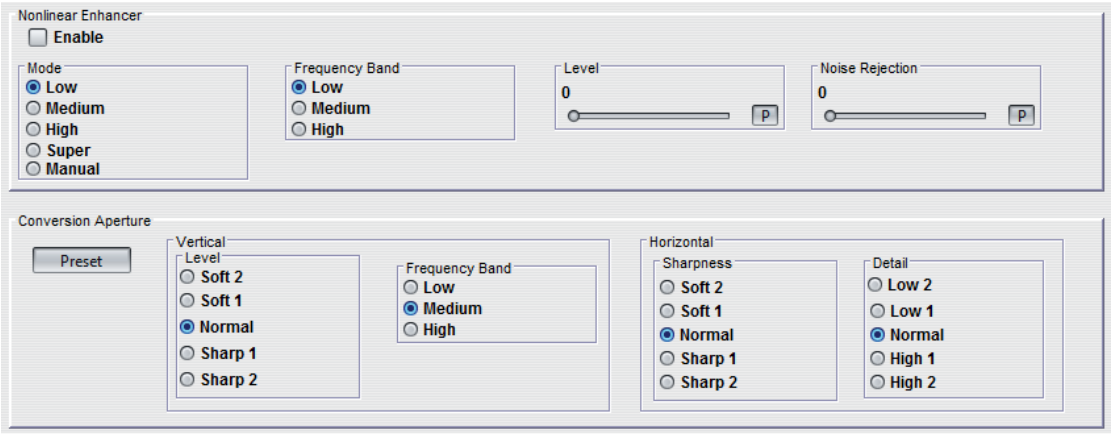
KudosPro

Product Application Note, # 1

‘Enhancer’

APPLICATION NOTE



Introduction:

This application note is applicable to all HD KudosPro Products. These include:

MC500

MC1000

MC2000

LC2000

LC4000

SV2000

SV4000

The Enhancer feature on this product range, offers a more powerful set of controls than is usually found on such a product. It is often generally the case that Enhancer feature controls just include simple Horizontal and Vertical Enhancement slide controllers enabling the magnitude of the Enhancement to be set both horizontally and vertically.

However, the KudosPro Enhancer feature allows for enhancement control to be selectively added with respect to Luminance Frequency. Separate Aperture control compliments the Non-linear Enhancement feature.

It should be considered that the primary purpose of the Enhancer is to regain lost detail. These maybe details lost as a result of post production processes, or maybe just because of the initial capture conditions. However, it is common for operators to use the Enhancer feature to artificially create the illusion of an ultra sharp aperture. This seems to be common in the Far East where the consequences of aliasing are often deemed of secondary importance.

Control Interface

Although full control of the Enhancement feature is available from the front panel, it is easier to control this feature via the Web Applet or via the Rollcall template:

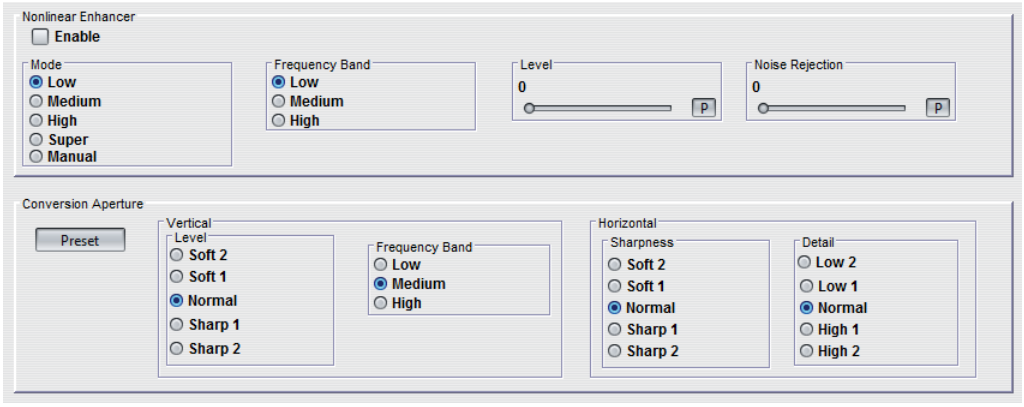


Figure 1: The Enhancer menu of the KudosPro RollCall template.

