

Agenda item: 7.10.3
Source: Broadcom, Lucent-Alcatel, Huawei, Nokia.
Title: SFBC Definition Based on the 3GPP WCDMA/HSDPA Standard
Document for: Discussion/Decision

1. Introduction

For the 2 transmit antenna diversity scheme, majority of the companies proposed during the Malta meeting, March 2007, Space-Frequency Block Code (SFBC) technique [1]. The SFBC technique proposed is based on the original Space-Time Block Code (STBC) technique proposed by Alamouti [2]. In the original Alamouti scheme, conjugate symbols are transmitted on both antennas. However, it would be more desirable that symbols without conjugation (without change) are transmitted on the first antenna during the two consecutive time slots (STBC scheme) or two consecutive frequency tones (SFBC). The same definition was adopted in the original 3GPP WCDMA standard [3]. The reason for such a definition is hardware compatibility with single transmit antenna and also that it makes testing of the proposed transmit diversity quite easier (with the second antenna disconnected the system falls back to the normal mode transmission).

2. SFBC Scheme

In the original Alamouti transmit diversity scheme [2], the transmission of symbols s_1 and s_2 during the two consecutive time slots t_1 and t_2 (or tones, i.e. frequencies f_1 and f_2) from the transmit antennas Tx1 and Tx2 is defined as follows:

	t_1 or f_1	t_2 or f_2	
Tx1	s_1	$-s_2^*$	(1)
Tx2	s_2	s_1^*	

We propose the following SFBC definition, same as [3]:

$$\begin{array}{ccc} & f1 & f2 \\ \text{Tx1} & s1 & s2 \\ \text{Tx2} & -s2^* & s1^* \end{array} \quad (2)$$

3. Conclusions

We propose that SFBC scheme described in Sec. 2, Eq(2), is adopted for the E-UTRA system because of the hardware compatibility with the single antenna transmission mode as well as for the ease of testing and debugging, more so because it is already a part of the 3GPP WCDMA/HSDPA standard.

4. References

- [1] R1-071457 – “Transmit Diversity Way Forward for E-UTRA Downlink Shared Data Channel”.
- [2] S. M. Alamouti “A *Simple Transmit Diversity Technique for Wireless Communications*,” IEEE Journal on Selected Areas in Communications, Vol. 16, No. 8, October 1998, pp. 1451-1458.
- [3] 3GPP TS 25.211 – “Physical Channels and Mapping of Transport Channels onto Physical Channels (FDD)”.