IEEE P802.11
Wireless LANs

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| TGaj Coexistence Assurance Document |
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Abstract

This serves as the coexistence assurance document for TGaj in meeting the requirement of the 5 criteria.

R0: Initial version.

R1: Updated based on comment resolution for LB217.

# Introduction

This document addresses coexistence of IEEE 802.11aj per the PAR and 5C’s [1] [2] [3]. The relevent sections of each are outlined below:

* PAR scope:
	+ Maintains backward compatibility with 802.11ad when it operates in the 59-64 GHz frequency band.
* 5C’s:
	+ The working group will create a CA document as part of the WG balloting process. The definition for coexistence is as defined in 802.15.2, with the shared environment being the 43.5-47 GHz and 60 GHz band in home and enterprise.

In 802.11aj [1], clause 9, 25 and 26 provide an overview of the features available in the specification that address coexistence with other mmWave technologies, including 802.11ad [4] and 802.15.3c [5]. These features will be highlighted in the sections below.

# Channelization

802.11aj defines a CDMG STA operating in the 60 GHz band with 2 channel modes, 2.16 GHz channel width or 1.08 GHz channel width.

A CDMG STA operating with a 2.16 GHz channel width uses the DMG PHY as defined in 802.11ad . To enhance coexistence, it uses the same 2.16 GHz channel spacing with the same common channelization as defined in Clause 20 for 802.11ad [4]. 802.11ad previously addressed the co-existence with 802.15.3c [4] [5], therefore a CDMG STA using the same DMG PHY co-exists with the 802.15.3c devices similarly.

A CDMG STA operating with a 1.08 GHz wide channel uses a Dynamic Bandwidth Control (DBC) mechanism (see 9.41a in 802.11aj) for establishing a CDMG BSS that is similar to the procedure defined in 802.11ad when establishing a DMG BSS.

A CDMG AP or PCP operating with a 1.08 GHz channel width within a 2.16GHz channel provides coexistence with DMG BSS by:

* scheduling a DMG beacon header interval (BHI) with the 2.16 GHz wide channel in at least a Beacon Interval (BI)
* transmitting DMG Beacon frames on both the 2.16 GHz and the 1.08 GHz channels
* scheduling DTI with the 2.16 GHz channel and/or the 1.08 GHz channel when operating a CDMG BSS

A CDMG STA operating on a 1.08 GHz channel transmit RTS / DMG CTS / DMG DTS frames for each TXOP on the 2.16 GHz channels.

A CDMG AP or PCP operating on a 1.08 GHz channel uses the EDMG AP or PCP clustering mechanism to mitigate Inter-BSS interference.

Therefore, other mmWave devices operating on the 2.16 GHz channel detect the DMG Beacon frame and a CDMG STA can detect a transmission from a device of other mmWave devices at least in a period of beacon interval.

STAs compliant with the physical layer defined in clause 25 of 80 2.11aj [1] operate in the channels defined in the additional rows introduced into the tables in Annex E of [1] (see below) when they operate in 60GHz frequency band.

When 802.11aj operates in the 45 GHz frequency band, it adopts a new channelization defined in the additional rows introduced into the tables in Annex E of [1] (see below) but no coexistence issue as there is no other wireless system operating in this 45 GHz frequency band in China at the time 802.11aj [1] was completed.

Table E-4 – Global operating classes

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Operating class** | **Nonglobal operating class(es)** | **Channel starting frequency (GHz)** | **Channel spacing (MHz)** | **Channel set** | **Channel center frequency index** | **Behavior limits set** |
| 108 | E-1-34, E-2-18, E-3-59 | 56.16 | 2160 | 1,2,3,4 | ---- | ---- |

