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Title	**Frame structure for out-of-band relay**
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Source(s)	Youngbin Chang, Changyoon Oh, Hyoung Kyu Lim, Jaeweon Cho, Panyuh Joo Samsung Electronics 416, Maetan-3dong, Youngtong-gu, Suwon-si, Gyeonggi-do, Korea [mail to: yb.chang@samsung.com changyoon.oh@samsung.com] Rakesh Taori Samsung Advanced Institute of Technology [mail to: rakesh.taori@samsung.com]
Re:	Call for technical proposals regarding IEEE project P802.16j
Abstract	This contribution proposes the frame structure for multi-hop relay in out of band system. When the RS has at least two available RF channels and two transceivers, the 16e frame structure can be applied to out-of-band relay with no changes.
Purpose	Discussion and Adoption in IEEE 802.16j
Notice	
Release	
Patent Policy and Procedures	

Frame structure for out-of-band relay

Youngbin Chang, Changyoon Oh, Hyoung Kyu Lim, Jaeweon Cho, Panyuh Joo
Samsung Electronics
Rakesh Taori
Samsung Advanced Institute of Technolog

Introduction

In [1], out-of-band relay is defined as “MMR using different RF channels on relay links (i.e. MMR-BS-to-RS or RS-to-RS) and access links (i.e. MMR-BS-to-MS or RS-to-MS)”. When 2 or more RF channels are available, one of the available RF channels may be allocated for communicating with upstream MMR-BS or RS, while another available RF channel may be used for communicating with MS and/or downstream RSs. The key idea underlying this proposal is that 16e frame can be reused for the out-of-band relay case.

2 hop relay

1. Basic considerations

- RS has two separate RF transceivers which can support two RF channel communication simultaneously.
- More than two transceivers are not considered due to hardware complexity in RS.

Figure 1 shows an example how two available RF channels can be allocated in a 2-hop situation. . From the RS’s perspective, one RF channel may be allocated for communication between MMR-BS and RS. The other channel may be allocated for communicating with the MSs.

