

Nokia Customer Care

Service Manual

RM-313 (Nokia N82; L3&4)

Part No: (Issue 1)

COMPANY CONFIDENTIAL



Amendment Record Sheet

Amendment No	Date	Inserted By	Comments
Issue 1	11/2007	ATu	

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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.

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.

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

Use the battery only for its intended purpose.

Never use any charger or battery which is damaged.

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

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

Do not dispose of batteries in a fire!

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

Nokia N82; L3&4 Service Manual Structure

- 1 General Information
- 2 Service Tools and Service Concepts
- 3 BB Troubleshooting and Tuning Guide
- 4 RF troubleshooting
- 5 Camera Module Troubleshooting
- 6 System Module
- Glossary

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Nokia Customer Care

1 — General Information



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■ Product selection

RM-313 is a WCDMA/GSM dual mode handportable phone, supporting EGSM850/900/1800/1900 and WCDMA2100.

RM-313 is a 3GPP Release 5 terminal supporting WCDMA/HSDPA, EGPRS and GPRS data bearers. For WCDMA HSDPA the maximum bit rate is up to 3.6 Mbps for downlink and 384 kbps for uplink with simultaneous CS speech or CS video (max. 64 kbps).

For 2G and 2.5G networks the RM-313 is a Class A EGPRS DTM MSC 11 which means maximum download speed of up to 236.8 kbps simultaneously with speech or Class B EGPRS MSC 32 which means a in maximum download speed of up to 296kbit/s with EGPRS, and up to 107kbit/s with GPRS.

According to GSM standard 05.05 it responds to class 4 (max. 2W) in GSM 850 and EGSM 900 class 1 (1W) in DCS 1800 and class 1 in PCS 1900. RM-313 supports EGPRS (EDGE) class B as well as Bluetooth 2.0 EDR standard.

RM-313 supports two way video calls with two integrated cameras, one on the front and one on the back.

RM-313 is an MMS (Multimedia Messaging Service) enabled multimedia computer with a 2.4" QVGA (240 x 320 pixels) TFT colour display and an integrated 5 Megapixel auto focus camera. The MMS implementation follows the OMA MMS standard release 1.2. The Browser is a highly advanced internet browser also capable of viewing operator domain XHTML Mobile Profile (MP) content.

RM-313 uses Symbian 9.2 operating system and supports also MIDP Java 2.0 & CLDC1.1, providing a good platform for compelling 3rd party applications.

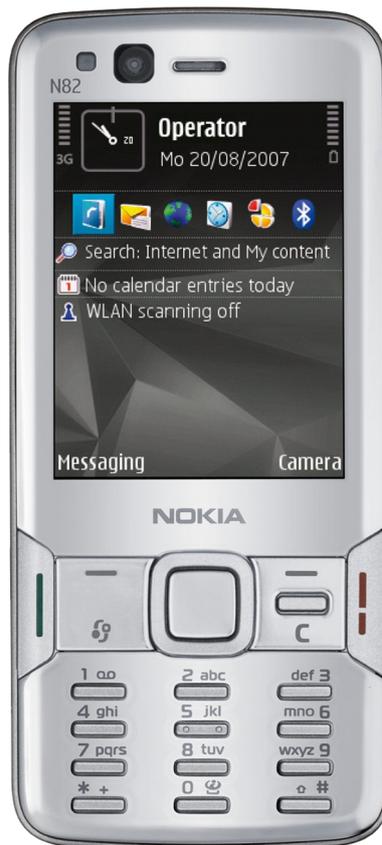


Figure 1 View of RM-313

■ Product features and sales package

Imaging

Main camera:

- Sensor: CMOS, 5 megapixel
- Carl Zeiss Optics: Tessar™ lens
- F number/Aperture: F2.8
- Focal length: 5.6 mm
35 mm (35 mm equiv.)
- Focus range: 10 cm ~ infinity
- Macro focus distance: 10-50 cm
- Shutter speed: Mechanical shutter 1/1000~1/4 s
- Lens protection: Sliding cover with activation

Video:

- Video resolution: up to VGA at 30 fps
- Audio recording: AAC (AMR for MMS)
- Video stabilization
- Video clip length: 59 min 59 sec
- Video file format: .mp4 (default) , .3gp (for MMS)
- White balance: automatic, sunny, cloudy, incandescent, fluorescent
- Scene: Auto, Night
- Colour tone: normal, sepia, B&W, vivid, negative
- Zoom (optical/digital): 1x / up to 10x (VGA 4X)

Photo:

- Still image resolutions: up to 5 megapixel: 2592 x 1944
- Still image file format: JPEG/EXIF
- Auto focus
- Auto exposure: center weighted AE
- Image orientation: automatic
- Exposure compensation: +2 ~ -2EV at 0.5 step
- White balance: automatic, sunny, cloudy, incandescent, fluorescent
- Scene: auto, sports, portrait, close-up, landscape, night, user defined
- Colour tone: normal, sepia, B&W, vivid, negative
- Zoom (digital): up to 20x (5Mpix 6X)

Other camera features:

- Xenon flash and recording indicator
- Front camera, CIF (352 x 288) sensor

Edit

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

View

- 2.4" QVGA (240 x 320 pixels) TFT colour display, ambient light detector - used to optimize display and keypad backlight brightness and power consumption
- Slideshow from Gallery

Share

- Nokia XpressShare - share effortlessly from Gallery or after capture via Email, Bluetooth or MMS
- Direct connection to TV via cable or WLAN (UPnP)
- Video call and video sharing support. (WCDMA services)
- Online Album : Image/Video uploading from Gallery

Print

- Nokia XpressPrint – direct printing via USB (PictBridge), Bluetooth (BPP), and WLAN (UPnP), from memory card or via online printing

Store

- Nokia XpressTransfer – easy to transfer and organize photos and video between your device and a compatible PC
- Photoshop Album 3.0 Starter Edition (PC)
- Nokia Lifeblog (mobile & PC)

Music

- Digital music player: supports MP3/AAC/M4A/WMA with playlists
- Dedicated music keys
- OMA DRM 2.0 & WMDRM support for music
- Stereo FM radio (87.5-108MHz)
- Integrated stereo handsfree speakers
- Music headset HS-44 & music remote AD-43

Media

- Mobile TV experience with video streaming
- Full web browser support (HTML)
- Visual Radio™ support

Productivity

Messaging:

- E-mail (SMTP, IMAP4, POP3), MMS, SMS

Office applications:

- Viewing of email attachments – .doc, .xls, .ppt, .pdf

PIM:

- Contacts, calendar, to-do, notes, recorder, calculator, clock, converter

Synchronization:

- Local/Remote (using SyncML)
 - Data: Calendar, Contacts, To-do, Notes, E-mail
 - PC Applications: Microsoft Outlook (98, 2000, 2002, 2003), Outlook Express, Lotus Organizer (5.0, 6.0), Lotus Notes (5.0, 6.0)

Call management:

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

- Nokia Push to Talk (PoC)

Connectivity

- WLAN - IEEE802.11 g/b with UPnP support
- Micro USB type B interface with USB 2.0 full speed
- 3.5mm stereo headphone plug and TV out support (PAL/NTSC)
- Bluetooth wireless technology 2.0 with A2DP stereo audio

Add-on software framework

- Symbian 9.2 OS
- Nokia Series 60, 3rd edition, feature pack 3.1
- Java: MIDP2.0
- C++ and Java SDKs

Additional technical specifications

- Vibrating alert
- 3GPP Rel 5 compliant
- Speech codecs supported in WCDMA: AMR
- Speech codecs supported in GSM: FR AMR/HR AMR/EFR/FR/HR
- WCDMA HSDPA 2100 MHz with simultaneous voice and packet data (PS max speed DL/UL= 3.6Mbps/ 384kbps, CS max speed 64kbps)
- Dual Transfer Mode (DTM) support for simultaneous voice and packet data connection in GSM/EDGE networks. Simple class A, multi slot class 11, max speed DL/UL: 118.4/118.4kbits/s
- EGPRS class B, multi slot class 32, (5 Rx + 3 Tx / Max Sum 6), max speed DL/UL= 296 / 177.6 kbits/s
- GPRS class B, multi slot class 32 (5 Rx + 3 Tx / Max Sum 6), max speed DL/UL= 107 / 64.2 kbits/s
- GPS

Sales package

- Transceiver RM-313
- Charger (AC-5)
- Battery (BP-6MT)
- Music headset (HS-43)
- Connectivity cable (CA-101)
- Video out cable (CA-75U)
- MicroSD card (MU-37)

■ Mobile enhancements

Table 1 Audio

Enhancement	Type
Music headset	HS-44 with AD-43 3.5mm stereo plug, HS-45 with AD-54 3.5mm stereo plug
Basic headset	HS-41
Stereo headset	HS-48, HS-16, HS-43

Enhancement	Type
Bluetooth headset	BH-900, BH-902 & BH-903
	BH-800
	STEREO BH-501
	BH-601
	MONO BH-200, BH-201
	BH-202
	BH-303
	BH-300
	BH-702
	BH-500
	BH-600, BH-602 & BH-604
	BH-101
	BH-803
Wireless stereo gateway	AD-42W
Music headphone	HS-61
Advanced headphone	HS-62
Music speaker	MD-3
Mini speaker	MD-4, MD-6
Audio Adapter	AD-53, AD-63
BT speakers	MD-5W, MD-7W
FM transmitters	CA-300

Table 2 Car

Enhancement	Type
Mobile charger	DC-4
Wireless plug-in car handsfree	HF-500
	HF-33W
	HF-300
Car kit	Nokia 616, 810
Multimedia car kit	CK-20W, CK-7W & CK-15W

Table 3 Data

Enhancement	Type
Connectivity cable	CA-101

Enhancement	Type
Video connectivity cable	CA-75U
MicroSD card	128MB - 2GB

Table 4 GPS

Enhancement	Type
Wireless GPS module	LD-3W
Navigation pack	LD-2

Table 5 Messaging

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

Table 6 Power

Enhancement	Type
Battery 1050mAh Li-ion	BP-6MT
Travel charger	AC-5
	AC-6, CA-100
Charger adapter	CA-44

Table 7 Carrying

Enhancement	Type
Carrying case	

■ Technical specifications

Transceiver general specifications

Unit	Dimensions (L x W x T) (mm)	Weight (g)	Volume (cm ³)
Transceiver with BP-6MT 1050mAh li-ion battery back	112 x 50.2 x 17.3	~ 120	

Main RF characteristics for GSM850/900/1800/1900 and WCDMA 2100 phones

Parameter	Unit
Cellular system	GSM850, EGSM900, GSM1800/1900, WCDMA 2100
Rx frequency band	GSM850: 869 - 894MHz
	EGSM900: 925 - 960 MHz
	GSM1800: 1805 - 1880 MHz
	GSM1900: 1930 - 1990 MHz
	WCDMA2100: 2110 - 2170 MHz
Tx frequency band	GSM850: 824 - 849MHz
	EGSM900: 880 - 915 MHz
	GSM1800: 1710 - 1785 MHz
	GSM1900: 1850 - 1910 MHz
	WCDMA2100: 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 -50 ... 24 dBm
Number of RF channels	GSM850: 124
	GSM900: 174
	GSM1800: 374
	GSM1900: 299
Number of WCDMA channels	WCDMA: 277
Channel spacing	200 kHz
Number of Tx power levels	GSM850: 15
	GSM900: 15
	GSM1800: 16
	GSM1900: 16

Battery endurance

Battery	Capacity (mAh)	Talk time	Stand-by
BP-6MT	1050	up to 180 min (WCDMA) up to 250 min (GSM)	up to 215 h (WCDMA) up to 230 h (GSM)

Charging times

AC-6
1h 30 min

Environmental conditions

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

2 — Service Tools and Service Concepts

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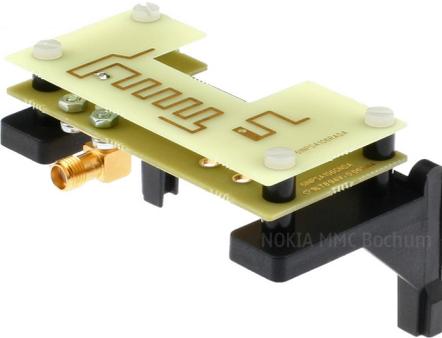
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■ **New tools**

The table below gives a short overview of service tools that can be used for testing, error analysis and repair of product RM-313, refer to various concepts.

 <p>FS-65</p>	FS-65	Flash adapter	
<p>FS-65 has the following features:</p> <ul style="list-style-type: none"> • Provides galvanic connection to terminal test pads • Provides standardized interface towards Control Unit • Provides RF connection using galvanic connector or coupler 			
 <p>MJ-151</p>	MJ-151	Module jig	
<p>MJ-151 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.</p>			
 <p>RJ-189</p>	RJ-189	Soldering jig	
<p>The jig is used for soldering and as a rework jig for the system module. It is made of lead-free rework compatible material.</p>			
 <p>SA-106</p>	SA-106	RF coupler	
<p>SA-106 is an RF coupler for WCDMA and GSM RF testing. It is used together with the product-specific flash adapter.</p>			

■ **Reused tools**

The table below gives a short overview of service tools that can be used for testing, error analysis and repair of product RM-313, refer to various concepts.

 <p>CA-101 100cm</p>	CA-101	Micro USB cable	
<p>The CA-101 is a USB-to-microUSB data cable that allows connections between the PC and the phone.</p>			
	CA-31D	USB cable	
<p>The CA-31D USB cable is used to connect FPS-10 or FPS-11 to a PC. It is included in the FPS-10 and FPS-11 sales packages.</p>			
	CA-35S	Power cable	
<p>CA-35S is a power cable for connecting, for example, the FPS-10 flash promoter to the Point-Of-Sales (POS) flash adapter.</p>			



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

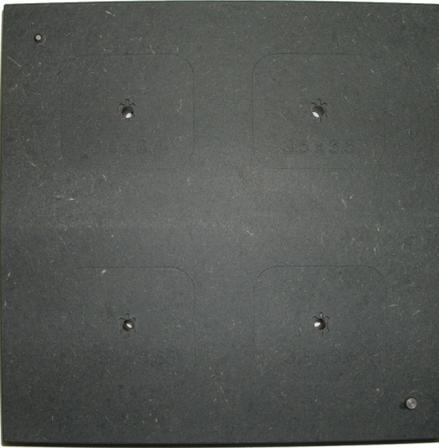
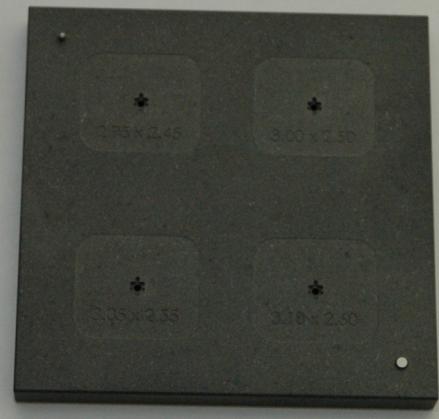
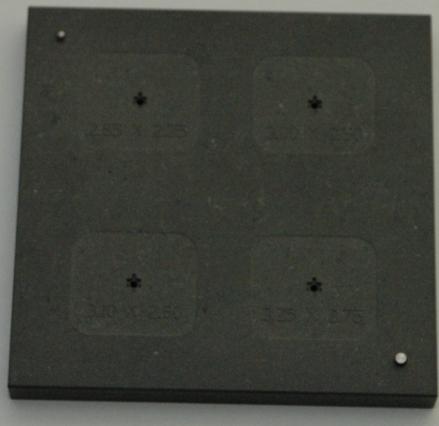
- 1 Connect a service tool (jig, flash adapter) to CU-4.
- 2 Connect CU-4 to your PC with a USB cable.
- 3 Connect supply voltage (12 V)
- 4 Connect an FBUS cable (if necessary).
- 5 Start Phoenix service software.

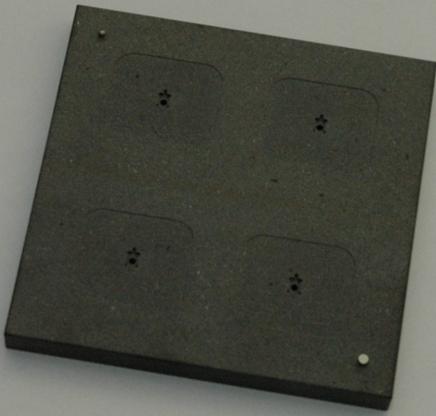
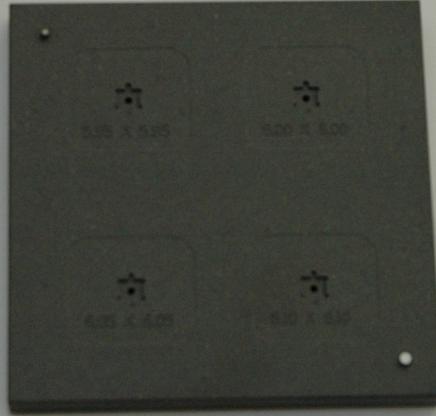
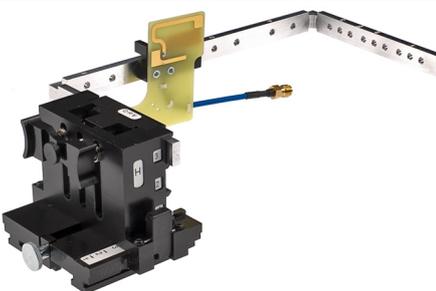


Note: Phoenix enables CU-4 regulators via USB when it is started.

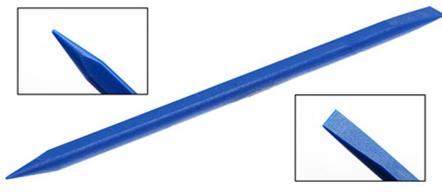
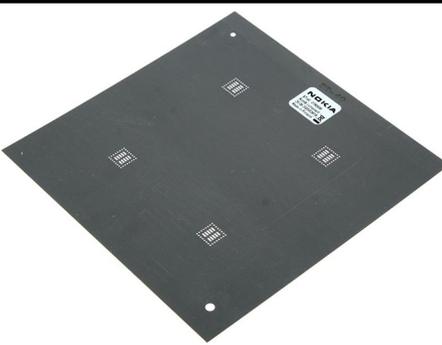
Reconnecting the power supply requires a Phoenix restart.

	FPS-10	Flash prommer	
	PCS-1	Power cable	
	PKD-1	SW security device	
<p>FPS-10 interfaces with:</p> <ul style="list-style-type: none"> • PC • Control unit • Flash adapter • Smart card <p>FPS-10 flash prommer features:</p> <ul style="list-style-type: none"> • Flash functionality for BB5 and DCT-4 terminals • Smart Card reader for SX-2 or SX-4 • USB traffic forwarding • USB to FBUS/Flashbus conversion • LAN to FBUS/Flashbus and USB conversion • Vusb output switchable by PC command <p>FPS-10 sales package includes:</p> <ul style="list-style-type: none"> • FPS-10 prommer • Power Supply with 5 country specific cords • USB cable <p>Note: FPS-21 is substitute FPS-10 if FPS-10 has not been set up.</p> <p>The PCS-1 power cable (DC) is used with a docking station, a module jig or a control unit to supply a controlled voltage.</p> <p>SW security device is a piece of hardware enabling the use of the service software when connected to the parallel (LPT) port of the PC. Without the device, it is not possible to use the service software. Printer or any such device can be connected to the PC through the device if needed.</p>			

	RJ-105	Rework jig	
<p>RJ-105 is a jig used for soldering and as a rework jig for the engine module. It is used together with the ST-38 stencil.</p>			
	RJ-157	Rework jig	
<p>RJ-157 is a jig used for soldering and as a rework jig for the engine module. It is used together with the ST-55 stencil.</p>			
	RJ-160	Rework jig	
<p>RJ-160 is a jig used for soldering and as a rework jig for the engine module. It is used together with the ST-55 stencil.</p>			

	RJ-166	Rework jig	
<p>RJ-166 is a jig used for soldering and as a rework jig for the engine module. It is used together with the ST-53 stencil.</p>			
	RJ-169	Rework jig	
<p>RJ-169 is a jig used for soldering and as a rework jig for the engine module. It is used together with the ST-59 stencil.</p>			
	RJ-93	Rework jig	
<p>RJ-93 is a rework jig used with ST-40.</p>			
	SA-131	RF coupler	
<p>SA-131 is a generic device for GPS testing. It is used together with SS-62.</p>			

	SB-6	Bluetooth tester	
<p>The SB-6 test box is a generic device to perform Bluetooth bit error rate testing and doing cordless FBUS connection via Bluetooth.</p>			
	SB-7	WLAN test box	
<p>WLAN test requires defined position for the device.</p>			
	SPS-2	Soldering paste spreader	
	SRT-6	Opening tool	
<p>SRT-6 is used to open phone covers.</p>			

	SS-46	Interface adapter	
<p>SS-46 acts as an interface adapter between the flash adapter and FPS-10.</p>			
	SS-62	Generic flash adapter base for BB5	
<ul style="list-style-type: none"> • 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	
<p>SS-93 is used for opening JAE connectors.</p>			
	ST-38	Rework stencil	
<p>ST-38 is a rework stencil used with rework jig RJ-105.</p>			
	ST-40	Rework stencil	
<p>ST-40 is a rework stencil and used with RJ-93.</p>			

	ST-53	Rework stencil	
<p>ST-53 is a rework stencil used with rework jig RJ-166.</p>			
	ST-55	Rework stencil	
<p>ST-55 is a rework stencil used with rework jig RJ-157 and RJ-160.</p>			
	ST-59	Rework stencil	
<p>ST-59 is a rework stencil used with rework jig RJ-169.</p>			
	SX-4	Smart card	
<p>SX-4 is a BB5 security device used to protect critical features in tuning and testing. SX-4 is also needed together with FPS-10 when DCT-4 phones are flashed.</p>			

	XCS-1	Service cable	
<p>The XCS-1 service cable is used to connect FLS-4S to the POS flash adapter for supplying a controlled operating voltage and data connection.</p>			
	XCS-4	Modular cable	
<p>XCS-4 is a shielded (one specially shielded conductor) modular cable for flashing and service purposes.</p>			
	XRS-6	RF cable	
<p>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.</p> <p>Attenuation for:</p> <ul style="list-style-type: none"> • GSM850/900: 0.3+-0.1 dB • GSM1800/1900: 0.5+-0.1 dB • WLAN: 0.6+-0.1dB 			

■ Service concepts

POS (Point of Sale) flash concept

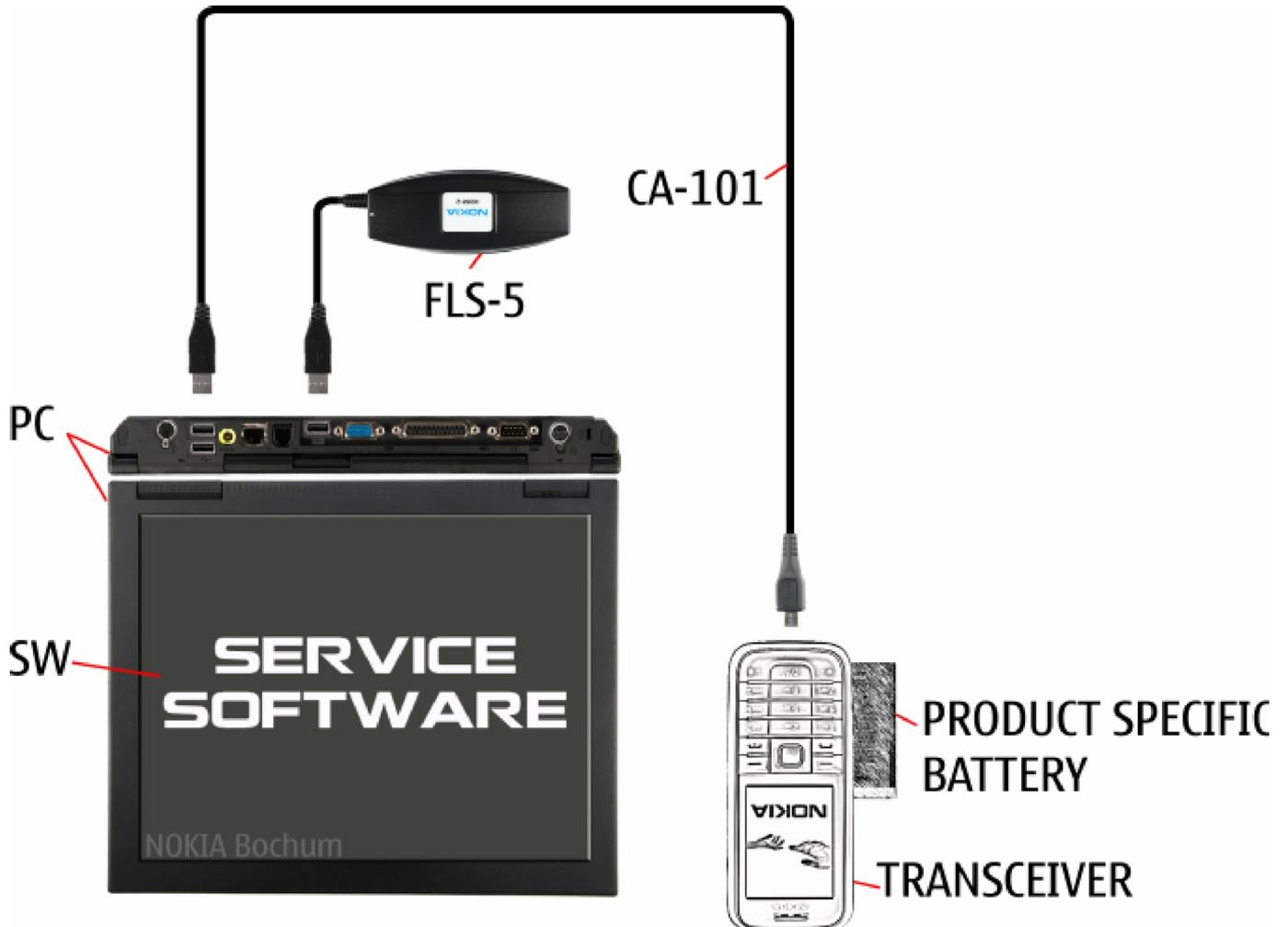


Figure 2 POS flash concept

Type	Description
Product specific tools	
BP-6MT	Battery
Other tools	
FLS-5	POS flash dongle
	PC with Phoenix service software
Cables	
CA-101	USB connectivity cable

Flash concept with FPS-10

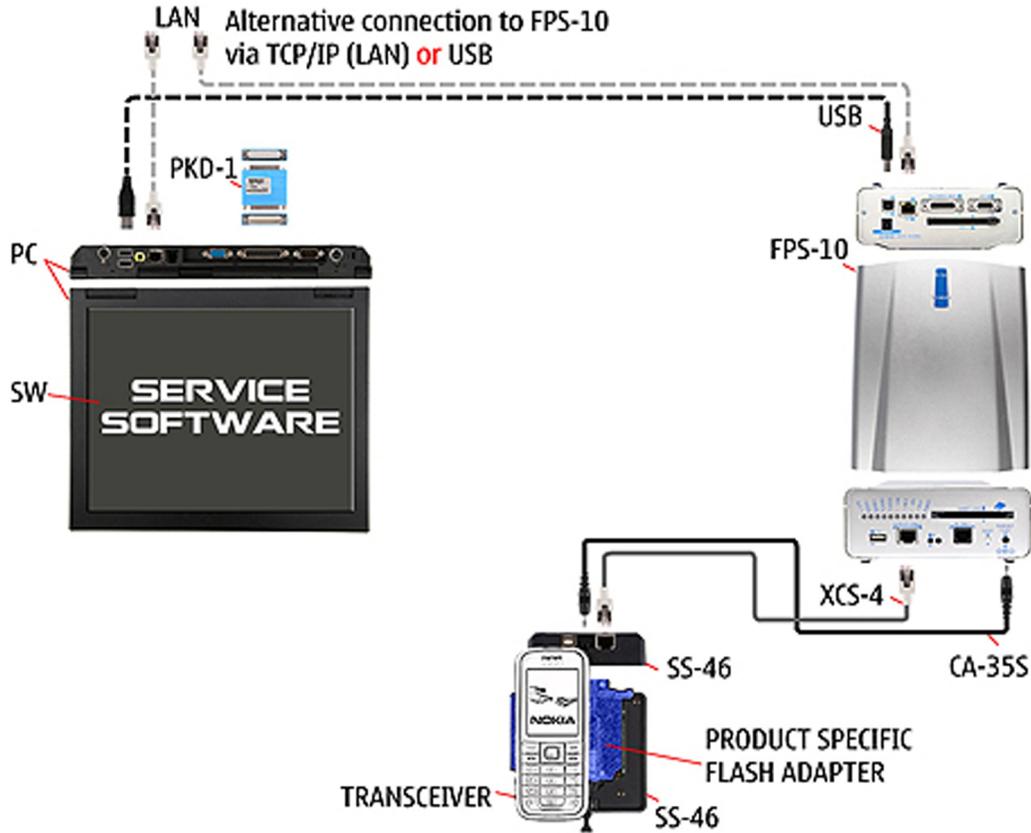


Figure 3 Basic flash concept with FPS-10

Type	Description
Product specific devices	
FS-65	Flash adapter
Other devices	
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-46	Interface adapter
	PC with Phoenix service software
Cables	
XCS-4	Modular cable
CA-35S	Power cable
	USB cable

CU-4 flash concept with FPS-10

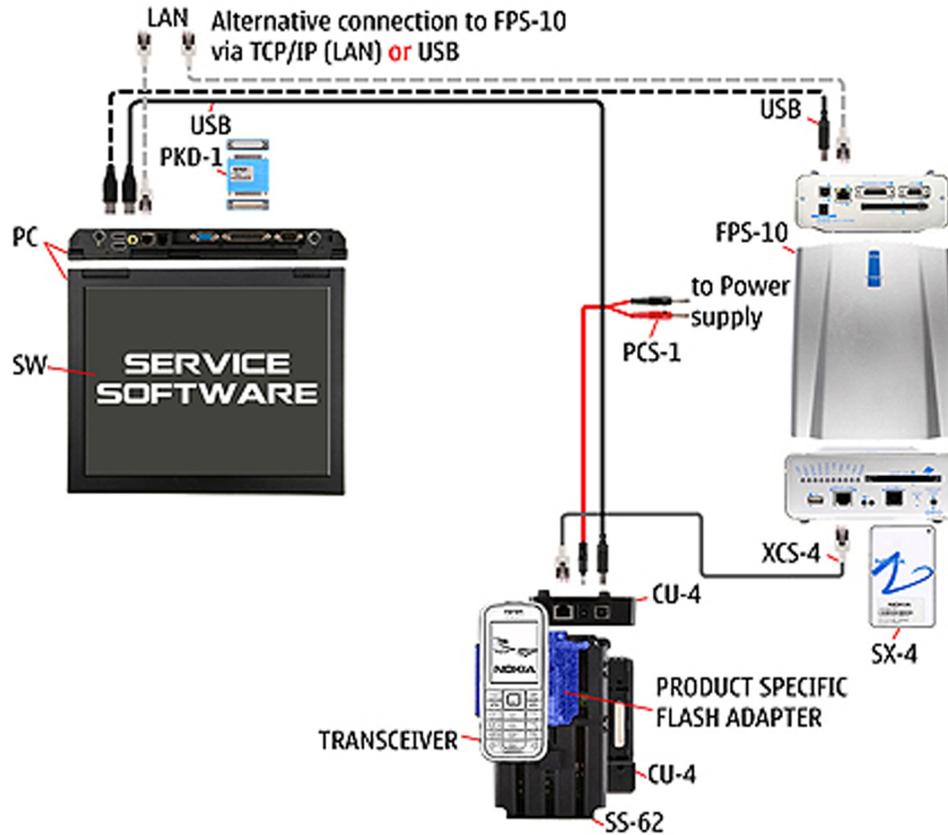


Figure 4 CU-4 flash concept with FPS-10

Type	Description
Product specific devices	
FS-65	Flash adapter
Other devices	
CU-4	Control unit
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-62	Flash adapter base
SX-4	Smart card
	PC with Phoenix service software
Cables	
PCS-1	Power cable
XCS-4	Modular cable
	Standard USB cable
	USB cable

Flash concept with FPS-10 and JBT-9

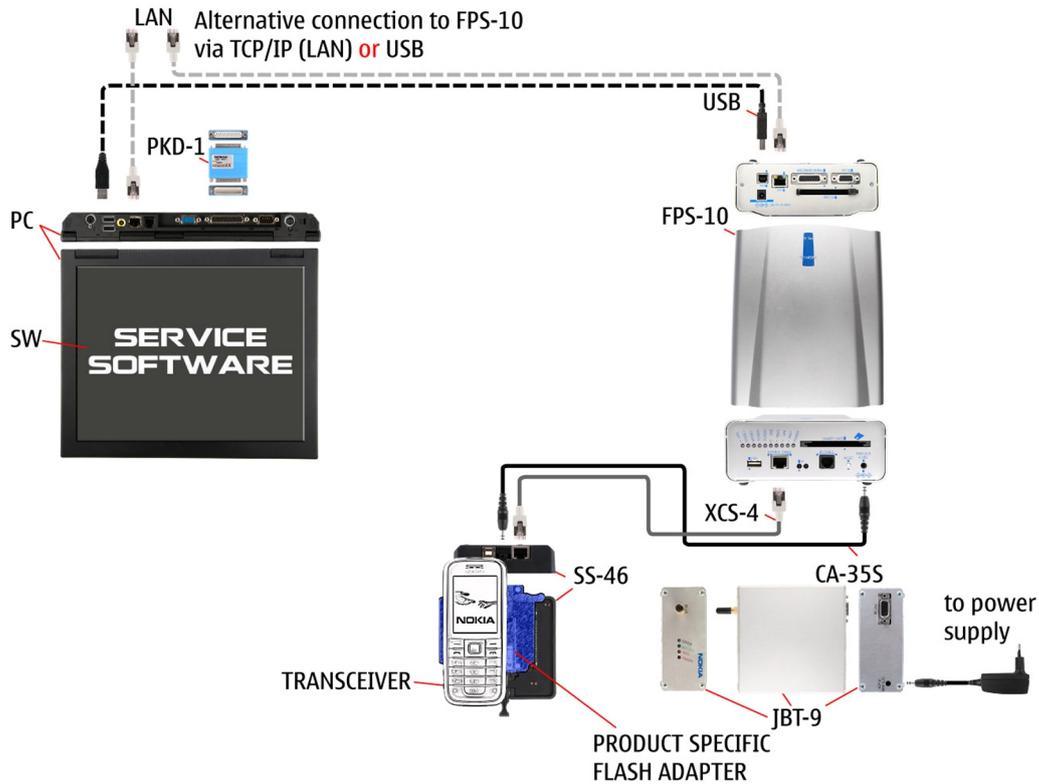


Figure 5 Flash concept with FPS-10 and JBT-9

Type	Description
Product specific tools	
FS-65	Flash adapter
Other tools	
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-46	Interface adapter
JBT-9	Bluetooth test and interface box
	PC with Phoenix service software
Cables	
XCS-4	Modular cable
CA-355	Power cable
	USB cable

Flash concept with SS-46 and CA-89DS

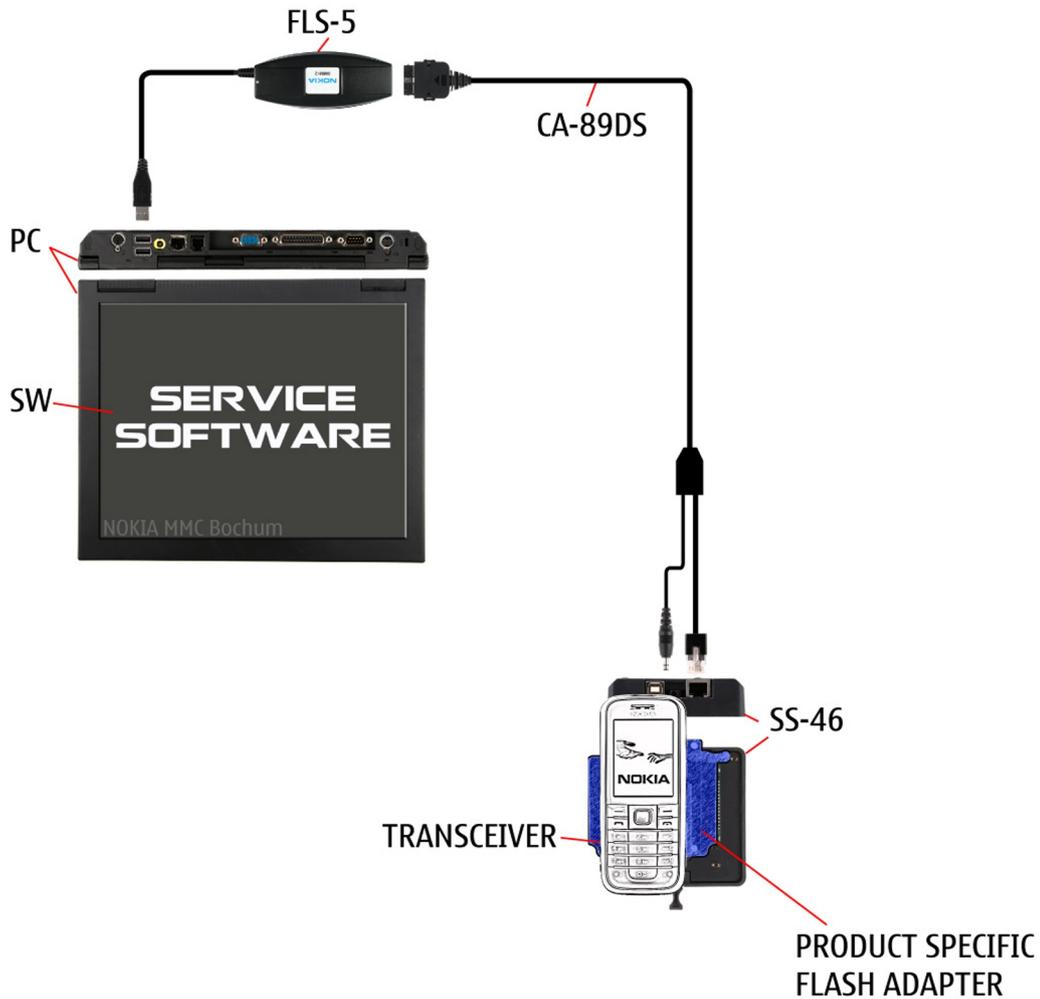


Figure 6 Flash concept with SS-46 and CA-89DS

Type	Description
Product specific tools	
FS-65	Flash adapter
Other tools	
FLS-5	Flash device
SS-46	Interface adapter
	PC with Phoenix service software
Cables	
CA-89DS	Cable

Flash concept with CA-89DS

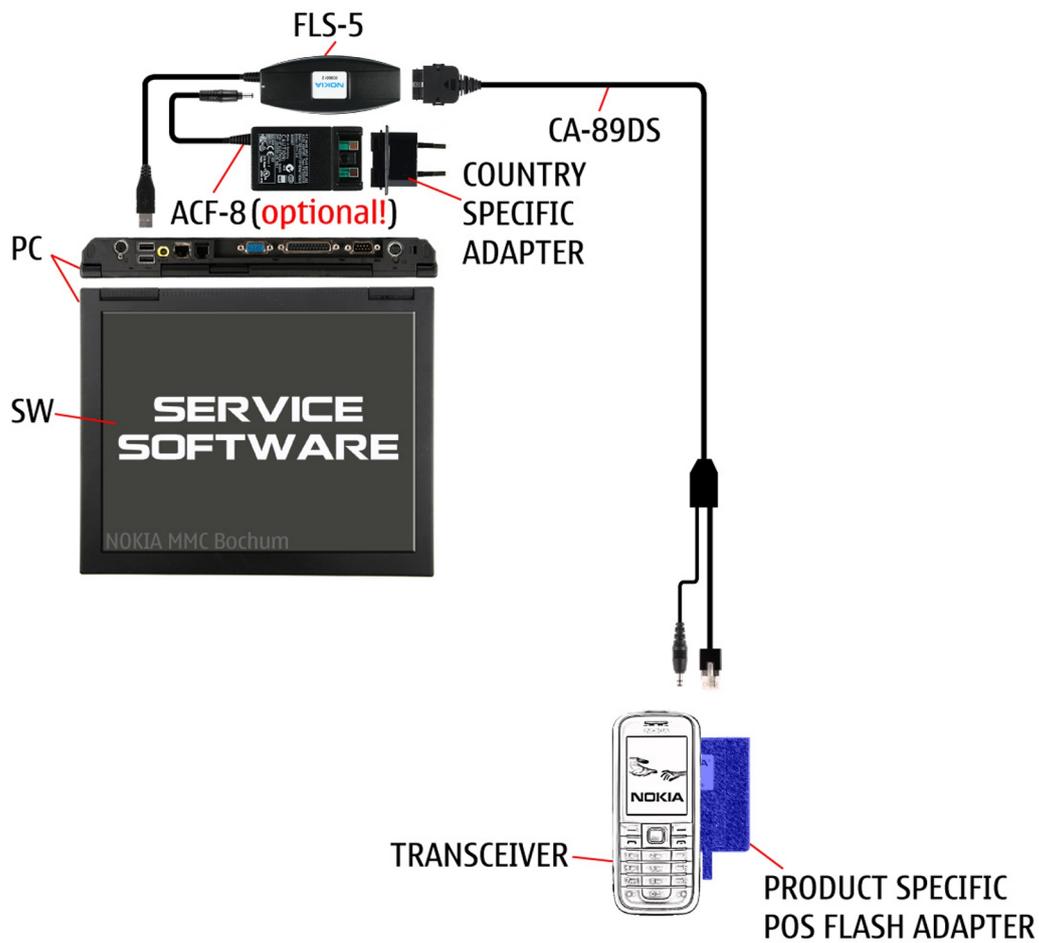


Figure 7 Flash concept with CA-89DS

Type	Description
Product specific tools	
FS-65	Flash adapter
Other tools	
FLS-5	Flash device
	PC with Phoenix service software
Cables	
CA-89DS	Cable

Flash concept with SS-62 and CA-89DS

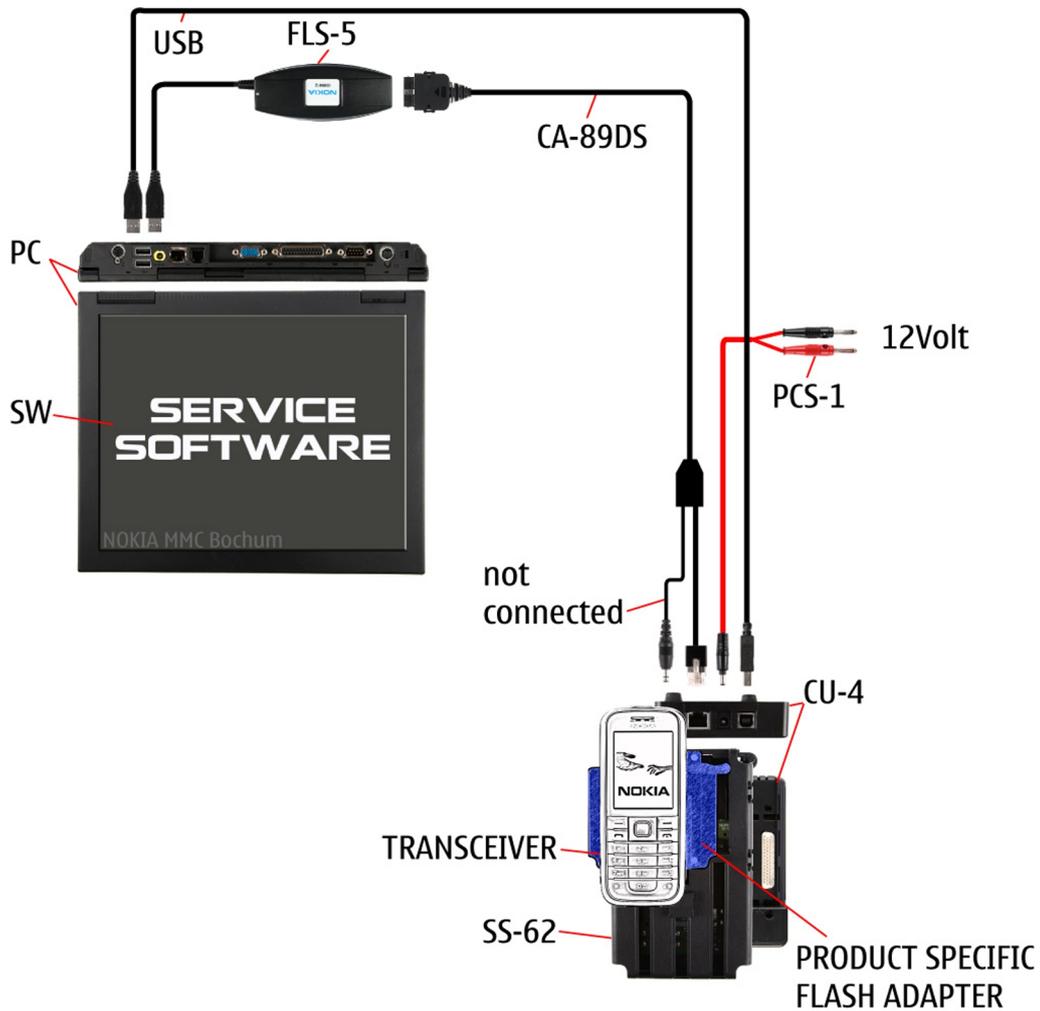


Figure 8 Flash concept with SS-62 and CA-89DS

Type	Description
Product specific tools	
FS-65	Flash adapter
Other tools	
CU-4	Control unit
FLS-5	Flash device
SS-62	Flash adapter base
	PC with Phoenix service software
Cables	
CA-89DS	Cable
PCS-1	Power cable
	USB cable

Flash concept with FPS-10, SS-62 and JBT-9

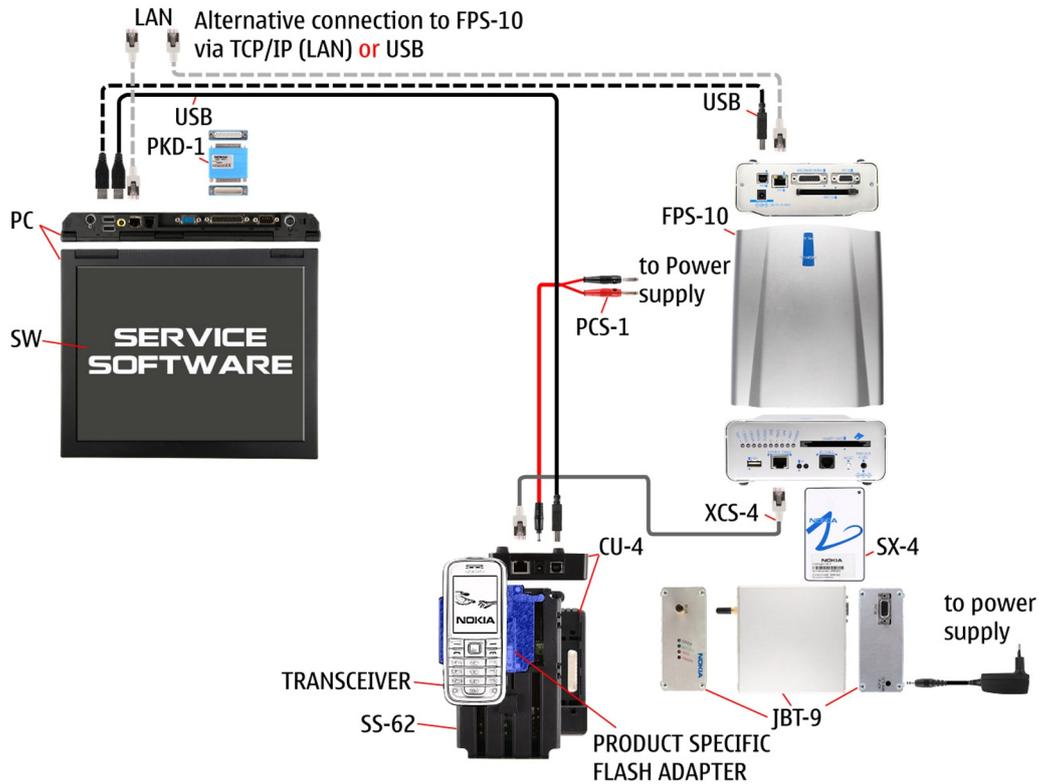


Figure 9 Flash concept with FPS-10, SS-62 and JBT-9

Type	Description
Product specific tools	
FS-65	Flash adapter
Other tools	
CU-4	Control unit
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-62	Flash adapter base
JBT-9	Bluetooth test and interface box
SX-4	Smart card
	PC with Phoenix service software
Cables	
XCS-4	Modular cable
PCS-1	Power cable
	USB cable

Flash concept with FPS-10, SS-62 and SB-7

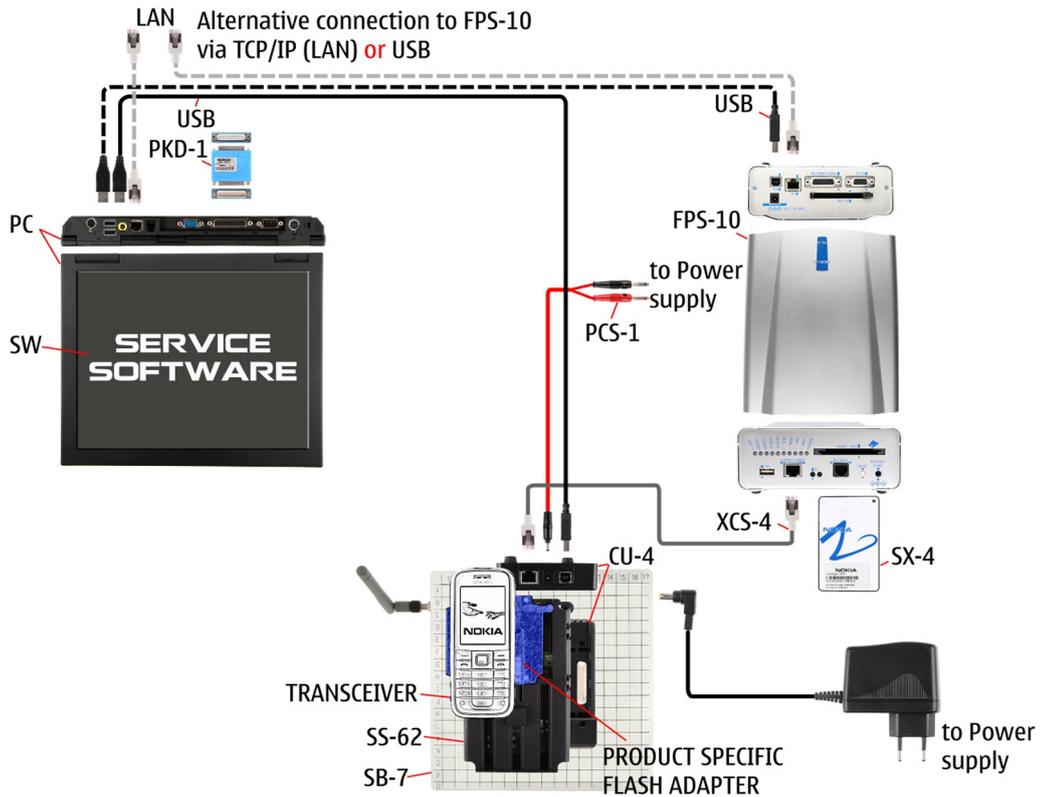


Figure 10 Flash concept with FPS-10, SB-7 and JBT-9

Type	Description
Product specific tools	
FS-65	Flash adapter
Other tools	
CU-4	Control unit
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SB-7	WLAN test box
SS-62	Flash adapter base
SX-4	Smart card
	PC with Phoenix service software
Cables	
XCS-4	Modular cable
PCS-1	Power cable
	USB cable

Module jig service concept

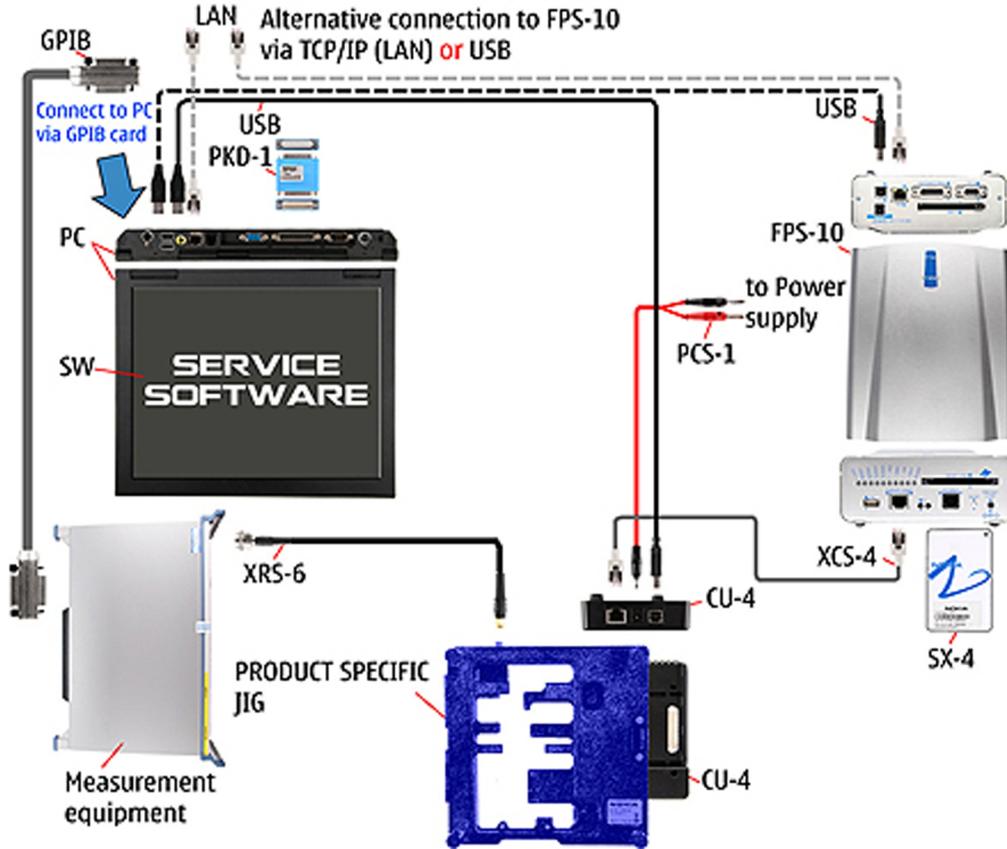


Figure 11 Module jig service concept

Type	Description
Phone specific devices	
MJ-151	Module jig
Other devices	
CU-4	Control unit
FPS-10	Flash prommer box
PK-1	SW security device
SX-4	Smart card
	PC with VPOS and Phoenix service software
	Measurement equipment
Cables	
PCS-1	DC power cable
XCS-4	Modular cable
XRF-1	RF cable
	USB cable

Type	Description
	GPIB control cable

Module jig service concept with JBT-9 and smart card reader

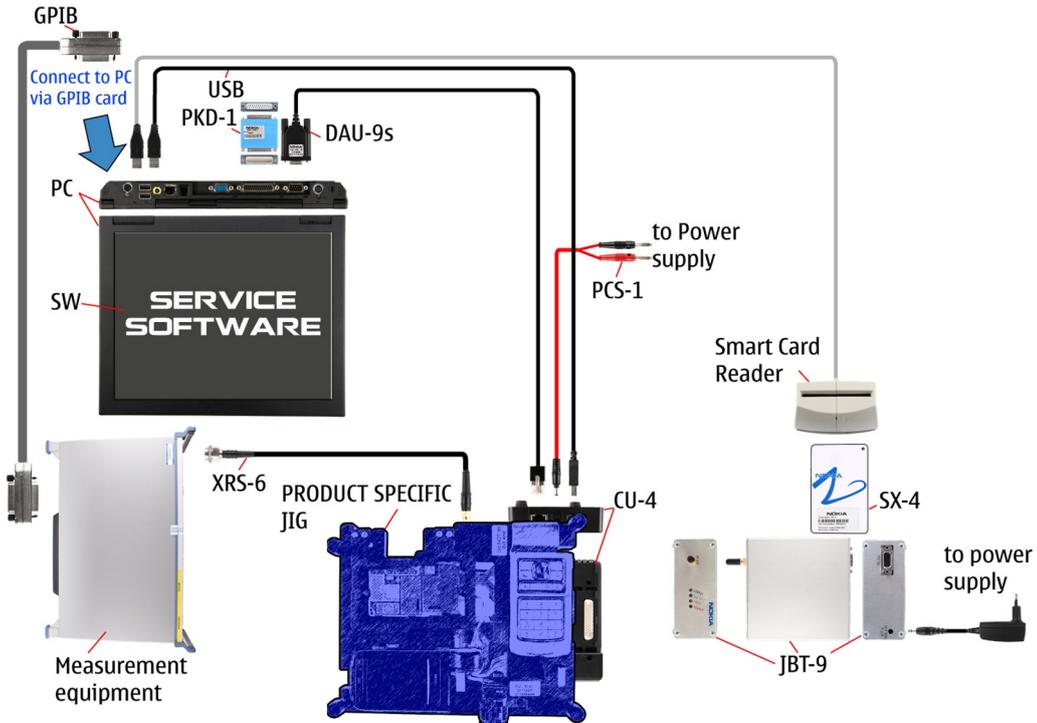


Figure 12 Service concept with JBT-9 and smart card reader

Type	Description
Product specific tools	
MJ-151	Module jig
Other tools	
CU-4	Control unit
JBT-9	Bluetooth test and interface box
PKD-1/PK-1	SW security device
SX-4	Smart card
	Measurement equipment
	PC with Phoenix service software
	Smart card reader
Cables	
DAU-9S	MBUS cable
PCS-1	DC power cable
XRS-6	RF cable
	GPIB control cable

Type	Description
	USB cable

Module jig service concept with JBT-9

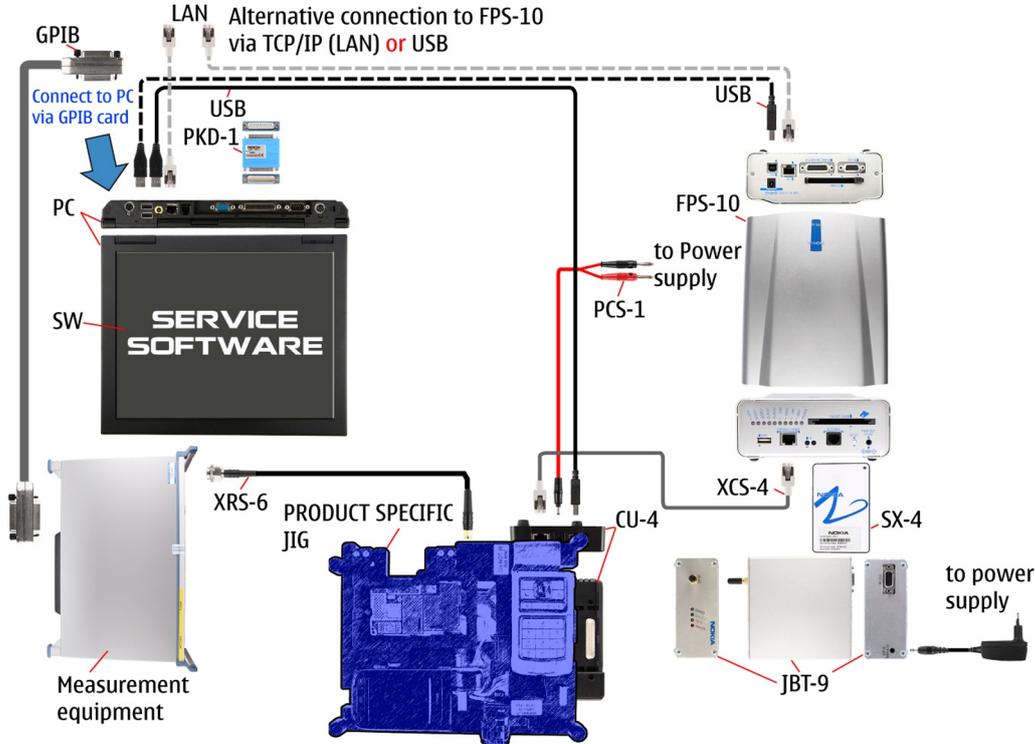


Figure 13 Module jig service concept with JBT-9

Type	Description
Product specific tools	
MJ-151	Module jig
Other tools	
CU-4	Control unit
FPS-10	Flash prommer box
JBT-9	Bluetooth test and interface box
PKD-1	SW security device
SX-4	Smart card
	Measurement equipment
	PC with Phoenix service software
Cables	
PCS-1	DC power cable
XCS-4	Modular cable
XRS-6	RF cable

