

INVENTION DISCLOSURE

1. Invention Title.

Mixing Legacy ATDMA DOCSIS with OFDMA

2. Invention Summary.

By correctly timing the transmission of legacy ATDMA it can be incorporated into an OFDMA transmission block and orthogonality can be maintained between the two disparate transmission methods.

3. Invention Description.

It is desirable to simultaneously use or share a bandwidth for both TDMA (or ATDMA) transmissions as used in DOCSIS 3.0 and OFDMA transmissions as used in OFDMA. This can be conventionally accomplished by treating them as two services using different bandwidth, and allow conventional filtering to separate them. This results in wasted bandwidth.

Fig 1 illustrates another approach. Basically, you set parameters on the DOCSIS 3.0 transmissions to fit-in with DOCSIS 3.1 frames. If a D3.0 carrier occupies 6.4 MHz, it can be assumed to be comprised of 128 (for 4k OFDM) or 256 subcarriers (for 8k OFDM). This is 6.4/.025 MHz or 6.4/.05MHz. It needs to start transmission at the beginning of an OFDM symbol, and conclude at the end. The obvious problem with this is that the ATDMA does not contain a cyclic prefix (CP or guard interval). This can be remedied by using a quiet time period as a cyclic prefix for the ATDMA.

Another obvious problem is the splatter from the OFDMA transmissions going into the ATDMA band. This will not be a problem either because the instant the splatter energy is being created by the OFDMA carriers, the ATDMA is not receiving.

Fig 1 is a spectral plot of 0 to 42 MHz showing OFDMA and ATDMA transmissions simultaneously. The OFDMA carriers stay out of the 6.4MHz band occupied by the ATDMA.

Fig 2A is a time plot of the OFDMA with a CP (guard interval). Fig 2B is a time plot of a ATDMA transmission with a same start time, and a same stop time as the OFDMA burst. A CP has been created by silence on the ATDMA carrier. This dead-air time CP is needed because an echo from the previous burst may land in the quiet time.

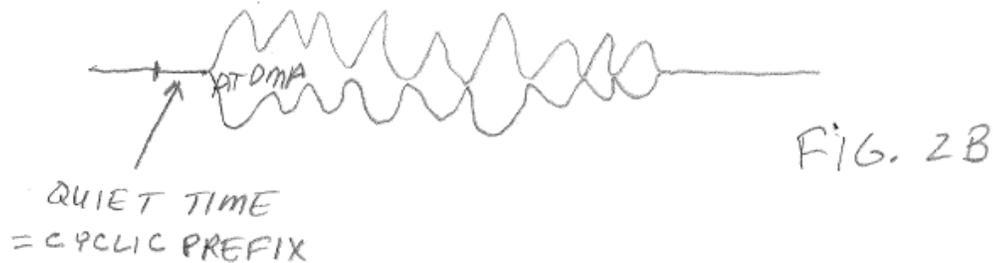
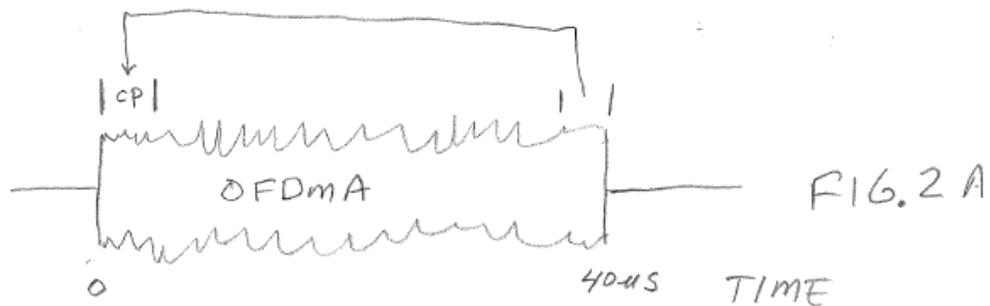
Equalization for the ATDMA may use predistortion. At the CMTS receiver any linear distortion in the ATDMA signal can be removed by frequency domain equalization, just like the OFDMA subcarriers utilize.

In essence, this idea uses already-deployed D3.1 carriers as SC-FDMA transmissions that can be fully-orthogonal to OFDMA subcarriers at other frequencies.

Another variant on this idea is to make D3.1 ATDMA carriers that are conventional SC-FDMA. This would be more a more efficient use of bandwidth relative to D3.0 carriers

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because you could get more time domain symbols into the OFDMA period if you did not gradually ramp up and ramp down the power level, and you use actual symbols for the cyclic prefix instead of quiet time.



Witness & understood
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Briefly outline the potential commercial value and customers of the invention.
Huge.

4. **How is this invention different from existing products, processes, systems?**
This idea shows how to orthogonally interleave legacy DOCSIS with OFDMA.