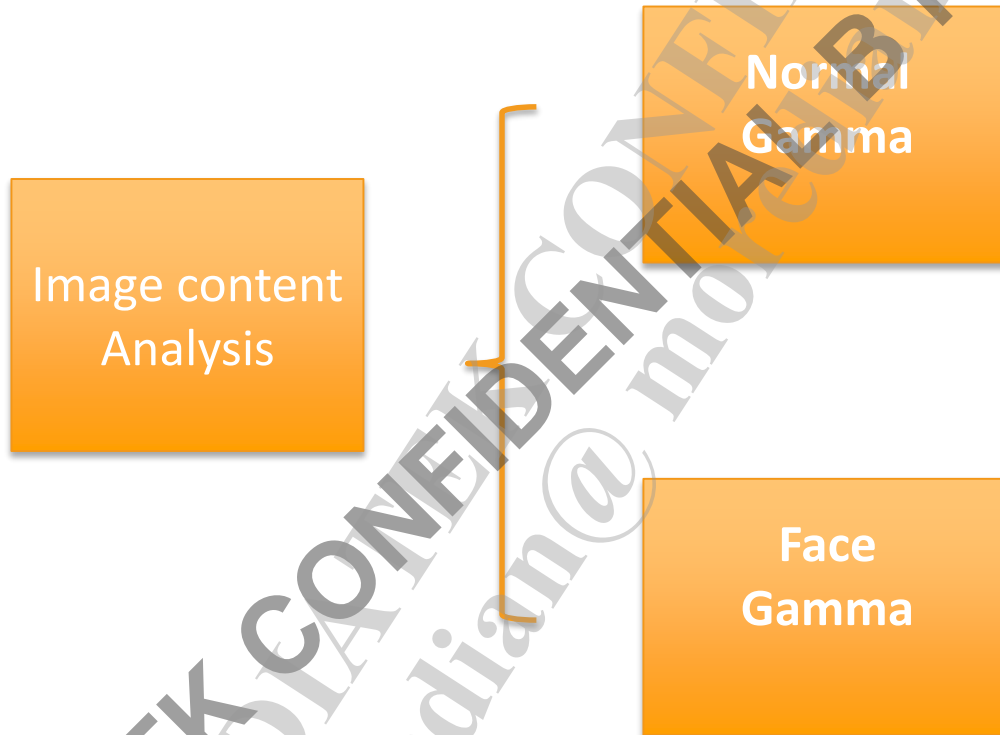# Gamma/LCE 1st Tuning

Gamma/LCE 1st Tuning

- ## Gamma
  - – gamma calibration
  - –ImagiqSimulator tool SOP for gamma
  - –Debug

- ## Contrast 2.0
  - –Contrast 2.0 theory
  - – Contrast 2.0 Tune
  - – debug log

Gamma tune

Image content Analysis

Normal Gamma

Face Gamma

Gamma tune

➢ Normal gamma

- Make sure AE is close to the target phone.
- Adjust gamma weight table make sure Lab Scene complete use normal gamma. Normal gamma should satisfy Q14 objective standard.

Gamma tune

tuning Gamma environment：
700LUX D65 LAB

1) Make sure LCE no work in lab scene。

DIP_X_LCE_ContrastIdx_L	10
DIP_X_LCE_ContrastIdx_H	10
DIP_X_LCE_LVIdx_L	6
DIP_X_LCE_LVIdx_H	7

|	
DIP_X_LCE_P1	2251
DIP_X_LCE_P50	2840
DIP_X_LCE_P500	3249
DIP_X_LCE_P950	3336
DIP_X_LCE_P999	3648
DIP_X_LCE_O1	2251
DIP_X_LCE_O50	2840
DIP_X_LCE_O500	3249
DIP_X_LCE_O950	3336
DIP_X_LCE_O999	3648