Type	Description
	GPIB control cable
	USB cable

RF testing concept with RF coupler

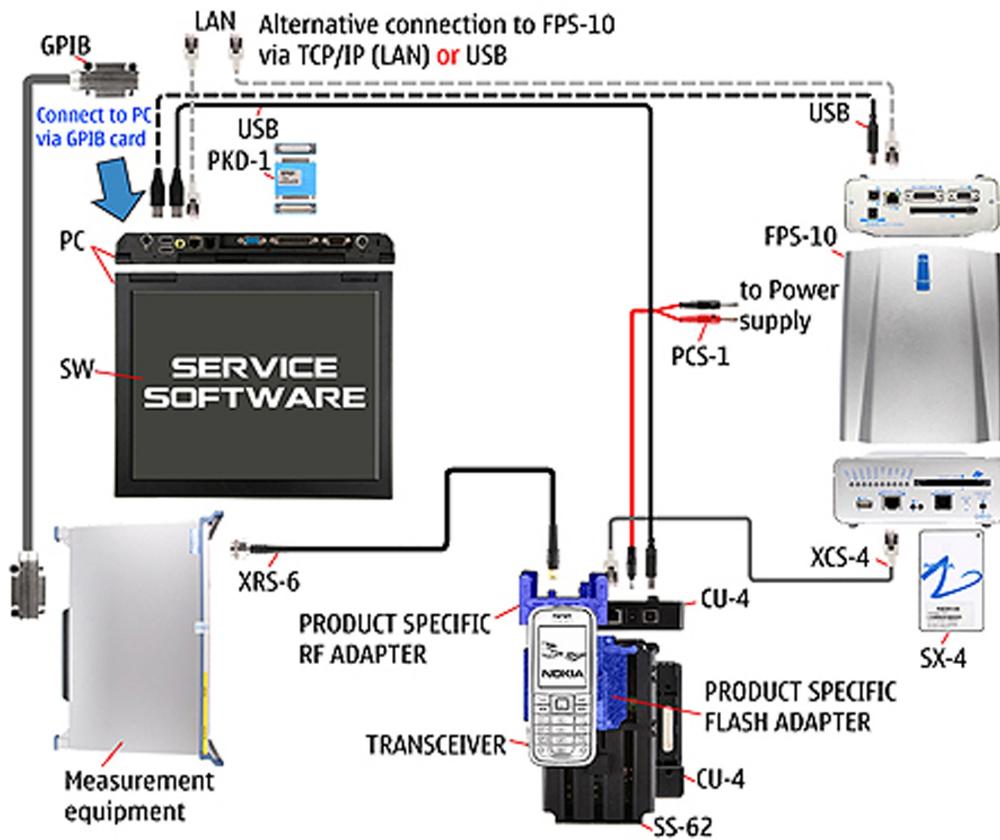


Figure 14 RF testing concept with RF coupler

Type	Description
Product specific devices	
FS-65	Flash adapter
SA-106	RF coupler
Other devices	
CU-4	Control unit
SX-4	Smart card
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-62	Flash adapter base
	Measurement equipment
	PC with Phoenix service software
Cables	

Type	Description
PCS-1	Power cable
XCS-4	Modular cable
XRS-6	RF cable
	GPIB control cable
	USB cable

Service concept for RF testing and RF/BB tuning

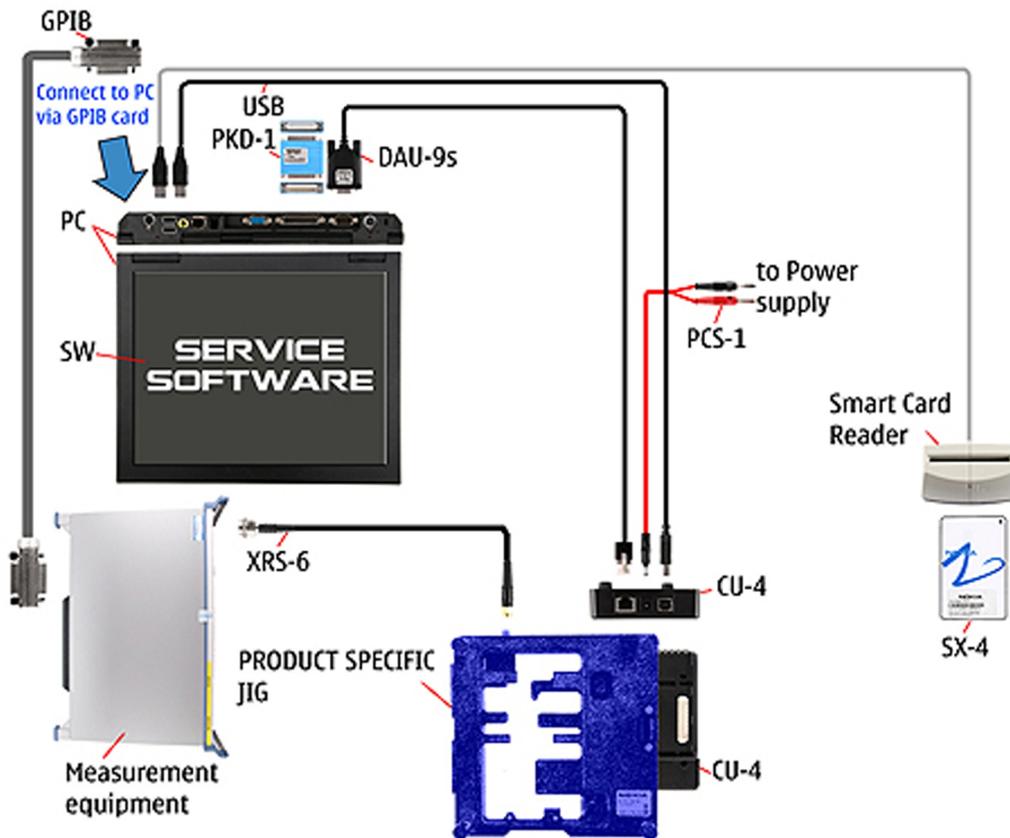


Figure 15 Service concept for RF testing and RF/BB tuning

Type	Description
Product specific devices	
MJ-151	Module jig
Other devices	
CU-4	Control unit
PK-1	SW security device
SX-4	Smart card
	Measurement equipment
	Smart card reader

Type	Description
	PC with Phoenix service software
Cables	
DAU-9S	MBUS cable
PCS-1	DC power cable
XRS-6	RF cable
	GPIB control cable
	USB cable

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3 — BB Troubleshooting and Tuning Guide

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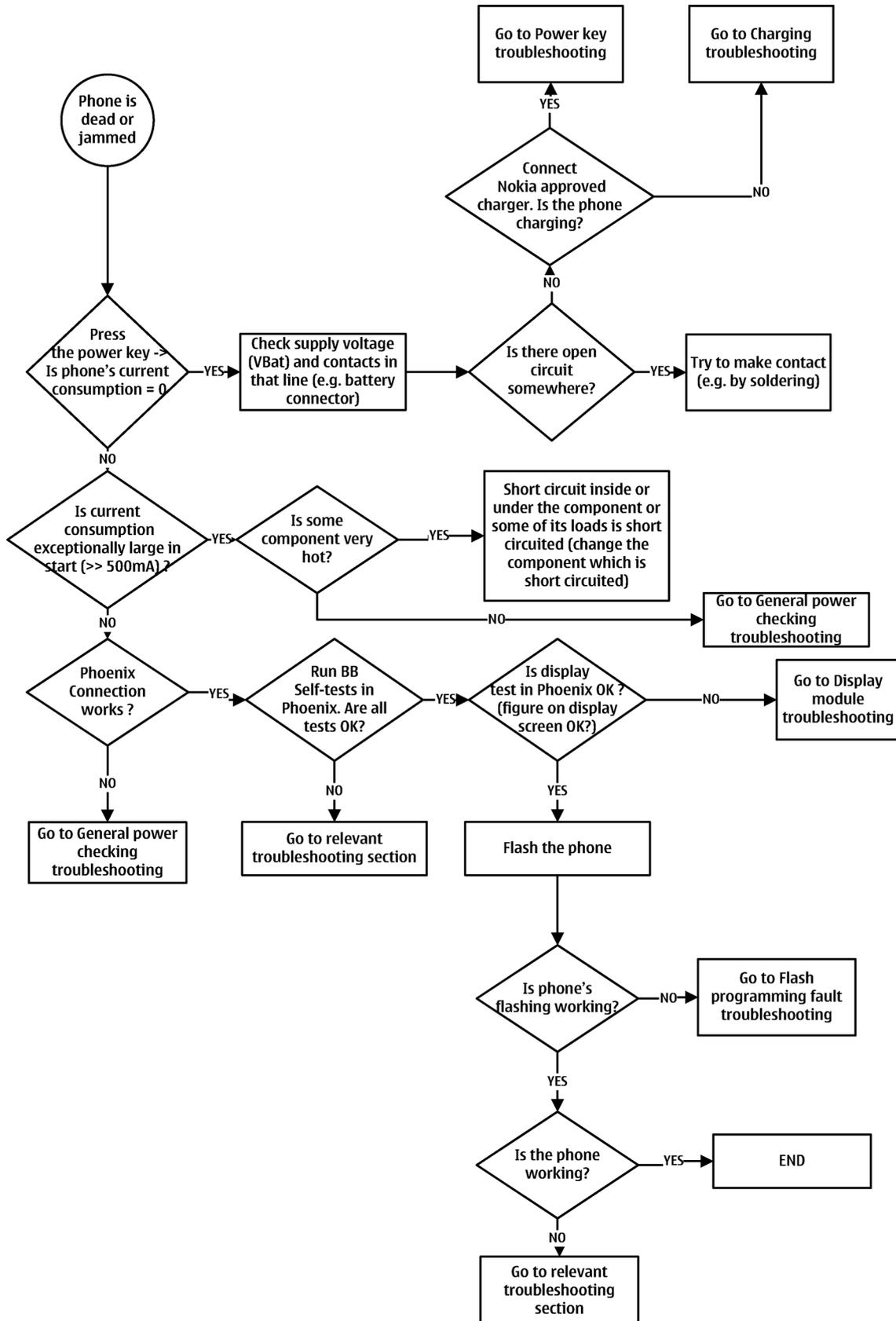
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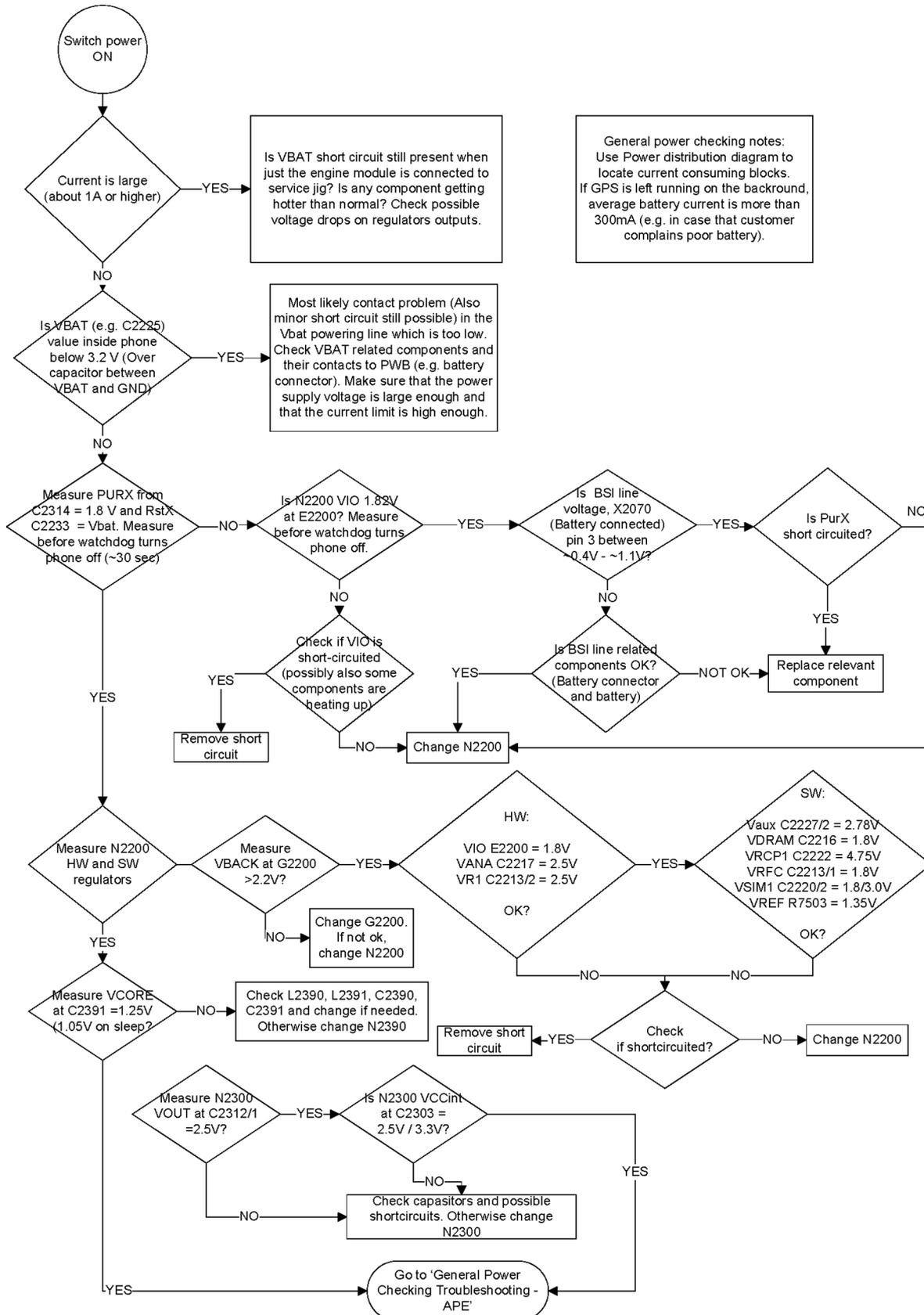
■ Dead or jammed device troubleshooting

Troubleshooting flow



■ General power checking troubleshooting - CMT

Troubleshooting flow



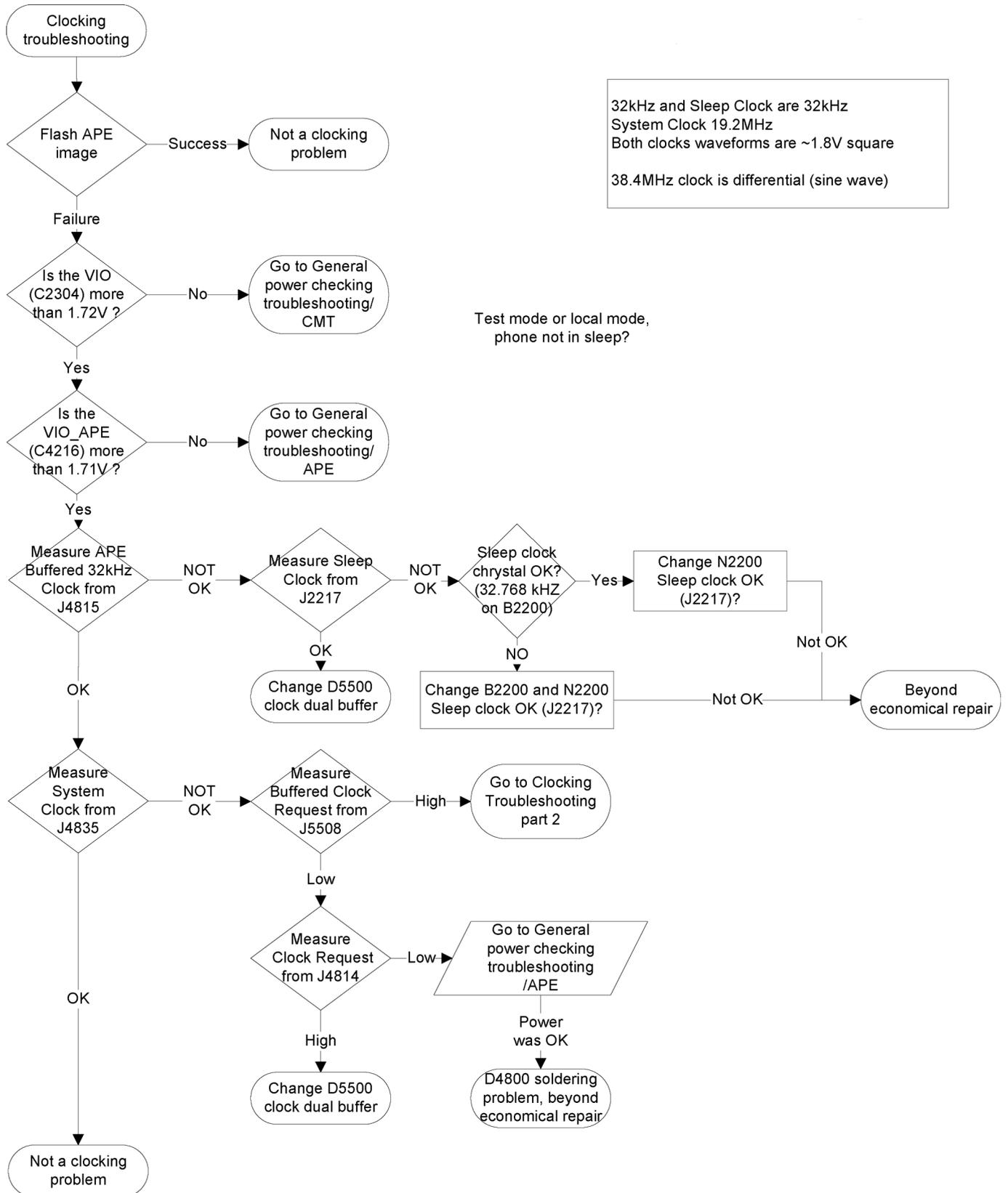
■ **General power checking troubleshooting - APE**

Troubleshooting flow



■ Clocking troubleshooting

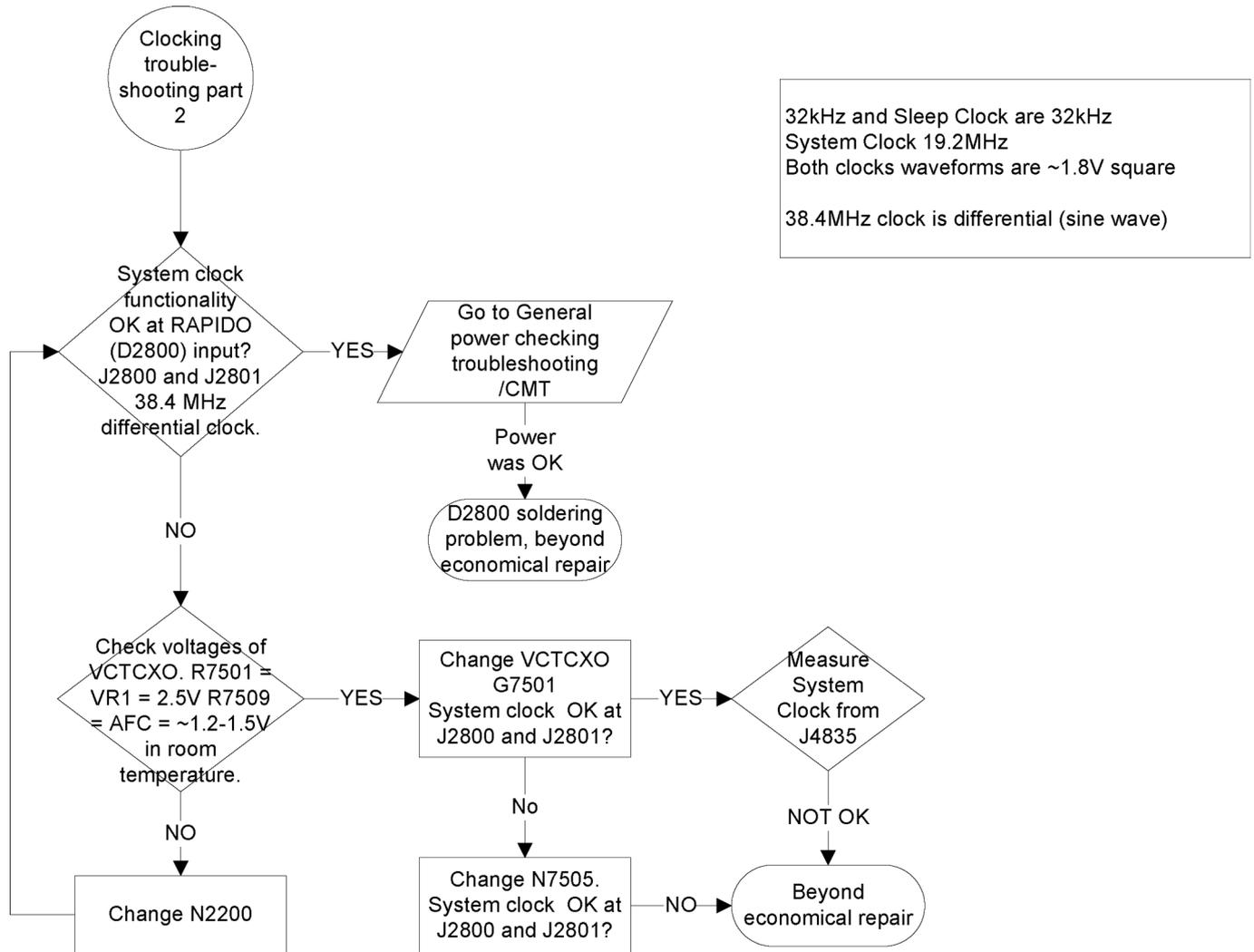
Troubleshooting flow



32kHz and Sleep Clock are 32kHz
System Clock 19.2MHz
Both clocks waveforms are ~1.8V square

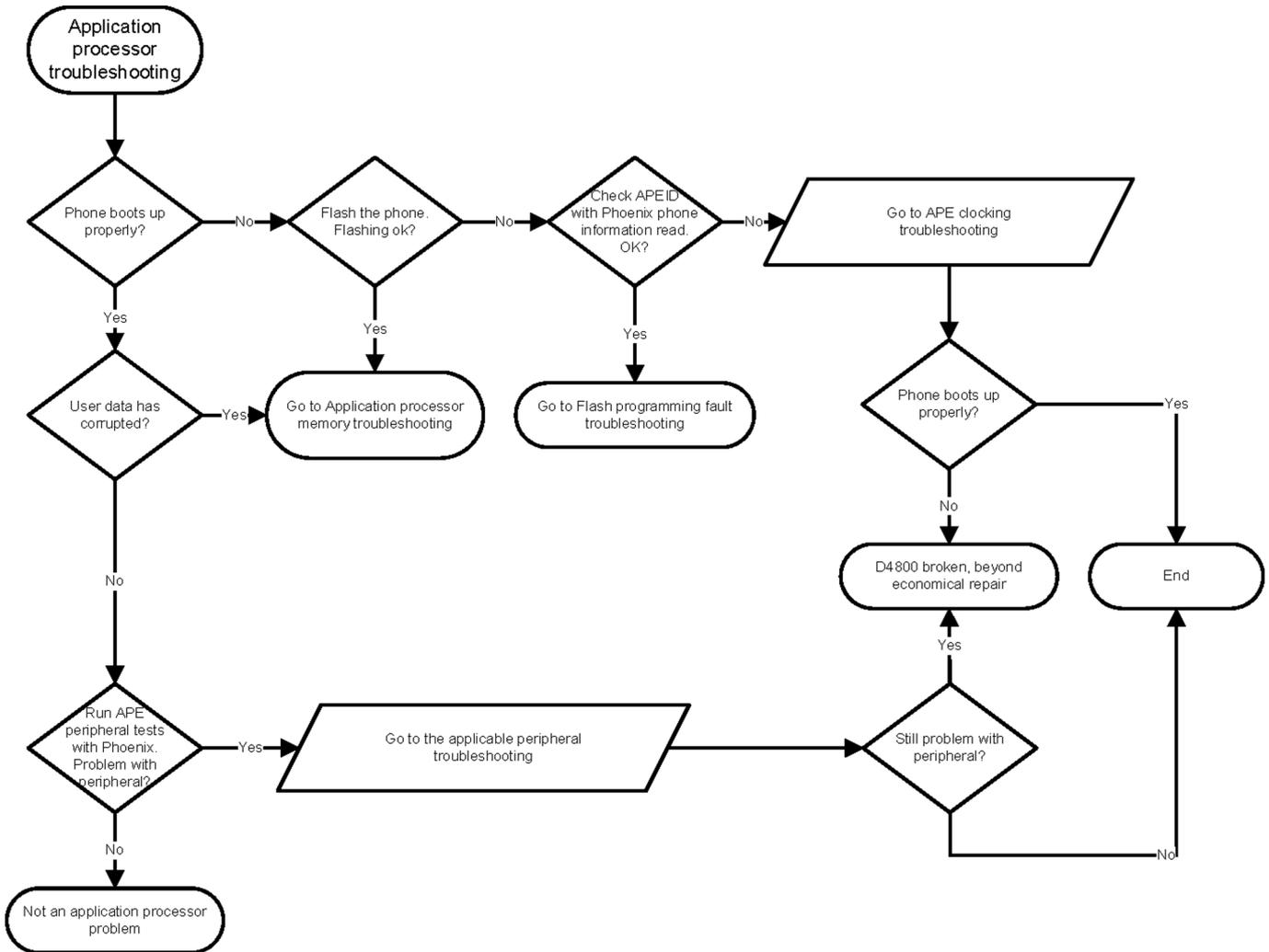
38.4MHz clock is differential (sine wave)

Test mode or local mode,
phone not in sleep?



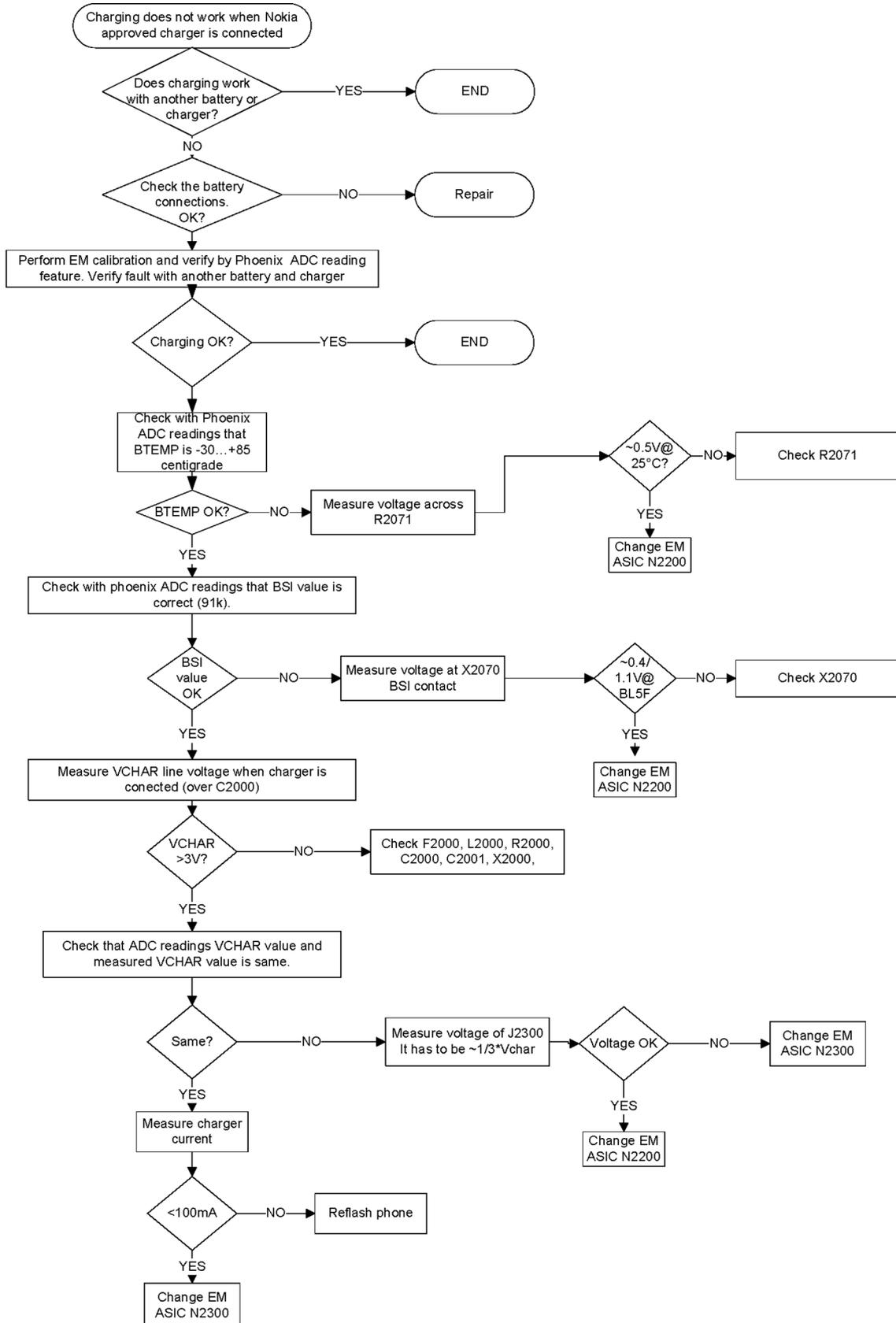
■ **Application processor troubleshooting**

Troubleshooting flow



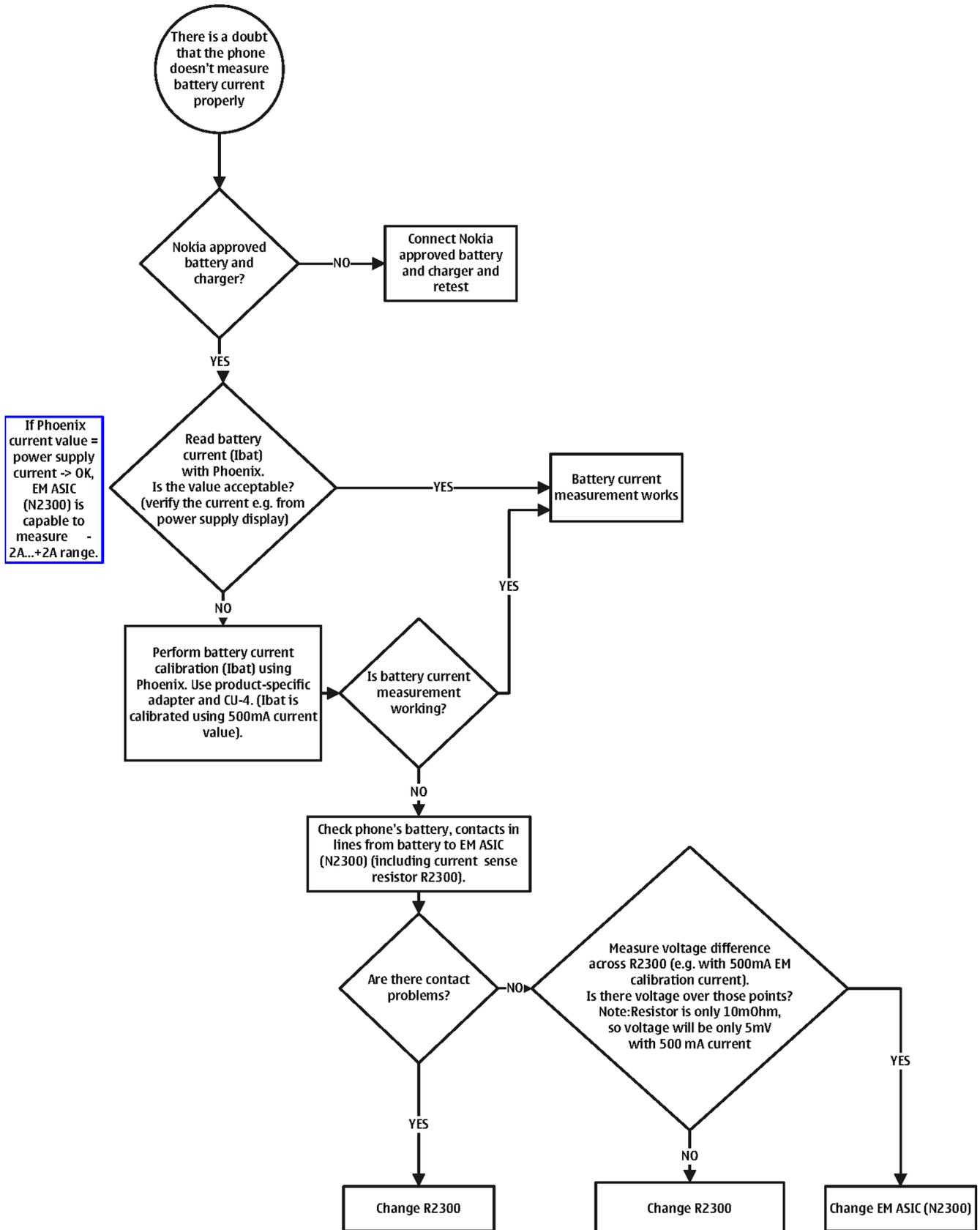
■ **Charging troubleshooting**

Troubleshooting flow



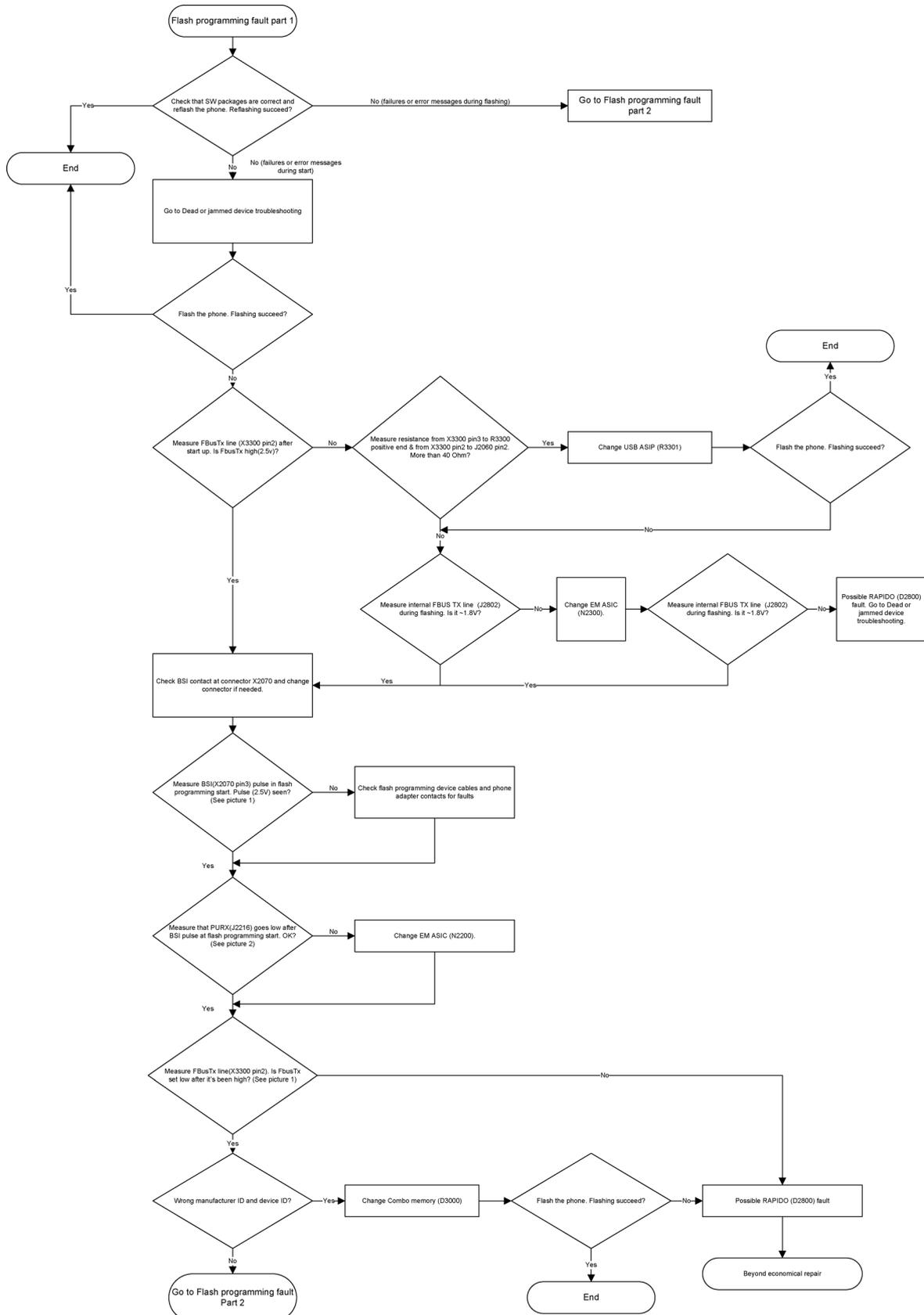
■ Battery current measuring fault troubleshooting

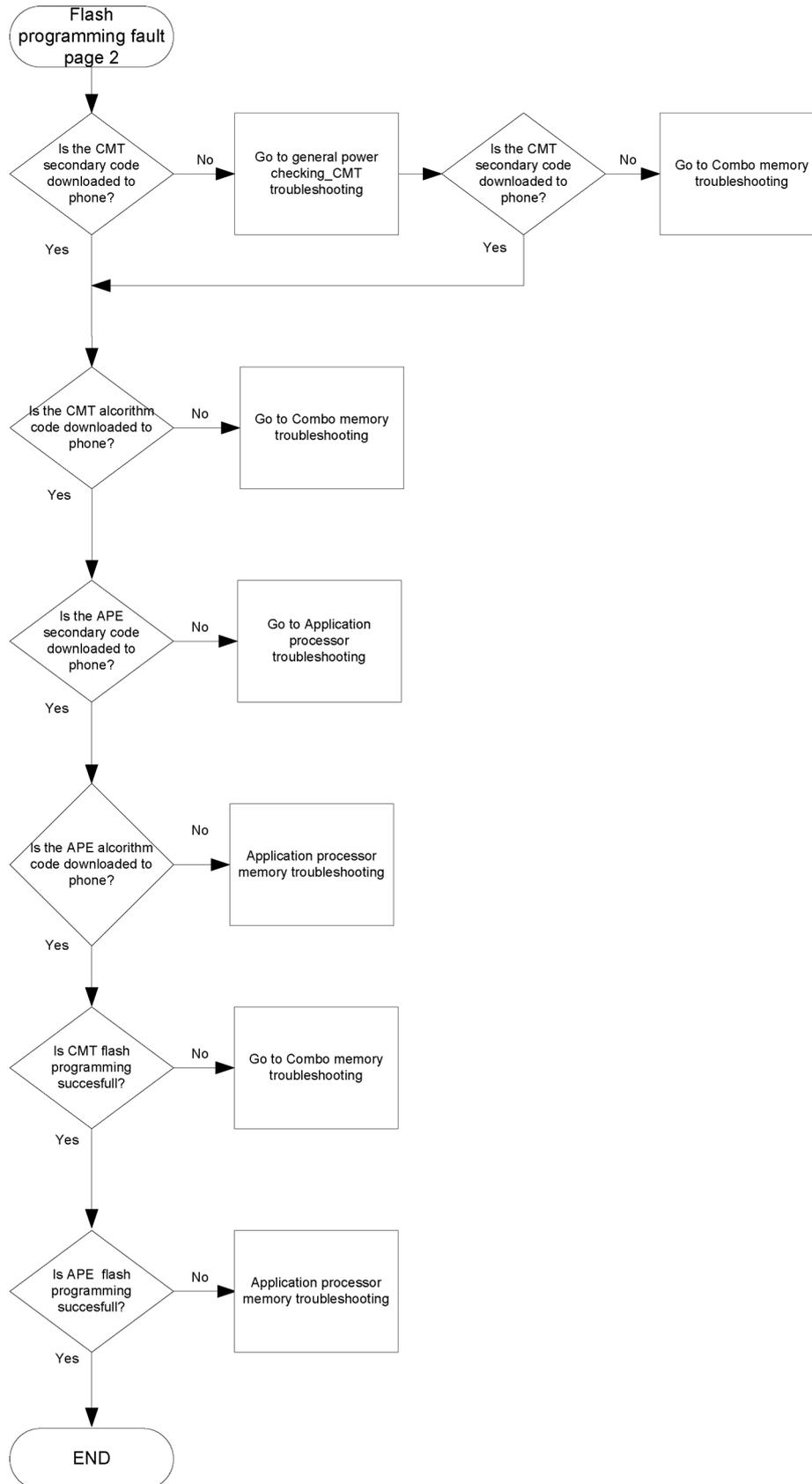
Troubleshooting flow



■ **Flash programming fault troubleshooting**

Troubleshooting flow





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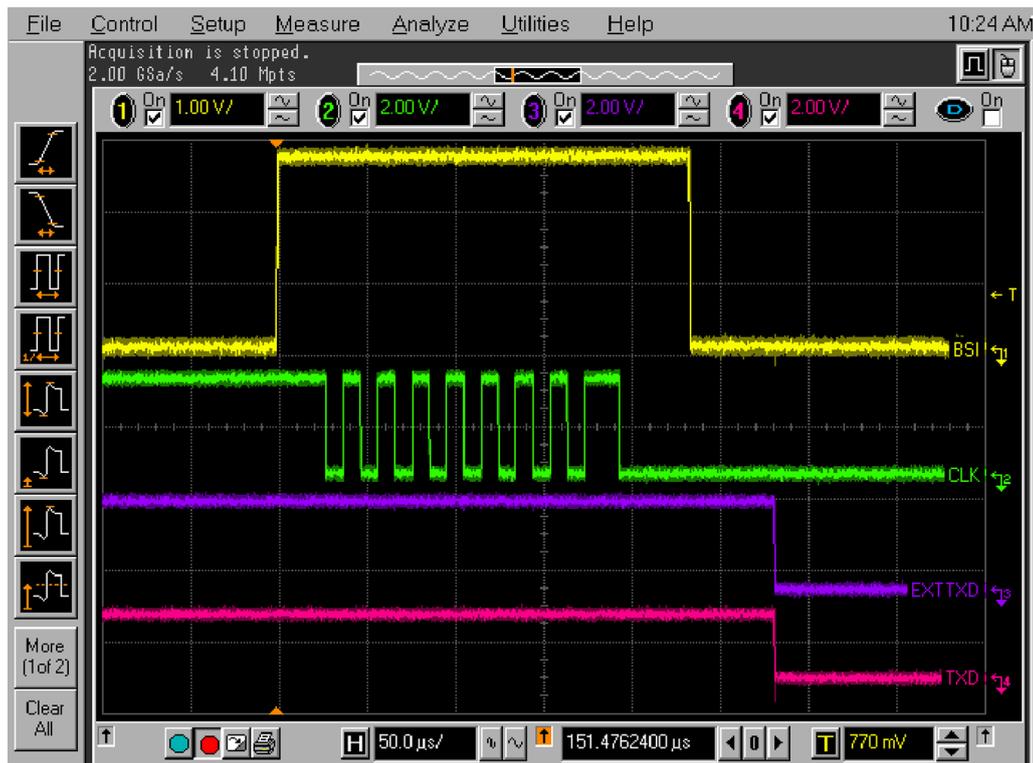


Figure 16 Flashing pic 1. Take single triggered measurement for the rise of the BSI signal

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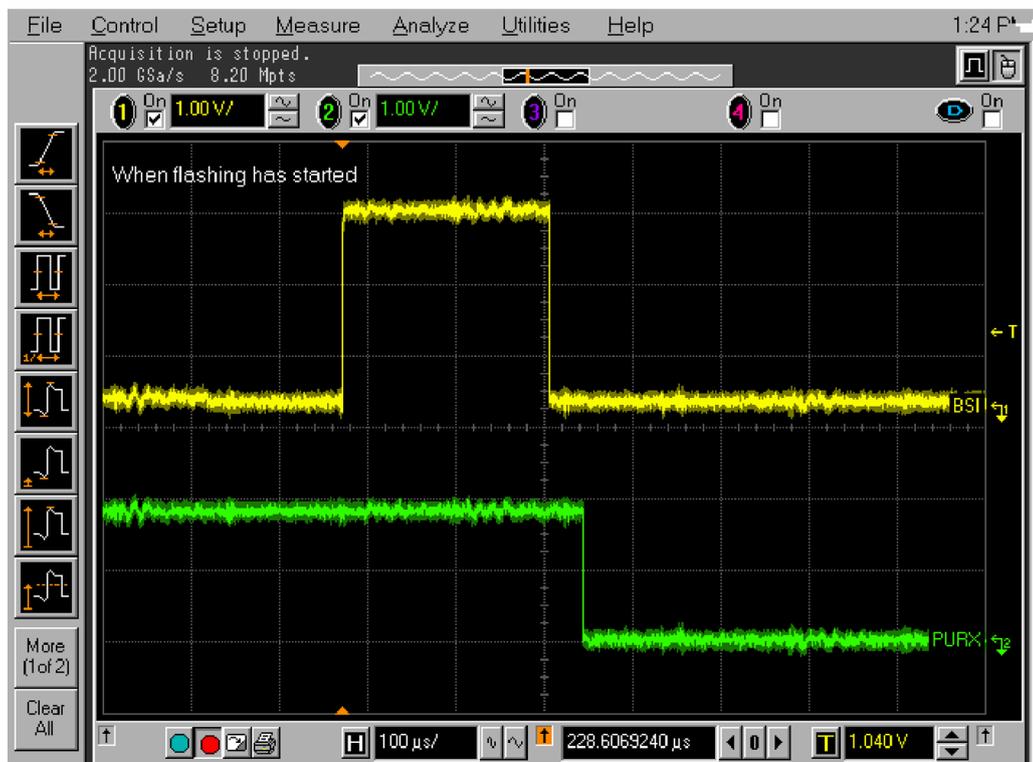
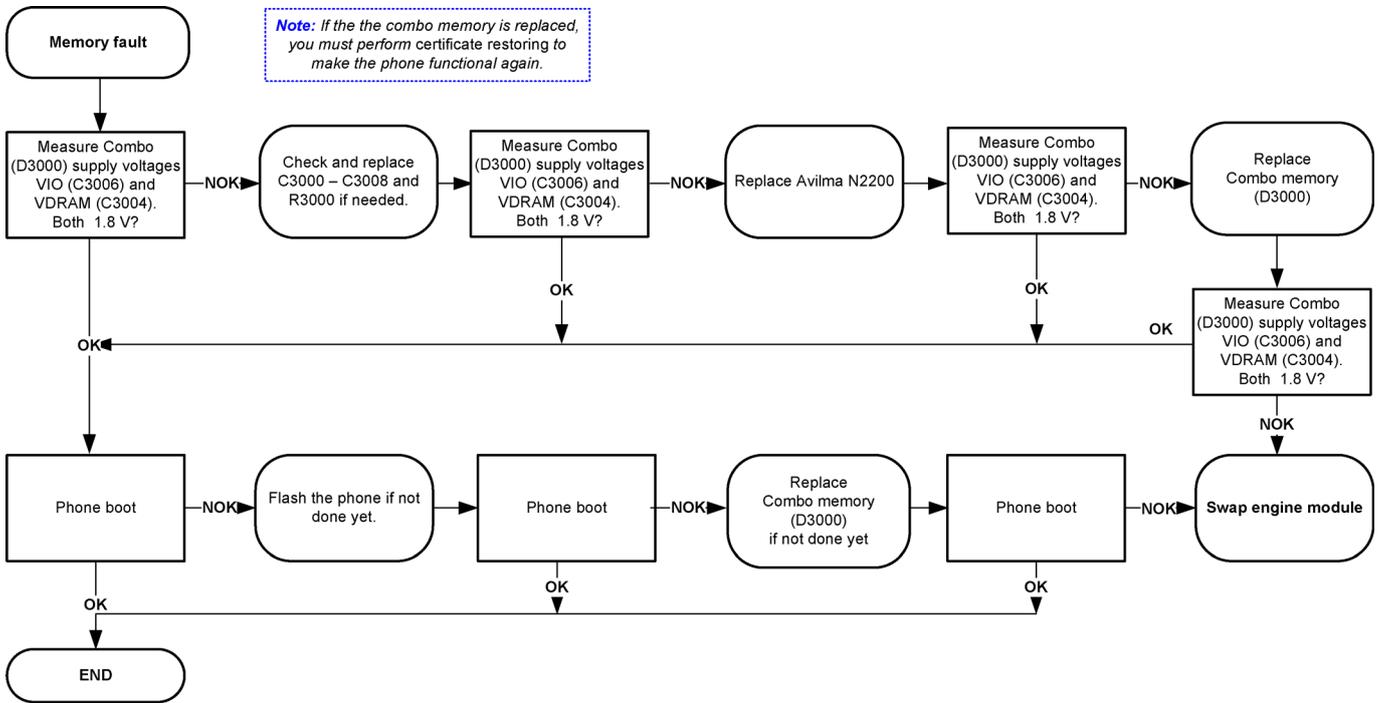


Figure 17 Flashing pic 2. Take single triggered measurement for the rise of the BSI signal

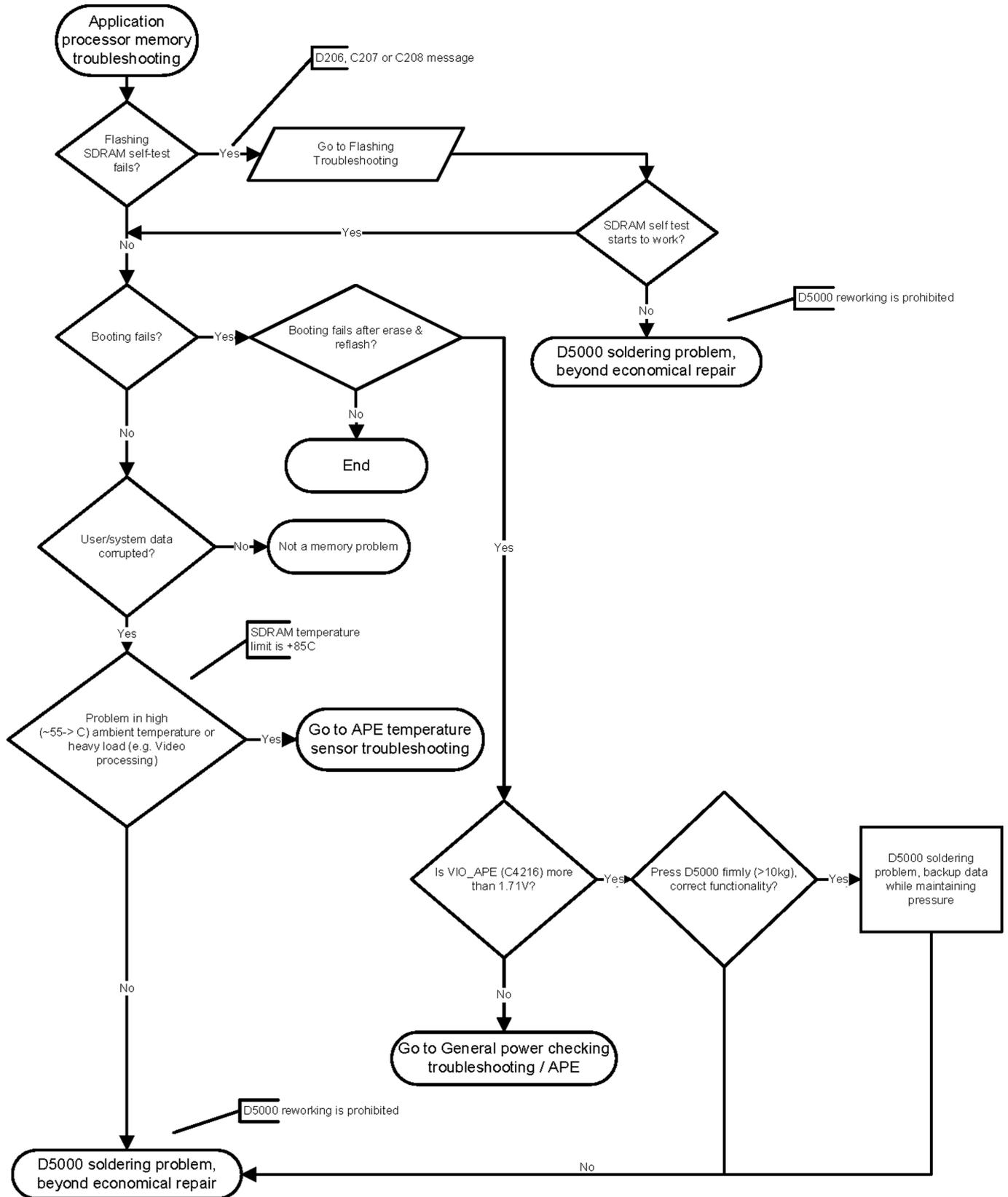
■ CMT combo memory fault troubleshooting

Troubleshooting flow



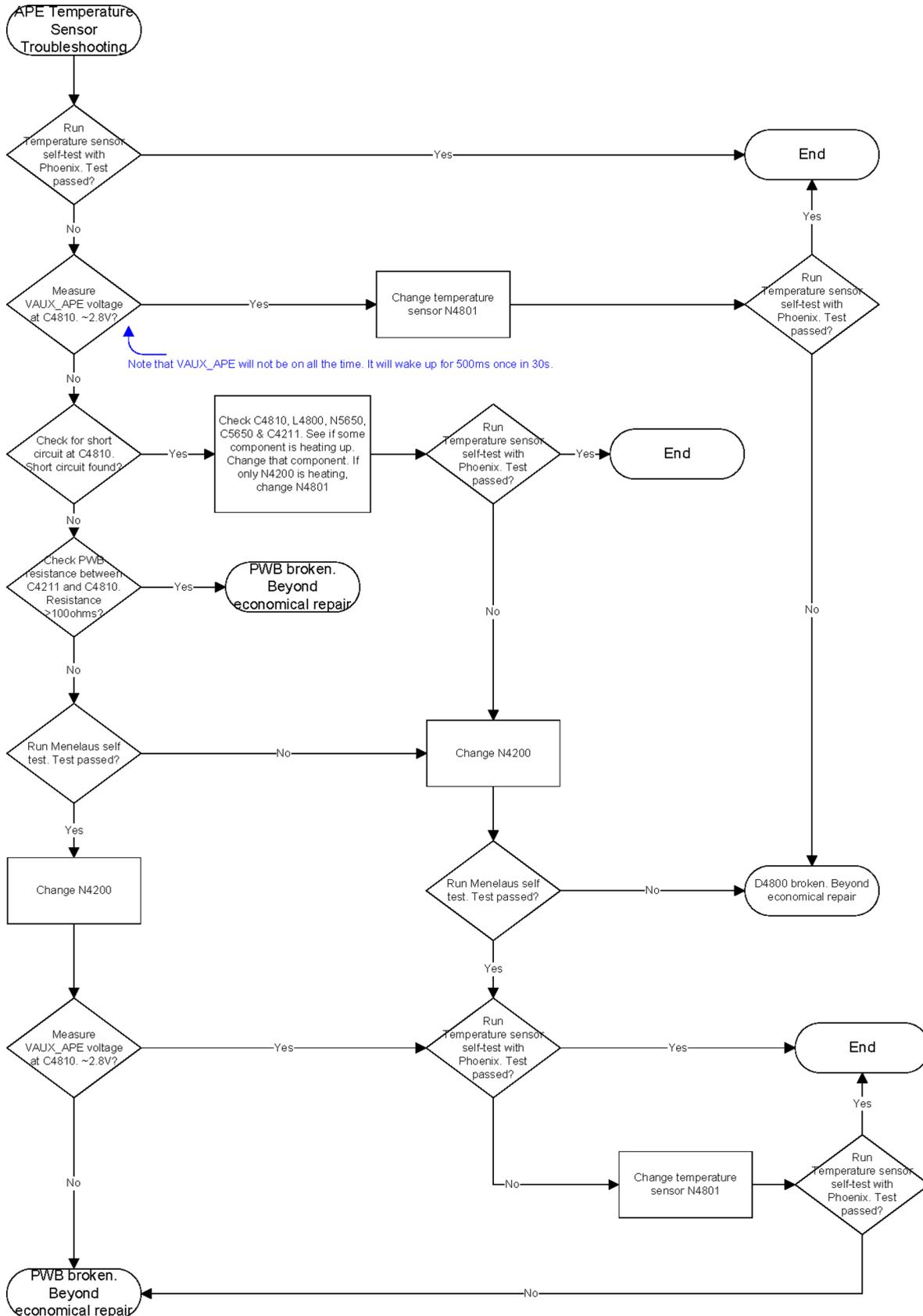
■ **Application processor memory troubleshooting**

Troubleshooting flow



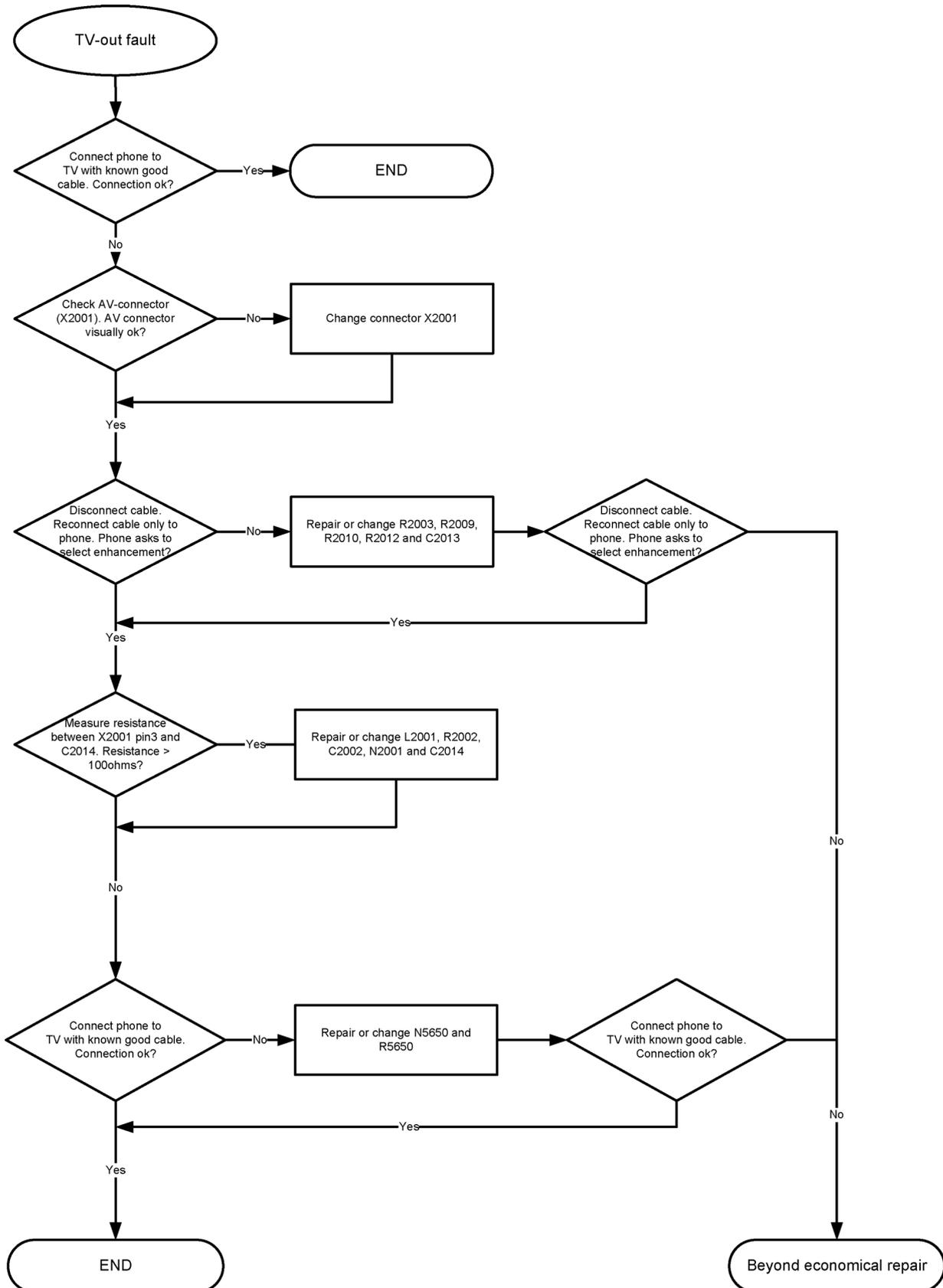
■ APE temperature sensor troubleshooting

