Nokia Customer Care

# *Service Manual*

## RM-635 (Nokia 2690)

# Mobile Terminal

***Part No: 9219028 (Issue 1)***

***COMPANY CONFIDENTIAL***

NOKIA
Care

## Amendment Record Sheet

| Amendment No | Date | Inserted By | Comments |
|---|---|---|---|
| Original issue | 12/2009 | Jeff Zhao | |

## Copyright



## 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 GSM or WCDMA transmitter without a proper antenna load, otherwise GSM or 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.

## CONNECTING 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 fulfil 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. Unauthorised 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 Ni-Cd/NiMh 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 endeavour 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.

Please state:

- Title of the Document + Issue Number/Date of publication
- Latest Amendment Number (if applicable)
- Page(s) and/or Figure(s) in error

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# Nokia 2690 Service Manual Structure

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# 1 — General Information

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### List of Figures

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## Product selection

RM-635 (Nokia 2690) is a GSM quad band phone, supporting GSM850/900/1800/1900 bands.


**Figure 1 RM-635 (Nokia 2690) product picture**

## Phone features

### Display and keypad features

- 1.8' 128x160 pixel, 262k true colour display
- 5-way , navi-key (2 soft-keys, call and end keys)

### Hardware features

- 0.3-megapixel camera with 4x digital zoom
- 3.5mm AV connector for stereo headset
- Micro USB port for data transfer (USB 2.0)
- Bluetooth (version 3.0)
- RDS Stereo radio and music player
- Internal vibrator and antenna
- Plug-in SIM (1.8 V and 3.0 V)
- MicroSD card hot swap slot (up to 8GB)

### RF features

- GSM850/900/1800/1900
- EGPRS: MSC 32 (MSC 31 in China)
- GPRS: MSC 32 (MSC 31 in China)

- HSCDS
- CSD

## User interface and software features

### Selection of software applications and services

- Audio messages
- XHTML browsing over TCP/IP
- Themes (wallpapers, icons, colors)
- Music Player supporting MP3, AAC, ACC+, eAAC+ and WMA
- Nokia Xpress audio messaging (AMS)
- OMA DRM 2.0 (Digital Right Management)
- OMA MMS 1.2, MMS Conformance 3.0, AMR and SMIL
- OMA Client Provisioning v1.1
- Java
- MP3 ringing tones, true tones and MIDI ringing, alert and gaming tones with support of 64 polyphony
- Video ringing tones
- WAP 2.0, XHTML browser over HTTP/TCP/IP stack
- SyncML (local and remote)
- TWIN PC Suite

## Accessories

### Sales package contents

- Nokia 2690 phone
- Nokia Battery BL-4C
- Nokia Charger: AC-3
  (AC-8C and CA-100C for China)
- Nokia wired stereo headset: WH-102
- CD rom
- User Guide

**Table 1 Battery and chargers**

| Type | Name |
|---|---|
| **Note:** This phone is charged through the smaller charger Nokia standard interface (2.mm plug). The standard 3.5mm standard charger can be used together with the CA-44 charger adapter. | |
| AC-3 | Charger |
| AC-8 | Charger |
| BL-4C | Battery 860 mAh Li-Ion |

**Table 2 Headsets**

| Type | Name |
|---|---|
| WH-102 | Stereo headset (wired) |

**Table 3 Data cables**

| Type | Name |
|---|---|
| CA-101 | Micro USB cable |

## Technical Specifications

### General specifications

| Unit | Dimension (mm) | Weight (g) | Volume (cc) |
|---|---|---|---|
| Transceiver with BL-4C 860 mAh Li-Ion battery pack | 107.5*45.5*13.8" | 80.72 | 58.81 |

### Battery endurance

| Battery | Capacity mAh | Best Talk Time | ECTEL Talk Time | Best Stand-by Time | ECTEL Stand-by Time |
|---|---|---|---|---|---|
| BL-4C | 860 | Up to 6.6 hours | 3.2 hours | Up to 16 days<br>Music 9.8 hours | 309 hours |

**Note:** Variation in operation times will occur depending on SIM card, network settings and usage.

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# 2 — Service Devices and Service Concepts

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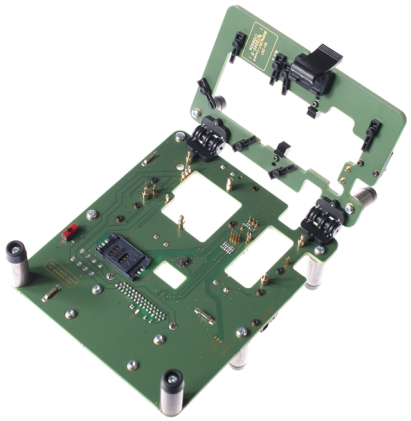
## Service devices

### Product specific devices

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-635. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

<table>
<tr><td rowspan="2">  </td><td>FS-144</td><td>Flash adapter</td><td></td></tr>
<tr><td colspan="3">• FS-144 is equipped with a clip interlock system<br>• provides standardised interface towards Control Unit<br>• provides RF connection using coupler<br>• multiplexing between USB and FBUS media, controlled by VUSB</td></tr>
<tr><td rowspan="2">  </td><td>MJ-267</td><td>Module jig</td><td></td></tr>
<tr><td colspan="3">MJ-267 is meant for component level troubleshooting.<br>The jig includes an RF interface for GSM and Bluetooth. In addition, it has the following features:<br>• Provides mechanical interface with the engine module<br>• Provides galvanic connection to all needed test pads in module<br>• Multiplexing between USB and FBUS media, controlled by Vusb<br>• MMC interface<br>• Duplicated SIM connector<br>• Connector for control unit<br>• Access for AV- and USB connectors<br>• CA-128RS cable is used together with this jig for RF testing.</td></tr>
</table>

### General devices

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-635. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

CU-4

| CU-4 | Control unit | |
|---|---|---|

CU-4 is a general service tool used with a module jig and/or a flash adapter. It requires an external 12 V power supply.

The unit has the following features:

- software controlled via USB
- EM calibration function
- Forwards FBUS/Flashbus traffic to/from terminal
- Forwards USB traffic to/from terminal
- software controlled BSI values
- regulated VBATT voltage
- 2 x USB2.0 connector (Hub)
- FBUS and USB connections supported

When using CU-4, note the special order of connecting cables and other service equipment:

## Instructions

1 Connect a service tool (jig, flash adapter) to CU-4.
2 Connect CU-4 to your PC with a USB cable.
3 Connect supply voltage (12 V)
4 Connect an FBUS cable (if necessary).
5 Start Phoenix service software.


**Note:** Phoenix enables CU-4 regulators via USB when it is started.

Reconnecting the power supply requires a Phoenix restart.

| FLS-5 | Flash device | |
|---|---|---|

FLS-5 is a dongle and flash device incorporated into one package, developed specifically for POS use.

**Note:** FLS-5 can be used as an alternative to PK-1.

FPS-21


| FPS-21 | Flash prommer | |
|---|---|---|

**FPS-21 sales package:**

- FPS-21 prommer
- AC-35 power supply
- CA-31D USB cable

**FPS-21 interfaces:**

*Front*

- Service cable connector

  Provides Flashbus, USB and VBAT connections to a mobile device.
- SmartCard socket

  A SmartCard is needed to allow DCT-4 generation mobile device programming.

*Rear*

- DC power input

  For connecting the external power supply (AC-35).
- Two USB A type ports (USB1/USB3)

  Can be used, for example, for connecting external storage memory devices or mobile devices
- One USB B type device connector (USB2)

  For connecting a PC.
- Phone connector

  Service cable connection for connecting Flashbus/FLA.
- Ethernet RJ45 type socket (LAN)

  For connecting the FPS-21 to LAN.

*Inside*

- Four SD card memory slots

  For internal storage memory.

  **Note:** In order to access the SD memory card slots inside FPS-21, the prommer needs to be opened by removing the front panel, rear panel and heatsink from the prommer body.


| PK-1 | Software protection key | |
|---|---|---|

PK-1 is a hardware protection key with a USB interface. It has the same functionality as the PKD-1 series dongle.

PK-1 is meant for use with a PC that does not have a series interface.

To use this USB dongle for security service functions please register the dongle in the same way as the PKD-1 series dongle.


| RJ-230 | Common jig | |
|---|---|---|

RJ-230 is a jig used for soldering and as a rework jig for the engine module.


| SB-6 | Bluetooth tester | |
|---|---|---|

The SB-6 test box is a generic device to perform Bluetooth bit error rate testing and doing cordless FBUS connection via Bluetooth.

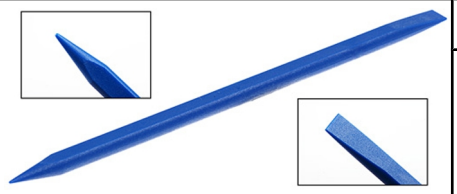

| SPS-2 | Soldering paste spreader | |
|---|---|---|

**Note:** Existing solder paste stencils and component holder jigs will be supported until January 2009. For all new parts needing solder paste support after January 1, 2009, please contact your solder machine manufacturer for the universal solutions for solder paste application for rework purposes.

| SRT-6 | Opening tool | |
|---|---|---|

SRT-6 is used to open phone covers.

**Note:** The SRT-6 is included in the Nokia Standard Toolkit.

| | | | |
|---|---|---|---|
|  | SS-108 | Peeling tool | |
| | The peeling tool SS-108 is used to peel off the shielding. | | |
|  | SS-46 | Interface adapter | |
| | SS-46 acts as an interface adapter between the flash adapter and FPS-21. | | |
|  | SS-62 | Generic flash adapter base for BB5 | |
| | • generic base for flash adapters and couplers<br>• SS-62 equipped with a clip interlock system<br>• provides standardised interface towards Control Unit<br>• provides RF connection using galvanic connector or coupler<br>• multiplexing between USB and FBUS media, controlled by VUSB | | |
|  | SS-93 | Blue stick tool | |
| | SS-93 is used for general disassembly and assembly tasks. | | |
|  | SX-4 | Smart card | |
| | SX-4 is a BB5 security device used to protect critical features in tuning and testing.<br>SX-4 is also needed together with FPS-21 when DCT-4 phones are flashed. | | |

## Cables

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-635. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.


| CA-101 | Micro USB cable | |
|---|---|---|
| The CA-101 is a USB-to-microUSB data cable that allows connections between the PC and the phone. | | |


| CA-89DS | Cable | |
|---|---|---|
| Provides VBAT and Flashbus connections to mobile device programming adapters. | | |

| DAU-9S | MBUS cable | |
|---|---|---|
| The MBUS cable DAU-9S has a modular connector and is used, for example, between the PC's serial port and module jigs, flash adapters or docking station adapters.<br>**Note:** Docking station adapters valid for DCT4 products. | | |

| | | | |
|---|---|---|---|
|  | PCS-1 | Power cable | |
| | The PCS-1 power cable (DC) is used with a docking station, a module jig or a control unit to supply a controlled voltage. | | |
|  | XRE-2 | Bluetooth cable | |
| | The bluetooth cable connects the bluetooth connector of the module jig to the bluetooth test box JBT-9. | | |

## Service concepts

### POS (Point of Sale) flash concept

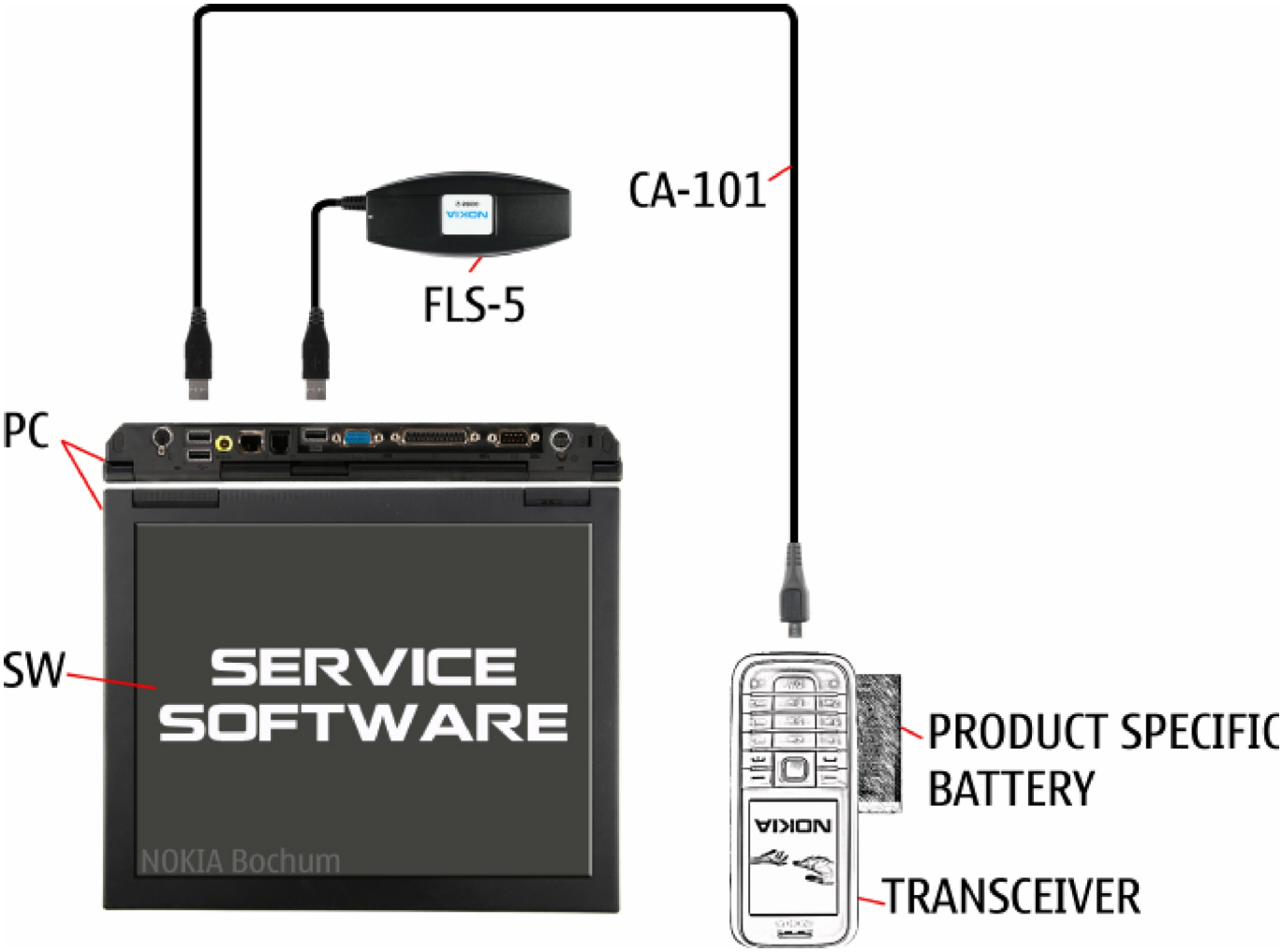



**Figure 2 POS flash concept**

| Type | Description |
|---|---|
| **Product specific tools** | |
| BL-4C | Battery |
| **Other tools** | |
| FLS-5 | POS flash dongle |
| | PC with Phoenix service software |
| **Cables** | |
| CA-101 | USB connectivity cable |

## BB5 Basic Flash Concept with FS-101

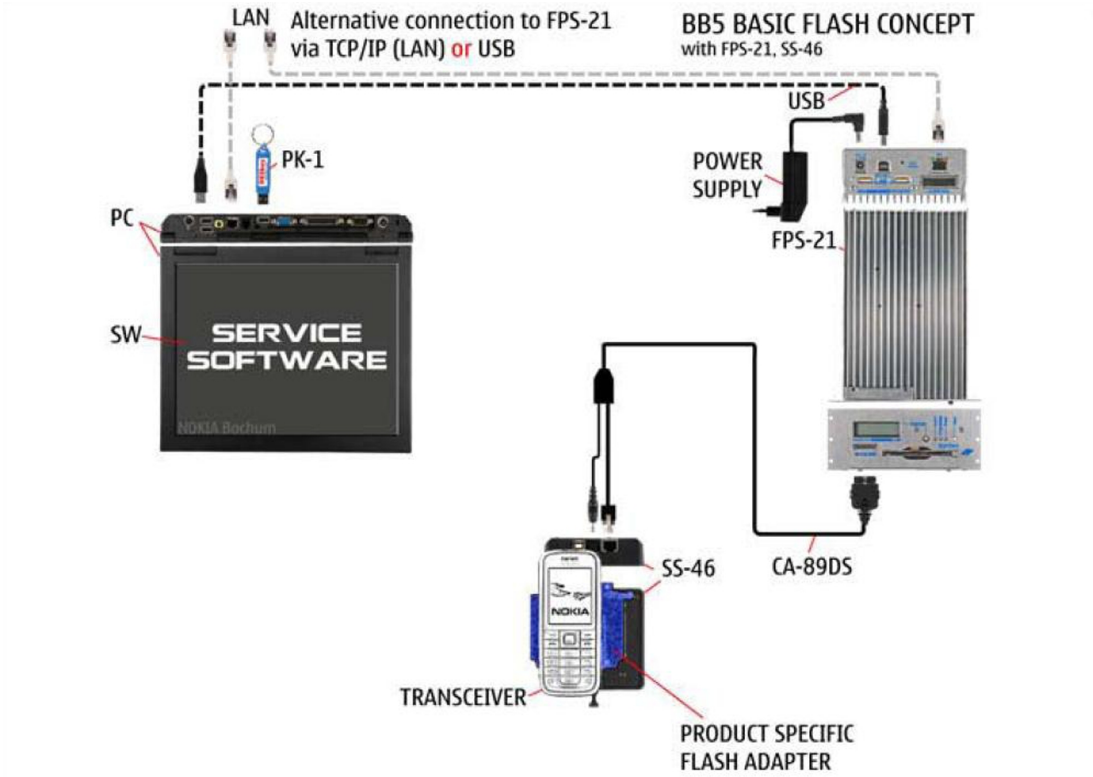



**Figure 3 BB5 Basic Flash Concept with FS-101**

## BB5 Basic Flash Concept with SS-62

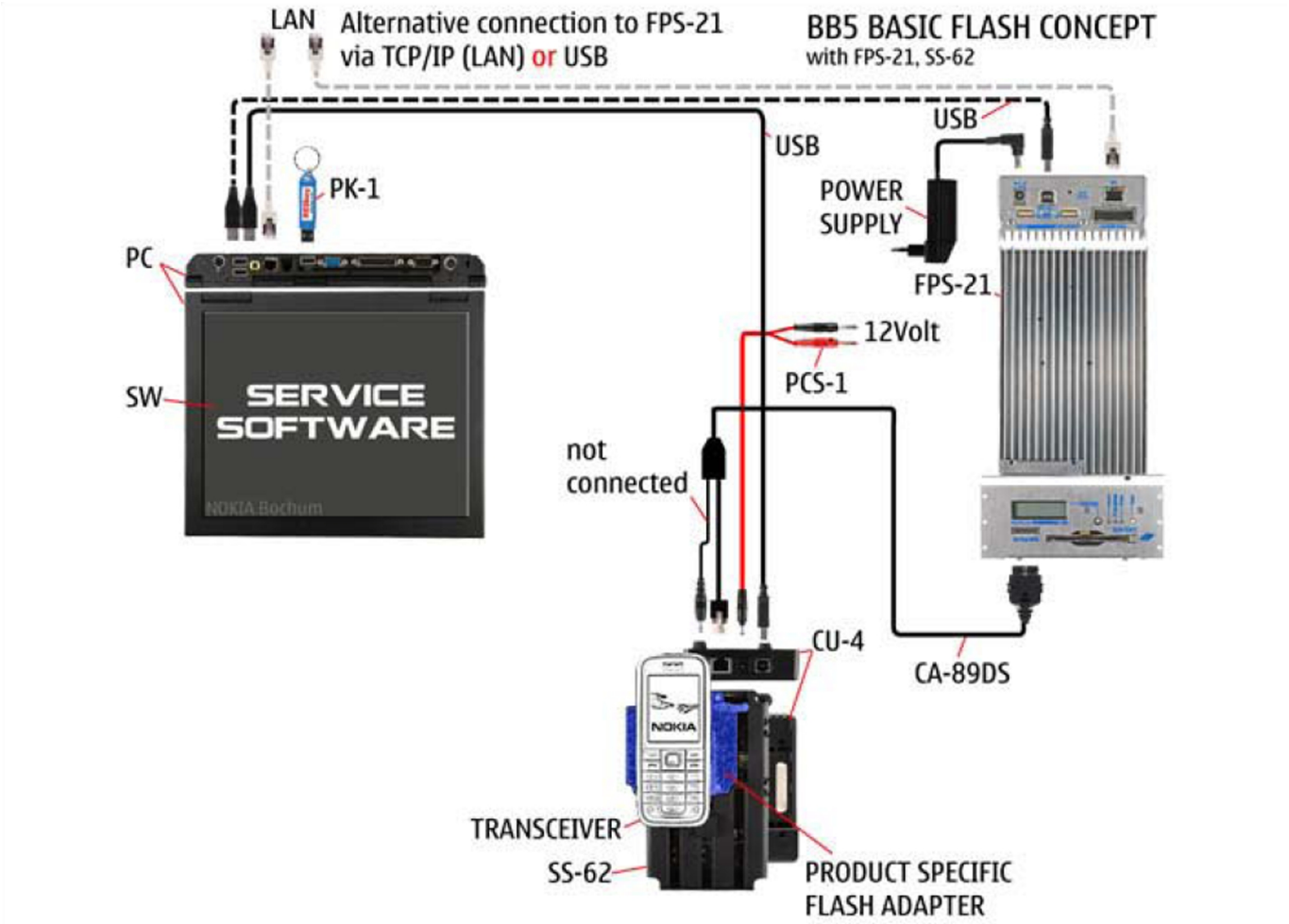



**Figure 4 BB5 Basic Flash Concept with SS-62**

## BB5 Basic RF & BB Tune Concept with FS-101

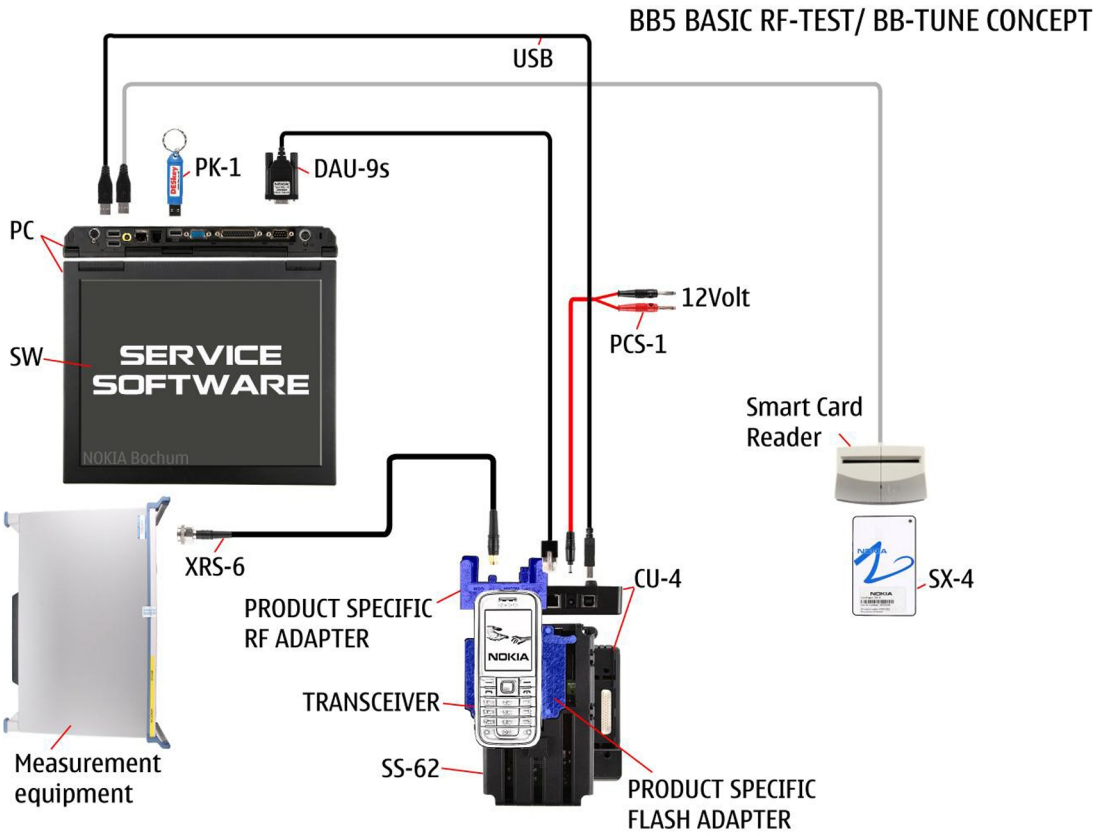



**Figure 5 BB5 Basic RF & BB Tune Concept with FS-101**

## BB5 Basic RF&BB Tune Concept with MJ-267

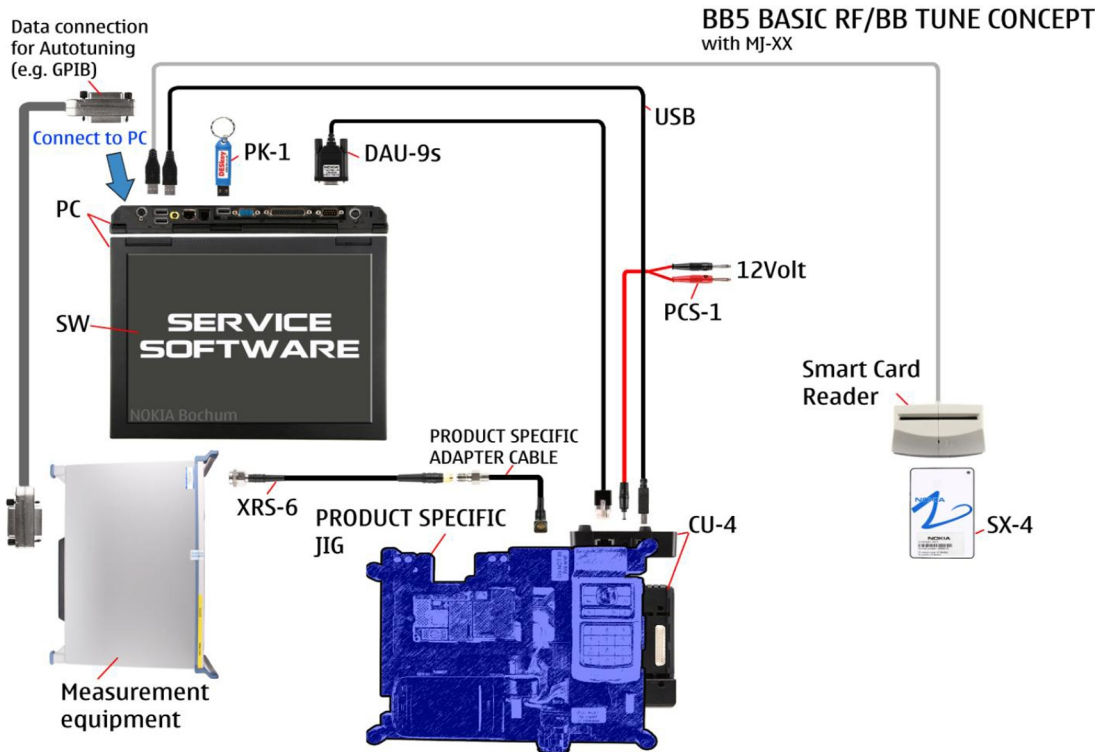



**Figure 6 BB5 Basic RF&BB Tune Concept with MJ-267**

# 3 — BB Troubleshooting and Manual Tuning Guide

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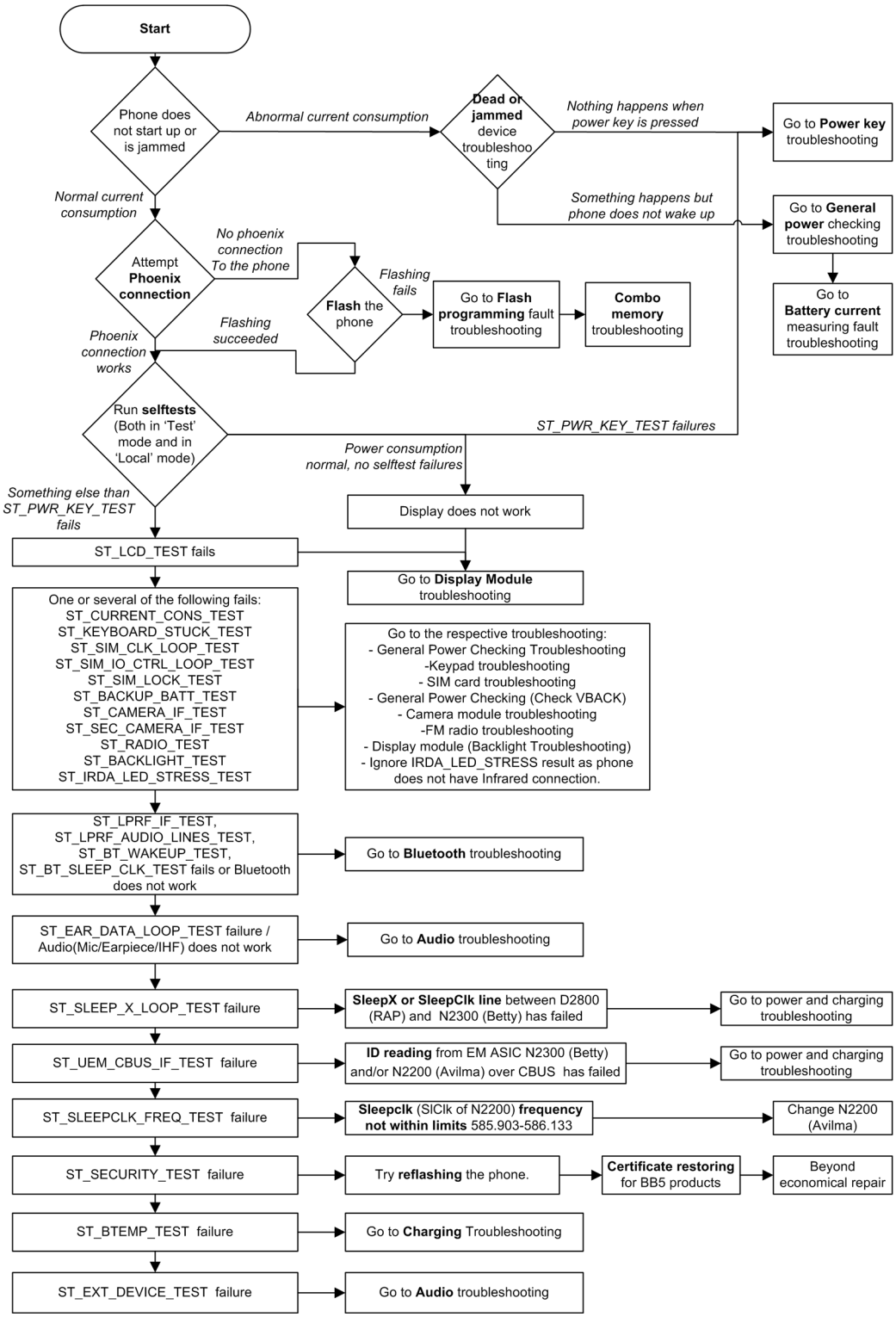
## Baseband self tests in Phoenix

### Context

Always start the troubleshooting procedure by running the Phoenix self tests. If a test fails, please follow the diagram below.

