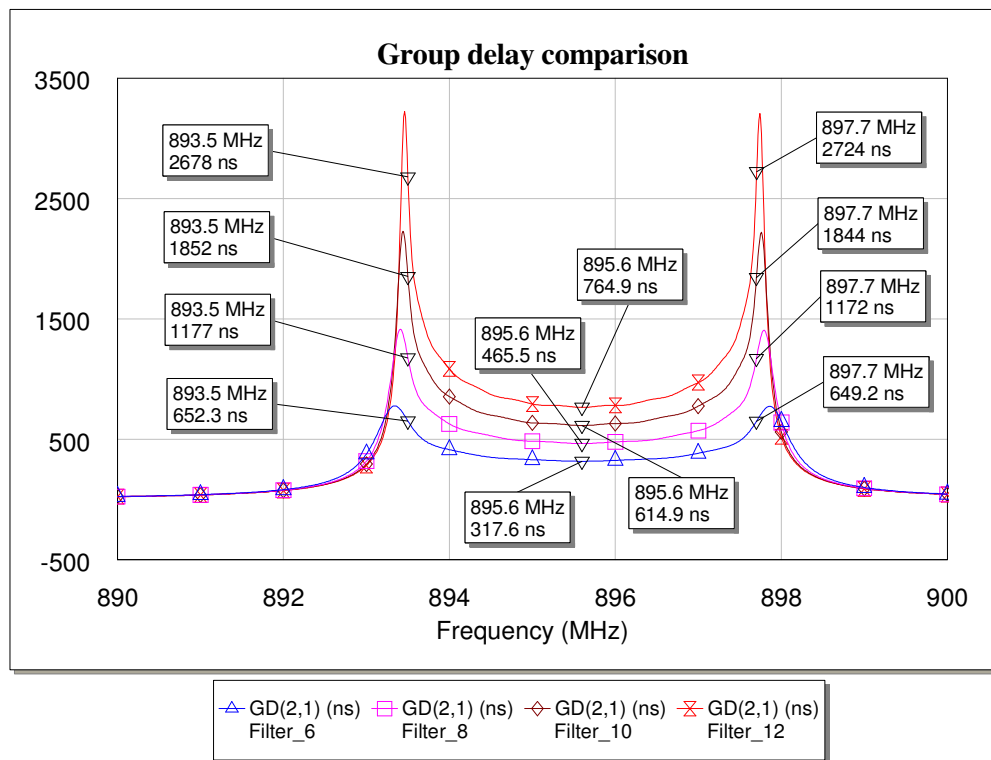## FILTER GROUP DELAY BEHAVIOUR

The following test case is used:

- TS bandwidth was used: 893.5 MHz – 897.7 MHz.
- Behavioural Chebyshev models from Microwave Office used.
- Transmitted (s_{21}) group delay is always considered.

STRAIGHT CHEBYSHEV FILTERS

Figure 1.1: Comparison of transmitted group delay
for straight Chebyshev filters with 6, 8, 10, and 12 resonators.

The following can be concluded:

- The flat section in the middle increases linearly with increasing the number of resonators.
- Peaks become (nonlinearly) higher, and they also move in towards the centre of the band.
- The slope connecting the flat section in the middle with the inner side of the peak (the largest variation), becomes (nonlinearly) steeper as the number of resonators increases.

Table and graphs below illustrate this.

| Number of resonators	Mid-band GD [ns]	Max band edge GD [ns]	GD variation [ns]
6	317.6	652.3	334.7
8	465.5	1177	711.5
10	614.9	1852	1237.1
12	764.9	2724	1959.1
18	1216.1	6066.6	4850.6
24	1667.9	10807	9139.5

