Nokia Customer Care

Service Manual

RM-364 (Nokia 3120 classic; L3&4)

Mobile Terminal

Part No: (Issue 1)

COMPANY CONFIDENTIAL

NOKIA
Care

Amendment Record Sheet

Amendment No	Date	Inserted By	Comments
Issue 1	04/2008	LB	

Copyright

IMPORTANT

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

Warnings and cautions

Warnings

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

Cautions

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

For your safety

QUALIFIED SERVICE

Only qualified personnel may install or repair phone equipment.

ACCESSORIES AND BATTERIES

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

CONNECTING TO OTHER DEVICES

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

Care and maintenance

This product is of superior design and craftsmanship and should be treated with care. The suggestions below will help you to fulfil any warranty obligations and to enjoy this product for many years.

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

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

ESD protection

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

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

To replace the covers ESD protection must be applied.

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

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

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

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

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

Battery information

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

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

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

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

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

Use the battery only for its intended purpose.

Never use any charger or battery which is damaged.

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

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

Do not dispose of batteries in a fire!

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

Company Policy

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

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

Please state:

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

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Nokia 3120 classic; L3&4 Service Manual Structure

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1 — General information

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Product selection

RM-364 (Nokia 3120 classic) is a GSM/WCDMA dual mode phone, supporting EGSM850/900/1800/1900 and WCDMA850/2100.

Figure 1 RM-364 (Nokia 3120 classic) product picture

Phone features

Display and keypad features

- 2.0” 240x320 pixel, 16M true colour display
- 5-way scroll, two soft keys, send and end keys
- Side volume keys with the zoom functionality

Hardware features

- 2.0 megapixel camera with flash, 8x digital zoom, landscape mode
- Secondary camera for video calls
- Micro USB port for data transfer (USB 2.0)
- 2.5 mm AV connector
- Bluetooth version 2.0
- Internal vibrator and antenna
- 24 MB user memory
- Hot swap microSD card slot
- Stereo FM radio and Music Player

RF features

- GSM/EGSM: 850/900/1800/1900
- WCDMA: 850/2100 (band V + I)
- EGPRS: MSC 32
- GPRS: MSC 32
- CSD

User interface and software features

Selection of software applications and services

- Nokia Xpress audio messaging (AMS)
- Flight mode
- Video streaming and recording
- Video telephony
- Themes (wallpapers, icons, colors)
- Music Player supporting MP3, MP4, AAC, eAAC+ and Windows Media Player
- OMA DRM 2.0 (Digital Right Management)
- OMA MMS 1.2, MMS Conformance 3.0, AMR and SMIL
- OMA Client Provisioning v1.1
- OMA IMPS
- Java
- 64 polyphonic ringing tones
- WAP 2.0
- XHTML browser over HTTP/TCP/IP stack
- SAIC
- SyncML (local and remote)
- Push to Talk
- Visual Radio
- Push e-mail client with attachment
- OTA download of ringing tones, themes, wallpapers
- FOTA - Firmware updates over the air
- SIM access profile in BT
- Nokia PC Suite

Accessories

Sales package contents

- Nokia 3120 classic phone
- Nokia Battery BL-4U
- Nokia Charger AC-3
- Nokia Wired headset HS-40
- User Guide

Table 1 Battery and chargers

Type	Name
Note: This phone is charged through the smaller charger Nokia standard interface (2.0 mm plug). The 3.5 mm standard charger can be used together with the CA-44 charger adapter.	
BL-4U	Battery 1000 mAh Li-Ion
AC-3	Compact charger
AC-4	Travel charger
AC-5	Compact travel charger
CA-70	Charging connectivity cable

Table 2 Car accessories

Type	Name
HF-9W	Dashboard/sunvisor with display
HF-300	Speakerphone
CK-15W	Bluetooth display car kit
CR-82	Universal charging holder
HH-12	Holder easy mount

Table 3 Headsets

Type	Name
Wired	
HS-47	Stereo headset
Wireless	
BH-900	Bluetooth headset
BH-202	Bluetooth headset

Table 4 Data cables

Type	Name
CA-101	Micro USB cable

Table 5 Memory cards

Type	Name
MU-28	512 MB microSD card
MU-22	1 GB microSD card
MU-37	2 GB microSD card

Type	Name
MU-41	4 GB microSD card

Technical specifications

Main RF characteristics for GSM850/900/1800/1900 and WCDMA V (850) and WCDMA I (2100) phones

Parameter	Unit
Cellular system	GSM850, EGSM900, GSM1800/1900, WCDMA V (850) and WCDMA I (2100)
Rx frequency band	GSM850: 869 - 894 MHz
	EGSM900: 925 - 960 MHz
	GSM1800: 1805 - 1880 MHz
	GSM1900: 1930 - 1990 MHz
	WCDMA V (850): 871 - 892 MHz
	WCDMA I (2100): 2110 - 2170 MHz
Tx frequency band	GSM850: 824 - 849 MHz
	EGSM900: 880 - 915 MHz
	GSM1800: 1710 - 1785 MHz
	GSM1900: 1850 - 1910 MHz
	WCDMA V (850): 826 - 847 MHz
	WCDMA I (2100): 1920 - 1980 MHz
Output power	GSM850: +5 ...+33dBm/3.2mW ... 2W
	GSM900: +5 ... +33dBm/3.2mW ... 2W
	GSM1800: +0 ... +30dBm/1.0mW ... 1W
	GSM1900: +0 ... +30dBm/1.0mW ... 1W
	WCDMA V (850): -50 ... +24 dBm/0.01µW ... 251.2mW
	WCDMA I (2100): -50 ... +24 dBm/0.01µW ... 251.2mW
Number of RF channels	GSM850: 124
	GSM900: 174
	GSM1800: 374
	GSM1900: 299
	WCDMA V (850): 108
	WCDMA I (2100): 277
Channel spacing	200 kHz

Parameter	Unit
Number of Tx power levels	GSM850: 15
	GSM900: 15
	GSM1800: 16
	GSM1900: 16
	WCDMA V (850): 75
	WCDMA I (2100): 75

General specifications

Unit	Dimension (mm)	Weight (g)	Volume (cc)
Transceiver with BL-4U 1000 mAh Li-Ion battery pack	111.3 x 45.4 x 13.4	85	60

Battery endurance

Battery	NMP Talk time	NMP Standby time
BL-4U 1000 mAh Li-ion	GSM up to 3h 20min WCDMA up to 2h 45min	GSM up to 300h WCDMA up to 300h

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

Environmental conditions

Environmental condition	Ambient temperature	Notes
Normal operation	-15 ºC ... +55 ºC	Specifications fulfilled
Reduced performance	55 ºC ... +70 ºC	Operational only for short periods
Intermittent or no operation	-40 ºC ... -15 ºC and +70 ºC ... +85ºC	Operation not guaranteed but an attempt to operate will not damage the phone
No operation or storage	<-40 ºC and >+85 ºC	No storage. An attempt to operate may cause permanent damage
Charging allowed	-15 ºC ... +55 ºC	
Long term storage conditions	0 ºC ... +85 ºC	

Environmental condition	Ambient temperature	Notes
Humidity and water resistance		Relative humidity range is 5 to 95%. Condensed or dripping water may cause intermittent malfunctions. Protection against dripping water has to be implemented in (enclosure) mechanics. Continuous dampness will cause permanent damage to the module.

2 — Service Devices and Service Concepts

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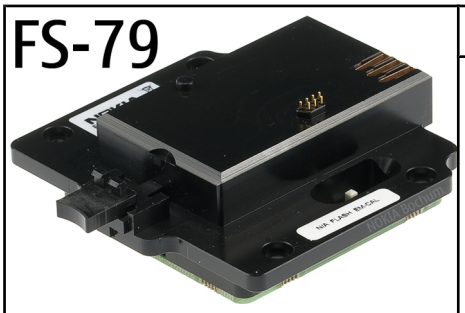
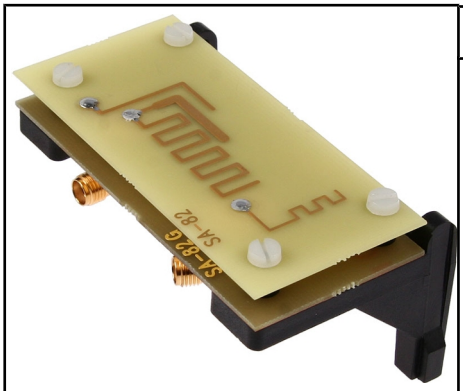
Service devices

Product specific devices

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-364. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

<table>
<tr><td rowspan="2"> 
</td><td>FS-79</td><td>Flash adapter</td><td></td></tr>
<tr><td colspan="3">• FS-79 is equipped with a clip interlock system
• provides standardised interface towards Control Unit
• provides RF connection using coupler
• multiplexing between USB and FBUS media, controlled by VUSB</td></tr>
<tr><td rowspan="2"> 
</td><td>MJ-164</td><td>Module jig</td><td></td></tr>
<tr><td colspan="3">MJ-164 is meant for component level troubleshooting.
The jig includes an RF interface for GSM, WCDMA and Bluetooth. In addition, it has the following features:
• Provides mechanical interface with the engine module
• Provides galvanic connection to all needed test pads in module
• Multiplexing between USB and FBUS media, controlled by Vusb
• MMC interface
• Duplicated SIM connector
• Connector for control unit
• Access for AV- and USB connectors</td></tr>
<tr><td rowspan="2"> 
</td><td>RJ-230</td><td>Soldering jig</td><td></td></tr>
<tr><td colspan="3">RJ-230 is a soldering jig used for soldering and as a rework jig for the engine module.</td></tr>
</table>



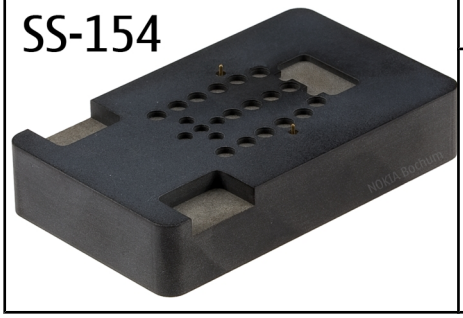
SA-82	RF coupler	

SA-82 is an RF coupler for GSM and WCDMA RF testing. It is used together with SS-46 and SS-62.

The following table shows attenuations from the antenna pads of the mobile terminal to the SMA connectors of SA-82:

Frequency	Att. (dB)
GSM850 TX	Low: 12.28 Mid: 10.42 High: 10.54
GSM850 RX	Low: 7.7 Mid: 8.1 High: 6.7
GSM900 TX	Low: 7.72 Mid: 7.18 High: 7.72
GSM900 RX	Low: 6.3 Mid: 5.7 High: 5.3
GSM1800 TX	Low: 9.08 Mid: 9.3 High: 9.78
GSM1800 RX	Low: 9.1 Mid: 10.1 High: 10.9
GSM1900 TX	Low: 11.32 Mid: 10.74 High: 10.8
GSM1900 RX	Low: 9.1 Mid: 9.1 High: 9.1
WCDMA Band I TX	Low: 10.284 Mid: 10.43 High: 11.038
WCDMA Band I RX	Low: 8.3 Mid: 8.1 High: 8.3
WCDMA Band V TX	Low: 9.53 Mid: 9.01 High: 8.51
WCDMA Band V RX	Low: 9.9 Mid: 9.7 High: 8.7

SS-154



SS-154	Domesheet tool	

The purpose of the domesheet tool SS-154 is to support the placement of a domesheet on the PWB.

General devices

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-364. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

CU-4

CU-4	Control unit	

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

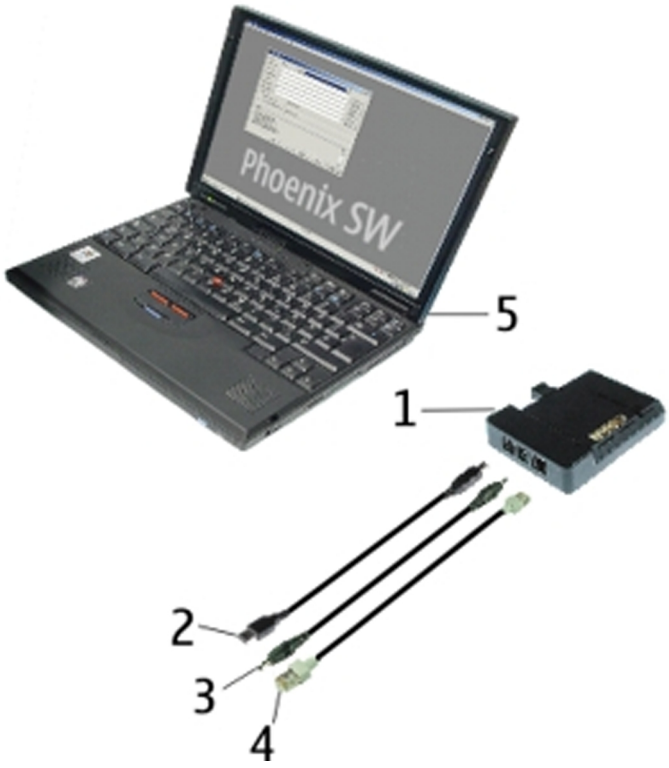
The unit has the following features:

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

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

Instructions

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



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

Reconnecting the power supply requires a Phoenix restart.

FLS-5	Flash device	

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

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

FPS-10	Flash prommer	

FPS-10 interfaces with:

- PC
- Control unit
- Flash adapter
- Smart card

FPS-10 flash prommer features:

- Flash functionality for BB5 and DCT-4 terminals
- Smart Card reader for SX-2 or SX-4
- USB traffic forwarding
- USB to FBUS/Flashbus conversion
- LAN to FBUS/Flashbus and USB conversion
- Vusb output switchable by PC command

FPS-10 sales package includes:

- FPS-10 prommer
- Power Supply with 5 country specific cords
- USB cable

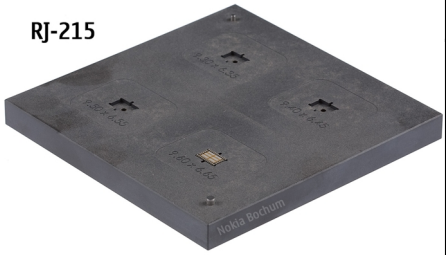
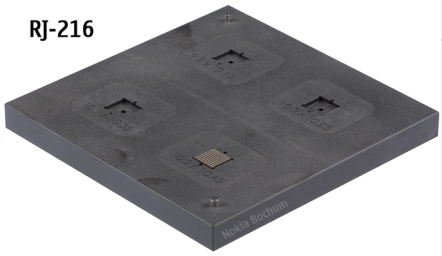
Note: FPS-21 is substitute FPS-10 if FPS-10 has not been set up.

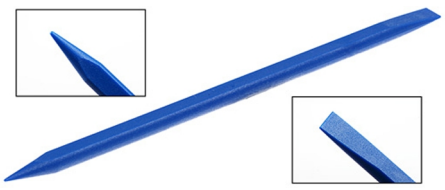
PK-1	Software protection key	

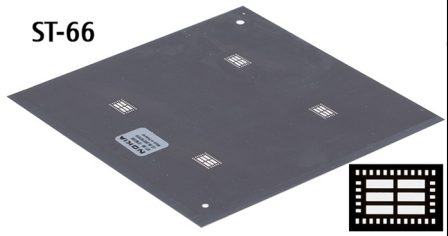
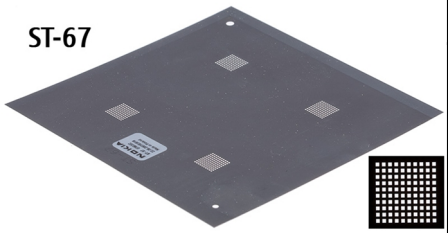
PK-1 is a hardware protection key with a USB interface. It has the same functionality as the PKD-1 series dongle.

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

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

	PKD-1	SW security device	
	SW security device is a piece of hardware enabling the use of the service software when connected to the parallel (LPT) port of the PC. Without the device, it is not possible to use the service software. Printer or any such device can be connected to the PC through the device if needed.		
RJ-215 	RJ-215	Rework jig	
	RJ-215 is a jig used for soldering and as a rework jig for the engine module. It is used together with the ST-66 stencil.		
RJ-216 	RJ-216	Rework jig	
	RJ-216 is a jig used for soldering and as a rework jig for the engine module. It is used together with the ST-67 stencil.		
	SB-6	Bluetooth tester	
	The SB-6 test box is a generic device to perform Bluetooth bit error rate testing and doing cordless FBUS connection via Bluetooth.		
	SPS-2	Soldering paste spreader	

	SRT-6	Opening tool	
	SRT-6 is used to open phone covers.		
	SS-46	Interface adapter	
	SS-46 acts as an interface adapter between the flash adapter and FPS-10.		
	SS-62	Generic flash adapter base for BB5	
	• generic base for flash adapters and couplers • SS-62 equipped with a clip interlock system • provides standardised interface towards Control Unit • provides RF connection using galvanic connector or coupler • multiplexing between USB and FBUS media, controlled by VUSB		
	SS-88	Camera removal tool	
	The camera removal tool SS-88 is used to remove/attach the front camera module from/to the socket.		
	SS-93	Blue stick tool	
	SS-93 is used for general disassembly and assembly tasks.		

	ST-66	Rework stencil	
	ST-66 is a rework stencil used with rework jig RJ-215.		
	ST-67	Rework stencil	
	ST-67 is a rework stencil used with rework jig RJ-216.		
	SX-4	Smart card	
	SX-4 is a BB5 security device used to protect critical features in tuning and testing. SX-4 is also needed together with FPS-10 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-364. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

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

CA-35S	Power cable	
CA-35S is a power cable for connecting, for example, the FPS-10 flash prommer to the Point-Of-Sales (POS) flash adapter.		

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

XCS-4	Modular cable	
XCS-4 is a shielded (one specially shielded conductor) modular cable for flashing and service purposes.		

	XRE-2	Bluetooth cable	
	The bluetooth cable connects the bluetooth connector of the module jig to the bluetooth test box JBT-9.		
	XRF-1	RF cable	
	The RF cable is used to connect, for example, a module repair jig to the RF measurement equipment. SMA to N-Connector ca. 610mm. 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

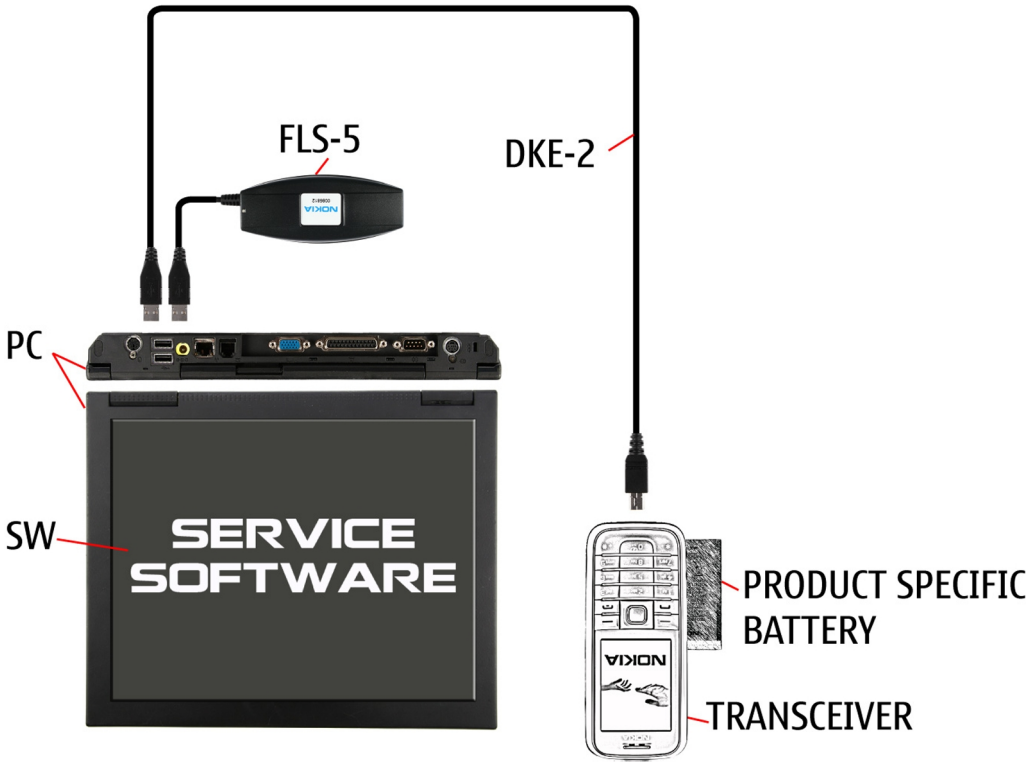


Figure 2 POS flash concept

Type	Description
Product specific tools	
BL-4U	Battery
Other tools	
FLS-5	POS flash dongle
	PC with Phoenix service software
Cables	
DKE-2	USB connectivity cable

Flash concept with FPS-10

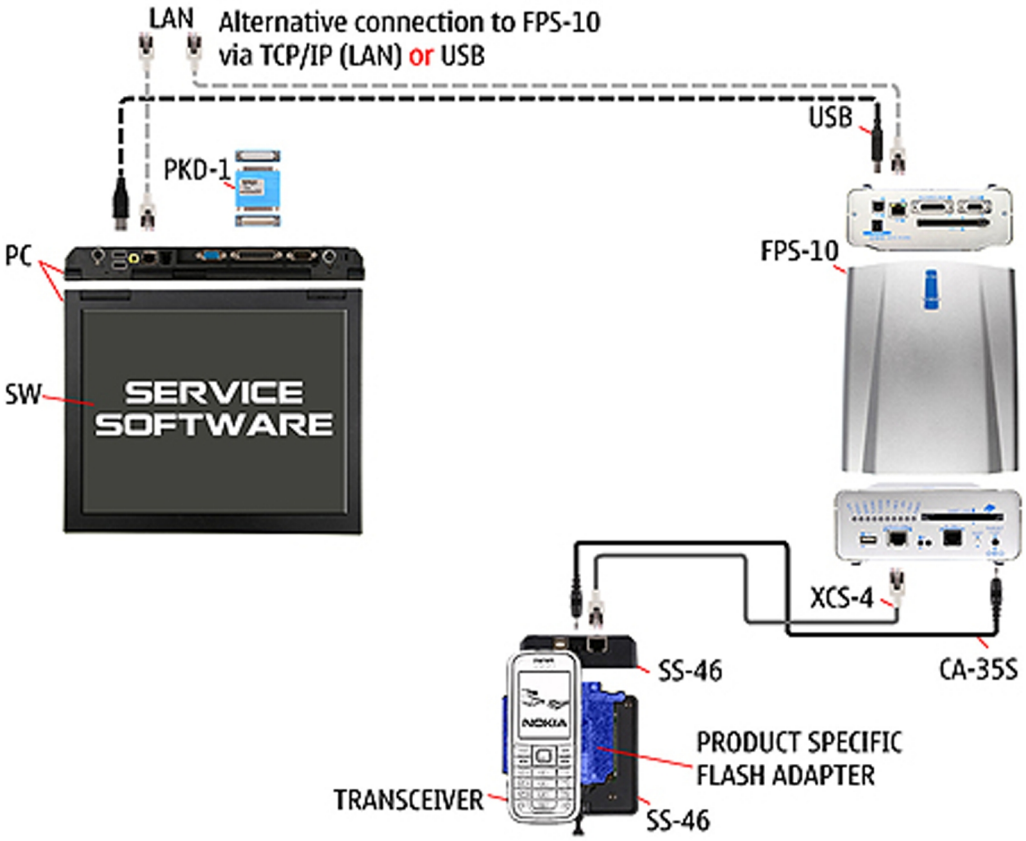


Figure 3 Basic flash concept with FPS-10

Type	Description
Product specific devices	
FS-79	Flash adapter
Other devices	
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-46	Interface adapter
	PC with Phoenix service software
Cables	
XCS-4	Modular cable
CA-35S	Power cable
	USB cable

CU-4 flash concept with FPS-10

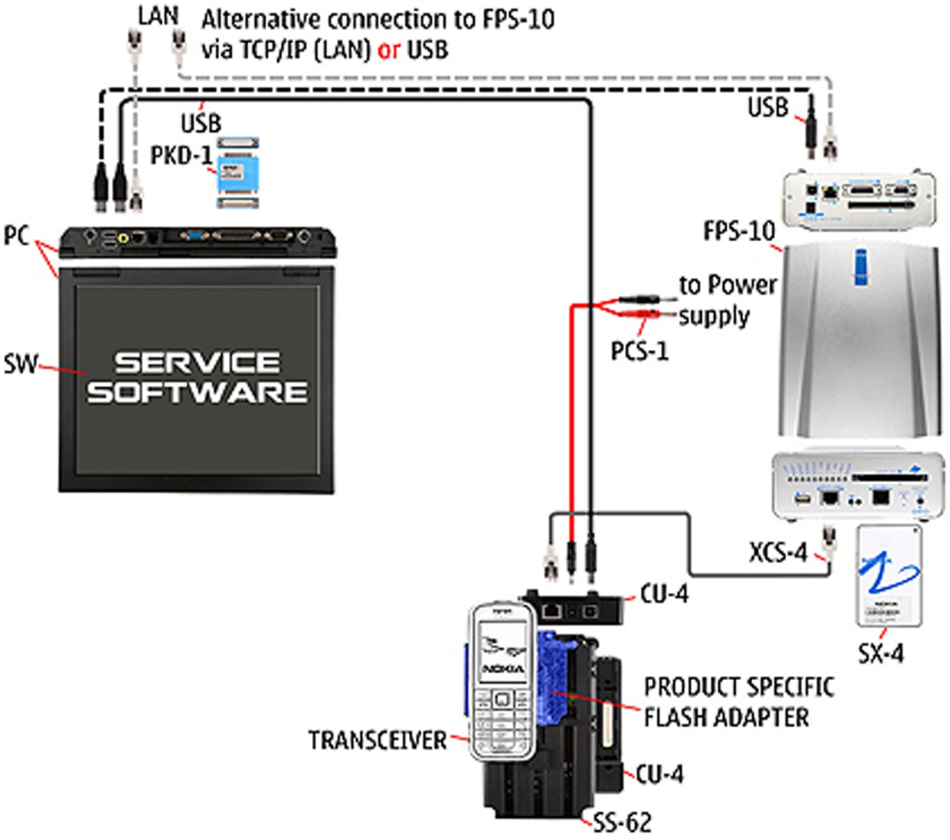


Figure 4 CU-4 flash concept with FPS-10

Type	Description
Product specific devices	
FS-79	Flash adapter
Other devices	
CU-4	Control unit
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-62	Flash adapter base
SX-4	Smart card
	PC with Phoenix service software
Cables	
PCS-1	Power cable
XCS-4	Modular cable
	Standard USB cable
	USB cable

Module jig service concept

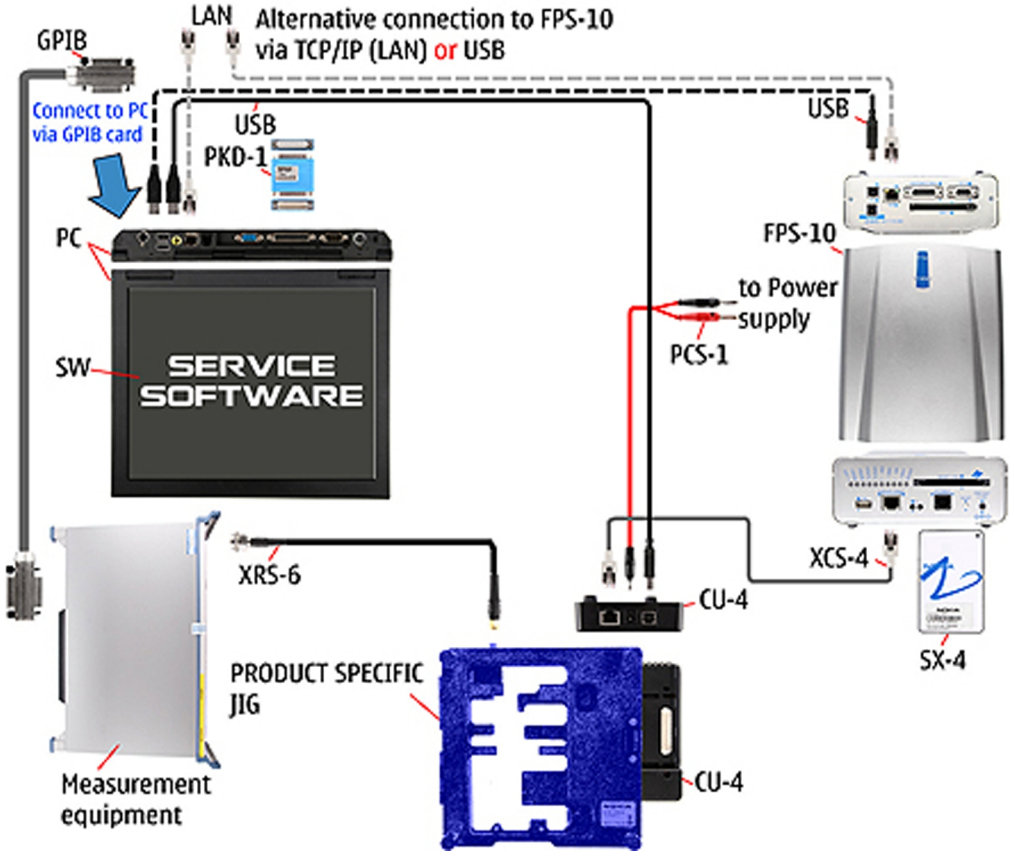


Figure 5 Module jig service concept

Type	Description
Phone specific devices	
MJ-164	Module jig
Other devices	
CU-4	Control unit
FPS-10	Flash prommer box
PK-1	SW security device
SX-4	Smart card
	PC with VPOS and Phoenix service software
	Measurement equipment
Cables	
PCS-1	DC power cable
XCS-4	Modular cable
XRF-1	RF cable
	USB cable

Type	Description
	GPIB control cable

RF testing concept with RF coupler

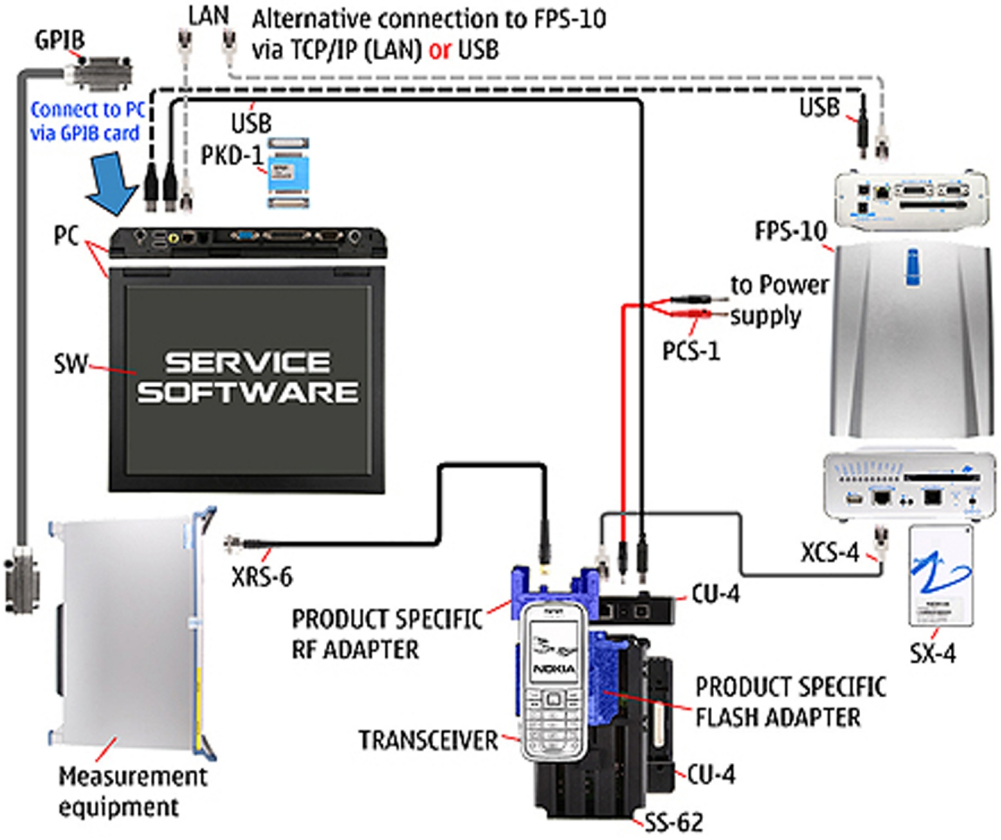


Figure 6 RF testing concept with RF coupler

Type	Description
Product specific devices	
FS-79	Flash adapter
SA-82	RF coupler
Other devices	
CU-4	Control unit
SX-4	Smart card
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-62	Flash adapter base
	Measurement equipment
	PC with Phoenix service software
Cables	
PCS-1	Power cable