If the phone is dead and you cannot perform the self tests, go to *Dead or jammed device troubleshooting.*

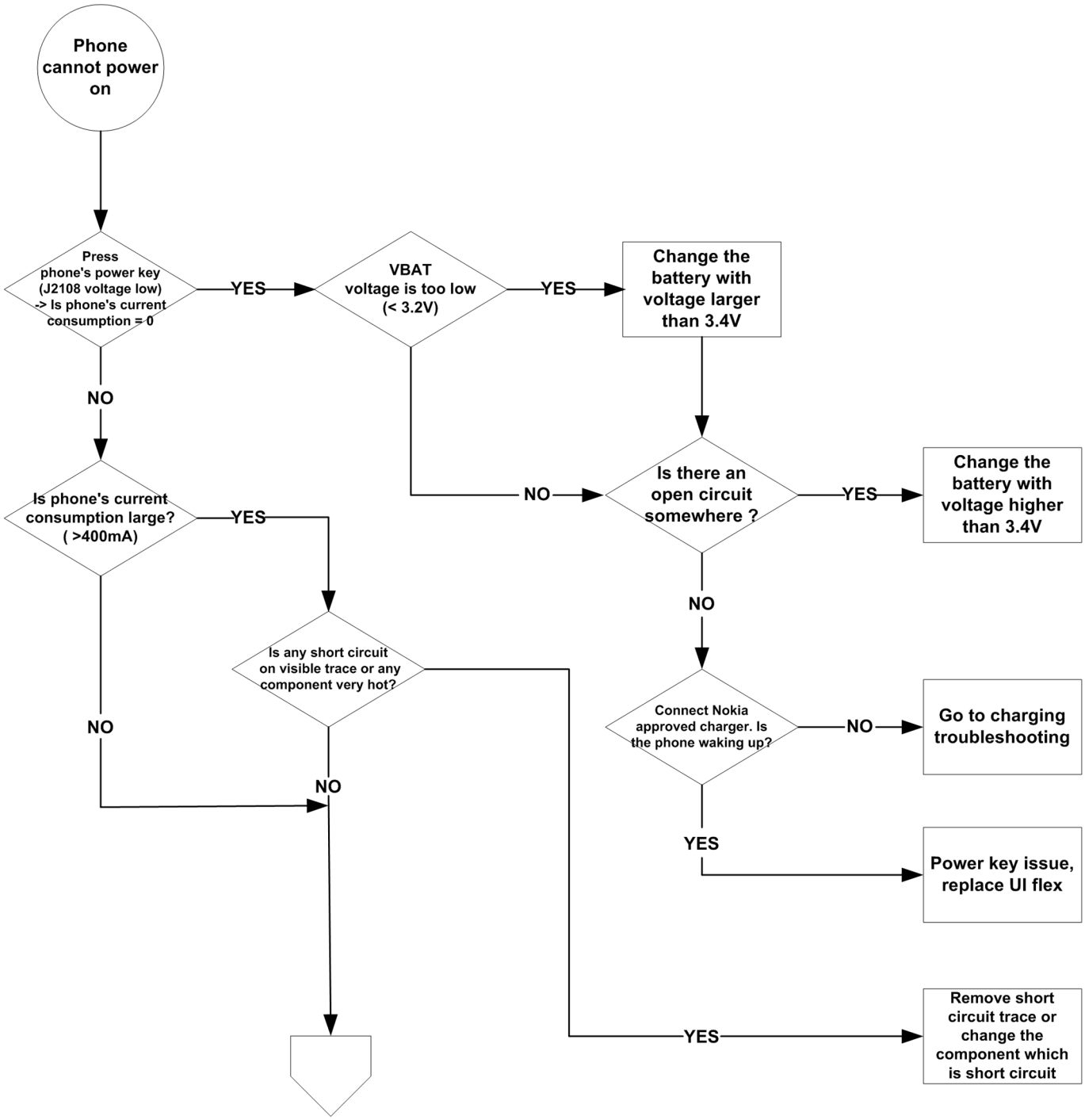
## Troubleshooting flow



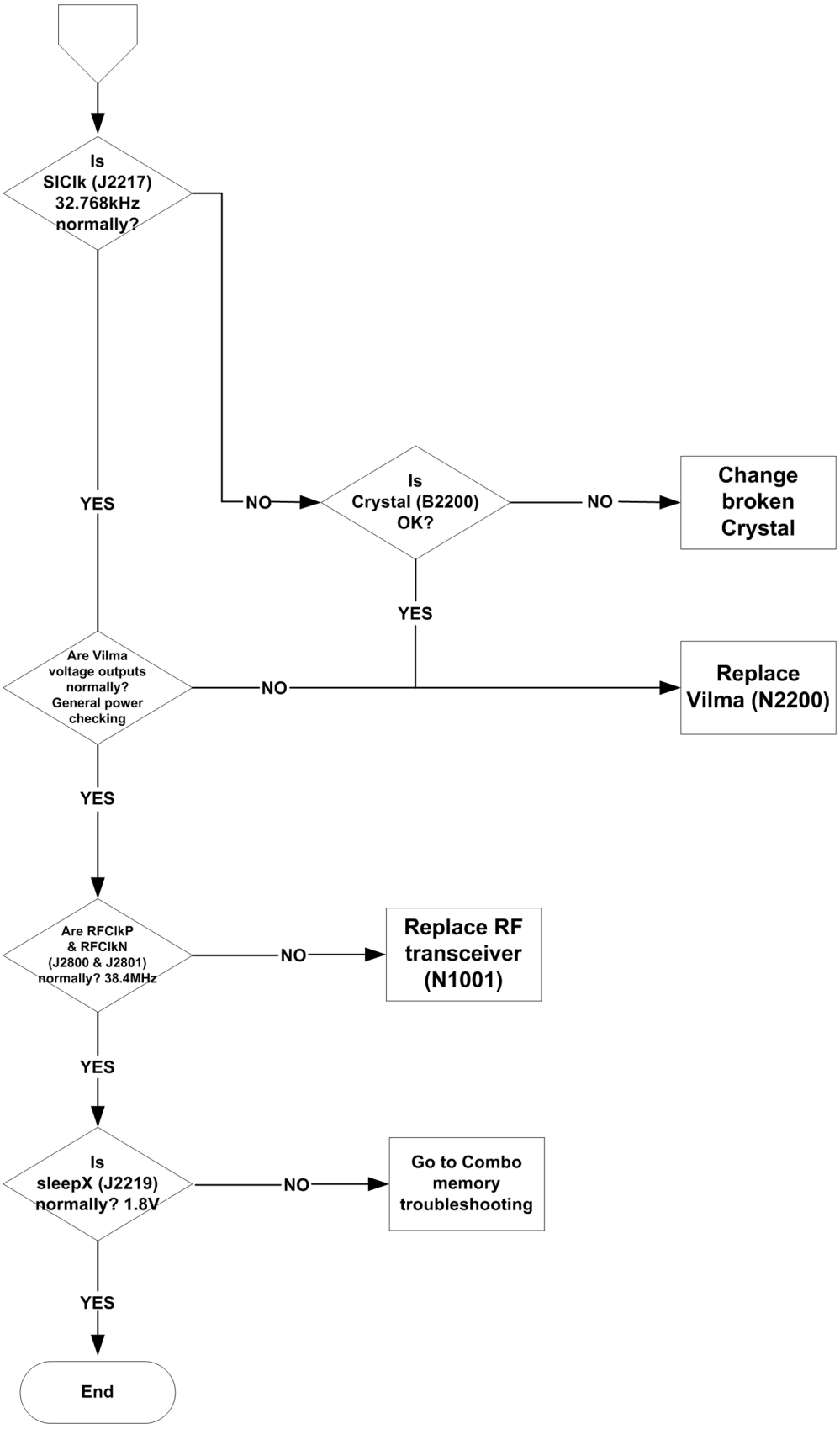
# Power and charging troubleshooting

## Dead or jammed device troubleshooting

### Troubleshooting flow



## Troubleshooting flow



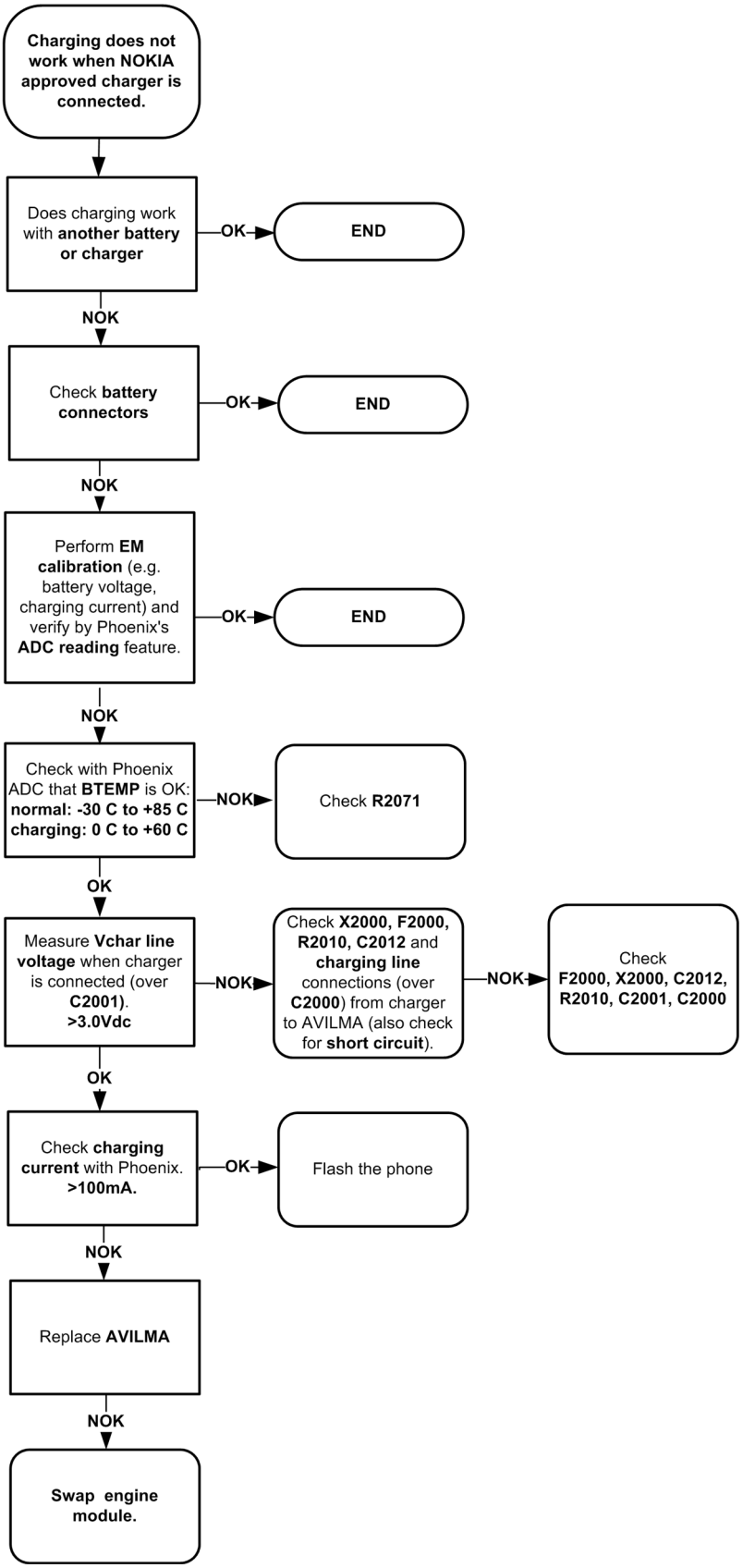
## General power checking

Check the following voltages:

| Signal name | Regulator | Sleep | Idle | Nominal voltage | Main user | Notes |
|---|---|---|---|---|---|---|
| VIO | AVILMA | ON | ON | 1.82 | Memory, I/Os, Display | |
| VSIM1 | AVILM | ON | ON | 1.8/3.0 | SIM card | |
| VDRAM | AVILMA | ON | ON | 1.82 | SDRAM | |
| VAUX | AVILMA | OFF | OFF | 2.8 | Camera, Display | |
| VR1 | AVILMA | OFF | ON | 2.5 | Crystal oscillators, RFIC | |
| VRFC | AVILMA | OFF | ON | 1.8 | RAPs converters | |
| VRCP1 | AVILMA | | | 4.75 | To RF parts | RF active |
| VREF | AVILMA | ON | ON | 1.35 | RF reference | |
| VCORE | BETTY | ON | ON | 1.05<br>1.25<br>1.35<br>1.40 | Combo memory | |
| VOUT | BETTY | OFF | OFF | 2.5 | | Accessory connected |

## Charging troubleshooting

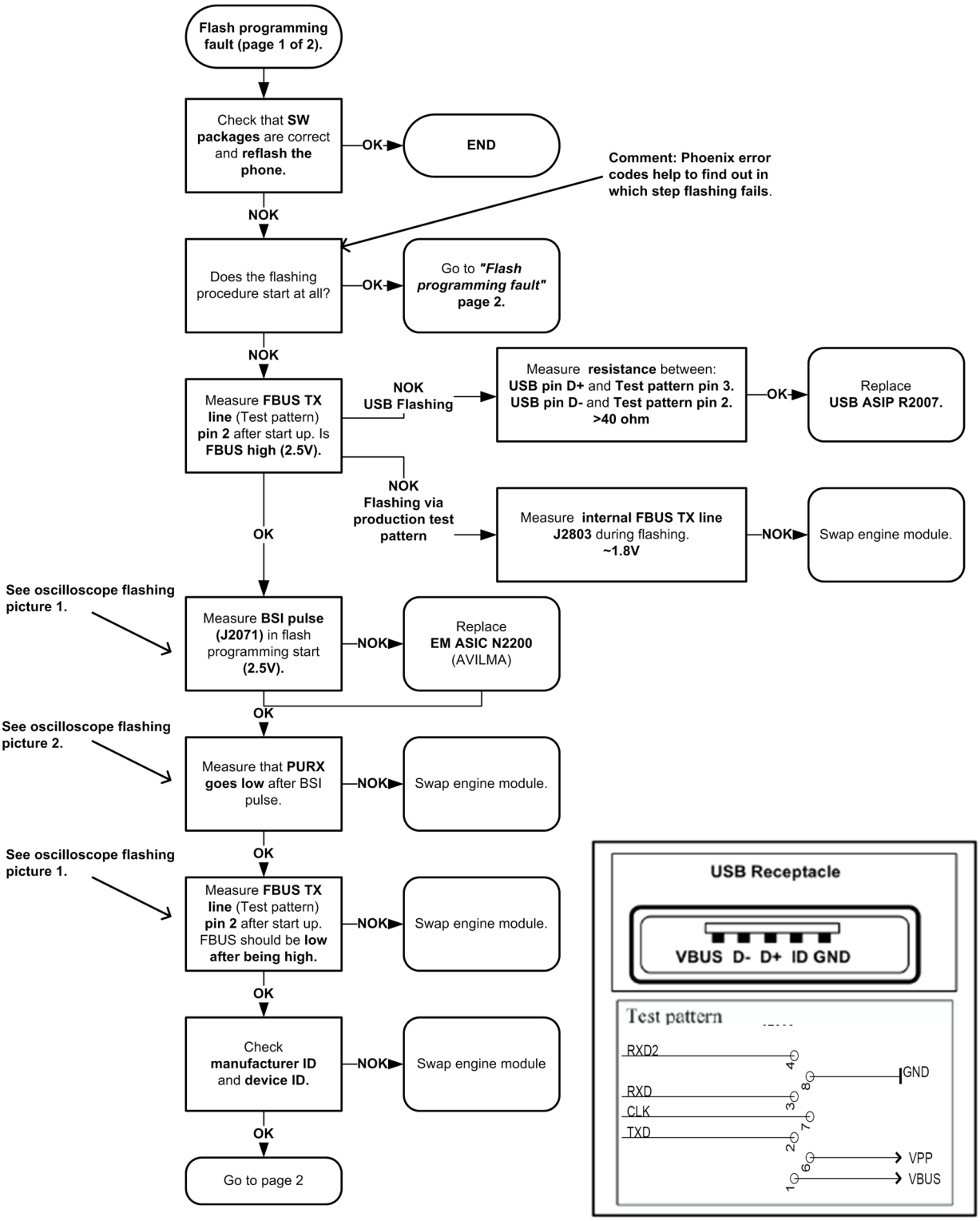
### Troubleshooting flow



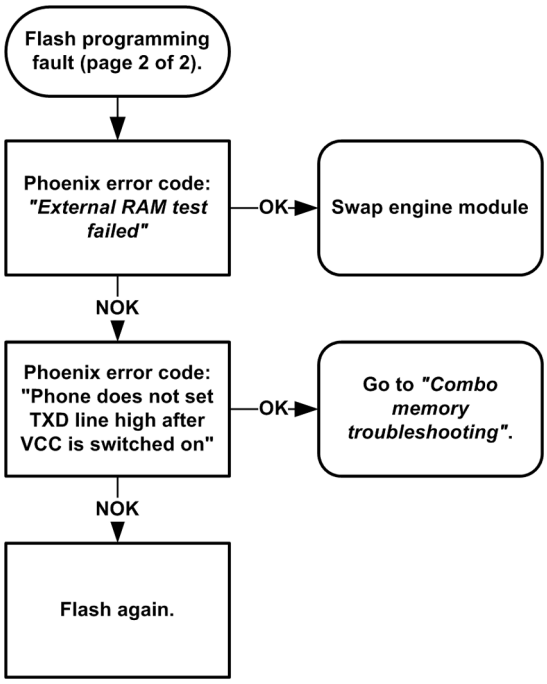
# Interface troubleshooting

## Flash programming fault troubleshooting

### Part 1



## Part 2



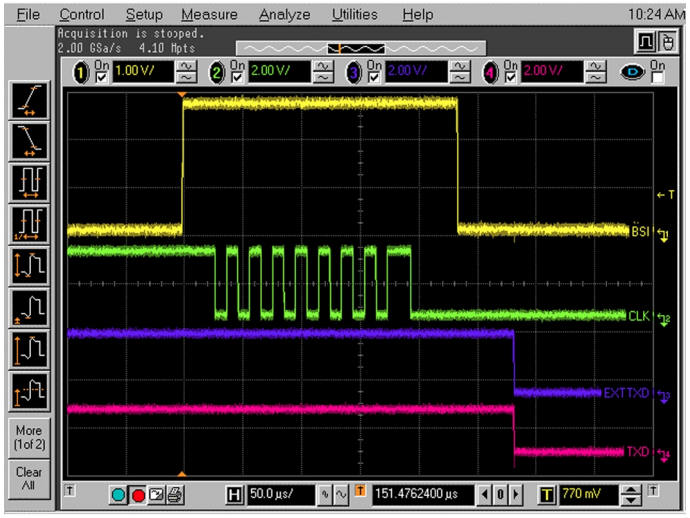




**Figure 7 Flashing pic 1. Take single trig measurement for the rise of the BSI signal.**

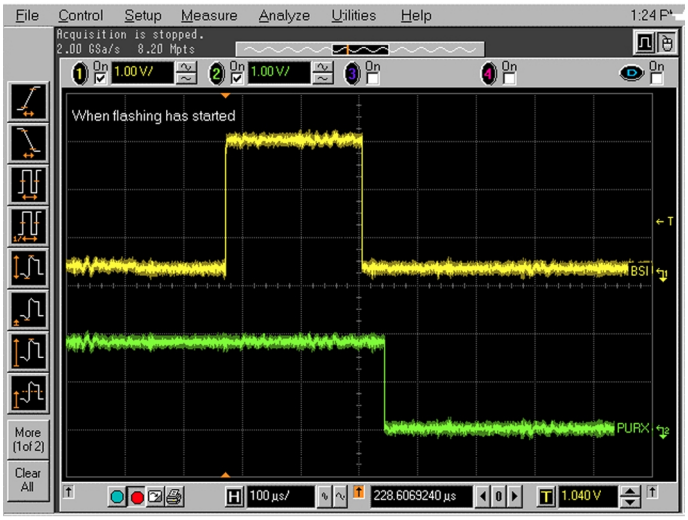
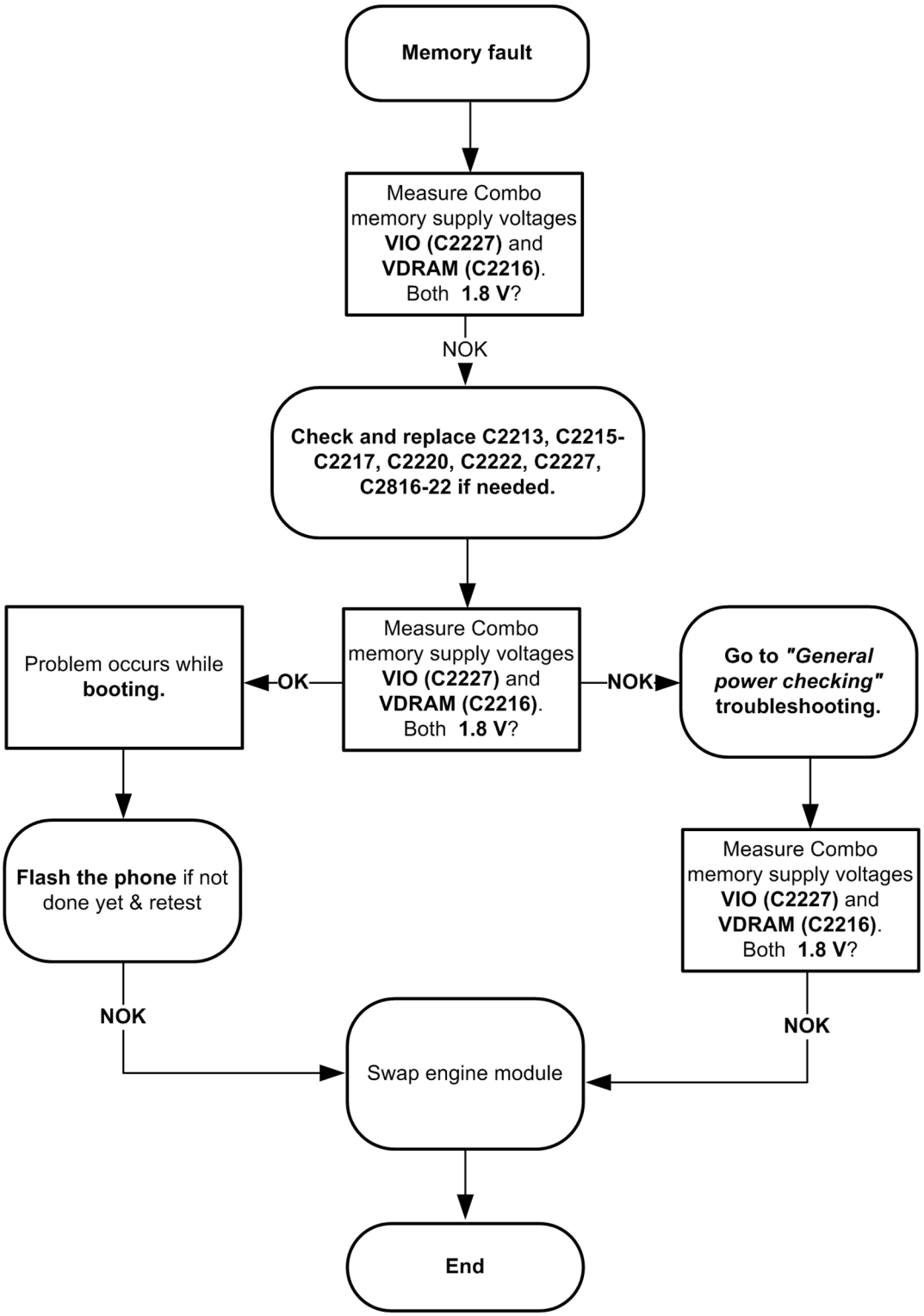



