IEEE P802.11  
Wireless LANs

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| Proposed resolution to CID 100, 101, 102, etc. in LB217 | | | | |
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Abstract

This document proposes resolutions to 100, 101, 102, 103, 110, 127, 128, 129, 116, 117, 118, 155, 166, 156, 167, 157, 119, 124, 126, 153, 158, 154, 159, 160, 161, 162, 164, 165, 169, 170, 171, 173, 174 CIDs on TGaj D1.0:

**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, we propose to ***insert the following two paragraphs after the first paragraph in 9.41a.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 Beacons 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, a source CDMG STA operating on a 1.08 GHz channel in a CDMG BSS shall transmit a RTS frame on the corresponding 2.16 GHz channel before transmitting a RTS frame on the 1.08 GHz channel if the 2.16 GHz channel is idle. After transmitting a DMG CTS or DMG DTS frame in response to the RTS frame on the 1.08 GHz channel, the corresponding destination STA shall transmit a DMG CTS and/or DMG DTS frame on the 2.16 GHz channel if the 2.16 GHz channel is idle. Then the DMG STAs can set their NAVs by receiving the RTS and DMG CTS/DTS 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 |
| 100 | 25.3.6 | 199 | 50 | T | The preamble structure is not backwards compatible with that of DMG STAs, as defined in section 20.3.6.2. For example, the number of repetitions in the STF are different. | Preferably, remove the CDMG PHY and simply reuse the DMG PHY. The CDMG PHY is not introducing any technical benefit in comparison to the DMG PHY.  Alternatively, given the backward compatibility requirement, every transmission from a CDMG STAs should be decodable by a DMG STAs. For that to happen, the preamble sequences should be the same. |  |

Proposed resolution: **Revised.**

Please see the need and benefits for the 802.11aj (60 GHz) project in China in clause 1 & 2 of the General discussions on proposed resolutions on page 2-3. The 1.08 GHz PHY is adopted by China 60 GHz national standard and therefore is one of the fundamental mandatory features for 11aj (60GHz).

3.2 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 and therefore a DMG STA could not decode it. So it is not necessary to use exactly the same DMG preamble structure for the CDMG 1.08 GHz PHY.

3.3 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.

In order to transmit the length information of a CDMG 1.08 GHz PPDU on the corresponding 2.16 GHz channel as much as possible, some modifications and amendments are proposed to 11aj D1.0. See details in clause 3.4 of the general discussions on proposed resolutions on page 3-4.

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| CID | Clause | Page | Line | Type | Comment | Proposed Change | Remark |
| 101 | E.1 | 299 | 31 | T | The channelization seems to be completely different from that of DMG STAs, including center frequencies. So, how are CDMG STAs being backward compatible with DMG STAs? | Preferably, remove the CDMG PHY and simply reuse the DMG PHY. The CDMG PHY is not introducing any technical benefit in comparison to the DMG PHY.  Alternatively, align the channelization, including Channel starting frequency and resulting center frequencies, MCSs, etc. |  |

Proposed resolution: **Revised.**

Please see the need and benefits for the 802.11aj (60 GHz) project in China in clause 1 & 2 of the General discussions on proposed resolutions on page 2-3.

3.1 The channelization of supporting both 1.08 GHz and 2.16 GHz bandwidth is adopted by China 60 GHz national standard and therefore is one of the fundamental mandatory features for 11aj. The channelization of 2.16 GHz bandwidth is exactly the same as that of 11ad (corresponding to channel 2&3). While the starting frequency and center frequency for the 1.08 GHz channels cannot be the same as 11ad due to the different channel bandwidth.

3.2 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 and therefore a DMG STA could not decode it. So it is not necessary to use exactly the same DMG preamble structure as well as DMG MCSs for the CDMG 1.08 GHz PHY.

In order to meet the requirement of backward compatibility with DMG STAs as much as possible, some modifications and amendments are proposed to 11aj D1.0. See details in clause 3.4 of the general discussions on proposed resolutions on page 3-4.

