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Wireless LANs

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| PDT PHY Unequal Modulation (UEQM) and New MCS |
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Abstract

This document contains Proposed Draft Text (PDT) for the features of Unequal modulation (UEQM) over spatial streams and new MCS of the 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 | Add draft text for each subclause |
|  |  |
|  |  |
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|  |  |

# Introduction

Interpretation of a Motion to Adopt

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

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

## Explanation of the proposed changes:

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

### Relevant passing motions:

[Motion #23, [1]]

* Define unequal modulation over different spatial streams

[Motion #34, [1]]

* Introduce new MCSs which are applicable to single spatial stream transmissions, as well as to equal modulation and unequal modulation cases in multiple spatial stream transmissions.

[Motion #39, [1]]

* For 4 SS, the UEQM patterns only include:
	+ 1st ss, 2nd ss, 3rd ss, 4th ss,
	+ [M, M, M, M-1]
	+ [M,M,M,M-2]
	+ [M,M,M-1,M-2]
	+ [M,M-1,M-1,M-2]

Note: M is the constellation index; M-1 refers to the constellation that is one order lower than M; M-2 refers to the constellation that is two orders lower than M.

[Motion #40, [1]]

* For a (non-ELR) UHR MU PPDU, there exists a 1-bit EQM/UEQM indication in a User field for non-MU-MIMO in the UHR-SIG field.

[Motion #42, [1]]

* Add the following modulation and code rate combinations as the new MCSs for 11bn:
	+ Modulations of {QPSK, 16QAM, 256QAM} with code rate R=2/3
	+ Modulation of 16QAM with code rate R=5/6

[Motion #43, [1]]

* UEQM patterns for Nss=3 are limited to three:
	+ [M, M, M-1]
	+ [M, M, M-2]
	+ [M, M-1, M-2]

Note: M is the constellation index; M-1 refers to the constellation that is one order lower than M; M-2 refers to the constellation that is two orders lower than M.

[Motion #52, [1]]

* UEQM patterns for Nss=2 are limited to two as:
	+ [M, M-1]
	+ [M, M-2]

Note: M is the constellation index; M-1 refers to the constellation that is one order lower than M; M-2 refers to the constellation that is two orders lower than M.

[Motion #53, [1]]

* UHR defines unequal modulation only for LDPC.

[Motion #84, [1]]

* For a (non-ELR) UHR MU PPDU, when EQM/UEQM indicates UEQM in a User field for non-MU-MIMO, there exists a MCS field, a NSS field and a 2 bit field indicating UEQM patterns.

[Motion #117, [1]]

* UHR defines unequal modulation which uses joint LDPC encoding across multiple spatial streams while at least one spatial stream uses a different modulation order compared to the first spatial stream, and is applicable only to non-MU-MIMO beamformed transmissions using 2 to 4 spatial streams in a UHR MU PPDU.

# Text to be adopted begins here:

***TGbn editor: Please add the following new subclauses for Unequal Modulation and New MCS to the 802.11bn draft D0.1:***

# 9. Frame formats

## 9.3 Format of individual frame types

### 9.3.1 Control frames

#### **9.3.1.22 Trigger frame format**

##### **9.3.1.22.x UHR variant User Info field**

# 38. Ultra High Reliablity (UHR) PHY specification

## 38.3 UHR PHY

### 38.3.8 Transmitter block diagram

The generation of each field in an UHR PPDU uses many of the following blocks:

1. Pre-FEC PHY padding
2. Scrambler
3. LDPC FEC encoder
4. Post-FEC PHY padding
5. EQM/UEQM stream parser
6. Segment parser (for RU or MRU size larger than 996 tones)
7. Constellation mappers for multiple modulation orders
8. Pilot insertion
9. Replication over multiple 20 MHz (for bandwidth greater than 20 MHz)
10. LDPC tone mapper
11. Segment deparser (for RU or MRU size larger than 996 tones)
12. CSD per spatial stream insertion
13. Spatial and frequency mapping
14. IDFT
15. GI insertion
16. Windowing

Figure 38-X1 (Transmitter block diagram for the UL transmission or DL non-MU-MIMO transmission of a Data field with LDPC encoding in an RU or MRU equal to or smaller than a 996-tone RU when UEQM applies) shows the transmitter blocks used to generate the Data field of a DL non-MU-MIMO transmission with LDPC encoding in an RU or MRU whose size is the same as or smaller than a 996-tone RU when UEQM is applied to the spatial streams of the user.



**Figure 38-X1 — Transmitter block diagram for the UL transmission or DL non-MU-MIMO transmission of a Data field with LDPC encoding in an RU or MRU equal to or smaller than a 996-tone RU when UEQM applies**

Figure 38-X2 (Transmitter block diagram for the UL transmission or DL non-MU-MIMO transmission of a Data field with LDPC encoding in an RU or MRU larger than a 996-tone RU when UEQM applies) shows the transmitter blocks used to generate the Data field of a DL non-MU-MIMO transmission with LDPC encoding in an RU or MRU whose size is larger than a 996-tone RU when UEQM is applied to the spatial streams of the user.



**Figure 38-X2 — Transmitter block diagram for the UL transmission or DL non-MU-MIMO transmission of a Data field with LDPC encoding in an RU or MRU larger than a 996-tone RU when UEQM applies**

### 38.3.10 UHR modulation and coding schemes (UHR-MCSs) and unequal modulation (UEQM)

UHR-MCS is a compact representation of the modulation and coding combinations. Rate dependent parameters for the full set of the UHR-MCSs are shown in [38.5 (Parameters for UHR-MCSs)](#_bookmark346).

MCS TBD are combinations of existing FEC coding rate and modulation order. MCS TBD may be used for single spatial stream transmissions, as well as to equal modulation and unequal modulation cases in multiple spatial stream transmissions.

UHR defines equal modulation (EQM) for 1 to TBD spatial streams, and UEQM for 2 to 4 spatial streams.

For EQM, the uncoded bits transmitted over all spatial streams for the same user in the Data field of the PPDU are jointly coded, and the coded bits parsed to each spatial stream are modulated with the same modulation order. In the case of EQM, UHR-MCS is a value that indicates the modulation and coding scheme for all spatial streams.

For UEQM, the uncoded bits transmitted over all spatial streams for the same user in the Data field of the PPDU are jointly coded, and the coded bits parsed to at least one of the spatial streams are modulated with a different modulation level from that of the first spatial stream. In the case of UEQM, UHR-MCS is a value that indicates the modulation and coding scheme for the first spatial stream in the Data field of the PPDU. The modulation orders of the subsequent spatial streams are indicated by the UEQM Pattern subfield in the user field of UHR-SIG in Table 38.X3 (UEQM pattern subfield encoding) in 38.3.12.8.5 (User Specific field).

UEQM is used only in a UHR MU PPDU with non-MU-MIMO beamformed transmission. UEQM is used only with LDPC. The combination of FEC coding rate and modulation order used in any spatial streams in UEQM transmission shall be a defined UHR-MCS. The allowed modulation levels used in UEQM are QPSK, 16-QAM, 64-QAM, 256-QAM, 1024-QAM and 4096-QAM. Inclusion of BPSK is TBD.

For a UHR MU PPDU, both the UHR-MCS and modulation pattern across spatial streams are carried per user in the non-MU-MIMO user field in the User Specific field of the UHR-SIG field; The MU-MIMO User field carries only the UHR-MCS per user in the User Specific field of the UHR-SIG field. For a UHR TB PPDU, the UHR-MCS is carried in the User Info field of the Trigger frame soliciting the UHR TB PPDU. For a UHR ELR PPDU, the UHR-MCS is carried in the ELR-SIG field.

### 38.3.12 Timing-related parameters

Table 38-X1 (Frequently used parameters) defines parameters used frequently in Clause 38 (Ultra high reliability (UHR) PHY specification).