How to confirm LCE no work

DP Pxxx=Oxxx→LCE no work，if not please tuning LCE param

2）check gamma brightest step ，confirm bright align，if not，tuning AE
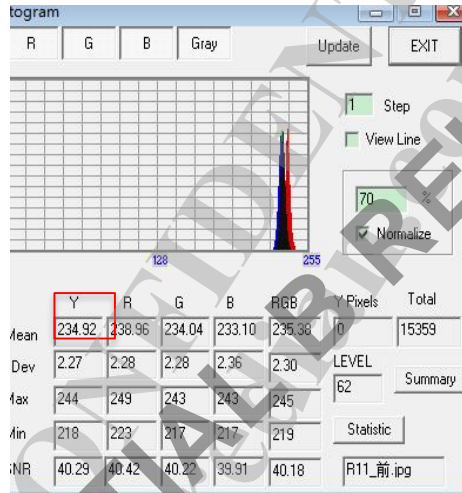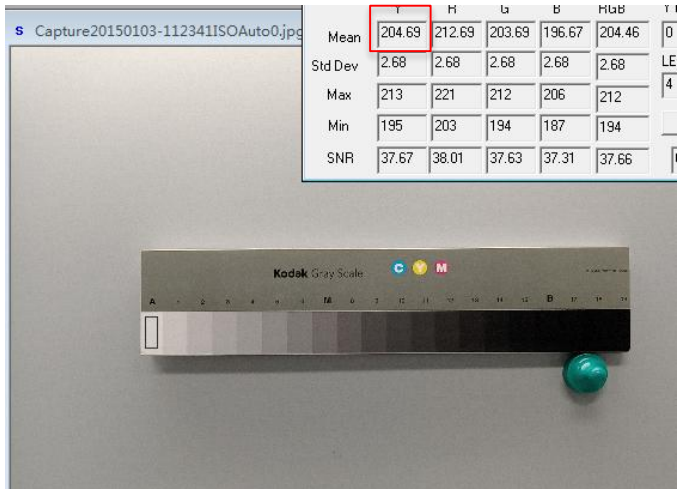
Ex: brightness difference is quite large as below show（0.19ev)，so tune AE first
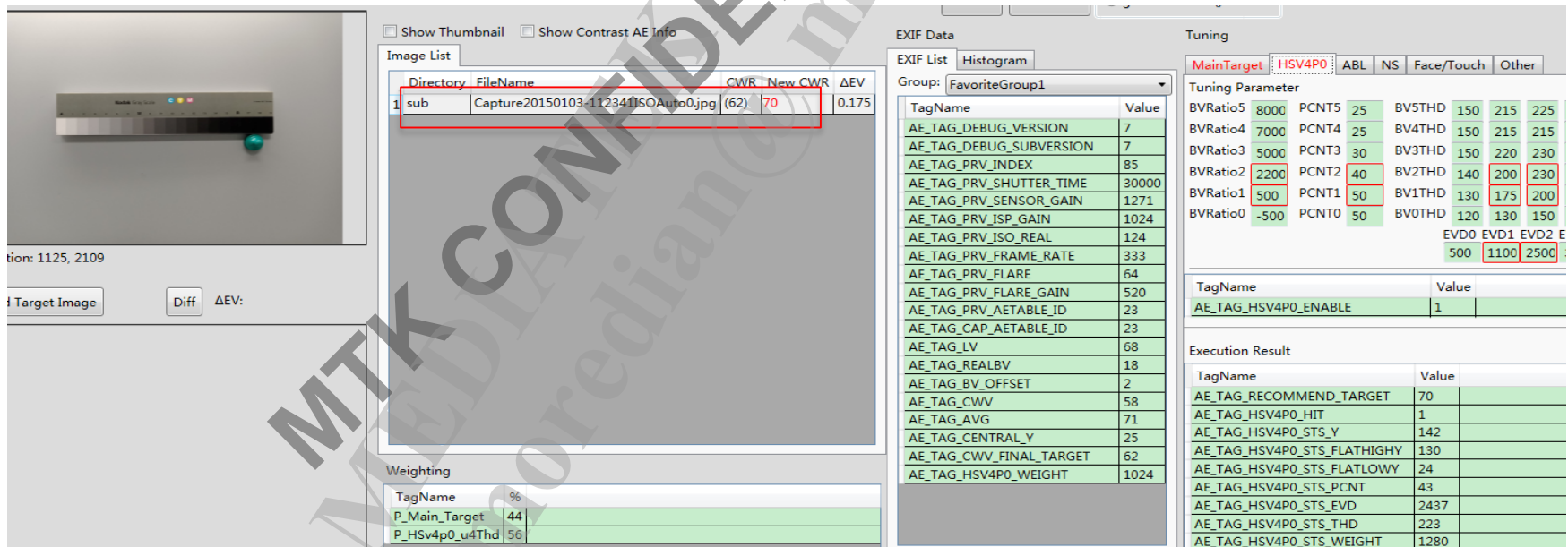
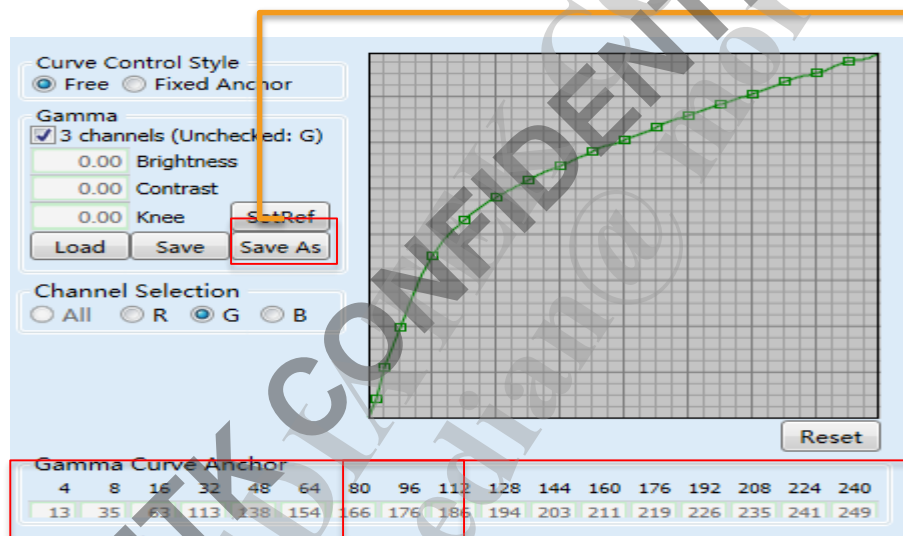3) use ImagiqSimulator tuning gamma curve to align target phone all step
bright。

在ImagiqSimulator tool的LCE 页面选择output BMP

measure LCE out bmp Q14 bright as gamma input，
Tuning gamma then get ouput
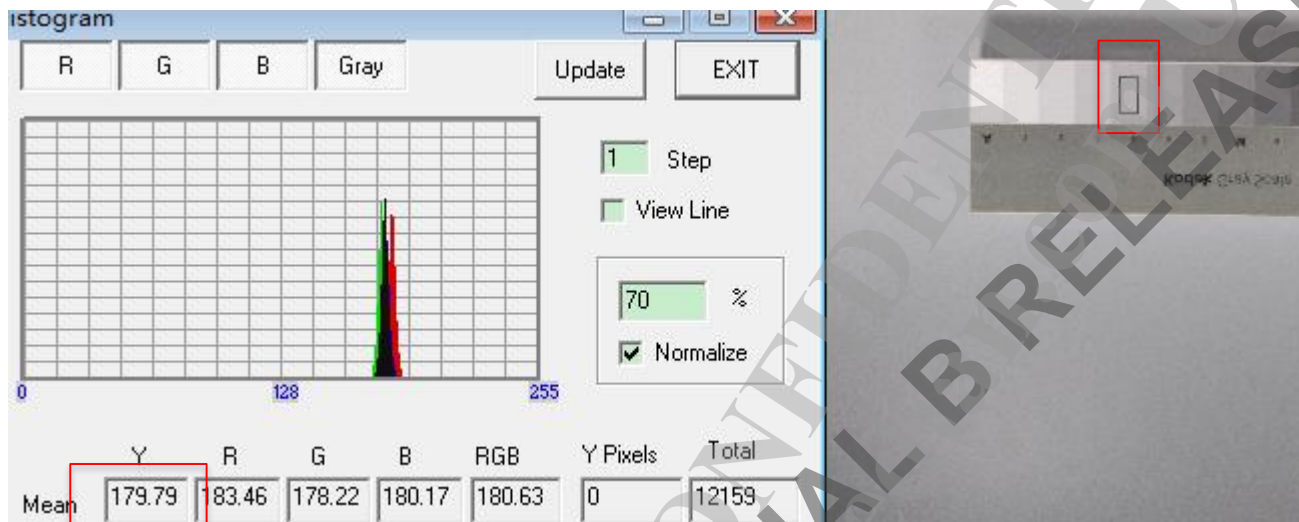
After first tuning
save gamma as ** .pat

