IEEE P802.11
Wireless LANs

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| Proposed Comment Resolutions |
| Date: 2013-03-18 |
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Abstract

Submission for P802.11af draft text. This document contains proposed resolutions for comments

2045 thru 2063

2065 thru 2068

2151

2152

2154

2155

2156

The baseline of this text is P802.11af\_D3

## Interpretation of a Motion to Adopt

A motion to approve this submission means that the editing instructions and any changed or added material are actioned in the TGaf Draft. This introduction is not part of the adopted material.

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

***TGaf Editor: Editing instructions preceded by “TGaf Editor” are instructions to the TGaf editor to modify existing material in the TGaf draft. As a result of adopting the changes, the TGaf editor will execute the instructions rather than copy them to the TGaf Draft.***

The editing instructions are shown in ***bold italic***. Four editing instructions are used: ***change, delete, insert, and replace***. Change is used to make corrections in existing text or tables. The editing instruction specifies the location of the change and describes what is being changed by using ~~strikethrough~~ (to remove old material) and underscore (to add new material). ***Delete*** removes existing material. ***Insert*** adds new material without disturbing the existing material. Insertions may require renumbering. If so, renumbering instructions are given in the editing instruction. ***Replace*** is used to make changes in figures or equations by removing the existing figure or equation and replacing it with a new one. Editorial notes will not be carried over into future editions because the changes will be incorporated into the base standard.

