

Nokia Customer Care

Service Manual

RM-849 (L3 & L4)

Mobile Terminal

Part No: (Issue 1)

COMPANY CONFIDENTIAL



Amendment Record Sheet

Amendment No	Date	Inserted By	Comments
Issue 1	2/24/2012	Serena Chen	

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IMPORTANT

This document is intended for use by qualified service personnel only.

Warnings and Cautions

Warnings

- IF THE DEVICE CAN BE INSTALLED IN A VEHICLE, CARE MUST BE TAKEN ON INSTALLATION IN VEHICLES FITTED WITH ELECTRONIC ENGINE MANAGEMENT SYSTEMS AND ANTI-SKID BRAKING SYSTEMS. UNDER CERTAIN FAULT CONDITIONS, EMITTED RF ENERGY CAN AFFECT THEIR OPERATION. IF NECESSARY, CONSULT THE VEHICLE DEALER/ MANUFACTURER TO DETERMINE THE IMMUNITY OF VEHICLE ELECTRONIC SYSTEMS TO RF ENERGY.
- THE PRODUCT MUST NOT BE OPERATED IN AREAS LIKELY TO CONTAIN POTENTIALLY EXPLOSIVE ATMOSPHERES, FOR EXAMPLE, PETROL STATIONS (SERVICE STATIONS), BLASTING AREAS ETC.
- OPERATION OF ANY RADIO TRANSMITTING EQUIPMENT, INCLUDING CELLULAR TELEPHONES, MAY INTERFERE WITH THE FUNCTIONALITY OF INADEQUATELY PROTECTED MEDICAL DEVICES. CONSULT A PHYSICIAN OR THE MANUFACTURER OF THE MEDICAL DEVICE IF YOU HAVE ANY QUESTIONS. OTHER ELECTRONIC EQUIPMENT MAY ALSO BE SUBJECT TO INTERFERENCE.
- BEFORE MAKING ANY TEST CONNECTIONS, MAKE SURE YOU HAVE SWITCHED OFF ALL EQUIPMENT.

Cautions

- Servicing and alignment must be undertaken by qualified personnel only.
- Ensure all work is carried out at an anti-static workstation and that an anti-static wrist strap is worn.
- Ensure solder, wire, or foreign matter does not enter the telephone as damage may result.
- Use only approved components as specified in the parts list.
- Ensure all components, modules, screws and insulators are correctly re-fitted after servicing and alignment.
- Ensure all cables and wires are repositioned correctly.
- Never test a mobile phone WCDMA transmitter with full Tx power, if there is no possibility to perform the measurements in a good performance RF-shielded room. Even low power WCDMA transmitters may disturb nearby WCDMA networks and cause problems to 3G cellular phone communication in a wide area.
- During testing never activate the WCDMA transmitter without a proper antenna load, otherwise WCDMA PA may be damaged.

For Your Safety

QUALIFIED SERVICE

Only qualified personnel may install or repair phone equipment.

ACCESSORIES AND BATTERIES

Use only approved accessories and batteries. Do not connect incompatible products.

CONNECTION TO OTHER DEVICES

When connecting to any other device, read its user's guide for detailed safety instructions. Do not connect incompatible products.

Care and Maintenance

- This product is of superior design and craftsmanship and should be treated with care. The suggestions below will help you to fulfill any warranty obligations and to enjoy this product for many years.
- Keep the phone and all its parts and accessories out of the reach of small children.
- Keep the phone dry. Precipitation, humidity and all types of liquids or moisture can contain minerals that will corrode electronic circuits.
- Do not use or store the phone in dusty, dirty areas. Its moving parts can be damaged.
- Do not store the phone in hot areas. High temperatures can shorten the life of electronic devices, damage batteries, and warp or melt certain plastics.
- Do not store the phone in cold areas. When it warms up (to its normal temperature), moisture can form inside, which may damage electronic circuit boards.
- Do not drop, knock or shake the phone. Rough handling can break internal circuit boards.
- Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the phone.
- Do not paint the phone. Paint can clog the moving parts and prevent proper operation.
- Use only the supplied or an approved replacement antenna. Unauthorized antennas, modifications or attachments could damage the phone and may violate regulations governing radio devices.

All of the above suggestions apply equally to the product, battery, charger or any accessory.

ESD Protection

Nokia requires that service points have sufficient ESD protection (against static electricity) when servicing the phone.

Any product of which the covers are removed must be handled with ESD protection. The SIM card can be replaced without ESD protection if the product is otherwise ready for use.

To replace the covers ESD protection must be applied.

All electronic parts of the product are susceptible to ESD. Resistors, too, can be damaged by static electricity discharge.

All ESD sensitive parts must be packed in metallized protective bags during shipping and handling outside any ESD Protected Area (EPA).

Every repair action involving opening the product or handling the product components must be done under ESD protection.

ESD protected spare part packages MUST NOT be opened/closed out of an ESD Protected Area.

For more information and local requirements about ESD protection and ESD Protected Area, contact your local Nokia After Market Services representative.

Battery Information

Note: A new battery's full performance is achieved only after two or three complete charge and discharge cycles!

The battery can be charged and discharged hundreds of times but it will eventually wear out. When the operating time (talk-time and standby time) is noticeably shorter than normal, it is time to buy a new battery.

Use only batteries approved by the phone manufacturer and recharge the battery only with the chargers approved by the manufacturer. Unplug the charger when not in use. Do not leave the battery connected to a charger for longer than a week, since overcharging may shorten its lifetime. If left unused a fully charged battery will discharge itself over time.

Temperature extremes can affect the ability of your battery to charge.

For good operation times with Li-Ion batteries, discharge the battery from time to time by leaving the product switched on until it turns itself off (or by using the battery discharge facility of any approved accessory available for the product). Do not attempt to discharge the battery by any other means.

Use the battery only for its intended purpose.

Never use any charger or battery which is damaged.

Do not short-circuit the battery. Accidental short-circuiting can occur when a metallic object (coin, clip or pen) causes direct connection of the + and - terminals of the battery (metal strips on the battery) for example when you carry a spare battery in your pocket or purse. Short-circuiting the terminals may damage the battery or the connecting object.

Leaving the battery in hot or cold places, such as in a closed car in summer or winter conditions, will reduce the capacity and lifetime of the battery. Always try to keep the battery between 15°C and 25°C (59°F and 77°F). A phone with a hot or cold battery may temporarily not work, even when the battery is fully charged.

Batteries' performance is particularly limited in temperatures well below freezing.

Do not dispose of batteries in a fire!

Dispose of batteries according to local regulations (e.g. recycling). Do not dispose as household waste.

Company Policy

Our policy is of continuous development; details of all technical modifications will be included with service bulletins.

While every endeavor has been made to ensure the accuracy of this document, some errors may exist. If any errors are found by the reader, NOKIA MOBILE PHONES Business Group should be notified in writing/e-mail.

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RM-849; L3 & L4 Service Manual Structure

- 1 - General Information
 - 2 - Service Tools and Service Concepts
 - 3 - BB Troubleshooting and Manual Tuning Guide
 - 4 - System Module
- Glossary

1 - General Information

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■ Product selection

RM-849 is GSM/WCDMA dual-mode hand portable multimedia computers with a capacitive touch UI, integrated GPS (A-GPS OMA SUPL), NFC and WLAN. RM-849 supports GSM 850/900/1800/1900 and WCDMA I/II/V/VIII bands, GPRS/EGPRS and WCDMA/HSDPA data bearers.

For WCDMA the maximum bit rate is up to 384kbit/s for downlink and 384 Kbit/s for uplink with simultaneous CS speech or CS video (max. 64kbit/s). The device supports HSDPA category 10 with downlink peak data rate up to 7.2 Mbit/s (in limited use cases), HSUPA belongs to category 6 with uplink peak data rate up to 5.76 Mbit/s (in limited use cases).

In PS/CS mode, the device supports DTM with multi slot class 11(max. 4 RX + 3 TX, sum 5). With EGPRS this means maximum download speed of up to 236.8kbit/s simultaneously with speech. With GPRS this means maximum download speed of up to 85.6kbit/s simultaneously with speech.

In PS only mode, the device supports MSC 12, a maximum of 4 RX + 4 TX, sum 6 timeslots resulting in maximum download speed of up to 296 Kbit/s with EGPRS, and up to 100Kbit/s with GPRS.

The device has a large 3.7" TFT (800 x 480 pixels) Normal Black WVGA touch display with 16 million colors and support for pinch zoom. It also has a 5 megapixel autofocus camera with OSRAM LED flash.

The MMS implementation follows the OMA MMS standard release 1.3. The browser is a highly advanced Internet browser also capable of viewing operator domain XHTML Mobile Profile (MP) content. The device also supports Bluetooth 2.1 + EDR standard with A2DP.

The device uses Windows Phone 7.5 operating system (release 7.5, Mango) and supports the full Web Browser for Internet Explorer 9 with desktop rendering which brings desktop-like Web browsing experience to mobile devices.



Figure 1 RM-849 product picture

■ Product features and sales package

Imaging

Main camera:

- Sensor: 5 megapixel
- Optical size: 1/4 inch optical format
- F number/Aperture: F2.4
- Digital zoom: 4x
- Auto focus: Two-stage capture key
- Focal length: 2.873 mm
- Focus range: 10 cm ~ infinity

Video:

- Video resolution: VGA(640x480), 30 fps
- Audio recording: AAC (AMR for MMS)
- Video stabilization
- Video clip length: Max. 90 min
- Video file format: .mp4 (default), .3gp (for MMS)
- White balance: automatic, daylight, cloudy, shade, incandescent, fluorescent
- Scene: auto, backlight, beach, candlelight, macro, landscape, night, portrait, snow, sports, sunset
- Colour tone: normal, sepia, B&W, solarize, negative
- Zoom (digital): 3x
- Continuous auto focus
- No Touch focus
- Video recording indicator

Photo:

- Aspect ratio: 5MP 4:3 (2592X1944), 4MP 16:9 (2592X1458)
- Still image file format: JPEG/EXIF
- Still image resolutions: up to 5 megapixel, 2592X1944
- No Continuous autofocus
- Touch focus
- View finder: Full screen view finder
- Auto exposure: center weighted AE
- Image orientation: automatic
- Automatic red eye removal
- Face tracking
- Exposure compensation: +2 ~ -2EV at 0.5 step
- White balance: automatic, daylight, cloudy, shade, incandescent, fluorescent
- Scene: auto, backlight, beach, candlelight, macro, landscape, night, portrait, snow, sports, sunset
- Colour tone: normal, sepia, B&W, solarize, negative
- Zoom (digital): 4x

Edit

On device Photo editor and Video editor (manual & automatic)

View

- 3.7" WVGA TFT Normal Black (800 x 480 pixels) color display, up to 16M colors.
- Dipro sensor - a combination of ALS and proximity. ALS to optimize display brightness and power consumption. Proximity for turning off the display when in a call for power consumption.
- Slideshow from Pictures

Share

- Share effortlessly from Pictures or after capture
- Video sharing support (WCDMA services)
- Online Album: Image/Video uploading from Pictures

Store

- 8 GB flash memory
- 256 MB SDRAM
- Easy to transfer and organize photos and video between your device and a compatible PC

Music

- Digital music player: supports MP3/ AAC/ eAAC/ eAAC+/ WMA/ AMR-NB/ WB-AMR with playlists, equalizer and album art
- Synchronize music with Zune PC application
- Stereo FM radio (87.5-108 MHz /76-90 MHz) with Visual Radio™ support
- Bluetooth speakers
- Integrated hands free speaker
- Nokia Stereo Headset (WH-208), inbox

Media

- Full-screen video playback to view downloaded, streamed or recorded video clips
- Supported video formats: MPEG-4 , H.264/AVC, H.263/3GPP, WMV, AVI, Mov

Productivity

Context management:

- Internet Explorer 9 with desktop rendering
- OMA DRM version 2.0
- OTA provisioning

Messaging:

- E-mail (SMTP, IMAP4, POP3), MMS, SMS, unified editor
- IM client
- Office applications:
- Viewing of email attachments – .doc, .xls, .ppt, .pdf, .zip
- Mail for Exchange

PIM:

- Contacts, calendar, calculator, clock

Synchronization:

- Local/Remote (using Zune PC SW)
- Data: Calendar, Contacts, E-mail
- PC Applications: Microsoft Outlook (98, 2000, 2002, 2003), Outlook Express

Call management:

- Call logs, speed dial, voice dialing (with SIND) and voice commands

Connectivity

- Integrated GPS (A-GPS OMA SUPL)
- WLAN - IEEE802.11 g/b/n with UPnP support
- Micro USB interface with USB 2.0 high speed
- Bluetooth wireless technology 2.1 + EDR
- NOKIA AV connector (3.5 mm)
- NFC

Add-on software framework

- Windows Phone Tango 7.5 OS
- C++ and Java SDKs
- Flash Lite 4.0

Additional technical specifications

- Vibrating alert
- 3GPP Rel 8/6 compliant
- Speech codecs supported: AMR, NB AMR, FR, EFR, HR, iLBC, G.711, G.729
- GPRS/EGPRS Class B, multi slot class 12
- Dual Transfer Mode (DTM) class A, multi slot class 11
- WCDMA DL 384 kbit/s, UL 384 kbit/s
- HSDPA up to 7.2 Mbps
- HSUPA up to 5.76Mbps

Sales package

- Transceiver RM-849
- Nokia high efficiency charger (AC-50)
- Connectivity cable (CA-185CD) Wired Stereo Headset (WH-902)
- Fold-out user guide , Extended product information booklet

■ Transceiver general specifications

Unit	Dimension(mm)	Weight(g)	Volume(cc)
Transceiver with BP-3L 1300mAh Li-Ion battery pack	119.24 x 62.18 x 12.3 mm	135	77.65

■ RM-849 Main RF characteristics for GSM850/900/1800/1900, WCDMA VIII/V/II/I phones

RTR6285A System Module

Parameter	Unit
Number of RF channels(GSM)	GSM850:124, GSM900:174, DCS1800:374, PCS:299
Channel Spacing	200kHz
Number of RF channels(WCDMA)	WCDMA2100:277, WCDMA1900:277, WCDMA850:102, WCDMA900:152
Channel Spacing	200kHz

■ Battery endurance

Battery	Talk time	Standby time	Music Playback	Video Playback H.264 720p 30fps
BP-3L 1300mAh Li-Ion battery	12h (GSM) 6h (WCDMA)	449h (GSM) 406h (WCDMA)	34h	7h

Note: Variation in operation times will occur depending on network parameters, phone setting and usage.

■ **Environmental Condition**

Environmental Condition	Ambient Temperature	Notes
Normal Operation	-15°C...+55°C	Specifications fulfilled
Reduced Performance	+55°C...+70°C	Operational only for short periods
Intermittent or No Operation	-40°C...-15°C and +70°C...+85°C	Operation not guaranteed but an attempt to operate will not damage the phone.
No Operation or Storage	<-40°C and >+85°C	No storage. An attempt to operate may cause permanent damage.
Charging Allowed	-15°C...+55°C	
Long Term Storage Conditions	0°C...+85°C	
Humidity and Water Resistance		Relative humidity range is 5 to 95%. Condensed or dripping water may cause intermittent malfunctions. Protection against dripping water has to be implemented (enclosure) mechanics. Continuous dampness will cause permanent damage to the module.

2 - Service Tools and Service Concepts

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■ **Service tools - Nokia**


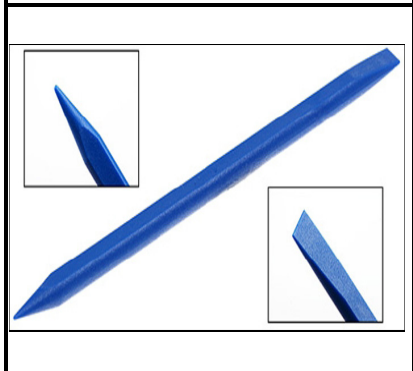
Product specific tools

	SS-287	Camera removal tool	0781189
The camera removal tool SS-287 is used to remove/attach the camera module from/to the socket.			

General tools

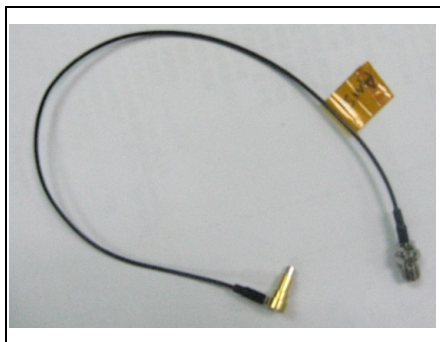

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

 <p>CA-190</p>	CA-190	Micro USB cable	0730634
The CA-190 is a USB-to-micro USB data cable that allows connections between the PC and the phone.			

	SRT-6	Opening tool	0770431
<p>SRT-6 is used to open phone covers. Note: The SRT-6 is included in the Nokia Standard Toolkit.</p>			
	SS-93	Opening tool	0780727
<p>SS-93 is used for opening JAE connectors. Note: The SS-93 is included in Nokia Standard Toolkit.</p>			

■ **Cables**

The table below gives a short overview of service devices that can be used for testing, error analysis and repair of product. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

	MXHT83QE3000	RF cable	0730231
<p>The RF cable is used to connect, for example, a module repair jig to the RF measurement equipment. Attenuation for:</p> <ul style="list-style-type: none"> • Cell band: 0.5+-0.1 dB 			
	CA-128RS	RF cable	
<p>The RF cable is used to connect, for example, a module repair jig to the RF measurement equipment.</p>			

XRS-6 - common RF attenuation				
GSM Bands				
Band	default f/MHz RX	Attenuation RX	default f/MHz TX	Attenuation TX
GSM 850	881.6	0.27	836.6	0.27
GSM 900	942.4	0.29	897.4	0.27
GSM 1800	1842.8	0.47	1747.8	0.44
GSM 1900	1960.0	0.47	1880.0	0.46
WCDMA Bands				
Band	default f/MHz RX	Attenuation RX	default f/MHz TX	Attenuation TX
WCDMA I	2140.0	0.51	1950.0	0.47
WCDMA II	1960.0	0.47	1880.0	0.46
WCDMA III	1842.4	0.47	1747.4	0.44
WCDMA IV	2140.0	0.51	1740.0	0.44
WCDMA V	880.0	0.27	835.0	0.27
WCDMA VI	880.0	0.27	835.0	0.27
WCDMA VII	2655.0	0.51	2535.0	0.50
WCDMA VIII	942.6	0.29	897.6	0.27
WCDMA IX	1862.4	0.47	1767.4	0.44
WLAN Bands				
Band	default f/MHz RX	Attenuation RX	default f/MHz TX	Attenuation TX
WLAN/BT	2442.0	0.50	2442.0	0.50
WiMAX	2598.0	0.50	2598.0	0.50
FM				
Band	default f/MHz RX	Attenuation RX	default f/MHz TX	Attenuation TX
FM	103.0	0.10	103.0	0.10
GPS				
Band	default f/MHz RX	Attenuation RX	default f/MHz TX	Attenuation TX
GPS/RX	1575.5	0.40	n / a	n / a
Comment 1: The default frequency is center band for the Phoenix RF losses in MHz				
Comment 2: All Attenuations measured in dB				
Comment 3: All Attenuations accurate to +/- 0.1 dB				

■ **Service concepts (Nokia)**

POS (Point of Sale) flash concept

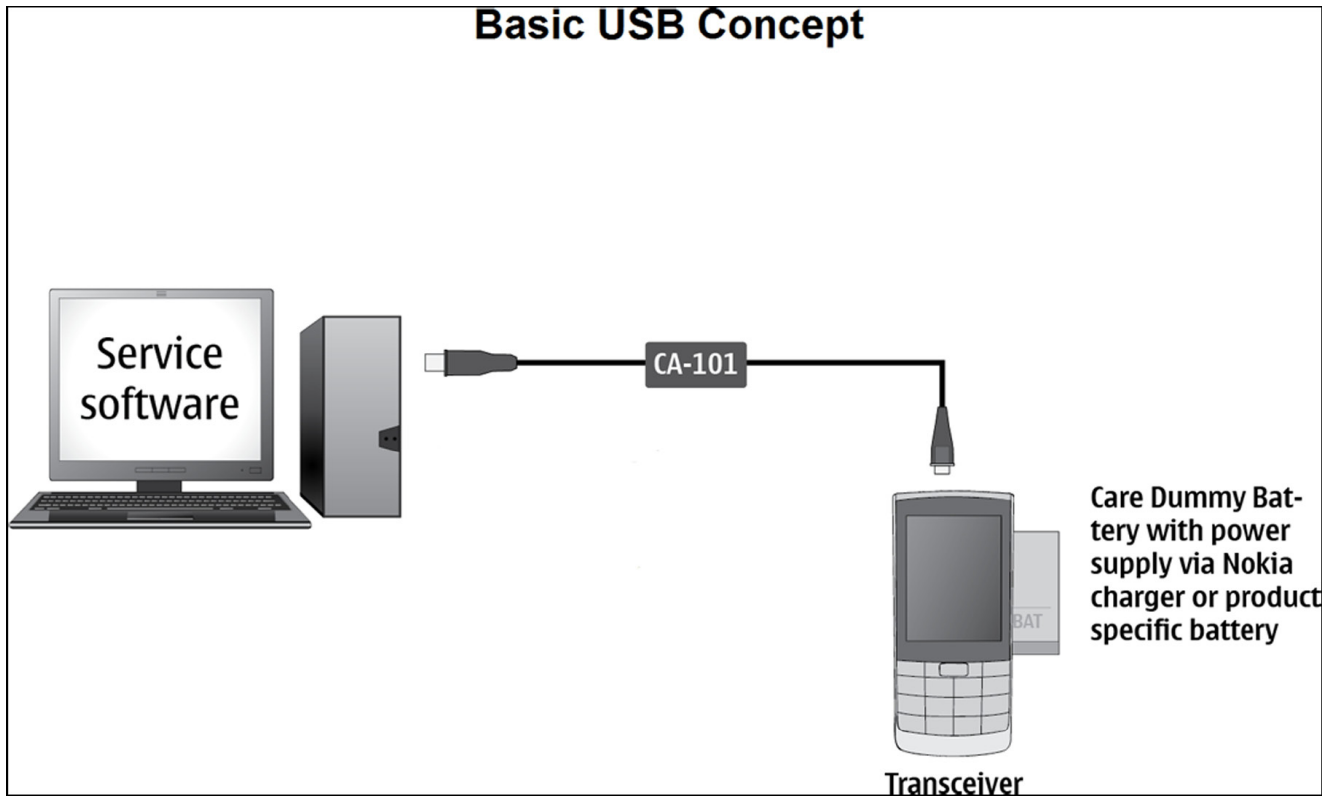


Figure 2 POS flash concept

Type	Description
Product Specific Devices	
BP-3L	Battery
Cables	
CA-101	Micro USB cable

Concept for flashing and product code change

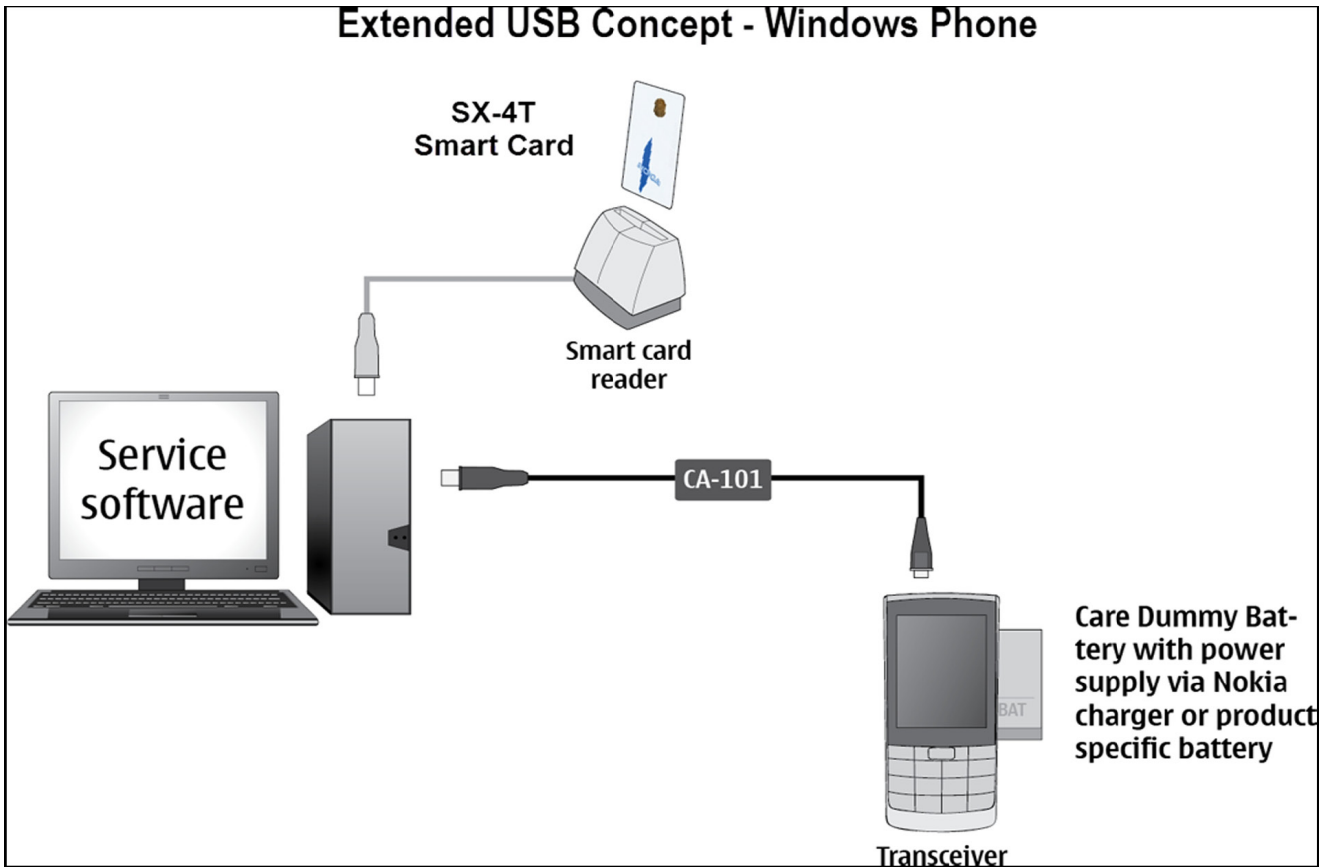


Figure 3 BE concept for flashing and product code change

Type	Description
Product Specific Devices	
BP-3L	Battery
Other Devices	
SX-4T	Smart Card
Cables	
CA-101	Micro USB cable

Optional Module jig service concept 1 (Troubleshooting)

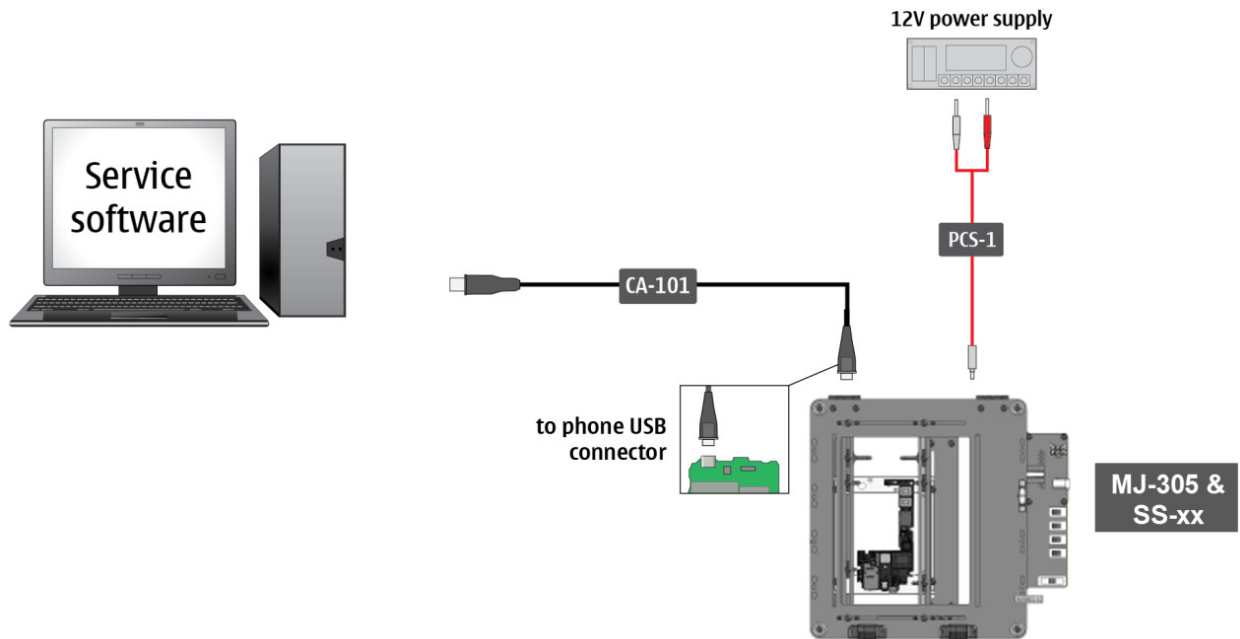


Figure 4 BE Module jig service concept 1

Type	Description
Product Specific Devices	
MJ-305	Module jig
SS-280	RF guide plate
Cables	
CA-101	Micro USB cable
PCS-1	DC Power cable

Optional Module jig service concept 2 (Troubleshooting + RF Measurement)

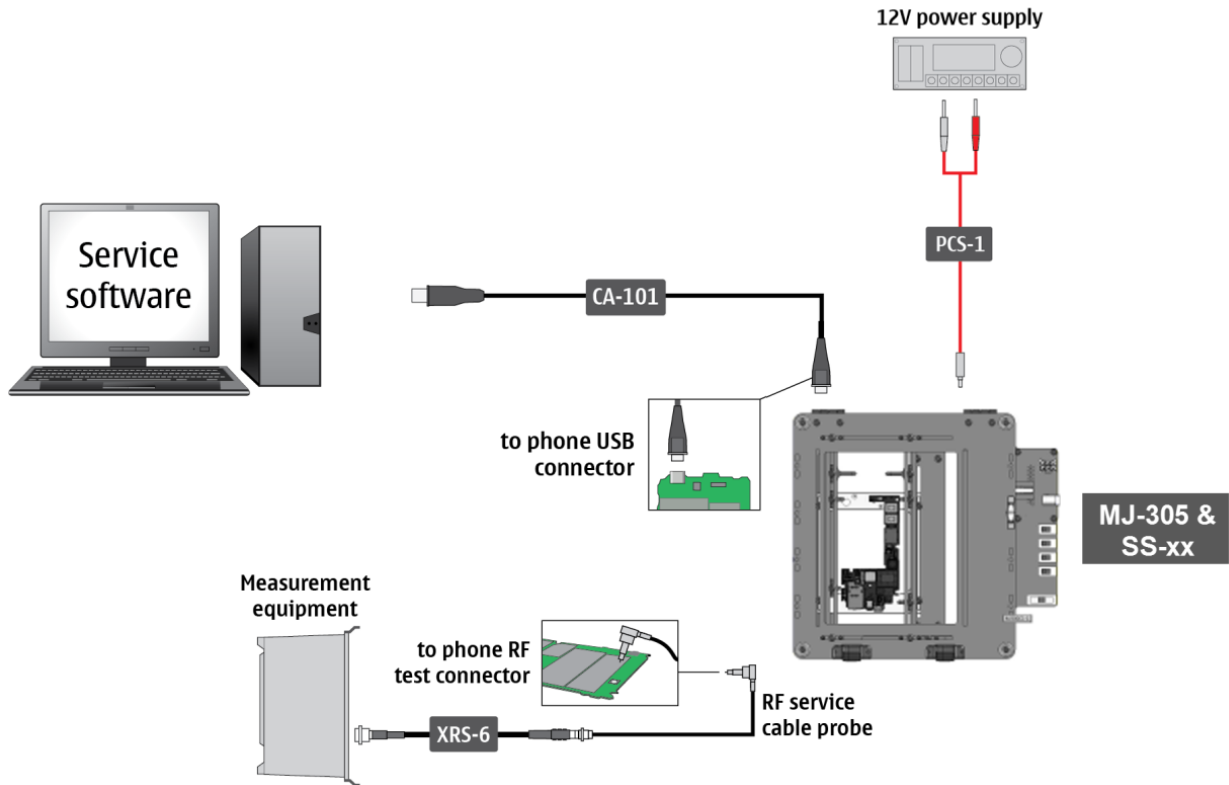


Figure 5 BE Module jig service concept 2

Type	Description
Product Specific Devices	
MJ-305	Module Jig
SS-280	RF guide plate
Cables	
CA-101	Micro USB cable
PCS-1	DC Power cable
XRS-6	RF cable

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3 - BB Troubleshooting and Manual Tuning Guide

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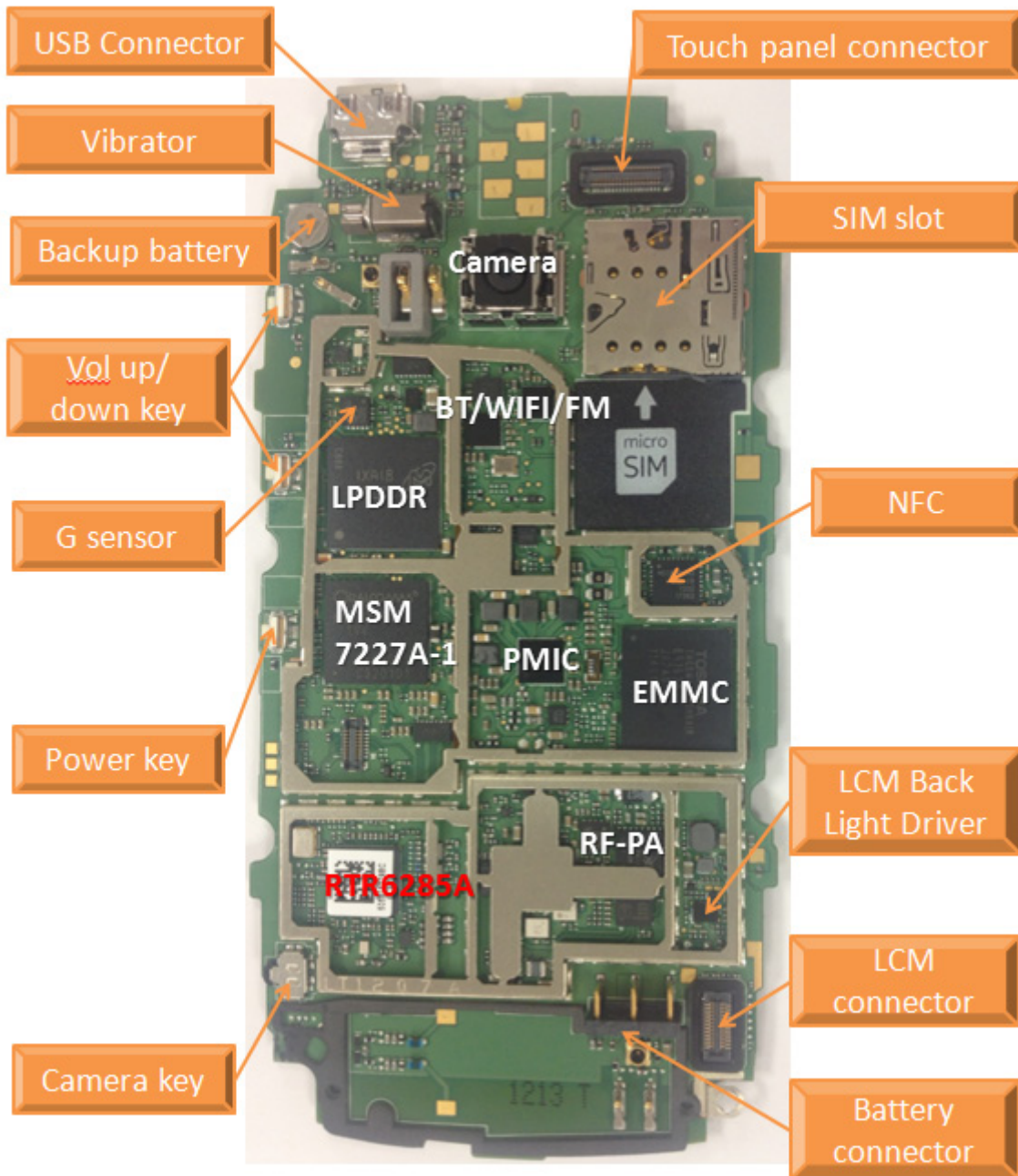
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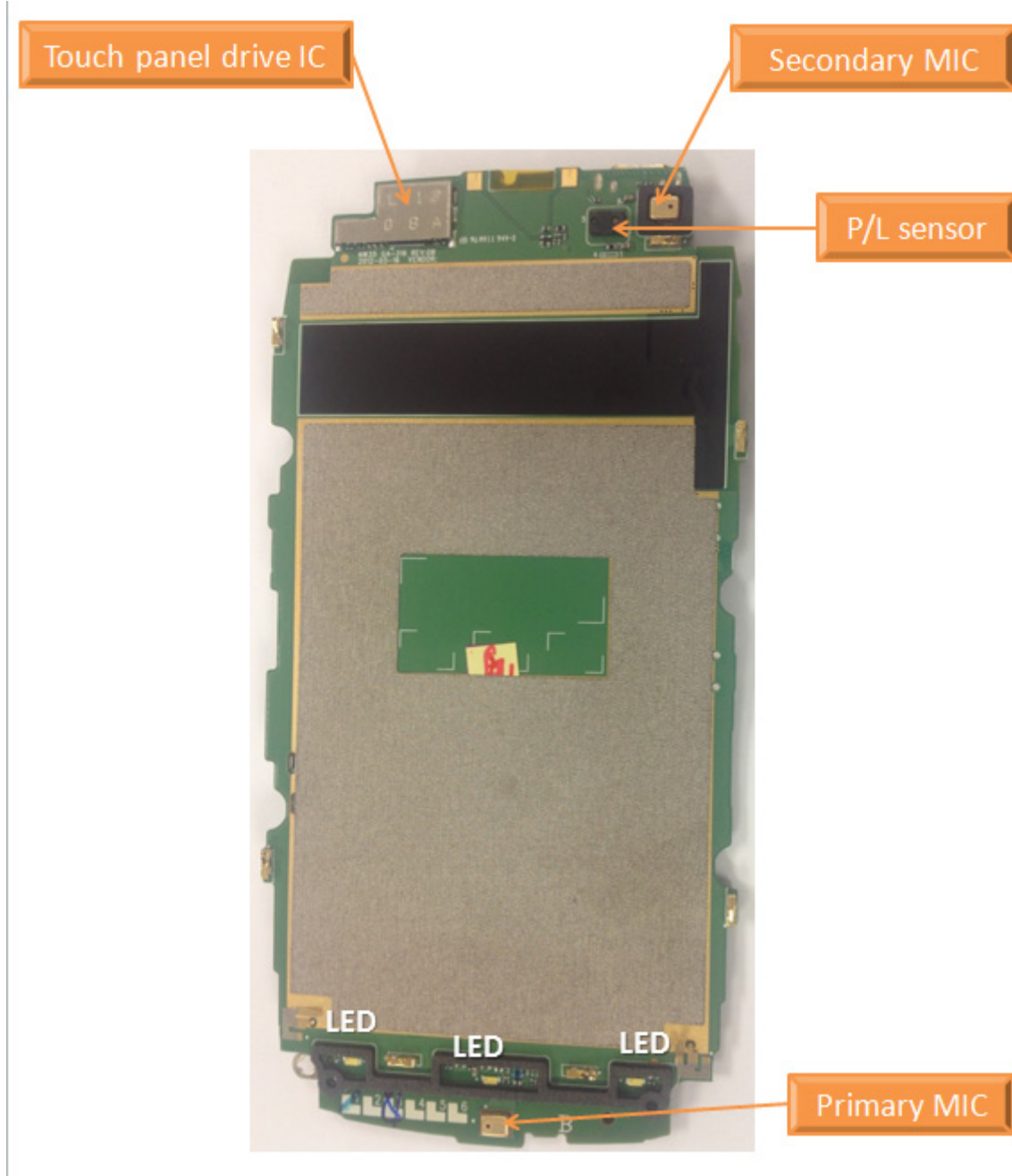
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■ Placement

