**IEEE P802.11
Wireless LANs**

|  |
| --- |
| **CR for 38.3.5 (Interference Mitigation)** |
| **Date:** 2025-07-24 |
| **Author(s):** |
| **Name** | **Affiliation** | **Address** | **Phone** | **email** |
| Shimi Shilo | Huawei |  |  | shimi.shilo@huawei.com |
| Rani Keren |  |  |  |
| Oded Redlich |  |  |  |
| Ross Jian Yu |  |  |  |

Abstract

This submission contains proposed comment resolutions to comments on P802.11bn D0.1.

The changes are based on P802.11be D0.3.

This submission provides a resolution to the following CIDs:

* 209, 1620, 2794

Revisions:

* Rev 0: Initial version of the document.
* Rev 1: Adding explicit values to LDPC TM shift equation
* Rev 2: changes based on comments received during presentation (consistency in terms of NSD and new definition of LDPC Tone Mapper block size NTM, added SU transmission in non-OFDMA non-punctured PPDU and no use with MCS 15)
* Rev 3: added UHR-MCS tables, added conditions in 38.3.5, cardinality is corrected for data field only in 38.3.14.4

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CID** | **Page/Line** | **Clause** | **Comment** | **Proposed Change** | **Resolution** |
| 209 | 111.14 | 38.3.5 | Complete the subclause on Interference mitigation | Same as comment | Revised. Agree with commenter, more details added to complete subclause. See instructions to editor below.Instructions to Editor: Please make changes as indicated in 25/1084r3. |
| 1620 | 111.14 | 38.3.5 | Define details for interference mitigation | As in comment | Revised.Same resolution as for CID 209. |
| 2794 | 88.15 | 38.1.1 | Interference mitigation mode needs to be defined | Section 38.3.5 Interference mitigation should be included in the spec. text with the content from the interference mitigation PDT document. Moreover IM pilot distribution should be defined. The commenter will provide a contribution with a detailed proposal. | Revised.Same resolution as for CID 209. |

Note to editor: Please make changes as indicated below

38.3.5 Interference mitigation

Interference Mitigation (IM) is a technique that enables reliable reception of the PPDU in the presence of an

interfering signal. To enable mitigation of the interference, additional pilots can be used within the data

portion of the PPDU.

A UHR STA may transmit a UHR PPDU with IM enabled if all of the following conditions are met:

* The UHR PPDU is a SU transmission using the UHR MU PPDU
* The Punctured Channel Information field in the U-SIG field is set to 0 (no puncturing)
* The UL/DL field in the U-SIG field is set to 1, or the UL/DL field in the U-SIG is set to 0 and the data field uses only one spatial stream
* The Data field does not use UHR-MCS 15

Otherwise, a UHR STA shall not transmit a UHR PPDU with IM enabled.

38.3.5.1 Supported coding for IM

The transmission of IM pilots is used only with LDPC. When IM is enabled, the number of data bits per symbol , coded bits per symbol and the number of data subcarriers are reduced, and the updated values are defined in 38.5 (Parameters for UHR MCS).

38.3.5.2 IM Pilot subcarriers

The IM pilots are used in every data OFDM symbol, and for a given BW, their subcarrier positions

are fixed across all OFDM symbols.

The IM pilots have zero energy. In order to spread the IM pilots in frequency, these zero valued pilots are inserted first into the LDPC Tone Mapper such that they occupy (as defined in 38.3.16.5 LDPC Tone Mapper) followed by the output of the constellation mapper which occupy ….

For a 160MHz and a 320MHz PPDU, the IM pilots are inserted separately within each 80MHz subblock.

The number of IM pilots and the LDPC Tone Mapper block size are defined in Table MM-MM.

|  |  |  |
| --- | --- | --- |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

The IM pilot subcarrier indices can be computed directly from the LDPC Tone Mapper operation which is defined in 38.3.16.5 (LDPC Tone Mapper).

38.3.16.5 LDPC Tone Mapper

The LDPC tone mapping for the UHR ELR PPDU Data field shall be applied to a 52-tone regular RU, using the same LDPC tone mapping distance parameter as defined in Table 36-52 (LDPC tone mapping distance for each RU or MRU size within an 80 MHz frequency subblock) for the 52-tone RU size.

When IM is enabled, the value of is defined in Table XX-XX.

