

**Nokia Customer Care**

# ***Service Manual***

**RM-638 (Nokia 6303i classic; L3&4)**

## **Mobile Terminal**

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

***COMPANY CONFIDENTIAL***



**Amendment Record Sheet**

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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.
- During testing never activate the GSM transmitter without a proper antenna load, otherwise the GSM 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 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.

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## **Nokia 6303i classic; L3&4 Service Manual Structure**

- 1 General information
- 2 Service Tools and Service Concepts
- 3 BB Troubleshooting and Manual Tuning Guide
- 4 RF Troubleshooting
- 5 System Module and User Interface
- Glossary

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# **Nokia Customer Care**

## **1 — General information**

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## ■ Product selection

RM-638 is a GSM triband handportable phone, supporting EGSM 900/1800/1900 bands and GPRS/EGPRS data bearers.

For GPRS/EGPRS networks RM-638 is a Class B EGPRS MSC 32 (5 Rx + 3 Tx, max sum 6), which means a maximum downlink speed of 296 kbit/s and uplink speed of 177.6 kbit/s. RM-638 also supports Dual Transfer Mode (DTM) for simultaneous voice and packet data connection in GSM/EDGE networks; simple class A, multi slot class 11, (4 Rx + 3 Tx, max sum 5), downlink speed of 177.6 kbit/s and uplink speed of 118.4 kbit/s.

RM-638 is an MMS (Multimedia Messaging Service) enabled multimedia device. The MMS implementation follows the OMA MMS standard release 1.3. RM-638 also supports Bluetooth 2.1 standard with stereo audio profiles.

RM-638 has a large 2.2" QVGA (320 x 240 pixels) TFT main display with 16.7 million colors. The device also has a 3.2 Megapixel ED0F camera with a dual LED flash and a 4x smooth digital zoom.

RM-638 supports the 3<sup>rd</sup> generation S40 UI and S40 OSS web browser, which brings desktop-like Web browsing experience to mobile devices.

RM-638 also supports MIDP Java 2.1, providing a good platform for compelling 3rd party applications.



Figure 1 View of RM-638

## ■ Product features and sales package

### Bearers and transport

- GSM/EDGE Class B, Multi slot class 32
- GPRS/EGPRS Class B, Multi slot class 32
- GSM/EDGE Dual Transfer Mode (DTM) class A, multi slot class 11

- DARP (SAIC version 2)

## Connectivity

- Bluetooth 2.1 with stereo audio profiles
- USB2.0 Full Speed with micro USB interface
- MicroSD memory card - support up to 8 GB (hotswap)
- Micro USB connector
- 3.5 mm AV connector
- 2.0 mm DC charger plug

## Display

- Large 2.2" QVGA (320 x 240 pixels) TFT display with 16.7 million colors

## Imaging and video

- Integrated 3.2 Megapixel EDOF (Extended Depth of Field) camera with a dual LED flash, NIPS and a 4x smooth digital zoom
- Video recording in VGA, CIF, QCIF and subQCIF (15fps)
- Video player with 3GPP H.263 playback and streaming, recording and MPEG4 playback

## Music

- Music Player supporting MP3, MP4, AAC, AAC+, enhanced AAC+, H.263, H.264
- Ring tones: Video, WAV, MP3, AAC, eAAC+ and 64 polyphonic ringing tones
- FM stereo radio

## Productivity

### Context management

- OMA DRM version 2.0
- Organizer (Calendar + To-Do + Active Notes)
- PC Suite
- Active Standby
- Local/remote SyncML data sync
- Web Browser (OSS), Java™ MIDP 2.1, XHTML browsing over TCP/IP

### Messaging

- Email: Max. message size is 600 kB (sending & receiving)
- OMA MMS 1.3 (600 kB MMS size)
- Audio Messaging (AMS)
- Instant Messaging

### Voice

- Speech codec support for HR, FR, EFR and AMR

## Add-on software framework

- Nokia Series 40, 3rd edition
- Java: MIDP2.1



## Additional features

- Vibrating alert
- Reminder light
- Nokia Maps 1.2 support

## Sales package

- Transceiver RM-638
- Battery (BL-5CT/1050 mAh)
- Nokia charger: AC-8E, AC-15X  
(AC-8C and CA-101 for China; AC-8N for India)
- Nokia wired stereo headset (WH-102)
- 2 GB MicroSD card (MU-37)
- USB data cable (CA-101D)
- User Guide

## ■ Product and module list

| Module name | Type code | Notes |
|-------------|-----------|-------|
| Main PWB    | 3FJA      |       |
| Flash PWB   | 2AHA      |       |

## ■ Mobile enhancements

Table 1 Audio

| Enhancement                   | Type            |
|-------------------------------|-----------------|
| Audio Adapter (2.5 to 3.5 mm) | AD-52           |
| Wired headsets                | HS-16           |
|                               | HS-41           |
|                               | HS-44 (+ AD-45) |
|                               | HS-45 (+ AD-54) |
|                               | HS-48           |
|                               | WH-102          |
|                               | WH-201          |
|                               | WH-500          |
|                               | WH-600          |
|                               | WH-700          |
|                               | WH-800          |

| Enhancement       | Type   |
|-------------------|--------|
| Wireless headsets | BH-101 |
|                   | BH-102 |
|                   | BH-103 |
|                   | BH-104 |
|                   | BH-200 |
|                   | BH-201 |
|                   | BH-202 |
|                   | BH-208 |
|                   | BH-212 |
|                   | BH-213 |
|                   | BH-215 |
|                   | BH-216 |
|                   | BH-301 |
|                   | BH-501 |
|                   | BH-504 |
|                   | BH-505 |
|                   | BH-600 |
|                   | BH-602 |
|                   | BH-604 |
|                   | BH-606 |
|                   | BH-700 |
|                   | BH-703 |
|                   | BH-800 |
|                   | BH-803 |
|                   | BH-804 |
|                   | BH-900 |
|                   | BH-902 |
|                   | BH-903 |
|                   | BH-904 |

**Table 2 Car**

| Enhancement                    | Type   |
|--------------------------------|--------|
| Car installation kit           | CK-100 |
|                                | CK-300 |
|                                | CK-600 |
|                                | CK-7W  |
|                                | CK-15W |
| Nokia 500 Auto Navigation      | PD-14  |
| Universal holder               | CR-39  |
|                                | CR-82  |
|                                | CR-99  |
|                                | CR-112 |
|                                | HH-12  |
|                                | HH-17  |
| Wireless plug-in car handsfree | HF-33W |
|                                | HF-200 |
|                                | HF-300 |
|                                | HF-310 |
|                                | HF-510 |

**Table 3 Data**

| Enhancement          | Type  |
|----------------------|-------|
| MicroSD card, 256 MB | MU-27 |
| MicroSD card, 512 MB | MU-28 |
| MicroSD card, 1 GB   | MU-22 |
| MicroSD card, 2 GB   | MU-37 |
| MicroSD card, 4 GB   | MU-41 |
| MicroSD card, 8 GB   | MU-43 |
| Wireless GPS Module  | LD-4W |

**Table 4 Music**

| Enhancement          | Type |
|----------------------|------|
| Wired music speakers | MD-4 |
|                      | MD-6 |
|                      | MD-8 |

| Enhancement             | Type  |
|-------------------------|-------|
| Wireless music speakers | MD-5W |
|                         | MD-7W |

Table 5 Power

| Enhancement                                                                                                                                                                       | Type            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| <b>This phone is charged through the smaller charger Nokia standard interface (2.0 mm plug). The standard 3.5 mm charger can be used together with the CA-44 charger adapter.</b> |                 |
| Battery 1050 mAh Li-Ion                                                                                                                                                           | BL-5CT          |
| First aid charger                                                                                                                                                                 | DC-8            |
| Mobile charger                                                                                                                                                                    | DC-4            |
|                                                                                                                                                                                   | DC-9            |
|                                                                                                                                                                                   | DC-11           |
| Travel charger                                                                                                                                                                    | AC-4            |
|                                                                                                                                                                                   | AC-5            |
|                                                                                                                                                                                   | AC-8            |
|                                                                                                                                                                                   | AC-15X          |
| USB charger                                                                                                                                                                       | AC-6C           |
| USB Charger Adapter Cable                                                                                                                                                         | CA-100          |
|                                                                                                                                                                                   | CA-100C         |
|                                                                                                                                                                                   | CA-101, CA-101D |
|                                                                                                                                                                                   | CA-126          |
| Charger adapter                                                                                                                                                                   | CA-44           |

## ■ Technical specifications

### General specifications

| Unit                                                 | Dimension (mm)      | Weight (g) | Volume (cc) |
|------------------------------------------------------|---------------------|------------|-------------|
| Transceiver with BL-5CT 1050 mAh Li-Ion battery pack | 108.8 x 46.2 x 11.7 | 96         | 57          |

### Battery endurance

| Battery                | Talk time | Stand-by time |
|------------------------|-----------|---------------|
| BL-5CT 1050 mAh Li-ion | Up to 8 h | Up to 450 h   |

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

## Main RF characteristics for GSM900/1800/1900 (triband) and EDGE phones

Table 6 Main RF characteristics

| Parameter                      | Unit                                    |
|--------------------------------|-----------------------------------------|
| Cellular system                | EGSM900, GSM1800/1900 and EDGE          |
| Rx frequency band              | EGSM900: 925 - 960 MHz                  |
|                                | GSM1800: 1805 - 1880 MHz                |
|                                | GSM1900: 1930 - 1990 MHz                |
| Tx frequency band              | EGSM900: 880 - 915 MHz                  |
|                                | GSM1800: 1710 - 1785 MHz                |
|                                | GSM1900: 1850 - 1910 MHz                |
| Output power                   | GSM900: +5 ... +33dBm/3.2mW ... 2W      |
|                                | GSM1800: +0 ... +30dBm/1.0mW ... 1W     |
|                                | GSM1900: +0 ... +30dBm/1.0mW ... 1W     |
| EDGE output power              | EDGE900: +5 ... +29dBm/3.2mW ... 794mW  |
|                                | EDGE1800: +0 ... +26dBm/1.0mW ... 400mW |
|                                | EDGE1900: +0 ... +26dBm/1.0mW ... 400mW |
| Number of RF channels          | GSM900: 194                             |
|                                | GSM1800: 374                            |
|                                | GSM1900: 299                            |
| Channel spacing                | 200 kHz                                 |
| Number of Tx power levels      | GSM900: 15                              |
|                                | GSM1800: 16                             |
|                                | GSM1900: 16                             |
| Number of EDGE Tx power levels | GSM900 EDGE: 12                         |
|                                | GSM1800 EDGE: 14                        |
|                                | GSM1900 EDGE: 14                        |

## Environmental conditions

### Temperature conditions

| Environmental condition | Ambient temperature            | Notes                               |
|-------------------------|--------------------------------|-------------------------------------|
| Normal operation        | -15°C...+55°C                  | Specifications fulfilled            |
| Reduced performance     | -25°C...-15°C<br>+55°C...+70°C | Operational for shorts periods only |

| Environmental condition      | Ambient temperature             | Notes                                                                         |
|------------------------------|---------------------------------|-------------------------------------------------------------------------------|
| Intermittent operation       | -40°C...-15°C<br>+70°C...+85 °C | Operation not guaranteed but an attempt to operate does not damage the phone. |
| No operation or storage      | <-40°C...>+85°C                 | No storage or operation: an attempt may damage the phone.                     |
| Charging allowed             | -25°C...+50°C                   |                                                                               |
| Long term storage conditions | 0°C...+85°C                     |                                                                               |

## Humidity

Relative humidity range is 5...95%.

The HW module is not protected against water. Condensed or splashed water might cause malfunction. Any submerge of the phone will cause permanent damage. Long-term high humidity, with condensation, will cause permanent damage because of corrosion.

## Vibration

The module should withstand the following vibrations:

- 5 - 10 Hz; +10dB / octave
- 10 - 50 Hz; 5.58 m<sup>2</sup> / s<sup>3</sup> (0.0558 g<sup>2</sup>/ Hz)
- 50 - 300 Hz; - 10 dB / octave

## ESD strength

Conducted discharge is 8 kV (>10 discharges) and air contact 15 kV ( >10 discharges ).

The standard for electrostatic discharge is IEC 61000-4-2, and this device fulfils level 4 requirements.

## RoHS

This device uses RoHS compliant components and lead-free soldering process.

## **2 — Service Tools and Service Concepts**

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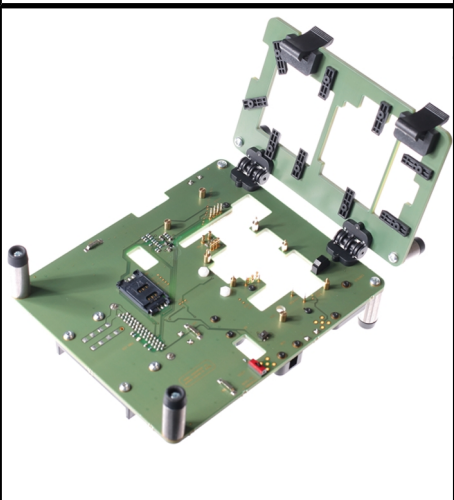
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## ■ Service tools

### Product specific tools

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-638. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

|                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |               |  |
|------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--|
|   | FS-121                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Flash adapter |  |
|                                                                                    | <ul style="list-style-type: none"> <li>• FS-121 is equipped with a clip interlock system</li> <li>• Provides standardised interface towards Control Unit</li> <li>• Provides RF connection using coupler</li> <li>• Multiplexing between USB and FBUS media, controlled by VUSB</li> </ul>                                                                                                                                                                                                                                                                                |               |  |
|  | MJ-240                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Module jig    |  |
|                                                                                    | <p>MJ-240 is meant for component level troubleshooting. The jig includes an RF interface for GSM and Bluetooth. In addition, it has the following features:</p> <ul style="list-style-type: none"> <li>• Provides mechanical interface with the engine module</li> <li>• Provides galvanic connection to all needed test pads in module</li> <li>• Multiplexing between USB and FBUS media, controlled by Vusb</li> <li>• MMC interface</li> <li>• Duplicated SIM connector</li> <li>• Connector for control unit</li> <li>• Access for AV- and USB connectors</li> </ul> |               |  |

### General tools

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-638. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

|                                                                                     |                                                                                                                                                                            |              |  |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--|
|  | AC-35                                                                                                                                                                      | Power supply |  |
|                                                                                     | <p>Universal power supply for FPS-21; included in the FPS-21 sales package.</p> <p>Input 100V...230V 50Hz...60Hz, output voltage of 12 V and output current up to 3 A.</p> |              |  |

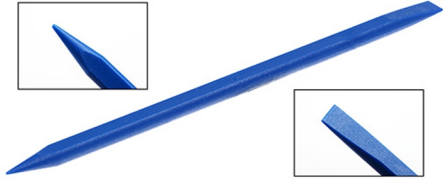
|                                                                                               |       |                        |  |
|-----------------------------------------------------------------------------------------------|-------|------------------------|--|
|  <p>ACF-8</p> | ACF-8 | Universal power supply |  |
| <p>The ACF-8 universal power supply is used to power FLS-5.</p>                               |       |                        |  |

|                                                                                                      |             |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|------------------------------------------------------------------------------------------------------|-------------|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>CU-4</b></p>  | <p>CU-4</p> | <p>Control unit</p> | <p>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.</p> <p>The unit has the following features:</p> <ul style="list-style-type: none"> <li>• software controlled via USB</li> <li>• EM calibration function</li> <li>• Forwards FBUS/Flashbus traffic to/from terminal</li> <li>• Forwards USB traffic to/from terminal</li> <li>• software controlled BSI values</li> <li>• regulated VBATT voltage</li> <li>• 2 x USB2.0 connector (Hub)</li> <li>• FBUS and USB connections supported</li> </ul> <p>When using CU-4, note the special order of connecting cables and other service equipment:</p> <p><b>Instructions</b></p> <ol style="list-style-type: none"> <li>1 Connect a service tool (jig, flash adapter) to CU-4.</li> <li>2 Connect CU-4 to your PC with a USB cable.</li> <li>3 Connect supply voltage (12 V)</li> <li>4 Connect an FBUS cable (if necessary).</li> <li>5 Start Phoenix service software.</li> </ol>  <p><b>Note:</b> Phoenix enables CU-4 regulators via USB when it is started.</p> <p>Reconnecting the power supply requires a Phoenix restart.</p> |
|------------------------------------------------------------------------------------------------------|-------------|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |              |  |
|-------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--|
|                       | FLS-5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Flash device |  |
| <p><b>FPS-21</b></p>  | FPS-21                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |              |  |
|                                                                                                       | Flash prommer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |              |  |
|                                                                                                       | <p><b>FPS-21 sales package:</b></p> <ul style="list-style-type: none"> <li>• FPS-21 prommer</li> <li>• AC-35 power supply</li> <li>• CA-31D USB cable</li> </ul> <p><b>FPS-21 interfaces:</b></p> <p><i>Front</i></p> <ul style="list-style-type: none"> <li>• Service cable connector<br/>Provides Flashbus, USB and VBAT connections to a mobile device.</li> <li>• SmartCard socket<br/>A SmartCard is needed to allow DCT-4 generation mobile device programming.</li> </ul> <p><i>Rear</i></p> <ul style="list-style-type: none"> <li>• DC power input<br/>For connecting the external power supply (AC-35).</li> <li>• Two USB A type ports (USB1/USB3)<br/>Can be used, for example, for connecting external storage memory devices or mobile devices</li> <li>• One USB B type device connector (USB2)<br/>For connecting a PC.</li> <li>• Phone connector<br/>Service cable connection for connecting Flashbus/FLA.</li> <li>• Ethernet RJ45 type socket (LAN)<br/>For connecting the FPS-21 to LAN.</li> </ul> <p><i>Inside</i></p> <ul style="list-style-type: none"> <li>• Four SD card memory slots<br/>For internal storage memory.</li> </ul> <p><b>Note:</b> 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.</p> |              |  |

|                                                                                                                                                                                                                                                                                                                                                                                                                                   |        |                                                  |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------------------------------------------------|--|
|                                                                                                                                                                                                                                                                                                                                                  | PK-1   | Software protection key                          |  |
|                                                                                                                                                                                                                                                                                                                                                  | RJ-230 | Soldering jig                                    |  |
|                                                                                                                                                                                                                                                                                                                                                 | SB-6   | Bluetooth test and interface box (sales package) |  |
|                                                                                                                                                                                                                                                                                                                                                | SRT-6  | Opening tool                                     |  |
|                                                                                                                                                                                                                                                                                                                                                | SS-46  | Interface adapter                                |  |
| <p>PK-1 is a hardware protection key with a USB interface. It has the same functionality as the PKD-1 series dongle.<br/>PK-1 is meant for use with a PC that does not have a series interface.<br/>To use this USB dongle for security service functions please register the dongle in the same way as the PKD-1 series dongle.</p>                                                                                              |        |                                                  |  |
| <p>RJ-230 is a soldering jig used for soldering and as a rework jig for the engine module.</p>                                                                                                                                                                                                                                                                                                                                    |        |                                                  |  |
| <p>The SB-6 test box is a generic service device used to perform Bluetooth bit error rate (BER) testing, and establishing cordless FBUS connection via Bluetooth. An ACP-8x charger is needed for BER testing and an AXS-4 cable in case of cordless interface usage testing .<br/>Sales package includes:</p> <ul style="list-style-type: none"> <li>• SB-6 test box</li> <li>• Installation and warranty information</li> </ul> |        |                                                  |  |
| <p>SRT-6 is used to open phone covers.<br/><b>Note:</b> The SRT-6 is included in the Nokia Standard Toolkit.</p>                                                                                                                                                                                                                                                                                                                  |        |                                                  |  |
| <p>SS-46 acts as an interface adapter between the flash adapter and FPS-21.</p>                                                                                                                                                                                                                                                                                                                                                   |        |                                                  |  |



|                                                                                    |                                                                                                                                                                                                                                                                                                                                                            |                                    |  |
|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|--|
|    | SS-62                                                                                                                                                                                                                                                                                                                                                      | Generic flash adapter base for BB5 |  |
|                                                                                    | <ul style="list-style-type: none"> <li>generic base for flash adapters and couplers</li> <li>SS-62 equipped with a clip interlock system</li> <li>provides standardised interface towards Control Unit</li> <li>provides RF connection using galvanic connector or coupler</li> <li>multiplexing between USB and FBUS media, controlled by VUSB</li> </ul> |                                    |  |
|   | SS-88                                                                                                                                                                                                                                                                                                                                                      | Camera removal tool                |  |
|                                                                                    | The camera removal tool SS-88 is used to remove/attach the camera module from/to the socket.                                                                                                                                                                                                                                                               |                                    |  |
|   | SS-93                                                                                                                                                                                                                                                                                                                                                      | Opening tool                       |  |
|                                                                                    | SS-93 is used for opening JAE connectors.<br><b>Note:</b> The SS-93 is included in Nokia Standard Toolkit.                                                                                                                                                                                                                                                 |                                    |  |
|  | 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-638. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

|                                                                                                               |                                                                                                  |                 |  |
|---------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-----------------|--|
| <br><b>CA-101</b><br>100cm | CA-101                                                                                           | Micro USB cable |  |
|                                                                                                               | The CA-101 is a USB-to-microUSB data cable that allows connections between the PC and the phone. |                 |  |



| <br><b>CA-128RS</b>           | CA-128RS                                                                                                                                                                                                                                                                                           | RF tuning cable |  |      |                |            |         |         |         |         |         |             |
|----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|--|------|----------------|------------|---------|---------|---------|---------|---------|-------------|
|                                                                                                                | Product-specific adapter cable for RF tuning.                                                                                                                                                                                                                                                      |                 |  |      |                |            |         |         |         |         |         |             |
|                                                                                                                | <div><div></div><div>Table 7 Attenuation values</div><table><tr><th>Band</th><th>Attenuation Rx</th></tr><tr><td>GSM850/900</td><td>0.30 dB</td></tr><tr><td>GSM1800</td><td>0.40 dB</td></tr><tr><td>GSM1900</td><td>0.45 dB</td></tr><tr><td>WLAN 2.4GHz</td><td>0.40 dB</td></tr></table></div> |                 |  | Band | Attenuation Rx | GSM850/900 | 0.30 dB | GSM1800 | 0.40 dB | GSM1900 | 0.45 dB | WLAN 2.4GHz |
| Band                                                                                                           | Attenuation Rx                                                                                                                                                                                                                                                                                     |                 |  |      |                |            |         |         |         |         |         |             |
| GSM850/900                                                                                                     | 0.30 dB                                                                                                                                                                                                                                                                                            |                 |  |      |                |            |         |         |         |         |         |             |
| GSM1800                                                                                                        | 0.40 dB                                                                                                                                                                                                                                                                                            |                 |  |      |                |            |         |         |         |         |         |             |
| GSM1900                                                                                                        | 0.45 dB                                                                                                                                                                                                                                                                                            |                 |  |      |                |            |         |         |         |         |         |             |
| WLAN 2.4GHz                                                                                                    | 0.40 dB                                                                                                                                                                                                                                                                                            |                 |  |      |                |            |         |         |         |         |         |             |
|                              | CA-31D                                                                                                                                                                                                                                                                                             | USB cable       |  |      |                |            |         |         |         |         |         |             |
|                                                                                                                | The CA-31D USB cable is used to connect FPS-21 to a PC. It is included in the FPS-21 sales package.                                                                                                                                                                                                |                 |  |      |                |            |         |         |         |         |         |             |
| <br><b>CA-89DS</b><br>100cm | CA-89DS                                                                                                                                                                                                                                                                                            | Cable           |  |      |                |            |         |         |         |         |         |             |
|                                                                                                                | Provides VBAT and Flashbus connections to mobile device programming adapters.                                                                                                                                                                                                                      |                 |  |      |                |            |         |         |         |         |         |             |

|                                                                                    |        |             |  |
|------------------------------------------------------------------------------------|--------|-------------|--|
|    | DAU-9S | MBUS cable  |  |
|   | PCS-1  | Power cable |  |
|  | XRS-6  | RF 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.

**Note:** Docking station adapters valid for DCT4 products.

The PCS-1 power cable (DC) is used with a docking station, a module jig or a control unit to supply a controlled voltage.

The RF cable is used to connect, for example, a module repair jig to the RF measurement equipment.

SMA to N-Connector approximately 610 mm.

Attenuation for:

- GSM850/900: 0.3+-0.1 dB
- GSM1800/1900: 0.5+-0.1 dB
- WLAN: 0.6+-0.1dB

## ■ Service concepts

### POS (Point of Sale) flash concept

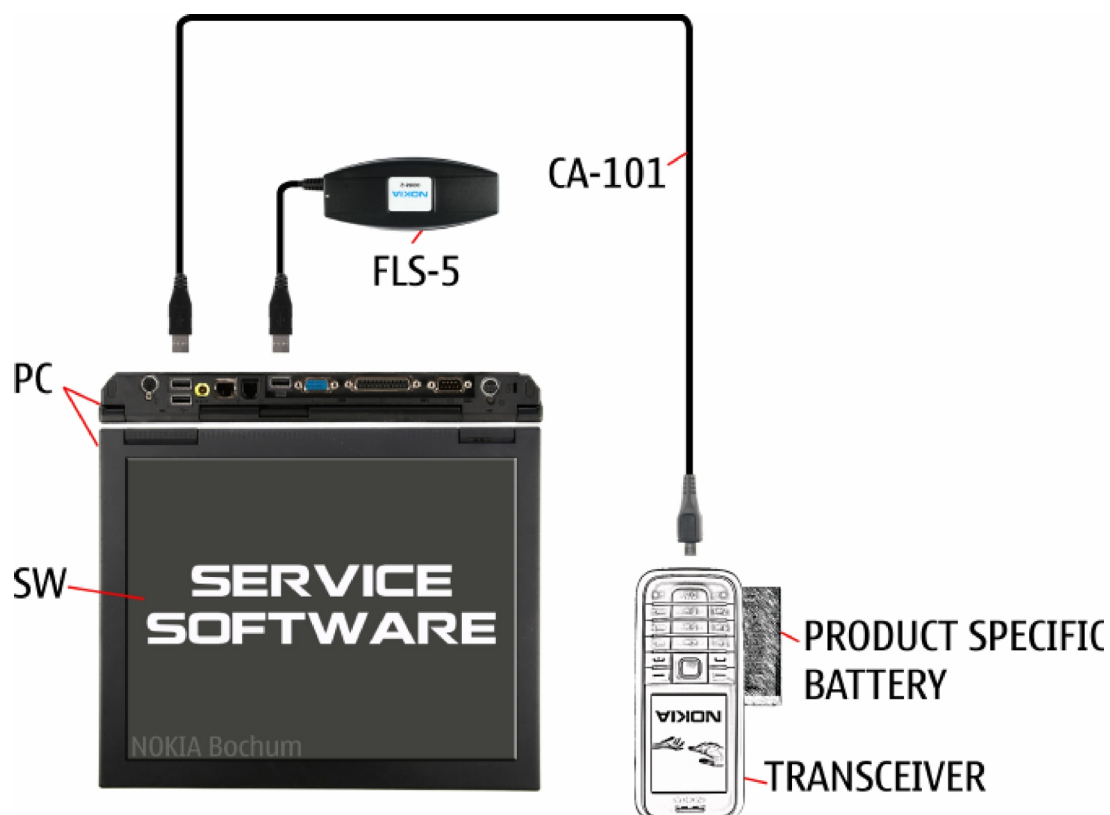


Figure 2 POS flash concept

| Type                          | Description                      |
|-------------------------------|----------------------------------|
| <b>Product specific tools</b> |                                  |
| BL-5CT                        | Battery                          |
| <b>Other tools</b>            |                                  |
| FLS-5                         | POS flash dongle                 |
|                               | PC with Phoenix service software |
| <b>Cables</b>                 |                                  |
| CA-101                        | Micro USB cable                  |

## Flash concept with FPS-21

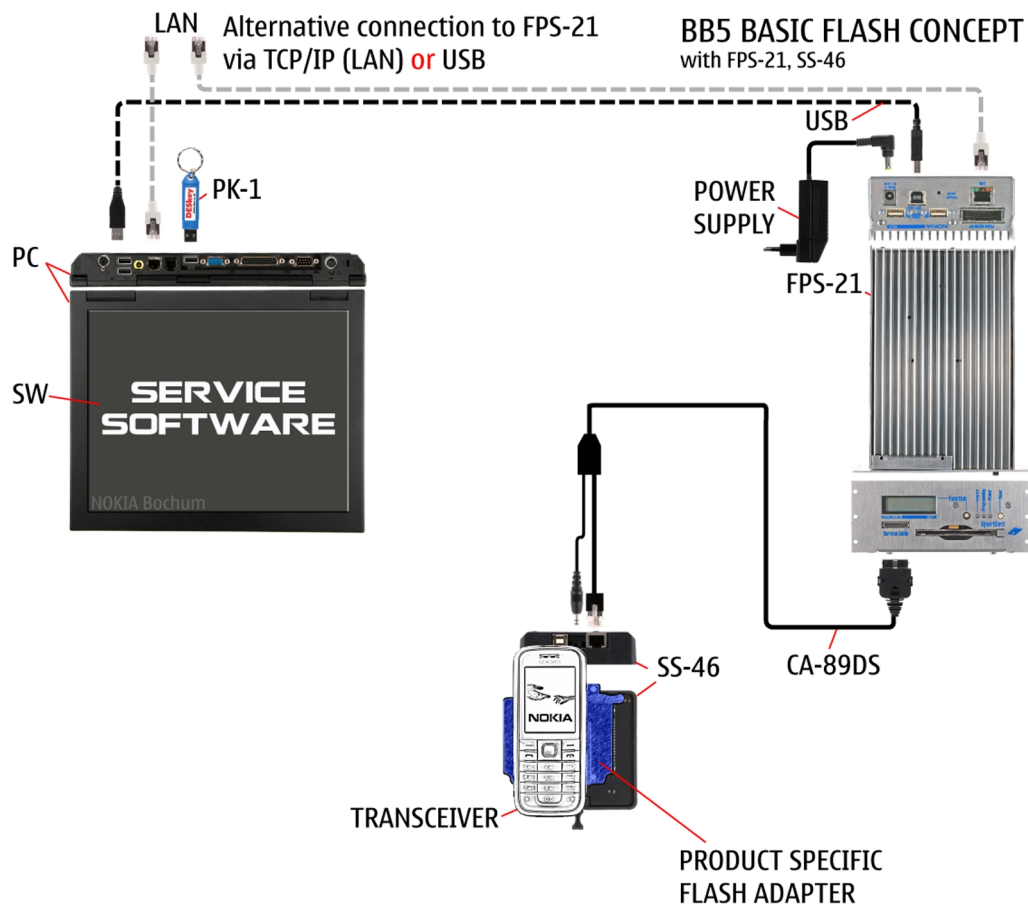


Figure 3 Basic flash concept with FPS-21

| Type                            | Description                      |
|---------------------------------|----------------------------------|
| <b>Product specific devices</b> |                                  |
| FS-121                          | Flash adapter                    |
| <b>Other devices</b>            |                                  |
| FPS-21                          | Flash prommer box                |
| AC-35                           | Power supply                     |
| PK-1                            | SW security device               |
| SS-46                           | Interface adapter                |
|                                 | PC with Phoenix service software |
| <b>Cables</b>                   |                                  |
| CA-89DS                         | Service cable                    |
|                                 | USB cable                        |

## CU-4 flash concept with FPS-21

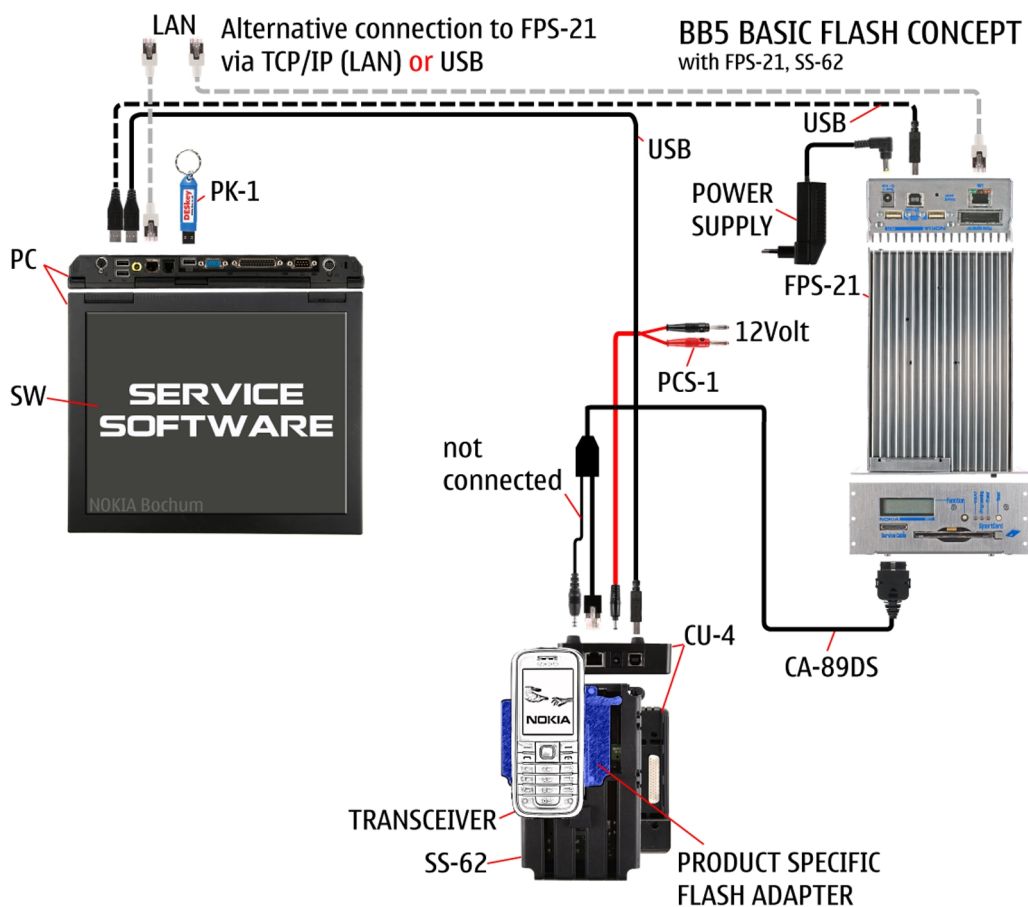


Figure 4 CU-4 flash concept with FPS-21

| Type                            | Description                                                 |
|---------------------------------|-------------------------------------------------------------|
| <b>Product specific devices</b> |                                                             |
| FS-121                          | Flash adapter                                               |
| <b>Other devices</b>            |                                                             |
| CU-4                            | Control unit                                                |
| FPS-21                          | Flash prommer box                                           |
| AC-35                           | Power supply                                                |
| PK-1                            | SW security device                                          |
| SS-62                           | Flash adapter base                                          |
| SX-4                            | Smart card (for DCT-4 generation mobile device programming) |
|                                 | PC with Phoenix service software                            |
| <b>Cables</b>                   |                                                             |
| PCS-1                           | Power cable                                                 |
| CA-89DS                         | Service cable                                               |
|                                 | Standard USB cable                                          |

| Type | Description |
|------|-------------|
|      | USB cable   |

## Module jig service concept

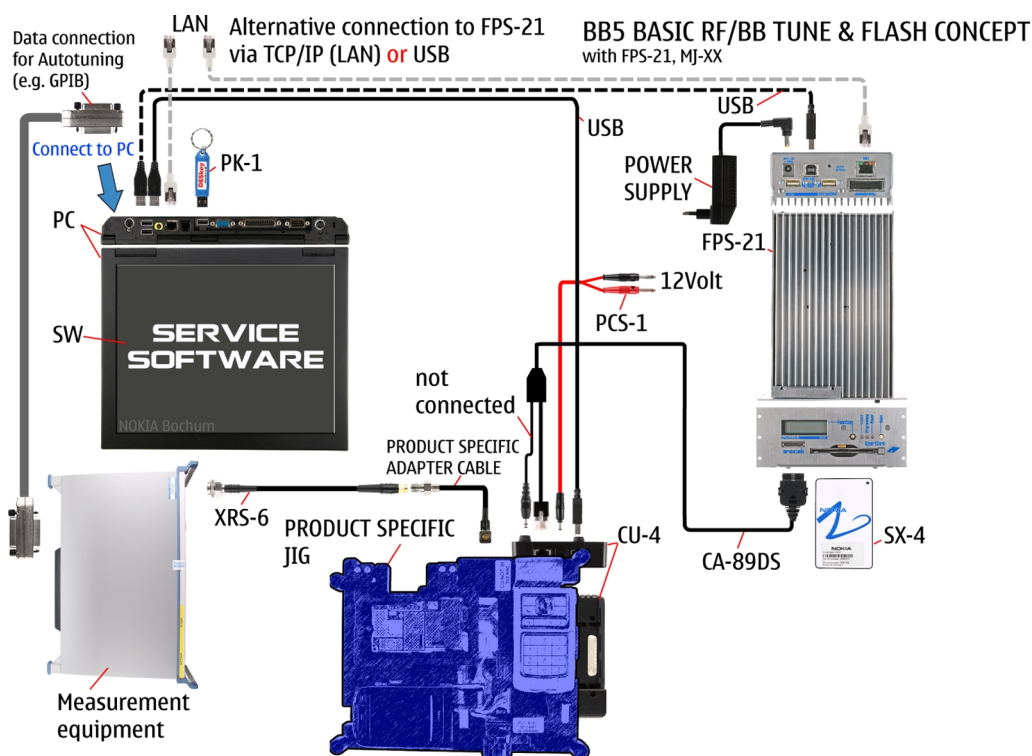


Figure 5 Module jig service concept

| Type                          | Description                               |
|-------------------------------|-------------------------------------------|
| <b>Phone specific devices</b> |                                           |
| MJ-240                        | Module jig                                |
| <b>Other devices</b>          |                                           |
| CU-4                          | Control unit                              |
| FPS-21                        | Flash prommer box                         |
| PK-1                          | SW security device                        |
| SX-4                          | Smart card                                |
|                               | PC with VPOS and Phoenix service software |
|                               | Measurement equipment                     |
| <b>Cables</b>                 |                                           |
| CA-89DS                       | Service cable                             |
| PCS-1                         | DC power cable                            |
| XRS-6                         | RF cable                                  |
|                               | USB cable                                 |

| Type | Description        |
|------|--------------------|
|      | GPIB control cable |