#### **Table 38-X1—Frequently used parameters**

|  |  |
| --- | --- |
| **Symbol** | **Explanation** |
| *NRU* | For pre-UHR modulated fields, *NRU* = 1 *.*For UHR modulated fields, *NRU* represents the number of occupied RU(s) or MRU(s) in the transmission. |
| *Nuser* *r* | For pre-UHR modulated fields, *Nuser* *r* = 1 .For UHR modulated fields, *Nuser* *r* represents the total number of users in the *r*-th occupied RU or MRU of the transmission. |
| *Nuser* *total* | Total number of users in all occupied RU(s) or MRU(s) of an UHR transmission, i.e.,*NRU* – 1*Nuser* *total* =  *Nuser* *r* .*r* = 0 |
| *NCBPS* *u* | Number of coded bits per OFDM symbol for user *u*, *u* = 0 1  *Nuser* *total* – 1 . |
| *NCBPS* *m,u* | Number of coded bits per OFDM symbol over the *m*-th spatial stream for user *u*, *m* = 1,2, …, *NSS* *u* innon-OFDMA transmission and *m* = 1,2, …,  *NSS* *r* *u* in OFDMA transmission*, u* = 0 1  *Nuser* *total* – 1 . |
| *NSD* | Effective number of data tones carrying unique data.NOTE—The *NSD* value with DCM (when applicable) is half of the *NSD* value without DCM, for each RU or MRU size. |
| *NSD* *u* | Effective number of data tones carrying unique data for user *u*, *u* = 0 1  *Nuser* *total* – 1 . |
| *NCBPSS* *u* | Number of coded bits per OFDM symbol per spatial stream for user *u*, *u* = 0 1  *Nuser* *total* – 1 . |
| *NCBPSS* *l* *u* | Number of coded bits per OFDM symbol per spatial stream for user *u* in the *l*-th 80 MHz frequency subblock, *u* = 0 1  *Nuser* *total* – 1, and *l* = 0 1  *L* – 1 . *L* is the number of 80 MHz frequency subblocks. |
| *NDBPS* *u* | Number of data bits per OFDM symbol for user *u*, *u* = 0 1  *Nuser* *total* – 1 .NOTE—For LDPC, *NDBPS* *u* is derived from *NCBPS* *u* using *Ru* , rather than the effective LDPC code rate, which may vary depending on shortening/puncturing/ repetition performed during LDPC encoding. |
| *NBPSCS* *u* | Number of coded bits per subcarrier per spatial stream for user *u*, *u* = 0 1  *Nuser* *total* – 1 . |
| *NBPSCS* *m,u* | Number of coded bits per subcarrier over the *m*-th spatial stream for user *u*, *m* =1, 2, …, *NSS* *u* innon-OFDMA transmission and *m* = 1,2, …,  *NSS* *r* *u* in OFDMA transmission, *u* = 0 1  *Nuser* *total* – 1 . |
| *NBPSCS* *l* *u* | Number of coded bits per subcarrier per spatial stream for user *u* in the *l*-th 80 MHz frequency block, *u* = 0 1  *Nuser* *total* – 1,and *l* = 0 1  *L* – 1 . *L* is the number of 80 MHz frequency subblocks. |
| *NRX* | Number of receive chains. |
| *NSS* *r* *u* , *NSS* *u* ,*NSS* | Number of spatial streams. For the Data field, *NSS* *r* *u* is the number of spatial streams at *r*-th RU or MRU for user *u*, *u* = 0 1  *Nuser* *r* – 1 , and *NSS* *u* is the number of spatial streams for user *u*, *u* = 0 1  *Nuser* *total* – 1 .*N* 1For the Data field of a UHR PPDU, *N* = *max RU N* .*SS r* = 0 *SS* *r* *total* |

### 38.3.14 UHR preamble

#### **38.3.14.9 UHR-SIG**

##### **38.3.14.9.6 User Specific field**

…

In the User field format for a non-MU-MIMO allocation, there is a 1-bit UEQM subfield.

The 1-bit UEQM subfield:

If the STA-ID subfield is not equal to 2046, it indicates whether EQM or UEQM is used:

Set to 0 for EQM.

Set to 1 for UEQM.

Set to an arbitrary value if the STA-ID subfield is 2046.

If the UL/DL subfield of the U-SIG field is set to 0 and if the value of STA-ID subfield does not match the user’s STA-ID, all values are Disregard.

If the 1-bit UEQM subfield is equal to 1, there is an MCS subfield, an NSS subfield, and a 2-bit UEQM pattern subfield.

The MCS subfield:

If the STA-ID subfield is not equal to 2046, this subfield indicates the following modulation and coding scheme:

Set to *n* for UHR-MCS *n*. Values corresponding to undefined UHR-MCS are Validate.

Set to an arbitrary value if the STA-ID subfield is equal to 2046.

If the UL/DL subfield of the U-SIG field is set to 0:

* If the value of STA-ID subfield matches the user’s STA-ID, the value of UHR-MCS 14 or UHR-MCS 15 is Validate if the condition described in [38.1.1 (Introduction to the UHR](file:///C%3A%5CUsers%5Cmtk28741%5CDownloads%5C11-24-1969-00-00bn-detailed-text-proposal-on-uequal-modulation-and-new-mcs%20%285%29.docx#_bookmark1) [PHY)](file:///C%3A%5CUsers%5Cmtk28741%5CDownloads%5C11-24-1969-00-00bn-detailed-text-proposal-on-uequal-modulation-and-new-mcs%20%285%29.docx#_bookmark1) is not met.
* If the value of STA-ID subfield does not match the user’s STA-ID, all values are Disregard.

If the UL/DL subfield of the U-SIG field is set to 1, the value of UHR-MCS 14 or UHR-MCS 15 is Validate if the condition described in [38.1.1 (Introduction to the](file:///C%3A%5CUsers%5Cmtk28741%5CDownloads%5C11-24-1969-00-00bn-detailed-text-proposal-on-uequal-modulation-and-new-mcs%20%285%29.docx#_bookmark1) UHR [PHY)](file:///C%3A%5CUsers%5Cmtk28741%5CDownloads%5C11-24-1969-00-00bn-detailed-text-proposal-on-uequal-modulation-and-new-mcs%20%285%29.docx#_bookmark1) is not met.

The NSS subfield:

If the STA-ID subfield is not equal to 2046, it indicates the number of spatial streams for up to TBD spatial streams.

Set to the number of spatial streams minus 1.

If the UEQM subfield is equal to 1, values other than 1-3 are Validate.

Set to an arbitrary value if the STA-ID subfield is equal to 2046.

If the UL/DL subfield of the U-SIG field is set to 0 and if the value of STA-ID subfield does not match the user’s STA-ID, all values are Disregard.

The 2-bit UEQM Pattern subfield:

If the STA-ID subfield is not equal to 2046, and the UEQM subfield is equal to 1:

The UEQM Pattern subfield indicates the UEQM pattern for the number of spatial streams indicated in the NSS subfield. See Table 38-X3 (UEQM pattern subfield encoding) for definition. Undefined values of this field are Validate.

Set to an arbitrary value if the STA-ID subfield is 2046.

If the UL/DL subfield of the U-SIG field is set to 0 and if the value of STA-ID subfield does not match the user’s STA-ID, all values are Disregard.

In Table 38-X3 (UEQM pattern subfield encoding), “s” is the constellation index value corresponding to the modulation order of the UHR-MCS used in the first spatial stream, which is defined in Table 9-417u (Constellation index), which is also computed as as in (19-43), and “s-∆” represents the modulation order(s) used in the rest of the spatial stream that is ∆ modulation levels lower than s.

NOTE – the modulation order from the first to the sixth corresponds to QPSK, 16-QAM, 64-QAM, 256-QAM, 1024-QAM, and 4096-QAM.

###### **Table 38-X3—UEQM pattern subfield encoding**

|  |  |  |  |
| --- | --- | --- | --- |
| Value in NSS subfield | Number of spatial streams | Value in the UEQM pattern subfield | UEQM pattern |
| Stream 1 | Stream 2 | Stream 3 | Stream 4 |
| 1 | 2 | TBD | s | s-1 | N/A | N/A |
|  |  | TBD | s | s-2 | N/A | N/A |
| 2 | 3 | TBD | s | s | s-1 | N/A |
|  |  | TBD | s | s | s-2 | N/A |
|  |  | TBD | s | s-1 | s-2 | N/A |
| 3 | 4 | TBD | s | s | s | s-1 |
| TBD | s | s | s | s-2 |
| TBD | s | s | s-1 | s-2 |
| TBD | s | s-1 | s-1 | s-2 |

### 38.3.15 Data field

#### **38.3.15.1 Coding**

##### **38.3.15.1.5 Encoding process for a UHR MU PPDU**

The encoding process described in 36.3.13.3.5 (Encoding process for an EHT MU PPDU) shall be applied to UHR SU transmission and MU transmission with the following modification:

The value used in Equation (36-49) shall be computed as:

, in which is the coding rate for the *u*-th user.

 , in which *is the* valuecorresponding to the occupied RU or MRU size of the *u*-th user, and are defined in Table 38-23 (Frequently used parameters).

#### **38.3.15.x Stream parser**

The coded bits after post-FEC padding for each user are parsed into the spatial streams allocated to the user.