**Relevant comments and discussion**

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| --- | --- | --- | --- | --- | --- |
| **CID** | **Page** | **Clause** | **Comment** | **Proposed Change** | **Proposed resolution** |
| 2045 |  | GENERAL | I disagree strongly with the LB189 comment resolutions rejecting comments 459,460,583,585,588,593,594,595,596,606,732,735,736,760,761,766,841,842, and 846. The justification for rejecting these comments is based on "We don't see the need/benefit for multiple MCS at this point. See multiple MCS discussion in 802.11-12/1337r2." Close scrutiny of 12/1337r2 indicates a fundamental misunderstanding of the TVWS environment with respect to the magnitude of the SNR differences among TVWS channels authorized for unlicensed use near DTV transmitting stations. Page 11 of 12/1337r2 states "For channels with around 12dB difference in SNR there could be some potential gain of up to 20% at best but such high SNR discrepancy is less likely." The table on Page 11 which presents a simplified analysis of the throughput gains when using independent MCSclearly shows that for 12dB difference (the last two rows in the table) the gain can be as high as 50%, and not limited to 20% as stated in the quoted text above. Furthermore the the statement that "such high (12dB) SNR discrepancy is less likely" indicates a basic misunderstanding of the highly varied SNR levels currently observable in the TVWS. InterDigital has presented 3 different engineering simulation studies (12/0924r0, 12/0924r1, and 13/0129r0) which examine realistic TVWS SNR conditions near DTV transmitters. Chart 5 of 12/0924r0 indicates the analysis which concludes that SNR variance across TVWS channels may be as high as 35dB. SNR variances of 12 dB and higher will be quite common in all urban areas surrounding DTV transmitters. The statement in 12/1337r2 that "such high (12dB) SNR discrepancy is less likely" is clearly wrong, and leads to the objectionable conclusion that the listed LB189 comments should be rejected. InterDigital's detailed simulation studies (p11 of 13/0129r0) do indicate that for very low SNR variances (less than 4-6dB) there is no significant gain when using independent MCS for each TVWS channel. Furthermore for very high SNR levels (as shown on p9 in each of the 3 IDCC contributions) for free space radio ranges of less than 70m, there is no significant gain for independent MCS. However for all SNR variance greater than 6dB (which includes all urban areas), and for radio ranges greater than 70m (free space path loss) , using independent MCS provides maximum throughput gains of 80-90% with average gains of 40-50%. Under these conditions, the throughput gains show in the simulations are very significant. The 11AF draft should include an optional mode which permits independent MCS selection for each TVWS channel when operating on multiple TVWS channels. The 11af decision to base its new TVWS standard on 11ac is an expedient decision to promote early adoption of TVWS products, but basing 11af on 11ac EXCLUSIVELY is a shortsighted and arbitrary decision which will limit the applicability of the 11AF standard in the long run. | Redesign the interleaver to allow for different signal constellations for different frequency segments. | Rejected.  |
| 2046 | 213.00 | 23.2.2 | This is rejected comment LB189CID583: Multiple MCS values should be added to Table 22-1 to support idependent MCS. | Due to regulations and/or realtime channel usage siutations, the conditions of available TV channels could be quite different from each other. Is it suitable to use a single MCS value, as shown in Table 22-1, for the PPDUs to be sent over multiple TV channels? 11AF ammendment needs to specify an option to permit use of independent MCS values for each available TV channel when multiple TV channels used. | Rejected. . |
| 2047 | 213.00 | 23.2.2 | This is rejected comment LB189CID757: Expand the TXVECTOR/RXVECTOR parameters to include the MCS for each contiguous or non-contiguous channel of bandwidth W, or, alternatively, modify the MCS parameters in such a way that the MCS contains a modulation and coding scheme for each channel of bandwidth W | Add MCS\_W1, MCS\_W2, MCS\_W3, MCS\_W4 specifying MCS for each congituous or non-contigous channel of bandwidth W in TVHT\_W, TVHT\_2W, TVHT\_4W, TVHT\_W+W and TVHT\_2W+2W. 11AF ammendment needs to specify an option to permit use of independent MCS values for each available TV channel when multiple TV channels used. | Rejected. |
| 2048 | 213.05 | 23.2.2 | This is rejected comment LB189CID585: The modifications to Table 22-1 is not sufficient to optimize the performance in TVWS: e.g, 1)SNR (when FORMAT is VHT) is a measure of the received SNR per spatial stream cannot be simply reused in the multi-channel case. In TVWS operation, SNR values of the multi-channels could be significantly different; 2) TXPWR\_LEVEL: a single tx power level is not sufficient in multi-TVWS-channel case, especially when one aggregated channel is adajacent to the DTV occupied channel. TXPWR\_LEVEL should be modified; 3) Single MCS is not sufficient in multi-channel case, where SNR values are highly fluctuated. | More modifications of Table 22-1 (TXVECTOR and RXVECTOR) are required to optimize the TVWS operation. 11AF ammendment needs to specify an option to permit use of independent MCS values for each available TV channel when multiple TV channels used. | Rejected. |
| 2049 | 226.00 | 23.3.3 | This is rejected comment LB189CID588: Simply using the PHY bonding of Clause 22 (same coding rate and modulation mode on aggregated channels) is not appropriate for the TVWS cases, where channel conditions are widely varied from channel to channel. | PHY bonding may not be optimum to support TVWS operation. 11AF ammendment needs to specify an option to permit use of independent MCS values for each available TV channel when multiple TV channels used. | Rejected. |
