

MEDIATEK

CONFIDENTIAL B

P40 ABF Introduction & Usage



Outline

- P23 → P40 ABF UI Change
- ABF Workflow (HWABF)
- Filter Tuning
- Simulation Result

P23 → P40

P23

P40

☒ NR2

BMP

Fast SWNR SW ABF

01 Control

☒ ON

☐ ITUNE_ROI

02 Saturation

230

STHRE R

230

STHRE G

230

STHRE B

03 ROI-NSR

8

NSR R1

15

NSR R2

04 ROI-R

190

R1

-190

R2

05 ROI-Y

0

Y0

1

Y1

236

Y2

252

Y3

511

Y SP0

-8

Y SP1

06 ROI-CX

96

CX0

108

CX1

196

CX2

210

CX3

42

CX SP0

-36

CX SP1

07 ROI-CY

122

CY0

130

CY1

184

CY2

205

CY3

64

CY SP0

-24

CY SP1

08 ROI-TH

0

THRE LO

100

THRE HI

09 Filter

16

BF WIDTH

20

BF U OFST

NBC2 CCR ABF Bokeh

Control

ABF NSR IDX

1

ABF BIL IDX

2

ABF ENC

☒

Filter

ABF BF U OFST

20

ROI-R

ABF R2

-190

ABF R1

190

ROI-Y

ABF Y3

252

ABF Y2

236

ABF Y1

1

ABF Y0

0

ABF Y SP1

-32

ABF Y SP0

511

ROI-CX

ABF CX3

210

ABF CX2

196

ABF CX1

108

ABF CX0

96

ABF CX SP1

-36

ABF CX SP0

42

ROI-CY

ABF CY3

205

ABF CY2

184

ABF CY1

130

ABF CY0

122

ABF CY SP1

-24

ABF CY SP0

64

Saturation

ABF STHRE B

200

ABF STHRE G

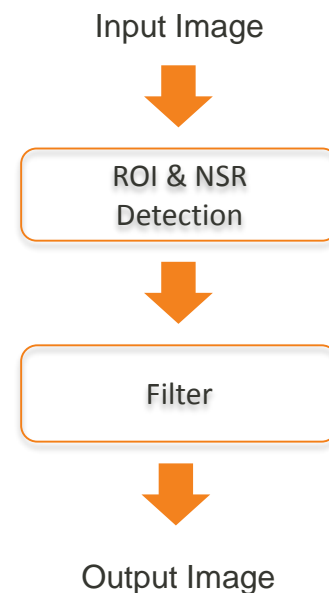
200

ABF STHRE R

200

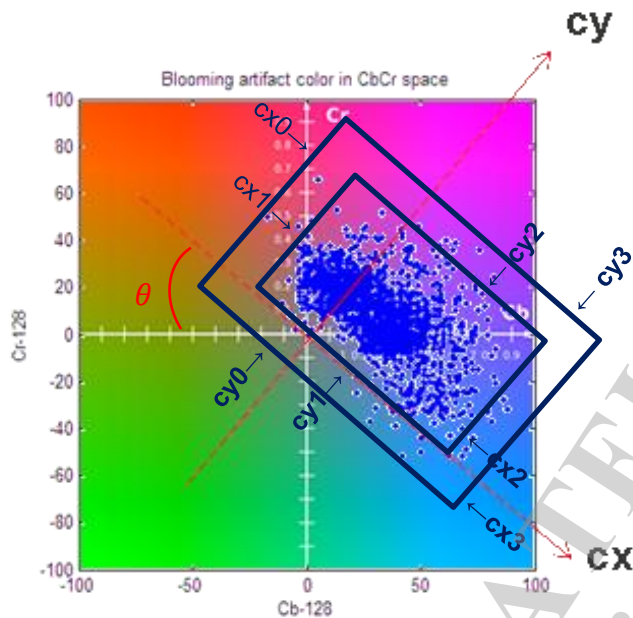
ABF Workflow

- ROI: Detect if the pixel falls into the predefined color region
- NSR: Detect if there is saturated region nearby
- Filter: Eliminate the purple fringing artifacts



Region of Interest (ROI) Detection

- Each color channel has its own boundary for determining the pixel's ROI

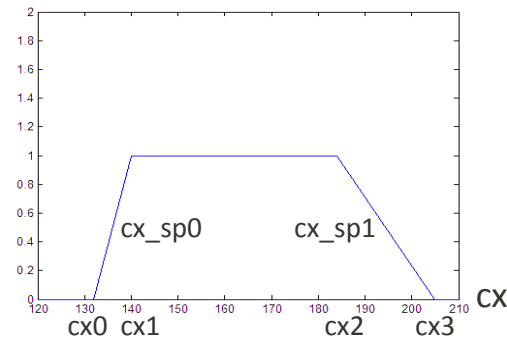


$$R1 = \cos\theta * 256, \text{ where } \theta \approx -40^\circ$$

$$R2 = \sin\theta * 256$$

boundary
Y : (y0, y1, y2, y3)
Cx: (cx0, cx1, cx2, cx3)
Cy: (cy0, cy1, cy2, cy3)

slope
(y_sp0, y_sp1)
(cx_sp0, cx_sp1)
(cy_sp0, cy_sp1)

