IEEE P802.11  
Wireless LANs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| PDT MAC M-AP Coordination Framework | | | | |
| Date: 2025-01-01 | | | | |
| Author(s): | | | | |
| Name | Affiliation | Address | Phone | email | |
| Arik Klein | Huawei |  | +972548085336 | Arik.Klein@huawei.com | |
| Abhishek Chaturvedi | Samsung Electronics |  |  | [ac.vrns@GMAIL.COM](mailto:ac.vrns@GMAIL.COM) | |
| Abhishek Patil | Qualcomm |  |  | [appatil@qti.qualcomm.com](mailto:appatil@qti.qualcomm.com) | |
| Alfred Asterjadhi | Qualcomm |  |  | [asterjadhi@gmail.com](mailto:asterjadhi@gmail.com) | |
| Binita Gupta | Cisco Systems |  |  | [bingupta.ieee@GMAIL.COM](mailto:bingupta.ieee@GMAIL.COM) | |
| Brian Hart | Cisco Systems |  |  | [brianh@cisco.com](mailto:brianh@cisco.com) | |
| Dana Ciochina | Sony Corporation |  |  | [Dana.Ciochina@sony.com](mailto:Dana.Ciochina@sony.com) | |
| Dibakar Das | Intel |  |  | [dibakar.das@intel.com](mailto:dibakar.das@intel.com) | |
| Gaius Wee | Panasonic Corporation |  |  | [yaohuang.wee@SG.PANASONIC.COM](mailto:yaohuang.wee@SG.PANASONIC.COM) | |
| Gaurang Naik | Qualcomm |  |  | [gnaik@qti.qualcomm.com](mailto:gnaik@qti.qualcomm.com) | |
| Guarav Patwardhan | Hewlett Packard Enterprise |  |  | [gauravpatwardhan1@gmail.com](mailto:gauravpatwardhan1@gmail.com) | |
| GeonHwan Kim | LG ELECTRONICS |  |  | [geonhwan.kim@LGE.COM](mailto:geonhwan.kim@LGE.COM) | |
| Giovanni Chisci | Qualcomm |  |  | [gchisci@qti.qualcomm.com](mailto:gchisci@qti.qualcomm.com) | |
| Gwangho Lee | Korea National University of Transportation |  |  | [gwangho.lee@A.UT.AC.KR](mailto:gwangho.lee@A.UT.AC.KR) | |
| Haorui Yang | China Mobile |  |  | [yanghaorui0217@163.COM](mailto:yanghaorui0217@163.COM) | |
| Hirohiko INOHIZA | Canon |  |  | [inohiza.hirohiko@mail.canon](mailto:inohiza.hirohiko@mail.canon) | |
| Insun Jang | LG ELECTRONICS |  |  | [insun.jang@LGE.COM](mailto:insun.jang@LGE.COM) | |
| Jason Yuchen Guo | Huawei |  |  | [guoyuchen@huawei.com](mailto:guoyuchen@huawei.com) | |
| Jay Yang | ZTE |  |  | [yang.zhijie@ZTE.COM.CN](mailto:yang.zhijie@ZTE.COM.CN) | |
| Jeongki Kim | Offino |  |  | [jeongki.kim.ieee@GMAIL.COM](mailto:jeongki.kim.ieee@GMAIL.COM) | |
| Jerome Gu | Clourney Semicondcutor |  |  | [jeg150@clourneysemi.com](mailto:jeg150@clourneysemi.com) | |
| Jiayi Zhang | Offino |  |  | [jzhang@ofinno.com](mailto:jzhang@ofinno.com) | |
| John Wullert | Peraton Labs |  |  | [jwullert@PERATONLABS.COM](mailto:jwullert@PERATONLABS.COM) | |