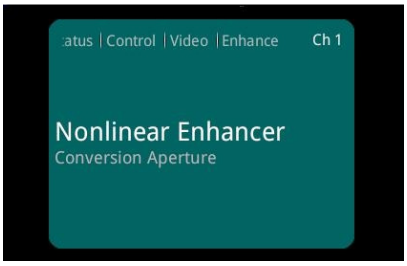


Figure 2: The Enhancer menu via the Front Panel.

Independent horizontal and vertical conversion aperture controls are offered. There is also separate control for the 'Nonlinear Enhancer'.

Note that on multiple channel units, that each channel has its own independent Enhancer feature.

Each channel can have a unique Enhancement configuration.

Note: The Rollcall Template and the Embedded Java Applet appear identical.

Nonlinear Enhancer:

The default setting for this control is 'Off'. To enable the feature, the 'Enable' box is selected:

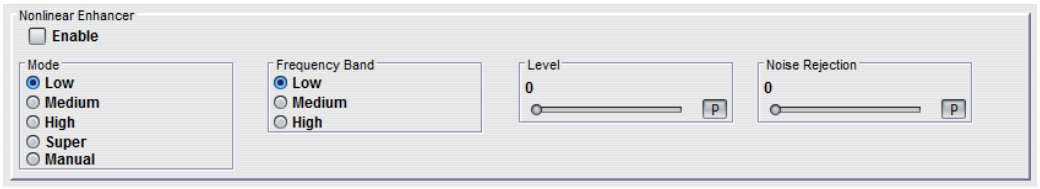


Figure 3: Nonlinear Enhancer 'Enable' control via Rollcall

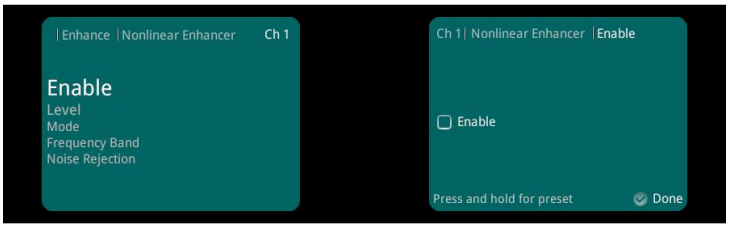


Figure 4: Nonlinear Enhancer 'Enable' control via the Front Panel

Note that the 'Nonlinear enhancer' is only applicable to the horizontal.

There are four sets of controls for the 'Nonlinear Enhancer':

-Mode

-Frequency Band

-Level

-Noise Rejection

Frequency Band

This parameter has three settings; Low, Medium and High. This relates to the frequency band being enhanced.

If a Line Sweep is considered as an input:

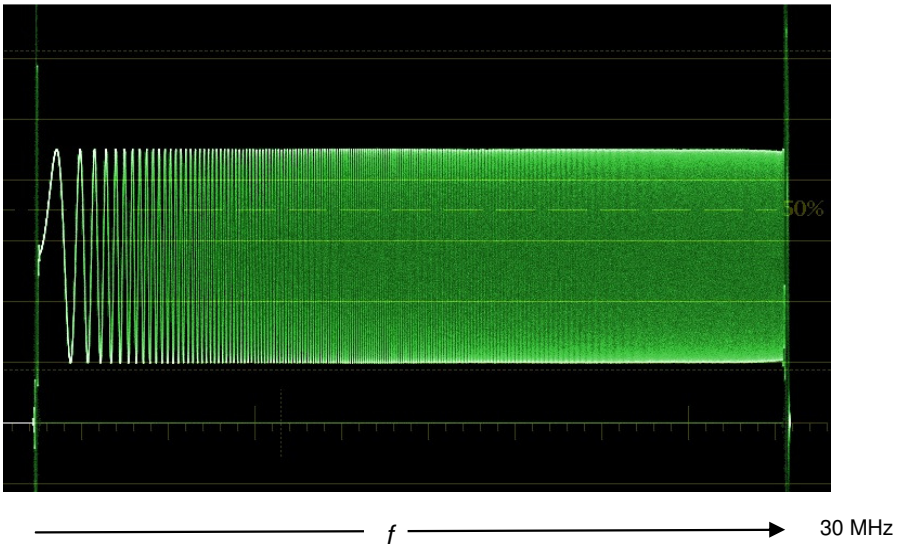


Figure 5: 0 to 30MHz Line sweep

Frequency Band control

This control allows selection of the particular frequency band to be enhanced:

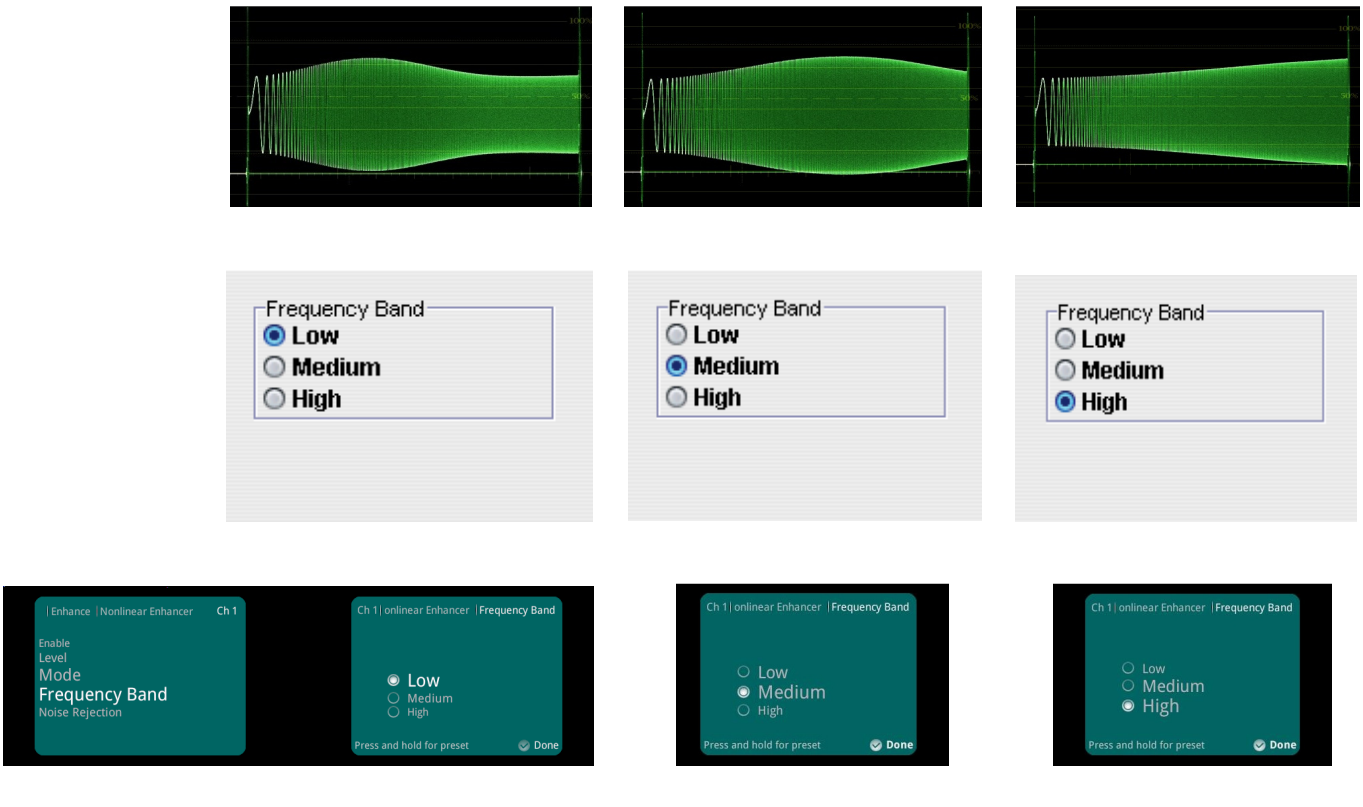


Figure 6: Frequency band controls via RollCall and via the Front Panel

Nonlinear Enhancer ‘Mode’ control

The ‘Mode’ control adjusts the magnitude of the enhancement applied. If this relatively low amplitude, HD Line-sweep is considered as the source:

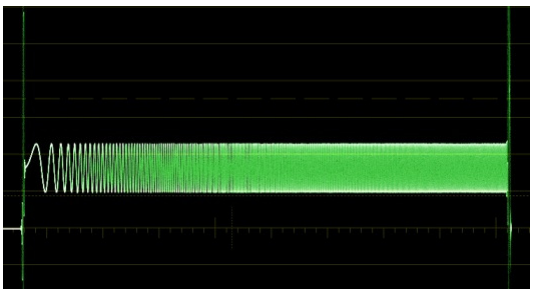


Figure 7: 0 to 30MHz, low amplitude sweep.