Fine Tune gamma by ImageiqSimulator

➤ ## Load raw

Fine Tune gamma by ImageiqSimulator

➢ Enable gma tuning & out BMP

Fine Tune gamma by ImageiqSimulator

➤ Load **.pat

Fine Tune gamma by ImageiqSimulator

➢ Fine tune Gamma

5. Create new gamma table

Fine Tune gamma by ImageiqSimulator

➢ Save new **pat & NVRAM

Fine Tune gamma by ImageiqSimulator

➢ Copy x.nvram [GGM] to reg file   xxxmipiraw_xxx_TONE.cpp
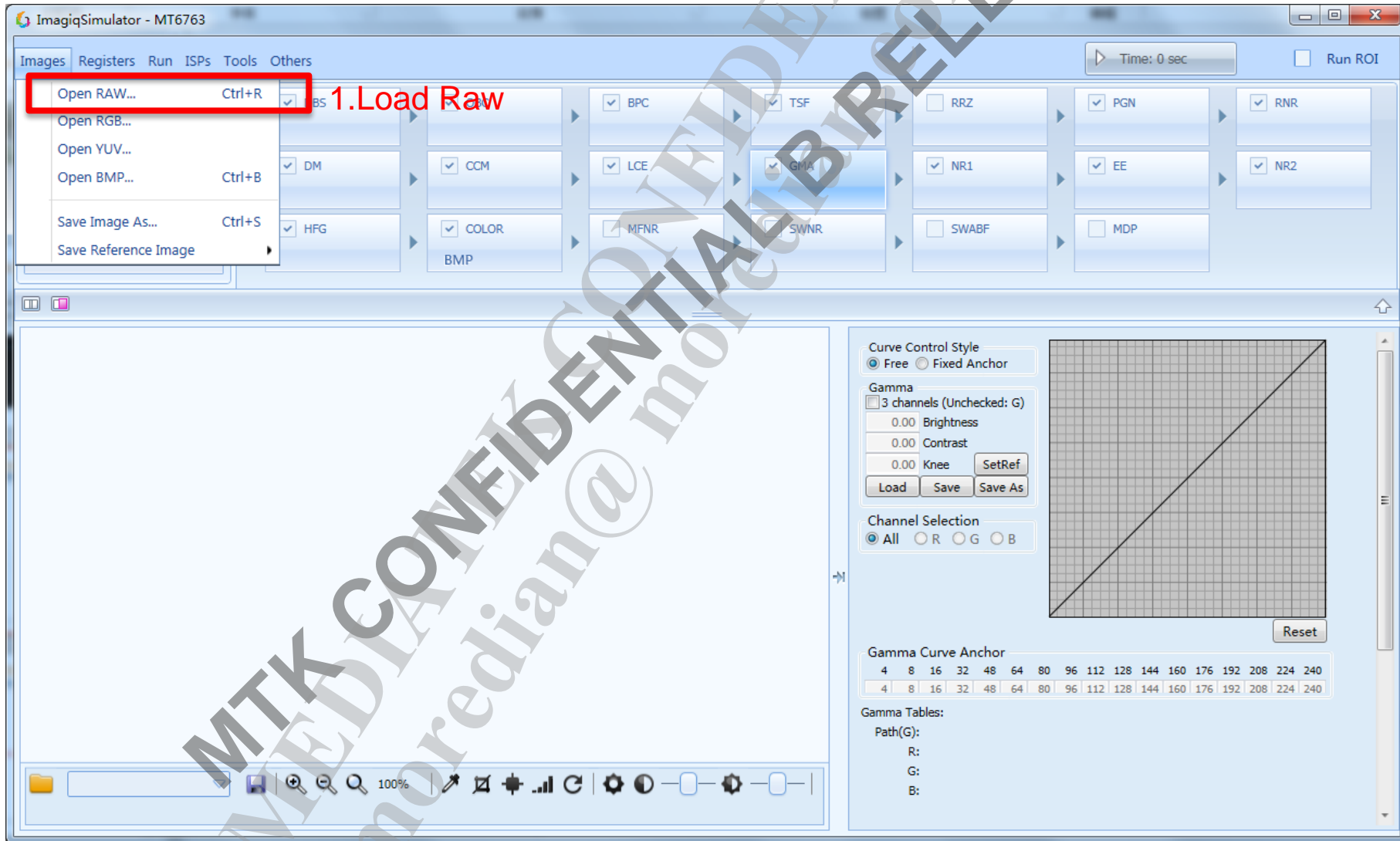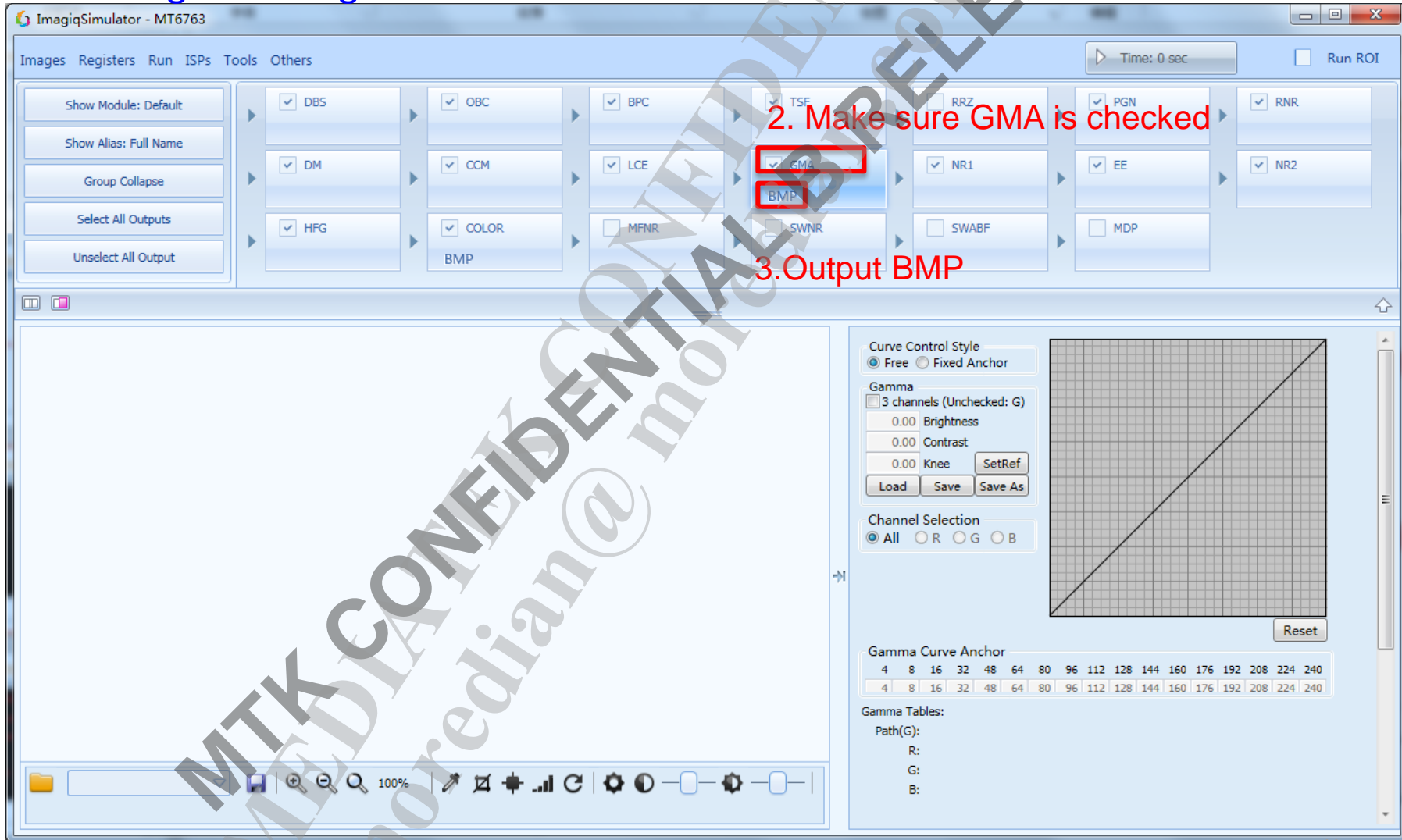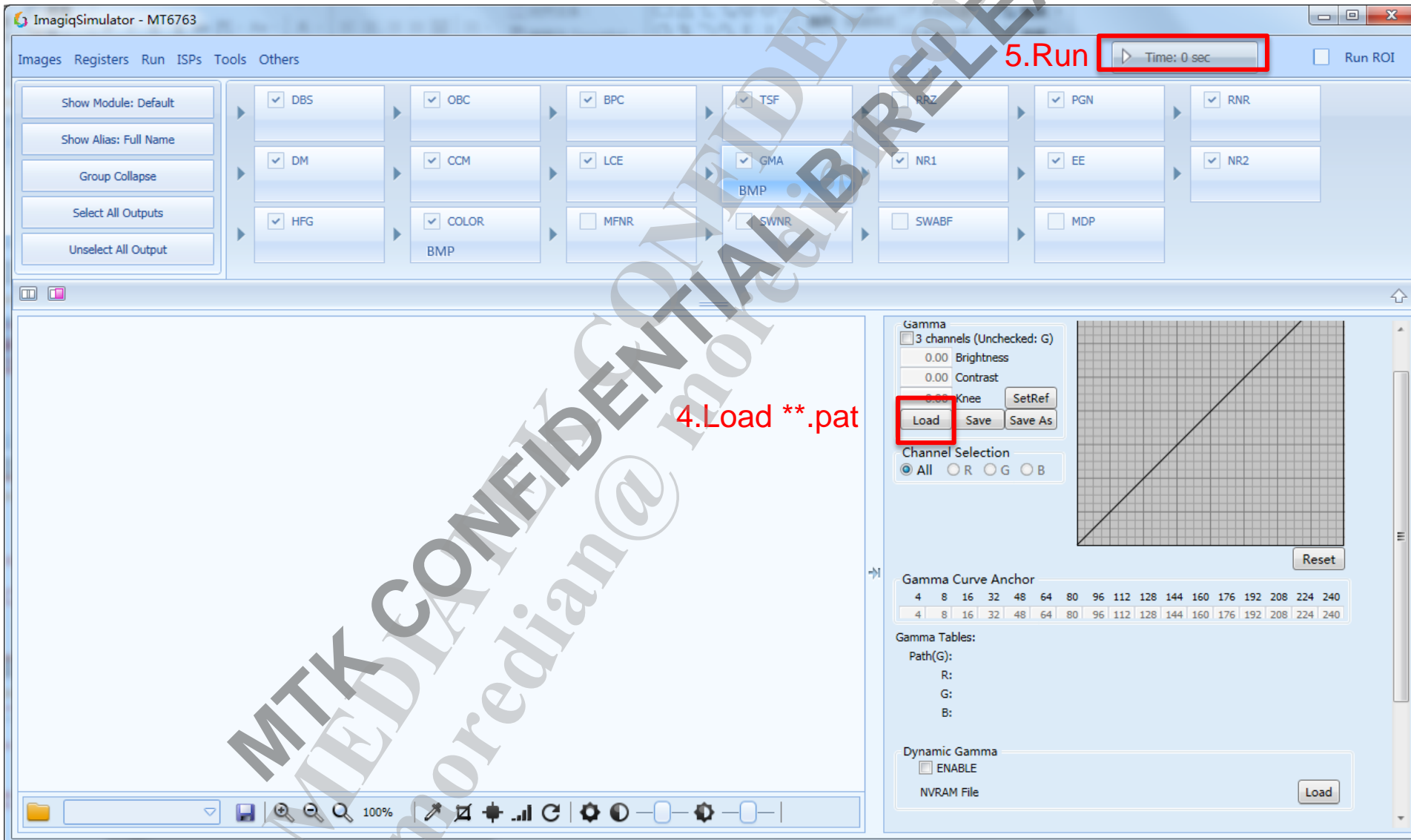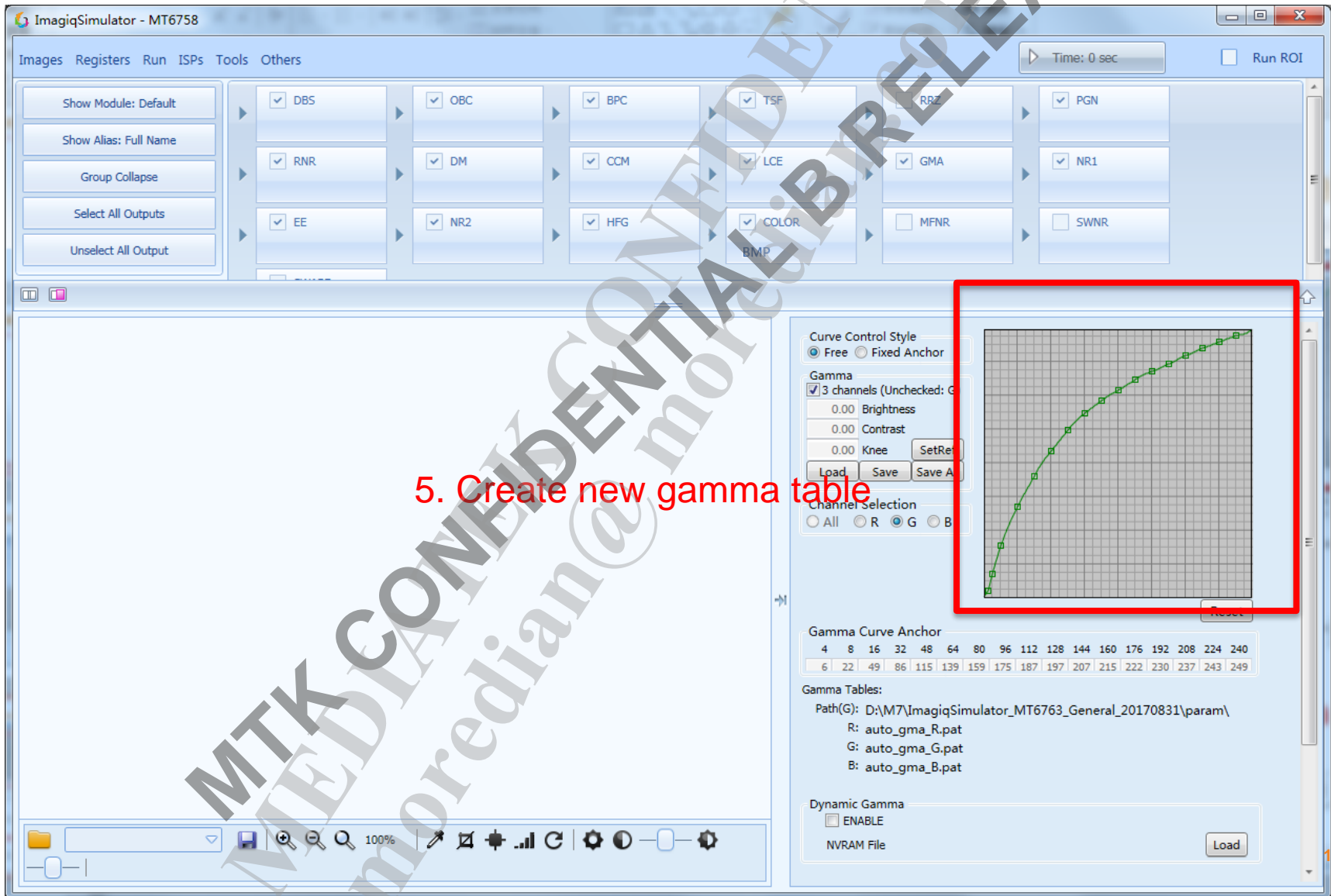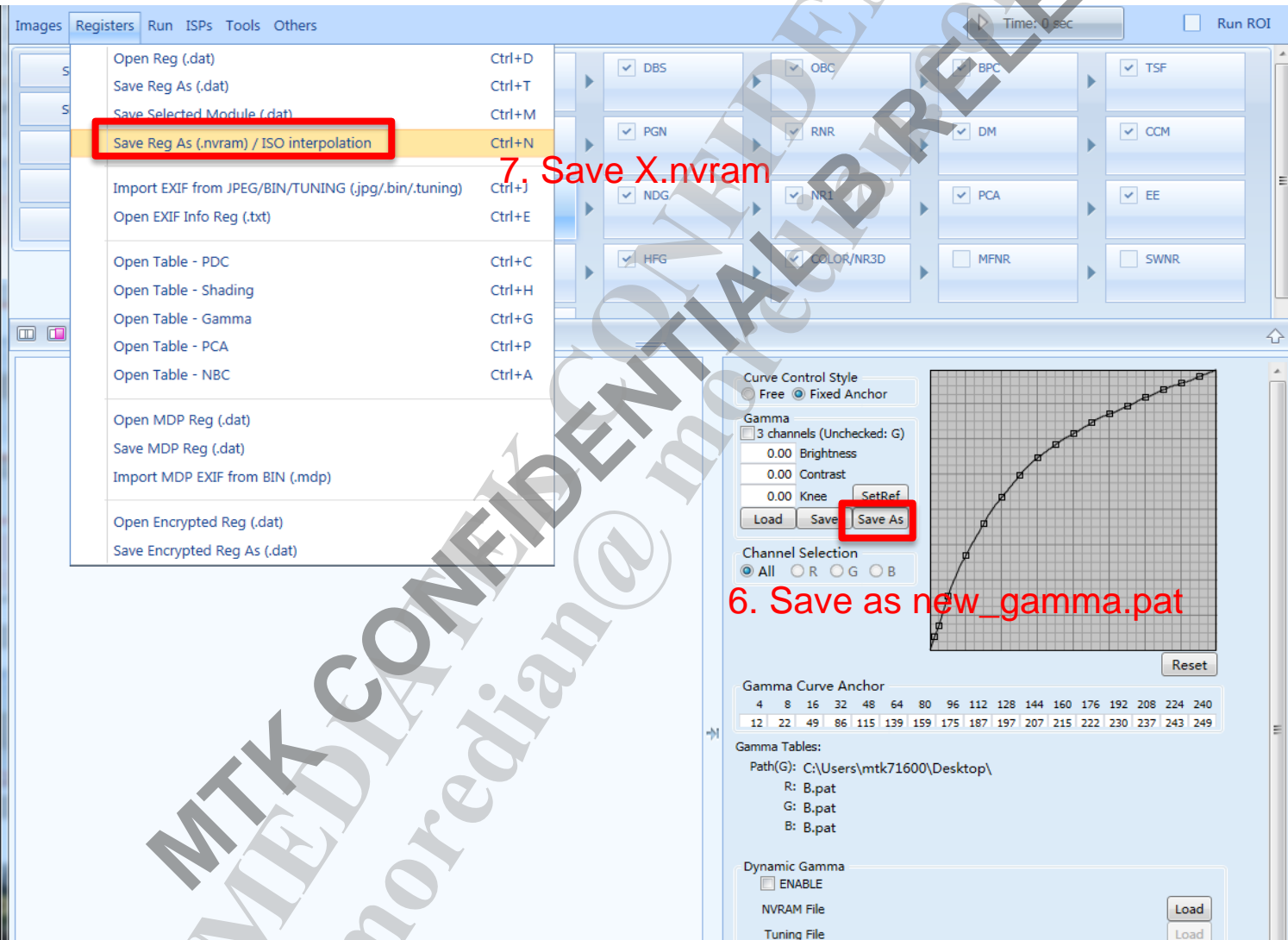
For 1st NVRAM param，we suggest 4 GGM keep same param，
if need ,we can fine tuning The fourth for face

```
{.set={
    0x00000000, 0x00601806, 0x00C0300C, 0x01004010, 0x01405014, 0x01A0681A, 0x02008020, 0x02409024, 0x0280A028, 0x0300C0
0x0380E038, 0x04210842, 0x04C1304C, 0x05415054, 0x05C1705C, 0x06419064, 0x06C1B06C, 0x0741D074, 0x07C1F07C, 0x08621886,