| Jonghoe Koo | Samsung Electronics |  |  | [jh89.koo@SAMSUNG.COM](mailto:jh89.koo@SAMSUNG.COM) | |
| Kaikai Huang | Nokia |  |  | [kaikai.huang@NOKIA-SBELL.COM](mailto:kaikai.huang@NOKIA-SBELL.COM) | |
| Kaiying Lu | Mediatek |  |  | [Kaiying.Lu@MEDIATEK.COM](mailto:Kaiying.Lu@MEDIATEK.COM) | |
| Kazuto Yano | ATR |  |  | [kzyano@IEEE.ORG](mailto:kzyano@IEEE.ORG) | |
| Ke Zhong | Ruijie Networks |  |  | [zhongke@RUIJIE.COM.CN](mailto:zhongke@RUIJIE.COM.CN) | |
| Kosuke Aio | Sony Corporation |  |  | [Kosuke.Aio@sony.com](mailto:Kosuke.Aio@sony.com) | |
| Kyosuke Inoue | SHARP CORPORATION |  |  | [kyosuke\_inoue@SHARP.CO.JP](mailto:kyosuke_inoue@SHARP.CO.JP) | |
| Lei Zhou | H3C Technologies |  |  | [zhou.leiH@H3C.COM](mailto:zhou.leiH@H3C.COM) | |
| Leif Wilhelmsson | Ericsson |  |  | [leif.r.wilhelmsson@ericsson.com](mailto:leif.r.wilhelmsson@ericsson.com) | |
| Leonardo Lanante | Ofinno |  |  | [llanante@OFINNO.COM](mailto:llanante@OFINNO.COM) | |
| Lili Hervieu | Cable Television Laboratories |  |  | [L.Hervieu@CABLELABS.COM](mailto:L.Hervieu@CABLELABS.COM) | |
| Liuming Lu | Guangdong Oppo |  |  | [luliuming@OPPO.COM](mailto:luliuming@OPPO.COM) | |
| Liwen Chu | NXP Semiconductors |  |  | [liwen.chu@nxp.com](mailto:liwen.chu@nxp.com) | |
| Lyutianyang Zhang | Huawei |  |  | [zhanglyutianyang@huawei.com](mailto:zhanglyutianyang@huawei.com) | |
| Massinissa Lalam | SAGEMCOM |  |  | [massinissa.lalam@SAGEMCOM.COM](mailto:massinissa.lalam@SAGEMCOM.COM) | |
| Jun Minotani | Panasonic |  |  | [minotani.jun@JP.PANASONIC.COM](mailto:minotani.jun@JP.PANASONIC.COM) | |
| Muhammad Kumail Haider | Meta |  |  | [kumail.ieee@GMAIL.COM](mailto:kumail.ieee@GMAIL.COM) | |
| Nima Namvar | Charter Communications |  |  | [nimanamvar1987@GMAIL.COM](mailto:nimanamvar1987@GMAIL.COM) | |
| Pascal Viger | Canon |  |  | [pascal.viger@crf.canon.fr](mailto:pascal.viger@crf.canon.fr) | |
| Patrice Nezou | Canon |  |  | [patrice.nezou@crf.canon.fr](mailto:patrice.nezou@crf.canon.fr) | |
| Pei Zhou | TCL |  |  | [Zhoupei36@gmail.com](mailto:Zhoupei36@gmail.com) | |
| Peshal Nayak | Samsung |  |  | [p.nayak@SAMSUNG.COM](mailto:p.nayak@SAMSUNG.COM) | |
| Rishabh Roy | Samsung Electronics |  |  | [201082002@IITDH.AC.IN](mailto:201082002@IITDH.AC.IN) | |
| Ross Jian Yu | Huawei |  |  | [ross.yujian@huawei.com](mailto:ross.yujian@huawei.com) | |
| Rubayet Shafin | Samsung |  |  | [r.shafin@SAMSUNG.COM](mailto:r.shafin@SAMSUNG.COM) | |
