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| Detailed Text Proposal on Unqual Modulation and New MCS |
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# Introduction

The authors prepared this document to further clarify our proposals related to unequal modulation (UEQM) across multiple spatial streams and New MCS in text format. The authors look forward to working with all interested participants to prepare an official proposal for specification text on UEQM and New MCS.

This document is drafted based on the following IEEE contributions on UEQM and New MCS:

[1] 11-24-0016-01-00bn-uhr-mimo-rvr-enhancement-with-unequal-modulation

[2] 11-24-0113-01-00bn-unequal-modulation-in-mimo-txbf-in-11bn

[3] 11-24-0117-01-00bn-improved-tx-beamforming-with-ueqm

[4] 11-24-0176-01-00bn-unequal-modulation-over-spatial-streams

[5] 11-24-0474-03-00bn-uhr-unequal-modulation-pattern-and-new-mcs

[6] 11-24-0469-00-00bn-new-mcss-for-11bn

[7] 11-24-0498-02-00bn-unequal-modulation-in-mimo-txbf-and-new-mcs-for-11bn

[8] 11-24-0507-02-00bn-ueqm-further-details.pptx

[9] 11-24-0734-01-00bn-on-ueqm-and-ueq-mcs

[10] 11-24-1186-00-00bn-new-mcss-for-11bn-follow-up

[11] 11-24-1695-01-00bn-11bn-signaling-design-for-extra-mcs-ueqm-2xldpc

[12] 11-24-1826-00-00bn-5bit-mcs-table-design

[13] 11-24-1834-00-00bn-11bn-non-elr-signaling-design-for-new-features

[14] 11-24-1840-00-00bn-uhr-mu-ppdu-user-info-field-signaling

# 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**

The UL UHR-MCS subfield of the User Info field indicates the UHR-MCS of the solicited UHR TB PPDU. The UL UHR-MCS subfield in the UHR variant User Info field format has 5 bits. The encoding of the UL UHR-MCS subfield is defined in 38.3.8 (UHR modulation and coding schemes (UHR-MCSs) and unequal modulation (UEQM)) and the value is set as defined in 37.x.x (UHR UL MU operation).

# 38. Ultra High Reliablity (UHR) PHY specification

## 38.3 UHR PHY

### 38.3.6 Transmitter block diagram

The generation of each field in an UHR PPDU with unequal modulation (UEQM) uses many of the following blocks:

1. Pre-FEC PHY padding
2. Scrambler
3. LDPC FEC encoder
4. Post-FEC PHY padding
5. 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 DL SU 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 transmission or 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 DL SU 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 DL SU 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 SU transmission or 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 DL SU 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**

### 38.3.8 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 TBD [38.5 (Parameters for UHR-MCSs)](#_bookmark346).

UHR-MCS 0-15 are the same as EHT-MCS 0-15, respectively. UHR-MCS 17, 19, 20, and 23 are MCSs in addition to the EHT-MCS, and are defined based on combinations of existing FEC coding rate and modulation order. UHR-MCSs 17, 19, 20, and 23 are defined for R=2/3 and QPSK, R=2/3 and 16-QAM, R=5/6 and 16-QAM, and R=2/3 and 256-QAM, respectively.

UHR defines equal modulation (EQM) for 1 to 8 spatial streams , and UEQM for the 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 same modulation order, which is the same as EHT modulation and coding scheme. 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. 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 order of the subsequent spatial streams are indicated by the UEQM Pattern subfield in the user field of UHR-SIG in Table 38.X3 in 38.3.12.8.5 (User Specific field).

UEQM shall be used only in non-MU-MIMO beamformed transmission. UEQM shall be 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. BPSK shall not be used in any spatial streams in UEQM transmission.

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

### 38.3.10 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 block, *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, ¼, *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* |

### 38.3.11 Mathematical description of signals

…

#### **38.3.11.4 Transmitted signal**

…

In an UHR MU PPDU and UHR ELR PPDU, for each field excluding the PE field, , is defined as the summation of one or more subfields. Each subfield, , is defined to be an inverse Fourier transform in Equation (38-9).

 (38-9)

In an UHR TB PPDU, transmitted by user *u* in the *r*-th occupied RU or MRU, each subfield, , is defined in Equation (38-10).

