IEEE P802.11
Wireless LANs

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| Proposed resolution to CID 608 and 624 in LB226 |
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 Abstract

This document proposes resolutions to CIDs: 608 and 624 on TGaj D4.0:

**Revision History**

R0: Initial version.

**General discussions:**

1. **Need for the 802.11aj (60 GHz) project in China:**
2. According to the radio regulations in China, there are only two physical 2.16 GHz bandwidth unlicensed channels available in 60 GHz band, compared to 3 or more in most other countries.

When developing Chinese 60GHz national standard, the China wireless personal area network (CWPAN) working group\* concluded that 802.11ad is the most promising technical solution among several existing international 60GHz standards and intended to adopt 802.11ad as the base line to set Chinese 60 GHz national standard. However, the China radio regulation committee pointed out that two channels will generate serious co-channel interference for many scenarios and suggested that more than 2 physical channels are necessary to avoid or mitigate the co-channel interference of inter-BSSs. Therefore two 2.16 GHz channels are further divided into four 1.08 GHz channels, which in general introduces 6 logical channels:

- Two 2.16 GHz bandwidth channels, which are compatible with 11ad devices.

- Four 1.08 GHz bandwidth channels, which are more suitable for low-power portable devices, such as smart phones/watches etc.

- Flexible bandwidth mechanism is applicable for various types of devices, applications and scenarios.

**This channelization scheme has been accepted as a key fundamental feature in Chinese 60 GHz national standard and makes it possible for 11ad devices to operate in China, meanwhile, meets the requirement from China radio regulation committee.**

*(\*China Wireless Personal Area Network (CWPAN) working group was launched by China National Information Technology Standardization (NITS) Technical Committee and is mainly responsible for defining technical specification related to WPAN in China.*[*http://www.nits.org.cn/getIndex.req?action=findAllNews&req=modulenvpromote&type=0&moduleId=422&sid=33*](http://www.nits.org.cn/getIndex.req?action=findAllNews&req=modulenvpromote&type=0&moduleId=422&sid=33) *)*

1. In order to provide a good opportunity for 11ad standard to enter the Chinese market and CWPAN to globalize its defined national standards in 60GHz and 45GHz, 802.11aj was formed as a platform for win-win collaboration between 802.11 and CWPAN after discussions in several joint meeting. **Also it is agreed that 802.11aj and the Chinese 60GHz national standard will be harmonized with each other as much as possible.** So the co-existence of 2.16 GHz and 1.08 GHz channels in 60 GHz band in China is a fundamental feature for 11aj 60GHz portion.
2. **Features and benefits of 11aj:**
	1. Providing up to 4 physical channels when more than 2 CDMG BSSs are operating on 1.08 GHz channels in China. Thus can avoid or mitigate inter-BSS interferences and improve spectrum efficiency in Chinese 60 GHz frequency band.
	2. Enhancing support of low power portable and mobile devices. The instantaneous power requirement is lower for battery powered devices when they are operating on a 1.08 GHz channel than on a 2.16 GHz, such as smart phone/watch.
	3. Defining the following new mechanisms to manage CDMG STAs and to improve the network efficiency: Dynamic Bandwidth Control, CDMG AP or PCP Clustering, Dynamic Channel Transfer, enhanced special reuse, opportunistic transmission mechanisms; enhanced mobile device support mode (enlarging the coverage for devices with small size antenna), 64-QAM SC mode, etc. More details please see 11-16/0456r0 (Overview of 802.11aj (60GHz) and its backward compatibility features).
3. **Backward compatibility and interoperability with DMG STAs**
	1. The channelization of supporting both 1.08 GHz and 2.16 GHz bandwidth is adopted as China 60 GHz national standard and is one of the fundamental mandatory features for 11aj. The channelization of 2.16 GHz bandwidth is the same as that of 11ad (corresponding to channel 2&3). While the center frequency for 1.08 GHz channel cannot be the same as 11ad due to the different channel bandwidth.
	2. In 11aj, a CDMG STA uses DMG PHY when operating on a 2.16 GHz channel. So a CDMG STA transmits exactly the same preamble as DMG PHY when operating on a 2.16 GHz channel. CDMG STAs can decode the header of DMG STAs when operating on 2.16 GHz channel and vice versa. The CDMG 1.08 GHz PHY is only applicable for a CDMG STA when it operates on a 1.08 GHz channel in China and therefore a DMG STA could not decode it. So if 1.08 GHz channelization is adopted by 11aj, there is no need to use exactly the same DMG preamble structure for the CDMG 1.08 GHz PHY.
	3. In 11aj MAC layer, the backward compatibility with DMG STAs is achieved by using the Dynamic Bandwidth Control (DBC) (9.41a) and AP and PCP clustering (9.37a) mechanisms. A CDMG AP or PCP shall allocate DMG Beacon header interval (BHI) and transmit beacons both on 2.16 GHz and 1.08 GHz channels. A DMG STA can communicate with a CDMG STA and request to join a CDMG BSS on a 2.16 GHz channel. The CDMG AP or PCP of a CDMG BSS can schedule both SPs and/or CBAPs on a 2.16 GHz and/or 1.08 GHz channel(s) during DTI in a beacon interval according to the transmission requirement of STAs in the BSS. Therefore the basic backward compatibility and interoperability requirement are met although some network efficiency loss. That a CDMG STA is absolutely not backward compatibility with a DMG STA means that a CDMG STA cannot communicate with a DMG STA at any time.
	4. In order to resolve the coexistence/backward compatibility issues and improve the network efficiency as much as possible when CDMG STAs co-locate with DMG STAs, the following amendments and changes are proposed to 11aj D1.0:

3.4.1 A CDMG STA should not establish a 1.08 GHz CDMG BSS within a 2.16 GHz channel on which it received a DMG Beacon frame from a DMG AP.

3.4.2 A DMG STA can obtain the SPs and CBAPs allocation information of a CDMG 1.08 GHz BSS by receiving the DMG Beacon frame and/or DMG Announce frame on the 2.16 GHz channel transmitted by the CDMG AP or PCP.

3.4.3 Define the support of CDMG AP or PCP Clustering mechanism as a mandatory feature for a CDMG AP or PCP to improve spatial sharing and interference mitigation with other co-channel DMG and CDMG BSSs.

3.4.4 In summary, in order to co-existence with DMG STAs, we proposed to ***insert the following two paragraphs as the 2nd and 3rd paragraph in 10.42.5 (******Backward compatibility and interoperation) as follows:***

“A CDMG STA should not establish a 1.08 GHz BSS within a 2.16 GHz channel on which it received a DMG Beacon frame from a DMG AP or PCP. A CDMG AP or PCP operating on a 1.08 GHz channel shall transmit DMG Beacon frames on both the 1.08 GHz channel and the corresponding 2.16 GHz channel. A DMG STA can request to join a CDMG BSS by transmitting an Association Request frame to the CDMG AP or PCP. The CDMG AP or PCP shall schedule SPs and/or CBAPs on the 2.16 GHz channel for those associated DMG STAs in its BSS. The length of the scheduled SPs or CBAPs for DMG STAs on the 2.16 GHz channel is variable and may be up to the entire DTI, which means all STAs in the CDMG BSS operate on the 2.16 GHz channel if SPs and/or CBAPs are scheduled only on the 2.16 GHz channel during the DTI. The algorithm to schedule SPs or CBAPs for DMG STAs in a CDMG BSS is implementation dependent and beyond the scope of this standard but should aim to maximize the network efficiency.

During an SP or a CBAP, the source and destination CDMG STAs operating on a 1.08 GHz channel in a CDMG BSS shall transmit an RTS frame and a DMG CTS or DMG DTS frame respectively on the corresponding 2.16 GHz channel after successfully transmitting and receiving an RTS frame and a DMG CTS or DMG DTS frame respectively on the 1.08 GHz channel if the 2.16 GHz channel is idle. Then the DMG STAs can set their NAVs by receiving the RTS or DMG CTS or DMG DTS frames transmitted on the 2.16 GHz channel by the CDMG STAs. After transmitting a CF-END frame to truncate a SP or TXOP on a 1.08 GHz channel within a 2.16 GHz channel, a CDMG STA shall also transmit a corresponding CF-END frame on the 2.16 GHz channel if it is idle.”

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| CID | Clause | Page | Line | Type | Comment | Proposed Change | Remark |
| 608 | 25 | 164 | 1 | T | CDMG uses the same spectrum as DMG but its signals are half the bandwidth of the DMG so DMG devices cannot decode CDMG signals meaning some of the spectrum sharing aspects of 802.11 protocol are not available to facilitate fair use. DMG devices are deploying now and will potentially experience future degradation of operation as CDMG devices are introduced into the same operating space. | Remove CDMG mode |  |

Proposed resolution: Rejected.

Per discussion above, in order to effectively share the same spectrum with DMG STAs as much as possible, besides existing MAC layer mechanisms defined in 11aj, some amendments are proposed to 11aj.

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| CID | Clause | Page | Line | Type | Comment | Proposed Change | Remark |
| 624 | 25 | 164 | 1 | T | 11aj should use only 11ad format when operating in 60GHz band to avoid coexistence | Remove CDMG from 11aj (limit it to QDMG). |  |

Proposed resolution: Rejected.

Please see the discussion above.