Because the operating classes for 802.11aj are not globally used. Remove modification to Table E-4 in Annex E from 11aj as follows:



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| CID | Clause | Page | Line | Type | Comment | Proposed Change | Remark |
| 102 | 25.6.2 | 211 | 10 | T | With this PPDU structure, what happens if a CDMG STA transmits a PPDU over a 1080MHz channel where there is also a DMG STA? How will the DMG STA be able to detect the PPDU and defer for the duration of the PPDU? | Preferably, remove the CDMG PHY and simply reuse the DMG PHY. The CDMG PHY is not introducing any technical benefit in comparison to the DMG PHY.  Alternatively, the STF, CE and Header fields should be the same as that of DMG STAs to allow them to detect and decode the length of the frame. Moreover, they also need to be transmitted over a 2.16 GHz channel and same center frequency of DMG STAs. If that does not happen, the backward compatibility requirement of CDMG with DMG (as required in the PAR) is not met. |  |

Proposed resolution: **Revised.**

Please see the need and benefits for the 802.11aj (60 GHz) project in China in clause 1 & 2 of the general discussions on proposed resolutions on page 2-3. The 1.08 GHz PHY is adopted by China 60 GHz national standard and therefore is one of the fundamental mandatory features for 11aj (60GHz).

3.2 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 and therefore a DMG STA could not decode it. So it is not necessary to use exactly the same DMG preamble structure as well as DMG MCSs for the CDMG 1.08 GHz PHY.

In order to transmit the length information of a CDMG 1.08 GHz PPDU on the corresponding 2.16 GHz channel as much as possible, some modifications and amendments are proposed to 11aj D1.0. See details in clause 3.4 of the general discussions on proposed resolutions on page 3-4.

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| CID | Clause | Page | Line | Type | Comment | Proposed Change | Remark |
| 103 |  |  |  | T | CDMG does not mandate that ALL STAs must be able to decode any Preamble type (CPHY, SC and OFDM), they look similar but they are not!. SC and OFDM have different CEF, CPHY has different Header. | Mandate that all STAs decode the Header of any CDMG transmission, including any symbol rate used and any modulation. |  |

Proposed resolution: **Revised.**

Yes, we should mandate that all CDMG STAs can decode the header of any CDMG transmission, including any symbol rate used and any modulation. Propose to remove OFDM PHY from 11aj to avoid co-existing issue with OFDM preamble and reduce the complexity of implementation. (CID117 also suggests removing OFDM mode from 11aj.)

***Insert the following paragraph after the third paragraph in 25.1.1:***

“A CDMG STA shall be able to decode all the types of preamble of the control mode and SC mode including the header of any CDMG transmission.”

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| CID | Clause | Page | Line | Type | Comment | Proposed Change | Remark |
| 110 |  |  |  | T | RTS, CTS CF-END not compatible to 11ad. This is a HUGE issue. CDMG and DMG stations will not be able to effectively share the same spectrum. Efficient access management in .11 family is achieved by CSMA and LBT, including the NAV mechanism. Since there is a fundamental incompatibility between CDMG and DMG protocols, this mechanism is totally broken. Just CCA based on power is far from sufficient even when directional antennas are used. | Mandate that CDMG will use RTS, CTS and CF-END compatible with DMG (11ad) |  |

Proposed resolution: **Revised.**

In order to transmit the length information of a CDMG 1.08 GHz PPDU on the corresponding 2.16 GHz channel as much as possible, some modifications and amendments are proposed to 11aj D1.0. See details in clause 3.4 of the general discussions on proposed resolutions on page 3-4.

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| CID | Clause | Page | Line | Type | Comment | Proposed Change | Remark |
| 127 | 9.37 |  |  | T | Section 9.37 describes a very unclear method that is supposed to do some coordination between the DMG and CDMG if they share the same DMG channel. The procedure description is very unclear. However it looks like the CDMG is assuming that the DMG operates in SP mode and then some timesharing can be used. At this time most DMG APs and PCPs do not use SP. | CDMG should operate only in DMG mode when operating in 60GHz band |  |
| 128 | 9.37 |  |  | T | Section 9.37 specifies some coordination method with DMG. The mechanism is unclear. It looks like it uses some SP coordination with the DMG. Since most DMG do not use SP. It is unclear how the synchronization will work. | CDMG to operate only in DMG mode in 60GHz band |  |

Proposed resolution: **Reject.**

Please see the need and benefits for the 802.11aj (60 GHz) project in China in clause 1 & 2 of the general discussions on proposed resolutions on page 2-3. The 1.08 GHz PHY is adopted by China 60 GHz national standard and therefore is one of the fundamental mandatory features for 11aj (60GHz).

