

**SAMSUNG**

# GSM TELEPHONE

## SGH-X160

# ***SERVICE*** *Manual*

### GSM TELEPHONE



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## **11. Reference data**

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# 1. Safety Precautions

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## 1-1. Repair Precaution

- Repair in Shield Box, during detailed tuning.  
Take specially care of tuning or test,  
because specipicty of cellular phone is sensitive for surrounding interference(RF noise).
- Be careful to use a kind of magnetic object or tool,  
because performance of parts is damaged by the influence of manetic force.
- Surely use a standard screwdriver when you disassemble this product,  
otherwise screw will be worn away.
- Use a thicken twisted wire when you measure level.  
A thicken twisted wire has low resistance, therefore error of measurement is few.
- Repair after separate Test Pack and Set because for short danger (for example an overcurrent and furious flames of parts etc) when you repair board in condition of connecting Test Pack and tuning on.
- Take specially care of soldering, because Land of PCB is small and weak in heat.
- Surely tune on/off while using AC power plug, because a repair of battery charger is dangerous when tuning ON/OFF PBA and Connector after disassembling charger.
- Don't use as you pleases after change other material than replacement registered on SEC System.  
Otherwise engineer in charge isn't charged with problem that you don't keep this rules.

## **1-2. ESD(Electrostatically Sensitive Devices) Precaution**

Several semiconductor may be damaged easily by static electricity. Such parts are called by ESD(Electrostatically Sensitive Devices), for example IC,BGA chip etc. Read Precaution below. You can prevent from ESD damage by static electricity.

- Remove static electricity remained your body before you touch semiconductor or parts with semiconductor. There are ways that you touch an earthed place or wear static electricity prevention string on wrist.
- Use earthed soldering steel when you connect or disconnect ESD.
- Use soldering removing tool to break static electricity. , otherwise ESD will be damaged by static electricity.
- Don't unpack until you set up ESD on product. Because most of ESD are packed by box and aluminum plate to have conductive power,they are prevented from static electricity.
- You must maintain electric contact between ESD and place due to be set up until ESD is connected completely to the proper place or a circuit board.

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## 2. Specification

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### 2-1. GSM General Specification

|                                    | GSM900<br>Phase 1        | EGSM 900<br>Phase 2      | DCS1800<br>Phase 1       |
|------------------------------------|--------------------------|--------------------------|--------------------------|
| Freq. Band[MHz]<br>Uplink/Downlink | 890~915<br>935~960       | 880~915<br>925~960       | 1710~1785<br>1805~1880   |
| ARFCN range                        | 1~124                    | 0~124 &<br>975~1023      | 512~885                  |
| Tx/Rx spacing                      | 45 MHz                   | 45 MHz                   | 95 MHz                   |
| Mod. Bit rate/<br>Bit Period       | 270.833 kbps<br>3.692 us | 270.833 kbps<br>3.692 us | 270.833 kbps<br>3.692 us |
| Time Slot<br>Period/Frame Period   | 576.9 us<br>4.615 ms     | 576.9 us<br>4.615 ms     | 576.9 us<br>4.615 ms     |
| Modulation                         | 0.3 GMSK                 | 0.3 GMSK                 | 0.3 GMSK                 |
| MS Power                           | 33 dBm~13 dBm            | 33 dBm~5 dBm             | 30 dBm~0 dBm             |
| Power Class                        | 5 pcl ~ 15 pcl           | 5 pcl ~ 19 pcl           | 0 pcl ~ 15 pcl           |
| Sensitivity                        | -102 dBm                 | -102 dBm                 | -100 dBm                 |
| TDMA Mux                           | 8                        | 8                        | 8                        |
| Cell Radius                        | 35 Km                    | 35 Km                    | 2 Km                     |

## 2-2. GSM Tx Power Class

| TX Power control level | GSM900   | TX Power control level | DCS1800  |
|------------------------|----------|------------------------|----------|
| 5                      | 33±2 dBm | 0                      | 30±3 dBm |
| 6                      | 31±2 dBm | 1                      | 28±3 dBm |
| 7                      | 29±2 dBm | 2                      | 26±3 dBm |
| 8                      | 27±2 dBm | 3                      | 24±3 dBm |
| 9                      | 25±2 dBm | 4                      | 22±3 dBm |
| 10                     | 23±2 dBm | 5                      | 20±3 dBm |
| 11                     | 21±2 dBm | 6                      | 18±3 dBm |
| 12                     | 19±2 dBm | 7                      | 16±3 dBm |
| 13                     | 17±2 dBm | 8                      | 14±3 dBm |
| 14                     | 15±2 dBm | 9                      | 12±4 dBm |
| 15                     | 13±2 dBm | 10                     | 10±4 dBm |
| 16                     | 11±3 dBm | 11                     | 8±4 dBm  |
| 17                     | 9±3 dBm  | 12                     | 6±4 dBm  |
| 18                     | 7±3 dBm  | 13                     | 4±4 dBm  |
| 19                     | 5±3 dBm  | 14                     | 2±5 dBm  |
|                        |          | 15                     | 0±5 dBm  |

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## 3. Product Function

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### Main Function

- Network services
- Sound settings
- Messages  
(SMS, MSM, Push messages)
- WAP browser
- Alarm, Calculator, Calendar, Time & Date, Voice mail

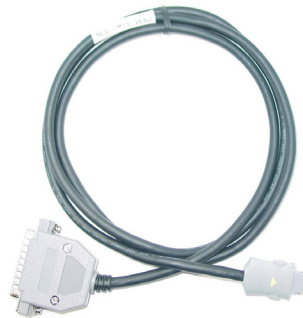
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## 4. Array course control

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**Test Jig (GH80-00865A)**



**Test Cable (GH39-00127A)**



**RF Test Cable (GH39-00397A)**

## **Software Downloading**

### **4-1. Downloading Binary Files**

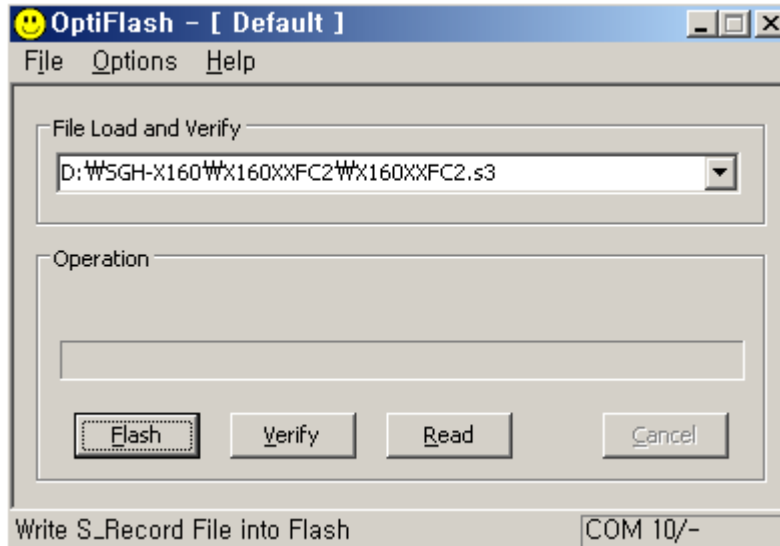
- Three binary files for downloading X160.
  - X160XXYY.s3 : Main source code binary.

### **4-2. Pre-requisite for Downloading**

- Downloader Program([OptiFlash.exe](#))
- X160 Mobile Phone
- Data Cable
- Binary files

### 4-3. S/W Downloader Program

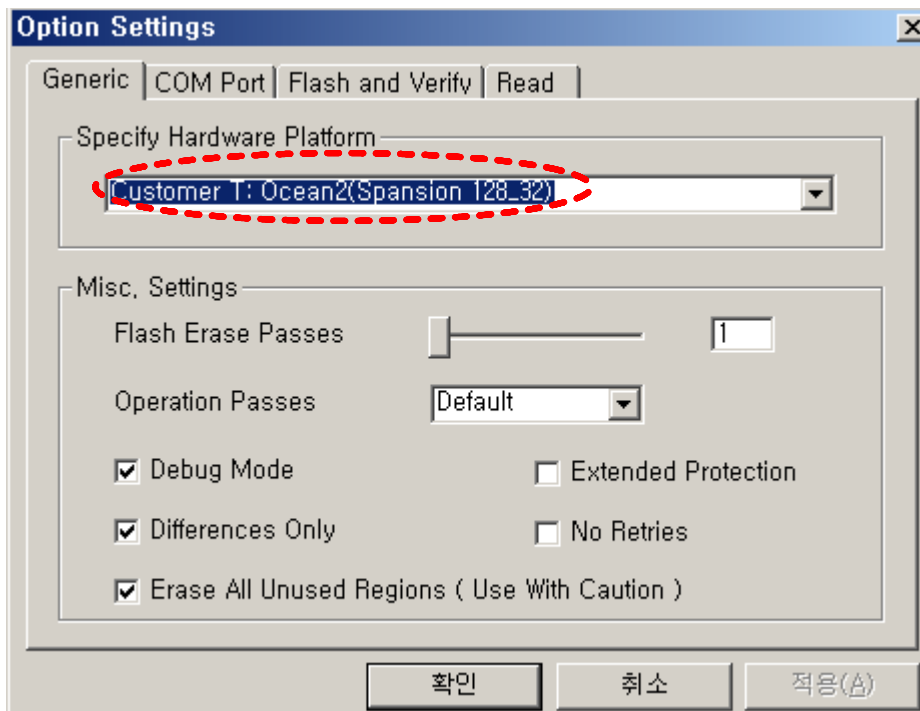
1. Load the binary download program by executing the "**OptiFlash.exe**"



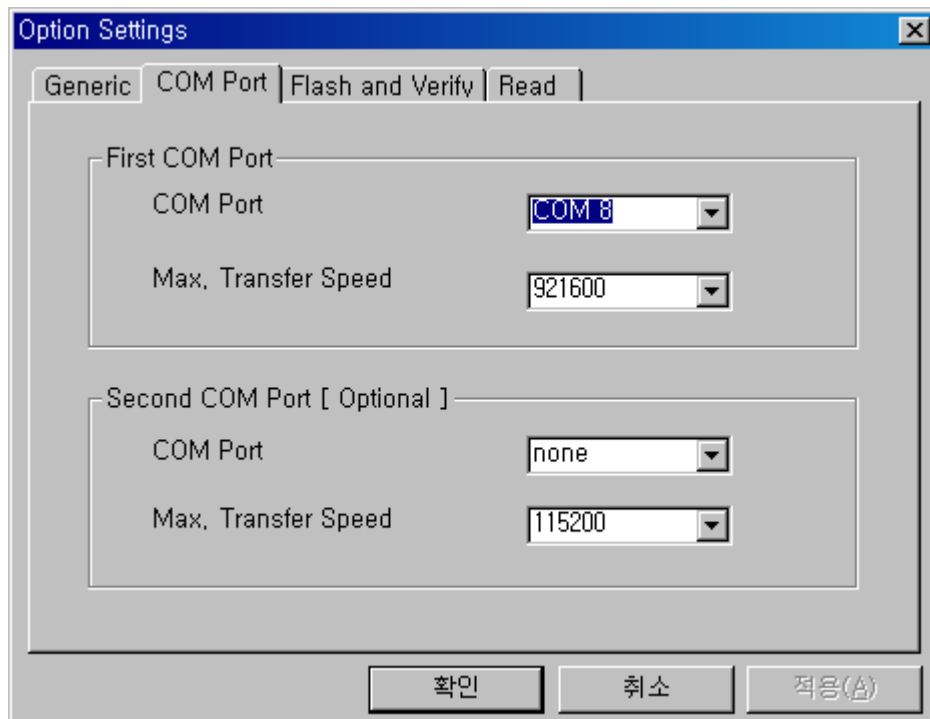
2. Select the "**Options**" -> "**Settings**" -> "**Generic**" -> "**Specify hardware platform**".

Choose hardware platform for the downloader file setting.

Set the everything else as the default values which are shown below



3. Select the **COM port** when the download cable is connected

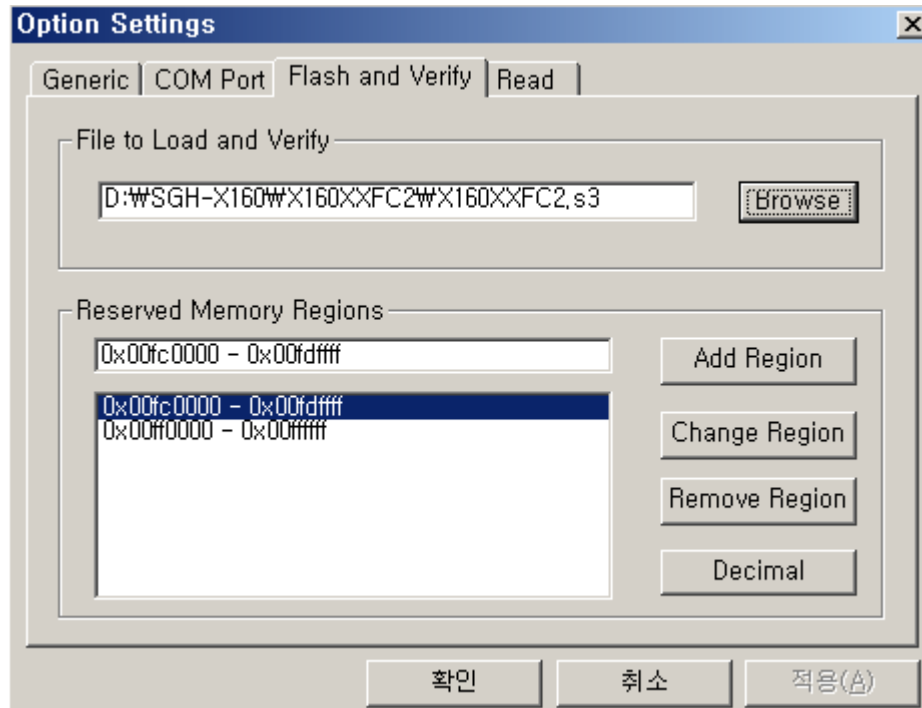


Up to twelve ports are supported. Additionally you can select the maximum transfer speed OptiFlash will use to communicate with the phone. However, OptiFlash will use a slower speed if either the PC's or the phone's serial hardware is incapable of handling the selected speed

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#### 4. Select the "**Flash&Verify**" -> "**Browse**"

Set the directory path and choose the latest s/w binary, for example "X160XXYY.s3", for the downloader binary setting.