Troubleshooting flow



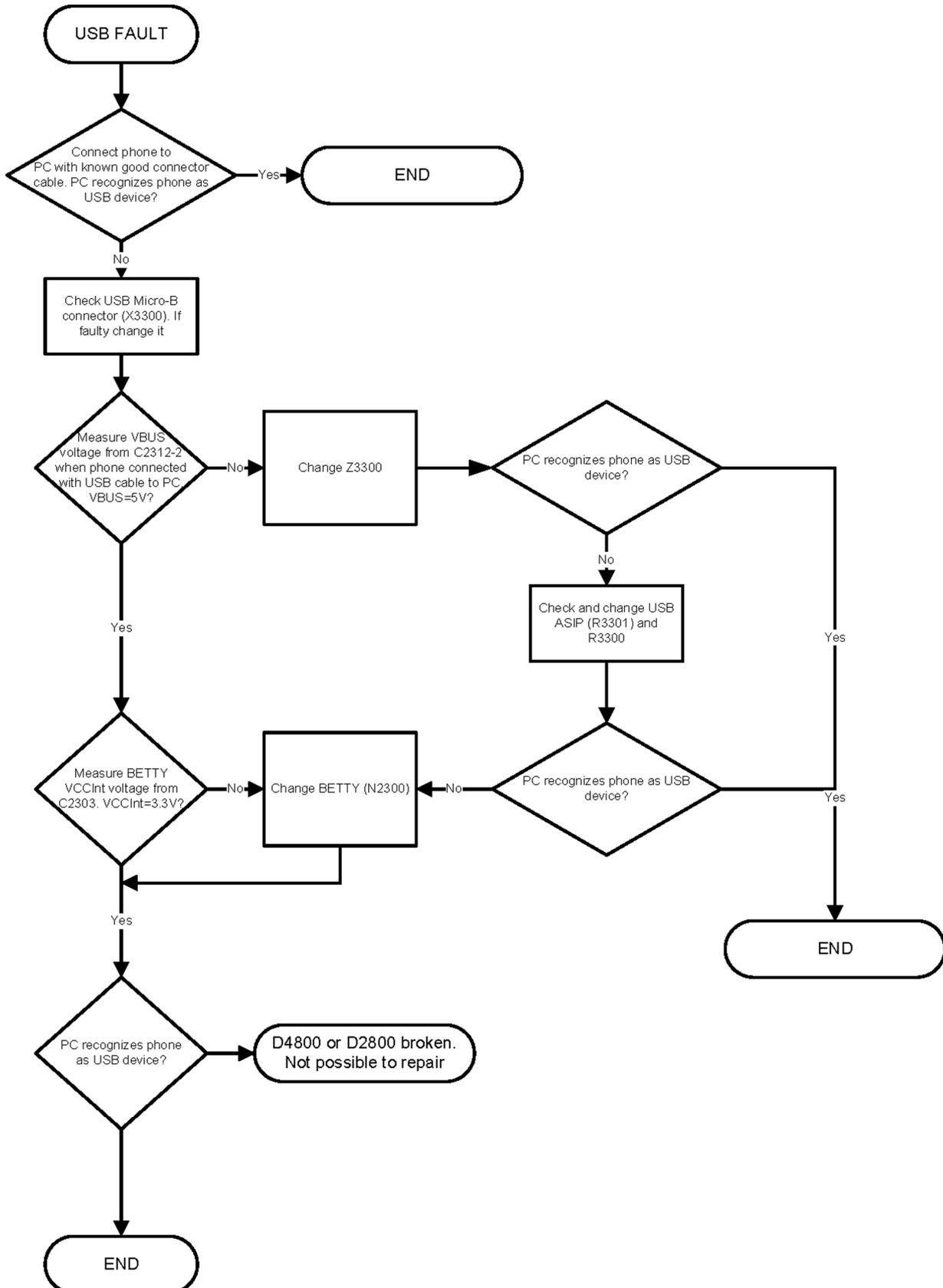
■ TV-out troubleshooting

Troubleshooting flow



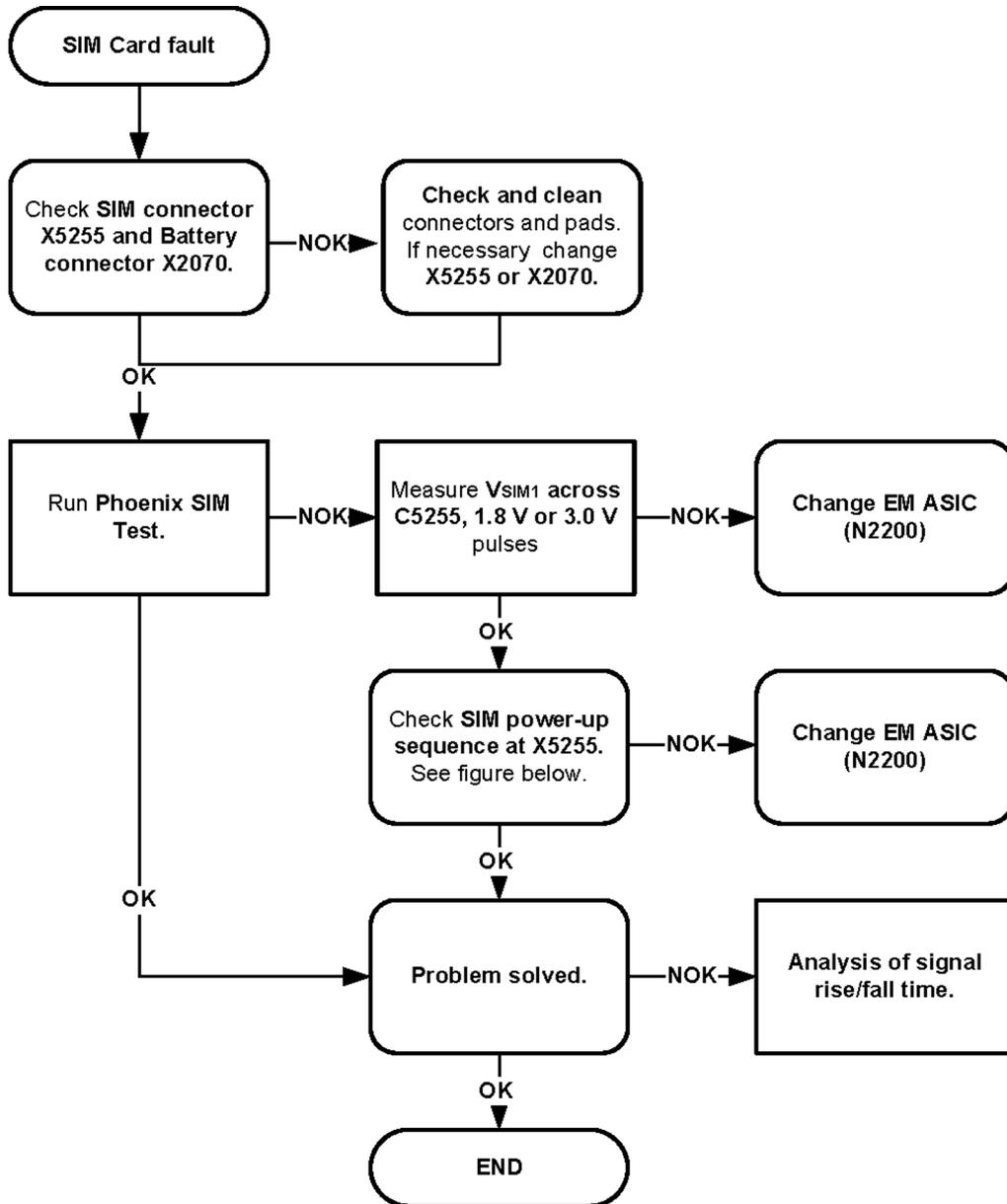
■ **USB interface troubleshooting**

Troubleshooting flow

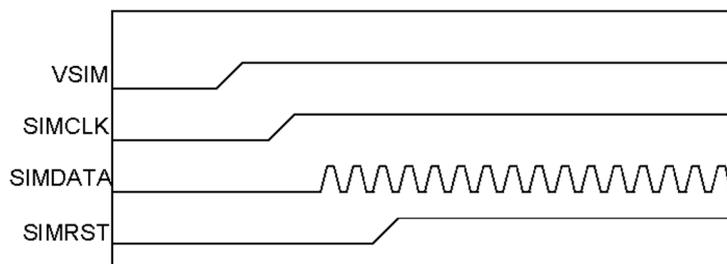


■ **SIM card troubleshooting**

Troubleshooting flow

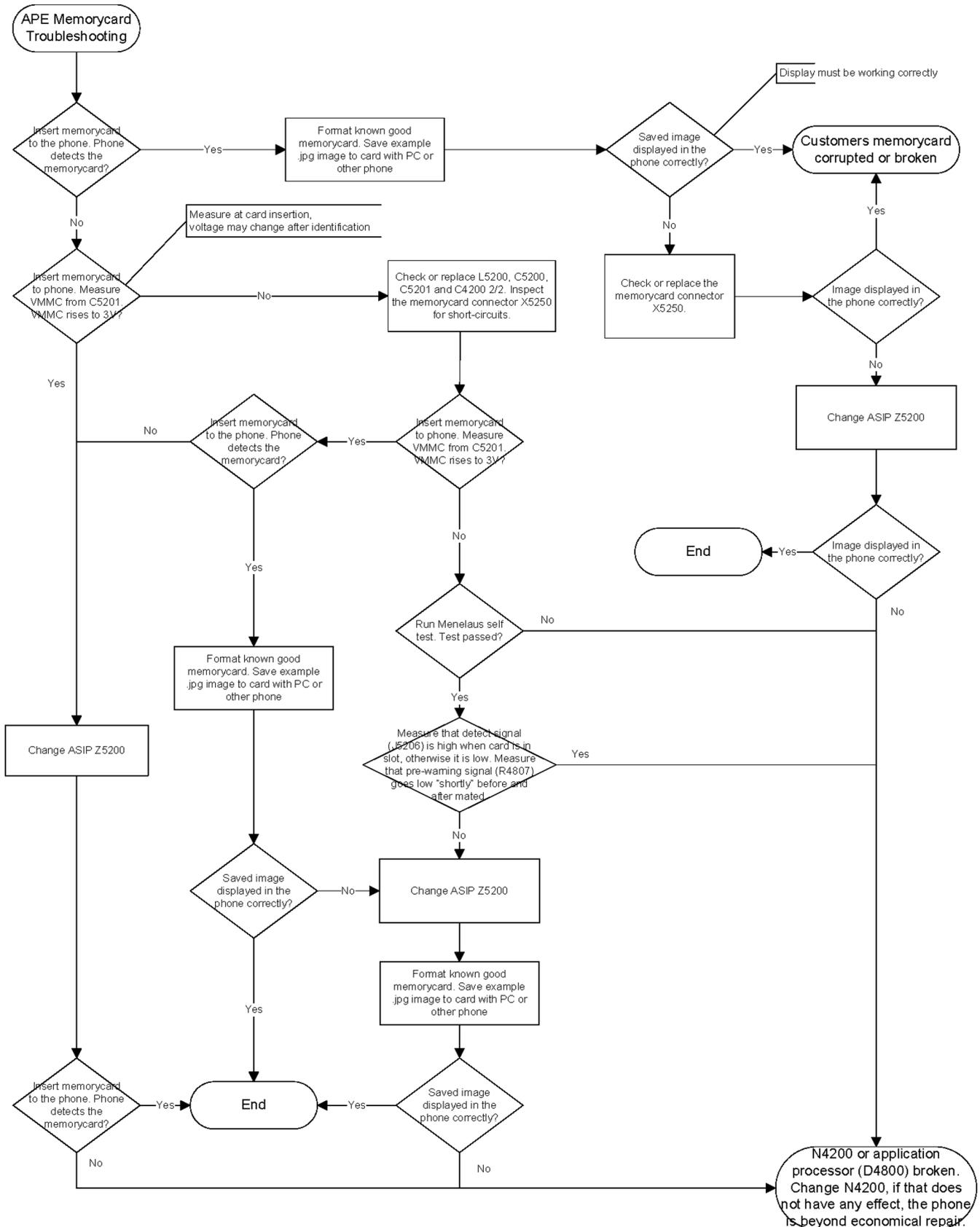


SIM power-up sequence



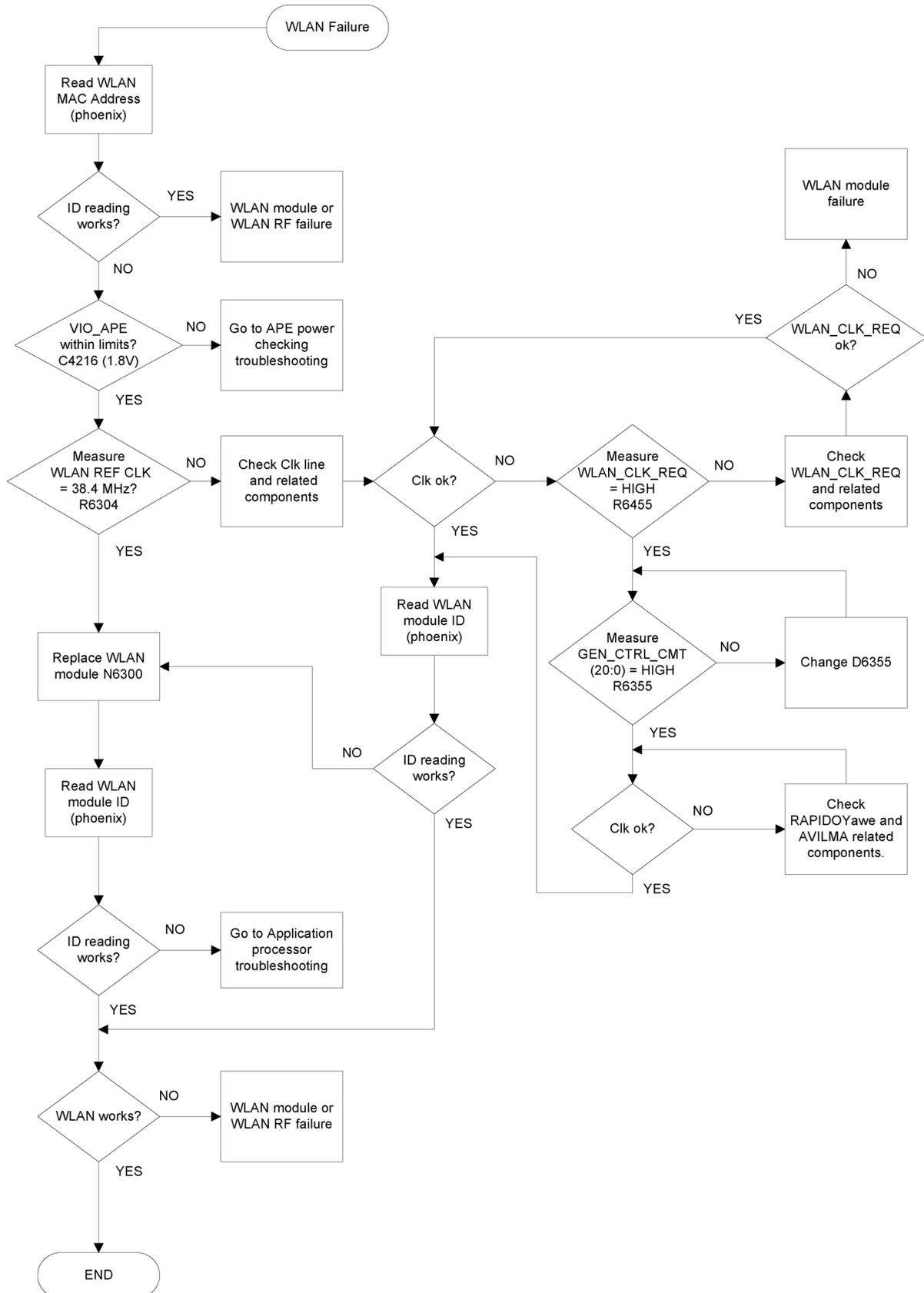
Memory card troubleshooting

Troubleshooting flow



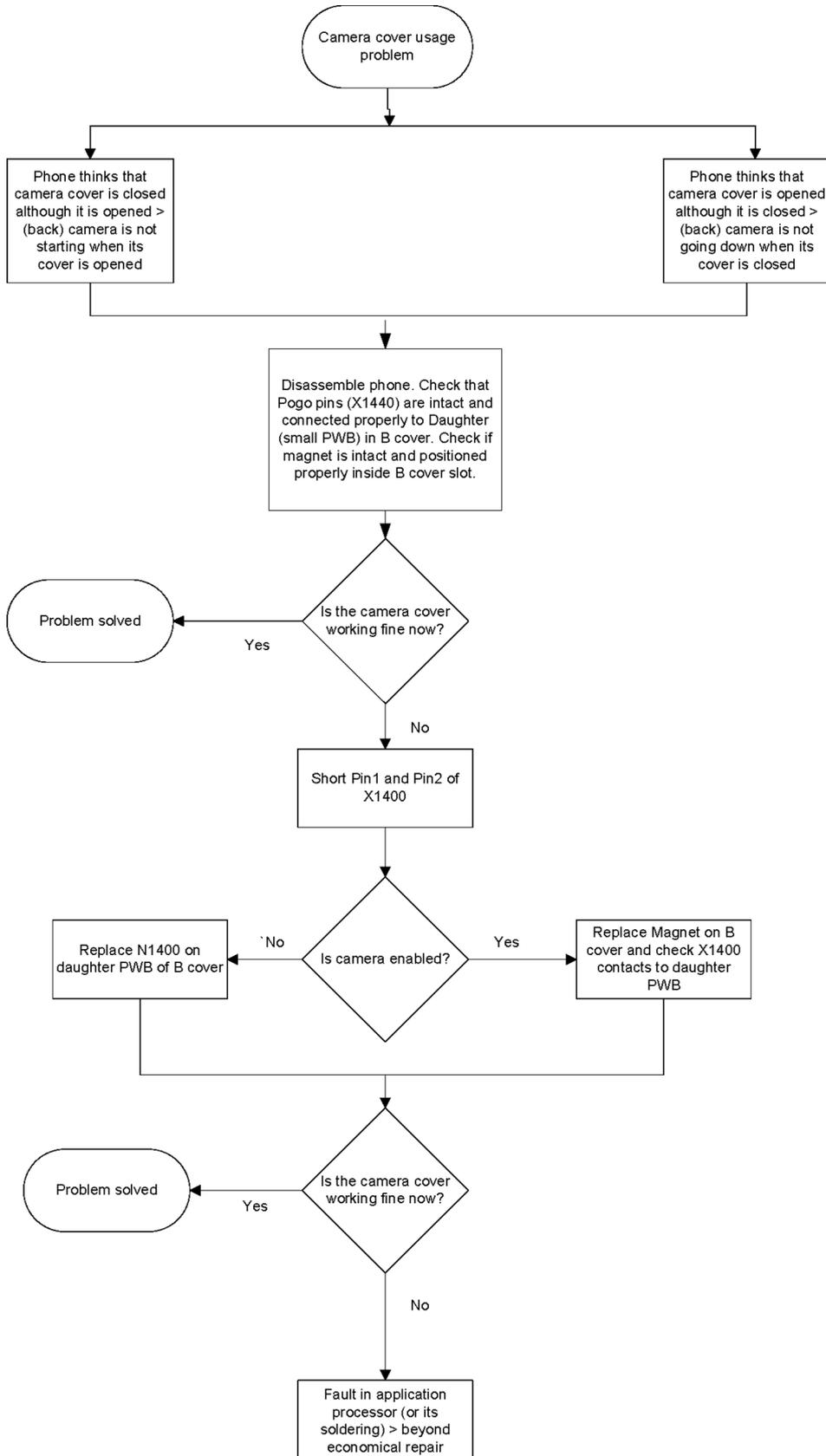
■ **WLAN interface troubleshooting**

Troubleshooting flow



■ Camera MR sensor troubleshooting

Troubleshooting flow



■ Certificate restoring for BB5 products

Context

This procedure is performed when the device flash content is changed or corrupted.

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

The procedure for certificate restoring is the following:

- Flash the phone with the latest available software using FLS-5 or FPS-10.
 - Note:** USB flashing does not work for a dead BB5 phone.
- Create a request file.
- Send the file to Nokia by e-mail. Use the following addresses depending on your location:
 - APAC: sydney.service@nokia.com
 - CHINA: repair.ams@nokia.com
 - E&A: salo.repair@nokia.com
- When you receive a reply from Nokia, carry out certificate restoring.
- Tune the phone completely.
 - Note:** The request won't be accepted without a SX-4 smart card. Before the request, the smart card must be registered in the online database.
- If the phone resets after certificate restoring, reflash the phone again.

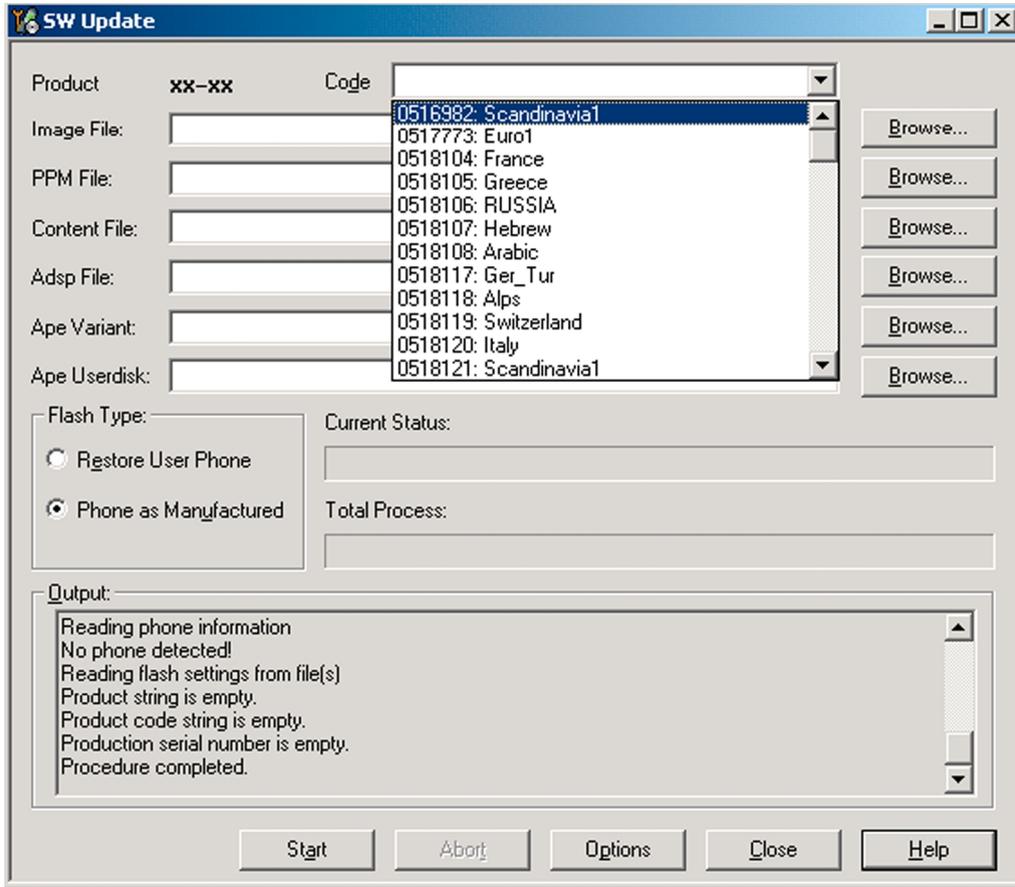
Required equipment and setup:

- Latest *Phoenix* service software.
- The latest phone model specific *Phoenix* data package.
- PKD-1 dongle
- SX-4 smart card (Enables BB5 testing and tuning features)
- External smart card reader
 - Note:** The smart card reader is only needed when FLS-5 is used. FPS-10 has an integrated smart card reader.
- Activated FLS-5 flash device **OR** FPS-10 flash prommer
- The latest flash update package for FLS-5 flash device or FPS-10 flash prommer
- CU-4 control unit
- USB cable from PC USB Port to CU-4 control unit
- Phone model specific adapter for CU-4 control unit
- PCS-1 cable to power CU-4 from external power supply
- XCS-4 modular cable between flash prommer and CU-4
 - Note:** CU-4 must be supplied with +12 V from an external power supply in all steps of certificate restoring.

Steps

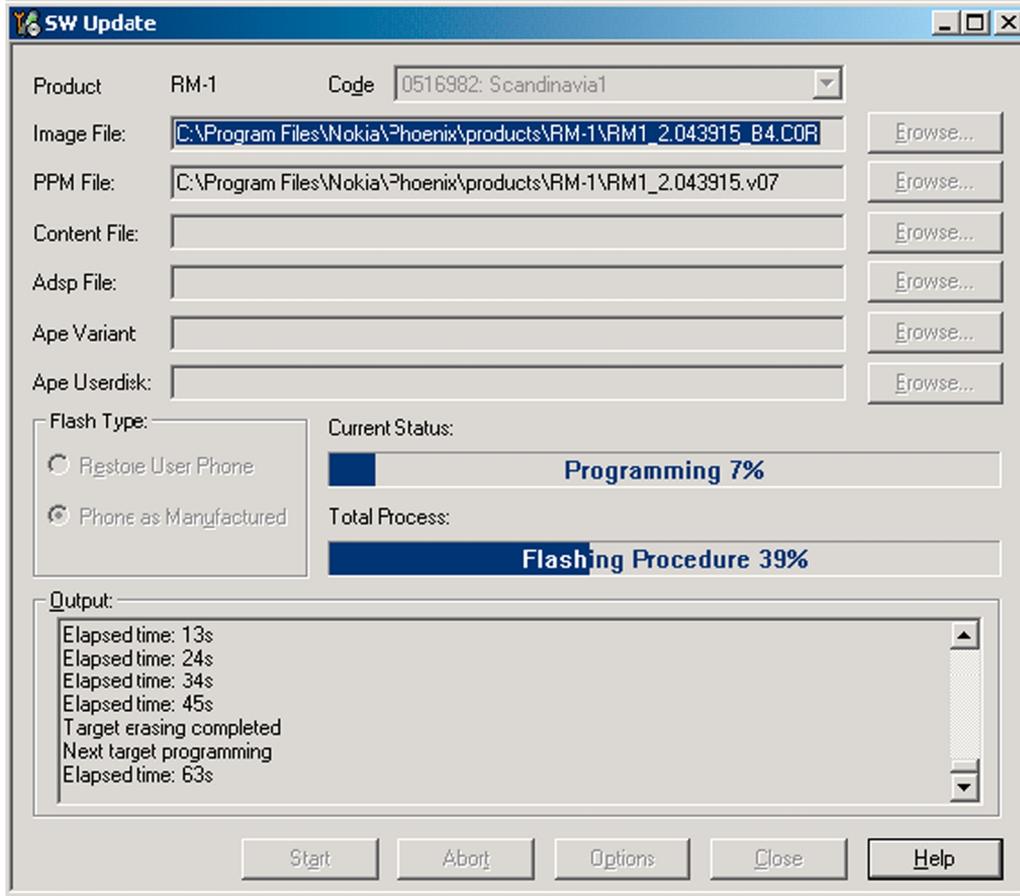
1. Program the phone software.
 - i Start *Phoenix* and login. Make sure the connection has been managed correctly for FLS-5 or FPS-10.
 - ii Update the phone MCU software to the latest available version.
 - If the new flash is empty and the phone cannot communicate with *Phoenix*, reflash the phone.

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



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

- v To continue, click **Start**.
Progress bars and messages on the screen show actions during phone programming, please wait.



Programming is completed when *Flashing Completed* message is displayed.

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

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

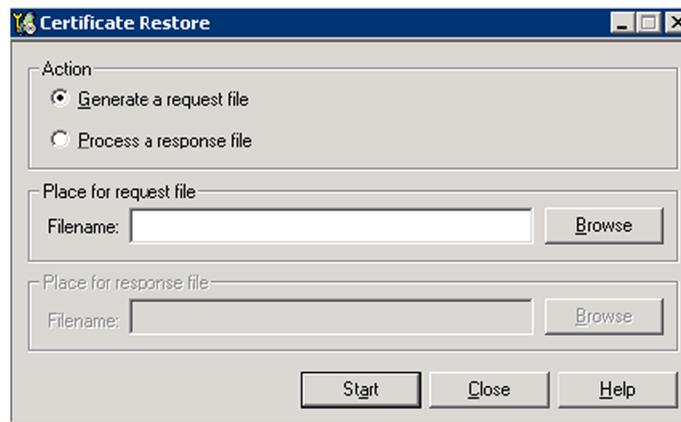
2. Create a *Request* file.

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

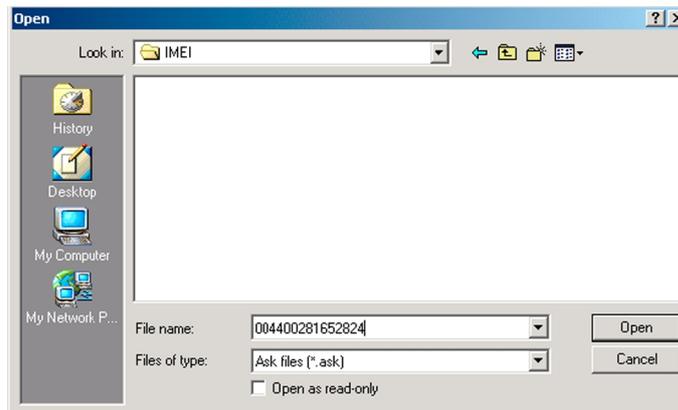
i To connect the phone with *Phoenix*, choose **File**→**Scan Product** .

ii Choose **Tools**→**Certificate Restore** .

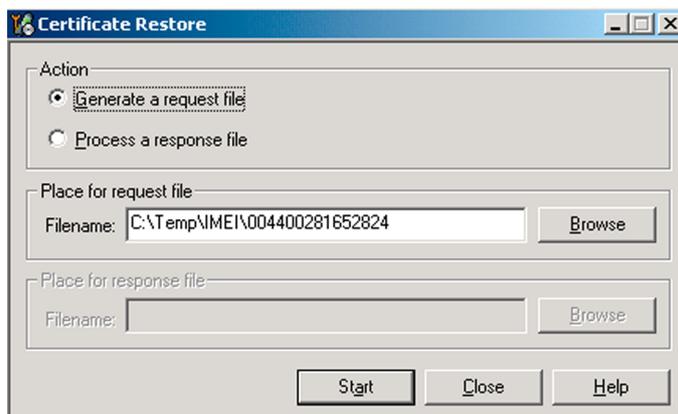
iii To choose a location for the request file, click **Browse**.



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



The name of the file and its location are shown.

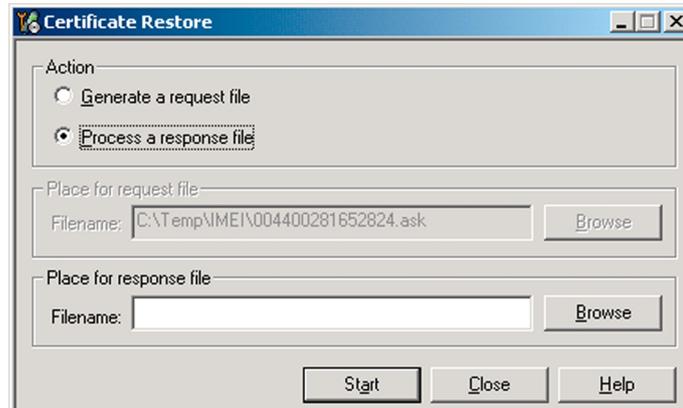


- v To create the *Request* file, click **Start**.
 - vi When the file for certificate restore has been created, send it to Nokia as an e-mail attachment.
3. Restore certificate.

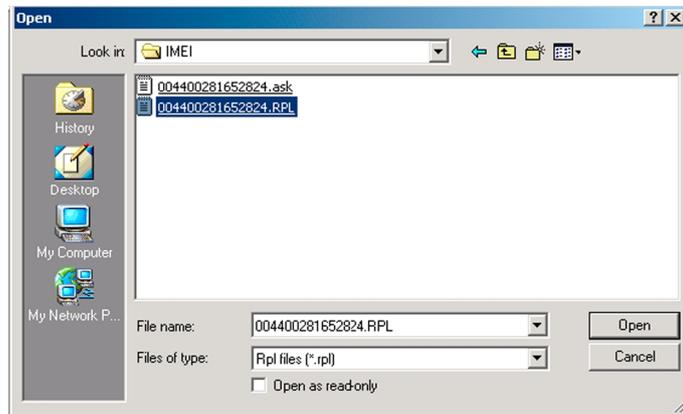
For this procedure, you must supply +12 V to CU-4 from an external power supply.

- i Save the reply file sent by Nokia to your computer.
- ii Start *Phoenix* service software.
- iii Choose **File**→**Scan Product** .

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

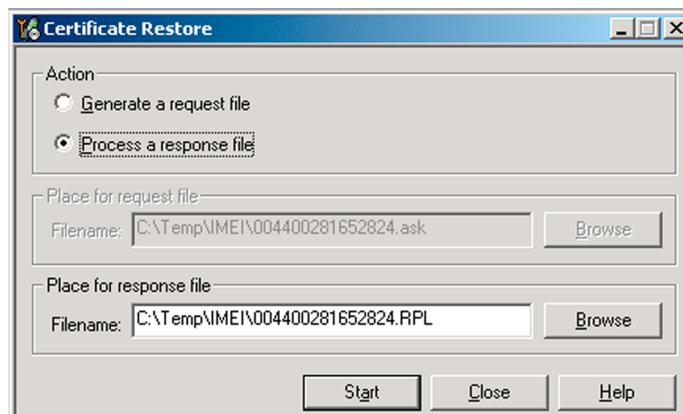


- v To choose the location where response file is saved, click **Browse**.
- vi Click **Open**.



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

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



Next actions

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

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

■ Keys troubleshooting

Keyboard troubleshooting

Context

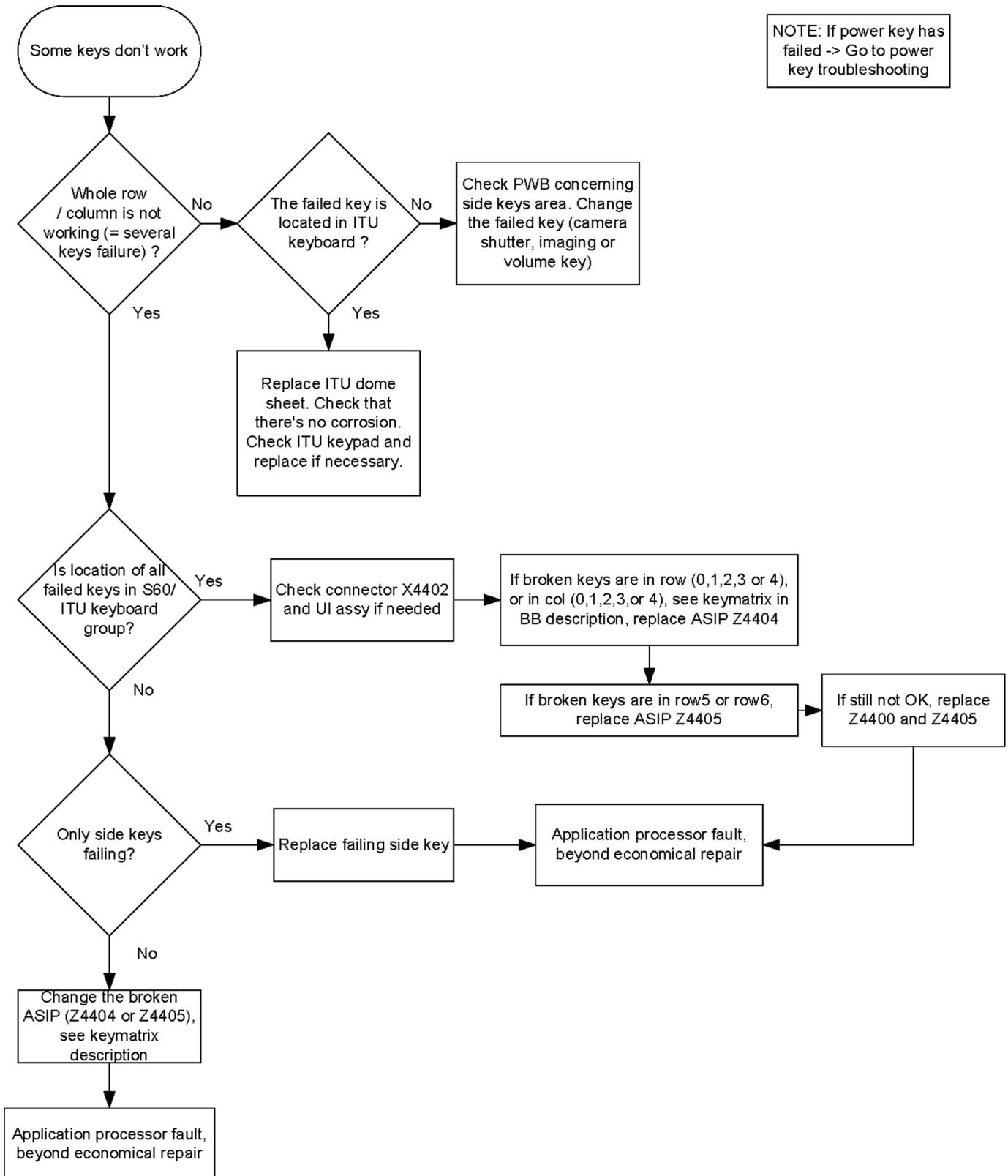
There are two possible failure modes in the keyboard module:

- 1 One or more keys are stuck, so that the key(s) does not react when you press a keydome. This kind of failure is caused by mechanical reasons (dirt, corrosion).
- 2 Malfunction of several keys at the same time; this happens when one or more rows or columns are failing (shortcut or open connection). For a more detailed description of the keyboard and keymatrix, see section **Keyboard**.

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

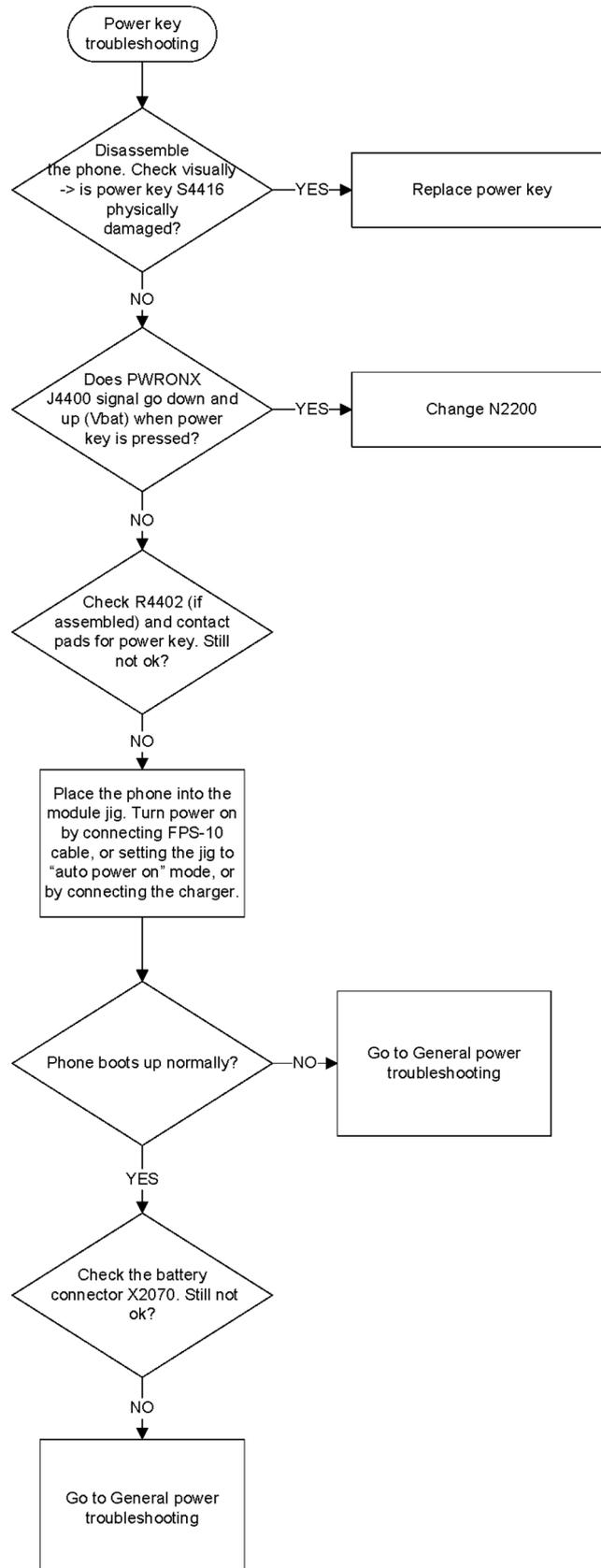
Troubleshooting flow

NOTE: If power key has failed -> Go to power key troubleshooting



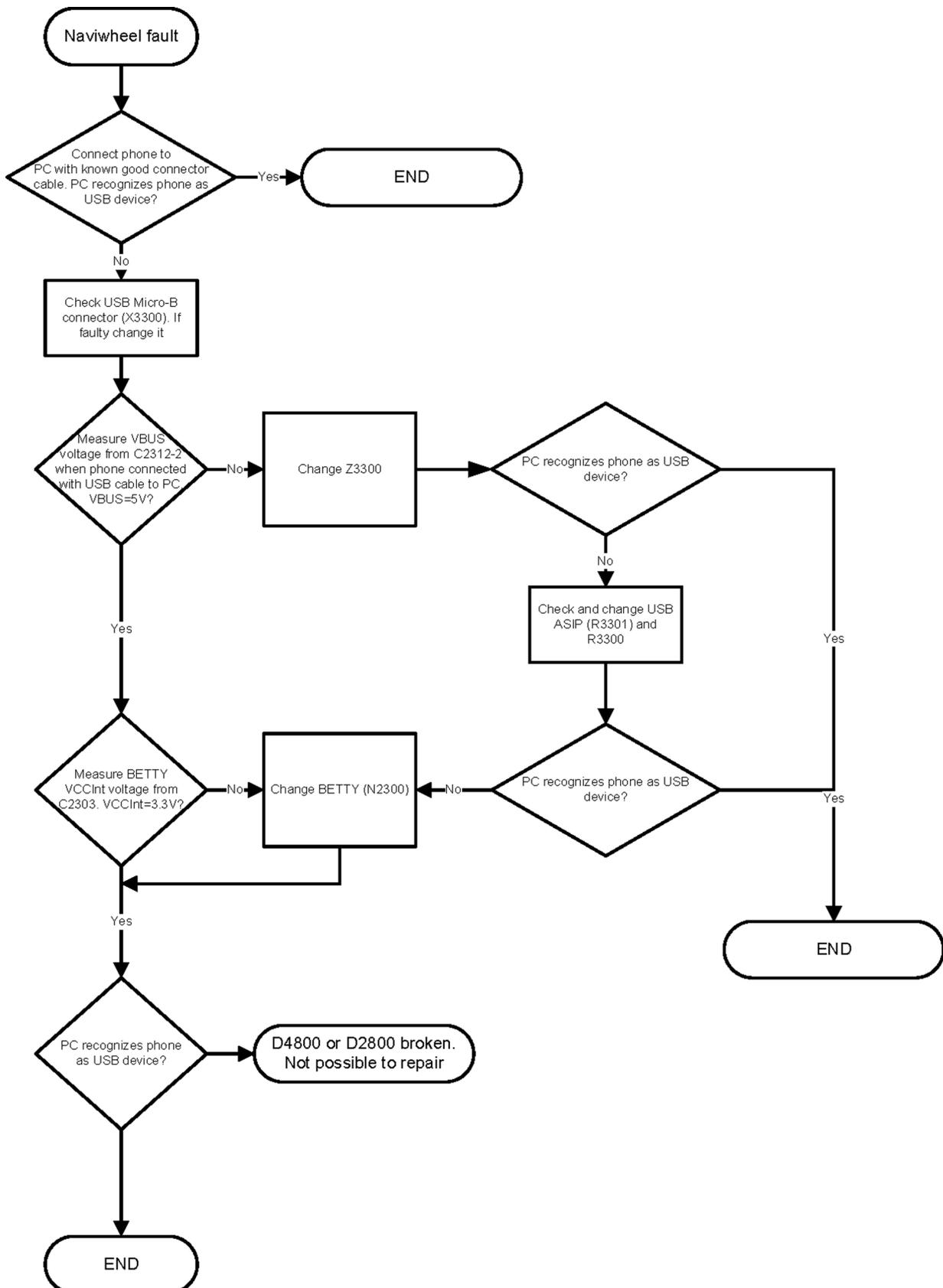
Power key troubleshooting

Troubleshooting flow



NaviWheel troubleshooting

Troubleshooting flow



■ **GPS troubleshooting**

GPS layout and basic test points

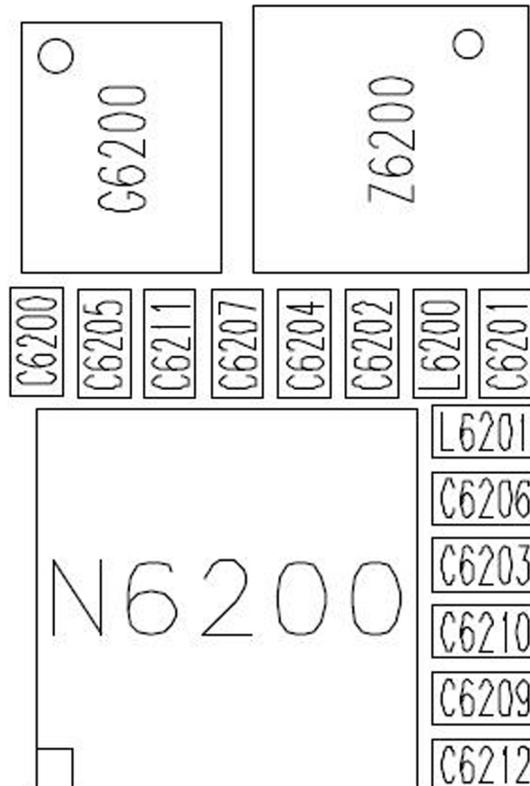


Figure 18 GPS layout and basic test points

VBat, ASIC internal LDO voltages, and clocks are available as shown in figure above. In addition to these, the following GPS signals are available on the test points:

- GPS_En_Reset – J6201
- U2Tx – J6202 (Activity on this pin indicates the GPS is operating.)
- IO_INT_U1CLK – J6203
- IO_TIMESTAMP_DATRDY – J6204
- SleepX – J2219
- Sleep Clk (RTC) – J2217

GPS settings for Phoenix

GPS control

Context

Use the following to test GPS using Phoenix.

Steps

1. Start Phoenix service software.
2. From the **File** menu, select **Scan Product** and check that the correct product version is displayed.

- From the **Testing** menu, select **GPS Control**. This opens up *GPS Control* dialogue box, as shown in the figure below, and enables the GPS.

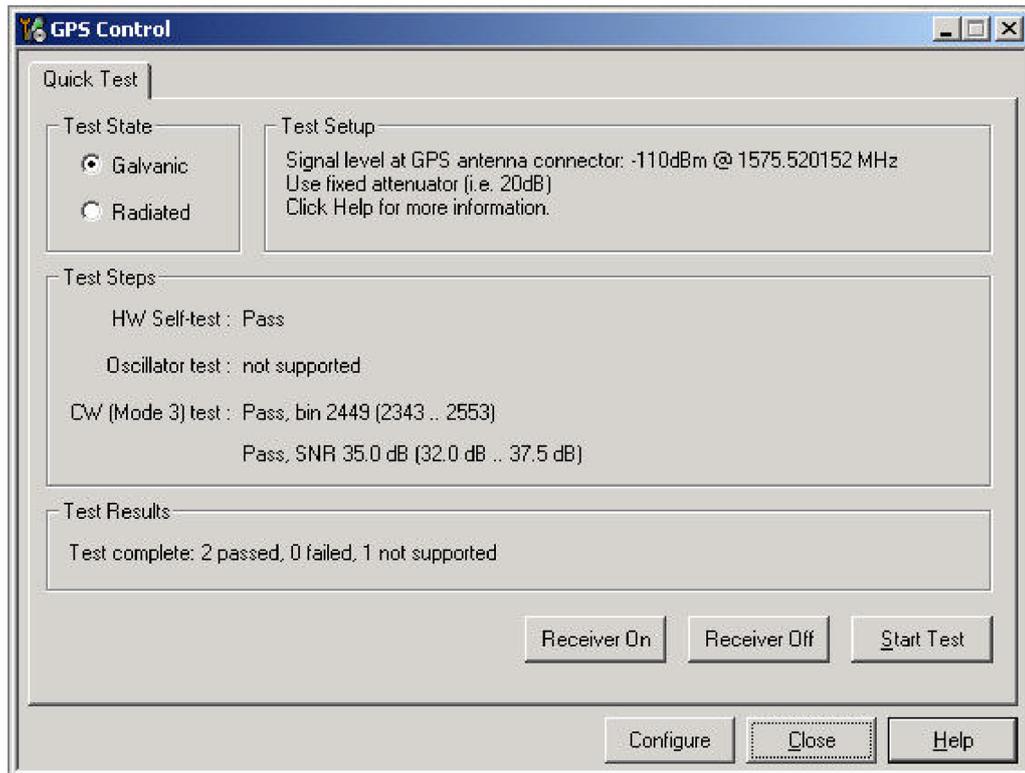


Figure 19 GPS Control dialog box

Select **Idle** to confirm the GPS is enabled and is in idle mode; at this point all clocks should be present, GPS_En_Reset & SleepX should be high, and Vdd_Dig, Vcc_TCXO & Vcc_PLL/VCO will be present.

Receiver On turns on all RF sections of the ASIC and so all LDOs will be on. These checks are part of [GPS Basic Checks Troubleshooting Flow \(page 3–39\)](#).

Quick Test window

The *Quick Test* window has all the necessary functionality for GPS troubleshooting. Ensure the test setup is correct and click **Start Test**. (Select **Help** for further information).

This test will perform 3 tests in one; Self Test, Oscillator Test and CW Test, and will provide a Pass/Fail response. It also contains a Receiver On button. These checks are part of [GPS failure troubleshooting \(page 3–37\)](#).

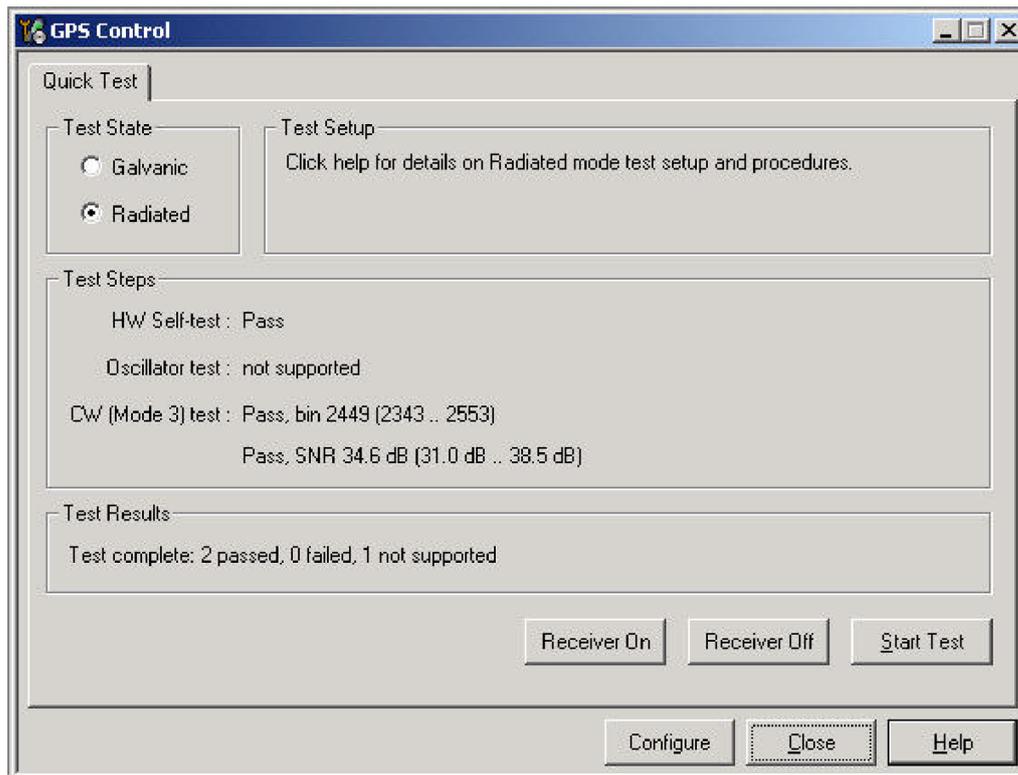


Figure 20 GPS Quick Test window for GPS troubleshooting

GPS RF test points

The GPS antenna test pads are located on the top side under the keymat as shown in figure "GPS antenna test pads". Checking for a connection between these two test points will confirm that the antenna is working correctly, as well as performing a radiated CW test.

J6212 = GPS Ant

J6213 = GPS Ant Gnd

In order to probe GPS RF test points, inject 1575.52 MHz tone @ -50dBm at the GPS antenna test connector and select **Receiver On**, then probe the GPS RF test points as shown in figure "GPS RF probe points". Compare RF levels with a known reference phone.

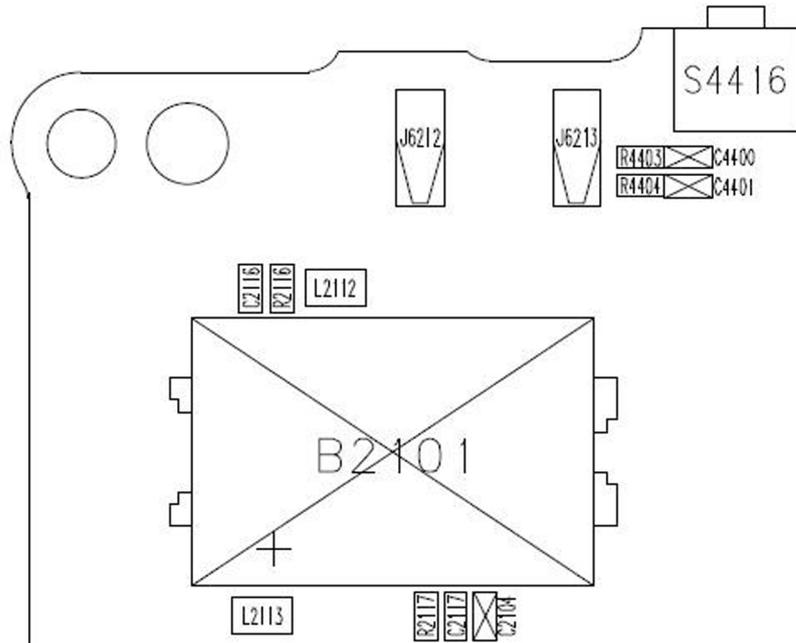


Figure 21 GPS antenna test pads

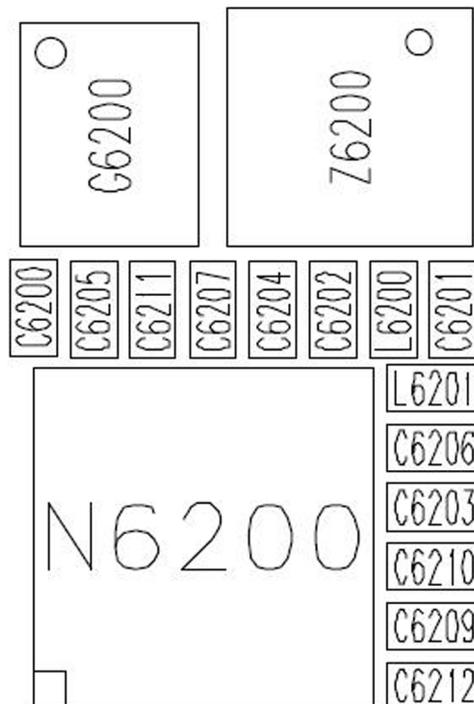


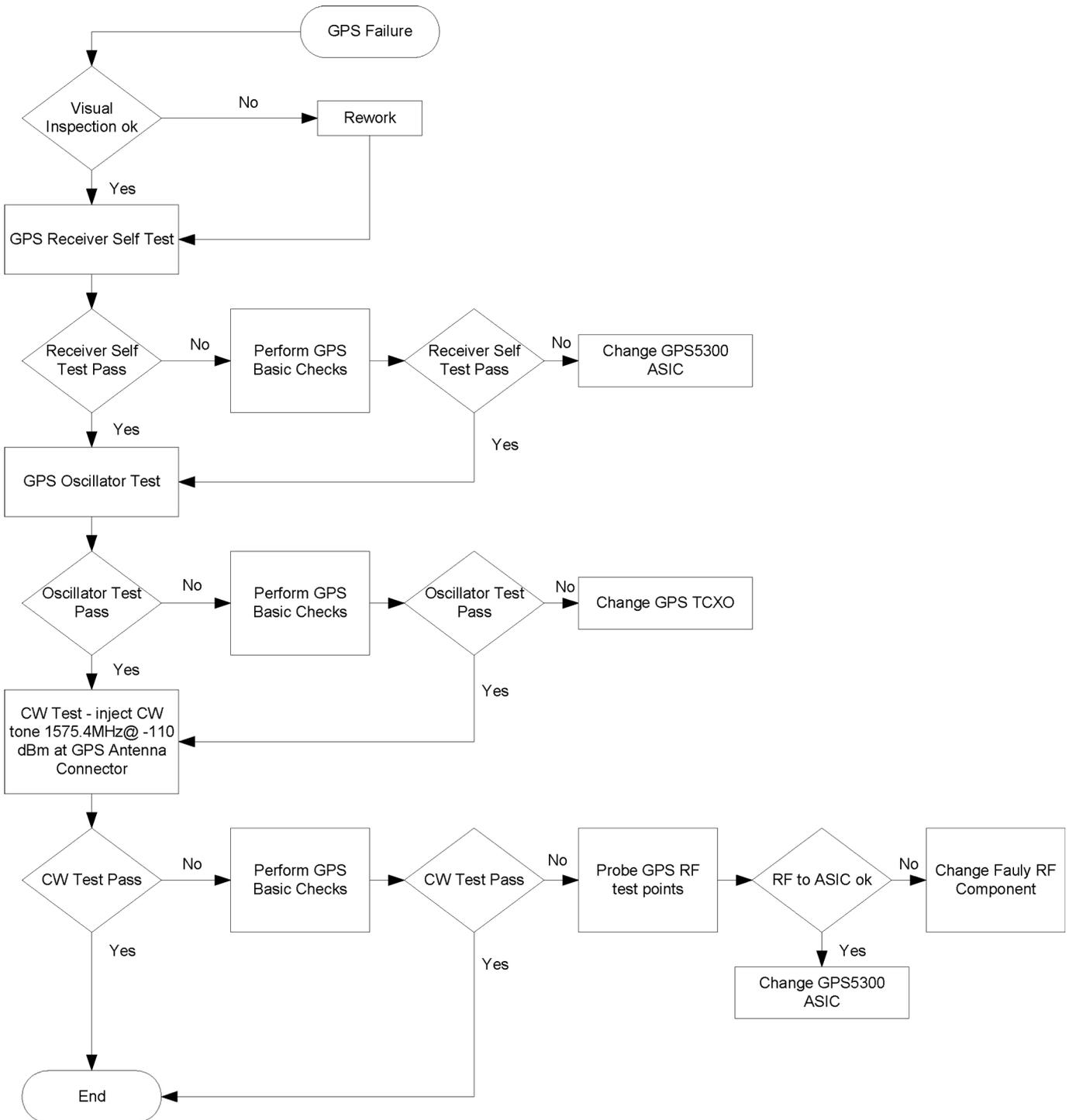
Figure 22 GPS RF probe points

GPS failure troubleshooting flow

Context

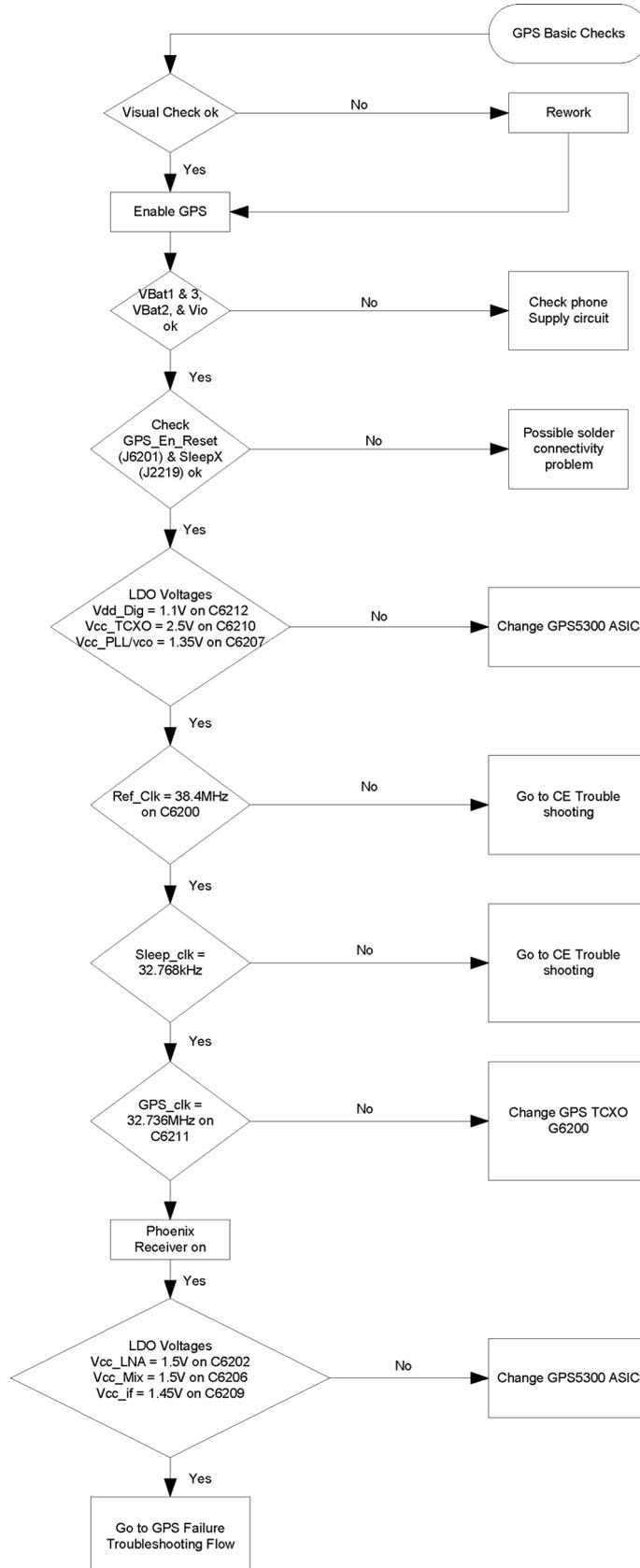
GPS troubleshooting is broken down into two parts: general GPS failure & GPS basic checks. The GPS failure troubleshooting flow can be followed and, where applicable, will feed into the Basic checks troubleshooting flow.

