

Agenda Item:

Source: CWTS

To: TSG RAN WG1

Title: The performance improvement from Smart Antenna

Document for: Discussion

Introduction

This paper introduces some simulation results for the performance analysis of smart antennas for low chip rate TDD.

The benefit of smart antenna

This section introduces the performance improvement from Smart Antenna for low chip rate TDD.

Simulation results for system with smart antenna and without smart antenna are both given in the following subsections. And the simulation results when deployed different number of users are also given. From the comparison of the simulation results, we can see that when smart antennas used, the required C/I is reduced and thus the system performance is evidently improved.

The antenna array used is a circular array with the elements $N=8$.

Simulation results

Multiplexing of 12.2kbps data and 2.4kbps data.
[For service mapping see section 13 B2 and B3 of TR25.928.]

1. 2.4kbps data path

Simulation parameters:

Channel model: vehicular A (Speed 120km/h)

Coding:CC ,coding rate =1/2

Link: Uplink

SF:16

Number of time slot: 1

Codes per user: 2

L1 control signals: No

TFCI: No

Case 1 number of user per time slot =1

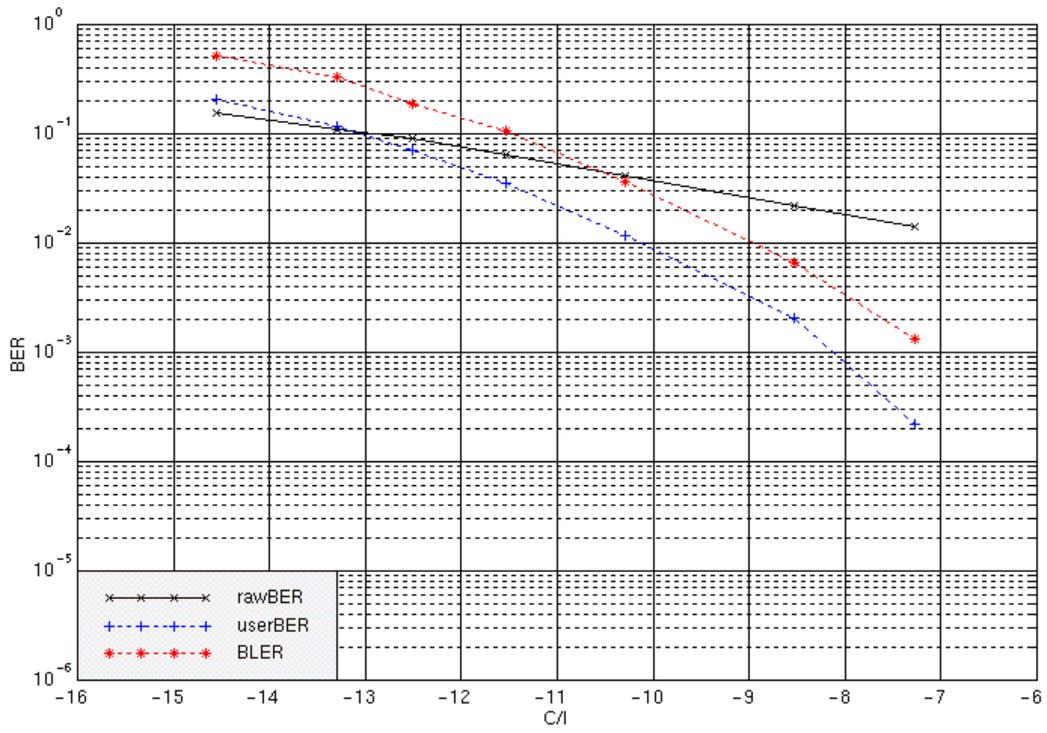


Figure 1: BER vs. C/I for 2.4kbps service, 1 user, with Smart Antenna

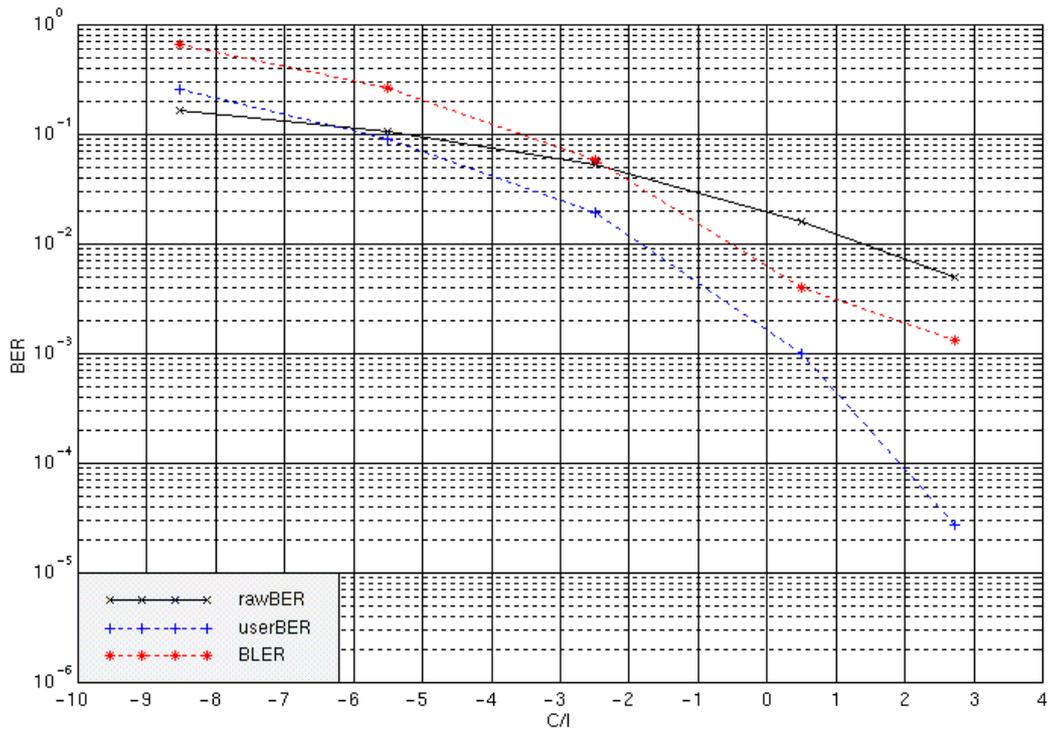


Figure 2 Performance of BER vs. C/I for 2.4k service, 1 users, without Smart Antenna

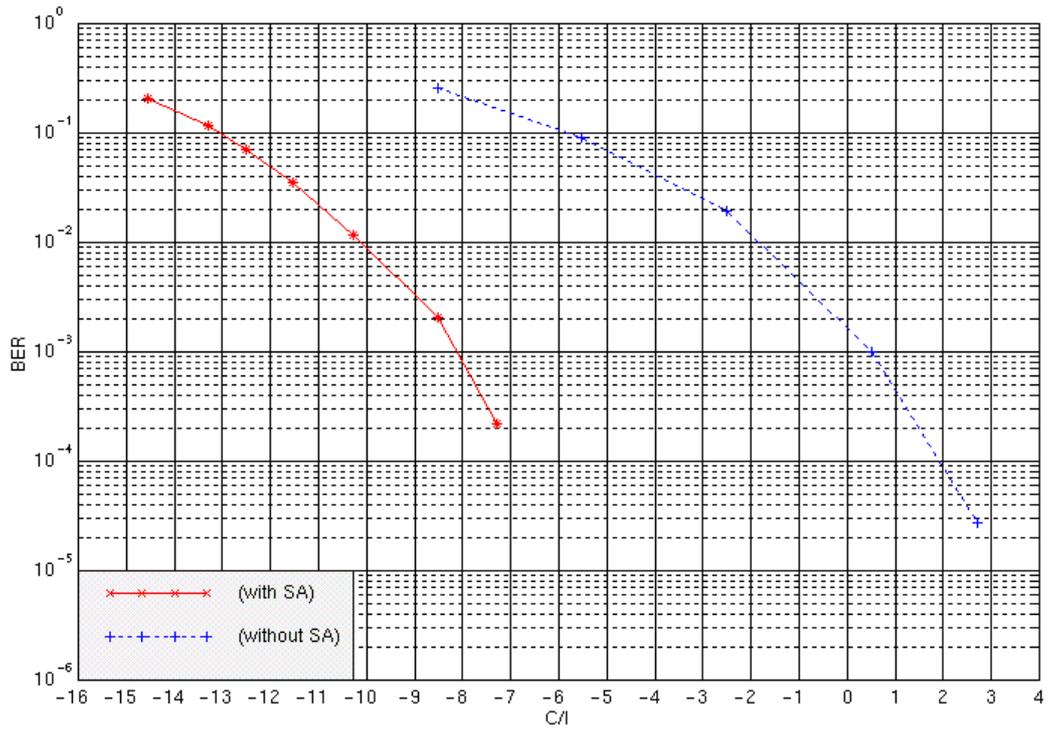


Figure 3 Performance comparison of UserBER vs. C/I for 2.4k service, 1 user, with SA or without SA