Placement – Main Board (Top side)



Placement - Main Board (Bottom side)



Placement -Unibody



Placement -LCD Panel

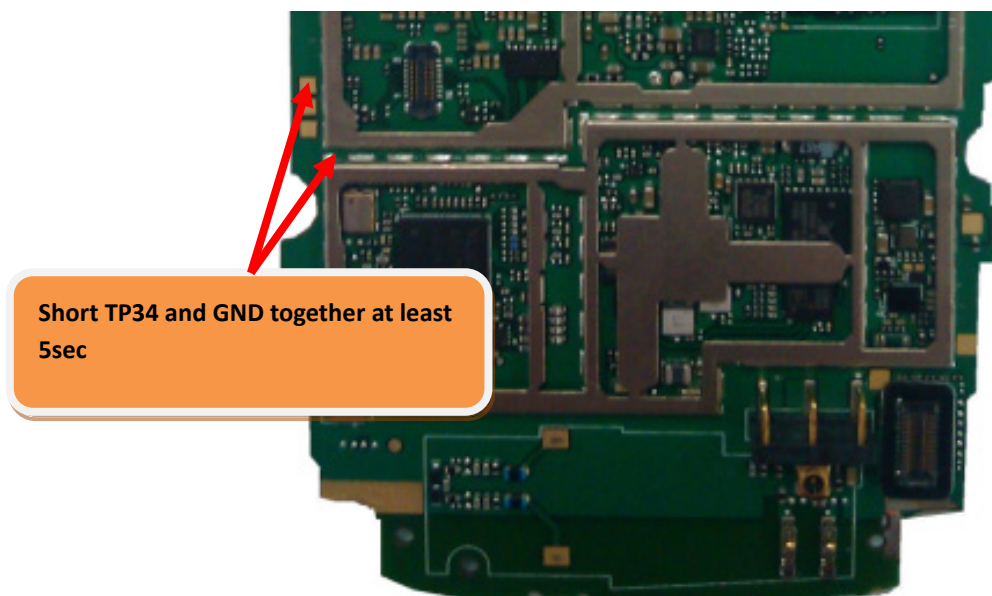


■ How to power on Handset

1. Push power key



2. Short TP11 and GND.



■ On-Device Diagnostic Tool

ODDT Installation

1. Enter ##634# on the on-screen keypad
2. Diagnostics app appears in Apps list

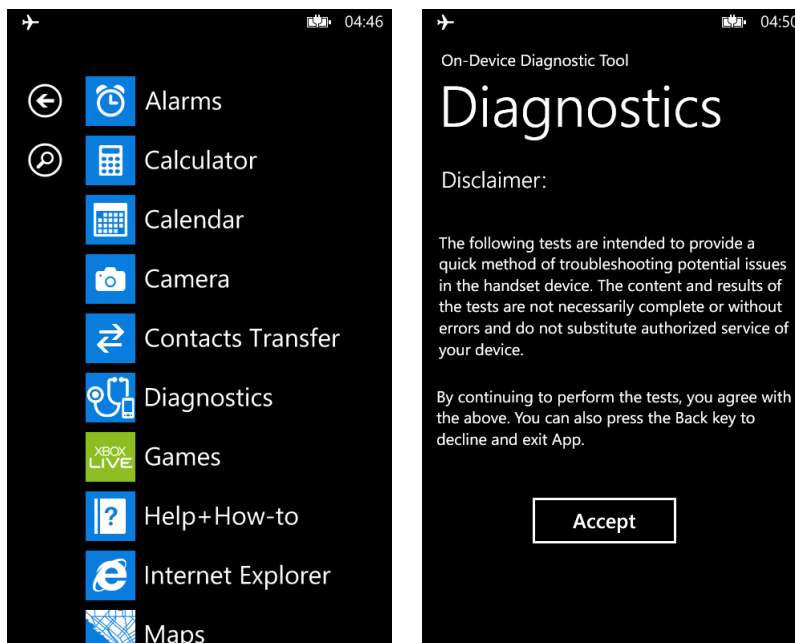
ODDT Removal

1. Tap and hold Diagnostics in the Apps list
2. Tap uninstall

Note: always remove the tool before returning the phone to the consumer

Disclaimer screen

Displayed when the user launches the ODDT application, the user must click on accept to proceed, Pressing the back '←' key will exit the application.

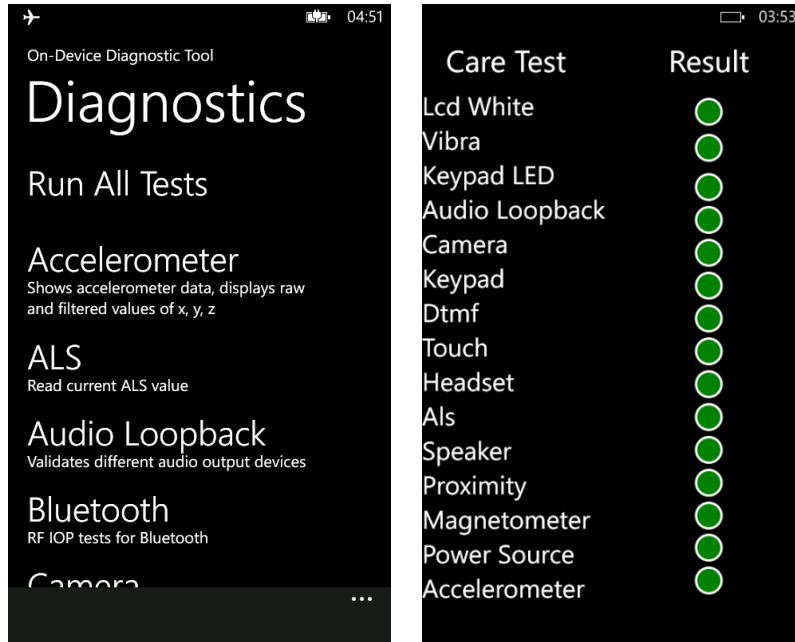


ODDT test item:

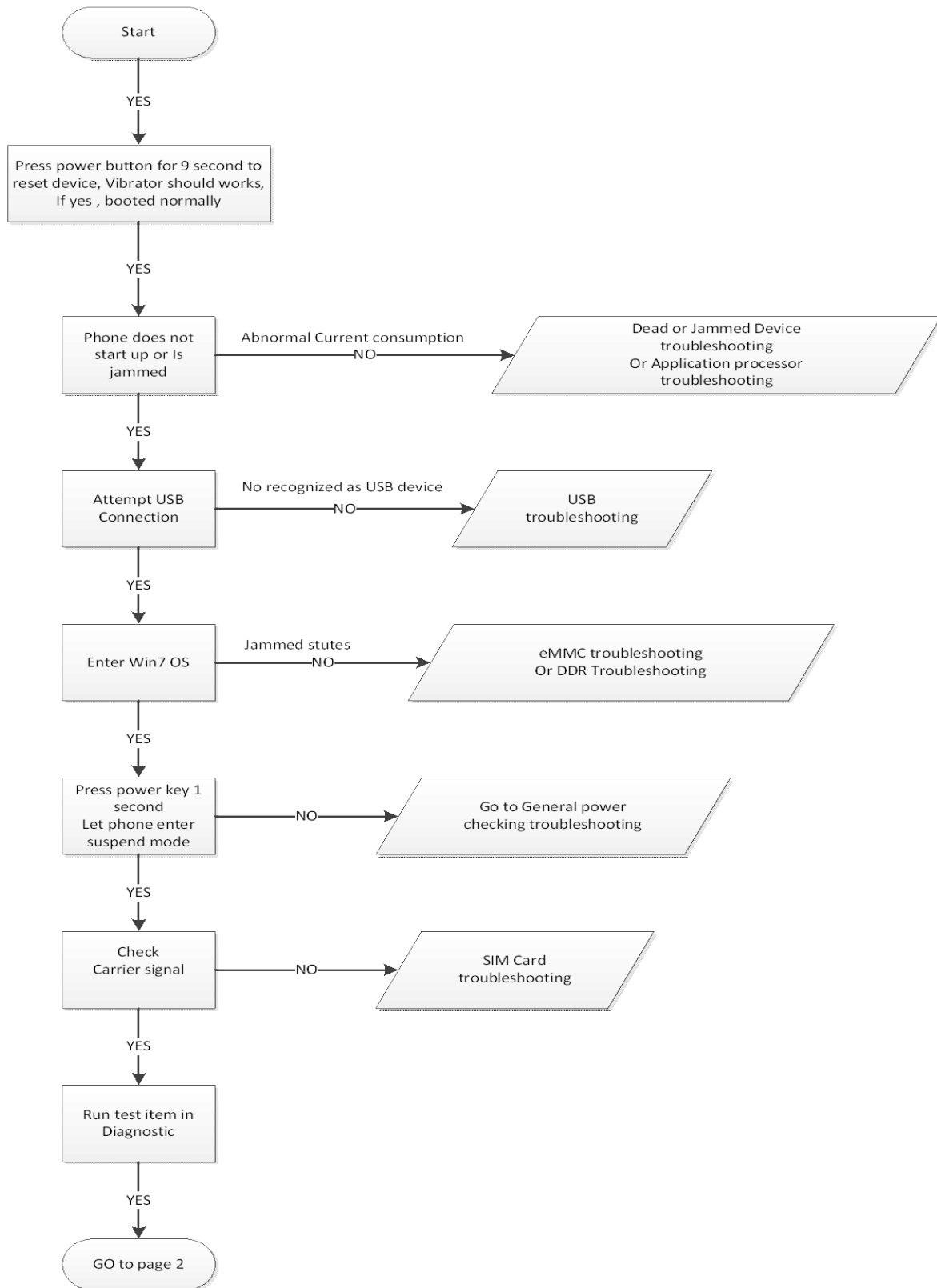
- ALS – Read current ALS value
- Audio loopback – Validates different audio output devices
- Camera – Verify image capture
- DTMF – Test DTMF tone generation.
- Hardware Buttons – Test hardware buttons.
- Headset detection – Validate headset connectivity
- Lights – Validates backlight functionality.
- Magnetometer – Reads current Magnetometer values.
- NFC – Validates NFC hardware.
- Power Source – Detects the active power source, either Battery or External
- Proximity – Shows the status of proximity sensor.
- Speaker – Validate basic integrity of speaker.
- Touch – Validate basic integrity of touch screen by allowing user to draw on screen.
- Vibrator – Validate basic integrity of vibrator

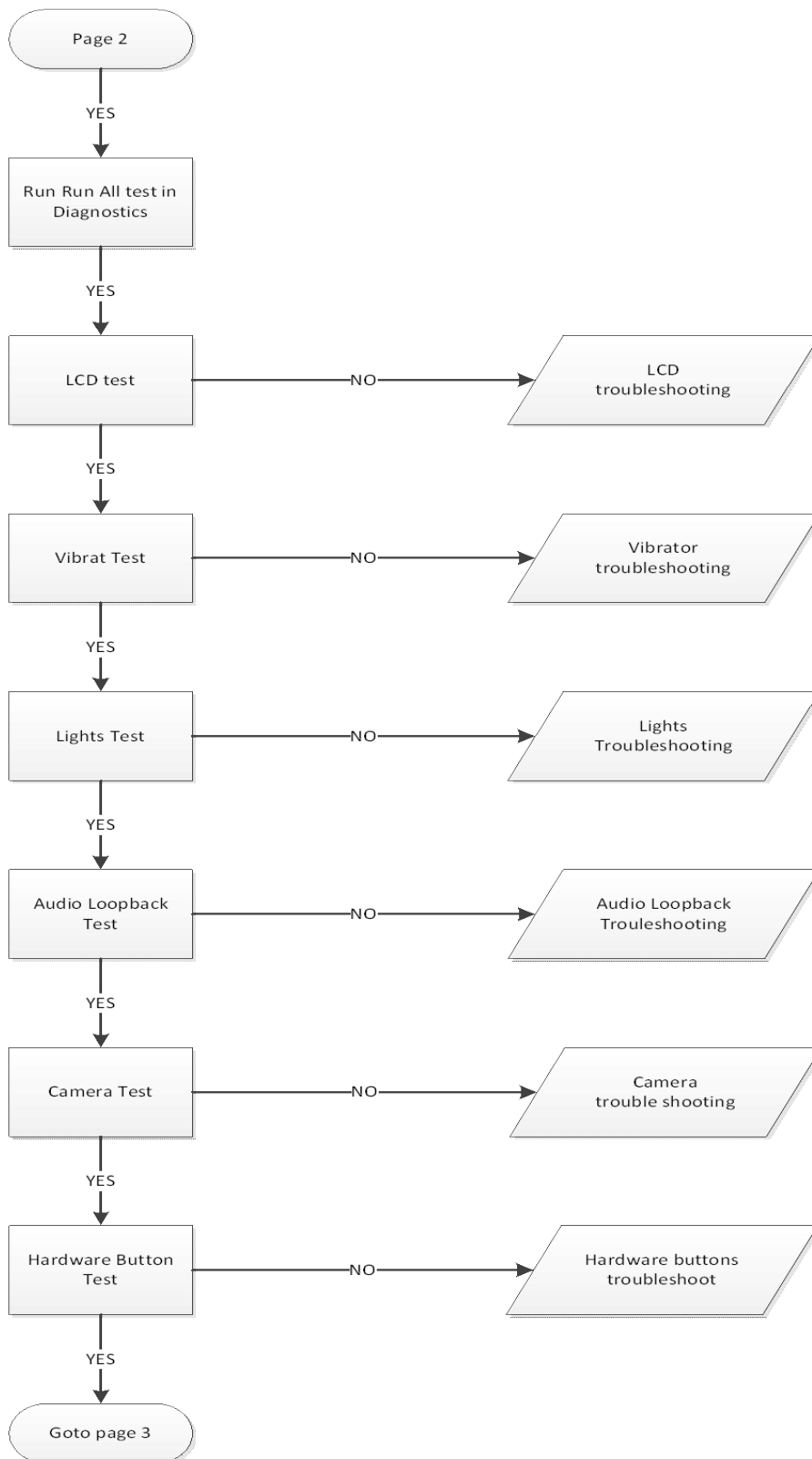
Run All Tests

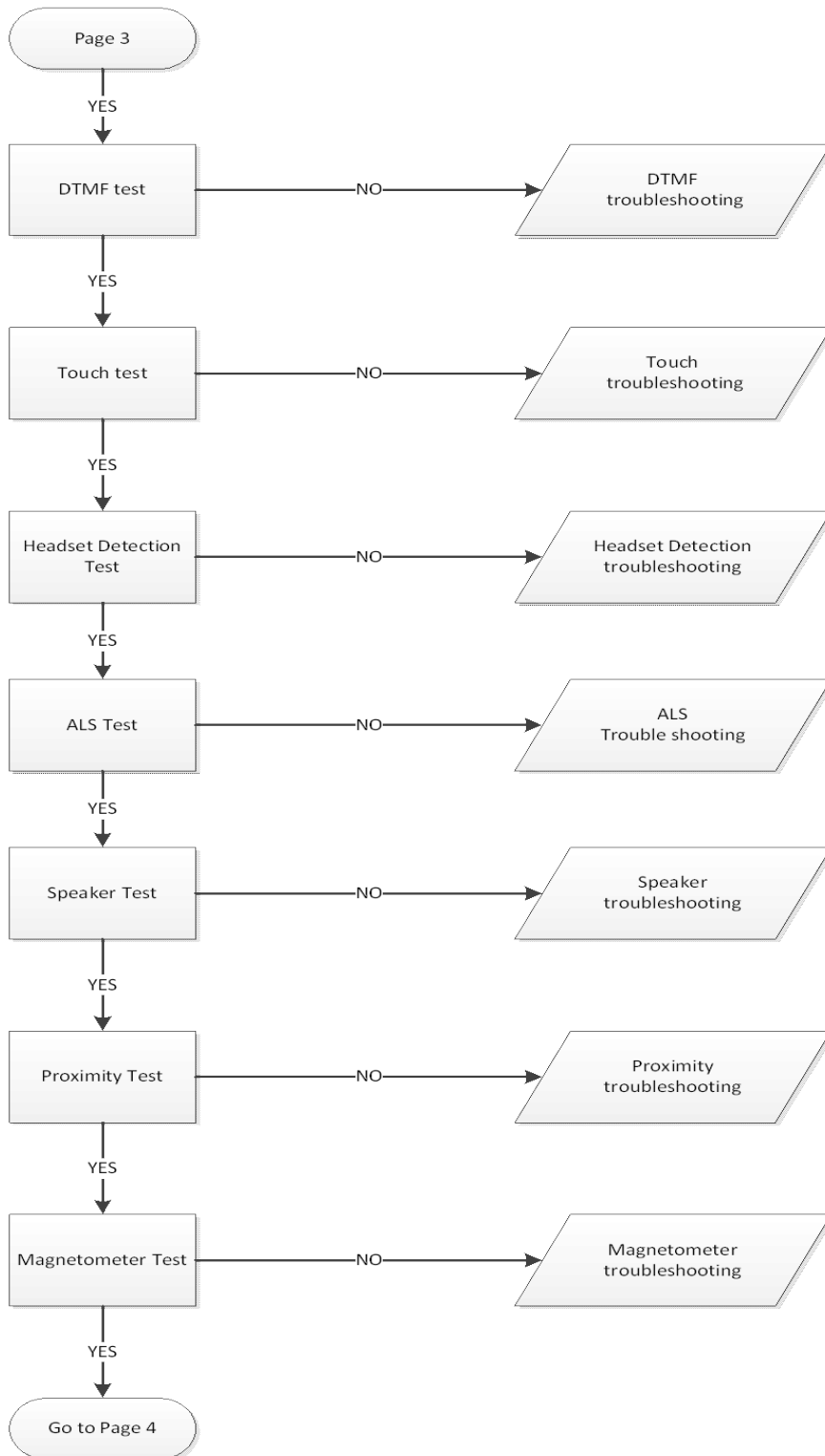
When the user selects 'Run all tests', all the tests are executed sequentially, At the end of every test, the user is asked to input the result of the test (pass/fail) according to him/her, At the end of the sequence, the result is shown (as shown on the under, Pressing the back '←' key will take the user to the main test menu).

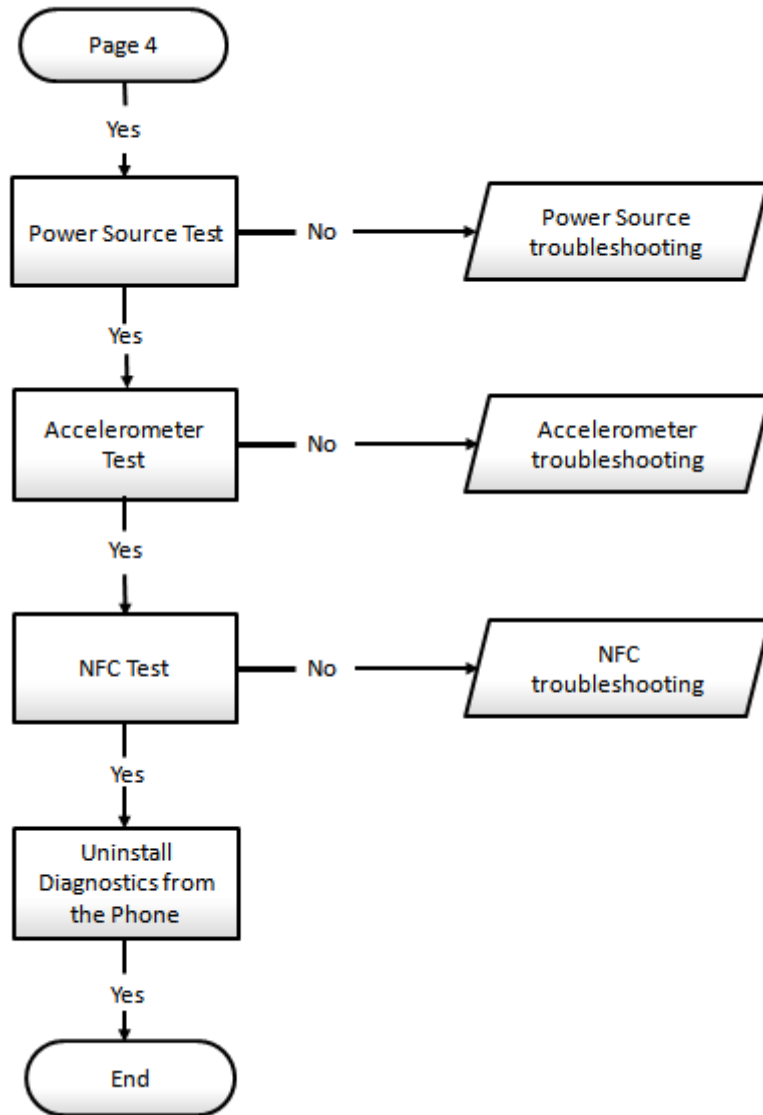


■ **Troubleshooting flow**

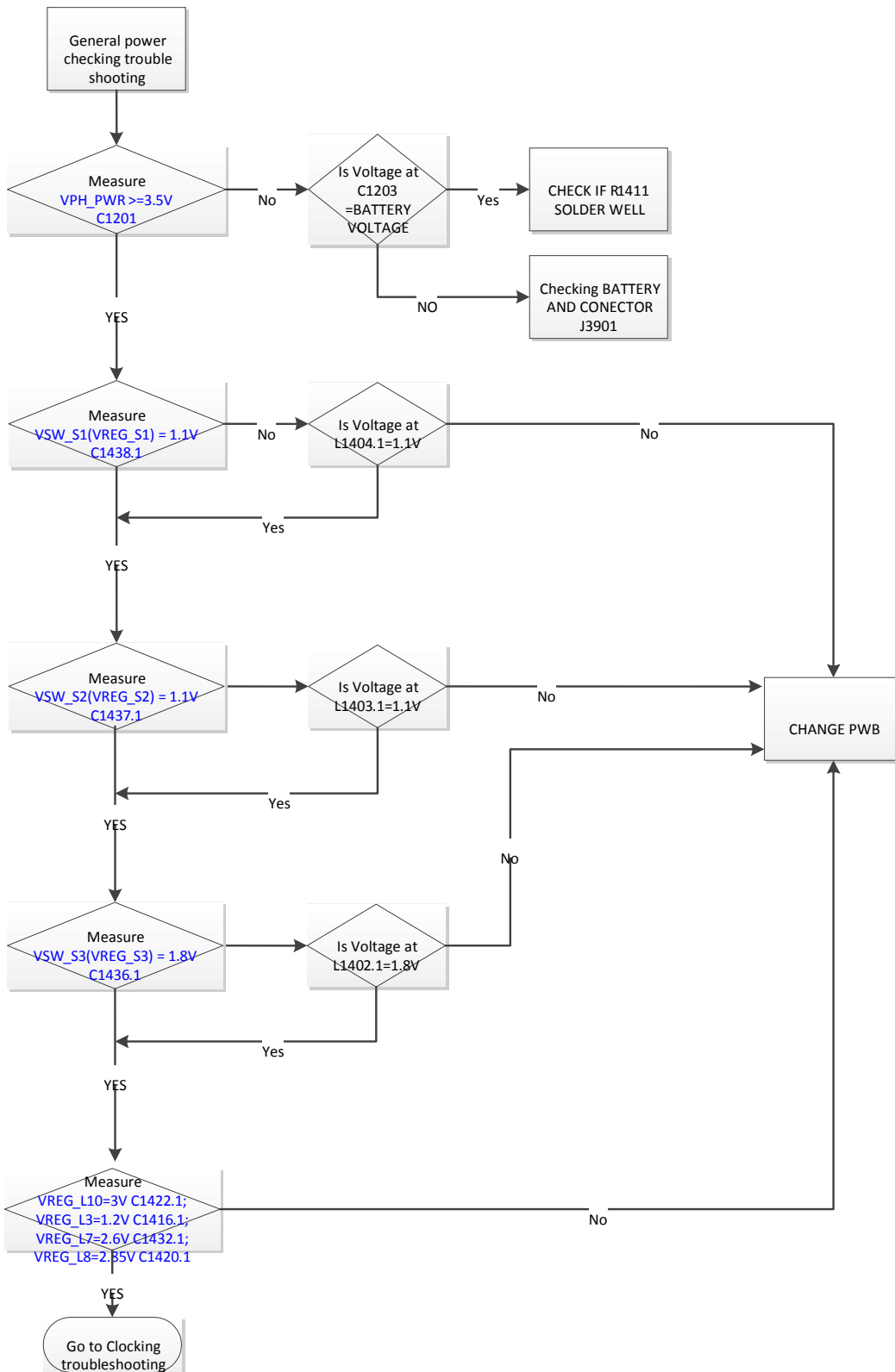




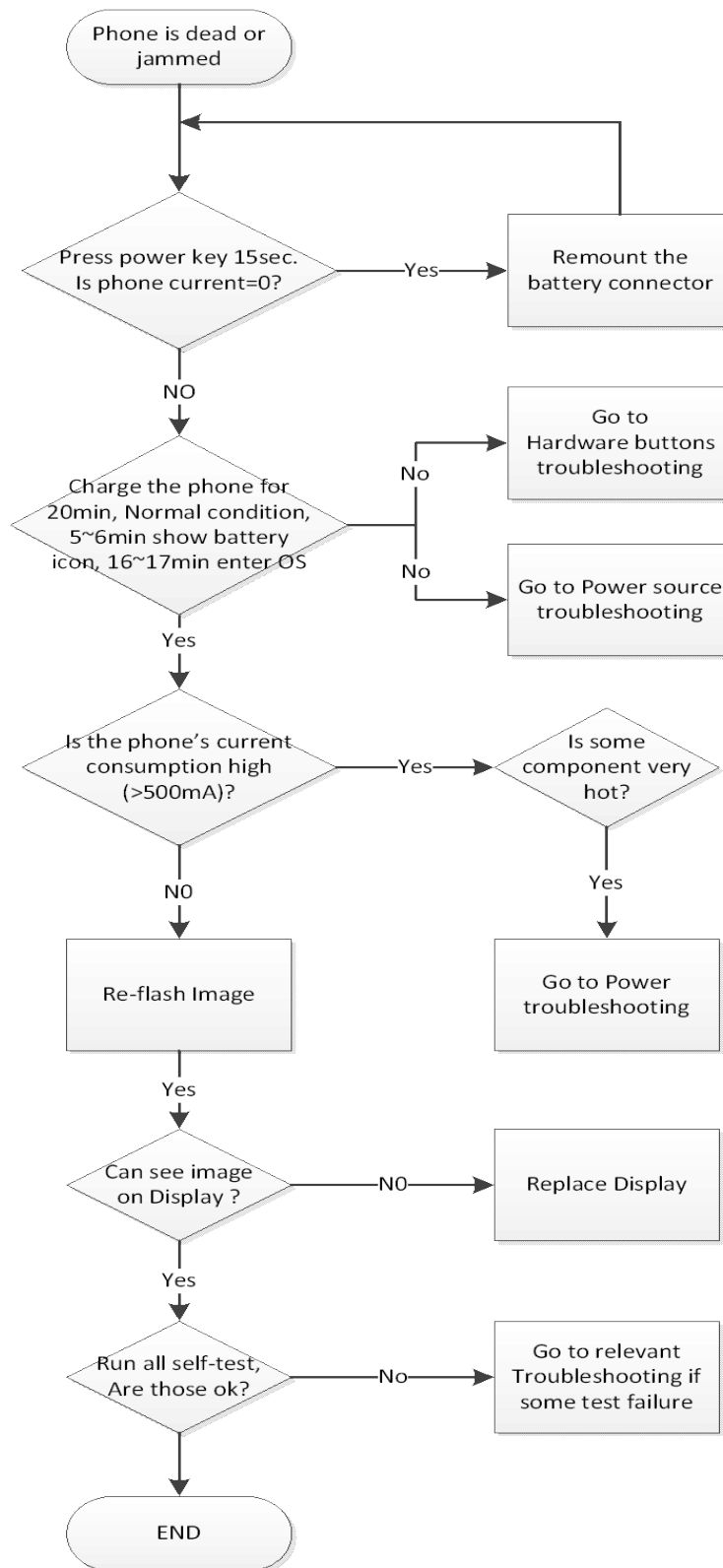




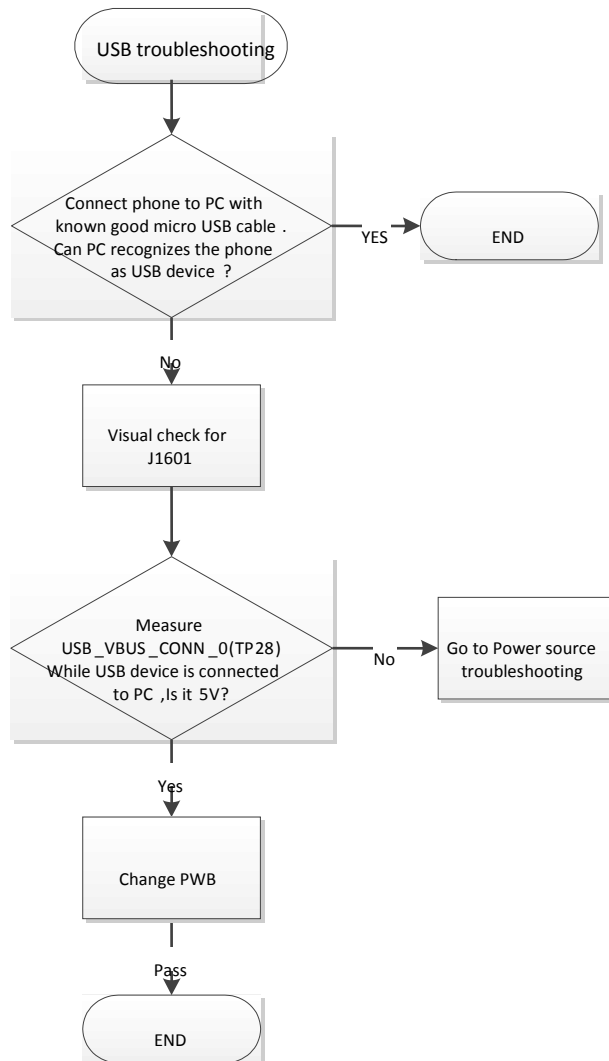
General power checking troubleshooting



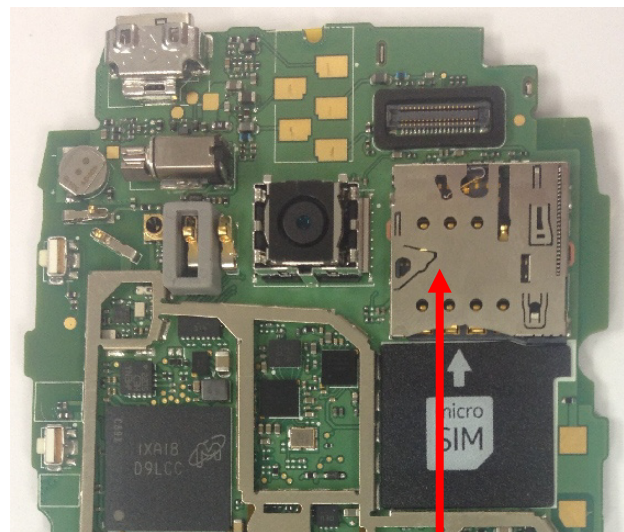
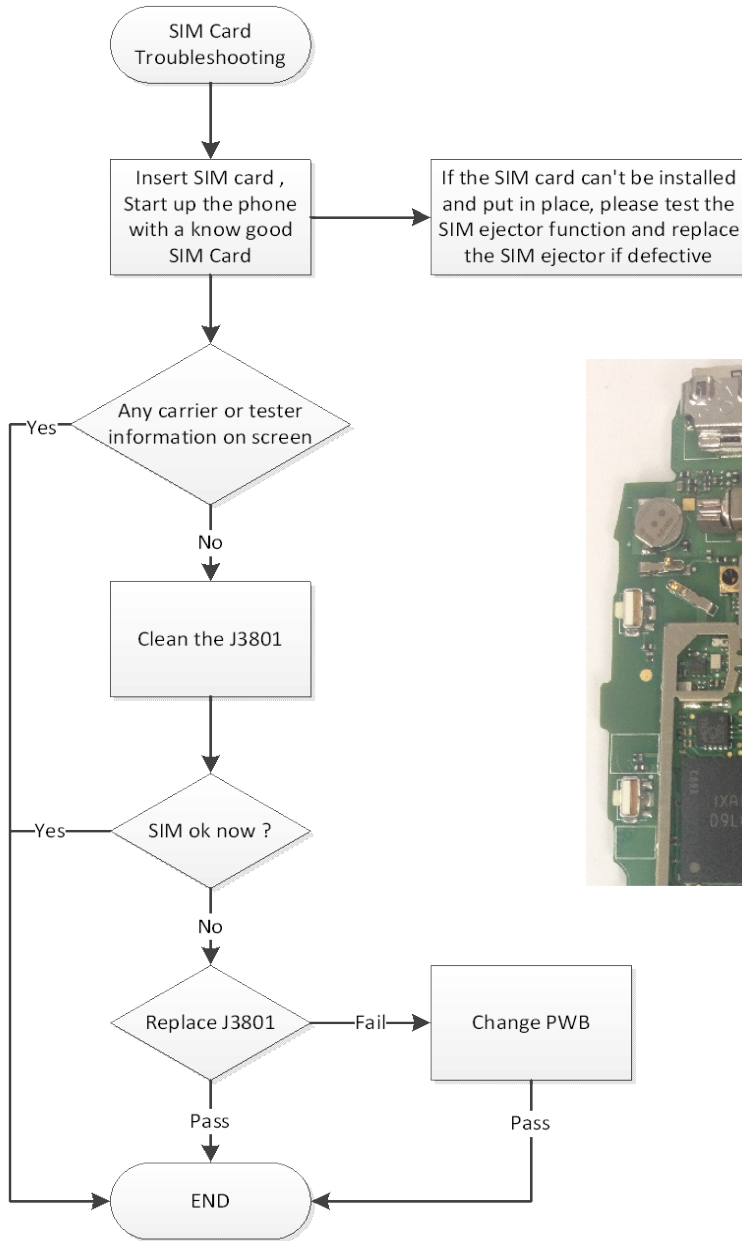
Dead or jammed device troubleshooting