Troubleshooting flow



GPS basic checks troubleshooting flow

Troubleshooting flow



■ **Display module troubleshooting**

General instructions for display troubleshooting

Context

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

Table 8 Display module troubleshooting cases

Display blank	There is no image on the display. The display looks the same when the phone is on as it does when the phone is off. The backlight can be on in some cases.
Image on the display not correct	Image on the display can be corrupted or a part of the image can be missing. If a part of the image is missing, change the display module. If the image is otherwise corrupted, follow the appropriate troubleshooting diagram.
Backlight dim or not working at all	Backlight LED components are inside the display module. Backlight failure can also be in the connector or in the backlight power source in the main engine of the phone. 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 9 Pixel defects

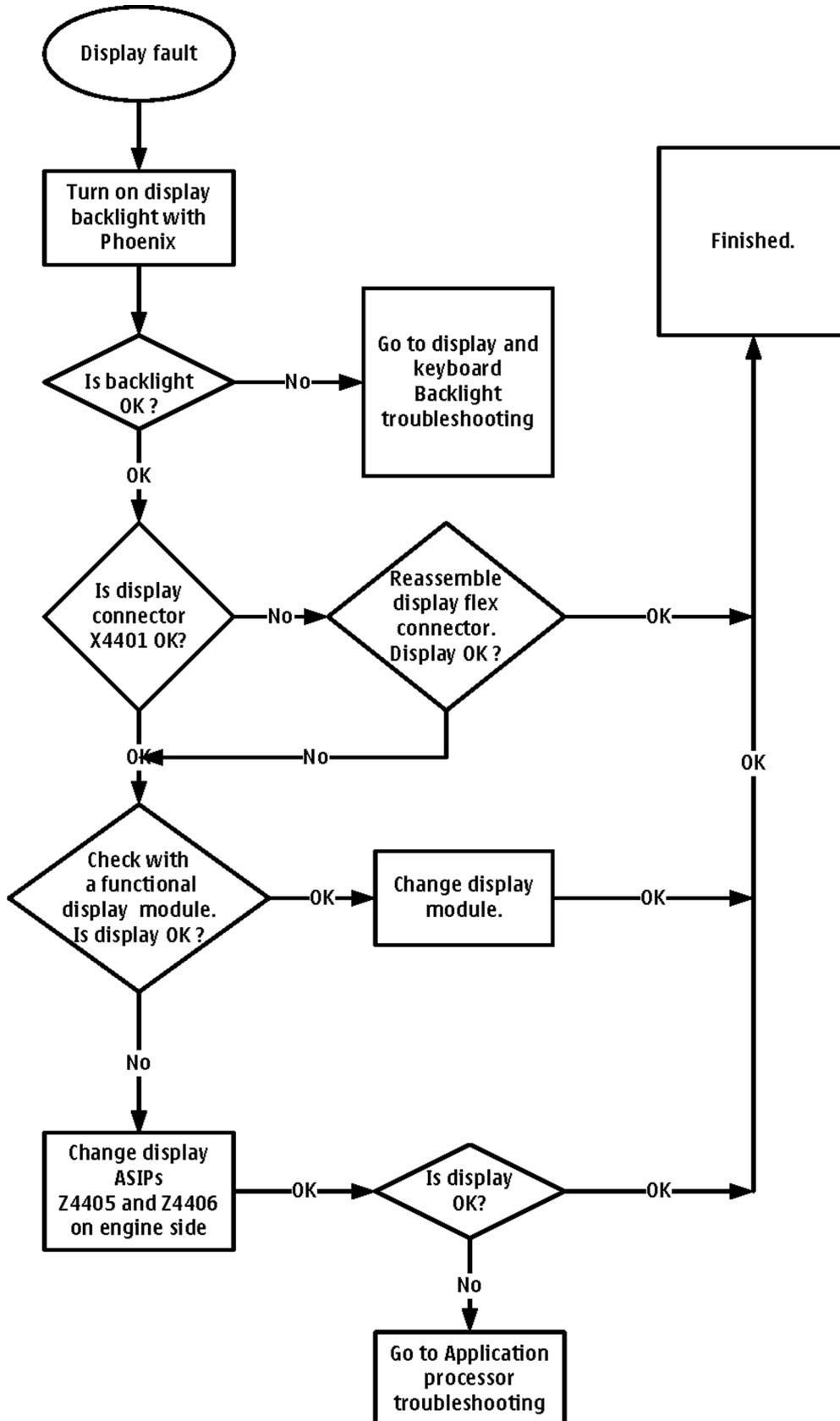
Item		White dot defect				Black dot defect	Total
		R	G	B	White Dot Total		
1	Defect counts	1	1	1	1	1	1
2	Combined defect counts	Not allowed. Two single dot defects that are within 5 mm of each other should be interpreted as combined dot defect.					

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

Display troubleshooting

Troubleshooting flow



Display and keyboard backlight troubleshooting

Context

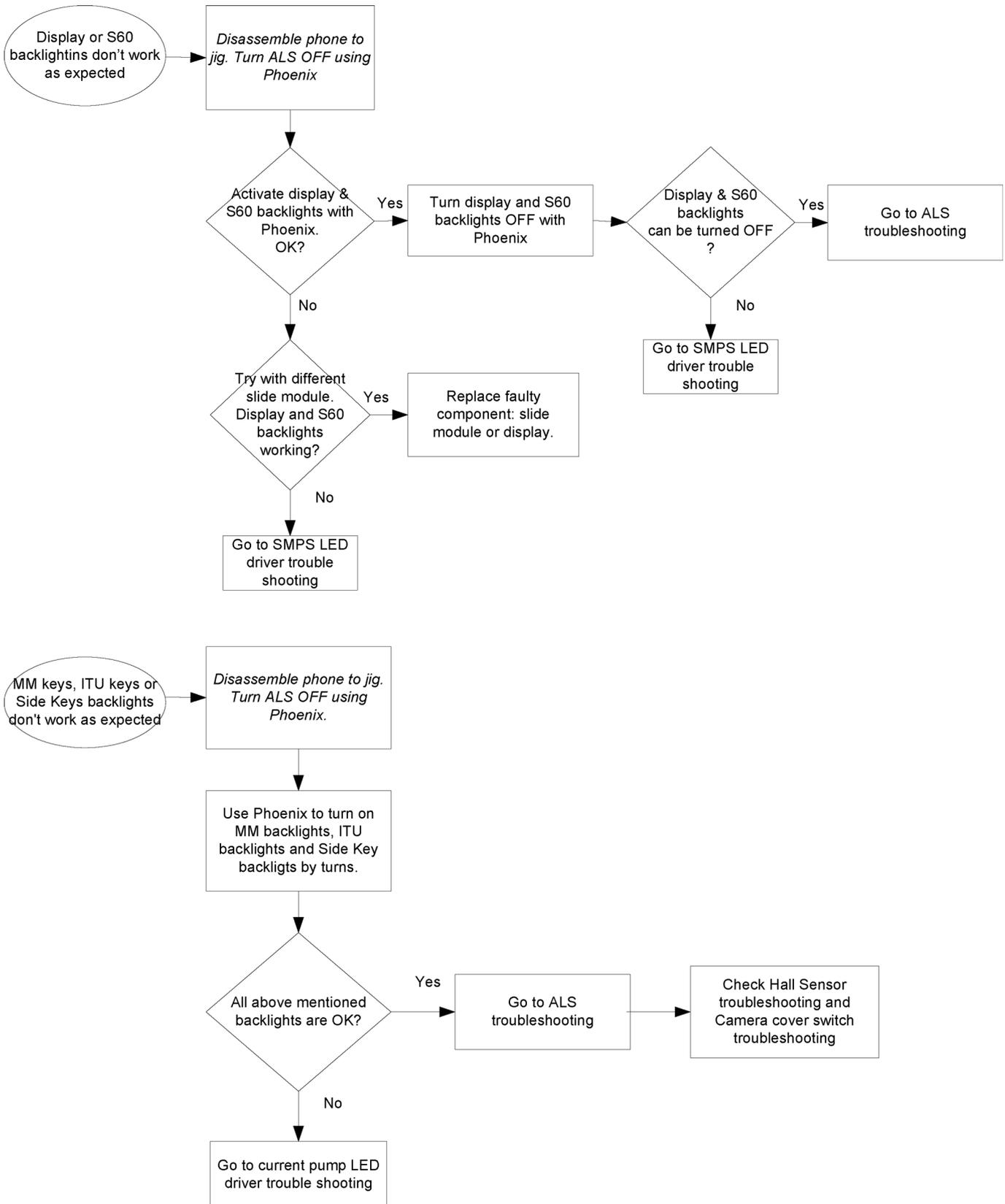
The device has one LED driver that provides current for both display and keyboard backlights and another LED driver that provides current for ITU and side key backlights.

Keyboard backlights are turned ON only in dark conditions. This is controlled by the Ambient Light Sensor (ALS). Also the brightness of the display is adjusted by the ambient light sensor.

You can enable/disable ALS with the help of Phoenix service software.

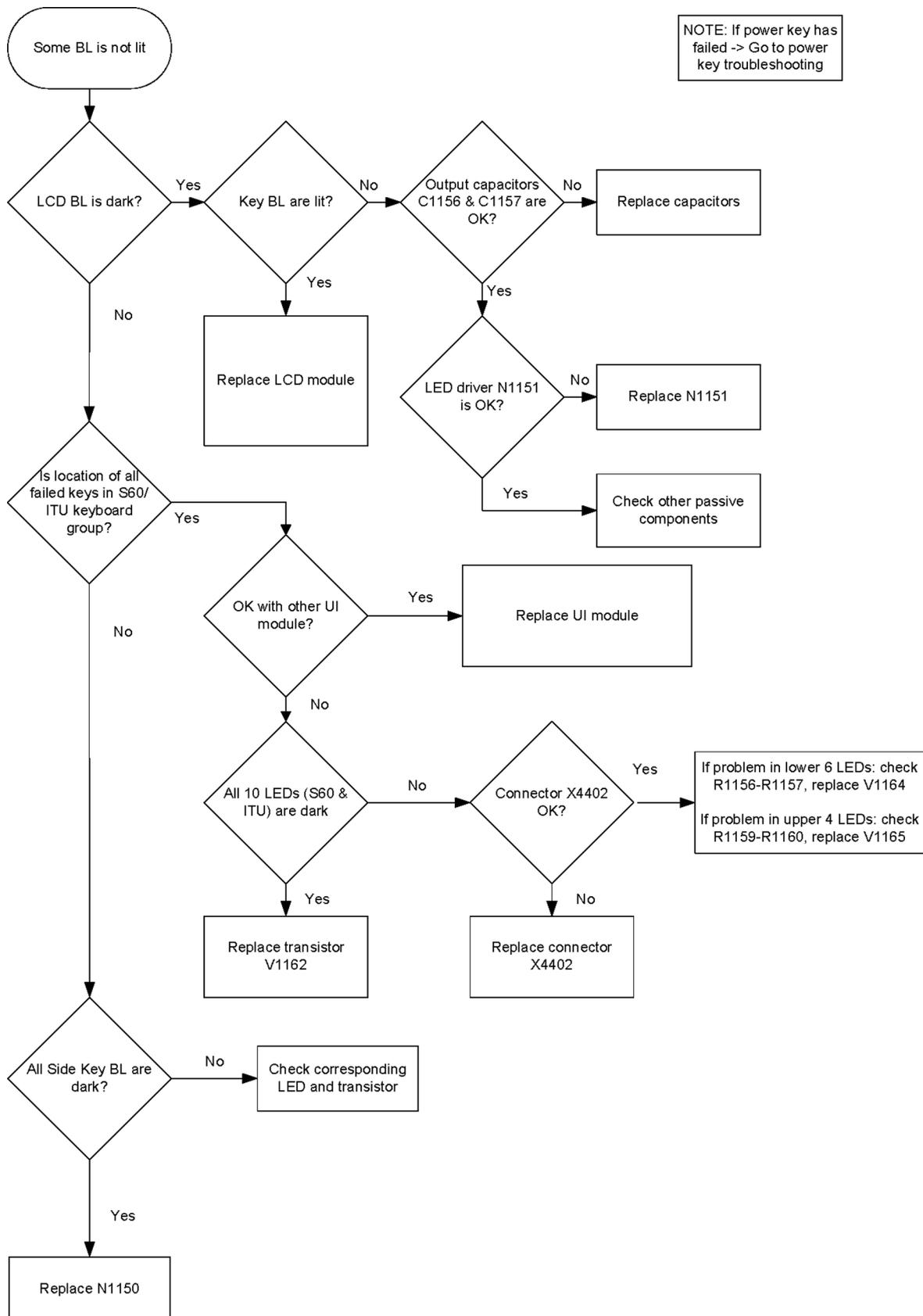
Display brightness can be adjusted manually, if ALS is disabled. If the ambient light sensor is enabled, it adjusts the display brightness automatically.

Troubleshooting flow



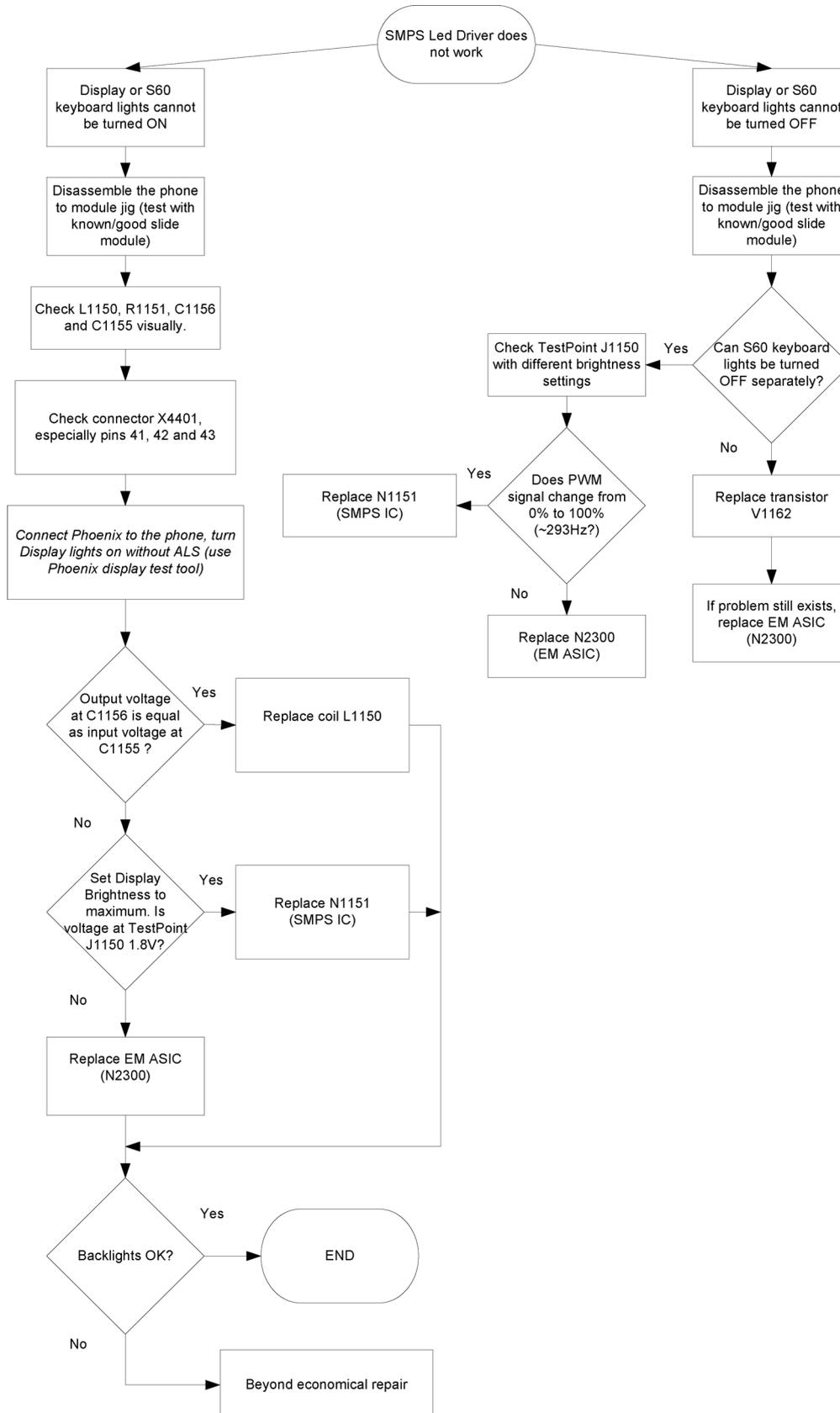
Backlight troubleshooting

Troubleshooting flow



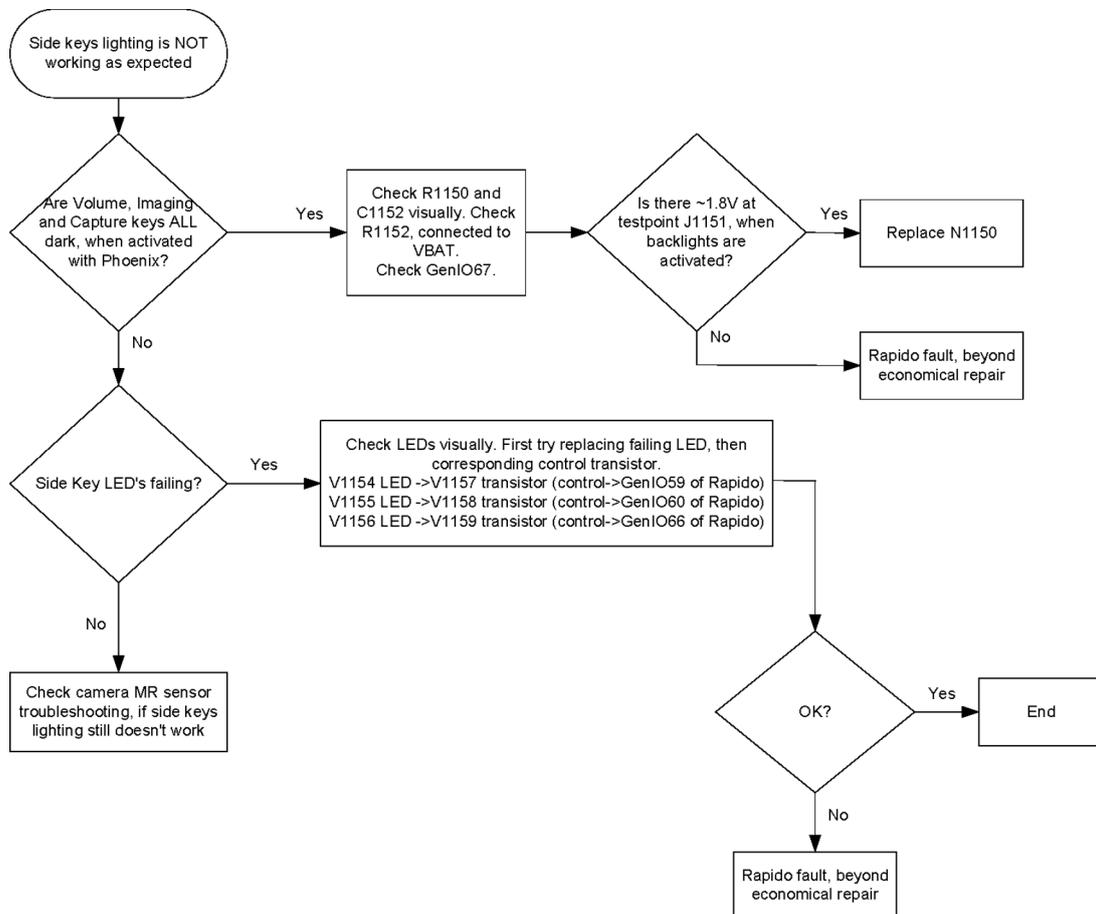
SMPS LED driver troubleshooting

Troubleshooting flow



Current pump LED driver troubleshooting

Troubleshooting flow



Ambient Light Sensor (ALS) troubleshooting

Context

- If ALS (Poliwag) is broken, replace it.
- After replacing the ALS, ALS re-tuning is required for example if calibration values of the new sensor are lost (see instructions later in this document).
- When carrying out the ALS calibration procedure, it is required to have a reference phone, which includes calibrated ALS. ALS re-tuning instructions below explain why the reference phone is needed.
- Make sure that you have completed [Display and keypad backlight troubleshooting \(page \)](#) first before starting **ALS troubleshooting**.

Here are some hints for ALS troubleshooting:

- In *Phoenix* Display Test tool, there is an *Ambient Light Sensor* window, which shows the luminance. The correct luminance in darkness is <20 lx, and in office environment 100-2000 lx. The luminance value depends strongly on the light source and the angle of the phone, so these values are only a rough guideline.
- LED drivers' control voltage measurement points can be found in the [SMPS LED drivers troubleshooting \(page 3-46\)](#) and [Current pump LED driver troubleshooting \(page 3-47\)](#) sections. When backlight brightness is set to 100%, the PWM signal is continuously on high state.

- *Phoenix* has an ambient light sensor calibration tool for changing calibration values. Concerning Poliwag ALS, there is no need for performing a pull-up resistor calibration (as for earlier Ambient Light Sensors).

Re-tune Poliwag ALS as follows:

Steps

1. Connect the reference phone to *Phoenix* and set the phone (e.g. on the table) so that the amount of ambient light is as stable as possible seen by Poliwag ALS. Light guide of the ALS is located in the upper part of the phone's A-Cover.
2. Start *Phoenix*.
3. Choose **File**→**Scan Product**.
4. Choose **Testing**→**Display Test**.

You should see the following window:

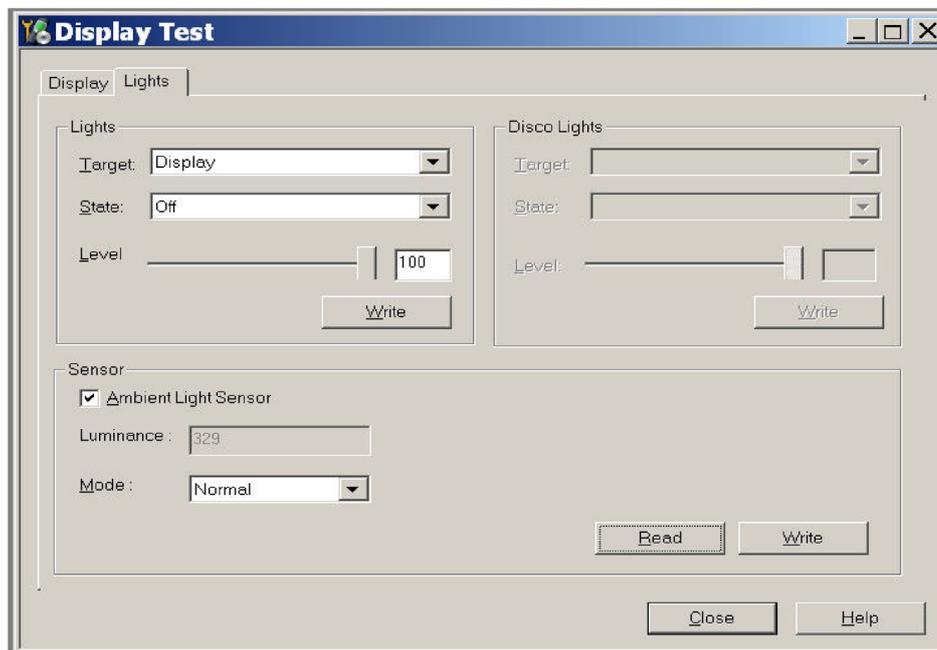
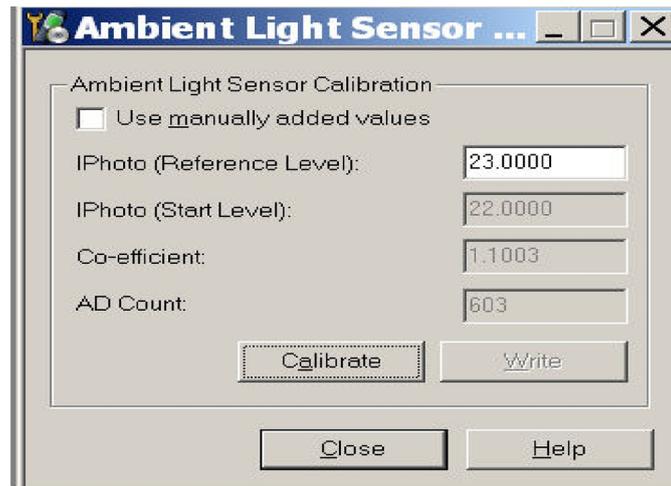


Figure 23 Ambient Light Sensor Calibration window

Open the **Lights** tab, check the **Ambient Light Sensor** check box, Click **Read** to get reference ambient light value from the **Luminance** text box and write it down.

5. Repeat steps 1 to 4 to calibrate the phone and make sure the phone to be calibrated is located in the same place as the reference phone was when luminance reading was taken. Write down the illuminance of the phone to be calibrated.
6. Calculate the co-efficient from the reference and the phone to be calibrated luminance values by division: $\text{Co-efficient} = \text{luminance (reference phone)} / \text{luminance (phone to be calibrated)}$, write down the calculated co-efficient value.
7. Choose **Tuning**→**Ambient Light Sensor Calibration** .

You should see the following window:



Iterate by changing **IPhoto** (reference level) value (remove cross from **Use manually added values**). After writing a value to **IPhoto** (reference value), press the **Calibrate** button. Stop iterating when the co-efficient is equal to the co-efficient calculated in bullet 6. Note that decimal numbers should be used in the iteration in order to achieve enough precision (e.g 23.2455).

8. After having a co-efficient value in the **Co-efficient** textbox as the calculated value, make sure that ambient light values (read using **TestingDisplay TestLuminance** textbox) are almost the same in the reference phone and the calibrated phone. Remember that illuminance readings for the reference and calibrated phones must be done in the same ambient light conditions. If illuminance values differ a lot (difference max. +- 10%), repeat the ALS re-tuning procedure from the beginning.
9. To end the calibration, click **Close**.

Backlights controlling in Phoenix

There are two power sources for lights. One is an SMPS type LED driver giving about 16V out, when 4 LEDs are connected as serial between its output and GND. Output is shared to two branches (4 + 4 LEDs in serial). This SMPS type LED driver is used for powering the display and S60 keyboard lights. Display lights must be switched ON before it is possible to switch ON S60 keyboard lights. However, S60 keyboard lights can be switched OFF, although display lights are still ON.

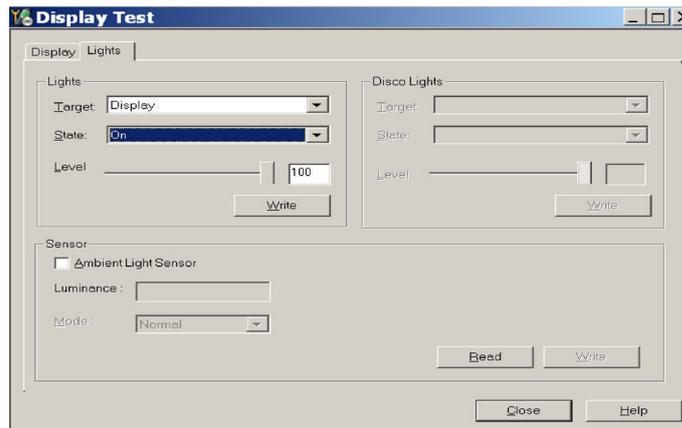
The second LED driver (a current pump type driver) is used for powering all other LEDs (ITU keyboard and side keys lights). This driver includes seven outputs. Each LED is connected straight from driver output to GND. Different keyboard lighting groups can be switched ON/OFF separately. In addition to that, it is possible to switch ON/OFF every side key light independently.

Switching display lighting on using Phoenix

Steps

1. Connect phone to *Phoenix*.
2. Start *Phoenix*.
3. Choose **File Scan Product**.
4. Choose **Display Display test**.

5. Click the **Lights** sheet.



6. From **Target** partition, select **Display**.

7. From **State** partition, select **On**.

8. Set **Level** to **100** and click **Write**.

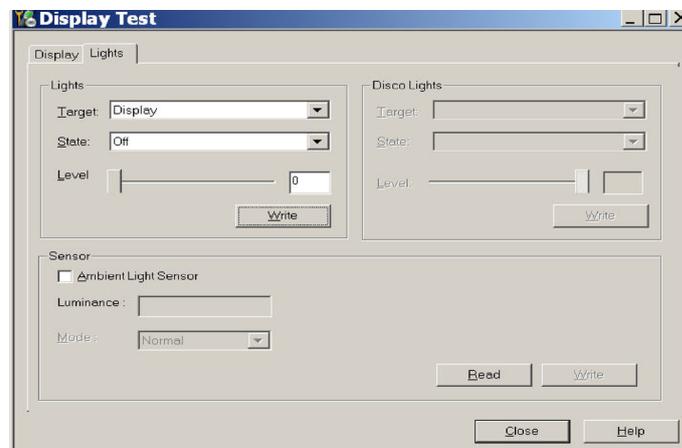
9. Click **Close** to end the lights testing.

Note: It is possible to set any value between 0...100 for display lights.

Switching display lighting OFF using Phoenix

Prerequisites

First, go through steps 1-5 in [Switching display lighting ON using Phoenix \(page 3–49\)](#), if not done yet



Steps

1. From **Target** partition, select **Display**.

2. From **State** partition, select **Off**.

3. Set **Level** to **0** and click **Write**.

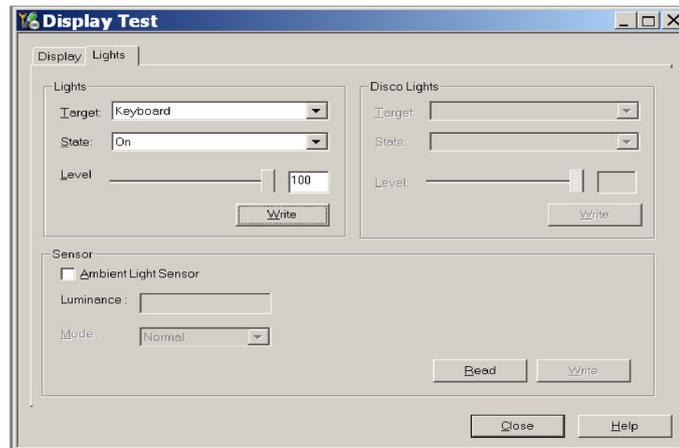
4. Click **Close** to end the lights testing.

Switching S60 keyboard lighting ON using Phoenix

Prerequisites

First, go through steps 1-5 in [Switching display lighting ON using Phoenix \(page 3–49\)](#), if not done yet.

Note: It is not possible to switch S60 keyboard lighting ON if display lighting is not activated (all other keyboard lights can be activated, although display lights would be OFF, but not S60 keyboard lights).



Steps

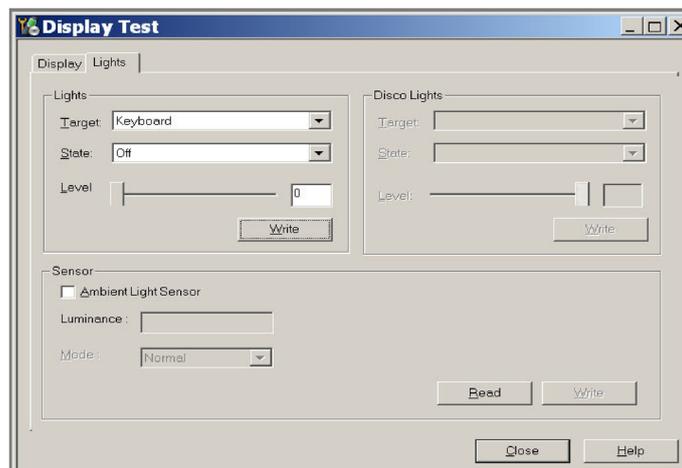
1. From **Target** partition, select **Keyboard**.
2. From **State** partition, select **On**.
3. Set **Level** to **100** and click **Write**.
4. Click **Close** to end the lights testing.

Note: The S60 keyboard lighting brightness follows display lighting brightness value, i.e. it is not possible to set different brightness for display and S60 keyboard lighting.

Switching S60 keyboard lighting OFF using Phoenix

Prerequisites

First go through steps 1-5 in [Switching display lighting ON using Phoenix \(page 3–49\)](#) if not done yet.



Steps

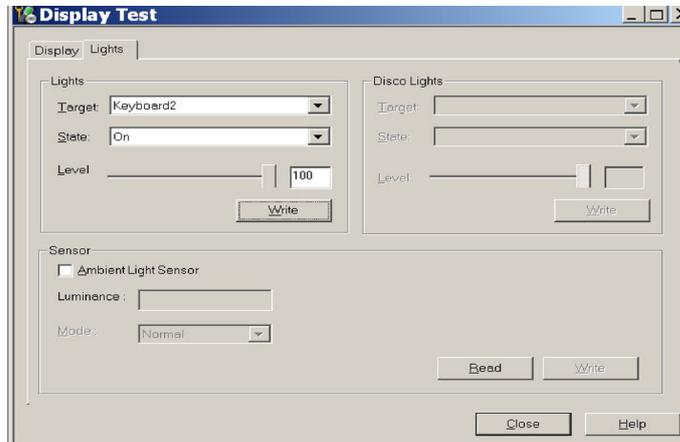
1. From **Target** partition, select **Keyboard**.
2. From **State** partition, select **Off**.
3. Set **Level** to **0** and click **Write**.

4. Click **Close** to end the lights testing.

Switching ITU (numeric) keyboard lighting ON using Phoenix

Prerequisites

First go through steps 1-5 in [Switching display lighting ON using Phoenix \(page 3–49\)](#) if not done yet.



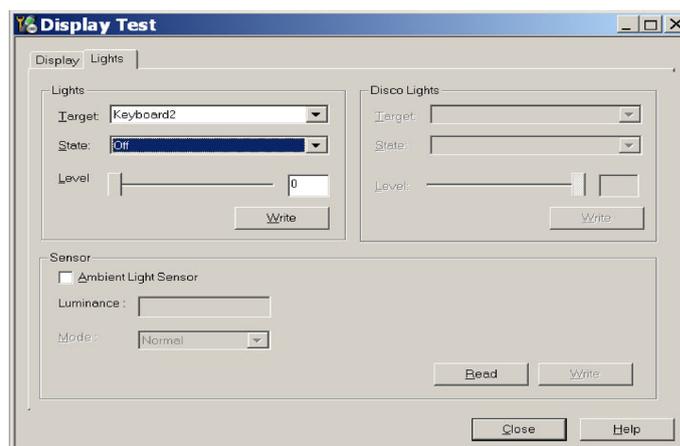
Steps

1. From **Target** partition, select **Keyboard2**.
2. From **State** partition, select **On**.
3. Set **Level** to **100** and click **Write**.
4. Click **Close** to end the lights testing.

Switching ITU (numeric) keyboard lighting OFF using Phoenix

Prerequisites

First go through steps 1-5 in [Switching display lighting ON using Phoenix \(page 3–49\)](#) if not done yet.



Steps

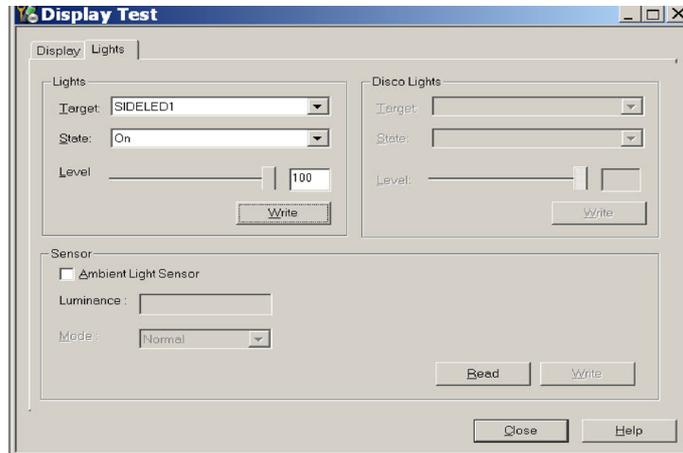
1. From **Target** partition, select **Keyboard2**.
2. From **State** partition, select **Off**.
3. Set **Level** to **0** and click **Write**.

4. Click **Close** to end the lights testing.

Switching volume keys lighting ON using Phoenix

Prerequisites

First go through steps 1-5 in [Switching display lighting ON using Phoenix \(page 3–49\)](#) if not done yet.



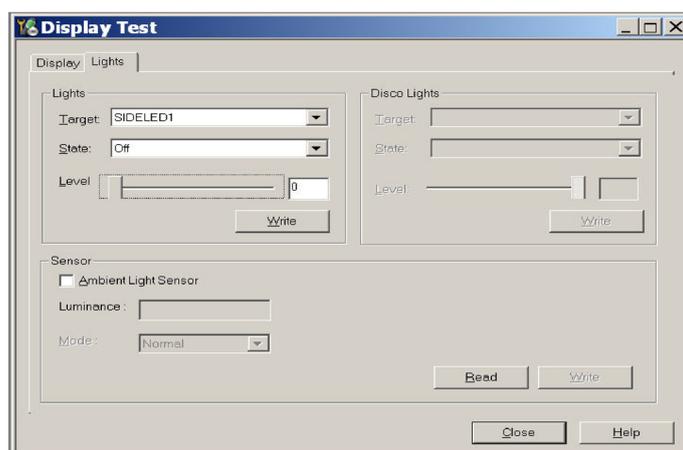
Steps

1. From **Target** partition, select **SIDELED1**.
2. From **State** partition, select **On**.
3. Set **Level** to **100** and click **Write**.
4. Click **Close** to end the lights testing.

Switching volume keys lighting OFF using Phoenix

Prerequisites

First go through steps 1-5 in [Switching display lighting ON using Phoenix \(page 3–49\)](#) if not done yet.



Steps

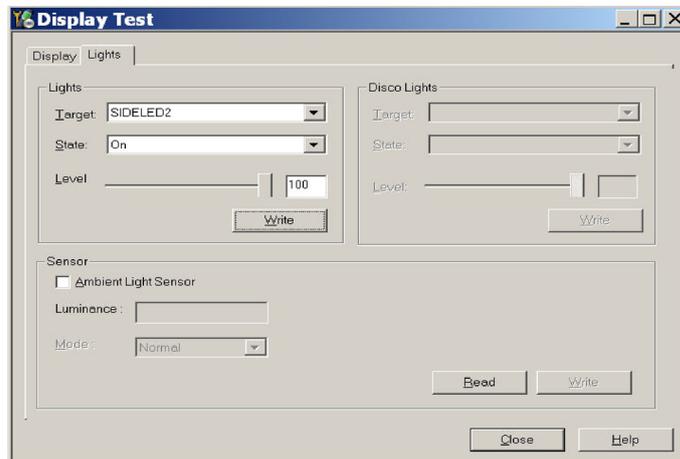
1. From **Target** partition, select **SIDELED1**.
2. From **State** partition, select **Off**.
3. Set **Level** to **0** and click **Write**.

4. Click **Close** to end the lights testing.

Switch imaging key lighting ON using Phoenix

Prerequisites

First go through steps 1-5 in [Switching display lighting ON using Phoenix \(page 3–49\)](#) if not done yet.



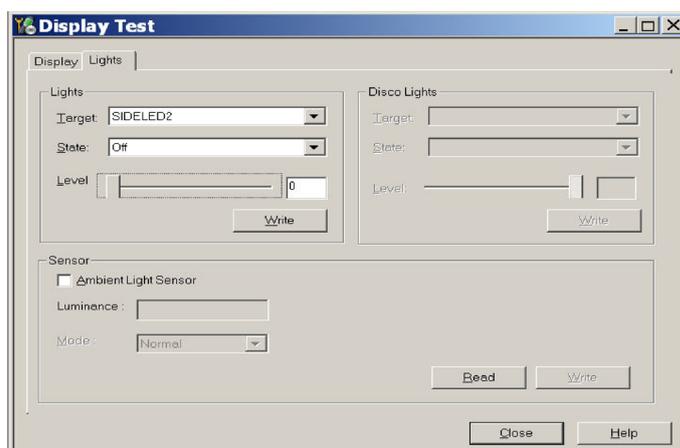
Steps

1. From **Target** partition, select **SIDELED2**.
2. From **State** partition, select **On**.
3. Set **Level** to **100** and click **Write**.
4. Click **Close** to end the lights testing.

Switching imaging key lighting OFF using Phoenix

Prerequisites

First go through steps 1-5 in [Switching display lighting ON using Phoenix \(page 3–49\)](#) if not done yet.



Steps

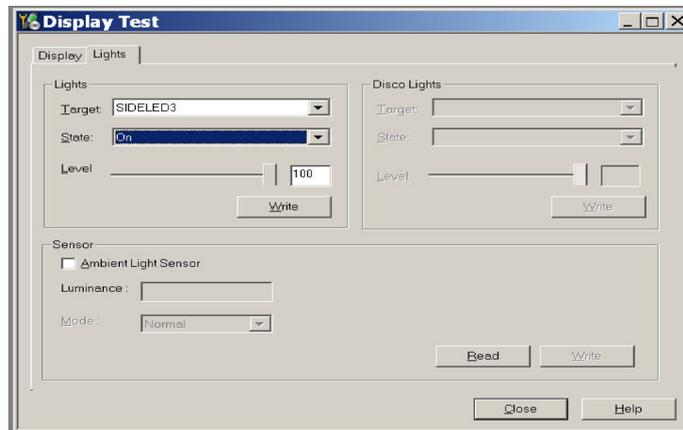
1. From **Target** partition, select **SIDELED2**.
2. From **State** partition, select **Off**.
3. Set **Level** to **0** and click **Write**.

4. Click **Close** to end the lights testing.

Switching shutter key lighting ON using Phoenix

Prerequisites

First go through steps 1-5 in [Switching display lighting ON using Phoenix \(page 3–49\)](#) if not done yet.



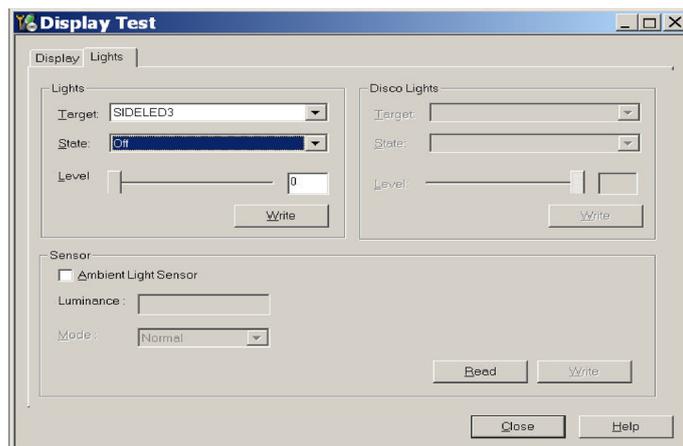
Steps

1. From **Target** partition, select **SIDELED3**.
2. From **State** partition, select **On**.
3. Set **Level** to **100** and click **Write**.
4. Click **Close** to end the lights testing.

Switching shutter key lighting OFF using Phoenix

Prerequisites

First go through steps 1-5 in [Switching display lighting ON using Phoenix \(page 3–49\)](#) if not done yet.



Steps

1. From **Target** partition, select **SIDELED3**.
2. From **State** partition, select **Off**.
3. Set **Level** to **0** and click **Write**.

4. Click **Close** to end the lights testing.

Bluetooth and FM radio troubleshooting

Introduction to Bluetooth troubleshooting

There are two main Bluetooth problems that can occur:

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

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

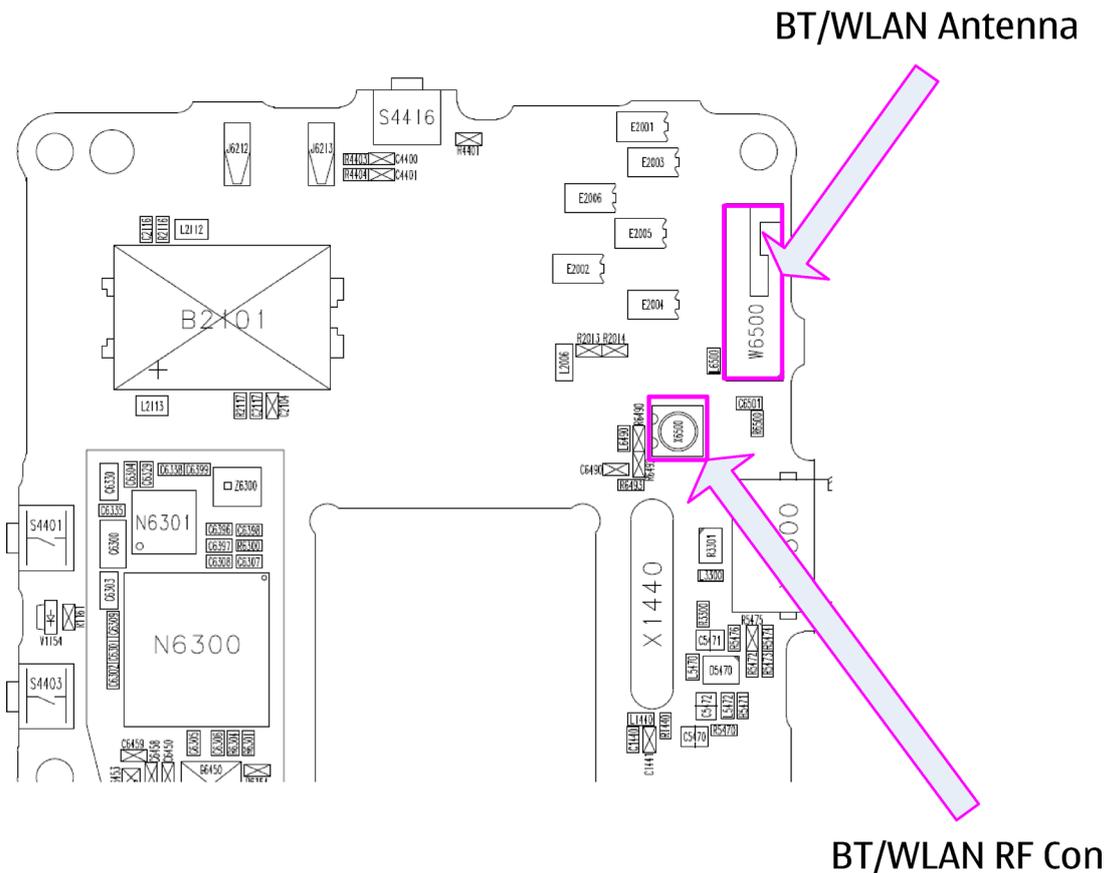


Figure 24 Bluetooth placement on the bottom side

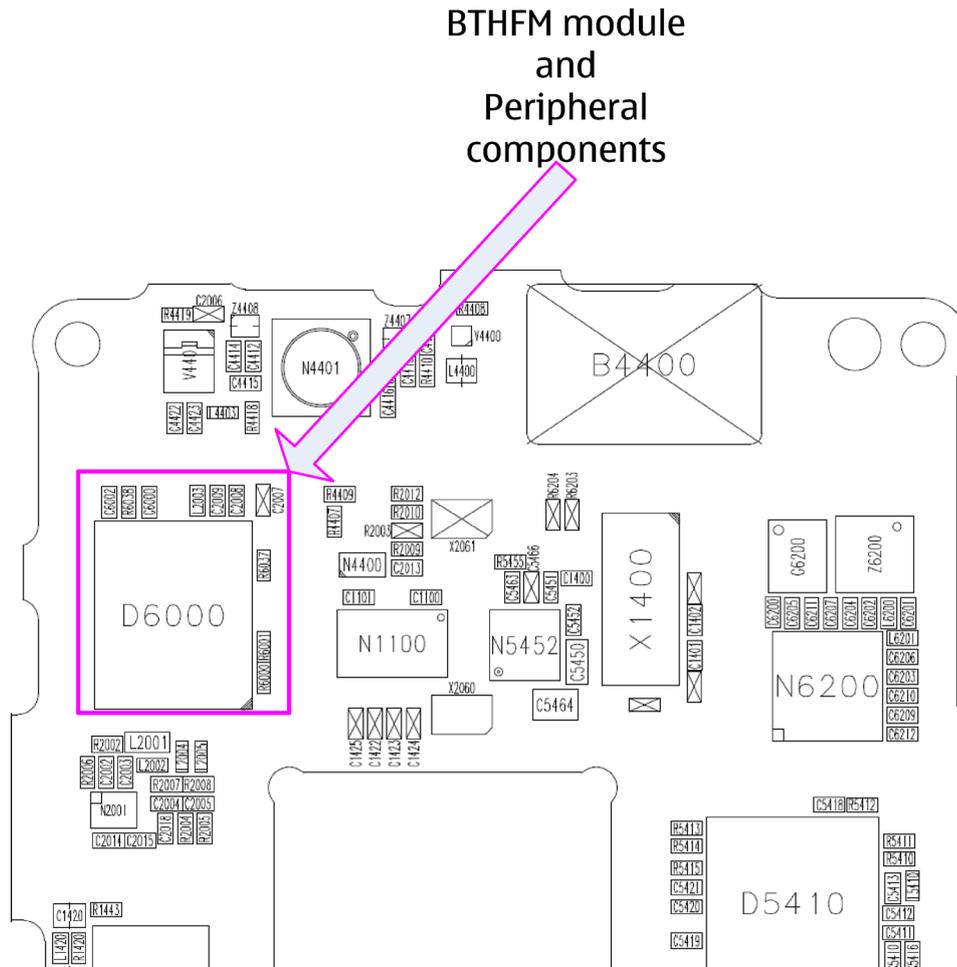


Figure 25 Bluetooth placement on the top side

Bluetooth settings for Phoenix

Steps

1. Start *Phoenix* service software.
2. From the **File** menu, choose **Open Product**, and then choose the correct type designator from the **Product** list.
3. Place the phone to a flash adapter in the local mode.
4. Choose **Testing**→**Bluetooth LOCALS** .
5. Locate JBT-9's serial number (12 digits) found in the type label on the back of JBT-9. In addition to JBT-9, also SB-6, JBT-3 and JBT-6 Bluetooth test boxes can be used.
6. In the *Bluetooth LOCALS* window, write the 12-digit serial number on the **Counterpart BT Device Address** line.
This needs to be done only once provided that JBT-9 is not changed.
7. Place the JBT-9 box near (within 10 cm) the BT antenna and click **Run BER Test**.

Results

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

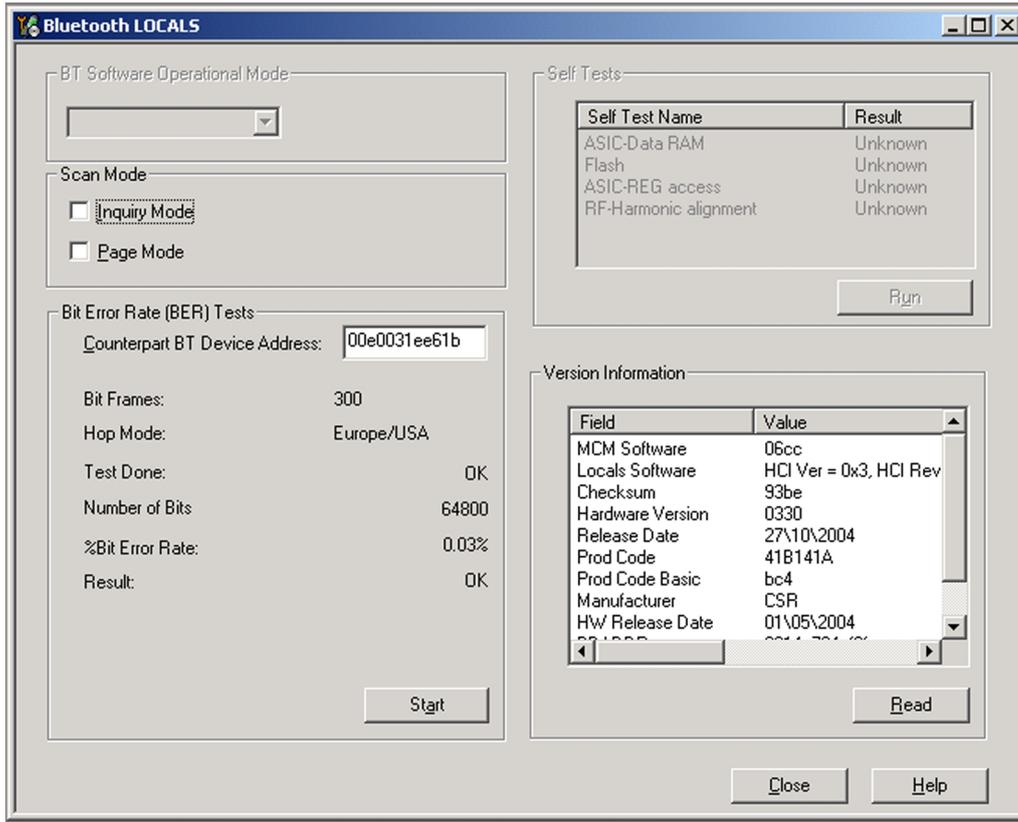


Figure 26 BER test result

Bluetooth self tests in Phoenix

Steps

1. Start *Phoenix* service software.
2. Choose **File** → **Scan Product**.
3. Place the phone to a flash adapter.
4. From the **Mode** drop-down menu, set mode to **Local**.
5. Choose **Testing** → **Self Tests**.
6. In the *Self Tests* window check the following Bluetooth related tests:
 - **ST_LPRF_IF_TEST**
 - **ST_LPRF_AUDIO_LINES_TEST**
 - **ST_BT_WAKEUP_TEST**

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

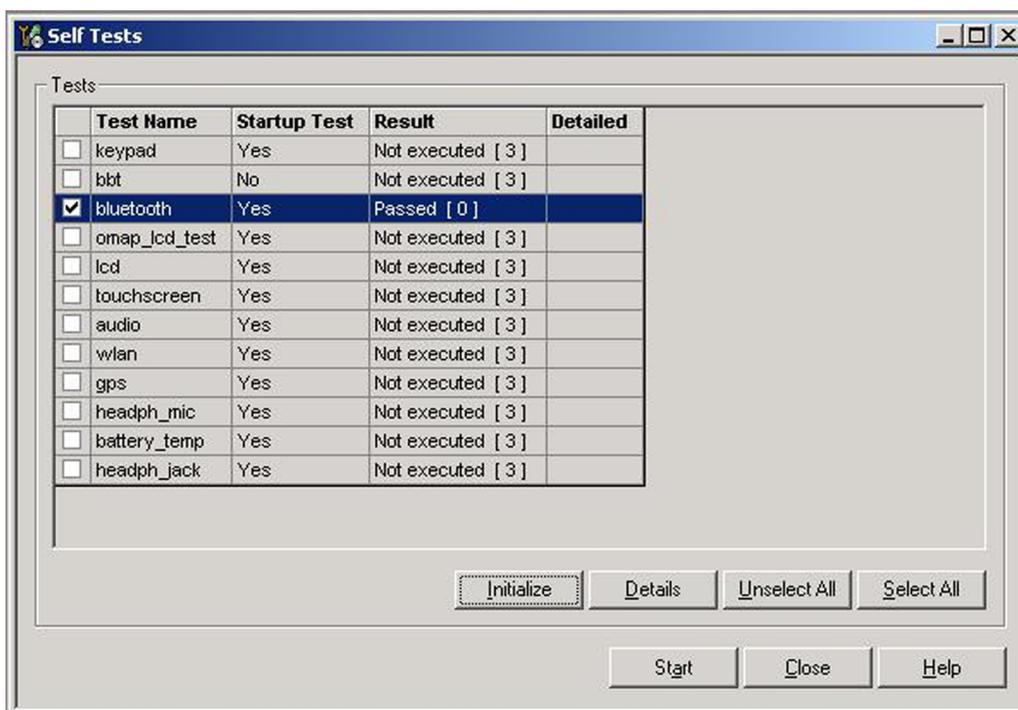
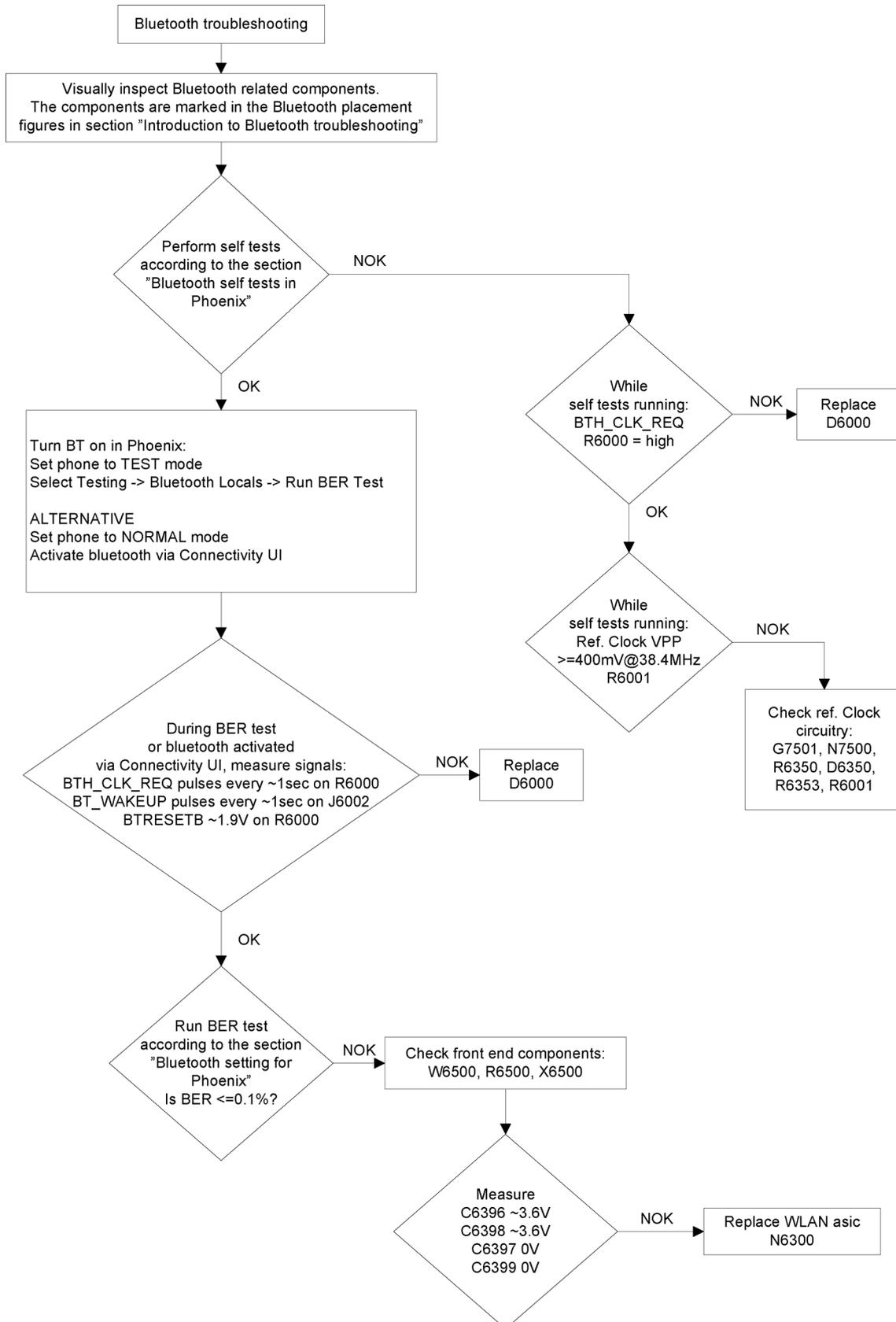


Figure 27 Bluetooth self tests in *Phoenix*

Bluetooth troubleshooting

Troubleshooting flow



FM radio troubleshooting

Context

AV Connector X2001

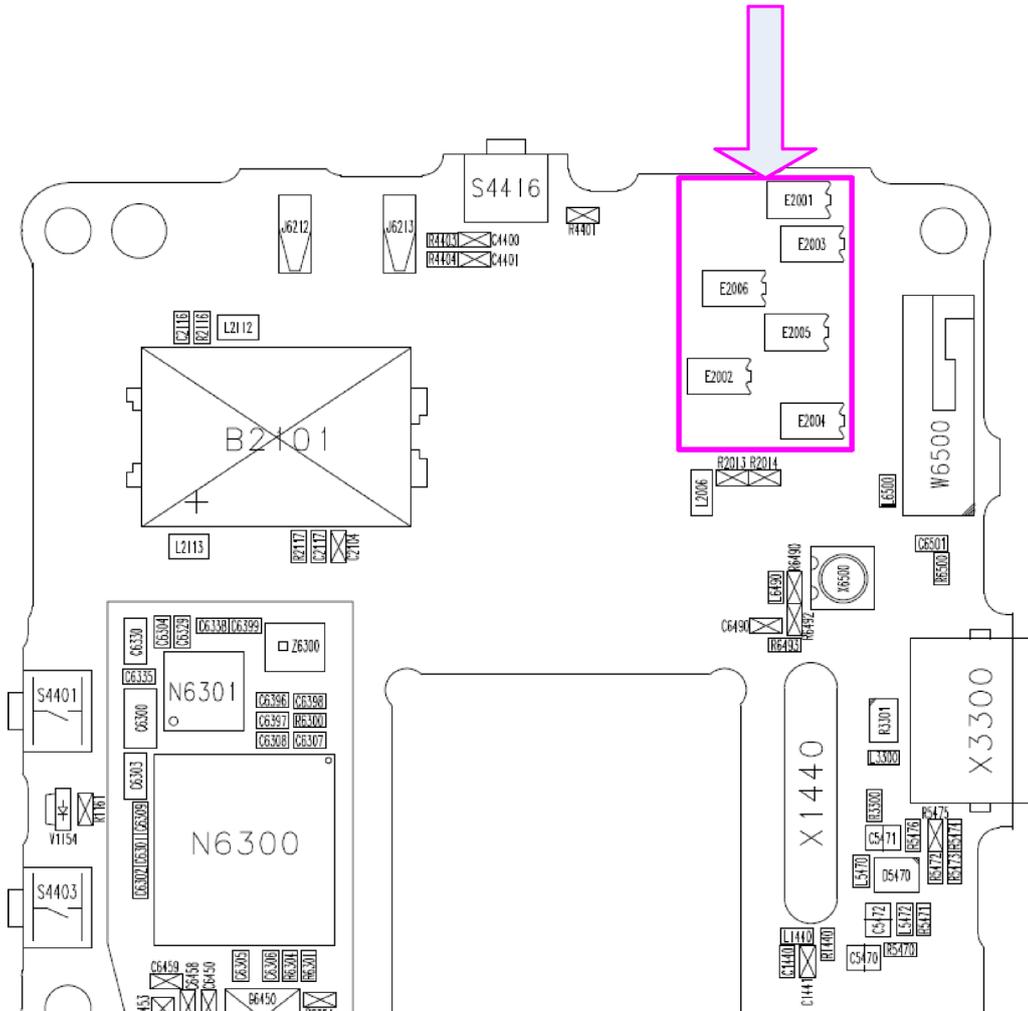
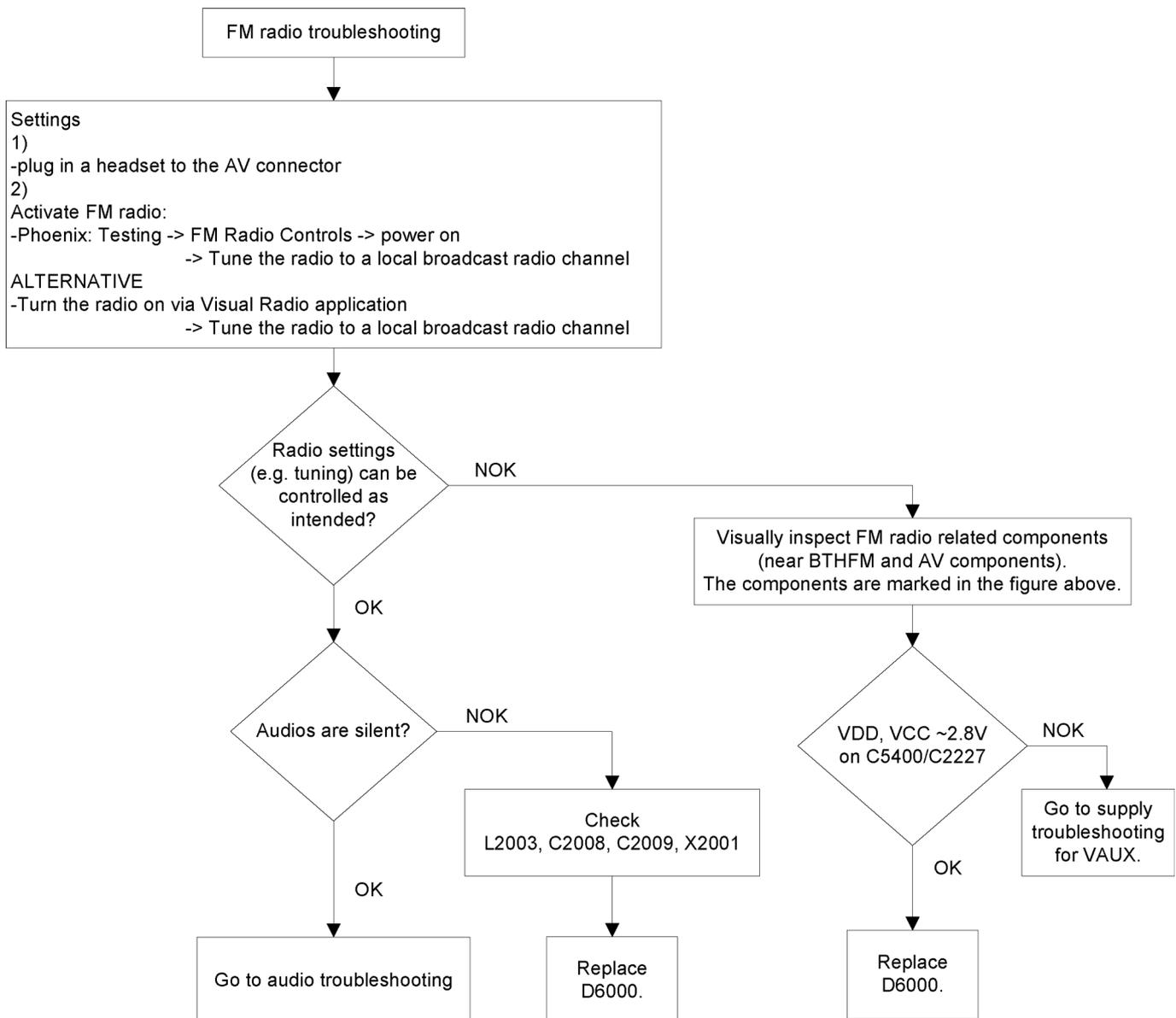


Figure 28 FM radio placement on the bottom side

Troubleshooting flow



■ Audio troubleshooting

Audio paths

The earpiece is driven directly by a built-in linear power amplifier included in the EM ASIC N2200 ASIC. The output has a differential output configuration. Signal lines are biased by the EM ASIC N2200.