### Service concept for RF testing and RF/BB tuning

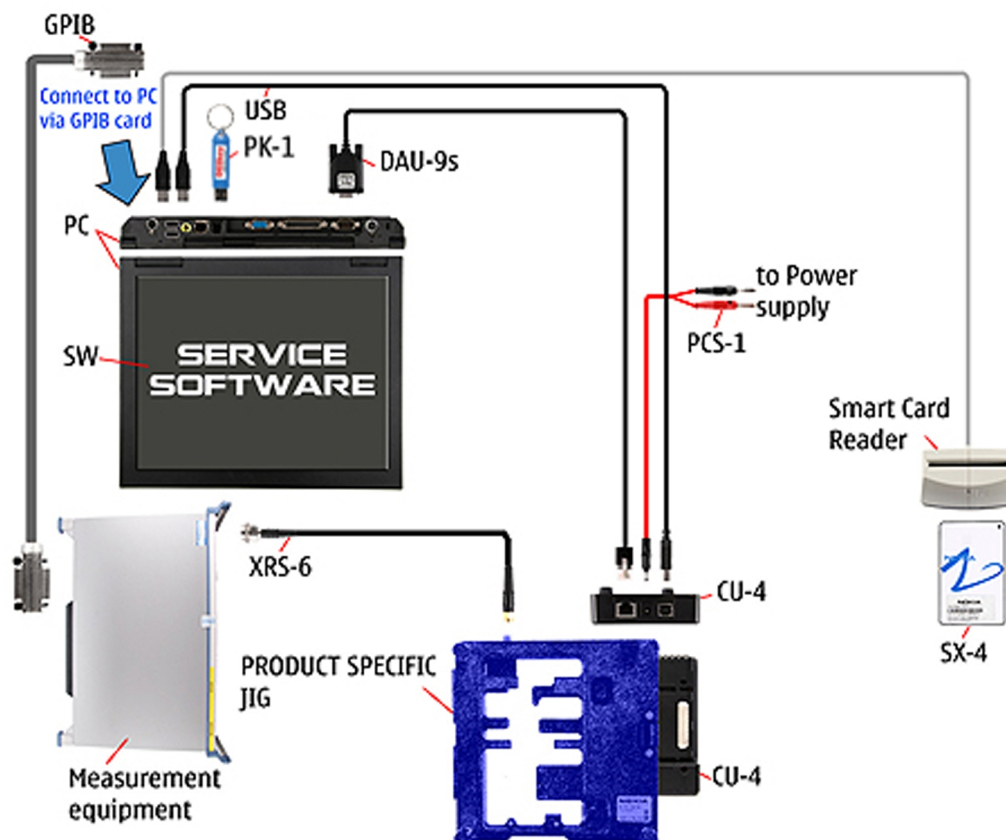


Figure 6 Service concept for RF testing and RF/BB tuning

| Type                            | Description                      |
|---------------------------------|----------------------------------|
| <b>Product specific devices</b> |                                  |
| MJ-240                          | Module jig                       |
| <b>Other devices</b>            |                                  |
| CU-4                            | Control unit                     |
| PK-1                            | SW security device               |
| SX-4                            | Smart card                       |
|                                 | Measurement equipment            |
|                                 | Smart card reader                |
|                                 | PC with Phoenix service software |
| <b>Cables</b>                   |                                  |
| DAU-9S                          | MBUS cable                       |
| PCS-1                           | DC power cable                   |



| Type  | Description        |
|-------|--------------------|
| XRS-6 | RF cable           |
|       | GPIO control cable |
|       | USB cable          |

### Bluetooth testing concept with SB-6

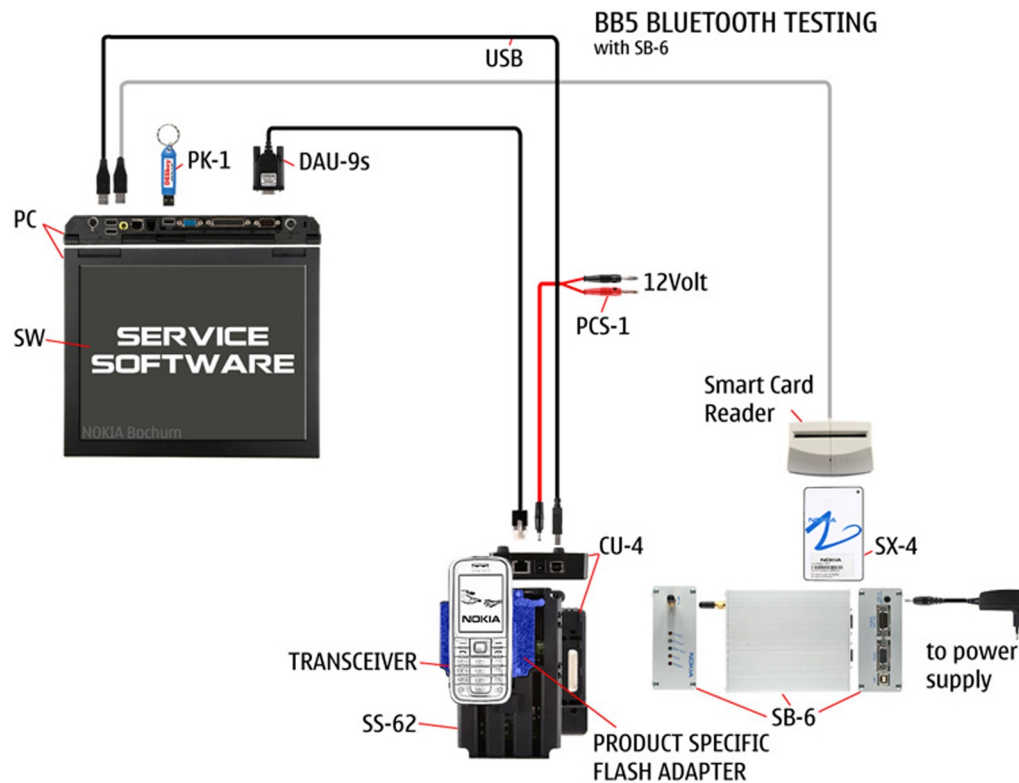


Figure 7 Service concept for RF testing and RF/BB tuning

| Type                            | Description                      |
|---------------------------------|----------------------------------|
| <b>Product specific devices</b> |                                  |
| FS-121                          | Flash adapter                    |
| <b>Other devices</b>            |                                  |
| CU-4                            | Control unit                     |
| SS-62                           | Flash adapter base               |
| PK-1                            | SW security device               |
| SX-4                            | Smart card                       |
| SB-6                            | Bluetooth test and interface box |
|                                 | Smart card reader                |
|                                 | PC with Phoenix service software |
| <b>Cables</b>                   |                                  |
| DAU-9S                          | MBUS cable                       |



| Type  | Description    |
|-------|----------------|
| PCS-1 | DC power cable |
|       | USB cable      |

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## **3 — BB Troubleshooting and Manual Tuning Guide**

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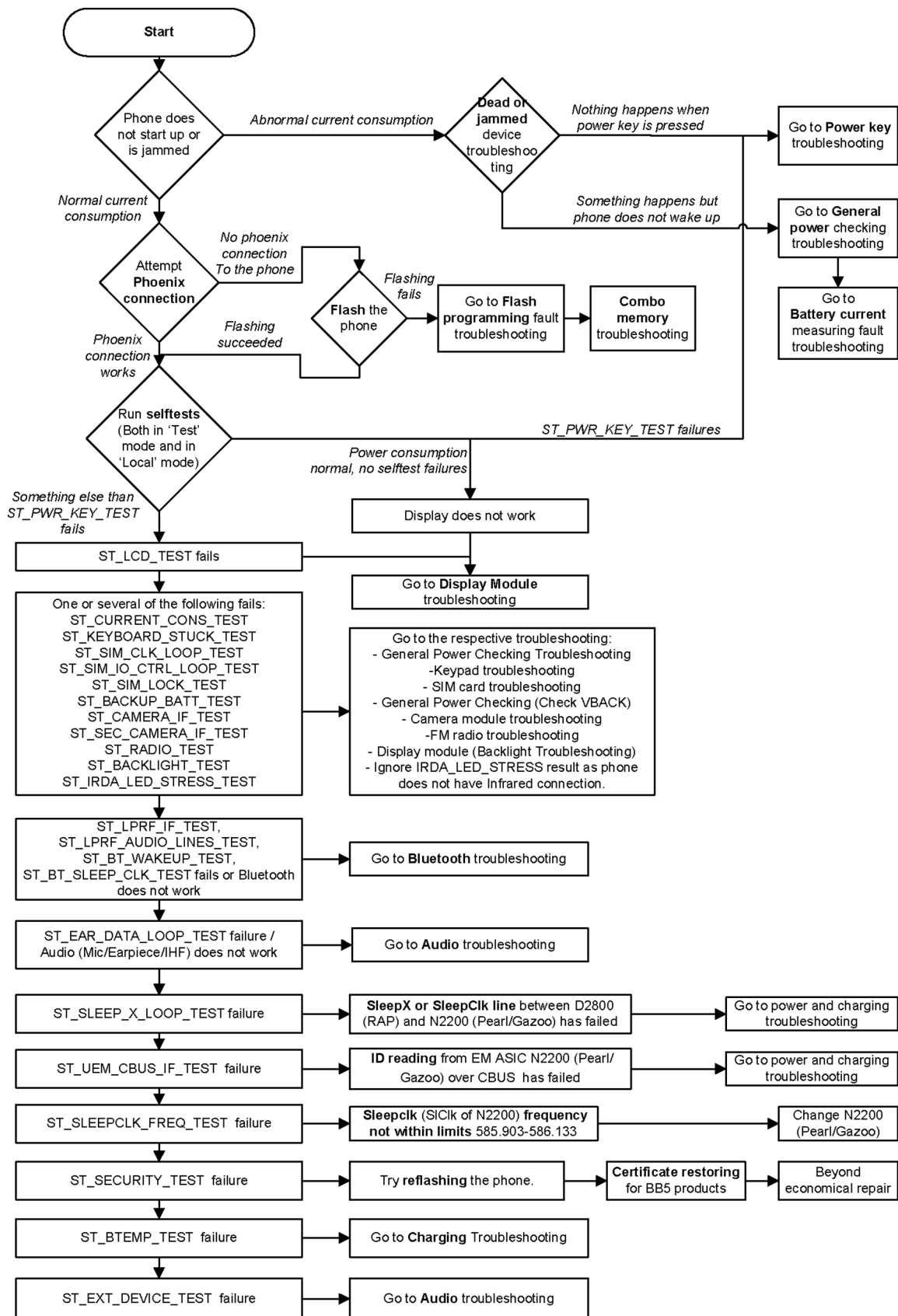
## ■ Baseband self tests in Phoenix

### 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

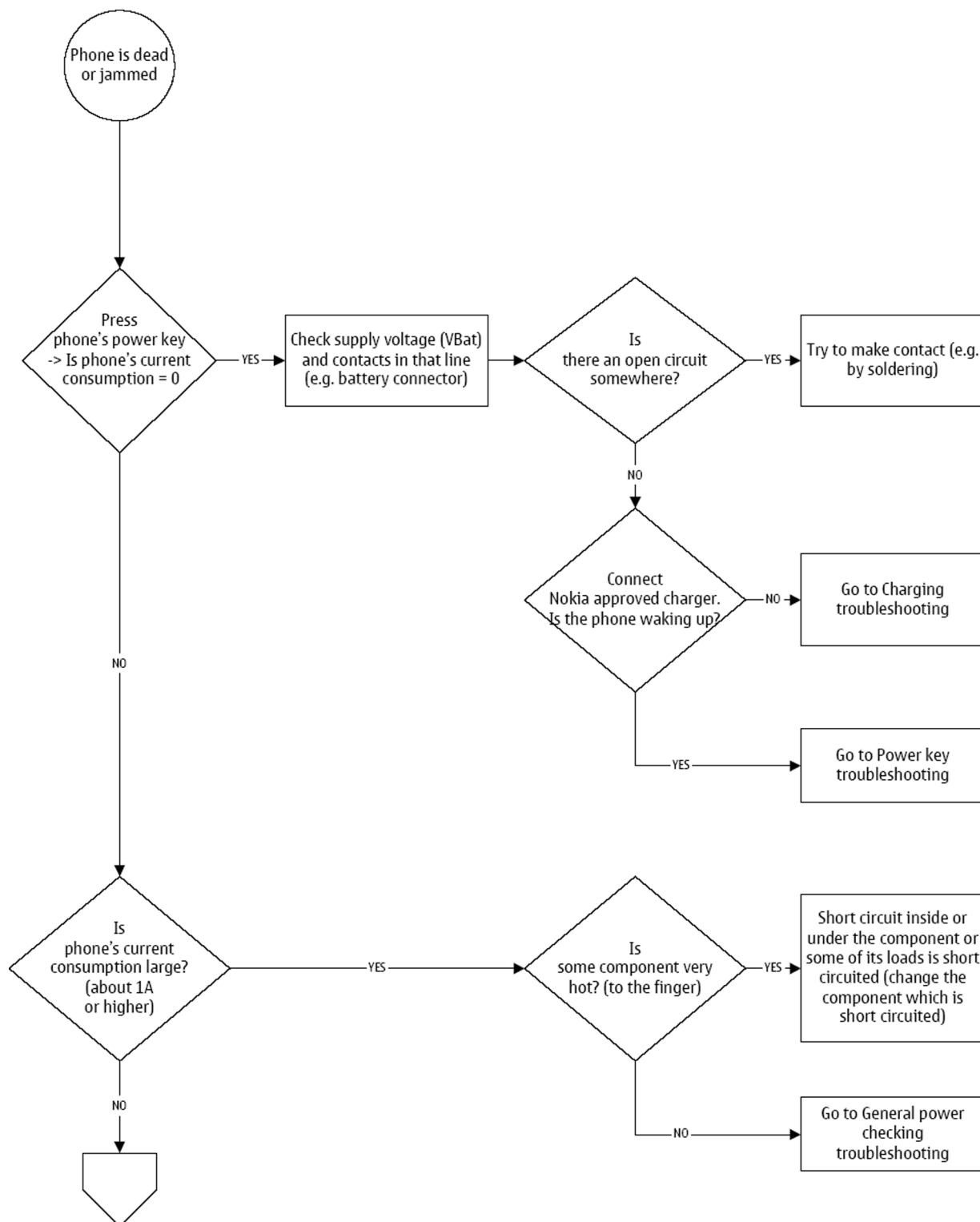




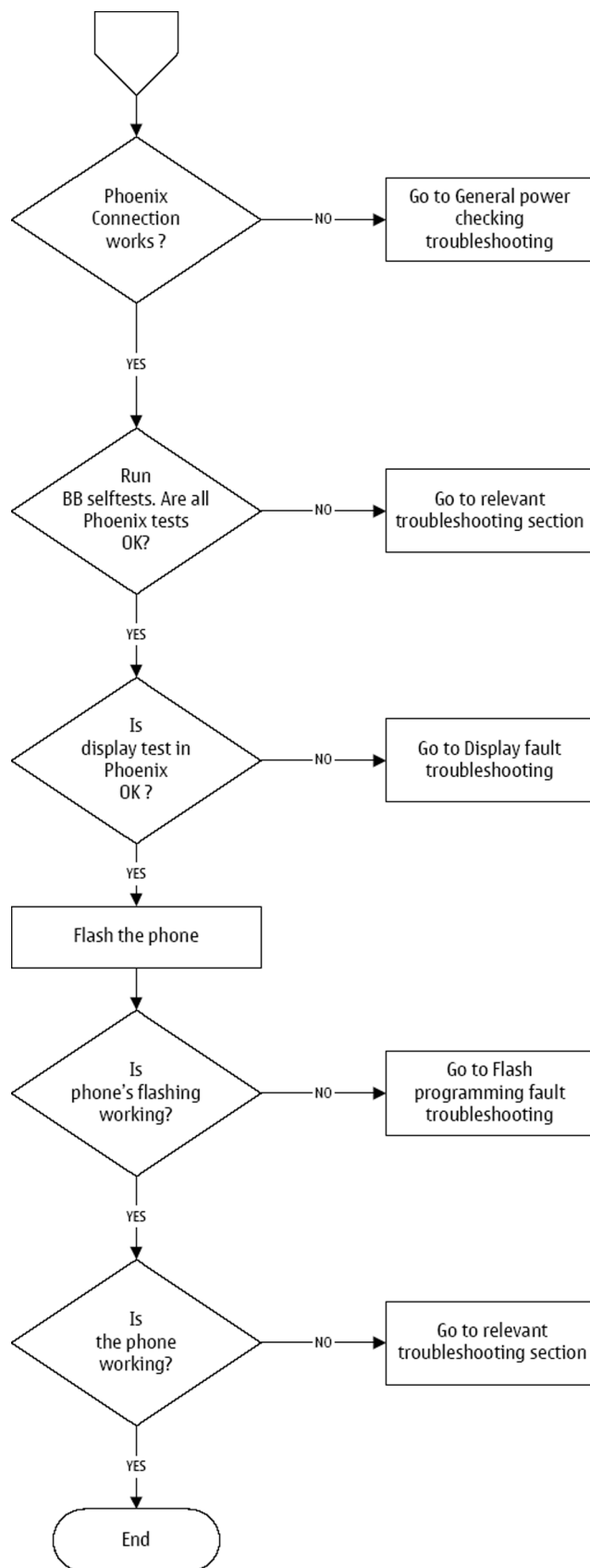
## ■ Power and charging troubleshooting

### Dead or jammed device troubleshooting

#### Troubleshooting flow



## Troubleshooting flow



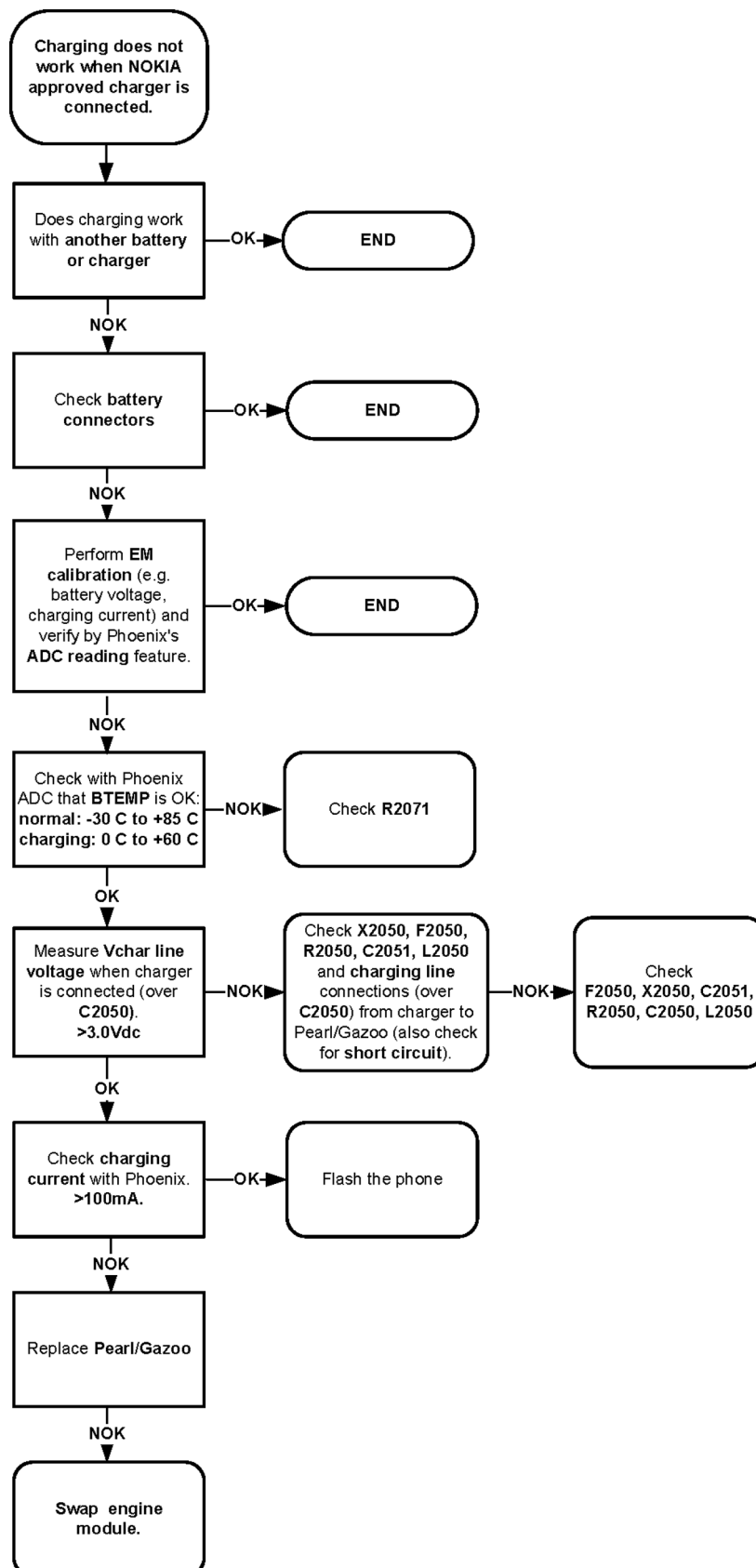
## General power checking

Check the following voltages:

| Signal name | Regulator   | Sleep | Idle | Nominal voltage              | Main user                 | Notes               |
|-------------|-------------|-------|------|------------------------------|---------------------------|---------------------|
| VANA        | Pearl/Gazoo |       |      | 2.5                          |                           |                     |
| VIO         | Pearl/Gazoo | ON    | ON   | 1.82                         | Memory, I/Os, Display     |                     |
| VBACK       | Pearl/Gazoo | ON    | ON   | 2.5                          | Back-up battery           |                     |
| VBUS        | Pearl/Gazoo |       |      | 5.0                          | USB                       |                     |
| VUSB        | Pearl/Gazoo |       |      | 3.3                          | USB                       |                     |
| VSIM        | Pearl/Gazoo | ON    | ON   | 1.8/3.0                      | SIM card                  |                     |
|             | Pearl/Gazoo | ON    | ON   | 2.5                          |                           |                     |
| VAUX1       | Pearl/Gazoo | ON    | ON   | 2.78                         | Camera, Display, ALS      |                     |
| VAUX2       | Pearl/Gazoo |       |      | 2.5                          |                           |                     |
| VR1         | Pearl/Gazoo | OFF   | ON   | 2.5                          | Crystal oscillators, RFIC |                     |
| VRFC        | Pearl/Gazoo | OFF   | ON   | 1.8                          | RAPS                      |                     |
| VRCP1       | Pearl/Gazoo |       |      | 4.75                         | To RF parts               | RF active           |
| VREF        | Pearl/Gazoo | ON    | ON   | 1.35                         | RF reference              |                     |
| VCORE       | Pearl/Gazoo | ON    | ON   | 1.05<br>1.25<br>1.35<br>1.40 | RAPS digital              |                     |
| VOUT        | Pearl/Gazoo | OFF   | OFF  | 2.5                          |                           | Accessory connected |
| VMEM        | Pearl/Gazoo | OFF   | OFF  | 2.9                          | External memory           | Disabled in sleep   |
| VDIGIMIC    | Pearl/Gazoo |       |      | 1.8                          | Microphone                |                     |

## Charging troubleshooting

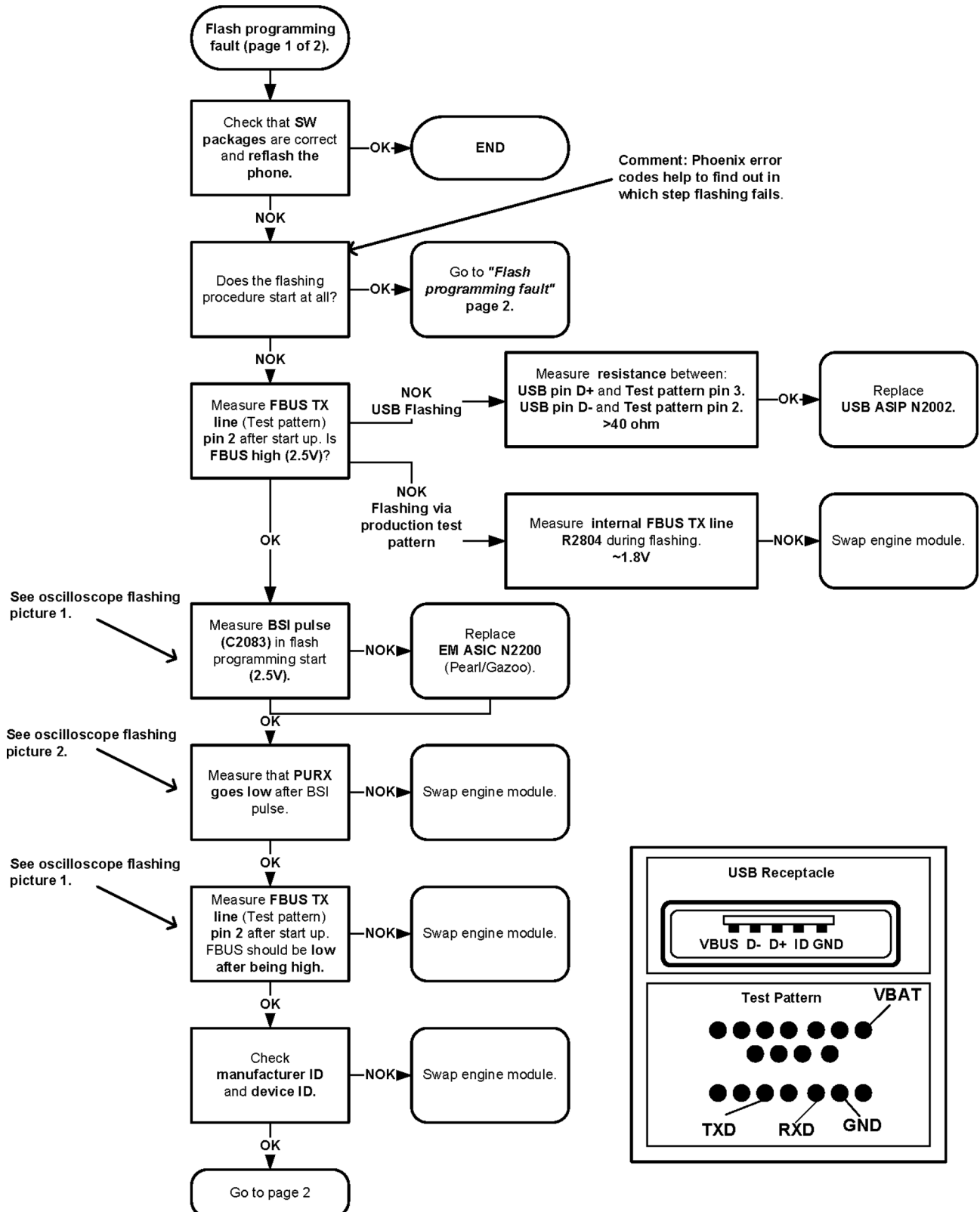
### Troubleshooting flow



## ■ Interface troubleshooting

### Flash programming fault troubleshooting

#### Part 1



## Part 2

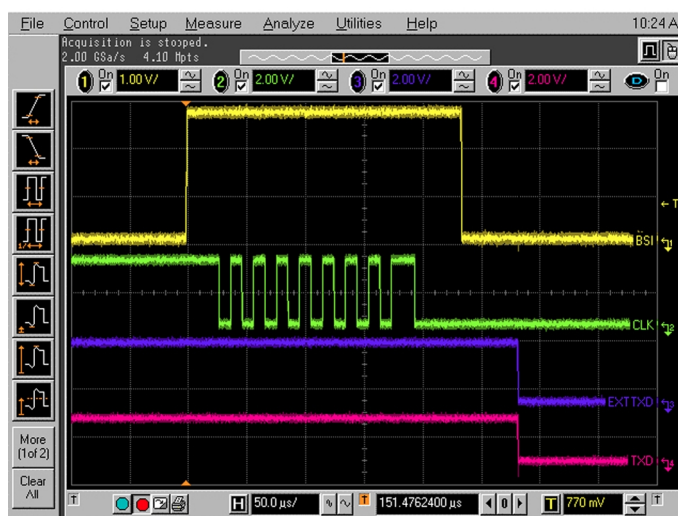
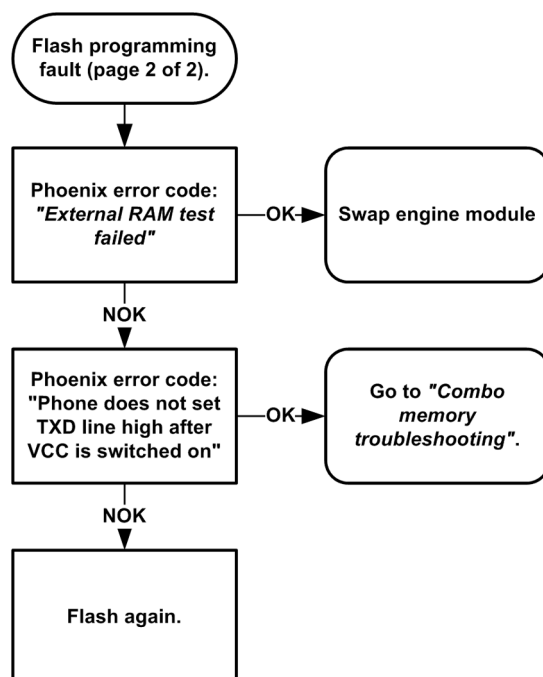
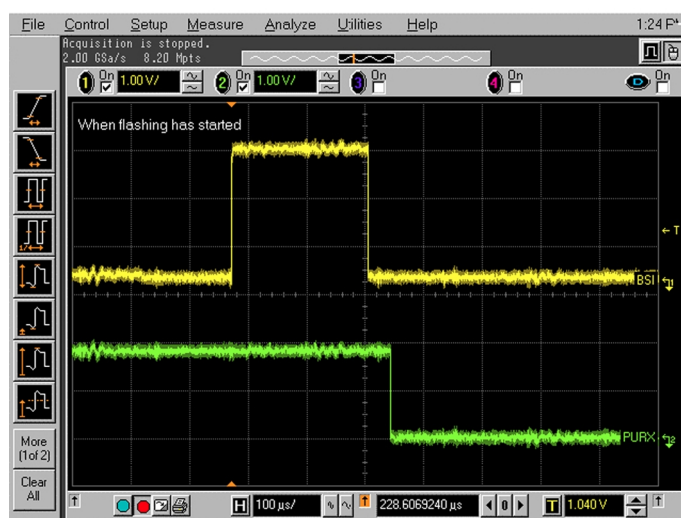


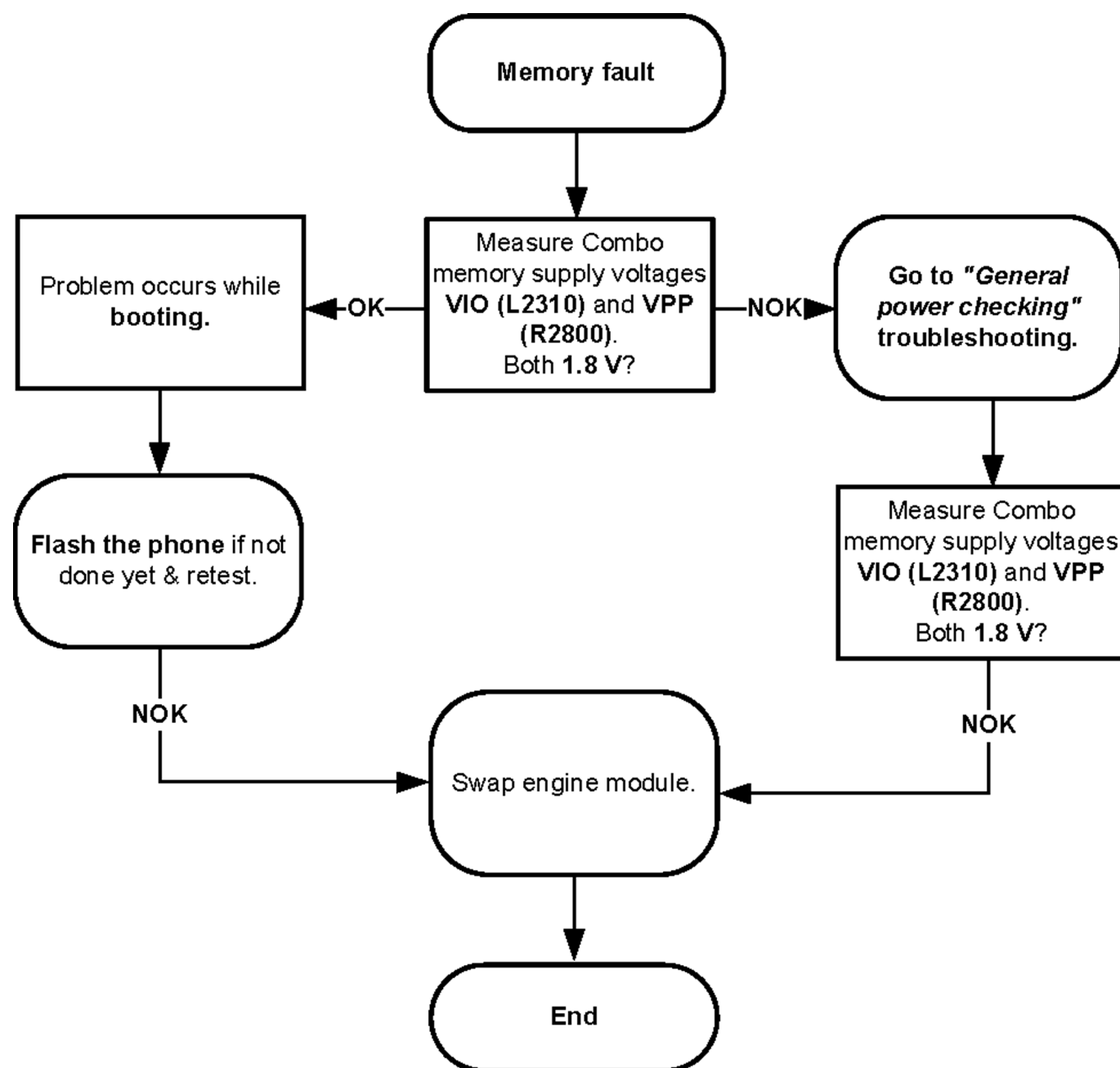
Figure 8 Flashing pic 1. Take single trig measurement for the rise of the BSI signal.



