Project: IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs)

Submission Title: [DF00 Beamforming Related Comment Resolutions: Part II]
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Source: [Junyi Wang, Zhou Lan, Chang woo Pyo, Chin-Sean Sum, Tuncer Baykas, Azizur Rahman, Ryuhei Funada, Fumihide Kojima, Hiroshi Harada, Shuzo Kato, Ismail Lakkis+, Jisung Oh*, Huai Rong Shao*, Su-Khiong Yong*]
Company [National Institute of Information and Communications Technology (NICT), Tensorcom, Samsung]
Address[1][3-4 Hikari-no-oka, Yokosuka-shi, Kanagawa 239-0847, Japan;
10875 Rancho Bernardo Rd, #108, San Diego, CA 92127+;
416 Maetan-3Dong Yeongtong-Gu Suwon-shi Kyunggi-Do 443-742, Korea*]
Voice[1]:[+81-46-847-5074] , FAX[1]: [+81-46-847-5440]
E-Mail[junyi.wang@nict.go.jp]
Re: []
Abstract: [Comment Resolutions related to Beamforming in DF00]

Purpose: [To be considered in TG3C baseline document.]

DF00 Beamforming Related Comment Resolutions: Part II

Summary

- This document provides the resolutions for the following 6 Beamforming comments
  - 1 comment in general:
    - 551
  - 2 comments for beamforming IE
    - 38 , 492
  - 2 comments for training/tracking/switching procedure
    - 300, 476
  - 1 comments for directional Beacon/CAP/Extended beacon
    - 35

- Comment 551: What is a "beam forming antenna"?
- Suggestion from the owner: One can use a directional antenna or an array of antennas that can be configured for beamforming. Please clarify what is meant? Is antenna selection (e.g., one of N high-gain antennas) specifically included in or excluded from this process?
- (subclause 5.3.14, L48, p3)
- Resolution: Change as recommended
  - Replace sentences in L48, p3
    - “The beam forming procedure allows a DEV and/or PNC which has a beam forming antenna to increase the antenna gain for supporting high data rate transmission.”
  - by
    - “The beam forming procedure allows a DEV and/or PNC which has a beam forming antenna, defined as an array of antennas that can be configured for beam forming, to increase the antenna gain for supporting high data rate transmission. ”

- Comment 38: Figure 48n: Tracking Period Resolution.
- Suggestion from the owner : what is this field and how is it used. Couldn‘t find further usage of this in the draft.
- (subclause 7.4.28, L31, p34)

- Resolution:
  - Since Tracking Period Resolution is used in neither beamforming nor beamtracking procedure, it is suggested to eliminate this field.

- Comment 492: Value for 0010-1101 does not specify but indicated as tracking period.
- Suggestion from the owner : specify the value
- (subclause 7.4.28, Figure 48e, p35)
- Resolution:
  - Some sentences will be added in L49, p34
    - The Best Cluster Tracking Period and Second Best Cluster Tracking Period fields shall be set to the tracking period of the best cluster and the second best cluster, respectively. The Tracking Period fields shall be encoded as defined in Table 48e, where 0000 is reserved for tracking period lower than 4us; The tracking period for 0010-1101 shall be less than 16ms and larger than 4us. The values shall be set by the implementer; 1111 is reserved for tracking period larger than 16ms
  - The Table 48e will be revised as follows

Table 48e – Tracking period encoding

Value	Tracking period value
0000	Reserved
0001	4us
0010 – 1101	~~Tracking period~~ 4us < Tracking period < 16ms
1110	16ms
1111	Reserved

- Comment 300: reference to a low-latency mode seems out-of-contect here
- Suggestion from the owner : Change mode name to allow "low latency mode" be of a single context; Delete the tracking mode for regular case and use the procedures in the draft for low latency beam tracking instead.
- (subclause 13.4.2, L37, p177)

- Resolution: Accept in principle. Suggest DO NOT delete tracking procedure for regular case. Procedures for regular case and low latency case have their own special features. The procedure for low latency can reduce the time interval between two frames which don not active tracking bit, because training sequences are distributed. However, the tracking results may be outdated because of the long distributed time for tracking. In other words, this is a procedure trying to guarantee low latency with the price of accuracy of tracking. On the other hand, the intention of regular mode is to provide guaranteed data transfer, which highly requires tracking accuracy. Therefore it is suggested to keep both modes here. Add reference to low latency mode section for the readers to clearly understand what is low latency mode.

- Comment 476: There is no text for the switching procedure between the best sector(beam) and the second best sector(beam).
- Suggestion from the owner : Describe how to utilize the second best sector(beam).
- (subclause 13.4, p166)

- Resolution:
  - Suggested changes for switching procedure are shown in next slide.

Suggested changes in D00 for beamswitching

- The sentences in L42, p177-L2, p178, will be replaced by the following sentences, starting a new paragraph
  - If both DEV1 and DEV2 support best and second best beam, switching between best and second best beam will be then triggered by the tracking results at DEV2 if the DEV2 finds the LQI of receive beam is lower than the required threshold and so can not continue its data exchange anymore. The threshold shall be decided by implementers.
  - If DEV2 does not have results indicating that a change in receive beam is desirable, DEV2 shall respond with an Imm-ACK and tracking continues.
  - If, however, DEV2 has results indicating that the receive beam can not be used anymore, DEV2 shall switch to the second best beam immediately and then respond with an empty data packet with ACK policy set to Imm-ACK. Upon receiving any results, DEV1 shall acknowledge the results with an Imm-ACK still using the old transmit beam.
  - It shall then continue the data exchange using the new receive beam.
  - If both the best and second best beam can not be used for data exchanged. The beamforming procedure will be restarted after a waiting timer is expired (The timer value shall be defined in MLE).
- Replace sentence in L16-17, p178
  - Tracking from DEV2 to DEV1 is implemented in a similar way and can by run independently of tracking from DEV1 to DEV2
- by
  - Tracking and switching from DEV2 and DEV1 is implemented in a similar way and can by run independently of tracking and switching from DEV1 to DEV2

- Comment 35: Beacon Offset Time
- Suggestion from the owner : Add to clause 8 (MAC functional description) how and why this is used.
- (subclause 7.4.22, L52, p31)

- Resolution:
  - Reject the comment. Beacon offset time is defined in L52, p31, it is broadcasted by the beacon, indicating the time that the start of this beacon is delayed from the start of the superframe.