Non-Linear Enhancer ‘mode’ settings

This example shows the effect of enhancing the low frequency band and selecting the various ‘Mode’ settings:

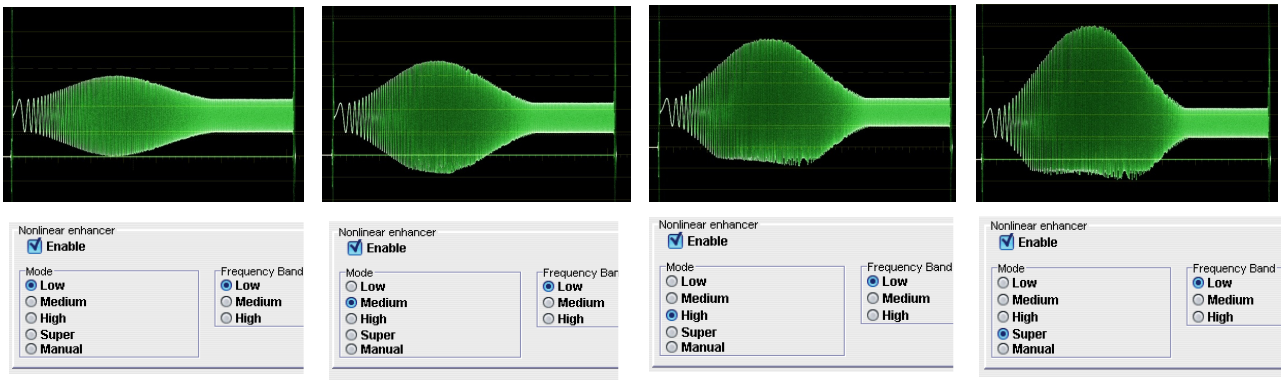


Figure 8: Non-Linear Enhancer ‘Mode’ settings via RollCall.

A full set of controls for the Non-Linear Enhancer controls are also available from the Front Panel.

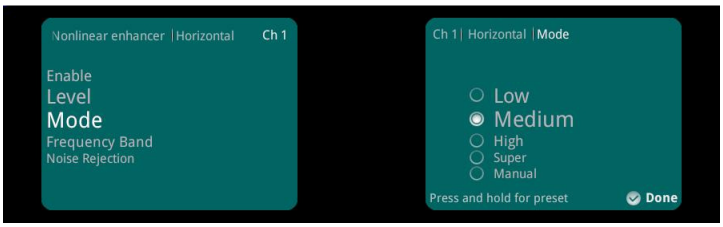


Figure 9: Non-Linear Enhancer ‘Mode’ settings.

Note – the waveform is slightly distorted when using higher Mode settings, due to the increased amplitude crushing against Black.

Note: MC500 does not have a ‘Super’ mode.

Non-Linear Enhancer Mode: 'Manual'

When 'Mode' is set to 'Manual', the actual amount of Enhancement can be controlled by the 'Level' slider.

The 'Manual' setting can be applied to any of the three frequency bands. Below are two examples of manual settings:

Figure 10: 'Manual' enhancement examples, via RollCall.

Manual Enhancement may be configured via the front panel:

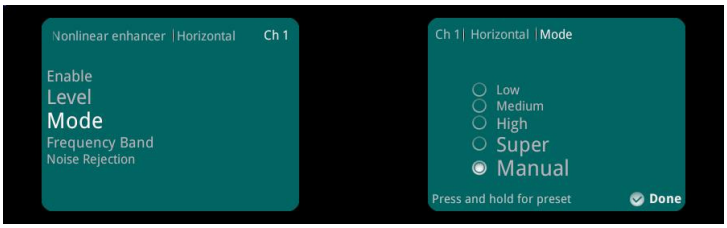


Figure 11: 'Manual' enhancement examples, via the Front Panel.

