IEEE P802.11  
Wireless LANs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CID Resolution CC50 for Co-RTWT | | | | |
| Date: 2025-07-25 | | | | |
| Author(s): | | | | |
| Name | Affiliation | Address | Phone | email |
| Giovanni Chisci | Qualcomm |  |  | [gchisci@qti.qualcomm.com](mailto:gchisci@qti.qualcomm.com) |
| Abhishek Patil | Qualcomm |  |  | [appatil@qti.qualcomm.com](mailto:appatil@qti.qualcomm.com) |
| Alfred Asterjadhi | Qualcomm |  |  | [asterjadhi@gmail.com](mailto:asterjadhi@gmail.com) |
| Gaurang Naik | Qualcomm |  |  | [gnaik@qti.qualcomm.com](mailto:gnaik@qti.qualcomm.com) |
| Sanket Kalamkar | Qualcomm |  |  | [sankal@qti.qualcomm.com](mailto:sankal@qti.qualcomm.com) |
| Sherief Helwa | Qualcomm |  |  | [shelwa@qti.qualcomm.com](mailto:shelwa@qti.qualcomm.com) |
| Duncan Ho | Qualcomm |  |  | [dho@qti.qualcomm.com](mailto:dho@qti.qualcomm.com) |
| George Cherian | Qualcomm |  |  | [gcherian@qti.qualcomm.com](mailto:gcherian@qti.qualcomm.com) |

Abstract

This document provides CRs for the following CIDs:

Co-RTWT CIDs (24 are resolved):

831, 894, 1438, 1714, 1868, 1909, 1911, 2206, 2210, 2695, 2837, 2838, 3152, 3153, 3154, 3155, 3583, 3584, 3711, 3735, 3752, 3754, 3794, 3813,

***TGbn editor:Baselines for this document are 11bn D0.3, 25/0599r16 (approved in Motion 435), 11be D7.0, and REVme D7.0***

# 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 | * Editorials * Adjusted language (modified to have normative language) in second to last paragraph of 37.13.1.3.1 (General) under 37.13.1.3 (MAPC agreement negotiation) * Clarification of behavior for setting MAPC Operation type when an agreement for a given B-TWT ID is or is not in existence (new sentences at the end of the second paragraph of 37.13.2.4.2)   + **To the PoCs of other MAPC schemes**: please add similar sentences in your ‘Scheme\_XYZ negotiations’ subclause * Moved a statement for ‘If the MAPC Operation Type field is set to 5, the MAPC Request Parameter Set shall be included.’ from the second to last paragraph in 37.13.1.3.1 to the third to last paragraph in 37.13.2.4.2   + **To the PoCs of other MAPC schemes**: Rationale is that depending on whether a scheme defines[does not define] the MAPC Request Parameter Set field format in its profile, the ‘alternate’ MAPC Operation Type is to allowed[not allowed] in spec:     - CoRTWT example: MAPC Request Parameter Set field format defined in its profile (9.4.2.aa3.2.5), then ‘alternate’ is allowed, then details provided in the moved text (third to last paragraph in 37.13.2.4.2)     - Scheme\_XYZ example: MAPC Request Parameter Set field format NOT defined in its profile (e.g., ‘The MAPC Request Parameter Set field is not included’ language in 9.4.2.aa3.2.XYZ), then in the subclause ‘Scheme\_XYZ negotiations’ a sentence as follows should be carried: ‘The AP shall not set the MAPC Operation Type field carried in the MAPC Scheme Request field of the Scheme\_XYZ profile that is carried in the MAPC Negotiation Response frame to 5’ |
| 2 | * Generalization in definition of ‘Co-RTWT parameter set’ |

# 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 and CIDs collected during CC50 on D0.1.

### Relevant Passing Motions

[Motion #50]

* 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 #51]

* 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 #120]

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

[Motion #135]

* 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 #147]

* 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 #148]

* 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 #184, [1]]

* 11bn enhances existing mechanism(s) to improve latency for a non-AP STA communication with another non-AP STA on the base channel and off-channel, respectively, by
  + enhancing mechanism(s) to allow an AP to share a TXOP with multiple peer-to-peer (P2P) non-AP STAs(s)
  + enhancing the baseline Channel Usage procedure to provide better recommendation on channel selection for P2P by enabling coordination between APs that do not belong to the same ESS so that the channels recommended for P2P operation sent by those APs are the same.

**Note 1:** the coordinated channel recommendation is an optional feature. Also, the responding AP has an option to reject the request for such coordination.

**Note 2:**

* Base channel is the channel where the AP associated with the non-AP STA is operating.
* A channel outside its associated AP’s operating BW is an off-channel for the non-AP STA.

[Motion #185]

* Define a mechanism in 11bn that defines:
  + AP-to-AP frame formats to enable interoperable MAPC across APs and including MLME primitive(s) so that a pair of AP’s SMEs can orchestrate the over-the-air transmission and reception of these frames
  + MLME primitive(s) so that a pair of AP’s SMEs may send the content of the non-real-time instances of such AP-to-AP frames over-the-DS between peer AP-MLMEs (rather than over-the-air via peer AP MACs)

[Motion #265]

* As a part of M-AP coordination agreement procedure, an AP may assign an AP ID to another AP with the following constraints:
  + The AP ID is used for the AP to identify another AP as a coordinated AP, when necessary.
  + The AP ID field has the same size and the field value has a range as defined in AID field (see 9.4.1.8)
  + The AP shall ensure that the AP ID value is not assigned by the AP or by its affiliated MLD to any other STA (e.g., STA is an associated non-AP STA, an unassociated non-AP STA that has been allocated a (Ranging session Identifier) RSID , or any other coordinated AP), or a non-AP MLD that is associated with the AP MLD
  + It's TBD whether the AP ID value is greater than 2^n where n is the maximum of the value carried in the MBSSID Indicator (n) field of the Multiple BSSID element for any AP affiliated with the AP MLD that belongs to a multiple BSSID set

[Motion #342]

* Established coordination between two APs can be terminated by an explicit teardown performed by one of the two APs.

[Motion #358]

* TGbn defines new actions for Public Action frames for MAPC communications such as discovery and negotiations
  + An action is defined for MAPC Discovery
  + An action is defined for MAPC Negotiation Request
  + An action is defined for MAPC Negotiation Response
  + Others are TBD

[Motion #359]

* When an AP use Management frames to discover the capabilities and/or parameters of individual M-AP coordination schemes, the AP shall use the defined MAPC Public Action frame with the following setting:
  + The action field is set to MAPC Discovery

[Motion #360]

* When an AP (AP1) uses an individually addressed Management frame to initiate a negotiation to establish agreements for M-AP coordination schemes (if enabled by another AP (AP2)), the AP (AP1) shall use the defined MAPC Public Action frame with the following setting:
  + The Action field is set to MAPC Negotiation Request
  + If new negotiations are disabled by another AP (AP2) the AP (AP1) shall not send a negotiation request to the other AP (AP2)
  + TBD details of ‘new negotiations disabled

[Motion #361]

* When an AP (AP2) receives an individually addressed Management frame that initiates a negotiation to establish agreements for M-AP coordination schemes, the AP (AP2) shall respond by using the defined MAPC Public Action frame with the following setting, if negotiations are enabled:
  + The Action field is set to MAPC Negotiation Response

[Motion #48]

* Define mechanisms that enable APs to coordinate their rTWT schedule(s) and/or to ensure that one AP provides the protection of the rTWT schedule(s) of the other AP.
* NOTE – TBD mechanisms including negotiation between 2 APs and advertisement.

[Motion #149]

* If an AP extends the protection of the rTWT schedule of another AP, following negotiation or through other means, then:
  + The AP shall ensure its TXOP ends before the start time of the corresponding OBSS rTWT SP(s)
  + The AP, if it has at least one associated STA that is capable of rTWT, shall advertise in the beacon frames it transmits the OBSS rTWT schedule so that its associated STAs supporting rTWT follow the baseline rTWT rules for the OBSS rTWT schedule.

