Nokia Customer Care

Service Manual

RM-529; RM-530; RM-584 (Nokia E72; L3&4)

Mobile Terminal

Part No: (Issue 1)

COMPANY CONFIDENTIAL

NOKIA
Care

Amendment Record Sheet

Amendment No	Date	Inserted By	Comments
Issue 1	09/2009	MT	

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IMPORTANT

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

Warnings and cautions

Warnings

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

Cautions

- Servicing and alignment must be undertaken by qualified personnel only.
- Ensure all work is carried out at an anti-static workstation and that an anti-static wrist strap is worn.
- Ensure solder, wire, or foreign matter does not enter the telephone as damage may result.
- Use only approved components as specified in the parts list.
- Ensure all components, modules, screws and insulators are correctly re-fitted after servicing and alignment.
- Ensure all cables and wires are repositioned correctly.
- Never test a mobile phone WCDMA transmitter with full Tx power, if there is no possibility to perform the measurements in a good performance RF-shielded room. Even low power WCDMA transmitters may disturb nearby WCDMA networks and cause problems to 3G cellular phone communication in a wide area.
- During testing never activate the 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.

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.

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.

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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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-Pol 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.

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Nokia E72; L3&4 Service Manual Structure

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1 — General Information

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Product selection

RM-529, RM-530 and RM-584 are quadband phones. RM-529 supports WCDMA850/1900/2100 bands and WLAN. RM-530 supports WCDMA900/1900/2100 bands and WLAN. RM-584 supports WCDMA850/1900/2100 bands, but does not support WLAN. The devices have HSDPA and HSUPA.

For WCDMA the maximum bit rate is up to 384 kbit/s for downlink and 384 kbit/s for uplink with simultaneous CS speech or CS video (max. 64 kbit/s). The HSDPA peak is 10.2 Mbps and HSUPA peak is 2 Mbps (with limited use cases).

In PS/CS mode, the device supports DTM Class with multi slot class 11 (max. 4 RX + 3TX, sum 5). With EGPRS this means maximum download speed of up to 236.8 kbit/s simultaneously with speech. With GPRS this means maximum download speed of up to 64.2 kbit/s simultaneously with speech.

In PS only mode, the device supports MSC 32 (max. 5 Rx + 3 TX, sum 6) timeslots resulting in maximum download speed of up to 296 kbit/s with EGPRS, and up to 107kbit/s with GPRS

The device is an MMS (Multimedia Messaging Service) enabled multimedia terminal. The MMS implementation follows the OMA MMS standard release 1.2. The device also supports A-GPS, and Bluetooth 2.0 standard with stereo audio profiles (A2DP & AVRCP).

The device has a QVGA 2.4" display (320 x 240) capable of displaying 16 million colours and an integrated 5 Mpix autofocus camera with flash. The 2nd VGA camera is for video calls.

The device uses Symbian 9.3 operating system, S60 (release 3.2) UI, and supports the full Web Browser for S60 which brings desktop-like Web browsing experience to mobile devices.

The device also supports MIDP Java 2.0, providing a good platform for compelling 3rd party applications.

Figure 1 View of RM-530

Product features and sales package

Bearers and transport

- CSD, HSCSD
- GPRS/EGPRS Class B, Multi slot class 32
- Dual Transfer Mode (DTM) class A, multi slot class 11
- WCDMA DL 384 kbit/s, UL 384 kbit/s
- HSDPA up to 10.2 Mbps
- HSUPA 2 Mbps

Connectivity

- Assisted GPS (A-GPS)
- WLAN (not in RM-584)
- Bluetooth 2.0 with stereo audio profiles (A2DP and AVRCP)
- High Speed USB with micro USB connector
- MicroSD memory card - support up to 16 GB
- 3.5 mm AV connector

Display

- QVGA 2.4" display (320 x 240), 16M colours
- Digital Ambient Light Sensor (ALS) – used to optimize display/key brightness and power consumption
- Orientation sensor (accelerometer) assisted UI turn (portrate / landscape) and turn-to-mute

Imaging and video

- 5 Mpix autofocus camera
- 2nd VGA camera for video calls
- Video streaming and sharing
- Dedicated keys for image capture, recording and zooming
- Image and video editors

Music

- Music player with MP3/AAC/AAC+/eAAC+/WMA support
- Noise cancellation (2- MIC noise cancellation for uplink)
- Speech codec support for AMR-WB, AMR, FR, EFR
- Mono IHF speaker
- RDS FM Radio

Productivity

Context management

- OMA DRM version 2.0
- PIM (Calendar + Contacts + Active Notes)
- OTA provisioning & over the air SW update (FOTA)
- PC Suite for local data synchronization

- Ovi
- Active Standby
- Active Synch data synchronization
- Web Browser (OSS), Java ™ MIDP 2.0, XHTML browsing over TCP/IP

Messaging

- Email (SMTP, IMAP4, POP3)
- SMS, MMS (OMA 1.3)
- Audio Messaging (AMS)

Voice

- Rich Calls: 2-way video conferencing (video call), video sharing
- Voice commands, enhanced voice dialling (SIND)
- Audio message reader for text messages and E-mail
- VoIP calls

Add-on software framework

- Symbian OS 9.3
- Nokia Series 60, 3rd edition, feature pack 3.2
- Java: MIDP2.0

Additional features

- City compass to support easy pedestrian routing and guidance
- Status LED light around navi-key to indicate events like missed call, SMS etc.
- Vibrating alert
- Speech codec support for AMR-WB, AMR, FR, EFR

Basic sales package

Basic sales package, there may be sales area variations.

- Transceiver RM-529, RM-530 or RM-584
- Battery (BP-4L/1500mAh)
- Travel charger AC-8
- Stereo headset (WH-601)
- Micro USB connectivity cable (CA-101)
- MicroSD card 4GB (MU-41)
- Nokia PC Suite in microSD card
- Short user guide

Product and module list

Module name	Type code	Notes
System/RF module PWB	2WS	
UI flex PWB	2WT	
Flash light PWB	2YD	

Module name	Type code	Notes
AV flex PWB	2WU	

Mobile enhancements

Table 1 Audio

Enhancement	Type
Headsets (stereo)	WH-601 inbox
	WH-500
	WH-600
Wireless headsets (BT stereo)	BH-503
	BH-504

Table 2 Car

Enhancement	Type
Car navigation	Nokia 500 Auto Navigation
Car kit	CK-7W
	CK-15W
	CK-100
	CK-300 (BT & plug-in)
	CK-600
FM transmitter	CA-300
Holder	CR-39
	CR-82
	CR-99
Mobile charger	DC-4
Mobile holder easy mount	HH-12
	HH-17
Plug-in car handsfree	HF-200
	HF-300
	HF-310
	HF-510

Table 3 Data

Enhancement	Type
MicroSD card, 512MB	MU-28
MicroSD card, 1GB	MU-22

Enhancement	Type
MicroSD card, 2GB	MU-37
MicroSD card, 4GB	MU-41
MicroSD card, 8GB	MU-43
MicroSD card, 16GB	MU-44
Micro USB connectivity adapter cable	CA-101/CA_101D

Table 4 Messaging

Enhancement	Type
Digital pen	SU-27W
Wireless keyboard	SU-8W

Table 5 Music

Enhancement	Type
Bluetooth speakers	MD-5W (BT & plug-in)
	MD-7W (BT & plug-in)
Music speakers	MD-6
	MD-8

Table 6 Navigation

Enhancement	Type
Wireless GPS module	LD-3W
	LD-4W

Table 7 Power

Enhancement	Type
Battery 1500 mAh Li-Polymer	BP-4L
Charger adapter	AC-146c
Charger	AC-5
	AC-8
	DC-8
	DC-9
	DC-11

Technical specifications

Transceiver general specifications

Unit	Dimensions (L x W x T) (mm)	Weight (g)	Volume (cm^3)
Transceiver with BP-4L 1500 mAh Li-Polymer battery back	114 x 59.5 x 10.1	128	65

Main RF characteristics for GSM850/900/1800/1900 and WCDMA VIII/II/I phones

Parameter	Unit
Cellular system	GSM850, EGSM900, GSM1800/1900, WCDMA VIII (900), WCDMA II (1900) and WCDMA I (2100)
Rx frequency band	GSM850: 869 - 894 MHz
	EGSM900: 925 - 960 MHz
	GSM1800: 1805 - 1880 MHz
	GSM1900: 1930 - 1990 MHz
	WCDMA VIII (900): 925- 960 MHz
	WCDMA II (1900): 1930-1990MHz
	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 VIII (900): 880 - 915 MHz
	WCDMA II (1900): 1850-1910MHz
	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 VIII (900): -50 ... +24 dBm/0.01µW ... 251.2mW
	WCDMA II (1900): -50 ... +24dBm/0.01µW ... 251.2mW
	WCDMA I (2100): -50 ... +24 dBm/0.01µW ... 251.2mW

Parameter	Unit
EDGE output power	EDGE850: +5 ... +27dBm/3.2mW ... 794mW
	EDGE900: +5 ... +27dBm/3.2mW ... 794mW
	EDGE1800: +0 ... +26dBm/1.0mW ... 400mW
	EDGE1900:+0 ... +26dBm/1.0mW ... 400mW
Number of RF channels	GSM850: 124
	GSM900: 174
	GSM1800: 374
	GSM1900: 299
	WCDMA VIII (900): 152
	WCDMA II (1900): 289
	WCDMA I (2100): 277
Channel spacing	200 kHz (WCDMA II 100/200 kHz)
Number of Tx power levels	GSM850: 15
	GSM900: 15
	GSM1800: 16
	GSM1900: 16
	WCDMA VIII (900): 75
	WCDMA II (1900): 75
	WCDMA I (2100): 75

Main RF characteristics for GSM850/900/1800/1900 and WCDMA V/II/I phones

Parameter	Unit
Cellular system	GSM850, EGSM900, GSM1800/1900, WCDMA V (850), WCDMA II (1900) and WCDMA I (2100)
Rx frequency band	GSM850: 869 - 894MHz
	EGSM900: 925 - 960 MHz
	GSM1800: 1805 - 1880 MHz
	GSM1900: 1930 - 1990 MHz
	WCDMA V (850): 869 - 894 MHz
	WCDMA II (1900): 1930 - 1990 MHz
	WCDMA I (2100): 2110 - 2170 MHz

Parameter	Unit
Tx frequency band	GSM850: 824 - 849MHz
	EGSM900: 880 - 915 MHz
	GSM1800: 1710 - 1785 MHz
	GSM1900: 1850 - 1910 MHz
	WCDMA V (850): 824 - 849 MHz
	WCDMA II (1900): 1850 - 1910 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 II (1900): -50 ... +24 dBm/0.01µW ... 251.2mW
	WCDMA I (2100): -50 ... +24 dBm/0.01µW ... 251.2mW
EDGE output power	EDGE850: +5 ... +27dBm/3.2mW ... 794mW
	EDGE900: +5 ... +27dBm/3.2mW ... 794mW
	EDGE1800: +0 ... +26dBm/1.0mW ... 400mW
	EDGE1900:+0 ... +26dBm/1.0mW ... 400mW
Number of RF channels	GSM850: 124
	GSM900: 174
	GSM1800: 374
	GSM1900: 299
	WCDMA V (850): 108
	WCDMA II (1900): 289
	WCDMA I (2100): 277
Channel spacing	200 kHz (WCDMA V and II 100/200 kHz)
Number of Tx power levels	GSM850: 15
	GSM900: 15
	GSM1800: 16
	GSM1900: 16
	WCDMA V (850): 75
	WCDMA II (1900): 75
	WCDMA I (2100): 75

Battery endurance

Table 8 GSM

Battery	Capacity (mAh)	Talk time	Stand-by
BP-4L	1500	~6.5 h (GSM) ~5 h (WCDMA)	~450 h (GSM) ~500 h (WCDMA)

Charging times

AC-8
2 h

Environmental conditions

Temperature conditions

Environmental condition	Ambient temperature	Notes
Normal operation	-15ºC...+55ºC	Specifications fulfilled
Reduced performance	-25ºC...-15ºC +55ºC...+70ºC	Operational for shorts periods only
Intermittent operation	-40ºC...-15ºC +70ºC...+85 ºC	Operation not guaranteed but an attempt to operate does not damage the phone.
No operation or storage	<-40ºC...>+85ºC	No storage or operation: an attempt may damage the phone.
Charging allowed	-25ºC...+50ºC	
Long term storage conditions	0ºC...+85ºC	

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^2 / s^3 (0.0558 g^2/ 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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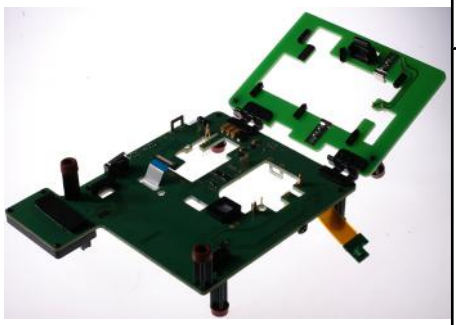
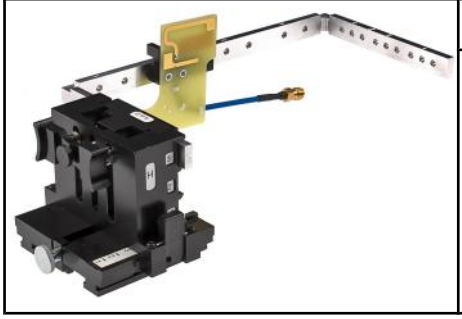
Service tools

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-529; RM-530; RM-584. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

	FS-114	Flash adapter	
	For flashing (also dead phones) with SS-64. RF testing (with RF coupler), and CU-4 supported.		
	MJ-222	Module jig	
	MJ-222 is meant for troubleshooting, testing, tuning and flashing on the engine level (CU-4 supported). The jig includes an RF interface for GSM, WCDMA and Bluetooth.		
	RJ-230	Soldering jig	
	RJ-230 is a soldering jig used for soldering and as a rework jig for the engine module.		
	SA-131	RF coupler	
	SA-131 is a generic device for GPS testing. It is used together with SS-62.		

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-529; RM-530; RM-584. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

	AC-35	Power supply	
	Universal power supply for FPS-21; included in the FPS-21 sales package. Input 100V...230V 50Hz...60Hz, output voltage of 12 V and output current up to 3 A.		
	ACF-8	Universal power supply	
	The ACF-8 universal power supply is used to power FLS-5.		

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-21	Flash prommer	

FPS-21 sales package:

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

FPS-21 interfaces:

Front

- Service cable connector

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

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

Rear

- DC power input

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

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

  For connecting a PC.
- Phone connector

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

  For connecting the FPS-21 to LAN.

Inside

- Four SD card memory slots

  For internal storage memory.

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

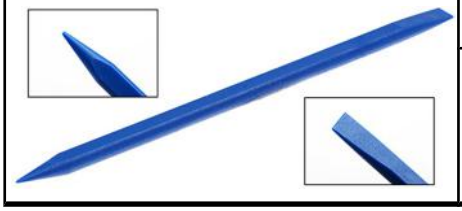
	JXS-1	RF shield box	
	Because the WCDMA network disturbs the RX side testing of the WCDMA phone and the Tx signal of the WCDMA phone can severely disturb the WCDMA network, a shield box is needed in all testing, tuning and fault finding which requires WCDMA RF signal. The shield box is not an active device, it contains only passive filtering components for RF attenuation.		
	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.		
	SB-6	Bluetooth test and interface box (sales package)	
	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 . Sales package includes: • SB-6 test box • Installation and warranty information		
	SB-7	WLAN test box	
	WLAN test requires defined position for the device.		

SRT-6	Opening tool	
SRT-6 is used to open phone covers. **Note:** The SRT-6 is included in the Nokia Standard Toolkit.		

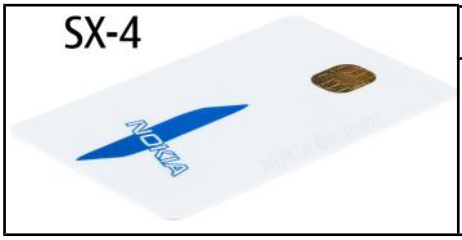
SS-210	Camera removal tool	
The camera removal tool SS-210 is used to remove/attach the camera module from/to the socket.		

SS-46	Interface adapter	
SS-46 acts as an interface adapter between the flash adapter and FPS-21.		

SS-62	Generic flash adapter base for BB5	
• generic base for flash adapters and couplers • 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-93	Opening tool	
SS-93 is used for opening JAE connectors. **Note:** 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. 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-529; RM-530; RM-584. 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-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.		

CA-35S	Power cable	

CA-35S is a power cable for connecting, for example, the FPS-21 flash prommer to the Point-Of-Sales (POS) flash adapter.

CA-58RS	RF tuning cable	

Product-specific adapter cable for RF tuning.

- **Table 9 Attenuation values**

Band	Attenuation Rx/Tx
GSM850/900	0.2...0.3 dB
GSM1800/1900	0.3...0.4 dB
WCDMA900	0.2...0.3 dB
WCDMA2100	0.3...0.4 dB

CA-89DS	Cable	

Provides VBAT and Flashbus connections to mobile device programming adapters.

DAU-9S	MBUS cable	

The MBUS cable DAU-9S has a modular connector and is used, for example, between the PC's serial port and module jigs, flash adapters or docking station adapters.

Note: Docking station adapters valid for DCT4 products.

PCS-1	Power cable	

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

XRS-6	RF cable	

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
- WCDMA/WLAN: 0.6+-0.1dB

Service concepts

POS (Point of Sale) flash concept

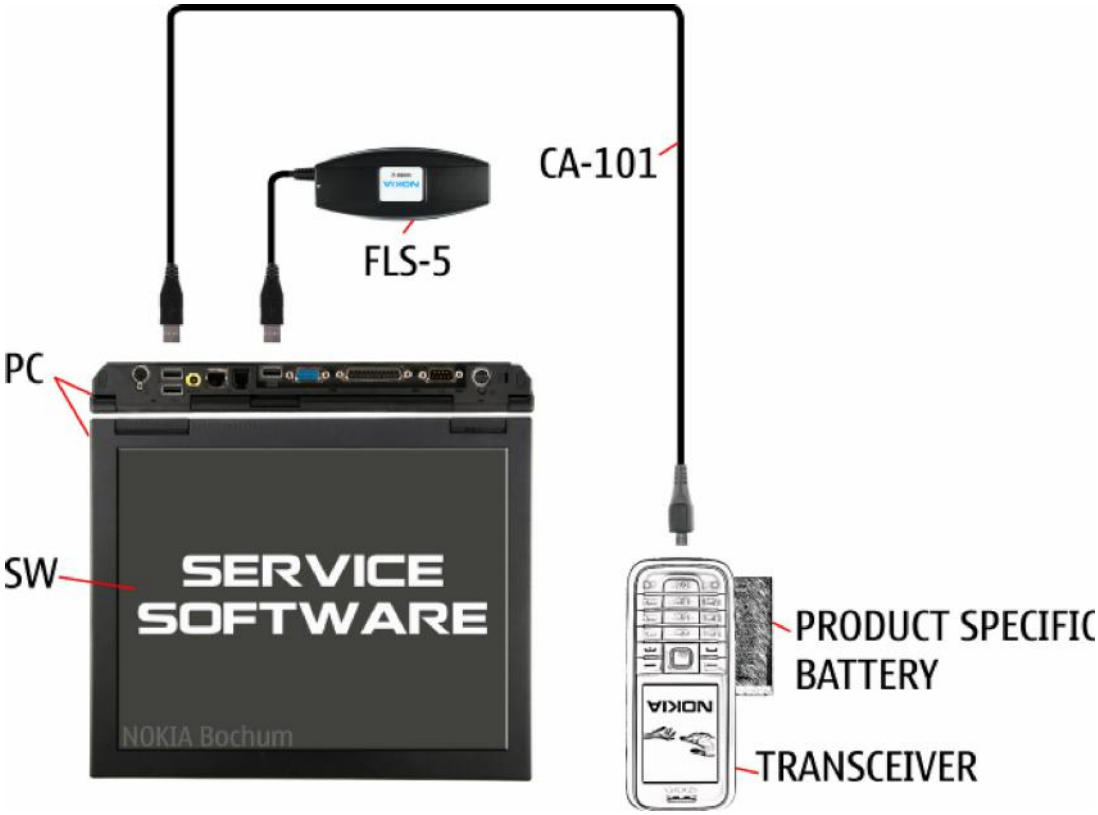


Figure 2 POS flash concept

Type	Description
Product specific tools	
BP-4L	Battery
Other tools	
FLS-5	POS flash dongle
	PC with Phoenix service software
Cables	
CA-101	Micro USB cable

Flash concept with FPS-21

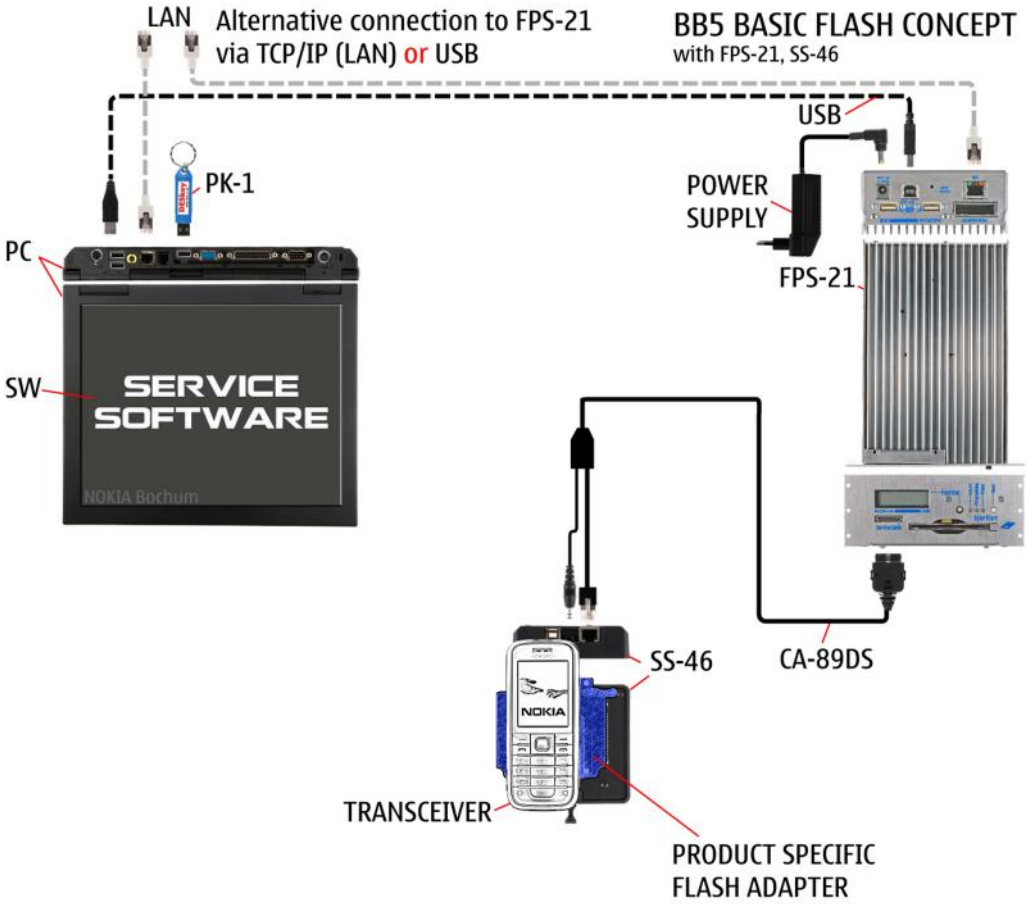


Figure 3 Basic flash concept with FPS-21

Type	Description
Product specific devices	
FS-114	Flash adapter
Other devices	
FPS-21	Flash prommer box
AC-35	Power supply
PK-1	SW security device
SS-46	Interface adapter
	PC with Phoenix service software
Cables	
CA-89DS	Service cable
	USB cable

CU-4 flash concept with FPS-21

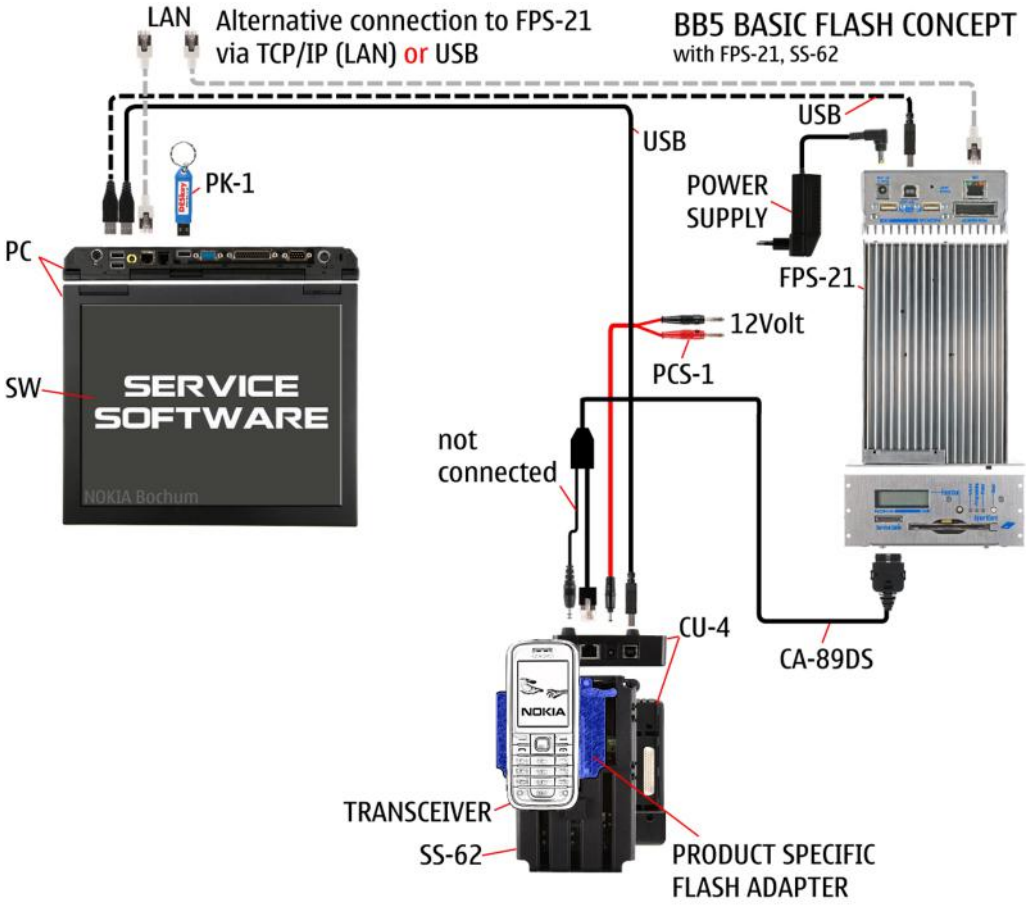


Figure 4 CU-4 flash concept with FPS-21

Type	Description
Product specific devices	
FS-114	Flash adapter
Other devices	
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
Cables	
PCS-1	Power cable
CA-89DS	Service cable
	Standard USB cable

Type	Description
	USB cable

Module jig service concept

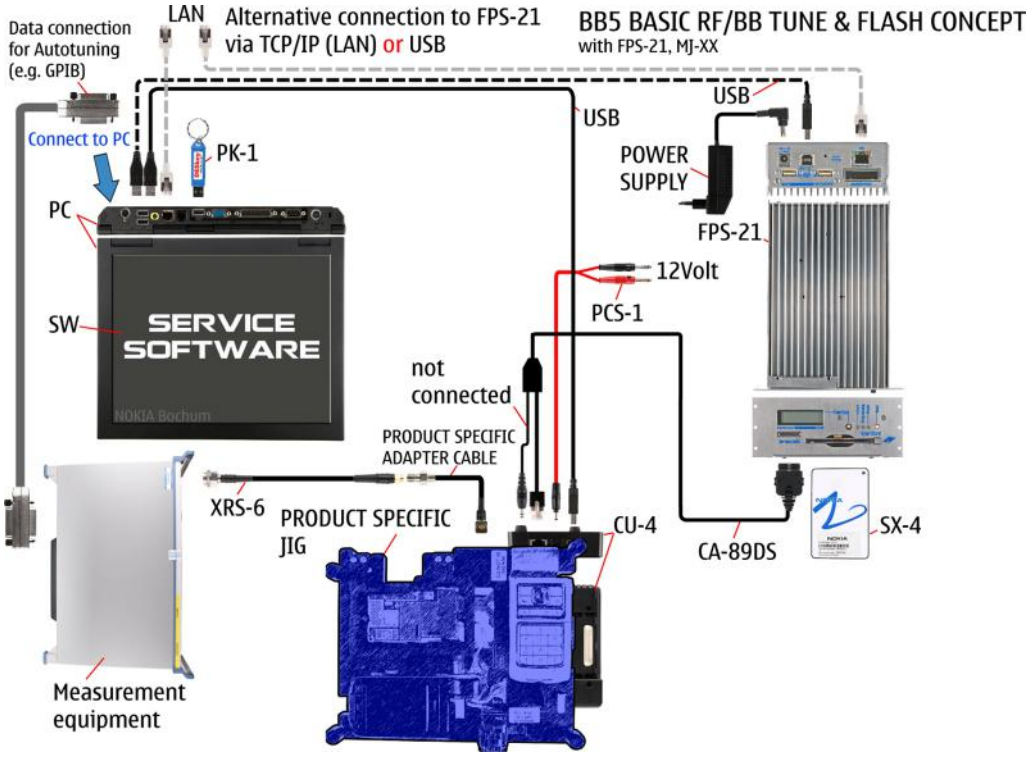
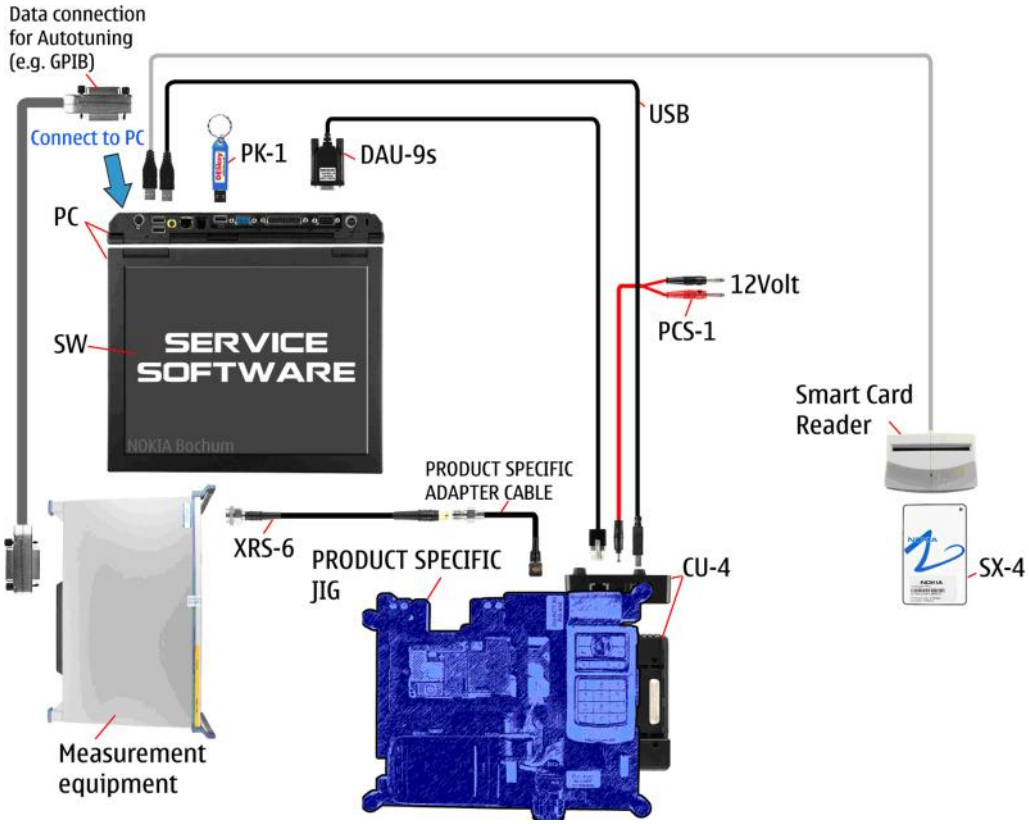


Figure 5 Module jig service concept

Type	Description
Phone specific devices	
MJ-222	Module jig
Other devices	
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
Cables	
CA-89DS	Service cable
PCS-1	DC power cable
XRS-6	RF cable
	USB cable

Type	Description
	GPIB control cable

BB/RF tuning concept with module jig



Type	Description
Product specific tools	
MJ-222	Module jig
Other tools	
CU-4	Control unit
PK-1	SW security device
SX-4	Smart card
	PC with Phoenix service software
	Smart card reader
Cables	
DAU-9S	MBUS cable
PCS-1	Power cable
XRS-6	RF cable
	USB cable

Bluetooth testing concept with SB-6

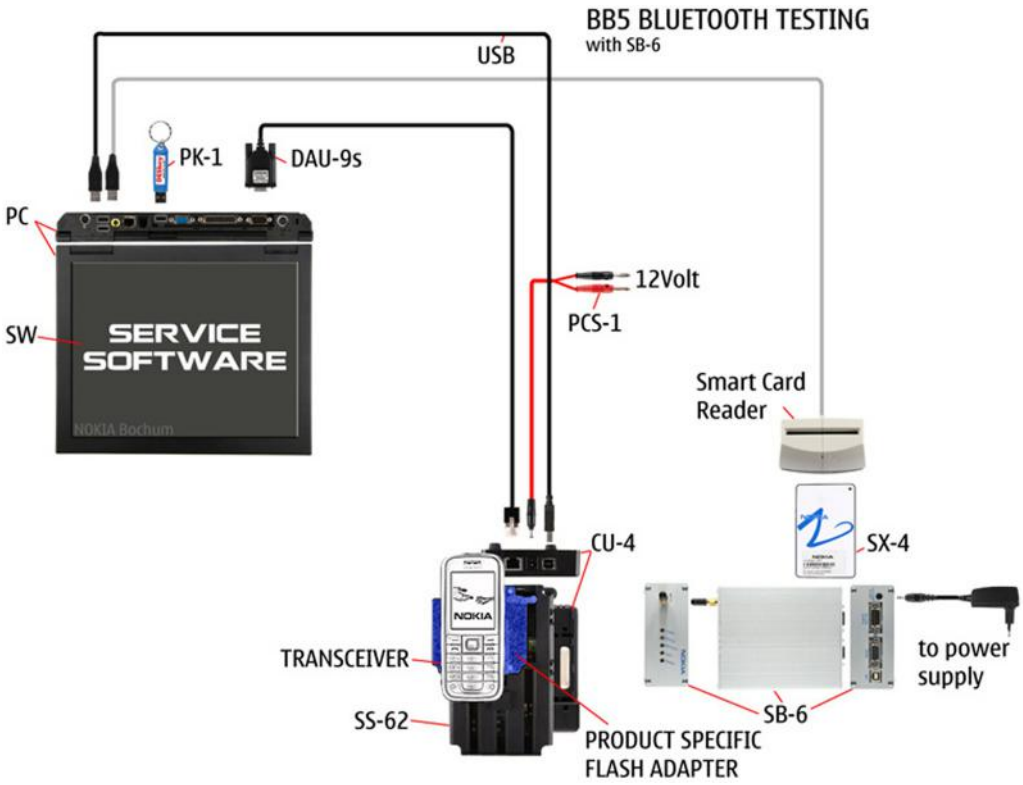


Figure 6 Service concept for RF testing and RF/BB tuning

Type	Description
Product specific devices	
FS-114	Flash adapter
Other devices	
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
Cables	
DAU-9S	MBUS cable
PCS-1	DC power cable
	USB cable

WLAN functionality testing concept with SB-7

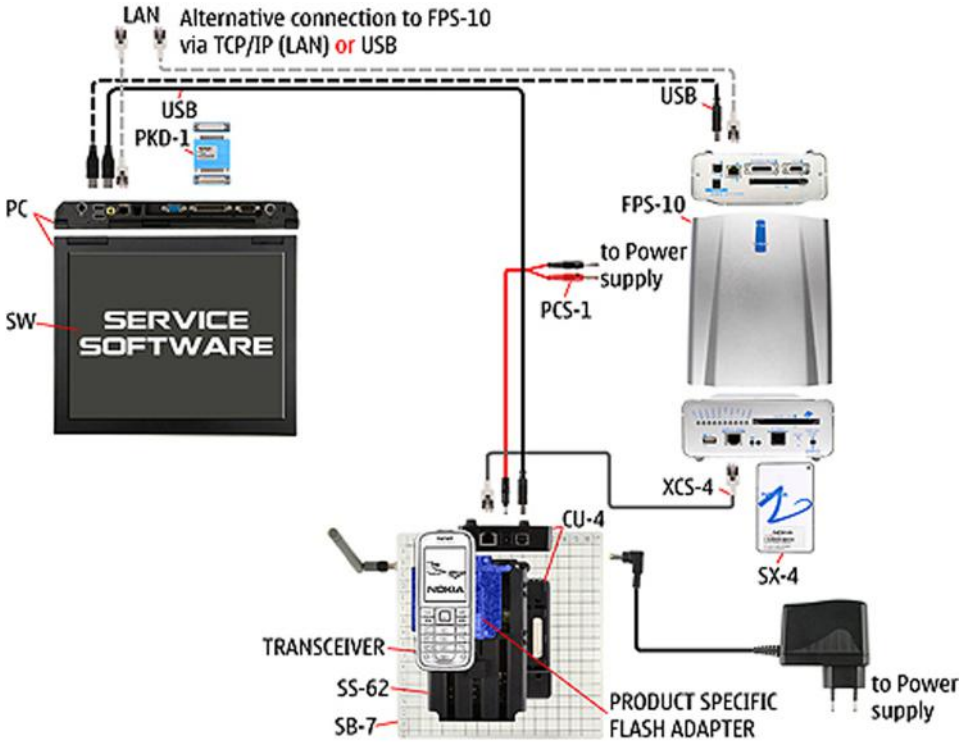


Figure 7 WLAN functionality testing concept with SB-7

Type	Description
Product specific tools	
FS-114	Flash adapter
Other tools	
CU-4	Control unit
PCS-1	DC power cable
PK-1	SW Security device
SS-62	Generic base adapter
Cables	
PCS-1	Power cable
DAU-9S	Cable
	Standard USB cable