**Make sure that not to change the reserved memory regions.♪**

**In case of X160 the reserved memory regions are :♪**

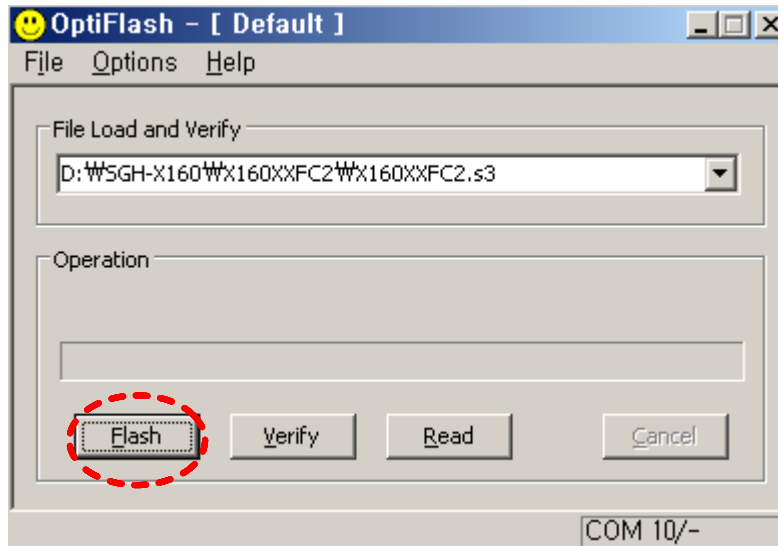
**-0x00fc0000 – 0x00fdffff**

**-0x00ff0000– 0x00ffffff**

5. Click "OK" button then press "Flash".♪

(Before pressing 'Flash' button, push the button '\*' and 'END' at the same time. Then press 'Flash'.))

Downloader will upload the binary file as below for the downloading. ♪



6. When downloading is finished successfully, there is a "All is well" message. ♪

7. After finishing downloading, Certain memory resets should be done to guarantee the normal performance.♪

8. Confirm the downloaded version name and etc. :♪

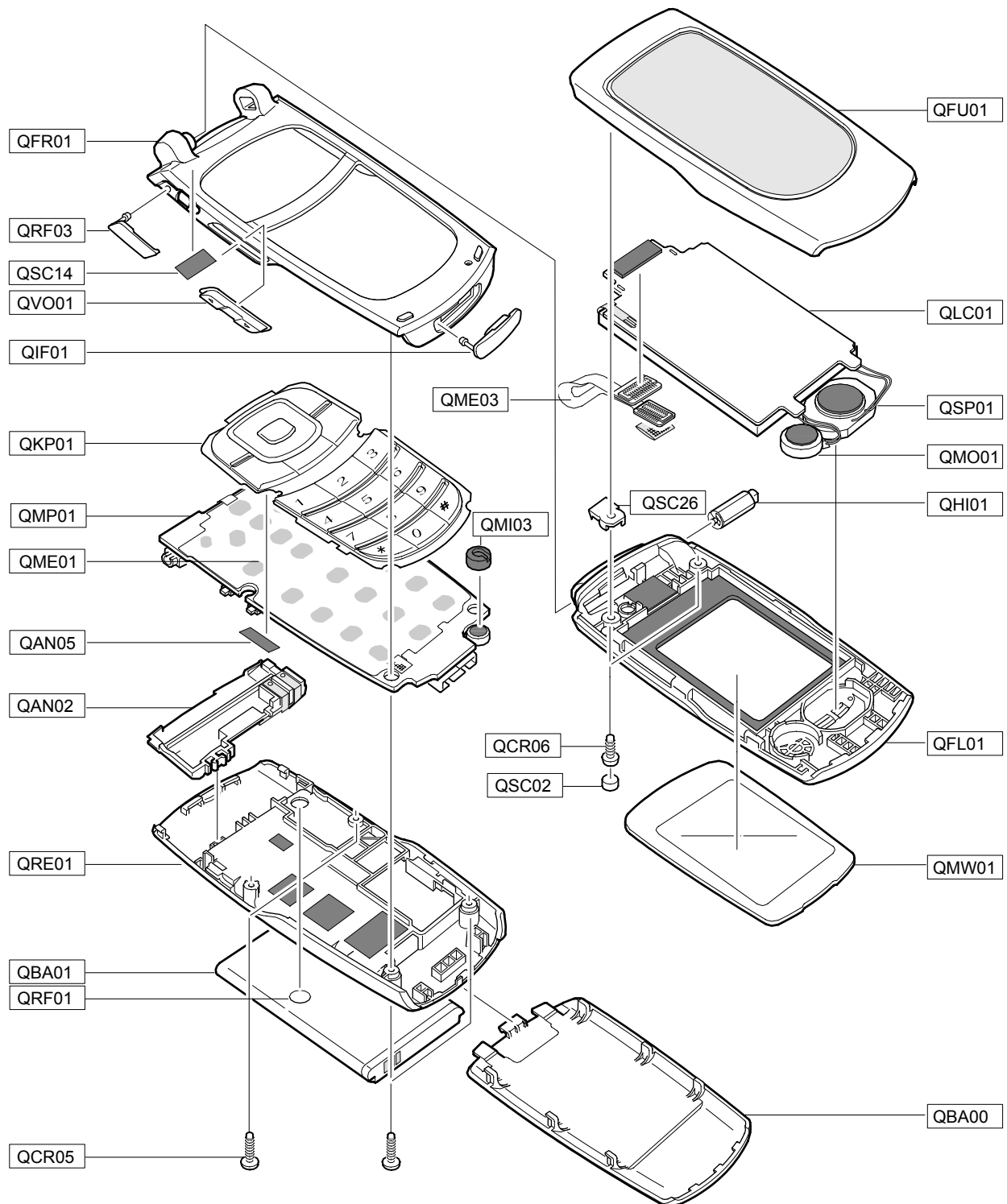
**\*#5002\*8376263#**♪

Full Reset : ♪

**\*2767\*3855#**

## 5. Exploded View and Parts List

### 5-1. Cellular phone Exploded View



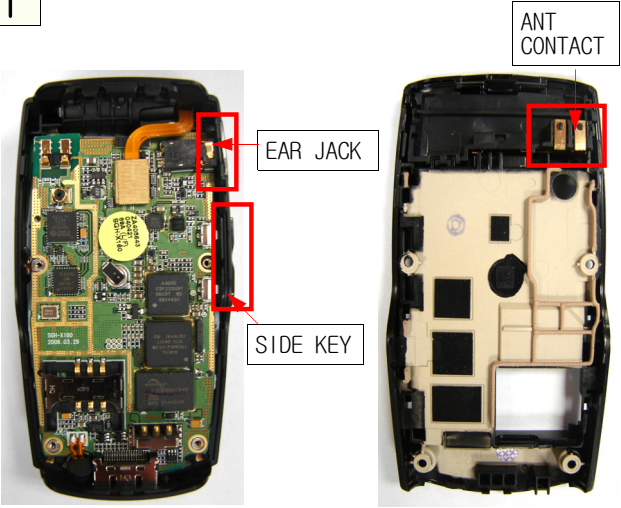
## 5-2. Cellular phone Parts list

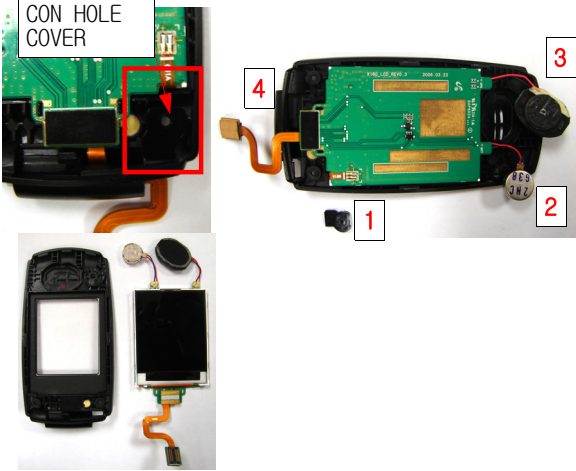
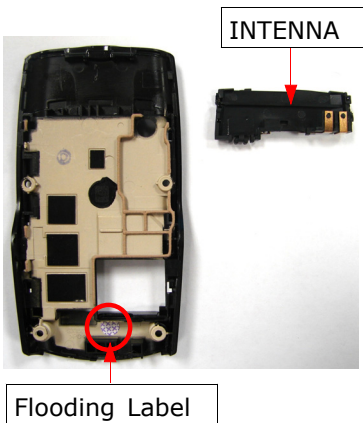
| Design LOC |       | Discription                    | SEC CODE    |
|------------|-------|--------------------------------|-------------|
| QAN02      |       | INTENNA-SGHX160                | GH42-00819A |
| QAN05      |       | MEC-INTENNA CONN RUBBER        | GH75-08200A |
| QBA00      |       | MEC-COVER BATT                 | GH75-09621B |
| QBA01      |       | INNER BATTERY PACK-800MAH,BLK, | GH43-01850A |
| QCR05      |       | SCREW-MACHINE                  | 6001-001478 |
| QCR06      |       | SCREW-MACHINE                  | 6001-001155 |
| QFU01      |       | ASSY-CASE-UPPER FOLDER         | GH98-00716A |
| QKP01      |       | ASSY-KEY-KEYPAD(SKA/SER)       | GH98-01132A |
| QLC01      |       | ELA UNIT-SGHX160 LCD MODULE SV | GH96-02196A |
| QME01      |       | UNIT-METAL DOME                | GH59-03135A |
| QME03      |       | UNIT-CON TO CON                | GH59-03136A |
| QMI01      |       | MICROPHONE-ASSY-6.25MM         | GH30-00177F |
| QMI03      |       | RMO-MIC HOLDER                 | GH73-05342A |
| QMO01      |       | MOTOR DC-SGHZ130               | GH31-00154A |
| QMP01      |       | PBA MAIN-SGHX160               | GH92-02684A |
| QMW01      |       | PMO-COVER LCD                  | GH72-30220A |
| QRE01      |       | ASSY-CASE-REAR                 | GH98-00719A |
| QRF01      |       | MPR-RF SHEET                   | GH74-17894B |
| QSC02      |       | RMO-FOLDER SCREW COVER         | GH73-05511A |
| QSC14      |       | MPR-TAPE FRONT HOLE            | GH74-23661A |
| QSC26      |       | PMO-COVER FPCB HOLE            | GH72-30082A |
| QSP01      |       | SPEAKER                        | 3001-001954 |
| QVO01      |       | MEC-VOL KEY                    | GH75-09622B |
| QFL01      |       | ASSY-CASE-LOWER FOLDER         | GH98-00717A |
|            | QHI01 | MEC-HINGE (CAN TYPE)           | GH75-09075A |
| QFR01      |       | ASSY-CASE-FRONT                | GH98-00718A |
|            | QIF01 | PMO-COVER IF                   | GH72-30078A |
|            | QRF03 | PMO-COVER EAR                  | GH72-30077B |

| Discription                | SEC CODE    |
|----------------------------|-------------|
| BAG PE                     | 6902-000297 |
| ADAPTOR-SGHN288 TAD        | GH44-00184A |
| LABEL(P)-WATER SOAK        | GH68-02026A |
| MANUAL-WARRANTY CARD       | GH68-02623A |
| MANUAL-SFC                 | GH68-04336A |
| LABEL(P)-BARCODE RUSSIA    | GH68-08494A |
| MANUAL USERS-EU RUSSIAN    | GH68-09790A |
| LABEL(R)-MAIN(SER)         | GH68-10842B |
| CUSHION-CASE (EU)          | GH69-03548A |
| BOX(P)-UNIT MAIN(SER)      | GH69-03926B |
| IPR-MAGNETIC               | GH70-01448A |
| RMO-BGA RUBBER T           | GH73-05471A |
| RMO-BGA RUBBER M           | GH73-05472A |
| RMO-BGA RUBBER B           | GH73-05473A |
| RMO-YAMAHA RUUBBER         | GH73-05641A |
| RMO-CUSHION B2B CON        | GH73-06773A |
| MPR-MAIN LCD BOHO VINYL(S) | GH74-05008A |
| MPR-BOHO VINYL LCD CONN    | GH74-15350A |
| MPR-MAIN CON GASKET        | GH74-17892A |
| MPR-BOHO VINYL UPPER       | GH74-18028A |
| MPR-FPCB PORON             | GH74-18593A |
| MPR-VINYL BOHO REAR        | GH74-19864A |
| MPR-TAPE SLIDE CON LCD     | GH74-20646A |
| MPR-TAPE DOME SHEET        | GH74-22759A |
| MPR-TAPE J TAG MASKING     | GH74-22760A |
| MPR-TAPE DOME SHEET TOP    | GH74-23945A |
| MPR-TAPE LCD               | GH74-24168A |

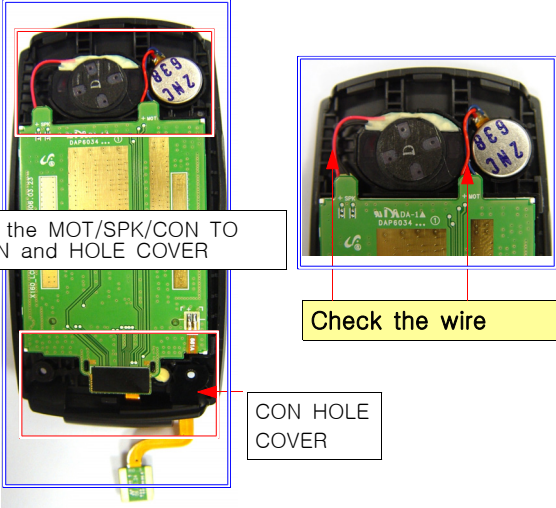
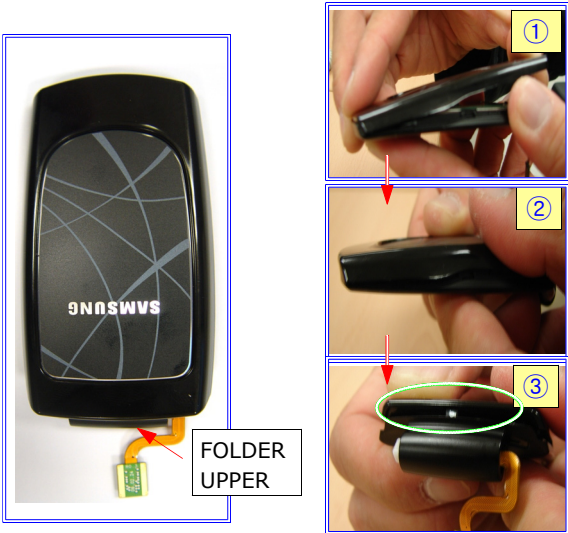
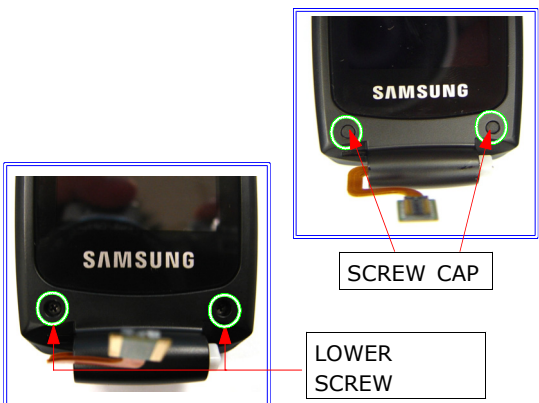
## 6. Disassembly and Assembly instructions