[Motion #453]

**Move to approve resolutions to the CIDs [68C]:**

* 148, 152, 153, 160, 161, 181, 669, 775, 876, 1318, 1319, 1320, 1324, 1395, 1398, 1399, 1428, 1491, 1494, 1739, 1788, 1789, 2466, 3254, 3438, 3606, 3779, 3780, 3781 in [11-25/0599r16](https://mentor.ieee.org/802.11/dcn/25/11-25-0599-16-00bn-pdt-mac-mapc-signaling-and-protocol-aspects.docx) *[29 CIDs]*
* *…*

### Comments (CIDs) resolved:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CID** | **Commenter** | **Clause** | **Page** | **Comment** | **Proposed Change** | **Resolution** |
| 831 | Oren Kedem | 37.8.2.4 | 74.34 | Does the Shared and Sharing APs participating in Coordinated R-TWT should sync their TSF ? | Please clarify | Revised  Agree in principle. A note is added to clarify that TSF synchronization is outside of the scope of this standard.  TGbn editor: please implement changes as shown in this document tagged #831. |
| 894 | Pascal VIGER | 3.2 | 21.14 | There exist both definitions of "Coordinated AP" and "Co-RTWT Coordinated AP", but the second does not rely on the first one, and so it is not sure if Coordinated AP refers to the same concept. | Please harmonize "Coordinated AP" definition and usage of this terminology per each MAP technology | Rejected  There have been discussions on these definitions and group has converged on using a common terminology for Co-SR, Co-TDMA, Co-BF, and a separate terminology for Co-RTWT. |
| 1438 | Akira Kishida | 37.8.2.4.3 Co-RTWT announcement rules | 75.19 | For the sake of OBSS AP(s) that do(es) not join Co-RTWT recognize Co-RTWT SP, the member APs of Co-RTWT should broadcast information of R-TWT SP that of each member of AP. | Define including the information in management frames, such as Beacon frames. | Revised  Agree in principle  TGbn editor: please implement changes as shown in this document tagged #1438. |
| 1714 | Gaius Wee | 37.8.2.4 | 74.29 | "Co-RTWT" can be better understood and associated with "R-TWT" by renaming as "Co-R-TWT". | Replace "Co-RTWT" with "Co-R-TWT" throughout | Rejected  For the time being, the group seems to be ok with the current handle.  The comment fails to identify a technical issue with the TGbn draft. |
| 1868 | Sanghyun Kim | 37.8.2.4.4 | 75.32 | If the ongoing TXOP does not occupy the primary channel of the Co-RTWT requesting AP, it may not be necessary to terminate the TXOP. Additionally, if the traffic transmitted through the ongoing TXOP is LL traffic, whether the TXOP should be terminated immediately seems to be a contentious issue. | Conditions and exceptions that specify when the ongoing TXOP must be terminated before the protected R-TWT SP should be defined | Revised  Agreed in principle. Some conditions are added for NPCA operation.  TGbn editor: please implement changes as shown in this document tagged #1868. |
| 1909 | Hyeonjun Sung | 37.8.2.4.3 | 75.19 | In TGbn draft 0.1 text, there is no consideration about the Co-RTWT coordinated AP's Beacon Interval when a Co-RTWT Requesting AP transmits request to protect its R-TWT schedule.  If not consider, Co-RTWT coordinated AP may not advertise the Co-RTWT schedule to associated non-AP STA after Co-RTWT negotiation. That Co-RTWT SP can be protected by Co-RTWT coordinated AP, but Co-RTWT coordinated AP's associated non-AP STA may not protect its R-TWT SP.  If the Co-RTWT requesting AP wants to protect its R-TWT schedule from AP and non-AP STA, it needs to define the announcement rules when the start time of Co-RTWT SP is before the Co-RTWT coordinated AP's TBTT | Please add a Co-RTWT announcement rules when the Co-RTWT SP starts before Co-RTWT coordinated AP's TBTT | Rejected  The comment fails to identify a technical issue with the TGbn draft. |
| 1911 | Hyeonjun Sung | 37.8.2.4.4 | 75.29 | Need to clarify the range of Co-RTWT protection.  In the following text, the Co-RTWT coordinated AP as a TXOP holder shall ensure that its TXOP ends before the start time of any active Co-RTWT SP. it seems only protecting the start time of Co-RTWT SP.  the Co-RTWT SP protecting method about middle of Co-RTWT SP is needed. | Please clarify the range of Co-RTWT protection | Rejected  It is confirmed that currently, the only agreed protection refers to the boundary of the SP as specified in 37.13.2.4.4 in Draft TGbn D0.3.  The comment fails to identify a technical issue in the TGbn draft. |
| 2206 | Brian Hart | 37.8.2.4.1 | 74.35 | The existing Co-RTWT requirements will be counterproductive in realistic environments with overlapping administrative domains, given that each domain may have a preferred Service Interval and/or start time and/or timebase. This will lead to the start time of RTWT SPs randomly landing very near other start times and/or drifting to be close in time. This is bad since the earlier SP will be a runt SP since it will be quickly terminated by the start of the OBSS's next SP | Enable two APs to negotiate exceptions to the Co-RTWT Start Time Protection Rule (STPR) when their SPs start too close together; such as by allowing the replacement of a runt RTWT SP by a Co-TDMA TXOP | Rejected  The comment fails to identify a technical issue with the TGbn draft. |
| 2210 | Brian Hart | 37.8.2.4.1 | 74.35 | For Co-RTWT to operate between individual APs makes sense for non-colocated APs but is inefficent (and even weird) for the colocated APs typically used to support different SSIDs (such as for resident/employee vs guest and WPA2 vs WPA3 vs IOT). | MAPC interactions between "APs" should all operate at the Colocated BSSID Set level: such as capability negotiation, buffer status, flow requirements, medium resource sharing, TXOP grant, and TXOP return | Revised  Agree in principle.  TGbn editor: please implement changes as shown in this document tagged #2210. |
| 2695 | Salvatore Talarico | 37.8.2.4.4 | 75.34 | Procedure related to how to endure the TxOP is ended before the start of any active Co-RTWT SP for NPCA capable STAs is missing | In order to avoid overprotection, a procedure to treat the case when Co-RTWT is used jointly with NPCA is needed so that to properly ensure TxOP truncation. | Revised  Agree in principle.  TGbn editor: please implement changes as shown in this document tagged #2695. |
| 2837 | Mark RISON | 3.2 | 0.00 | "Co-RTWT agreement" and "Co-RTWT negotiation" definitions are circular | As it says in the comment | Revised  Agree in principle. "Co-RTWT agreement" definition is removed.  TGbn editor: please implement changes as shown in this document tagged #2837. |
| 2838 | Mark RISON | 3.2 | 0.00 | It is not clear how a Co-RTWT coordinated AP differs from a Co-RTWT responding AP | As it says in the comment | Revised  Agree in principle. Co-RTWT responding AP was removed in a previous iteration.  TGbn editor: please implement changes as shown in this document tagged #2838. |
| 3152 | Yunbo Li | 3.2 | 21.32 | The Co-RTWT agreement and Co-RTWT negotiation refer to each other, but neither of them explain what's the function or purpose of Co-RTWT. | combine them into one terminology to reduce the number of terminologies under Co-RTWT. | Revised  Agree in principle. "Co-RTWT agreement" definition is removed.  TGbn editor: please implement changes as shown in this document tagged CID3152. |
| 3153 | Yunbo Li | 3.2 | 21.47 | It is not clear Co-RTWT AP requests protection from whom. If request protection from association STAs, that is RTWT, not Co-RTWT. | complete the sentence to make it clear. | Revised  Agree in principle  TGbn editor: please implement changes as shown in this document tagged #3153. |
| 3154 | Yunbo Li | 3.2 | 21.32 | Seems too many Co-RTWT related terminologies. For now, there are 8 terms for Co-RTWT, 1 for Co-BF, 1 for CSR, 1 for Co-TDMA. | It is not clear to me why Co-RTWT need much more terminologies than other flavors of MAPC. For the proposed change, please align the descriptoin styles for all flavors of MAPC. | Revised  Agree in principle  TGbn editor: please implement changes as shown in this document tagged #3154. |
| 3155 | Yunbo Li | 3.2 | 21.56 | "during which Co-RWT coordinated APs extend protection to", the protection from coordinated APs only applies for the start of Co-RTWT SP. | modify the text to align with the technical behaviors. For example change "during" to "for". | Revised  Definition is removed, since we can simply refer to the R-TWT SPs that are protected.  TGbn editor: please implement changes as shown in this document tagged #3155. |
| 3583 | Malcolm Smith | 37.8.2.4.1 | 74.49 | Fundamentally, exhcnaging individual R-TWT SPs between CoRTWT APs based on the underlying R-TWT SP is unscalable and (as per comment 9) unlikely to have high market adoption. A CoRWT AP should be able to formulate Service Period (SP) parameters based either on sets of R-TWTs in it's BSS (e.g. aggregate) and/or based on other scheduliung data (e.g. SCS QC flows enforced via TUA-O and MU-EDCA). | Expand the definiiton of SPs exchanged between CoRTWT APs to include R-TWT derived SPs but also non-R-TWT derived SPs and allow the SP to represent a grouping of undrlying BSS SPs | Rejected  The comment fails to identify a technical issue with the draft. |
| 3584 | Malcolm Smith | 37.8.2.4.2 | 75.08 | Fundamentally, exhcnaging individual R-TWT SPs between CoRTWT APs based on the underlying R-TWT SP is unscalable and (as per comment 9) unlikely to have high market adoption. A CoRWT AP should be able to formulate Service Period (SP) parameters based either on sets of R-TWTs in it's BSS (e.g. aggregate) and/or based on other scheduliung data (e.g. SCS QC flows enforced via TUA-O and MU-EDCA). | Expand the definiiton of SPs exchanged between CoRTWT APs to include R-TWT derived SPs but also non-R-TWT derived SPs and allow the SP to represent a grouping of undrlying BSS SPs | Rejected  The comment fails to identify a technical issue with the draft. |
| 3711 | Li-Hsiang Sun | 37.8.2.4.2 | 75.26 | Whether the channel access rules applies to the NPCA if the responding AP's NPCA primary channel (e.g. in responding AP's S160) is outside co-RTWT requesting AP's operating channel (e.g. in P160) ? | The Co-RTWT AP indicates in its advertised RTWT schedule that a RTWT is not applicable to NPCA with BW < certain value | Revised  Agree in principle. There may be no need of explicit indication, although a simple rule can be added.  TGbn editor: please implement changes as shown in this document tagged #3711. |
| 3735 | Jiayi Zhang | 37.8.1.3.1 | 71.58 | How does the cooridnating AP select one MAPC scheme of multiple schemes negotiated with the coordinated AP? The coordinated AP may indicate its preferred/recommnended scheme to the coordinating AP, and then the coordinating AP can consider the preferred scheme indicated by the coordinated AP when the coordinating AP selects the MAPC scheme | Define a mechanism for the coordinating AP to select one MAPC scheme of multiple schemes negotiated with the coordinated AP. | Rejected  The comment fails to identify a technical issue with the draft. |
| 3752 | Leonardo Lanante | 37.8.2.4.4 | 75.31 | It is unclear why a coordinated AP would accept extending TXOP protections for R-TWT schedules of another AP. We need to define mechanisms for the coordinated APs to limit the effects of these TXOP protections. Otherwise, a coordinated AP may just reject any request. | Define alternative access mechanisms for coordinated APs during co-RTWT SPs. We can leverage NPCA and/or DSO to allow coordinated APs to communicate during another AP's R-TWT SPs. | Revised  Agree in principle.  TGbn editor: please implement changes as shown in this document tagged #3752. |
| 3754 | Rishabh Roy | 37.8.2.4.4 | 75.31 | There is not enough clarity on what the Co-RTWT coordinated AP does to extend protection after the Co-RTWT SP starts. It seems the Co-RTWT coordinated AP only extends protection at the start of the Co-RTWT SP by ending its TXOP if it is a TXOP holder but not so sure what it does during the Co-RTWT SP duration as it is free to contend for the channel during that time | Define how exactly Co-RTWT coordinated AP extends protection for the entire Co-RTWT SP duration | Rejected  It is confirmed that currently, the only agreed protection refers to the boundary of the SP as specified in 37.13.2.4.4 in Draft TGbn D0.3.  The comment fails to identify a technical issue in the TGbn draft. |
| 3794 | Yongho Seok | 37.8.2.4.3 | 75.24 | "...shall advertise the R-TWT schedule(s) in its transmitted Beacon frames if the Co-RTWT coordinated AP has at least one associated STA that supports RTWT." If an R-TWT schedule is already prohibited by the PUO, it does not need to be advertised. Change 'shall' with 'should' or specify any applicable exceptions. | As in the comment | Rejected  If the advertised SPs of the R-TWT schedule overlaps with an unavailability period, there are no issues.  The comment fails to identify a technical issue with the draft. |
| 3813 | Abhishek Patil | 3.2 | 21.61 | Coordinating APs do not need to have the same clock - i.e., have independent TSF. Therefore, clarify in the definition that this is TSF of the requesting AP. | Add "of the Co-RTWT Requesting AP" after '(TSF)' and "belonging to the Co-RTWT Requesting AP" after 'SP'. | Revised  Agree in principle  TGbn editor: please implement changes as shown in this document tagged #3813. |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

