IEEE P802.11  
Wireless LANs

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| CID 4228 | | | | |
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Abstract

This submission proposes resolutions to CID 4228.

The CID is in reference to Comment database on Draft IEEE 802.11ay/D3.0.

Revision 0: Initial proposal

Revision 1: Added TDD and scheduling coordination rationale to AA.2.

Revision 2: Turned the resolution to Reject.

Revision 3: Refined the wording from REV2.

# Comment:

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| **CID** | **PP.LL** | **Comment** | **Proposed Change** | **Suggested Resolution** |
| 4219 | 763.03 | How we can form Distribuiton Network as described in 11-17/1321 are still not clear from the current specification. Per 11-18/1801, technical components to form Distribution Network are described. In addition to it, it should be a good idea to have some example practice how the TDD channel access is actually used to form Distribution Nodes, in order to make it more reader friendly. | Please add an example implementation practice to form distribution network in Annex. Commenter is willing to provide a resolution text. | Revised:  Implement changes suggested by 11-19/759. |

# Discussion:

The commenter is asking to add distribution network example leveraging 802.11ay STA. It is reasonable to show example implementation in Annex.

# Proposed resolution:

***To TGay Editor: Insert the following new Annex to the end of the 802.11ay draft specification.***

Annex AA

(informative)

Extended wireless network formation by DMG STAs

AA.1 General

The purpose of this annex is to show an example implementation of the extended wireless network formation using wireless devices that implement DMG STAs. The extended wireless network is intended to complement limited signal range of the DMG STAs. This type of network is useful when multiple wireless devices are operating in neighborhood and they are seeking for End-to-End communication path over wireless link opportunistically. Once wireless devices form extended network, it is possible for the system to run routing protocol at higher layer to discover efficient End-to-End communication path over multiple wireless links. The extended wireless network described in this annex is similar to mesh network. However, DMG STAs are not mesh STAs and cannot form mesh BSS. This annex describes alternative approach of extended wireless network formation utilizing multiple BSSs. This approach is applicable for non-DMG STAs as well, or even more flexible for non-DMG STAs as they can form infrastructure BSS, IBSS, or MBSS.

Figure AA-1 shows an example of an extended wireless network formation by wireless devices that implement DMG STAs.



Figure AA-1— Example of an extended network formation by wireless devices that implement DMG STAs

AA.2 Layer 3 network consists of multiple BSSs

DMG STAs can form either infrastructure BSS or PBSS. Neither DMG BSS nor PBSS is intended to form mesh topology network by itself. However, a device can implement multiple STA instance and join multiple BSSs in its neighborhood. Figure AA-2 depicts an extended network formation consists of multiple BSSs. Note that even PBSS can be configured in the extended network.



Figure AA-2— Example of an extended network consists of multiple infrastructure BSSs and PBSS

Multiple STA instances inside a device can be managed by a single SME using either MM-SME (see 4.9.3 (Reference model for supporting multiple Mac sublayers)) or co-channel coordinated management (see 4.9.5 (Reference model for co-channel coordinated management operation)). SME can manage multiple DMG STA instances in a device so each STA are bridged from higher layer perspective.

With the network topology shown in Figure AA-2, Device 1 can connect to Device 8 within a single BSS, which is BSS 4 (see Figure AA-3). In this case, an 802 communication is established between Device 1 and Device 8 via Device 4. Application running at Device 1 and Device 8 are accommodated in a single BSS network.



Figure AA-3— Connectivity between Device 1 and Device 8 via Device 4 in Figure AA-2

Device 4 can connect to Device 7 using 2 BSSs, which are BSS 4 and PBSS 7 (see Figure AA-4). In this case, 802 communications are terminated at STAs in the Device 8. However, Device 8 can configure bridging function among DMG AP and DMG STA inside it. Application running at Device 4 and Device 7 can communicate each other with an assist of the layer 3 and above.



Figure AA-4— Connectivity between Device 4 and Device 7 via Device 8 in Figure AA-2

When forming an extended network over multiple BSSs, interference mitigation among neighboring STAs is essential to obtain better network performance. As typical DMG STAs leverage directional transmission, there is a better chance that multiple DMG STAs in a vicinity can transmit signal simultaneously without causing severe interference, which leads to better spatial reuse. TDD channel access can be used to maximize the effect of spatial reuse. It should be also noted that network wide scheduling coordination, i.e., coordination of TDD SPs among neighboring BSSs, is also essential to achieve high spectral efficiency. How the scheduling of the TDD SPs are determined among neighbor STAs is beyond the scope of the standard.

AA.3 Optional use of multi-band operation

When a device implements both DMG STA and non-DMG STA, it is also possible that the devices integrate non-DMG STA to collect STA presence in its neighborhood beyond signal coverage of a single DMG link. The non-DMG STA might become a member of the non-DMG BSS and communicate with STAs in the BSS to collect information that is necessary to form an extended network (see 11.32.6 (Multi-band discovery assistance procedure) for details). Figure AA-5 depicts an example scenario where Device 3 implements non-DMG AP, and rest of the devices implement non-DMA STAs that associates to the non-DMG AP in Device 3. All STAs in the basic service area can communicate each other via non-DMG BSS, even before devices become a member of a DMG BSS.

In some scenarios, it can be helpful to gain connectivity to neighbor STAs via non-DMG link to discover potential neighbor STAs, negotiate the device role in a DMG BSS, and coordinate resource allocations. How devices negotiate device role in DMG BSSs are beyond the scope of the standard.



Figure AA-5— Example of an extended network using multiple DMG BSSs with multi-band assistance

# Reference:

[1] Draft P802.11REVmd D3.0

[2] 11-19/297 “Comments on 11ay/D3.0”

[3] 11-17/1321 “Features for mmW Distribution Netework Use Case”, Djordje Tujkovic, et.al.

[4] 11-17/1670 “Configurations Options for Distribution Networks”, Xiaofei Wang, et.al.

[5] 11-17/1880 “Mapping DN/CN of mmWave Distribution Network to DMG Entities”, Lochan Verma, et.al.

[6] 11-18/816 “Discovery Assistance for 802.11ay”, Mohamed Abouelseoud, et.al.