IEEE P802.11  
Wireless LANs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| LB200 TGah D1.0 MAC Comment Resolutions on Sectorization Part 1 | | | | |
| Date: 2014-05-07 | | | | |
| Author(s): | | | | |
| Name | Affiliation | Address | Phone | Email |
| Jae Seung Lee | ETRI | 161 Gajeong-dong,  Yuseong-gu, Daejeon, Korea | +82 42 860 1326 | [jasonlee@etri.re.kr](mailto:jasonlee@etri.re.kr) |
| James Wang | MediaTek |  |  | [james.wang@mediatek.com](mailto:james.wang@mediatek.com) |
| George Calcev | Huawei |  |  | [George.Calcev@huawei.com](mailto:George.Calcev@huawei.com) |
| Young Hoon Kwon | Huawei |  | +1-858-882-0329 | [younghoon.kwon@huawei.com](mailto:younghoon.kwon@huawei.com) |

This document provides resolutions for MAC CIDs on Sectorization (Part 1).

CID 1070, 1734, 2765, 2922, 2923, 2494

| **CID** | **Commenter** | | **Page** | **Clause** | | **Assignee** | **Comment** | **Proposed Change** | | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1070 | Adrian Stephens | | 202.62 | 9.47.5.1 | | Jae Seung, James, Younghoon | "The sector training is one way to help" - grammar | "Sector training is one way to help"  Review all 23 instances of "the sector training" and replace with "sector training" where the phrase is expressing the concept of sector training. | | REVISED.  Refer to doc. 14/0638. |
| 1734 | David Hunter | | 203.17 | 9.47.5.2 | | Jae Seung, James, Younghoon | "In the case that" is a complicated way of saying "when". | Replace "In the case that" with "When". | | REVISED.  Refer to doc. 14/0638. |
| <Discussion>  As the commenter pointed out, changed expression into “sector training” where the phrase is expressing the concept of sector training.    **TGah editor: modify the D1.3 text from P255L06, as follows**  Sector training is one way to help the stations to determine the best sectors to communicate with the AP. Sector training requires the AP to transmit training NDPs over all sectors. The best sector might be chosen by a station based on instantaneous or averaged CSI. The specific method of choosing the sector is beyond the scope of this standard. The results of sector training may be fed-back by the stations to the AP using Sector ID feedback frame. These training NDPs shall be transmitted consecutively and should be sent within a single TXOP. The training information is exchanged using the HT variant Control field. Ssector training supports up to eight sectors. The AP may use other methods to determine the station's best sector.  **TGah editor: modify the D1.3 text from P255L15, as follows**  **9.48.5.2 Procedure**  In sector training, the AP sends a sector training announcement followed by a series of NDP sector training frames separated by SIFS.  In TXOP-based sectorization operation, sector training may occur periodically with the training period and the beacon interval in which the training occurs as indicated in S1G Sector Operation element (TXOP-based), in response to a request from a STA, or initiated by the AP. The stations may perform sector training by receiving the training NDPs from AP. When the AP receives the sector training request from a station, the AP shall initiate sector training. AP supporting TXOP-based sectorization shall support sector training and sector training request. In the S1G Sector Operation element (TXOP-based) (see 8.4.2.170e), which is transmitted in beacon, probe response, or association response, the AP indicates in which beacon interval and in how many beacon intervals sector training occurs.  In group sectorization operation, a STA can find its best sector ID by listening to all the sectorized beacons. The S1G Sector Operation element (group) carried in the sectorized beacon provides the sectorized beacons rotation period, sector ID, the sub-period of the current sector and the group IDs of the groups of STAs which are allowed to transmit within the current beacon interval. Sector training may also be used for STAs to reduce time for sector discovery and allow STAs which don't listen to all the sectorized beacons for its power saving.  **TGah editor: modify the D1.3 text from P255L44, as follows**  The station may request sector training(#1682) from AP by using the HT Variant Control field if it is capable of sector training request. By setting the MAI=14 in the Link Adaptation Control subfield of the HT Variant Control field, the station indicates HT variant control field is used for signaling sector training(#1682) (or Antenna Selection) information. Sector(#1682) training (or sector training resumption) is requested by a station when the ASELC subfield is equal(#1185) to 1 and the ASEL Data subfield with values in the range of 1 to 15, being the number of the first NDP training frames to be transmitted when the command is sector training resumption(#1682), where 0 corresponds to the first training frame in the sector training request.