Edge Enhancement

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Support Chip

- MT6771

What is Edge Enhancement

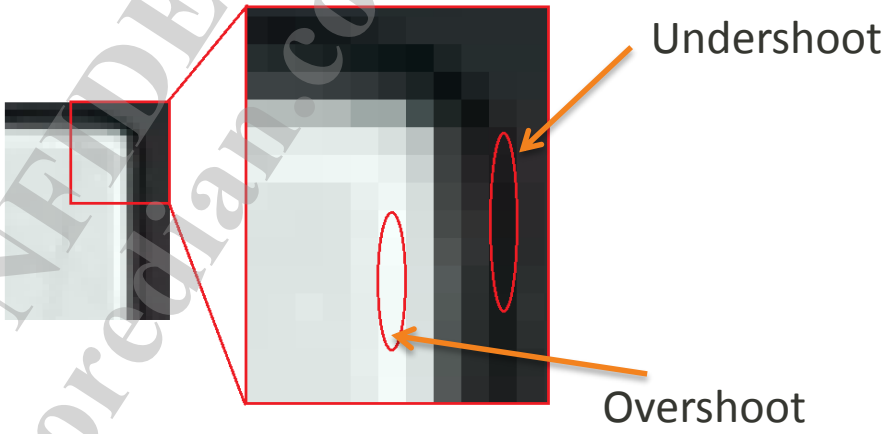
An image processing to improve image's or video's sharpness

