IEEE P802.11  
Wireless LANs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| D0.1 Comment Resolution, brianh, part 3 | | | | |
| Date: 2011-04-07 | | | | |
| Author(s): | | | | |
| Name | Affiliation | Address | Phone | email |
| Brian Hart | Cisco Systems | 170 W Tasman Dr, San Jose, CA 95134, USA |  | brianh@cisco.com |

##### Baseline is 11ac D0.3. Changes indicated by a mixture of Word track-changes and instructions. For equation changes, Latex notation is sometimes used. E.g. a\_{xyz}^b denotes axyzb

Coex CIDs addressed: 220

MU CIDs addressed: 451, 454, 455, 456, 459, 463, 470, **[476, 468, 284, 453]**

PHY CIDs addressed: 374, 417, 377, 381, 344, 384, 394, 398, 402, 404, 407, 411, 412, 413, 414, 418, 421, 420, 621, 424, 436, 438, 277, **[283 revised]**, 599, 1304, 486, 1309, 487, 490, 903, 904, 545, 996, 1319, 1510,

***Coex***

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 220 | Gong, Michelle | 7.2.1.1 | 8 | 57 | TR | Section 9.2.0b.6a has defined how to determine the two parameters are valid or not. The term "valid" is used consistently throughput section 9.2.0b.6a and 9.2.0b.7. Note that the two parameters may be present in RXVECTOR even though they may not be valid. | Replace "present" with "are valid" |

**Proposed resolution: Accept in principle**

**Discussion:**

1. The language is not incorrect, since it is limited to TXVECTOR, where the question of validity does not arise. However, the language is incomplete (it does not address the question of RXVECTOR or provide the right reference to clause 9). Accordingly, let’s only define the significance of the bit being set, but leave the heavy lifting to clause 9 where it belongs via reference.
2. Let’s align the CTS language more closely with the RTS language, and add the vital clause 9 reference too.
3. We notice that the clause 22 interface is incorrect in the same way (it addresses the TXVECTOR case only), so fix the clause 22 description at the same time.

***Change:***

**8.3.1.2 RTS frame format**

***Change the third paragraph as follows:***

The TA field is the address of the STA transmitting the RTS frame. If the RTS frame is transmitted by a VHT STA in a non-HT or non-HT duplicate format, the Individual/Group bit in the TA field is set to 1 to indicate that the scrambling sequence carries the CH\_BANDWIDTH\_IN\_NON\_HT and DYN\_BANDWIDTH\_IN\_NON\_HT TXVECTOR parameters (see section 9.3.2.6a). Otherwise the Individual/Group bit in the TA field is set to 0.

**8.3.1.3 CTS frame format**

***Change the second paragraph as follows:***

When the CTS frame follows an RTS frame, the RA field of the CTS frame is copied from the TA field of the immediately previous RTS frame to which the CTS is a response and the Individual/Group bit in the RA field is set to 0. If the CTS is a response to an RTS with the Individual/Group bit in the TA set to 1, then the CTS response is transmitted in a non-HT or non-HT duplicate format and carries the CH\_BANDWIDTH\_IN\_NON\_HT TXVECTOR parameter (see 9.3.2.7). When the CTS is the first frame in a frame exchange, the RA field is set to the MAC address of the transmitter.

Table 22-1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| DYN\_BANDWIDTH\_IN\_NON\_HT | FORMAT is NON\_HT | When present in the TXVECTOR or when present in the RXVECTOR and valid (see 9.3.2.6a), indicates whether the transmitter is capable of Static or Dynamic bandwidth operation:Enumerated type:  Static if the transmitter is capable of Static bandwidth operation  Dynamic if the transmitter is capable of Dynamic bandwidth operation | Y | Y |
| Otherwise | Not present | N | N |
| CH\_BANDWIDTH\_IN\_NON\_HT | FORMAT is NON\_HT | When present in the TXVECTOR or when present in the RXVECTOR and valid (see 9.3.2.6a and 9.3.2.7), indicates the channel width of the transmitted packet which is signaled via the scrambling sequence.  Enumerated type:  NON\_HT\_CBW20, NON\_HT\_CBW40, NON\_HT\_CBW80, NON\_HT\_CBW160, NON\_HT\_CBW80+80 | Y | Y |
| Otherwise | Not present | N | N |

##### MU

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 451 | Hart, Brian | 22.3.12.1 | 132 | 48 | TR | Current description could be mistaken for groupcast. Also, "subset" is relatively imprecise | Try "With MU-MIMO beamforming, the space-time streams are partitioned into two or more parts, with each part intended for a single STA." |

**Proposed resolution: Accept in principle**

**Discussion**: Implement as per commenter, but keeping slightly more draft text

***Change:***

**22.3.12.1 General**

With MU-MIMO beamforming, the space-time streams are partitioned into two or more parts, where each part is intended for reception at a single STA.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 454 | Hart, Brian | 22.3.12.1 | 132 | 61 | TR | NTX | NRX |

**Proposed resolution: Accept**

***Change:***

**22.3.12.1 General**

For MU-MIMO beamforming, the receive signal vector in subcarrier *k* at beamformee *i*, ***y****k,i* = [*yk*,1, *yk*,2, …, *yk*,NRX]*T*, is shown in Equation (22-77),

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 455 | Hart, Brian | 22.3.12.1 | 132 | 61 | TR | "transmit signal vector" to me implies a time domain representation | Try "transmitted spatially mapped signal vector" |

**Proposed resolution: Accept in principle**

**Discussion**: Use the phrase “in subcarrier k” to clarify the terminology consistent with other language in the same paragraph.

***Change:***

**22.3.12.1 General**

For MU-MIMO beamforming, the receive signal vector in subcarrier *k* at beamformee *i*, ***y****k,i* = [*yk*,1, *yk*,2, …, *yk*,NTX]*T*, is shown in Equation (22-77), when a transmit signal vector in subcarrier *k* for multiple users up to the *Nu* beamformee is ***x****k* = [**x***Tk*,1, **x***Tk*,2, … … **x***Tk*,Nu]*T* with …

*i*.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 456 | Hart, Brian | 22.3.12.1 | 132 | 63 | TR | "for multiple users up to the Nu BFee" | for all Nu BFees/users |

**Proposed resolution: Accept**

***Change:***

**22.3.12.1 General**

For MU-MIMO beamforming, the receive signal vector in subcarrier *k* at beamformee *i*, ***y****k,i* = [*yk*,1, *yk*,2, …, *yk*,NTX]*T*, is

shown in Equation (22-77), when a transmit signal vector for all *Nu* beamformees is ***x****k* = [**x***Tk*,1, **x***Tk*,2, … … **x***Tk*,Nu]*T* with …