If equal modulation is used for the user, the modulation order is the same across all the allocated streams, the operation described in 27.3.12.6 (Stream parser) shall be used. If unequal modulation is used for the user, the operation described in 19.3.11.8.2 (Stream parser) shall be used with the following restrictions and modifications:

1. ,
2. , for , inclusion of is TBD
3. The number of encoders equals one, ,
4. The encoder type is LDPC.

#### **38.3.15.2 Segment parser**

The bit stream of each spatial stream is further parsed to the frequency segments if the RU or MRU size of the user is larger than 996 tones. The segment parser operation described in 36.3.13.5 (Segment parser) is specified for one of the spatial streams in EQM transmission, and the parsing is carried out in the same way per stream. For multi-stream UEQM transmissions, the segment parser operation described in 36.3.13.5 (Segment parser) shall be applied to each spatial stream using the parameters corresponding to the modulation order of the stream.

## 38.5 Parameters for UHR-MCS

The rate-dependent parameters for various RU or MRU sizes using *NSS* *u* = 1 are provided in [Table 38-71](#_bookmark349) [(UHR-MCSs for 26-tone RU, NSS,u = 1)](#_bookmark349) through [Table 38-86 (UHR-MCSs for 4×996-tone RU, NSS,u = 1)](#_bookmark364). The rate-dependent parameters for UHR DUP mode are provided in [Table 38-87 (UHR-MCS 14 for UHR](#_bookmark365) [DUP mode, NSS,u = 1)](#_bookmark365).

For EQM transmission*, NCBPS* *u* for a given UHR-MCS *M* using *NSS* *u* (>1) can be obtained as the product of *NSS* *u* and *NCBPS* *u* for UHR-MCS *M* using *NSS* *u* = 1 .

For UEQM transmission, *NCBPS* *u* for a given UEQM pattern {s-*Δm*} in m-th spatial streamusing *NSS* *u* (>1) can be obtained using Equation (38-122).

 (38-122)

where

m = 1, 2, …, Nss,u

*NCBPS,m,u*can be obtained as *NCBPS* *u* in Table 38-X4 (UHR-MCSs for 26-tone RU, NSS,u = 1) through Table 38-X19 (UHR-MCSs for 4×996-tone RU, NSS,u = 1) corresponding to the modulation and code rate of the m-th spatial stream, where the coding rate is the same as the first stream and the modulation is determined based on the constellation index {s-*Δm*} of spatial stream m.

Δm is the number of modulation levels lower than s in the m-th spatial stream. Δm is defined in Table 38-X3 (UEQM pattern subfield encoding), and Δ1 is always 0.

*NDBPS* *u* and data rate in megabits per second (*D*) are computed using [Equation (38-123)](#_bookmark347) and [Equation (38-](#_bookmark348) [124)](#_bookmark348), respectively.

(38-123)

 (38-124)

where

 is the coding rate for user *u*, *u* = 0 1  *Nuser* *total* – 1

 is the GI duration for the Data field in microseconds.

UHR-MCSs 14 and 15 are supported only with *NSS* *u* = 1.

UHR-MCSs 0–13, 15 and TBDs are defined for user *u* in SU transmission or MU transmission. UHR-MCS 14 is defined for user *u* in SU transmission only, and for bandwidths 80 MHz, 160 MHz, and 320 MHz only.

UHR-MCSs TBDs are not defined.

### 38.5.1 UHR-MCSs for 26-tone RU

The rate-dependent parameters for the 26-tone RU are provided in [Table 38-X4 (UHR-MCSs for 26-tone RU,](#_bookmark349) [NSS,u = 1)](#_bookmark349).

#### **Table 38-X4—UHR-MCSs for 26-tone RU, NSS,u = 1**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **UHR- MCS****index** | **Modulation** | ***Ru*** | ***NBPSCS,u*** | ***NSD,u*** | ***NCBPS,u*** | ***NDBPS,u*** | **Data rate (Mb/s)** |
| **0.8 µs GI** | **1.6 µs GI** | **3.2 µs GI** |
| 0 | BPSK | 1/2 | 1 | 24 | 24 | 12 | 0.9 | 0.8 | 0.8 |
| 1 | QPSK | 1/2 | 2 | 48 | 24 | 1.8 | 1.7 | 1.5 |
| 2 | 3/4 | 36 | 2.6 | 2.5 | 2.3 |
| 3 | 16-QAM | 1/2 | 4 | 96 | 48 | 3.5 | 3.3 | 3.0 |
| 4 | 3/4 | 72 | 5.3 | 5.0 | 4.5 |
| 5 | 64-QAM | 2/3 | 6 | 144 | 96 | 7.1 | 6.7 | 6.0 |
| 6 | 3/4 | 108 | 7.9 | 7.5 | 6.8 |
| 7 | 5/6 | 120 | 8.8 | 8.3 | 7.5 |
| 8 | 256-QAM | 3/4 | 8 | 192 | 144 | 10.6 | 10.0 | 9.0 |
| 9 | 5/6 | 160 | 11.8 | 11.1 | 10.0 |
| 10 | 1024-QAM | 3/4 | 10 | 240 | 180 | 13.2 | 12.5 | 11.3 |
| 11 | 5/6 | 200 | 14.7 | 13.9 | 12.5 |
| 12 | 4096-QAM | 3/4 | 12 | 288 | 216 | 15.9 | 15.0 | 13.5 |
| 13 | 5/6 | 240 | 17.6 | 16.7 | 15.0 |
| 15 | BPSK-DCM | 1/2 | 1 | 12 | 12 | 6 | 0.4 | 0.4 | 0.4 |
| TBD | QPSK |  2/3 | 2 | 24 | 48 | 32  | 2.4 | 2.2 | 2.0 |
| TBD | 16-QAM |  2/3 | 4 | 96 | 64  | 4.7 | 4.4 | 4.0 |
| TBD | 16-QAM |  5/6 | 4 | 96 | 80  | 5.9 | 5.6 | 5.0 |
| TBD | 256-QAM |  2/3 | 8 | 192 | 128  | 9.4 | 8.9 | 8.0 |

### 38.5.2 UHR-MCSs for 52-tone RU

The rate-dependent parameters for the 52-tone RU are provided in [Table 38-X5 (UHR-MCSs for 52-tone RU,](#_bookmark349) [NSS,u = 1)](#_bookmark349).

#### **Table 38-X5—UHR-MCSs for 52-tone RU, NSS,u = 1**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **UHR- MCS****index** | **Modulation** | ***Ru*** | ***NBPSCS,u*** | ***NSD,u*** | ***NCBPS,u*** | ***NDBPS,u*** | **Data rate (Mb/s)** |
| **0.8 µs GI** | **1.6 µs GI** | **3.2 µs GI** |
| 0 | BPSK | 1/2 | 1 | 48 | 48 | 24 | 1.8 | 1.7 | 1.5 |
| 1 | QPSK | 1/2 | 2 | 96 | 48 | 3.5 | 3.3 | 3.0 |
| 2 | 3/4 | 72 | 5.3 | 5.0 | 4.5 |
| 3 | 16-QAM | 1/2 | 4 | 192 | 96 | 7.1 | 6.7 | 6.0 |
| 4 | 3/4 | 144 | 10.6 | 10.0 | 9.0 |
| 5 | 64-QAM | 2/3 | 6 | 288 | 192 | 14.1 | 13.3 | 12.0 |
| 6 | 3/4 | 216 | 15.9 | 15.0 | 13.5 |
| 7 | 5/6 | 240 | 17.6 | 16.7 | 15.0 |
| 8 | 256-QAM | 3/4 | 8 | 384 | 288 | 21.2 | 20.0 | 18.0 |
| 9 | 5/6 | 320 | 23.5 | 22.2 | 20.0 |
| 10 | 1024-QAM | 3/4 | 10 | 480 | 360 | 26.5 | 25.0 | 22.5 |
| 11 | 5/6 | 400 | 29.4 | 27.8 | 25.0 |
| 12 | 4096-QAM | 3/4 | 12 | 576 | 432 | 31.8 | 30.0 | 27.0 |
| 13 | 5/6 | 480 | 35.3 | 33.3 | 30.0 |
| 15 | BPSK-DCM | 1/2 | 1 | 24 | 24 | 12 | 0.9 | 0.8 | 0.8 |
| TBD | QPSK |  2/3 | 2 | 48 | 96 | 64  | 4.7 | 4.4 | 4.0 |
| TBD | 16-QAM |  2/3 | 4 | 192 | 128  | 9.4 | 8.9 | 8.0 |
| TBD | 16-QAM |  5/6 | 4 | 192 | 160  | 11.8 | 11.1 | 10.0 |
| TBD | 256-QAM |  2/3 | 8 | 384 | 256  | 18.8 | 17.8 | 16.0 |

### 38.5.3 UHR-MCSs for 52+26-tone RU

The rate-dependent parameters for the 52+26-tone MRU are provided in [Table 38- X6 (UHR-MCSs for](#_bookmark351) [52+26-tone MRU, NSS,u = 1)](#_bookmark351).