**Figure 8 Flashing pic 2. Take single trig measurement for the rise of the BSI signal.**

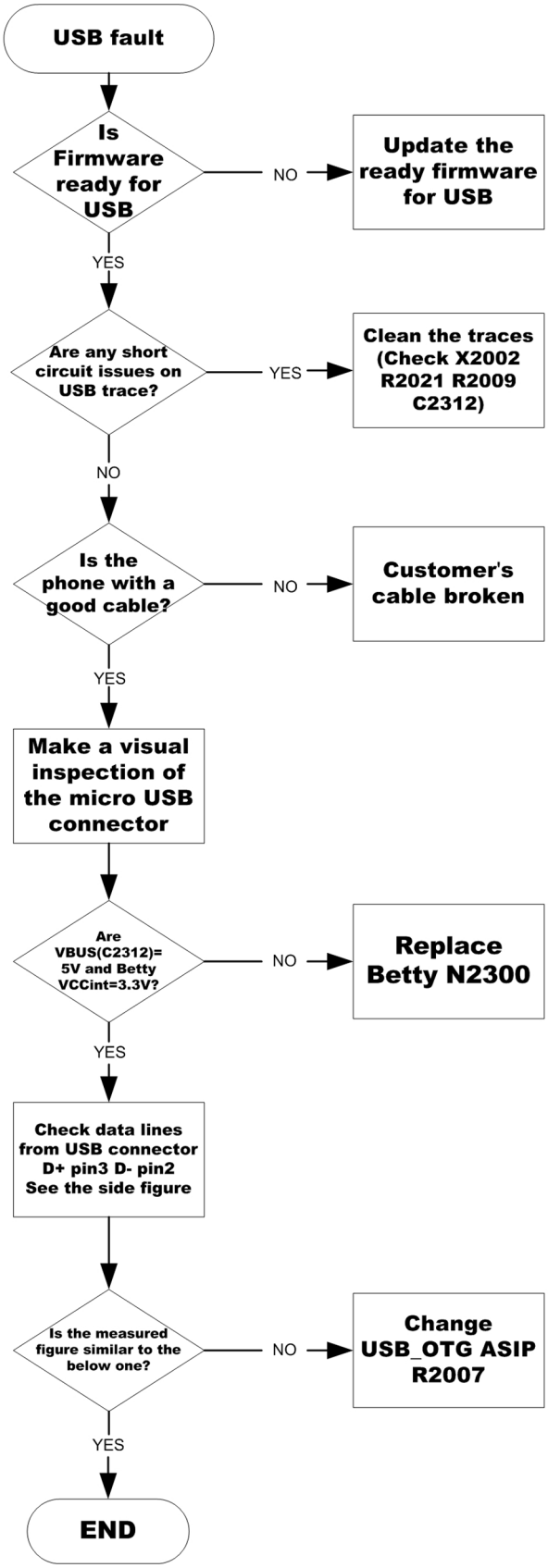
## Combo memory troubleshooting

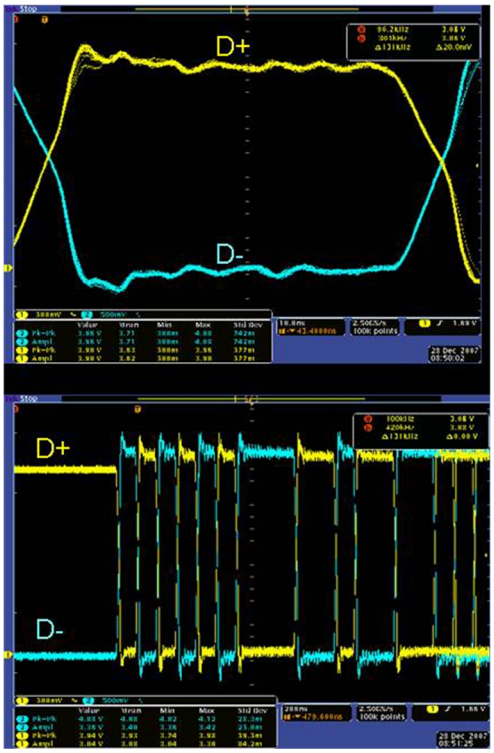
### Troubleshooting flow

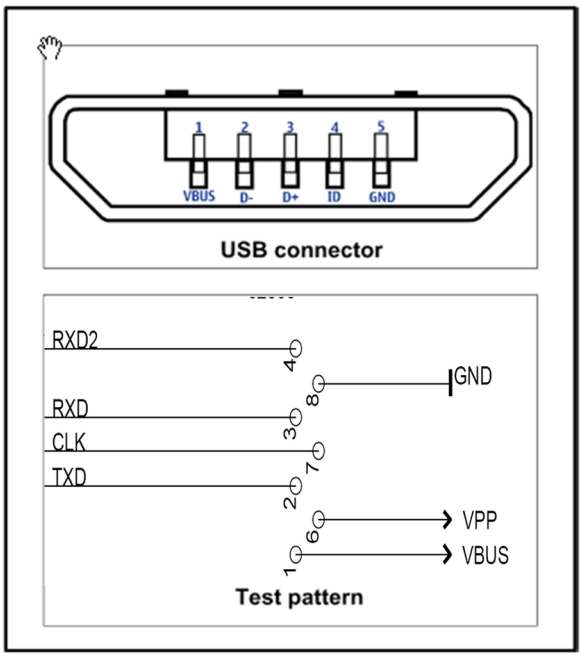


## USB interface troubleshooting

### Troubleshooting flow

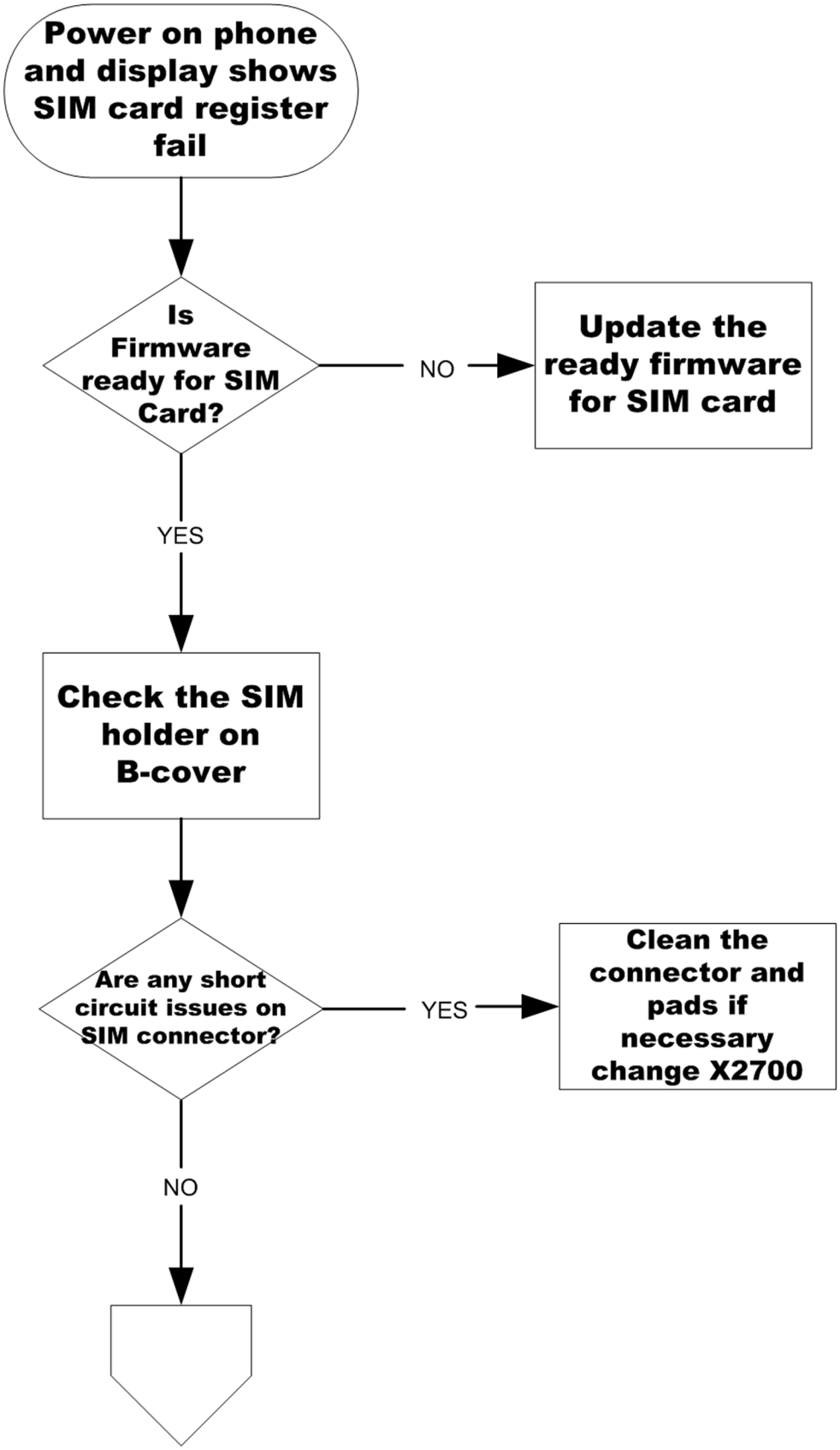


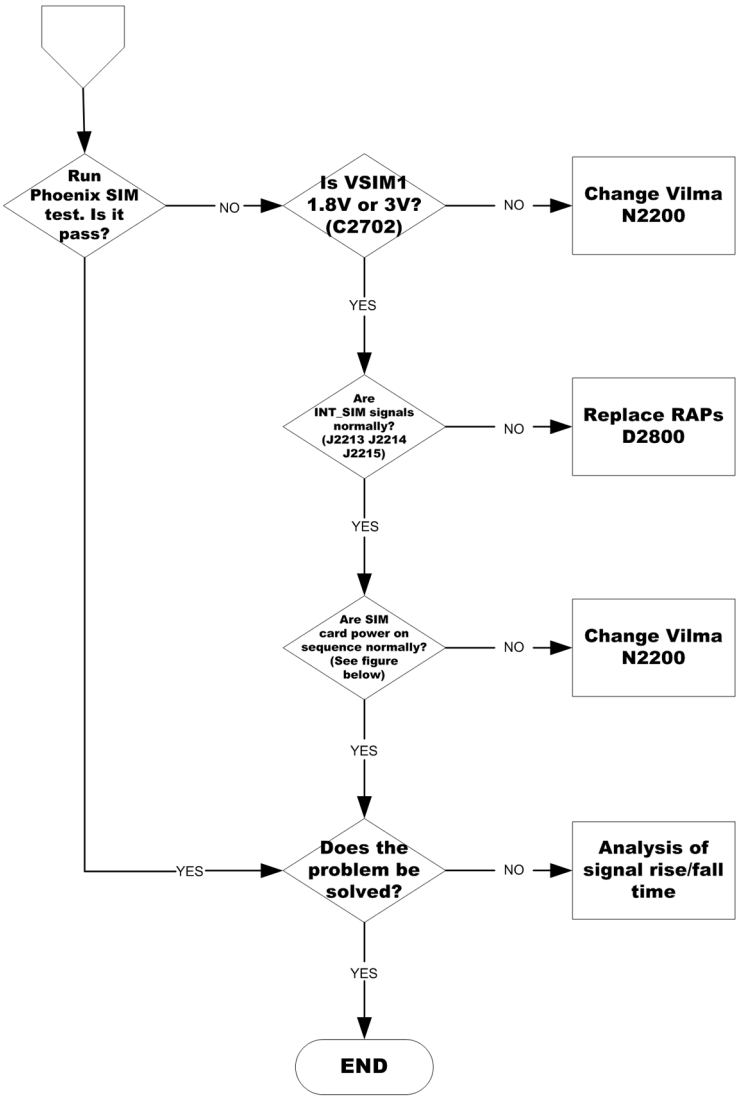



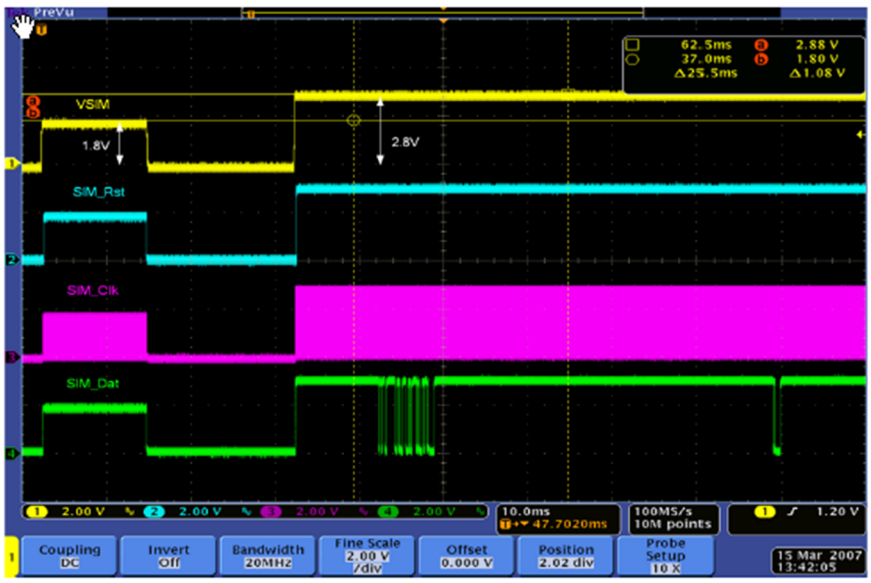



## SIM card troubleshooting

### Troubleshooting flow





# User interface troubleshooting

## Keypad troubleshooting

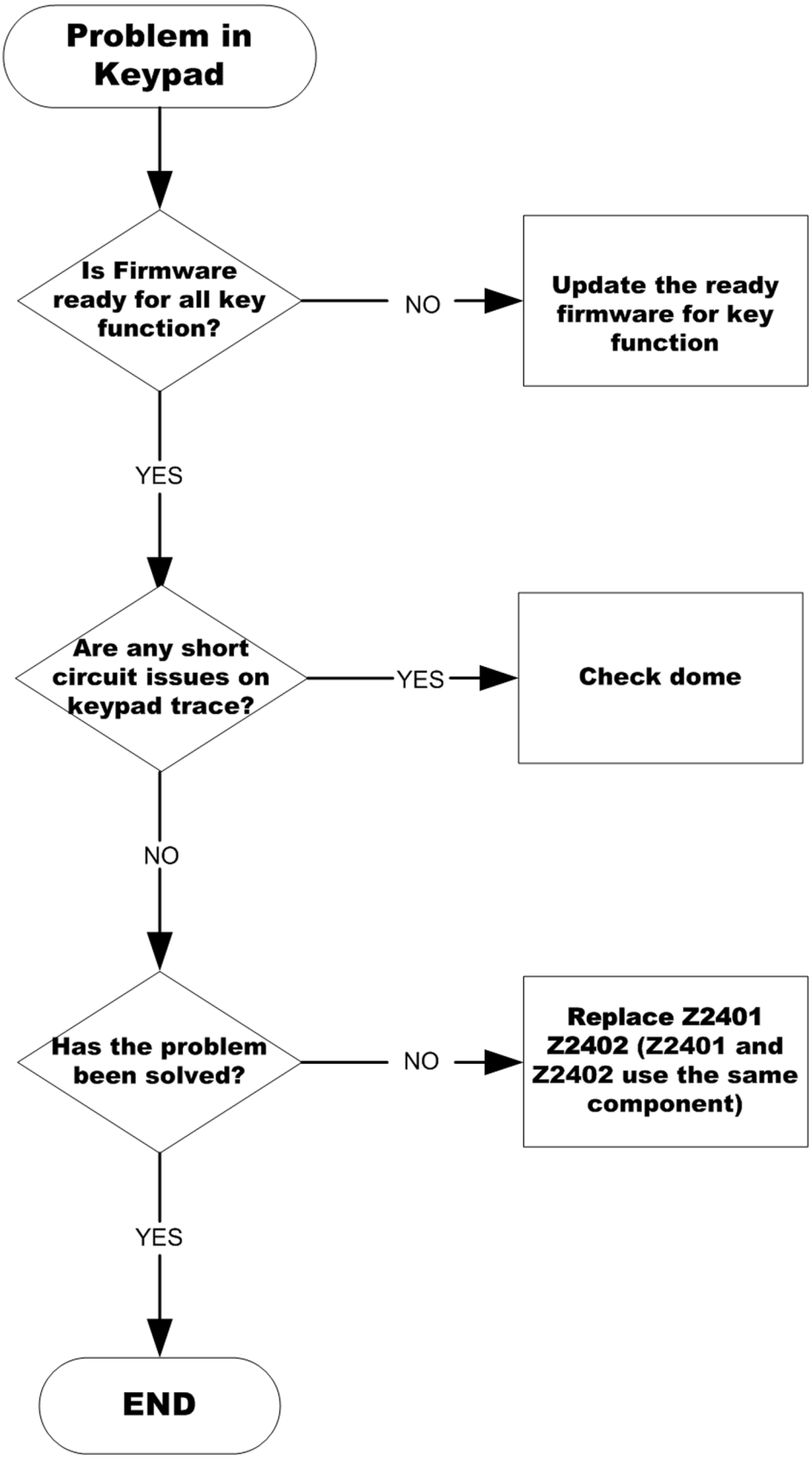
### Context

There are two possible failure modes in the keyboard module:

- One or more keys are stuck, so that the key does not react when a keydome is pressed. This kind of failure is caused by mechanical reasons (dirt, rust, mechanical damage, etc.)
- Malfunction of several keys at the same time; this happens when one or more rows or columns in the key matrix are failing (shortcut or open connection).

If the failure mode is not clear, start with the Keyboard test in Phoenix.

## Troubleshooting flow



## Display module troubleshooting

### *General instructions for display troubleshooting*

### Context

- The display is in a normal mode when the phone is in active use.
- Display is in a partial idle mode when the phone is in the screen saver mode.
- The operating modes of the display can be controlled with the help of *Phoenix*.

**Table 4 Display module troubleshooting cases**

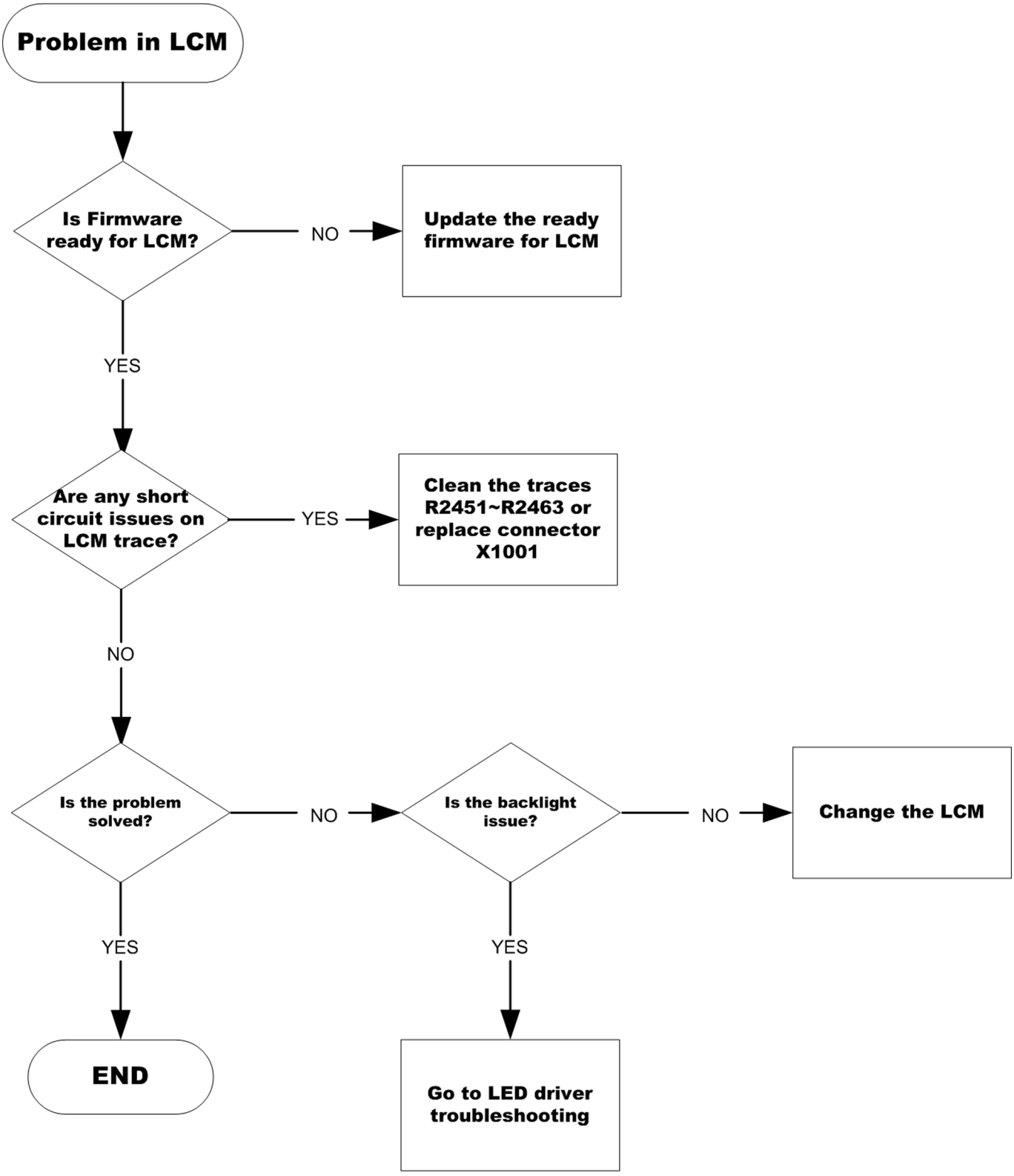
| | |
|---|---|
| Display blank | There is no image on the display. The display looks the same when the phone is on as it does when the phone is off. The backlight can be on in some cases. |
| Image on the display not correct | Image on the display can be corrupted or a part of the image can be missing. If a part of the image is missing, change the display module. If the image is otherwise corrupted, follow the appropriate troubleshooting diagram. |
| Visual defects (pixel) | Pixel defects can be checked by controlling the display with Phoenix. Use both colours, black and white, on a full screen.<br>The display may have some random pixel defects that are acceptable for this type of display. The criteria when pixel defects are regarded as a display failure, resulting in a replacement of the display, are presented the following table. |

**Table 5 Pixel defects**

<table>
<tr><th>Item</th><th></th><th colspan="4">White dot defect</th><th>Black dot defect</th><th>Total</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Defect counts</td><td>R</td><td>G</td><td>B</td><td>White Dot Total</td><td rowspan="2">1</td><td rowspan="2">1</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>2</td><td>Combined defect counts</td><td colspan="6">Not allowed.<br>Two single dot defects that are within 5 mm of each other should be interpreted as combined dot defect.</td></tr>
</table>