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 459 | Hart, Brian | 22.3.12.1 | 133 | 21 | TR | Or additive colored noise or WiFi interference or non-WiFi interference - no need to be so constraining | "is additive noise and interference" |

**Proposed resolution: Accept**

***Change:***

**22.3.12.1 General**

***n*** is additive noise and may include interference

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 463 | Hart, Brian | 22.3.12.2 | 133 | 62 | TR | Refer to the source of SNRj | As in comment |

**Proposed resolution: Disagree**

**Discussion**: The source of SNRj is defined in the previous section: i.e.

“The MU-MIMO steering matrix can be found by the beamformer using the

beamforming feedback matrices *Vk,j* and *SNRj* information from beamformee, where *j=1,2,…,Nu*. The …”

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 470 | Hart, Brian | 22.3.12.3 | 134 | 15 | TR | the designated signals | a STA's designated space time streams |

**Proposed resolution: Accept in principle**

**Discussion**: Implement as per commenter, with additional improvements

***Change:***

**22.3.12.3 Group ID**

The Group ID field in VHT-SIG-A (see 22.3.9.2.3 (VHT-SIG-A definition)) identifies the recipients of an

MU-MIMO transmission, where the group definition information is informed by AP to MU-MIMO capable

STAs using the Group ID Management frame as defined in 8.5.16.3 (Group ID Management frame format), before an MUMIMO data packet is sent to them. The group definition also determines the position of space-time streams

of a user within the total space-time streams being transmitted in an MU transmission. When an MU-MIMO

data packet is received, each STA identifies whether it is a member of the group for this packet by detecting

the Group ID field in VHT-SIG-A. If an STA finds it is a member of the group for the MU-MIMO data packet,

the STA reads its own number of space-time streams in the NSTS field by locating its STA position within the

group as fixed by the group definition of the corresponding Group ID. At this point, a STA is also able to

identify which space-time streams correspond to its own data and which space-time streams correspond to interference. For an MU-MIMO transmission, VHT-LTFs are used to measure not only the channel for a beamformee’s designated space-time streams but also may be used to suppress the interference at the beamformee. While receiving an MU-MIMO transmission, it is recommended that the receiver use the channel knowledge to all spatial streams (including those which are interference) to do receive processing, in order to avoid interference from other users' space time streams due to the imperfect MU beamforming done at the

AP.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 476 | | Hart, Brian | | 22.3.12.3 | | 134 | | 24 | | TR | | This sentence | |  |
| 468 | Hart, Brian | | 22.3.12.3 | | 134 | | 13 | | TR | | We are using NSTS in two senses in this section: "NSTS field of all MU STAs" and "NSTS subfield of a single STA" (P134L24). Much cleaner & clearer if the NSTS field is renamed, perhaps to MU-NSTS field, or NSTS vector field, etc | | As in comment | |
| 284 | Hart, Brian | | 22.2.2 | | 77 | | 1 | | TR | | User indexing is confusing, and probably would benefit from the concept of a null user. For instance, user indices are 0-3, USER\_NUM is another "index" (see P77L59) that seems to run 1…NUM\_USERS. (NUM\_USERS != USER\_NUM is an error-prone distinction) | | a) All MU parameters in this table should be length-4, indexed by USER\_INDEX. Discard USER\_NUM. Parameters for null users (0 STS) should be reserved. NUM\_USERS should be the sum of non-null users.  Or, b) Rename USER\_INDEX to USER\_SIGA\_INDEX, and update the SIGA descriptions accordingly. Rename USER\_NUM to USER\_VECTOR\_INDEX.  Also, relate Nu to NUM\_USERS, perhaps at Table 22-5 | |
| 453 | Hart, Brian | | 22.3.12.1 | | 132 | | 59 | | TR | | We are talking about BFee i, and this is equivalent to the (oddly named) USER\_NUM in the TXVECTOR | | Pick a way of indexing the users and stick with it | |

**Proposed resolution: Accept in principle**

**(284 was transferred to MU)**

**Discussion**: Although the commenter’s intent in CID 476 is unclear, the comment is used to make editorial changes that make the sentence more readable.

The other comments relate to USER\_INDEX etc. The current language is duplicative. The math uses u and Nu, the MAC/PHY interface uses USER\_NUM, NUM\_USERS and USER\_INDEX. For example, given NSTS = [0 0 3 2] (Matlab notation), then

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Position or STA position | Unspecified: could reasonably be 0 or 1 | Unspecified: could reasonably be 1 or 2 | Unspecified: could reasonably be 2 or 3 | Unspecified: could reasonably be 3 or 4 | Notes: |
| NSTSu (e.g.) | 0 | 0 | 3 | 2 |  |
| u | - | - | 0 | 1 | Nu = 2 |
| USER\_NUM | - | - | 1 | 2 | NUM\_USERS=2 |
| USER\_INDEX | - | - | 2 | 3 |  |

Relationships:

u = find(NSTSu)-1 % Matlab code

Nu = sum(NSTSu > 0) % Matlab code

Position = STA position = USER\_INDEX[u] + (TBD ? 0 : 1) /\* C code \*/

Identities:

NUM\_USERS = Nu

USER\_NUM = u+1

USER\_INDEX ?= Position = STA position

A spec should strive to avoid identities: it should delete derived terms that add little value.

Proposal: explicitly set Nu to equal NUM\_USERS. Do away with USER\_NUM in favour of u. Replace “position” and USER\_INDEX by “STA position” and “STA\_POSITION” (that is also the term used in clause 7 for group assignment); where the *u*th user has its NSTS*u* indicated at STA\_POSITION[u]; and the STA\_POSITION array starts with index 0.

XXXX Change STA\_POSITION to USER\_POSITION

***Change:***

**22.2.2 TXVECTOR and RXVECTOR parameters**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| STA\_POSITION | FORMAT is VHT | Index for user in MU transmission. Integer: range 0-3 | MU | N |
| Otherwise | Not present | N | N |
| NOTE 1— In the “TXVECTOR” and “RXVECTOR” columns, the following apply:  Y = Present;  N = Not present;  O = Optional;  MU indicates that the parameter is present per user. Parameters specified to be present per user are conceptually supplied  as an array of values indexed by *u*, where *u* takes values 0 through NUM\_USERS-1. | | | | |

**Table 22-5—Frequently used parameters**

|  |  |
| --- | --- |
| *Nu* | Number of users in a transmission, equal to the NUM\_USERS parameter in the TXVECTOR. *Nu* = 1 for SU transmission. |

**22.3.12.3 Group ID**

The Group ID field in VHT-SIG-A (see 22.3.9.2.3 (VHT-SIG-A definition)) identifies the recipients of an