#### **Table 38-X6—UHR-MCSs for 52+26-tone MRU, NSS,u = 1**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **UHR- MCS****index** | **Modulation** | ***Ru*** | ***NBPSCS,u*** | ***NSD,u*** | ***NCBPS,u*** | ***NDBPS,u*** | **Data rate (Mb/s)** |
| **0.8 µs GI** | **1.6 µs GI** | **3.2 µs GI** |
| 0 | BPSK | 1/2 | 1 | 72 | 72 | 36 | 2.6 | 2.5 | 2.3 |
| 1 | QPSK | 1/2 | 2 | 144 | 72 | 5.3 | 5.0 | 4.5 |
| 2 | 3/4 | 108 | 7.9 | 7.5 | 6.8 |
| 3 | 16-QAM | 1/2 | 4 | 288 | 144 | 10.6 | 10.0 | 9.0 |
| 4 | 3/4 | 216 | 15.9 | 15.0 | 13.5 |
| 5 | 64-QAM | 2/3 | 6 | 432 | 288 | 21.2 | 20.0 | 18.0 |
| 6 | 3/4 | 324 | 23.8 | 22.5 | 20.3 |
| 7 | 5/6 | 360 | 26.5 | 25.0 | 22.5 |
| 8 | 256-QAM | 3/4 | 8 | 576 | 432 | 31.8 | 30.0 | 27.0 |
| 9 | 5/6 | 480 | 35.3 | 33.3 | 30.0 |
| 10 | 1024-QAM | 3/4 | 10 | 720 | 540 | 39.7 | 37.5 | 33.8 |
| 11 | 5/6 | 600 | 44.1 | 41.7 | 37.5 |
| 12 | 4096-QAM | 3/4 | 12 | 864 | 648 | 47.6 | 45.0 | 40.5 |
| 13 | 5/6 | 720 | 52.9 | 50.0 | 45.0 |
| 15 | BPSK-DCM | 1/2 | 1 | 36 | 36 | 18 | 1.3 | 1.3 | 1.1 |
| TBD | QPSK | 2/3 | 2 | 72 | 144 | 96 | 7.1 | 6.7 | 6.0 |
| TBD | 16-QAM | 2/3 | 4 | 288 | 192 | 14.1 | 13.3 | 12.0 |
| TBD | 16-QAM | 5/6 | 4 | 288 | 240 | 17.6 | 16.7 | 15.0 |
| TBD | 256-QAM | 2/3 | 8 | 576 | 384 | 28.2 | 26.7 | 24.0 |

### 38.5.4 UHR-MCSs for 106-tone RU

The rate-dependent parameters for the 106-tone MRU are provided in [Table 38-X7 (UHR-MCSs for](#_bookmark351) [106-tone MRU, NSS,u = 1)](#_bookmark351).

#### **Table 38-X7—UHR-MCSs for 106-tone RU, NSS,u = 1**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **UHR- MCS****index** | **Modulation** | ***Ru*** | ***NBPSCS,u*** | ***NSD,u*** | ***NCBPS,u*** | ***NDBPS,u*** | **Data rate (Mb/s)** |
| **0.8 µs GI** | **1.6 µs GI** | **3.2 µs GI** |
| 0 | BPSK | 1/2 | 1 | 102 | 102 | 51 | 3.8 | 3.5 | 3.2 |
| 1 | QPSK | 1/2 | 2 | 204 | 102 | 7.5 | 7.1 | 6.4 |
| 2 | 3/4 | 153 | 11.3 | 10.6 | 9.6 |
| 3 | 16-QAM | 1/2 | 4 | 408 | 204 | 15.0 | 14.2 | 12.8 |
| 4 | 3/4 | 306 | 22.5 | 21.3 | 19.1 |
| 5 | 64-QAM | 2/3 | 6 | 612 | 408 | 30.0 | 28.3 | 25.5 |
| 6 | 3/4 | 459 | 33.8 | 31.9 | 28.7 |
| 7 | 5/6 | 510 | 37.5 | 35.4 | 31.9 |
| 8 | 256-QAM | 3/4 | 8 | 816 | 612 | 45.0 | 42.5 | 38.3 |
| 9 | 5/6 | 680 | 50.0 | 47.2 | 42.5 |
| 10 | 1024-QAM | 3/4 | 10 | 1 020 | 765 | 56.3 | 53.1 | 47.8 |
| 11 | 5/6 | 850 | 62.5 | 59.0 | 53.1 |
| 12 | 4096-QAM | 3/4 | 12 | 1 224 | 918 | 67.5 | 63.8 | 57.4 |
| 13 | 5/6 | 1 020 | 75.0 | 70.8 | 63.8 |
| 15 | BPSK-DCM | 1/2 | 1 | 51 | 51 | 25 | 1.8 | 1.7 | 1.6 |
| TBD | QPSK |  2/3 | 2 | 102 | 204 | 136  | 10.0 | 9.4 | 8.5 |
| TBD | 16-QAM |  2/3 | 4 | 408 | 272  | 20.0 | 18.9 | 17.0 |
| TBD | 16-QAM |  5/6 | 4 | 408 | 340  | 25.0 | 23.6 | 21.3 |
| TBD | 256-QAM |  2/3 | 8 | 816 | 544  | 40.0 | 37.8 | 34.0 |

### 38.5.4 UHR-MCSs for 106+26-tone MRU

The rate-dependent parameters for the 106+26-tone MRU are provided in [Table 38-X8 (UHR-MCSs for](#_bookmark353) [106+26-tone MRU, NSS,u = 1)](#_bookmark353).

#### **Table 38-X8—UHR-MCSs for 106+26-tone MRU, NSS,u = 1**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **UHR- MCS****index** | **Modulation** | ***Ru*** | ***NBPSCS,u*** | ***NSD,u*** | ***NCBPS,u*** | ***NDBPS,u*** | **Data rate (Mb/s)** |
| **0.8 µs GI** | **1.6 µs GI** | **3.2 µs GI** |
| 0 | BPSK | 1/2 | 1 | 126 | 126 | 63 | 4.6 | 4.4 | 3.9 |
| 1 | QPSK | 1/2 | 2 | 252 | 126 | 9.3 | 8.8 | 7.9 |
| 2 | 3/4 | 189 | 13.9 | 13.1 | 11.8 |
| 3 | 16-QAM | 1/2 | 4 | 504 | 252 | 18.5 | 17.5 | 15.8 |
| 4 | 3/4 | 378 | 27.8 | 26.3 | 23.6 |
| 5 | 64-QAM | 2/3 | 6 | 756 | 504 | 37.1 | 35.0 | 31.5 |
| 6 | 3/4 | 567 | 41.7 | 39.4 | 35.4 |
| 7 | 5/6 | 630 | 46.3 | 43.8 | 39.4 |
| 8 | 256-QAM | 3/4 | 8 | 1 008 | 756 | 55.6 | 52.5 | 47.3 |
| 9 | 5/6 | 840 | 61.8 | 58.3 | 52.5 |
| 10 | 1024-QAM | 3/4 | 10 | 1 260 | 945 | 69.5 | 65.6 | 59.1 |
| 11 | 5/6 | 1 050 | 77.2 | 72.9 | 65.6 |
| 12 | 4096-QAM | 3/4 | 12 | 1 512 | 1 134 | 83.4 | 78.8 | 70.9 |
| 13 | 5/6 | 1 260 | 92.6 | 87.5 | 78.8 |
| 15 | BPSK-DCM | 1/2 | 1 | 63 | 63 | 31 | 2.3 | 2.2 | 1.9 |
| TBD | QPSK |  2/3 | 2 | 126 | 252 | 168  | 12.4 | 11.7 | 10.5 |
| TBD | 16-QAM |  2/3 | 4 | 504 | 336  | 24.7 | 23.3 | 21.0 |
| TBD | 16-QAM |  5/6 | 4 | 504 | 420  | 30.9 | 29.2 | 26.3 |
| TBD | 256-QAM |  2/3 | 8 | 1008 | 672  | 49.4 | 46.7 | 42.0 |

### 38.5.6 UHR-MCSs for 242-tone RU

The rate-dependent parameters for the 242-tone RU are provided in [Table 38-X9 (UHR-MCSs for 242-tone](#_bookmark354) [RU, NSS,u = 1)](#_bookmark354).