# Discussion:

### MAPC element in 25/0599r16

The structure of the MAPC element defined in subclause 9.4.2.aa3 (MAPC element) of 25/0599r16 (approved document in Motion 453) is summarized in the figure below.

A group of white papers with text and numbers

AI-generated content may be incorrect.

# Text to be adopted begins here:

3.2 Definitions specific to IEEE 802.11

***TGbn editor: Please modify the body of subclause 3.2 (Definitions specific to IEEE 802.11) as follows (tracked changes):***

**coordinated restricted target wake time (R-TWT):** [Co-RTWT] A procedure that enables an AP to coordinate its R-TWT schedule(s) with OBSS AP(s) to(#909, #2654) obtain extended protection for its R-TWT schedule(s) from OBSS APs and their BSS.(#2837, #3152)

**coordinated restricted target wake time (Co-RTWT) coordinated access point (AP):** [Co-RTWT coordinated AP] An AP that extends protection for the R-TWT schedule(s) for which protection is requested by a Co-RTWT requesting AP.

**coordinated restricted target wake time (Co-RTWT) negotiation:** [Co-RTWT negotiation] A MAPC agreement negotiation for Co-RTWT encompassing one or more requested R-TWT schedules(#3152).

**coordinated restricted target wake time (Co-RTWT) parameter set:** [Co-RTWT parameter set] A set of parameters specifying an R-TWT schedule specified by an AP in a Co-RTWT negotiation.

**coordinated restricted target wake time (Co-RTWT) requesting access point (AP):** [Co-RTWT requesting AP] An AP that requests(#742) other OBSS APs and their BSSs to protect one or more of its R-TWT schedules.(#2838, #3153)(#3154, #3155)

**multi-AP**(#1679) **coordination:** [MAPC] A framework that includes a set of coordination schemes (such as(#462) Co-BF, Co-SR, Co-TDMA, Co-RTWT, (#876)and Co-CR) and procedures in which APs operating their BSSs on the same primary 20 MHz channel coordinate to reduce interference levels and to improve network performance such as medium utilization efficiency, communication reliability, and latency.(#1965, #2841)

**9.4.2 Elements**

**9.4.2.1 General**

9.4.2.aa3 MAPC element

9.4.2.aa3.1 General(#3448)

The format of the MAPC element is shown in Figure 9-aa7 (MAPC element format). The usage of this element

is described in 37.13 (Multi-AP coordination (MAPC) framework).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Element ID | Length | Element ID Extension | MAPC Control | MAPC Common Info | MAPC Schemes Info |
| Octets: | 1 | 1 | 1 | 1 | variable | variable |

Figure 9-aa7—MAPC element format

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

The format of the MAPC Control field is defined in Figure 9-aa8 (MAPC Control field).

|  |  |  |
| --- | --- | --- |
|  | B0 | B1 B7 |
|  | AP ID Present | Reserved |
| Bits: | 1 | 7 |

Figure 9-aa8—MAPC Control field format

The AP ID Present field is set to 1 if the AP ID field is present in the MAPC Common Info field, and it is set to 0 otherwise.

The MAPC Common Info field carries information that is common to all the MAPC schemes. The format of the MAPC Common Info field is defined in Figure 9-aa9 (MAPC Common Info field format).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | MAPC Common Info Length | MAPC Capabilities | MAPC Parameters | AP ID |
| Octets: | 1 | 2 | 2 | 0 or 2 |

Figure 9-aa9— MAPC Common Info field format

The MAPC Common Info Length field indicates the number of octets in the MAPC Common Info field including one octet for the MAPC Common Info Length field.

(#CID2118)(#CID3179)The format of the MAPC Capabilities field is defined in Figure 9-aa10 (MAPC Capabilities field format).

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | B0 | B1 | B2 | B3 | B4 | B5 | B6 B15 |
|  | AP TB PPDU Response Supported | Co-BF Supported | Co-SR Supported | Co-TDMA Supported | Co-RTWT Supported | Co-CR Supported | Reserved |
| Bits: | 1 | 1 | 1 | 1 | 1 | 1 | 10 |

Figure 9-aa10— MAPC Capabilities field format

The AP TB PPDU Response Supported field is set to 1 if the AP supports transmitting a TB PPDU in response to a Trigger frame. Otherwise, the AP TB PPDU Response Supported field is set to 0 to indicate that the AP does not support transmitting a TB PPDU in response to a Trigger frame.

(#3179)The Co-BF Supported field is set to 1 if the AP supports Co-BF. Otherwise, the Co-BF Supported field is set to 0.

(#3179)The Co-SR Supported field is set to 1 if the AP supports Co-SR. Otherwise, the Co-SR Supported field is set to 0.

(#3179)The Co-TDMA Supported field is set to 1 if the AP supports Co-TDMA. Otherwise, the Co-TDMA Supported field is set to 0.