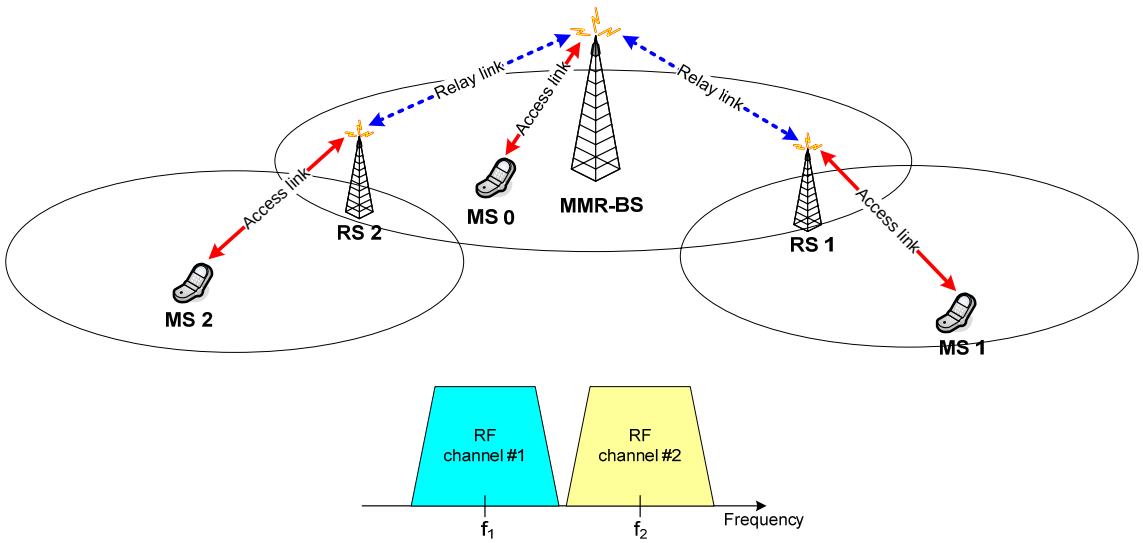

Figure 1. 2-hop relaying environment with 2 RF channels

2. Frame structure for 2-hop

Figure 2 shows the RF channel allocation in out-of-band relay environment when the RS has two transceivers. MMR-BS can allocate different RF channels to different RSs and MSs.. From RS's perspective, however, RS uses one RF channel to communicate with the BS and another to communicate with the MSs. Figure 3 represents the out-of-band relay frame structure when RS has two RF transceivers. In figure 3, the frame structure corresponding to the illustration of Figure 2, is shown. RS frames on each RF channel follow the 16e frame structure. On RF channel #1 (f1), RS1 operates like an MS and RS2 operates like BS. On RF channel #2 (f2), RS1 operates like BS, while RS2 operates like an MS.

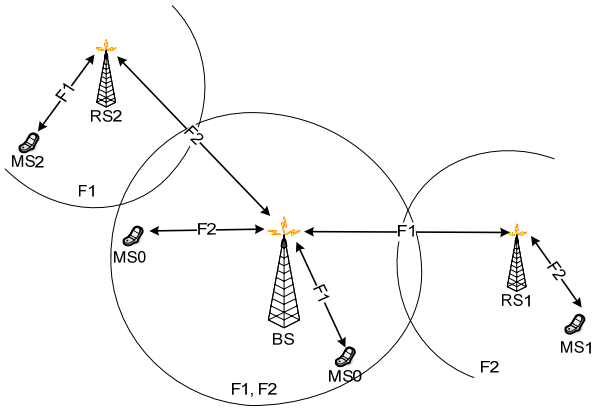

Figure 2. RF channel allocation in 2-hop out-of-band relay environment

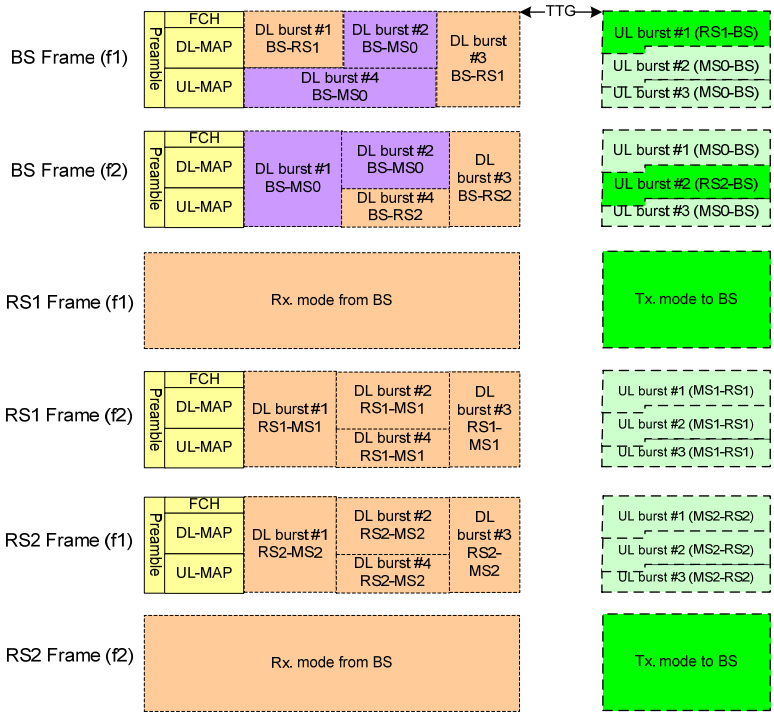

Figure 3. Frame structure when RS has two RF transceivers

3. Summary

- Legacy 16e frame structure can be reused to support the 2-hop scenario the case of out-of-band relay.