Type	Description
XCS-4	Modular cable
XRS-6	RF cable
	GPIB control cable
	USB cable

Service concept for RF testing and RF/BB tuning

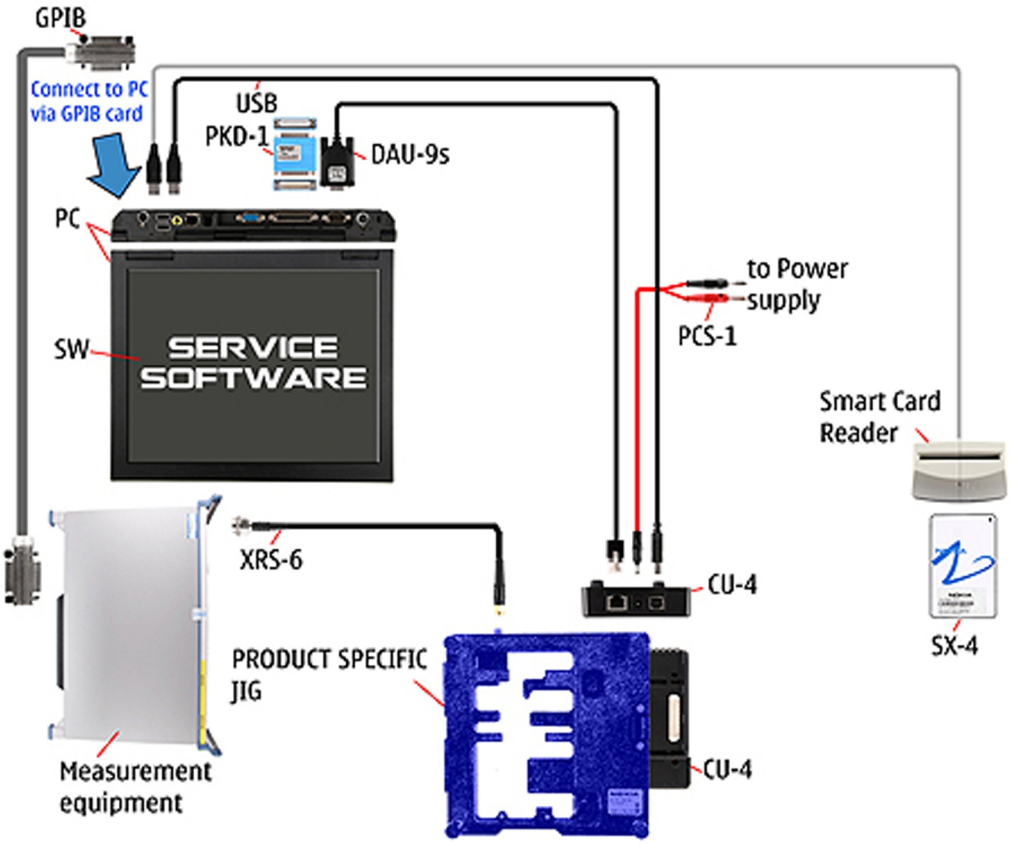


Figure 7 Service concept for RF testing and RF/BB tuning

Type	Description
Product specific devices	
MJ-164	Module jig
Other devices	
CU-4	Control unit
PK-1	SW security device
SX-4	Smart card
	Measurement equipment
	Smart card reader
	PC with Phoenix service software

Type	Description
Cables	
DAU-9S	MBUS cable
PCS-1	DC power cable
XRS-6	RF cable
	GPIB control cable
	USB cable

3 — BB Troubleshooting and Manual Tuning Guide

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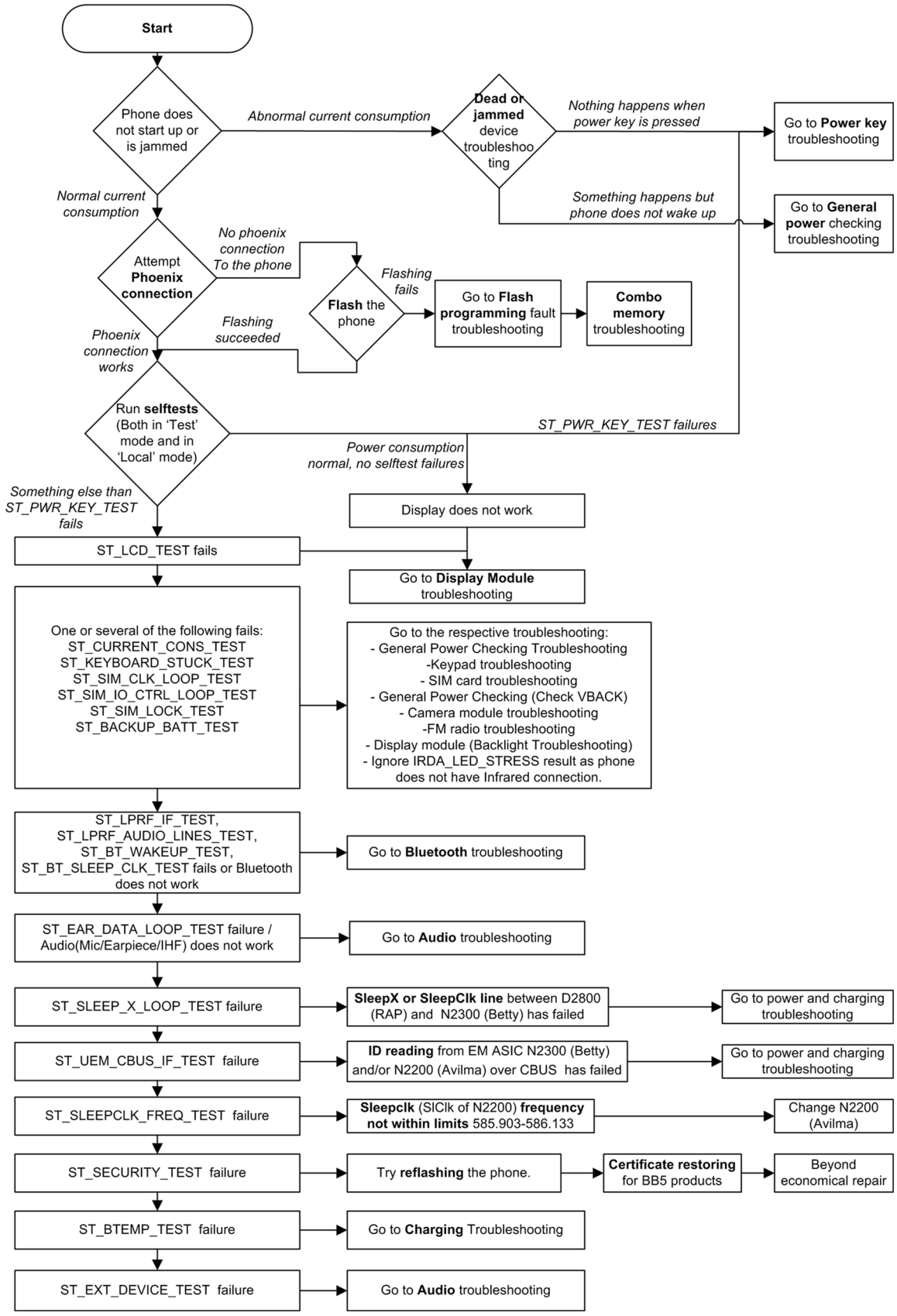
Baseband self tests in Phoenix

Context

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

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

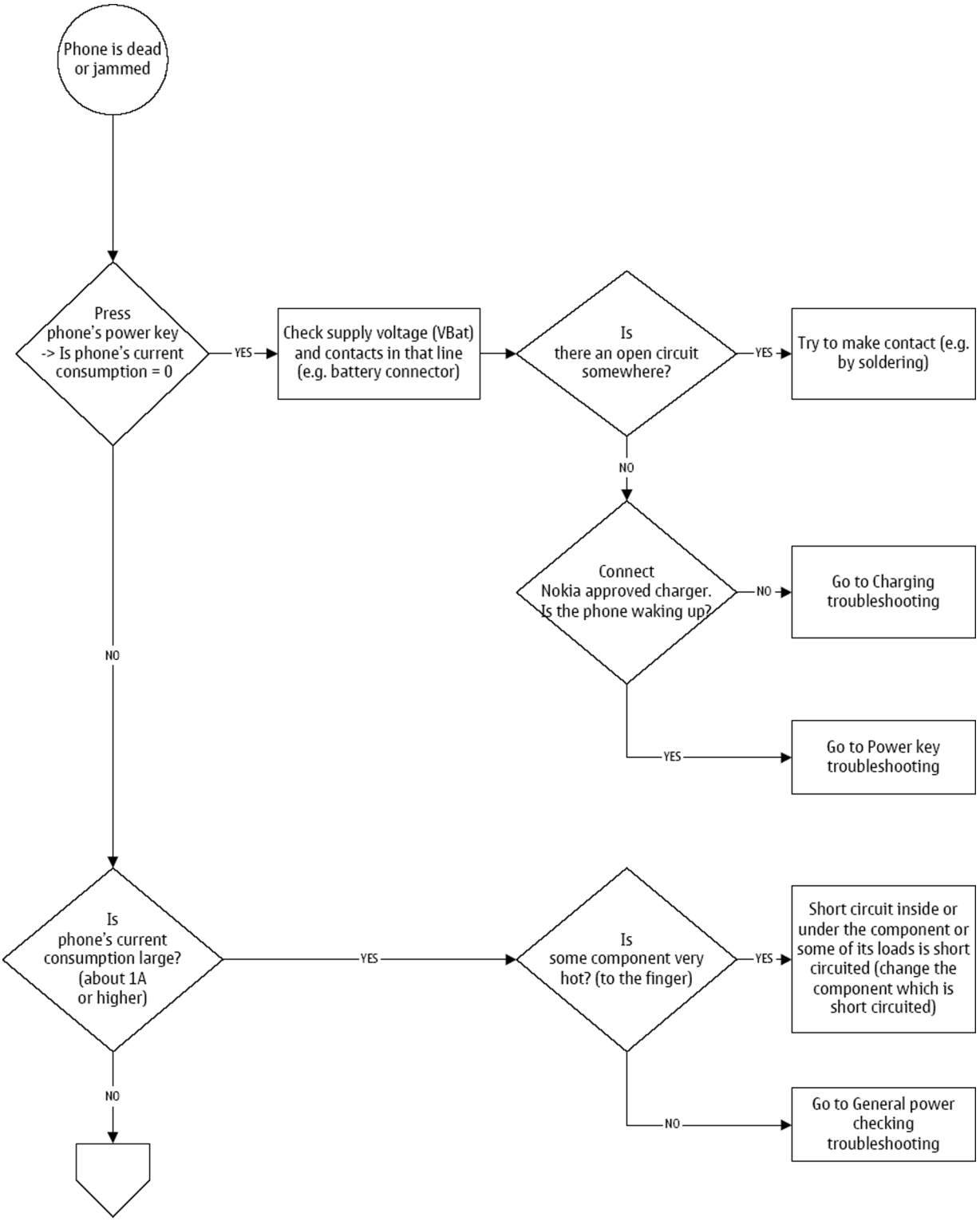
Troubleshooting flow



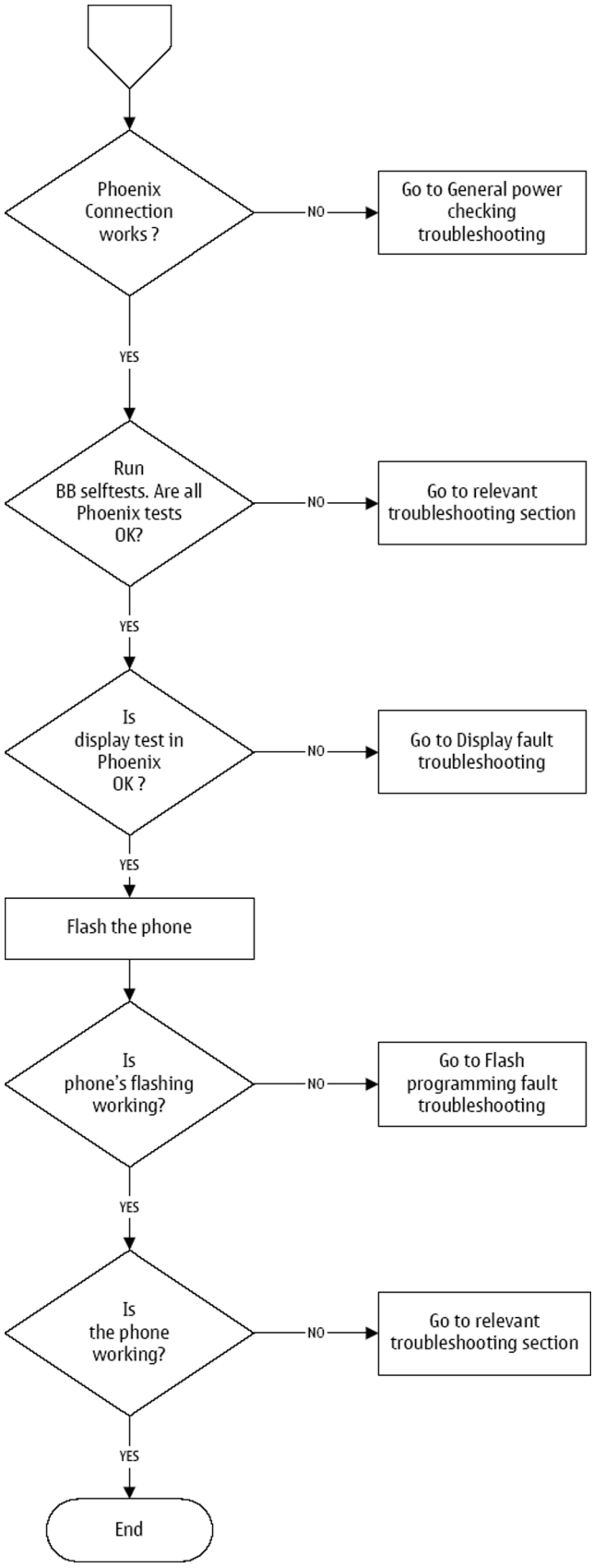
Power and charging troubleshooting

Dead or jammed device troubleshooting

Troubleshooting flow



Troubleshooting flow



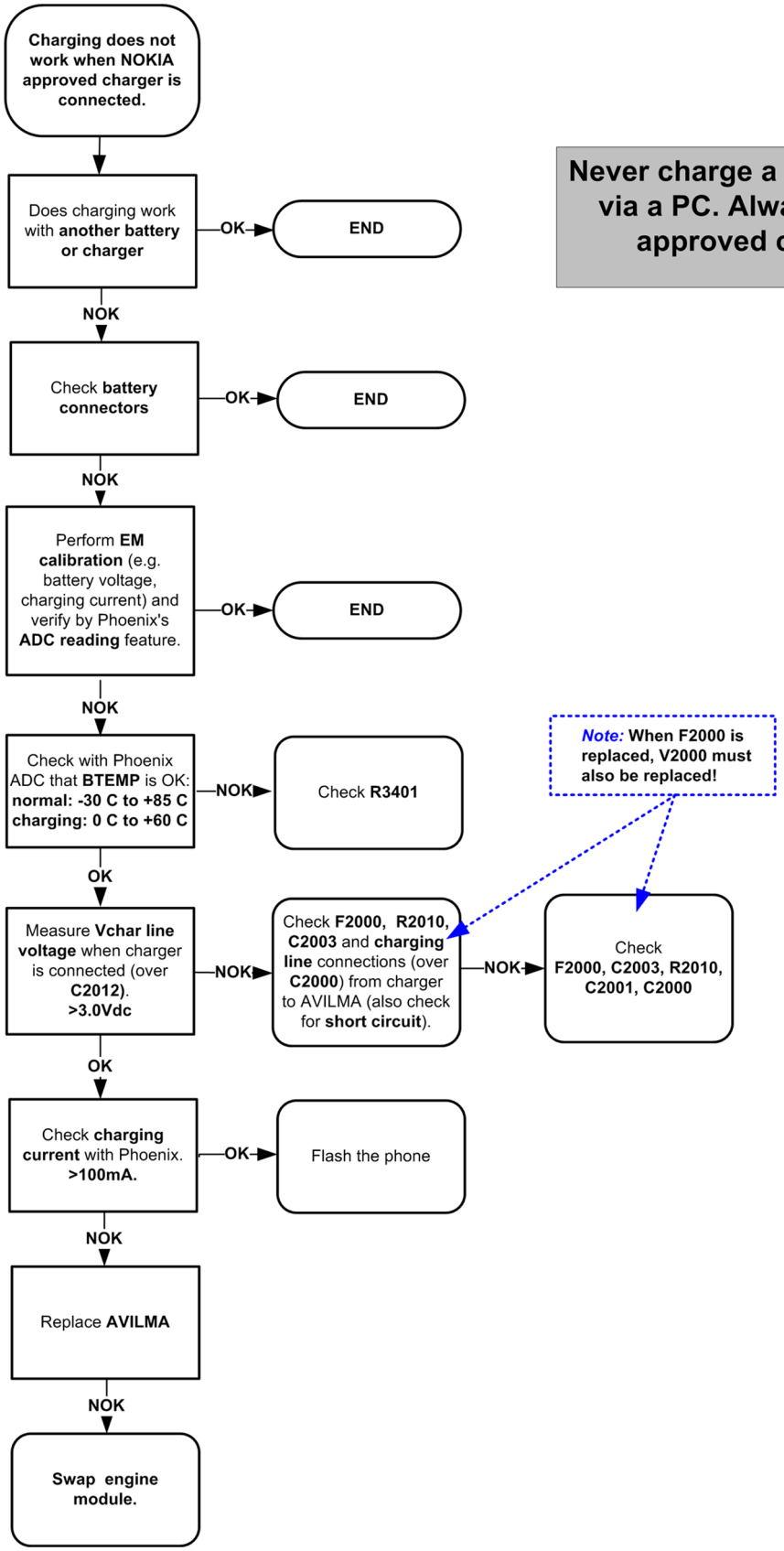
General power checking

Check the following voltages:

Signal name	Regulator	Sleep	Idle	Nominal voltage	Main user	Notes
VIO	AVILMA	ON	ON	1.82	Memory, I/Os, Display	
VBACK	AVILMA	ON	ON	2.5	Back-up battery	
VSIM1	AVILMA	ON	ON	1.8/3.0	SIM card	
VDRAM	AVILMA	ON	ON	1.82	SDRAM	
VAUX	AVILMA	OFF	OFF	2.5	Camera, ALS, Display	
VR1	AVILMA	OFF	ON	2.5	Crystal oscillators, Ahneus	
VRFC	AVILMA	OFF	ON	1.8	RAP3G converters	
VRCP1	AVILMA			4.75	To RF parts	RF active
VREF	AVILMA	ON	ON	1.35	RF reference	
VCORE	BETTY	ON	ON	1.05 - 1.40	RAP3G digital	
VOUT	BETTY	OFF	OFF	2.5		Accessory connected
VCAM_2V8	LP3987ITLX-2.85/N3351	OFF	OFF	2.850	Camera	Disabled in sleep
VCAM_1V8	LM3677TLX-1.82/L1000	OFF	OFF	1.800	Camera	Disabled in sleep
VSIM2_MMC	KMBGN000A/L1001	OFF	OFF	1.8	Internal memory	Disabled in sleep

Charging troubleshooting

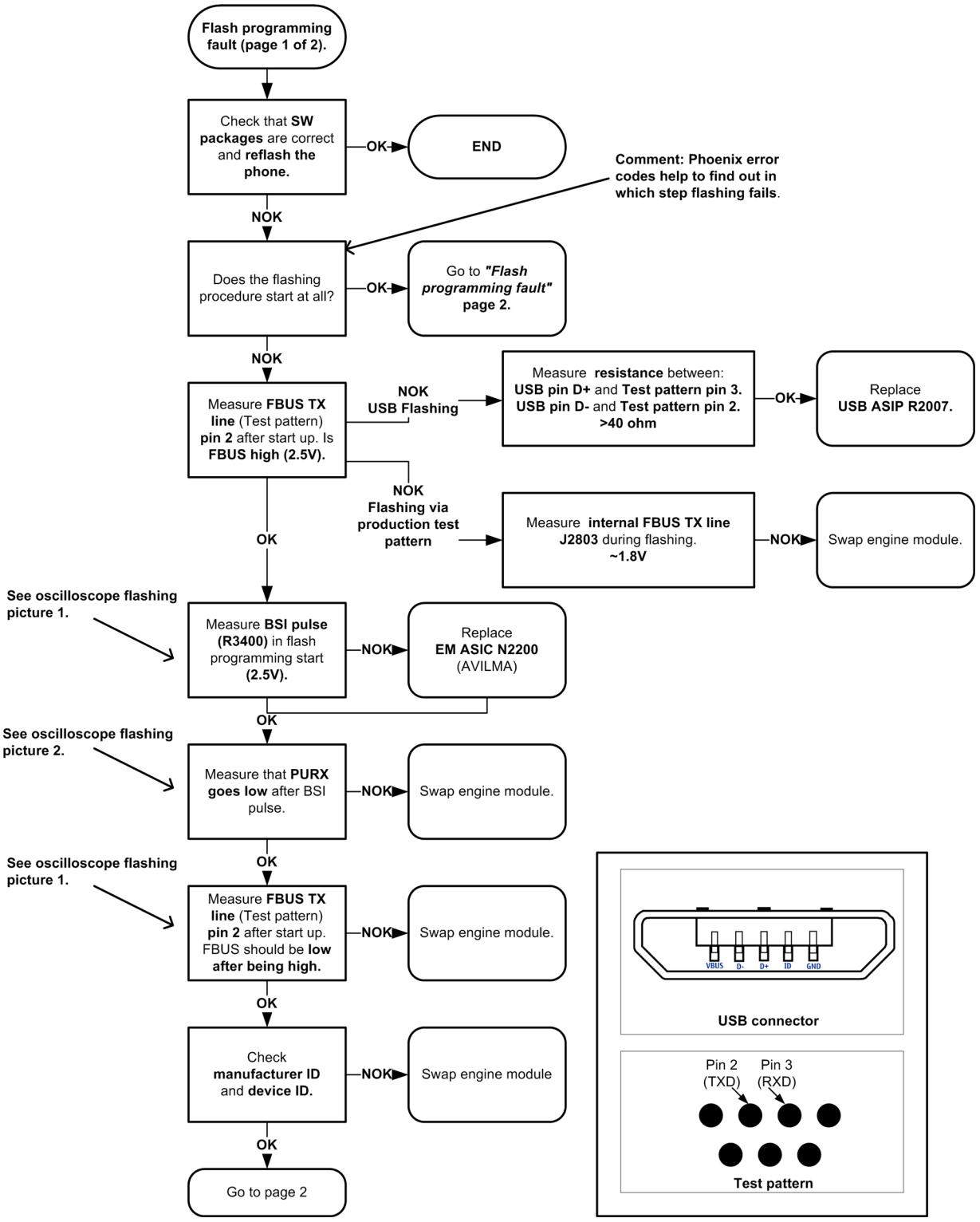
Troubleshooting flow



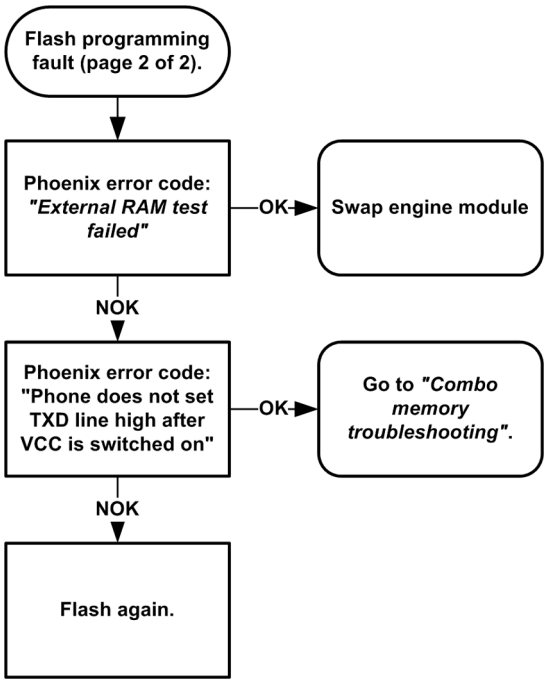
Interface troubleshooting

Flash programming fault troubleshooting

Part 1



Part 2



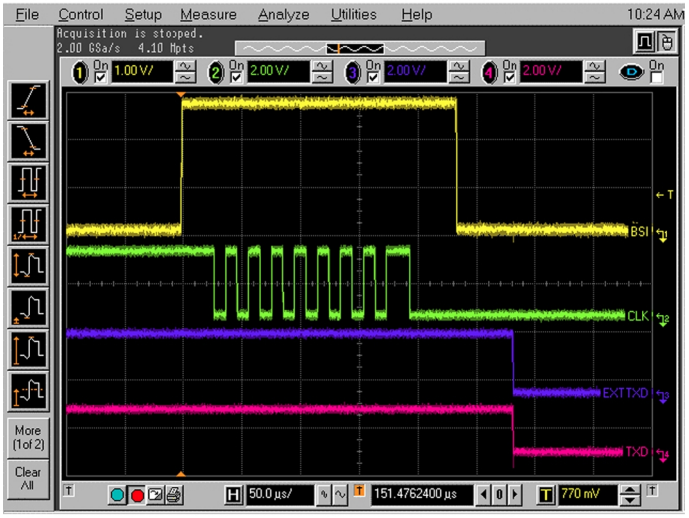


Figure 8 Flashing pic 1. Take single trig measurement for the rise of the BSI signal.

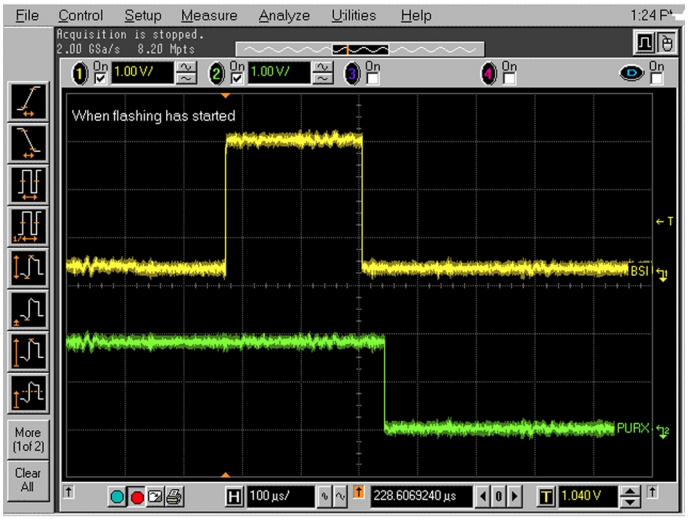
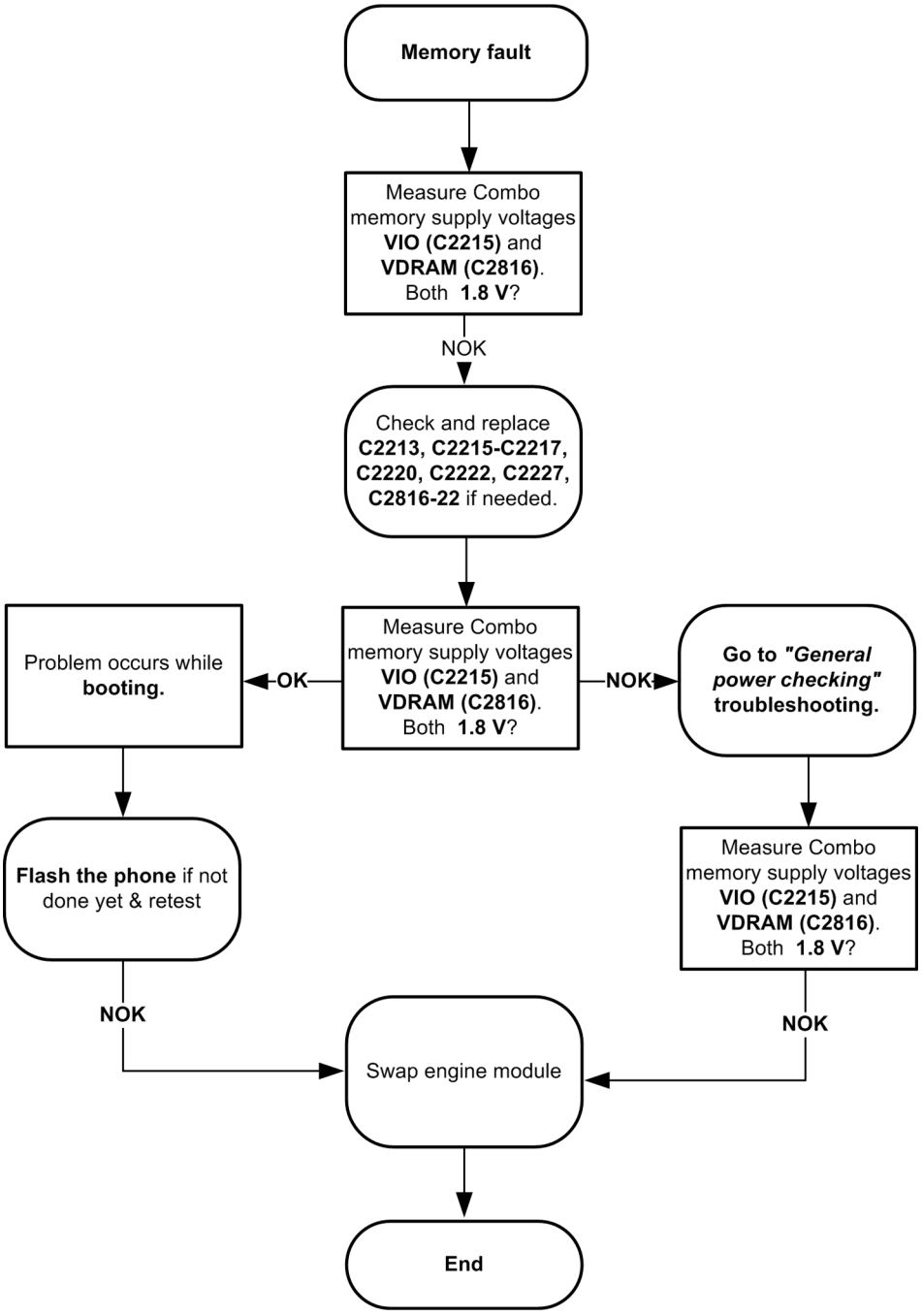


Figure 9 Flashing pic 2. Take single trig measurement for the rise of the BSI signal.