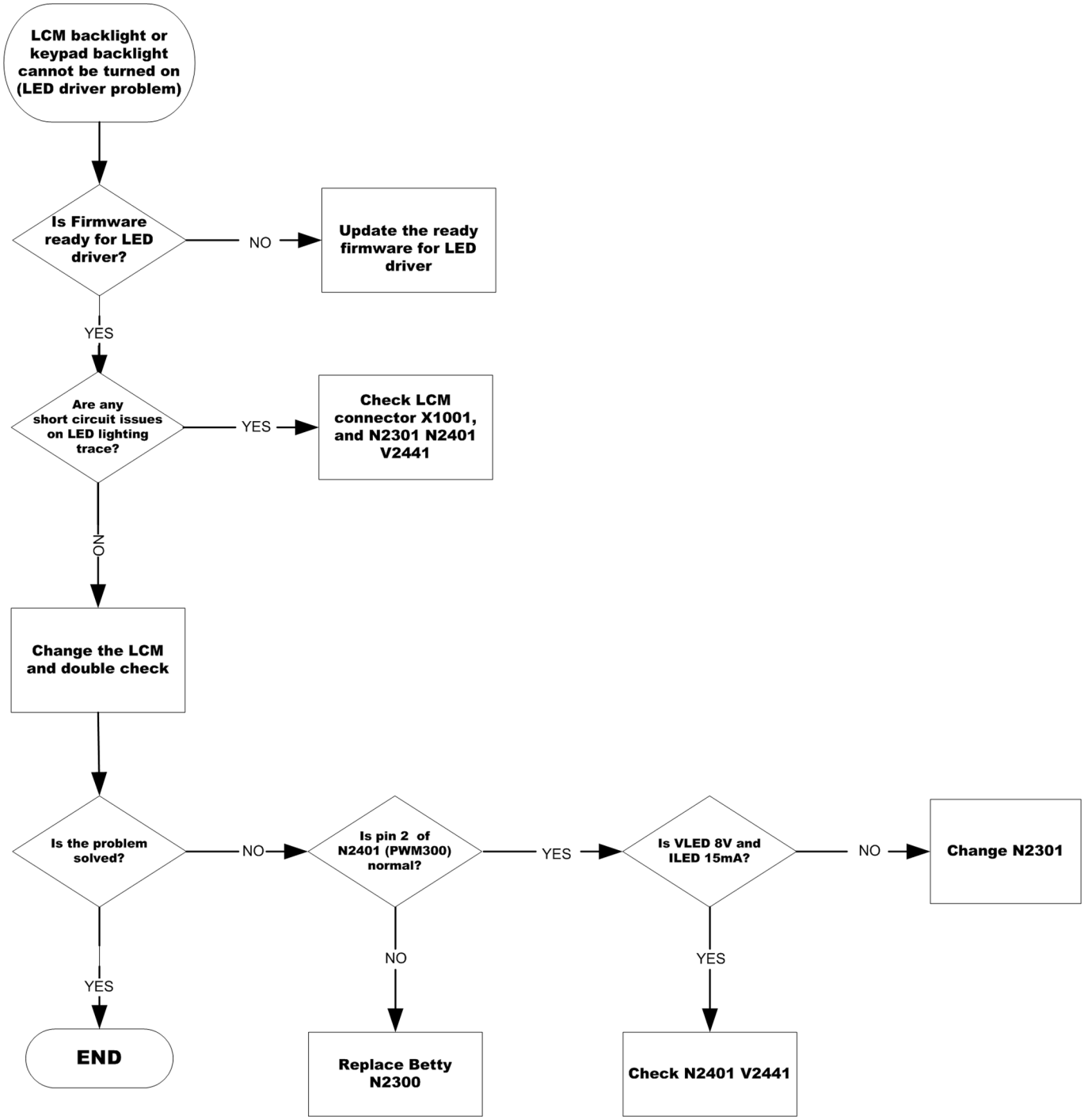
## *Display troubleshooting*

### Troubleshooting flow



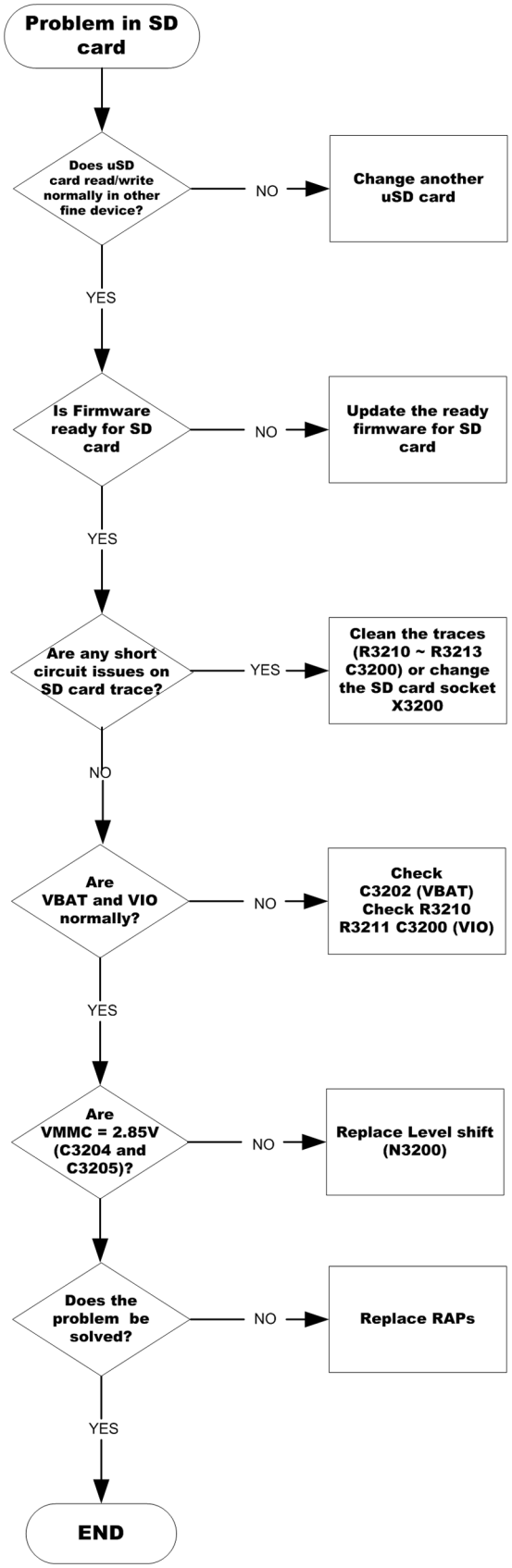
## *Keyboard backlight troubleshooting*

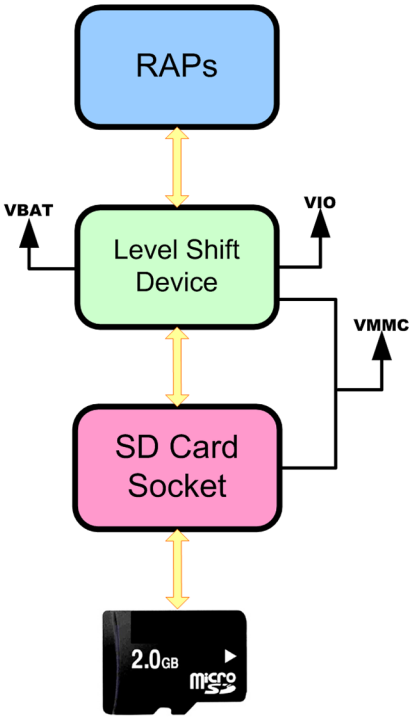
### Troubleshooting flow



## *SD card troubleshooting*

### Troubleshooting flow

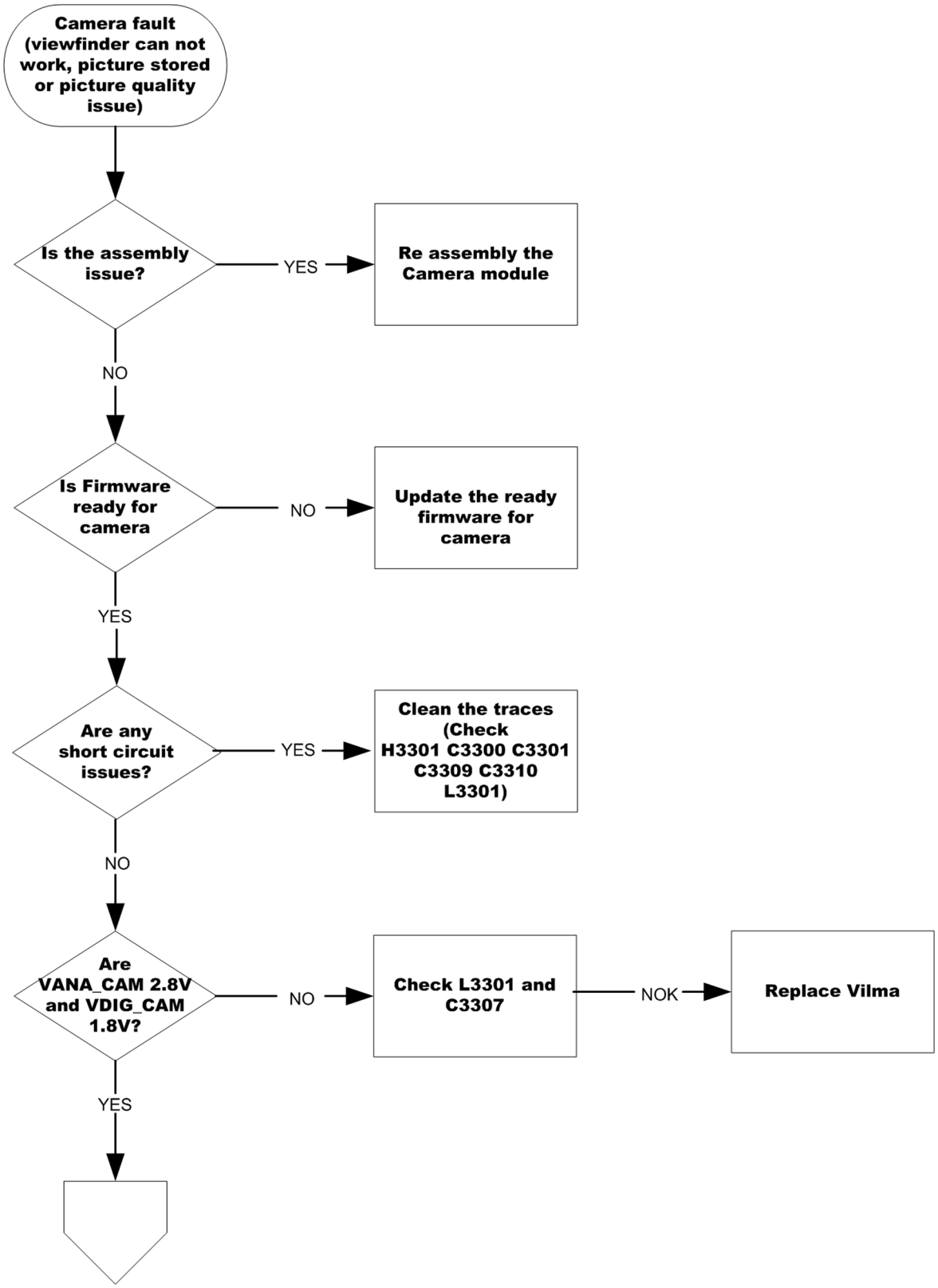


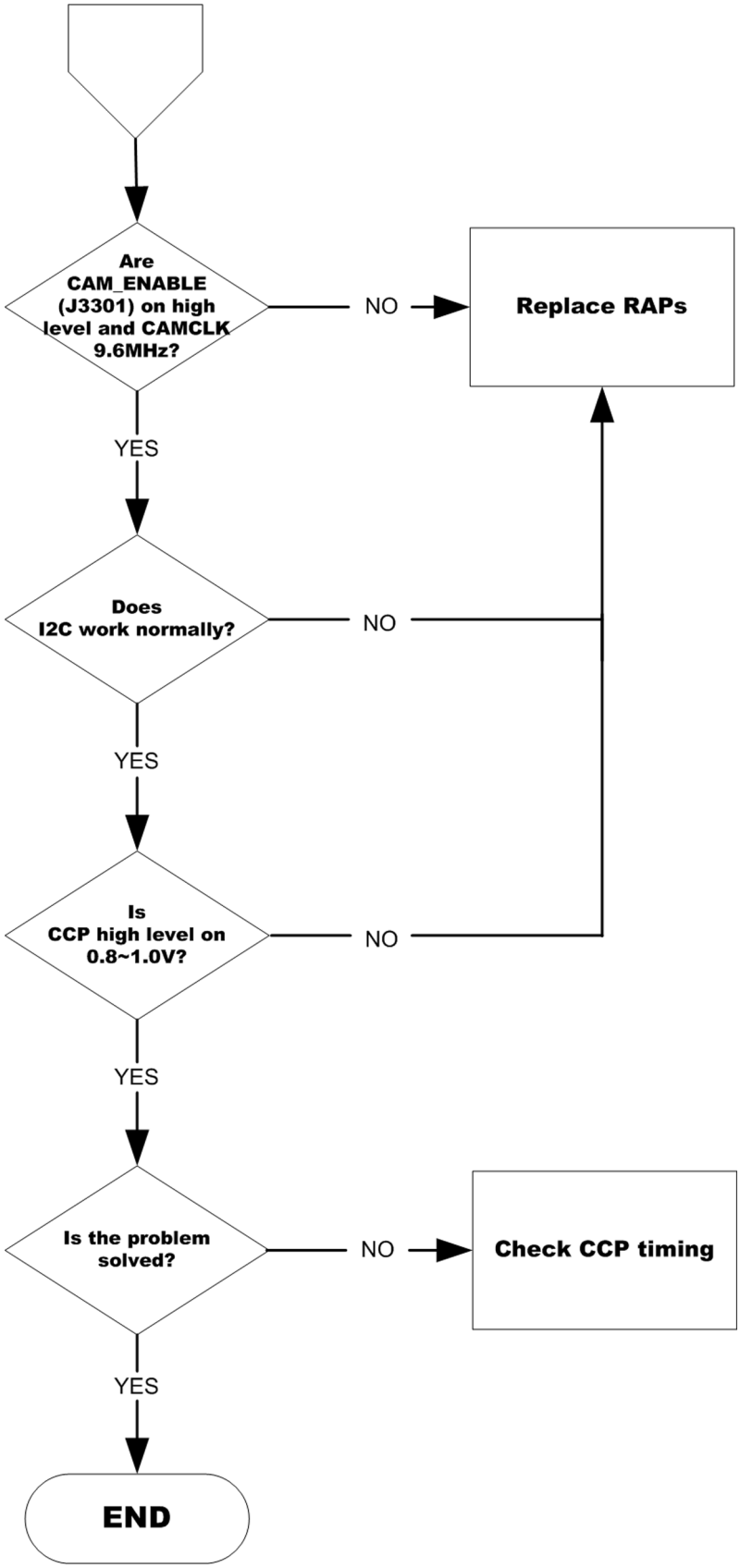



# Camera troubleshooting

## Camera troubleshooting

### Troubleshooting flow





# Audio troubleshooting

## Audio troubleshooting test instructions

Differential external earpiece and internal earpiece outputs can be measured either with a single-ended or a differential probe.

When measuring with a single-ended probe each output is measured against the ground.

Internal handsfree output is measured using a current probe, if a special low-pass filter designed for measuring a digital amplifier is not available. Note also that when using a current probe, the input signal frequency must be set to 2kHz.

The input signal for each loop test can be either single-ended or differential.

### Required equipment

The following equipment is needed for the tests:

- Oscilloscope
- Function generator (sine waveform)
- 'Active speaker' or 'speaker and power amplifier'
- Sound level meter
- Current probe (Internal handsfree DPMA output measurement)
- Phoenix service software
- Battery voltage 3.7V

### Test procedure

Audio can be tested using the Phoenix audio routings option. Three different audio loop paths can be activated:

- External microphone to Internal earpiece
- External microphone to Internal handsfree speaker
- Internal microphone to External earpiece

Each audio loop sets routing from the specified input to the specified output enabling a quick in-out test. Loop path gains are fixed and they cannot be changed using Phoenix. Correct pins and signals for each test are presented in the following table.

### Phoenix audio loop tests and test results

The results presented in the table apply when no accessory is connected and battery voltage is set to 3.7V.

Earpiece, internal microphone and speaker are in place during measurement. Applying a headset accessory during measurement causes a significant drop in measured quantities.

The gain values presented in the table apply for a differential output vs. single-ended/differential input.

| Loop test | Input terminal | Output terminal | Path gain [dB] (fixed) | Input voltage [mVp-p] | Differential output voltage [mVp-p] | Output DC level [V] | Output current [mA] |
|---|---|---|---|---|---|---|---|
| External Mic to External Earpiece | XMICP and GND | HSEAR R P, HSEAR R N and GND | -2.9 | 1000 | 720 | 1.2 | NA |
| | | HSEAR P, HSEAR N and GND | | | | | |
| | XMICN and GND | HSEAR R P, HSEAR R N and GND | | | | | |
| | | HSEAR P, HSEAR N and GND | | | | | |
| External Mic to Internal Earpiece | XMICP and GND | EarP and GND | -4.5 | 1000 | 600 | 1.2 | NA |
| | | EarN and GND | | | | | |
| | XMICN and GND | EarP and GND | | | | | |
| | | EarN and GND | | | | | |
| External Mic to Internal handsfree | XMICP and GND | B2152 pads | -5 | 1000 | 560 | 0 | 25mA (calc.) |
| | XMICN and GND | B2152 pads | | | | | |
| Internal Mic to External Earpiece | B2150 (OUT/GND) | HSEAR R P, HSEAR R N and GND | 22.7 | 100 | 1360 | 1.2 | NA |
| | | HSEAR P, HSEAR N and GND | | | | | |
| | | HSEAR R P, HSEAR R N and GND | | | | | |
| | | HSEAR P, HSEAR N and GND | | | | | |

## Measurement data

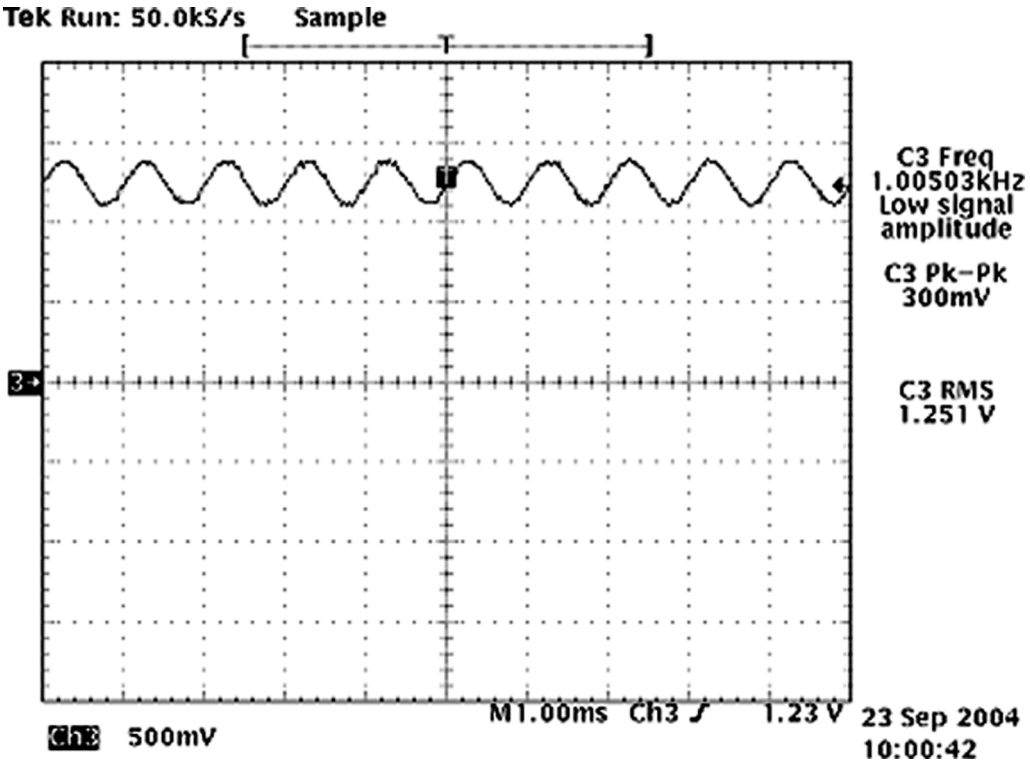
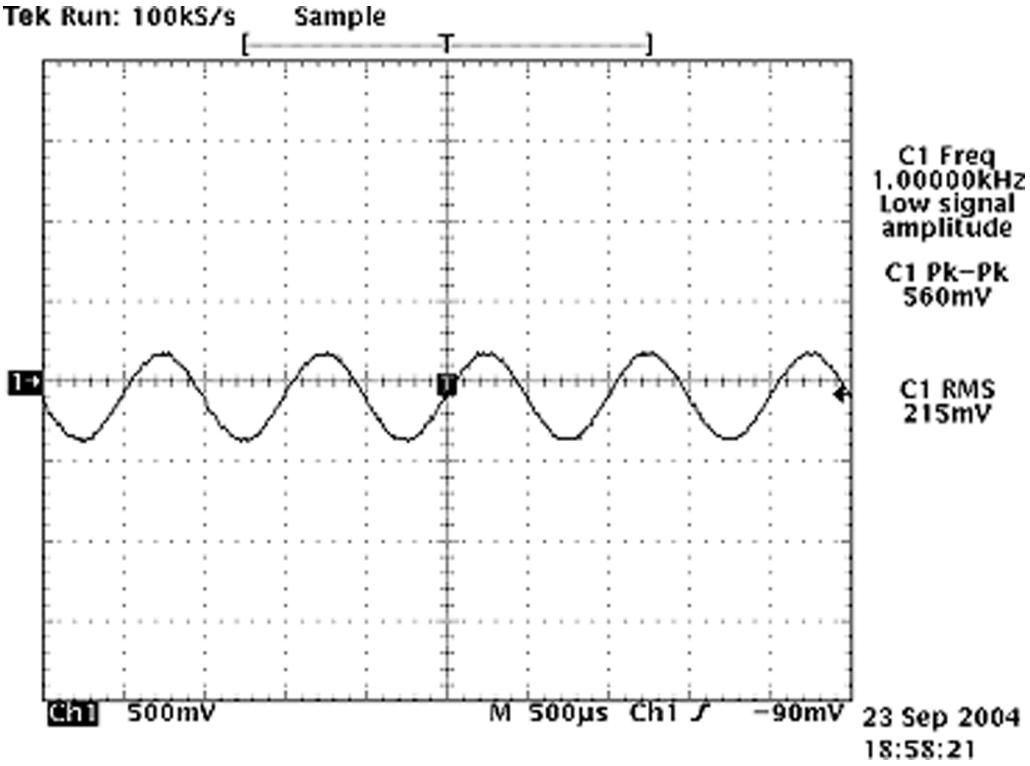



**Figure 9 Single-ended output waveform of the Ext_in_HP_out measurement when earpiece is connected.**




If a special low-pass filter designed for measuring digital amplifiers is unavailable, the measurement must be performed with a current probe and the input signal frequency must be 2kHz.

**Figure 10 Differential output waveform of the Ext_in_IHF_out out loop measurement when speaker is connected.**

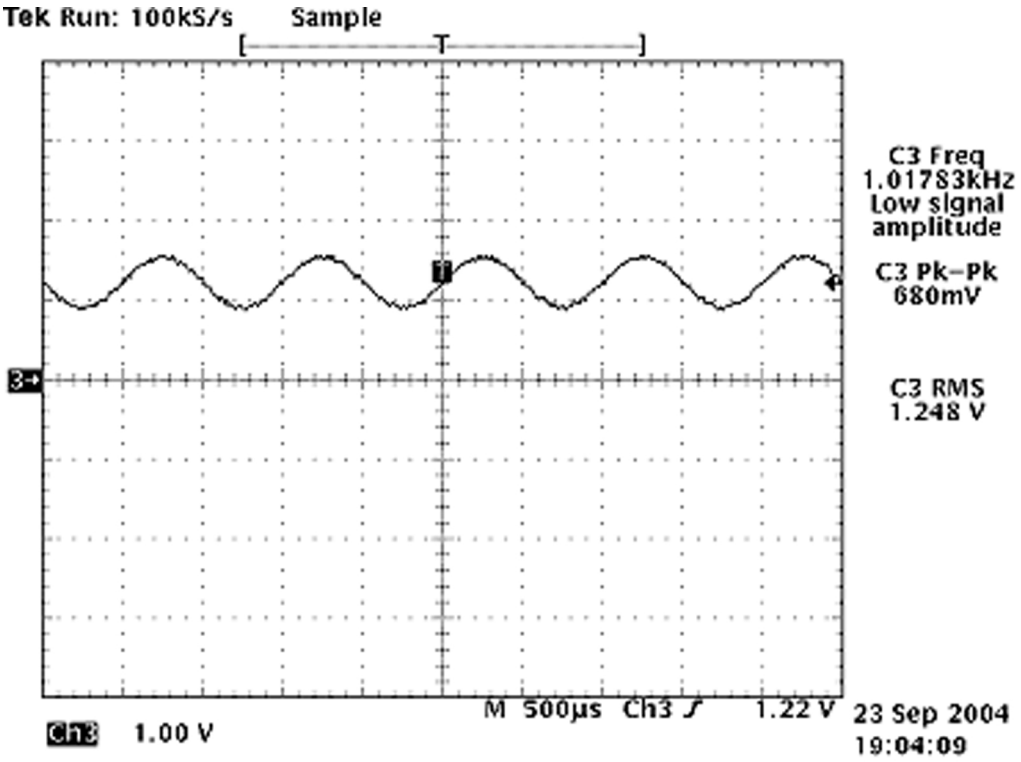
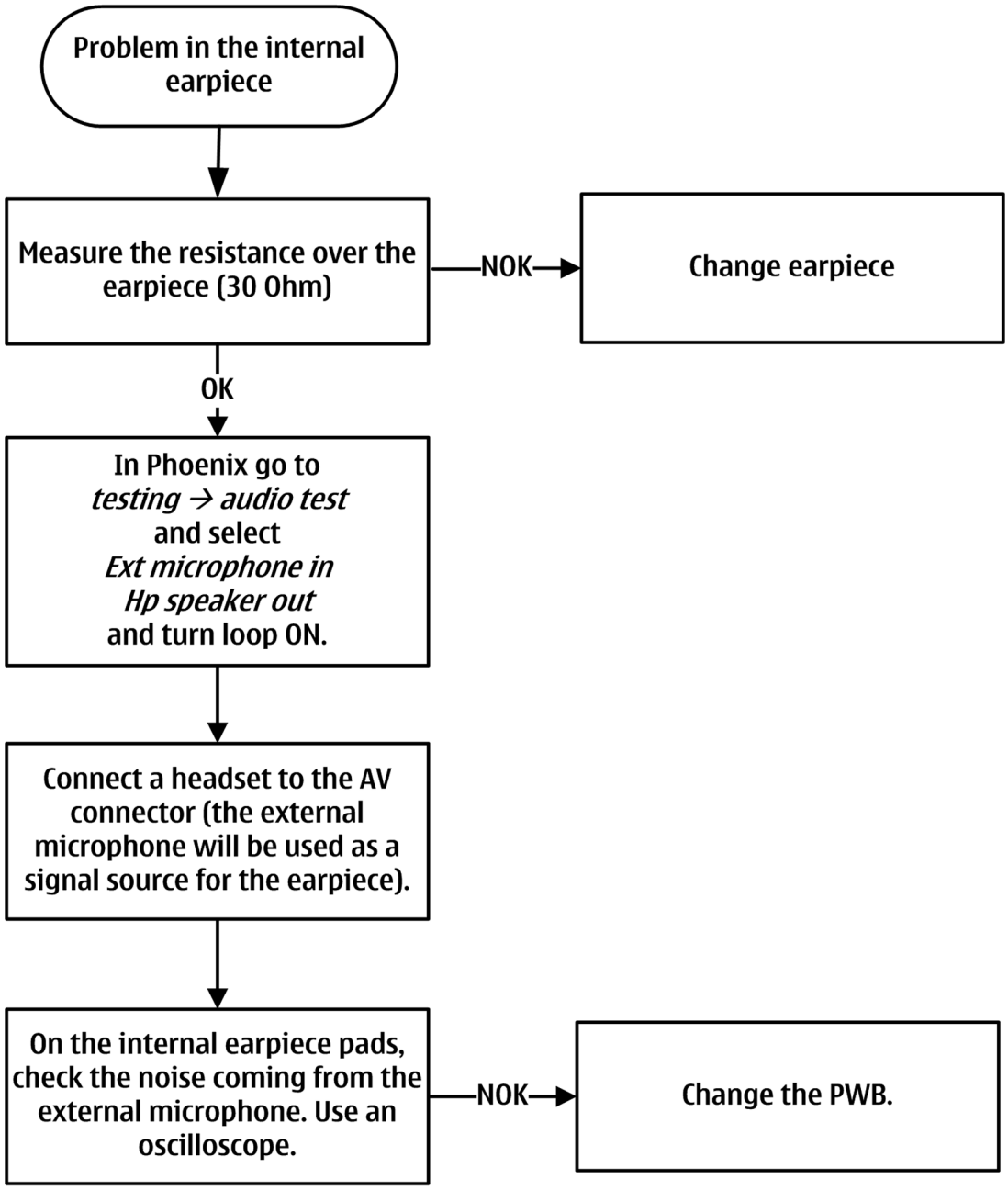