#### **Table 38-X9—UHR-MCSs for 242-tone RU, NSS,u = 1**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **UHR- MCS****index** | **Modulation** | ***Ru*** | ***NBPSCS,u*** | ***NSD,u*** | ***NCBPS,u*** | ***NDBPS,u*** | **Data rate (Mb/s)** |
| **0.8 µs GI** | **1.6 µs GI** | **3.2 µs GI** |
| 0 | BPSK | 1/2 | 1 | 234 | 234 | 117 | 8.6 | 8.1 | 7.3 |
| 1 | QPSK | 1/2 | 2 | 468 | 234 | 17.2 | 16.3 | 14.6 |
| 2 | 3/4 | 351 | 25.8 | 24.4 | 21.9 |
| 3 | 16-QAM | 1/2 | 4 | 936 | 468 | 34.4 | 32.5 | 29.3 |
| 4 | 3/4 | 702 | 51.6 | 48.8 | 43.9 |
| 5 | 64-QAM | 2/3 | 6 | 1 404 | 936 | 68.8 | 65.0 | 58.5 |
| 6 | 3/4 | 1 053 | 77.4 | 73.1 | 65.8 |
| 7 | 5/6 | 1 170 | 86.0 | 81.3 | 73.1 |
| 8 | 256-QAM | 3/4 | 8 | 1 872 | 1 404 | 103.2 | 97.5 | 87.8 |
| 9 | 5/6 | 1 560 | 114.7 | 108.3 | 97.5 |
| 10 | 1024-QAM | 3/4 | 10 | 2 340 | 1 755 | 129.0 | 121.9 | 109.7 |
| 11 | 5/6 | 1 950 | 143.4 | 135.4 | 121.9 |
| 12 | 4096-QAM | 3/4 | 12 | 2 808 | 2 106 | 154.9 | 146.3 | 131.6 |
| 13 | 5/6 | 2 340 | 172.1 | 162.5 | 146.3 |
| 15 | BPSK-DCM | 1/2 | 1 | 117 | 117 | 58 | 4.3 | 4.0 | 3.6 |
| TBD | QPSK |  2/3 | 2 | 234 | 468 | 312  | 22.9 | 21.7 | 19.5 |
| TBD | 16-QAM |  2/3 | 4 | 936 | 624  | 45.9 | 43.3 | 39.0 |
| TBD | 16-QAM |  5/6 | 4 | 936 | 780  | 57.4 | 54.2 | 48.8 |
| TBD | 256-QAM |  2/3 | 8 | 1872 | 1248  | 91.8 | 86.7 | 78.0 |

### 38.5.7 UHR-MCSs for 484-tone RU

The rate-dependent parameters for the 484-tone RU are provided in [Table 38-X10 (UHR-MCSs for 484-tone](#_bookmark355) [RU, NSS,u = 1)](#_bookmark355).

#### **Table 38-X10—UHR-MCSs for 484-tone RU, NSS,u = 1**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **UHR- MCS****index** | **Modulation** | ***Ru*** | ***NBPSCS,u*** | ***NSD,u*** | ***NCBPS,u*** | ***NDBPS,u*** | **Data rate (Mb/s)** |
| **0.8 µs GI** | **1.6 µs GI** | **3.2 µs GI** |
| 0 | BPSK | 1/2 | 1 | 468 | 468 | 234 | 17.2 | 16.3 | 14.6 |
| 1 | QPSK | 1/2 | 2 | 936 | 468 | 34.4 | 32.5 | 29.3 |
| 2 | 3/4 | 702 | 51.6 | 48.8 | 43.9 |
| 3 | 16-QAM | 1/2 | 4 | 1 872 | 936 | 68.8 | 65.0 | 58.5 |
| 4 | 3/4 | 1 404 | 103.2 | 97.5 | 87.8 |
| 5 | 64-QAM | 2/3 | 6 | 2 808 | 1 872 | 137.6 | 130.0 | 117.0 |
| 6 | 3/4 | 2 106 | 154.9 | 146.3 | 131.6 |
| 7 | 5/6 | 2 340 | 172.1 | 162.5 | 146.3 |
| 8 | 256-QAM | 3/4 | 8 | 3 744 | 2 808 | 206.5 | 195.0 | 175.5 |
| 9 | 5/6 | 3 120 | 229.4 | 216.7 | 195.0 |
| 10 | 1024-QAM | 3/4 | 10 | 4 680 | 3 510 | 258.1 | 243.8 | 219.4 |
| 11 | 5/6 | 3 900 | 286.8 | 270.8 | 243.8 |
| 12 | 4096-QAM | 3/4 | 12 | 5 616 | 4 212 | 309.7 | 292.5 | 263.3 |
| 13 | 5/6 | 4 680 | 344.1 | 325.0 | 292.5 |
| 15 | BPSK-DCM | 1/2 | 1 | 234 | 234 | 117 | 8.6 | 8.1 | 7.3 |
| TBD | QPSK |  2/3 | 2 | 468 | 936 | 624  | 45.9 | 43.3 | 39.0 |
| TBD | 16-QAM |  2/3 | 4 | 1872 | 1248  | 91.8 | 86.7 | 78.0 |
| TBD | 16-QAM |  5/6 | 4 | 1872 | 1560  | 114.7 | 108.3 | 97.5 |
| TBD | 256-QAM |  2/3 | 8 | 3744 | 2496  | 183.5 | 173.3 | 156.0 |

### 38.5.8 UHR-MCSs for 484+242-tone MRU

The rate-dependent parameters for the 484+242-tone MRU are provided in [Table 38-X11 (UHR-MCSs for](#_bookmark356) [484+242-tone MRU, NSS,u = 1)](#_bookmark356)

#### **Table 38-X11—UHR-MCSs for 484+242-tone MRU, NSS,u = 1**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **UHR- MCS****index** | **Modulation** | ***Ru*** | ***NBPSCS,u*** | ***NSD,u*** | ***NCBPS,u*** | ***NDBPS,u*** | **Data rate (Mb/s)** |
| **0.8 µs GI** | **1.6 µs GI** | **3.2 µs GI** |
| 0 | BPSK | 1/2 | 1 | 702 | 702 | 351 | 25.8 | 24.4 | 21.9 |
| 1 | QPSK | 1/2 | 2 | 1 404 | 702 | 51.6 | 48.8 | 43.9 |
| 2 | 3/4 | 1 053 | 77.4 | 73.1 | 65.8 |
| 3 | 16-QAM | 1/2 | 4 | 2 808 | 1 404 | 103.2 | 97.5 | 87.8 |
| 4 | 3/4 | 2 106 | 154.9 | 146.3 | 131.6 |
| 5 | 64-QAM | 2/3 | 6 | 4 212 | 2 808 | 206.5 | 195.0 | 175.5 |
| 6 | 3/4 | 3 159 | 232.3 | 219.4 | 197.4 |
| 7 | 5/6 | 3 510 | 258.1 | 243.8 | 219.4 |
| 8 | 256-QAM | 3/4 | 8 | 5 616 | 4 212 | 309.7 | 292.5 | 263.3 |
| 9 | 5/6 | 4 680 | 344.1 | 325.0 | 292.5 |
| 10 | 1024-QAM | 3/4 | 10 | 7 020 | 5 265 | 387.1 | 365.6 | 329.1 |
| 11 | 5/6 | 5 850 | 430.1 | 406.3 | 365.6 |
| 12 | 4096-QAM | 3/4 | 12 | 8 424 | 6 318 | 464.6 | 438.8 | 394.9 |
| 13 | 5/6 | 7 020 | 516.2 | 487.5 | 438.8 |
| 15 | BPSK-DCM | 1/2 | 1 | 351 | 351 | 175 | 12.9 | 12.2 | 10.9 |
| TBD | QPSK |  2/3 | 2 | 702 | 1404 | 936  | 68.8 | 65.0 | 58.5 |
| TBD | 16-QAM |  2/3 | 4 | 2808 | 1872  | 137.6 | 130.0 | 117.0 |
| TBD | 16-QAM |  5/6 | 4 | 2808 | 2340  | 172.1 | 162.5 | 146.3 |
| TBD | 256-QAM |  2/3 | 8 | 5616 | 3744  | 275.3 | 260.0 | 234.0 |

### 38.5.9 UHR-MCSs for 996-tone RU

The rate-dependent parameters for the 996-tone RU are provided in [Table 38-X12 (UHR-MCSs for 996-tone](#_bookmark357) [RU, NSS,u = 1)](#_bookmark357).

