### IEEE P802.11 Wireless LANs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Detailed text proposal for Dynamic Subband Operation (DSO) | | | | |
| Date: 2024-12-04 | | | | |
| Author(s): | | | | |
| Name | Affiliation | Address | Phone | email |
| Morteza Mehrnoush | Apple |  |  |  |
| Reza Hedayat | Apple |  |  |  |
| Minyoung Park | Apple |  |  |  |
| Laurent Cariou | Intel |  |  |  |
| Liwen Chu | NXP |  |  |  |
| Matthew Fischer | Broadcom |  |  |  |
| Gaurang Naik | Qualcomm |  |  |  |
| Sengho Byeon | Samsung |  |  |  |
| Vishnu Ratnam | Samsung |  |  |  |
| Aniruddh Kabbinale | Samsung |  |  |  |

**Introduction**

The authors prepared this document to give a better view of the different proposals on DSO in text format.

The authors look forward to working with all interested participants to prepare an official proposal for specification text on DSO.

IEEE contributions:

11-22/2204, 11-23/2141, 11-23/2027,

11-23/843, 11-23/1496, 11-24/591,

11-23/1892, 11-23/1913, 11-23/1935,

11-24/1553, 11-24/1564, 11-24/1589,

11-24/1588, 11-24/2141, 11-24/1587

Revisions:

* Rev 0: Initial version of the document.

3. Definitions, acronyms, and abbreviations

* Abbreviations and acronyms

***TGbn editor: Insert the following acronym definitions (maintaining alphabetical order) except green tag:***

DSO: Dynamic Subband Operation

ICF: Initial Control Frame

***TGbn editor: Please add the following subclause 37.x Mechanisms for Dynamic Subband Operation (DSO) in 802.11bn D0.1:***

37. Ultra High Reliability (UHR) MAC specification

**37.x Dynamic Subband Operation**

A non-AP STA that supports DSO operation is called a DSO STA and shall set the DSO Supported field of the UHR MAC Capabilities Information field of the UHR Capabilities element to 1. An AP that supports DSO operation is called a DSO AP and shall set the DSO Supported field of the UHR MAC Capabilities Information field of the UHR Capabilities element to 1.

DSO is a mechanism where narrower bandwidth DSO STA can dynamically, on a per-TXOP basis, be allocated resources outside of its current operating bandwidth within the DSO AP’s BSS bandwidth. AP’s dynamic resource allocation is contained within a TXOP.

For a DSO STA, the channel whose bandwidth is equal to its operating bandwidth and that includes the BSS primary channel is referred to as primary subband. For a DSO STA, the channel whose bandwidth is equal to its operating bandwidth outside of its primary subband where it can be allocated resources by the AP during a DSO frame exchange is referred to as a DSO subband.

Only 80MHz operating bandwidth UHR STAs and 160MHz operating bandwidth UHR STAs can be DSO STAs. The DSO ICF-ICR exchange and the PPDUs that follows it shall only be between UHR STAs. One 80MHz subband in 320MHz BSS can be a DSO subband. It is TBD if more than one 80MHz subband can be a DSO subband in 320MHz BSS. The secondary 80MHz in 160MHz BSS can be a DSO subband and secondary 160MHz in 320MHz BSS can be a DSO subband.

***Enable/disable and signaling:***

A DSO non-AP STA may enable or disable the DSO mode, with a TBD mechanism, if the AP has supported the DSO mode.

Whether a DSO AP can enable/disable the DSO mode for its BSS is TBD.

***AP/STA Behavior****:*

If a DSO AP and a DSO STA operate in the DSO mode, the following applies:

1) A DSO AP that initiates a DSO frame exchange that includes neither group addressed Data nor group addressed Management frames and requires the DSO STA to switch to the DSO subband shall begin the frame exchanges by transmitting a DSO ICF to the non-AP STA with the limitations specified below:

