Project	**IEEE 802.16 Broadband Wireless Access Working Group** <http://ieee802.org/16>
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Source(s)	Ozgur Oyman, Jerry Sydir, Alexei Davydov, Alexander Maltsev, Honggang Li, Rui Huang, Vadim Sergeyev E-mail: ozgur.oyman@intel.com Email : jerry.sydir@intel.com Intel Corporation 2200 Mission College Blvd., Santa Clara, CA 95054 U.S.A.
Re:	TGm SDD: Relay IEEE 802.16m-08/040: Call for Comments and Contributions on Project 802.16m System Description Document (SDD)
Abstract	This document provides an overview of cooperative relay for 802.16m to enable throughput and reliability improvement.
Purpose	For consideration and adoption into the 16m SDD document.
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Cooperative Relaying for IEEE 802.16m

*Ozgur Oyman, Jerry Sydir, Alexei Davydov, Alexander Maltsev,
Honggang Li, Rui Huang, Vadim Sergeyev*

Intel Corporation

A. Introduction:

This document provides an overview of cooperative relaying for IEEE 802.16m to enable throughput and reliability improvement. Further technical content toward the SDD on related cooperative relay concepts can be found in the following contributions:

[1] A. Davydov et. al., "Cooperative Relaying Mode Proposal for IEEE 802.16m", IEEE C802.16m-08/1280

[2] O. Oyman et. al., "Cooperative HARQ for IEEE 802.16m: DL Mode", IEEE C802.16m-08/1278

[3] O. Oyman et. al., "Cooperative HARQ for IEEE 802.16m: UL Mode", IEEE C802.16m-08/1279

B. Proposed Text:

[Insert the following text into section 15 of the SDD:]

15.X Cooperative Relaying

Cooperative relaying is a technique whereby either the BS and one or more RSs, or multiple RSs cooperatively transmit or receive the same data to/from an MS. This enables multiple transmitting/receiving stations to partner in sharing their antennas and other resources to create a virtual antenna array, allowing the extraction of multiple-input multiple-output (MIMO) system benefits such as transmit/receive diversity, spatial multiplexing and array gains (i.e., power efficiency) from the wireless channel in a distributed fashion.

RS-1 coverage
area

BS coverage area

MS

Cooperative mode
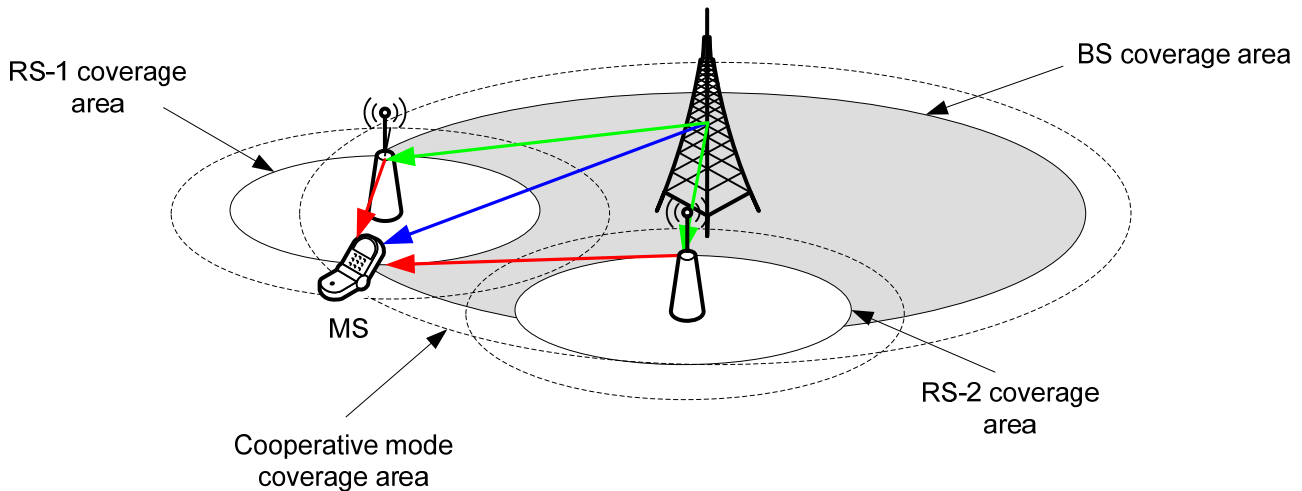coverage area

RS-2 coverage
area

Figure X- Example for cooperative relaying in the DL mode.

In 16m, cooperative relaying can be used within sectors in which RSs are deployed. Cooperative relaying is used in 16m in both downlink (DL) and uplink (UL) modes. In DL cooperative relaying, the BS and/or multiple RSs transmit in cooperation the same data to a target MS. In UL cooperative relaying, the BS and/or multiple RSs receive in cooperation the same data from the target MS. Figure X shows some examples of cooperative relay transmissions in the downlink. Cooperation may occur just across multiple RSs, as illustrated by the red transmissions from the two RSs to the MS. The BS may also join the set of cooperating stations, such that cooperation occurs between the BS and one or more RSs.

In 16m, cooperative relay modes can be defined in terms of the MIMO modes which are specified as part of the baseline system. Specific MIMO modes are selected for use with cooperative relaying. These modes can include both open loop MIMO techniques and closed-loop MIMO techniques. Moreover, both MIMO transmit/receive diversity and MIMO spatial multiplexing techniques that are part of the 16m baseline system can be utilized in conjunction with cooperative relaying. Some example cooperative relaying modes include distributed space-time block coding (STBC) or space-frequency block coding (SFBC), cooperative source/transmit/hybrid diversity, and cooperative precoding/beamforming. See sections 15.X.1 and 15.X.2 for a description of these modes. *[Note to editor: these sections are proposed in contribution C80216m-08_1280]*

Another important aspect of cooperative relaying is the handling of errors that might occur in the process of DL and UL transmissions in 16m. Cooperative HARQ techniques are used to deal with these errors in a more reliable manner. For instance, in the DL cooperative HARQ context, appropriately coded signals across BS and/or one or more RS terminals are transmitted cooperatively during the forwarding and retransmission of a burst to the MS, to ensure high decoding reliability. See section 15.X.3 for a description of cooperative HARQ techniques. *[Note to editor: this section is proposed in contributions C80216m-08_1278 and C80216m-08_1279]*