Some DMG STAs might not use SPs to transmit a video stream as described in 11.4 (TS operation). However, a non-AP and non-PCP DMG STA shall be capable of processing Poll frames and the Extended Schedule element, see 10.36.4 in REVmc 5.3. This means all the DMG STAs can process the timing of CBAPs and SPs. So, Using SP for TS operation and using SP/CBAP for TDMA is different. A DMG STA can transmit in an SP.

A CDMG AP or PCP can schedule both SPs and CBAPs for DMG STAs. To make it clear, some modifications and amendments are proposed to 11aj D1.0. See details in clause 3.4 of the general discussions on proposed resolutions on page 3-4.

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| CID | Clause | Page | Line | Type | Comment | Proposed Change | Remark |
| 129 | 9.37 |  |  | T | The coordination mechanism with DMG presents that CDMG AP and PCP transmit beacons in DMG mode. It is not clear what they will do if a DMG STA will answer and attempt to associate. | CDMG shall operate only as DMG in 60 GHz band |  |

Proposed resolution: **Reject.**

A CDMG STA is a DMG STA when operating on 2.16 GHz channel. ACDMG AP or PCP shall transmit DMG Beacon frames in DMG mode on a 2.16 GHz channel, also can see details in 9.41a in 11aj D1.0. It also maintains the BHI structure to accept the association request of a DMG STA. A DMG STA can request to associate with the CDMG AP or PCP if it receives a DMG frame. The CDMG AP or PCP can schedule SPs or CBAPs for the DMG STA.

To make it clearer, some modifications and amendments are proposed to 11aj D1.0. See details in clause 3.4 of the general discussions on proposed resolutions on page 3-4.

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| CID | Clause | Page | Line | Type | Comment | Proposed Change | Remark |
| 116 | 25 | 183 |  | T | CDMG is fundamentally backward incompatible with DMG because it operates in the same spectrum as DMG and uses half the bandwidth (1.08 GHz) of each DMG channel (2.16 GHz). No part of the PPDUs transmitted by a 1.08 GHz CDMG device can be decoded by a 2.16 GHz DMG device, so the universal 802.11 practice of protection using the packet duration is not even feasible. The MAC-based protection mechanisms in CDMG (create pseudo-static DMG allocations and operate with half the bandwidth inside) are fragile and will break with increasing density and mobility of DMG devices, which have been productized and will deploy in handset devices in very large volumes. Operating with half the bandwidth (and speed) does not bring any advantage in throughput and capacity, because the same capacity can be provided with twice the bandwidth and half the airtime. | Remove CDMG from 11aj (limit it to QDMG). |  |

Proposed resolution: **Reject.**

Please see the need and benefits for the 802.11aj (60 GHz) project in China in clause 1 & 2 of the general discussions on proposed resolutions on page 2-3. The 1.08 GHz PHY is adopted by China 60 GHz national standard and therefore is one of the fundamental mandatory features for 11aj (60GHz).

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 D1.0. See details in clause 3.4 of the general discussions on proposed resolutions on page 3-4.

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| CID | Clause | Page | Line | Type | Comment | Proposed Change | Remark |
| 117 | 25.5 | 205 |  | T | The optional DMG OFDM mode has serious design flaws: (1) DMG OFDM PHY header is transmitted in OFDM, which makes it not decodable to Single Carrier only (SC-only) devices; creating serious co-existence issues. (2) OFDM subcarriers are defined such that when two channels are bonded the subcarriers for the wide channel will not fall on a uniform frequency grid for FFT. It is anticipated that the DMG OFDM mode will be deprecated/removed for the same reason. | Remove CDMG, or remove CDMG OFDM mode. |  |

Proposed resolution: **Revised.**

In order to avoid this co-existence issue, propose to remove the optional CDMG OFDM mode from 802.11aj (60GHz).

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| CID | Clause | Page | Line | Type | Comment | Proposed Change | Remark |
| 118 | 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: **Reject.**

Please see the need and benefits for the 802.11aj (60 GHz) project in China in clause 1 & 2 of the general discussions on proposed resolutions on page 2-3. The 1.08 GHz PHY is adopted by China 60 GHz national standard and therefore is one of the fundamental mandatory features for 11aj (60GHz).

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 D1.0. See details in clause 3.4 of the general discussions on proposed resolutions on page 3-4.