GPS testing concept with GPS RF coupler

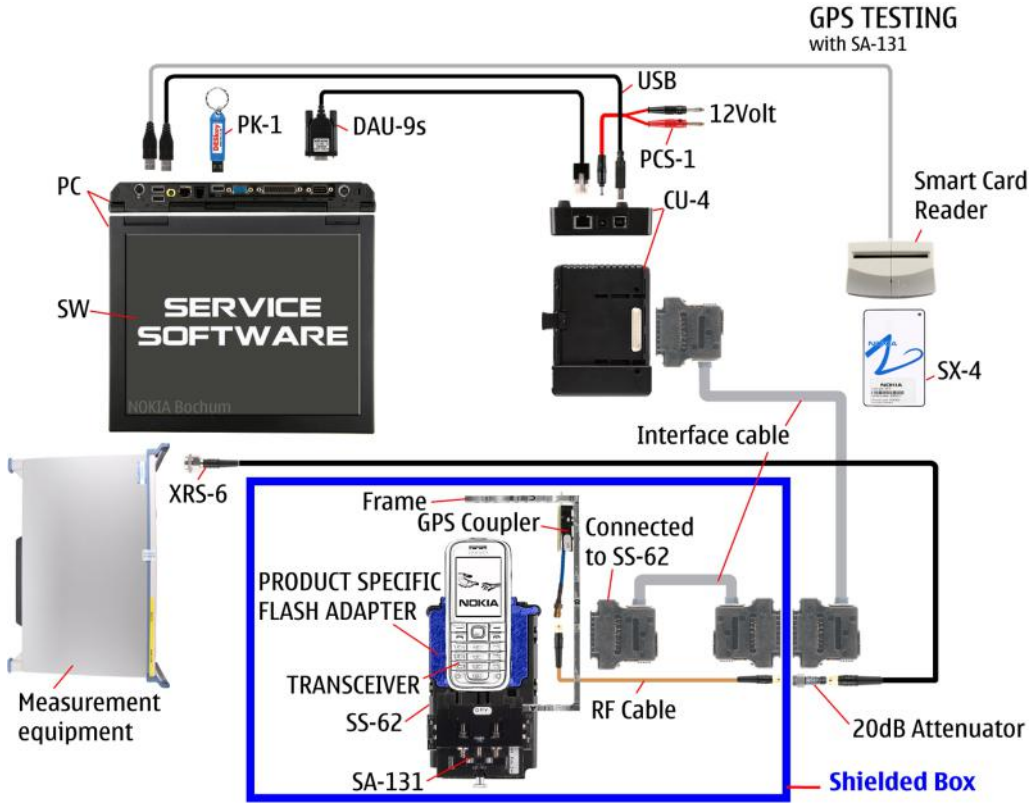


Figure 8 RF testing concept with RF coupler

Type	Description
Product specific devices	
FS-114	Flash adapter
SA-131	GPS RF coupler
Other devices	
CU-4	Control unit
SX-4	Smart card
JXS-1	RF shield box
PK-1	SW security device
SS-62	Flash adapter base
	Smart card reader
	Measurement equipment
	PC with Phoenix service software
Cables	
CA-58RS	RF service cable (product-specific adapter cable)
PCS-1	Power cable
DAU-9S	MBUS cable

Type	Description
XRS-6	RF cable
	20dB attenuator
	Interface cable
	USB cable

3 — BB Troubleshooting and Manual Tuning Guide

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Table of Contents

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List of Figures

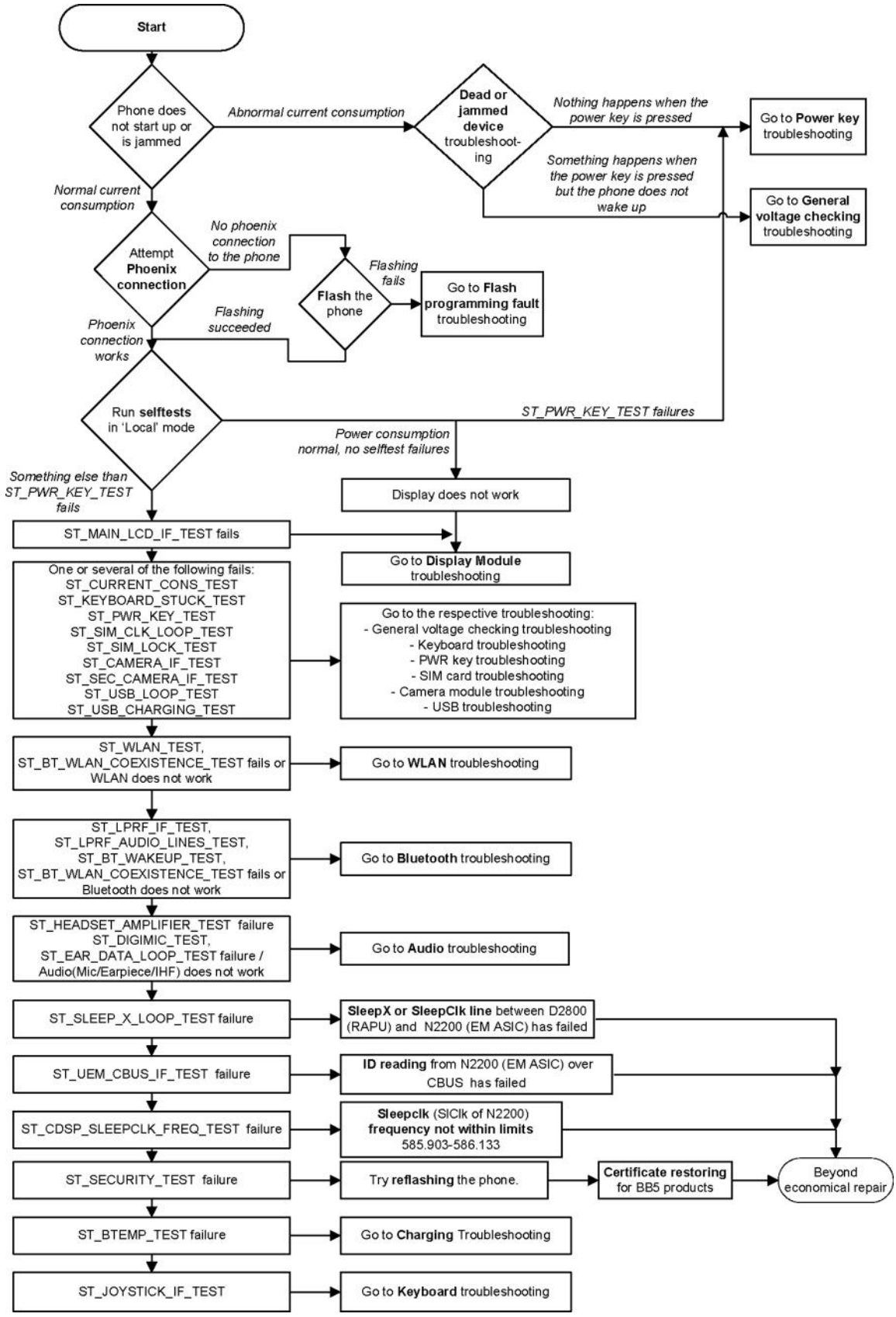
Baseband self tests in Phoenix

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 (page 3–7).

Troubleshooting flow



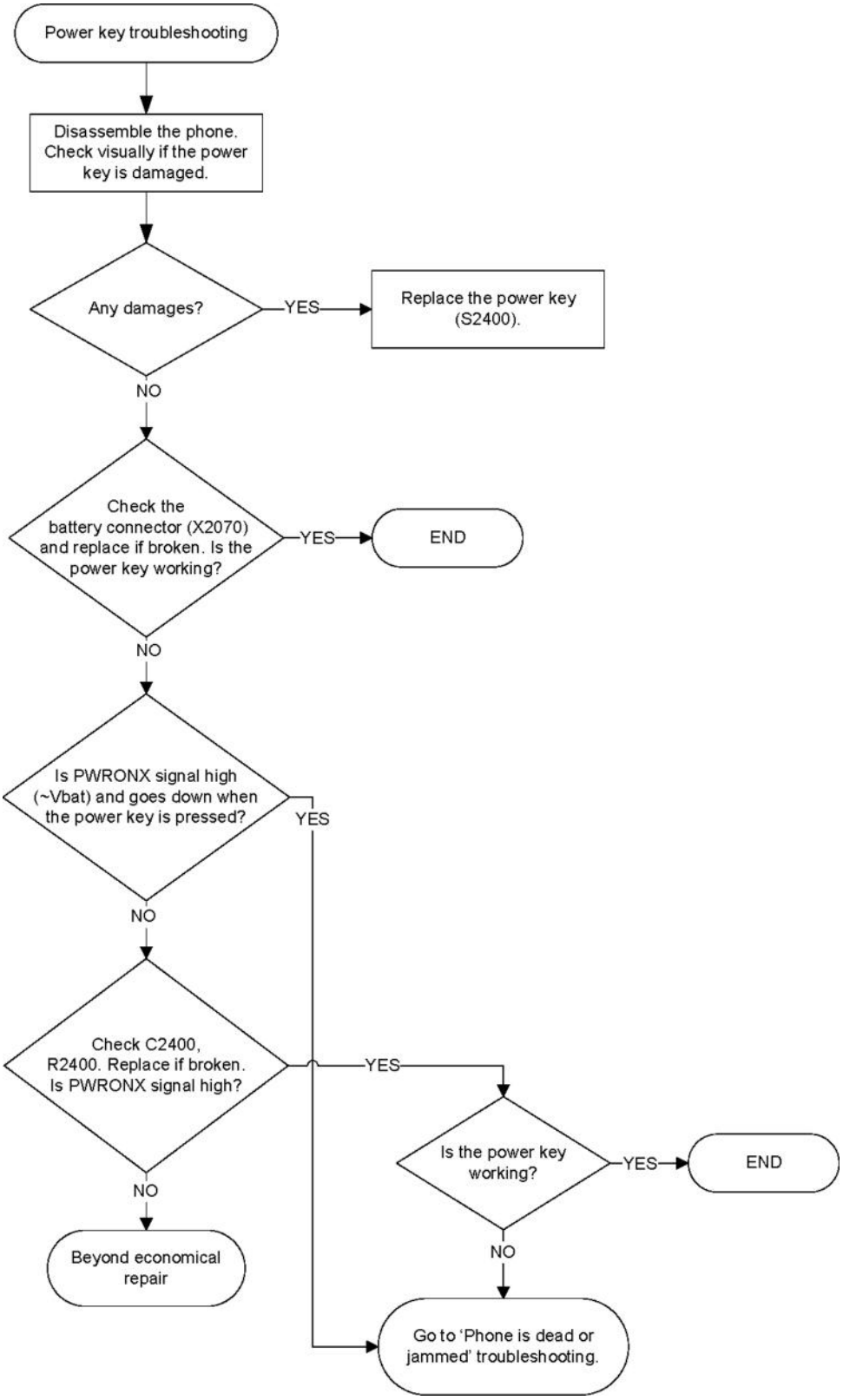
Power and charging troubleshooting

Dead or jammed device troubleshooting

Troubleshooting flow

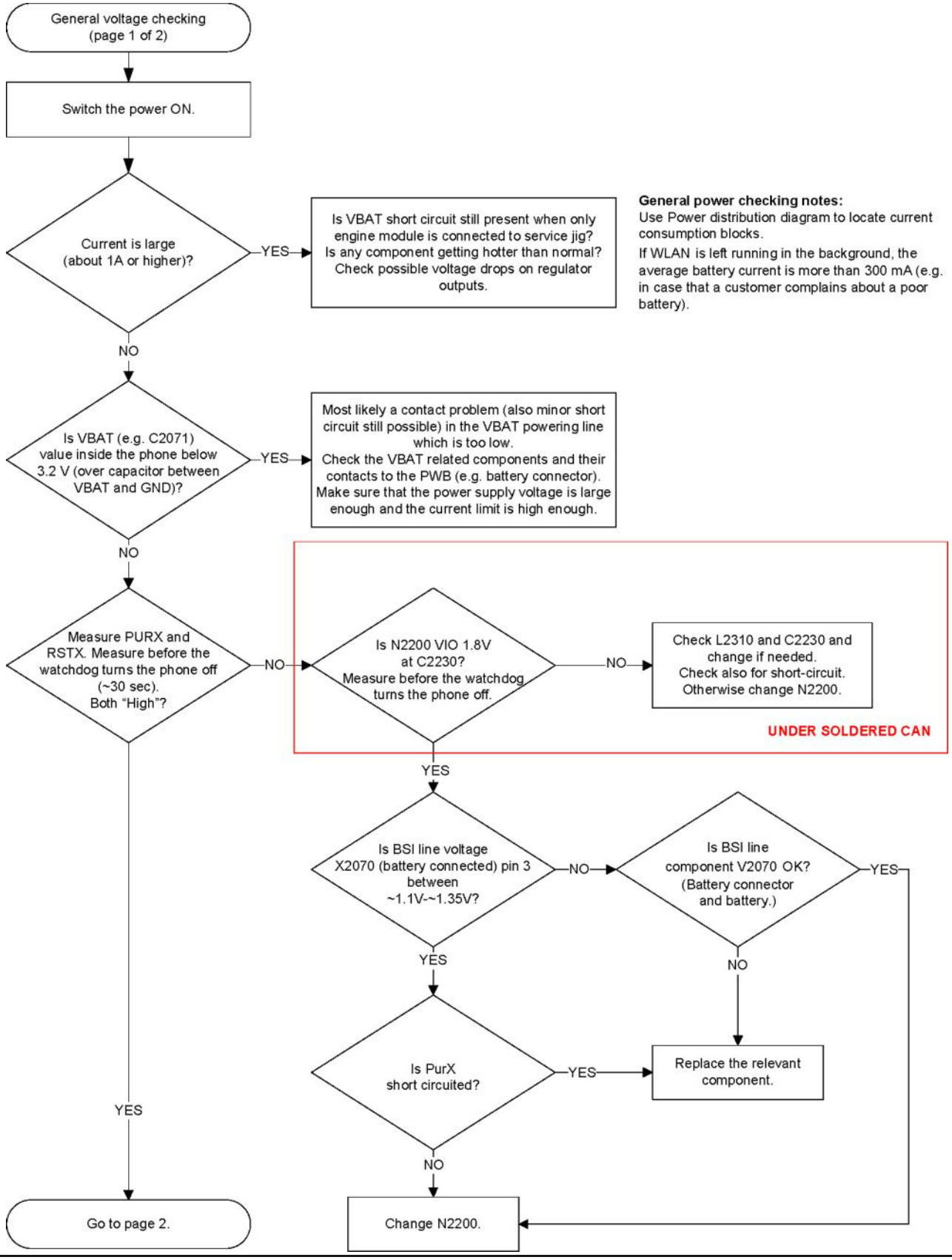
Power key troubleshooting

Troubleshooting flow

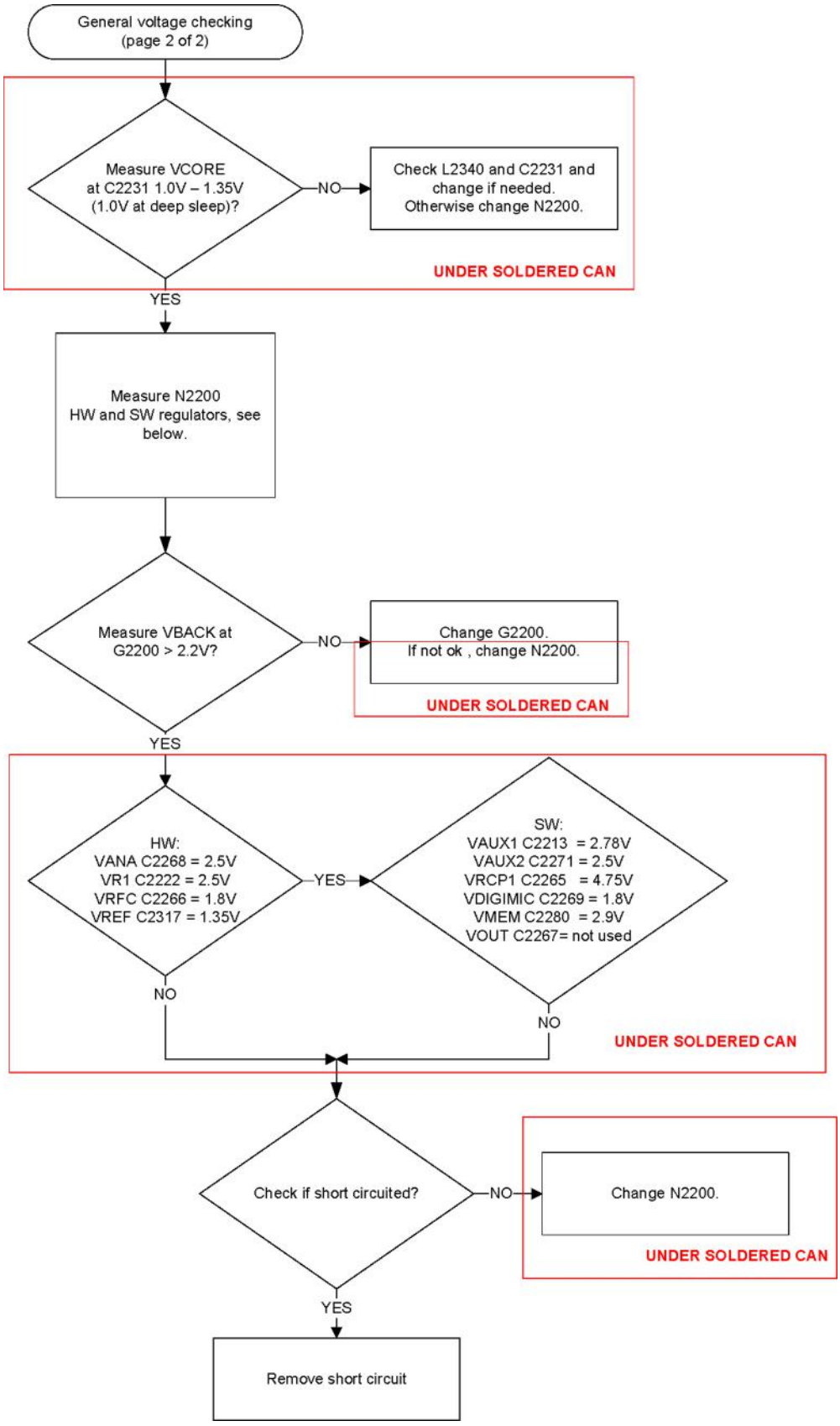


General voltage checking troubleshooting

Troubleshooting flow - Page 1 of 2



Troubleshooting flow - Page 2 of 2



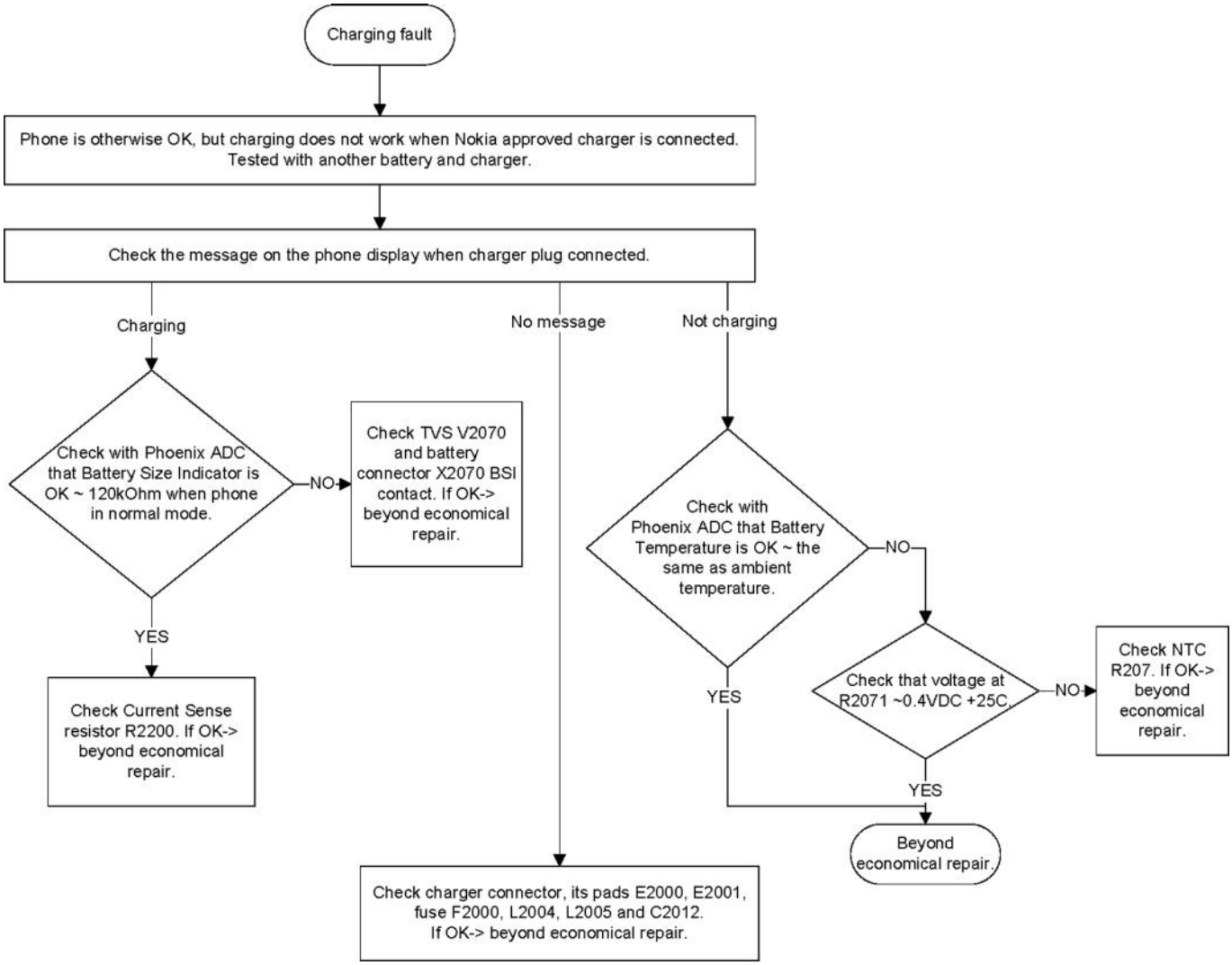
General power checking

Check the following voltages:

Signal Rename	Regulator	Sleep	Idle	Nominal voltage	Main user	Notes
VIO	Gazoo/Pearl	ON	ON	1.8	Memory, I/Os, display, WLAN, GPS	
VBACK	Gazoo/Pearl	ON	ON	2.5	Back-up battery	
VSIM1	Gazoo/Pearl	ON	ON	1.8/3.0	SIM card	
VAUX1	Gazoo/Pearl	ON	ON	2.8	Display, 3D magnetometer, OFN	
VAUX2	Gazoo/Pearl	OFF	OFF	2.5	ALS, accelerometer	
VANA	Gazoo/Pearl	ON	ON	2.5	Not used	
VR1	Gazoo/Pearl	OFF	ON	2.5	Crystal oscillators	
VRFC	Gazoo/Pearl	OFF	ON	1.8	RAPU converters	
VRCP1	Gazoo/Pearl			4.75	To RF parts	
VREF	Gazoo/Pearl	ON	ON	1.25	RF reference	
VCORE	Gazoo/Pearl	ON	ON	1.2	RAPU digital	Can change due to RAPU version & SW
VOUT	Gazoo/Pearl	OFF	OFF	2.5	Not used	
VCAM_2V8	N1401	OFF	OFF	2.8	Camera	Disabled in sleep
VCAM_1V8	N1402	OFF	OFF	1.800	Camera	Disabled in sleep
VMEM	Gazoo/Pearl	OFF	OFF	2.9	microSD	Disabled in sleep

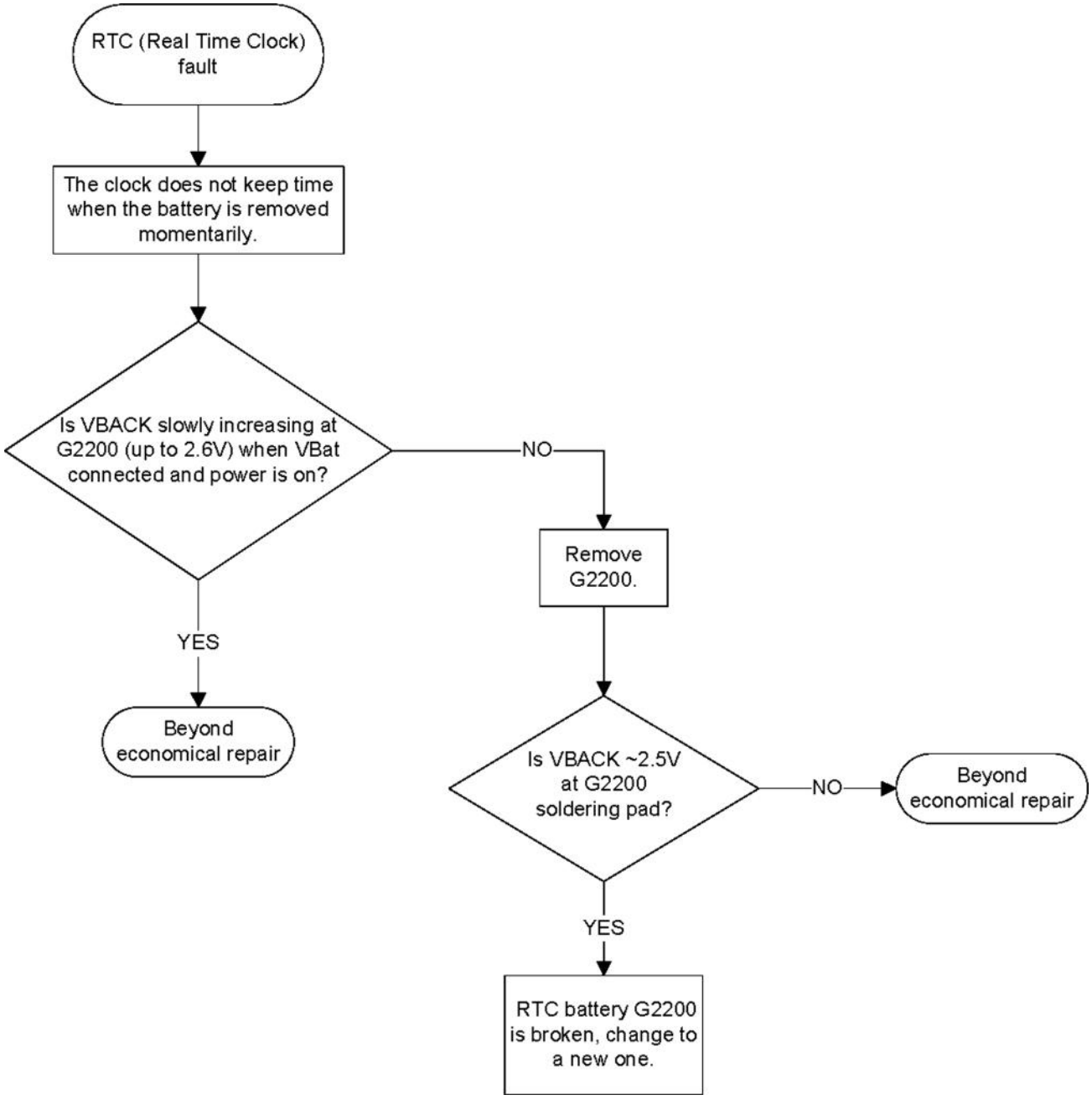
Charging troubleshooting

Troubleshooting flow



RTC troubleshooting

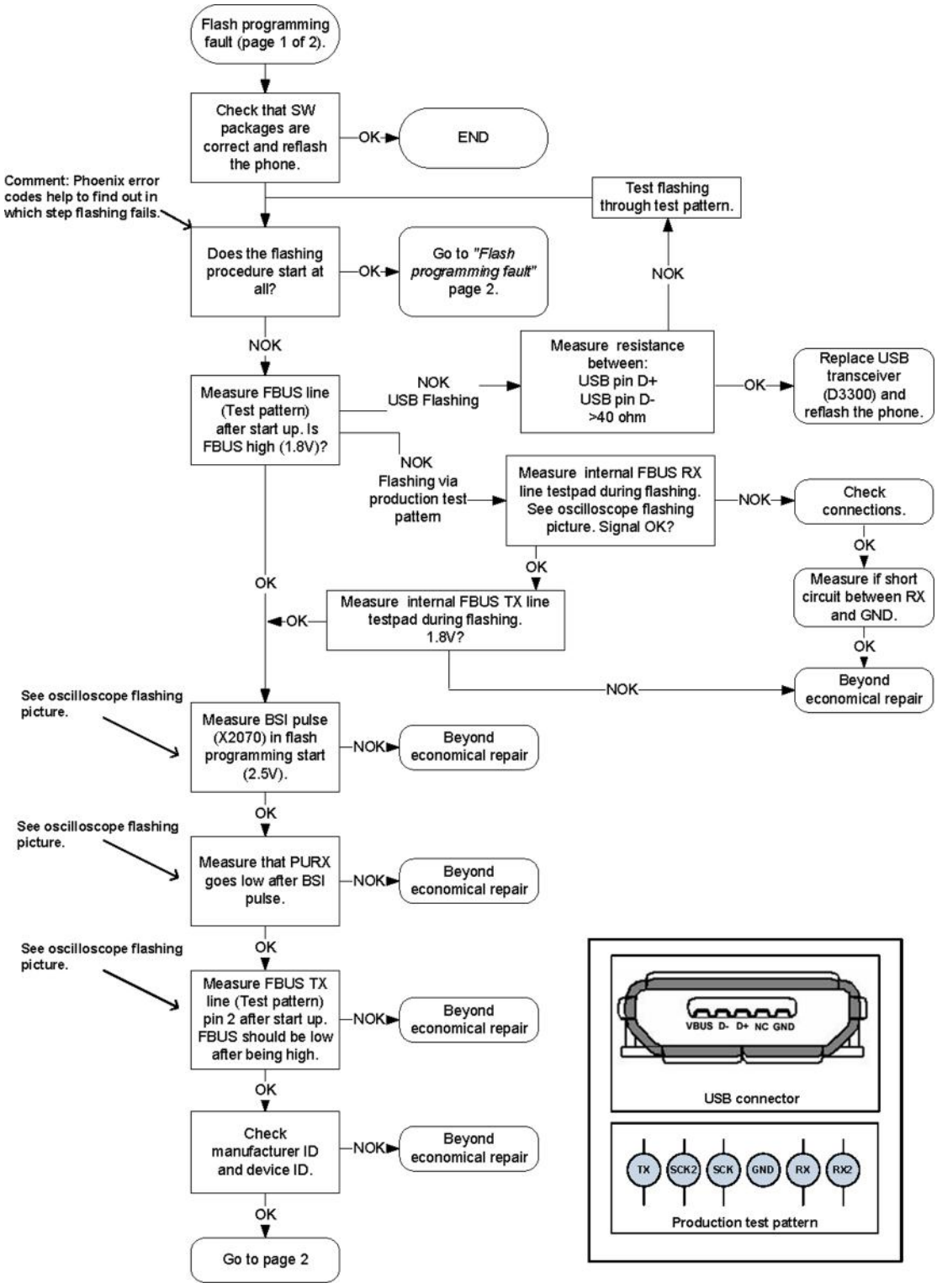
Troubleshooting flow



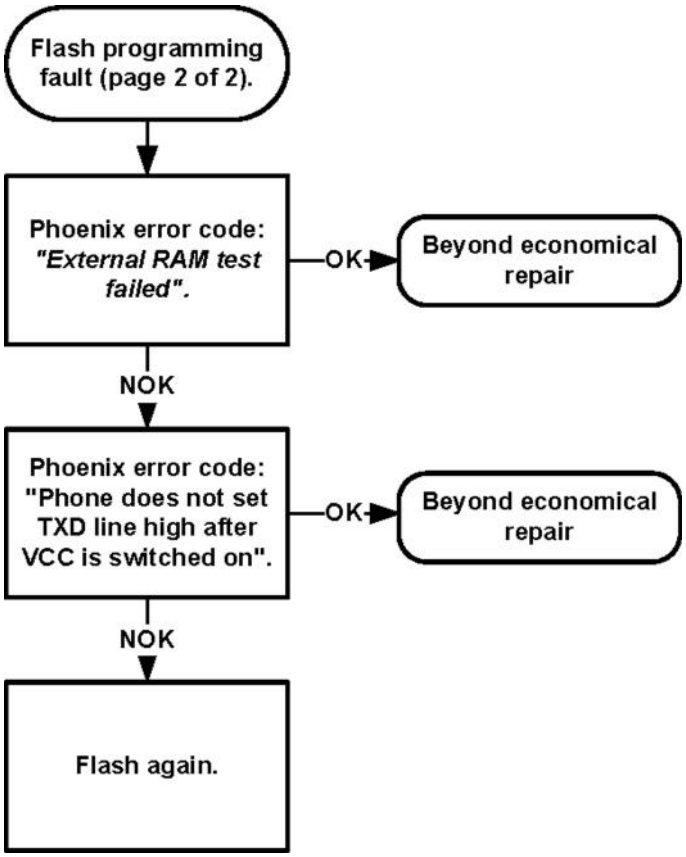
Interface troubleshooting

Flash programming fault troubleshooting

Troubleshooting flow - Page 1 of 2



Troubleshooting flow - Page 2 of 2



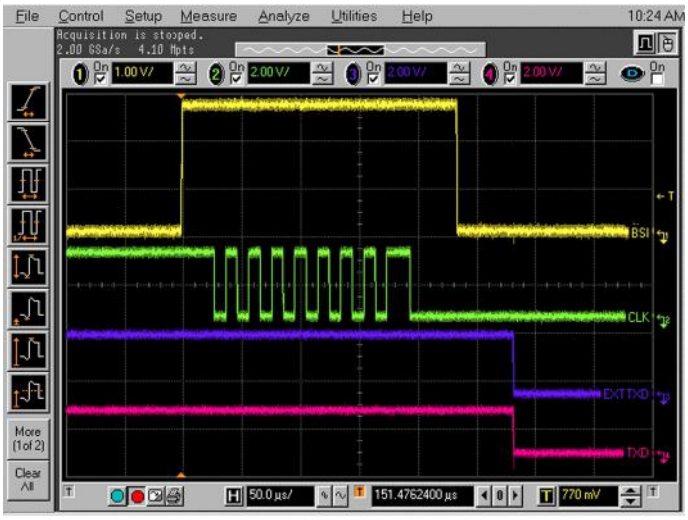


Figure 9 Flashing pic 1. Take single trig measurement for the rise of the BSI signal

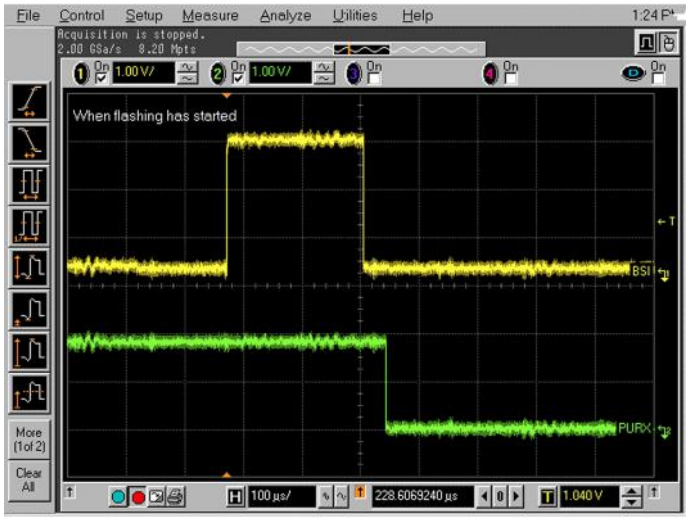
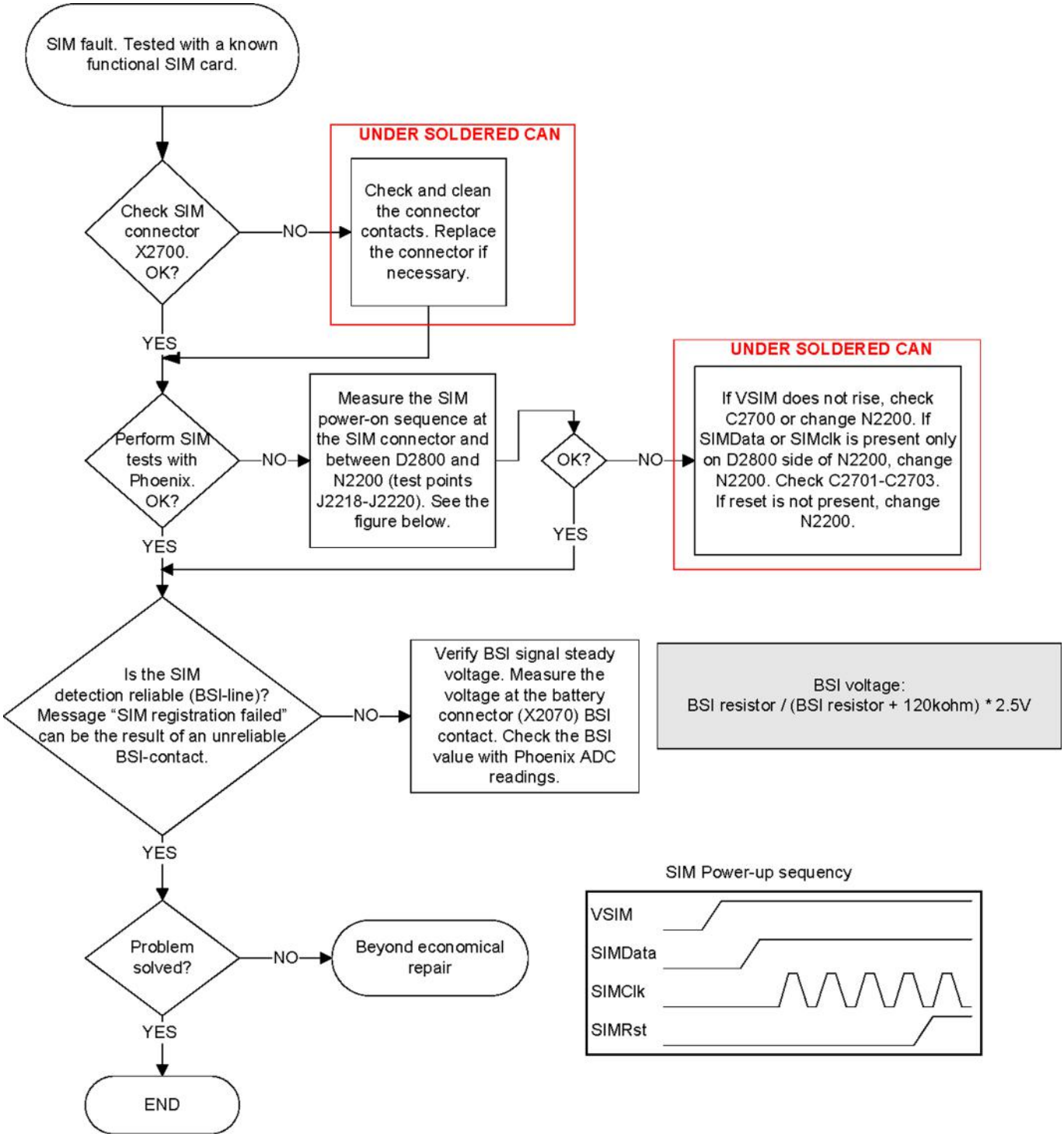