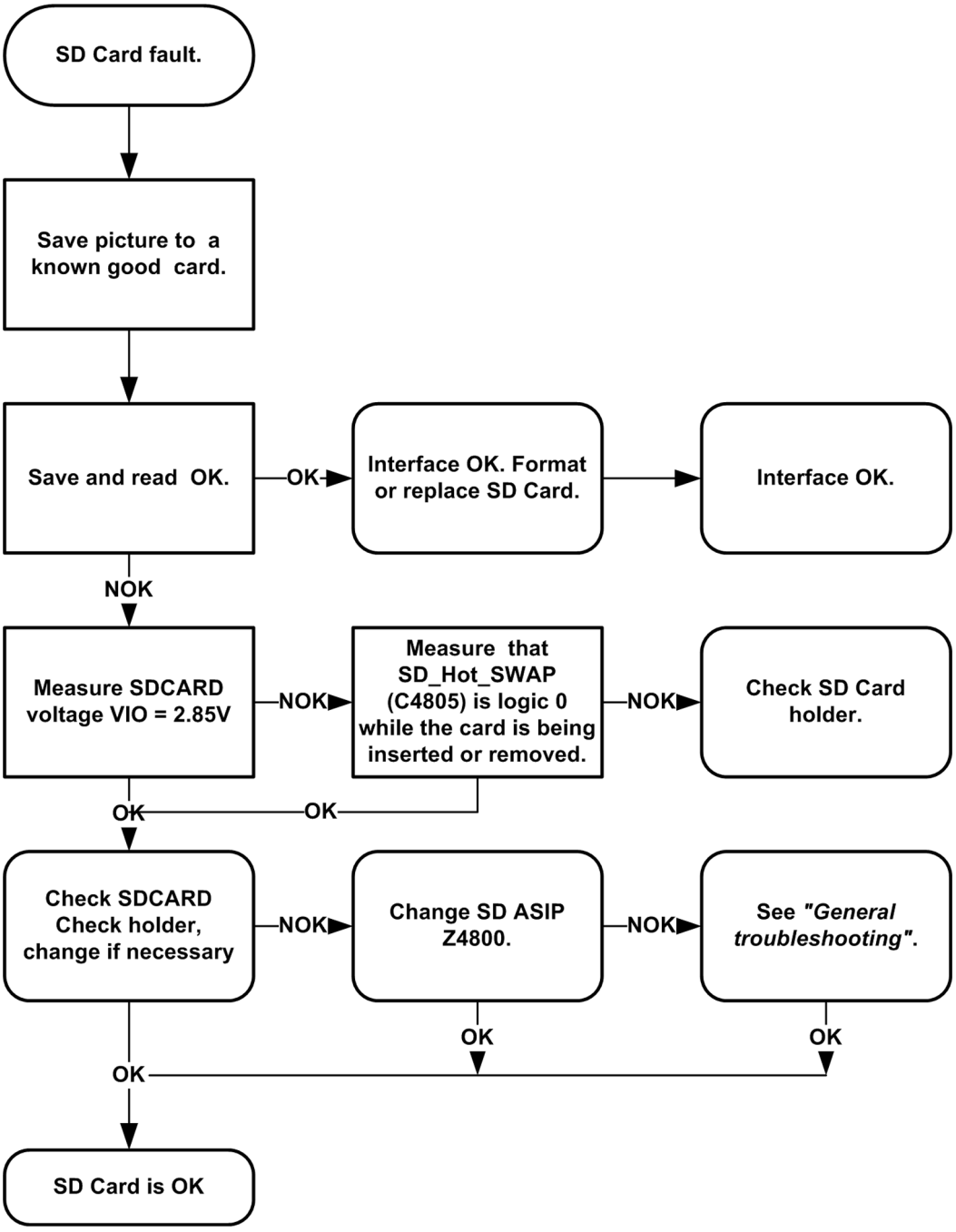
Combo memory troubleshooting

Troubleshooting flow



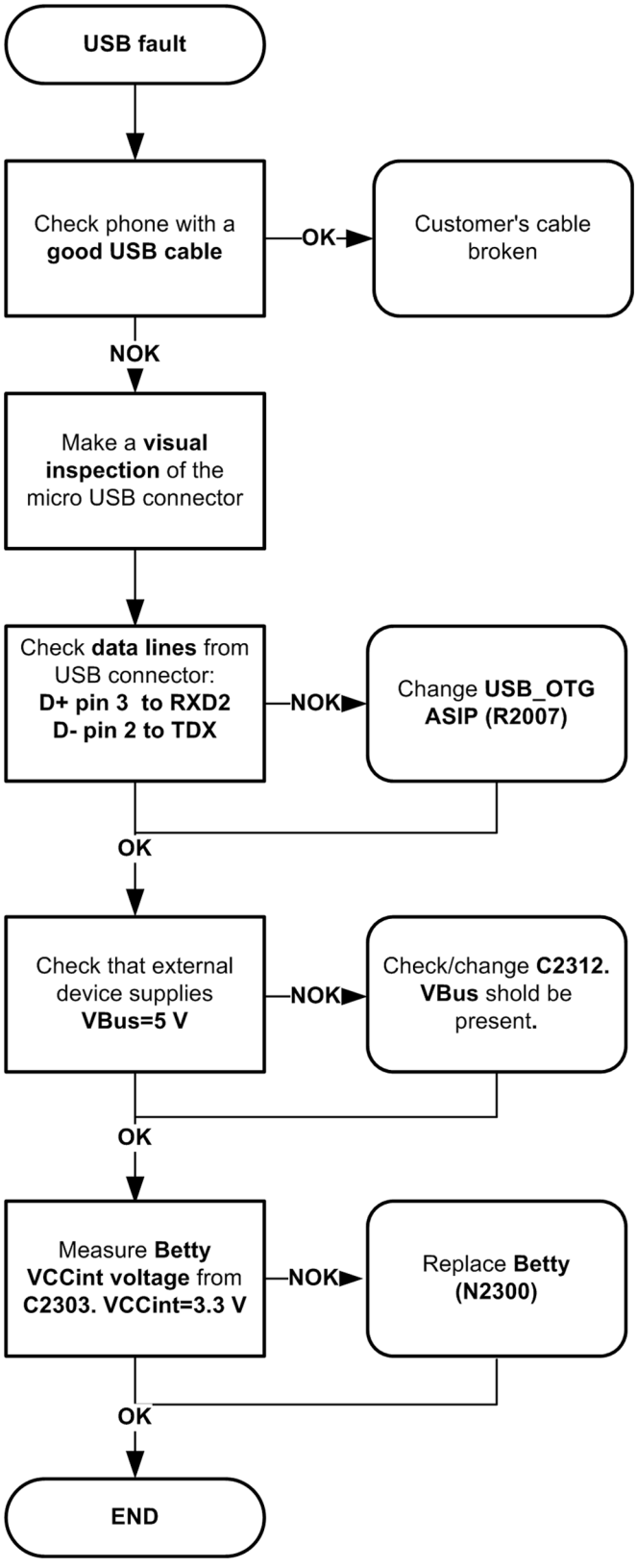
SD card troubleshooting

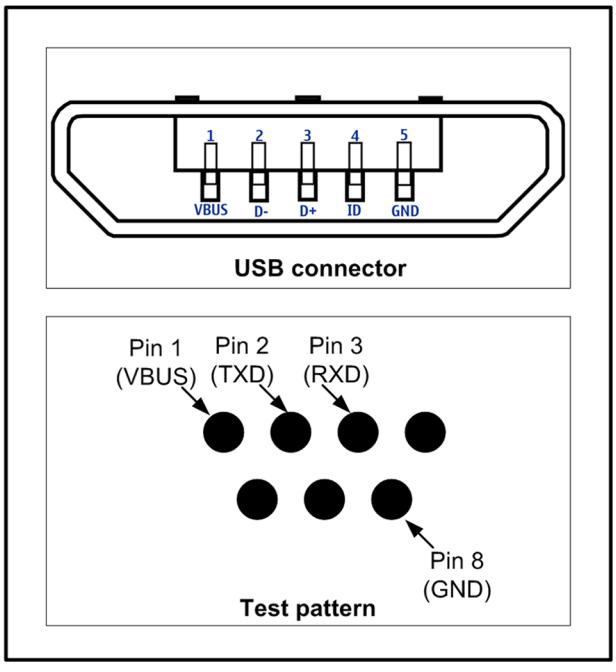
Troubleshooting flow



USB interface troubleshooting

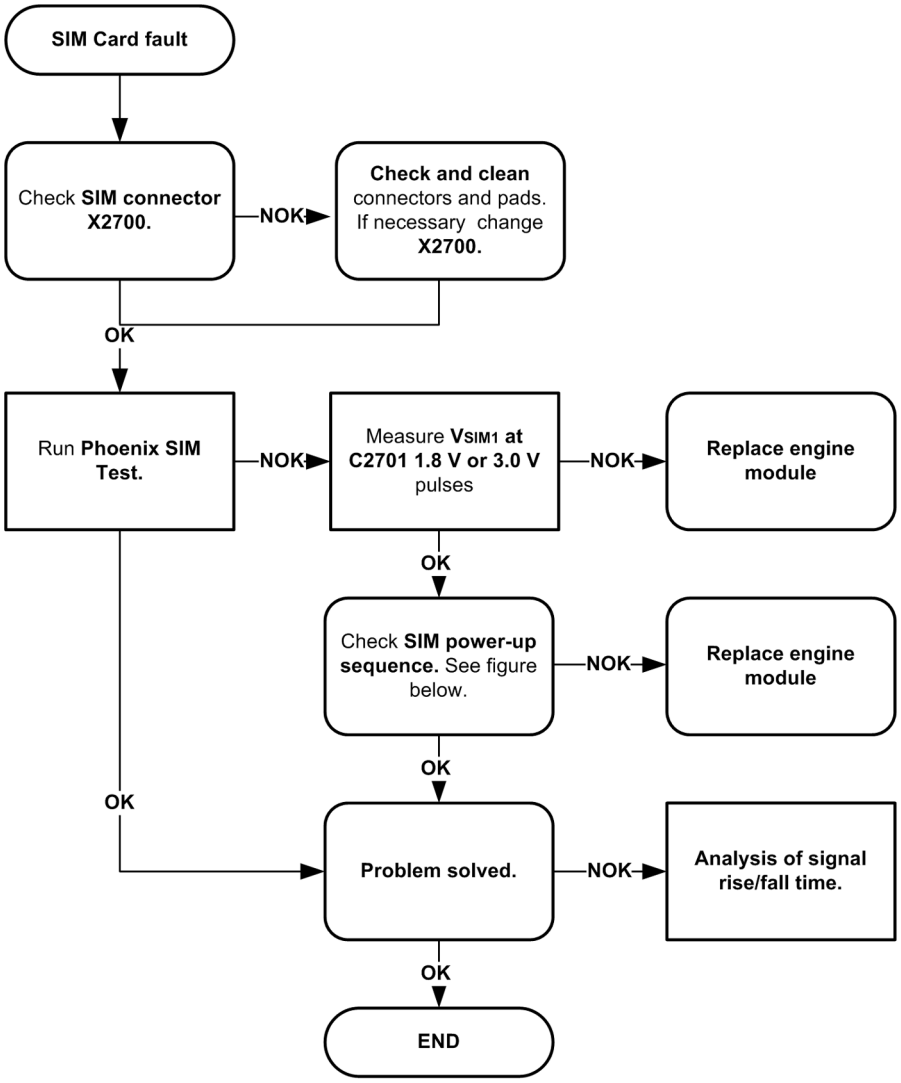
Troubleshooting flow

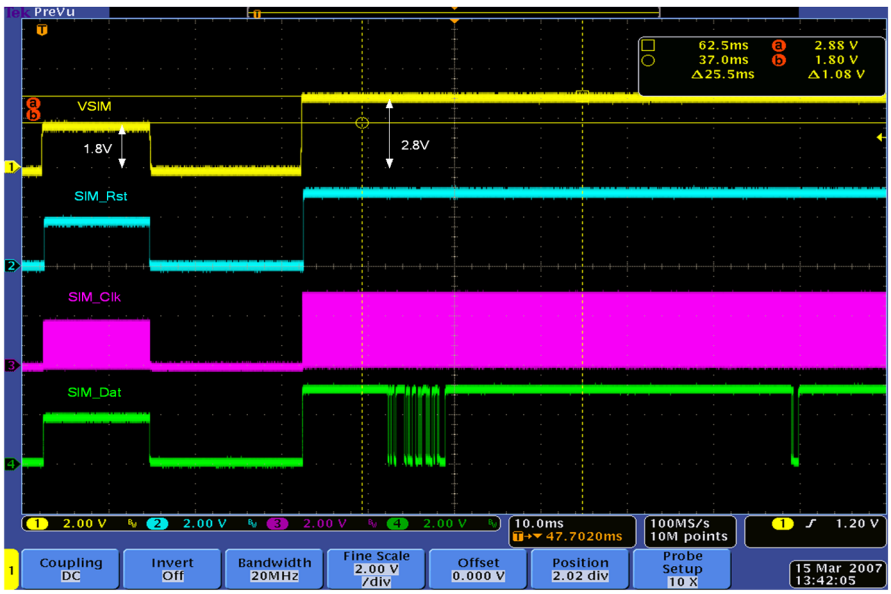




SIM card troubleshooting

Troubleshooting flow





User interface troubleshooting

Keypad troubleshooting

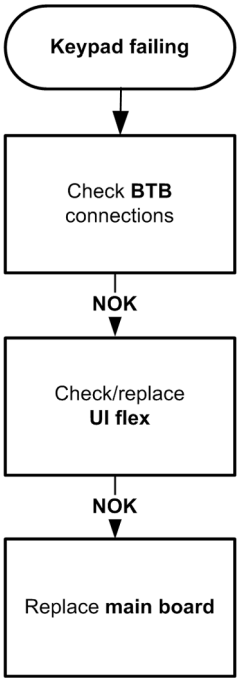
Context

There are two possible failure modes in the keyboard module:

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

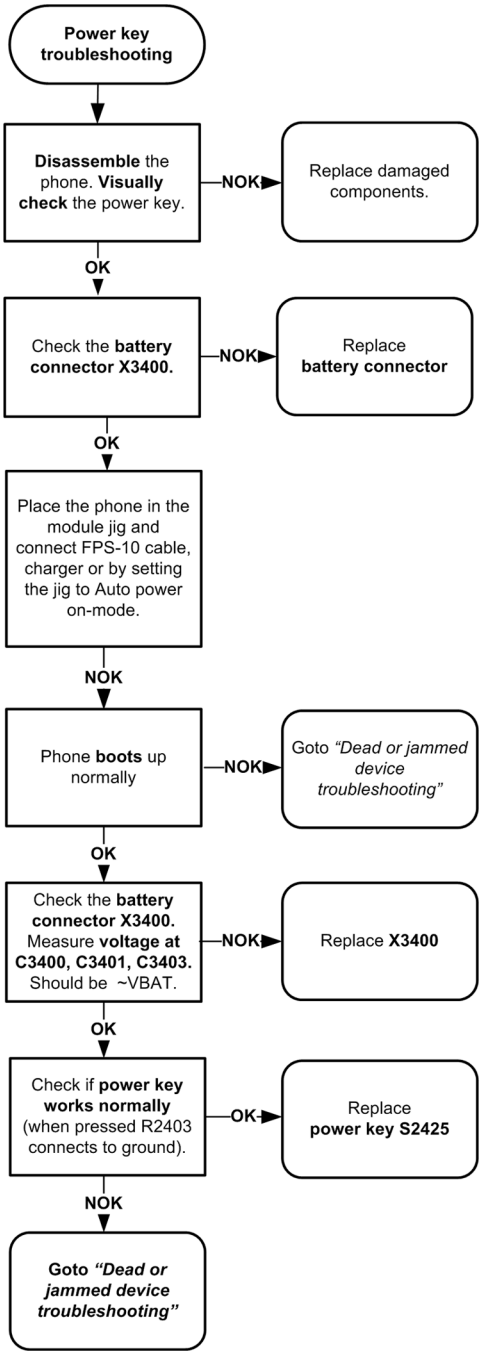
If the failure mode is not clear, start with the Keyboard test in Phoenix.

Troubleshooting flow



Power key 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 partial idle mode when the phone is in the screen saver mode.

- The operating modes of the display can be controlled with the help of *Phoenix*.

Table 6 Display module troubleshooting cases

Display blank	There is no image on the display. The display looks the same when the phone is on as it does when the phone is off. The backlight can be on in some cases.
Image on the display not correct	Image on the display can be corrupted or a part of the image can be missing. If a part of the image is missing, change the display module. If the image is otherwise corrupted, follow the appropriate troubleshooting diagram.
Visual defects (pixel)	Pixel defects can be checked by controlling the display with Phoenix. Use both colours, black and white, on a full screen. 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 7 Pixel defects

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

Steps

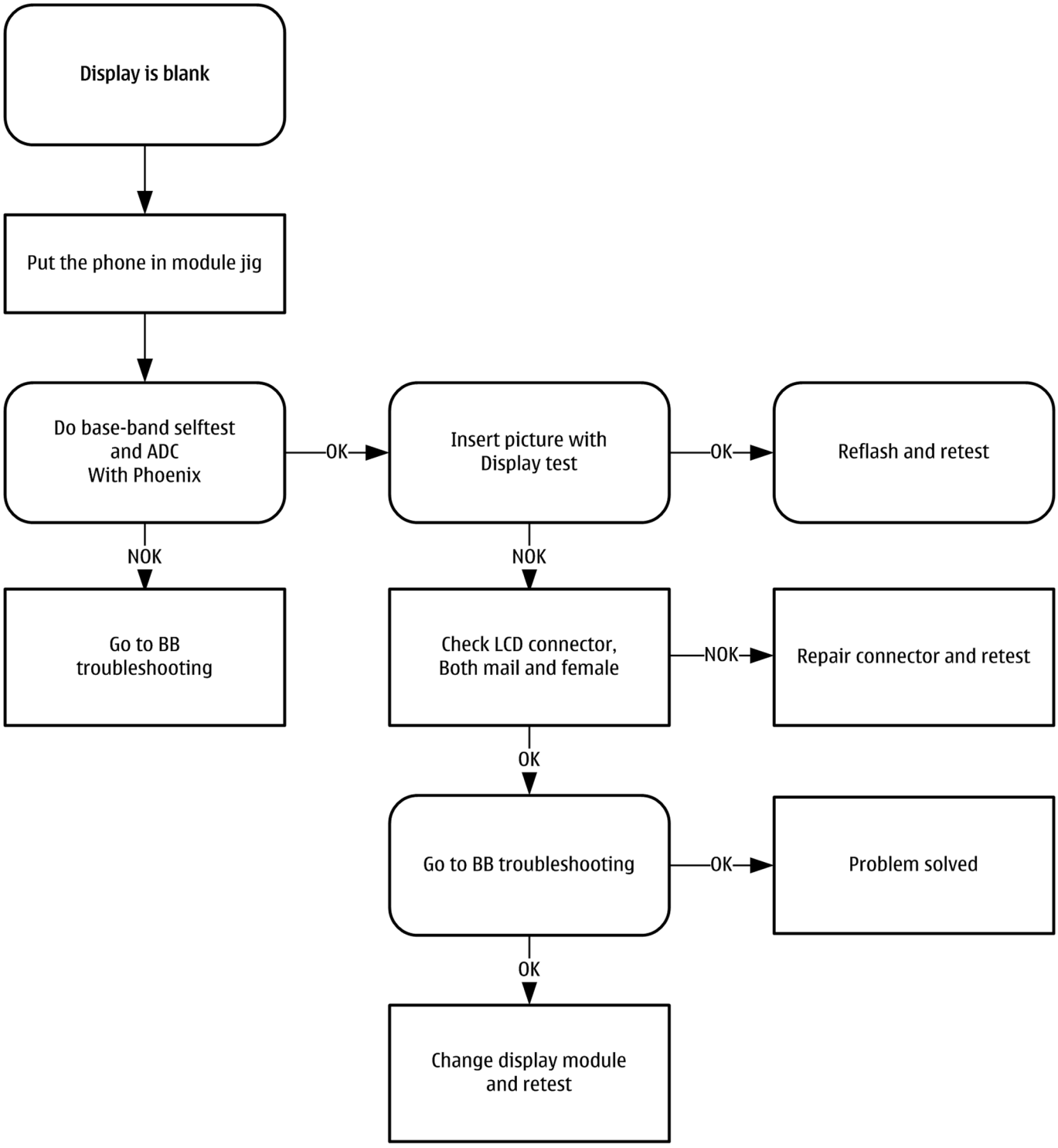
1. Verify with a working display that the fault is not on the display module itself.
   The display module cannot be repaired.
2. Check that the cellular engine is working normally.
   i To check the functionality, connect the phone to a docking station.
   ii Start *Phoenix* service software.
   iii 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.

Blank display troubleshooting

Context

The phone is in normal mode and there is no image on the display. Display back light could be on in some cases.

Troubleshooting flow

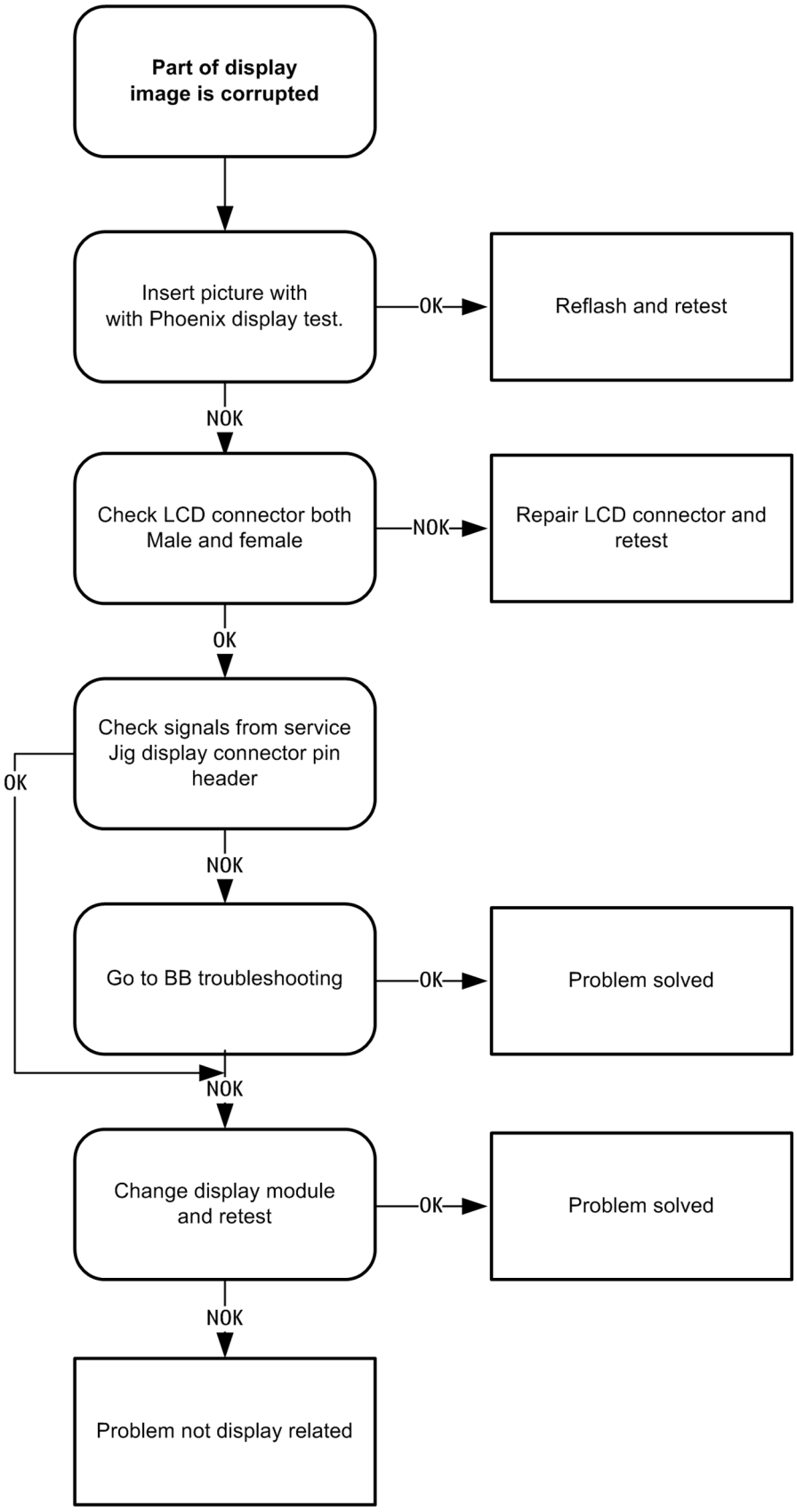


Faulty image troubleshooting

Context

The image on the display is corrupted or part of the image is missing. If a part of the image is missing, change the display module. Otherwise, follow the flowchart below.

Troubleshooting flow

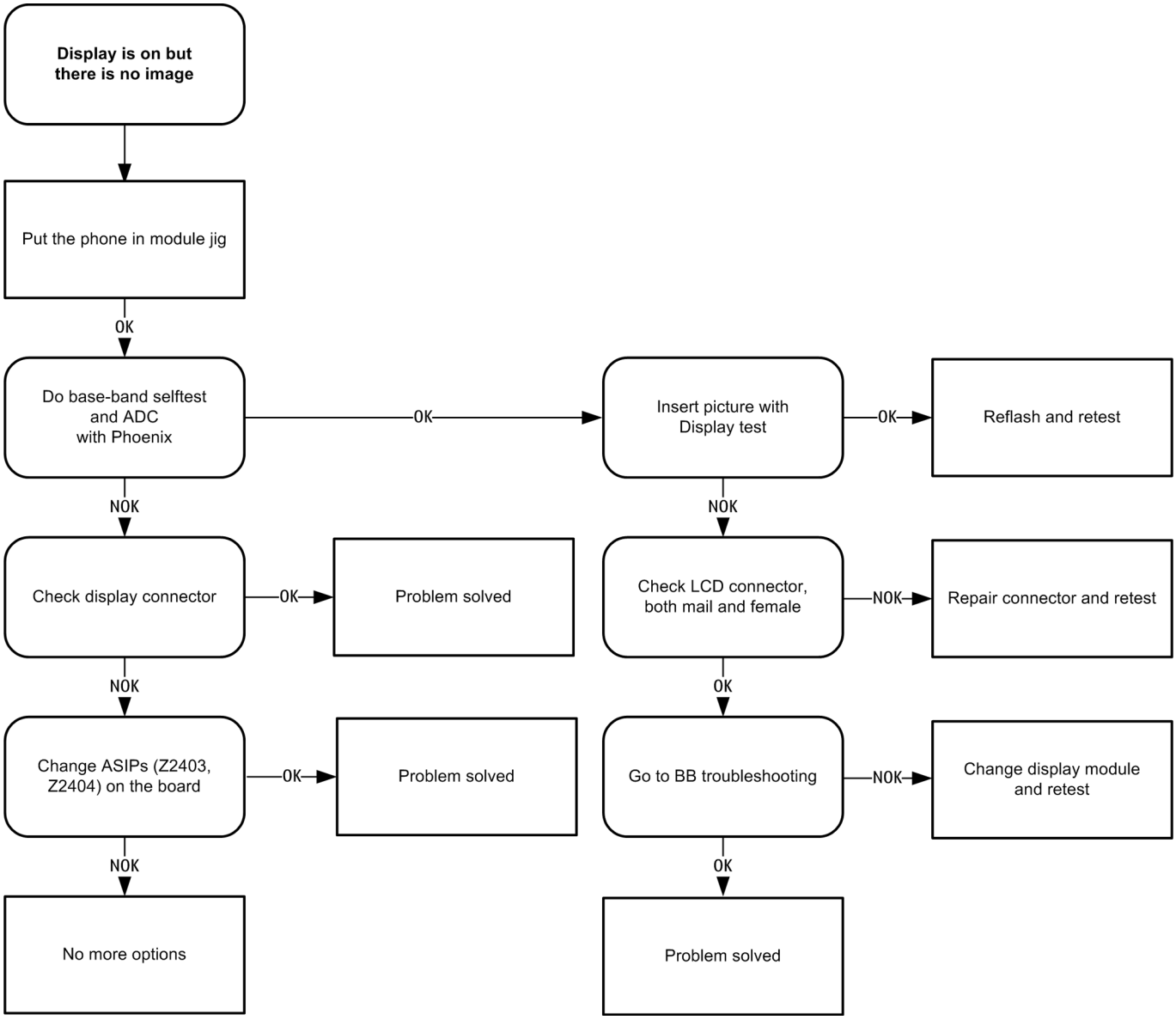


Display on but no image troubleshooting

Context

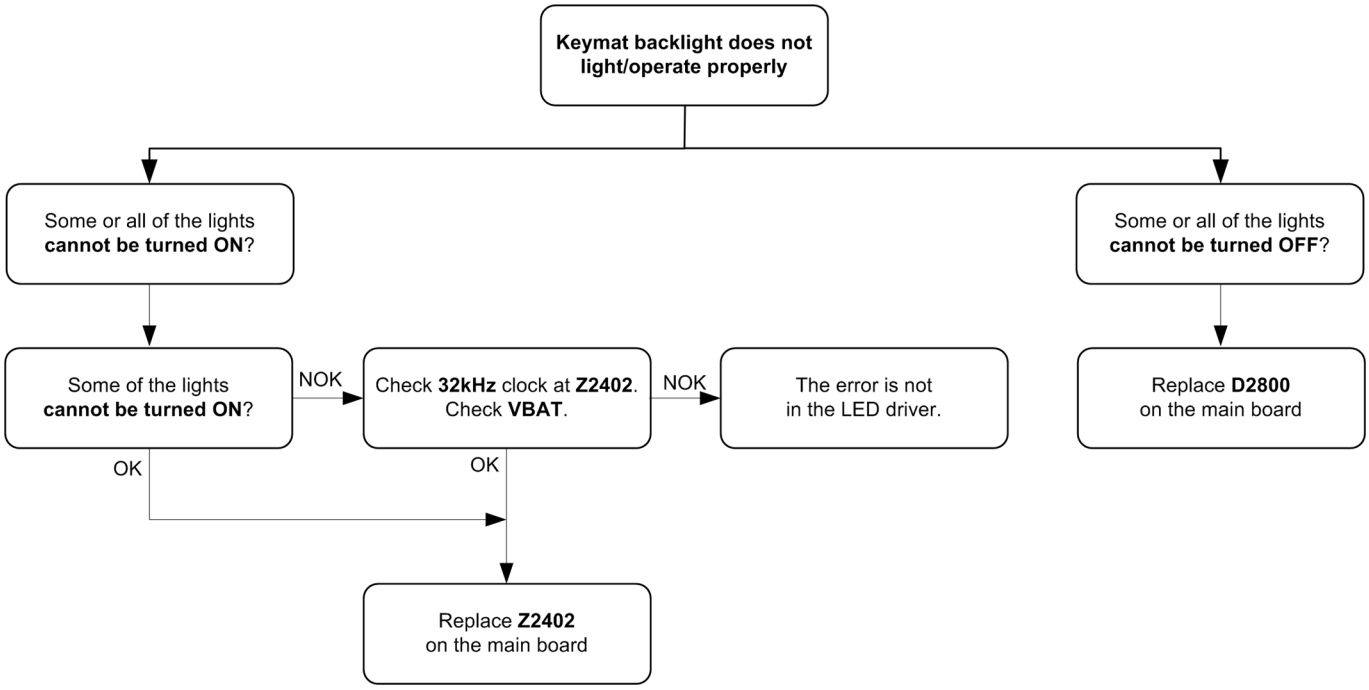
The phone is on, display active and blank, but no image.

Troubleshooting flow



Keyboard backlight troubleshooting

Troubleshooting flow



Camera module troubleshooting

Introduction to camera troubleshooting

Bad conditions often cause bad pictures. Therefore, the camera operation has to be checked in constant conditions or by using a second, known-to-be-good Nokia device as reference. Image quality is hard to measure quantitatively, and the difference between a good and a bad picture can be small. Some training or experience may be needed to detect what is actually wrong.

When checking for possible errors in camera functionality, knowing what error is suspected significantly helps the testing by narrowing down the amount of test cases. The following types of image quality problems are common:

- Dust (black spots)
- Lack of sharpness
- Bit errors

Main (back) camera troubleshooting

Taking and evaluating test pictures with main camera

When *taking* a test picture, remember the following:

- Avoid bright fluorescent light, 50/60Hz electrical network or high artificial illumination levels
- If the phone is hot, let it rest for a while before taking the picture
- Make sure the optical system is clean
- Use highest possible resolution
- Make sure the light is sufficient (bright office lightning)

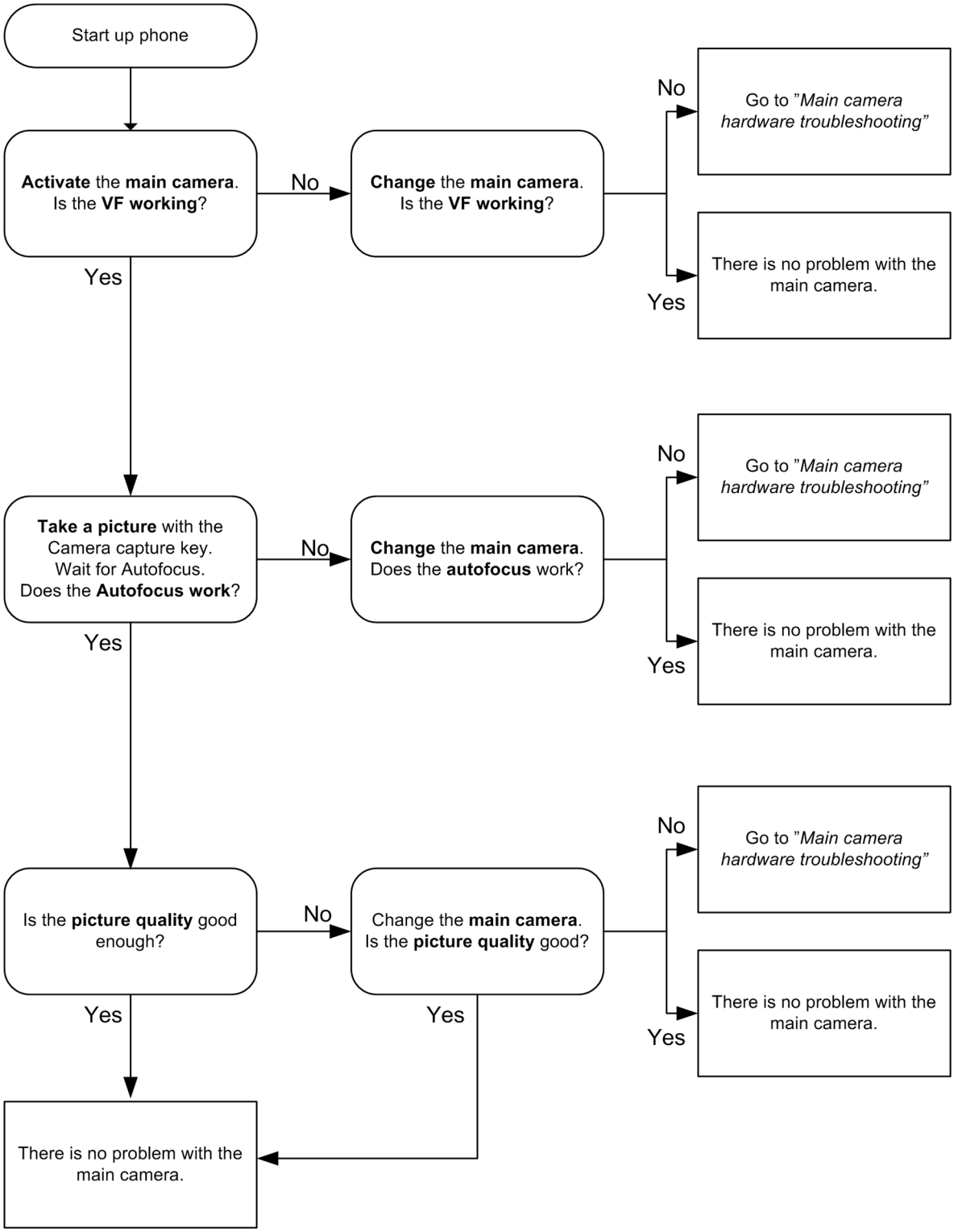
- Do not take the picture towards a light source
- Hold the phone as still as possible when taking the picture
- If camera has auto focus: Pictures should be taken both at infinity ~>2m and at macro distance ~10-15 cm in order to verify auto focus functionality

When *evaluating* a test picture, remember the following:

- The center of the picture is sharper than the edges
- The image may be blurred, though it does not show in the viewfinder
- Analyse the picture from your PC monitor, full colour setting is recommended
- If possible, compare with a picture of the same motive taken with a similar Nokia device
- If camera has auto focus: Remember that the white focussing frame which appears when the camera button is pressed halfway down, must turn green for auto focus lock. If the frame turns red, the camera is not focussed!