### 6-1. Disassembly

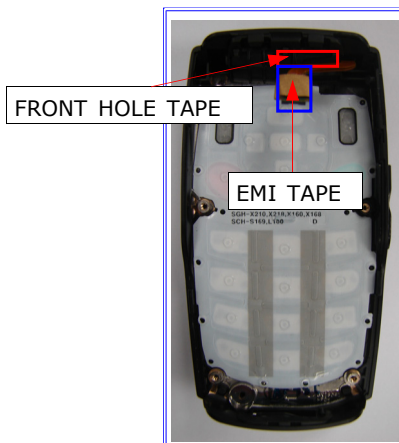
|                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>1</p>                                                                                                                                                                                                                                                                                                                       | <p>2</p>                                                                                                                                                                                                                                                                                         |
| <ol style="list-style-type: none"> <li>1. loosen the four screws at the rear cover</li> <li>2. Open the rear cover from the bottom-side hook</li> </ol> <p>※ <b>caution</b></p> <ol style="list-style-type: none"> <li>1. Handle the HOOK with care, and check No bending the board and front cover</li> <li>2. MIC RUBBER is the proper place</li> <li>3. Do not touch antenna contact with fingers</li> </ol> | <ol style="list-style-type: none"> <li>1. Disconnect LCD CONN from the Main Board</li> <li>2. Take off the main board from the case after taking out the IF cover</li> <li>3. Take off the Key pad</li> </ol> <p>※ <b>caution</b></p> <ol style="list-style-type: none"> <li>1. Handle with care LCD CONN itself and dust</li> </ol>                                               |
| <p>3</p>  <p>after disassembly</p>                                                                                                                                                                                                                                                                                           | <p>4</p>                                                                                                                                                                                                                                                                                       |
| <ol style="list-style-type: none"> <li>1. Take out the FRONT HOLE TAPE</li> <li>2. Take off the Hinge with widening the left side gap with front cover.</li> <li>3. Carefully take out the LCD FPCB through FRONT HOLE</li> </ol> <p>※ <b>caution</b></p> <ol style="list-style-type: none"> <li>1. LCD FPCB is easy to break</li> </ol>                                                                        | <ol style="list-style-type: none"> <li>1. Pull up the SCREW CAP with pinset.</li> <li>2. Loosen the screws from cover(2 POINT)</li> <li>3. Open the FOLDER UPPER</li> </ol> <p>※ <b>caution</b></p> <ol style="list-style-type: none"> <li>1. Do not Scratch with the JIG to open</li> <li>2. Handle the HOOK with care, and check No bending the board and front cover</li> </ol> |

|                                                                                                                                                                                                                    |                                                                                                                                                                                                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>5</p>  <p>CON HOLE COVER</p> <p>1</p> <p>2</p> <p>3</p> <p>4</p>                                                               | <p>6</p>  <p>ANTENNA</p> <p>Flooding Label</p>                                                               |
| <p>1. Take out the CON HOLE COVER</p> <p>2. Take out MOTOR/FPCB/SPEAKER/LCD</p> <p><b>* caution</b></p> <p>1.Handle with care LCD CONN itself and dust.</p> <p>2.Handle with care MOTOR / SPEAKER WIRE and LCD</p> | <p>1. Take out ANTENNA with using a PINSET</p> <p><b>* caution</b></p> <p>1.Take care of ANTENNA damage.</p> <p>2.Flooding Label check</p> <p>3.Do not touch antenna contact with fingers.</p> |

## 6-2. Assembly

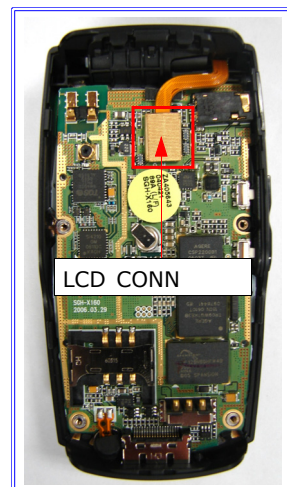
|                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>1</p>  <p>Put the MOT/SPK/CON TO CON and HOLE COVER</p> <p>Check the wire</p> <p>CON HOLE COVER</p>                                                                                                   | <p>2</p>  <p>FOLDER UPPER</p>                                                                                                                                                                                                                                                                                          |
| <p>1. insert CON TO CON to LOWER CON HOLE<br/>2. PUT the LCD / MOT / SPK / CON HOLE COVER in order</p> <p><b>* caution</b></p> <p>1. Handle wires and CON TO CON with care<br/>2. Check every thing is proper place and conformed<br/>3. Do not touch front side of LCD (fingerprint)</p> | <p>1. Assemble FOLDER UPPER, Follow the picture 1-2-3</p> <p><b>* caution</b></p>                                                                                                                                                                                                                                                                                                                        |
| <p>3</p>  <p>SCREW CAP</p> <p>LOWER SCREW</p>                                                                                                                                                          | <p>4</p>                                                                                                                                                                                                                                                                                                             |
| <p>1. Tighten LOWER SCREW (2 POINT)<br/>2. Insert the SCREW CAPS</p> <p><b>* caution</b></p>                                                                                                                                                                                              | <p>1. Put the LCD CON TO CON through the hole and insert to HINGE HOUSING<br/>2. After finishing left side, bend front cover to make space and push the hinge in.<br/>3. Repeat open and close to place the hinge and connector</p> <p><b>* caution</b></p> <p>1. Handle the CON TO CON with care.<br/>2. Do not make scratch at the hinge insertion<br/>3. Check the FOLDER tension is good enough.</p> |

5



1. Set the FRONT HOLE TAPE at the line
  2. Set the F-PCB GASKET TAPE
  2. Put the KEY PAD
- ※ **caution**
1. No scratch
  2. The tapes are proper place.
  3. key pad does not get loose

6



1. PUT the PBA after Air Blow
  2. Connect LCD CONN
- ※ **caution**
1. Take care the components on the board
  2. Check the LCD CON is conformed
  3. No dust should be inside.

7



1. Assemble the REAR ASS'Y from the upper Hook
  2. Tighten REAR SCREW (4 POINT)
- HOLE
- ※ **caution**
1. No Scratch.
  2. Check there is no gap

8



## 7. MAIN Electrical Parts List

| SEC Code    | Design LOC | Discription         | SEC CODE |
|-------------|------------|---------------------|----------|
| 0403-001547 | ZD300      | DIODE-ZENER         | SA       |
| 0406-001083 | ZD302      | DIODE-TVS           | SA       |
| 0406-001083 | ZD303      | DIODE-TVS           | SA       |
| 0406-001083 | ZD304      | DIODE-TVS           | SA       |
| 0501-000225 | Q300       | TR-SMALL SIGNAL     | SA       |
| 0504-000168 | Q103       | TR-DIGITAL          | SA       |
| 0601-002070 | LED300     | LED                 | SA       |
| 0601-002070 | LED301     | LED                 | SA       |
| 0601-002070 | LED302     | LED                 | SA       |
| 0601-002070 | LED303     | LED                 | SA       |
| 0601-002070 | LED304     | LED                 | SA       |
| 0601-002070 | LED305     | LED                 | SA       |
| 0601-002070 | LED306     | LED                 | SA       |
| 0601-002070 | LED307     | LED                 | SA       |
| 0601-002070 | LED308     | LED                 | SA       |
| 0601-002070 | LED309     | LED                 | SA       |
| 0601-002070 | LED310     | LED                 | SA       |
| 0601-002070 | LED311     | LED                 | SA       |
| 0601-002070 | LED315     | LED                 | SA       |
| 0601-002070 | LED316     | LED                 | SA       |
| 0801-002529 | U109       | IC-CMOS LOGIC       | SA       |
| 1001-001306 | U300       | IC-ANALOG MULTIPLEX | SA       |
| 1009-001020 | U203       | IC-HALL EFFECT S/W  | SA       |
| 1108-000070 | UME201     | IC-MCP              | SA       |
| 1201-002063 | U301       | IC-AUDIO AMP        | SA       |
| 1201-002278 | PAM100     | IC-POWER AMP        | SA       |
| 1203-003304 | UCD107     | IC-POWER SUPERVISOR | SA       |
| 1203-003328 | U204       | IC-DC/DC CONVERTER  | SA       |
| 1203-003663 | U105       | IC-BATTERY          | SA       |
| 1204-001811 | UCD106     | IC-MELODY           | SA       |
| 1205-002683 | UCD101     | IC-TRANSCIEVER      | SA       |
| 1209-001219 | U202       | IC-SENSOR           | SA       |
| 1405-001082 | VR300      | VARISTOR            | SA       |
| 1405-001082 | VR301      | VARISTOR            | SA       |
| 1405-001082 | VR302      | VARISTOR            | SA       |
| 1405-001082 | VR303      | VARISTOR            | SA       |
| 1405-001082 | VR304      | VARISTOR            | SA       |
| 1405-001082 | VR309      | VARISTOR            | SA       |
| 1405-001082 | VR310      | VARISTOR            | SA       |
| 1405-001082 | VR311      | VARISTOR            | SA       |
| 1405-001082 | VR312      | VARISTOR            | SA       |
| 1405-001082 | VR313      | VARISTOR            | SA       |
| 1405-001082 | VR314      | VARISTOR            | SA       |
| 1405-001082 | VR315      | VARISTOR            | SA       |