Table XX-XX – LDPC tone mapping distance for each RU within an 80 MHz frequency subblock, when IM is enabled

|  |  |
| --- | --- |
| Parameter | RU size (tones) |
| 242 | 484 | 996 |
|  | 9 | 9 | 10 |

When IM is enabled, the LDPC tone mapping operation is identical to that defined by Equation (36-72), with the following exception:

38.3.14.4 Transmitted Signal

For pre-UHR modulated fields, is the set of subcarriers indices for all the tones in the corresponding 20 MHz channels where UHR modulated fields are located for the *r*-th occupied RU or MRU. For UHR modulated fields in a nonpunctured non-OFDMA UHR PPDU that is not a UHR ELR PPDU, is the set of subcarriers indices from to excluding DC subcarriers as defined in 38.3.13 (Timing-related parameters) and null subcarriers as defined in 38.3.2.3 (Null subcarriers) if present. For the UHR data field in a nonpunctured non-OFDMA UHR PPDU using SU transmission when IM is enabled, is the set of subcarriers indices from to excluding DC subcarriers as defined in 38.3.13 (Timing-related parameters) and IM pilots as defined in 38.3.5 (Interference mitigation).For UHR modulated fields in a punctured non-OFDMA UHR PPDU and an OFDMA UHR PPDU, is the set of subcarriers indices for the tones in the *r*-th RU, MRU or DRU. For UHR modulated fields in a UHR ELR PPDU, is the set of subcarriers indices in the *r*-th 52-tone RU where . Data and pilot subcarrier indices for an RU, MRU or DRU are defined in 38.3.2.1 (Tone plan for RUs and MRUs).

38.3.13 Timing Related Parameters

Table 38-19 (Subcarrier allocation related constants for the UHR ELR PPDU) defines subcarrier allocation related parameters for UHR ELR PPDU. Subcarrier allocation related parameters for the UHR modulated fields in a nonpunctured non-OFDMA UHR PPDU that is not a UHR ELR PPDU or when IM is not enabled is the same as those for EHT modulated fields in a nonpunctured non-OFDMA EHT PPDU, see Table 36-19 (Subcarrier allocation related constants for the EHT-modulated fields in a nonpunctured non-OFDMA EHT PPDU). Subcarrier allocation related parameters for the UHR modulated fields in a nonpunctured non-OFDMA UHR PPDU when IM is enabled are given in Table MM-MM.

Table MM-MM—Subcarrier allocation related constants for the UHR-modulated fields in a nonpunctured non-OFDMA UHR PPDU, when IM is enabled

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | CBW20 | CBW40 | CBW80 | CBW160 | CBW320 | Description |
|  | 208 | 416 | 882 | 1764 | 3528 | Total number of data subcarriers |
|  | 26 | 52 | 98 | 196 | 392 | Number of IM pilots |
|  | 234 | 468 | 980 | 980 | 980 | LDPC Tone Mapper block size |
|  | 8 | 16 | 16 | 32 | 64 | Number of pilot subcarriers |
|  | 242 | 484 | 996 | 1992 | 3984 | Total number of subcarriers |
|  | 122 | 244 | 500 | 1012 | 2036 | Highest data subcarrier index |
|  | 3 | 5 | 5 | 23 | 23 | Number of null subcarriers at DC |
|  | 6 | 12 | 12 | 12 | 12 | Number of low frequency guard subcarriers |
|  | 5 | 11 | 11 | 11 | 11 | Number of high frequency guard subcarriers |

38.3.16.1.5 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:

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

, in which is the value corresponding to the

occupied RU or MRU size of the *u*-th user, and are defined in Table 38-21 (Frequently

used parameters).

When IM is enabled, the value of is defined in Table ZZ-ZZ.

Table ZZ-ZZ Values of when IM is enabled

|  |  |
| --- | --- |
| RU size |  |
| 242-tone | 48 |
| 484-tone | 108 |
| 996-tone | 216 |
| 2x996-tone | 444 |
| 4x996-tone | 888 |

Insert new subclause 38.5.18:

38.5.18 UHR-MCSs for 242-tone RU with IM enabled

The rate-dependent parameters for the 242-tone RU with IM enabled are provided in Table AA-AA (UHR-MCSs for 242-tone RU, NSS,u = 1, when IM is enabled).