**Figure 9 Flashing pic 2. Take single trig measurement for the rise of the BSI signal.**

## Combo memory troubleshooting

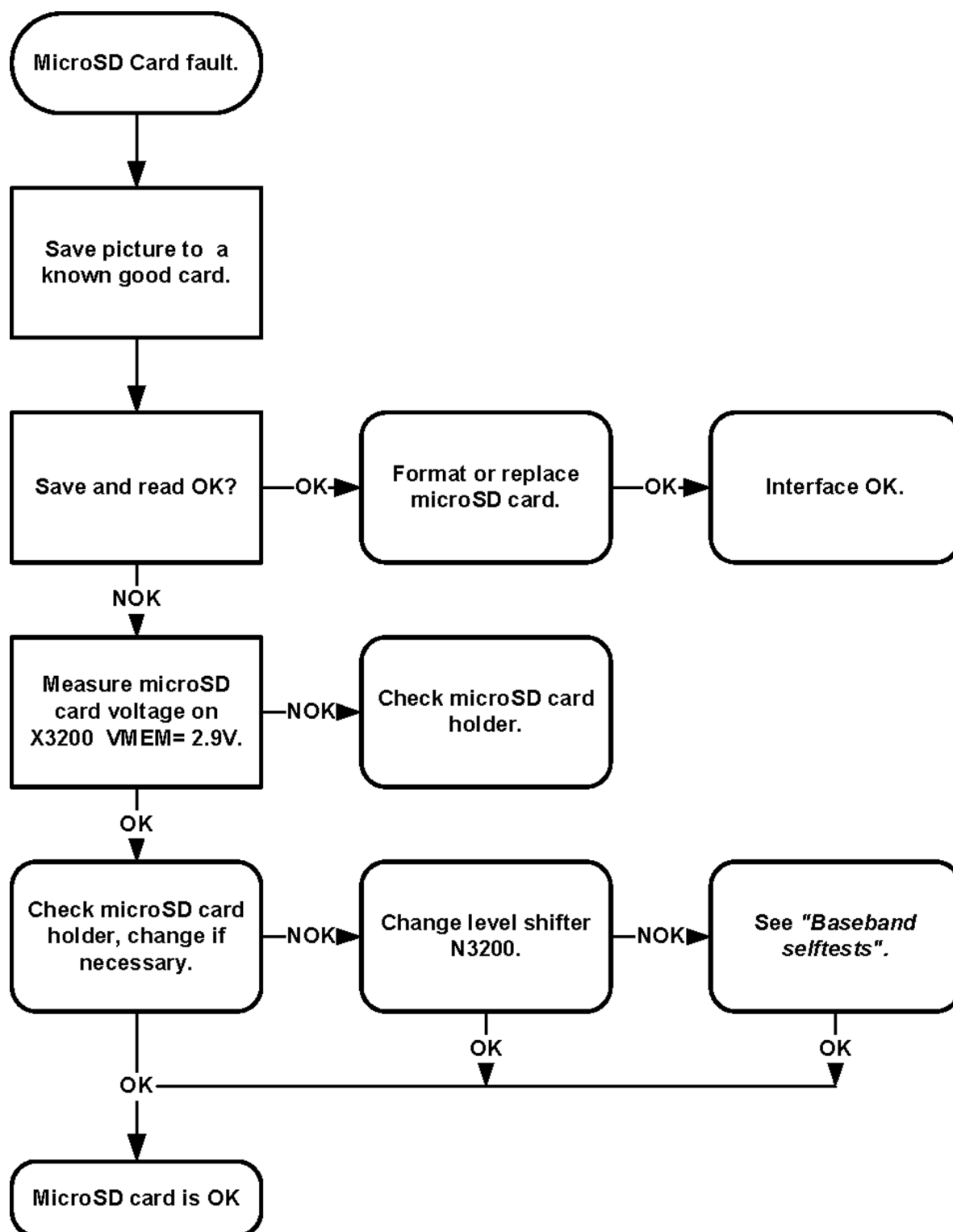
### Troubleshooting flow





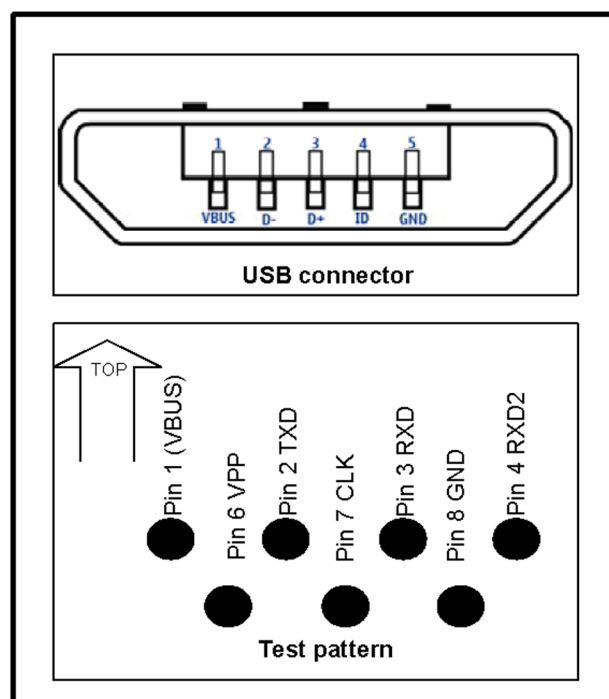
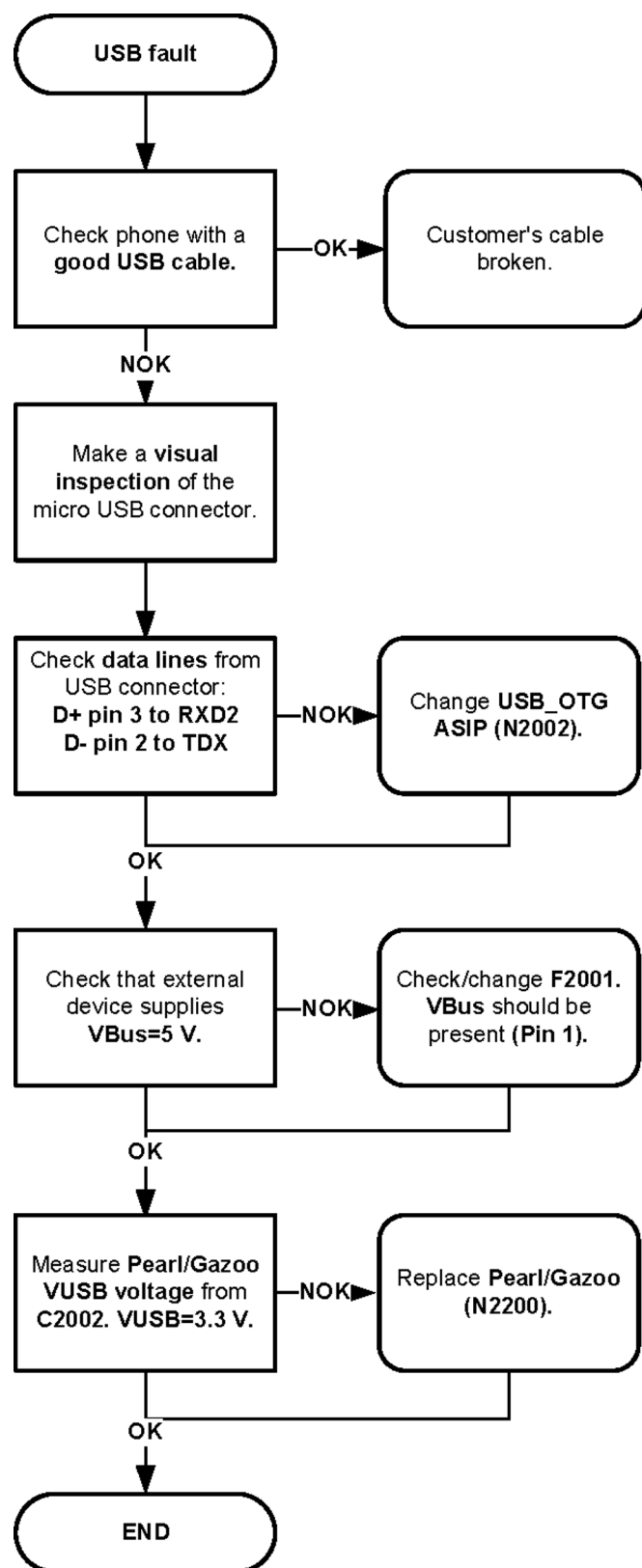
## MicroSD card troubleshooting

### Troubleshooting flow



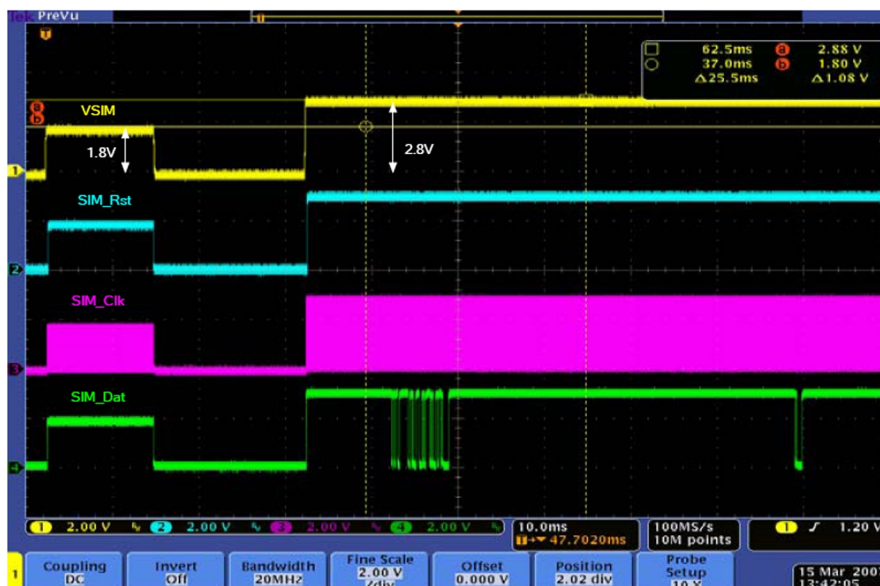
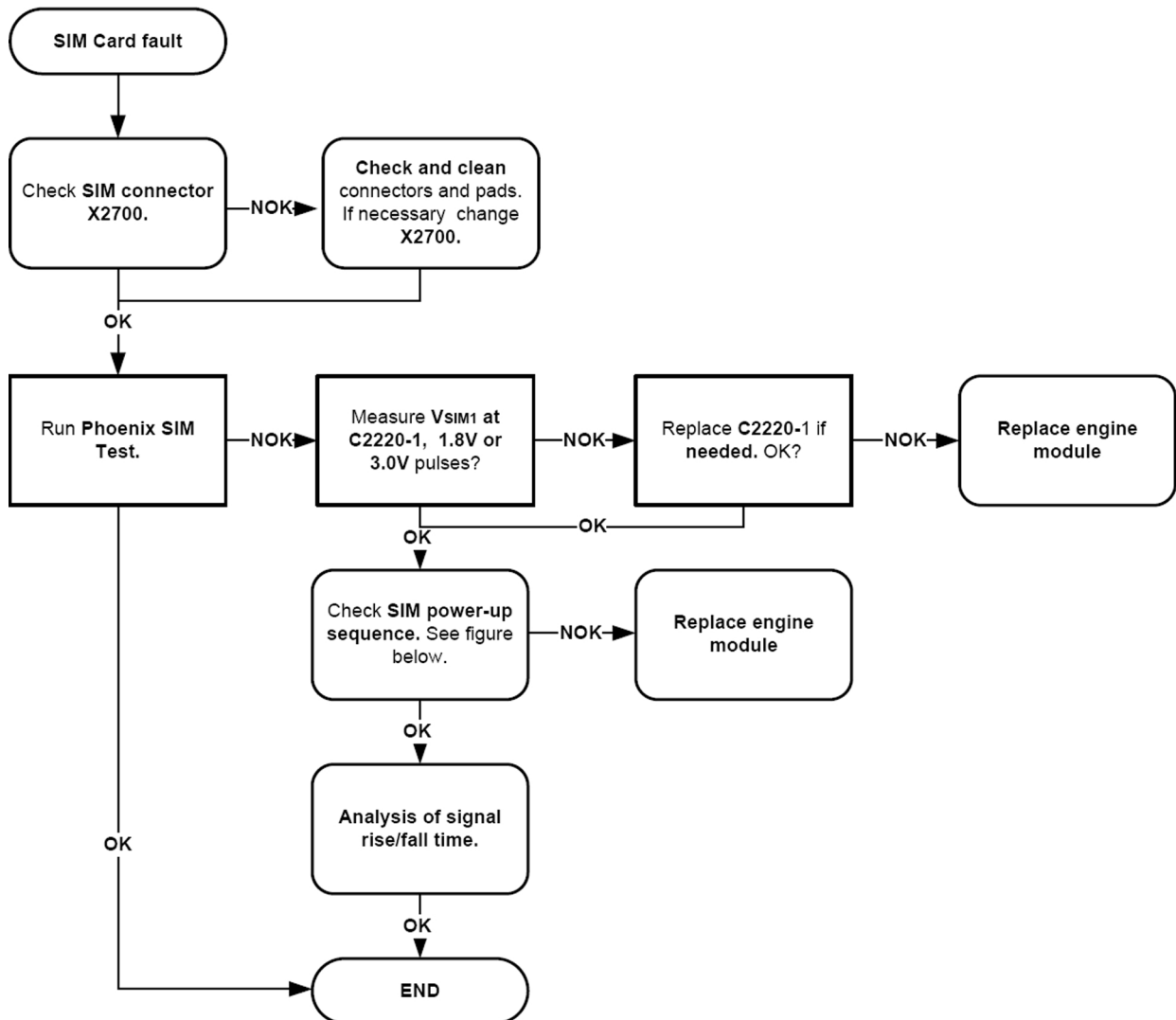
## USB interface troubleshooting

### Troubleshooting flow



## SIM card troubleshooting

### Troubleshooting flow



## ■ User interface troubleshooting

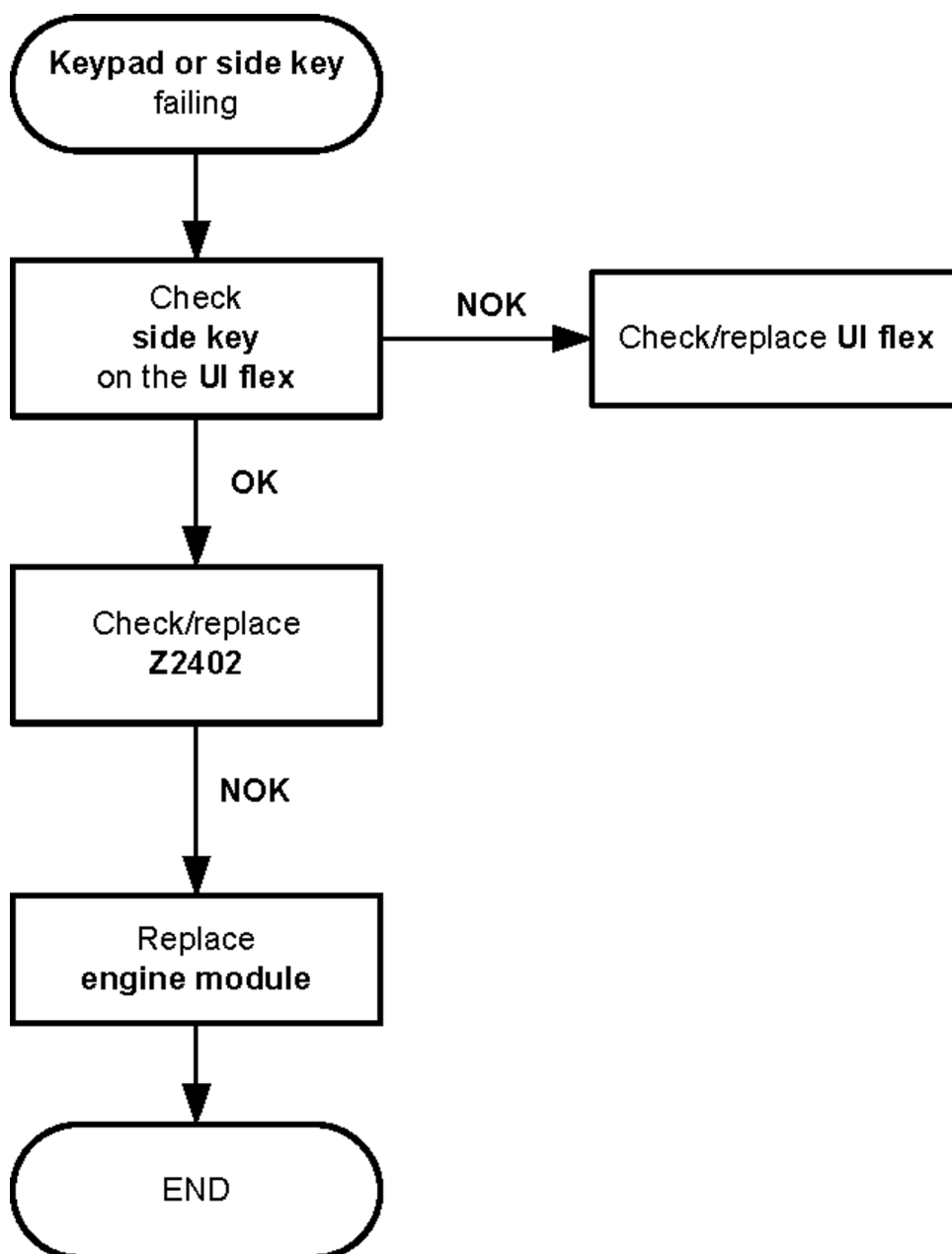
### Keypad and side key troubleshooting

#### Context

If one or more keys are stuck, so that the key does not react when a keydome or the side key is pressed, the failure is caused by mechanical reasons (dirt, rust, mechanical damage, etc.)

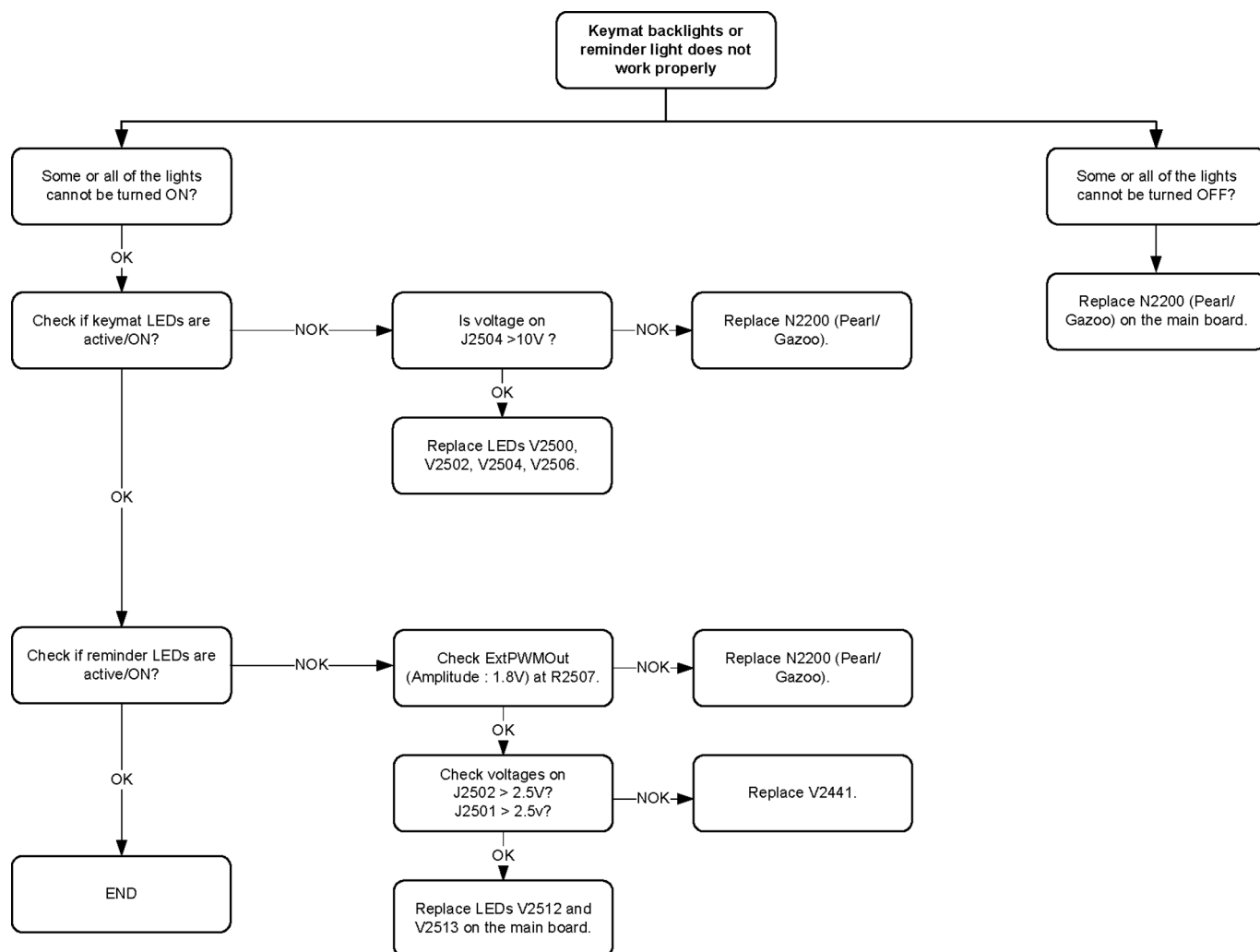
If the failure mode is not clear, start with the Keyboard test in Phoenix.

#### Troubleshooting flow



## Keymat backlight and reminder light troubleshooting

### 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 sleep mode when the phone is in the screen saver mode.

**Table 8 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.                                                                                                                                                 |
| Backlight dim or not working at all | Backlight LED components are inside the display module. Backlight failure can also be in the connector or in the backlight power source in the main engine of the phone.<br><br>This means that in case the display is working (image OK), the backlight is faulty.                                                                                                             |
| 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><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 9 Pixel defects

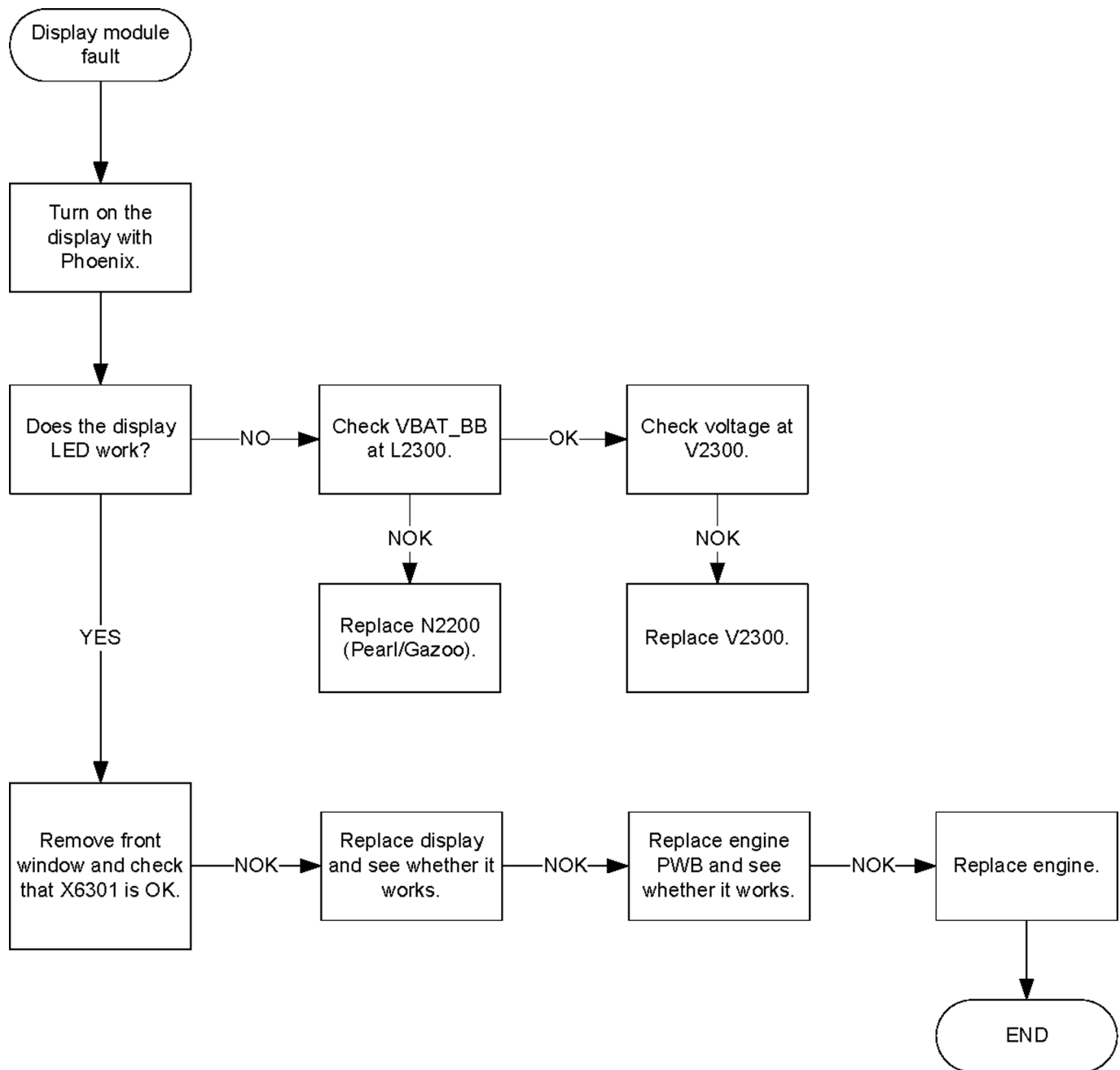
| Item |                        | White dot defect                                                                                                        |   |   |                 | Black dot defect | Total |
|------|------------------------|-------------------------------------------------------------------------------------------------------------------------|---|---|-----------------|------------------|-------|
| 1    | Defect counts          | R                                                                                                                       | G | B | White Dot Total | 1                | 1     |
|      |                        | 1                                                                                                                       | 1 | 1 | 1               |                  |       |
| 2    | Combined defect counts | Not allowed.<br>Two single dot defects that are within 5 mm of each other should be interpreted as combined dot defect. |   |   |                 |                  |       |

## Steps

1. Verify with a working display that the fault is not on the display module itself.  
The display module cannot be repaired.
2. Check that the cellular engine is working normally.
  - i To check the functionality, connect the phone to a docking station.
  - ii Start *Phoenix* service software.
  - iii Read the phone information to check that also the application engine is functioning normally (you should be able to read the APE ID).
3. Proceed to the display troubleshooting flowcharts.  
Use the **Display Test** tool in *Phoenix* to find the detailed fault mode.

## Display module troubleshooting

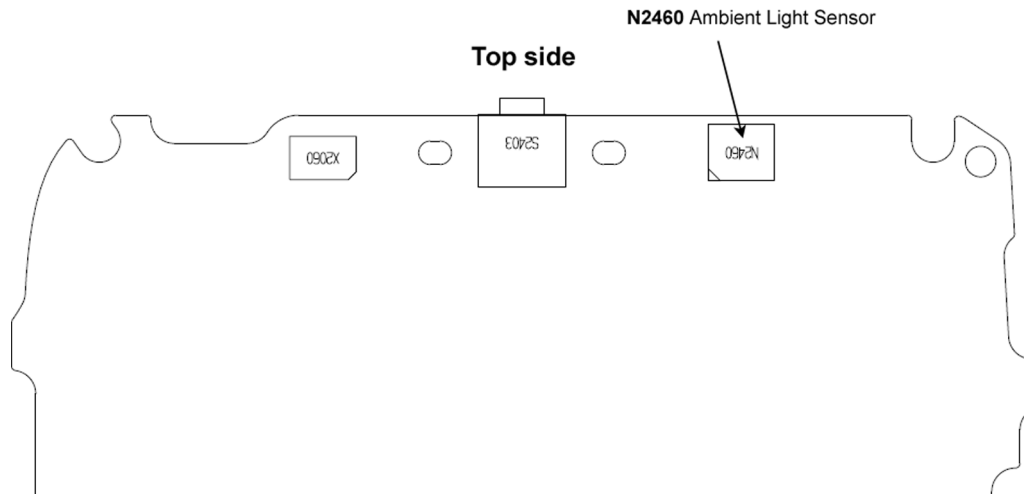
### Troubleshooting flow



## ■ Ambient Light Sensor troubleshooting and re-calibration

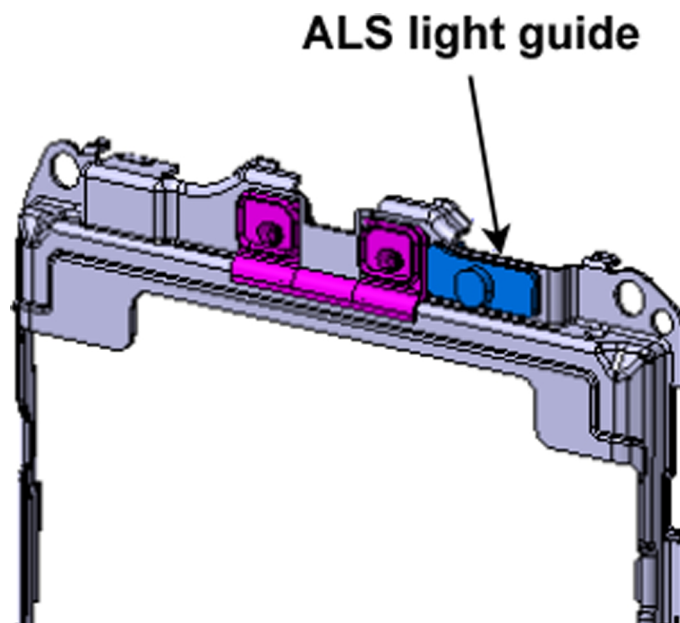
### Introduction to ALS troubleshooting and re-calibration

If the Ambient Light Sensor (ALS) functionality is inoperative, check the sensor (N2460) located at the top side of the main PWB. If necessary, change sensor.



**Figure 10 Ambient Light Sensor location**

Also, check the ALS light guide located at the top side of the UI shielding assembly.



**Figure 11 ALS light guide location**

After replacing the ALS sensor, or if the calibration values of the sensor are lost or for some other reason, ALS calibration is required. For more information, see [ALS functionality check \(page 3-23\)](#) and [Calibrating ALS \(page 3-24\)](#).

**Note:** ALS calibration is also required for Light SWAP Engines, because ALS is not factory calibrated for Light SWAP.

When executing the ALS calibration, a reference phone that includes calibrated ALS is required. The ALS re-tuning instructions show why the reference phone is needed.

**Note:** Make sure that you have completed the display and keyboard backlights troubleshooting before starting the ALS troubleshooting.

There is an Ambient Light Sensor window in the Phoenix Display Test tool, which shows the luminance value. The correct luminance in darkness is <20 lx, and in an office environment 100-2000 lx.



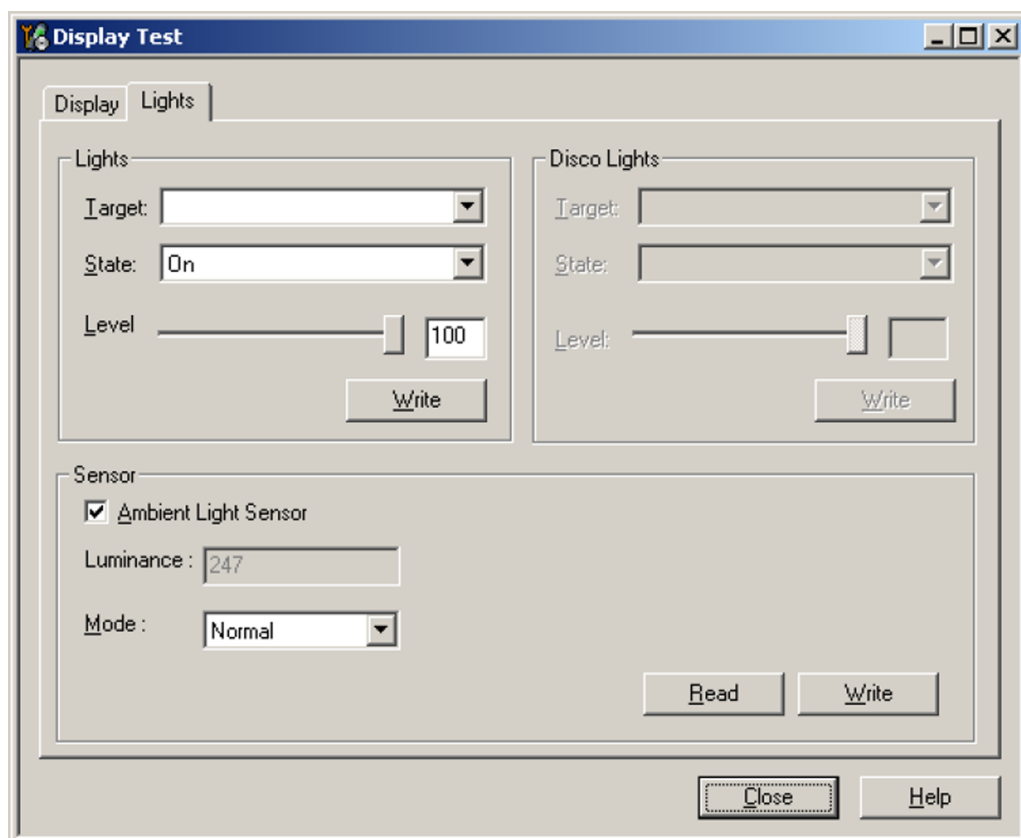
**Note:** The luminance value depends heavily on the light source and the angle of the phone against the light source, so the values above can only be used as a rough guideline. Phoenix has an ambient light sensor calibration tool for changing the calibration values.

## Ambient Light Sensor calibration

### ALS functionality check

#### Steps

1. Connect the phone to *Phoenix*, start the *Phoenix* software, and set the phone (e.g. on the table) so that the ambient light visible to ALS is stable. The light guide of the ALS is located on the upper part of the phone's front cover, right next to the secondary camera.
2. Scan product on Phoenix (**CTRL+R**)
3. Choose **Testing**→**Display test**.



4. Open the **Lights** tab, and check the Ambient light sensor check box. Click the **Read** button in order to get the reference ambient light value. Cover the sensor and click **Read** again. When covered, the luminance reading should be less than after clicking **Read** without covering the sensor.
5. If the component does not give any reading or the reading does not change when sensor is/is not covered, replace the part.

**Note:** The ALS module is located on the main PWB. ALS calibration must always be done when the main PWB is changed. Also, if the ALS calibration values are lost from the phone, ALS needs to be recalibrated.

The ALS calibration procedure requires a reference phone with a calibrated ALS.

## Calibrating ALS

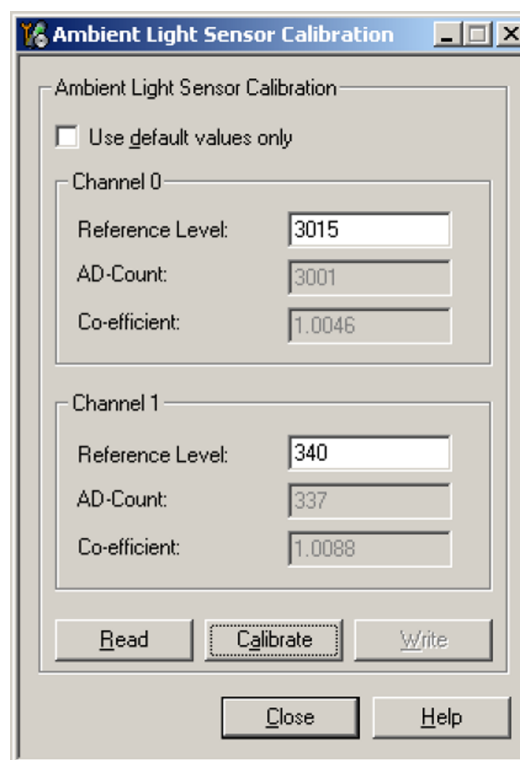
### Context

Before doing the manual ALS calibration, test the following default values:

- 1 Check the Use default values only box from the **Ambient Light Sensor Calibration** window
- 2 Click Write
- 3 Open the **Display Test** window
- 4 Read the luminance value from the **Display Test** window. If the luminance value differs a lot (difference max. +- 10%) when compared to the reference phone, perform a manual ALS tuning procedure by following the instructions below.

### Steps

1. Connect the phone to *Phoenix*, start the *Phoenix* software, and set the phone (e.g. on the table) so that the ambient light visible to ALS is stable. The light guide of the ALS is located on the upper part of the phone's front cover, right next to the secondary camera.
2. Scan product on Phoenix (**CTRL+R**)
3. Choose **Tuning**→**Ambient Light Sensor Calibration**.



4. Uncheck the Use default values only check box, click the **Read** button to get the AD-Count values for Channel 0 and Channel 1, and write them down.  
**Note:** In the example graphic the reference phone values are: Channel 0=3001 and Channel 1=337
5. Repeat steps 1-4 for the phone to be calibrated.  
**Note:** Make sure the phone to be calibrated is located in the same place as the reference phone was when luminance reading was taken.

6. Calculate and write down co-efficient value by division:

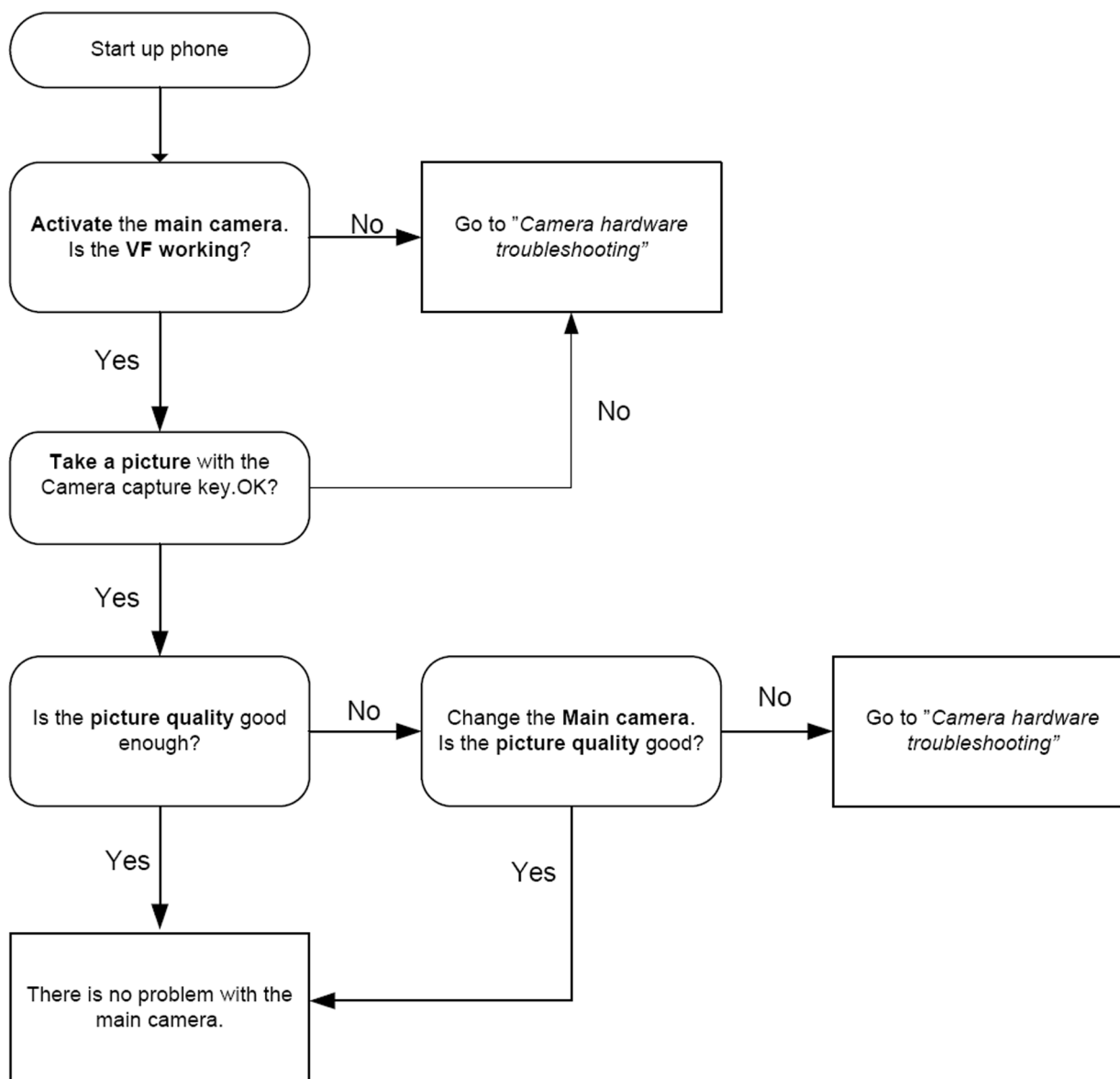
$$\text{Co-efficient(CH0)} = \frac{\text{Channel(0)}_{(\text{ref.phone})}}{\text{Channel(0)}} \quad \text{Co-efficient(CH1)} = \frac{\text{Channel(1)}_{(\text{ref.phone})}}{\text{Channel(1)}}$$

7. To calibrate ALS, the value in the **Reference Level** textbox needs to be adjusted for both channels until the **Co-efficient** calculated by Phoenix equals the values calculated in step 6. Click **Calibrate** after each try (and uncheck the Use default values only check box).
8. Calibration is done when the **Co-efficient** is equal to the co-efficient value calculated in step 6.  
**Note:** Decimal numbers should be used in the iteration in order to achieve adequate precision (e.g. 200.2455)
9. Use Phoenix (**Testing**→**Display test**→**Lights** tab) to verify the calibration by reading the luminance value for both the reference phone and calibrated phone.  
**Note:** Remember that the illuminance readings for the reference and calibrated phones must be done in the same ambient light conditions. If the illuminance values differ more than +- 10%, repeat the whole ALS calibration procedure.
10. To end the calibration, click Close.