Table E-5 – Operating classes in China

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Operating class** | **Nonglobal operating class(es)** | **Channel starting frequency (GHz)** | **Channel spacing (MHz)** | **Channel set** | **Channel center frequency index** | **Behavior limits set** |
| <ANA> | <ANA> | 59.4 | 2160 | 2,3 | ---- | ---- |
| <ANA> | <ANA> | 59.4 | 1080 | 5,6,7,8 | ---- | ---- |
| <ANA> | <ANA> | 42.66 | 540 | 1,2,3,4,5,6,7,8 | ---- | LicenseExemptBehavior |
| <ANA> | <ANA> | 47.52 | 540 | 9,10 | ---- | LicenseExemptBehavior |
| <ANA> | <ANA> | 42.93 | 1080 | 11,12,13,14 | ---- | LicenseExemptBehavior |
| <ANA> | <ANA> | 47.79 | 1080 | 15 | ---- | LicenseExemptBehavior |
| <ANA> | Reserved | Reserved | Reserved | Reserved | ---- | Reserved |

# Preamble Design for Coexistence

When 802.11aj operates on a 2.16 GHz channel in the Chinese 60 GHz frequency band, it uses exactly the same preamble design as 802.11ad [1] [4]. This enables the co-existence with 802.11ad. While 802.11ad uses repetitions of the same sized Golay codes and SC chip rate as 802.15.3c in preamble respectively. The same preamble design therefore enables simple correlators to significantly enhance detection of one another between 802.11ad/802.11aj and 802.15.3c.

When 802.11aj operates in the 45 GHz frequency band, it uses a different preamble design from 802.11ad [1] [4] but no coexistence issue as there is no other wireless system operating in 45GHz frequency band in China [1] [6] at the time 802.11aj [1] was completed.

# BSS Establishment

When 802.11aj operates in the 60 GHz frequency band, to minimize interference to other systems, an 802.11aj AP should not start an infrastructure BSS on a channel where the signal level is at or above -48dBm or upon detecting a valid IEEE 802.11ad preamble or IEEE 802.15.3c CMS preamble at a receive level equal to or greater than -60 dBm. As previously described, commonalities in the preamble design of 802.11aj, 802.11ad and 802.15.3c enable detection with tighter thresholds.

* In 802.11a/n, MCS 0 (BPSK, R=1/2) receive sensitivity is -82dBm and non-802.11 detection level is -62 dBm → 20 dB difference
* In 60 GHz, SC MCS 1 receive sensitivity is -68 dBm → 8 dB difference with respect to required 802.15.3c CMS preamble detection threshold
* Requirement of detection of 802.15.3c CMS preamble is 12dB more stringent than 802.11a/n and non-802.11 detection!

When 802.11aj operates in the 45 GHz frequency band, there is no coexistence issue as there is no other wireless system operating in the 45 GHz frequency band in China at the time 802.11aj [1] was completed.

# Coexistence Analysis

When 802.11aj operates in 60 GHz frequency band, as described in section 2, the same channel spacing for 802.11ad was kept to match both 802.11ad and 802.15.3c. As described in Section 3, the similar 802.11ad preambles were kept to be similar to both 802.11ad and 802.15.3c. Furthermore transmit power levels and receive sensitivity of 802.11aj system should be comparable to both 802.11ad and 802.15.3c.

When 802.11aj operates in the 45 GHz frequency band, there is no coexistence issue as there is no other wireless system operating in the 45 GHz frequency band in China at the time 802.11aj [1] was completed.

# Acronyms

* AP Access Point
* STA Station
* CMS Common Mode Signaling
* BSS Basic Service Set
* MCS Modulation and Coding Scheme

# References

[1] Draft P802.11aj D1.0

[2] 11-12-0141-07-cmmw-ieee-802-11-cmww-sg-5c

[3] 11-12-0140-09-cmmw-ieee-802-11-cmmw-sg-par

[4] IEEE Std 802.11ad-2012

[5] IEEE Std 802.15.3c-2009

[6] 11-13-1365-02-00aj-45ghz-spectrum-allocation-in-china