USB troubleshooting

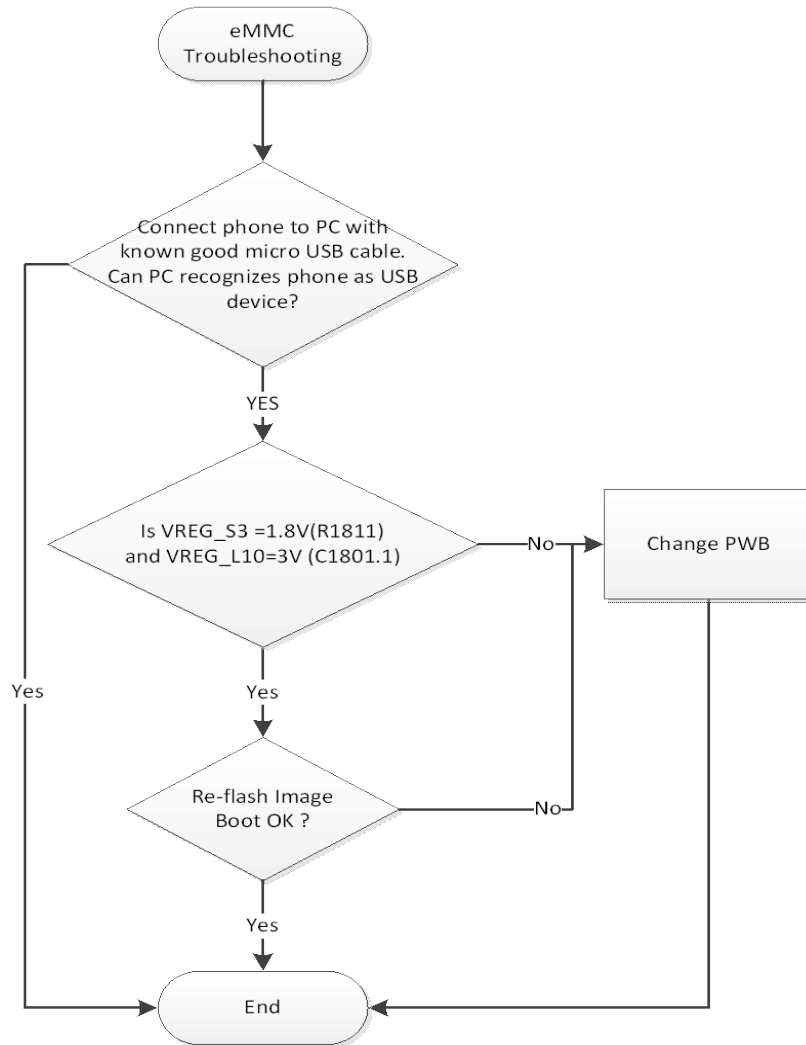


SIM Card troubleshooting

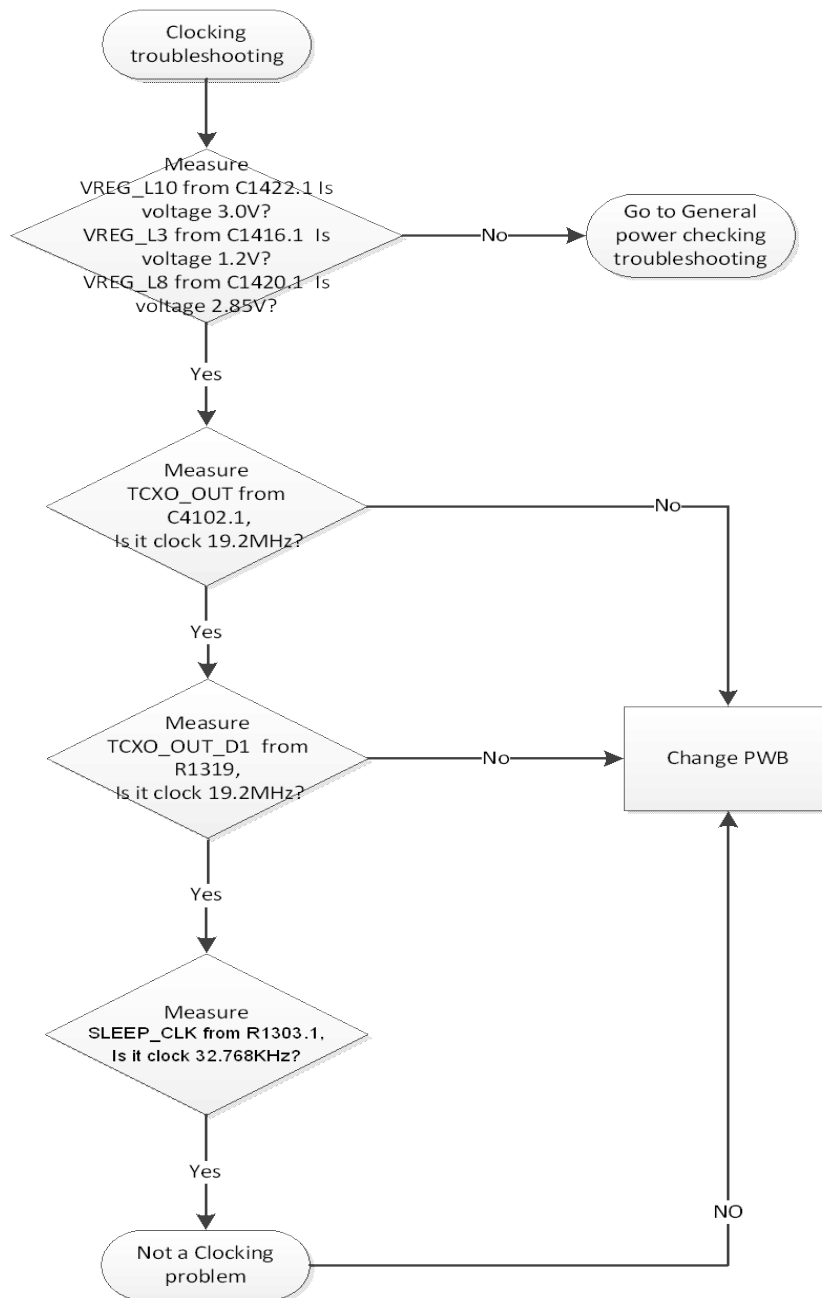


Micro SIM connector

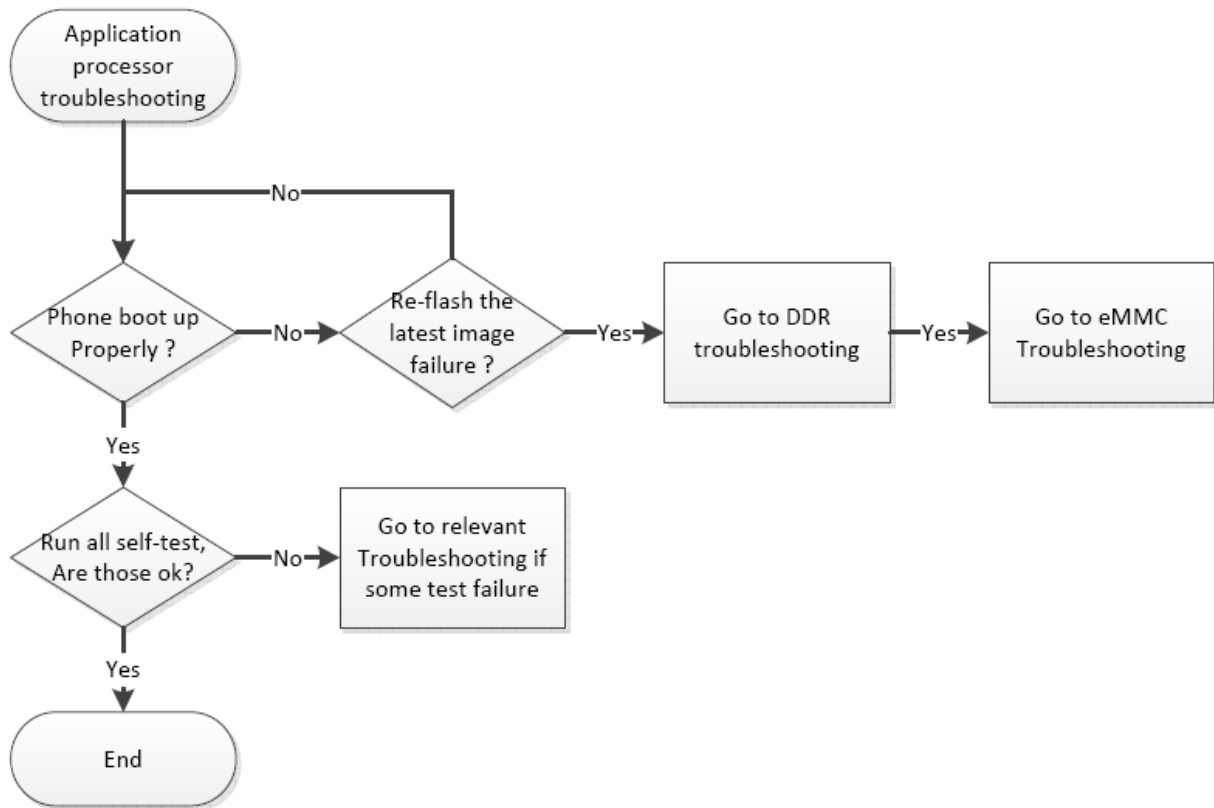
eMMC troubleshooting



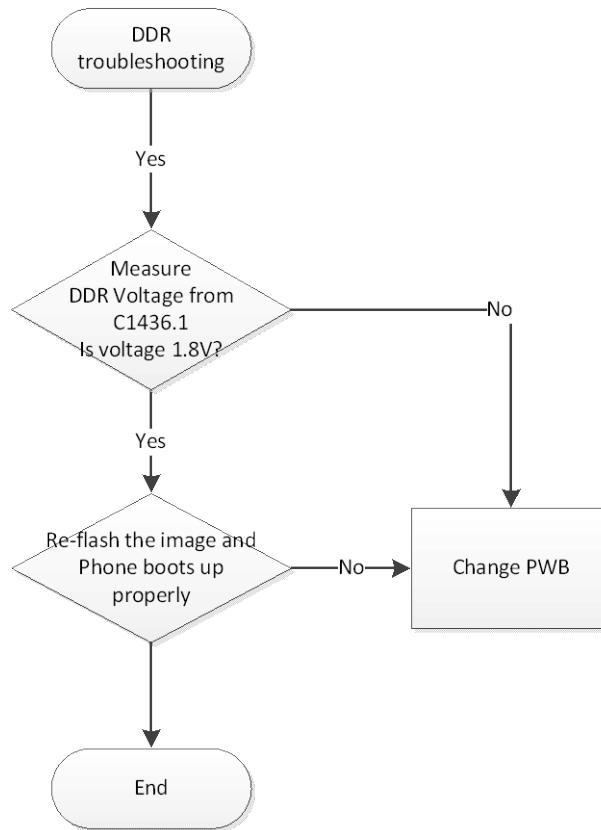
Clocking troubleshooting



Application processor troubleshooting



DDR troubleshooting



Accelerometer test

Displayed data:

- Numeric values for X, Y and Z direction movement
- Raw and filtered data (amplitude changes < 0.05 are ignored) will be displayed
- A moving ball

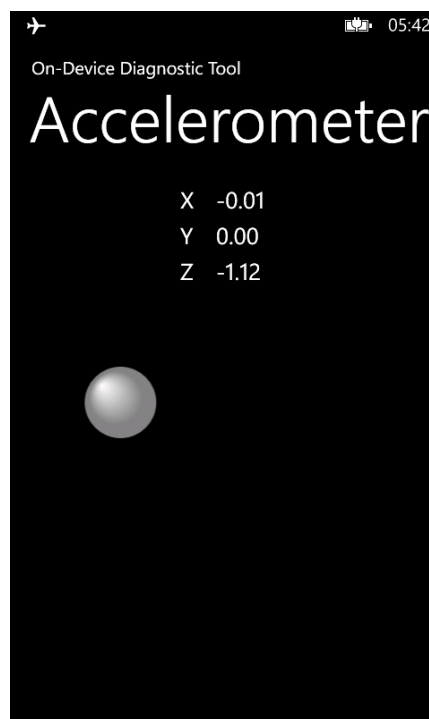
User can change settings for:

- none

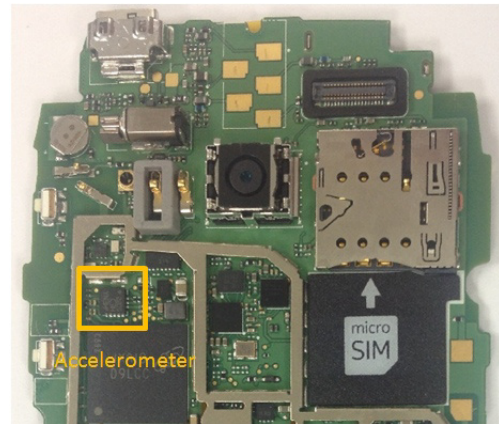
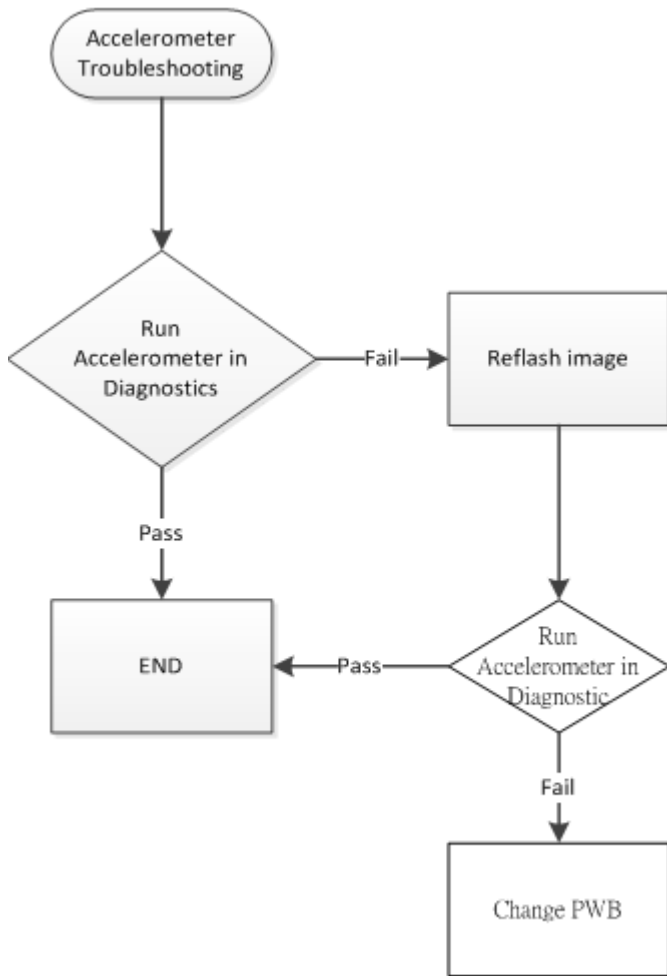
User can test:

- Movements of the device will change displayed values
- A ball will move around on the screen to visualize the tilt of the device

Pressing the back '←' key will navigate back to the main menu



Accelerometer troubleshooting



ALS Test

Displayed data:

- Light intensity in mLux
- A gray scale rectangle with varying intensity

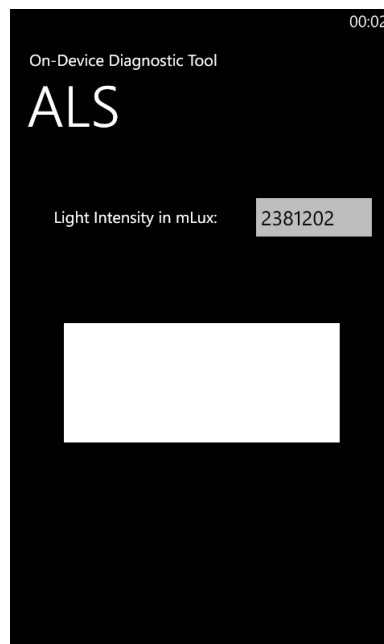
User can change settings for:

- N/A

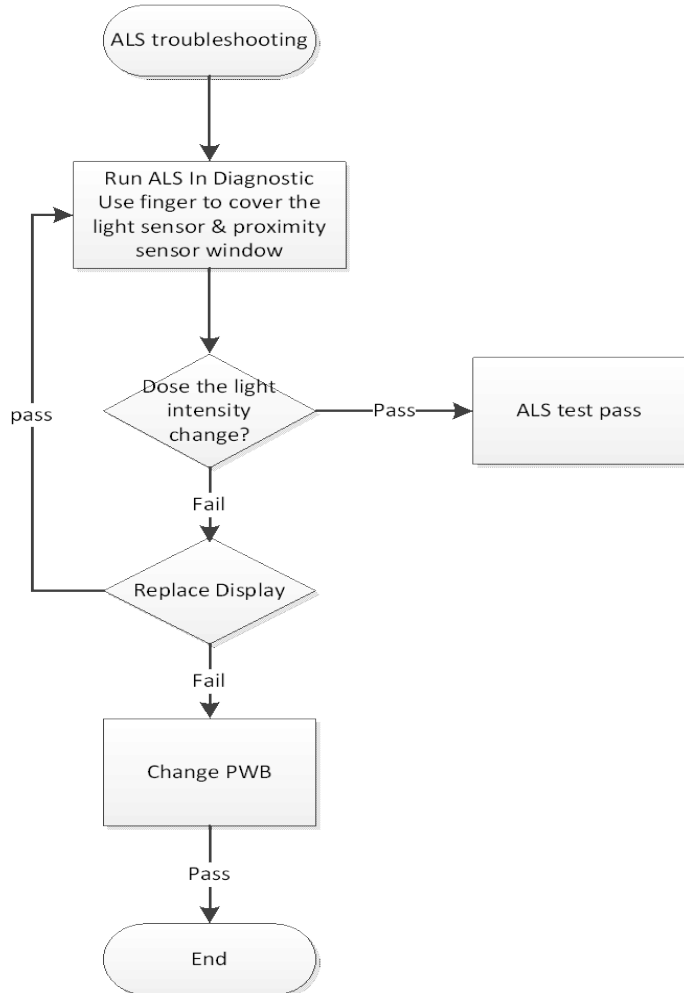
User can test:

- Cover the opening in the front of the phone over ALS component
- The value of the light intensity should change dynamically and displayed in the textbox
- The changing value can be visualized with changing brightness of the gray scale

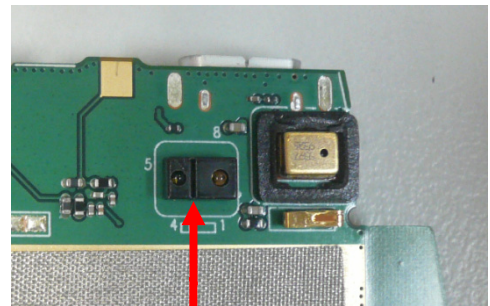
Pressing the back '←' key will take the user back to the application menu



ALS troubleshooting



Window of Proximity / Light sensor



Window of Proximity / Light

Audio Loopback test

Displayed data:

- none

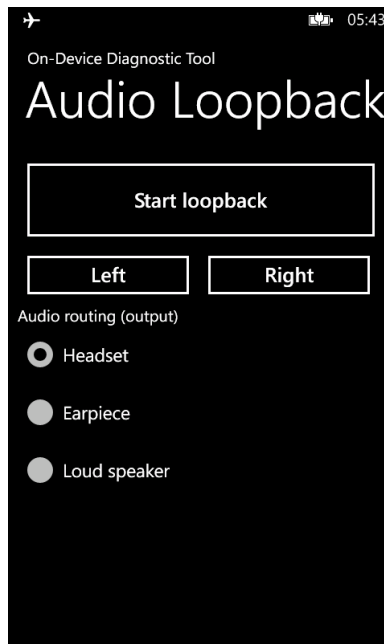
User can change settings for:

- Audio routing output
 - Headset
 - Earpiece
 - Loud speaker
- Headset audio channel (left/right)

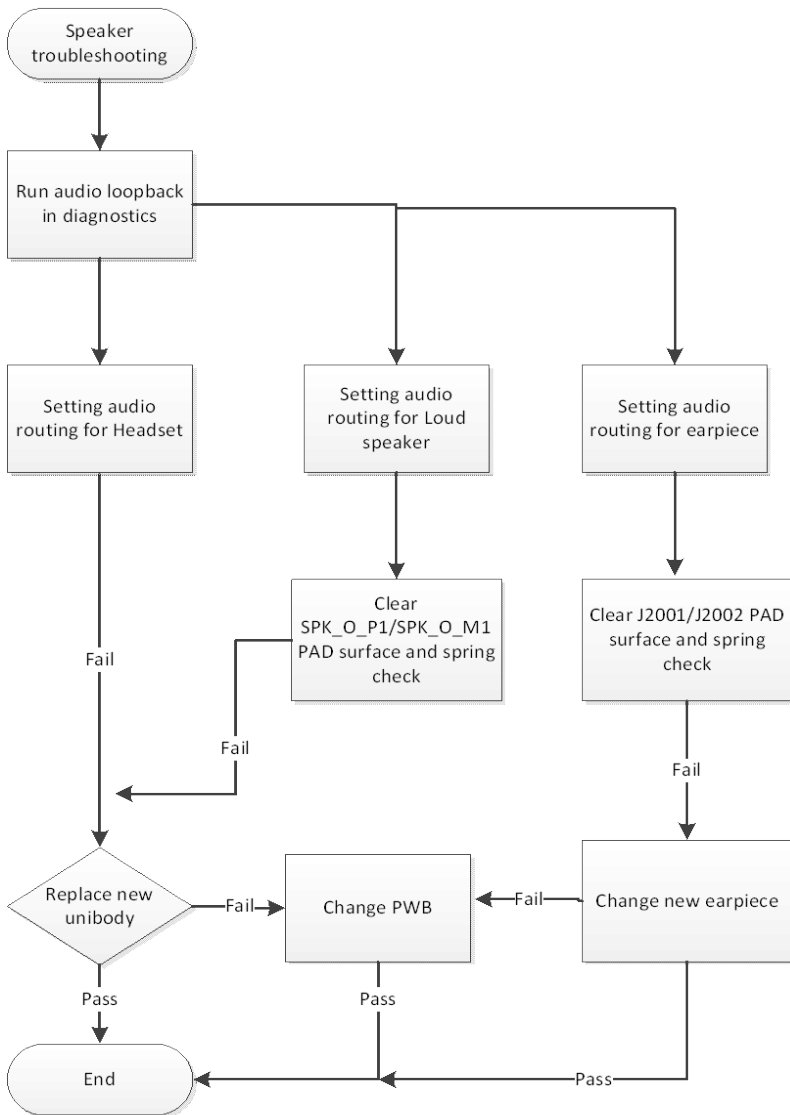
User can test:

- Pressing "Loopback On/Off" button starts/stops playback of audio received from the microphone with a slight delay
- The Audio routing will be transferred based upon the output location select
- When the output is set to headset, then user has an option to test headset channels (left/right) – a short clip will be played
- When user selects start loopback when output is set to headset, then the channel test is disabled

Pressing the back '←' key will navigate back to the main menu



Audio Loopback troubleshooting



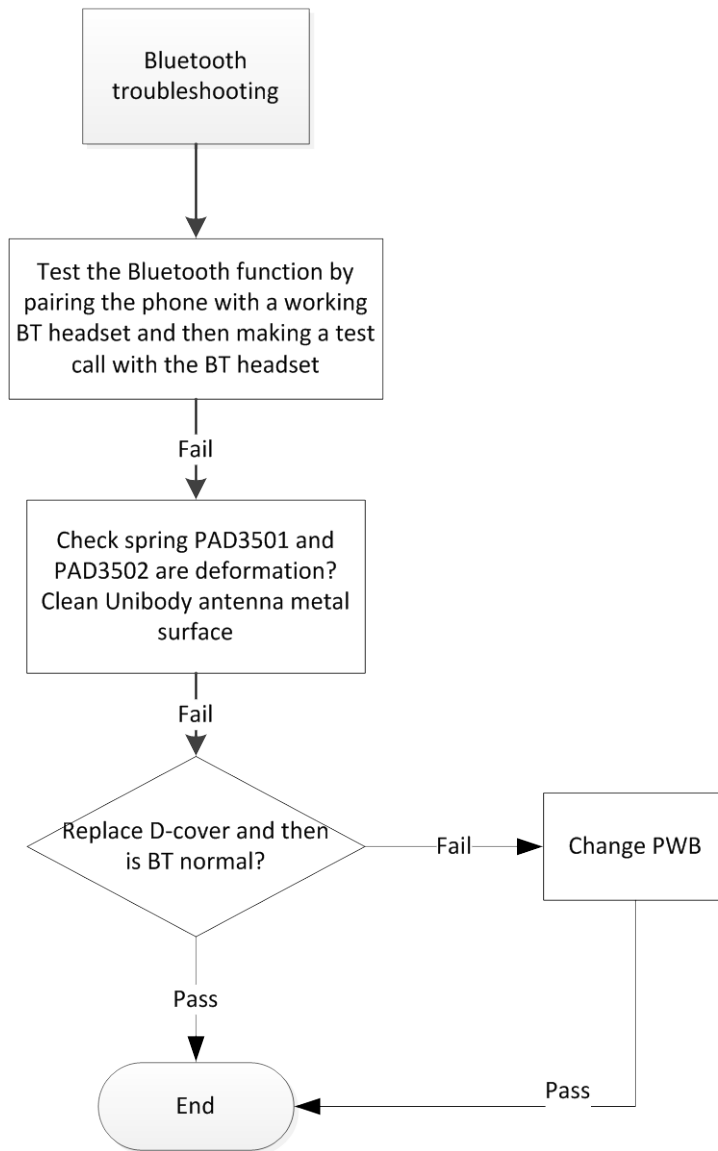
Speaker spring check



Earpiece spring check

Spare part:

Bluetooth troubleshooting



Camera test

Displayed data:

- none

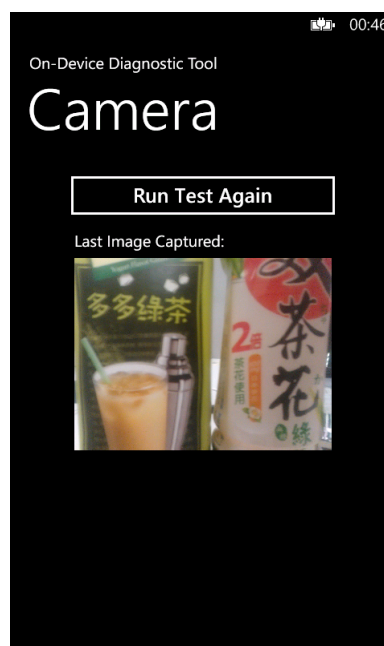
User can change settings for:

- none

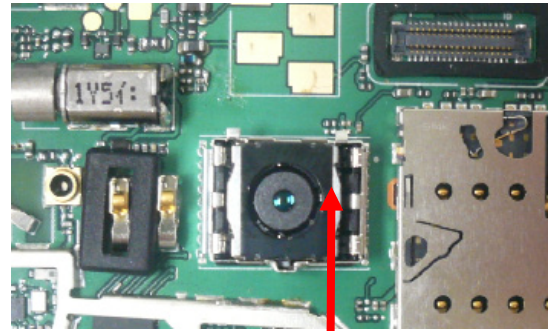
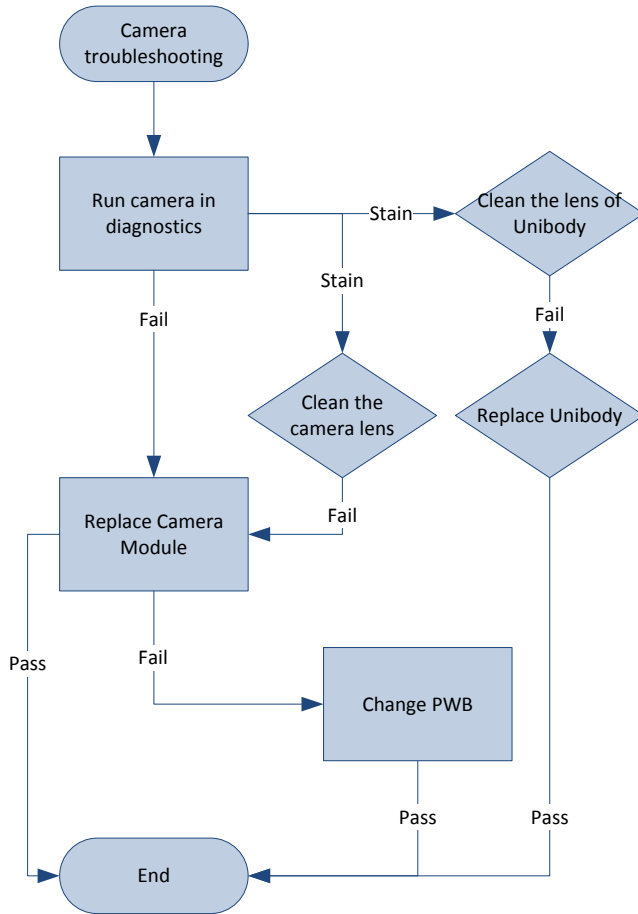
User can test:

- The phone views a camera viewfinder and a picture can be taken by pressing camera button. Captured picture is viewed then on Camera test view.
- "Run Test Again" button will show camera viewfinder and new picture can be captured.

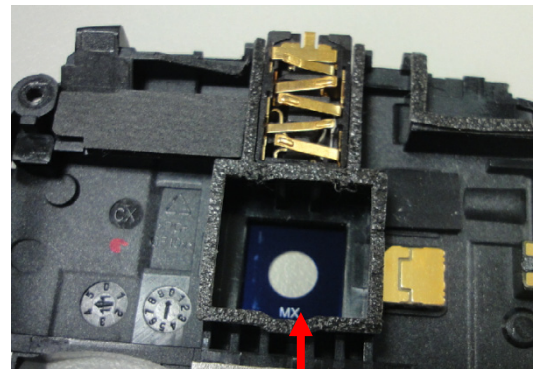
Pressing the back '←' key will navigate back to the main menu



Camera troubleshooting



Camera Module



Lens of unibody

Battery Status

Displayed data:

- Show the battery states
 - Battery voltage
 - Current

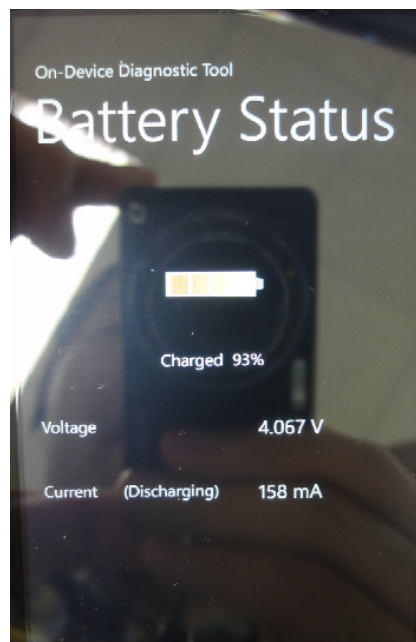
User can change settings for:

- none

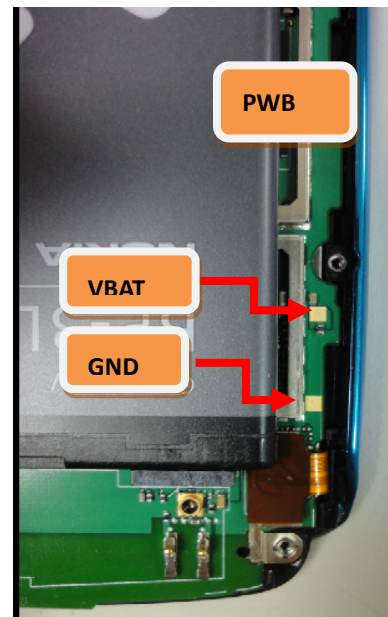
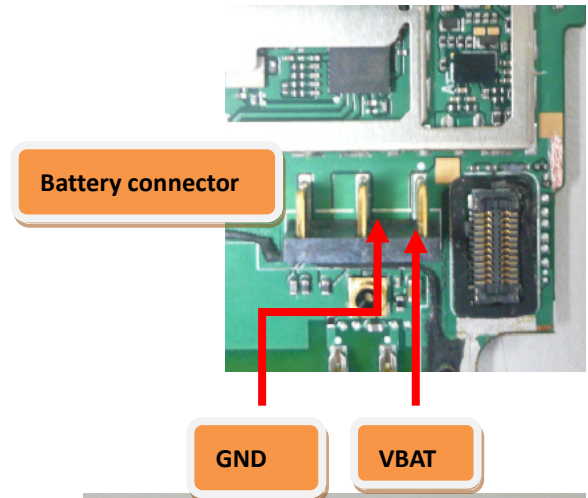
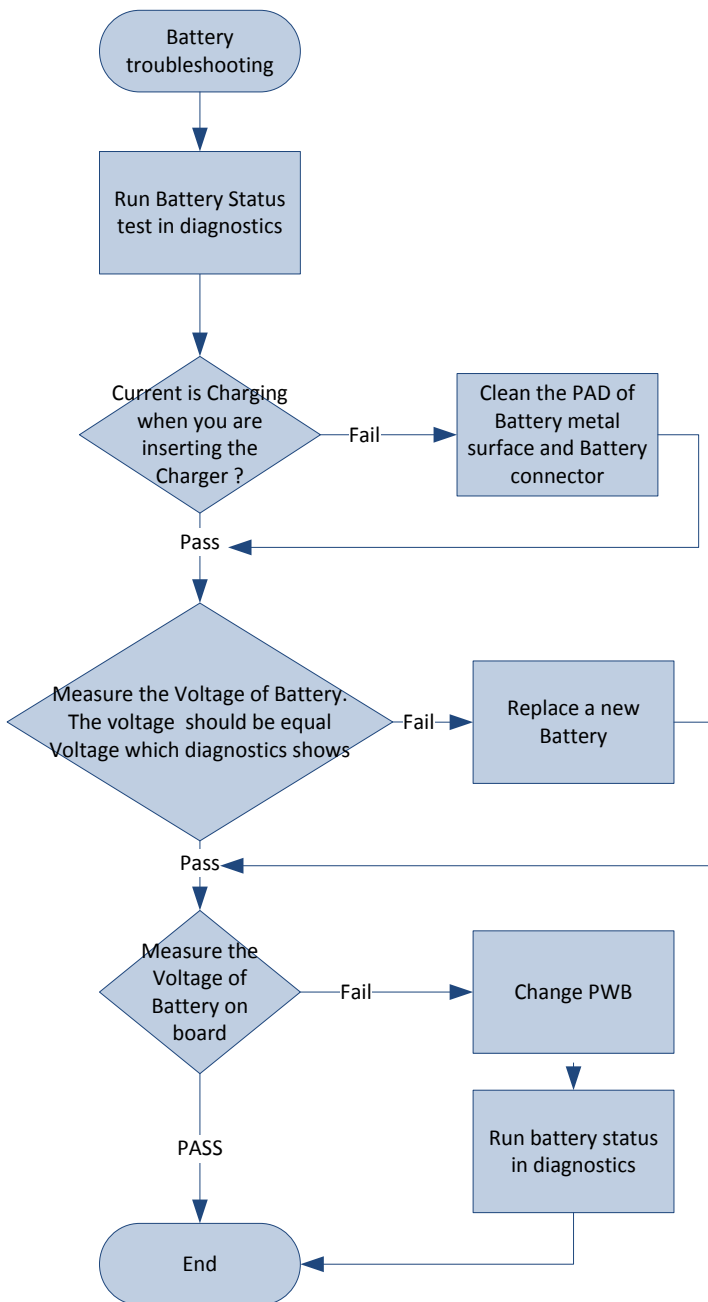
User can test:

- none

Pressing the back '←' key will navigate back to the main menu



Battery troubleshooting



DTMF test

DTMF test will proceed along a predefined pattern of sound output from the loud speaker followed by sound output from the earpiece. The UI will display the various DTMF buttons (1 – 0, A –D, * and #) which will produce the appropriate tones when tapped

Displayed data:

- The status message will update to display the current sound output device

User can change settings for:

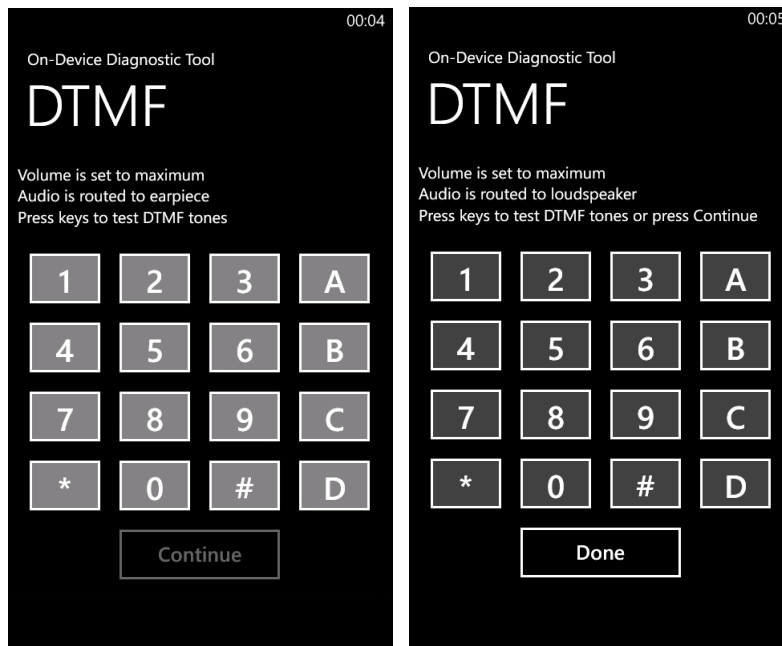
- Audio routing output
 - Earpiece
 - Loud speaker

User can test:

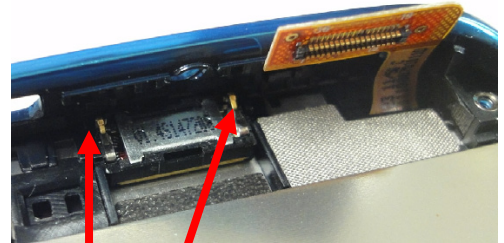
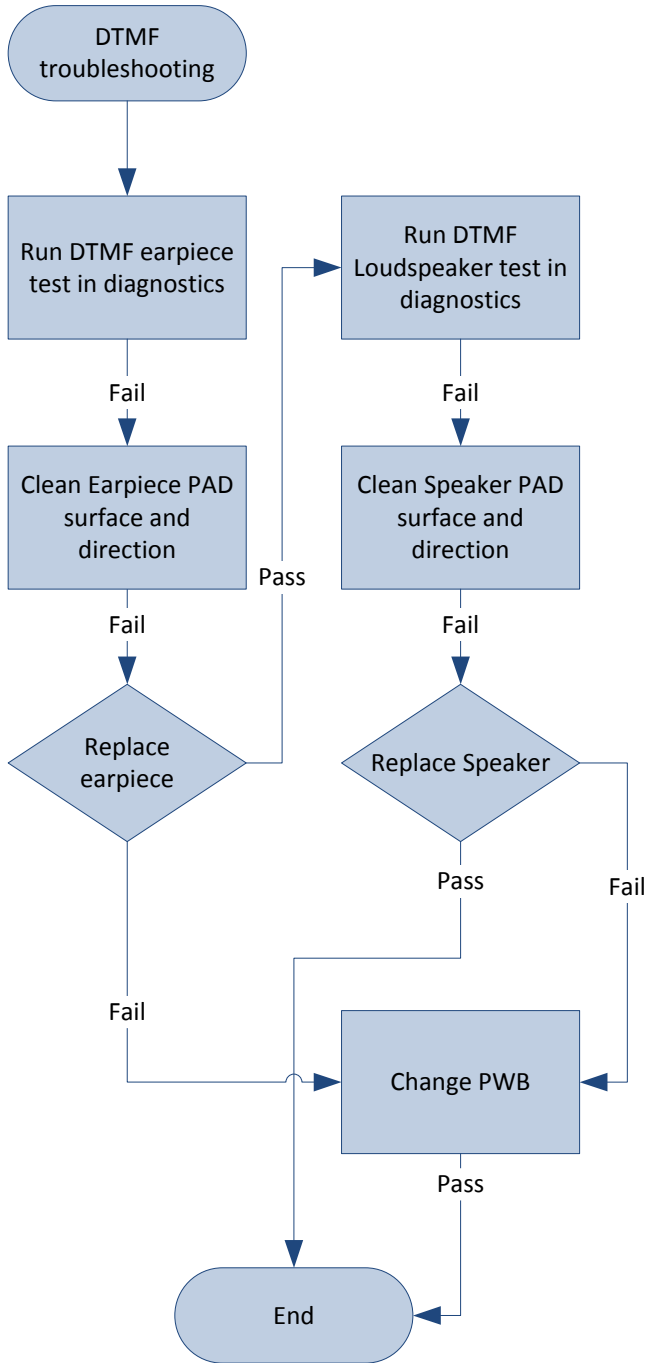
- Once a key has been tapped, it will change color to recognize the event
- Once a key has been tapped the "Continue" button will activate
- Tapping "Continue" button will proceed to next test and any previously tapped keys will be reset