(#2118)(#3179)The Co-RTWT Supported field is set to 1 if the AP supports Co-RTWT. Otherwise, the Co-RTWT Supported field is set to 0.

(#876)The Co-CR Supported field is set to 1 if the AP supports Co-CR. Otherwise, the Co-CR Supported field is set to 0.

The format of the MAPC Parameters field is defined in Figure 9-aa11 (MAPC Parameters field format).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | B0 | B1 | B2 | B3 | B4 | B5 B15 |
|  | Co-BF Agreement Establishment Enabled | Co-SR Agreement Establishment Enabled | Co-TDMA Agreement Establishment Enabled | Co-RTWT Agreement Establishment Enabled | Co-CR Agreement Establishment Enabled | Reserved |
| Bits: | 1 | 1 | 1 | 1 | 1 | 11 |

Figure 9-aa11— MAPC Parameters field format

The Co-BF Agreement Establishment Enabled field is set to 1 if the Co-BF Supported field is set to 1 and the AP has enabled MAPC negotiations for establishing new MAPC agreements for Co-BF. Otherwise, the Co-BF Agreement Establishment Enabled field is set to 0.

The Co-SR Agreement Establishment Enabled field is set to 1 if the Co-SR Supported field is set to 1 and the AP has enabled MAPC negotiations for establishing new MAPC agreements for Co-SR. Otherwise, the Co-SR Agreement Establishment Enabled field is set to 0.

The Co-TDMA Agreement Establishment Enabled field is set to 1 if the Co-TDMA Supported field is set to 1 and the AP has enabled MAPC negotiations for establishing new MAPC agreements for Co-TDMA. Otherwise, the Co-TDMA Agreement Establishment Enabled field is set to 0.

(#2118)The Co-RTWT Agreement Establishment Enabled field is set to 1 if the Co-RTWT Supported field is set to 1 and the AP has enabled MAPC negotiations for establishing new MAPC agreements for Co-RTWT. Otherwise, the Co-RTWT Agreement Establishment Enabled field is set to 0.

(#876)The Co-CR Agreement Establishment Enabled field is set to 1 if the Co-CR Supported field is set to 1 and the AP has enabled MAPC negotiations for establishing new MAPC agreements for Co-CR. Otherwise, the Co-CR Agreement Establishment Enabled field is set to 0.

The AP ID field is used to assign an AP ID to another AP. The AP ID field is optionally included in the MAPC Common Info field of a MAPC element (see Table 9-aa9 (MAPC Common Info field format)) as defined in 37.13.1.3.2.2 (AP ID assignment).

9.4.2.aa3.2 MAPC Schemes Info field

9.4.2.aa3.2.1 General

(#1409)(#1416)The MAPC Schemes Info field carries information specific to one or more MAPC schemes and is optionally present. When the MAPC Schemes Info field is present, it contains one or more subelements. The Subelement ID field values for the subelements are shown in Table 9-349e (Optional subelement IDs of the MAPC Scheme Info field).

**Table 9-349e—** **Optional subelement IDs of the MAPC Scheme Info field**

|  |  |  |
| --- | --- | --- |
| **Subelement ID** | **Subelement name** | **Extensible** |
| 0 | Per-Scheme Profile | Yes |
| 1-220 | Reserved |  |
| 221 | Vendor Specific | Vendor defined |
| 222-253 | Reserved |  |
| 254 | Fragment | No |
| 255 | Reserved |  |

The format of the Per-Scheme Profile subelement is defined in Figure 9-aa12 (Per-Scheme Profile subelement format).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Subelement ID | Length | MAPC Scheme Control | MAPC Scheme Parameter Set | MAPC Scheme Request Set |
| Octets: | 1 | 1 | 1 | variable | variable |

Figure 9-aa12— Per-Scheme Profile subelement format

The format of the MAPC Scheme Control field is defined in Figure 9-aa13 (MAPC Scheme Control field format).

|  |  |  |
| --- | --- | --- |
|  | B0 B3 | B4 B7 |
|  | MAPC Scheme Type | Reserved |
| Bits: | 4 | 4 |

Figure 9-aa13— MAPC Scheme Control field format

The MAPC Scheme Type field indicates a value that identifies a MAPC scheme as defined in Table 9-349f (MAPC Scheme Type field values).

**Table 9-349f—** **MAPC Scheme Type field values**

|  |  |
| --- | --- |
| **Value** | **Meaning** |
| 0 | Co-BF profile |
| 1 | Co-SR profile |
| 2 | Co-TDMA profile |
| 3 | Co-RTWT profile |
| 4 | Co-CR profile |
| 5-15 | Reserved |

The MAPC Schemes Info field contains zero or one Co-BF profile, Co-SR profile, Co-TDMA profile, Co-RTWT profile, and Co-CR profile.

The MAPC Scheme Parameter Set field carries parameters specific to the AP for the MAPC scheme indicated by the MAPC Scheme Type field. The MAPC Scheme Parameter Set field is optionally included and it has a format defined for each MAPC scheme in 9.4.2.aa3.2.2 (Co-BF profile), 9.4.2.aa3.2.3 (Co-SR profile), 9.4.2.aa3.2.4 (Co-TDMA profile), 9.4.2.aa3.2.5 (Co-RTWT profile), and 9.4.2.aa3.2.6 (Co-CR profile), respectively.

The MAPC Scheme Request Set field is optionally included. When the MAPC element that includes the Per-Scheme Profile subelement is carried in a MAPC Negotiation Request frame, the MAPC Scheme Request Set field is included and carries information related to request(s) for MAPC agreement(s) specific to the MAPC scheme indicated by the MAPC Scheme Type field. When the MAPC element that includes the Per-Scheme Profile subelement is carried in a MAPC Negotiation Response frame, the MAPC Scheme Request Set field is included and carries information related to response(s) to request(s) for MAPC agreement(s) specific to the MAPC scheme indicated by the MAPC Scheme Type field. The MAPC Scheme Request Set field is not included when the MAPC element that includes the Per-Scheme Profile subelement is carried in a MAPC Discovery Request frame or a MAPC Discovery Response frame. The MAPC Scheme Request Set field carried in a Co-BF, Co-SR, or Co-TDMA profile contains a single MAPC Scheme Request field. (#1417)(#3449)The MAPC Scheme Request Set field carried in a Co-RTWT profile contains one or more MAPC Scheme Request fields, each corresponding to an R-TWT schedule.

The format of the MAPC Scheme Request field is defined in Figure 9-aa14 (MAPC Scheme Request field format).

|  |  |  |  |
| --- | --- | --- | --- |
|  | MAPC Request Control | MAPC Per-Scheme Info | MAPC Request Parameter Set |
| Octets: | 1 | 0 or 1 | variable |

Figure 9-aa14— MAPC Scheme Request field format

(#1417)(#1418)The MAPC Request Control field format is defined in Figure 9-aa15 (MAPC Request Control field format).

|  |  |  |  |
| --- | --- | --- | --- |
|  | B0 B2 | B3 | B4 B7 |
|  | MAPC Operation Type | MAPC Per-Scheme Info Present | Reserved |
| Bits: | 3 | 1 | 4 |

Figure 9-aa15— MAPC Request Control field format

The MAPC Operation Type field indicates the type of operation to be carried out. Table 9-349g (MAPC Operation Type field values) shows the values and meaning of the MAPC Operation Type field and (#1418)the frame that carries the MAPC element with this MAPC Operation Type value.

**Table 9-349g—** **MAPC Operation Type field values**

|  |  |  |
| --- | --- | --- |
| **Value** | **Meaning** | **Contained in** |
| 0 | Agreement Establishment | MAPC Negotiation Request frame |
| 1 | Agreement Update | MAPC Negotiation Request frame |
| 2 | Agreement Teardown | MAPC Negotiation Request frame |
| 3 | Agreement Accept | MAPC Negotiation Response frame |
| 4 | Agreement Reject | MAPC Negotiation Response frame |
| 5 | Agreement Alternate | MAPC Negotiation Response frame |
| 6-7 | Reserved |  |

The MAPC Per-Scheme Info Present field is set to 1 when the MAPC Per-Scheme Info field is included. Otherwise, MAPC Per-Scheme Info Present field is set to 0.

The MAPC Per-Scheme Info field carries information specific to the MAPC scheme identified by the MAPC Scheme Type field. The MAPC Per-Scheme Info field is defined for each MAPC scheme in 9.4.2.aa3.2.2 (Co-BF profile), 9.4.2.aa3.2.3 (Co-SR profile), 9.4.2.aa3.2.4 (Co-TDMA profile), 9.4.2.aa3.2.5 (Co-RTWT profile), and 9.4.2.aa3.2.6 (Co-CR profile), respectively.