Noise Rejection

The 'Non-Linear Enhancer' feature also includes a 'Noise Rejection' filter. When processing noisy sources, enhancing the video can make the noise more obvious, because the noise is also subject to enhancement. The 'Noise Rejection' filter is designed to stop noise artefacts being enhanced when the Enhancer feature is employed. When enabled, the output noise should be no more noticeable in the output, than it was in the input.

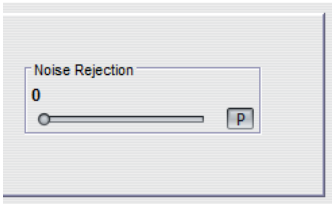


Figure 12. Noise Rejection control via RollCall

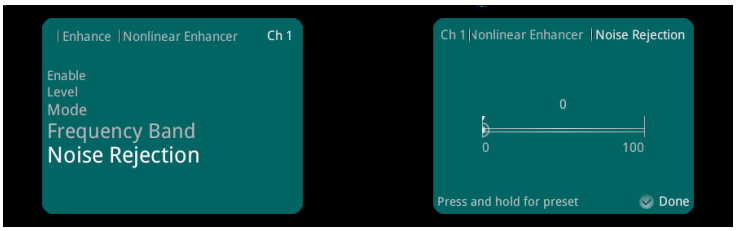


Figure 13: Noise Rejection control via the Front Panel

Conversion Aperture: Vertical

It should be considered that the 'Conversion Aperture: Vertical' feature is far more subtle than the 'Conversion Aperture: Horizontal'. The reason for this is largely down to design limitations. It is a fundamental fact that Vertical Enhancement requires a lot more demands upon hardware, compared to Horizontal Enhancement. Under normal working conditions, Enhancement controls are generally used with restraint, making the extra investment of hardware that would be required to allow a more aggressive Vertical Enhancement feature, not to be justified.

Note that it is more difficult to demonstrate the effects of the Vertical Enhancer using test patterns, hence the lack of examples in this document.

Control

The default setting for this control is 'Normal'. In this mode this feature is effectively switched 'off'.

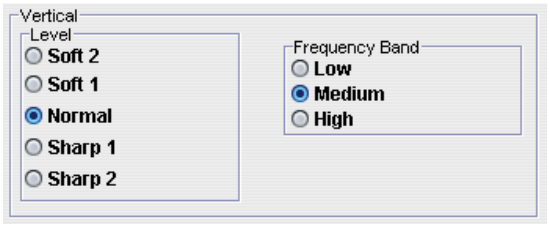
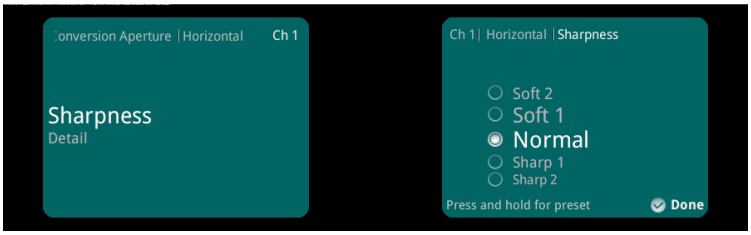


Figure 14: Conversion aperture: Vertical controls via RollCall.



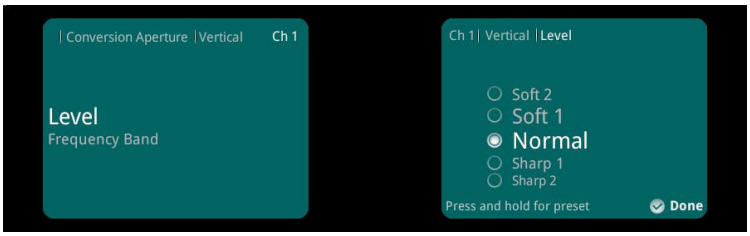


Figure 15: Conversion aperture: Vertical controls via the Front Panel

Two sets of controls are offered with the Vertical Conversion aperture feature. 'Frequency band' allows the User to choose a particular frequency band to Enhance. Vertical 'Level' allows the User to set the intensity of the enhancement; Sharp 3 having the greatest effect.