| 2050 | 227.52 | 23.3.3 | This is rejected comment LB189CID759: Unlike in 802.11ac, unequal power transmission should be specified in 802.11af for cases where more than one frequency segment is used. For example, if one of the aggregated channels has a limitation of 40 mW (adjacent channel) and another channel has a limit of 100 mW, 802.11af should allow transmission of unequal power levels | Insert a multiplicative factor on each frequency segment prior to D/A to reflect difference in transmitted power. Alternatively, insert different TxPwrLevels for each channel/frequency segment in the TXVector. Or alternatively modify the VHT Transmit Power Envelope to enable a different local maximum power for each separte TV channel use in the aggregated TVHT waveform. The VHT Transmit Power Envelope sets a SINGLE local maximum power for the sum of all TV channels used, and cannot specify a lower maximum power for a single TV channel (subchannel of the aggregate waveform) even if required by regulation. | Rejected.11ac operates in several different band where power limits vary much more than 40mW vs. 100mW.The topic has been discussed in 11ac and the decision should uphold in 11af as well |
| 2051 | 231.29 | 23.3.5 | This is rejected comment LB189CID459: For aggregated channels, It might be good to allow unequal MCS. Unequal MCS is more efficient when conditions varies from channel to channel. | Insert 'Unequal MCSs could be applied to streams assigned to non-contiguous channels'. 11AF ammendment needs to specify an option to permit use of independent MCS values for each available TV channel when multiple TV channels used. | Rejected. |
| 2052 | 231.00 | 23.3.5 | This is rejected comment LB189CID460: Use separate interleaving and coding on different frequency segments. This will allow the easy use of different MCS on different frequency segments. | add proper text to Allow separate interleaving/coding/modulation per frequency segment. 11AF ammendment needs to specify an option to permit use of independent MCS values for each available TV channel when multiple TV channels used. 11AF ammendment needs to specify an option to permit use of independent MCS values for each available TV channel when multiple TV channels used. | Rejected. |
| 2053 | 231.00 | 23.3.5 | This is rejected comment LB189CID593: Due to regulations and/or realtime channel usage siutations, the conditions of available TV channels could be quite different from each other. Need to optionally specify independent MCS value for each available TV channel, if multiple TV channels are to be used. | Need to specify an option to permit use of independent MCS value for each available TV channel, if multiple TV channels are to be used. 11AF ammendment needs to specify an option to permit use of independent MCS values for each available TV channel when multiple TV channels used. | Rejected. |
| 2054 | 231.30 | 23.3.5 | This is rejected comment LB189CID595: For aggregated channels, It is better to allow unequal MCS. Unequal MCS is more efficient when conditions varies from channel to channel. | Insert 'Unequal MCSs could be applied to streams assigned to non-contiguous channels'. 11AF ammendment needs to specify an option to permit use of independent MCS values for each available TV channel when multiple TV channels used. | Rejected. |
| 2055 | 231.00 | 23.3.5 | This is rejected comment LB189CID596: Use separate interleaving and coding on different frequency segments. This will allow the easy use of different MCS on different frequency segments. | Allow separate interleaving/coding/modulation per frequency segment. 11AF ammendment needs to specify an option to permit use of independent MCS values for each available TV channel when multiple TV channels used. | Rejected. |
| 2056 | 231.00 | 23.3.5 | This is rejected comment LB189CID733: For aggregated channels, we need to add an option for independent MCS per channel, as described in 11-12-0924-00-00af-SNR\_Variance&Effects. Unequal MCS is more efficient when conditions varies from channel to channel.Use separate interleaving and coding on different frequency segments. This will allow the easy use of different MCS on different frequency segments. | Allow option for separate interleaving/coding/modulation per frequency segment. Details and specification text to be provided in a contribution by InterDigital. 11AF ammendment needs to specify an option to permit use of independent MCS values for each available TV channel when multiple TV channels used. | Rejected. |
| 2057 | 231.31 | 23.3.5 | This is rejected comment LB189CID760: For aggregated channels, It may be beneficial to allow unequal MCS, as unequal MCS is more efficient when conditions vary from channel to channel. | Insert 'Unequal MCSs may be applied to streams assigned to non-contiguous channels'. 11AF ammendment needs to specify an option to permit use of independent MCS values for each available TV channel when multiple TV channels used. | Rejected. |
| 2058 | 231.00 | 23.3.5 | This is rejected comment LB189CID761: Use separate interleaving and coding on different frequency segments. | Allow separate interleaving/coding/modulation per frequency segment. 11AF ammendment needs to specify an option to permit use of independent MCS values for each available TV channel when multiple TV channels used. | Rejected. |
| 2059 | 234.00 | 23.3.7 | This is rejected comment LB189CID604: Table 23-10 needs to be updated if more operation modes are added | Current operation modes is insufficient to support all typical cases in TVWS operation, especially in some highly populated areas, e.g., urban areas. 11AF ammendment needs to specify an option to permit use of independent MCS values for each available TV channel when multiple TV channels used. | Rejected. |
| 2060 | 241.00 | 23.3.10.8 | This is rejected comment LB189CID735: Design a single interleaver across frequency segments that will allow different modulation levels for each frequency segment. This will keep the code-rate the same, but change the signal constellation. | Interleaver needs to be redesigned. This would accommodate an option to permit use of independent MCS values for each available TV channel when multiple TV channels used. | Rejected. |
