

Document ID: EUG-019-190307-1

# **eGalaxTuner80HXXX**

## **User Guide**

**Firmware Tuning Utility for  
EXC80HXXX/82HXXX Series**



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## Revision History

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EUG-019-190307-1	2019/03/07	Update kernel release note: v05_128 -> v05_138

## Related EETI documents

The EETI documents below are needed for further EETI solution integration.

Document Name	Description
EDG-002-PCAP_Sensor_Design_Rule	Touch sensor design rule.
EDG-004-PCAP_System_Assembly_Rule	System integration and mechanical design.
EDG-025-PCAP_Layout_Design_Rule_EXC80H80_EXC80H100	Controller layout design.
EDG-008-PCAP_and_EMC	EMC tests and system design.
EUG-020-eGalaxWorks_User_Guide_EXC80HXXX	Production line integration and software utility.
EDG-027-PCAP_Water_Resistance_EXC80HXXX	Water resistance feature and testing criteria.

## Symbol definition:

The ***bold and italics*** font refers to a button in user interface.

The brackets [ ] refers to a parameter in the parameter editor window.



## What's New in Firmware Utility Kernel v07\_117?

### Firmware Kernel:

- Improvement.

Fix idle determine bug.

Fix eGalaxTouch driver reporting bug.

Fixe sleep mode bug.

Improve signal stability.

Improve palm performance.

Improve waterline performance.

Improve linearity.

Please refer to [Chapter 17.9-Firmware Kernel Release Note](#) for more information

- HWT version upgrade to v1.9

New parameters:

- ⊙ [Hardware Settings]\SCAN\_CTRL\_VKEY
- ⊙ [Phase Target Config]
- ⊙ [Freq-X General Config]\ClkSrc
- ⊙ [Freq-X General Config]\PreScaler
- ⊙ [Freq-X Img Reg Channel Config]
- ⊙ [IO-VKey Config]
- ⊙ [Freq – X IO-VKey Reg Parameters]
- ⊙ [AA-VKey Area]
- ⊙ [AA-VKey AreaX]

- SWT upgrade to v4.0

Remove below parameter:

- ⊙ [Alg General Config]\Ctrl\_ENHANCE\_LINEARITY (Function cancelled)
- ⊙ [Palm Setting]\PalmRange
- ⊙ [Compensation Setting]\DrawInOutCheckRange

New parameters:

- ⊙ [Palm Setting]\NumsOfTouchDisablePalm
- ⊙ [IO-VKey Setting]
- ⊙ [Compensation Setting]\DrawInOutRange; DrawInOutSpeed;
- ⊙ [Alg General Config]\VKeyTouchMode; Ctrl\_MULTITOUCH\_DISABLE\_PALM; Ctrl\_ENHANCE\_DOUBLE\_CLICK; Ctrl\_NO\_REPORT\_SAME\_POINT;
- ⊙ [Alg General Water Setting ]\WLDisableThTx; WLDisableThRx;

- ⊙ [---Water-X]\WaterDisableRangeTop; WaterDisableRangeBottom; WaterDisableRangeLeft; WaterDisableRangeRight;
- ⊙ [---Point Alg Setting-X)\ExtraConstArea
- ⊙ [Freq Hopping Setting]\DyCookThRatio\_Palm; DyCookThRatio\_Noise; NoiseMaxReportPoint;
- ⊙ [Image Check Noise Hopping Setting]\Ctrl\_CHK\_NOISE\_STRONG\_NOISE\_HOPPING; DyImgCheckNoiseThRatio;
- ⊙ [Palm Setting]\PalmRange\_Rx; PalmRange\_Tx;
- ⊙ [Palm Setting]\NumsOfTouchDisablePalm
- ⊙ [IO-VKey Setting]\VKeyTouchTh; VKeyDownCount; VKeyUpCount;
- ⊙ [Double Click]
- ⊙ [Noise Filter]\NoiseFilterAttr; NoiseFilterChannelCnt;
- ⊙ [Compensation Setting]\DrawInOutInnerRange; DrawInOutRange; DrawInOutSpeed;
- ⊙ [NotifySetting]\NoiseCondNotifyTime; WaterCondNotifyTime; StrayLowNotifyTime;
- ⊙ [Operate Config\_X]
- ⊙ [Operate Param\_X]
- ⊙ [Behavior Param\_X]

#### eGalaxTuner\_80HXXX\_Dev

- User interface improvement.
  - ⊙ Font size is adjustable in **Draw Test page** and **Image Data page**.
  - ⊙ Average signal calculation in **Image data page**.
  - ⊙ Section selector change to Tree view in **Autotune Editor page**.

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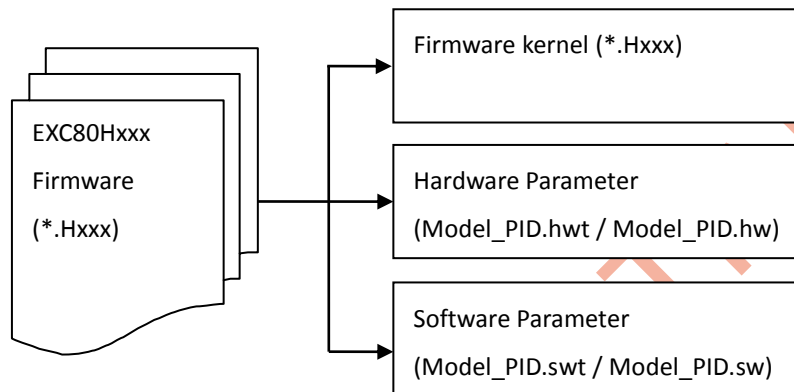
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## 1 Introduction to eGalaxTuner80Hxxx Firmware Tuning Utility

eGalaxTuner80Hxxx firmware tuning utility is designed for EETI EXC80Hxxx Projected Capacitive (PCAP) firmware fine-tune. EXC80Hxxx firmware consists of three parts: Firmware kernel, Hardware parameter and Software parameter.



Firmware kernel is the core of EXC80Hxxx firmware. Hardware parameter and software parameter are required to define your PCAP product. The Firmware kernel is shown below:

Firmware Kernel Version	07_117
VID	0x0EEF
PID	0xC000
Supported Channel	Please refer to <a href="#">Chapter 1.1 - 80Hxxx Product Table</a> .
Supported Touch Points	10
Supported Report Mode	HID mouse. HID multi-touch. HID digitizer for active pen.
Selective Suspend	Disabled
Supported Interface	Please refer to <a href="#">Chapter 1.1 - 80Hxxx Product Table</a> . For UART interface: Baud rate = 115200 with limited touch performance.
Working Frequency	71 kHz to 250 kHz (Maximum of 4 sets available in a firmware)

eGalaxTuner80Hxxx firmware tuning utility provides a self-tuning process: **Autotune**. By referring to the parameters in the setting files, **Autotune** process optimizes the touch system's RC loading (Touch sensor, EETI touch controller, LCD and the system). A balanced RC loading contributes to a good touch performance. Besides, sensor design in different types leads to different RC characteristic, which might cause signal drops and affect the mutual capacitance signal quality. For more information about signal drops, please refer to [Chapter 17.1 - RC Loading for PCAP Touch Solution](#).

This document introduces a basic workflow to generate EXC80Hxxx firmware with eGalaxBuilder4 utility. Please follow the steps in this document to make a firmware with proper touch performance and manufacture quality for test function. For manufacturing test functions it needs eGalaxWorks80Hxxx utility. Please refer to EETI document:

**EUG-020-eGalaxWorks\_User\_Guide\_EXC80Hxxx.**

## 1.1 8xHxxx Product Table

Type	Interface	Channel (Tx*Rx)
EXC80H80	USB + UART + I2C	57 * 80
EXC80H100	USB + UART + I2C	64 * 100
EXC82H80+59100	USB + UART + I2C	100 * 140
EXC82H100+59100	USB + UART + I2C	120 * 198

**Note:** Please reserve shielding channels in advanced. Typically it costs 2 shielding channel per connector.

For EXC80H80:

For Tx usage: 2 shielding + 55 Tx channels.










For Rx usage: 2 shielding + 78 Rx channels.

For EXC80H100:

For Tx usage: 2 shielding + 62 Tx channels.

For Rx usage: 4 shielding + 98 Rx channels. (If Rx uses 2 connectors)

EXC80Hxxx firmware tuning utility related files:

Items	Comment
 <b>eGalaxTuner_80HXXX_Dev</b> Type: Application	Integrative tool for EXC80Hxxx firmware tuning, including draw test function, raw data viewer and parameter editor.
 <b>eGalaxBuilder4_DEV</b> Type: Application	EXC80Hxxx firmware tuning tool for Firmware Tuning Utility.
 <b>eGalax5960Suite</b> Type: Application	Calibration tool for Firmware Tuning Utility.
 <b>eGalaxSignalAnalyzer2</b> Type: Application	Signal analyze tool for fine-tune process.
 <b>eGalaxTouchSignalCalibration</b> Type: Application	Image delay adjustment tool. By following this tool it can fine-tune the image delay by region quickly.
 <b>eGalaxSensitivityAdjuster</b> Type: Application	Adjustment tool for sensitivity. Provide direction swap, sensitivity level, max report point settings.
 <b>eGalaxSpectrum</b> Type: Application	Analysis tool for environment noise.
 <b>HIDdAPI.dll</b> Type: Application extension	Related API.
 <b>eGalax.dat</b> Type: DAT File	EETI utility license file.



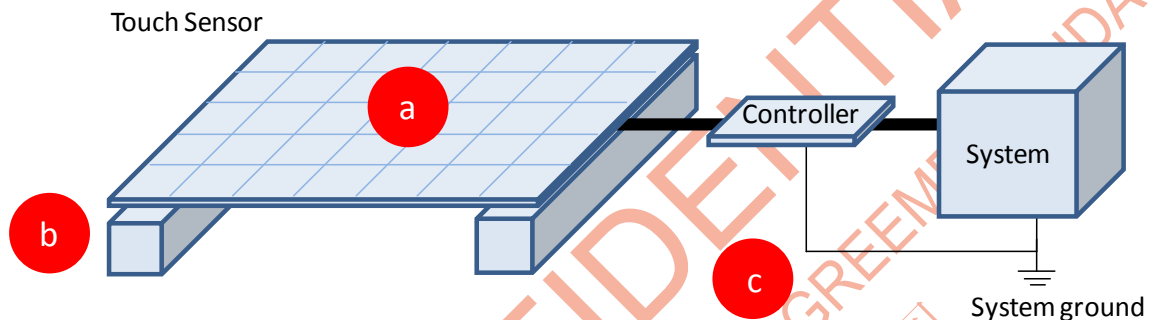
## 2 System installation

### 2.1 Environment Setup

In order to avoid unexpected interference, please install touch module as follows:

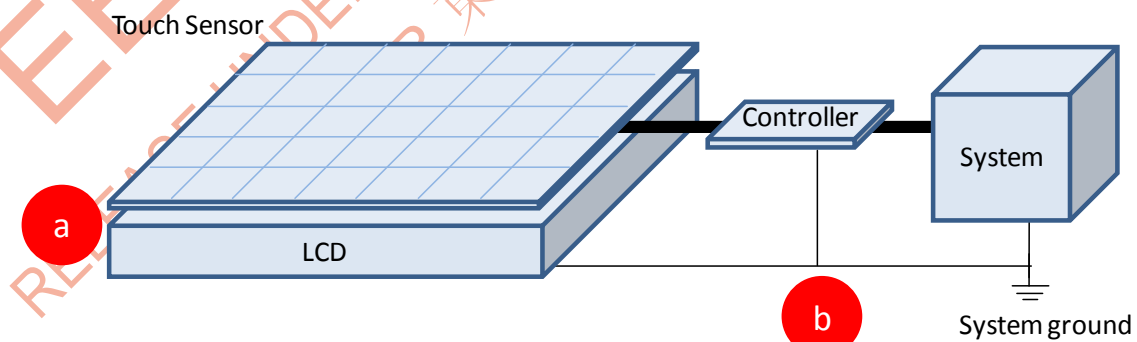
#### Touch sensor only:

- Please remove the screen protectors on both sides of the touch sensor, which affect fine-tune result.
- Please place touch sensor on nonconductive material and keep distance between sensor and tabletop beyond 10mm.
- Please make sure there are no floating parts in the system and all conductive parts are connected to the system ground.  
E.g. The shielding layer, back side steel behind COF.



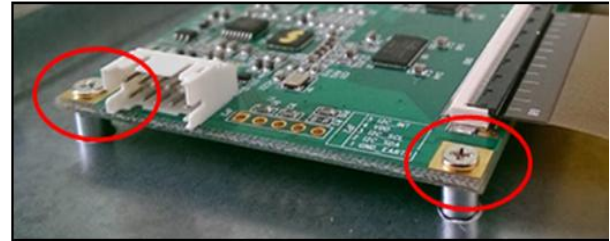
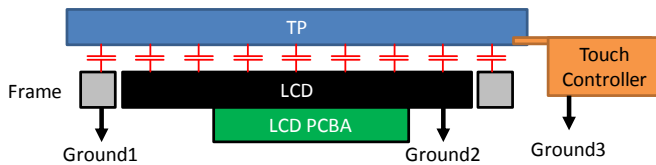
#### Touch sensor + LCD:

- When fine-tuning a touch module (Touch sensor + LCD), please firmly fix the touch sensor on LCD. The touch sensor's position should not be moved when fingers are put on it. In addition, a proper air gap between the touch sensor and LCD is required. The purpose of the air gap is to reduce noise interference from LCD and bending effects on the touch sensor. The height of the gap (between ITO and LCD) depends on the touch sensor size and LCD noise condition, typically > 0.8mm for 10", or greater for big-sized sensors.  
For the first fine-tune, please do not power on the LCD, which might cause more noise and affect the result. The LCD noise will be checked later in [Chapter 10 - Touch System Verification](#).
- Please also make sure the LCD bezel and PCBA are connected to the system ground.

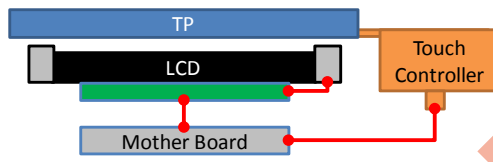


## 2.2 Grounding

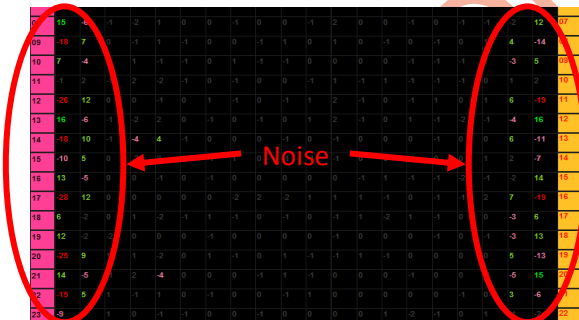
In order to let reference voltage level are same, a touch controller, LCD frame, LCD PCBA and shielding layer are must grounded in same ground system. Please fix and ground the touch controller by screws. Please do not use a conductive adhesive tape or ground line to fix and ground the touch controller, or the grounding condition may not be reliable.



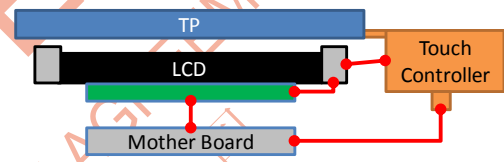
Poorly Grounded  
(Touch controller grounded by interface)



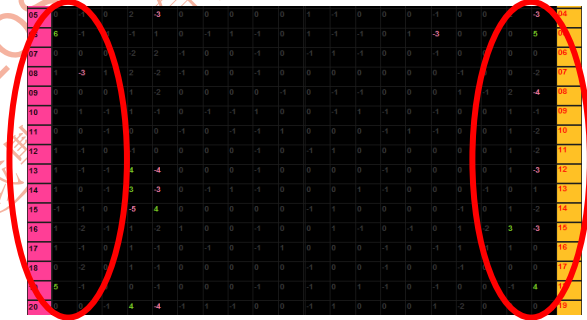
Because of poor grounding, capacitance between sensor and LCD is unstable.



Well Grounded  
(Touch controller grounded by interface and mechanism)

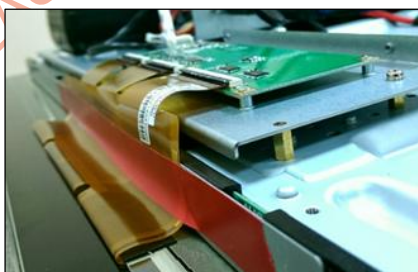


Capacitance is stable between sensor and LCD due to well

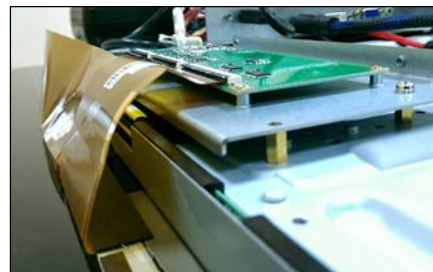


The Tx/ Rx FPC tail position is also important for environment capacitance. Please fix the FPC tail firmly to avoid it from moving arbitrarily. An unstable FPC may cause unexpected signal interference.

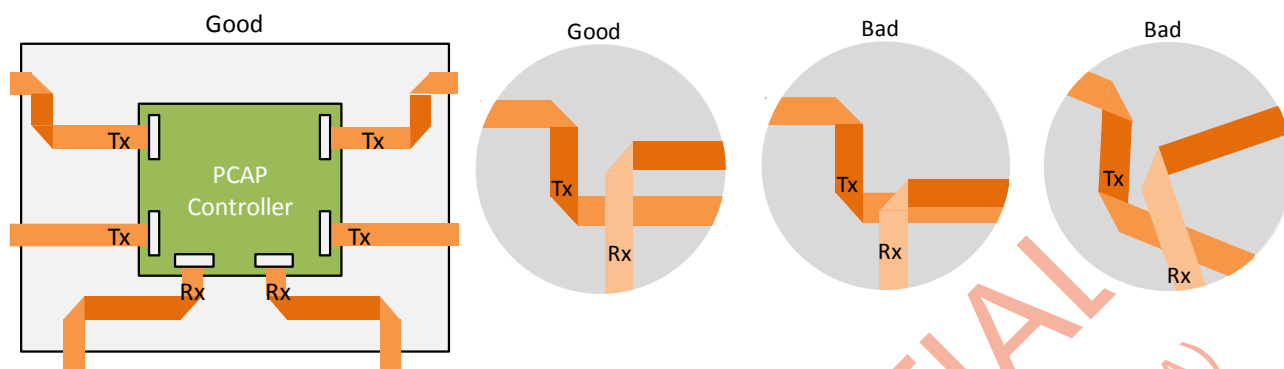
Good



Bad



Please arrange Tx and Rx FPC tails tidily. If Tx and Rx tails have to be overlapped for some mechanical / interference purpose, please overlap them orthogonally (90 degrees). Other angles may cause unexpected signal interference between Tx and Rx FPC.



It is better to fine-tune on a complete system, for the environmental condition will be closer to the end user situation and the fine-tune result will be more accurate. For the system design and integration guideline, please refer to EETI document:

**EDG-004-System\_Assembly\_Rule.**

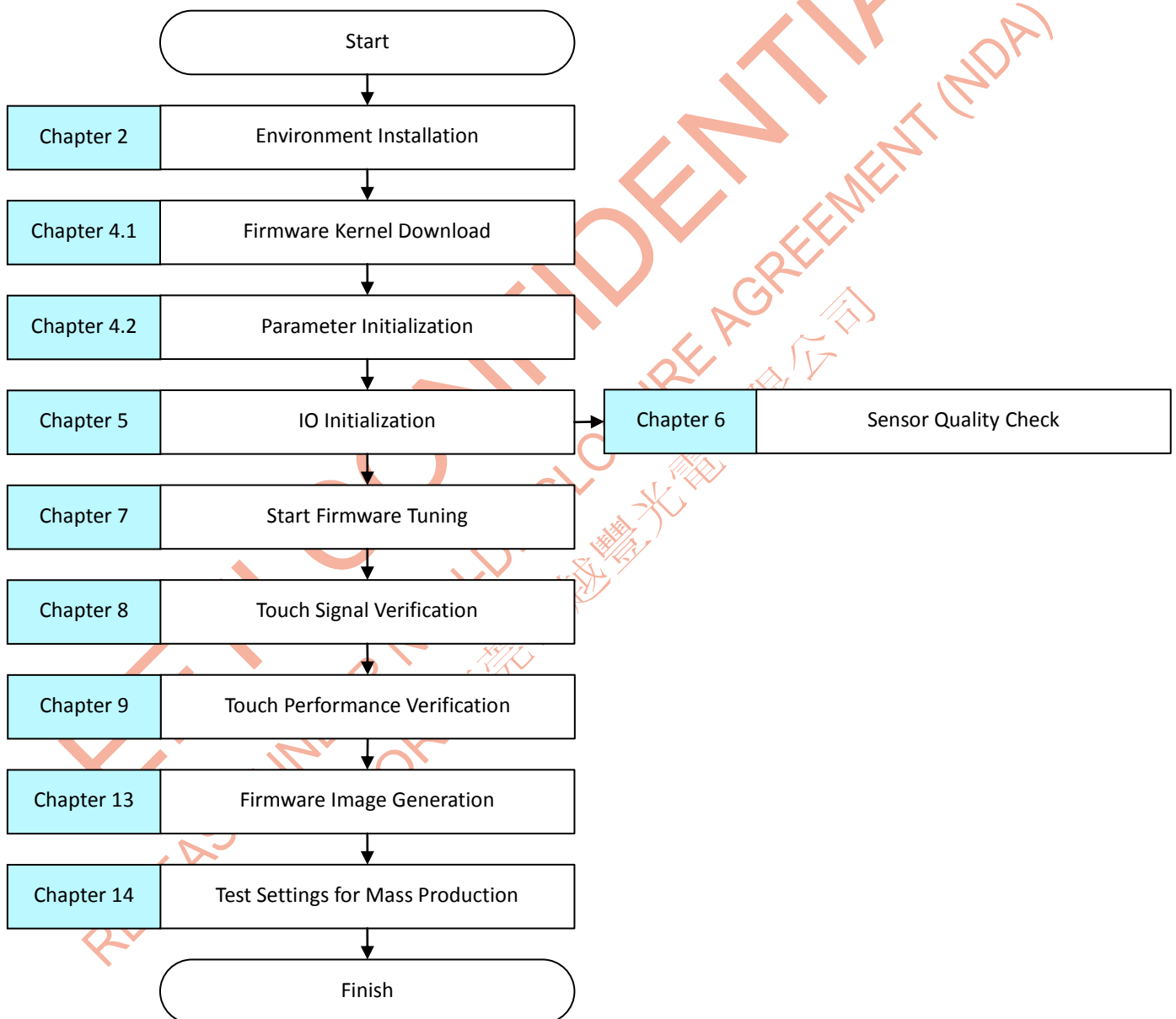
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### 3 eGalaxTuner80Hxxx Firmware Tuning Workflow

#### 3.1 For Touch Sensor Maker

The fine-tune flowchart is as below. Sensor makers need to build up a basic firmware for production, which includes:

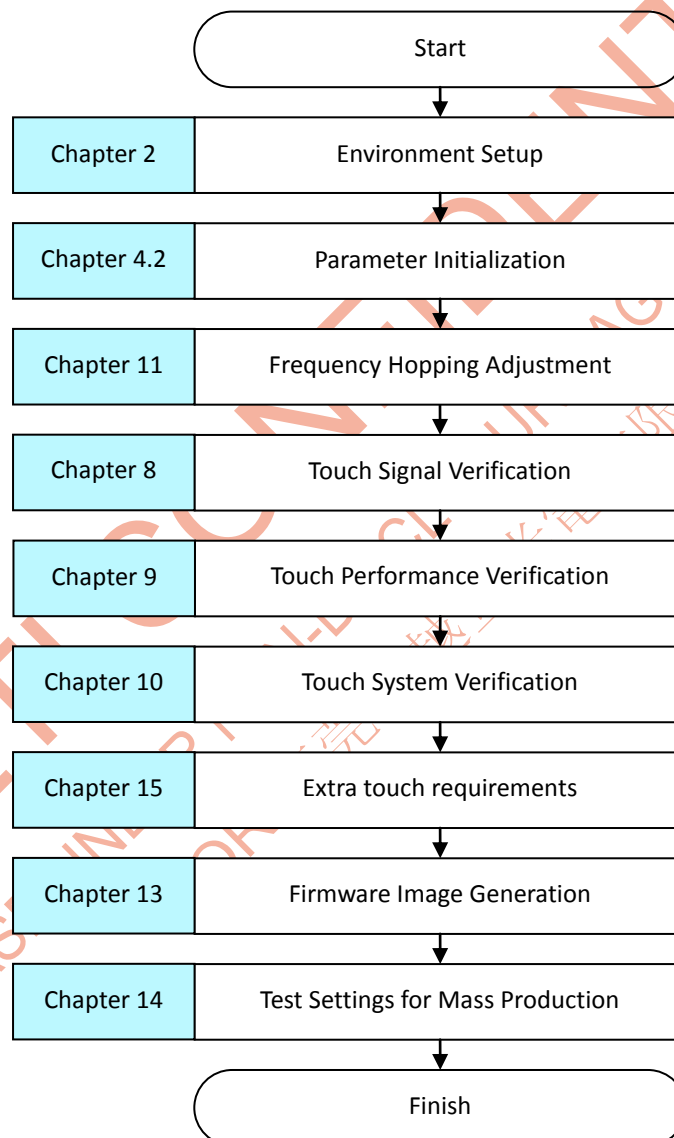
- Basic firmware settings (Model name, IO setting, and direction mapping).
- Analyzing sensor raw data to improve sensor quality.
- Creating firmware image for firmware update.
- Creating sensor test package for production testing.



### 3.2 For Distributer

The fine-tune flowchart is as below. According to the basic firmware provided from sensor makers, distributors need to fine-tune touch performance and extra requirements for the touch system, which includes:

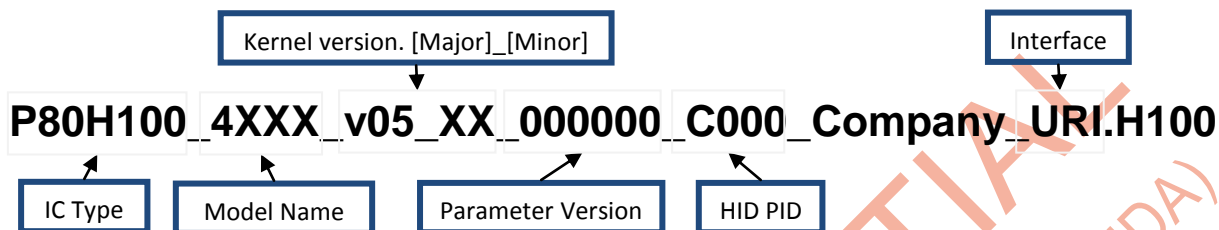
- a. Frequency hopping function for EMC requirements.
- b. Adjust touch performance.
- c. Fine-tuning extra requirements, e.g. Water resistance or palm rejection.
- c. Creating firmware image for firmware update.
- d. Creating sensor test package for production test.



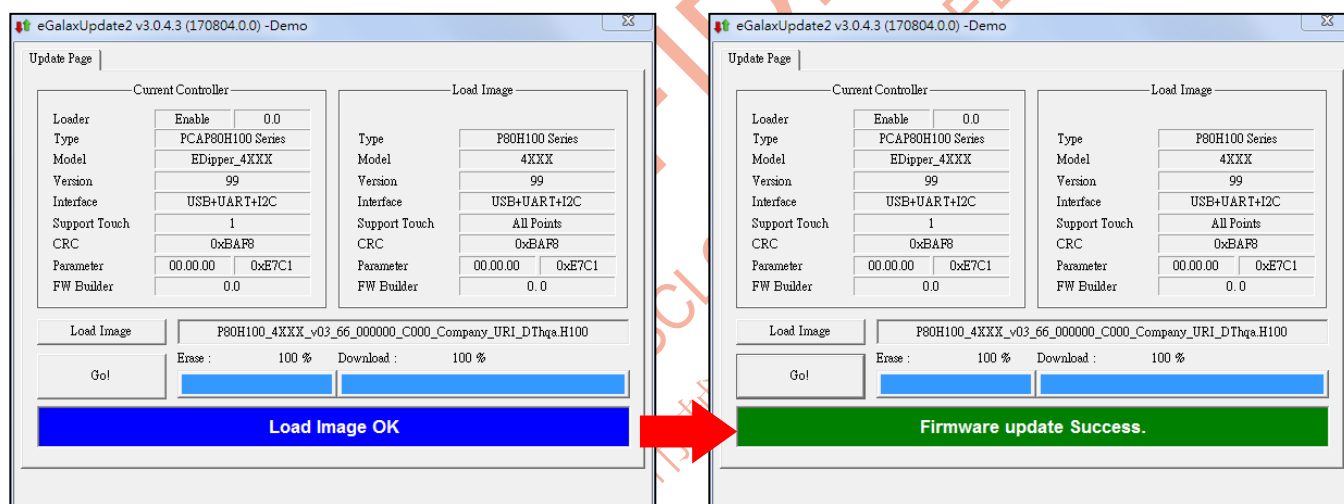
## 4 Parameter Initialization

### 4.1 Firmware Kernel Selection

In order to launch controller successfully, please select right kernel and update it through eGalaxUpdate2. For more information about eGalaxUpdate2, please refer to EETI document: **EUG-020-eGalaxWorks\_User\_Guide\_EXC80Hxxx**.



Interface	Description
URI	USB+UART+I2C

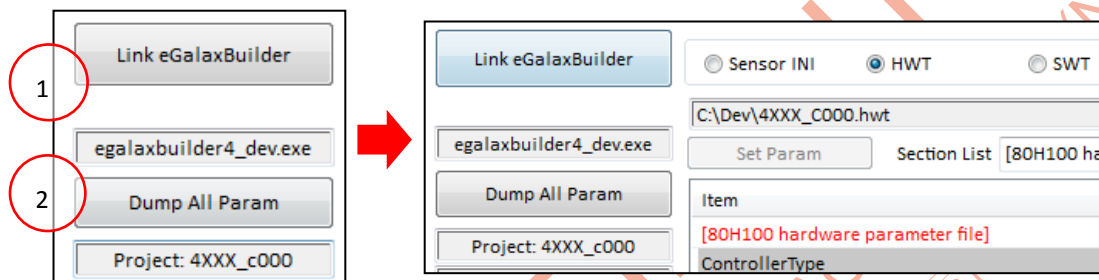


## 4.2 Default Parameters Generation

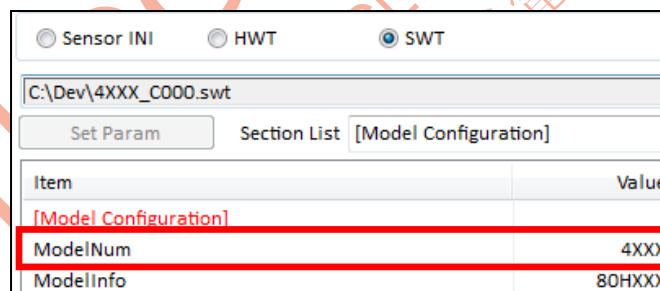
Firmware setting is integrated with three parts as follows:

- Tune\_Project.ini:** It contains sensor and fine-tune settings.
- Project.hwt:** It contains hardware descriptions, working frequencies and controller descriptions.
- Project.swt:** It contains touch function parameters.

Please switch to Autotune Editor page and click **Link eGalaxBuilder** to initialize the eGalaxBuilder4. If setting files already exist in the folders, the Autotune Editor will load them after link eGalaxBuilder4. Or click **Dump All Param** to load previous setting from controller, all parameters will be shown in the working directory.



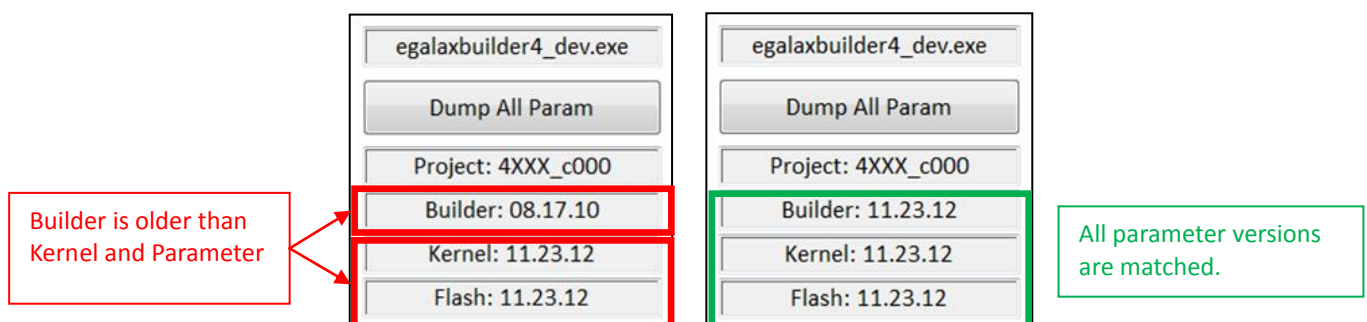
**Note1:** Once default parameters are generated, please change the [ModelNum] from 4XXX to other numbers for a new model. **DO NOT use default [ModelNum]: 4XXX which is a default setting for test. When using default model name the EETI tools will disable calibration function.** Please change [ModelNum] to a new one ranged from 0000 to 9999.



**Note2:** There are limitations on the HW and SW parameter version:

- The eGalaxBuilder's parameter version (HW, SW) must same or larger than the kernel's.
- The Parameter's version (HW, SW) must same or larger than the kernel's

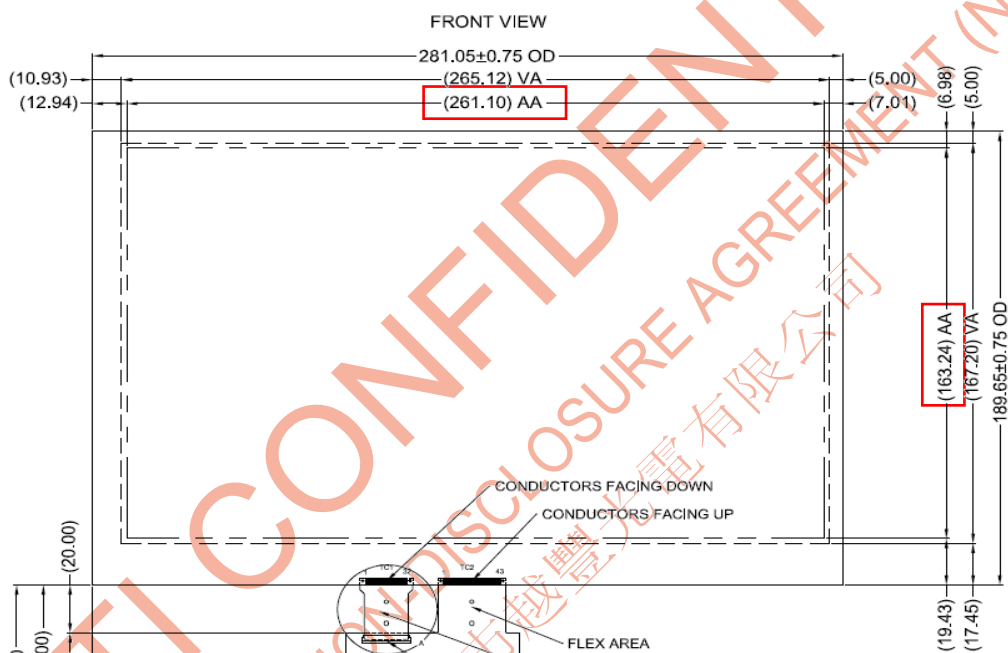
There will be error codes and the touch function will not work version is not compatible. Please refer to [Chapter 16.1 Parameter Version Inconsistence](#) to solve parameter version problem.



## 5 IO Initialization

First, please enter the active area dimension information of touch sensor. The unit of dimension is 0.1mm. [XDimension] means the length for Rx channels, [YDimension] means the length for Tx channels. Take the sensor below for example, please modify [XDimension] to 2611 and [YDimension] to 1632.

Item	Value
[Sensor Config]	
*XDimension	2611
*YDimension	1632

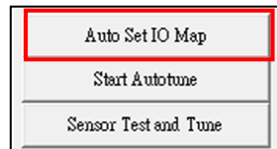


After dimension is set, the next step is IO setting for IC. There are two methods to configure IO setting: **Auto Set IO** and **Manual Set IO**.



### 5.1 Auto Set IO

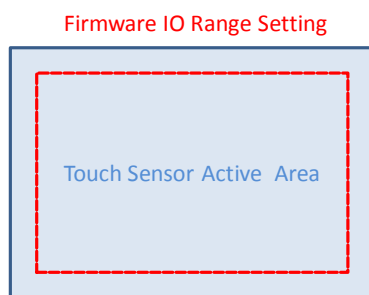
The **Auto Set IO** button is in Autotune Editor page. The function scans the channel status to find Tx and Rx IO setting. After Auto set IO procedure finishes, please verify if the Tx and Rx channel counts are correct to make everything work. If **Auto Set IO** result is not correct, please set IO manually to meet IO setting of the system.



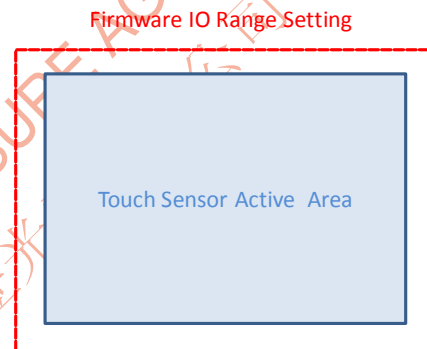
Verify:

- Is Tx and Rx channel count correct?
- Is Tx or Rx Channel offset?
- When putting a finger on the edge channels, can these channels show touch signal correctly in **Image Data Page\ Image Mode: Touch Signal?**

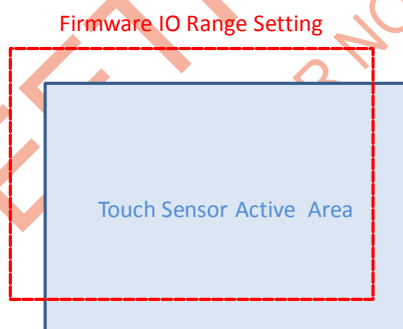
Case1: IO Range smaller than active area.



Case2: IO Range larger than active area.