| Sanket Kalamkar | Qualcomm |  |  | [sankal@qti.qualcomm.com](mailto:sankal@qti.qualcomm.com) | |
| Shawn Kim | WILUS |  |  | [Shawn.kim@wilusgroup.com](mailto:Shawn.kim@wilusgroup.com) | |
| Shuang Fan | Sanechips Technology |  |  | [fan.shuang@SANECHIPS.COM.CN](mailto:fan.shuang@SANECHIPS.COM.CN) | |
| Shubhodeep Adhikari | Broadcom |  |  | [shubhodeep.adhikari@broadcom.com](mailto:shubhodeep.adhikari@broadcom.com) | |
| Sindhu Verma | Broadcom |  |  | [sindhu.verma@broadcom.com](mailto:sindhu.verma@broadcom.com) | |
| Sungjin Park | senscomm |  |  |  | |
| SunHee Baek | LG ELECTRONICS |  |  | [sunhee.baek@LGE.COM](mailto:sunhee.baek@LGE.COM) | |
| Taeyoung Ha | Samsung Electronics |  |  | [ty1115.ha@samsung.com](mailto:ty1115.ha@samsung.com) | |
| Tong Bian | Panasonic Corporation |  |  | [tong.bian@SG.PANASONIC.COM](mailto:tong.bian@SG.PANASONIC.COM) | |
| Vishnu Ratnam | Samsung |  |  | [vishnu.r@SAMSUNG.COM](mailto:vishnu.r@SAMSUNG.COM) | |
| Woojin Ahn | KNUT |  |  | [Woojin.ahn@ut.ac.kr](mailto:Woojin.ahn@ut.ac.kr) | |
| Xiandong Dong | Xiaomi |  |  |  | |
| Xiangxin Gu | Spreadtrum |  |  | [Xiangxin.Gu@UNISOC.COM](mailto:Xiangxin.Gu@UNISOC.COM) | |
| Xiaofei Wang | Interdigital |  |  | [Xiaofei.Wang@INTERDIGITAL.COM](mailto:Xiaofei.Wang@INTERDIGITAL.COM) | |
| Xuwen Zhao | TCL |  |  | [li.yan16@zte.com.cn](mailto:li.yan16@zte.com.cn) | |
| Yajun Cheng |  |  |  | [000038d07d12e9a7-dmarc-request@listserv.ieee.org](mailto:000038d07d12e9a7-dmarc-request@listserv.ieee.org) | |
| Yanjun Sun | Apple Inc |  |  | [yanjunsunstd@GMAIL.COM](mailto:yanjunsunstd@GMAIL.COM) | |
| Yaoshen Cui | TP-Link Systems |  |  | [cuiyaoshen@TP-LINK.COM.HK](mailto:cuiyaoshen@TP-LINK.COM.HK) | |
| Yelin Yoon | LG ELECTRONICS |  |  | [yl.yoon@LGE.COM](mailto:yl.yoon@LGE.COM) | |
| Yongho Seok | Apple Inc |  |  | [y\_seok@apple.com](mailto:y_seok@apple.com) | |
| Yongsen Ma | Samsung Electronics |  |  | [yongsen.ma@samsung.com](mailto:yongsen.ma@samsung.com) | |
| Yuki Fujimori | Canon |  |  | [Yuki.Fujimori@CRF.CANON.FR](mailto:Yuki.Fujimori@CRF.CANON.FR) | |
| Yunpeng Yang | TP-Link Systems |  |  | [yangyunpeng@TP-LINK.COM.HK](mailto:yangyunpeng@TP-LINK.COM.HK) | |
| Yusuke Tanaka | Sony Corporation |  |  | [yusuke.yt.tanaka@sony.com](mailto:yusuke.yt.tanaka@sony.com) | |
| Yuxin Lu | TCL |  |  | [eeluyx@GMAIL.COM](mailto:eeluyx@GMAIL.COM) | |
| Zhenpeng Shi | Huawei |  |  | [shizhenpeng1@huawei.com](mailto:shizhenpeng1@huawei.com) | |
|  |  |  |  |  | |
|  |  |  |  |  | |