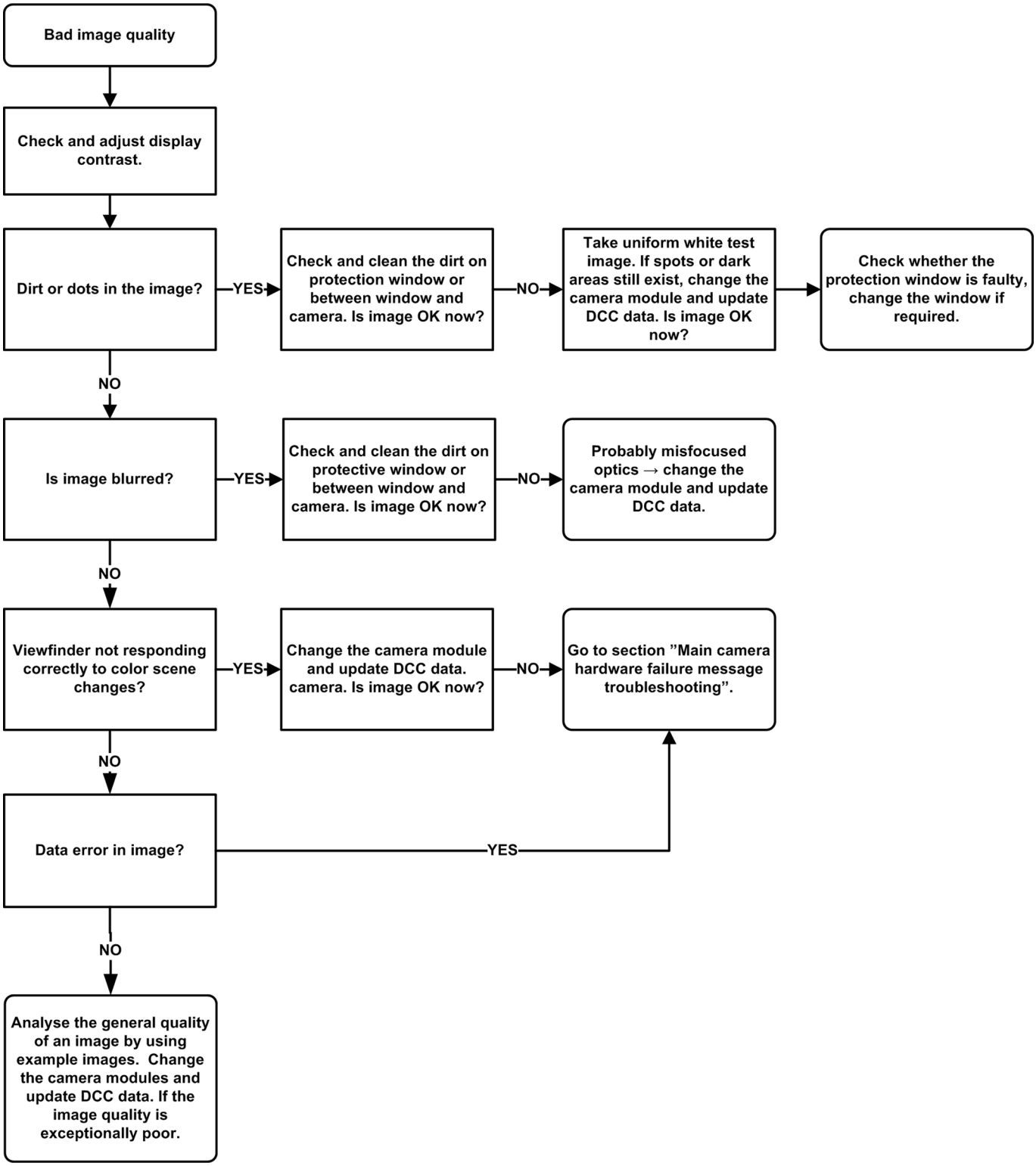
Main camera troubleshooting

Troubleshooting flow



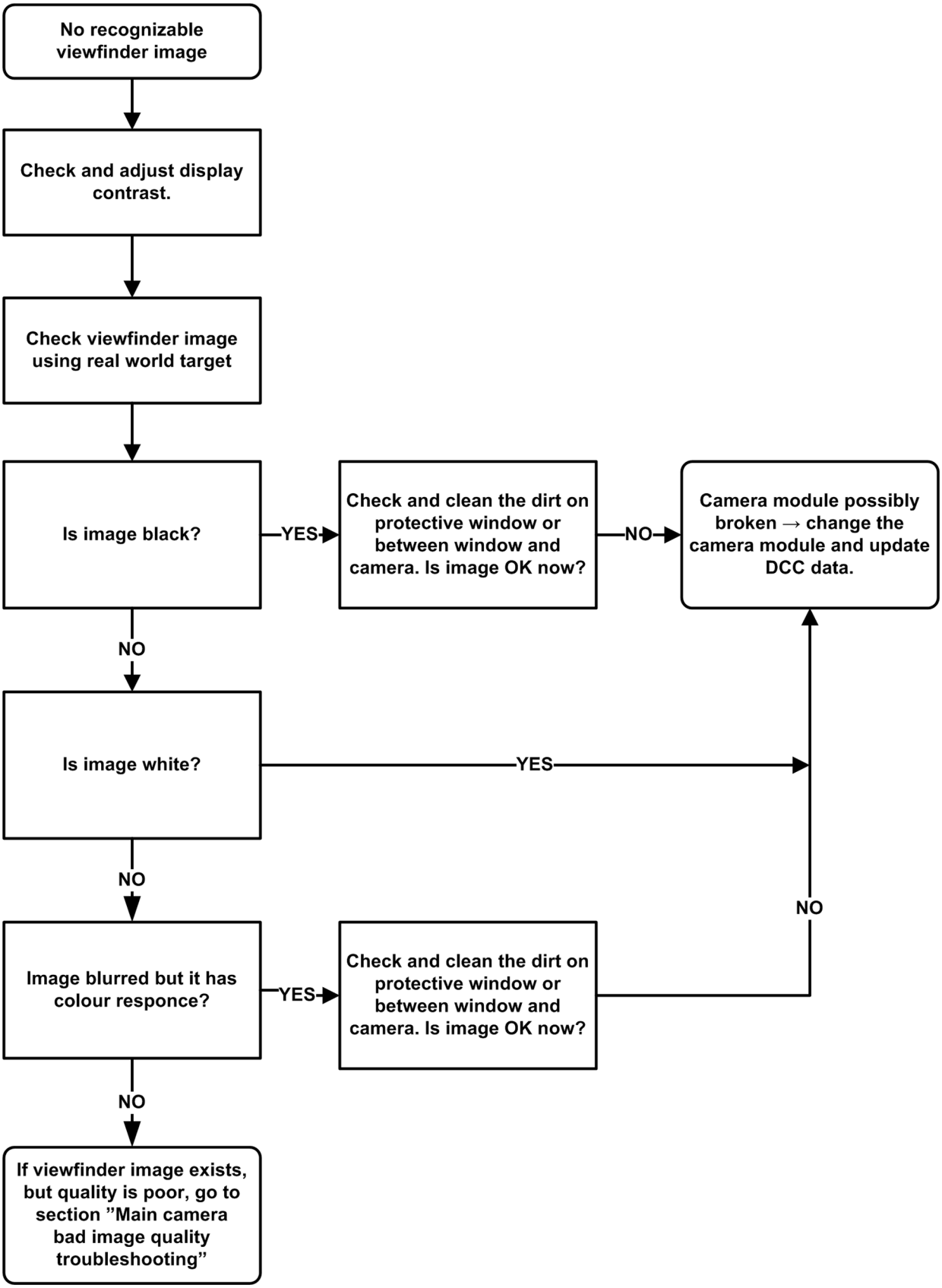
Main camera bad image quality troubleshooting

Troubleshooting flow



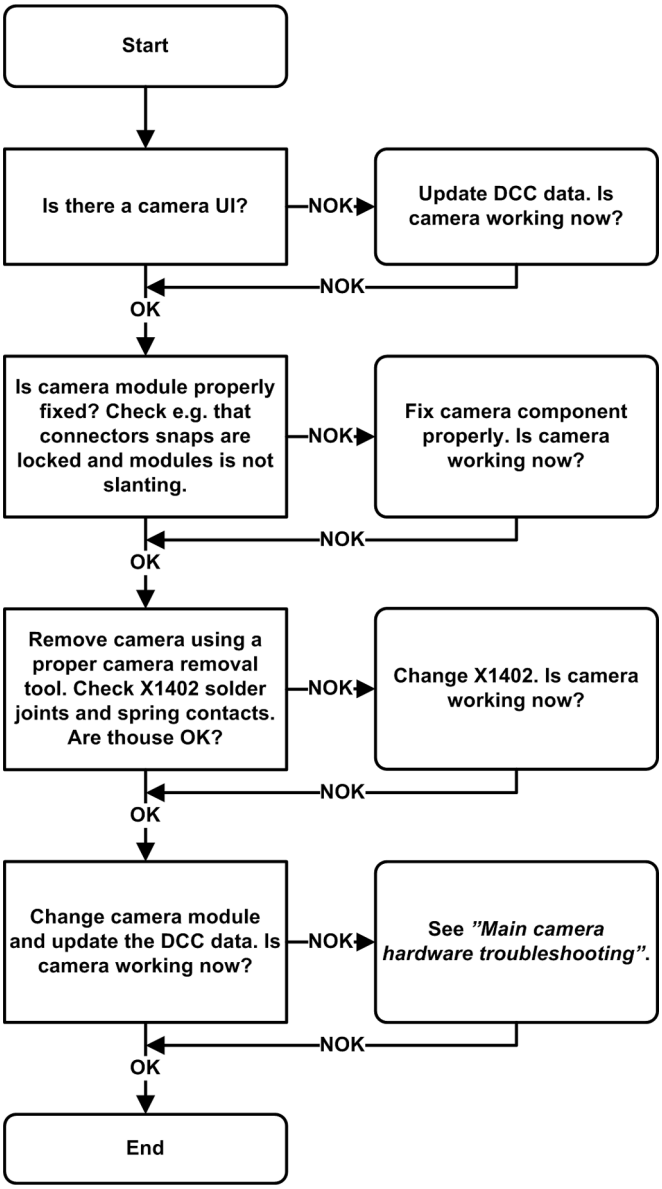
Main camera viewfinder troubleshooting

Troubleshooting flow



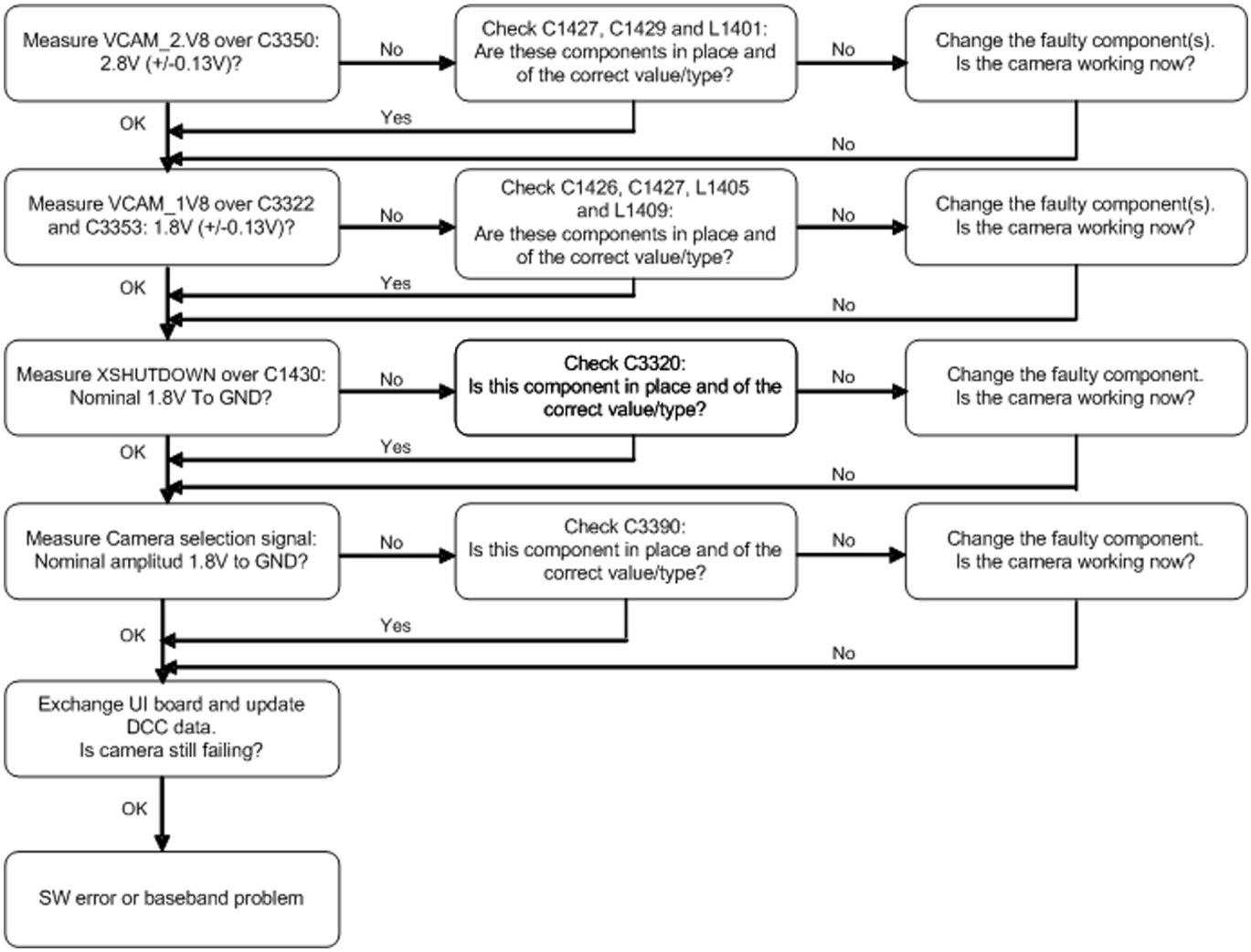
Main camera hardware failure message troubleshooting

Troubleshooting flow



Main camera hardware troubleshooting

Troubleshooting flow

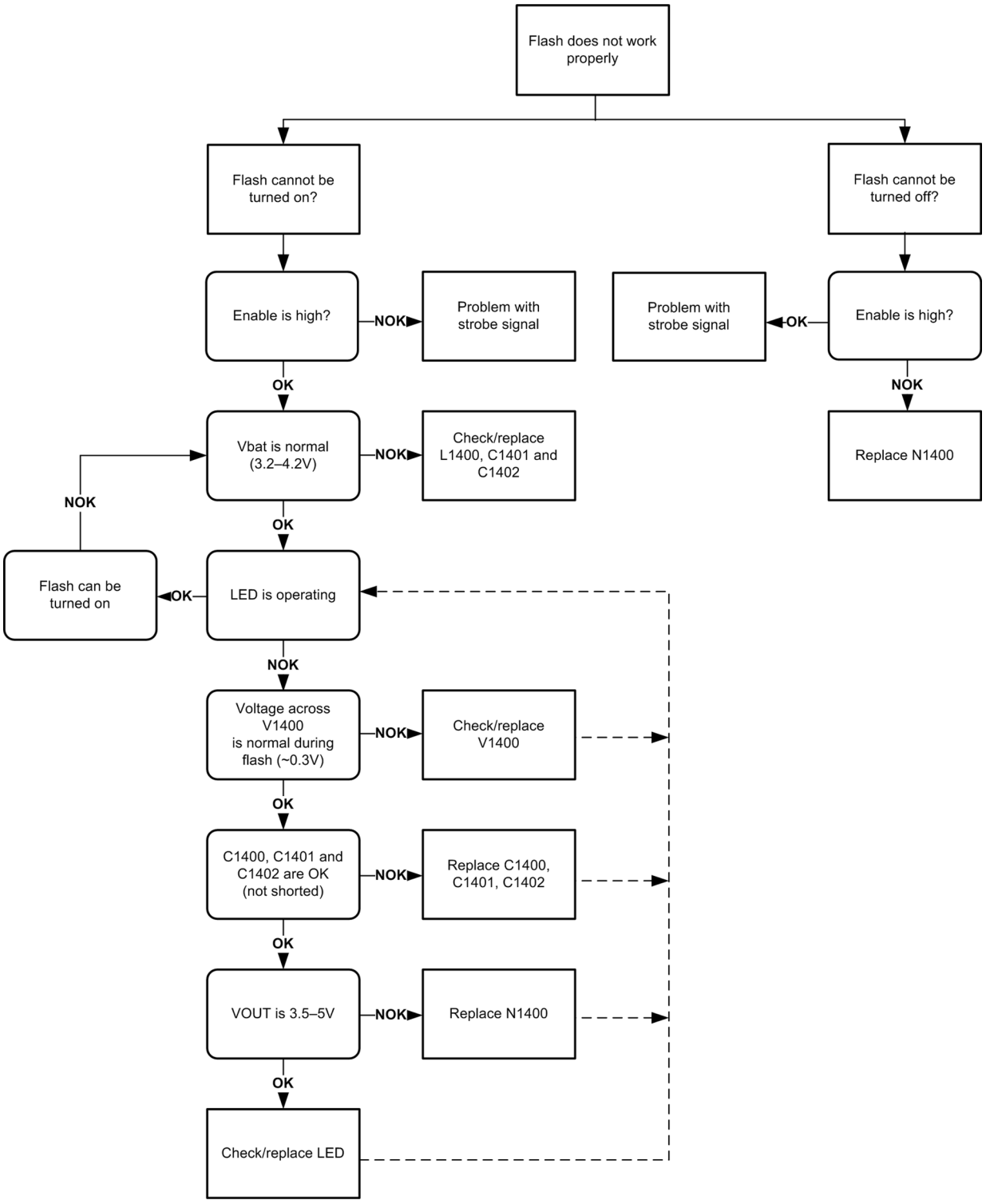


Camera LED flash troubleshooting

Context

Note: There are three different flash modes.

Troubleshooting flow



Secondary (front) camera troubleshooting

Evaluating videocall picture quality from secondary camera

When testing the picture quality of a videocall, remember the following:

- Avoid bright fluorescent light, 50/60Hz electrical network or high artificial illumination levels
- Make sure the optical system is clean
- Make sure the light is suffiecient (bright office lightning)
- Do not take the picture towards light source
- Hold the phone as still as possible when evaluating the video call image quality.
- Distance should be approximately 40 cm

When *evaluating* the picture quality of a video call, remember the following:

> **Note:** Always use the "troubled" phone when evaluating a picture in a video call. Do not evaluate the picture on the receiving phone.

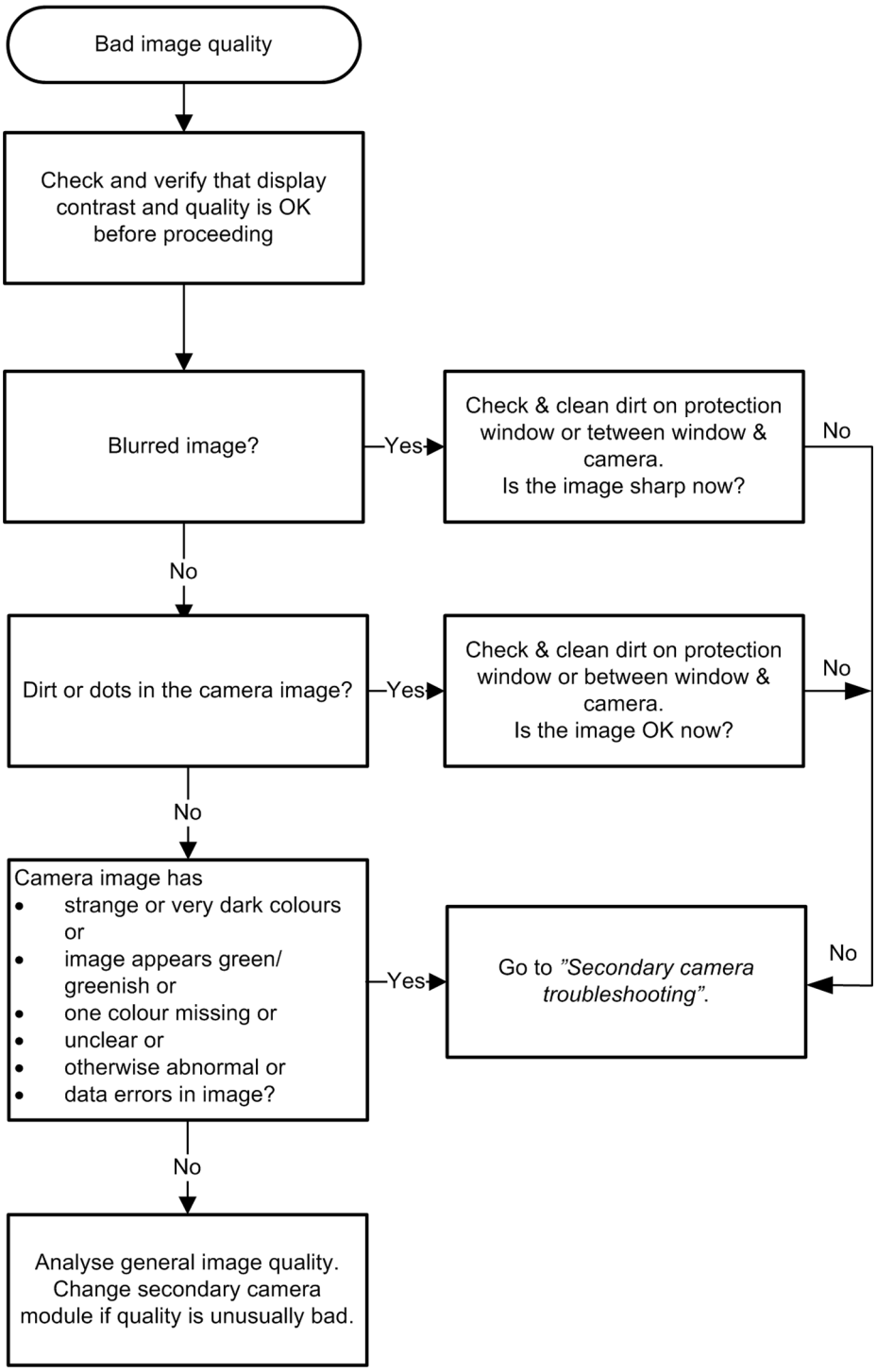
- The center of the picture is sharper than the edges
- If possible, compare with the picture on another Nokia device in a videocall, and of the same motive.

Secondary camera bad image quality troubleshooting

Troubleshooting flow

***Note**: Phone must be in a video call for the front camera to be active.*

***Note:** Always use the "troubled" phone when evaluating a picture in a video call. Do not evaluate the picture on the receiving phone.*

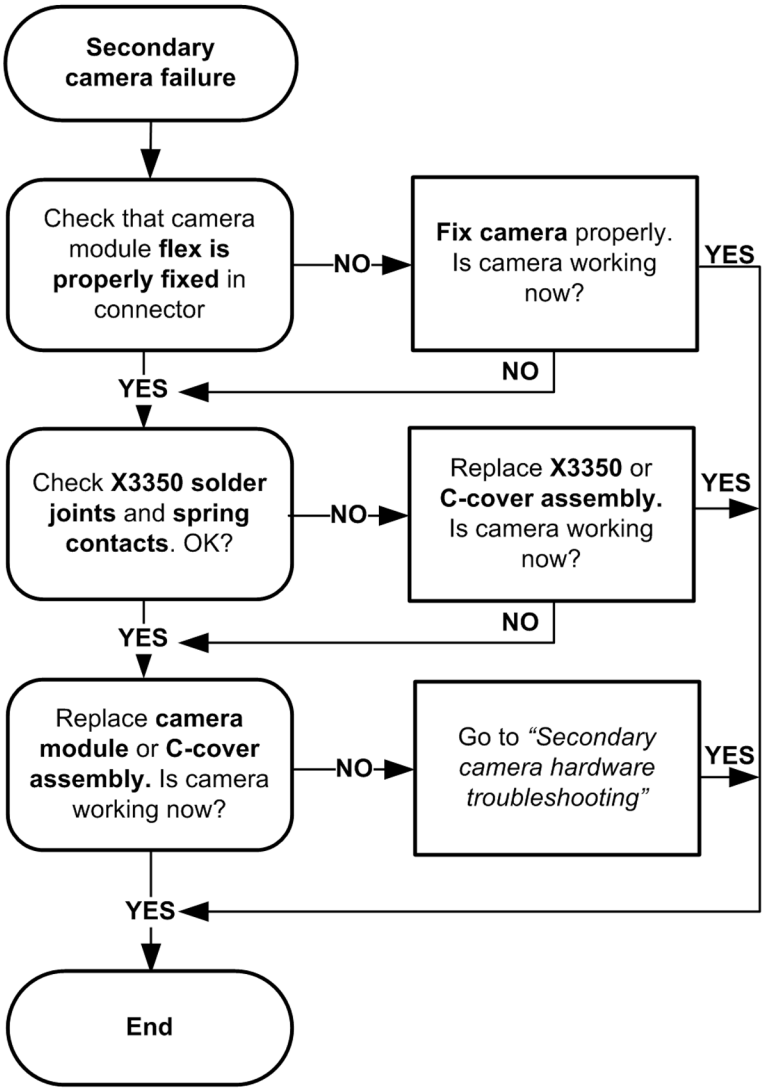


Secondary camera troubleshooting

Troubleshooting flow

***Note**: Phone must be in a video call for the front camera to be active.*

***Note:** Always use the "troubled" phone when evaluating a picture in a video call. Do not evaluate the picture on the receiving phone.*

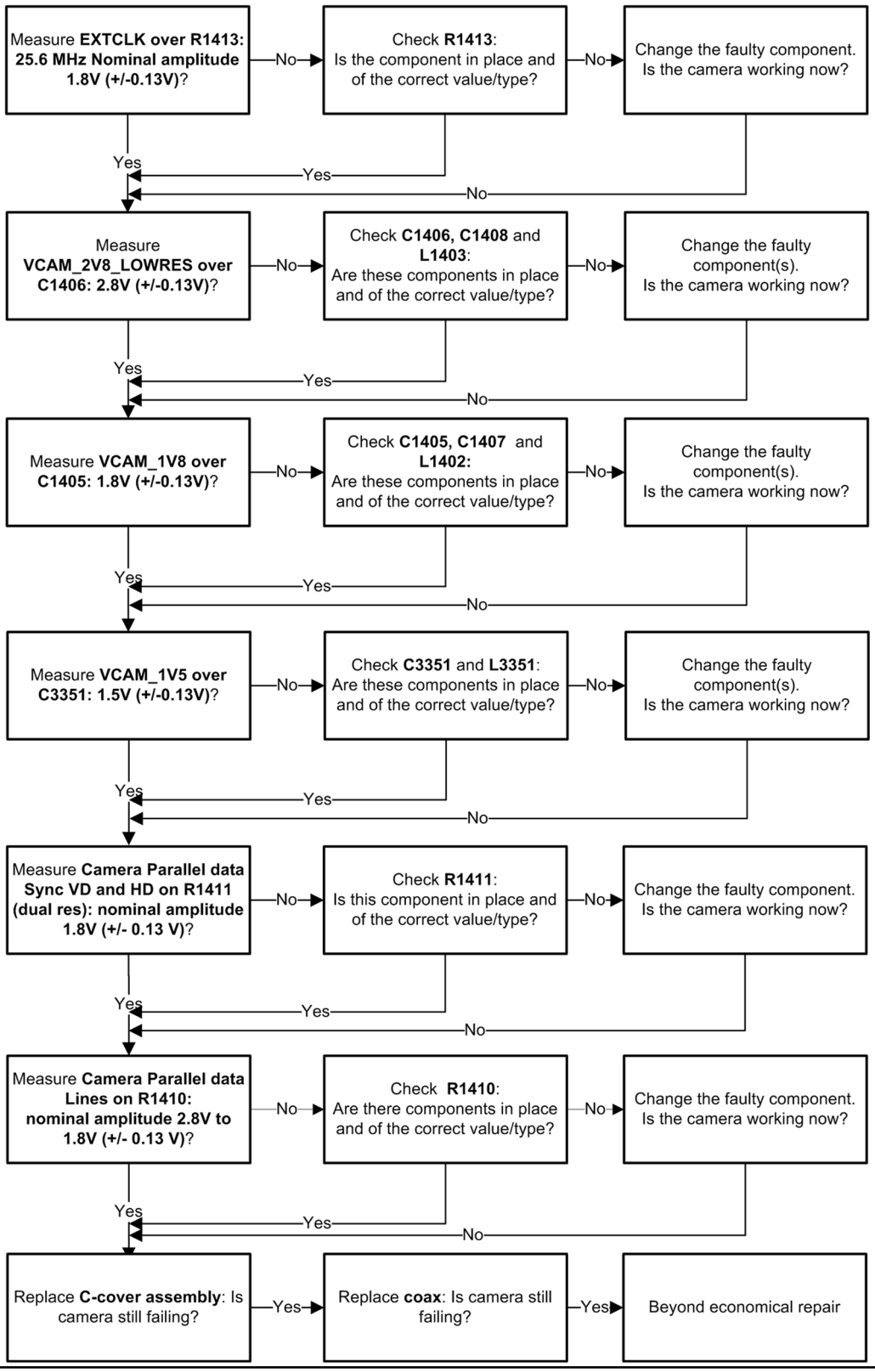


Secondary camera hardware troubleshooting

Troubleshooting flow

Note: *Phone must be in a video call for the secondary camera to be active with signals and voltages present.*

Note: *Always use the "troubled" phone when evaluating a picture in a video call. Do not evaluate the picture on the receiving phone.*



Audio troubleshooting

Audio troubleshooting test instructions

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

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

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

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

Required equipment

The following equipment is needed for the tests:

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

Test procedure

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

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

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

Phoenix audio loop tests and test results

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

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

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

Loop test	Input terminal	Output terminal	Path gain [dB] (fixed)	Input voltage [mVp-p]	Differential output voltage [mVp-p]	Output DC level [V]	Output current [mA]
External Mic to External Earpiece	XMICP and GND	HSEAR R P, HSEAR R N and GND	-2.9	1000	720	1.2	NA
		HSEAR P, HSEAR N and GND					
	XMICN and GND	HSEAR R P, HSEAR R N and GND					
		HSEAR P, HSEAR N and GND					
External Mic to Internal Earpiece	XMICP and GND	EarP and GND	-4.5	1000	600	1.2	NA
		EarN and GND					
	XMICN and GND	EarP and GND					
		EarN and GND					
External Mic to Internal handsfree	XMICP and GND	B2102 pads	-5	1000	560	0	25mA (calc.)
	XMICN and GND	B2102 pads					
Internal Mic to External Earpiece	B2100 (OUT/GND)	HSEAR R P, HSEAR R N and GND	22.7	100	1360	1.2	NA
		HSEAR P, HSEAR N and GND					
		HSEAR R P, HSEAR R N and GND					
		HSEAR P, HSEAR N and GND					

