IEEE P802.11
Wireless LANs

|  |
| --- |
| **Specification Framework for TGbn** |
| **Date:** 2024-05-23 |
| **Author(s):** |
| **Name** | **Affiliation** | **Address** | **Phone** | **email** |
| Ross Jian Yu | Huawei | Building F3, HUAWEI Industrial Base, Bantian, Longgang District, Shenzhen, 518129, P.R. China |  | ross.yujian@huawei.com |

Abstract

This document provides the framework from which the draft TGbn amendment will be developed. The document provides an outline of each the functional blocks that will be a part of the final amendment. The document is intended to reflect the working consensus of the group on the broad outline for the draft specification. As such it is expected to begin with minimal detail reflecting agreement on specific techniques and highlighting areas on which agreement is still required. It may also begin with an incomplete feature list with additional features added as they are justified. The document will evolve over time until it includes sufficient detail on all the functional blocks and their inter-dependencies so that work can begin on the draft amendment itself.

# Revision history

|  |  |  |
| --- | --- | --- |
| Revision | Date | Changes |
| 0 | Jan 25, 2024 | Initial version |
| 1 | Mar 25, 2024 | Add motions passed in 2024 March meeting |
| 2 | May 23, 2024 | Added motions passed in 2024 May meeting |
| 3 | May 29, 2024 | Updated the references |

**Table of Contents**

[Revision history 2](#_Toc167452322)

[1. Abbreviations and acronyms 4](#_Toc167452323)

[2. UHR PHY 4](#_Toc167452324)

[2.1 General 4](#_Toc167452327)

[2.2 Distributed-tone RU 4](#_Toc167452328)

[2.2.1 General 4](#_Toc167452329)

[2.2.2 Tone plan 5](#_Toc167452330)

[2.2.3 UHR-STF 5](#_Toc167452331)

[2.2.4 Pilot 5](#_Toc167452332)

[2.3 PHY feature #3 6](#_Toc167452333)

[2.4 PHY feature #4 6](#_Toc167452334)

[3. UHR MAC 6](#_Toc167452335)

[3.1 General 6](#_Toc167452337)

[3.2 Roaming 6](#_Toc167452338)

[3.3 Power save 6](#_Toc167452339)

[3.4 Non-primary channel access 6](#_Toc167452340)

[3.5 Buffer status report 7](#_Toc167452341)

[3.6 MAC feature #6 7](#_Toc167452342)

[4. Frame format 7](#_Toc167452343)

[4.1 General 7](#_Toc167452345)

[4.2 Field #1 7](#_Toc167452346)

[5. References 7](#_Toc167452347)

# Abbreviations and acronyms

AP access point

BSS basic service set

BW bandwidth

CSD cyclic shift diversity

DRU distributed tone RU

FCS frame check sequence

MAC medium access control

MCS modulation and coding scheme

MLD multi-link device

NAV network allocation vector

NPCA non-primary channel access

OBSS overlapping basic service set

OFDMA orthogonal frequency division multiple access

PHY physical layer

PPDU physical layer (PHY) protocol data unit

RRU regular RU

RU resource unit

SS spatial stream

STA station

STF short training field

TB trigger-based

TBD to be decided

TID traffic identifier

UHR ultra high reliability

UL uplink

# UHR PHY

1.
2.

## General

This section describes the functional blocks in the UHR PHY.

## Distributed-tone RU

### General

* 11bn will define distributed tone RU (“DRU”) transmission

[Motion #3, [1] and [10]]

* 11bn supports a distributed tone RU (DRU) for a TB PPDU transmission
	+ The DRU means an RU which consists of subcarriers spreading across a certain bandwidth

[Motion #1, [1] and [2]]

* DRU is allowed in a punctured UHR TB transmission

[Motion #4, [1] and [11]]

* 11bn supports the hybrid mode with DRUs (Distributed tone RU) and RRUs (Regular RU as existing RU defined in 11ax/be) in UHR UL TB OFDMA transmissions
	+ Minimum PPDU BW for hybrid mode is TBD

[Motion #7, [1] and [14]]

### Tone plan

* DRUs tone plan design on distribution BW 20MHz and 40MHz is 26-tone RU based DRU method (using 26-tone DRUs as basic building blocks).
	+ DRUs tone plan design on other distribution BWs is TBD.

