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<b>Project</b>	<b>IEEE 15.4a</b>
<b>Title</b>	<b>Draft for optional CSMA multiple access control</b>
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<b>Re:</b>	<b>[]</b>
<b>Abstract</b>	<b>[Definition of optional CCA modes]</b>
<b>Purpose</b>	<b>[Preliminary optional CCA modes draft for further editing]</b>
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# Draft for optional CSMA multiple access control of 15.4a

## 6.8a.2.1 Frame structure which supports optional CCA modes

The PHY is optional to provide the capability to perform CCA operation. The optional CCA modes are used to support heavy loaded network which consists of large number of devices in a piconet. CSMA-CA mechanism for channel access shall be used when the optional CCA mode is enabled.

Because of the low radiation power, carrier-less, sparse and transient nature of impulse UWB signal, CCA of impulse UWB signal is considered to be difficult. Distinguishing from the carrier sense in the narrow band systems where CCA is provided by detecting energy from carrier, the CCA of impulse UWB symbol is implemented by detecting presence of UWB traffic. There are regular structures in the preamble portion of a frame (7.5.7a.2.1). The periodicity of preamble remains ever after multipath channel propagation. This enables the time average processing without frame synchronization. Spreading gain of the preamble symbol also benefits detection of preamble symbol. As a contrast, after scrambling by a long scrambler sequence, the data portion is random and lack of reliable structure for CCA. To enable CCA of impulse UWB signal at any time, regular structure is added into the data portion of frame by interleaving preamble symbols in the PSDU segments alternatively in the time domain. The insterted preamble symbols serve as regular CCA structures of the frame.

Figure CS-1 shows the frame structure which support optional CCA modes. The PSDU part of frame originates from the MAC sublayer (5.4.3). After adding SHR and PHR at the beginning of PSDU, the PHY layer of transmitter regularly inserts preamble symbols into the PSDU. The total PSDU is divided into PSDU segments, which are interleaved by preamble symbols alternatively. Each PSDU segments consists of *numPSDUBits* PSDU bits. The first preamble symbol shall be inserted immediately after the SFD. The PSDU shall be ended with a preamble symbol.

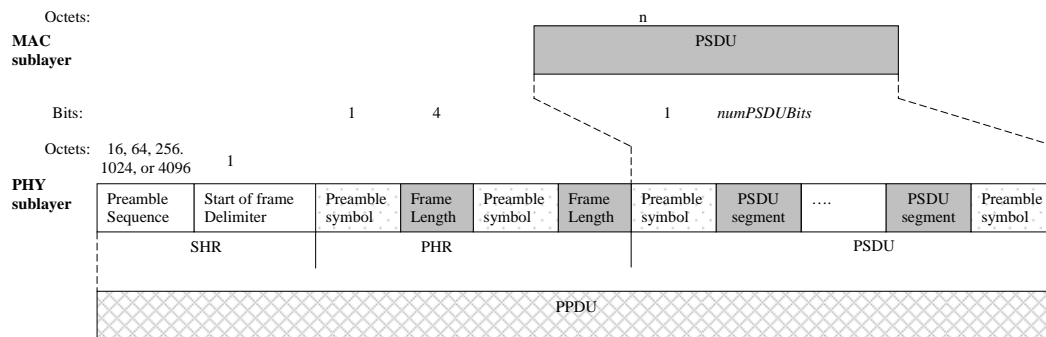


Fig.CS-1 Schematic view of frame structure which supports optional CCA modes

The modulation and waveform of the inserted preamble symbols shall use the mandatory setting. The spread code and PRF of inserted preamble symbols shall be the same as those of the regular frame preamble. The time interval between neighbour inserted preamble symbols shall be computed as per mandatory data rate (see 6.8a.1). When the mandatory data rate is used, the *numPSDUBits* shall be 4. The PHY layers shall guarantee the constant time interval no matter which optional data rate is used. Figure CS-2 shows the constant CCA detection window. Wherever the CCA detection window starts, either from the regular preamble or from the data portion in a frame, the CCA detectors shall find at least 8 preamble symbols in the CCA detection window.

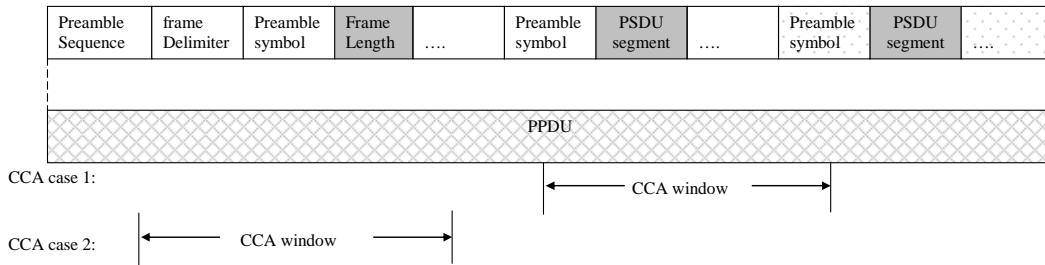


Fig.CS-2 CCA detection window

The PHY PIB attribute *phyCCAMode* (see 6.4) shall indicate the appropriate optional CCA mode.

The frame structures shall only be applied to data frame and MAC frame in the CAP when the PHY PIB attribute *phyCCAMode* (see 6.4) is set to the optional CCA mode. The frame structures shall not applied to

- all frames when PHY PIB attribute *phyCCAMode* (see 6.4) is set to mandatory ALOHA mode;
- data frame in the CFP;
- beacon frame and acknowledgement frame.

If the PLME-CCA.request primitive is received by the PHY during reception of a PDU, CCA shall report a busy medium. Otherwise, an idle medium shall be reported.

When receiving the frame structure, the PHY layer of the destinated device simply skips or discards the inserted preamble segments. Only the de-spread PSDU is passed to the MAC.

### 7.4.2a MAC PIB attributes

Table 86 — MAC PIB attributes

Attribute	Identifier	Type	Range	Descriptions	Default
...	...	...	...	...	
<i>macUWBCSMASupported</i>	xx	Boolean	TRUE or FALSE	TRUE if CSMA-CA of UWB PHY is supported. FALSE otherwise	FALSE
<i>macUWBCSMA</i>	xx	Boolean	TRUE or FALSE	Indication of whether CSMA-CA channel access of UWB PHY is enabled. TRUE if CSMA-CA is used. FALSE otherwise	FALSE