Before EE

After EE

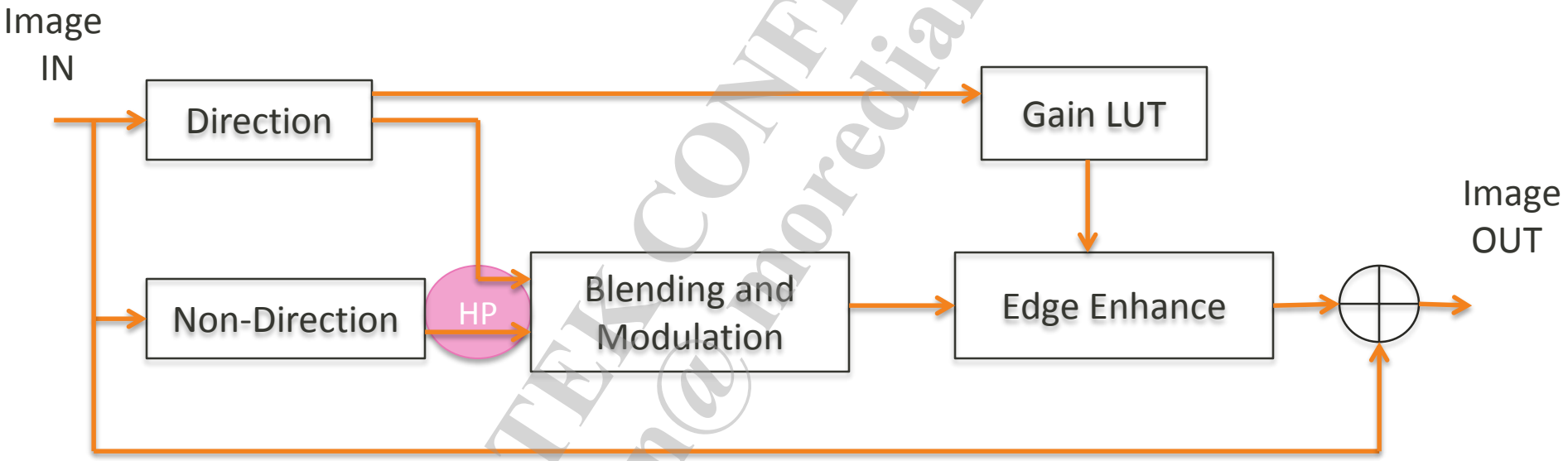
What issue might meet

- Overshoot/Undershoot

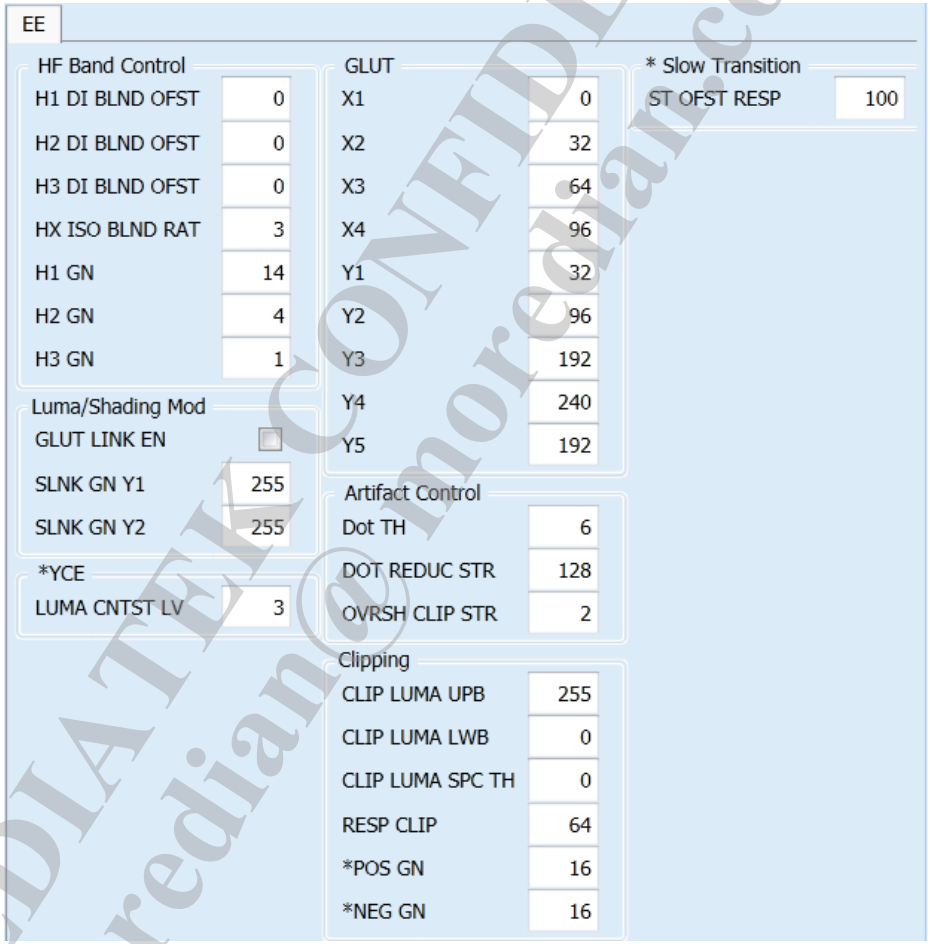


- Edge Enhance (include Detail & Texture)

Block Diagram



UI



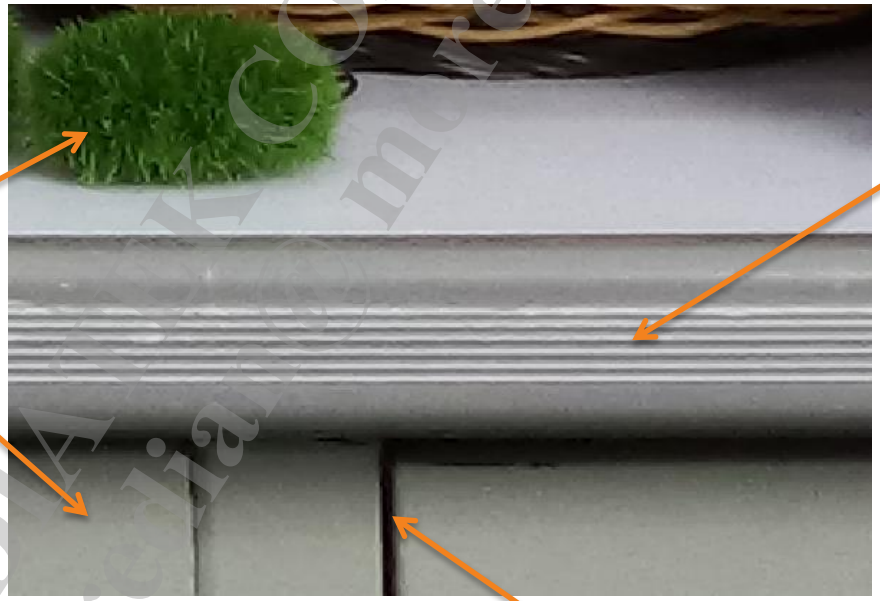
Freq. Division EE

- Parameters
  - H1 GN
    - Means Signal level. Fine Detail ↑, Signal ↑, more Noisy
  - H2 GN
    - Means Signal level. Fine Texture ↑, Signal ↑, more Noisy
  - H3 GN
    - Means Signal level. Fine Edge ↑, Signal ↑, more Noisy
  - Suggestion
    - Sharpness is the combination of three parameters
    - If not satisfied the Sharpness result, fine tune Detail and fine Texture and fine tune Edge