| SEC Code    | Design LOC | Discription | SEC CODE |
|-------------|------------|-------------|----------|
| 1405-001082 | VR316      | VARISTOR    | SA       |
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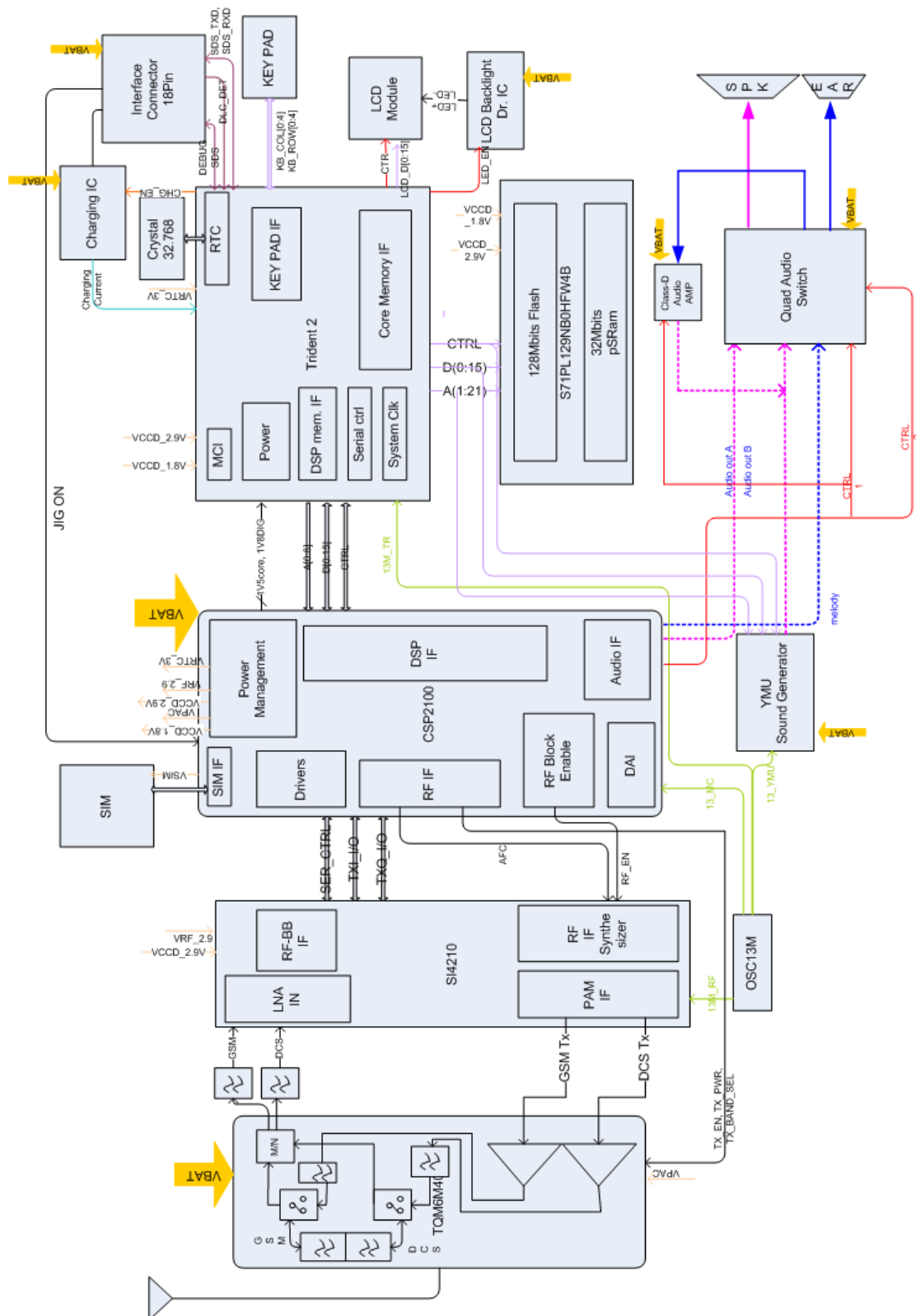
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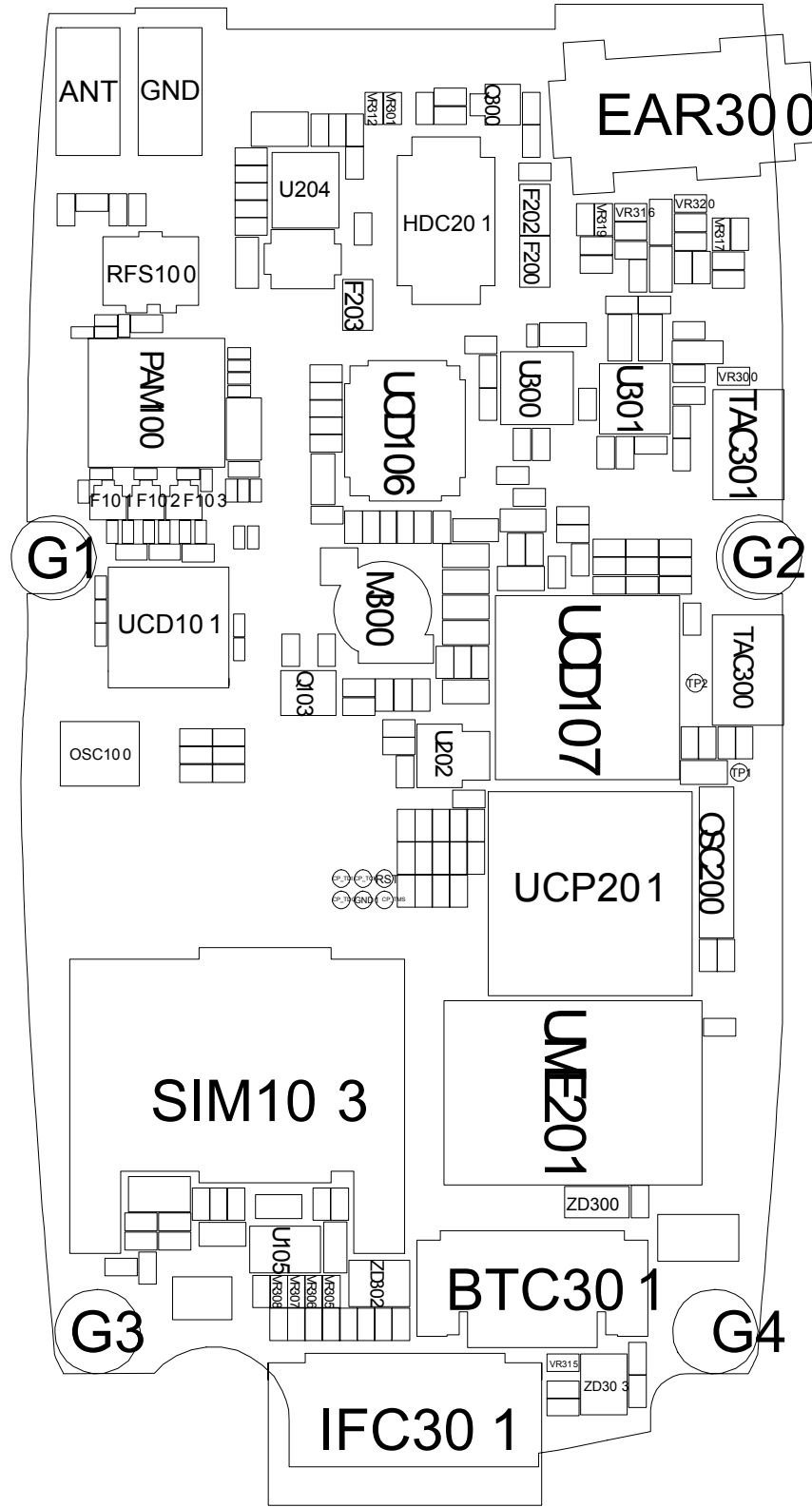
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| 2404-001374 | C111       | C-TA,CHIP    | SA       |
| 2404-001381 | C186       | C-TA,CHIP    | SA       |
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| 2703-002313 | L303       | INDUCTOR-SMD | SA       |
| 2703-002313 | L304       | INDUCTOR-SMD | SA       |
| 2703-002485 | L104       | INDUCTOR-SMD | SA       |
| 2703-002558 | L110       | INDUCTOR-SMD | SA       |
| 2703-002603 | L105       | INDUCTOR-SMD | SA       |
| 2703-002767 | L201       | INDUCTOR-SMD | SA       |
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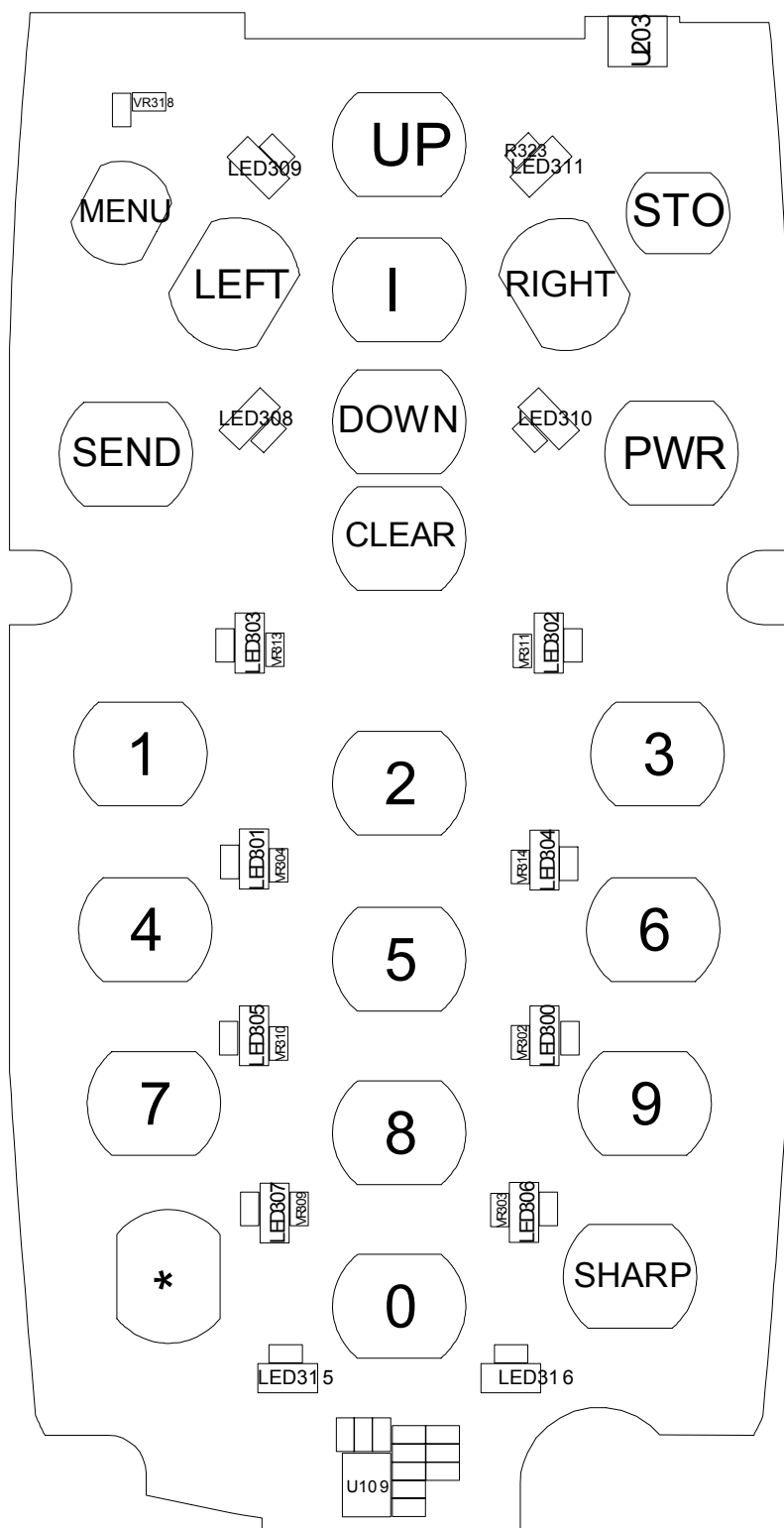
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| 2901-001296 | F202       | FILTER-EMI SMD        | SA       |
| 2901-001296 | F203       | FILTER-EMI SMD        | SA       |
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| 2904-001599 | F102       | FILTER-SAW            | SA       |
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| 3301-001158 | L302       | BEAD-SMD              | SA       |
| 3301-001342 | L200       | BEAD-SMD              | SA       |
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| 3404-001152 | TAC301     | SWITCH-TACT           | SA       |
| 3705-001358 | RFS100     | CONNECTOR-COAXIAL     | SA       |
| 3709-001384 | SIM103     | CONNECTOR-CARD EDGE   | SA       |
| 3710-001611 | IFC301     | CONNECTOR-INTERFACE   | SA       |
| 3711-005728 | HDC201     | HEADER-BOARD TO BOARD | SA       |
| 3711-006228 | BTC301     | HEADER-BATTERY        | SA       |
| 3722-002067 | EAR300     | JACK-EAR PHONE        | SA       |
| 4302-001130 | M300       | BATTERY-LI(2ND)       | SA       |
| GH09-00036A | UCP201     | IC MICOM-SGHX480      | SA       |
| GH71-04813A | ANT        | NPR-ANTENNA CONTACT   | SA       |
| GH71-04813A | GND        | NPR-ANTENNA CONTACT   | SA       |

## 8. Block Diagrams



## 9. PCB Diagrams

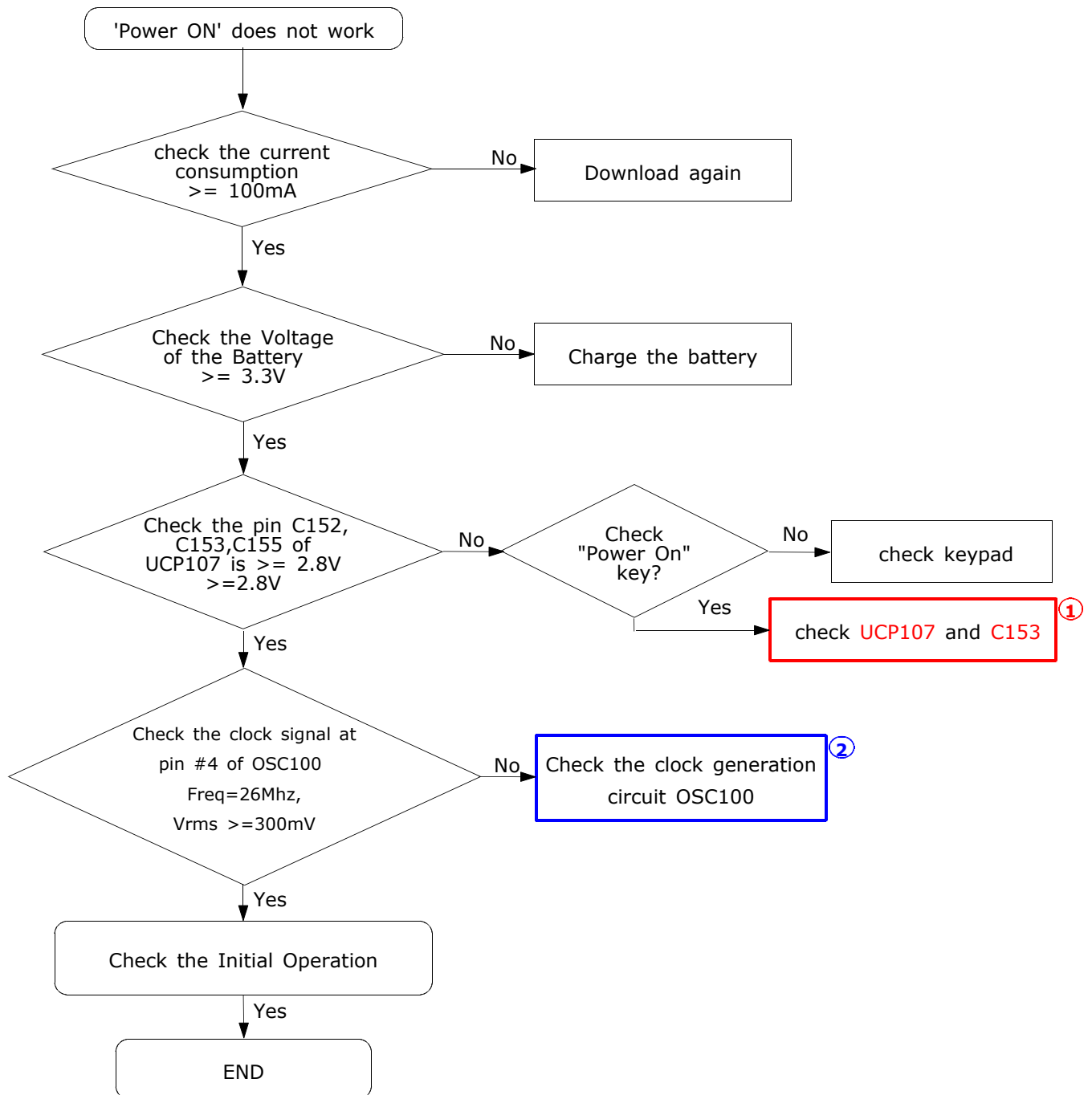


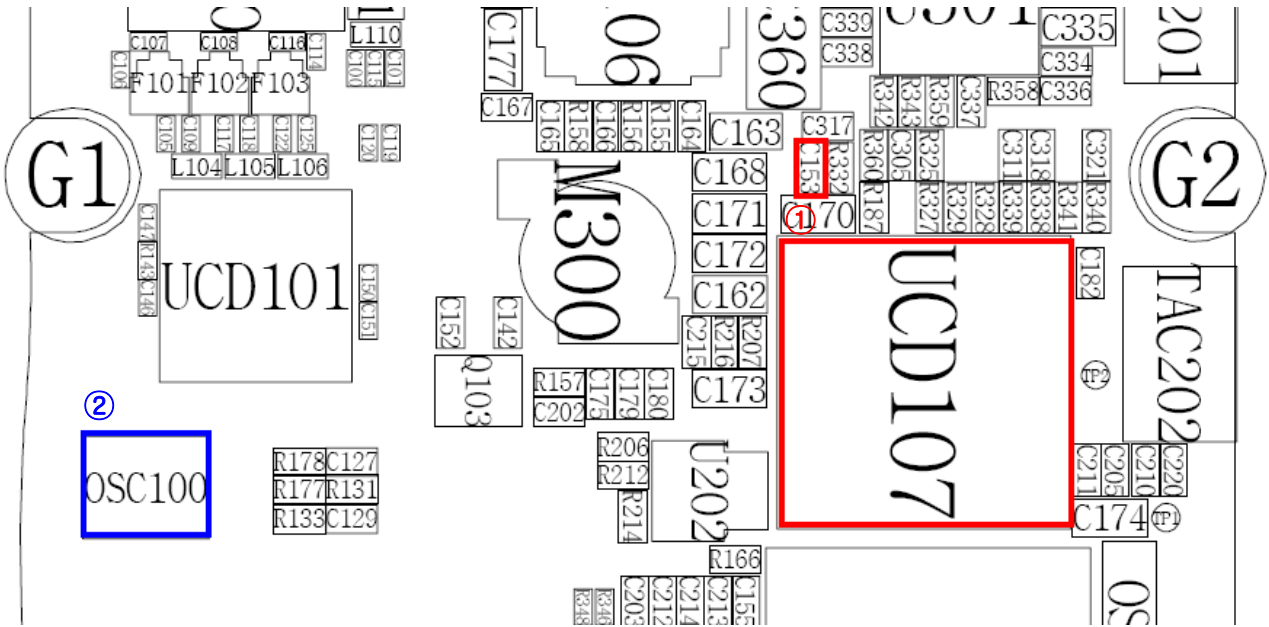
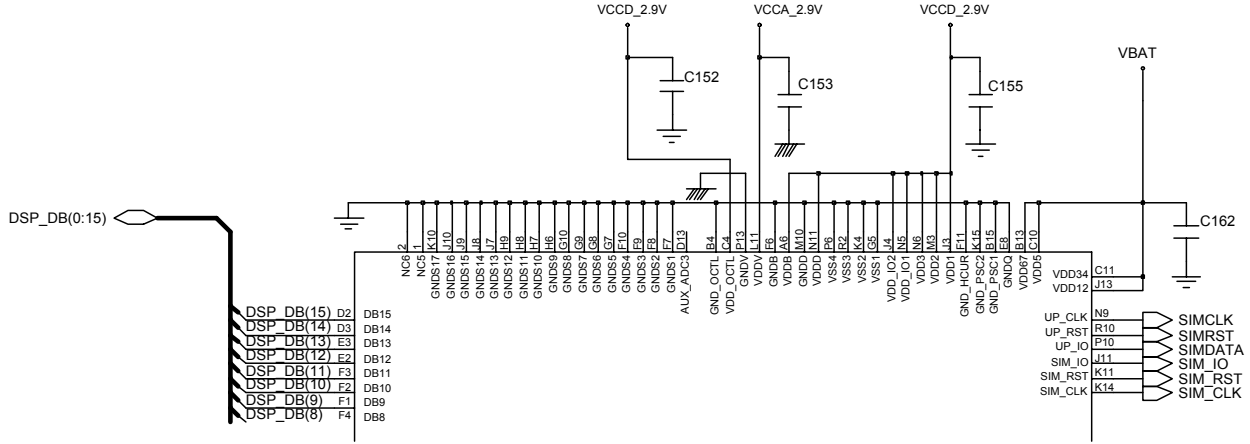