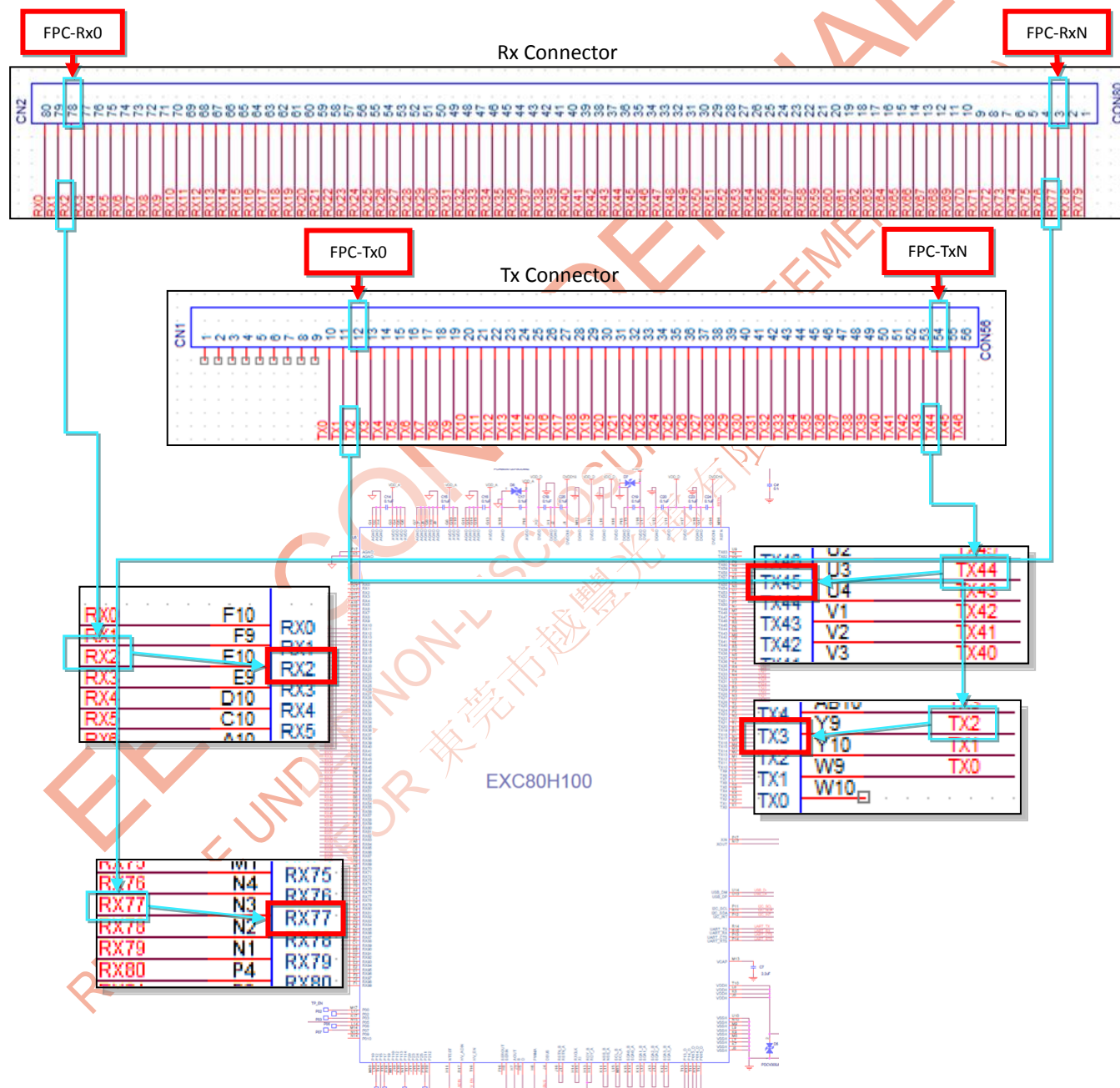


Case3: IO Range offset.

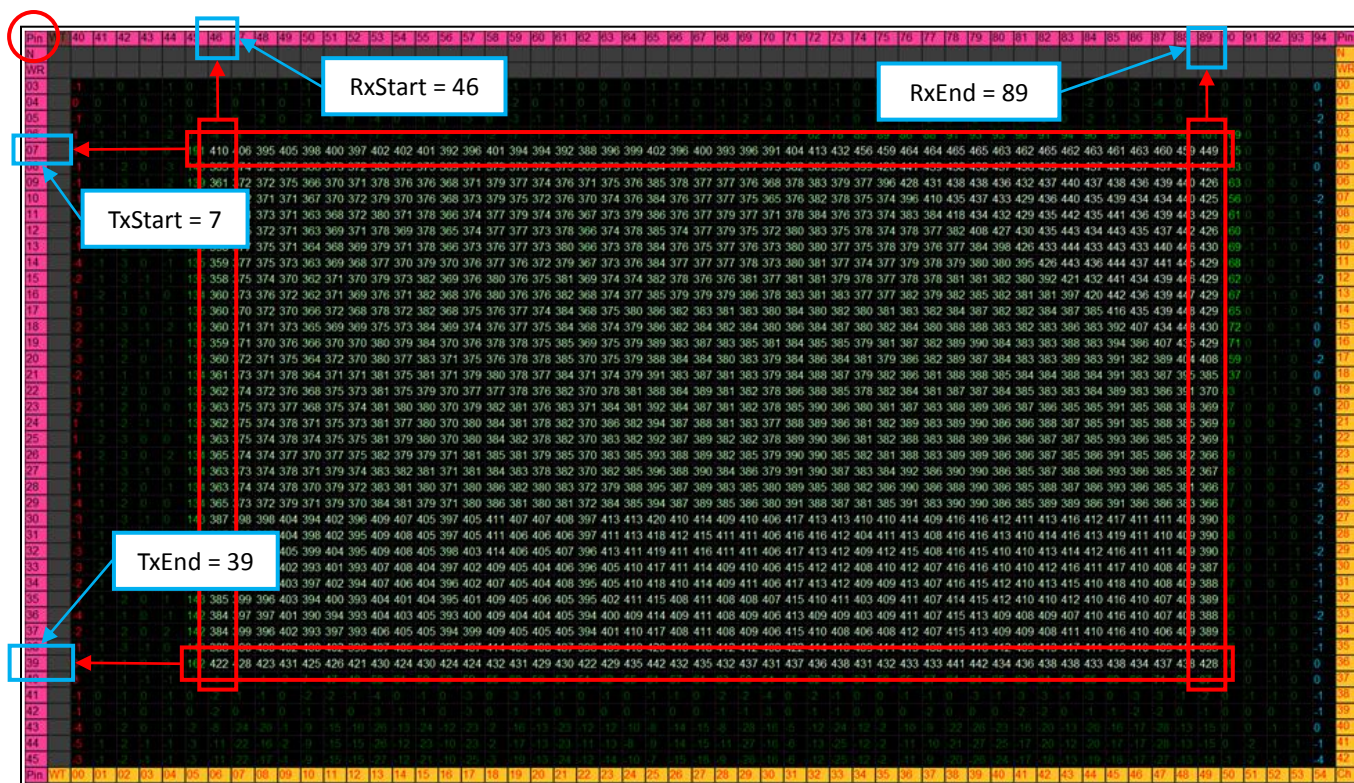


## 5.2 Manual Set IO

Take the circuit diagram below for example, please trace the Tx and Rx start/end channel number to the IC inner channel number. E.g. The Tx channels (not including shielding pins) connect to connector's TX2 to TX44, which are mapping to IC pin Tx3 and Tx45, so please set [TXStart0, TXEnd0] = [3, 45]. Refer to the same concept. The setting of [RXStart0, RXEnd0] = [2, 77].

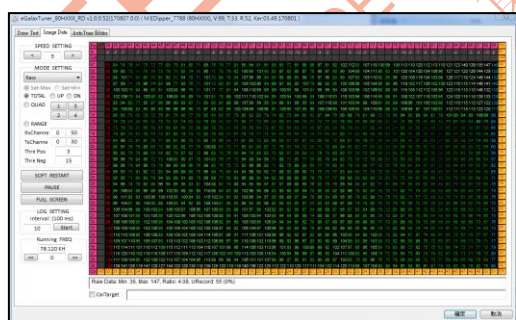


Another way to set IO quickly is to enable all channels of Tx and Rx, and find the signal boundary in the raw data. The signal boundary should represent the touch sensor channels. Please refer to the **left side** index as Tx parameter index and **up side** index as Rx parameter index. In the case shown below, the [TXStart0, TXEnd0] = [7, 39]. [RXStart0, RXEnd0] = [46, 89].



After IO setting is completed, please click HWT - **Set Param** to download parameters. Then, go to **Image Data Page\ Image Mode: Raw**. If any abnormal value is shown in image, there might be channel open issues or incorrect IO settings.

Image Data Page – Raw Mode



Normal

733	727	730	726	727	709	715
736	737	733	736	732	736	717
752	746	749	750	747	747	727
749	751	743	747	747	747	728
745	742	740	740	738	723	6
753	744	749	751	748	728	6
766	753	761	760	764	738	737
768	749	764	760	753	739	735
782	785	778	775	769	752	746

Abnormal

733	784	1	0	8	9
768	816	1	0	8	9
789	821	1	0	8	9
800	832	1	0	8	9
791	832	1	0	8	9
785	830	1	0	8	9
786	835	2	0	8	9
800	852	2	0	8	9

180	170	166	165	165	163
179	169	165	164	164	162
182	172	169	167	167	165
1	0	2	1	3	1
1	0	2	1	2	1
181	171	168	167	167	165
177	167	163	162	163	161
178	167	164	163	163	161

For detailed definitions of hardware parameters, please refer to [Chapter 17.5 - Hardware parameters](#).

**Note:** Touch performance is also highly related to sensor design, please refer to EETI document:

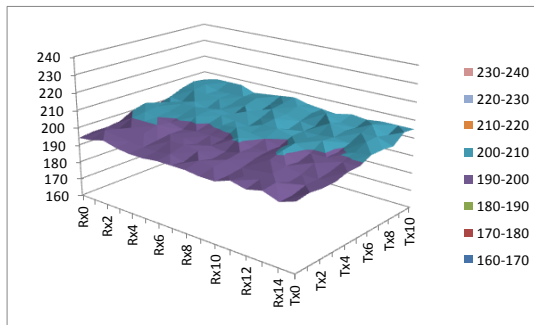
**EDG-002-PCAP\_Sensor\_Design\_Rule** to design touch sensors.

## 6 Sensor Quality Check

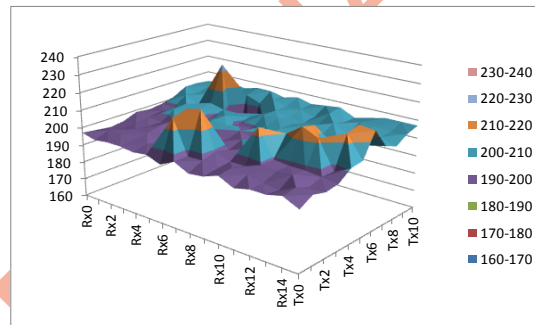
After finishing IO settings, touch sensor makers can check the touch sensor quality by referring to the touch sensor raw data.

Please click Editor Page - **Dump Sensor Raw State** button. The raw data (before fine-tune and after fine-tune) of the touch sensor will be dumped into the log file: **eGalaxCheck.csv**, stored in the BuilderLog folder with eGalaxTuner\_80HXXX\_Dev.exe. The flatness of raw data surface can be used to analyze the RC loading, ITO matching, and hardware defects. A good touch sensor is supposed to has a flat raw data.

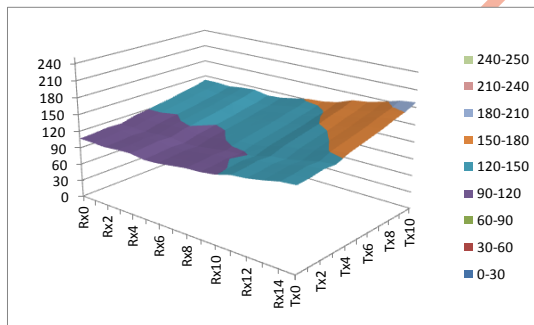
Good Quality – Uniform Surface



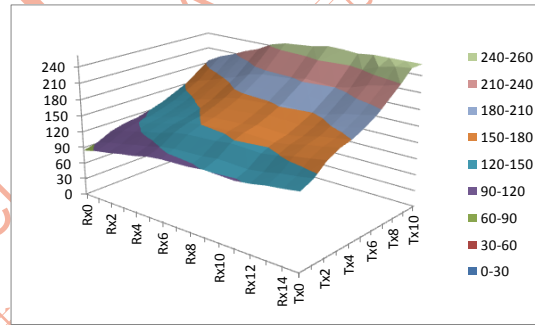
Poor Quality – Not Uniform



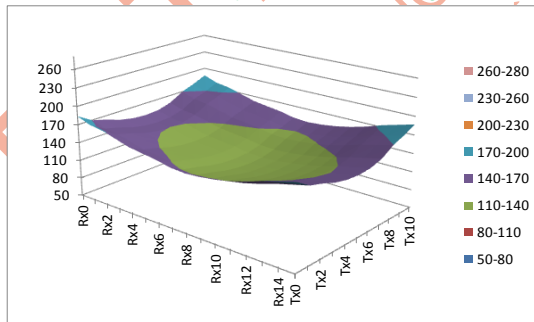
Good Quality – Single Routing



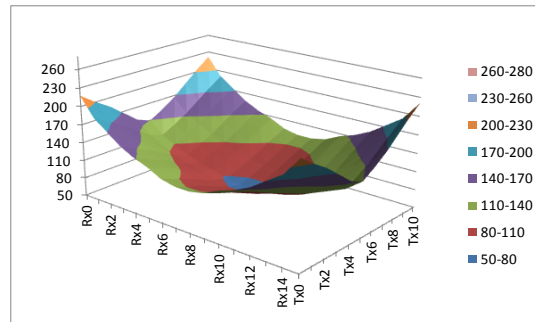
Poor Quality – Single Routing



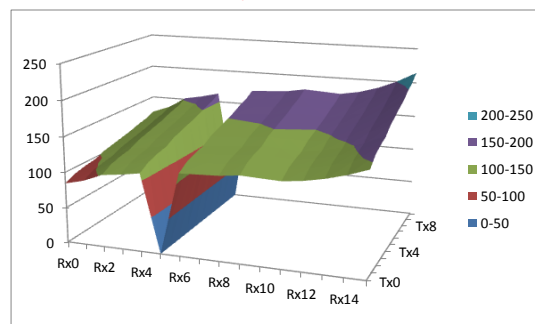
Good Quality – Double Routing



Poor Quality – Double Routing



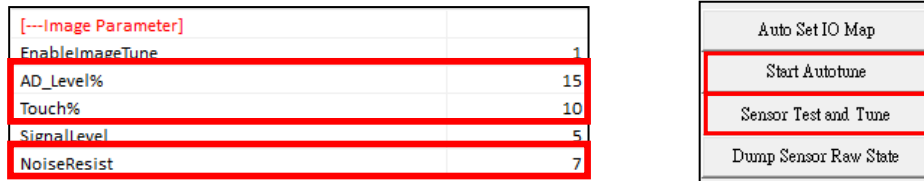
Poor Quality – Channel Open





## 7 Start Firmware Tuning

After entering correct dimension parameters and IO parameters, please run first-time hardware initialization with the default INI setting: [AD\_Level%] = 15, [Touch%] = 10 and [NoiseResist]=7, and click Autotune Editor- **Start Autotune** or **Sensor Test and Tune** button to start tuning process according to the situation:



### a. Sensor Test and Tune:

If the sensor follows EETI sensor design rule, **Sensor Test and Tune** might be a better choice for first fine-tune, it can make self-diagnosis and skip the defect channels to tune the firmware.

### b. Start Autotune:

If the sensor does not follow EETI design rule, it may have high RC loading overhead. So please use **Start Autotune** as the first step, and recheck the hardware defects on the signal check stage.

Please wait until the autotune process completes. The tuning process will generate log files in the folder: \BuilderLog. When technical support is needed, please provide the log files to EETI engineers.

```

Tuning Section 4.....
End Section TimeStamp @ 00:00:49.526
Open Scaling = 33026 TimeStamp @ 00:00:50.811
Mutual Scaling = 33026 TimeStamp @ 00:00:50.812
Download Parameter Success
Create Uniformity Table Success
Execute command: "autotune" SUCCESS!
請按任意鍵繼續 . . .

Customer Mode TimeStamp @ 00:00:00.001
TUNER MajorVersion: 0, MinorVersion: 1, Bulid NO: 37 TimeStamp @ 00:00:00.001
Calibrating... TimeStamp @ 00:00:00.001

Raw Data Error Use The Same CalVref TimeStamp @ 00:00:00.345
Calibration Fail... TimeStamp @ 00:00:00.345
Execute command: "autotune" FAIL!
請按任意鍵繼續 . . .

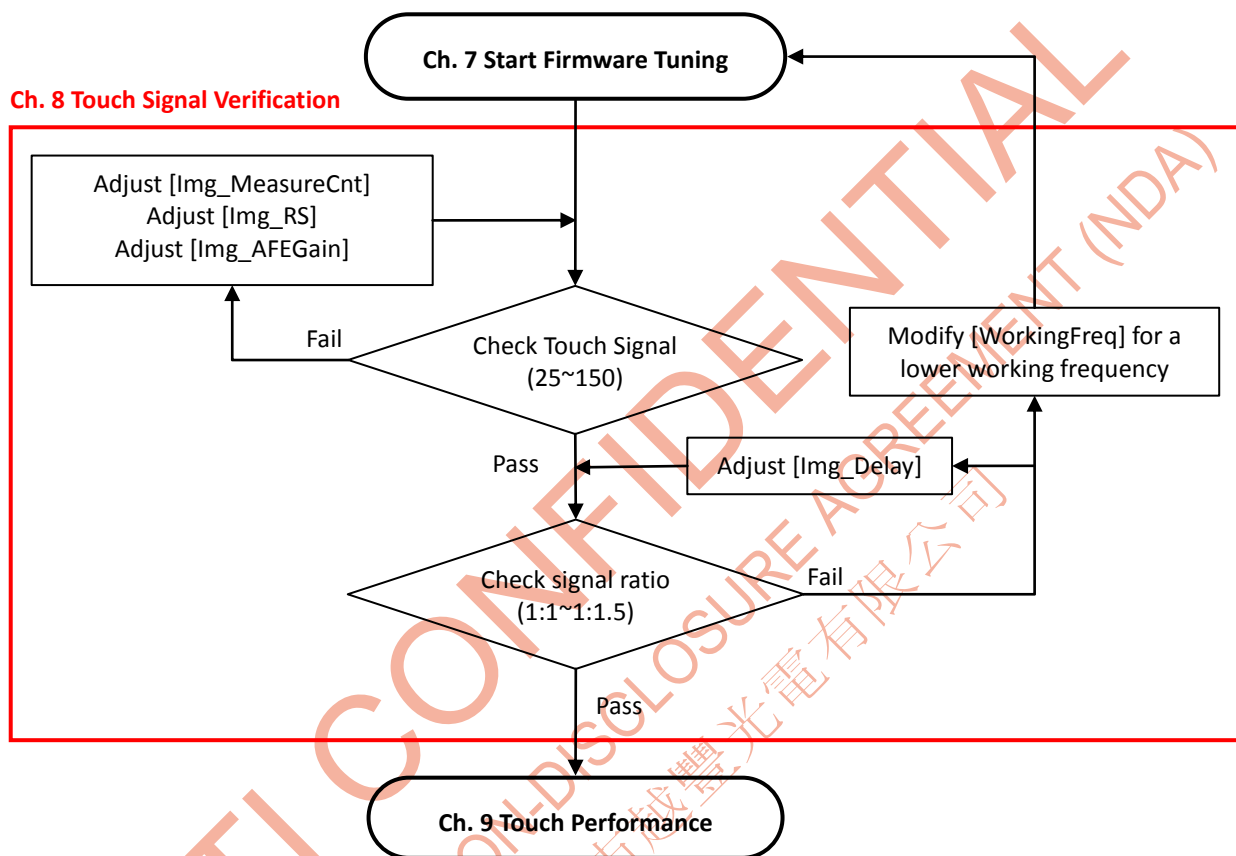
Tuning Section 4.....
Sensing cycle too high, please modify NoiseMargin and fine tune again TimeStamp
@ 00:01:16.892
End Section TimeStamp @ 00:01:16.892
Signal Adjustment Fail... TimeStamp @ 00:01:16.894
Execute command: "autotune" FAIL!
請按任意鍵繼續 . . .

```

**Note:** If "Signal Adjustment Fail" shows, it means base signal strength is too weak on the touch sensor. Please magnify signal strength by increasing [AD\_Level%]. After [AD\_Level%] is modified, click **Start Autotune** again.

## 8 Touch Signal Verification

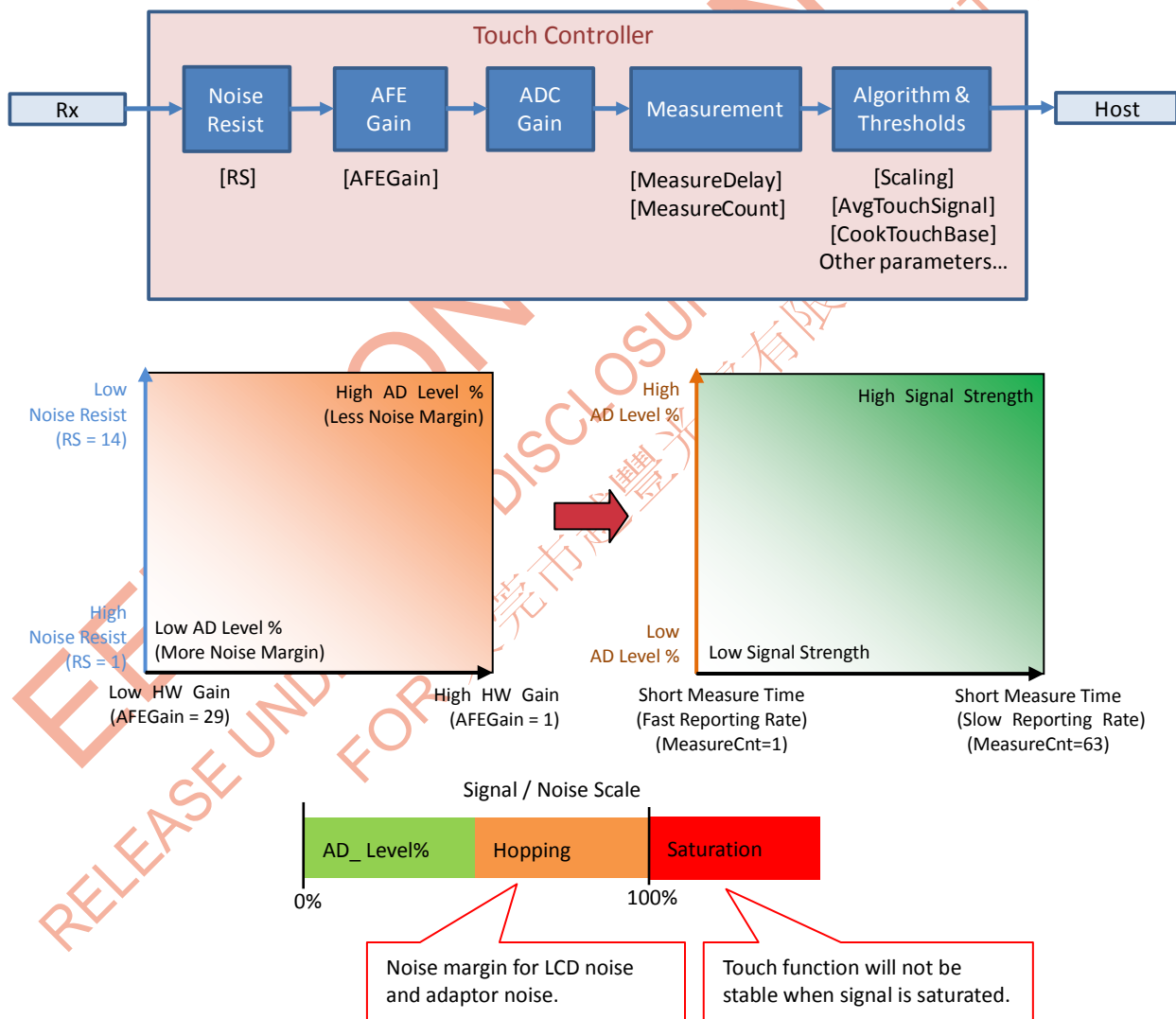
After autotune process is completed, please verify the signal quality. The proper touch signal strength should be in the range of 25~150 and the touch signal on the touch sensor active area should not have much different. The strong signal to weak signal ratio should be in the range of 1:1 ~ 1:1.5. The signal verification flow is showed below:



### 8.1 Signal Strength Adjustment

Touch signal strength is related to AD Level % and [Img\_MeasureCnt]. Please go to **Image Data Page\ Image Mode: Touch Signal**, put a finger on the center of the sensor and check the value (Ideal value is around 25~150). If the touch signal is not at the proper level, please adjust [Img\_RS], [Img\_AFEGain] and [Img\_MeasureCnt]. Please note that these parameters will affect AD level % and report rate as well. The idea is to find the balance in signal strength, reporting rate and noise margin to resist noise interference.

- Lower [Img\_RS] will increase noise resistant ability and SNR, but decrease AD Level %.
- Lower [Img\_AFEGain] will increase AD Level % and SNR, but decrease noise margin.
- Higher AD Level % will make higher touch signal strength.
- Higher [Img\_MeasureCnt] will make higher touch signal strength but decrease report rate.

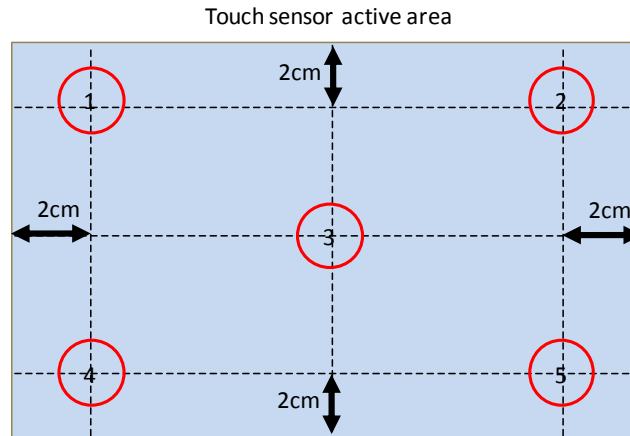


**Note:** The characteristic of a better touch sensor is Touch %  $\geq 5$  and Signal and Noise Ratio (SNR)  $\geq 5$ . If Touch % value  $< 5$ , the SNR may be too low for touch function. In order to have a touch sensor with greater Touch %, please try modifying ITO pattern design to enhance Cm strength. For more information about Touch%, please refer to [Chapter 17.2 - Touch %](#). For more information about SNR, please refer to [Chapter 8.2 - Adjust Signal Ratio](#). For a better touch sensor design, please refer to EETI document: **EDG-002-PCAP\_Sensor\_Design\_Rule**.

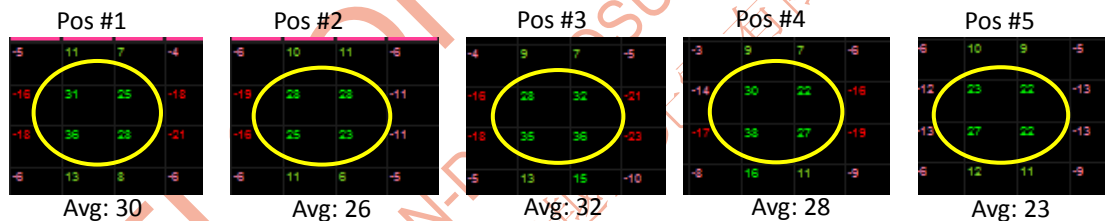
## 8.2 Signal Ratio Adjustment

In **Image Data Page\Image Mode: Touch Signal**, please measure the touch signal by putting on a finger or a proper-sized copper stick on the 5 locations shown below, and adjust your finger position slightly to make the signal even on 4 nodes.

**Note:** When doing fine-tune, the proper diameter of a contact object is range from 1.5 or 2 times as ITO pitch. E.g. ITO pitch = 5mm, the idea contact diameter to have good signal strength will be 7.5mm~10mm.



The signal ratio of a touch is calculated by the strongest and weakest signals in the five locations above on the sensor. The best ratio is under 1.5. Take the figure below for example, the touch ratio is 32:23 which approximates to 1.39.



The signal ratio is related to the RC loading of the sensor. There are two parameters related to signal ratio: [Img\_Delay] and [WorkingFreq]. About RC loading of a touch sensor, please refer to [Chapter 17.1: RC Loading for PCAP Touch Solution](#).

- [Img\_Delay]

The signal ratio issue is caused by the RC loading and the signal drop due to the sensor design. [Img\_Delay] can change the RC charging time to reduce the signal drop. If the ratio is greater than 1.5 after autotune process, please try increasing or decreasing this parameter to improve the signal ratio. [Img\_Delay] ranges from 0 to Max. Please find the Max value in the comment of [Img\_Delay]. First, please check the changing trend of the signal ratio by increasing and decreasing [Img\_Delay]. Then, adjust it to the value with proper signal ratio.

- [WorkingFreq]

If adjusting [MeasureDelayTime] does not work, please change to a lower working frequency and fine-tune again. Please select a new frequency that is lower than the current one.

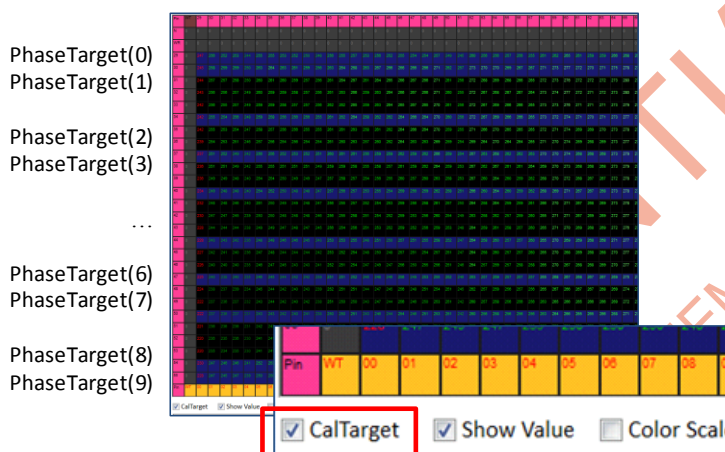
For example, if the current working frequency is 166khz ( [WorkingFreq]=8 ), then use 136khz ( [WorkingFreq]=15 ) as a new working frequency.

**Note:** For better touch performance and less signal drop, please make Tx double routing and Rx single routing. Please refer to EETI document: **EDG-002-Sensor\_Design\_Rule**



### 8.3 Signal Adjustment by Region

The parameters in [Chapter 8.1](#) are for overall signal fine-tune. However, for a large size touch sensor (Larger than 32 inch), it's difficult to use one universal setting to make every area has same signal strength. It's necessary to use different settings on different region. There are 10 phase targets predefined across Tx channels and it's possible to use different settings for each phase target. The nearby two phase targets define a region. The Tx channels inside the region will use the interpolation settings from two boundary phase targets. The **CalTarget** in Image Data Page can display these phase target location.



Like the [Img Reg Parameter] settings, there are same parameters on each target. The default value of each phase target is created by auto-tune process and the [Img Reg Parameter] will apply the maximum value of all phase targets. There are two conditions in using universal settings and phase target settings:

- When you modified the [Img Reg Parameter] setting, the phase target setting will remain the same value, but the controller will scaled the phase target settings to the universal settings when doing signal scan.
- When you modify the phase target parameter, the [Img Reg Parameter] will be re-aligning to the maximum value of all phase targets.

In other word, the universal settings can adjust the overall signal strength quickly. The phase target setting can adjust the signal strength precisely. By using the target parameters in [Img Reg Channel Config] properly, it's possible to optimize the signal strength for larger size touch sensor.

[Freq-0 Img Reg Parameters]	
Img_MeasureCnt	23
Img_AFEGain	26
Img_RS	8
Img_Delay	30
Img_ADCGain	3
Img_Scaling	4

[Freq-0 Img Reg Channel Config]	
Img_Delay	30
Img_Delay(0)	10
Img_Delay(1)	10
Img_Delay(2)	15
Img_Delay(3)	15
Img_Delay(4)	20
Img_Delay(5)	20
Img_Delay(6)	25
Img_Delay(7)	25
Img_Delay(8)	30
Img_Delay(9)	30
Img_RS	8
Img_RS(0)	0

Maximum value from all targets

**Note:** The tool: **eGalaxTouchSignalCalibration.exe** can guide user to adjust [Img\_Delay] and [Img\_MeasureCnt] by region quickly. If the result is not good as expect, please configure the phase target parameter manually.

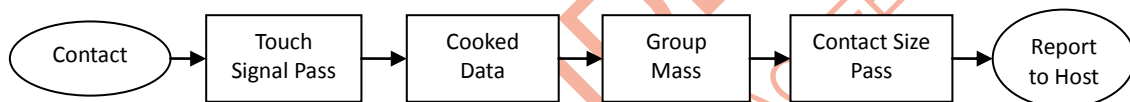
## 9 Touch Performance Verification

After finish hardware signal tuning, it's necessary to set proper thresholds for good sensitivity and good user experience. Touch reporting rate, sensitivity, filter and edge accuracy parameters can be adjusted in SWT section.

### 9.1 Sensitivity Thresholds

[---Sensitivity-0]				
AvgTouchSignal	150	0~65534	The average value of touch signal.	
CookTouchBase	120	0~65534	Threshold for a valid contact in cooked data. Cook Data*(50%~80%)	
GroupMassBase	1000	0~65534	Threshold for a valid touch. Z Value*(50%~70%)	
SensitivityLevel	0	-5~5	The general sensitivity setting to adjust touch thresholds.	
TouchSizeMin	0	0~254	If touch size less or equal this value, it will be rejected.	
TouchSizeMax	250	0~254	If touch size larger or equal this value, it will be rejected.	
Uniformity	20	0~65534	Threshold for baseline adjustment.	

The touch sensitivity is the thresholds for performing a touch action with conductive objects. In EXC80HXXX solution, the parameters related to sensitivity are [AvgTouchSignal], [CookTouchBase], [GroupMassBase] and [TouchSizeMin/Max]. Below is the threshold verifying process for a touch action in the system:

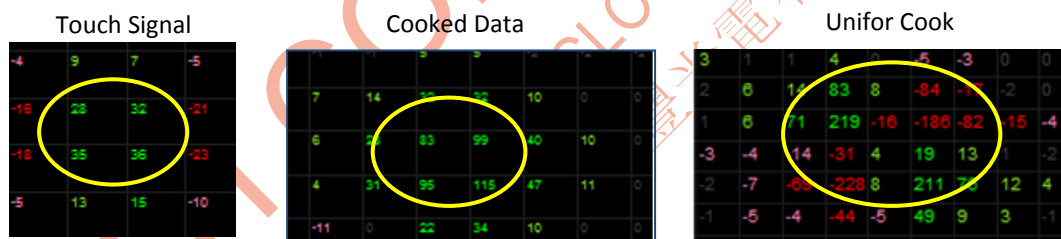


If any value above cannot pass its threshold, the contact will be rejected in the above process. Each value rejected has its corresponding AlgState code shown in TouchInfo window ([Chapter 16.2 Malfunction of Touch](#)). There are two ways to configure the thresholds: **Automatic setting** ([Chapter 9.2-Automatic Sensitivity Setting \(eGalaxSignalAnalyzer2\)](#)) and **Manual setting** ([Chapter 9.3-Manual Sensitivity Setting](#)).

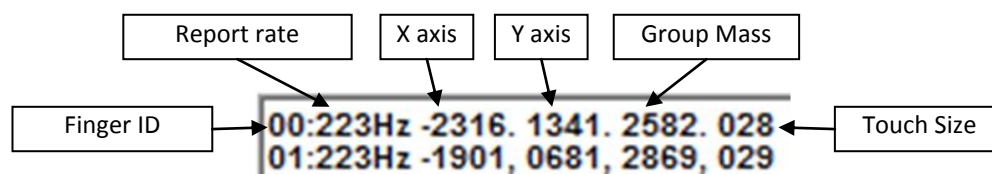
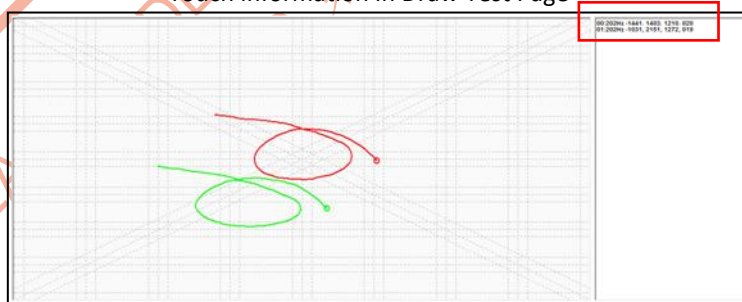
## 9.2 Manual Sensitivity Setting

Below is an example to set up proper thresholds:

- In **Image Data Page\ Image Mode: Touch Signal**, make the signal distributed equally to the 4 nodes, and set the [AvgTouchSignal] value equal to it. E.g. If the average touch signal is around 32, please set [AvgTouchSignal] to 32.
- In **Image Data Page\ Image Mode: Cooked Data**, make the signal distributed equally to the 4 nodes, and set the [CookTouchBase] value to 50%~80% of the touch value. E.g. If the average value is 100, please set [CookTouchBase] to  $100 * (0.5 \sim 0.8) = 50 \sim 80$ .
- In **Draw Test Page**, set the [GroupMassBase] value to 50%~70% of the z value from a finger touch. Take the figure below as reference, please set [GroupMassBase] to  $1100 * (0.5 \sim 0.7) = 550 \sim 770$ .
- In **Image Data Page\ Image Mode: Unifor Cook**, make the signal distributed equally to the 4 areas, and set the [Uniformity] value to 50%~70% of a max unifor cook value. E.g. If the max value is 200, please set [Uniformity] to  $200 * 0.5 = 100$ . The [Uniformity] is a threshold for baseline calibration. ([Chapter 10.1 Hardware Calibration](#))
- If above thresholds cannot meet the requirements, please consider [TouchSizeMin] and [TouchSizeMax].