Multi-hop relay

1. Basic considerations

- RS has two separate RF transceivers which can support two RF channel communication simultaneously. More than two transceivers are not considered due to hardware complexity in RS.
- Multi-hop in out of band is simple extension of 2-hop relay.
- In RS perspective, one RF channel may be allocated to upstream RS/MMR-BS, another may be allocated to its MS and downstream RS.
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Figure 5 shows an example of a multi-hop environment wherein the MMR-BS serves 1st hop RSs and legacy MSs, the kth hop RS communicates with the downstream RSs, upstream RS/MMR-BS and the legacy MSs, while the last hop RS communicates with the upstream RS and legacy MSs.

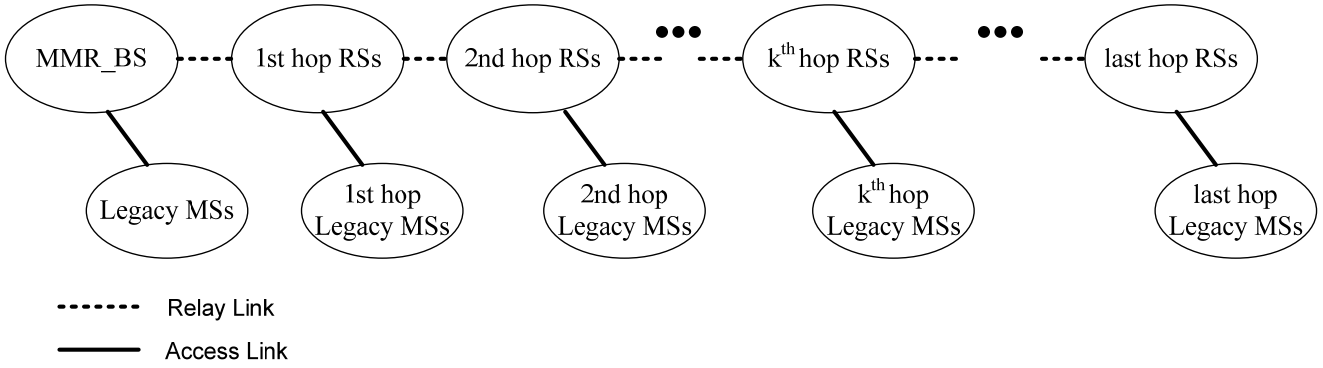

Figure 5. Multi-hop relay environment

2. Frame structure for multi-hop

Figure 6 shows an example of how RF channel allocation can be carried out in an out-of-band relay system with more than 2 hops.. RS1 communicates with MMR-BS using RF channel #1 (f1), and serves its MSs and downstream RS3 using RF channel #2(f2). RS3 communicates with upstream RS1 using RF channel #2 (f2), and serves its MSs using RF channel #1(f1).

Figure 7 represents the frame structure corresponding to the for multi-hop scenario of figure 6. The only difference compared with the 2-hop case is that in a multi-hop case an RS may have subordinate RSs and so the RS can communicate in upstream direction and downstream direction on two different RF channels. In multi-hop relay case, 16e frame structure can be reused like the 2-hop case.