Case 2 number of users per time slot = 4

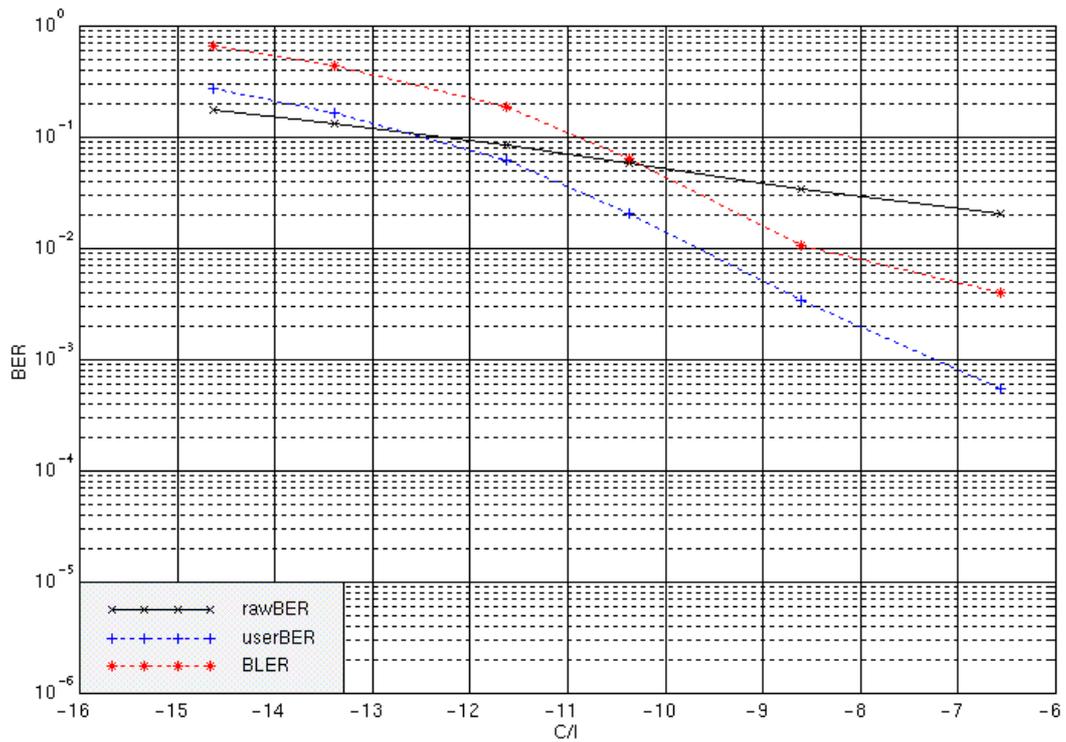


Figure 4 Performance of BER vs. C/I for 2.4k service, 4 users, with SA

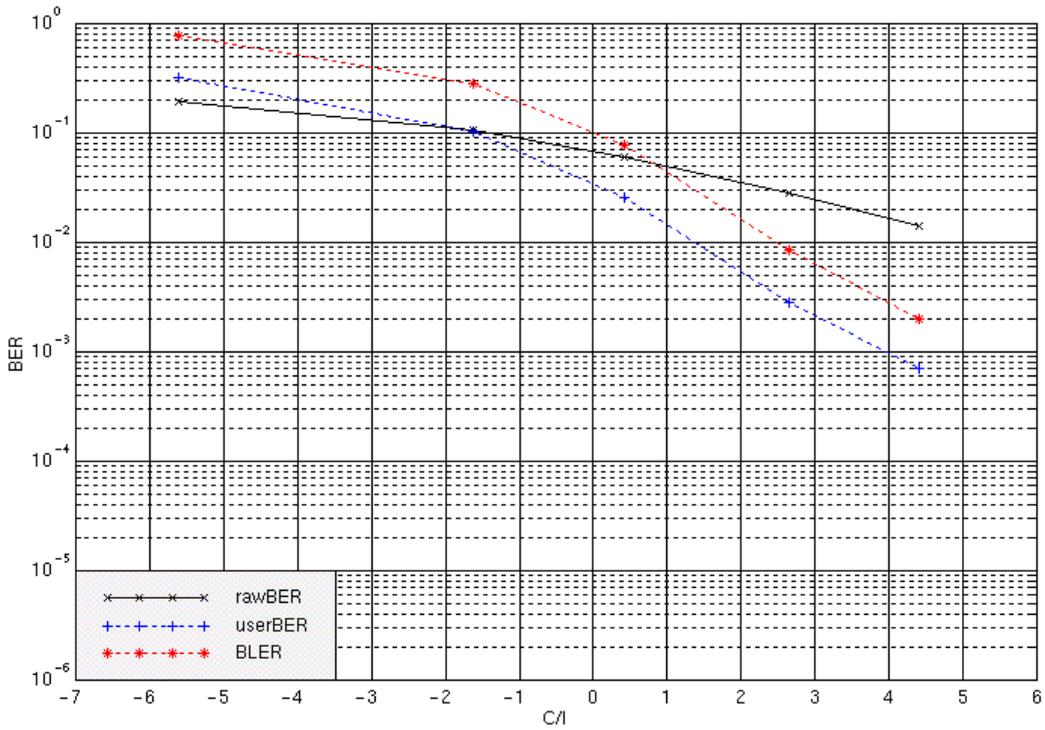


Figure 5 Performance of BER vs. C/I for 2.4k service, 4 users, without SA

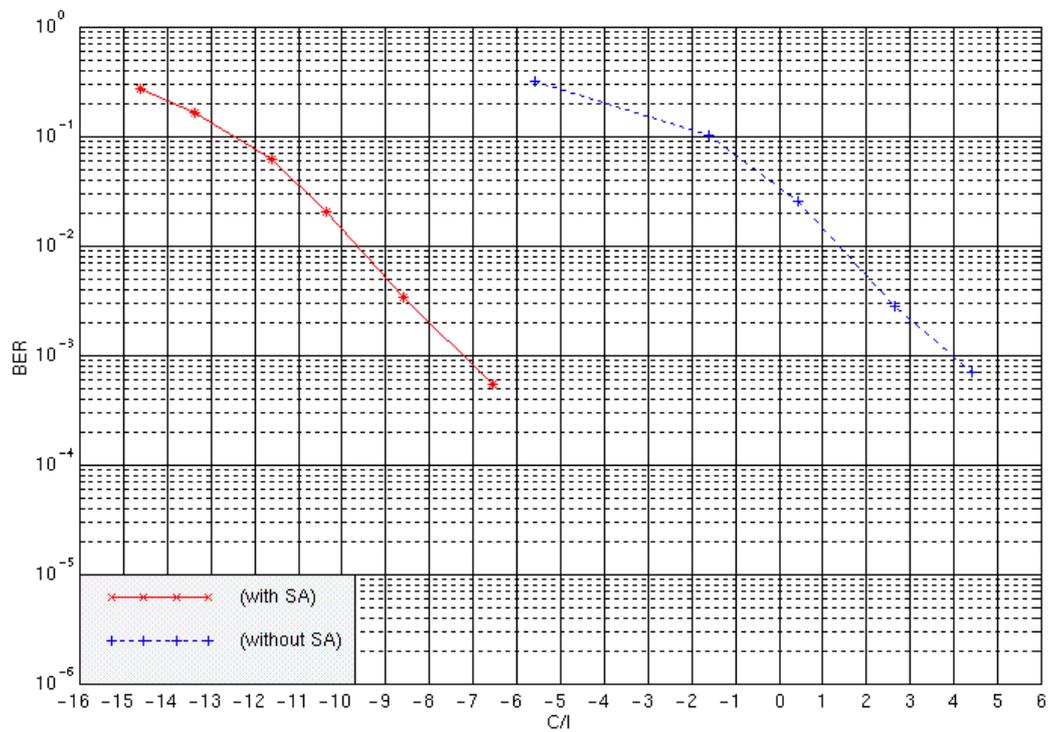


Figure 6 Performance comparison of UserBER vs. C/I for 2.4k service, 4 users, with SA or without SA

Comparison of C/I (BER 10^{-3})

	With Smart Antenna	Without Smart Antenna
One user	-8.1	0.5
Four user	-7.2	4

2. 12.2kbps data path

Simulation parameters:

Channel model: vehicular A (Speed 120km/h)

Coding: CC ,coding rate=1/2,class C and B

CC, coding rate=1/3,class A

Link: Uplink

SF:16

Number of time slot: 1

Codes per user: 2

L1 control singals: 4 bits.