Figure 10 Flashing pic 2. Take single trig measurement for the rise of the BSI signal

SIM card troubleshooting

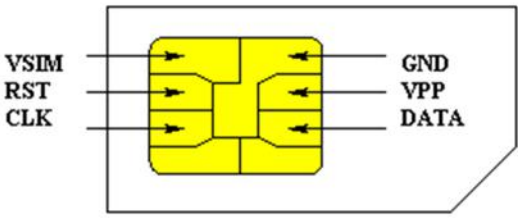
Troubleshooting flow



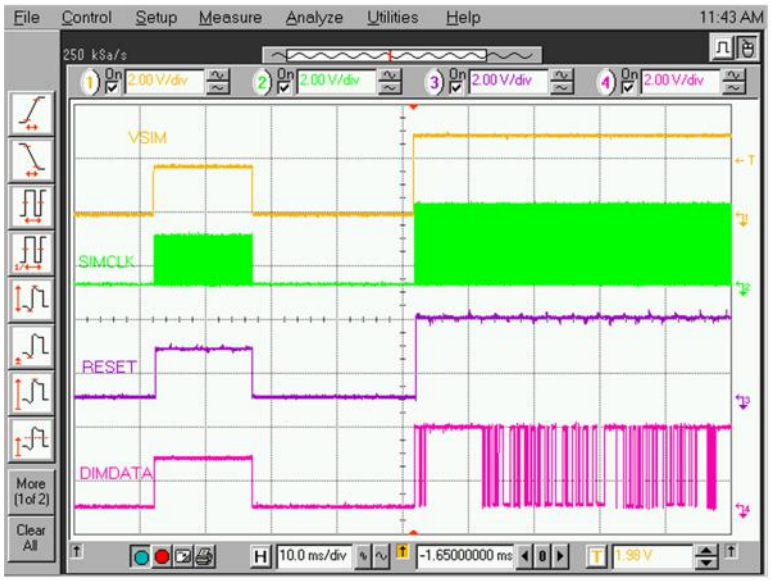
SIM power-on sequence

Testpoints between
RAPU and EM ASIC
J2218 = SIMData
J2219 = SIMClk
J2220 = SIMIOC

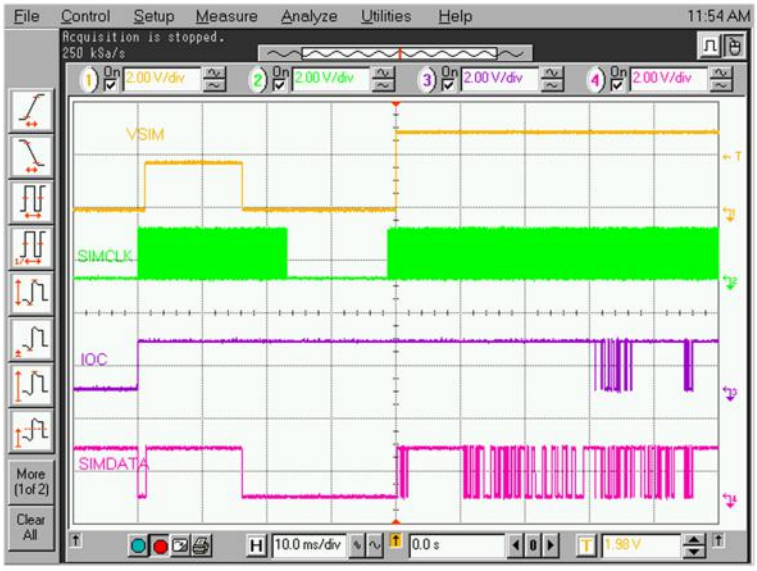
Fsimclk = 3.8MHz



SIM contacts



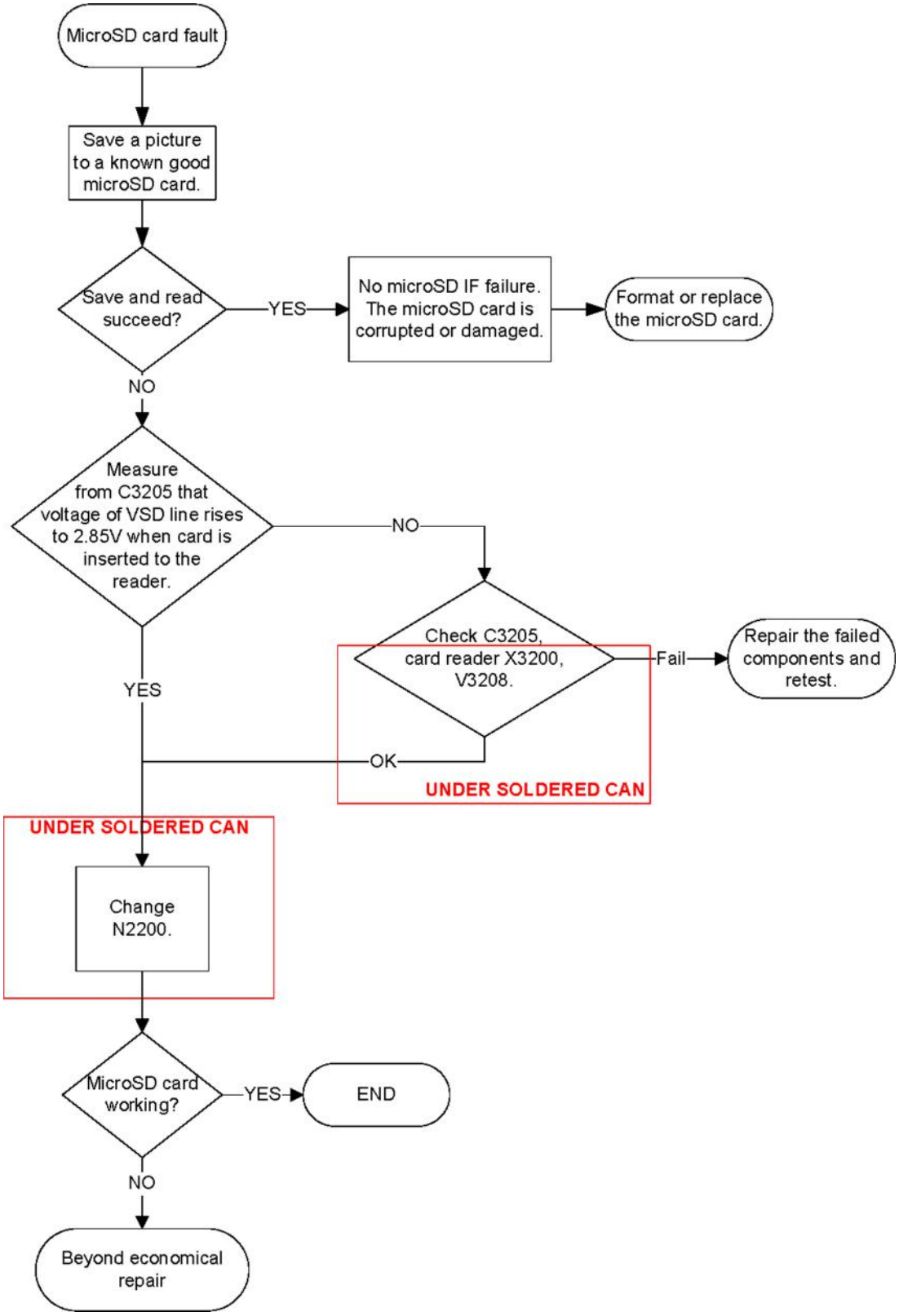
SIM power-on sequence on X2700.



SIM power-on sequence between RAPU and EM ASIC.

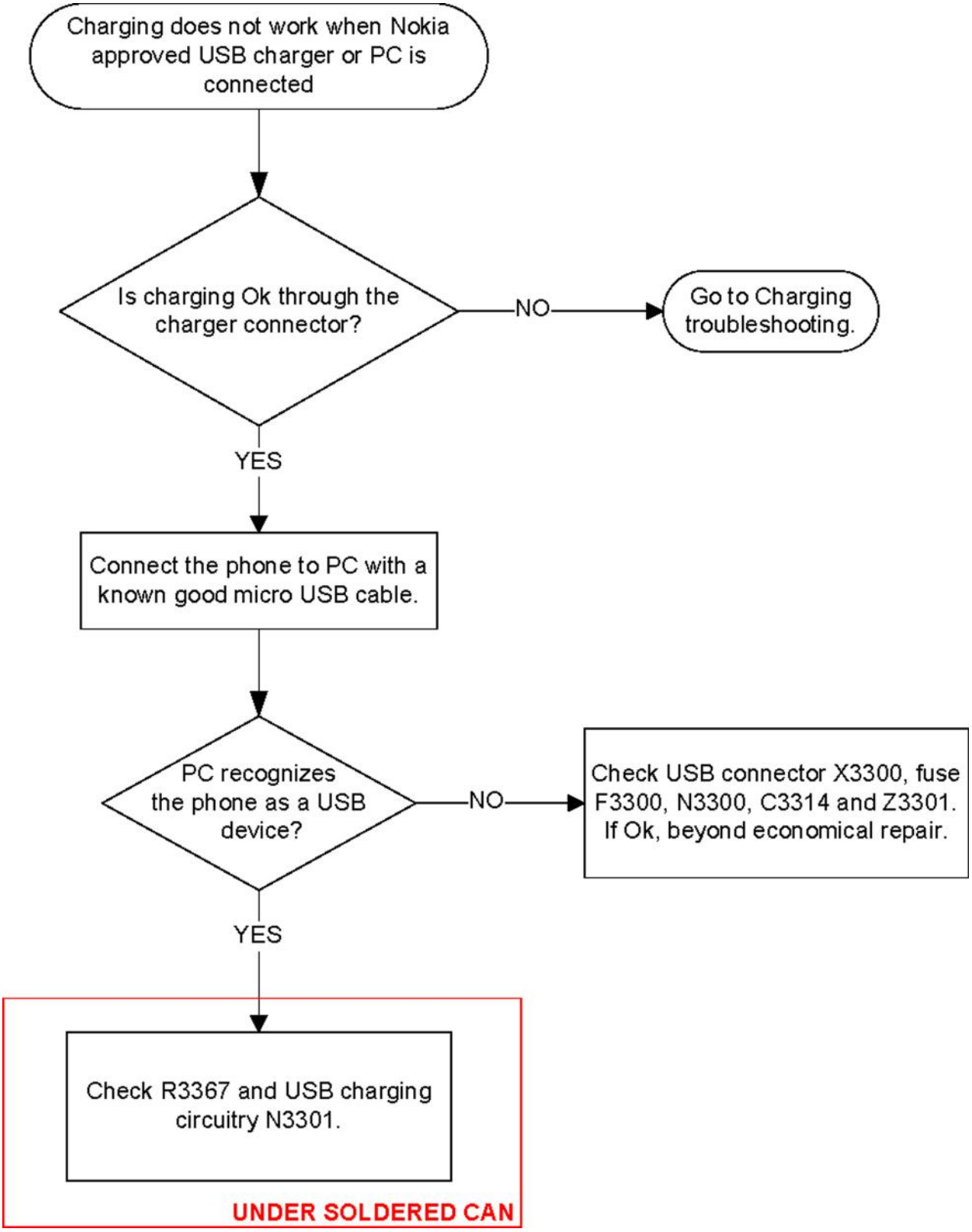
MicroSD card troubleshooting

Troubleshooting flow



USB interface troubleshooting

Troubleshooting flow



User interface troubleshooting

Keyboard troubleshooting

Context

There are two possible failure modes in the keyboard:

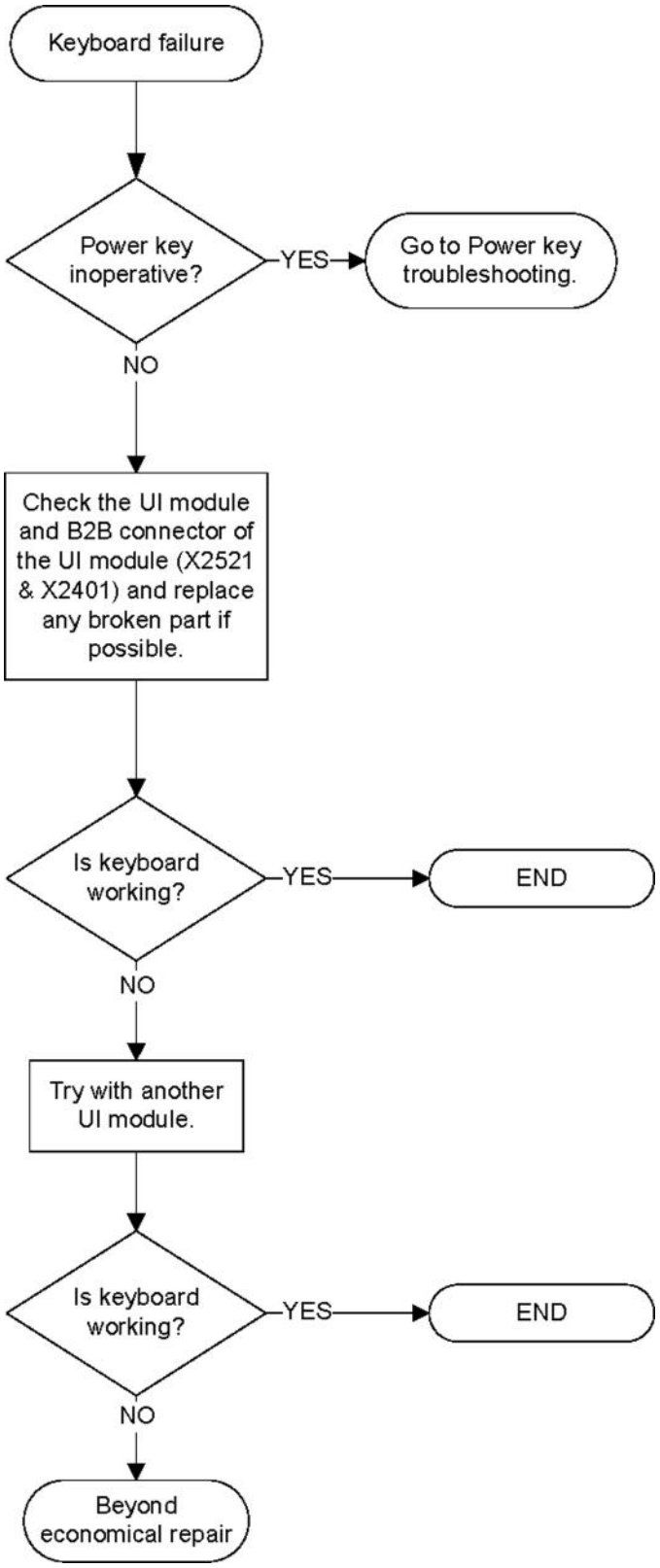
- One or more keys are stuck, so that the key does not react when a keydome or a side key is pressed. This kind of failure is caused by mechanical reasons (dirt, rust, mechanical damage, etc.).
- Malfunction of several keys at the same time. This happens when one or more rows or columns in the key matrix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

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

In this phone the keyboard is connected to D2800 I/O pins.

There are no serviceable parts for the optical navi key. Scratches on the joystick cover decrease its performance. Self test ST_JOYSTICK_IF_TEST checks interfaces to the system module. If the self test fails, check connector X2401 and UI module connector X2521.

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

Table 10 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 display fault troubleshooting flowchart.
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. 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. 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 11 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. 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.

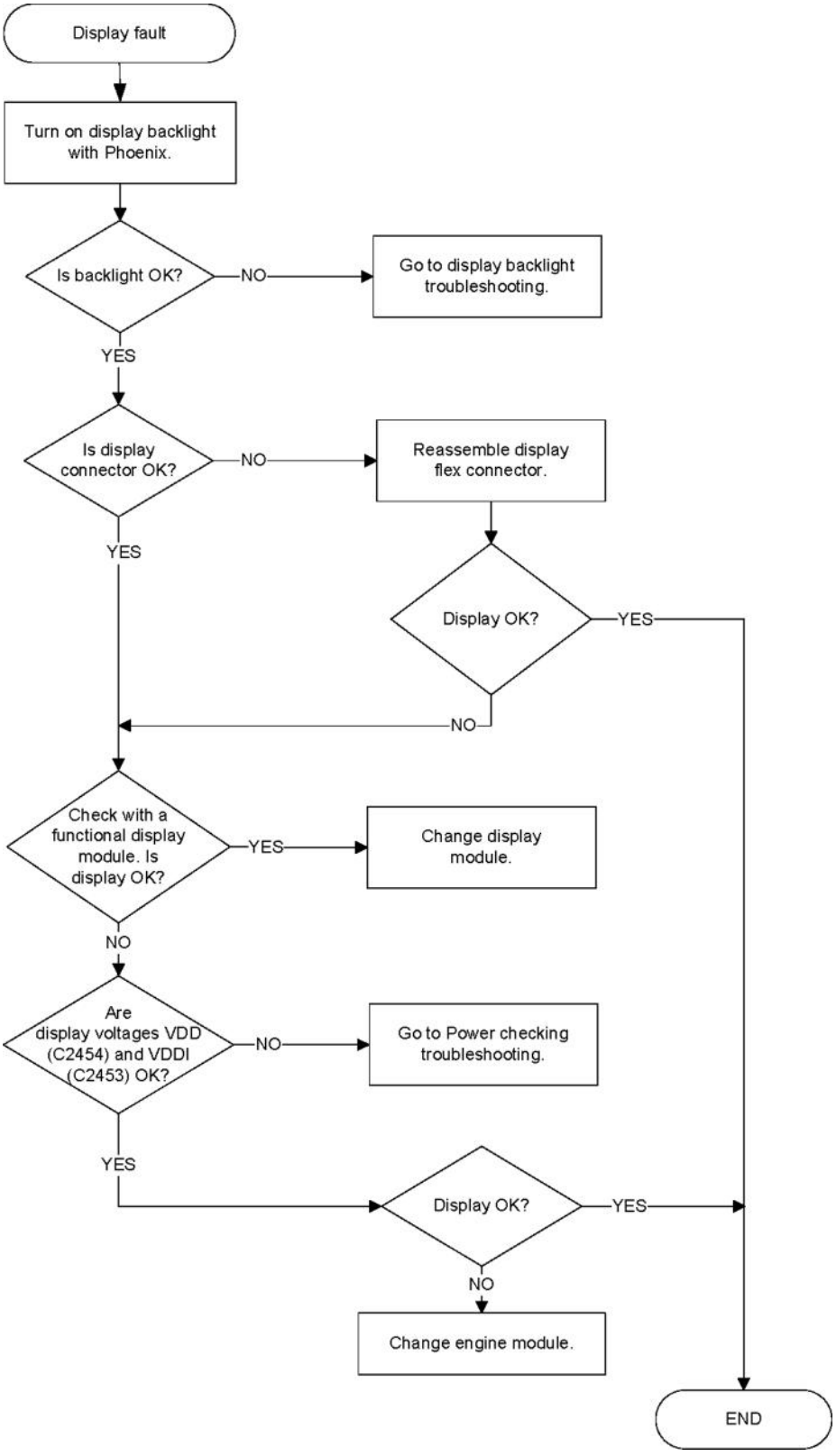
2. Check that the cellular engine is working normally.
   i To check the functionality, connect the phone to a docking station.
   ii Start *Phoenix* service software.
   iii Read the phone information to check that also the application engine is functioning normally (you should be able to read the APE ID).

3. Proceed to the display fault troubleshooting flowchart.

   Use the **Display Test** tool in *Phoenix* to find the detailed fault mode.

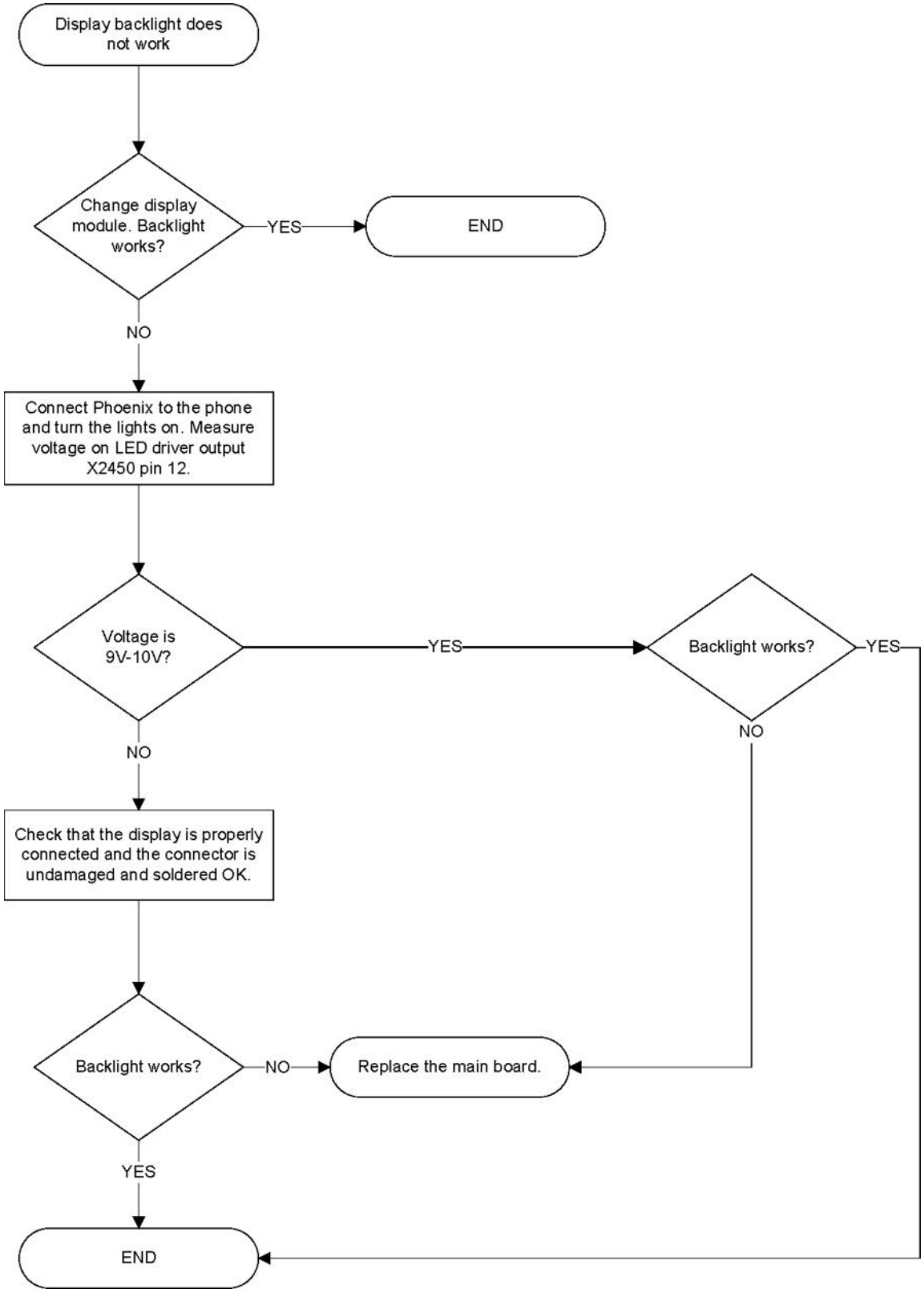
Display fault troubleshooting

Troubleshooting flow



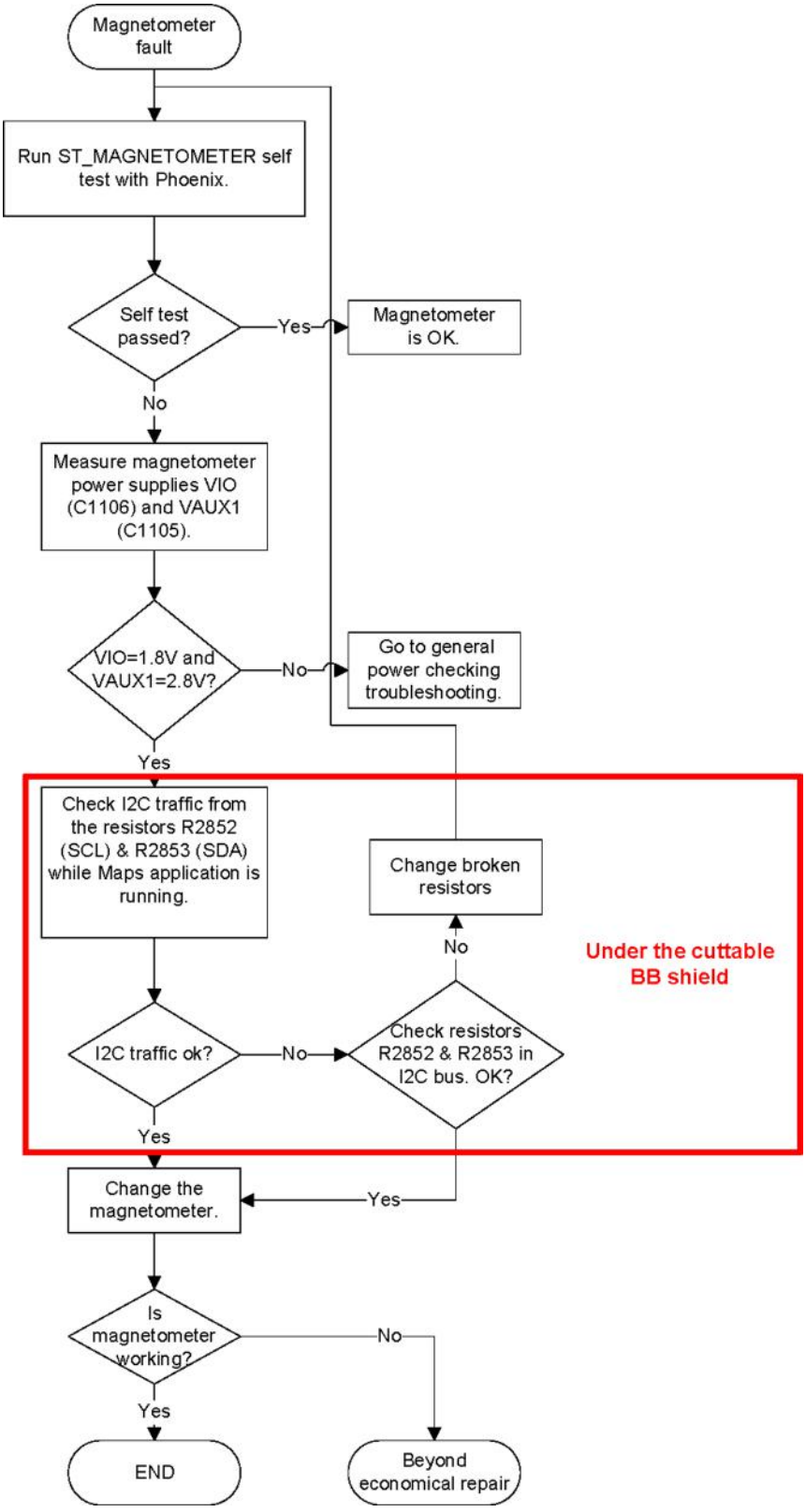
Display backlight troubleshooting

Troubleshooting flow



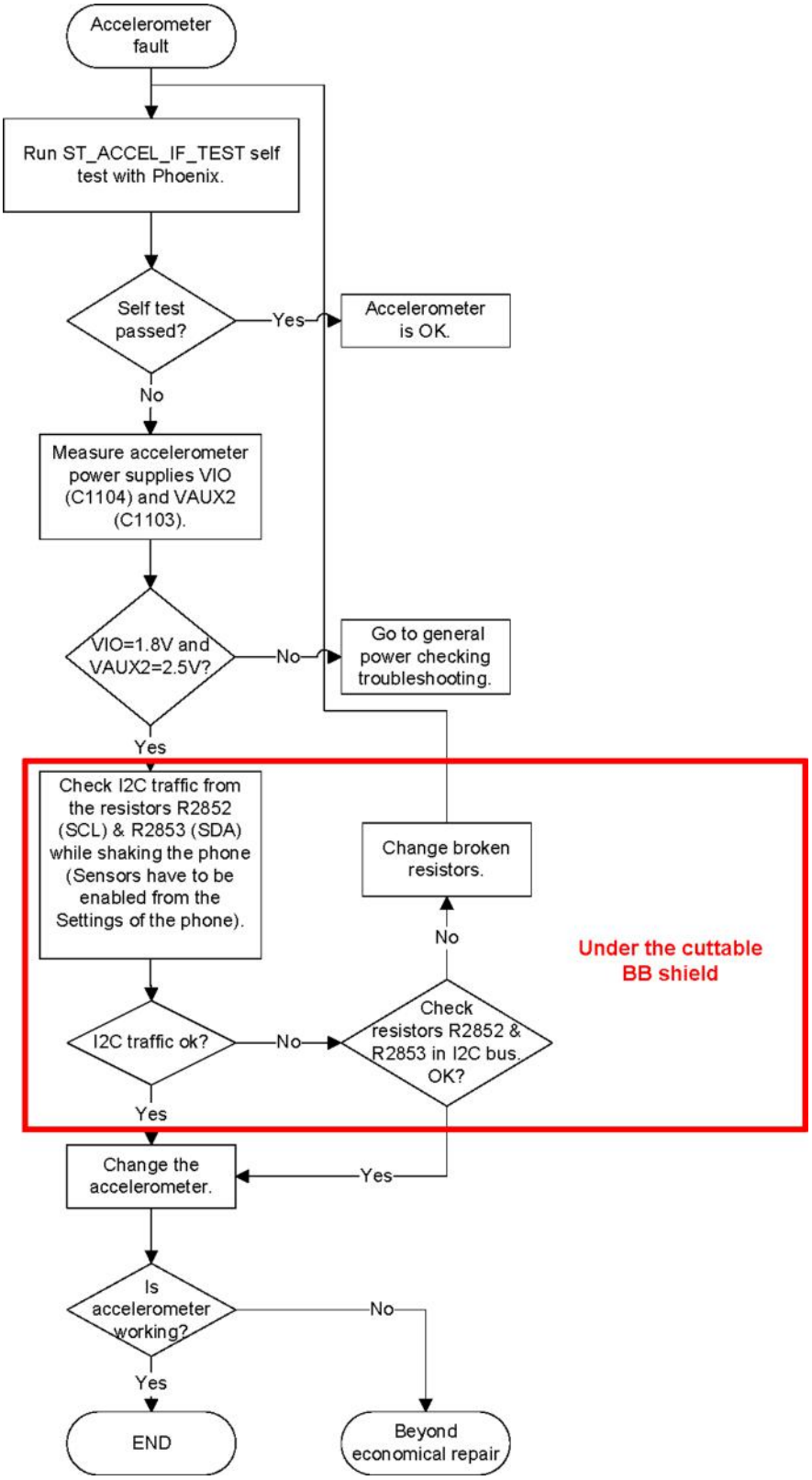
Magnetometer troubleshooting

Troubleshooting flow



Accelerometer troubleshooting

Troubleshooting flow



Ambient Light Sensor troubleshooting and re-calibration

Introduction to ALS troubleshooting and re-calibration

The Ambient Light Sensor (ALS) consists of the following components:

- Ambient Light Sensor (N1100). ALS is a digital I2C interface component that has two channels with different spectral sensitivities. When combined, the component responds to illuminance similar as human eye.
- Vdd filtering capacitor (C1100)

The ALS components are located at the top side of the main PWB.

ALS information is used to control the keypad and display brightness of the phone. The keyboard backlight is turned OFF, when it is not needed. Display brightness is dimmed, when environment lighting is dark. ALS is calibrated in production and can be re-tuned in service points though not recommended unless calibration coefficient is lost for some reason.

> **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.

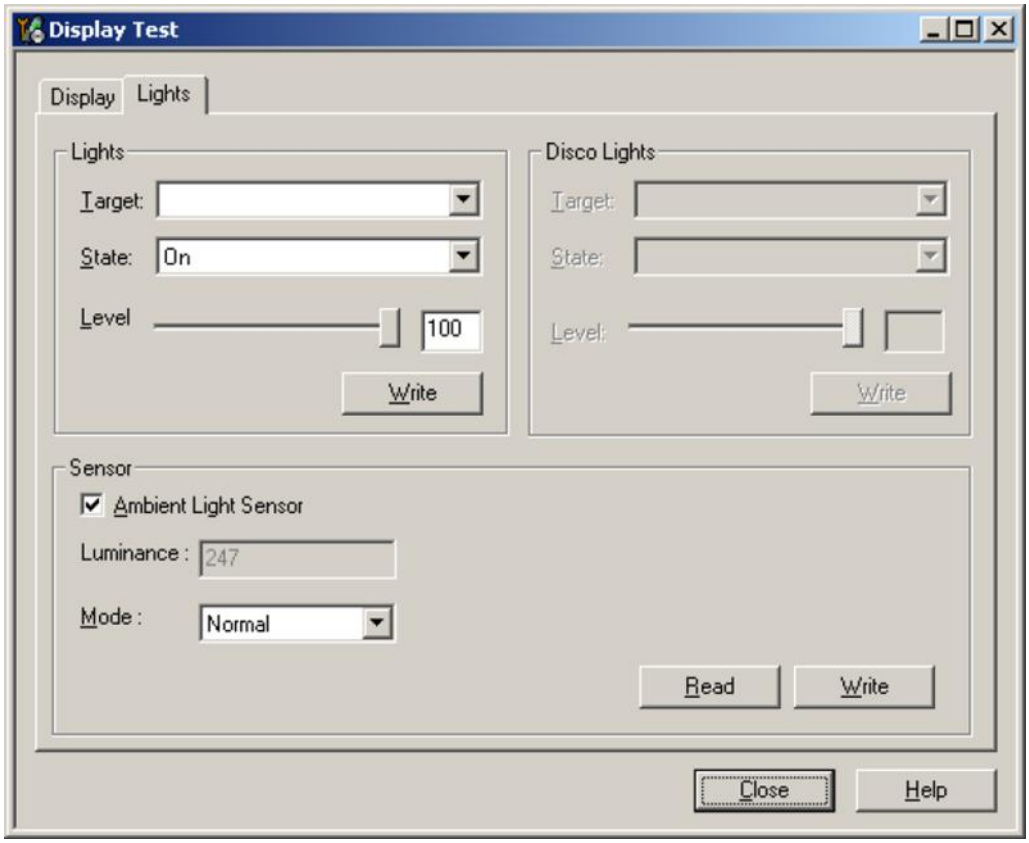
> **Note:** The luminance value depends heavily on the light source and the angle of the phone against the light source, so the values above can only be used as a rough guideline. Phoenix has an ambient light sensor calibration tool for changing the calibration values.

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 quide 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.**

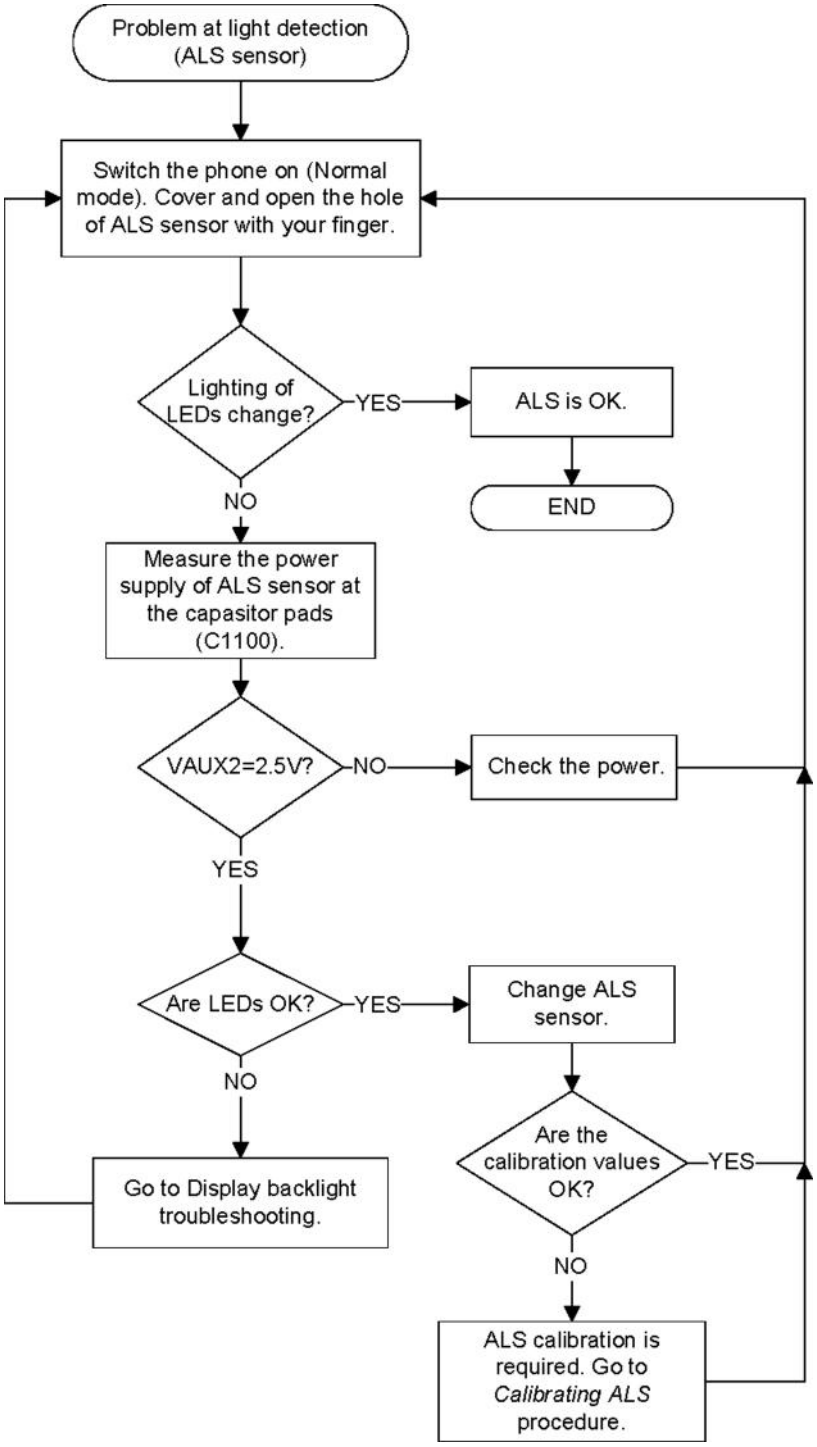


4. Open the **Lights** tab, and check the Ambient light sensor check box. Click the **Read** button in order to get the reference ambient light value. Cover the sensor and click **Read** again. When covered, the luminance reading should be less than after clicking **Read** without covering the sensor.
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 calibration procedure requires a reference phone with a calibrated ALS.

