Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Frequency Domain Power Allocation for Stationary Relay Links**
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Re:	IEEE 802.16j-06/034: “Call for Technical Proposals regarding IEEE Project 802.16j”
Abstract	A frequency domain power allocation scheme for stationary relay links for interference management and throughput optimization is proposed.
Purpose	For discussion and approval for inclusion of the proposed text into P802.16j baseline document.
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Frequency Domain Power Allocation for Stationary Relay Links

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1. Motivation and Concept

It has been recognized that deploying MRSs in the traditional cellular network architecture can increase coverage and throughput. However, since the relay links (RLs: MR-BS—RS and RS—RS links) are essentially backhaul links that carry aggregated traffic from multiple SSs, it is important to provision high and stable capacity for these links. Moreover, multi-hop relaying can potentially consume multiple spectral and temporal resources for duplicate traffic over multiple hops. To minimize the loss in the throughput due to such inefficient radio resource usage and to maximize the overall throughput, it is desirable to reuse the spectral resource as much as possible and to maximize the spectral efficiency of the transmission. One way of meeting these challenges is to employ adaptive power allocation [1].

The focus of this proposal is an intelligent *frequency domain* power allocation scheme mainly for stationary RLs (See Fig. 1). An important usage scenario in a 16j network is deploying static or nomadic RSs for coverage and throughput enhancement. In this usage scenario, the channel characteristics can be closely approximated as quasi-static. Thus, it becomes feasible that the MR-BS (infrequently) collects the statistics on the mutual interference between the RLs to centrally optimize the power profile for each of the RLs in its MR cell.

Since the antenna height of the RSs are typically much lower than that of the BSs, depending on the deployment scenarios, the RLs may exhibit high frequency selectivity. From the viewpoint of interference management, this means that the links may interfere or not depending on the frequency bands (See Fig 2). Therefore, significant gain can be achieved by optimizing the transmit power profile in the frequency domain.

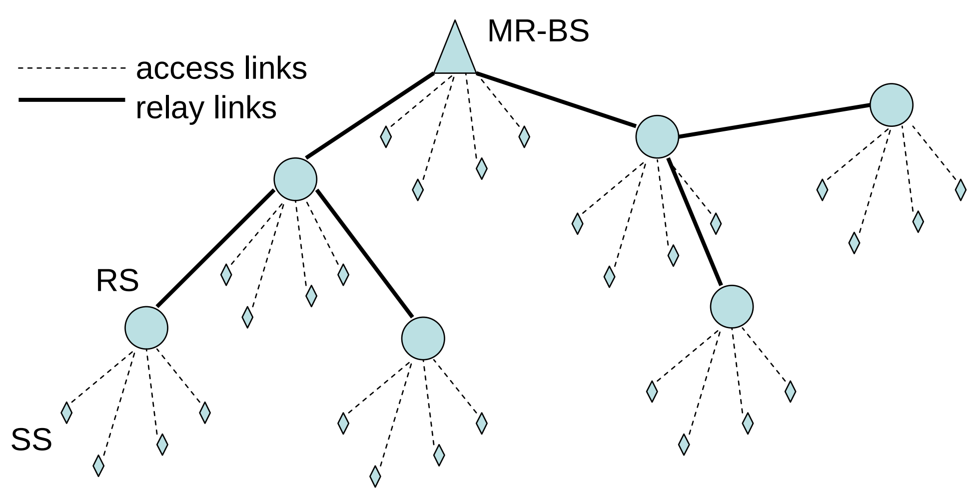

Fig. 1: A MR network example.

