**IEEE P802.15**

**Wireless Personal Area Networks**

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| Project | IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs) |
| Title | Proposed resolution to MIMO Array training feedback command in the PHY section |
| Date Submitted | 14, March, 2016 |
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| Re: | LB114\_Consolidated\_Comments |
| Abstract | Proposes comment resolution on CID 3 and CID 4. Provides a proposed change in MIMO Array training feedback command in the MAC section, currently after 6.5.9.5. |
| Purpose | To be used by the technical editor to apply the necessary changes to the draft. |
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In this document we propose to insert some descriptions for the array training feedback command into the PHY section, along with the LB114 comments shown in the table below.

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| **CID** | **Page** | **Sub-clause** | **Line #** | **Comment** | **Proposed Change** | **E/T** | **Must Be Satisfied? (enter Yes or No)** | **Resolution Status** |
| 5 | 105 | 11a.2.8.3 | 1 | Figure 11a-11 does not contain Array Training Feedback command as commented above. | In the figure, insert the Array training feedback and ACK for that command after the last array training command. | T | Yes | Accepted |
| 6 | 104 | 11a.2.8.3 | 9~41 | This description does not contain the Array training feedback command. | Insert descriptions into this subclause. | T | Yes | Accepted |
| 72 | 105 | 11a.2.8.3 | 1 | Figure 11a-11 is hard to read | Large font, simple description | E | No |  |

In page 105, we propose to add Array training feedback command into Figure 11a-11 as shown in the next page (CID#5). In this figure, we inserted the Array training feedback and ACK for that command after the last array training command. The revised figure employs lager font and simple descriptions (CID#72).



**Figure 11a-11 —Setup sequence for MIMO transmission**

In "subclause “11a.2.8.3 Link setup procedure for MIMO mode” on page 104, we propose to replace line#9 - line#41 with text below. New texts are highlighted.

This revises descriptions on the Array training feedback command as commented with CID #6.

If value of *Nar* is more than zero, the next step for MIMO transmission is to start the antenna selecting mode. If *Nar* is equal to zero this mode shall be skipped. In this mode all commands are sent in no-Ack mode. DEV starts sending Array training commands after DEV recognizes it is not moving around on the array surface of the PPC. The method for the recognition is up to implementation, for example the NFC communication or optical camera imaging can be used, or by using time (e.g., 2 sec) assuming the user stabilizes the positions of DEV within a certain time (e.g. 2 sec).

The number of Antenna training commands, excluding retransmitted ones, sent is equal to *Nar*. These are transmitted from antenna element #1 to allow PPC to select antenna elements for following MIMO transmission.

While transmissions of Array training commands the remaining number is counted down. All Array training commandsshall be with No-ACK policy.

Though the PPC’s antenna switching procedure in the antenna selecting mode is up to the implementation, it is recommended to make sure the reception of the first and the last Array training commands. For example, PPC starts receiving Array training command using antenna element which has sent Association response.

If the Array training feedback command described below for Array training #*Nar* is not received by DEV, the DEV shall retransmit Array training #*Nar*.

The multiple of Array Training commands transmission is necessary for the antenna selecting procedure, which is described in the following subsection. The number of Array Training commands sent from DEV (*Nar*) and their time period (*Tar*) are notified by the beacon. If *Nar* = 0, that means the PPC does not request Array Training command, the antenna selecting mode is omitted. MIMO PHY frame exchange is started when Association Response is received by DEV.

When *M < Marray*, PPC selects *M* antenna elements. For example, procedure selecting antenna is, select using reception levels and Array training commands are sent *Nar* times, hence *Nar* antenna *Nar* combinations of antennas are switched on to receive these commands. On the other hand when *M* = *Marray*, PPC does not have to select antenna element.

When the last Array Training command is received, PPC selects, if necessary, *M* antenna elements, from *Marray*, elements that are going to be used in following MIMO mode. When PPC is ready to switch into MIMO mode, PPC sends an Array training feedback to DEV The Array training feedback command comprises the number of Array training received successfully and optionally RSSI map for each Array training reception. If the Array training feedback command is not received by DEV, the DEV shall retransmit Array training *#Nar.*

The Array training feedback command comprises information below:

* List of successfully received training commands
* RSSI report (optional)

After that both devices switch into MIMO mode and start MIMO frame exchange with channel aggregation or channel bonding. The MIMO mode cannot be turned into SISO mode until the communication session ends.