**Figure 11 Single-ended output waveform of the HP_in_Ext_out loop when microphone is connected.**

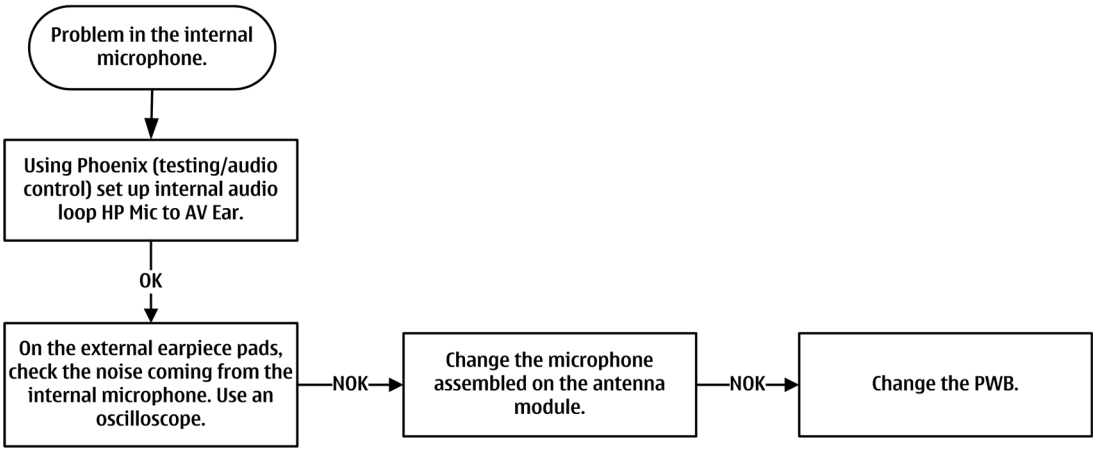
## Internal earpiece troubleshooting

### Troubleshooting flow



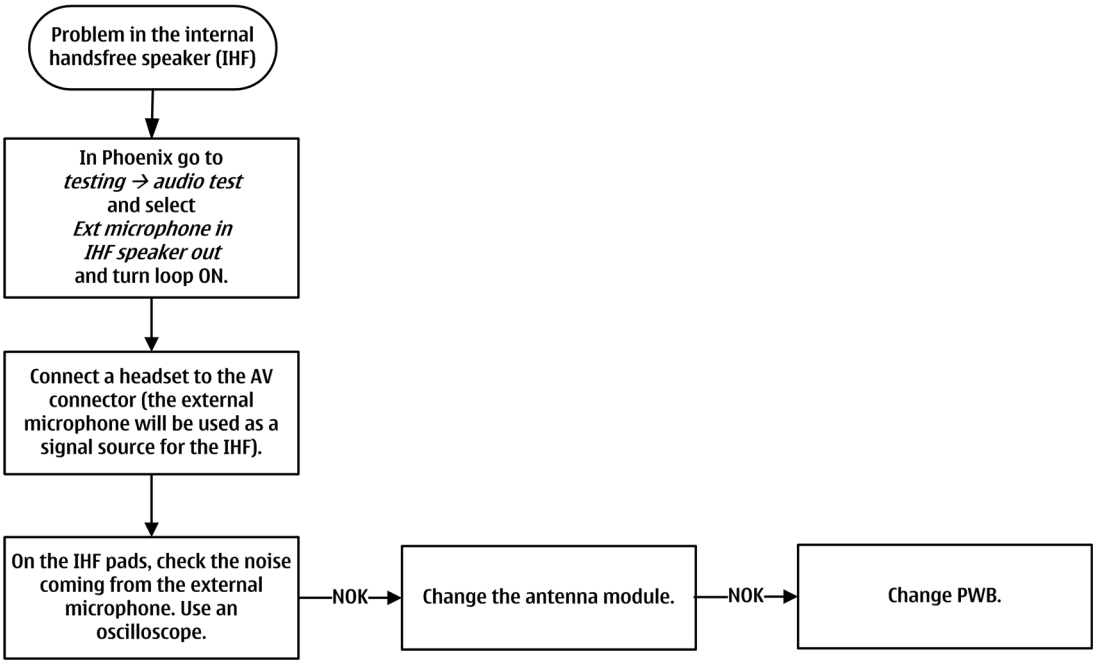
## Internal microphone troubleshooting

### Troubleshooting flow



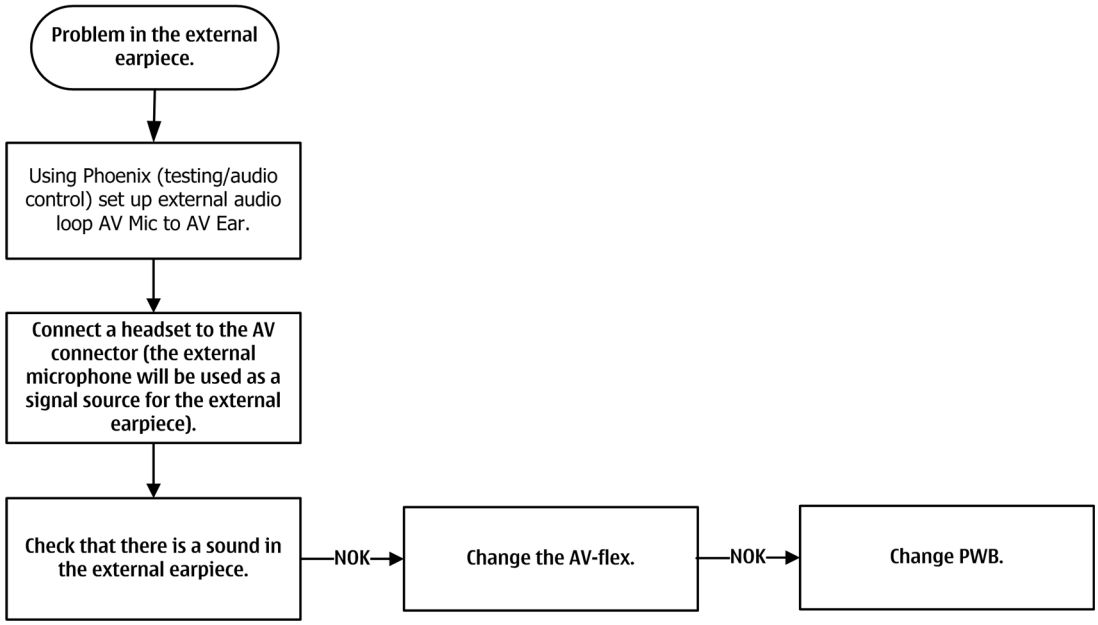

## Internal handsfree (IHF) troubleshooting

### Troubleshooting flow



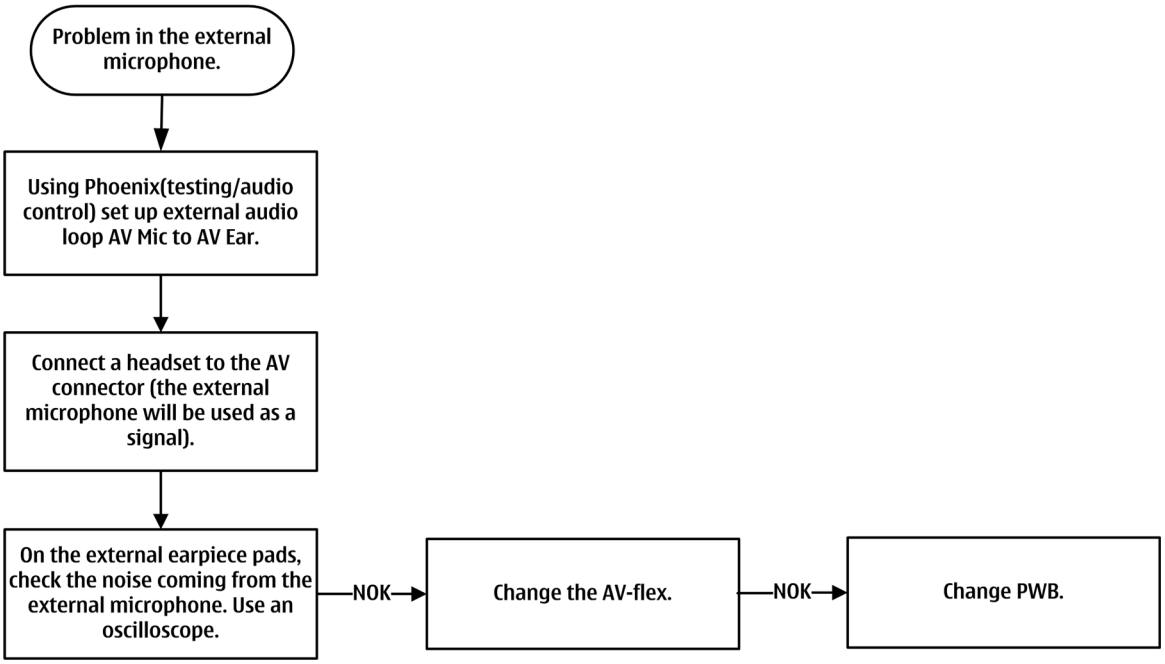
## External earpiece troubleshooting

### Troubleshooting flow



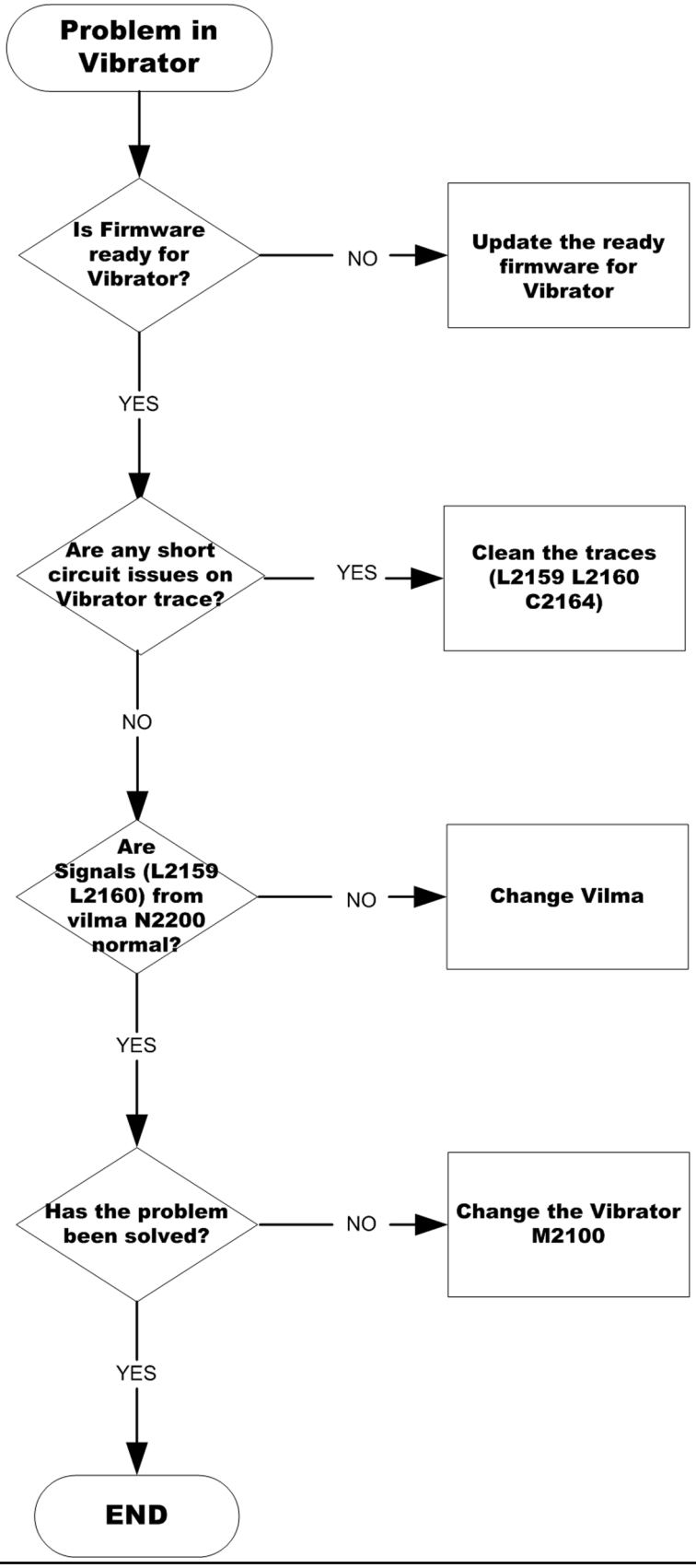

## External microphone troubleshooting

### Troubleshooting flow



## Vibra troubleshooting

### Troubleshooting flow



# Baseband manual tuning guide

## Certificate restoring for BB5 products

### Context

This procedure is performed when the device certificate is corrupted for some reason.

All tunings (RF & Baseband, UI) must be done after performing the certificate restoring procedure.

The procedure for certificate restoring is the following:

- Flash the phone with the latest available software using FPS-21.

  **Note:** USB flashing does not work for a dead BB5 phone.
- Create a request file.
- Send the file to Nokia by e-mail. Use the following addresses depending on your location:
  - APAC: sydney.service@nokia.com
  - CHINA: repair.ams@nokia.com
  - E&A: salo.repair@nokia.com
  - AMERICAS: fls1.usa@nokia.com
- When you receive a reply from Nokia, carry out certificate restoring.
- Tune the phone completely.

  **Note:** SX-4 smart card is needed.
- If the phone resets after certificate restoring, reflash the phone again.

Required equipment and setup:

- *Phoenix* service software v 2009.20 or newer
- The latest phone model specific *Phoenix* data package
- PKD-1 dongle
- SX-4 smart card (Enables BB5 testing and tuning features)
- External smart card reader
- Activated FPS-21 flash prommer
- Flash update package 09.23.12.4 or newer for FPS-21 flash prommer
- CU-4 control unit
- USB cable from PC USB Port to CU-4 control unit
- Phone model specific adapter for CU-4 control unit
- PCS-1 cable to power CU-4 from external power supply
- XCS-4 modular cable between flash prommer and CU-4.

  **Note:** CU-4 must be supplied with +12 V from an external power supply in all steps of certificate restoring.

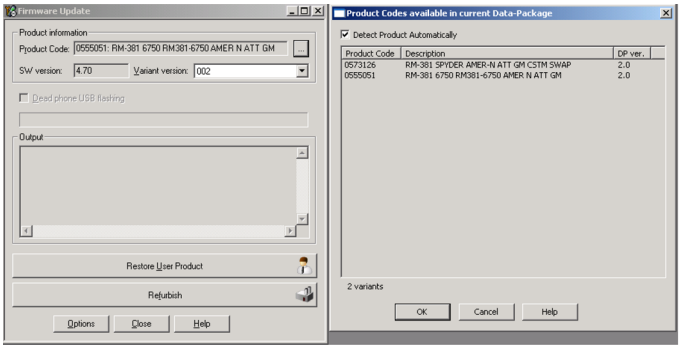
### Steps

1. Program the phone software.
   i Start *Phoenix* and login. Make sure the connection has been managed correctly for FPS-21.
   ii Update the phone MCU software to the latest available version.
   If the new flash is empty and the phone cannot communicate with *Phoenix*, reflash the phone.

iii Choose the product manually from **File → Open Product** , and click **OK**.

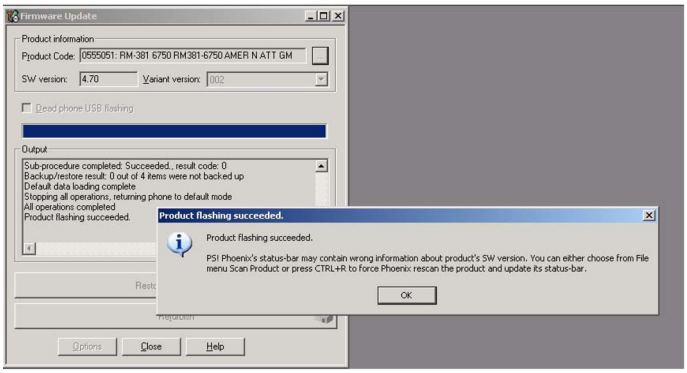
Wait for the phone type designator (e.g. "RM-381" ) to be displayed in the status bar.

iv Go to **Flashing → Firmware update** and wait until *Phoenix* reads the product data as shown in the following picture.




v To continue, click **Refurbish**.

Progress bars and messages on the screen show actions during phone programming, please wait.




Programming is completed when Flashing Completed message is displayed.

The product type designator and MCU SW version are displayed in the status bar.

vi Close the *SW Update* window and then choose **File → Close Product** .

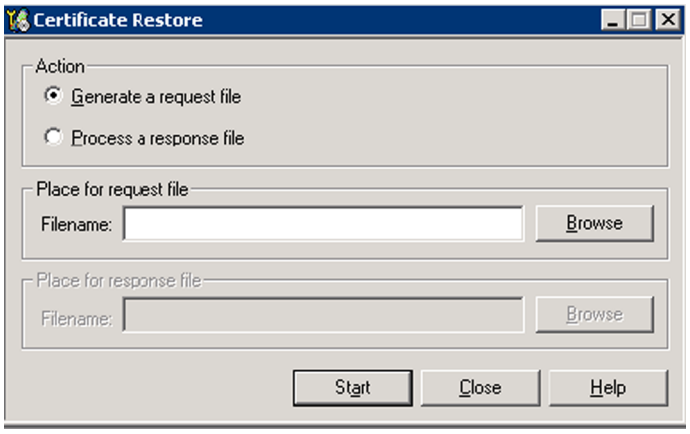
2. Create a *Request* file.

For this procedure, you must supply +12 V to CU-4 from an external power supply.

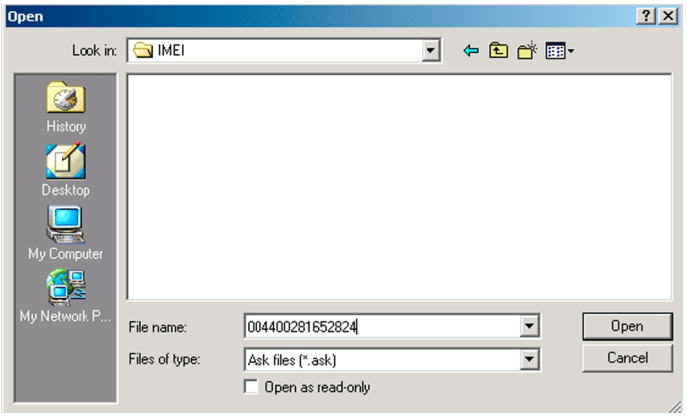
i To connect the phone with *Phoenix*, choose **File → Scan Product** .

ii Choose **Tools → Certificate Restore** .

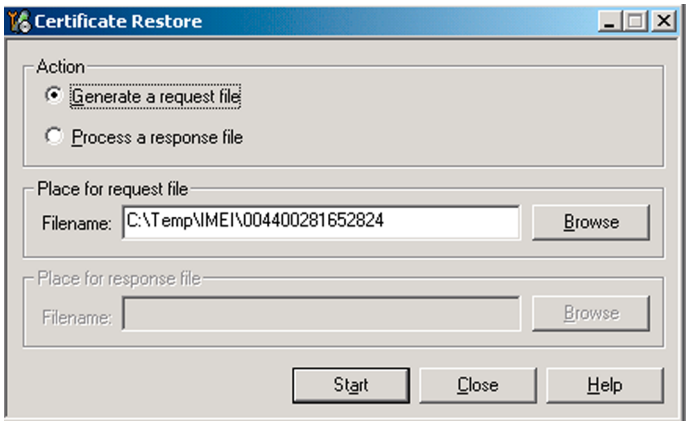
iii To choose a location for the request file, click **Browse**.




iv Name the file so that you can easily identify it, and click **Open**.




The name of the file and its location are shown.




v To create the *Request* file, click **Start**.

vi When the file for certificate restore has been created, send it to Nokia as an e-mail attachment.

3. Restore certificate.

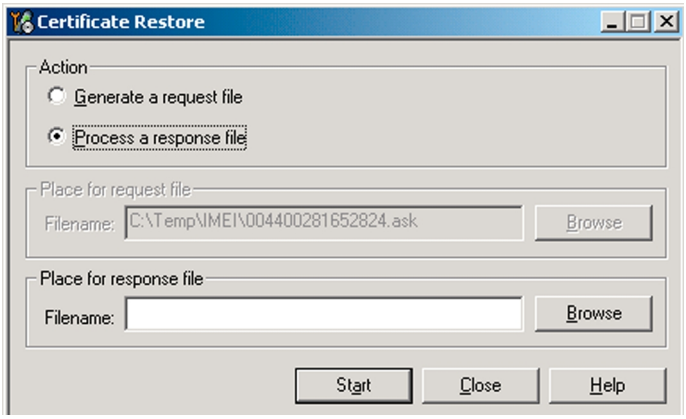
For this procedure, you must supply +12 V to CU-4 from an external power supply.

i Save the reply file sent by Nokia to your computer.

ii Start *Phoenix* service software.

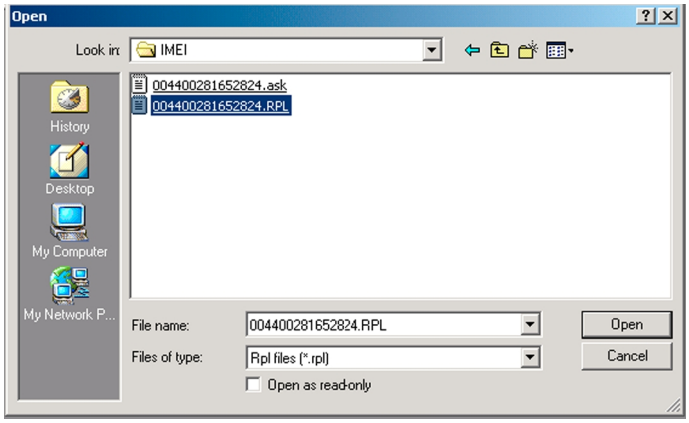
iii Choose **File → Scan Product** .

iv From the **Tools** menu, choose **Certificate Restore** and select **Process a response file** in the *Action* pane.



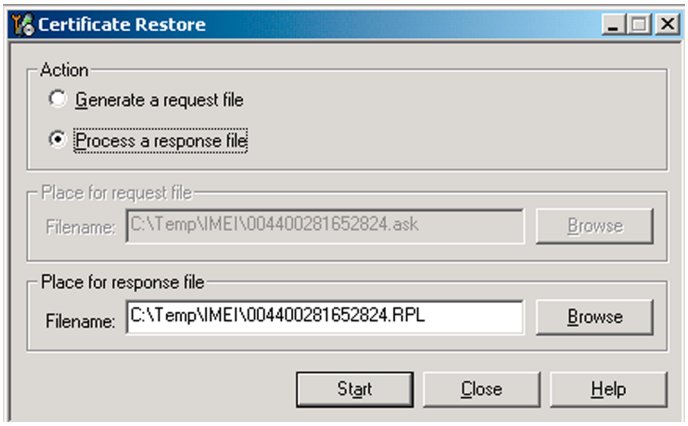

v To choose the location where response file is saved, click **Browse**.

vi Click **Open**.




The name of the file and the path where it is located are shown.

vii To write the file to phone, click **Start**.




## Next actions

After a successful rewrite, you must retune the phone completely by using *Phoenix* tuning functions.

**Important:** Perform all tunings: RF, BB, and UI.

## Energy management calibration

### Prerequisites

Energy Management (EM) calibration is performed to calibrate the setting (gain and offset) of AD converters in several channels (that is, **battery voltage**, **BSI**, **battery current**) to get an accurate AD conversion result.

Hardware setup:

- An external power supply is needed.
- Supply 12V DC from an external power supply to CU-4 to power up the phone.
- The phone must be connected to a CU-4 control unit with a product-specific flash adapter.

### Steps

1. Place the phone to the docking station adapter (CU-4 is connected to the adapter).
2. Start *Phoenix* service software.
3. Choose **File** → **Scan Product.**
4. Choose **Tuning** → **Energy Management Calibration.**
5. To show the current values in the phone memory, click **Read**, and check that communication between the phone and CU-4 works.
6. Check that the **CU-4 used** check box is checked.
7. Select the item(s) to be calibrated.

   **Note:** ADC calibration has to be performed before other item(s). However, if all calibrations are selected at the same time, there is no need to perform the ADC calibration first.
8. Click **Calibrate**.

   The calibration of the selected item(s) is carried out automatically.

   The candidates for the new calibration values are shown in the *Calculated values* column. If the new calibration values seem to be acceptable (please refer to the following "Calibration value limits" table), click **Write** to store the new calibration values to the phone permanent memory.

**Table 6 Calibration value limits**

| Parameter | Min. | Max. |
|---|---|---|
| ADC Offset | -20 | 20 |
| ADC Gain | 12000 | 14000 |
| BSI Gain | 1100 | 1300 |
| VBAT Offset | 2400 | 2650 |
| VBAT Gain | 19000 | 23000 |
| VCHAR Gain | N/A | N/A |
| IBAT (ICal) Gain | 7750 | 12250 |

9. Click **Read**, and confirm that the new calibration values are stored in the phone memory correctly. If the values are not stored to the phone memory, click **Write** and/or repeat the procedure again.
10. To end the procedure, close the *Energy Management Calibration* window.

# 4 — RF troubleshooting

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## Table of Contents



**List of Figures**

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# General RF troubleshooting

## Introduction to RF troubleshooting

### Troubleshooting process

RF troubleshooting is performed in this order:

1 Autotuning
2 General power checking
3 Selftests
4 RX and TX troubleshootings

### Most RF semiconductors are static discharge sensitive

ESD protection must be applied during repair (ground straps and ESD soldering irons).

### Pre-baking

These parts are moisture sensitive and must be pre-baked prior to soldering:

- RFIC N1001
- Front End Module (FEM) N1002

### Discrete components

In addition to the two key-components, there are few number of discrete components (capacitors and inductors) for which troubleshooting is done mainly by *visual inspection*.

Capacitors: check for short circuits.

**Note:** In-circuit measurements should be evaluated carefully

### Measuring equipment

All measurements should be done using:

- An oscilloscope for low frequency and DC measurements. Recommended probe: 10:1, 10Mohm//8pF.
- A radio communication tester including RF generator and spectrum analyser, for example Rohde & Schwarz CMU200. (Alternatively a spectrum analyser and an RF generator can be used. Some tests in this guide are not possible to perform if this solution is chosen).

  **Note:** All measurements with an RF coupler should be performed in an RF-shielded environment because nearby base stations can disturb sensitive receiver measurements. If there is no possibility to use RF shielded environment, testing at frequencies of nearby base stations should be avoided.

### Level of repair

The scope of this guideline is to enable repairs at key-component level. Please refer to the troubleshooting instructions for further information.

## RF key components

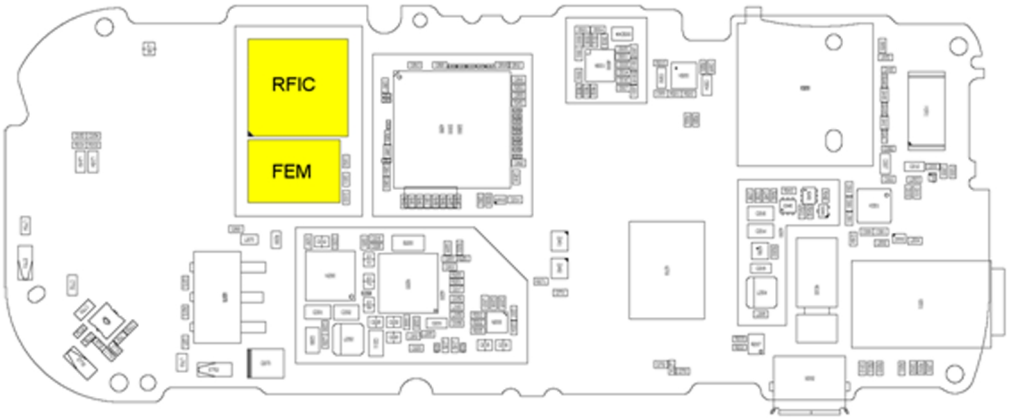



**Figure 12 RF key components**

## Auto tuning for RF

This phone can be tuned automatically.

Autotune is designed to align the phone's RF part easier and faster. It performs calibrations, tunings and measurements of RX and TX. The results are displayed and logged in a result file, if initiated.

### Hardware set up

Hardware requirements for auto tuning:

- PC (Windows 2000/XP) with GPIB card
- Power supply
- Product specific module jig
- Cables: XRS-6 (RF cable), USB cable, GBIP cable and DAU-9S
- Signal analyser (TX), signal generator (RX) and RF-splitter *or* one device including all.

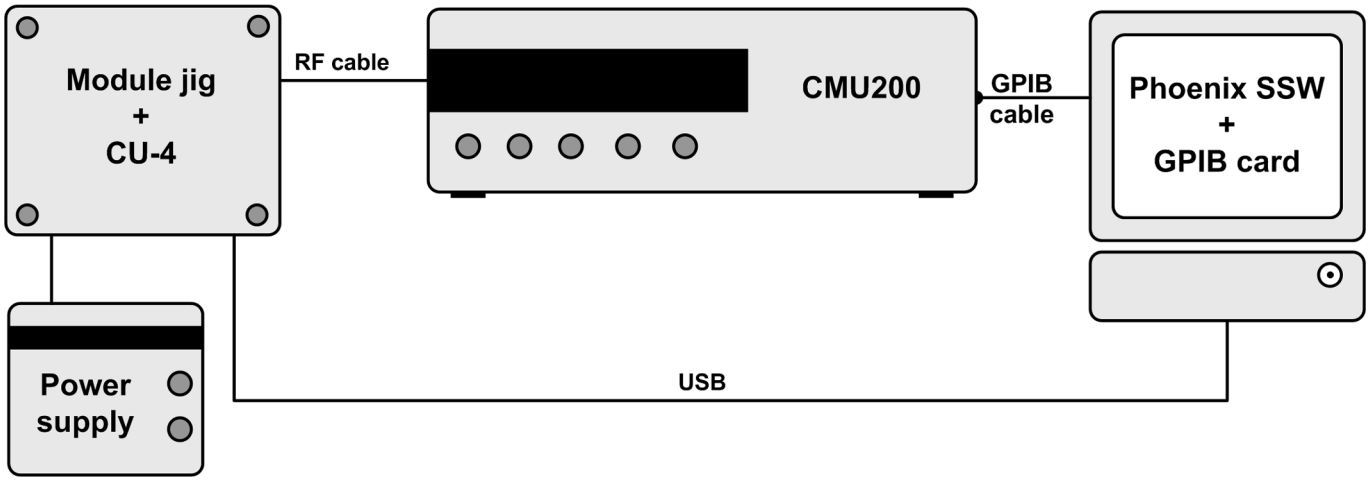



**Figure 13 Auto tuning concept with CMU200**

### Phoenix preparations

Install the phone specific data package, for example *RM-495_dp_1.78_sw_sh3.26.exe*. This defines phone specific settings.