#### **Table 38-X12—UHR-MCSs for 996-tone RU, NSS,u = 1**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **UHR- MCS****index** | **Modulation** | ***Ru*** | ***NBPSCS,u*** | ***NSD,u*** | ***NCBPS,u*** | ***NDBPS,u*** | **Data rate (Mb/s)** |
| **0.8 µs GI** | **1.6 µs GI** | **3.2 µs GI** |
| 0 | BPSK | 1/2 | 1 | 980 | 980 | 490 | 36.0 | 34.0 | 30.6 |
| 1 | QPSK | 1/2 | 2 | 1 960 | 980 | 72.1 | 68.1 | 61.3 |
| 2 | 3/4 | 1 470 | 108.1 | 102.1 | 91.9 |
| 3 | 16-QAM | 1/2 | 4 | 3 920 | 1 960 | 144.1 | 136.1 | 122.5 |
| 4 | 3/4 | 2 940 | 216.2 | 204.2 | 183.8 |
| 5 | 64-QAM | 2/3 | 6 | 5 880 | 3 920 | 288.2 | 272.2 | 245.0 |
| 6 | 3/4 | 4 410 | 324.3 | 306.3 | 275.6 |
| 7 | 5/6 | 4 900 | 360.3 | 340.3 | 306.3 |
| 8 | 256-QAM | 3/4 | 8 | 7 840 | 5 880 | 432.4 | 408.3 | 367.5 |
| 9 | 5/6 | 6 533 | 480.4 | 453.7 | 408.3 |
| 10 | 1024-QAM | 3/4 | 10 | 9 800 | 7 350 | 540.4 | 510.4 | 459.4 |
| 11 | 5/6 | 8 166 | 600.4 | 567.1 | 510.4 |
| 12 | 4096-QAM | 3/4 | 12 | 11 760 | 8 820 | 648.5 | 612.5 | 551.3 |
| 13 | 5/6 | 9 800 | 720.6 | 680.6 | 612.5 |
| 15 | BPSK-DCM | 1/2 | 1 | 490 | 490 | 245 | 18.0 | 17.0 | 15.3 |
| TBD | QPSK |  2/3 | 2 | 980 | 1960 | 1306  | 96.0 | 90.7 | 81.6 |
| TBD | 16-QAM |  2/3 | 4 | 3920 | 2613  | 192.1 | 181.5 | 163.3 |
| TBD | 16-QAM |  5/6 | 4 | 3920 | 3266  | 240.1 | 226.8 | 204.1 |
| TBD | 256-QAM |  2/3 | 8 | 7840 | 5226  | 384.3 | 362.9 | 326.6 |

### 38.5. 10 UHR-MCSs for 996+484-tone MRU

The rate-dependent parameters for the 996+484-tone MRU are provided in [Table 38-X13 (UHR-MCSs for](#_bookmark358) [996+484-tone MRU, NSS,u = 1)](#_bookmark358).

#### **Table 38-X13—UHR-MCSs for 996+484-tone MRU, NSS,u = 1**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **UHR- MCS****index** | **Modulation** | ***Ru*** | ***NBPSCS,u*** | ***NSD,u*** | ***NCBPS,u*** | ***NDBPS,u*** | **Data rate (Mb/s)** |
| **0.8 µs GI** | **1.6 µs GI** | **3.2 µs GI** |
| 0 | BPSK | 1/2 | 1 | 1 448 | 1 448 | 724 | 53.2 | 50.3 | 45.3 |
| 1 | QPSK | 1/2 | 2 | 2 896 | 1 448 | 106.5 | 100.6 | 90.5 |
| 2 | 3/4 | 2 172 | 159.7 | 150.8 | 135.8 |
| 3 | 16-QAM | 1/2 | 4 | 5 792 | 2 896 | 212.9 | 201.1 | 181.0 |
| 4 | 3/4 | 4 344 | 319.4 | 301.7 | 271.5 |
| 5 | 64-QAM | 2/3 | 6 | 8 688 | 5 792 | 425.9 | 402.2 | 362.0 |
| 6 | 3/4 | 6 516 | 479.1 | 452.5 | 407.3 |
| 7 | 5/6 | 7 240 | 532.4 | 502.8 | 452.5 |
| 8 | 256-QAM | 3/4 | 8 | 11 584 | 8 688 | 638.8 | 603.3 | 543.0 |
| 9 | 5/6 | 9 653 | 709.8 | 670.3 | 603.3 |
| 10 | 1024-QAM | 3/4 | 10 | 14 480 | 10 860 | 798.5 | 754.2 | 678.8 |
| 11 | 5/6 | 12 066 | 887.2 | 837.9 | 754.1 |
| 12 | 4096-QAM | 3/4 | 12 | 17 376 | 13 032 | 958.2 | 905.0 | 814.5 |
| 13 | 5/6 | 14 480 | 1 064.7 | 1 005.6 | 905.0 |
| 15 | BPSK-DCM | 1/2 | 1 | 724 | 724 | 362 | 26.2 | 25.1 | 22.6 |
| TBD | QPSK |  2/3 | 2 | 1448 | 2896 | 1930  | 141.9 | 134.0 | 120.6 |
| TBD | 16-QAM |  2/3 | 4 | 5792 | 3861  | 283.9 | 268.1 | 241.3 |
| TBD | 16-QAM |  5/6 | 4 | 5792 | 4826  | 354.9 | 335.1 | 301.6 |
| TBD | 256-QAM |  2/3 | 8 | 11584 | 7722  | 567.8 | 536.3 | 482.6 |

### 38.5.11 UHR-MCSs for 996+484+242-tone MRU

The rate-dependent parameters for the 996+484+242-tone MRU are provided in [Table 38-X14 (UHR-MCSs](#_bookmark359) [for 996+484+242-tone MRU, NSS,u = 1)](#_bookmark359).

#### **Table 38-X14—UHR-MCSs for 996+484+242-tone MRU, NSS,u = 1**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **UHR- MCS****index** | **Modulation** | ***Ru*** | ***NBPSCS,u*** | ***NSD,u*** | ***NCBPS,u*** | ***NDBPS,u*** | **Data rate (Mb/s)** |
| **0.8 µs GI** | **1.6 µs GI** | **3.2 µs GI** |
| 0 | BPSK | 1/2 | 1 | 1 682 | 1 682 | 841 | 61.8 | 58.4 | 52.6 |
| 1 | QPSK | 1/2 | 2 | 3 364 | 1 682 | 123.7 | 116.8 | 105.1 |
| 2 | 3/4 | 2 523 | 185.5 | 175.2 | 157.7 |
| 3 | 16-QAM | 1/2 | 4 | 6 728 | 3 364 | 247.4 | 233.6 | 210.3 |
| 4 | 3/4 | 5 046 | 371.0 | 350.4 | 315.4 |
| 5 | 64-QAM | 2/3 | 6 | 10 092 | 6 728 | 494.7 | 467.2 | 420.5 |
| 6 | 3/4 | 7 569 | 556.5 | 525.6 | 473.1 |
| 7 | 5/6 | 8 410 | 618.4 | 584.0 | 525.6 |
| 8 | 256-QAM | 3/4 | 8 | 13 456 | 10 092 | 742.1 | 700.8 | 630.8 |
| 9 | 5/6 | 11 213 | 824.5 | 778.7 | 700.8 |
| 10 | 1024-QAM | 3/4 | 10 | 16 820 | 12 615 | 927.6 | 876.0 | 788.4 |
| 11 | 5/6 | 14 016 | 1 030.6 | 973.3 | 876.0 |
| 12 | 4096-QAM | 3/4 | 12 | 20 184 | 15 138 | 1 113.1 | 1 051.3 | 946.1 |
| 13 | 5/6 | 16 820 | 1 236.8 | 1 168.1 | 1 051.3 |
| 15 | BPSK-DCM | 1/2 | 1 | 841 | 841 | 420 | 30.9 | 29.2 | 26.3 |
| TBD | QPSK |  2/3 | 2 | 1682 | 3364 | 2242  | 164.9 | 155.7 | 140.1 |
| TBD | 16-QAM |  2/3 | 4 | 6728 | 4485  | 329.8 | 311.5 | 280.3 |
| TBD | 16-QAM |  5/6 | 4 | 6728 | 5606  | 412.2 | 389.3 | 350.4 |
| TBD | 256-QAM |  2/3 | 8 | 13456 | 8970  | 659.6 | 622.9 | 560.6 |

### 38.5.12 UHR-MCSs for 2×996-tone RU

The rate-dependent parameters for the 2×996-tone RU are provided in [Table 38-X15 (UHR-MCSs for 2×996-](#_bookmark360) [tone RU, NSS,u = 1)](#_bookmark360).