[Motion #14, [1] and [33]]

* In a non-punctured 80 MHz PPDU, the following distribution bandwidth modes are allowed for DRU
	+ 80 MHz
	+ 20 MHz + 20 MHz + 40 MHz (or 40 MHz + 20 MHz + 20 MHz)

[Motion #20, [1] and [36]]

### UHR-STF

* Global CSD is used for DRU UHR-STF transmission to solve unintentional beamforming issue
* Global CSD is applied in each distribution BW

 [Motion #15, [1] and [34]]

* DRU transmission reuses the 8 CSD table/values in 11ax/be for global CSD allocation

[Motion #16, [1] and [34]]

* The UHR-STF for DRU in a TB PPDU uses 11ax/11be trigger based STF sequences.

[Motion #18, [1] and [35]]

* For UHR-STF corresponding to distribution bandwidth for DRU,
	+ STF sequence depends on PPDU BW.
	+ Occupied STF tones are the same as that of the largest RRU corresponding to the distribution BW within PPDU BW.
* [Motion #19, [1] and [35]]

### Pilot

* 11bn supports hierarchical pilot structure for DRU
	+ Pilot locations of a larger DRU is a subset of pilot locations of smaller component DRUs within the same PPDU BW

[Motion #5, [1] and [12]]

* The number of pilot tones for the same size DRU and RRU (regular RU) is the same
	+ The RRU means the existing RU defined in 11ax and 11be

[Motion #6, [1] and [13]]

## PHY feature #3

Description for PHY feature #3

## PHY feature #4

Description for PHY feature #4

# UHR MAC

1.

## General

This section describes the functional blocks in the UHR MAC.

## Roaming

* 11bn defines a mechanism that enables a non-AP MLD to roam from one AP MLD to another AP MLD and the non-AP MLD remains in state 4 (see 11.3) during and after roaming to the other AP MLD

[Motion #2, [1] and [3-9]]

## Power save

* TGbn defines a power save mode for a STA that is a UHR Mobile AP or a UHR non-AP STA wherein the STA may transition from a lower capability mode to a higher capability mode upon reception of an initial control frame
	+ Lower capability mode (e.g., 20 MHz BW, one SS, limited data rates, PPDU format)
	+ Higher capability mode (e.g., operating BW, NSS and MCSs, with at least one higher capability than that in the lower power capability mode)
	+ Initial Control frame is TBD
	+ Whether that applies for a non-mobile AP is TBD

[Motion #9, [1] and [15-19]]

* TGbn defines cross link power save signaling mechanism
	+ Allowing a non-AP MLD to indicate to its associated AP MLD that supports the mechanism, in a frame sent on one enabled link, the power management mode for one or more of its affiliated non-AP STAs
	+ Whether support for the mechanism is mandatory or optional is TBD
* [Motion #10, [1] and [19-20]]

## Non-primary channel access

Description for MAC feature #3

* TGbn defines a mode of operation that enables a STA to access the secondary channel while the primary channel is known to be busy due to OBSS traffic or other TBD conditions.
	+ The mode of operation shall not assume that the STA is capable to detect or decode a frame and obtain NAV information of the secondary channel concurrently with the primary channel.
	+ A BSS shall only have a single NPCA primary channel (name TBD) on which the STA contends while the primary channel of the BSS is known to be busy due to OBSS traffic or other TBD conditions.
* [Motion #11, [1] and 21-30]]

## Buffer status report

* **TGbn enables per-TID buffer size reporting of a larger queue in UHR**
	+ Note: It is an optional feature.
	+ Note: In the baseline, the maximum approximate per-TID queue size to report is 2,147,328 octets
* [Motion #13, [1] and [32]]

## MAC feature #6

Description for MAC feature #6

# Frame format

1.

## General

* TGbn defines a way in 11bn to include in an initial control frame an intermediate FCS for UHR STA(s) that precedes padding and the FCS field
* [Motion #11, [1] and [31, 19]]