## Auto tuning procedure

1 Make sure the phone (in the jig) is connected to the equipment. Else, some menus will not be shown in Phoenix.

2 To go to autotune, select *Tuning (Alt-U)* > *Auto-Tune (Alt-A)* from the menu.

3 Start autotuning, clicking the *Tune* button.

## General voltage checking

### Steps

1. Set up the main board in the module jig. The phone should be in local mode.
2. Check the following:

| # | Signal name | Test point | Voltage (all bands) |
|---|---|---|---|
| 1 | Vbat at N1002 (FEM) | J2903 | 3.0-4.7 V |
| 2 | Vbat at N1001 (Transceiver) | C1002 | 3.0-4.7 V |
| 3 | VCCXO supply | C2213 | 2.4-2.6 V |


**Figure 14 General voltage checking test points (main board, both sides)**

## Selftest troubleshooting

### RF selftests

### Prerequisites

Do a hardware initialization before you start the selftests:

**Testing** → **GSM** → **RF Controls** → **RX** and then press **Stop**.

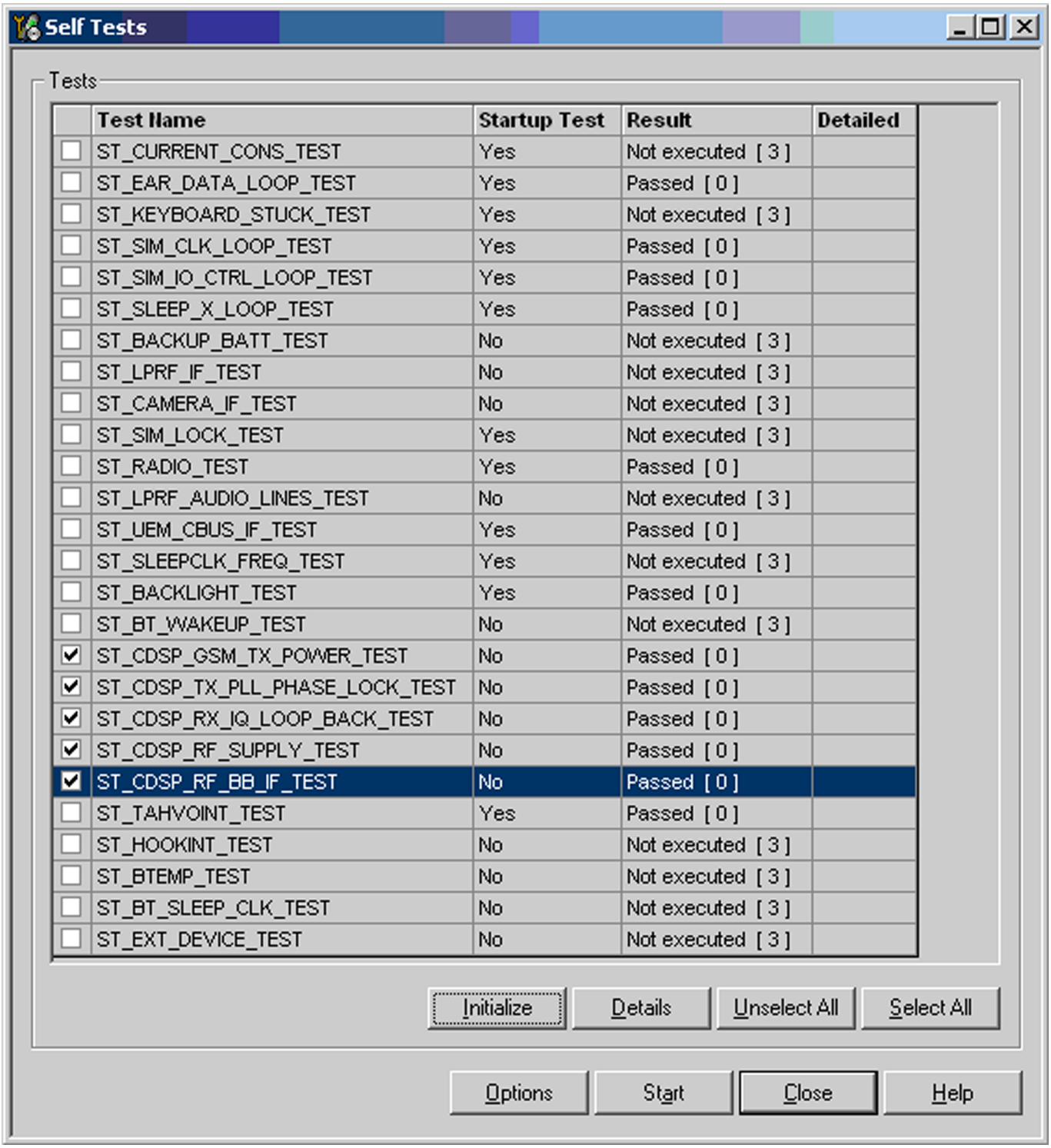
## Context

**Note:** The RF connector should be terminated to 50 Ohms or connected to the antenna. Check this carefully before performing the self tests.

**Note:** The phone should be in **local mode** when performing Self tests

## Steps

1. Check the tests shown in the figure below: **Testing** → **Self Tests** , and press the **Start** button.



2. A test is either Passed or Fatal. If **Fatal** continue the selftest troubleshooting. If **Passed** continue with the other RF troubleshootings.
3. If Fatal, press **Details** to see error codes

   Error codes will now show up in the right most column marked *Detailed*.

| | | | | |
|---|---|---|---|---|
| ☑ | ST_CDSP_RX_IQ_LOOP_BACK_TEST | No | Fatal [ 12 ] | 0x00,0x10,0x00,0xDF |
| ☑ | ST_CDSP_RF_SUPPLY_TEST | No | Fatal [ 12 ] | 0xA8,0x00,0x00,0x00,0x02,0x60,0x02,0x5F,0x0 |
| ☑ | ST_CDSP_RF_BB_IF_TEST | No | Fatal [ 12 ] | 0x00,0xC0,0x00,0x00 |
| ☐ | ST_TAHVOINT_TEST | Yes | Passed [ 0 ] | |
| ☐ | ST_SECURITY_TEST | No | Not executed [ 3 ] | |

**Note:** The Error Code contains the two first words: *0x00* and *0xC0*.

## Fatal selftests troubleshooting

If a self test is fatal, check the **Details** → **Error code** and follow the instructions below.

**Note:** If **ST_CDSP_RF_BB_IF_TEST** is fatal, the other self tests will also be fatal. Always start troubleshooting ST_CDSP_RF_BB_IF_TEST.

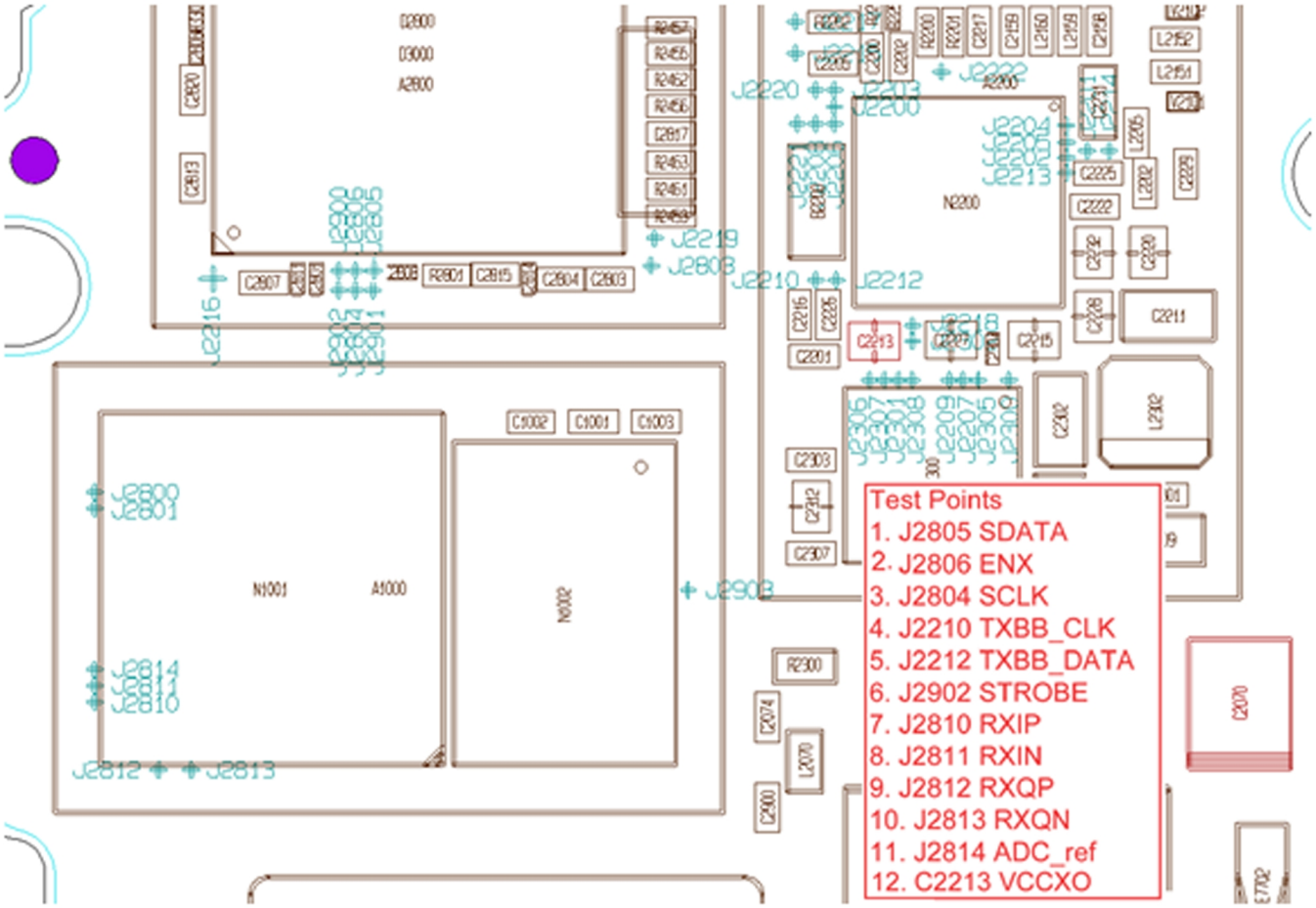
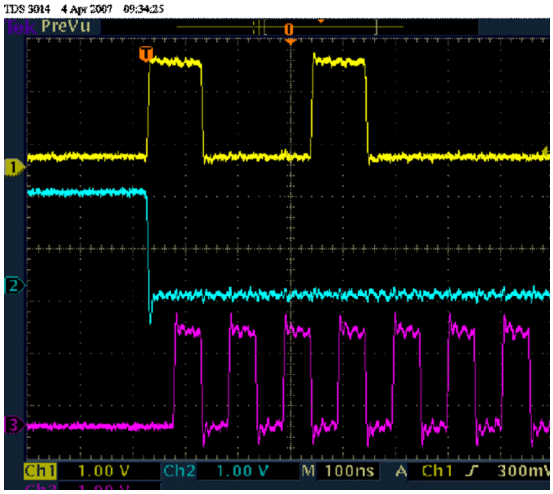
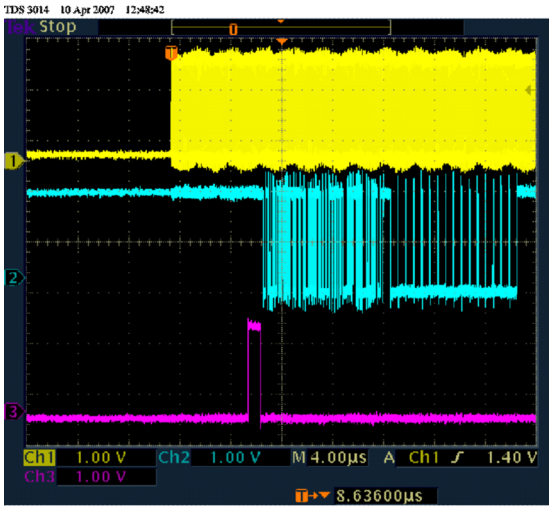



**Figure 15 Testpoints used after fatal self tests**

## ST_CDSP_RF_BB_IF_TEST is fatal

This test is checking the communication between baseband and RF. It will show in what part the problem is located.

| Error code | Test | Action |
|---|---|---|
| ST_RFBUS_WRITE_READ_FAIL (0x00, 0x40) or combination (0x00, 0xC0) | In Phoenix **Testing** → **GSM** → **RF Controls** → **RX**<br>Probe:<br>1 J2805 SDATA (Ch1) [1]<br>2 J2806 ENX (Ch2) [2]<br>3 J2804 SCLK (Ch3) [3]<br>The **result** should look like this:<br>  <br>**Figure 16 Settings: Time 1ns/d + 0.1Vpp/d** | **All OK**: replace N1001<br>**NOK** : go to BB troubleshooting |

| Error code | Test | Action |
|---|---|---|
| ST_TXFIFO_WRITE_READ_FAIL (0x00, 0x80) | In Phoenix: **Testing** → **GSM** → **RF Controls** → **TX**<br>Probe:<br>1 J2210 TXBB_CLK (Ch1) [4]<br>2 J2212 TXBB_DATA (Ch2) [5]<br>3 J2902 STROBE (Ch3) [6]<br>The **result** should look like this:<br>  <br><br>**Figure 17 Settings: Time 1ns/d + 0.3Vpp/d** | **All OK**: replace N1001<br>**NOK** : go to BB troubleshooting |

## ST_CDSP_GSM_TX_POWER_TEST is fatal

This test is checking power amplifier functionality.

| Error code | Test | Action |
|---|---|---|
| ST_GSM1800_TX_PWR_LOW (0x00, 0x02)<br>ST_GSM850_TX_PWR_LOW (0x00, 0x08)<br>Or combination (0x00, 0x0A) | - | Replace N1002 |
| ST_TXDAC_FAIL (0x00, 0x10)<br>Or combination (0x00, 0x1A), (0x00, 0x12), (0x00, 0x18) | - | Replace N1001 |

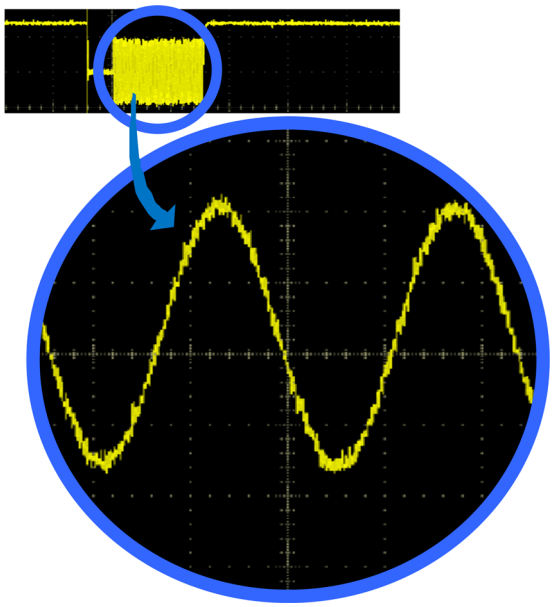
## ST_CDSP_TX_PLL_PHASE_LOCK_TEST is fatal

This test is checking if phase lock loop is working.

| Error code | Test | Action |
|---|---|---|
| ST_TX_PLL_FAIL (0x00, 0x08) | | Replace N1001 |

## ST_CDSP_RX_IQ_LOOP_BACK_TEST is fatal

This test is checking the analogue RX communication between baseband and RF.

| Error code | Test | Action |
|---|---|---|
| ST_FIMRCAL_FAIL (0x00, 0x40) or combination (0x00, 0x50) and (0x00, 0x60) | | Replace N1001 |
| ST_IQ_POWER_TOO_SMALL (0x00, 0x10)<br>ST_IQ_POWER_TOO_HIGH (0x00, 0x20) | In Phoenix: **Testing** → **GSM** → **RF Controls** → **RX**<br>Apply -80dBm signal at 948.06771 MHz<br>Probe during RX operation:<br>1 J2810 RXIP [7]<br>2 J2811 RXIN [8]<br>3 J2812 RXQP (Ch1) [9]<br>4 J2813 RXQN [10]<br>5 J2814 ADC_ref [11]<br>Check voltage level between 0.7-0.8V<br>The **result** should look like this:<br>  <br>**Figure 18 Frequency ~ 100kHz** | **All OK** : go to BB troubleshooting<br>**NOK**: replace N1001 |

## ST_CDSP_RF_SUPPLY_TEST is fatal

This test is checking internal voltage regulators.

| Error code | Test | Action |
|---|---|---|
| ST_VREG_LDO2 (0x20, 0x00)<br>ST_VREG_VCCXO (0x80, 0x00)<br>Or combination (0xA0, 0x00) | Check<br>1 VCCXO value at testpoint C2213 = 2 .4 – 2.6 V [12]<br>2 2. VBat = 3.0 – 4.7 V | **All OK**: replace N1001<br>**NOK** : go to power troubleshooting |

## Receiver troubleshooting

### Introduction to receiver (RX) troubleshooting

RX can be tested by making a phone call or in local mode. For the local mode testing, use Phoenix service software.

The main RX troubleshooting measurement is RSSI reading. This test measures the signal strength of the received signal. For GSM RSSI measurements, see *GSM RX chain activation for manual measurements/GSM RSSI measurement*.

### GSM RX chain activation for manual measurements/GSM RSSI measurement

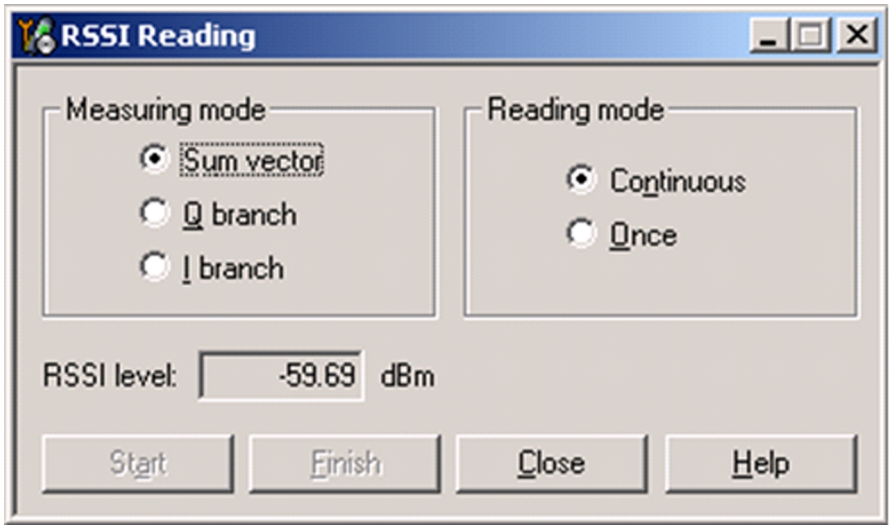
#### Prerequisites

Make the following settings in Phoenix service software and in the signal generator:

| Setting | GSM850 | GSM900 | GSM1800 | GSM1900 |
|---|---|---|---|---|
| Phoenix Channel | 190 | 37 | 700 | 661 |
| Signal generator to antenna connector | 881.66771 MHz (67.71kHz offset) at -60dBm | 942.46771 MHz (67.71kHz offset) at -60dBm | 1842.86771 MHz (67.71kHz offset) at -60dBm | 1960.06771 MHz (67.71kHz offset) at -60dBm |

#### Steps

1. Set the phone to local mode.
2. Activate RSSI reading in Phoenix ( **Testing** → **GSM** → **RSSI reading** )



### Results

With the *Measuring mode* set to *Sum vector*, the reading should reflect the level of the signal generator (-losses) +/- 5 dB.

When varying the level in the range -30 to -102 dBm the reading should then follow within +/-5 dB.

Now select the measuring mode to *Q branch* and *I Branch*. In each case the reading should be 3 dB below the signal generator level.

### Next actions

RSSI-reading AND TX troubleshooting is failing: replace N1002.

TX is OK and RX is failing: replace N1001.

## Transmitter troubleshooting

### General instructions for transmitter (TX) troubleshooting

Please note the following before performing transmitter tests:

- TX troubleshooting requires TX operation.
- Do not transmit on frequencies that are in use!
- The transmitter can be controlled in local mode for diagnostic purposes.
- The most useful Phoenix tool for GSM transmitter testing is “RF Controls”.
- Remember that re-tuning is not a fix! Phones are tuned correctly in production

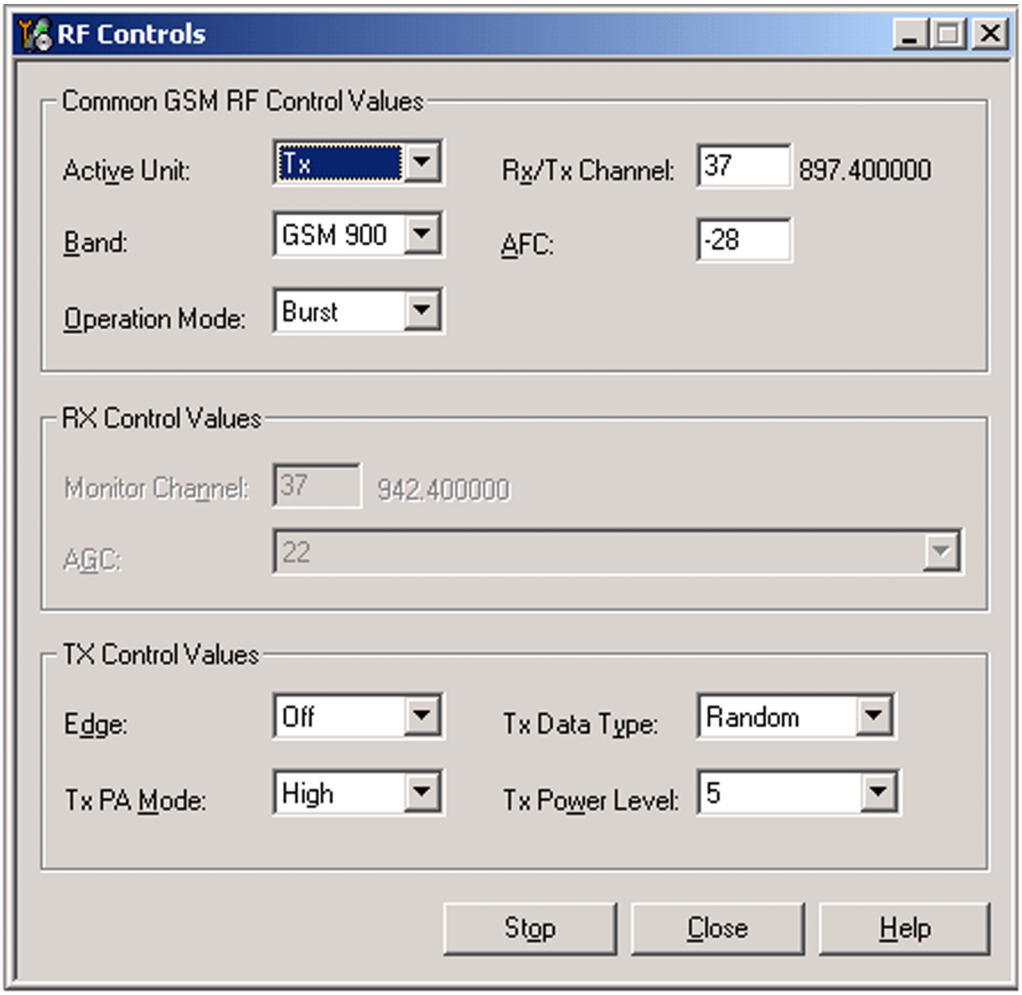
  **Note:** Never activate the GSM transmitter without a proper antenna load. Always connect a 50 Ω load to the RF connector (antenna, RF-measurement equipment or at least a 2 W dummy load); otherwise the power amplifier may be damaged.

### GSM transmitter troubleshooting

### Steps

1. Set the phone to local mode.
2. Activate RF controls in Phoenix ( **Testing** → **GSM** → **Rf Controls** ).

   Make settings as shown in the picture:




3. Check the basic TX parameters (i.e. power, phase error, modulation and switching spectrum), using a communication analyser (for example CMU200).

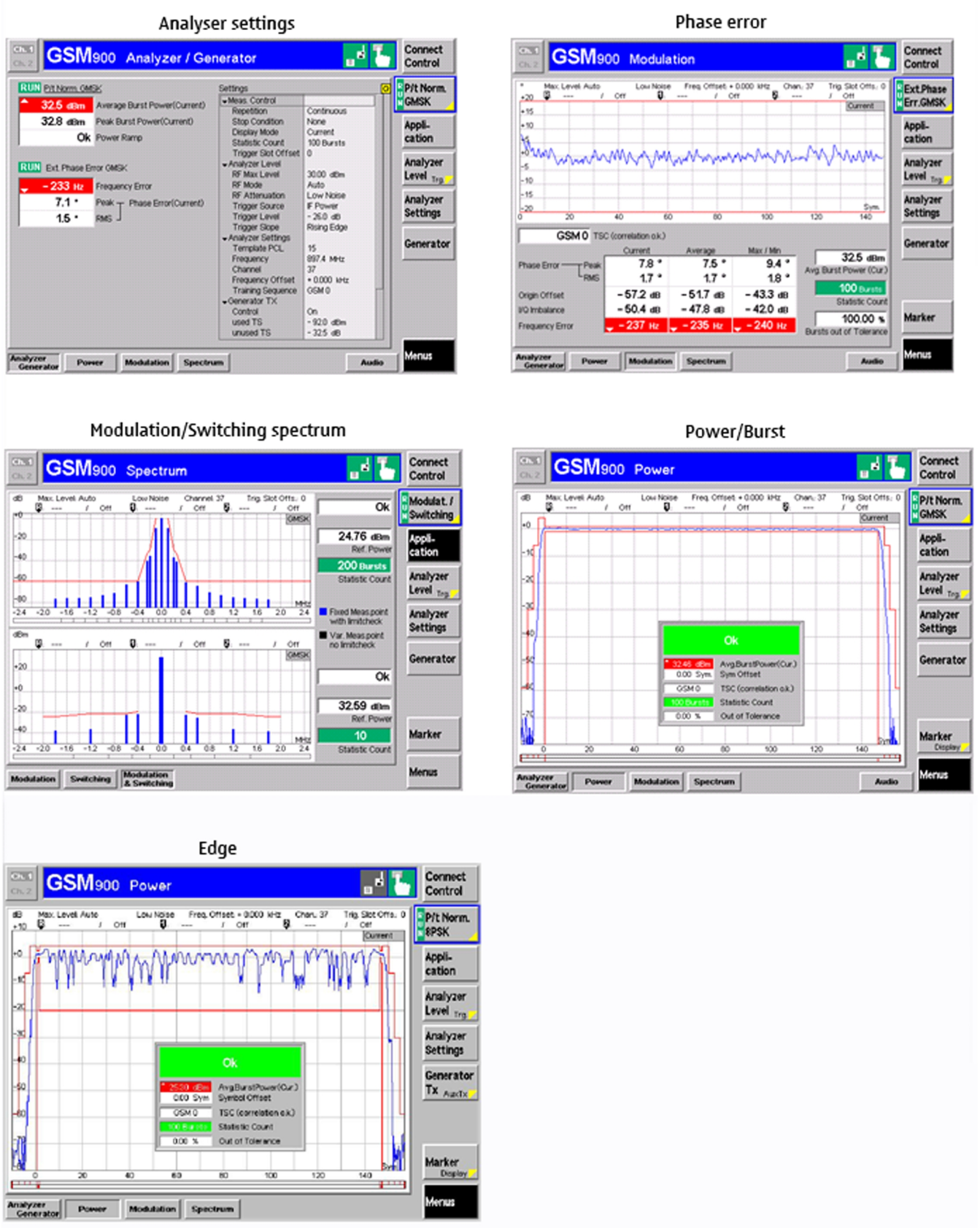



**Figure 19 Typical readings**

4. Change power level (RF controls) and make sure the power reading follows accordingly.

## Next actions

TX is failing and RX is OK: replace N1002

If you want to troubleshoot the other bands, change band with RF controls and set the communication analyzer accordingly.