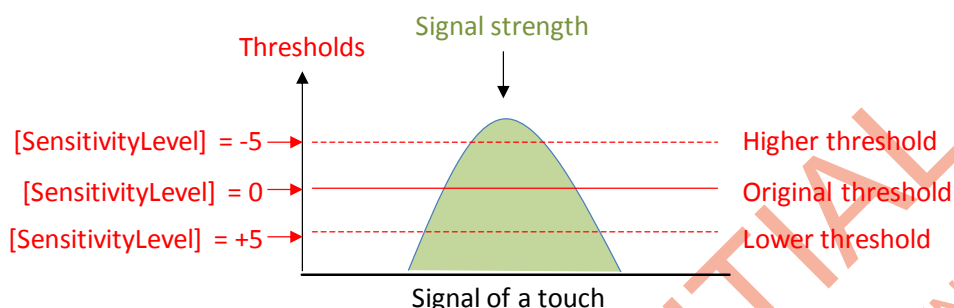


Touch information in Draw Test Page



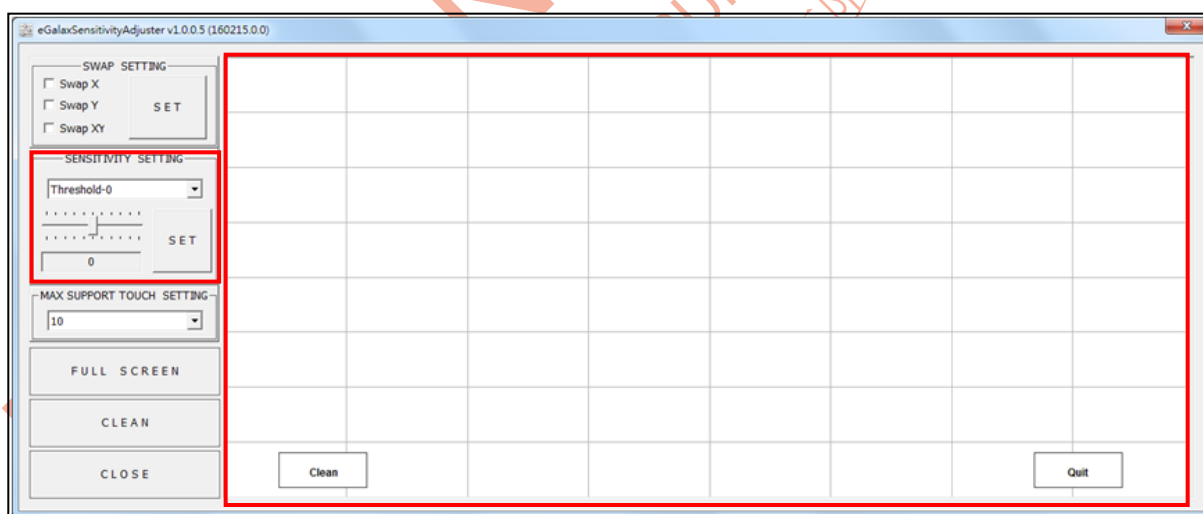
### 9.3 Sensitivity Adjustment

If the sensitivity is intended to be changed, there is a simple way to effectively change sensitivity without redefining above parameters, which is by modifying the [SensitivityLevel] parameter.



The [SensitivityLevel] ranges from -5 to 5. Each count of [SensitivityLevel] will cause a 10% difference to the touch threshold. For example, if [SensitivityLevel] is set to 3, it will make the threshold 30% lower than the base value and 30% improvement to the sensitivity at the same time. If adjusting the [Sensitivity] parameter still can't meet the requirement, please fine-tune again to get proper signal strength.

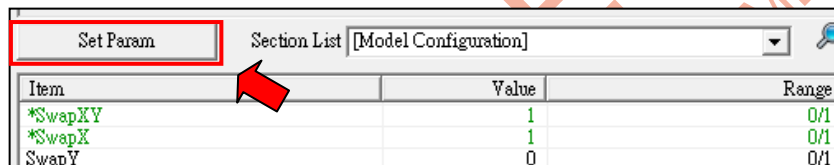
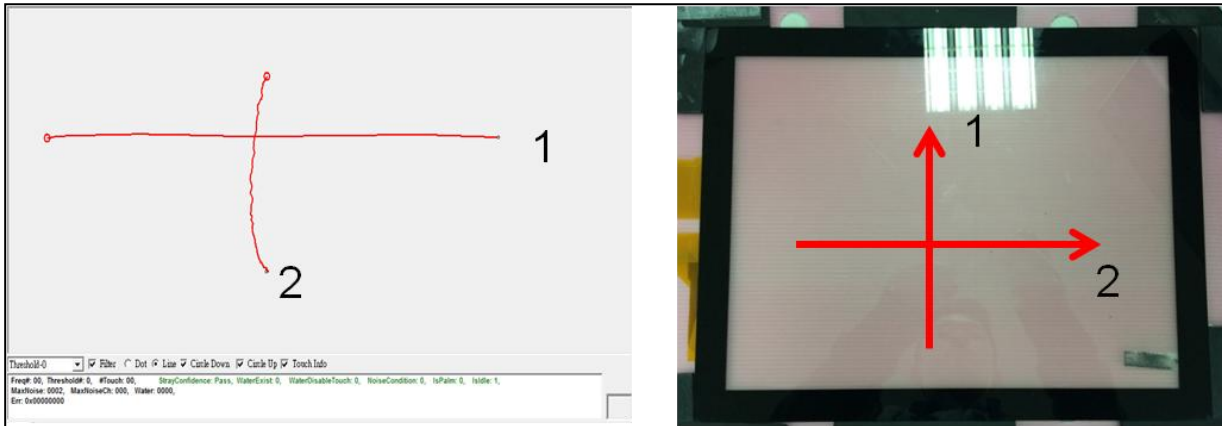
The Tool: **eGalaxSensitivityAdjuster.exe** provides the basic functions to quickly adjust the sensitivity. Users can modify [SensitivityLevel] by changing the slide bar and verify the sensitivity result in the draw test window.



**Note:** An excessive sensitivity will cause the touch function unstable, and disable the touch firmware from automatically calibrating environment variation, leading to false touch easily. Please set the sensitivity proper for your product. (Refer to [Chapter 10.6 Touch System Stability](#))

## 9.4 Direction Mapping

If XY, X and Y directions are different, please swap the directions in software parameter.



## 9.5 Reporting Rate

The reporting rate is based on the hardware settings, working frequency and signal strength. A proper reporting rate ranges from 150Hz to 200Hz for a decent touch performance in 80HXXX solution. The reporting rate information can be checked in **Draw Test page**. The reporting rate may be different when the screen is touched with different numbers of fingers.

**If touch reporting rate is intended to be increased**, please follow either action below:

- Select a higher working frequency.
- Reduce [Img\_MeasureCnt] to make reporting rate faster. The signal strength and thresholds may need to be configured again.

**If touch reporting rate is intended to be reduced**, please follow either action below:

- First try to increase SWT\[ReportRateScanTime] to make reporting rate slower. There is no need to fine-tune again for slowing down the reporting rate.
- Otherwise you can try to increase HWT\[Img\_MeasureCnt]. It increases hardware scan time and make reporting rate slower. However, it will affect signal strength and thresholds may need to be configured again.

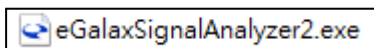
## 9.6 eGalaxSignalAnalyzer2

eGalaxSignalAnalyzer2 is a simple signal analysis tool which provides functions below:

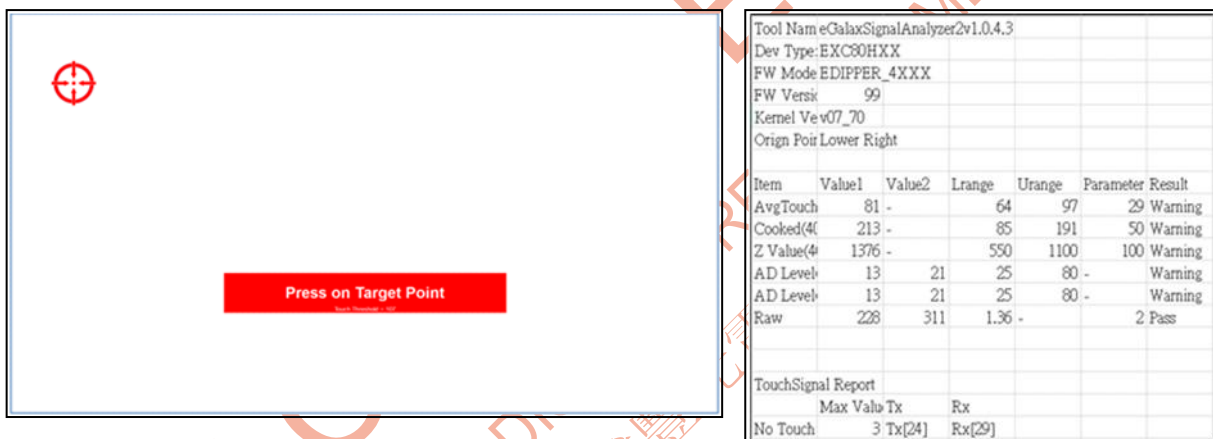
- Analyze signal strength and SNR.
- Compare the signal strength and thresholds.
- Analyze raw data uniformity and saturation level.
- Generate analysis report.

Please follow actions below to run eGalaxSignalAnalyer2:

- a. Please double click the eGalaxSignalAnalyser2.exe.

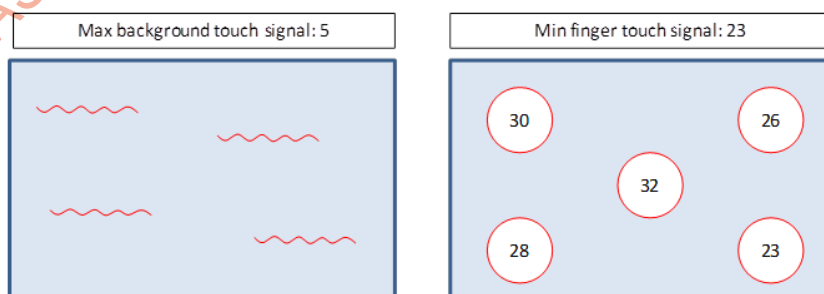


- b. Please follow the instructions on screen to complete SignalAnalyzer2 process.



- c. Verify sensitivity performance in Draw Test page, and modify [SensitivityLevel] if necessary. (Please refer to [Chapter 9.4 Sensitivity Adjustment](#))
- d. The analysis report will be stored in the folder: **SALog\Date-Time\SARepor-[Model]-[Version]-[Date].csv**.

**Note:** The Signal and Noise Ratio (SNR) is the ratio of finger touch to idle condition in **Touch Signal**. For example, if the minimum of the finger touch signals on the 5 locations is 23, and the maximum of the touch signals without a touch (idle condition) is 5, we can conclude that the SNR is 23:5 which approximates to 4.6:1. The suggested SNR is 5:1.



## 10 Touch System Verification

### 10.1 Hardware Calibration

Signals differ from one system to another due to the offset of touch sensor, hardware components, and system assembly. The offset may cause signal saturated and touch function abnormal. In order to compensate the system offset and variation, hardware calibration function is needed. Hardware calibration will be executed during fine-tune, firmware update and the sensor test process.

Hardware calibration stores the variations of touch environment (system offset), while the firmware compensates the variation by referring to system offset information. A firmware with correct system offset information can compensate abnormal RC characteristics, verify the baseline and correct it. If the system offset information is incorrect, it is possible to rectify baseline in the wrong way and cause false touch. **In order to store the latest system offset in EXC80HXXX controller, it is necessary to run sensor test at each production stage and on a complete system.**

If the system offset is different from the original condition, the hardware calibration data becomes unreliable. The information: **StrayConfidence** in the **Draw Test Page** will show Fail. It means the system offset value is over the thresholds and that the firmware considers the baseline to be incorrect. It could result from below factors:

- The ITO defects.
- Sensor stack changed.
- Air gap changed.
- Noise interference.
- Ground condition of touch controller or LCD changed.

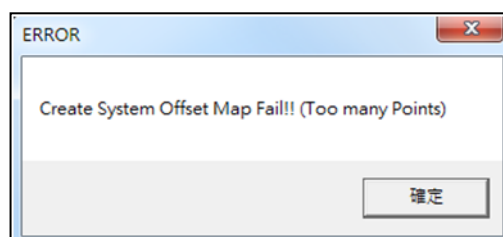
```
Freq#: 00, Threshold#: 0, #Touch: 00 (00), StrayConfidence: Low, WL: (-1, -1),
WaterState: No Water, WaterDisableTouch: 0, NoiseCondition: 0, IsPalm: 0, IsIdle: 0, IsFinger: 0,
MaxNoise: 0000, NoiseCh: 032, Water: 0000, CMax: 0000, CMin: 0000, S/F: 0014 / 28, PalmCnt: 000, WaterNodeCnt: 0000,
```

It is necessary to run hardware calibration again to rebuild system offset information.

```
Freq#: 00, Threshold#: 0, #Touch: 00 (00), StrayConfidence: Pass, WL: (-1, -1),
WaterState: No Water, WaterDisableTouch: 0, NoiseCondition: 0, IsPalm: 0, IsIdle: 1, IsFinger: 0,
MaxNoise: 0000, NoiseCh: 033, Water: 0000, CMax: 0000, CMin: 0000, S/F: 0014 / 28, PalmCnt: 000, WaterNodeCnt: 0000,
```

**Note1:** Baseline is the environmental capacitance for a controller to reference. The controller calculates the signal variation between raw data and baseline, and translates it into touch information.

**Note2:** The system offset threshold is related to the [Uniformity]. Please set proper [Uniformity] for a stable baseline calibration function. If the touch sensor quality is poor or the [Uniformity] is too low, the system offset information might be too much that can be accepted. The error message: **Create Uniformity Table Fail** or **Create System Offset Fail** may pop up when doing hardware calibration. Please inform EETI for further technical support.

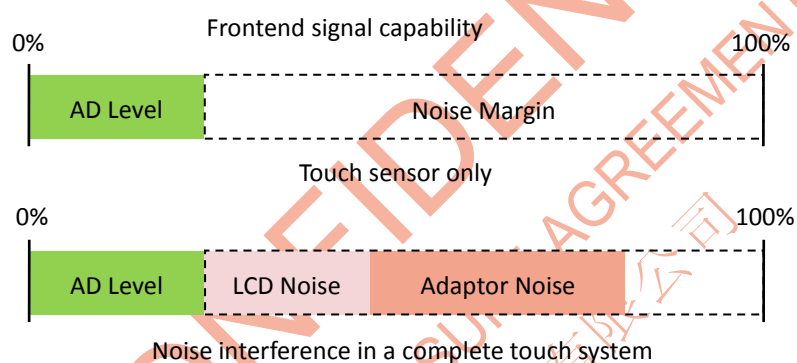




## 10.2 AD Level

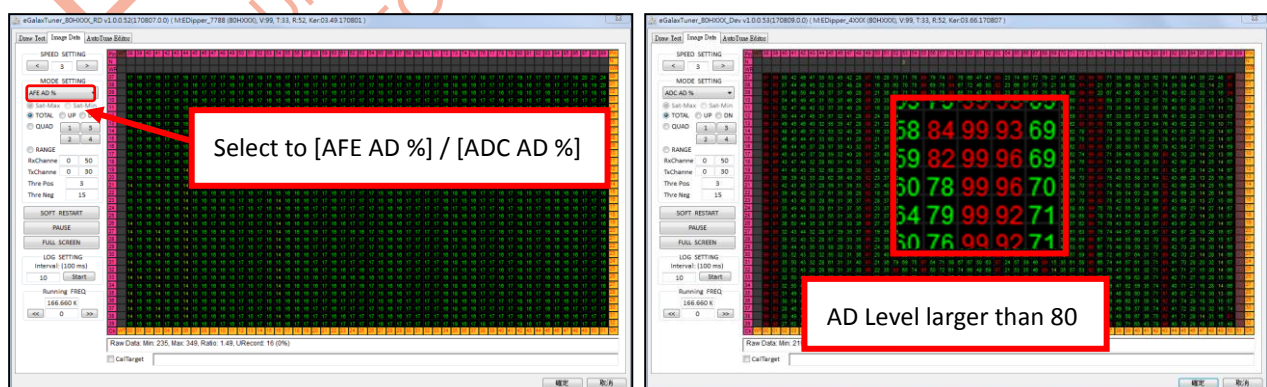
The AD Level refers to the front-end hardware signal strength, which is related to the fine-tune parameters and the environment interference. The value is expressed as a percentage. If the value reaches 100%, it means the hardware signal is saturated and that the touch signal can't be detected correctly. The parameter [AD\_Level%] defines the target signal strength for the touch system. When running autotune, it will try to optimize the hardware gain parameters to reach [AD\_Level%]. After that, user can adjust hardware gain parameters to fine-tune AD Level.

The common interference sources are LCD, power adaptor and radiated electromagnetic waves. If the environment interference causes AD Level value to approach or reach 100%, the touch function will become abnormal and result in problems like reporting ghost point or jittering.



**It is very important to ensure the AD Level value is secure in a complete touch system.** The AD Level signal can be viewed in **Image Data Page\ Image Mode: AFE AD Level %** and **ADC AD Level %**. It shows the percentage of the maximum of AD level. If the AD Level % is higher than 80 (value in red color), please take actions below to reduce AD Level:

- Check grounding status of the controller, LCD, and system. ([Chapter 2.2 - Grounding](#))
- Change working frequency to avoid interferences from the LCD or power adaptor.
- Decrease AD Level by modifying gain parameters ([Img\_RS], [Img\_AFEgain]) to avoid signal saturation. However, the signal strength will also be reduced.



For the information about interference in PCAP touch system, please refer to EETI document:

**EDG-008-EMC\_and\_Capacitive\_Touch\_System.**



### 10.3 Accuracy Alignment

In most of the cases, there is no need to calibrate accuracy for PCAP solution. The design of PCAP sensor and EXC80HXXX solution can guarantee certain performance of touch accuracy. However, there may be assembly offset between the touch sensor active area and LCD view area. In this case, it may need to run accuracy calibration tool for alignment. The accuracy condition can be checked in eGalaxTuner\_80HXXX\Draw Test window.

**EXC80HXXX typical accuracy spec:  $\pm 2.5\text{mm}$ .**

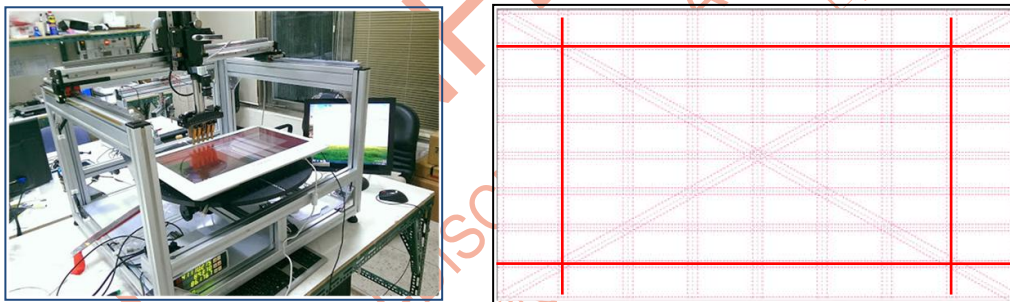
**EXC80HXXX typical jitter spec:  $\pm 1\text{mm}$ .**

Accuracy is related to touch sensor design, system noise and input methods, e.g., glove, thick cover glass...

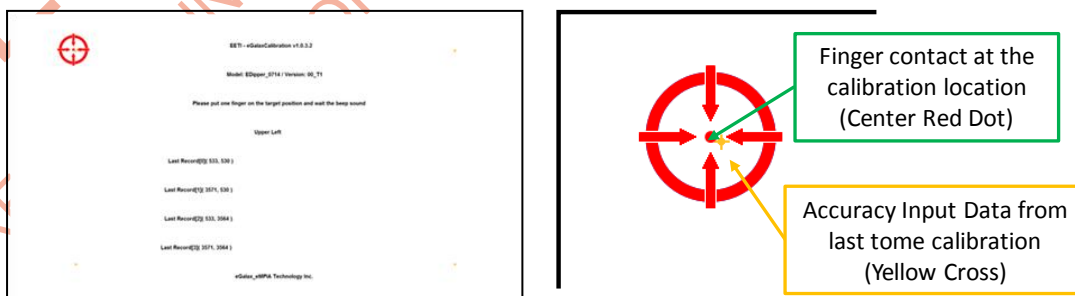
#### Accuracy and linearity verification equipments:

- X-Y Table and Touch jig (9-mm-diameter copper stick to simulate a finger touch)
- Touch sensor should be bonded on a monitor with proper size.

To verify touch system's accuracy, please switch to **Draw Test Page**, click **Full Screen** button and click **Space bar** to refresh draw window. Draw on target lines as the figure below on four sides. Less offset on the target lines means higher accuracy.



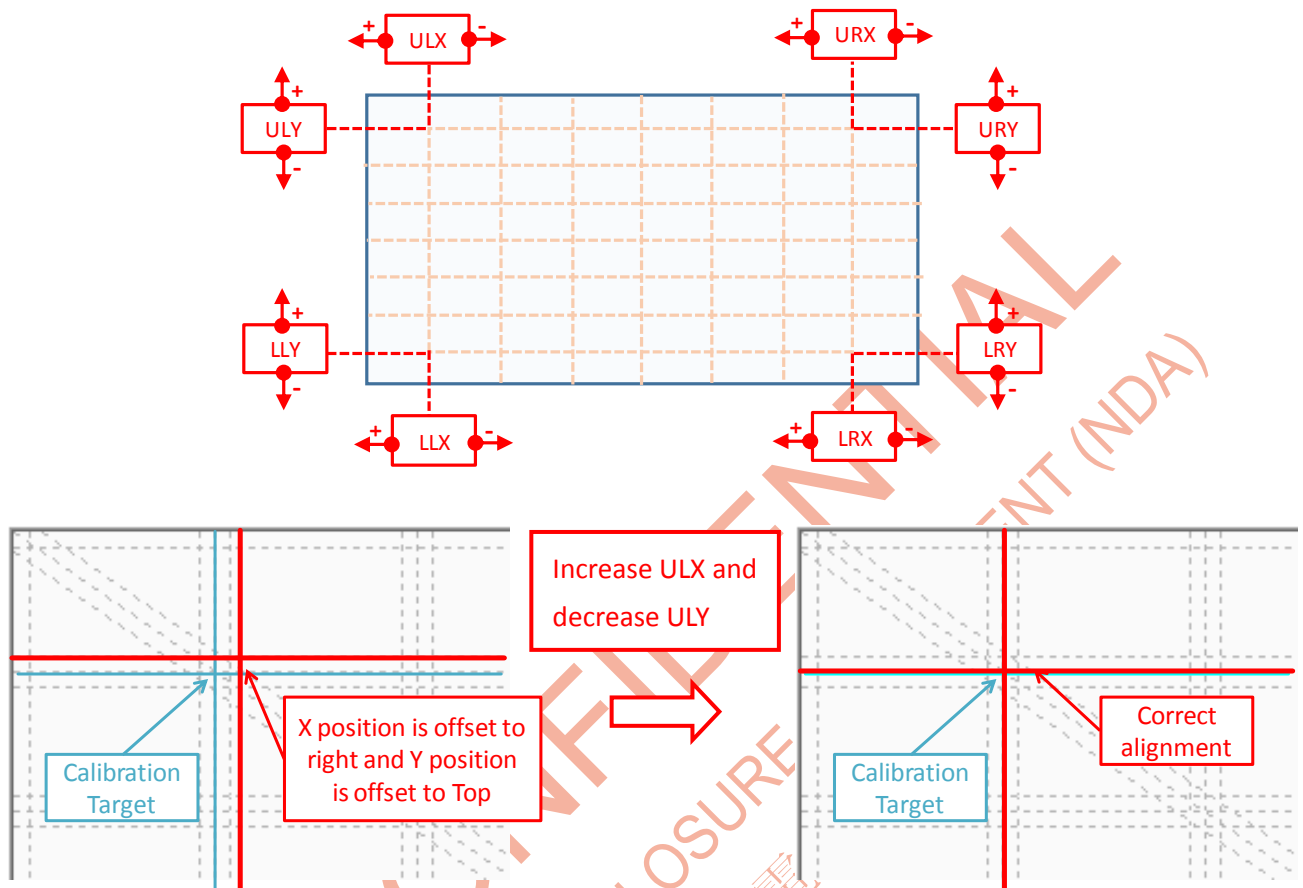
If the accuracy is not good enough, please run **Editor Page\Run 4Pt Calibration** for accuracy calibration. Please touch and hold on the calibration location until it turns to OK. For higher accuracy and reliable calibrate result, we recommend to use a 9mm copper stick as a test jig..



**Note1:** The eGalaxCalibration.exe is in the eGalaxWorks folder. Please copy eGalaxCalibration.exe and eGalaxCalibration.ini and paste to the same folder with eGalaxTuner.exe.

**Note2:** To return to default accuracy condition, please click **Clear 4Pt Calibration**.

To verify the calibration result, please draw on the target lines to check the offset from reported lines and background grid lines. You can also modify the calibration parameter manually to adjust the alignment result. The 4 points calibration result will be shown in SWT\Calibration Setting].



Take the upper left calibration location for example:

To increase ULX will shift the report x coordinate to left side of ULX.

To decrease ULX will shift the report x coordinate to right side of ULX.

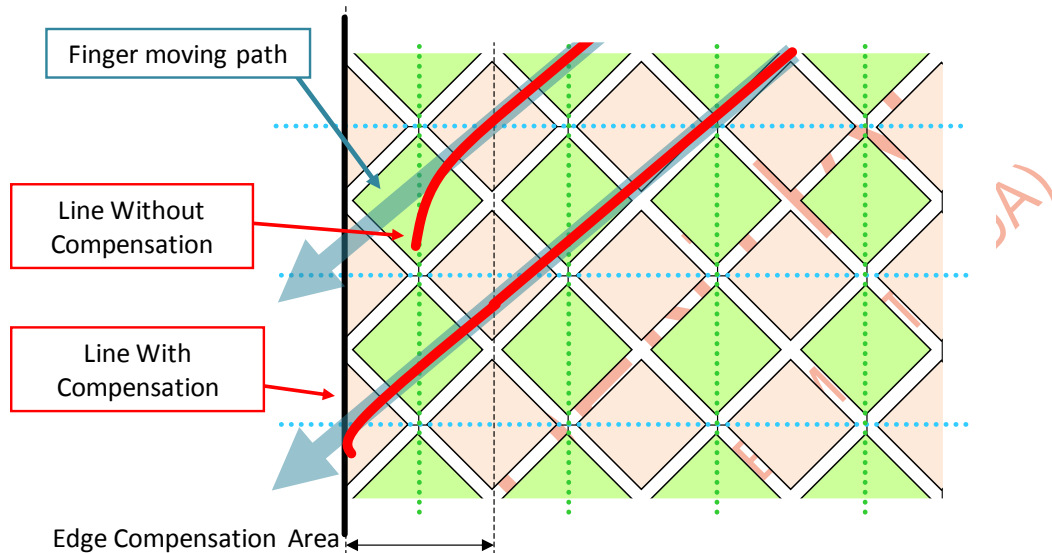
To increase ULY will shift the report y coordinate to up side of ULY.

To decrease ULY will shift the report x coordinate to down side of ULY.

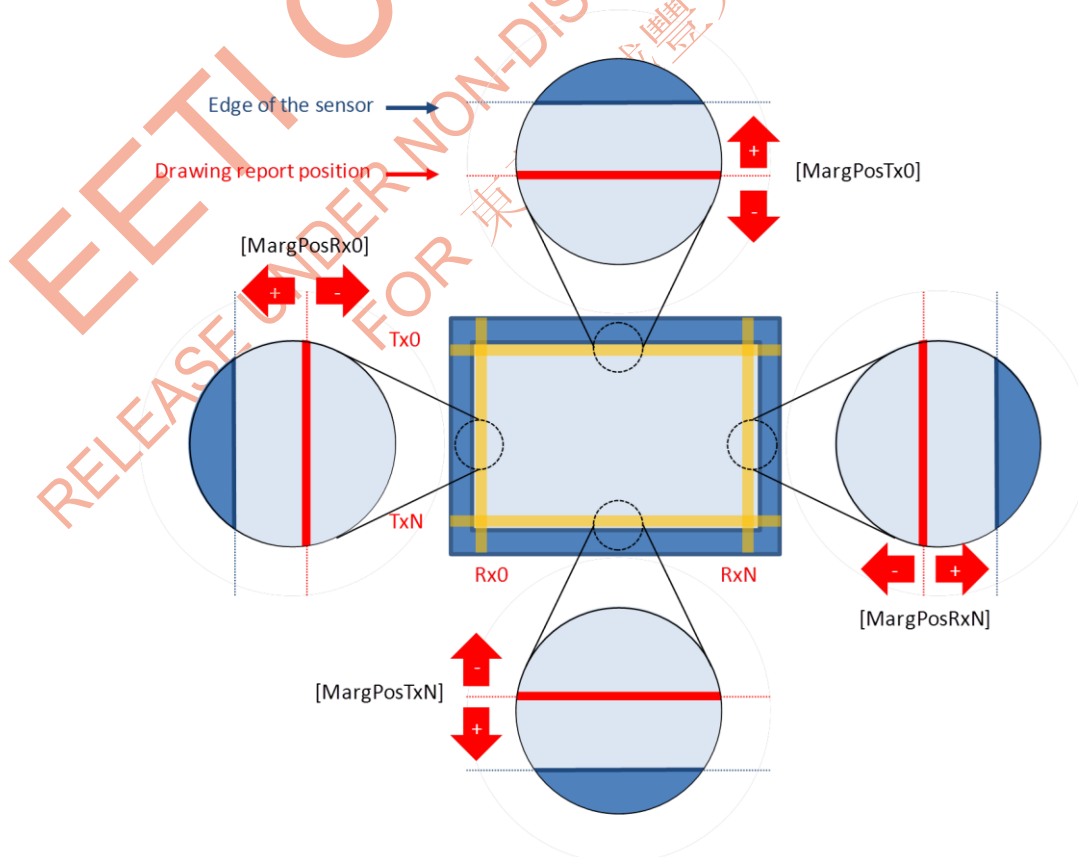
By modifying the X/Y parameters of these 4 locations, it's able to make report points align to the target lines.

#### 10.4 Edge Accuracy

PCAP touch solution may not be accurate on the **edge channels of the sensor**. It could result from the sensor design, LCD noise interference or the thickness of the cover glass. If the edge area is unreachable, please adjust edge compensation parameters.



There are four edge compensation parameters mapped to the Tx0, TxN, Rx0 and RxN side. The default value of edge compensation parameters is 0, and it ranges from +127 to -128 (Typical range: -8~+8). Increasing the edge accuracy parameters can make touch position closer to the edge, while decreasing parameters can make it farther from the edge. Please click **Set Param** to apply software parameter change.



**Note:** Touch position may not be able to reach edge area under thick cover glass structure.

## 10.5 Filter

Filter parameters (in Software section) are used to balance the linearity, response time and stabilize the touch function.

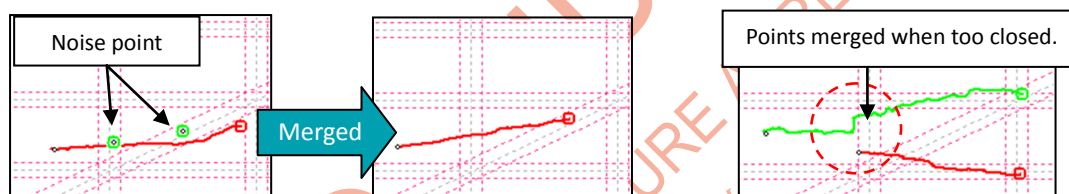
[Filter Setting]	
MaxFilter	26
MinFilter	20
FirstDownConstArea	10
NormalConstArea	0
SlowMoveTh	3
SlowMoveConst	1

[Point Alg Setting]	
MergeDistance	6
MaxReportPoint	10
ReportRateScanTime	0
DownCount	1
DownCntInNoise	2
DownCntInWater	2
DownCountForEdge	1
FingerSeperationLevel	-1
Tx2CH_FingerSeperationLevel	-1

### a. [MergeDistance]/[ExtraMergeDistance]

This parameter defines a range near the drawing path, in which all the unexpected noise points will be blocked. The typical value of [MergeDistance] is 6~15 (mm). The [ExtraMergeDistance] is additional for each threshold condition. As a result, the final report range will be [MergeDistance] + [ExtraMergeDistance].



The shortest distance between fingers (Or the Input separation in Windows touch logo test) also depends on the ITO pitch and cover glass thickness. The general horizontal/ vertical input separation is: 2.5\*ITO pitch, and the diagonal is: 3.5\*ITO pitch.

**Note1:** Input separation will increase if the thickness of cover glass > 2.0mm.

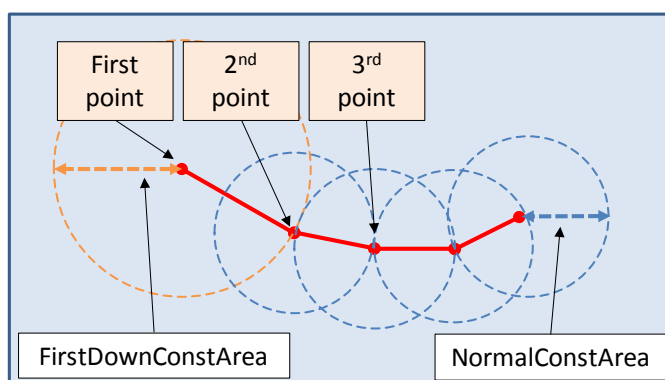
**Note2:** Setting [ENHANCE\_FINGER\_SEPARATION] and [ENHANCE\_VER\_SEPARATION] = 1 may help improve the finger separation performance. **It may also have the risk to separate single touch into two reports, please use it carefully.**

### b. [FirstDownConstArea] / [NormalConstArea] / [SlowMoveConst]

These parameters define the position lock range. If the moving distance between points is smaller than the lock range, the report will be locked to the same location (report constant location).

**Note1:** The moving speed is in eGalaxTuner\Draw Test page\Touch Info. The S/F means the speed and filter.

**Note2:** Setting [SKIP\_CONSTANT\_POINT]=1 will block the reports in same location (The points inside the lock area).

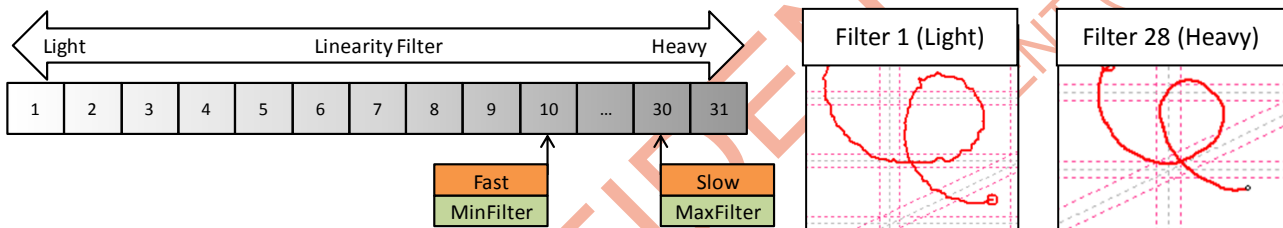


- c. [DownCount] / [DownCountInWater] / [DownCountInNoise] / [DownCountForEdge] / [ExtraDownCount]

These parameters define the response time of a contact in Normal, Water, Noise, and Edge condition. Increasing this value will increase the touch response time, which may help block unexpected touch and noise effects.

- d. [MinFilter] / [MaxFilter]

These two parameters affect drawing linearity. Filter level ranges from 1 to 31, and these two parameters define the boundaries of filter level. The firmware will adjust linearity filter automatically according to the drawing speed. Lower filter level provides fast tracking response but poor linearity, while higher filter level provides slow tracking response but good linearity. Linearity depends on SNR of the touch system as well. Please adjust [MinFilter] and [MaxFilter] according to the system condition and requirements.



## 10.6 Touch System Stability

The environment capacitance will change because of various temperature, humidity, moisture, and mechanics. EXC80HXXX firmware will automatically refresh the environment characteristic with no touch operation (Idle state). The flag **Idle** in **Draw Test Page** indicates the idle condition.

When there is no touch operation, **Idle** should always be 1. If you find the **Idle** state 0 without finger touch, it might be caused by the too high sensitivity or noise interference from the environment.

```
Freq#: 00, Threshold#: 0, #Touch: 00 (00), StrayConfidence: Pass, WL: (-1, -1),
WaterState: No Water, WaterDisableTouch: 0, NoiseCondition: 0, IsPalm: 0, Idle: 1, IsFinger: 0,
MaxNoise: 0000, NoiseCh: 000, Water: 0000, CMax: 0000, CMin: 0000, S/F: 0002 / 28, PalmCnt: 000, WaterNodeCnt: 0000,
```

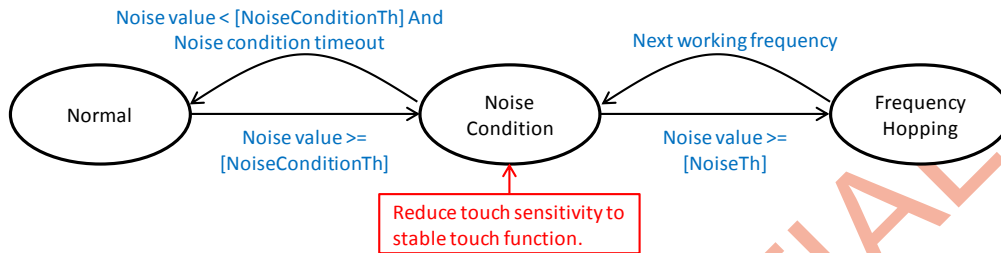
**Note:** Firmware will switch to idle state if no touch signal is detected beyond 2 seconds.

To verify touch system stability, it is necessary to run a burn-in or environment test. There should be no false touch, and the touch function should remain normal during and after the test.

The higher sensitivity or the lower SNR is, the higher risk of failing the environment test will be. In this condition, the signal will be easier to pass the touch threshold, so that the controller cannot do idle update and refresh the baseline correctly. Thus, the touch function will not work properly in the future. To avoid the risk, a higher Touch % and good SNR is suggested for a stable touch system.

