Interference Mitigation with Coordinated Symbol Repetition

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Purpose:

For discussion of inter cell interference mitigation

Introduction

- Improving the cell edge user throughput is important aspect in the system requirement. Legacy system employs the bit repetition to improve the signal to interference power ratio (SIR) in cell edge area.
- This contribution presents interference mitigation with Coordinated Symbol Repetition (CSR) among cells aiming at improved cell edge user throughput.
- We propose the CSR as new main functionality on interference mitigation.

Interference mitigation method with Coordinated Symbol Repetition (CSR)

- If same signals are transmitted on frequency f1 and f2 and interference on f1 and f2 are identical, an MMSE receiver can cancel them.
- A frequency domain interleaver can be employed as long as the repeated symbol mapping is identical among the neighboring cells.

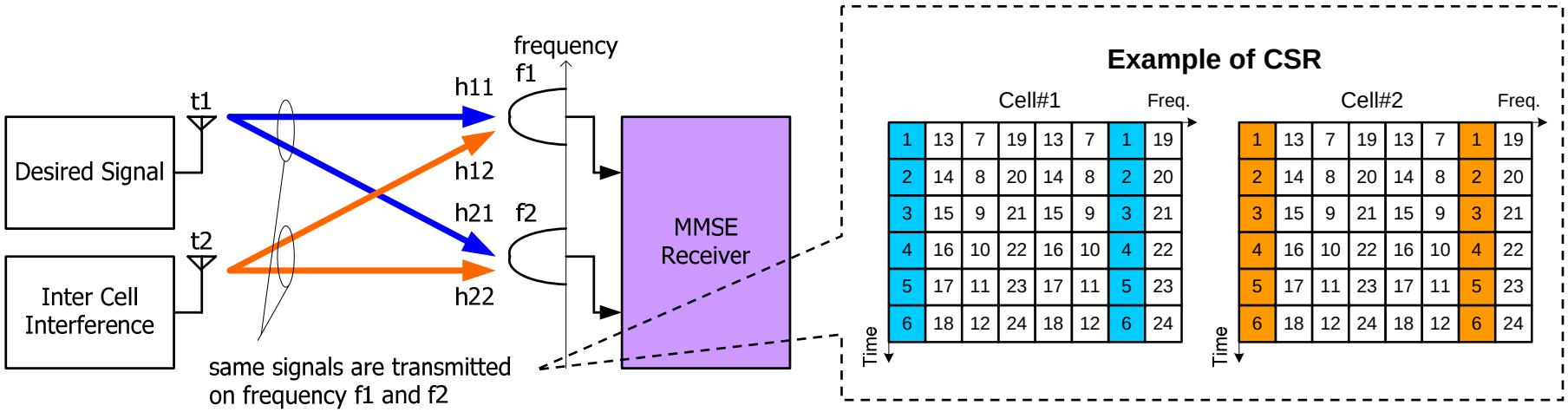

Fig.1 Interference mitigation with the CSR.

Comparison to legacy bit repetition interference mitigation

- An MMSE receiver in ***legacy bit repetition*** can mitigate (N-1) interference signals while that in ***interference mitigation with CSR*** can mitigate (N*RF-1) interference signals thanks to extension into space and frequency domain. (N: Number of reception antennas, RF: Repetition Factor)
- Interference mitigation with CSR has as RF times freedom as that of the legacy bit repetition and needs less numbers of reception antennas to mitigate same number of interference signals.

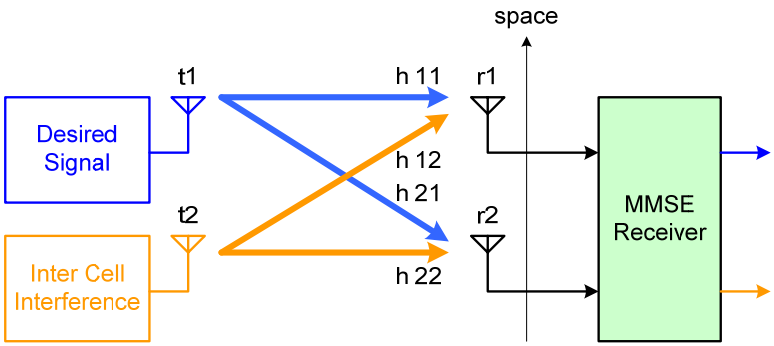

Fig.2(a) An MMSE receiver in ***legacy bit repetition*** (N=2)