## ■ Camera troubleshooting

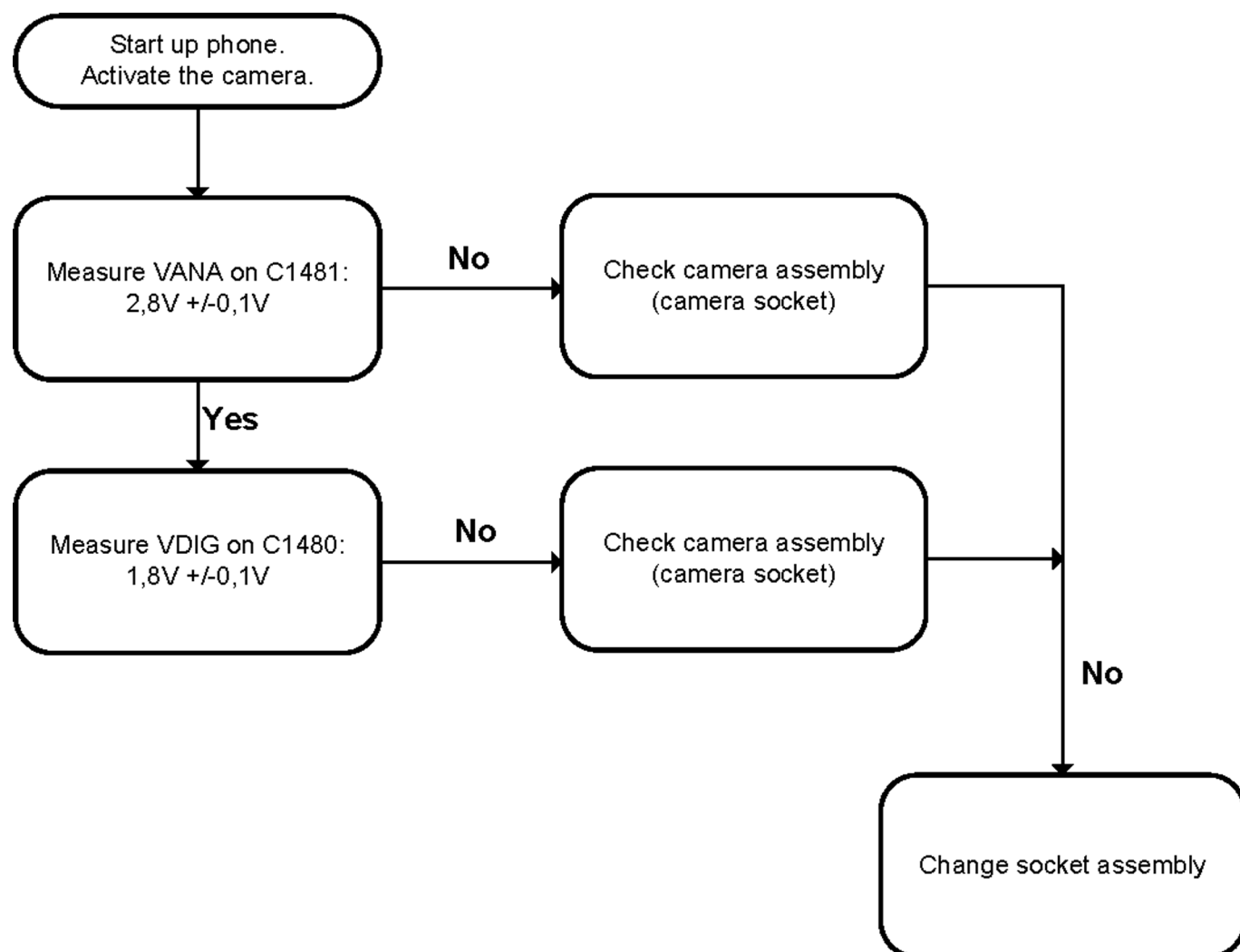
### Camera troubleshooting

#### Troubleshooting flow



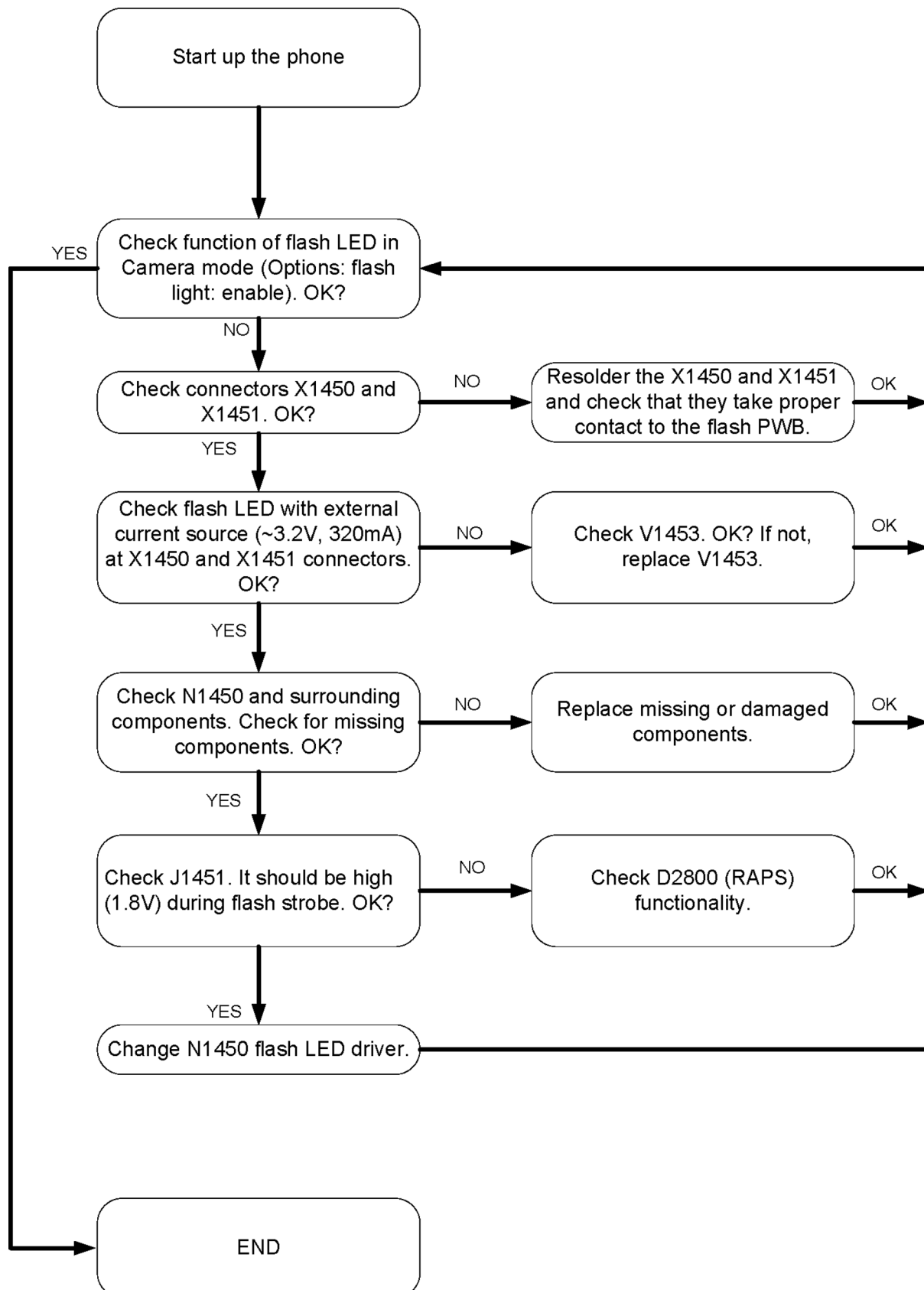
## Camera hardware troubleshooting

### Troubleshooting flow



## Camera flash LED troubleshooting

### Troubleshooting flow



## ■ Audio troubleshooting

### Audio troubleshooting test instructions

Single-ended external earpiece and differential 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. Exception to this is a digital microphone, which needs input signal from an external sound source (laptop speaker) to playback eg. 1kHz sine wave from 5cm distance.

### Required equipment

The following equipment is needed for the tests:

- Oscilloscope
- Function generator (sine waveform)
- Current probe (Internal handsfree PWM output measurement)
- Phoenix service software
- Battery voltage 3.7V
- Sound source (laptop speaker or B&K type 4231 calibrator)

### 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
- Digital stereo 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] | Output voltage [mVp-p] | Output DC level [V] | Output current [mA] |
|------------------------------------|----------------------------------|-----------------|------------------------|-----------------------|------------------------|---------------------|---------------------|
| External Mic to External Earpiece  | HS_MIC & GND                     | HS_EAR_L & GND  | 12                     | 140                   | 1.9Vpp                 | 1.2                 | NA                  |
|                                    |                                  | HS_EAR_R & GND  |                        |                       |                        |                     |                     |
| External Mic to Internal Earpiece  | HS_MIC & GND                     | EarP & GND      | 0                      | 100                   | 100                    | 1.2                 | NA                  |
|                                    |                                  | EarN & GND      |                        |                       |                        |                     |                     |
| External Mic to Internal handsfree | HS_MIC & GND                     | J2103 & J2104   | 6                      | 200                   | 500                    |                     |                     |
|                                    |                                  | J2101 & J2102   |                        |                       |                        |                     |                     |
| Digital Mic to External Earpiece   | Acoustical input, 1kHz sine wave | HS_EAR_L & GND  | NA                     | 94 dB SPL             | 100                    |                     | NA                  |
|                                    |                                  | HS_EAR_R & GND  |                        |                       |                        |                     |                     |

## Measurement data

### Earpiece signal

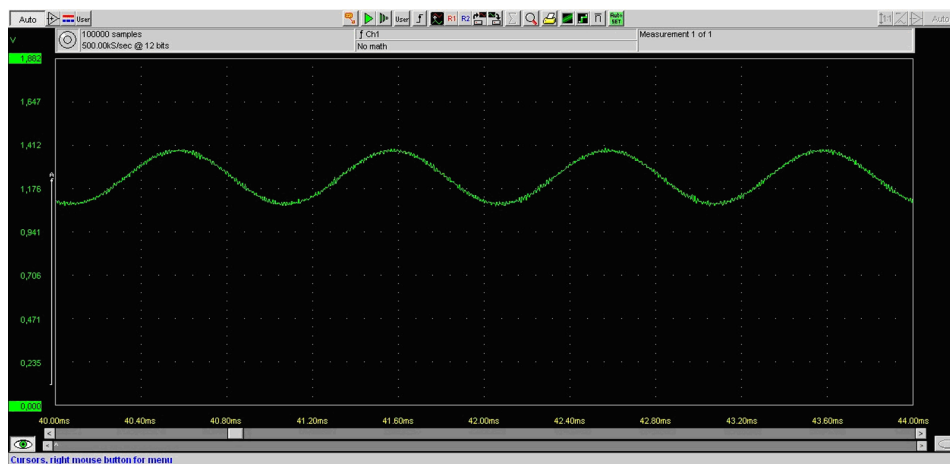


Figure 12 Single-ended output waveform of the Ext\_in\_HP\_out measurement when earpiece is connected.

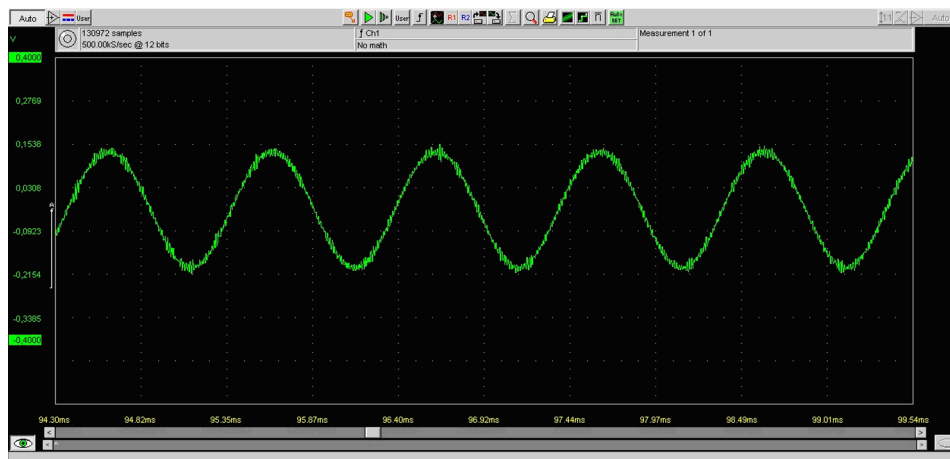
### Integrated handsfree signal





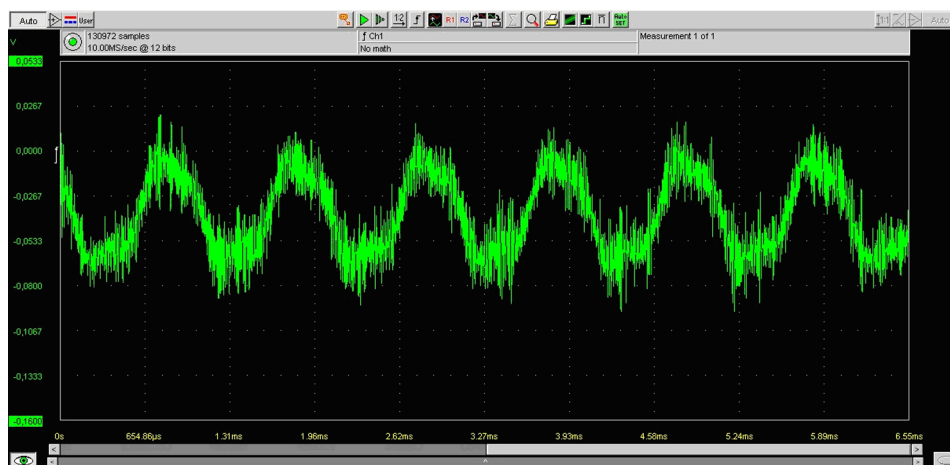
**Figure 13** Single-ended output waveform of the Ext\_in\_IHF\_out out loop measurement when speaker is connected (measured at speaker pads). No filter is used.

### External output from AV



**Figure 14** Single-ended output waveform of the Ext\_in\_Ext\_out loop.

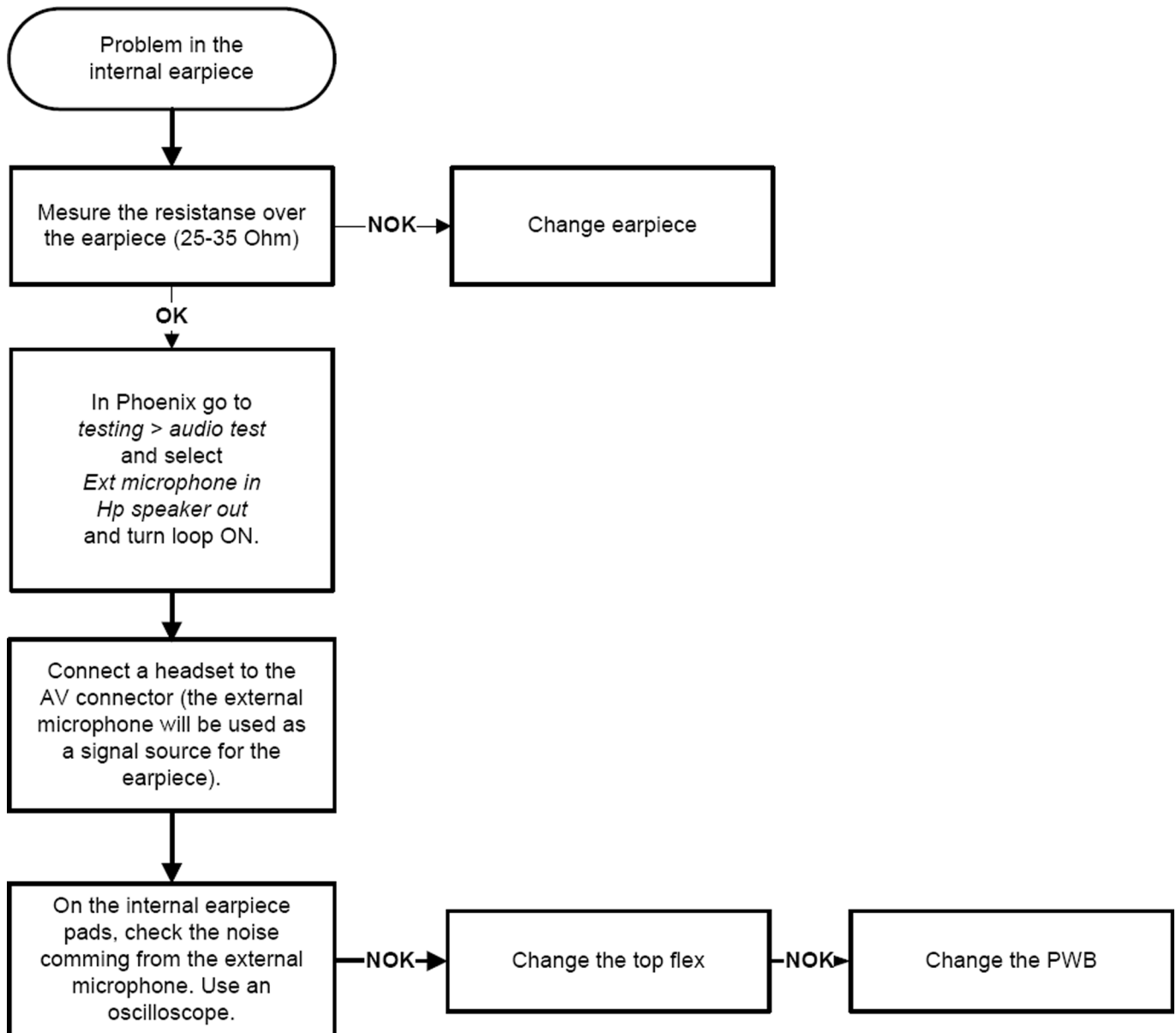
### External output from AV (acoustic input)



**Figure 15** Single-ended output waveform of the Digital\_stereo\_microphone\_in\_Ext\_out loop.

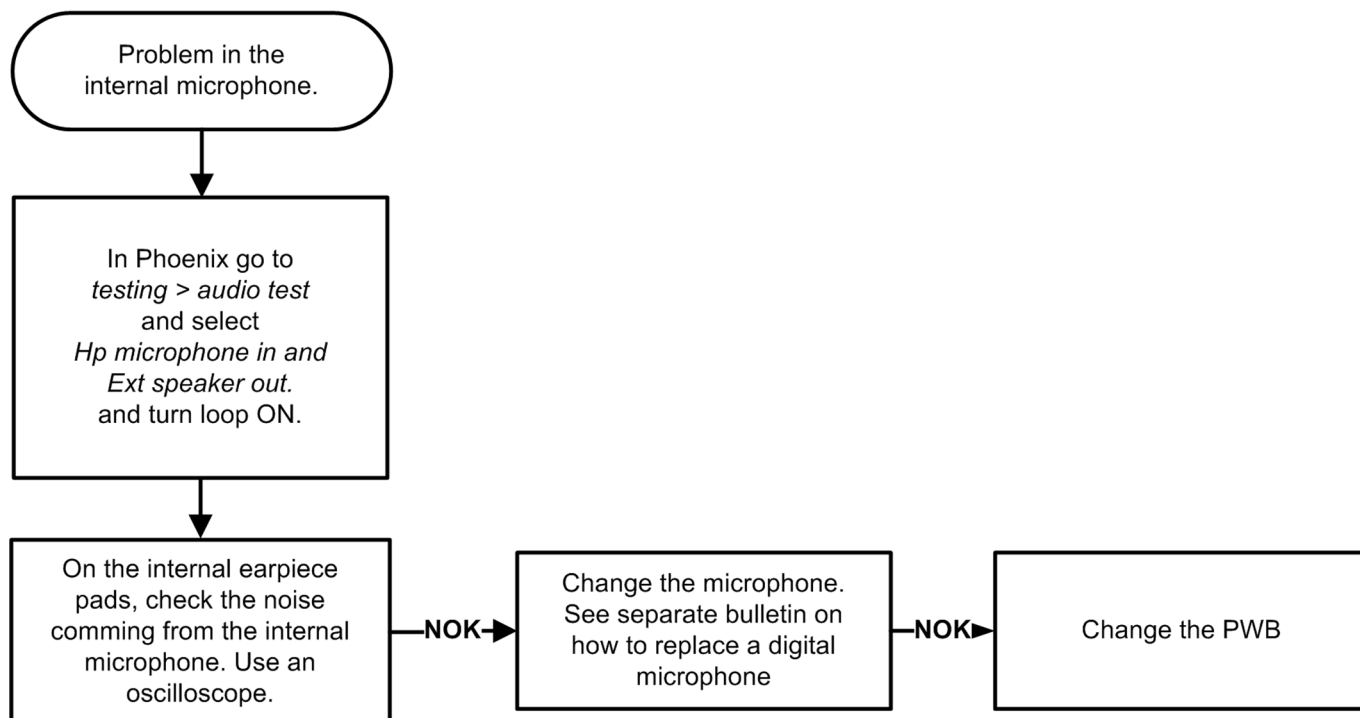
## Internal earpiece troubleshooting

### Troubleshooting flow



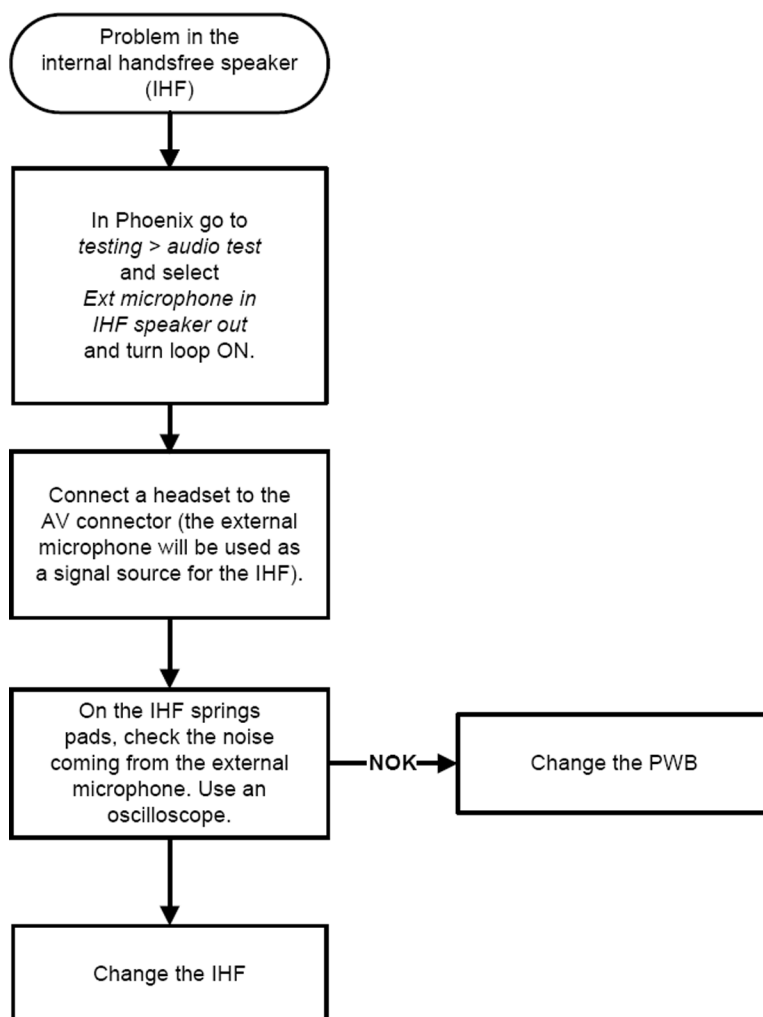
## Internal microphone troubleshooting

### Troubleshooting flow



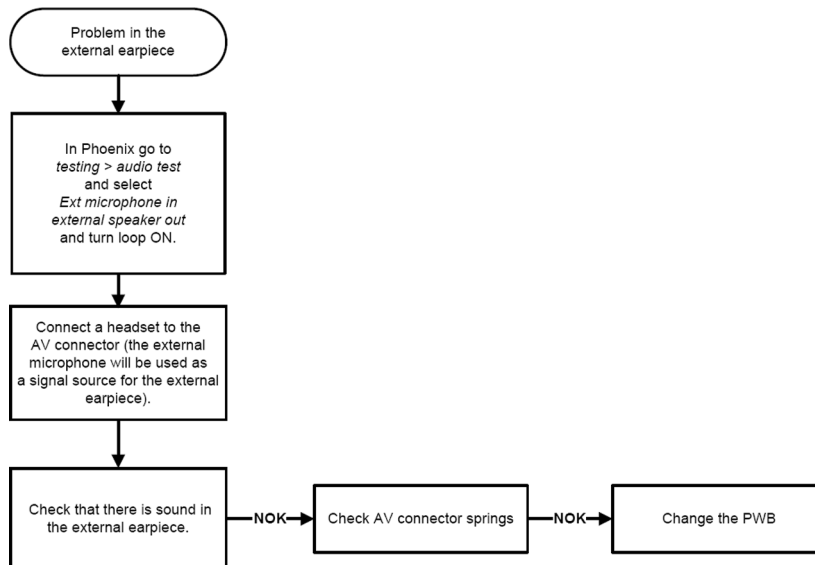
## Internal handsfree (IHF) troubleshooting

### Troubleshooting flow



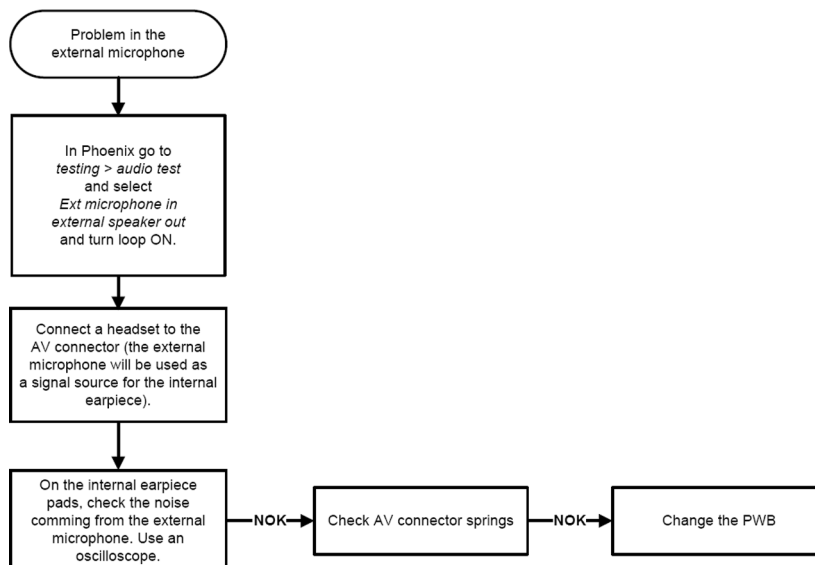
## External earpiece troubleshooting

### Troubleshooting flow



## External microphone troubleshooting

### Troubleshooting flow



## Acoustics troubleshooting

### Introduction to acoustics troubleshooting

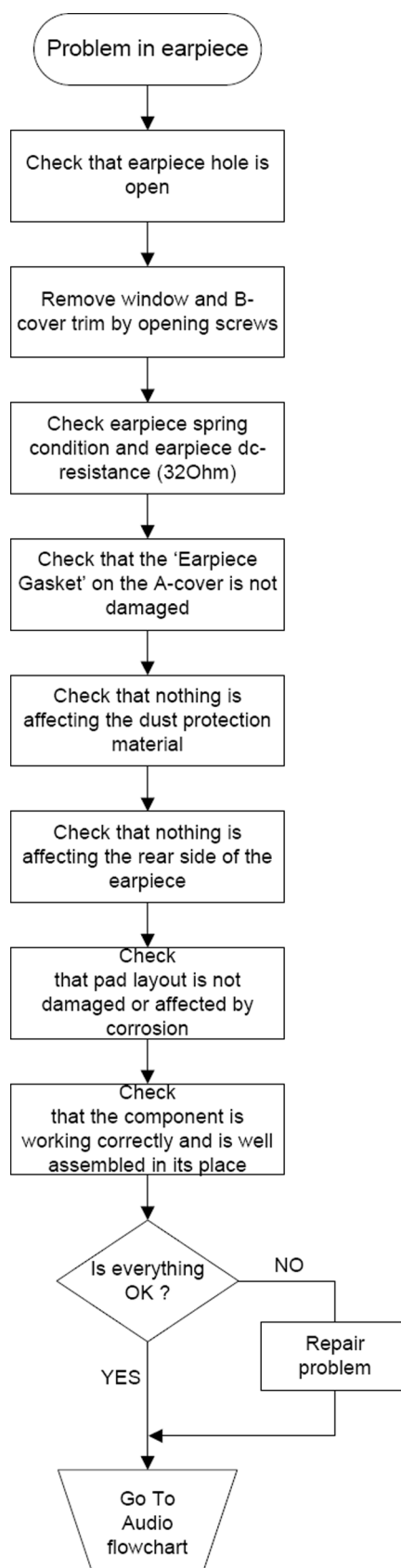
Acoustics design ensures that the sound is detected correctly with a microphone and properly radiated to the outside of the device by speaker(s). The acoustics of the phone includes three basic systems: earpiece, Integrated Hands Free (IHF) and microphone.

The sound reproduced from the earpiece radiates through a single hole on the front cover (A-cover). The sound reproduced from the IHF speaker (located under the battery cover) radiates from the sound holes on the battery cover. The microphone is located inside the fold (in the lower block) at the bottom right corner.

For a correct functionality of the phone, all sound holes must be always open. When the phone is used, care must be taken not to close any of those holes with a hand or fingers. The phone should be dry and clean, and no objects must be located in such a way that they close any of the holes.

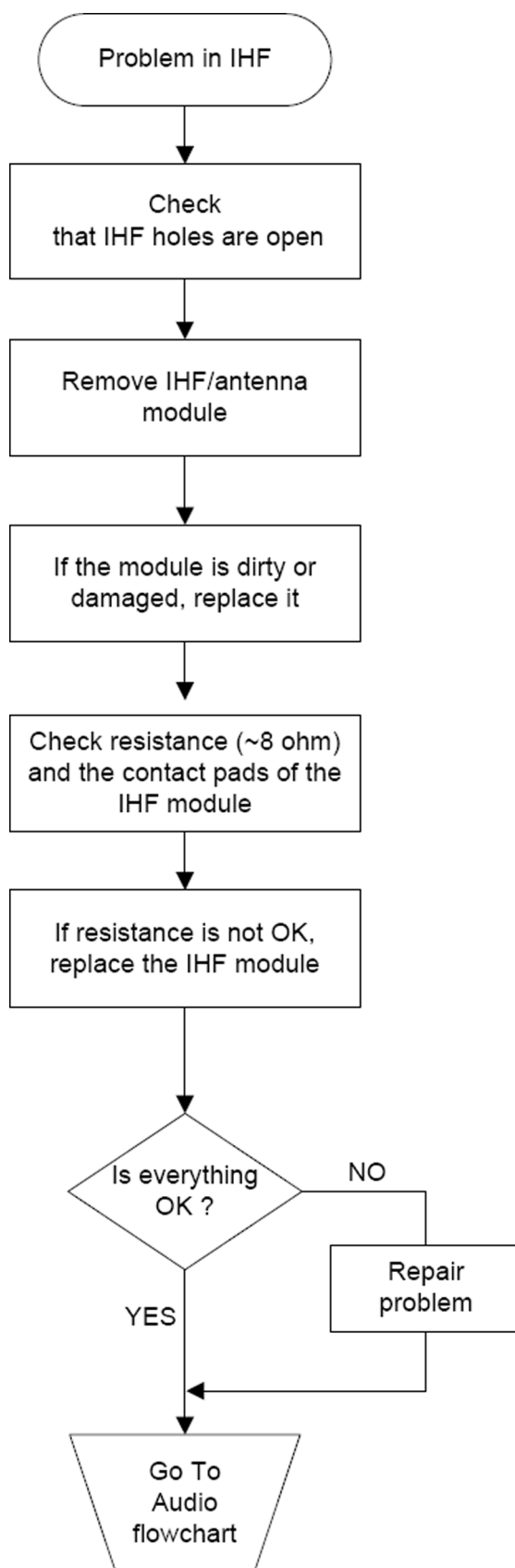
## *Earpiece troubleshooting*

### Troubleshooting flow



## *IHF troubleshooting*

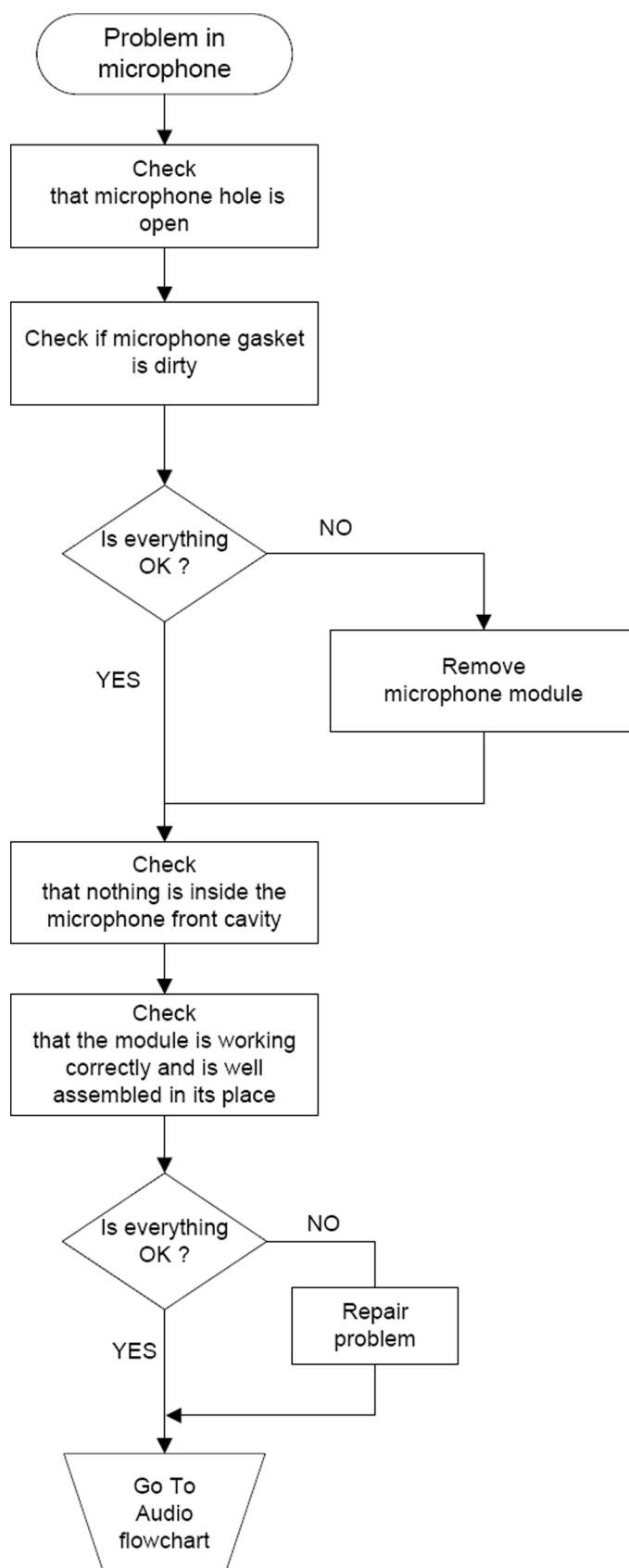
### Troubleshooting flow





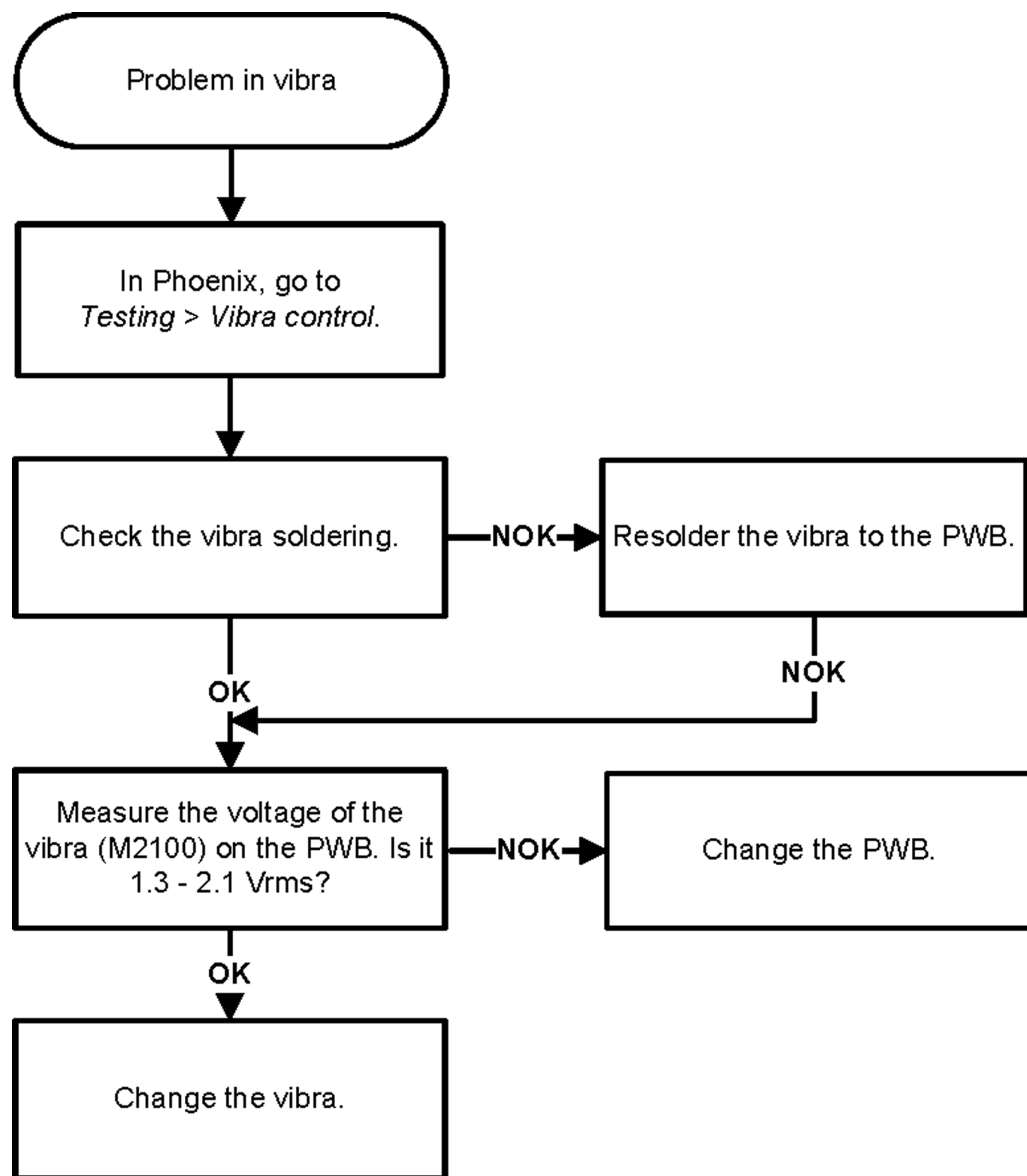
## Microphone troubleshooting

### Troubleshooting flow



## Vibra troubleshooting

### Troubleshooting flow



## ■ Bluetooth and FM radio troubleshooting

### Introduction to Bluetooth/FM Radio troubleshooting

There are two main Bluetooth problems that can occur:

| Problem                                                                  | Description                                                                                                                                                              |
|--------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Detachment of the BT antenna.                                            | This would most likely happen if the device has been dropped repeatedly to the ground. It could cause the BT antenna to become loose or partially detached from the PWB. |
| A malfunction in the BT ASIC, BB ASICs or the phone's BT SMD components. | This is unpredictable and could have many causes i.e. SW or HW related.                                                                                                  |

The main issue is to find out if the problem is related to the BT antenna, the BT system, or the phone's BB and then replace/fix the faulty component.

