

Achim Trutschel

Senior Digital Design Engineer

Wideband Transmission for High-Throughput Satellites

Wideband satellite transponders are often still operated in multicarrier mode with several narrowband carriers side by side. Each of these carriers is provided by different modulators transmitting one single or multiple input streams. All these modulators operate at symbol rates that are a fraction of the satellite's transponder bandwidth. Guard bands between the carriers are required in order to avoid spectral overlap. Additionally, transponders operated in multiple carrier mode require higher output backoff (OBO) compared with operation in single carrier mode. This keeps the carrier-to-carrier interference caused by the nonlinearities of the transponder within an acceptable limit.

The multiplex efficiency of a number of narrowband carriers is lower than using a wideband carrier. To circumvent this problem rather complicated channel bonding schemes have been introduced. As a result, the transponder's capacity is not used as efficiently as it could be.

Combining all the input streams into one multiplex and transmitting them by one single wideband carrier allows for a more efficient use of the available bandwidth. Operating at higher output power enables higher modulation order and/or less FEC protection, resulting in a higher throughput of payload data.

This wideband carrier is now provided by one high-speed modulator with powerful signal processing capabilities. One or more input streams can be aggregated and tagged as a specific time slice of the overall multiplex. Each time slice within a multiplex in time domain can be understood as a virtual symbol rate. This is just a portion of the wideband carrier, which sometimes also called a virtual transponder.

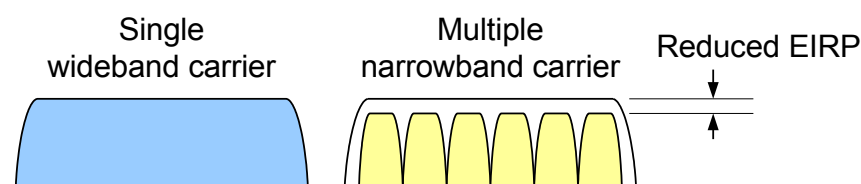


Fig.1 Single Wideband Vs Multiple Narrowband Carriers

With single wideband carrier operation, flexible allocation of capacity within the wideband transponder is possible. This can result in a higher multiplex efficiency and a higher overall throughput.

Wideband operation requires demodulators providing at least high-speed demodulation and high-speed processing on the physical layer, whereby only a few time slices of the complete multiplex may be selected for further FEC and output processing. Annex M of the DVB-S2 standard describes a suitable signal format for such purposes. In addition, Annex E of the DVB-S2x standard describes signal formats suitable for time slicing.