ALS troubleshooting

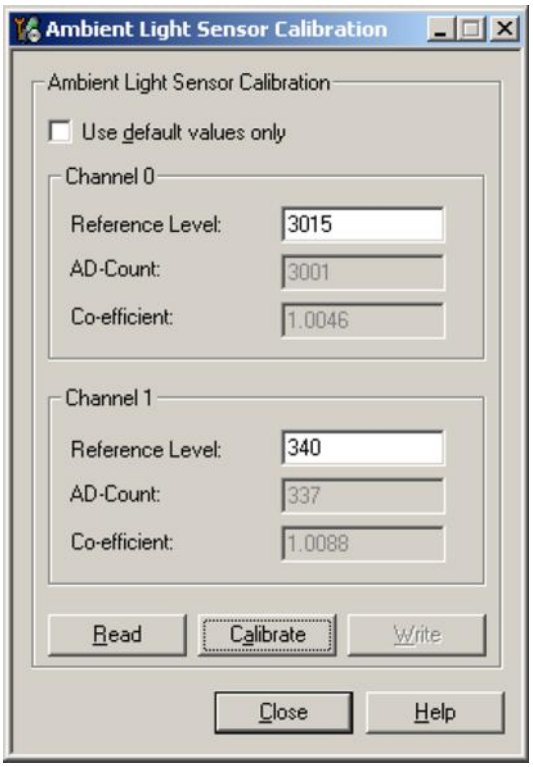
Troubleshooting flow



Calibrating ALS

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 quide 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→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:

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

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 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.

Audio troubleshooting

Audio troubleshooting test instructions

External earpiece, internal earpiece and internal handsfree 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.

The input signal for each loop test is single-ended.

Required equipment

The following equipment is needed for the tests:

- Oscilloscope
- Function generator (sine waveform)
- Phoenix service software
- Battery voltage 3.7V

Test procedure

Audio can be tested using the Phoenix audio routings option. Three different audio loop paths are used in the tests:

- AV mic to AV ear
- AV mic to HP ear
- Ext microphone in Int handsfree out

  Note: The internal uplink microphones can be tested using the Phoenix self test "ST-DIGIMIC-TEST". If the test result is PASS, the uplink microphones are electrically OK. For more thorough testing, see section Internal microphone troubleshooting (page 3–37).

Each audio loop sets routing from the specified input to the specified output enables 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 a table in the following section.

Phoenix audio loop tests and test results

The results presented in this 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, 1 kHz sine [mVp-p]	Single-ended output voltage [mVp-p]	Output DC level [V]
AV mic to AV ear	HS_MIC and GND	HS_EAR_R and GND HS_EAR_L and GND	+21.3	100	584	0
AV mic to HP ear	HS_MIC and GND	B2101 pad1 and GND B2101 pad2 and GND	+18.2	100	407	1.5
Ext microphone in Int handsfree out	HS_MIC and GND	B2102 pad1 and GND B2102 pad2 and GND	+3.6 with lowpass filter	1000	758 with lowpass filter See the *Measurement data* graphics below	NA

Measurement data

Figure 11 AV mic to AV ear, single-ended loop measurement. 16 kHz lowpass filter is used to attenuate noise from the signal. The filter is optional.

Figure 12 AV mic to HP ear, single-ended loop measurement. 62.5 kHz lowpass filter is used to attenuate noise from the signal. The filter is optional.

Figure 13 Ext microphone in Int handsfree out, single-ended loop measurement without filter.

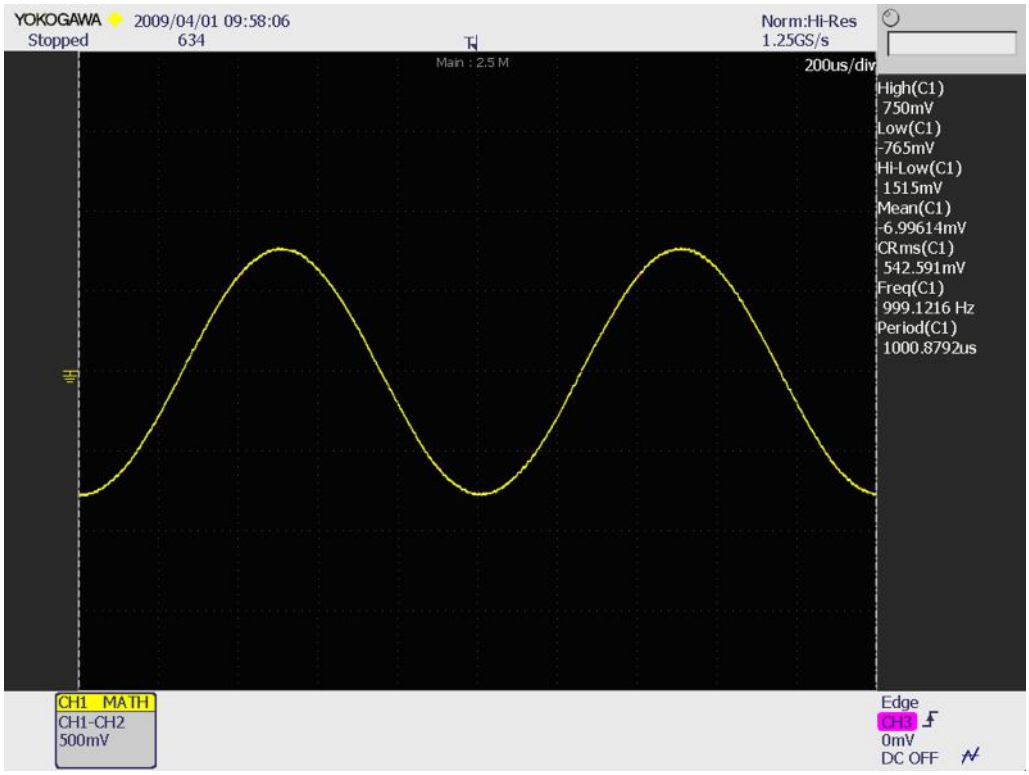
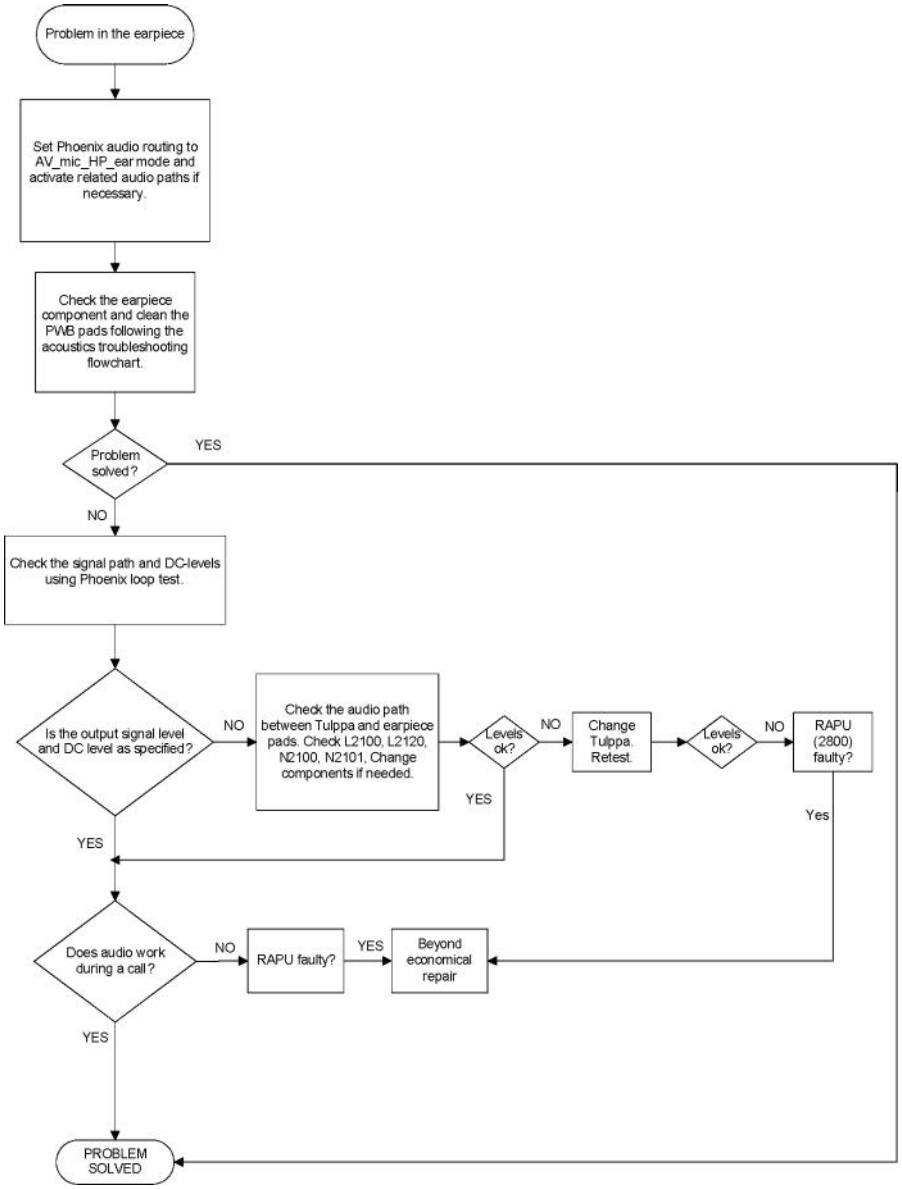


Figure 14 Ext microphone in Int handsfree out, differential loop measurement with 8 kHz lowpass filter. The signal is measured differentially between the pads of B2102.

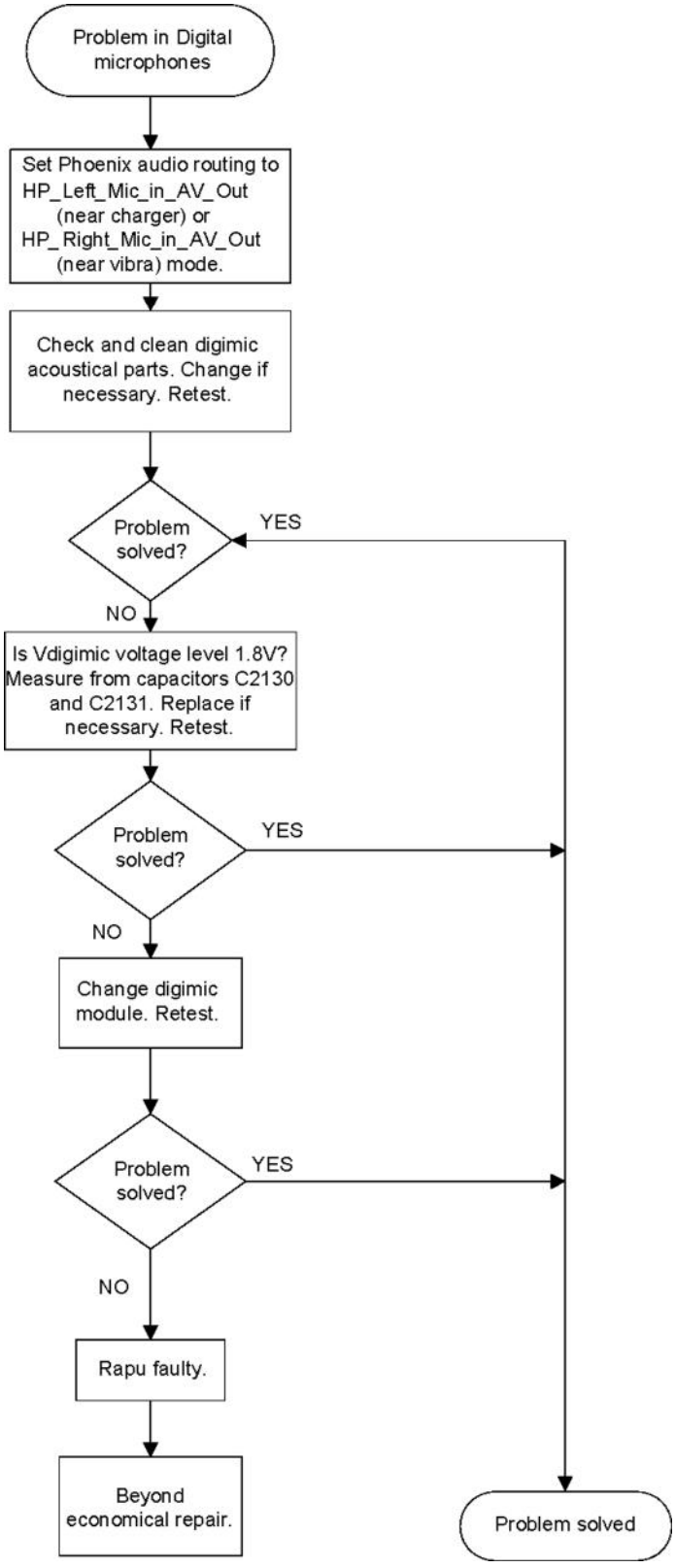
Internal earpiece troubleshooting

Troubleshooting flow



Internal microphone troubleshooting

Troubleshooting flow



EANC microphone testing

Context

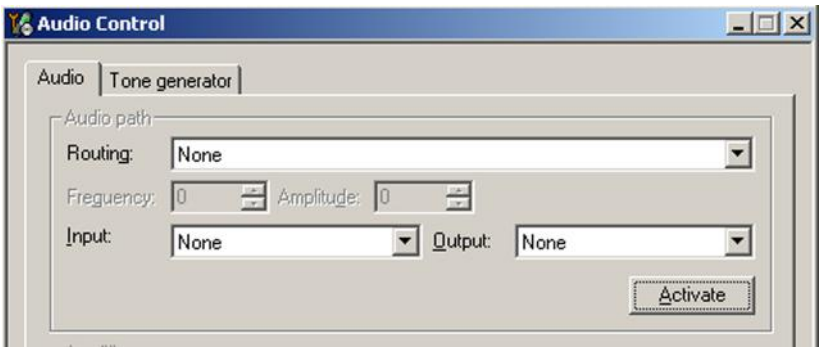
For this test, Phoenix 2009.07.002.37336 or newer is needed.

Steps

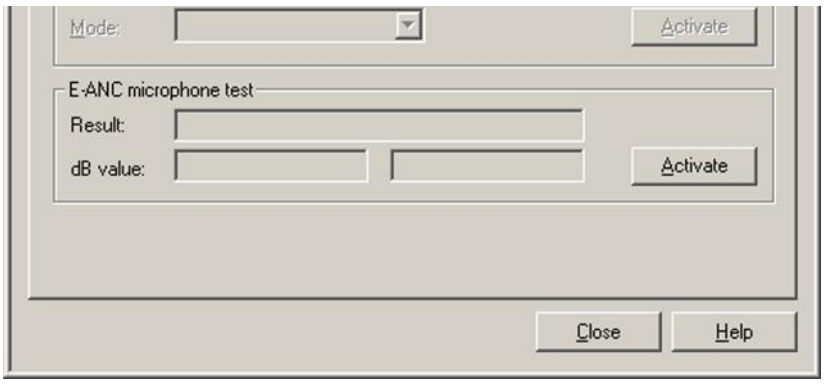
1. Put the phone on the jig on a table.

   The area around the phone should be free from objects. Ambient noise should be low so it does not disturb the test.
2. Start Phoenix service software.
3. From the *File* menu, select **Scan Product** and check that the correct product version is displayed.
4. Set the phone in test mode.
5. From the **Testing** menu, select **Audio Control**.

   The *Audio Control* dialogue box is displayed.
6. Audio routing must be turned off before this test. In the *Audio Control* window, select **None** and click **Activate**.

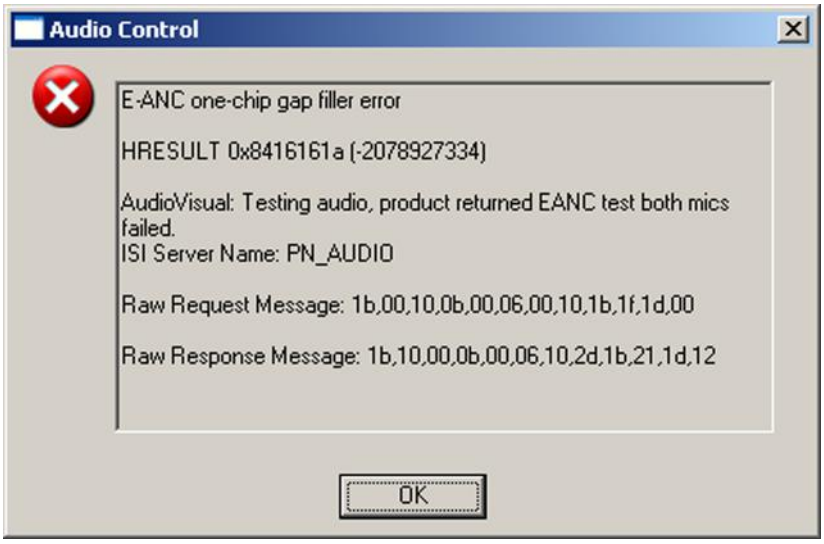


   Failing this, several dB of measurement error is created. Check this especially after uplink microphone tests.
7. In the *Audio Control* window, activate **E-ANC Microphone Test**.

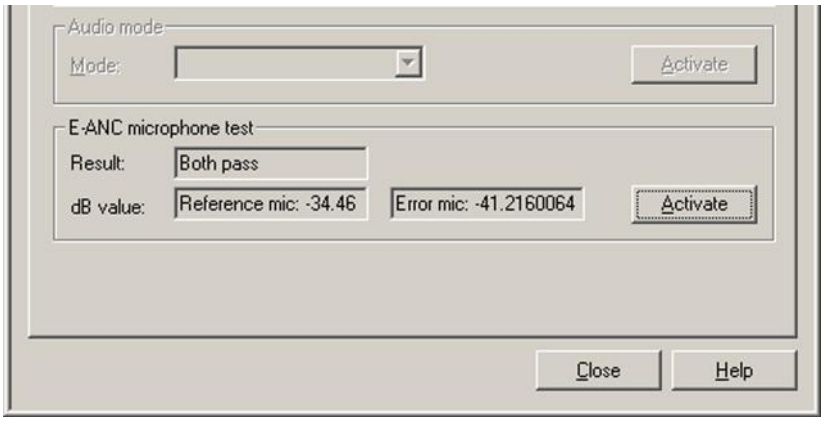


   The IHF speakers emit a 1 kHz tone and the EANC microphones measure the sound level.

8. Close the error pop-up window, if it appears.



9. The test returns dB values for reference mic (the backside mic) and the error mic (the earpice mic).



Acceptable dB values are:

- Reference mic: -21 dB ... -41 dB
- Error mic: -28 dB ... -48 dB

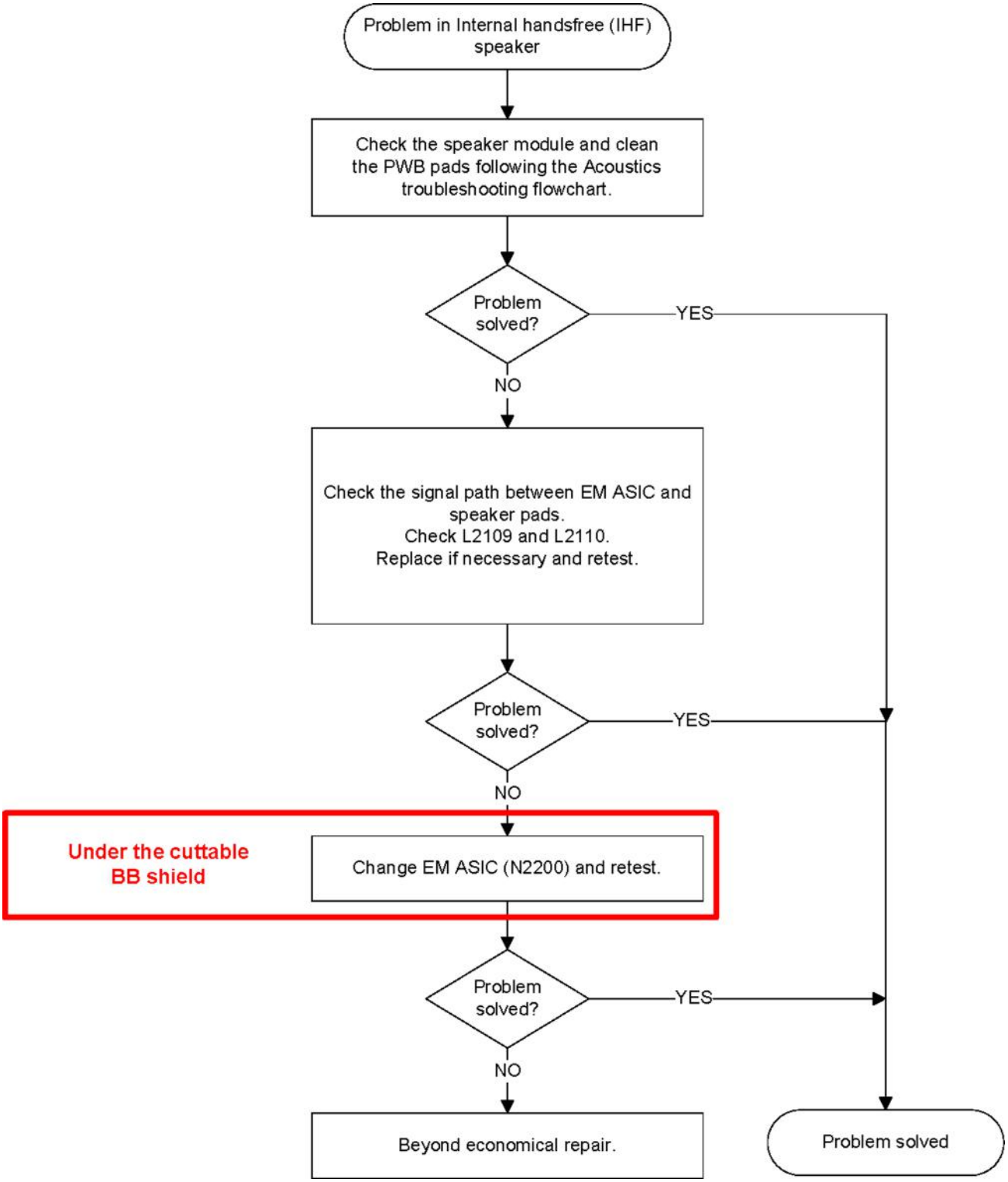
A much lower value may indicate a fault in the microphone or a block in the sound inlet.

It is recommended to run this test more than once and observe the results. There may be an electrical fault if a microphone gives exactly the same result each time.

The test returns also PASS/FAIL information for both microphones.

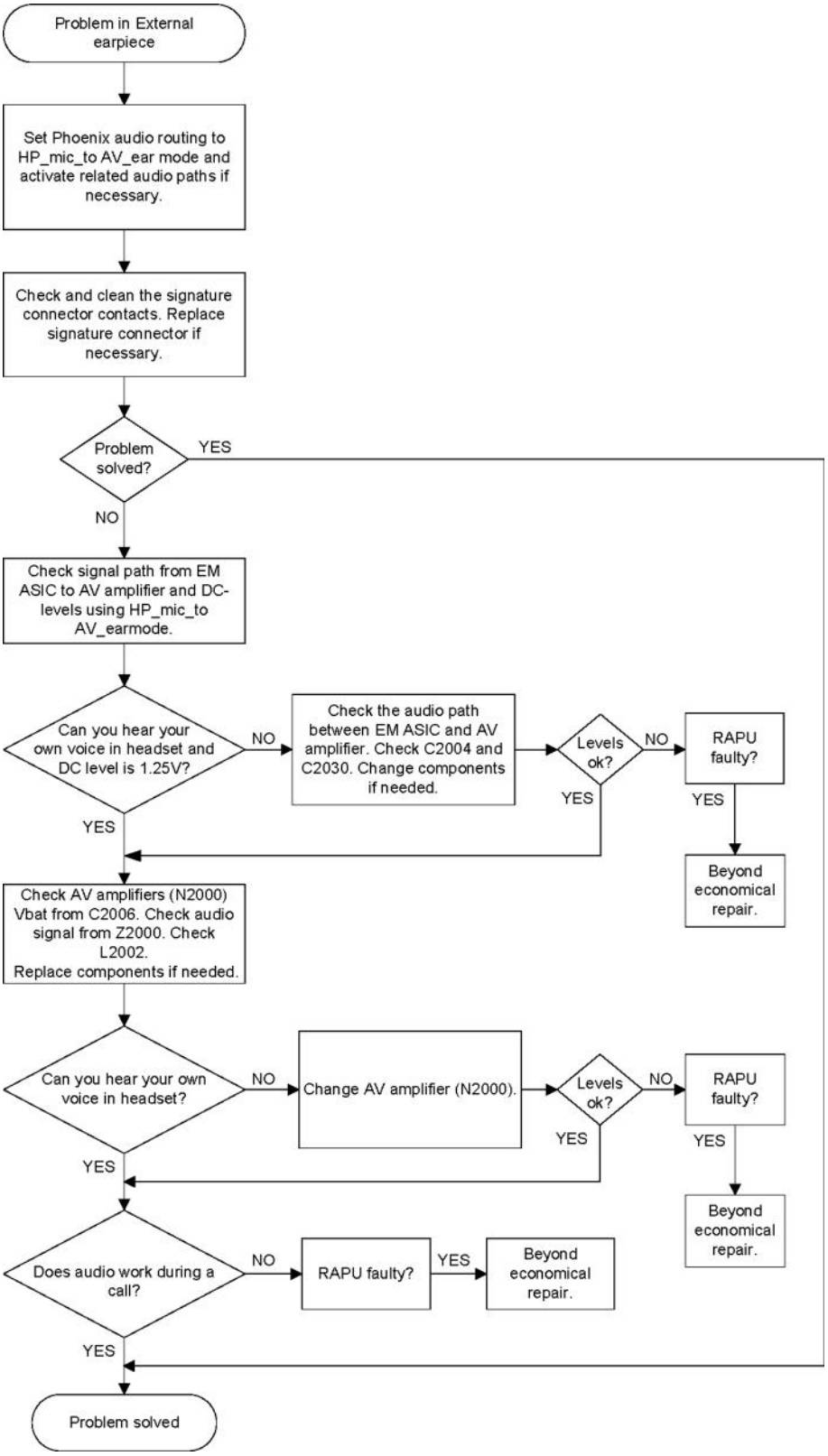
Internal handsfree (IHF) troubleshooting

Troubleshooting flow



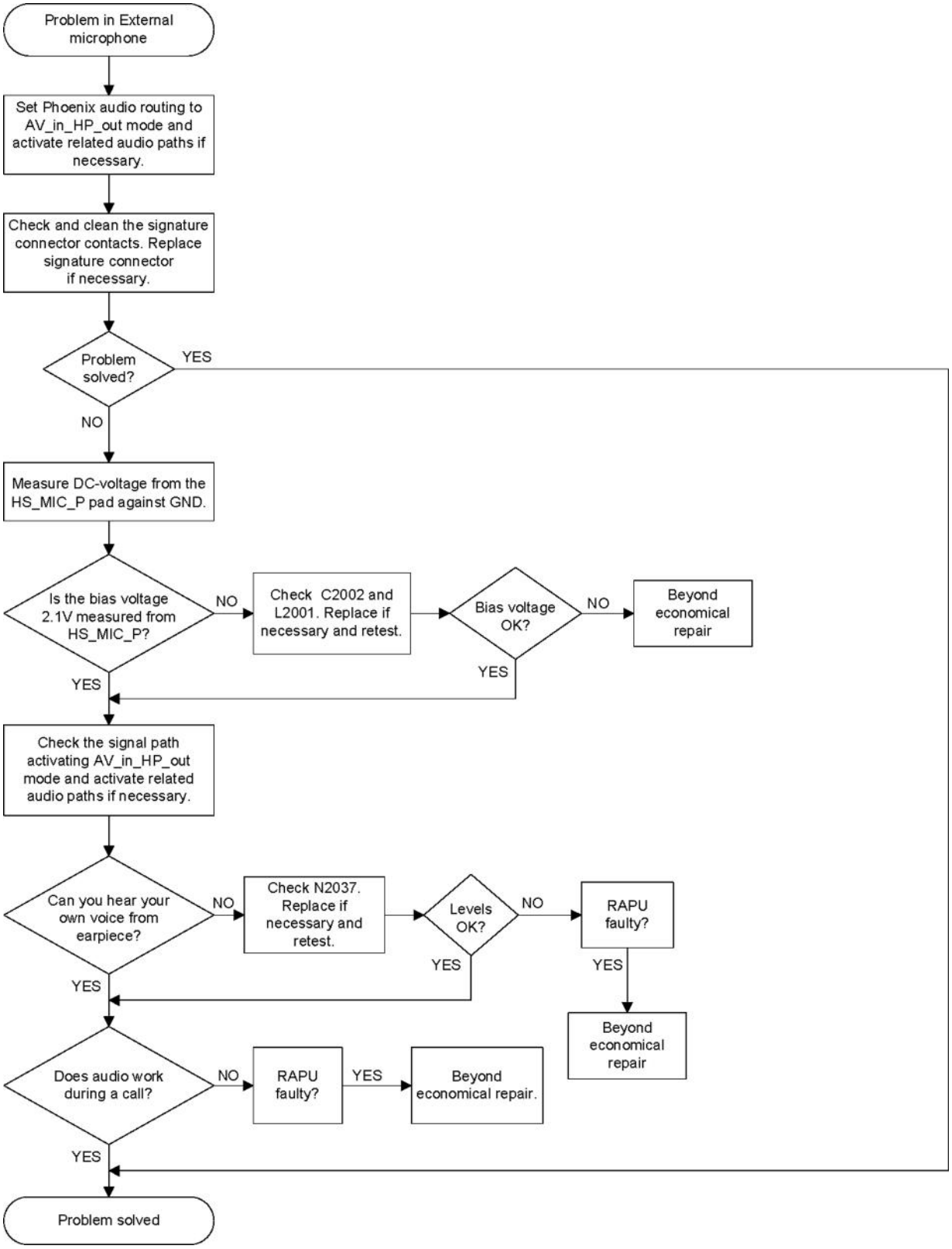
External earpiece troubleshooting

Troubleshooting flow



External microphone troubleshooting

Troubleshooting flow



Acoustics troubleshooting

Introduction to acoustics troubleshooting

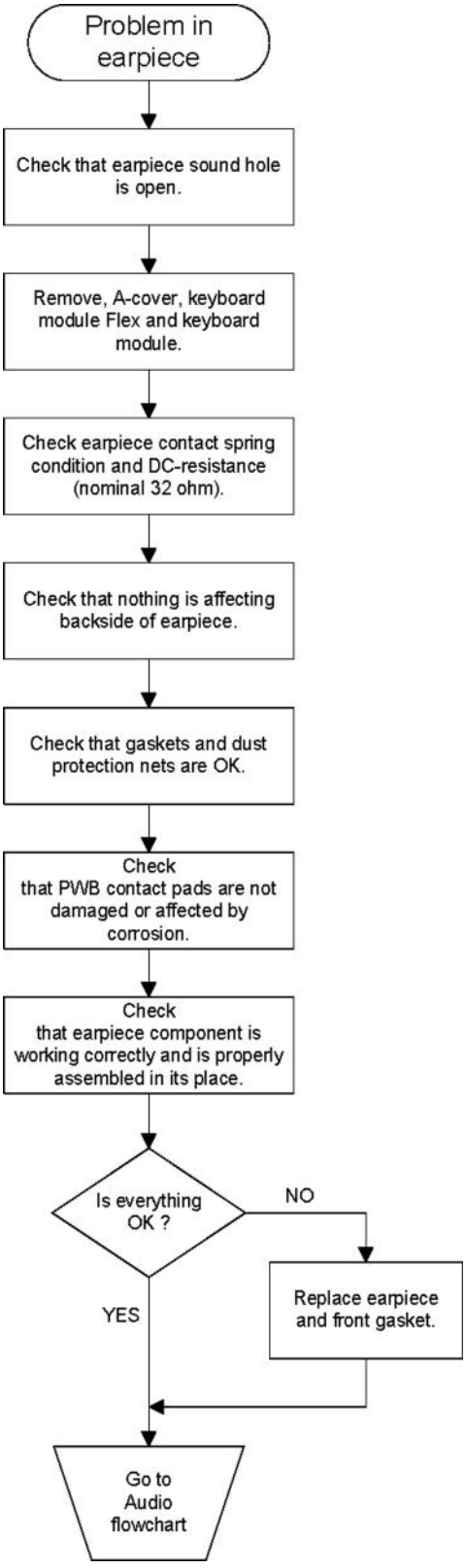
Acoustics design ensures that the sound is detected correctly with a microphone and properly radiated to the outside of the device by the speaker. The acoustics of the phone include these basic systems: earpiece, integrated handsfree (IHF), EANC error microphone, EANC reference microphone and two digital uplink microphones.

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 bottom part of the back cover. The EANC error microphone is located in the opening in the front of the earpiece. The reference microphone is located at the bottom side and its sound hole is near the camera. The uplink microphones are located on the top side of the PWB. The sound hole of the primary microphone is in the bottom, left corner. The sound hole of the secondary microphone is in the keyboard near the Q-key.

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.

