Time-domain specifications in EMI Filters design.

In most cases during EMI specifications for a converter are given in terms of the maximum allowed peak-to-peak ripple of a given time-domain signal.

The question arises of how to translate these specifications into a frequency-domain description of the EMI filter. This note is meant to point out some important facts to be considered:

Given a time-domain signal with multiple frequency components and a certain peak-to-peak ripple, there is no guarantee that when processed through an LTI filter with magnitude less than 1 at all frequencies, the resulting peak-to-peak output ripple will be smaller than that of the input.

Example:

If the LTI filter (which presumably models the EMI filter we are designing) has a steep roll-off at frequencies higher than the fundamental of the input ripple, then we can assume to the first order that the output ripple will contain only the fundamental and therefore:

Magnitude of LTI filter & ripple fundamental has to be less than the allowed peak-to-peak magnitude output ripple divided by the peak-to-peak magnitude of the fundamental of the input ripple.