Table AA-AA—UHR-MCSs for 242-tone RU, NSS,u = 1, when IM is enabled

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **UHR-MCS index** | **Modulation** |  |  |  |  |  | **Data rate (Mb/s)** |
| **0.8 μs GI** | **1.6 μs GI** | **3.2 μs GI** |
| 0 | BPSK | 1/2 | 1 | 208 | 208 | 104 | 7.6 | 7.2 | 6.5 |
| 1 | QPSK | 1/2 | 2 | 416 | 208 | 15.3 | 14.4 | 13.0 |
| 2 | QPSK | 3/4 | 416 | 312 | 22.9 | 21.7 | 19.5 |
| 3 | 16-QAM | 1/2 | 4 | 832 | 416 | 30.6 | 28.9 | 26.0 |
| 4 | 3/4 | 832 | 624 | 45.9 | 43.3 | 39.0 |
| 5 | 64-QAM | 2/3 | 6 | 1248 | 832 | 61.2 | 57.8 | 52.0 |
| 6 | 3/4 | 1248 | 936 | 68.8 | 65.0 | 58.5 |
| 7 | 5/6 | 1248 | 1040 | 76.5 | 72.2 | 65.0 |
| 8 | 256-QAM | 3/4 | 8 | 1664 | 1248 | 91.8 | 86.7 | 78.0 |
| 9 | 5/6 | 1664 | 1386 | 101.9 | 96.3 | 86.6 |
| 10 | 1024-QAM | 3/4 | 10 | 2080 | 1560 | 114.7 | 108.3 | 97.5 |
| 11 | 5/6 | 2080 | 1733 | 127.4 | 120.3 | 108.3 |
| 12 | 4096-QAM | 3/4 | 12 | 2496 | 1872 | 137.6 | 130.0 | 117.0 |
| 13 | 5/6 | 2496 | 2080 | 152.9 | 144.4 | 130.0 |
| 17 | QPSK | 2/3 | 2 | 416 | 277 | 20.4 | 19.2 | 17.3 |
| 19 | 16-QAM | 2/3 | 4 | 832 | 554 | 40.7 | 38.5 | 34.6 |
| 20 | 16-QAM | 5/6 | 4 | 832 | 693 | 51.0 | 48.1 | 43.3 |
| 23 | 256-QAM | 2/3 | 8 | 1664 | 1109 | 81.5 | 77.0 | 69.3 |

Insert new subclause 38.5.19:

38.5.19 UHR-MCSs for 484-tone RU with IM enabled

The rate-dependent parameters for the 484-tone RU with IM enabled are provided in Table BB-BB (UHR-MCSs for 484-tone RU, NSS,u = 1, when IM is enabled).

Table BB-BB—UHR-MCSs for 484-tone RU, NSS,u = 1, when IM is enabled

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **UHR-MCS index** | **Modulation** |  |  |  |  |  | **Data rate (Mb/s)** |
| **0.8 μs GI** | **1.6 μs GI** | **3.2 μs GI** |
| 0 | BPSK |  1/2 | 1 | 416 | 416 | 208 | 15.3 | 14.4 | 13.0 |
| 1 | QPSK |  1/2 | 2 | 832 | 416 | 30.6 | 28.9 | 26.0 |
| 2 | QPSK |  3/4 | 832 | 624 | 45.9 | 43.3 | 39.0 |
| 3 | 16-QAM |  1/2 | 4 | 1664 | 832 | 61.2 | 57.8 | 52.0 |
| 4 |  3/4 | 1664 | 1248 | 91.8 | 86.7 | 78.0 |
| 5 | 64-QAM |  2/3 | 6 | 2496 | 1664 | 122.4 | 115.6 | 104.0 |
| 6 |  3/4 | 2496 | 1872 | 137.6 | 130.0 | 117.0 |
| 7 |  5/6 | 2496 | 2080 | 152.9 | 144.4 | 130.0 |
| 8 | 256-QAM |  3/4 | 8 | 3328 | 2496 | 183.5 | 173.3 | 156.0 |
| 9 |  5/6 | 3328 | 2773 | 203.9 | 192.6 | 173.3 |
| 10 | 1024-QAM |  3/4 | 10 | 4160 | 3120 | 229.4 | 216.7 | 195.0 |
| 11 |  5/6 | 4160 | 3466 | 254.9 | 240.7 | 216.6 |
| 12 | 4096-QAM |  3/4 | 12 | 4992 | 3744 | 275.3 | 260.0 | 234.0 |
| 13 |  5/6 | 4992 | 4160 | 305.9 | 288.9 | 260.0 |
| 17 | QPSK |  2/3 | 2 | 832 | 554 | 40.7 | 38.5 | 34.6 |
| 19 | 16-QAM |  2/3 | 4 | 1664 | 1109 | 81.5 | 77.0 | 69.3 |
| 20 | 16-QAM |  5/6 | 4 | 1664 | 1386 | 101.9 | 96.3 | 86.6 |
| 23 | 256-QAM |  2/3 | 8 | 3328 | 2218 | 163.1 | 154.0 | 138.6 |

