

Project	IEEE 802.16 Broadband Wireless Access Working Group < http://ieee802.org/16 >	
Title	Proposal to Amend Section 8.3.5.11.4 of TG3&4 Draft Document	
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Re:	TG3&4 Draft document	
Abstract	This document proposes a new section 8.3.5.11.4 to replace the old one in the 802.16ab draft document. Section 8.3.5.11.4 describes burst frame format details for the Single Carrier mode.	
Purpose	To propose replacement of section 8.3.5.11.4 and its dependent, descending subsections with the contents of this document.	
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Proposal to Amend Section 8.3.5.11.4 of TG3&4 Draft Document

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8.3.5.11.4 Burst Format Element Details

This section describes burst elements which are common to both TDM and TDMA bursts illustrated in Figure 46. The basic burst format is illustrated in Figure 1.

As is evident from Figure 1, a burst consists of, basically, three elements: an acquisition sequence, a payload, and null transmit (quiet) region following the end of a burst. The acquisition sequence enables the receiver to acquire and/or update parameters used to receive a burst. Burst profile parameters delivered by the MAC indicate the length of the acquisition sequence, with the nominal value used in system messages TBD. The acquisition sequence consists of at least one Unique Word, resident at the acquisition sequence end. All symbols (if any) preceding this Unique Word are a cyclic extension (i.e., a partial or full replication) of this 'final' acquisition sequence resident Unique Word. The acquisition sequence also contains a ramp-up region during which the power of the transmitter is ramped up. This ramping may be achieved by initializing the transmit filter memory with zeros, and then inserting the first few non-zero symbols of the 'actual' initialization sequence.

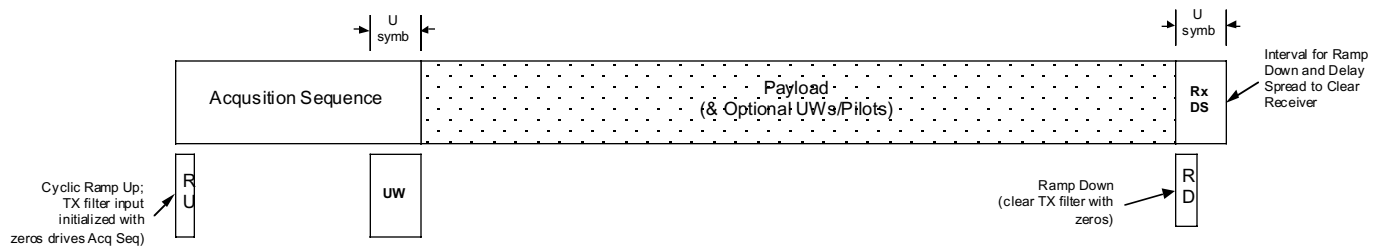


Figure 1: Basic Burst Format

The payload contains the data to be transmitted, and may also contain extra pilot symbols, grouped together in UWs, which may repeat at a regular interval. The null transmit region (RxDS) is a period over which the transmitter ramps down, and the receiver collects delay-spread versions of symbols at the end of the burst. The RxDS region should be the length of a UW, i.e., at least the delay spread of the channel. Note that the transmitter is expected to ramp down during this region by filling the transmit filter memory with zeros, and allowing its pulse shape to naturally drive the power to zero. Note that, in a TDD system, the transmitter may switch over to receive mode after the ramping region concludes; however, the receiver may not be able to switch over to transmit mode (without receiver performance degradation) until all of the delay spread is collected, and the RxDS region concludes.

Figure 2 illustrates, in more detail, a burst which is equalized by a frequency domain equalizer using an overlap-save type FFT method. Note that although a single FFT length is used in Figure 2, arbitrary payload sizes are accommodated, due to (a), the overlapping FFT sections, and (b), the receiver's use of zero padding at the end of the receive burst, to fill out enough data to complete the final FFT. Mark that the zero padded symbols are not transmitted; they are added at the receiver immediately before computing the final FFT. Use of this arbitrary length format would be specified by a burst profile designating its selection. Note that pilot symbols may be interspersed within the payload as desired; they just are not explicitly used by the FFT processing engine.