The MAPC Request Parameter Set field carries parameters specific to a request and is optionally included. The format of the MAPC Request Parameter Set field is defined for each MAPC scheme in 9.4.2.aa3.2.2 (Co-BF profile), 9.4.2.aa3.2.3 (Co-SR profile), 9.4.2.aa3.2.4 (Co-TDMA profile), 9.4.2.aa3.2.5 (Co-RTWT profile), and 9.4.2.aa3.2.6 (Co-CR profile), respectively. The MAPC Request Parameter Set is included according to the rules defined in 37.13.2 (Rules for specific multi-AP coordination schemes) for each specific MAPC scheme.

9.4.2.aa3.2.2 Co-BF profile

The MAPC Scheme Type field is set to the value for Co-BF as indicated in Table 9-349f.

9.4.2.aa3.2.3 Co-SR profile

The MAPC Scheme Type field is set to the value for Co-SR as indicated in Table 9-349f.

9.4.2.aa3.2.4 Co-TDMA profile

The MAPC Scheme Type field is set to the value for Co-TDMA as indicated in Table 9-349f.

9.4.2.aa3.2.5 Co-RTWT profile

(#1409)(#1410)(#1415)(#1806)The MAPC Scheme Type field is set to the value for Co-RTWT as indicated in Table 9-349f.

***TGbn editor: Please modify the body of subclause 9.4.2.aa3.2.5 (Co-RTWT profile) as follows (tracked changes):***

The MAPC Scheme Parameter Set field is not included.

The MAPC Per-Scheme Info Present field shall be set to 1.

The format of the MAPC Per-Scheme Info field is defined in Figure 9-aaX.

|  |  |  |  |
| --- | --- | --- | --- |
|  | B0 B4 | B5 | B6 B7 |
|  | Broadcast TWT ID | Last Co-RTWT Request | Reserved |
| Bits: | 5 | 1 | 2 |

Figure 9-aaX— MAPC Per-Scheme Info field of the Co-RTWT profile format

The Broadcast TWT ID field carries the identifier of the R-TWT schedule.

The Last Co-RTWT Request field is set to 0 to indicate that the Co-RTWT profile carries a subsequent MAPC Scheme Request field that follows this MAPC Scheme Request field. The Last Co-RTWT Request field is set to 1 to indicate that this is the last MAPC Scheme Request field in the Co-RTWT profile.

(#3447)The MAPC Request Parameter Set field contains a Co-RTWT Parameter Set field with format defined in Figure 9-aa16 (Co-RTWT Parameter Set field format).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Target Wake Time | Nominal Minimum TWT Wake Duration | TWT Wake Interval Mantissa | Service Period Info |
| Octets: | 8 | 1 | 2 | 2 |

Figure 9-aa16—Co-RTWT Parameter Set field format

(#277)(#1411)(#1599)(#2519)(#3258)The Target Wake Time field contains an unsigned integer corresponding to the R-TWT SP start time expressed in terms of the TSF of the Co-RTWT requesting AP(#3813).

The Nominal Minimum TWT Wake Duration field indicates the nominal duration of the R-TWT SPs, in units of 256 μs.

The TWT Wake Interval Mantissa field is set to the value of the mantissa of the TWT wake interval value in microseconds, base 2.

(#3178)The format of the Service Period Info field is defined in Figure 9-aa17 (Service Period Info field format).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | B0 B4 | B5 B12 | B13 B14 | B15 |
|  | TWT Wake Interval Exponent | Broadcast TWT Persistence | Restricted TWT Schedule Info | Reserved |
| Bits: | 5 | 8 | 2 | 1 |

Figure 9-aa17— Service Period Info field format

The TWT Wake Interval Exponent field is set to the value of the exponent of the TWT wake interval value in microseconds, base 2. The TWT wake interval is the time between successive R-TWT SPs start times and is equal to (TWT Wake Interval Mantissa) × .

The Broadcast TWT Persistence field indicates the number of TBTTs of the Co-RTWT requesting AP during which the R-TWT SPs corresponding to this Co-RTWT parameter set are present. The number of TBTTs of the Co-RTWT requesting AP during which the R-TWT SPs are present is equal to the value in the Broadcast TWT Persistence field plus 1, except that the value 255 indicates that the R-TWT SPs are present until explicitly terminated.

(#3178)The Restricted TWT Schedule Info field is defined in Table 9-349a (Restricted TWT Schedule Info subfield values).

9.4.2.aa3.2.6 Co-CR profile(#876)

The MAPC Scheme Type field is set to the value for Co-CR as indicated in Table 9-349f.

9.6.7 Public Action frame details

9.6.7.1 Public Action field

**Table 9-471—Public Action field values**

|  |  |
| --- | --- |
| **Public Action field value** | **Description** |
| … | … |
| <ANA> | MAPC Discovery Request |
| <ANA> | MAPC Discovery Response |
| <ANA> | MAPC Negotiation Request |
| <ANA> | MAPC Negotiation Response |
| … | … |

9.6.7.64 MAPC Discovery Request frame format

The MAPC Discovery Request frame is used by an AP to advertise its capabilities and common parameters for MAPC. The format of the MAPC Discovery Request frame is defined in Figure 9-aa20 (MAPC Discovery Request frame format).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Category | Public Action | Dialog Token | MAPC Discovery Info |
| Octets: | 1 | 1 | 1 | variable |

Figure 9-aa20— MAPC Discovery Request frame format

The Category field is defined in 9.4.1.11 (Action field).

The Public Action field is defined in 9.6.7.1 (Public Action field).

The Dialog Token field is set to a nonzero value chosen by the AP sending the MAPC Discovery Request frame.

The MAPC Discovery Info field carries a MAPC element as defined in 9.4.2.aa3.1 (MAPC element).

NOTE —When a MAPC element carrying per-scheme profiles is included in a MAPC Discovery Request frame, the MAPC Scheme Request Set field is not included in the reported per-scheme profiles.

9.6.7.65 MAPC Discovery Response frame format

The MAPC Discovery Response frame is used by an AP to respond to a MAPC Discovery Request frame. The format of the MAPC Discovery Response frame is defined in Figure 9-aa21 (MAPC Discovery Response frame format).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Category | Public Action | Dialog Token | MAPC Discovery Info |
| Octets: | 1 | 1 | 1 | variable |

Figure 9-aa21— MAPC Discovery Response frame format

The Category field is defined in 9.4.1.11 (Action field).

The Public Action field is defined in 9.6.7.1 (Public Action field).

The Dialog Token field is set to a nonzero value chosen by the AP sending the MAPC Discovery Response frame.

The MAPC Discovery Info field carries a MAPC element as defined in 9.4.2.aa3.1 (MAPC element).

NOTE —When a MAPC element carrying per-scheme profiles is included in a MAPC Discovery Response frame, the MAPC Scheme Request Set field is not included in the reported per-scheme profiles.

9.6.7.66 MAPC Negotiation Request frame format

(#1408)The MAPC Negotiation Request frame is used by an AP to request to establish, update, or teardown agreement(s) for MAPC scheme(s). (#152)The format of the MAPC Negotiation Request frame is defined in Figure 9-aa22 (MAPC Negotiation Request frame format).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Category | Public Action/Protected Dual Of Public Action | Dialog Token | MAPC Negotiation Info |
| Octets: | 1 | 1 | 1 | variable |

Figure 9-aa22— MAPC Negotiation Request frame format

The Category field is defined in 9.4.1.11 (Action field).

The Public Action/Protected Dual of Public Action field is defined in 9.6.7.1 (Public Action field) and in 9.6.10 (Protected Dual Of Public Action frames).

The Dialog Token field is set to a nonzero value chosen by the AP sending the MAPC Negotiation Request frame.

The MAPC Negotiation Info field carries a MAPC element as defined in 9.4.2.aa3.1 (MAPC element).

NOTE —When a MAPC element carrying per-scheme profiles is included in a MAPC Negotiation Request frame, the MAPC Scheme Request Set field is included in the reported per-scheme profiles.

9.6.7.67 MAPC Negotiation Response frame format

(#1408)The MAPC Negotiation Response frame is used by an AP to respond to another AP that transmits a MAPC Negotiation Request frame. (#153)The format of the MAPC Negotiation Response frame is defined in Figure 9-aa23 (MAPC Negotiation Response frame format).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Category | Public Action/Protected Dual of Public Action | Dialog Token | Status Code | MAPC Negotiation Info |
| Octets: | 1 | 1 | 1 | 2 | variable |

Figure 9-aa23— MAPC Negotiation Response frame format

The Category field is defined in 9.4.1.11 (Action field).

The Public Action/Protected Dual Of Public Action field is defined in 9.6.7.1 (Public Action field) and in 9.6.10 (Protected Dual Of Public Action frames).

The Dialog Token field is set to a nonzero value chosen by the AP sending the MAPC Negotiation Response frame.