 (38-10)

In an UHR MU PPDU and UHR ELR PPDU, the total power of the time domain UHR modulated field signals summed over all transmit chains should not exceed the total power of the time domain pre-UHR modulated field signals summed over all transmit chains.

…

ηField is the power scaling factor of a given field within an OFDM symbol. For the pre-UHR modulated fields of the UHR TB PPDU, ηField is in the range when the size of the *r*-th occupied RU or MRU is the same or smaller than 242 tones; otherwise, ηField = 1. For UHR TB PPDU, the same ηField value applies to all pre-UHR modulated fields, and for UHR modulated fields, ηField = 1. For UHR MU PPDU, hField = 1 for all pre-UHR and UHR modulated fields. For an UHR ELR PPDU, ηField is for all the subcarriers of the L-STF, L-LTF, UHR-STF, and UHR-LTF fields, and ηField = 1 in all other fields.

…

### 38.3.12 UHR preamble

#### **38.3.12.8 UHR-SIG**

##### **38.3.12.8.5 User Specific field**

…

The User field format for a non-MU-MIMO allocation is defined in Table 38-XXX (User field format for a non-MU-MIMO allocation).

###### **Table 38-X2—User field format for a non-MU-MIMO allocation**

|  |  |  |  |
| --- | --- | --- | --- |
| **Bit** | **Subfield** | **Number of bits** | **Description** |
| B0–B10 | STA-ID | 11 | Set to a value of the TXVECTOR parameter STA-ID (see TBD 37.11.1.1 (STA\_ID)). |
| B11–B15 | MCS | 5 | 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*, where *n* = 0, 1, …, 15, 17, 19, 20 and 23. Values 16, 18, 21-22, 24-31 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 TBD [38.1.1 (Introduction to the UHR](#_bookmark1) [PHY)](#_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](#_bookmark1) UHR [PHY)](#_bookmark1) is not met. |

###### **Table 38-X2—User field format for a non-MU-MIMO allocation (continued)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Bit** | **Subfield** | **Number of bits** | **Description** |
| B16–B18 | NSS | 3 | If the STA-ID subfield is not equal to 2046, it indicates the number of spatial streams for up to eight spatial streams.Set to the number of spatial streams minus 1.If the UEQM subfield is equal to 1, values 0, 4-7 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 does not match the user’s STA-ID, all values are Disregard.
 |
| B19 | UEQM | 1 | If the STA-ID subfield is not equal to 2046, it indicates whether equal modulation (EQM) or unequal modulation (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. |
| B20-B21 | Beamformed, Coding And UEQM Pattern | 2 | If the STA-ID subfield is not equal to 2046, and the UEQM subfield is equal to 0:B20 is the Beamformed subfield, which is used to indicate transmit beamforming:Set to 1 if a beamforming steering matrix is applied to the waveform in a non-MU-MIMO allocation.Set to 0 otherwise.B21 is the Coding subfield, which indicates whether BCC or LDPC is used:Set to 0 for BCC.Set to 1 for LDPC.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 STA-ID subfield is not equal to 2046, and the UEQM subfield is equal to 1:B20-B21 is the UEQM Pattern subfield, which indicates the UEQM pattern for the number of spatial streams indicated in the NSS subfield. See Table 38-A (UEQM Pattern Subfield Encoding) for definition.Set to an arbitrary value if the STA-ID subfield is 2046. |
| B22 | 2x LDPC | 1 | If the STA-ID subfield is not equal to 2046, and either both the UEQM subfield is equal to 0 and the Coding subfield is equal to 1 or the UEQM subfield is equal to 1, this subfield indicates whether nominal LDPC codeword length of 3888 is used:Set to 0 to indicate the nominal LDPC codeword length of 648, 1296 or 1944 is used.Set to 1 to indicate the nominal LDPC codeword length of 3888 is used.If the STA-ID subfield is not equal to 2046, the UEQM subfield is equal to 0 and the Coding subfield is equal to 0, this subfield is set to 1 and treat as 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, “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 | 0 | s | s-1 | N/A | N/A |
| 1 | s | s-2 | N/A | N/A |
| 2-3 | Validate |
| 2 | 3 | 0 | s | s | s-1 | N/A |
| 1 | s | s | s-2 | N/A |
| 2 | s | s-1 | s-2 | N/A |
| 3 | Validate |
| 3 | 4 | 0 | s | s | s | s-1 |
| 1 | s | s | s | s-2 |
| 2 | s | s | s-1 | s-2 |
| 3 | s | s-1 | s-1 | s-2 |

A User field for an MU-MIMO allocation includes a 5-bit UHR-MCS subfield. The value is set to *n* for UHR-MCS *n*, where *n* = 0, 1, …, 13, 17, 19, 20 and 23. Values 14-16, 18, 21-22, 24-31 are Validate.

