IEEE P802.11
Wireless LANs

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| Partial Multi-Antenna SLS |
| Date: 2017-03-27 |
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Abstract

This document suggest text to for the partial SLS

Changes are based on Draft 0.30

Discussion:

Two stations that have an established EDMG beamformed link between them may lose the link due to a blocker (human or other) blocking the link or a movement (rotation) of one of the stations. When the link is lost, the devices can re-establish the link by performing an SLS based beamforming training. SLS based beamforming training may be very long due large number of sectors in some devices. This is problematic in the case of applications that require low latency and continuous data transmission such VR/AR. The beamforming initiator may choose to use only a small number of sectors in a link-lost sector sweep to try to recover the link without begin off the air for a long period. The selected set of sectors may be based on backup set from another sector sweep or sectors around the current sector. If the sector sweep fails, the stations will resort to the long sector sweep.

This may be easily done with devices that have only a single DMG antenna since the number of sectors in this case does not need to be known in advance. In the case in which one of the devices has more than one DMG antenna, the number of sector needs to be known in advance because the receiving device needs to switch receive DMG antenna for every sector sweep over all transmitter sectors the transmitting device does and the transmitting device needs to repeat its sweep over all its sectors to all transmit antennas.

***802.11ay editor: add the following text after 9.4.2.257***

**9.4.2.258 EDMG Partial Sector Level Sweep**

The EDMG partial Sector Level Sweep is used to exchange the length of a sector sweep to be performed when the link is lost before the STA’s resort to full length sweep.

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|  | B0 B5 | B6 B16 | B17 B19 | B20 B22 | B23 B26 | B27 | B28 | B28 B31 |
|  | Partial Number of Sectors | Total Number of Sectors | Partial Number of Rx Antennas | Total Number of Rx Antennas | Time to Switch to full Sector Sweep | Agree to change Initiator/ Responder Roles | Agree to Partial Sector Sweep | Reserved |
| Bits: | 6 | 11 | 3 | 3 | 4 | 1 | 1 | 4 |

Figure 1- EDMG Partial Sector Level Sweep Element

The Partial Number of Sector field indicates the number of sectors the sender intends to use as a transmitter per each of the other STA’s receive antennas as part of the partial sector sweep.

The Total Number of Sector field indicates the number of sectors the sender intends to use a as a transmitter per each of the other STA’s receive antennas as part of the full sector sweep.

The Partial Number of Rx antennas field indicates the number of RX antennas the sender intends to use when receiving the partial sector sweep.

The Total Number of Rx antennas field indicates the number of RX antennas the sender intends to use when receiving the full sector sweep.

When sent by the initiator of the EDMG partial sector sweep exchange, the Time to Switch to full Sector Sweep is the time, in 1ms units, after the expiration of the beamformed link maintenance timer, that the initiator of the exchange proposes to switch to full sector sweep. This field is reserved when sent by the responder of this exchange.

When sent by the initiator of the EDMG partial sector sweep exchange, when set to 1, the Agree to change Initiator/Responder Roles field indicates that it wants to change the roles of initiator/responder in the sector sweep starting when beamformed link maintenance timer expires.

When sent by the initiator of the EDMG partial sector sweep exchange, the Agree to Partial Sector Sweep field is set to 1. When sent by the responder of the EDMG partial sector sweep exchange, the Agree to Partial Sector Sweep field is set to 1 to indicate agreement to the partial sector sweep and set to 0 if it does not agree to the partial sector sweep.

***TGay Editor: Add the partial sector level sweep to the table 9-417 in P41 in the Draft***

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| ***9*** | ***EDMG Partial Sector Sweep Element*** |

***TGay Editor add the following text at the end of 9.6.22.3 (end of P41 in the TGay Draft)***

The EDMG Partial Sector Sweep Element is defined in 9.4.2.258.

***TGay Editor add the following text at the end of* 10.38.6.4.1 (802.11-16 P1564)**

An Initiator EDMG STA may send the EDMG Partial Sector Sweep Element as part of a BRP transaction. The responding EDMG STA shall respond with a BRP frame with an EDMG partial Sector Sweep Element representing its preferences for a sector sweep that will happen when the beamformed link maintenance timer expires. If the initiator has set the Agree to change Initiator/ Responder Roles field to 1, and the responder agrees to change beamforming initiator/responder roles when the beamformed link maintenance link expires, it should set the Agree to change Initiator/ Responder Roles field to 1. If the initiator has the Agree to change Initiator/ Responder Roles field to 0, this field in the response is ignored. If the responder has set the Agree to Partial Sector Sweep to 1, the exchange is considered successful, otherwise it is considered as failed.

***TGay Editor: Insert the following modification of the text in 6 and 7th paragraphs in P1682 in 802.11-16:***

The responder DMG STA of the beamformed link in the CBAP shall configure its receive antenna to a quasi-omni antenna pattern following the expiration of dot11BeamLinkMaintenanceTime except when it is involved in a frame exchange with another STA. If the responder and the initiator are EDMG STAs, and the responder has more than one DMG receive antenna, and it has successfully exchanged an EDMG partial sector sweep element with the initiator, and the time indicated in the Time to Switch to Full Sweep field after the expiration of the dot11BeamLinkMaintenanceTime has not passed, then it shall switch it receive DMG antennas at a rate corresponding to the number of sectors indicated in the Partial Number of Sectors field of the initiators EDMG partial sector sweep element. If the Time to Switch to Full Sweep after expiration of the dot11BeamLinkMaintenanceTime has passed, and there was no successful sector sweep between the initiator and responder, the responder shall switch its receive DMG antennas at a rate corresponding to the number of sectors indicated in the Total Number of Sectors field of the initiators EDMG partial sector sweep element.

Any time after dot11BeamLinkMaintenanceTime has elapsed, the initiator DMG STA of the beamformed link in the CBAP may initiate an ISS to restore the beamformed link with the responder STA following the rules defined in 10.38.2. The initiator STA may initiate the ISS before expiration of dot11BeamLinkMaintenanceTime. If the responder and the initiator are EMDG STAs, and the responder has more than one EDMG receive antenna, and it has successfully exchanged an EDMG partial sector sweep element with the initiator, and the time indicated in the Time to Switch to Full Sweep field after the expiration of the dot11BeamLinkMaintenanceTime has not passed, then it shall use the number of sectors indicated in the Partial Number of Sectors field, and repeat its sector sweep with this number of sectors to 1 more than the number of antennas indicated in the Partial Number of Rx DMG antennas field by responder. If the Time to Switch to Full Sweep after expiration of the dot11BeamLinkMaintenanceTime has passed, or there was no successful sector sweep between the initiator and responder, the initiator shall perform a sector sweep with the number of sectors indicated in the Full number of Sectors Field, and repeat it sector sweep with this number of sector to one more than the number of antennas indicated in the Full Nubmer of Rx DMG antennas field by the responder.

**References:**