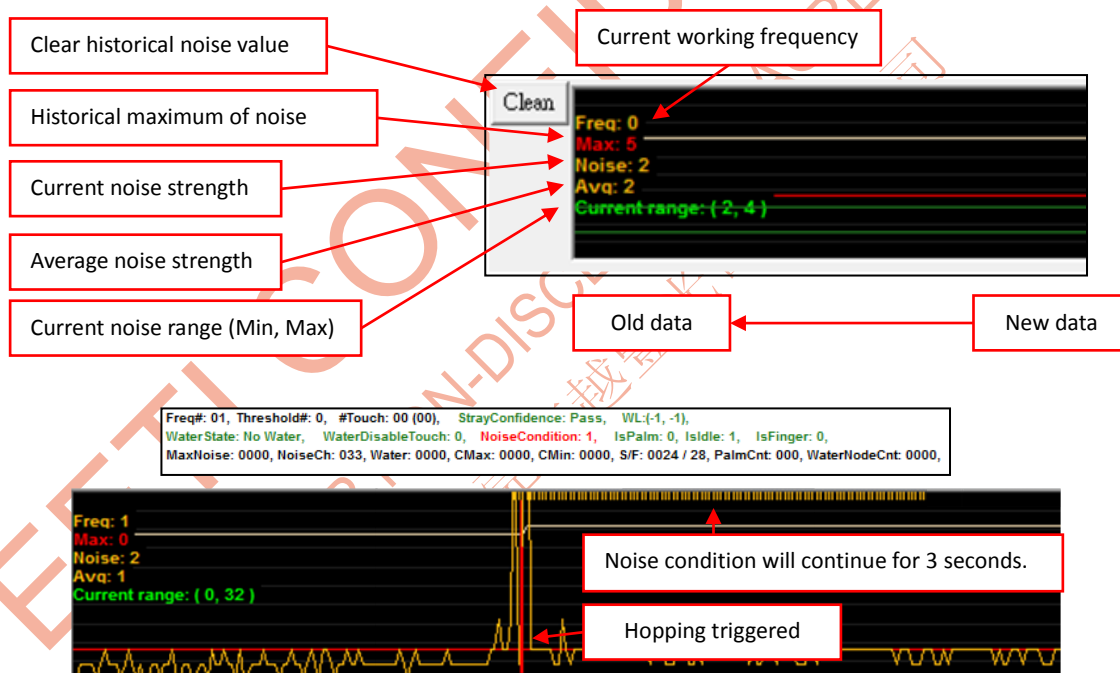
## 11 Multiple Working Frequencies and Frequency Hopping

### 11.1 Frequency Hopping State Diagram



When the noise strength is larger than [NoiseConditionTh], **Noise Condition** state will be enabled; it will reduce touch sensitivity to make touch function more stable. Noise Condition will remain for 3 seconds and can be continuously triggered if the noise strength exceeds [NoiseConditionTh] again. When the noise strength is larger than [NoiseTh], it triggers frequency hopping process. The firmware will switch to next working frequency to avoid the noise interference.

The **Noise Information Window in Draw Test Page** indicates the noise strength information in real time:



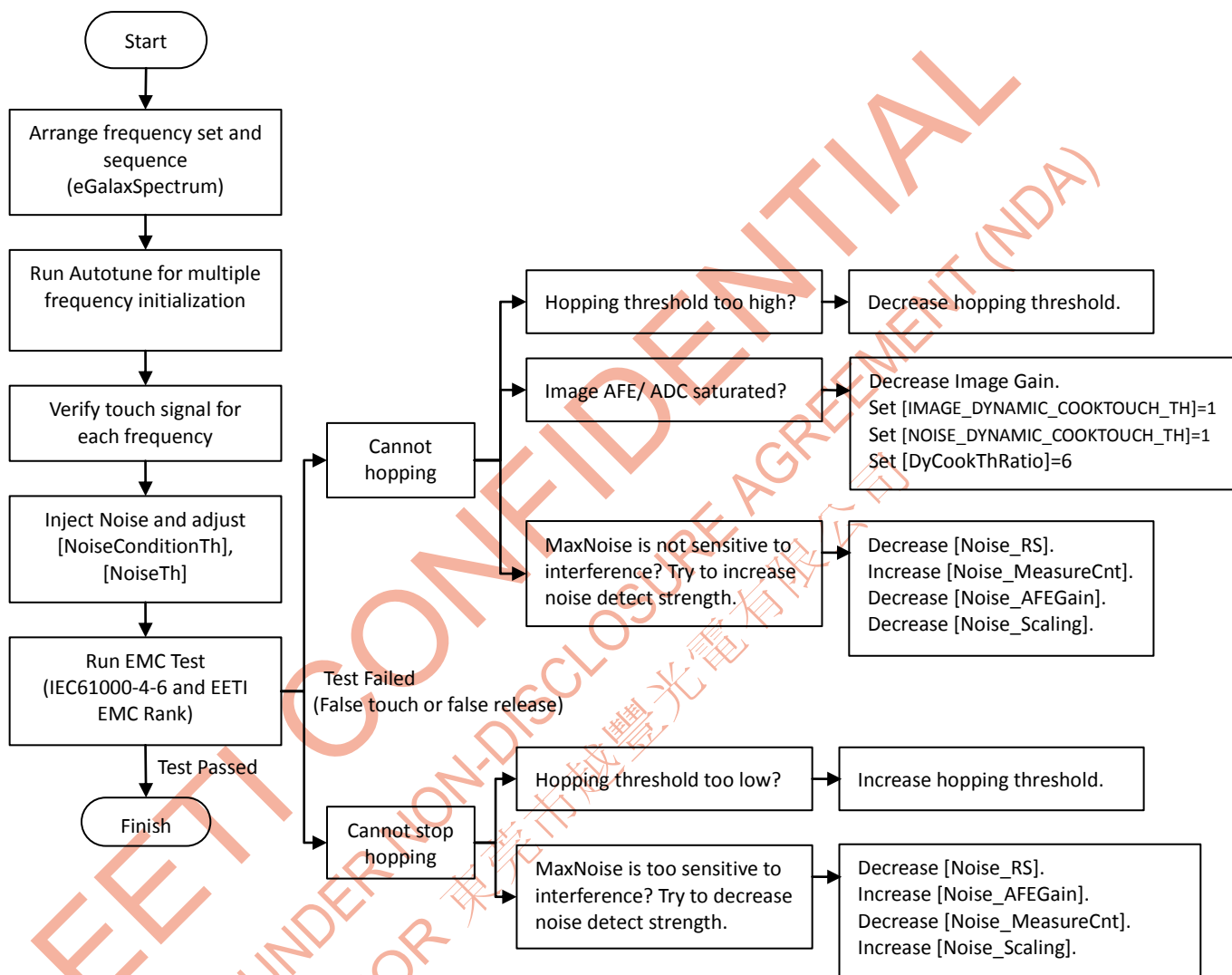
The characteristic of conductive noise interference:

- More finger touch causes stronger noise interference.
- When an operator is grounded to the touch system, the noise interference become smaller or disappeared.

For more information about frequency hopping and **Electromagnetic susceptibility (EMS)**, please refer to [Chapter 17.3 - Electromagnetic Susceptibility for PCAP System](#).

## 11.2 Frequency Hopping Fine-tune Tutorial

The goal for fine-tuning the frequency hopping is to find out the proper MaxNoise value and set thresholds for the noise condition and the frequency hopping. It may take some iteration to optimize the performance. Please follow the tuning flowchart below to set proper parameters for frequency hopping:

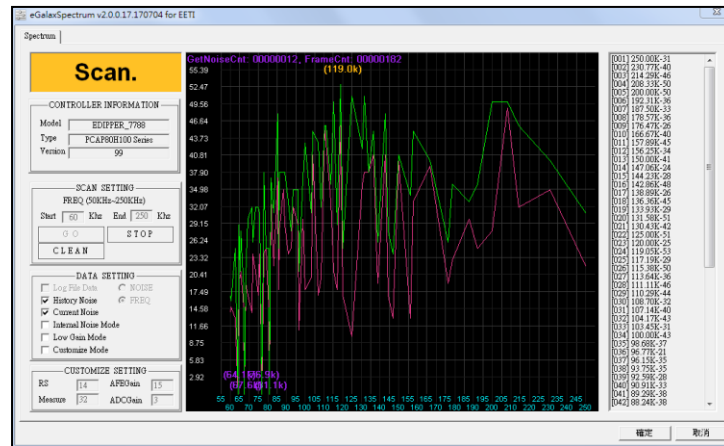




Here is an example for 3 working frequencies tuning and adjust frequency hopping for conducted interference:

- a. Use eGalaxSpectrum to find out working frequencies with less noise. E.g. 86kHz, 125 kHz, and 166 kHz.

**Note:** Please put finger on touch sensor when running eGalaxSpectrum to simulate conductive noise environment.



- b. Set **Tune\_Project.ini**-[NumsOfFreq] to 3 (3 working frequency set).

Set [WorkingFreq0] = 9 (166 kHz)

Set [WorkingFreq1] = 39 (86 kHz)

Set [WorkingFreq2] = 21 (125 kHz)

[Tuning Parameter]	
NumsOfFreq	3
WorkingFreq0	9
WorkingFreq1	39
WorkingFreq2	21
WorkingFreq3	-1
WorkingFreq4	-1

For a better frequency hopping result, please make the difference between each frequency larger than 30 kHz. The frequency hopping sequence in this example is 166 kHz → 86 kHz → 125 kHz → 166 kHz.

After modifying above parameters, please click **Set Param** and click **Start Autotune**.

- c. Check the signal in each working frequency. The sensitivity and signal ratio in each working frequency should not have too much difference. To change working frequency, please find the **FREQ** settings in **Draw Test Page** and **Image Data Page**, adjust frequency set number (0~2) to apply the current working frequency.
- d. In **Software section**, set [AUTO\_FREQUENCY] = 0 and click **Set Param** to disable frequency hopping.

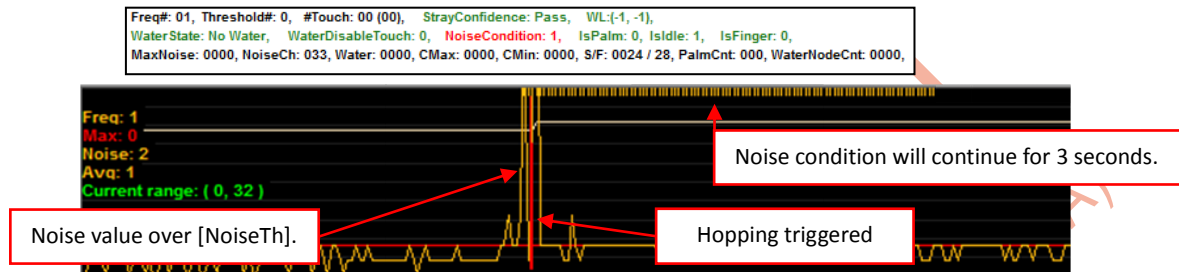
[Alg General Config]	
TouchMode	0
NumsOfThresholds	1
SWAP_XY	1
SWAP_X	0
SWAP_Y	1
Ctrl(0)_AUTO_FREQUENCY	1

- e. In **Draw Test page**, change the current working frequency to 0 (e.g. 166 kHz).



**Note:** Soft Restart will reset the working frequency to 0.

- f. In **Draw Test** page, enable the external noise source (e.g. 166 kHz), and draw on the touch sensor with a finger. When the noise strength is larger than [NoiseConditionTh], **Noise Condition** state will be enabled; it will reduce touch sensitivity to make touch function more stable. When noise strength is larger than [NoiseTh], the firmware will hops to next working frequency.



- g. If the MaxNoise value is too sensitive or not sensitive enough to the noise interference, please try to decrease or increase noise detection strength by modifying noise hardware parameters.
- h. After modifying [NoiseConditionTh] and [NoiseTh] for each working frequency, please Set [AUTO\_FREQUENCY] = 1 and click **Set Param** to enable the frequency hopping. Then, follow the working instructions of EMS test and verify the EMS performance. If the frequency hopping process fails, please follow frequency hopping tuning workflow ([Chapter 11.2 - Frequency Hopping Fine-tune Tutorial](#)) and try again.

**Note1:** If there are ghost points during frequency hopping, please try setting [IMAGE\_DYNAMIC\_COOKTOUCH\_TH]=1, [NOISE\_DYNAMIC\_COOKTOUCH\_TH]=1 and [DyCookThRatio]=6 to enable dynamic touch threshold function. It will increase cook touch threshold by referring to the CMax value ( $CMax \times 6/8$ ). It may help filter out the noise touch whose cook signal strength is smaller than a finger touch. Adjust [DyCookThRatio] to increase or decrease dynamic threshold level, higher dynamic level may cause low sensitivity when there are contacts with strong CMax.

[Freq-0 Noise Reg Parameters]	
Noise_MeasureCnt	8
Noise_AFEGain	10
Noise_RS	7
Noise_Delay	12
Noise_ADCGain	4
Noise_Scaling	4

[Alg General Config]	
TouchMode	0
NumsOfThresholds	1
SWAP_XY	1
SWAP_X	0
SWAP_Y	1
Ctrl(1)_ENHANCE_PALM_REJECTION	0
Ctrl(2)_IMAGE_DYNAMIC_COOKTOUCH_TH	0
Ctrl(2)_NOISE_DYNAMIC_COOKTOUCH_TH	0

[Freq Hopping Setting]	
NoiseConditionTh(0)	10
NoiseTh(0)	20
NoiseConditionTh(1)	64
NoiseTh(1)	80
NoiseConditionTh(2)	64
NoiseTh(2)	80
DyCookThRatio	2

### 11.3 Evaluation of the EMS Performance

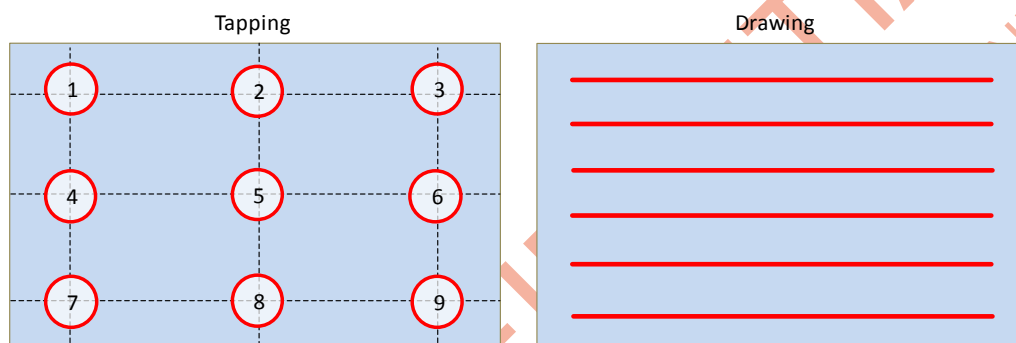
#### a. Test Methods

According to the system's usage and application, there are two general test methods for conducted interference:

**Tapping:** Tap on several locations on touch sensor to check for false release and false touch issue.

**Drawing:** Draw several paths on touch sensor to check for jitter, false release and false touch issue.

**Note:** Typically test with one finger. Conductive interference will become much higher and hard to pass the test with multi-fingers touches.



#### b. Classification

PCAP touch solution is a highly customized product. The requirements and criteria for touch performance will be much different according to the application. In IEC 61000-4-2, IEC 61000-4-3, and IEC 61000-4-6, the test results shall be classified in terms of the loss of function or degradation of performance of the equipment under test, relative to a performance level defined by manufacturer or customer requirement between the manufacturer and purchaser of the product.

Based on the IEC classifications and the features of PCAP touch, EETI defines IEC class A into 4 ranks to represent different levels in touch requirements. These 4 ranks define different levels of temporary performance drop during noise interfering, and the firmware needs to have the ability to detect the interference and recover to normal function automatically.

IEC61000-4-6 classification:

Class	Class Description	EETI EMC Rank
<b>A</b>	Normal performance within limits specified by the manufacturer, requestor or purchaser.	R1
		R2
		R3
		R4
<b>B</b>	Temporary loss of function or degradation of performance which ceases after the disturbance ceases, and from which the equipment under test recovers its normal performance, without operator intervention.	
<b>C</b>	Temporary loss of function or degradation of performance, the correction of which requires operator intervention;	
<b>D</b>	Loss of function or degradation of performance which is not recoverable, owing to damage to hardware or software, or loss of data.	

## EETI EMC Ranks:

Rank	Rank Description
<b>R1</b>	When finger <b>drawing</b> during noise interfering, there is no jitter, false touch and false release.
<b>R2</b>	When finger <b>drawing</b> during noise interfering, there is no false touch but temporary light jitter and false release. Then, it is able to recover to the normal performance automatically without operator intervention.
<b>R3</b>	When finger <b>drawing</b> during noise interfering, there is temporary jitter, false release and false touch. Then, it is able to recover to the normal performance automatically without operator intervention.
<b>R4</b>	When finger <b>tapping</b> during noise interfering, there is no jitter, false release and false touch, Then, it is able to recover to normal performance automatically without operator intervention.

**Note:** EMS test is to examine the susceptibility of a touch system, and the result of EMS test depends on the condition of:

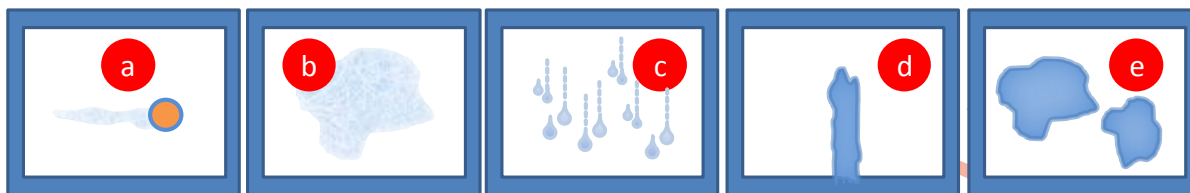
- Touch sensor design.
- System mechanical design.
- System internal interferences, including the LCD, power adaptor and other electromagnetic components.

To achieve better EMS performance, well-experienced firmware tuning and optimized system integration are both very important. Please follow EETI design rules and contact EETI for technical support.

## 12 Water and Touch Performance

Liquids or conductive materials can affect mutual capacitance signal and make touch performance unstable.

Below describes how the touch performance is affected by water for a projected capacitive (PCAP) touch system.



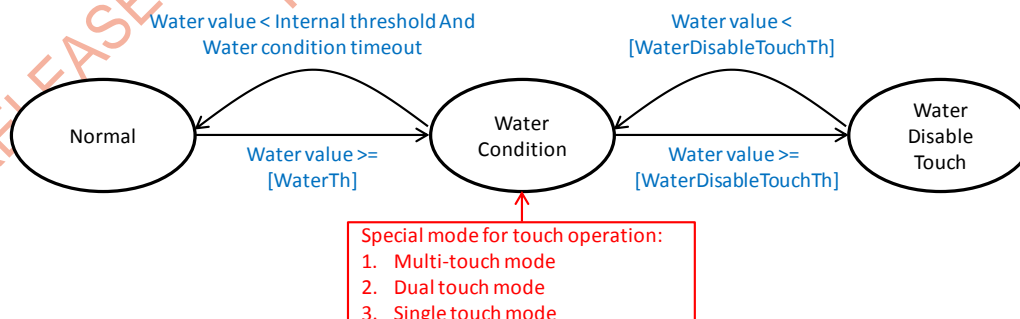
	Condition	Touch Performance
a	Wet Finger	Few jitter or not accurate influences on sensitivity and linearity.
b	Sprayed / Moisture	Some jitter or not accurate influences on sensitivity and linearity.
c	Water Drips	Running water drips might cause a false touch. There might be a false touch, break or jitter when drawing across water drips.
d	Pouring	Pouring may cause a false touch. There may be some false touches, breaks or jitters when drawing across pouring water.
e	Puddles	Puddles would cause a false touch. There may be some obvious false touches, breaks or jitters in the trace when drawing across puddles.

**The water resistance performance is related to the touch sensitivity. If the customer wants to apply high sensitivity for glove touch, it will cause very poor water resistance performance.**

### 12.1 Water Resistance State Diagram

Please set [WATER\_PROOF] to 1 to enable it. EETI water resistance can avoid the false touch caused by water. There are also limitations depends on the water case. The following are EETI water resistance parameters and state diagram:

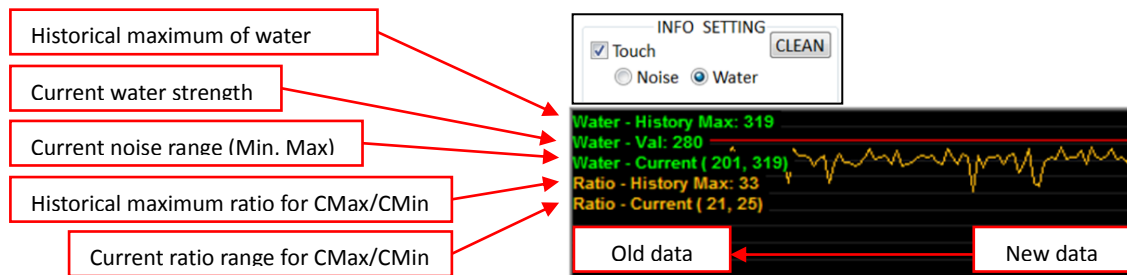
[---Water-0]		
WaterTh	65500	0~65535
WaterTouchDisableTh	65530	0~65534
WaterCookTouchTh	100	0~65534
WaterTouchSizeMin	5	0~254
WaterTouchSizeMax	250	0~254
WaterMaxReportPoint	2	0~10
GestureDetectTime	200	0~65534
WaterNegativeTh	25	0~65534



The Water information is in **Draw Test Page\ Firmware information window**:

```

Freq#: 00, Threshold#: 0, #Touch: 01, StrayConfidence: Pass, WL: (-1, -1),
WaterState: No Water, WaterDisableTouch: 0, NoiseCondition: 0, IsPalm: 0, IsIdle: 0, IsFinger: 1,
MaxNoise: 0030, NoiseCh: 094, Water: 0268, CMax: 0196, CMin: -082, S/F: 0000 / 28, PalmCnt: 000,
AlgState0: 0x0000, AlgState1: 0x0040, AlgState2: 0x0000, AlgState3: 0x0000,
  
```



**Water:** The controller calculates the water signal strength. When there is water on the touch screen, negative touch signals will be generated in **Image Data page\ Image Mode: Cooked Data**. The touch controller calculates the negative values smaller than [WaterNegativeTh] and represents it as Water value in information window. When the water value is larger than [WaterTh], the water condition will be enabled. The water condition will remain for [WaterKeepTime] milliseconds and can be continuous triggered if the water strength exceeds [WaterTh]. The sensitivity of Water strength is related to [WaterNegativeTh]. Please check the [WaterTh] again once [WaterNegativeTh] is changed.



**WaterState:** Water condition information indicates states as follows:

- No Water  
Default state when there is no water interfering, and no touch performance lost.
- M-Water (working with [SCAN\_CTRL\_WATER] = 0)  
Water condition is enabled with multi-touch function. Touch sensitivity will become lower for stabilization. In water condition, a touch needs to pass extra thresholds to become a valid touch:
 

- a. Cooked data  $\geq$  [WaterCookTouchTh] and
  - b. Touch size  $\geq$  [WaterTouchSizeMin] and
  - c. Touch size  $\leq$  [WaterTouchSizeMax] and
  - d. Numbers of contact  $\leq$  [WaterMaxReportPoint]
- D-Water (working with [SCAN\_CTRL\_WATER] = 1)  
Water condition is enabled with dual-touch function. In this mode, the touch function is limited to two finger touches. Only simple two-finger gestures (e.g., panning, zooming-in/ zooming-out, and rotating) can be performed during water interfering. This mode is available only when [WaterMaxReportPoint] = 2.
- S-Water (working with [SCAN\_CTRL\_WATER] = 1)  
Water condition is enabled with single-touch function. In this mode, the touch function is limited to one finger touch. It provides the most stable operation performance during water interfering.

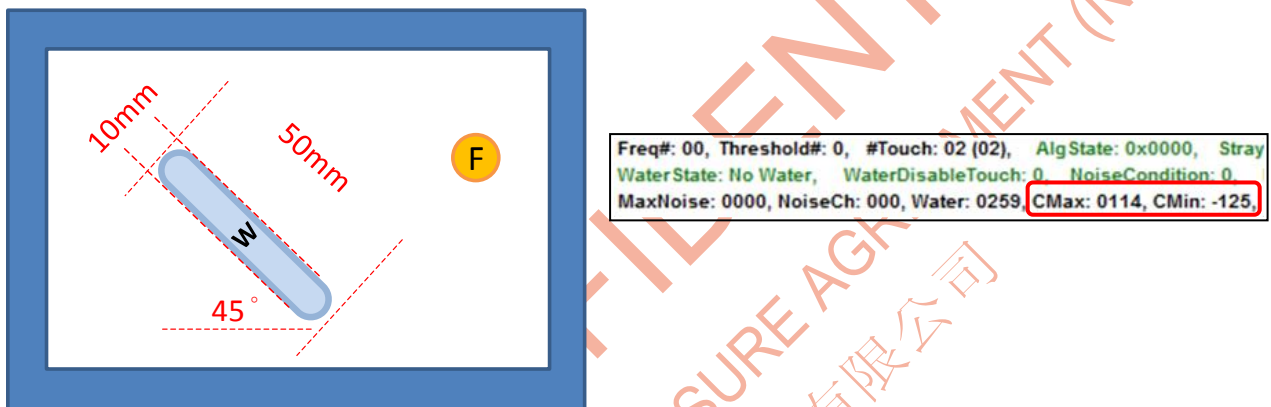
About water line function, please refer to [Chapter 12.3 - Water Resistance Fine-tune Tutorial \(Water Line Enabled\)](#)

**WaterDisableTouch:** Touch function is disabled in water condition. When water value is larger than [WaterTouchDisableTh], touch function will be disabled.

## 12.2 Water Resistance Fine-tune Tutorial (Water Line Disabled)

The concept of water resistance is to compare the signals caused by water and fingers and assigning proper thresholds. In proper sensitivity, the firmware is able to filter out water interference and leave finger signal. However, the sensitivity to water interference is related to touch sensor design (ITO pattern, cover glass thickness ...etc.). Before tuning water resistance, it is necessary to understand the water sensitivity of the touch sensor.

Please make a 10mm\*50mm (45 ° degrees) of water on the touch sensor as below. Observe the maximum and minimum signals from water and a finger in **Image Data page\ Image Mode: Cooked Data**, and compare these two signal strengths. CMax/ CMin information can be found in the **Draw Test page – Touch information window** as well.



The relation between **Water CMax** and **Finger CMax** tells the water resistance performance of the touch sensor:

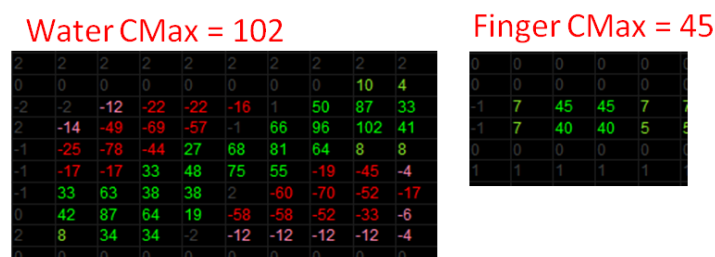
- **Water CMax << Finger CMax**

This kind of touch sensor has low sensitivity to water interfering. Water may not affect touch performance. It is easy to define a threshold to distinguish finger signals from water ones.



- **Water CMax >> Finger CMax**

The touch sensor is highly sensitive to water, whose signal strength is much higher than finger's. In this case, it is not possible to tuning water resistance.





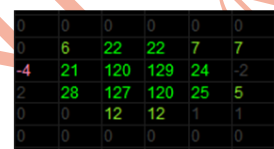
### ● Water CMax ≈ Finger CMax

The signal strength of fingers and water are similar. It is necessary to make **Finger strength** larger than **Water strength** to make water resistance work. For instance, users have to put a finger with bigger contact area to make **Finger CMax** larger than **Water CMax**. In other words, we need to lower touch sensitivity to filter out water interference. The **Water** value in touch information window can show the water strength on the touch sensor. We have to define a proper [WaterTh] to enable water condition, which will use [WaterCookTh] instead of [CookTouchBase] for applying different sensitivity. If we can't find proper [WaterTh] to enable water condition, please try to make sensitivity lower in normal mode to avoid water interference.

Water CMax = 120

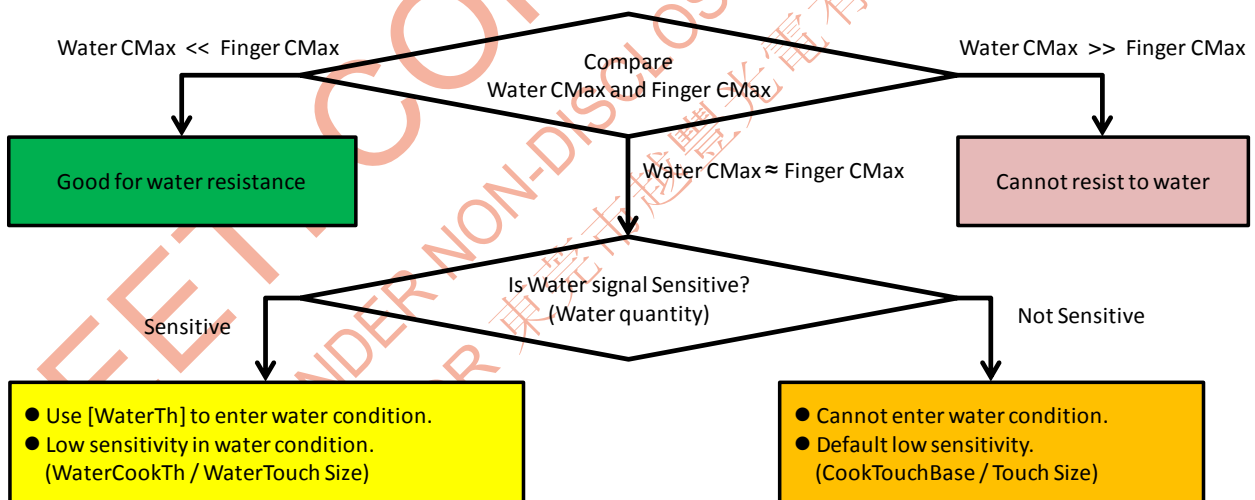


Finger CMax = 129



Freq#: 00, Threshold#: 0, #Touch: 02 (02), AlgState: 0x0000, Stray  
WaterState: No Water, WaterDisableTouch: 0, NoiseCondition: 0,  
MaxNoise: 0000, NoiseCh: 000 Water: 0259 CMax: 0114, CMin: -125,

Please follow diagrams below to understand the status of water resistance performance of the touch system.



**Note:** In some conditions, the finger touch may induce water value (Negative Cooked Data) and false trigger water condition.

The following actions may help solve it:

- Increase [WaterNegativeTh]. To avoid calculate negative cooked data induced by finger.
- Increase AD Level by modifying the gain parameters ([Img\_RS], [Img\_AFEgain]). 25% or larger may help reduce false trigger in water condition.

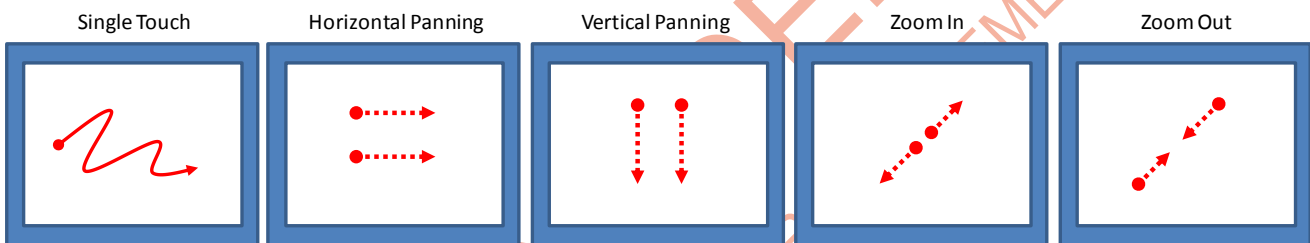


### 12.3 Water Resistance Fine-tune Tutorial (Water Line Enabled)

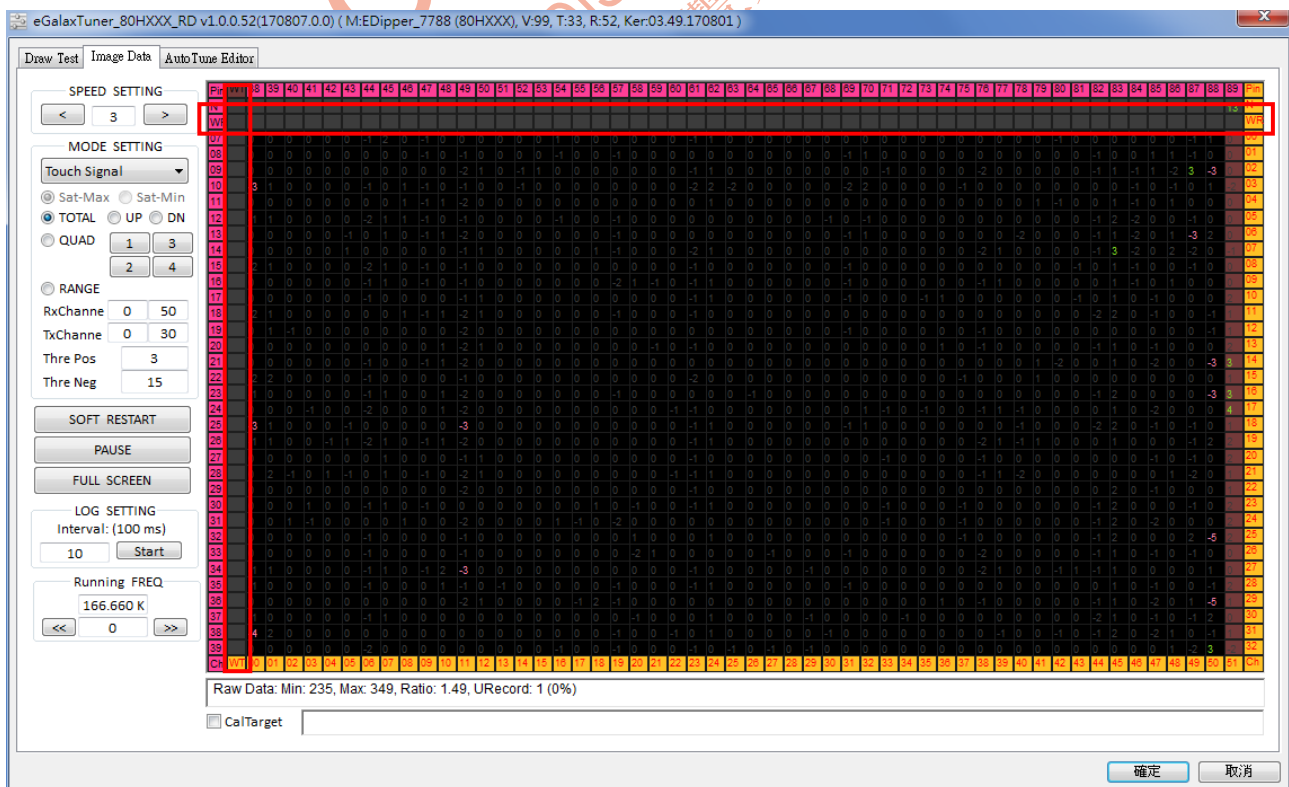
The function: **Water Line** in EXC80HXXX provides extra signal information to enhance water resistance, which can ignore water signals but remain touch ones. After finished [Chapter 12.2 - Water Resistance Fine-tune Tutorial \(Water Line Disabled\)](#) tuning process, please set HWT[SCAN\_CTRL\_WATER]=1 to enable advanced water resistance function. Touch function will be optimized for single touch and two-finger gestures under water interfering. The simplified operations are:

- Single touch
- Horizontal and vertical panning
- Zoom in and zoom out.

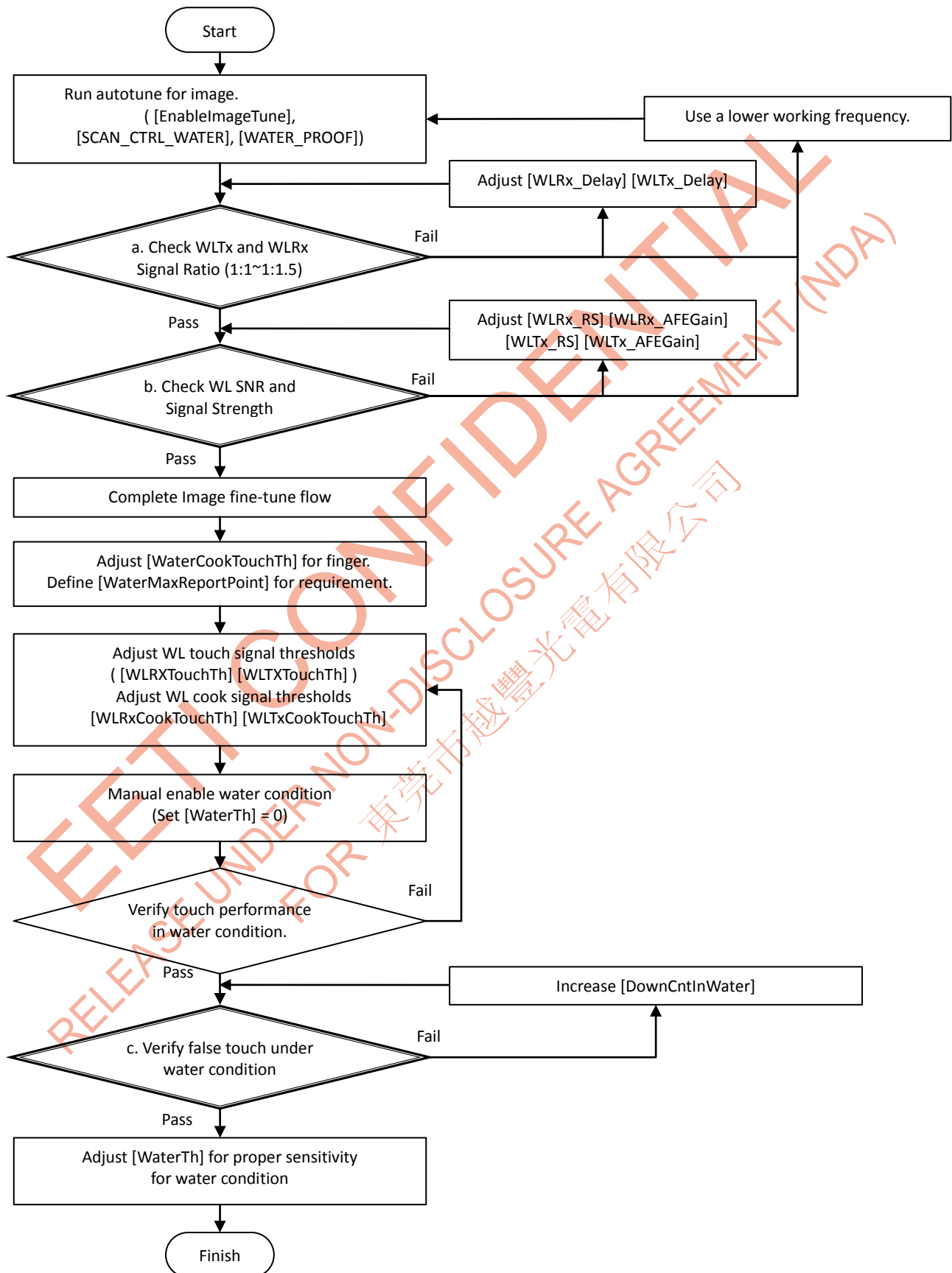
**Note1:** When setting [WaterMaxReportPoint] = 2 for two finger usage. The water line touch algorithm will detect touch actions and automatically switch to single or dual touch mode. The detect interval is defined by [GestureDetectTime].