MU-MIMO transmission, where the group definition information is informed by AP to MU-MIMO capable

STAs using the Group ID Management frame as defined in 8.5.16.3 (Group ID Management frame format), before an MU-MIMO data packet is sent to them. The group definition also determines the STA position of space-time streams of a user within the total space-time streams being transmitted in an MU transmission. When an MU-MIMO

data packet is received, each STA identifies whether it is a member of the group for this packet by detecting

the Group ID field in VHT-SIG-A. If an STA finds it is a member of the group for the MU-MIMO data packet,

the STA reads its own number of space-time streams in the NSTS field by locating its STA position within the

group as fixed by the group definition of the corresponding Group ID. At this point, a STA is also able to

identify which streams correspond to its own signals and which streams correspond to interference. For an

MU-MIMO transmission, VHT-LTFs are used to measure not only the channel for the designated signals but

also to suppress the interference at a beamformee. While receiving an MU-MIMO transmission, it is recommended

that the receiver use the channel knowledge to all spatial streams (including those which are interference)

to do receive processing, in order to avoid interference on the eigenmodes that were not part of the

beam-forming done at the AP.

If a STA finds that it is not a member of the group, or the STA is a member of the group but the NSTS*u* at its STA position indicates that there are zero space-time streams for the STA in the packet, then the STA may elect to not process the remainder of the packet.

##### PHY

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 374 | Hart, Brian | 22.3.9.1.2 | 96 | 25 | TR | These equations depend on BW via Gamma\_{k,BW}, but the LHS does not list BW as a parameter (but say P132L5 does have it listed) | Insert BW on LHS, probably 10+ times. |
| 417 | Hart, Brian | 22.3.9.2.6 | 112 | 52 | TR | Dk and M'(k) should have a "BW" subscript or superscript | As in comment |

**Proposed resolution: Agree in principle**

**Discussion**: The overarching objective is clarity and avoidance of ambiguity. Yet it is pretty clear that all the generated fields are a function of bandwidth, so an explicit indication of bandwidth adds little value and so for notational simplity, it is cleaner to simply omit BW. For instance, BW was not an explicit parameter in 11n for r(t).

The current text uses BW sparsely where helpful: it has BW as a parameter of Gamma, since that is BW-dependent, and BW for non-HT packets, since BW describes the level of duplication. It would be helpful to add bandwidth for the subcarrier mapping M, and STS symbols D, since there BW is also integral to the operation. In other contexts, BW is just a cumbersome addition.

Along the way, we notice that some equations a) lost tildes or b) tried to omit u, but this meant dropping superscript (u) too which creates a “syntax error”where the reader must assume D^{u} is the same as D, so fix up these issue at the same time.

***Change the following terms in the following equations:***

**22.3.7 Mathematical description of signals**

This general representation holds for all subfields. An example definition of the windowing function, ,

is given in 17.3.2.4. represents the number of users in the transmission, and *u* is the user index. For SU

transmissions, . For MU transmissions, the non-VHT portion (L-STF, L-LTF and L-SIG) and VHTSIG-

A are common to all users and thus shall also use in Equation (22-3).(#354) For MU transmissions,

the VHT portion starting from the VHT-STF shall have (#362) depending on the number of

users in the transmission. The frequency-domain symbols (#1169) represent(#363) the output of

any spatial processing in subcarrier *k* of user *u* for frequency segment of transmit chain required for

the field. is the highest data subcarrier index per frequency segment and has values(#364) listed in

Table 22-4. is the subcarrier spacing (312.5 kHz).For notational simplicity, the parameter *BW* is omitted from some bandwidth-dependent terms.

***Later Sections:***

(22-15) D\_{k,BW}

***Definitions below “where” after (22-15), change***

D\_{k,BW}, d\_{M\_{BW}^{r}}(k), M\_{BW}^{r}(k)

(22-16) D\_{k,n,BW}

***Definitions below “where” after (22-16), change***

D\_{k,n,BW}, d\_{M\_{BW}^{r},n}(k), M\_{BW}^{r}(k)

(22-35) D\_{k,BW}^{(u)}

***Definitions below “where” after (22-35), change***

D\_{k,BW}^{(u)}, d\_{M\_{BW}^{r}(k)}^{(u)} ***(four times)***, M\_{BW}^{r}(k) ***(four times)***

(22-71) \tilde{D}\_{k,i\_{STS,u},n,BW}^{(u)},

***Definitions below “where” after (22-72), change***

\tilde{D}\_{k,i\_{STS,u},n,BW}^{(u)}, \

tilde{D}\_{k,i\_{STS,u},n,BW}^{(u)} ***(four times in (22-73/4/5/6))***, \tilde{d}\_{M\_{BW}^{r}(k),i\_{STS,u },n}^{(u)} ***(four times in (22-73/4/5/6))***

where M\_{BW}^{r}(k) is defined in Equation (22-. ***(four times immediately after (22-73/4/5/6))***

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 377 | Hart, Brian | 22.3.9.1.3 | 97 | 7 | TR | T\_{VHT-LTF} | T\_{L-LTF} |

**Proposed resolution: Accept**

Duplicate (CID 1172).

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 381 | Hart, Brian | 22.3.9.1.4 | 97 | 40 | TR | I struggle to endorse "channel spacing" even this far | Rewrite to "for the 20 MHz spacing column of Table 17-5" |

**Proposed resolution: Accept**

***Change***

**22.3.9.1.4 L-SIG definition**

The Rate field shall be set to represent 6 Mbps for the 20 MHz channel spacing column according to Table 17-5.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 344 | Hart, Brian | 22.3.9.1.4 | 98 | 3 | TR | T\_SYM => T\_LSIG | As in comment |

**Proposed resolution: Counter**

**Discussion**: Use T\_{L-SIG} as per Table 22-4

***Change***

(22-15) w\_{T\_{L-SIG}}

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 384 | Hart, Brian | 22.3.9.1.4 | 98 | 19 | TR | It doesn't change the waveform, but a much more natural Kshift mapping is (2i-(N-1))\*32 (preserves the sign of i) | Change |

**Proposed resolution: Accept in principle**

**Discussion**: The current maths has k = -26, iBW = 0 defining the lowest subcarrier, which is most natural. So disagree with the bulk of the comment. However the second (22-76) does not use KShift and therefore is somewhat bloated. Thus, use this comment to align the second (22-76) with other similar equations

***Change:***

**22.3.11.11 Non-HT duplicate transmission**

***To allow parallel editing of this equation, change last row of existing (22-76) by noting differences between the existing and modified versions of (22-76) below, then change the subsequent text as marked:***

***Existing***

 (22-76)