**Table 1.1**: Mid-band, max band-edge, and GD variation values.
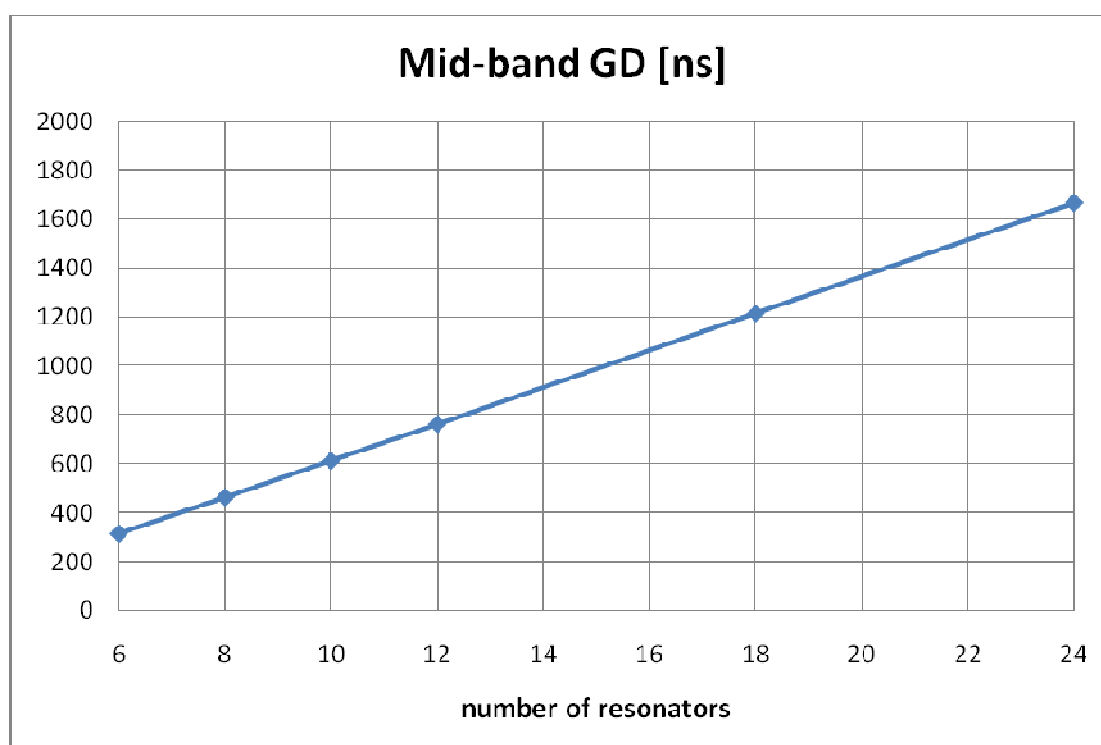
Figure 1.2: Change in mid-band group delay value with increasing the number of resonators in a straight Chebyshev configuration. The increase in group delay value is clearly linear.
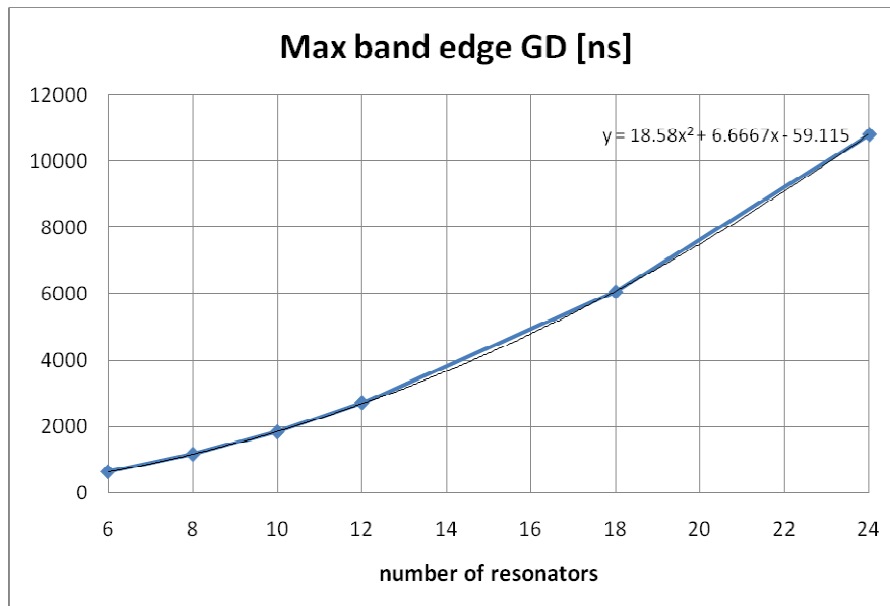
Figure 1.3: Increase in group delay value at the filter band edge with increasing number of resonators. Unlike the linear increase in the centre of the band, the change in group delay value is faster than linear. A second-order polynomial function can be used to fit the group delay behaviour.