Please find the water line Tx (WLTx) and Rx (WLRx) information in **Image Data** page. Like image signals, the water line needs some extra fine-tune efforts and proper thresholds for touch.



Below is the water line tuning working flowchart:

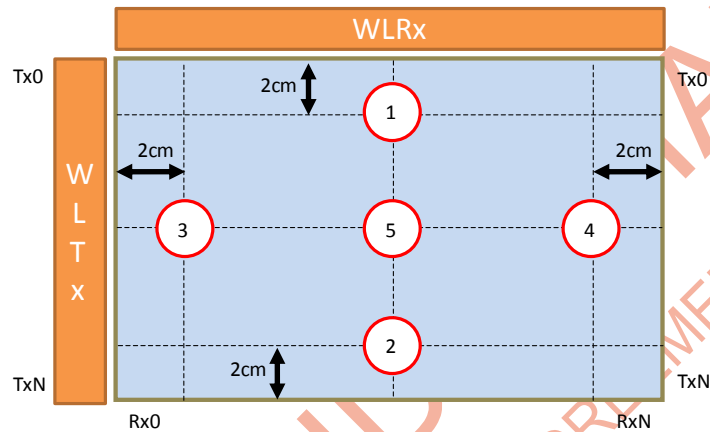


**Note:** Please refer to following section for more information.

### a. Check WLTx and WLRx Signal Ratio

In **Image Data Page\ Image Mode: Touch Signal**, the strong signal to weak signal ratio of water line should be in the range of 1.1~1.5. [WLTx\_Delay] and [WLRx\_Delay] shall be adjusted or select a lower working frequency to improve signal ratio.

Please verify the 5 locations below for both WLRx/WLTx and make the signal even on 2 nodes in proper position:

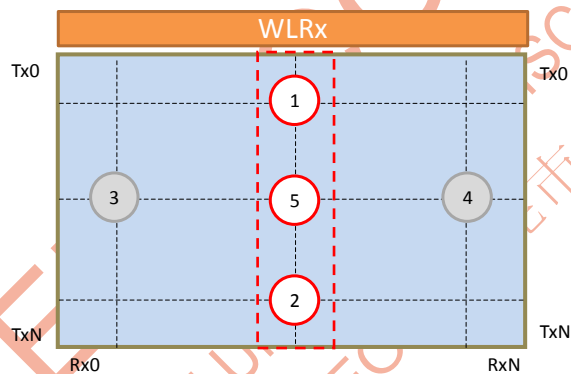


For WLRx:

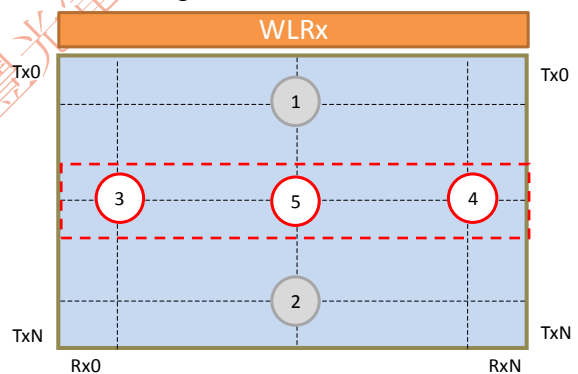
Case 1: Poor signal ratio across Tx channels, please select a lower working frequency and fine-tune again.

Case 2: Poor signal ratio across Rx channels, please adjust [WLRx\_Delay].

Case 1: Poor signal ratio across Tx channels



Case 2: Poor signal ratio across Rx channels

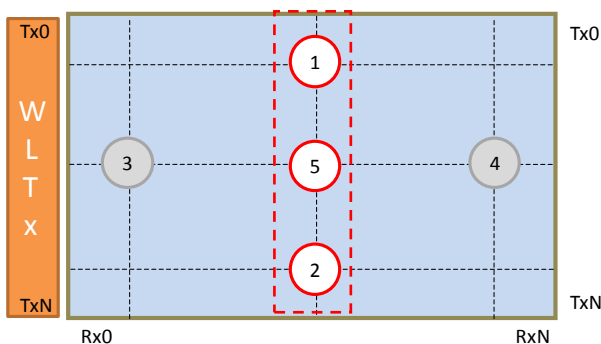


For WLTx:

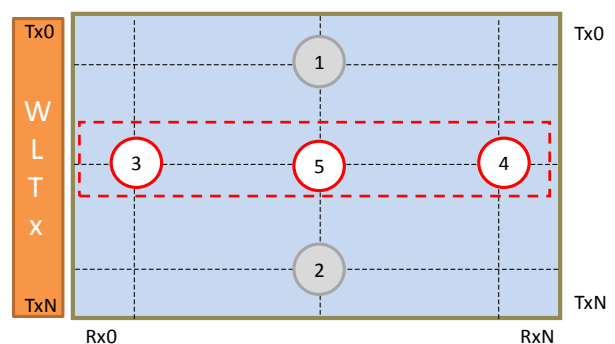
Case 1: Poor signal ratio across Tx channels, please adjust [WLTx\_Delay].

Case 2: Poor signal ratio across Rx channels, please select a lower working frequency and fine-tune again.

Case 1: Poor signal ratio across Tx channels



Case 2: Poor signal ratio across Rx channels



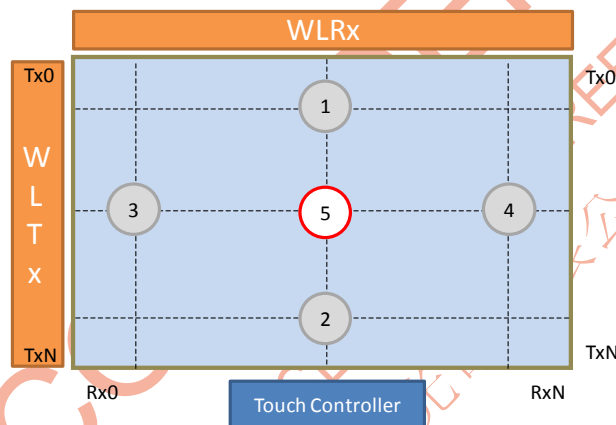
## b. Check SNR and Signal Strength

In **Image Data Page\Image Mode: Touch Signal**, please measure the touch signal by a finger or a proper-sized copper stick on location 5 in proper position to make the signal even on 2 nodes. A proper touch signal should range from **25 to 150**. For water line SNR analysis, please compare the **Touch Signal** and back ground value (Maximum touch signal without touch operation). The suggested ratio of Water Line Signal to Noise is larger than 3:1. Please use **Image Data\ Test Mode** for historical value analysis.

To improve water line signal strength and SNR, the procedure is shown as follows:

- Adjust water line hardware parameters: [RS], [AFEGain], [MeasureCnt]
- Select proper working frequencies and fine-tune again.

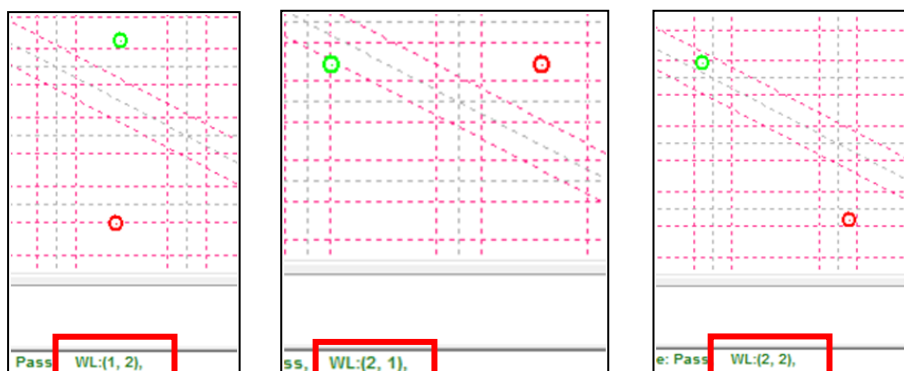
About tuning signal strength and adjusting hardware parameters, please refer to [Chapter 8.1- Adjust Signal Strength](#)



## c. Verify WL Touch Performance in Water Condition

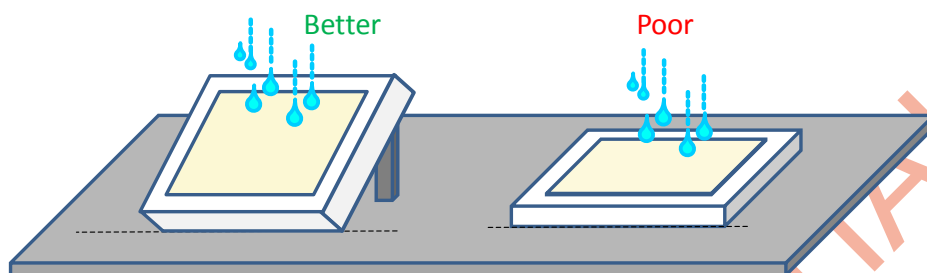
In this stage, please verify the single and dual touch under water condition. Please set [WaterTh] = 0 to manually enable water condition and use **Draw Test page** for one finger drawing and two-finger gesture operations. The WL(Rx, Tx) information in touch information windows indicates the contact count on WLRx and WLTx. If there is any false touch or a false release when drawing under water condition, it could result from the improper thresholds. Please use following actions below to adjust to proper sensitivity for water line touch:

- Check if the WL(Rx, Tx) information corresponds to the actual finger contact.
- If not, please review [WLRxTouchTh], [WLTxTouchTh], [WLRxCookTouchTh], [WLTxCookTouchTh].
- If the WL(Rx, Tx) is correct, please review [WaterCookTouchTh].



## 12.4 Evaluation of the Water Resistance Performance

The followings are the water resistance criteria after applying water resistance function when simulating the water condition on the touch system tilted to proper angle (e.g., 60° degrees).



Water Resistance Performance Table (Water Line Disabled)

	Water behavior	Fresh Water		5% Salt Water	
		False Touch	Touch Performance	False Touch	Touch Performance
1	Wet finger	No False Touch	Normal	No False Touch	Normal
2	Spray/ Moisture	Low Risk	Normal	Low Risk	Medium Impact
3	Water Drips	Low Risk	Low Impact	Medium Risk	High Impact
4	Pouring	Medium Risk	High Impact	High Risk	N/A
5	Puddles	High Risk	High Impact	High Risk	N/A
6	Wipe out water	No False Touch*	Normal	No False Touch*	Normal

Water Resistance Performance Table (Water Line Enabled)

	Water behavior	Fresh Water			5% Salt Water		
		False Touch	Single Touch	Two Finger Gesture	False Touch	Single Touch	Two Finger Gesture
1	Wet finger	No False Touch	Normal	Normal	No False Touch	Normal	Normal
2	Spray/ Moisture	Low Risk	Normal	Normal	Low Risk	Low Impact	Low Impact
3	Water Drips	Low Risk	Low Impact	Low Impact	Medium Risk	Medium Impact	Medium Impact
4	Pouring	Medium Risk	Medium Impact	High Impact	High Risk	High Impact	N/A
5	Puddles	High Risk	High Impact	High Impact	High Risk	High Impact	N/A
6	Wipe out water	No False Touch*	Normal	Normal	No False Touch*	Normal	Normal

False Touch	Description
Low Risk	Rarely a false touch near the border.
Medium Risk	Occasionally a false touch near the border.
High Risk	Often a false touch near the border.
Wipe out	The contact of wiping may cause a touch. No false touches after wiping out the water.

Touch Performance	Description
Normal	No obvious performance drop.
Low Impact	Rarely broken line or jittered drawing.
Medium Impact	Occasionally broken line or jittered drawing.
High Impact	Often broken line or jittered drawing.
N/A	Very poor performance and not suitable for touch operation.

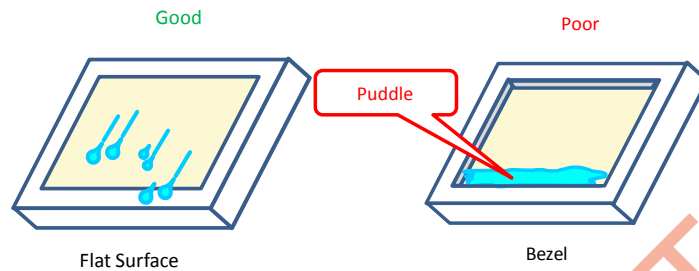
**Note:** Salt water or other liquid with high conductivity will cause serious signal interference and make touch unstable.

Besides, the water resistance performance is related to the touch sensitivity. If customers want to apply high sensitivity for glove touch, that will cause poor performance of water resistance.

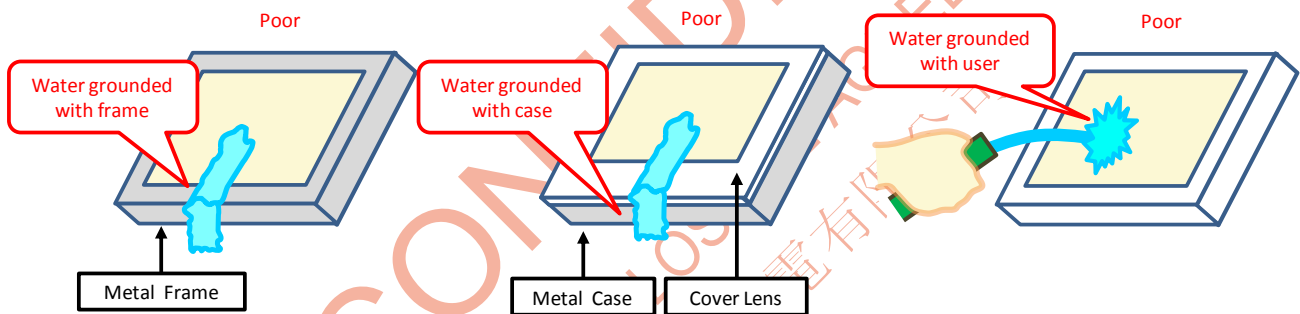
## 12.5 Better System Design for Water Resistance

The followings are the better designs for good water resistance performance:

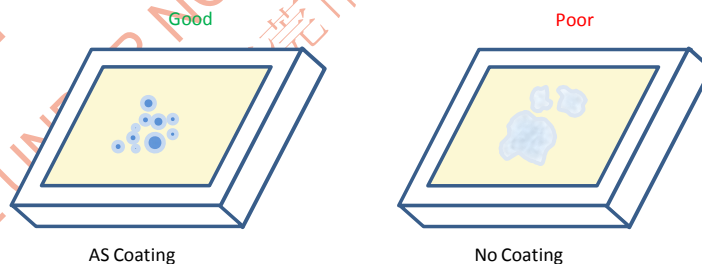
- a. System should be a flat surface design and able to drain water off easily.



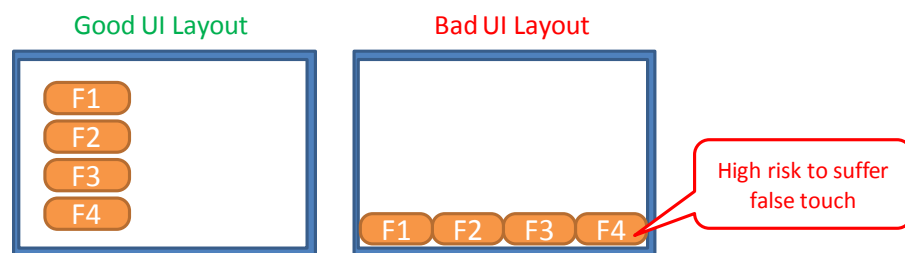
- b. The border around touch sensor should not be conductive. Water will be grounded to the system through the metal border. The water signal is similar to a real touch. If water connects users and touch panel, it is similar to a finger touch, too.



- c. Water repellent coating (AS coating) on the cover glass will help a lot to decrease the water contact area, which reduces the water interference signal strength.



- d. A proper UI design can help reduce the risk of abnormal operation, since the water is more easily to have false touches on the edge area. Please avoid designing UI functions around the edge area.

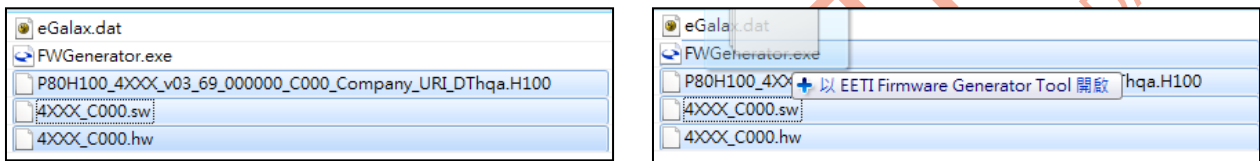


### 13 Firmware Image Generation

When firmware tuning is finished, please click **Autotune Editor- Dump All Param** to dump the final parameters. The parameters will be stored in **Project.sw** and **Project.hw** files in the fine-tune tool folder. To generate the final firmware, three files need to be merged: **Firmware kernel (\*.H100)**, **Project.hw** and **Project.sw**.

The firmware generation procedure is as follows:

- Dump latest **Project.sw** and **Project.hw** file.
- Select the kernel, **Project.sw** and **Project.hw** and drag them to FWGenerator.exe.



- Enter and verify firmware information in the command window.

```

===== EETI Firmware Generator v1.2.3.1 <170809.0.0> =====
Detect controller type: P80H100
Kernel Version: v03_69

The current PID is "C000".
Click 'Enter' to continue, or keyin customized PID for this model
>

=====
Controller Type:      P80H100
Firmware Model:      4XXX
Firmware Version:     99
Firmware Interface:   USB+UART+I2C
Firmware Dimension:   3820x2150 mm
=====
Is it correct?? <y/n>
>y
Skip merge Pen Parameter.
Merge Software Parameter success!
Merge Hardware Parameter success!
Convert FW done!
  
```

After combining **Firmware kernel**, **Project.sw** and **Project.hw** files, a final firmware will be generated and named **P80H100\_[Model]\_[Version]\_[PID]\_[Customer]\_[Interface]\_Dthqa.H100** (e.g. **P80H100\_4XXX\_v04\_42\_000000\_C000\_Company\_URI\_DThqa.H100**)

**Note:** The firmware kernel and parameters cannot be merged if the parameter version is in compatible (Please refer to the picture below). Please refer to [Chapter 16.1 - Parameter Version Inconsistence](#) to get the latest **Project.sw**, **Project.hw** and kernel firmware files, and then repeat [Chapter 13 - Generate Firmware Image](#).

```

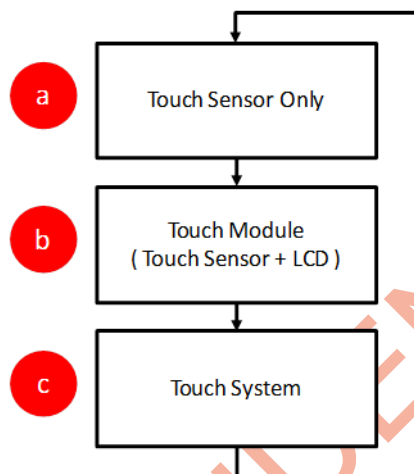
===== EETI Firmware Generator v1.2.0.4 <150210.0.0> =====
Detect controller type: 3188UI SoC
[ERROR] The Kernel binary(05) is not compatible with this SW Parameter(03)?
[ERROR] The Kernel binary(05) is not compatible with this HW Parameter(03)?
請按任意鍵繼續 . . .
  
```

When this final firmware is updated to the end product, the touch performance still needs to be verified on the complete system. (Please refer to [Chapter 10 - Touch System Performance Verification](#)) Otherwise, this firmware cannot be applied to mass production.

### 13.1 Sensor Test Settings for Production

#### 13.2 PCAP Firmware Tuning Stages

For a PCAP touch project, fine-tuning the touch sensor is only the first step. Below is the complete workflow for a PCAP project. There are four stages and it may need to repeat the fine-tune process many times for each stage:



- a. **Touch sensor stage:** Create initial firmware and initial test threshold for touch sensor manufacture.
- b. **Touch module stage:** Fine-tune for LCD interference and evaluate the test threshold for touch module
- c. **Touch system stage:** Fine-tune for system reliability test and evaluate the test threshold for complete system.
- d. **Mass production stage:** Apply the final firmware to all stages, the firmware is ready for production.

For each stage with different firmware, it's necessary to run eGalaxSensorTester4 to check the sensor characteristic and hardware defects.

#### 13.3 eGalaxSensorTest4 Test Settings

The Procedure for eGalaxSensorTester4 is shown as follows:

- a. In eGalaxWorks80Hxxx folder, open **SensorTestDefault.ini** and add the MODEL name (e.g. 1234) in **[SupportModel]** to make eGalaxSensorTester3 supports this model.

```
[Setting Param]
SupportModel = 79FF,79FD,22FF,22FD,1234
```

- b. Modify test thresholds, the typical test thresholds for each stage:

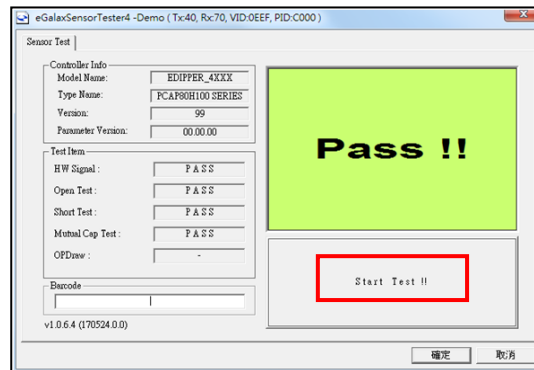
Test Item	Touch Sensor Stage	Touch Module Stage	Touch System Stage
Open Test	Reference Value*0.9	Reference Value*0.85	Reference Value*0.85
Short Test	30	30	30
Mutual Test	50	60	60

**The open test is sensitive to the environment capacitance; the test value might be different on each stage, it is necessary to collect a small batch (around 15 pieces) of test logs to adjust a proper open test threshold for each stage.**



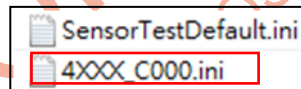
c. Please launch **eGalaxSensorTester4.exe**. Please click **Start Test** to start self diagnostic process, the test result will be show in the application window. For more information about eGalaxSensorTester4, please refer to EETI document:

**EUG-020-eGalaxWorks\_User\_Guide\_EXC80HXXX.**



**Note1:** The default thresholds may be over strict. According to the condition of touch sensors, it may need to gather a batch of logs and change to a proper thresholds which is based on the condition to mass production. Please refer to [Chapter 13.4 - Create Reference Open Test Threshold](#).

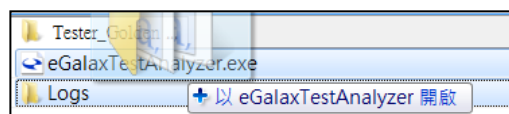
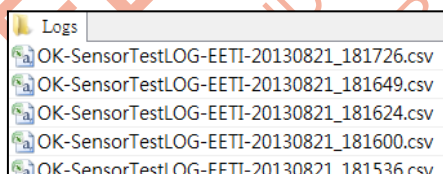
**Note2:** If the test thresholds are intended to be different from default test value for specific model, please copy the SensorTestDefault.ini and rename it to MODEL\_PID.ini. The sensor test tool will load the MODEL\_PID.ini in first priority.



### 13.4 Reference Setup for Open Test Threshold

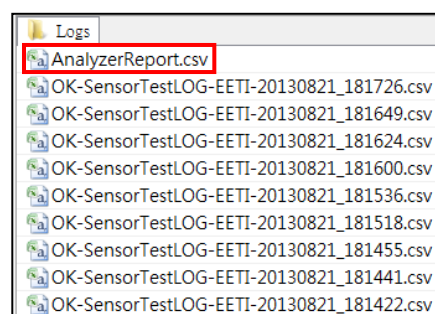
Please follow below instruction to parse test logs for open test reference value:

- Collect the test logs (SensorTestLOG.csv) which need to be analyzed in a directory (for example: Logs).
- Drag the Logs directly to **eGalaxWorks80Hxxx\eGalaxTestAnalyzer.exe**.



- Get the reference value for open test and detail report (AnalyzerReport.csv) in the Logs directory. Please take the Open Data Min Value as reference and refer to the [Chapter 13.3 Table](#).

```
Version: v1.0.1.3
Start calculate...
OK-SensorTestLOG-EETI-20130821_181422.CSV... OK. Min Value:2996
OK-SensorTestLOG-EETI-20130821_181441.CSV... OK. Min Value:2996
OK-SensorTestLOG-EETI-20130821_181455.CSV... OK. Min Value:2996
OK-SensorTestLOG-EETI-20130821_181518.CSV... OK. Min Value:2996
OK-SensorTestLOG-EETI-20130821_181536.CSV... OK. Min Value:2996
OK-SensorTestLOG-EETI-20130821_181600.CSV... OK. Min Value:2996
OK-SensorTestLOG-EETI-20130821_181624.CSV... OK. Min Value:2996
OK-SensorTestLOG-EETI-20130821_181649.CSV... OK. Min Value:2996
OK-SensorTestLOG-EETI-20130821_181726.CSV... OK. Min Value:3032
Open Data Min Value :2996
Total: 9 log files done.
```



## 14 Special Functions

The special function includes palm rejection and water resistance improvements. Some of the parameters are listed in the **Software** section. The value 0 means disabling the function; value 1 means enabling the function.

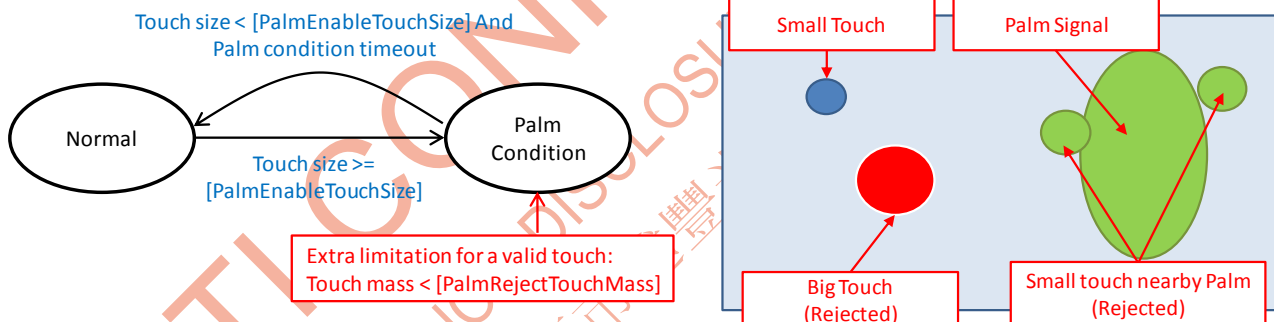
[Alg Threshold-0 Setting]			
[---Ctrl Flag-0]			
Ctrl(0)_PALM_REJECTION	0	0~1	
Ctrl(0)_WATER_PROOF	0	0~1	

[Alg General Config]			
TouchMode	0	0~254	
NumsOfThresholds	1	1~3	
SWAP_XY	1	0~1	
SWAP_X	1	0~1	
SWAP_Y	1	0~1	
Ctrl(0)_AUTO_FREQUENCY	1	0~1	
Ctrl(0)_DRAW_IN_COMPENSATION	1	0~1	
Ctrl(0)_LIFT_OFF_COMPENSATION	1	0~1	
Ctrl(0)_ENHANCE_FINGER_SEPARATION	0	0~1	
Ctrl(0)_MARGIN_IMPROVE	1	0~1	
Ctrl(1)_ENHANCE_LINEARITY	0	0~1	
Ctrl(1)_TP_EN_GPIO	1	0~1	
Ctrl(1)_ENHANCE_PALM_REJECTION	1	0~1	
Ctrl(2)_IMAGE_DYNAMIC_COOKTOUCH...	0	0~1	

### 14.1 Palm Rejection Mode

Please set [PALM\_REJECTION] = 1 to enable it. Palm rejection is designed to avoid accidental a large area of contact.



When detecting a contact size larger than [PalmEnableTouchSize], palm rejection mode will be enabled. Palm mode will remain for 1.5 seconds and can be continuously triggered. In palm mode, the mass of a valid touch needs to be smaller than [PalmRejectTouchMass] or it will be rejected. When putting a palm or fist on the touch sensor, the temporary small contact may not be considered as a palm. When the contact become stable in large contact size, palm mode will be enabled and the IsPalm flag will change to 1.

```
Freq#: 00, Threshold#: 0, #Touch: 08 (12), StrayConfidence: Pass, WL: (-1, -1),
WaterState: No Water, WaterDisableTouch: 0, NoiseCondition: 0, IsPalm: 1, IsIdle: 0, IsFinger: 1,
MaxNoise: 0027, NoiseCh: 008, Water: 0000, CMax: 0153, CMin: 0000, S/F: 0047 / 27, PalmCnt: 003, WaterNodeCnt: 0000,
```

When [PALM\_REJECTION] = 1, the control flag [ENHANCE\_PALM\_REJECTION] will enhance the contact rejection around the palm contact.

**Note1:** Palm rejection is a function to ignore contacts with large area.

**Note2:** There may be conflict in glove touch and palm rejection function.

## 14.2 Glove Touch Fine-tune

For glove touch fine-tune, the fine-tune process is the same as the finger's. Generally, the touch with glove will generate small touch signal. The key point to support glove touch is to raise the sensitivity, i.e.. Reduce touch thresholds. **However, the high sensitivity also means the low reliability and stability. There will be more risks against environmental variances, ghost touch, water resistance...,etc. For a reliable and stable touch performance, EETI suggest the touch % > 5 and SNR >= 5 in the required input condition if possible.**

		
Thickness: 0.25 mm	Thickness: 0.3 mm	Thickness: 1.0 mm
Material: Nylon	Material: Rubber	Material: Leather
Cover glass limitation: < 6.0 mm	Cover glass limitation: < 6.0 mm	Cover glass limitation: < 3.0 mm

		
Thickness: 1.0 mm	Thickness: 1.5 mm	Thickness: 1.5 mm
Material: Synthetic leather	Material: Leather	Material: Synthetic leather
Cover glass limitation: < 3.0 mm	Cover glass limitation: < 2.0 mm	Cover glass limitation: < 2.0 mm

	
Thickness: 1.8 mm	Thickness: 2.0 mm
Material: Cotton	Material: Suede
Not recommend	Not recommend

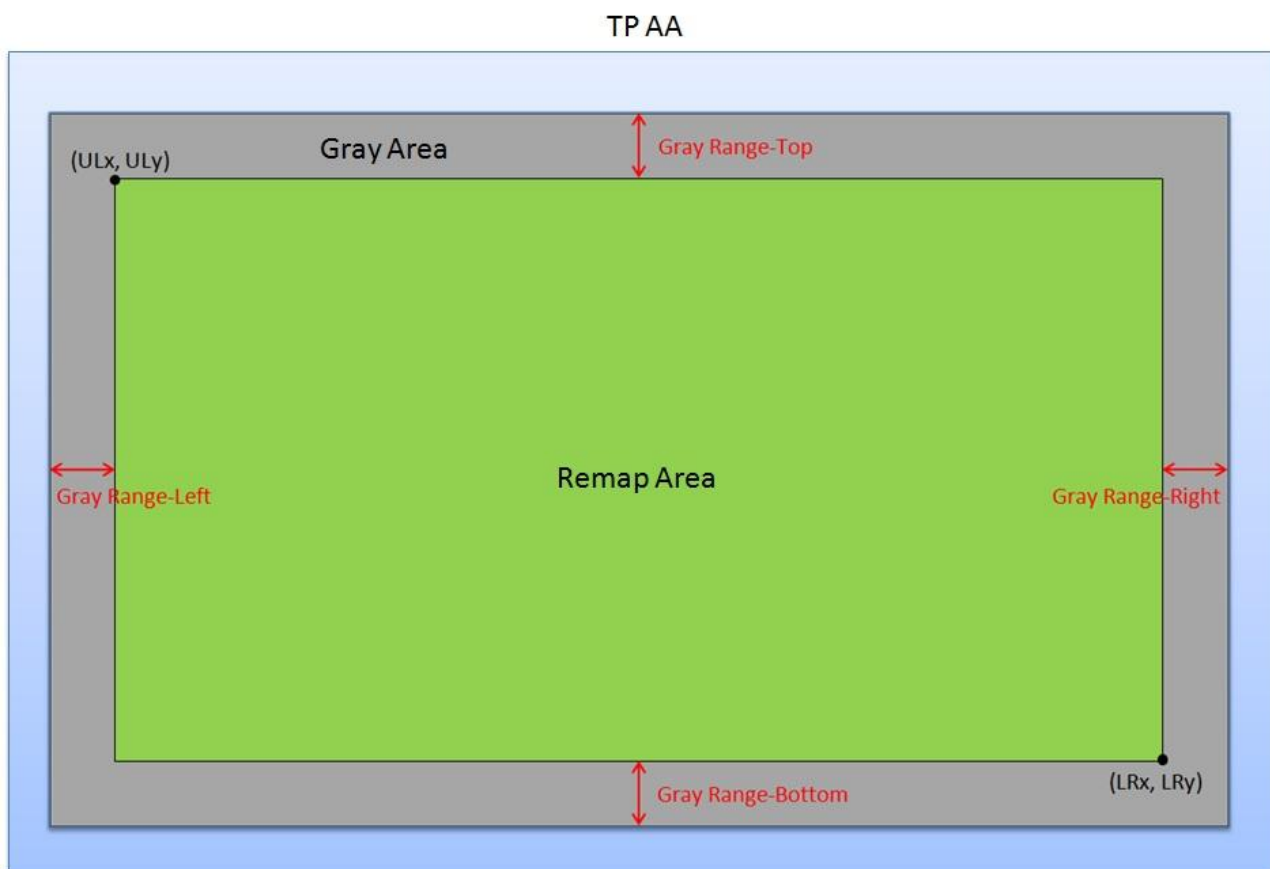
### 14.3 Enhance Finger Separation

Set [ENHANCE\_FINGER\_SEPARATION] = 1 to enable special process to improve close finger performance. This function also increases the risk to report ghost touch with large contact size (e.g. thumb).

### 14.4 Remap Area and Gray Area

Set [Remap AreaX\Attr] = 1 to enable remap area function. If [Remap AreaX\Attr] = 1, you should do 4pt calibration twice. First, you should do the 4pt calibration before enable the remap function. After enable the remap function (Set [Remap AreaX\Attr] = 1), you should do the 4pt calibration again.

The remap and gray area can be expressed as below.



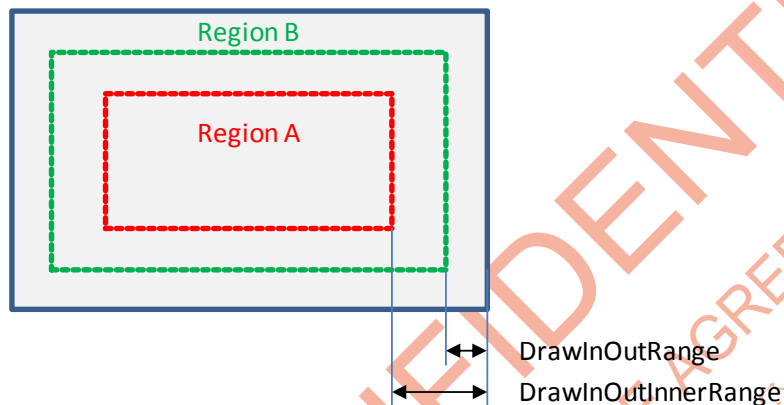
### 14.5 Draw In and Draw Out

Set [Ctrl\_DRAW\_IN\_COMPENSATION] = 1 and [Ctrl\_LIFT\_OFF\_COMPENSATION] = 1 to enable draw in and draw out function.

To trigger draw-in-out should satisfy 3 conditions.

1. Inner Region
2. Edge Region
3. Moving Speed

The area can be expressed by the picture below



Draw In:

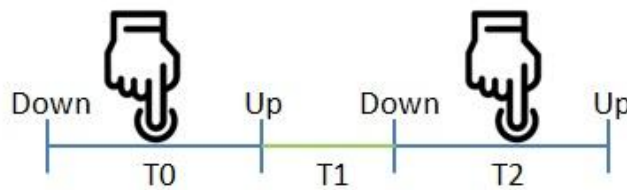
1. First point should hit the Edge Region.
2. The last point should hit Inner Region.
3. The moving speed should exceed the DrawInOutSpeed.

Draw Out:

1. First point should hit the Inner Region.
2. The Last point should hit the Edge Region.
3. The moving speed should exceed the DrawInOutSpeed.

#### 14.6 Double Click

Set [Ctrl(3)\_ENHANCE\_DOUBLE\_CLICK] = 1 to enhance the double click. If the touch behaves like double click which satisfy 3 conditions. The second point will report the same point as first point.



If the 2 touch point positions are very close which within ClickRange, the touch time is very short (First touch time  $T0 < \text{DownDuration}$ ) and the duration between 2 touch is very short ( $T1 < \text{UpDuration}$ ), it may probably a double click behavior. So we could let the second point report the same position as first point.

#### 14.7 Operation Control

This function can configure a combination of specific operation events and reaction behavior.