## 10. Flow Chart of Troubleshooting

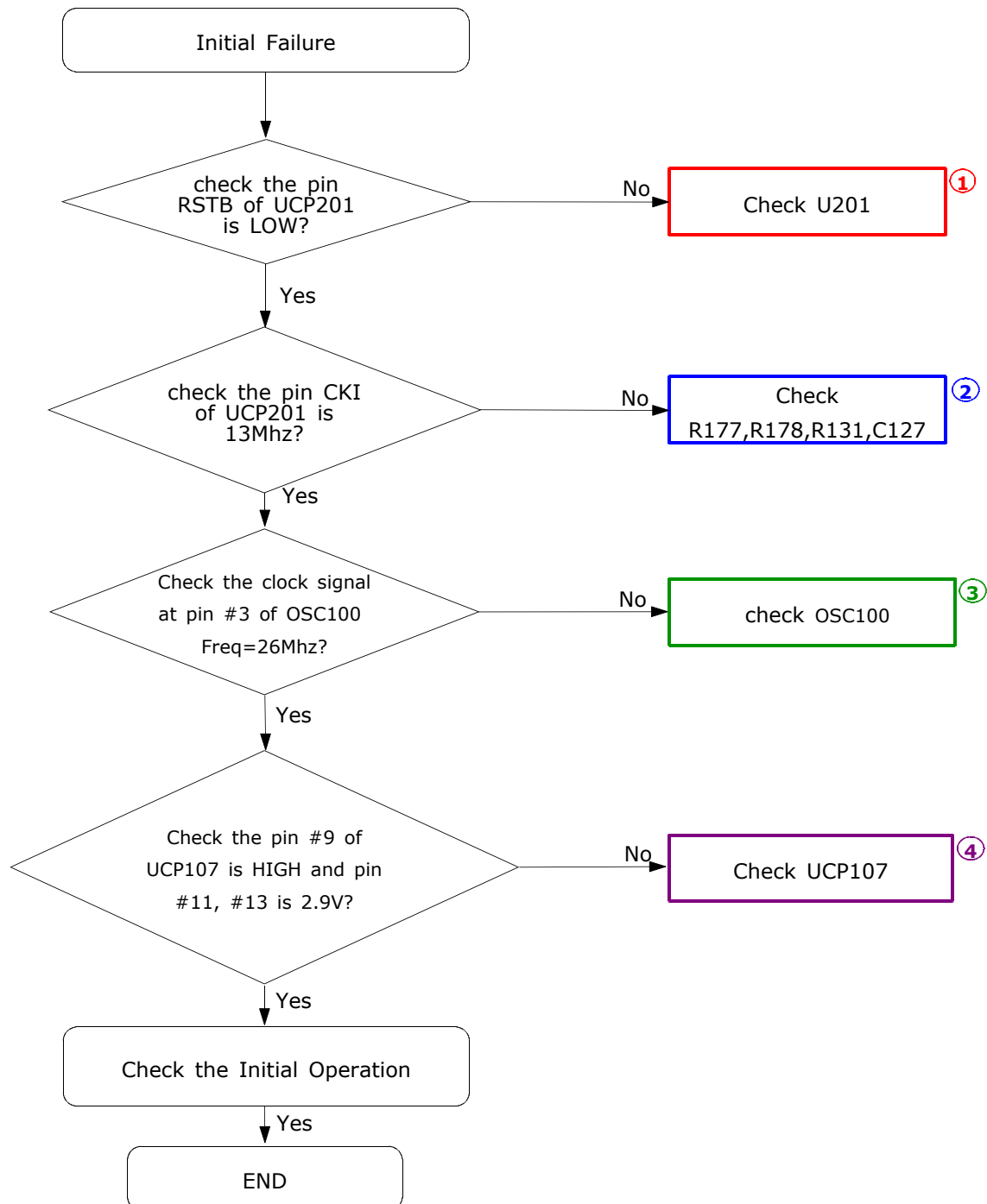
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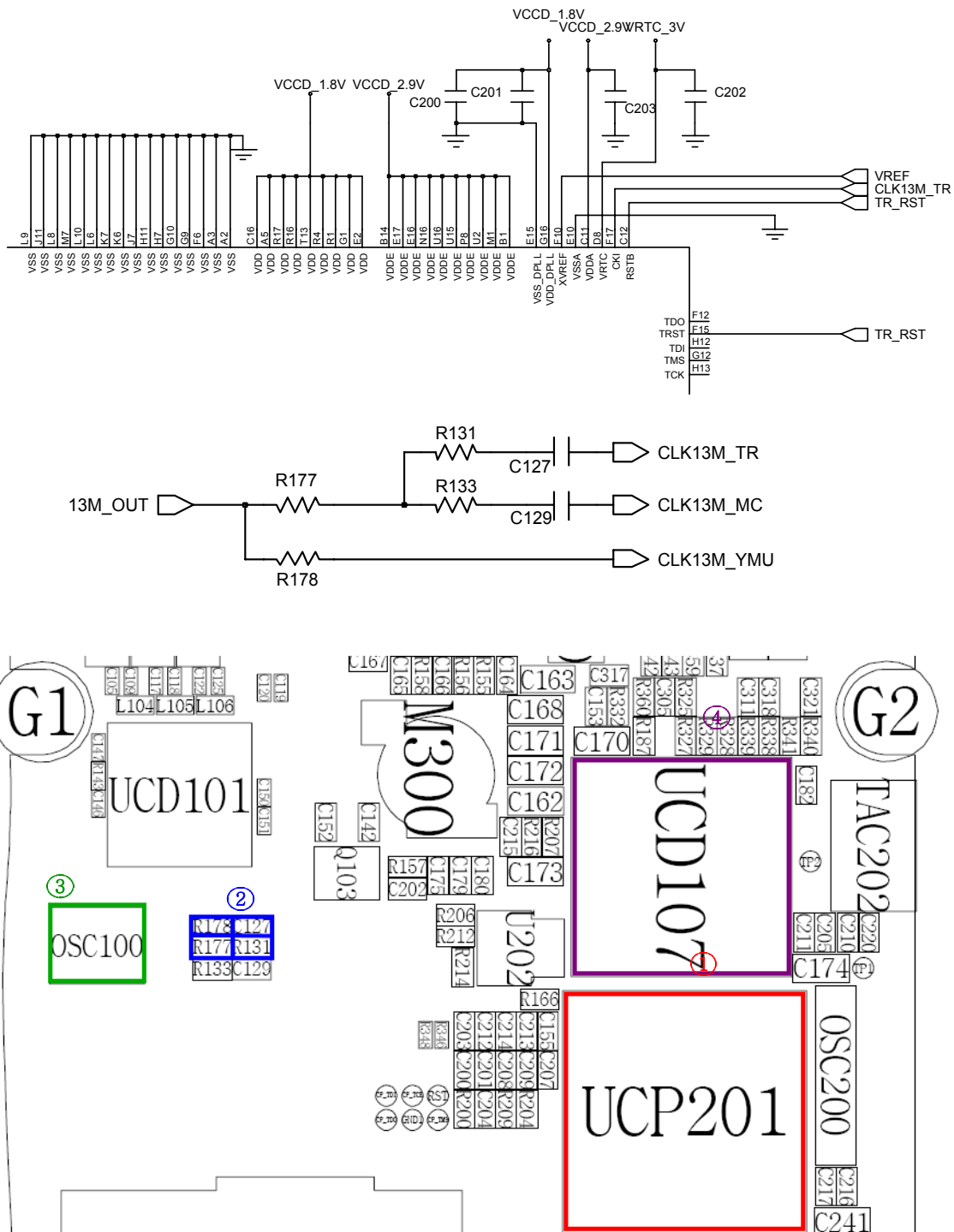
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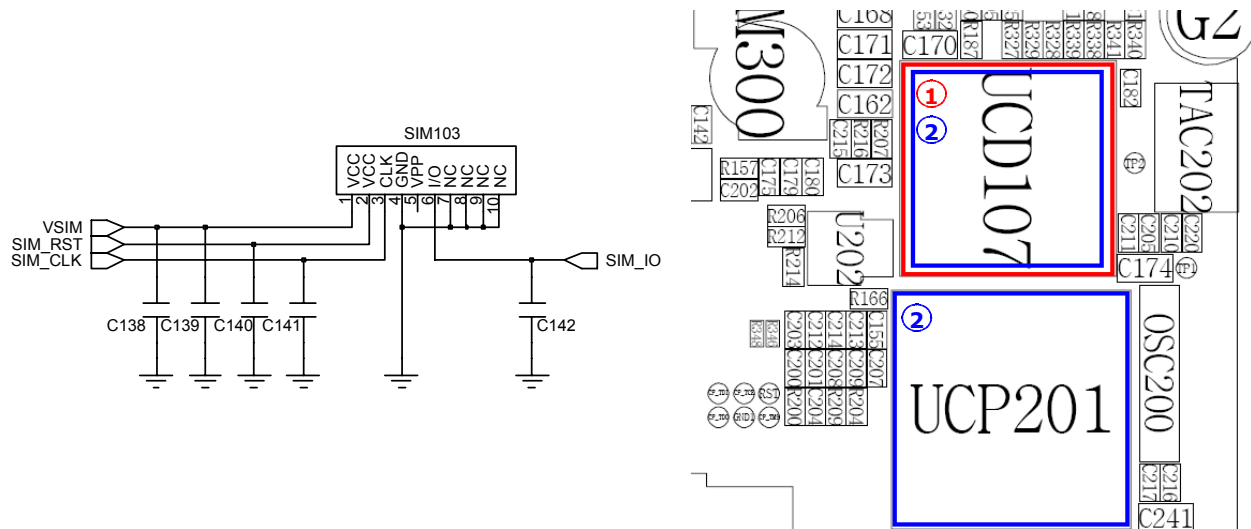
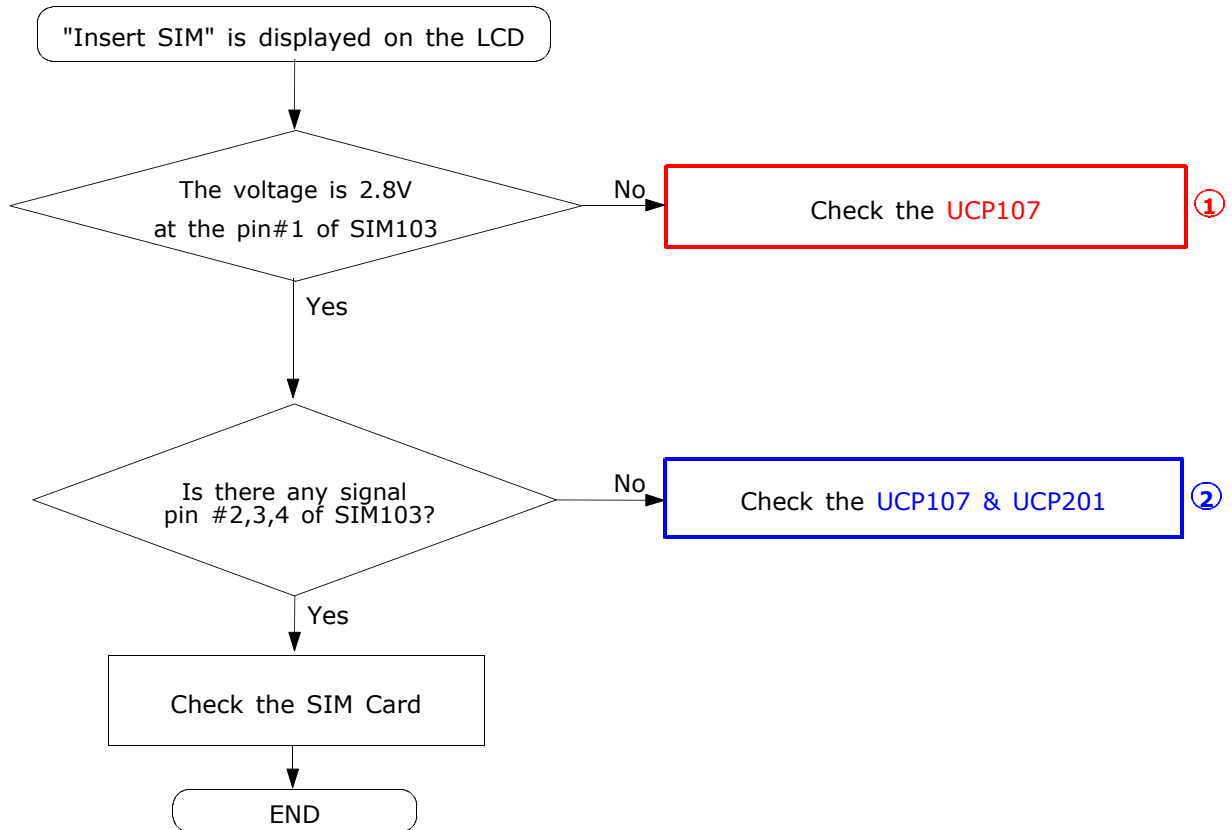