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| CID | Clause | Page | Line | Type | Comment | Proposed Change | Remark |
| 155 | 2 | 2 |  | T | Comment on coexistence assurance document: Section 2 (Channelization) says" While adopting 1.08GHz channel as described in Clause 25 for 802.11aj [1], 802.11aj ensures coexistence with 802.11ad by using DBC mechanism defined in clause 9 in 802.11aj [1]". The DBC mechanism in Draft 1.0 is a MAC-based protection that breaks with density and mobility of DMG devices; to the best of my knowledge all viable 802.11 amendments have used a PHY-based protection using legacy headers. 802.11aj will NOT be backward compatible with 802.11ad unless using the 11ad preamble; otherwise no part of a CDMG packet can be decoded by a DMG device. | Define a PHY-based plan for coexistence with 11ad. Suggestion is to limit 802.11aj to QDMG. |  |
| 166 |  |  |  |  | In Section 2 (Channelization) of coexistence assurance document it states that " While adopting 1.08GHz channel as described in Clause 25 for 802.11aj [1], 802.11aj ensures coexistence with 802.11ad by using DBC mechanism defined in clause 9 in 802.11aj [1]". The DBC is a MAC based approach, quite different from PHY based coexistence approach as in all other 11 standards. In addition the DBC relies on using SP both on DMG and CDMG. Since DMG is using CBAP mainly, the DBC mechanism may not work well. | Define a phy-based plan for coexistence with 11ad. Suggest limiting 802.11aj to QDMG |  |

Proposed resolution: **Revised.**

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 D1.0, including transmitting the length of the 1.08 GHz PPDU on 2.16 GHz channel. See details in clause 3.4 of the general discussions on proposed resolutions on page 3-4.

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| CID | Clause | Page | Line | Type | Comment | Proposed Change | Remark |
| 156 | 3 | 3 |  | T | Comment on coexistence assurance document: Section 3 (Preamble Design for Coexistence) says: "When 802.11aj operates in the 60 GHz frequency band, it uses the same preamble design as 802.11ad [1] [4]. This enables the co-existence with 802.11ad." -- Using the same "design" does not enable coexistence - using the same exact preamble as 802.11ad through a legacy header does, as other 802.11 amendments have done. | Use the same DMG header for CDMG or limit the standard to QDMG. |  |
| 167 | 3 | 3 |  | T | In section 3 of coexistence assurance document, it states "When 802.11aj operates in the 60 GHz frequency band, it uses the same preamble design as 802.11ad [1] [4]. This enables the co-existence with 802.11ad." The statement is problematic since the preambles are not EXACTLY the same so DMG devices will fail to decode and set NAV accordingly. CDMG should use EXACTLY the same preambles with same chip-rate as DMG to be able to be backward compatible and share the medium. | Use the same DMG header for CDMG or limit the standard to QDMG. |  |

Proposed resolution: **Revised.**

3.2 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 and therefore a DMG STA could not decode it. So it is not necessary to use exactly the same DMG preamble structure as well as DMG MCSs for the CDMG 1.08 GHz PHY.

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 D1.0. See details in clause 3.4 of the general discussions on proposed resolutions on page 3-4.

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| CID | Clause | Page | Line | Type | Comment | Proposed Change | Remark |
| 157 | 1 | 11.5.3 |  | T | Comment on the CSD document (IEEE 802.11 China MM-Wave (CMMW) 5C's): There is no reference to 802.11ad in the document. With 802.11ad added to the document, and with CDMG in scope, Section 11.5.3 (Distinct Identity) fails to justify 11aj (a) is "Substantially different from other IEEE 802 LMSC standards", (b) offers "one unique solution per problem (not two solutions to a problem)". | Provide unique contrast between CDMG and DMG, or limit 11aj to Q-band. |  |

Proposed resolution: **Revised.**

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 the CWPAN working group was developing Chinese 60GHz national standard, 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-BSS. Therefore two 2.16 GHz channels are further divided into four 1.08 GHz channels, which in general introduces 6 logical channels: 2 channels with 2.16 GHz bandwidth and 4 channels with 1.08 GHz bandwidth. 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.

One unique solution per problem:

Only 802.11aj supports 4 physical channels when more than 2 CDMG BSSs are operating in Chinese 60 GHz band. Thus can avoid or mitigate inter-BSS interferences and improve spectrum efficiency in Chinese 60 GHz frequency band. Meanwhile, meets the requirement from China radio regulation committee. So it is the unique solution.