0x09024090, 0x09826098, 0x0A0280A0, 0x0A82A0A8, 0x0B02C0B0, 0x0B82E0B8, 0x0C0300C0, 0x0C8320C8, 0x0D0340D0, 0x0D8360D8,
0x0E0380E0, 0x0E83A0E8, 0x0F03C0F0, 0x0F83E0F8, 0x10040100, 0x10641906, 0x10C4310C, 0x11445114, 0x11C4711C, 0x12248922,
0x1284A128, 0x12E4B92E, 0x1344D134, 0x13A4E93A, 0x14050140, 0x14651946, 0x14C5314C, 0x15254952, 0x15856158, 0x15E5795E,
0x16459164, 0x16A5A96A, 0x1705C170, 0x1765D976, 0x17C5F17C, 0x18060180, 0x18461184, 0x18A6298A, 0x19064190, 0x19465194,
0x19866198, 0x19E6799E, 0x1A4691A4, 0x1A86A1A8, 0x1AC6B1AC, 0x1B46D1B4, 0x1C0701C0, 0x1C8721C8, 0x1D0741D0, 0x1D8761D8,
0x1E0781E0, 0x1E87A1E8, 0x1F07C1F0, 0x1F87E1F8, 0x20080200, 0x20481204, 0x20C8320C, 0x21485214, 0x21C8721C, 0x22088220,
0x2288A228, 0x2308C230, 0x2388E238, 0x24090240, 0x24491244, 0x24C9324C, 0x25094250, 0x25495254, 0x25C9725C, 0x26098260,
0x2689A268, 0x26C9B26C, 0x2709C270, 0x2749D274, 0x2789E278, 0x27C9F27C, 0x280A0280, 0x288A2288, 0x290A4290, 0x298A6298,
0x2A0A82A0, 0x2A8AA2A8, 0x2B0AC2B0, 0x2B8AE2B8, 0x2C0B02C0, 0x2C8B22C8, 0x2D0B42D0, 0x2D8B62D8, 0x2E0B82E0, 0x2E4B92E4,