## 10-1-2. Initial



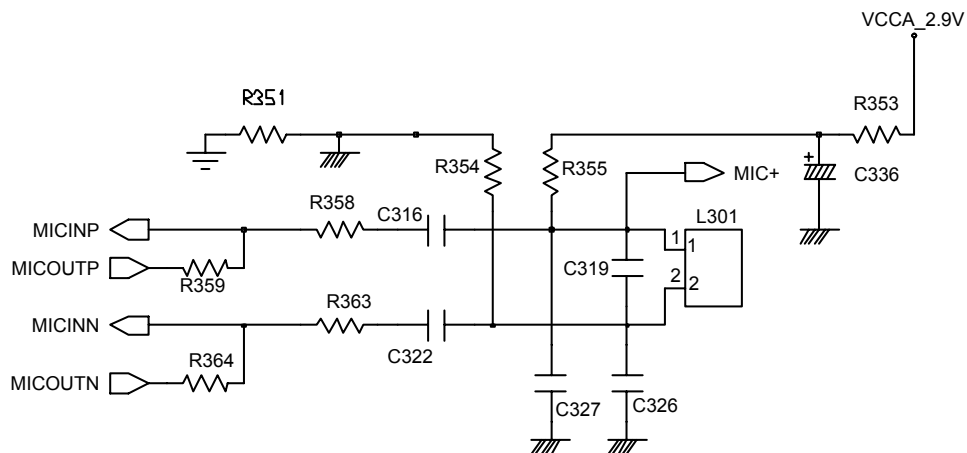
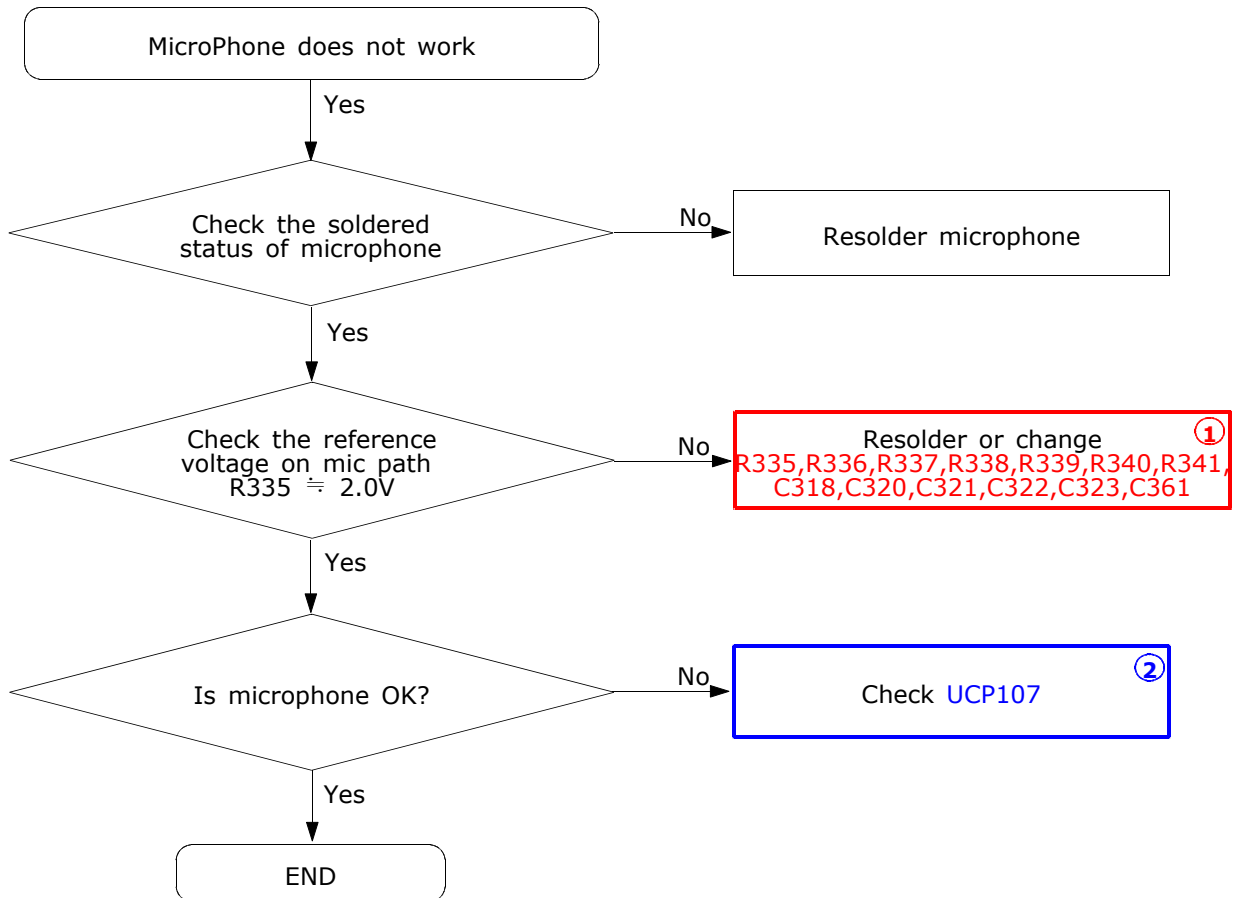


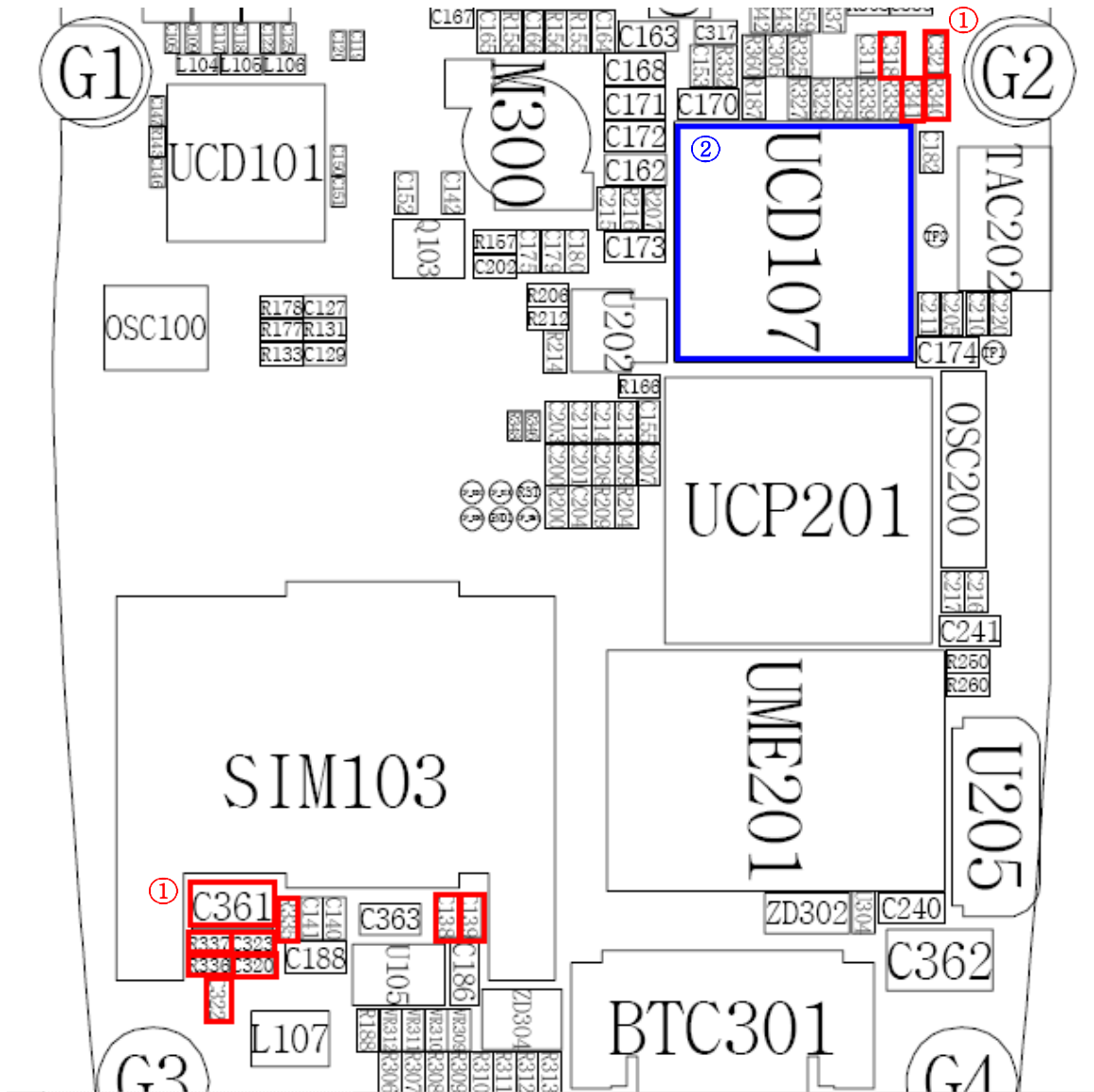
## 10-1-3. Sim Part



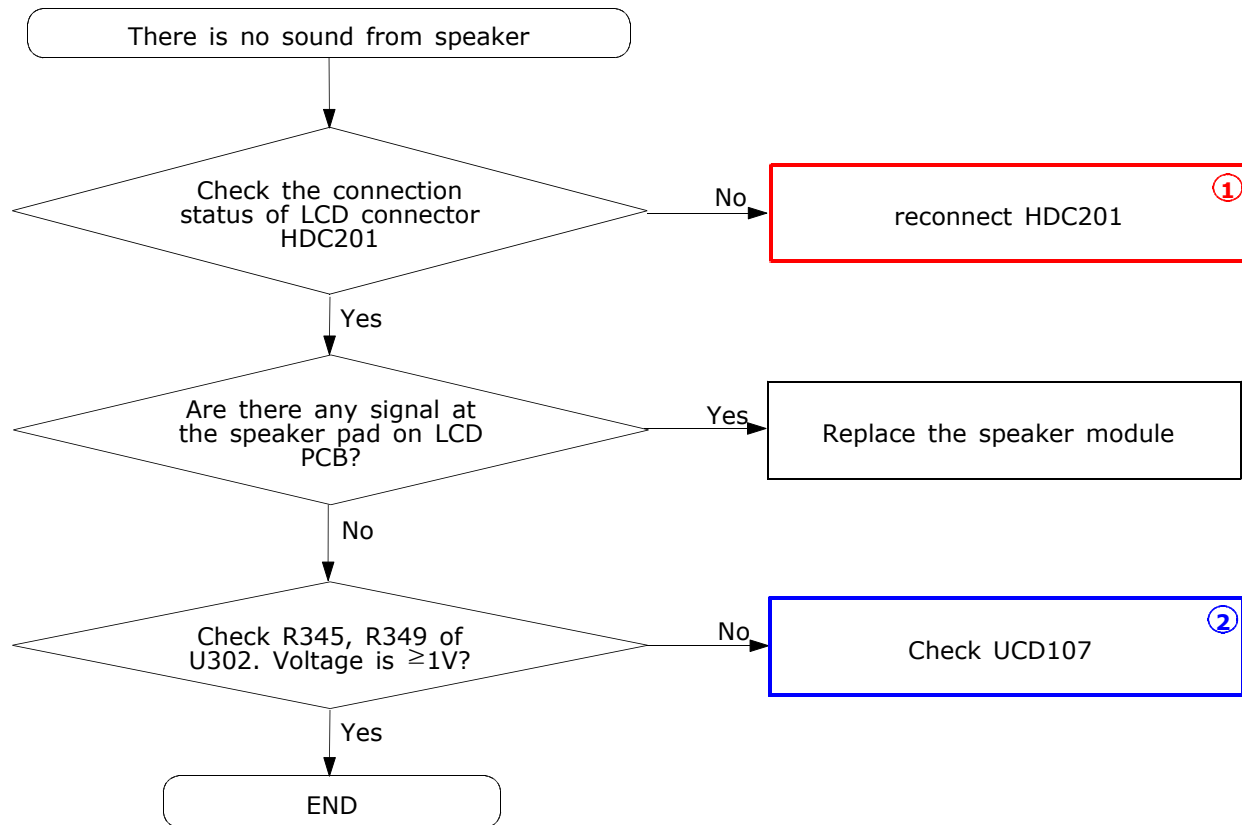
## 10-1-4. Microphone Part

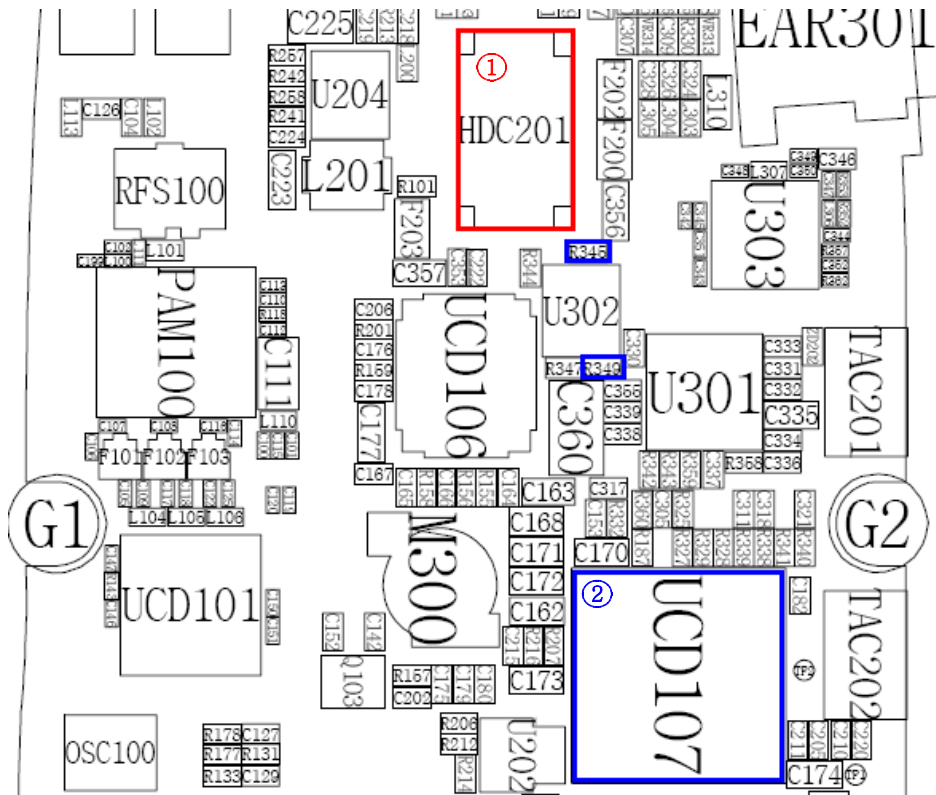
\* Call with Sim before testing.



