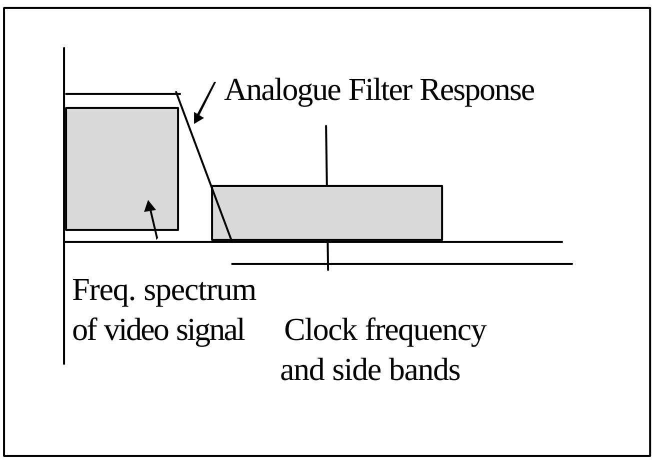
VIDEO FILTERS

Antialiasing and Reconstruction Video Filters

The main application of video filters is in the conversion from analogue to digital and digital to analogue for full broadcast standard signals. The CCIR recommendation 601 specifies the filters to be used. These filters are usually referred to as antialiasing and reconstruction filters. In sampling theory the Nyquist rule that the minimum sampling rate must be at lease twice the maximum frequency of the signal to be retained is used. As filters cannot have an infinite cut off rate (if they did unacceptable time domain ringing would be introduced) a sampling frequency slightly greater than twice is usually chosen. Before sampling the bandwidth of the signals should be limited to restrict the lower side-band frequency components of the samples signal. Otherwise these may modulate with the base-band signal after conversion back to analogue. This would lead to noticeable aliasing components appearing on the picture.

After the digital to analogue conversion the sampling frequency and its sidebands remains and the signals is seen as made up from discrete packets of frequencies. A reconstruction filter removes the sampling frequency and its sidebands which results in the reconstruction of a smooth analogue signal.

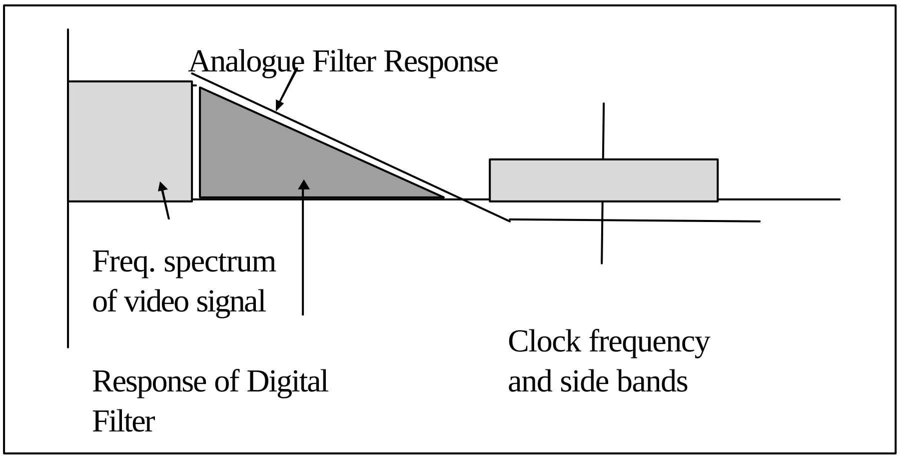
The diagram below illustrates the above for a system using a normal sampling system.



PACKAGE DETAIL

Oversampling Filters

As can be seen the filter need to have a fairly sharp cut-off rate and hence be group delay and amplitude equalised. To reduce the complexity of the filter it is possible in many systems to employ oversampling techniques. In standard definition video systems for the luminance channel the standard oversampling frequency is 27MHz. A digital filter is included in the decimator to attenuate the energy from the end of the passband up to 19.25MHz. An analogue filter having a relatively slow cut-off rate and little or no equalisation can then be employed. This removes the clock frequency and the sidebands and reconstructs the signal.



Sinx/x Distortion

When a signal is sampled the sampling window is usually constant and hence as the frequency being sampled increases less energy is 'collected'. This results in the signals having a loss against frequency. For a 5.5MHz bandwidth signal sampled at 13.5MHz the loss at 5.5MHz is 2.56dB. The shape of the loss frequency curve is a function of frequency and is defined by an equation of sinx/x form. It is usual to include a correction for this in the passband of the reconstruction filter.

Timing Considerations

In many video systems, for instance with component video, the luminance and colour difference signals pass through filters with widely different cut off frequencies. This results in the filters having different insertion delays. In order to restore the correct timing it is necessary to delay the luminance signal by the delay difference. For a typical full CCIR rec.601 system the delay may be of the order of 600ns. As video delay lines are expensive and will add further distortion to the signal. A more elegant solution is to delay the

Faraday Technology Ltd.
Croft Road Industrial Estate,
Newcastle, Staffordshire
ST5 0QZ. England.

Tel: + 44 (0)1782 661501
Fax: + 44 (0)1782 630101
Email: sales@faradaytech.co.uk
Web site: http://www.faradaytech.co.uk

luminance signal by a number of clock cycles in the digital domain and to either introduce a small analogue delay line or to purchase filters which are matched in insertion delay to the nearest integer of the clock frequency. The difference in the reconstruction delay between the luminance and chrominance channels must also be taken into account.

Faraday Technology Ltd.
Croft Road Industrial Estate,
Newcastle, Staffordshire
ST5 0QZ. England.

Tel: + 44 (0)1782 661501
Fax: + 44 (0)1782 630101
Email: sales@faradaytech.co.uk
Web site: http://www.faradaytech.co.uk