## Field #1

Description for Field #1

# References

1. [11-24-0171r8](https://mentor.ieee.org/802.11/dcn/24/11-24-0171-08-00bn-tgbn-motions-list-part-1.pptx): 11-24-0171-06-00bn-tgbn-motions-list-part-1, Alfred Asterjadhi (Qualcomm Inc.)
2. [11-23/1919r1](https://mentor.ieee.org/802.11/dcn/23/11-23-1919-01-00bn-dru-proposal.pptx): 11-23-1919-01-00bn-dru-proposal, Eunsung Park (LG Electronics)
3. [11-23/1884r2](https://mentor.ieee.org/802.11/dcn/23/11-23-1884-02-00bn-seamless-roaming.pptx): 11-23-1884-02-00bn-seamless-roaming, Duncan Ho (Qualcomm Technologies, Inc.)
4. [11-23/1898r1: 11-23-1898-01-00bn-signaling-details-for-non-colocated-ap-mld, Guogang Huang (Huawei)](https://mentor.ieee.org/802.11/dcn/23/11-23-1898-01-00bn-signaling-details-for-non-colocated-ap-mld.pptx)
5. [11-23/1908r2: 11-23-1908-02-00bn-seamless-roaming-procedure, Yelin Yoon (LG Electronics)](https://mentor.ieee.org/802.11/dcn/23/11-23-1908-02-00bn-seamless-roaming-procedure.pptx)
6. [11-23/1937r1](https://mentor.ieee.org/802.11/dcn/23/11-23-1937-01-00bn-smooth-roaming-follow-up-1.pptx): 11-23-1937-01-00bn-smooth-roaming-follow-up-1, Liwen Chu (NXP)
7. [11-23/1971r2](https://mentor.ieee.org/802.11/dcn/23/11-23-1971-02-00bn-further-thoughts-on-seamless-roaming.pptx): 11-23-1971-02-00bn-further-thoughts-on-seamless-roaming, Ryuichi Hirata (Sony Corporation)
8. [11-23/1996r0](https://mentor.ieee.org/802.11/dcn/23/11-23-1996-00-00bn-improve-roaming-between-mlds.pptx): 11-23-1996-00-00bn-improve-roaming-between-mlds, Po-Kai Huang (Intel)
9. [11-23/2157r2](https://mentor.ieee.org/802.11/dcn/23/11-23-2157-02-00bn-seamless-roaming-within-a-mobility-domain.pptx): 11-23-2157-02-00bn-seamless-roaming-within-a-mobility-domain, Binita Gupta (Cisco Systems)
10. [11-23/1988r2](https://mentor.ieee.org/802.11/dcn/23/11-23-1988-02-00bn-considerations-on-dru-design-and-application.pptx): 11-23-1988-02-00bn-considerations-on-dru-design-and-application, Lin Yang (Qualcomm Inc.)
11. [11-23/2200r3](https://mentor.ieee.org/802.11/dcn/23/11-23-2200-03-00bn-distribution-bandwidth-of-dru.pptx): 11-23-2200-03-00bn-distribution-bandwidth-of-dru, Ross Jian Yu (Huawei)
12. [11-24/0501r2](https://mentor.ieee.org/802.11/dcn/24/11-24-0501-02-00bn-pilot-design-considerations-for-dru.pptx): 11-24-0501-02-00bn-pilot-design-considerations-for-dru, Lin Yang (Qualcomm Inc.)
13. [11-24/0402r1](https://mentor.ieee.org/802.11/dcn/24/11-24-0501-02-00bn-pilot-design-considerations-for-dru.pptx): 11-24-0402-01-00bn-20-mhz-tone-plan-and-pilot-design-for-dru, Eunsung Park (LG Electronics)
14. [11-24/0477r2](https://mentor.ieee.org/802.11/dcn/24/11-24-0477-02-00bn-high-level-perspective-on-dru-follow-up.pptx): 11-24-0477-02-00bn-high-level-perspective-on-dru-follow-up, Shengquan Hu (Mediatek)
15. [11-23/0010r0](https://mentor.ieee.org/802.11/dcn/23/11-23-0010-00-0uhr-considerations-for-enabling-ap-power-save.pptx): 11-23-0010-00-0uhr-considerations-for-enabling-ap-power-save, Alfred Asterjadhi (Qualcomm Inc.)
16. [11-23/1875r1](https://mentor.ieee.org/802.11/dcn/23/11-23-1875-01-00bn-power-save-proposal-for-non-ap-mobile-ap.pptx): 11-23-1875-01-00bn-power-save-proposal-for-non-ap-mobile-ap, Shubhodeep Adhikari (Broadcom)
17. [11-23/1936r0](https://mentor.ieee.org/802.11/dcn/23/11-23-1936-00-00bn-ap-mld-power-save-follow-up.pptx): 11-23-1936-00-00bn-ap-mld-power-save-follow-up, Liwen Chu (NXP)
18. [11-23/1965r2](https://mentor.ieee.org/802.11/dcn/23/11-23-1965-02-00bn-dynamic-power-save-follow-up.pptx): 11-23-1965-02-00bn-dynamic-power-save-follow-up, Alfred Asterjadhi (Qualcomm Inc.)