0x2ECBB2EC, 0x2F0BC2F0, 0x2F8BE2F8, 0x2FCBF2FC, 0x300C0300, 0x308C2308, 0x30CC330C, 0x310C4310, 0x314C5314, 0x31CC731C,
0x320C8320, 0x324C9324, 0x32CCB32C, 0x330CC330, 0x334CD334, 0x338CE338, 0x338CE338, 0x33CCF33C, 0x340D0340, 0x344D1344,
0x344D1344, 0x348D2348, 0x34CD334C, 0x350D4350, 0x350D4350, 0x354D5354, 0x358D6358, 0x35CD735C, 0x360D8360, 0x364D9364,
0x368DA368, 0x36CDB36C, 0x36CDB36C, 0x370DC370, 0x374DD374, 0x378DE378, 0x378DE378, 0x37CDF37C, 0x380E0380, 0x384E1384,
0x384E1384, 0x388E2388, 0x38CE338C, 0x390E4390, 0x390E4390, 0x394E5394, 0x394E5394, 0x398E6398, 0x398E6398, 0x39CE739C,
0x3A0E83A0, 0x3A4E93A4, 0x3A4E93A4, 0x3A8EA3A8, 0x3A8EA3A8, 0x3ACEB3AC, 0x3ACEB3AC, 0x3B0EC3B0, 0x3B4ED3B4, 0x3B8EE3B8,
0x3BCEF3BC, 0x3C0F03C0, 0x3C0F03C0, 0x3C4F13C4, 0x3C4F13C4, 0x3C8F23C8, 0x3CCF33CC, 0x3D0F43D0, 0x3D0F43D0, 0x3D4F53D4,
0x3D4F53D4, 0x3D8F63D8, 0x3D8F63D8, 0x3DCF73DC, 0x3E0F83E0, 0x3E0F83E0, 0x3E4F93E4, 0x3E4F93E4, 0x3E8FA3E8, 0x3ECFB3EC,
0x3F4FD3F4, 0x3F8FE3F8
```