Unique contrast between CDMG and DMG:

A CDMG STA supports both 2.16 GHz and 1.08 GHz bandwidth channels in China to meet the requirement of the China radio regulation committee, providing up to 4 physical channels in Chinese 60 GHz band. While a DMG STA only supports 2.16 GHz channel and there are only 2 physical channels available in China.

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| CID | Clause | Page | Line | Type | Comment | Proposed Change | Remark |
| 119 | 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: **Reject**.

Please see the need and benefits for the 802.11aj (60 GHz) project in China in clause 1 & 2 of the general discussions on proposed resolutions on page 2-3. The 1.08 GHz PHY is adopted by China 60 GHz national standard and therefore is one of the fundamental mandatory features for 11aj (60GHz).

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 D1.0. Please see details in clause 3.4 of the general discussions on proposed resolutions on page 3-4.

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| CID | Clause | Page | Line | Type | Comment | Proposed Change | Remark |
| 124 | 3.2 | 27 | 14 | T | How does CDMG coexist with DMG since a DMG would be unable to decode CDMG transmissions? | Remove CDMG from the specification. |  |

Proposed resolution: **Reject.**

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 D1.0. Please see details in clause 3.4 of the general discussions on proposed resolutions on page 3-4.

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| CID | Clause | Page | Line | Type | Comment | Proposed Change | Remark |
| 126 | 25.3.6 | 199 | 50 | T | The preamble structure is not compatible with 802.11ad that makes the CDMG not backward compatible with DMG | Use the DMG PHY, there is no need seeing for CDMG PHY |  |

Proposed resolution: **Reject.**

Please see the need and benefits for the 802.11aj (60 GHz) project in China in clause 1 & 2 of the general discussions on proposed resolutions on page 2-3. The 1.08 GHz PHY is adopted by China 60 GHz national standard and therefore is one of the fundamental mandatory features for 11aj (60GHz).

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 D1.0. Please see details in clause 3.4 of the general discussions on proposed resolutions on page 3-4.

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| CID | Clause | Page | Line | Type | Comment | Proposed Change | Remark |
| 153 | 25 | 189 |  | T | CDMG is backward incompatible with DMG because it operates in the same spectrum as DMG and uses half the bandwidth of each DMG channel. No part of the PPDUs transmitted by a 1.08 GHz CDMG device can be decoded by a 2.16 GHz DMG device, so the universal 802.11 practice of protection using the packet duration is not feasible. The MAC-based protection mechanisms in CDMG are fragile and will break with increasing density and mobility of DMG devices, which have been productized and will deploy in handset devices in very large volumes. Operating with half the bandwidth (and speed) does not bring any advantage in throughput and capacity, because the same capacity can be provided with twice the bandwidth and half the airtime. | Remove CDMG from 11aj (limit it to QDMG). |  |
| 158 | 25 | 189 |  | T | CDMG is backward incompatible with DMG because it operates in the same spectrum as DMG and uses half the bandwidth of each DMG channel. No part of the PPDUs transmitted by a 1.08 GHz CDMG device can be decoded by a 2.16 GHz DMG device, so the universal 802.11 practice of protection using the packet duration is not even feasible. The MAC-based protection mechanisms in CDMG are fragile and will break with increasing density and mobility of DMG devices, which have been productized and will deploy in handset devices in very large volumes. Operating with half the bandwidth (and speed) does not bring any advantage in throughput and capacity, because the same capacity can be provided with twice the bandwidth and half the airtime. | Remove CDMG from 11aj (limit it to QDMG). |  |

Proposed resolution: **Reject.**

Please see the need and benefits for the 802.11aj (60 GHz) project in China in clause 1 & 2 of the general discussions on proposed resolutions on page 2-3. The 1.08 GHz PHY is adopted by China 60 GHz national standard and therefore is one of the fundamental mandatory features for 11aj (60GHz).

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 D1.0. Please see details in clause 3.4 of the general discussions on proposed resolutions on page 3-4.