| 2061 | 245.06 | 23.3.14 | This is rejected comment LB189CID847: TVWS channels are co-shared and a limited resource. In highly populated areas, e.g., urban areas, there may only be 2W+W channels available. Therefore the existing transmission modes are not sufficient to cover the typical scenarios expected to exist in the TVWS. | Table 23-17 needs to be updated if more operation modes are added to supported more robust operation in the TVWS bands. 11AF ammendment needs to specify an option to permit use of independent MCS values for each available TV channel when multiple TV channels used. | Rejected.  |
| 2062 | 252.05 | 23.3.19.2 | This is rejected comment LB189CIDx853: TVWS channels are co-shared and a limited resource. With unique and varying channel requirements. The current Minimum required adjacent and nonadjacent channel rejection levels table (Table 23-23) may not support enough operational modes to allow for efficient use of the TVWS resources. | Additional operation modes should be added to Table 23-16 to allow for more efficient use of the TVWS resources. 11AF ammendment needs to specify an option to permit use of independent MCS values for each available TV channel when multiple TV channels used. | Rejected.. |
| 2063 | 265.08 | 23.6.4.4 | This is rejected comment LB189CID736: Table 23-38: Single TXPWR\_LEVEL and single MCS may not be sufficient for TVWS operation. Multiple power and multiple MCS's for multi-aggregated TVWS channel should be supported | FCC rules define depending on the combination of gelocation and channel location, the TX power in an aggregated TVHT waveform must be varied from one TV subchannel to the nest subchannel. Single TxPOW Level would not be sufficient. The VHT Transmit Power Envelope is not sufficent to enable a different local maximum power for each separte TV channel use in the aggregated TVHT waveform. The VHT Transmit Power Envelope sets a SINGLE local maximum power for the sum of all TV channels used, and cannot specify a lower maximum power for a single TV channel (subchannel of the aggregate waveform) even if required by regulation. | Rejected. |
| 2065 |  |  | I strongly disagree with the LB189 comment resolutions that rejecting comments 841, 842, and 846. The justification for rejecting these comments is based on "We don't see the need/benefit for multiple MCS at this point. See multiple MCS discussion in 802.11-12/1337r2." I my view 12/1337r2 indicates a fundamental misunderstanding of the TVWS environment with respect to the magnitude of the SNR differences among TVWS channels authorized for unlicensed use near DTV transmitting stations. Page 11 of 12/1337r2 states "For channels with around 12dB difference in SNR there could be some potential gain of up to 20% at best but such high SNR discrepancy is less likely." The table on Page 11 which presents a single point analysis of the throughput gains when using independent MCS for each channel clearly shows that for 12dB difference the gain can be as high as 50%, and not 20% as stated in the quoted text above. Furthermore, I do not agree with the statement that "such high (12dB) SNR discrepancy is less likely". I believe that it is likely that there will be a high (12dB or greater) SNR discrepancy in the TVWS bands and that this level of SNR discrepancy is currently observable in the TVWS bands. InterDigital has provided 3 engineering simulation studies to 11AF that study realistic TVWS SNR conditions near DTV transmitters (12/0924r0, 12/0924r1, and 13/0129r0). Chart 5 of 12/0924r0 indicates the analysis which concludes that SNR variance across TVWS channels may be as high as 35dB, and SNR variances of 12 dB and higher will be quite common in all urban areas surrounding DTV transmitters. Hence, I do not accept the reason for rejection of my previous comments. As the statement in 12/1337r2 "such high (12dB) SNR discrepancy is less likely" is clearly wrong. InterDigital's detailed simulation studies (p11 of 13/0129r0) do indicate that for very low SNR variances (less than 4-6dB) there is no significant gain when using independent MCS for each TVWS channel. Furthermore for very high SNR levels as shown on p9 in each of the 3 IDCC contributions for free space radio ranges of less than 70m, there is no significant gain for independent MCS. However for all SNR variance greater than 6dB (which In my view includes all urban areas), and for free space radio ranges greater than 70m, using independent MCS provides maximum throughput gains of 80-90% with average gains of 40-50%. So for case of urban deployment and free space radio ranges greater than 70m, the throughput gains are significant. In my view these two deployment scenarios are critical to the success of the 802.11af standard. | The 802.11af amendment should include a mode that permits independent MCS selection for each TVWS channel when operating on multiple TVWS channels. The related clause number and page are in the following repeated comments from LB189 (841,842,846). | Rejected. |
| 2066 | 23.00 | 275 | As channel conditions in aggregated channels will typically vary is seems overly restrictive to not unequal MCS in aggregated channels. Unequal MCS should allow for more efficient channel use and higher throughput, if allowed. | Insert 'Unequal MCSs may be applied to streams assigned to non-contiguous channels'. | Rejected.. |
| 2067 | 23.00 | 275 | Allow for separate interleaving and coding on different frequency segments. This will enable the use of different MCS on different frequency segments. | Allow separate interleaving/coding/modulation per frequency segment. | Rejected. |
| 2068 | 23.00 | 287 | Design a single interleaver across frequency segments that will allow for different modulation levels for each frequency segment. This will allow the code-rate the same, but for different signal constellations. | Redesign the interleaver to allow for different signal constellations for different frequency segments. | Rejected. |

