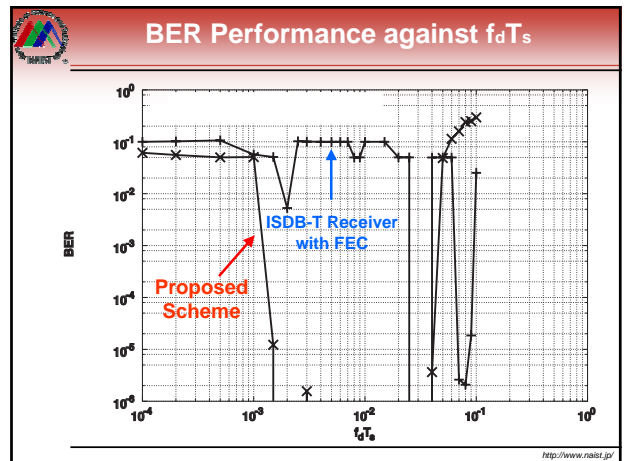
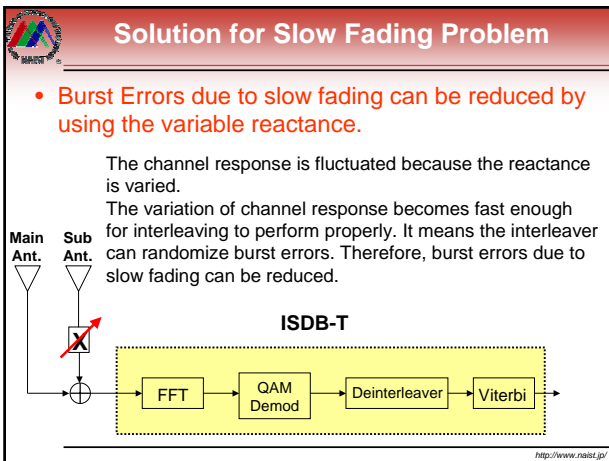
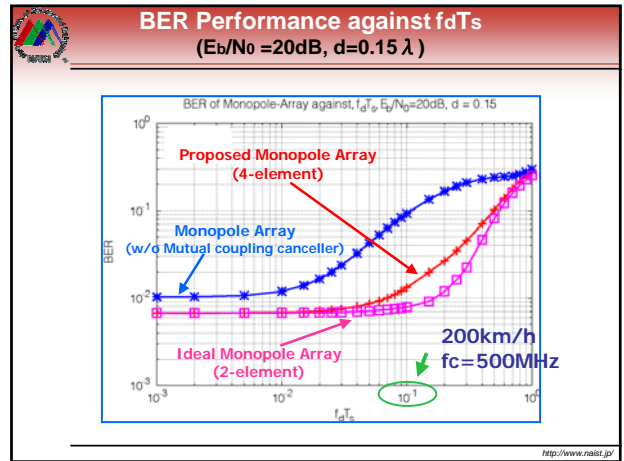
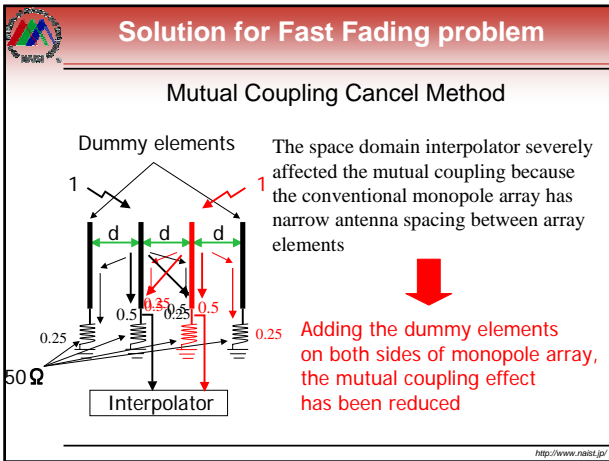
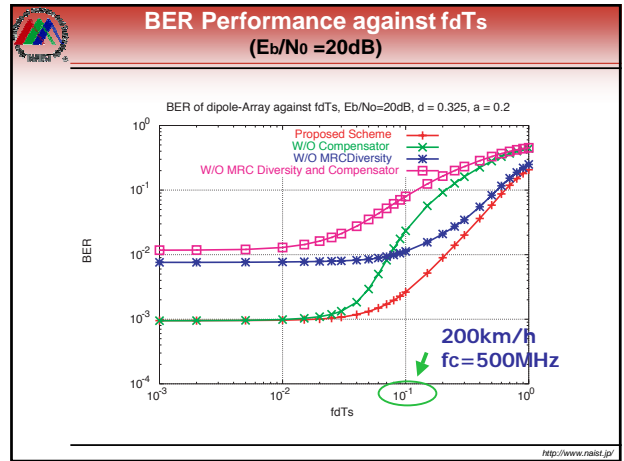
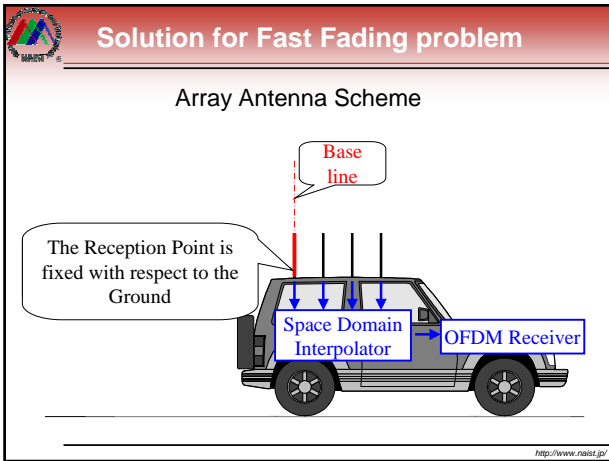
Slow Fading Environment