(#1682) When the NDP Announcement field is also equal(#1185) to 1, it indicates training NDP frames to follow with two consecutive training NDP frames separated by SIFS.  The frame exchange sequence for sector training is shown in Figure 9-41 (Sector training), where the AP transmits training NDP frames, and the STA provides Sector ID feedback. The frame exchange comprises the following steps:  a) (Optional) A station may initiate sector training by sending a +HTC frame with the ASELC set to 1 for sector training request. | | | | | | | | | | |
| **TGah editor: modify the D1.3 text from P256L60, as follows**  Sector training within the Sounding RAW starts with a frame with NDP announcement indicator equal(#1185) to 1 in the HT control field and is followed in SIFS by a number of NDP CTS frames, each transmitted through different antenna sector starting with Sector ID equal to 0, and separated by SIFS. The Sounding RAW indication subfield equal(#1185) to 0 indicates no sector sounding is performed within the RAW. | | | | | | | | | | |
|  | | | | | | | | | | |
| 2765 | | SHOUKANG ZHENG | 204.45 | 9.47.5.2 | | Jae Seung, James, Younghoon | change "SST Sounding RAW" to "Sector Sounding RAW" | as commented | REVISED. Refer to doc. 14/0638. | |
| 2922 | | Young Hoon Kwon | 204.47 | 9.47.5.2 | | Jae Seung, James, Younghoon | In case of sector training, RAW Type option subfield should be set to sector sounding RAW instead of SST sounding RAW. | Change "SST Sounding RAW" to "Sector Sounding RAW" in line 47 and 49. | REVISED. Refer to doc. 14/0638. | |
| <Discussion>  It looks like a typo. Changed as the commenter suggested.    **TGah editor: modify the D1.3 text from P256L53, as follows**  AP may schedule sector sounding for multiple STAs by RAW in a beacon interval using the RAW Parameter Set element with the RAW Type field equal(#1185) to Sounding RAW and the RAW Type Options subfield equal(#1185) to Sector Sounding RAW (see 8.4.2.170a (RPS element)). During the Sounding RAW, non-AP STAs are prohibited to transmit but can elect to listen to the sector training for the entire RAW. This Sector Sounding RAW may be scheduled as periodic or non-periodic. | | | | | | | | | | |
| 2923 | | Young Hoon Kwon | 204.57 | 9.47.5.2 | Jae Seung, James, Younghoon | | It is not clear how to set the bandwidth for sector training. It needs further clarification. | As mentioned in the Comment. | | REVISED.  Refer to doc. 14/0638. |
| <Discussion>  When sector training, bandwidth for sector training definitely is within the BSS bandwidth indicated in the beacon.  Please refer to the following text (bandwidth indication in SST operation) we’ve described for SST training.  Because NDP frames used for sector training is already defined as NDP CTS frames (1MHz format or 2MHz format with BW indication) and sector training on more than 2MHz operating channels can be transmitted only in parallel way over multiple 2MHz channels, S1G\_DUP\_2M transmission is needed for sector training.  In addition to that, bandwidth indication in the SIG field of NDP CTS frames for sector sounding and the channel indication field in the RPS element for sector sounding RAW need to be set accordingly.  *<D1.3 text from P246L35>*  *The AP may transmit sounding frames to SST STAs for the purpose of estimating channel parameters. The AP may transmit sounding frames for SST STA channel estimation either in parallel (e.g. with a value of S1G\_DUP\_2M for the TXVECTOR parameter FORMAT and a value of CBW8 for the TXVECTOR parameter CH\_ BANDWIDTH in a BSS with an operating width of 8 MHz) or in series (e.g. sequential transmissions, each with a value of S1G\_DUP\_2M for the TXVECTOR parameter FORMAT and a value of CBW2 for the TXVECTOR parameter CH\_ BANDWIDTH and each transmitted on a different 2 MHz subchannel in a BSS with an 8 MHz operating width) or a combination of the two.*  *<D1.3 text from P247L30>*  *If an SST STA receives a local Beacon which contains no SST element, the SST STA may transmit on the primary channel of the BSS a PPDU of width up to the BSS bandwidth indicated in the beacon during the (short) Beacon Interval that began at the T(S)BTT immediately previous to the reception of the S1G Beacon frame.*  **TGah editor: modify the D1.3 text from P257L03, as follows (new addition)**  Channel bandwidth for sector training shall be a width up to the BSS bandwidth indicated in the S1G Beacon frame during the (short) Beacon Interval. The AP may transmit sounding frames (NDP CTS frames) for sector sounding in parallel (e.g., with a value of S1G\_DUP\_2M for the TXVECTOR parameter FORMAT and a value of CBW8 for the TXVECTOR parameter CH\_BANDWIDTH in a BSS with an operating width of 8MHz). The Bandwidth Indication field in the souding frames (in NDP\_2M CTS) and the Channel Indication field in the Sounding RAW shall comply with the TXVECTOR parameter CH\_BANDWIDTH. | | | | | | | | | | |