Abstract

This document contains Proposed Draft Text (PDT) for the Multi AP (M-AP) Coordination framework feature of the proposed TGbn (UHR, Ultra High Reliability) amendment to the 802.11 standard.

# 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 | Typo corrections, adding AP ID definition, updates in 9.4.2.x UHR Capabilities element, text modifications in 37.7.1 General due to comments from: Jay, Xiaofei, Giovanni |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

# 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 TGbe 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 TGbe 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 passing motions:

* 11bn defines a common framework of a Multi-AP Coordination for various coordination schemes.
  + Note - Coordination schemes such as (but not limited to): Co-SR (TXOP-based with power control), Co-BF, Co-TDMA, Co-RTWT, etc.

[Motion #50, [1] and [131, 151, 134, 137, 141, 152-156, 117, 157, 158]]

* 11bn defines a common framework of a Multi-AP Coordination that can enable the following procedures:
  + Multi-AP Coordination Discovery procedure
  + Multi-AP Coordination agreement negotiation procedure
  + Note: Details of the procedures and whether the above procedures are mandatory/optional - TBD

[Motion #51, [1] and [131, 151, 134, 137, 141, 152-156, 117, 157, 158]]

* A UHR AP shall indicate to another AP its capability to respond in a TB PPDU or not  
  [Motion #120, [1] and [108, 115, 122, 123, 124]]
* APs that intend to participate in Multi-AP coordination can use management frames to advertise/discover the capabilities and/or parameters of individual schemes.

[Motion #147, [1] and [134, 110, 117, 157, 158, 218]]

* APs that discovered each other and want to establish agreement(s) for Multi-AP coordination scheme(s), can use individually addressed management frames to establish the agreement(s) and negotiate parameters
  + Note: The management frame can be a Public Action and/or new Action frames, and so on.

[Motion #148, [1] and [134, 110, 117, 157, 158, 218]]

* 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 #135, [1] and [207, 208, 157, 117, 118, 122, 123, 108, 115, 124, 158]]

# Text to be adopted begins here:

***TGbn editor: Please make the following changes to the 802.11bn draft D0.1:***

3.2 Definitions specific to IEEE Std 802.11

***TGbn editor: Please insert a new definition as follows:***

access point identifier: [AP ID] A value used for identifying an AP, with which a Multi -AP coordination agreement has been set, in TBD frames, prior to or during a M-AP Coordination transmission.

**9.3.3.5. Association Request frame format**

***TGbn editor: Please insert a new row as follows:***

**Table 9-64—Association Request frame body**

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| … |  |  |
| <Last assigned + 1> | UHR Capabilities | The UHR Capabilities element is present if dot11UHROptionImple- mented is true; otherwise, it is not present. |

**9.3.3.6. Association Response frame format**

***TGbn editor: Please insert a new row as follows:***

**Table 9-63—Association Response frame body**

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| … |  |  |
| <Last assigned + 1> | UHR Capabilities | The UHR Capabilities element is present if dot11UHROptionImple- mented is true; otherwise, it is not present. |
| <Last assigned + 2> | UHR Operation | The UHR Operation element is present if dot11UHROptionImple- mented is true; otherwise, it is not present. |

**9.3.3.7. Reassociation Request frame format**

***TGbn editor: Please insert a new row as follows:***

**Table 9-66—Association Request frame body**

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| … |  |  |
| <Last assigned + 1> | UHR Capabilities | The UHR Capabilities element is present if dot11UHROptionImplemented is true; otherwise, it is not present. |

* + - 1. **Reassociation Response frame format**

***TGbn editor: Please insert a new row as follows:***

**Table 9-65—Reassociation Response frame body**

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| … |  |  |
| <Last assigned + 1> | UHR Capabilities | The UHR Capabilities element is present if dot11UHROptionImple- mented is true; otherwise, it is not present. |
| <Last assigned + 2> | UHR Operation | The UHR Operation element is present if dot11UHROptionImple- mented is true; otherwise, it is not present. |

* + - 1. **Probe Request frame format**

***TGbn editor: Please insert a new row as follows:***

**Table 9-68—Probe Request frame body**

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| … |  |  |
| <Last assigned + 1> | UHR Capabilities | The UHR Capabilities element is present if dot11UHROptionImplemented is true; otherwise, it is not present. |

* + - 1. **Probe Response frame format (TBD)**

***TGbn editor: Please insert a new row as follows:***

**Table 9-67—Probe Response frame body**

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| … |  |  |
| <Last assigned + 1> | UHR Capabilities | The UHR Capabilities element is present if dot11UHROptionImple- mented is true; otherwise, it is not present. |
| <Last assigned + 2> | UHR Operation | The UHR Operation element is present if dot11UHROptionImple- mented is true; otherwise, it is not present. |