Insert new subclause 38.5.20:

38.5.20 UHR-MCSs for 996-tone RU with IM enabled

The rate-dependent parameters for the 996-tone RU with IM enabled are provided in Table CC-CC (UHR-MCSs for 996-tone RU, NSS,u = 1, when IM is enabled).

Table CC-CC—UHR-MCSs for 996-tone RU, NSS,u = 1, when IM is enabled

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **UHR-MCS index** | **Modulation** |  |  |  |  |  | **Data rate (Mb/s)** |
| **0.8 μs GI** | **1.6 μs GI** | **3.2 μs GI** |
| 0 | BPSK |  1/2 | 1 | 882 | 882 | 441 | 32.4 | 30.6 | 27.6 |
| 1 | QPSK |  1/2 | 2 | 1764 | 882 | 64.9 | 61.3 | 55.1 |
| 2 | QPSK |  3/4 | 1764 | 1323 | 97.3 | 91.9 | 82.7 |
| 3 | 16-QAM |  1/2 | 4 | 3528 | 1764 | 129.7 | 122.5 | 110.3 |
| 4 |  3/4 | 3528 | 2646 | 194.6 | 183.8 | 165.4 |
| 5 | 64-QAM |  2/3 | 6 | 5292 | 3528 | 259.4 | 245.0 | 220.5 |
| 6 |  3/4 | 5292 | 3969 | 291.8 | 275.6 | 248.1 |
| 7 |  5/6 | 5292 | 4410 | 324.3 | 306.3 | 275.6 |
| 8 | 256-QAM |  3/4 | 8 | 7056 | 5292 | 389.1 | 367.5 | 330.8 |
| 9 |  5/6 | 7056 | 5880 | 432.4 | 408.3 | 367.5 |
| 10 | 1024-QAM |  3/4 | 10 | 8820 | 6615 | 486.4 | 459.4 | 413.4 |
| 11 |  5/6 | 8820 | 7350 | 540.4 | 510.4 | 459.4 |
| 12 | 4096-QAM |  3/4 | 12 | 10584 | 7938 | 583.7 | 551.3 | 496.1 |
| 13 |  5/6 | 10584 | 8820 | 648.5 | 612.5 | 551.3 |
| 17 | QPSK |  2/3 | 2 | 1764 | 1176 | 86.5 | 81.7 | 73.5 |
| 19 | 16-QAM |  2/3 | 4 | 3528 | 2352 | 172.9 | 163.3 | 147.0 |
| 20 | 16-QAM |  5/6 | 4 | 3528 | 2940 | 216.2 | 204.2 | 183.8 |
| 23 | 256-QAM |  2/3 | 8 | 7056 | 4704 | 345.9 | 326.7 | 294.0 |

Insert new subclause 38.5.21:

38.5.21 UHR-MCSs for 2x996-tone RU with IM enabled

The rate-dependent parameters for the 2x996-tone RU with IM enabled are provided in Table DD-DD (UHR-MCSs for 2x996-tone RU, NSS,u = 1, when IM is enabled).