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| CID | Clause | Page | Line | Type | Comment | Proposed Change | Remark |
| 154 | 25.5 | 205 |  | T | The optional DMG OFDM mode has serious design flaws: (1) DMG OFDM PHY header is transmitted in OFDM, which makes it not decodable to Single Carrier only (SC-only) devices; creating serious co-existence issues. (2) OFDM subcarriers are defined such that when two channels are bonded the subcarriers for the wide channel will not fall on a uniform frequency grid for FFT. It is anticipated that the DMG OFDM mode will be deprecated/removed for the same reason. | Remove CDMG, or remove CDMG OFDM mode. |  |

Proposed resolution: **Revised.**

In order to avoid this co-existence issue, propose to remove the optional CDMG OFDM PHY mode from 802.11aj (60GHz).

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| CID | Clause | Page | Line | Type | Comment | Proposed Change | Remark |
| 159 | 25.5 | 205 |  | T | The optional DMG OFDM mode has design flaws: (1) DMG OFDM PHY header is transmitted in OFDM, which makes it not decodable to Single Carrier only (SC-only) devices; creating serious co-existence issues. | Remove CDMG, or remove CDMG OFDM mode. |  |

Proposed resolution: **Revised.**

As suggested, propose to remove CDMG OFDM mode.

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| CID | Clause | Page | Line | Type | Comment | Proposed Change | Remark |
| 160 |  |  |  | T | 802.11aj in the 60GHz band is not backward compatible with 802.11ad because it uses a bandwidth of 1.08 GHz, which is half the bandwidth of 802.11ad and therefore 802.11ad devices in proximity to 802.11aj devices in the 60GHz band will not be able to use the normal protection procedures in general use by 802.11 devices. 802.11aj provides a MAC based method of protection, this is much different from the other 802.11 standards that employ PHY based mechanisms using legacy preambles and therefore is not proven to be robust in dense usage scenarios. | Remove operation of 802.11aj in the 60GHz band, limit operation to 45 GHz band. |  |

Proposed resolution: **Reject.**

Please see the need and benefits for the 802.11aj (60 GHz) project in China in clause 1 & 2 of the general discussions on proposed resolutions on page 2-3. The 1.08 GHz PHY is adopted by China 60 GHz national standard and therefore is one of the fundamental mandatory features for 11aj (60GHz).

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 D1.0. Please see details in clause 3.4 of the general discussions on proposed resolutions on page 3-4.

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| CID | Clause | Page | Line | Type | Comment | Proposed Change | Remark |
| 161 | 25.3.6 | 199 | 50 | T | As defined in section 20.3.6.2, the preamble structure is not backward compatible with that of DMG STAs. As an example, the number of repetitions in STFs are different | Recommend removing CDMG PHY and reuse DMG PHY. CDMG PHY does not offer any technical benefit.  Due to the backward compatibility requirement for the standard, one may also consider making sure that all transmissions from CDMG STAs are decodable by DMG STAs |  |

Proposed resolution: **Revised.**

See resolution to this CID at the beginning of this document.

Please see the need and benefits for the 802.11aj (60 GHz) project in China in clause 1 & 2 of the general discussions on proposed resolutions on page 2-3. The 1.08 GHz PHY is adopted by China 60 GHz national standard and therefore is one of the fundamental mandatory features for 11aj (60GHz).

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 D1.0. Please see details in clause 3.4 of the general discussions on proposed resolutions on page 3-4.

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| CID | Clause | Page | Line | Type | Comment | Proposed Change | Remark |
| 162 | E.1 | 324 | 31 | T | Channelization appears to be quite different from those of DMG STAs, and this would make CDMG STAs not being backward compatible with DMG STAs. | CDMG PHY is not adding any technical benefit as compared to the DMG PHY, and therefore recommend removal of CDMG PHY and replace it with DMG PHY.  Another possibility is the alignment of channelization including but not limited to channel starting frequency, center frequency, MCSs, etc. |  |

Proposed resolution: **Reject.**

Please see the need and benefits for the 802.11aj (60 GHz) project in China in clause 1 & 2 of the General discussions on proposed resolutions on page 2-3.

3.1 The channelization of supporting both 1.08 GHz and 2.16 GHz bandwidth is adopted by China 60 GHz national standard and therefore is one of the fundamental mandatory features for 11aj. The channelization of 2.16 GHz bandwidth is exactly the same as that of 11ad (corresponding to channel 2&3). While the starting frequency and center frequency for the 1.08 GHz channels cannot be the same as 11ad due to the different channel bandwidth.