Debug

- If you consider some issue are caused by gamma, such as Luma noise
    A. Disable gamma:

       adb shell setprop isp.ggm.disable 1

    B. If work, weaken gamma strength.

    C. If not work, prepare mtklog and raw data to mtk confirm.

AE Contents

- Gamma
  - Dynamic gamma tune
  - Tune gamma by ImageiqSimulator
  - Debug

- Contrast 2.0
  - Contrast 2.0 theory
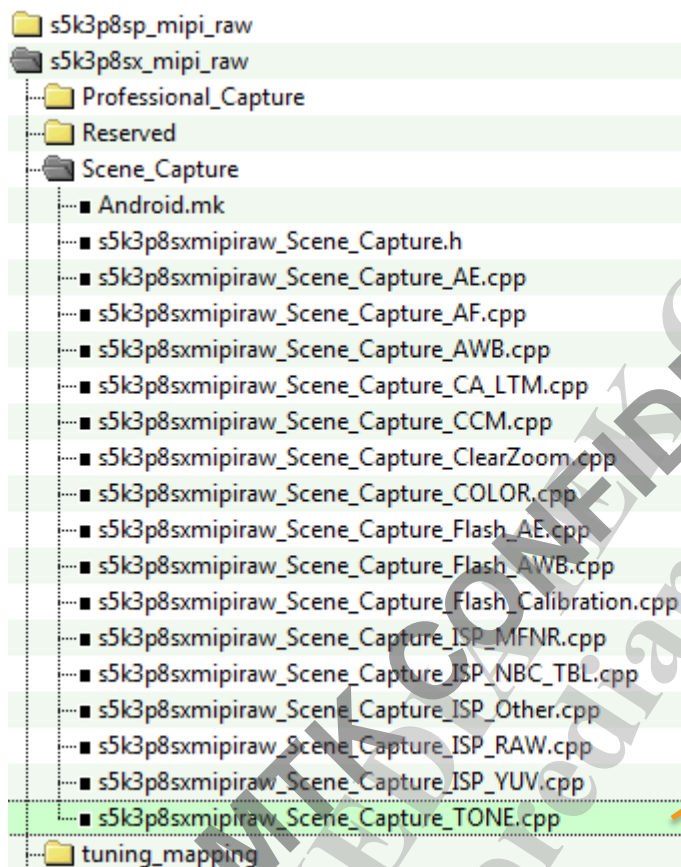 - Contrast 2.0 Tune
  - debug log

Outline

❑ Contrast 2.0 = LCE 5.0 + DCE 1.0

  ➢ LCE 5.0

  ➢ DCE 1.0

Step 1:Tone Curve Generation

- [**Sensor**]_[**Scenario**]_TONE.cpp

Step 2: Target tuning

```
.rLCEPara = {
//     LV0    LV1    LV2    LV3    LV4    LV5    LV6    LV7    LV8    LV9   LV10   LV11   LV12   LV13   LV14   LV15   LV16   LV17   LV18
{     1024,  1024,  1024,  1194,  1364,  1534,  1704,  1874,  2048,  2048,  2048,  2048,  2048,  2048,  2048,  2048,  2048,  2048,  2048},  //0 LVTarget
{      950,   950,   940,   930,   920,   910,   900,   890,   880,   880,   880,   880,   880,   880,   880,   880,   880,   880,   880},  //1 BriRatio
{     3400,  3400,  3400,   400,   390,  3380,  3370,  3360,  3350,  3350,  3350,  3350,  3350,  3350,  3350,  3350,  3350,  3350,  3350},  //2 BriLimit
{     2600,  2600,  2600,  2600,  2642,  2684,  2726,  2770,  2812,  2854,  2900,  2900,  2900,  2900,  2900,  2900,  2900,  2900,  2900},  //3 FlatBriTH
{    10000, 10000, 10000, 10000, 10000, 10000, 10000, 10000, 10000, 10000, 10000, 10000, 10000, 10000, 10000, 10000, 10000, 10000, 10000},  //4 FlatHiBound
{     7000,  7000,  7000,  7000,  7000,  7166,  7332,  7498,  7664,  7830,  8000,  8000,  8000,  8000,  8000,  8000,  8000,  8000,  8000},  //5 FlatLoBound
{       85,    85,    85,    85,    85,    85,    85,    85,    85,    85,    85,    85,    85,    85,    85,    85,    85,    85,    85},  //6 LumaHiBoundRatio
{       70,    70,    70,    70,    70,    70,    70,    70,    70,    70,    70,    70,    70,    70,    70,    70,    70,    70,    70},  //7 LumaLoBoundRatio
{        0,     0,     0,     0,     0,     0,     0,     0,     0,     0,     0,     0,     0,     0,     0,     0,     0,     0,     0},  //i4LCEPara8
{        0,     0,     0,     0,     0,     0,     0,     0,     0,     0,     0,     0,     0,     0,     0,     0,     0,     0,     0},  //i4LCEPara9
{        0,     0,     0,     0,     0,     0,     0,     0,     0,     0,     0,     0,     0,     0,     0,     0,     0,     0,     0}   //i4LCEPara10
```

