### IEEE P802.11 Wireless LANs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| PDT MAC 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 |  |  |  |
| Kerstin Johnsson | Nokia |  |  |  |
| Mark Rison | Samsung |  |  |  |

Abstract

This document contains Proposed Draft Text (PDT) for the Dynamic Subband Operation (DSO) feature of the proposed TGbn (UHR, Ultra High Reliability) amendment to the 802.11 standard.

Relevent 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

# Revision information

The following is a summary of the important changes that occurred within each revision of this document:

|  |  |
| --- | --- |
| **Revision** | **Major changes** |
| 0 | Initial revision |
| 1 | Editorial changes and some minor clarifications |
| 2 | Some more editorial changes and clarifications (added TBD for DSO STA enablement given it is TBD if the AP can enable DSO for associated STAs) |
| 3 | More clarification updates based on the received comments |
|  |  |
|  |  |

# Introduction

Interpretation of a Motion to Adopt

A motion to approve this submission means that the editing instructions and any changed or added material are actioned in the TGbn Draft. The abstract, revision information, introduction, explanation of the proposed changes, discussion and references sections are not part of the adopted material.

***Editing instructions formatted like this are intended to be copied into the TGbn Draft (i.e. they are instructions to the 802.11 editor on how to merge the text with the baseline documents).***

***TGbn Editor: Editing instructions preceded by “TGbn Editor” are instructions to the TGbn editor to modify existing material in the TGbn draft. As a result of adopting the changes, the TGbn editor will execute the instructions rather than copy them to the TGbn Draft.***

# Text to be adopted begins here:

***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 non-AP 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 a DSO non-AP STA which has a bandwidth narrower than DSO AP can dynamically be allocated frequency resources outside of its current operating bandwidth within the DSO AP’s BSS bandwidth, on a per TXOP basis.

For a DSO non-AP STA, the channel whose bandwidth equals the STA’s operating bandwidth, which includes the BSS primary channel, is referred to as the primary subband. For a DSO non-AP STA, the channel whose bandwidth equals the STA’s operating bandwidth, which lies outside of the STA’s primary subband, where it can be allocated resources by the DSO AP during a DSO frame exchange, is referred to as a DSO subband.

Only 80 MHz and 160 MHz operating bandwidth UHR STAs can be DSO non-AP STAs. The DSO ICF-ICR exchange and the PPDUs that follow it shall only be between UHR STAs. In a 160 MHz BSS, the secondary 80 MHz subband can be a DSO subband for an 80 MHz DSO non-AP STA. In a 320 MHz BSS, one of the secondary 80 MHz subbands can be a DSO subband for an 80MHz DSO non-AP STA; it is TBD whether more than one secondary 80 MHz subband can be a DSO subband. In a 320 MHz BSS, the secondary 160 MHz subband can be a DSO subband for a 160 MHz DSO non-AP STA.

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

A DSO non-AP STA may enable or disable the DSO mode, with a TBD mechanism, if the AP supports and enables [TBD] 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 non-AP STA operate in DSO mode, the following apply:

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 non-AP STA to switch to the DSO subband shall begin the frame exchanges by transmitting a DSO ICF to the DSO non-AP STA with the following limitations:

* 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 DSO 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 ICF’s MAC padding duration, which follows the intermediate FCS if needed by DSO non-AP STA, is greater than or equal to the DSO switch delay last indicated by the DSO non-AP STA, and also satisfies any padding requirements related to other mechanisms that the DSO non-AP STA is engaged in (e.g. EMLSR, DPS).
* The DSO ICF may be a BSRP Trigger frame. Whether DSO ICF may be an MU-RTS Trigger frame 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.
* In DSO ICF, AID12 subfield of the User Info field shall be set to the AID of the DSO non-AP STA and the RU Allocation subfield shall be set to an RU assigned to the DSO non-AP STA that is contained in a single DSO subband.
* 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 non-AP STA that is an intended recipient of the DSO ICF.

* Note: an intermediate FCS might not be needed, e.g., if the DSO non-AP STA requires no padding.

3) If a DSO non-AP STA receives a DSO ICF from its DSO AP, where the allocated RU to the DSO non-AP STA is contained in a DSO subband, the DSO non-AP STA 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 the DSO ICF. If the DSO ICF is a BSRP Trigger frame, the DSO non-AP STA’s ICR shall be sent in its allocated RU contained in the indicated DSO subband. A DSO non-AP 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 PPDU carrying the ICR.

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

4) The DSO 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 DSO 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 DSO 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 20 μs, starting at the end of the PPDU transmitted by the DSO non-AP STA as a response to the most recently received frame from the DSO AP within the DSO frame exchange or starting at the end of the reception of the PPDU containing a frame for the DSO non-AP STA from the DSO AP that does not require immediate acknowledgement.
* The MAC of the DSO 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 DSO non-AP STA as a response to the most recently received frame from the DSO AP within the DSO frame exchange or starting at the end of the reception of the PPDU containing a frame for the DSO non-AP STA from the DSO AP that does not require immediate acknowledgement, and the DSO 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 DSO non-AP STA
  + a Trigger frame that has one of the User Info fields addressed to the DSO non-AP STA
  + a CTS-to-self frame with the RA equal to the MAC address of the DSO AP
  + a Multi-STA BlockAck frame that has one of the Per AID TID Info fields addressed to the DSO non-AP STA
  + an NDP Announcement frame that has one of the STA Info fields addressed to the DSO non-AP STA followed by a sounding NDP
* The DSO non-AP STA that received the DSO ICF does not respond to the most recently received frame from the DSO AP within the DSO frame exchange that requires an immediate response after a SIFS

It is TBD whether a DSO non-AP STA needs to perform medium synchronization recovery after it 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 DSO 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
* Continue the DSO frame exchange sequence by ensuring that the primary 20 MHz is occupied
* Whether there are other options is TBD

# Text to be adopted ends here.

**SP: Do you agree** **to incorporate the proposed text changes for DSO in 11-25/0454r0 to the latest TGbn draft?**

**References:**

1. 11-24-0171r21: 11-24-0171-21-00bn-tgbn-motions-list-part-1, Alfred Asterjadhi (Qualcomm Inc.)