| 2494 | | Matthew Fischer | 203.10 | 9.47.5.2 | | Jae Seung, James, Younghoon | Everywhere that NDP is mentioned with regard to sectorized beam operation should be changed to NDP CTS, the problem is rampant within 9.47.5.2 but might appear in other places as well. | Within all of the sectorized beam operation sublcauses, change all occurrences of unqualified NDP with NDP CTS - I also see "CTS NDP" which should be "NDP CTS" I believe - that occurrence of "CTS NDP" might be in a different subclause than the one referenced for the comment, but somewhere within sectorized beam operation anyway - find it and fix it. Also, at P202 L32 and at P203L56, behind the corrected NDP CTS occurrence, add "with the Address Indication bit set to 1 and the RA/Partial BSSID field set to the PARTIAL\_BSSID of the AP" | | REVISED.  Refer to doc. 14/0638. |
| <Discussion>  As the commnter pointed out, it is better to change into “NDP CTS” for more specific expression to prevent any ambiguity.  FYI, some NDP CTS frames mentioned in clause 9.48.4 (TXOP-based Sectorization Operation) with value of 1 for Early Sector Indicator are different ones (one of preceding frames before SO exchange) from other NDP CTS frames to be used for sector sounding.    **TGah editor: modify the D1.3 text from P255L01, as follows**  **9.48.5 Sector training operation**  **9.48.5.1 Introduction**  The sector training is one way to help the stations to determine the best sectors to communicate with the AP. Sector training requires the AP to transmit training NDP CTSs over all sectors. The best sector might be chosen by a station based on instantaneous or averaged CSI. The specific method of choosing the sector is beyond the scope of this standard. The results of the sector training may be fed-back by the stations to the AP using Sector ID feedback frame. These training NDP CTSs (with the Address Indication bit set to 1 and the RA/Partial BSSID field set to the PARTIAL\_BSSID of the AP) shall be transmitted consecutively and should be sent within a single TXOP. The training information is exchanged using the HT variant Control field. The sector training supports up to eight sectors. The AP may use other methods to determine the station's best sector. | | | | | | | | | | |
| **TGah editor: modify the D1.3 text from P255L15, as follows**  **9.48.5.2 Procedure**  In the sector training, the AP sends a sector training announcement followed by a series of NDP CTS sector training frames separated by SIFS.  In TXOP-based sectorization operation, the sector training may occur periodically with the training period and the beacon interval in which the training occurs as indicated in S1G Sector Operation element (TXOP-based), in response to a request from a STA, or initiated by the AP. The stations may perform the sector training by receiving the training NDP CTSs from AP. In the case that the AP receives the sector training request from a station, the AP shall initiate a sector training. AP supporting TXOP-based sectorization shall support sector training and sector training request. In the S1G Sector Operation element (TXOP-based) (see 8.4.2.170e), which is transmitted in beacon, probe response, or association response, the AP indicates in which beacon interval and in how many beacon intervals a sector training occurs.  In group sectorization operation, a STA can find its best sector ID by listening to all the sectorized beacons. The S1G Sector Operation element (group) carried in the sectorized beacon provides the sectorized beacons rotation period, sector ID, the sub-period of the current sector and the group IDs of the groups of STAs which are allowed to transmit within the current beacon interval. The sector training may also be used for STAs to reduce time for sector discovery and allow STAs which don't listen to all the sectorized beacons for its power saving.  