#### **Table 38- X15—UHR-MCSs for 2×996-tone RU, NSS,u = 1**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **UHR- MCS****index** | **Modulation** | ***Ru*** | ***NBPSCS,u*** | ***NSD,u*** | ***NCBPS,u*** | ***NDBPS,u*** | **Data rate (Mb/s)** |
| **0.8 µs GI** | **1.6 µs GI** | **3.2 µs GI** |
| 0 | BPSK | 1/2 | 1 | 1 960 | 1 960 | 980 | 72.1 | 68.1 | 61.3 |
| 1 | QPSK | 1/2 | 2 | 3 920 | 1 960 | 144.1 | 136.1 | 122.5 |
| 2 | 3/4 | 2 940 | 216.2 | 204.2 | 183.8 |
| 3 | 16-QAM | 1/2 | 4 | 7 840 | 3 920 | 288.2 | 272.2 | 245.0 |
| 4 | 3/4 | 5 880 | 432.4 | 408.3 | 367.5 |
| 5 | 64-QAM | 2/3 | 6 | 11 760 | 7 840 | 576.5 | 544.4 | 490.0 |
| 6 | 3/4 | 8 820 | 648.5 | 612.5 | 551.3 |
| 7 | 5/6 | 9 800 | 720.6 | 680.6 | 612.5 |
| 8 | 256-QAM | 3/4 | 8 | 15 680 | 11 760 | 864.7 | 816.7 | 735.0 |
| 9 | 5/6 | 13 066 | 960.7 | 907.4 | 816.6 |
| 10 | 1024-QAM | 3/4 | 10 | 19 600 | 14 700 | 1 080.9 | 1 020.8 | 918.8 |
| 11 | 5/6 | 16 333 | 1 201.0 | 1 134.2 | 1 020.8 |
| 12 | 4096-QAM | 3/4 | 12 | 23 520 | 17 640 | 1 297.1 | 1 225.0 | 1 102.5 |
| 13 | 5/6 | 19 600 | 1 441.2 | 1 361.1 | 1 225.0 |
| 15 | BPSK-DCM | 1/2 | 1 | 980 | 980 | 490 | 36.0 | 34.0 | 30.6 |
| TBD | QPSK |  2/3 | 2 | 1960 | 3920 | 2613  | 192.1 | 181.5 | 163.3 |
| TBD | 16-QAM |  2/3 | 4 | 7840 | 5226  | 384.3 | 362.9 | 326.6 |
| TBD | 16-QAM |  5/6 | 4 | 7840 | 6533  | 480.4 | 453.7 | 408.3 |
| TBD | 256-QAM |  2/3 | 8 | 15680 | 10453  | 768.6 | 725.9 | 653.3 |

### 38.5.13 UHR-MCSs for 2×996+484-tone MRU

The rate-dependent parameters for the 2×996+484-tone MRU are provided in [Table 38-X16 (UHR-MCSs for](#_bookmark361) [2×996+484-tone MRU, NSS,u = 1)](#_bookmark361).

#### **Table 38-X16—UHR-MCSs for 2×996+484-tone MRU, NSS,u = 1**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **UHR- MCS****index** | **Modulation** | ***Ru*** | ***NBPSCS,u*** | ***NSD,u*** | ***NCBPS,u*** | ***NDBPS,u*** | **Data rate (Mb/s)** |
| **0.8 µs GI** | **1.6 µs GI** | **3.2 µs GI** |
| 0 | BPSK | 1/2 | 1 | 2 428 | 2 428 | 1 214 | 89.3 | 84.3 | 75.9 |
| 1 | QPSK | 1/2 | 2 | 4 856 | 2 428 | 178.5 | 168.6 | 151.8 |
| 2 | 3/4 | 3 642 | 267.8 | 252.9 | 227.6 |
| 3 | 16-QAM | 1/2 | 4 | 9 712 | 4 856 | 357.1 | 337.2 | 303.5 |
| 4 | 3/4 | 7 284 | 535.6 | 505.8 | 455.3 |
| 5 | 64-QAM | 2/3 | 6 | 14 568 | 9 712 | 714.1 | 674.4 | 607.0 |
| 6 | 3/4 | 10 926 | 803.4 | 758.8 | 682.9 |
| 7 | 5/6 | 12 140 | 892.6 | 843.1 | 758.8 |
| 8 | 256-QAM | 3/4 | 8 | 19 424 | 14 568 | 1 071.2 | 1 011.7 | 910.5 |
| 9 | 5/6 | 16 186 | 1 190.1 | 1 124.0 | 1 011.6 |
| 10 | 1024-QAM | 3/4 | 10 | 24 280 | 18 210 | 1 339.0 | 1 264.6 | 1 138.1 |
| 11 | 5/6 | 20 233 | 1 487.7 | 1 405.1 | 1 264.6 |
| 12 | 4096-QAM | 3/4 | 12 | 29 136 | 21 852 | 1 606.8 | 1 517.5 | 1 365.8 |
| 13 | 5/6 | 24 280 | 1 785.3 | 1 686.1 | 1 517.5 |
| 15 | BPSK-DCM | Not valid |
| TBD | QPSK | 2/3 | 2 | 2428 | 4856 | 3237 | 238.0 | 224.8 | 202.3 |
| TBD | 16-QAM | 2/3 | 4 | 9712 | 6474 | 476.0 | 449.6 | 404.6 |
| TBD | 16-QAM | 5/6 | 4 | 9712 | 8093 | 595.1 | 562.0 | 505.8 |
| TBD | 256-QAM | 2/3 | 8 | 19424 | 12949 | 952.1 | 899.2 | 809.3 |

### 38.5.14 UHR-MCSs for 3×996-tone MRU

The rate-dependent parameters for the 3×996-tone MRU are provided in [Table 38-X17 (UHR-MCSs for](#_bookmark362) [3×996-tone MRU, NSS,u = 1)](#_bookmark362).

#### **Table 38-X17—UHR-MCSs for 3×996-tone MRU, NSS,u = 1**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **UHR- MCS****index** | **Modulation** | ***Ru*** | ***NBPSCS,u*** | ***NSD,u*** | ***NCBPS,u*** | ***NDBPS,u*** | **Data rate (Mb/s)** |
| **0.8 µs GI** | **1.6 µs GI** | **3.2 µs GI** |
| 0 | BPSK | 1/2 | 1 | 2 940 | 2 940 | 1 470 | 108.1 | 102.1 | 91.9 |
| 1 | QPSK | 1/2 | 2 | 5 880 | 2 940 | 216.2 | 204.2 | 183.8 |
| 2 | 3/4 | 4 410 | 324.3 | 306.3 | 275.6 |
| 3 | 16-QAM | 1/2 | 4 | 11 760 | 5 880 | 432.4 | 408.3 | 367.5 |
| 4 | 3/4 | 8 820 | 648.5 | 612.5 | 551.3 |
| 5 | 64-QAM | 2/3 | 6 | 17 640 | 11 760 | 864.7 | 816.7 | 735.0 |
| 6 | 3/4 | 13 230 | 972.8 | 918.8 | 826.9 |
| 7 | 5/6 | 14 700 | 1 080.9 | 1 020.8 | 918.8 |
| 8 | 256-QAM | 3/4 | 8 | 23 520 | 17 640 | 1 297.1 | 1 225.0 | 1 102.5 |
| 9 | 5/6 | 19 600 | 1 441.2 | 1 361.1 | 1 225.0 |
| 10 | 1024-QAM | 3/4 | 10 | 29 400 | 22 050 | 1 621.3 | 1 531.3 | 1 378.1 |
| 11 | 5/6 | 24 500 | 1 801.5 | 1 701.4 | 1 531.3 |
| 12 | 4096-QAM | 3/4 | 12 | 35 280 | 26 460 | 1 945.6 | 1 837.5 | 1 653.8 |
| 13 | 5/6 | 29 400 | 2 161.8 | 2 041.7 | 1 837.5 |
| 15 | BPSK-DCM | 1/2 | 1 | 1 470 | 1 470 | 735 | 54.0 | 51.0 | 45.9 |
| TBD | QPSK |  2/3 | 2 | 2 940 | 5880 | 3920  | 288.2 | 272.2 | 245.0 |
| TBD | 16-QAM |  2/3 | 4 | 11760 | 7840  | 576.5 | 544.4 | 490.0 |
| TBD | 16-QAM |  5/6 | 4 | 11760 | 9800  | 720.6 | 680.6 | 612.5 |
| TBD | 256-QAM |  2/3 | 8 | 23520 | 15680  | 1152.9 | 1088.9 | 980.0 |

### 38.5.15 UHR-MCSs for 3×996+484-tone MRU

The rate-dependent parameters for the 3×996+484-tone MRU are provided in [Table 38-X18 (UHR-MCSs for](#_bookmark363) [3×996+484-tone MRU, NSS,u = 1)](#_bookmark363).