**Multiple MCS Discussion:**

This is a resubmission of rejected comments on allowing different MCS to be used in modes that use multiple channels (e.g. W+W).

We note that although nothing changed from a pure technical point of view, the continuing regulatory issues in regards to TVWS and the uncertainty concerning the availability of channels in urban areas make the issue of adding additional modes to the design much less appealing at this point. It is unclear what channels, at what transmit powers and what interference levels will remain available after next year proposed auction.

We also note that according to OFCOM rules, transmission on multiple channels shall not use a sum power higher than the minimum allowed on those channels, hence reducing the appeal of unequal power allocation or unequal MCS.

We further would like to repeat our previous argument about 11ac doing away with unequal MCS for closed loop MIMO transmissions (a mode that existed in 11n).

As far as the comment referring our table, we would like to correct a misunderstanding – the potential gains are 20% and not 50% because the transmission mode will be chosen as the best one out of the three shown in the table using link adaptation. In other words, when the SNR difference between two channels is as high as 12dB, it may sometime be better to only use the best channel only and some times both channels.

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| Two MCS on two Channels | Tput Gain over min MCS +1 |  |  |
| QPSK, 16QAM (coding ½) | 0% |  |  |
| QPSK, 16QAM (coding ¾) | 12.5% |  |  |
| 16QAM,64QAM (coding ¾) | -6.5% |  |  |
| 64QAM, 256QAM (coding ¾) | 5% |  |  |
| 64QAM, 256QAM (coding 5/6) | -2.8% |  |  |
|  | Tput Gain over max MCS over **one channel** | Tput Gain over next higher MCS relative to min**Two channels** | Tput Gain over next second higher MCS relative to min |
| QPSK,64QAM (coding ¾) | 20% | 50% | 0% |
| 16QAM, 256QAM (coding ¾) | 35% | 12.5% | 0% |
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**Relevant comments and discussion**

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| **CID** | **Page** | **Clause** | **Comment** | **Proposed Change** | **Proposed resolution** |
| 2151 | 211.02 | 23.1.1 | "the number of encoders (N\_{ES})" -> "the number of BCC encoders (N\_{ES})" | As in comment. | Rejected.This applies to LDPC as well |
| 2152 | 211.02 | 23.1.1 | Is the number of encoders for each MU Bfee (N\_{ES, u}) always 1 as well as SU BFee? | Please clarify it. | Accepted |
| 2154 | 227.33 | 23.3.3 | The number of BCC Encoder in Figure 23-2 contradicts with the spefication "Note that N\_{ES} values are 1 for all Clause 23 modulations" on P256L59. | Make the number of BCC encoders 1 and delete BCC Encoder Parser. | Accepted |
| 2155 | 256.59 | 23.5 | As specified in 23.5 (P256L59), TVHT PHY always uses N\_{ES} of 1. Therefore, N\_{ES,u} is also fixed to 1. Assuming that both N\_{ES} and N\_{ES,u} are always 1, BCC encoder paser is not needed for TVHT PHY. | Specify N\_{ES,u} is always 1.Delete BCC Encoder Parser block in Figure 23-2.Add the sentence "c) BCC encoder paser is omitted" in 23.3.4.9.1 (Using BCC) on P230L24. | Accepted modified |
| 2156 | 256.65 | 23.5 | N\_{ES} and N\_{ES,u} do not exist on Tables 23-26 to 23-37. | Delete N\_{ES} and N\_{ES,u} from the sentence "In the case of TVHT MCSs for MU transmission, ..." | Agreed |

*TGaf Editor: Pls make the following changes in 23.1.1 page 211.2*

PMD sublayer) with a sampling clock change to fit into each of the basic channel unit bandwidths, and with the number of encoders (*NES*) always being 1 (for SU-MIMO and per user in MU-MIMO).