The Status Code field is defined in 9.4.1.9 (Status Code field). Status Code field indicates the status of a MAPC negotiation as indicated in Table 9-80 (Status codes) and it is set by following the rules defined in 37.13.1.3 (MAPC agreement negotiation).

The MAPC Negotiation Info field carries a MAPC element as defined in 9.4.2.aa3.1 (MAPC element).

NOTE —When a MAPC element carrying per-scheme profiles is included in a MAPC Negotiation Response frame, the MAPC Scheme Request Set field is included in the reported per-scheme profiles.

9.6.10 Protected Dual of Public Action frame details

**Table 9-516—Public Action field values defined for Protected Dual of Public Action frames**

|  |  |  |
| --- | --- | --- |
| **Public Action field value** | **Description** | **Defined in** |
| … | … |  |
| <ANA> | (#181)Protected MAPC Negotiation Request | 9.6.7.66 (MAPC Negotiation Request frame format) |
| <ANA> | (#181)Protected MAPC Negotiation Response | 9.6.7.67 (MAPC Negotiation Response frame format) |
| … | … |  |

37.13 Multi-AP coordination (MAPC) framework

37.13.1 Common procedures for all multi-AP coordination schemes

37.13.1.1 General

(#3710)(#1439)The MAPC framework includes a set of schemes (such as Co-BF, Co-SR, Co-TDMA, Co-RTWT, (#876)and Co-CR) and procedures in which APs operating their BSSs on the (#1788)same primary 20 MHz channel coordinate to reduce interference levels and to improve network performance such as medium utilization efficiency, communication reliability, and latency.

An AP may use a MAPC scheme with another AP if it has established an agreement for that MAPC scheme by following the procedures defined in 37.13.1 or via other means out of the scope of this standard(#3780).

This subclause details the common procedures applicable for all the coordination schemes. The MAPC discovery procedure is defined in 37.13.1.2 (MAPC discovery). The MAPC agreement negotiation procedure is defined in 37.13.1.3 (MAPC agreement negotiation).

NOTE — For example, two APs that belong to the same ESS can enable the use of MAPC schemes via other means than the MAPC discovery and MAPC agreement negotiation procedures defined in this subclause.

All other procedures that are specific to each coordination scheme are detailed in 37.13.2 (Procedures for specific multi-AP coordination schemes).

37.13.1.2 MAPC discovery

This subclause defines MAPC discovery procedures for APs to advertise and discover MAPC capabilities and parameters of other APs(#148)(#3606)(#3779).

An AP may advertise its MAPC capabilities, common MAPC parameters, and parameters specific to MAPC schemes by transmitting a MAPC Discovery Request frame (see 9.6.7.64 (MAPC Discovery Request frame format)) to the broadcast address, or as an individually addressed frame to another AP(#1324)(#1398)(#3254).

If an AP receives a soliciting MAPC Discovery Request frame from a transmitting AP, the AP shall respond by sending a MAPC Discovery Response frame to the broadcast address or as an individually addressed Management frame to the transmitting AP. The value of the Dialog Token field of the MAPC Discovery Response frame (see Figure 9-aa21) by the AP shall be set equal to the value of the Dialog Token field of the soliciting MAPC Discovery Request frame.

An AP that transmits a MAPC Discovery Request frame or a MAPC Discovery Response frame may include a Per-Scheme Profile subelement in the reported MAPC element for each MAPC scheme for which it signals a capability (see Figure 9-aa10). The AP shall not include the MAPC Scheme Request Set field in the reported Per-Scheme Profile subelements.

37.13.1.3 MAPC agreement negotiation

37.13.1.3.1 General

(#1408)This subclause defines procedures for MAPC agreement negotiation. An AP shall follow the rules defined in this subclause to establish(#669), update or tear down agreements for MAPC through negotiation, in addition to the specific rules for multi-AP coordination schemes defined in 37.13.2 (Procedures for specific multi-AP coordination schemes).

A MAPC requesting AP is an AP that initiates a MAPC negotiation for (#775)(#3438)one or more MAPC schemes with another AP(#1491).

(#1050)(#1494)(#2118)(#3179)A MAPC requesting AP shall not initiate a MAPC negotiation for a specific MAPC scheme with a peer AP if the peer AP has set the corresponding field for the support of that MAPC scheme in the MAPC Common Info field (see Figure 9-aa10 (MAPC Capabilities field format)) reported in the MAPC Discovery Request frame, MAPC Discovery Response frame, or MAPC Negotiation Request frame most recently received by the MAPC requesting AP to 0.

A MAPC responding AP is an AP that responds to a MAPC requesting AP.

***TGbn editor: Please modify the body of subclause 37.13.1.3.1 (General) as follows (tracked changes):***

(#3257)A MAPC requesting AP may initiate a MAPC negotiation for one or more MAPC schemes by sending an individually addressed (#1399)MAPC Negotiation Request frame (see 9.6.7.66 (MAPC Negotiation Request frame format)) to another AP. The MAPC Negotiation Request frame shall include a MAPC element including at least one Per-Scheme Profile subelement in the MAPC Schemes Info field. Additionally, the MAPC requesting AP shall not include the Per-Scheme Profile subelement for a specific MAPC scheme in the MAPC element (see Table 9-349f (MAPC Scheme Type field values)) if it has not indicated support for that MAPC scheme in the MAPC Capabilities field carried in the MAPC element (see Figure 9-aa10 (MAPC Capabilities field format)). If a Per-Scheme Profile subelement is included in the MAPC element, it shall carry the MAPC Scheme Request Set field including at least one MAPC Scheme Request field.

NOTE—Each Per-Scheme Profile subelement of the MAPC Schemes Info field in a MAPC Negotiation Request frame carries request(s) for a specific MAPC scheme (see 9.4.2.aa3.2 (MAPC Schemes Info field)).

(#3257)A MAPC responding AP that receives an individually addressed MAPC Negotiation Request frame from a MAPC requesting AP shall respond by sending an individually addressed (#1399)MAPC Negotiation Response frame to the MAPC requesting AP. The value of the Dialog Token field of the MAPC Negotiation Response frame (see Figure 9-aa23 (MAPC Negotiation Response frame format)) shall be set equal to the value of the Dialog Token field of the MAPC Negotiation Request frame (see Figure 9-aa22 (MAPC Negotiation Request frame format)). The Status Code field shall be set to SUCCESS if the MAPC responding AP accepts at least one of the requests carried in the received MAPC Negotiation Request frame. Otherwise, the MAPC responding AP shall set the corresponding Status field to indicate an appropriate rejection status code as per Table 9-80 (Status codes). The MAPC Negotiation Response frame shall include a MAPC element including one Per-Scheme Profile subelement in the MAPC Schemes Info field for each Per-Scheme Profile subelement included by the MAPC requesting AP in the MAPC Negotiation Request frame. (#1416)In the MAPC Negotiation Response frame, each Per-Scheme Profile subelement shall include a MAPC Scheme Request field with MAPC Operation Type field set to 3, 4, or 5 (see Table 9-349g (MAPC Operation Type field values)). If the MAPC Operation Type field is set to 3 or 4, the MAPC Request Parameter Set field shall not be included. To accept a request, the MAPC Operation Type field shall be set to 3. To reject a request, the MAPC Operation Type field shall be set to 4. To reject a request and to indicate that the MAPC responding AP may accept a subsequent request with parameter values as those included by the MAPC responding AP in the MAPC Request Parameter Set, the MAPC Operation Type field shall be set to 5.

After two APs establish a MAPC agreement, any of the two APs may initiate a MAPC negotiation as MAPC requesting AP to update or teardown the MAPC agreement.

37.13.1.3.2 MAPC agreement establishment

To request for a new agreement establishment, the MAPC requesting AP shall set the MAPC Operation Type field to 0 (see Table 9-349g (MAPC Operation Type field values)). If the MAPC Operation Type field is set to 0, the MAPC Request Parameter Set is included according to the rules defined in 37.13.2 (Rules for specific multi-AP coordination schemes) for each specific MAPC scheme.

(#1050, #1494, #1717, #1718, #2118)A MAPC requesting AP shall not request to establish a new agreement for a specific MAPC scheme if the MAPC responding AP has set to 0 the corresponding field for enabling MAPC agreement establishment for that MAPC scheme (see Figure 9-aa11) in the MAPC Discovery Request frame, MAPC Discovery Response frame, or MAPC Negotiation Request frame most recently received by the MAPC requesting AP.

***TGbn editor: Please modify the body of subclause 37.13.1.3.2 (MAPC agreement establishment) as follows (tracked changes):***

To accept, reject, or reject with a suggestion for alternative parameters for a MAPC agreement establishment, the MAPC responding AP shall follow the rules defined in 37.13.1.3.1 (General).