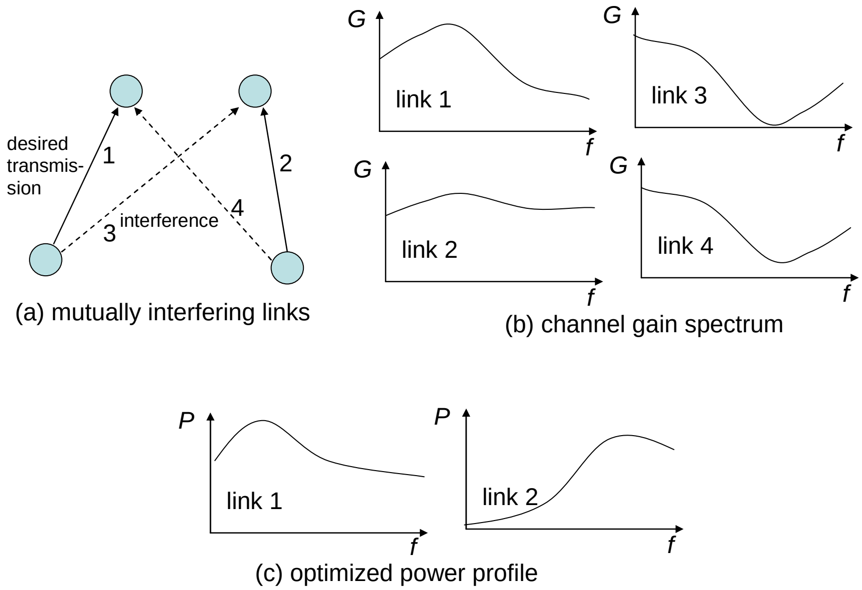

Fig. 2: Optimized power profile example. Since link 1 and link 3 mutually interfere considerably through link 3 and link 4, an interference management scheme that does not take the gain spectrum into account may decide that link 1 and link 3 cannot reuse the same spectral resource. However, in fact, the two links do not interfere very much in the high frequency band, which can be exploited to achieve significant gain.

2. Procedure

For the RL sounding, which can be performed periodically, the MR-BS shall collect the channel gain spectra between the backhaul stations (MR-BS and RSs). The MR-BS first determines and broadcasts the sounding parameters to the RSs in its MR cell. When a station transmits the sounding signal, all the other backhaul stations shall listen to estimate the channel gain spectrum. This process is repeated until the channel gain spectra of the links from all stations are measured at each station. The channel gain spectra are then collected at the MR-BS to run the RRM algorithm. The implementation of the RRM algorithm is out of scope of the standard. Then, the MR-BS transmits the optimal transmit power profile to be used at each RS.

To get an updated channel gain spectra during the time period between the periodic RL sounding operations, the CINR is estimated in the frequency domain in each of the RLs. When the MR-BS solicits the RSs for channel measurement reports, the RSs reply with the CINR measurements from their neighbor backhaul stations. The MR-BS can occasionally update the transmit power spectra for the RLs in its cell based on these measurements.

3. Text Proposal

Insert a new subclause 6.3.27.2:

6.3.27.2 Frequency domain power allocation for stationary relay links

In the case the relay links are relatively static (e.g. in the static or nomadic RS deployment scenarios), transmit power allocation for the relay links in a MR cell can be centrally optimized for interference management and throughput enhancement. To account for the frequency selectivity of the relay links, the channel gain spectra must be collected for the channels between the MR-BS and the RSs in the MR cell as well as the channels between the RSs in the MR cell.

Insert a new subclause 6.3.27.2.1:

6.3.27.2.1 Sounding of relay link channel gain spectra

The procedure for sounding the channel gain spectra is described.

Insert a new subclause 6.3.27.2.2:

6.3.27.2.2. Update for relay link channel gain spectra

The procedure for measurement and update of the channel gain spectra is described.

11.11 REP-REQ management message encodings

Change fourth row of the second table in 11.11 as indicated:

Name	Type	Length	Value
Channel Type request	1.3	1	0b00 = Normal subchannel, 0b01 = Band AMC Channel, 0b10 = Safety Channel, 0b11 = ~~Reserved~~Sounding 0b110 = RL Sounding

11.12 REP-RSP management message encodings

Insert the following rows into the third table as indicated:

REP-REQ Channel Type request	Name	Type	Length	Value
0b110	RL Sounding Report	2.6	TBD	TBD

References

[1] IEEE C802.16j-06/169r2, "Harmonized text proposal for interference measurement"