* The DSO ICF shall be sent in the non-HT duplicate PPDU format using a rate of 6 Mb/s, 12 Mb/s, or 24 Mb/s.
* The AP shall set the length of the Padding field of the DSO ICF based on the rules defined in 37.x1 (Padding for a Trigger frame in presence of intermediate FCS) to ensure that the MAC padding duration of the ICF, after intermediate ICF if needed by DSO STA, is greater than or equal to the DSO Switch Delay last indicated by the non-AP STA, in addition to the padding requirements for other mechanisms that the non-AP STA operates with (e.g. EMLSR, DPS).
* The BSRP Trigger frame may be a DSO ICF. Whether MU-RTS Trigger frame is a DSO ICF is TBD. The number of spatial streams for the response to the BSRP Trigger frame that is a DSO ICF shall be limited to one, which shall be indicated in the BSRP Trigger frame.
* DSO ICF which includes a User Info field corresponding to the DSO STA shall set the AID12 subfield to the AID of the non-AP STA and the DSO subband is indicated by the RU Allocation field, wherein the RU assigned to the non-AP STA shall be located within a single DSO sub-band. It is TBD if additional signaling is needed to indicate a TXOP as a DSO TXOP.

2) A DSO AP shall include an intermediate FCS in the DSO ICF if needed by a DSO STA that is an intended recipient of the DSO ICF.

* Note: intermediate FCS may not be needed, for instance, if the DSO STA requires no padding.

3) A DSO STA, upon reception of a DSO ICF from its DSO AP if it’s scheduled in an RU on the DSO subband, shall transition to the indicated DSO subband and transmit the corresponding ICR in the indicated DSO subband a SIFS after the end of the PPDU carrying DSO ICF; if the DSO ICF is a BSRP Trigger frame, then the transmission in the indicated DSO subband from the DSO STA shall be on its allocated RU. A DSO STA that switches to the DSO subband shall be able to receive frames or be triggered to transmit frames, subject to its spatial stream capabilities and operation mode, in the DSO subband, a SIFS after the end of the response frame.

* Note: how the STA performs CS check before responding to DSO ICF is TBD.

4) [TBD] The non-AP STA shall switch back from the DSO subband to the primary subband no later than the DSO switch back delay indicated by the non-AP STA in the most recent successfully transmitted TBD field, as measured from the end of the DSO frame exchange, which occurs when any of the following conditions is met:

* The MAC of the non-AP STA that received the DSO ICF does not receive a PHY-RXSTART.indication primitive during a timeout interval of aSIFSTime + aSlotTime + aRxPHYStartDelay, where aRxPHYStartDelay is equal to 20us, starting at the end of the PPDU transmitted by the non-AP STA as a response to the most recently received frame from the AP within the DSO frame exchange or starting at the end of the reception of the PPDU containing a frame for the non-AP STA from the AP that does not require immediate acknowledgement.
* The MAC of the non-AP STA that received the DSO ICF receives a PHY-RXSTART.indication primitive during a timeout interval of aSIFSTime + aSlotTime + aRxPHYStartDelay starting at the end of the PPDU transmitted by the non-AP STA as a response to the most recently received frame from the AP within the DSO frame exchange or starting at the end of the reception of the PPDU containing a frame for the non-AP STA from the AP that does not require immediate acknowledgement and this non-AP STA does not detect, within the PPDU corresponding to the PHY-RXSTART.indication any of the following frames:
  + an individually addressed frame with the RA equal to the MAC address of the non-AP STA
  + a Trigger frame that has one of the User Info fields addressed to the non-AP STA
  + a CTS-to-self frame with the RA equal to the MAC address of the AP
  + a Multi-STA BlockAck frame that has one of the Per AID TID Info fields addressed to the non-AP STA
  + an NDP Announcement frame that has one of the STA Info fields addressed to the non-AP STA and a sounding NDP
* The non-AP STA that received the DSO ICF does not respond to the most recently received frame from the AP within the DSO frame exchange that requires an immediate response after a SIFS

It is TBD whether a DSO STA needs to perform medium synchronization recovery after the DSO STA switches back to the primary subband from the DSO subband.

5) If no non-AP STA that is assigned resources in the primary 20 MHz subband responds to the DSO ICF and there is at least one response to the DSO ICF from a non-AP STA on any other subband, the AP shall do one of the following:

* Terminate the DSO frame exchange sequence with all non-AP STAs, or
* Continue the DSO frame exchange sequence by ensuring that the primary 20 MHz is occupied
* Whether there are other options is TBD