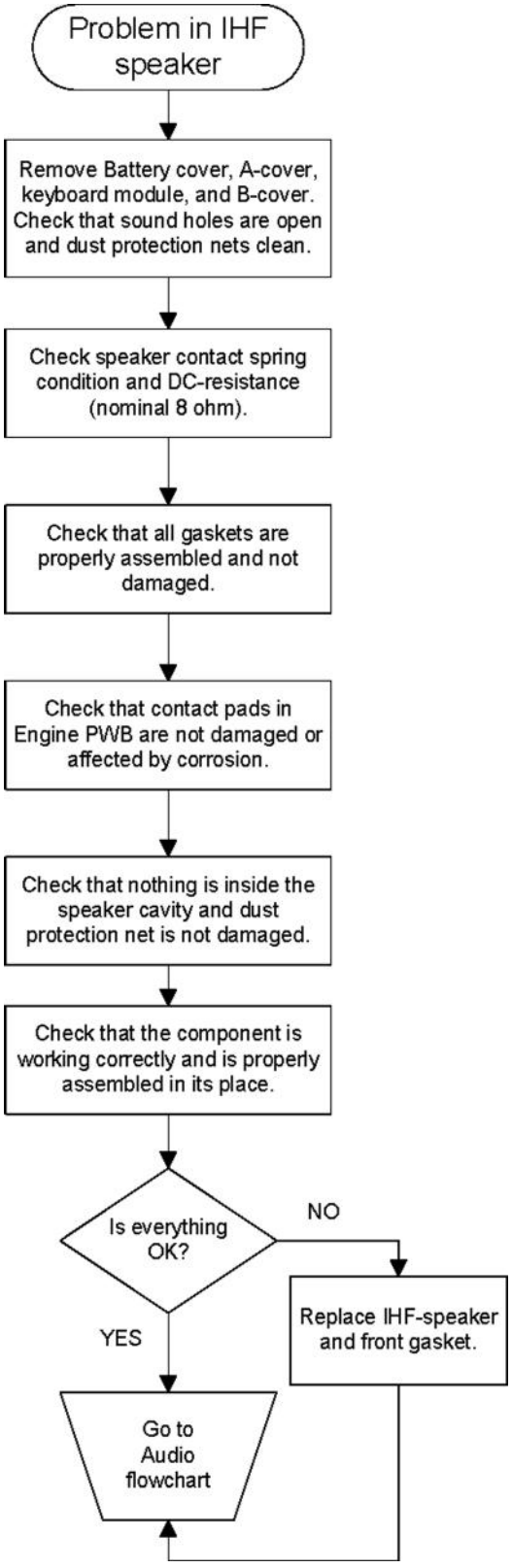
Earpiece troubleshooting

Troubleshooting flow



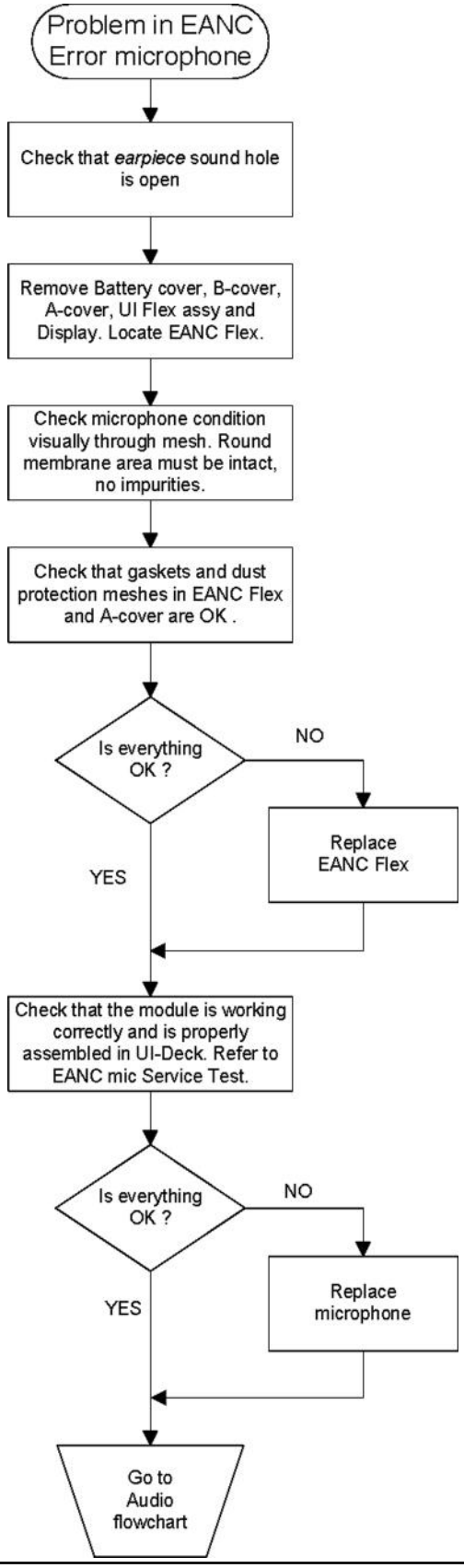
IHF troubleshooting

Troubleshooting flow



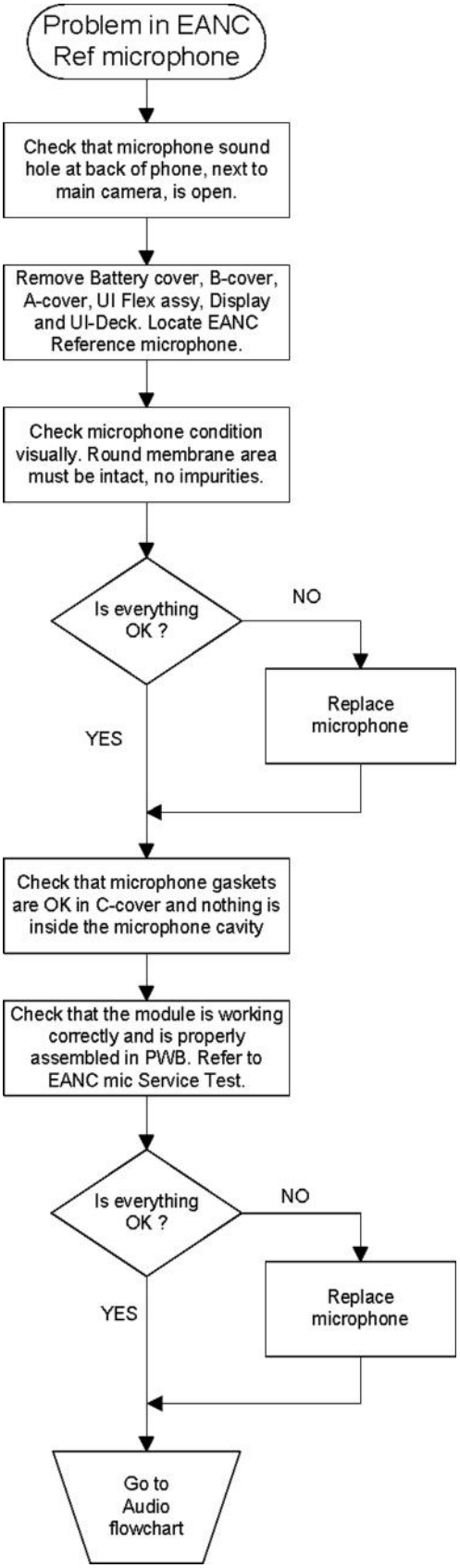
EANC error microphone troubleshooting

Troubleshooting flow



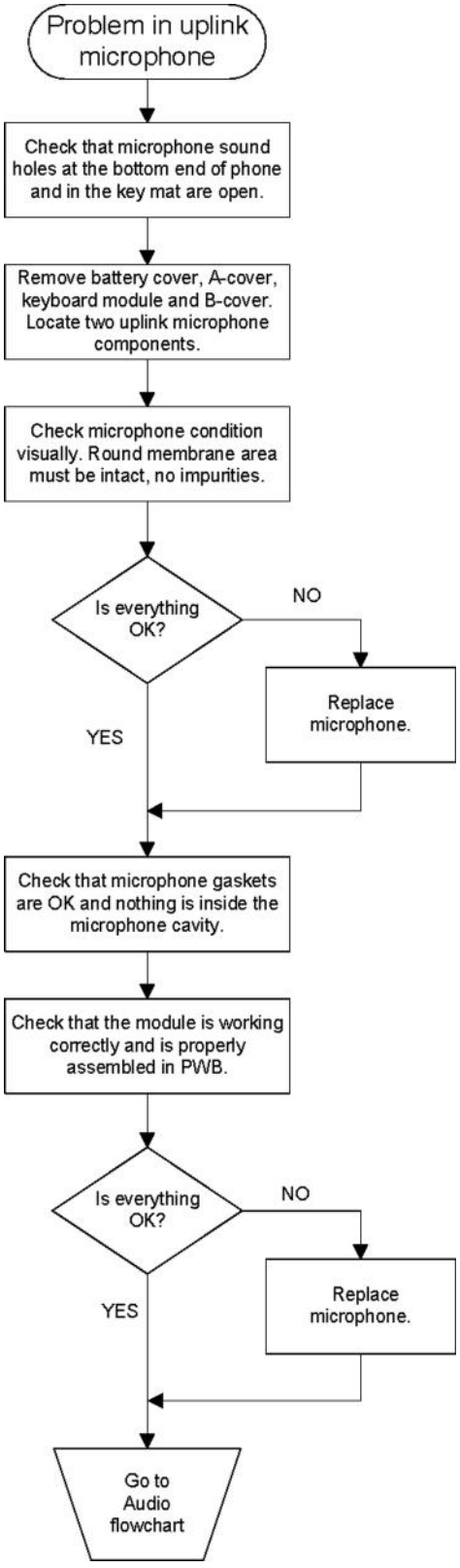
EANC reference microphone troubleshooting

Troubleshooting flow



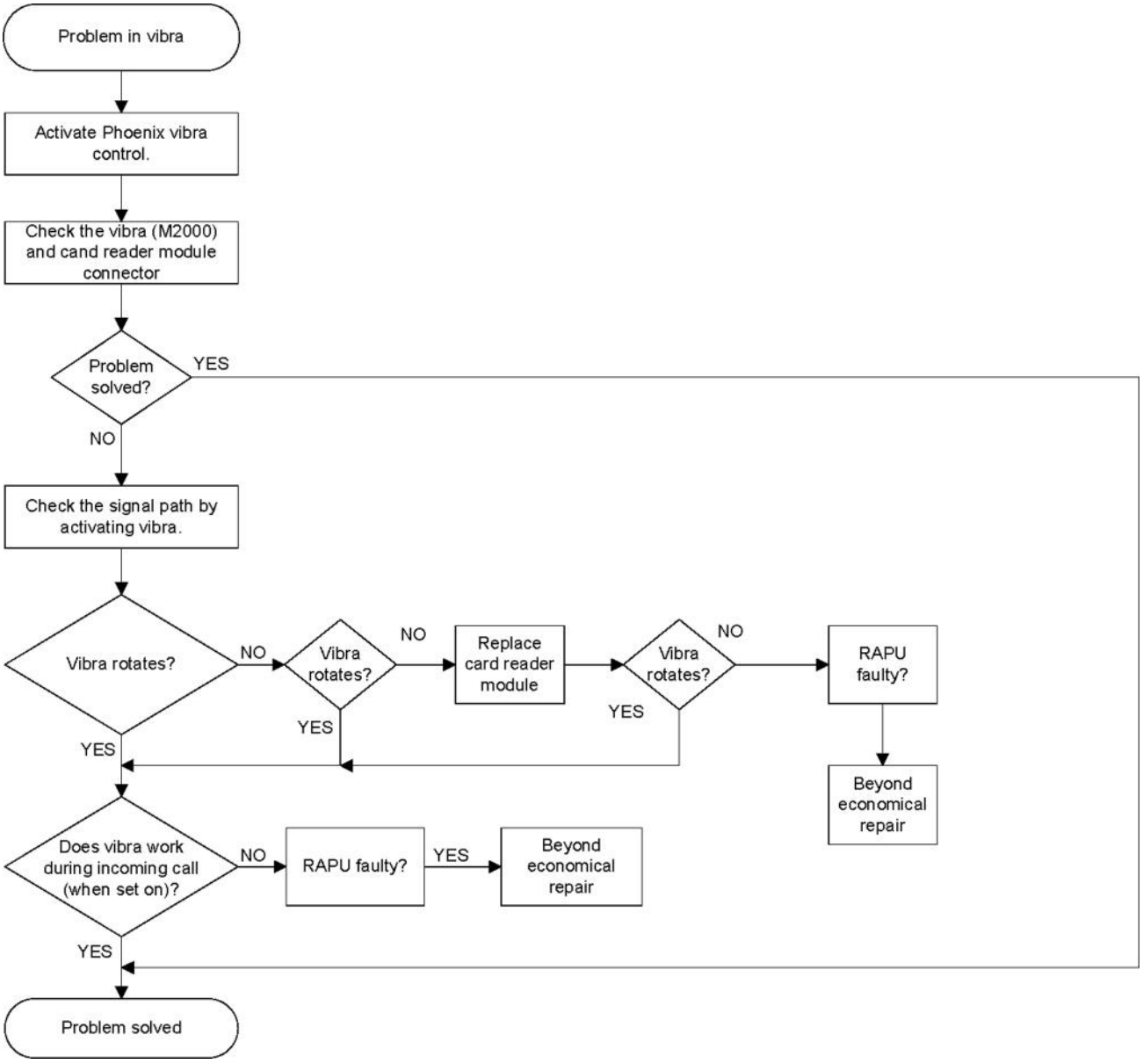
Microphone troubleshooting

Troubleshooting flow



Vibra troubleshooting

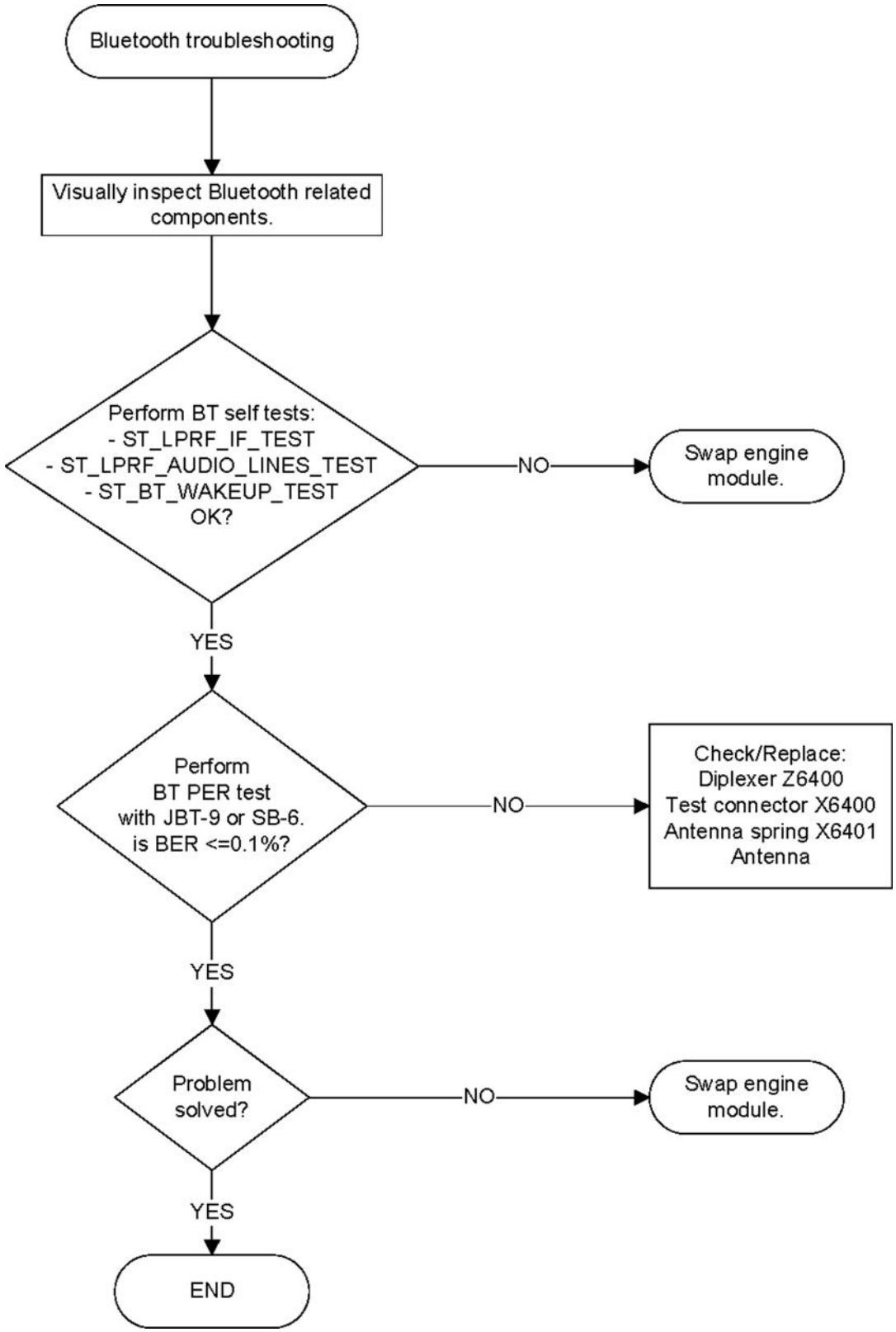
Troubleshooting flow



Bluetooth and FM radio troubleshooting

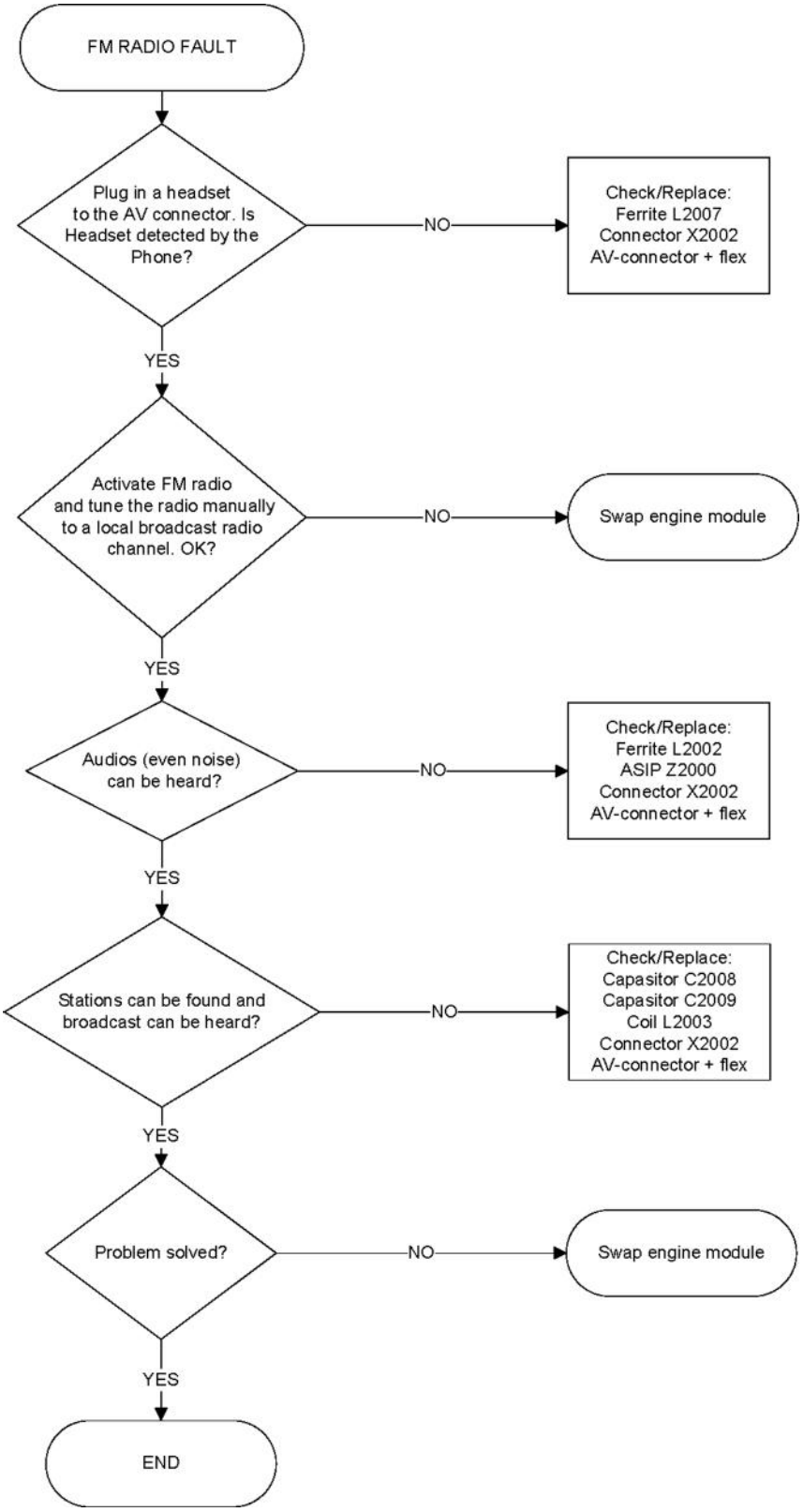
Bluetooth troubleshooting

Troubleshooting flow



FM radio troubleshooting

Troubleshooting flow



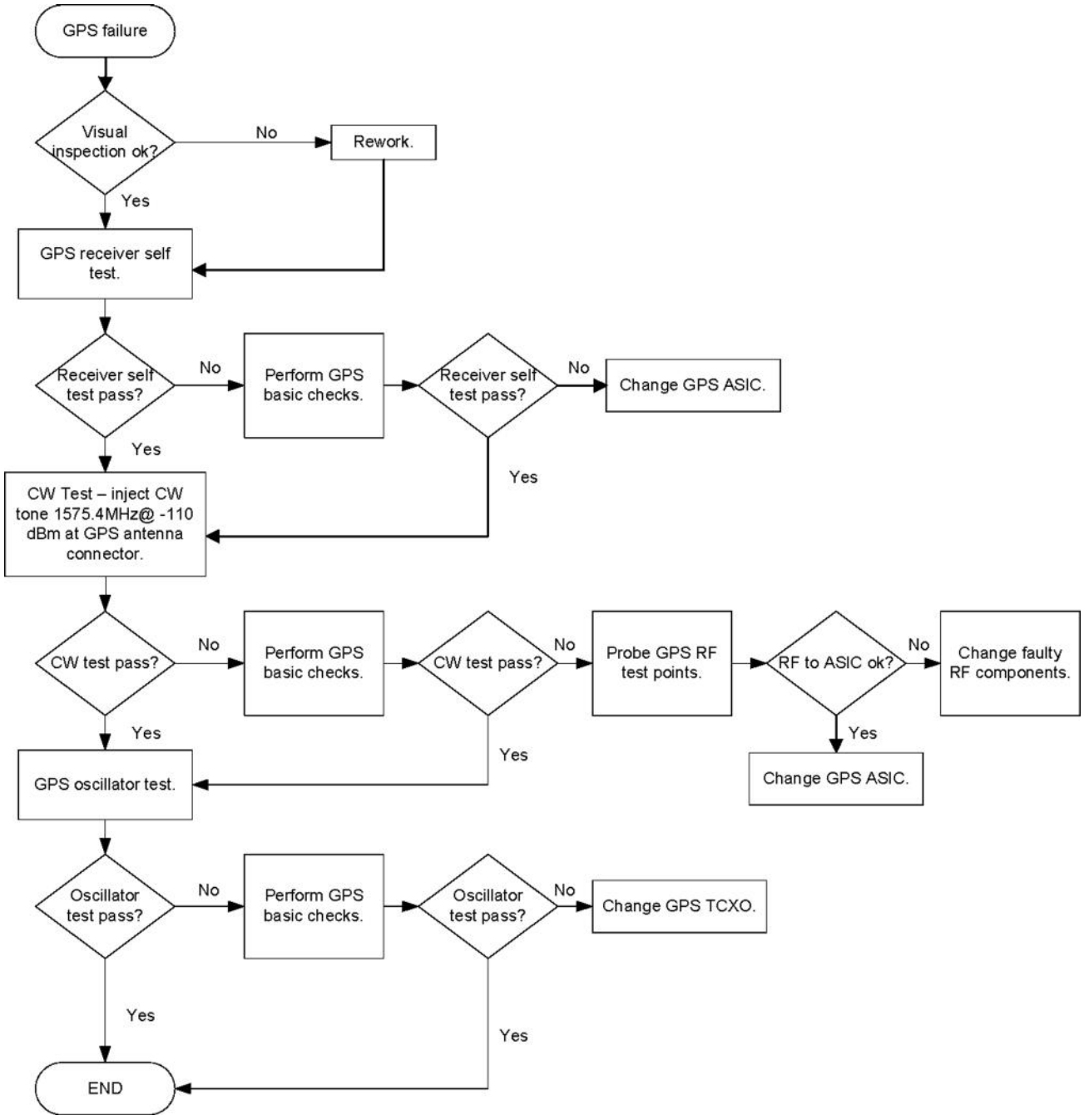
GPS troubleshooting

GPS failure troubleshooting

Context

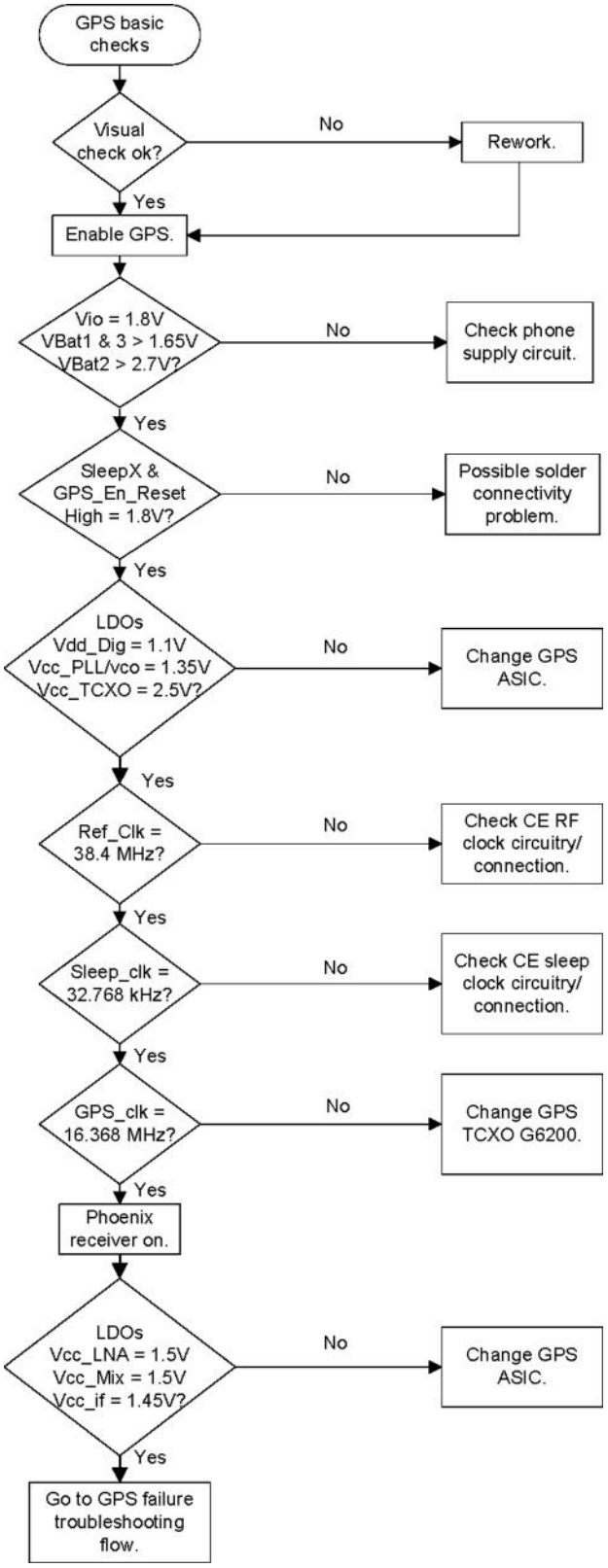
GPS troubleshooting is broken down into two parts: general GPS failure troubleshooting and GPS basic checks troubleshooting. The GPS failure troubleshooting flow can be followed and, where applicable, will feed into the GPS basic checks troubleshooting flow.

Troubleshooting flow



GPS basic checks troubleshooting

Troubleshooting flow



WLAN troubleshooting

WLAN functionality test using SB-7 and Phoenix

Steps

1. Place the phone on the SB-7 WLAN test box (see figure below). **The co-ordinates are J4 (for the lower left foot)**.

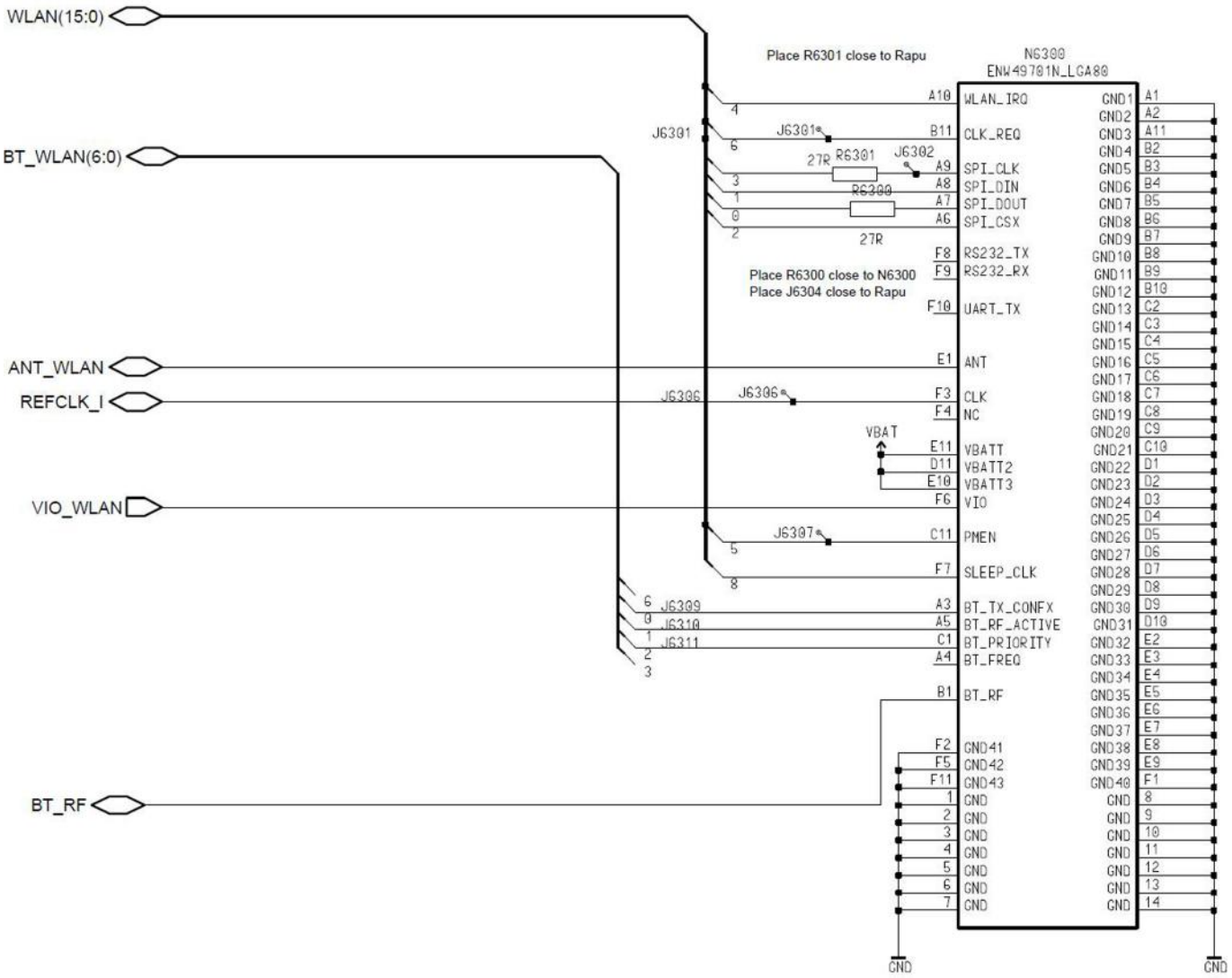
2. Start the phone to normal or offline (RF inactive) mode.
3. Search for SB-7 WLAN test box via the phone's **WLAN** menu. Go to **Menu→Ctrl.panel →Connectivity →WLAN wiz.**, and the *Searching for WLAN network* pop-up window appears.
4. The SB-7 access point is named *default*. Connect to the SB-7 access point by **selecting the WLAN network named *default***, and then go to **Options→Start web browsing**. After this, go to **Options→Go to New web page**. Select **Go to** without even typing any real web address. If the phone is in offline mode, select Yes when the question *Create WLAN connection in offline mode?* pops up. The device cannot connect to the internet through SB-7, but connection to access point default is now established.
5. Check the signal level from the **Connection Manager** menu. Go to **Menu→Ctrl.panel→Connectivity→Conn. Mgr. →Active data connections**. You should see the *default* connection in the connection list with the connection time running. Go to **Options→Details**. Observe the signal strength. *Signal* should show a signal strength Medium (35%) or higher.

   Note: The local WLAN environment may affect test results, especially if there are many WLAN access points nearby and any of them is using the same WLAN channel as SB-7. If you have problems performing the test, consider repeating the test in a place where local networks do not interfere with the lower strength signal of the SB-7 box.

If you still cannot find the WLAN test box named *default* after scanning the networks, or if you have connected to the test box but signal strength is lower that 235%, the WLAN functionality is not working properly. In that case, proceed to WLAN failure troubleshooting.

WLAN layout and test points

The WLAN module has been optimised to achieve the smallest possible PWB area and adding test points will compromise this layout efficiency. There is also an added risk that test point will compromise the WLAN performance. Therefore there are no test points in the WLAN layout. Software tests will be used instead to verify the operation of the WLAN module. The WLAN schematic is provided below.



WLAN settings for Phoenix

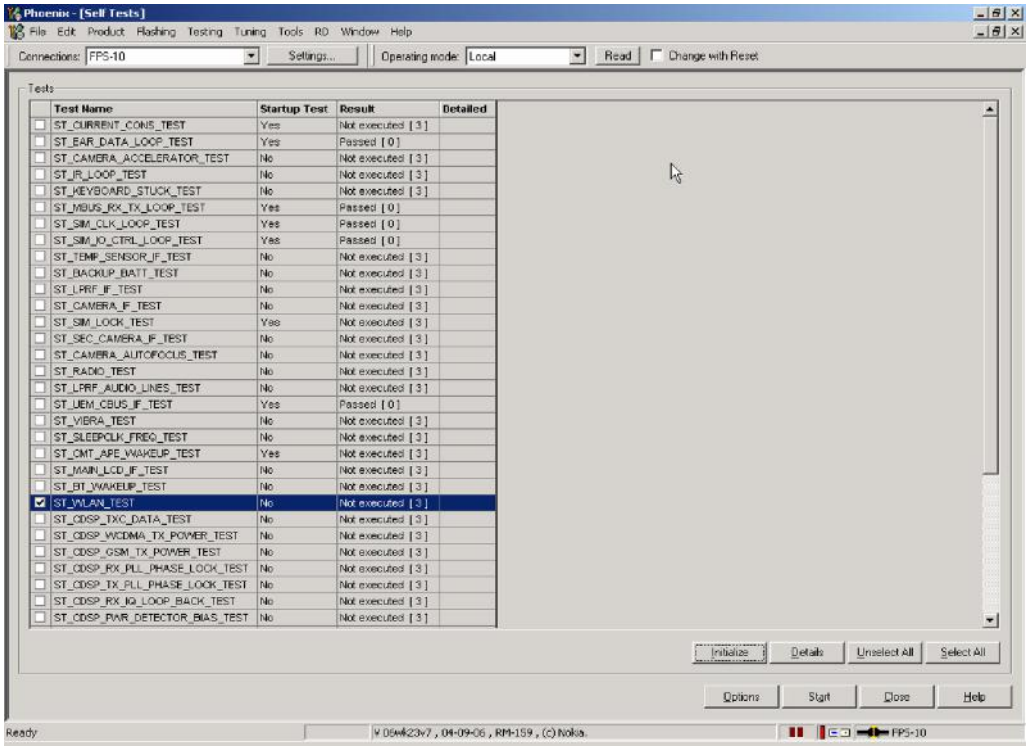
Use the following to test WLAN using Phoenix:

1 Set phone into Local Mode .

2 From the **File** menu, select **Scan Product** and check that the correct product version is displayed

3 From the **Testing** menu, select **Self Test**. This opens up a Self Test dialogue box, as shown below.

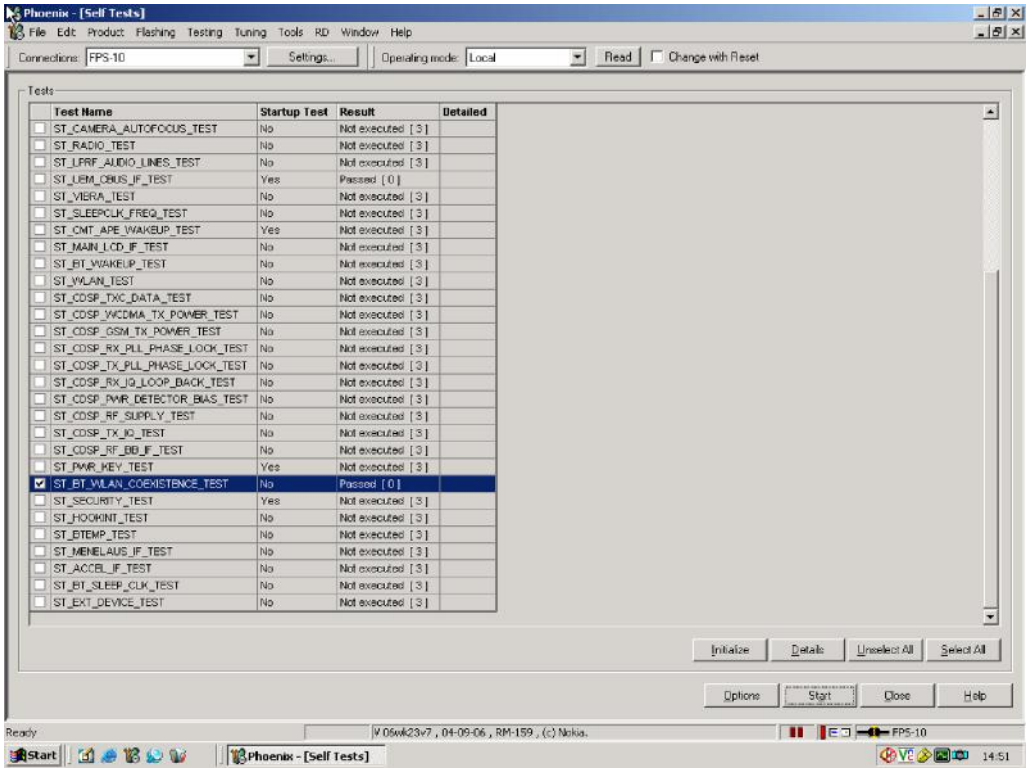
Select the **ST_WLAN_TEST** check box as shown and then select **Start** button. The test turns on the WLAN, sets up the SPI interface and then downloads the WLAN firmware into the WLAN module. During the download the WLAN acknowledges the data blocks and so the self test is a good way to confirm that the WLAN module is communicating with the Host. The result column will change to **Passed** after a few seconds if operating properly.



In addition, a test of the WLAN to BT interface can be done by selecting the **ST_BT_WLAN_COEXISTENCE_TEST** check box and selecting Start button.

This test verifies that the WLAN to BT co-existence interface signals are properly connected and there are no open circuit or shorts on the four interface signals.

The co-existence interface comprises BT Txconfig, BT RF Active, BT Priority, and BT Frequency.



In summary these two Self tests provide a simple means of ensuring the Host engine is able to communicate with the WLAN module and check the interface to BT. More detailed WLAN performance test is covered in WLAN functional test section.

WLAN functional tests

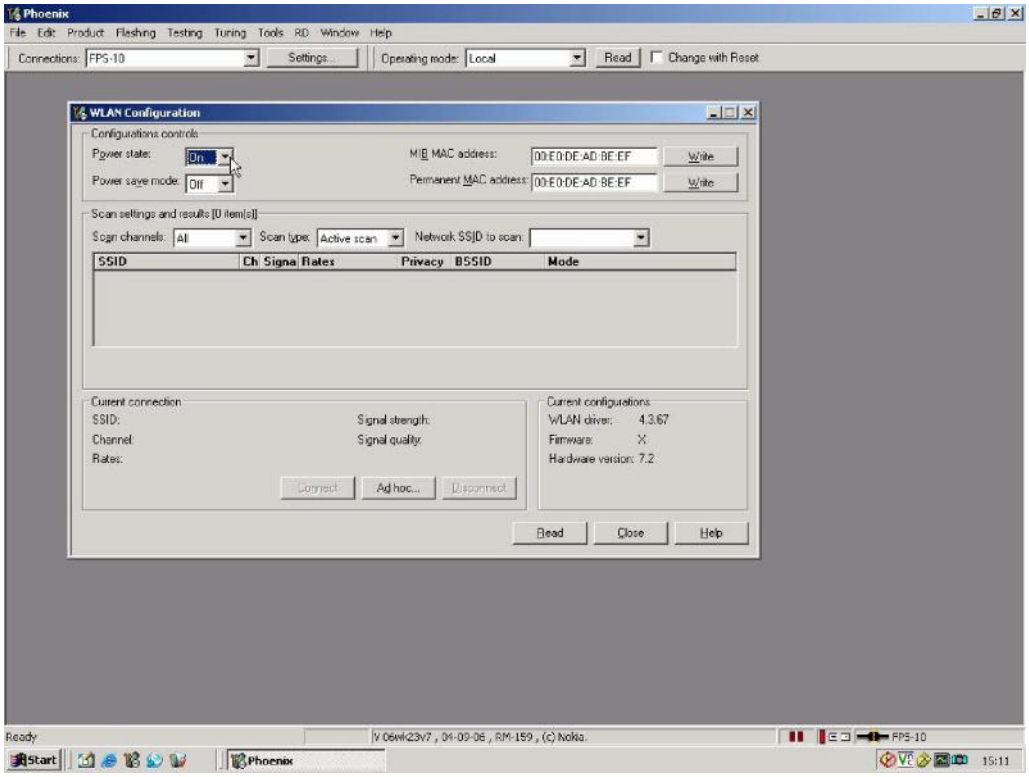
On/Off test

From the testing toolbar select **WLAN Configuration** option. This opens the WLAN configuration dialogue box below. Selecting the Power state option button (as indicated), the WLAN can be turned ON and OFF:

1 With Power State set to OFF, measure the dc power supply current consumption of the flash adaptor.

2 Next return the Power state to ON and re-measure the dc power supply current of the flash adaptor.

The difference between the currents in (1) and (2) should be between 170 and 220 mA When WLAN is ON, the firmware has been downloaded and the WLAN module is in the receive state. When OFF WLAN is powered down.



