Invention Title
N+0 Architecture with a Bidirectional Mid-Band

Invention Summary
A flexible N+0 architecture allowing a bi-directional frequency band in the middle. It is backwards compatible with legacy terminal equipment, and allows sub-split, mid-split and high-split gear to co-exist on the same plant. Accommodates switchable diplex filters. Mid-band can be FDD or TDD.

Invention Description
See below.

Invention Commercial Value/Customers
Very large.

N + 0 Architecture Using a Bi-Directional Mid-Band

Problem:

As cable network evolve and cascade lengths shorten, the argument about an optimal upstream/downstream frequency split becomes one of terminal equipment; there are no diplex filters in N + 0 coaxial plant because there are no amplifiers in the coax line. Legacy equipment, especially set-top boxes, are an incredibly valuable asset that cannot be scrapped.

Solution:

See Fig. 1. This is a frequency plan that has a dedicated 5-42MHz band for legacy upstream signals, a 500-1200MHz band for only downstream signals, and a 42-500 MHz band that can be used for either upstream or downstream transmissions. (The 500MHz number is for reference and is open for discussion).

The problem with the 42-500MHz band is that legacy terminals are expecting 54MHz and above to be a receive band. A transmission from inside a home (e.g. at 65dBmV) could desensitize a legacy receiver also inside that home because of poor splitter isolation. This can be remedied by a $3 windowed filter placed in front of the legacy receivers. The window would pass the out-of-band (OOB) signal, and prevent receiver desensitization.

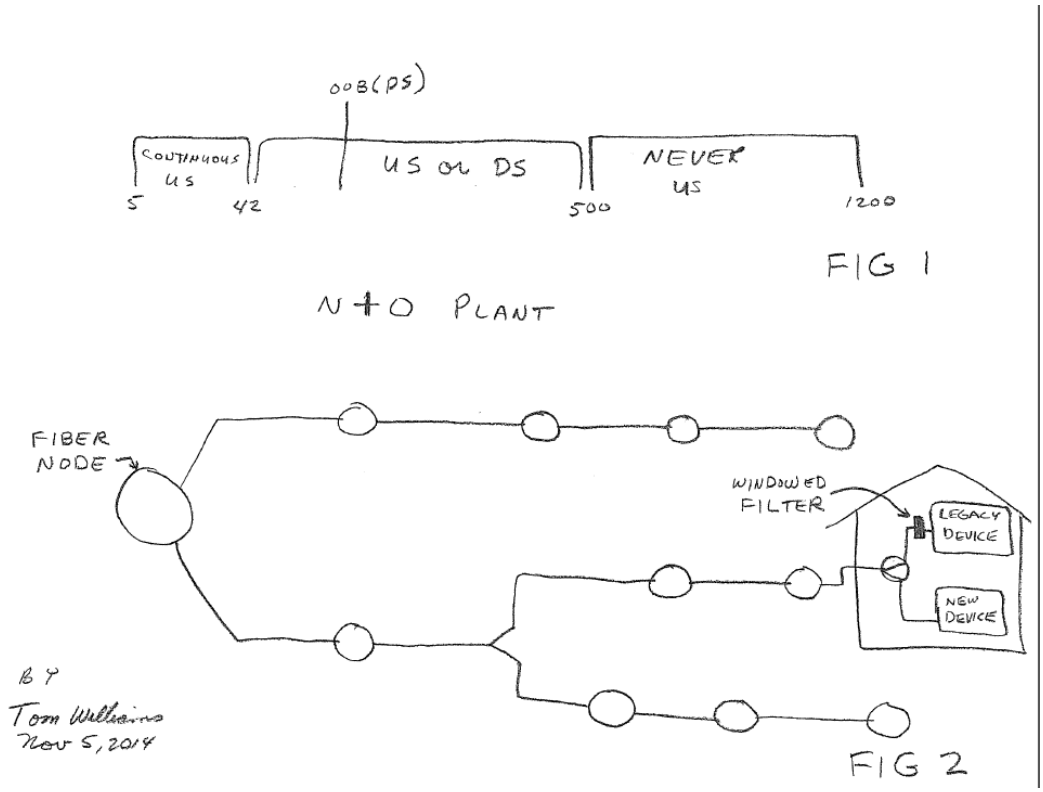
With the 42-500MHz band available for 2-way communications, there are multiple possibilities:

1. Run the legacy 5-42 and 54-1000 plant just as it is today, with no changes and no window filters.
2. Put in the window filters on legacy STBs and CMs and run DOCSIS 3.1 modems with 204 MHz upstreams.
3. Put in the window filters and allow the 42-500MHz band to carry TDD (time division duplex) data. The DOCSIS 3.1 upstream transmission system (OFDMA) could be used bi-directionally. The OOB frequency would be avoided by upstream traffic.

Fig 3 is a N+0 cascade frequency response (S21=S12) for reference.

The windowed protection filter could be installed inside a gateway. Inside the gateway the windowed protection filter could have a variable high-pass frequency to accommodate changing the 500MHz frequency divide dynamically.

Alternately, the gateway could also include MOCA isolation filtering.



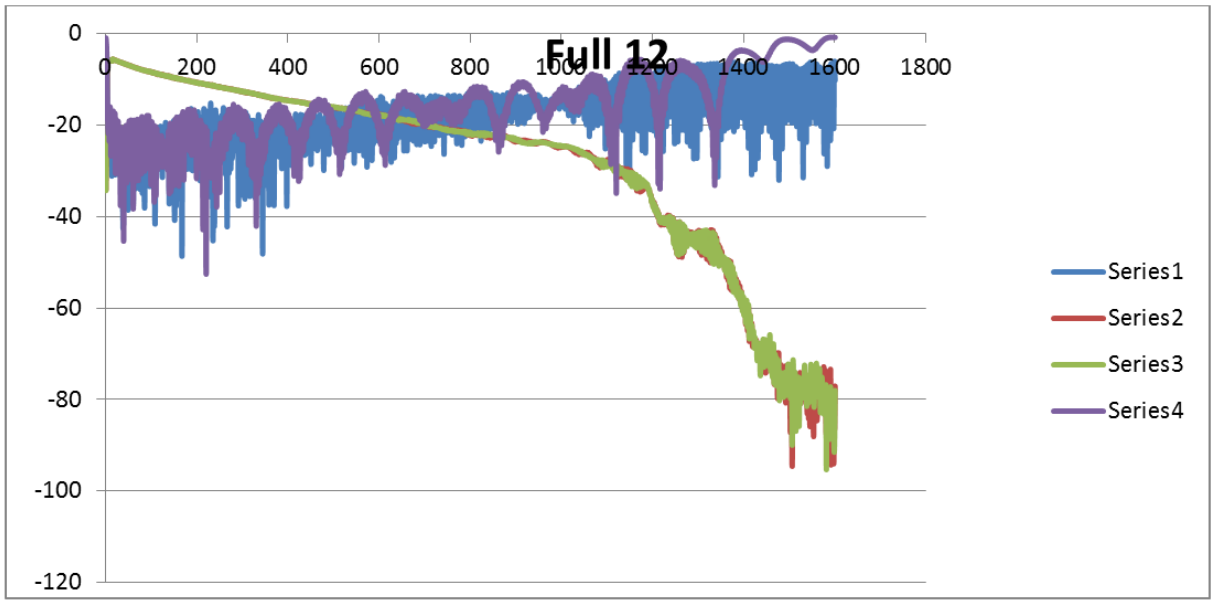


Fig 3. A Frequency Response Plot (green) for a N+0 cascade with 4 taps.