

Nokia Customer Care

Service Manual

RM-645 (Nokia C5-00; L3&4)

Mobile Terminal

Part No: (Issue 1)

COMPANY CONFIDENTIAL



Amendment Record Sheet

Amendment No	Date	Inserted By	Comments
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IMPORTANT

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

Warnings and cautions

Warnings

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

Cautions

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

For your safety

QUALIFIED SERVICE

Only qualified personnel may install or repair phone equipment.

ACCESSORIES AND BATTERIES

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

CONNECTING TO OTHER DEVICES

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

ESD protection

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

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

To replace the covers ESD protection must be applied.

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

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

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

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

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

Care and maintenance

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

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

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

Company policy

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

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

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- Latest Amendment Number (if applicable)
- Page(s) and/or Figure(s) in error

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Battery information

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

The battery can be charged and discharged hundreds of times but it will eventually wear out. When the operating time (talk-time and standby time) is noticeably shorter than normal, it is time to buy a new battery. Use only batteries approved by the phone manufacturer and recharge the battery only with the chargers approved by the manufacturer. Unplug the charger when not in use. Do not leave the battery connected to a charger for longer than a week, since overcharging may shorten its lifetime. If left unused a fully charged battery will discharge itself over time.

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

For good operation times with Li-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.

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Nokia C5-00; L3&4 Service Manual Structure

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

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Nokia Customer Care

1 — General Information

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■ Product selection

RM-645 is a HSDPA/HSUPA/WCDMA/GSM handportable phone with a monoblock form factor and A-GPS support. It supports EGSM850/900/1800/1900 and WCDMA900/2100 bands, and GPRS/EGPRS, WCDMA/HSDPA/HSUPA data bearers.

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

For GPRS/EGPRS networks, RM-645 is a Class B EGPRS MSC 32 (5 Rx + 3 Tx, max sum 6), which means a maximum upload speed of up to 298 kbit/s with EGPRS, and download speed of up to 178.8 kbit/s with GPRS. The device also supports Dual Transfer Mode (DTM) for simultaneous voice and packet data connection in GSM/EDGE networks; simple class A, multi slot class 11, (3 Rx + 2Tx), UL/DL=178.8/118.2 kbit/s.

RM-645 is an MMS (Multimedia Messaging Service) enabled multimedia device. The MMS implementation follows the OMA MMS standard release 1.2. The device also supports Bluetooth 2.0 standard with stereo audio profiles (A2DP & AVRCP).

RM-645 has a large 2.2" QVGA (320 x 240 pixels) display with 16.7 million colors, a 3.2 Megapixel main camera that has an integrated LED flash and a digital zoom, and a 2nd VGA camera for video calls.

RM-645 uses Symbian 9.3 operating system, S60 (release 3.2) UI, and supports the full Web Browser for S60, which brings desktop-like Web browsing experience to mobile devices.

RM-645 also supports MIDP Java 2.0, providing a good platform for compelling 3rd party applications.



Figure 1 View of RM-645

■ Product features and sales package

Bearers and transport

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

Connectivity

- Assisted GPS (A-GPS)
- Bluetooth 2.0 with stereo audio profiles (A2DP and AVRCP)
- High Speed USB with micro USB connector
- MicroSD memory card - support up to 16GB
- 3.5 mm AV connector
- 2.0 mm DC connector
- USB charging

Display

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

Imaging and video

- 3.2 Megapixel EDOF (Extended Depth of Field) camera with a digital zoom, and an integrated LED flash
- 2nd VGA camera for video calls
- Video streaming and sharing
- Horizontal camera mode
- Image capture, recording and zooming by navi key
- Media player with MPEG-4, H. 263 and H.264 support
- Image and video editors

Music

- MP3 player supporting MP3, MP4, AAC, eAAC+ and WMA, progressive download from music player
- Stereo FM Radio

Productivity

Context management

- OMA DRM version 2.0
- PIM (Calendar + Contacts + Active Notes) & Presence enhanced contacts
- OTA provisioning & over the air SW update (FOTA)
- Ovi Suite
- Active Standby
- Local/remote SyncML data sync
- Web Browser (OSS), Java™ MIDP 2.0, XHTML browsing over TCP/IP

Messaging

- E-mail (SMTP, IMAP4, POP3)
- SMS, MMS (OMA 1.2)
- Audio Messaging (AMS)

Voice

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

Add-on software framework

- Symbian OS
- Nokia Series 60, 3rd edition, feature pack 3.2
- Java: MIDP2.0
- C++ and Java SDKs

Additional features

- Tutorial
- MP3 and AAC ringing tones, 64 polyphonic, 3D stereo ringing tones, video ringing tones
- Flashlite 2.0
- Vibrating alert
- Speech codec support for AMR, EFR, FR
- Nokia Online Share 4.3 (OVI Share)
- Nokia Maps 3.0

Basic sales package

Basic sales package, there may be sales area variations.

- Transceiver RM-645
- Battery (BL-5CT/1050 mAh)
- Travel charger (AC-8)
- Stereo headset (WH-102)
- Micro USB connectivity cable (CA-101)
- MicroSD card 2GB (MU-37) with pre-loaded maps and OVI Suite 2.0
- Short user guide

■ Product and module list

Module name	Type code	Notes
System/RF module PWB	3FT	
UI flex	3FU	

■ **Mobile enhancements**

Table 1 Audio

Enhancement	Type
Wired headsets	HS-45/AD-44
	WH-102 (inbox)
Bluetooth headsets	BH-102
Bluetooth headsets (stereo)	BH-103
	BH-604

Table 2 Car

Enhancement	Type
Car kit	CK-15W
	CK-300 (BT & plug-in)
	CK-7W
Holder	CR-39
	CR-82
	CR-115
	HH-17
Plug-in car handsfree	HF-510

Table 3 Data

Enhancement	Type
MicroSD card	MU-22, 1 GB
	MU-37, 2 GB (inbox)
	MU-41, 4 GB
	MU-43, 8 GB
	MU-44, 16 GB
Connectivity cable	CA-101D (inbox)

Table 4 Music

Enhancement	Type
Bluetooth speakers	MD-7W (BT & plug-in)
Mini speakers	MD-9

Table 5 Messaging

Enhancement	Type
Wireless keyboard	SU-8W

Table 6 Power

Enhancement	Type
Battery 1050 mAh Li-ion	BL-5CT
Charger	AC-6
	AC-8 or AC-15 (inbox)
	AC-10

■ Technical specifications

Transceiver general specifications

Unit	Dimensions (L x W x T) (mm)	Weight (g)	Volume (cm ³)
Transceiver with BL-5CT 1050 mAh Li-ion battery back	112.3 x 46 x 12.3	95	56.2

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

Parameter	Unit
Cellular system	GSM850, EGSM900, GSM1800/1900, WCDMA VIII (900) and WCDMA I (2100)
Rx frequency band	GSM850: 869 - 894 MHz
	EGSM900: 925 - 960 MHz
	GSM1800: 1805 - 1880 MHz
	GSM1900: 1930 - 1990 MHz
	WCDMA VIII (900): 925- 960 MHz
	WCDMA I (2100): 2110 - 2170 MHz
Tx frequency band	GSM850: 824 - 849 MHz
	EGSM900: 880 - 915 MHz
	GSM1800: 1710 - 1785 MHz
	GSM1900: 1850 - 1910 MHz
	WCDMA VIII (900): 880 - 915 MHz
	WCDMA I (2100): 1920 - 1980 MHz

Parameter	Unit
Output power	GSM850: +5 ...+33dBm/3.2mW ... 2W
	GSM900: +5 ... +33dBm/3.2mW ... 2W
	GSM1800: +0 ... +30dBm/1.0mW ... 1W
	GSM1900: +0 ... +30dBm/1.0mW ... 1W
	WCDMA VIII (900): -50 ... +24 dBm/0.01μW ... 251.2mW
	WCDMA I (2100): -50 ... +24 dBm/0.01μW ... 251.2mW
EDGE output power	EDGE850: +5 ... +27dBm/3.2mW ... 501mW
	EDGE900: +5 ... +27dBm/3.2mW ... 501mW
	EDGE1800: +0 ... +26dBm/1.0mW ... 400mW
	EDGE1900:+0 ... +26dBm/1.0mW ... 400mW
Number of RF channels	GSM850: 124
	GSM900: 174
	GSM1800: 374
	GSM1900: 299
	WCDMA VIII (900): 152
	WCDMA I (2100): 277
Channel spacing	200 kHz
Number of Tx power levels	GSM850: 15
	GSM900: 15
	GSM1800: 16
	GSM1900: 16
	WCDMA VIII (900): 75
	WCDMA I (2100): 75

Environmental conditions

Temperature conditions

Environmental condition	Ambient temperature	Notes
Normal operation	-15°C...+55°C	Specifications fulfilled
Reduced performance	-25°C...-15°C +55°C...+70°C	Operational for shorts periods only
Intermittent operation	-40°C...-15°C +70°C...+85 °C	Operation not guaranteed but an attempt to operate does not damage the phone.

Environmental condition	Ambient temperature	Notes
No operation or storage	<-40°C...>+85°C	No storage or operation: an attempt may damage the phone.
Charging allowed	-25°C...+50°C	
Long term storage conditions	0°C...+85°C	

Humidity

Relative humidity range is 5...95%.

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

Vibration

The module should withstand the following vibrations:

- 5 - 10 Hz; +10dB / octave
- 10 - 50 Hz; 5.58 m² / s³ (0.0558 g² / Hz)
- 50 - 300 Hz; - 10 dB / octave

ESD strength

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

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

RoHS

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

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2 — Service Tools and Service Concepts

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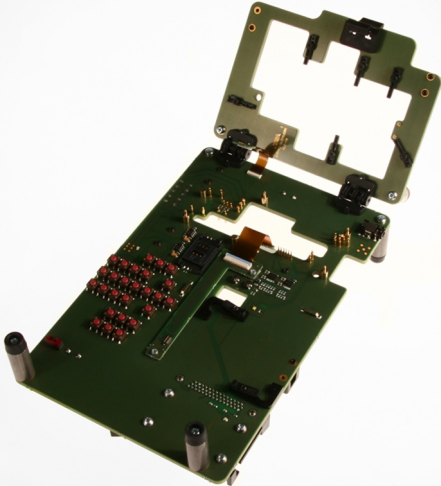
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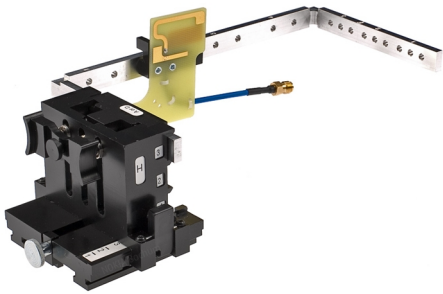
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■ **Service tools**

Product specific tools



The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-645. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

	FS-150	Flash adapter																																				
<p>For flashing (also dead phones) with SS-46. CU-4 supported.</p>																																						
	MJ-276	Module jig																																				
<p>MJ-276 is meant for component level troubleshooting. The jig includes an RF interface for GSM, WCDMA and Bluetooth. In addition, it has the following features:</p> <ul style="list-style-type: none"> • Provides mechanical interface with the engine module • Provides galvanic connection to all needed test pads in module • Multiplexing between USB and FBUS media, controlled by Vusb • MMC interface • Duplicated SIM connector • Connector for control unit • Access for AV- and USB connectors • CA-128RS cable is used together with this jig for RF testing 																																						
<p>• Attenuation values for galvanic RF connection MJ-276</p>																																						
<table border="1"> <thead> <tr> <th>Band</th> <th>Default f/ MHz RX</th> <th>Att. RX</th> <th>Default f/ MHz TX</th> <th>Att. TX</th> </tr> </thead> <tbody> <tr> <td>GSM 850</td> <td>881.6</td> <td>18.0</td> <td>836.6</td> <td>18.0</td> </tr> <tr> <td>GSM 900</td> <td>942.4</td> <td>18.0</td> <td>897.4</td> <td>18.0</td> </tr> <tr> <td>GSM 1800</td> <td>1842.8</td> <td>24.0</td> <td>1747.8</td> <td>24.0</td> </tr> <tr> <td>GSM 1900</td> <td>1960.0</td> <td>24.0</td> <td>1880.0</td> <td>24.0</td> </tr> <tr> <td>WCDMA I</td> <td>2140.0</td> <td>17.0</td> <td>1950.0</td> <td>17.0</td> </tr> <tr> <td>WCDMA VIII</td> <td>942.6</td> <td>18.0</td> <td>897.6</td> <td>18.0</td> </tr> </tbody> </table>				Band	Default f/ MHz RX	Att. RX	Default f/ MHz TX	Att. TX	GSM 850	881.6	18.0	836.6	18.0	GSM 900	942.4	18.0	897.4	18.0	GSM 1800	1842.8	24.0	1747.8	24.0	GSM 1900	1960.0	24.0	1880.0	24.0	WCDMA I	2140.0	17.0	1950.0	17.0	WCDMA VIII	942.6	18.0	897.6	18.0
Band	Default f/ MHz RX	Att. RX	Default f/ MHz TX	Att. TX																																		
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WCDMA I	2140.0	17.0	1950.0	17.0																																		
WCDMA VIII	942.6	18.0	897.6	18.0																																		

	SA-131	RF coupler	
	<p>SA-131 is a generic device for GPS testing. It is used together with SS-62.</p>		

General tools

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-645. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

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

CU-4



CU-4

Control unit

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

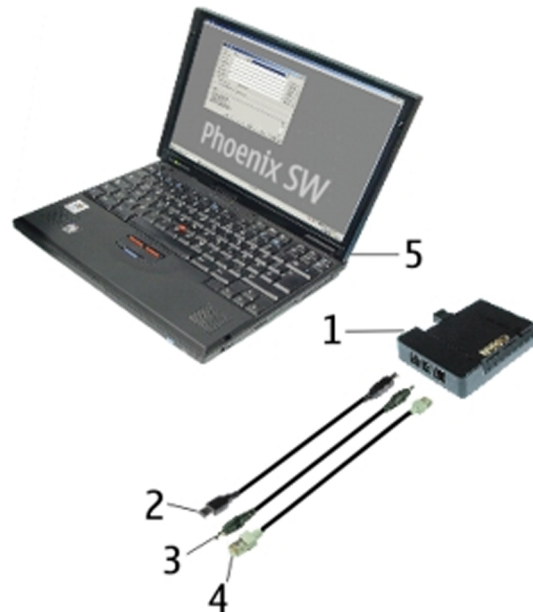
The unit has the following features:

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

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



Instructions






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



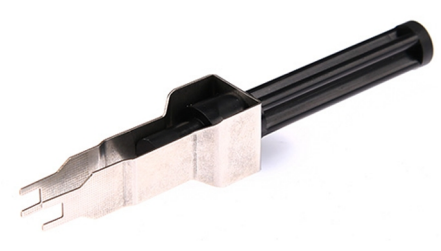
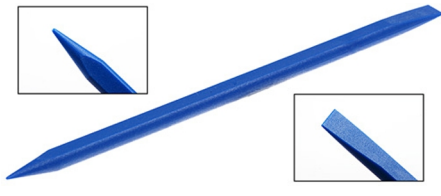



Note: Phoenix enables CU-4 regulators via USB when it is started.

Reconnecting the power supply requires a Phoenix restart.




	<p>FLS-5</p>	<p>Flash device</p>	
<p>FLS-5 is a dongle and flash device incorporated into one package, developed specifically for POS use.</p> <p>Note: FLS-5 can be used as an alternative to PK-1.</p>			
<p>FPS-21</p> 	<p>FPS-21</p>	<p>Flash prommer</p>	
<p>FPS-21 sales package:</p> <ul style="list-style-type: none"> • FPS-21 prommer • AC-35 power supply • CA-31D USB cable <p>FPS-21 interfaces:</p> <p><i>Front</i></p> <ul style="list-style-type: none"> • Service cable connector Provides Flashbus, USB and VBAT connections to a mobile device. • SmartCard socket A SmartCard is needed to allow DCT-4 generation mobile device programming. <p><i>Rear</i></p> <ul style="list-style-type: none"> • DC power input For connecting the external power supply (AC-35). • Two USB A type ports (USB1/USB3) Can be used, for example, for connecting external storage memory devices or mobile devices • One USB B type device connector (USB2) For connecting a PC. • Phone connector Service cable connection for connecting Flashbus/FLA. • Ethernet RJ45 type socket (LAN) For connecting the FPS-21 to LAN. <p><i>Inside</i></p> <ul style="list-style-type: none"> • Four SD card memory slots For internal storage memory. <p>Note: In order to access the SD memory card slots inside FPS-21, the prommer needs to be opened by removing the front panel, rear panel and heatsink from the prommer body.</p>			





	JXS-1	RF shield box	
<p>Because the WCDMA network disturbs the RX side testing of the WCDMA phone and the Tx signal of the WCDMA phone can severely disturb the WCDMA network, a shield box is needed in all testing, tuning and fault finding which requires WCDMA RF signal.</p> <p>The shield box is not an active device, it contains only passive filtering components for RF attenuation.</p>			
	PK-1	Software protection key	
<p>PK-1 is a hardware protection key with a USB interface. It has the same functionality as the PKD-1 series dongle.</p> <p>PK-1 is meant for use with a PC that does not have a series interface.</p> <p>To use this USB dongle for security service functions please register the dongle in the same way as the PKD-1 series dongle.</p>			
	RJ-230	Soldering jig	
<p>RJ-230 is a soldering jig used for soldering and as a rework jig for the engine module.</p>			
	SB-6	Bluetooth test and interface box (sales package)	
<p>The SB-6 test box is a generic service device used to perform Bluetooth bit error rate (BER) testing, and establishing cordless FBUS connection via Bluetooth. An ACP-8x charger is needed for BER testing and an AXS-4 cable in case of cordless interface usage testing .</p> <p>Sales package includes:</p> <ul style="list-style-type: none"> • SB-6 test box • Installation and warranty information 			
	SRT-6	Opening tool	
<p>SRT-6 is used to open phone covers.</p> <p>Note: The SRT-6 is included in the Nokia Standard Toolkit.</p>			


 <p>SS-46</p>	SS-46	Interface adapter	
<p>SS-46 acts as an interface adapter between the flash adapter and FPS-21.</p>			
 <p>SS-62</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 • multiplexing between USB and FBUS media, controlled by VUSB 			
 <p>SS-88</p>	SS-88	Camera removal tool	
<p>The camera removal tool SS-88 is used to remove/attach the camera module from/to the socket.</p>			
 <p>SS-93</p>	SS-93	Opening tool	
<p>SS-93 is used for opening JAE connectors.</p> <p>Note: The SS-93 is included in Nokia Standard Toolkit.</p>			
 <p>SX-4</p>	SX-4	Smart card	
<p>SX-4 is a BB5 security device used to protect critical features in tuning and testing.</p> <p>SX-4 is also needed together with FPS-21 when DCT-4 phones are flashed.</p>			

Cables

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-645. For the correct use of the service devices, and the best effort of workbench setup, please 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>			
 <p>CA-128RS</p>	CA-128RS	RF tuning cable	
<p>Product-specific adapter cable for RF tuning.</p>			
	CA-31D	USB cable	
<p>The CA-31D USB cable is used to connect FPS-21 to a PC. It is included in the FPS-21 sales package.</p>			

 <p>CA-89DS 100cm</p> 	CA-89DS	Cable	
<p>Provides VBAT and Flashbus connections to mobile device programming adapters.</p>			
	DAU-9S	MBUS cable	
<p>The MBUS cable DAU-9S has a modular connector and is used, for example, between the PC's serial port and module jigs, flash adapters or docking station adapters.</p> <p>Note: Docking station adapters valid for DCT4 products.</p>			
	PCS-1	Power cable	
<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>			

	XRS-6	RF cable
	<p>The RF cable is used to connect, for example, a module repair jig to the RF measurement equipment.</p> <p>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 • WCDMA2100/WLAN: 0.6+-0.1 dB • WCDMA900: 0.3+-0.1 dB 	

■ Service concepts

POS (Point of Sale) flash concept

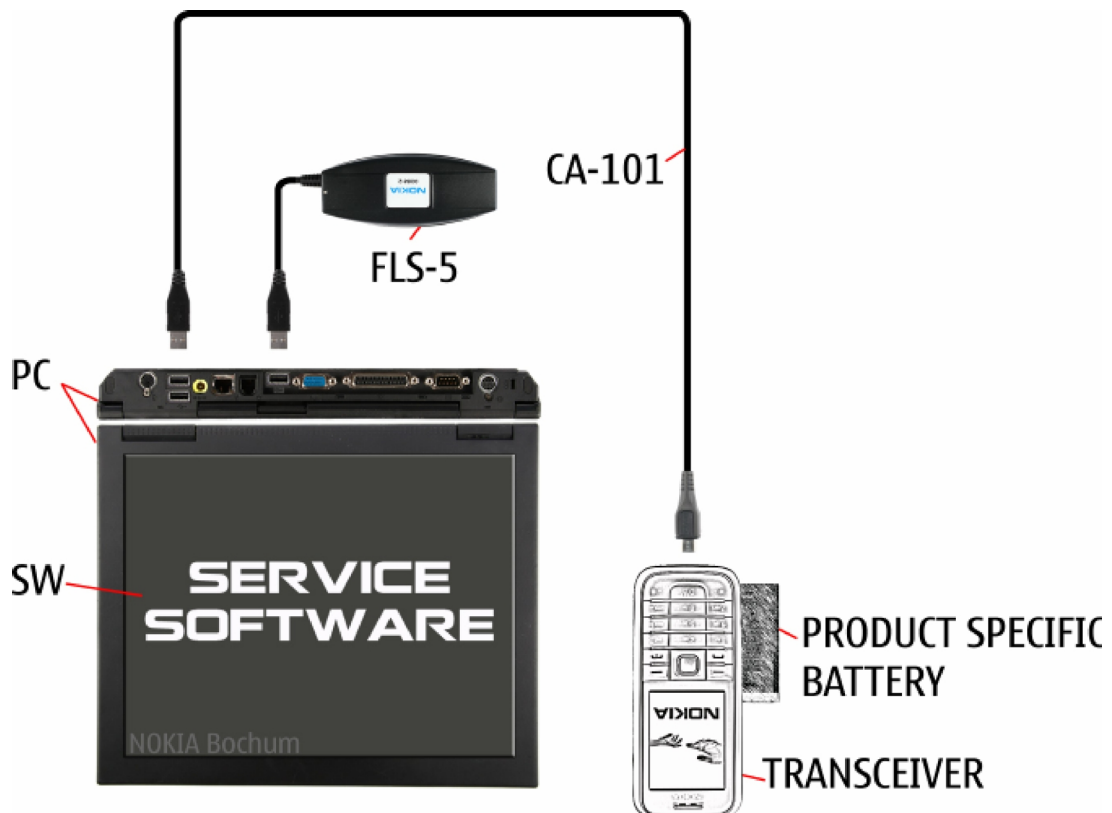


Figure 2 POS flash concept

Type	Description
Product specific tools	
BL-5CT	Battery
Other tools	
FLS-5	POS flash dongle
	PC with Phoenix service software

Type	Description
Cables	
CA-101	Micro USB cable

Flash concept with FPS-21

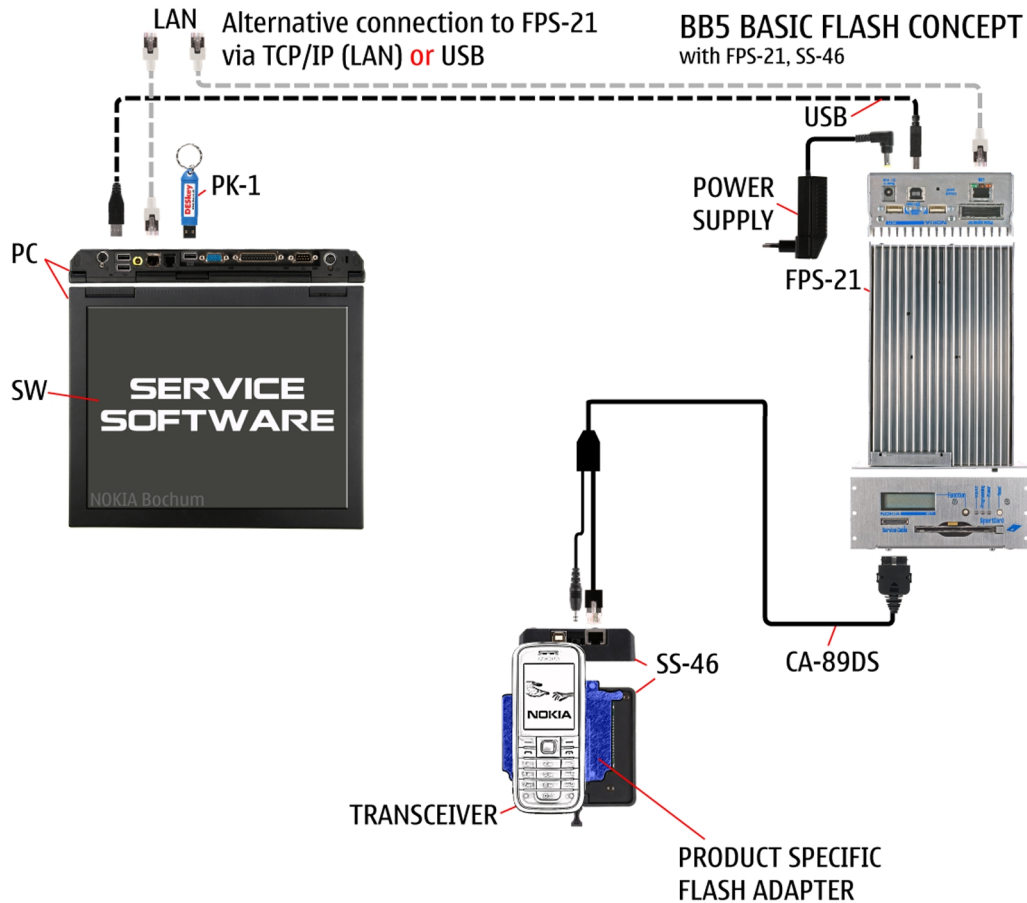


Figure 3 Basic flash concept with FPS-21

Type	Description
Product specific devices	
FS-150	Flash adapter
Other devices	
FPS-21	Flash promoter box
AC-35	Power supply
PK-1	SW security device
SS-46	Interface adapter
	PC with Phoenix service software
Cables	
CA-89DS	Service cable

Type	Description
	USB cable

CU-4 flash concept with FPS-21

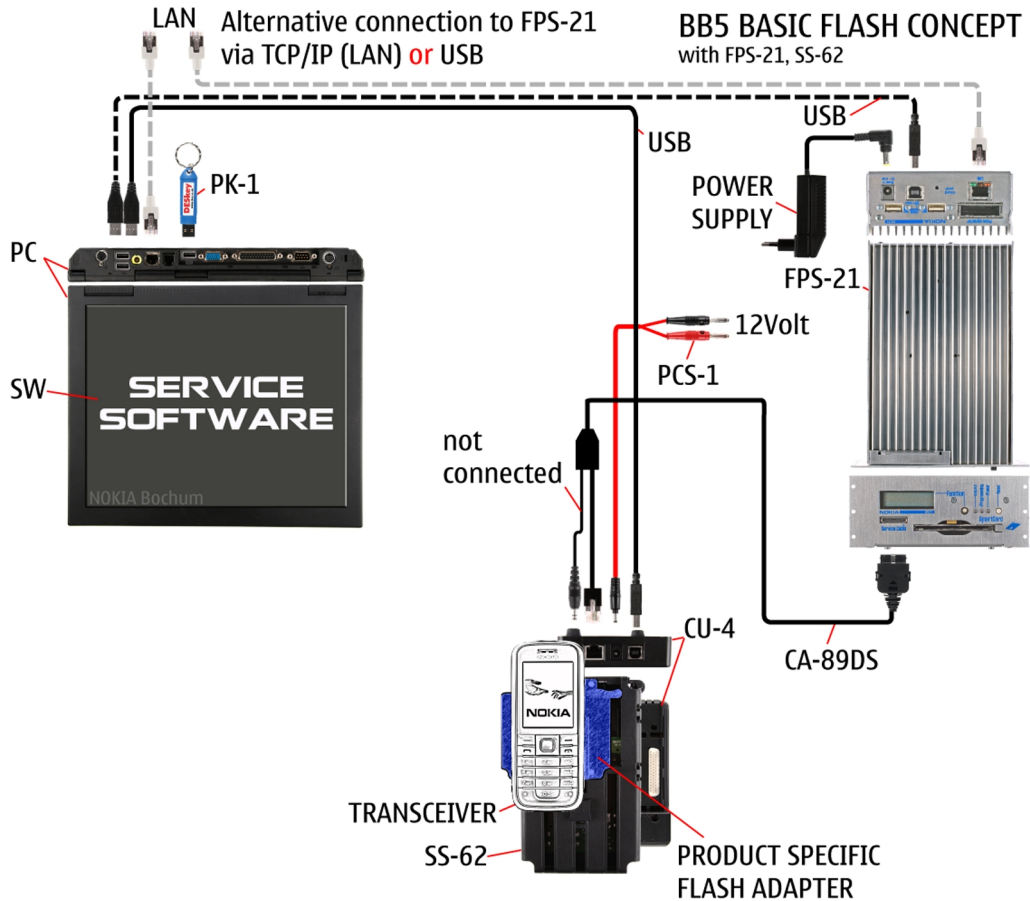


Figure 4 CU-4 flash concept with FPS-21

Type	Description
Product specific devices	
FS-150	Flash adapter
Other devices	
CU-4	Control unit
FPS-21	Flash prommer box
AC-35	Power supply
PK-1	SW security device
SS-62	Flash adapter base
SX-4	Smart card (for DCT-4 generation mobile device programming)
	PC with Phoenix service software
Cables	

Type	Description
PCS-1	Power cable
CA-89DS	Service cable
	Standard USB cable
	USB cable

Module jig service concept

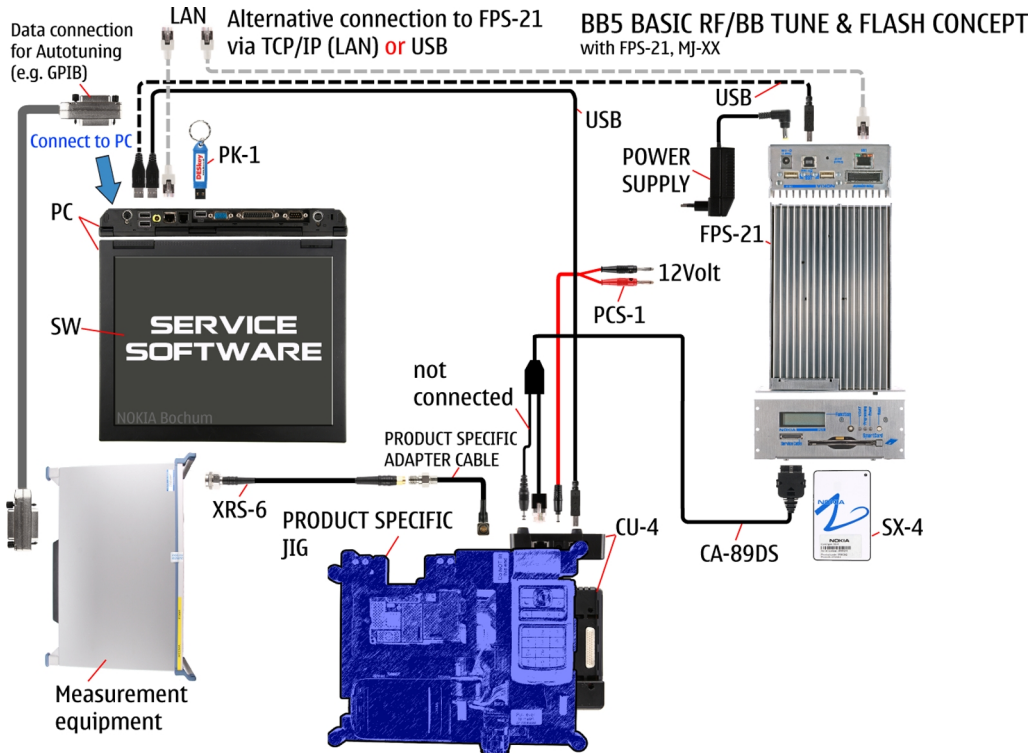
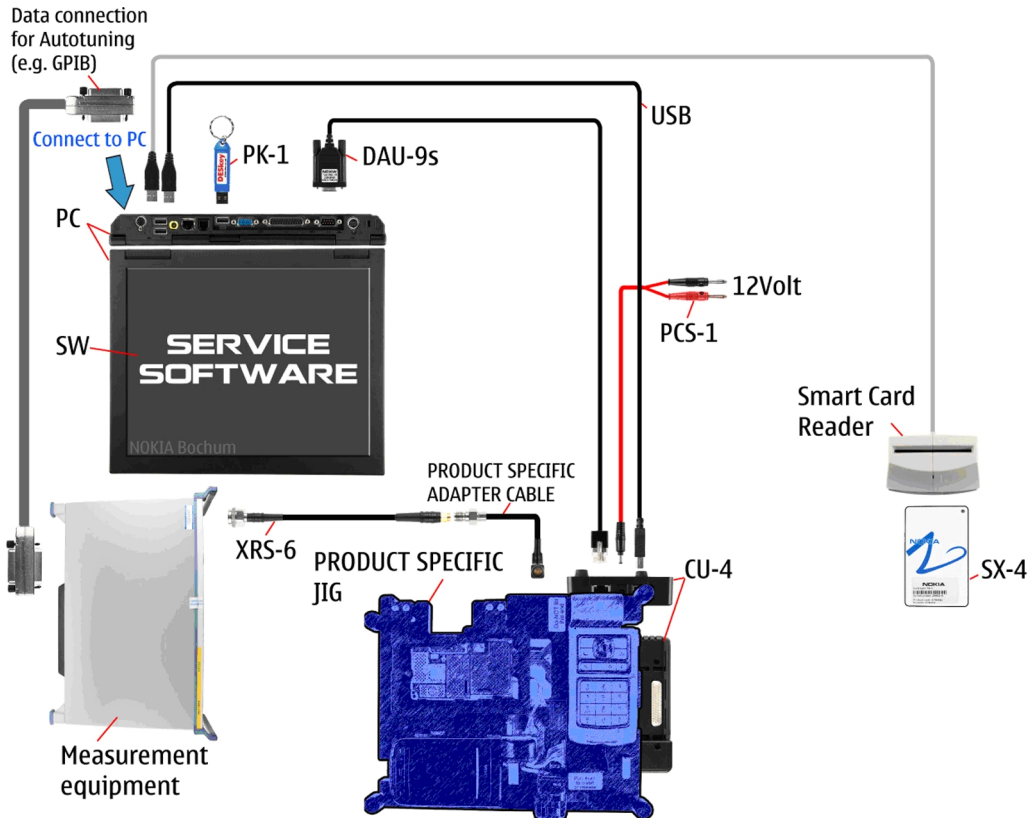


Figure 5 Module jig service concept

Type	Description
Phone specific devices	
MJ-276	Module jig
Other devices	
CU-4	Control unit
FPS-21	Flash prommer box
PK-1	SW security device
SX-4	Smart card
	PC with VPOS and Phoenix service software
	Measurement equipment
Cables	
CA-89DS	Service cable

Type	Description
PCS-1	DC power cable
XRS-6	RF cable
	USB cable
	GPIB control cable

BB/RF tuning concept with module jig



Type	Description
Product specific tools	
MJ-276	Module jig
Other tools	
CU-4	Control unit
PK-1	SW security device
SX-4	Smart card
	PC with Phoenix service software
	Smart card reader
Cables	
DAU-9S	MBUS cable
PCS-1	Power cable

Type	Description
XRS-6	RF cable
	USB cable

Bluetooth testing concept with SB-6

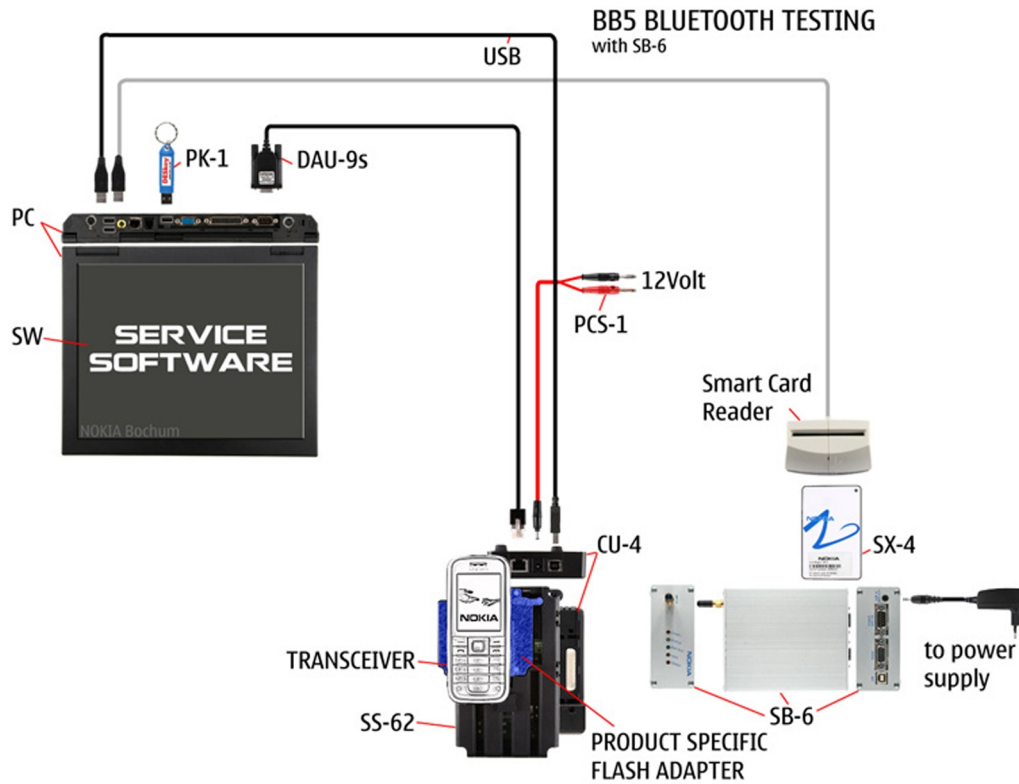


Figure 6 Service concept for RF testing and RF/BB tuning

Type	Description
Product specific devices	
FS-150	Flash adapter
Other devices	
CU-4	Control unit
SS-62	Flash adapter base
PK-1	SW security device
SX-4	Smart card
SB-6	Bluetooth test and interface box
	Smart card reader
	PC with Phoenix service software
Cables	
DAU-9S	MBUS cable
PCS-1	DC power cable

Type	Description
	USB cable

GPS testing concept with GPS RF coupler

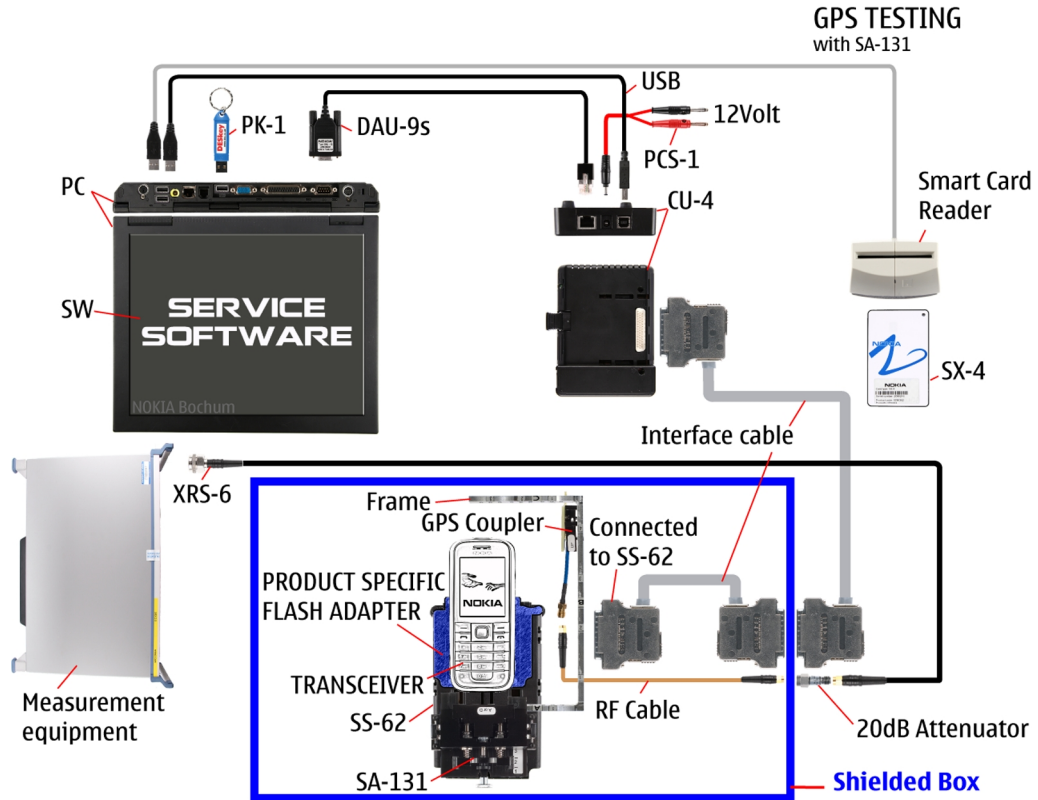


Figure 7 RF testing concept with RF coupler

Type	Description
Product specific devices	
FS-150	Flash adapter
SA-131	GPS RF coupler
Other devices	
CU-4	Control unit
SX-4	Smart card
JXS-1	RF shield box
PK-1	SW security device
SS-62	Flash adapter base
	Smart card reader
	Measurement equipment
	PC with Phoenix service software
Cables	

Type	Description
CA-128RS	RF service cable (product-specific adapter cable)
PCS-1	Power cable
DAU-9S	MBUS cable
XRS-6	RF cable
	20dB attenuator
	Interface cable
	USB cable

