IEEE P802.11  
Wireless LANs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| PDT MAC Co-TDMA | | | | |
| Date: 2024-12-19 | | | | |
| Author(s): | | | | |
| Name | Affiliation | Address | Phone | email |
| Sanket Kalamkar | Qualcomm Technologies, Inc |  |  | sankal@qti.qualcomm.com |
| Abhishek Patil | Qualcomm Technologies, Inc |  |  | appatil@qti.qualcomm.com |
| Klaus Doppler | Nokia |  |  | Klaus.doppler@nokia.com |
| Eda Genc | Nokia |  |  | eda.genc@nokia.com |
| Shubhodeep Adhikari | Broadcom |  |  | shubhodeep.adhikari@broadcom.com |
| Samat Shabdanov | MediaTek Inc. |  |  | Samat.Shabdanov@mediatek.com |
| GeonHwan Kim | LG Electronics |  |  | geonhwan.kim@lge.com |
| Sean Coffey | Realtek Semiconductor Corp. |  |  | coffey@realtek.com |
| Liwen Chu | NXP Semiconductors |  |  |  |
| Yajun Cheng | Xiaomi Communications Co., Ltd. |  |  |  |
| Shawn Kim | WILUS |  |  |  |
| Chaoming Luo | Beijing OPPO telecommunications corp., ltd. |  |  |  |
| Pei Zhou | TCL |  |  |  |
| Yuxin Lu | TCL Industries |  |  |  |
| Pascal Viger | Canon Research Centre France |  |  |  |
| Juseong Moon | Korea National University of Transportation |  |  |  |
| Ronny Peng | MediaTek Inc. |  |  |  |
| Yongho Kim | Korea National University of Transportation |  |  |  |
| Gwangho Lee | Korea National University of Transportation |  |  |  |
| Patrice Nezou | Canon Research Centre France |  |  |  |
| Arik Klein | Huawei Technologies Co., Ltd |  |  |  |
| Serhat Erkucuk | Ofinno |  |  |  |
| Brian Hart | Cisco Systems, Inc. |  |  |  |
| Binita Gupta | Cisco Systems, Inc. |  |  |  |
| Si-Chan Noh | Newracom Inc. |  |  |  |
| Muhammad Kumail Haider | Meta Platforms Inc. |  |  |  |
| Jeongki Kim | Ofinno |  |  |  |
| Yue Qi | Samsung Research America |  |  |  |
| Insun Jang | LG Electronics |  |  |  |
| Fangxin Xu | Longsailing Semiconductor |  |  |  |
| Gaius Wee | Panasonic Holdings Corporation |  |  |  |
| Liuming Lu | Guangdong OPPO Mobile Telecommunications Corp.,Ltd |  |  |  |
| Yanchun Li | Huawei Technologies Co., Ltd |  |  |  |
| Yurong Qian | ZTE Corporation |  |  |  |
| Zisheng Wang | ZTE Corporation |  |  |  |
| Li Quan | ZTE Corporation |  |  |  |
| Inaki Val Beitia | MaxLinear, Inc. |  |  |  |
| Dana Ciochina | Sony Corporation |  |  |  |
| Okan Mutgan | Nokia |  |  |  |
| Shuyu Shi | TP-Link Corporation Limited |  |  |  |
| Taeyoung Ha | Samsung Electronics Co., Ltd. |  |  |  |
| Tong Bian | Panasonic |  |  |  |
| Jungjun Kim | Samsung Electronics |  |  |  |
| Alfred Asterjadhi | Qualcomm Technologies, Inc |  |  |  |
| Ming Gan | Huawei Technologies Co., Ltd |  |  |  |
| Yunbo Li | Huawei Technologies Co., Ltd |  |  |  |
| Hui Che | Ruijie Networks Co., Ltd |  |  |  |
| Gaurav Patwardhan | Hewlett Packard Enterprise |  |  |  |
| Tomoko Adachi | TOSHIBA Corporation |  |  |  |
| Woojin Ahn | KNUT |  |  |  |
| Jonghoe KOO | Samsung Electronics |  |  |  |
| Hirohiko INOHIZA | Canon |  |  |  |
| Giovanni Chisci | Qualcomm Technologies, Inc |  |  |  |
| Seongho Byeon | Samsung Electronics |  |  |  |
| Dibakar Das | Intel Corporation |  |  |  |
| Yue Qi | Samsung Research America |  |  |  |
| Rubayet Shafin | Samsung Electronics |  |  |  |
| Lei Zhou | H3C Technologies Co., Limited |  |  |  |
| Behnam Dezfouli | Nokia |  |  |  |
| Gaurang Naik | Qualcomm Technologies, Inc |  |  |  |
| Shuang Fan | Sanechips Technology Co., Ltd. |  |  |  |
| Lili Hervieu | Cable Television Laboratories Inc. (CableLabs) |  |  |  |
| Kiseon Ryu | NXP Semiconductors |  |  |  |
| Peshal Nayak | Samsung Research America |  |  |  |
| Xiaofei Wang | InterDigital, Inc. |  |  |  |
| Nima Namvar | Charter Communications |  |  |  |
| Ross Jian Yu | Huawei Technologies Co., Ltd |  |  |  |
| Zhenpeng Shi | Huawei Technologies Co., Ltd |  |  |  |
| Sang Kim | LG Electronics |  |  |  |
| Jason Yuchen Guo | Huawei Technologies Co., Ltd |  |  |  |
| Hank Hyeonjun Sung | WILUS Inc. |  |  |  |
| Sungjin Park | senscomm |  |  |  |
| John Wullert | Peraton Labs |  |  |  |
| Jiayi Zhang | Ofinno |  |  |  |
| Leonardo Lanante | Ofinno |  |  |  |
| Jay Yang | ZTE Corporation |  |  | yang.zhijie@zte.com.cn |