If the MAPC responding AP has accepted the request to establish a new MAPC agreement for a specific MAPC scheme, the MAPC requesting AP and the MAPC responding AP have established a MAPC agreement for that specific MAPC scheme.

NOTE —If, for example, a MAPC requesting AP transmits a MAPC Negotiation Request frame including a Co-BF profile and a Co-RTWT profile, where the Co-BF profile includes a MAPC Scheme Request field for a new agreement establishment request (MAPC Operation Type is set to 0) and the Co-RTWT profile includes three MAPC Scheme Request fields for three new agreement establishment requests, the MAPC responding AP responds with a MAPC Negotiation Response frame including a Co-BF profile and a Co-RTWT profile, where the Co-BF profile includes a MAPC Scheme Request field indicating the response to the agreement establishment request and the Co-RTWT profile includes three MAPC Scheme Request fields each indicating the response to the corresponding agreement establishment. In this example the MAPC requesting AP and the MAPC responding AP can establish up to one Co-BF agreement, and up to three Co-RTWT agreements (one for each R-TWT schedule).

A MAPC requesting AP and a MAPC responding AP may establish up to one MAPC agreement for each one of Co-BF, Co-SR, and Co-TDMA, and up to one MAPC agreement per R-TWT schedule for Co-RTWT.

37.13.1.3.2.1 AP ID assignment

***TGbn editor: Please modify the body of subclause 37.13.1.3.2.1 (AP ID assignment) as follows (tracked changes):***

When an AP participates in a MAPC negotiation to establish new MAPC agreement(s) as defined in 37.13.1.3.2 (MAPC agreement establishment), the AP shall additionally follow the rules defined in this subclause to assign an AP ID to a peer AP with which the AP establishes a MAPC agreement(#3781).

The AP ID is as described in 9.4.1.8 (AID field).

The same AP ID value shall not be assigned by the AP or by its affiliated MLD to any other STA.

NOTE— The STA is an associated non-AP STA, an unassociated non-AP STA that has been allocated a (Ranging session Identifier) RSID, any other coordinated AP, or a non-AP MLD that is associated with the AP MLD.

The same AP ID value shall not be assigned by any other AP within the same multiple BSSID set to any other STA.

The AP ID value shall not be assigned by any other AP MLD that has any affiliated AP within the same multiple BSSID set to any other non-AP MLD.

The AP ID value shall be greater than 2n where n the value carried in the MBSSID Indicator (n) field of the Multiple BSSID element if the AP belongs to a multiple BSSID set.

To assign an AP ID to another AP, an AP shall include the AP ID field in a MAPC element (see 9.4.2.aa3 (MAPC element)).

(#161)A MAPC requesting AP shall include the AP ID field in the MAPC element carried in the transmitted MAPC Negotiation Request frame only if the MAPC requesting AP has not established any MAPC agreement for any one of Co-BF, Co-SR, or Co-TDMA with the MAPC responding AP and the MAPC requesting AP is requesting to establish a new MAPC agreement for any one of Co-BF, Co-SR, or Co-TDMA by following the rules defined in 37.13.1.3.2.

A MAPC responding AP shall include the AP ID field in the MAPC element carried in the transmitted MAPC Negotiation Response frame, only if the MAPC responding AP has not established any MAPC agreement for any one of Co-BF, Co-SR, or Co-TDMA with the MAPC requesting AP and the MAPC responding AP is accepting a new MAPC agreement for any one of Co-BF, Co-SR, or Co-TDMA by following the rules defined in 37.13.1.3.2.

NOTE —For example, if the MAPC responding AP rejects all the requests for new agreements establishment, and there are no previously existing agreements, then the AP ID assignment from the MAPC requesting AP is considered void, and the MAPC responding AP does not assign an AP ID in the MAPC Negotiation Response frame.

The AP IDs assigned to the MAPC requesting AP and the MAPC responding AP shall be valid until at least one established agreement among Co-BF, Co-SR, and Co-TDMA is in existence between the two APs.

37.13.1.3.3 MAPC agreement update

(#161)(#1395)To request a parameter update for an established MAPC agreement, the MAPC requesting AP shall set the MAPC Operation Type field to 1 (see Table 9-349g (MAPC Operation Type field values)). If the MAPC Operation Type field is set to 1, the MAPC Request Parameter Set is included according to the rules defined in 37.13.2 (Rules for specific multi-AP coordination schemes) for each specific MAPC scheme.

***TGbn editor: Please modify the body of subclause 37.13.1.3.3 (MAPC agreement update) as follows (tracked changes):***

To accept, reject, or reject with a suggestion for alternative parameters for an update of an existing MAPC agreement, the MAPC responding AP shall follow the rules defined in 37.13.1.3.1 (General). If the MAPC responding AP rejects the update by setting the MAPC Operation Type field to 4 or 5, the agreement update procedure fails and the parameters of the MAPC agreement are not updated.

37.13.1.3.4 MAPC agreement teardown

(#1414)(#1789)To request the teardown of an established agreement, the MAPC requesting AP shall set the MAPC Operation Type field to 2 (see Table 9-349g (MAPC Operation Type field values)) in the MAPC Scheme Request field that carries the request. If the MAPC Operation Type field is set to 2, the MAPC Request Parameter Set field shall not be included.

The MAPC responding AP shall accept the request to teardown an existing MAPC agreement by following the rules defined in 37.13.1.3.1 (General).

NOTE —When a MAPC requesting AP tears down the last MAPC agreement among Co-BF, Co-SR, and Co-TDMA with a MAPC responding AP, the mutually assigned AP IDs are released and their values can be reassigned.

37.13.2 Procedures for specific multi-AP coordination schemes

**37.13.2.4 Coordinated R-TWT (Co-RTWT)**

***TGbn editor: Please apply changes to the body of subclause 37.13.2.4 (Coordinated R-TWT (Co-RTWT)) as follows (tracked changes):***

**37.13.2.4.1 General**

(#3259)Coordinated restricted target wake time (Co-RTWT) operations described in subclause 37.13.2.4 (Coordinated R-TWT (Co-RTWT)) enable an AP to coordinate its R-TWT schedule(s) with OBSS AP(s) and/or obtain extended protection for its R-TWT schedule(s) from OBSS APs and their BSSs.

A Co-RTWT requesting AP is an AP with (#1715)dot11CoRTWTOptionImplemented equal to true that requests protection for one or more of its R-TWT schedules. A Co-RTWT requesting AP may request protection for its R-TWT schedule(s) either via Co-RTWT negotiations or via other means out of the scope of this standard.(#1716, #1719, #2117, #2674, #3175, #3885).

(#2938, #3176, #3177, #3445, #3446)A Co-RTWT coordinated AP is an AP with (#1715)dot11CoRTWTOptionImplemented equal to true that extends protection for R-TWT schedule(s) that are requested by a Co-RTWT requesting AP, either via Co-RTWT negotiations or via other means(#1716, #1719, #2117, #2674, #3175, #3885) out of the scope of this standard, (#832, #3450, #3582)by following the rules defined in 37.13.2.4.3 (Co-RTWT announcement rules) and 37.13.2.4.4 (TXOP and backoff procedure rules for Co-RTWT (#901)).

Co-RTWT negotiation(s) to establish Co-RTWT agreement(s) are performed by following the rules defined in (#1050, #1408, #1414, #1416, #1417, #1717, #1718, #3257)37.13.1.3 (MAPC agreement negotiation) and 37.13.2.4.2 (Co-RTWT negotiations).

(#1716, #1719, #2117, #2674, #3175, #3885)NOTE—An AP with dot11CoRTWTOptionImplemented set to 1 can participate in Co-RTWT by means that do not follow the protocol defined in 37.13.1 and are out of the scope of this standard. For example, an AP (Co-RTWT coordinated AP) can be configured by the network to extend protection for R-TWT schedules of another AP (Co-RTWT requesting AP) in the same ESS. In another example, an AP (Co-RTWT coordinated AP) might listen to the Beacon frame of another AP (Co-RTWT requesting AP) in the same ESS and extend protection for R-TWT schedules that are announced in that Beacon frame.

**37.13.2.4.2 Co-RTWT negotiations**

(#3447, #3710, #1806, #3179, #3447, #3448, #3710, #3886, #3887, #3888)A Co-RTWT requesting AP that follow the rules defined in 37.13.1.3 (MAPC agreement negotiation) to establish, update, or tear down Co-RTWT agreement(s) is also a MAPC requesting AP and additionally follows the rules defined in this subclause.