### Bluetooth antenna

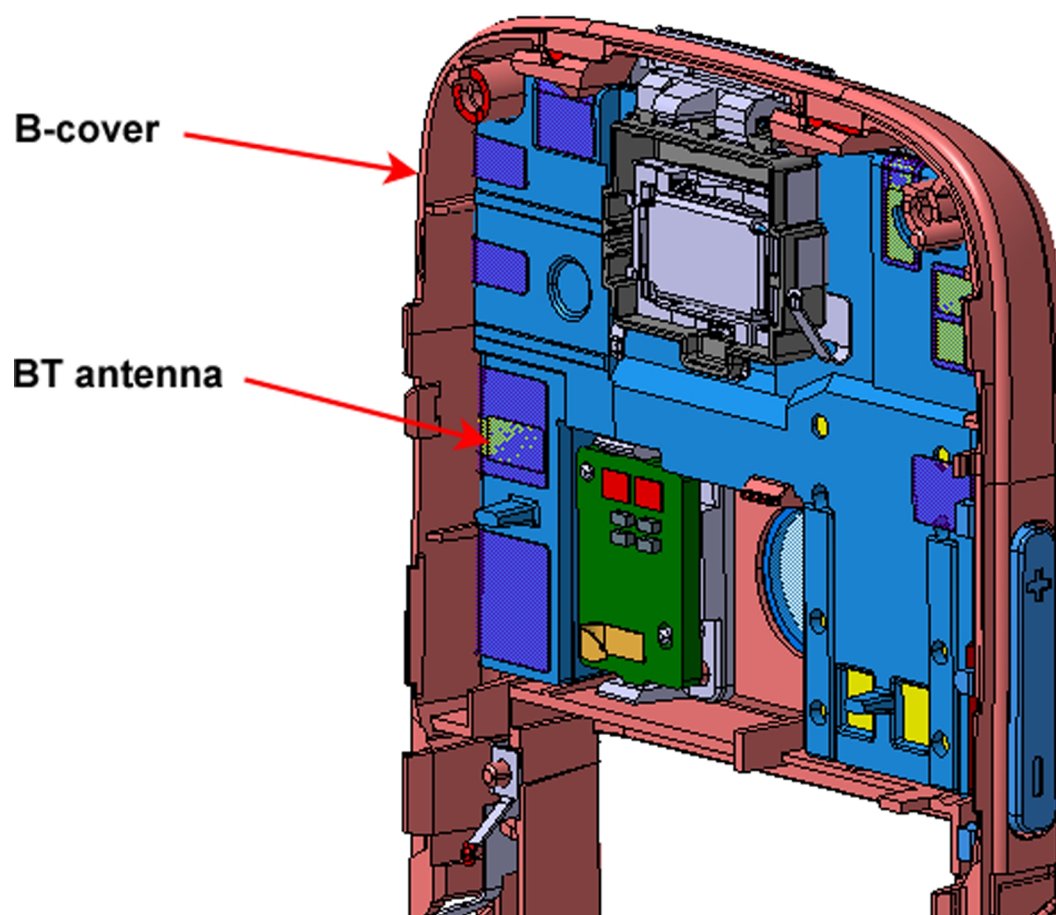


Figure 16 Bluetooth antenna location

**Bottom**

**Antenna C-clip**

**BT antenna filter**

**BTHFMRDS3.0a chip**

**Figure 17 Bluetooth and FM radio component layout**

## Bluetooth settings for Phoenix

## Steps

1. Start *Phoenix* service software.
  2. Place the phone to a flash adapter in the local mode.
  3. From the **File** menu, choose **Open Product**, and then choose the correct type designator from the **Product** list.
  4. Choose **Testing**→**Bluetooth LOCALS**.
  5. Locate SB-6's serial number (12 digits) found in the type label on the back of SB-6.
- In addition to SB-6, also JBT-3, JBT-6 and JBT-9 Bluetooth test boxes can be used.

6. In the *Bluetooth LOCALS* window, write the 12-digit serial number on the **Counterpart BT Device Address** line.

This needs to be done only once provided that SB-6 is not changed.

7. Place the SB-6 box near (within 10 cm) the BT antenna and click **Run BER Test**.

## Results

Bit Error Rate test result is displayed in the *Bit Error Rate (BER) Tests* pane in the *Bluetooth LOCALS* window.

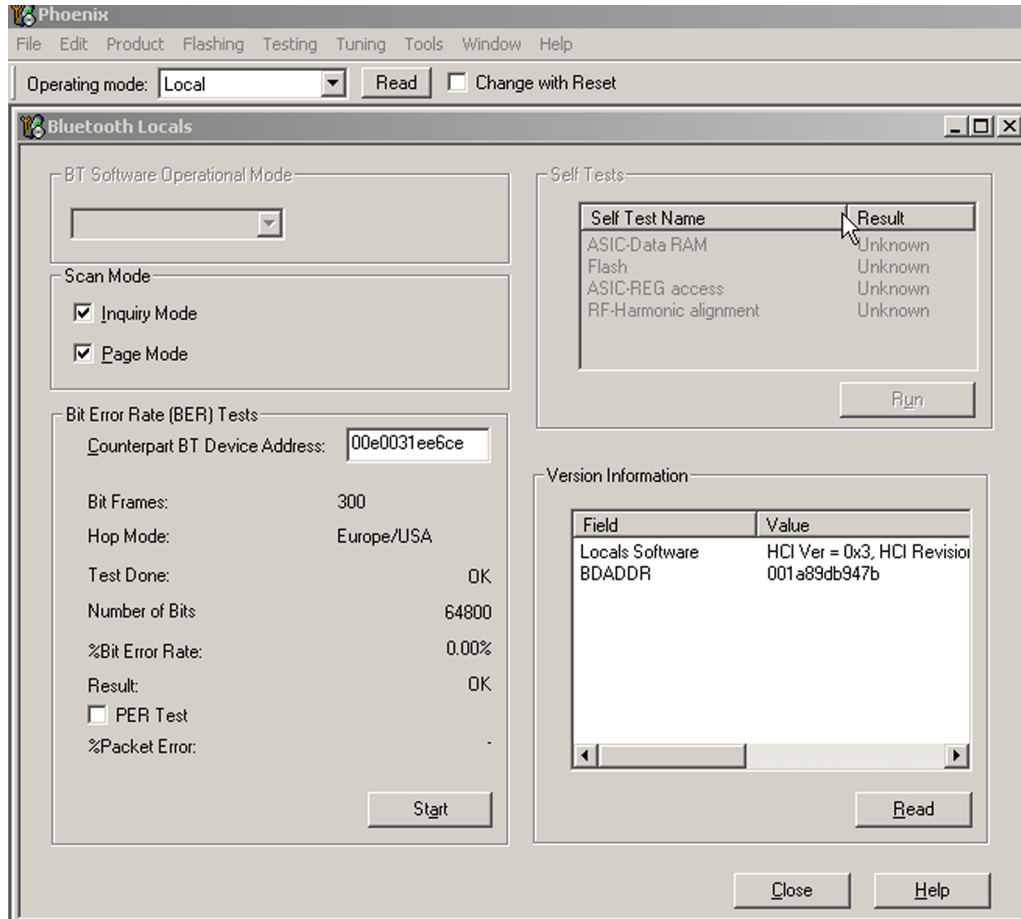


Figure 18 BER test result

## Bluetooth self tests in Phoenix

### Steps

1. Start *Phoenix* service software.
2. Choose **File**→**Scan Product**.
3. Place the phone to a flash adapter.
4. From the **Mode** drop-down menu, set mode to **Local**.
5. Choose **Testing**→**Self Tests**.
6. In the *Self Tests* window check the following Bluetooth related tests:
  - **ST\_LPRF\_IF\_TEST**
  - **ST\_LPRF\_AUDIO\_LINES\_TEST**
  - **ST\_BT\_WAKEUP\_TEST**

7. To run the tests, click **Start**.

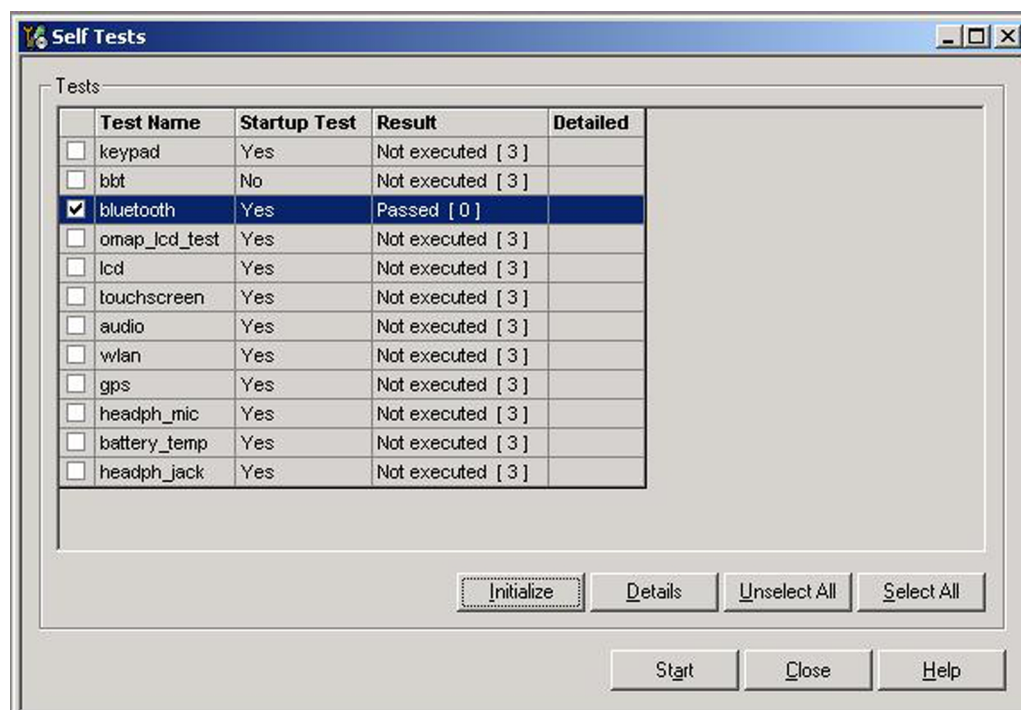
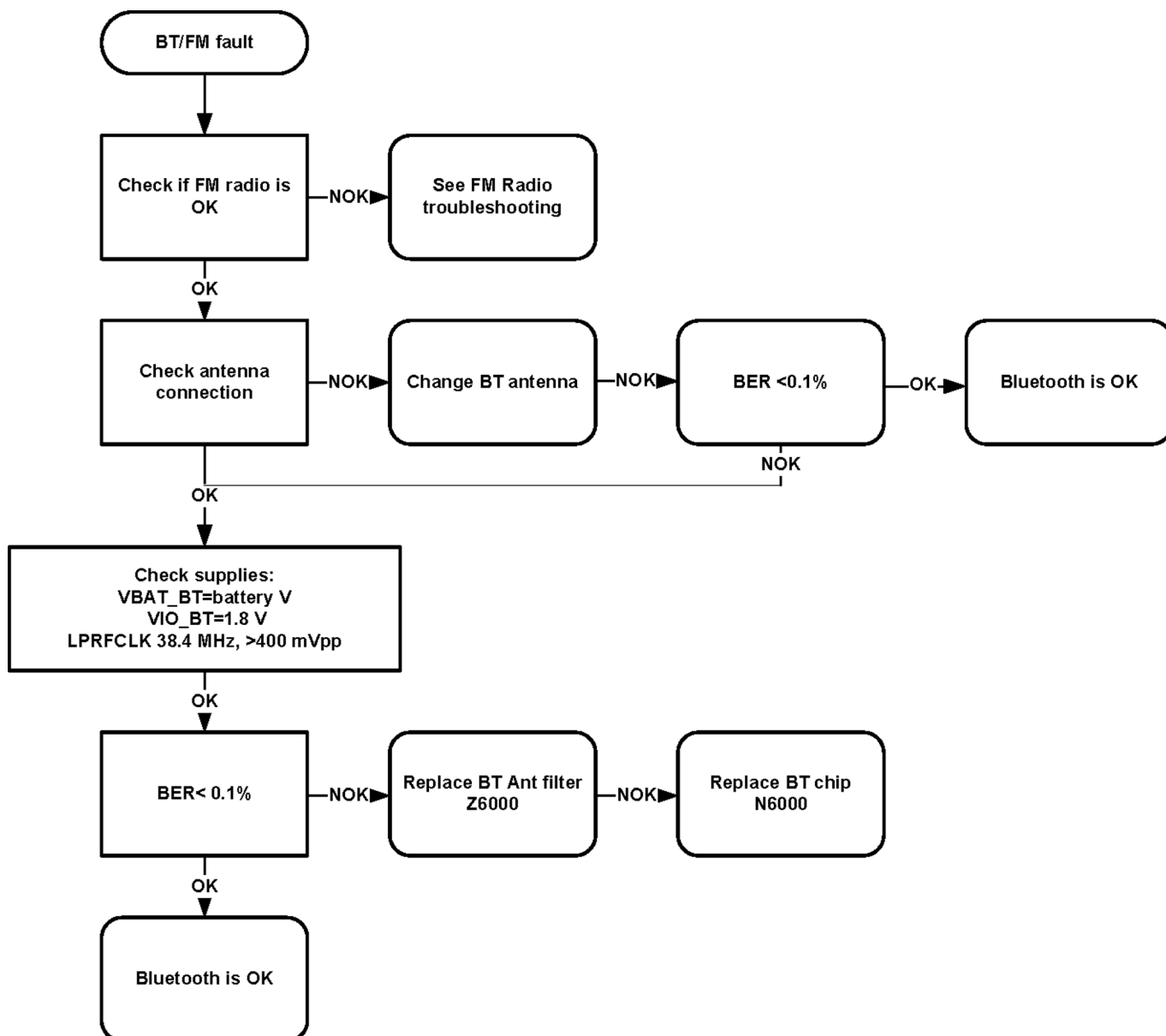


Figure 19 Bluetooth self tests in *Phoenix*

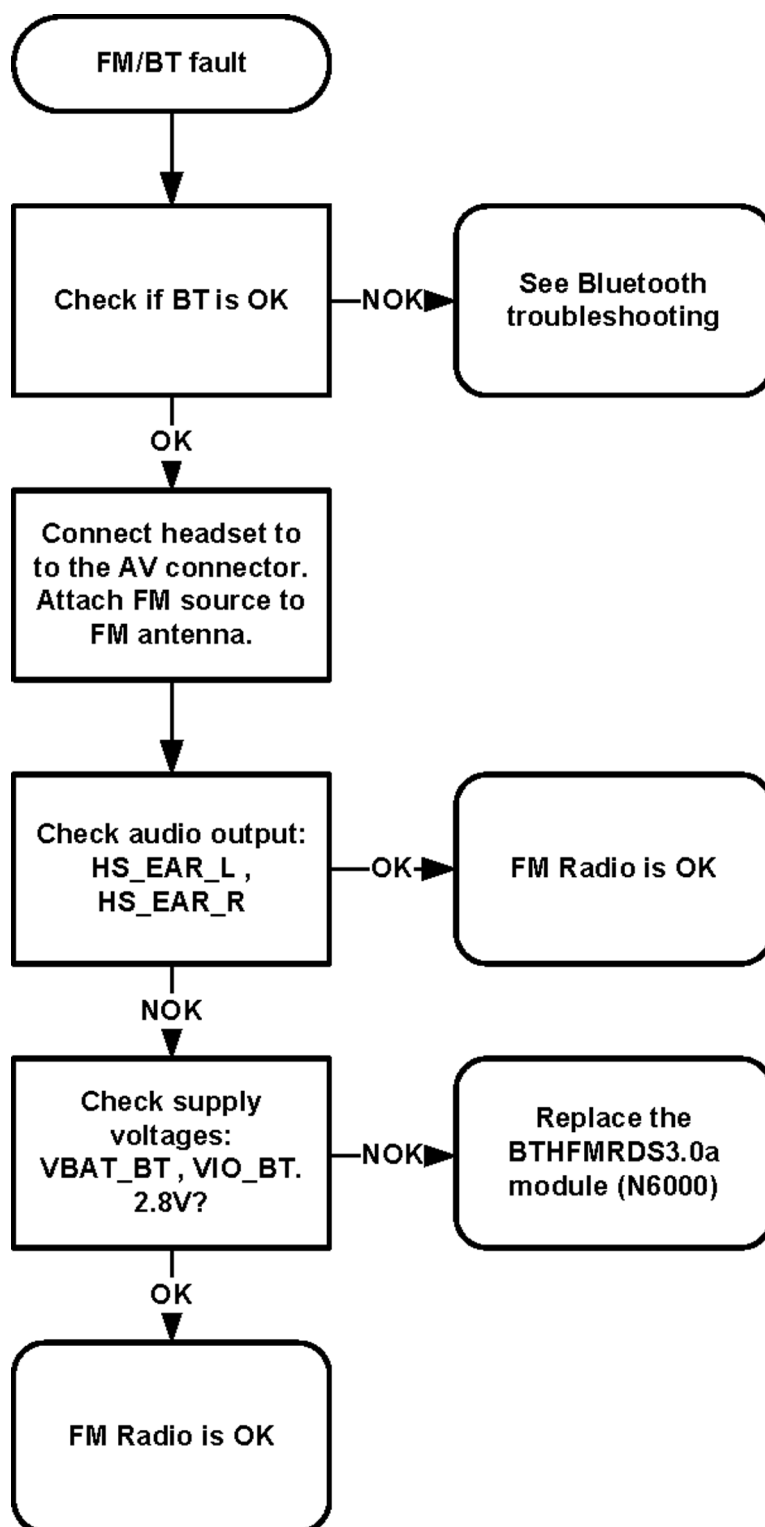
## Bluetooth troubleshooting

### Troubleshooting flow



## FM radio 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-20 or 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 2008.34/38 or newer.
- The latest phone model specific *Phoenix* data package.
- Care dongle
- SX-4 smart card (Enables BB5 testing and tuning features)
- Activated FPS-20 flash prommer **OR** FPS-21 flash prommer
- Flash update package 08.30.012 or newer for FPS-20 or FPS-21 flash prommers
- 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
- Service cable between flash prommer and CU-4

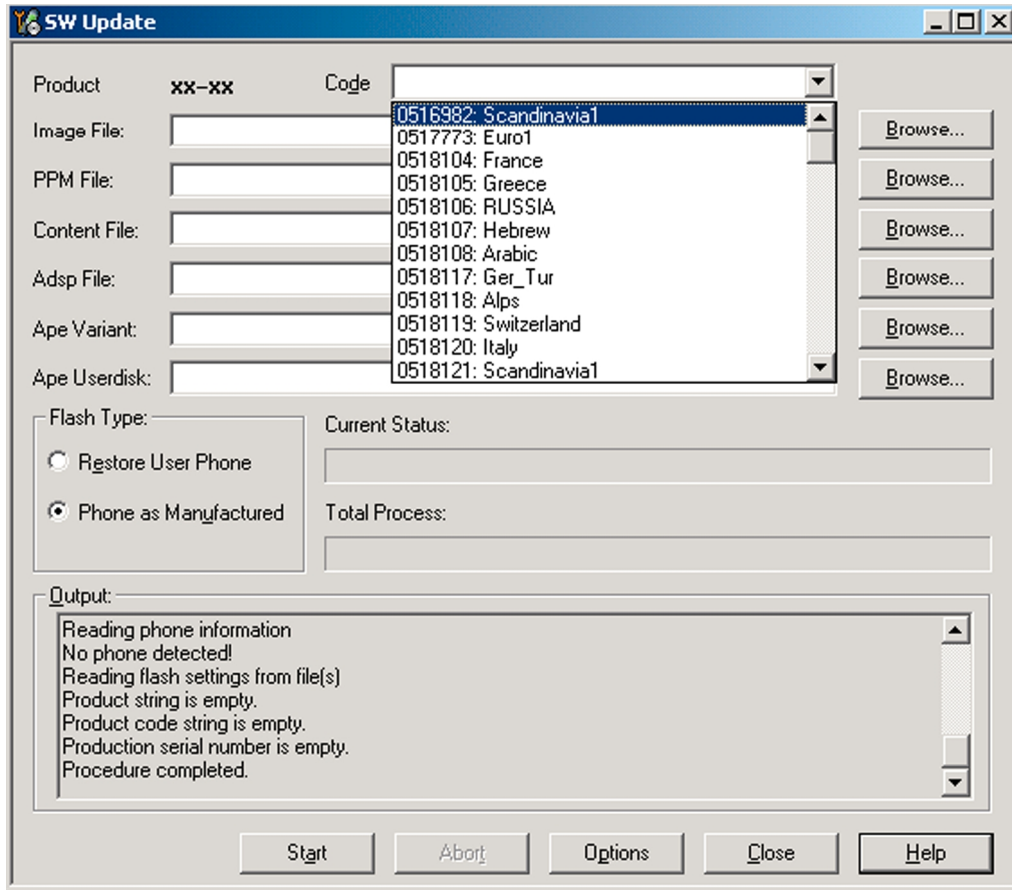
**Note:** CU-4 must be supplied with +12 V from an external power supply in all steps of certificate restoring.

#### Steps

1. Program the phone software.
  - i Start *Phoenix* and login. Make sure the connection has been managed correctly for FPS-20 or FPS-21.
  - ii Update the phone MCU software to the latest available version.

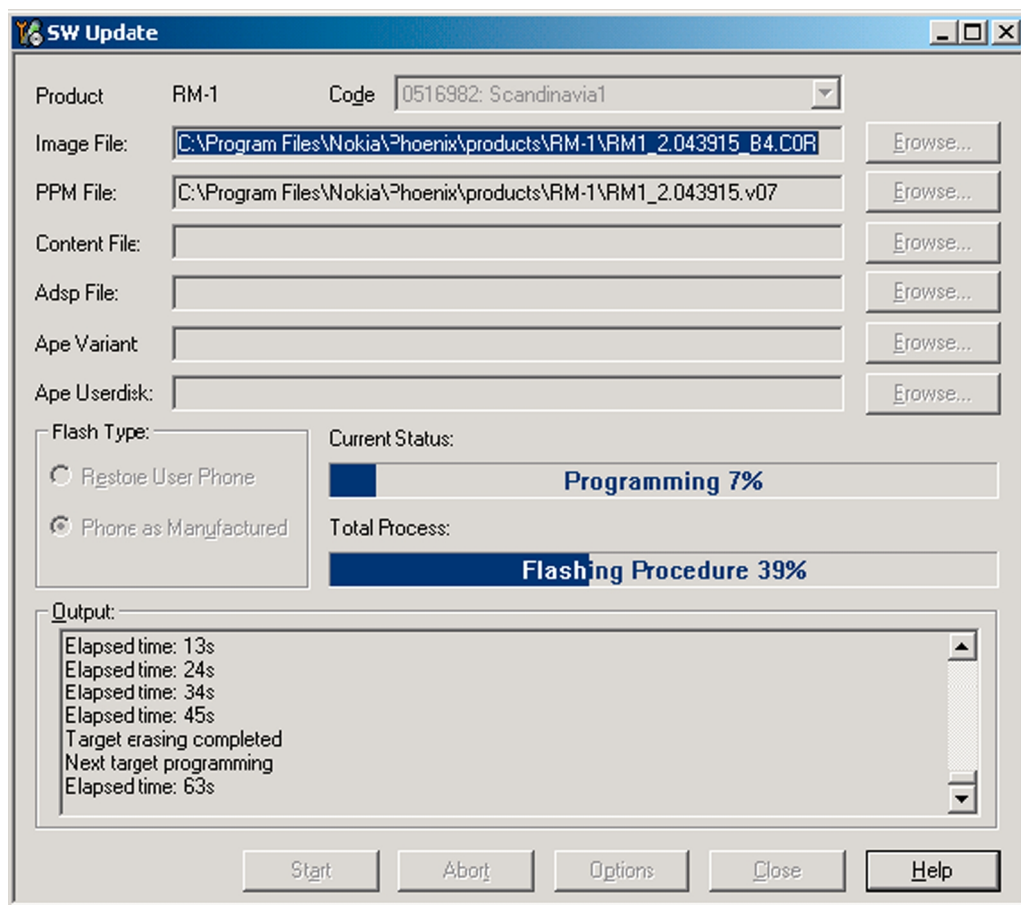
If the new flash is empty and the phone cannot communicate with *Phoenix*, reflash the phone.

- iii Choose the product manually from **File→Open Product** , and click **OK**.  
Wait for the phone type designator (e.g. "RM-1" ) to be displayed in the status bar.
- iv Go to **Flashing→SW Update** and wait until *Phoenix* reads the product data as shown in the following picture.



|                   |                                                                                                                                                                                                 |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Product</b>    | is automatically set according to the phone support module which was opened manually, but the flash files cannot be found because the correct data cannot be read from the phone automatically. |
| <b>Code</b>       | must be chosen manually, it determines the correct flash files to be used. Please choose the correct product code (can be seen in the phone type label) from the dropdown list.                 |
| <b>Flash Type</b> | must be set to <b>Phone as Manufactured</b> .                                                                                                                                                   |

- v To continue, click **Start**.  
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**.

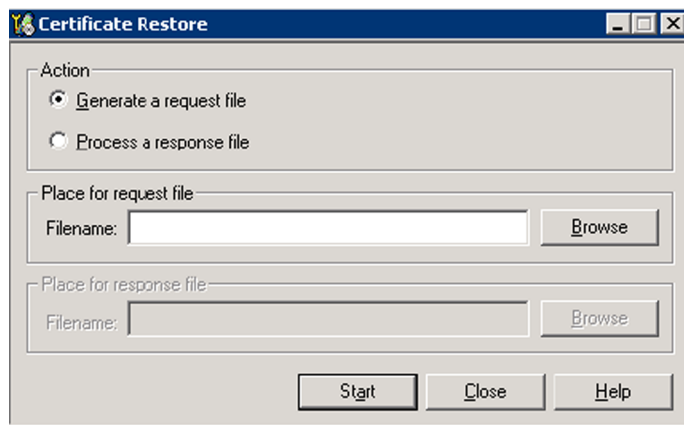
2. Create a *Request* file.

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

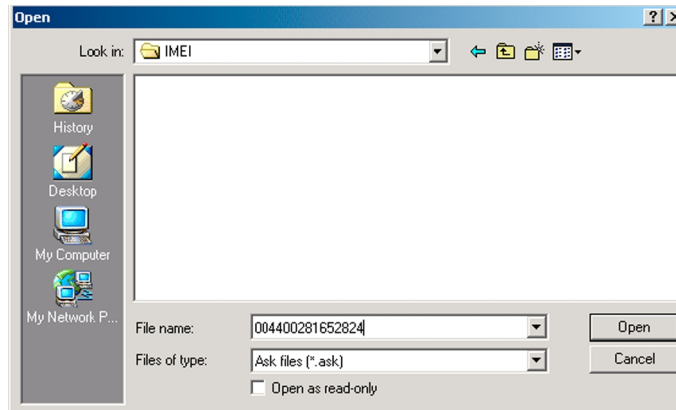
i To connect the phone with *Phoenix*, choose **File→Scan Product**.

ii Choose **Tools→Certificate Restore**.

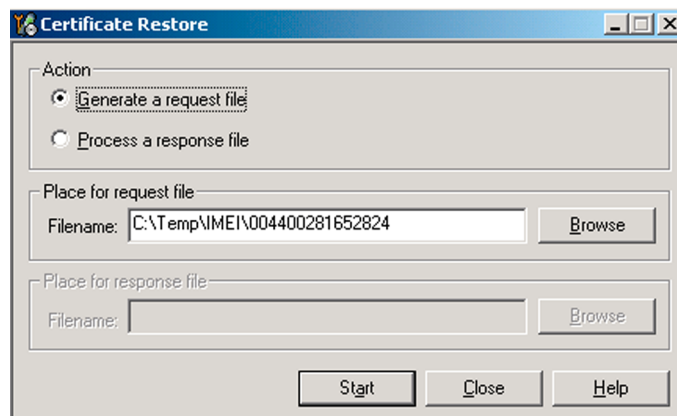
iii To choose a location for the request file, click **Browse**.



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

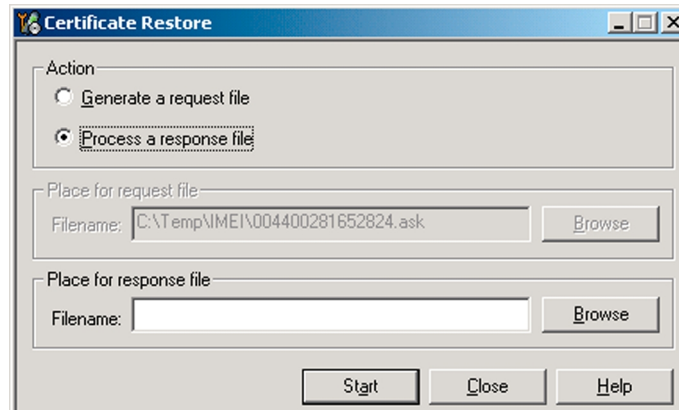


The name of the file and its location are shown.

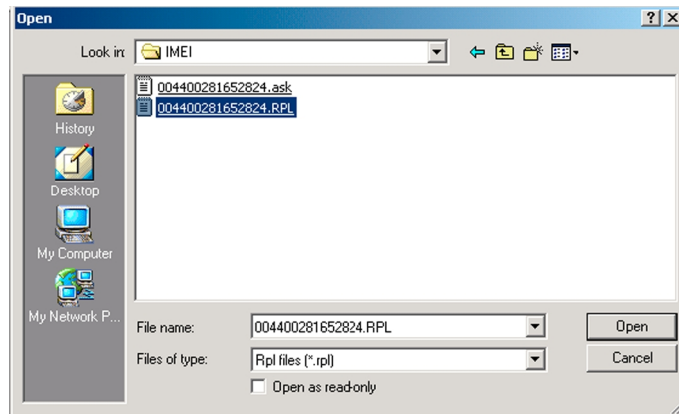


- v To create the *Request* file, click **Start**.
  - vi When the file for certificate restore has been created, send it to Nokia as an e-mail attachment.
3. Restore certificate.
- For this procedure, you must supply +12 V to CU-4 from an external power supply.
- i Save the reply file sent by Nokia 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.

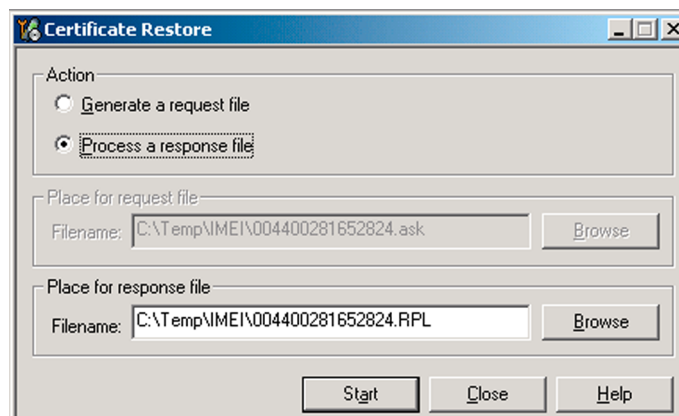


- v To choose the location where response file is saved, click **Browse**.
- vi Click **Open**.



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 10 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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- Cables: RF cable + additional product-specific Murata RF probe (MXHS83QE1000), USB cable, GBIP cable and DAU-9S cable
- Smart Card Reader with Super Dongle: SX-4 (connected to the PC)
- Radio Communication Tester (R&S CMU200 or Willtec) or separate RF signal analyser, RF signal generator and RF splitter.

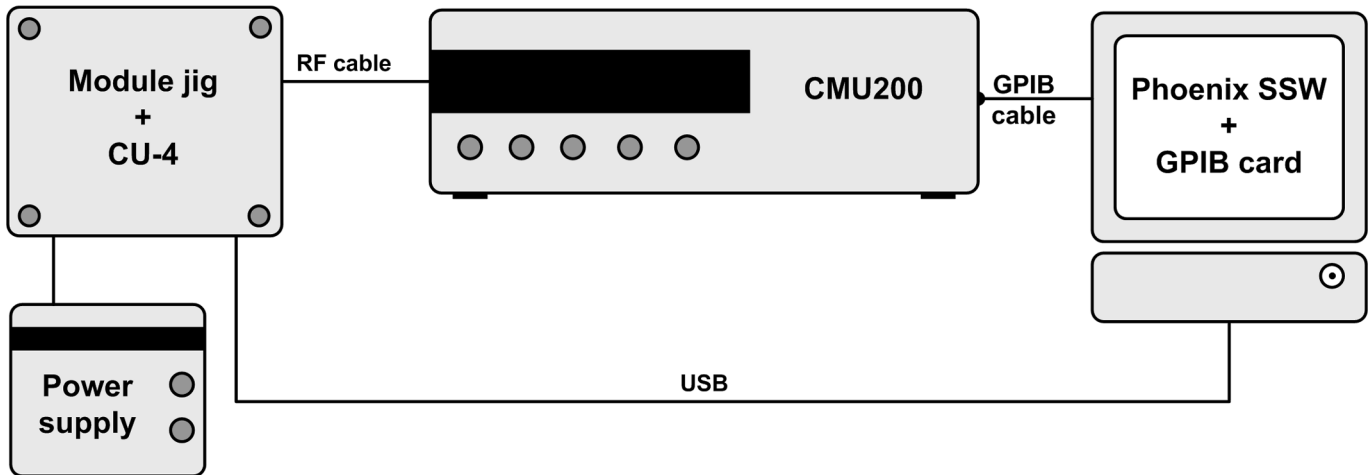


Figure 21 Auto-tuning concept with CMU200

## Phoenix preparations

Install the phone-specific data package. This defines the phone-specific settings.

## Auto-tuning procedure

- 1 Make sure the phone (in the jig) is connected to the equipment and product detected in Phoenix.
- 2 Select **Auto-Tune** from the **Tuning** menu.
- 3 Ensure that the correct cable attenuations are set in SetLoss feature, accessible in the **Tuning** menu with higher CCS dongles (not with PKD-1).
- 4 Click the *Tune* button to start auto-tuning.

## ■ RF self tests

### Running RF self tests with Phoenix

#### Prerequisites

**Caution:** The RF connector should be terminated to 50 Ohms or connected to the antenna. Check this carefully before performing the self tests, otherwise the PA may be damaged.

The order in which the self tests must be executed is specified below:

#### 1 ST\_CDSP\_RF\_BB\_IF\_TEST

**Note:** If this self test fails, all other self tests will fail even if the functionality might be OK. **Run this self test before running all others.**

#### 2 ST\_CDSP\_RF\_SUPPLY\_TEST

**Note:** If this self test fails, it might also affect all the following self tests.

#### 3 ST\_CDSP\_PLL\_PHASE\_LOCK\_TEST

**Note:** If this self test fails, it affects the **RX\_IQ\_LOOP\_BACK** self test.

#### 4 ST\_CDSP\_RX\_IQ\_LOOP\_BACK\_TEST

## 5 ST\_CDSP\_PWR\_DETECTOR\_BIAS\_TEST

**Note:** If this self test fails, the **GSM\_TX\_POWER** self test will also fail.

## 6 ST\_CDSP\_GSM\_TX\_POWER\_TEST

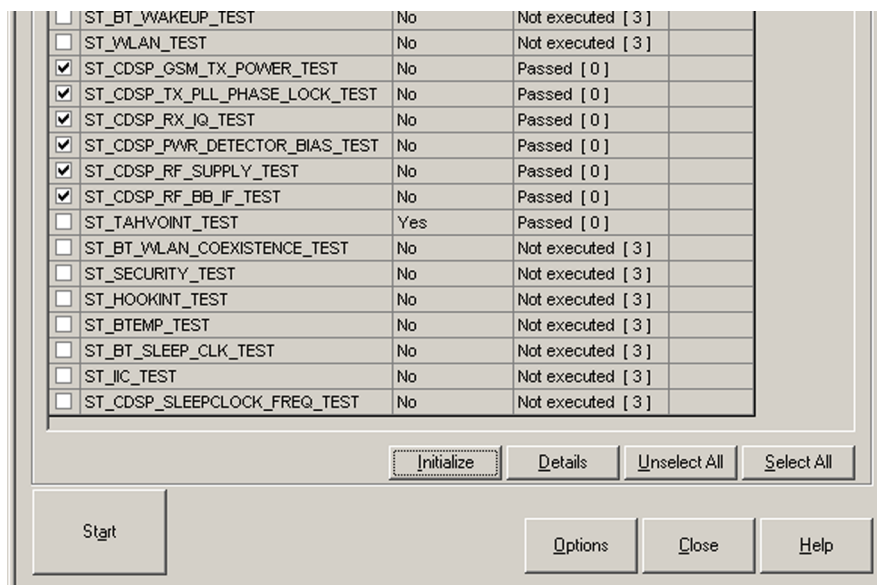
The instructions for running the tests are given below.

### Steps

1. Select in Phoenix **Testing**→**Self Tests** in Phoenix.

Check the tests shown in the figure below.

**Note:** Keep in mind the order in which the self tests should be executed.



2. Click **Details** to see the error codes.

### Next actions

If a self test result is fatal, check the error codes from [RF self test error codes \(page 4–7\)](#), and follow the instructions given in [RF self test troubleshooting overview \(page 4–9\)](#).

### RF self test error codes

If the result of the **ST\_CDSP\_RF\_BB\_IF\_TEST** is fatal, the result of all the other self tests will also be fatal. Always start troubleshooting with the **ST\_CDSP\_RF\_BB\_IF\_TEST**.