Abstract

This document contains Proposed Draft Text (PDT) for the Coordinated Time Division Multiple Access (Co-TDMA) feature of the proposed TGbn (UHR, Ultra High Reliability) amendment to the 802.11 standard.

This version of PDT includes the motions passed in IEEE up to November 2024.

# 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: motions passed until September 2024 |
| 1 | Additional specification text based on the motions passed until November 2024. Added more TTT members as authors. |
| 2 | Changes based on the comments from Klaus and Jay. Some changes based on discussions with Sean, Michail on the negative response from a polled AP to the received ICF. |
| 3 | Tagged paragraphs with relevant motion numbers |
| 4 | Changes based on the comments from Brian, Kosuke, and Yunbo. |
|  |  |

# 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 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).***

## Explanation of the proposed changes:

The proposed changes to the 802.11 TGbn draft within this document are based on the following motions adopted by the TGbn task group:

### Relevant passed motions:

[Motion #46, [1]]

* TGbn shall define a Coordinated TDMA (Co-TDMA) procedure for an AP to share its time resources of an obtained TXOP with a set of APs.
  + Set of APs is TBD.
  + The set can consist of one AP.

[Motion #120, [1]]

* A UHR AP shall indicate to another AP its capability to respond in a TB PPDU or not.

[Motion #121, [1]]

* As part of the Co-TDMA procedure, a sharing AP may solicit a poll response in a TB PPDU from another AP only if the other AP has indicated support for responding via a TB PPDU.

[Motion #135, [1]]

* The sharing AP, that transmits a Trigger frame as part of a transmission sequence in a Multi-AP coordinated transmission scheme, identifies the shared AP via an AP ID carried in the AID12 field of the User Info field of the frame.
  + Note: the name of “sharing AP” and “shared AP” are TBD.
  + Note: Multi-AP coordinated transmission schemes are Co-SR, Co-BF and Co-TDMA.

[Motion #156, [1]]

* A TXOP owner AP announces its intention of sharing a portion of the time resource of its TXOP for Co-TDMA operation, in an Initial Control frame (exact ICF and name TBD) sent at the beginning of the TXOP. The frame polls AP(s) with whom it may share the TXOP to determine their interest
  + A TXOP owner AP that intends to share its TXOP is referred to as a sharing AP.
  + A candidate AP identified (polled) in the ICF is referred to as a polled AP.
  + The Duration field of the frame is set to the length of time required to transmit the solicited response frame plus one SIFS.
  + Whether or not the sharing AP is mandated to send the ICF that announces that intention is TBD.

[Motion #157, [1]]

* As part of the Co-TDMA procedure, a candidate AP that is polled by the sharing AP shall provide, via a response,
  + Its intention not to participate in TXOP sharing during the current TXOP.
    - Note: If the sharing AP doesn’t receive a response from a polled AP, it assumes that the polled AP is not interested in TXOP sharing during the current TXOP.
  + Its intention to participate in TXOP sharing during the current TXOP.
  + Signaling details (including traffic indication) are TBD.

[Motion #159, [1]]

* As part of the Co-TDMA procedure, to share a time portion of its TXOP, a sharing AP shall send a MU-RTS TXS Trigger frame to another non-collocated AP.
  + The Allocation Duration field of the frame indicates the duration of that time portion.
  + The Duration field of the frame is set to the time required to transmit the solicited response frame plus one SIFS.

[Motion #160, [1]]

* As part of the Co-TDMA procedure, TGbn defines a mechanism for an AP, that received a time portion of a TXOP from a sharing AP, to return the remainder of the allocated time (if any) back to the sharing AP.
  + Signaling details and the condition(s) for TXOP return are TBD.

# Text to be adopted begins here:

### 3.2 Definitions specific to IEEE Std 802.11

**coordinated access point (AP)**: [coordinated AP] An AP with which a sharing AP shares a portion of its obtained TXOP.

**coordinated time division multiple access (Co-TDMA) sharing access point (AP)**: [Co-TDMA sharing AP] A sharing AP that intends to share a time portion of its obtained TXOP with a set of APs as part of Co-TDMA operation.