Operation events:

OperationType	Operation events definition
0	None (function disable)
1	Monitor the IsIdle=0 <ul style="list-style-type: none"> <li>● OpCtrlParams0: The duration of IsIdle=0 (ms)</li> </ul>
2	Monitor the IsIdle=0 and drawing. Once user starts drawing, the duration will be increased. <ul style="list-style-type: none"> <li>● OpCtrlParams1: Extra duration for IsIdle=0 (ms)</li> </ul>
3	Reserved (no function).
4	Monitor the frequency hopping event.
5	Monitor the abnormal frequency hopping in short time. <ul style="list-style-type: none"> <li>● OpCtrlParams0: The timeframe to detect hopping. (ms)</li> <li>● OpCtrlParams1: Hopping counts.</li> </ul>
6	Monitor the abnormal signal situation <ul style="list-style-type: none"> <li>● OpCtrlParams0: The signal situation type (Multi-select in bits) <ul style="list-style-type: none"> <li>■ 0x0001: The signal of WLRx[0] WLR[N] larger than threshold at the same time.</li> <li>■ 0x0002: IsIdle and WL(Rx, Tx) contradiction, or IsIdle=0 but no touch points report to the host.</li> <li>■ 0x0004: Too many touch signal in Image data.</li> <li>■ 0x0008: Too much negative signal in cooked data.</li> </ul> </li> <li>● OpCtrlParams1: The duration of the situation (ms).</li> <li>● OpCtrlParams2: Touch signal quantity threshold.</li> <li>● OpCtrlParams3: Cooked data negative threshold.</li> </ul>

Corresponding reaction behavior:

BehaviorType	Reaction behavior definition
0	None (function disable)

1	Reset base-line data.
2	Software reset (Reset slave IC, baseline, algorithm state)
3	Disable touch. <ul style="list-style-type: none"> <li>● BehaviorParams0 is 0: Disable touch till the Idle back to 1.</li> <li>● BehaviorParams0 is not 0: Disable touch duration. (sec)</li> </ul>
4	Reserved (no function).
5	Reserved (no function).
6	Move to next threshold mode. (Rotate)
7	Change max report point. <ul style="list-style-type: none"> <li>● BehaviorParams0: New max report point. When event triggered again, it will restore to the original max report point.</li> </ul>
8	Disable water condition. <ul style="list-style-type: none"> <li>● BehaviorParams0: The duration of not trigger water condition. (sec)</li> </ul>

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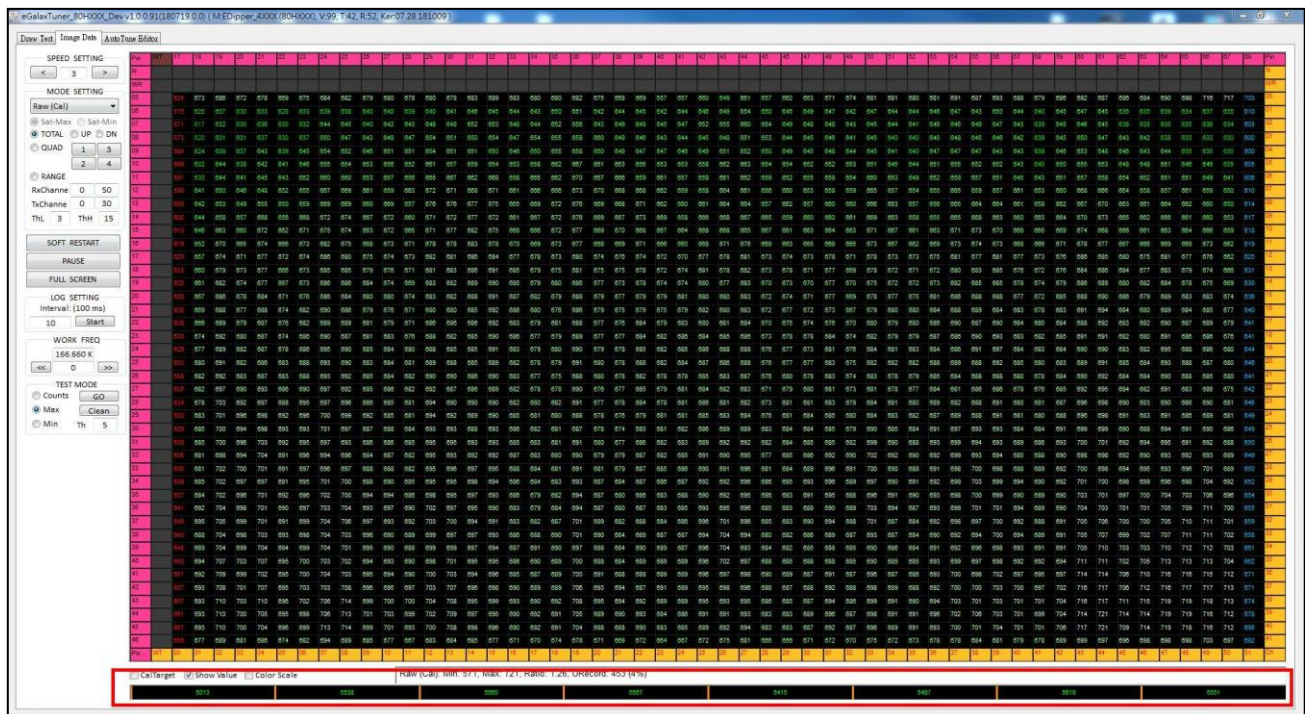
FOR 東莞市越豐光電有限公司



## 14.8 IO-VKey Setting

Set [SCAN\_CTRL\_VKEY] = 1 to enable IO-VKey function. The IO setting must base on the circuit diagram.

The hardware IO can be set in the [IO-VKey Config] of the hardware parameter area. The IO-VKey setting will be refreshed after relaunching the eGalaxTuner, and the IO-VKey signal will be shown on the bottom of Image Data page as the picture below.

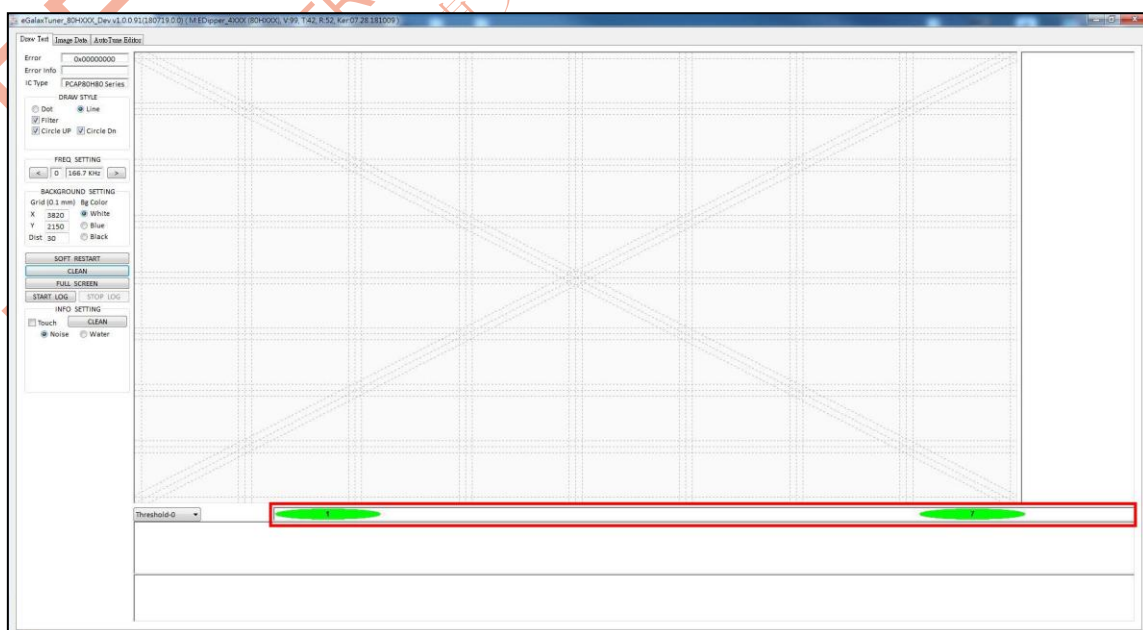


Modify the IO-VKey setting in the [Freq-X IO-VKey Reg Parameters] of the hardware parameter area to improve the SNR of IO-VKey and avoid the signal saturation.

The cooked data is shown in the [Image Data\ Cooked Data] page, the threshold can be set base on the value.

If the thresholds are not appropriate, the thresholds can be modified in the [IO-VKey Setting] of the software parameter area.

The IO-VKey function can be checked in the Draw Test page.



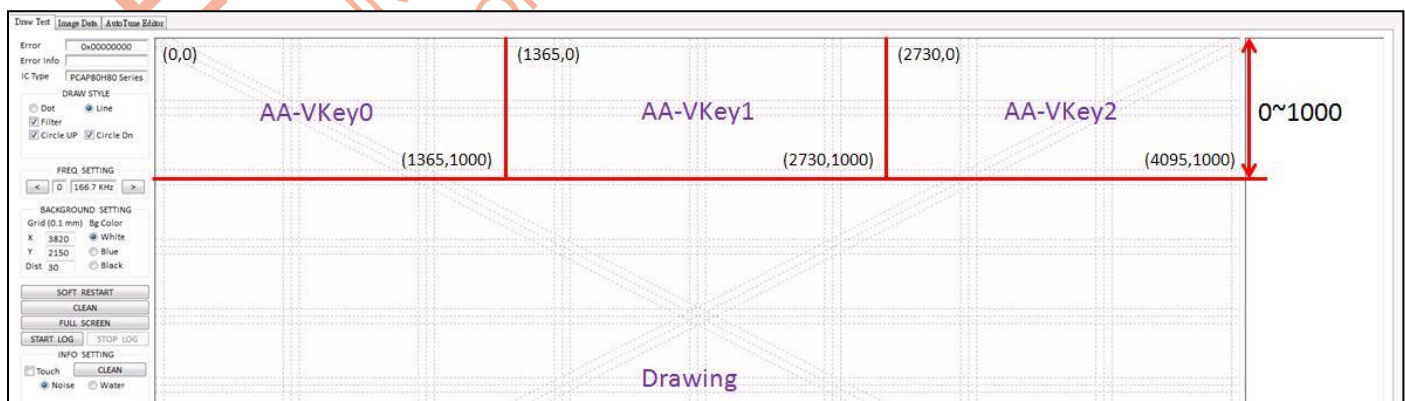


## 14.9 AA-VKey Setting

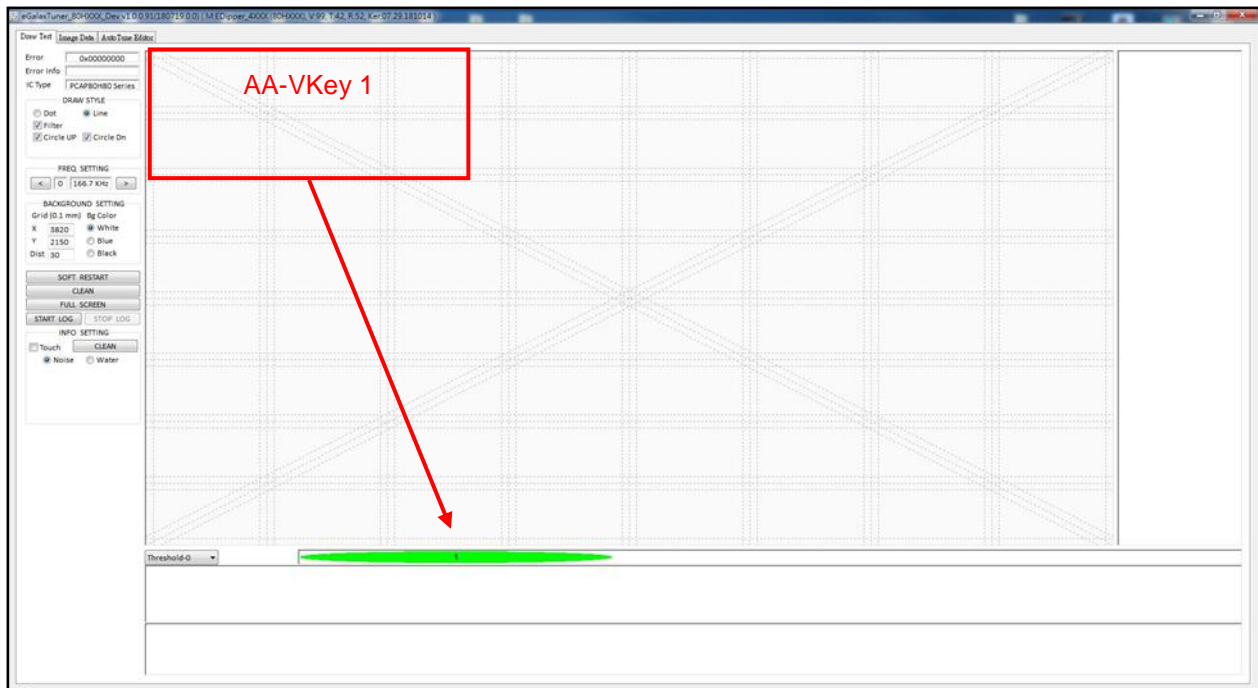
Set the numbers of AA-VKey you want in the [AA-VKey Area] of the hardware parameter area. Set the AA-VKey type and area separately. If you want to report the HID Keyboard event, please refer to the HID Keyboard KeyCode Table to set the [AA-VKey AreaX\KeyCode]. For Example, the AA-VKeys are set as follow.

<b>[AA-VKey Area]</b>	
NumsOfKey	3
<b>[AA-VKey Area0]</b>	
Attr	2
DelayCnt	0
KeyCode	0
GroupMassTh	200
ULx	0
ULy	0
LRx	1365
LRy	1000
<b>[AA-VKey Area1]</b>	
Attr	2
DelayCnt	0
KeyCode	0
GroupMassTh	200
ULx	1365
ULy	0
LRx	2730
LRy	1000
<b>[AA-VKey Area2]</b>	
Attr	2
DelayCnt	0
KeyCode	0
GroupMassTh	200
ULx	2730
ULy	0
LRx	4095
LRy	1000

According to the setting above, the active area will be separated into 4 parts which contain three AA-VKeys and drawing AA area.



After finish the setting of AA-VKey, the relaunch of eGalaxTuner is required. Then the AA-VKeys function can be checked in the Draw Test page. If you touch the TP within (0,0)~(1365,1000), it'll report VKey event instead of touch point position.

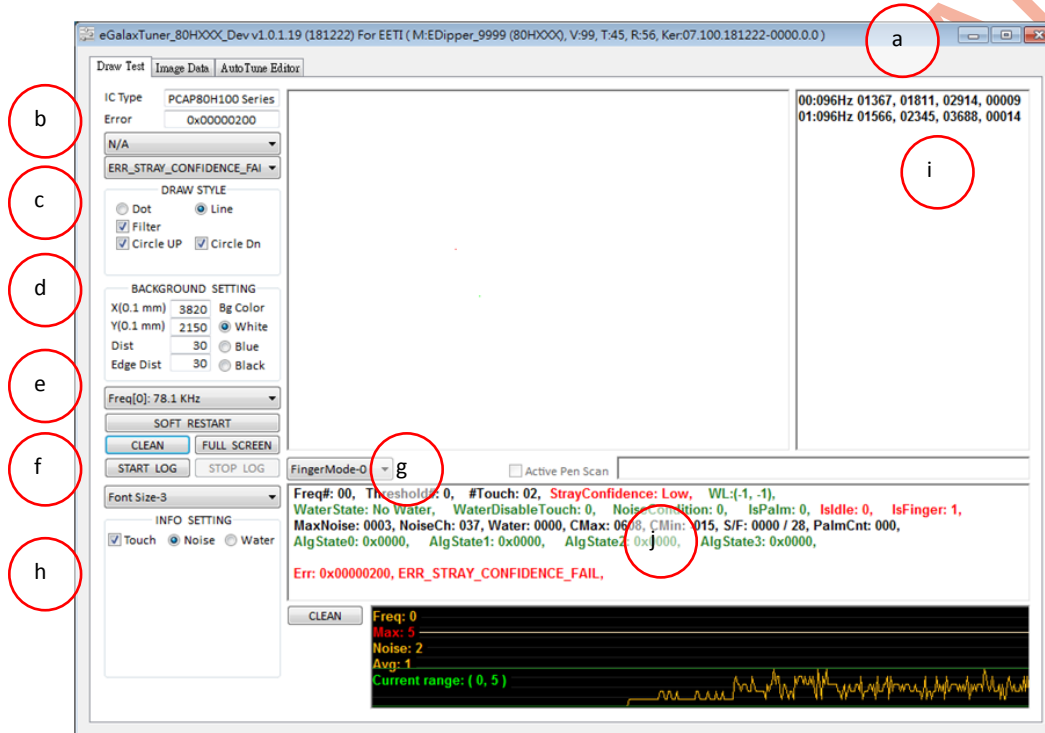


## 15 Introduction to eGalaxTuner\_80HXXX\_Dev

eGalaxTuner\_80HXXX\_Dev.exe is the primary tool for firmware tuning, which provides the function to edit parameter, run tuning process, signal verification, and verify touch function. The introduction to each page is as follows.

### 15.1 Draw Test Page

This page provides touch information which includes reporting rate, touch drawings, firmware status and noise information.



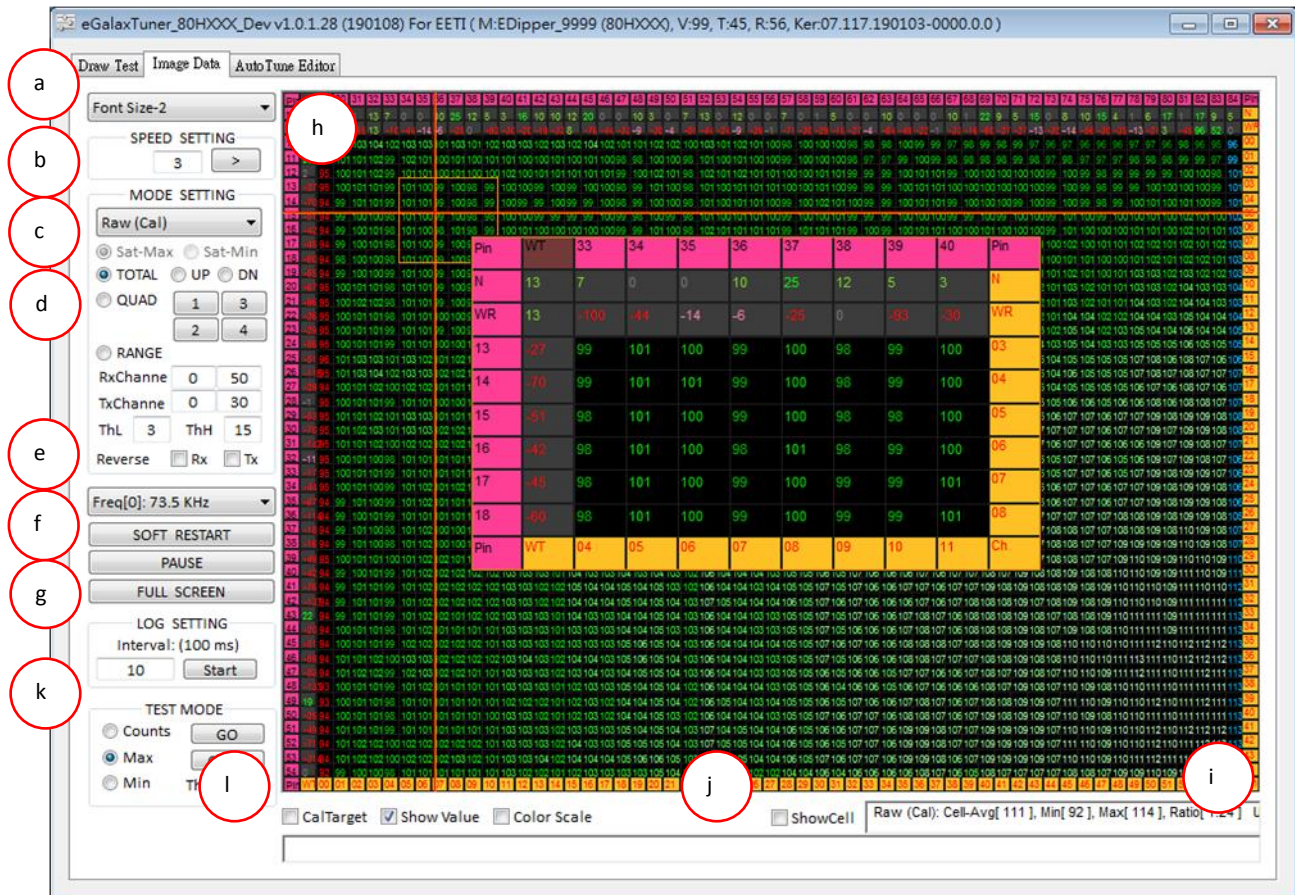
- a. eGalaxTuner Title will show the controller information:
  - Application version
  - Controller model / model information
  - Controller firmware version / Kernel version
  - The number of Tx and Rx channel
- b. Touch information window:
  - Error code information and IC type
- c. Drawing Style:
  - **Filter**: Show touch positions with filter.
  - **Dot mode/ Line mode**: Show touch positions in dots or line.
  - **Circle Down/ Circle Up**: Show finger down and up state with a circle.
- d. Background Setting:
  - X: X dimension of the active area. [unit: 0.1mm]
  - Y: Y dimension of the active area. [unit: 0.1mm]
  - Dist: The tolerance line gap (dot line) for each grid line[unit: 0.1mm]
  - Background color: White, blue and black.
- e. Freq Setting:
  - **Index**: Working frequency index and current working frequency (kHz).

- f. Function buttons:
- **Soft Restart:** Make the controller software restart to reset touch function.
  - **Clean:** Clean the draw data window.
  - **Full Screen:** View the draw data window in full screen mode.
  - **Start/Stop Log:** Save/Stop all the X/Y coordinates in a log file.
  - **Font Size:** Change display font size in information window.
- g. **Threshold-#:** Index of current threshold setting.
- h. Info Setting
- Touch: show firmware status.
  - Noise: show noise status information at monitor window.
    - **Freq:** Current working frequency index.
    - **Max:** Maxima noise value of the environment.
    - **Noise:** Current noise value of the environment.
    - **Avg:** Average noise value of the environment.
    - **Current range:** Current noise range inside the noise monitor window.
  - Water: show water status information at monitor window.
    - **Water- History Max:** Maximum water value of the environment.
    - **Water- Val:** Current water value of the environment.
    - **Water- Current:** Current water value range inside the monitor window
  - Clean button: Clean information records.
- i. Touch position and report rate.
- j. Firmware status:
- Freq#: Index of current working frequency.
  - Threshold#: Index of current threshold setting.
  - #Touch: Total number of valid touches.
  - StrayConfidence: State of baseline. If the baseline is incorrect, the "StrayConfidence" will be "Low".
  - WaterState: State of water condition including no water, single touch in water and dual touch in water.
  - WaterDisableTouch: Water condition and touch is disabled.
  - NoiseCondition: Show noise condition state.
  - IsPalm: Show palm rejection state.
  - IsIdle: Show touch or idle condition.
  - MaxNoise: Maxima noise value of the environment.
  - NoiseCh: The index of Rx channel which has maxima noise value.
  - Water: Water quantity of water detect algorithm.
  - CMax: Maximal value in Cooked Data image data page.
  - CMin: Minimal value in Cooked Data image data page.
  - S/F: Value for speed and filter level.
  - PalmCnt: Count of palm objects.
  - AlgState#: Algorithm debug information



## 15.2 Image Data Page

This page shows EXC80HXXX sensing data and hardware status.



a. Font size: Change display font size.

b. Speed Setting

Refresh rate of the raw data. Default setting is to refresh the window every 1 frames. Decrease this value will make the image data to refresh faster.

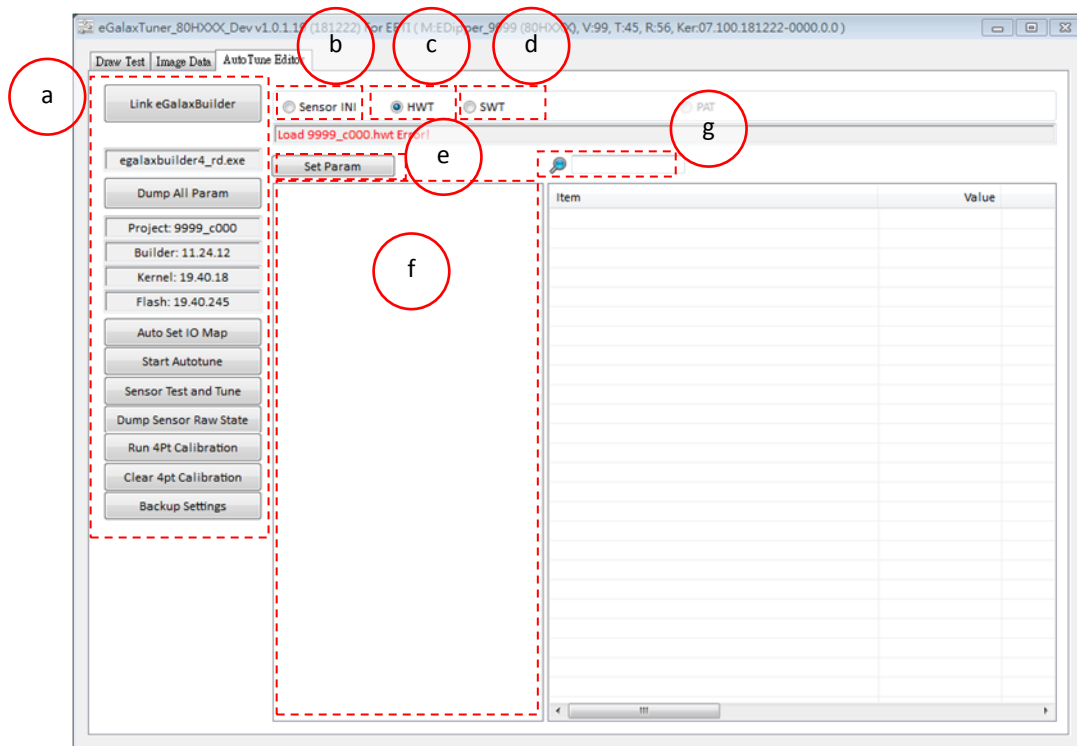
c. Mode Setting

There are several modes for EETI PCAP controller sensing data:

- **Raw (Cal)**: PCAP raw data scanned from EXC80HXXX controller. (With fine-tune calibration)
- **Raw (NoCal)**: PCAP raw data scanned from EXC80HXXX controller. (Without fine-tune calibration)
- **Cooked Data**: The signal difference between raw data and the Baseline.
- **Touch Signal**: EETI algorithm calculated value from raw data and Cooked Data.
- **Touch %**: The percentage variance of mutual capacitance of a contact. Please refer to [Chapter 8.1 - Touch % Verification](#).
- **AFE AD % / ADC AD %**: Signal strength of the **analog frontend** / **after analog to digital convertor**. The higher AD LEVEL % value, the higher risk to suffer signal saturation. Please refer to [Chapter 10.2 - AD Level](#).
- **Uniformity**: The uniformity value **before hardware calibration**. (Refer to [Chapter 10.1 - Hardware Calibration](#)).
- **Unifor Cook**: The uniformity value **after hardware calibration**. If there is large value in Unifor Cook page, that means the system offset may be different to the state when hardware calibration is made, it can be damage or distortion of the touch system.

- d. Image range:
- **TOTAL:** Display complete image data.
  - **UP:** Display upper half part of image data.
  - **DN:** Display lower half part of image data.
  - **QUAD:** Display quarter part of image data.
  - **RANGE:** Display specified numbers of Rx/Tx range of image data.
  - **Thre Low:** Highlight the value if the absolute value is larger than **Threshold Low**.
  - **Thre High:** Highlight the value if the absolute value is larger than **Threshold High**.
- e. Running Freq
- **Frequency:** Current working frequency (kHz).
  - **Index:** Working frequency index.
- f. Display function buttons:
- **Soft Restart:** Refresh the baseline, controller will go back to default working state.
  - **Pause:** Freeze the image signal in the signal window.
  - **Full Screen:** enlarge the signal window to full screen.
- g. Log Setting: Set record log interval time. [unit: 100ms]
- h. The up side and left side index is the IC pin number of each channel. Different color means different IC.
- i. The right side and down side index are the Tx/ Rx index of each channel.
- j. Raw Data Information: Displays the max and min raw data, the max/min ratio, and the number and the usage of system offset data.
- k. Test Mode Function
- When test mode is enabled, the data will change to display **Image Mode** historical records of each node. It can be used for stability of touch signal analysis.
- **Maximum:** To keep the maximum value of historical records.
  - **Minimum:** To keep the minimum value of historical records.
  - **Threshold:** The historical value larger than threshold will be display in different color.
  - **Go:** Start historical record mode.
  - **Stop:** Stop historical record mode.
  - **Clean:** Reset the historical records to 0.
- l. Image data display mode.
- **CalTarget:** Show calibration channel.
  - **Show Value:** Show data value.
  - **Color Scale:** Show data in color scale.
  - **ShowCell:** Calculate the average signal on the location with maximum signal variance.

### 15.3 AutoTune Editor Page



#### a. Firmware fine-tune related functions

- **Link eGalaxBuilder:** Link to eGalaxBuilder.
- eGalaxBuilder file name
- The MODEL\_PID information for current project.
- The parameter version of tool, firmware kernel and parameters.
- **Dump All Param:** Get all parameters from the controller and update to editor window.
- **Auto Set IO Map:** Automatically search Tx & Rx pin setting
- **Start Autotune:** Start firmware auto-tune function.
- **Sensor Test and Tune:** An integrated function for first fine-tunes. It will check hardware defect and make tuning by skipping sensor's open/ short channels.
- **Dump Sensor Raw State:** Dump touch sensor raw state and store in eGalaxChecl.csv.
- **Run 4Pt Calibration:** Run eGalaxCalibration to doing 4 point calibration.
- **Clear 4Pt Calibration:** Run eGalaxCalibration to clear 4 point calibration data.
- **Backup Settings:** Store current setting files to a Backup-Date-Time directory.

#### b. Sensor INI: Show the contents of Tune\_Project.ini

#### c. HWT: Show hardware parameters.

#### d. SWT: Show software parameters.

#### e. Set Param: Store current contents to controller.

#### f. Parameter Section List: Quick navigate to specific section.

#### g. Search Parameter function: Quick search in the parameter editor.

## 15.4 Hotkey Table

### a. Draw Test Page

Hotkey	Function
L	Start/ Stop log.
F	Full screen
R	Soft Restart
T	Enable/ Disable touch info window
+	Increase working frequency index
-	Decrease working frequency index
Space bar	Clean draw window
ESC	Exit full screen mode

### b. Image Data Page

Hotkey	Function
P	Pause
F	Full screen
Z	Zoom in (Switch to "Range display mode")
X	Zoom out (Switch to "Total display mode")
Up/ Down/ Left/ Right	Move display range in zoom in mode
+	Increase font size
-	Decrease font size
Mouse left button single click	Enable magnifier on mouse position.
Mouse right button single click	Mark the Tx/Rx channel on mouse position.
Mouse left button double click	Enable magnifier and lock on mouse position. Double click again to disable the magnifier lock.

### c. Autotune Editor Page

Hotkey	Function
Ctrl+F	Go to search box.
ESC	Leave search box and go to parameter window. Leave parameter edit state.
Up/ Down	Move select box in parameter window.
Enter	Edit parameter.
Up/ Down/ Left/ Right	Move display range in zoom in mode
Ctrl+Mouse left button	Multi-line select on parameters.
Shift+Mouse left button	Multi-line select on parameters.



## 16 Trouble Shooting

### 16.1 Parameter Version Incompatible

Parameter compatibility is checking by below rule:

The eGalaxBuilder's parameter version must same or larger than the kernel's.

The Parameter's version must same or larger than the kernel's

If the parameter is incompatible, please use the latest version of eGalaxBuilder to operate the parameter. The latest eGalaxBuilder will sync the parameter version to the latest version by following process:

- Connect the controller with old parameter version.
- Open the latest eGalaxTuner\_80HXXX.exe
- Click **Dump All Param** button to get the setting files, the files will also be converted to the latest version.
- Set the converted HW and SW parameter to controller.

After completed above actions, now you can start to fine-tune the firmware with correct and latest parameter version.

### 16.2 Malfunction of Touch

The followings are two possible conditions which can cause touch no function:

- Touch threshold too high: Please adjust threshold parameters according to touch signal. The AlgState in touch info window indicates the algorithm state.

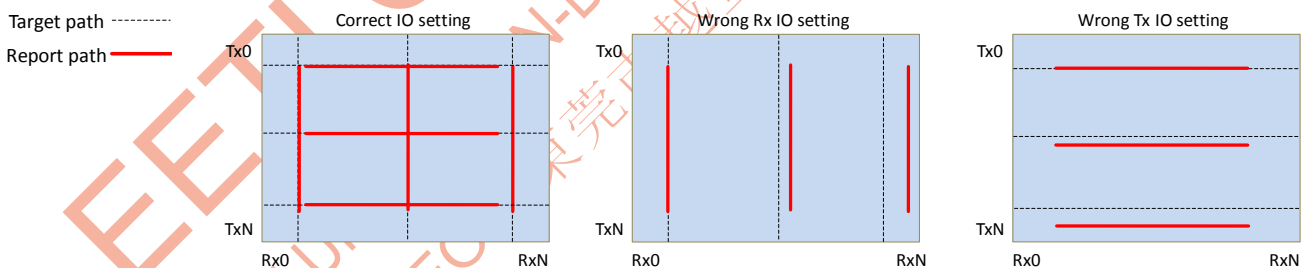
Alg State	Comment
0x0000	No Error
0x0001	TouchTh not passed
0x0002	Stray confidence not passed
0x0004	(Water condition) Touch size not passed
0x0008	Edge sensitivity not passed
0x0010	(Palm condition) Palm contact
0x0020	Touch size not passed
0x0040	Group mass not passed
0x0080	Touch function disabled
0x0100	(Water condition) Water line threshold not pass.
0x0200	Water line Tx not passed
0x0400	Water line Rx not passed
0x0800	Reserved.
0x1000	Reserved.
0x2000	Reserved.
0x4000	Reserved.
0x8000	Reserved.

- b. Firmware error: It could be caused by invalid parameters or hardware defects. Please send the Error Code to EETI.

Error Code	Error Info	Comment
0x0000 0000	ERR_NO_ERROR	-
0x0000 0001	ERR_ALG_PARAM	The version between SWT section and eGalaxBuilder4 is not matched.
0x0000 0002	ERR_HW_PARAM	The version between HWT section and eGalaxBuilder4 is not matched.
0x0000 0010	ERR_ADC	The hardware signal from driving/sensing chip is incorrect.
0x0000 0080	ERR_TX_SHORT	There is a short defect on TX channels.
0x0000 0100	ERR_UTABLE_CHECKSUM_FAIL	The system offset information is incorrect.
0x0000 0200	ERR_STRAY_CONFIDENCE_FAIL	The system offset is over the thresholds.
0x0000 0400	ERR_EXT_DISABLE_TOUCH	Touch function is disabled by the external GPIO (Disable touch) is pull low.
0x0000 0800	ERR_WATER_DISABLE_TOUCH	Touch function is disabled by the water condition.
0x0000 1000	ERR_SW_DISABLE_TOUCH	Touch function is disabled by the host command.
0x0000 2000	ERR_MEMORY_INVALID	The numbers of TX/Rx channels exceed the firmware support channels.
0x0000 4000	ERR_HV_INVALID	The HV component is not ready.
0x0000 8000	ERR_STRAY_INVALID	The baseline of firmware is incorrect.
0x0020 0000	ERR_NOISE_CONDITION	Firmware is in noise condition.
0x0040 0000	ERR_WATER_CONDITION	Firmware is in water condition.
0x0080 0000	ERR_CAL_DCOFFSET	Hardware signal offset of sensing chip is incorrect.

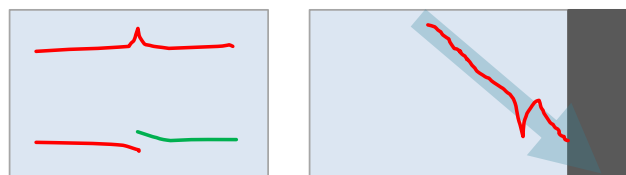
### 16.3 Touch Not Accurate on Edge Channels

If touch accuracy has offset which is related to the Tx or Rx channels, it could be caused by wrong Tx channel setting, please check Tx or Rx IO settings.



### 16.4 Abnormal Drawing Jitter

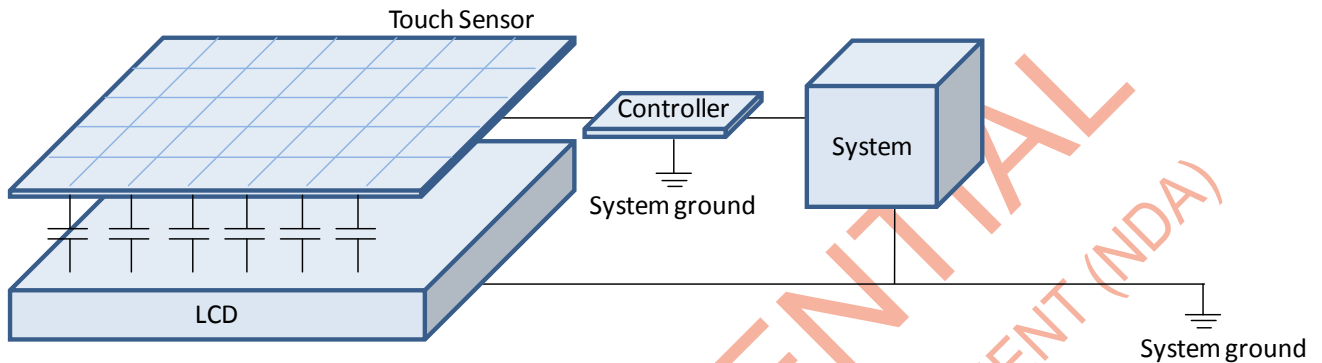
If you find drawing jitter like below, please set [ENHANCE\_FINGER\_SEPARATION] = 0 and [MergeDistance] = 0, and check the drawing function again. The [ENHANCE\_FINGER\_SEPARATION] may cut the correct touch contact into two points and affect the drawing performance.



## 17 Appendix

### 17.1 RC Loading for PCAP Touch Solution

The purpose of fine-tune process is to optimize the RC loading of the touch system (Touch sensor, EETI touch controller, LCD and the system). A balanced RC loading is very important to touch performance.

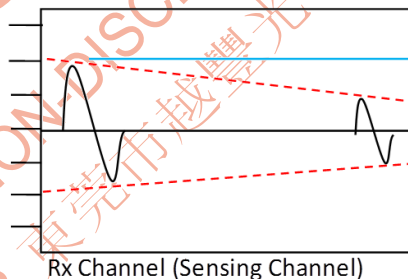


The most of RC loading depends on the design and material of touch sensor. RC loading will causes signal drop and affects signal quality. If there is any defect in touch sensor, it will also affect the RC characteristic and make the tuning result totally different. The tuning process will attempt to optimize the RC loading, minimize the signal drop and target the defects in touch sensor. For sensor design rules please refer to EETI document: **EDG-002-Sensor\_Design\_Rule**.

In a single routing sensor design, the front end of a Tx channel has stronger signal strength while the back end has weaker signal strength.

Tx single routing design

Tx Channel  
(Driving Channel)

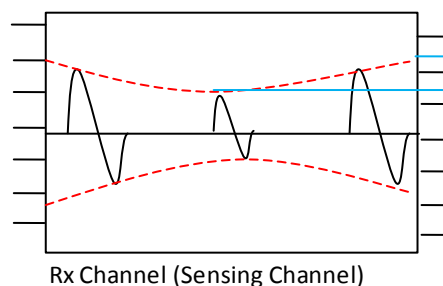


Signal drop

In a double routing sensor design, both the front and back end has stronger signal strength while the middle has weaker signal strength.