TX tests

From the testing toolbar select WLAN Tx Test option shown below. This test can be used to verify TX configuration and functionality. The default settings are sufficient for testing the TX operation, although other channels and data rates are equally suitable. To start the test, select the Start option button:

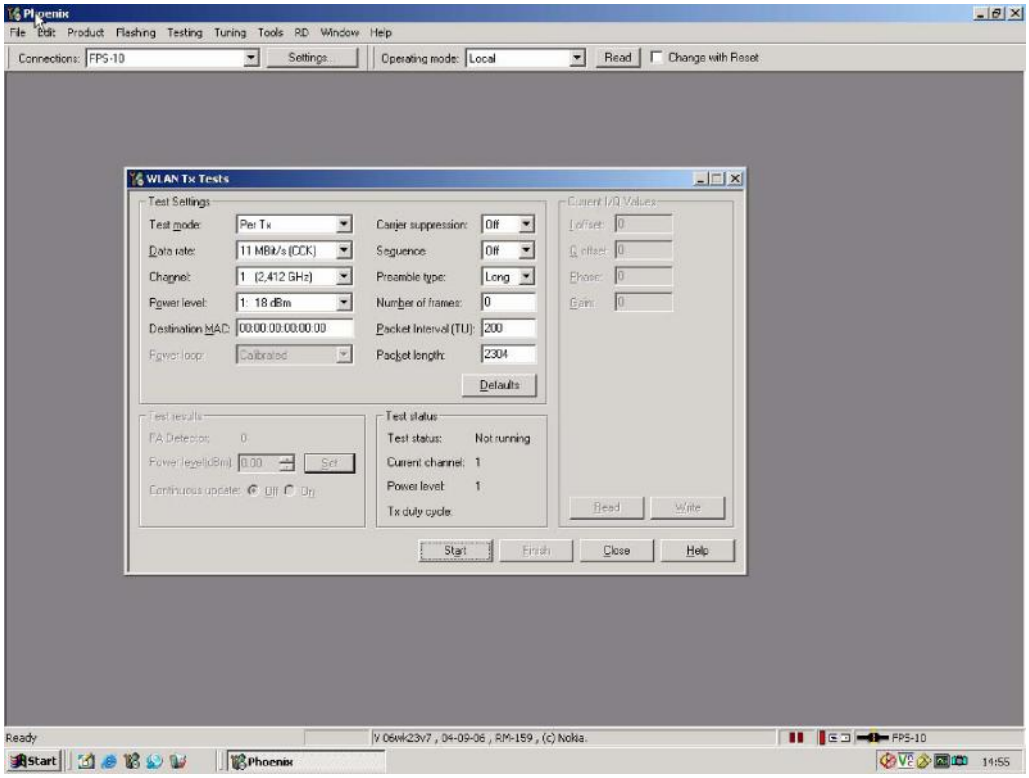
1 Measure and record the TX ON current consumption of the Phone/ flash adaptor.

2 Monitor the WLAN TX spectrum on a Spectrum analyser either using a co-ax cable connected to the WLAN TX antenna port or by making a radiated test with a suitable WLAN antenna connected to the spectrum analyser input. (When making a radiated test ensure that other WLAN devices are not transmitting as these may be detected as well, confusing the result).

3 To finish the test select the Finish option button

4 Measure the TX OFF current consumption of the phone/flash adaptor.

The difference between the two readings should be 110 - 180 mA and measures the transmit current in 11MBPS, 802.11b mode of operation.



RX Tests

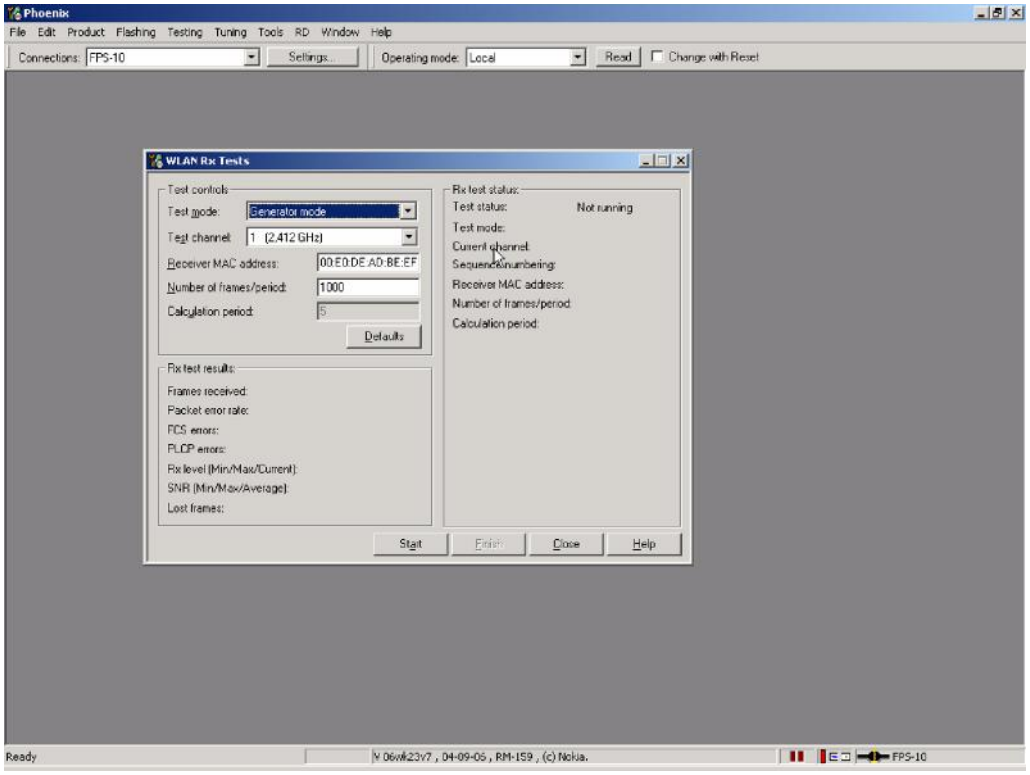
There are different options available for testing the Rx path. The simplest is to use the WLAN to report Rx packets when operating in an area where there is an active WLAN network. Simply starting an Rx test will show the number of packets detected by the WLAN module as it monitors the network. However, it does require a properly configured WLAN network. The alternative approach is to make a conducted test using a signal generator connected to the WLAN antenna port. The drawback in this approach is that the WLAN antenna connection in the phone is not actually tested.

From the testing toolbar select WLAN Rx Test option shown below. This test can be used to verify Rx configuration and functionality.

To start the test, select the Start option button.

As the WLAN monitors an active WLAN network, the Rx test results window will update and show the number of Frames received, as well as the Packer error rate. If there is no data reported in the "Rx test results" screen, please change the "test channel" number.

Monitoring the detected frames is a simple method to verify the WLAN antenna and receiver path is working properly. The current consumption of the phone/flash adaptor before and during the Rx test should be the same (10 mA max difference).



WLAN auto tuning

In case of WLAN ASIC change, RF power auto tuning is needed. Connect WLAN RF test connector to CMU200 input using proper RF cable. Start Phoenix WLAN autotune window. Check the settings and verify your PC communicates with CMU200 via GPIB.

Auto tuning procedure

1 Start tuning by pressing **Tune**.

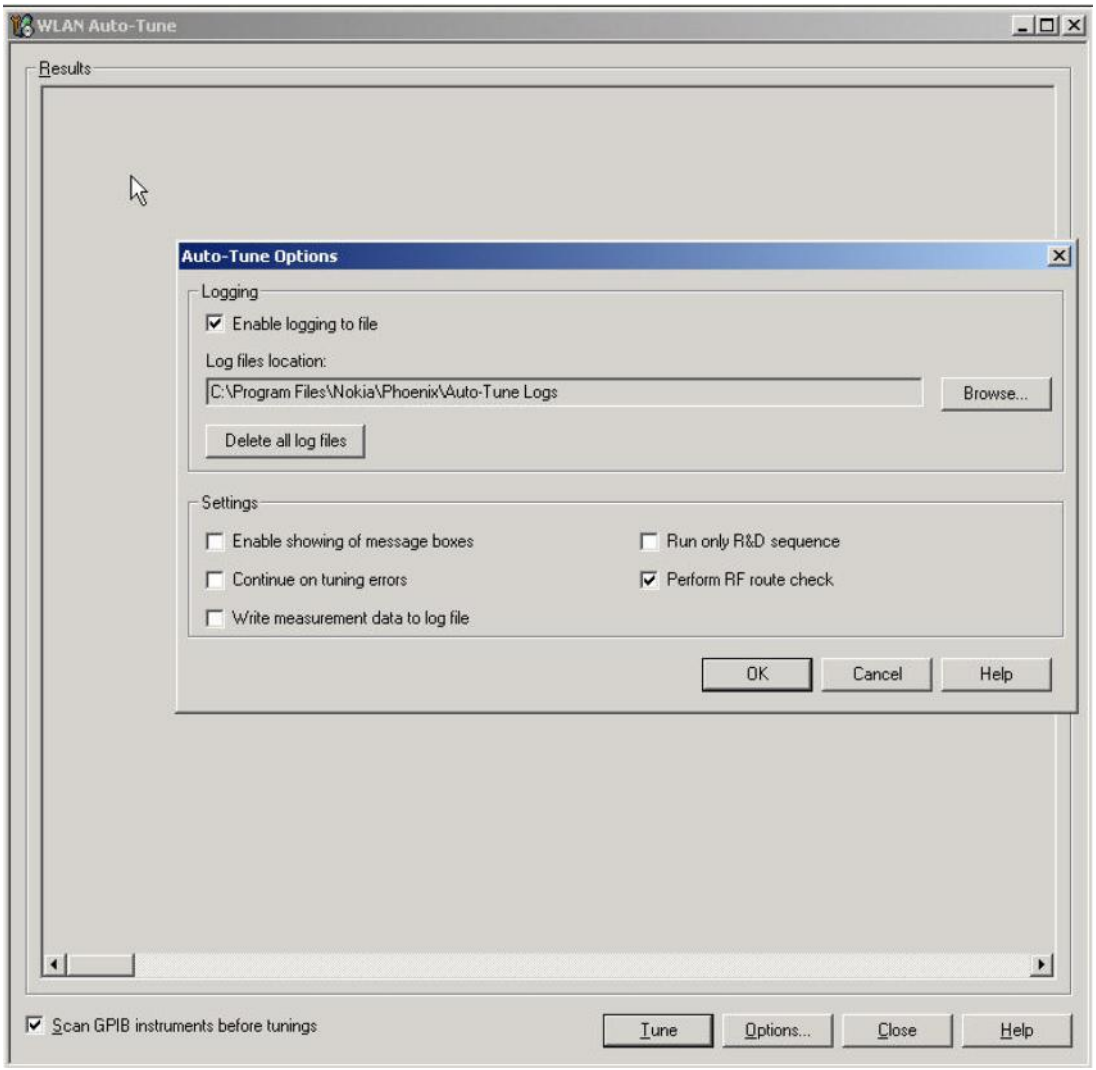


Figure 15 WLAN auto tune settings

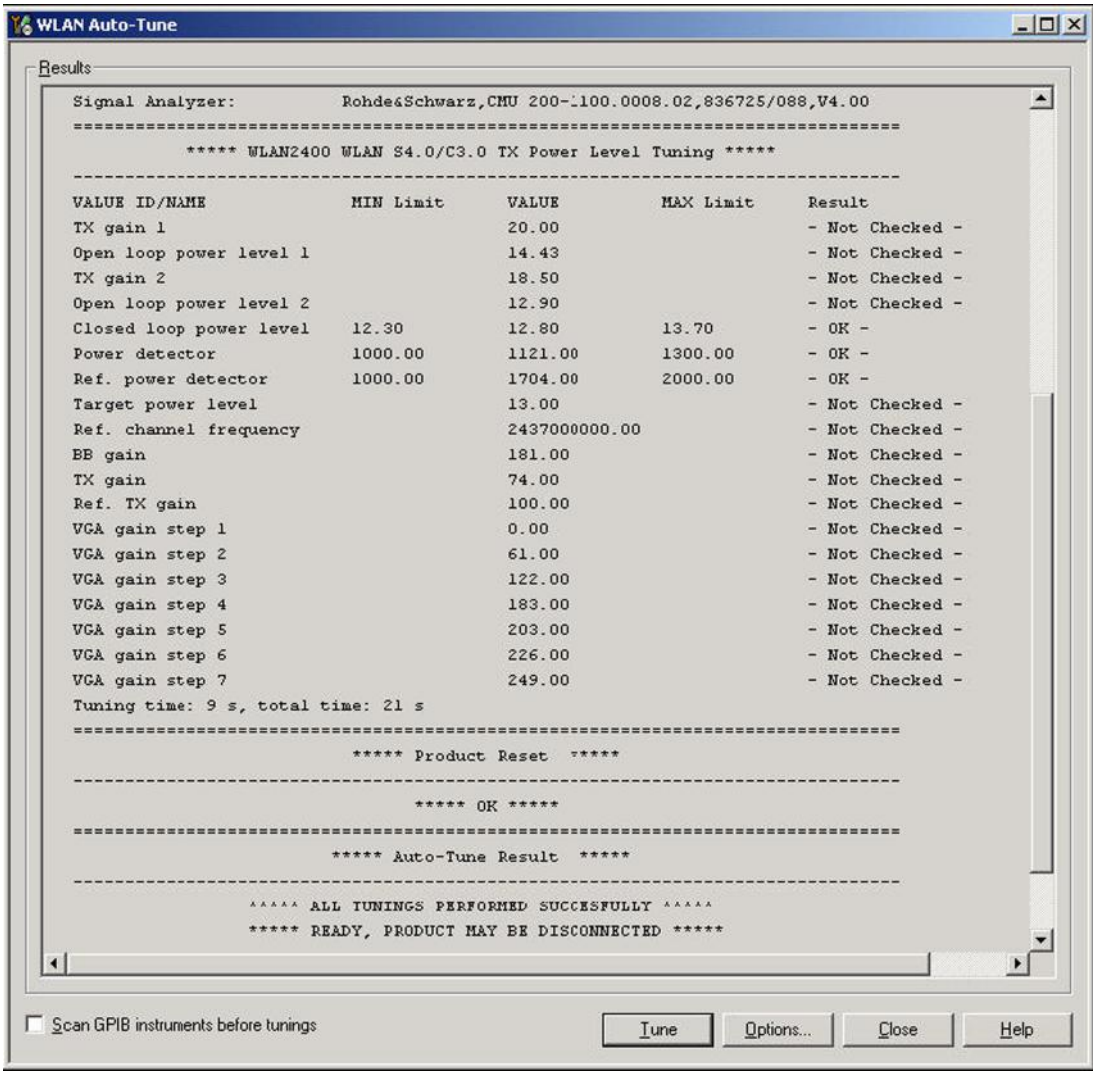
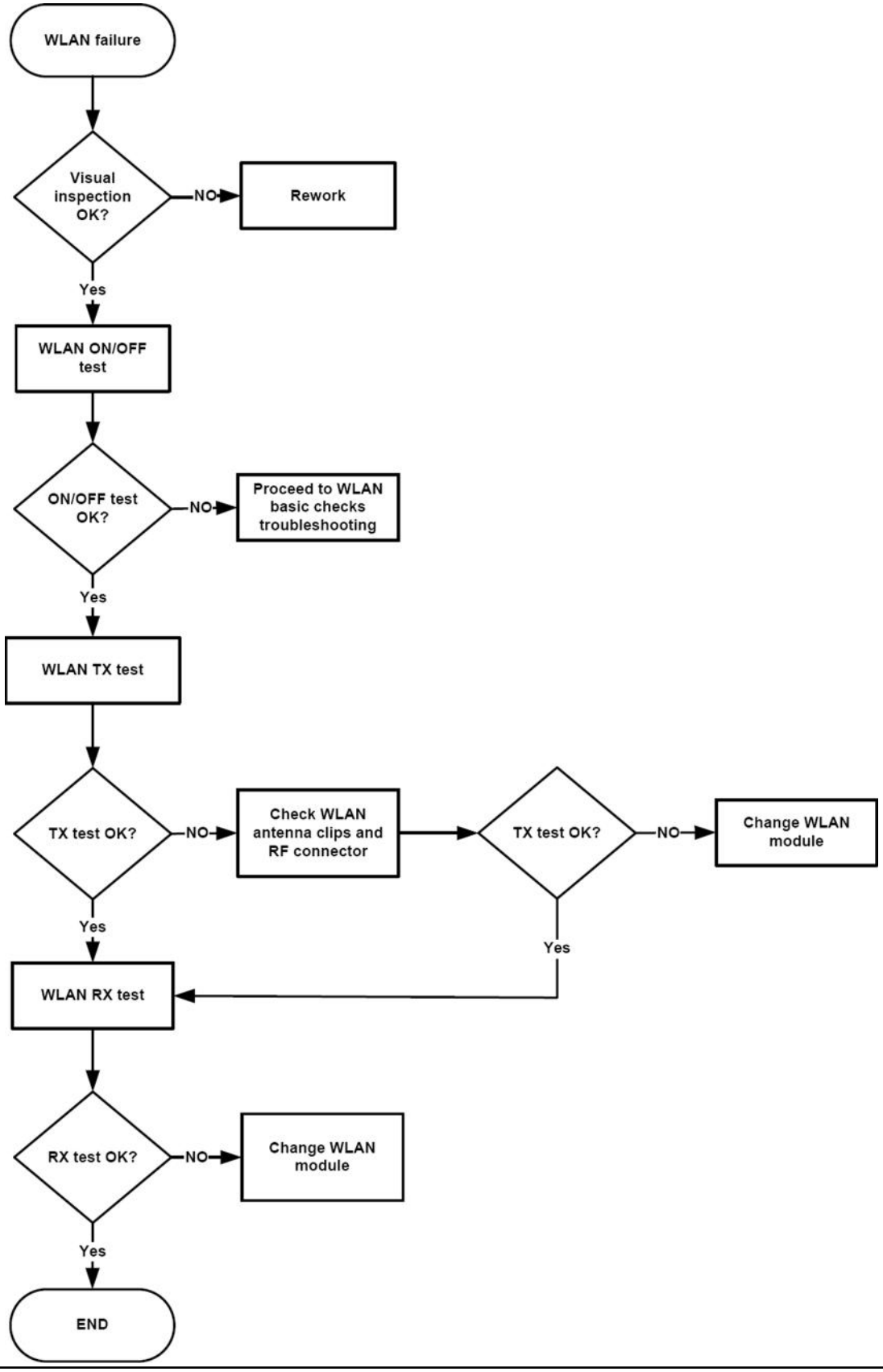


Figure 16 WLAN auto tune results

RM-530 WLAN tuning target is 11 dBm. Use RM-530_wlan_size4.xml file in Program files/Nokia/Phoenix/products/RM-529 and RM-530 directories.

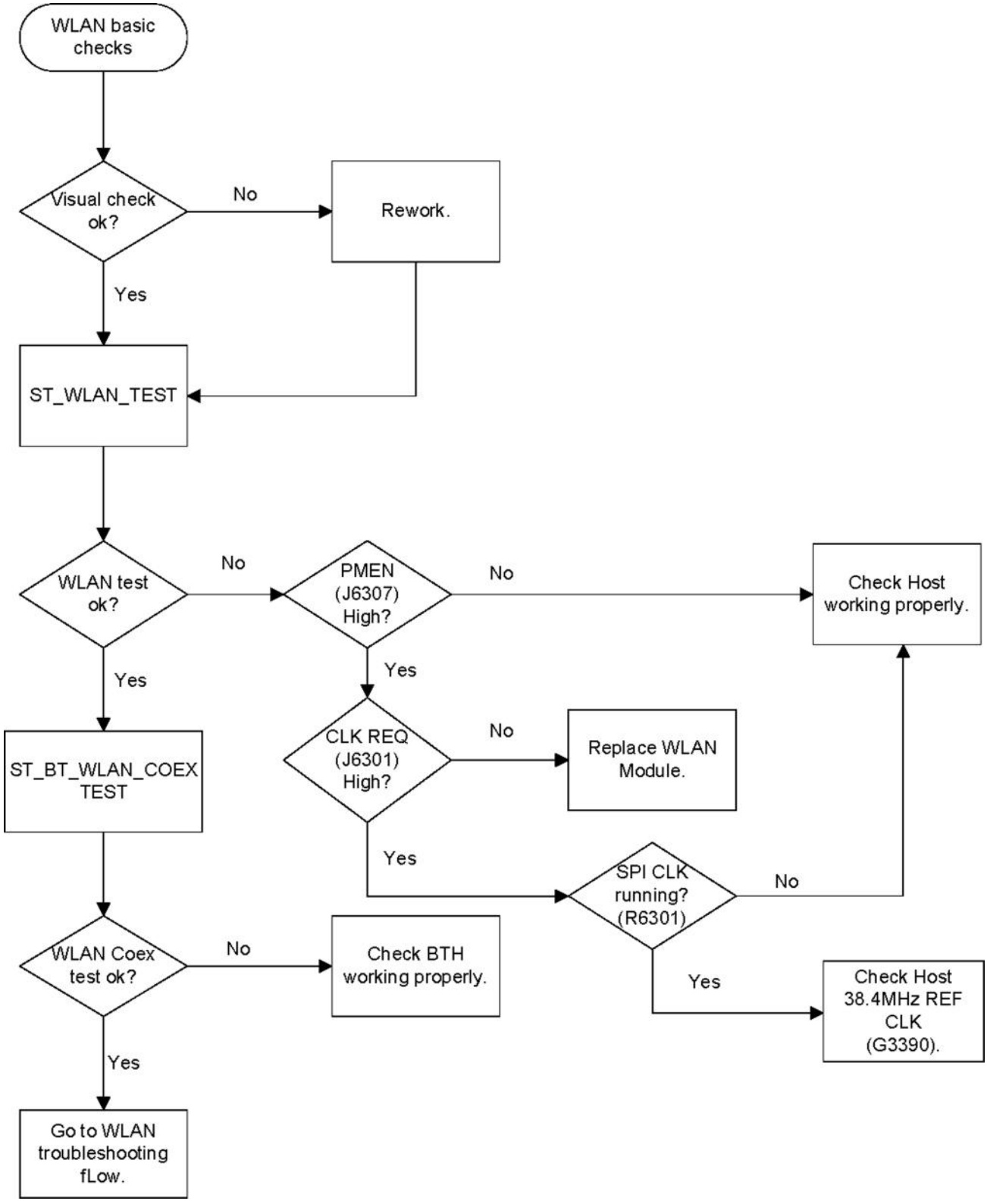
WLAN failure troubleshooting

Troubleshooting flow



WLAN basic checks 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.

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:

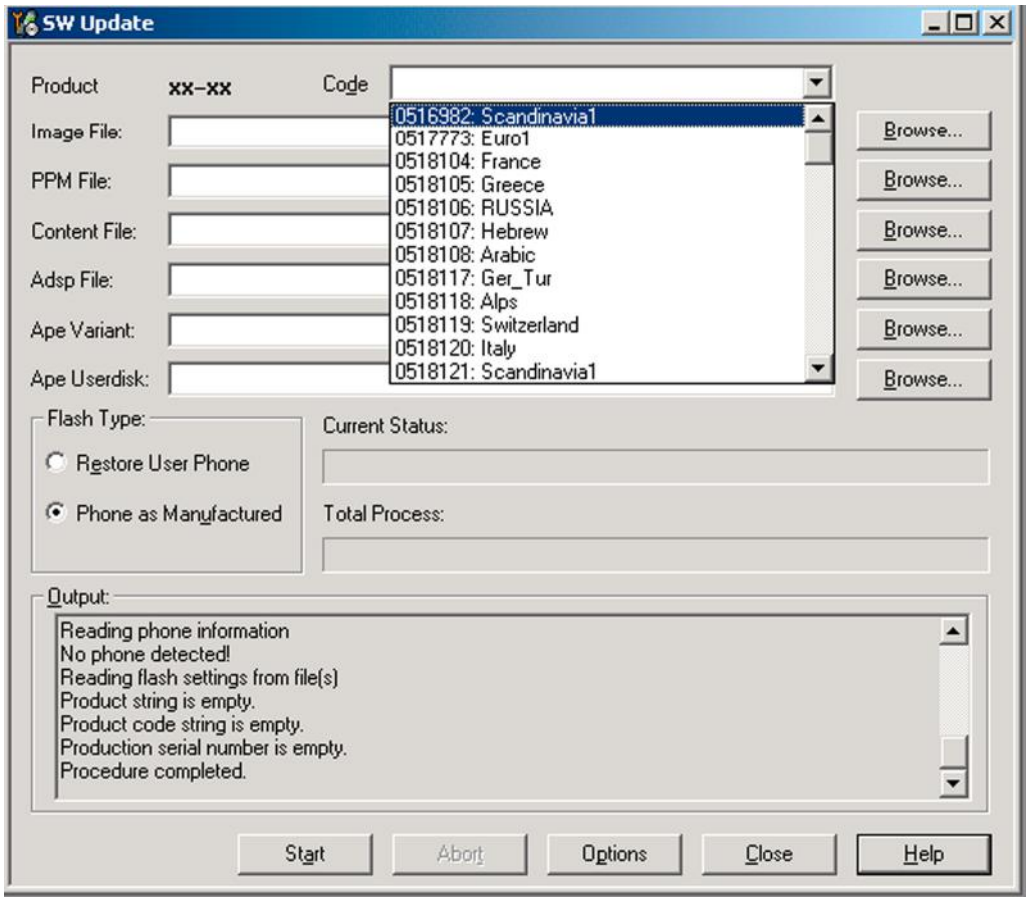
- *Phoenix* service software v 2008.34/38 or newer.
- The latest phone model specific *Phoenix* data package.
- PKD-1 dongle
- SX-4 smart card (Enables BB5 testing and tuning features)
- Activated FPS-20 flash prommer **OR** FPS-21 flash prommer
- Flash update package 08.30.012 or newer for FPS-20 or 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
- 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-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.

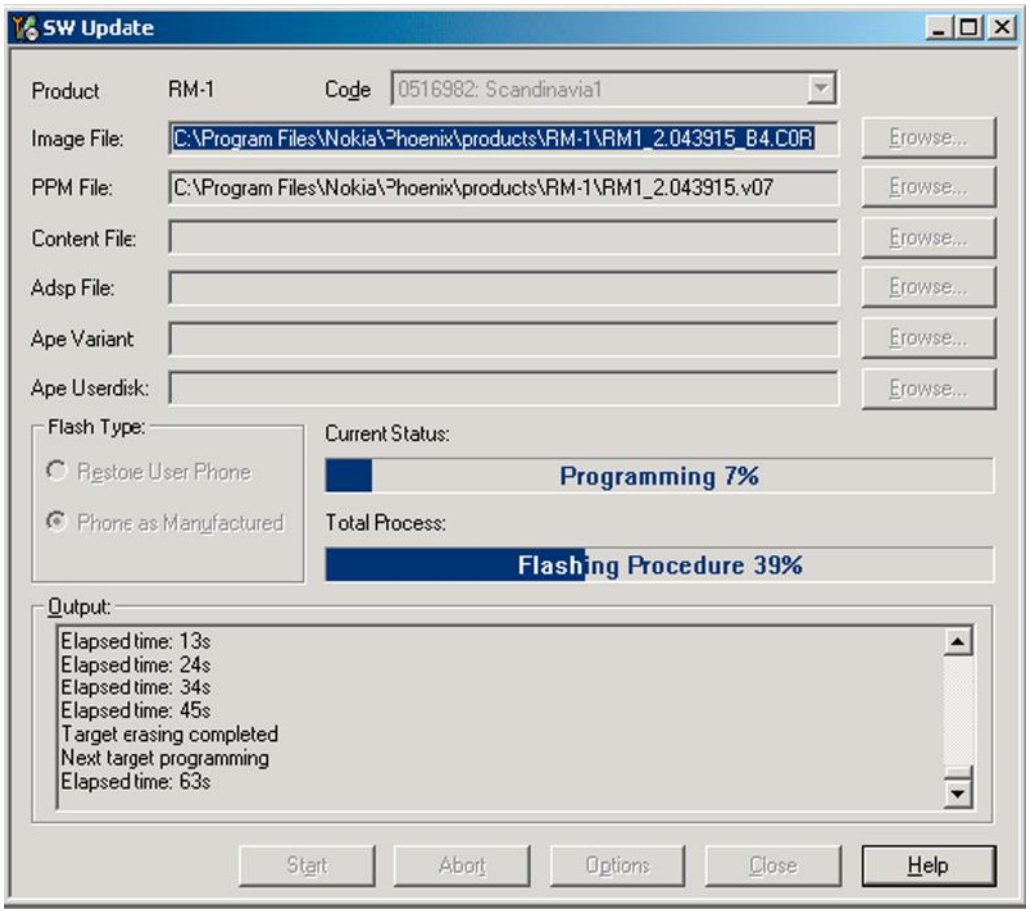
iv Go to **Flashing→SW Update** and wait until *Phoenix* reads the product data as shown in the following picture.



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** .

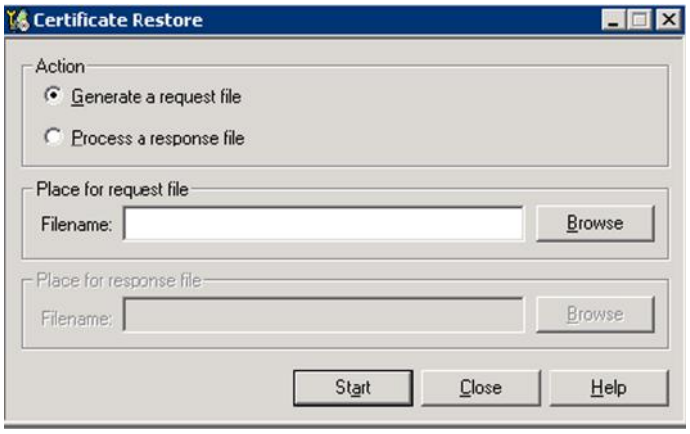
2. Create a *Request* file.

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

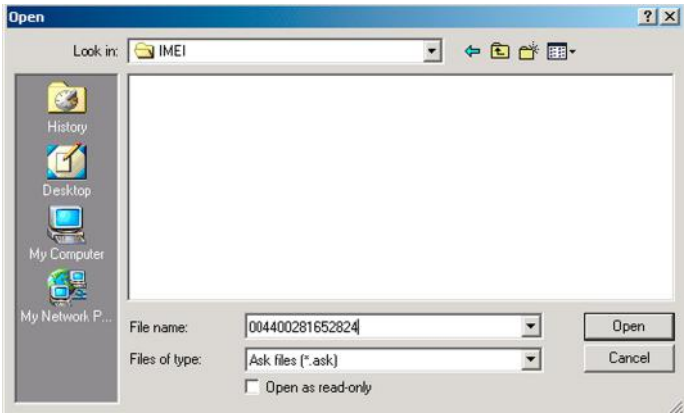
i To connect the phone with *Phoenix*, choose **File→Scan Product** .

ii Choose **Tools→Certificate Restore** .

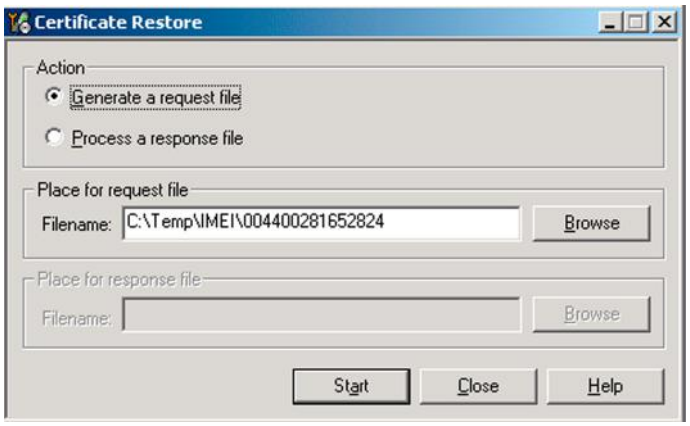
iii To choose a location for the request file, click **Browse**.



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.

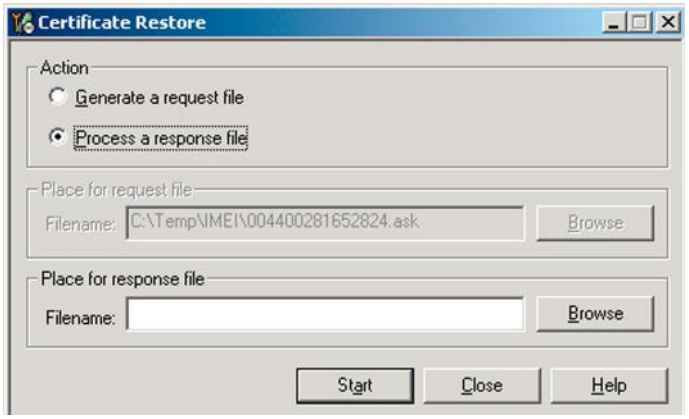
   For this procedure, you must supply +12 V to CU-4 from an external power supply.

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

   ii Start *Phoenix* service software.

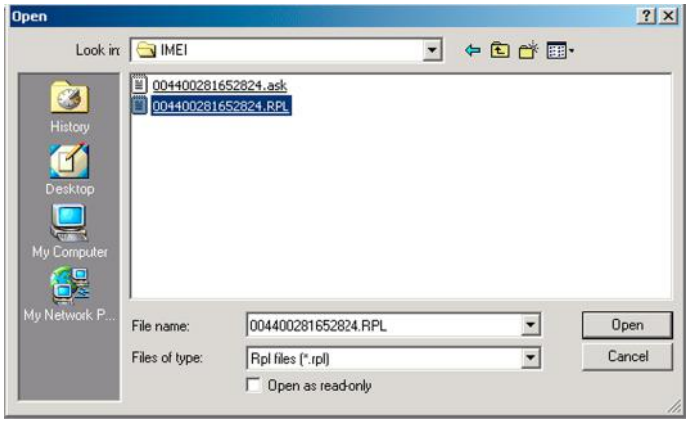
   iii Choose **File→Scan Product** .

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



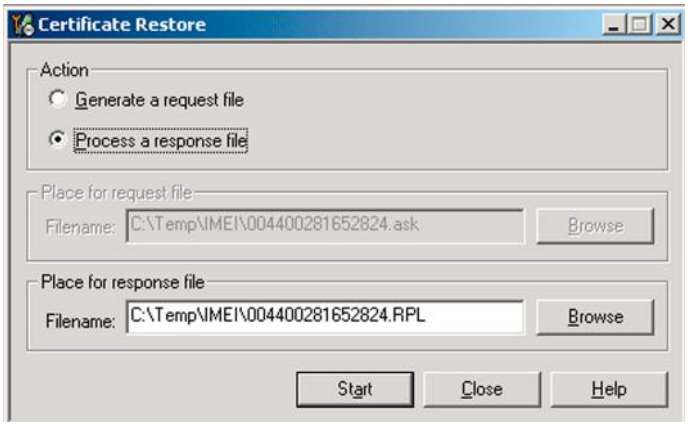
v To choose the location where response file is saved, click **Browse**.

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**.



4 — RF Troubleshooting

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List of Figures

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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).

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 (it is only 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 communication Test Set Screen dumps are from CMU200. Other testers are different.

  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 verify functionality of the cellular RF block without removing RF shield.

RF connector and antenna contacts

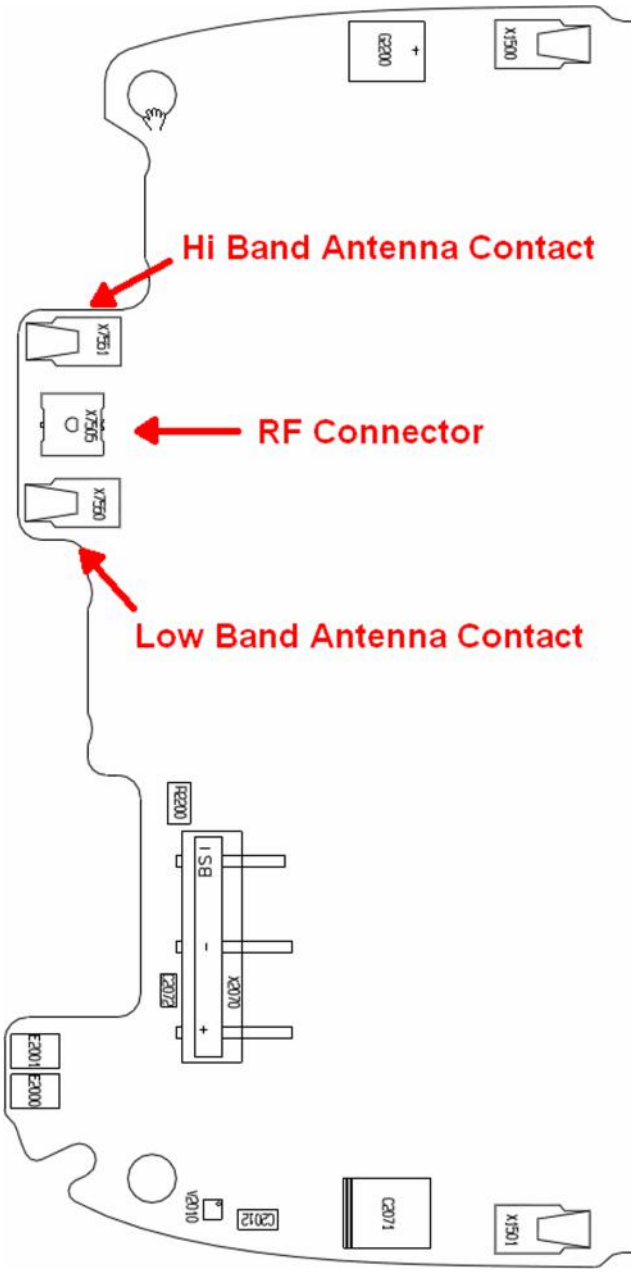


Figure 17 RF connector and antenna contacts - bottom

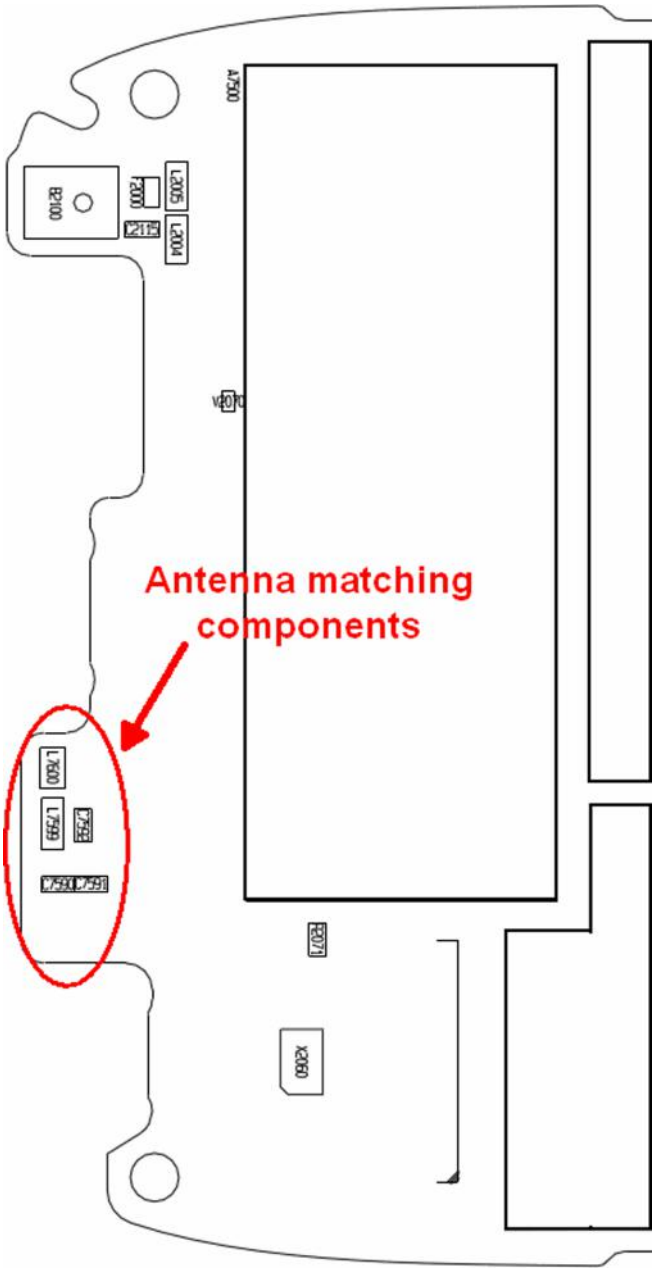


Figure 18 Antenna matching components - top

Auto tuning

Introduction to RF tunings

RF tuning is always performed with the help of a product-specific module jig, never with an RF coupler. Using an RF coupler in the tuning phase will cause a complete mistuning of the RF part.