variable name: LVTarget
data range: 0 - 4095
The value to determine the brightness of LV Target

Step 3: Strength tuning

❑ Dark Strength table : <u>LV</u> and <u>DR idx</u>

❑ Bright Strength table : <u>LV</u> and <u>DR idx</u>

```
.rLCELUTs = {//i4LCETbl
  {// /*                            Dark     Strangth                              */ | /*    Bright     Strength    */
  //   LV0   LV1   LV2   LV3   LV4   LV5   LV6   LV7   LV8   LV9   LV10  LV11  LV12  LV13 |  LV2   LV4   LV6   LV8   LV10
     {602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,   682,  682,  682,  682,  682},   //  0 DR index
     {602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,   682,  682,  682,  682,  682},   //  1
     {602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,   682,  682,  682,  682,  682},   //  2
     {602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,   682,  682,  682,  682,  682},   //  3
     {602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,   682,  682,  682,  682,  682},   //  4
     {602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,   682,  682,  682,  682,  682},   //  5
     {602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,   682,  682,  682,  682,  682},   //  6
     {602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,   682,  682,  682,  682,  682},   //  7
     {602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,   682,  682,  682,  682,  682},   //  8
     {602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,   682,  682,  682,  682,  682},   //  9
     {602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,  602,   682,  682,  682,  682,  682}    // 10
  },
```

variable name: i4LCETb1
The Dark/Bright Strength table

Accurate Face Brightness Control

- [**Sensor**]_[**Scenario**]_AE.cpp
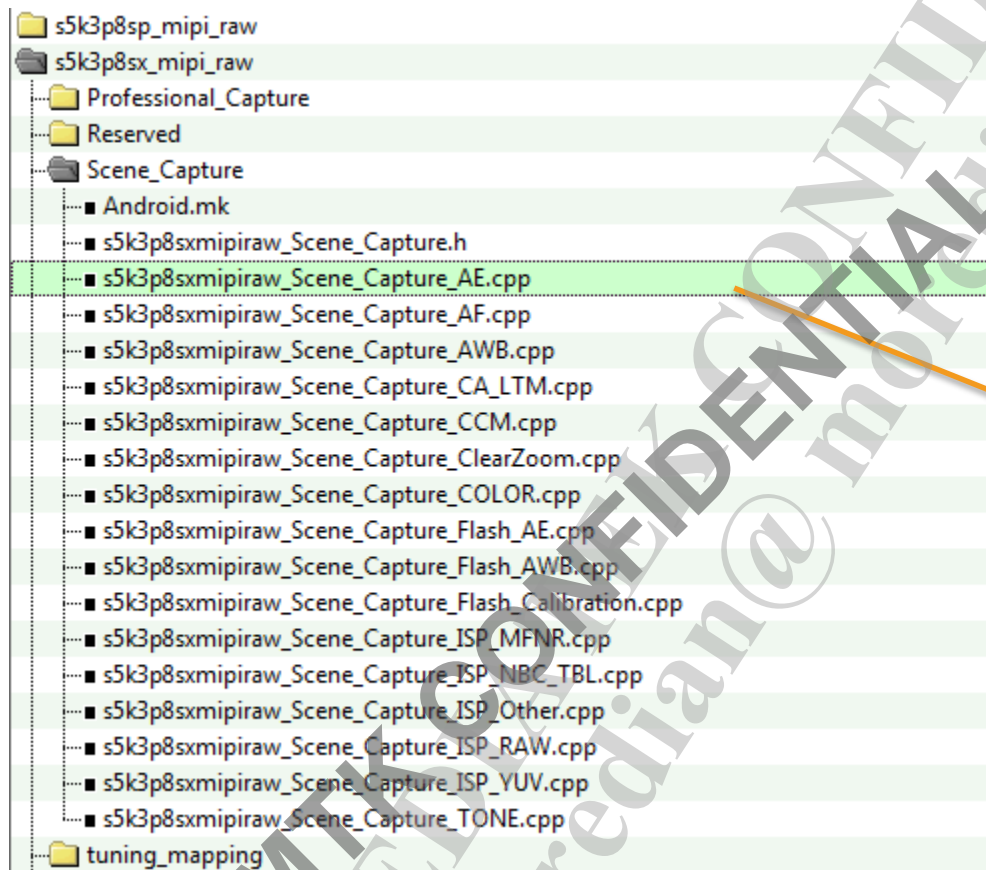
Step 5: LCE-AE link method

```
.rHistConfig = {
    0,
    30,
    200,
    300,
    0,
    1024,
    {1024, 1024, 13, 210, 200},
    {200, 300, 1024, 0, 141},
    {250, 400, 450, 450, 500}
},
```

variable name: LCE-AE link enable
data range: 0 / 1
The flag to disable/enable the LCE-AE link method

OE Check[+]

```
.rHistConfig = {
    0,
    30,
    200,
    300,
    0,
    1024,
    {1024, 1024, 13, 210, 200},
    {200, 300, 1024, 0, 141},
    {250, 400, 450, 450, 500}
},
```

variable name: bright part ratio
data range: 0 - 1000
The ratio to define the bright part to calculate AVEbright

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OE Check[+]

```
.rHistConfig = {
    0,
    30,
    200,
    300,
    0,
    1024,
    {1024, 1024, 13, 210, 200},
    {200, 300, 1024, 0, 141},
    {250, 400, 450, 450, 500}
},
```

variable name: OE table
The ratio table for determine OECheck ratio for mixing the face and normal target

OE ratio

200   300

100 % ← | → 0 %

AVEbright

Normal AE Target should be mixed more

Normal AE Target   Face Target

Brightness
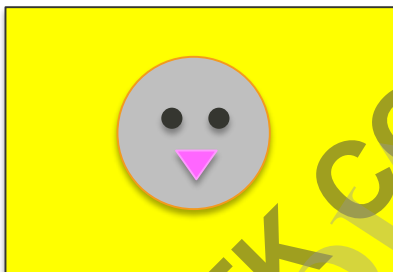
OE Check⁺

```
.rHistConfig = {
    0,
    30,
    200,
    300,
    0,
    1024,
    {1024, 1024, 13, 210, 200},
    {200, 300, 1024, 0, 141},
    {250, 400, 450, 450, 500}
},
```

variable name: inverse OE table
The ratio table for determine OECheck ratio for mixing the face and normal target