3 — BB Troubleshooting and Manual Tuning Guide

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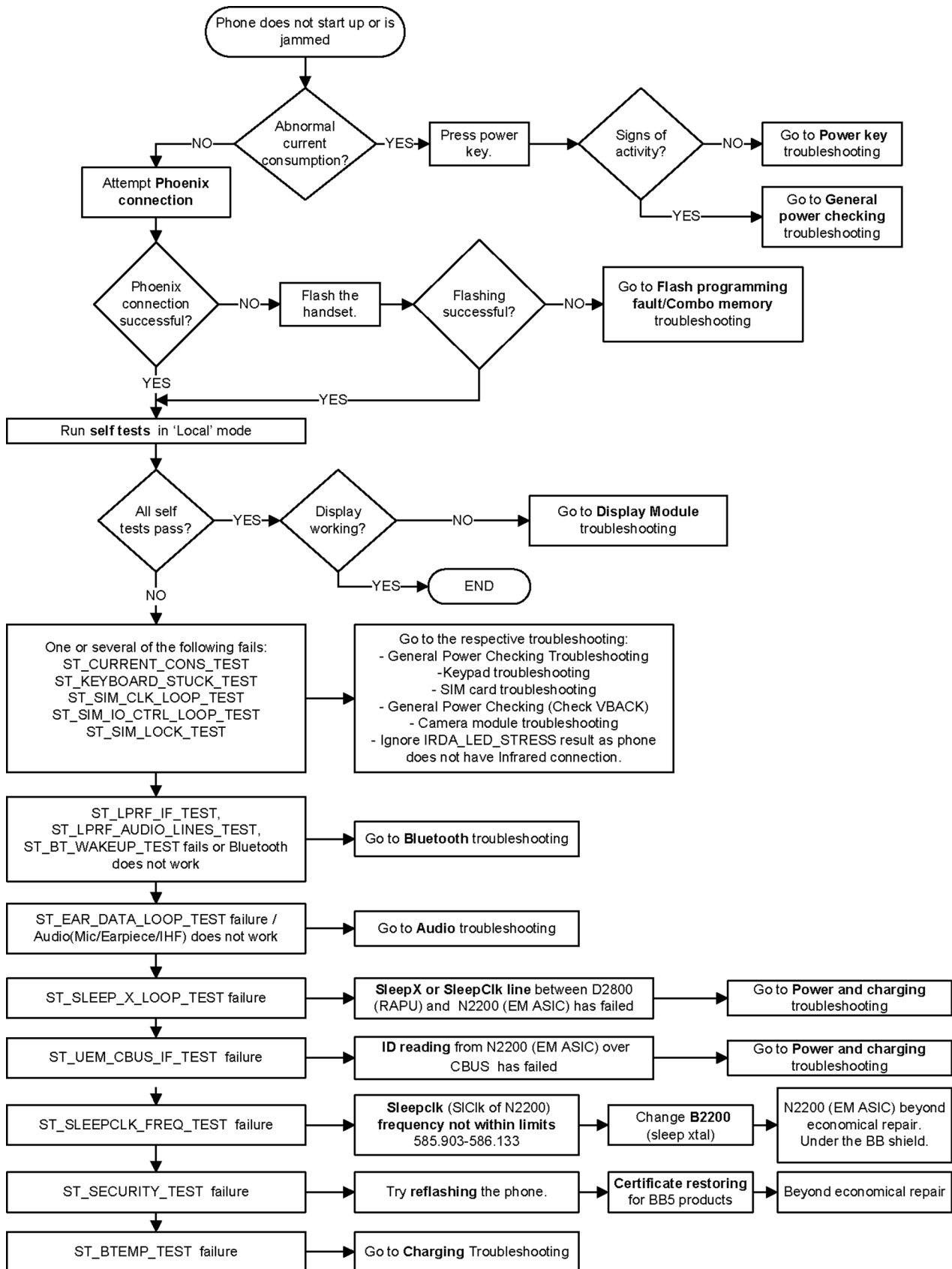
■ Baseband self tests in Phoenix

Context

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

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

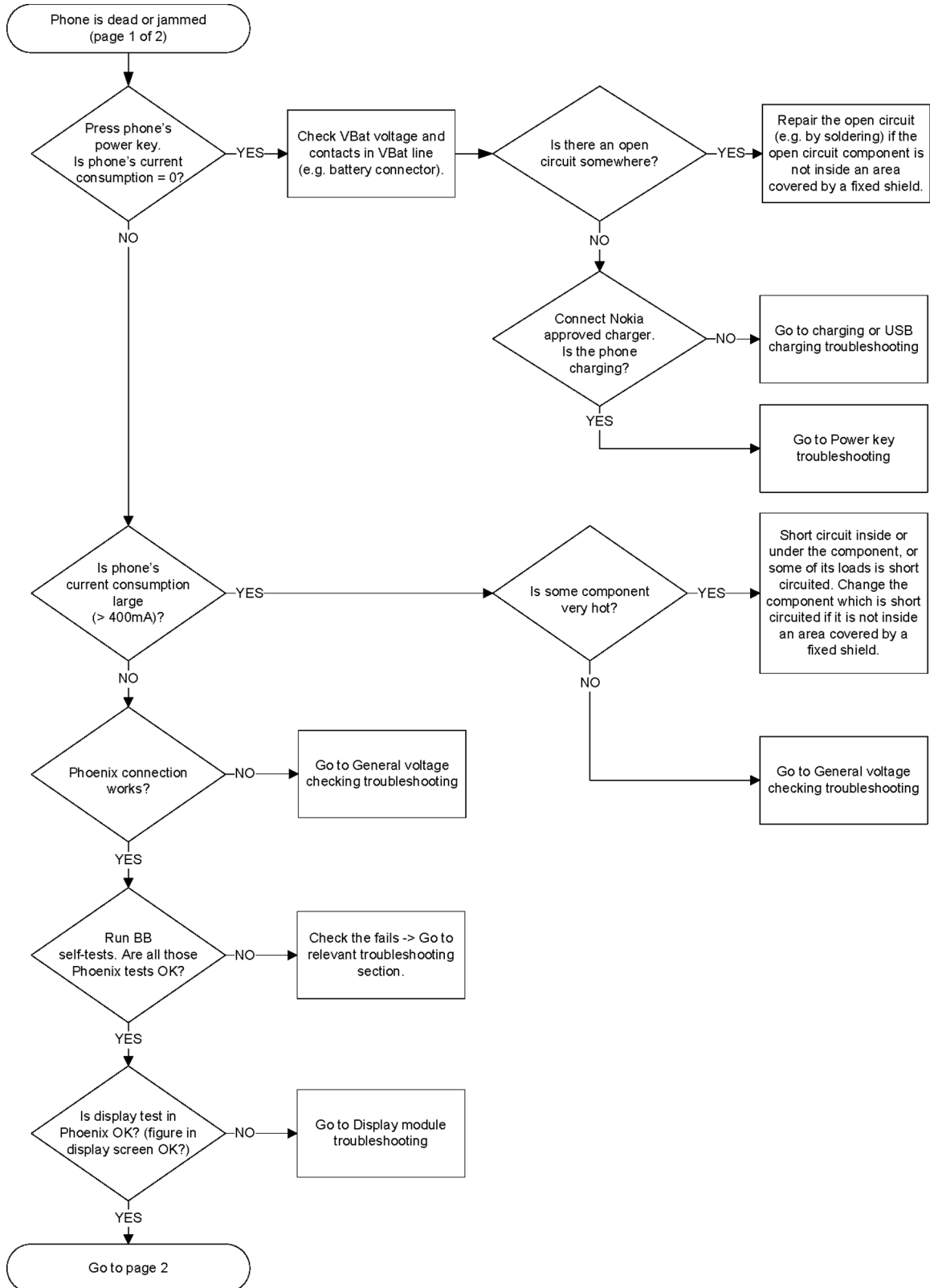
Troubleshooting flow



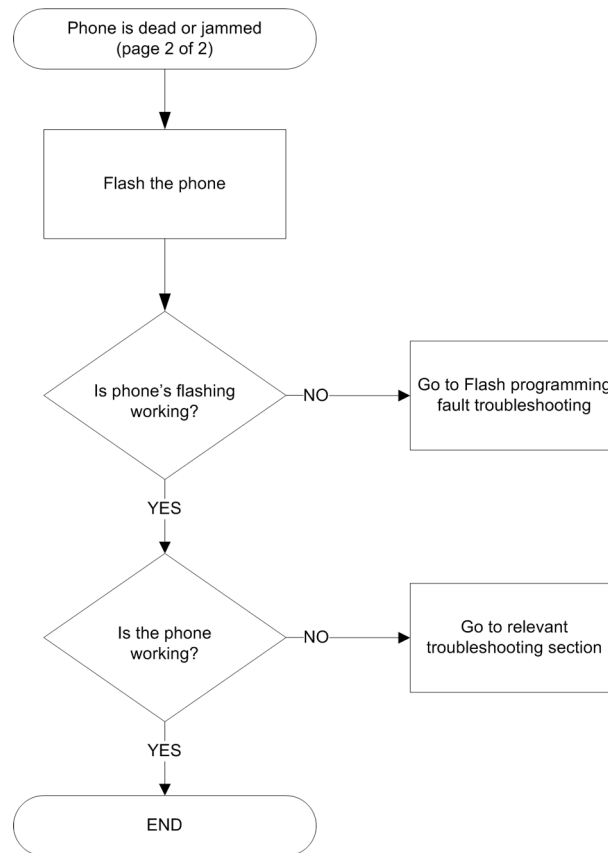
■ Power and charging troubleshooting

Dead or jammed device troubleshooting

Troubleshooting flow - Page 1 of 2

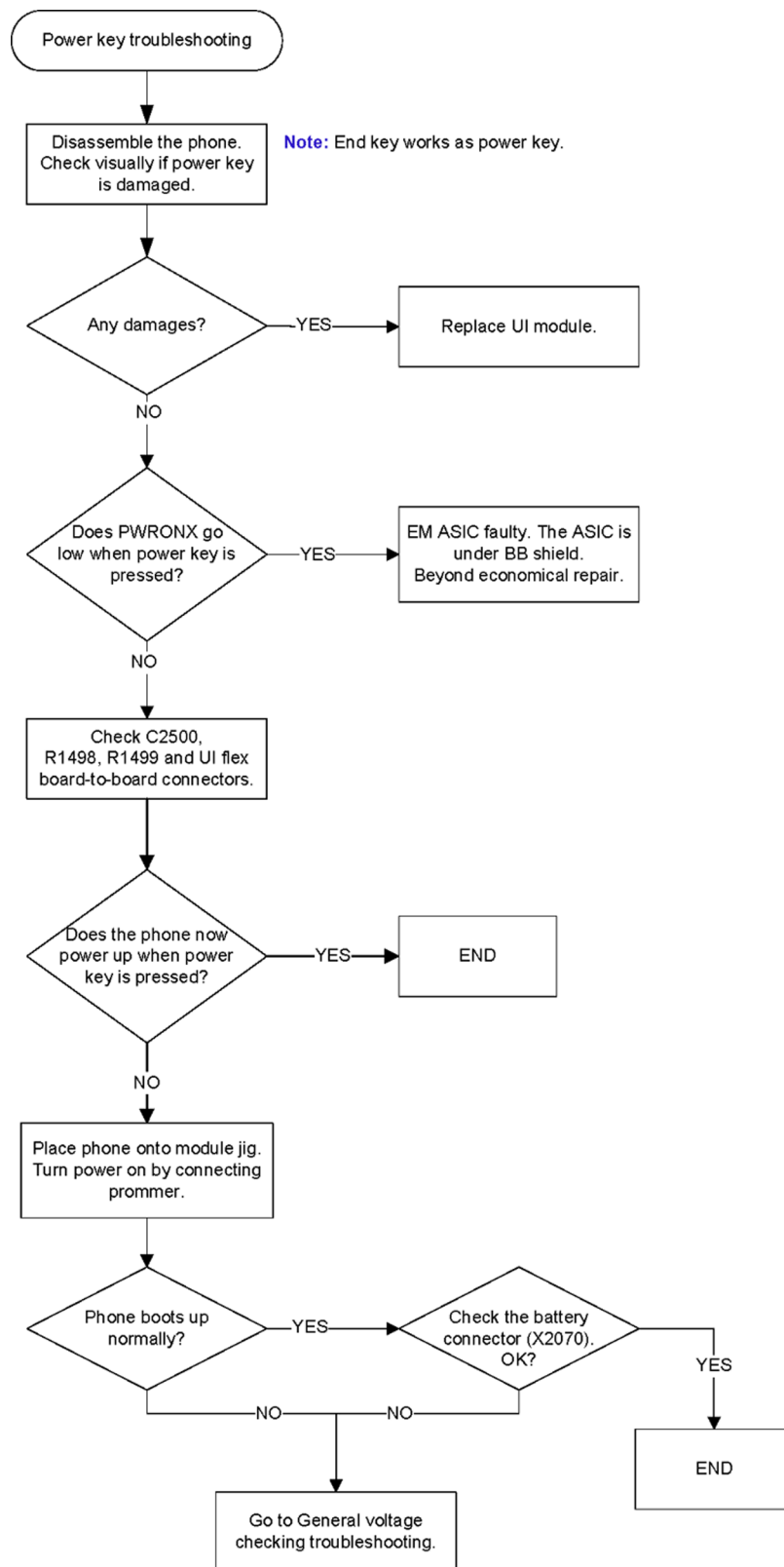


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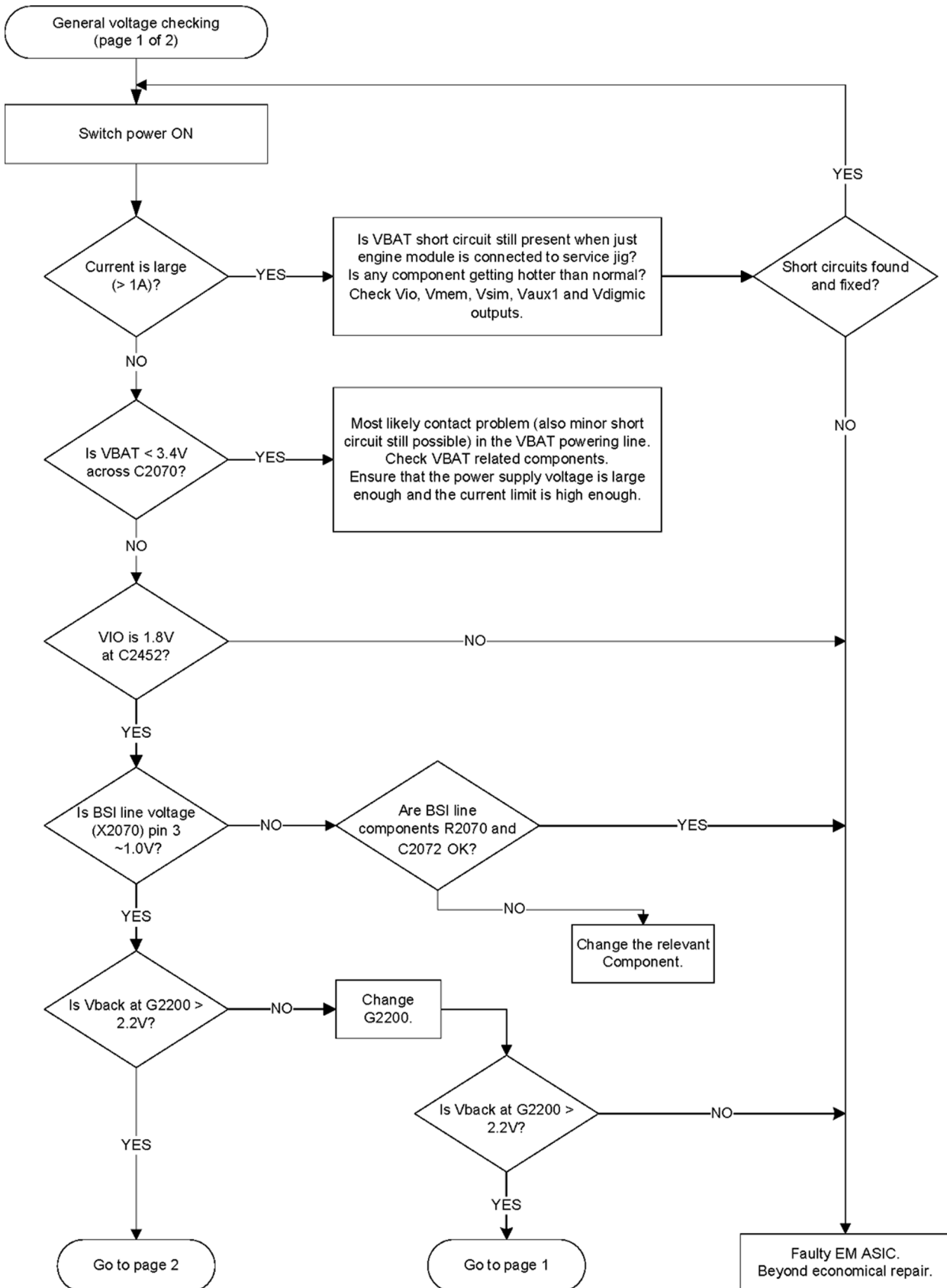
Power key troubleshooting

Troubleshooting flow

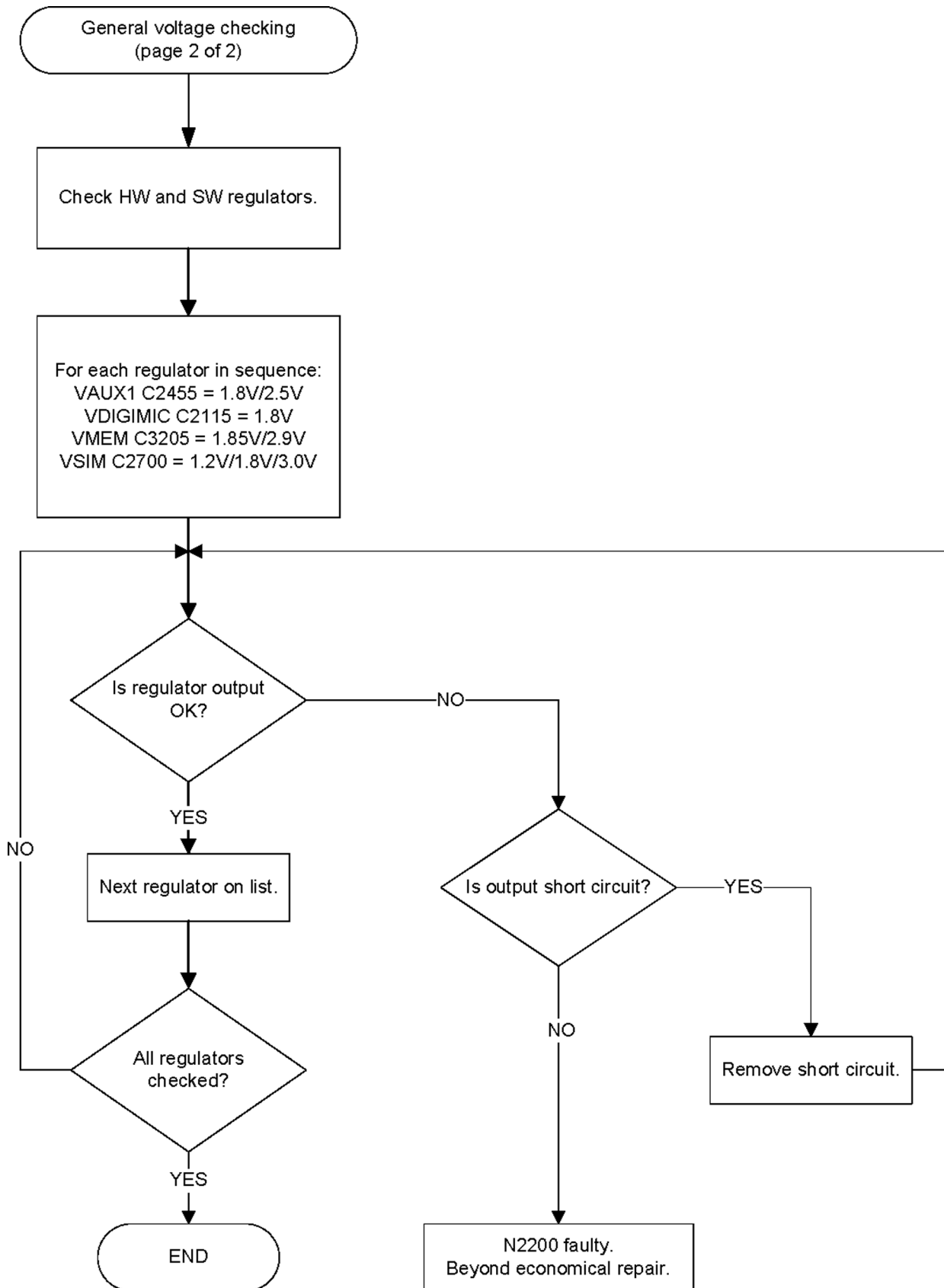


General voltage checking troubleshooting

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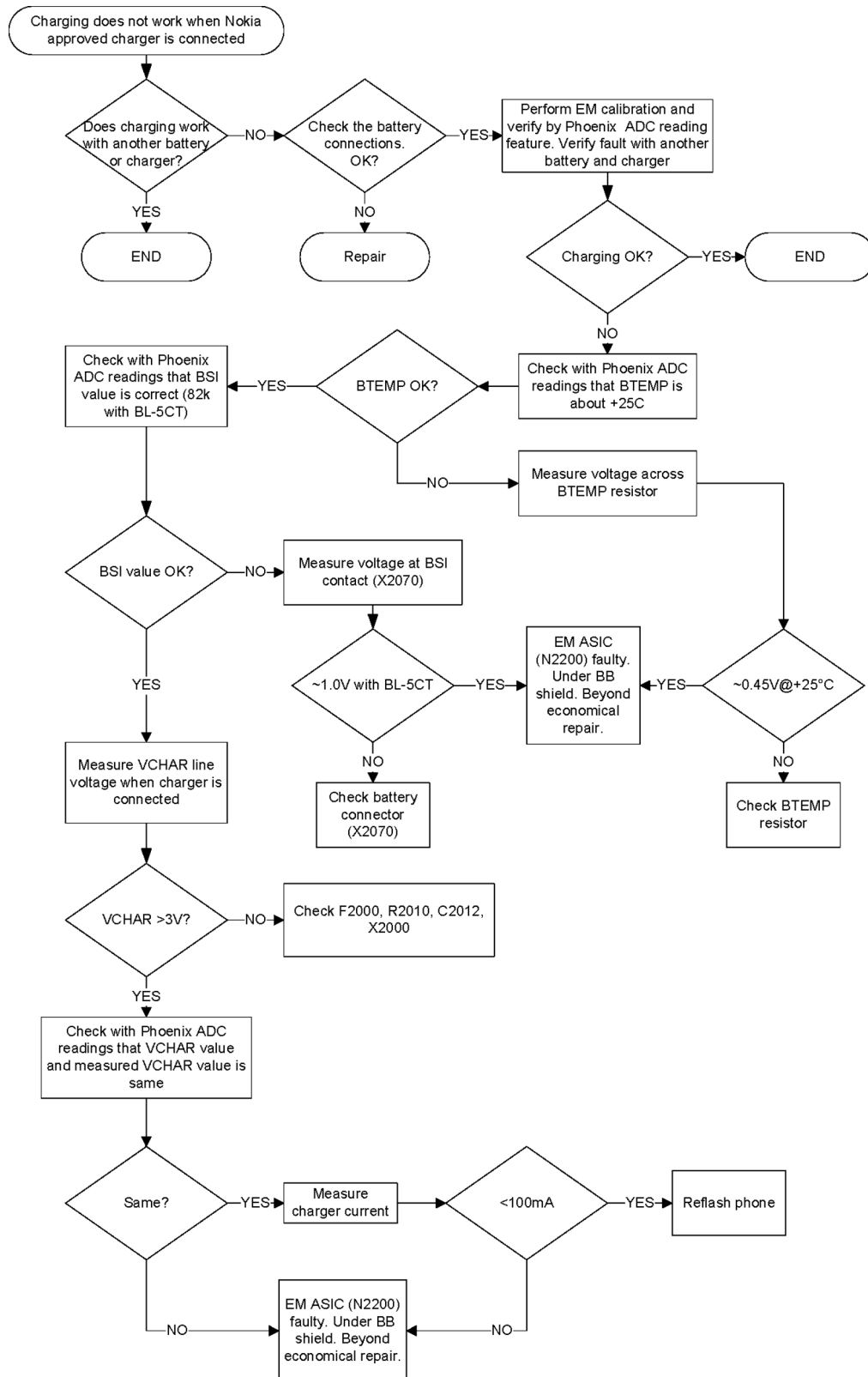
General power checking

Check the following voltages:

Signal Rename	Regulator	Sleep	Idle	Nominal voltage	Main user	Notes
VIO	Gazoo	ON	ON	1.8	Memory, I/Os, display	
VSIM	Gazoo	ON	ON	1.8/3.0	SIM card	
VAUX1	Gazoo	ON	ON	2.8	Display	
VMEM	Gazoo	OFF	OFF	2.9	MicroSD	Disabled in sleep
VDIGMIC	Gazoo	OFF	OFF	1.8	Audio	

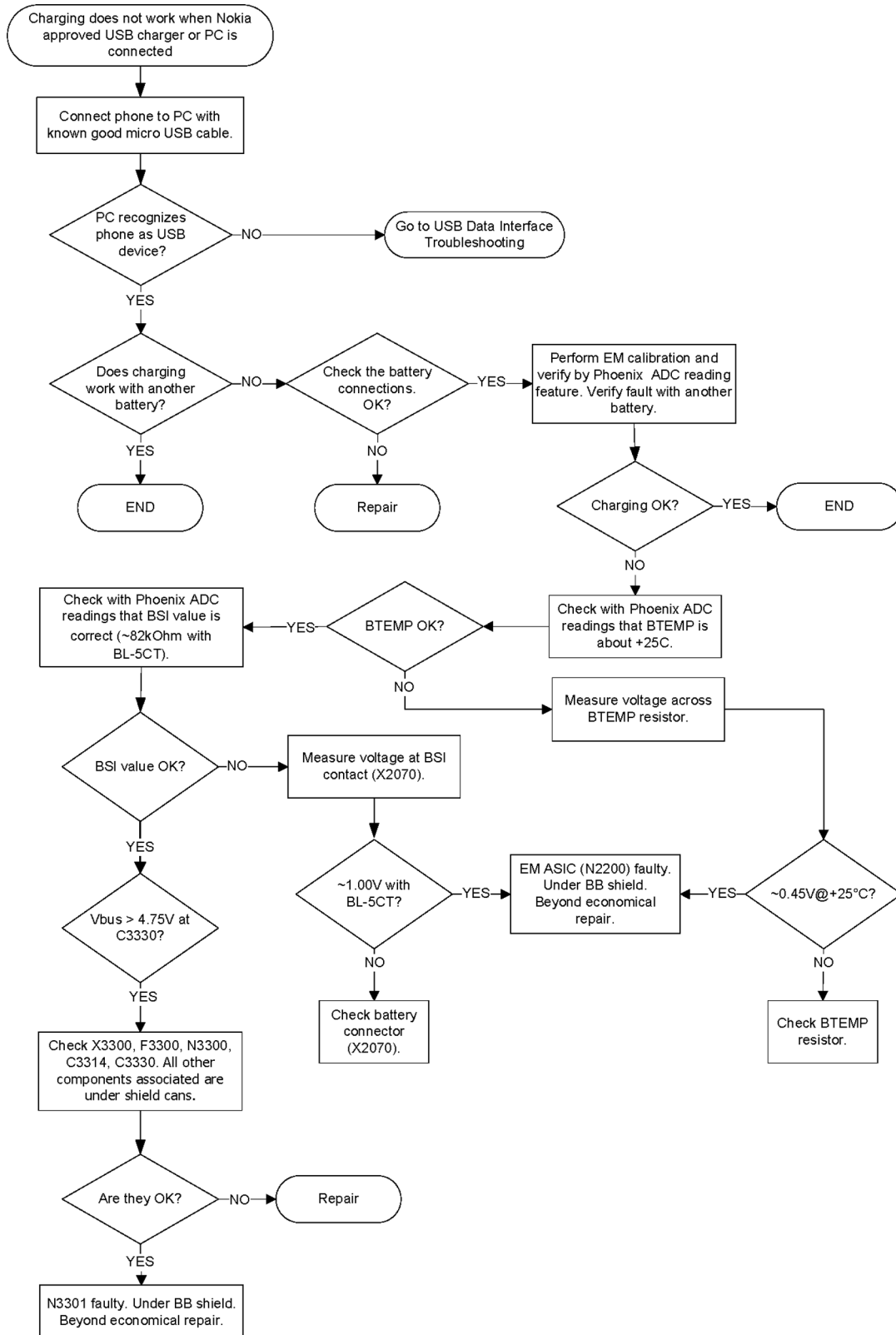
Charging troubleshooting

Troubleshooting flow



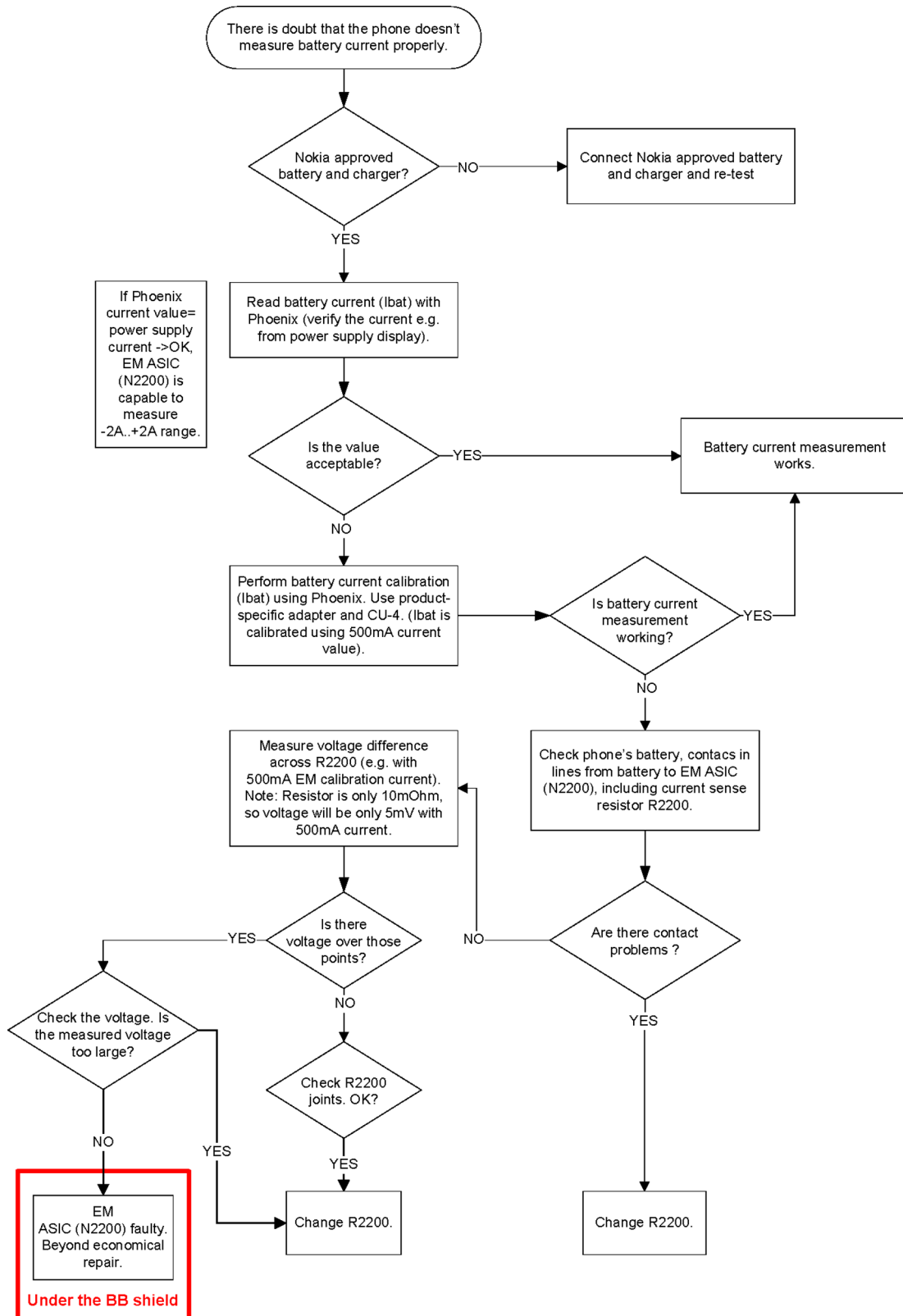
USB charging troubleshooting

Troubleshooting flow



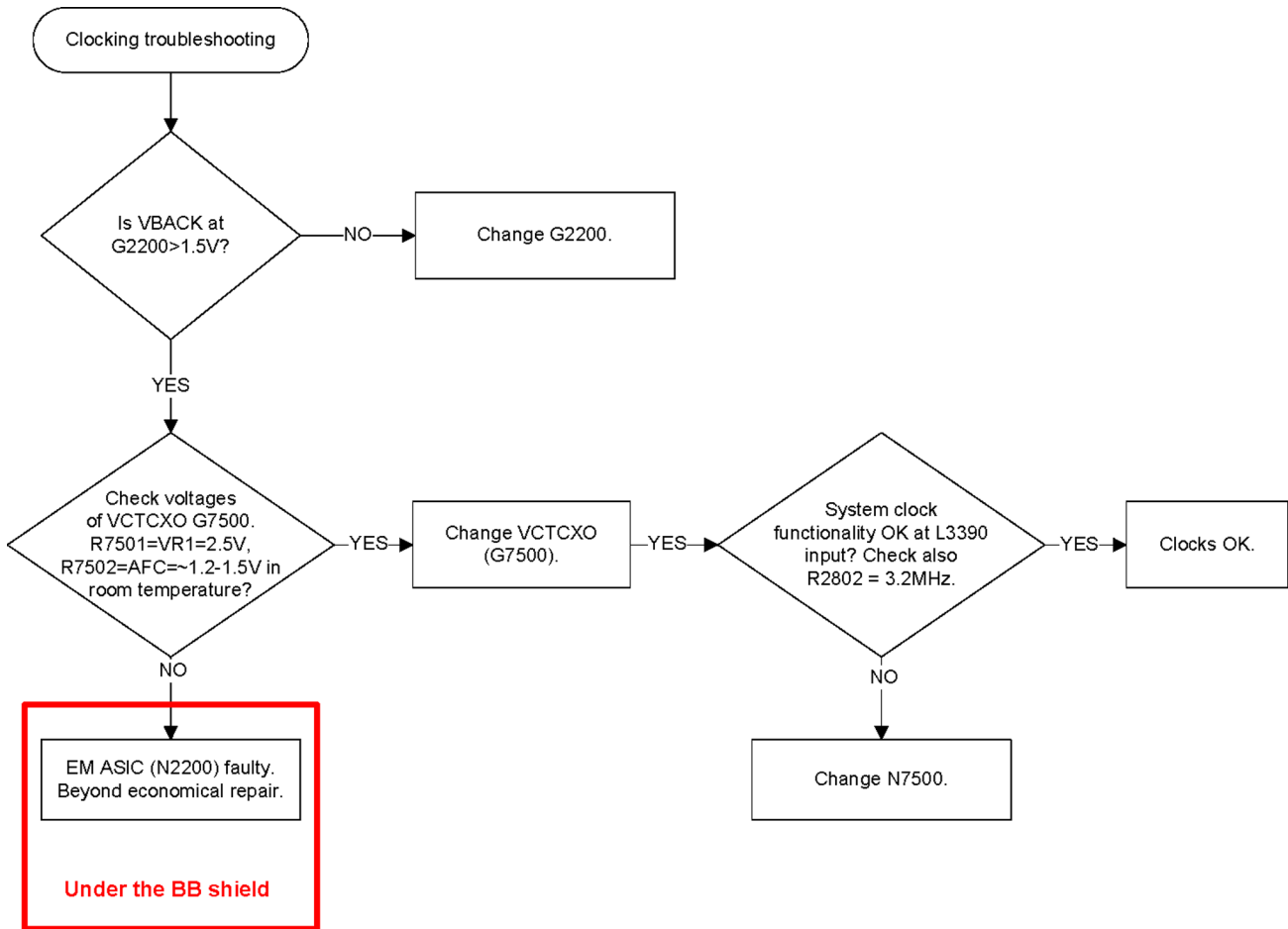
Battery current measuring fault troubleshooting

Troubleshooting flow



Clocking troubleshooting

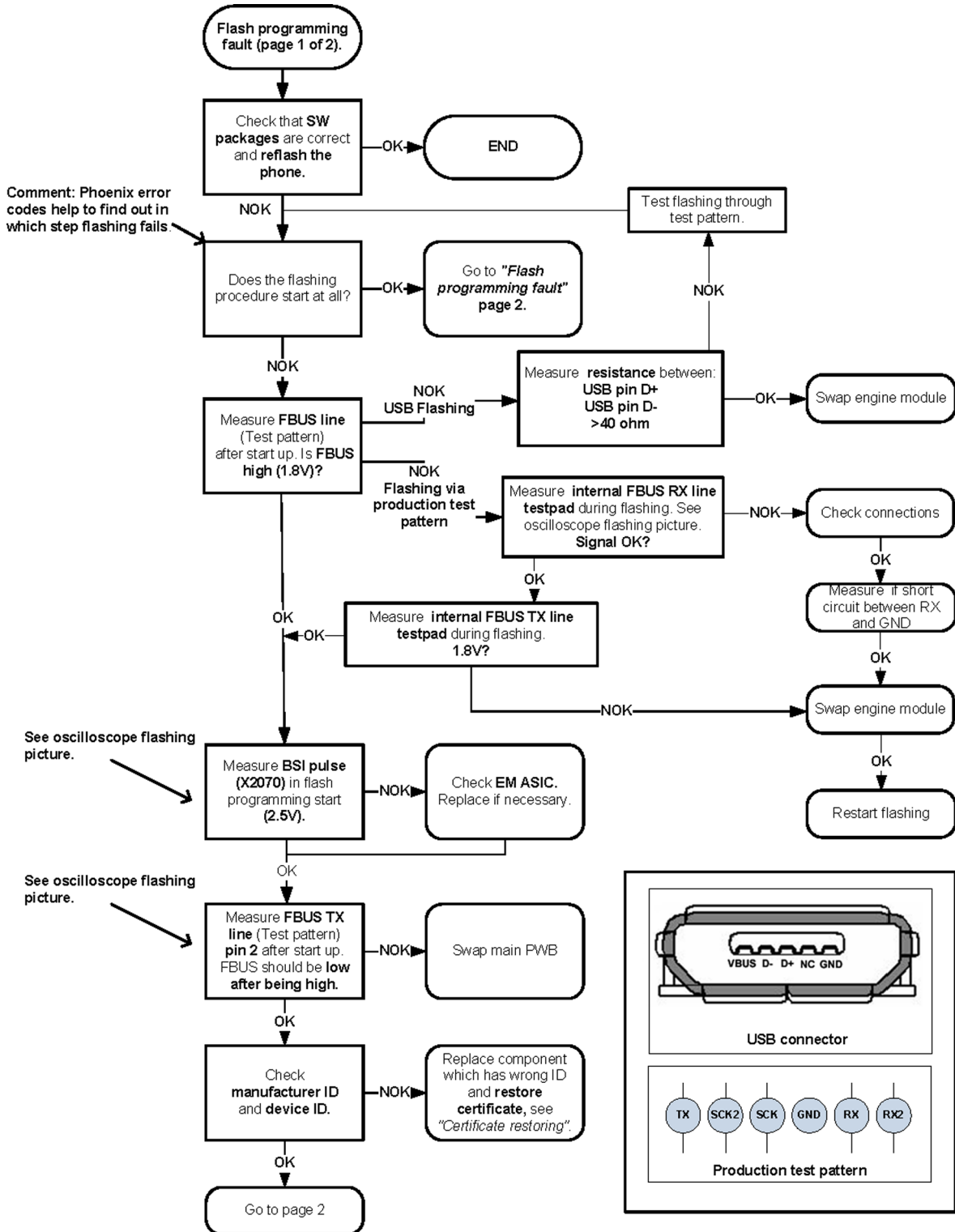
Troubleshooting flow



■ **Interface troubleshooting**

Flash programming fault troubleshooting

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Troubleshooting flow - Page 2 of 2

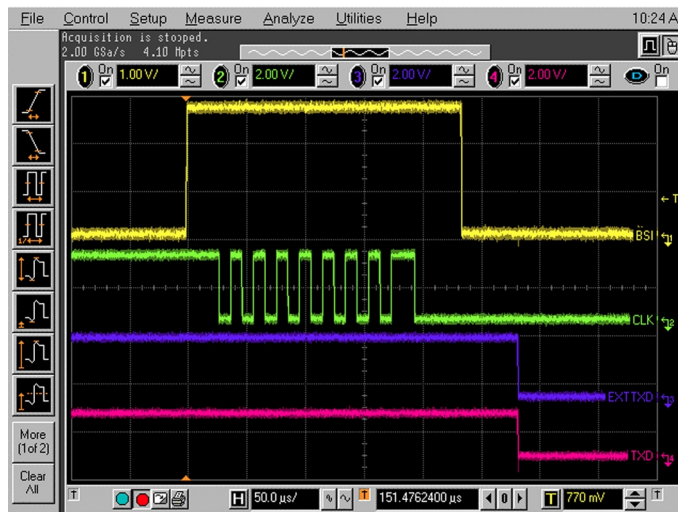
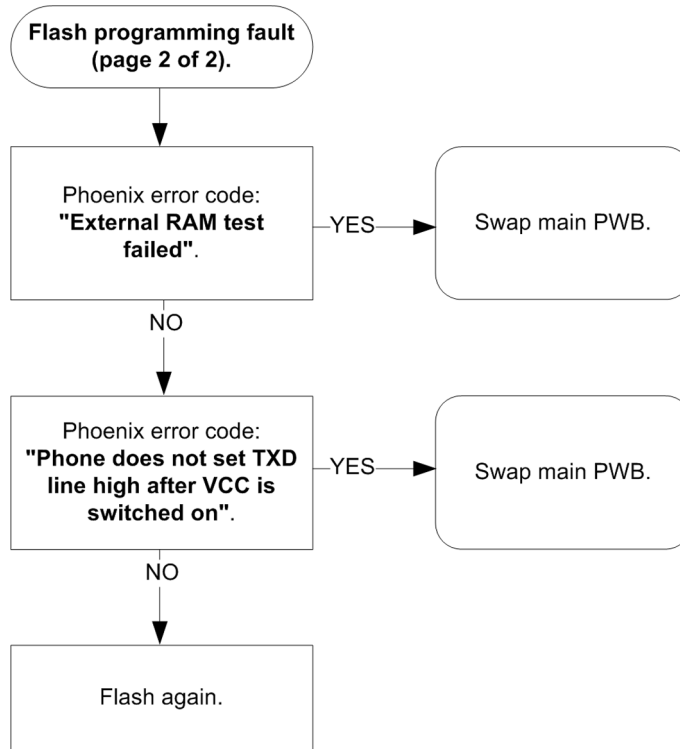


Figure 8 Flashing pic 1. Take single trig measurement for the rise of the BSI signal