H1 GN	14
H2 GN	4
H3 GN	1

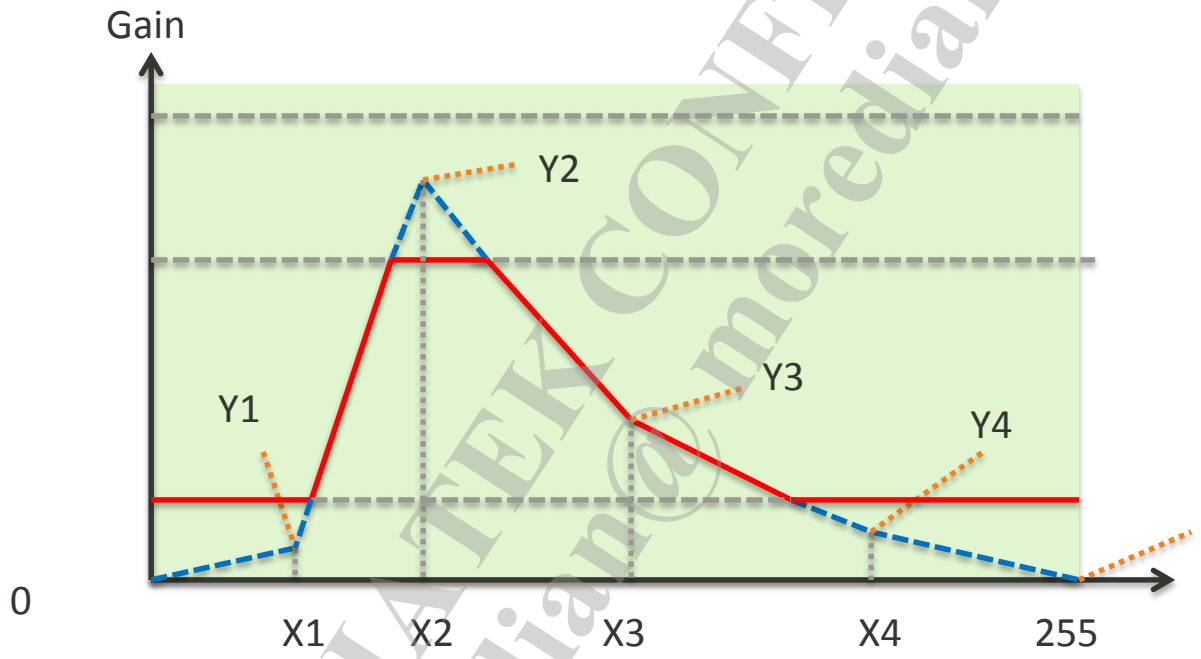
Edge Response

- We will enhance edge by High Pass Filter
- Use edge response to judge which to enhance or not



LUT

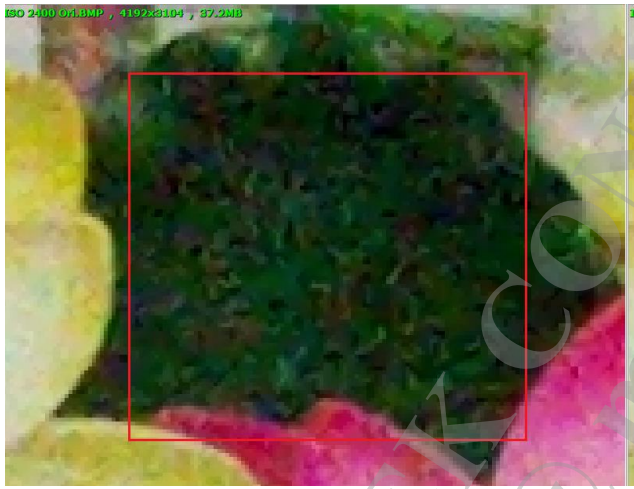
- Use Look Up Table to add edge strength of different scales
- Use Edge Response to decide enhance region

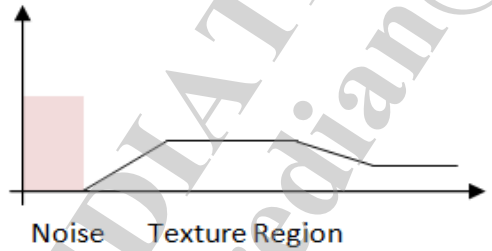


GLUT	
X1	0
X2	32
X3	64
X4	96
Y1	32
Y2	96
Y3	192
Y4	240
Y5	192

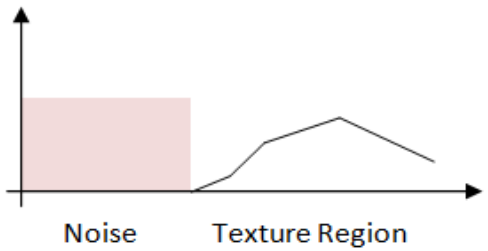
LUT Example

Small Noise Region



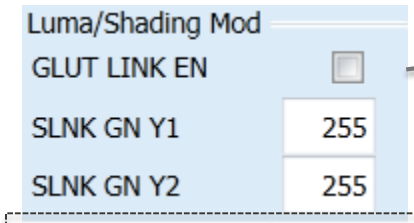


Large Noise Region



Corner Noise

- Some noise will be enhance than center, by control strength to decrease corner noise



