IEEE P802.11
Wireless LANs

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| CR for CID 1598 and CID 2035 |
| Date: 2017-03-06 |
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Abstract

This document proposes comment resolution to CIDs 1598 and 2035.

Draft text changes are based on TGay D1.1 [1].

**Comments**

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| **CID** | **Clause** | **Comment** | **Proposed Change** |
| 1598 | 10.38.9.6 | When reading the specification of first path beamforming, it is unclear what first path beamforming actually is | Refine wording of first path BF training: E.g. "In such a transaction, all TX and RX training are used to identify the first arrival path of the impulse response which corresponds to the line-of-sight path in a line-of-sight communication scenario. Such a beamforming is applicable for positioning applications for example" |

Proposed Resolution: **Revised**

**Discussion**

The comment reveals the following issues

1. The first path beamforming specification has no definition of first path.
2. First path training description does not clearly mention what the target is.
	* Text says “TX and RX beamforming training are used to find the first path” which is not precise because any channel measurement in beamforming training has a first path.
3. As first path beamforming training may result in links with low link budget, it should be mentioned what the envisioned purpose is while not limiting to this purpose only.

These issues may lead to different interpretation of the standard and to a potential lack of interoperability or reduced system performance.

Proposals

1. The first path is defined to be the propagation between TX and RX which is estimated to have smallest delay.
2. TX and RX beamforming training are used the identify the best first path
3. Add a note/ reference to positioning applications

How the first path and the best first path are determined is implementation dependent.

The proposed changes correspond to 11/17-1436r1 “First-Path-BF-Text”.

*TGay Editor: Please modify 10.39.9.6 “First path beamforming training” as follows*

**10.39.9.6 First path beamforming training**

An EDMG STA that has the First Path Training Supported subfield in the STA’s EDMG Capabilities element equal to 1 is first path ~~beamformimg~~beamforming capable.

An EDMG STA shall not initiate first path beamforming training with a peer EDMG STA that is not first path beamforming capable.

An EDMG STA requests first path beamforming training transmitting a BRP frame as part of a BRP setup or BRP training request that has the First Path Training subfield set to 1. An EDMG STA that is first path beamforming capable and that receives a BRP frame with the First Path Training subfield equal to 1 shall set the First Path Training subfield to 1 in the frame that it sends in response to the reception of the BRP frame.

In a BRP transaction that is part of a first path beamforming training, all transmitted BRP frames shall have the First Path Training subfield set to 1 and shall have the FIRST\_PATH\_TRAINING parameter in the TXVECTOR set to 1. In such a transaction, all TX and RX beamforming training are used to find the best first path and not the best path. The first path is defined to be the propagation path between TX and RX which is estimated to have smallest delay. In line of sight (LOS) conditions, the first path corresponds to the LOS path. The method a STA uses to determine the first path and the best first path is implementation dependent and beyond the scope of this standard.

NOTE – First path beamforming training may be employed for positioning applications where it is desired that range and direction measurements are performed with beamforming in favor of the LOS path.

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| **CID** | **Clause** | **Comment** | **Proposed Change** |
| 2035 | 30.6.8.3.2 | Within one page, the notations Q and P are used for very different purposes. Thus Q denotes both the spatial mapping matrix within the transmit waveform equation as well as the mapping matrix for the spreading within SQPSK. Similarly, P is used as value of the pilot sequence for the waveform and as index of subcarrier pair in SQPSK and QPSK. | It would be useful to make the notations cleaner within these 2 subchapters. |

Proposed Resolution: **Revised**

**Discussion**

The comment reveals the following issues

1. The P(k) in Clause 30.6.8.3.3 ‘SQPSK modulation’ and Clause 30.6.8.3.5 ‘QPSK modulation’ is different from P(k) in Clause 30.6.8.3.3 ‘DCM SQPSK modulation’. It is not clear where it is defined.
2. The Q in Clause 30.6.8.3.3 and 30.6.8.3.5 may confuse the reader with the spatial mapping matrix Q defined in Clause 30.6.8.3.2.

Proposals

1. Add a reference to clarify where P(k) is defined in case of SQPSK and QPSK modulation, i.e. Clause 30.6.8.3.8 ‘Tone pairing for SQPSK and QPSK’
2. Change $Q$ to  $\tilde{Q}$ in wording of Clause 30.6.8.3.3 and 30.6.8.3.5.

 *TGay Editor: Please modify 30.6.8.3.3 “SQPSK modulation” as follows*

* + - * 1. SQPSK modulation

The input encoded bits belonging to the iSSth spatial stream are broken into the groups of NCBPS bits, , where *q* denotes the group number. Each pair of bits , k = 0, 1, …, NSD/2 – 1, is converted into the pair of complex points . The modulation is performed in two steps:

* First, two BPSK points are modulated as , 
* Second, two BPSK points  are converted to two QPSK points  by multiplication on mapping matrix ~~Q~~  as follows: 

where index *P(k)* is defined in the range NSD/2 to NSD – 1 as described in 30.6.8.3.8. The qth modulated data block of the iSSth spatial stream is mapped to NSD data subcarriers of the qth OFDM symbol of the iSSth spatial stream.

*TGay Editor: Please modify 30.6.8.3.5 “QPSK modulation” as follows*

* + - * 1. QPSK modulation

The input encoded bits of the iSSth spatial stream are broken into the groups of NCBPS bits, , where q denotes the group number. Each four bits , k = 0, 1, …, NSD/2 – 1, are converted into the pair of complex points . The modulation is performed in two steps:

* First, two QPSK points are modulated as , 
* Second, two QPSK points  are converted to two 16-QAM points  by multiplication on mapping matrix ~~Q~~  as follows: 

where index *P(k)* is defined in the range NSD/2 to NSD – 1 as described in 30.6.8.3.8. The qth modulated data block of the iSSth spatial stream is mapped to NSD data subcarriers of the qth OFDM symbol of the iSSth spatial stream.

**References**

[1] 802.11ay Draft 1.1

Straw Poll

Do you agree to accept comment resolutions for CIDs 1598 and 2035 as proposed in 11-18/0489r0?