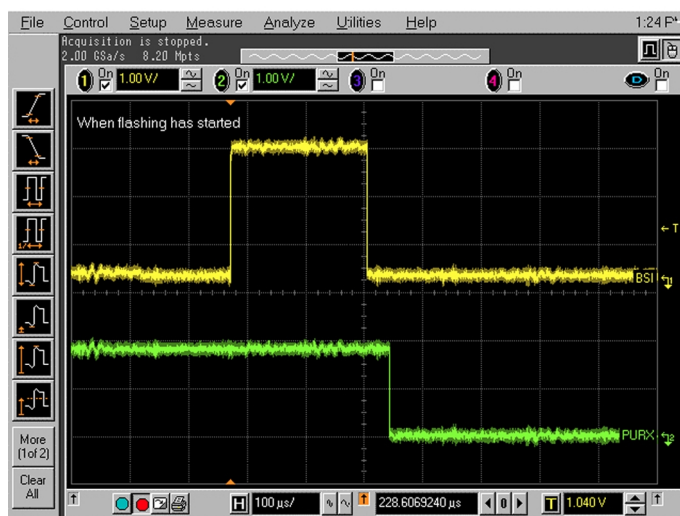
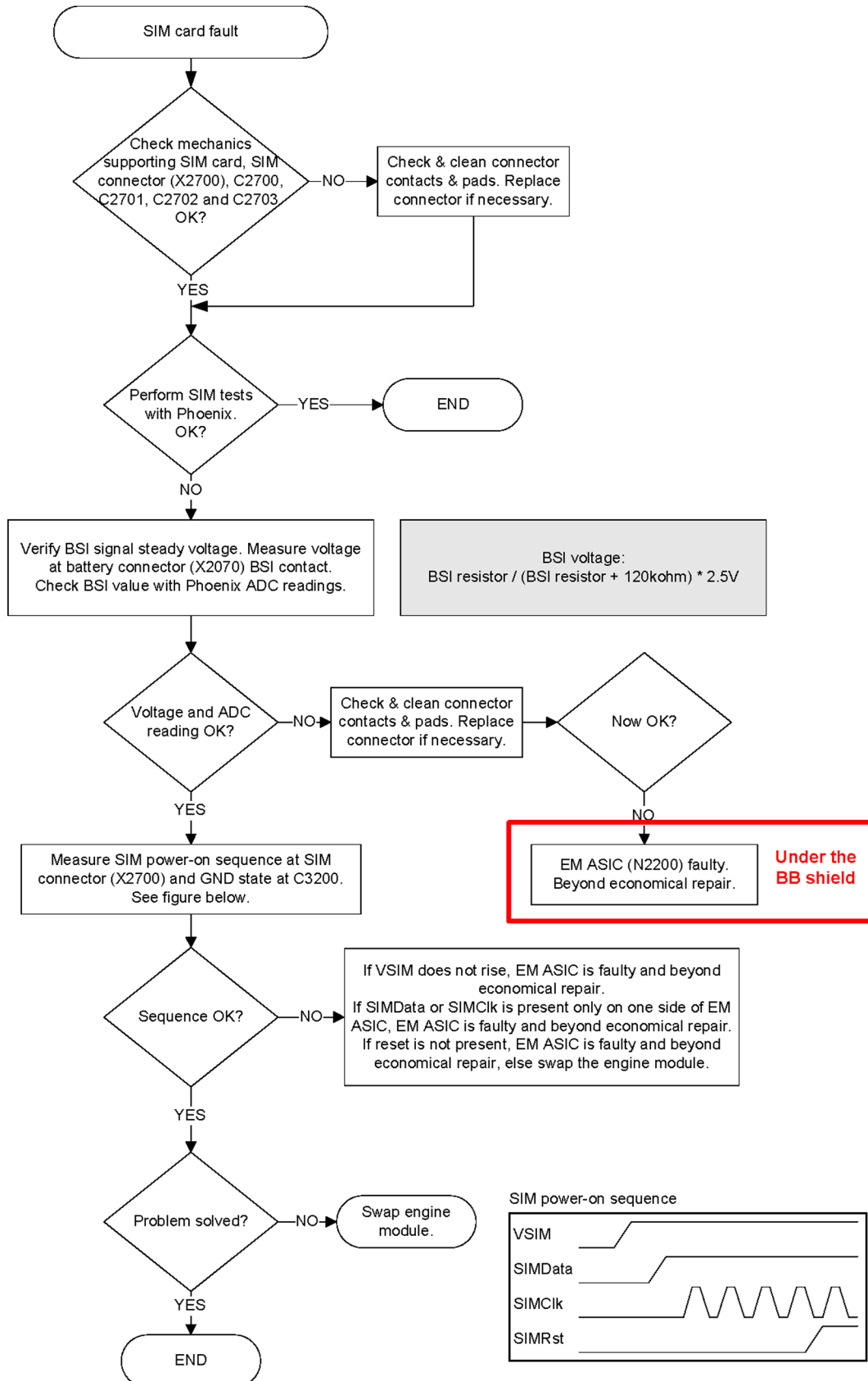


Figure 9 Flashing pic 2. Take single trig measurement for the rise of the BSI signal

SIM card troubleshooting

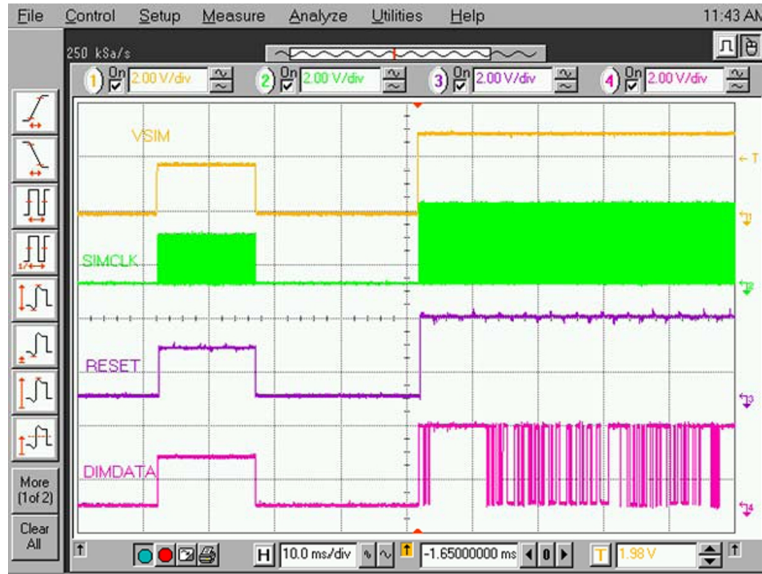
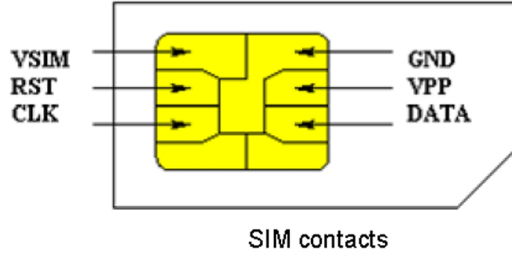
Troubleshooting flow



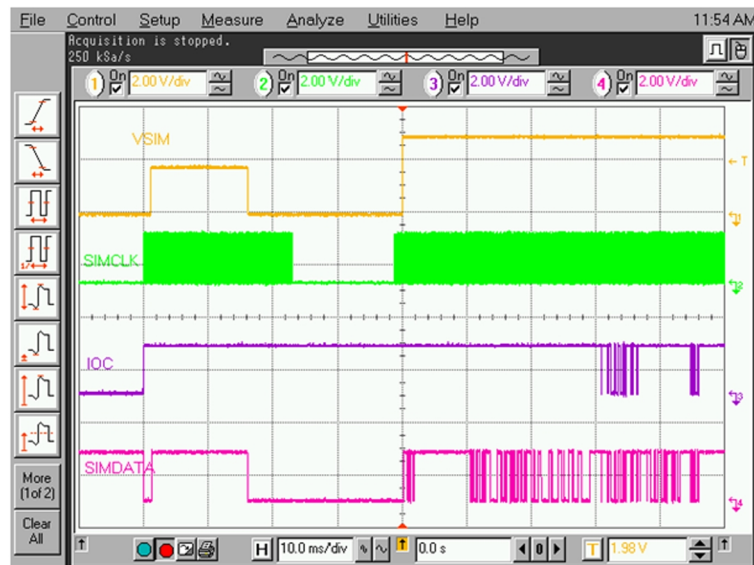
SIM power-on sequence

Testpoints between
RAPU and EM ASIC
SIMDa = SIMData
SIMClkA = SIMClk
SIMIOc = SIMIOc

Fsimclk = 3.8MHz



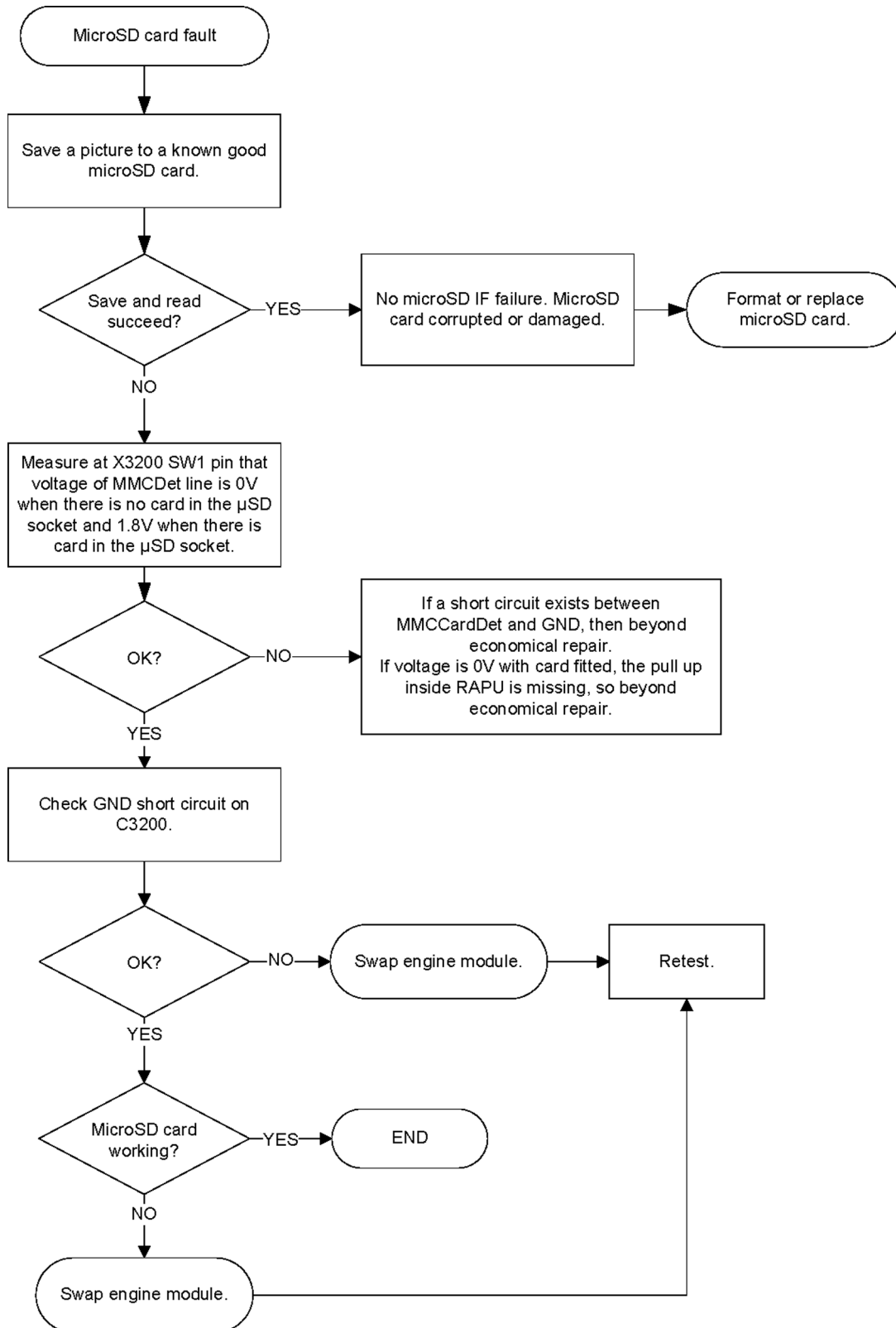
SIM power-on sequence on X2700.



SIM power-on sequence between RAPU and EM ASIC.

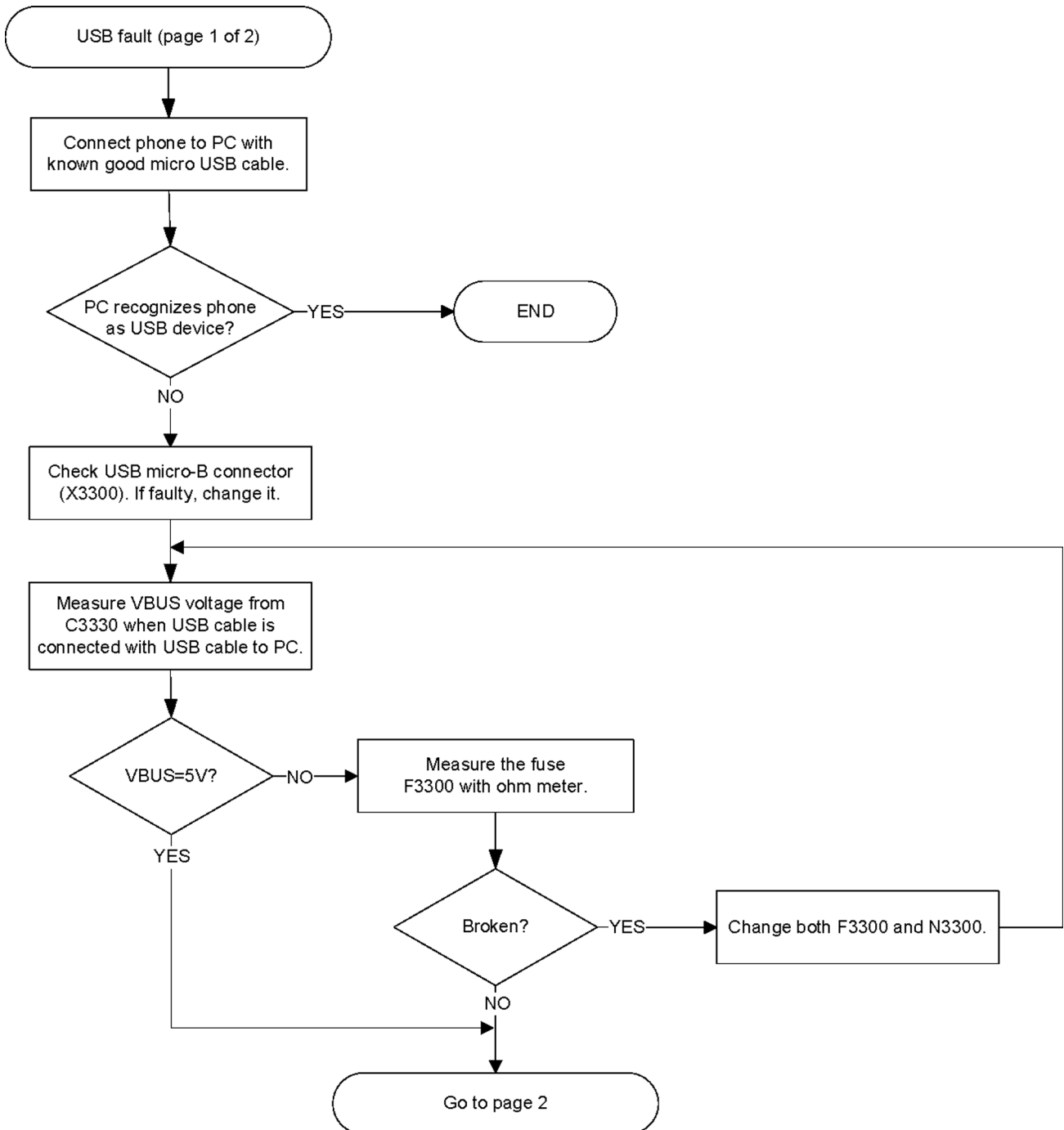
MicroSD card troubleshooting

Troubleshooting flow

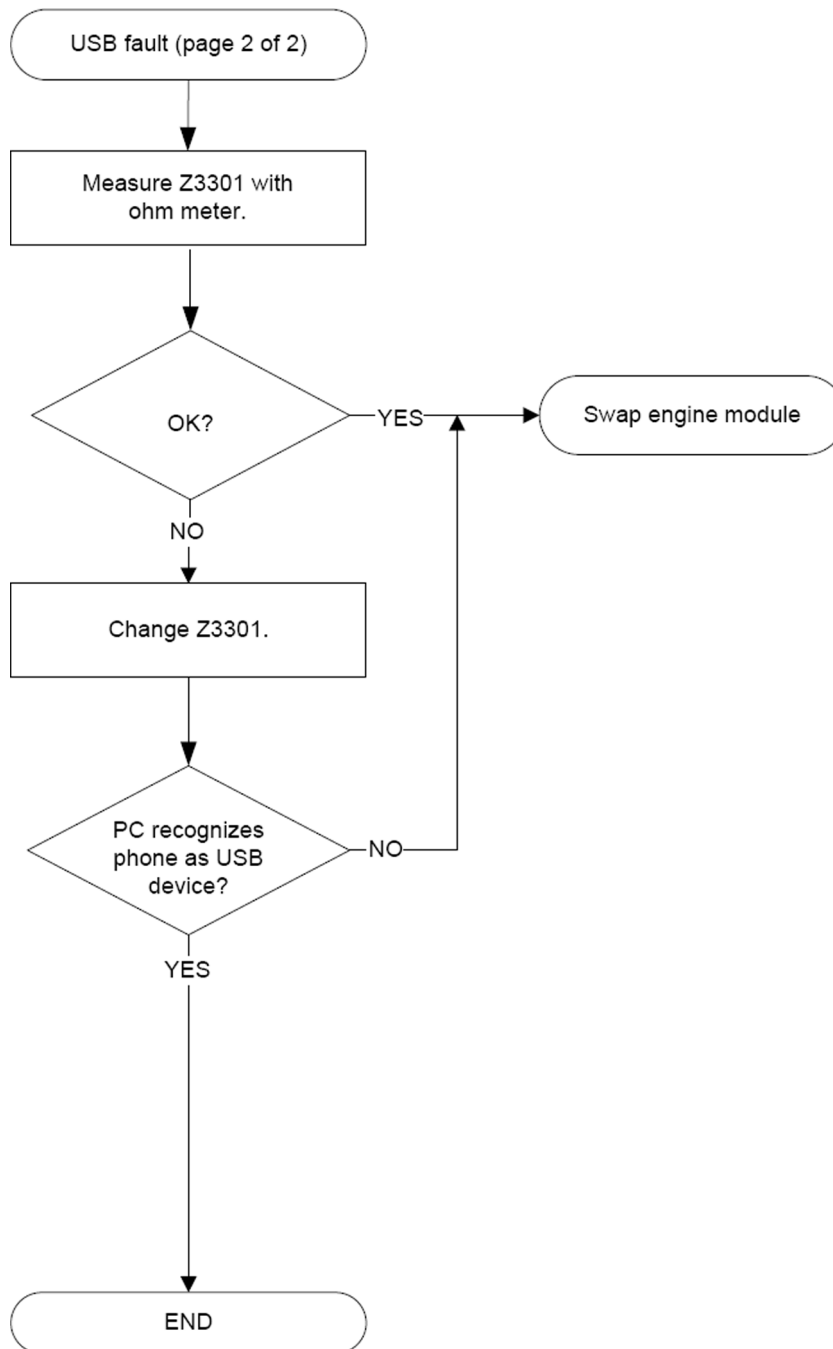


USB data interface troubleshooting

Troubleshooting flow - Page 1 of 2



Troubleshooting flow - Page 2 of 2



■ **User interface troubleshooting**

Keyboard and side keys troubleshooting

Context

There are two possible failure modes in the keyboard module:

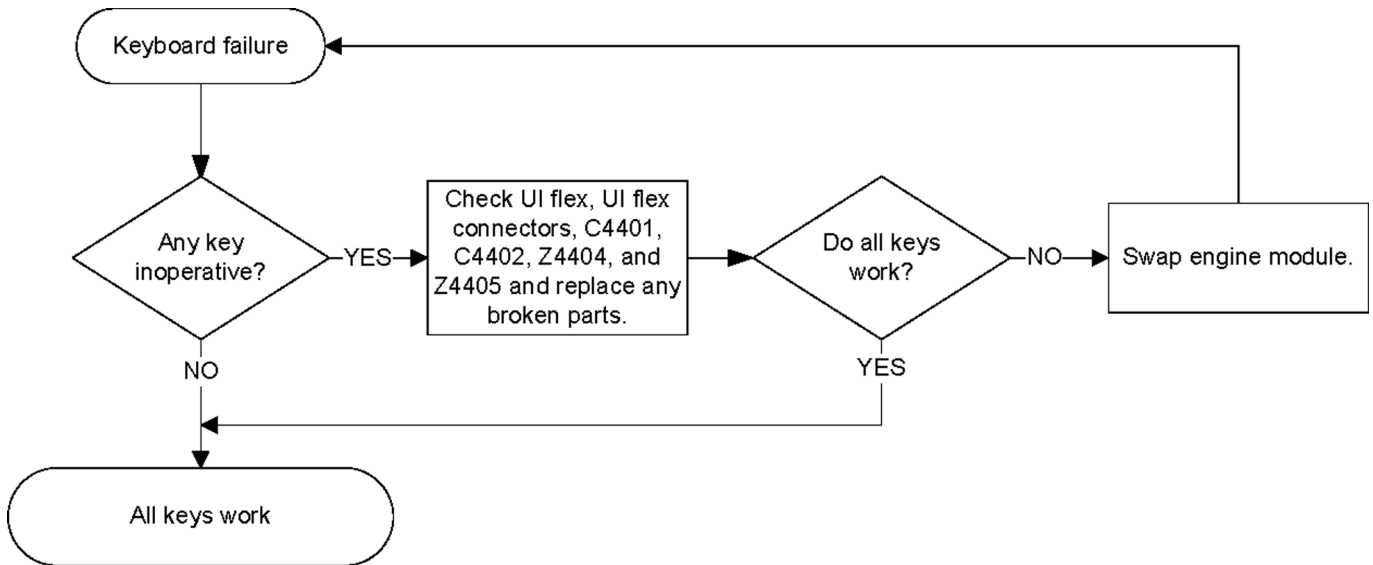
- One or more keys are stuck, so that the key does not react when a keydome or a side key is pressed. This kind of failure is caused by mechanical reasons (dirt, rust, mechanical damage, etc.)

- Malfunction of several keys at the same time. This happens when one or more rows or columns in the key matrix are failing (shortcut or open connection).

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

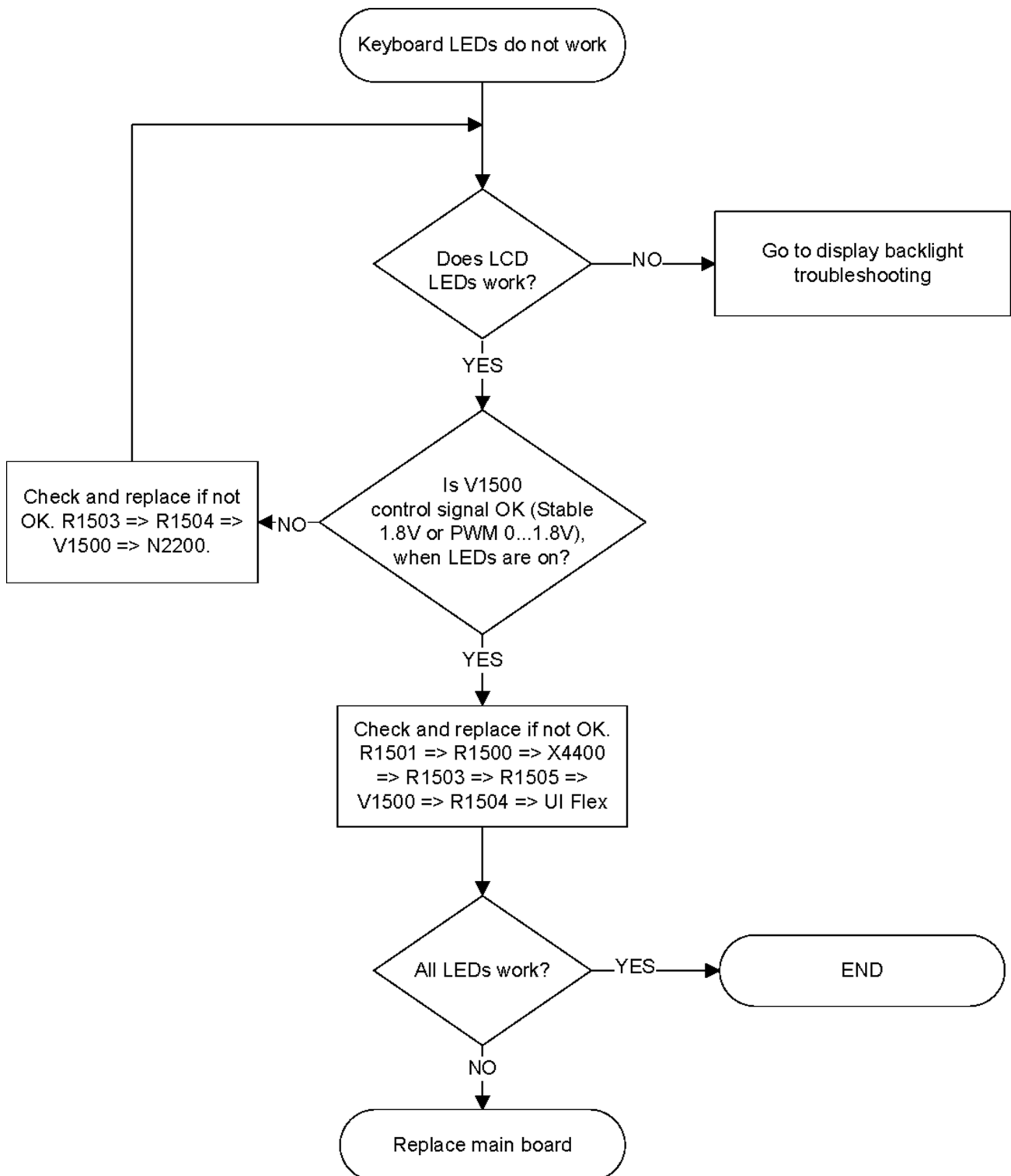
In this phone the keyboard is connected to D2800 I/O pins.

Troubleshooting flow



Keyboard LEDs troubleshooting

Troubleshooting flow



Display module troubleshooting

General instructions for display troubleshooting

Context

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

Table 7 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. <ul style="list-style-type: none"> • If a part of the image is missing, change the display module. • If the image is otherwise corrupted, follow the display fault troubleshooting flowchart.
Backlight dim or not working at all	Backlight LED components are inside the display module. Backlight failure can also be in the connector or in the backlight power source in the main engine of the phone. This means that in case the display is working (image OK), the backlight is faulty.
Visual defects (pixel)	Pixel defects can be checked by controlling the display with Phoenix. Use both colours, black and white, on a full screen. The display may have some random pixel defects that are acceptable for this type of display. The criteria when pixel defects are regarded as a display failure, resulting in a replacement of the display, are presented the following table.

Table 8 Pixel defects

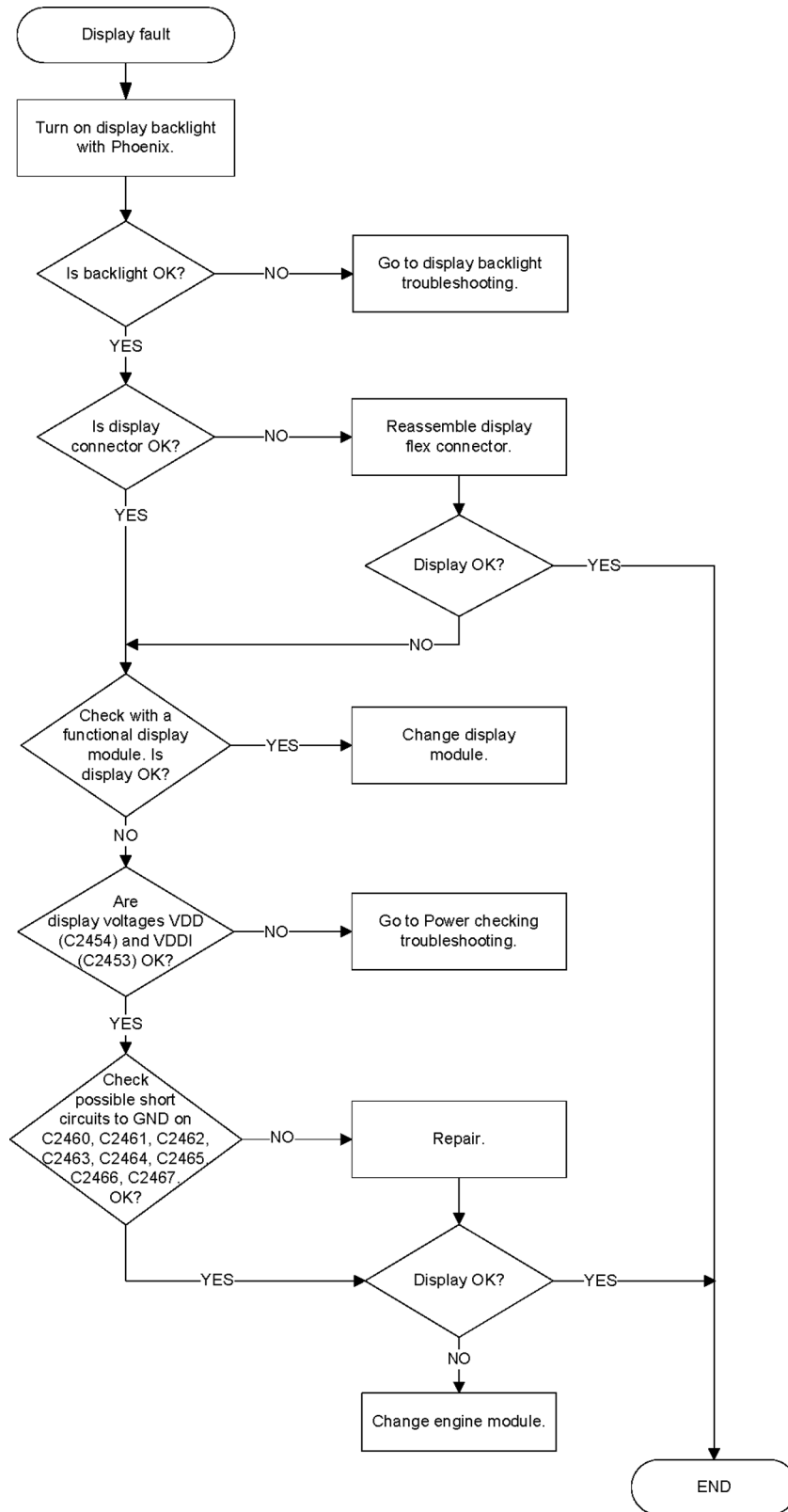
Item		White dot defect				Black dot defect	Total
		R	G	B	White Dot Total		
1	Defect counts	R	G	B	White Dot Total	1	1
		1	1	1	1		
2	Combined defect counts	Not allowed. Two single dot defects that are within 5 mm of each other should be interpreted as combined dot defect.					

Steps

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

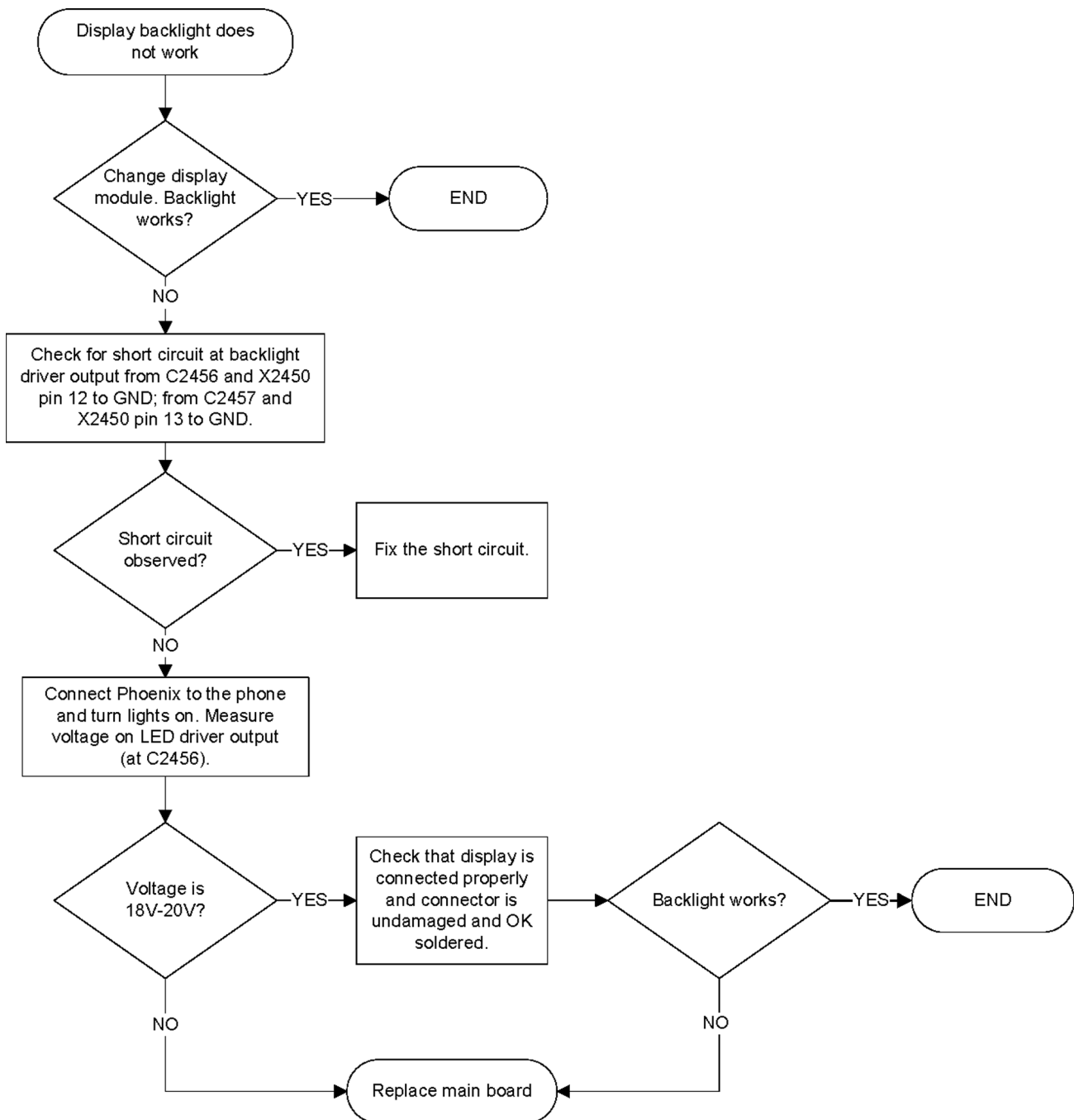
Display fault troubleshooting

Troubleshooting flow



Display backlight troubleshooting

Troubleshooting flow



■ Audio troubleshooting

Audio troubleshooting test instructions

External earpiece, internal earpiece and internal handsfree outputs can be measured either with a single-ended or a differential probe.

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

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

Required equipment

The following equipment is needed for the tests:

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

Test procedure

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

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

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

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

Phoenix audio loop tests and test results

The results presented in this table apply when no accessory is connected and battery voltage is set to 3.7V. Earpiece, internal microphone and speakers are in place during measurement. Applying a headset accessory during measurement causes a significant drop in measured quantities.

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

Loop test	Input terminal	Output terminal	Path gain [dB] (fixed)	Input voltage, 1 kHz sine [mVp-p]	Single-ended output voltage [mVp-p]	Output DC level [V]
AV mic to AV ear	HS_MIC and GND	HS_EAR_R and GND	+21.3	100	584	0
		HS_EAR_L and GND				
AV mic to HP ear	HS_MIC and GND	B2101 pad1 and GND	+18.2	100	407	1.5
		B2101 pad2 and GND				

Loop test	Input terminal	Output terminal	Path gain [dB] (fixed)	Input voltage, 1 kHz sine [mVp-p]	Single-ended output voltage [mVp-p]	Output DC level [V]
Ext microphone in Int handsfree out	HS_MIC and GND	B2102 pad1 and GND	+3.6 with lowpass filter	1000	758 with lowpass filter See the <i>Measurement data</i> graphics below	NA
		B2102 pad2 and GND				
		B2103 pad1 and GND				
		B2103 pad2 and GND				

Measurement data

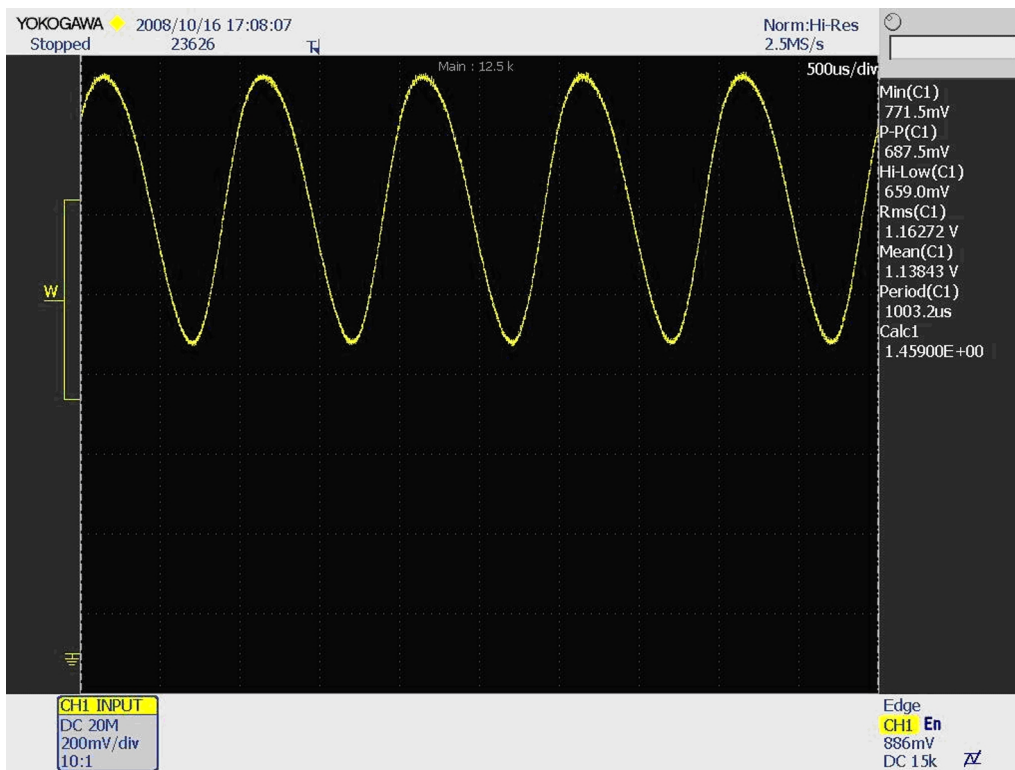


Figure 10 AV_IN - HP_OUT, single-ended loop measurement

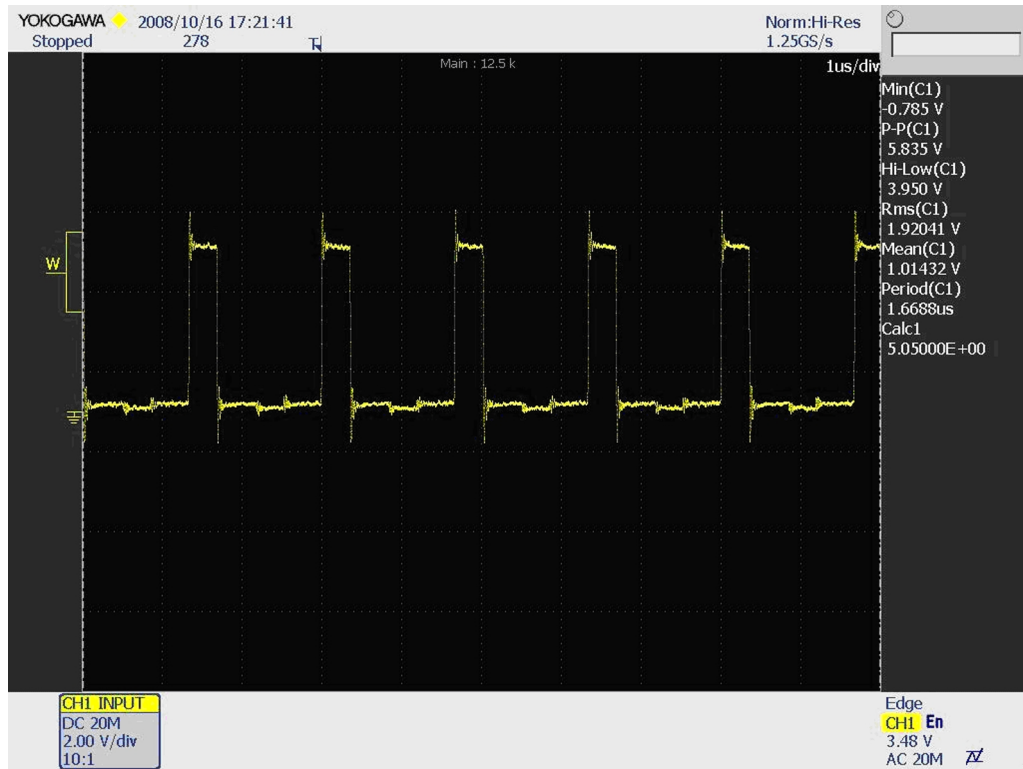


Figure 11 AV_IN - IHF_L_OUT, single-ended loop measurement without filter

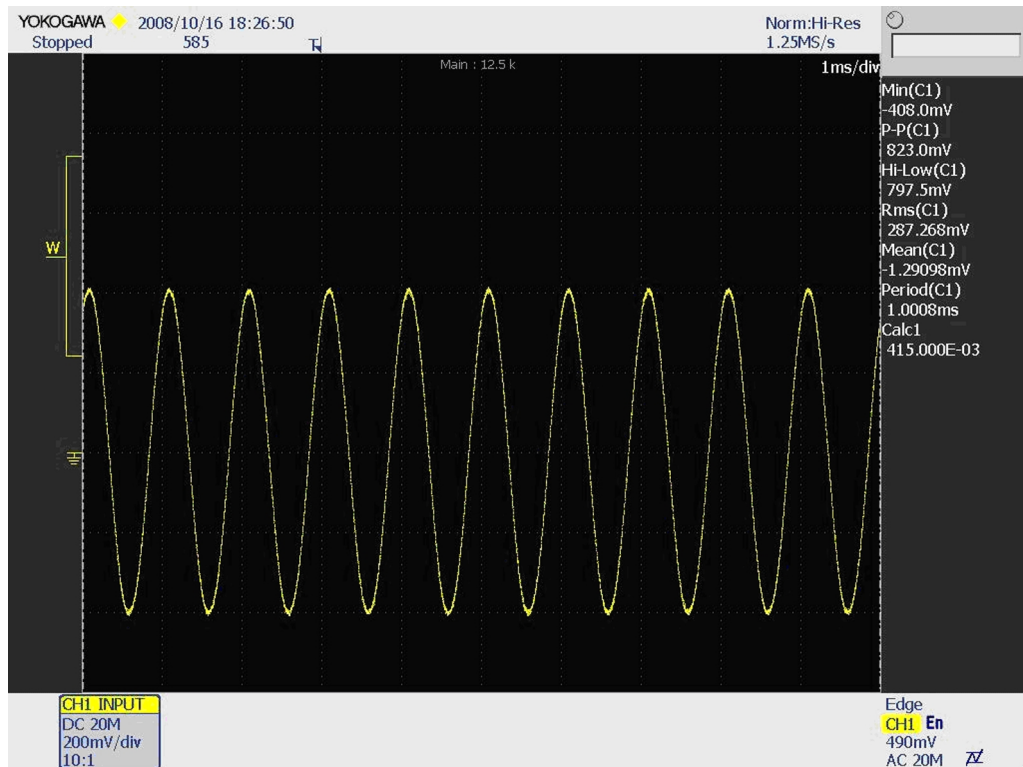
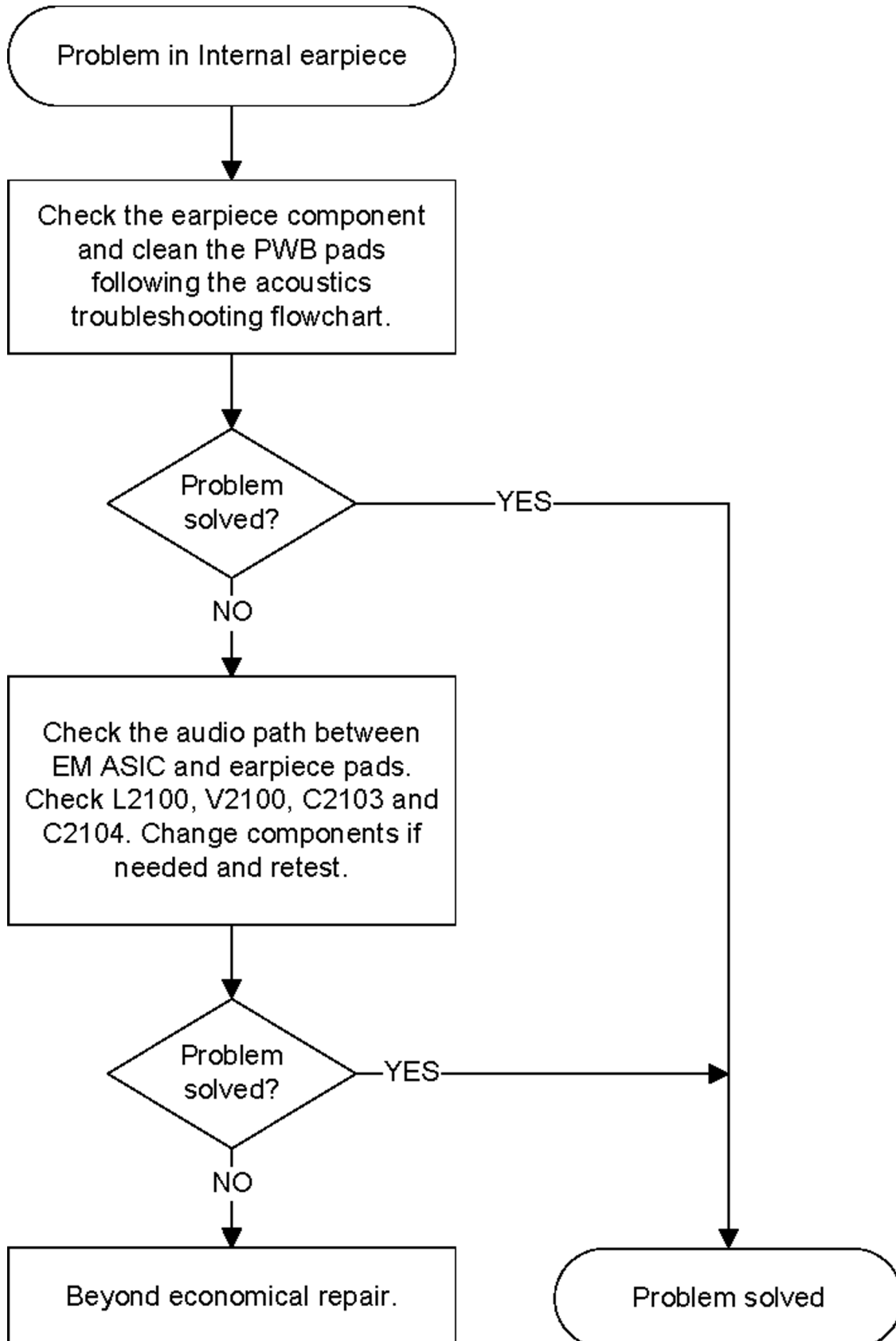