### ST\_CDSP\_RF\_BB\_IF\_TEST result is fatal

| Error code               | Error code | Comment                        |
|--------------------------|------------|--------------------------------|
| ST_RFBUS_WRITE_READ_FAIL | (0x0040)   | RF bus write/read test failed. |

### ST\_CDSP\_RF\_SUPPLY\_TEST result is fatal

| Error code           | Error code | Comment                           |
|----------------------|------------|-----------------------------------|
| ST_VBAT_OUT_OF_RANGE | (0x0001)   | VBat voltage is not within range. |

**ST\_CDSP\_PLL\_PHASE\_LOCK\_TEST result is fatal**

| Error code     | Error code | Comment             |
|----------------|------------|---------------------|
| ST_TX_PLL_FAIL | (0x0008)   | Tx PLL test failed. |

**ST\_CDSP\_RX\_IQ\_LOOP\_BACK\_TEST result is fatal**

| Error code           | Error code | Comment                   |
|----------------------|------------|---------------------------|
| ST_RX_IQ_TEST_FAILED | (0x0001)   | Break in Rx signal chain. |

**ST\_CDSP\_PW\_DETECTOR\_BIAS\_TEST result is fatal**

| Error code                  | Error code | Comment                                  |
|-----------------------------|------------|------------------------------------------|
| ST_PWR_VALUE_OUTSIDE_LIMITS | (0x0004)   | Power detector values outside the range. |

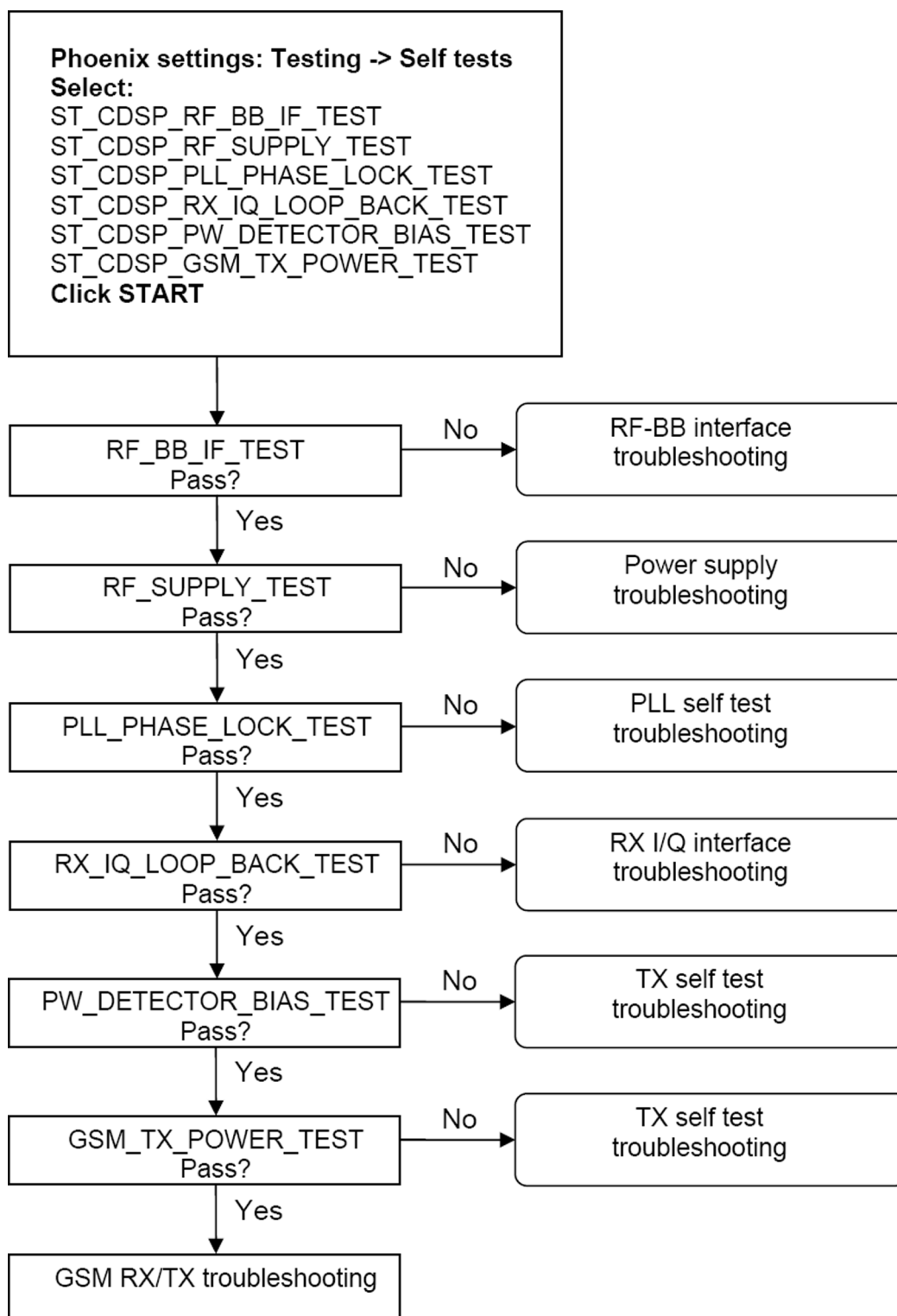
**ST\_CDSP\_GSM\_TX\_POWER\_TEST result is fatal**

| Error code              | Error code | Comment                              |
|-------------------------|------------|--------------------------------------|
| ST_GSM900_TX_PWR_LOW    | (0x0001)   | GSM900 Tx power is under threshold.  |
| ST_GSM1800_TX_PWR_LOW   | (0x0002)   | GSM1800 Tx power is under threshold. |
| ST_GSM1900_TX_PWR_LOW   | (0x0004)   | GSM1900 Tx power is under threshold. |
| ST_GSM900_ADC_OVERFLOW  | (0x0010)   | GSM900 ADC overflow.                 |
| ST_GSM1800_ADC_OVERFLOW | (0x0020)   | GSM1800 ADC overflow.                |
| ST_GSM1900_ADC_OVERFLOW | (0x0040)   | GSM1900 ADC overflow.                |

## Troubleshooting with RF self tests

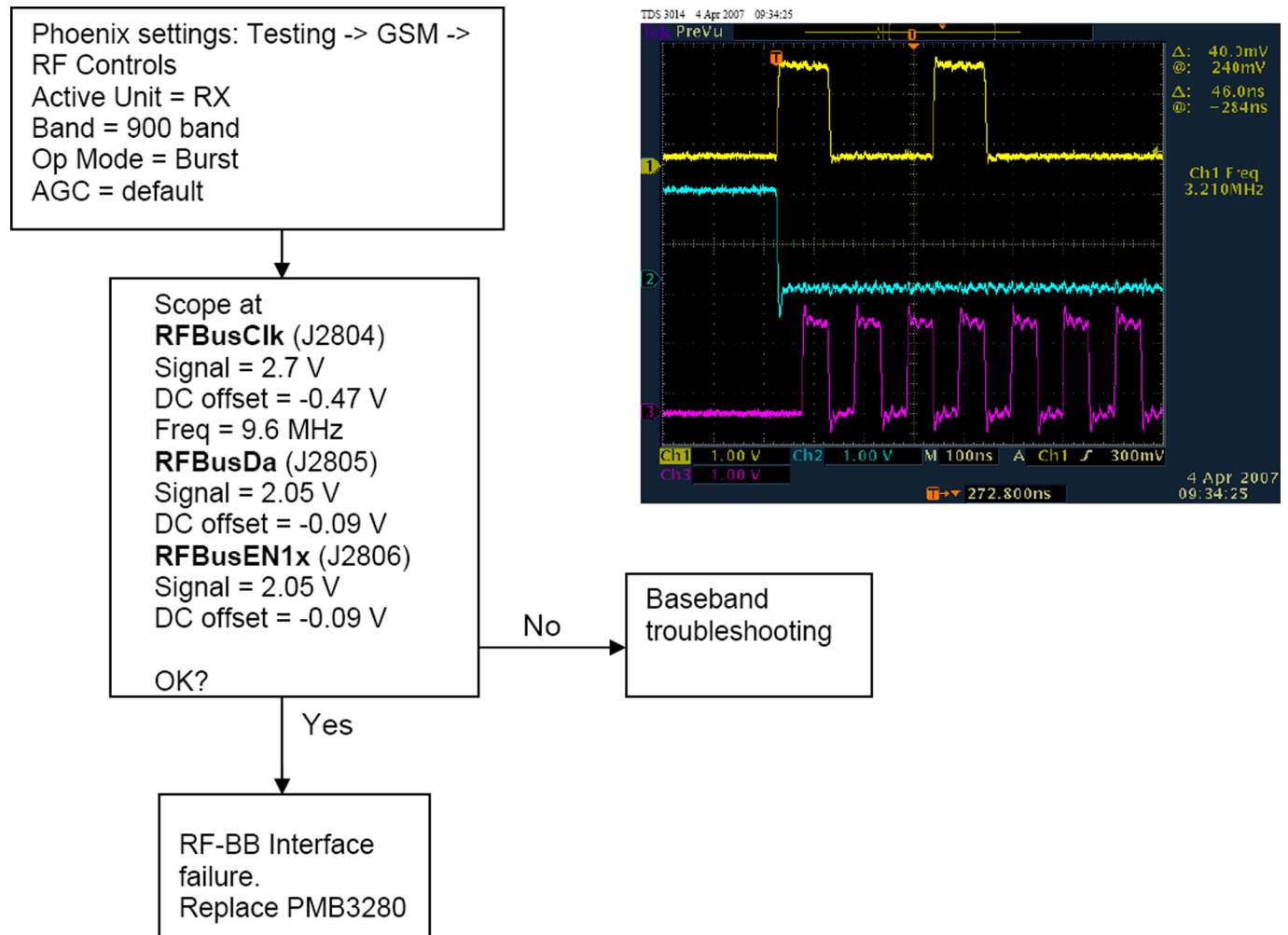
### RF self test troubleshooting overview

#### Troubleshooting flow



## RF-BB interface troubleshooting (ST\_CDSP\_RF\_BB\_IF\_TEST)

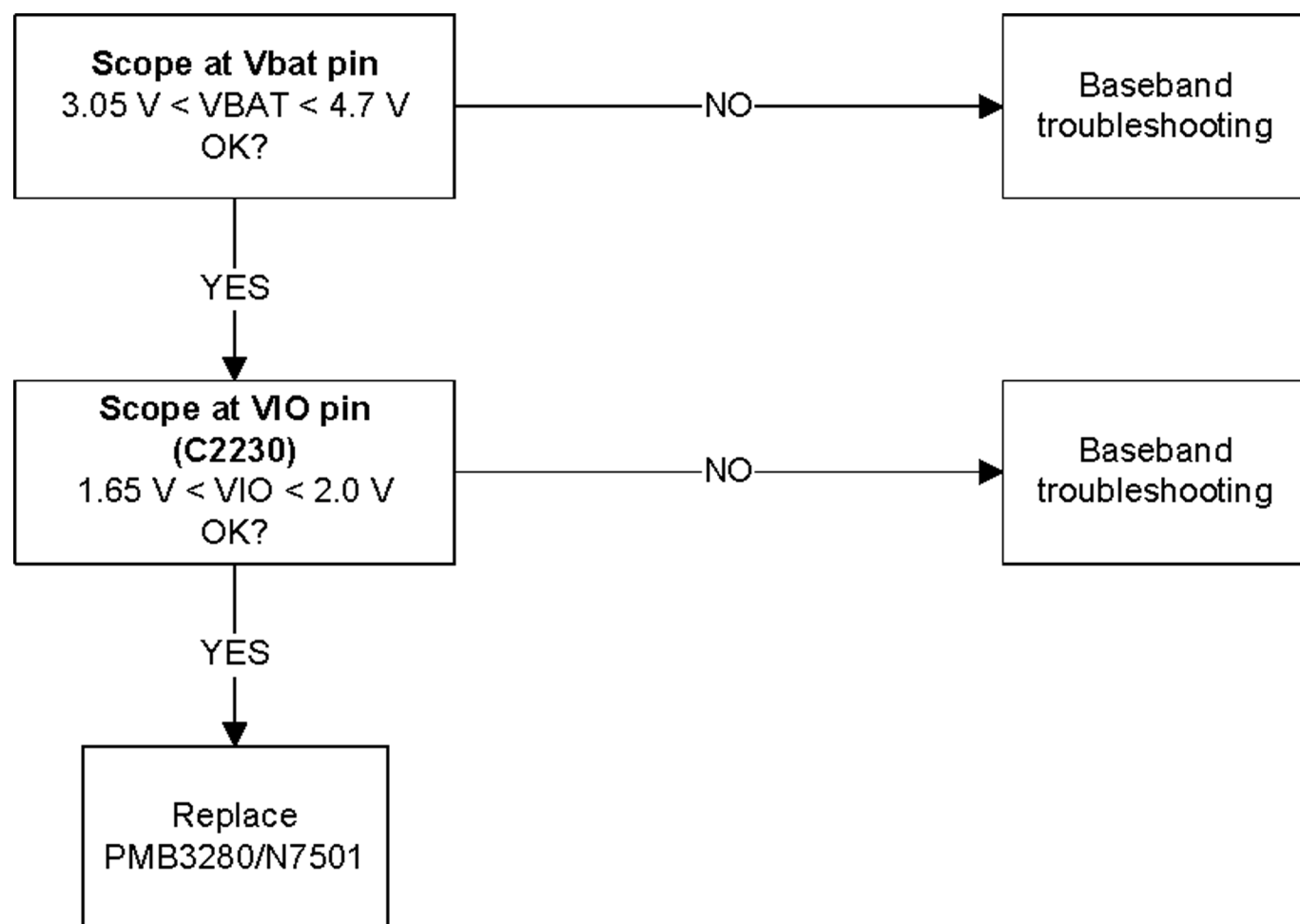
### Troubleshooting flow





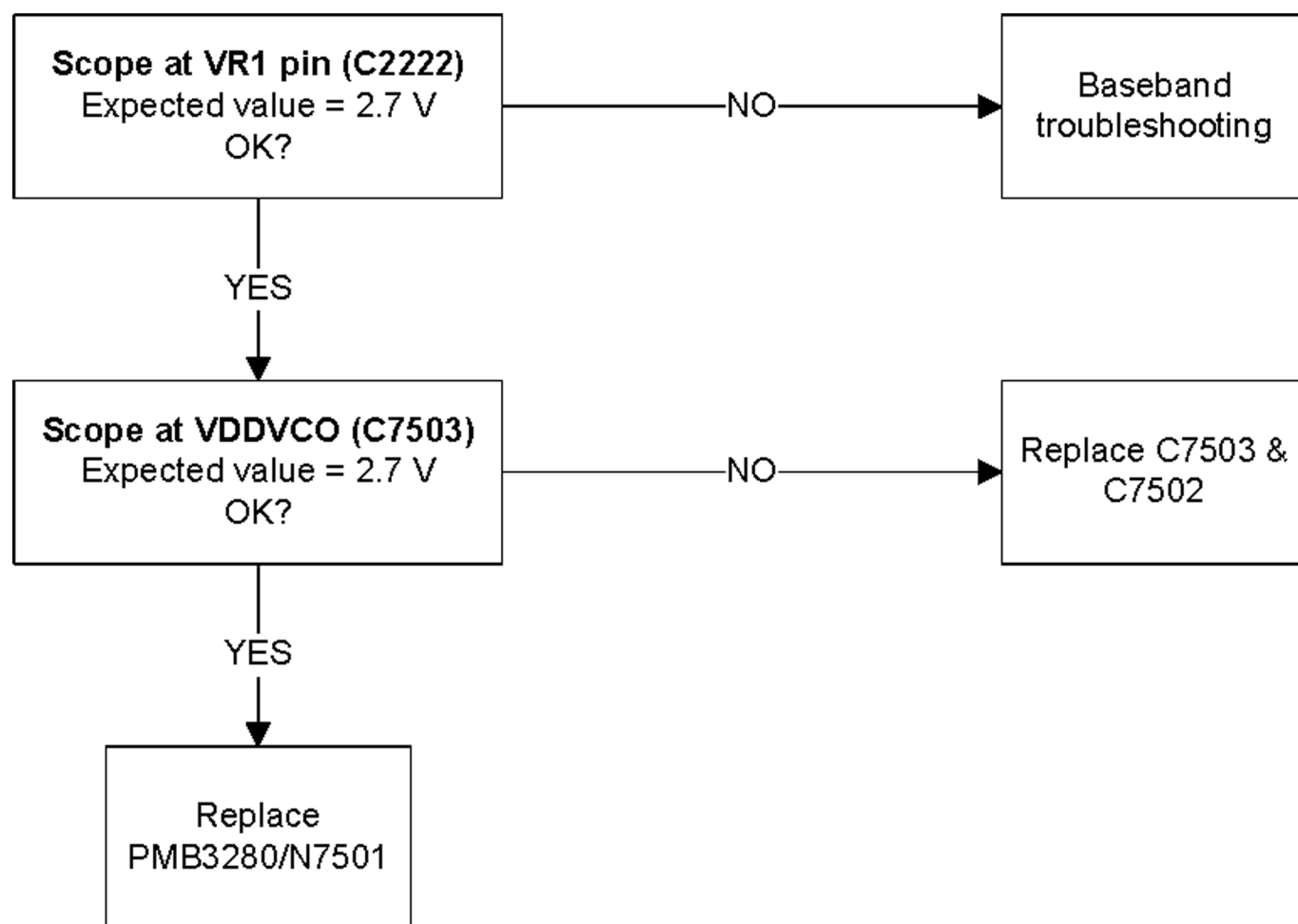
*Power supply troubleshooting (ST\_CDSP\_RF\_SUPPLY\_TEST)*

**Troubleshooting flow**



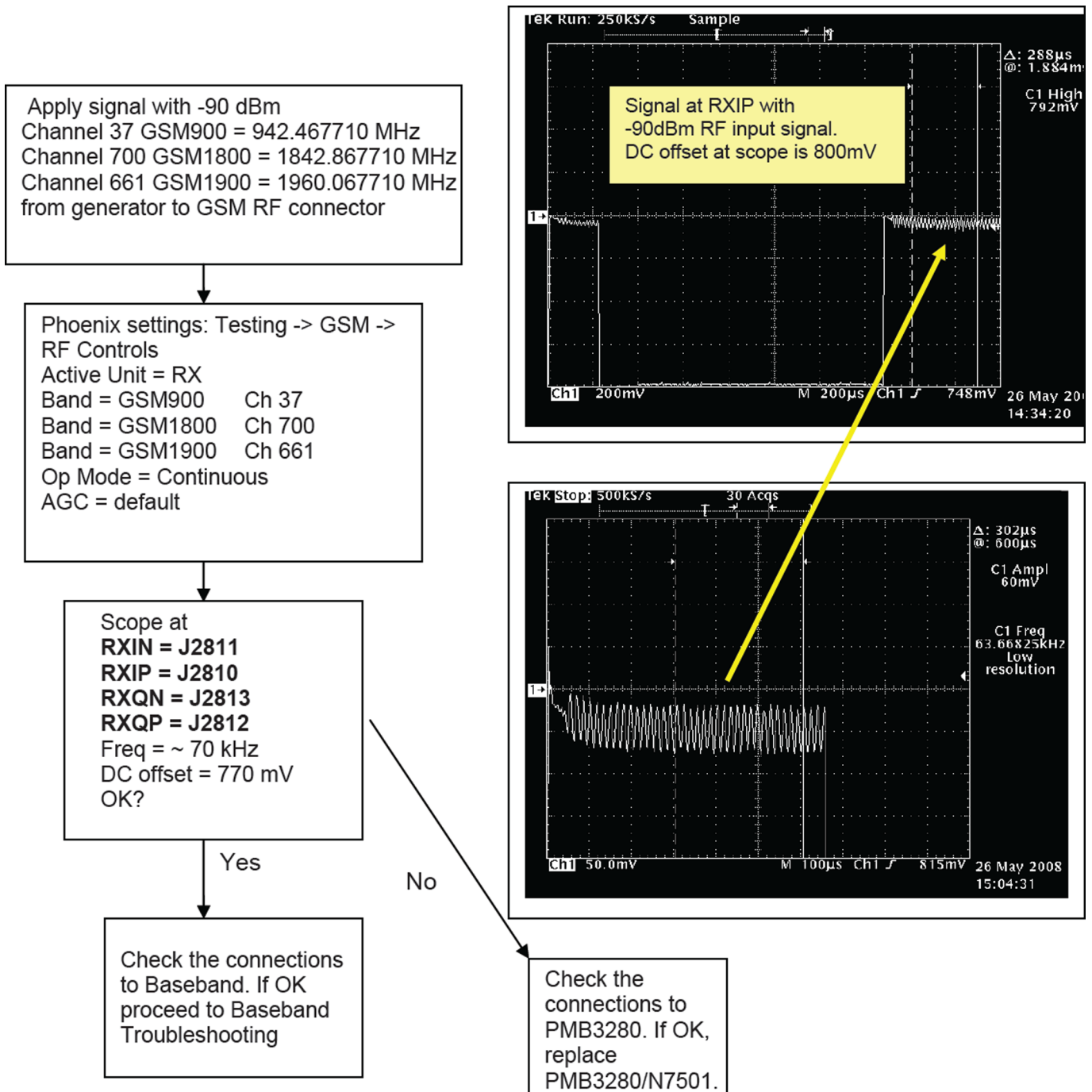
*PLL self test troubleshooting (ST\_CDSP\_PLL\_PHASE\_LOCK\_TEST)*

**Troubleshooting flow**



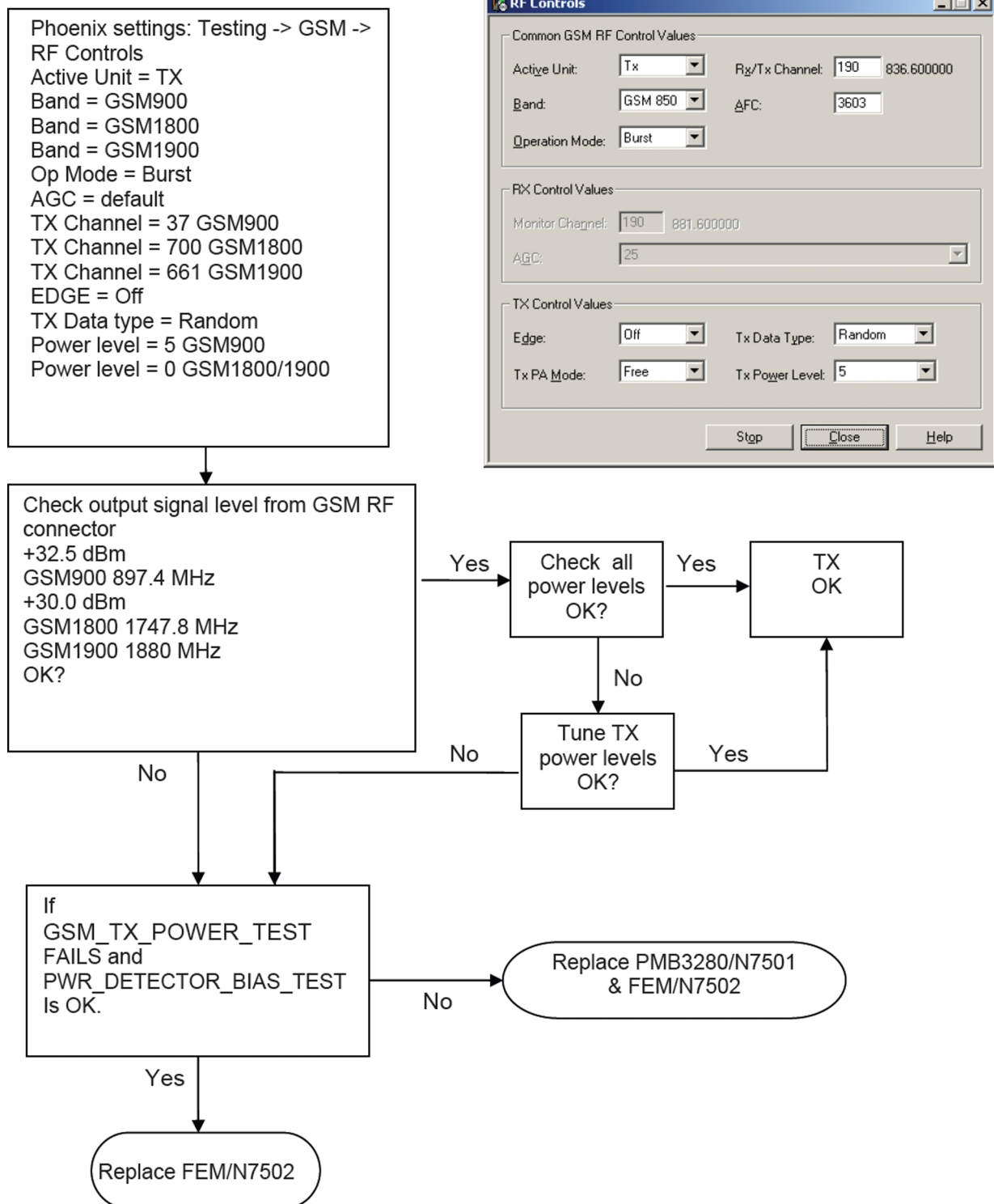
## ***RX IQ interface troubleshooting (ST\_CDSP\_RX\_IQ\_LOOP\_BACK\_TEST)***

### **Troubleshooting flow**



***TX selftest troubleshooting (ST\_CDSP\_PWR\_DETECTOR\_BIAS\_TEST and ST\_CDSP\_GSM\_TX\_POWER\_TEST)***

**Troubleshooting flow**



## ■ Receiver troubleshooting

### Introduction to 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 \(page 4–15\)](#).

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

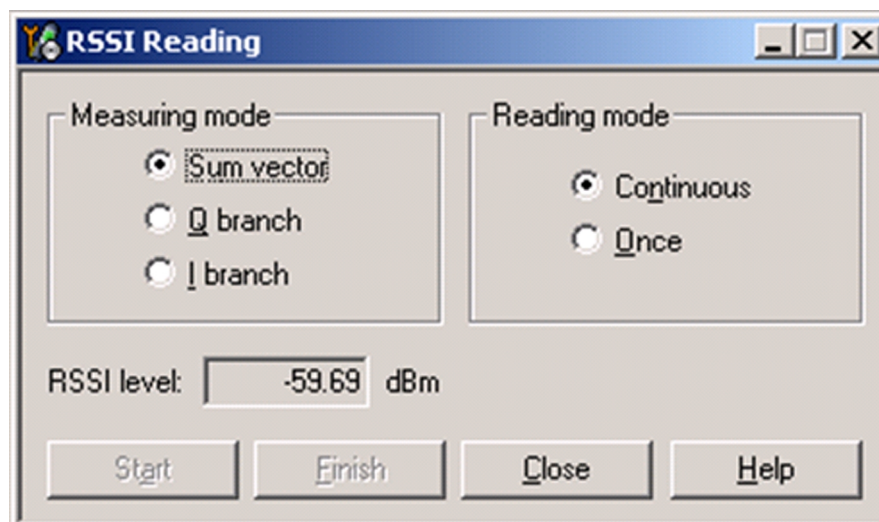
#### Prerequisites

Make the following settings in Phoenix service software:

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

#### Steps

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



#### Results

The reading should reflect the level of the signal generator (-losses) +/- 1dB.

When varying the level in the range -30 to -102 dBm, the reading should then follow within +/-2 dB.

## ■ Transmitter troubleshooting

### General instructions for 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 Ohm load to the RF connector (antenna, RF measurement equipment or at least a 2 Watt dummy load); otherwise the GSM PA may be damaged.

## GSM transmitter troubleshooting

### Steps

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

Use the following settings:

**RF Controls**

Common GSM RF Control Values

Active Unit: **Tx** Rf/Tx Channel: **37** 897.400000

Band: **GSM 900** AFC: **-28**

Operation Mode: **Burst**

RX Control Values

Monitor Channel: **37** 942.400000

AGC: **22**

TX Control Values

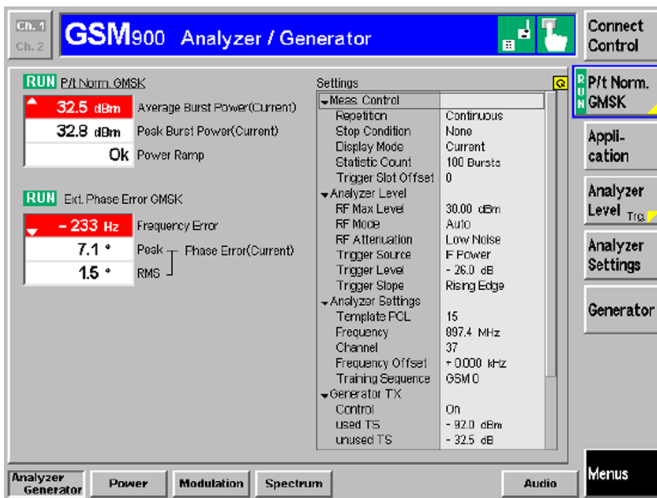
Edge: **Off** Tx Data Type: **Random**

Tx PA Mode: **High** Tx Power Level: **5**

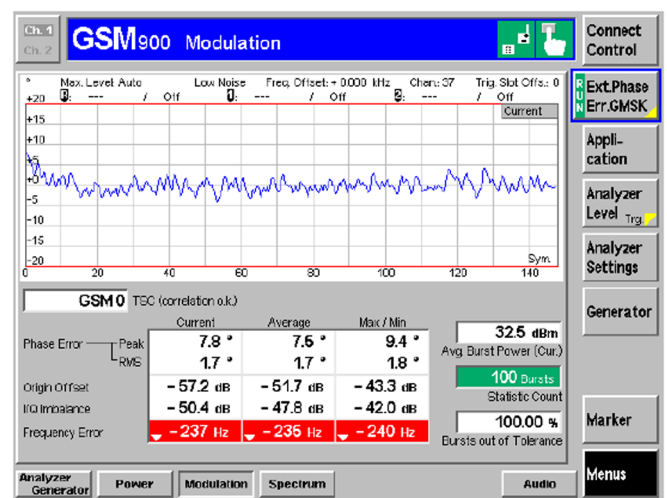
Stop Close Help

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

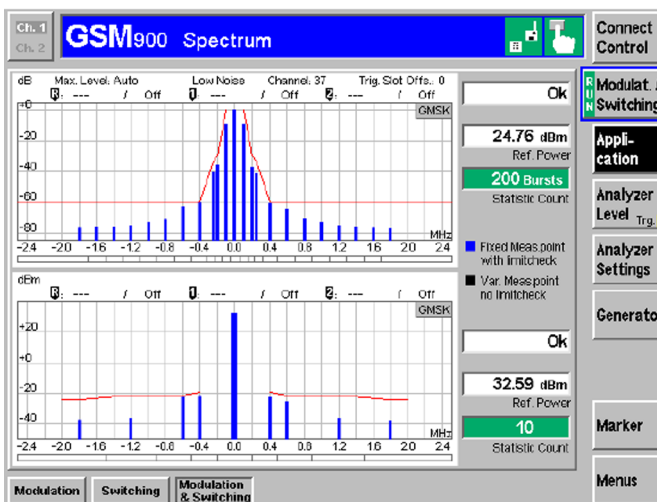
Analyzer settings:



Phase error:



Modulation-/Switching spectrum:



Power / burst:

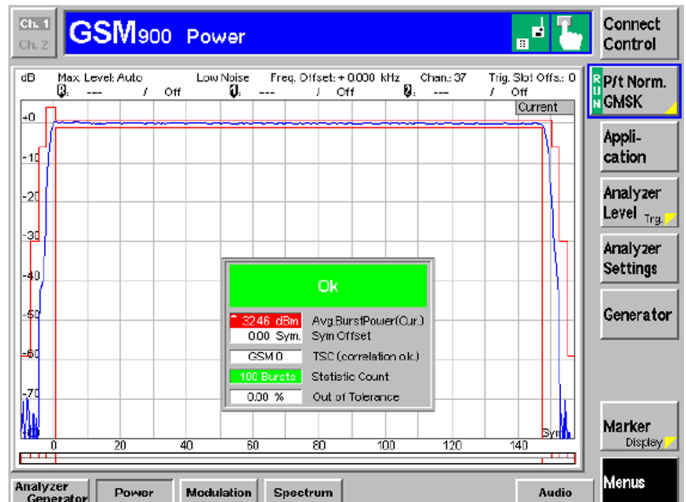


Figure 22 Typical readings

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

## Next actions

You can troubleshoot the GSM transmitter for each GSM band separately, one band at a time. If you want to troubleshoot GSM1800 or GSM1900, change the band with the RF controls and set the communication analyser accordingly.

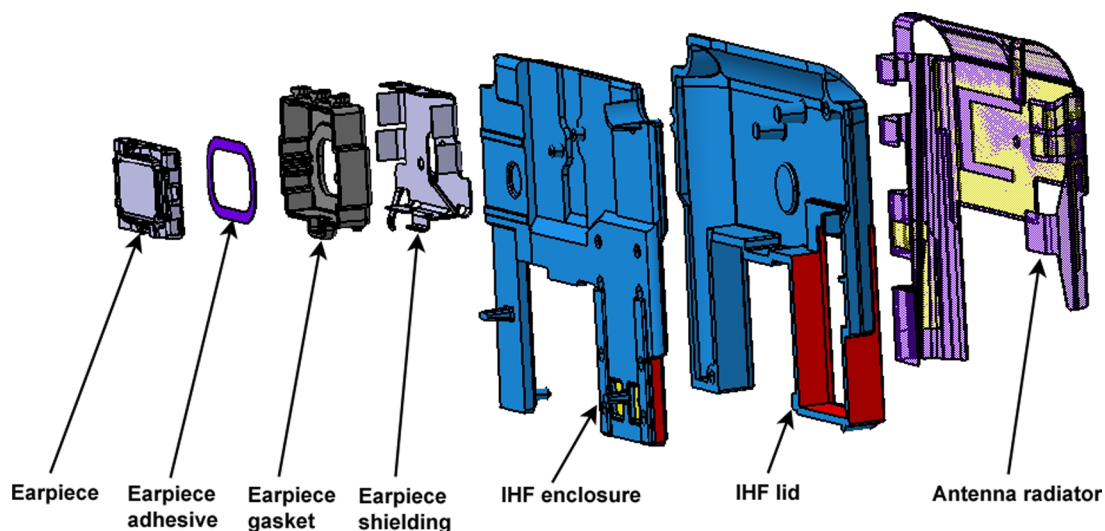
## Antenna

### Checking antenna functionality

#### Antenna overview

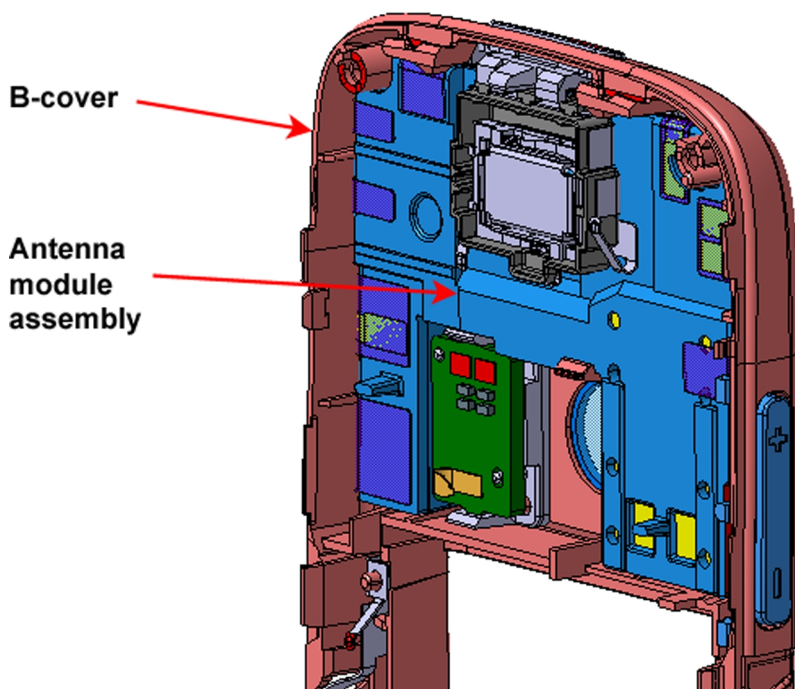
Both antennas (GSM and Bluetooth) and the IHF are integrated into the same antenna module assembly. Clips on the main PWB provide the connection to the antenna module.





**Figure 23 Antenna module assembly**

The antenna module assembly is attached to the B-cover.



**Figure 24 Antenna module assembly attached to the B-cover**



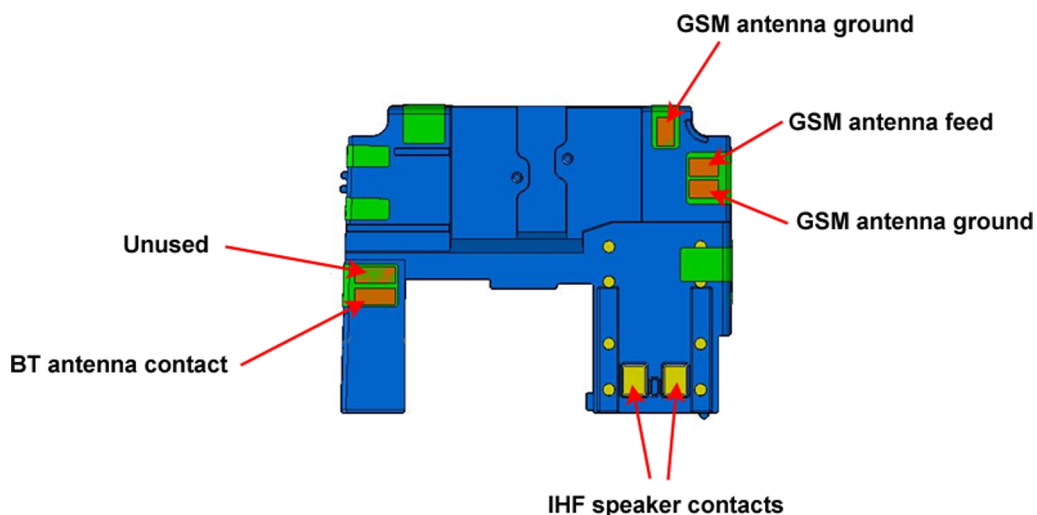


Figure 25 Antenna components and contacts

### Main antenna functionality

The main GSM antenna is functioning normally when the antenna module assembly is visually intact in the B-cover and PWB, and the antenna radiator is visually intact in the antenna module assembly.

The main antenna functionality must also be checked by measuring the transmitted power with RF coupler at:

- GSM900 channel 124
- GSM1800 channel 885
- GSM1900 channel 810

### BT antenna functionality

The BT antenna is functioning normally when the antenna spring clips take proper contact to PWB.