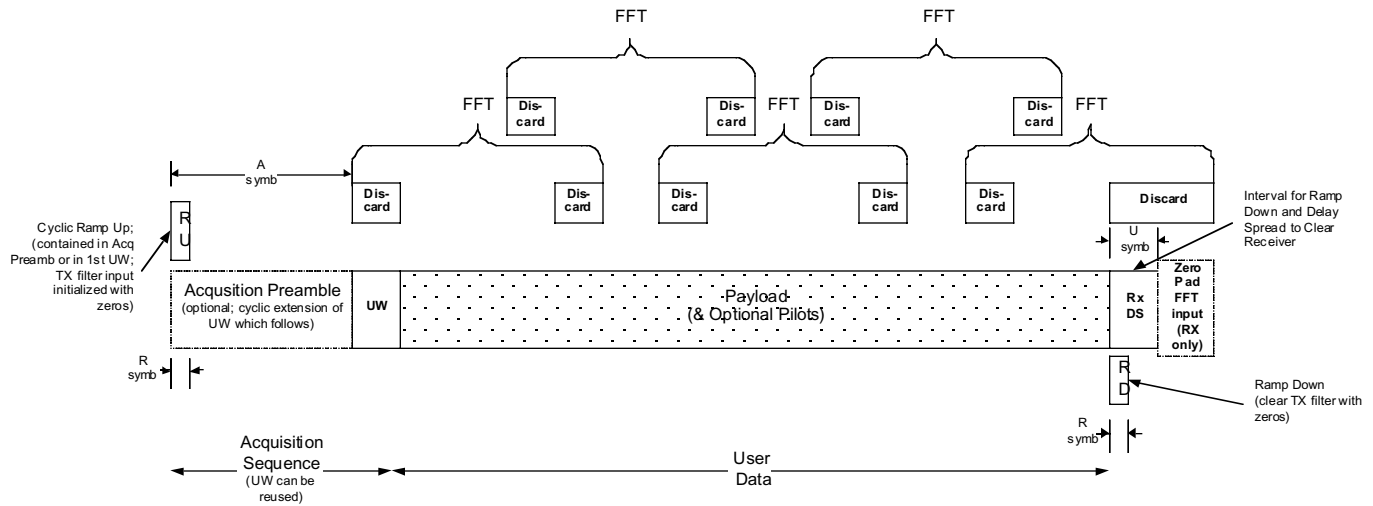


Figure 2: Burst frame format with arbitrary payload size, being equalized by a receiver using overlapping FFTs and receiver-injected zero-pad data.

Another burst frame format, which is more efficient in its use of FFT computational resources, but is less efficient in its utilization of channel resources, is illustrated in Figure 3. Note the explicit use of regularly spaced Unique Words. For this case, the UWs are spaced at intervals that accommodate FFT processing, so that the overlapping of Figure 2 is not necessary. Each FFT shown in Figure 3 spans a payload block and UW, which together are of a power of 2 length that is particularly amenable to efficient FFT processing. This constraint, however, limits the payload size to finite multiples of $F - U = N$, where F is the FFT size and U is the Unique Word length. To allow a limited amount of flexibility in block sizes, some receivers might enable the final FFT to be shortened to a smaller power of 2, as Figure 3 illustrates. Note that a receiver which can equalize a burst such as the one in Figure 2 would automatically be capable of processing a burst such as the one shown in Figure 3. Observe also from the figure that a final UW be transmitted, which can be unwanted overhead when burst lengths are small. Due to the channel inefficiencies of this approach when handling small bursts, the facility of a receiver to process bursts formatted as depicted in Figure 2 is mandatory (so that control bursts can be sent in that format). A receiver can request that it receive selected data bursts in the optional burst profile format of Figure 3, however.