Cable and adapter losses

RF cables and adapters have some losses. They have to be taken into account when the phone is tuned. As all RF losses are frequency dependent, the user has to act very carefully and understand the measurement setup. For RF attenuations of the module jig and RF cable, please refer to the Service Tools section.

Auto tuning

This phone can be tuned automatically.

Auto tuning 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

For hardware requirements for auto tuning, please refer to *Service concept for BB/RF tuning with module jig*.

Phoenix preparations

Install the phone specific data package, for example *Nokia_firmware_RM-530_EUROPE_10.014_v41.0.exe*. This defines phone specific settings.

Auto tuning procedure

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

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

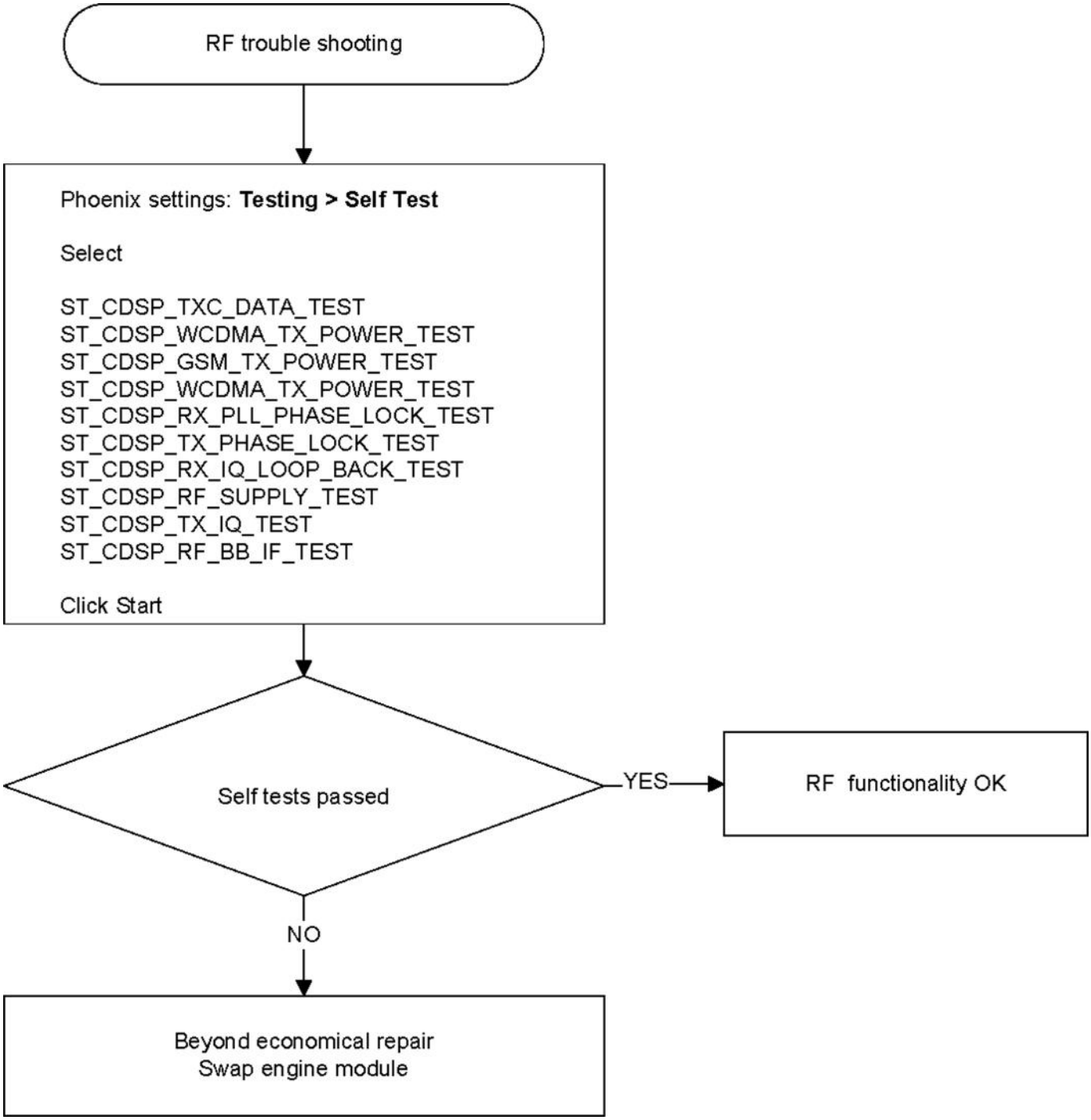
3 Start autotuning by clicking the *Tune* button.

Self Test Troubleshooting

Self test troubleshooting

Troubleshooting flow

Note: Self tests are recommended to be made when phone is in jig and 50 Ohm load is connected to RF connector. Otherwise power tests may fail depending on antenna load.



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 (page 4–10). For a similar test in WCDMA mode, see WCDMA RSSI measurement (page 4–12).

GSM RX chain activation for manual measurements/GSM RSSI measurement

Prerequisites

Make the following settings in Phoenix service software:

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

Steps

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

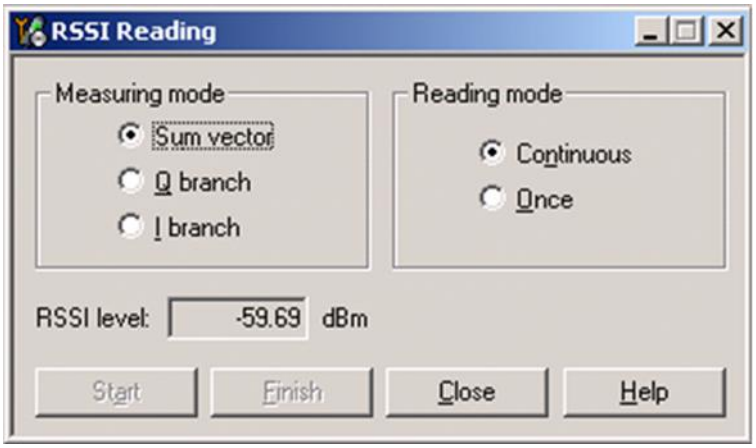


Figure 19 Phoenix GSM RSSI reading window

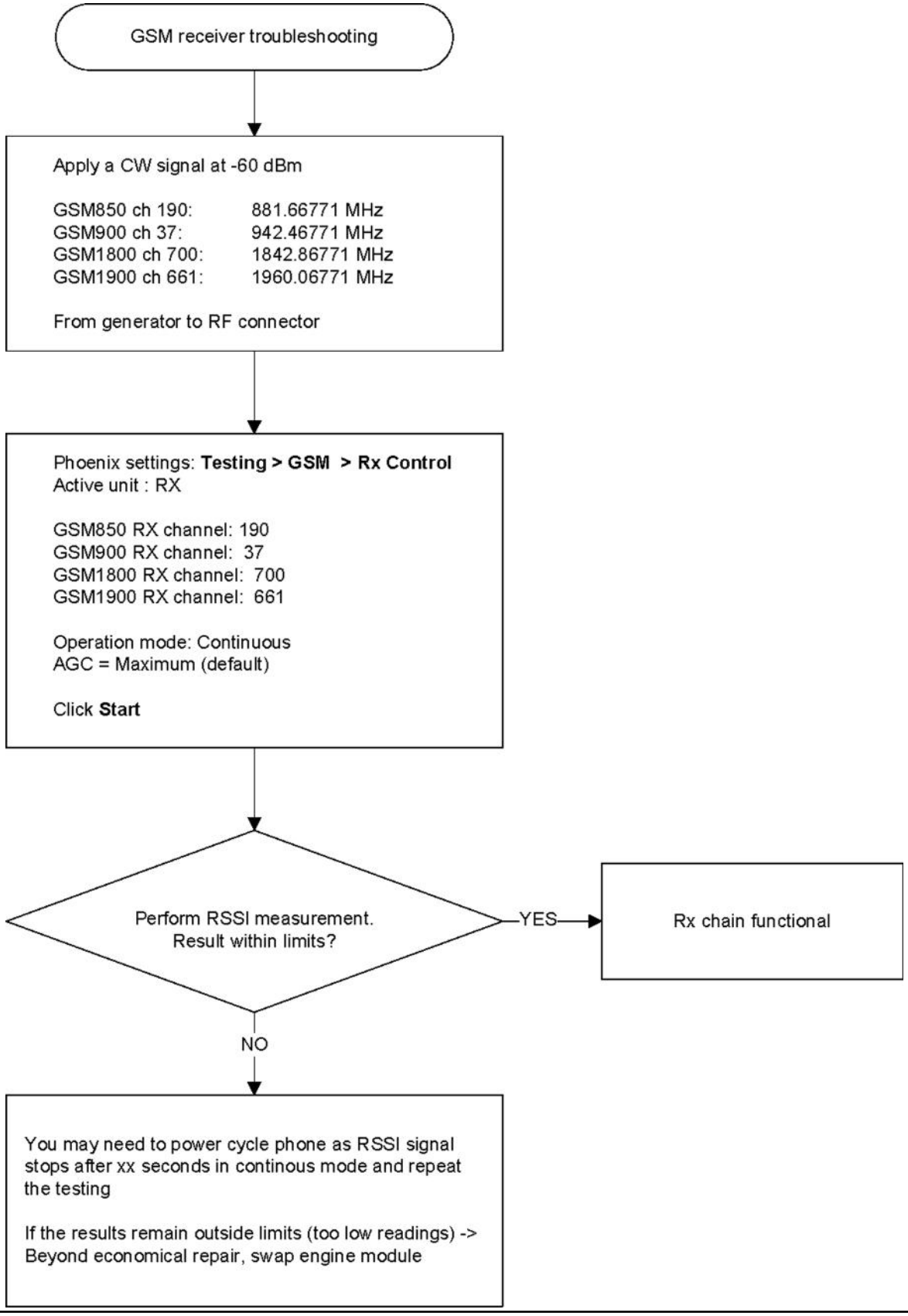
Results

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.

GSM receiver troubleshooting flowchart

Troubleshooting flow



WCDMA RX chain activation for manual measurement

Steps

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

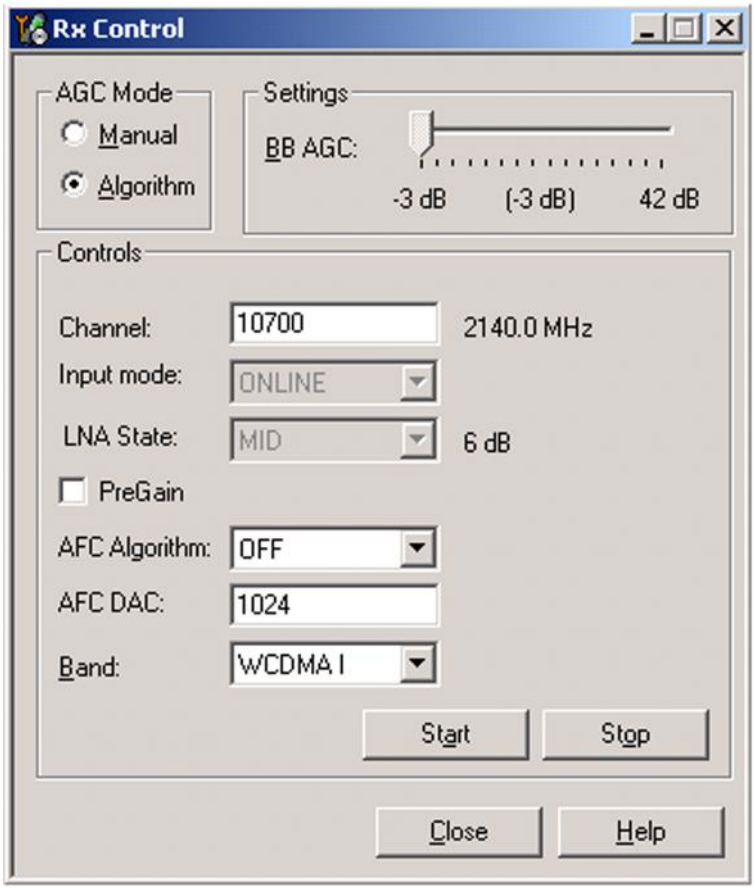


Figure 20 Phoenix WCDMA RX Control window

Note: Channel for band WCDMA II 9800, V 4408, VIII 3012

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.

WCDMA RSSI measurement

Prerequisites

WCDMA RX must be activated before RSSI can be measured. For instructions, please refer to WCDMA RX chain activation. Connect signal generator to RF connector and use appropriate frequency for each channel (2141 MHz for channel 10700 WCDMA band I, WCDMA modulation).

Steps

1. Set the following RF generator settings:

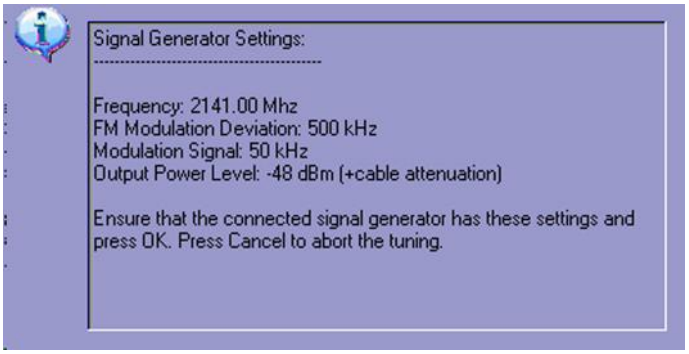


Figure 21 WCDMA RX generator settings

Note: Frequency for band WCDMA II 1961.0 MHz, V 882.6 MHz, VIII 943.4 MHz

2. From the Phoenix testing menu, select **WCDMA→RX Power measurement**
3. In the RX power measurement window, make the following settings:

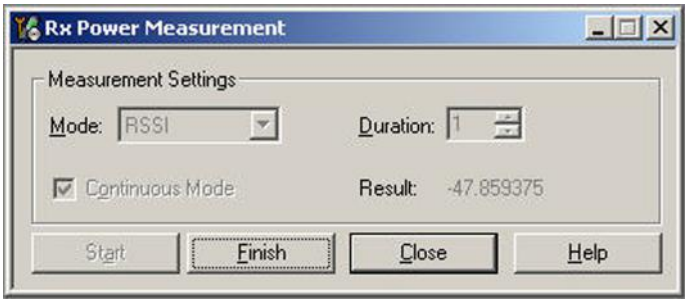


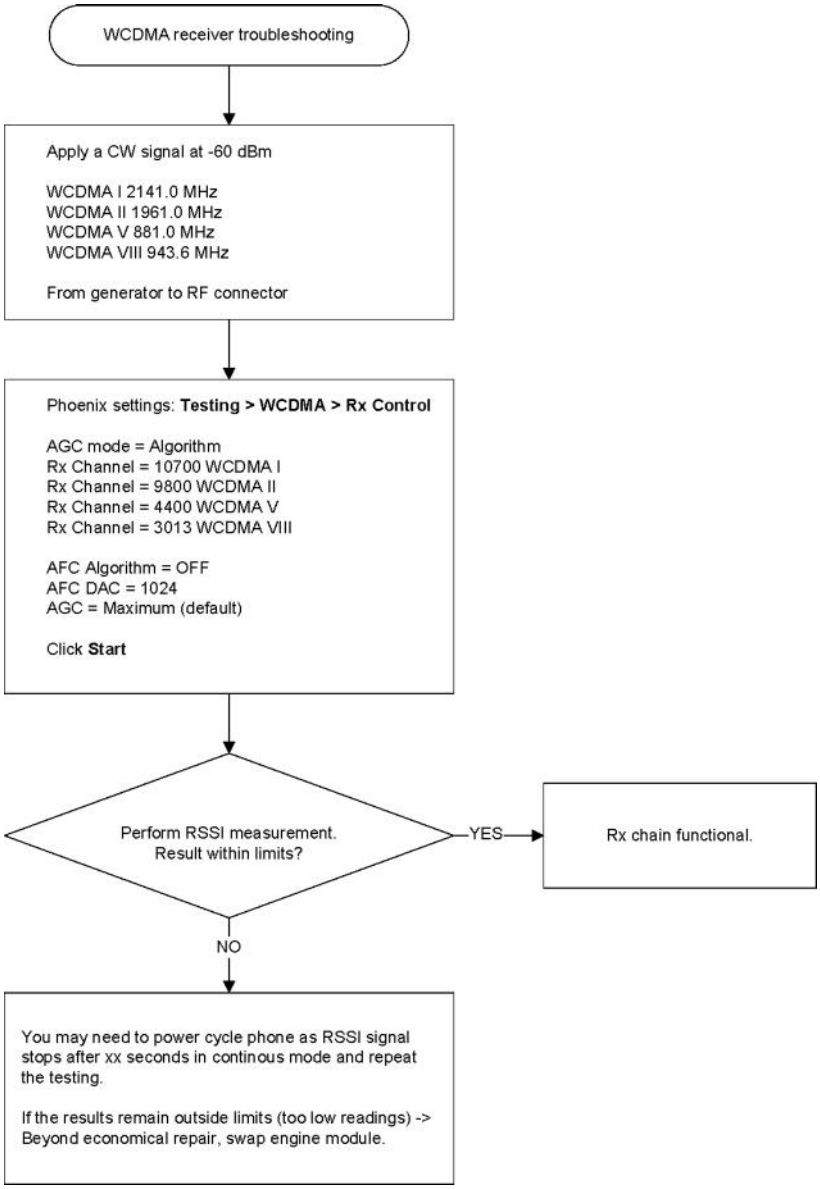
Figure 22 Phoenix WCDMA RX power measurement window

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

Note: WCDMA RSSI measurement is accurate only with WCDMA modulated signal.

WCDMA receiver troubleshooting flowchart

Troubleshooting flow



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 figure:

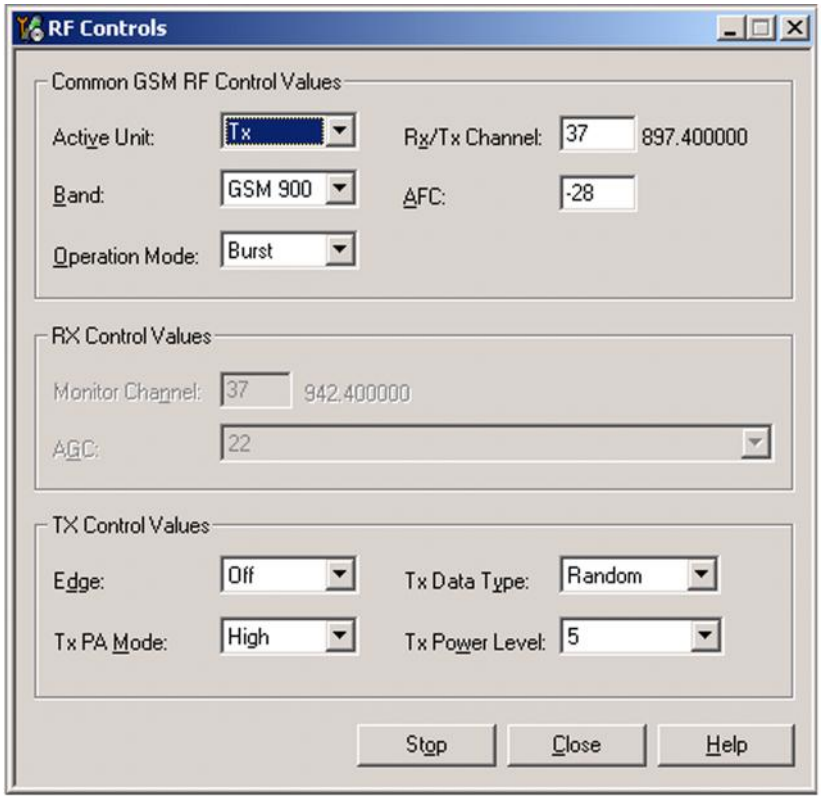
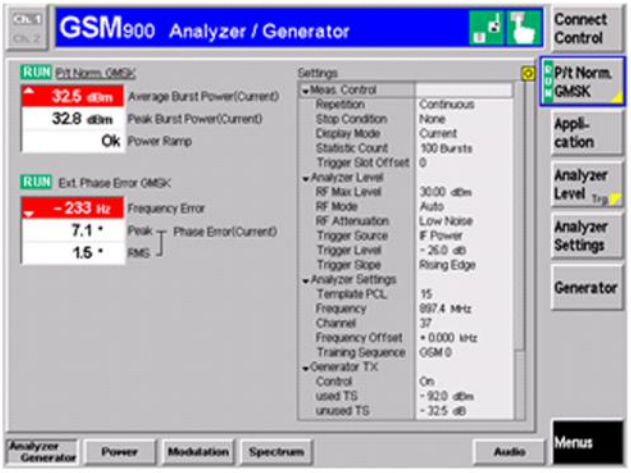


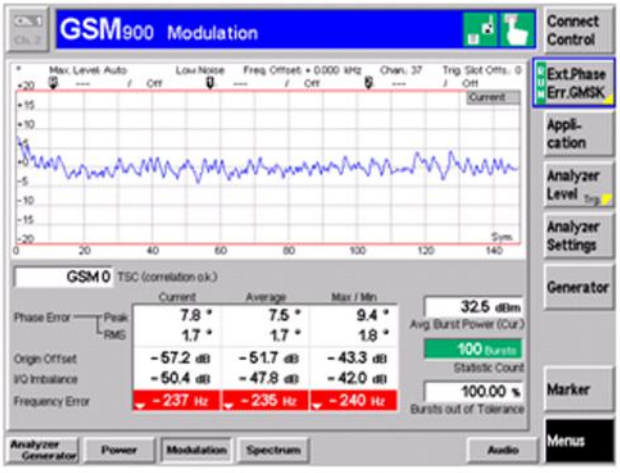
Figure 23 Phoenix GSM RF controls window

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

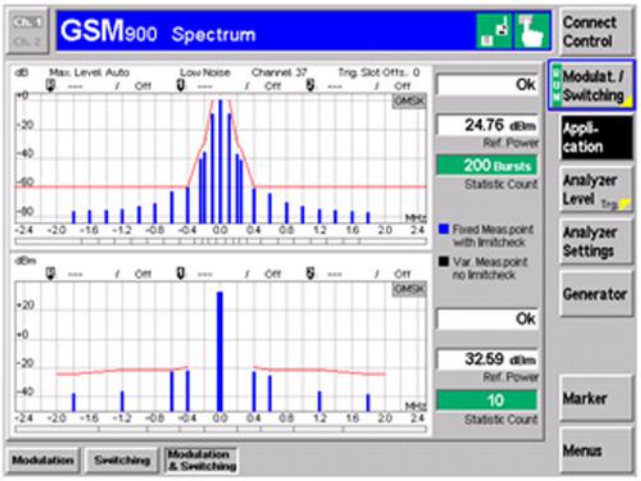
Analyser settings



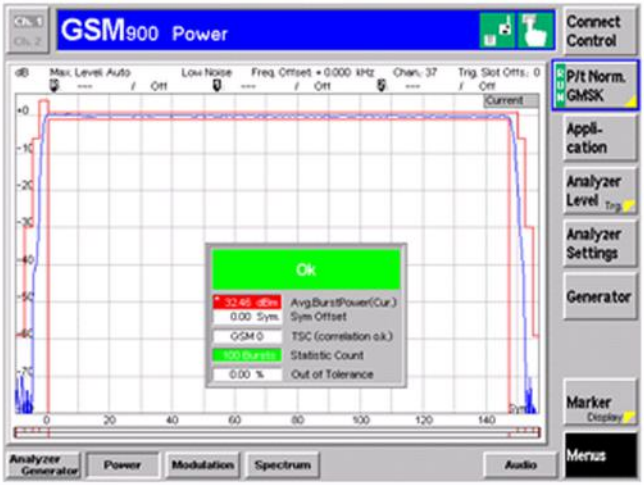
Phase error



Modulation/Switching spectrum



Power/Burst GSM/GPRS (GMSK)



Power/Burst - EDGE (8PSK)

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

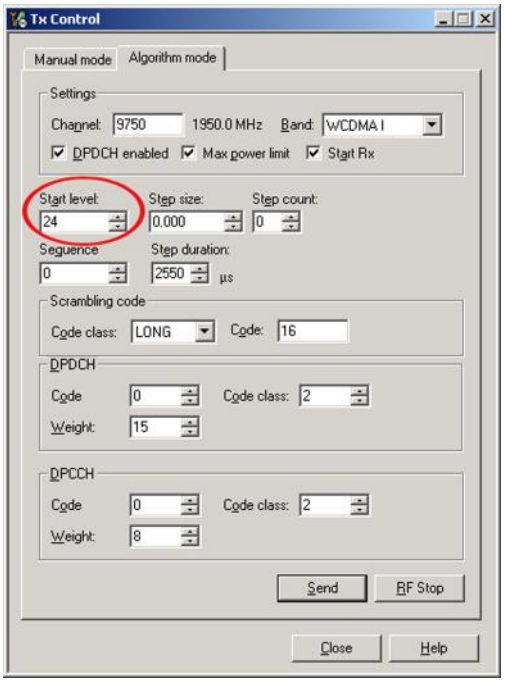
Next actions

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

WCDMA transmitter troubleshooting

Steps

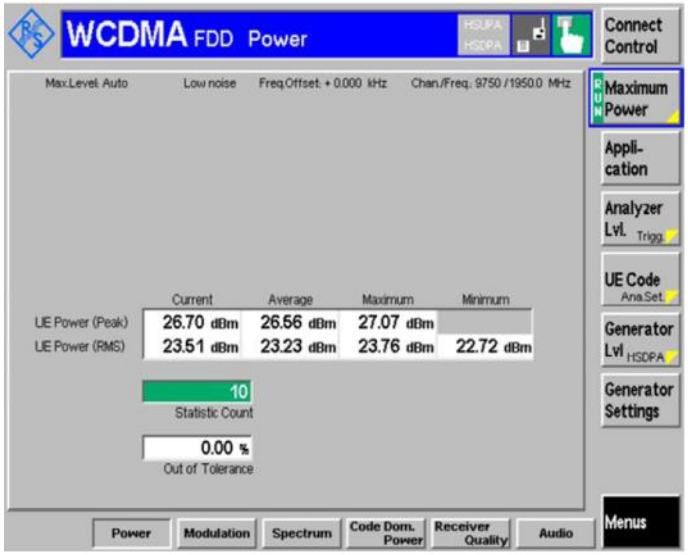
1. Set the phone to local mode.
2. In Phoenix, select **Testing→WCDMA→TX control** .
3. In the TX control window, make settings as in the picture:



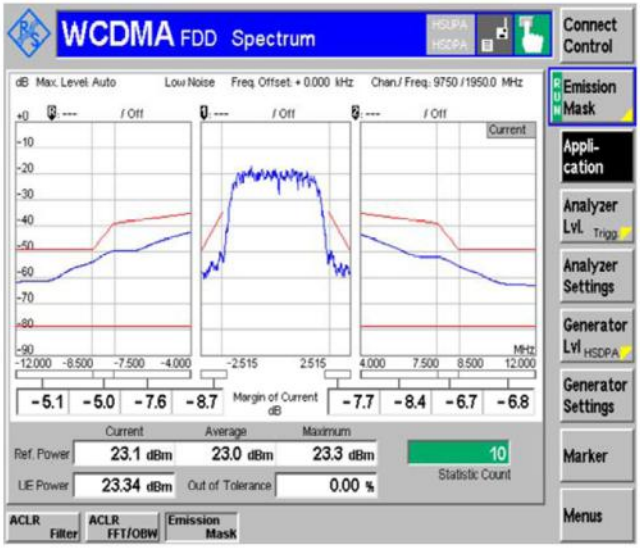
Note: For WCDMA TX channels: band II 9400, V 4183, VIII 2787

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.
5. Check the basic TX parameters using a communication analyzer (for example CMU200).

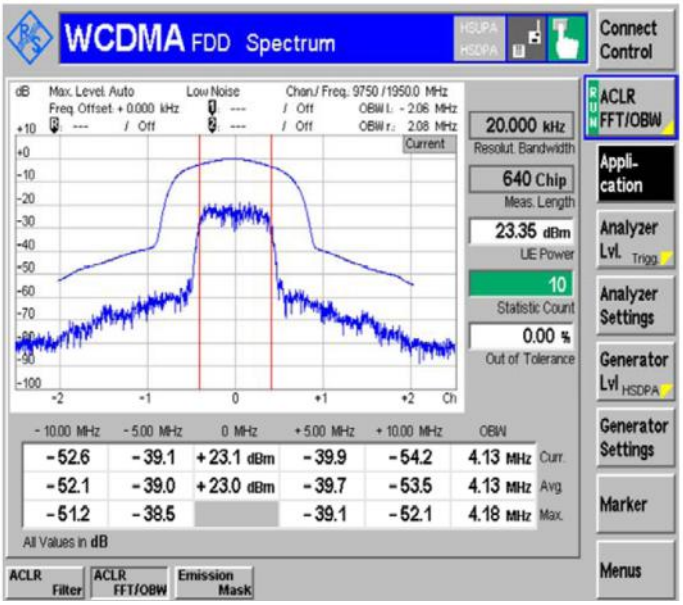
Power



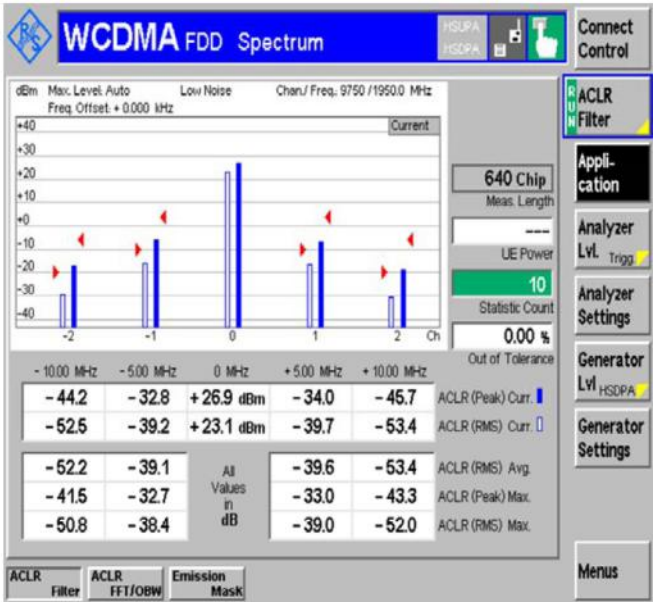
Spectrum - Emission Mask



Spectrum - ACLR (FFT/OBW)



Spectrum - ACLR (Filter)



Next actions

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

Antenna troubleshooting

Visual check for antenna contacts

There are two antenna contact springs (X7550 and X7551) for the cellular antenna. Check the shape of the springs and replace if damaged.

5 — Camera Module Troubleshooting

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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!

Camera troubleshooting with Phoenix

Context

- Connect the phone to the flash jig.
- In test or local mode run the following self tests:

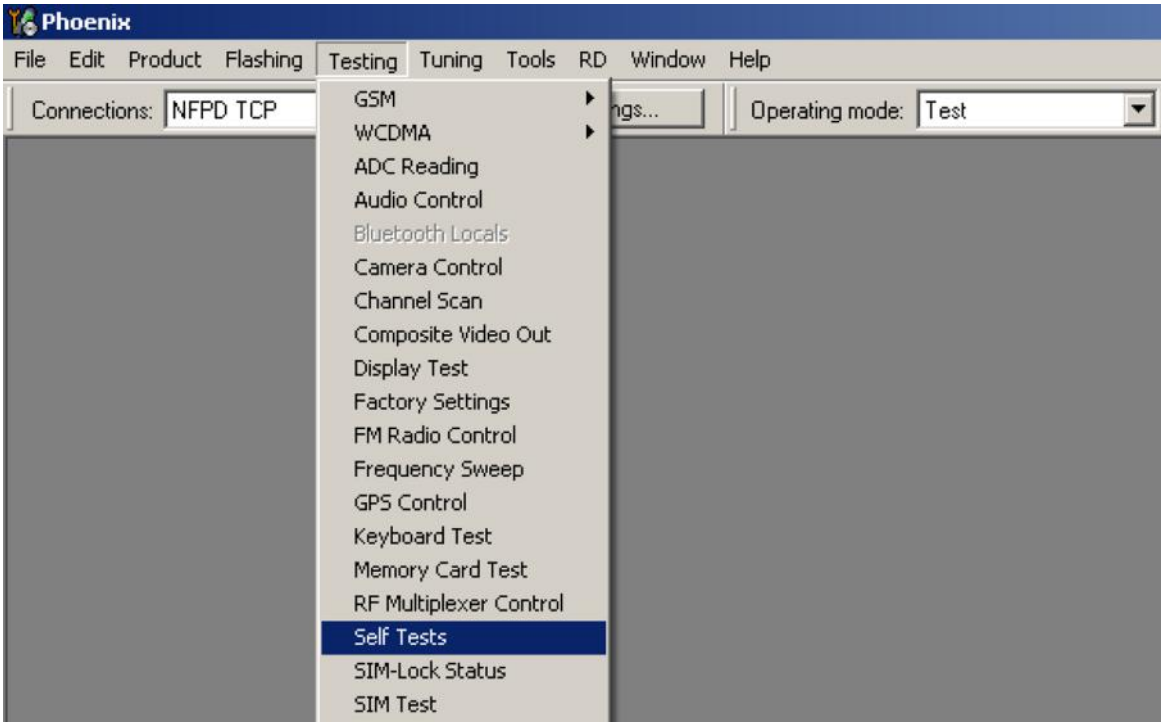


Figure 24 Camera troubleshooting with Phoenix

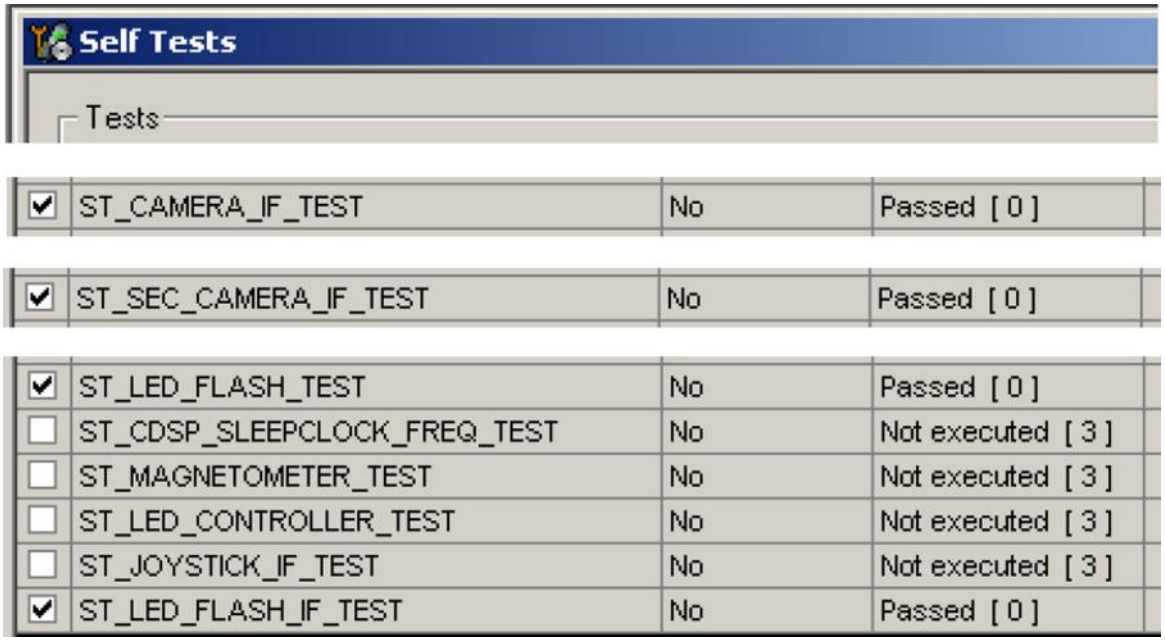


Figure 25 Camera troubleshooting Phoenix self tests

Camera troubleshooting with self tests

Context

1 ST_CAMERA_IF_TEST

- Electrical interface problem. Camera connection or camera module is broken. Check the camera assembly to the socket. Change the camera module if needed.

2 ST_SEC_CAMERA_IF_TEST

- Electrical interface problem. Secondary camera connection or camera module is broken. Check the components around the secondary camera.

3 ST_LED_FLASH_IF_TEST
- This tests the interface to the flash driver without the need of flash LED. If the test fails, check the driver and components around it.

4 ST_LED_FLASH_TEST
- Note that when using camera application dim red flash is seen during still imaging even when the flash is manually turned off. This is called an indicator and its normal behavior – do not change the components.
- This test flashes both red indicator and white flash LED. If the flash is not visible, check the flash PWB connection. Change the flash PWB if needed.