# Bluetooth and FM radio troubleshooting

## Bluetooth troubleshooting

### Troubleshooting flow

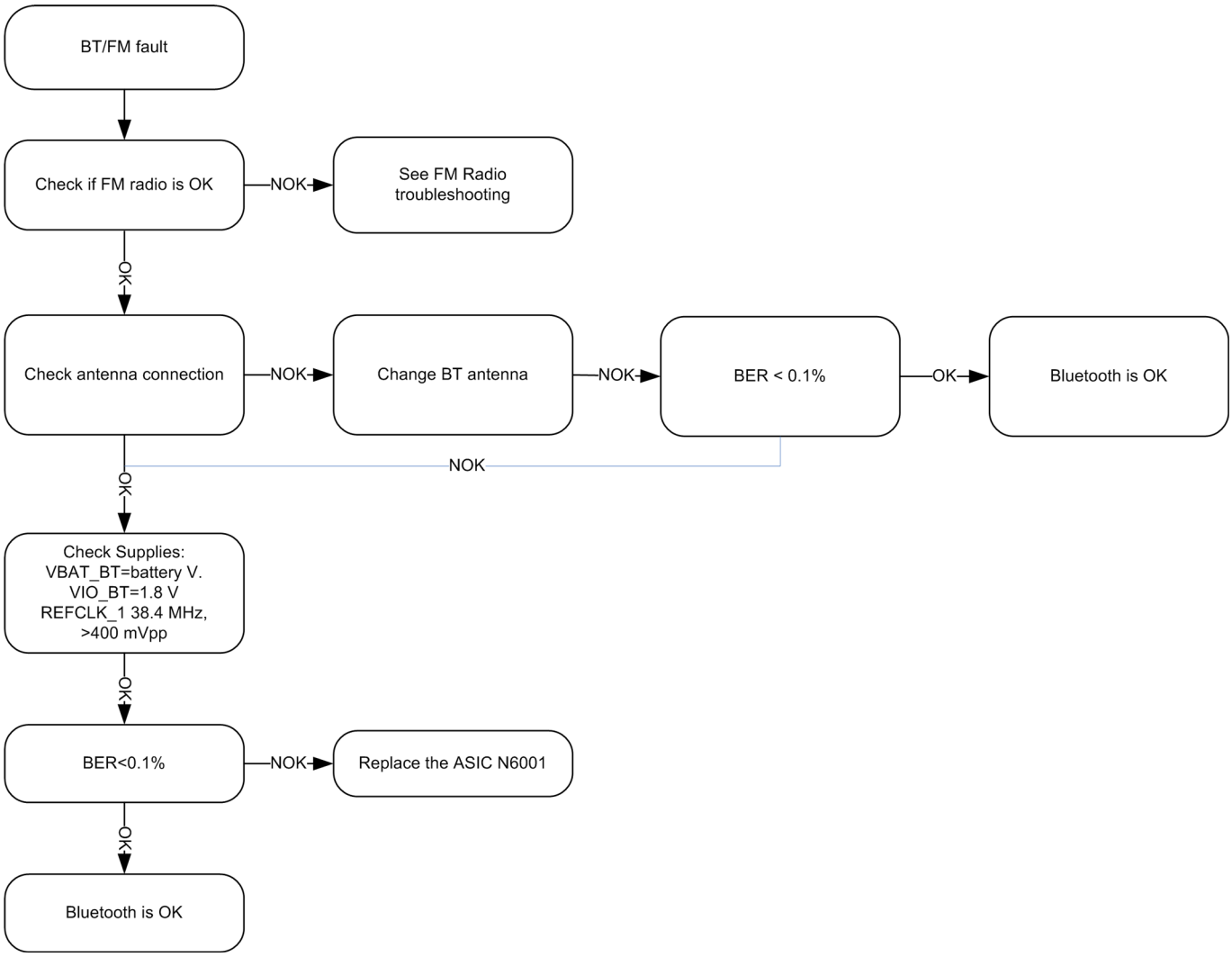
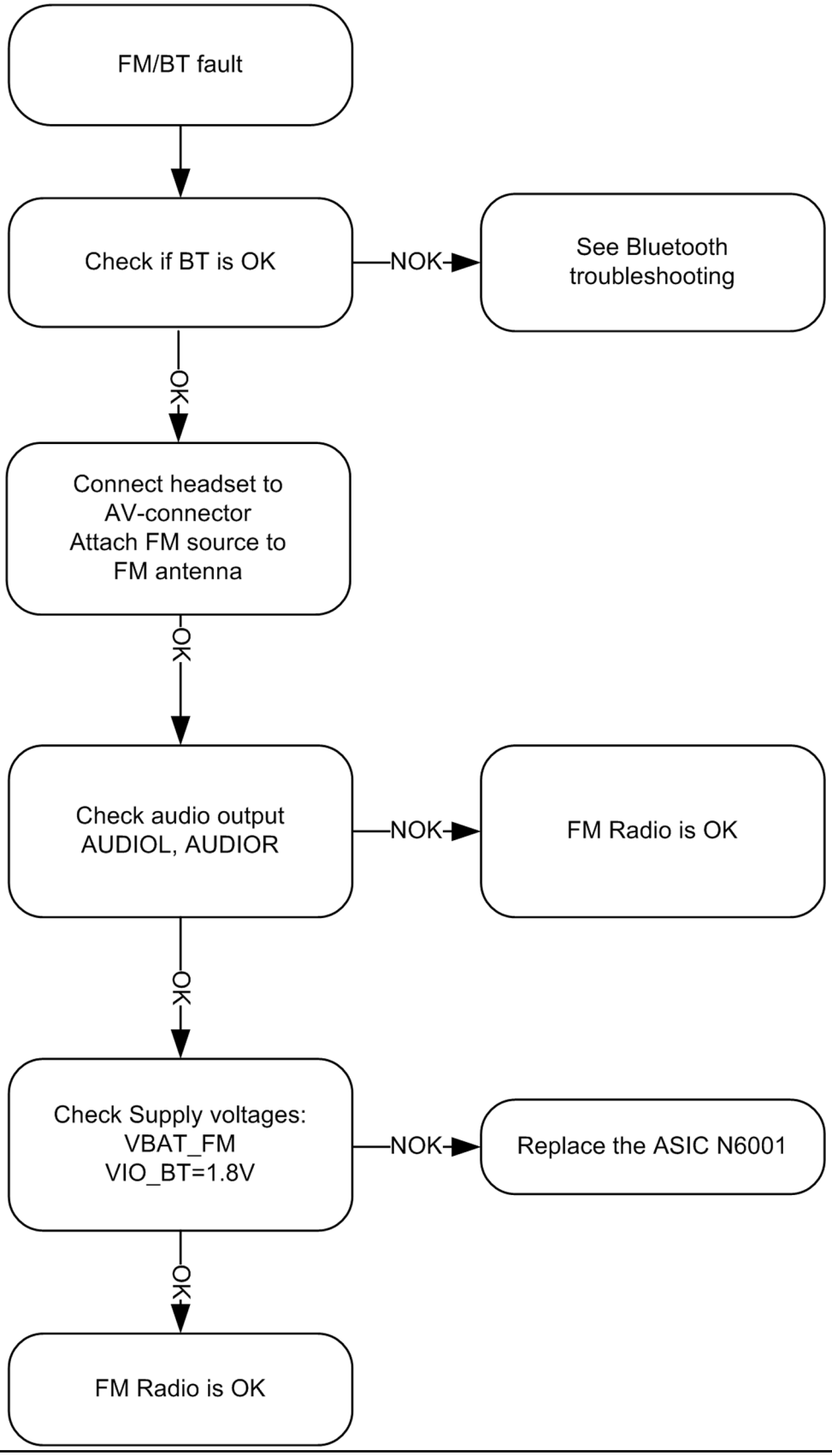



**Figure 20 Troubleshooting diagram: Bluetooth**

## FM radio troubleshooting

### Troubleshooting flow



# 5 — System Module

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## Table of Contents



### List of Tables



### List of Figures

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# Introduction

## Phone description

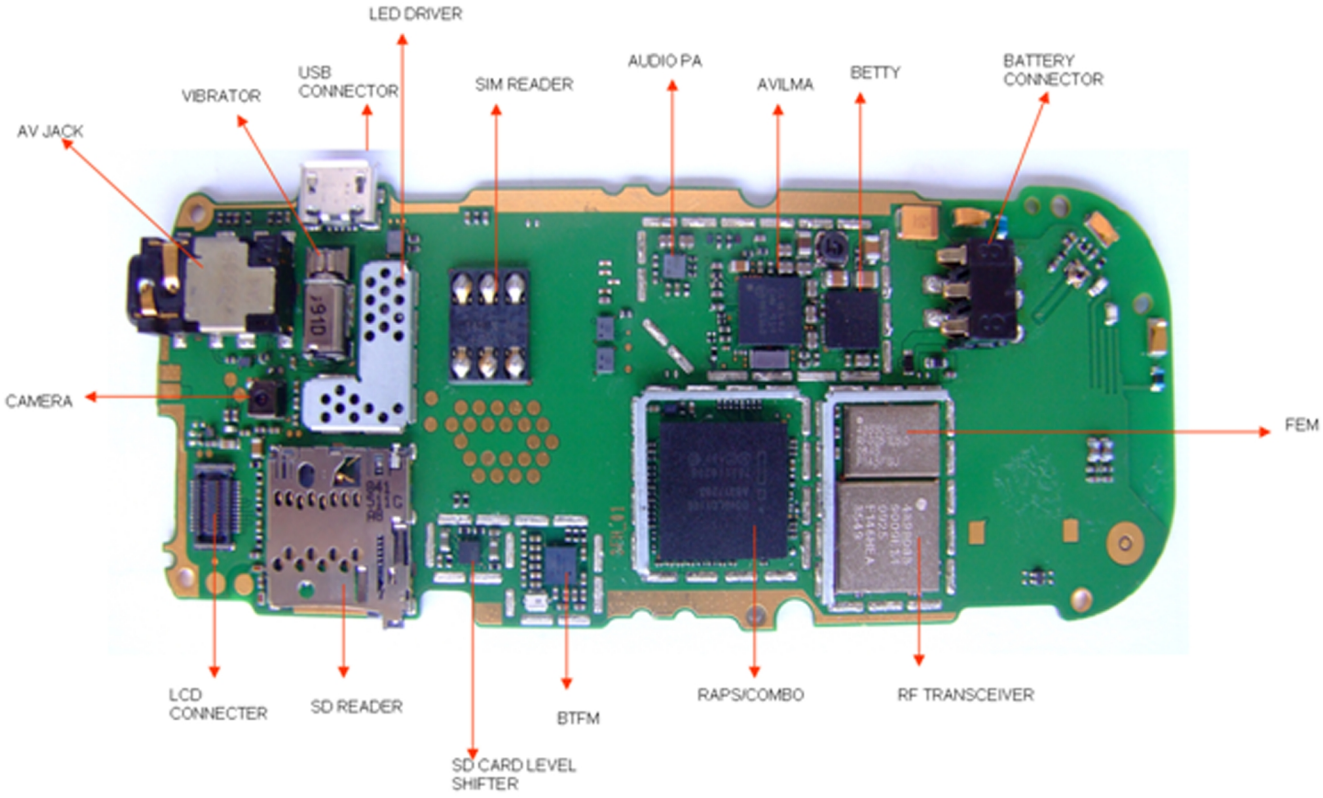
RAP is the main digital baseband ASIC in the phone. It contains functionality for GSM EDGE. The hardware accelerator is used as a camera accelerator.

N2200 (AVILMA) is mainly the audio ASIC in the phone and N2300 (BETTY) is basically the energy management controller for the phone.

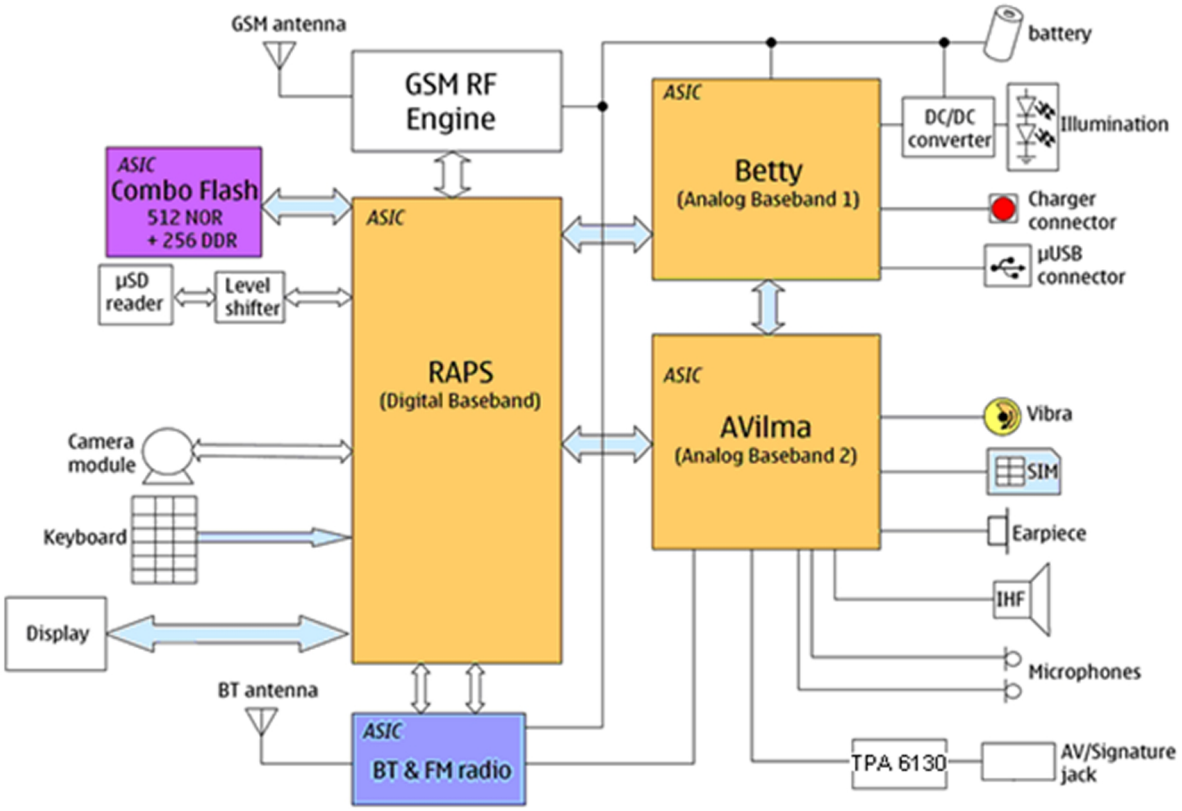
## Key components

| Function | Description | Item ref |
|---|---|---|
| Main board | 3FH | |
| Energy management ASIC | AVILMA<br>BETTY | N2200<br>N2300 |
| RF ASIC | RF IC | N1001 |
| Processor | RAPS_V3.03-PA | D2800 |
| PA GSM | Front end module (FEM), quad band | N1002 |
| Memory | 512 Mbit NOR + 256 Mbit DRAM Combo (Stacked with RAP) | D3000 |
| Bluetooth | BL6450 | N6001 |
| Battery | BL-4C 860 mAh | |
| Battery connector | Lynx interface | X2070 |
| µUSB connector | For data, support USB full speed | AV flex: X2002 |

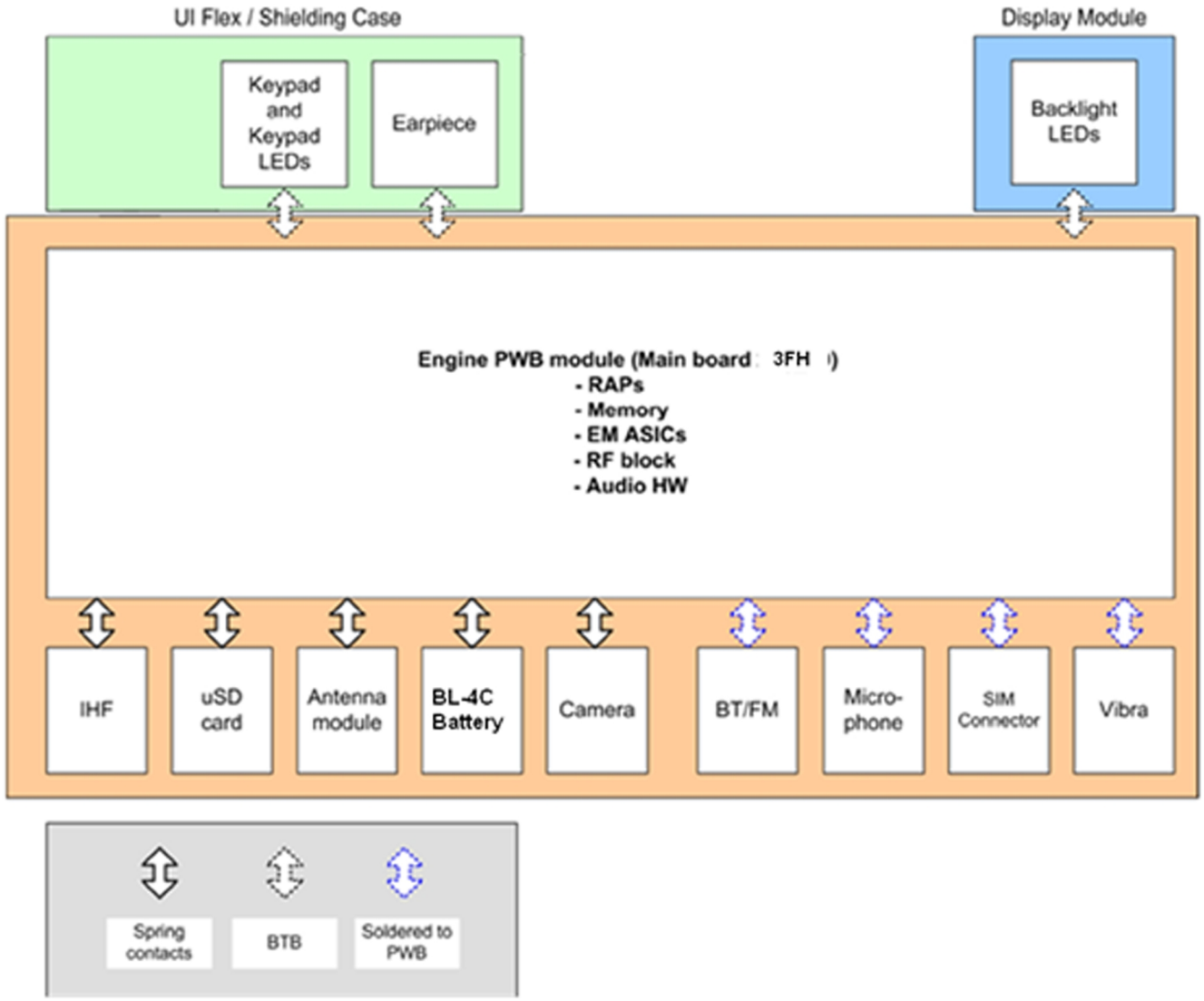
## Key component placement



## System module block diagram




## Board and module connections




## Energy management

### Battery and charging

### BL-4C battery

The phone is powered by a 3-pole BL-4C 860 mAh battery. The three poles are named VBAT, BSI and GND where the BSI line is used to recognize the battery capacity. This is done by means of an internal battery pull down resistor.

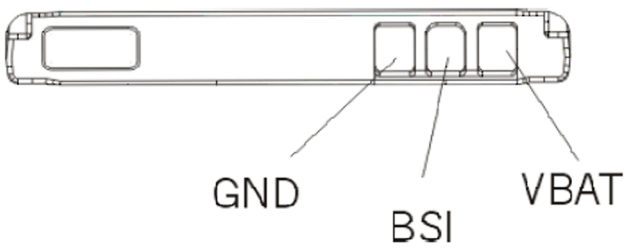



**Figure 21 Battery pin order**

The battery temperature can be measured from the UI flex.

## Battery connector

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

- BSI (Battery size indicator)
- GND (Ground)
- VBAT (Battery voltage)

The BSI line is used to recognize the battery capacity by a battery internal pull down resistor.

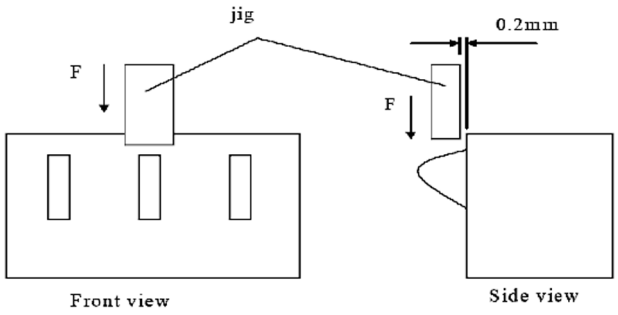



**Figure 22 Battery connector**

## Charging

This phone is charged through a separate charger connector.

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

Energy management is mainly carried out in the two Application Specific Integrated Circuits (ASICs) N2300 BETTY and N2200 AVILMA. These two circuits contains a number of regulators. In addition there are some external regulators too.

In the table below normal and extreme voltages are shown when a BL-4C battery is used.

**Table 7 Nominal voltages**

| Voltage | Voltage [V] | Condition |
|---|---|---|
| General Conditions | | |
| Nominal voltage | 4.0 | |
| Lower extreme voltage | 3.145 | |
| Higher extreme voltage (fast charging) | 4.230 | |
| HW Shutdown Voltages | | |
| Vmstr+ | 2.1 ± 0.1 | Off to on |
| Vmstr- | 1.9 ± 0.1 | On to off |
| SW Shutdown Voltages | | |
| Sw shutdown | 3.106 | In call |
| Sw shutdown | 3.2 | In idle |

| Voltage | Voltage [V] | Condition |
|---|---|---|
| Min Operating Voltage | | |
| Vcoff+ | 2.9 ± 0.1 | Off to on |
| Vcoff- | 2.6 ± 0.1 | On to off |

## Power key and system power-up

When the battery is placed in the phone the power key circuits are energized. When the power key is pressed, the system boots up (if an adequate battery voltage is present).

Power down can be initiated by pressing the power key again (the system is powered down with the aid of SW). The power key is connected to EM ASIC N2200 (AVILMA) via PWRONX signal.

## Modes of operation

| Mode | Description |
|---|---|
| NO_SUPPLY | (dead) mode means that the main battery is not present or its voltage is too low (below N2200 AVILMA master reset threshold) and that the back-up battery voltage is too low. |
| BACK_UP | The main battery is not present or its voltage is too low but back-up battery voltage is adequate and the 32 kHz oscillator is running (RTC is on). |
| PWR_OFF | In this mode (warm), the main battery is present and its voltage is over N2300 BETTY master reset threshold. All regulators are disabled, PurX is on low state, the RTC is on and the oscillator is on. PWR_OFF (cold) mode is almost the same as PWR_OFF (warm), but the RTC and the oscillator are off. |
| RESET | RESET mode is a synonym for start-up sequence. RESET mode uses 32 kHz clock to count the REST mode delay (typically 16ms). |
| SLEEP | SLEEP mode is entered only from PWR_ON mode with the aid of SW when the system's activity is low. |
| FLASHING | FLASHING mode is for SW downloading. |

# USB, SIM, µSD

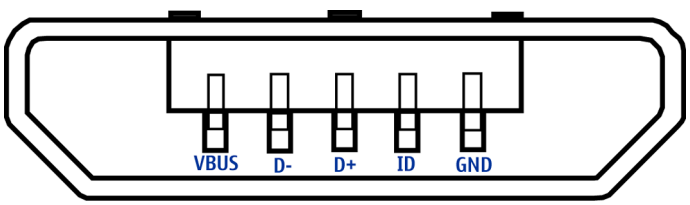
## Micro USB interface

The micro USB (Universal Serial Bus) provides a wired connectivity between a PC and peripheral devices. It is a differential serial bus.

USB 2.0 is supported with full speed (12 Mbps).

Hot swap is supported, which means that USB devices may be plugged in/out at any time.

This phone is provided with a specific connector for µUSB.



## SIM interface

The device has one SIM (Subscriber Identification Module) interface. It is only accessible if battery is removed. The SIM interface consists of an internal interface between RAP and EM ASIC AVILMA (N2200), and of an external interface between N2200 and SIM contacts.

The SIM IF is shown in the following figure:

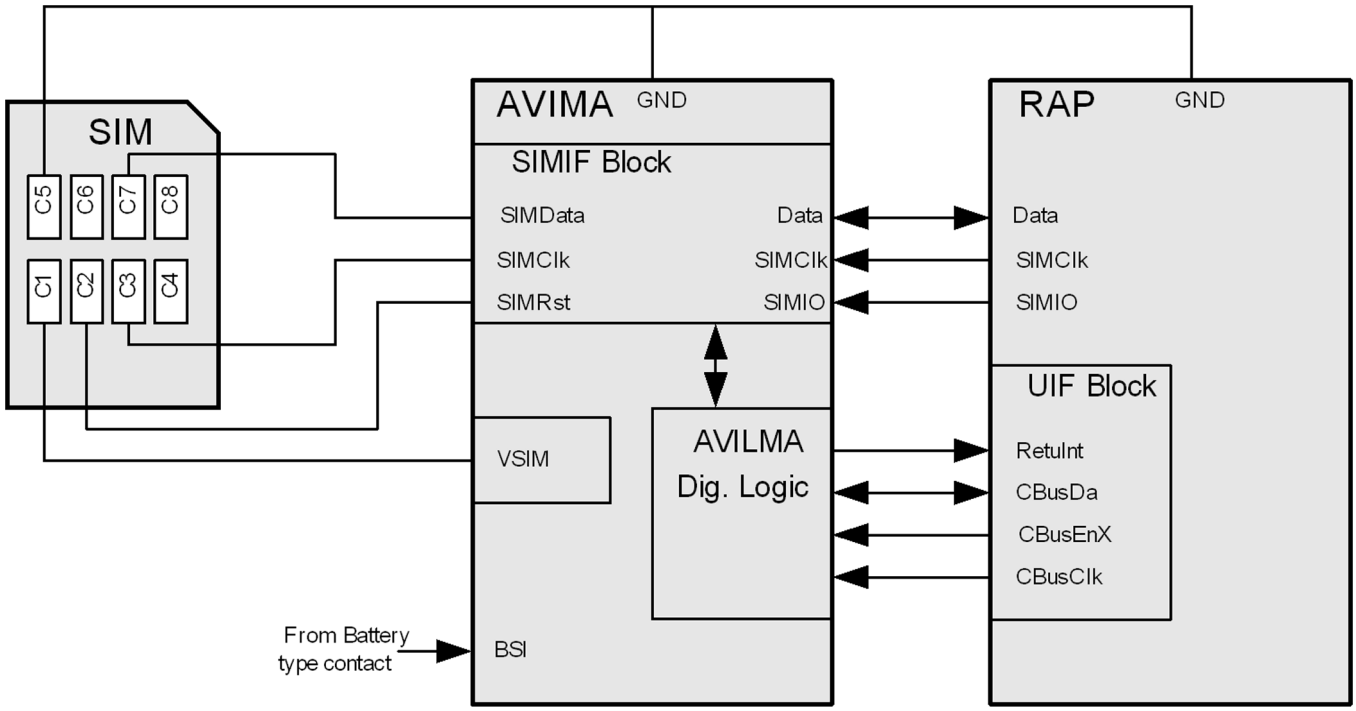
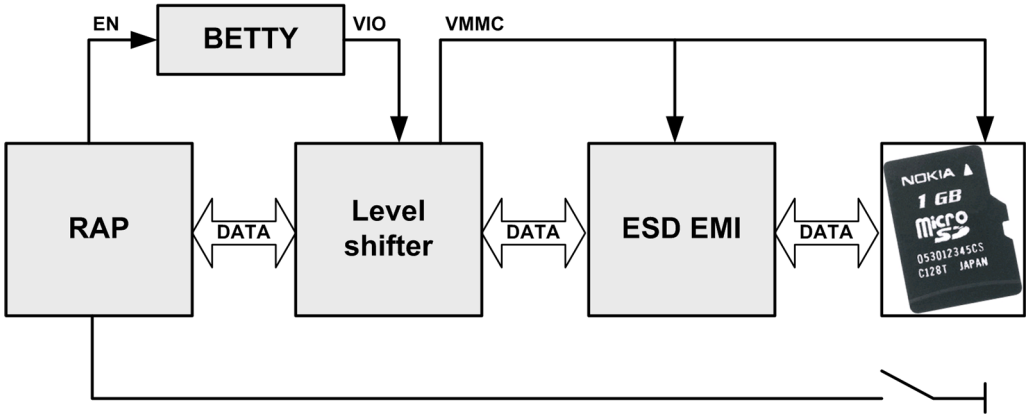



**Figure 23 SIM interface**

The EM ASIC AVILMA handles the detection of the SIM card. The detection method is based in the BSI line. Because of the location of the SIM card, removing the battery causes a quick power down of the SIM interface.

The SIM interface supports both 1.8 V and 3.0 V SIM cards. The SIM interface voltage is first 1.8 V when the SIM card is inserted, and if the card does not response to the ATR a 3 V interface voltage is used.

## µSD card interface




The µSD card is connected to the engine by an external level shifter and ESD protection filter. Supplied voltages:

- VMMC: 2.85 V (from level shifter)
- VIO: 1.8 V (from AVILMA)

The card removal is detected by a push detect switch.

## User interface

### Display module

The interconnection between the LCD module and the engine is implemented with a 24-pin board-to-board connector.

The LCD module does not require any tuning in service.