Pressing the back '←' key will navigate back to the main menu

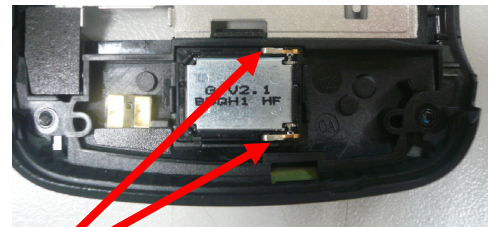
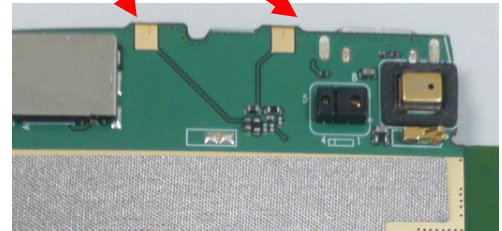
Test by Earpiece Test by Loudspeaker



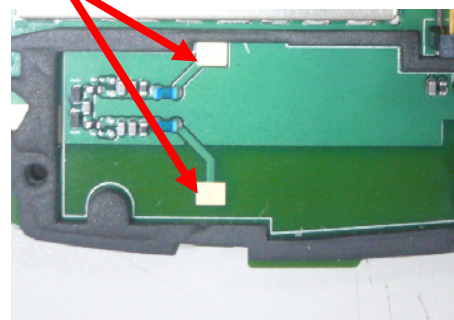
DTMF troubleshooting



Check the Earpiece spring and PAD



Check the Speaker spring and PAD



Headset detection test

Headset test will allow the tester to check if a headset is connected or disconnected

Displayed data:

- The status image and message will update to display if headset is connected or disconnected

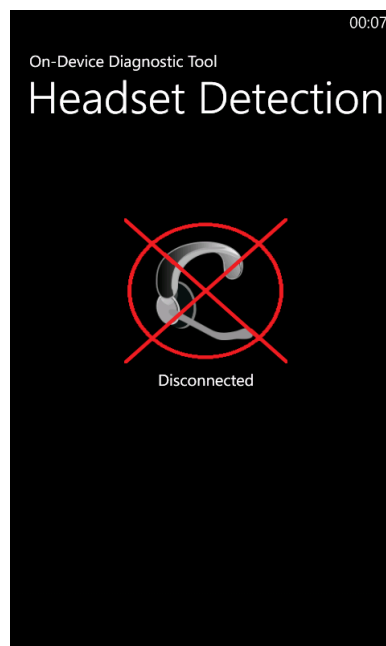
User can change settings for:

- none

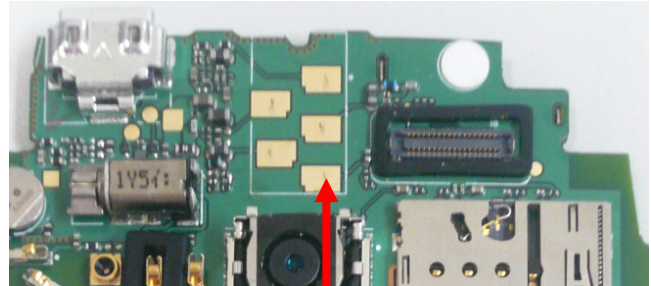
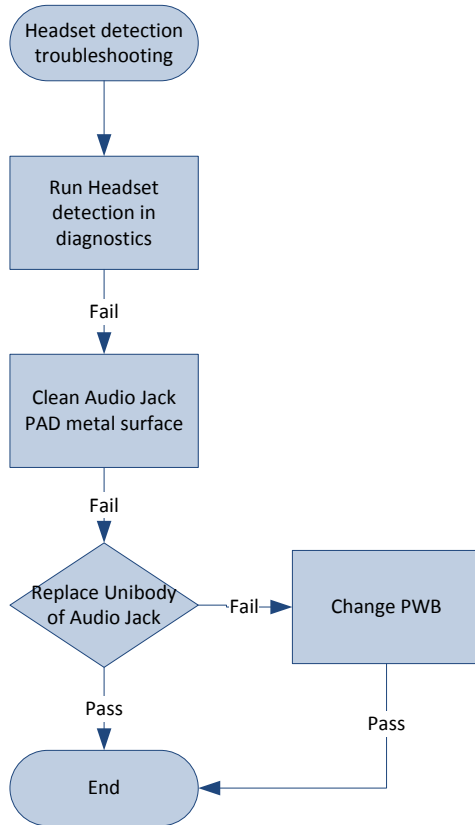
User can test:

- If a headset not connected, then the display will show an 'X' mark on the headset image and the status message will display 'Disconnected'
- Once a headset has been connected, the 'X' mark will disappear and the status message will change to 'Connected'

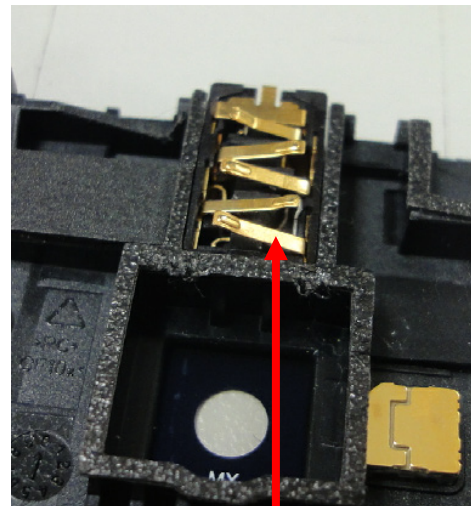
Pressing the back '←' key will navigate back to the main menu



Headset detection troubleshooting



Audio Jack PAD



Audio Jack

LCD White

Displays color screens for verifying pixel integrity

Displayed data:

- Display color screens will reveal five kinds of color.
 - White
 - Black
 - Red
 - Green
 - Blue

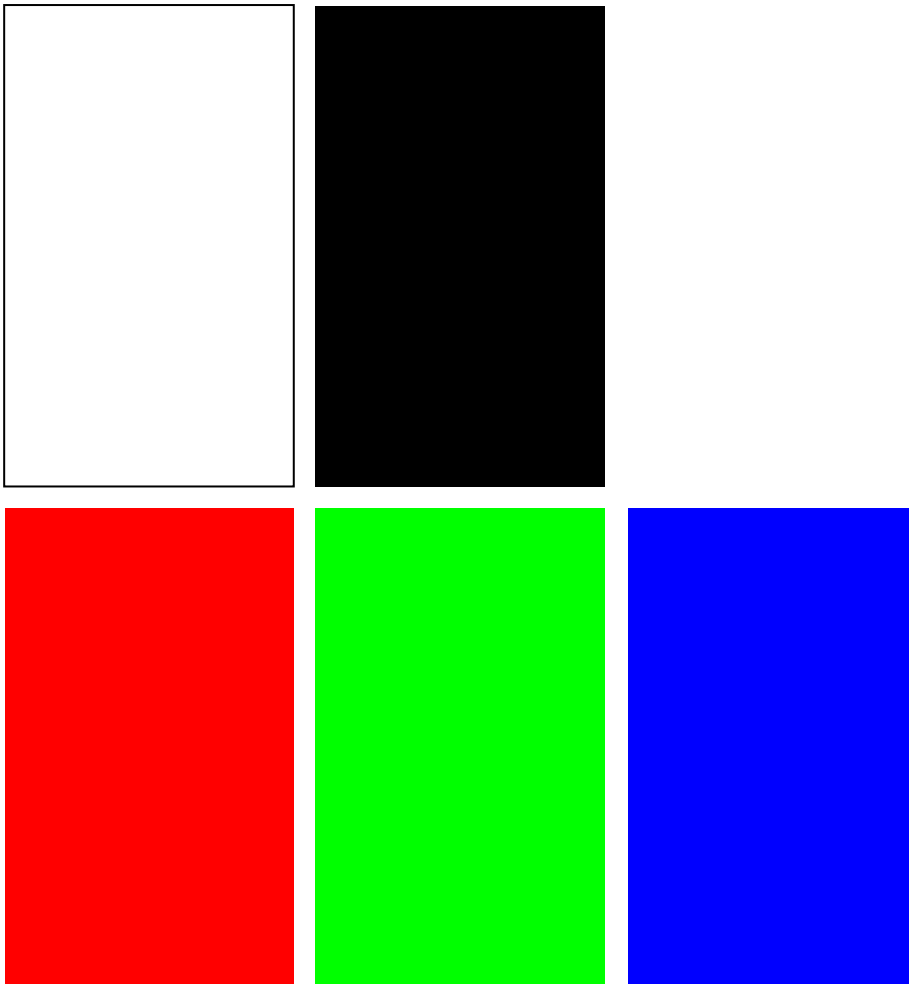
User can change settings for:

- none

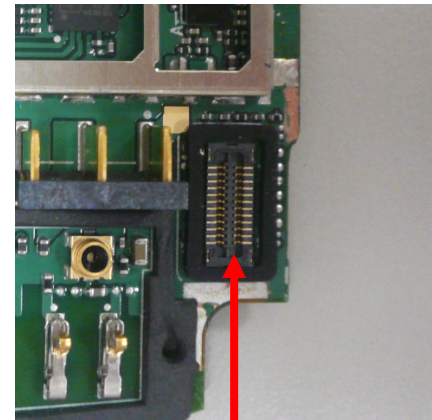
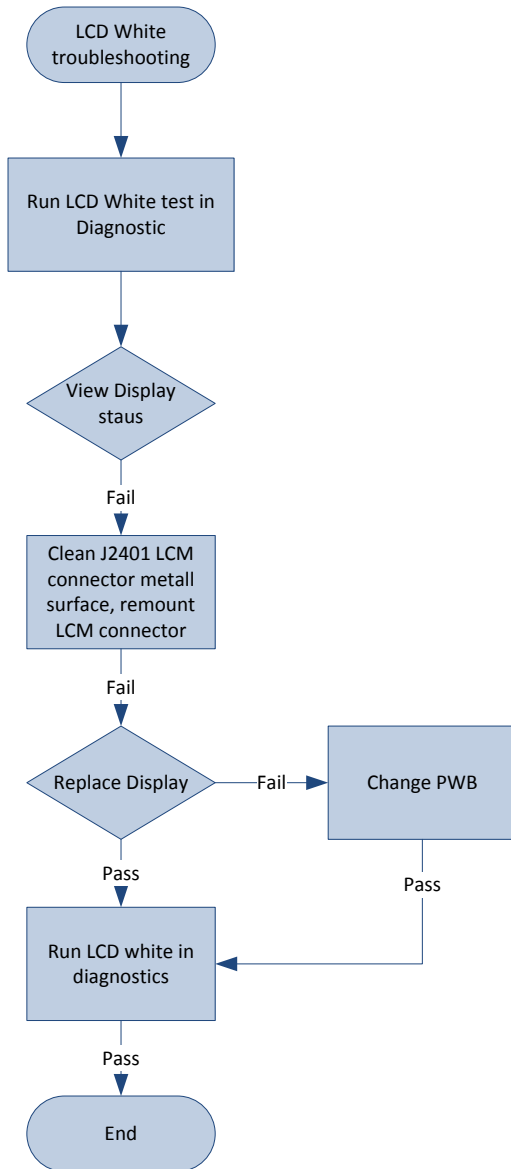
User can test:

- When the user to touch the display, the display will replace new color from white to blue.

Pressing the back '←' key will navigate back to the main menu



LCD troubleshooting



LCM Connector J2401

Lights test

Displayed data:

- none

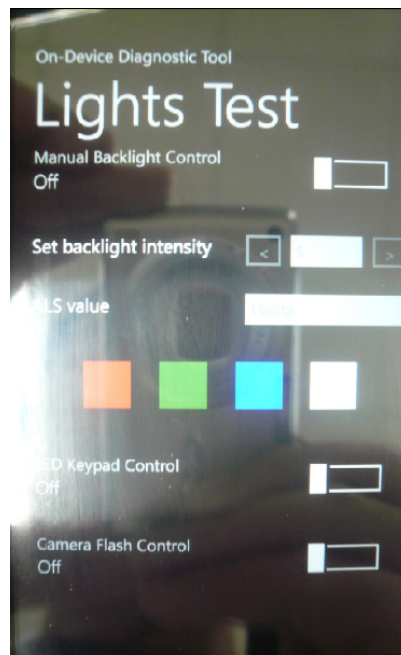
User can change settings for:

- Manual backlight intensity control:
 - When the toggle is in off position, backlight intensity is controlled by the ALS sensor value.
 - When the toggle is in on position, the user can change the backlight intensity by using the slider.
- Keypad backlight
 - When the toggle is in off position, keypad backlight is off and when toggle is on, the keypad backlight in on.
- Camera flash light
 - Camera flash control turns on the flash LED for 10 seconds.

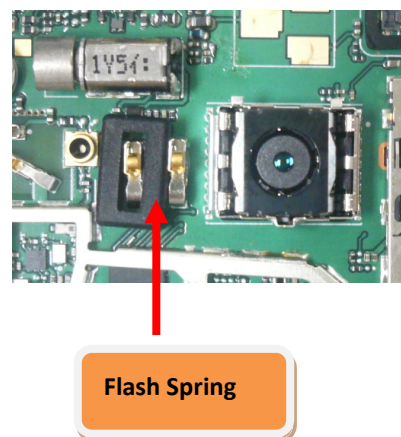
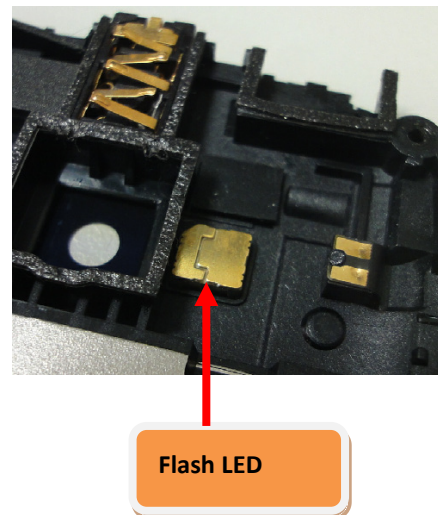
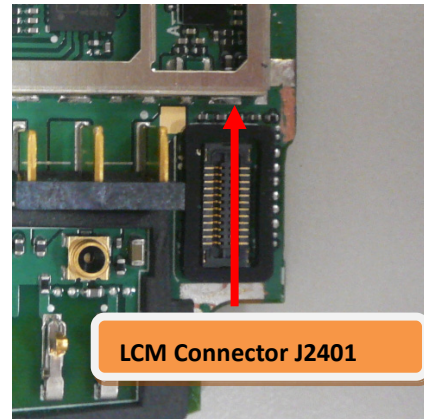
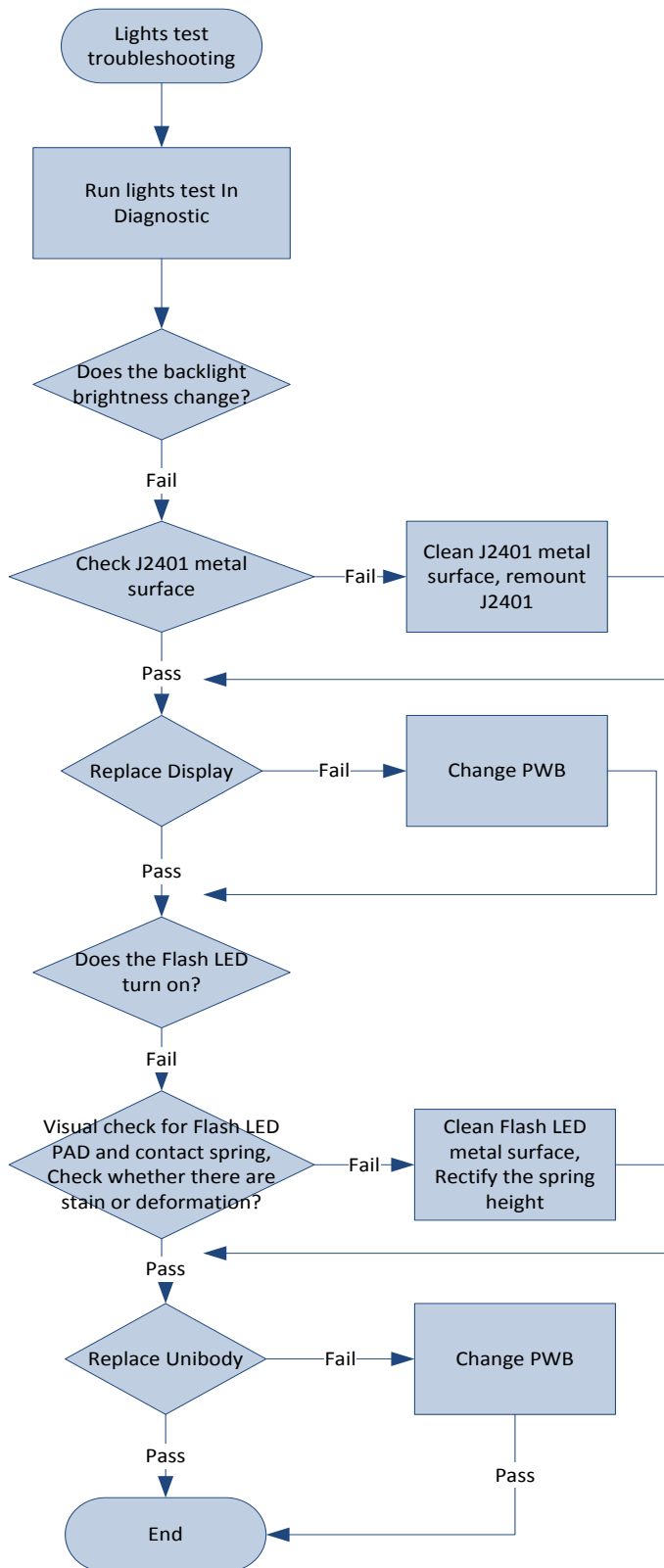
User can test:

- That the backlight intensity can be varied.
- Display backlight can be turned off completely.
- The white rectangle helps the user to understand the intensity level better.
- Keypad backlight can be toggled.
- Camera flash can be toggled.

Pressing the back '←' key will exit the screen and take the user to the main menu



Lights troubleshooting



Hardware buttons test

Displayed data:

- All physical keys of the device

User can change settings for:

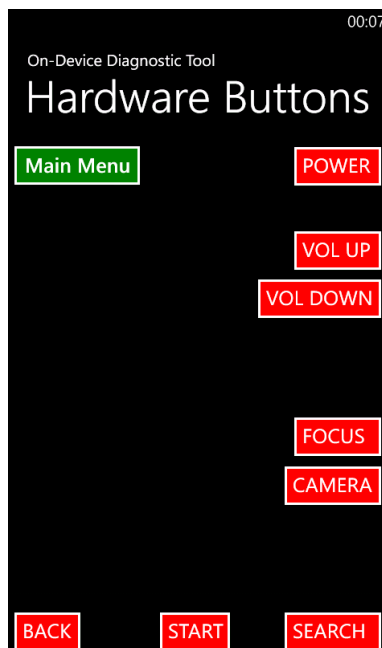
- none

User can test:

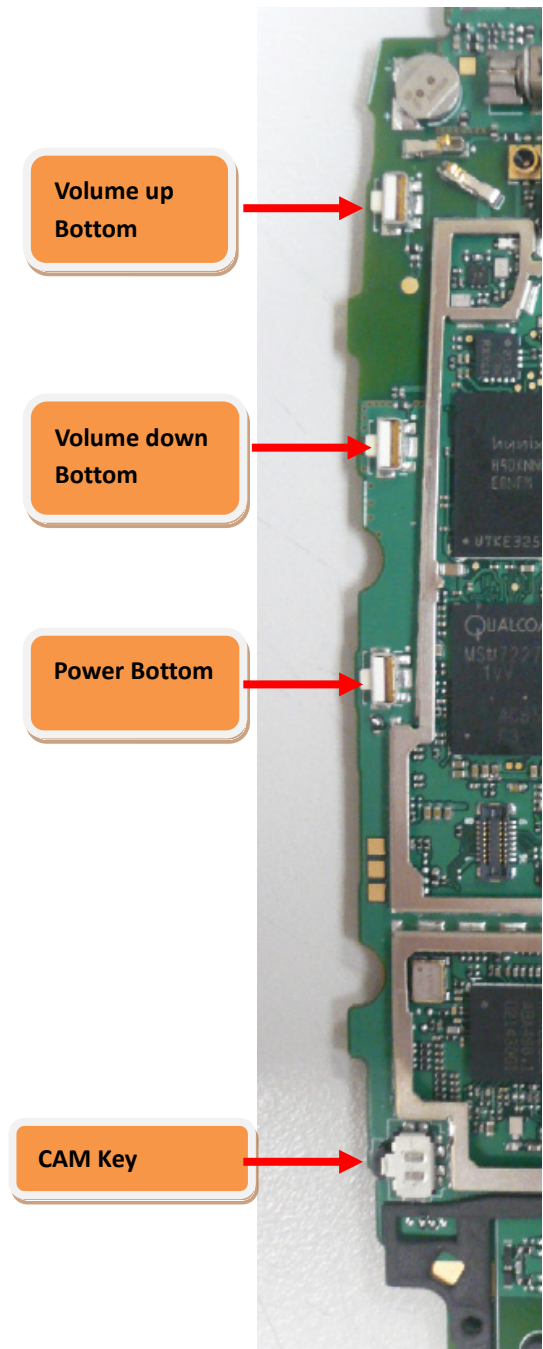
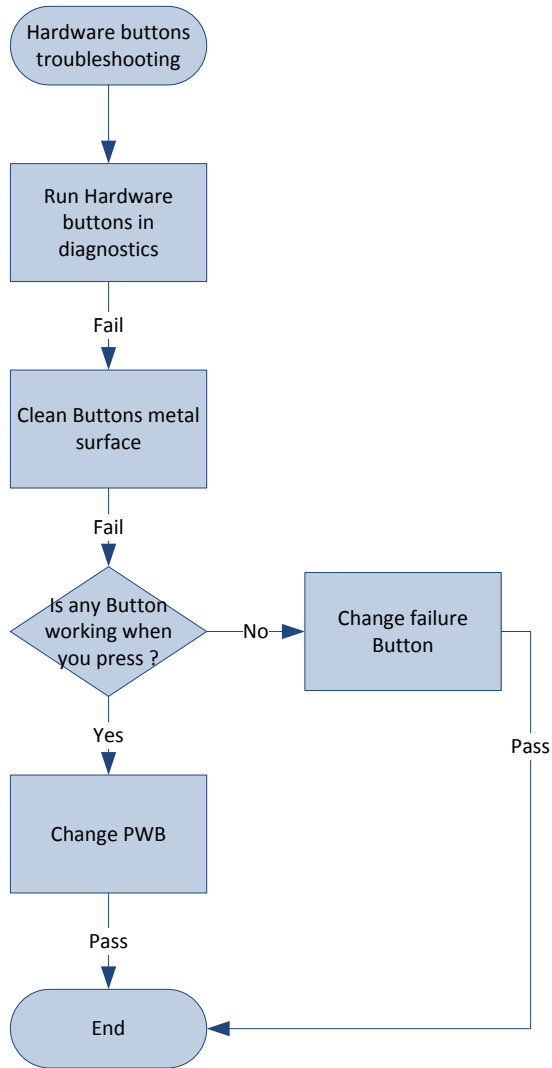
- Once a particular key has been pressed, it will change color to green
- When the pressed (green) button is released, the UI will not show that button anymore
- "Main Menu" button will close Hardware Buttons test

Pressing the back '←' key will change "Back" button color

NOTE: On RM-849 / RM-819, 'Back', 'Start', and 'Search' buttons are virtual (not hardware) and should not be tested.



Hardware buttons troubleshooting



Power source (Charging) test

The power source test will allow the user to check what is currently powering the phone

Displayed data:

- An image of a battery will display when the phone is running on battery power and the image of a power plug if the phone is running on an external source (USB or wall charger)

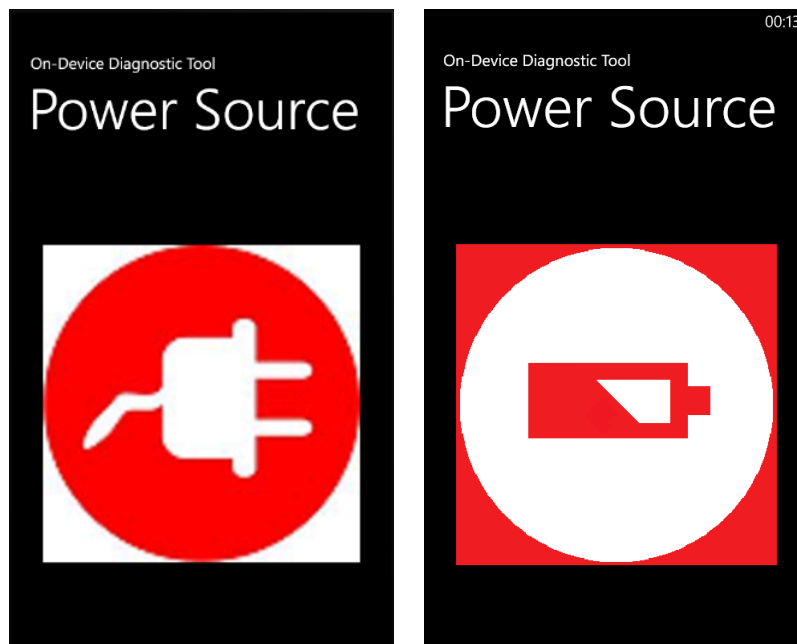
User can change settings for:

- none

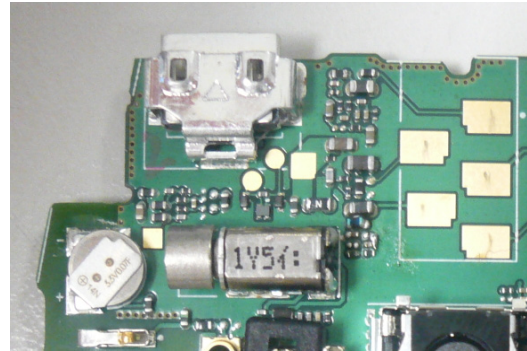
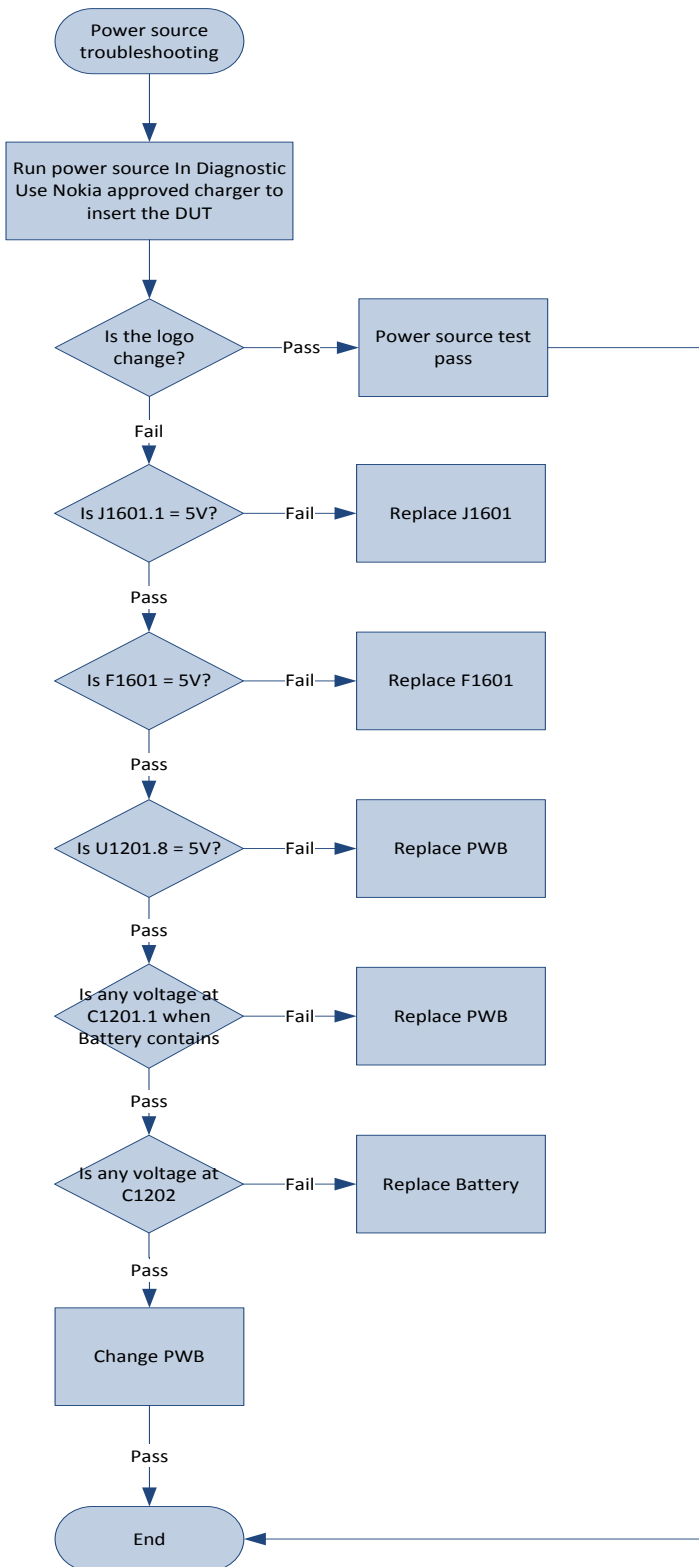
User can test:

- What source is powering the phone (battery/ external)

Pressing the back '←' key will navigate back to the main menu



Power source (Charging) troubleshooting



Proximity test

The proximity test will allow the user to check if the proximity sensor is able to detect the presence of an object in front of it.

Displayed data:

- A filled circle (Yellow or Green in color) and information text (not-detected or detected)

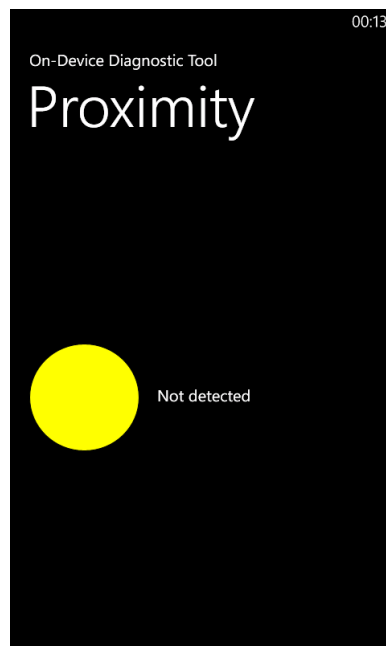
User can change settings for:

- none

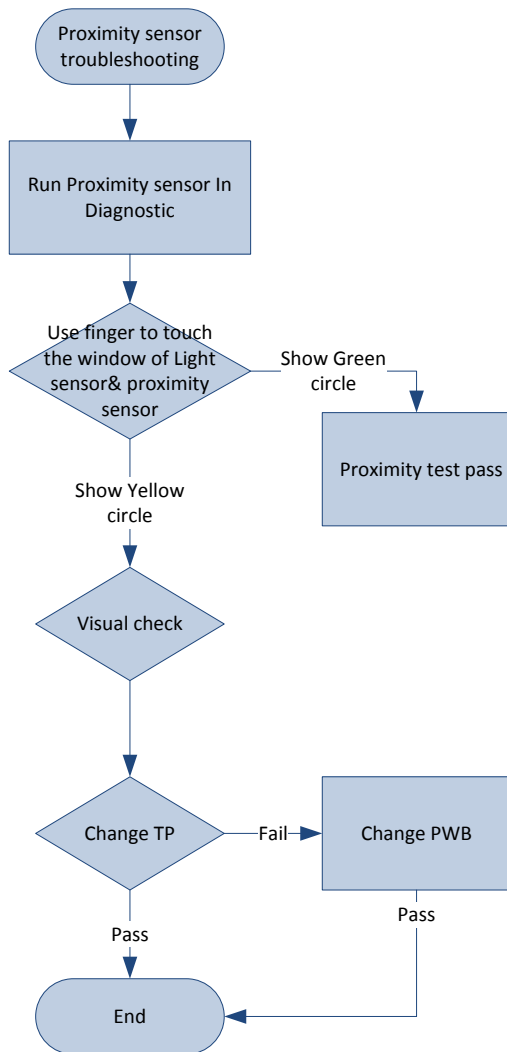
User can test:

- If the proximity sensor is able to detect an object in front of it

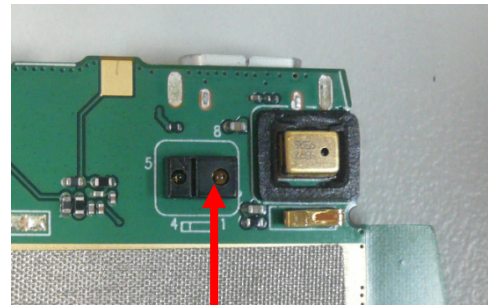
Pressing the back '←' key will exit the application



Proximity troubleshooting



Window of Proximity / Light sensor



Window of Proximity / Light sensor

Speaker test

The speaker test will allow the user to check if the device speaker is functioning.