Table DD-DD—UHR-MCSs for 2x996-tone RU, NSS,u = 1, when IM is enabled

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **UHR-MCS index** | **Modulation** |  |  |  |  |  | **Data rate (Mb/s)** |
| **0.8 μs GI** | **1.6 μs GI** | **3.2 μs GI** |
| 0 | BPSK |  1/2 | 1 | 1764 | 1764 | 882 | 64.9 | 61.3 | 55.1 |
| 1 | QPSK |  1/2 | 2 | 3528 | 1764 | 129.7 | 122.5 | 110.3 |
| 2 | QPSK |  3/4 | 2 | 3528 | 2646 | 194.6 | 183.8 | 165.4 |
| 3 | 16-QAM |  1/2 | 4 | 7056 | 3528 | 259.4 | 245.0 | 220.5 |
| 4 |  3/4 | 4 | 7056 | 5292 | 389.1 | 367.5 | 330.8 |
| 5 | 64-QAM |  2/3 | 6 | 10584 | 7056 | 518.8 | 490.0 | 441.0 |
| 6 |  3/4 | 6 | 10584 | 7938 | 583.7 | 551.3 | 496.1 |
| 7 |  5/6 | 6 | 10584 | 8820 | 648.5 | 612.5 | 551.3 |
| 8 | 256-QAM |  3/4 | 8 | 14112 | 10584 | 778.2 | 735.0 | 661.5 |
| 9 |  5/6 | 8 | 14112 | 11760 | 864.7 | 816.7 | 735.0 |
| 10 | 1024-QAM |  3/4 | 10 | 17640 | 13230 | 972.8 | 918.8 | 826.9 |
| 11 |  5/6 | 10 | 17640 | 14700 | 1080.9 | 1020.8 | 918.8 |
| 12 | 4096-QAM |  3/4 | 12 | 21168 | 15876 | 1167.4 | 1102.5 | 992.3 |
| 13 |  5/6 | 12 | 21168 | 17640 | 1297.1 | 1225.0 | 1102.5 |
| 17 | QPSK |  2/3 | 2 | 3528 | 2352 | 172.9 | 163.3 | 147.0 |
| 19 | 16-QAM |  2/3 | 4 | 7056 | 4704 | 345.9 | 326.7 | 294.0 |
| 20 | 16-QAM |  5/6 | 4 | 7056 | 5880 | 432.4 | 408.3 | 367.5 |
| 23 | 256-QAM |  2/3 | 8 | 14112 | 9408 | 691.8 | 653.3 | 588.0 |

Insert new subclause 38.5.22:

38.5.22 UHR-MCSs for 4x996-tone RU with IM enabled

The rate-dependent parameters for the 4x996-tone RU with IM enabled are provided in Table EE-EE (UHR-MCSs for 4x996-tone RU, NSS,u = 1, when IM is enabled).

Table EE-EE—UHR-MCSs for 4x996-tone RU, NSS,u = 1, when IM is enabled

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **UHR-MCS index** | **Modulation** |  |  |  |  |  | **Data rate (Mb/s)** |
| **0.8 μs GI** | **1.6 μs GI** | **3.2 μs GI** |
| 0 | BPSK |  1/2 | 1 | 3528 | 3528 | 1764 | 129.7 | 122.5 | 110.3 |
| 1 | QPSK |  1/2 | 2 | 7056 | 3528 | 259.4 | 245.0 | 220.5 |
| 2 | QPSK |  3/4 | 2 | 7056 | 5292 | 389.1 | 367.5 | 330.8 |
| 3 | 16-QAM |  1/2 | 4 | 14112 | 7056 | 518.8 | 490.0 | 441.0 |
| 4 |  3/4 | 4 | 14112 | 10584 | 778.2 | 735.0 | 661.5 |
| 5 | 64-QAM |  2/3 | 6 | 21168 | 14112 | 1037.6 | 980.0 | 882.0 |
| 6 |  3/4 | 6 | 21168 | 15876 | 1167.4 | 1102.5 | 992.3 |
| 7 |  5/6 | 6 | 21168 | 17640 | 1297.1 | 1225.0 | 1102.5 |
| 8 | 256-QAM |  3/4 | 8 | 28224 | 21168 | 1556.5 | 1470.0 | 1323.0 |
| 9 |  5/6 | 8 | 28224 | 23520 | 1729.4 | 1633.3 | 1470.0 |
| 10 | 1024-QAM |  3/4 | 10 | 35280 | 26460 | 1945.6 | 1837.5 | 1653.8 |
| 11 |  5/6 | 10 | 35280 | 29400 | 2161.8 | 2041.7 | 1837.5 |
| 12 | 4096-QAM |  3/4 | 12 | 42336 | 31752 | 2334.7 | 2205.0 | 1984.5 |
| 13 |  5/6 | 12 | 42336 | 35280 | 2594.1 | 2450.0 | 2205.0 |
| 17 | QPSK |  2/3 | 2 | 7056 | 4704 | 345.9 | 326.7 | 294.0 |
| 19 | 16-QAM |  2/3 | 4 | 14112 | 9408 | 691.8 | 653.3 | 588.0 |
| 20 | 16-QAM |  5/6 | 4 | 14112 | 11760 | 864.7 | 816.7 | 735.0 |
| 23 | 256-QAM |  2/3 | 8 | 28224 | 18816 | 1383.5 | 1306.7 | 1176.0 |