Tx double routing design

Tx Channel  
(Driving Channel)

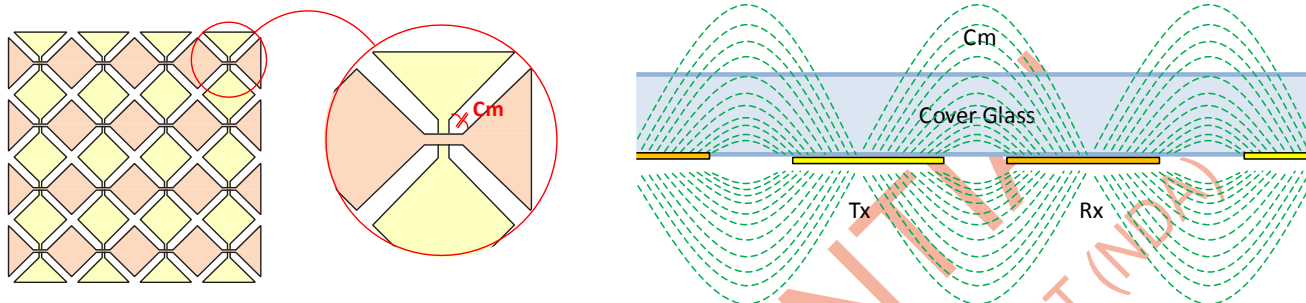


Signal drop

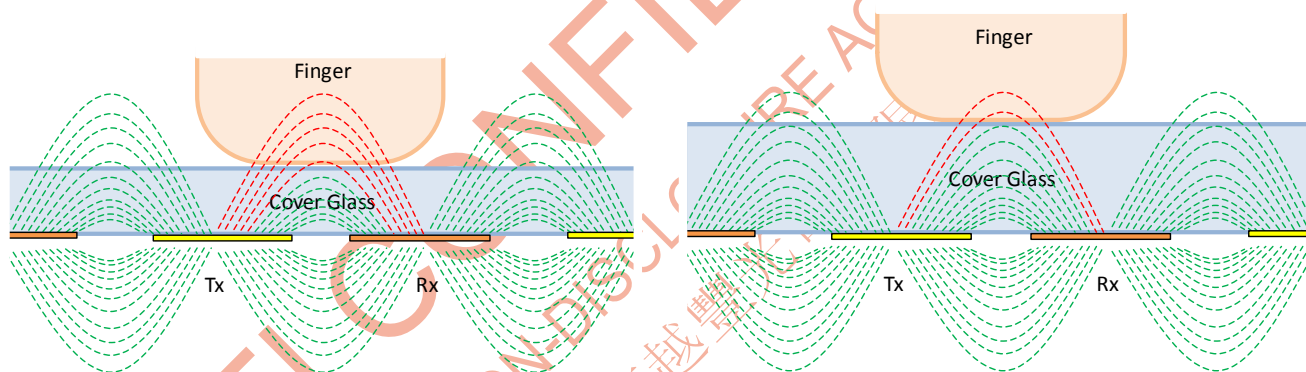
Tx double routing design is suggested, since the RC loading and signal drop will be smaller than single routing. However, we do not suggest to use Rx double routing.

## 17.2 Touch %

Touch % indicates the percentage of mutual capacitance ( $C_m$ ) being affected by contact object in a touch system. It is decided by sensor design (ITP pattern, cover glass, stacks...etc). It is important to setup a correct Touch % for fine-tune process. Tuning utility adjusts parameters based on the touch %.



Higher Touch % means more signal difference when finger touch on sensor. Lower Touch % may be caused by: Bad ITO pattern design, thick cover glass, a shielding layer, and touch through a glove...etc. A good Touch % can guarantee good Signal and Noise Ratio (SNR). Take below diagram as a reference: It's more difficult for a finger to affect electronic field ( $C_m$ ).

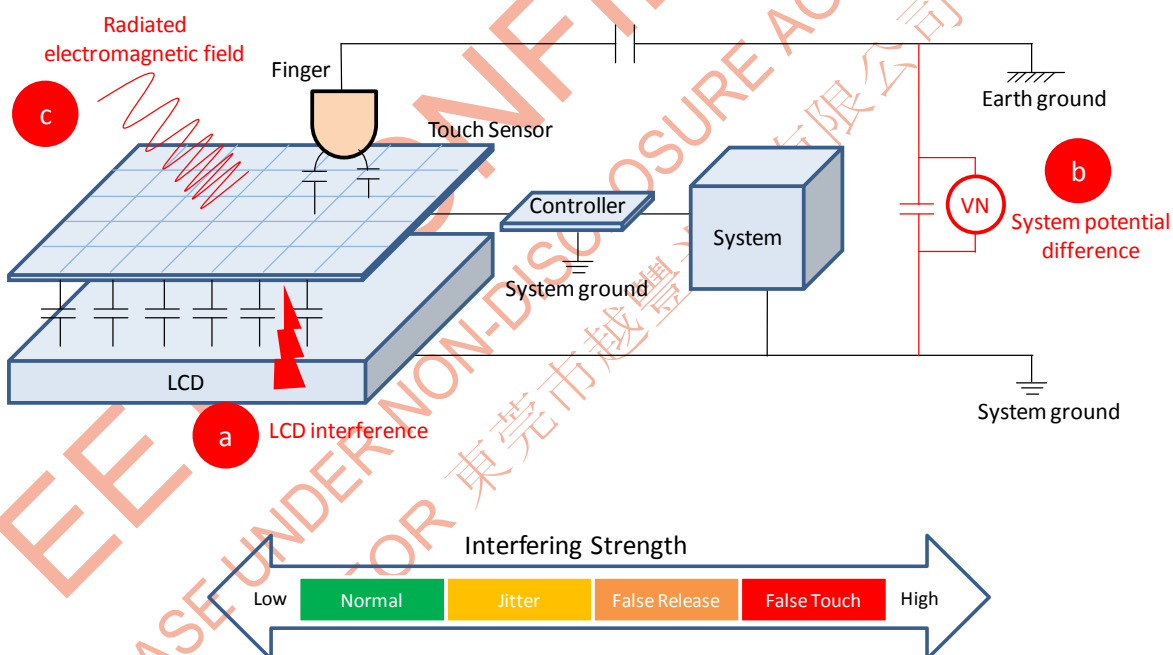


### 17.3 Electromagnetic Susceptibility for PCAP System

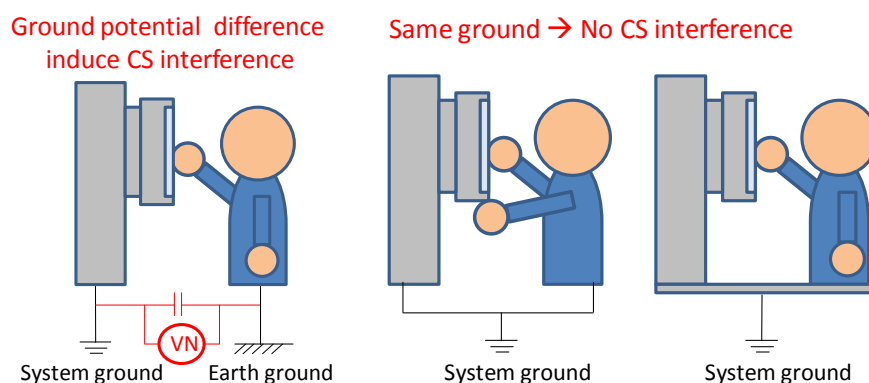
**Electromagnetic susceptibility (EMS)** is important to PCAP touch system because PCAP is very sensitive to electromagnetic interferences. The common noise sources for a PCAP touch system are:

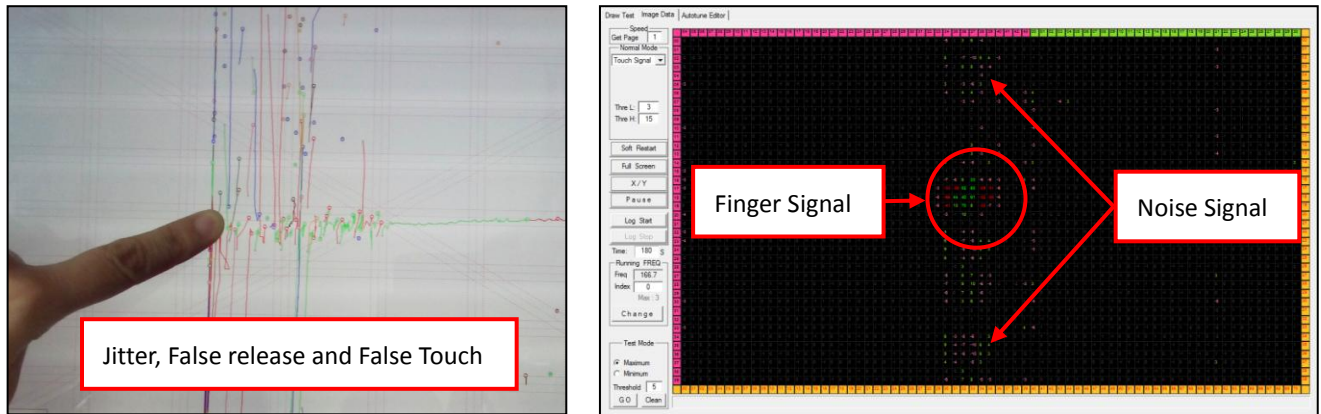
- LCD interference (Environment capacitance coupling interference).
- Power adaptor interference (Conducted interference).
- Environmental electromagnetic interference (Radiated interference).

The equivalent circuit of PCAP can be expressed in the following diagram. Controller is connected with the host system and is powered by this system. Touch sensor is mounted on LCD monitor. The touch sensor was driven by touch controller. When user put finger on touch sensor, it changes the distribution of electrical field on sensor and there would be signal flow through the capacitance between finger and touch sensor. The most common noise for PCAP system is conducted interference. The potential difference between system ground and human ground causes noise, and, if the noise frequency is similar to PCAP working frequency, touch signal would be unstable and causes touch function abnormal. The phenomenon under noise interfering (From low to high strength) can be: normal performance, jitter, false release and false touch.

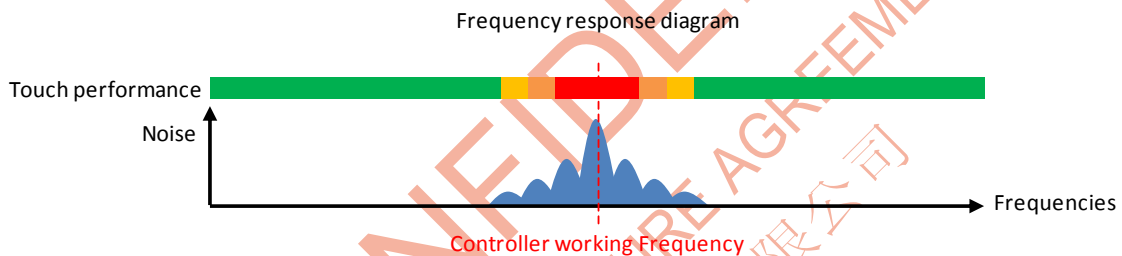


There are two ways to avoid CS interference: Make human ground same as system ground, e.g. for hand held touch devices, there is no potential difference between human and system ground. Or, use proper working frequency to avoid interference.

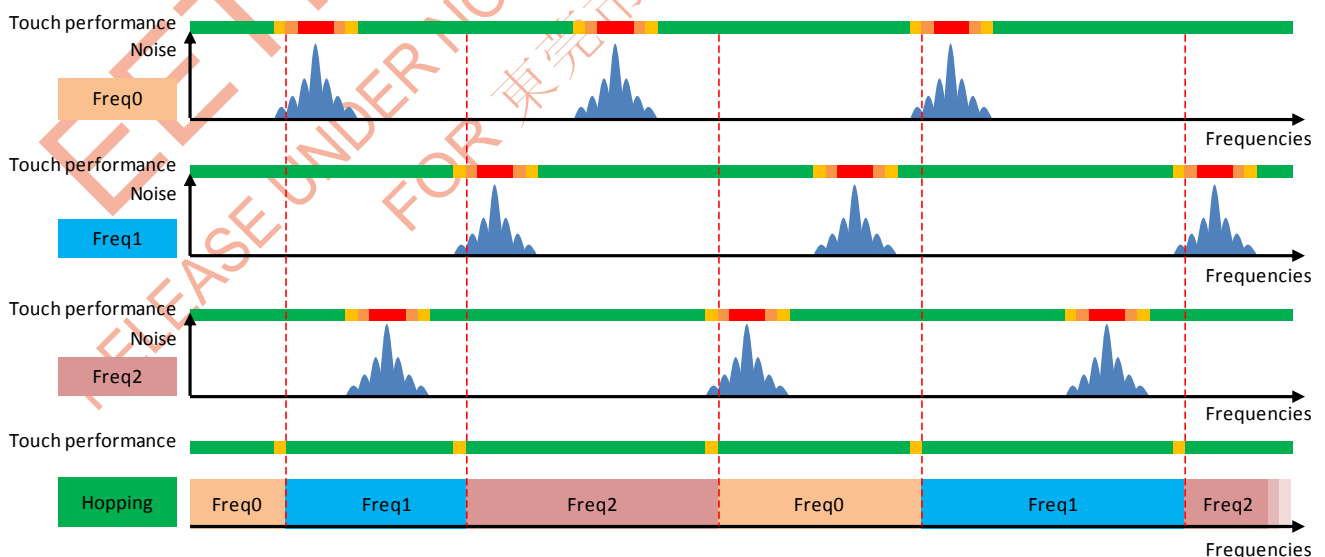




When noise frequency is closed to controller's working frequency, the noise strength raises and affects touch performance. Frequency hopping can make firmware can switch to a proper working frequency at proper time.



Different working frequency will be interfered in different frequency range. To arrange proper frequency sequence for firmware to slip away from noise is important. Working frequency starts from [WorkingFreq0], the hopping sequence is: [WorkingFreq0] → [WorkingFreq1] → [WorkingFreq2] → [WorkingFreq3] → [WorkingFreq0] → ... User can set multiple working frequencies (maximum 4 settings) in firmware for frequency hopping.



The supported working frequency of EXC80HXXX is ranged from 71 kHz to 250 kHz. The available working frequency range will be different according to sensor design. With higher RC loading, it needs a low working frequency for better signal ratio. For more information of EMC, please refer to EETI document: **EDG-008-EMC\_and\_Capacitive\_Touch\_System**.

## 17.4 Sensor INI Parameter List

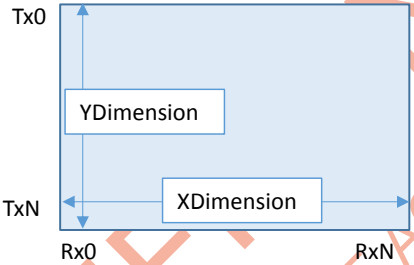
[Tuning Parameter]	Description	Default	Range
NumsOfFreq	The total number of the working frequencies.	1	1~4
WorkingFreq[0:4]	The working frequency set. Please refer to working frequency table in the end of Sensor.ini file for working frequency index mapping table.	0	0~46
[---Image Parameters]			
EnableImageTune	The function to start image autotune process.	1	0 or 1
AD_Level%	Target signal AFE signal strength for autotune process. NoiseMargin + ADLevel = 100% Increase AD_Level% to increase signal strength. Decrease AD_Level% to avoid signal saturation.	15	10~50
Touch%	Mutual capacitance % of a touch, please refer to Image Page \Touch % mode.	10	1~50
SignalLevel	Adjust AFE signal strength, increasing this value will increase signal strength, touch signal will become bigger but noise margin will become smaller.	5	1~30
NoiseResist	The ability to resist noise interference. Usually raising NoiseResist can increase Signal and Noise Ratio but it will also decrease touch signal strength. Increase NoiseResist to increase SNR but touch signal may become smaller. Decrease NoiseResist to have larger touch signal but SNR may become smaller.	7	1~14
[Sensor Test]			
TurnOffMonitor	If your fine-tune with a touch monitor, you may need to turn off monitor during fine-tune, 0: Do not turn off monitor during auto-tune process 1: Turn off monitor during auto-tune process Please do not use keyboard or mouse When LCD is off.	0	0 or 1

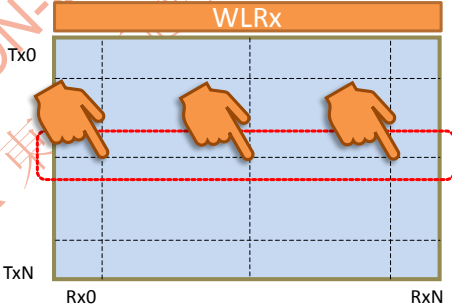
## 17.5 Frequency Table

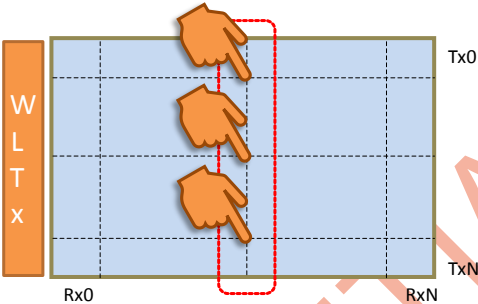
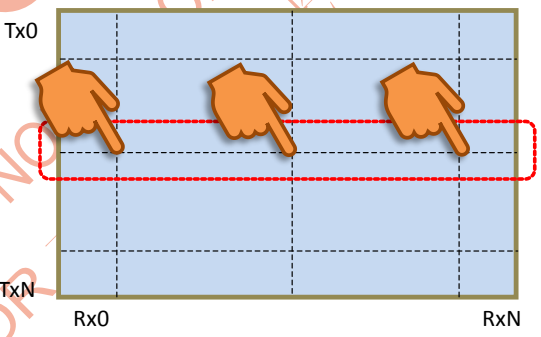
Freq Index.	0	1	2	3	4	5	6	7	8	9
Freq.(kHz)	250.00	230.77	214.29	208.33	200.00	192.31	187.50	178.57	176.4	166.67
(ClkSrc, PreScaler)	(0, 12)	(0, 13)	(0, 14)	(1, 12)	(0, 15)	(1, 13)	(0, 16)	(1, 14)	(0, 17)	(0, 18)
Freq Index.	10	11	12	13	14	15	16	17	18	19
Freq.(kHz)	157.89	156.25	150.00	147.06	144.23	142.86	138.89	136.36	133.93	131.58
(ClkSrc, PreScaler)	(0, 19)	(1, 16)	(0, 20)	(1, 17)	(2, 13)	(0, 21)	(1, 18)	(0, 22)	(2, 14)	(1, 19)
Freq Index.	20	21	22	23	24	25	26	27	28	29
Freq.(kHz)	130.43	125.00	120.00	117.19	115.38	113.64	111.11	110.29	107.14	104.17
(ClkSrc, PreScaler)	(0, 23)	(0, 24)	(0, 25)	(2, 16)	(0, 26)	(1, 22)	(0, 27)	(2, 17)	(0, 28)	(1, 24)
Freq Index.	30	31	32	33	34	35	36	37	38	39
Freq.(kHz)	103.45	100.00	98.68	96.77	93.75	92.59	90.91	89.29	88.24	86.21
(ClkSrc, PreScaler)	(0, 29)	(0, 30)	(2, 19)	(0, 31)	(0, 32)	(1, 27)	(0, 33)	(1, 28)	(0, 34)	(1, 29)
Freq Index.	40	41	42	43	44	45	46			
Freq.(kHz)	85.71	83.33	81.08	78.13	73.53	72.12	71.43			
(ClkSrc, PreScaler)	(0, 35)	(0, 36)	(0, 37)	(1, 32)	(1, 34)	(2, 26)	(1, 35)			



## 17.6 Hardware Parameters (v19)

[Version Information]	Firmware version parameter		
MajorVersion	The major version number of hardware parameters. It's a read only parameter.		
MinorVersion	The minor version number of hardware parameters. It's a read only parameter.		
TunerMajorVersion	The major version number of eGalaxTuner_80HXXX_Dev. It's a read only parameter.		
TunerMinorVersion	The major version number of eGalaxTuner_80HXXX_Dev. It's a read only parameter.		
TunerBuildNO	The version of eGalaxBuilder4. It's a read only parameter.		
[Hardware Settings]	Special Function	Default	Range
SCAN_CTRL_WATER	Enable/Disable water line function.	0	0~1
SCAN_CTRL_VKEY	Enable/Disable IO-VKey function.	0	0~1
SCAN_CTRL_TX_2CH	Enable/Disable drive two TX channel function.	0	0~1
[Sensor Config]	Sensor and Pin settings	Default	Range
			
XDimension	X dimension of the active area of the LCD. [unit: 0.1mm]	3820	0~65534
Ydimension	Y dimension of the active area of the LCD. [unit: 0.1mm]	2150	0~65534
NumsOfRxChips	The number of sensing chips. 80Hxxx default: 1; 82Hxxx default: 2	1/2	1~2
NumsOfTxChips	The number of driving chips. 80Hxxx default: 1; 82Hxxx default: 2	1/2	1~2
NumsOfFreq	The total number of the working frequencies after tuning.	1	1~4
FreqStartIndex	The index of initial working frequency when controller is reset or power on. This value should be in the range 0 to [NumsOfFreq]-1	0	0~3
TXStart(X)	The active TX start channel of the Xth chip.	0	0~MaxTx
TXEnd(X)	The active TX end channel of the Xth chip..	63	0~ MaxTx
RXStart(X)	The active RX start channel of the Xth chip. (Rx channel must starts from 1)	1	0~ MaxRx
RXEnd(X)	The active RX start channel of the Xth chip. (Rx channel must starts from 1)	99	0~ MaxRx
StartSkipCnt	The skip count of initial stray.	3	1~254
HopFreqSkipCnt	The skip count of updating stray when frequency hopping.	3	1~254
ShortDelay	The delay time for short test. Note: Short test result may abnormal if the touch sensor's RC loading is too high, in this case increase the short test delay can improve the test result.	6	0~254
PweOnShortTestTh	Reserve.	30	0~254
PowerOnDelayTime	Power on delay time (ms). Touch controller will be initialized after this delay. Modify this value to avoid Touch-LCD power on sequence noise issue.	0	0~65534
[Phase Target Config]	Image scan calibration settings	Default	Range
PhaseTarget(X)	Calibration channels of Tx pin. <b>Note:</b> these parameters will be modified automatically after running <b>Autotune</b> or <b>Auto set IO Map</b> functions. Usually user should not modify these settings.	-	-
[IO-VKey Conf]	IO- Vkey Pin Setting	Default	Range
VKeyTxChipsSel	The Vkey tx chip index. Please refer to the circuit diagram.	0	0~1
VKeyRxChipsSel	The Vkey rx chip index. Please refer to the circuit diagram.	0	0~1
VKeyTxStart	The first active Vkey tx channel of the driving chip.	0	0~63
VKeyTxEnd	The last active Vkey tx channel of the driving chip.	0	0~63

VKeyRxStart	The first active Vkey rx channel of the sensing chip.	1	0~99
VKeyRxEnd	The last active Vkey rx channel of the sensing chip.	1	0~99
<b>[Freq-X General Config]</b>	<b>Frequency General settings</b>	<b>Default</b>	<b>Range</b>
WorkingFreq	The working frequency. (Read Only)	N/A	N/A
ClkSrc	Working frequency parameter. Please refer to the INI\frequency index table.	0	0~4
PreScaler	Working frequency parameter. Please refer to the INI\frequency index table.	18	12~37
<b>[Freq-X Noise Reg Parameters]</b>	<b>The Noiseline Setting of Frequency-X</b>	<b>Default</b>	<b>Range</b>
Noise_MeasureCnt	Signal measurement count for Noise line scan. More measure count will raise signal strength but decrease reporting rate. The typical value is [Img_MeasureCnt]*0.3.	30	0~63
Noise_AFEGain	Analog front end gain value. Please make this value same as [Img_AFEGain]	20	1~29
Noise_RS	The ability to resist noise interference. Please make this value same as [Img_RS]	7	1~14
Noise_Delay	The offset of measure time for noise detection. Please make this value same as [Img_Delay]	15	0~X
Noise_ADCGain	Analog-to-digital converter gain value. Please make this value same as [Img_ADCGain]	3	2~4
Noise_Scaling	For signal normalization. +1 means divided by 2, -1 means multiplied by 2.	4	0~15
<b>[Freq-X WLRx Reg Parameters]</b>	<b>The Waterline Rx Setting of Frequency-X</b>	<b>Default</b>	<b>Range</b>
WLRx_MeasureCnt	Signal measurement count for WLRx scan. More measure count will raise signal strength also decrease reporting rate.	30	0~63
WLRx_AFEGain	Analog front end gain value. Decrease this value to increase gain. Higher gain means higher signal strength but less noise margin.	1	1~29
WLRx_Delay	WLRx measure delay time. Adjust this parameter to balance the RC characteristic of touch sensor. It will affect the signal strength and ratio. Usually there is no need to modify this parameter except the touch sensor's R or C characteristic too high.	13	0~X
			
WLRx_Scaling	For signal normalization. +1 means divided by 2, -1 means multiplied by 2.	4	0~15
<b>[Freq-X WLTX Reg Parameters]</b>	<b>The Waterline Tx Setting of Frequency-X</b>	<b>Default</b>	<b>Range</b>
WLTX_MeasureCnt	Signal measurement count for WLTX scan. More measure count will raise signal strength also decrease reporting rate.	30	0~63
WLTX_AFEGain	Analog front end gain value. Decrease this value to increase gain. Higher gain means higher signal strength but less noise margin.	1	1~29

WLTx_Delay	WLTx measure delay time. Adjust this parameter to balance the RC characteristic of touch sensor. It will affect the signal strength and ratio. Usually there is no need to modify this parameter except the touch sensor's R or C characteristic too high. 	13	0~X
WLTx_Scaling	For signal normalization. +1 means divided by 2, -1 means multiplied by 2.	4	0~15
<b>[Freq-X Img Reg Parameters]</b>	<b>The Image Setting of Frequency-X</b>	<b>Default</b>	<b>Range</b>
Img_MeasureCnt	Signal measurement count for Rx scan. More measure count will raise signal strength also decrease reporting rate.	30	0~63
Img_AFEGain	Analog front end gain value. Decrease this value to increase gain. Higher gain means higher signal strength but less noise margin.	20	1~29
Img_RS	The ability of image scan to resist noise interference. Usually to decrease RS can increase Signal and Noise Ratio but it will decrease signal strength.	7	1~14
Img_Delay	Image data measure delay time. Adjust this parameter to balance the RC characteristic of touch sensor. It will affect the signal strength and ratio. Usually there is no need to modify this parameter except the touch sensor's R or C characteristic too high. 	15	0~X
Img_ADGAIN	Analog-to-digital converter gain value. Increase this value to increase ADC gain. Also it will increase the ADC AD% saturation risks.	3	2~4
Img_Scaling	For signal normalization. +1 means divided by 2, -1 means multiplied by 2.	4	0~15
<b>[Freq-X Img Reg Channel Config]</b>	<b>Image scan channel config of Frequency-X</b>	<b>Default</b>	<b>Range</b>
Img_Delay	Indicate the maximum value of below Img_Delay(X) (Read only)	15	0~Max
Img_Delay(X)	The Xth Tx channel's Img_Delay setting. The range is: 0~PreScaler*3-1.	15	0~Max
Img_RS	Indicate the maximum value of below Img_RS(X) (Read only)	7	1~14
Img_RS(X)	The Xth Tx channel's Img_RS setting.	7	1~14
Img_AFEGain	Indicate the maximum value of below Img_AFEGain(X) (Read only)	20	1~29
Img_AFEGain(X)	The Xth Tx channel's Img_AFEGain setting.	20	1~29
Img_MeasureCnt	Indicate the maximum value of below Img_MeasureCnt(X) (Read only)	30	0~63
Img_MeasureCnt(X)	The Xth Tx channel's Img_MeasureCnt setting.	30	0~63
Img_GainE(X)	Reserve.	0	0~63
<b>[Freq-X IO-VKey Reg Parameters]</b>	<b>IO-VKey settings of Frequency-X</b>	<b>Default</b>	<b>Range</b>

FREQCTRL_VKEY_LOW_GAIN_MODE	Enable IO-VKey low gain mode. (Default enable) <b>Note:</b> When there is only one IO-VKey, it can only work with low gain mode enabled.	1	0~1
IO-VKey_MeasureCnt	Signal measurement count for IO-VKey scan. More measure count will raise signal strength also decrease reporting rate.	30	0~63
IO-VKey_AFEGain	Analog front end gain value. Decrease this value to increase gain. Higher gain means higher signal strength but less noise margin.	20	1~29
IO-VKey_RS	The ability of image scan to resist noise interference. Usually to decrease RS can increase Signal and Noise Ratio but it will decrease signal strength.	7	1~14
IO-VKey_Delay	Image data measure delay time. Adjust this parameter to balance the RC characteristic of touch sensor. It will affect the signal strength and ratio. Usually there is no need to modify this parameter except the touch sensor's R or C characteristic too high.	15	0~Max
IO-VKey_ADCGain	Analog-to-digital converter gain value. Increase this value to increase ADC gain. Also it will increase the ADC AD% saturation risks. <b>Note:</b> When FREQCTRL_VKEY_LOW_GAIN_MODE is enabled. The VKey-ADCGain hardware is disabled so this parameter will not work.	3	2~4
IO-VKey_Scaling	For signal normalization. +1 means divided by 2, -1 means multiplied by 2.	4	0~15
<b>[Channel Ctrl]</b>	<b>Channels enable Setting</b>	<b>Default</b>	<b>Range</b>
ChannelCtrl	0: Disable channel ctrl. 1: Enable channel ctrl	0	0 or 1
TxEnable_S_E	Control flags to disable/ enable Tx channel. Each bit represents one channel ranged in S~E.	11111111	0 or 1
RxEnable_S_E	Control flags to disable/ enable Rx channel. Each bit represents one channel ranged in S~E.	11111111	0 or 1
<b>[Remap Area-X]</b>	<b>Remap Active Area Setting</b>	<b>Default</b>	<b>Range</b>
<p>Gray Area: When touch point exceed the remap active area but still in the gray area. The touch point will not be release. Gray area is a extend range based on remap area.</p>			
Attr	0: Disable. 1: Area Remap. Define a smaller working area in the touch panel, the touch resolution in the smaller area (ULx, ULy)~(LRx, LRy) will be remapping to (0, 0)~(Max-X, Max-Y). When there is a smaller display and use only partial area of touch sensor, a working area remapping is required. 2: Resolution Shrink Redefine the resolution of touch sensor working area. The resolution will be adjust from (0, 0)~(Max-X, Max-Y) to (ULx, ULy)~(LRx, LRy). When there is a smaller touch sensor and use only partial area of the display, a resolution remapping is required.	0	0~254
DelayCnt	Additional delay of this area. [unit: scan counts]	0	0~254
GroupMassTh	(Reserved)	0	0~65534
ULx	The x-coordinate of the Top-Left corner for remap area. [Unit: Resolution]	0	0~65534
ULy	The y-coordinate of the Top-Left corner for remap area. [Unit: Resolution]	0	0~65534
LRx	The x-coordinate of the Bottom-Right corner for remap area. [Unit: Resolution]	0	0~65534

LRy	The y-coordinate of the Bottom-Right corner for remap area. [Unit: Resolution]	0	0~65534
<b>[Gray Range-X]</b>	<b>Gray Area Setting</b>	<b>Default</b>	<b>Range</b>
Top	Extend top gray area from RemapAA. [Unit: Resolution]. The Gray Area upper bound will be the ULy – Top.	0	0~65534
Bottom	Extend bottom gray area from RemapAA. [Unit: Resolution]. The Gray Area lower bound will be the LRy + Bottom.	0	0~65534
Left	Extend left gray area from RemapAA. [Unit: Resolution]. The Gray Area left bound will be the ULx - Left.	0	0~65534
Right	Extend right gray area from RemapAA. [Unit: Resolution]. The Gray Area right bound will be the LRy + Right.	0	0~65534
<b>[AA-VKey Area]</b>	<b>Active Area VKey Setting</b> <b>Use the touch sensor active area for a virtual key, the virtual key can be defined to report EETI key event or HID key code.</b>	<b>Default</b>	<b>Range</b>
NumsOfVKey	Numbers of AA-Vkey.	0	0~48
<b>[AA-VKey Area-X]</b>	<b>Active Area VKey Setting</b>	<b>Default</b>	<b>Range</b>
Attr	0: Disable. 1: Report HID Keyboard for this AA-VKey Area. <b>(Need special version firmware kernel for HID keyboard feature).</b> 2: Report EETI Virtual Key Event for this AA-VKey Area. The application needs to use EETI HID API to handle the EETI VKey event.	0	0~254
DelayCnt	Additional delay of this AA-VKey area. [unit: scan counts]	0	0~254
KeyCode	HID KeyCode for this AA-VKey area. Please refer HID Keyboard KeyCode Table.		
GroupMassTh	0: Disable additional GroupMassTh. Other: Additional GroupMassTh for this AA-VKey Area.	0	0~254
ULx	The x-coordinate of the Top-Left corner for AA-VKey area. [Unit: Resolution]	0	0~65534
ULy	The y-coordinate of the Top-Left corner for AA-VKey area. [Unit: Resolution]	0	0~65534
LRx	The x-coordinate of the Bottom-Right corner for AA-VKey area. [Unit: Resolution]	0	0~65534
LRy	The y-coordinate of the Bottom-Right corner for AA-VKey area. [Unit: Resolution]	0	0~65534

## 17.7 HID Keyboard KeyCode Table

**Note: The HID Keyboard function need special firmware kernel.**

0x00	Reserved (no event indicated)	0x3A	Keyboard F1	0x74	Keyboard Execute
0x01	Keyboard ErrorRollOver	0x3B	Keyboard F2	0x75	Keyboard Help
0x02	Keyboard POSTFail	0x3C	Keyboard F3	0x76	Keyboard Menu
0x03	Keyboard ErrorUndefined	0x3D	Keyboard F4	0x77	Keyboard Select
0x04	Keyboard a and A	0x3E	Keyboard F5	0x78	Keyboard Stop
0x05	Keyboard b and B	0x3F	Keyboard F6	0x79	Keyboard Again
0x06	Keyboard c and C	0x40	Keyboard F7	0x7A	Keyboard Undo
0x07	Keyboard d and D	0x41	Keyboard F8	0x7B	Keyboard Cut
0x08	Keyboard e and E	0x42	Keyboard F9	0x7C	Keyboard Copy
0x09	Keyboard f and F	0x43	Keyboard F10	0x7D	Keyboard Paste
0x0A	Keyboard g and G	0x44	Keyboard F11	0x7E	Keyboard Find
0x0B	Keyboard h and H	0x45	Keyboard F12	0x7F	Keyboard Mute

0x0C	Keyboard i and I	0x46	Keyboard PrintScreen	0x80	Keyboard Volume Up
0x0D	Keyboard j and J	0x47	Keyboard Scroll Lock	0x81	Keyboard Volume Down
0x0E	Keyboard k and K	0x48	Keyboard Pause	0x82	Keyboard Locking Caps Lock
0x0F	Keyboard l and L	0x49	Keyboard Insert	0x83	Keyboard Locking Num Lock
0x10	Keyboard m and M	0x4A	Keyboard Home	0x84	Keyboard Locking Scroll Lock
0x11	Keyboard n and N	0x4B	Keyboard PageUp	0x85	Keypad Comma
0x12	Keyboard o and O	0x4C	Keyboard Delete Forward	0x86	Keypad Equal Sign
0x13	Keyboard p and P	0x4D	Keyboard End	0x87	Keyboard International1
0x14	Keyboard q and Q	0x4E	Keyboard PageDown	0x88	Keyboard International2
0x15	Keyboard r and R	0x4F	Keyboard RightArrow	0x89	Keyboard International3
0x16	Keyboard s and S	0x50	Keyboard LeftArrow	0x8A	Keyboard International4
0x17	Keyboard t and T	0x51	Keyboard DownArrow	0x8B	Keyboard International5
0x18	Keyboard u and U	0x52	Keyboard UpArrow	0x8C	Keyboard International6
0x19	Keyboard v and V	0x53	Keypad Num Lock and Clear	0x8D	Keyboard International7
0x1A	Keyboard w and W	0x54	Keypad /	0x8E	Keyboard International8
0x1B	Keyboard x and X	0x55	Keypad *	0x8F	Keyboard International9
0x1C	Keyboard y and Y	0x56	Keypad -	0x90	Keyboard LANG1
0x1D	Keyboard z and Z	0x57	Keypad +	0x91	Keyboard LANG2
0x1E	Keyboard 1 and !	0x58	Keypad ENTER	0x92	Keyboard LANG3
0x1F	Keyboard 2 and @	0x59	Keypad 1 and End	0x93	Keyboard LANG4
0x20	Keyboard 3 and #	0x5A	Keypad 2 and Down Arrow	0x94	Keyboard LANG5
0x21	Keyboard 4 and \$	0x5B	Keypad 3 and PageDn	0x95	Keyboard LANG6
0x22	Keyboard 5 and %	0x5C	Keypad 4 and Left Arrow	0x96	Keyboard LANG7
0x23	Keyboard 6 and ^	0x5D	Keypad 5	0x97	Keyboard LANG8
0x24	Keyboard 7 and &	0x5E	Keypad 6 and Right Arrow	0x98	Keyboard LANG9
0x25	Keyboard 8 and *	0x5F	Keypad 7 and Home	0x99	Keyboard Alternate Erase
0x26	Keyboard 9 and (	0x60	Keypad 8 and Up Arrow	0x9A	Keyboard SysReq/Attention
0x27	Keyboard 0 and )	0x61	Keypad 9 and PageUp	0x9B	Keyboard Cancel
0x28	Keyboard Return (ENTER)	0x62	Keypad 0 and Insert	0x9C	Keyboard Clear
0x29	Keyboard ESCAPE	0x63	Keypad . and Delete	0x9D	Keyboard Prior
0x2A	Keyboard DELETE (Backspace)	0x64	Keyboard Non-US \ and	0x9E	Keyboard Return
0x2B	Keyboard Tab	0x65	Keyboard Application	0x9F	Keyboard Separator
0x2C	Keyboard Spacebar	0x66	Keyboard Power	0xA0	Keyboard Out
0x2D	Keyboard - and (underscore)	0x67	Keypad =	0xA1	Keyboard Oper
0x2E	Keyboard = and +	0x68	Keyboard F13	0xA2	Keyboard Clear/Again
0x2F	Keyboard [ and {	0x69	Keyboard F14	0xA3	Keyboard CrSel/Props
0x30	Keyboard ] and }	0x6A	Keyboard F15	0xA4	Keyboard ExSel
0x31	Keyboard \ and	0x6B	Keyboard F16	0xE0	Keyboard LeftControl
0x32	Keyboard Non-US # and ~	0x6C	Keyboard F17	0xE1	Keyboard LeftShift

0x33	Keyboard ; and :
0x34	Keyboard ' and "
0x35	Keyboard Grave Accent and Tilde
0x36	Keyboard, and <
0x37	Keyboard . and >
0x38	Keyboard / and ?
0x39	Keyboard Caps Lock

0x6D	Keyboard F18
0x6E	Keyboard F19
0x6F	Keyboard F20
0x70	Keyboard F21
0x71	Keyboard F22
0x72	Keyboard F23
0x73	Keyboard F24