***Changed last two rows***

(22-76)

where *N*20MHz and *K*Shift(*i*) are defined in 22.3.9.1.4 (L-SIG definition)

*Pk* and *pn* are defined in 17.3.5.9,

*Dk*,*n* is defined in 20.3.9.4.3,

 is defined in Equations (22-6) and (22-7),

 represents the cyclic shift for transmitter chain  with a value given in Table 20-8 (Cyclic shift for non-HT portion of packet) for up to 4 antennas. For more than 4 antennas, the cyclic shifts are TBD.

 has the value given in Table 22-6.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 394 | Hart, Brian | 22.3.9.2.3 | 101 | 34 | TR | Insert Values 5-7 are reserved | As in comment |

**Proposed resolution: Accept**

***Change***

**22.3.9.2.3 VHT-SIG-A definition**

***Table 22-9***

|  |  |  |  |
| --- | --- | --- | --- |
| B10-21 | N\_{STS} | 12 | For MU: 3 bits/user with maximum of 4 users (user u uses  bits B(10+3\*u)-B(12+3\*u), u=0,1,2,3)  Set to 0 for 0 space time streams  Set to 1 for 1 space time stream  Set to 2 for 2 space time streams  Set to 3 for 3 space time streams  Set to 4 for 4 space time streams  Values 5-7 are reserved  For SU:  B10-B12  Set to 0 for 1 space time stream  Set to 1 for 2 space time streams  Set to 2 for 3 space time streams  Set to 3 for 4 space time streams  Set to 4 for 5 space time streams  Set to 5 for 6 space time streams  Set to 6 for 7 space time streams  Set to 7 for 8 space time streams  B13-B21  Partial AID: 9 LSB bits of AID. |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 398 | Hart, Brian | 22.3.9.2.3 | 103 | 5 | TR | "BF steering matrix … in 20.3.11.10.1" yet 20.3.11.10.1 describes both CDD and Q (called "spatial mapping matrix") but not BF steering matrix | Use consistent terminology: e.g. both spatial mapping matrix or BF steering matrix. |

**Proposed resolution: Disagree**

**Discussion**: From 11n, “spatial mapping” and “spatial mapping matrix” are general terms, whereas a BF steering matrix is a matrix that improves reception based on some knowledge of the channel.Thus there is a need for two terms and usage in 11ac is unchanged from usage in 11n. 20.3.11.10.1 in 11mb4.01 does describe the Beamforming steering matrix.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 402 | Hart, Brian | 22.3.9.2.3 | 103 | 30 | TR | For clarity, write "The first and second half of the stream of …" | As in comment |

**Proposed resolution: Agree in principle**

**Discussion**: changes can go further than proposed to maximize clarity

***Change***

**22.3.9.2.3 VHT-SIG-A definition**

The first and second half of the stream of 96 complex numbers generated by these steps is divided into two groups of 48 complex numbers d\_{k,n}, k=0…47, where n=0,1 respectively

.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 404 | Hart, Brian | 22.3.9.2.4 | 104 | 48 | TR | "replicating it in each 20 MHz band" sounds like freq shifting is happening as a byproduct | Remove "frequency shifting" |

**Proposed resolution: Agree in principle**

**Discussion**: greater clarity is possible by keeping the language but moving it around. 11n used “duplicating and frequency shifting and by rotating the upper subcarriers by 90deg”, but this language cannot be directly generalized and the repeated “and”s is inelegant. The new text does preserve the “duplicate”verb, in part because “replicate in each ...band”is not a proper use of “replicate”.

***Change:***

**22.3.9.2.4 VHT-STF definition**

In 40 and 80 MHz transmissions, the VHT-STF is constructed from the 20 MHz version by frequency shifting a duplicate of it to each 20 MHz sub-band, and applying appropriate phase rotations per 20MHz sub-band.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 407 | Hart, Brian | 22.3.9.2.4 | 106 | 7 | TR | "QAM mapper outputs" yet BPSK is an allowed constellation | QAM mapper => constellation mapper |

**Proposed resolution: Accept**

***Change:***

**22.3.9.2.5 VHT-LTF definition**

The VHT long training field (VHT-LTF) provides a means for the receiver to estimate the MIMO channel

between the set of constellation mapper outputs (or, if STBC is applied, the STBC encoder outputs) and the receive chains.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 411 | Hart, Brian | 22.3.9.2.5 | 108 | 48 | TR | "Generation of VHT-LTFs" | "Generation of VHT-LTFs per segment" |

**Proposed resolution: Agree in principle**

**Discussion**: Fig 22-11 shows a single IFFT per antenna; and fig 22-7 ( 80+80 block diagram) has one IDFT per segment, so for the nominal implementation, this does refer to a single segment.

22.3.9.2.5 VHT-LTF definition

***Change***

**22.3.9.2.5 VHT-LTF definition**

The generation of the time domain VHT-LTFs per frequency segment is shown in Figure 22-11 where

Figure 22-11—Generation of VHT-LTFs per frequency segment

***NOTE TO EDITOR: in D0.2, in (22-30), VHT-LTF****k* ***changed into VHTSk. Recommend double checking this.***

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 412 | Hart, Brian | 22.3.9.2.5 | 109 | 4 | TR | TVHTLTFs | TVHTLTF |

**Proposed resolution: Accept**

Duplicate (CID 1172).

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 413 | Hart, Brian | 22.3.9.2.5 | 110 | 13 | TR | shall is redundant since it arises as a side effect of (22-30) | Delete sentence or convert to informative language |

**Proposed Resolution: Agree in principle**

**Discussion**: 1) applies equally to VHT-STF, and 2) let’s avoid magic numbers where possible, so rewrite to avoid 800ns reference.

In a later version of the spec, we could probably dispense with “as indicated by ...(22-xx)”, but this is kept at this stage for clarity.

***Change***

**22.3.9.2.4 VHT-STF definition**

As indicated by Equations (22-2) and (22-21), the duration of VHT-STF is *T*VHT-STF regardless of the Short GI Field setting in VHT-SIG-A.