The 'Vertical Conversion aperture' controls include a 'Soft' setting. It is not usual practice to want to make pictures 'softer' than the source. However, in some circumstances this is a requirement. An example of this maybe where there is a requirement that ultra-sharp high definition content is to be down-converted. The high frequency content of the source may cause aliasing in the down-converted output. By 'softening' the processed pictures, the aliasing can be reduced or eliminated.

Conversion Aperture: Horizontal

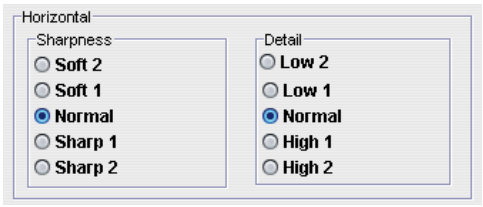


Figure 16: Conversion Aperture: Horizontal' control via RollCall

Figure 17: Conversion Aperture: Horizontal' control via the Front Panel

Like the 'Soft' setting for the Vertical Enhancer, the primary function of the 'Horizontal Conversion aperture' is to control aliasing in down-converted content. When the source content is ultra-sharp, the soft settings can be used to eliminate any aliasing in the output. The 'Horizontal Conversion aperture' has two sets of controls 'Sharpness' and 'Detail'. These controls modify the horizontal filter response. The 'Detail' control modifies the filter's upper cut-off frequency, while the 'Sharpness' modifies the filter roll-off characteristic.

The optimum settings of the 'Horizontal Conversion aperture' are dependent on the source. The amount of Aliasing will be dependent upon the higher frequencies present in the source content.

If we consider a source 1080/50i multiburst test pattern (0 to 20MHz):

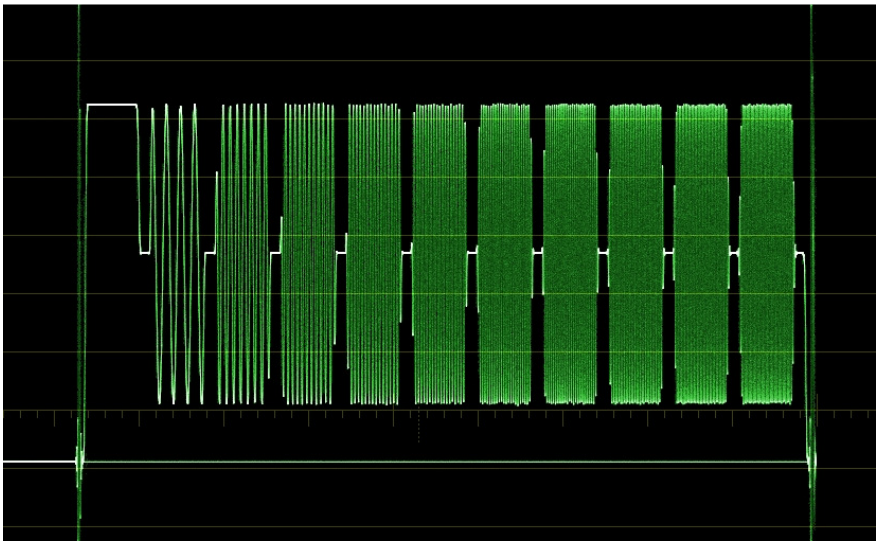


Figure 18: 20MHz Multiburst 1080/50i source

When Down-converting, the upper frequencies of the multiburst pattern, if they were not filtered out, would cause aliasing in the converted SD output. For optimum performance, as much high frequency detail as possible, should be captured without causing aliasing. The 'Conversion Aperture: Horizontal' control allows us to modify the filter characteristic in order to achieve this.