### 38.3.13 Data field

#### **38.3.13.3 Coding**

##### **38.3.13.3.5 Encoding process for an 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).

#### **38.3.13.4 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 ,
3. The number of encoders equals one, ,
4. The encoder type is LDPC.

#### **38.3.13.5 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. 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 Equal Modulation (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 Unequal Modulation (UEQM) transmission, *NCBPS*, *u* for a given UEQM pattern {s-*Δm} in m-th spatial stream* using *NSS*, *u* (>1) can be obtained using Equation (38-122).

 (38-122)

where

m = 1, 2, …, Nss,u

Δm is the modulation levels lower than s in m-th spatial streamΔm is defined in Table TBD, Δ1 is always 0.

*NCBPS,m,u*can be obtained as *NCBPS*, *u* in Table 38-71 through Table 38-86 corresponding to the Modulation and code rate of the m-th spatial stream.

*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 17, 19, 20, 23 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 16, 18, 21, 22, 24-31 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 38-71 (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 |
| 17 | QPSK |  2/3 | 2 | 24 | 48 | 32  | 2.4 | 2.2 | 2.0 |
| 19 | 16-QAM |  2/3 | 4 | 96 | 64  | 4.7 | 4.4 | 4.0 |
| 20 | 16-QAM |  5/6 | 4 | 96 | 80  | 5.9 | 5.6 | 5.0 |
| 23 | 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 38-72 (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 |
| 17 | QPSK |  2/3 | 2 | 48 | 96 | 64  | 4.7 | 4.4 | 4.0 |
| 19 | 16-QAM |  2/3 | 4 | 192 | 128  | 9.4 | 8.9 | 8.0 |
| 20 | 16-QAM |  5/6 | 4 | 192 | 160  | 11.8 | 11.1 | 10.0 |
| 23 | 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 38-73 (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 |
| 17 | QPSK | 2/3 | 2 | 72 | 144 | 96 | 7.1 | 6.7 | 6.0 |
| 19 | 16-QAM | 2/3 | 4 | 288 | 192 | 14.1 | 13.3 | 12.0 |
| 20 | 16-QAM | 5/6 | 4 | 288 | 240 | 17.6 | 16.7 | 15.0 |
| 23 | 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 38-74 (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 |
| 17 | QPSK |  2/3 | 2 | 102 | 204 | 136  | 10.0 | 9.4 | 8.5 |
| 19 | 16-QAM |  2/3 | 4 | 408 | 272  | 20.0 | 18.9 | 17.0 |
| 20 | 16-QAM |  5/6 | 4 | 408 | 340  | 25.0 | 23.6 | 21.3 |
| 23 | 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 38-75 (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 |
| 17 | QPSK |  2/3 | 2 | 126 | 252 | 168  | 12.4 | 11.7 | 10.5 |
| 19 | 16-QAM |  2/3 | 4 | 504 | 336  | 24.7 | 23.3 | 21.0 |
| 20 | 16-QAM |  5/6 | 4 | 504 | 420  | 30.9 | 29.2 | 26.3 |
| 23 | 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 38-76 (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 |
| 17 | QPSK |  2/3 | 2 | 234 | 468 | 312  | 22.9 | 21.7 | 19.5 |
| 19 | 16-QAM |  2/3 | 4 | 936 | 624  | 45.9 | 43.3 | 39.0 |
| 20 | 16-QAM |  5/6 | 4 | 936 | 780  | 57.4 | 54.2 | 48.8 |
| 23 | 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 38-77 (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 |
| 17 | QPSK |  2/3 | 2 | 468 | 936 | 624  | 45.9 | 43.3 | 39.0 |
| 19 | 16-QAM |  2/3 | 4 | 1872 | 1248  | 91.8 | 86.7 | 78.0 |