**22.3.9.2.5 VHT-LTF definition**

As indicated by Equations (22-2) and (22-30), the duration of VHT-LTF is *T*VHT-LTF regardless of the Short GI Field setting in VHT-SIG-A.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 414 | Hart, Brian | 22.3.9.2.6 | 110 | 35 | TR | This field is called Length, length amd VHT-SIG-B Length | Pick VHT-SIG-B Length (to distinguish it from LSIG LENGTH) and stick with it |

**Proposed resolution: Accept**

***Change***

**22.3.4.7 Construction of VHT-SIG-B**

b) VHT-SIG-B Bits: For VHT PPDU set the MCS (for MU only) and the VHT-SIG-B Length field according to 22.3.9.2.6 (VHT-SIG-B definition)(#319). Add the reserved bits (for SU only) and 6 bits tail. For an NDP(#42) a unique fixed bit pattern is defined for each channel bandwidth.(#331)

**22.3.9.2.6 VHT-SIG-B definition**

Table 22-11—VHT-SIG-B fields

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| VHT-SIG-B Length | B0-B15 (16) | B0-B16 (17) | B0-B18 (19) | B0-B16 (17) | B0-B18 (19) | B0-B20 (21) | length of useful  data in PSDU in  units of 4 octets |

NOTE–varying the VHT-SIG-B Length field size ensures that a consistent maximum packet duration of approximately 5.46 ms (the max packet duration from L-SIG) is maintained across all channel widths with both SU and MU formats.

The VHT-SIG-B Length field shall be set using Equation (22-34).

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 418 | Hart, Brian | 22.3.11 | 114 | 52 | TR | "the constellation" | "a/the constellation point". Also, move the parenthetical comment to the end of the sentence for clarity |

**Proposed resolution: Agree in principle**

**Discussion**: Section should be 22.3.9.2.6. Terminology elsewhere is “complex numbers” (not apposite for the BPSK that we have here) or “constellation points” as recommended by the commenter. “the” remains the right choice since there is only one value of d that meets the subsequent definition.

***Change***

**22.3.9.2.6 VHT-SIG-B definition**

In Equations (22-36), (22-38), (22-40) and (22-42),d\_k^{(u)} is the constellation point of VHT-SIG B for user u at subcarrier k (prior to multiplication by P\_{VHTLTF}).

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 421 | Hart, Brian | 22.3.11 | 115 | 13 | TR | Nservice is regretably undefined | Path of least resistance is just to replace it by 16. Also, there is no equation for calculating Ntail,u - need to add, or define |

**Proposed resolution: Agree in principle**

**Discussion**: Let’s avoid magic numbers. Define Nservice and Ntail in Table 22-4 then refer to them

***Change:***

**22.3.4.3 Construction of L-SIG(#980)**

a) Before FEC Encoder: For a(#317) VHT PPDU set the RATE in the SIGNAL field to 6 Mbps. Set

the LENGTH in the SIGNAL field according to 22.3.9.1.4 (L-SIG definition)(#78). Add calculated

one bit parity and *Ntail* tail bits into the L-SIG(#318) symbol.

**22.3.4.4 Construction of VHT-SIG-A**

The VHT-SIG-A consists of two symbols VHT-SIG-A1 and VHT-SIG-A2 as defined in 22.3.2 (VHT PPDU

format)(#319).

a) Before FEC Encoder: Obtain the CH\_BANDWIDTH, STBC, GROUP\_ID, PARTIAL\_AID (for SU

only), NUM\_STS, GI\_TYPE, FEC\_CODING, MCS (for SU only), [SU-Beamformed],

NUM\_USERS from the TXVECTOR(#595). Add the (#1222)reserved bits(#322) and *Ntail* tail bits as

shown in section 22.3.9.2.3 (VHT-SIG-A definition). Calculate the CRC and append it. Partition the

VHT-SIG-A bits such that the first 24 uncoded bits are modulated by the VHT-SIG-A1 symbol, and

the second 24 uncoded bits are modulated by the VHT-SIG-A2 symbol.

**22.3.4.7 Construction of VHT-SIG-B**

b) VHT-SIG-B Bits: For VHT PPDU set the MCS (for MU only) and the Length field according to

22.3.9.2.6 (VHT-SIG-B definition)(#319). Add the reserved bits (for SU only) and *Ntail* tail bits. For an

NDP(#42) a unique fixed bit pattern is defined for each channel bandwidth.(#331)

**22.3.4.8.1 Using BCC**

b) PHY Padding: PHY pad bits and *NtailNES* tail bits are appended to the PSDU.

**22.3.6 Timing-related parameters**

***Add a new rows to Table 22-4***

***Note to reader, not for inclusion in draft: these are only peripherally timing-related but still there is no better table and they do affect the duration of the packet.***

|  |  |
| --- | --- |
| *Nservice*: Number of bits in the Service field | 16 |
| *Ntail:* Number of bits in the Service field | 6 |

**22.3.11 Data field**

When BCC encoding is used, the Data field shall consist of the *Nservice*-bit SERVICE field, the PSDU, the PHY

pad bits and the tail bits (*NtailNES* bits for SU and *NtailNES,u* bits for each user u in MU). When LDPC encoding is used, the Data field shall consist of the *Nservice* -bit SERVICE field, the PSDU and the PHY pad bits. No tail bits are present when LDPC encoding is used.

***After (22-44), insert***

where

PSDU\_LENGTHu is the number of octets delivered by the MAC for user *u* and is given

by Equation (22-88),

*Nservice* is defined in Table 22-4,

*NSYM* is the number of symbols in the Data field and is the same for all users,

*Ntail* is defined in Table 22-4,

*NES,u* is the number of BCC encodes for user *u*.

In case of MU LDPC encoding, the PHY padding bits are calculated using Equation (22-45).

**<equation omitted purely for convience>** (22-45)

where

PSDU\_LENGTHu is the number of octets delivered by the MAC for user *u* and is given

by Equation (22-88), and

NSYM\_max\_init is given by Equation (22-50)

*Nservice* is defined in Table 22-4,

***Editor, in (22-48), change 16 to Nservice***

***Editor, after, (22-48), insert:***

*Nservice* is defined in Table 22-4,

**22.3.11.4.1.1Encoder parsing operation**

If multiple encoders are used, the scrambled SERVICE, PSDU and pad bits are divided between the encoders

by sending bits to different encoders in a round robin manner. The *i*-th bit to the *j*-th encoder, denoted , is:

Following the parsing operation, *Ntail* zero tail bits are appended in each FEC input sequence.