Measurement data

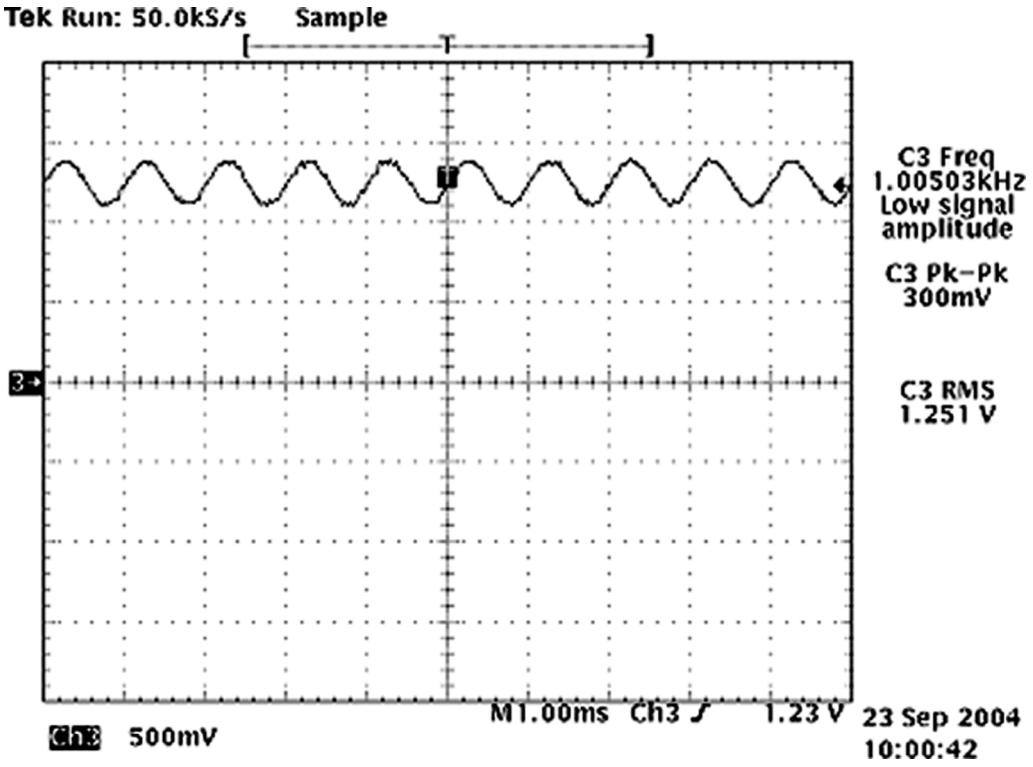
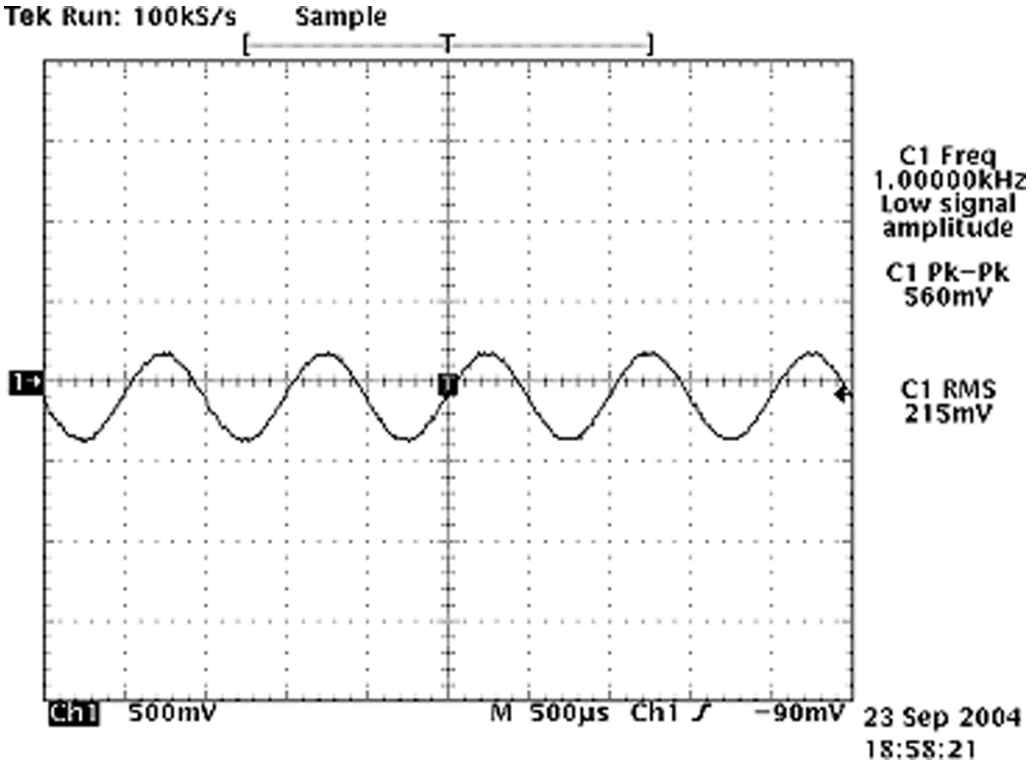


Figure 10 Single-ended output waveform of the Ext_in_HP_out measurement when earpiece is connected.



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

Figure 11 Differential output waveform of the Ext_in_IHF_out out loop measurement when speaker is connected.

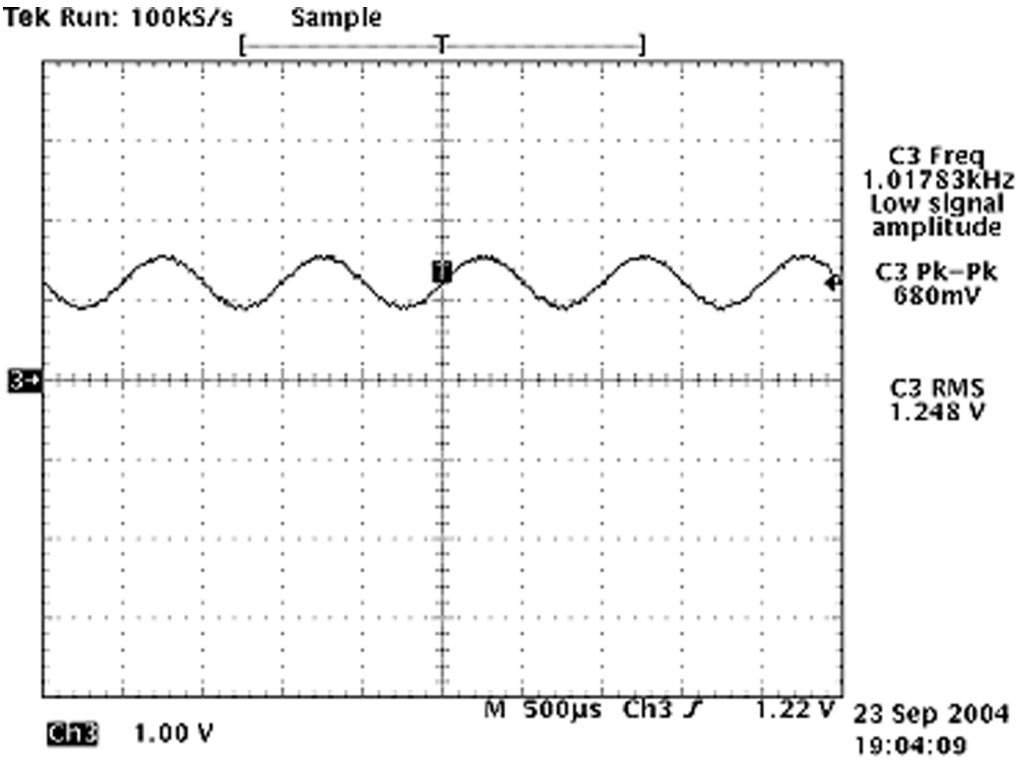
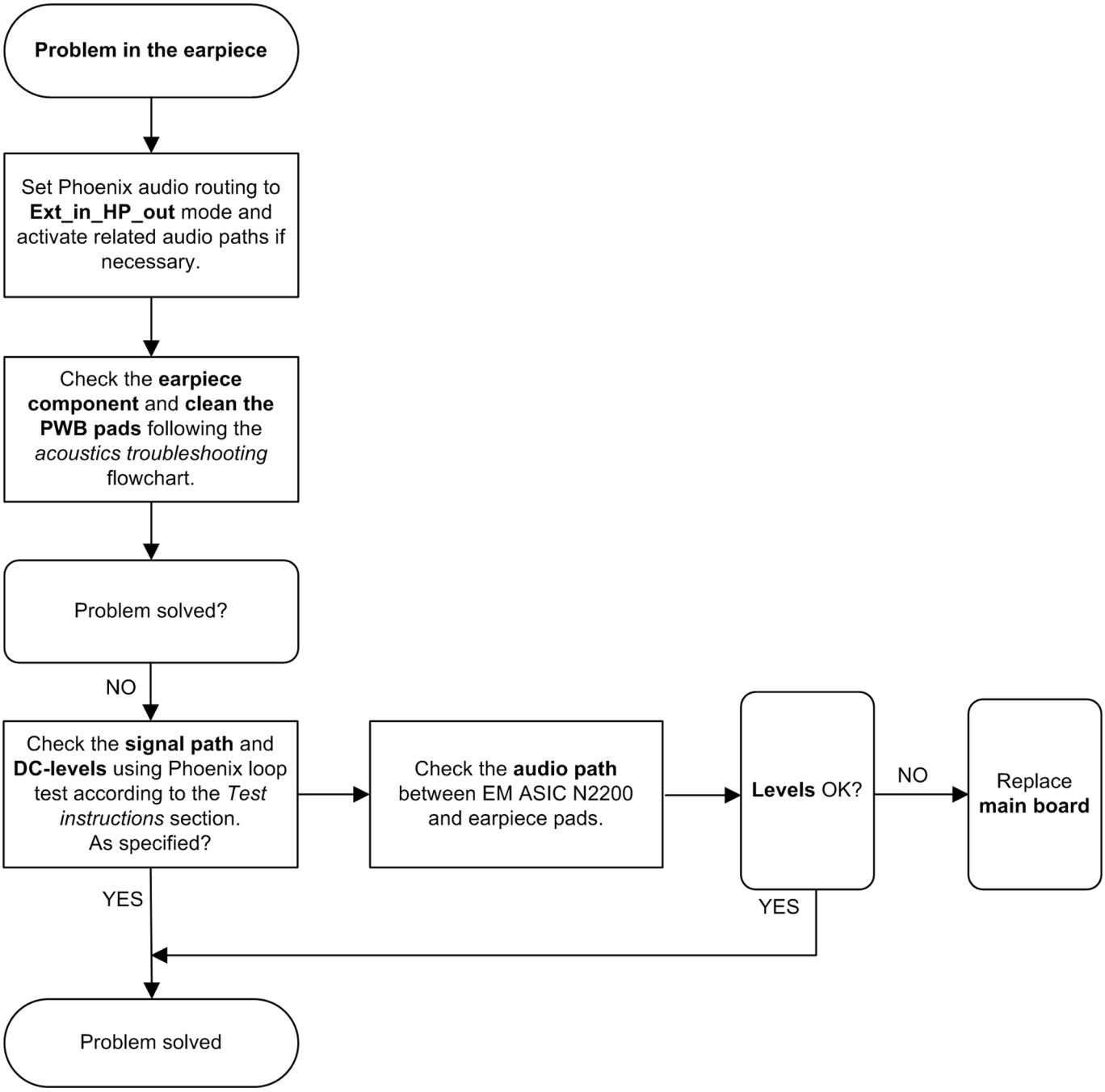


Figure 12 Single-ended output waveform of the HP_in_Ext_out loop when microphone is connected.

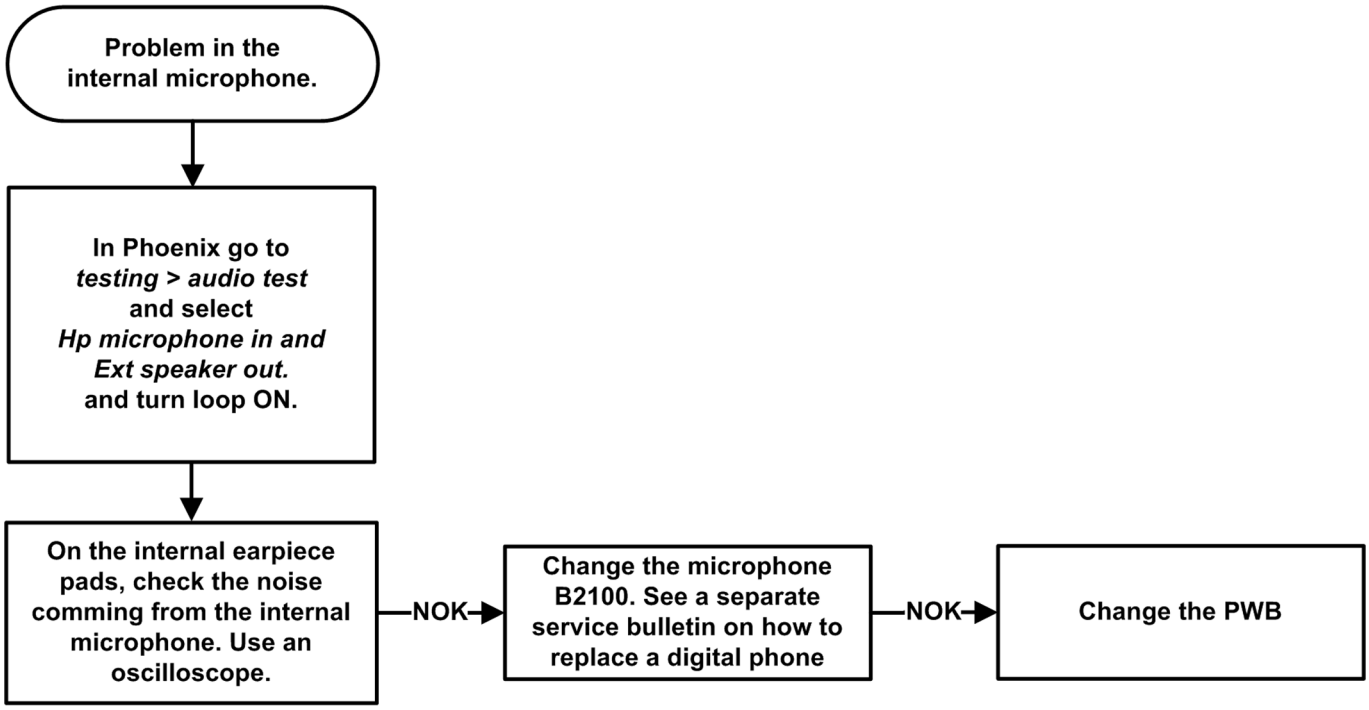
Internal earpiece troubleshooting

Troubleshooting flow



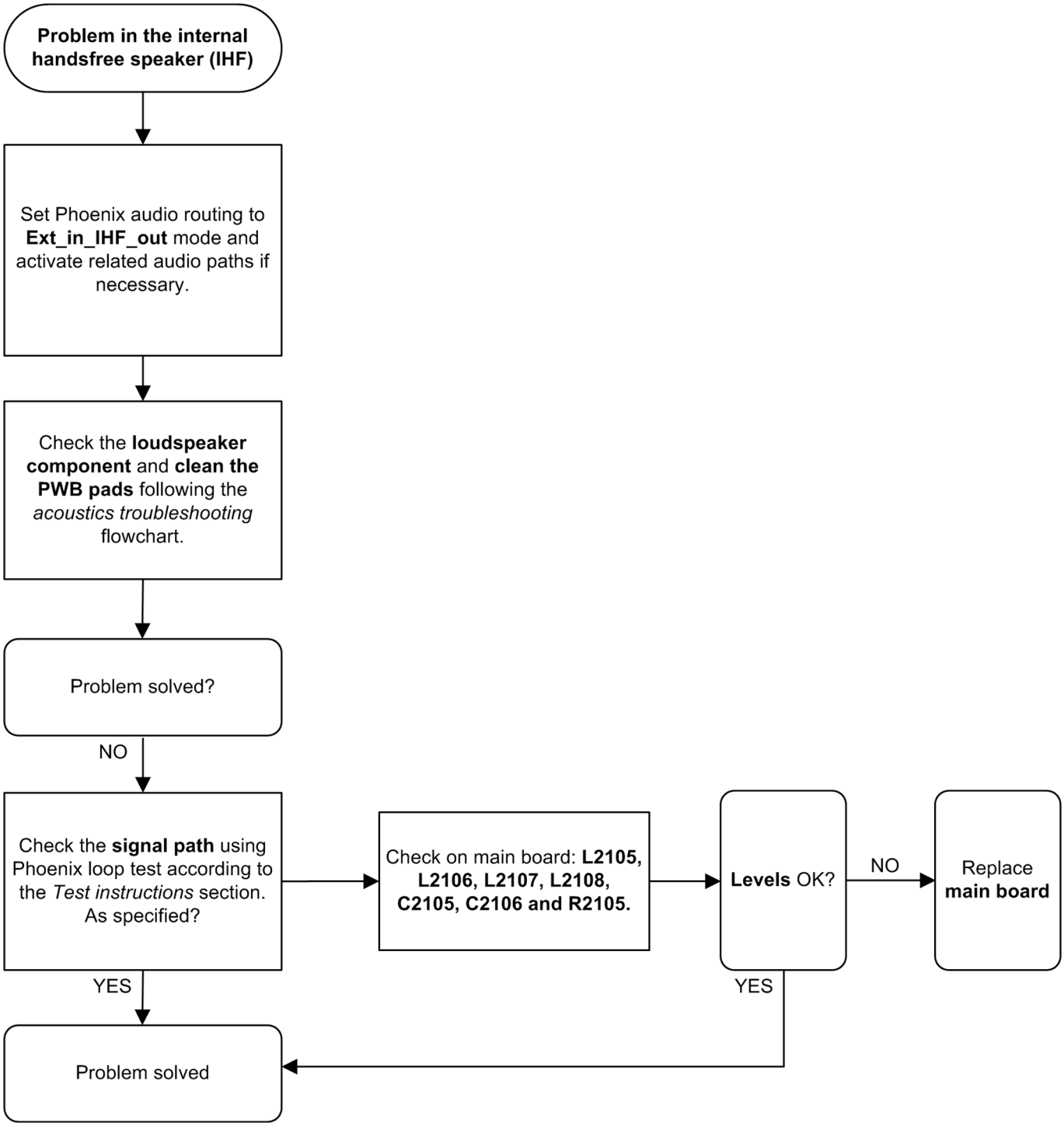
Internal microphone troubleshooting

Troubleshooting flow



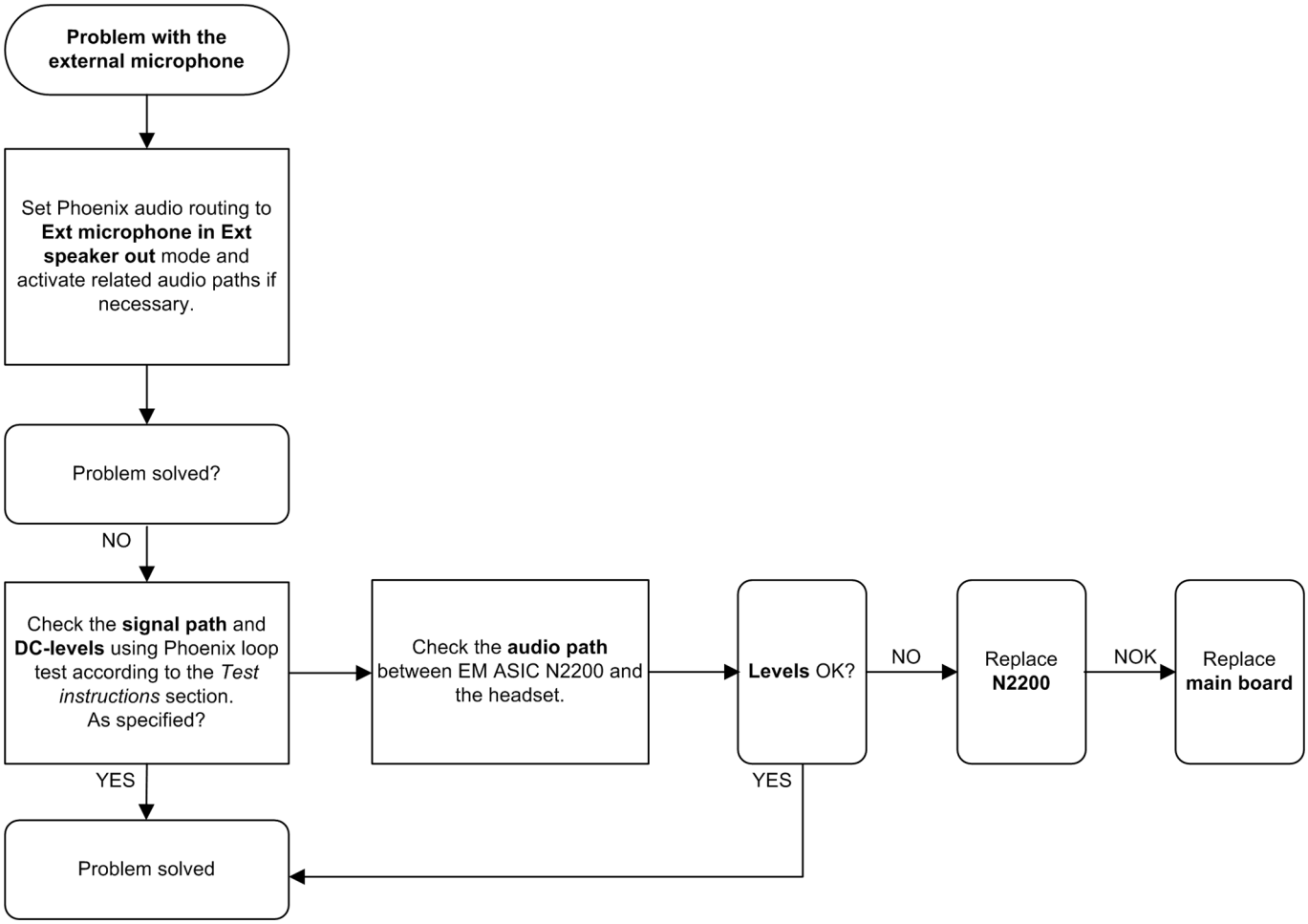
Internal handsfree (IHF) troubleshooting

Troubleshooting flow



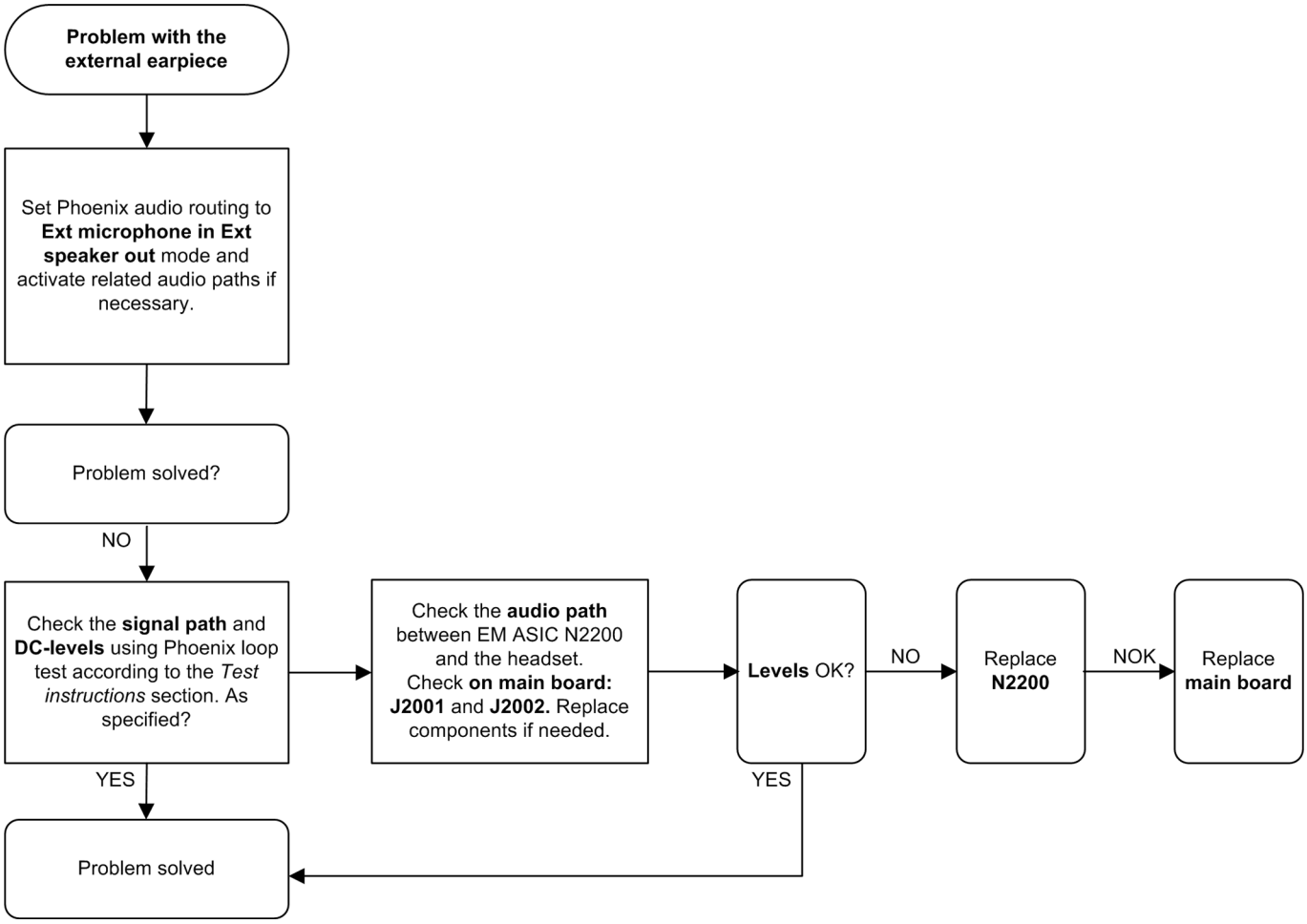
External microphone troubleshooting

Troubleshooting flow



External earpiece troubleshooting

Troubleshooting flow



Acoustics troubleshooting

Introduction to acoustics troubleshooting

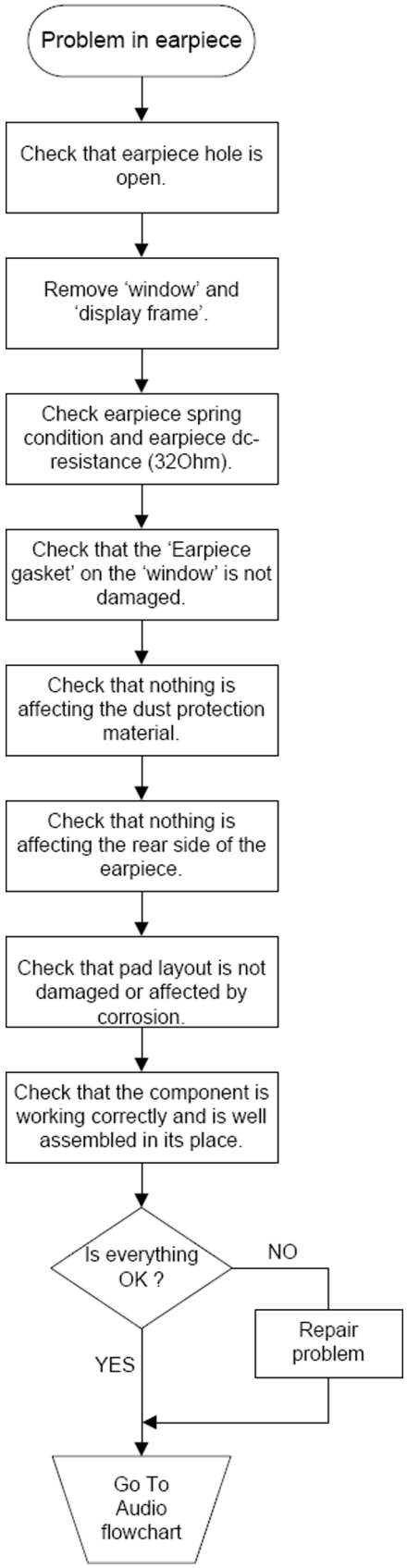
Acoustics design ensures that the sound is detected correctly with a microphone and properly radiated to the outside of the device by the speaker. The acoustics of the phone includes three basic systems: earpiece, Integrated Hands Free (IHF) and microphone.

The sound reproduced from the earpiece readiates through a single hole on the front cover (A-cover). The sound reproduced from the IHF speaker radiates from the sound holes located on the left side of the device. Microphone is located at the bottom, next to the system connector.

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.

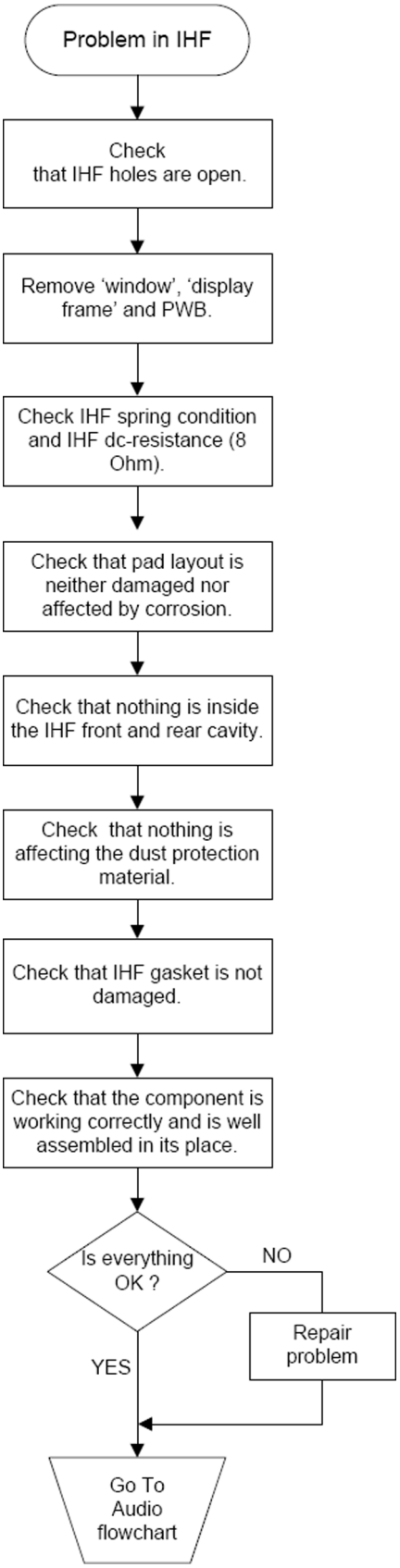
Earpiece troubleshooting

Troubleshooting flow



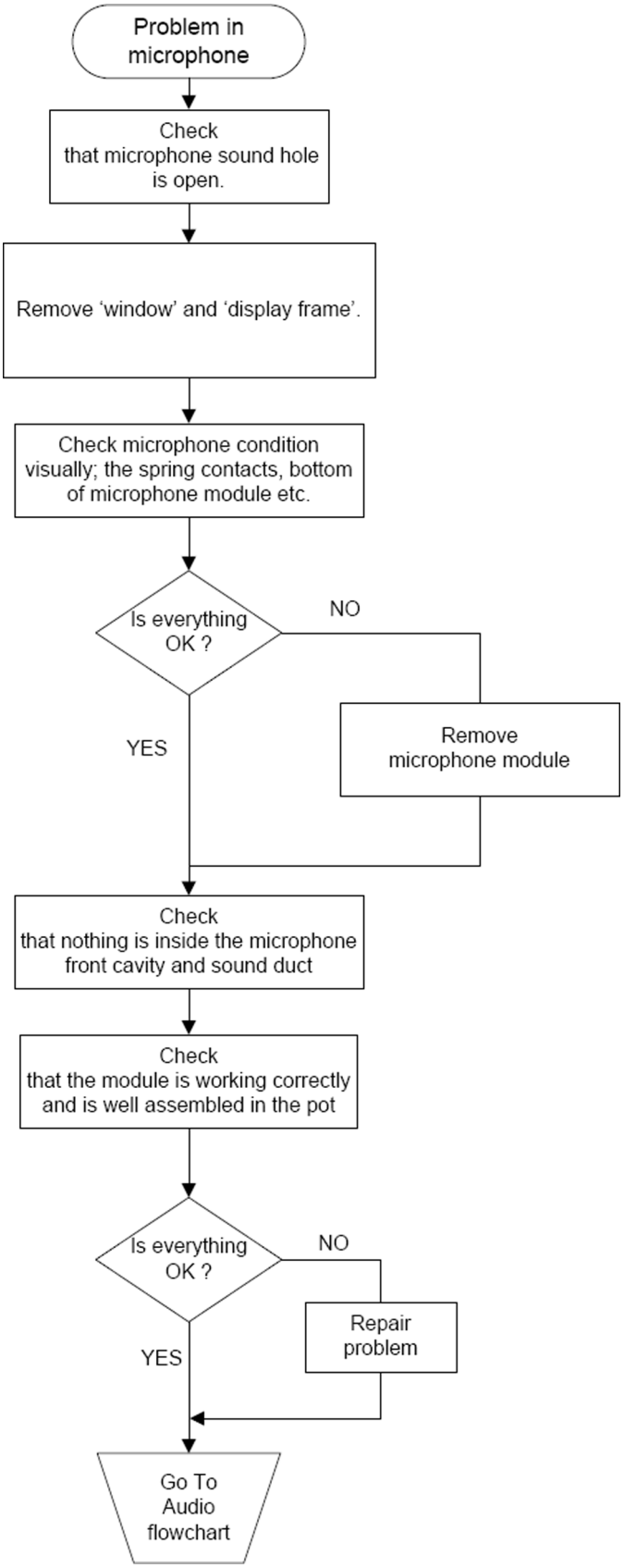
IHF troubleshooting

Troubleshooting flow



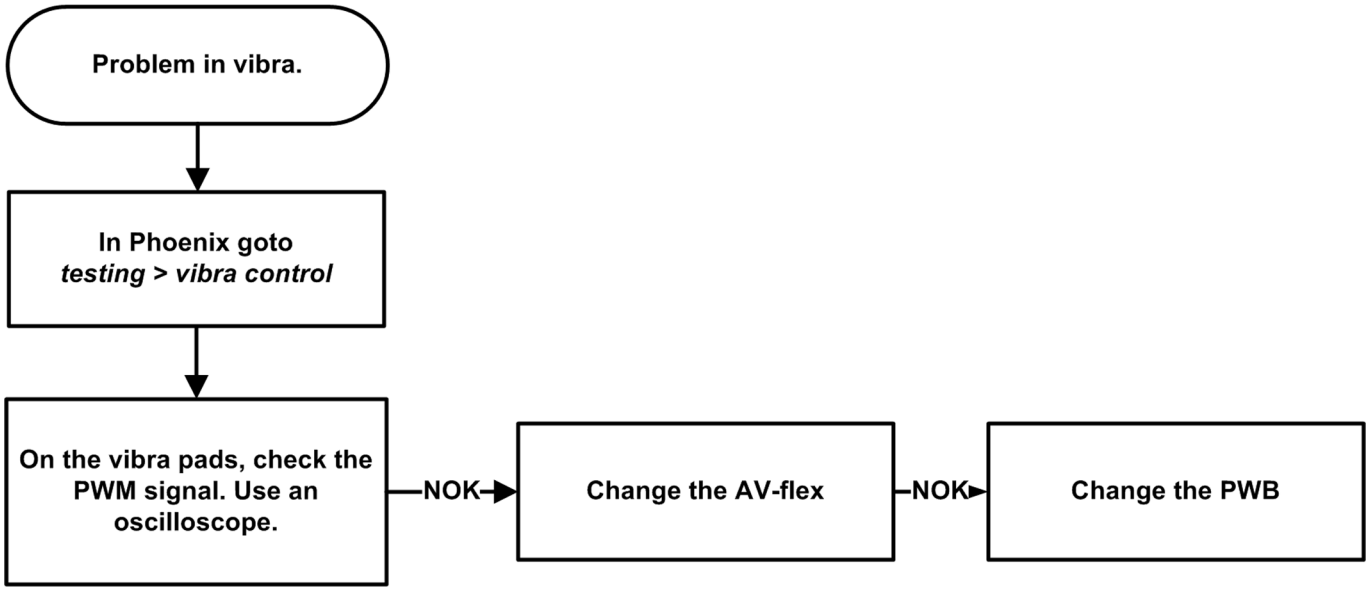
Microphone troubleshooting

Troubleshooting flow



Vibra troubleshooting

Troubleshooting flow



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-8 or FPS-10.