Displayed data:

- None

User can change settings for:

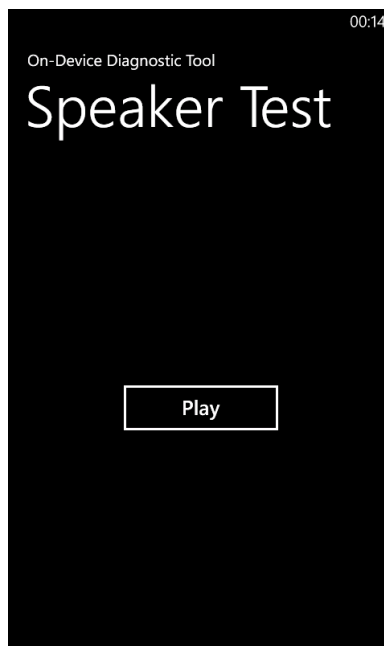
- Melody playing. Melody will play when the user taps 'Play'. If melody is playing the button will change to 'Stop'

User can test:

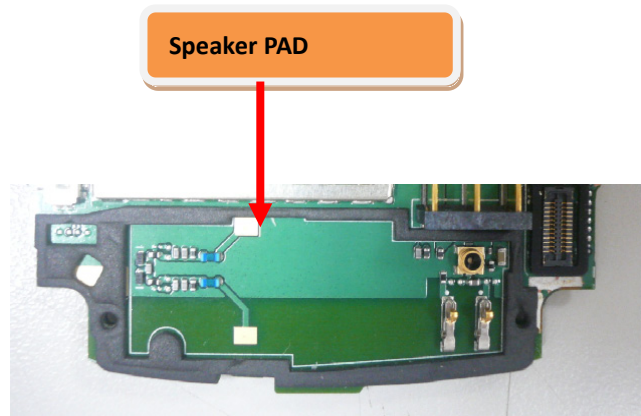
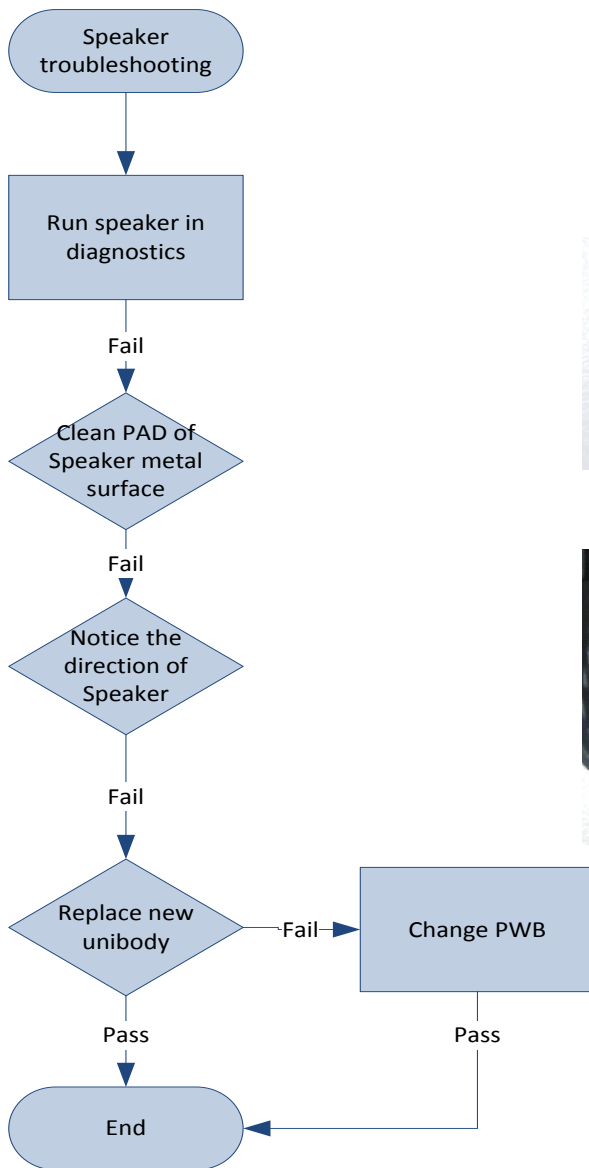
- When melody is playing the user should be able to hear the tune via the speaker

Tapping 'Done' will end the test and exit the application

Pressing the back '←' key will navigate back to the main menu



Speaker troubleshooting



Touch test

Displayed data:

- none

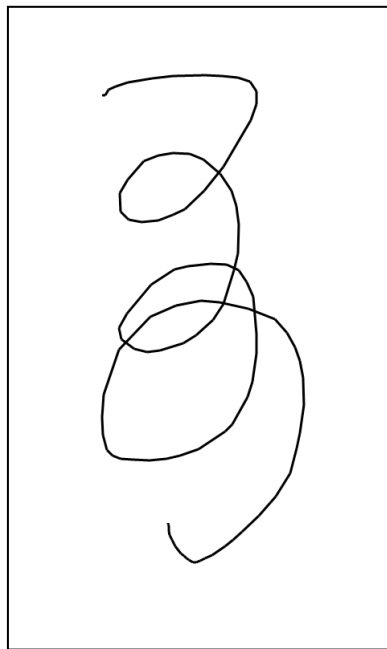
User can change settings for:

- none

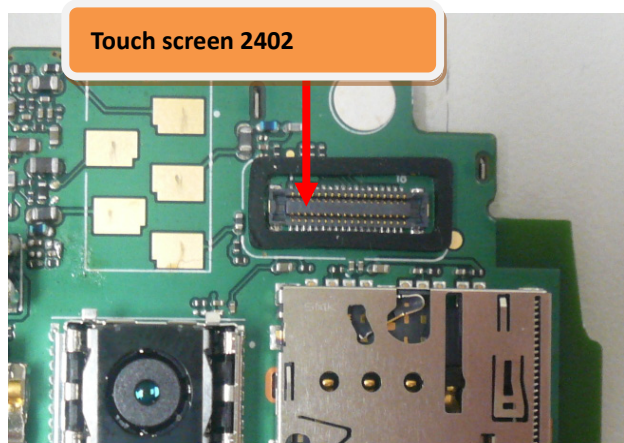
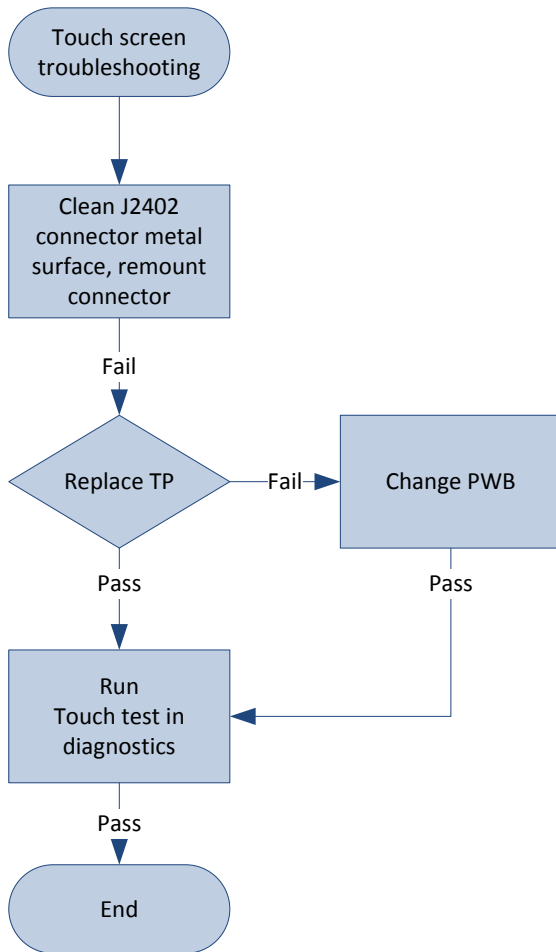
User can test:

- By moving finger on the white area of the screen, phone will draw a black line according finger movement
- When the user lifts the finger off the screen, the "Done" button will show itself
- "Done" button will close Touch test

Pressing the back '←' key will navigate back to the main menu



Touch troubleshooting



Vibrator test

Displayed data:

- none

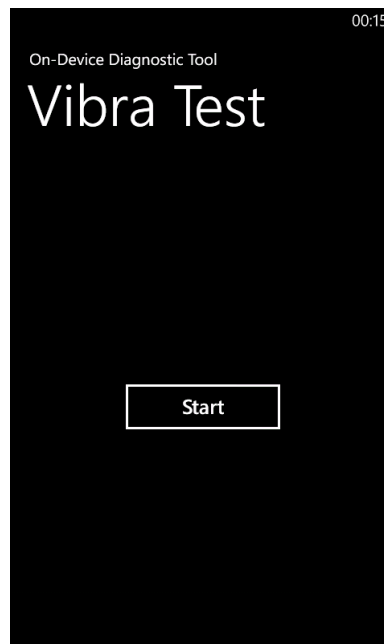
User can change settings for:

- none

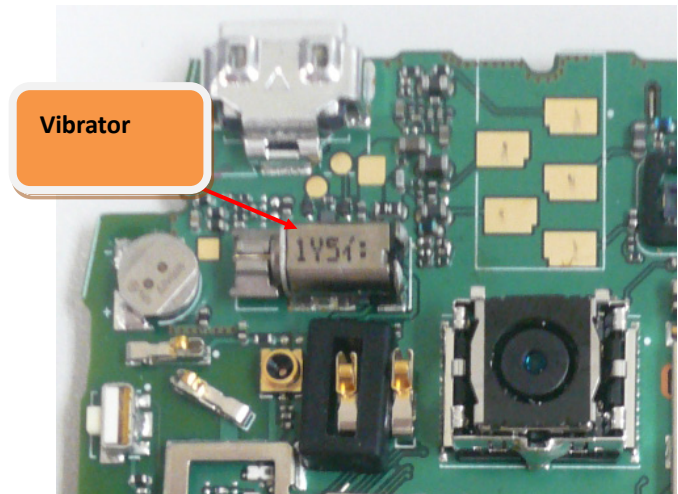
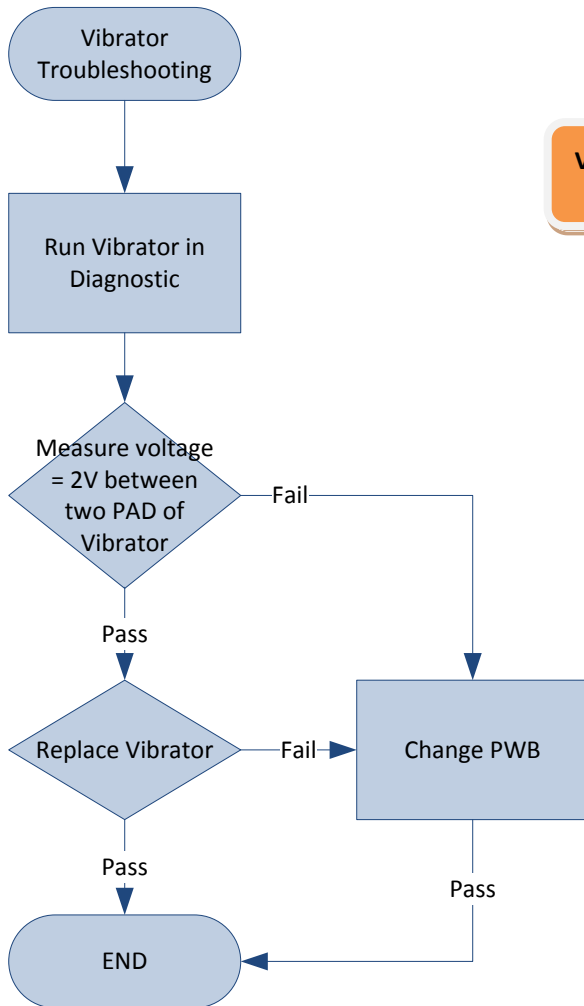
User can test:

- Pressing "start" button starts vibrator to vibrate and changes button text to "Done"
- Pressing "Done" button stops vibration and changes button text to "Start"

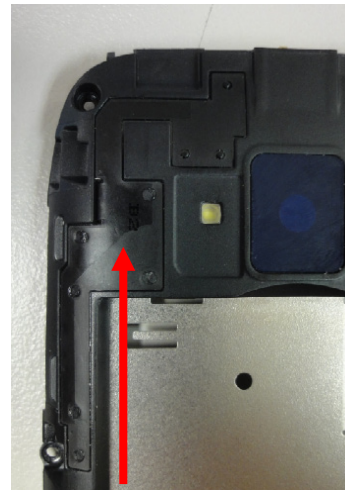
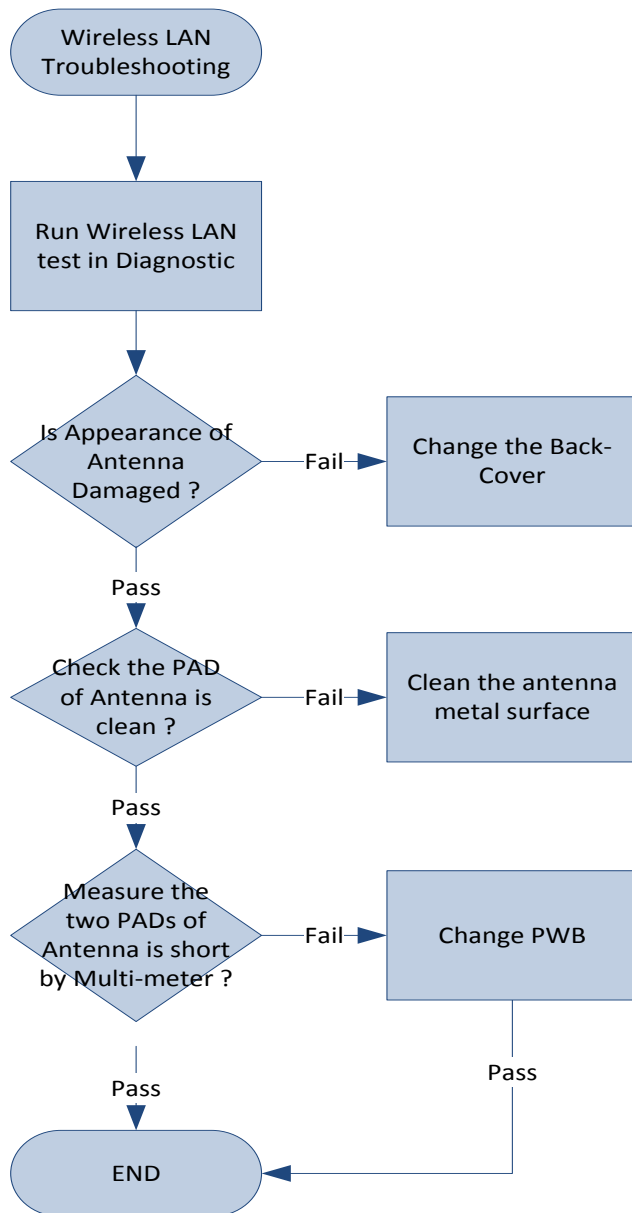
Pressing the back '←' key will navigate back to the main menu



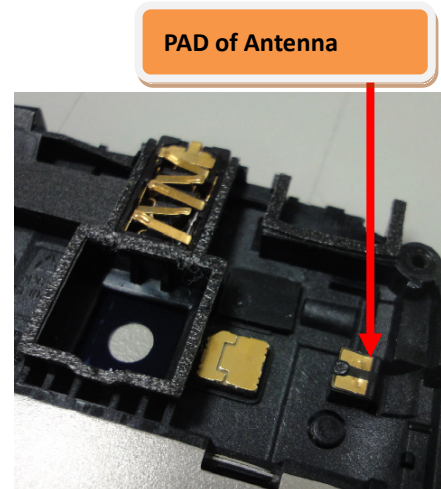
Vibrator Troubleshooting



Wireless LAN troubleshooting

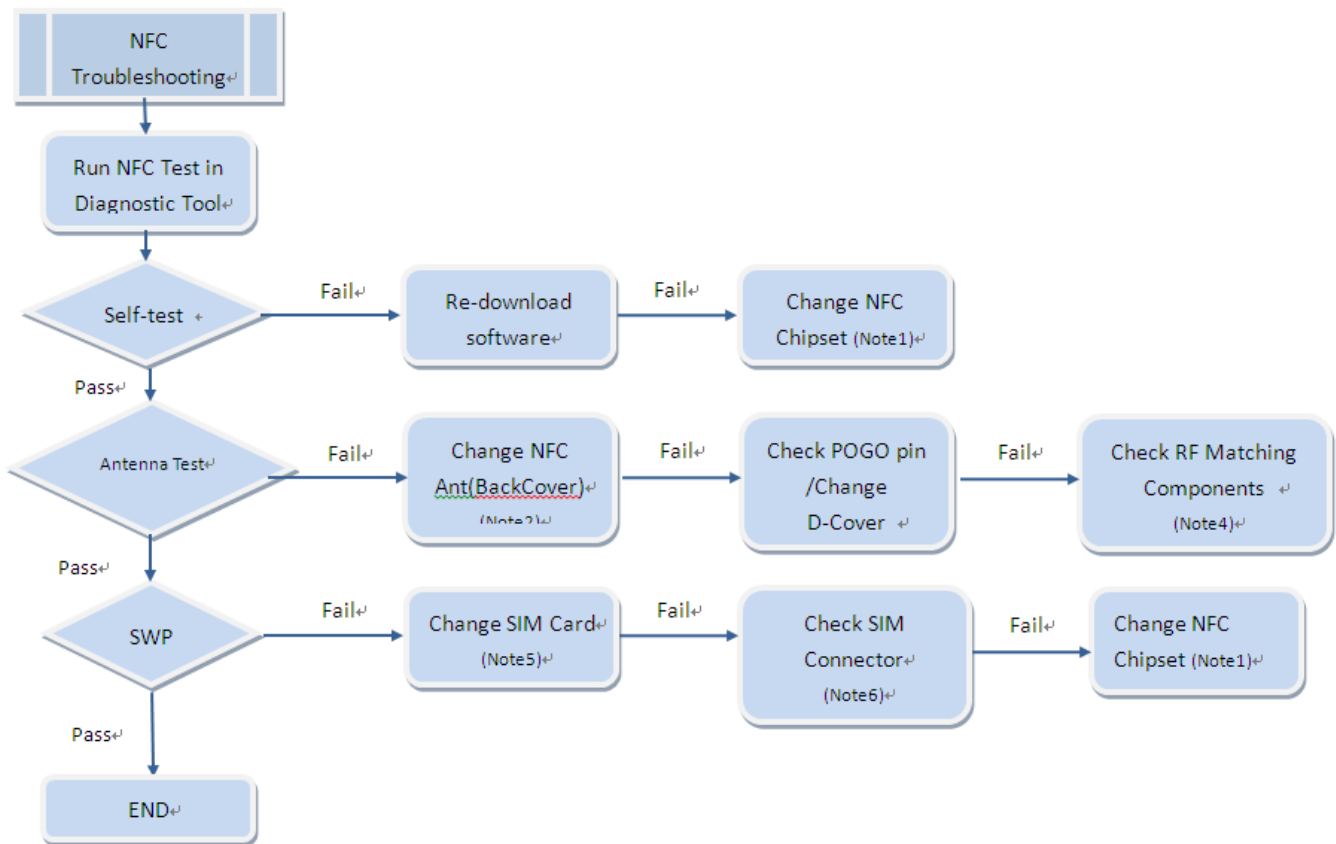


Antenna

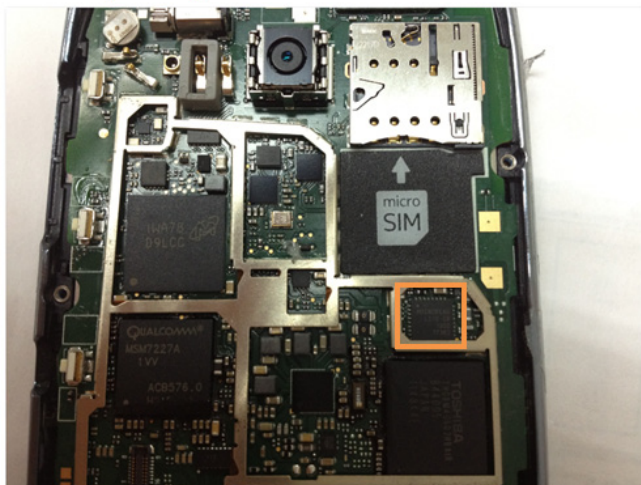


PAD of Antenna

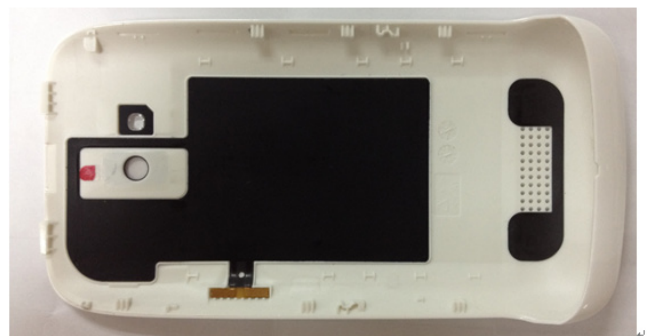
NFC troubleshooting



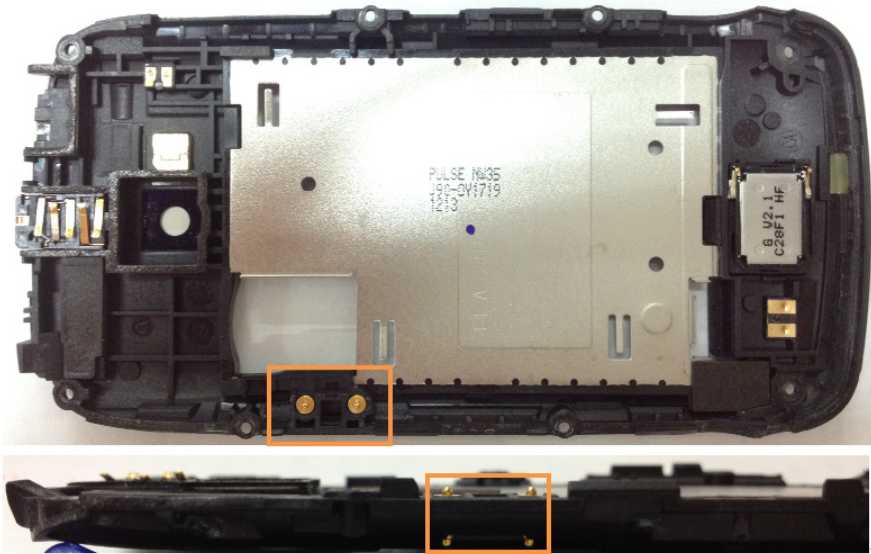
Note 1 - Change NFC Chipset



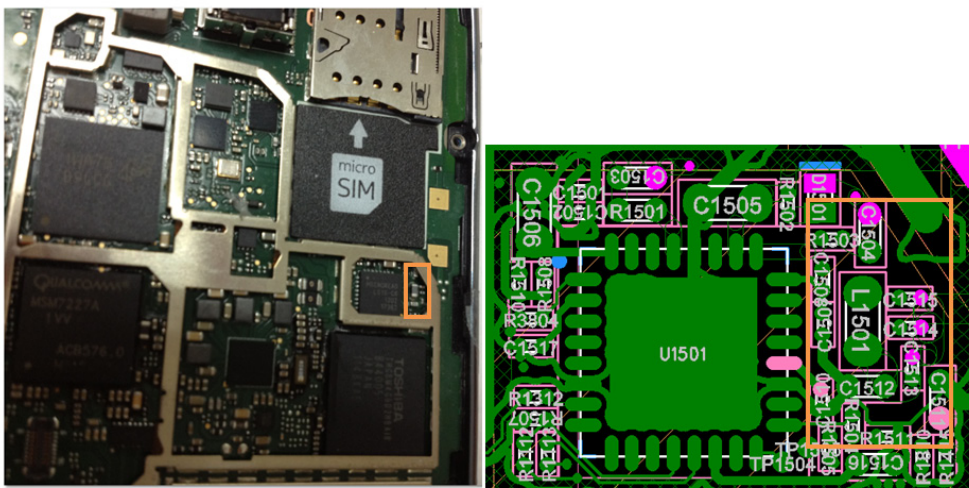
Note 2 - Change NFC Ant (BackCover)



Note 3 - Check POGO pin /Change D-Cover'



Note 4 - Check RF Matching Components



Note 5 - Change SIM Card



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4 - System Module

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■ Introduction

Phone description

MSM7227A-1 is the Qualcomm MSM device and supports GSM/EDGE, WCDMA, HSPDA, GPS.

Phone key components and placement

Function	Description (P/N)	Item Reference
MSM7227A-1	ARM Cortex A5 800MHz (apps.)	U1
PMIC	PM8029 QUALCOMM	U2
Camera socket	CMCS-75A3 NMP(HF) JST	J2201
Micro-USB connector	2UB1000-000201F MICRO USB SING	J1601
EMI/ESD Filter	EMI4183MUTAG ONSEMI	FL2401 , FL2201
uSIM Switch	CLE1008-4990F	J3801
LPDDR1	MT46H128M32L2KQ-5 IT MICRON	U3
eMMC	THGBM4G7D2HBAIN TOSHIBA	U4
MOSFET	CSD25302Q2 SON TI	Q1202
3G PA	ACPM-5001-TR1/ACPM-5005-TR1/ACPM-5008-TR1/ACPM-5002-TR1 AVAGO	U2701/U2801/U2804/U2704
2G PA	SKY77336-21 GSM QUAD-BAND SKYWORK	U2901
BT/FM module	WCN2243 QUALCOMM	U6
WiFi module	AR6005G-CF1B-R Atheros	U7
CURR-FUSE	ERBRE2R00V2A 32V 0603 PANASON	F1601
RF Transceiver	WCDMA / GSM / GPS	U5
RF connector	C90P103-00004-H SPEED	J3201
TX SAW B1	SAFEB1G95KA0F00	U2702
TX SAW B8	SAFEB897MAL0F00 897MHZ MURATA	U2803
TX SAW B2	FAR-F6KA-1G8800-L4AF	U2703
TX SAW B5	SAFEB836MAL0F00	U2802
CRYSTAL	ENG3088A 19.2MHZ NDK	Y4101
CRYSTAL	TZ2102A 26MHz 13.5pF 10ppm TST	Y3401
CRYSTAL	FC-135 32.768KHZ 12.5PF 20PPM	Y1301
IC S.R	LM3555TLX MICRO SMD NS	U2301
IC S.R	FAN5903UCX WLCSP FAIRCHILD	U2902
FPC connector LCM	BM10NB(0.8)-24DS-0.4V(75) E68	J2401
TOUCHSENS	ATMXT224E ATMEL	U2402

Rx SAW filter	FAR-G6KC-1G9600-Y4YY	U3101
Rx SAW filter	FAR-G5KC-942M50-Y4YW	U3102
FPC connector TP	AXE536124 PANASONIC	J2402
IC GAUGE	BQ27520YZFR-G1 DSBGA TI	U1601
G SENS	LIS3DH LGA ST	U3602
Light & Proximity sensor	APDS-9900 SMALL PACKAGE AVAGO	U3601
NFC	MICROREAD MR-V3	U1501

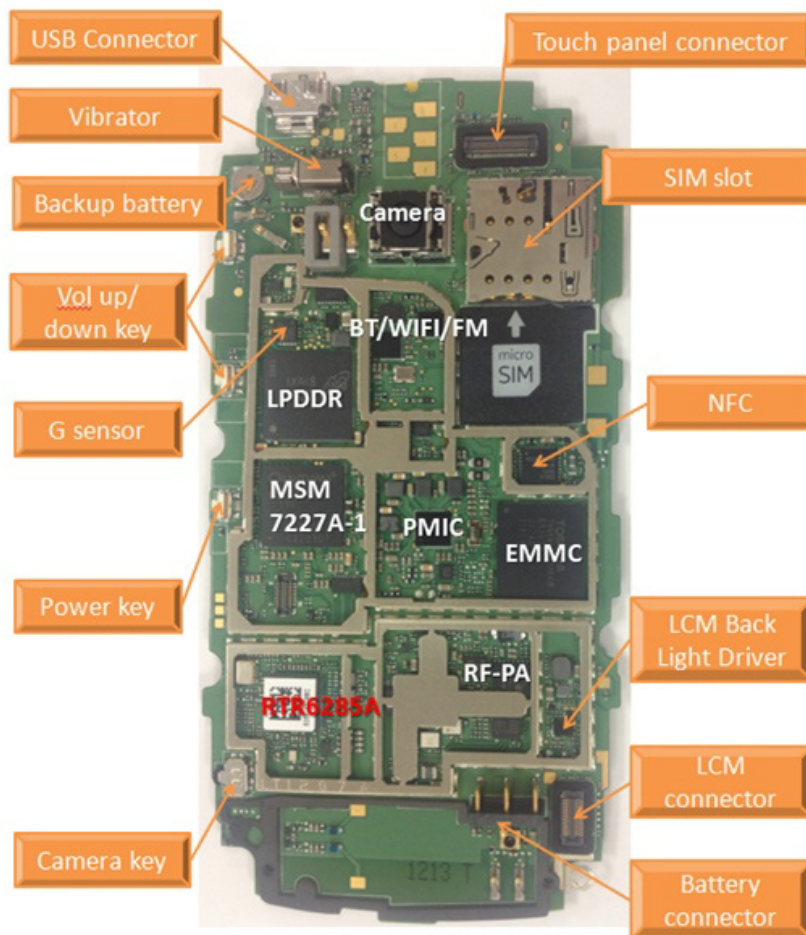


Figure 6 Main board, Top side

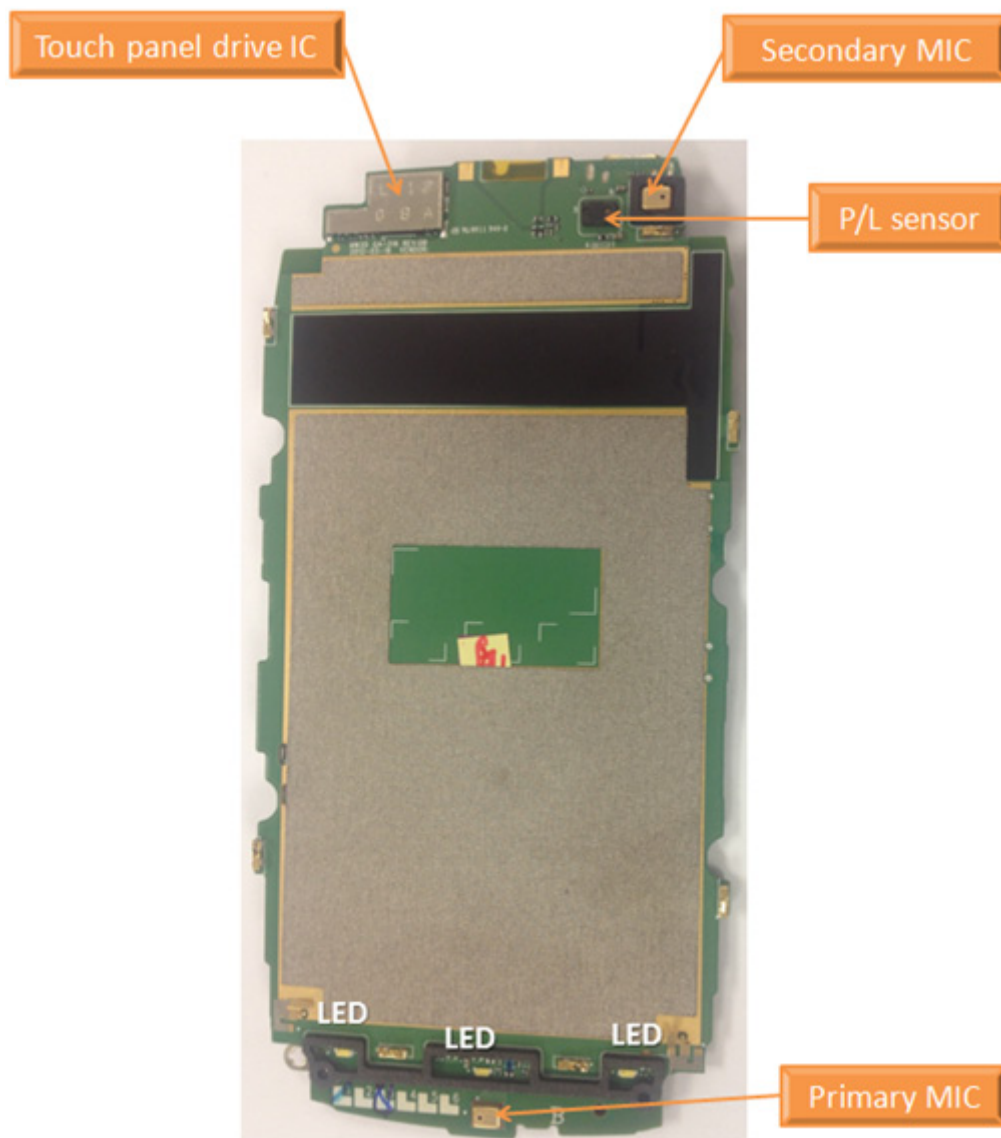
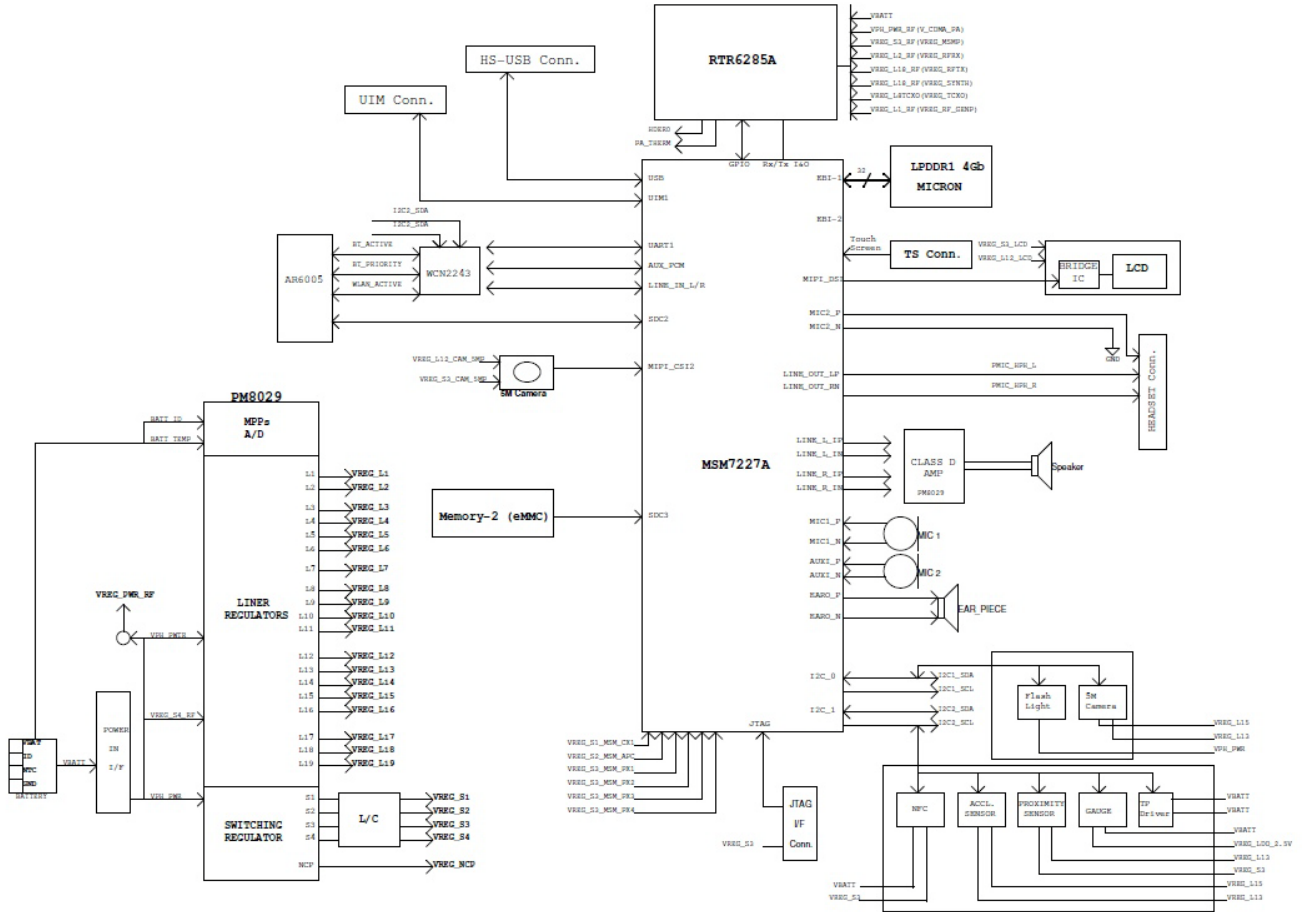


Figure 7 Main board, bottom side

System block introduction

MSM7227A System Module.



■ Energy management

Battery and charging

BP-3L battery

The phone is powered by a 3-pole BP-3L 1300 mAh battery. The three poles are named VBAT, GND and BSI where the BSI line is used to recognize the battery capacity. This is done by means of an internal battery pull down resistor.

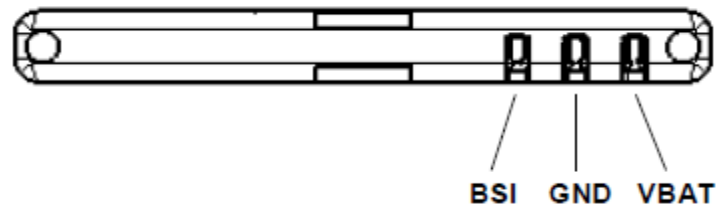


Figure 8 Battery pin order

The battery connector is a blade connector. It has three blades,

- VBAT (Battery voltage)
- BSI (Battery size indicator. The BSI line is used to recognize the battery capacity by a BL-3P battery internal pull down resistor 39Kohm).
- GND (Ground)

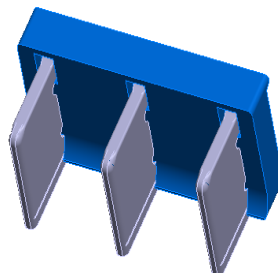


Figure 9 Battery connector

Charging

This phone is charged through the μ USB interface only (there is no separate connector for a charger). Supported are two charging modes for normal USB2.0 charging and Nokia uUSB AC-50 charger. Charging is controlled by energy management, and external components are needed to protect the baseband module against EMC, reverse polarity and transient frequency deviation.

Normal and extreme voltages

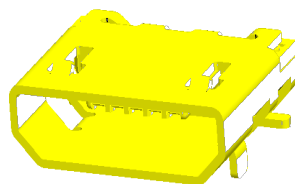
In the table below normal and extreme voltages are shown, when a BP-3L battery is used.

Table 1 Nominal voltages

Voltage	Voltage [V]	Condition
General conditions		
Nominal voltage	3.7	
Lower extreme voltage	3.4	
Higher extreme voltage(fast charging)	4.35	
HW shutdown voltages		
Vmstr +	2.6 \pm 0.1	off to on
Vmstr -	2.6 \pm 0.1	on to off
SW shutdown voltages		
SW shutdown	3.4	in call
Min operation voltage		
Vcoff +	3.4	off to on
Vcoff -	3.3	on to off

USB

In this phone the USB connector is the only physical connector, which means that the USB port is used both for data transfer as well as for charging. The USB 2.0 is supported with full speed (12 Mbps). It also supports hot swap, which means that USB devices may be plugged in/out at any time. This phone is provided with a specific connector for USB.



User interface

Display

The display used in RM-849 is TFT a-Si IPS WVGA 3.7", display controller via MIPI.

Camera

The supported camera has a 5M pixels and a dedicated camera key.

Audio concept

The functional core of the audio hardware is built in PM8029.