The vibra is driven directly by a built-in digital pulse modulated amplifier included in the EM ASIC N2200 ASIC. The output has a differential output configuration.

Nokia AV stereo output is driven by a discrete stereo headphone amplifier that is connected to the single-ended outputs of the EM ASIC N2200 ASIC (shared output with the discrete stereo speaker amplifier). The discrete stereo headphone output has a single-ended ground reference output. It's controlled gain change via I2C IF.

Stereo speakers are driven by a discrete digital stereo speaker amplifier that is connected to the single-ended outputs of the EM ASIC N2200 (shared output with the discrete stereo headphone amplifier). The discrete stereo speaker amplifier has a differential output configuration.

The internal microphone is connected directly to the single-ended input of the EM ASIC N2200. Signal line is biased by the EM ASIC N2200.

Nokia AV mono input is connected to the EM ASIC N2200 single-ended input via two switches: data-switch and video-switch. The input is biased by the EM ASIC N2200.

Audio loop test

Audio paths can be tested via a built-in audio loop test routine. To test a specific audio path, an electrical test signal can be fed into the mono input of the Nokia AV-connector and looped to specified audio output: earpiece, stereo speakers or the Nokia AV stereo output. Similarly, an acoustical or an electrical test signal can be fed into the internal microphone and looped to the Nokia AV stereo output. Loop routines can be initiated using the audio test interface in the Phoenix service program.

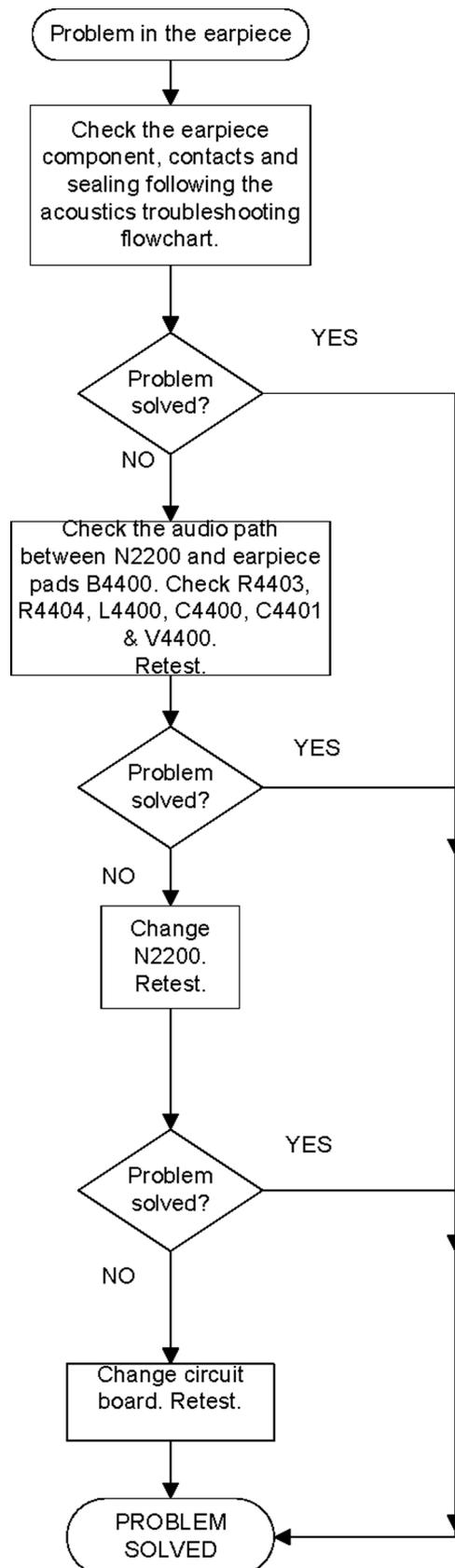
Vibra can be tested by dedicated vibra test in the Phoenix service program.

Table 10 Audio loop test reference results

Audio loop	Input terminal	Output terminal	Frequency	Input signal	Output signal
XMIC to EAR	AV connector	Internal earpiece	1kHz	0.1 [V]	y [V]
XMIC to IHF	AV connector	Stereo speakers	2kHz	0.1 [V]	y [A]
XMIC to XEAR	AV connector	AV connector	1kHz	0.1 [V]	y [V]
INTMIC to XEAR	Internal microphone	AV connector	1kHz	0.01 [V]	y [V]

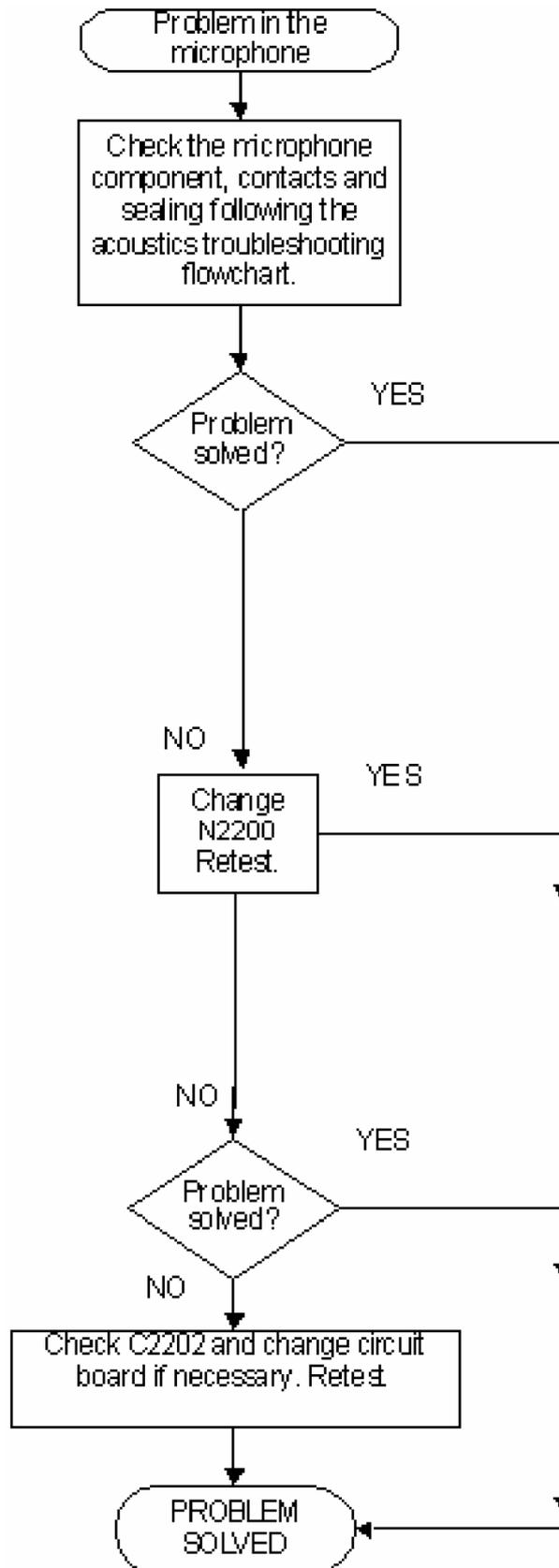
Internal earpiece troubleshooting

Troubleshooting flow



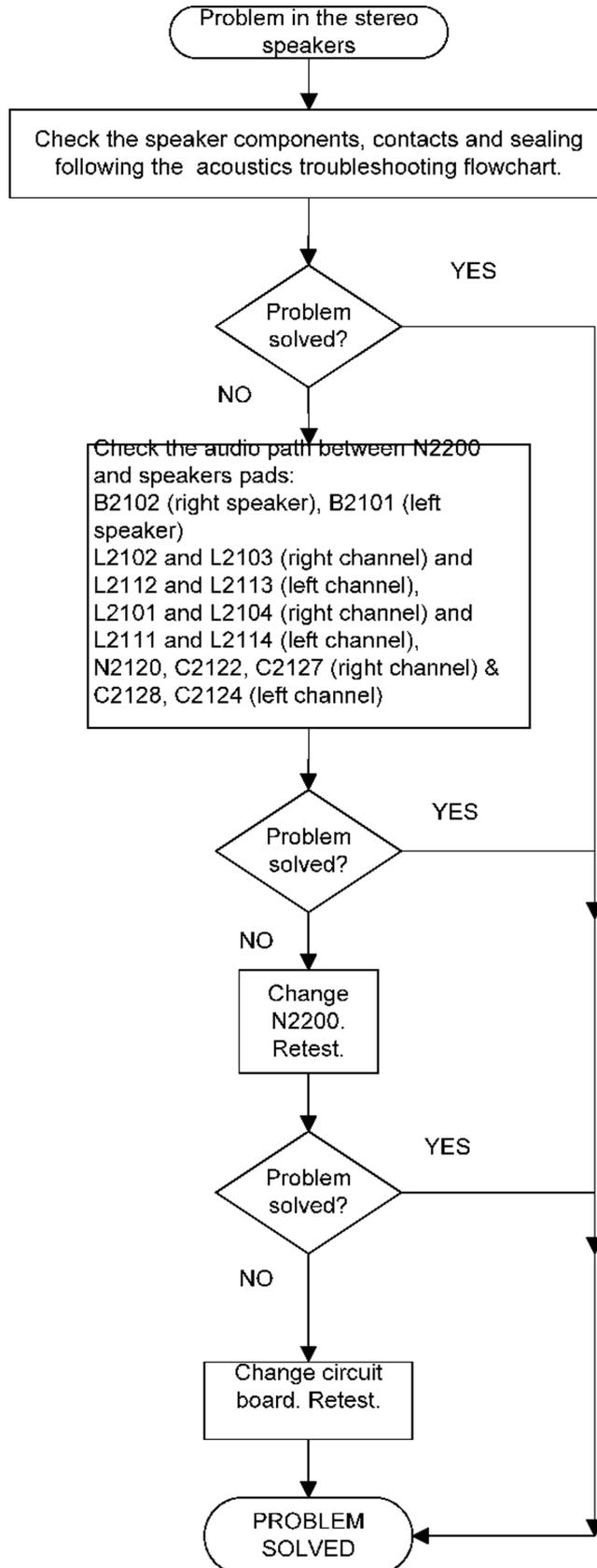
Internal microphone troubleshooting

Troubleshooting flow



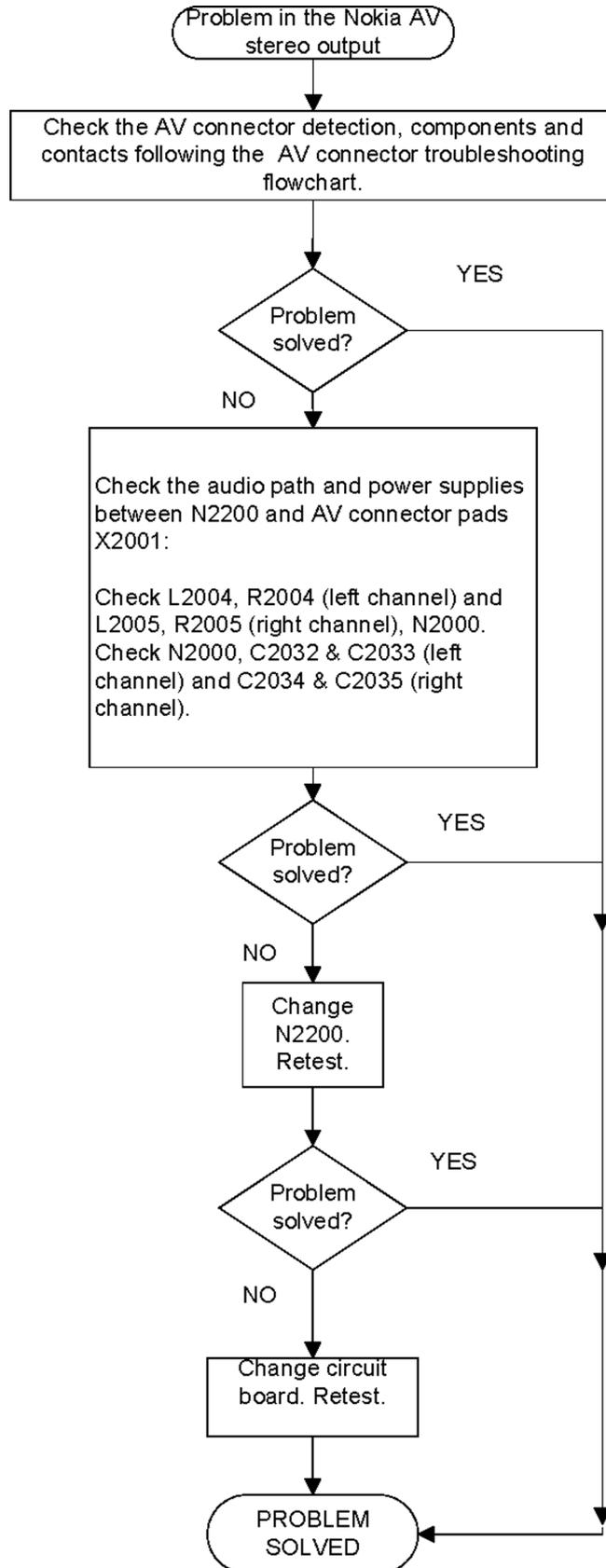
Stereo speakers troubleshooting

Troubleshooting flow



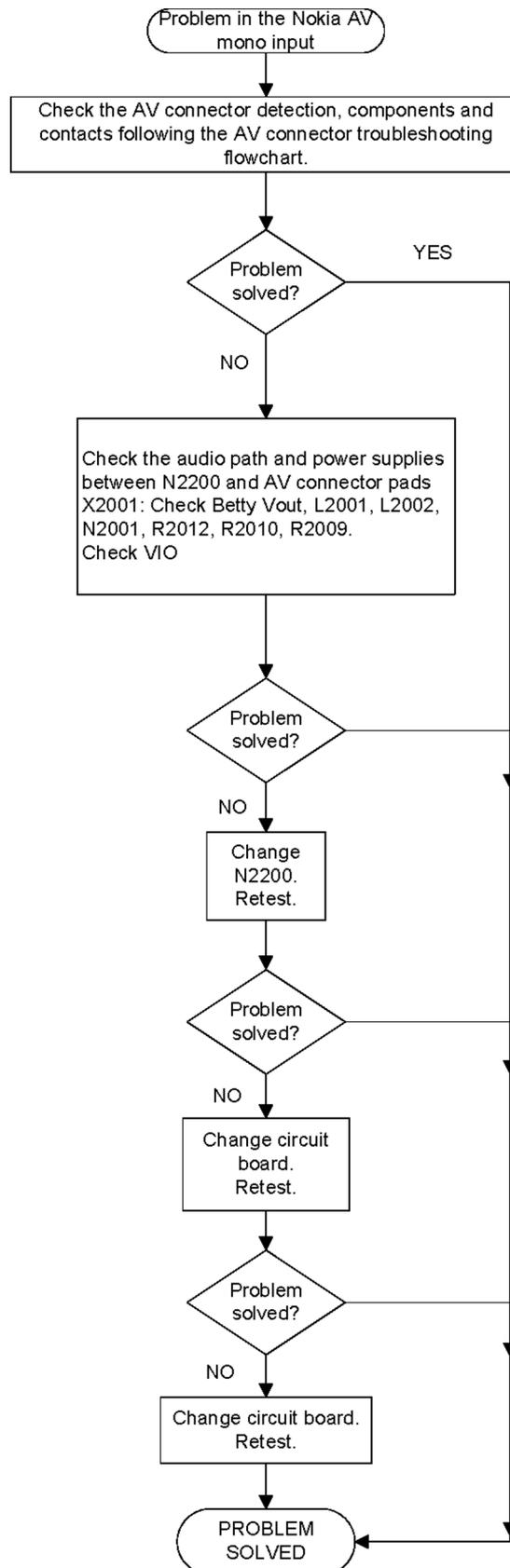
AV stereo output troubleshooting

Troubleshooting flow

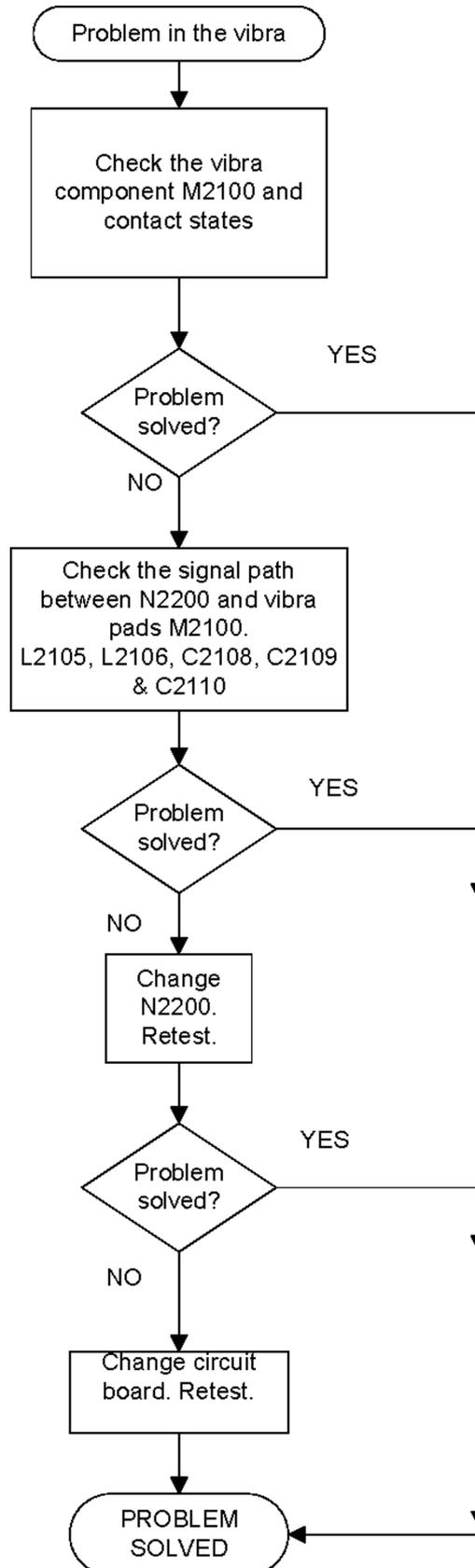


AV mono input troubleshooting

Troubleshooting flow



Vibra troubleshooting
Troubleshooting flow



■ Baseband manual tuning guide

Energy management calibration

Prerequisites

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

Hardware setup:

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

Steps

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

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

8. Click **Calibrate**.

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

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

Table 11 Calibration value limits

Parameter	Min.	Max.
ADC Gain	13000	13350
ADC Offset	-14	14
BSI Gain	1100	1300
VBAT_SCAL Gain	21000	21900
VBAT_SCAL Offset	2450	2570
IBAT Gain	7750	12250

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

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4 — RF troubleshooting

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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).

Pre-baking

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

- RF IC N7505
- Front End Module (FEM) N7520
- WCDMA PA N7540

Discrete components

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

Capacitors: check for short circuits.

Resistors: check value with an ohm meter.

Note: In-circuit measurements should be evaluated carefully

Measuring equipment

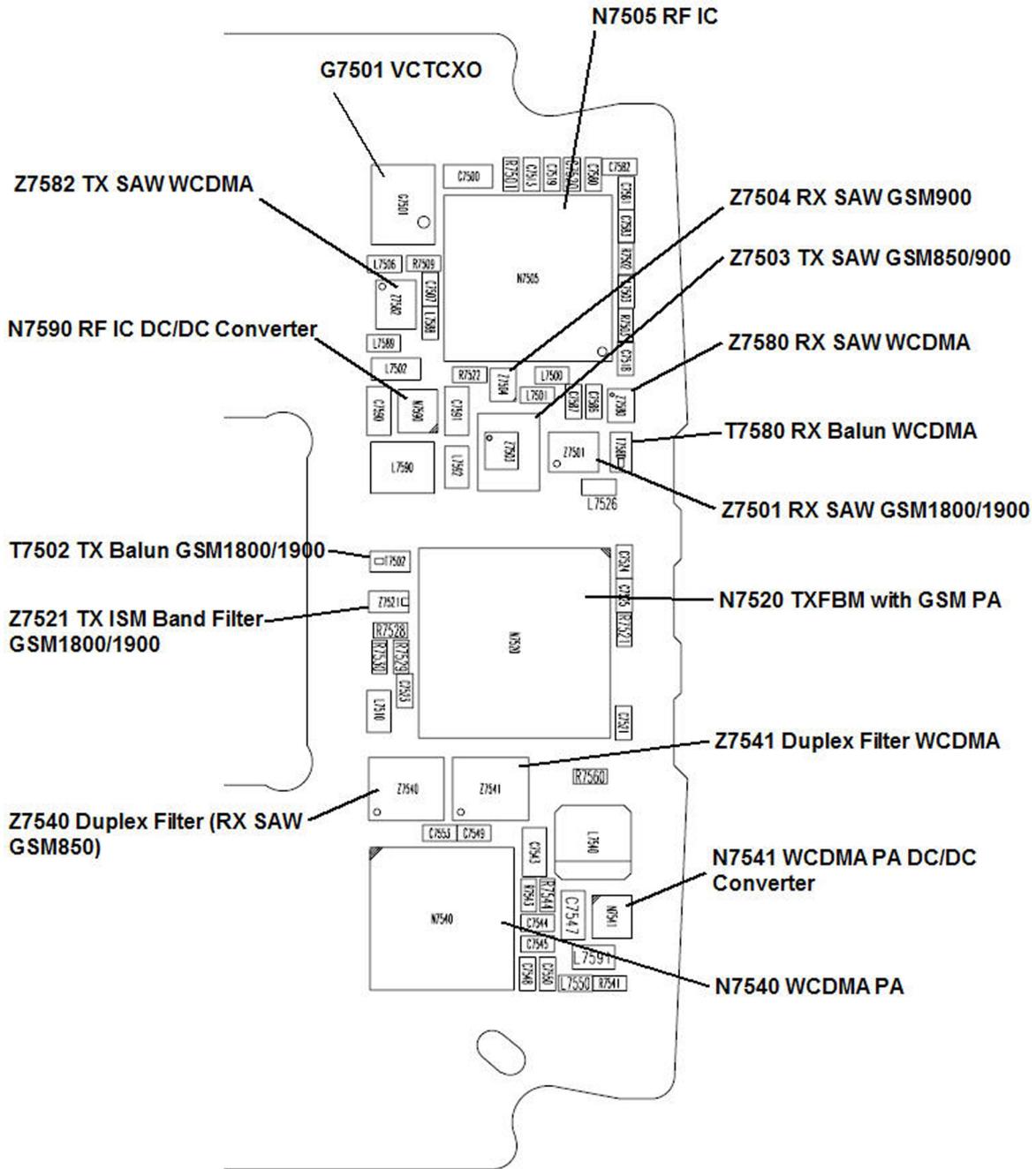
All measurements should be done using:

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

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

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

RF key components



Auto tuning for BB5.0

This phone can be tuned automatically.

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

Hardware set up

Hardware requirements for auto tuning:

- PC (Windows 2000/XP) with GPIB card

- Power supply
- Product specific module jig
- Cables: XRF-1 (RF cable), USB cable, GBIP cable and DAU-9S
- Signal analyser (TX), signal generator (RX) and RF-splitter *or* one device including all.

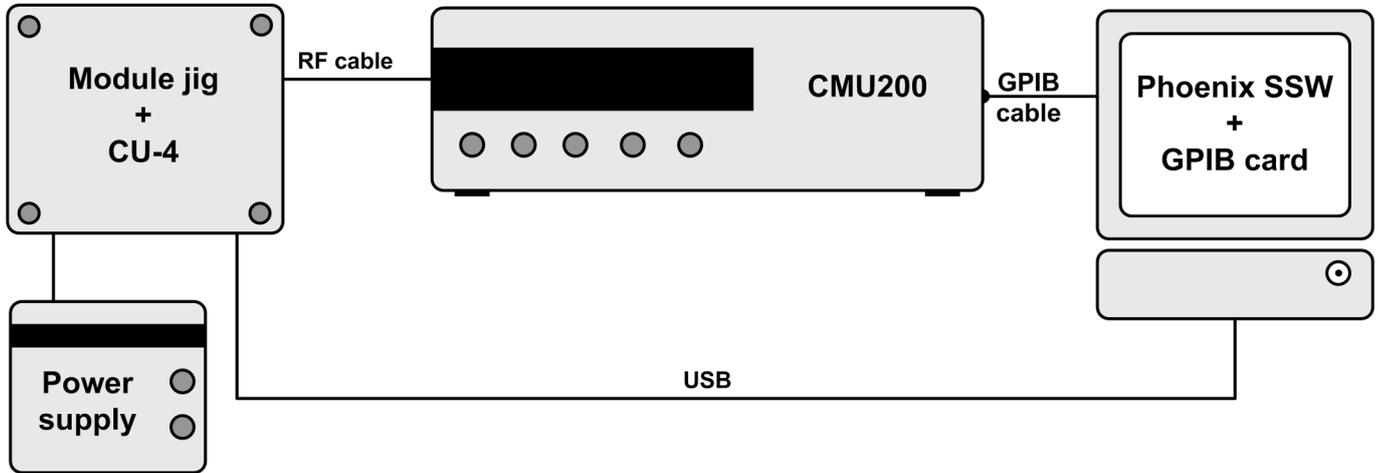


Figure 30 Auto tuning concept with CMU200

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

Phoenix preparations

Install the phone specific data package, for example *Nokia_firmware_RM-313_emea_nsu_10.0.005_v1.0.exe*. This defines phone specific settings..

Auto tuning procedure

- 1 Make sure the phone (in the jig) is connected to the equipment. Else, some menus will not be shown in Phoenix.
- 2 To go to autotune, select *Tuning (Alt-U) > Auto-Tune (Alt-A)* from the menu.
- 3 Start autotuning, clicking the *Tune* button.

■ General checkings

Antenna line component checking

Check R7560 (0ohm resistor).

Voltage checking

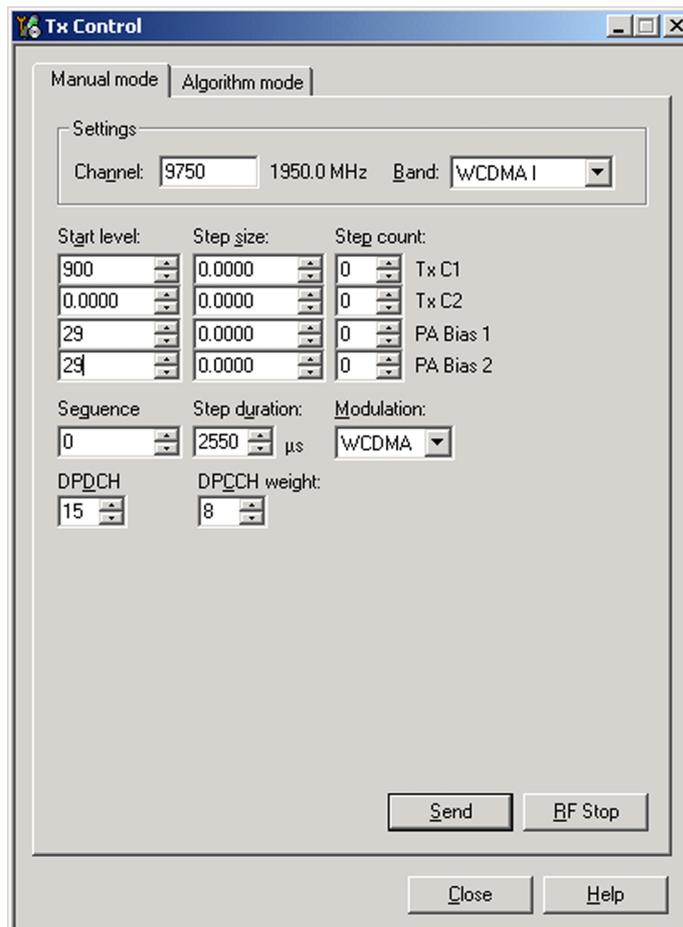
Steps

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

#	Signal name	Test point	Voltage (all bands)
1	VCTCX0 supply	R7501	2.5 V
2	AHNEUS supply from DC/DC conv	L7502	3.2 V

#	Signal name	Test point	Voltage (all bands)
3	TXFBM supply	C7523	3.9 V
4	WCDMA PA supply from DC/DC conv	C7543	0 V (When transmitting 1.3 V - 3.1 V depending on output power. *3.1 V with settings as in the note below.)
5	Vbat at WCDMA PA	L7550	3.9 V
6	Supply to AHNEUS DC/DC conv	L7592	3.9 V

* With these settings, the result should be 3.1V.



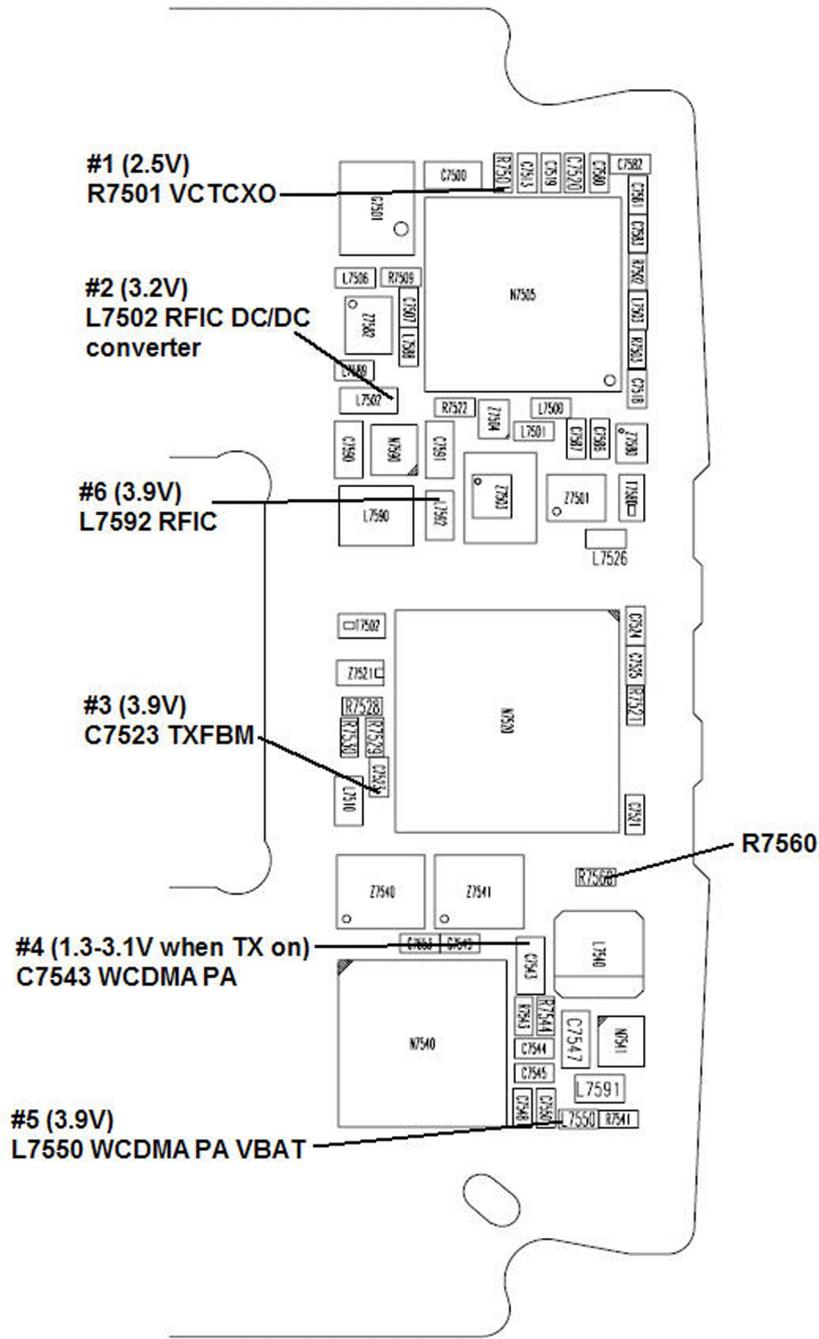
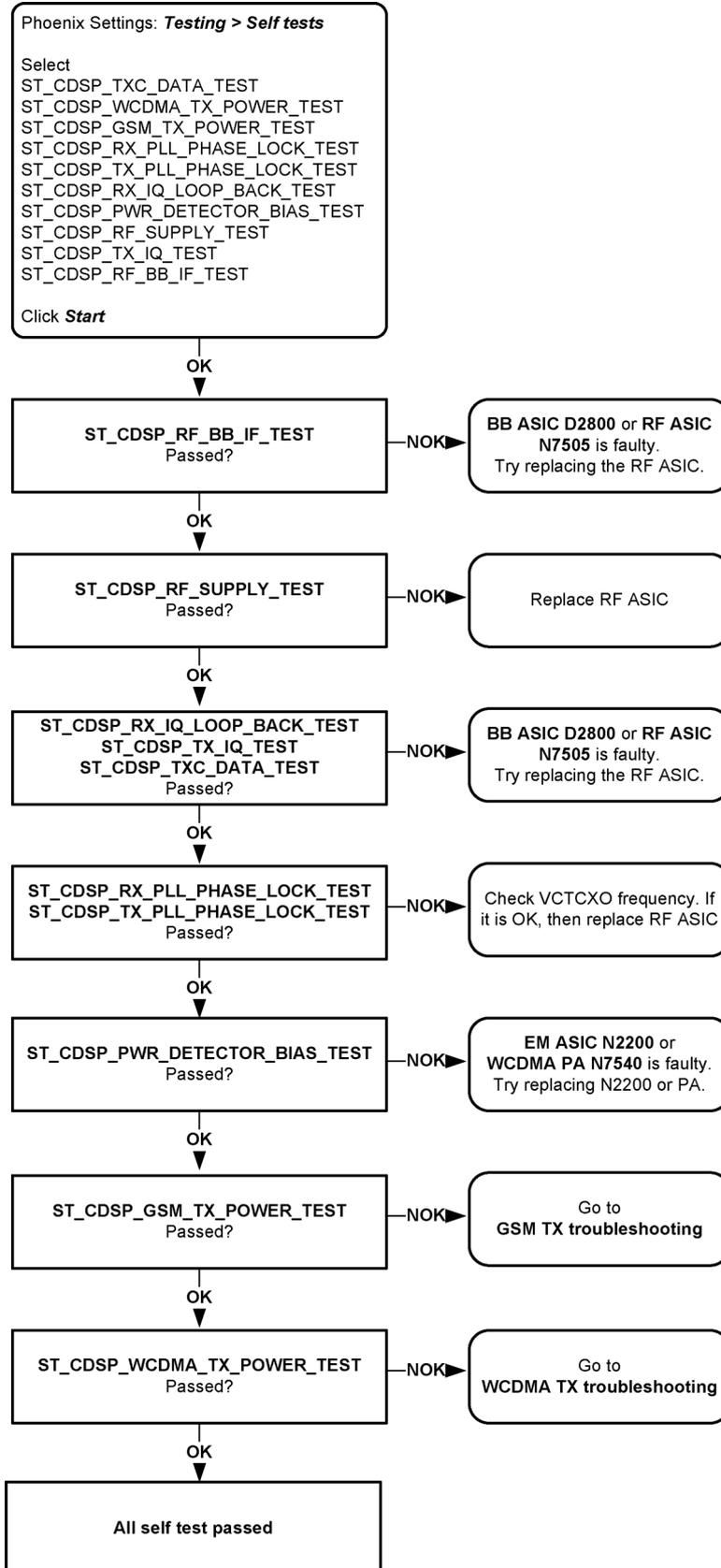


Figure 31 General voltage checking test points

■ Self test troubleshooting

Troubleshooting flow



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 \(page 4-11\)](#). For a similar test in WCDMA mode, see [WCDMA RX chain activation for manual measurement / WCDMA RSSI measurement \(page 4-12\)](#).

GSM RX chain activation for manual measurements/GSM RSSI measurement

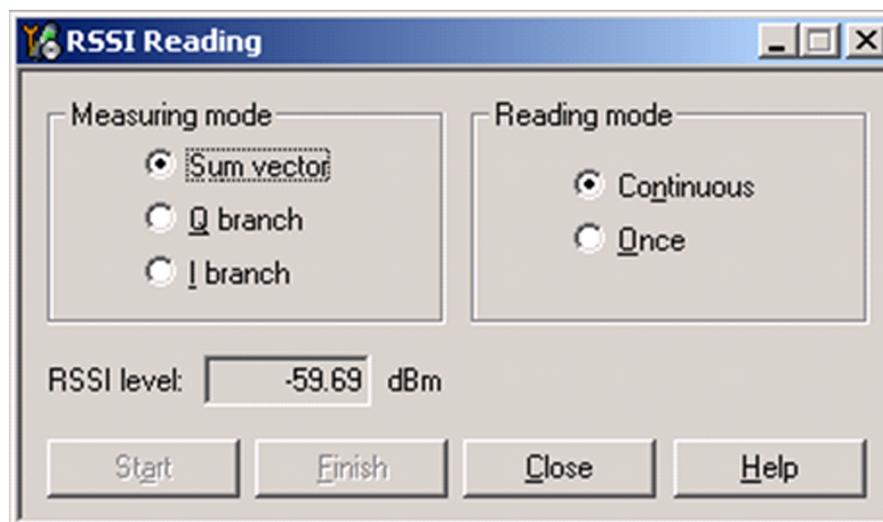
Prerequisites

Make the following settings in Phoenix service software:

Setting	GSM850	GSM900	GSM1800	GSM1900
Phoenix Channel	189	37	700	661
Signal generator to antenna connector	881.46771MHz (67.71KHz offset) at -60dBm	942.46771MHz (67.71kHz offset) at -60dBm	1842.86771MHz (67.71kHz offset) at -60dBm	1960.06771MHz (67.71kHz offset) at -60dBm

Steps

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



Results

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

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

WCDMA RX chain activation for manual measurement/WCDMA RSSI measurement

Prerequisites

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

Setting	Band I
Phoenix channel	10700
Signal generator to antenna connector	2141.0 MHz
Signal generator RF-level (CW-signal)	-70 dBm

Steps

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

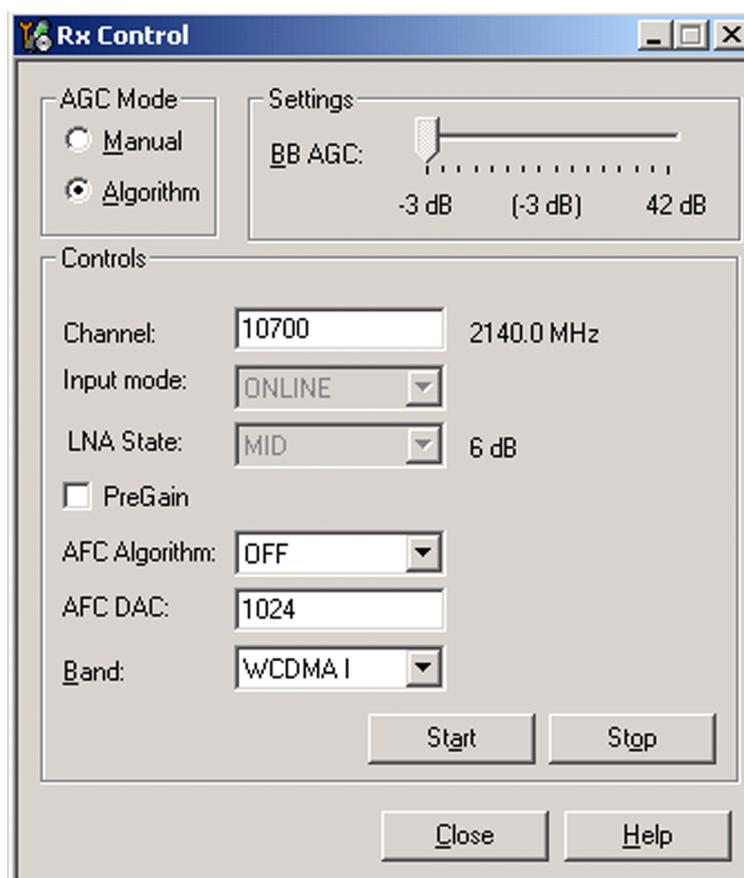
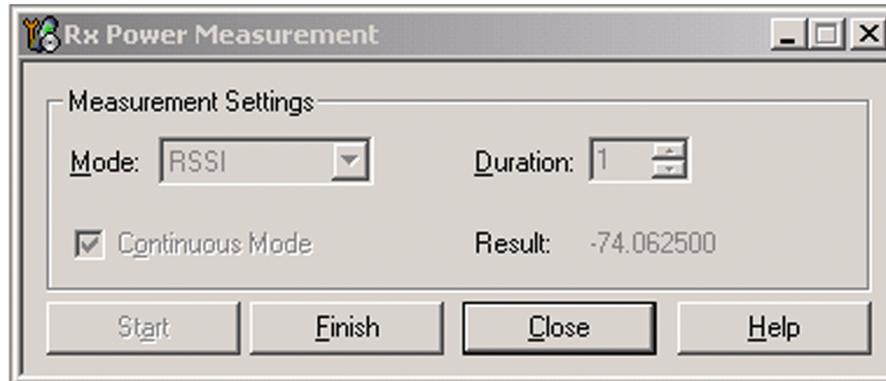


Figure 32 RX Control window with example settings

3. Click **Start** to activate the settings.
If the settings are changed later on (for example, change of channel) you have to click **Stop** and **Start** again.
Note: Clicking **Stop** also disables TX control if it was active.
4. From the Phoenix testing menu, select **WCDMA→RX Power measurement**
5. In the RX Power measurement window, select:

- Mode: RSSI
- Continuous mode



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

Results

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

■ Transmitter troubleshooting

General instructions for transmitter (TX) troubleshooting

Please note the following before performing transmitter tests:

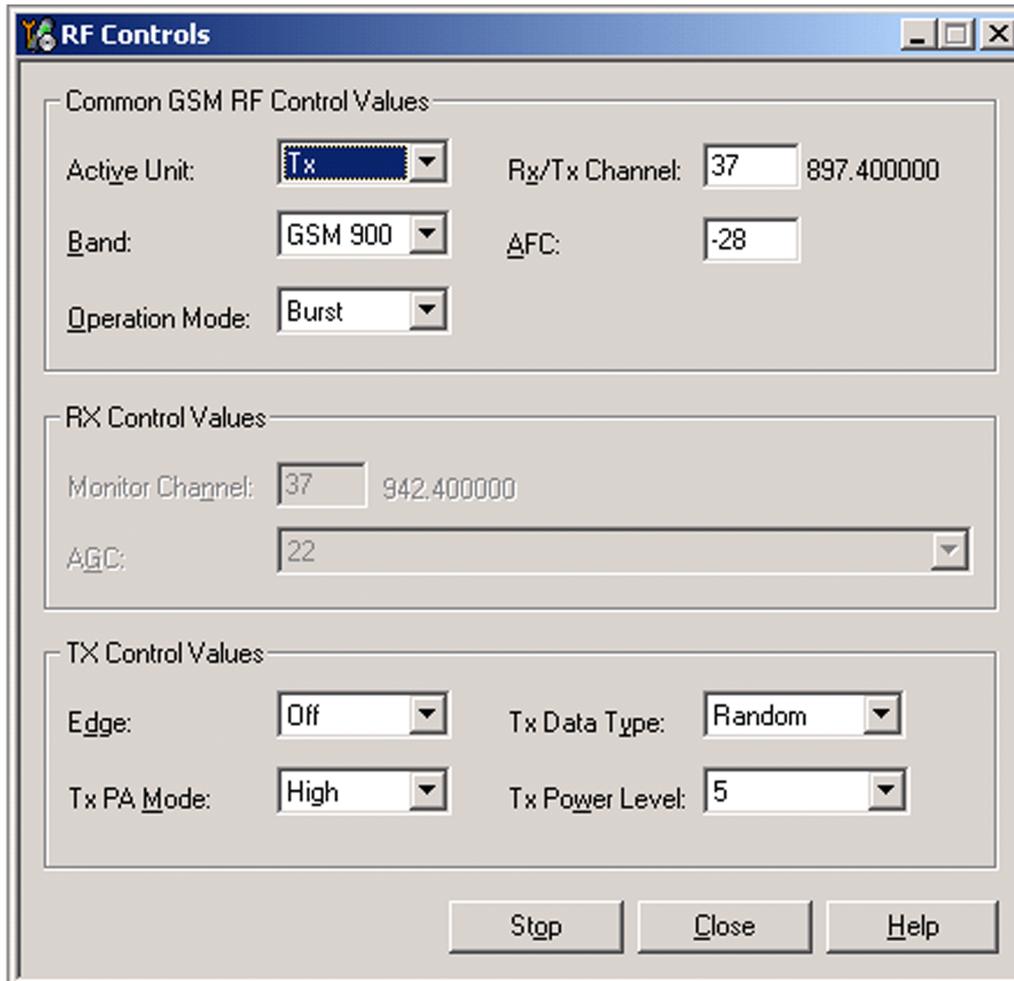
- TX troubleshooting requires TX operation.
- Do not transmit on frequencies that are in use!
- The transmitter can be controlled in local mode for diagnostic purposes.
- The most useful Phoenix tool for GSM transmitter testing is "RF Controls"; in WCDMA transmitter testing the best tool is "TX Control".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

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

GSM transmitter troubleshooting

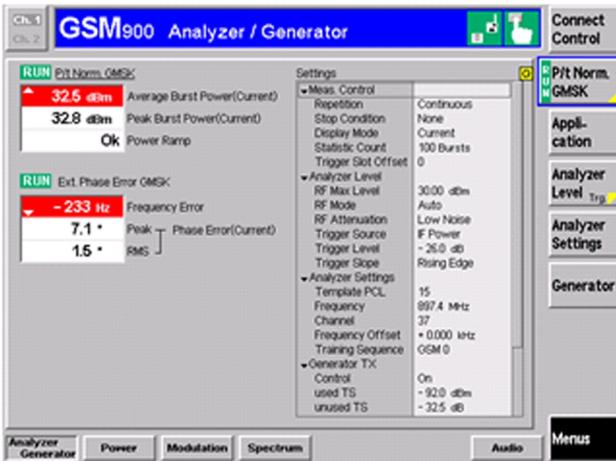
Steps

1. Set the phone to local mode.
2. Activate RF controls in Phoenix (**Testing**→**GSM**→**Rf Controls**).
Make settings as shown in the picture:

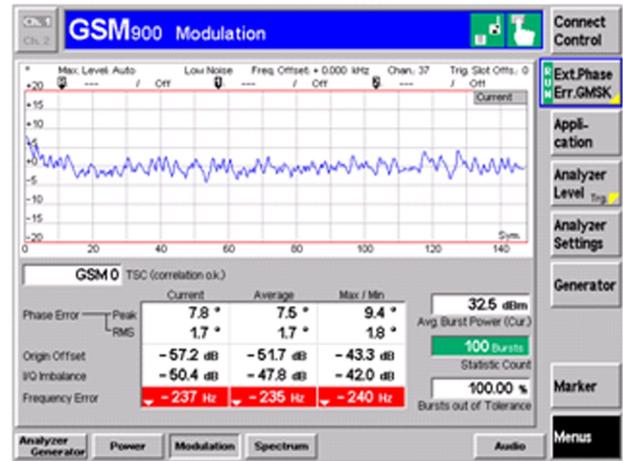


3. Check the basic TX parameters (i.e. power, phase error, modulation and switching spectrum), using a communication analyser (for example CMU200).

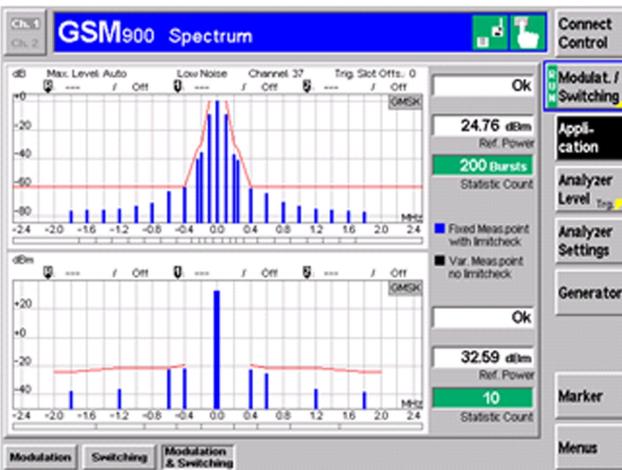
Analyser settings



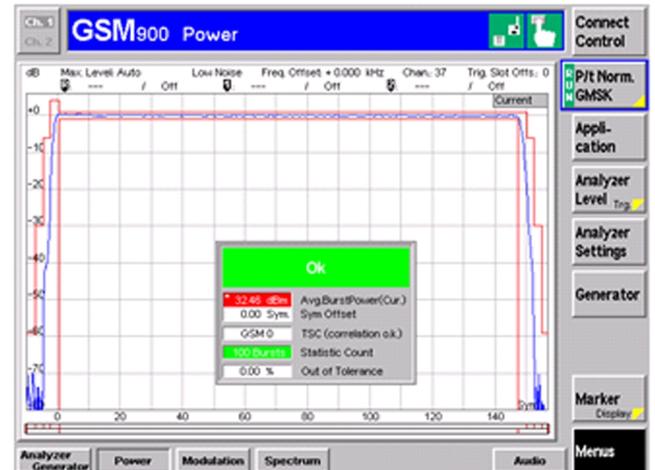
Phase error



Modulation/Switching spectrum



Power/Burst



Edge



Figure 33 Typical readings

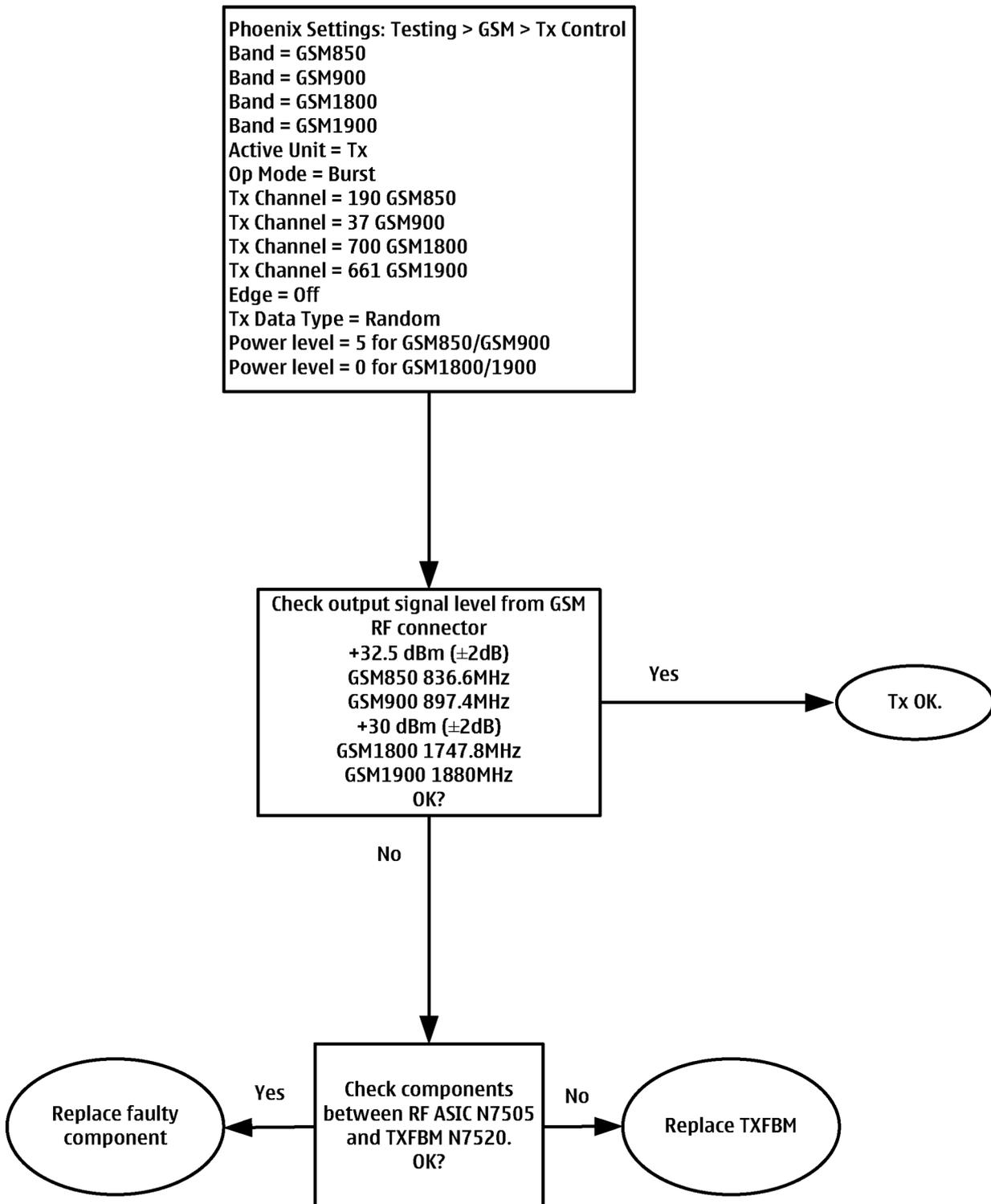
4. Change power level (RF controls) and make sure the power reading follows accordingly.