-> Enable bit

0: off 1: on

Y1/Y2 Usage:

GN Y1/Y2 ↓ -> Corner Noise ↓, Corner Sharpness ↓

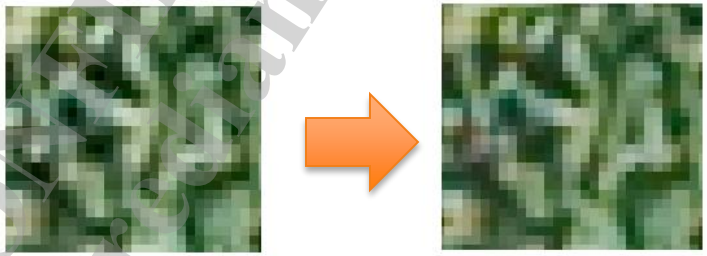
GN Y1: Control the noise between center and boundary

GN Y2: Control the noise of boundary

White/Dark Edge Suppression (1)

- Overshoot/Undershoot Clipping
- Default Value

Clipping	
CLIP LUMA UPB	255
CLIP LUMA LWB	0
CLIP LUMA SPC TH	0
RESP CLIP	64
*POS GN	16
*NEG GN	16



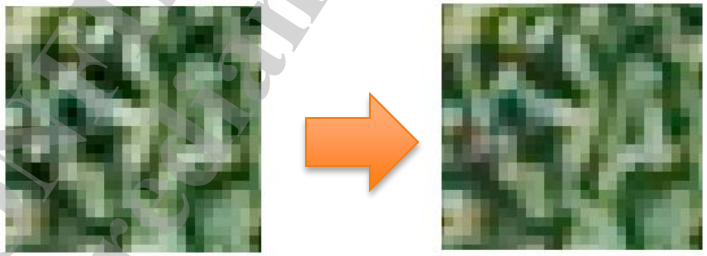
Method 1 (Locally adjusted by luma value and edge response)
CLIP LUMA UPB: To suppress overshoot
CLIP LUMA UPB ↓ → Overshoot ↓
CLIP LUMA LWB : To suppress undershoot
CLIP LUMA LWB ↑ → Undershoot ↓
CLIP LUMA SPC TH: Select suppression signal
Only the edge response > CLIP LUMA SPC TH would be suppressed
(0: flat region; 255: strong edge)

White/Dark Edge Suppression (2)

- Overshoot/Undershoot Clipping
- Default Value

Clipping

CLIP LUMA UPB	255
CLIP LUMA LWB	0
CLIP LUMA SPC TH	0
RESP CLIP	64
*POS GN	16
*NEG GN	16



Method 2 (Global clipping)

- RESP CLIP: Overall edge enhancement would not exceed this limit (0: no EE)

Method 3 (Only depends on overshoot or undershoot response)

- POS GN: Adjust overshoot level (base = 16; 0 = no overshoot)
- NEG GN: Adjust undershoot level (base = 16; 0 = no undershoot)

Line Pattern Reduction

- Use for reducing line pattern

Default Value

HF Band Control	
H1 DI BLND OFST	0
H2 DI BLND OFST	0
H3 DI BLND OFST	0
HX ISO BLND RAT	3

Step:
1.Use default value as initial
2.First fine tune H1~3 DI BLND OFST
3.Then fine tune HX ISO BLND RAT

H1 DI BLND OFST ↓ → Detail line pattern ↓
H2 DI BLND OFST ↓ → Texture line pattern ↓
H3 DI BLND OFST ↓ → Edge line pattern ↓
HX ISO BLND RAT ↓ → Line Pattern ↓

YCE

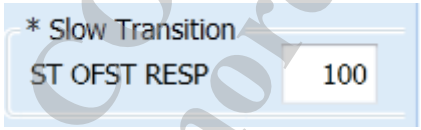
- Speed up edge transition speed by drawing pixels close to local max/min ones.

- No overshoot/undershoot introduced

LUMA CNTST LV ↑ → Stronger EE

Slow Transition

- Avoid applying EE in gradient region for preventing **contour** artifact



- Range suggestion: 96~128
  - Lower means less contour (but the edge may become smoother)

everyday genius