| 20 | 16-QAM |  5/6 | 4 | 1872 | 1560  | 114.7 | 108.3 | 97.5 |
| 23 | 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 38-78 (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 |
| 17 | QPSK |  2/3 | 2 | 702 | 1404 | 936  | 68.8 | 65.0 | 58.5 |
| 19 | 16-QAM |  2/3 | 4 | 2808 | 1872  | 137.6 | 130.0 | 117.0 |
| 20 | 16-QAM |  5/6 | 4 | 2808 | 2340  | 172.1 | 162.5 | 146.3 |
| 23 | 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 38-79 (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 |
| 17 | QPSK |  2/3 | 2 | 980 | 1960 | 1306  | 96.0 | 90.7 | 81.6 |
| 19 | 16-QAM |  2/3 | 4 | 3920 | 2613  | 192.1 | 181.5 | 163.3 |
| 20 | 16-QAM |  5/6 | 4 | 3920 | 3266  | 240.1 | 226.8 | 204.1 |
| 23 | 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 38-80 (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 |
| 17 | QPSK |  2/3 | 2 | 1448 | 2896 | 1930  | 141.9 | 134.0 | 120.6 |
| 19 | 16-QAM |  2/3 | 4 | 5792 | 3861  | 283.9 | 268.1 | 241.3 |
| 20 | 16-QAM |  5/6 | 4 | 5792 | 4826  | 354.9 | 335.1 | 301.6 |
| 23 | 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 38-81 (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 |
| 17 | QPSK |  2/3 | 2 | 1682 | 3364 | 2242  | 164.9 | 155.7 | 140.1 |
| 19 | 16-QAM |  2/3 | 4 | 6728 | 4485  | 329.8 | 311.5 | 280.3 |
| 20 | 16-QAM |  5/6 | 4 | 6728 | 5606  | 412.2 | 389.3 | 350.4 |
| 23 | 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 38-82 (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 |
| 17 | QPSK |  2/3 | 2 | 1960 | 3920 | 2613  | 192.1 | 181.5 | 163.3 |
| 19 | 16-QAM |  2/3 | 4 | 7840 | 5226  | 384.3 | 362.9 | 326.6 |
| 20 | 16-QAM |  5/6 | 4 | 7840 | 6533  | 480.4 | 453.7 | 408.3 |
| 23 | 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 38-83 (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 |
| 17 | QPSK | 2/3 | 2 | 2428 | 4856 | 3237 | 238.0 | 224.8 | 202.3 |
| 19 | 16-QAM | 2/3 | 4 | 9712 | 6474 | 476.0 | 449.6 | 404.6 |
| 20 | 16-QAM | 5/6 | 4 | 9712 | 8093 | 595.1 | 562.0 | 505.8 |
| 23 | 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 38-84 (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 |
| 17 | QPSK |  2/3 | 2 | 2 940 | 5880 | 3920  | 288.2 | 272.2 | 245.0 |
| 19 | 16-QAM |  2/3 | 4 | 11760 | 7840  | 576.5 | 544.4 | 490.0 |
| 20 | 16-QAM |  5/6 | 4 | 11760 | 9800  | 720.6 | 680.6 | 612.5 |
| 23 | 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 38-85 (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 |
| 17 | QPSK | 2/3 | 2 | 3 408 | 6816 | 4544 | 334.1 | 315.6 | 284.0 |
| 19 | 16-QAM | 2/3 | 4 | 13632 | 9088 | 668.2 | 631.1 | 568.0 |
| 20 | 16-QAM | 5/6 | 4 | 13632 | 11360 | 835.3 | 788.9 | 710.0 |
| 23 | 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 38-86 (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 |
| 17 | QPSK |  2/3 | 2 | 3 920 | 7840 | 5226  | 384.3 | 362.9 | 326.6 |
| 19 | 16-QAM |  2/3 | 4 | 15680 | 10453  | 768.6 | 725.9 | 653.3 |
| 20 | 16-QAM |  5/6 | 4 | 15680 | 13066  | 960.7 | 907.4 | 816.6 |
| 23 | 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 36-87 (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 36-88 (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. |