**coordinated time division multiple access (TDMA)**: [Co-TDMA] A procedure that enables an AP that has obtained a TXOP to share a time portion of the obtained TXOP with a set of APs.

coordinated time division multiple access (Co-TDMA) coordinated access point (AP): [Co-TDMA coordinated AP] An AP with which the Co-TDMA sharing AP shares a time portion of its obtained TXOP.

initial control frame (ICF): [ICF] A Control frame that is sent to poll one or more STAs to determine their availability and/or willingness to participate during the TXOP. A STA’s participation might require transitioning to a different mode of operation.

**polled access point (AP)**: [polled AP] An AP polled by a sharing AP in the ICF that is transmitted as part of a Multi-AP coordinated operation.

**sharing access point (AP)**: [sharing AP] An AP that intends to share a portion of its obtained TXOP with a set of APs.

37.10 **Coordinated time division multiple access**

**37.10.1 General**

The Co-TDMA procedure enables an AP to share a time portion of an obtained TXOP with another AP that belongs to a set of APs (the set is TBD and can consist of one AP) to transmit one or more PPDUs.**[#M46]**

Figure 37.X (Example of a Co-TDMA procedure between three APs) shows an example of Co-TDMA procedure that includes a polling phase, a TXOP allocation phase, and a TXOP return phase.



37.X—Example of a Co-TDMA procedure between three APs

**37.10.2 Polling phase**

A Co-TDMA sharing AP may solicit, from another AP, a poll response sent in a TB PPDU only if the other AP has indicated support for responding in a TB PPDU.**[#M121]**

A Co-TDMA sharing AP announces its intention of sharing a time portion of an obtained TXOP with another AP in an ICF sent at the beginning of the TXOP. The ICF polls one or more APs to solicit a response to determine the intent of the polled AP(s) if receiving a time allocation from the Co-TDMA sharing AP within the TXOP.**[#M156]**

The Duration field of the ICF is set to one SIFS plus the time required to transmit the solicited response from the polled AP(s). **[#M156]**

The ICF that polls AP(s) to determine their intent if receiving a time allocation from the Co-TDMA sharing AP within the TXOP is a TBD Trigger frame. The Co-TDMA sharing AP identifies each AP to be polled by setting, in the Trigger frame, the AID12 subfield of the polled AP’s User Info field to the polled AP’s AP ID.**[#M135]**

Whether or not the Co-TDMA sharing AP is mandated to send the ICF as part of the Co-TDMA procedure is TBD.**[#M156]**

A polled AP shall provide, in a response to the received ICF,

* Its intention not to receive time allocation from the Co-TDMA sharing AP during the current TXOP.
  + Note: If a Co-TDMA sharing AP does not receive a response from the polled AP, the Co-TDMA sharing AP shall consider that the polled AP does not intend to receive time allocation from the Co-TDMA sharing AP during the current TXOP.
* Its intention to receive time allocation from the Co-TDMA sharing AP during the current TXOP.
* Signaling details (including traffic indication) are TBD.**[#M157]**

**37.10.3 TXOP allocation phase**

A Co-TDMA sharing AP may allocate a time portion within its obtained TXOP to another AP that is not colocated with the Co-TDMA sharing AP. To share a time portion of the Co-TDMA sharing AP’s obtained TXOP, the AP shall transmit an MU-RTS TXS Trigger frame to the other AP that is not colocated with the Co-TDMA sharing AP.**[#M159]**

Note—The MU-RTS TXS Trigger frame is defined in 9.3.1.22.9 (MU-RTS Trigger frame format) with TBD modifications for the Co-TDMA procedure.

The Duration field of the MU-RTS TXS Trigger frame is set to one SIFS plus the time required to transmit the solicited CTS response frame.**[#M159]**

A Co-TDMA sharing AP identifies the Co-TDMA coordinated AP with which a time portion of the obtained TXOP is to be shared by setting the AID12 subfield of the User Info field of the MU-RTS TXS Trigger frame to the Co-TDMA coordinated AP’s AP ID.**[#M135]**

After a Co-TDMA coordinated AP receives an MU-RTS TXS Trigger frame from the Co-TDMA sharing AP that contains a User Info field that identifies the Co-TDMA coordinated AP, the AP may transmit and/or receive one or more PPDUs within the time allocation signaled in the MU-RTS TXS Trigger frame. The first PPDU of the exchange shall carry a CTS frame transmitted as per the rules defined in 26.2.6.3 (CTS frame sent in response to an MU-RTS Trigger frame).**[#M159]**

The time allocated to a Co-TDMA coordinated AP identified in the MU-RTS TXS Trigger frame is specified in the Allocation Duration subfield in the MU-RTS TXS Trigger frame.**[#M159]**

**37.10.4 TXOP return phase**

A Co-TDMA coordinated AP may return the remainder of the allocated time (if any) to the Co-TDMA sharing AP. The condition(s) for TXOP return and signaling details on how to return the TXOP are TBD.**[#M160]**

# Text to be adopted ends here.

**References:**

1. [11-24-0171r21](https://mentor.ieee.org/802.11/dcn/24/11-24-0171-21-00bn-tgbn-motions-list-part-1.pptx): 11-24-0171-21-00bn-tgbn-motions-list-part-1, Alfred Asterjadhi (Qualcomm Inc.)