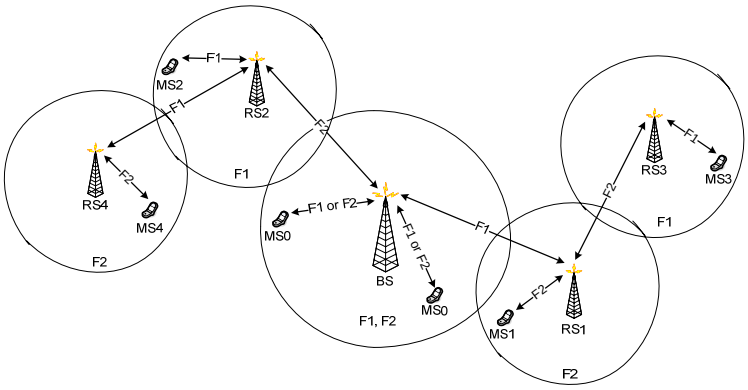

Figure 6. RF channel allocation of out-of-band relay in multi-hop environment

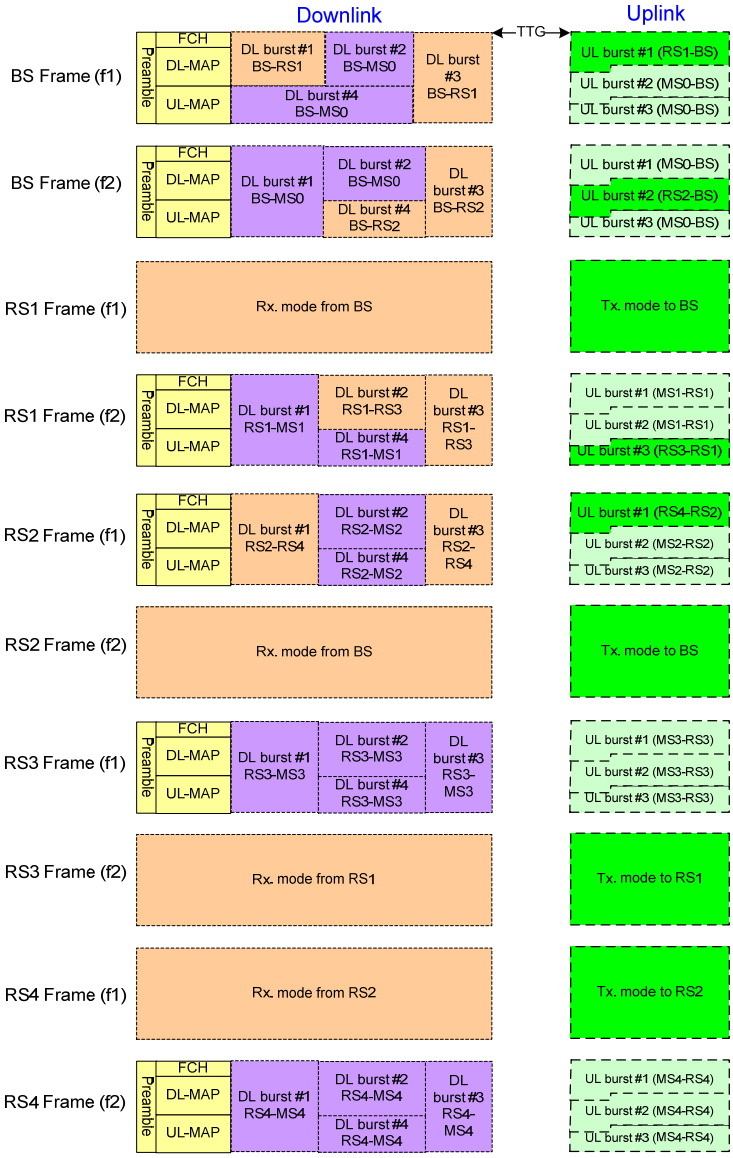

Figure 7. Frame structure for supporting figure 6.

3. Summary

- Both Access link as well as the relay link can reuse the same frame structure as defined for the 16e frame..
- In the case of out-of-band relay, , one of the available RF channels is for used for communicating with upstream MMR-BS or RS, while another RF channel is for used for MS and downstream RS and/or MSs.

4. Proposed Text Change

[Insert the followings after the end of section 8.4.4.8:]

8.4.4.8.x. PMP Frame structure in out-of-band relay

RS can concurrently communicate with BS (or upstream RS) on one RF channel and with MS (and/or downstream RS) on another RF channel. The frame structure used for communicating on both the RF channels is identical to the one shown in Figure 218.

References

[1] C80216j-06_14, “Harmonized definitions and terminology for 802.16j Mobile Multihop Relay”, Sep. 2006.