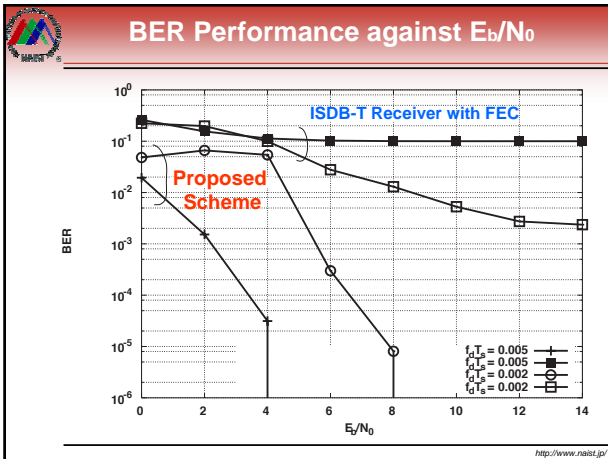
- Slow fading is the result of shadowing by buildings, mountains, hills, and other objects.
 - This phenomenon occurs the mobile TV users walking and standing in the city.
- Burst errors occur due to slow fading.
 - Burst errors can be reduced by using an interleaver.
 - The interleaver is not sufficient for randomizing the burst errors when the maximum Doppler shift frequency is less than 5Hz.
 - (Because the interleaver depth in ISDB-T is around 200ms.)



Solution for Fast Fading problem

- Array Antenna Scheme for Reduction of Doppler Spread Effect
 - Space domain interpolator estimates virtual reception point which is fixed on a ground.
- Dummy Elements Scheme for Reduction of Mutual Coupling Effect
 - Dummy elements can be reduced mutual coupling effect between main elements by coupling between dummy elements and main elements.





Conclusion

- Reactance-domain modulation scheme can reduce burst errors under slow fading environment
 - The variable reactance is possible to change the radiation pattern.
 - The channel response is fluctuated because the radiation pattern is changed.
 - The variation of channel response becomes fast enough for interleaving to perform properly. It means the interleaver can randomize burst errors.
 - Therefore, burst errors due to slow fading can be reduced.