  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 2007.19 or newer.
- The latest phone model specific *Phoenix* data package.
- PKD-1 dongle

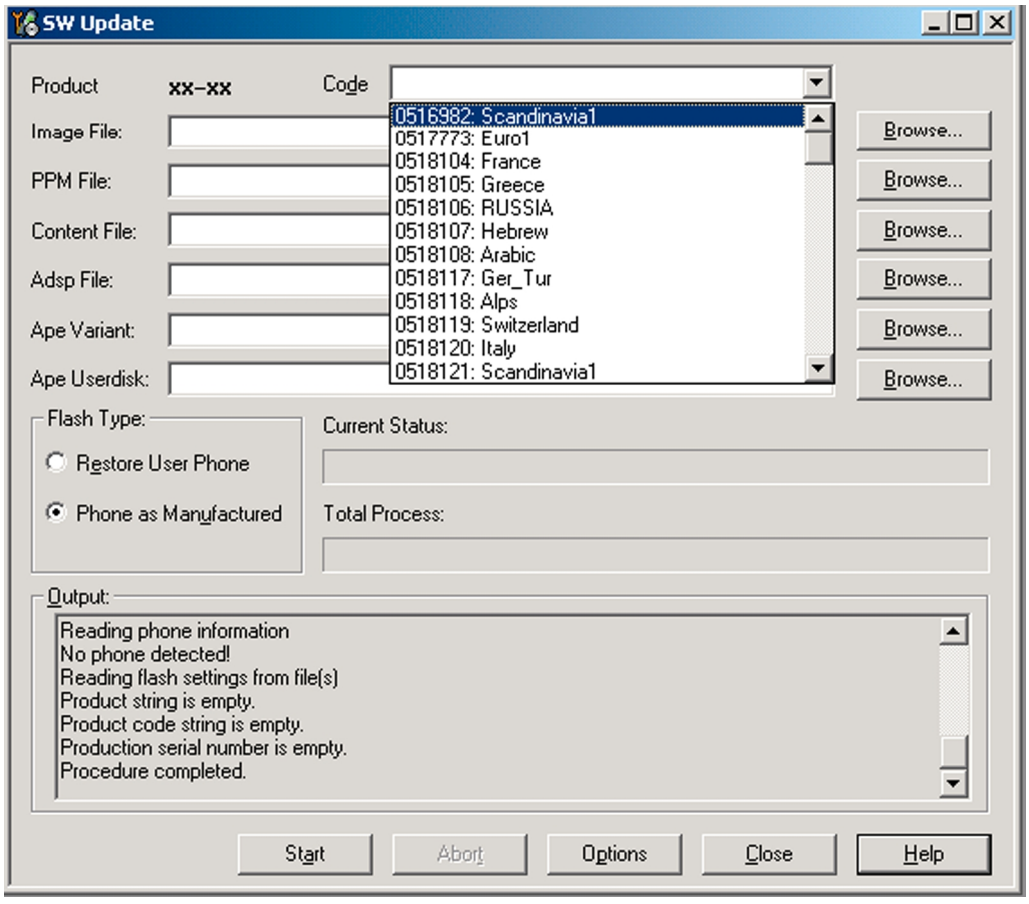
- SX-4 smart card (Enables BB5 testing and tuning features)
- External smart card reader

  Note: The smart card reader is only needed when FPS-8 is used. FPS-10 has an integrated smart card reader.
- Activated FPS-8 flash prommer **OR** FPS-10 flash prommer
- Flash update package 03.18.004 or newer for FPS-8 or FPS-10 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
- XCS-4 modular cable between flash prommer and CU-4

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

Steps

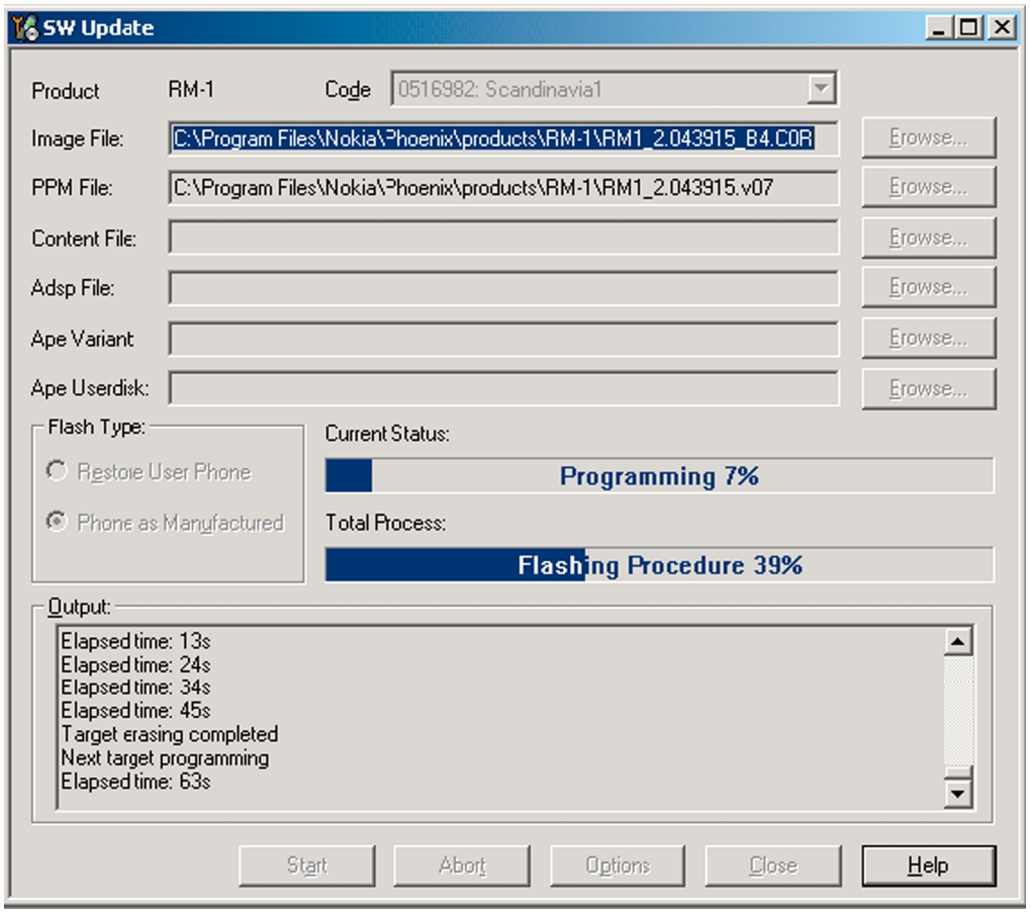
1. Program the phone software.
   i Start *Phoenix* and login. Make sure the connection has been managed correctly for FPS-8 or FPS-10.
   ii Update the phone MCU software to the latest available version.
   If the new flash is empty and the phone cannot communicate with *Phoenix*, reflash the phone.
   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.



Product	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.
Code	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.
Flash Type	must be set to **Phone as Manufactured**.

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** .

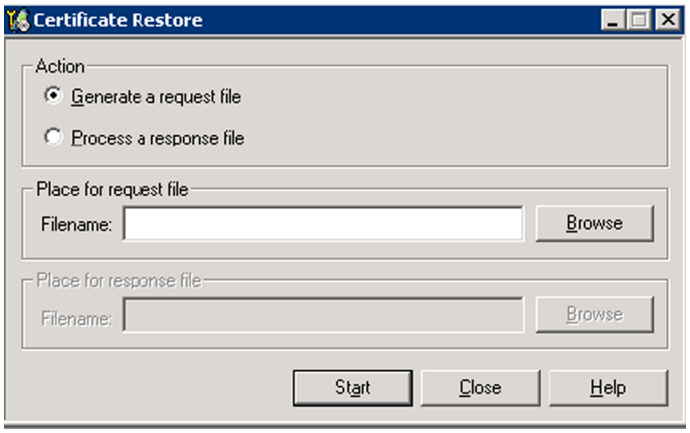
2. Create a *Request* file.

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

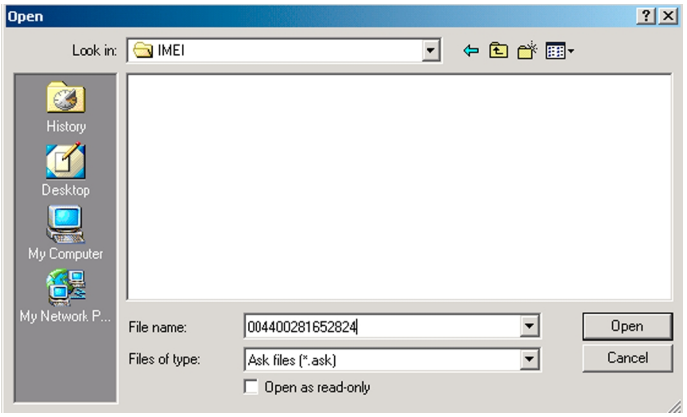
i To connect the phone with *Phoenix*, choose **File→Scan Product** .

ii Choose **Tools→Certificate Restore** .

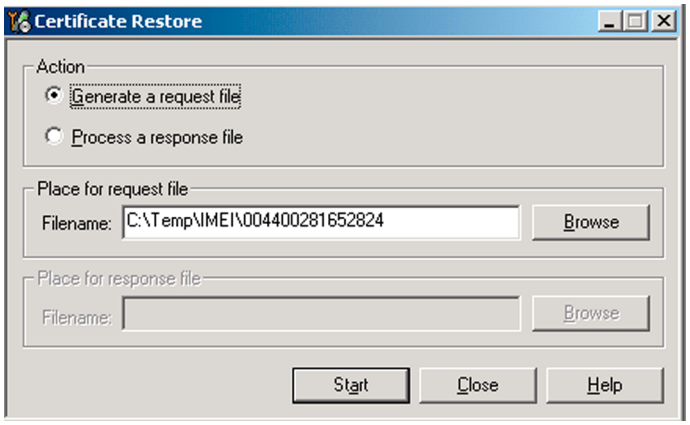
iii To choose a location for the request file, click **Browse**.



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.

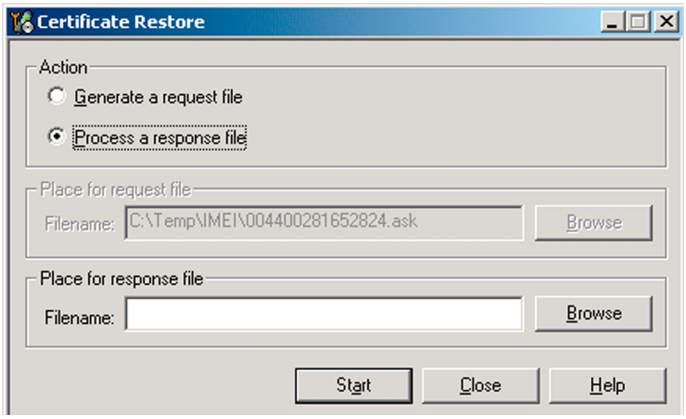
For this procedure, you must supply +12 V to CU-4 from an external power supply.

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

ii Start *Phoenix* service software.

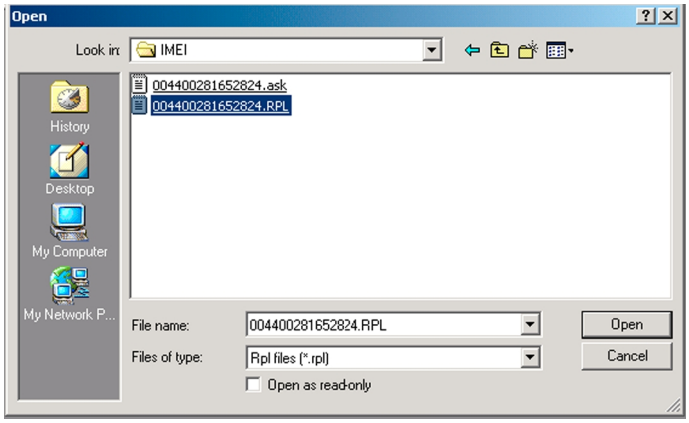
iii Choose **File→Scan Product** .

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



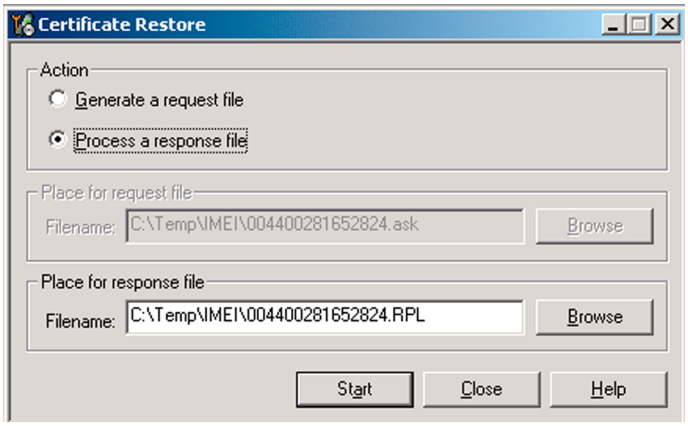
v To choose the location where response file is saved, click **Browse**.

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 8 Calibration value limits

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

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

4 — RF troubleshooting

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Table of Contents

List of Figures

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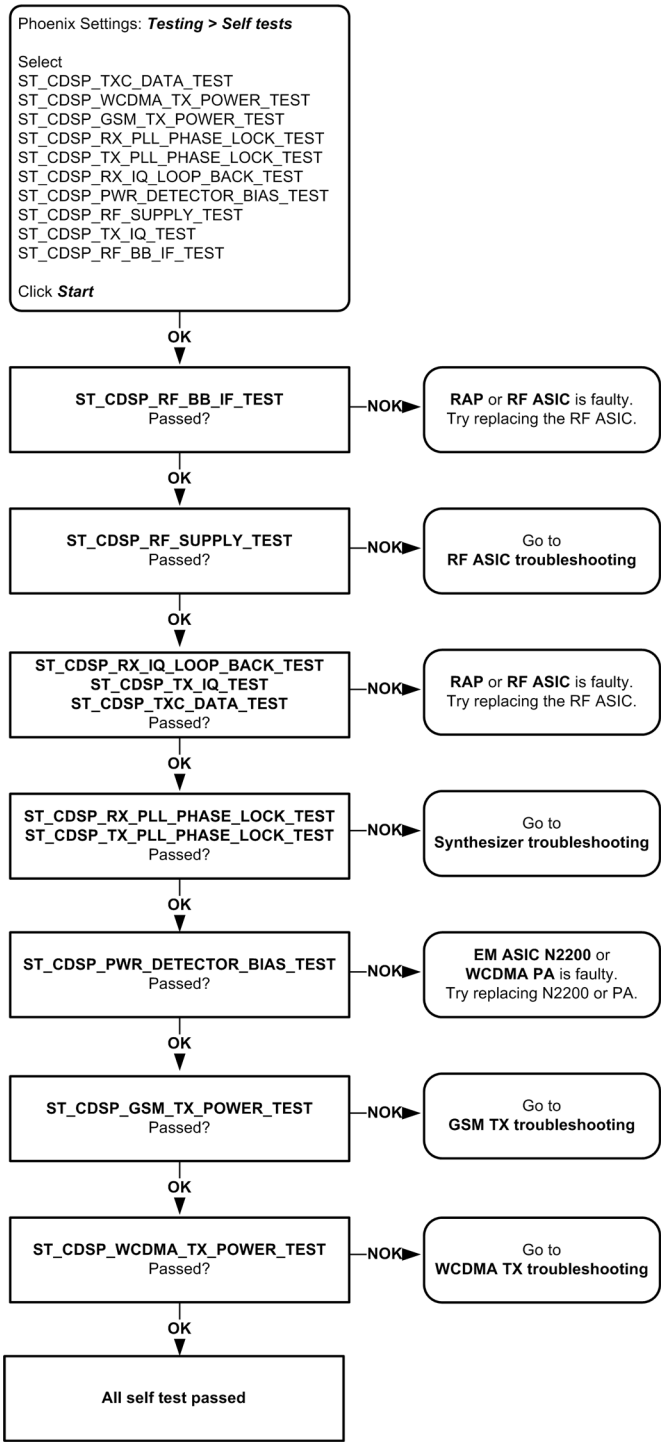
RF self tests in Phoenix

Context

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

Troubleshooting flow



General RF troubleshooting

Introduction to RF troubleshooting

Most RF semiconductors are static discharge sensitive

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

Pre-baking

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

- RFIC N7505
- Front End Module (FEM) N7520

Discrete components

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

Capacitors: check for short circuits.

Resistors: check value with an ohm meter.

Note: In-circuit measurements should be evaluated carefully

Measuring equipment

All measurements should be done using:

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

  Note: A mobile phone WCDMA transmitter should never be tested with full TX power (only it possible to perform the measurements in a good RF-shielded room). Even low power WCDMA transmitters may disturb nearby WCDMA networks and cause problems to 3G cellular phone communication in a wide area.

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

Level of repair

The scope of this guideline is to enable repairs at key-component level. Some key-components are not accessible, i.e. not replaceable. Please refer to the list of *Non replaceable RF components*.

Note: If the RF shieldning can is removed (for measurement or repair), it must always be replaced with a new one.

RF key components

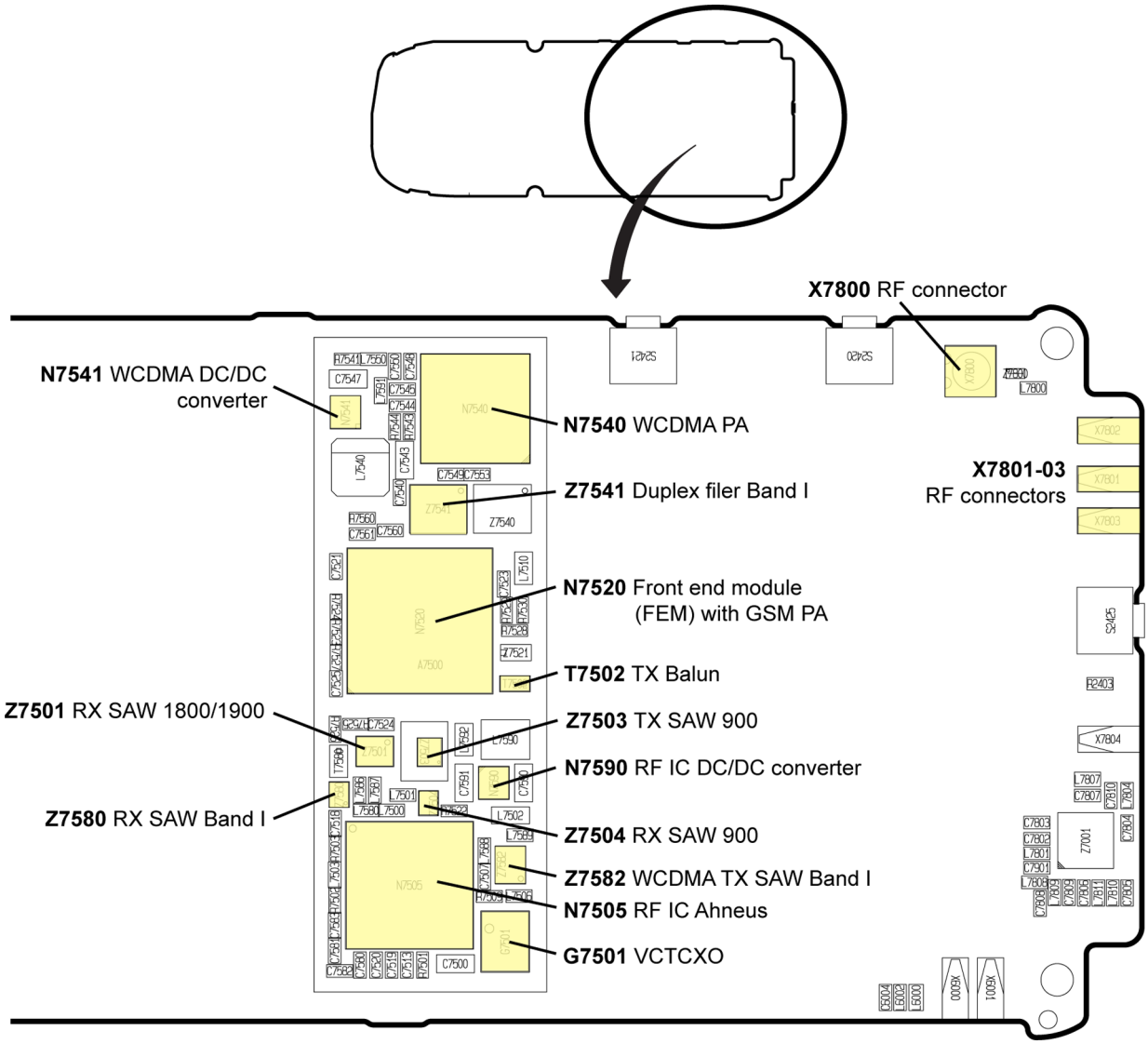


Figure 13 RF key components

Non-replaceable RF components

Because of their location on the PWB, the following RF components cannot be replaced without replacing the whole shield frame:

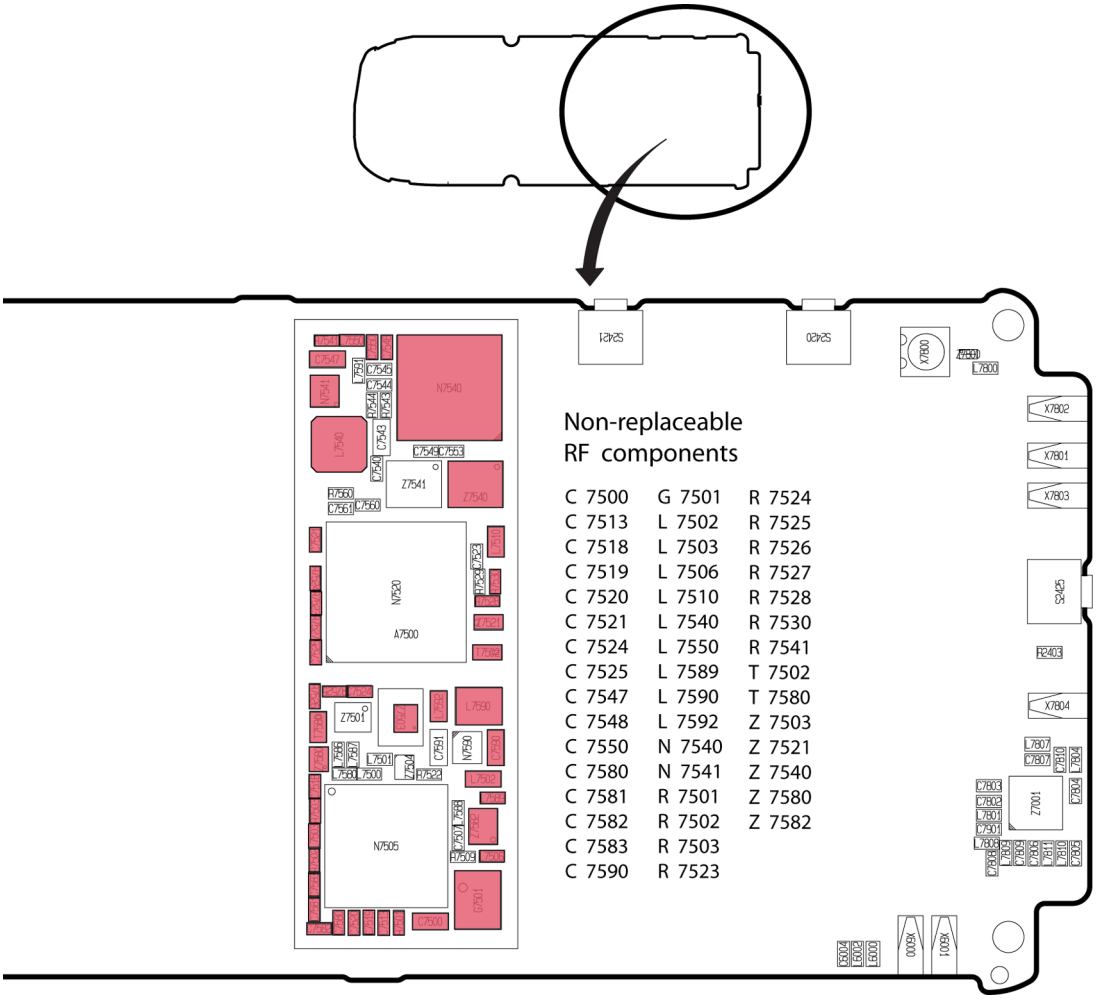


Figure 14 Non-replaceable RF components

Auto tuning for BB5.0

This phone can be tuned automatically.

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

Hardware set up

Hardware requirements for auto tuning:

- PC (Windows 2000/XP) with GPIB card
- Power supply
- Product specific module jig
- Cables: XRF-1 (RF cable), USB cable, GPIB cable and DAU-9S
- Signal analyser (TX), signal generator (RX) and RF-splitter *or* one device including all.

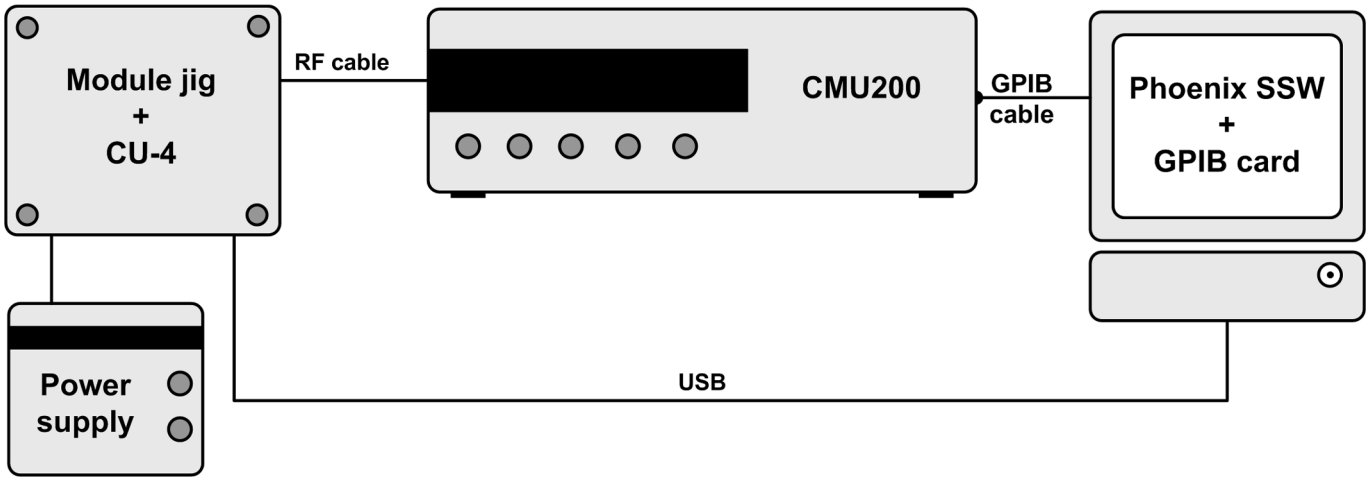


Figure 15 Auto tuning concept with CMU200

Note: Crossover Cable connection between computer and CU200 is recommended (refer to Service Devices chapter and Module Jig concept).

Phoenix preparations

Install the phone specific data package, for example *RM-364_dp_1.78_sw_sh3.26.exe*. This defines phone specific settings.

Auto tuning procedure

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

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

3 Start autotuning, clicking the *Tune* button.

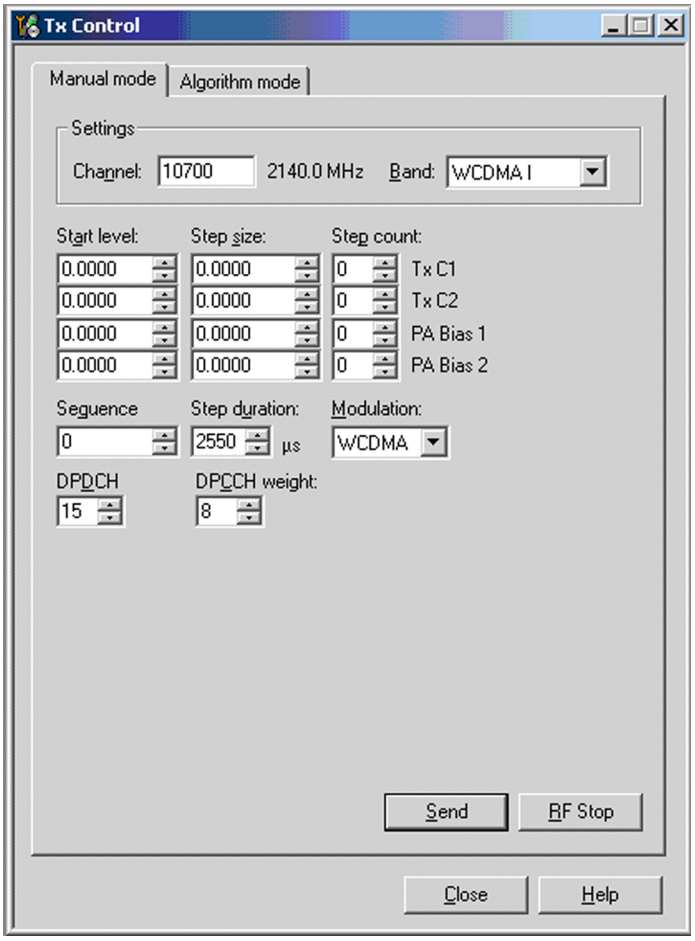
General voltage checking

Steps

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

#	Signal name	Test point	Voltage (all bands)
1	VCTCXO supply	R7501	2.5 V
2	AHNEUS supply from DC/DC conv	C7590	3.1 V
3	FEM supply	C7523	3.9 V
4	WCDMA PA supply from DC/DC conv	C7543	0 V (1.3 V* when transmitting. Settings as in note below)
5	Vbat at WCDMA PA	C7547	3.9 V
6	Supply input to DC/DC conv	L7591	3.9 V

* With these settings, the result should be 1.3 V.