Figure 12 AV_IN - AV_L_OUT, single-ended loop measurement

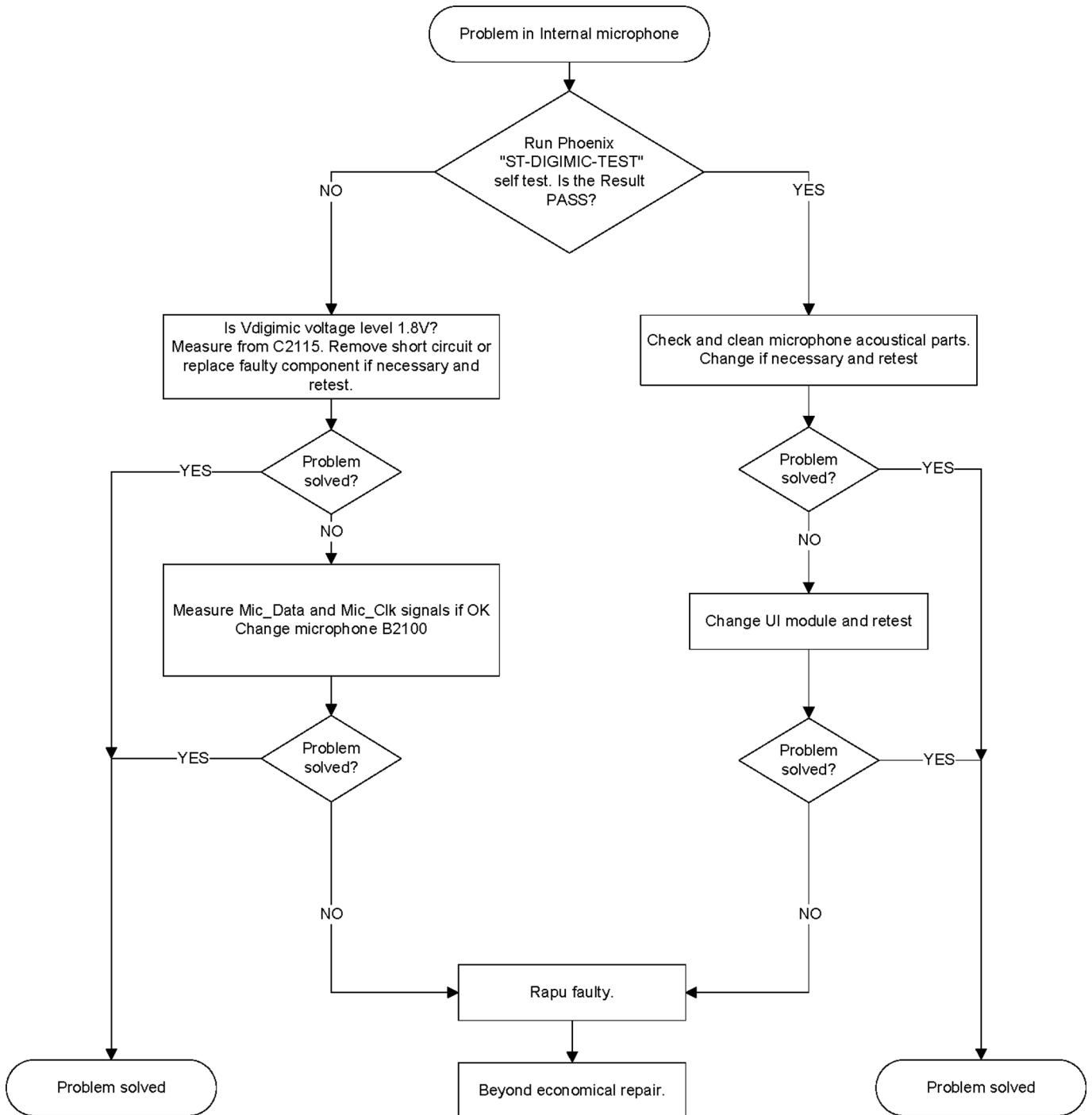
Internal earpiece troubleshooting

Troubleshooting flow



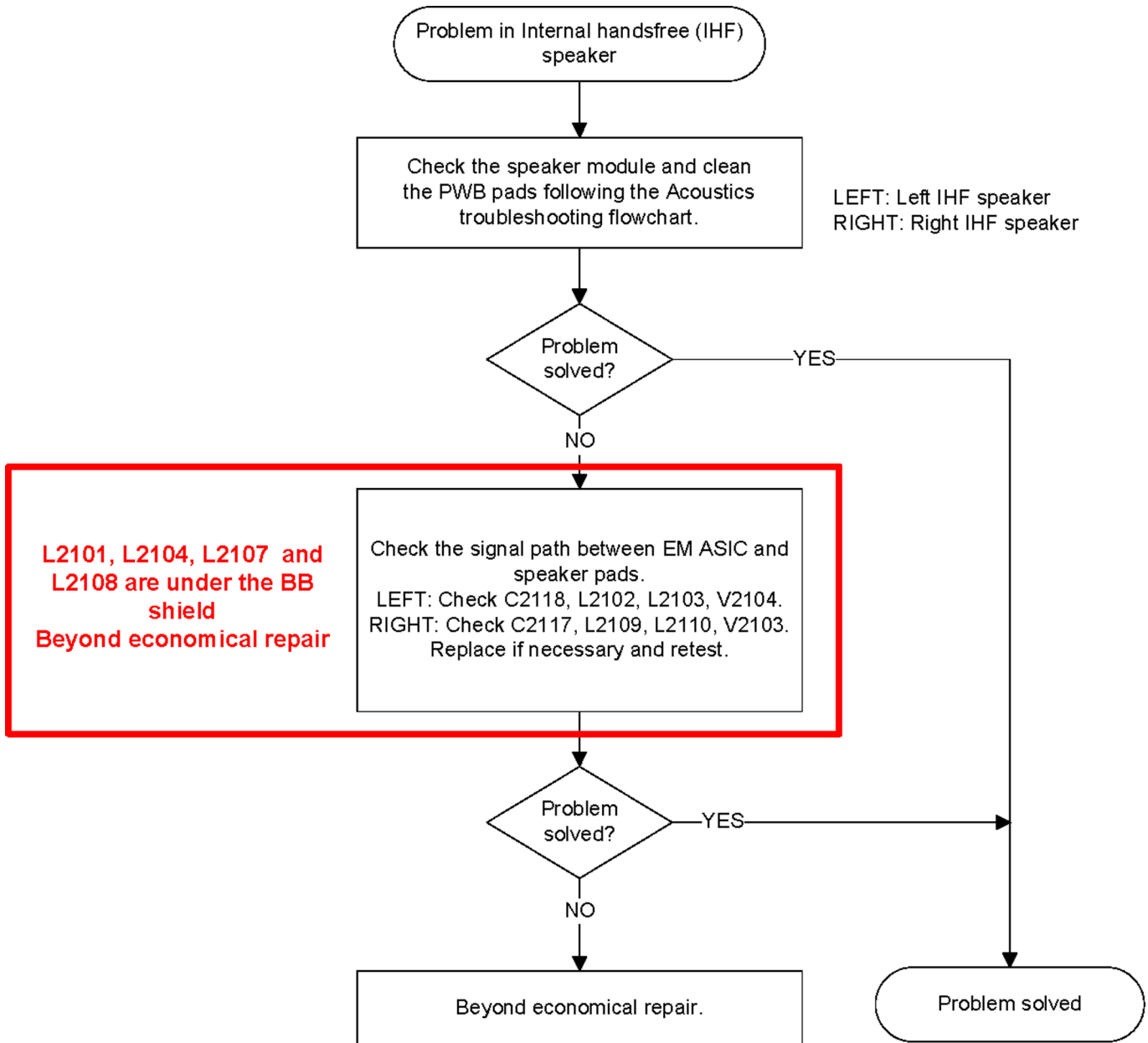
Internal microphone troubleshooting

Troubleshooting flow



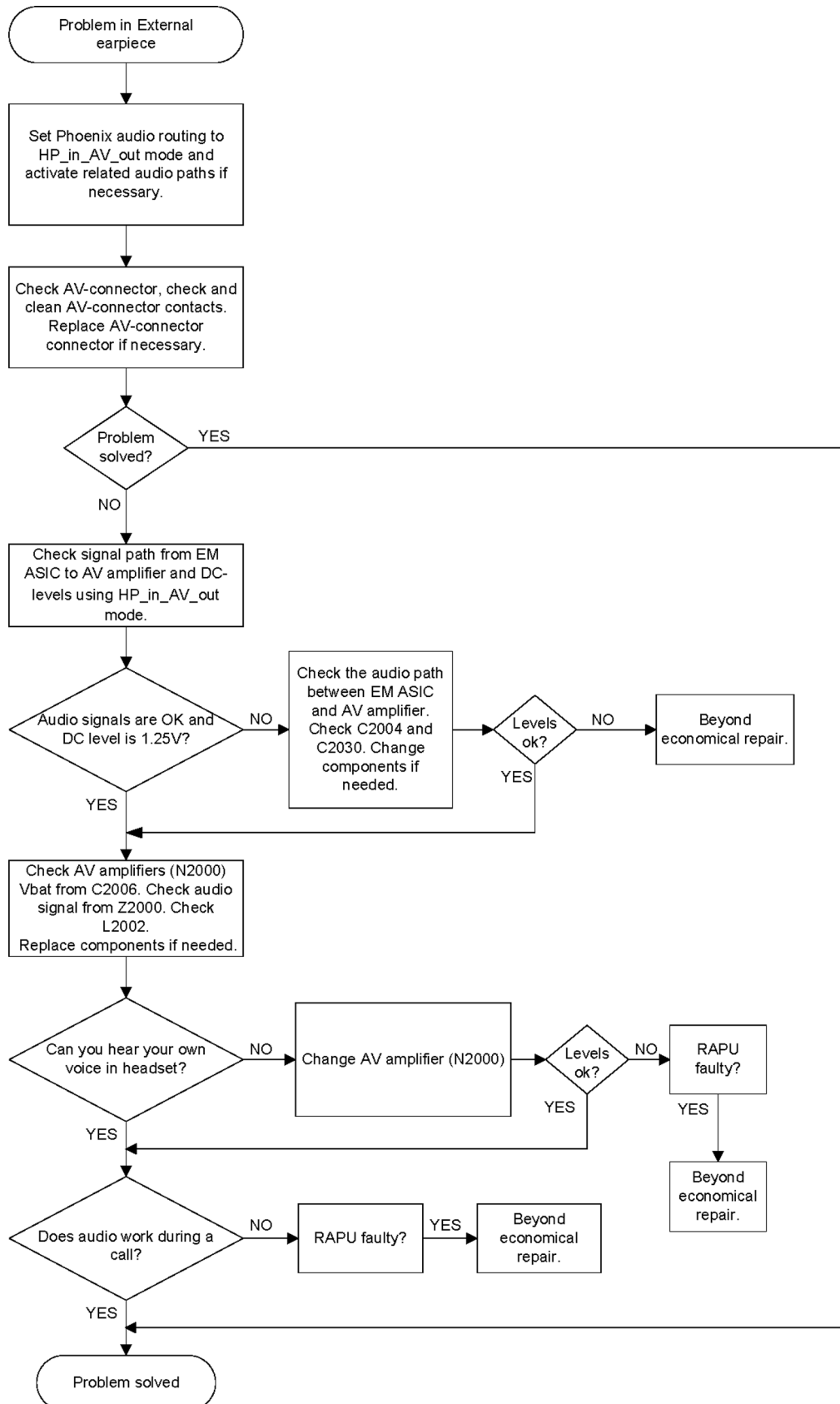
Internal handsfree (IHF) troubleshooting

Troubleshooting flow



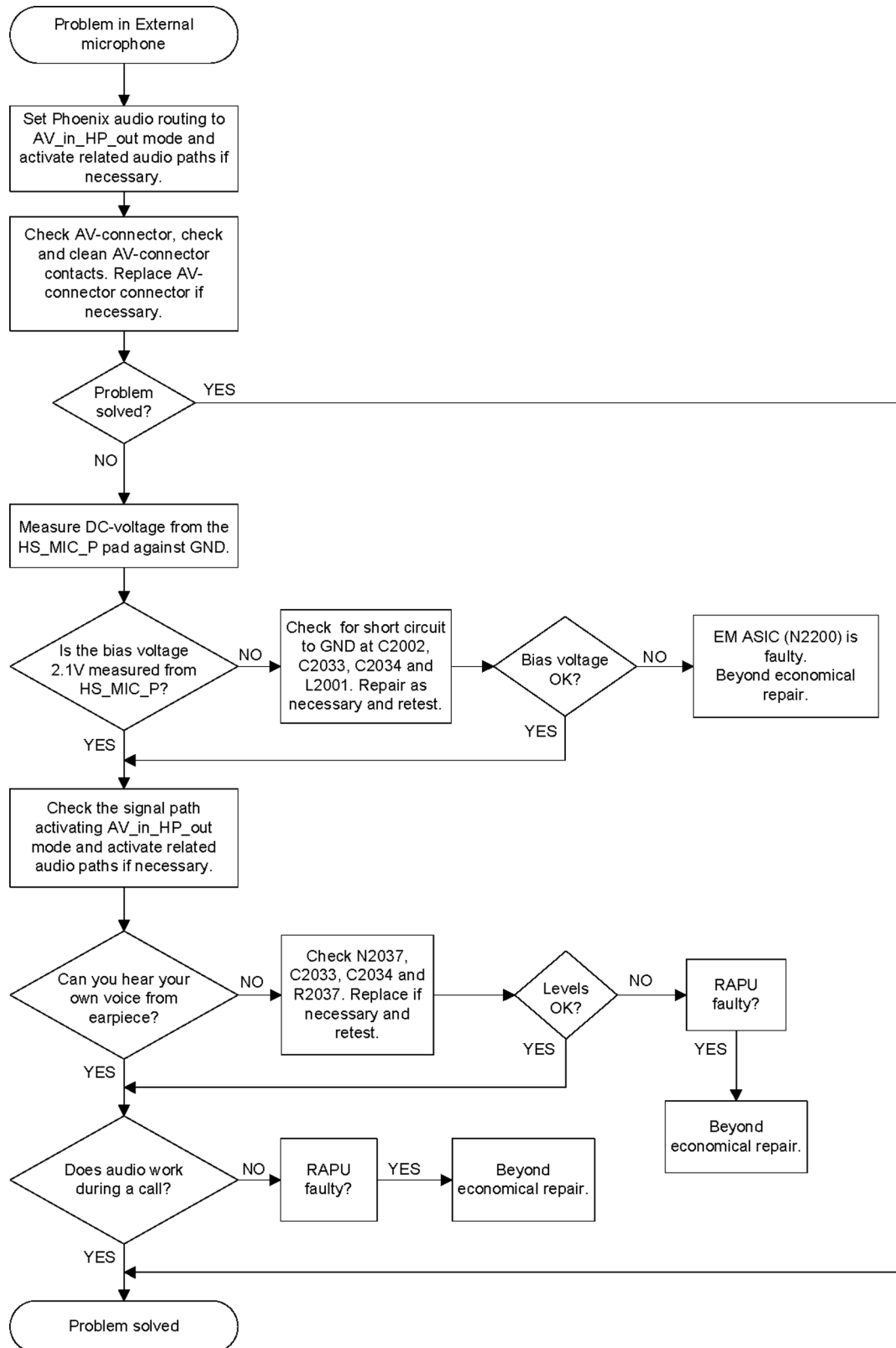
External earpiece troubleshooting

Troubleshooting flow



External microphone troubleshooting

Troubleshooting flow



Acoustics troubleshooting

Introduction to acoustics troubleshooting

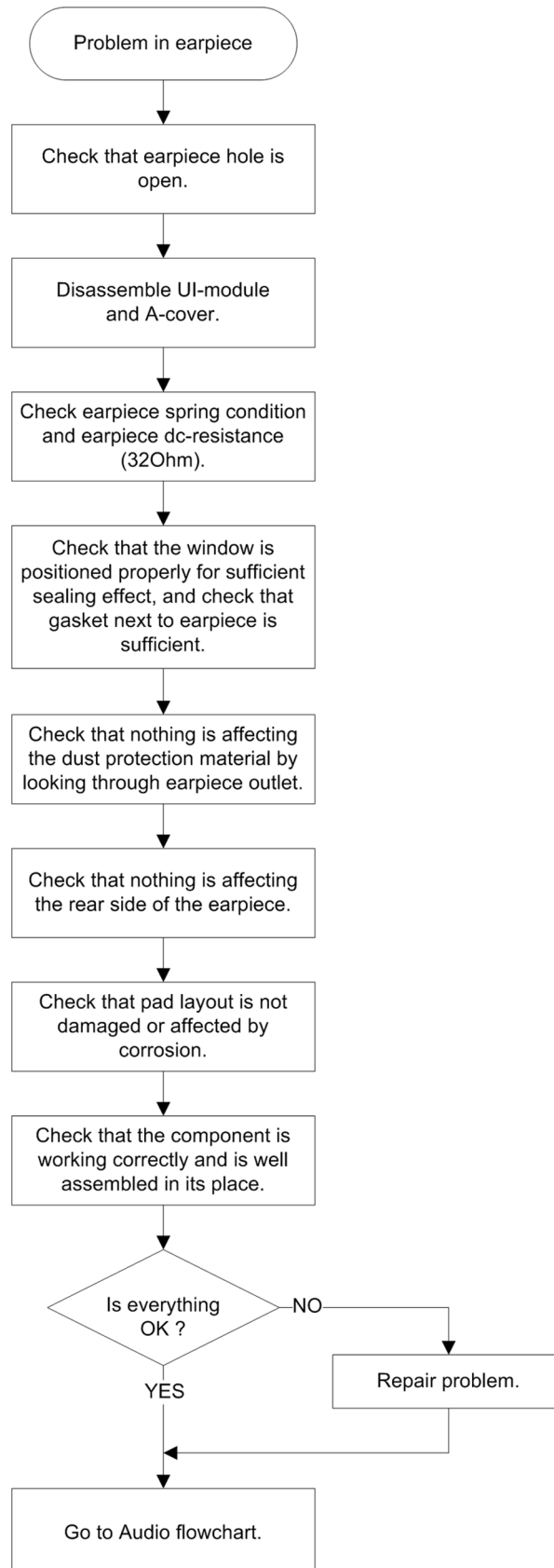
Acoustics design ensures that the sound is detected correctly with a microphone and properly radiated to the outside of the device by the speaker. The acoustics of the phone include three basic systems: earpiece, stereo integrated handsfree (IHF) and digital microphone.

The sound reproduced from the earpiece radiates through a single hole on the front cover (A-cover). The sound reproduced from the 2 IHF speakers radiates from the sound holes located on the bottom part of the back cover. The microphone is located on the top side of the PWB, and the sound hole is in the keyboard near the 0-key.

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

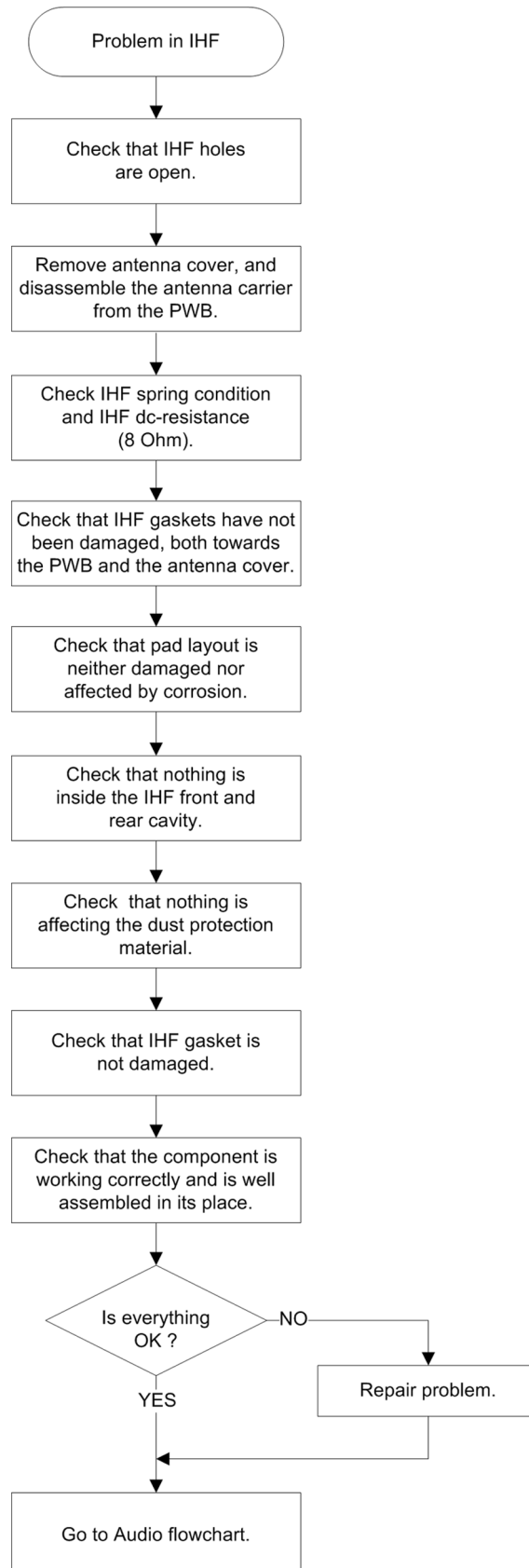
Earpiece troubleshooting

Troubleshooting flow



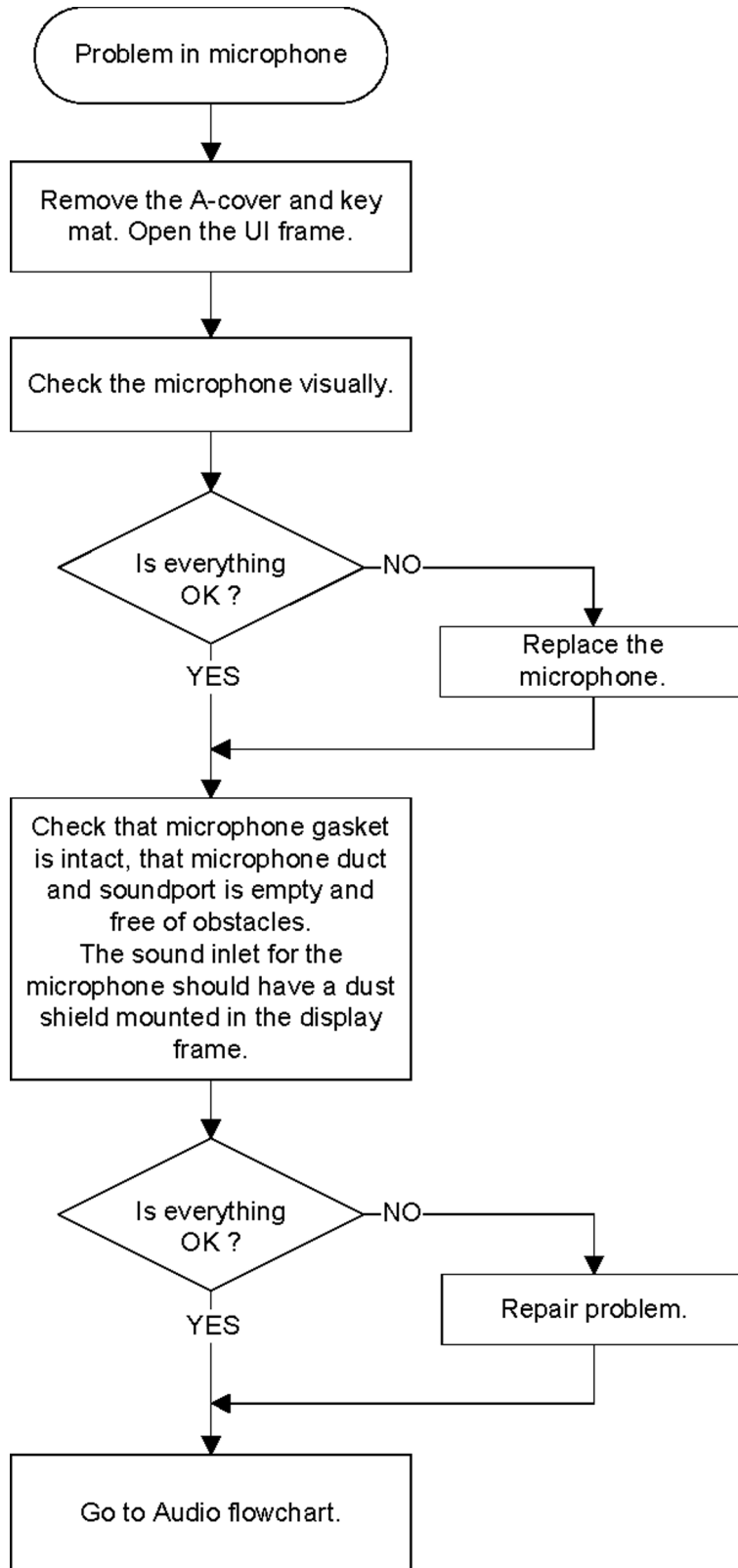
IHF troubleshooting

Troubleshooting flow



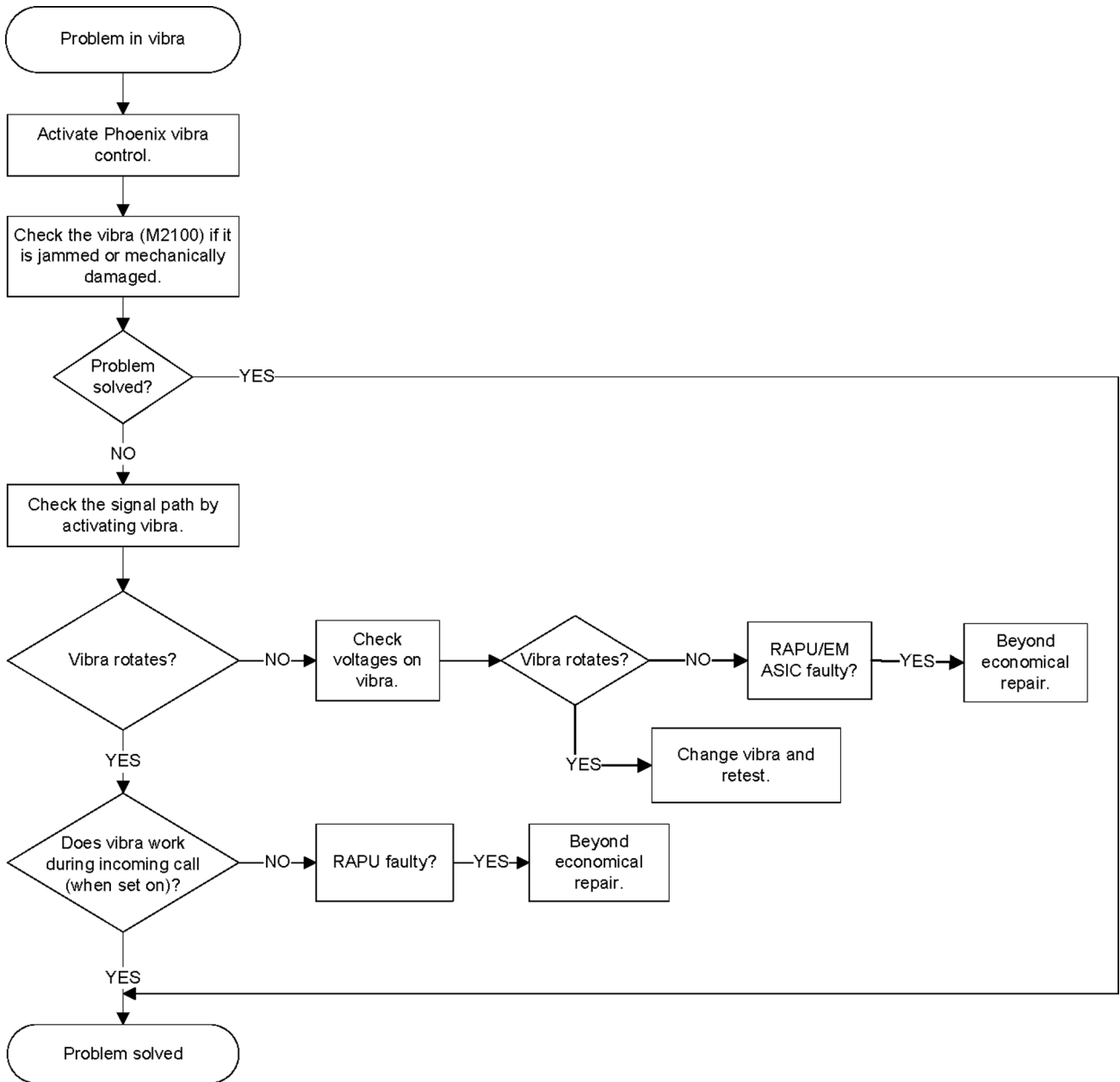
Microphone troubleshooting

Troubleshooting flow



Vibra troubleshooting

Troubleshooting flow



■ GPS troubleshooting

GPS antenna

The GPS antenna is located on the back side of the B-cover (left-hand side, upper corner).

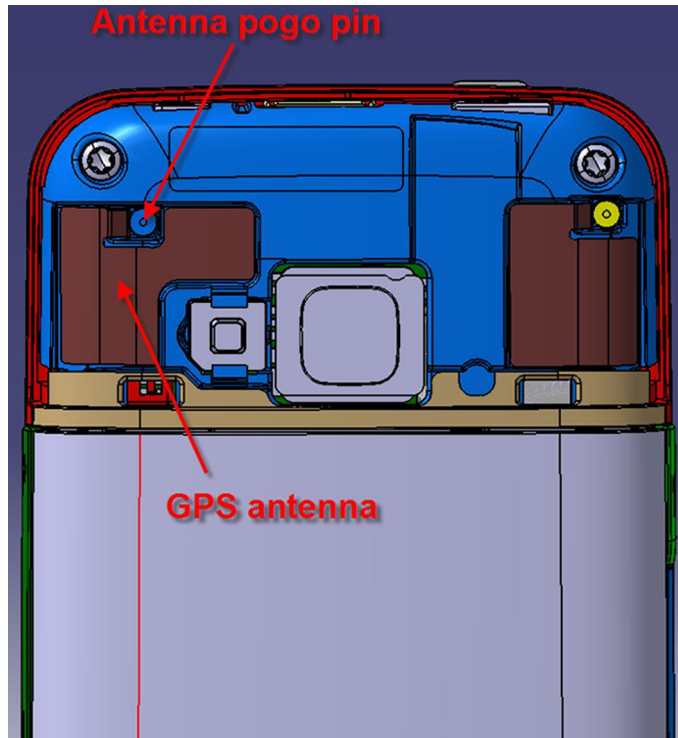


Figure 13 GPS antenna

GPS layout and basic test points

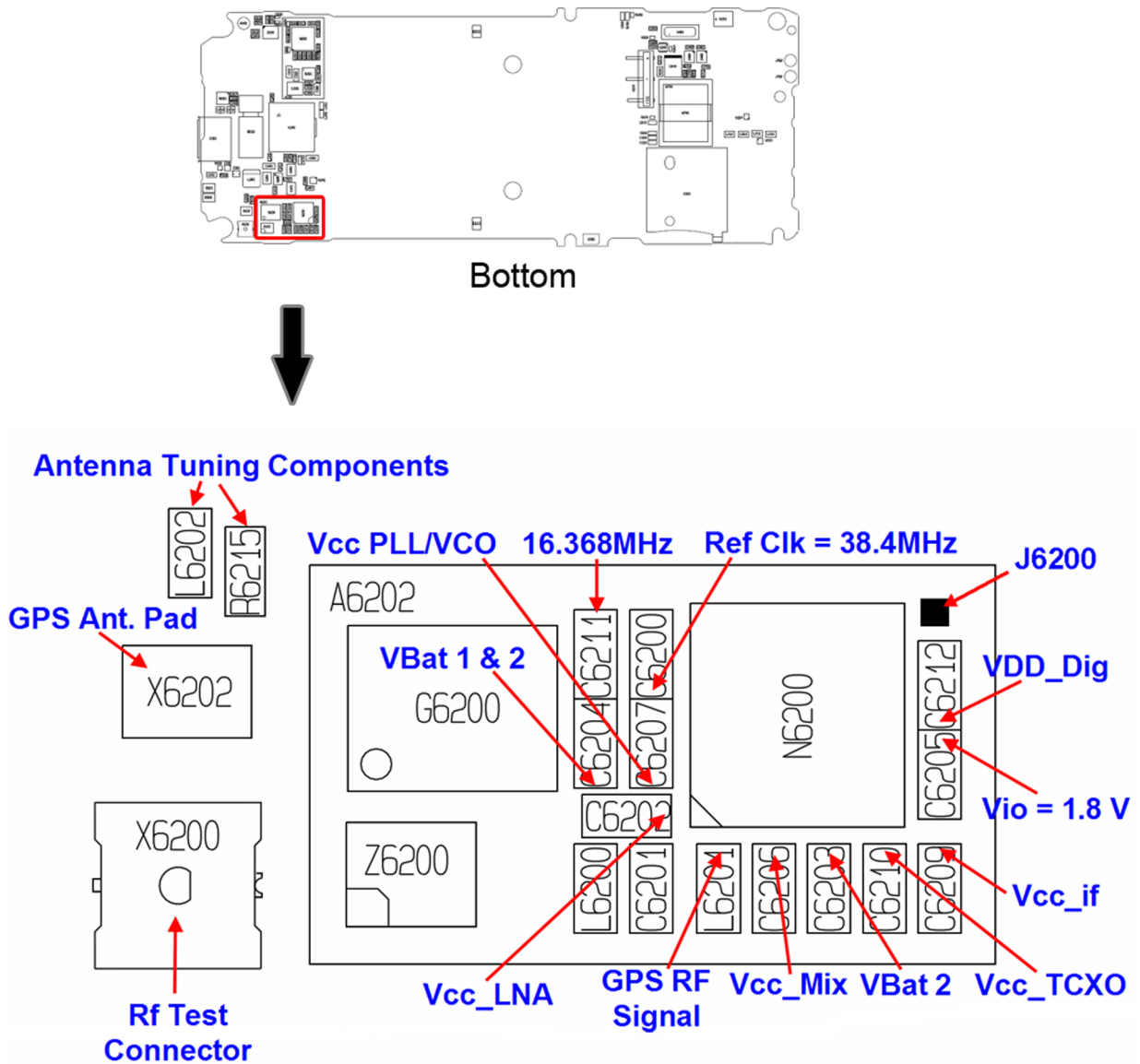


Figure 14 GPS layout and basic test points

VBat, ASIC internal LDO voltages, clocks and one test pad J6200 (activity on this pad indicates the GPS is operating) are available as shown in figure "GPS layout and basic test points" above.

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.

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

Select **Idle** to confirm the GPS is enabled and is in idle mode; at this point all clocks should be present, GPS_En_Reset should be high (1.8V), and Vdd_Dig (1.1V), Vcc_TCXO (2.5V) & Vcc_PLL/VCO (1.35V) should be present. Turning **Receiver Action On** will turn on all the RF sections of the ASIC and so all LDOs will be on.

Note: These checks are part of [GPS basic checks troubleshooting \(page 3-52\)](#) .

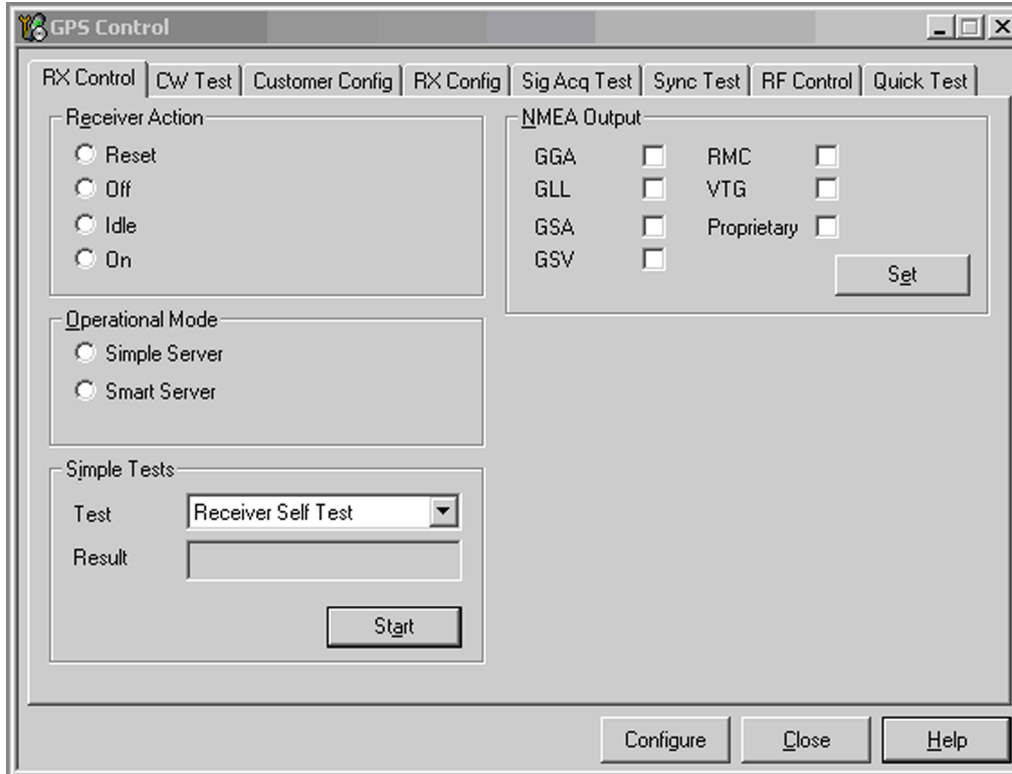


Figure 15 GPS Control dialog box

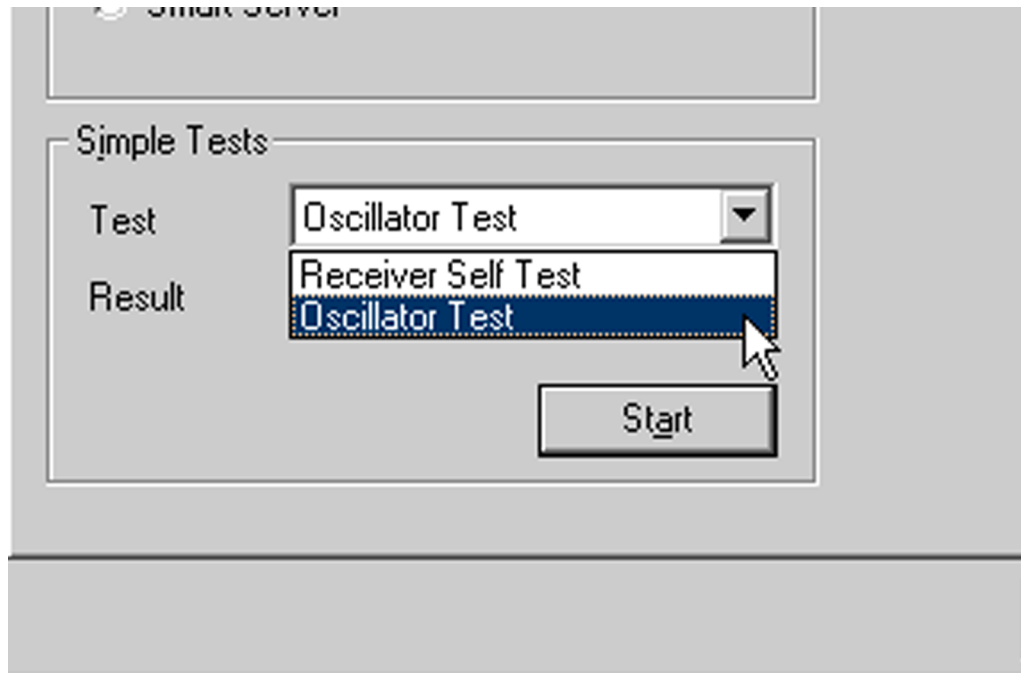


Figure 16 Simple Tests – Oscillator Test & Receiver Self Test

Oscillator test

Context

The 16.368 MHz GPS Clk is compared against the CE Ref Clk and the output is the GPS Clk offset.

Steps

1. Start Phoenix service software.
2. From the **Testing** menu, select **GPS Control**. This opens up *GPS Control* dialogue box and enables the GPS. In the *Rx Control* window, go to the **Simple Tests** section, select **Oscillator Test** and click **Start**. The Offset result will be returned and should be within the limits of +/- 84Hz.