19. [11-23/2003r1](https://mentor.ieee.org/802.11/dcn/23/11-23-2003-01-00bn-client-power-save.pptx): 11-23-2003-01-00bn-client-power-save, Laurent Cariou (Intel)
20. [11-24/0602](https://mentor.ieee.org/802.11/dcn/24/11-24-0602-00-00bn-multi-link-power-management-for-mlo.pptx)r0: 11-24-0602-00-00bn-multi-link-power-management-for-mlo, Morteza Mehrnoush (Apple Inc)
21. [11-23/1911r0](https://mentor.ieee.org/802.11/dcn/23/11-23-1911-00-00bn-secondary-channel-access-and-frame-transmission.pptx): 11-23-1911-00-00bn-secondary-channel-access-and-frame-transmission, Dongju Cha (LG Electronics)
22. [11-23/1913r2](https://mentor.ieee.org/802.11/dcn/23/11-23-1913-02-00bn-secondary-channel-access-operation.pptx): 11-23-1913-02-00bn-secondary-channel-access-operation, Dongju Cha (LG Electronics)
23. [11-23/1935r1](https://mentor.ieee.org/802.11/dcn/23/11-23-1935-01-00bn-secondary-channel-usage-follow-up.pptx): 11-23-1935-01-00bn-secondary-channel-usage-follow-up, Liwen Chu (NXP)
24. [11-23/2005r1](https://mentor.ieee.org/802.11/dcn/23/11-23-2005-01-00bn-non-primary-channel-access-npca.pptx): 11-23-2005-01-00bn-non-primary-channel-access-npca, Minyoung Park (Intel Corp.)
25. [11-23/2023r1](https://mentor.ieee.org/802.11/dcn/23/11-23-2023-01-00bn-further-discussion-on-non-primary-channel-access.pptx): 11-23-2023-01-00bn-further-discussion-on-non-primary-channel-access, Sindhu Verma (Broadcom)
26. [11-24/0070r1](https://mentor.ieee.org/802.11/dcn/24/11-24-0070-01-00bn-some-details-about-non-primary-channel-access.pptx): 11-24-0070-01-00bn-some-details-about-non-primary-channel-access, Yunbo Li (Huawei)
27. [11-24/0458r0](https://mentor.ieee.org/802.11/dcn/24/11-24-0458-01-00bn-considerations-on-non-primary-channel-access.pptx): 11-24-0458-01-00bn-considerations-on-non-primary-channel-access, Salvatore Talarico (Sony)
28. [11-24/0486r0](https://mentor.ieee.org/802.11/dcn/24/11-24-0486-00-00bn-some-considerations-on-non-primary-channel-access.pptx): 11-24-0486-00-00bn-some-considerations-on-non-primary-channel-access, Ming Gan (Huawei)
29. [11-24/0538r0](https://mentor.ieee.org/802.11/dcn/24/11-24-0538-00-00bn-sp-based-non-primary-channel-access.pptx): 11-24-0538-00-00bn-sp-based-non-primary-channel-access, Yue Zhao (Huawei)
30. [11-24/0670r0](https://mentor.ieee.org/802.11/dcn/24/11-24-0670-00-00bn-different-view-problems-of-npca.pptx): 11-24-0670-00-00bn-different-view-problems-of-npca, Sanghyun Kim (WILUS)
31. [11-23/1873r1](https://mentor.ieee.org/802.11/dcn/23/11-23-1873-01-00bn-post-fcs-mac-padding.pptx): <https://mentor.ieee.org/802.11/dcn/23/11-23-1873-01-00bn-post-fcs-mac-padding.pptx>, Sindhu Verma (Broadcom)
32. [11-23/2007r2](https://mentor.ieee.org/802.11/dcn/23/11-23-2007-02-00bn-enhancement-of-bsr.pptx): 11-23-2007-02-00bn-enhancement-of-bsr, Frank Hsu (Mediatek Inc.)
33. [11-24/0468r2](https://mentor.ieee.org/802.11/dcn/24/11-24-0468-02-00bn-dru-tone-plan-for-11bn.pptx): 11-24-0468-02-00bn-dru-tone-plan-for-11bn, Shengquan Hu (Mediatek)
34. [11-24/0752r2](https://mentor.ieee.org/802.11/dcn/24/11-24-0752-02-00bn-stf-design-consideration-for-dru.pptx): 11-24-0752-02-00bn-stf-design-consideration-for-dru, Lin Yang (Qualcomm Inc.)
35. [11-24/0749r2](https://mentor.ieee.org/802.11/dcn/24/11-24-0749-02-00bn-thoughts-on-stf-design-for-dru.pptx): 11-24-0749-02-00bn-thoughts-on-stf-design-for-dru, Bo Gong (Huawei)
36. [11-24/0766r2](https://mentor.ieee.org/802.11/dcn/24/11-24-0766-02-00bn-distribution-bandwidth-within-80-mhz-for-dru.pptx): 11-24-0766-02-00bn-distribution-bandwidth-within-80-mhz-for-dru, Eunsung Park (LG Electronics)