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## **5 — System Module and User Interface**

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## ■ Introduction

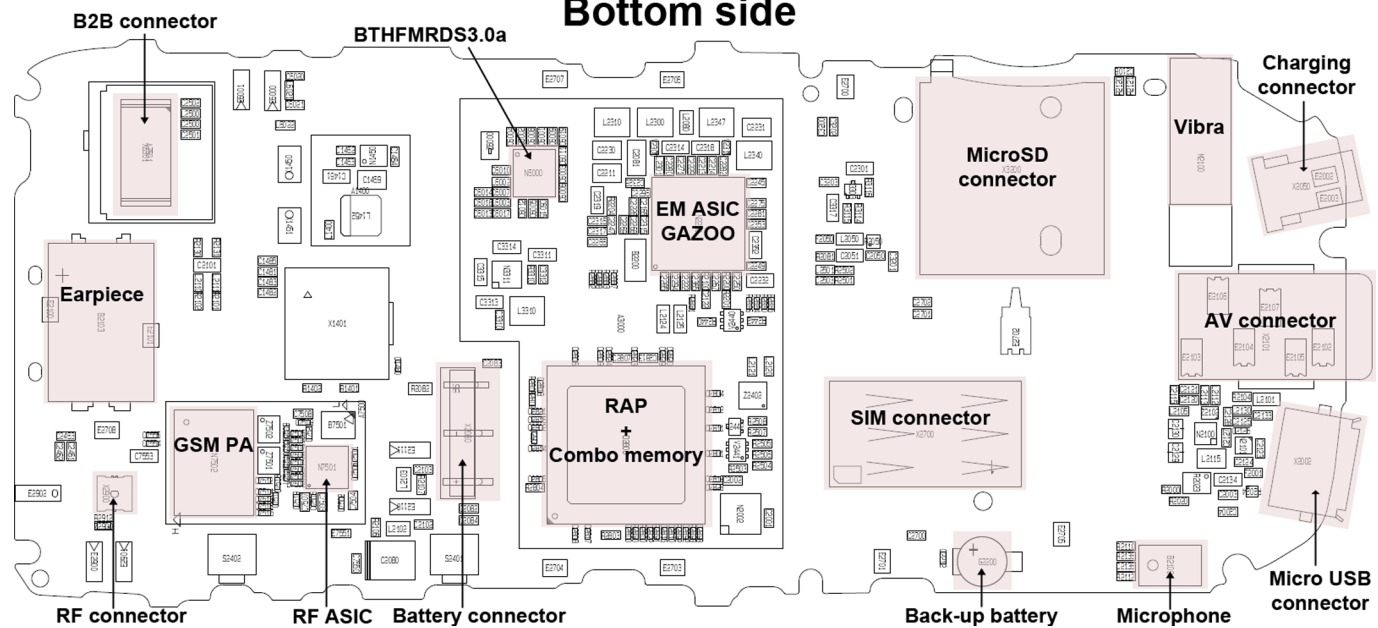
### Phone description

RAPs2 is the main digital baseband ASIC in the phone. It contains functionality for the GSM EDGE.  
N2200 (GAZ00) is the main audio and energy management controller for the phone.

### Key components

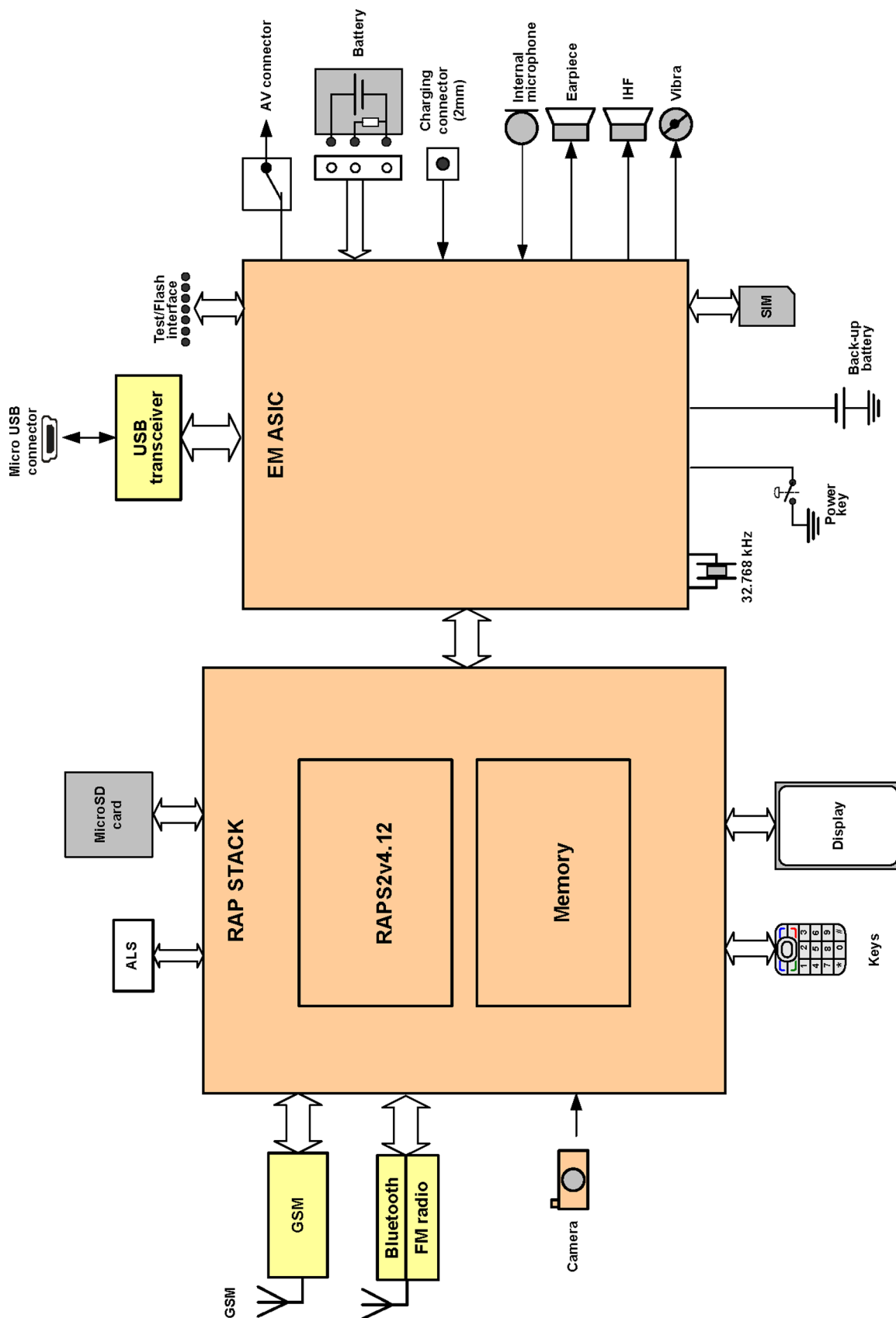
| Function               | Description                                                         | Item ref |
|------------------------|---------------------------------------------------------------------|----------|
| Main board             | 3FJA                                                                |          |
| Flash PWB              | 2AHA                                                                |          |
| Energy management ASIC | Pearl/Gazoo                                                         | N2200    |
| RF ASIC                | RFIC Hugin PM                                                       | N7501    |
| Processor              | RAPs2 (v4.12)                                                       | D2800    |
| PA GSM                 | Front end module (FEM), triband (GSM900/1800/1900)                  | N7502    |
| RF connector           |                                                                     | X2900    |
| Memory                 | 1 Gbit M3 NAND Flash + 512 Mbit DDR RAM Combo (stacked with RAP3GS) | D3000    |
| Bluetooth              | BTHFMRDS3.0a                                                        | N6000    |
| FM radio               | BTHFMRDS3.0a                                                        | N6000    |
| Battery                | BL-5CT 1050 mAh                                                     |          |
| Battery connector      | Tabby interface                                                     | X2080    |
| Back-up battery        |                                                                     | G2200    |
| B2B connector          |                                                                     | X6301    |
| Micro USB connector    | For data and audio                                                  | X2002    |
| MicroSD connector      |                                                                     | X3200    |
| SIM connector          |                                                                     | X2700    |
| Charging connector     |                                                                     | X2050    |
| AV connector (3.5 mm)  |                                                                     | X2101    |
| Earpiece               |                                                                     | B2103    |
| Microphone             |                                                                     | B2100    |
| Vibra                  |                                                                     | M2100    |

## Top side

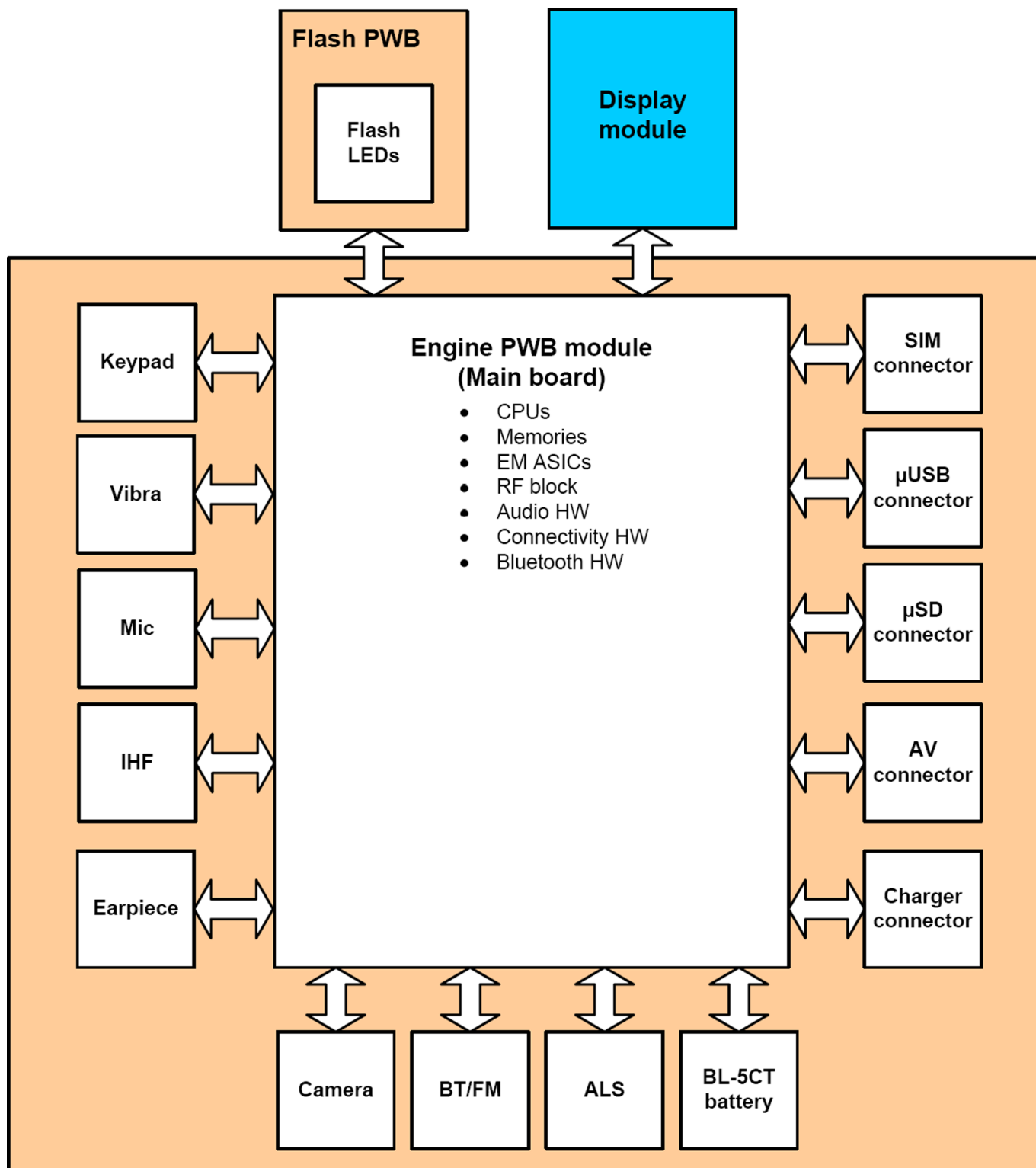




## System module block diagram



## Board and module connections



## ■ Energy management

### Battery and charging

#### BL-5CT battery

The phone is powered by a 3-pole BL-5CT 1050 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.

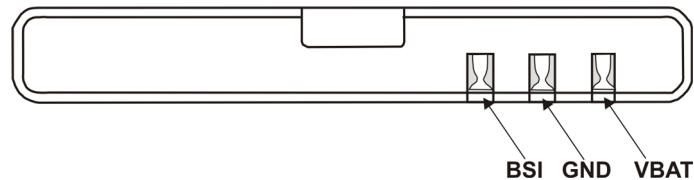


Figure 26 Battery pin order

The battery temperature is estimated by measuring separate battery temperature NTC via the BTEMP line. This is located on the main PWB, at the place where the phone temperature is closest to the battery temperature.

#### 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.

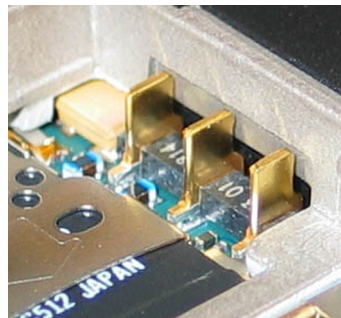


Figure 27 Blade battery connector

#### Charging

This phone is charged through the smaller Nokia standard interface (2.0 mm plug). The wider standard charger (3.5 mm) can be used together with the CA-44 charger adapter.



Figure 28 Small (right) and wide (left) charger plugs

The phone can also be charged through the micro USB interface.

Charging is controlled by energy management, and external components are needed to protect the baseband module against EMC, reverse polarity and transient frequency deviation.

### Charging a dead battery

Charging of a dead battery has to be carried out via an approved NOKIA charger. Charging of a dead battery via a PC is not allowed since this procedure is not including a current regulator (the battery can be charged with a too high current level).

### Normal and extreme voltages

Energy management is mainly carried out in the EM ASIC (N2200). that contains a number of regulators. In addition there are also some external regulators.

In the table below normal and extreme voltages are shown when a BL-5CT battery is used.

Table 11 Nominal voltages

| Voltage                                   | Voltage [V] | Condition |
|-------------------------------------------|-------------|-----------|
| General Conditions                        |             |           |
| Nominal voltage                           | 4.0         |           |
| Lower extreme voltage                     | 3.1         |           |
| Higher extreme voltage<br>(fast charging) | 4.2         |           |
| HW Shutdown Voltages                      |             |           |
| V <sub>mstr+</sub>                        | 2.1 ± 0.1   | Off to on |
| V <sub>mstr-</sub>                        | 1.9 ± 0.1   | On to off |
| SW Shutdown Voltages                      |             |           |
| Sw shutdown                               | 3.1         | In call   |
| Sw shutdown                               | 3.2         | In idle   |
| Min Operating Voltage                     |             |           |
| V <sub>coff+</sub>                        | 2.9 ± 0.1   | Off to on |
| V <sub>coff-</sub>                        | 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 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 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 N2200 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 RESET 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.                                                                                                                                                                                                                                                                |

## ■ Connectivity

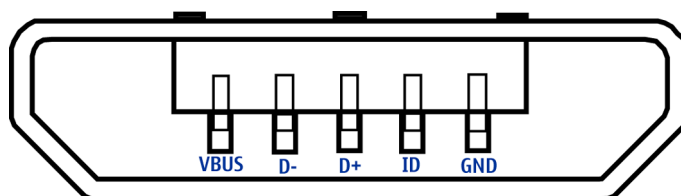
### Micro USB interface

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.

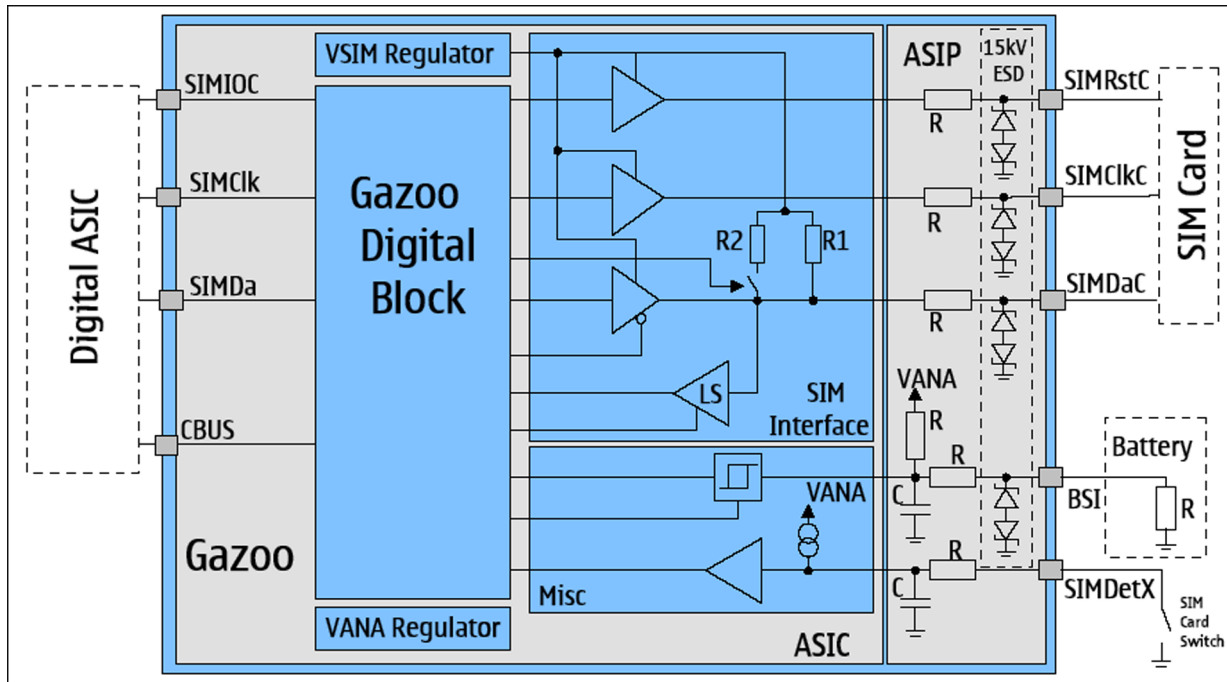
This phone is provided with a specific connector for µUSB.



### SIM interface

The phone has a SIM (Subscriber Identification Module) interface including a SIM connector. The connector is only accessible when the battery is removed.

The interface is located in two ASICs; RAPS2v4.12 contains most of the interface functionality and MS ASIC takes care of card power up/down, card detect, ATR counting and level shifting functions.



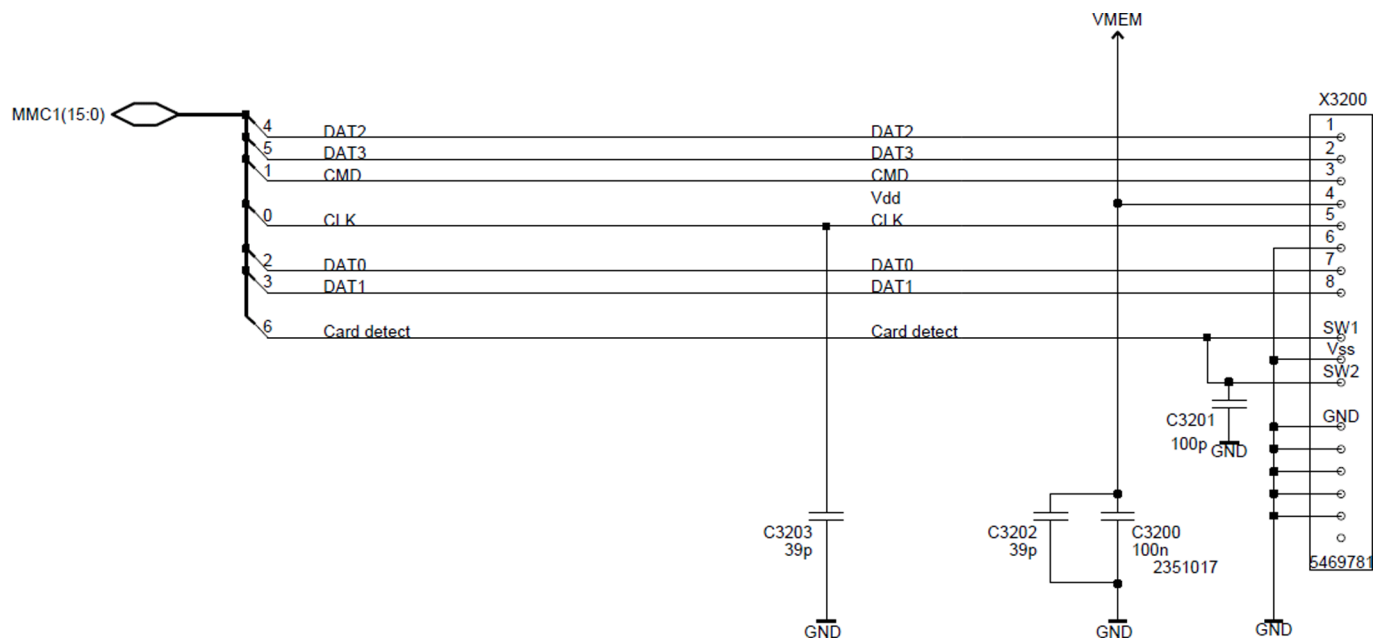
**Figure 29 SIM interface**

The SIM interface supports 1.2V, 1.8V and 3V technology smart cards.

## MicroSD card interface

The microSD card is connected to the engine via SD IF of the RAPS.

The card removal is detected by a push detect switch.



### Figure 30 MicroSD card engine interface

## Charger interface

The charger interface is a 2 mm Dynamo charger plug. Older chargers with a 3.5 mm plug are supported via the charger adapter cable CA-44.

Charging is controlled by EM ASIC. Additional external components are needed for EMC purposes, reverse polarity and transient protection of the input to the baseband module.

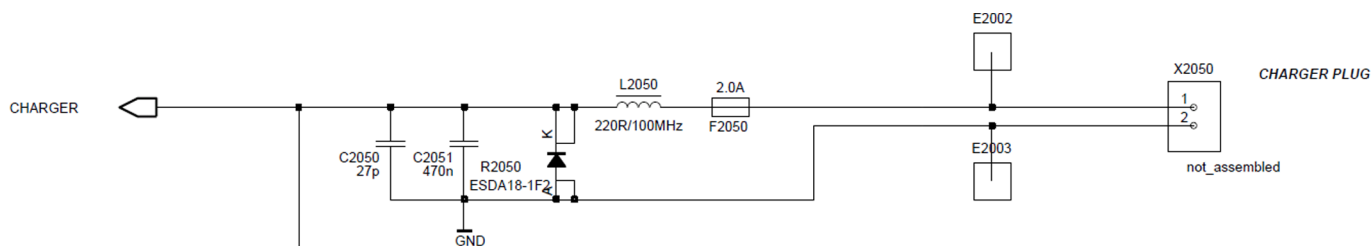


Figure 31 Charger interface

## AV connector

The 3.5 mm AV connector consists of mono or stereo audio output, mono audio input and optional features like control data over microphone line.

A connected male connector is detected on pin 6 (PLUG\_DET).

Accessories are detected as basic headset (no ECI) or as intelligent ECI communication devices.

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

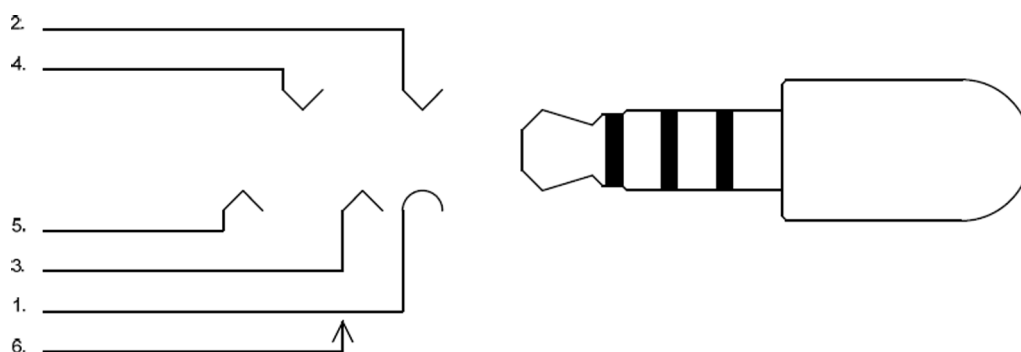


Figure 32 AV connector pin layout

Table 12 AV connector pins

| Pin  | Signal name | Direction | Description                                                                          |
|------|-------------|-----------|--------------------------------------------------------------------------------------|
| 1, 2 | HS_GND      | -         | Ground contacts                                                                      |
| 3    | HS_MIC      | Input     | Multiplexed microphone audio and control data/muxed: MIC2P and ACI, control: GenIO34 |
| 4    | HS_EAR_R    | Output    | Audio output (XEAR_R)                                                                |
| 5    | HS_EAR_L    | Output    | Audio output (XEAR_L)                                                                |
| 6    | PLUG_DET    | Input     | Terminal internal connection, plug detection/ GenIO 33                               |

## Bluetooth interface

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 BTHFMRDS module.

Bluetooth is physically integrated with FM radio in the BTHFM module ASIC, but from a functional point of view they have nothing in common.

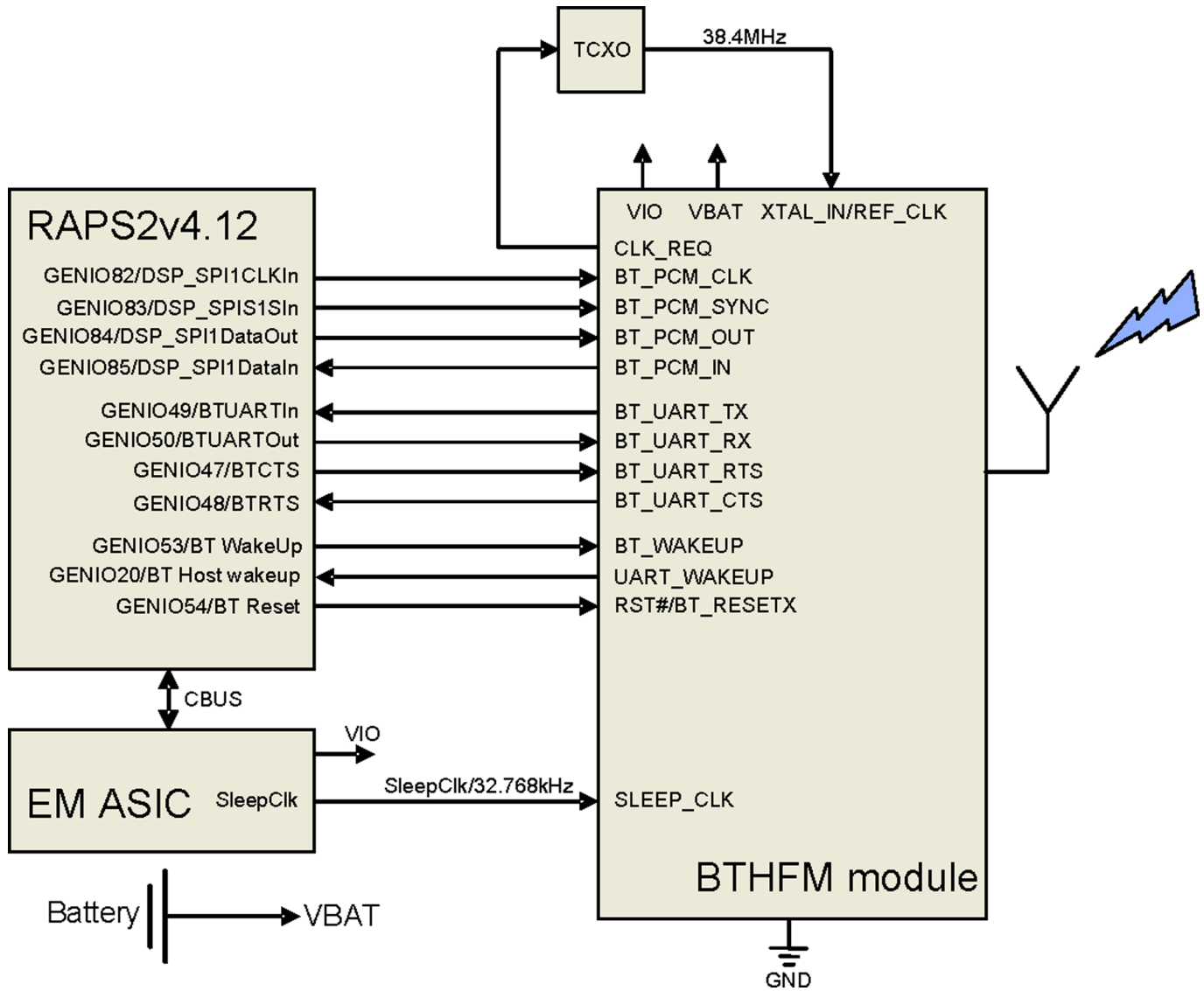


Figure 33 Bluetooth interface

The BTHFMRDS module is powered by VBAT or 1.8V.

An UART (universal asynchronous receiver/transmitter) is used for data communication and controls for both Bluetooth and FM.

### FM radio interface

The FM receiver supports Japanese and European/USA bands (76MHz to 108MHz) with RDS functionality. The FM receiver comprises an RF receiver with fully integrated VCO, a stereo FM demodulator and a RDS demodulator.

FM receiver (50Ω) antenna connection points for a product-specific antenna. The phone headset is used as the FM receiver antenna, so a product-specific interface circuit is needed between the headset connector and the FM radio.

FM radio is physically integrated with Bluetooth in the BTHFM module ASIC, but from a functional point of view FM radio and Bluetooth have nothing in common.



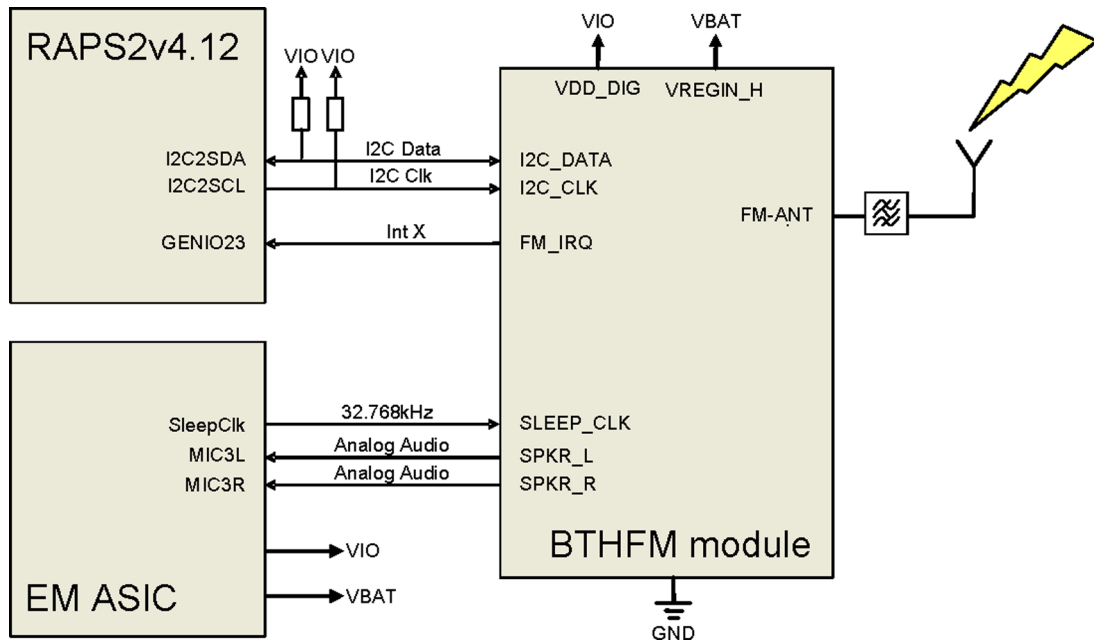


Figure 34 FM radio interface

An UART (universal asynchronous receiver/transmitter) is used for data communication and controls for both FM and Bluetooth.

## ■ Camera concept

### Camera characteristics

The device has an integrated high resolution 3.2 Megapixel EDOF digital camera supporting still image and video capture. The camera also has a dual LED flash and a 4x smooth digital zoom for still pictures.

The camera is connected directly to the baseband, no hardware accelerator is used. Processing of the image is done by the phone processor using NIPS (Nokia Imaging Perfection System) algorithms. The camera is controlled by the I2C bus.

Control signals to and from the camera flash driver are connected directly to RAPS (GENIOs).

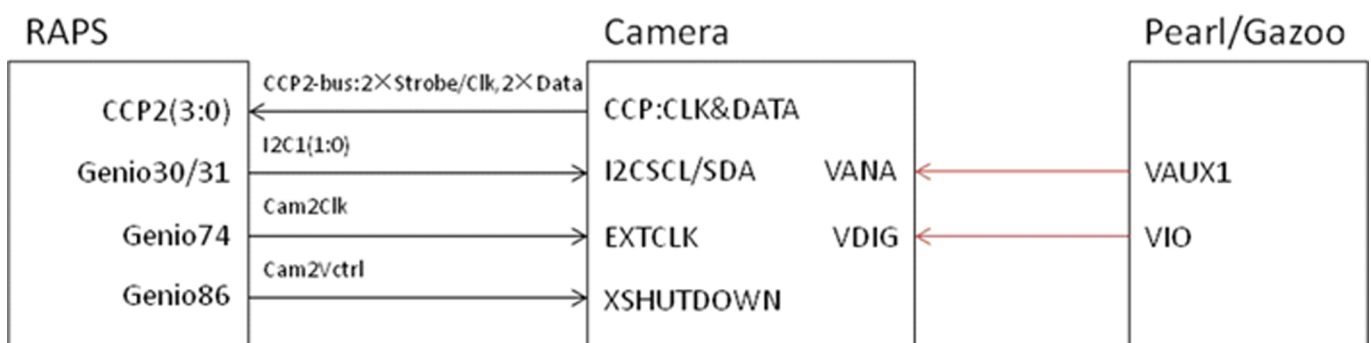


Figure 35 Camera concept

### Camera flash

The camera has a dual LED flash located next to the camera.

The flash LEDs are located on a separate flash PWB that is attached to the B-cover.

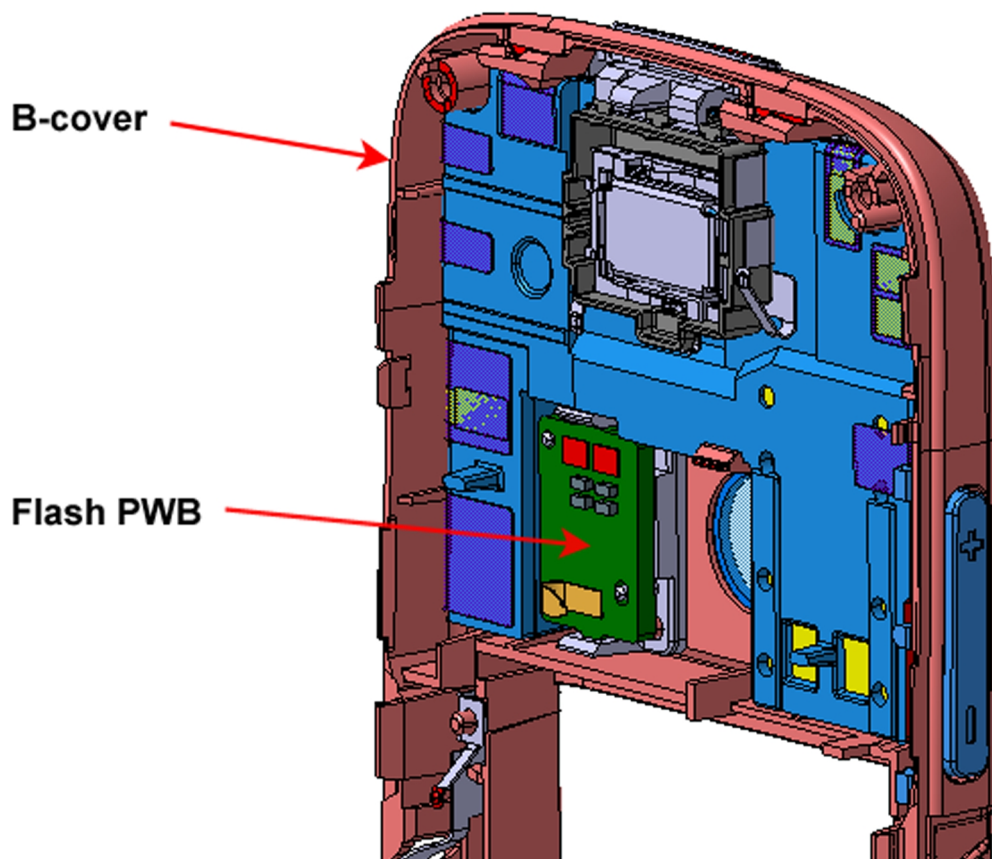


Figure 36 Camera flash main components

The flash LEDs (V1200, V1201) are located on the top side of the flash PWB.

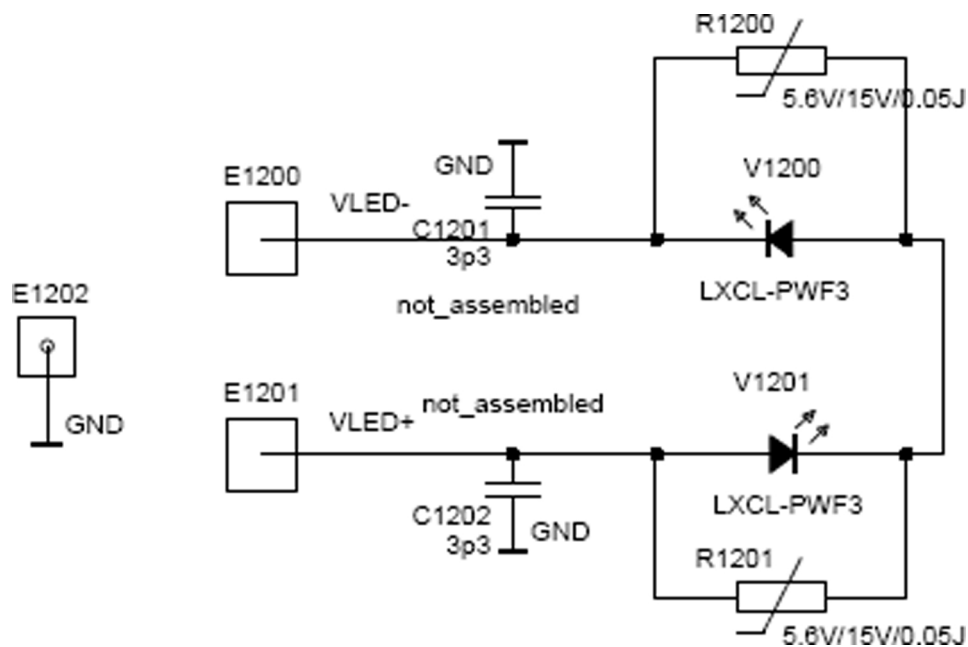
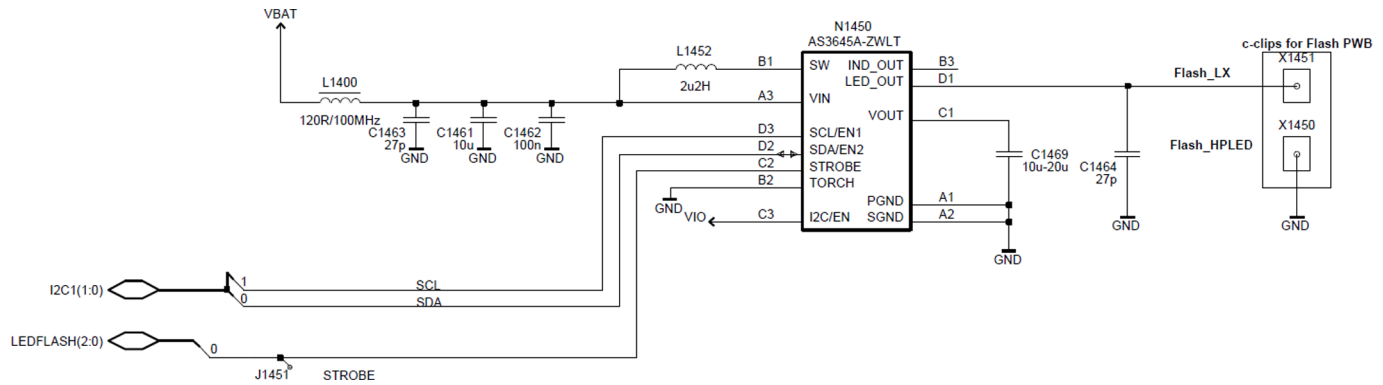


Figure 37 Design for camera flash LEDs

The flash LED driver (N1450) is located on the bottom side of the main PWB.