*TGaf Editor: Pls make the following changes in 23.3.3*

**23.3.3 Transmitter block diagram**

The transmit process for the L-SIG and TVHT-SIG-A fields of a VHT PPDU using one BCU is shown in Figure 22-44 (Transmitter block diagram for the L-SIG and VHT-SIG-A fields), with TVHT replacing VHT while bandwidth should be corrected according to TVHT bandwidth.

The transmit process for generating the TVHT-SIG-B field of a VHT SU PPDU and VHT MU PPDU using one frequency segment are shown in Figure 22-45 (Transmitter block diagram for the VHT-SIG-B field of a VHT SU PPDU) and Figure 22-46 (Transmitter block diagram for the VHT-SIG-B field of a VHT MU PPDU) respectively, with TVHT replacing VHT while bandwidth should be corrected according to TVHT bandwidth.

The transmit process for generating the Data field of a SU PPDU in TVHT\_MODE\_1, or TVHT\_MODE\_2C, or TVHT\_MODE\_4C with BCC and LDPC encodings, using one BCU, are shown Figure 22-47 (Transmitter block diagram for the Data field of a 20 MHz, 40 MHz or 80 MHz VHT SU PPDU with BCC encoding) and Figure 22-48 (Transmitter block diagram for the Data field of a 20 MH, 40 MHz or 80 MHz VHT SU PPDU with LDPC encoding) respectively, with TVHT replacing VHT while bandwidth should be corrected according to TVHT bandwidth. Single BCC encoder shall be assumed in Figure 22-47 (Transmitter block diagram for the Data field of a 20 MHz, 40 MHz or 80 MHz VHT SU PPDU with BCC encoding).

The transmit process for generating the Data field of a MU PPDU in TVHT\_MODE\_1, or TVHT\_MODE\_2C, or TVHT\_MODE\_4C with BCC and LDPC encoding is shown in Figure 22-49 (Trans­mitter block diagram for the Data field of a 20 MHz, 40 MHz or 80 MHz VHT MU PPDU), with TVHT replacing VHT while bandwidth should be corrected according to TVHT bandwidth. In the case of BCC encoding, single BCC encoder shall be assumed in Figure 22-49 (Trans­mitter block diagram for the Data field of a 20 MHz, 40 MHz or 80 MHz VHT MU PPDU).

Figure 23-2 (Transmitter block diagram for the Data field of a TVHT\_MODE\_2N or TVHT\_MODE\_4N SU PPDU with BCC encoding) and Figure 23-3 (Transmitter block diagram for the Data field of a TVHT\_MODE\_2N or TVHT\_MODE\_4N SU PPDU with LDPC encoding) show the transmit process for generating the Data field of a TVHT\_MODE\_2N or TVHT\_MODE\_4N SU PPDU with BCC and LDPC encoding, respectively, where the subcarrier allocation block allocates the subcarriers for the two IDFTs in each transmit path by the subcarrier mapper as described in 22.3.10.11.1 (Transmission in VHT format).

*TGaf Editor: Pls replace Figure 23-2 by the following figure:*



**Figure 23-2—Transmitter block diagram for the Data field of a TVHT\_MODE\_2N or**

**TVHT\_MODE\_4N SU PPDU with BCC encoding**

*TGaf Editor: Pls add the following text in 23.3.4.9.1:*

The construction of the Data field in a TVHT SU PPDU with BCC encoding proceeds as defined in 22.3.4.9.1 (Using BCC) reading Clause 23 for references to Clause 22 except:

d) BCC encoder: only one encoder is used

*TGaf Editor: Pls change the following text in 23.5 page 257.1:*

*R*, *NBPSCS*, *NCBPS*, *NDBPS*, and *~~NES~~* are replaced with *NSS,u*, *Ru*, *NBPSCS,u*, *NCBPS,u*, *NDBPS,u*, and *~~NES,u~~*, respectively.