OE ratio

200   300

0 % ←————|————→ 100 %

AVEbright

Normal AE Target should be mixed less

Face Target   Normal AE Target

|————————————————————————→ Brightness

LCE Maximum Gain

```
.rHistConfig = {
    0,
    30,
    200,
    300,
    0,
    1024,
    {1024, 1024, 13, 210, 200},
    {200, 300, 1024, 0, 141},
    {250, 400, 450, 450, 500}
},
```
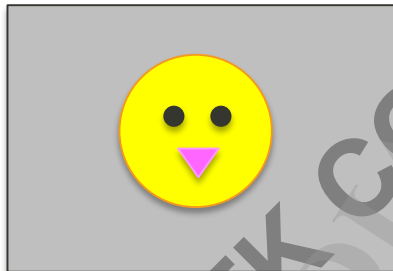
variable name: Maximum LCE gain table
The maximum LCE gain for face enhancement

LV	0	5	10	15	18
Maximum LCE gain	250	400	450	450	500

DCE 1.0

Step 6: Strength tuning

- ❑ Dark Strength table : <u>LV</u> and <u>DR idx</u>
- ❑ Bright Strength table : <u>LV</u> and <u>DR idx</u>

```
{ //i4DCETbl1
// DarkStrength                                          BrightStrength
// LV0   LV2   LV4   LV6   LV8   LV10  LV12  LV14  LV16  LV0   LV2   LV4   LV6   LV8   LV10  LV12  LV14  LV16  TBD
   { 30,   30,   30,   30,   30,   30,   30,   30,   30,   80,   80,   80,   80,   80,   80,   80,   80,   80,   100}, //   0 DR index
   { 30,   30,   30,   30,   30,   30,   30,   30,   30,   80,   80,   80,   80,   80,   80,   80,   80,   80,   100}, //   1
   { 30,   30,   30,   30,   30,   30,   30,   30,   30,   80,   80,   80,   80,   80,   80,   80,   80,   80,   100}, //   2
   { 30,   30,   30,   30,   30,   30,   30,   30,   30,   80,   80,   80,   80,   80,   80,   80,   80,   80,   100}, //   3
   { 30,   30,   30,   30,   30,   30,   30,   30,   30,   80,   80,   80,   80,   80,   80,   80,   80,   80,   100}, //   4
   { 30,   30,   30,   30,   30,   30,   30,   30,   30,   80,   80,   80,   80,   80,   80,   80,   80,   80,   100}, //   5
   { 30,   30,   30,   30,   30,   30,   30,   30,   30,   80,   80,   80,   80,   80,   80,   80,   80,   80,   100}, //   6
   { 30,   30,   30,   30,   30,   30,   30,   30,   30,   80,   80,   80,   80,   80,   80,   80,   80,   80,   100}, //   7
   { 30,   30,   30,   30,   30,   30,   30,   30,   30,   80,   80,   80,   80,   80,   80,   80,   80,   80,   100}, //   8
   { 30,   30,   30,   30,   30,   30,   30,   30,   30,   80,   80,   80,   80,   80,   80,   80,   80,   80,   100}, //   9
   { 30,   30,   30,   30,   30,   30,   30,   30,   30,   80,   80,   80,   80,   80,   80,   80,   80,   80,   100}, // 10
```

variable name: i4DCETbl1
data range: 0 - 100
The Dark/Bright Strength table

Step 7: Strength tuning

- ☐ Dark Strength table in face case : <u>LV</u>
- ☐ Bright Strength table in face case : <u>LV</u>

```
{ //i4DCETbl2
  // LV0    LV2   LV4   LV6   LV8  LV10  LV12  LV14  LV16   LV0   LV2   LV4   LV6   LV8  LV10  LV12  LV14  LV16  TBD
  {    0,    0,    0,    0,    0,    0,    0,    0,    0,    0,    0,    0,    0,    0,    0,    0,    0,    0,  100}, // Face_DarkStrength : Face_BrightStrength
  { 3300, 3300, 3300, 3300, 3300, 3300, 3300, 3300, 3300, 3500, 3500, 3500, 3500, 3500, 3500, 3500, 3500, 3500,  100}, // SkyDetectThr : SkyLimitThr
  {   20,   20,   20,   20,   20,   20,   20,   20,   20,   10,   10,   10,   10,   10,   10,   10,   10,   10,  100}, // SkyProtectOnThr : SkyProtectOffThr
  {  150,  150,  150,  150,  150,  150,  150,  150,  150,   80,   80,   80,   80,   80,   80,   80,   80,   80,  100}, // ContourLimitThr
  {   30,   30,   30,   30,   30,   30,   30,   30,   30,   80,   80,   80,   80,   80,   80,   80,   80,   80,  100}, // TBD
  {   30,   30,   30,   30,   30,   30,   30,   30,   30,   80,   80,   80,   80,   80,   80,   80,   80,   80,  100}, // TBD
  {   30,   30,   30,   30,   30,   30,   30,   30,   30,   80,   80,   80,   80,   80,   80,   80,   80,   80,  100}, // TBD
  {   30,   30,   30,   30,   30,   30,   30,   30,   30,   80,   80,   80,   80,   80,   80,   80,   80,   80,  100}, // TBD
  {   30,   30,   30,   30,   30,   30,   30,   30,   30,   80,   80,   80,   80,   80,   80,   80,   80,   80,  100}, // TBD
  {   30,   30,   30,   30,   30,   30,   30,   30,   30,   80,   80,   80,   80,   80,   80,   80,   80,   80,  100}, // TBD
  {   30,   30,   30,   30,   30,   30,   30,   30,   30,   80,   80,   80,   80,   80,   80,   80,   80,   80,  100}, // TBD
}
```

variable name: i4DCETbl2[0] – Face DarkStrength/Face BrightStrength
data range: 0 - 100
The Dark/Bright Strength table

For Tone 1st tuning ,please reference param above diagram shows

the other param keep defult when 1st tuning

Open AE log adb command:

CCU:
```
adb shell setprop debug.drv.ccu_drv 6
adb shell setprop debug.ccuif.ccu_drv 6
```

ae algo:
```
adb shell setprop debug.ae.enable 9
```

3a:
```
adb shell setprop debug.aaa.pvlog.enable 1
```

lce:
```
adb shell setprop debug.dynamic_lce.log 1
adb shell setprop debug.lce.core.enable 1
adb shell setprop debug.lce.face.log.enable 1
adb shell setprop debug.mapping_mgr.enable 2
```

THANKS