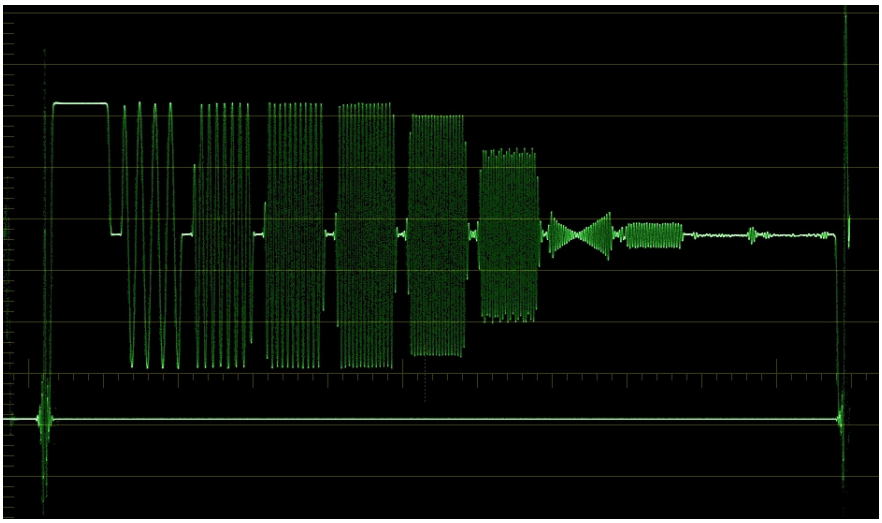


Figure 19: 625i Down-converted output with Normal settings

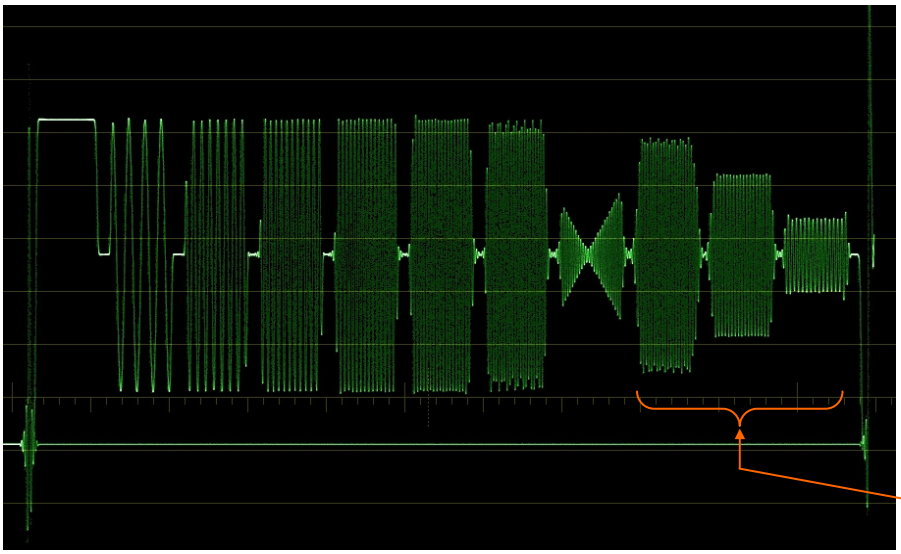


Figure 20: 625i Down-converted output with excessive H-aperture settings

In this example, the 'Conversion Aperture: Horizontal' has been adjusted to allow more high frequency content through. Although this will have the benefit of making the output pictures appear sharper, but the effect comes at the cost of 'aliasing'.

The effects of aliasing in actual pictures can be quite noticeable. In the following example, first we see the correctly adjusted version, followed by an example showing aliasing.