PM8029 provides an interface for the transducers. Built-in headphone amplifier and mono class-D speaker Amp for hands free (IHF) speakers

There are four audio transducers:

- 1 EARPICE for handset
- 1 speaker
- 1 HPH for headset

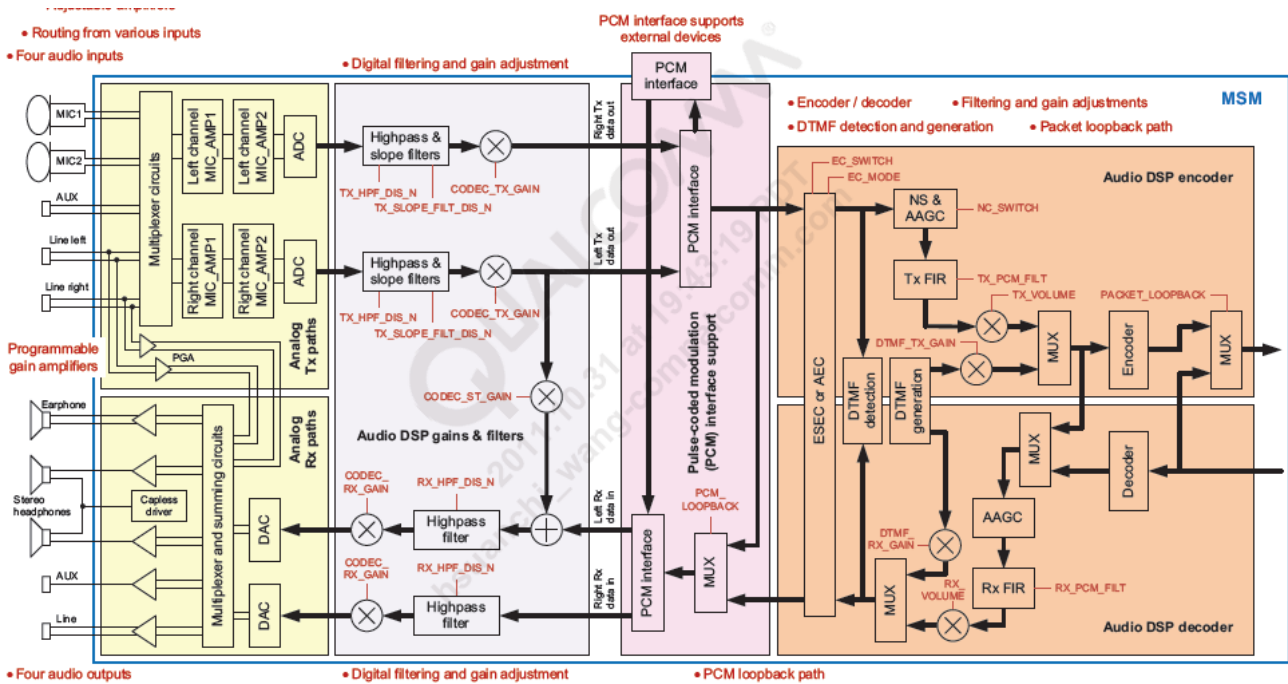


Figure 10 Audio block diagram

Internal audio

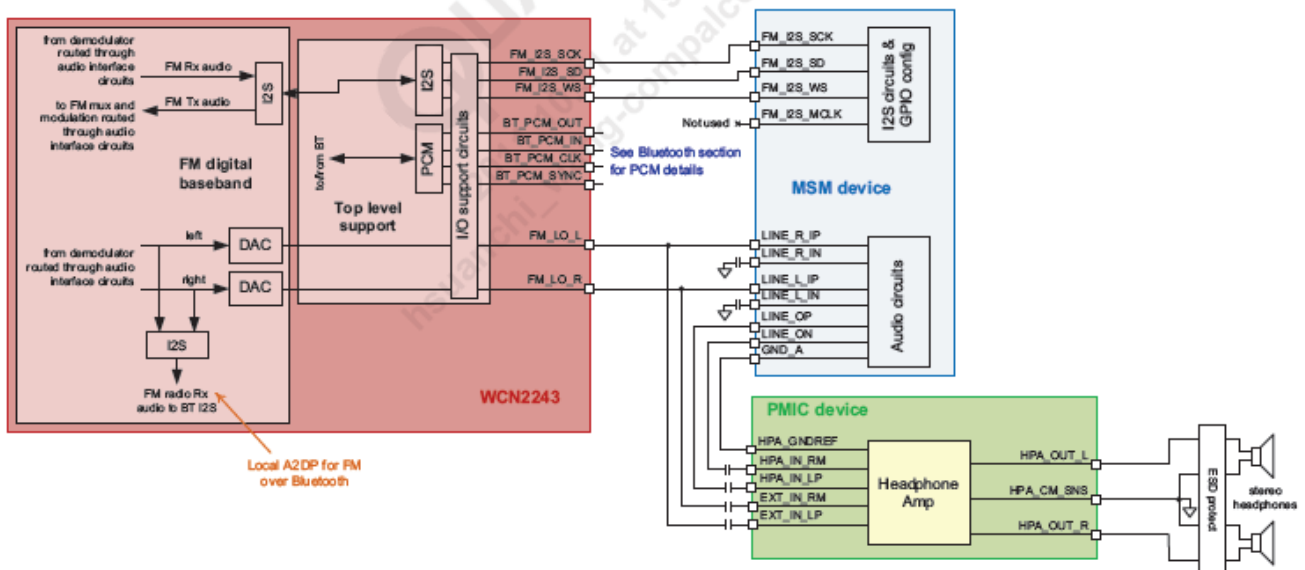
The internal audio components are used in these modes

	Hand Portable Mode	Headset Mode	Hand Free Mode
MIC1	X		X
MIC2	X	X	
MIC3			
EARPIECE	X		
SPEAKER			X
LINE_IN		X	
HPH_OUT		X	

FM radio interface

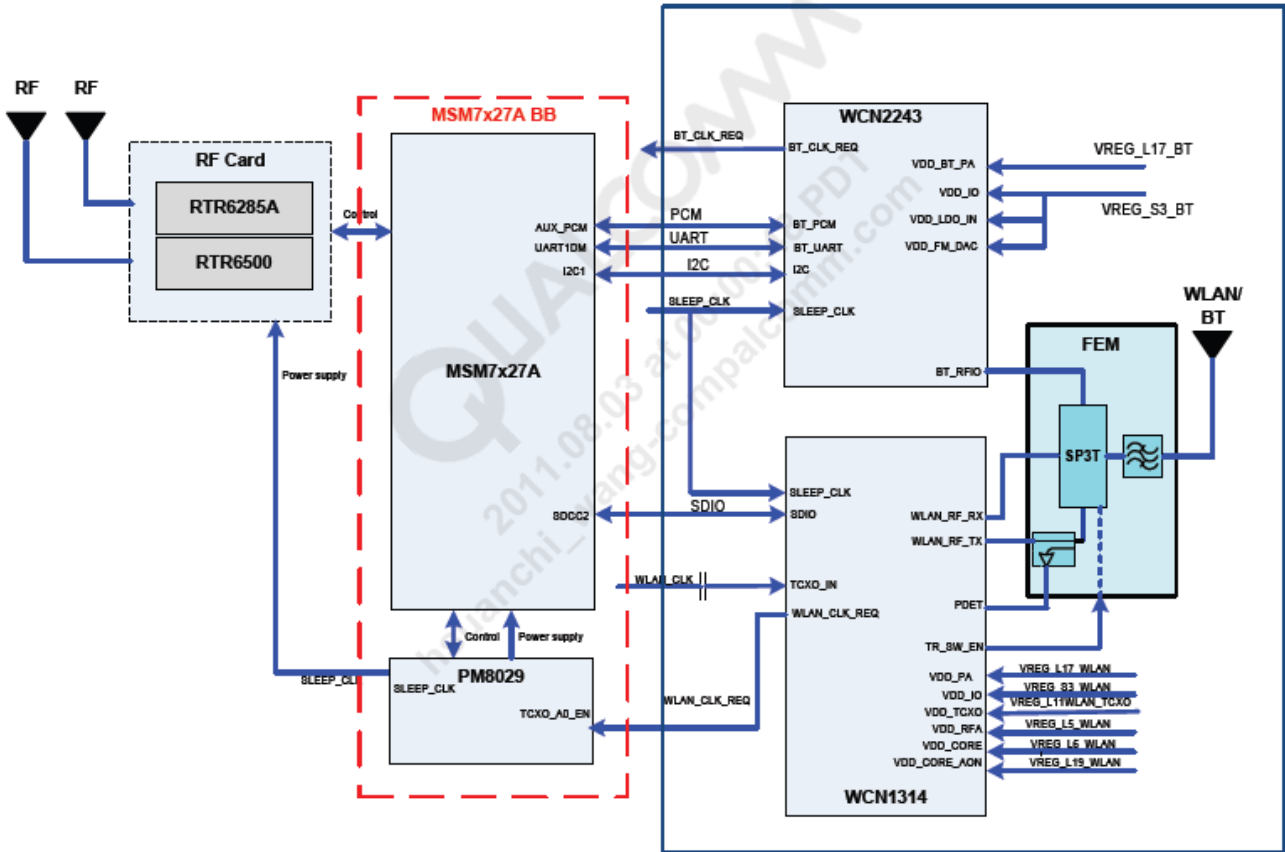
RM-849 supports FM RDS, I2C is the control bus from WCN2243. The line-up signal provides an analogue signal to WCN2243.

Output music to ear-piece or loud speaker.



Bluetooth

The WCN2243 chip is a single-chip radio and baseband IC for Bluetooth 2.4GHz systems including enhanced data rate (EDR) to 3Mbps. With the on-chip Bluetooth software stack, it provides a fully compliant Bluetooth v3.0+ EDR and FM transceiver specification system for data and voice communications.



NFC

microread® is an innovative, RF integrated circuit that implements Near Field Communication (NFC) for proximity data transactions. Targeted to cell phone, PDA or PC integration, it enables them to operate both as RF readers and contactless smart cards or RF tags.

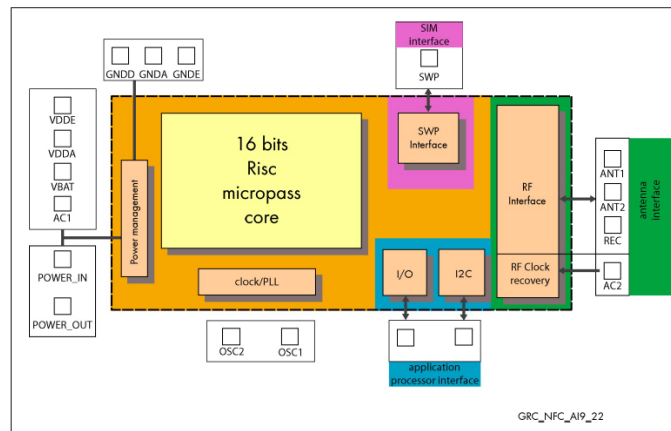


Figure 2 - microread block diagram

■ RF description

Receiver (RX)

An analogue signal is received by phone's antenna. The signal is converted to a digital signal and then transferred further to the baseband (e.g. to the earpiece).

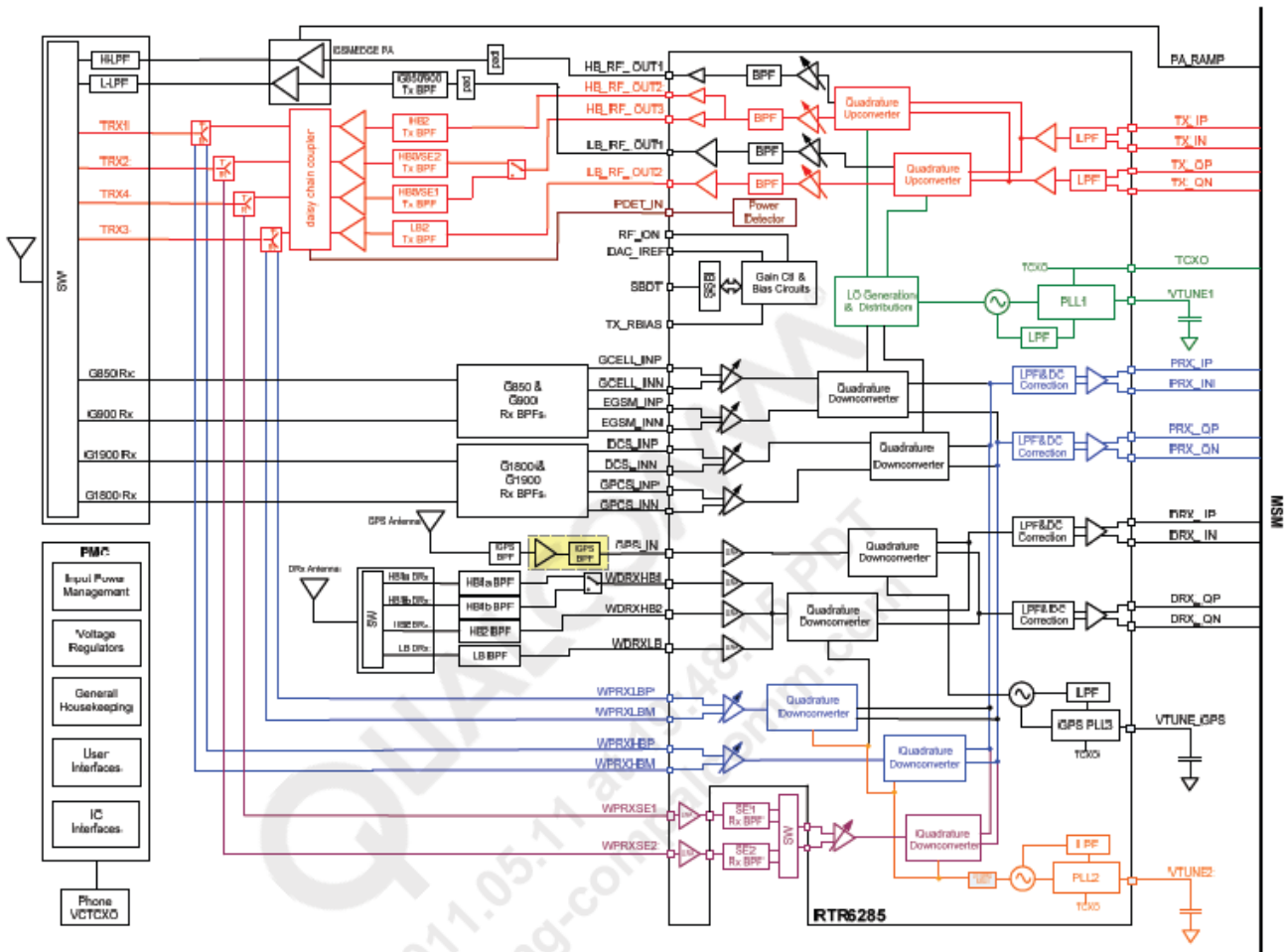
The receiver functions are implemented in the RTR6285A RF block. Signals at different frequencies goes different path, and are therefore is processed by different components.

Transmitter (TX)

The digital baseband signal (e.g. from the microphone) is converted to an analogue signal, which is then amplified by amplifier and transmitted from the antenna. The frequency of this signal can be tuned to match the bandwidth of the system in use (e.g. WCDMA Band1 band).

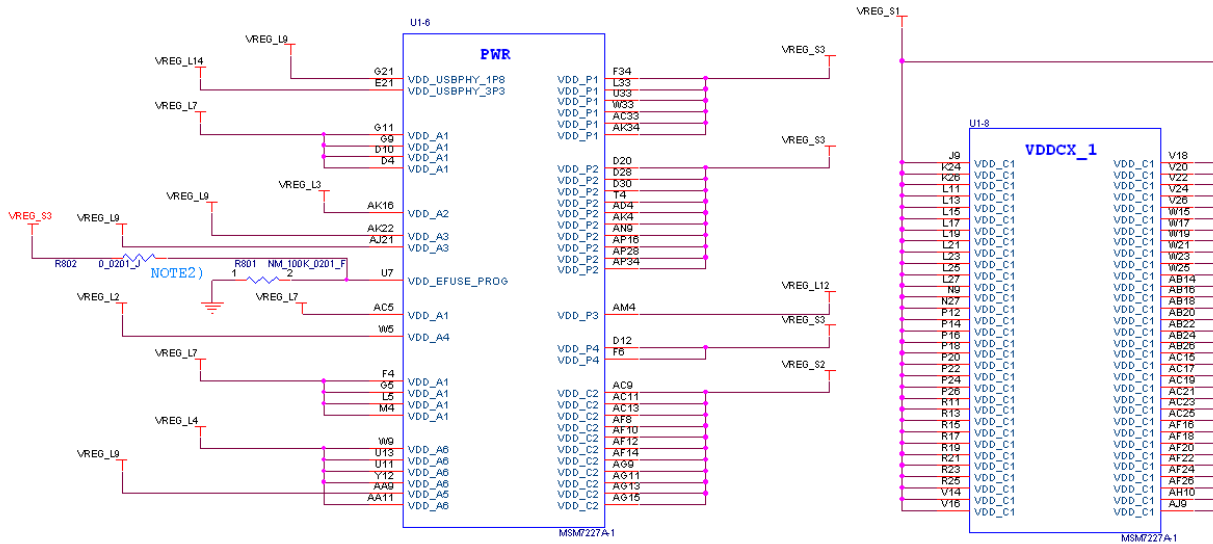
The transmitter functions are implemented in the RTR6285A RF block. Even though WCDMA Band1 signals are sent via different components, the principles of the transmission are the same.