TFCI: 16 bits(8 bits per subframe).

Case 1 number of user per time slot = 1

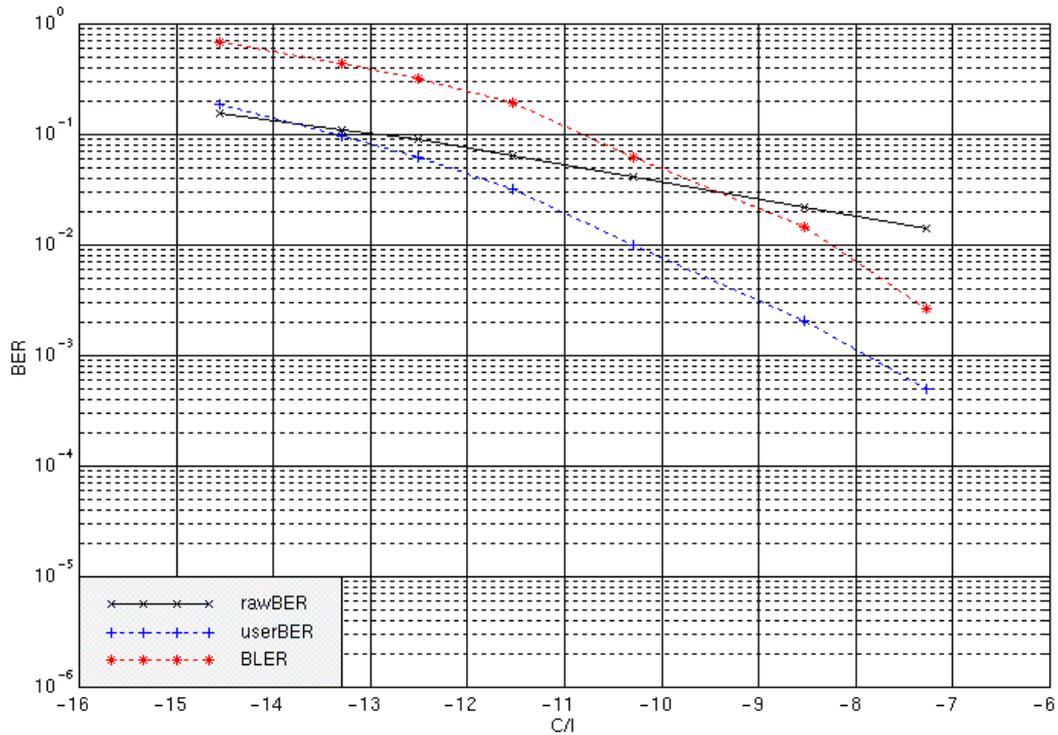


Figure 7 Performance of BER vs. C/I for 12.2k service, 1 user, with SA

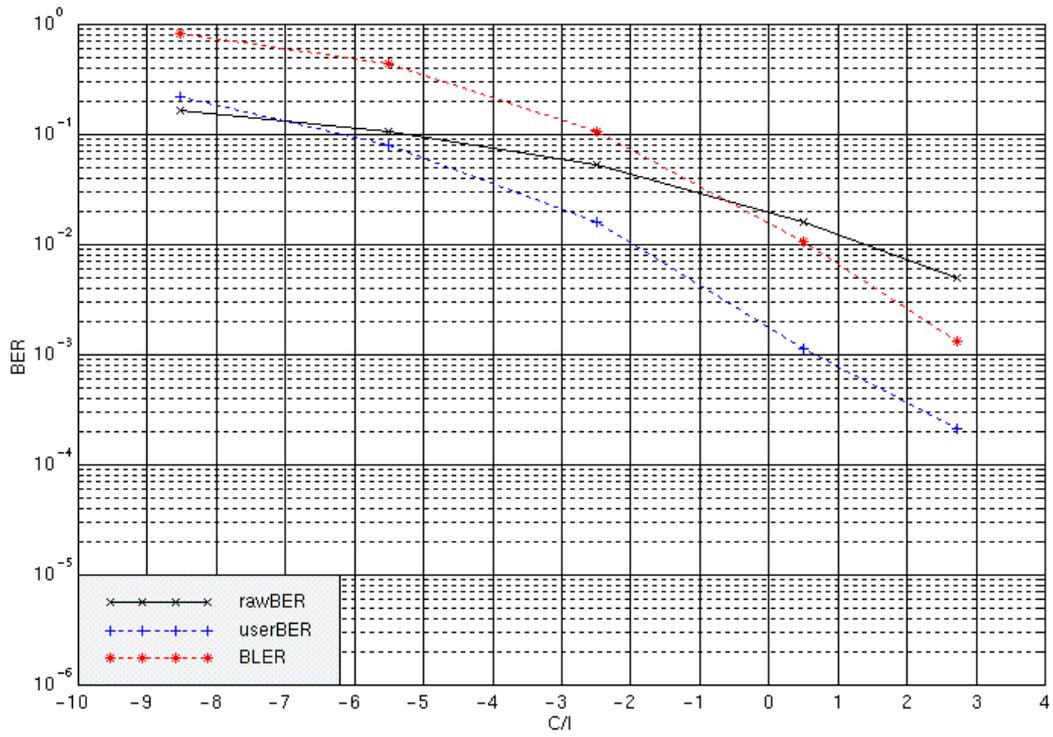