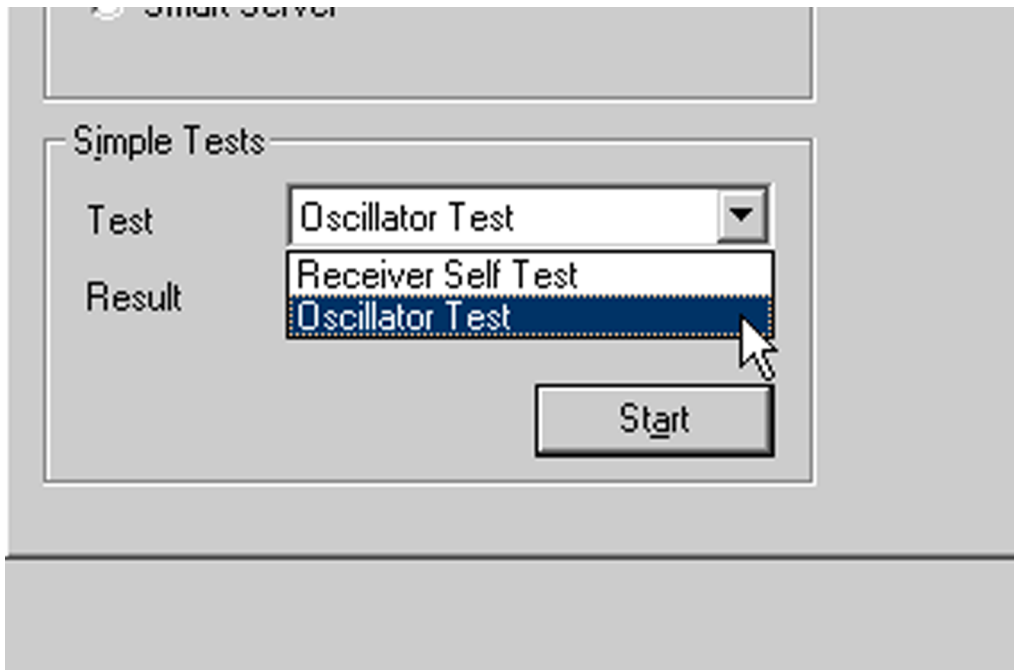


Figure 17 Simple Tests – Oscillator Test

Receiver self test

Context

Receiver self test can be used to check the correct functionality of the receiver core. For the test, GPS software configures internal test source to generate synthetic GPS-like data, processing it in the baseband and writing the results into the channel processor memory. The test compares the data in the channel memory against the expected value and reports a PASS/FAIL status.

Steps

1. Start Phoenix service software.
2. From the **Testing** menu, select **GPS Control**. This opens up *GPS Control* dialogue box and enables the GPS. In the *Rx Control* window, go to the **Simple Tests** section, select **Receiver Self Test** and click **Start**. The test returns a PASS/FAIL result.

Note: The Oscillator Test should not be run after the Receiver Self Test. This sequence of tests may cause the Oscillator test to prolong and result in Phoenix timing out. If you are carrying out both of these tests, run the Oscillator Test first, after which you can run the Receiver Self Test.

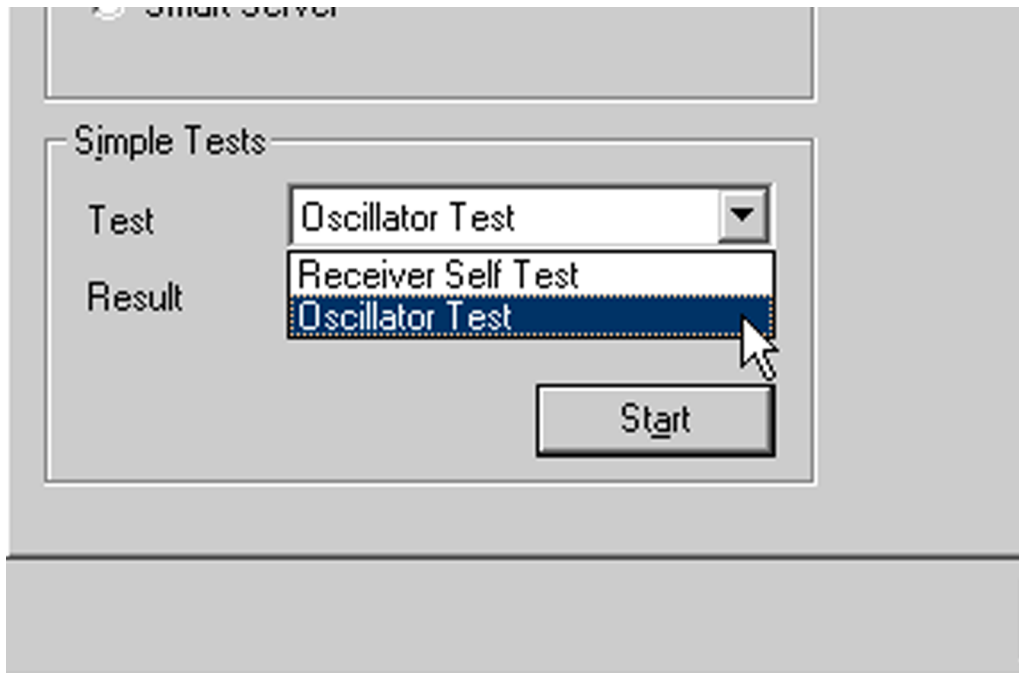


Figure 18 Simple Tests – Receiver Self Test

CW Test

Context

This test reports the SNR of a CW signal input to the GPS antenna port.

Steps

1. Start Phoenix service software.
2. From the **Testing** menu, select **GPS Control**. This opens up *GPS Control* dialogue box and enables the GPS.

In the *CW Test* window, ensure the input settings are as shown in the figure below. Inject 1575.52 MHz tone at the GPS antenna test connector at a level of -110dBm and click **Start**.

For Pin = -110dBm and negligible other losses, the expected result ranges are:

- Galvanic 29.8dB to 38.1dB
- Radiated 25.8dB to 38.1dB

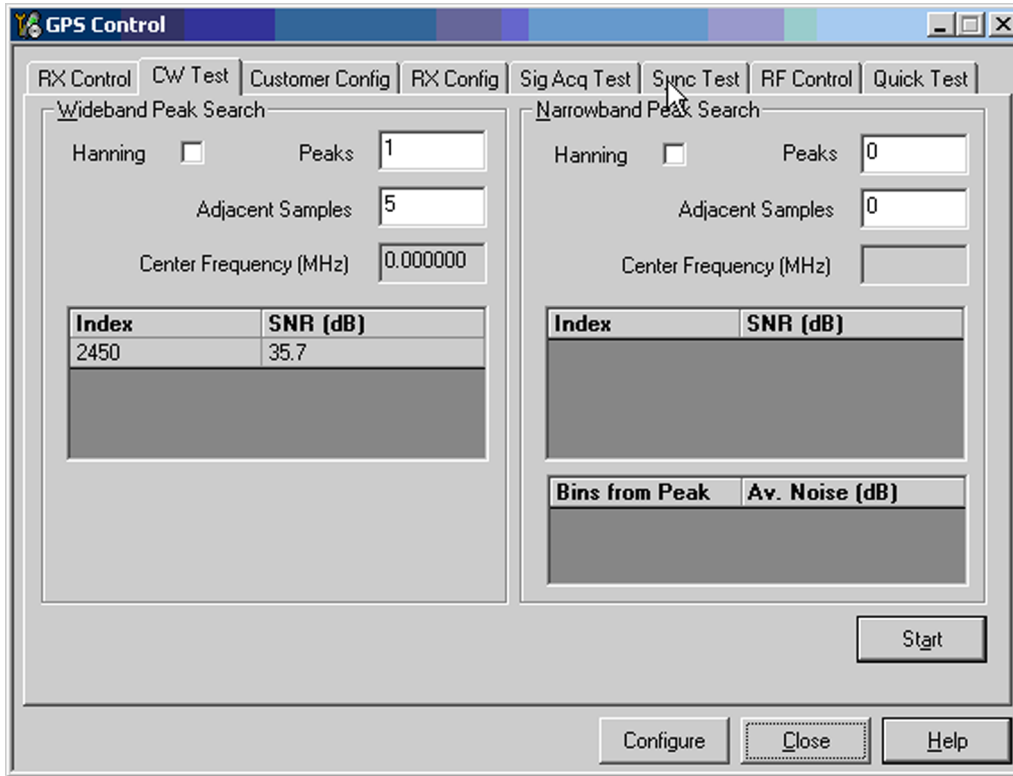


Figure 19 CW Test window

Quick Test window

Because the *Quick Test* runs the *Receiver Self Test* before the *Oscillator Test*, it may cause a timeout on the *Oscillator Test*. It does not necessarily mean that *Oscillator Test* has failed, but carrying out the [Oscillator Test \(page 3-47\)](#), [Receiver Self Test \(page 3-48\)](#) and [CW Test \(page 3-49\)](#) individually will give more valid results.

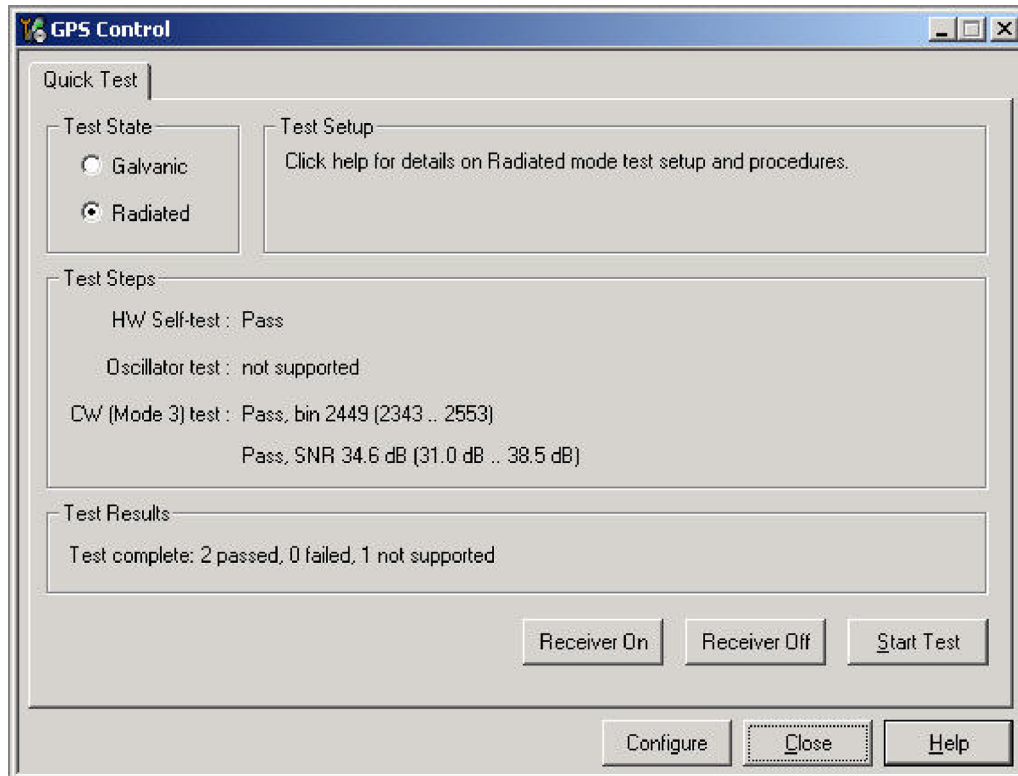


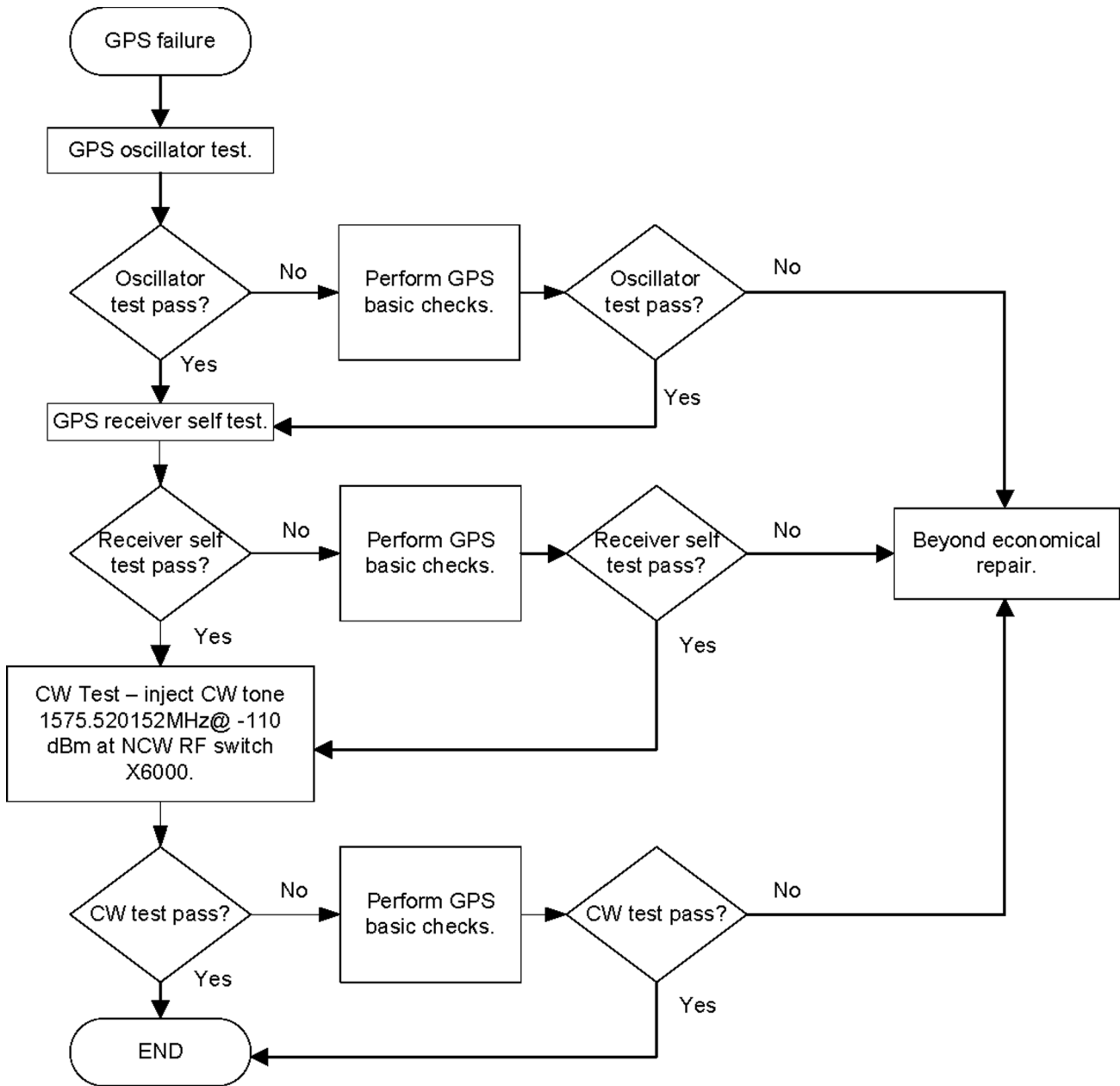
Figure 20 GPS Quick Test window for GPS troubleshooting

GPS failure troubleshooting

Context

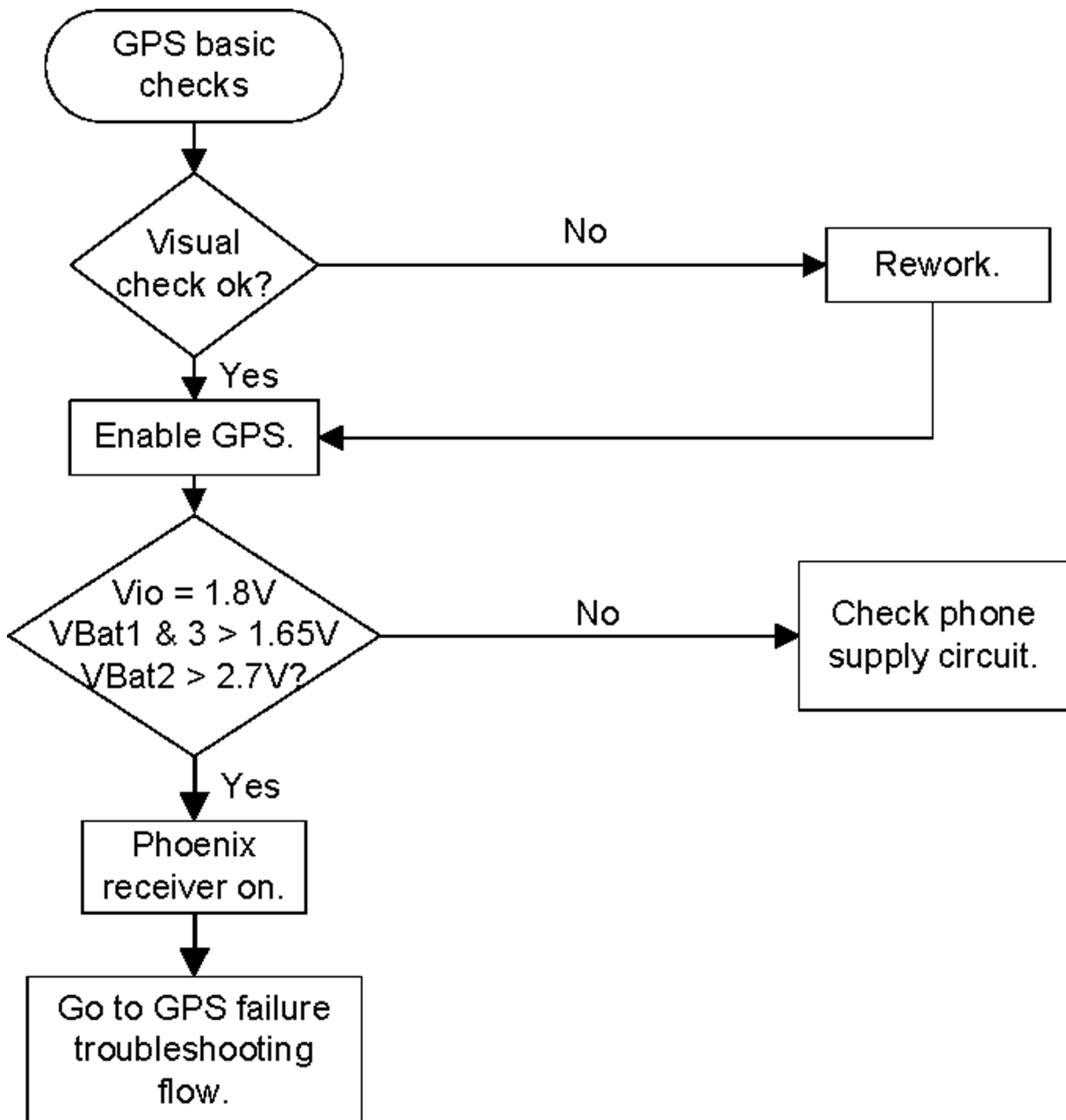
GPS troubleshooting is broken down into two parts: General GPS failure and GPS basic checks. The GPS failure troubleshooting flow can be followed and, where applicable, will feed into the basic checks troubleshooting flow.

Troubleshooting flow



GPS basic checks troubleshooting

Troubleshooting flow



■ Bluetooth and FM radio troubleshooting

Bluetooth and FM radio introduction

The Bluetooth and FM radio are combined in the same ASIC, so both features are checked when troubleshooting. The following problems can occur with the Bluetooth and FM radio hardware:

Symptom	Problem	Repair solution
Unable to switch on Bluetooth on phone user interface.	Open circuit solder joints or component failure of BTH/FM ASIC/module BB ASICs or SMD components.	Replacement of the engine.
Able to send data file to another Bluetooth device, but unable to hear audio through functional Bluetooth headset.	Open circuit solder joints or component failure of BTH/FM ASIC/module BB ASICs (PCM interface).	Replacement of the engine.
Able to turn on Bluetooth on phone user interface, but unable to detect other Bluetooth devices.	Open circuit solder joints or detached component in Bluetooth antenna circuit or Pogo Pin not making contact with C-cover.	Repair of the Bluetooth antenna circuit or replacement of the BT/GPS antenna (C-cover).
Able to turn on FM radio and Bluetooth on phone user interface, but unable to detect local FM radio stations with FM headset inserted.	Open circuit solder joints or detached component in FM antenna circuit.	Repair of the FM antenna circuit or replacement of the AV connector.
Able to perform scans to detect local FM radio stations with functional FM headset inserted, but unable to hear FM audio through headset.	Open circuit solder joints or detached component in FM audio path between Bluetooth/FM ASIC and headset.	Repair or replacement of the FM audio AV connector and circuits.

Bluetooth and FM radio component placement

The figure below shows the key component placement for BTHFMRDS2.2D in RM-645.

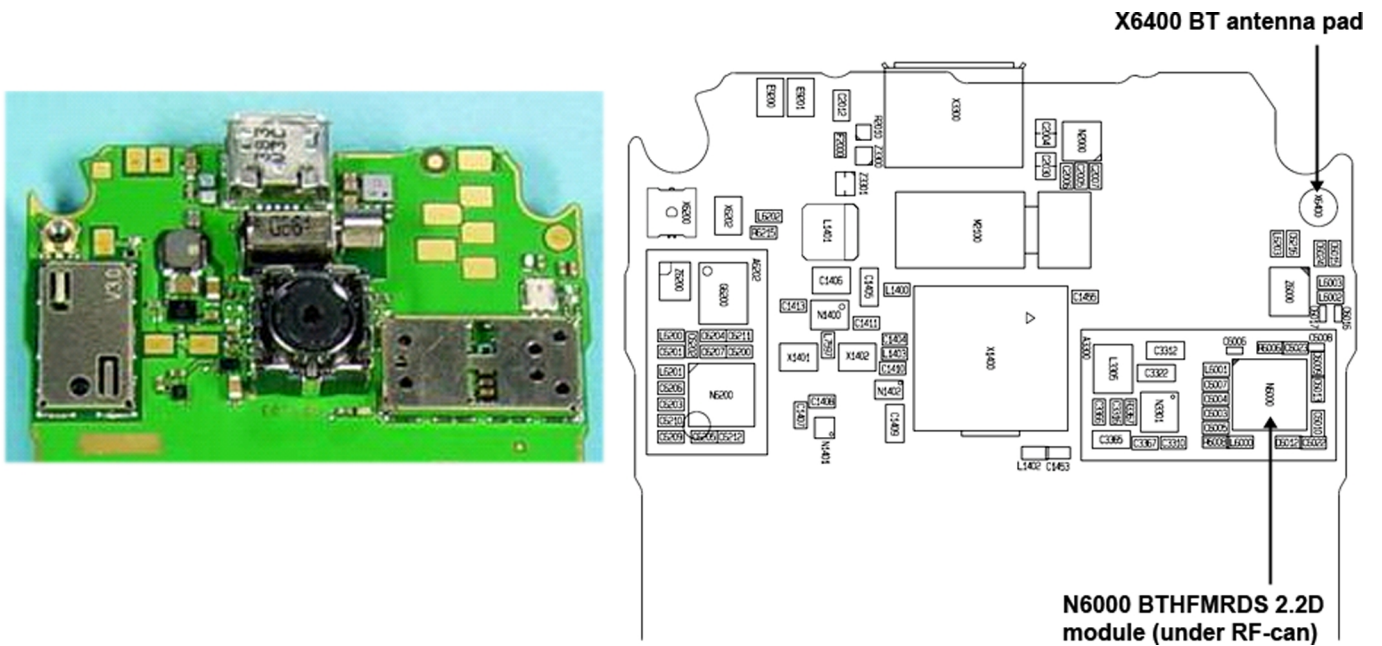


Figure 21 Key component placement for BTHFMRDS2.2D

The Bluetooth antenna element and the antenna pogo pin are attached to the B-cover, and the Bluetooth RF signal is routed through X front-end module.

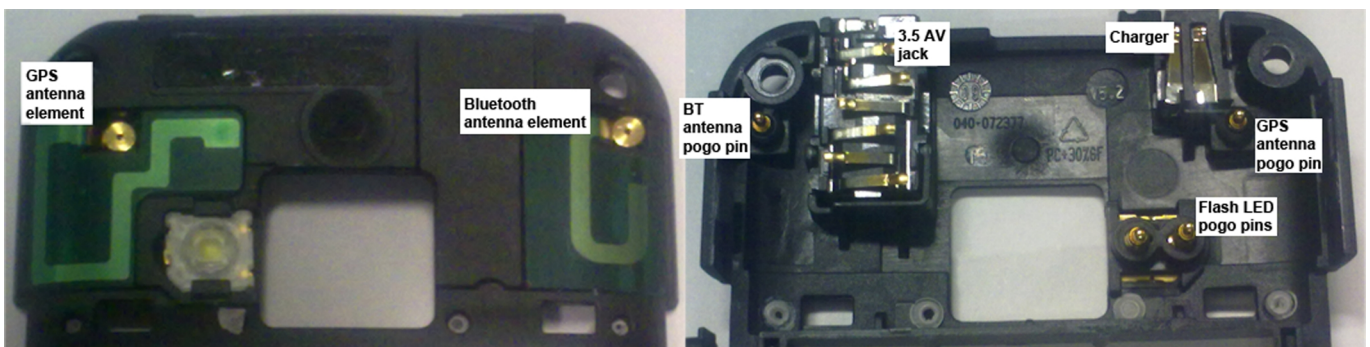


Figure 22 BT antenna

The FM radio audio signal is routed to the headset connector through the BB ASIC shared by the phone audio functions.

Bluetooth and FM Radio Self Tests

Context

A flash adapter (or phone data cable) connected to a PC with Phoenix service software is required.

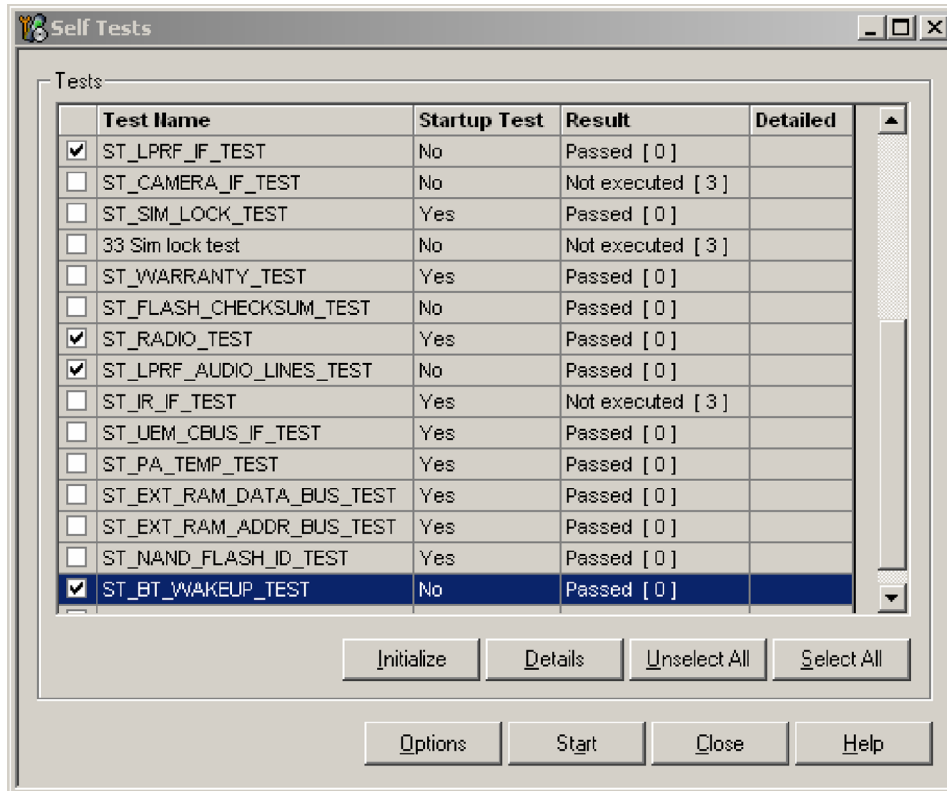
Steps

1. Place the phone in the flash adapter.
2. Start Phoenix service software.
3. Choose File → Scan Product.
4. From the Mode drop-down menu, set to Local.
5. Choose Testing → Self Tests.

6. In the Self Tests window check the following Bluetooth and FM Radio tests:

- ST_LPRF_IF_TEST
- ST_LPRF_AUDIO_LINES_TEST
- ST_BT_WAKEUP_TEST
- ST_RADIO_TEST

7. To run the test, click Start

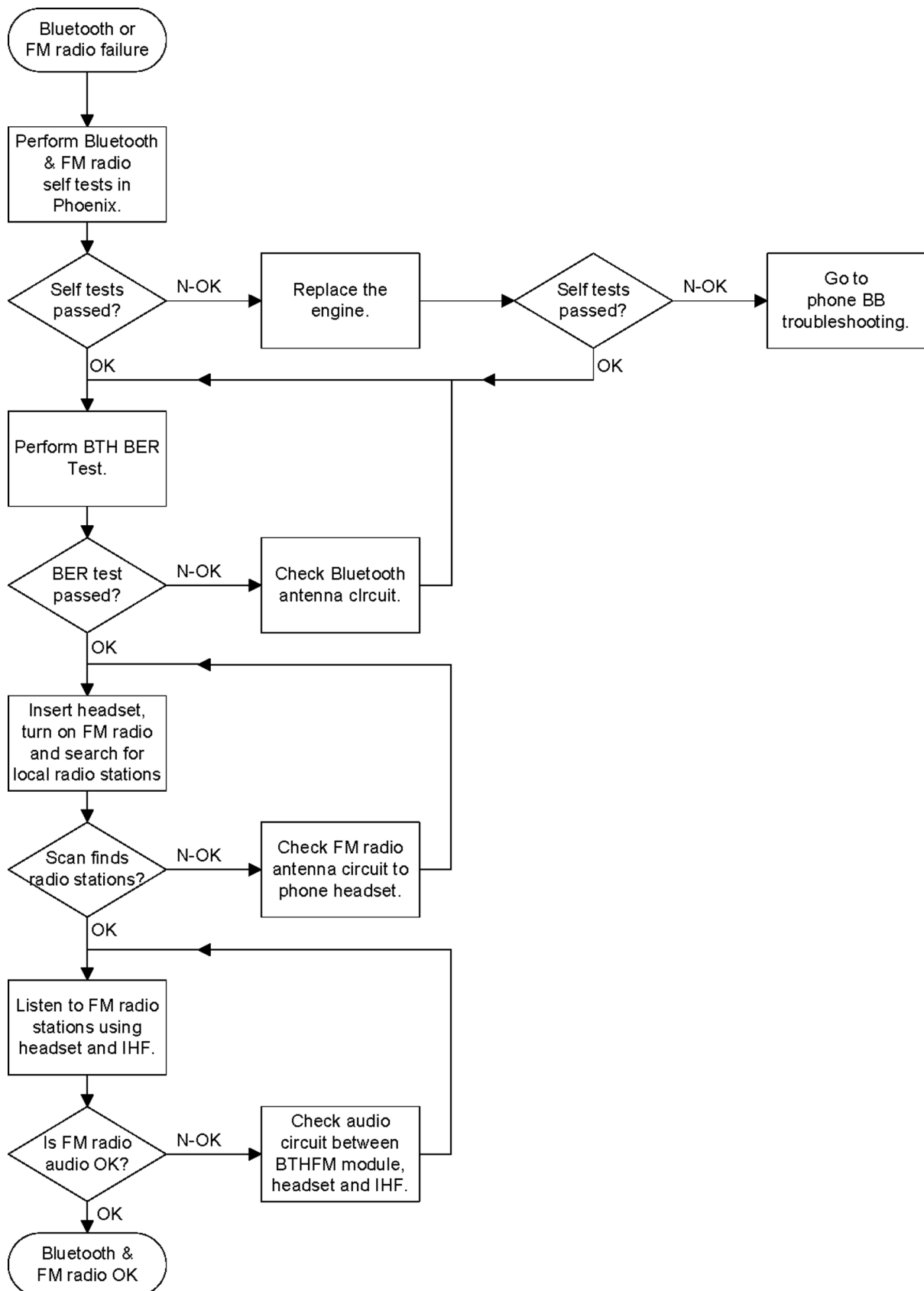


Bluetooth BER test

JBT-9 or SB-6 Bluetooth test box (BT box) is required to perform a BER test. If a BT box is not available, Bluetooth functionality can be checked by transferring a file to another Bluetooth phone.

Bluetooth and FM radio module troubleshooting

Troubleshooting flow



■ Baseband manual tuning guide

Certificate restoring for BB5 products

Context

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

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

The procedure for certificate restoring is the following:

- Flash the phone with the latest available software using FPS-20 or FPS-21.
 - Note:** USB flashing does not work for a dead BB5 phone.
- Create a request file.
- Send the file to Nokia by e-mail. Use the following addresses depending on your location:
 - APAC: sydney.service@nokia.com
 - CHINA: repair.ams@nokia.com
 - E&A: salo.repair@nokia.com
 - AMERICAS: fls1.usa@nokia.com
- When you receive a reply from Nokia, carry out certificate restoring.
- Tune the phone completely.
 - Note:** SX-4 smart card is needed.
- If the phone resets after certificate restoring, reflash the phone again.

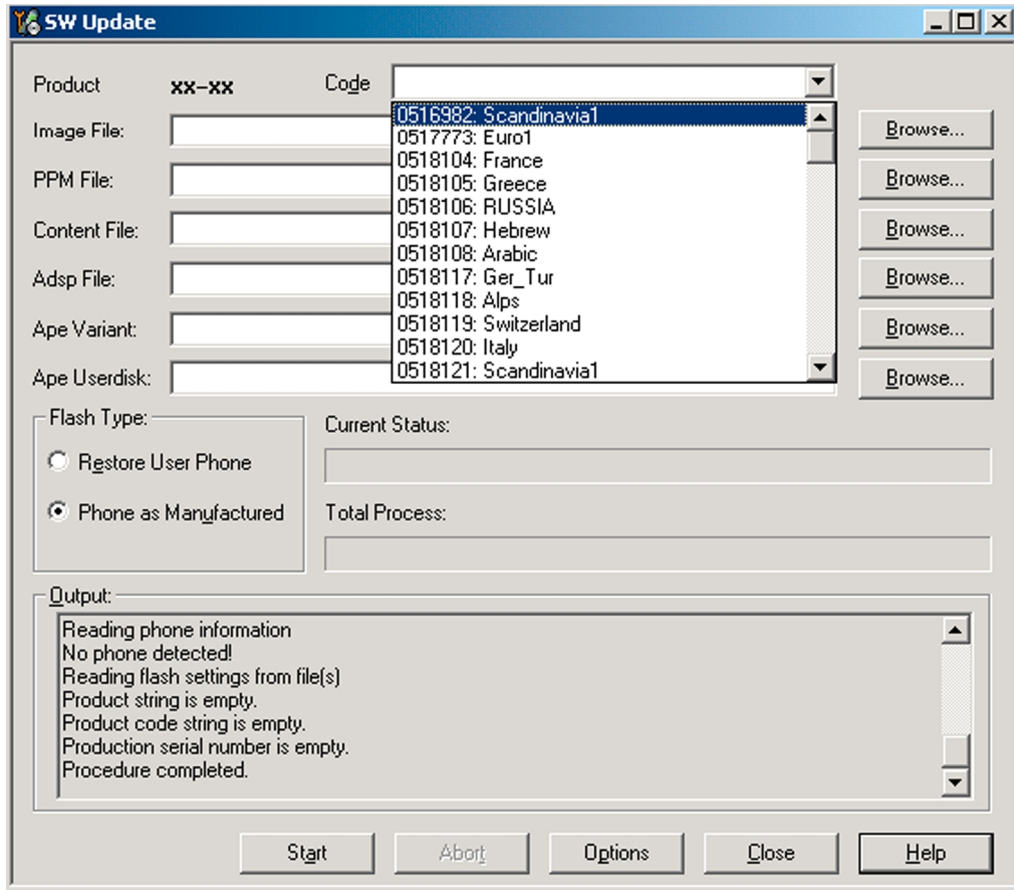
Required equipment and setup:

- *Phoenix* service software v 2008.34/38 or newer.
- The latest phone model specific *Phoenix* data package.
- Care dongle
- SX-4 smart card (Enables BB5 testing and tuning features)
- Activated FPS-20 flash prommer **OR** FPS-21 flash prommer
- Flash update package 08.30.012 or newer for FPS-20 or FPS-21 flash prommers
- CU-4 control unit
- USB cable from PC USB Port to CU-4 control unit
- Phone model specific adapter for CU-4 control unit
- PCS-1 cable to power CU-4 from external power supply
- Service cable between flash prommer and CU-4
 - Note:** CU-4 must be supplied with +12 V from an external power supply in all steps of certificate restoring.

Steps

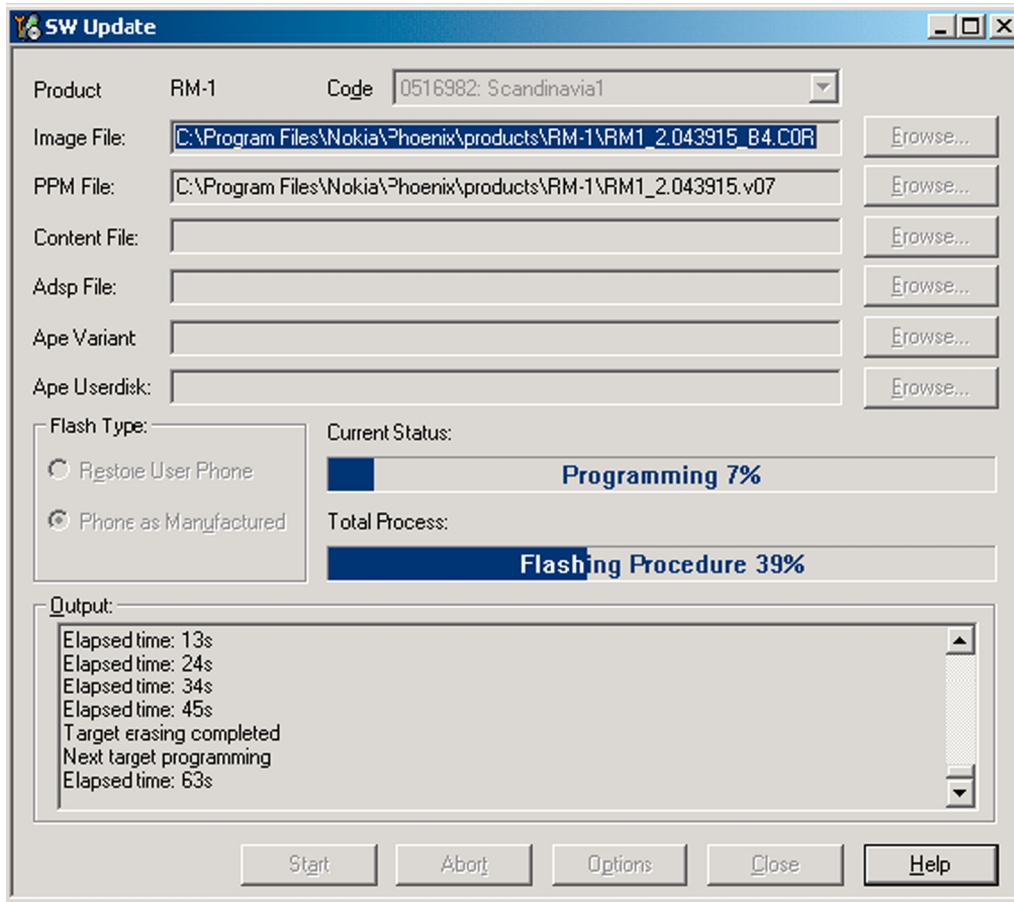
1. Program the phone software.
 - i Start *Phoenix* and login. Make sure the connection has been managed correctly for FPS-20 or FPS-21.
 - ii Update the phone MCU software to the latest available version.
 - If the new flash is empty and the phone cannot communicate with *Phoenix*, reflash the phone.

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



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

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



Programming is completed when Flashing Completed message is displayed.

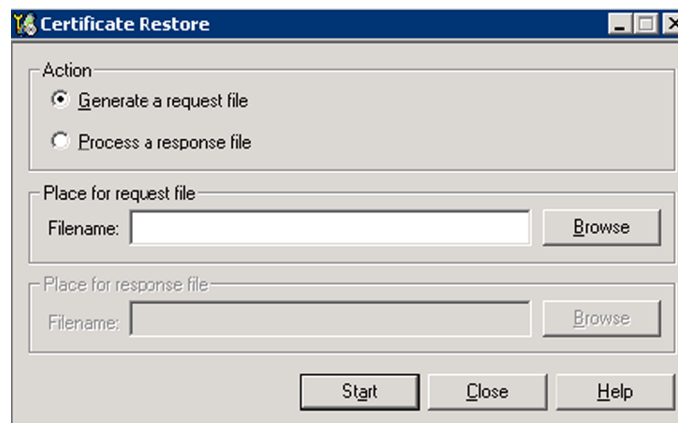
The product type designator and MCU SW version are displayed in the status bar.

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

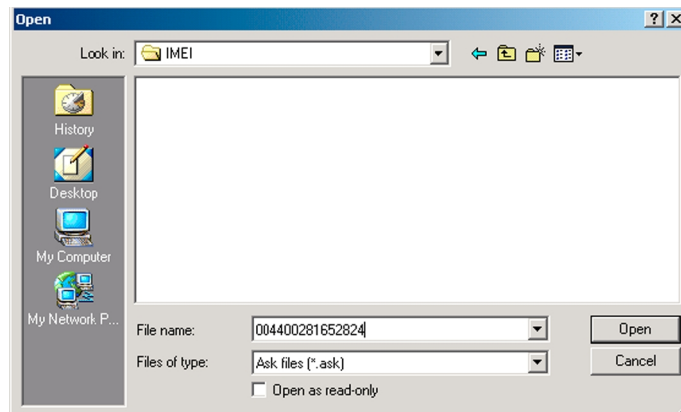
2. Create a *Request* file.

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

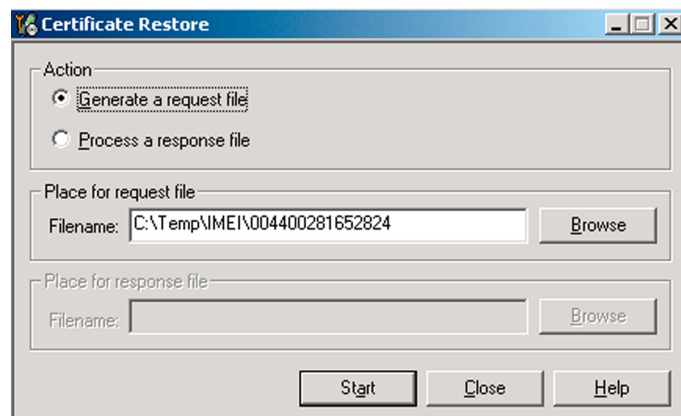
- i To connect the phone with *Phoenix*, choose **File** → **Scan Product** .
- ii Choose **Tools** → **Certificate Restore** .
- iii To choose a location for the request file, click **Browse**.



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

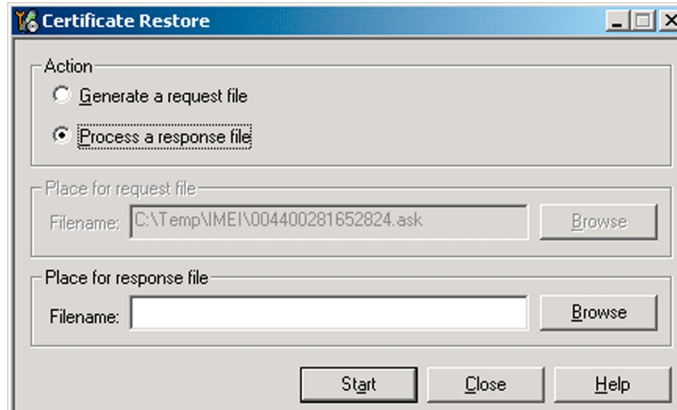


The name of the file and its location are shown.