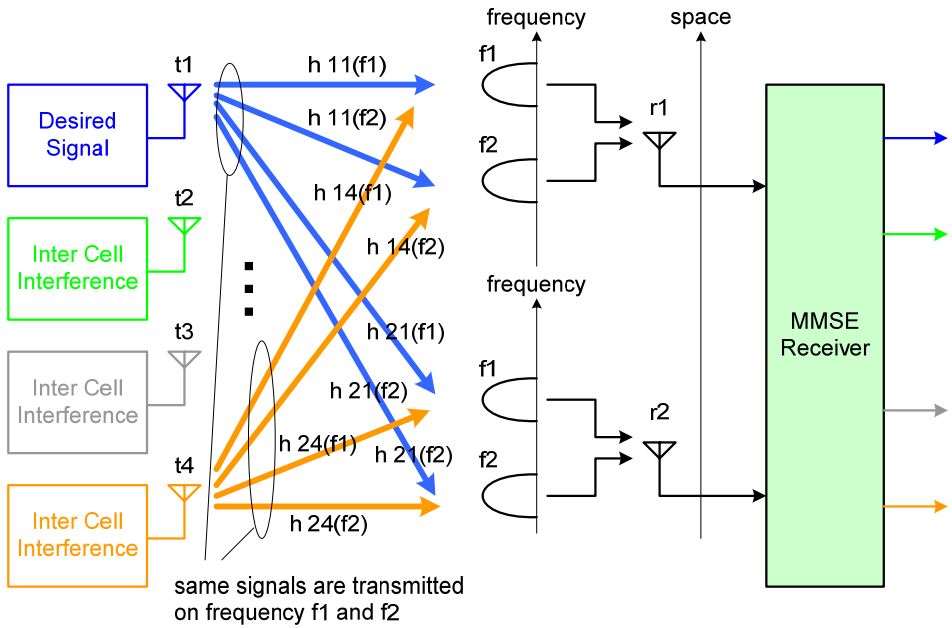

Fig.2(b) An MMSE receiver in ***interference mitigation with CSR*** (N=2, RF=2)

Comparative evaluation

- The interference mitigation with CSR mitigates the inter cell interference by means of MMSE reception, while legacy bit repetition without interference mitigation has “floor” saturation.

Table 1 Simulation assumption.[*]

Cell layout	Desired cell and 1 interference cell
# of reception ntennas	1 [**]
Transmission BW	10MHz
Sub-carrier spacing	15kHz
Sampling frequency	15.36MHz
FFT size	1024
Channel environments	Typical Urban 3km/h
Channel estimation	Ideal
Decoder algorithm	Max-Log-MAP with 8 iterations
Modulation	QPSK
Channel coding	Turbo code as 1/3
Repetition	•Legacy bit repetition •Symbol repetition
Bit repetition	Rate matching repeats to 1/4
Symbol repetition	Puncturing to 1/2 by bit level and then symbol level repetition to 1/4 (RF=2)

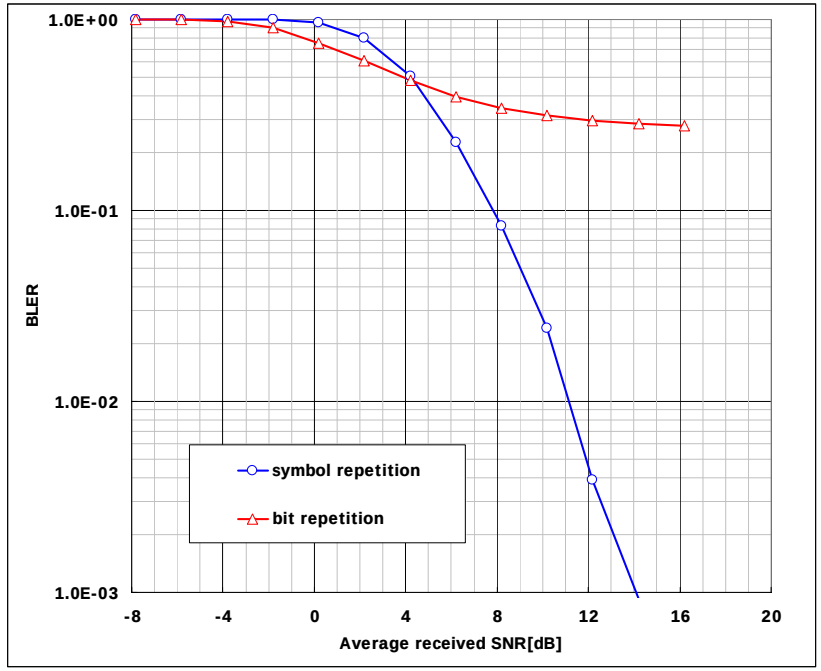

Fig. 3 Block error rate (BLER).

[*]Note that although simulation assumption is not 16m reference, characteristic tendency is same.

[**] We assumed one reception antenna since the effect of interference mitigation in both two reception antennas with RF=2 case and one reception antenna with RF=2 case.

Conclusion

- Improving cell edge throughput is a key issue to achieve the system requirement.
- Interference mitigation with CSR serves better inter cell interference mitigation ability than legacy bit repetition without interference mitigation.
- We believe that interference mitigation should be discussed in SDD.
- We propose to adopt interference mitigation with CSR as new main functionality on interference mitigation to SDD discussion.