3.2 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 and therefore a DMG STA could not decode it. So it is not necessary to use exactly the same DMG preamble structure as well as DMG MCSs for the CDMG 1.08 GHz PHY.

In order to meet the requirement of backward compatibility with DMG STAs as much as possible, some modifications and amendments are proposed to 11aj D1.0. See details in clause 3.4 of the general discussions on proposed resolutions on page 3-4.

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| CID | Clause | Page | Line | Type | Comment | Proposed Change | Remark |
| 164 | 25.3.6 | 199 | 48 | T | Preamble structure is inconsistent with the PAR requirement of being interoperable with 11ad. | Align with 11ad |  |

Proposed resolution: **Revised.**

Please see the need and benefits for the 802.11aj (60 GHz) project in China in clause 1 & 2 of the General discussions on proposed resolutions on page 2-3. The 1.08 GHz PHY is adopted by China 60 GHz national standard and therefore is one of the fundamental mandatory features for 11aj (60GHz).

3.2 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 and therefore a DMG STA could not decode it. So it is not necessary to use exactly the same DMG preamble structure for the CDMG 1.08 GHz PHY.

3.3 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.

In order to meet the requirement of backward compatibility with DMG STAs as much as possible, some modifications and amendments are proposed to 11aj D1.0. See details in clause 3.4 of the general discussions on proposed resolutions.

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| CID | Clause | Page | Line | Type | Comment | Proposed Change | Remark |
| 165 | E | 324 | 30 | T | Channelization scheme of 11aj needs to be consistent with 11ad, however it does bear resemblance | align to 11ad. |  |

Proposed resolution: **Revised.**

Please see the need and benefits for the 802.11aj (60 GHz) project in China in clause 1 & 2 of the General discussions on proposed resolutions on page 2-3.

3.1 The channelization of supporting both 1.08 GHz and 2.16 GHz bandwidth is adopted by China 60 GHz national standard and therefore is one of the fundamental mandatory features for 11aj. The channelization of 2.16 GHz bandwidth is exactly the same as that of 11ad (corresponding to channel 2&3). While the starting frequency and center frequency for the 1.08 GHz channels cannot be the same as 11ad due to the different channel bandwidth.

3.2 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 and therefore a DMG STA could not decode it. So it is not necessary to use exactly the same DMG preamble structure as well as DMG MCSs for the CDMG 1.08 GHz PHY.

In order to meet the requirement of backward compatibility with DMG STAs as much as possible, some modifications and amendments are proposed to 11aj D1.0. See details in clause 3.4 of the general discussions on proposed resolutions.

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| CID | Clause | Page | Line | Type | Comment | Proposed Change | Remark |
| 169 | 1 |  |  | T | CDMG and DMG PHYs are not compatible. CDMG STA cannot decode the header of DMG STAs and vice versa. Hence, CDMG and DMG stations will not be able to effectively share the same spectrum. | Change CDMG to use CPHY and SC PHY as DMG STAs use. Defined in DMG document (11ad). |  |

Proposed resolution: **Revised.**

In order to meet the requirement of backward compatibility with DMG STAs as much as possible, some modifications and amendments are proposed to 11aj D1.0. See details in clause 3.4 of the general discussions on proposed resolutions.

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| CID | Clause | Page | Line | Type | Comment | Proposed Change | Remark |
| 170 | 1 |  |  | T | Remove 11aj out of 60 GHz (remove CDMG) and limit it to 45 GHz (QDMG). |  |  |
| 171 | 1 |  |  | T | Limit 11aj to 45ghz |  |  |
| 173 | 1 |  |  | T | Restrict 802.11aj to 45GHz. | Restrict 802.11aj to 45GHz. |  |
| 174 | 1 |  |  | T | CDMG preamble is not backwards compatible and will hence interfere with DMG devices | The only reliable solution is to limit the use spectrum up to maximum 45 GHz. |  |

Proposed resolution: **Reject**

Please see the need and benefits for the 802.11aj (60 GHz) project in China in clause 1 & 2 of the general discussions on proposed resolutions on page 2-3. The 1.08 GHz PHY is adopted by China 60 GHz national standard and therefore is one of the fundamental mandatory features for 11aj (60GHz).

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 D1.0. Please see details in clause 3.4 of the general discussions on proposed resolutions on page 3-4.