### Keyboard

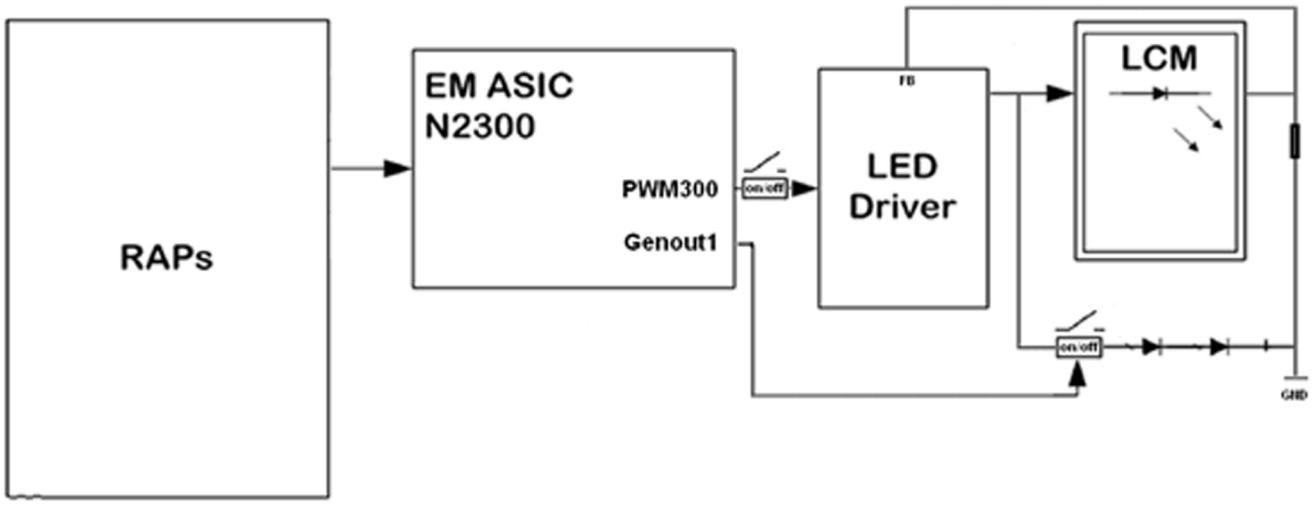
**Table 8 Key signal matrix**

| GENIO | ROW | Col_0 (GENIO-39) | Col_1 (GENIO-40) | Col_2 (GENIO-41) | Col_3 (GENIO-42) |
|---|---|---|---|---|---|
| 32 | ROW0 | Left SK | Left | Right SK | Right |
| 33 | ROW1 | Send | UP | Action | Down |
| 34 | ROW2 | 1 | 4 | 7 | * |
| 35 | ROW3 | 2 | 5 | 8 | 0 |
| 36 | ROW4 | 3 | 6 | 9 | # |

### Backlight and illumination

There is backlight illuminating for the display consisting of 1 LED.

The keypad is side lit by 2 LEDs with film lightguide.




## Audio concept

This phone has a conventional solution on earpiece and vibra. Both are handled by AVILMA N2200. Integrated handsfree speaker is driven by an additional amplifier also handled by AVILMA. The microphone has a digital interface and its RF-filtered lines are directly connected to RAP D2800 for processing.

This phone has an external PA N2000 for external headset directly connected to AVILMA N2200.

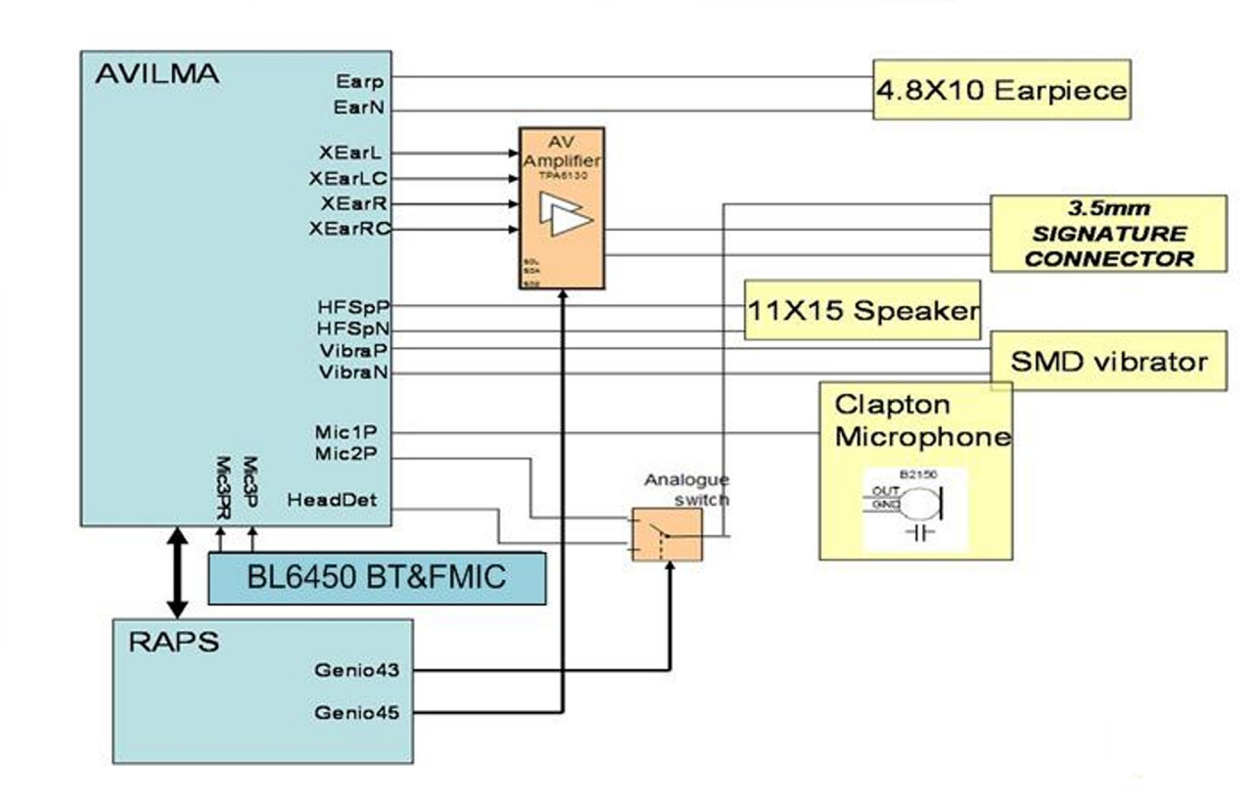



**Figure 24 Audio block diagram**

The Plug detector (PLUG_DET) in the AV connector enables the external microphone, when the phone function is used.

## AV connector

The AV connector is used to connect headsets both in the handsfree phone function and for using the phone as a media player (see the audio concept heading). The six pins are used in accordance with the table below.

A connected male connector is detected on pin 6 (PLUG_DET).

**Note:** Only use an approved cable for connecting to the AV connector ( e.g. headset HS-125).

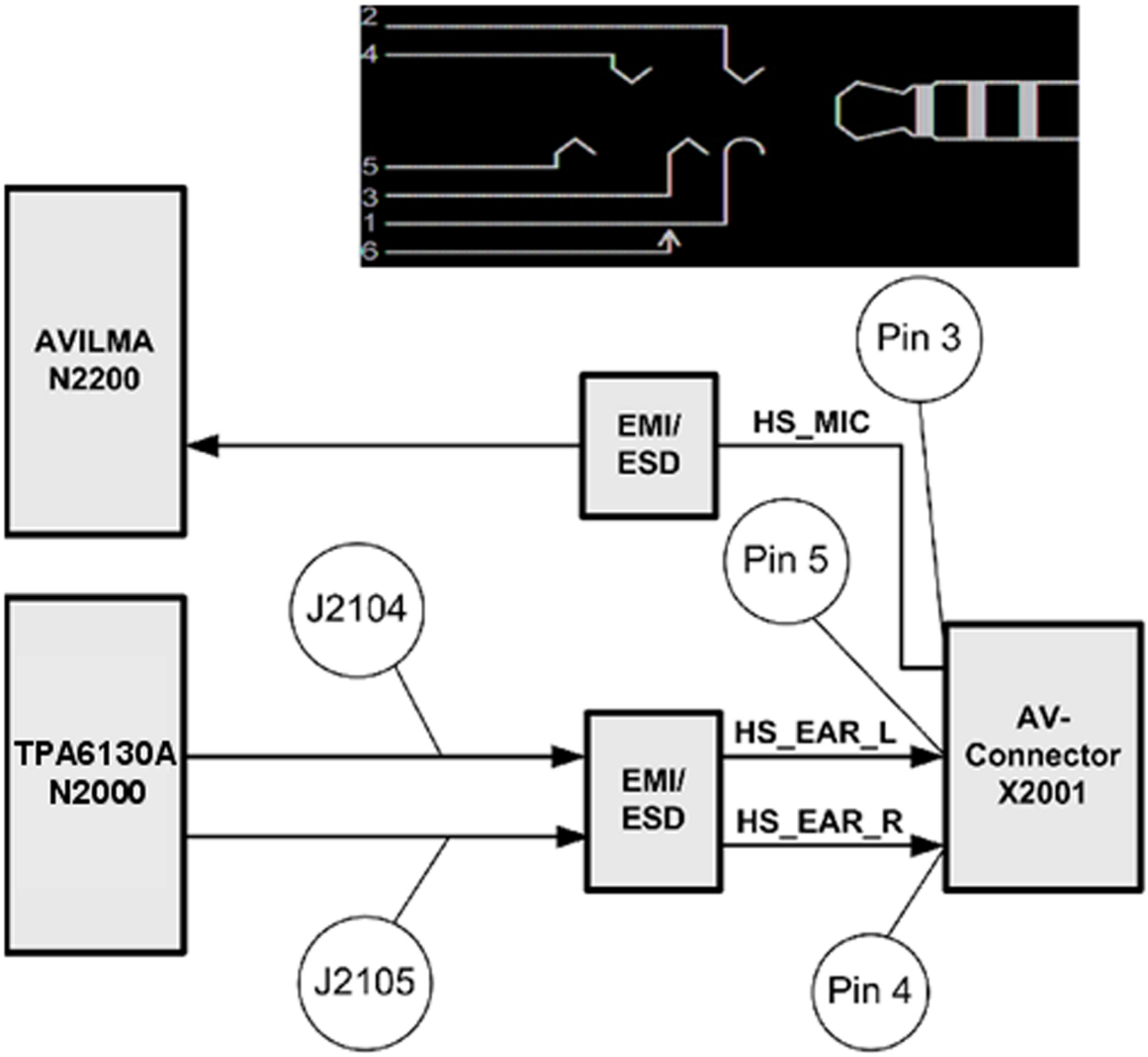



**Table 9 AV connector pins**

| Pin | Signal name | Direction | Description |
|---|---|---|---|
| 1, 2 | HS_ GND | - | Ground) |
| 3 | HS_MIC | Input | Microphone |
| 4 | HS_EAR_R | Output | Audio out |
| 5 | HS_EAR_L | Output | Audio out |
| 6 | PLUG_DET | Input | Plug detection |

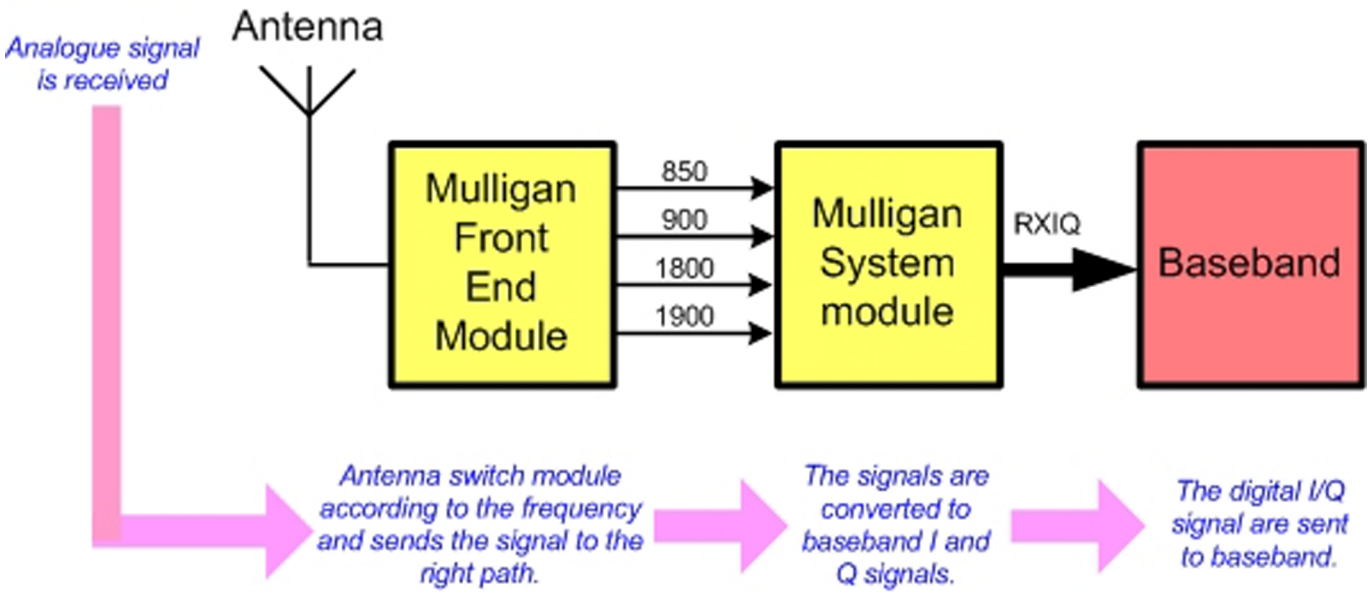
## RF description

### Receiver (RX)

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

The receiver functions are implemented in the RF ASIC.

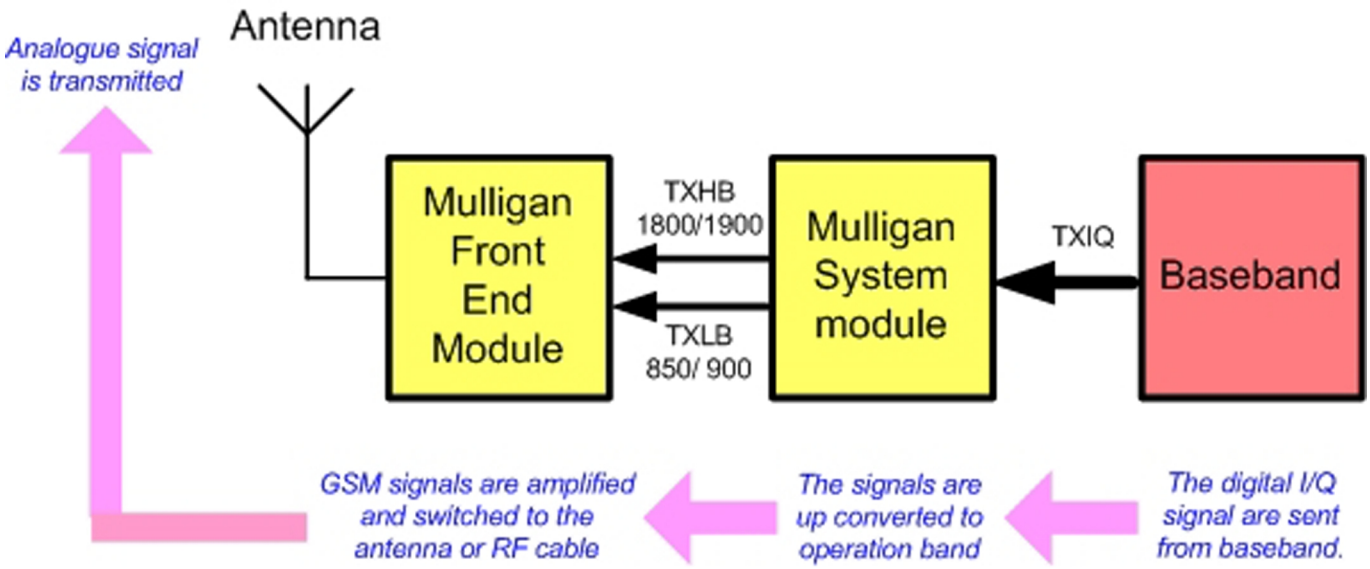
Signals with different frequencies take different paths, therefore being handled by different components.




## Transmitter (TX)

The digital baseband signal (eg. from the microphone) is converted to an analogue signal, which is then amplified and transmitted from the antenna. The frequency of this signal can be tuned to match the bandwidth of the system in use (eg. GSM900).

The transmitter functions are implemented in the RF ASIC.




## Bluetooth

Bluetooth provides a fully digital link for communication between a master unit (the phone) and one or more slave units (e.g. a wireless headset). Data and control interface for a low power RF module is provided by the module.

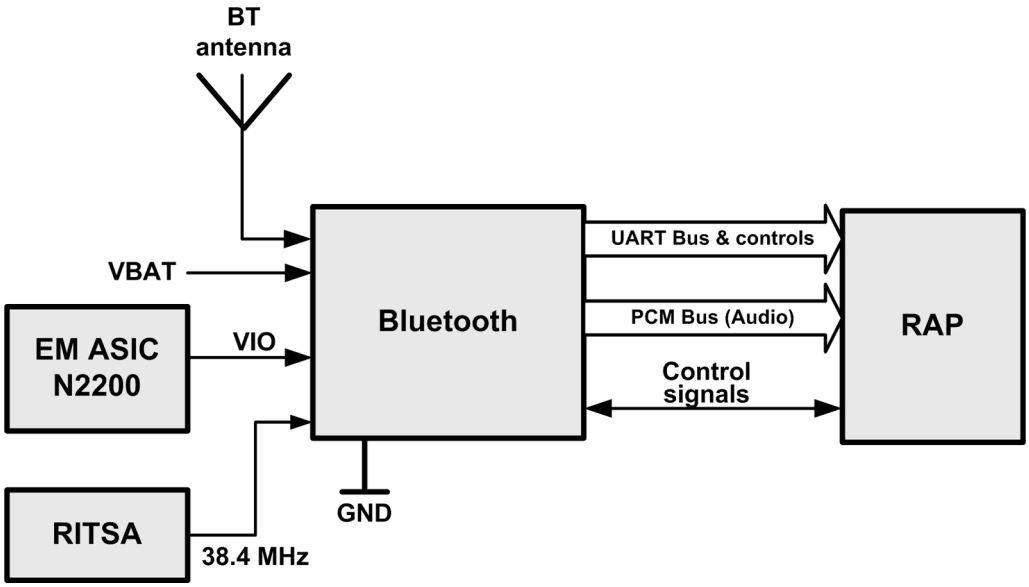



**Figure 25 Bluetooth interface**

The Bluetooth has a separate built in antenna and is powered by VBAT and the regulated voltage VIO. For audio applications the Bluetooth has a PCM data bus. In addition a UART (universal asynchronous receiver/ transmitter) is used for data communication and controls.

## Technical specifications

### Main RF characteristics for GSM band phone

| Parameter | Unit |
|---|---|
| Cellular system | GSM850/900/1800/1900 |
| RX frequency band | GSM850: 869- 894 MHz |
| | GSM900: 925- 960 MHz |
| | GSM1800: 1805 - 1880 MHz |
| | GSM1900: 1930 - 1990 MHz |
| TX frequency band | GSM850: 824- 849 MHz |
| | GSM900: 880- 915 MHz |
| | GSM1800: 1710 - 1785 MHz |
| | GSM1900: 1850 - 1910 MHz |
| Output power | GSM850: +5 ... +32.4 dBm |
| | GSM900: +5 ... +32.4 dBm |
| | GSM1800: +0 ... +30.3 dBm |
| | GSM1900: +0 ... +30.5 dBm |
| Number of RF channels | GSM850: 124 |
| | EGSM900: 172 |
| | GSM1800: 375 |
| | GSM1900: 300 |

| Parameter | Unit |
|---|---|
| Channel spacing | GSM 200 KHz |
| Number of Tx power levels | GSM850: 15 |
| | GSM900: 15 |
| | GSM1800: 16 |
| | GSM1900: 16 |

## Environmental conditions

| Environmental condition | Ambient temperature | Notes |
|---|---|---|
| Normal operation | -15 ºC ... +55 ºC | Specifications fulfilled |
| Reduced performance | 55 ºC ... +70 ºC | Operational only for short periods |
| Intermittent or no operation | -40 ºC ... -15 ºC and +70 ºC ... +85ºC | Operation not guaranteed but an attempt to operate will not damage the phone |
| No operation or storage | <-40 ºC and >+85 ºC | No storage. An attempt to operate may cause permanent damage |
| Charging allowed | -15 ºC ... +55 ºC | |
| Long term storage conditions | 0 ºC ... +85 ºC | |
| Humidity and water resistance | | Relative humidity range is 5 to 95%.<br>Condensed or dripping water may cause intermittent malfunctions.<br>Protection against dripping water has to be implemented in (enclosure) mechanics.<br>Continuous dampness will cause permanent damage to the module. |

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# 6 — LCD flex bending instruction

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## Table of Contents

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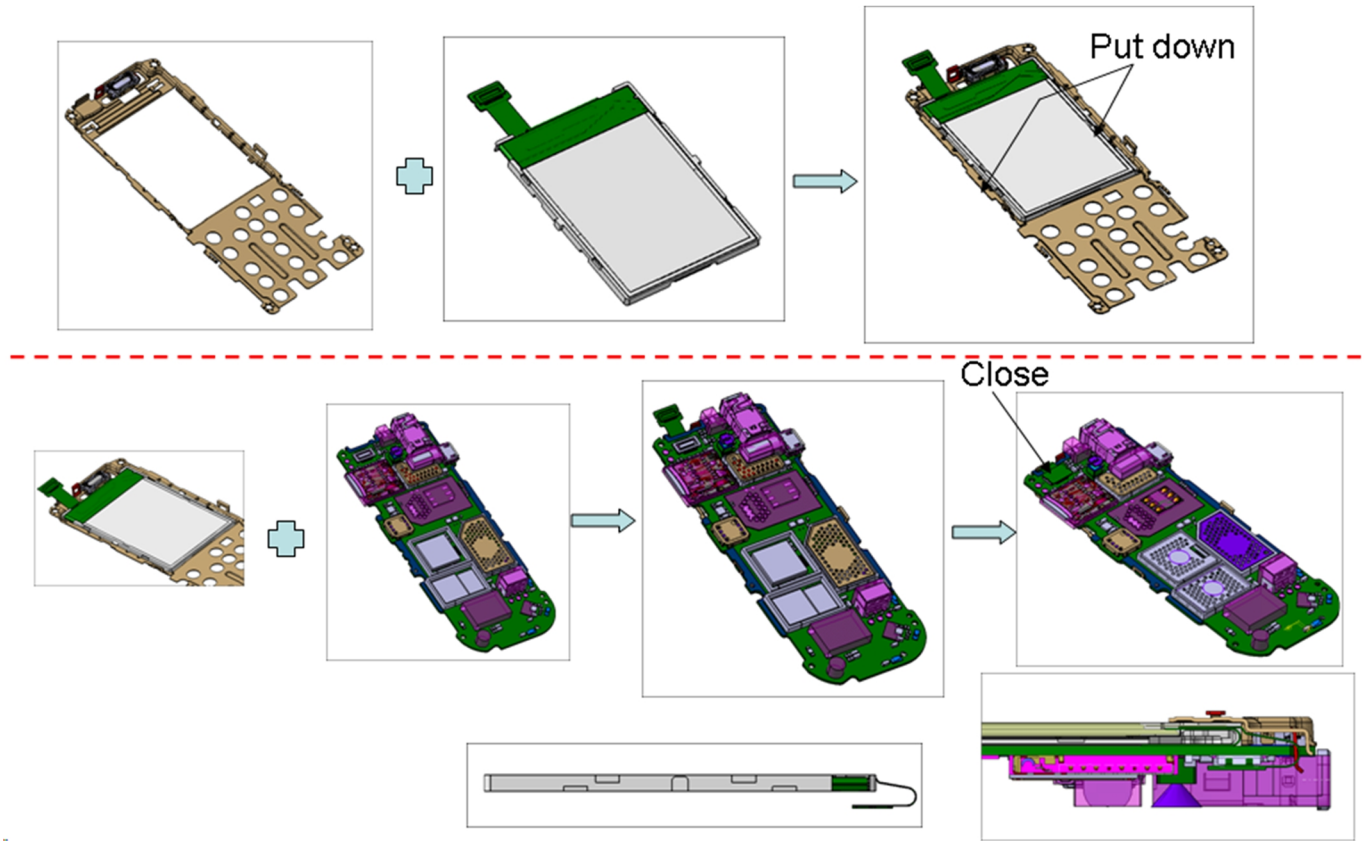
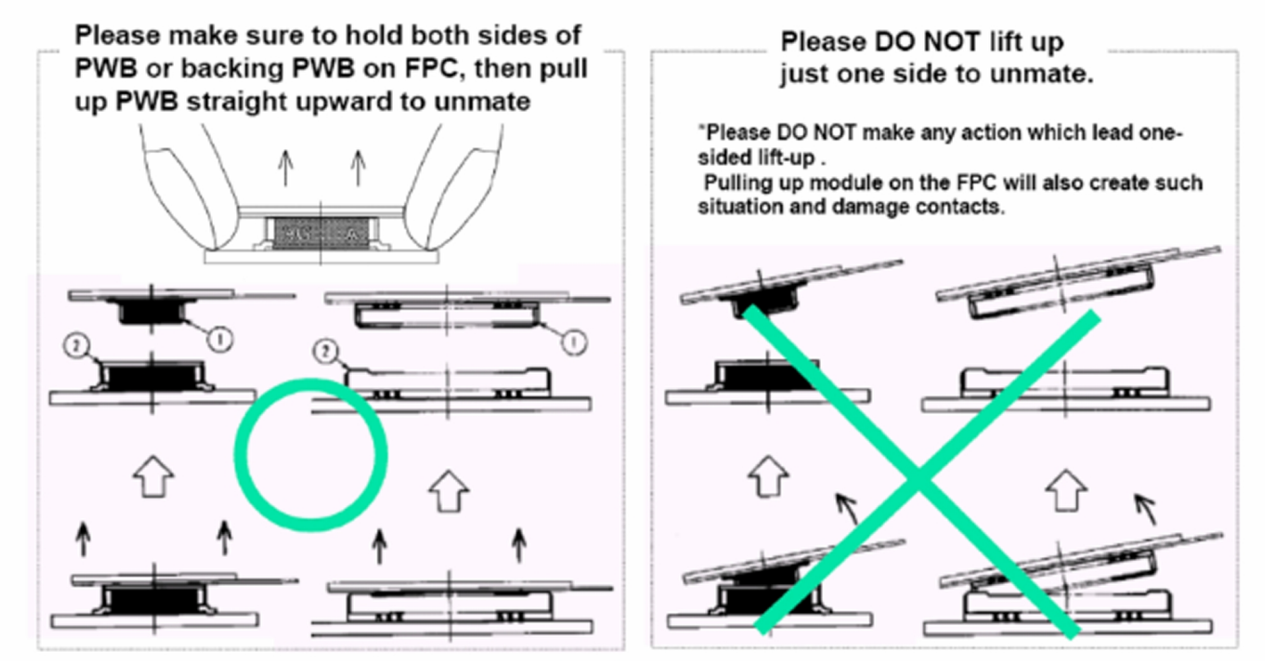
## Steps of LCD assembling

Press on connector first then no U-bend flex frontad.



## Mating/unmating method of B to B connector



# 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 |
| BA | Board Assembly |
| 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 |
| CDMA | 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 |
| FM | Frequency Modulation |
| 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 | Handsfree 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, mic | Microphone |
| MIDP | Mobile Information Device Profile |
| MIN | Mobile identification number |
| MIPS | Million instructions per second |
| MMC | Multimedia card |
| MMS | Multimedia messaging service |
| MP3 | Compressed audio file format developed by Moving Picture Experts Group |
| 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 |
| PCM | Pulse Code Modulation |
| 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 |
| RDS | Radio Data Service |
| 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 |
| VF | View Finder |
| 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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