***Editor, in (22-50), change 16 to Nservice, , two times***

***Editor, in (22-50), change 6 to Ntail***

***Editor, after, (22-50), insert:***

*Nservice* is defined in Table 22-4,

*Ntail* is defined in Table 22-4,

***Editor, in figure 22-22, change***

Change coding rate

and modulation type

TX encoded

*Nservice*-bit service field

prepended

Padding and tail bits

appended

***Editor, in (22-85), change 16 to Nservice***

***Editor, in (22-85), change 6 to Ntail***

***Editor, after, (22-85), insert:***

*Nservice* is defined in Table 22-4,

*Ntail* is defined in Table 22-4,

***Editor, in (22-86), change 16 to Nservice***

***Editor, in (22-86), change 6 to Ntail***

***Editor, after, (22-86), insert:***

*Nservice* is defined in Table 22-4,

*Ntail* is defined in Table 22-4,

***Editor, in (22-87), change 16 to Nservice***

***Editor, after, (22-87), insert:***

*Nservice* is defined in Table 22-4,

***Editor, in (22-88), change 16 to Nservice, , two times***

***Editor, in (22-88), change 6 to Ntail***

***Editor, after, (22-88), insert:***

*Nservice* is defined in Table 22-4,

*Ntail* is defined in Table 22-4,

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 420 | Hart, Brian | 22.3.11 | 115 | 11 | TR | Insert "For BCC encoding", to distinguish it from (22-45). And, this fix is incomplete since NES,u is undefined for SU LDPC. Add a separate equation for SU LDPC | As in comment |
| 621 | Kim, Youhan | 22.3.11 | 115 | 30 | TR | PHY padding computation for LDPC encoding in case of SU transmission is not defined. Equation (22-45) also applies to SU case as well in principle, with some additional clarifications. | Change "In case of MU LDPC encoding," to "In case of LDPC encoding," on line 30. On line 42, change "Equation (22-50)" to "Equation (22-50) in case of MU. N\_{SYM\_max\_init} = N\_{SYM,init} in case of SU where N\_{SYM,init} is given by Equation 22-48)" |

**Proposed resolution: Accept in principle**

**Discussion**:

1. Although it is true PSDU\_LENGTHu is defined in (22-88), this is for the purpose of the MAC so the MAC can correctly set the PSDU\_LENGTH parameter in the TXVECTOR. Thus when generating the waveform from the TXVECTOR, the correct reference is the TXVECTOR
2. SU LDPC padding is indeed undefined, so add an equation for that, which is a simplified version of the MU equation. The proposal is equivalent to the one proposed by CID 621, but longer, in order to make direct use of existing equations.

***Change:***

**22.3.11 Data field**

The padding flow is as follows. The MAC delivers a PSDU that fills the available octets in the Data field(#294) of the PPDU for each user u. In the case of BCC, the PHY determines the number of pad bits to add using Equation (22-44) and appends them to the PSDU. The number of pad bits added will always be between 0 and 7 inclusive.

<equation omitted solely for convenience> (22-44)

where

PSDU\_LENGTH*u* is the number of octets delivered by the MAC for user *u* and is given in the TXVECTOR,

*NSYM* is the number of symbols in the Data field and is the same for all users,*NDBPS,u* is *NDBPS* for user *u*, where *NDBPS* is defined in Table 22-5,

*Ntail,u* is the number of tail bits for user *u*,

*NES,u* is the number of BCC encoders for user *u*.

In the case of SU LDPC encoding, the PHY padding bits are calculated using Equation (22-44a).

*NPAD* = *NSYM,initNDBPS* – 8·PSDU\_LENGTH – *Nservice* (22-44a)

where

*NSYM,init* is given by Equation (22-48)

In the case of MU LDPC encoding, the PHY padding bits are calculated using Equation (22-45).

*NPAD,u* = *NSYM\_max\_initNDBPS,u* – 8.PSDU\_LENGTH*u* – *Nservice* (22-45)

where

PSDU\_LENGTH*u* is the number of octets delivered by the MAC for user *u* and is given in the TXVECTOR, and

*NSYM\_max\_init* is given by Equation (22-51)

**22.3.11.4.3 Encoding process for MU transmissions**

Then, for each LDPC user in the MU packet, compute the LDPC encoding parameters based on steps (a) through (d) in Section 20.3.11.6, with the exception that Equation (22-50a) is used to compute *Npld* instead of Equation (19-35).

*Npld* = *NSYM\_max\_initNDBPS ,u* (22-50a)

Let *NSYM,u* be the *NSYM* computed by Equation (19-41) in step (d) of Section 20.3.11.6.5 for user u.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 424 | Hart, Brian | 22.3.11.4.1.1 | 117 | 22 | TR | Range of i is not described | Report range of i (esp. does it start at 0 or 1?) |

**Proposed resolution: Accept in principle**

**Discussion**: Implement as per commenter’s intent, with complete detail.

***Change:***

**22.3.11.4.1.1Encoder parsing operation**

If multiple encoders are used, the scrambled SERVICE, PSDU and pad bits are divided between the encoders by sending bits to different encoders in a round robin manner. The i-th bit to the j-th encoder, denoted xi(j), is:

xi(j) = bNES·i+j; 0 ≤ i; 0 ≤ j ≤ NES,u-1; *NES,u*·i+j ≤ *NSYM,NDBPS,u*

where

*NES,u* is the number of BCC encoders for user u.

*NDBPS,u* is *NDBPS* for user *u*, where *NDBPS* is defined in Table 22-5,

Following the parsing operation, 6 zero tail bits are appended in each FEC input sequence.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 436 | Hart, Brian | 22.3.11.8.3 | 127 | 36 | TR | "which are mapped to NTX transmit chains" | True, but not the subject of this section - delete |

**Proposed resolution: Accept**

***Change:***

**22.3.11.8.3 Space-time block coding**

This subclause defines a set of optional robust transmission formats that are applicable only when using STBC coding. In this case, *NSS* spatial streams are mapped to *NSTS* space-time streams. These formats are based on STBC. When the VHT-SIG-A STBC field is set to 1, a symbol operation shall occur between the constellation mapper and the spatial mapper as defined in this subclause.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 438 | Hart, Brian | 22.3.11.8.3 | 127 | 43 | TR | In d\_{k,1,m}, the 1 should be a i, 7x in this clause | As in comment |

**Proposed resolution: Accept in principle**

**Discussion**: Implement as per commenter, and also add a further improvement. It is a curious thing that in 11n, and again in 11ac, \tilde(*d*)*k,i,n* actually refers to two quantities: the 2i-1-th and 2i-th STSs. This ambiguity can be avoided by some very simple notational changes, and then we have a more solid mathematical description of the transform from NSS to NSTS.

***Change***

**22.3.11.8.3 Space-time block coding**

If STBC is applied, the stream of complex numbers, *dk,i,n*; *k* = 0 … *NSD*-1; *i* = 1 … NSS; *n* = 0 … *NSYM*-1, generated by the constellation mapper, is the input of the STBC encoder, which produces as output the stream of complex numbers \tilde(*d*)*k,iSTS,n*; *k* = 0 … *NSD*-1; *iSTS* = 1 … *NSTS*; *n* = 0 … *NSYM*-1. For given values of *k* *a*nd *i*, STBC processing operates on the complex modulation symbols in sequential pairs of OFDM symbols so that the value of \tilde(*d*)*k,*2*i*-1*,*2*m* and \tilde(*d*)*k,*2*i,*2*m* depend on *dk,**i,2m* and *dk,i,2m+1*, and also \tilde(*d*)*k,*2*i*-1*,*2*m*+1 and \tilde(*d*)*k,*2*i,*2*m*+1 also depend on *dk,i,2m* and *dk,i,2m*+1, as defined in Table 22-16.