RTR6285A System Module

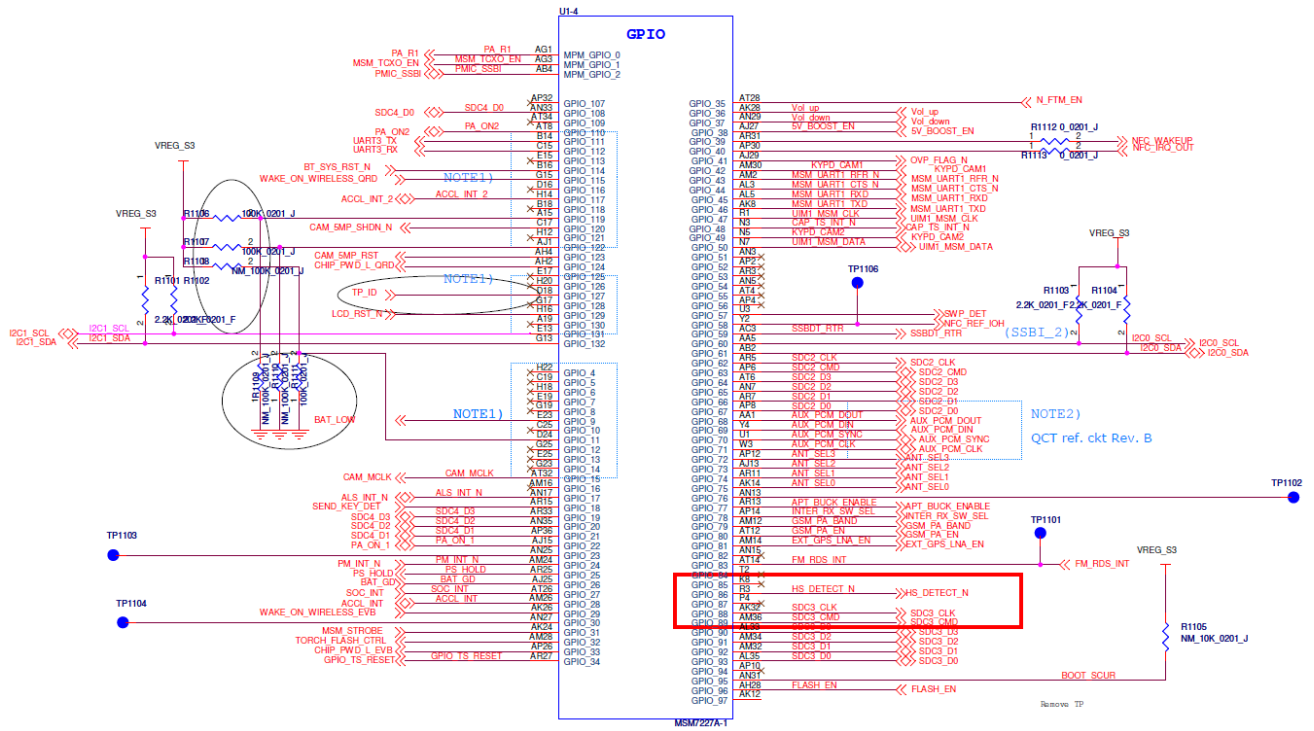


Phone Schematic

Baseband Power

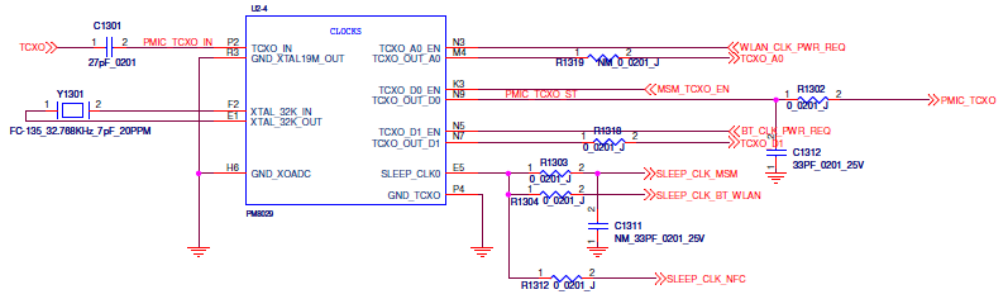


Baseband GPIO

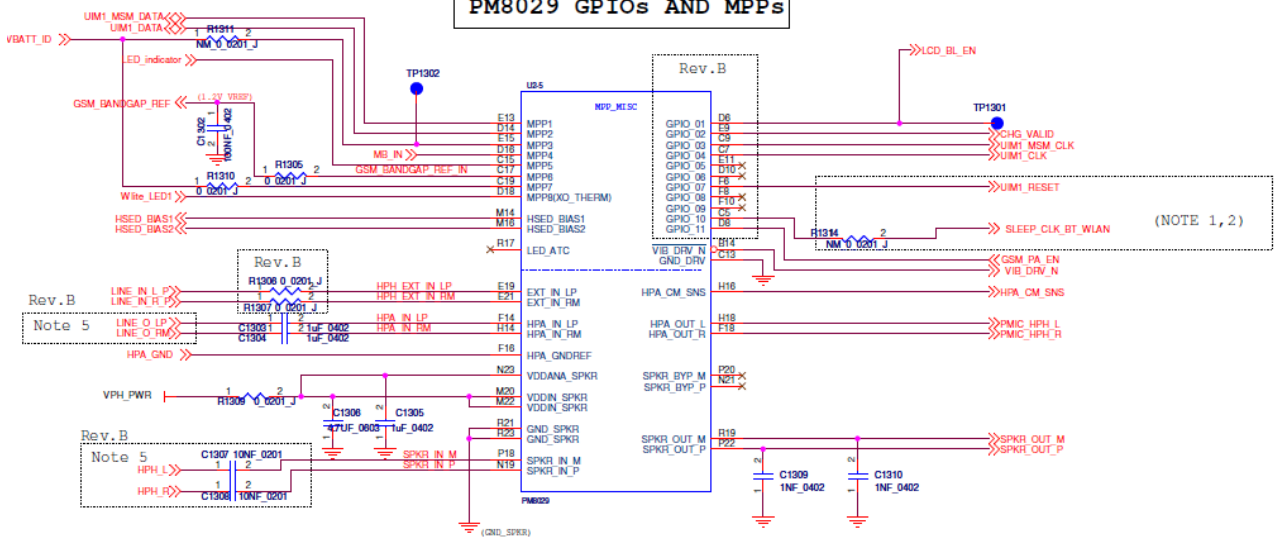


PMIC clock and GPIO

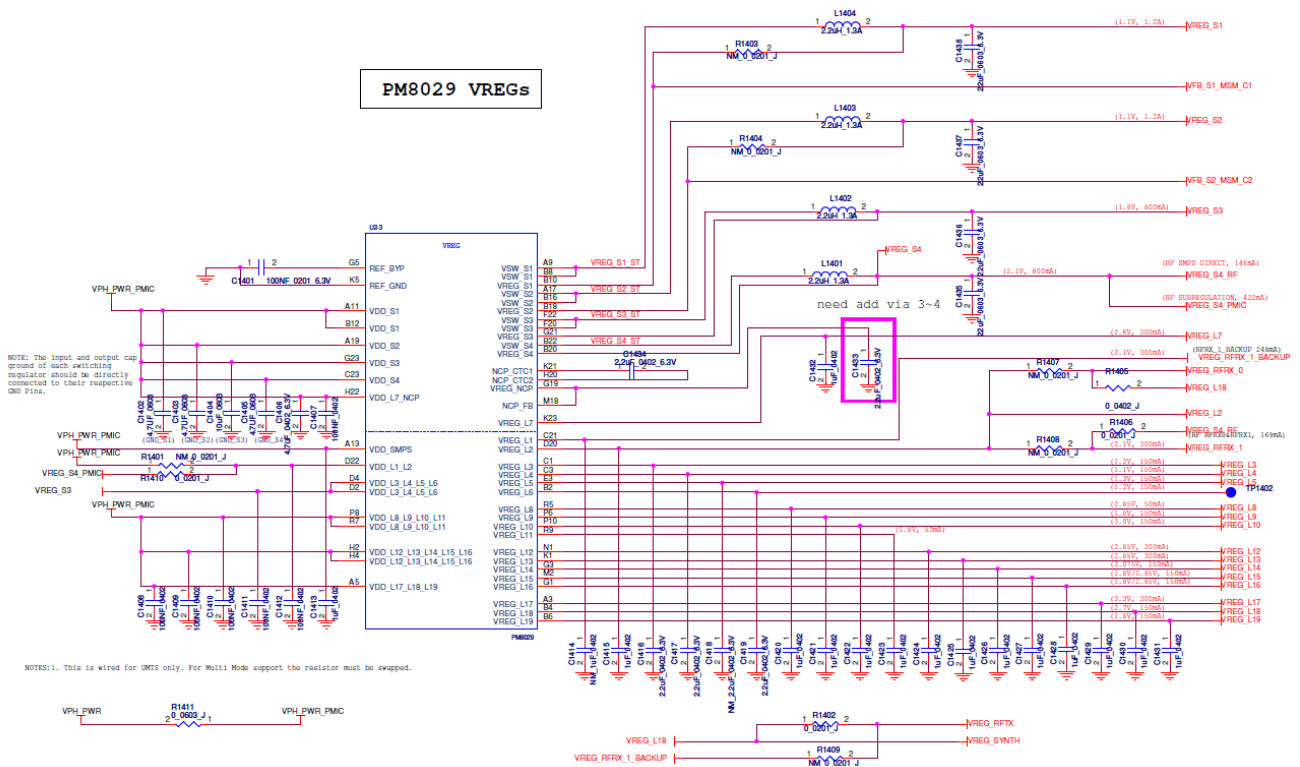
PM8029 CLOCKS



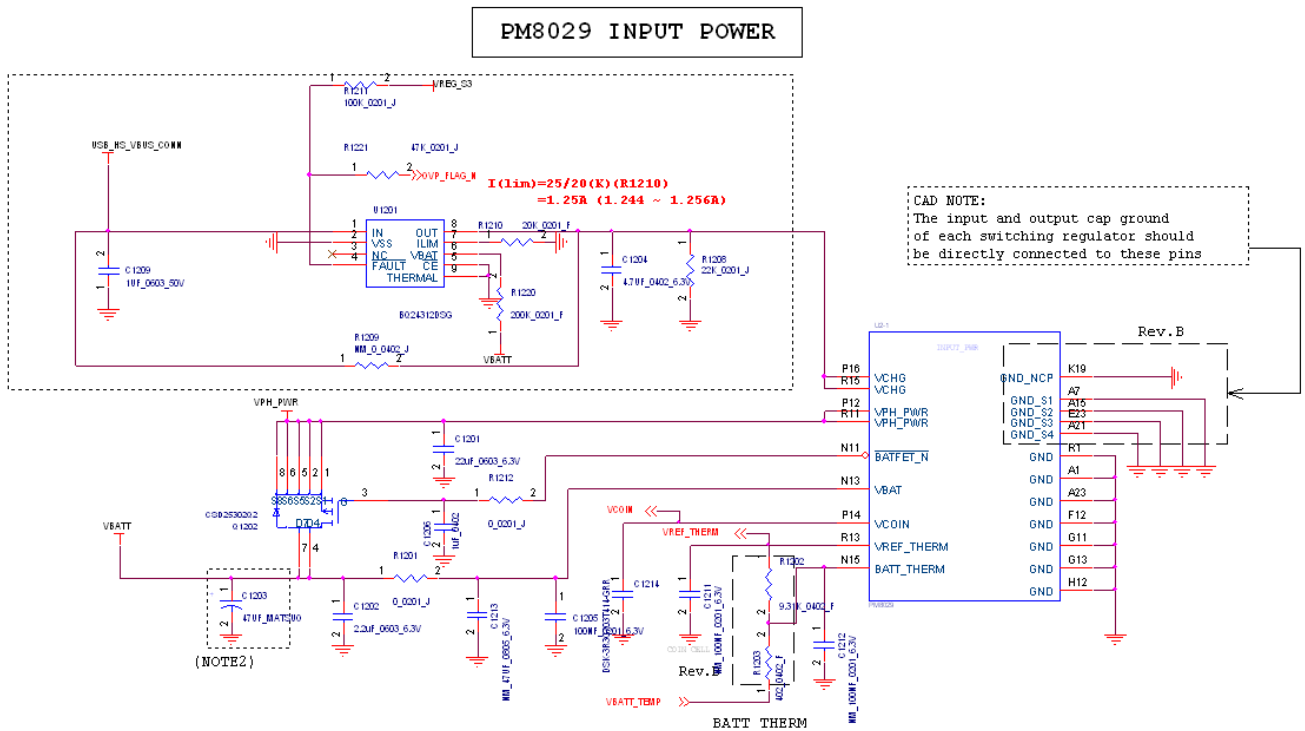
PM8029 GPIOs AND MPPs

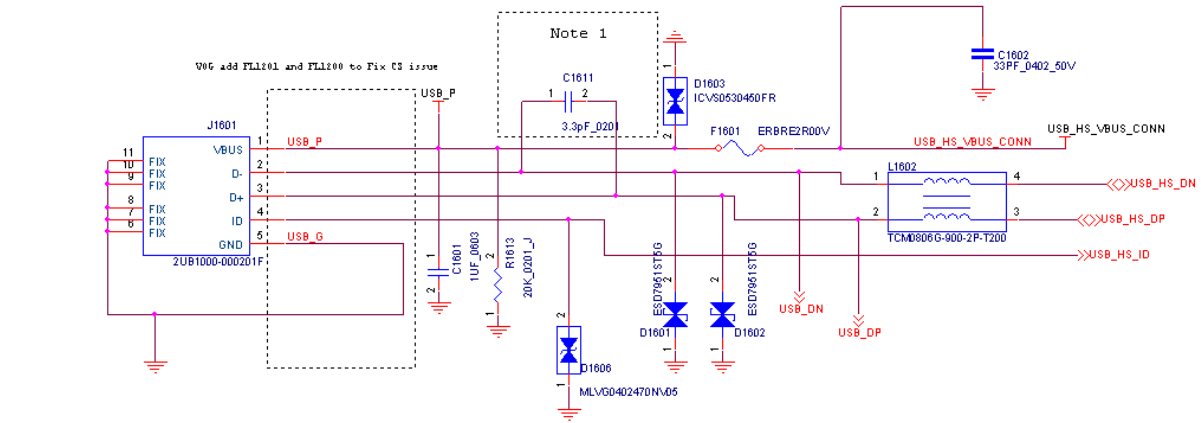


PMIC internal SW LDO and LDO

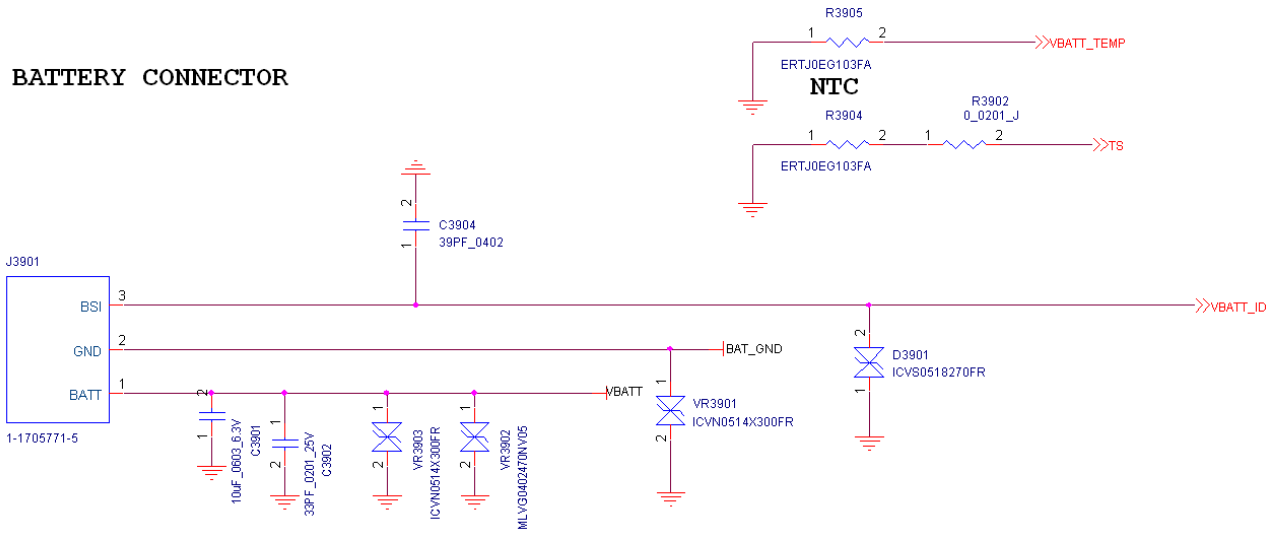


PMIC charger and battery circuit

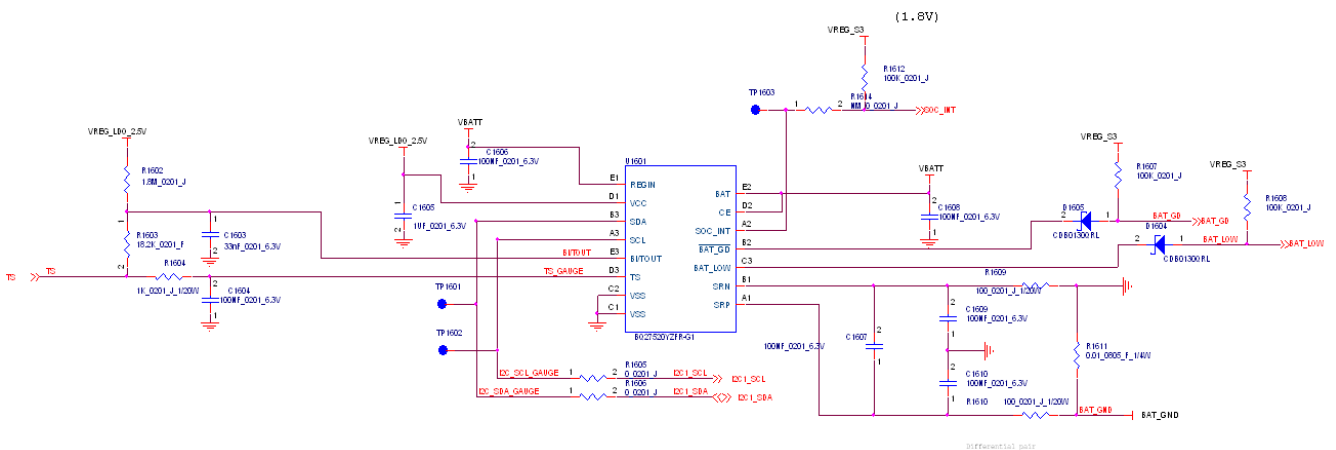




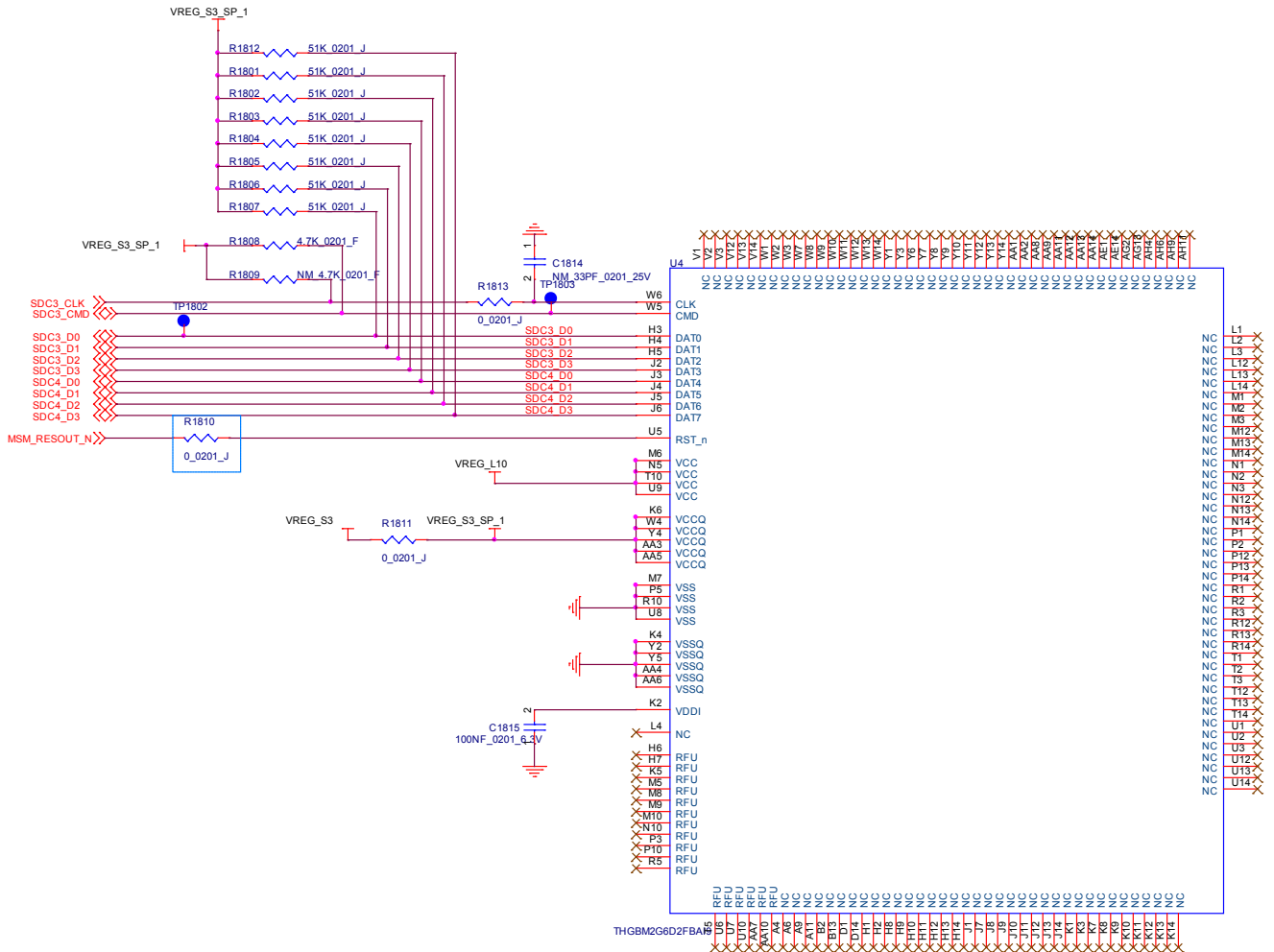
BATTERY CONNECTOR



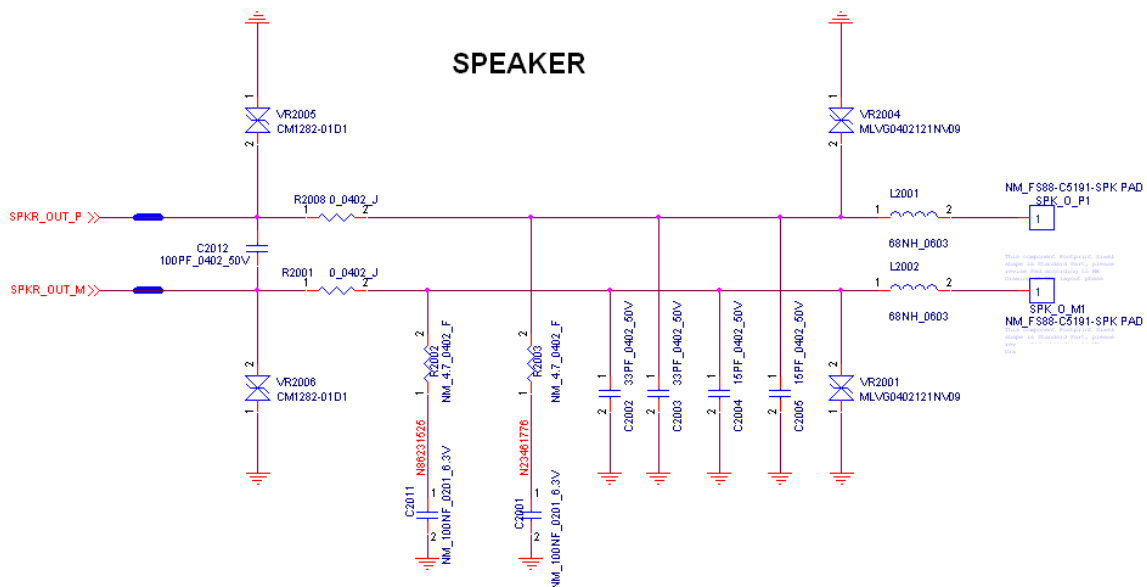
External SWLDO and Gauge

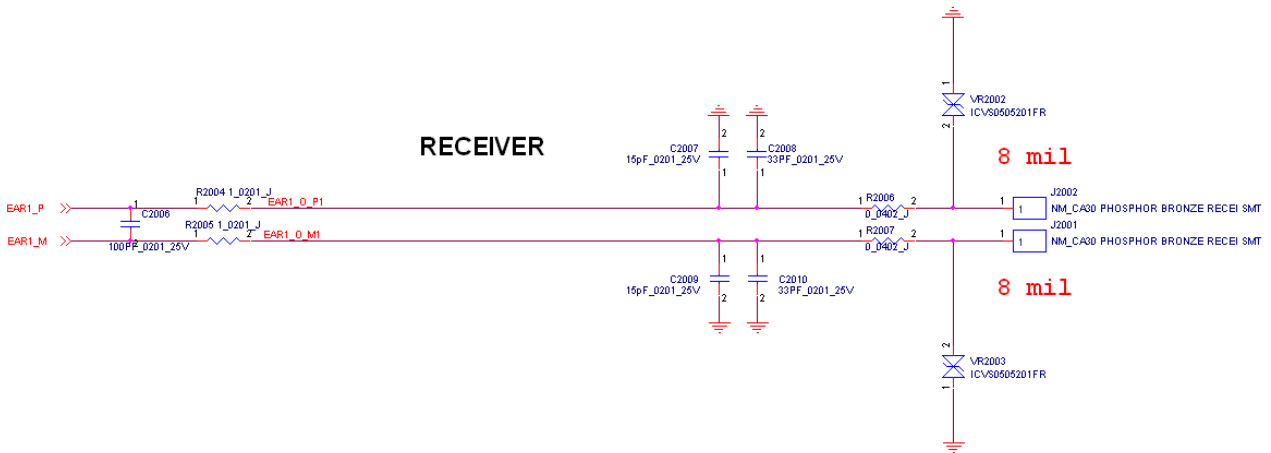


eMMC

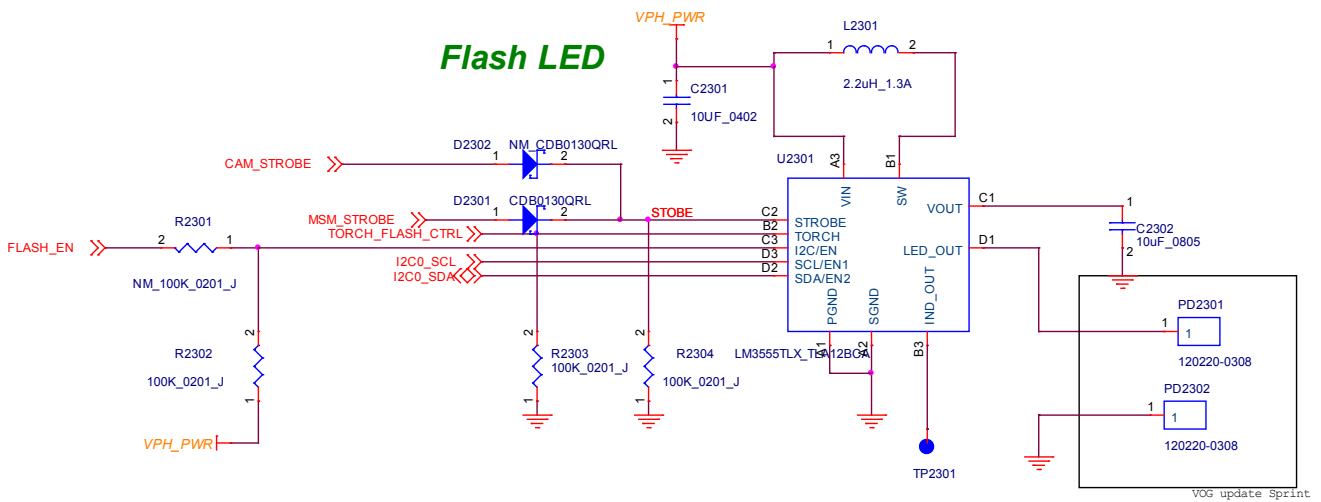


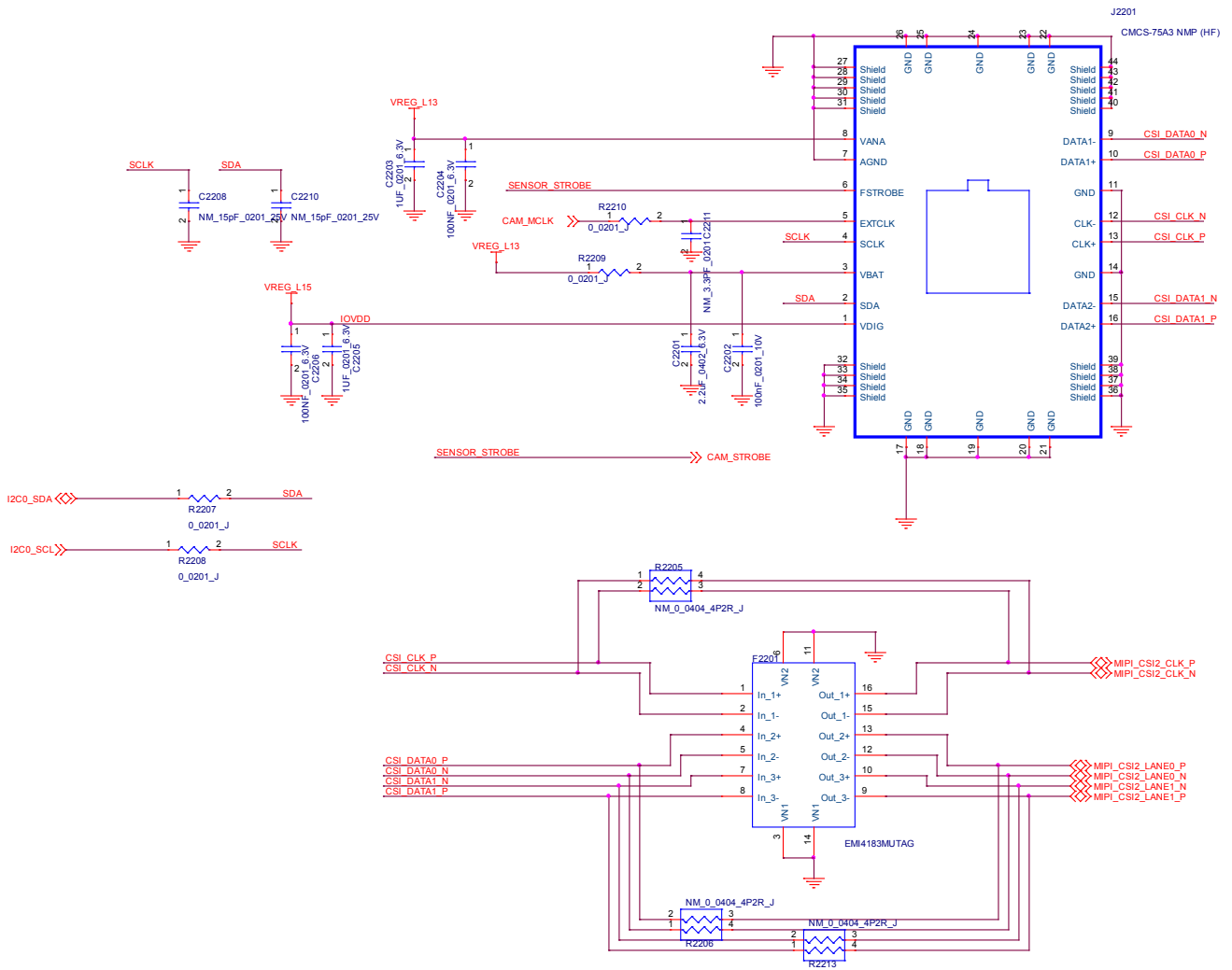
Speaker & Receiver



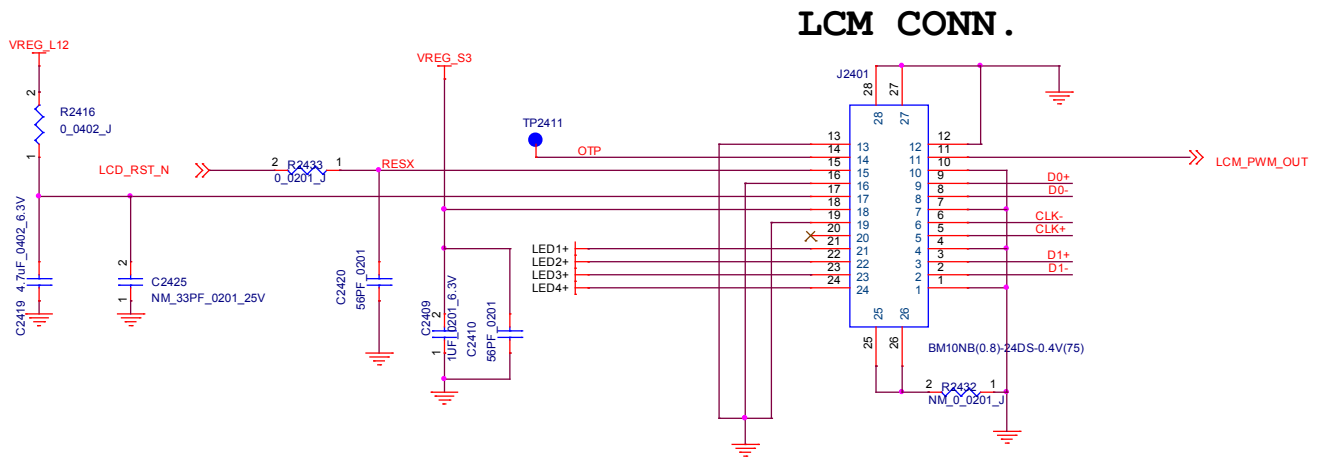


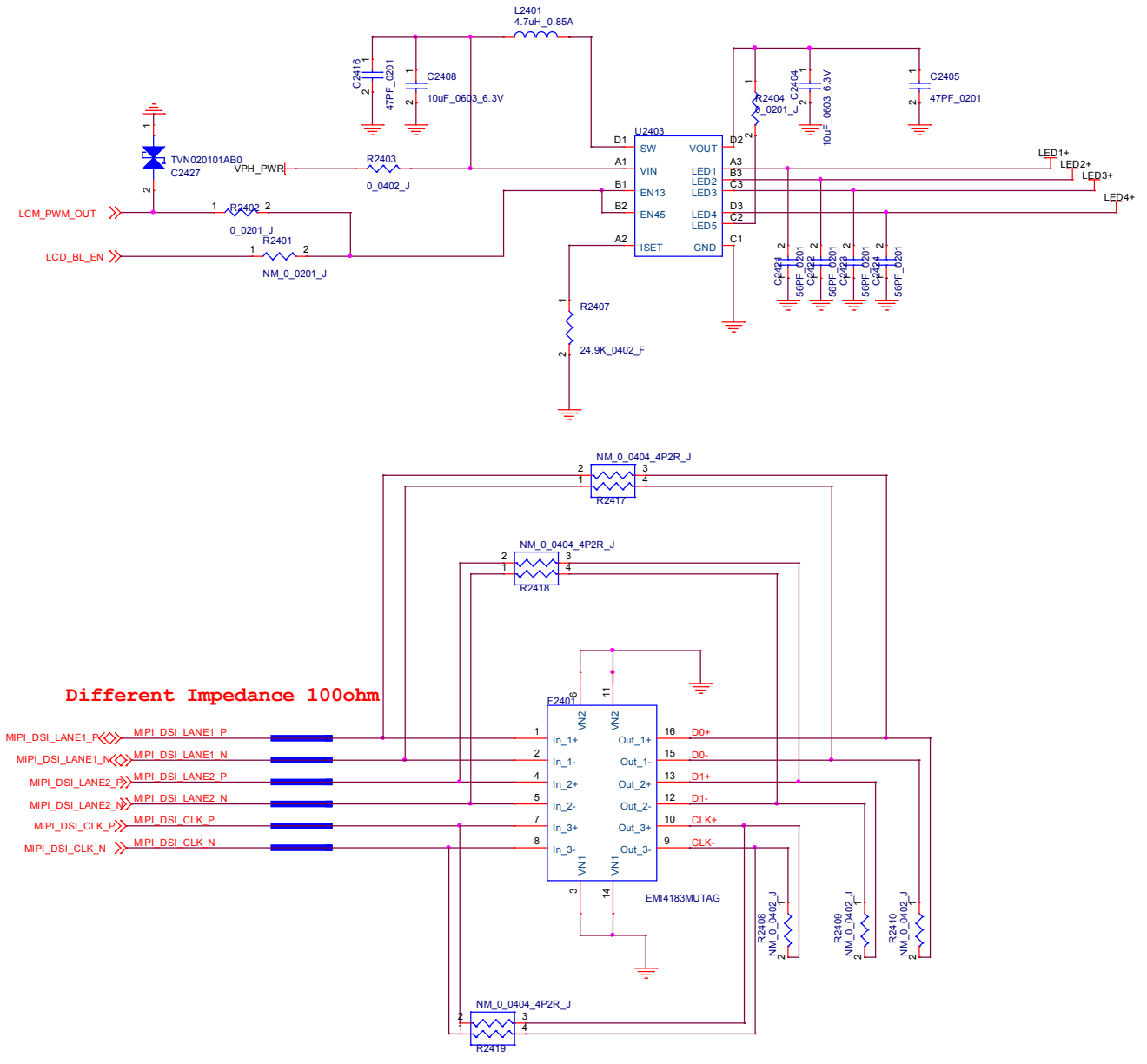
Camera circuit



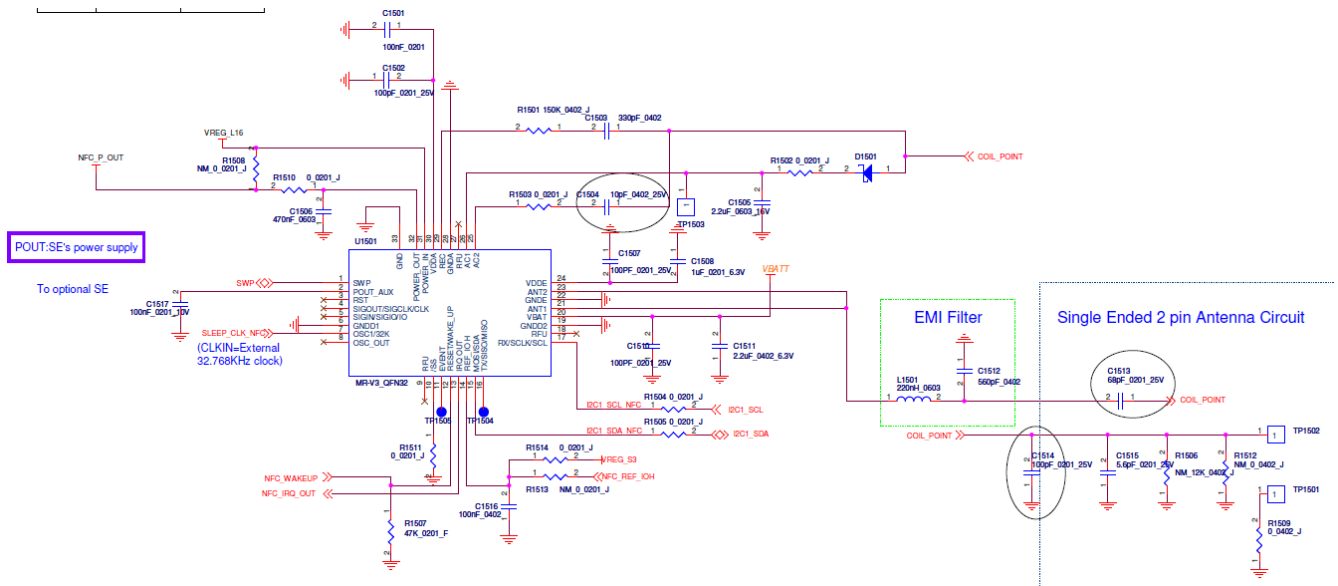


Display circuit

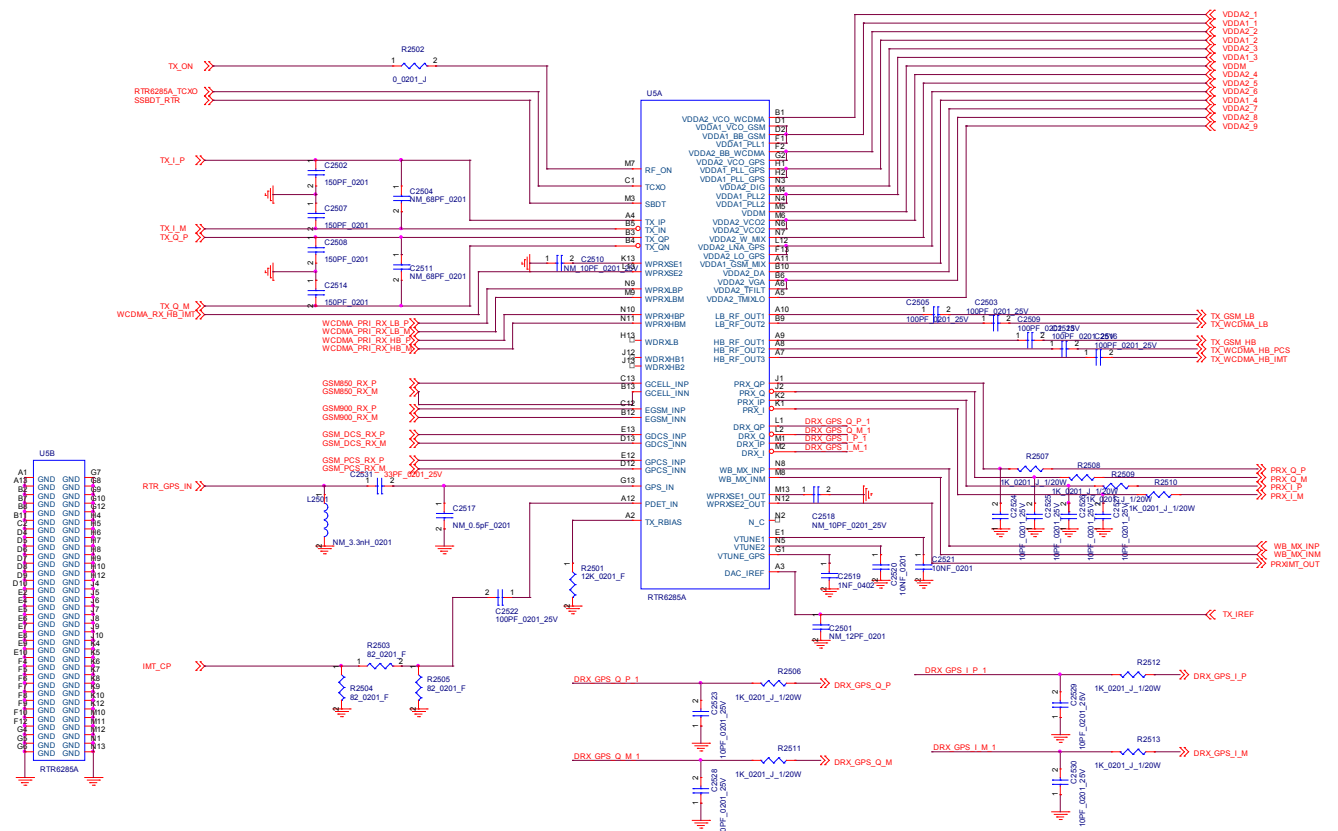


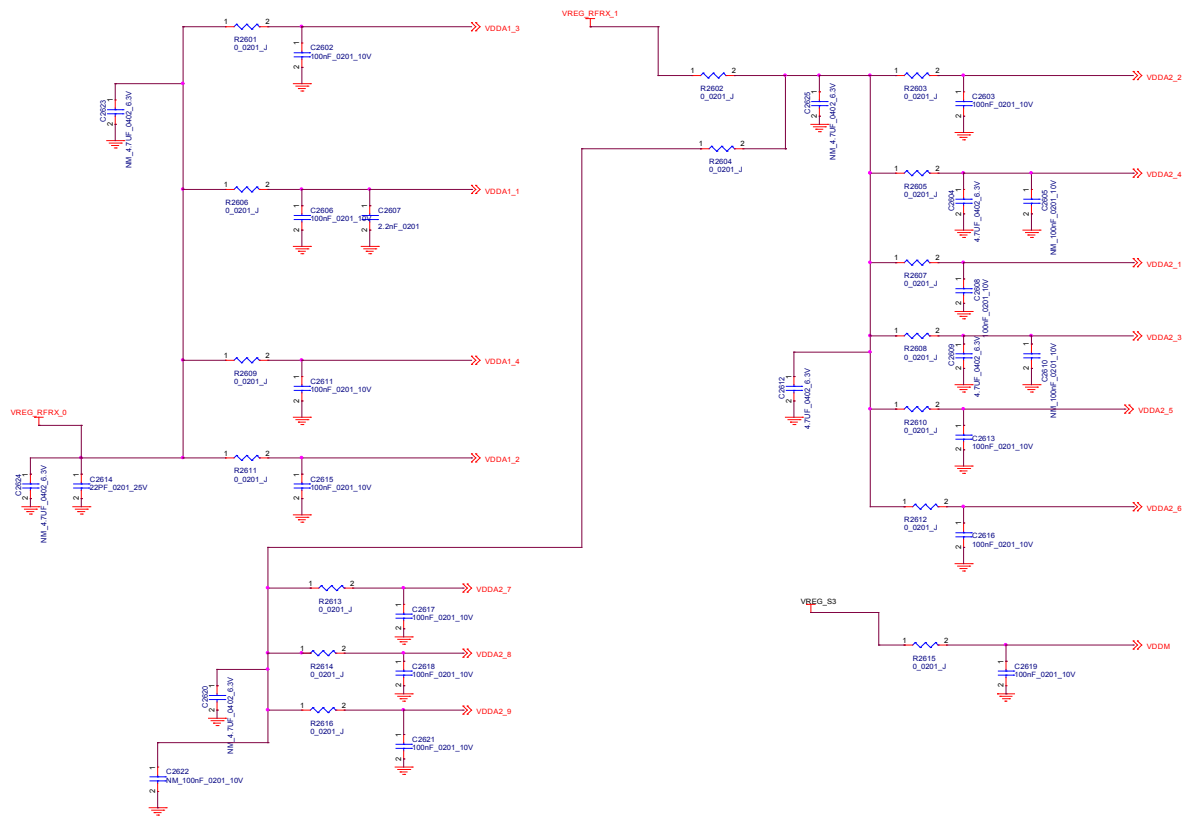


NFC circuit

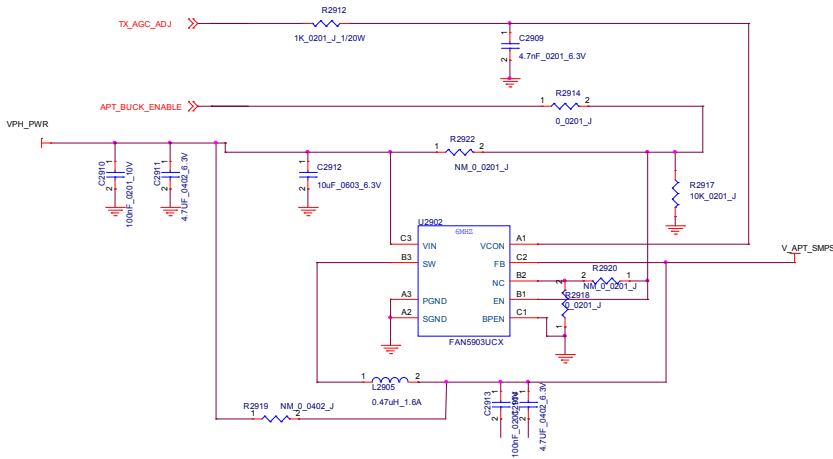
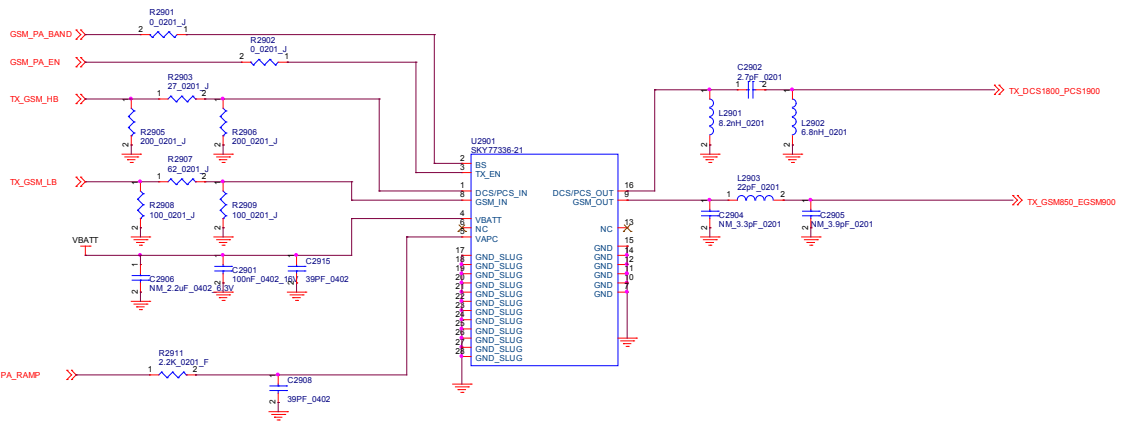


RF Transceiver

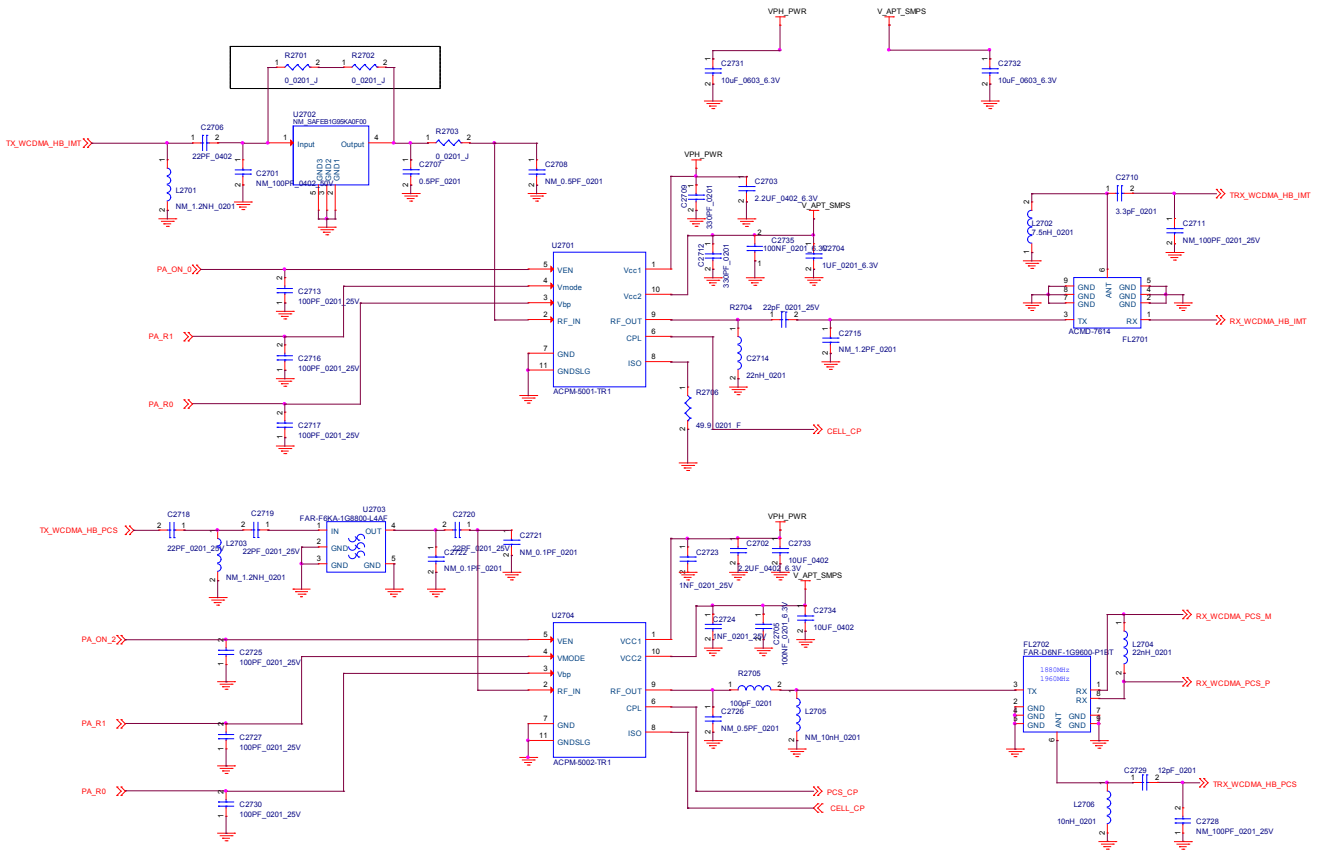




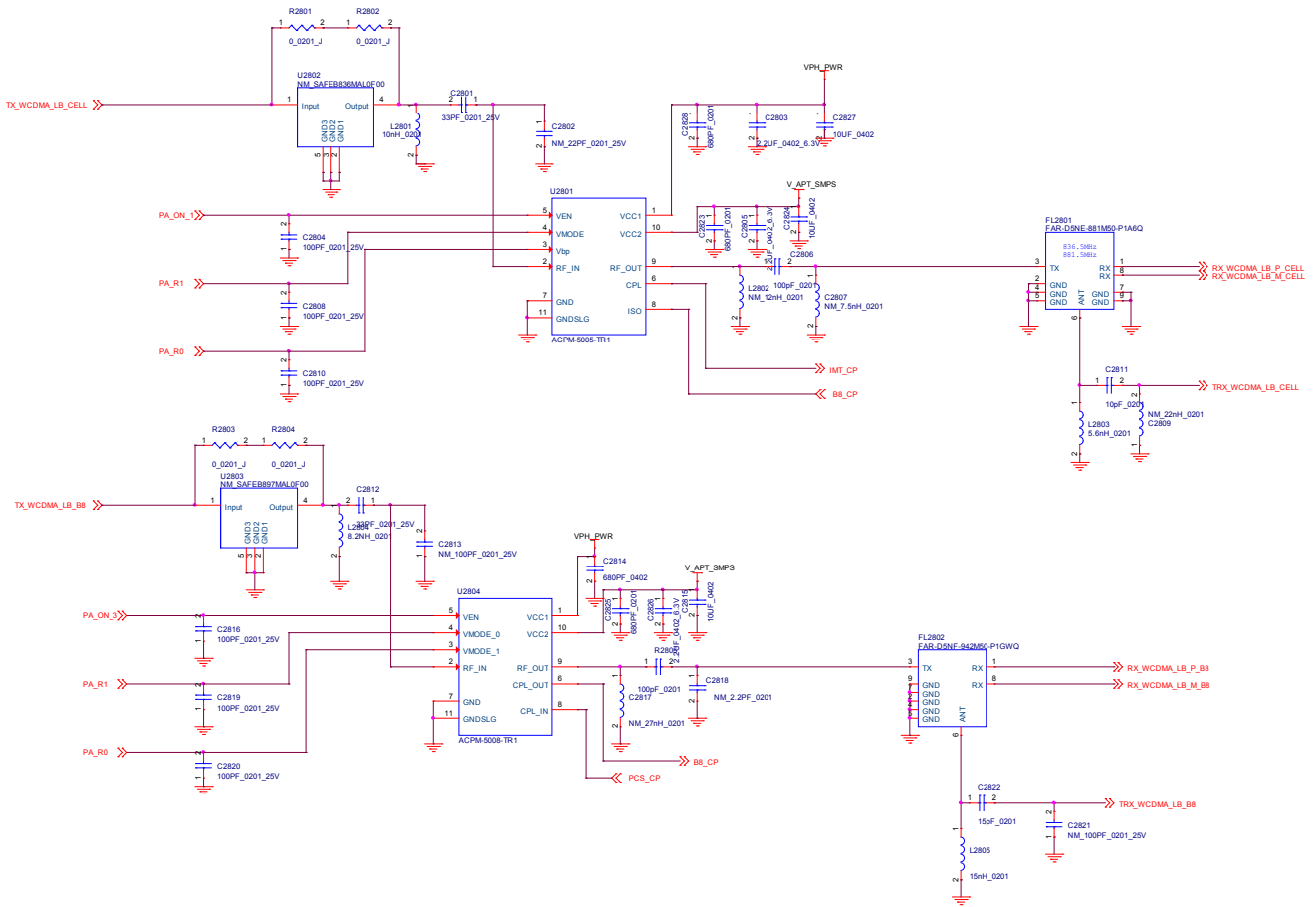
RF PA-1(GSM & UMTS APT)



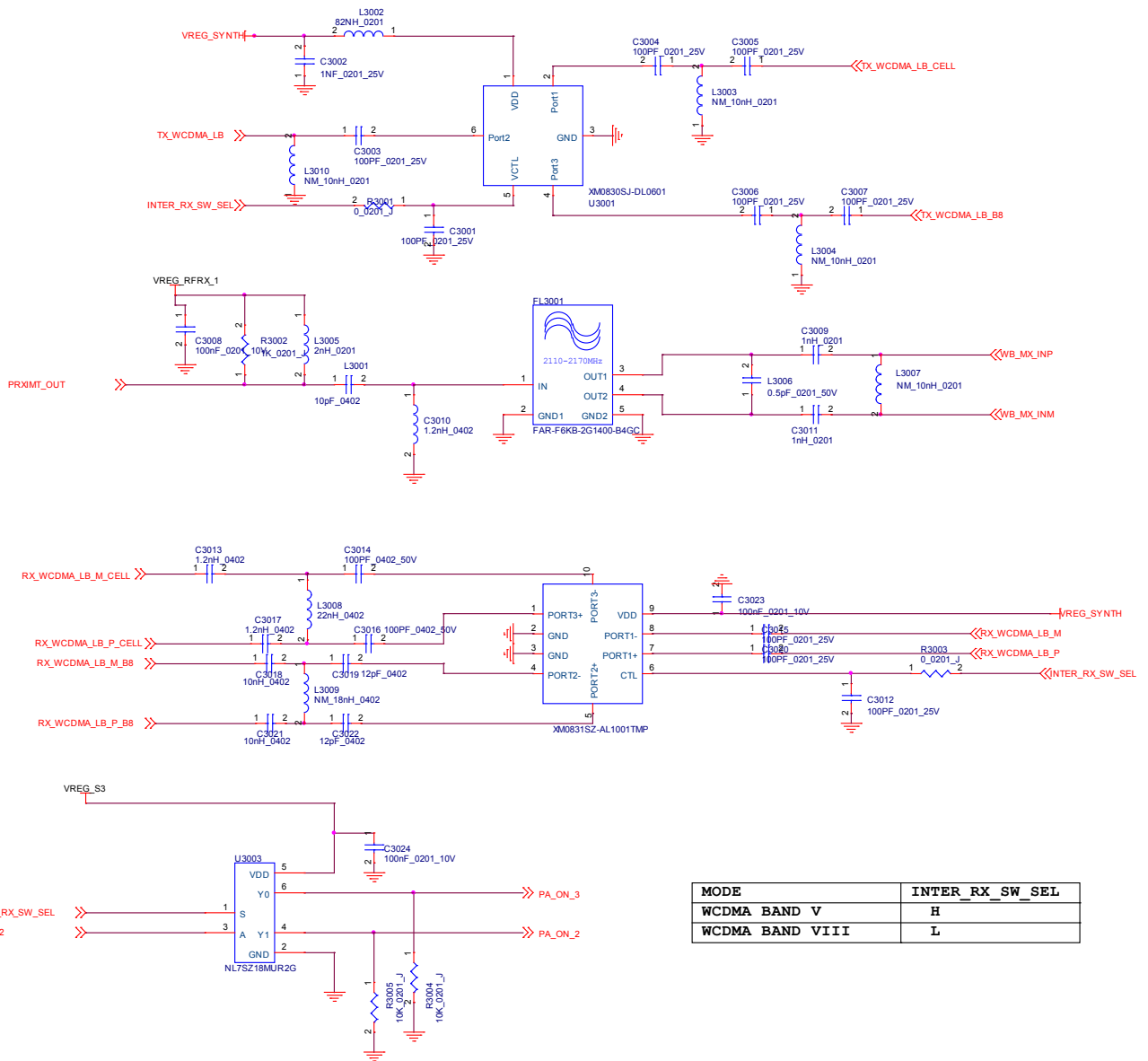
RM-849 -- RF PA-1(WCDMA PA & Duplexer)



RM-819 -- RF PA-1(WCDMA PA & Duplexer)