0xE2	Keyboard LeftAlt
0xE3	Keyboard Left GUI
0xE4	Keyboard RightControl
0xE5	Keyboard RightShift
0xE6	Keyboard RightAlt
0xE7	Keyboard Right GUI

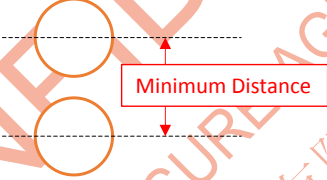
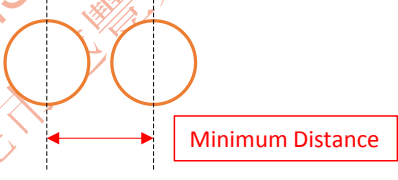
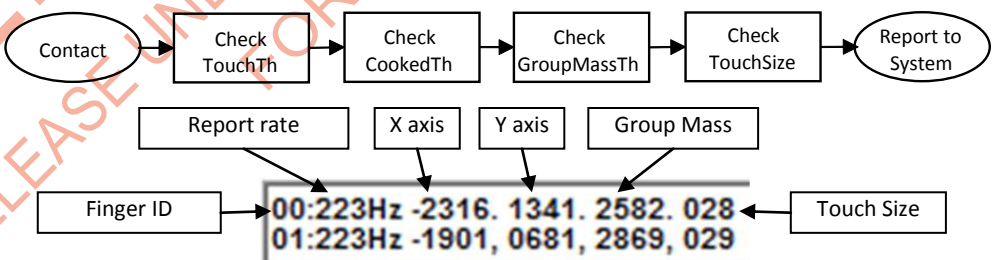
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## 17.8 Software Parameters (v40)

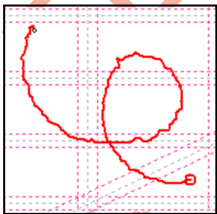
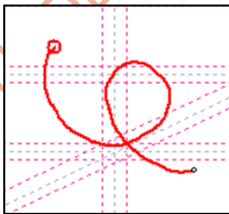
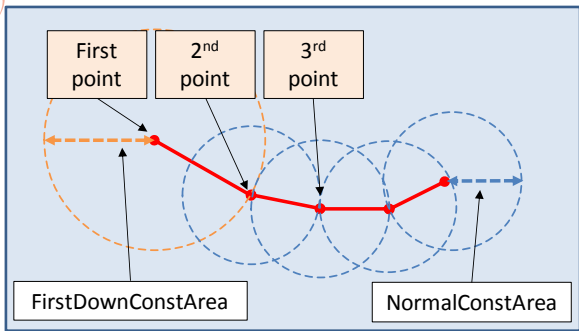
[Model Configuration]	Model name and version settings	Default	
ModelNum	The Model Number of the sensor. It' a 4 character string. Please apply a new model name ( "0000" to "9999" )to your project, <b>do not use default "4XXX"</b>	4XXX	
ModelInfo	Extra information for model. It's a 7 character string.	"80HXXX"	
FWVersion	The version of the firmware. It's a 15 character string.	99	
[Version Information]			
MajorVersion	The major version number of software parameter. It's a read only parameter.		
MinorVersion	The minor version number of software parameter. It's a read only parameter.		
TunerMajorVersion	The major version number of eGalaxTuner_80HXXX _Dev. It's a read only parameter.		
TunerMinorVersion	The major version number of eGalaxTuner_80HXXX _Dev. It's a read only parameter.		
TunerBulidNO	The version of eGalaxBuilder4. It's a read only parameter.		
[Alg General Config ]	Settings of general purpose	Default	Range
TouchMode	Touch click mode. 0: Normal. 1: Click on Touch. 2: Click on Release. 3: Click on Touch, other contacts will report move state. 4: Click on Release, other contacts will report move state.	0	0~4
VKeyTouchMode	(Reserved)	0	0~4
NumsOfThresholds	The total number of threshold settings.	1	1~3
StartThreshold	The initial threshold index after power on. Range: 0~ NumsOfThresholds-1	0	0~2
SwapXY	Swap X axis and Y axis.	1	0 or 1
SwapX	Inverse X axis mapping.	1	0 or 1
SwapY	Inverse Y axis mapping.	1	0 or 1
Ctrl(0)_AUTO_FREQUENCY	Enable frequency hopping in noise interference condition.	0	0 or 1
Ctrl(0)_DRAW_IN_COMPENSATION	Enable draw in compensation. Related parameter: DrawInOutRange; DrawInOutSpeed; DrawInOutInnerRange;	1	0 or 1
Ctrl(0)_LIFT_OFF_COMPENSATION	Enable lift off compensation. Related parameter: DrawInOutRange; DrawInOutSpeed; DrawInOutInnerRange;	1	0 or 1
Ctrl(0)_DIAGNOSTIC_FREQ	Enable diagnostic frequency. The default working frequency for sensor test (eGalaxSensorTest) is the start frequency (usually Freq=0). If enabling the diagnostic frequency, firmware will use the last one of frequency table for sensor testing, and the frequency hopping process will skip the diagnostic frequency (last frequency).  Note: When the working frequency and fine-tune result makes the raw data not proper to show the defect channels, it may need to arrange a standalone frequency settings for sensor test. Typically the higher working frequency requires higher sensor RC quality. Therefore we suggest using the highest working frequency in the table for sensor testing, it can provide the most accurate test result and match the actual touch performance in every working frequency.  E.g. There are three working frequencies: Freq=0(80kHz), Freq=1(187kHz) and Freq=2 (133kHz). Please modify the HWT\NumsOfFreq=4, Enable the DIAGNOSTIC_FREQ function and add additional Freq=3(187kHz). The hardware settings of Freq=3(187kHz) can be focus on the raw data uniformity and no need to care about touch signal uniformity.	0	0 or 1

Ctrl(0)_MARGIN_IMPROVE	Enable edge compensation.	1	0 or 1
Ctrl(1)_ENHANCE_LINEARITY	Enable enhance linearity function.	0	0 or 1
Ctrl(1)_TP_EN_GPIO	Enable TPEn GPIO function.	1	0 or 1
Ctrl(2)_IMAGE_DYNAMIC_COOKTOUCH_TH	Enable Dynamic CookTouchTh in normal condition. The new CookTh will be maximum of [CookTouchBase] and $CMax * [DyCookThRatio] / 8$ . Related parameter: DyCookThRatio; DyCookThRatio_Palm;	0	0 or 1
Ctrl(2)_NOISE_DYNAMIC_COOKTOUCH_TH	Enable Dynamic CookTouchTh in noise condition. The new CookTh will be maximum of [CookTouchBase] and $CMax * [DyCookThRatio\_Noise] / 8$ . Related parameter: DyCookThRatio_Noise	0	0 or 1
Ctrl(2)_FAST_TRACKING	Enable fast tracking if system performance is poor. Note: when using UART or I2C interface, the communication speed may not fast enough to process the touch data, the data will accumulation in the touch controller and causes touch reporting delay. This function may help to improve the delay but may decrease the drawing quality.	0	0 or 1
Ctrl(2)_LOW_CONFIDENCE_DISABLE_TOUCH	Remove all touch point when stray confidence low.	0	0 or 1
Ctrl(2)_PALM_DISABLE_TOUCH	Remove all touch point when palm condition.	0	0 or 1
Ctrl(2)_IMG_CHECK_NOISE	Enable image check noise condition and frequency hopping. Related parameter: DyImgCheckNoiseThRatio. Note: When enabling image check noise function, The noise line data becomes pre-check information for image quality analysis. If the noise line value larger than the NoiseConditionTh, the controller will start to analyze the image raw data quality to see if there is noise interfering. Depends on the image quality result, the firmware may enable the noise condition or frequency hopping. The image quality threshold is predefined in controller and can be adjust by the DyImgCheckNoiseThRatio. This function can help if the noise line has some problem in frequency hopping. Also, this function may be too sensitive in frequency hopping for a smaller size touch sensor.	0	0 or 1
Ctrl(3)_LOW_CONFI_ENABLE_WATER	Enable enter water condition if stray confidence is low.	0	0 or 1
Ctrl(3)_MULTITOUCH_DISABLE_PALM	Enable to stop entering the palm condition when multi-touch. Related parameter: NumOfTouchDisablePalm.	0	0 or 1
Ctrl(3)_ENHANCE_DOUBLE_CLICK	Enhance double click performance. Note: It can improve the pass rate of double click gesture especially the sensor ITO pitch is too wide, or the poor SNR causes the large jitter in touch position. Related parameter: [Double Click Setting]	0	0 or 1
Ctrl(3)_NO_REPORT_SAME_POINT	Enable don't report same position points. The "same position" is related to the constant area parameters: FirstDownConstArea; NormaConstArea; SlowMoveConst; Note: It can reduce the communication throughputs to reduce the host loading.	0	0 or 1
<b>[Alg General Water Setting ]</b>	<b>Settings of general purpose</b>	<b>Default</b>	<b>Range</b>
WaterKeepTime	Duration of water condition. [unit: ms] Note: When water quantity > [WaterTh], it will enable water condition.	3000	0~65534
FingerKeepTime	Duration of touch condition. [unit: ms] Note: When the $CMax > [CookTouchBase] * 1.3$ , it will enable IsFinger condition.	300	0~65534
WaterDisableTouchKeepTime	Duration of disabling touch in water condition. [unit: ms]	3000	0~65534

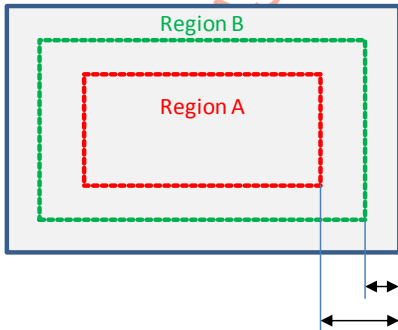
	Note: When water quantity > [WaterDisableTouchTh], it will enable water condition.		
WLDisableThTx	Disable touch when max cooked data of WLTx > [V]	5000	0~65534
WLDisableThRx	Disable touch when max cooked data of WLRx > [V]	5000	0~65534
<b>[Alg Threshold-X Setting]</b>			
<b>[---Ctrl Flag-X]</b>	<b>Special function</b>	<b>Default</b>	<b>Range</b>
Ctrl(0)_PALM_REJECTION	Enable/Disable palm rejection function. Related parameter: [---Palm-X]; [Palm Setting]; Note: When detect palm contact, it will enable palm condition.	0	0 or 1
Ctrl(0)_WATER_PROOF	Enable/Disable water resistance function. Related parameter: [---Water Line Rx Setting-X]; [---Water Line Tx Setting-X]; Note: When SCAN_CTRL_WATER is enabled, it will enable advanced water resistance function by reference the water line signal.	0	0 or 1
Ctrl(0)_ENHANCE_FINGER_SEPARATION	Enable/Disable enhanced finger separation (Horizontal drawing). Related parameter: FingerSeperationLevel Note: It can improve the horizontal separation but may increase the risk in ghost touch and reduce the palm rejection performance. 	0	0 or 1
Ctrl(0)_ENHANCE_VER_SEPARATION	Enable/Disable enhance finger separation (Vertical drawing). Note: It can improve the vertical separation but may increase the risk in ghost touch and reduce the palm rejection performance. 	0	0 or 1
<b>[---Sensitivity-X]</b>	<b>Threshold settings</b>	<b>Default</b>	<b>Range</b>
			
AvgTouchSignal	The touch signal value where distribute equally on the 4 nodes under proper contact definition. If the touch signal is larger enough, it will be considered as a contact. (Image Data\ Image Mode: Touch Signal)	150	15~150
CookTouchBase	Threshold for a valid contact in cooked data. If contact strength in cook data is larger than CookTouchBase, it will be considered as a valid group. Suggestion: Based on the cook data of a touch, typically use 50% as the threshold. (Image Data\ Image Mode: Cooked Data)	120	0~65534
GroupMassBase	Threshold for a valid touch. If group strength (Mass of a group) is larger than GroupMassTh, it will be considered as a valid touch and report to the system. Suggestion: Based on the z value of a touch, typically use 50% as the	1000	0~65534

	threshold.		
SensitivityLevel	The general sensitivity setting to adjust touch thresholds. +1 makes 10% more sensitive. -1 makes 10% more insensitive. Note: When the [SensitivityLevel] is not zero, the controller will adjust the threshold parameters inside the algorithm. The modified value will be shown in the comment of threshold parameters.	0	-5~+5
TouchSizeMin	If touch size <= this value, it will be rejected.	0	0~254
TouchSizeMax	If touch size >= this value, it will be rejected.	250	0~254
Uniformity	Threshold for baseline adjustment. Suggestion: Based on the Unifor Cook value of a touch, typically use 50% as the threshold. This parameter will affect baseline recover function, baseline stability and frequency hopping. Note: If the uniformity cook value larger than the threshold, the StrayConfidence will show Low.	35	0~65534
[---Water-X]	<b>Water resistance settings</b> <b>Note: This section needs Ctrl_WATER_PROOF enabled.</b>	<b>Default</b>	<b>Range</b>
WaterTh	Water threshold to enter water condition.	200	0~65534
WaterTouchDisableTh	Water threshold to disable touch.	500	0~65534
WaterCookTouchTh	Threshold for a valid contact in cooked data under water condition.	100	0~65534
WaterTouchSizeMin	If touch size <= this value in water condition, it will be rejected.	0	0~254
WaterTouchSizeMax	If touch size >= this value in water condition, it will be rejected.	250	0~254
WaterMaxReportPoint	Max contact number in water condition.	2	0~10
GestureDetectTime	Duration of detecting touch gesture. [unit: ms]	350	0~65534
WaterNegativeTh	If signal in Cooked Data page < -[V], it will be calculate into water quantity. Note: Usually the water will causes negative values in Cooked Data.	50	0~65534
WaterDisableRangeTop	The touch function disabled range (from top edge) when in water condition. [unit: mm]	0	0~254
WaterDisableRangeBottom	The touch function disabled range (from bottom edge) when in water condition. [unit: mm]	0	0~254
WaterDisableRangeLeft	The touch function disabled range (from left edge) when in water condition. [unit: mm]	0	0~254
WaterDisableRangeRight	The touch function disabled range (from right edge) when in water condition. [unit: mm]	0	0~254
[---Palm-X]	<b>Palm rejection settings</b> <b>Note: This section needs Ctrl_PALM_REJECTION enabled.</b>	<b>Default</b>	<b>Range</b>
PalmEnableTouchSize	The touch size threshold to enable palm rejection mode. When touch size > [PalmEnableTouchSize], it will enable palm condition.	40	0~254
PalmRejectTouchMass	If group mass > [V] under palm condition, it will be rejected.	3000	0~65534
[---Point Alg Setting-X]	<b>Reporting settings</b>	<b>Default</b>	<b>Range</b>
ExtraDownCount	Extra Response delay in normal mode. [unit: report count] Note: The final down count will be: DownCount+ExtraDownCount.	0	0~254
ExtraMergeDistance	Extra minimum distance between two report points. If distance < [V] the points will be merged into one point. [unit: mm] Note: The final merge distance will be: MergeDistance+ExtraMergeDistance.	0	0~254
ExtraConstArea	Extra constant area for each threshold table which affect first point and normal movement. (unit: 0.1mm) Note: The final constant area will be: FirstDownConst+ExtraConstArea and NormalConst+ExtraConstArea	0	0~254
[---Water Line Rx Setting-X]	<b>Water line settings</b>	<b>Default</b>	<b>Range</b>

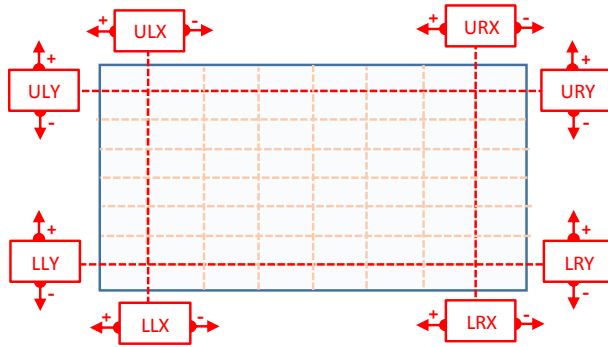
	<b>Note: This section needs SCAN_CTRL_WATER enabled.</b>		
WLRxTouchTh	The touch signal value on Rx water line where distribute equally on the 4 nodes under proper contact definition.	20	0~254
WLRxCookTouchTh	Threshold for a valid contact in cooked data on Rx water line channel.	50	0~254
<b>[---Water Line Tx Setting-X]</b>	<b>Water line settings</b> <b>Note: This section needs SCAN_CTRL_WATER enabled.</b>	<b>Default</b>	<b>Range</b>
WLTxTouchTh	The touch signal value on Tx water line where distribute equally on the 4 nodes under proper contact definition.	20	0~254
WLTxCookTouchTh	Threshold for a valid contact in cooked data on Tx water line channel.	50	0~254
<b>[Freq Hopping Setting]</b>	<b>Frequency hopping settings</b>	<b>Default</b>	<b>Range</b>
NoiseConditionTh(X)	Threshold to enable noise condition for frequency index X.	250	0~65534
NoiseTh(X)	Threshold to enable frequency hopping for frequency index X.	250	0~65534
NoiseKeepTime	Duration of noise condition. [unit: ms]	3000	0~65534
DyCookThRatio	Dynamic ratio for dynamic Cook Threshold. (New threshold = CMax*[V]/8) Related parameter: Ctrl_IMAGE_DYNAMIC_COOKTOUCH_TH;	6	1~8
DyCookThRatio_Palm	Dynamic ratio for dynamic Cook Threshold in palm condition. (New threshold = CMax*[V]/8) Related parameter: Ctrl_IMAGE_DYNAMIC_COOKTOUCH_TH;	4	1~8
DyCookThRatio_Noise	Dynamic ratio for dynamic Cook Threshold in noise condition. (New threshold = CMax*[V]/8) Related parameter: Ctrl_NOISE_DYNAMIC_COOKTOUCH_TH;	7	1~8
HopFreqCondTime	Define the abnormal frequency hopping condition. When the first frequency hopping happened and the following hopping counts exceeds [HopFreqCntTh] during [HopFreqCondTime], it will trigger the NOTIFY_CTRL_FREQ_HOPPING_ERROR. Related parameter: [Operate Config_X]	0	0~65534
HopFreqCntTh	Related parameter: [Operate Config_X]	3	0~254
NoiseMaxReportPoint	Max contact number in noise condition.	10	0~40
<b>[Image Check Noise Hopping Setting]</b>	<b>Image Check noise hopping scheme settings</b> <b>Note: This section needs Ctrl_IMG_CHECK_NOISE enabled.</b>	<b>Default</b>	<b>Range</b>
Ctrl(0)_CHK_NOISE_STRONG_NOISE_HOPPING	When the noise line value > NoiseTh*2, do frequency hopping.	0	0 or 1
DyImgCheckNoiseThRatio	Adjust image check noise sensitivity. Lower ratio means higher sensitivity.	6	0~8
<b>[Point Alg Setting]</b>	<b>General reporting settings</b>	<b>Default</b>	<b>Range</b>
MergeDistance	Minimum distance between two report points. If distance < [V] the points will be merged into one point. [unit: mm]	10	0~254
MaxReportPoint	The maximum numbers of support touches.	10	0~40
ReportRateScanTime	This value can <b>make report rate slow down</b> , each count can provide approximately 0.5ms delay to the report rate. The original report rate is the upper bond. E.g. If the original report rate is 200hz, than the value from 0~10 cannot make the report rate become faster. If the value is set to 20, the report rate will slow down to around 100hz. [unit: ms]	0	0~100
DownCount	Response delay in normal mode. Note: The skip count before register a valid contact and report to the	0	0~254

	system. Increase this value will make user to touch much longer to trigger a touch event, and it will increase the touch down response time.		
DownCntInNoise	Response delay in noise condition. The down count value will add to DownCount.	2	0~254
DownCntInWater	Response delay in water condition. The down count value will add to DownCount.	2	0~254
DownCountForEdge	Response delay in edge. The down count value will add to DownCount.	1	0~254
FingerSeperationLevel	The finger separation level in normal condition. Increase it to enhance the finger separation performance but may have risk to report ghost touch. Related parameter: Ctrl(0)_ENHANCE_FINGER_SEPARATION	0	-5~5
Tx2CH_FingerSeperationLevel	The finger separation level when SCAN_CTRL_TX2CH set to 1. Related parameter: Ctrl(0)_ENHANCE_FINGER_SEPARATION; HWT\SCAN_CTRL_TX2CH	-2	-5~5
<b>[Palm Setting]</b>	<b>Palm settings</b> <b>This section needs Ctrl_PALM_REJECTION enabled.</b>	<b>Default</b>	<b>Range</b>
PalmKeepTime	The duration of palm condition.	1500	0~65534
PalmRange_RX	Rx extend range to block contacts from a palm contact group. [unit: Rx channels]	4	0~254
PalmRange_TX	Tx extend range to block contacts from a palm contact group. [unit: Tx channels]	4	0~254
NumsOfTouchDisablePalm	When MULTITOUCH_DISABLE_PALM enabled and the report point exceed [V], cannot enter into palm condition.	10	1~40
<b>[IO-VKey Setting]</b>	<b>IO-VKey settings</b> <b>This section needs SCAN_CTRL_VKEY enabled.</b>	<b>Default</b>	<b>Range</b>
VKeyTouchTh	The threshold on IO-Vkey Signal. (Image data\Cooked Data of VKey)	600	0~65534
VKeyDownCount	Response delay for IO-VKey.	2	0~254
VKeyUpCount	The delay of report up event for IO-VKey.	2	0~254
<b>[Filter Setting]</b>	<b>Filter settings</b>	<b>Default</b>	<b>Range</b>
<div style="display: flex; align-items: center;"> <div style="margin-right: 20px;"> <p>Filter 1 (Light)</p>  </div> <div style="margin-right: 20px;"> <p>Filter 28 (Heavy)</p>  </div> <div>  </div> </div>			
MaxFilter	The maximum linearity filtering level when drawing in slow speed.	28	0~31
MinFilter	The minimum linearity filtering level when drawing in fast speed.	22	0~31
FirstDownConstArea	Const area for a first contact point. (unit: 0.1mm)	10	0~65534
NormalConstArea	Const area for a already moved contact point. (unit: 0.1mm)	0	0~65534
SlowMoveTh	Speed threshold to define a slow moving state.	30	0~65534
SlowMoveConst	Extra const area for a slow moving contact point. (unit: 0.1mm)	2	0~65534
<b>[Double Click Setting]</b>	<b>Double Click settings</b> <b>This section needs Ctrl_ENHANCE_DOUBLE_CLICK enabled.</b>	<b>Default</b>	<b>Range</b>
ClickRange	When two clicks fall within this range [V], which satisfies the double click condition. [Unit: mm]	600	0~65534
UpDuration	The duration between 2 clicks < [V], which satisfies the double click	500	0~65534



	condition. [Unit: ms]		
DownDuration	The duration of first click < [V], which satisfies the double click condition. [Unit: ms]	500	0~65534
<b>[Noise Filter]</b>	<b>Noise Filter Setting</b>	<b>Default</b>	<b>Range</b>
NoiseFilterAttr	0: Disable 1: Apply noise filter to all channels. 2: Apply noise filter on channels except the Tx channels where WLtx touch signal larger than threshold. 3: Apply noise filter on channels except the Tx channels where the touch signal larger than [TouchTh]. 4: Apply the noise filter in the edge area from Rx0 and RxN. The range of Rx channels is defined by [NoiseFilterChannelCnt]. Note: The noise filter can suppression the background noise, improve signal SNR and decrease the reporting rate.	0	0~4
NoiseFilterChannelCnt	Noise filtering channels from RX0 and RxN. (For NoiseFilterAttr = 4)	0	0~254
<b>[Compensation Setting]</b>	<b>Edge accuracy settings</b> <b>The Margin function needs Ctrl_MARGIN_IMPROVE enabled.</b> <b>The DrawInOut function needs Ctrl_DRAW_IN_COMPENSATION and Ctrl_DRAW_OUT_COMPENSATION enabled.</b>	<b>Default</b>	<b>Range</b>
MarginPosTx0	Edge compensation level on Tx0 side. Increase [V] to make reporting location close to boundary.	4	-128~127
MarginPosTxN	Edge compensation level on TxN side. Increase [V] to make reporting location close to boundary.	4	-128~127
MarginPosRx0	Edge compensation level on Rx0 side. Increase [V] to make reporting location close to boundary.	4	-128~127
MarginPosRxN	Edge compensation level on RxN side. Increase [V] to make reporting location close to boundary.	4	-128~127
WLMarginPosTx0	Edge compensation level on water line Tx0 side. Increase [V] to make reporting location close to boundary.	0	-128~127
WLMarginPosTxN	Edge compensation level on water line TxN side. Increase [V] to make reporting location close to boundary.	0	-128~127
WLMarginPosRx0	Edge compensation level on water line Rx0 side. Increase [V] to make reporting location close to boundary.	0	-128~127
WLMarginPosRxN	Edge compensation level on water line RxN side. Increase [V] to make reporting location close to boundary.	0	-128~127
<div style="display: flex; align-items: flex-start;"> <div style="flex: 1;">  <div style="margin-left: 10px;"> <p>The DrawInOut parameters can improve the draw in and draw out gesture performance. To make the report position more close to the border.</p> <p>Draw in:</p> <ol style="list-style-type: none"> <li>1. The first report point needs to hit the Region B.</li> <li>2. Draw to Region A with a proper speed.</li> </ol> <p>Draw out:</p> <ol style="list-style-type: none"> <li>1. The first report point needs to hit the Region A.</li> <li>2. Draw to Region B with a proper speed.</li> </ol> </div> </div> </div>			
DrawInOutInnerRange	Define the inner range. [Unit:0.1mm]	500	0~65534
DrawInOutRange	Define the outer rang. [Unit:0.1mm]	100	0~65534
DrawInOutSpeed	The draw-in-out speed should > [V]. [Unit:mm/sec]	30	0~254
<b>[Calibration Setting]</b>	<b>Accuracy settings</b>	<b>Default</b>	<b>Range</b>

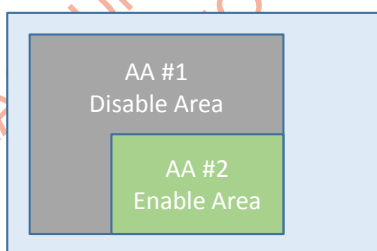




Usually the calibration parameters is created by the 4 points calibration tool (eGalaxCalibration ).

It's also possible to modify it manually to fine tune the alignment precisely.

LLX	Calibration reference position- lower left X. Increase: Shift the report x coordinate to left side of LLX. Decrease: Shift the report x coordinate to right side of LLX.	512	0~65534
LLY	Calibration reference position- lower left Y. Increase: Shift the report y coordinate to up side of LLY. Decrease: Shift the report x coordinate to down side of LLY.	3584	0~65534
ULX	Calibration reference position- upper left X. Increase: Shift the report x coordinate to left side of ULX. Decrease: Shift the report x coordinate to right side of ULX.	512	0~65534
ULY	Calibration reference position- upper left Y. Increase: Shift the report y coordinate to up side of ULY. Decrease: Shift the report x coordinate to down side of ULY.	512	0~65534
URX	Calibration reference position- upper right X. Increase: Shift the report x coordinate to left side of URX. Decrease: Shift the report x coordinate to right side of URX.	3584	0~65534
URY	Calibration reference position- upper right Y. Increase: Shift the report y coordinate to up side of URY. Decrease: Shift the report x coordinate to down side of URY.	512	0~65534
LRX	Calibration reference position- lower right X. Increase: Shift the report x coordinate to left side of LRX. Decrease: Shift the report x coordinate to right side of LRX.	3584	0~65534
LRY	Calibration reference position- lower right Y.	3584	0~65534
<b>[Active Area Setting - X]</b>		<b>Specified active area settings</b>	<b>Default Range</b>



The active area settings can define a area that cannot report touch (Disable Area), or remain the touch function (Enable area).

Enable Area priority is higher than Disable Area

AA_ATTR_VALID	Enable/Disable the special functions in this specified area.	0	0~1
AA_ATTR_DELAY_TOUCH	Add extra down count in this specified area, DelayCnt*8 counts.	0	0~1
AA_ATTR_DISABLE_TOUCH	Disable touch in this specified area.	0	0~1
AA_ATTR_ENABLE_TOUCH	Enable touch in this specified area. (Highest priority)	0	0~1
DelayCnt	Extra down count of this specified area.[unit: 8 scan counts] Note: For every delay counts will make the touch data delay to report by 8 scans.	0	0~254
ULx	The x-coordinate of the Top-Left corner for this specified area.	0	0~65534
ULy	The y-coordinate of the Top-Left corner for this specified area.	0	0~65534
LRx	The x-coordinate of the Bottom-Right corner for this specified area.	0	0~65534

LRy	The y-coordinate of the Bottom-Right corner for this specified area.	0	0~65534
<b>[USB SW Setting]</b>	<b>USB settings</b>	<b>Default</b>	<b>Range</b>
RightClickEn	For HID Mouse mode.	1	0~1
RightClickCnt	Right click delay: 30ms*[V].	66	0~254
ReportIDSel	Report ID selection. 0: Auto. (Depends on OS) 1: HID mouse. 6: HID Touch.	0	0,1 or 6
<b>[Interface Support]</b>	<b>Interface settings</b>	<b>Default</b>	<b>Range</b>
RS232Ctrl_HWFlowCtrl	Enable hardware flow control for UART.	1	0~1
<b>[NotifyCtrl]</b>	<b>Firmware status Notification control</b> <b>Note: The application needs to use EETI HID API to handle the EETI notify message.</b>	<b>Default</b>	<b>Range</b>
NOTIFY_CTRL_NOISE_CONDITION	Enable/Disable notify message for noise condition.	0	0~1
NOTIFY_CTRL_FREQ_HOPPING	Enable/Disable notify message for frequency hopping.	0	0~1
NOTIFY_CTRL_WATER_CONDITION	Enable/Disable notify message for water condition.	0	0~1
NOTIFY_CTRL_WATER_DISABLE_TOUCH	Enable/Disable notify message for water disable touch.	0	0~1
NOTIFY_CTRL_PALM_CONDITION	Enable/Disable notify message for palm condition.	0	0~1
NOTIFY_CTRL_PEN_BUTTON	Enable/Disable notify message for eGalaxPen button.	0	0~1
NOTIFY_CTRL_TOUCH_WHEN_TOUCH_DISABLED	Enable/Disable notify message for touch under touch disabled condition..	0	0~1
NOTIFY_CTRL_NOISE_CONDITION_ERROR	Enable/ Disable Abnormal noise condition message ° Related parameter: NoiseCondNotifyTime; Note: When noise condition too long, send a message to the host.	0	0~1
NOTIFY_CTRL_WATER_CONDITION_ERROR	Enable/ Disable Abnormal Water condition message ° Related parameter: WaterCondNotifyTime; Note: When water condition too long, send a message to the host.	0	0~1
NOTIFY_CTRL_FREQ_HOPPING_ERROR	Enable/ Disable Abnormal frequency hopping message ° Related parameter: HopFreqCondTime; HopFreqCntTh Note: When too many hopping in short time, send a message to the host.	0	0~1
NOTIFY_CTRL_STRAY_CONFIDENCE_LOW_ERROR	Enable/ Disable Abnormal baseline message ° Related parameter: StrayLowNotifyTime; Note: When Stray Confidence=Low too long, send a message to the host.	0	0~1
NOTIFY_CTRL_REPORT_POINT_ERROR	Reserve	0	0~1
<b>[NotifySetting]</b>	<b>Notify settings</b>	<b>Default</b>	<b>Range</b>
NoiseCondNotifyTime	When noise condition keep enabled longer than NoiseCondNotifyTime(ms), send a message to host.	3000	0~65534
WaterCondNotifyTime	When water condition keep enabled longer than WaterCondNotifyTime (ms), send a message to host.	3000	0~65534
StrayLowNotifyTime	When Stray Confidence Low keep longer than StrayLowNotifyTime (ms), send a message to host.	3000	0~65534
<b>[Operate Config_X]</b>	<b>When meets some touch operation, trigger a specified behavior.</b> <b>Please refer to <u>Chapter 14.7 Operate control</u></b>	<b>Default</b>	<b>Range</b>
OperationType	Define the operation to be monitored. Once detect the operation it will trigger the behavior defined in the [Behavior Param_X] 0: Disable operation monitoring. 1: Monitor the IsIdle=0 [OpCtrlParams0]: The duration of IsIdle=0 (ms) 2. Monitor the IsIdle=0 and drawing. Once user starts drawing, the duration will be increased. [OpCtrlParams1]: Extra duration for IsIdle=0 (ms) 3: Reserved. 4: Monitor the frequency hopping event.	0	0~254

	<p>5: Monitor the abnormal frequency hopping in short time. [OpCtrlParams0]: The timeframe to detect hopping. (ms) [OpCtrlParams1]: Hopping counts.</p> <p>6: Monitor the abnormal signal situation [OpCtrlParams0]: The signal situation type (Multi-select in bits) 0x0001: The signal of WLRx[0] WLR[N] larger than threshold at the same time. 0x0002: Isidle and WL(Rx, Tx) contradiction, or Isidle=0 but no valid touch points report to the host. 0x0004: Too many touch signal in Image data. 0x0008: Too much negative signal in cooked data. [OpCtrlParams1]: The duration of the situation (ms). [OpCtrlParams2]: Touch signal quantity threshold. [OpCtrlParams3]: Cooked data negative threshold.</p>		
BehaviorType	<p>The behavior to specific operation event:</p> <p>0: No behavior.</p> <p>1: Reset baseline.</p> <p>2: Software reset (Reset slave IC, baseline, algorithm state)</p> <p>3: Disable touch. [BehaviorParams0] is 0: Disable touch till the Isidle back to 1. [BehaviorParams0] is not 0: Disable touch duration. (sec)</p> <p>4: Reserved.</p> <p>5: Reserved.</p> <p>6: Move to next threshold mode.</p> <p>7: Change max report point. [BehaviorParams0]: New max report point. When event triggered again, it will restore to the original max report point.</p> <p>8: Disable water condition. [BehaviorParams0]: The duration of not trigger water condition. (sec)</p>	0	0~254
<b>[Operate Param_X]</b>		<b>Default</b>	<b>Range</b>
	Please refer to the [OperationType].		
<b>[Behavior Param_X]</b>		<b>Default</b>	<b>Range</b>
	Please refer to the document [BehaviorType].		

### 17.9 Firmware Kernel Release Note

Severity 1: Add function, no effect on performance.

Severity 2: Improvement under specific condition.

Severity 3: Evaluated by customers.

Severity 4: Must update for next version.

Severity 5: Must update immediate after released.

Version	#	Improvements	Severity	Consequence if not updated
03_78	1	First released. (Beta)	-	-
04_43	1	First 80HXXX ECN released.	-	
	1	Fix HID mouse right click not working	3	HID mouse right click not working.
	2	Fix suspend function bugs	5	Probability to have abnormal touch function after controller resumes.
	3	Fix hardware calibration bugs	5	If hardware calibration data crashed, touch function will not working.
	4	Support UEFI BIOS	1	Touch function not working under UEFI BIOS.
	5	Power consumption improvement	3	Power consumption rises slightly.
	6	Short test bug fix	5	Probability to false trigger short test error.
04_51	1	Fix water condition bug	3	When enable water line, firmware cannot trigger water condition.
	2	Fix baseline auto calibration bugs	3	When making large contact area on touch sensor, power on touch controller, and remove the contacts, the baseline cannot restore automatically.
	3	Palm rejection improvement.	2	
04_54	1	Fix stray confidence low bugs	5	When stray confidence becomes low, the reporting rate will become very slow.
	2	Fix water resistance bugs	3	
04_56	1	Fix frequency hopping bugs	5	When use 82H series, sometimes the stray cannot fix automatically.
	2	Improve Image check noise performance	2	Sometimes frequency hopping cannot work.
	3	Improve stray confidence low performance		When stray confidence is very poor, reporting rate will become very slow.
04_60	1	Fix stray confidence low bugs	5	When stray confidence become low, touch function will become abnormal. Sometimes line drawing will be broken easily.
	2	Fix water line baseline bugs.	3	Water line baseline sometimes not correct. It will affect water resistance function.
	3	Fix palm rejection bugs	3	Touch can be detected as palm when doing CS test.
	4	Fix 82H controller hardware signal bugs	5	After running software reset the hardware signal will become abnormal.
05_123	1	Fix water resistance bug.	2	Probability to have broken line when frequency hopping.
	2	Fix SCAN_CTRL_TX_2CH bug.	2	
	3	Fix Linux kernel (before 3.12) PnP failed issue.	3	Linux kernel before 3.12 will have PnP failed issue. (timeout initializing report)
	4	Fix I2C communication stability bug.	2	If SCL not stable, the I2C communication may lost and the issue can be recovered by controller power reset.
	5	Fix 4-point calibration not accuracy bug.	4	Not accuracy after running 4-point calibration tool.
	6	Fix selective suspend bug.	3	Touch controller may not response when in selective suspend state for a while.
	7	Touch performance improvement.	3	
	8	Frequency hopping performance improvement.	3	
	9	Auto calibration performance improvement.	3	
	10	Water resistance performance improvement.	3	
	11	Power consumption improvement.	3	
	12	Signal uniformity on EXC82H series improvement.	3	

Version	#	Improvements	Severity	Consequence if not updated
05_138	1	Fix selective suspend bug.	5	With USB interface, when system put controller into suspend state, there is possibility that touch input can't wake up controller and touch function will be lost until host communicates to the controller again.
	2	Fix software restart bug	2	When apply software restart on controller, the threshold table will be reset to Threshold-0.
	3	Fix eGalaxTouch driver compatibility issue	2	
	4	Fix sensitivity level parameter bug	2	When enable multi-threshold modes, the SensitivityLevel can only effects mode-0.
	5	Fix FPC / Sensor tester tool bug	3	Short test result may not stable.
07_117	1	ESD reliability improvement	4	There is low possibility that the ESD can cause Tx signal stop working, and it needs to reset touch controller to fix it.
	2	Touch performance improvement.	3	
	3	Draw in/ draw out performance improvement.	3	
	4	Fix eGalaxTouch driver compatibility issue.	3	When use two interface (U+R), and install driver on the UART interface, the USB interface may lost touch function.
	5	Fix short test stability issue.	2	The short test value may be unstable and may cause wrong judgment.
	6	Fix 4-points calibration bug.	4	The accuracy may become poor after ding 4-point calibration.
	7	Fix VKey data display issue.	2	The VKey data in image data page may not correct.
	8	Fix water condition report point issue.	3	When enable Water line and enter water condition, the report position may not correct if two fingers are too close.
	9	Fix water condition report point issue.	3	When enable Water line and enter water condition, there may have ghost points if user put fingers more than MaxReportPoints.

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