The station may use the Sector ID feedback frame (see 8.6.24.11 (Sector ID Feedback frame format)) to signal to the AP which sector is the best sector found.  The station may request sector training(#1682) from AP by using the HT Variant Control field if it is capable of sector training request. By setting the MAI=14 in the Link Adaptation Control subfield of the HT Variant Control field, the station indicates HT variant control field is used for signaling sector training(#1682) (or Antenna Selection) information. The sector(#1682) training (or sector training resumption) is requested by a station when the ASELC subfield is equal(#1185) to 1 and the ASEL Data subfield with values in the range of 1 to 15, being the number of the first NDP CTS training frames to be transmitted when the command is sector training resumption(#1682), where 0 corresponds to the first training frame in the sector training request.(#1682) When the NDP Announcement field is also equal(#1185) to 1, it indicates training NDP CTS frames to follow with two consecutive training NDP CTS frames separated by SIFS.  The frame exchange sequence for sector training is shown in Figure 9-41 (Sector training), where the AP transmits training NDP CTS frames, and the STA provides Sector ID feedback. The frame exchange comprises the following steps:  a) (Optional) A station may initiate the sector training by sending a +HTC frame with the ASELC set to 1 for sector training request.  b) The AP sends out consecutive training NDP CTSs (with the Address Indication bit set to 1 and the RA/Partial BSSID field set to the PARTIAL\_BSSID of the AP) separated by SIFS in a TXOP of which it is the TXOP holder with no Ack over different sectorized beams. NDP CTS frames (8.9.1.1), with NDP MAC Frame Type=0, are used in sector training. Each training NDP CTS is transmitted over one sector beam. The first training NDP CTS frame shall be preceded by a +HTC frame with NDP announcement subfield set to 1. The positions of the training NDP CTS frames correspond to the sector IDs of the sectorized beams, in ascending order starting with Sector ID =0.  c) The station(s) may perform training by estimating the received signal quality corresponding to each training NDP CTS.  d) The station(s) engages in the training by receiving the sector training frames may respond with a selected sector ID using the sector ID feedback frame in a subsequent TXOP or during Sector Report RAW which may be indicated by beacon for fast sector discovery of multiple STAs (see 9.48.5.4 (Fast Sector Discovery)). | | | | | | | | | | |
| **TGah editor: modify the D1.3 text from P256L15, as follows**  ***Please replace all the “NDP” with “NDP CTS” in the figure.***     * Sector training | | | | | | | | | | |
| **TGah editor: modify the D1.3 text from P256L41, as follows**  If the AP receives a +HTC MPDU with the MAI subfield equal to 14, the ASEL Command subfield equal to sector training request(#1682) (=1), and the ASEL Data subfield equal to a zero to correspond to the command sector training(#1682), the station shall assume a total number of training NDP CTSs that corresponds to the total number of sectors. If the AP receives a +HTC MPDU with the MAI subfield equal to 14, the ASEL Command subfield equal to sector training request(#1682) (=1), and the ASEL Data subfield equal nonzero value to correspond to the command sector training resumption (a resumption MPDU), the station shall assume the number of training frames that follow the resumption MPDU is equal to the number of training NDP CTSs from the total number of sectors minus the order number transmitted in the ASEL Data subfield of the Resumption MPDU.  AP may schedule sector sounding for multiple STAs by RAW in a beacon interval using the RAW Parameter Set element with the RAW Type field equal(#1185) to Sounding RAW and the RAW Type Options subfield equal(#1185) to SST Sounding RAW (see 8.4.2.170a (RPS element)). During the Sounding RAW, non-AP STAs are prohibited to transmit but can elect to listen to the sector training for the entire RAW. This SSTSounding RAW may be scheduled as periodic or non-periodic.  The sector training within the Sounding RAW starts with a frame with NDP announcement indicator equal(#1185) to 1 in the HT control field and is followed in SIFS by a number of NDP CTS frames, each transmitted through different antenna sector starting with Sector ID equal to 0, and separated by SIFS. The Sounding RAW indication subfield equal(#1185) to 0 indicates no sector sounding is performed within the RAW. | | | | | | | | | | |