* + 1. **Elements**
       1. **General**

***TGbn editor: Please insert a new row as follows:***

**Table 9-128—Element IDs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Element** | **Element ID** | **Element ID Extension** | **Extensible** | **Fragmentable** |
| … |  |  |  |  |
| UHR Capabilities (see [9.4.2.x (UHR](#_bookmark180)  [Capabilities element)](#_bookmark180)) | 255 | <ANA> | Yes | No |
| UHR Operation (see [9.4.2.x (UHR](#_bookmark180)  [Capabilities element)](#_bookmark180)) | 255 | <ANA> | Yes | No |

***TGbn editor: Please insert a new subclause as follows:***

**9.4.2.x UHR Capabilities element**

The format of the UHR Capabilities element is shown in [Figure 9-X1 (UHR Capabilities element format)](#_bookmark181).

|  |  |  |  |
| --- | --- | --- | --- |
| Element ID | Length | Element ID Extension | UHR MAC Capabilities Information |

Octets: 1 1 1 TBD

**Figure 9-X1—UHR Capabilities element format**

The Element ID, Length, and Element ID Extension fields are defined in 9.4.2.1 (General)

The format of the UHR MAC Capabilities Information field is defined in Figure 9-X2 (UHR MAC

Capabilities Information field format).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | B0 | B1 | B2 - TBD |  |
|  | NPCA Supported | AP TB PPDU Response | Reserved |  |
| Bits: | 1 | 1 | TBD |  |

**Figure 9-X2—** **UHR MAC Capabilities Information field format**

The AP TB PPDU Response subfield indicates whether an AP supports a TB PPDU Response to a preceding TF that is destined to that AP. A value of 1 in this subfield indicates that the AP supports a TB PPDU response to a Trigger frame that includes it’s AP ID value in the User Info field. A value of 0 in this subfield indicates that the AP does not support a TB PPDU response to a Trigger frame that includes it’s AP ID value in the User Info field.

NOTE: This subfield is relevant only for UHR AP.

***TGbn editor: Please add the following subclause 37.7 M-AP Coordinated framework in 802.11bn D0.1:***

37.7 Multi-AP Coordination framework

37.7.1 General

The Multi-AP Coordination feature includes a set of schemes and procedures in which OBSS Aps coordinate their transmission to improbe communication reliability.

This section details all the procedures that are common for all coordination schemes:

The Multi -AP Coordination Discovery procedure is defined in 37.7.2.

The Multi -AP Coordination agreement negotiation procedure is defined in 37.7.3

All other procedures that are specific per coordination scheme are detailed in 37.7.2 (Coordinated beamforming), 37.7.3 (Coordinated spatial reuse), 37.7.4 (Coordinated time division multiple access), 37.7.5 (Coordinated R-TWT).

37.7.1.1 Multi -AP Coordination Discovery

UHR APs participating in Multi -AP coordination may transmit TBD Management frames to advertise capabilities of M-AP coordination schemes and their parameters.

Details are TBD

37.7.1.2 Multi -AP Coordination Agreement Negotiation

A UHR AP shall follow the rules defined in this subclause to establish an agreement for Multi-AP Cooridnation through negotiation, in addition to the specific rules for Multi-AP coordination scheme used for this agreement and are defined in TBD subclause.

A UHR AP may initiate a negotiation with one or more UHR APs that were discovered to support Multi-AP Coordination scheme (as the initiating AP) and may transmit a TBD individually addressed Management frame(s) to establish a Multi-AP Coordination agreement with the one or more UHR APs.

Details are TBD

37.7.1.3 AP ID assignment

A UHR AP shall follow the rules defined in this subclause additionally to the rules defined in 37.7.1.2 (Multi -AP Coordination Agreement Negotiation) to assign an AP ID to another AP with which it establishes a Multi-AP Coordination agreement.

Details of AP ID assignment are TBD

# 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.)