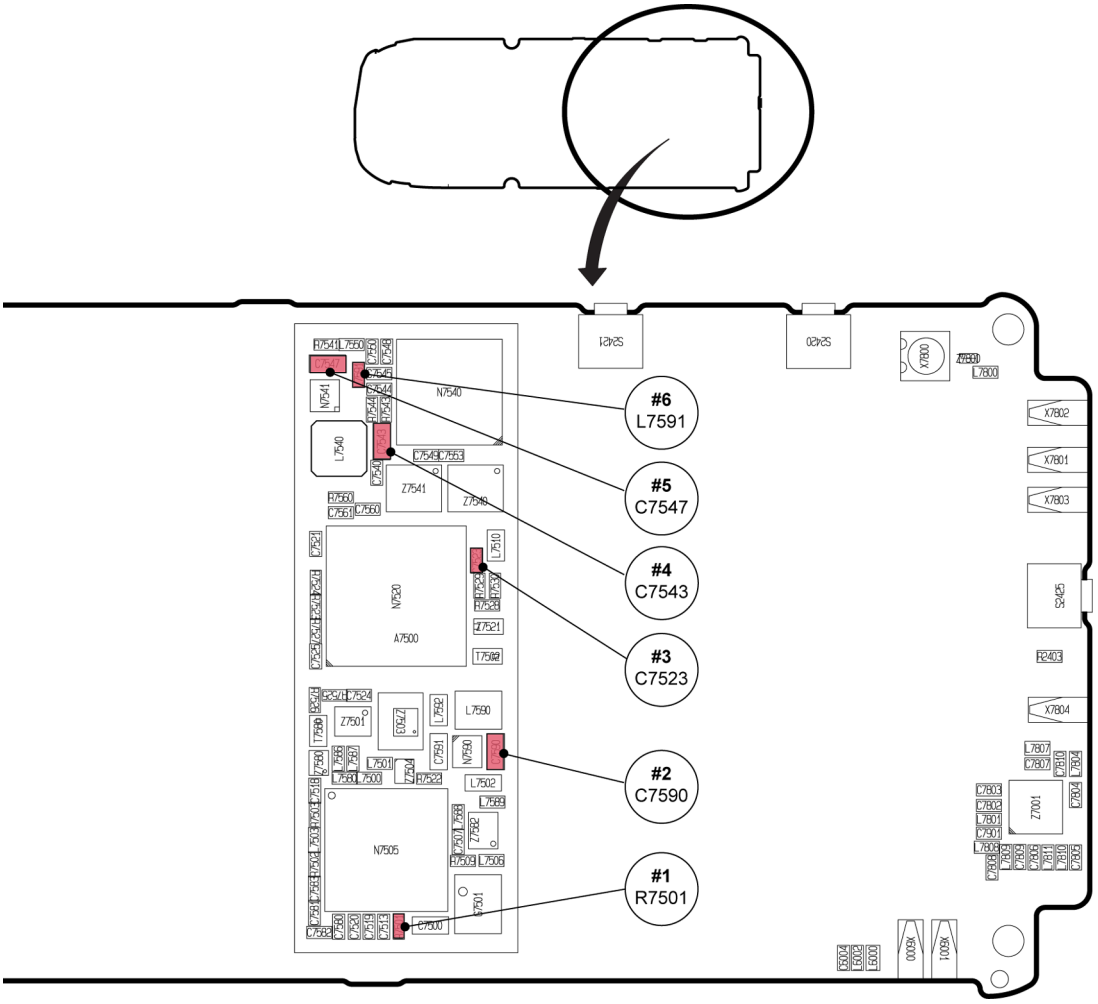


Figure 16 General voltage checking test points (main board, top side)

Receiver troubleshooting

Introduction to receiver (RX) troubleshooting

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

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

GSM RX chain activation for manual measurements/GSM RSSI measurement

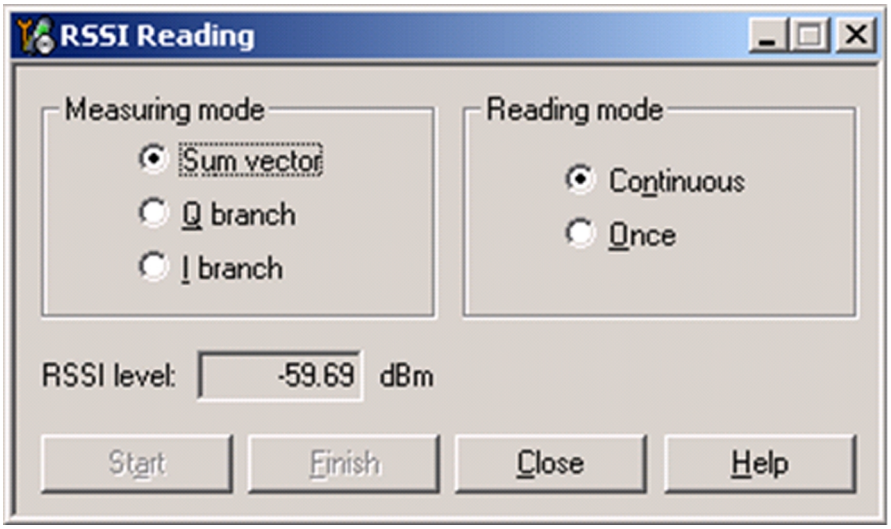
Prerequisites

Make the following settings in Phoenix service software:

Setting	GSM900	GSM1800	GSM1900
Phoenix Channel	37	700	661
Signal generator to antenna connector	942.46771MHz (67.71kHz offset) at -60dBm	1842.86771MHz (67.71kHz offset) at -60dBm	1960.046771MHz (67.71kHz offset) at -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) +/- 5 dB.

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

WCDMA RX chain activation for manual measurement/WCDMA RSSI measurement

Prerequisites

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

Setting	Band I
Phoenix channel	10700
Signal generator to antenna connector	2141.0 MHz

Steps

1. Via Phoenix Testing menu, choose **WCDMA/RX Control**.
2. In the RX control window, make the following settings:

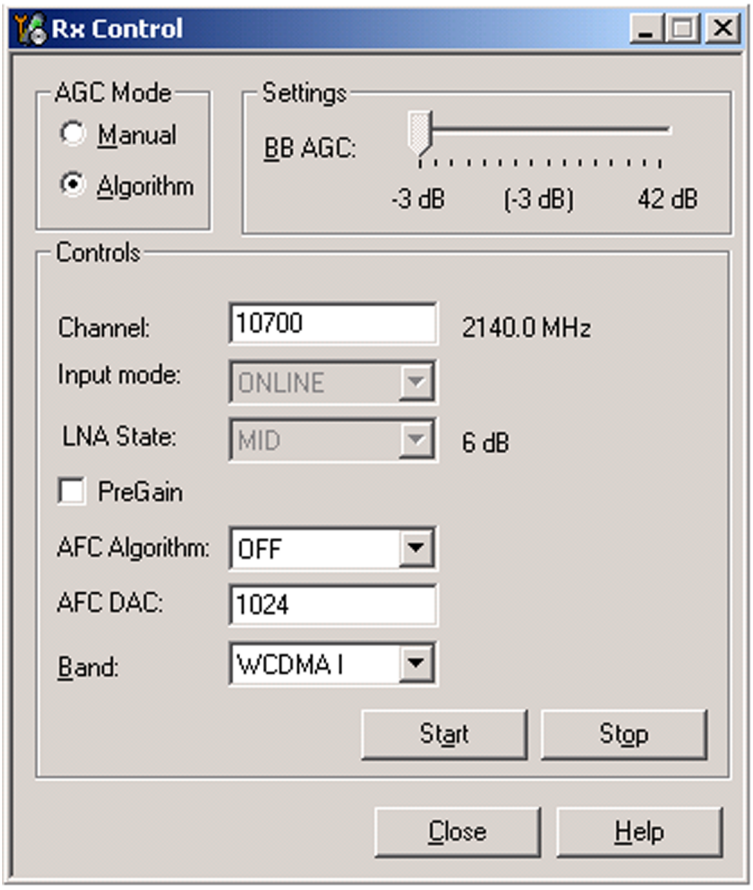


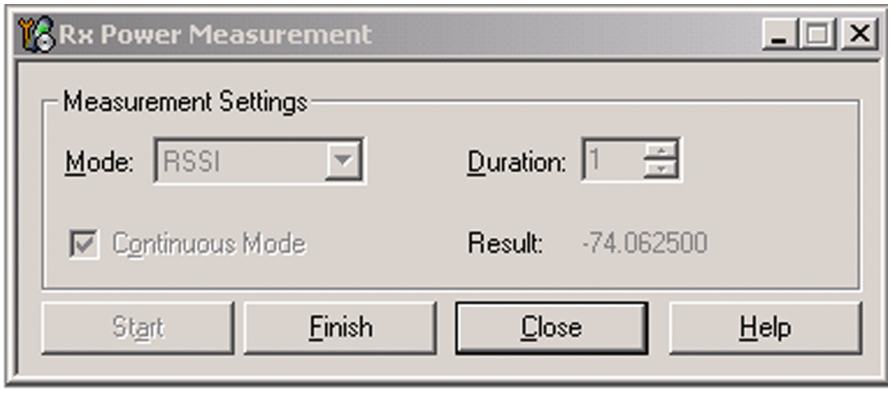
Figure 17 RX Control window with example settings

3. Click **Start** to activate the settings.

   If the settings are changed later on (for example, change of channel) you have to click **Stop** and **Start** again.

   Note: Clicking **Stop** also disables TX control if it was active.

4. From the Phoenix testing menu, select **WCDMA→RX Power measurement**
5. In the RX Power measurement window, select:
   - Mode: RSSI
   - Continuous mode



6. Click **Start** to perform the measurement.

Results

The reading should reflect the level of the signal generator (-losses) ± 5 dB.

Transmitter troubleshooting

General instructions for transmitter (TX) troubleshooting

Please note the following before performing transmitter tests:

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

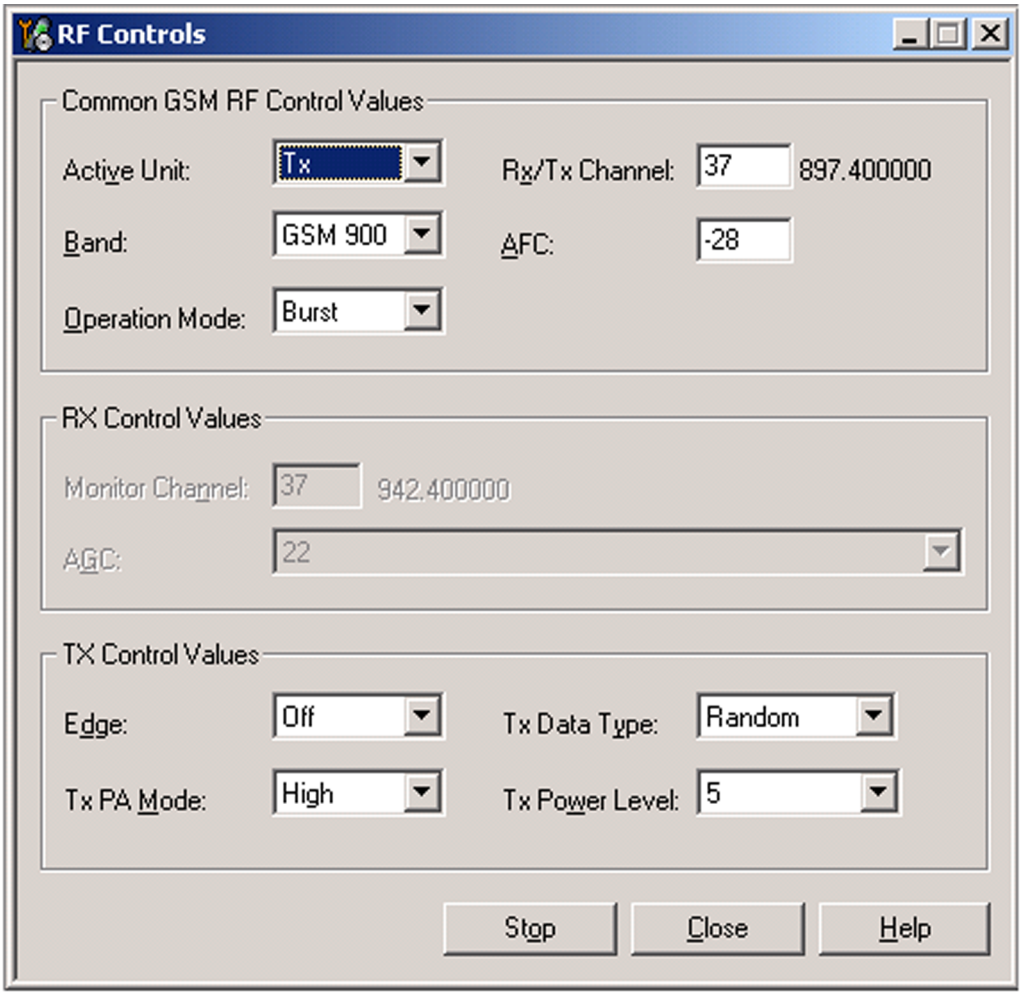
  Note: Never activate the GSM or WCDMA transmitter without a proper antenna load. Always connect a 50 Ω load to the RF connector (antenna, RF-measurement equipment or at least a 2 W dummy load); otherwise the GSM or WCDMA Power amplifier (PA) may be damaged.

GSM transmitter troubleshooting

Steps

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

   Make settings as shown in the picture:



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

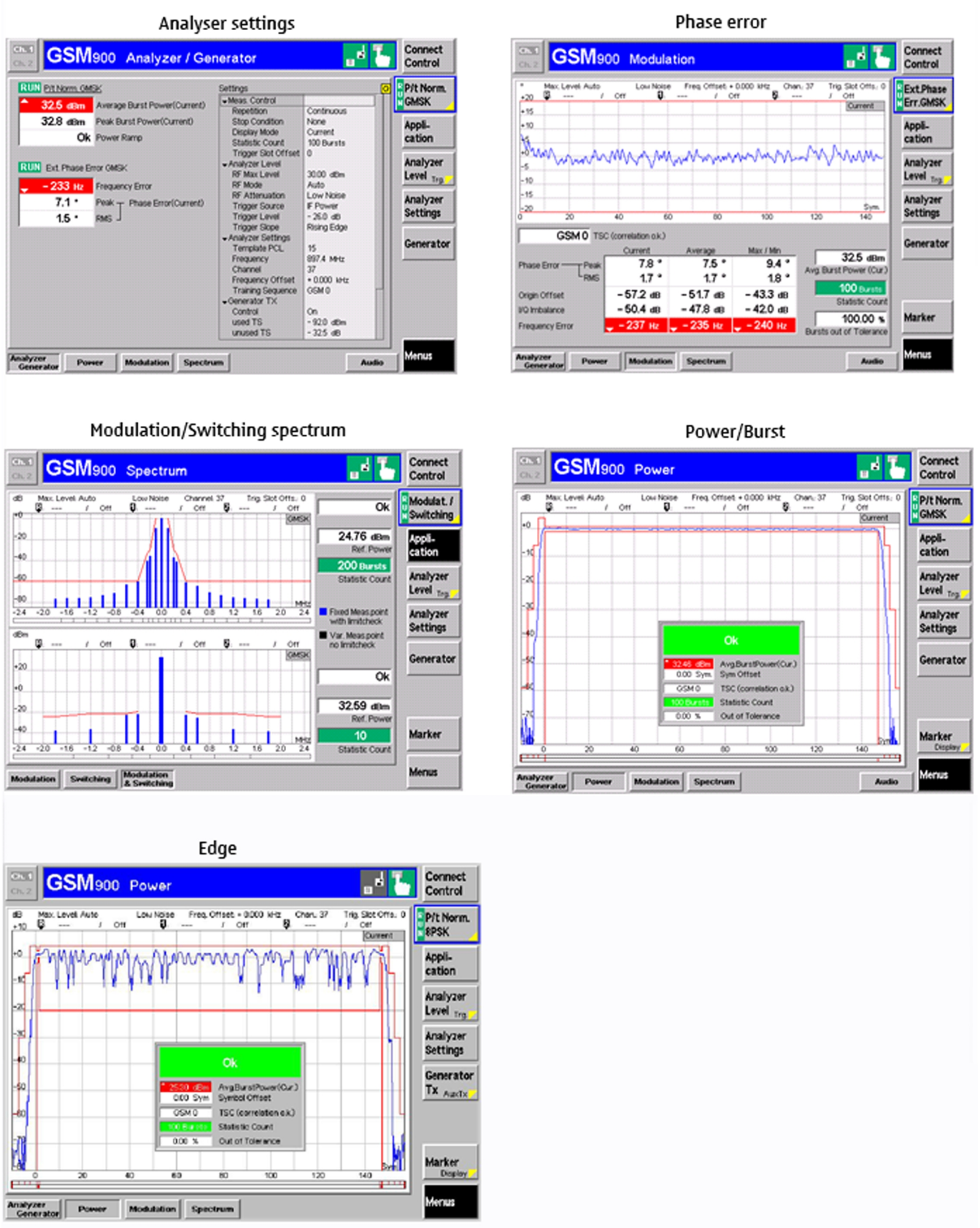


Figure 18 Typical readings

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

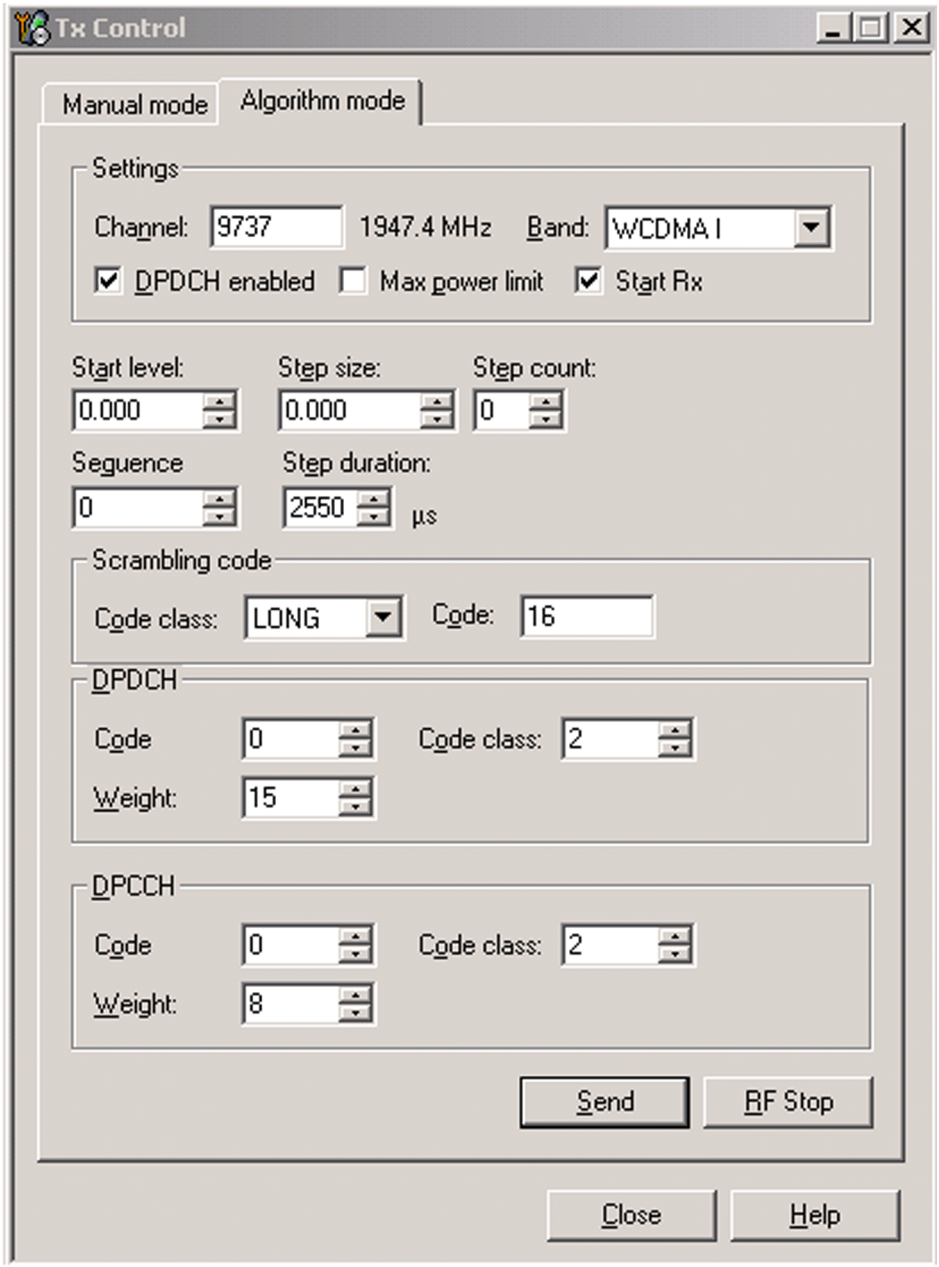
Next actions

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

WCDMA transmitter troubleshooting

Steps

1. Set the phone to local mode.
2. In Phoenix, select **Testing→WCDMA→TX control** .
3. In the TX control window, make settings like in the picture:



4. Click **Send** to enable the settings and activate TX.
   If settings are changed (eg. new channel), you have to click **RF Stop** and **Send** again.

Bluetooth and FM radio troubleshooting

Bluetooth troubleshooting

Troubleshooting flow

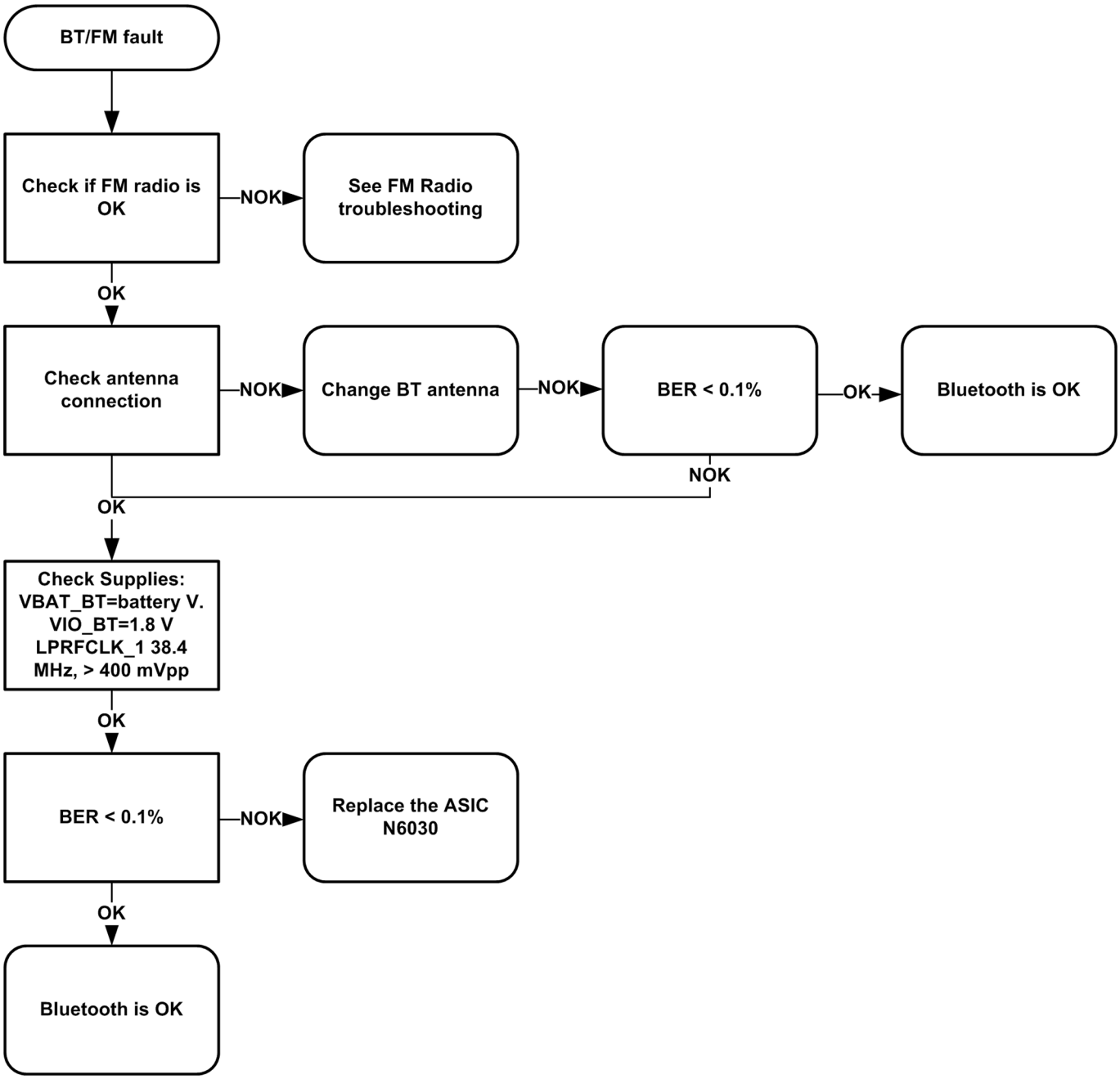


Figure 19 Troubleshooting diagram: Bluetooth

FM radio troubleshooting

Troubleshooting flow

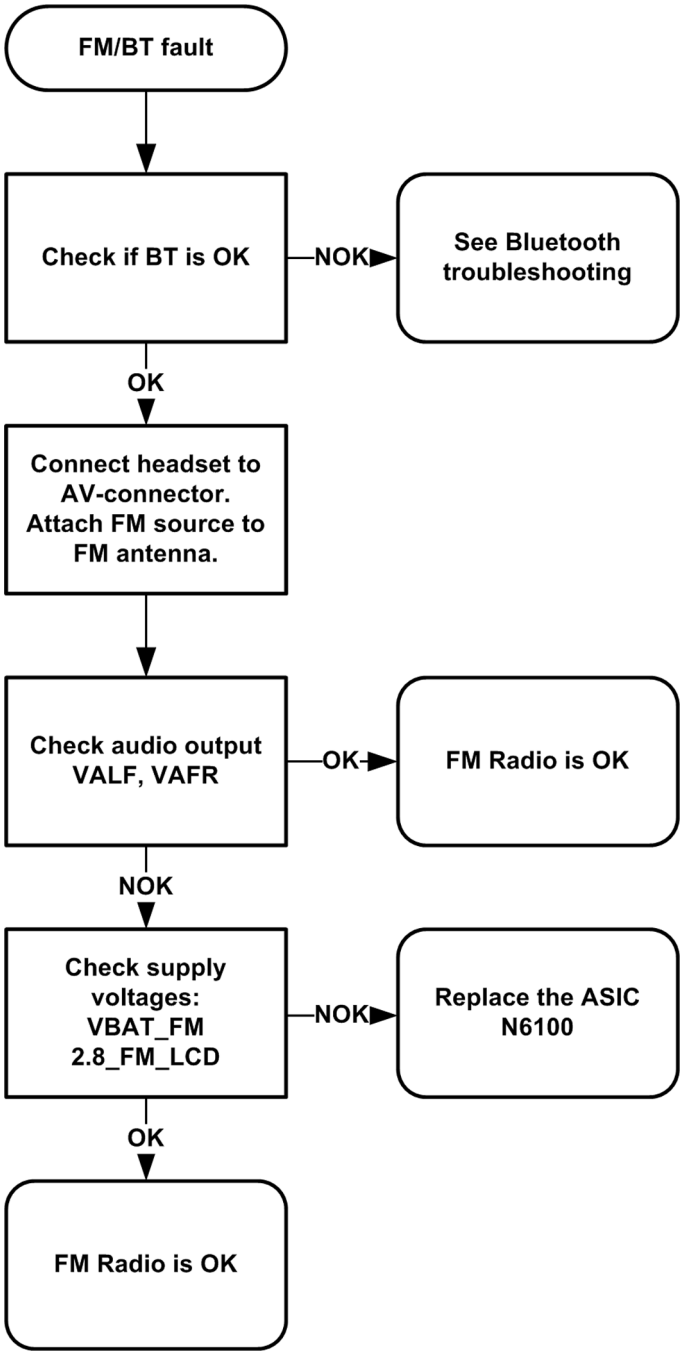


Figure 20 Troubleshooting diagram: FM radio

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5 — System Module Description

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Introduction

Phone description

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

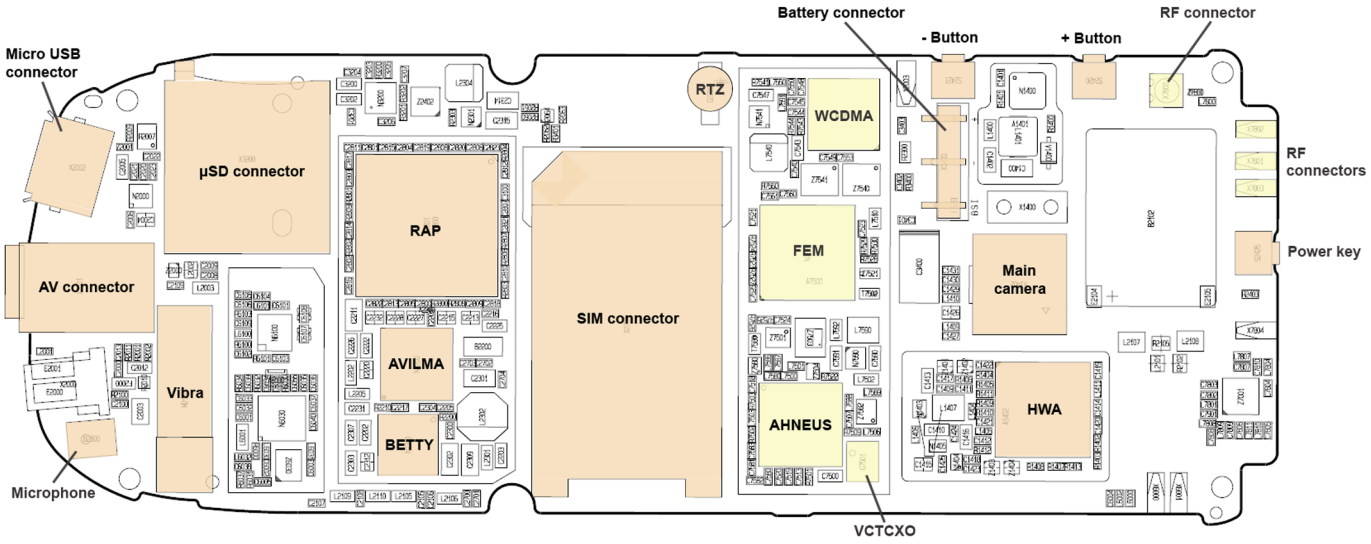
N2200 (AVILMA) is mainly the audio ASIC in the phone and N2300 (BETTY) is basically the energy management controller for the phone.