Table Error! No text of specified style in document.‑--Constellation mapper output to spatial mapper input for STBC

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***NSTS*** | ***NSS*** | ***iSTS*** | \tilde(*d*)*k,iSTS,*2*m* | tilde(*d*)*k,iSTS,*2*m*+1 |
| 2 | 1 | 1 |  |  |
| 2 |  |  |
| 4 | 2 | 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
| 6 | 3 | 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
| 5 |  |  |
| 6 |  |  |
| 8 | 4 | 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
| 5 |  |  |
| 6 |  |  |
| 7 |  |  |
| 8 |  |  |

If STBC is not applied, and .

*NOTE--*When STBC is applied, an odd number of space time streams per user is not allowed, and .

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 277 | Hart, Brian | 22.2.2 | 74 | 26 | TR | There are 30 non-ANA TBDs that need to be rsolved before going to WG LB | Resolve TBDs |

**Proposed resolution: Disagree**

**Discussion**: Commenter is correct, yet non-ANA TBDs are addressed via other comments; and this CID is too broad to be useful for tracking individual TBDs.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 283 | Hart, Brian | 22.2.2 | 76 | 51 | TR | "excluding the padding" - seems to be ambiguous - PHY padding or zero-length A-MPDU subframe? | Be specific - e.g. A-MPDU padding octets | Brian. 11/372r2. [Ed: Need to revisit this resolution. Octets are always 'whole'. More importantly the intent was to exclude A-MPDU EOF delimiter padding from the length not just A-MPDU padding octets.] |

**Proposed resolution: Accept in principle**

**Discussion**: As per editor’s comment

XXXX Delete this comment, and hand over to Robert

***Change:***

**22.2.2 TXVECTOR and RXVECTOR parameters**

Indicates the number of octets in the range 0 to 1 048 575 of useful data in the PSDU, i.e. the

number of octets in the A-MPDU up to and including the last octet of the last non-zero length A-MPDU subframe but excluding a) the first A-MPDU subframe that has the MPDU Length subfield set to 0 and the EOF subfield set to 1 in the AMPDU delimiter field, b) all subsequent A-MDPU subframes, and c) the EOF Pad field. This parameter is placed in the VHT-SIG-B Length field rounded up to a 4 octet boundary with the low order two bits removed.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 599 | Kim, Youhan | 22.3.5 | 86 | 65 | TR | 80+80 MHz missing. | Change "160 MHz." to "160/80+80 MHz". |

**Proposed resolution: Accept in principle**

***Change:***

**22.3.5 Modulation and coding scheme (MCS)**

The MCS is a value that determines the modulation and coding used in the Data field of the packet. It is a

compact representation that is carried in the VHT-SIG-A for SU or VHT-SIG-B for MU. Rate-dependent parameters for the full set of MCSs are shown in Table 22-25 (VHT MCSs for mandatory 20 MHz, NSS = 1) to(#341) Table 22-56 (VHT MCSs for optional 160 MHz, NSS = 8) (in 22.5 (Parameters for VHT MCSs)). These tables give rate-dependent parameters for MCSs with indices 0 to(#341) 9, with number of spatial streams from 1 to 8 and bandwidth options of 20 MHz, 40 MHz, 80 MHz and either160 MHz or 80+80 MHz. Equal modulation (EQM) is applied to all streams for a particular user.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1304 | Stephens, Adrian | 22.3.11.4.3 | 119 | 56 | TR | "then B3 of VHT-SIG-A2 should be set to 1." - is this really just a recommendation, or a normative requirement. | If a normative requirement, use "shall". Ditto next sentence. |

**Proposed resolution: Accept**

**Discussion**: Commenter is correct that this is a normative requirement (since there are no normative statements wrt B3 elsewhere); both here and in the previous section. Also, the reference to these sections are weak, so fix up the incoming cross-reference

***Change:***

**22.3.9.2.3 VHT-SIG-A definition**

**Table 22-9—Fields in the VHT-SIG-A field**

|  |  |  |  |
| --- | --- | --- | --- |
| B2-B3 | Coding | 2 | B2:  For SU, B2 is set to 0 for BCC, 1 for LDPC  For MU, if the NSTS field for user 1 is non-zero,  then B2 indicates the coding used for user 1; set  to 0 for BCC and 1 for LDPC. If the NSTS field  for user 1 is set to 0, then this field is reserved  and set to 1.  B3: set to 1 if LDPC PPDU encoding process (or  at least one LPDC user’s PPDU encoding  process) results in an extra OFDM symbol (or  symbols) as described in22.3.11.4.2 and 22.3.11.4.3. Set to 0  otherwise. |

**22.3.11.4.2 LDPC coding**

In addition, if *NSYM* computed in Equation (19-41) in step (d) of Section 19.3.11.7.5 is greater than *NSYM,init*, then B3 of VHT-SIG-A2 shall be set to 1. Otherwise, B3 of VHT-SIG-A2 shall be set to 0.

**22.3.11.4.3 Encoding process for MU transmissions**

In addition, if *NSYM* computed in Equation (22-52) is greater than *NSYM\_max\_init* computed in Equation (22-

51), then B3 of VHT-SIG-A2 shall be set to 1. Otherwise, B3 of VHT-SIG-A2 shall be set to 0.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 486 | Hart, Brian | 22.3.16 | 136 | 31 | TR | 22.3.16 is "shall", 22.3.17 is "is defined" - which is needed? Shall or cross ref? | Harmonize |
| 1309 | Stephens, Adrian | 22.3.16 | 136 | 31 | TR | "The transmitter RF delay shall follow 17.3.8.5." normative verbs are reserved for description of the behaviour of behavioural protocol entities. And an RF delay is not such | Reword so that it relates to STA behaviour or turn into a declarative statement |

**Proposed resolution: Agree in principle**

***Change:***

**22.3.16 Transmit RF delay**

The transmitter RF delay is defined in 17.3.8.5.