#### **Table 38-X18—UHR-MCSs for 3×996+484-tone MRU, NSS,u = 1**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **UHR- MCS****index** | **Modulation** | ***Ru*** | ***NBPSCS,u*** | ***NSD,u*** | ***NCBPS,u*** | ***NDBPS,u*** | **Data rate (Mb/s)** |
| **0.8 µs GI** | **1.6 µs GI** | **3.2 µs GI** |
| 0 | BPSK | 1/2 | 1 | 3 408 | 3 408 | 1 704 | 125.3 | 118.3 | 106.5 |
| 1 | QPSK | 1/2 | 2 | 6 816 | 3 408 | 250.6 | 236.7 | 213.0 |
| 2 | 3/4 | 5 112 | 375.9 | 355.0 | 319.5 |
| 3 | 16-QAM | 1/2 | 4 | 13 632 | 6 816 | 501.2 | 473.3 | 426.0 |
| 4 | 3/4 | 10 224 | 751.8 | 710.0 | 639.0 |
| 5 | 64-QAM | 2/3 | 6 | 20 448 | 13 632 | 1 002.4 | 946.7 | 852.0 |
| 6 | 3/4 | 15 336 | 1 127.6 | 1 065.0 | 958.5 |
| 7 | 5/6 | 17 040 | 1 252.9 | 1 183.3 | 1 065.0 |
| 8 | 256-QAM | 3/4 | 8 | 27 264 | 20 448 | 1 503.5 | 1 420.0 | 1 278.0 |
| 9 | 5/6 | 22 720 | 1 670.6 | 1 577.8 | 1 420.0 |
| 10 | 1024-QAM | 3/4 | 10 | 34 080 | 25 560 | 1 879.4 | 1 775.0 | 1 597.5 |
| 11 | 5/6 | 28 400 | 2 088.2 | 1 972.2 | 1 775.0 |
| 12 | 4096-QAM | 3/4 | 12 | 40 896 | 30 672 | 2 255.3 | 2 130.0 | 1 917.0 |
| 13 | 5/6 | 34 080 | 2 505.9 | 2 366.7 | 2 130.0 |
| 15 | BPSK-DCM | 1/2 | Not valid |
| TBD | QPSK | 2/3 | 2 | 3 408 | 6816 | 4544 | 334.1 | 315.6 | 284.0 |
| TBD | 16-QAM | 2/3 | 4 | 13632 | 9088 | 668.2 | 631.1 | 568.0 |
| TBD | 16-QAM | 5/6 | 4 | 13632 | 11360 | 835.3 | 788.9 | 710.0 |
| TBD | 256-QAM | 2/3 | 8 | 27264 | 18176 | 1336.5 | 1262.2 | 1136.0 |

### 38.5.16 UHR-MCSs for 4×996-tone RU

The rate-dependent parameters for the 4×996-tone RU are provided in [Table 38-X19 (UHR-MCSs for 4×996-](#_bookmark364) [tone RU, NSS,u = 1)](#_bookmark364).

#### **Table 38-X19—UHR-MCSs for 4×996-tone RU, NSS,u = 1**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **UHR- MCS****index** | **Modulation** | ***Ru*** | ***NBPSCS,u*** | ***NSD,u*** | ***NCBPS,u*** | ***NDBPS,u*** | **Data rate (Mb/s)** |
| **0.8 µs GI** | **1.6 µs GI** | **3.2 µs GI** |
| 0 | BPSK | 1/2 | 1 | 3 920 | 3 920 | 1 960 | 144.1 | 136.1 | 122.5 |
| 1 | QPSK | 1/2 | 2 | 7 840 | 3 920 | 288.2 | 272.2 | 245.0 |
| 2 | 3/4 | 5 880 | 432.4 | 408.3 | 367.5 |
| 3 | 16-QAM | 1/2 | 4 | 15 680 | 7 840 | 576.5 | 544.4 | 490.0 |
| 4 | 3/4 | 11 760 | 864.7 | 816.7 | 735.0 |
| 5 | 64-QAM | 2/3 | 6 | 23 520 | 15 680 | 1 152.9 | 1 088.9 | 980.0 |
| 6 | 3/4 | 17 640 | 1 297.1 | 1 225.0 | 1 102.5 |
| 7 | 5/6 | 19 600 | 1 441.2 | 1 361.1 | 1 225.0 |
| 8 | 256-QAM | 3/4 | 8 | 31 360 | 23 520 | 1 729.4 | 1 633.3 | 1 470.0 |
| 9 | 5/6 | 26 133 | 1 921.5 | 1 814.8 | 1 633.3 |
| 10 | 1024-QAM | 3/4 | 10 | 39 200 | 29 400 | 2 161.8 | 2 041.7 | 1 837.5 |
| 11 | 5/6 | 32 666 | 2 401.9 | 2 268.5 | 2 041.6 |
| 12 | 4096-QAM | 3/4 | 12 | 47 040 | 35 280 | 2 594.1 | 2 450.0 | 2 205.0 |
| 13 | 5/6 | 39 200 | 2 882.4 | 2 722.2 | 2 450.0 |
| 15 | BPSK-DCM | 1/2 | 1 | 1 960 | 1 960 | 980 | 72.1 | 68.1 | 61.3 |
| TBD | QPSK |  2/3 | 2 | 3 920 | 7840 | 5226  | 384.3 | 362.9 | 326.6 |
| TBD | 16-QAM |  2/3 | 4 | 15680 | 10453  | 768.6 | 725.9 | 653.3 |
| TBD | 16-QAM |  5/6 | 4 | 15680 | 13066  | 960.7 | 907.4 | 816.6 |
| TBD | 256-QAM |  2/3 | 8 | 31360 | 20906  | 1537.2 | 1451.8 | 1306.6 |

### 38.5.17 UHR-MCS 14 for UHR DUP mode

The rate-dependent parameters for UHR-MCS 14 are provided in [Table 36-X20 (UHR-MCS 14 for UHR DUP](#_bookmark365) [mode, NSS,u = 1)](#_bookmark365)

#### **Table 38-X20—UHR-MCS 14 for UHR DUP mode, NSS,u = 1**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Modulation** | **Bandwidth** | ***R*** | ***NBPSCS*** | ***NSD*** | ***NCBPS*** | ***NDBPS*** | **Data rate (Mb/s)** |
| **0.8 µs GI** | **1.6 µs GI** | **3.2 µs GI** |
| BPSK-DCM | 80 MHz | 1/2 | 1 | 234 | 234 | 117 | 8.6 | 8.1 | 7.3 |
| BPSK-DCM | 160 MHz | 1/2 | 1 | 490 | 490 | 245 | 18.0 | 17.0 | 15.3 |
| BPSK-DCM | 320 MHz | 1/2 | 1 | 980 | 980 | 490 | 36.0 | 34.0 | 30.6 |

### 38.5.18 Parameters for UHR-SIG MCSs

The UHR-SIG MCSs, defined in [Table 36-X21 (UHR-SIG MCSs)](#_bookmark366), are used for the UHR-SIG field transmission in the UHR MU PPDU.

#### **Table 38-X21—UHR-SIG MCSs**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Value of the UHR-SIG****MCS field** | **UHR-MCS****index** | **Modulation** | ***R*** | ***NBPSCS*** | ***NSD*** | ***NCBPS*** | ***NDBPS*** | **UHR-SIG****rate (Mb/s)** |
| 0 | UHR-MCS 0 | BPSK | 1/2 | 1 | 52 | 52 | 26 | 6.5 |
| 1 | UHR-MCS 1 | QPSK | 1/2 | 2 | 52 | 104 | 52 | 13 |
| 2 | UHR-MCS 3 | 16-QAM | 1/2 | 4 | 52 | 208 | 104 | 26.0 |
| 3 | UHR-MCS 15 | BPSK-DCM | 1/2 | 1 | 26 | 26 | 13 | 3.3 |
| NOTE—The parameters *NSD* , *NCBPS* , and *NDBPS* are used for the UHR-SIG field transmission in each 20 MHz subchannel. |

# 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.)