Project	IEEE 802.16 Broadband Wireless Access Working Group <**http://ieee802.org/16**>
Title	Proposal for 802.16h Interference Cancellation
Date Submitted	2005-07-09
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Re:	**Call for Contributions, IEEE 802.16h Task Group on License-Exempt Coexistence, IEEE 80216h-05_014**
Abstract	**Propose the Interference Cancellation for 802.16h**
Purpose	**Information**
Notice	
Release	
Patent Policy and Procedures	

Proposal for 802.16h Interference Cancellation

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1. Introduction

The scope of the paper is to provide text for the IEEE 802.16h standard, to be inserted as a new section name "Interference cancellation".
The co-channel interference (CCI) is the basic barrier which the coexistence systems will encounter. Besides the mechanism of interference detection, interference identification, interference prevention, pro-active cognitive approach and interference reduction policies [5], interference cancellation is one of the promising candidates which can help solving the CCI issue and facilitate the system coexistence.

2. Background

Interference cancellation can be interpreted to mean the class of techniques that demodulate and/or decode desired information, and then use this information along with channel estimates to cancel received interference from the received signal.

The advantages of interference cancellation are as follows:

- **It makes it possible for 802.16 system to coexist with either 802.16 system or non 802.16 system.**
- **It doesn't matter whether or not the TX/RX of MAC frame is synchronized. However, TX/RX synchronization can ease the complexity of interference canceller.**
- **It is possible to be combined with the current "Time-division" coexistence mechanism to limit a complex community into a reasonable size.**
- **It can be "technology independent" and is backward compatible with current standards.**

The interference cancellation can be achieved by advanced signal processing techniques at the physical layers at both the BSs and SSs. The interference cancellation technique is similar with multi-user detection (MUD). However, it has less complexity and cost in the circumstance of system coexistence compared with the CDMA's multi-address interference. In CDMA, in the uplink the base station receiver must decode all desired users while suppressing other cell interference from many independent sources. But in 802.16h, in both the downlink and the uplink, each receiver of either BS or SS only needs to decode a single desired signal from the interfered signal, while suppressing other co-channel interference from a few dominant sources.

CCI cancellation can be best handled by an ML receiver. But the ML complexity is exponential with respect to the number of interference, this is generally too complex. Linear techniques are frequently considered, usually in the form of zero-forcing or MMSE designs, and are attractive from a complexity point of view but not very robust. Nonlinear interference cancellation techniques tend to be the most practical solution with the best performance.

Hybrid schemes that employ a combination of linear and nonlinear processing are also possible. The

hybrid schemes are referred to as "blind" techniques since they do not require estimation of the channel response of the interferer. It makes the single-antenna interference cancellation (SAIC) receivers possible. These kinds of interference "cancelling" receivers may employ either ML detection or predetection processing rather than the postdetection interference cancellation.

For more than two years, the Third Generation Partnership Project, Technical Specification Group, GSM/EDGE Radio Access Network (3GPP TSG GERAN) has carried out a feasibility study on SAIC for GSM networks (Release 6) [1], aimed at reducing the reuse factor of GSM/GPRS/EDGE networks. Since November 2003, a new work item, Downlink Advanced Receiver Performance (DARP), has been set up within 3GPP TSG GERAN to specify the performance requirements for mobile terminals from Release 6 onward. In field trails, significant gains due to interference cancellation have already been demonstrated [2].

3. Example of Interference cancellation

Well-known and successful examples of interference cancellation, such as the Vertical BLAST system [3] and industry adaptations of spatial interference cancellation receivers for multi-antenna systems [4] can be used to separate spatially multiplexed streams of data.

A high-level block diagram of a BLAST system is shown in Fig. 1. A single data stream is demultiplexed into *n* substreams, A1,…An, and each substream is then encoded into symbols and fed to its respective transmitter. The V-BLAST detector consists of two components: a linear transformation and an ordered successive interference canceller. The linear transformation eliminates the spatial interference and can be based on a zero-forcing or minimum mean squared error (MMSE) criterion. Following the transformation, the coded symbols of the substream with the highest signal to noise ratio (SINR) are detected, and its signal is subtracted from the received signal. The linear transformation and ordered successive interference cancellation are repeated until all substreams have been detected. These types of post-processing receivers often significantly outperform standalone linear receivers such as MMSE or zero-forcing in noisy environments.