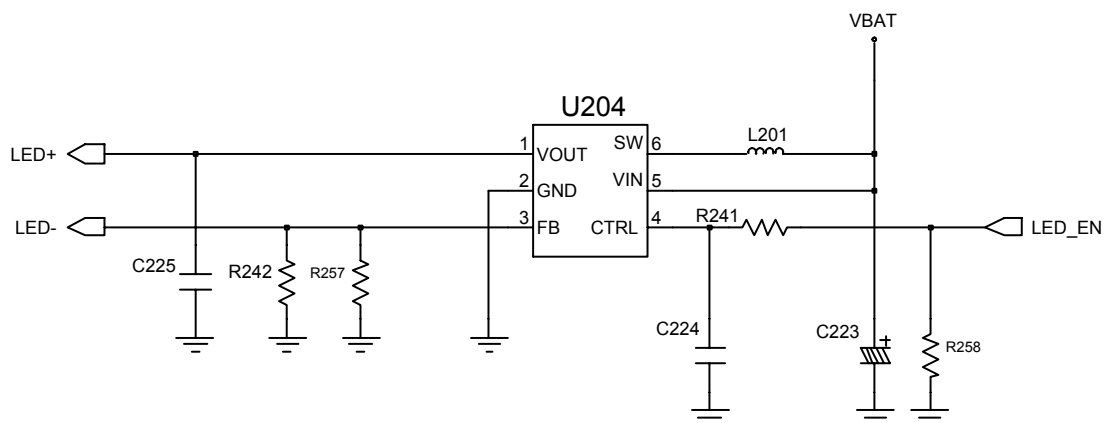
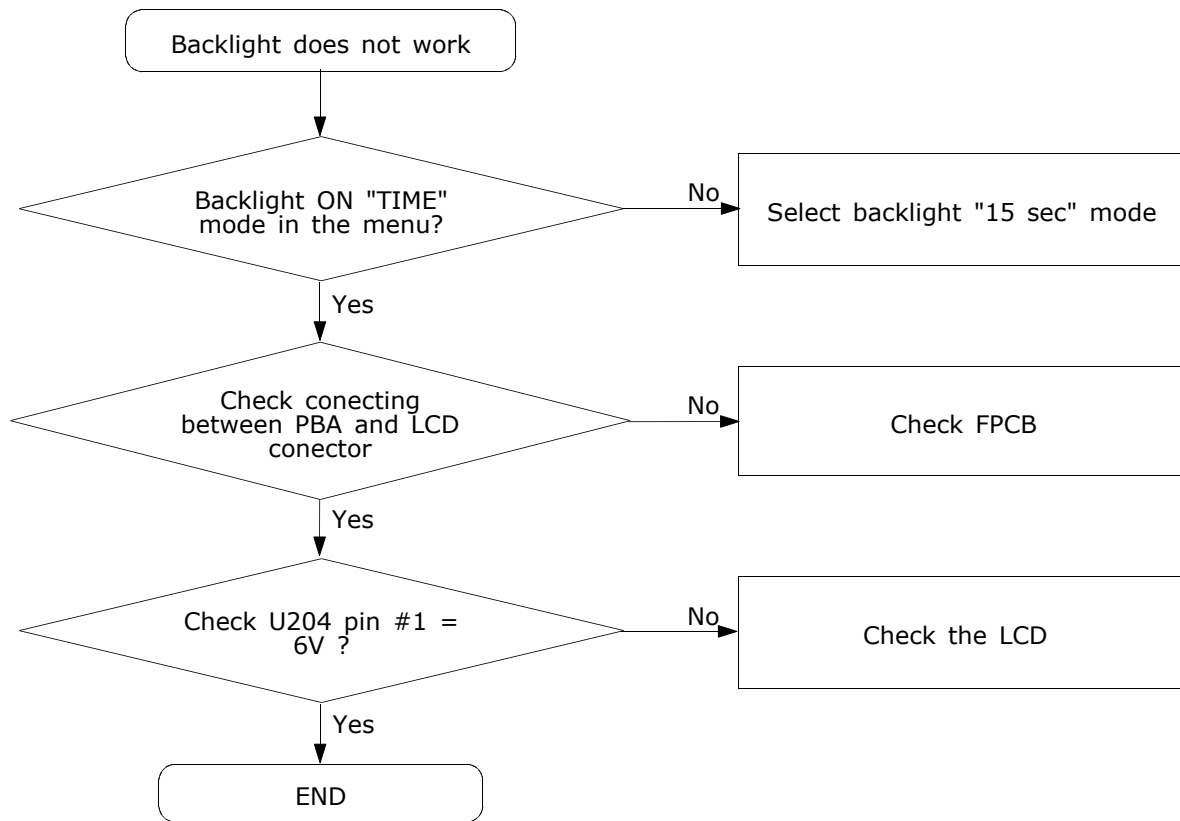