Figure 8 Performance of BER vs. C/I for 12.2k service, 1 users, without SA

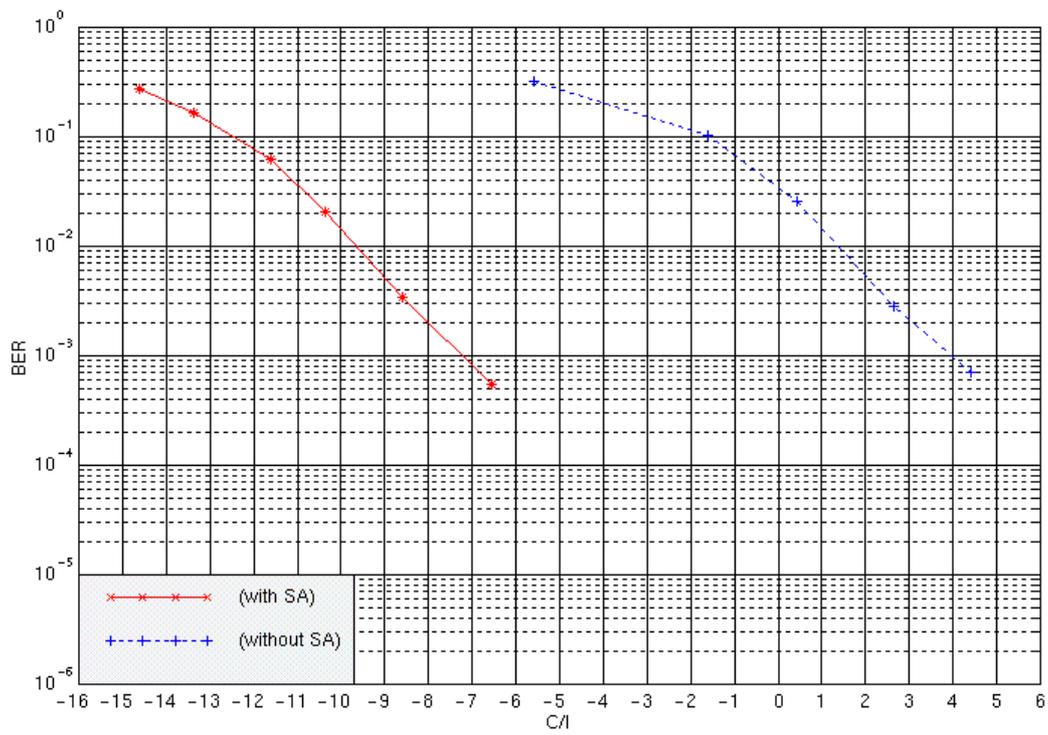


Figure 9 Performance comparison of UserBER vs. C/I for 12.2k service, 1 user, with SA or without SA