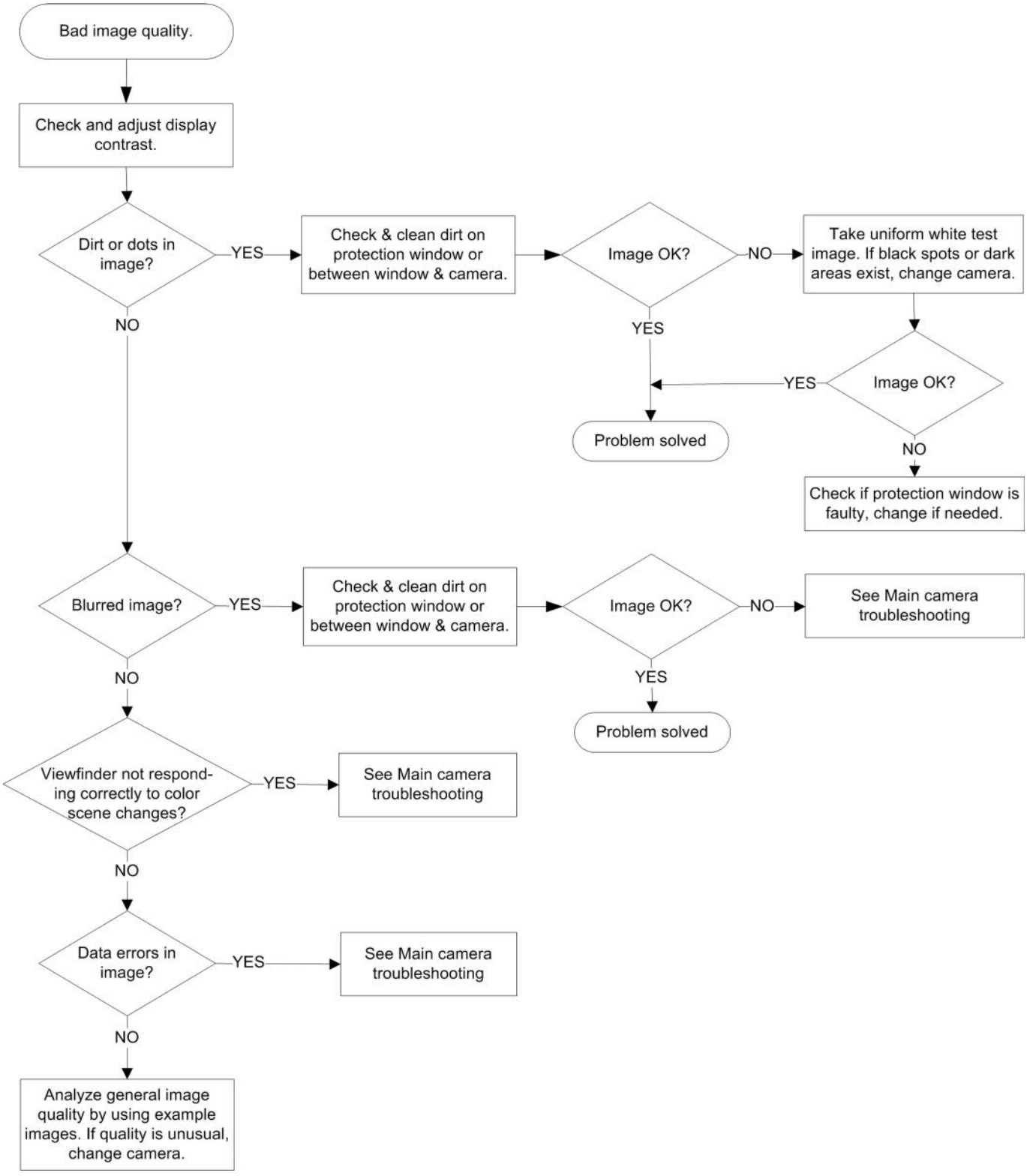
Autofocus (AF) failure

Steps

1. Use the camera application and focus the viewfinder image to a close distance by putting your finger on top of the optical joystick. Another way to do the focusing, depending on the SW settings, is to press the joystick button and hold it down until the focus is done.
   - Focus is done when the green or red color is shown. Usually auto mode does not get green result when the target is closer than 30-50 cm. To be able to focus to targets as close as 10 cm, please select close-up mode from the side menu.
   - Lens movement should be seen from the viewfinder when the camera is doing AF. If it is seen, the camera is ok.
2. If the lens is not moving check fuse F1400 by measuring its resistance. The resistance should be close to zero. Voltage measurement is not reliable since a broken fuse is not always totally open loop, but there might be resistance of few kilo ohms.
3. If the fuse is broken, change the camera module and the fuse.

Main camera bad image quality troubleshooting

Troubleshooting flow



Camera flash troubleshooting

Context

Flash tests are described in Camera troubleshooting with self tests (page 5–6). Before checking flash functionality, make sure that the main camera is working ok.

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 hardware troubleshooting

Context

The secondary camera can be tested with the camera application by selecting it from the Options menu. Another option is to use a video call. For secondary camera hardware troubleshooting, see Camera troubleshooting with Phoenix (page 5–5) and Camera troubleshooting with self tests (page 5–6).

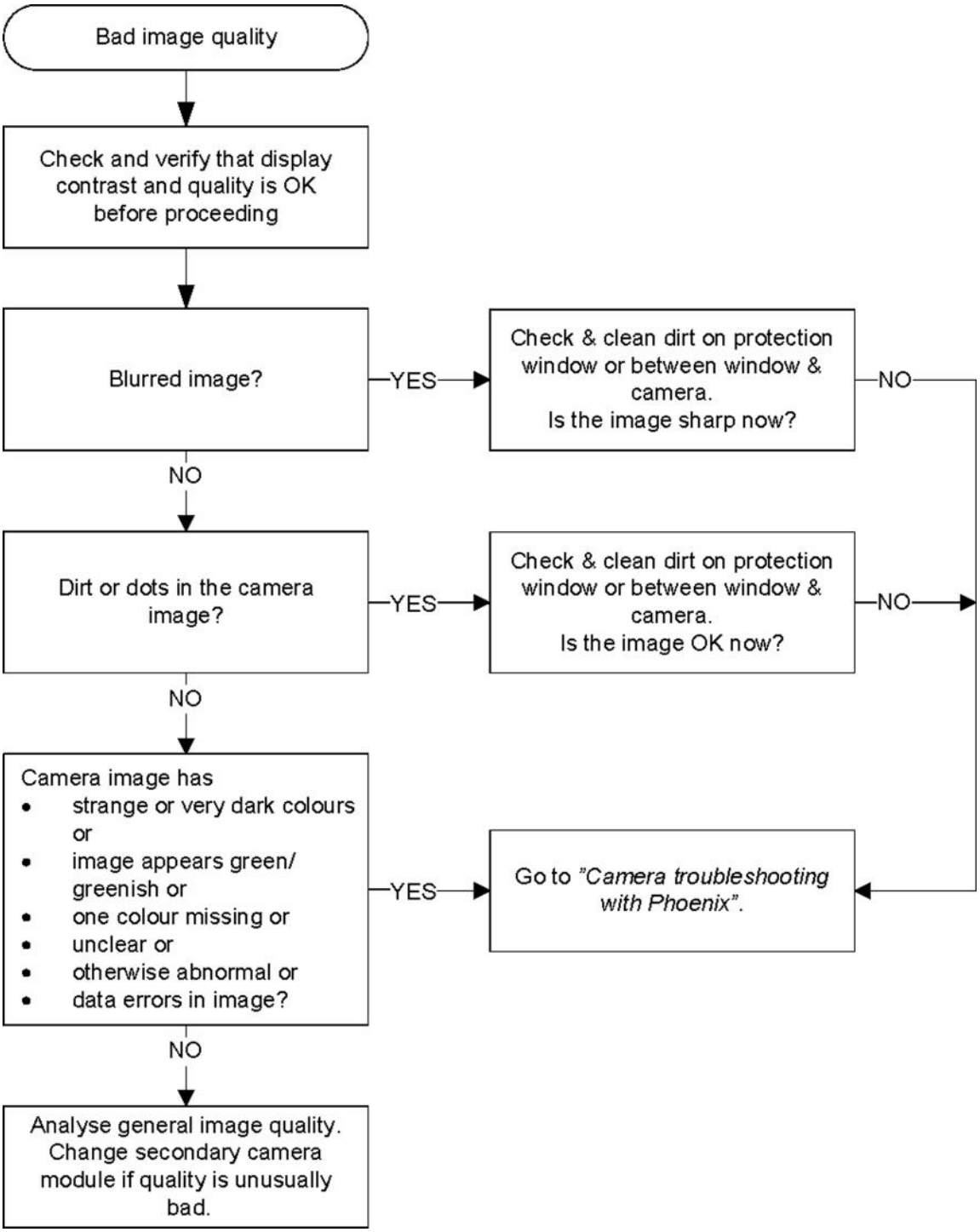
> **Note:** If a video call is used, always use the "troubled" phone when evaluating a picture in a video call. Do not evaluate the picture on the receiving phone.

Secondary camera bad image quality troubleshooting

Context

> **Note:** If a video call is used, always use the "troubled" phone when evaluating a picture in a video call. Do not evaluate the picture on the receiving phone.

Troubleshooting flow



6 — System Module

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Introduction

Phone description

RAPUYAMA is the main digital baseband ASIC in the phone. It contains functionality for both WCDMA and GSM EDGE.

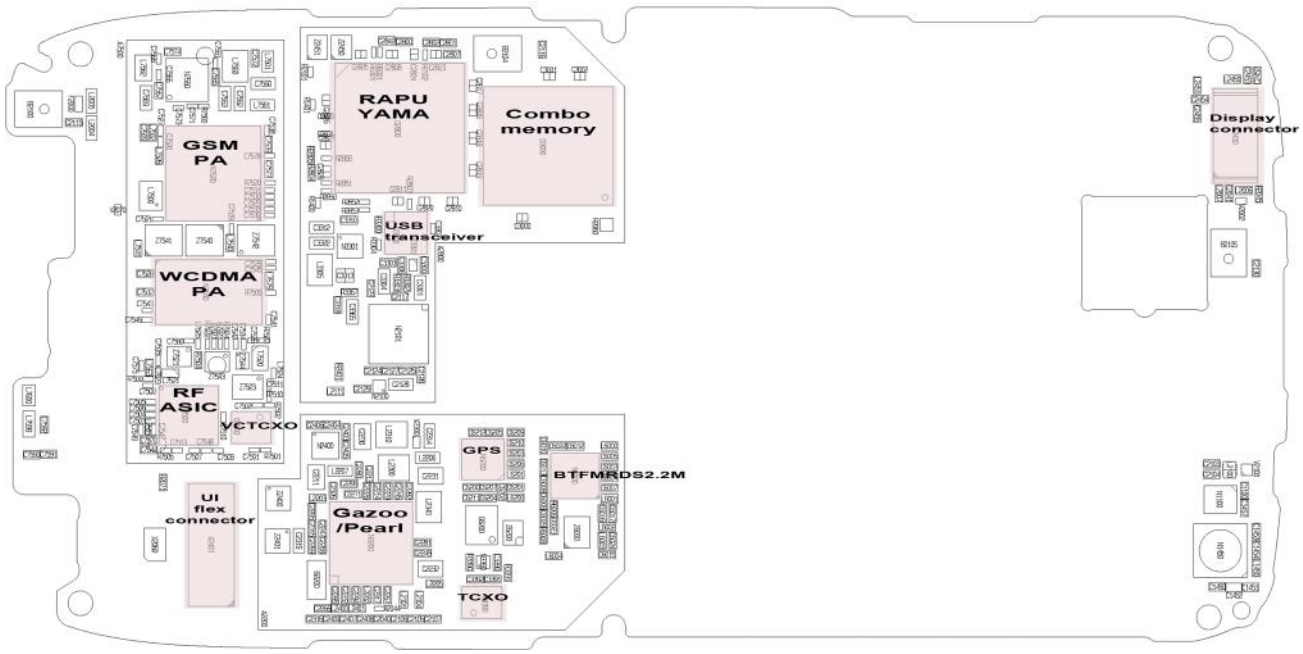
GAZOO/PEARL (N2200) is the main audio and energy management controller for the phone.

Key components

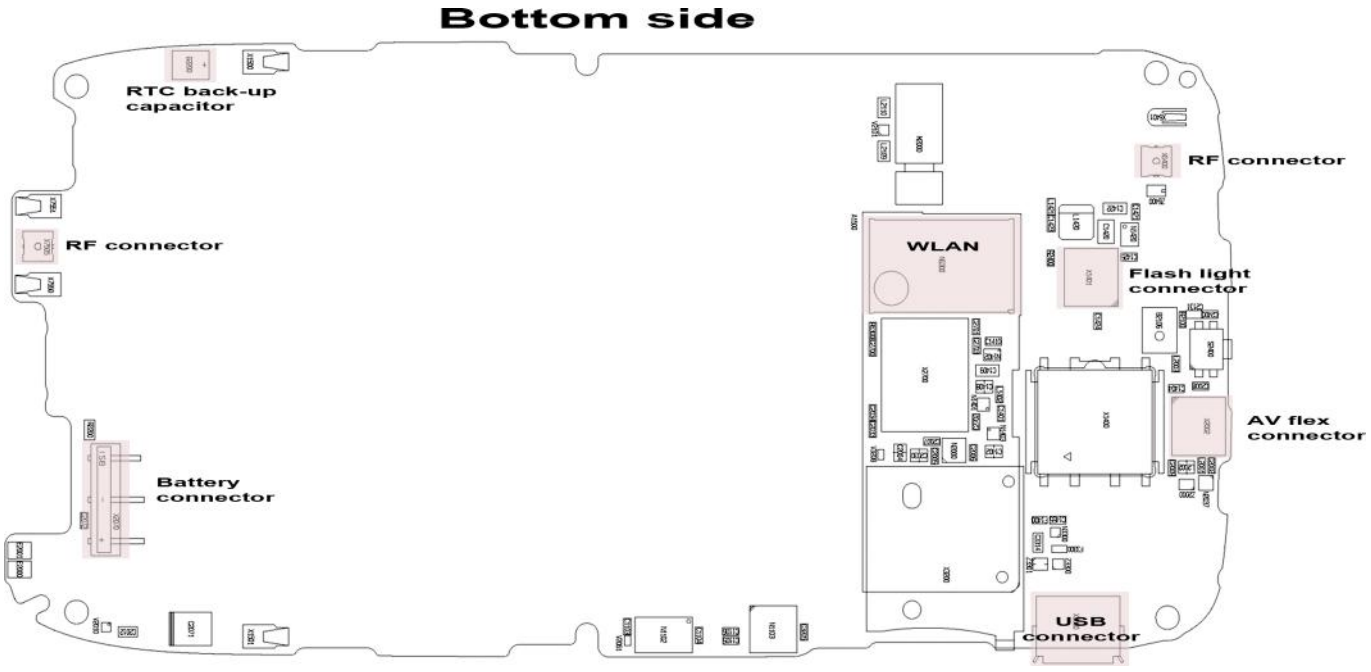
Function	Description	Item ref
Main PWB	2WS	
UI flex PWB	2WT	
Flash light PWB	2YD	
AV flex PWB	2WU	
Baseband ASIC	EM ASIC GAZOO/PEARL	N2200
RF ASIC	VAPAUS	N7500
Processor	RAPUYAMA	D2800
GSM PA	Front end module (FEM), quad band	N7520
WCDMA PA		N7540
Oscillators	VCTCXO TCXO	G7500 G3390
Memory	Combo 1G DDR + 4G M3	D3000
Back-up capacitor	RTC back-up capacitor	G2200
Bluetooth	BTFMRDS2.2M module	N6000
FM radio	BTFMRDS2.2M module	N6000
WLAN	WLAN module	N6300
GPS	GPS module	N6200
USB	USB tranceiver	D3300
Battery	BP-4L	
Battery connector	Tabby blade interface	X2070
UI flex connector	Board-to board connector for UI flex module	X2401
Flash light connector	Spring connector for flash light module	X1401
AV flex connector	Spring connector for AV flex assembly	X2002
Display connector	Board-to-board connector	X2450
RF connectors		X6400 X7505
USB connector		X3300

Key component placement

Top side



Bottom side



System module block diagram

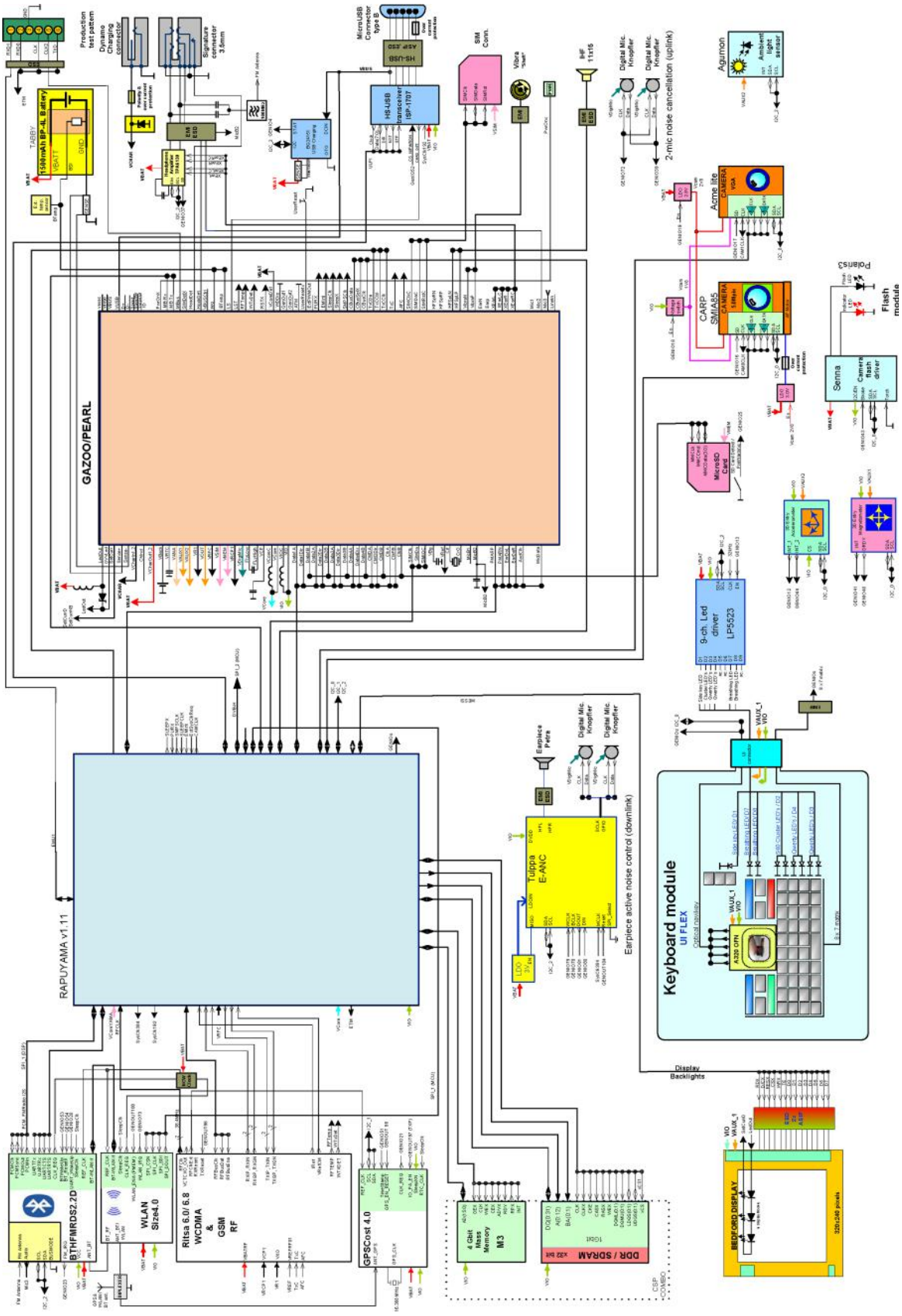


Figure 26 RM-529/RM-530 System module block diagram

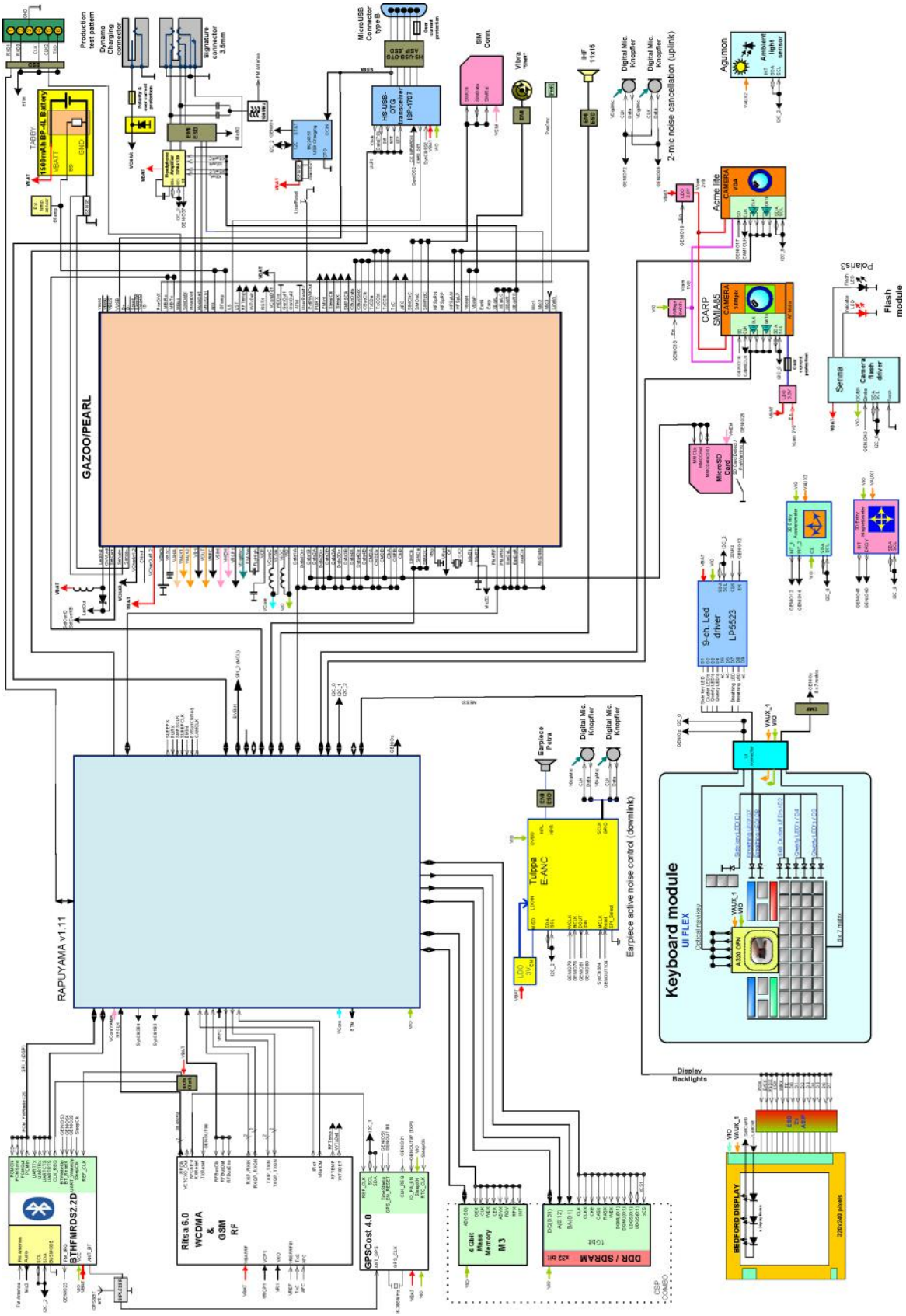


Figure 27 RM-584 System module block diagram

Energy management

Battery and charging

BP-4L battery

The phone is powered by a 3-pole BP-4L 1500 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.

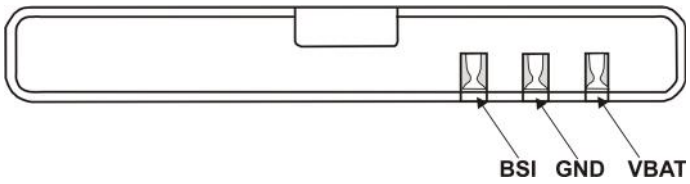


Figure 28 Battery pin order

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.

Charging

The phone is charged through the charging connector and 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 BP-4L battery is used.

Table 12 Nominal voltages

Voltage	Voltage [V]	Condition
General Conditions		
Nominal voltage	3.700	
Lower extreme voltage	3.5	

Voltage	Voltage [V]	Condition
Higher extreme voltage (fast charging)	4.1	
HW Shutdown Voltages		
Vmstr+	2.1 ± 0.1	Off to on
Vmstr-	1.9 ± 0.1	On to off
SW Shutdown Voltages		
Sw shutdown	3.1	In call
Sw shutdown	3.2	In idle
Min Operating Voltage		
Vcoff+	2.9 ± 0.1	Off to on
Vcoff-	2.7 ± 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 and the system is powered down with the aid of SW. The power key is connected to EM ASIC (N2200) via the 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 EM ASIC 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 EM ASIC 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 32kHz clock to count the REST mode delay (typically 16ms).
SLEEP	SLEEP mode is entered only from PWR_ON mode with the aid of SW when the system's activity is low.
FLASHING	FLASHING mode is for SW downloading.

Clocking scheme

In BB5.44, two main clocks are provided to the system: 38.4MHz RF clock produced by VCTCXO in the RF section and 32.768kHz sleep clock produced by EM ASIC N2200 with an external crystal.

32 k Sleep Clock is always powered on after startup. Sleep clock is used by RAPU for low-power operation.

SMPS Clk is 2.4MHz clock line from RAPU to EM ASIC N2200. In deep sleep mode, when VCTCXO is off, this signal is set to '0'-state.

CLK600. The clock source is an internal RC oscillator in EM ASIC N2200 (during the power-up sequence) or RAPU SMPS Clk.

Bluetooth and WLAN have a separate 38.4MHz TCXO clock oscillator.

Power distibution

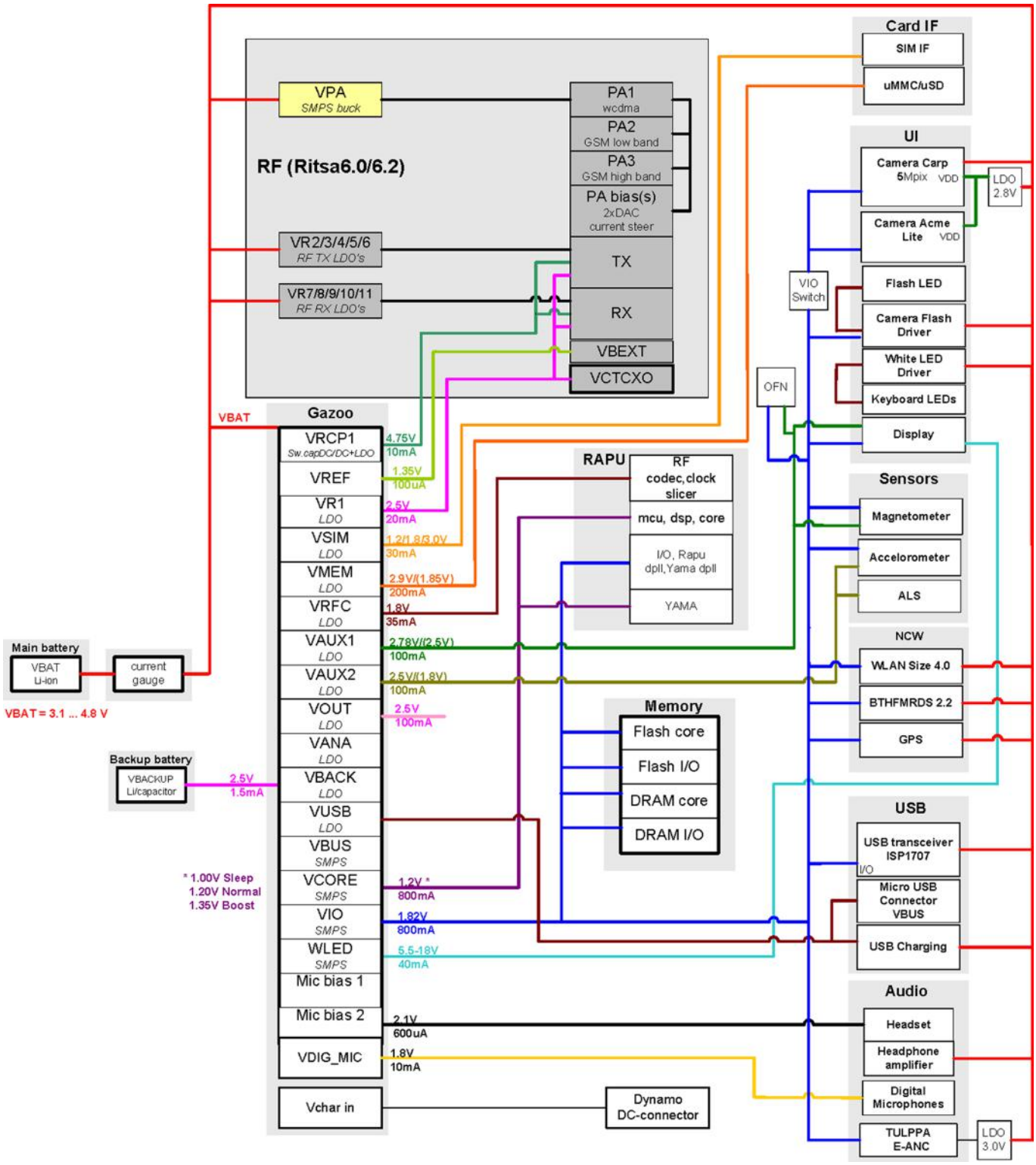


Figure 29 Power distribution diagram

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 SIM interface consists of an internal interface between RAPU and EM ASIC (N2200), and an external interface between EM ASIC and SIM connector contacts.

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

The SIM interface supports both 1.8V and 3.0V 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 (Answer to Request), a 3V interface voltage is used.

For SIM interface, see the System module block diagram in Phone description (page 6–5).

MicroSD card interface

The microSD card interface has one internal interface between RAPU and EM ASIC and one external interface between EM ASIC and the microSD card.

The removal of a microSD card is detected by a push detect switch.

For MicroSD card interface, see the System module block diagram in Phone description (page 6–5).

USB

USB interface

The phone has an interface for USB (Universal Serial Bus). USB is a differential serial bus that provides a wired connectivity between a PC and peripheral devices, as in this case a mobile phone.

The phone supports USB 2.0 with High-Speed (480 Mbps).

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

For USB interface, see the System module block diagram in Phone description (page 6–5).

MicroUSB connector

This phone is provided with a specific connector for microUSB.

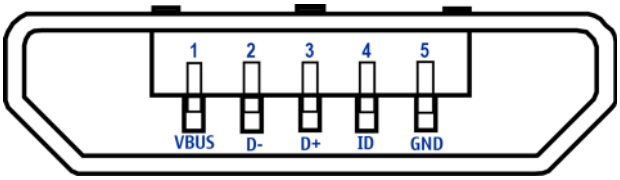


Figure 30 MicroUSB connector

User interface

Display interface

The System module block diagram illustrates the display interface, see Phone description (page 6–5).

Display backlight is provided directly by EM ASIC.

Keyboard interface

The System module block diagram shows the keyboard interface, see Phone description (page 6–5). The keyboard interface is implemented with RAPU's GENIOs. Keyboard GENIOs are protected from ESD with 10-channel ASIPs Z2400 and Z2401.

The keyboard illumination is handled by a separate LED driver. The driver is controlled by I2C bus.

Optical navi key interface

The optical finger navigation (OFN) sensor is connected to I2C bus. Two GENIOs are reserved for interrupts and two others for reset and shutdown functions.

The OFN sensor captures the image of finger print and detects the direction of finger movement. This is done by using IR LED whose light is reflected from the finger to the sensor through a lens.

Ambient light sensor (ALS) interface

Ambient light sensor information is used to control keyboard and display brightness.

- Keyboard backlight is turned OFF, when it is not needed.
- Display brightness is dimmed, when environment lighting is dark.

The ambient light sensor is calibrated in production and can be re-tuned in service points, though not recommended unless calibration coefficient is lost for some reason.

For ALS interface, see the System module block diagram in Phone description (page 6–5).

Accelerometer

The accelerometer measures the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion or shock.

It has the following features:

- 2.16V to 3.6V supply voltage
- 1.8V compatible IOs
- Low power consumption
- ±2g/±8g dynamically selectable scale
- I^2C/SPI digital output interface
- Embedded self test
- 10000g high shock survivability
- Pb free/RoHS compliancy

The accelerometer (N1102) is connected to I2C. One GENIO is reserved for interrupt.

For accelerometer interface, see the System module block diagram in Phone description (page 6–5).

Magnetometer

The device has an I2C controlled 3-axis magnetometer for compassing purpose.

The magnetometer has the following features:

- 3-axis magnetometer device suitable for compass application
- Built-in A to D converter for magnetometer data out
- Self test function
- I2C bus interface
- Power modes: OFF mode, stand-by mode and active mode
- DRDY function for measurement data ready
- INT function to inform exceeding magnetic field strength threshold.

The operating temperature is -20°C to +85°C.

The operating supply voltages are:

- Analogue supply +2.4V to +3.6V
- Digital interface supply +1.70V to analogue supply voltage.

For magnetometer interface, see the System module block diagram in Phone description (page 6–5).

GPS interface

The device includes an inbuilt GPS receiver and it works as a stand-alone positioning device.

The GPS system is connected to RAPU ASIC.

For GPS interface, see the System module block diagram in Phone description (page 6–5).

WLAN interface

The phone contains a WLAN transceiver, that provides a fully integrated wireless radio solution. The WLAN transceiver supports the IEEE 802.11 standards for low error rate data transfer between mobiles and WLAN networks. Data rates up to 54Mbps are possible in 802.11g mode of operation.

WLAN shares the antenna with Bluetooth.

The WLAN software is downloaded from RAPU when WLAN is turned on, over the dedicated SPI interface.

For WLAN interface, see the System module block diagram in Phone description (page 6–5).

Camera interface

The device has an autofocus (AF) type main camera.

In this device the main camera, the secondary camera and the camera flash driver are connected directly to RAPU and controlled by the I2C bus, port 0. Both cameras are supplied by separate voltage regulators enabled by the camera software (GENIOs).

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

For camera interface, see the System module block diagram in Phone description (page 6–5).

Audio interface

The System module block diagram illustrates the audio interface of the phone, see Phone description (page 6–5).

The digital uplink microphones are connected directly to RAPU. There are two uplink microphones, primary and secondary, which are required for the uplink Two Microphone Noise Cancellation (2micNC) algorithm and are located at the lower end of the phone.

Stereo output is provided by a separate stereo audio amplifier which is connected to EM ASIC. The output from the stereo audio amplifier is fed to the AV connector.

The earpiece is driven by Tulppa chip which includes an amplifier and Earpiece Active Noise Control (EANC). The EANC uses two digital microphones: the one next to the earpiece is called error microphone and the other close to the main camera is called reference microphone.

The stereo IHF speaker is driven directly by a built-in stereo amplifier included in EM ASIC.

The vibra is driven directly by a built-in amplifier included in EM ASIC.

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 BTHFM 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.

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

Bluetooth shares the antenna with WLAN.

For Bluetooth interface, see the System module block diagram in Phone description (page 6–5).

FM radio interface

The FM radio system is controlled by RAPU via the I2C bus. EM ASIC delivers the needed voltages and the clock reference (32.768kHz SleepClk). EM ASIC also processes the analog audio.

The FM receiver fully supports reception over US/European (87.5MHz to 108MHz) FM band. The FM receiver comprises an RF receiver with fully integrated VCO, a stereo FM demodulator and an RDS demodulator.

A headset accessory is used as an external antenna. The headset is connected to the AV connector.

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

For FM radio interface, see the System module block diagram in Phone description (page 6–5).

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 (e.g. 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 (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 bandwith of the system in use (e.g. GSM900).

The transmitter functions are implemented in the RF ASIC.

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

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Glossary

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

DCT-4	Digital Core Technology
DMA	Direct memory access
DP	Data Package
DPLL	Digital Phase Locked Loop
DSP	Digital Signal Processor
DTM	Dual Transfer Mode
DtoS	Differential to Single ended
EDGE	Enhanced data rates for global/GSM evolution
EGSM	Extended GSM
EM	Energy management
EMC	Electromagnetic compatibility
EMI	Electromagnetic interference
ESD	Electrostatic discharge
FCI	Functional cover interface
FM	Frequency Modulation
FPS	Flash Programming Tool
FR	Full rate
FSTN	Film compensated super twisted nematic
GMSK	Gaussian Minimum Shift Keying
GND	Ground, conductive mass
GPIB	General-purpose interface bus
GPRS	General Packet Radio Service
GSM	Group Special Mobile/Global System for Mobile communication
HSDPA	High-speed downlink packet access
HF	Hands free
HFCM	Handsfree Common
HS	Handset
HSCSD	High speed circuit switched data (data transmission connection faster than GSM)
HW	Hardware
I/O	Input/Output
IBAT	Battery current
IC	Integrated circuit
ICHAR	Charger current
IF	Interface
IHF	Integrated hands free
IMEI	International Mobile Equipment Identity

IR	Infrared
IrDA	Infrared Data Association
ISA	Intelligent software architecture
JPEG/JPG	Joint Photographic Experts Group
LCD	Liquid Crystal Display
LDO	Low Drop Out
LED	Light-emitting diode
LPRF	Low Power Radio Frequency
MCU	Micro Controller Unit (microprocessor)
MCU	Multiport control unit
MIC, mic	Microphone
MIDP	Mobile Information Device Profile
MIN	Mobile identification number
MIPS	Million instructions per second
MMC	Multimedia card
MMS	Multimedia messaging service
MP3	Compressed audio file format developed by Moving Picture Experts Group
MTP	Multipoint-to-point connection
NFC	Near field communication
NTC	Negative temperature coefficient, temperature sensitive resistor used as a temperature sensor
OMA	Object management architecture
OMAP	Operations, maintenance, and administration part
Opamp	Operational Amplifier
PA	Power amplifier
PCM	Pulse Code Modulation
PDA	Pocket Data Application
PDA	Personal digital assistant
PDRAM	Program/Data RAM (on chip in Tiku)
Phoenix	Software tool of DCT4.x and BB5
PIM	Personal Information Management
PLL	Phase locked loop
PM	(Phone) Permanent memory
PUP	General Purpose IO (PIO), USARTS and Pulse Width Modulators
PURX	Power-up reset
PWB	Printed Wiring Board

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

USB	Universal Serial Bus
VBAT	Battery voltage
VCHAR	Charger voltage
VCO	Voltage controlled oscillator
VCTCXO	Voltage Controlled Temperature Compensated Crystal Oscillator
VCXO	Voltage Controlled Crystal Oscillator
VF	View Finder
Vp-p	Peak-to-peak voltage
VSIM	SIM voltage
WAP	Wireless application protocol
WCDMA	Wideband code division multiple access
WD	Watchdog
WLAN	Wireless local area network
XHTML	Extensible hypertext markup language
Zocus	Current sensor (used to monitor the current flow to and from the battery)

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