**Figure 38 Camera flash LED driver design**

## ■ User interface

### Display module

The display module consists of the following:

- A main 2.2" 240 x 320 TFT display with 16M colors

The interconnection between the display module and RAP engine is implemented with a 24-pin board-to-board connector. The display module is equipped with a driver with bi-directional 8-bit parallel interfaces. If the display is found to be faulty, the entire display module must be replaced.

### Backlights and illumination

The device has the following backlights:

- 4 display backlight LEDs (included in the display module) controlled by the EM ASIC N2200
- 4 keymat backlight LEDs (V2500, V2502, V2504, V2506) controlled by the RAP
- 2 reminder light LEDs (V2512, V2513) controlled by the EM ASIC N2200

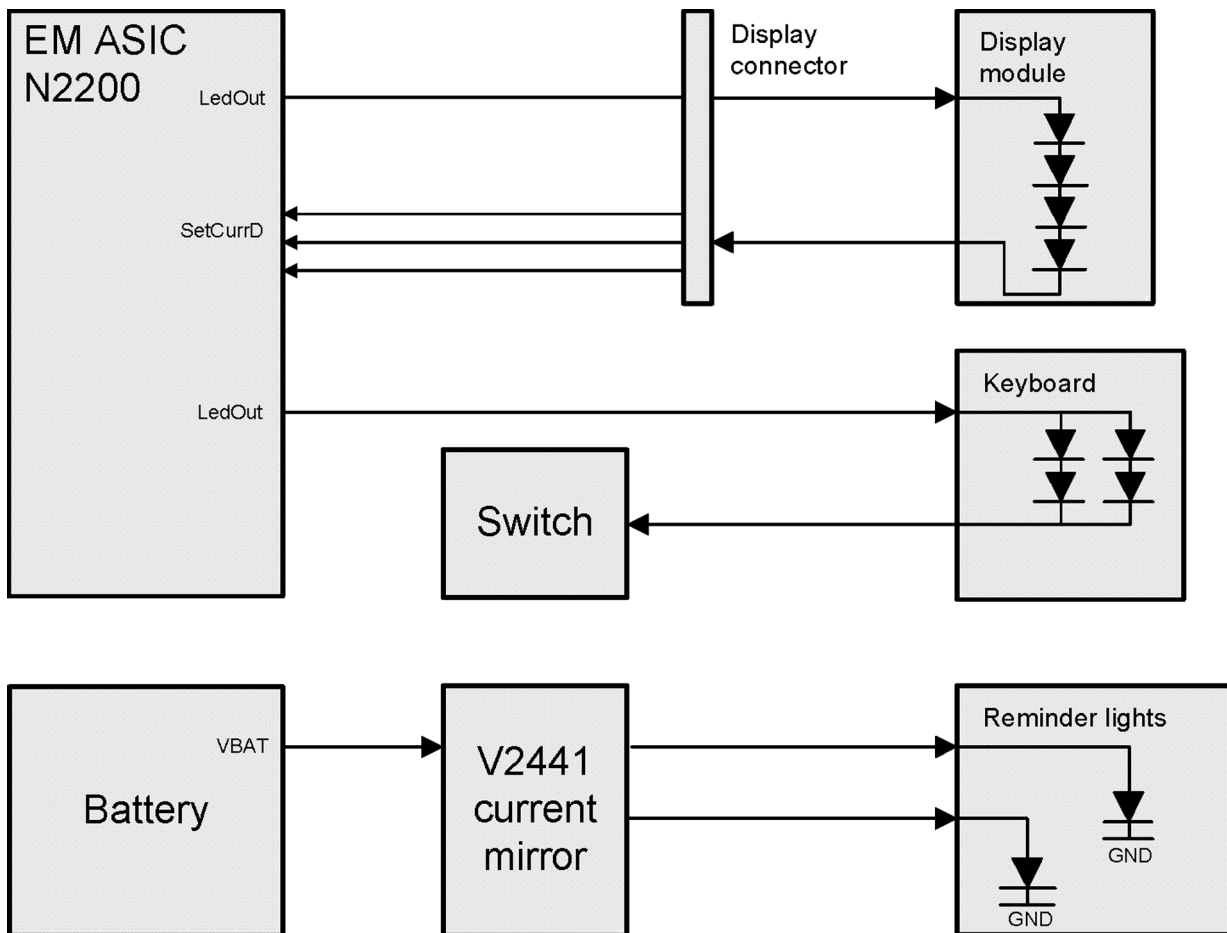


Figure 39 Backlights and illumination

### Digital Ambient Light Sensor (ALS)

The digital Ambient Light Sensor (N2460) is used to monitor the lighting conditions. The sensor is located at the top side of the main PWB.

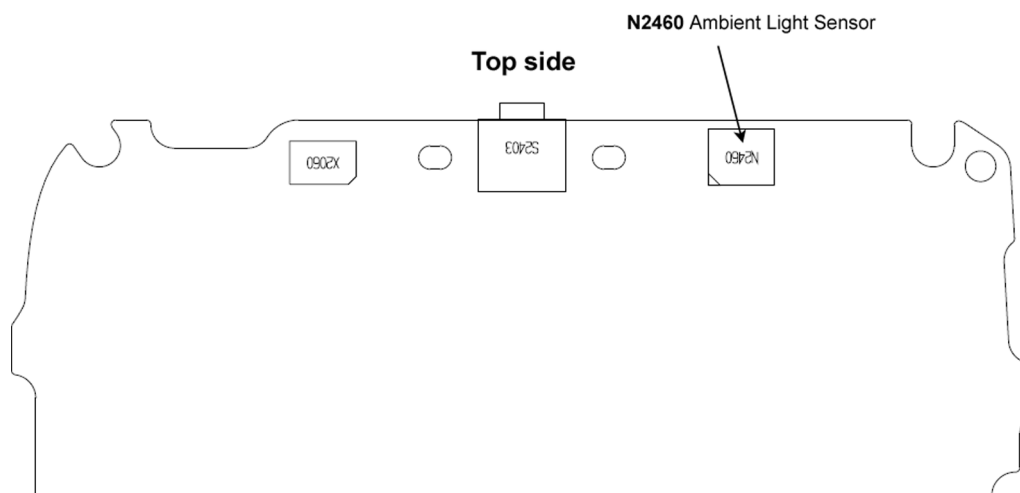
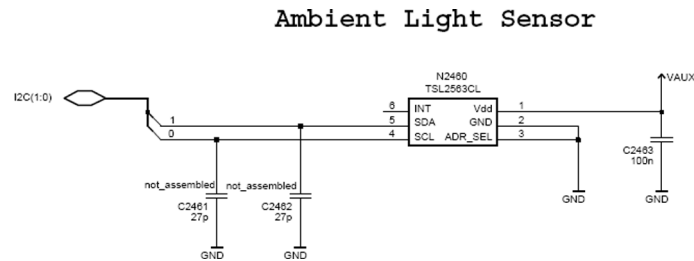
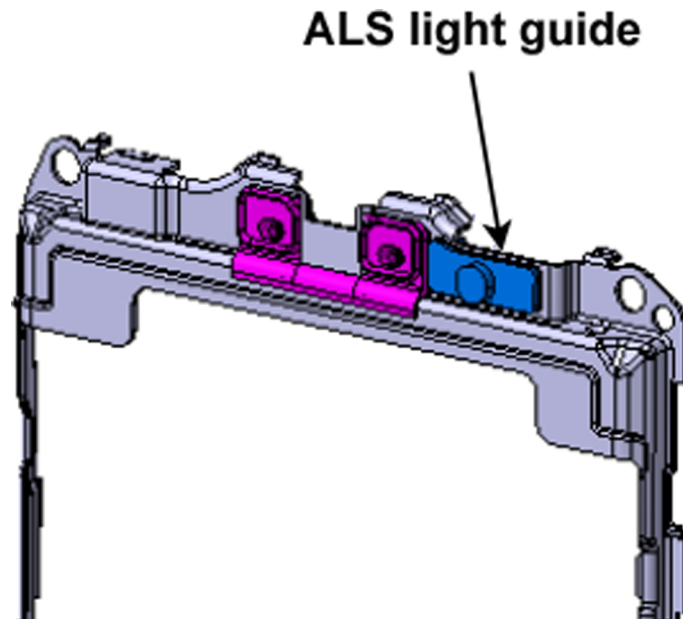


Figure 40 Ambient Light Sensor location



**Figure 41 Ambient Light Sensor design**

The ALS light guide is located at the top side of the UI shielding assembly.



**Figure 42 ALS light guide location**

## ■ Combo memory

The combo memory (D3000) is stacked on top of RAPS. The combo itself consists of a die stacked 512 Mbit DDR SDRAM and 1 Gbit M3 NAND type flash memory in a POP2 package.

The RAPS memory connections support NOR flash densities up to 2x512 Mbit, DDR SDRAM densities up to 512 Mbit, and Mass Memory densities of several gigabits, but only M3 NAND combo memories are used with RM-638.

## ■ Audio

### Audio concept

The functional core of the audio hardware is built around the EM ASIC N2200 and RAP.

EM ASIC N2200 provides an interface for the transducers.

There are three audio transducers:

- 1 digital microphone
- 1 earpiece
- 1 IHF (internal handsfree) speaker

EM ASIC N2200 also provides an output for the vibra motor.

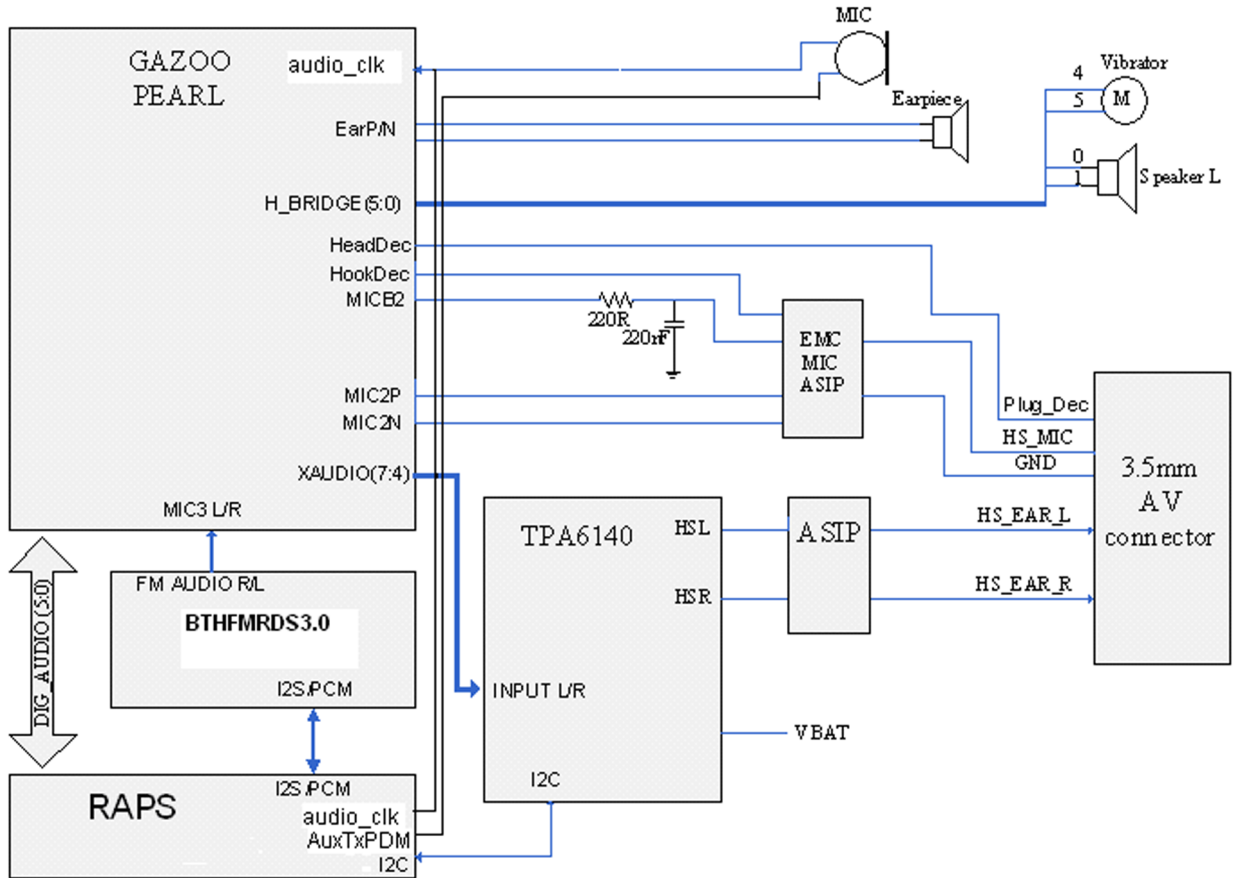


Figure 43 Audio block diagram

## Internal microphone

The digital internal microphone (B2100) is located at the bottom side of the main board. To save current when the microphone is not needed, its supply voltage is controlled by VSIM2. The Data and Clk lines are directly connected to RAPS.

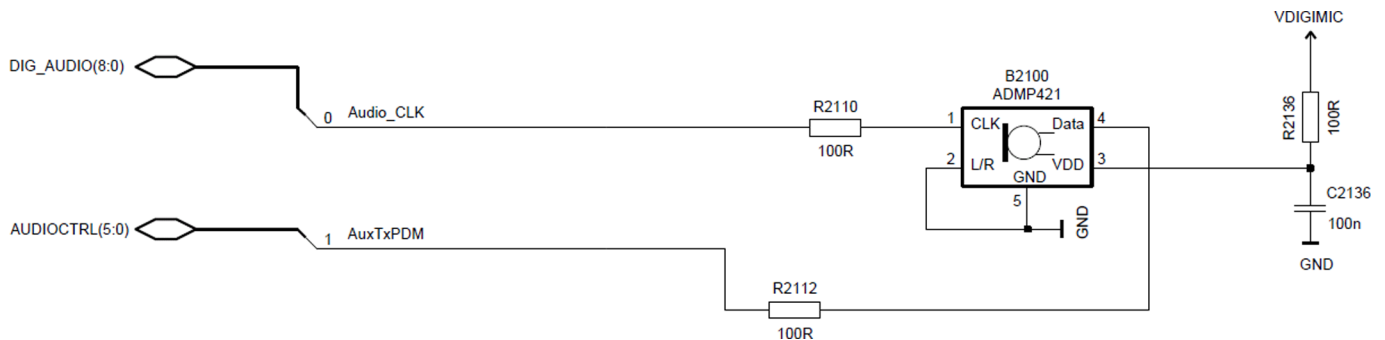


Figure 44 Internal microphone design

## Internal earpiece

The internal earpiece (B2103) is located at the bottom side of the main PWB. The earpiece is directly driven by the internal ear amplifiers of the EM ASIC and no additional amplifier is used.

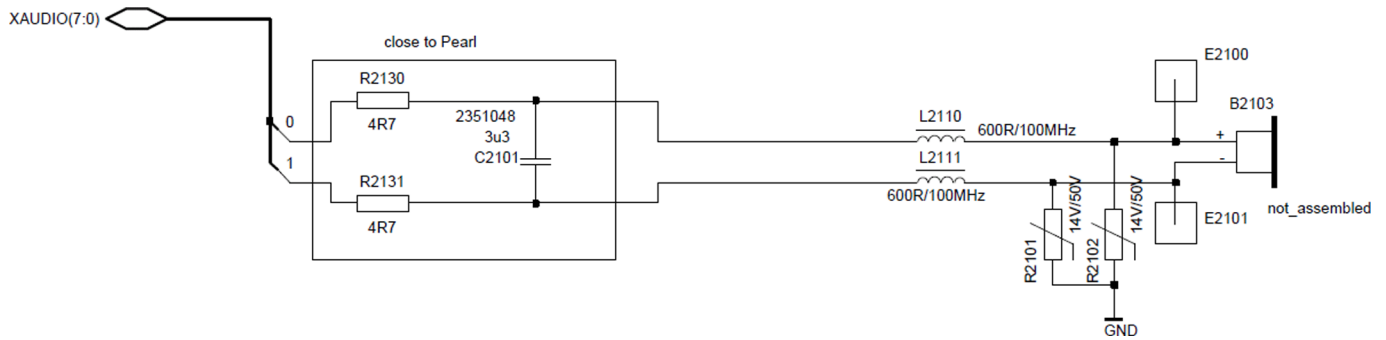


Figure 45 Internal earpiece

## IHF speaker

The IHF speaker (E2110/E2111) is integrated in the EM ASIC. No additional amplifier is used.

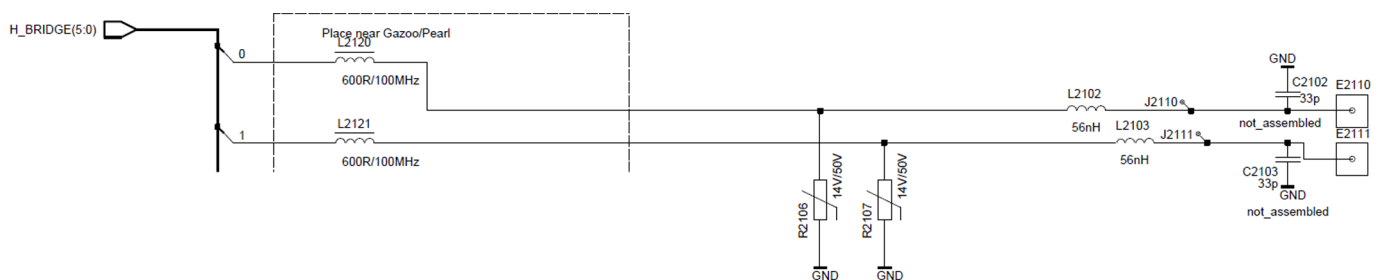


Figure 46 IHF speaker

## External microphone

An external microphone can be connected to the device via the 3.5 mm AV connector (X2101) located at the bottom side of the main board.

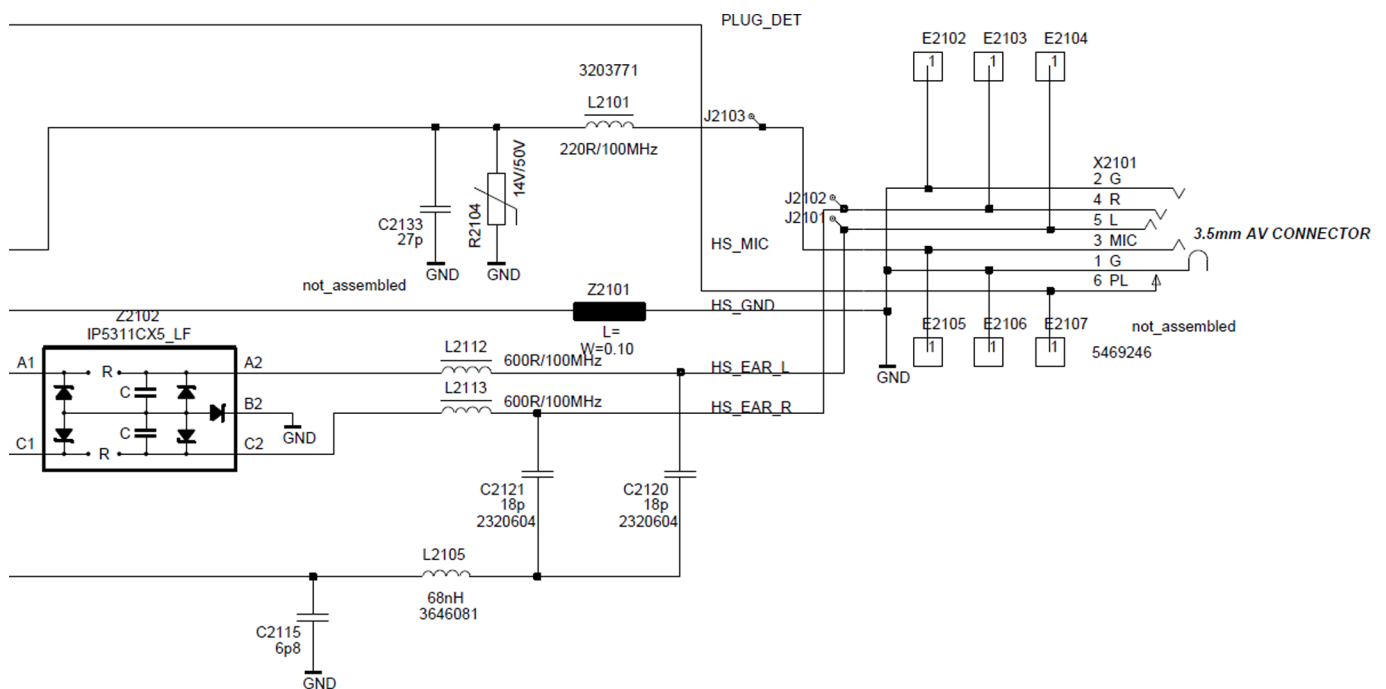
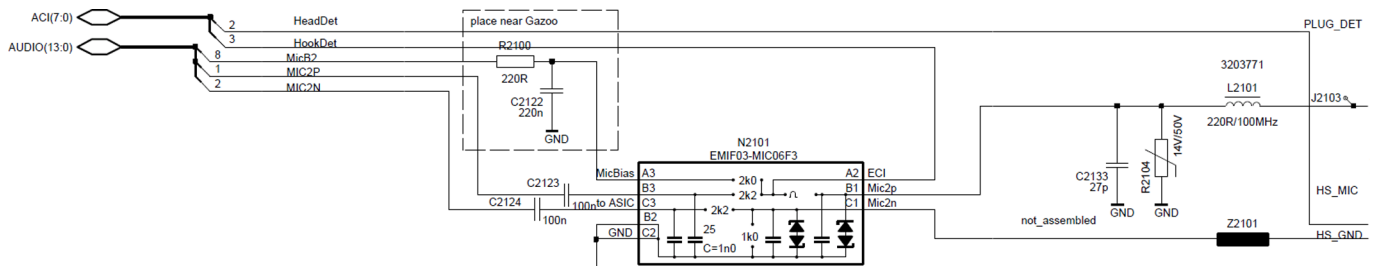


Figure 47 AV connector design

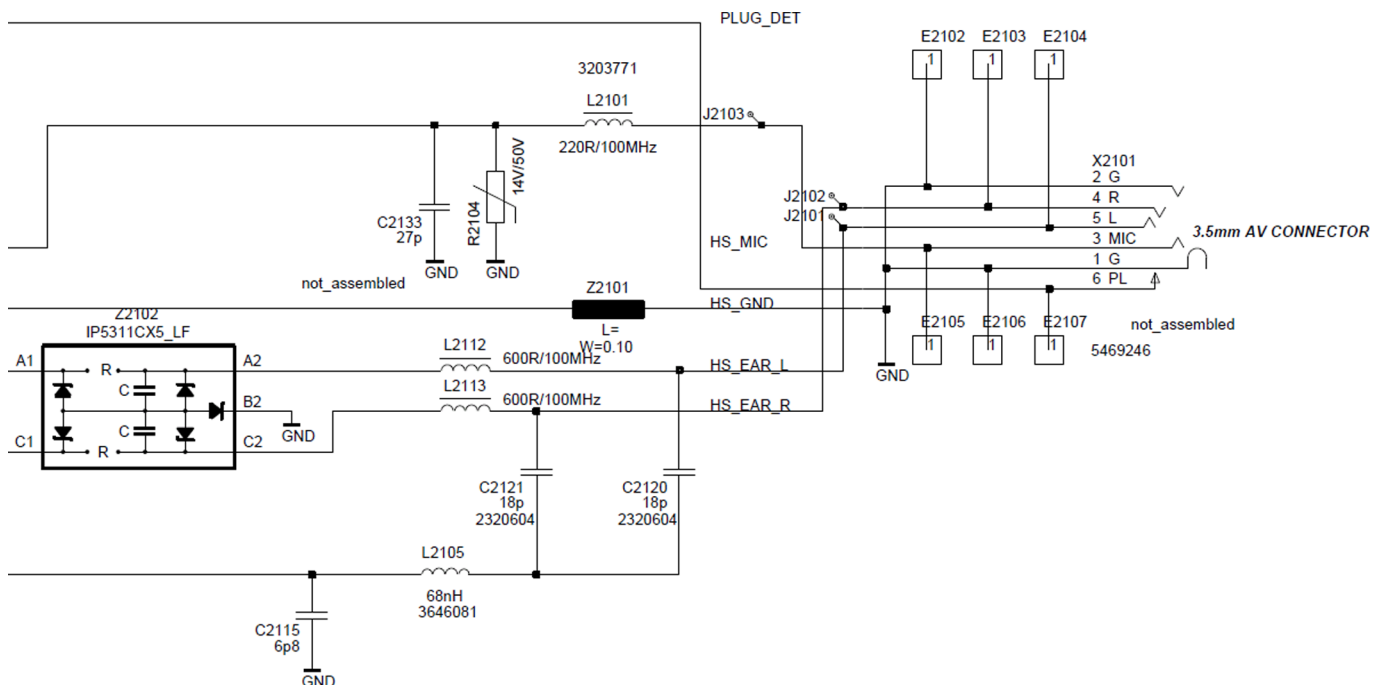


**Figure 48 External microphone**

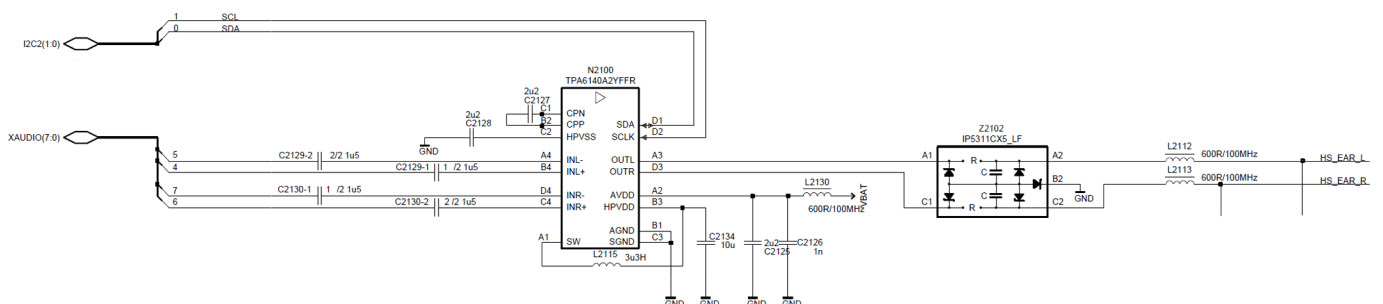
## External earpiece

An external earpiece can be connected to the device via the 3.5 mm AV connector (X2101) located at the bottom side of the main board.

TPA6140 (N2100), located at the bottom side of the main board, is needed for the AV interface as a power amplifier with volume control. This analogue stereo amplifier may be controlled via the I<sup>2</sup>C for volume adjustment and setup of the output channels.



**Figure 49 AV connector design**



**Figure 50 AV interface power amplifier TPA6140**

## Vibra

The vibra (M2100) is a mounted SMD located at the bottom side of the main board. It is supplied directly from the EM ASIC Vibra outputs.



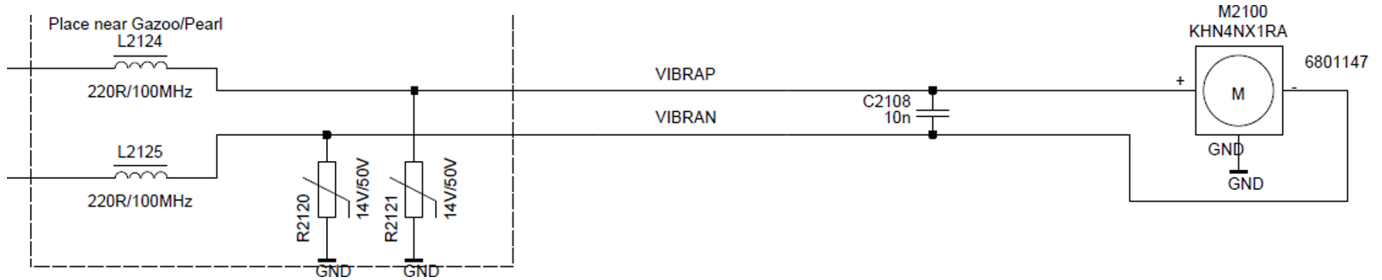


Figure 51 Vibra design

## ■ RF description

### RF block

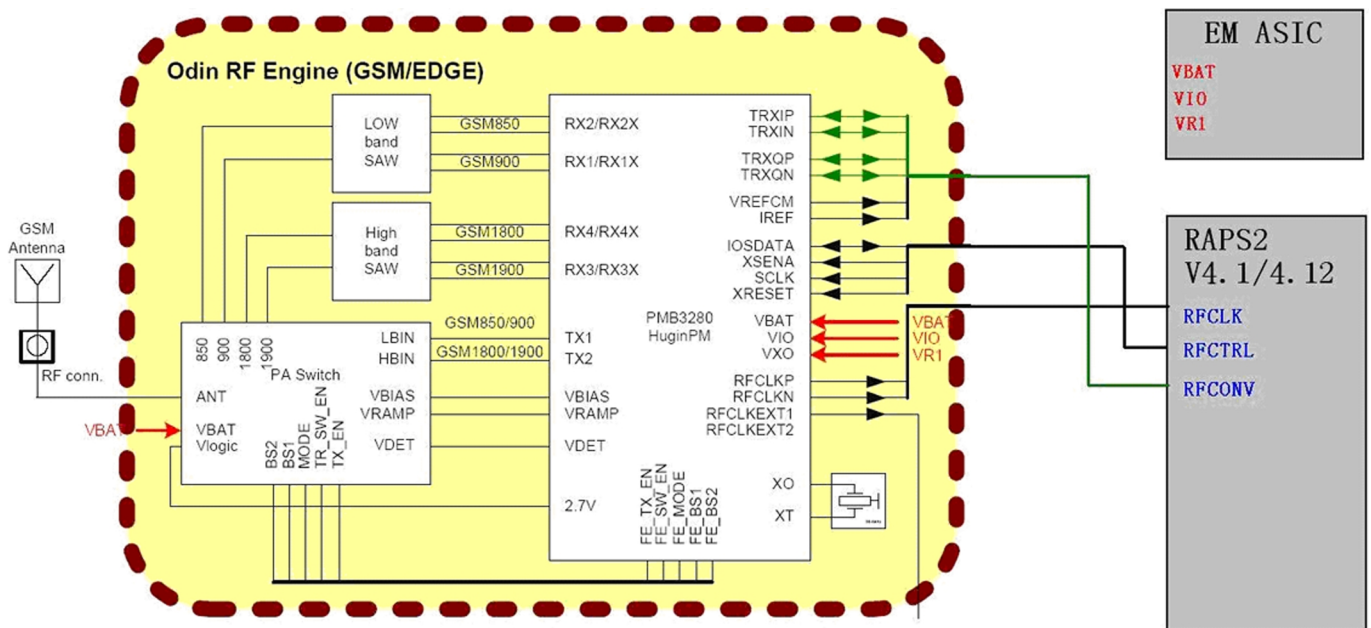


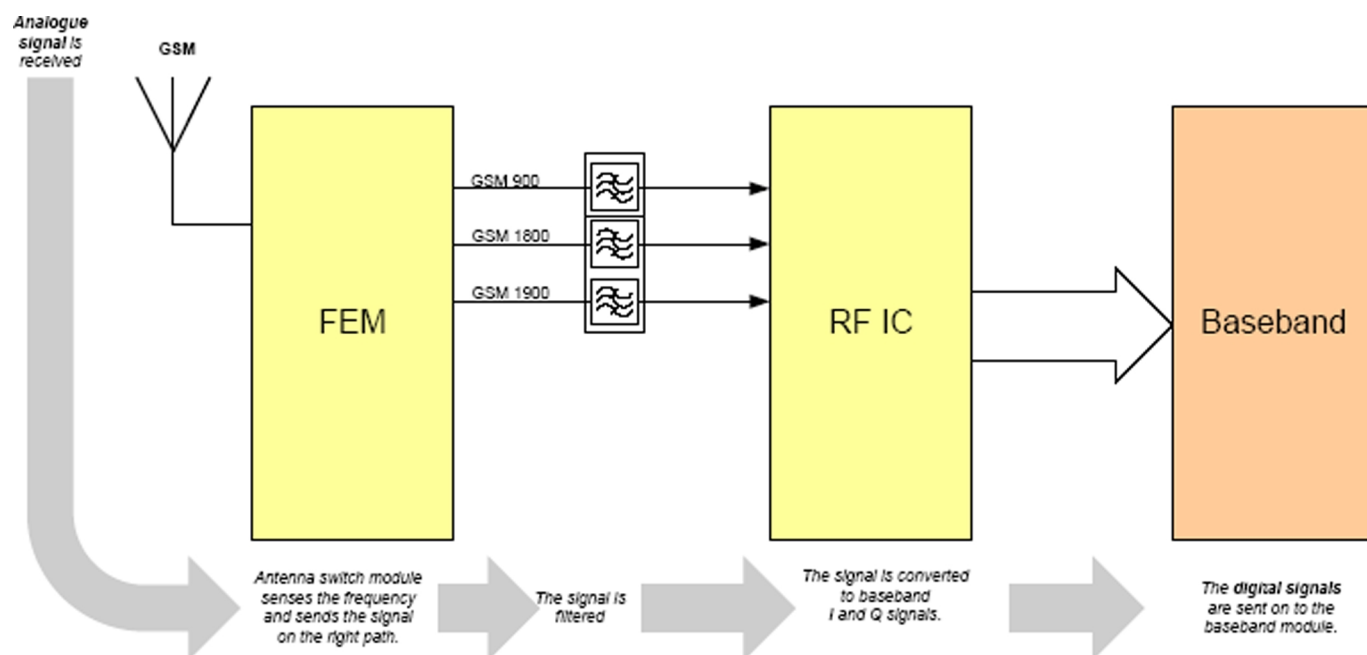
Figure 52 RF block diagram

### 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.

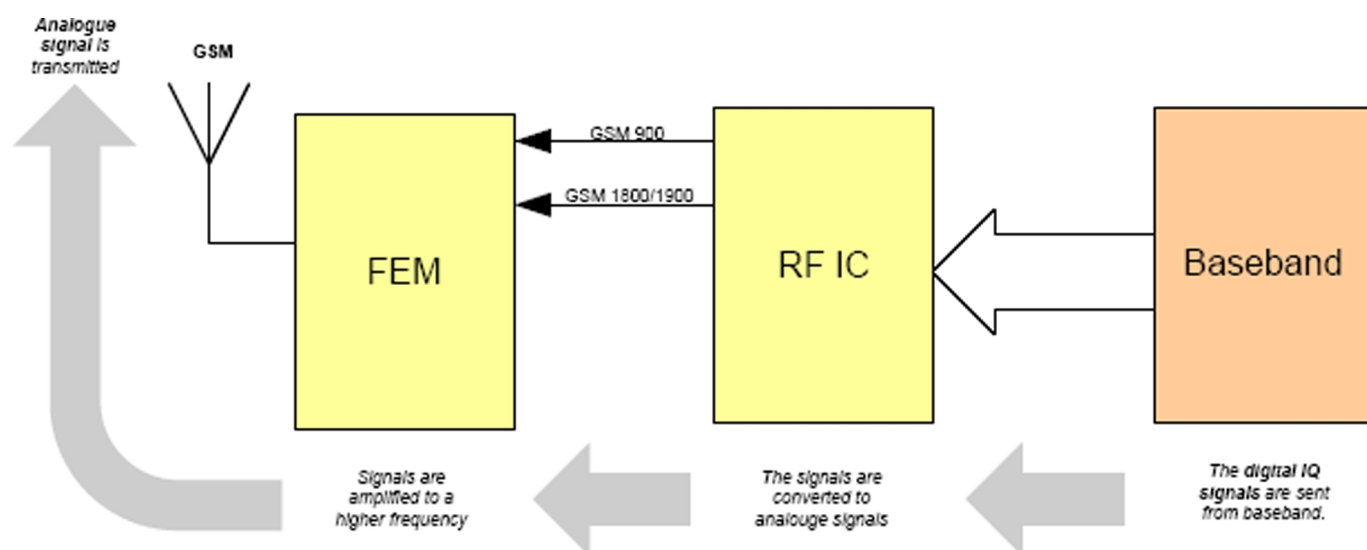
Signals with different frequencies take different paths, therefore being handled by different components.



## Transmitter (TX)

The digital baseband signal (e.g. 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 (e.g. GSM900).

The transmitter functions are implemented in the RF ASIC.



# Nokia Customer Care

## 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                                                     |
| 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                                  |
| FPS      | Flash Programming Tool                                      |
| FR       | Full rate                                                   |
| FSTN     | Film compensated super twisted nematic                      |
| GMSK     | Gaussian Minimum Shift Keying                               |
| GND      | Ground, conductive mass                                     |
| GPIO     | General-purpose interface bus                               |
| GPRS     | General Packet Radio Service                                |
| GSM      | Group Special Mobile/Global System for Mobile communication |
| HF       | Hands free                                                  |
| HFCM     | Handsfree Common                                            |
| HS       | Handset                                                     |
| 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                                                                  |
| MTP         | Multipoint-to-point connection                                                                |
| 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                                             |
| 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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