Case 2 number of users per time slot = 4

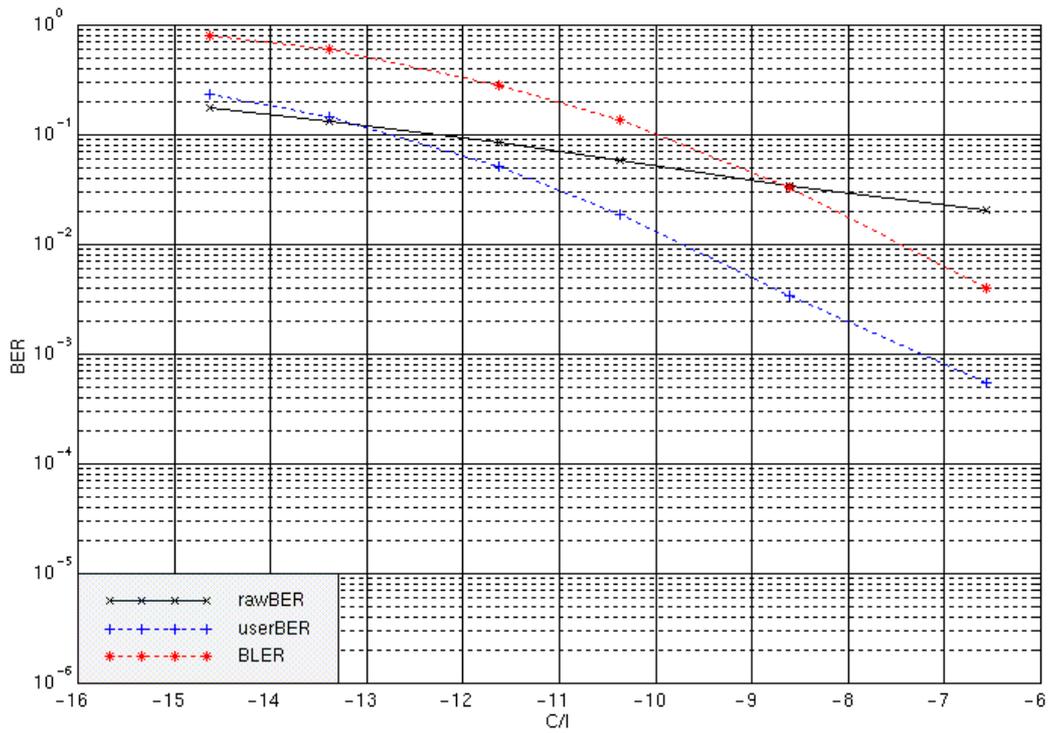


Figure 10 Performance of BER vs. C/I for 12.2k service, 4 users, with SA

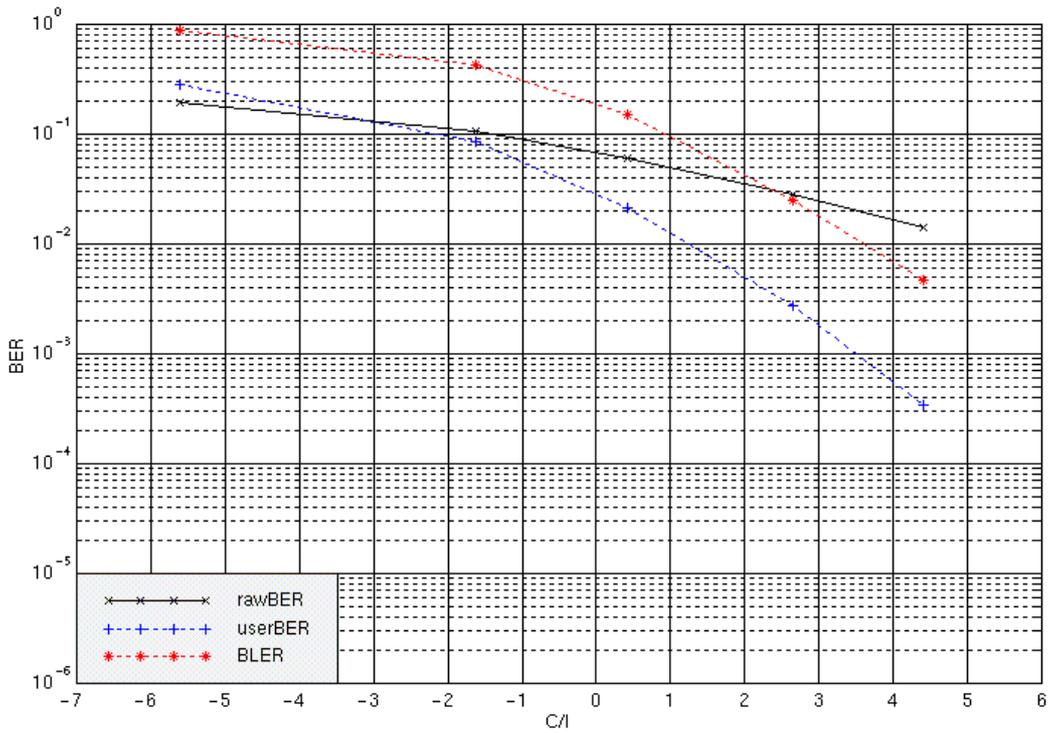


Figure 11 Performance of BER vs. C/I for 12.2k service, 4 users, without SA

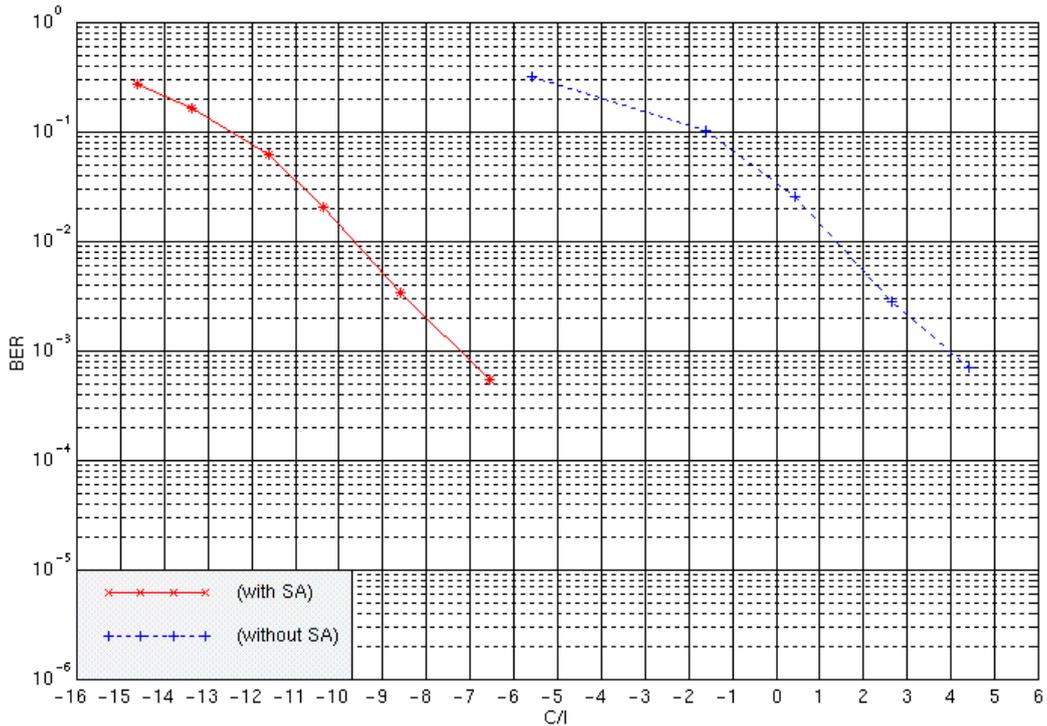


Figure 12 Performance comparison of UserBER vs. C/I for 12.2k service, 4 users, with SA or without SA

Comparison of C/I (BER 10^{-3})

	With Smart Antenna	Without Smart Antenna
One user	-7.9	0.7
Four user	-7.2	3.5

Benefit can be seen from comparison

Compare the figures with smart antenna and that without smart antenna, one can find that with the applying of smart antenna, the C/I is evidently reduced. And the direction gain of the circular antenna array is about N, so the gain of beamforming can be $10\log N$ dB in theory. Actually, the gain maybe a little different to the theory value because of the different diversity gains.

With more users in the same timeslot, the Multi Access interference is increased and the required C/I is increased. With smart antenna, using the beamforming, the multi access interference from other users can be greatly reduced. And then the system performance can be improved. This gives the possibility to work on the whole code channels designed simultaneously.

conclusion

From the comparison of several aspect, such as different service, different number of users, we can draw a conclusion that smart antenna will effectively reduce the interference from other user and thus greatly improve the system performances.

Smart antennas play an important role in interference cancellation and the improvement of the performance. It provides the possibility to work on the whole code channels in one time slot simultaneously and to enhance the system capacity. At the same time the spectrum efficiency can be greatly increased.

As one of the key features of low chip rate option, smart antennas have obvious benefit to the system, so it is recommended to adopt this technology.