Next actions

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

GSM transmitter troubleshooting flowchart

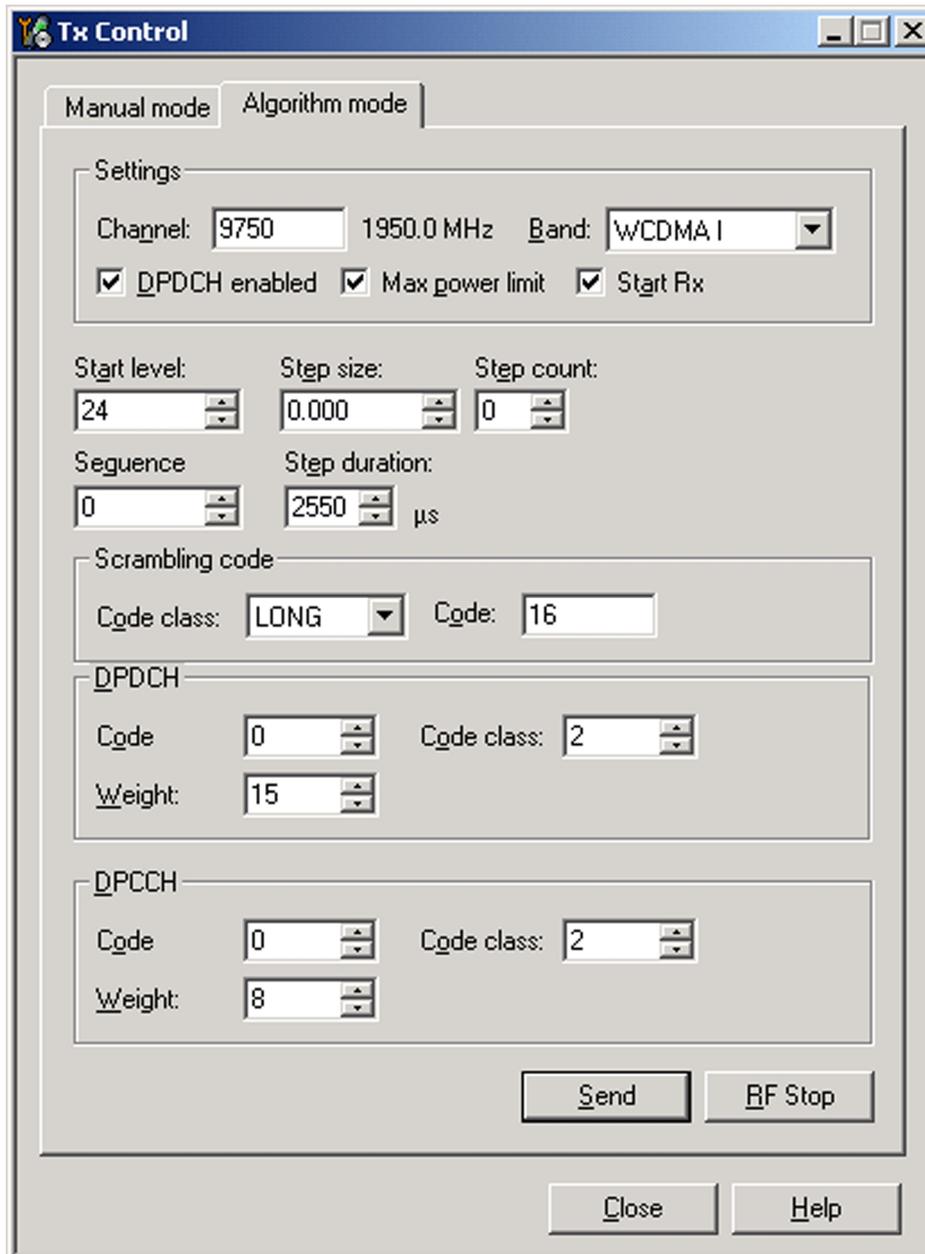
Troubleshooting flow



WCDMA transmitter troubleshooting

Steps

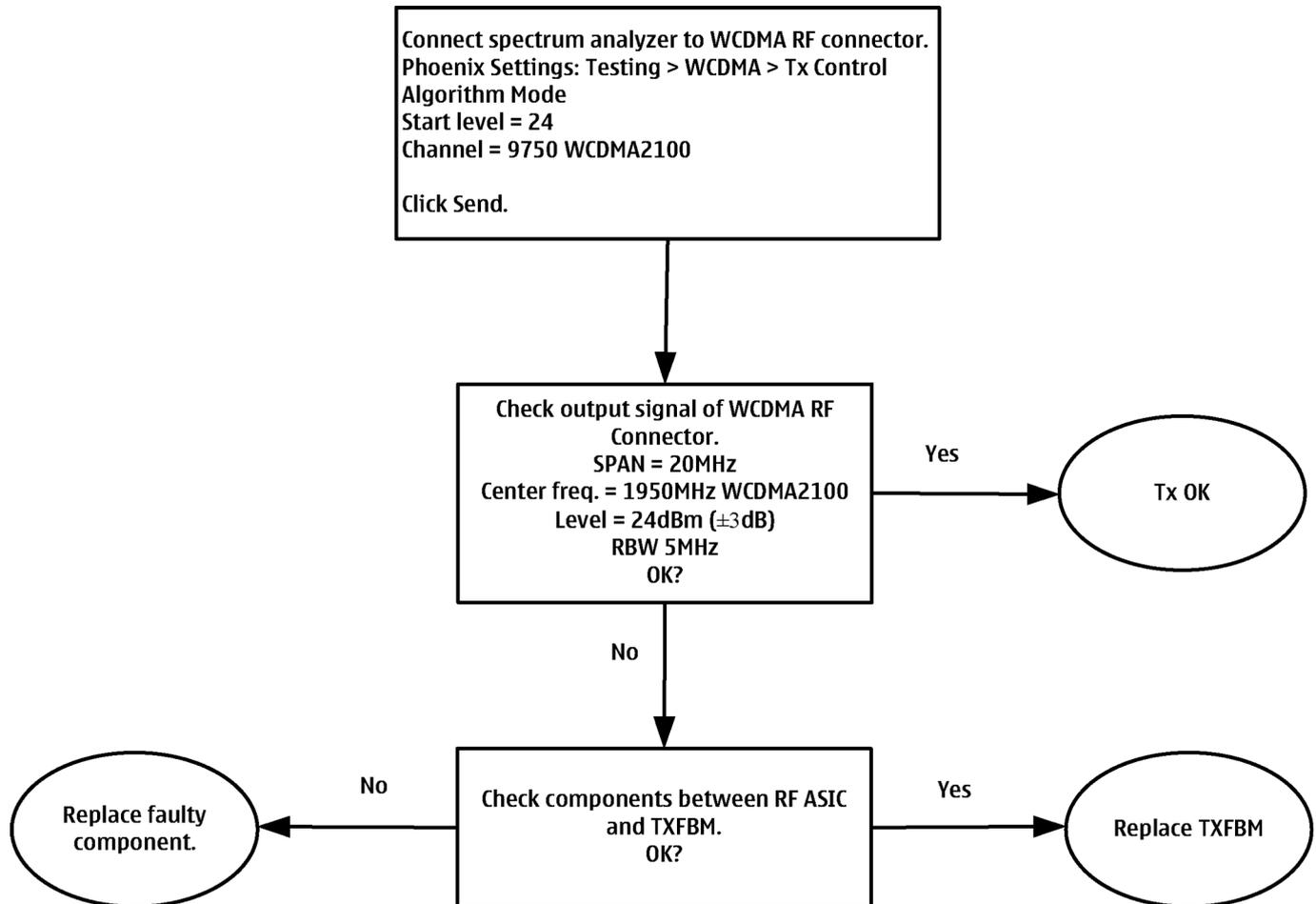
1. Set the phone to local mode.
2. In Phoenix, select **Testing**→**WCDMA**→**TX control**.
3. In the TX control window, make settings like in the picture:



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

WCDMA transmitter troubleshooting flowchart

Troubleshooting flow



5 — Camera Module Troubleshooting

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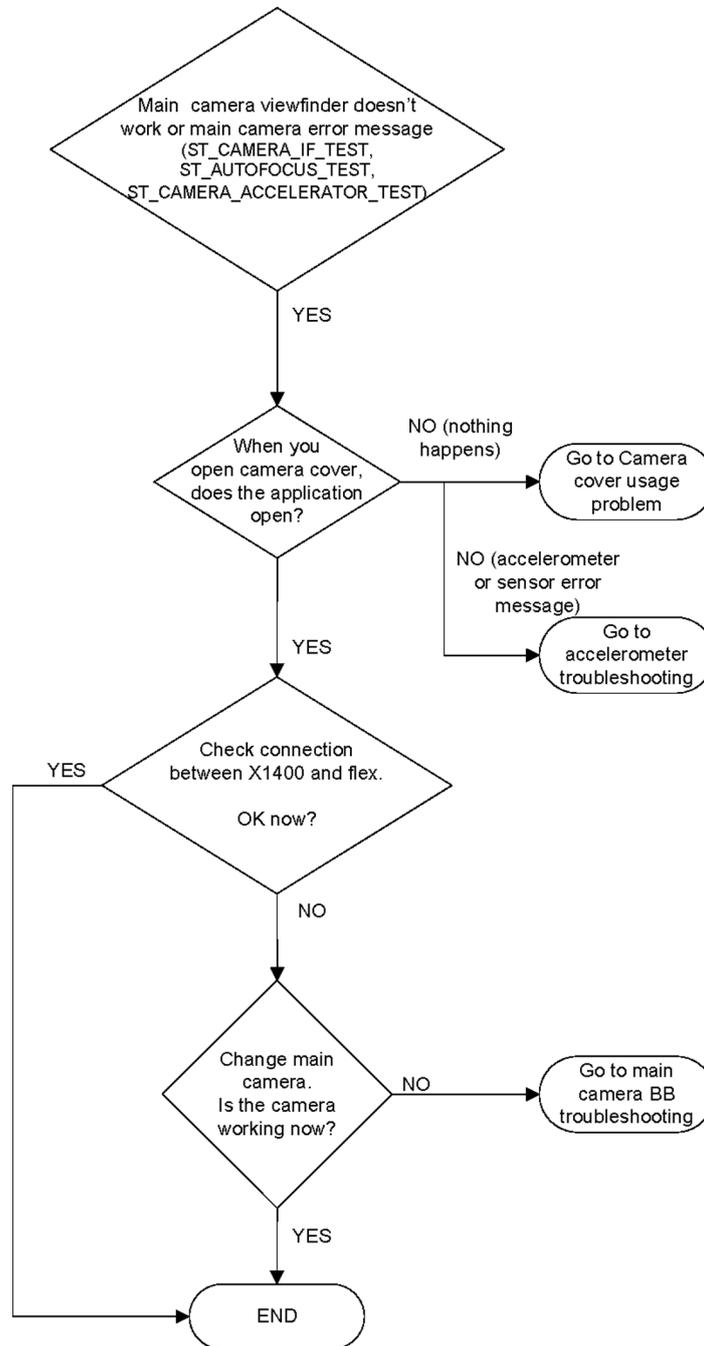
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■ Main (back) camera troubleshooting flowcharts

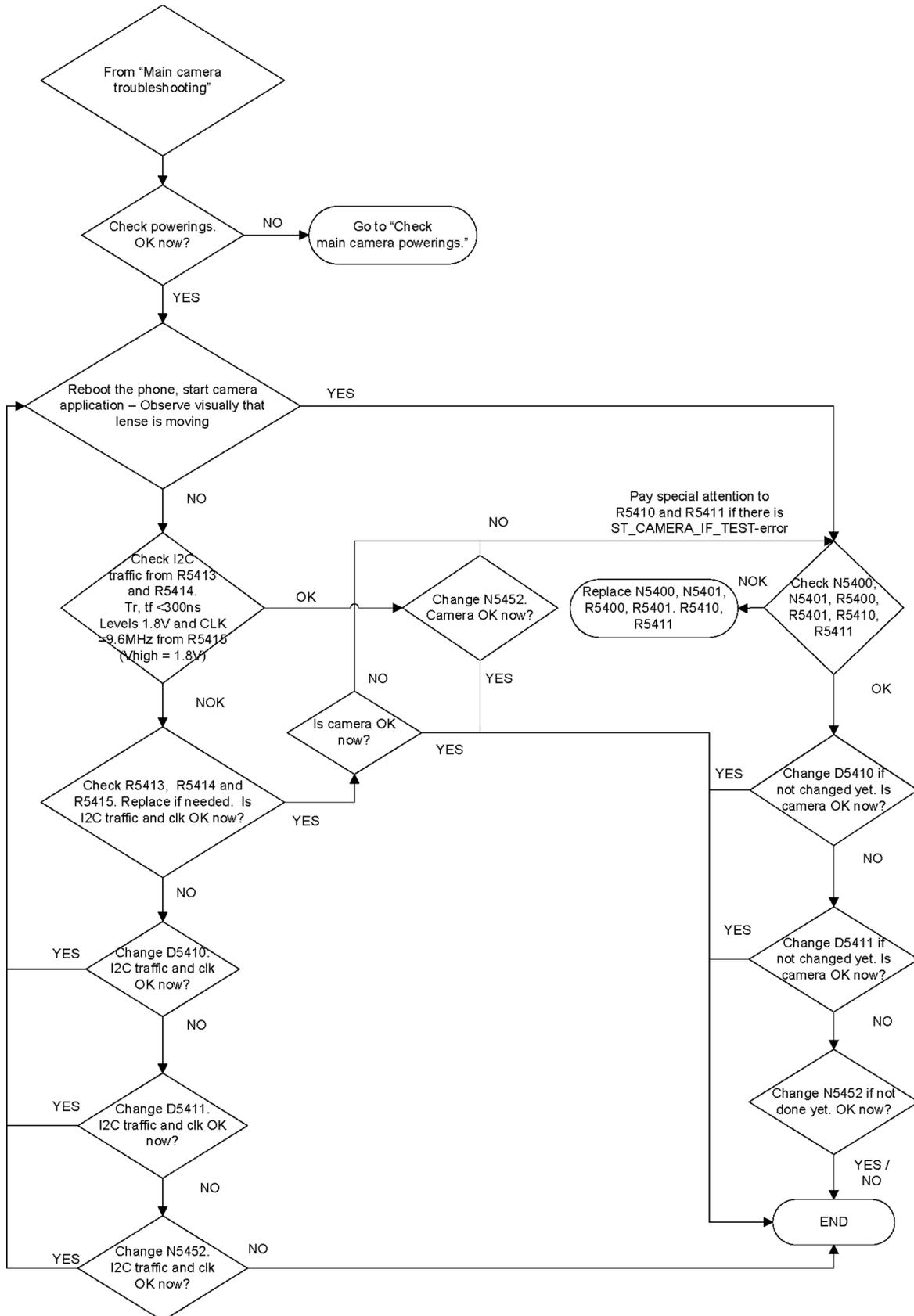
Main camera troubleshooting

Troubleshooting flow



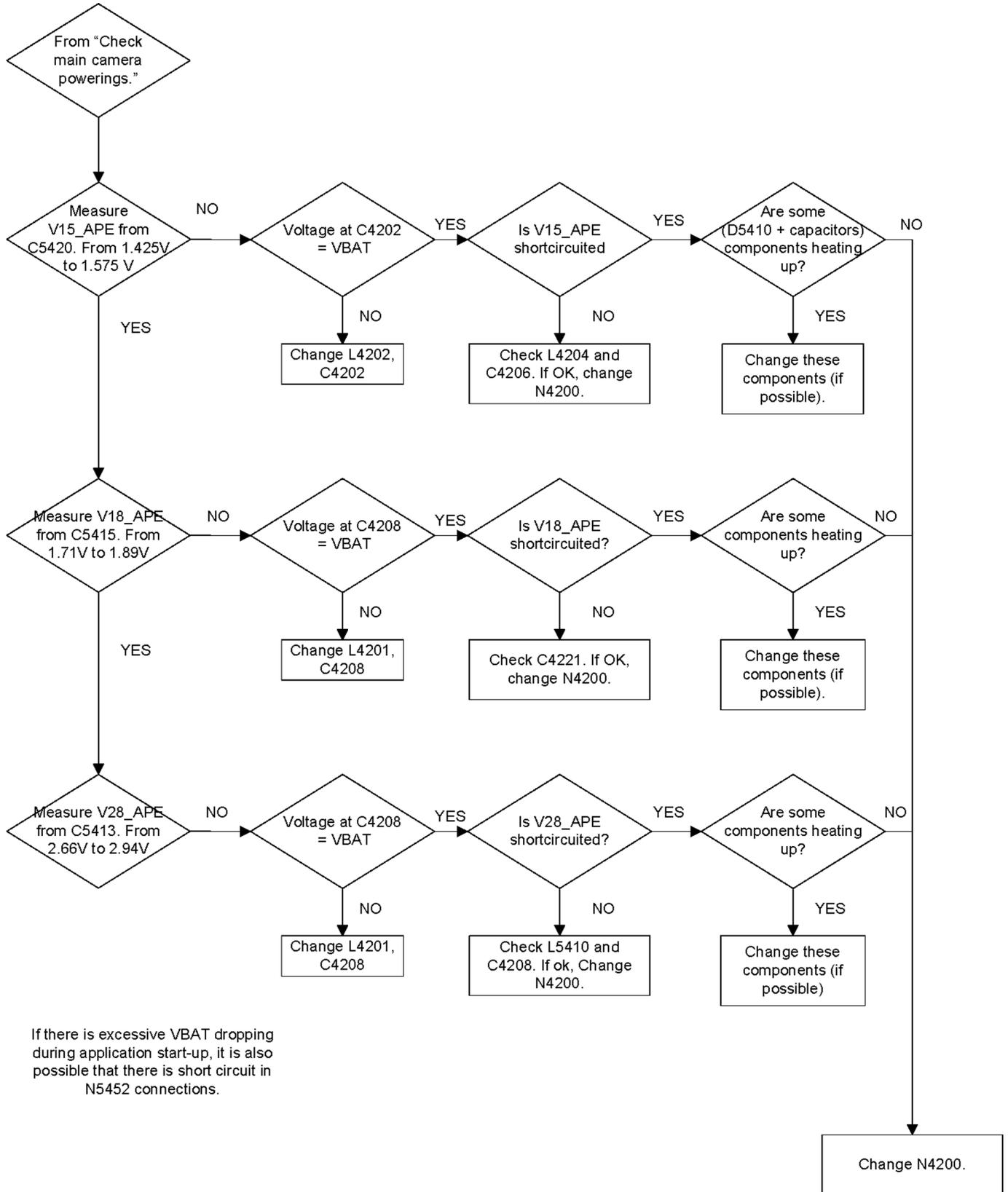
Main camera baseband troubleshooting

Troubleshooting flow



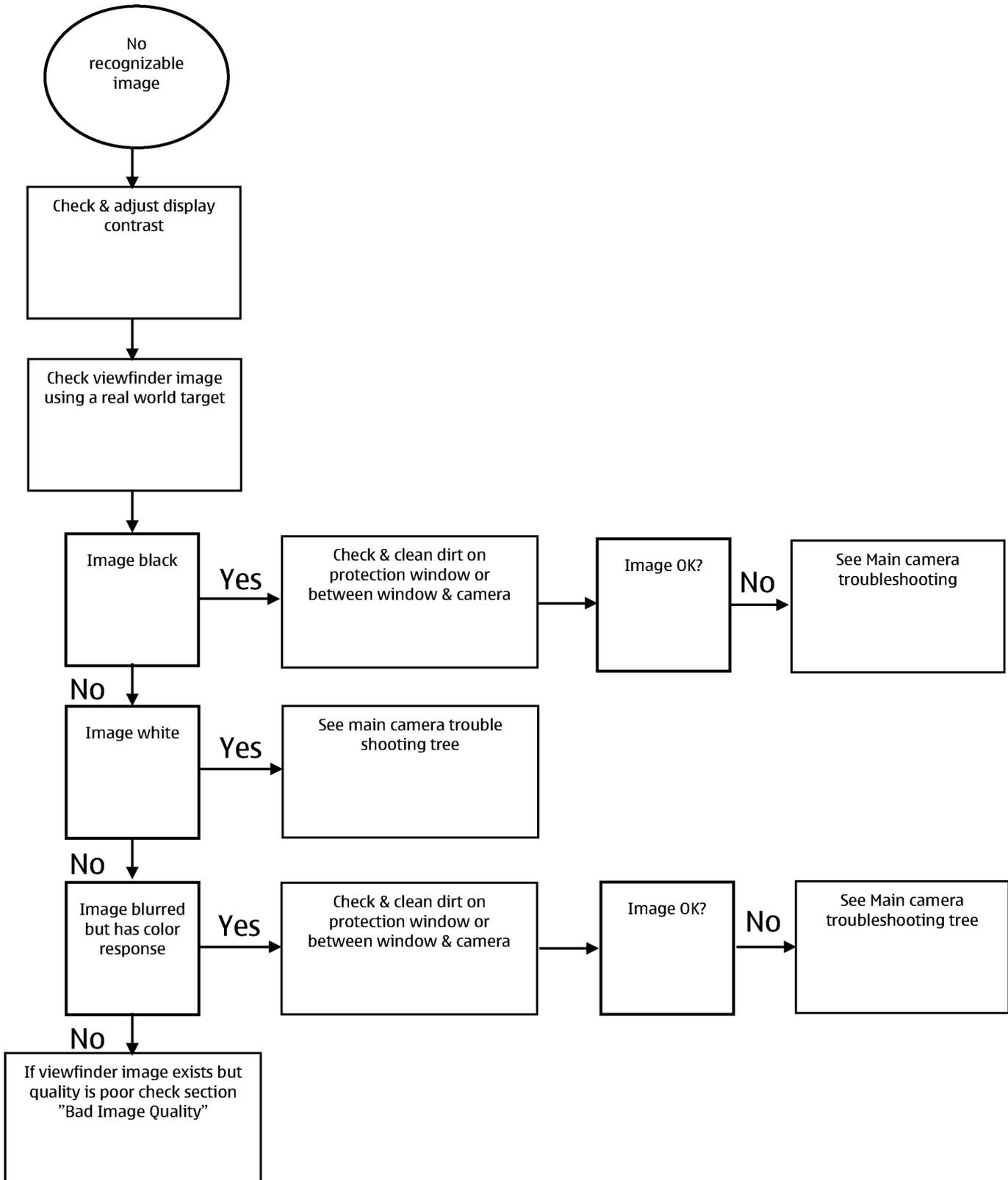
Main camera baseband troubleshooting - powerings

Troubleshooting flow



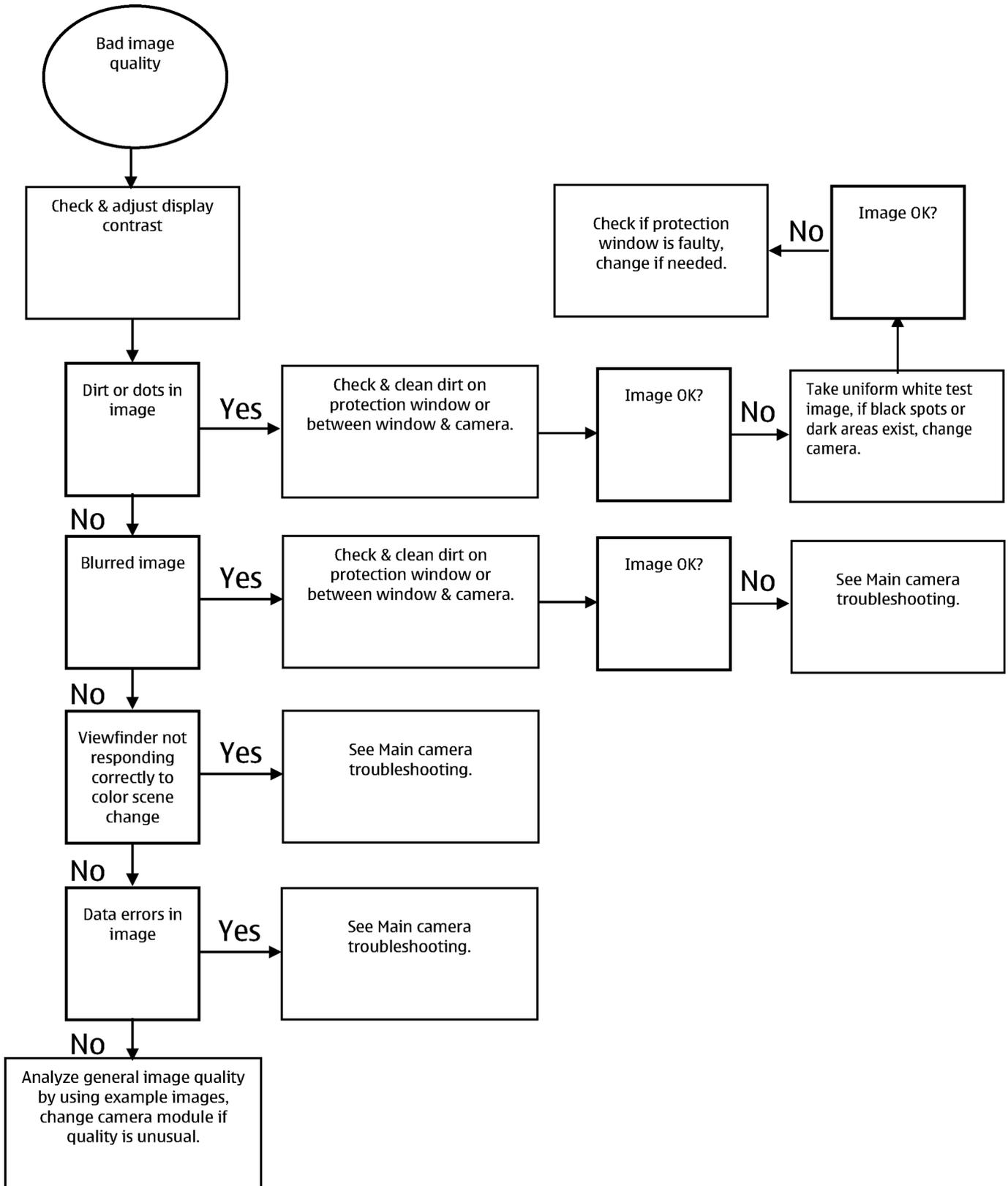
No recognizable viewfinder image

Troubleshooting flow



Bad image quality troubleshooting

Troubleshooting flow

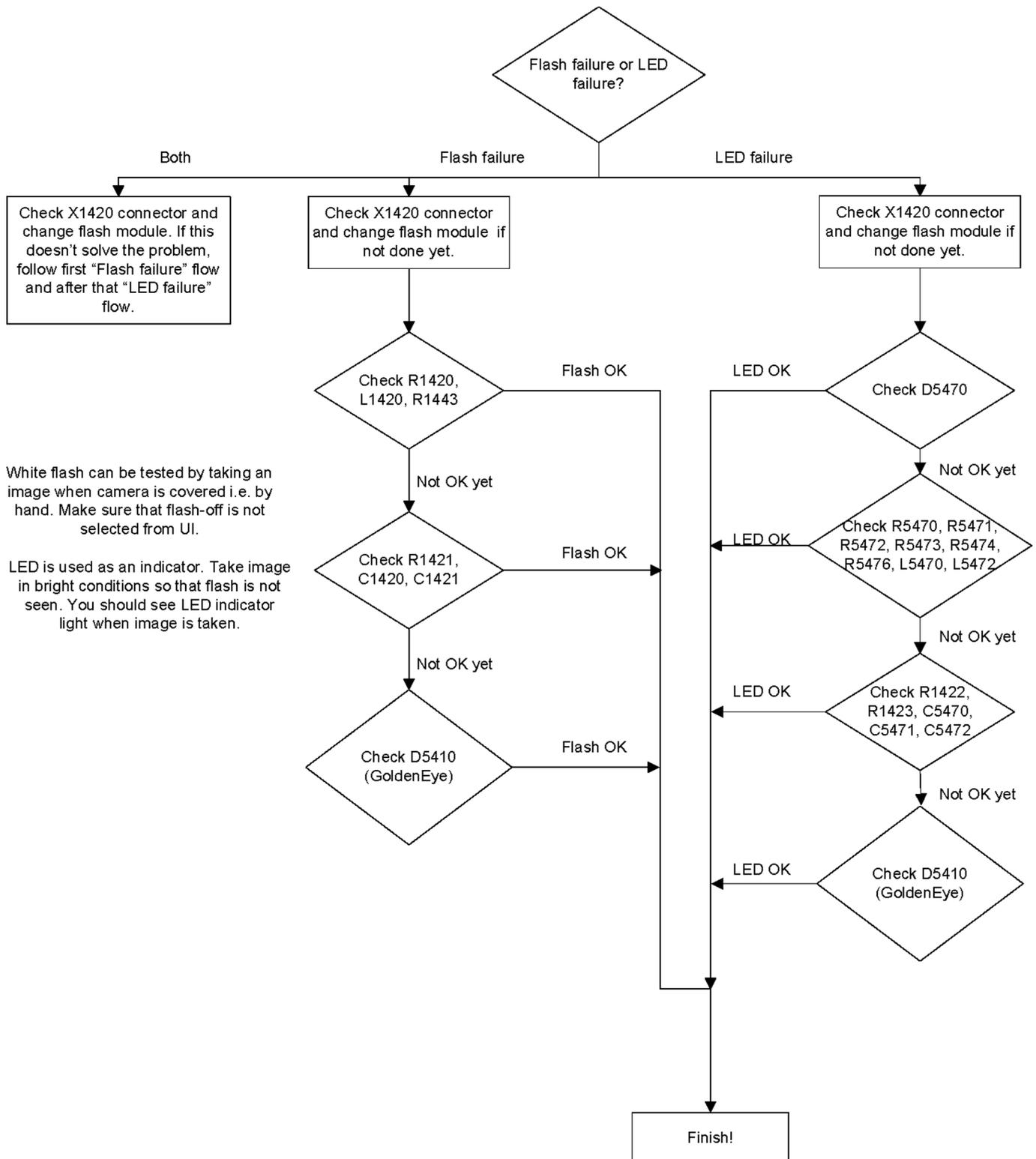


Flash and LED troubleshooting

Context

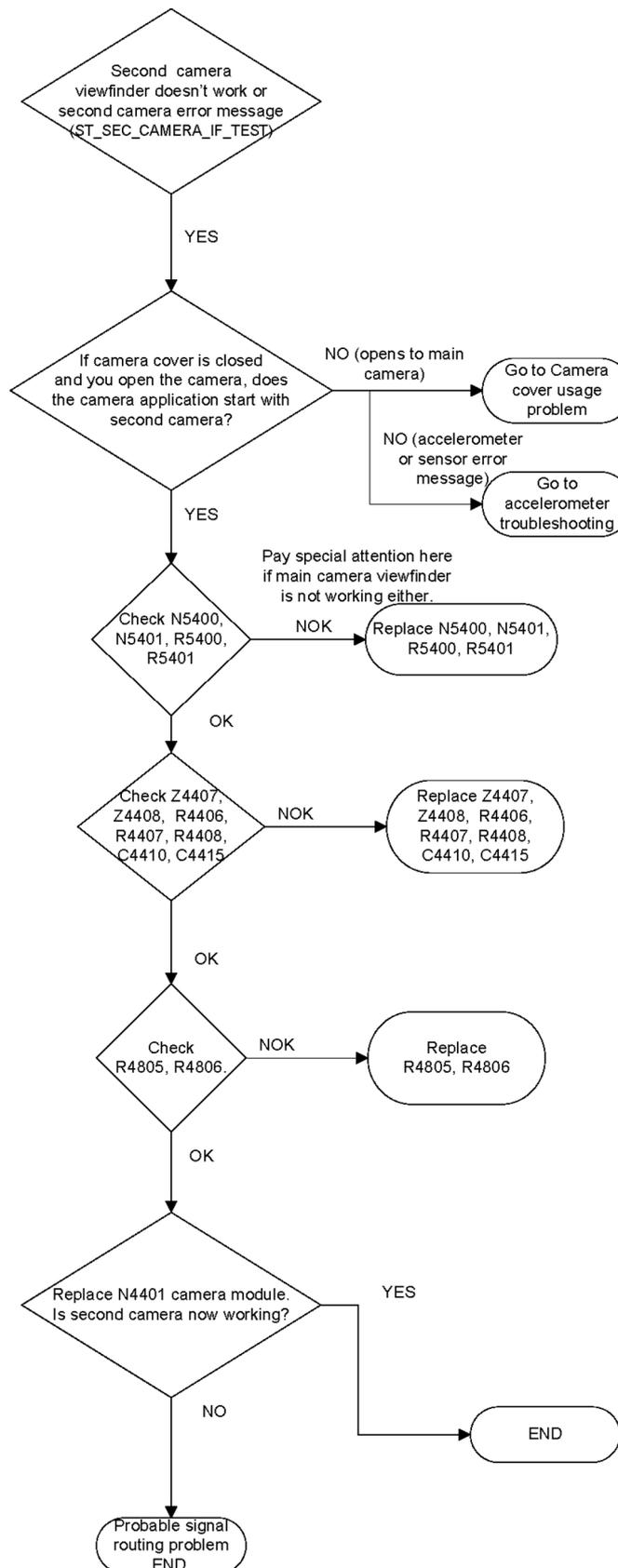
Note: Before checking flash functionality, make sure that the main camera is working OK.

Troubleshooting flow



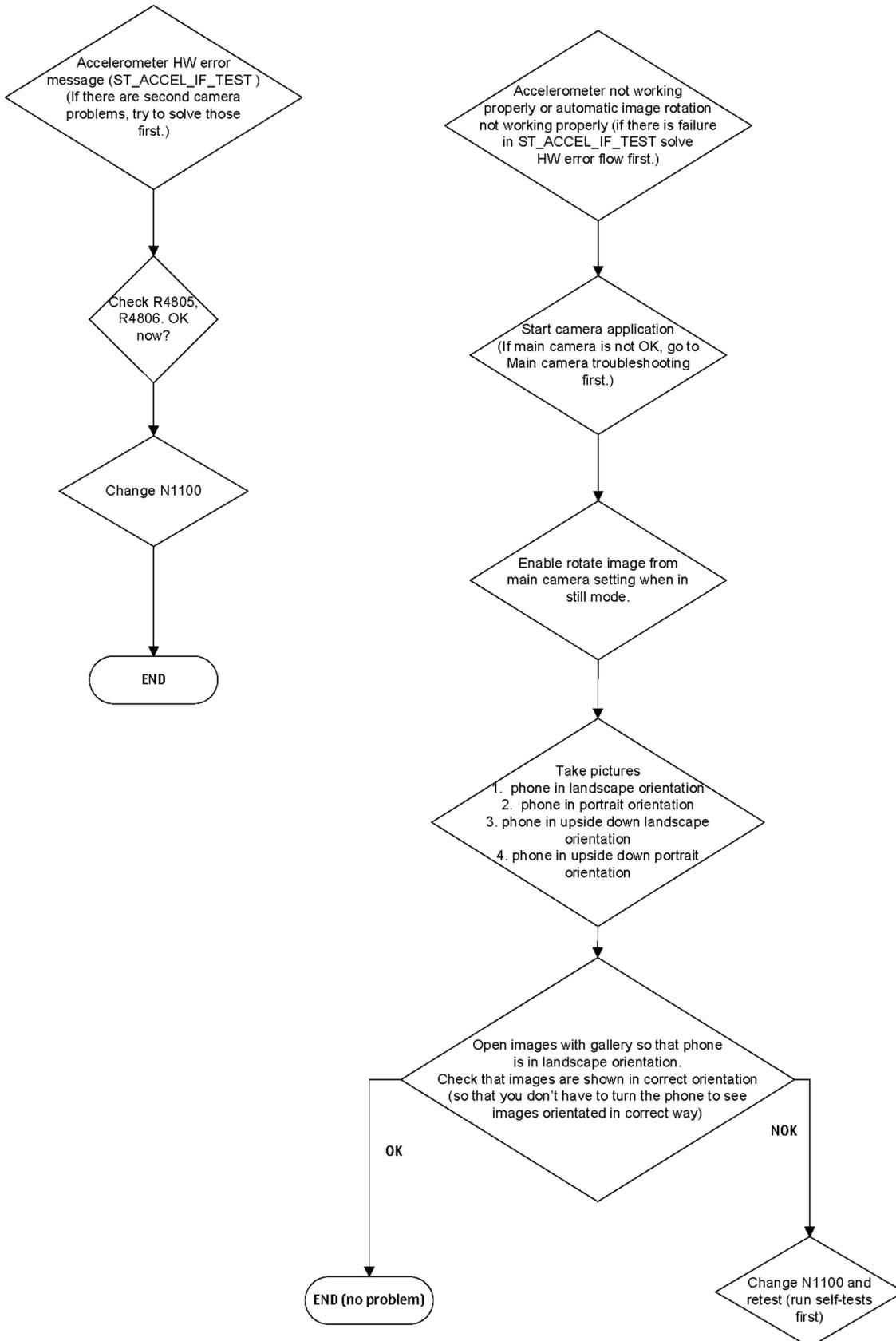
■ Secondary (front) camera troubleshooting flow

Troubleshooting flow



■ Accelerometer troubleshooting

Troubleshooting flow



■ Xenon flash troubleshooting

Introduction to camera module troubleshooting

Background, tools and terminology

Faults or complaints in camera operation can be roughly categorised into two subgroups:

- 1 Flash is not functional at all; no image can be taken.
- 2 Images can be taken and they are recognizable but for some reason the quality of images is seriously degraded, or customer complains about image quality

Image quality is very hard to measure quantitatively, and even comparative measurements are difficult (comparing two images) to do, if the difference is small. Especially if the user is not satisfied with his/her device's image quality, and tells, for example, that the images are not sharp, it is fairly difficult to accurately test the device and get an exact figure which would tell whether the device is functioning properly.

Often subjective evaluation has to be used for finding out if a certain property of the camera is acceptable or not. Some training or experience of a correctly operating reference device may be needed in order to detect what actually is wrong.

It is easy for the user to take bad images in bad conditions. Therefore the camera and the flash operation have to be checked always in constant conditions (lighting, temperature) or by using a second, known-to-be good device as reference.

When checking for possible errors in camera functionality, knowing what error is suspected significantly helps the testing by narrowing down the amount of test cases.

Terms

<i>Dynamic range</i>	Camera's ability to capture details in dark and bright areas of the scene simultaneously.
<i>Exposure time</i>	Camera modules use silicon sensor to collect light and for forming an image. The imaging process roughly corresponds to traditional film photography, in which exposure time means the time during which the film is exposed to light coming through optics. Increasing the time will allow for more light hitting the film and thus results in brighter image. The operation principle is exactly the same with silicon sensor, but the shutter functionality is handled electronically i.e. there is no mechanical moving parts like in film cameras.
<i>Noise</i>	Variation of response between pixels with same level of input illumination.
<i>Resolution</i>	Usually the amount of pixels in the camera sensor. In some occasions the term resolution is used for describing the sharpness of the images.
<i>Sensitivity</i>	Camera module's sensitivity to light. In equivalent illumination conditions, a less sensitive camera needs a longer exposure time to gather enough light in forming a good image. Analogous to ISO speed in photographic film.
<i>Sharpness</i>	Good quality images are 'sharp' or 'crisp', meaning that image details are well visible in the picture. However, certain issues, such as non-idealities in optics, cause image blurring, making objects in picture to appear 'soft'. Each camera type typically has its own level of performance.

The effect of image taking conditions on image quality

There are some factors, which may cause poor image quality, if not taken into account by the end user when shooting images, and thus may result in complaints. The items listed are normal to camera and Xenon flash operation and are not a reason for changing the camera or Xenon flash modules.

Distance to target (too close)

The Xenon module may overexpose the image if the object is too close to the camera. The flash feedback system may not work, if the distance to the object is closer than 20cm.



Figure 34 Overexposed image

Distance to the target (too far away)

The power of Xenon flash is limited and if the target is too far, it cannot be illuminated correctly. The maximum distance for the acceptable image quality is roughly 2m. If the distance is greater than 2m the images may start to be too dark and the noise level increases. This is normal behavior; do not change the flash module.

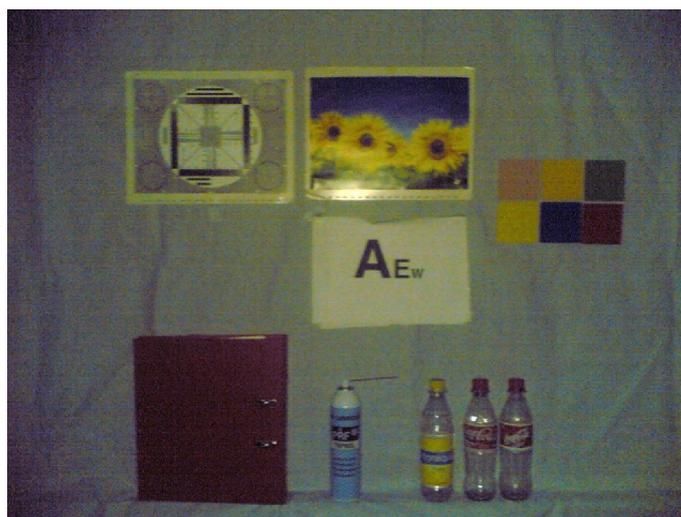


Figure 35 Dark and noisy image

Examples of good quality images

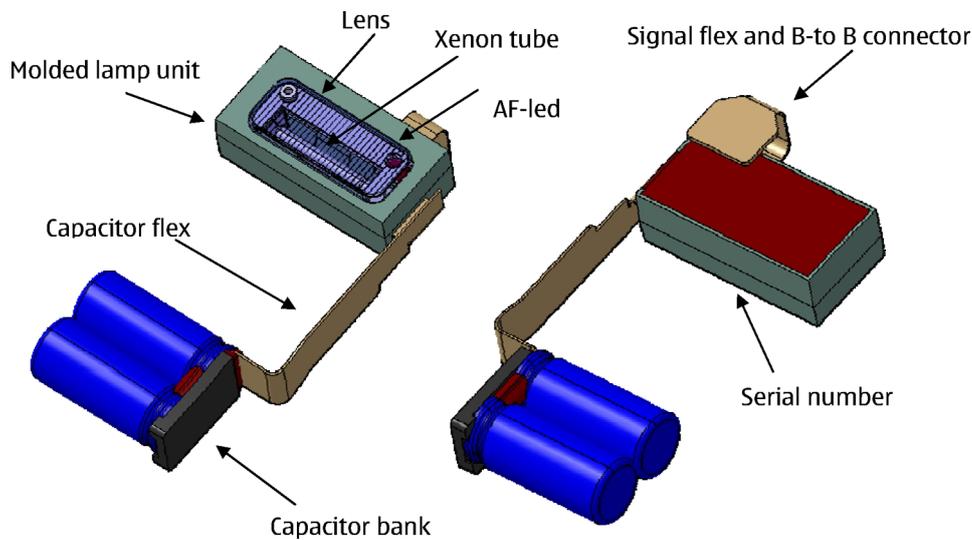


Figure 36 Good image taken indoors



Figure 37 Good image taken outdoors

Xenon flash construction



For RM-313, Tabasco 1 module (4860024) is used. The feedback sensor is not used, only 1 capacitor.

The Xenon flash module as a component is not a repairable part i.e. components / parts in the module cannot be changed. Cleaning dust from the lens is the only allowable operation, do this by using clean compressed air.

The main parts of the module are:

- Molded lamp unit
- Fresnell lens area
- Xenon tube
- Auto focus LED
- Board-to-board connector to connect module to main pwb of device
- Signal flex
- Capacitor bank (with different amount / size capacitors)
- Ink marked serial number

Tabasco Xenon flash fixed to the phone mechanics e.g. with special clips and double side tape. The contacts to the main PWB are formed by using B-to-B connectors (Hirose DF23C-10DP-0.5V - Nokia code 5409207).

List of risks

The Xenon module includes electrolytic capacitor(s) charged to voltage of 320V. Energy stored in the capacitor (s) is 1.0...1.5J immediately after charging. If exposed to an electric shock it will most likely feel very nasty on fingers. Possible risks causing an electric shock in a xenon module are:

- Broken flex between capacitors and lamp unit. The damage may be not visual.
- Broken molding on the lamp unit or capacitors.
- Cover window broken and xenon lamp exposed to the user.

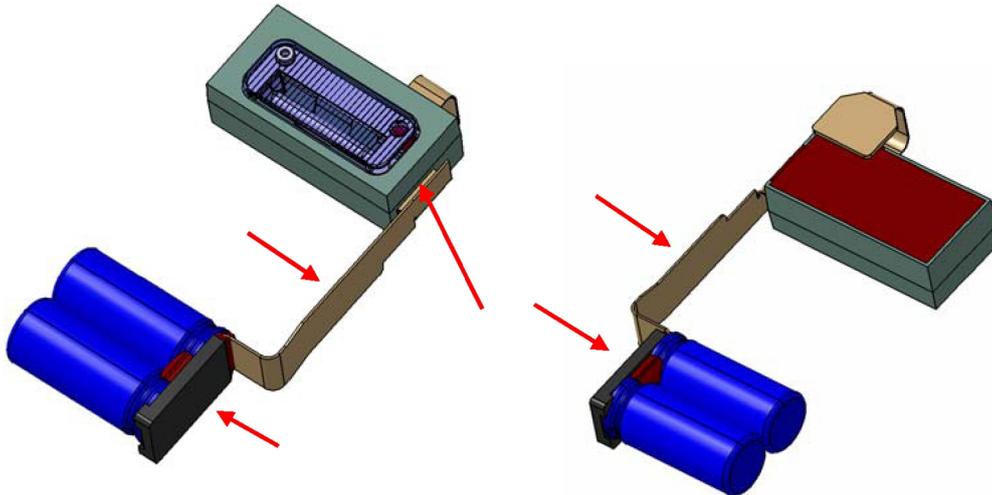


Figure 38 Possible sources of electric shocks

Handling instructions

With an undamaged module there is no possibility of an electric shock. However, the possible damage cannot always be seen and therefore insulating gloves should be always worn, when handling the Xenon module.

Disassembling the module is never allowed, because there is no way to fully discharge the module and also repairing is impossible.

Care must be taken, when module is removed from the phone, because the flex is quite sensitive and can be broken during removing. The flex should also not be bended or twisted unnecessarily.

Image quality analyses

Possible faults in image quality

When checking for possible errors in the flash functionality, knowing what error is suspected will significantly help the testing by narrowing down the amount of test cases. The following types of image quality problems may be expected to appear:

- Xenon module is not flashing at all
- Colours of the images are bad
- Flash power is weak (long distances, over 2m)
- Images overexposed at short distances (less than 20cm)

Testing module functionality

For testing module overall functionality, take an image with the flash and monitor same time whether the LED flashes or not.

To do this test use always FORCED FLASH mode in the phone, not AUTOMATIC mode.

FORCED FLASH mode forces the LED module to flash even if there is some ambient light in present.

Testing image colors with the flash

For testing image colors with the flash. Take an image of the target, which contains something white. You should take the image in the total darkness and from the ~ 1m range.

If the white target appears to be white then the flash is working correctly. However remember that there is some variation in the flash color from module to module (see previous figure).

Testing Flash power

For testing flash power, take an image with the flash in total darkness (ambient light level < 1 lux) from the target about 80cm – 1m away from you.

If the flash is working normally with adequate power level the image is correctly exposed from 80cm – 1m distances. Remember that the brightness level in the corners is always less than in the center of the image, due to camera and flash optics.

Flash is not aligned correctly



Figure 39 Flash not aligned correctly

Flash aligned correctly



Figure 40 Flash aligned correctly

Image overexposed at ~0.5m distance

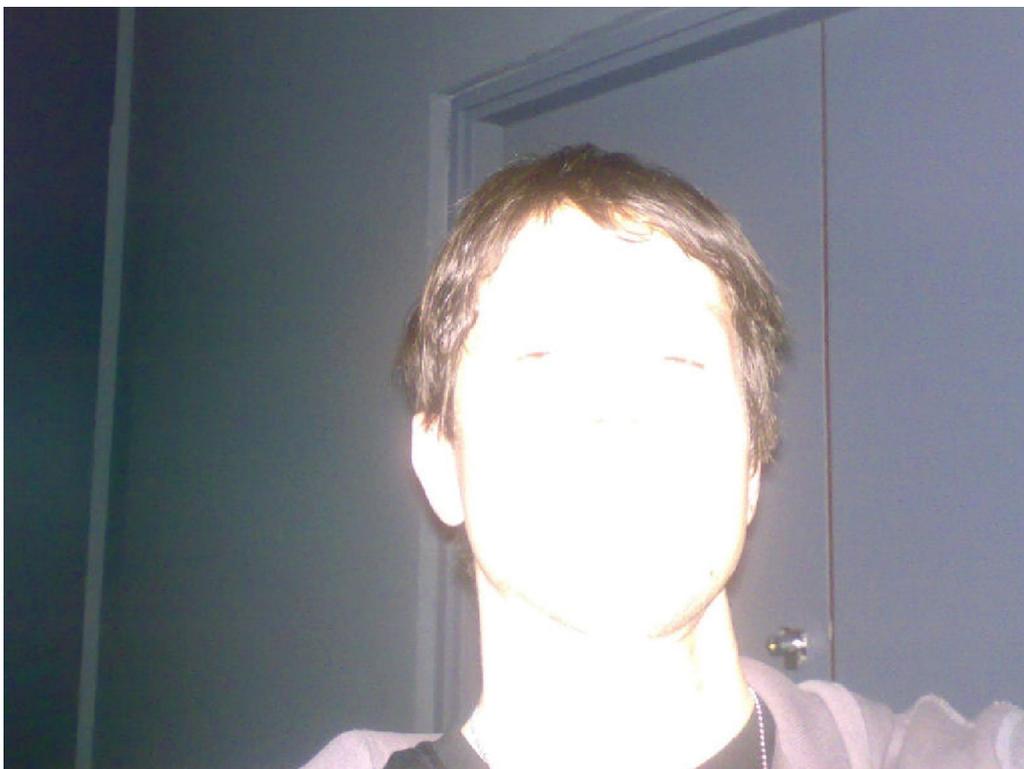


Figure 41 Overexposed image

Troubleshooting Xenon flash

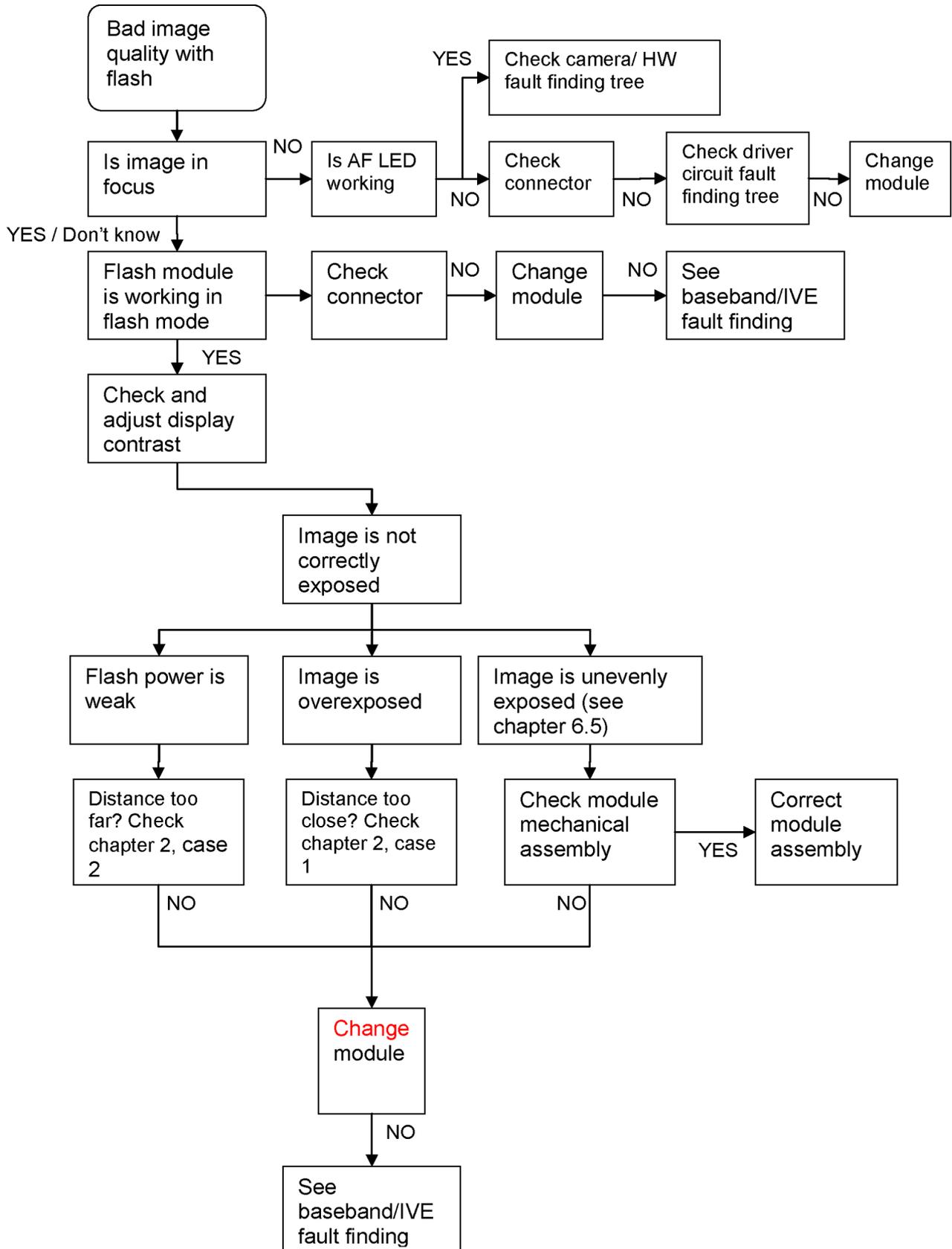
For testing flash overall functionality, take an image with the flash and monitor same time whether the Xenon module flashes or not.

To do this test use always FORCED FLASH mode in the phone, not AUTOMATIC mode. FORCED FLASH mode forces the Xenon module to flash even if there is some ambient light in present.

Assumption is that other components (UI.etc.) are working correctly and only flash & driver functionality are troubleshooted.

Bad image troubleshooting

Troubleshooting flow

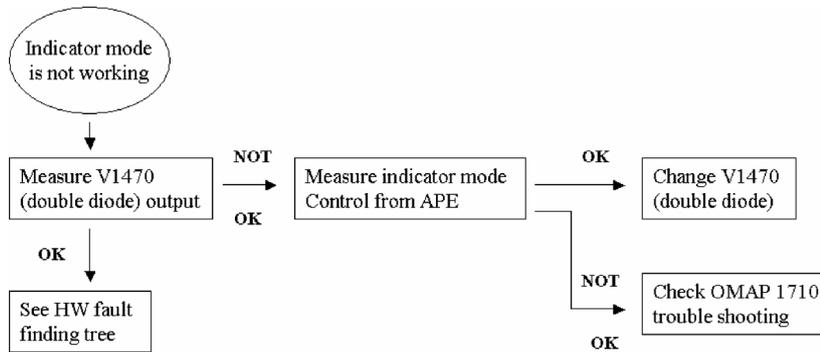


Indicator mode troubleshooting

Context

For checking the indicator mode functionality force camera to record a video clip and monitor the AF led at the same time. LED should work with very low brightness constantly all the time the video is recorded.

Troubleshooting flow



Nokia Customer Care

6 — System Module

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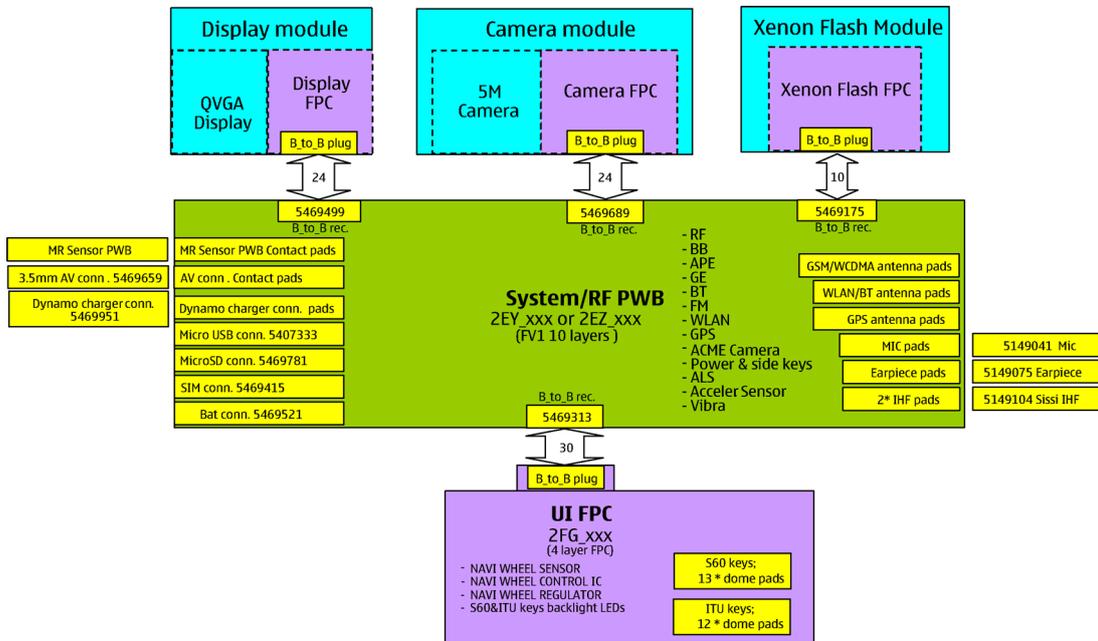
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■ Baseband description

System module block diagram

The device consists of two different main modules: transceiver and UI/slide module. Transceiver board consists of baseband and RF components. UI/slide module consists of UI-FPC and keys.



Baseband functional description

Digital baseband consists of an ISA (Intelligent Software Architecture) based modem and symbian based application sections. The modem functionality is in RAPIDOYawe, and the application processor acts as a platform for Symbian applications.

The modem section consists of a RAPIDOYawe ASIC with combo memory (128Mbit NOR Flash + 128Mbit SDRAM) as the core. RAPIDOYawe supports WCDMA/HSDPA and GSM protocols. RAPIDOYawe operates with the 38.4MHz system clock, which comes from VCTCX0, and provides 19.2MHz system clock to application processor.

The application section includes an application processor ASIC OMAP2420 with combo memory (512Mb DDR + 2G NAND) as the core. Combo memory is soldered Package-On-Package (POP) on top of OMAP2420.

Absolute maximum ratings

Signal	Min	Nom	Max	Unit	Notes
Battery voltage (idle)	-0.3		+4.5	V	Battery voltage maximum value is specified during charging is active
Battery voltage (Call)	+3.2		+4.3	V	Battery voltage maximum value is specified during charging is active
Charger input voltage	-0.3		+20	V	
Back-Up supply voltage	0	2.5	2.6	V	Maximum capacity of the backup power supply assumed to be 4 μAh.

Phone 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 N2200 master reset threshold) and that the back-up battery voltage is too low.
BACK_UP	The main battery is not present or its voltage is too low, but back-up battery voltage is adequate and the 32kHz oscillator is running (RTC is on).
PWR_OFF	In this mode (warm), the main battery is present and its voltage is over EM ASIC N2200 master threshold. All regulators are disabled, PurX is on low state, the RTC is on and the oscillator is on. PWR_OFF (cold) 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. In this mode certain regulators are enabled and after they and RfClk have stabilized, the system reset (PurX) is released and PWR_ON mode entered. 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 activity is low. There are in principle three different sleep modes: <ul style="list-style-type: none"> • Application processor sleep • RAPIDO sleep • Application processor and RAPIDO sleep (deep sleep) In sleep mode N2200's regulators VIO, VDRAM, VSIM1 and VANA are in low quiescent current mode (output voltages still present but regulators will not give as much current out). VSIM2 is permanently off, and VAUX is always in the power on mode. Other regulators including VR1 supplying system clock oscillator are disabled. In SLEEP mode, N2390 VCore SMPS regulator is in low quiescent current mode. In SLEEP mode, N2300 EM ASIC linear regulator VOUT state depends on the accessory connected to the AV connector, if there is any.
FLASHING	FLASHING mode is for SW downloading.

Voltage limits

Parameter	Description	Value
VMSTR	Master reset threshold (N2200)	2.2V (typ.)
VMSTR+	Threshold for charging, rising (N2300)	2.1V (typ.)
VMSTR-	Threshold for charging, falling (N2300)	1.9V (typ.)
VCOFF+	Hardware cutoff (rising)	2.9V (typ.)
VCOFF-	Hardware cutoff (falling)	2.6V (typ.)
SWCOFF	SW cutoff limit	~3.25V

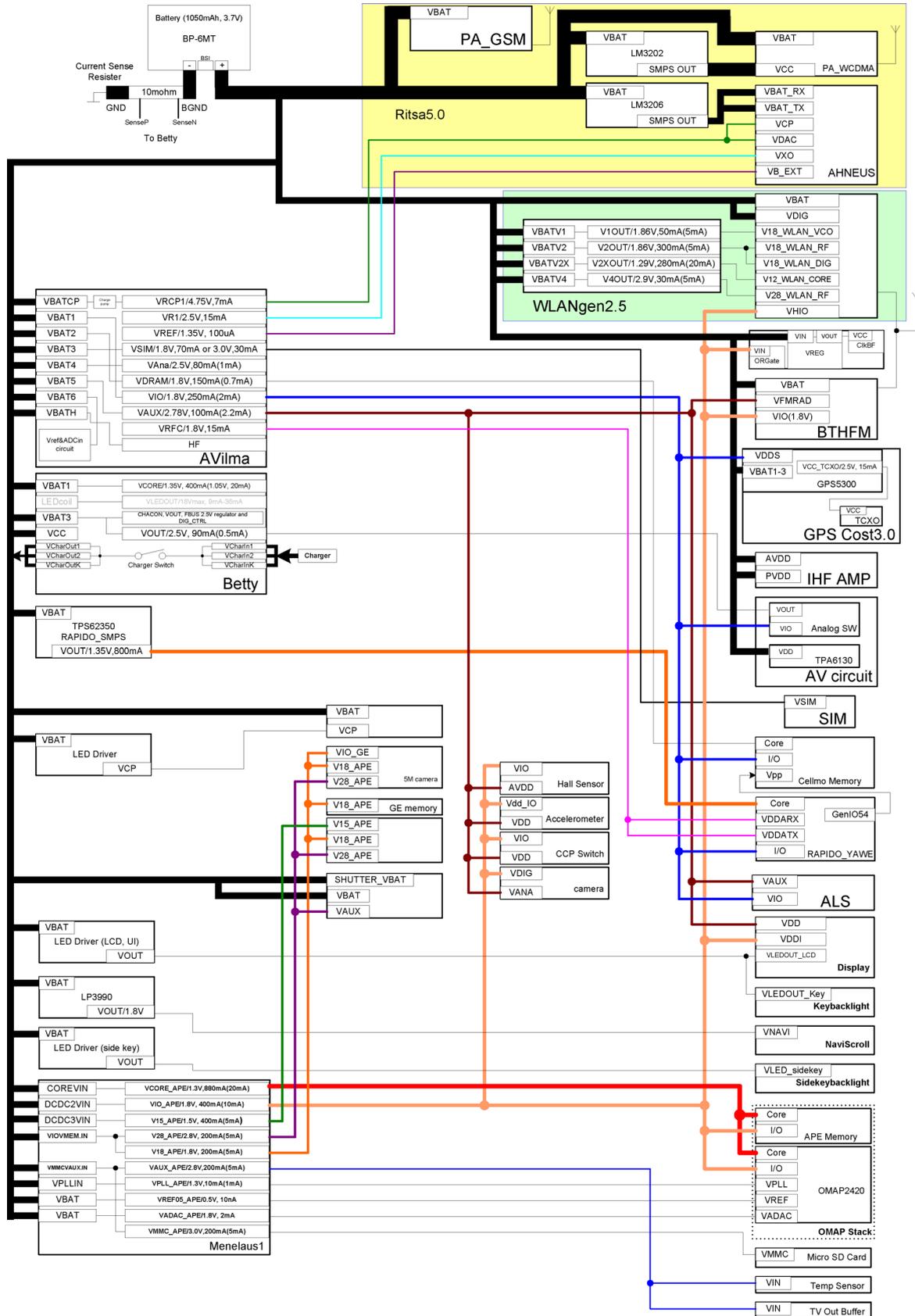
The master reset threshold controls the internal reset of EM ASICs. If battery voltage is above VMSTR, N2300 charging control logic is alive. Also, RTC is active and supplied from the main battery. Above VMSTR, N2300 allows the system to be powered on although this may not succeed due to voltage drops during start up. SW can also consider battery voltage too low for operation and power down the system.

Power key

The system boots up, when power key is pressed (adequate battery voltage, VBAT, present).