Key components

Function	Description	Item ref
Main board	2kza	
Flash board	2kzb	
Energy management ASIC	AVILMA BETTY	N2200 N2300
RF ASIC	Ahneus	N7505
Processor	RAP3GS v2.0	D2800
Hardware (camera) accelerator	Julie	N1000
PA GSM	Front end module (FEM), quad band	N7520
PA WCDMA	Triple band PA	N7540
Oscillators	VCTCXO	G7501
Memory	512 Mbit NOR + 256 Mbit DRAM Combo (Stacked with RAP)	D2801
Back-up battery	RTC back-up battery 311	G2200
Bluetooth	BC4-ROM1	D6030
Battery	BL-4U 1000 mAh	
Battery connector	Tabby blade interface	X3400
µSD connector	For µSD card	X3200
µUSB connector	For data	X2002
LED driver		N2301

Key component placement

Top side



Bottom side

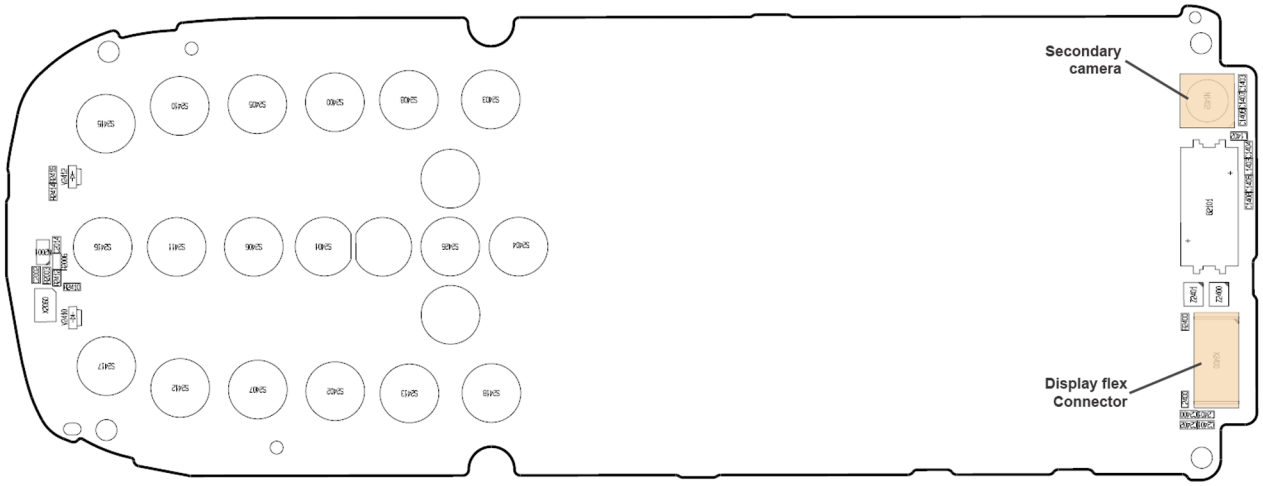
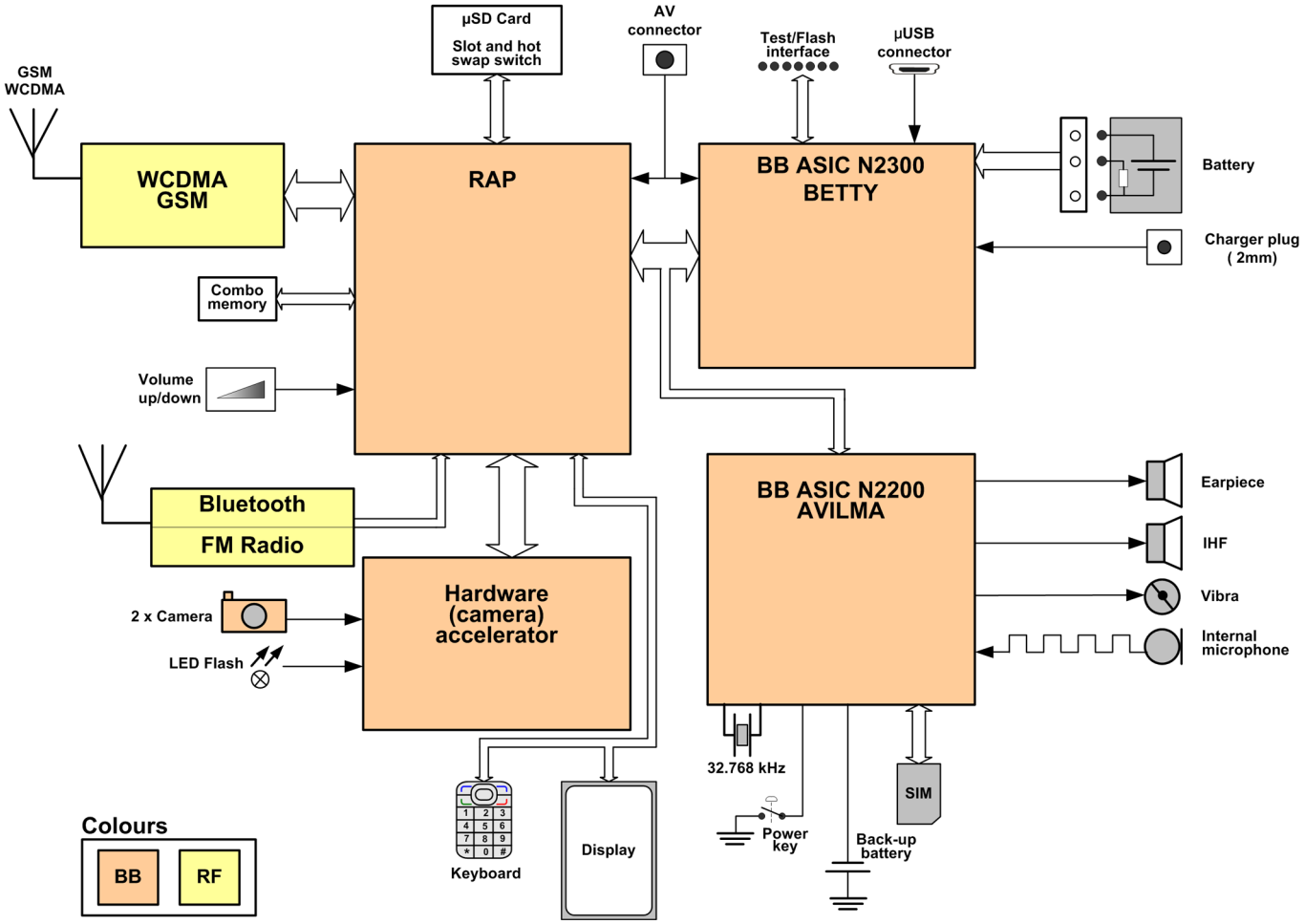
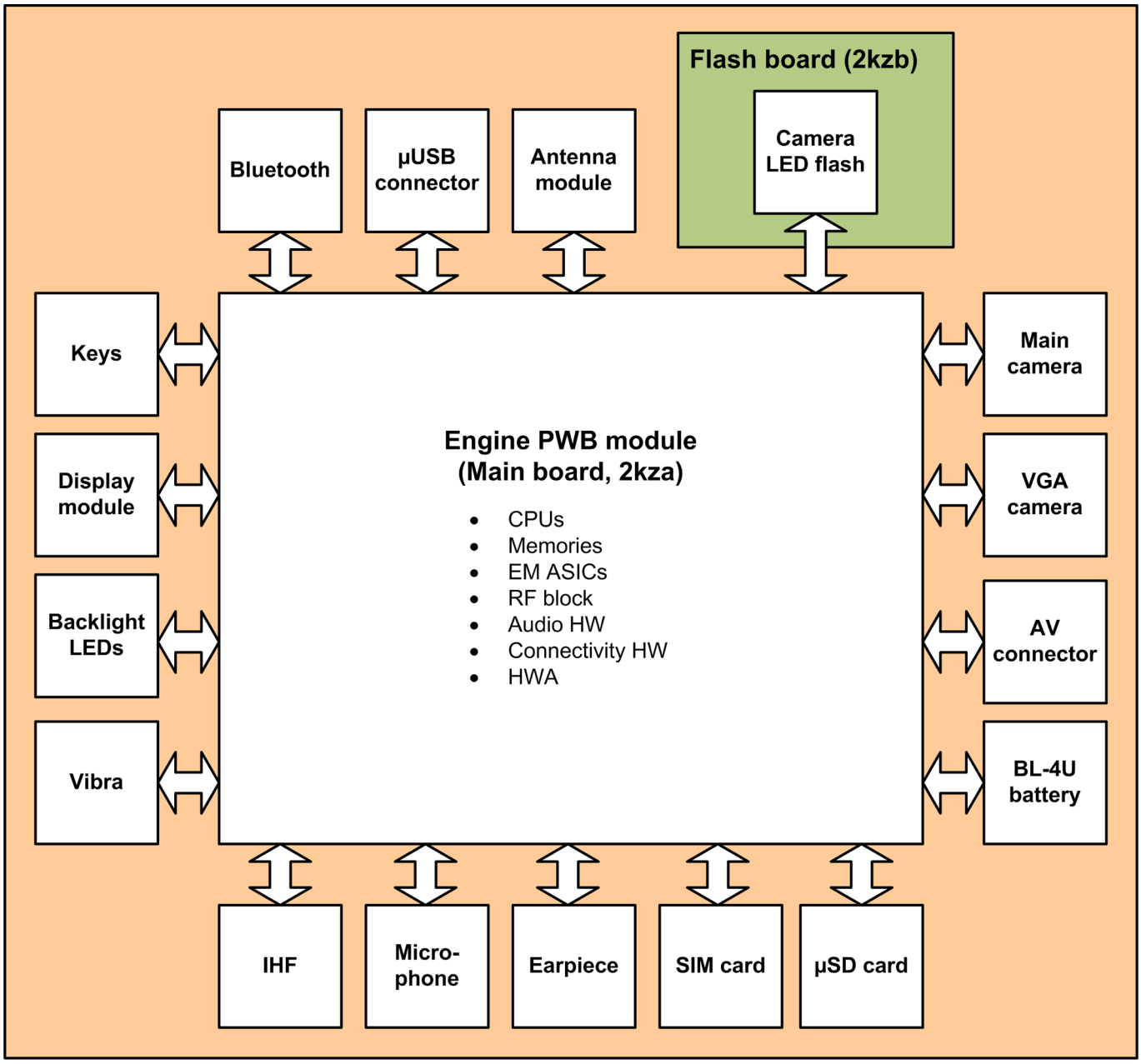


Figure 21 Main board

System module block diagram



Board and module connections



Energy management

Battery and charging

BL-4U battery

The phone is powered by a 3-pole BL-4U 1000 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.

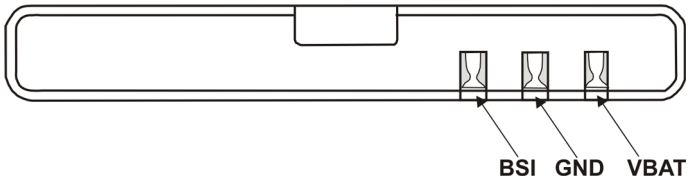


Figure 22 Battery pin order

The battery temperature can be measured from the main board.

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.

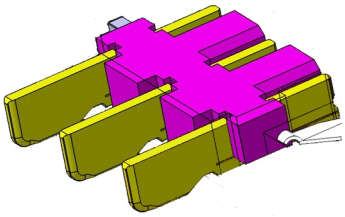


Figure 23 Battery connector

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 the CA-44 charger adapter.

Figure 24 Wide (left) and small (right) charger plugs

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 one of the two approved NOKIA chargers (AC-6 and DC-6). Charging 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 two Application Specific Integrated Circuits (ASICs) N2300 BETTY and N2200 AVILMA. These two circuits contains a number of regulators. In addition there are some external regulators too.

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

Table 9 Nominal voltages

Voltage	Voltage [V]	Condition
General Conditions		
Nominal voltage	4.0	
Lower extreme voltage	3.4	
Higher extreme voltage (fast charging)	4.4	
HW Shutdown Voltages		
Vmstr+	2.2 ± 0.1	Off to on
Vmstr-	2.2 ± 0.1	On to off
SW Shutdown Voltages		
Sw shutdown	3.1	In call
Sw shutdown	3.2	In idle
Min Operating Voltage		
Vcoff+	2.9 ± 0.1	Off to on
Vcoff-	2.6 ± 0.1	On to off

Power key and system power-up

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

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

Modes of operation

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

Mode	Description
SLEEP	SLEEP mode is entered only from PWR_ON mode with the aid of SW when the system's activity is low.
FLASHING	FLASHING mode is for SW downloading.

USB, SIM, µSD

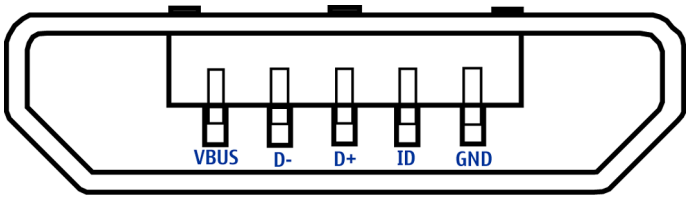
Micro USB

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

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

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

This phone is provided with a specific connector for µUSB.



SIM interface

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

The SIM IF is shown in the following figure:

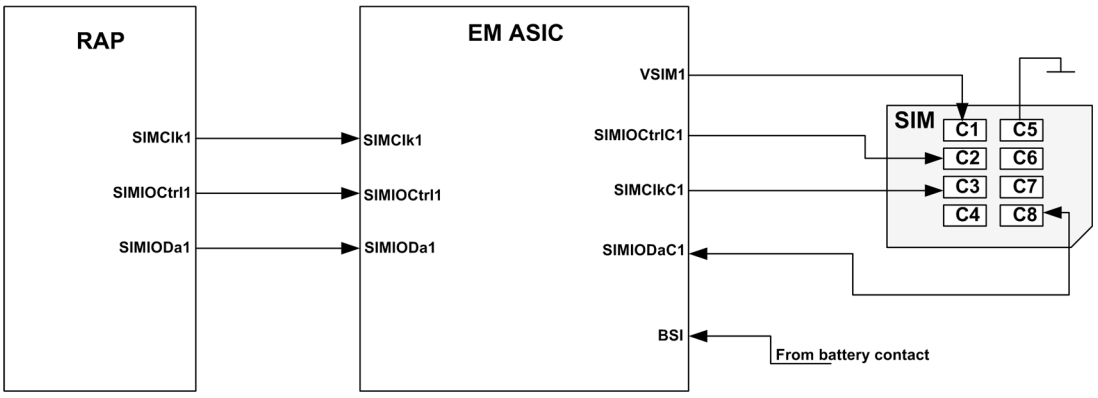


Figure 25 SIM interface

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

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

µSD card interface

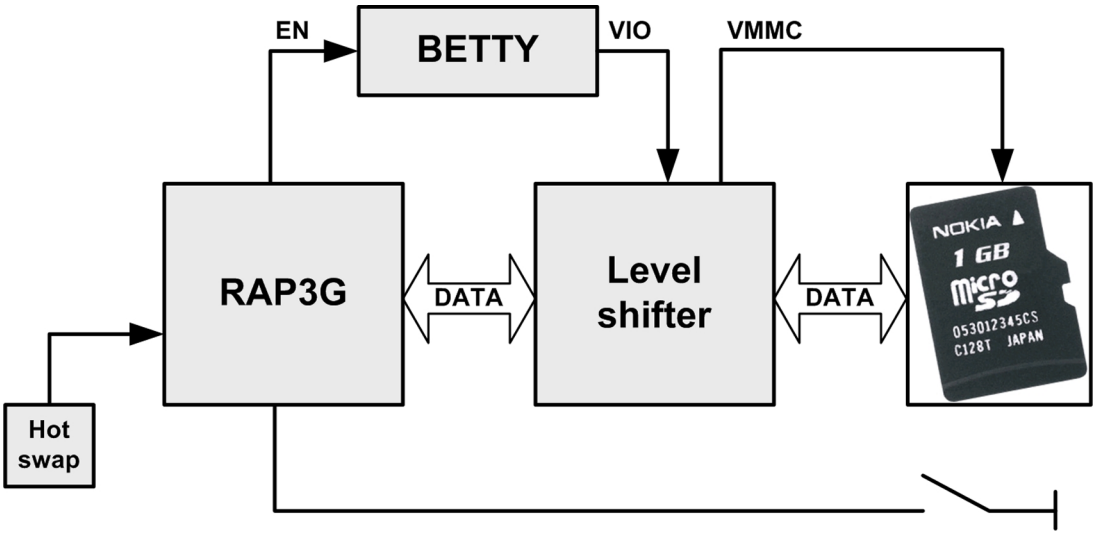


Figure 26 µSD card interface

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

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

The card removal is detected by a push detect switch.

Hot swap is supported, which means that the card may be plugged in/out at any time, without removing the battery.

Camera concept

This phone has two cameras:

- A main 2.0 megapixel camera with 8x zoom and a LED flash.
- A secondary VGA camera used for video calls.

Both cameras are supported by a hardware accelerator (HWA), which also handles the main camera flash function (LED flash diode).

User interface

Display module

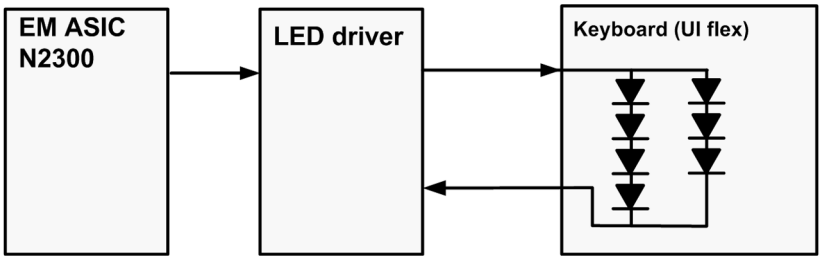
The interconnection between the LCD module and the engine is implemented with a 24-pin board-to-board connector.

The LCD module does not require any tuning in service.

Backlight and illumination

The display has no separate backlight, it is included in the display module.

The keypad, placed on the main board, is top lit by 7 LEDs.



Audio concept

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

N2200 provides an interface for the trancducers. Integrated hands free (IHF) stereo speakers are driven by D-class audio amplifiers.

There are three audio transducers:

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

N2200 also provides an output for the vibra motor.

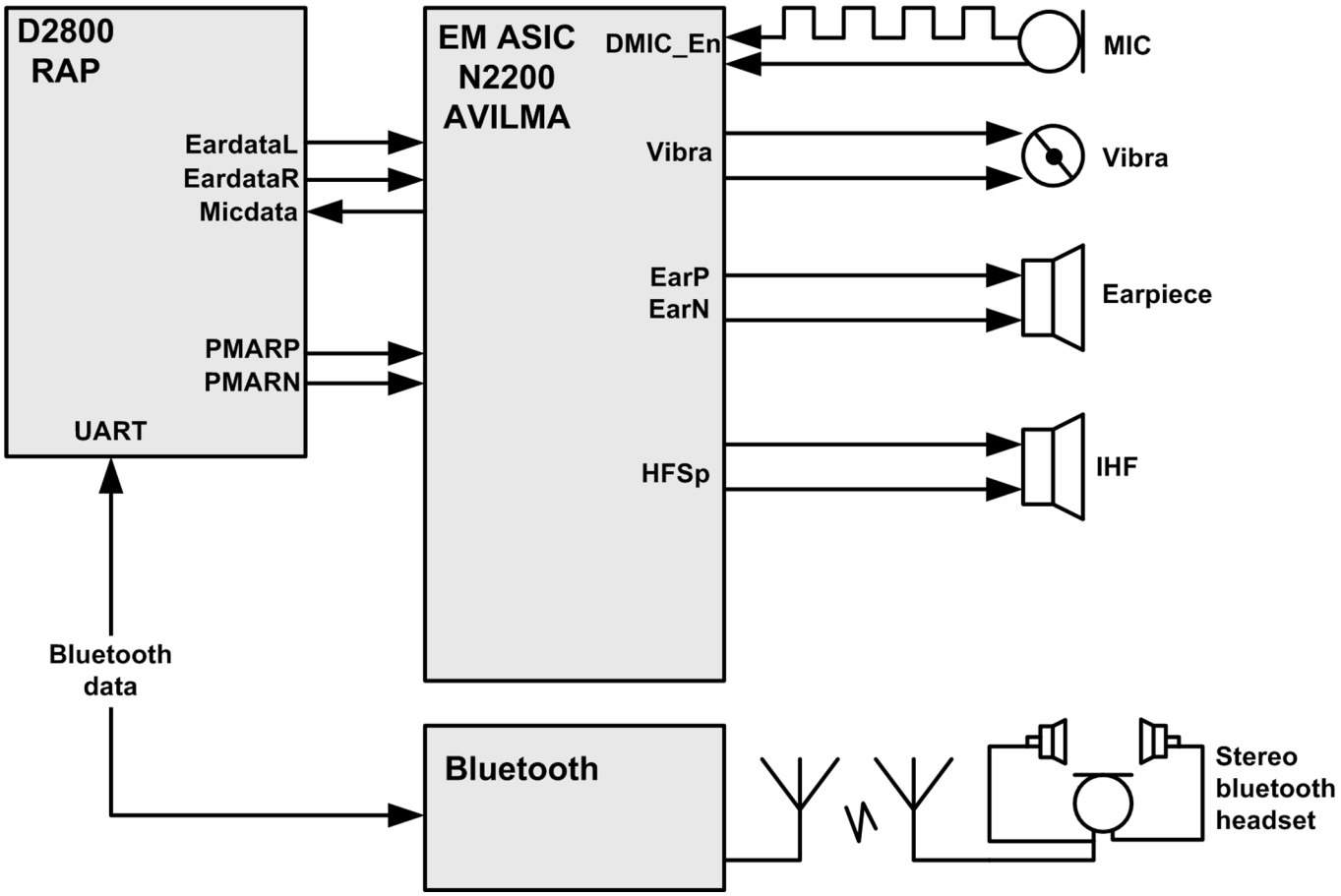


Figure 27 Audio block diagram

Internal audio

The internal audio components are used in these modes:

	Hand portable (HP) mode	Internal hands free (IHF) mode
Microphone	X	X
Earpiece	X	
Speaker		X

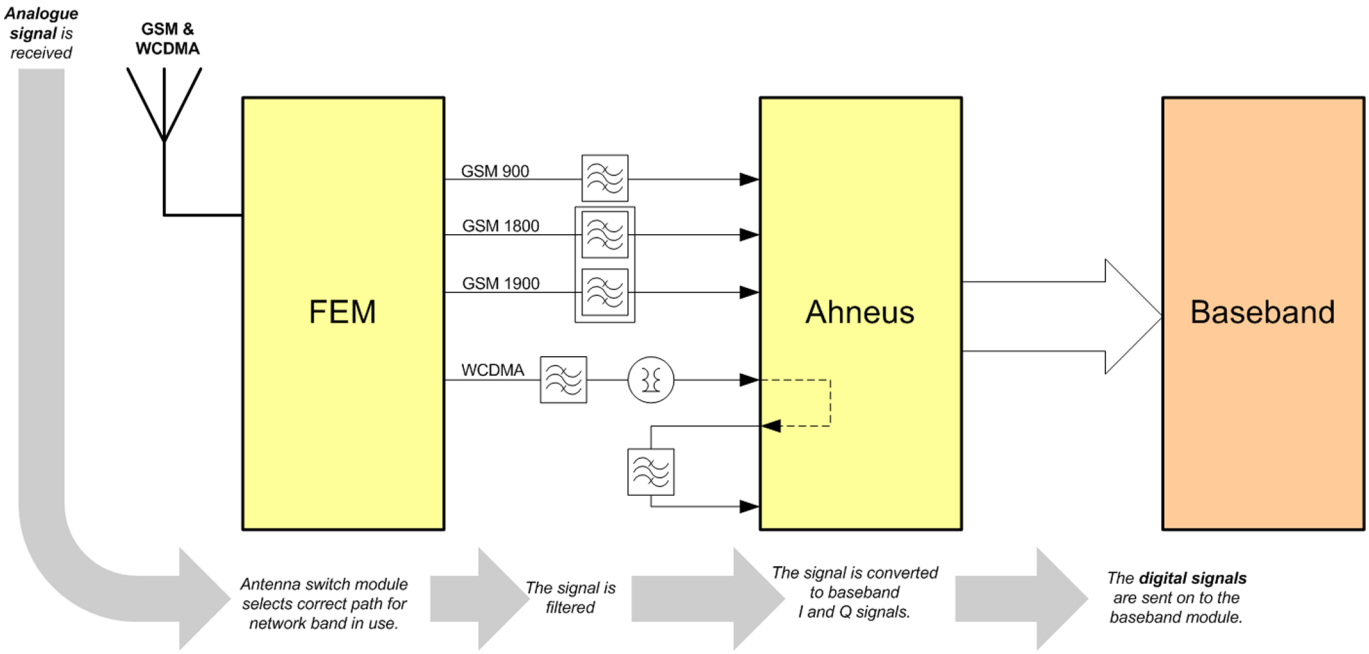
RF description

Receiver (RX)

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

The receiver functions are implemented in the RF ASIC.

Signals with different frequencies take different paths, therefore being handled by different components. The principle of GSM and WCDMA is the same.

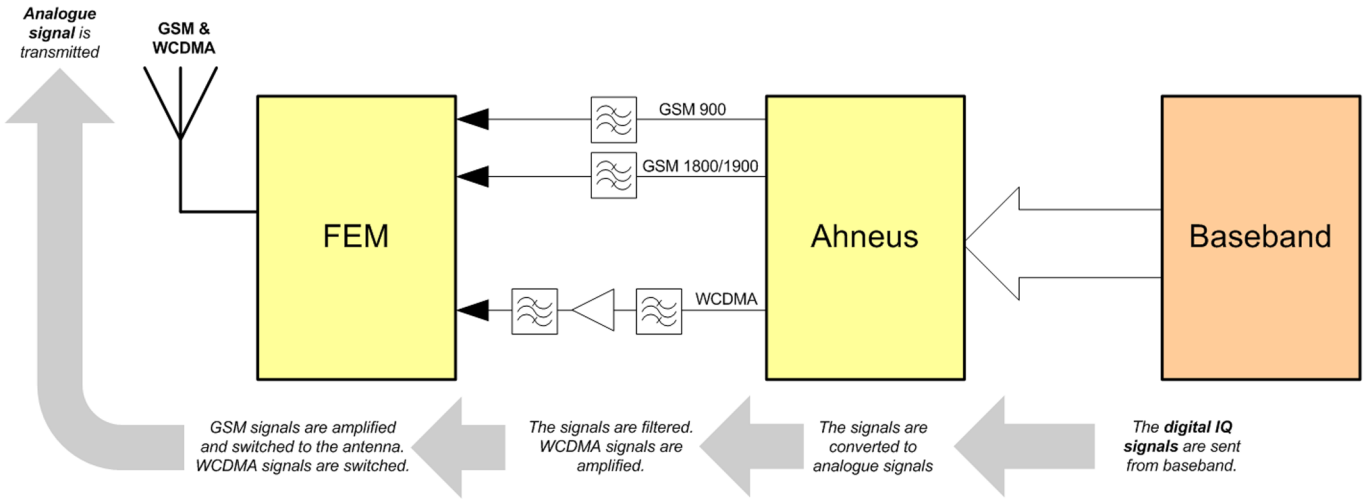


Transmitter (TX)

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

The transmitter functions are implemented in the RF ASIC.

Even though the GSM and WCDMA signals are sent via different components, the principles of the transmission is the same.



Bluetooth

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

The Bluetooth is physically integrated with the FM radio into one single module. From a functional point of view they, however, have nothing in common.

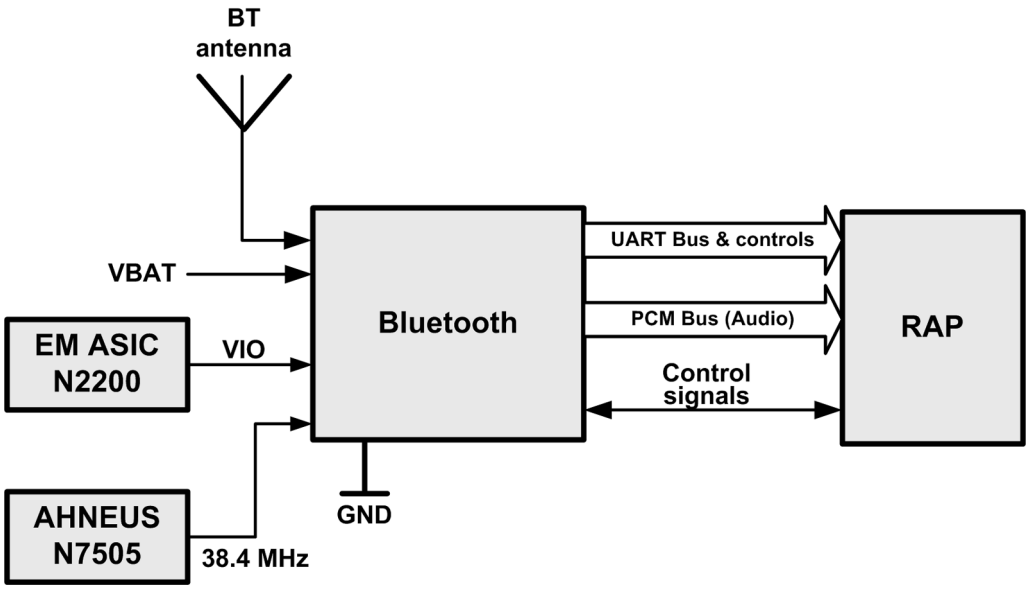


Figure 28 Bluetooth interface

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

FM radio

The FM radio is physically integrated with the Bluetooth into one single module. From a functional point of view they, however, have nothing in common.

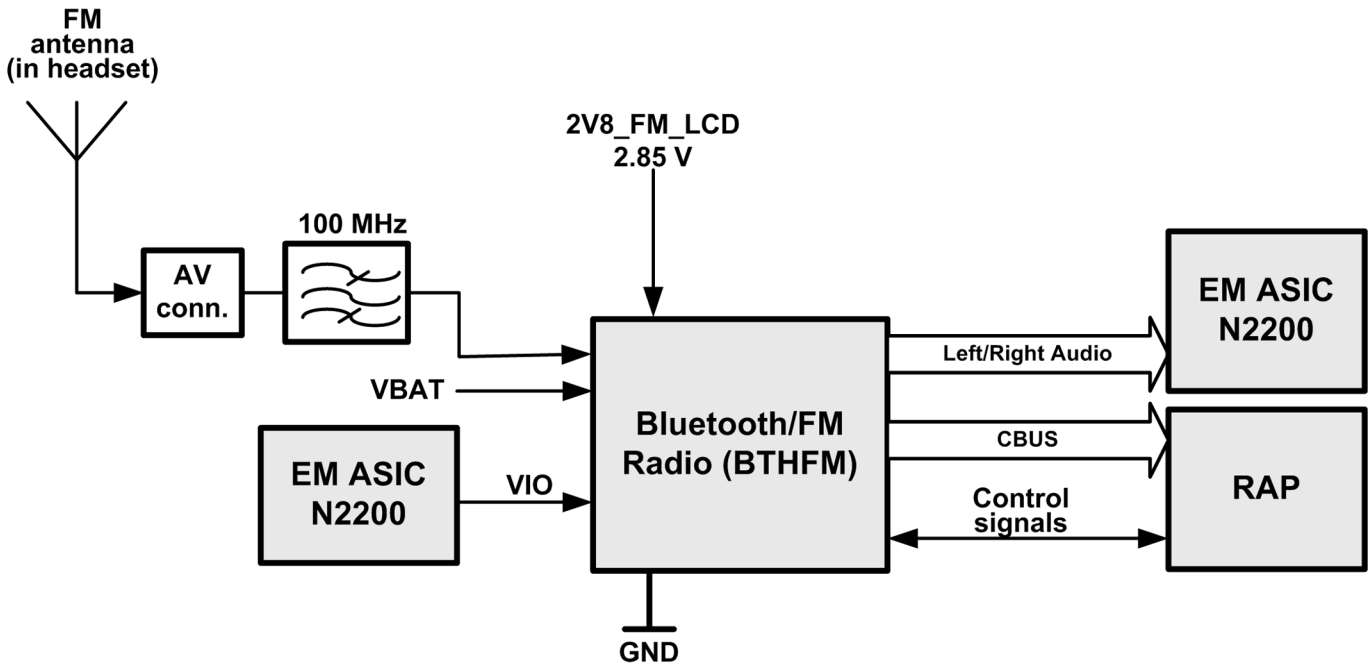


Figure 29 FM interface

The FM radio is an integrated circuit, controlled by MCU software through a serial bus interface. The wires of the headset are used as poles of the antenna, and no other antenna is needed for FM radio reception.

In addition to the Bluetooth unit the FM radio is provided with LDO (low drop out) voltage 2V8_FM_LCD.

The radio has an automatic band search function, which can search for a strong write/read signal from a certain frequency. When this is found, data is transmitted to the radio. When the signal strength is low, the EM ASIC N2200 (AVILMA) can read data, which is available until the signal is strong again.

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
GPIB	General-purpose interface bus
GPRS	General Packet Radio Service
GSM	Group Special Mobile/Global System for Mobile communication
HSDPA	High-speed downlink packet access
HF	Hands free
HFCM	Handsfree Common
HS	Handset
HSCSD	High speed circuit switched data (data transmission connection faster than GSM)
HW	Hardware
I/O	Input/Output
IBAT	Battery current
IC	Integrated circuit
ICHAR	Charger current
IF	Interface
IHF	Integrated hands free
IMEI	International Mobile Equipment Identity
IR	Infrared
IrDA	Infrared Data Association

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

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

VCXO	Voltage Controlled Crystal Oscillator
Vp-p	Peak-to-peak voltage
VSIM	SIM voltage
WAP	Wireless application protocol
WCDMA	Wideband code division multiple access
WD	Watchdog
WLAN	Wireless local area network
XHTML	Extensible hypertext markup language
Zocus	Current sensor (used to monitor the current flow to and from the battery)

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