(#1721, #1806, #3447, #3448)The Co-RTWT requesting AP shall include a Co-RTWT profile in the MAPC element carried in a transmitted individually addressed MAPC Negotiation Request frame. (#3449)The Co-RTWT profile shall include one or more MAPC Scheme Request fields, each corresponding to an R-TWT schedule. The Broadcast TWT ID field identifies the R-TWT schedule, (#1413)and shall be set equal to the value of the Broadcast TWT ID field of the Restricted TWT Parameter Set field corresponding to the R-TWT schedule that is announced by the Co-RTWT requesting AP in its own BSS (see 35.8.3.1 (Rules for R-TWT scheduling AP)). (#880)The MAPC Operation Type shall be set to 0 to establish a new Co-RTWT agreement, to 1 to update an existing Co-RTWT agreement, (#1414)or to 2 to teardown an existing Co-RTWT agreement (see Table 9-349g). If the MAPC Operation Type is set to 0 or 1, the MAPC Request Parameter Set field defined in 9.4.2.aa3.2.5 (Co-RTWT profile) shall be included in the MAPC Scheme Request field. The MAPC Operation Type field shall not be set to 1 or 2 if a Co-RTWT agreement is not yet established for the R-TWT schedule identified by the value of the Broadcast TWT ID field carried in this MAPC Scheme Request field. The MAPC Operation Type field shall not be set to 0 if a Co-RTWT agreement is already established for the R-TWT schedule identified by the value of the Broadcast TWT ID field carried in this MAPC Scheme Request field.

(#1721, #1806, #3447, #3448)If the MAPC Request Parameter Set field is included in the MAPC Scheme Request field for an R-TWT schedule, the MAPC Request Parameter Set field shall specify the associated Co-RTWT Parameter Set field as described in 9.4.2.aa3.2.5 (Co-RTWT profile) and in accordance to the Restricted TWT Parameter Set field corresponding to the associated R-TWT schedule that is announced by the Co-RTWT requesting AP in its own BSS as defined in 35.8.3.1.

An AP that responds to a Co-RTWT requesting AP in a MAPC agreement negotiation for Co-RTWT agreement(s) is also a MAPC responding AP and responds by following the rules defined in 37.13.1.3. Additionally, when the AP provides a response for a specific R-TWT schedule by setting the MAPC Operation Type field carried in the MAPC Scheme Request field associated with the specific R-TWT schedule to 5, the MAPC Request Parameter Set field containing the suggested parameters for this Co-RTWT agreement shall be included.

An AP that has established one or more MAPC agreements for Co-RTWT with a Co-RTWT requesting AP is a Co-RTWT coordinated AP.

Each Co-RTWT agreement is uniquely identified by the <broadcast TWT ID, MAC address> tuple, where the broadcast TWT ID is the value of the Broadcast TWT ID field (see 9.4.2.aa3.2.5 (Co-RTWT profile)) and is greater than 0 and the MAC address is the address of the Co-RTWT requesting AP.

**37.13.2.4.3 Co-RTWT announcement rules**

(#1435, #3582, #1419)As part of extending protection for R-TWT schedule(s) of a Co-RTWT requesting AP, the Co-RTWT coordinated AP shall advertise the (#3884)active R-TWT schedule(s) in its transmitted Beacon frames if the Co-RTWT coordinated AP has at least one associated STA that supports R-TWT.

(#1720, #3181, #3795, #2119)NOTE —The Co-RTWT coordinated AP’s associated STA(s) that support R-TWT follow the rules defined in 35.8.4.1 (TXOP and backoff procedure rules for R-TWT SPs) for the R-TWT schedule(s).

To advertise (#3884)active R-TWT schedule(s) of a Co-RTWT requesting AP, the Co-RTWT coordinated AP shall announce R-TWT schedule(s) information by including Restricted TWT Parameter Set field(s) in the Broadcast TWT element defined in 9.4.2.198 (TWT element) and contained in transmitted Management frame(s) as specified in 26.8.3 (Broadcast TWT operation), 35.8 (Restricted TWT (R-TWT)), and by additionally following the rules defined in this subclause.

(#439, #1420)When a Co-RTWT coordinated AP advertises an (#3884)active R-TWT schedule of a Co-RTWT requesting AP, the Co-RTWT coordinated AP shall include a Restricted Parameter Set field describing the R-TWT schedule in the Broadcast TWT element:

* With the Restricted TWT Schedule Info subfield set to 3, and
* With the Broadcast TWT ID subfield set to 31.

(#439, #1420, #1438, #2210)When a Co-RTWT coordinated AP in a co-hosted BSSID set advertises an (#439, #1420)active R-TWT schedule of a Co-RTWT requesting AP, then all the other APs in the same co-hosted BSSID set are Co-RTWT coordinated APs and shall advertise the same R-TWT schedule:

* With the Restricted TWT Schedule Info subfield set to 3, and
* With the Broadcast TWT ID subfield set to 31.

(#1721)When a Co-RTWT coordinated AP advertises an (#3884)active R-TWT schedule of a Co-RTWT requesting AP, the Co-RTWT coordinated AP shall set all the other parameters of the Restricted TWT Parameter Set field as follows:

* The TWT Wake Interval Exponent field, the TWT Wake Interval Mantissa field shall be set equal to the corresponding value of the R-TWT schedule of the Co-RTWT requesting AP,
* (#202, #277, #1411, #2519)The Target Wake Time field and the four MSBs of the Nominal Minimum TWT Wake Duration/Target Wake Time Extension field shall be set by following the rules defined in 35.8.3 (R-TWT announcement), where TSF=, and corresponds to the start time of the R-TWT scheduled for this Restricted TWT parameter set that will occur after the Co-RTWT coordinated AP has queued for transmission the frame that contains the TWT element. The value of is obtained by converting the start time of the R-TWT schedule of the Co-RTWT requesting AP(#3813) to the Co-RTWT coordinated AP’s local TSF.
* The Broadcast TWT Persistence subfield for the R-TWT schedule shall be set to a value equal to the number of the Co-RTWT coordinated AP’s TBTTs for which the R-TWT schedule of the Co-RTWT requesting AP is expected to be in existence, counting forward from the current Co-RTWT coordinated AP’s TBTT. (#830)The value shall be determined by the Co-RTWT coordinated AP to include the TBTT immediately following the time at which the R-TWT schedule of the Co-RTWT requesting AP ceases to exist, that is obtained by the Broadcast TWT Persistence field of the most recent R-TWT schedule of the Co-RTWT requesting AP. The Co-RTWT coordinated AP may change the value of the Broadcast TWT Persistence subfield for any Broadcast TWT within any transmitted TWT element.

NOTE —A non-AP STA does not request to establish membership in an R-TWT schedule advertised by the R-TWT scheduling AP with the Restricted TWT Schedule Info subfield set to 3 (see 35.8.3.2 (Rules for the R-TWT scheduled STA)).

NOTE —TSF synchronization between Co-RTWT requesting AP and Co-RTWT coordinated AP is out of the scope of this standard.(#831)

**37.13.2.4.4 TXOP and backoff procedure rules for Co-RTWT(#901)**

(#1435)(#3582)As part of extending protection for R-TWT schedule(s) of a Co-RTWT requesting AP, the Co-RTWT coordinated AP as a TXOP holder shall ensure that its TXOP ends before the start time of any active R-TWT SP for which protection is extended. (#1868, #2695, #3711, #3752)In the following exceptional cases, the Co-RTWT coordinated AP may elect to continue its TXOP:

* the Co-RTWT coordinated AP performs PHYLEN NPCA (see, 37.16 (Non-primary channel access)) based on a PPDU transmitted by the Co-RTWT requesting AP and the PPDU length exceeds the start time of the R-TWT SP, and
* the Co-RTWT coordinated AP’s TXOP obtained via the NPCA primary channel (see, 37.16 (Non-primary channel access)) occupies channel(s) that do not overlap with the BSS operating channel(s) of the Co-RTWT requesting AP.

(#994)In addition, before starting transmission of any PPDU, the Co-RTWT coordinated AP shall check if there is enough time for the frame exchange to complete prior to the start of the R-TWT SP and, if there is not enough time, then the Co-RTWT coordinated AP shall defer transmission by selecting a random backoff count using the present CW[AC] (without advancing to the next value of CW[AC]). The QSRC[AC] for the MSDU or A-MSDU is not affected. In the following exceptional cases, the Co-RTWT coordinated AP may elect to avoid deferring transmissions:

* the Co-RTWT coordinated AP performs PHYLEN NPCA (see, 37.16 (Non-primary channel access)) based on a PPDU transmitted by the Co-RTWT requesting AP and the PPDU length exceeds the start time of the R-TWT SP, and
* the Co-RTWT coordinated AP’s TXOP obtained via the NPCA primary channel (see, 37.16 (Non-primary channel access)) occupies channel(s) that do not overlap with the BSS operating channel(s) of the Co-RTWT requesting AP.

# Text to be adopted ends here.

**References:**