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

Power distribution



System power-up

After inserting the main battery, regulators started by HW are enabled. SW checks, if there is some reason to keep the power on. If not, the system is set to power off state by watchdog. Power up can be caused by following reasons:

- Power key is pressed
- Charger is connected
- RTC alarm occurs
- MBUS wakeup

CellMo engine (WG4.1M) is master during power up sequence i.e. CellMo side makes the decision when phone is powered on. RSTX signal from AVilma is used to enable the startup sequence of Rel3.1 engine. The rising edge of RSTX starts all the resources needed to boot RAPIDOWawe and OMAP2420 chips following the required sequence:

- 1 When a valid wake up event happens (power key press, charger detection, RTC alarm or voltage detected in MBUS line), AVILMA asserts RSTX signal high. RSTX enables the internal regulators of AVilma (VIO, VANA, VDRAM and VR1), Betty, Menelaus1 and the discrete SMPS for RAPIDOWawe core. VIO enables the AVilma's internal 32kHz output buffer and VR1 starts the 38.4MHz VCTCXO on RF. Both 32kHz sleep clock and 38.4MHz RF clock start to run and are available in the system.
- 2 It takes max 0.65ms before Menelaus1 is ready to start the power-up sequence on the APE side. VIO_APE starts first. It supplies power for APE side memories and OMAP2420POP I/Os.
- 3 SysClkReq signal has an internal pull-up resistor to IO voltage (VIO_APE) of OMAP, so it follows the slope of VIO_APE. RAPIDOWawe activates the 19.2MHz system clock when it interprets SysClkReq as a logical 1. This happens when SysClkReq reaches about 1V level.
- 4 When VIO_APE has completed its power-up, it is possible to apply signals to OMAP I/Os. 32 kHz sleep clock is applied to OMAP.
- 5 When VIO_APE has completed its power-on sequence, the VCORE_APE is enabled and starts its ramp up sequence.
- 6 When VCORE_APE ramp up is complete, VPLL_APE starts ramping up.
- 7 When VPLL_APE has ramped up, the PWROK signal is asserted to signal that the OMAP2420 power-up sequence has been completed.
- 8 After a 16ms (typ) delay, the PURX signal is asserted high by AVILMA. Both CellMo and APE processors are released out of reset with this signal. SW can start the controlling of SW controllable regulators on the CellMo side.
- 9 OMAP2420POP completes its power-on sequence, and asserts nRESWARM high (after ~5x32kHz clock cycles) when it is completed.
- 10 SW can start the controlling of VMMC_APE, VAUX_APE, VADAC_APE, VDCDC3_APE, V18_APE and V28_APE regulators of M1 via the I2C interface.

Clocking scheme

There are two main clocks in the system:

- 38.4MHz RF clock produced by VCTCXO in RF section
- 32.768kHz sleep clock produced by the EM ASIC N2200 with an external crystal.

RF clock is generated only when VCTCXO is powered on by the EM ASIC regulator. The regulator itself is activated by SleepX signal from RAPIDO. When both CPU's are on sleep, RF clock is stopped.

RF clock is used by RAPIDOWawe, which provides 19.2MHz SysClk to the application processor. Both RAPIDO and OMAP2420 have internal PLL's that create clock signals for other peripheral devices/interfaces like SD card, SIM, CCP, I2C and memories.

BT and WLAN have their own 38.4MHz crystal oscillator that generates clock signal when clock request from either WLAN or BT is high.

32k Sleep Clock is always powered on after startup. Sleep clock is used by RAPIDO and the application processor for low power operation. Sleep clock is also used by GPS, FM Radio, Bluetooth and WLAN. RAPIDOWawe and GPS the sleep clock is not buffered, for other modules the sleep clock is buffered (VIO_APE is the buffer power supply).

SMPS Clk is a 2.4MHz clock line from RAPIDO to EM ASIC N2300 and discrete SMPS N2390. In deep sleep, when VCTCXO is off, this signal is set to '0' state.

9.6MHz Camera Clock is generated by Golden Eye.

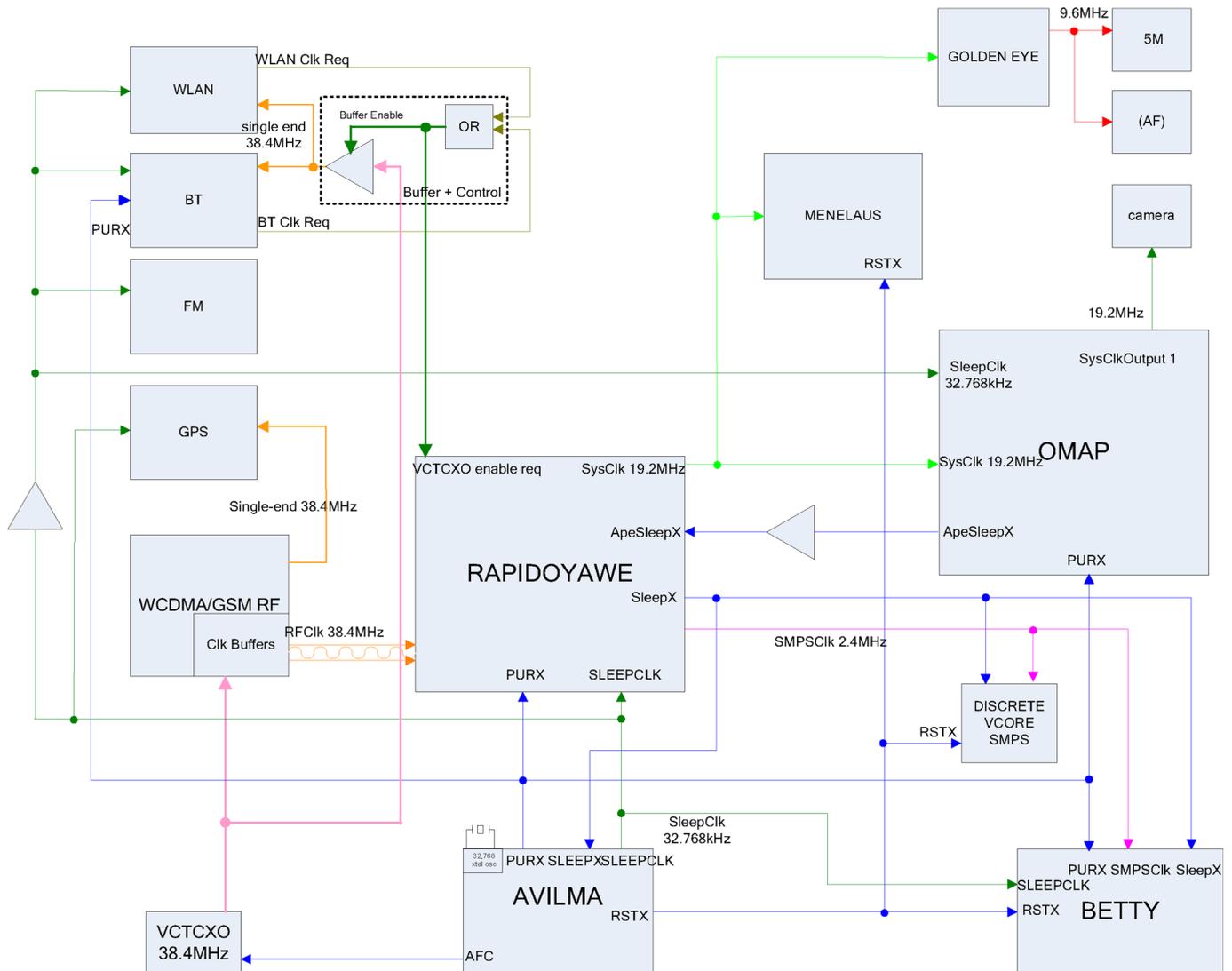


Figure 42 Clocking diagram

Bluetooth and FM radio

Bluetooth

Bluetooth provides a fully digital link for communication between a master unit and one or more slave units. Data and control interface for a low power RF module is provided. This device supports Bluetooth 2.0 +EDR standard.

The Bluetooth module (D6000) is a single chip solution that uses common clock signal (38.4 MHz) with WLAN module. BT has interfaces to modem ASIC D2800 (PCM for BT audio), application ASIC D4800 (UART for BT data) and to WLAN, which controls antenna usage.

FM radio

The FM radio is an integrated circuit, controlled by MCU software through a serial bus interface. The wires of the headset are used as poles of the antenna, and no other antenna is needed for FM radio reception. The FM radio utilizes the AV connector for its antenna connectivity. The RF input of the FM radio module is connected to the stereo audio output pins (HS_EAR_L/R) via RF coupling circuitry. Wired headset connected to the AV connector works as an antenna for FM radio. The FM radio is controlled by I2C commands from RAPIDO. The audio output of the FM radio (D6000) is fed to the headset via EM ASIC N2200.

Bluetooth and FM radio block diagram

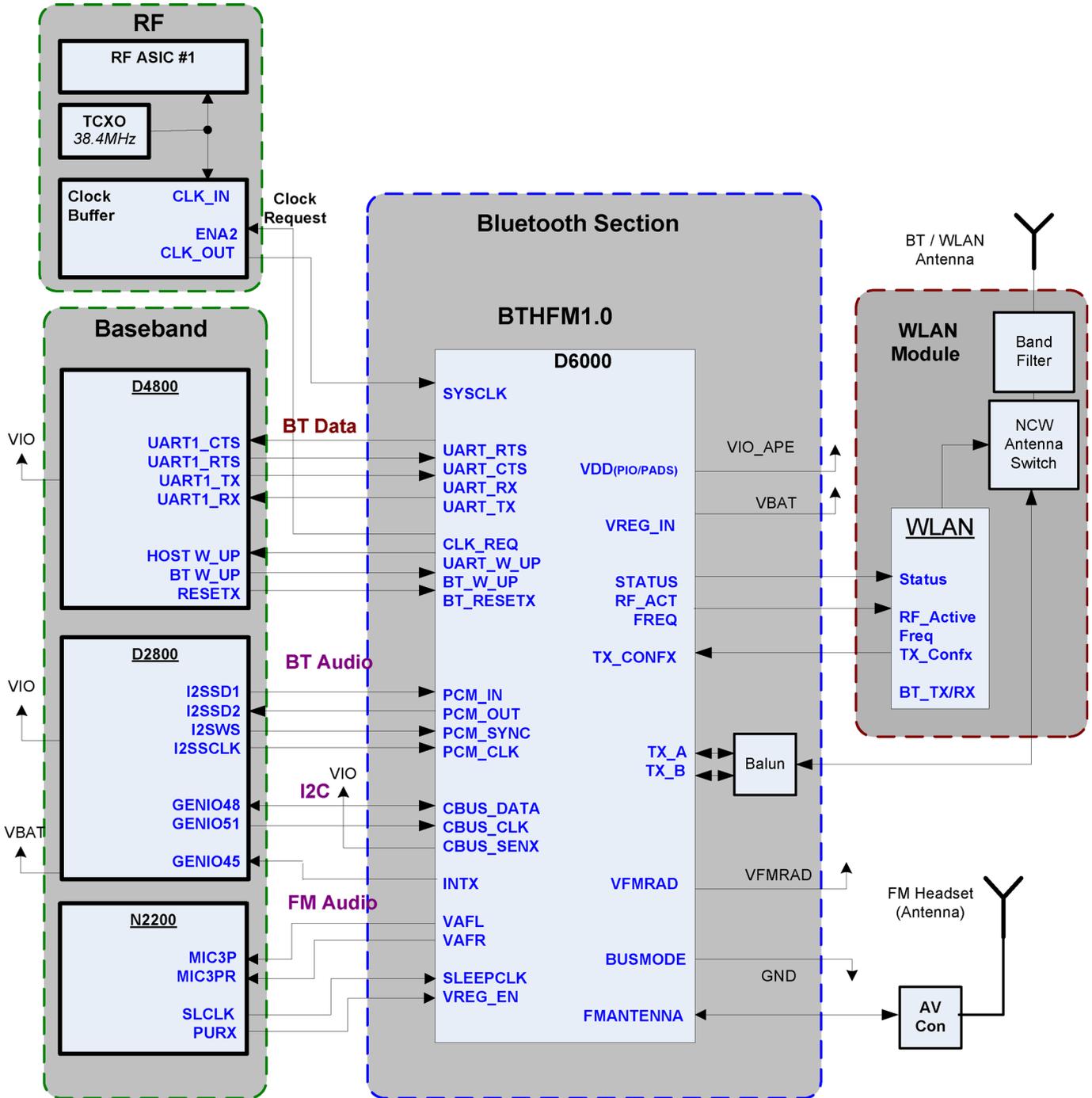


Figure 43 Bluetooth and FM radio block diagram

WLAN

WLAN engine is divided into STLC4550 WLAN transceiver module and radio front-end module (FEM) RF5924. STMicroelectronics Phaser STLC4550 is a three-die multichip module, partitioned to radio, baseband and energy management die. STLC4550 is packaged to 8.5 mm x 8.0 mm x 1.4 mm 240-ball 0.5 mm pitch LFBGA.

STLC4550 implements 802.11b/g WLAN radio for embedded, low-power and small form factor mobile applications. STLC4550 conforms to the IEEE 802.11b/g protocols operating in 2.4 GHz band supporting OFDM data rates of 54, 48, 36, 24, 18, 12, 9, and 6 Mbps as well as CCK data rates of 11 and 5.5 Mbps and legacy data rates of 2 and 1 Mbps. IEEE802.11e/i protocol extensions are included to implement quality of service (QoS) and security functions.

STLC4550 has a fully integrated radio chip including a direct-conversion transceiver, RF synthesizer and VCO, and high-speed data converters. Digital interface is used for transferring the sampled data between radio and baseband chip. The baseband chip implements OFDM/CCK digital baseband processor and ARM9- based MAC with internal SRAM memories. The baseband includes required logic and interfaces to enable time-shared simultaneous use of BT and WLAN.

The energy management unit integrates required power management functions to operate the system from VBAT (3.0 – 5.5 V). The EM unit generates 1.2 V digital core voltage, two 1.8 V supplies for RF and 2.8 V LDO for PA bias supply. The EM unit also integrates power-on reset circuitry and level-shifters for RF front-end GaAs switches.

Host interface is provided by a flexible serial interface (SPI) supporting clock frequency upto 48 MHz. The maximum usable SPI clock rate depends on the host side clocking options and timing requirements. Typically rates of 14 – 24 MHz are achieved. WLAN/BT coexistence interface enables automatic time shared usage of WLAN and Bluetooth.

The system uses 38.4 MHz reference clock. In this device dedicated oscillator circuit for WLAN and Bluetooth reference clock is used. Low power sleep mode operation is enabled using 32768Hz low speed clock and energy management stand-by state.

WLAN RFMD RF5924 front end module is used. Power amplifier, RF-switches and baluns are integrated to FEM. The PA includes power detector for closed-loop power control purposes. WLAN/BT bandpass filter is external ceramic filter.

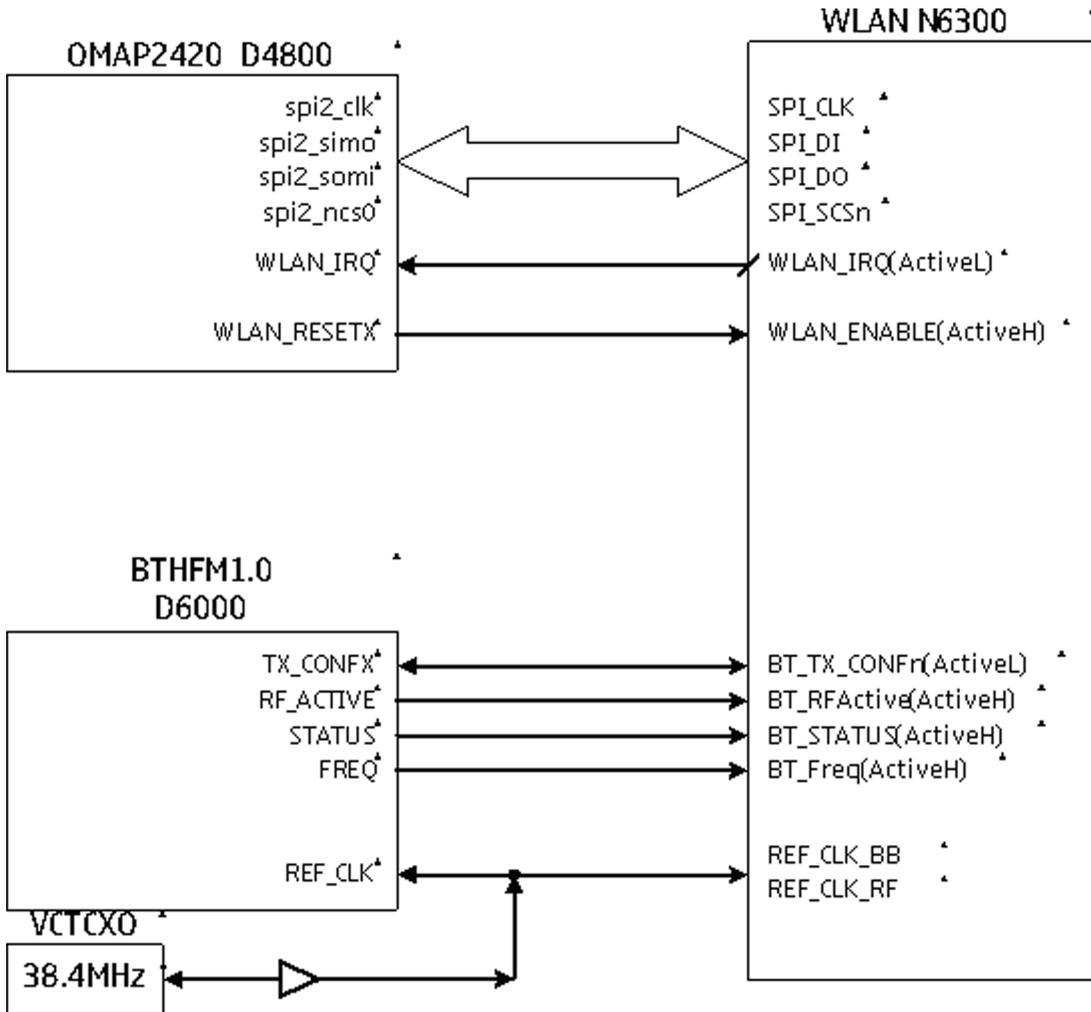


Table 12 General WLAN specifications

Supported channels	USA 1-11 (2412-2462MHz)
	ETSI 1-13 (2412-2472MHz)
Transmitter power	17dBm
Barker/CCK (1, 2, 5.5, 11Mbps datarate)	15dBm
OFDM-BPSK(6, 9 Mb/s)	15dBm
OFDM-QPSK(12,18 Mb/s)	13dbm
OFDM-16QAM (24, 36 Mb/s)	13dBm
OFDM-64QAM (48,54 Mb/s)	
Power control range	0-17dBm
Receiver sensitivity (typical)	-83dBm
11M/bits. 1024bytes / 8% PER	-70dBm
54 Mb/s, 1000 bytes, 10% PER	

GPS interface

The device includes an inbuilt GPS receiver and it works as a stand-alone positioning device. The antenna is located below the main keypad in the bottom of the product.

The GPS system is connected to RAPIDO ASIC.

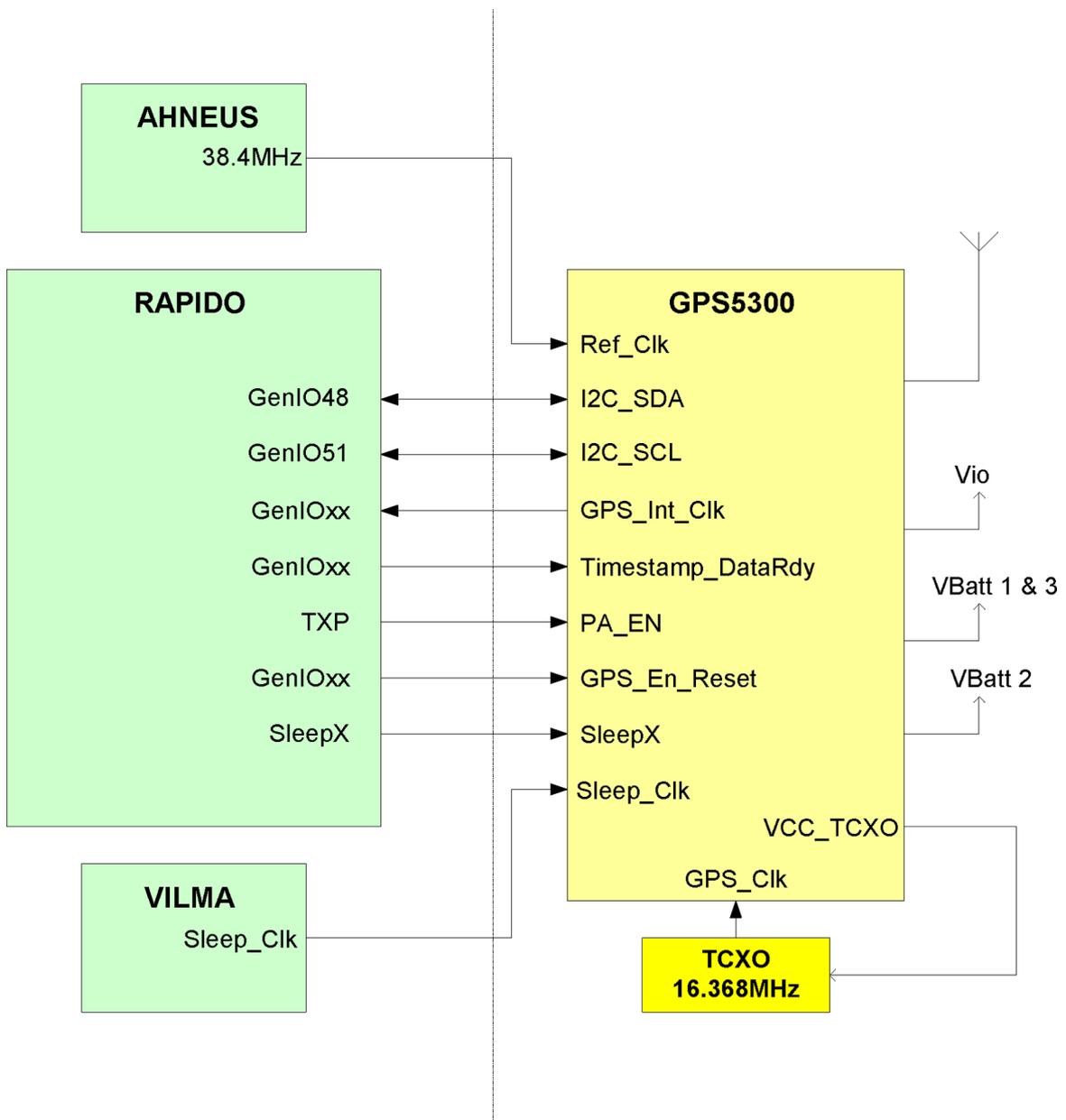
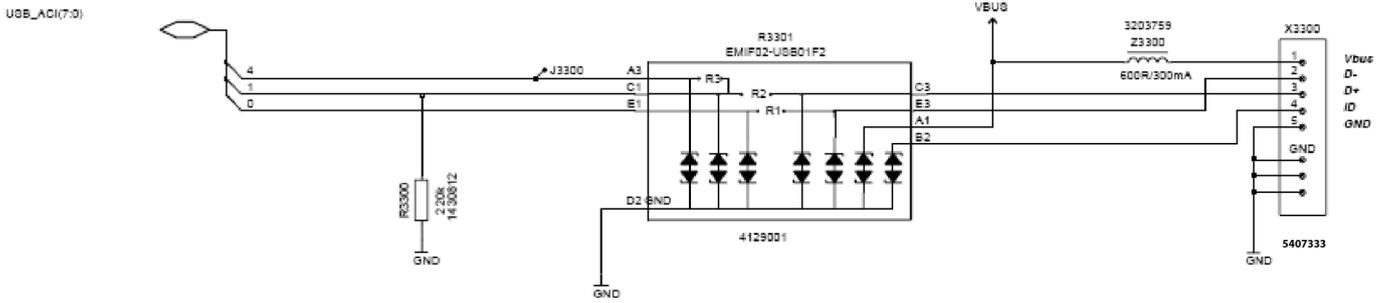


Figure 44 Block diagram of the GPS system

USB

The device supports USB 2.0 full speed, with micro-USB connector.

USB connection is implemented using the Application ASIC D4800 USB controller interface and N2300 EM ASIC's USB transceiver. External interface is the micro-B connector. The interface between N2300 transceiver and micro-B receptacle is standard USB interface specified Universal Serial Bus specification Rev. 2.0. The USB transfers signal and power over four-wire interface. Interface carries differential data, Vbus and GND. Signalling occurs over differential data line, D+ and D-. The clock is transmitted, encoded along with the differential data. ESD protection is done with USB ASIP. VBUS (+5V) is provided by the host device.



SIM interface

The SIM (Subscriber Identification Module) interface is located in two ASICs; Cellular Modem ASIC D2800 contains most of the interface functionality and the mixed signal ASIC N2200 takes care of power up/down, card detect, ATR counting and level shifting. ESD protection components are integrated to N2200 ASIP.

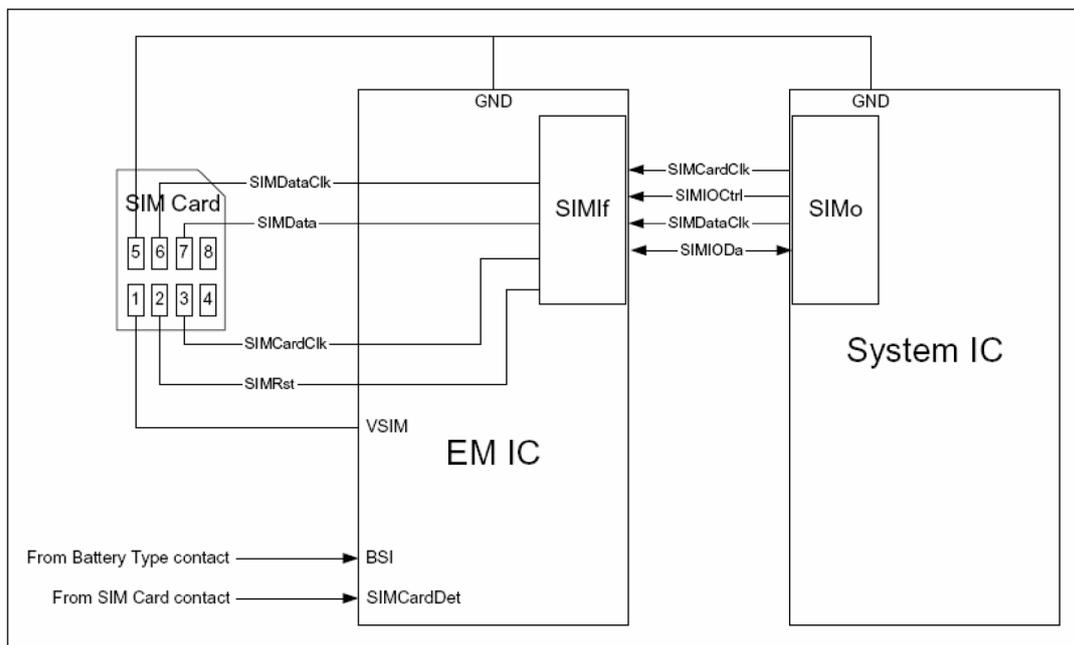


Figure 45 SIM interface

SD card interface

Memory card interface is compliant with the MultiMediaCard Specification version 4.x, the SD Memory Card Specification, Physical Layer Specification version 2.00 and Secure Digital Input/Output Card Specification, Version 1.20.

The host in the SD card interface is application ASIC D4800. SD card transceiver/level shifter is in application side mixed signal IC (N4200). There are four data signals, one command signal and a clock output signal going in N4200. For transceiver control, there are direction signals to each data signals and one also for CMD. A feedback clock is coming from transceiver to host. Memory card transceiver is controlled by D4800 I2C_APE. Clock frequency used is 24MHz. ESD protection is implemented with an ESD ASIP, Z5200.

Hot-Swap

To enable Hot-Swap of the micro SD card, the device uses an SD card connector with a pre-warning signal. To enable card removal, the user needs to push SD-card further in to the connector first. This gives so-called pre-warning signal to the system and ongoing write/read operation can be finished safely before card is removed. Note that this is just a backup mechanism and does not cover all the use cases (writing/reading large amount of data): the user should always close the SD-card before starting the card removal.

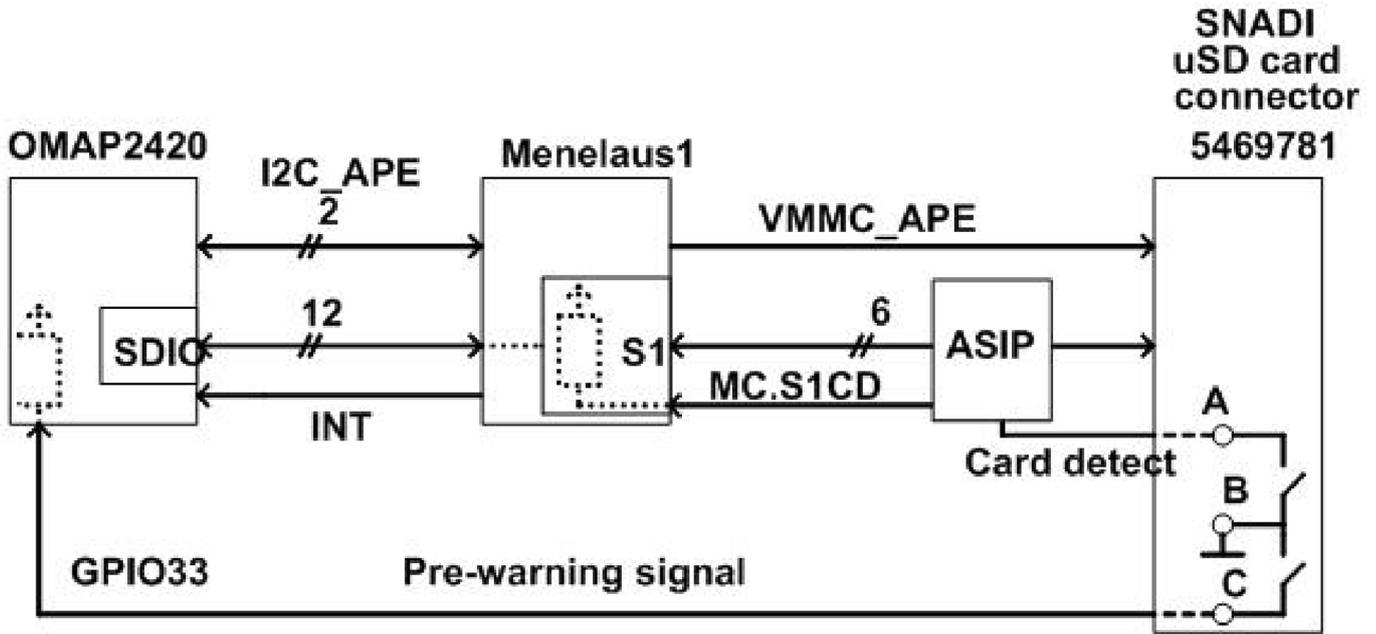


Figure 46 Pre-warning principle

TV-out interface

A TV-out connection is implemented using the application processor (D4800) Video DAC interface and an external analogue line driver (N5650). The device engine supports the following systems using composite video (CVBS):

- M/NTSC
- J/NTSC
- 4.43/NTSC
- M/PAL
- N/PAL
- Nc/PAL
- B/PAL
- G/PAL
- D/PAL
- H/PAL
- I/PAL

CVBS is a single video signal containing all the necessary information to reproduce a colour picture. The video signal is filtered with ASIP R5650, and connected to AV-connector pin 3. Switch N2002 is used to connect AV connector pin 3 to TV-out, the same pin is used also as a microphone line.

Battery interface

The device uses BP-6MT Battery with TABBY interface. There are two manufacturers for BP-6MT Batteries and they have different discharge curves; SW recognizes battery manufacturer from BSI resistor value (27k or 82k).

Charging

Charging is controlled by different blocks depending on the situation: If battery is totally empty, the charging is controlled by CHACON block in N2300 and the battery is first charged with constant current until the voltage rises above certain limit (VMSTR+). Then the digital part of N2300 takes care of the charging and PWM charging is done until PURX is released. After this SW starts to control the charging.

The device has Li-Ion battery, which has protection circuit that limits the lowest battery voltage to 2.8V, and constant current mode is practically never used.

Camera interfaces

Camera system

The device's camera system consists of camera processor, which is connected to the application processor. The camera processor has external SDRAM and it used N5452 IC to control AF and mechanical shutter. The main camera and flash driver is connected to the camera processor. The front camera (second camera) is connected to application processor and it shares the CCP-bus with the camera processor through switches N5400 and 5401.

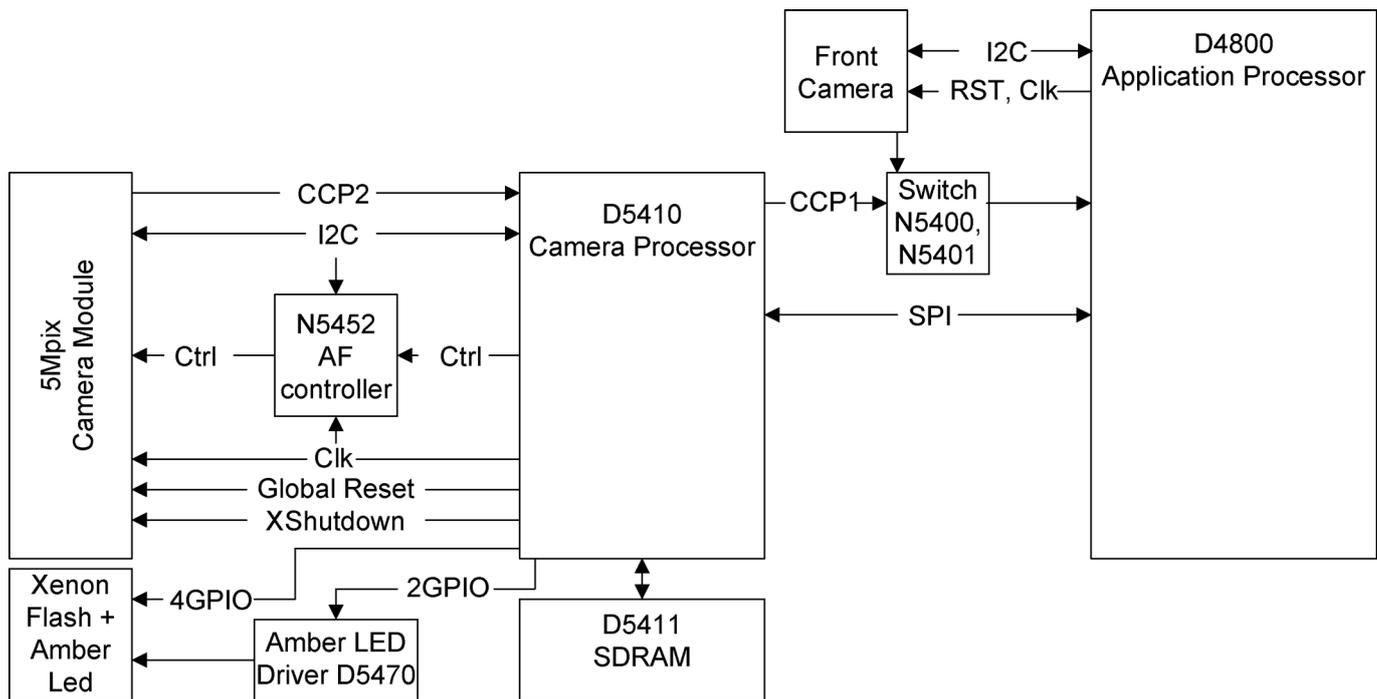


Figure 47 Camera system block diagram

Main camera characteristics

Sensor type	CMOS
Sensor photo detectors	5.0 million (2592 x 1944 pixels)
F number/Aperture	f/2.8

Focal length	5.6/35 mm (35 mm equal)
Focus range	10 cm to infinity
Still Image resolutions	up to 5 Megapixel: 2592x1944
Still images file format	EXIF (JPEG), *.jpg
Video resolutions	VGA 640 x 480 at 30 fps/15 fps 320 x 240 (QVGA) at 30/15 fps 176 x 144 at 15 fps (QCIF)
Video clip length	Maximal clip length is 60 mins (High or Normal quality) or limited to MMS size approx. 30 seconds (Sharing quality) Note: Clip length is dependable on available memory
Video file format	.mp4 (default) and .3gp (for MMS)
Auto exposure	Center weighted AE
White balance	Automatic, sunny, cloudy, incandescent, flurescent
Colour tones	Normal, sepia, vivid, black&white, negative
Capture Modes	Still capture mode, video mode and sequence mode
Selftimer	2, 10, or 20 secs
Flash settings	Auto, off, forced, anti red-eye
Automatic image rotation	On / Off

Camera flash

The device has also camera xenon flash located directly beside the main camera, providing better image quality in darker environments. The xenon flash has also build in Amber AF/indicator LED that is used as a AF (Auto Focus) assistant light and a privacy indicator. The Amber led is lit during video recording and it is also used to indicate image capture with main camera.

The xenon flash is located on flex and the flex is connected to main PWB through connector. The camera flash has one xenon tube and one Amber LED inside the module. The module also includes a lens with its plastic housing to ensure a proper AF assistance at the target.

Secondary camera characteristics

Sensor type	CMOS
Sensor Photo detectors	CIF
F number/Aperture	f/2.8
Focal length	43 mm (35mm equivalent)
Focus range	10 cm to infinity
Still Image resolutions	QVGA
Still images file format	JPEG/EXIF

Accelerometer

The device has an accelerometer, which is used in automatic image rotation. Accelerometer is connected to application processor through I²C bus. Image rotation has build-in hysteresis.

Audio concept

Audio HW architecture

The functional core of the audio hardware is built around two ASIC's: Cellular Modem ASIC D2800 and the mixed signal EM ASIC N2200.

There are four audio transducers:

- Dynamic earpiece (part of UI/Slide module)
- 2 Dynamic speakers
- Electret microphone

In addition to the audio transducers, N2200 also provides an output for the dynamic Vibra component. All galvanic audio accessories are connected to the AV-connector. Bluetooth audio module, that is connected to Cellular Modem ASIC D2800 supports Bluetooth audio functionality. For some audio applications, part of the processing is done on application processor ASIC D4800, for example for Music Player.

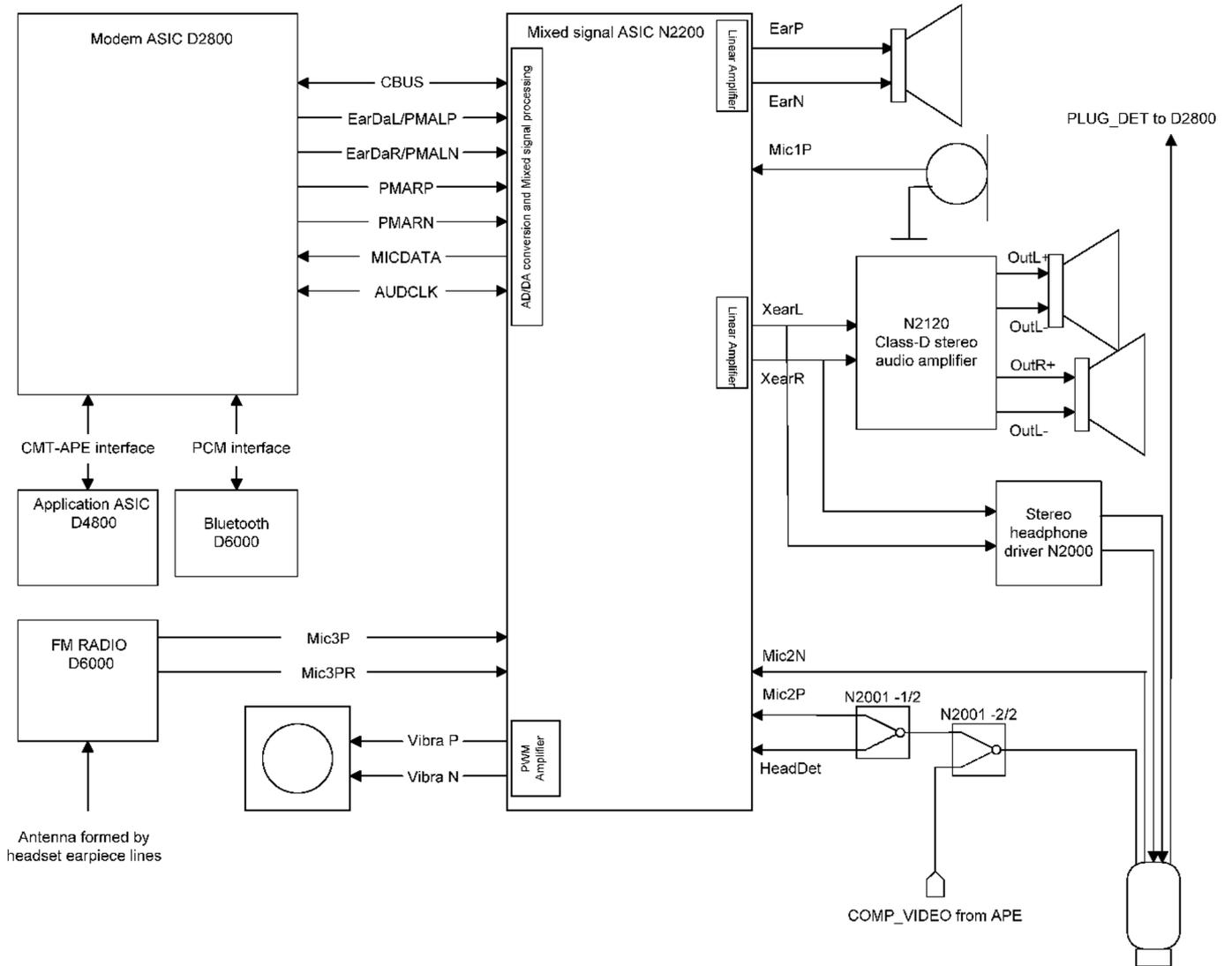
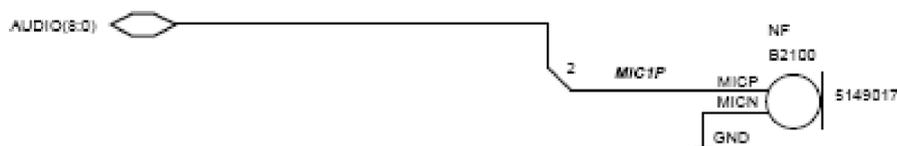


Figure 48 Audio block diagram

Internal microphone

The internal microphone is used for HandPortable (HP) and Internal HandsFree (IHF) call modes. Also if the accessory headset does not have microphone, the phone uses the internal microphone. An analogue electret microphone is connected to the EM ASIC N2200 Mic1P input via asymmetric electrical connection. The microphone is biased by the EM ASIC MicB1 bias voltage output.



External microphone

Galvanic accessories are connected to the 3.5mm AV-connector. Accessory audio mode is automatically enabled/disabled during connection/disconnection of dedicated phone accessories. External microphone is connected to EM ASIC N2200 input Mic2P and Mic2N. Mic2P, Head_Det line of EM ASIC N2200 and Composite Video input from application ASIC are multiplexed to the same AV-connector line.

AV connector

The device has a 3.5mm AV-connector. The user can use it to connect any audio accessory or e.g. TV-out cable to the phone. In-box headset (HS-43) is so-called Enhancement Control Interface (ECI) accessory. If the connected cable is not ECI accessory, cable recognizing is based on impedance on the microphone line. If the cable cannot be recognized, the user can select which accessory type is connected to the phone.

There are five Audio Control lines from Cellular Modem ASIC D2800 to control control audio and AV-connector related electronics. Those signals and default stages of the signals are described in the following table.

Table 13 AUDIOCTRL interface

Signal	Control	Default state / action
AUDIOCTRL(0), AVPaEn	Headphone amplifier	0 (shutdown)
AUDIOCTRL(1), AVPlugDet	Plug_det from AV-connector	1.8V (VIO), grounded when 3.5mm plug inserted
AUDIOCTRL(2), AVEICtrl	Mic2P / head_det switch N2001	Default 0 (microphone line connected to Mic2P). When 1, microphone line connected to head_det -> ECI-detection
AUDIOCTRL(3), AVVideoCtrl	Mic2P / Comp_Video switch N2002	Default 0, (microphone line connected to Mic2P). When 1, Composite Video from APE connected to microphone line.
AUDIOCTRL(4), IHF_AMP_EN	Attenuation switches N2030 and N2031, IHF amp N2120	Default 0, IHF amplifier and attenuation not used.

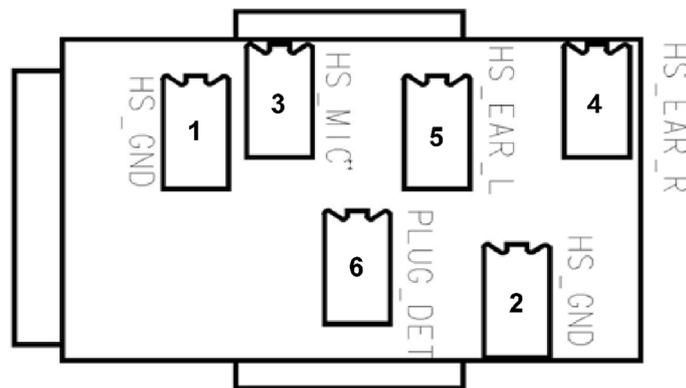


Figure 51 AV connector component layout and pads

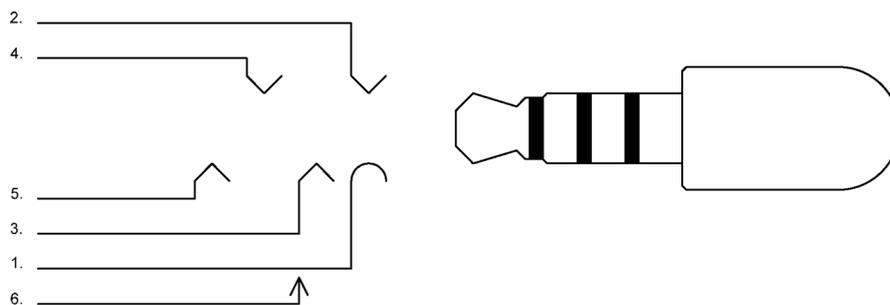


Figure 52 Connector pin layout (Plug conductors from left to right HS EAR L, HS EAR R, HS MIC/Cntrl. and HS GND)

Table 14 Pin configuration

3.5mm Pin #	Signal name	Direction	Description
6	PLUGDET	In	Terminal internal connection, plug detection
5	HS EAR L	In / Out	Audio output
4	HS EAR R	In / Out	Audio output,
3	HS MIC	In / Out	Multiplexed microphone audio and control data, C-video out
1, 2	HS GND	-	Ground contacts

There are three different use cases for AV connection. In all cases the PLUG_DET is used for detecting plug insertion and removal. EAR lines are used for FM antenna reception.

- **Headset or similar with ECI or without ECI.**

When a headset is detected the terminal will check if there is ECI circuit in the accessory. If the ECI chip is present, tuning values for that is taken into use otherwise basic audio tuning parameters are used.

- **Headphones**

For the headphones and any 3-pole connector devices, the headphones option is used.

Note: The mic line and the ground line are connected together.

- **Video out**

For example, when connecting terminal to television all pins are used.

Note: The microphone is multiplexed to C-video. The cable has to be inserted first to television set and then to the terminal, otherwise the automatic detection does not work according to the specification.

User interface

Display

Display features

- Module size (width x height x thickness) 41.78 mm x 58.37 mm x 2.1 mm
- Resolution QVGA (240*320)
- Numbers of colours up to 16.7M
- Partial display function; power saving by pausing display process on part of the screen
- Built-in RAM capacity 240 columns x 320 rows x 24 bits RAM
- Transflective optics

The display has two different operating modes:

- Normal mode, Full screen, 16.7 million colors
- Partial idle mode, 8 colors but only part of the display is active

Display is located on front side of phone. The interconnection between the LCD module and Engine is done with a 24-pin B2B-connector.

The display is controlled via MeSSi-8 interface with an 8-bit bus by the application processor. All MeSSi signals go through the EMC filtering ASIPs (Z4405 and Z4406). The display module does not require any tunings in service.

Display and keyboard backlight

The device uses SMPS Led Driver to drive display and S60 keyboard LED's. Three display backlight LED's are connected in series (located in display module). Three S60 LEDs are also connected in series, parallel to display LED branch via current mirror. Current feedback is done with display LED current. SMPS (N1151) and related discrete components are located on system/ RF module. Current mirror and S60 LED's are placed on UI-FPC. Display LED brightness can be controlled with PWM signal (0-100%, ~293Hz). S60 LEDs can be turned OFF separately.

ITU keyboard and Side Keys are illuminated with LED's that are driven with charge pump N1150. ITU keys can be turned on as one group. Side keys will always be turned ON and OFF as a light sequence. Brightness of charge pump driven LED's cannot be controlled

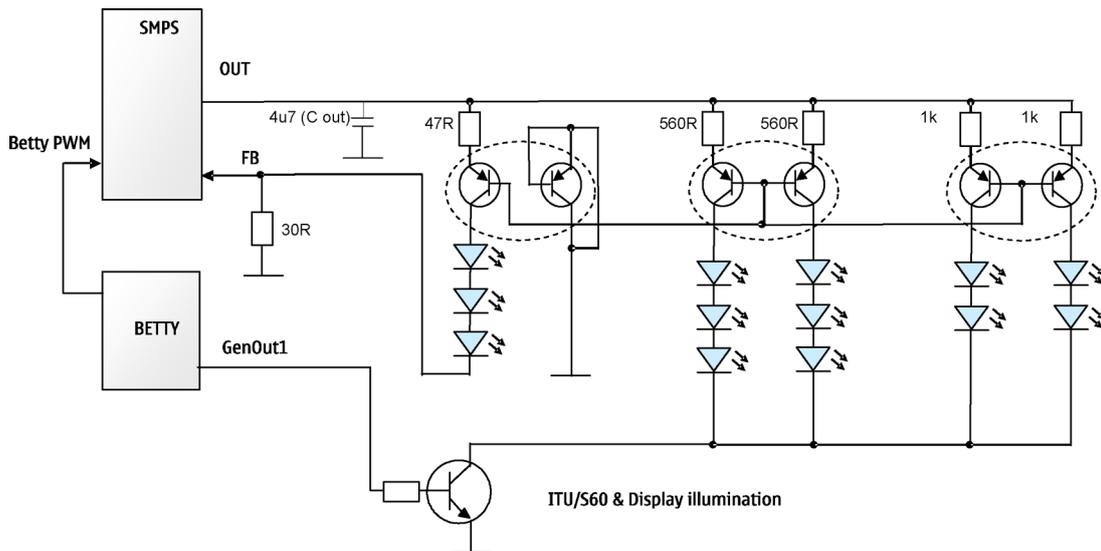
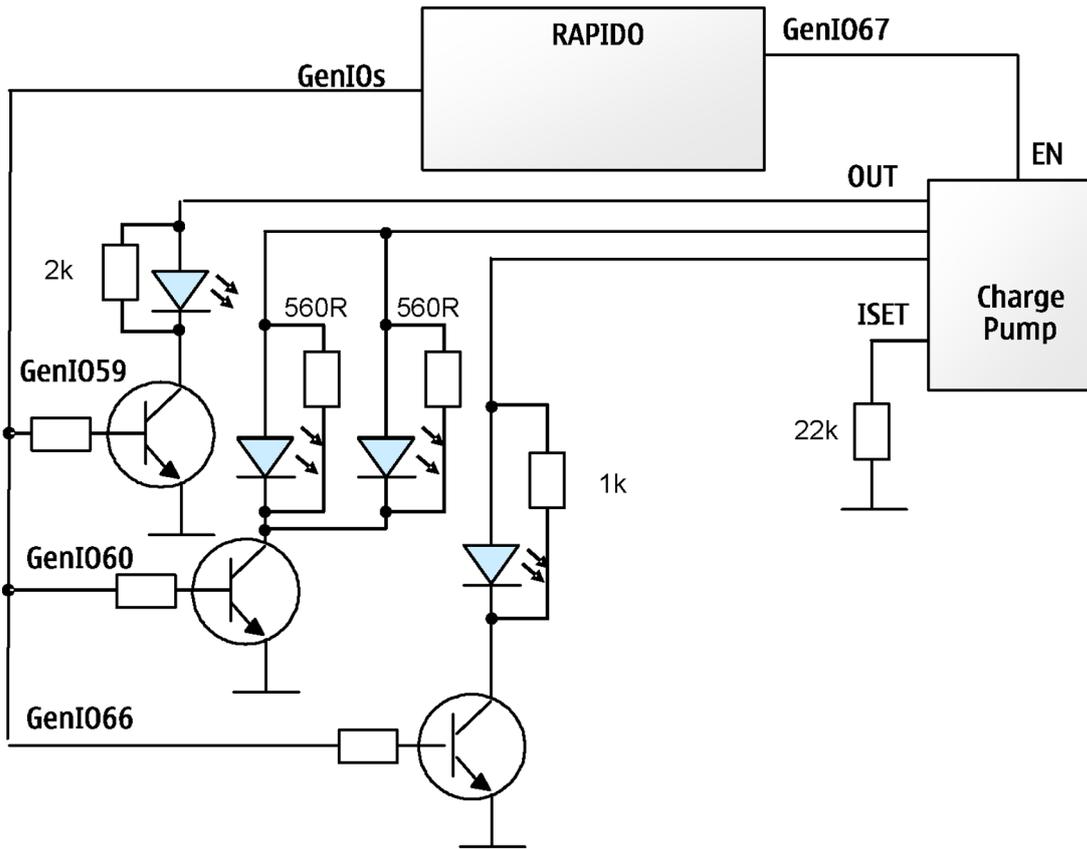


Figure 53 ITU/S60 display circuitry



sidekeys illumination

Figure 54 Side key illumination circuitry

Ambient Light Sensor

Ambient Light Sensor is located in the UI/Slide module, in the upper part of the phone. It consists of the following components:

- Lightguide (part of UI/Slide module cover).
- Ambient Light Sensor (ALS). ALS is logarithmic, which response to light is similar to human eye. ALS is located on UI-FPC and it is not a spare part.
- Analog switch N4400, to turn on operating voltage VAUX to ALS only when needed.
- Pull-down resistor R4400 to convert current signal to voltage.

Ambient Light Sensor information is used to control backlights of the phone. Keyboard backlight is turned OFF, when they are not needed. Display backlight is dimmed, when environment lighting is dark. Outdoors, when environment is bright, display backlight is turned off. Ambient Light Sensor is calibrated in production. In service points, calibration is not possible.

Keyboard

The device has two separate keyboards:

- S60 keyboard
- ITU keyboard

The S60 keyboard is assembled on the UI/slide module. If there's failure on this part, the whole module has to be replaced. ITU keyboard pads are placed directly on the system/RF module.

ITU keyboard is visible, when display is moved upwards. Keypads are on the system/RF module. System/RF module includes also side keys (Volume Keys, Imaging Key and 2-position camera key)

	Col0(Gpio117)	Col1 (Gpio94)	Col2(Gpio115)	Col3 (Gpio96)	Col4 (Gpio95)
Row0 (Gpio28)	LeftSK	RightSK	NaviLEFT	NaviRIGHT	Not used
Row1 (Gpio23)	SEND	NaviSELECT	NaviUP	NaviDOWN	Zoom/Vol Up
Row2 (Gpio69)	7	2	End	Not used	#
Row3 (Gpio70)	5	Capture Full	Not used	Not used	4
Row4 (Gpio27)	9	*	Review	Not used	3
Row5 (Gpio68)	1	Capture Half	Multimedia	Not used	6
Row6 (Gpio58)	0	8	Clear	Application	Zoom/Vol Down

- Col 0-4 and Row 0-4 are filtered with ASIP Z4405.
- Row 5 and Row 6 are filtered with ASIP Z4406.

Power key is also placed on the system/RF module. It connected directly to EM ASIC N2200 PWRONX PIN.

Slide position sensors and camera cover switch

MR Sensor is used to detect camera cover open/ close position. MR Sensor is located on a separate PWB (daughter PWB) which is located inside the B-Cover. Magnet is located inside the camera door cover. MR Sensor is connected to the application processor ASIC (D4800) GPIO's. Sliding the camera door cover will enable main camera and vice versa.

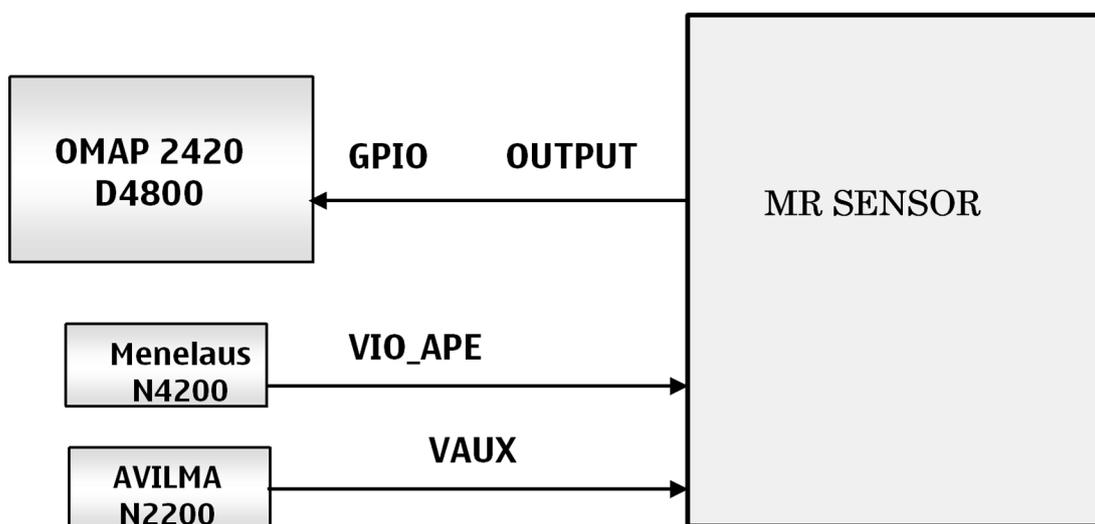


Figure 55 Camera cover block diagram

RF description

Block diagram

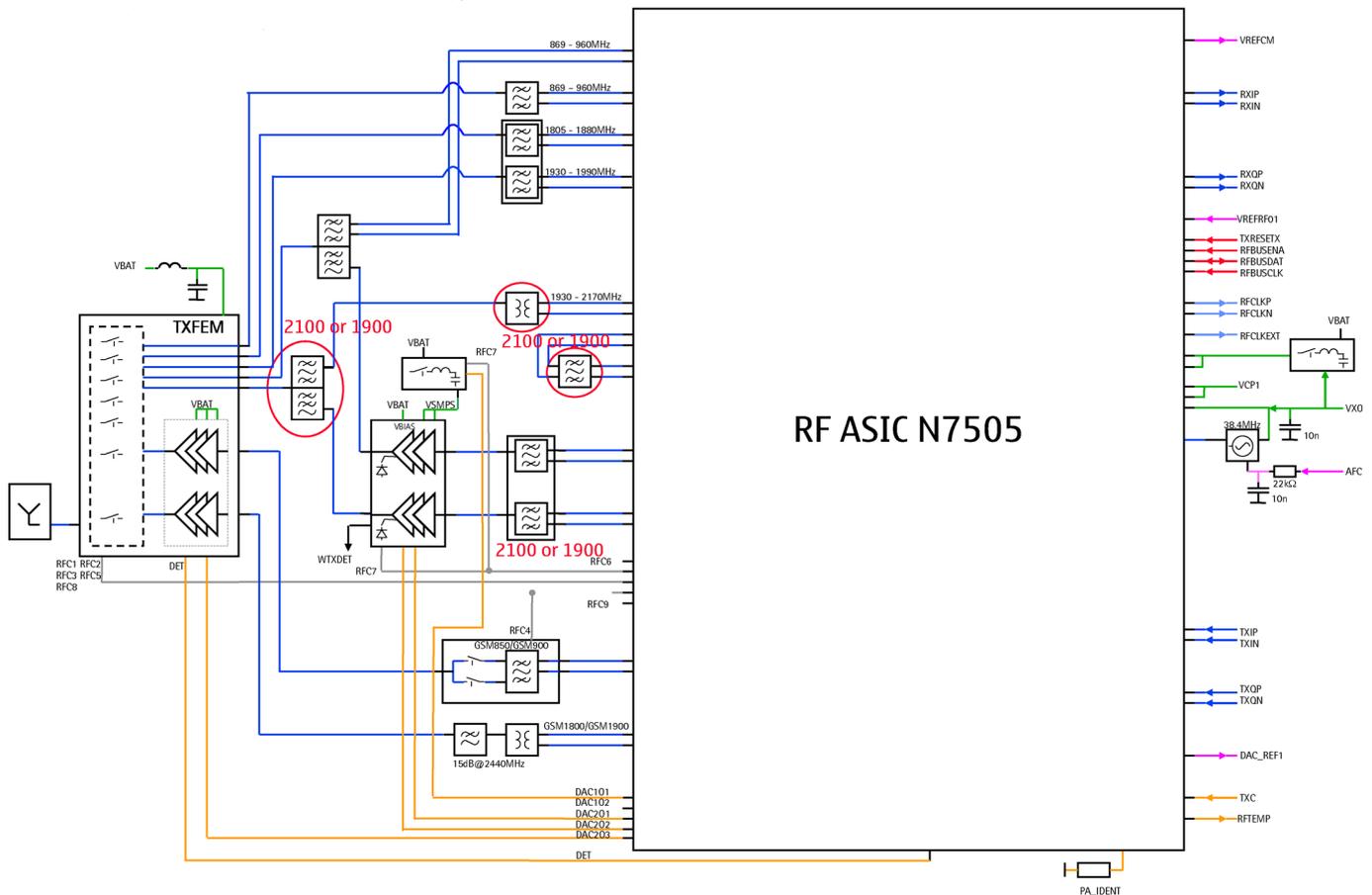


Figure 56 RF block diagram RM-313 using RF ASIC N7505

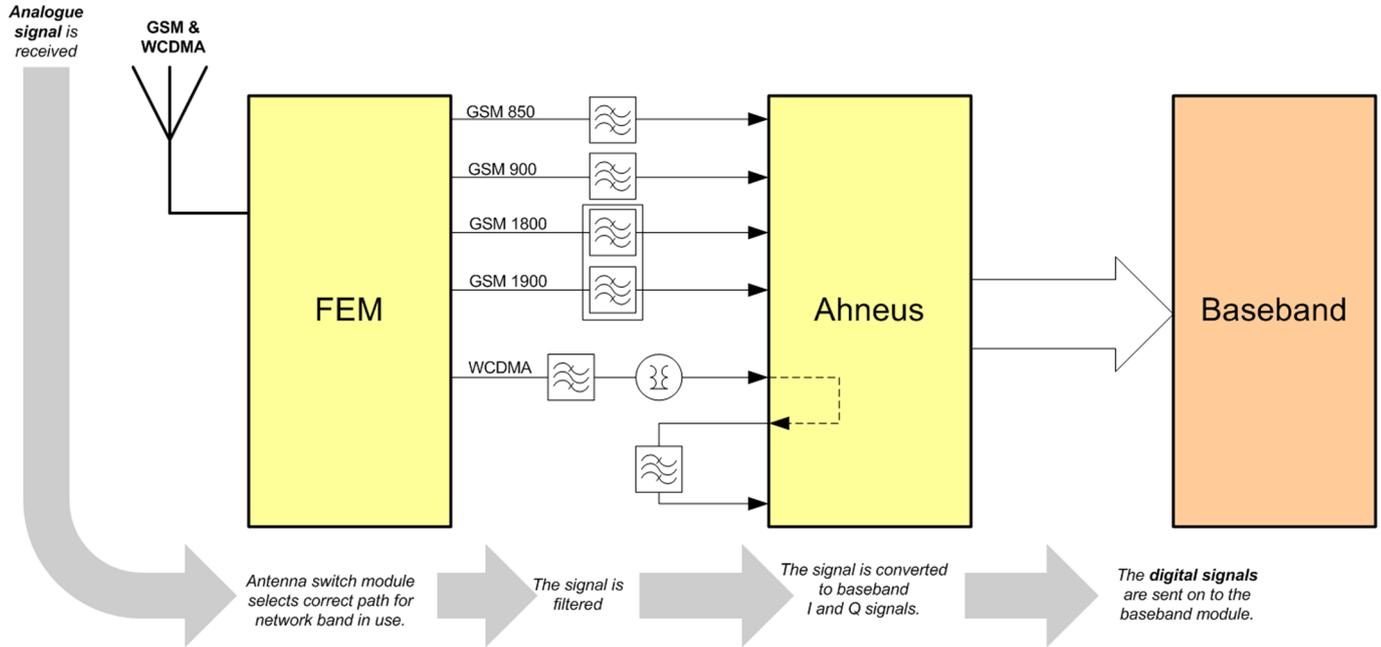
The RF block diagram for RM-313 uses RF ASIC N7505 that performs the RF back-end functions of receive and transmit function of the cellular transceiver.