**22.3.17 Slot time**

The slot time is defined in 17.3.8.6.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 487 | Hart, Brian | 22.3.19.1 | 136 | 53 | TR | default is undefined. | default => 802.11 |

**Proposed resolution: Accept in principle**

***Change:***

**22.3.19.1 Transmit spectrum mask**

NOTE 1–In the presence of additional regulatory restrictions, the device has to meet both the regulatory requirements

and the mask defined in this section – i.e., the device’s emissions can be no higher at any frequency offset than the minimum of the values specified in the regulatory mask and the mask defined in this section.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 490 | Hart, Brian | 22.3.19.1 | 139 | 36 | TR | 180 => 200. ALso, a linear sum will produce a curved line | As in comment |

**Proposed resolution: Accept**

***Change Fig 22-20 to the following (Visio diagram included here)***

XXXX Editorially update figure provided by Robert.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 903 | Pulikkoonattu, Rethna | 22.3.19.6.4 | 141 | 61 | TR | Channel estimation procedure It is not explicit whether channel estimation to be done only from the training symbols. Is it kept as open deliberately? Say for instance, continuous adaptation of channel from the data is allowed? |  |
| 904 | Pulikkoonattu, Rethna | 22.3.19.6.4 | 142 | 1 | TR | Channel tracking Enabled Looks like channel tracking (payload tracking) is technically allowed? Is it going stay as it is? |  |

**Proposed resolution: Agree in principle**

Duplicate (CID 206/498)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 545 | Hart, Brian | 22.4.4 | 155 | 46 | TR | Clause 10 work is needed to make this real | As in comment |

**Proposed resolution: Accept in principle**

Duplicate (CID 1307 and 1308).

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 996 | Seok, Yongho | 22.4.4 | 155 | 56 | TR | TBD in aPSDUMaxLength | Determine the value. |
| 1319 | Stephens, Adrian | 22.4.4 | 155 | 56 | TR | There's a TBD | resolve it |

**Proposed resolution: Accept in principle**

**Discussion:** aPSDUMaxLength is completely unused elsewhere in 11acD2.0. In the baseline, a) aPSDUMaxLength is defined as a optional PHY characteristic parameter, b) is defined for 11n only, c) and in the description of dot11FragmentationThreshold. VHT single MPDUs can be fragmented, so let’s look at dot11FragmentationThreshold

dot11FragmentationThreshold OBJECT-TYPE

SYNTAX Unsigned32(#2214) (256..8000)(11n)

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"This is a control variable(#1005).

It is written by an external management entity(#1005).

Changes take effect as soon as practical in the implementation(#1005).

This attribute specifies the current maximum size, in octets, of the MPDU

that may be delivered to the security encapsulation. This maximum size

does not apply when an MSDU or A-MSDU is transmitted using an HT-immediate

or HT-delayed Block Ack agreement, or when an MSDU, A-MSDU or MMPDU is

carried in an A-MPDU.(11n) Fields added to the frame by security encapsulation

are not counted against the limit specified by this attribute.

Except as described above, an MSDU, A-MSDU,(11n) or MMPDU is fragmented

when the resulting frame has an individual address in the Address1 field,

and the length of the frame is larger than this threshold, excluding security

encapsulation fields(#1339). **The default value for this attribute**

**is(#1452) the lesser of 8000(11n) or the aMPDUMaxLength or the aPSDUMaxLength(**

**11n) of the attached PHY and the value(Ed) never exceeds(#1452)**

**the lesser of 8000 or the aMPDUMaxLength or the aPSDUMaxLength(11n) of the**

**attached PHY.(#1590)**"

::= { dot11OperationEntry 5 }

aPSDUMaxLength is defined as the maximum number of octets in a PSDU that can be conveyed by a

PPDU, and is 216-1 for 11n since the Length field is 16 bits and in GF is unconstrained by LSIG.

For 11ac, aPSDUMaxLength would be the utter max data rate allowed \* max packet length from LSIG spoofing, then aPSDUMaxLength = (2\*234)\*8\*8\*5/6/3.6e-6 \* 4e-6\*( ceil((16+8\*4095+6)/24) - 2-1-8-1) = 6933 Mbps \* 5416usec = 37.55MB.

By the definition of dot11FragmentationThreshold, dot11FragmentationThreshold = min(8000,aMPDULength, 37.55MB) = 8000 and aPSDUMaxLength does not affect dot11FragmentationThreshold.

So aPSDUMaxLength has no effect anywhere in the spec and can be deleted. If deleted, aPSDUMaxLength is undefined for 11ac, as for 11a/b/g, and so aPSDUMaxLength can be implicitly ignored when calculating dot11FragmentationThreshold, as for 11a/b/g.

***Change:***

**22.4.4 PHY characteristics**

The static VHT PHY characteristics, provided through the PLME-CHARACTERISTICS service primitive,

shall be as shown in Table 20-24 unless otherwise listed in Table 22-24. The definitions for these characteristics

are given in 10.4.

**Table 22-24—VHT PHY characteristics**

|  |  |
| --- | --- |
| **Characteristics** | **Value** |
|  |  |
| aCCAMidTime | < 25 μs |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1510 | RISON, Mark | 22.2.2;22.3.9.2.3 | 77;101 | 26;51 | TR | 9.7e states that the PARTIAL\_AID in TXVECTOR is 0, the lsbs of the BSSID, or a function of the AID and the BSSID, depending on the context.  However the locations referenced suggest it's the lsbs of the BSSID (or, in the first location, 0). | Change to refer to 9.7e for construction of partial AID. |

**Proposed resolution: Accept in principle**

**Discussion**: Changes to section 22.2.2 are a duplicate of CID 286, addressed in 11/372r2. Additional changes are required for section 22.3.9.2.3

Rules are complicated, so let’s just refer to the TXVECTOR parameter, and providea basic description plus a reference to 9.17a. Since there are rules for group addressed frame and individually addressed frames, this is ultimately a function of RA, AID and/or BSSID, so the term “intended recipients(s)” is appropriately broad.

***Change:***

**22.3.9.2.3 VHT-SIG-A definition**

**Table 22-9—Fields in the VHT-SIG-A field**

|  |  |  |  |
| --- | --- | --- | --- |
| B10-B21 | NSTS | 12 | For MU: 3 bits/user with maximum of 4 users (user u uses bits B(10+3\*u)-B(12+3\*u), u=0,1,2,3)  Set to 0 for 0 space time streams  Set to 1 for 1 space time stream  Set to 2 for 2 space time streams  Set to 3 for 3 space time streams  Set to 4 for 4 space time streams  For SU:  B10-B12  Set to 0 for 1 space time stream  Set to 1 for 2 space time streams  Set to 2 for 3 space time streams  Set to 3 for 4 space time streams  Set to 4 for 5 space time streams  Set to 5 for 6 space time streams  Set to 6 for 7 space time streams  Set to 7 for 8 space time streams  B13-B21  Partial AID: Set to the PARTIAL\_AID parameter in TXVECTOR. Partial AID provides an abbreviated indication of the intended recipient(s) of the frame (see 9.17a). |