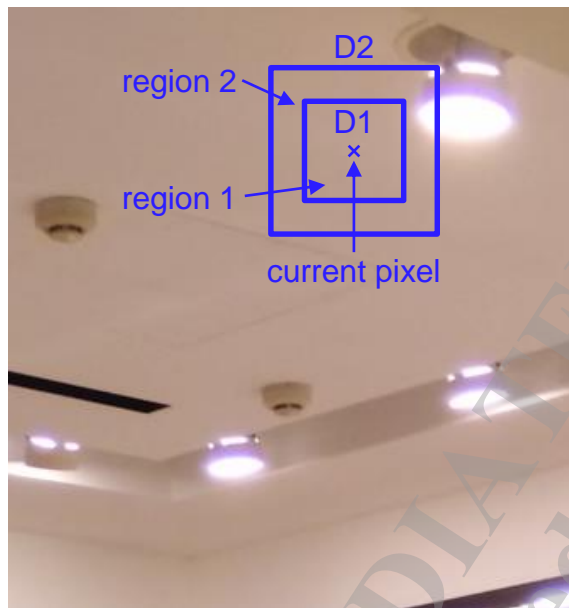


ROI-R	
ABF R1	190
ABF R2	-190
ROI-Y	
ABF Y0	0
ABF Y1	1
ABF Y2	236
ABF Y3	252
ABF Y SP0	511
ABF Y SP1	-32
ROI-CX	
ABF CX0	96
ABF CX1	108
ABF CX2	196
ABF CX3	210
ABF CX SP0	42
ABF CX SP1	-36
ROI-CY	
ABF CY0	122
ABF CY1	130
ABF CY2	184
ABF CY3	205
ABF CY SP0	64
ABF CY SP1	-24

Near Saturation Region (NSR) Detection

ABF NSR IDX	1
Saturation	
ABF STHRE B	200
ABF STHRE G	200
ABF STHRE R	200

- Two square regions are defined for determining the NSR
 - the size of the regions are selected via the register **NSR_IDX**
- When all of the R/G/B value exceed the given threshold value (STHRE R/ STHRE G/ STHRE B) are defined as the saturation region



- Region Size: **NSR_IDX** (0~3)

NSR_IDX ↑, Region ↑ ($D2 > D1$)

$$\Rightarrow Str = \begin{cases} Str1, & \text{if } p_{clip} \text{ exists in region 1 } (Str1 \geq Str2) \\ Str2, & \text{if } p_{clip} \text{ exists in region 2} \\ 0 & \text{otherwise} \end{cases}$$

- Saturation Region:

$R \geq \text{STHRE_R} \ \& \ G \geq \text{STHRE_G} \ \& \ B \geq \text{STHRE_B}$

Filter Tuning

Filter	
ABF BF U OFST	20
ABF BIL IDX	2

- Filter Strength: **BF_U_OFST** (0~63)

BF_U_OFST ↑, Strength ↑

- Filter Size: **BIL_IDX** (0~2)

BIL_IDX ↑, Filter Size ↑

Simulation Result

ABF OFF

ABF ON



Registers

Group	MSB	LSB	Name	Default Value	Description
ABF_CON1	11	10	ABF_NSR_IDX	1	clip filter size mode: {11x21/18x37,13x25/23x45,17x33/31x61} Valid: 0~2
ABF_CON1	9	8	ABF_BIL_IDX	2	bilateral filter size mode: {9x17,13x25,17x33}
ABF_CON1	0	0	ABF_EN	0	ABF enable/disable
ABF_CON2	5	0	ABF_BF_U_OFST	20	Bilateral filter chroma offset/bias
ABF_RCON	24	16	ABF_R2	-190	Coordinate conversion from (Cb, Cr) to (CX, CY) 2's complement signed value
ABF_RCON	8	0	ABF_R1	190	Coordinate conversion from (Cb, Cr) to (CX, CY) 2's complement signed value
ABF_YLUT	31	24	ABF_Y3	186	Y control point 3
ABF_YLUT	23	16	ABF_Y2	150	Y control point 2
ABF_YLUT	15	8	ABF_Y1	1	Y control point 1
ABF_YLUT	7	0	ABF_Y0	0	Y control point 0
ABF_CXLUT	31	24	ABF_CX3	210	CX control point 3
ABF_CXLUT	23	16	ABF_CX2	198	CX control point 2
ABF_CXLUT	15	8	ABF_CX1	138	CX control point 1
ABF_CXLUT	7	0	ABF_CX0	126	CX control point 0
ABF_CYLUT	31	24	ABF_CY3	205	CY control point 3
ABF_CYLUT	23	16	ABF_CY2	184	CY control point 2
ABF_CYLUT	15	8	ABF_CY1	140	CY control point 1
ABF_CYLUT	7	0	ABF_CY0	132	CY control point 0
ABF_YSP	25	16	ABF_Y_SP1	-14	Y control slope 1 2's complement signed value
ABF_YSP	9	0	ABF_Y_SP0	511	Y control slope 0 2's complement signed value
ABF_CXSP	25	16	ABF_CX_SP1	-36	CX control slope 1 2's complement signed value
ABF_CXSP	9	0	ABF_CX_SP0	56	CX control slope 0 2's complement signed value
ABF_CYSP	25	16	ABF_CY_SP1	-24	CY control slope 1 2's complement signed value
ABF_CYSP	9	0	ABF_CY_SP0	64	CY control slope 0 2's complement signed value
ABF_CLP	23	16	ABF_STHRE_B	250	B channel clipping threshold
ABF_CLP	15	8	ABF_STHRE_G	250	G channel clipping threshold
ABF_CLP	7	0	ABF_STHRE_R	250	R channel clipping threshold

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everyday genius