Receiver (RX)

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

The receiver functions are implemented in the RF ASIC.

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

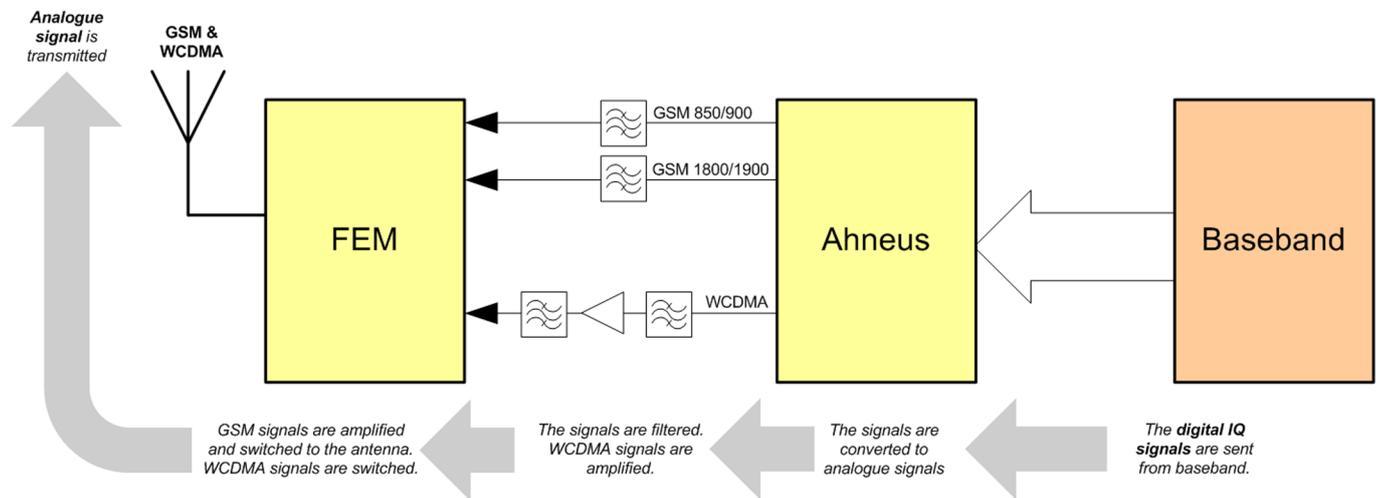


Transmitter (TX)

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

The transmitter functions are implemented in the RF ASIC.

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



■ Frequency mappings

GSM850 frequencies

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
128	824.2	869.2	3296.8	3476.8	170	832.6	877.6	3330.4	3510.4	212	841.0	886.0	3364.0	3544.0
129	824.4	869.4	3297.6	3477.6	171	832.8	877.8	3331.2	3511.2	213	841.2	886.2	3364.8	3544.8
130	824.6	869.6	3298.4	3478.4	172	833.0	878.0	3332.0	3512.0	214	841.4	886.4	3365.6	3545.6
131	824.8	869.8	3299.2	3479.2	173	833.2	878.2	3332.8	3512.8	215	841.6	886.6	3366.4	3546.4
132	825.0	870.0	3300.0	3480.0	174	833.4	878.4	3333.6	3513.6	216	841.8	886.8	3367.2	3547.2
133	825.2	870.2	3300.8	3480.8	175	833.6	878.6	3334.4	3514.4	217	842.0	887.0	3368.0	3548.0
134	825.4	870.4	3301.6	3481.6	176	833.8	878.8	3335.2	3515.2	218	842.2	887.2	3368.8	3548.8
135	825.6	870.6	3302.4	3482.4	177	834.0	879.0	3336.0	3516.0	219	842.4	887.4	3369.6	3549.6
136	825.8	870.8	3303.2	3483.2	178	834.2	879.2	3336.8	3516.8	220	842.6	887.6	3370.4	3550.4
137	826.0	871.0	3304.0	3484.0	179	834.4	879.4	3337.6	3517.6	221	842.8	887.8	3371.2	3551.2
138	826.2	871.2	3304.8	3484.8	180	834.6	879.6	3338.4	3518.4	222	843.0	888.0	3372.0	3552.0
139	826.4	871.4	3305.6	3485.6	181	834.8	879.8	3339.2	3519.2	223	843.2	888.2	3372.8	3552.8
140	826.6	871.6	3306.4	3486.4	182	835.0	880.0	3340.0	3520.0	224	843.4	888.4	3373.6	3553.6
141	826.8	871.8	3307.2	3487.2	183	835.2	880.2	3340.8	3520.8	225	843.6	888.6	3374.4	3554.4
142	827.0	872.0	3308.0	3488.0	184	835.4	880.4	3341.6	3521.6	226	843.8	888.8	3375.2	3555.2
143	827.2	872.2	3308.8	3488.8	185	835.6	880.6	3342.4	3522.4	227	844.0	889.0	3376.0	3556.0
144	827.4	872.4	3309.6	3489.6	186	835.8	880.8	3343.2	3523.2	228	844.2	889.2	3376.8	3556.8
145	827.6	872.6	3310.4	3490.4	187	836.0	881.0	3344.0	3524.0	229	844.4	889.4	3377.6	3557.6
146	827.8	872.8	3311.2	3491.2	188	836.2	881.2	3344.8	3524.8	230	844.6	889.6	3378.4	3558.4
147	828.0	873.0	3312.0	3492.0	189	836.4	881.4	3345.6	3525.6	231	844.8	889.8	3379.2	3559.2
148	828.2	873.2	3312.8	3492.8	190	836.6	881.6	3346.4	3526.4	232	845.0	890.0	3380.0	3560.0
149	828.4	873.4	3313.6	3493.6	191	836.8	881.8	3347.2	3527.2	233	845.2	890.2	3380.8	3560.8
150	828.6	873.6	3314.4	3494.4	192	837.0	882.0	3348.0	3528.0	234	845.4	890.4	3381.6	3561.6
151	828.8	873.8	3315.2	3495.2	193	837.2	882.2	3348.8	3528.8	235	845.6	890.6	3382.4	3562.4
152	829.0	874.0	3316.0	3496.0	194	837.4	882.4	3349.6	3529.6	236	845.8	890.8	3383.2	3563.2
153	829.2	874.2	3316.8	3496.8	195	837.6	882.6	3350.4	3530.4	237	846.0	891.0	3384.0	3564.0
154	829.4	874.4	3317.6	3497.6	196	837.8	882.8	3351.2	3531.2	238	846.2	891.2	3384.8	3564.8
155	829.6	874.6	3318.4	3498.4	197	838.0	883.0	3352.0	3532.0	239	846.4	891.4	3385.6	3565.6
156	829.8	874.8	3319.2	3499.2	198	838.2	883.2	3352.8	3532.8	240	846.6	891.6	3386.4	3566.4
157	830.0	875.0	3320.0	3500.0	199	838.4	883.4	3353.6	3533.6	241	846.8	891.8	3387.2	3567.2
158	830.2	875.2	3320.8	3500.8	200	838.6	883.6	3354.4	3534.4	242	847.0	892.0	3388.0	3568.0
159	830.4	875.4	3321.6	3501.6	201	838.8	883.8	3355.2	3535.2	243	847.2	892.2	3388.8	3568.8
160	830.6	875.6	3322.4	3502.4	202	839.0	884.0	3356.0	3536.0	244	847.4	892.4	3389.6	3569.6
161	830.8	875.8	3323.2	3503.2	203	839.2	884.2	3356.8	3536.8	245	847.6	892.6	3390.4	3570.4
162	831.0	876.0	3324.0	3504.0	204	839.4	884.4	3357.6	3537.6	246	847.8	892.8	3391.2	3571.2
163	831.2	876.2	3324.8	3504.8	205	839.6	884.6	3358.4	3538.4	247	848.0	893.0	3392.0	3572.0
164	831.4	876.4	3325.6	3505.6	206	839.8	884.8	3359.2	3539.2	248	848.2	893.2	3392.8	3572.8
165	831.6	876.6	3326.4	3506.4	207	840.0	885.0	3360.0	3540.0	249	848.4	893.4	3393.6	3573.6
166	831.8	876.8	3327.2	3507.2	208	840.2	885.2	3360.8	3540.8	250	848.6	893.6	3394.4	3574.4
167	832.0	877.0	3328.0	3508.0	209	840.4	885.4	3361.6	3541.6	251	848.8	893.8	3395.2	3575.2

EGSM900 frequencies

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
975	880,2	925,2	3520,8	3700,8	1	890,2	935,2	3560,8	3740,8	63	902,6	947,6	3610,4	3790,4
976	880,4	925,4	3521,6	3701,6	2	890,4	935,4	3561,6	3741,6	64	902,8	947,8	3611,2	3791,2
977	880,6	925,6	3522,4	3702,4	3	890,6	935,6	3562,4	3742,4	65	903,0	948,0	3612,0	3792,0
978	880,8	925,8	3523,2	3703,2	4	890,8	935,8	3563,2	3743,2	66	903,2	948,2	3612,8	3792,8
979	881,0	926,0	3524,0	3704,0	5	891,0	936,0	3564,0	3744,0	67	903,4	948,4	3613,6	3793,6
980	881,2	926,2	3524,8	3704,8	6	891,2	936,2	3564,8	3744,8	68	903,6	948,6	3614,4	3794,4
981	881,4	926,4	3525,6	3705,6	7	891,4	936,4	3565,6	3745,6	69	903,8	948,8	3615,2	3795,2
982	881,6	926,6	3526,4	3706,4	8	891,6	936,6	3566,4	3746,4	70	904,0	949,0	3616,0	3796,0
983	881,8	926,8	3527,2	3707,2	9	891,8	936,8	3567,2	3747,2	71	904,2	949,2	3616,8	3796,8
984	882,0	927,0	3528,0	3708,0	10	892,0	937,0	3568,0	3748,0	72	904,4	949,4	3617,6	3797,6
985	882,2	927,2	3528,8	3708,8	11	892,2	937,2	3568,8	3748,8	73	904,6	949,6	3618,4	3798,4
986	882,4	927,4	3529,6	3709,6	12	892,4	937,4	3569,6	3749,6	74	904,8	949,8	3619,2	3799,2
987	882,6	927,6	3530,4	3710,4	13	892,6	937,6	3570,4	3750,4	75	905,0	950,0	3620,0	3800,0
988	882,8	927,8	3531,2	3711,2	14	892,8	937,8	3571,2	3751,2	76	905,2	950,2	3620,8	3800,8
989	883,0	928,0	3532,0	3712,0	15	893,0	938,0	3572,0	3752,0	77	905,4	950,4	3621,6	3801,6
990	883,2	928,2	3532,8	3712,8	16	893,2	938,2	3572,8	3752,8	78	905,6	950,6	3622,4	3802,4
991	883,4	928,4	3533,6	3713,6	17	893,4	938,4	3573,6	3753,6	79	905,8	950,8	3623,2	3803,2
992	883,6	928,6	3534,4	3714,4	18	893,6	938,6	3574,4	3754,4	80	906,0	951,0	3624,0	3804,0
993	883,8	928,8	3535,2	3715,2	19	893,8	938,8	3575,2	3755,2	81	906,2	951,2	3624,8	3804,8
994	884,0	929,0	3536,0	3716,0	20	894,0	939,0	3576,0	3756,0	82	906,4	951,4	3625,6	3805,6
995	884,2	929,2	3536,8	3716,8	21	894,2	939,2	3576,8	3756,8	83	906,6	951,6	3626,4	3806,4
996	884,4	929,4	3537,6	3717,6	22	894,4	939,4	3577,6	3757,6	84	906,8	951,8	3627,2	3807,2
997	884,6	929,6	3538,4	3718,4	23	894,6	939,6	3578,4	3758,4	85	907,0	952,0	3628,0	3808,0
998	884,8	929,8	3539,2	3719,2	24	894,8	939,8	3579,2	3759,2	86	907,2	952,2	3628,8	3808,8
999	885,0	930,0	3540,0	3720,0	25	895,0	940,0	3580,0	3760,0	87	907,4	952,4	3629,6	3809,6
1000	885,2	930,2	3540,8	3720,8	26	895,2	940,2	3580,8	3760,8	88	907,6	952,6	3630,4	3810,4
1001	885,4	930,4	3541,6	3721,6	27	895,4	940,4	3581,6	3761,6	89	907,8	952,8	3631,2	3811,2
1002	885,6	930,6	3542,4	3722,4	28	895,6	940,6	3582,4	3762,4	90	908,0	953,0	3632,0	3812,0
1003	885,8	930,8	3543,2	3723,2	29	895,8	940,8	3583,2	3763,2	91	908,2	953,2	3632,8	3812,8
1004	886,0	931,0	3544,0	3724,0	30	896,0	941,0	3584,0	3764,0	92	908,4	953,4	3633,6	3813,6
1005	886,2	931,2	3544,8	3724,8	31	896,2	941,2	3584,8	3764,8	93	908,6	953,6	3634,4	3814,4
1006	886,4	931,4	3545,6	3725,6	32	896,4	941,4	3585,6	3765,6	94	908,8	953,8	3635,2	3815,2
1007	886,6	931,6	3546,4	3726,4	33	896,6	941,6	3586,4	3766,4	95	909,0	954,0	3636,0	3816,0
1008	886,8	931,8	3547,2	3727,2	34	896,8	941,8	3587,2	3767,2	96	909,2	954,2	3636,8	3816,8
1009	887,0	932,0	3548,0	3728,0	35	897,0	942,0	3588,0	3768,0	97	909,4	954,4	3637,6	3817,6
1010	887,2	932,2	3548,8	3728,8	36	897,2	942,2	3588,8	3768,8	98	909,6	954,6	3638,4	3818,4
1011	887,4	932,4	3549,6	3729,6	37	897,4	942,4	3589,6	3769,6	99	909,8	954,8	3639,2	3819,2
1012	887,6	932,6	3550,4	3730,4	38	897,6	942,6	3590,4	3770,4	100	910,0	955,0	3640,0	3820,0
1013	887,8	932,8	3551,2	3731,2	39	897,8	942,8	3591,2	3771,2	101	910,2	955,2	3640,8	3820,8
1014	888,0	933,0	3552,0	3732,0	40	898,0	943,0	3592,0	3772,0	102	910,4	955,4	3641,6	3821,6
1015	888,2	933,2	3552,8	3732,8	41	898,2	943,2	3592,8	3772,8	103	910,6	955,6	3642,4	3822,4
1016	888,4	933,4	3553,6	3733,6	42	898,4	943,4	3593,6	3773,6	104	910,8	955,8	3643,2	3823,2
1017	888,6	933,6	3554,4	3734,4	43	898,6	943,6	3594,4	3774,4	105	911,0	956,0	3644,0	3824,0
1018	888,8	933,8	3555,2	3735,2	44	898,8	943,8	3595,2	3775,2	106	911,2	956,2	3644,8	3824,8
1019	889,0	934,0	3556,0	3736,0	45	899,0	944,0	3596,0	3776,0	107	911,4	956,4	3645,6	3825,6
1020	889,2	934,2	3556,8	3736,8	46	899,2	944,2	3596,8	3776,8	108	911,6	956,6	3646,4	3826,4
1021	889,4	934,4	3557,6	3737,6	47	899,4	944,4	3597,6	3777,6	109	911,8	956,8	3647,2	3827,2
1022	889,6	934,6	3558,4	3738,4	48	899,6	944,6	3598,4	3778,4	110	912,0	957,0	3648,0	3828,0
1023	889,8	934,8	3559,2	3739,2	49	899,8	944,8	3599,2	3779,2	111	912,2	957,2	3648,8	3828,8
0	890,0	935,0	3560,0	3740,0	50	900,0	945,0	3600,0	3780,0	112	912,4	957,4	3649,6	3829,6
					51	900,2	945,2	3600,8	3780,8	113	912,6	957,6	3650,4	3830,4
					52	900,4	945,4	3601,6	3781,6	114	912,8	957,8	3651,2	3831,2
					53	900,6	945,6	3602,4	3782,4	115	913,0	958,0	3652,0	3832,0
					54	900,8	945,8	3603,2	3783,2	116	913,2	958,2	3652,8	3832,8
					55	901,0	946,0	3604,0	3784,0	117	913,4	958,4	3653,6	3833,6
					56	901,2	946,2	3604,8	3784,8	118	913,6	958,6	3654,4	3834,4
					57	901,4	946,4	3605,6	3785,6	119	913,8	958,8	3655,2	3835,2
					58	901,6	946,6	3606,4	3786,4	120	914,0	959,0	3656,0	3836,0
					59	901,8	946,8	3607,2	3787,2	121	914,2	959,2	3656,8	3836,8
					60	902,0	947,0	3608,0	3788,0	122	914,4	959,4	3657,6	3837,6
					61	902,2	947,2	3608,8	3788,8	123	914,6	959,6	3658,4	3838,4
					62	902,4	947,4	3609,6	3789,6	124	914,8	959,8	3659,2	3839,2

GSM1800 frequencies

Ch	Tx	Rx	VCO Tx	VCO Rx	Ch	Tx	Rx	VCO Tx	VCO Rx	Ch	Tx	Rx	VCO Tx	VCO Rx	Ch	Tx	Rx	VCO Tx	VCO Rx
512	1710.2	1805.2	3420.4	3610.4	606	1729.0	1824.0	3458.0	3648.0	700	1747.8	1842.8	3495.6	3685.6	793	1766.4	1861.4	3532.8	3722.8
513	1710.4	1805.4	3420.8	3610.8	607	1729.2	1824.2	3458.4	3648.4	701	1748.0	1843.0	3496.0	3686.0	794	1766.6	1861.6	3533.2	3723.2
514	1710.6	1805.6	3421.2	3611.2	608	1729.4	1824.4	3458.8	3648.8	702	1748.2	1843.2	3496.4	3686.4	795	1766.8	1861.8	3533.6	3723.6
515	1710.8	1805.8	3421.6	3611.6	609	1729.6	1824.6	3459.2	3649.2	703	1748.4	1843.4	3496.8	3686.8	796	1767.0	1862.0	3534.0	3724.0
516	1711.0	1806.0	3422.0	3612.0	610	1729.8	1824.8	3459.6	3649.6	704	1748.6	1843.6	3497.2	3687.2	797	1767.2	1862.2	3534.4	3724.4
517	1711.2	1806.2	3422.4	3612.4	611	1730.0	1825.0	3460.0	3650.0	705	1748.8	1843.8	3497.6	3687.6	798	1767.4	1862.4	3534.8	3724.8
518	1711.4	1806.4	3422.8	3612.8	612	1730.2	1825.2	3460.4	3650.4	706	1749.0	1844.0	3498.0	3688.0	799	1767.6	1862.6	3535.2	3725.2
519	1711.6	1806.6	3423.2	3613.2	613	1730.4	1825.4	3460.8	3650.8	707	1749.2	1844.2	3498.4	3688.4	800	1767.8	1862.8	3535.6	3725.6
520	1711.8	1806.8	3423.6	3613.6	614	1730.6	1825.6	3461.2	3651.2	708	1749.4	1844.4	3498.8	3688.8	801	1768.0	1863.0	3536.0	3726.0
521	1712.0	1807.0	3424.0	3614.0	615	1730.8	1825.8	3461.6	3651.6	709	1749.6	1844.6	3499.2	3689.2	802	1768.2	1863.2	3536.4	3726.4
522	1712.2	1807.2	3424.4	3614.4	616	1731.0	1826.0	3462.0	3652.0	710	1749.8	1844.8	3499.6	3689.6	803	1768.4	1863.4	3536.8	3726.8
523	1712.4	1807.4	3424.8	3614.8	617	1731.2	1826.2	3462.4	3652.4	711	1750.0	1845.0	3500.0	3690.0	804	1768.6	1863.6	3537.2	3727.2
524	1712.6	1807.6	3425.2	3615.2	618	1731.4	1826.4	3462.8	3652.8	712	1750.2	1845.2	3500.4	3690.4	805	1768.8	1863.8	3537.6	3727.6
525	1712.8	1807.8	3425.6	3615.6	619	1731.6	1826.6	3463.2	3653.2	713	1750.4	1845.4	3500.8	3690.8	806	1769.0	1864.0	3538.0	3728.0
526	1713.0	1808.0	3426.0	3616.0	620	1731.8	1826.8	3463.6	3653.6	714	1750.6	1845.6	3501.2	3691.2	807	1769.2	1864.2	3538.4	3728.4
527	1713.2	1808.2	3426.4	3616.4	621	1732.0	1827.0	3464.0	3654.0	715	1750.8	1845.8	3501.6	3691.6	808	1769.4	1864.4	3538.8	3728.8
528	1713.4	1808.4	3426.8	3616.8	622	1732.2	1827.2	3464.4	3654.4	716	1751.0	1846.0	3502.0	3692.0	809	1769.6	1864.6	3539.2	3729.2
529	1713.6	1808.6	3427.2	3617.2	623	1732.4	1827.4	3464.8	3654.8	717	1751.2	1846.2	3502.4	3692.4	810	1769.8	1864.8	3539.6	3729.6
530	1713.8	1808.8	3427.6	3617.6	624	1732.6	1827.6	3465.2	3655.2	718	1751.4	1846.4	3502.8	3692.8	811	1770.0	1865.0	3540.0	3730.0
531	1714.0	1809.0	3428.0	3618.0	625	1732.8	1827.8	3465.6	3655.6	719	1751.6	1846.6	3503.2	3693.2	812	1770.2	1865.2	3540.4	3730.4
532	1714.2	1809.2	3428.4	3618.4	626	1733.0	1828.0	3466.0	3656.0	720	1751.8	1846.8	3503.6	3693.6	813	1770.4	1865.4	3540.8	3730.8
533	1714.4	1809.4	3428.8	3618.8	627	1733.2	1828.2	3466.4	3656.4	721	1752.0	1847.0	3504.0	3694.0	814	1770.6	1865.6	3541.2	3731.2
534	1714.6	1809.6	3429.2	3619.2	628	1733.4	1828.4	3466.8	3656.8	722	1752.2	1847.2	3504.4	3694.4	815	1770.8	1865.8	3541.6	3731.6
535	1714.8	1809.8	3429.6	3619.6	629	1733.6	1828.6	3467.2	3657.2	723	1752.4	1847.4	3504.8	3694.8	816	1771.0	1866.0	3542.0	3732.0
536	1715.0	1810.0	3430.0	3620.0	630	1733.8	1828.8	3467.6	3657.6	724	1752.6	1847.6	3505.2	3695.2	817	1771.2	1866.2	3542.4	3732.4
537	1715.2	1810.2	3430.4	3620.4	631	1734.0	1829.0	3468.0	3658.0	725	1752.8	1847.8	3505.6	3695.6	818	1771.4	1866.4	3542.8	3732.8
538	1715.4	1810.4	3430.8	3620.8	632	1734.2	1829.2	3468.4	3658.4	726	1753.0	1848.0	3506.0	3696.0	819	1771.6	1866.6	3543.2	3733.2
539	1715.6	1810.6	3431.2	3621.2	633	1734.4	1829.4	3468.8	3658.8	727	1753.2	1848.2	3506.4	3696.4	820	1771.8	1866.8	3543.6	3733.6
540	1715.8	1810.8	3431.6	3621.6	634	1734.6	1829.6	3469.2	3659.2	728	1753.4	1848.4	3506.8	3696.8	821	1772.0	1867.0	3544.0	3734.0
541	1716.0	1811.0	3432.0	3622.0	635	1734.8	1829.8	3469.6	3659.6	729	1753.6	1848.6	3507.2	3697.2	822	1772.2	1867.2	3544.4	3734.4
542	1716.2	1811.2	3432.4	3622.4	636	1735.0	1830.0	3470.0	3660.0	730	1753.8	1848.8	3507.6	3697.6	823	1772.4	1867.4	3544.8	3734.8
543	1716.4	1811.4	3432.8	3622.8	637	1735.2	1830.2	3470.4	3660.4	731	1754.0	1849.0	3508.0	3698.0	824	1772.6	1867.6	3545.2	3735.2
544	1716.6	1811.6	3433.2	3623.2	638	1735.4	1830.4	3470.8	3660.8	732	1754.2	1849.2	3508.4	3698.4	825	1772.8	1867.8	3545.6	3735.6
545	1716.8	1811.8	3433.6	3623.6	639	1735.6	1830.6	3471.2	3661.2	733	1754.4	1849.4	3508.8	3698.8	826	1773.0	1868.0	3546.0	3736.0
546	1717.0	1812.0	3434.0	3624.0	640	1735.8	1830.8	3471.6	3661.6	734	1754.6	1849.6	3509.2	3699.2	827	1773.2	1868.2	3546.4	3736.4
547	1717.2	1812.2	3434.4	3624.4	641	1736.0	1831.0	3472.0	3662.0	735	1754.8	1849.8	3509.6	3699.6	828	1773.4	1868.4	3546.8	3736.8
548	1717.4	1812.4	3434.8	3624.8	642	1736.2	1831.2	3472.4	3662.4	736	1755.0	1850.0	3510.0	3700.0	829	1773.6	1868.6	3547.2	3737.2
549	1717.6	1812.6	3435.2	3625.2	643	1736.4	1831.4	3472.8	3662.8	737	1755.2	1850.2	3510.4	3700.4	830	1773.8	1868.8	3547.6	3737.6
550	1717.8	1812.8	3435.6	3625.6	644	1736.6	1831.6	3473.2	3663.2	738	1755.4	1850.4	3510.8	3700.8	831	1774.0	1869.0	3548.0	3738.0
551	1718.0	1813.0	3436.0	3626.0	645	1736.8	1831.8	3473.6	3663.6	739	1755.6	1850.6	3511.2	3701.2	832	1774.2	1869.2	3548.4	3738.4
552	1718.2	1813.2	3436.4	3626.4	646	1737.0	1832.0	3474.0	3664.0	740	1755.8	1850.8	3511.6	3701.6	833	1774.4	1869.4	3548.8	3738.8
553	1718.4	1813.4	3436.8	3626.8	647	1737.2	1832.2	3474.4	3664.4	741	1756.0	1851.0	3512.0	3702.0	834	1774.6	1869.6	3549.2	3739.2
554	1718.6	1813.6	3437.2	3627.2	648	1737.4	1832.4	3474.8	3664.8	742	1756.2	1851.2	3512.4	3702.4	835	1774.8	1869.8	3549.6	3739.6
555	1718.8	1813.8	3437.6	3627.6	649	1737.6	1832.6	3475.2	3665.2	743	1756.4	1851.4	3512.8	3702.8	836	1775.0	1870.0	3550.0	3740.0
556	1719.0	1814.0	3438.0	3628.0	650	1737.8	1832.8	3475.6	3665.6	744	1756.6	1851.6	3513.2	3703.2	837	1775.2	1870.2	3550.4	3740.4
557	1719.2	1814.2	3438.4	3628.4	651	1738.0	1833.0	3476.0	3666.0	745	1756.8	1851.8	3513.6	3703.6	838	1775.4	1870.4	3550.8	3740.8
558	1719.4	1814.4	3438.8	3628.8	652	1738.2	1833.2	3476.4	3666.4	746	1757.0	1852.0	3514.0	3704.0	839	1775.6	1870.6	3551.2	3741.2
559	1719.6	1814.6	3439.2	3629.2	653	1738.4	1833.4	3476.8	3666.8	747	1757.2	1852.2	3514.4	3704.4	840	1775.8	1870.8	3551.6	3741.6
560	1719.8	1814.8	3439.6	3629.6	654	1738.6	1833.6	3477.2	3667.2	748	1757.4	1852.4	3514.8	3704.8	841	1776.0	1871.0	3552.0	3742.0
561	1720.0	1815.0	3440.0	3630.0	655	1738.8	1833.8	3477.6	3667.6	749	1757.6	1852.6	3515.2	3705.2	842	1776.2	1871.2	3552.4	3742.4
562	1720.2	1815.2	3440.4	3630.4	656	1739.0	1834.0	3478.0	3668.0	750	1757.8	1852.8	3515.6	3705.6	843	1776.4	1871.4	3552.8	3742.8
563	1720.4	1815.4	3440.8	3630.8	657	1739.2	1834.2	3478.4	3668.4	751	1758.0	1853.0	3516.0	3706.0	844	1776.6	1871.6	3553.2	3743.2
564	1720.6	1815.6	3441.2	3631.2	658	1739.4	1834.4	3478.8	3668.8	752	1758.2	1853.2	3516.4	3706.4	845	1776.8	1871.8	3553.6	3743.6
565	1720.8	1815.8	3441.6	3631.6	659	1739.6	1834.6	3479.2	3669.2	753	1758.4	1853.4	3516.8	3706.8	846	1777.0	1872.0	3554.0	3744.0
566	1721.0	1816.0	3442.0	3632.0	660	1739.8	1834.8	3479.6	3669.6	754	1758.6	1853.6	3517.2	3707.2	847	1777.2	1872.2	3554.4	3744.4
567	1721.2	1816.2	3442.4	3632.4	661	1740.0	1835.0	3480.0	3670.0	755	1758.8	1853.8	3517.6	3707.6	848	1777.4	1872.4	3554.8	3744.8
568	1721.4	1816.4	3442.8	3632.8	662	1740.2	1835.2	3480.4	3670.4	756	1759.0	1854.0							

GSM1900 frequencies

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
512	1850.2	1930.2	3700.4	3860.4	606	1869.0	1949.0	3738.0	3898.0	700	1887.8	1967.8	3775.6	3935.6	794	1906.6	1986.6	3813.2	3973.2
513	1850.4	1930.4	3700.8	3860.8	607	1869.2	1949.2	3738.4	3898.4	701	1888.0	1968.0	3776.0	3936.0	795	1906.8	1986.8	3813.6	3973.6
514	1850.6	1930.6	3701.2	3861.2	608	1869.4	1949.4	3738.8	3898.8	702	1888.2	1968.2	3776.4	3936.4	796	1907.0	1987.0	3814.0	3974.0
515	1850.8	1930.8	3701.6	3861.6	609	1869.6	1949.6	3739.2	3899.2	703	1888.4	1968.4	3776.8	3936.8	797	1907.2	1987.2	3814.4	3974.4
516	1851.0	1931.0	3702.0	3862.0	610	1869.8	1949.8	3739.6	3899.6	704	1888.6	1968.6	3777.2	3937.2	798	1907.4	1987.4	3814.8	3974.8
517	1851.2	1931.2	3702.4	3862.4	611	1870.0	1950.0	3740.0	3900.0	705	1888.8	1968.8	3777.6	3937.6	799	1907.6	1987.6	3815.2	3975.2
518	1851.4	1931.4	3702.8	3862.8	612	1870.2	1950.2	3740.4	3900.4	706	1889.0	1969.0	3778.0	3938.0	800	1907.8	1987.8	3815.6	3975.6
519	1851.6	1931.6	3703.2	3863.2	613	1870.4	1950.4	3740.8	3900.8	707	1889.2	1969.2	3778.4	3938.4	801	1908.0	1988.0	3816.0	3976.0
520	1851.8	1931.8	3703.6	3863.6	614	1870.6	1950.6	3741.2	3901.2	708	1889.4	1969.4	3778.8	3938.8	802	1908.2	1988.2	3816.4	3976.4
521	1852.0	1932.0	3704.0	3864.0	615	1870.8	1950.8	3741.6	3901.6	709	1889.6	1969.6	3779.2	3939.2	803	1908.4	1988.4	3816.8	3976.8
522	1852.2	1932.2	3704.4	3864.4	616	1871.0	1951.0	3742.0	3902.0	710	1889.8	1969.8	3779.6	3939.6	804	1908.6	1988.6	3817.2	3977.2
523	1852.4	1932.4	3704.8	3864.8	617	1871.2	1951.2	3742.4	3902.4	711	1890.0	1970.0	3780.0	3940.0	805	1908.8	1988.8	3817.6	3977.6
524	1852.6	1932.6	3705.2	3865.2	618	1871.4	1951.4	3742.8	3902.8	712	1890.2	1970.2	3780.4	3940.4	806	1909.0	1989.0	3818.0	3978.0
525	1852.8	1932.8	3705.6	3865.6	619	1871.6	1951.6	3743.2	3903.2	713	1890.4	1970.4	3780.8	3940.8	807	1909.2	1989.2	3818.4	3978.4
526	1853.0	1933.0	3706.0	3866.0	620	1871.8	1951.8	3743.6	3903.6	714	1890.6	1970.6	3781.2	3941.2	808	1909.4	1989.4	3818.8	3978.8
527	1853.2	1933.2	3706.4	3866.4	621	1872.0	1952.0	3744.0	3904.0	715	1890.8	1970.8	3781.6	3941.6	809	1909.6	1989.6	3819.2	3979.2
528	1853.4	1933.4	3706.8	3866.8	622	1872.2	1952.2	3744.4	3904.4	716	1891.0	1971.0	3782.0	3942.0	810	1909.8	1989.8	3819.6	3979.6
529	1853.6	1933.6	3707.2	3867.2	623	1872.4	1952.4	3744.8	3904.8	717	1891.2	1971.2	3782.4	3942.4					
530	1853.8	1933.8	3707.6	3867.6	624	1872.6	1952.6	3745.2	3905.2	718	1891.4	1971.4	3782.8	3942.8					
531	1854.0	1934.0	3708.0	3868.0	625	1872.8	1952.8	3745.6	3905.6	719	1891.6	1971.6	3783.2	3943.2					
532	1854.2	1934.2	3708.4	3868.4	626	1873.0	1953.0	3746.0	3906.0	720	1891.8	1971.8	3783.6	3943.6					
533	1854.4	1934.4	3708.8	3868.8	627	1873.2	1953.2	3746.4	3906.4	721	1892.0	1972.0	3784.0	3944.0					
534	1854.6	1934.6	3709.2	3869.2	628	1873.4	1953.4	3746.8	3906.8	722	1892.2	1972.2	3784.4	3944.4					
535	1854.8	1934.8	3709.6	3869.6	629	1873.6	1953.6	3747.2	3907.2	723	1892.4	1972.4	3784.8	3944.8					
536	1855.0	1935.0	3710.0	3870.0	630	1873.8	1953.8	3747.6	3907.6	724	1892.6	1972.6	3785.2	3945.2					
537	1855.2	1935.2	3710.4	3870.4	631	1874.0	1954.0	3748.0	3908.0	725	1892.8	1972.8	3785.6	3945.6					
538	1855.4	1935.4	3710.8	3870.8	632	1874.2	1954.2	3748.4	3908.4	726	1893.0	1973.0	3786.0	3946.0					
539	1855.6	1935.6	3711.2	3871.2	633	1874.4	1954.4	3748.8	3908.8	727	1893.2	1973.2	3786.4	3946.4					
540	1855.8	1935.8	3711.6	3871.6	634	1874.6	1954.6	3749.2	3909.2	728	1893.4	1973.4	3786.8	3946.8					
541	1856.0	1936.0	3712.0	3872.0	635	1874.8	1954.8	3749.6	3909.6	729	1893.6	1973.6	3787.2	3947.2					
542	1856.2	1936.2	3712.4	3872.4	636	1875.0	1955.0	3750.0	3910.0	730	1893.8	1973.8	3787.6	3947.6					
543	1856.4	1936.4	3712.8	3872.8	637	1875.2	1955.2	3750.4	3910.4	731	1894.0	1974.0	3788.0	3948.0					
544	1856.6	1936.6	3713.2	3873.2	638	1875.4	1955.4	3750.8	3910.8	732	1894.2	1974.2	3788.4	3948.4					
545	1856.8	1936.8	3713.6	3873.6	639	1875.6	1955.6	3751.2	3911.2	733	1894.4	1974.4	3788.8	3948.8					
546	1857.0	1937.0	3714.0	3874.0	640	1875.8	1955.8	3751.6	3911.6	734	1894.6	1974.6	3789.2	3949.2					
547	1857.2	1937.2	3714.4	3874.4	641	1876.0	1956.0	3752.0	3912.0	735	1894.8	1974.8	3789.6	3949.6					
548	1857.4	1937.4	3714.8	3874.8	642	1876.2	1956.2	3752.4	3912.4	736	1895.0	1975.0	3790.0	3950.0					
549	1857.6	1937.6	3715.2	3875.2	643	1876.4	1956.4	3752.8	3912.8	737	1895.2	1975.2	3790.4	3950.4					
550	1857.8	1937.8	3715.6	3875.6	644	1876.6	1956.6	3753.2	3913.2	738	1895.4	1975.4	3790.8	3950.8					
551	1858.0	1938.0	3716.0	3876.0	645	1876.8	1956.8	3753.6	3913.6	739	1895.6	1975.6	3791.2	3951.2					
552	1858.2	1938.2	3716.4	3876.4	646	1877.0	1957.0	3754.0	3914.0	740	1895.8	1975.8	3791.6	3951.6					
553	1858.4	1938.4	3716.8	3876.8	647	1877.2	1957.2	3754.4	3914.4	741	1896.0	1976.0	3792.0	3952.0					
554	1858.6	1938.6	3717.2	3877.2	648	1877.4	1957.4	3754.8	3914.8	742	1896.2	1976.2	3792.4	3952.4					
555	1858.8	1938.8	3717.6	3877.6	649	1877.6	1957.6	3755.2	3915.2	743	1896.4	1976.4	3792.8	3952.8					
556	1859.0	1939.0	3718.0	3878.0	650	1877.8	1957.8	3755.6	3915.6	744	1896.6	1976.6	3793.2	3953.2					
557	1859.2	1939.2	3718.4	3878.4	651	1878.0	1958.0	3756.0	3916.0	745	1896.8	1976.8	3793.6	3953.6					
558	1859.4	1939.4	3718.8	3878.8	652	1878.2	1958.2	3756.4	3916.4	746	1897.0	1977.0	3794.0	3954.0					
559	1859.6	1939.6	3719.2	3879.2	653	1878.4	1958.4	3756.8	3916.8	747	1897.2	1977.2	3794.4	3954.4					
560	1859.8	1939.8	3719.6	3879.6	654	1878.6	1958.6	3757.2	3917.2	748	1897.4	1977.4	3794.8	3954.8					
561	1860.0	1940.0	3720.0	3880.0	655	1878.8	1958.8	3757.6	3917.6	749	1897.6	1977.6	3795.2	3955.2					
562	1860.2	1940.2	3720.4	3880.4	656	1879.0	1959.0	3758.0	3918.0	750	1897.8	1977.8	3795.6	3955.6					
563	1860.4	1940.4	3720.8	3880.8	657	1879.2	1959.2	3758.4	3918.4	751	1898.0	1978.0	3796.0	3956.0					
564	1860.6	1940.6	3721.2	3881.2	658	1879.4	1959.4	3758.8	3918.8	752	1898.2	1978.2	3796.4	3956.4					
565	1860.8	1940.8	3721.6	3881.6	659	1879.6	1959.6	3759.2	3919.2	753	1898.4	1978.4	3796.8	3956.8					
566	1861.0	1941.0	3722.0	3882.0	660	1879.8	1959.8	3759.6	3919.6	754	1898.6	1978.6	3797.2	3957.2					
567	1861.2	1941.2	3722.4	3882.4	661	1880.0	1960.0	3760.0	3920.0	755	1898.8	1978.8	3797.6	3957.6					
568	1861.4	1941.4	3722.8	3882.8	662	1880.2	1960.2	3760.4	3920.4	756	1899.0	1979.0	3798.0	3958.0					
569	1861.6	1941.6	3723.2	3883.2	663	1880.4	1960.4	3760.8	3920.8	757	1899.2	1979.2	3798.4	3958.4					
570	1861.8	1941.8	3723.6	3883.6	664	1880.6	1960.6	3761.2	3921.2	758	1899.4	1979.4	3798.8	3958.8					
571	1862.0	1942.0	3724.0	3884.0	665	1880.8	1960.8	3761.6	3921.6	759	1899.6	1979.6	3799.2	3959.2					
572	1862.2	1942.2	3724.4	3884.4	666	1881.0	1961.0	3762.0	3922.0	760	1899.8	1979.8	3799.6	3959.6					
573	1862.4	1942.4	3724.8	3884.8	667	1881.2	1961.2	3762.4	3922.4	761	1900.0	1980.0	3800.0	3960.0					
574	1862.6	1942.6	3725.2	3885.2	668	1881.4	1961.4	3762.8	3922.8	762	1900.2	1980.2	3800.4	3960.4					
575	1862.8	1942.8	3725.6	3885.6	669	1881.6	1961.6	3763.2	3923.2	763									

WCDMA 2100 Rx frequencies

Ch	RX	VCO RX												
10562	2112.4	4224.8	10625	2125	4250	10688	2137.6	4275.2	10751	2150.2	4300.4	10814	2162.8	4325.6
10563	2112.6	4225.2	10626	2125.2	4250.4	10689	2137.8	4275.6	10752	2150.4	4300.8	10815	2163	4326
10564	2112.8	4225.6	10627	2125.4	4250.8	10690	2138	4276	10753	2150.6	4301.2	10816	2163.2	4326.4
10565	2113	4226	10628	2125.6	4251.2	10691	2138.2	4276.4	10754	2150.8	4301.6	10817	2163.4	4326.8
10566	2113.2	4226.4	10629	2125.8	4251.6	10692	2138.4	4276.8	10755	2151	4302	10818	2163.6	4327.2
10567	2113.4	4226.8	10630	2126	4252	10693	2138.6	4277.2	10756	2151.2	4302.4	10819	2163.8	4327.6
10568	2113.6	4227.2	10631	2126.2	4252.4	10694	2138.8	4277.6	10757	2151.4	4302.8	10820	2164	4328
10569	2113.8	4227.6	10632	2126.4	4252.8	10695	2139	4278	10758	2151.6	4303.2	10821	2164.2	4328.4
10570	2114	4228	10633	2126.6	4253.2	10696	2139.2	4278.4	10759	2151.8	4303.6	10822	2164.4	4328.8
10571	2114.2	4228.4	10634	2126.8	4253.6	10697	2139.4	4278.8	10760	2152	4304	10823	2164.6	4329.2
10572	2114.4	4228.8	10635	2127	4254	10698	2139.6	4279.2	10761	2152.2	4304.4	10824	2164.8	4329.6
10573	2114.6	4229.2	10636	2127.2	4254.4	10699	2139.8	4279.6	10762	2152.4	4304.8	10825	2165	4330
10574	2114.8	4229.6	10637	2127.4	4254.8	10700	2140	4280	10763	2152.6	4305.2	10826	2165.2	4330.4
10575	2115	4230	10638	2127.6	4255.2	10701	2140.2	4280.4	10764	2152.8	4305.6	10827	2165.4	4330.8
10576	2115.2	4230.4	10639	2127.8	4255.6	10702	2140.4	4280.8	10765	2153	4306	10828	2165.6	4331.2
10577	2115.4	4230.8	10640	2128	4256	10703	2140.6	4281.2	10766	2153.2	4306.4	10829	2165.8	4331.6
10578	2115.6	4231.2	10641	2128.2	4256.4	10704	2140.8	4281.6	10767	2153.4	4306.8	10830	2166	4332
10579	2115.8	4231.6	10642	2128.4	4256.8	10705	2141	4282	10768	2153.6	4307.2	10831	2166.2	4332.4
10580	2116	4232	10643	2128.6	4257.2	10706	2141.2	4282.4	10769	2153.8	4307.6	10832	2166.4	4332.8
10581	2116.2	4232.4	10644	2128.8	4257.6	10707	2141.4	4282.8	10770	2154	4308	10833	2166.6	4333.2
10582	2116.4	4232.8	10645	2129	4258	10708	2141.6	4283.2	10771	2154.2	4308.4	10834	2166.8	4333.6
10583	2116.6	4233.2	10646	2129.2	4258.4	10709	2141.8	4283.6	10772	2154.4	4308.8	10835	2167	4334
10584	2116.8	4233.6	10647	2129.4	4258.8	10710	2142	4284	10773	2154.6	4309.2	10836	2167.2	4334.4
10585	2117	4234	10648	2129.6	4259.2	10711	2142.2	4284.4	10774	2154.8	4309.6	10837	2167.4	4334.8
10586	2117.2	4234.4	10649	2129.8	4259.6	10712	2142.4	4284.8	10775	2155	4310	10838	2167.6	4335.2
10587	2117.4	4234.8	10650	2130	4260	10713	2142.6	4285.2	10776	2155.2	4310.4			
10588	2117.6	4235.2	10651	2130.2	4260.4	10714	2142.8	4285.6	10777	2155.4	4310.8			
10589	2117.8	4235.6	10652	2130.4	4260.8	10715	2143	4286	10778	2155.6	4311.2			
10590	2118	4236	10653	2130.6	4261.2	10716	2143.2	4286.4	10779	2155.8	4311.6			
10591	2118.2	4236.4	10654	2130.8	4261.6	10717	2143.4	4286.8	10780	2156	4312			
10592	2118.4	4236.8	10655	2131	4262	10718	2143.6	4287.2	10781	2156.2	4312.4			
10593	2118.6	4237.2	10656	2131.2	4262.4	10719	2143.8	4287.6	10782	2156.4	4312.8			
10594	2118.8	4237.6	10657	2131.4	4262.8	10720	2144	4288	10783	2156.6	4313.2			
10595	2119	4238	10658	2131.6	4263.2	10721	2144.2	4288.4	10784	2156.8	4313.6			
10596	2119.2	4238.4	10659	2131.8	4263.6	10722	2144.4	4288.8	10785	2157	4314			
10597	2119.4	4238.8	10660	2132	4264	10723	2144.6	4289.2	10786	2157.2	4314.4			
10598	2119.6	4239.2	10661	2132.2	4264.4	10724	2144.8	4289.6	10787	2157.4	4314.8			
10599	2119.8	4239.6	10662	2132.4	4264.8	10725	2145	4290	10788	2157.6	4315.2			
10600	2120	4240	10663	2132.6	4265.2	10726	2145.2	4290.4	10789	2157.8	4315.6			
10601	2120.2	4240.4	10664	2132.8	4265.6	10727	2145.4	4290.8	10790	2158	4316			
10602	2120.4	4240.8	10665	2133	4266	10728	2145.6	4291.2	10791	2158.2	4316.4			
10603	2120.6	4241.2	10666	2133.2	4266.4	10729	2145.8	4291.6	10792	2158.4	4316.8			
10604	2120.8	4241.6	10667	2133.4	4266.8	10730	2146	4292	10793	2158.6	4317.2			
10605	2121	4242	10668	2133.6	4267.2	10731	2146.2	4292.4	10794	2158.8	4317.6			
10606	2121.2	4242.4	10669	2133.8	4267.6	10732	2146.4	4292.8	10795	2159	4318			
10607	2121.4	4242.8	10670	2134	4268	10733	2146.6	4293.2	10796	2159.2	4318.4			
10608	2121.6	4243.2	10671	2134.2	4268.4	10734	2146.8	4293.6	10797	2159.4	4318.8			
10609	2121.8	4243.6	10672	2134.4	4268.8	10735	2147	4294	10798	2159.6	4319.2			
10610	2122	4244	10673	2134.6	4269.2	10736	2147.2	4294.4	10799	2159.8	4319.6			
10611	2122.2	4244.4	10674	2134.8	4269.6	10737	2147.4	4294.8	10800	2160	4320			
10612	2122.4	4244.8	10675	2135	4270	10738	2147.6	4295.2	10801	2160.2	4320.4			
10613	2122.6	4245.2	10676	2135.2	4270.4	10739	2147.8	4295.6	10802	2160.4	4320.8			
10614	2122.8	4245.6	10677	2135.4	4270.8	10740	2148	4296	10803	2160.6	4321.2			
10615	2123	4246	10678	2135.6	4271.2	10741	2148.2	4296.4	10804	2160.8	4321.6			
10616	2123.2	4246.4	10679	2135.8	4271.6	10742	2148.4	4296.8	10805	2161	4322			
10617	2123.4	4246.8	10680	2136	4272	10743	2148.6	4297.2	10806	2161.2	4322.4			
10618	2123.6	4247.2	10681	2136.2	4272.4	10744	2148.8	4297.6	10807	2161.4	4322.8			
10619	2123.8	4247.6	10682	2136.4	4272.8	10745	2149	4298	10808	2161.6	4323.2			
10620	2124	4248	10683	2136.6	4273.2	10746	2149.2	4298.4	10809	2161.8	4323.6			
10621	2124.2	4248.4	10684	2136.8	4273.6	10747	2149.4	4298.8	10810	2162	4324			
10622	2124.4	4248.8	10685	2137	4274	10748	2149.6	4299.2	10811	2162.2	4324.4			
10623	2124.6	4249.2	10686	2137.2	4274.4	10749	2149.8	4299.6	10812	2162.4	4324.8			
10624	2124.8	4249.6	10687	2137.4	4274.8	10750	2150	4300	10813	2162.6	4325.2			

WCDMA 2100 Tx frequencies

Ch	Tx	VCO Tx												
9612	1922.4	3844.8	9671	1934.2	3868.4	9730	1946	3892	9789	1957.8	3915.6	9848	1969.6	3939.2
9613	1922.6	3845.2	9672	1934.4	3868.8	9731	1946.2	3892.4	9790	1958	3916	9849	1969.8	3939.6
9614	1922.8	3845.6	9673	1934.6	3869.2	9732	1946.4	3892.8	9791	1958.2	3916.4	9850	1970	3940
9615	1923	3846	9674	1934.8	3869.6	9733	1946.6	3893.2	9792	1958.4	3916.8	9851	1970.2	3940.4
9616	1923.2	3846.4	9675	1935	3870	9734	1946.8	3893.6	9793	1958.6	3917.2	9852	1970.4	3940.8
9617	1923.4	3846.8	9676	1935.2	3870.4	9735	1947	3894	9794	1958.8	3917.6	9853	1970.6	3941.2
9618	1923.6	3847.2	9677	1935.4	3870.8	9736	1947.2	3894.4	9795	1959	3918	9854	1970.8	3941.6
9619	1923.8	3847.6	9678	1935.6	3871.2	9737	1947.4	3894.8	9796	1959.2	3918.4	9855	1971	3942
9620	1924	3848	9679	1935.8	3871.6	9738	1947.6	3895.2	9797	1959.4	3918.8	9856	1971.2	3942.4
9621	1924.2	3848.4	9680	1936	3872	9739	1947.8	3895.6	9798	1959.6	3919.2	9857	1971.4	3942.8
9622	1924.4	3848.8	9681	1936.2	3872.4	9740	1948	3896	9799	1959.8	3919.6	9858	1971.6	3943.2
9623	1924.6	3849.2	9682	1936.4	3872.8	9741	1948.2	3896.4	9800	1960	3920	9859	1971.8	3943.6
9624	1924.8	3849.6	9683	1936.6	3873.2	9742	1948.4	3896.8	9801	1960.2	3920.4	9860	1972	3944
9625	1925	3850	9684	1936.8	3873.6	9743	1948.6	3897.2	9802	1960.4	3920.8	9861	1972.2	3944.4
9626	1925.2	3850.4	9685	1937	3874	9744	1948.8	3897.6	9803	1960.6	3921.2	9862	1972.4	3944.8
9627	1925.4	3850.8	9686	1937.2	3874.4	9745	1949	3898	9804	1960.8	3921.6	9863	1972.6	3945.2
9628	1925.6	3851.2	9687	1937.4	3874.8	9746	1949.2	3898.4	9805	1961	3922	9864	1972.8	3945.6
9629	1925.8	3851.6	9688	1937.6	3875.2	9747	1949.4	3898.8	9806	1961.2	3922.4	9865	1973	3946
9630	1926	3852	9689	1937.8	3875.6	9748	1949.6	3899.2	9807	1961.4	3922.8	9866	1973.2	3946.4
9631	1926.2	3852.4	9690	1938	3876	9749	1949.8	3899.6	9808	1961.6	3923.2	9867	1973.4	3946.8
9632	1926.4	3852.8	9691	1938.2	3876.4	9750	1950	3900	9809	1961.8	3923.6	9868	1973.6	3947.2
9633	1926.6	3853.2	9692	1938.4	3876.8	9751	1950.2	3900.4	9810	1962	3924	9869	1973.8	3947.6
9634	1926.8	3853.6	9693	1938.6	3877.2	9752	1950.4	3900.8	9811	1962.2	3924.4	9870	1974	3948
9635	1927	3854	9694	1938.8	3877.6	9753	1950.6	3901.2	9812	1962.4	3924.8	9871	1974.2	3948.4
9636	1927.2	3854.4	9695	1939	3878	9754	1950.8	3901.6	9813	1962.6	3925.2	9872	1974.4	3948.8
9637	1927.4	3854.8	9696	1939.2	3878.4	9755	1951	3902	9814	1962.8	3925.6	9873	1974.6	3949.2
9638	1927.6	3855.2	9697	1939.4	3878.8	9756	1951.2	3902.4	9815	1963	3926	9874	1974.8	3949.6
9639	1927.8	3855.6	9698	1939.6	3879.2	9757	1951.4	3902.8	9816	1963.2	3926.4	9875	1975	3950
9640	1928	3856	9699	1939.8	3879.6	9758	1951.6	3903.2	9817	1963.4	3926.8	9876	1975.2	3950.4
9641	1928.2	3856.4	9700	1940	3880	9759	1951.8	3903.6	9818	1963.6	3927.2	9877	1975.4	3950.8
9642	1928.4	3856.8	9701	1940.2	3880.4	9760	1952	3904	9819	1963.8	3927.6	9878	1975.6	3951.2
9643	1928.6	3857.2	9702	1940.4	3880.8	9761	1952.2	3904.4	9820	1964	3928	9879	1975.8	3951.6
9644	1928.8	3857.6	9703	1940.6	3881.2	9762	1952.4	3904.8	9821	1964.2	3928.4	9880	1976	3952
9645	1929	3858	9704	1940.8	3881.6	9763	1952.6	3905.2	9822	1964.4	3928.8	9881	1976.2	3952.4
9646	1929.2	3858.4	9705	1941	3882	9764	1952.8	3905.6	9823	1964.6	3929.2	9882	1976.4	3952.8
9647	1929.4	3858.8	9706	1941.2	3882.4	9765	1953	3906	9824	1964.8	3929.6	9883	1976.6	3953.2
9648	1929.6	3859.2	9707	1941.4	3882.8	9766	1953.2	3906.4	9825	1965	3930	9884	1976.8	3953.6
9649	1929.8	3859.6	9708	1941.6	3883.2	9767	1953.4	3906.8	9826	1965.2	3930.4	9885	1977	3954
9650	1930	3860	9709	1941.8	3883.6	9768	1953.6	3907.2	9827	1965.4	3930.8	9886	1977.2	3954.4
9651	1930.2	3860.4	9710	1942	3884	9769	1953.8	3907.6	9828	1965.6	3931.2	9887	1977.4	3954.8
9652	1930.4	3860.8	9711	1942.2	3884.4	9770	1954	3908	9829	1965.8	3931.6	9888	1977.6	3955.2
9653	1930.6	3861.2	9712	1942.4	3884.8	9771	1954.2	3908.4	9830	1966	3932			
9654	1930.8	3861.6	9713	1942.6	3885.2	9772	1954.4	3908.8	9831	1966.2	3932.4			
9655	1931	3862	9714	1942.8	3885.6	9773	1954.6	3909.2	9832	1966.4	3932.8			
9656	1931.2	3862.4	9715	1943	3886	9774	1954.8	3909.6	9833	1966.6	3933.2			
9657	1931.4	3862.8	9716	1943.2	3886.4	9775	1955	3910	9834	1966.8	3933.6			
9658	1931.6	3863.2	9717	1943.4	3886.8	9776	1955.2	3910.4	9835	1967	3934			
9659	1931.8	3863.6	9718	1943.6	3887.2	9777	1955.4	3910.8	9836	1967.2	3934.4			
9660	1932	3864	9719	1943.8	3887.6	9778	1955.6	3911.2	9837	1967.4	3934.8			
9661	1932.2	3864.4	9720	1944	3888	9779	1955.8	3911.6	9838	1967.6	3935.2			
9662	1932.4	3864.8	9721	1944.2	3888.4	9780	1956	3912	9839	1967.8	3935.6			
9663	1932.6	3865.2	9722	1944.4	3888.8	9781	1956.2	3912.4	9840	1968	3936			
9664	1932.8	3865.6	9723	1944.6	3889.2	9782	1956.4	3912.8	9841	1968.2	3936.4			
9665	1933	3866	9724	1944.8	3889.6	9783	1956.6	3913.2	9842	1968.4	3936.8			
9666	1933.2	3866.4	9725	1945	3890	9784	1956.8	3913.6	9843	1968.6	3937.2			
9667	1933.4	3866.8	9726	1945.2	3890.4	9785	1957	3914	9844	1968.8	3937.6			
9668	1933.6	3867.2	9727	1945.4	3890.8	9786	1957.2	3914.4	9845	1969	3938			
9669	1933.8	3867.6	9728	1945.6	3891.2	9787	1957.4	3914.8	9846	1969.2	3938.4			
9670	1934	3868	9729	1945.8	3891.6	9788	1957.6	3915.2	9847	1969.4	3938.8			

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Nokia Customer Care

Glossary

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

DMA	Direct memory access
DP	Data Package
DPLL	Digital Phase Locked Loop
DSP	Digital Signal Processor
DTM	Dual Transfer Mode
DtoS	Differential to Single ended
EDGE	Enhanced data rates for global/GSM evolution
EGSM	Extended GSM
EM	Energy management
EMC	Electromagnetic compatibility
EMI	Electromagnetic interference
ESD	Electrostatic discharge
FCI	Functional cover interface
FPS	Flash Programming Tool
FR	Full rate
FSTN	Film compensated super twisted nematic
GMSK	Gaussian Minimum Shift Keying
GND	Ground, conductive mass
GPIO	General-purpose interface bus
GPRS	General Packet Radio Service
GSM	Group Special Mobile/Global System for Mobile communication
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
ICHA	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	Multiprotocol control unit
MIC, mic	Microphone
MIDP	Mobile Information Device Profile
MIN	Mobile identification number
MIPS	Million instructions per second
MMC	Multimedia card
MMS	Multimedia messaging service
MTP	Multipoint-to-point connection
NTC	Negative temperature coefficient, temperature sensitive resistor used as a temperature sensor
OMA	Object management architecture
OMAP	Operations, maintenance, and administration part
Opamp	Operational Amplifier
PA	Power amplifier
PDA	Pocket Data Application
PDA	Personal digital assistant
PDRAM	Program/Data RAM (on chip in Tiku)
Phoenix	Software tool of DCT4.x and BB5
PIM	Personal Information Management
PLL	Phase locked loop
PM	(Phone) Permanent memory
PUP	General Purpose IO (PIO), USARTS and Pulse Width Modulators
PURX	Power-up reset
PWB	Printed Wiring Board
PWM	Pulse width modulation
RC-filter	Resistance-Capacitance filter
RF	Radio Frequency
RF PopPort™	Reduced function PopPort™ interface
RFBUS	Serial control Bus For RF

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

Vp-p	Peak-to-peak voltage
VSIM	SIM voltage
WAP	Wireless application protocol
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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