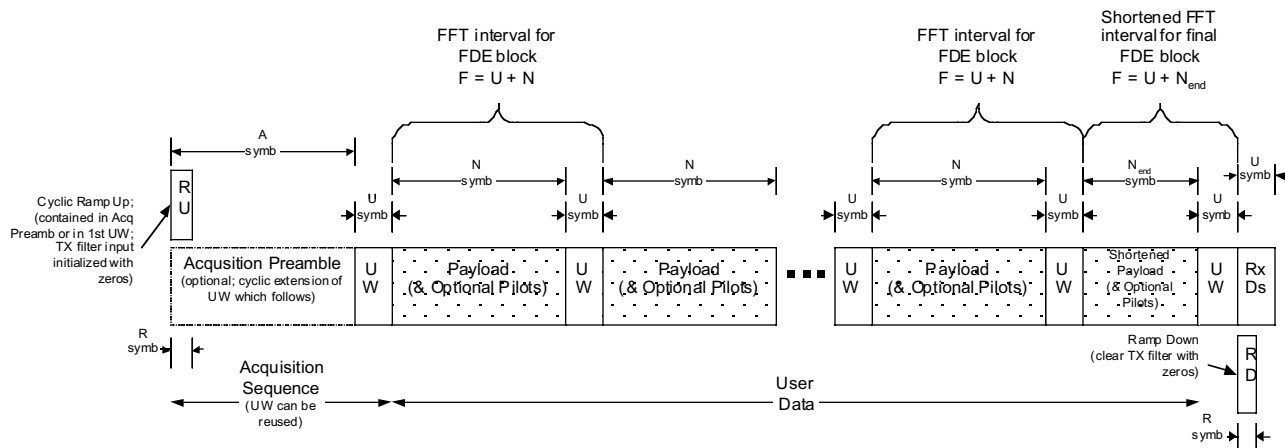


Figure 3: Burst with UWs incorporated and spaced to facilitate efficient frequency domain equalization.

Another optional burst profile format is illustrated in Figure 4. As Figure 4 demonstrates, if a FDE-equipped receiver is capable of 'backing up' its last FFT to the beginning of the last Unique Word (as well as adding zero

padding pre-FFT, and discarding redundant equalized data), the receiver may equalize bursts of arbitrary sizes, and also eliminate the final Unique Word. Note that the format of Figure 4 is nothing more than a special case of Figure 2. However, it takes advantage of the FFT-sized spacing of Unique Words so that overlapping is only necessary when processing the last FFT.

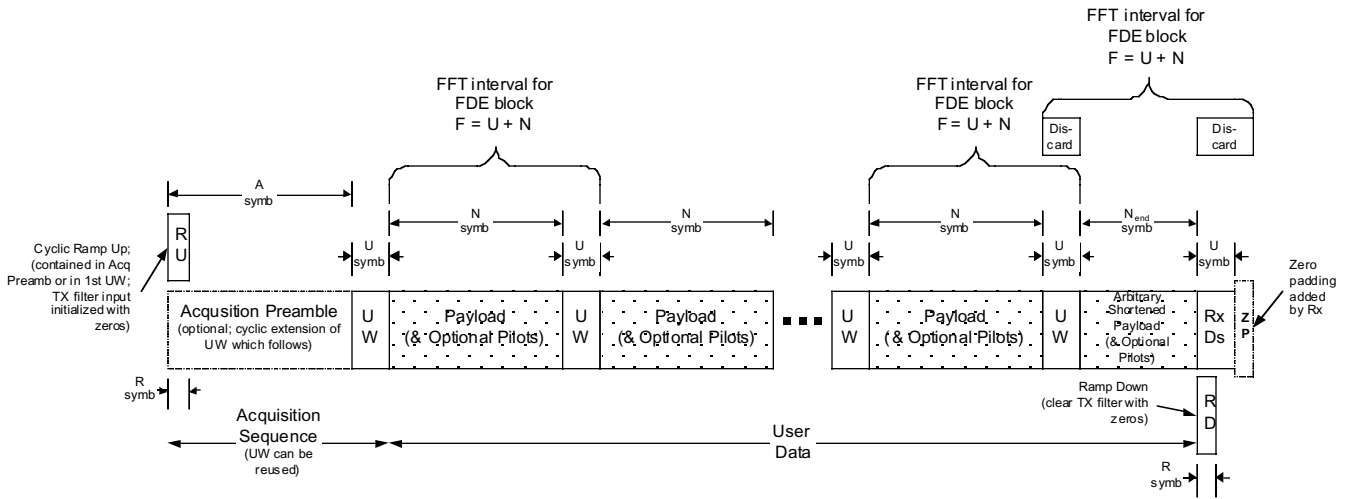


Figure 4: Burst format of arbitrary payload size with UWs spaced to facilitate efficient frequency domain equalization.

Observe that although the preceding burst formats have been described and formulated in terms of applicability to frequency domain equalization techniques, these formats should also be amenable to temporal domain equalization techniques, as well.