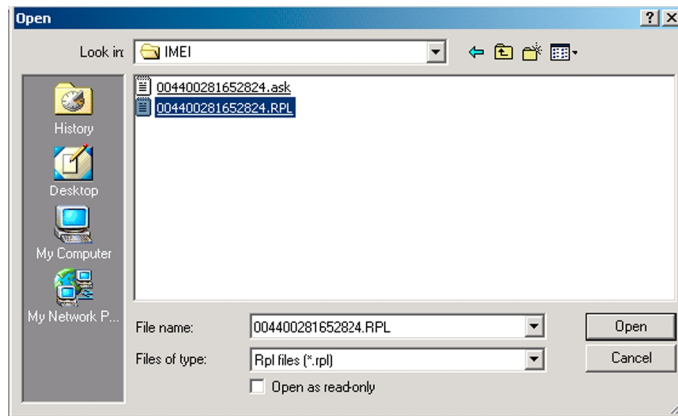


- v To create the *Request* file, click **Start**.
 - vi When the file for certificate restore has been created, send it to Nokia as an e-mail attachment.
3. Restore certificate.
- For this procedure, you must supply +12 V to CU-4 from an external power supply.
- i Save the reply file sent by Nokia to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

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

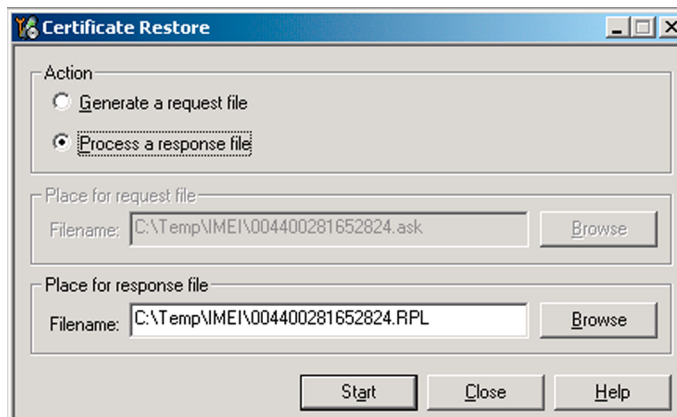


- v To choose the location where response file is saved, click **Browse**.
- vi Click **Open**.



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

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



Next actions

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

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

Energy management calibration

Prerequisites

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

Hardware setup:

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

Steps

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

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

8. Click **Calibrate**.

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

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

Table 9 Calibration value limits

Parameter	Min.	Max.
ADC Offset	-30	+40
ADC Gain	12000	14000
BSI Gain	1100	1350
VBAT Offset	2635	2755
VBAT Gain	14900	15900
VCHAR Gain	N/A	N/A
IBAT (ICal) Gain	9000	11000

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:

- VAP AUS RFIC (N7500)
- TX FEM (N7520)
- WCDMA PA (N7540)
- Aura DC/DC converter (N7560)

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:

- Module jig MJ-276
- Flash adapter FS-150
- Control unit CU-4/Interface adapter SS-46
- An oscilloscope for low frequency and DC measurements. Recommended probe: 10:1, 10M Ω /8pF.
- A radio communication tester including RF generator and spectrum analyser, for example Rohde & Schwarz CMU200. (Alternatively a spectrum analyser and a RF generator can be used. However, 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 it is possible to perform the measurement in a good RF-shielded room). Even low power WCDMA transmitters may disturb nearby WCDMA networks and cause problems to 3G cellular phone communication in a wide area.

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

Level of repair

The scope of this guideline is to verify functionality of the cellular RF block.

RF key components

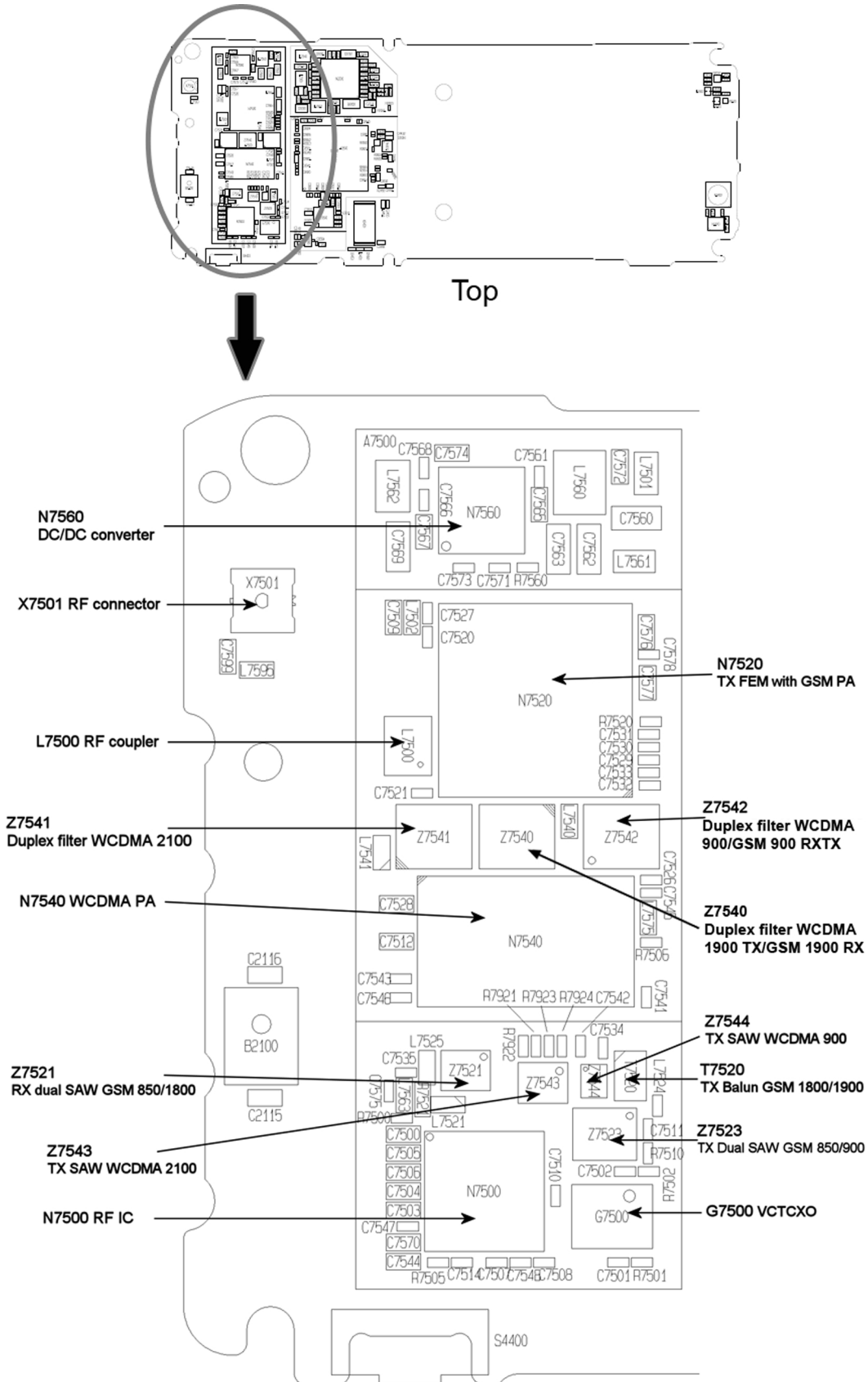


Figure 23 RF key components

■ Auto tuning

Introduction to auto tuning

This phone can be tuned automatically.

Auto tune 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
- PK-1 service dongle
- Power supply
- Product specific module jig
- Cables: RF cable XRS-6, USB cable, GPIB cable and MBUS cable DAU-9S
- Signal analyser (TX), signal generator (RX) and RF-splitter or one device including all.

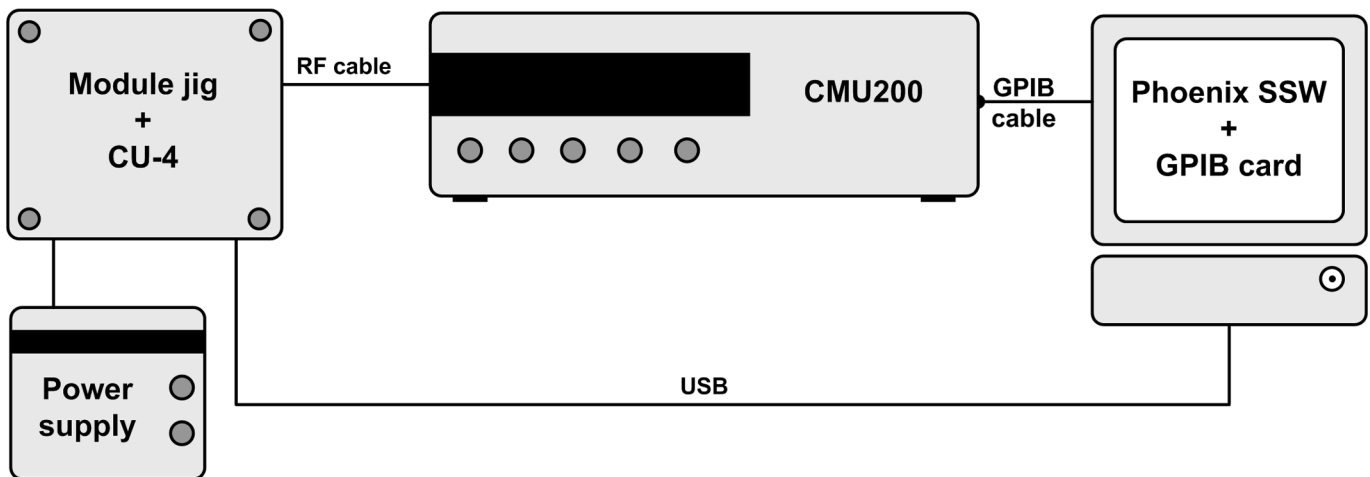


Figure 24 Auto tuning concept with CMU200

Auto tuning procedure

Prerequisites

Install the phone-specific data package, e.g. *Nokia_firmware_RM_645_Europe_0.11.10_v1.00.exe*.

The data package defines the phone-specific settings and it supports the non-signaling tests (RF FINUI Tests).

Note: The External Phoenix version must be 2008.34.10.36039 or newer.

Steps

1. Make sure the phone (in the jig) is connected to the equipment. Else, some menus will not be shown in Phoenix.
2. Go to loss settings by selecting **Tuning (Alt_U) → SET LOSS** from the menu.
3. Set the loss between CMU200 and the phone. (Total loss = cable + jig)
4. Go to auto tuning by selecting **Tuning (Alt_U) → Auto-tune (Alt_A)** from the menu.
5. Start auto tuning by clicking the **Tune** button.

■ Self test troubleshooting

Phoenix self test troubleshooting

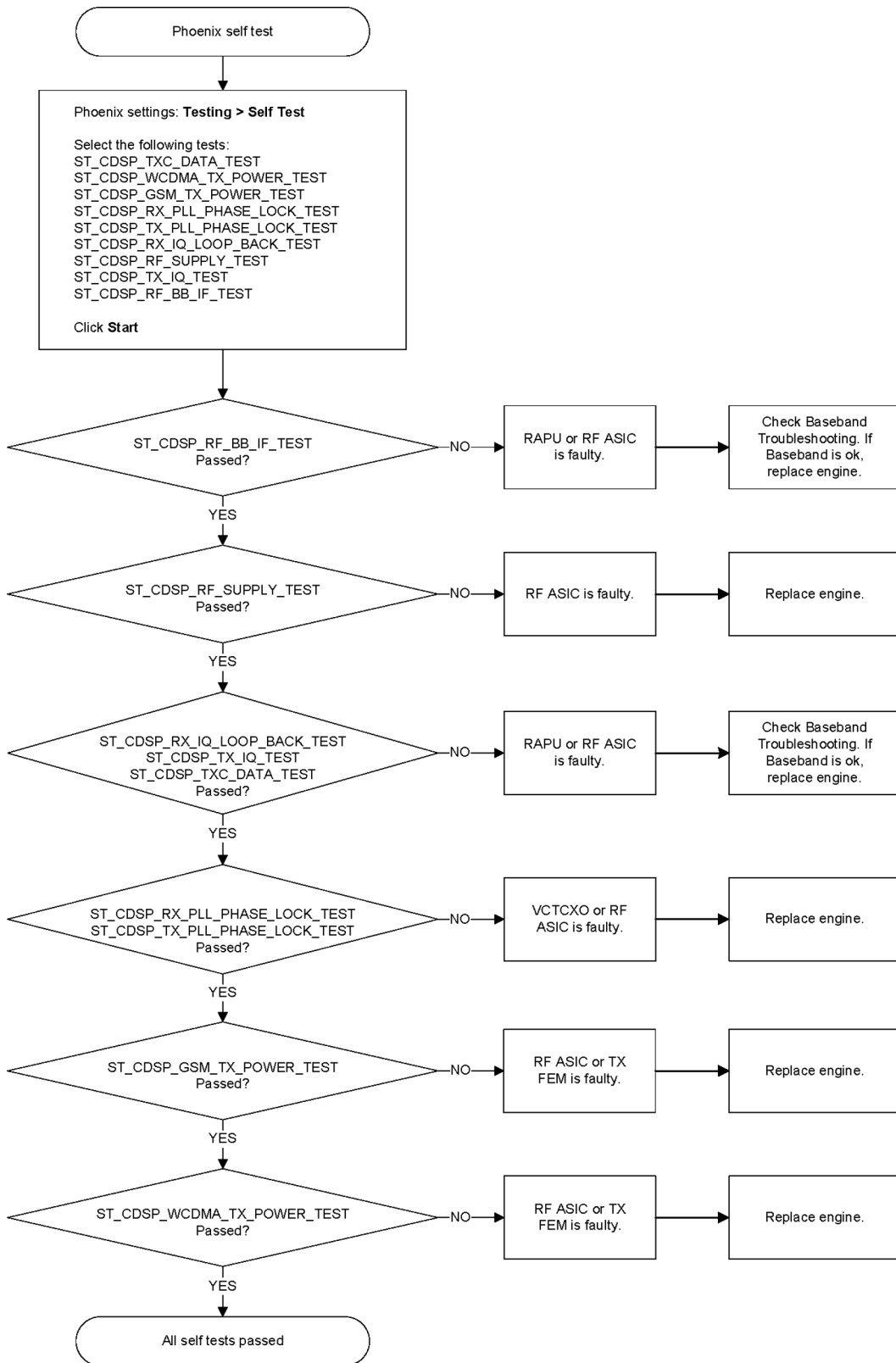
Context

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

If the phone is dead and you cannot perform the self tests, go to *Dead or jammed device troubleshooting* in chapter 3, BB Troubleshooting and Manual Tuning Guide.

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

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 section [GSM RX chain activation for manual measurements/GSM RSSI measurement \(page 4–10\)](#) . For a similar test in WCDMA mode, see section [WCDMA RSSI measurement \(page 4–13\)](#) .

GSM RX chain activation for manual measurements/GSM RSSI measurement

Prerequisites

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

Setting	GSM850	GSM900	GSM1800	GSM1900
Phoenix Channel	190	37	700	661
Signal generator to antenna connector	881.66771MHz (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 by selecting **Testing** → **GSM** → **RSSI reading** .

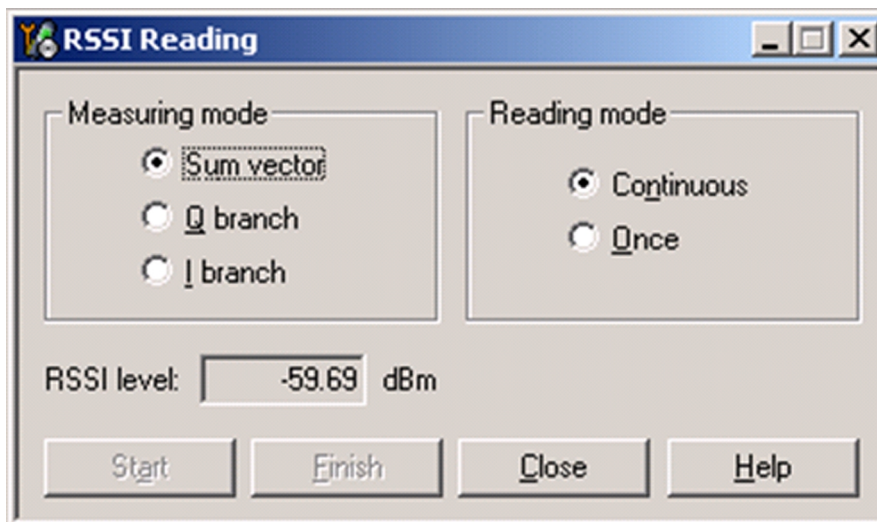


Figure 25 Phoenix RSSI Reading window

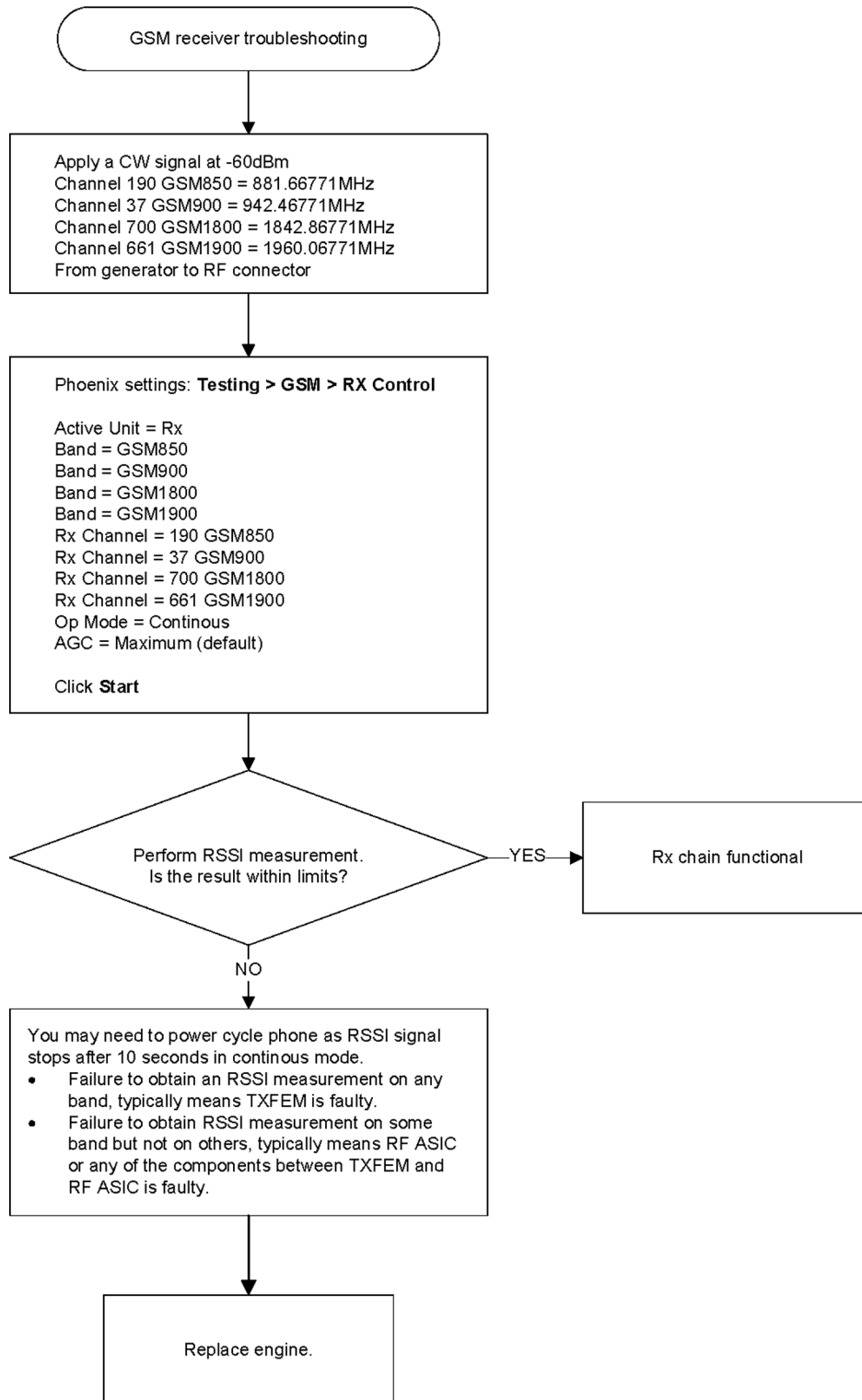
Results

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

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

GSM receiver troubleshooting flowchart

Troubleshooting flow



WCDMA RX chain activation for manual measurement

Steps

1. In Phoenix, select **Testing** → **WCDMA** → **Rx Control** . The Phoenix Rx Control window opens.

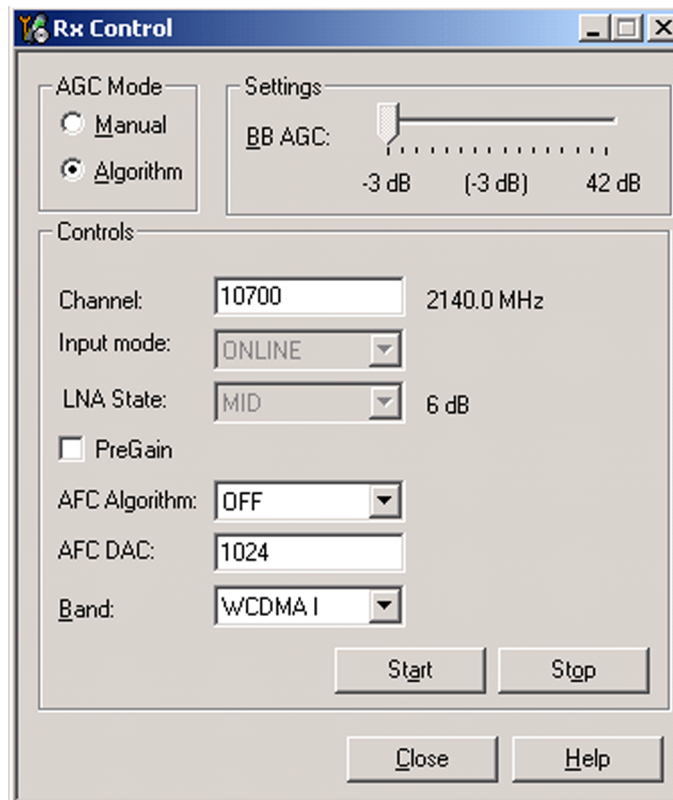


Figure 26 Phoenix Rx Control window with sample settings (WCDMA band I)

2. Make settings for the band to be tested according to the following table:

Band to be tested	Phoenix Channel	Signal generator to antenna connector
WCDMA I	10700	2141.0MHz
WCDMA VIII	3013	943.6MHz

3. Make the following general settings (the same values for all bands):

Setting	Value
AGC Mode	Algorithm
AFC Algorithm	OFF
AFC DAC	1024

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

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

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

WCDMA RSSI measurement

Prerequisites

WCDMA RX must be activated before RSSI can be measured. For instructions, please refer to [WCDMA RX chain activation for manual measurement \(page 4-12\)](#).

Connect signal generator to RF connector and use appropriate frequency for each channel.

Steps

1. In Phoenix select **Testing** → **WCDMA** → **RX Power measurement**. The Rx Power Measurement window opens.

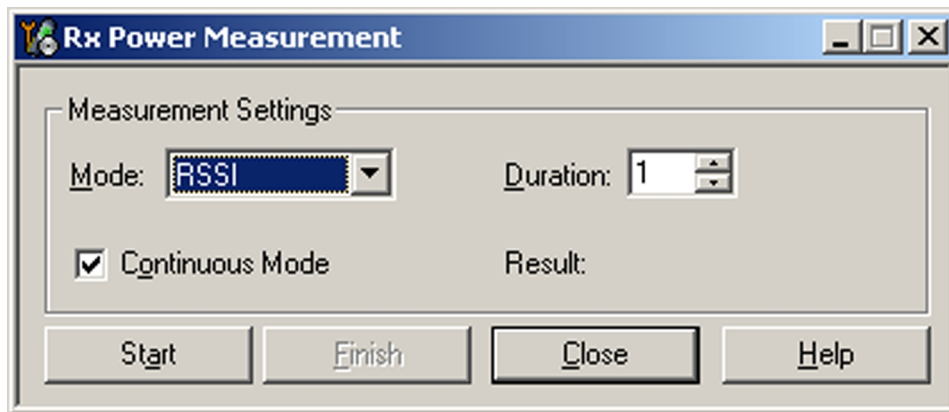


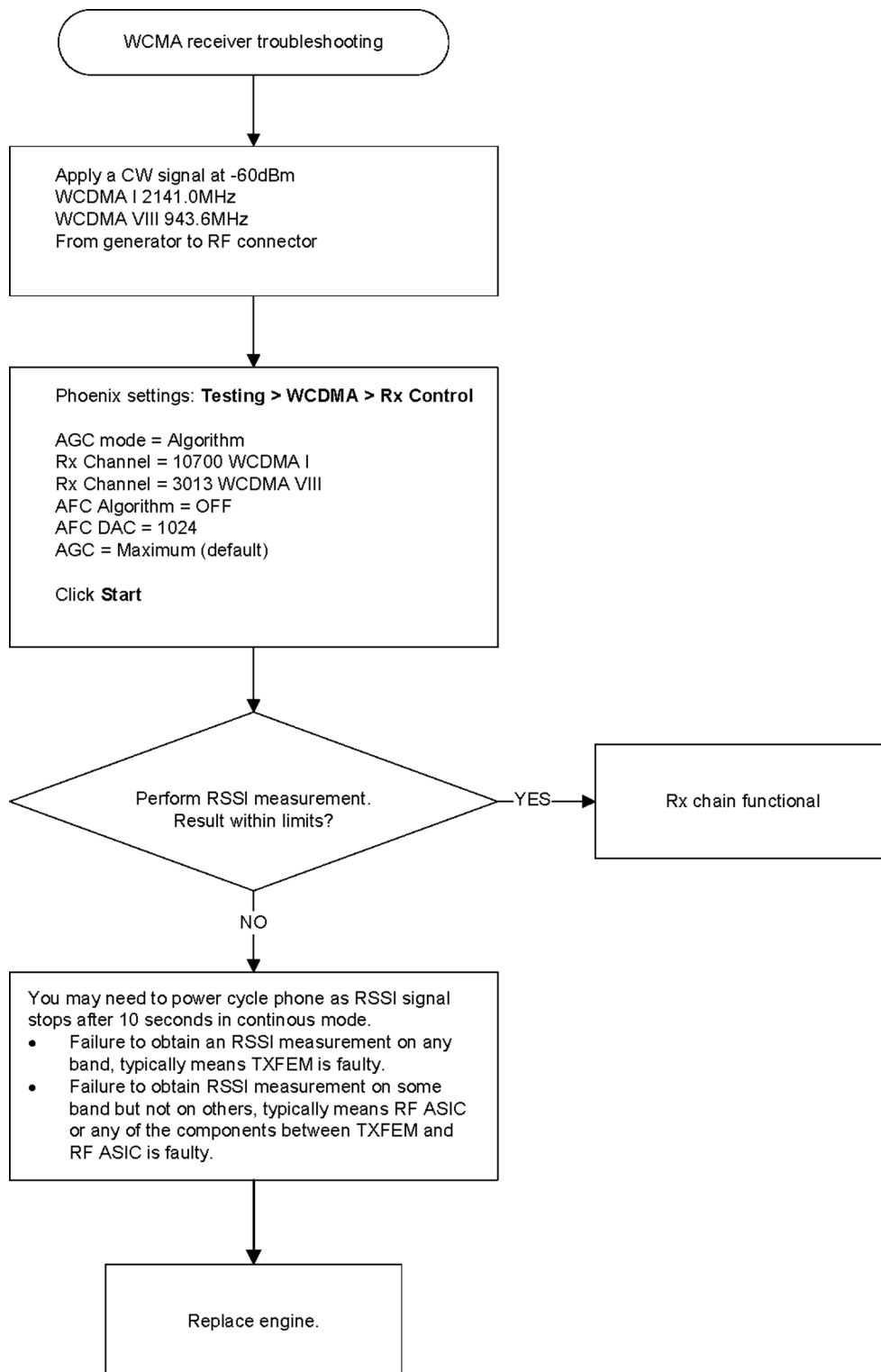
Figure 27 Phoenix Rx Power Measurement window

2. In the RX Power measurement window, select:
 - Mode: RSSI
 - Continuous mode
3. Click **Start** to perform the measurement.

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

WCDMA receiver troubleshooting flowchart

Troubleshooting flow



■ Transmitter troubleshooting

Introduction to 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 Control"; 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 50Ω load to the RF connector (antenna, RF-measurement equipment or at least a 2W 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. In Phoenix, select **Testing** → **GSM** → **Rf Controls** . The RF Controls window opens.

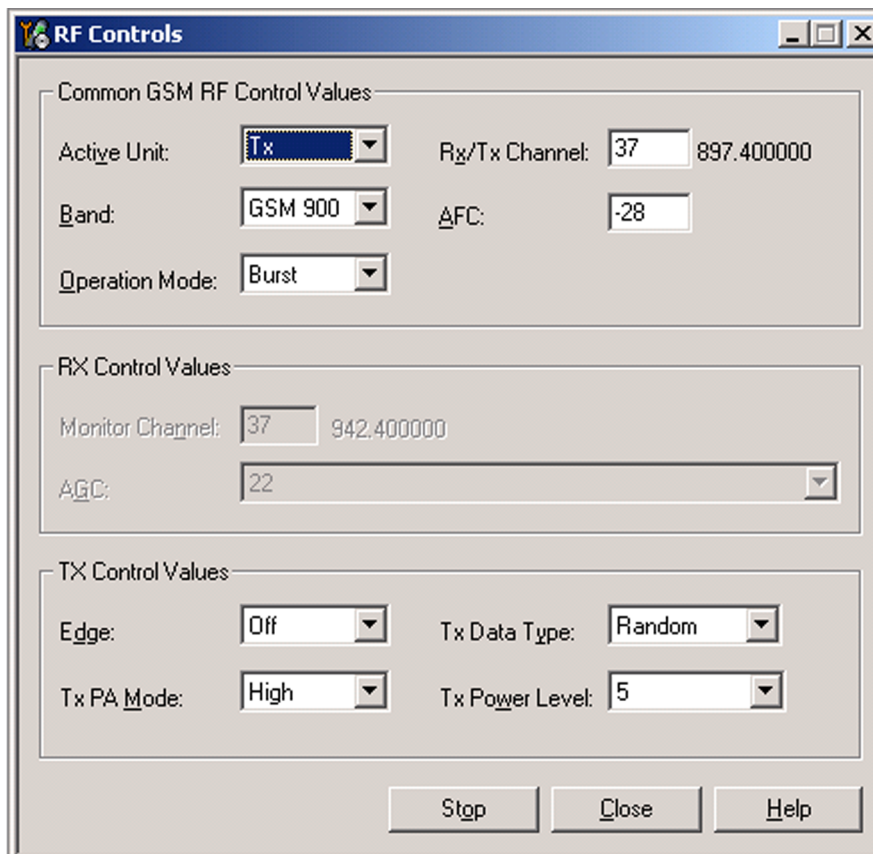


Figure 28 Phoenix RF Controls window

3. Make the following settings:

Setting	Value
Active Unit	Tx
Rx/Tx Channel	37
Band	GSM 900
AFC	-28
Operation Mode	Burst
Edge	Off
Tx Data Type	Random
Tx PA Mode	High
Tx Power Level	5

4. Check the basic TX parameters, using a communication analyser (e.g. CMU200).
- Power
 - Phase error
 - Modulation
 - Switching spectrum

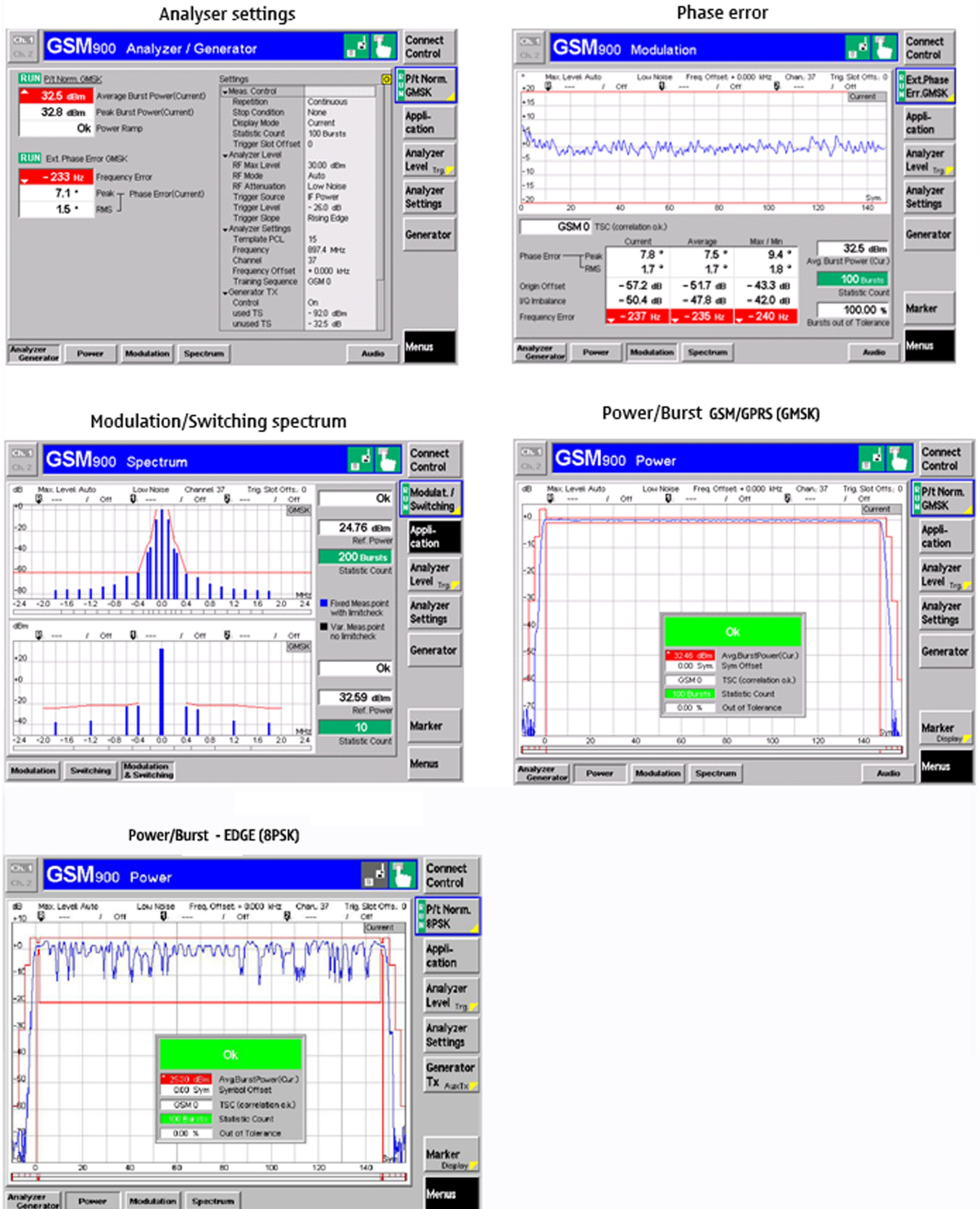


Figure 29 Typical readings

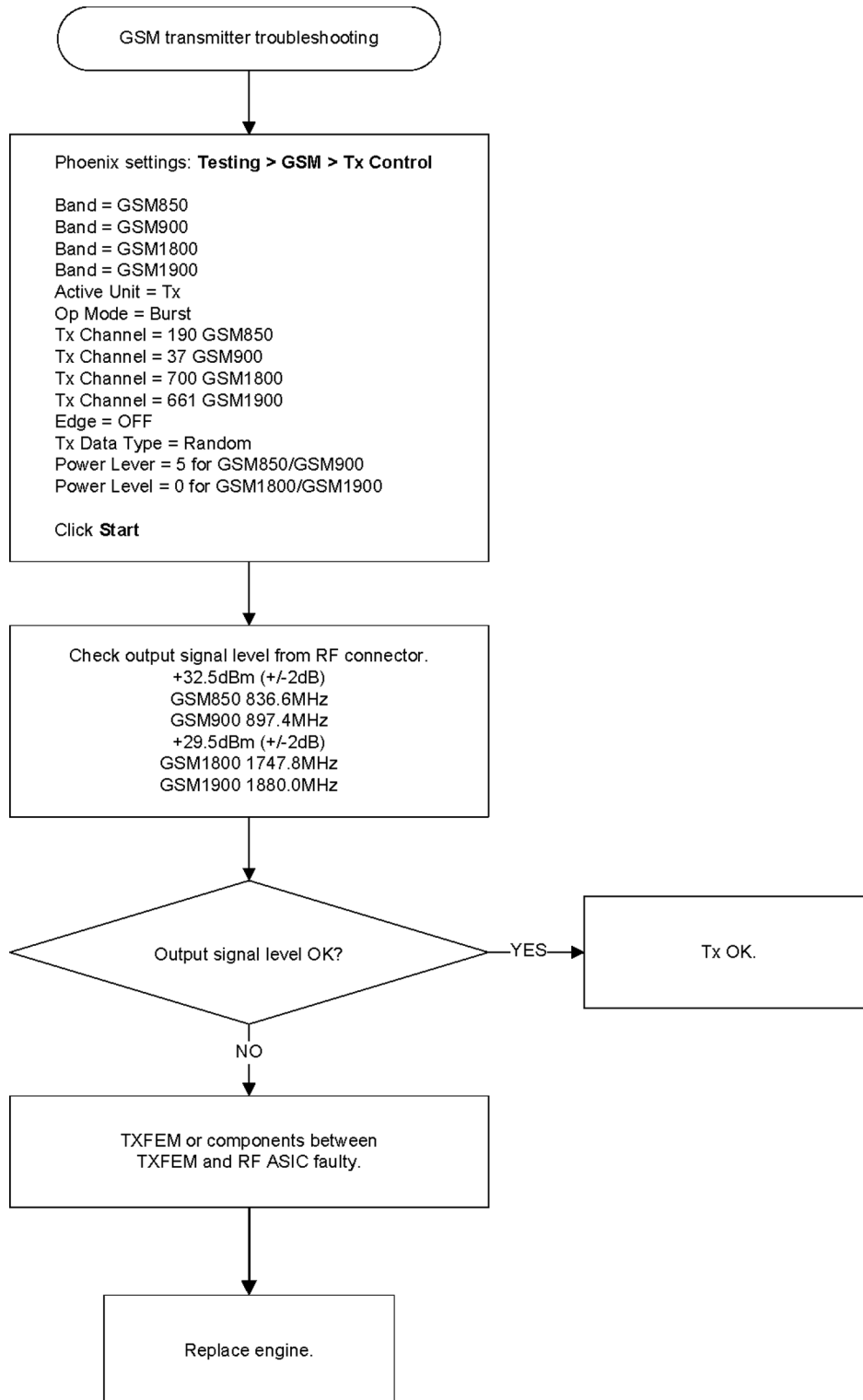
5. Change the power level in RF controls window and make sure the power reading follows accordingly.

Next actions

You can troubleshoot the GSM transmitter for each GSM band separately, one band at a time. If you want to troubleshoot GSM850, GSM1800 or GSM1900, change the band in the RF controls window 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** . The Tx Control window opens.

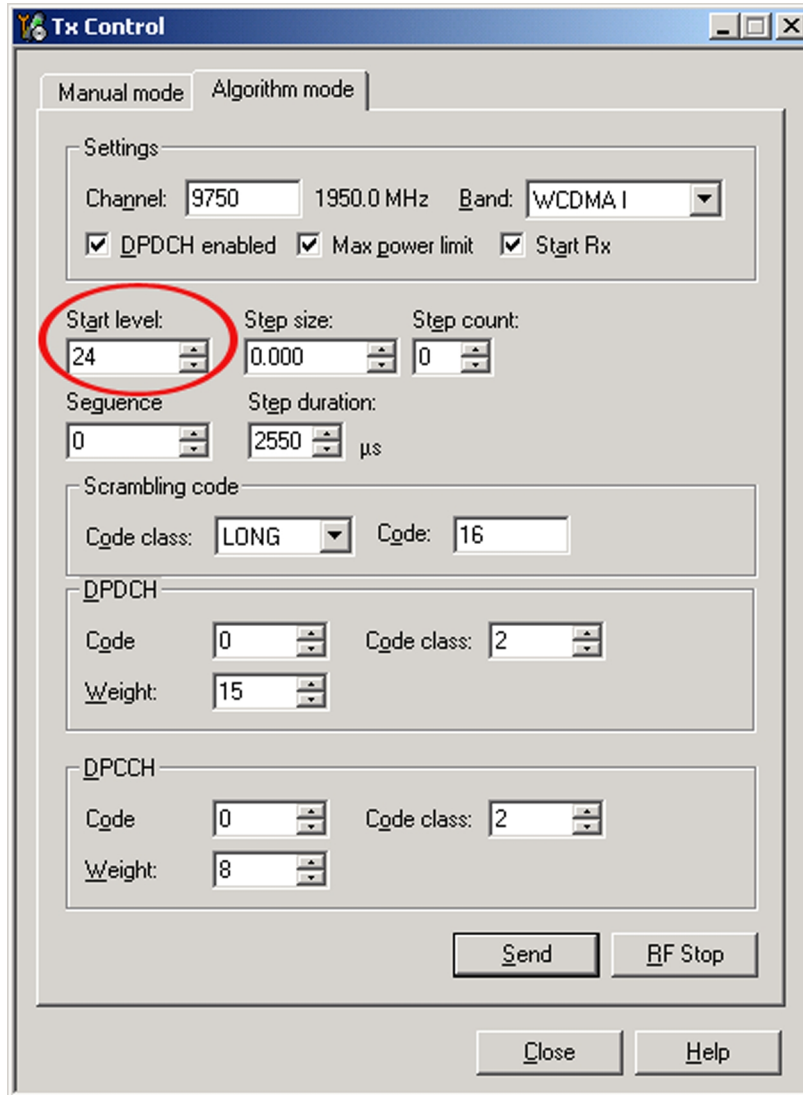


Figure 30 Phoenix WCDMA Tx control window

3. Make settings for the band to be tested, according to the following table:

Band	Channel
WCDMA I	9750
WCDMA VIII	2788

4. Make the following general settings (the same values for all bands). Note that Max power limit is not checked by default.

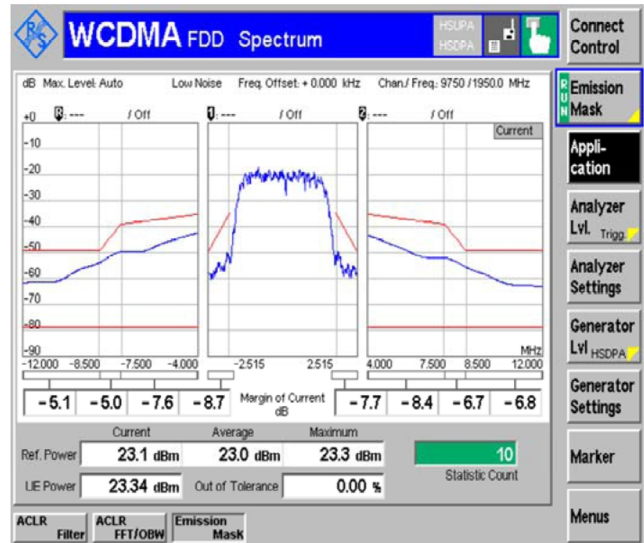
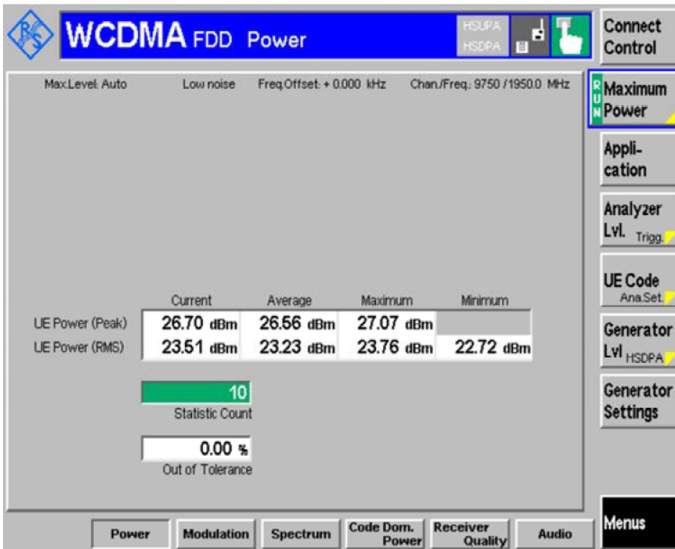
Setting	Value
DPDCH enabled	Checked
Max power limit	Checked
Start Rx	Checked
Start level	24
Step size	0
Step count	0
Sequency	0
Step duration	2550
Code class	LONG
Code	16
DPDCH code	0
Weight	15
Code class	2
DPCCH code	0
Weight	8
Code class	2

Note: Use the **Start level** option to set the TX power level.