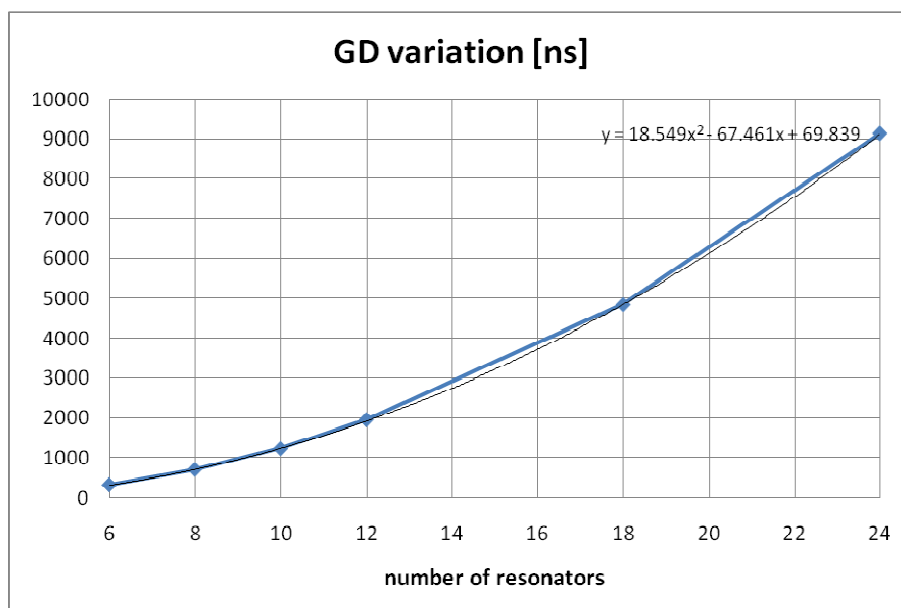
Figure 1.4: Increase in group delay variation over the filter passband. This is the difference between band-edge values shown in Fig. 1.3, and mid-band values shown in Fig. 1.2. As it is a straight difference, the behaviour can still be fitted by a second-order polynomial function.
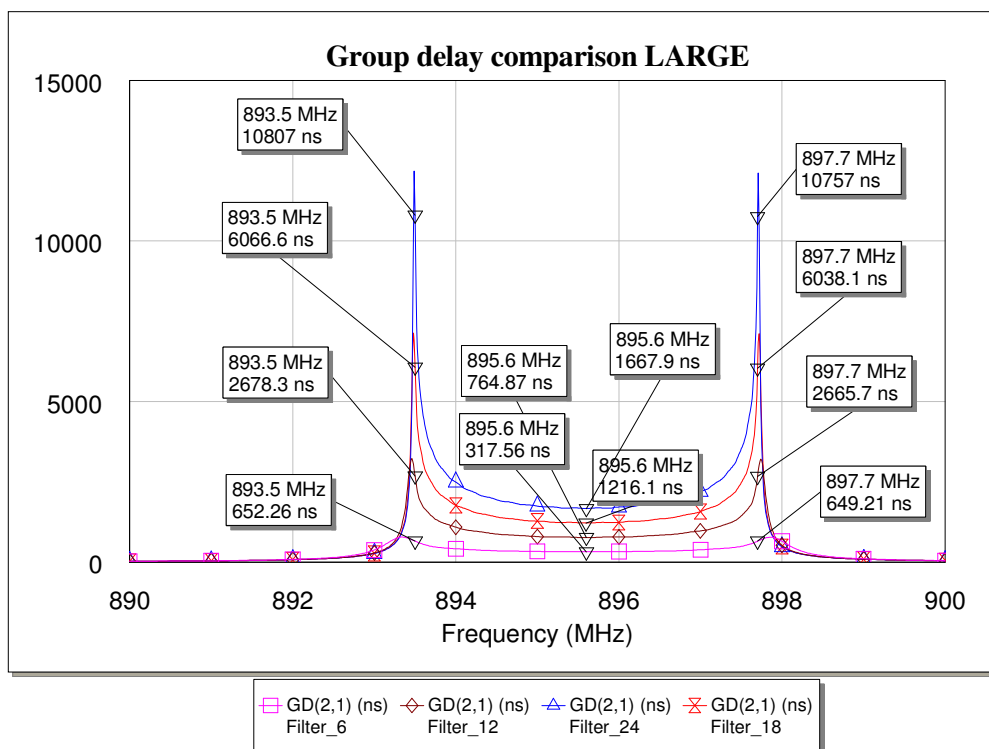
Figure 1.5: Comparison of transmitted group delay
for straight Chebyshev filters with 6, 12, 18, and 24 resonators.
The behaviour and conclusions are the same as in the case of Fig. 1.1.

VERSION INFORMATION

Version 1 (12 MAR 2009): First release.