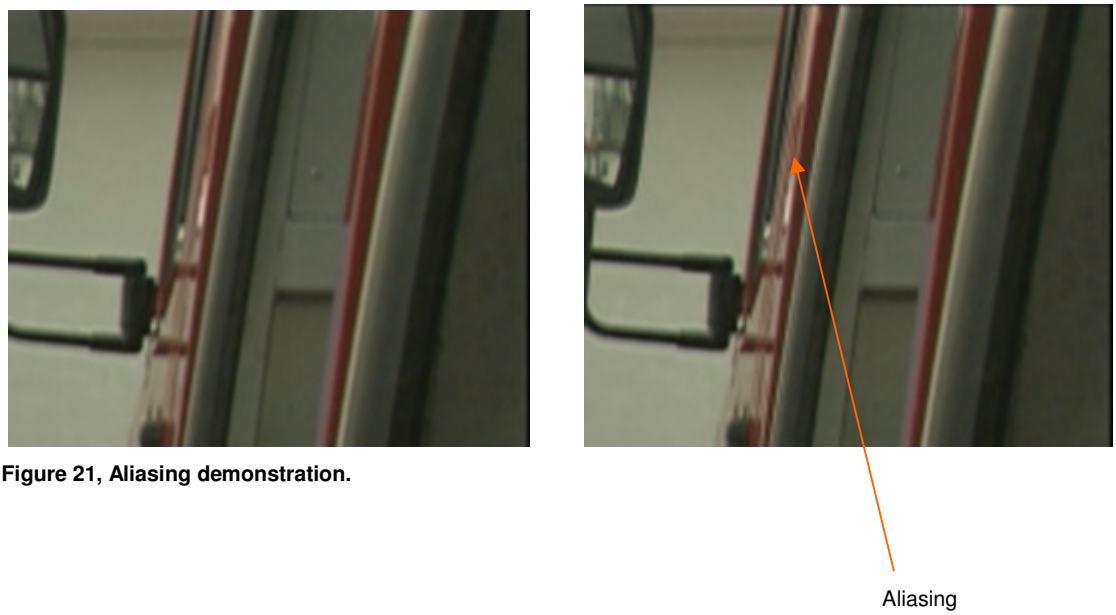


Figure 21, Aliasing demonstration.

Practical Use of the Enhancer feature

The primary use of the Enhancement feature is to attempt to regain lost detail in content that, maybe as a consequence of post production, transmission, or storage, has been softened and degraded. By careful use of the Enhancer feature it should be possible to restore content close to its original state.

However, the Enhancer feature is not just limited to use on degraded content. It is often the case that program makers enjoy the capacity to sharpen up content particularly in the HD domain, the intention being to emphasize the benefits of HD over SD. While reserving judgement on the correctness of utilising the Enhancer feature in this way, the KudosPro Enhancer does lend itself well to this function.

Enhancement Working Example

If we consider the HD picture shown in Figure 9 below, as the source. Note the soft appearance to the picture. The writing on the signs is particularly difficult to read:

Figure 22: Original source picture with no enhancement

It is a curious fact regarding enhancement, that the Horizontal Enhancer control appears to Enhance vertical detail, while the Vertical Enhancer appears to enhance horizontal detail. When we consider the Sweep pattern as above, it can be seen why this is, but when enhancing actual pictures this can become confusing.

Enhancement Examples

The following examples show the effects of various Enhancement settings on our Source picture:

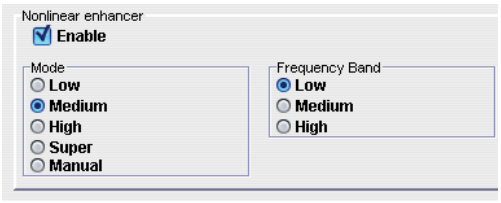


Figure 23: Nonlinear Enhancer only

The 'Nonlinear Enhancer' is a horizontal enhancing filter. Note how the vertical detail appears enhanced.

Vertical Conversion aperture

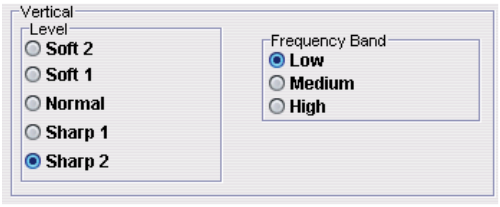
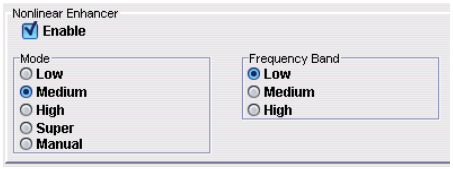


Figure 24: Vertical enhancement only

Note how the horizontal detail appears enhanced.

Combination Vertical aperture and Nonlinear Enhancer



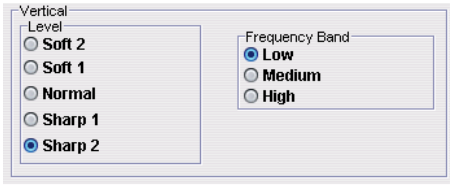


Figure 25: Fully enhanced version