5. Click **Send** to enable the settings and activate TX.
If settings are changed (eg. new channel selected), you have to click **RF Stop** and **Send** again.
6. Check the basic TX parameters using a communication analyser (e.g. CMU200).

Power

Spectrum - Emission Mask



Spectrum - ACLR (FFT/OBW)

Spectrum - ACLR (Filter)

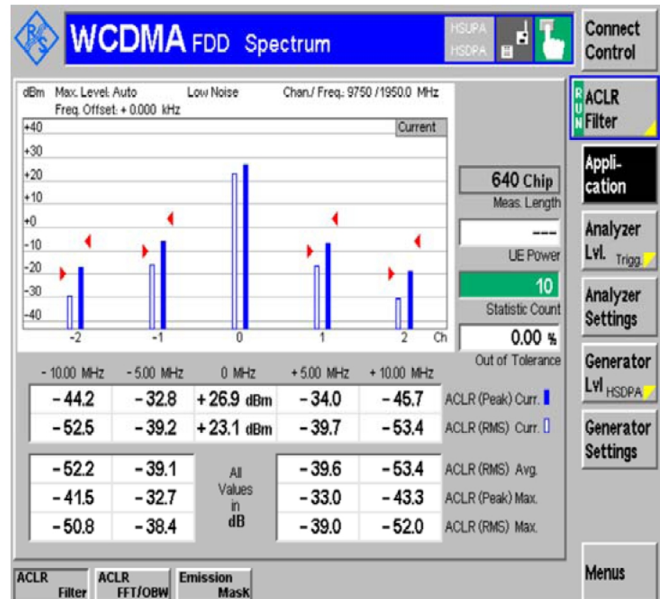
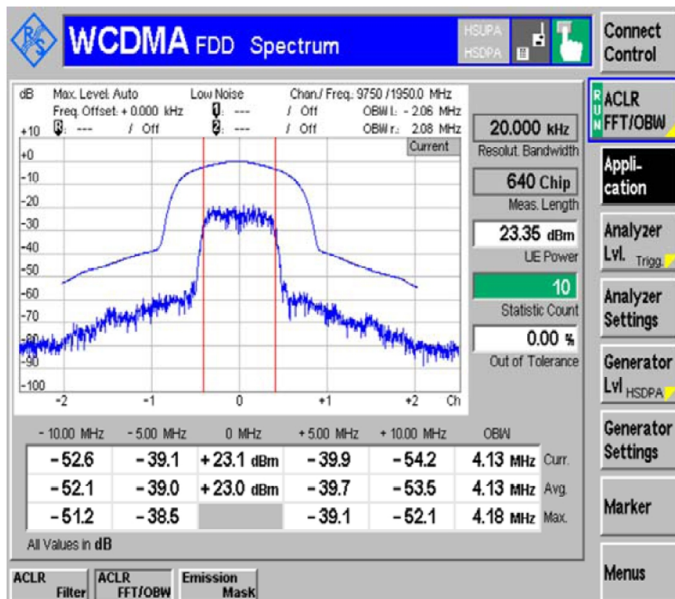
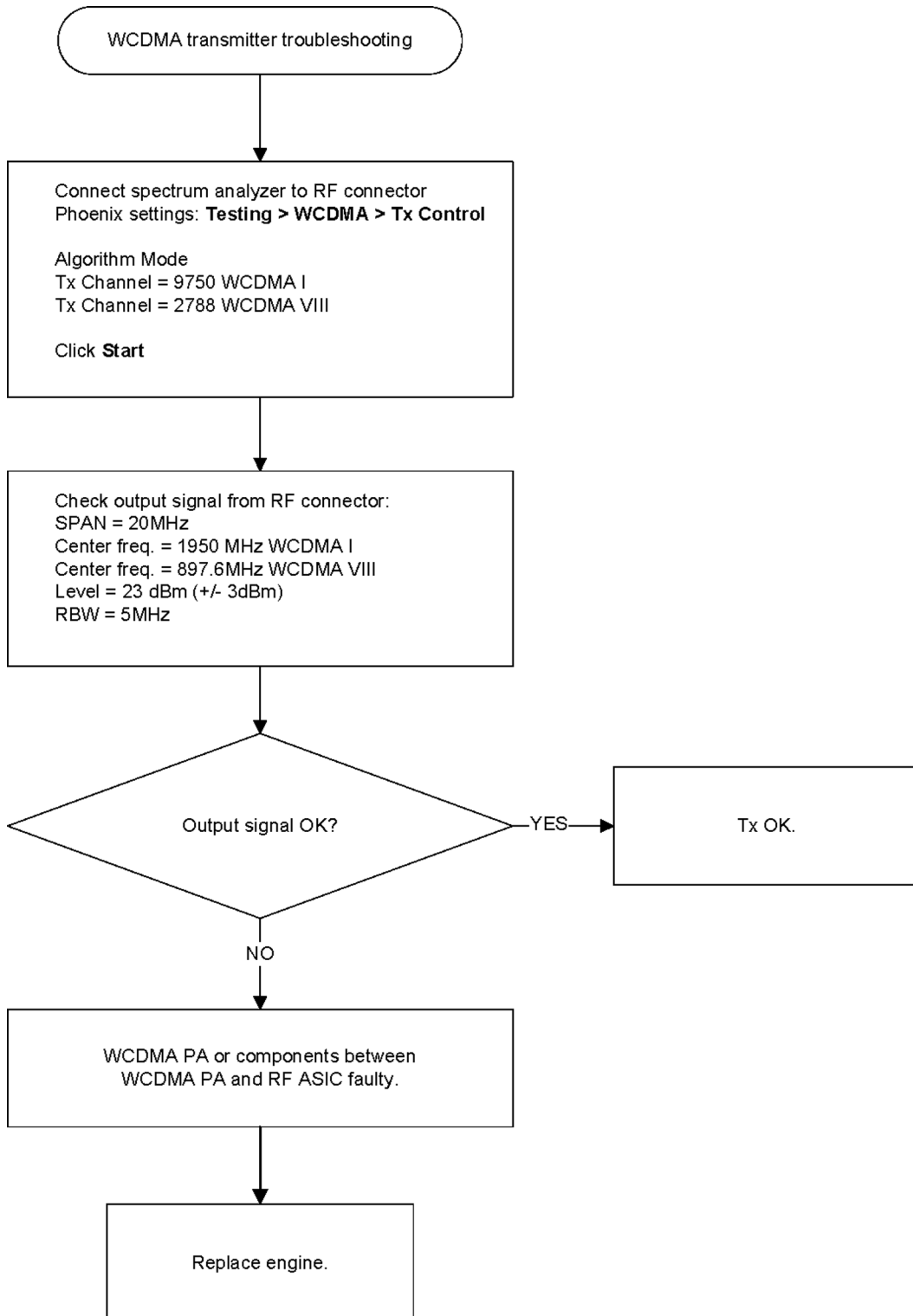


Figure 31 Typical readings

WCDMA transmitter troubleshooting flowchart

Troubleshooting flow



■ **Antenna troubleshooting**

Visual check for antenna contacts

In the main antenna there is one feed and one GND contact. Check that GND and feed pads take proper contact to the pogo pin on the main PWB and the radiator flex.

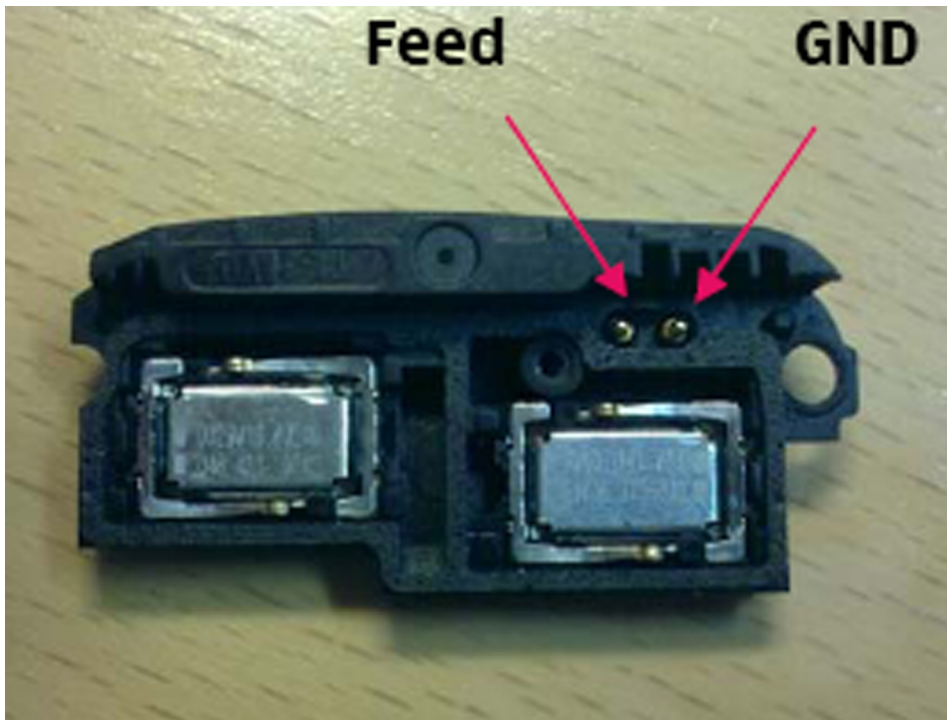


Figure 32 Antenna contacts

5 — Camera Module Troubleshooting

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■ Main (back) camera troubleshooting

Taking and evaluating test pictures with main camera

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

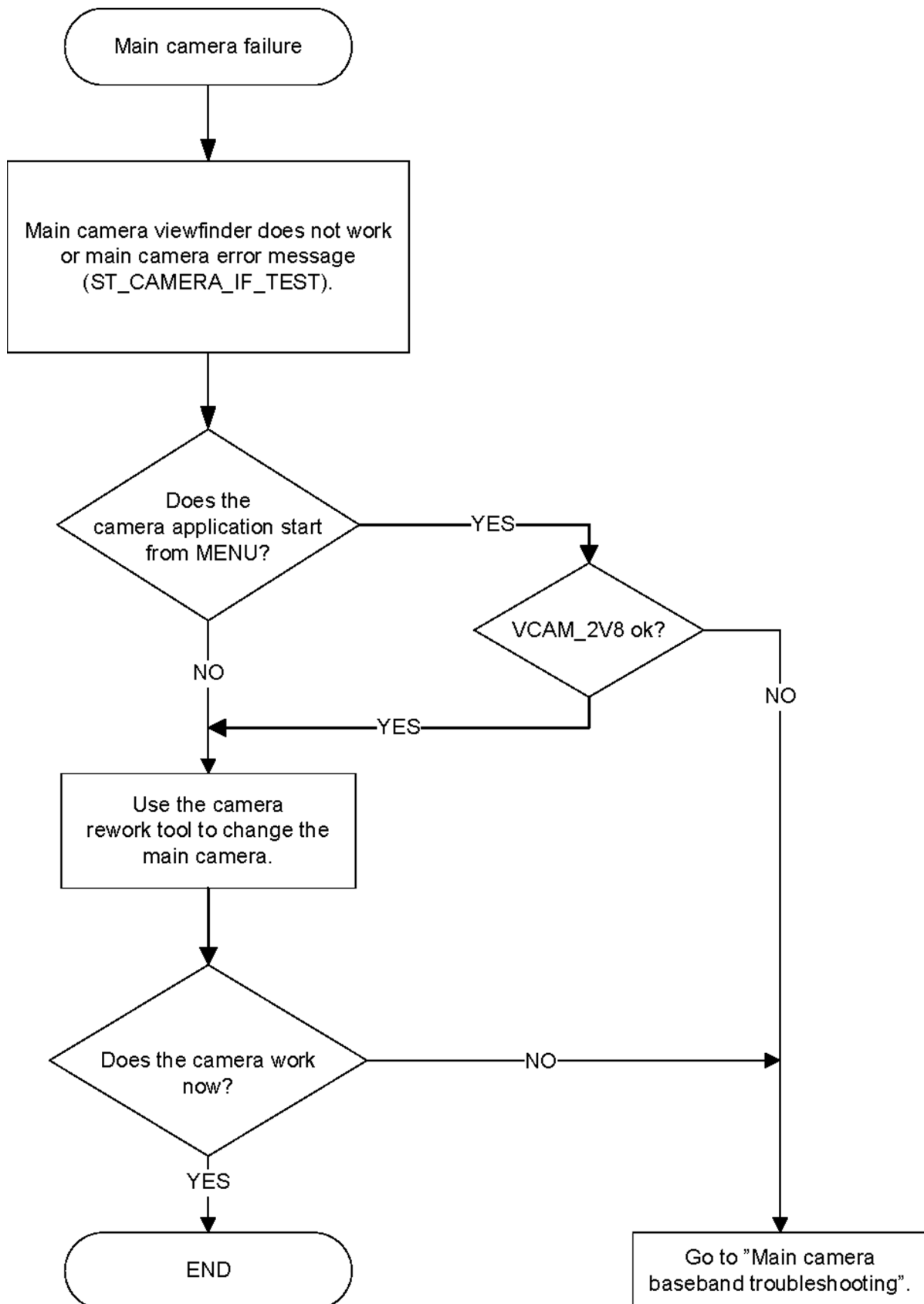
- Avoid bright fluorescent light, 50/60Hz electrical network or high artificial illumination levels
- If the phone is hot, let it rest for a while before taking the picture
- Make sure the optical system is clean
- Use the highest possible resolution
- Make sure the light is sufficient (bright office lighting)
- Do not take the picture towards a light source
- Hold the phone as still as possible when taking the picture

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

- The centre of the picture is sharper than the edges
- The image may be blurred, though it does not show in the viewfinder
- Analyse the picture from your PC monitor, full colour setting is recommended
- If possible, compare with a picture of the same motive taken with a similar Nokia device

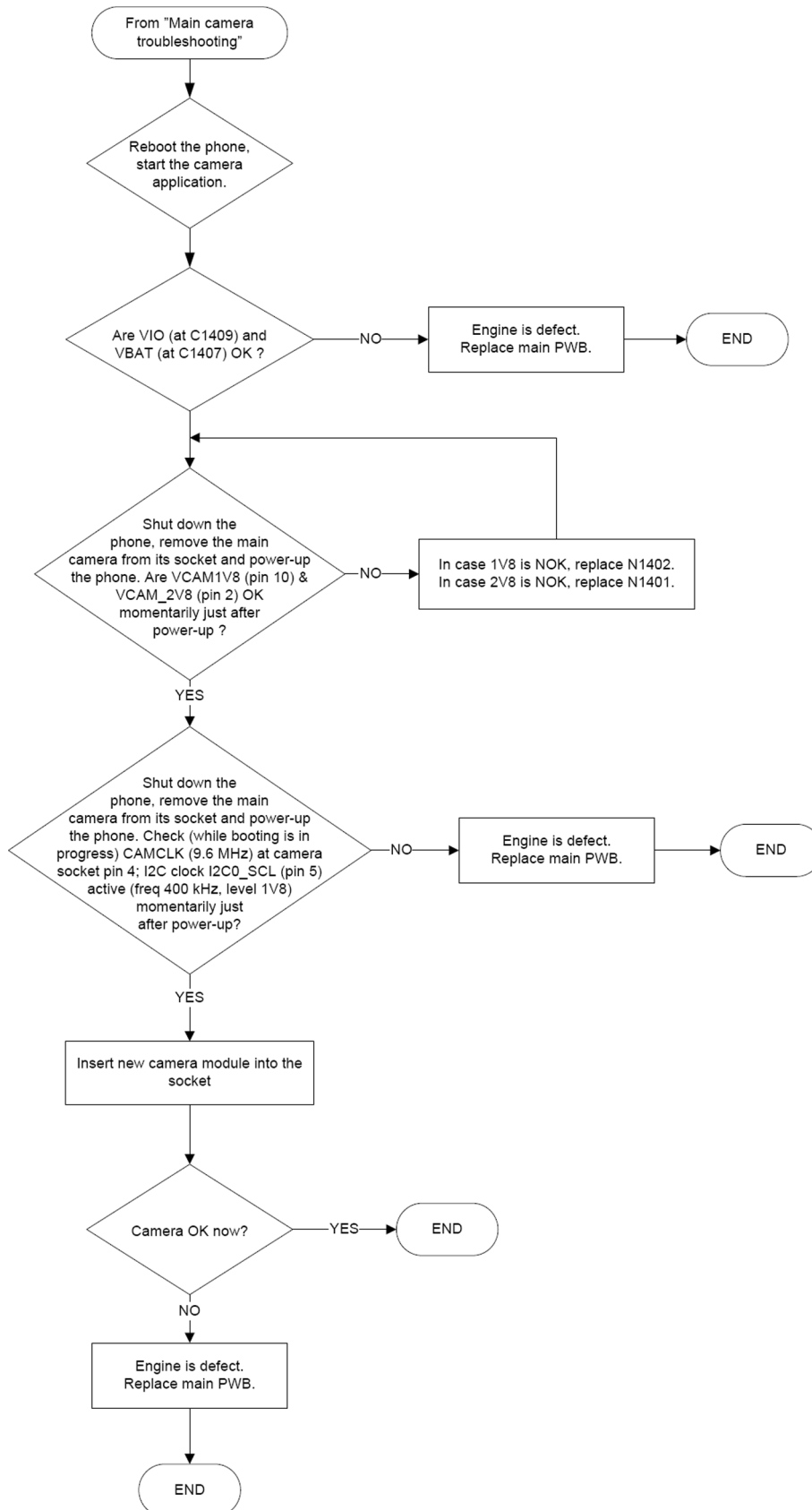
Main camera troubleshooting

Troubleshooting flow



Main camera baseband troubleshooting

Troubleshooting flow



Camera socket pin order

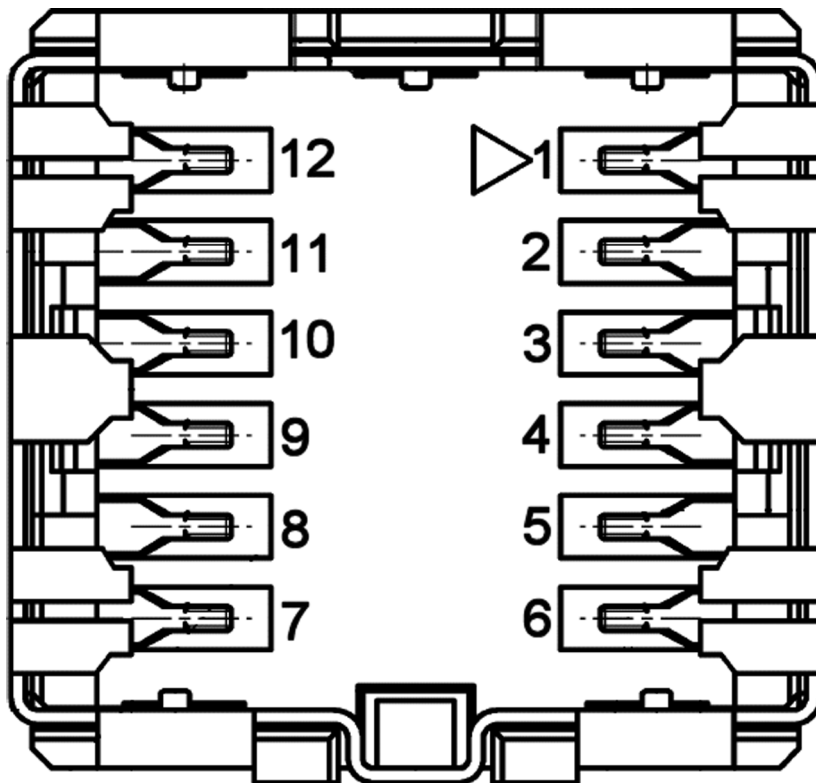
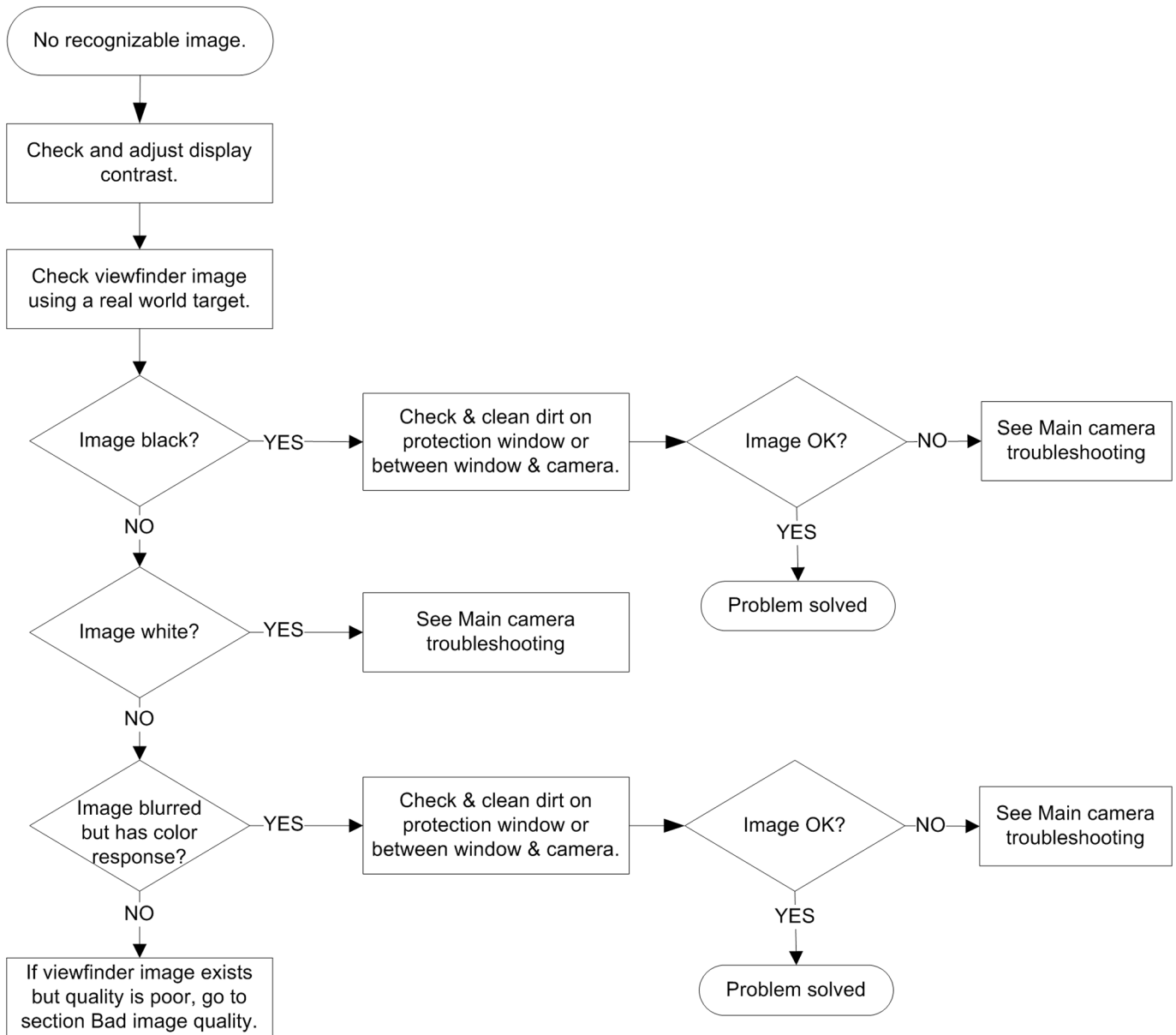


Figure 33 Camera socket pin order

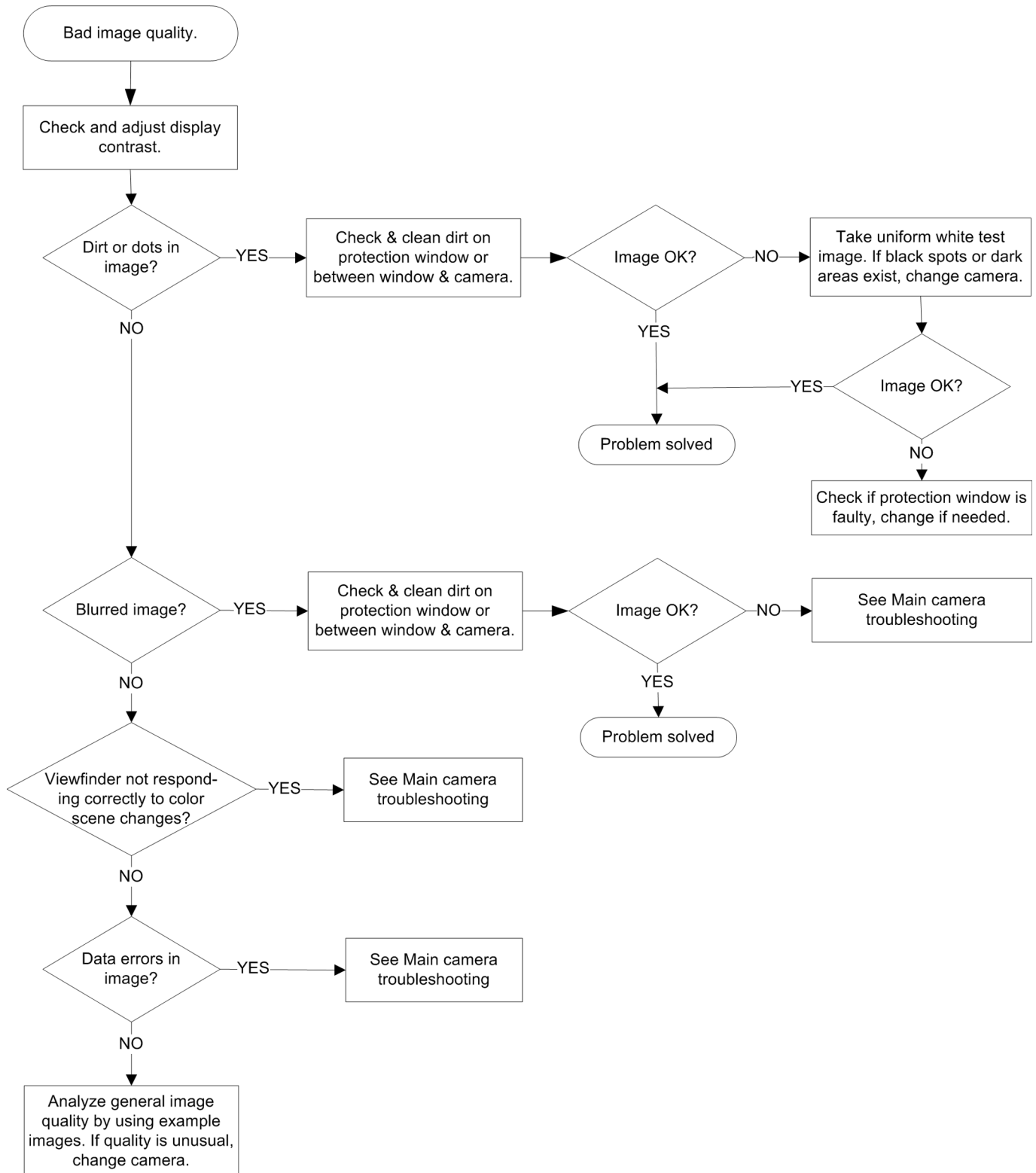
Main camera no recognizable viewfinder image troubleshooting

Troubleshooting flow



Main camera bad image quality troubleshooting

Troubleshooting flow

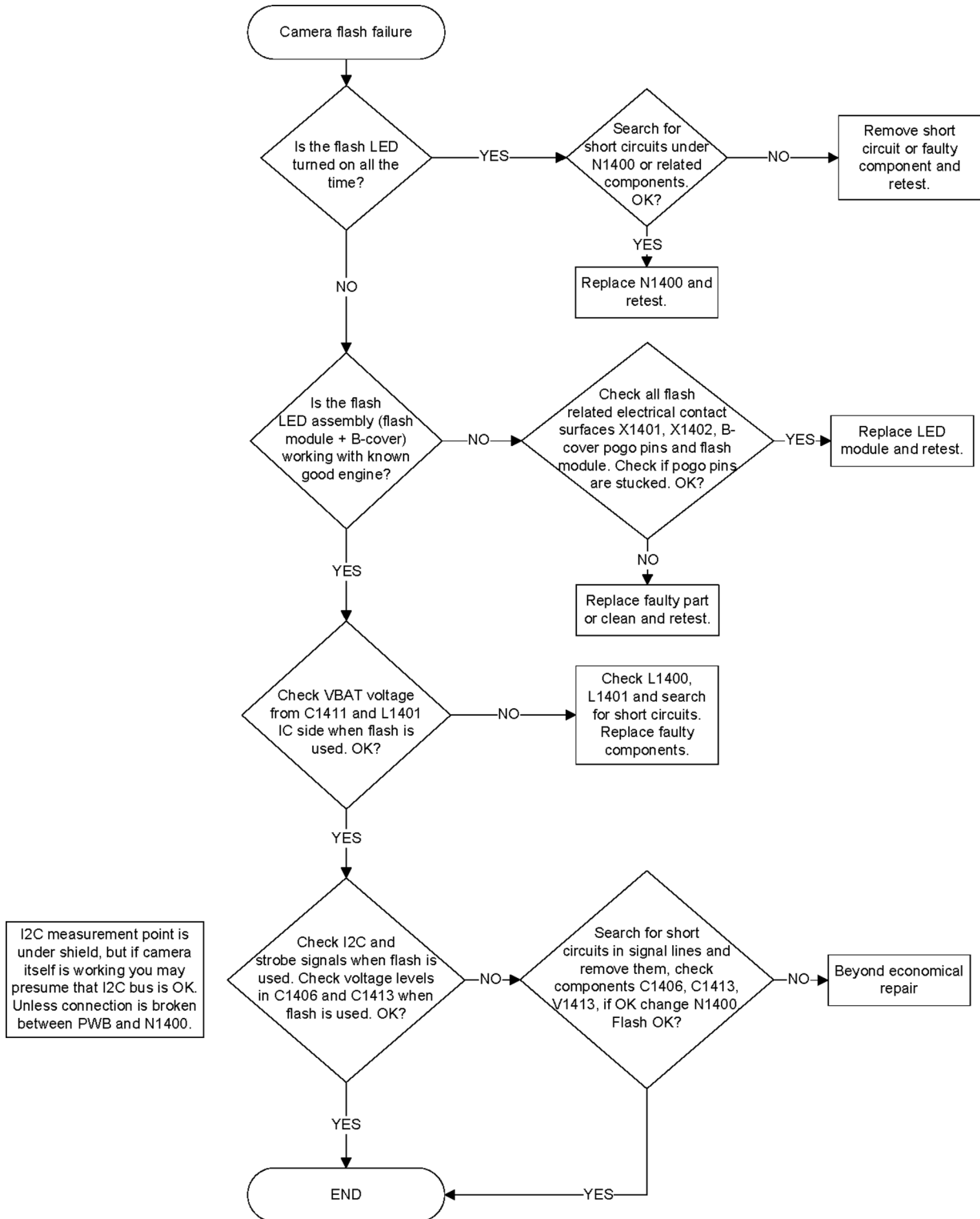


Camera flash troubleshooting

Context

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

Troubleshooting flow



■ Secondary (front) camera troubleshooting

Evaluating video call picture quality from secondary camera

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

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

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

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

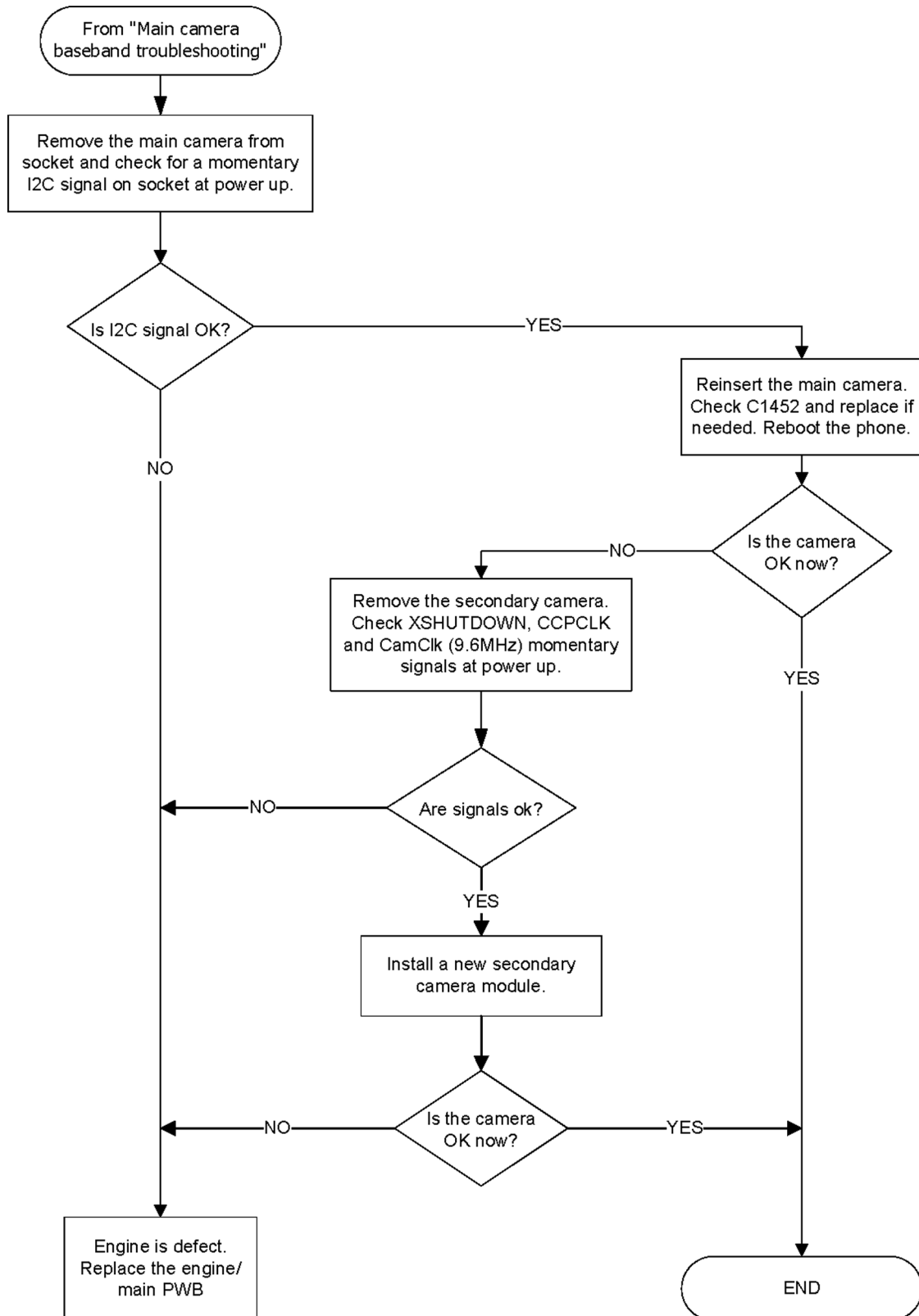
- The centre of the picture is sharper than the edges
- If possible, compare with the picture on another Nokia device in a video call, and of the same motive

Secondary camera hardware troubleshooting

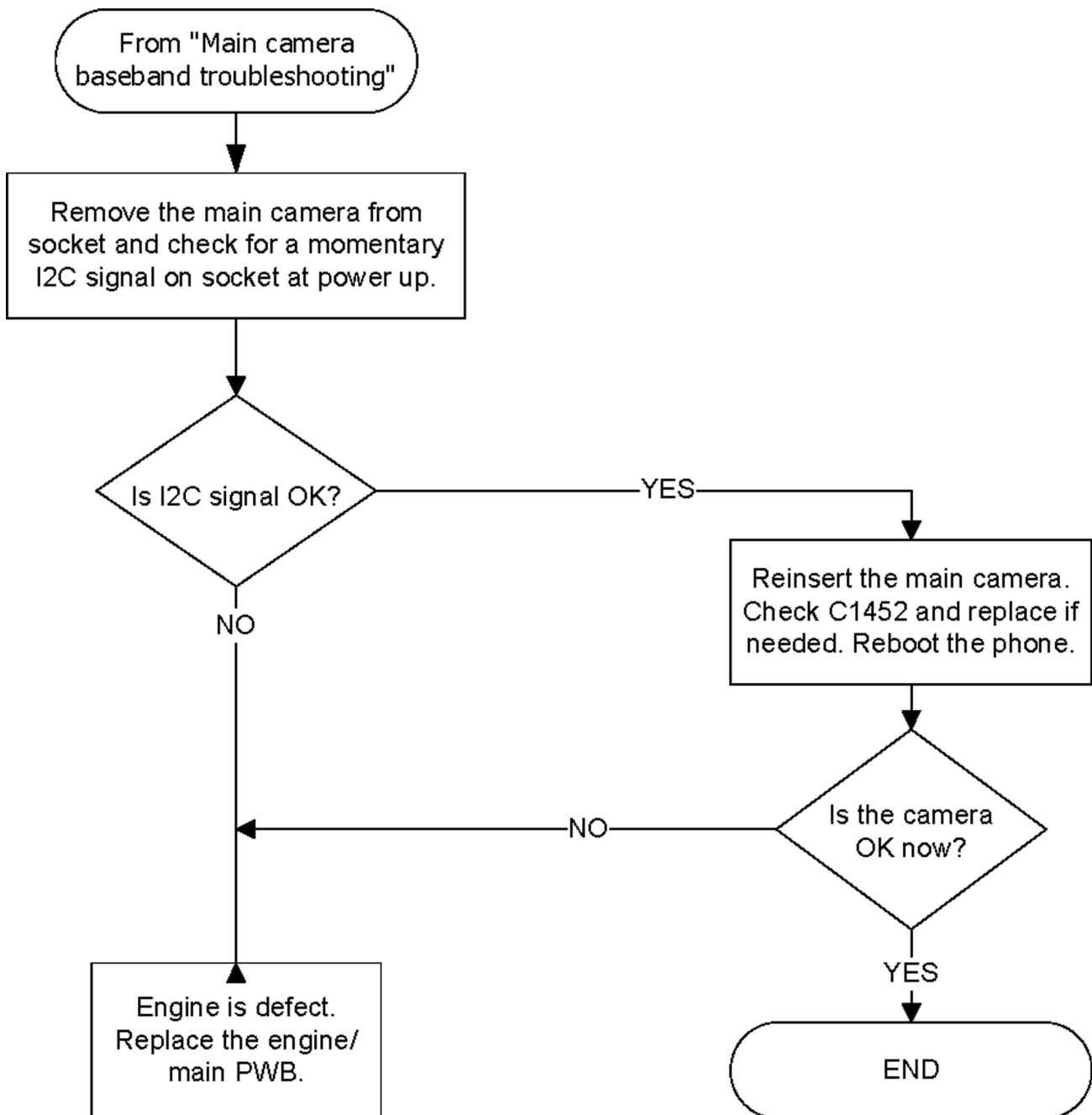
If the front camera is NOT underfilled

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

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



If the front camera is underfilled



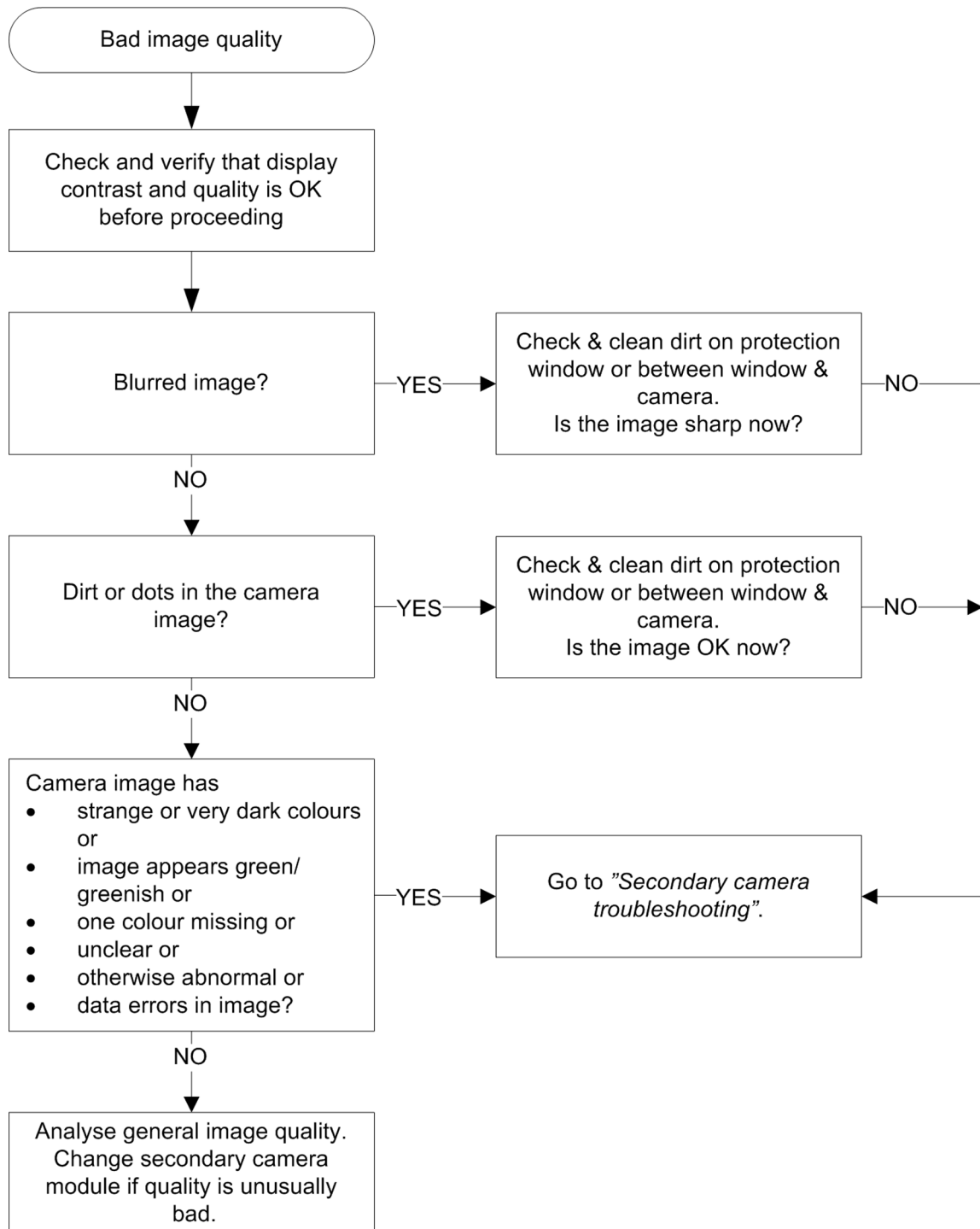
Secondary camera bad image quality troubleshooting

Context

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

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

Troubleshooting flow



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Nokia Customer Care

6 — System Module

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■ Introduction

Phone description

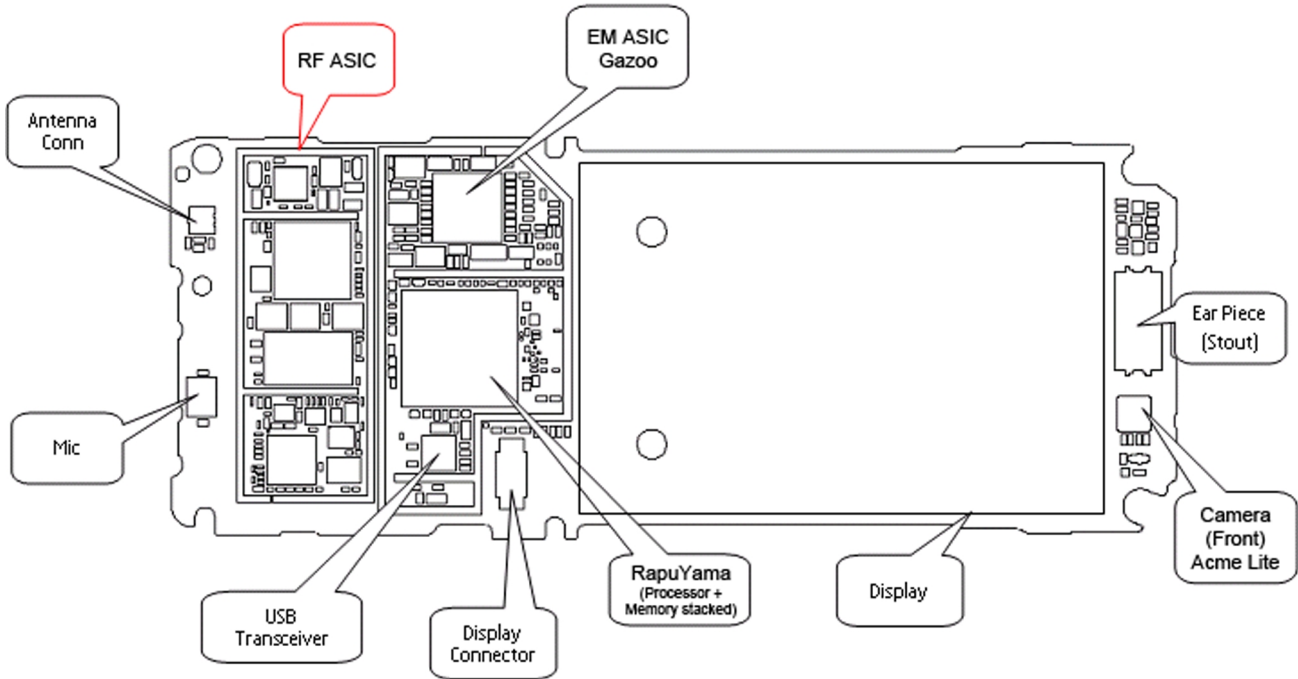
RAPU is the main digital baseband ASIC in the phone. It contains functionality for both WCDMA and GSM EDGE. GAZOO (N2200) is the main audio and energy management controller for the phone.