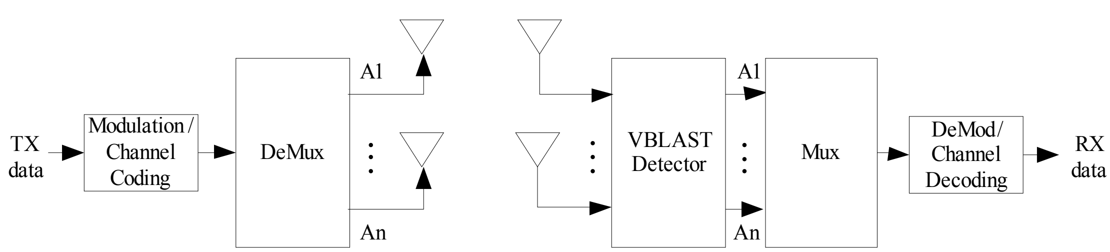

Fig. 1 V-BLAST system diagram

Since the *n* substreams in V-BLAST system can be independent, one possible approach of interference cancellation with similar MIMO receiver is shown in Fig.2 and Fig.3 to cancel co-channel SS-to-BS interference and co-channel BS-to-SS interference.

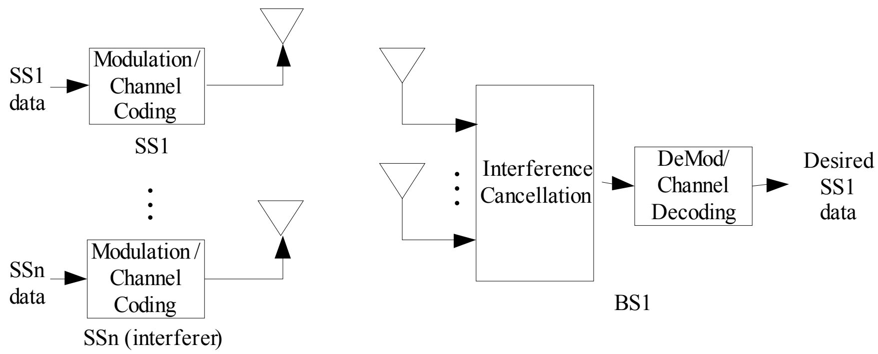

Fig. 2 Uplink MIMO receiver with Interference cancellation

Fig. 3 Downlink MIMO receiver with Interference cancellation

4. Proposed Text Changes

Acronyms

IC Interference cancellation

[*Insert the following section after section "4 Interference prevention"*]

5 Interference cancellation

5.1 MIMO interference cancellation

5.2 Single-antenna interference cancellation

References

[1] 3GPP TSG GERAN TR, "DRAFT Feasibility Study on Single Antenna Interference Cancellation (SAIC) for GSM Networks (Release 6)," Apr. 2004.
[2] A. Mostafa et al., "Single Antenna Interference Cancellation (SAIC) for GSM Networks," Proc. IEEE VTC, Orlando, FL, Oct. 2003, pp. 1089–93.
[3] P. W. Wolniansky, G. J. Foschini, G. D. Golden, R. A. Valenzuela, "V-BLAST: An Architecture for Realizing Very High Data Rates Over the Rich-Scattering Wireless Channel", Bell Laboratories, Lucent Technologies, Crawford Hill Laboratory 791 Holmdel-Keyport Rd., Holmdel, NJ 07733
[4] Lucent, "Increasing MIMO Throughput with Per-Antenna Rate Control," TSGR1#21(01)0879, Turin, Italy, Aug. 2001, pp. 1–13.
[5] IEEE 802.16-05/013: working document Amendment for Improved Coexistence Mechanisms for License-Exempt Operation 2005-06-06