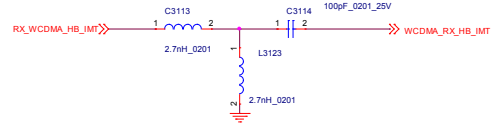
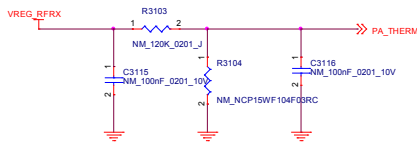
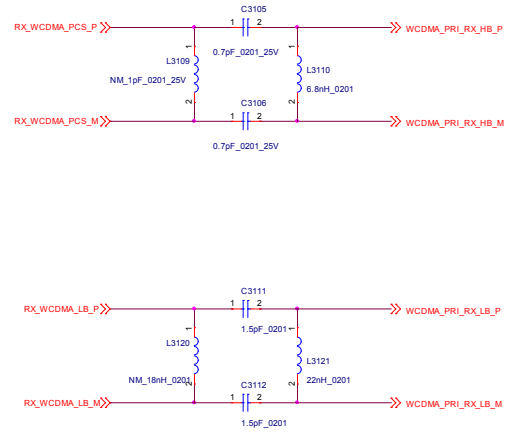
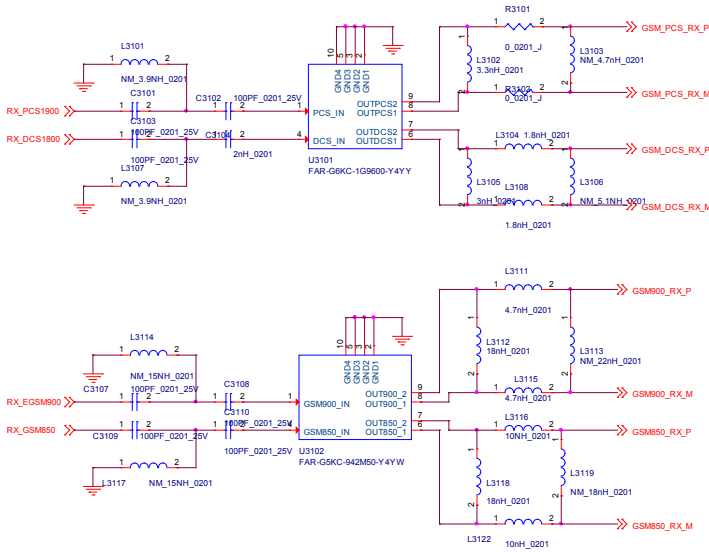


RM-849 -- RF Front End

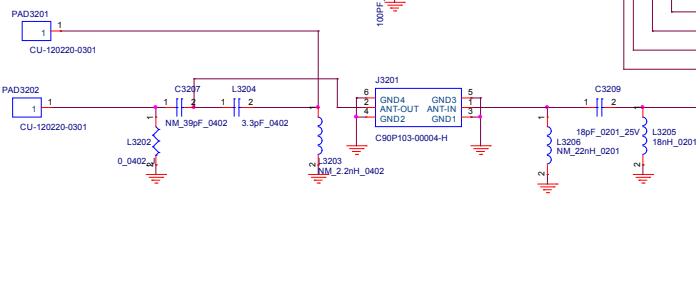
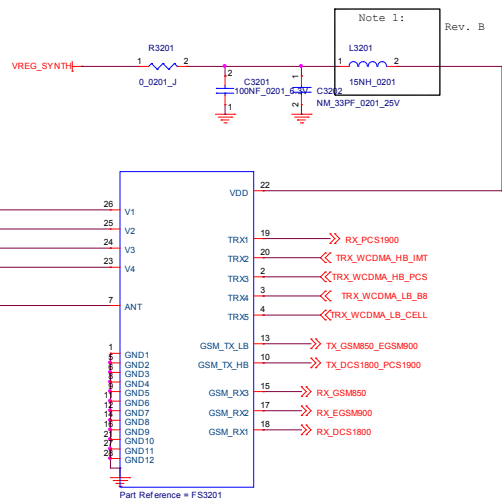
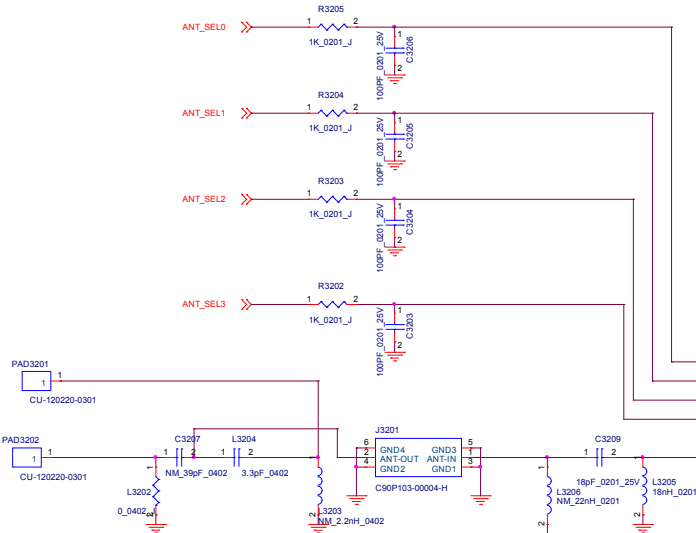


MODE	INTER_RX_SW_SEL
WCDMA BAND V	H
WCDMA BAND VIII	L

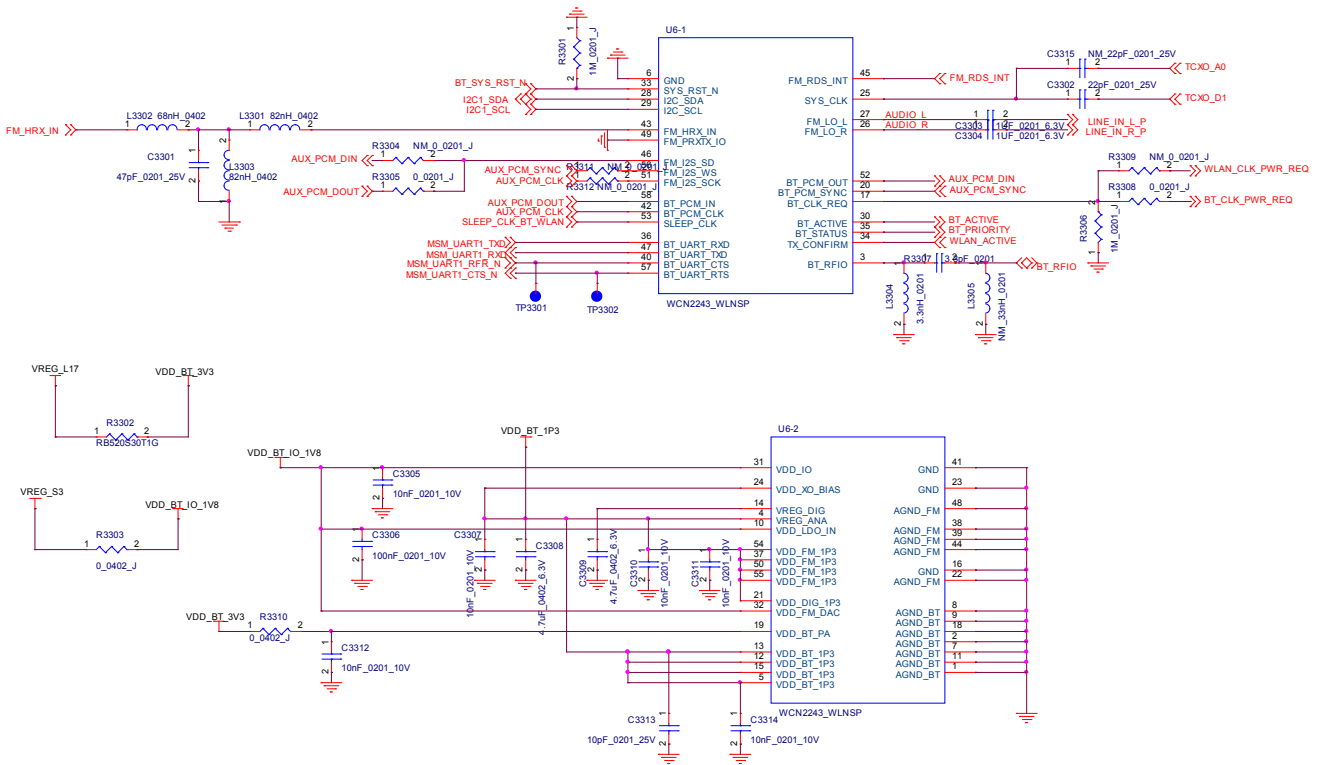
RM-819 -- RF Front End



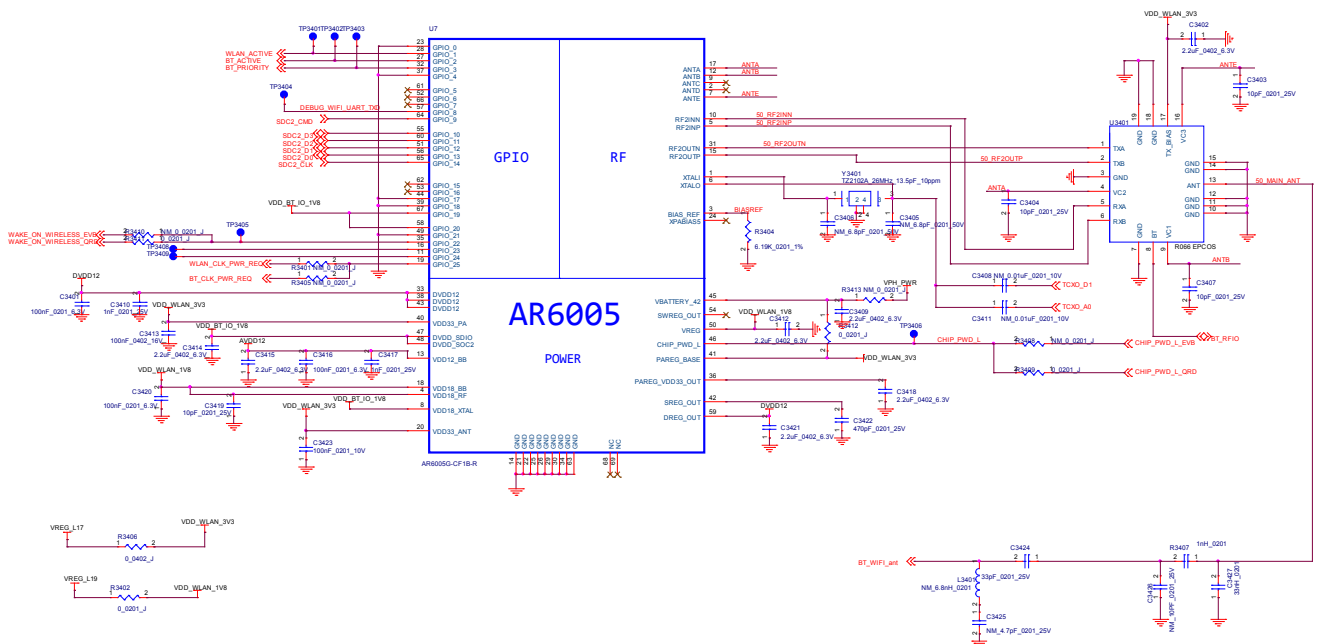
MODE	ANT_SEL0	ANT_SEL1	ANT_SEL2	ANT_SEL3
GSM850/EGSM TX	H	H	L	L
DCS1800/PCS1900TX	H	L	L	L
GSM850 RX	L	H	L	L
DCS1800 RX	L	L	H	L
EGSM900 RX	L	H	H	L
PCS1900 RX	H	L	H	L
WCDMA CELL TRX	H	L	L	H
WCDMA PCS TRX	H	L	H	H
WCDMA B8 TRX	H	H	H	H
WCDMA IMT TRX	H	H	H	L
SLEEP (VREG_SYNTH=NO)	L	L	L	H
POWER DOWN	L	L	L	L



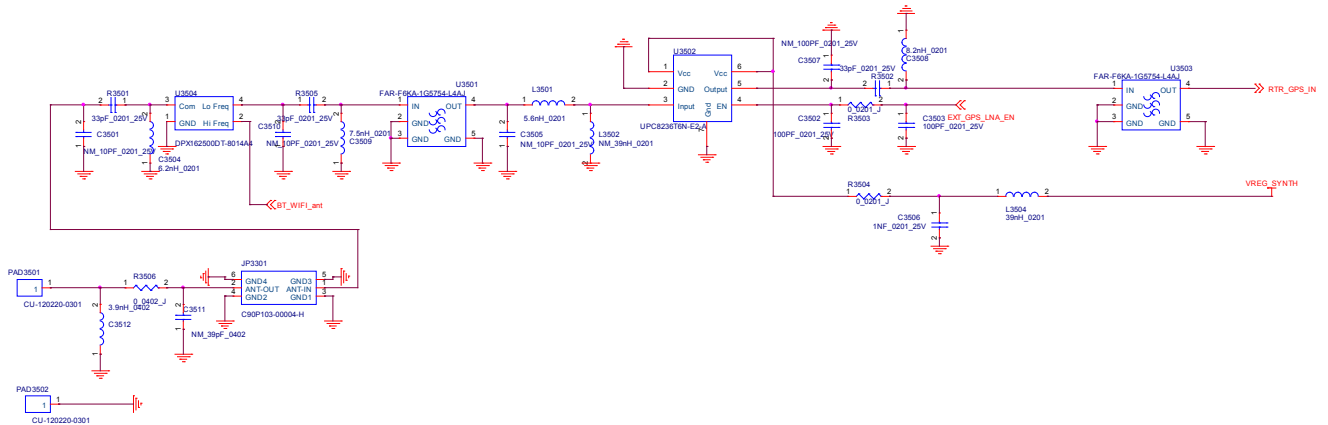
QUALCOMM WCN2243 -- BT/FM



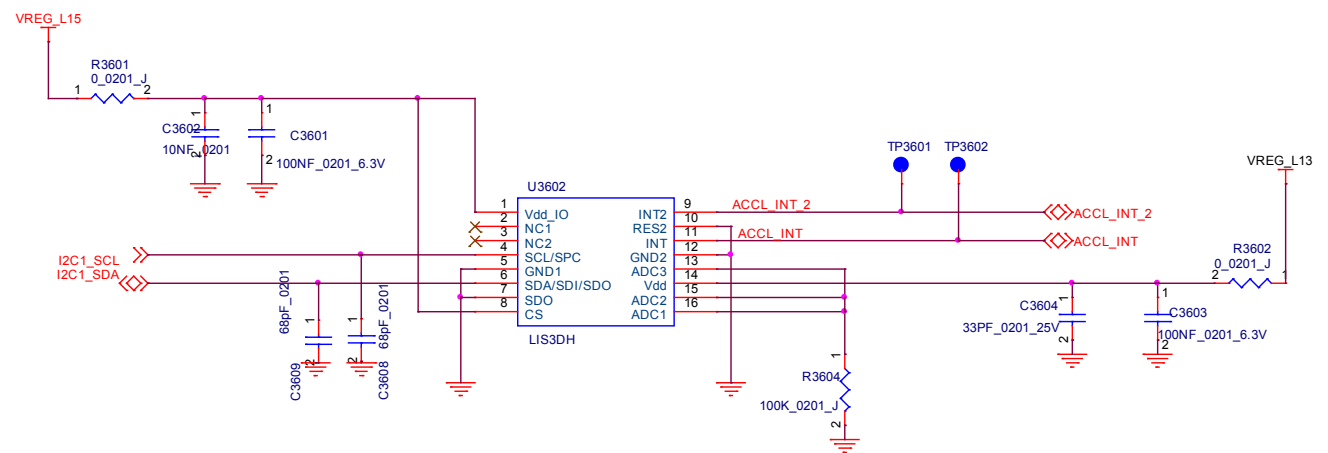
ATHEROS AR6005 -- WIFI



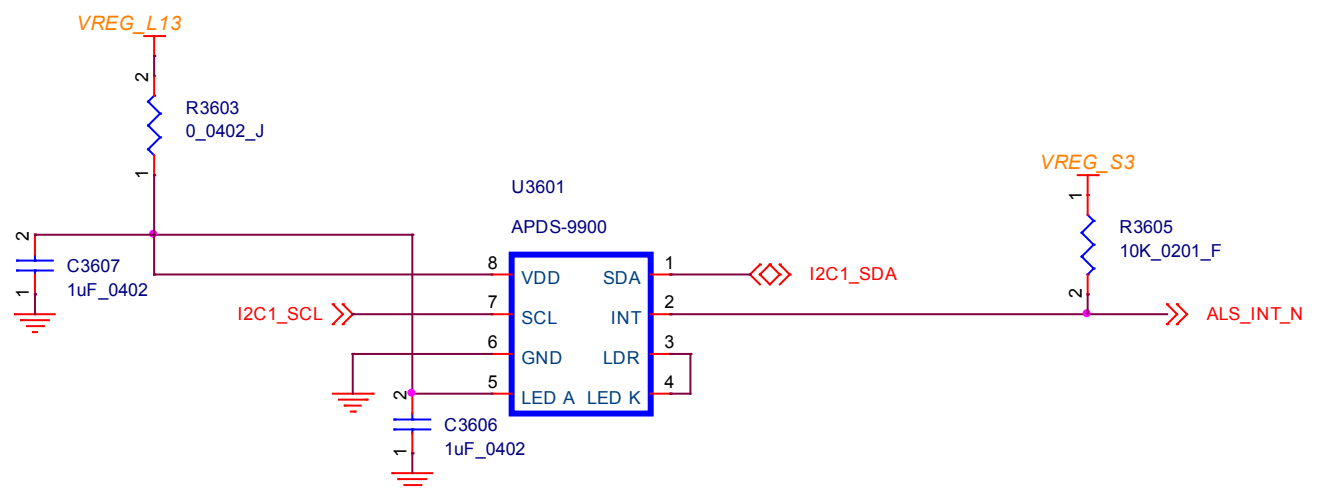
GPS



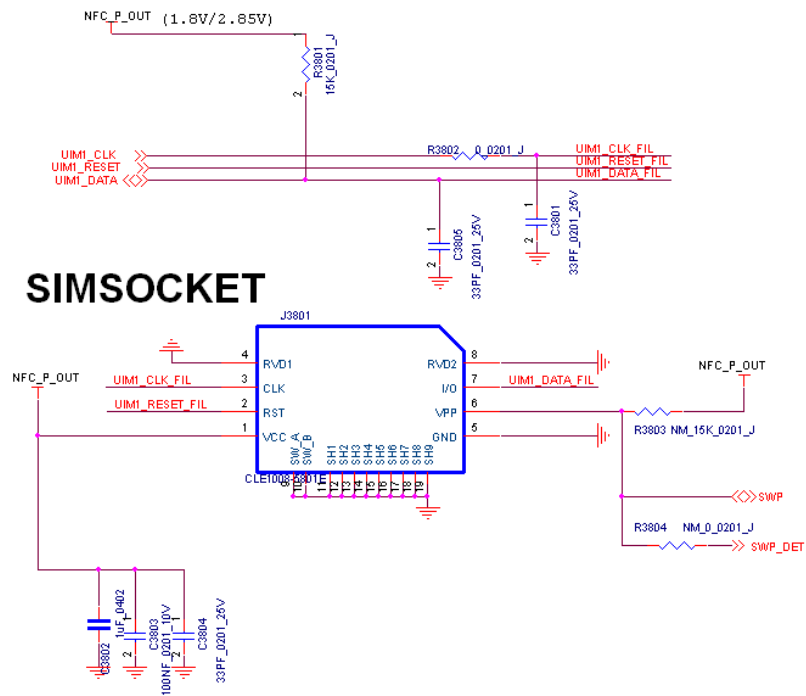
G-Sensor



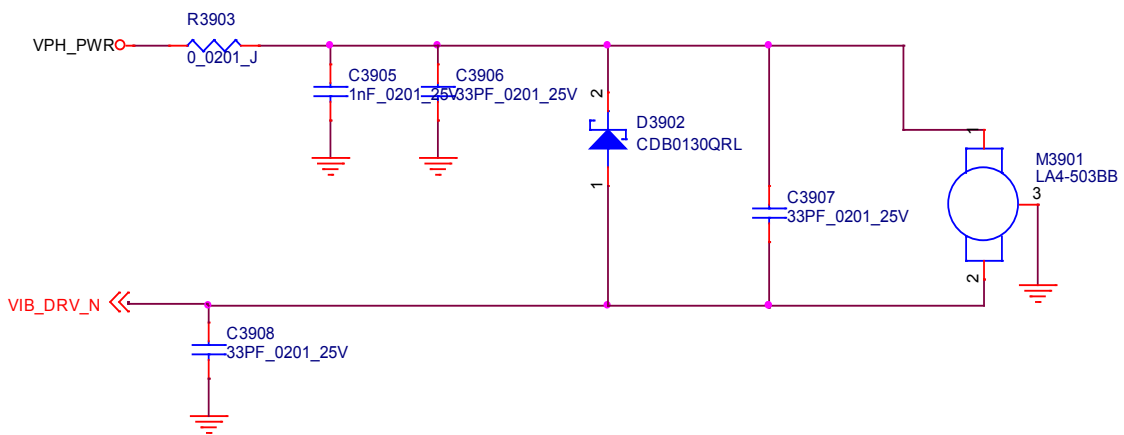
Light & proximity Sensor



SIM

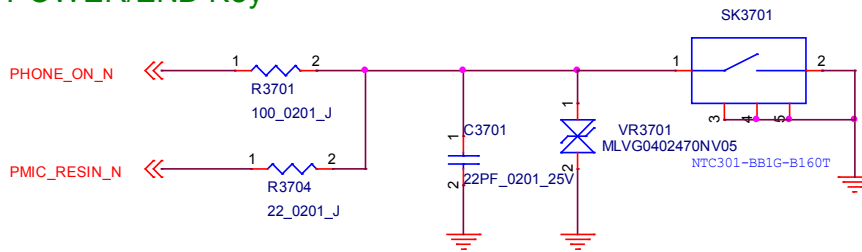


Vibrator



Side key

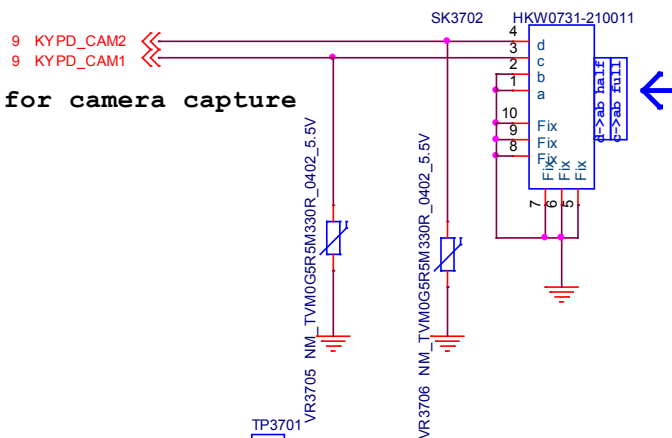
POWER/END Key



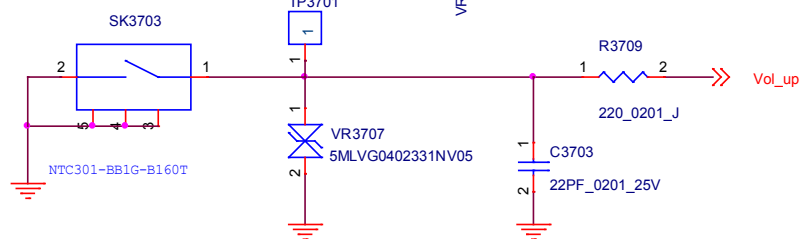
Camera capture key

KYPD_CAM2 for camera AF

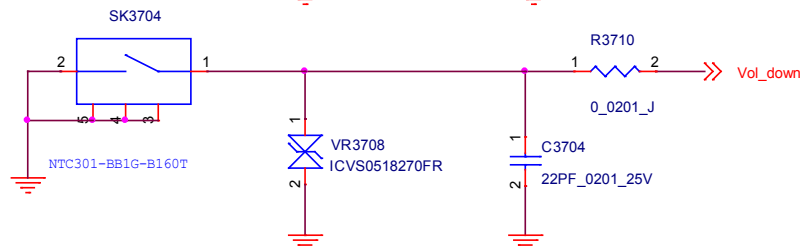
KYPD_CAM1 for camera capture



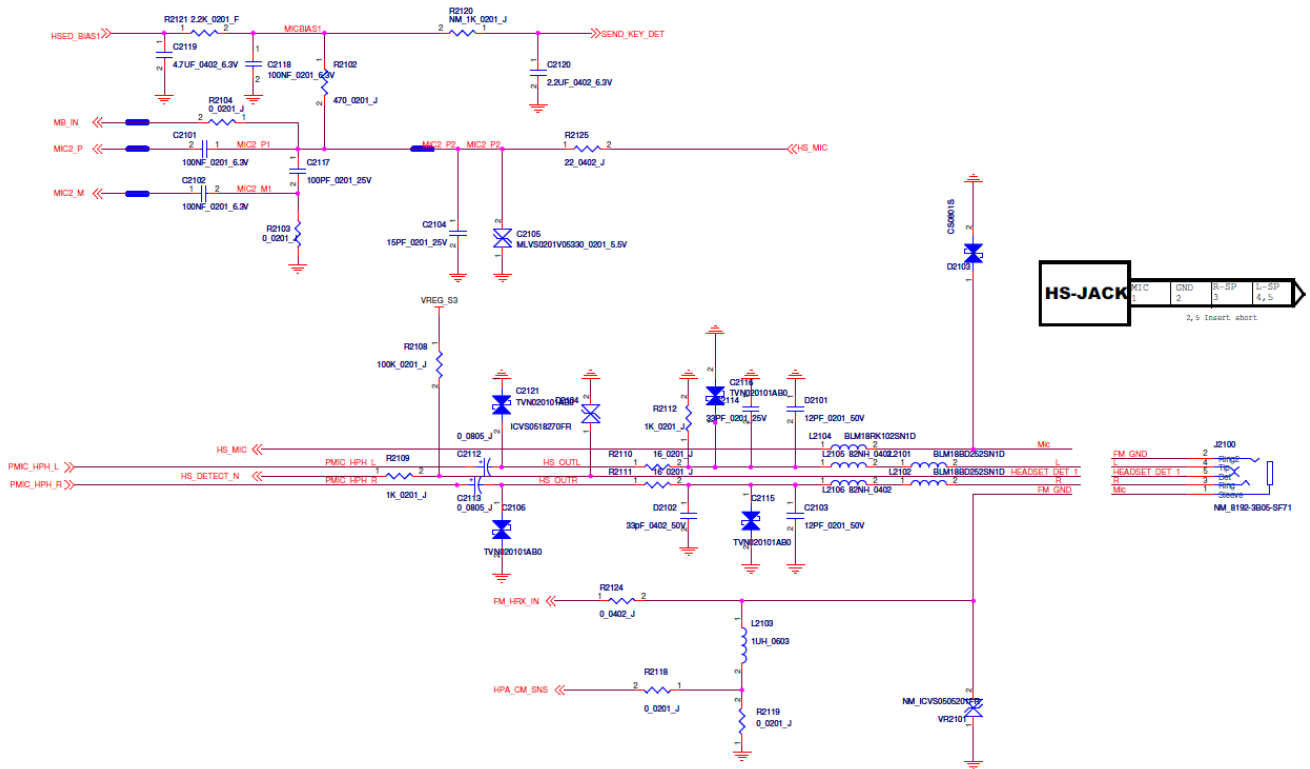
VOL_UP



VOL_DOWN

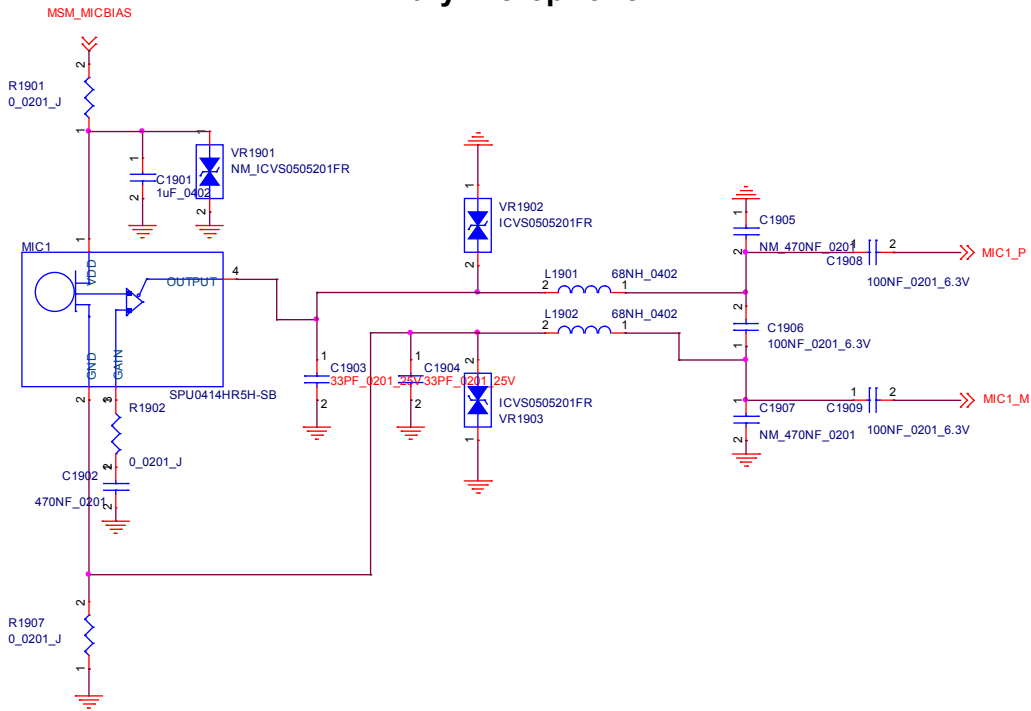


Audio Jack

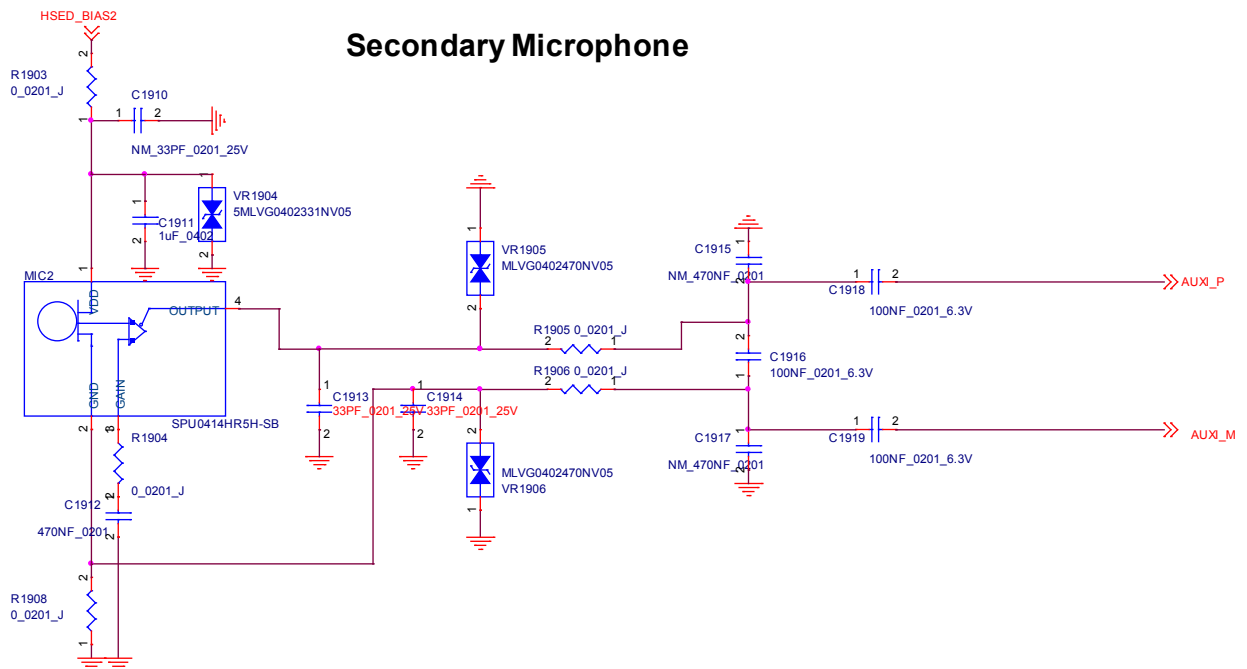


Microphone

Primary Microphone



Secondary Microphone



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Glossary

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A/D-converter	Analogue-to-digital converter
ACI	Accessory Control Interface
ADC	Analogue-to-digital converter
ADSP	Application DPS (expected to run high level tasks)
AGC	Automatic gain control (maintains volume)
ALS	Ambient light sensor
AMSL	After Market Service Leader
ARM	Advanced RISC Machines
ARPU	Average revenue per user (per month or per year)
ASIC	Application Specific Integrated Circuit
ASIP	Application Specific Interface Protector
B2B	Board to board, connector between PWB and UI board
BB	Baseband
BC02	Bluetooth module made by CSR
BIQUAD	Bi-quadratic (type of filter function)
BSI	Battery Size Indicator
BT	Bluetooth
CBus	MCU controlled serial bus connected to UPP_WD2, UEME and Zocus
CCP	Compact Camera Port
WCDMA	Code division multiple access
CDSP	Cellular DSP (expected to run at low levels)
CLDC	Connected limited device configuration
CMOS	Complimentary metal-oxide semiconductor circuit (low power consumption)
COF	Chip on Foil
COG	Chip on Glass
CPU	Central Processing Unit
CSD	Circuit-switched data
CSR	Cambridge silicon radio
CSTN	Colour Super Twisted Nematic
CTSI	Clock Timing Sleep and interrupt block of Tiku
CW	Continuous wave
D/A-converter	Digital-to-analogue converter
DAC	Digital-to-analogue converter
DBI	Digital Battery Interface
DBus	DSP controlled serial bus connected between UPP_WD2 and Helgo
DCT-4	Digital Core Technology
DMA	Direct memory access

DP	Data Package
DPLL	Digital Phase Locked Loop
DSP	Digital Signal Processor
DTM	Dual Transfer Mode
DtoS	Differential to Single ended
EDGE	Enhanced data rates for global/GSM evolution
EGSM	Extended GSM
EM	Energy management
EMC	Electromagnetic compatibility
EMI	Electromagnetic interference
ESD	Electrostatic discharge
FCI	Functional cover interface
FPS	Flash Programming Tool
FR	Full rate
FSTN	Film compensated super twisted nematic
GMSK	Gaussian Minimum Shift Keying
GND	Ground, conductive mass
GPIB	General-purpose interface bus
GPRS	General Packet Radio Service
GSM	Group Special Mobile/Global System for Mobile communication
HSDPA	High-speed downlink packet access
HF	Hands free
HFCM	Hands free Common
HS	Handset
HSCSD	High speed circuit switched data (data transmission connection faster than GSM)
HW	Hardware
I/O	Input/Output
IBAT	Battery current
IC	Integrated circuit
ICHAR	Charger current
IF	Interface
IHF	Integrated hands free
IMEI	International Mobile Equipment Identity
IR	Infrared
IrDA	Infrared Data Association
ISA	Intelligent software architecture
JPEG/JPG	Joint Photographic Experts Group

LCD	Liquid Crystal Display
LDO	Low Drop Out
LED	Light-emitting diode
LPRF	Low Power Radio Frequency
MCU	Micro Controller Unit (microprocessor)
MCU	Multiport control unit
MIC,	Microphone
MIDP	Mobile Information Device Profile
MIN	Mobile identification number
MIPS	Million instructions per second
MMC	Multimedia card
MMS	Multimedia messaging service
MTP	Multipoint-to-point connection
NFC	Near Field Communication
NTC	Negative temperature coefficient, temperature sensitive resistor used as a temperature sensor
OMA	Object management architecture
OMAP	Operations, maintenance, and administration part
Opamp	Operational Amplifier
PA	Power amplifier
PDA	Pocket Data Application
PDA	Personal digital assistant
PDRAM	Program/Data RAM (on chip in Tiku)
Phoenix	Software tool of DCT4.x and BB5
PIM	Personal Information Management
PLL	Phase locked loop
PM	(Phone) Permanent memory
PUP	General Purpose IO (PIO), USARTS and Pulse Width Modulators
PURX	Power-up reset
PWB	Printed Wiring Board
PWM	Pulse width modulation
RC-filter	Resistance-Capacitance filter
RF	Radio Frequency
RF	PopPort™ Reduced function PopPort™ interface
RFBUS	Serial control Bus For RF
RSK	Right Soft Key
RS-MMC	Reduced size Multimedia Card

RSS	Web content Syndication Format
RSSI	Receiving signal strength indicator
RST	Reset Switch
RTC	Real Time Clock (provides date and time)
RX	Radio Receiver
SARAM	Single Access RAM
SAW	filter Surface Acoustic Wave filter
SDRAM	Synchronous Dynamic Random Access Memory
SID	Security ID
SIM	Subscriber Identity Module
SMPS	Switched Mode Power Supply
SNR	Signal-to-noise ratio
SPR	Standard Product requirements
SRAM	Static random access memory
STI	Serial Trace Interface
SW	Software
SWIM	Subscriber/Wallet Identification Module
TCP/IP	Transmission control protocol/Internet protocol
TCXO	Temperature controlled Oscillator
Tiku	Finnish for Chip, Successor of the UPP
TX	Radio Transmitter
UART	Universal asynchronous receiver/transmitter
UEME	Universal Energy Management chip (Enhanced version)
UEMEK	See UEME
UI	User Interface
UPnP	Universal Plug and Play
UPP	Universal Phone Processor
UPP_WD2	Communicator version of DCT4 system ASIC
USB	Universal Serial Bus
VBAT	Battery voltage
VCHAR	Charger voltage
VCO	Voltage controlled oscillator
VCTCXO	Voltage Controlled Temperature Compensated Crystal Oscillator
VCXO	Voltage Controlled Crystal Oscillator
Vp-p	Peak-to-peak voltage
VSIM	SIM voltage
WAP	Wireless application protocol

WCDMA	Wideband code division multiple access
WD	Watchdog
WLAN	Wireless local area network
XHTML	Extensible hypertext markup language
Zocus	Current sensor (used to monitor the current flow to and from the battery)

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