## 10-1-5. Speaker Part



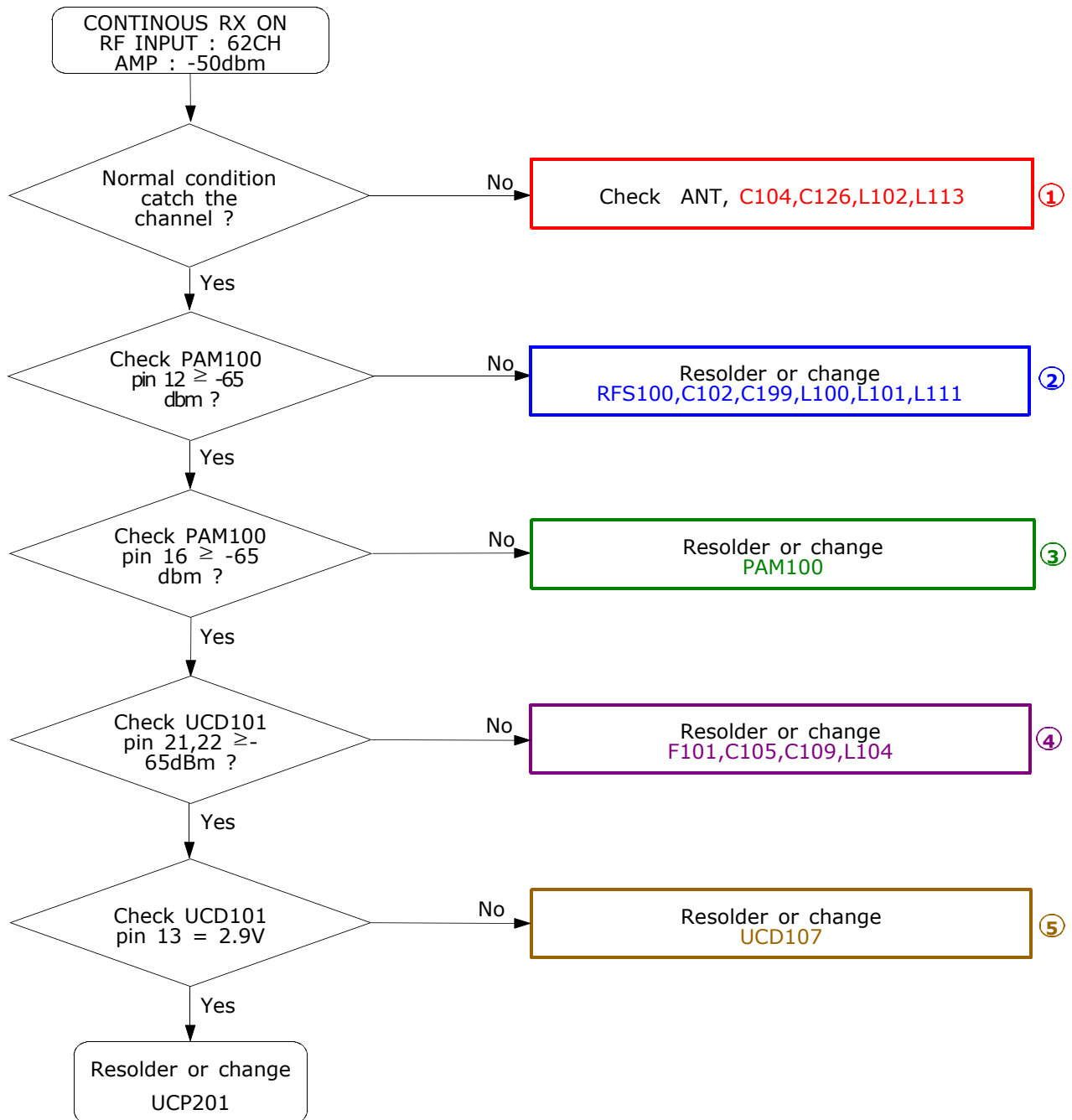


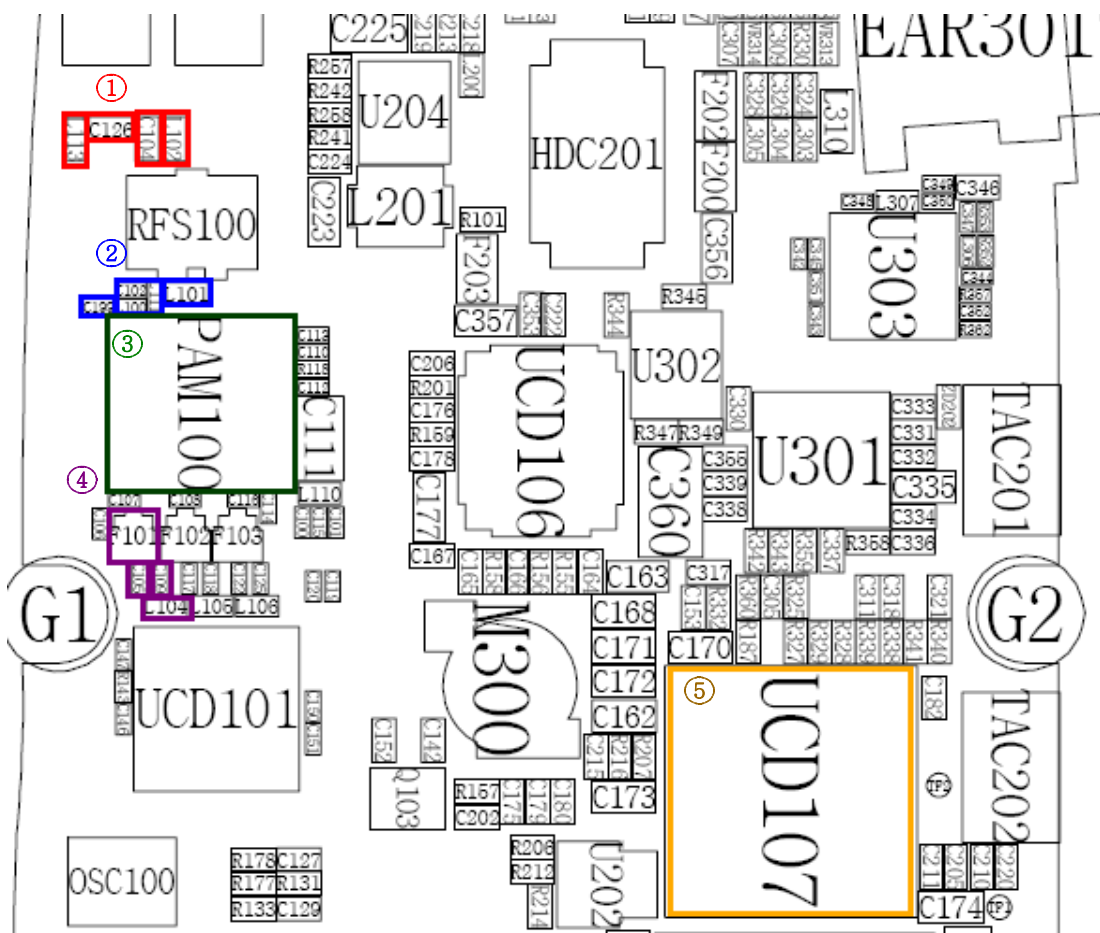
## 10-1-6. LCD backlight



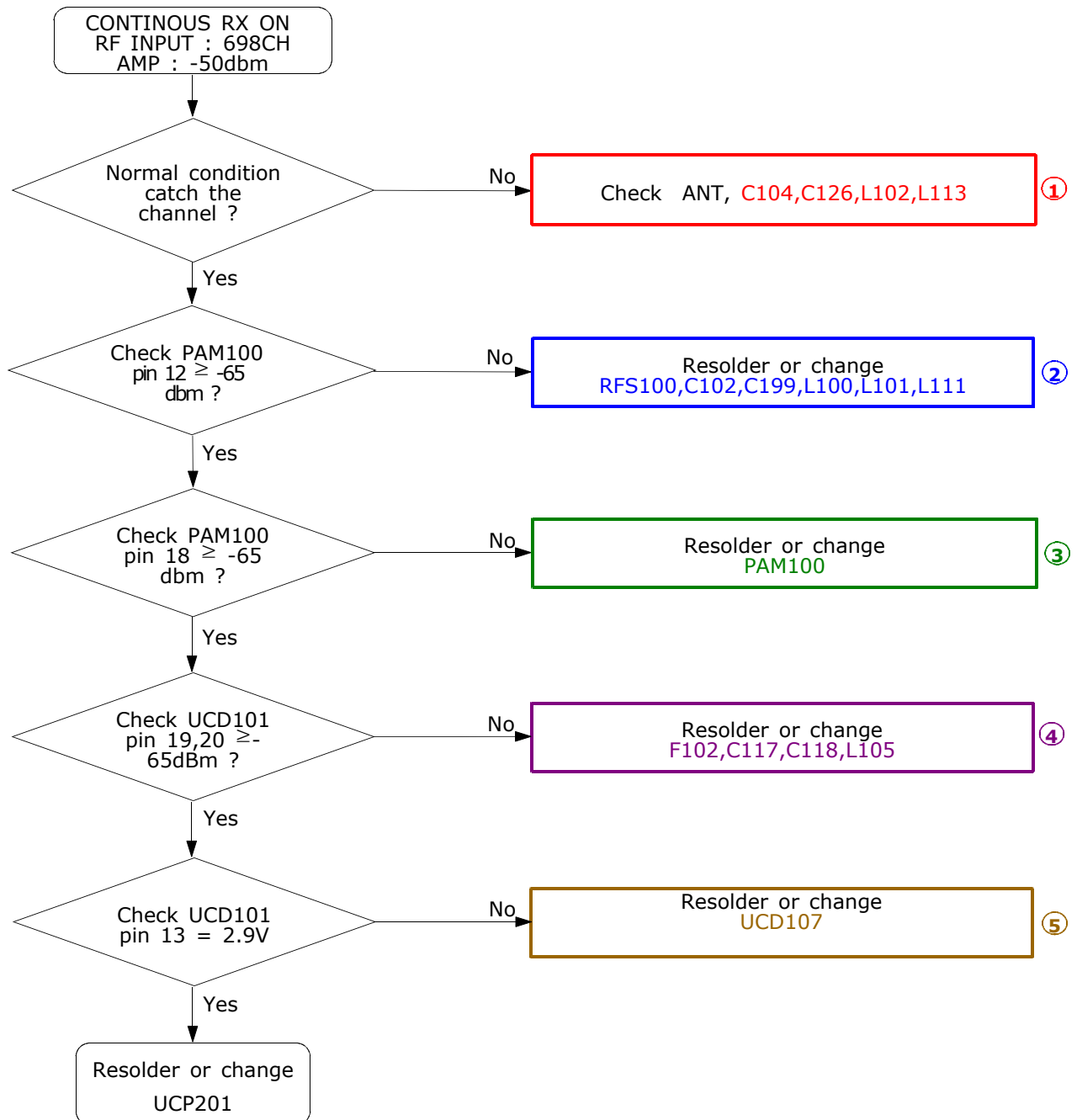
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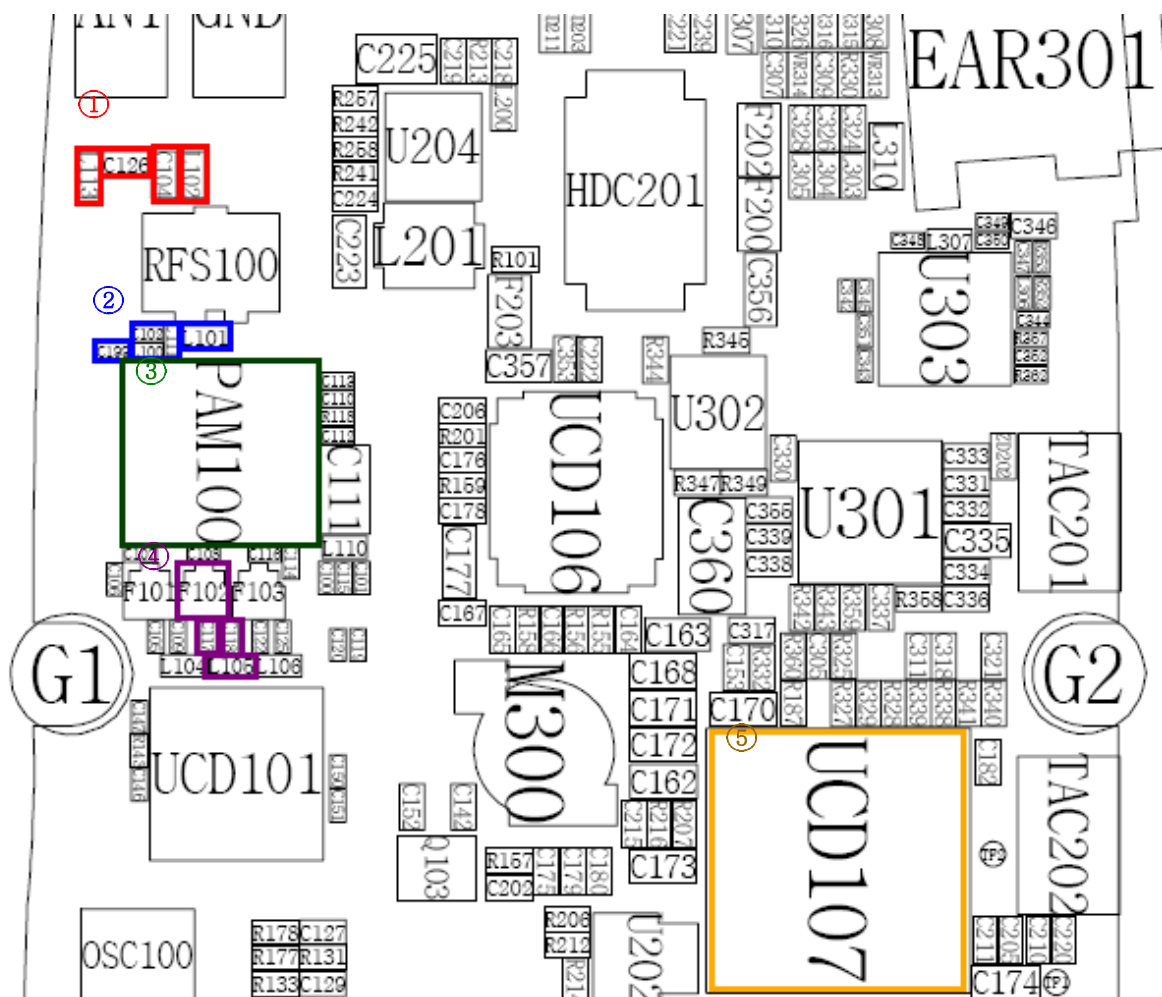
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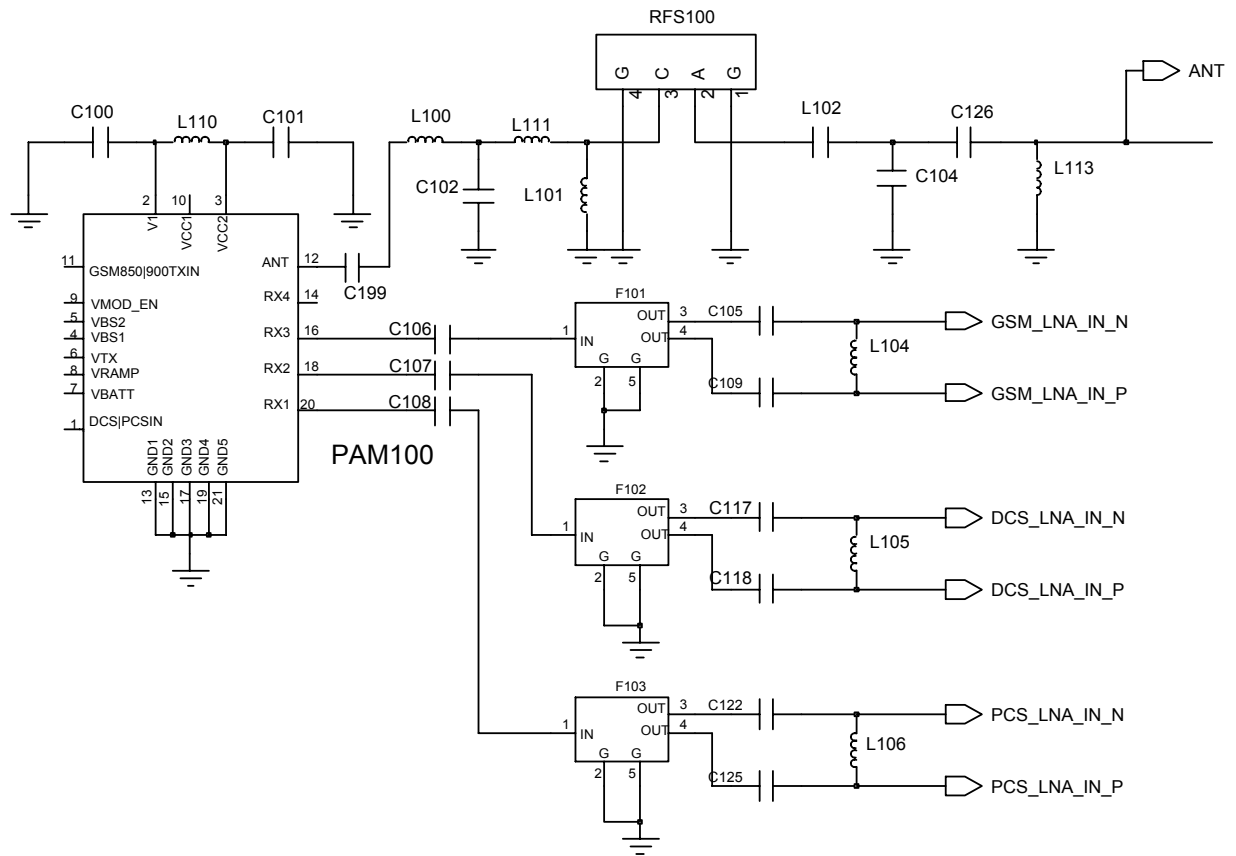




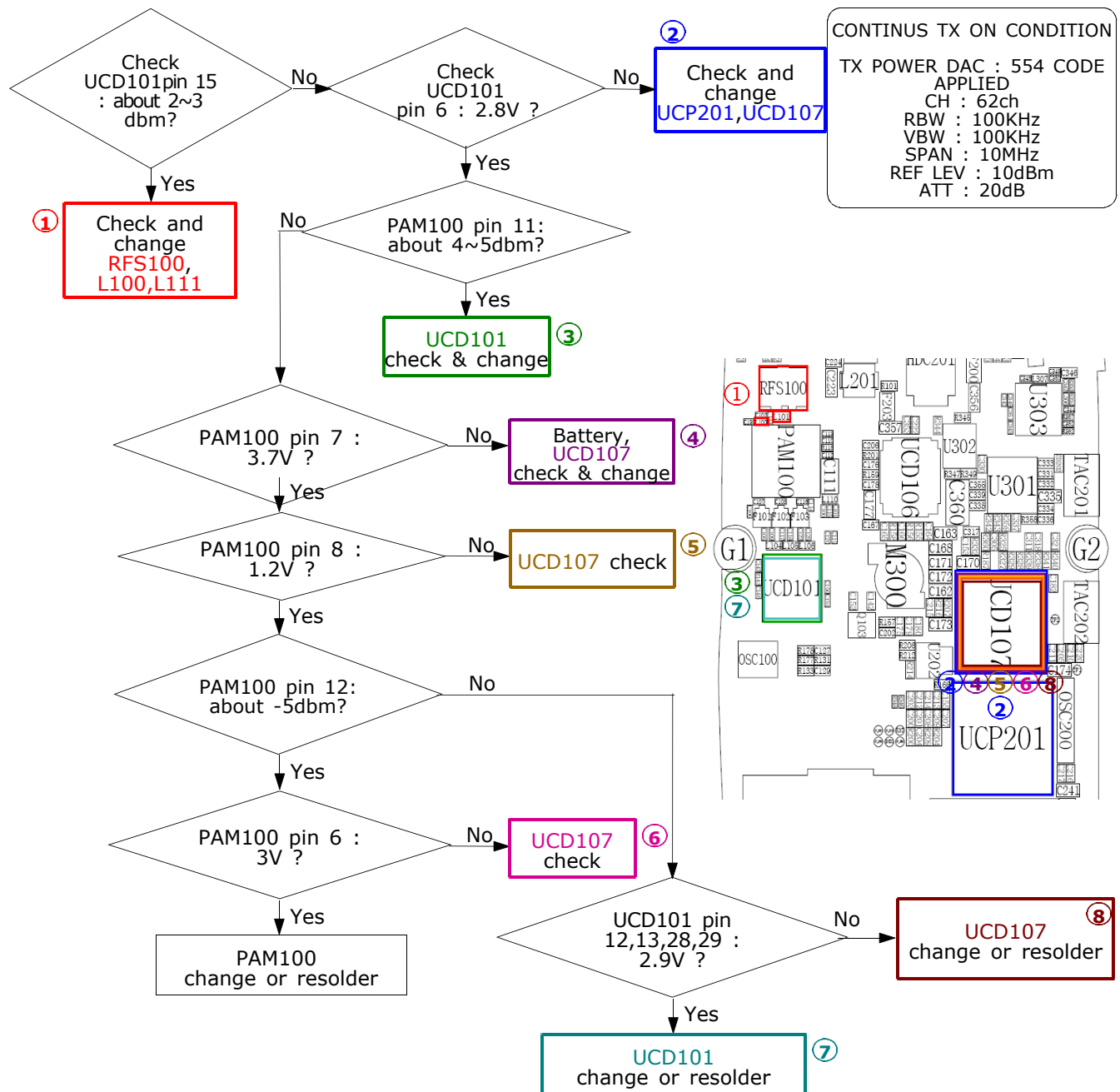
## 10-2-2. DCS Rx



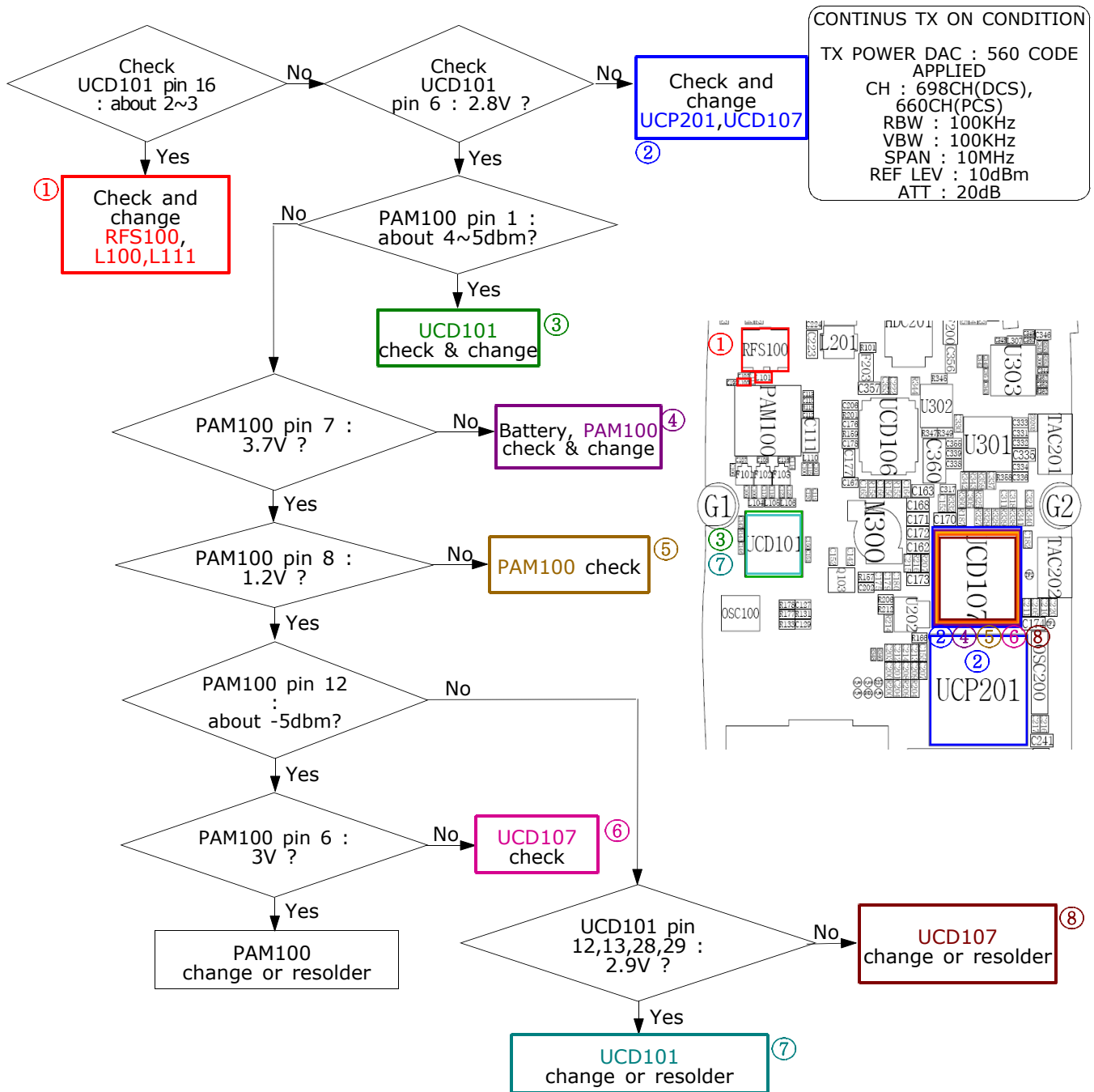




## 10-2-3. GSM Tx



## 10-2-4. DCS Tx



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## 11. Reference data

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### 11-1. Reference Abbreviate

**AAC**: Advanced Audio Coding.

**AVC** : Advanced Video Coding.

**BER** : Bit Error Rate

**BPSK**: Binary Phase Shift Keying

**CA** : Conditional Access

**CDM** : Code Division Multiplexing

**C/I** : Carrier to Interference

**DMB** : Digital Multimedia Broadcasting

**EN** : European Standard

**ES** : Elementary Stream

**ETSI**: European Telecommunications Standards Institute

**MPEG**: Moving Picture Experts Group

**PN** : Pseudo-random Noise

**PS** : Pilot Symbol

**QPSK**: Quadrature Phase Shift Keying

**RS** : Reed-Solomon

**SI** : Service Information

**TDM** : Time Division Multiplexing

**TS** : Transport Stream

**SAMSUNG  
ELECTRONICS**