Key components

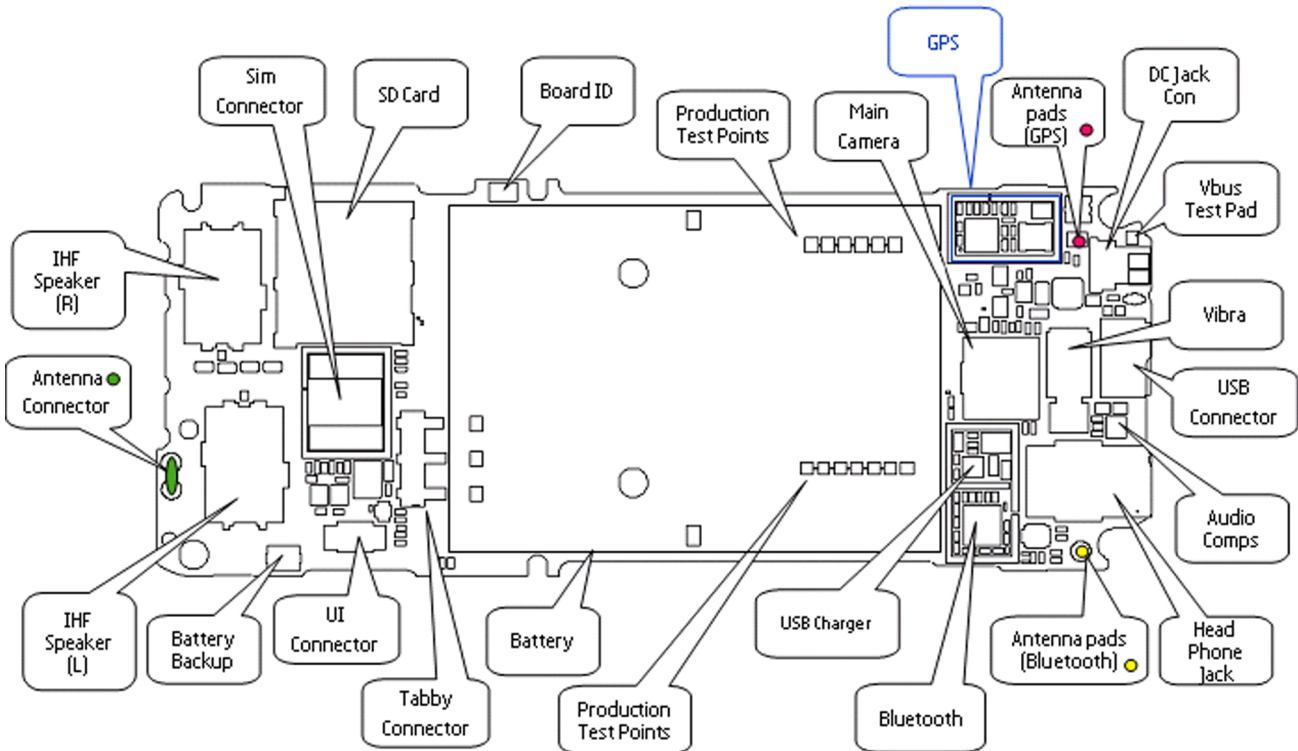
Function	Description	Item ref
Main PWB	3FT	
UI flex PWB	3FU	
Baseband ASIC	EM ASIC GAZOO	N2200
RF ASIC	VAPAUS	N7500
Processor	RAPU	D2800
GSM PA	Front end module (FEM), quad band	N7520
WCDMA PA	WCDMA power amplifier module	N7540
Oscillators	VCTCX0 Balun GSM	G7500 T7520
Memory	Combo 1G DDR + 2G M3 (stacked with RAPU)	D3000
Back-up battery	RTC back-up battery 311	G2200
Bluetooth	BTFMRDS2.2D module	N6000
FM radio	BTFMRDS2.2D module	N6000
A-GPS	A-GPS module	N6200
USB	USB transceiver	D3300
Battery	BL-5CT	
Battery connector	Tabby blade interface	X2070
MicroSD connector		X3200
Micro USB connector		X3300
BTB connector	Board-to-board connector	X4400
RF connectors		X6200 X7501
SIM connector		X2700

Key component placement

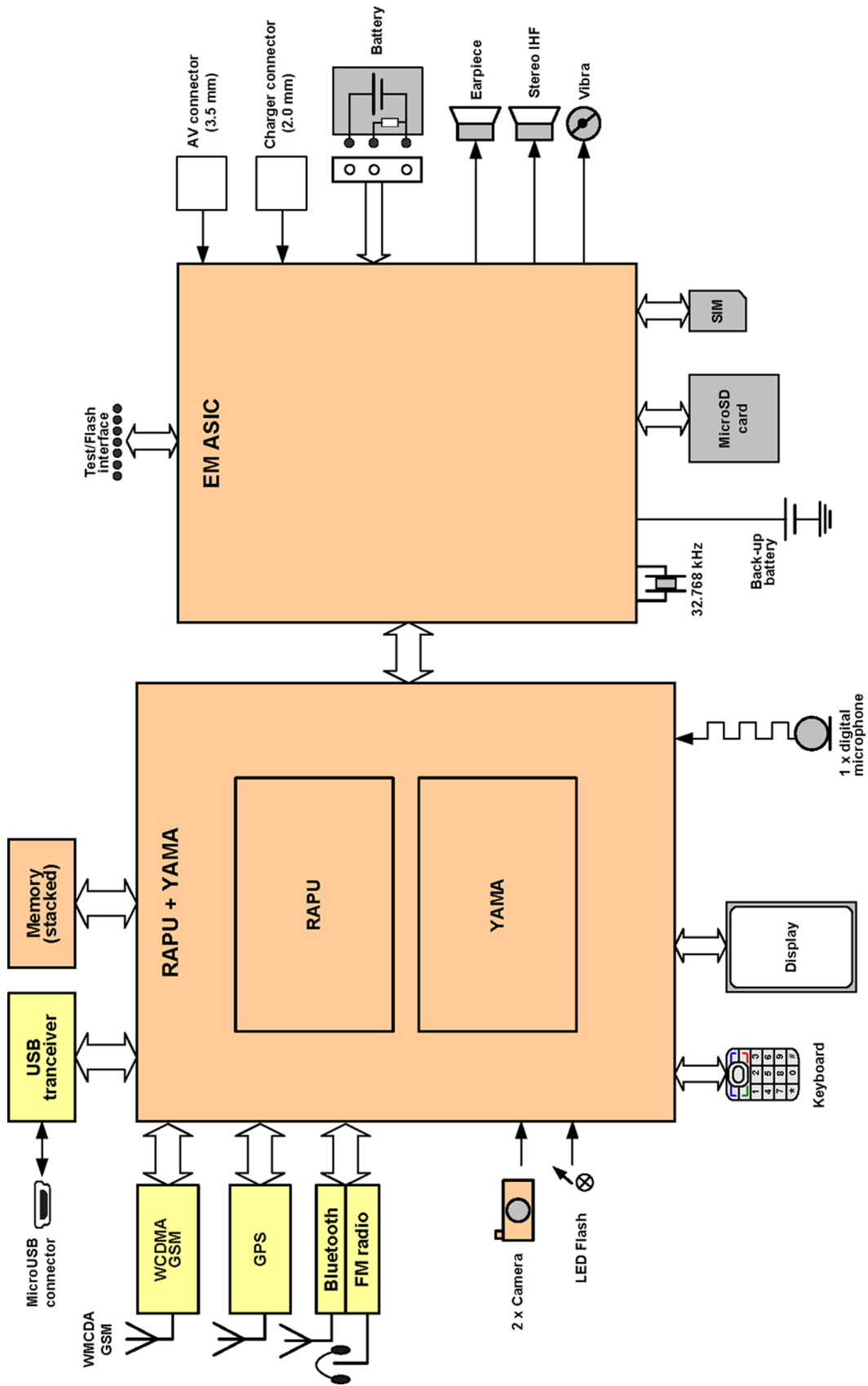
Top side



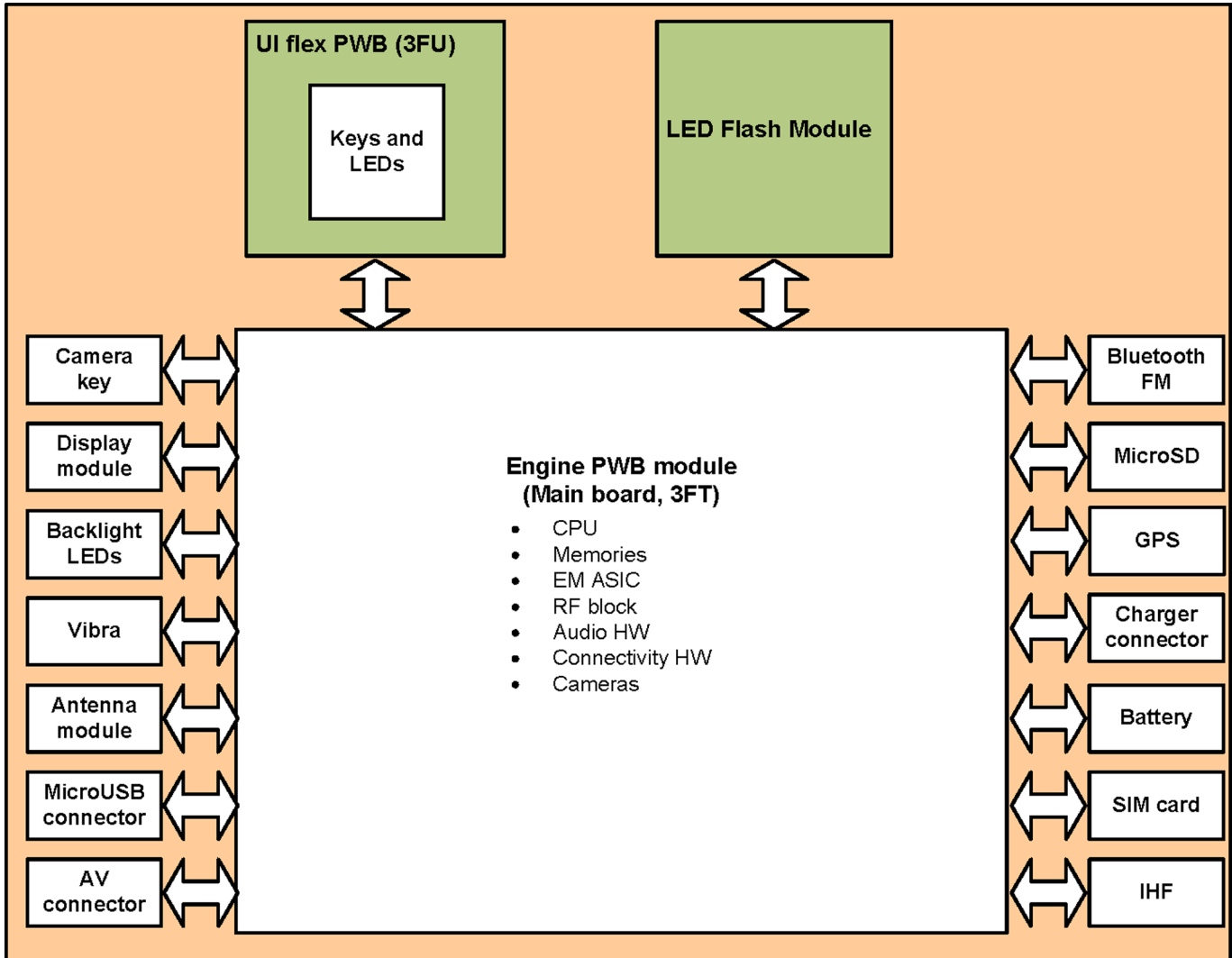
Bottom side



System module block diagram



Board and module connections



■ Energy management

Battery and charging

BL-5CT battery

The phone is powered by a 3-pole BL-5CT 1050 mAh battery. The three poles are named VBAT, BSI and GND where the BSI line is used to recognize the battery capacity. This is done by means of an internal battery pull down resistor.

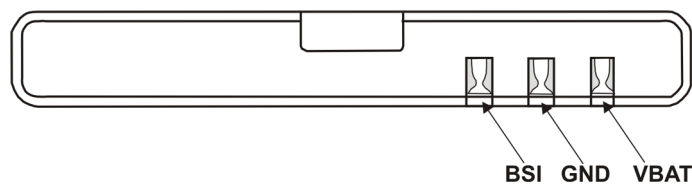


Figure 34 Battery pin order

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

Battery connector

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

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

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

Charging

The phone can be charged through the dedicated charger interface or through the micro USB interface. Charging is controlled by energy management, and external components are needed to protect the baseband module against EMC, reverse polarity and transient frequency deviation.

Charging a dead battery

It may take up to several minutes before the phone indicates that it is charging if the battery is dead.

Normal and extreme voltages

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

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

Table 10 Nominal voltages

Voltage	Voltage [V]	Condition
General Conditions		
Nominal voltage	3.700	
Lower extreme voltage	3.5	
Higher extreme voltage	4.2	
(fast charging)		
HW Shutdown Voltages		
Vmstr+	2.1 ± 0.1	Off to on
Vmstr-	1.9 ± 0.1	On to off
SW Shutdown Voltages		
Sw shutdown	3.1	In call
Sw shutdown	3.2	In idle
Min Operating Voltage		
Vcoff+	2.9 ± 0.1	Off to on
Vcoff-	2.7 ± 0.1	On to off

Power key and system power-up

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

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

Modes of operation

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

Clocking scheme

In BB5.44, two main clocks are provided to the system: 38.4MHz RF clock produced by VCTCX0 in the RF section and 32.768kHz sleep clock produced by EM ASIC N2200 with an external crystal.

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

SMPS Clk is 3.2MHz clock line from RAPU to EM ASIC N2200. In deep sleep mode, when VCTCX0 is off, this signal is set to '0'-state.

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

Bluetooth uses a buffered and filtered 38.4MHz system clock from VCTCX0 G7500.

Power distribution

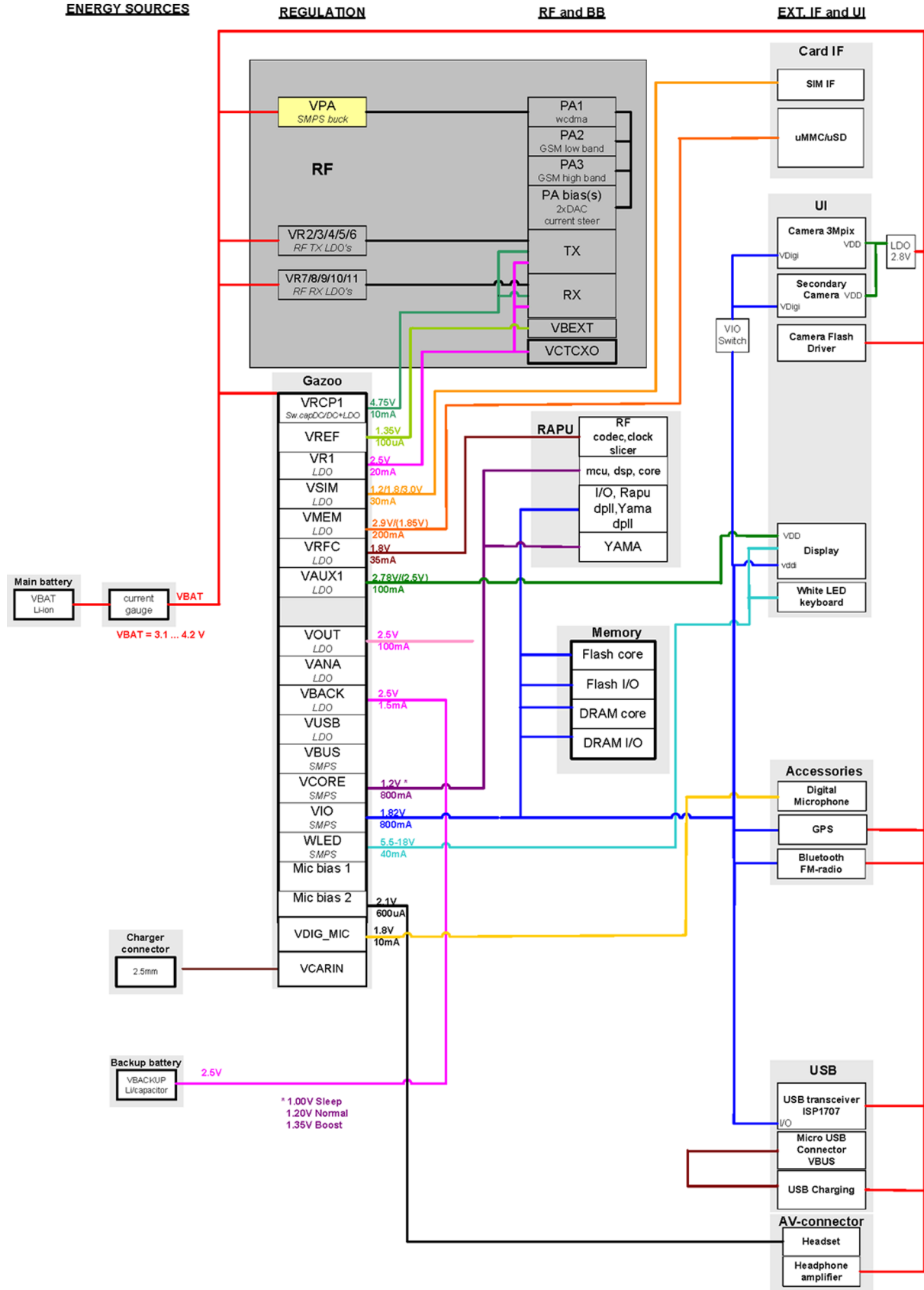


Figure 35 Power distribution diagram

■ SIM interface

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

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

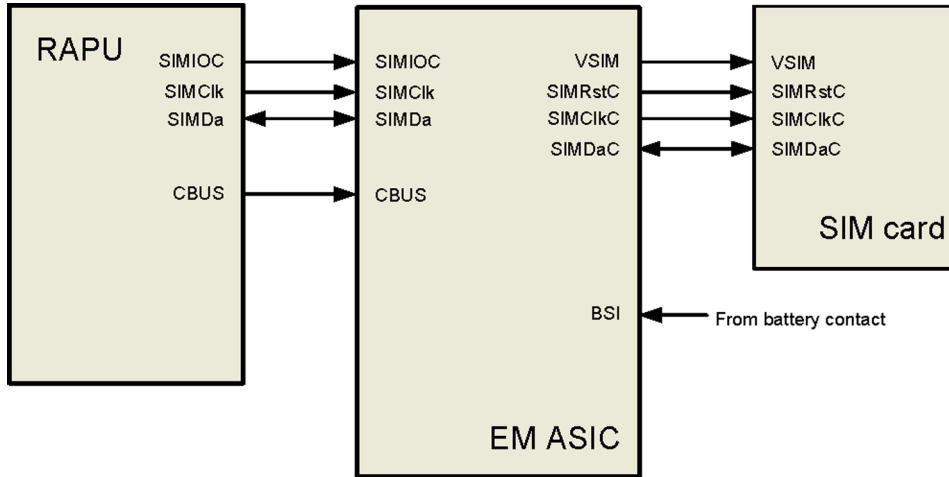


Figure 36 SIM interface

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

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

■ MicroSD card interface

The microSD card interface has one internal interface between RAPU and EM ASIC and one external interface between EM ASIC and the microSD card. The microSD card connector is mounted on the main PWB.

The μSD removal detection switch is inside the card socket.

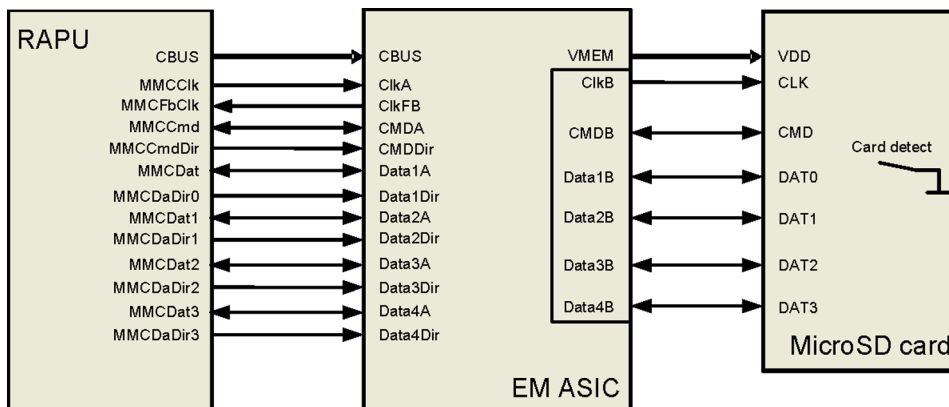


Figure 37 MicroSD card interface

■ **USB**

USB interface

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

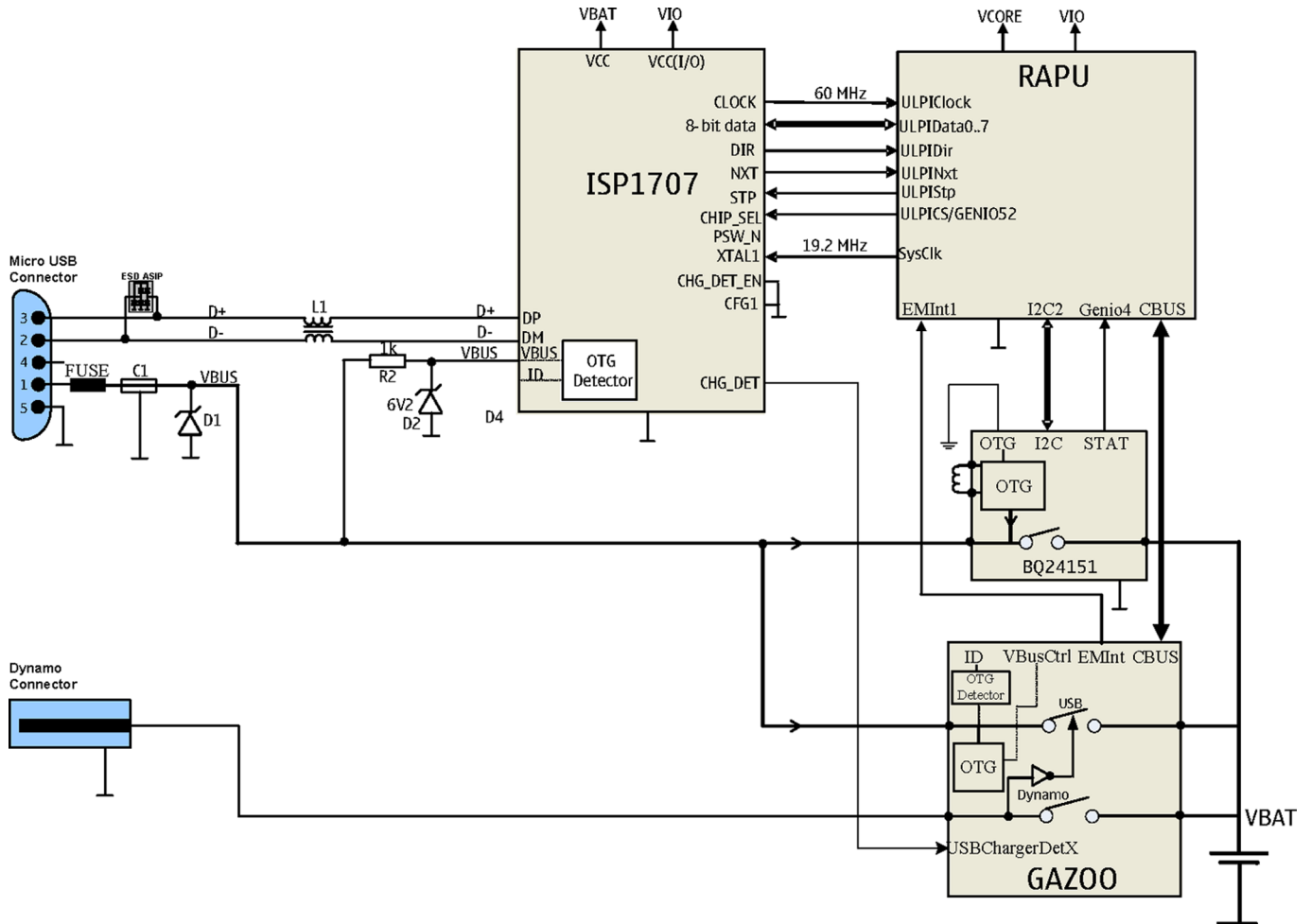


Figure 38 USB interface

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

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

MicroUSB connector

This phone is provided with a specific connector for microUSB.

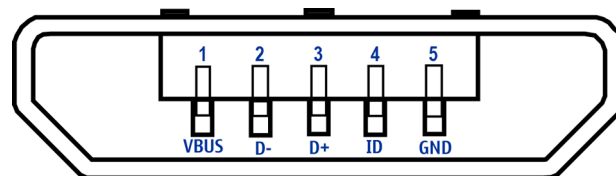


Figure 39 MicroUSB connector

■ **User interface**

Display interface

The following block diagram illustrates the display interface.
Display backlight is provided directly by EM ASIC.

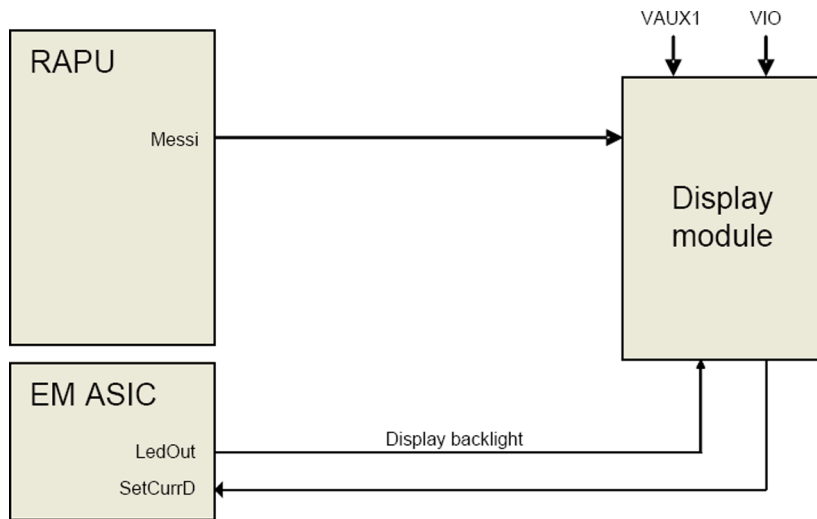


Figure 40 Display interface

Keyboard interface

The following block diagram shows the keyboard interface. The keyboard interface is implemented with RPU's GENIOs. Keyboard GENIOs are protected from ESD with 10-channel ASIPs Z4404 and Z4405. In addition there are two capacitors C4401 and C4402 added to PWB for improving the immunity to the device's own low band TX.

RM-645 keyboard supports 3 keys multikeypress functionality.

The LEDs at the UI mechanic assembly for main keyboard are controlled by EM ASIC.

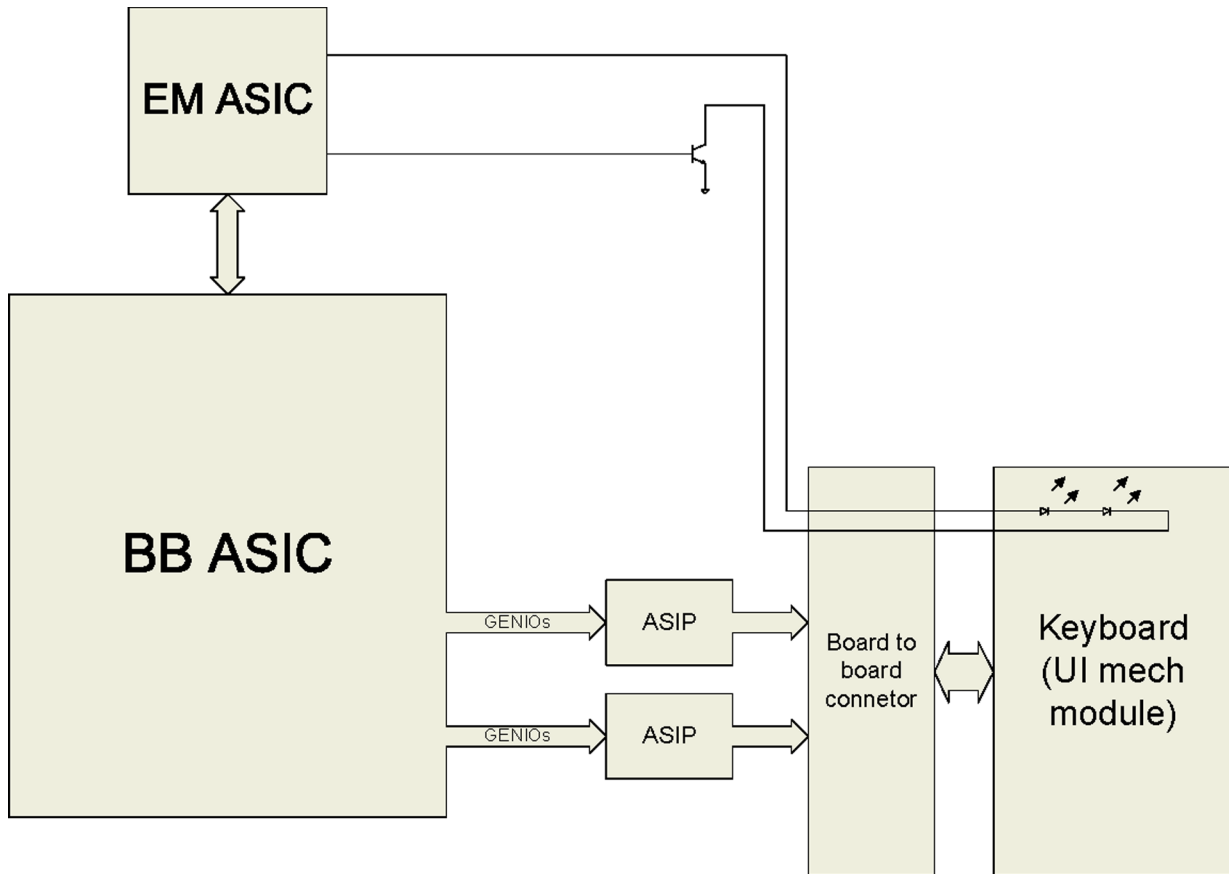


Figure 41 Keyboard interface

■ Camera interface

The main camera is able to take images over larger depth of field (from 30 cm to infinity) than normal fixed focus camera. When compared to autofocus (AF) cameras, it is to be noted that there are no moving parts inside this camera.

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

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

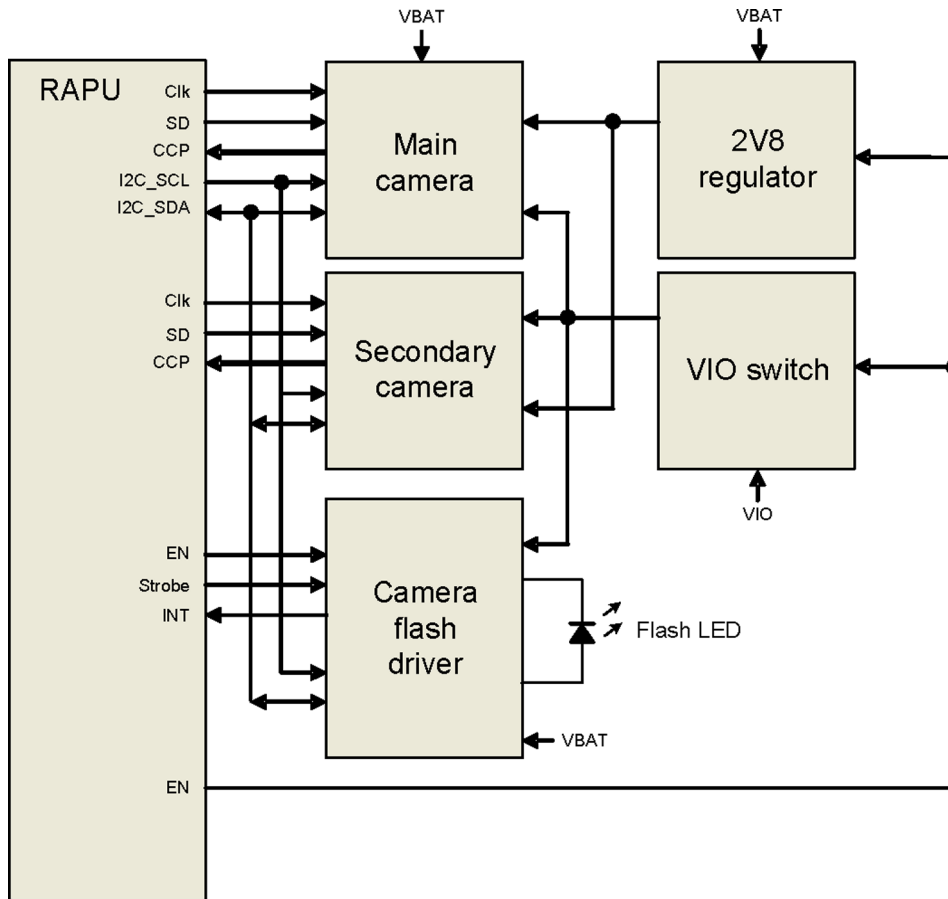


Figure 42 Camera interface

■ **Audio interface**

The following block diagram illustrates the audio interface of the phone:

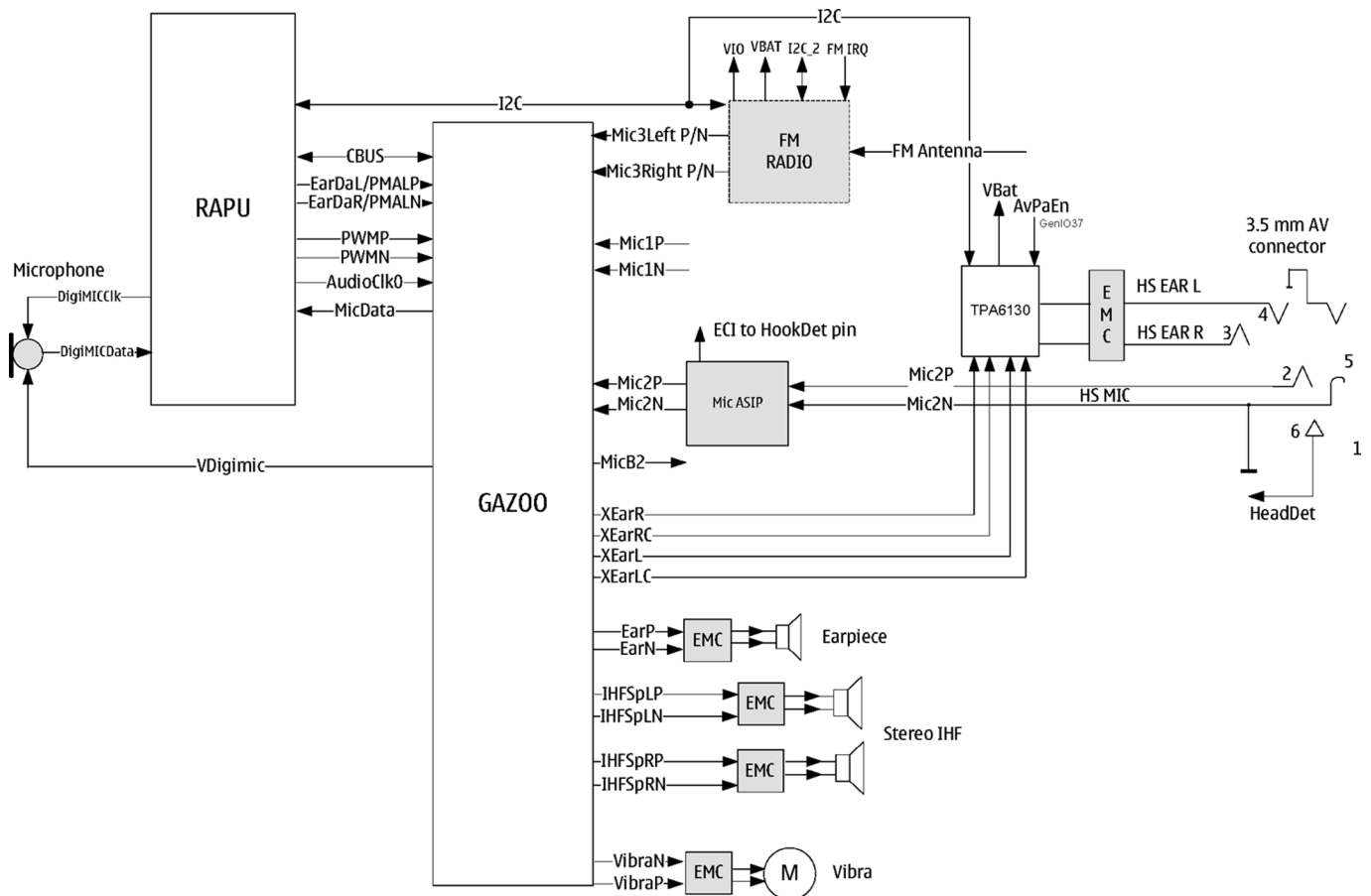


Figure 43 Audio interface

The digital microphone is connected directly to RAPU.

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

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

The stereo IHF speakers are driven directly by a built-in stereo amplifier included in EM ASIC.

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

■ Bluetooth interface

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

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

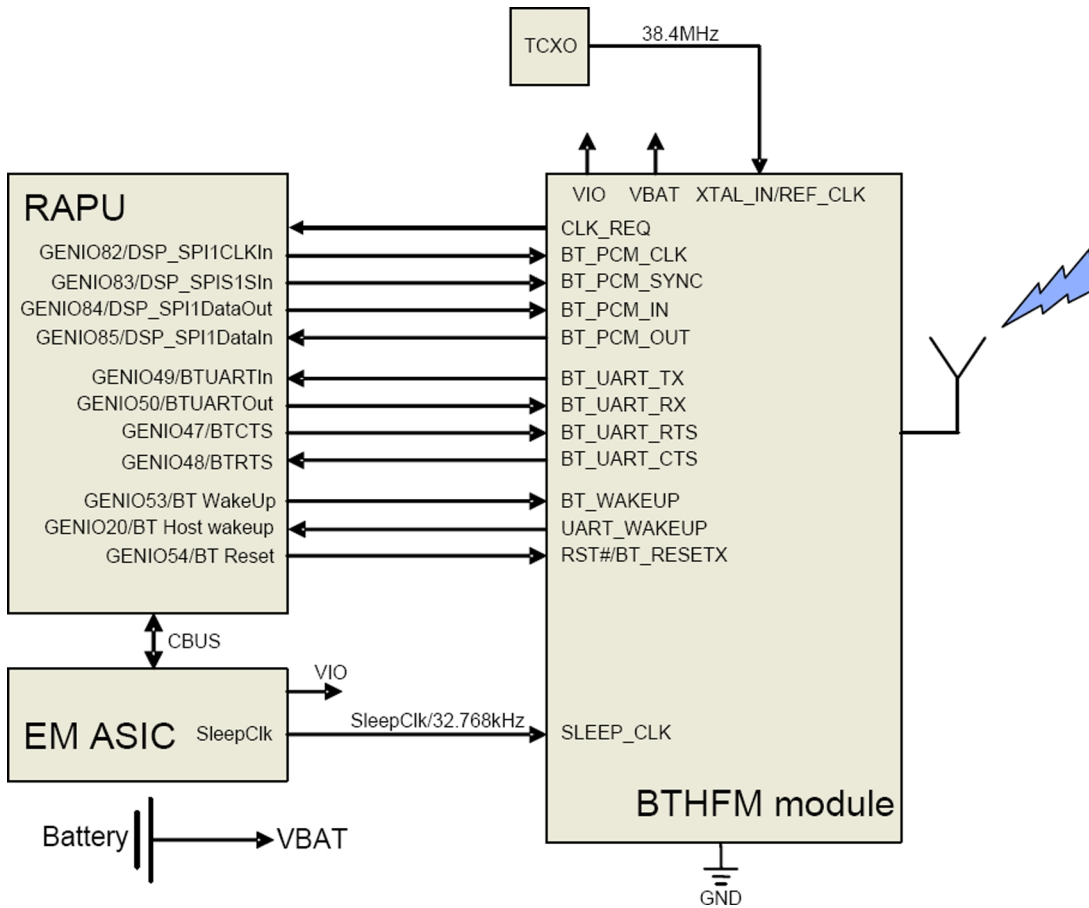


Figure 44 Bluetooth interface

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

■ GPS interface

The device includes an inbuilt GPS receiver and it works as a stand-alone positioning device. The GPS system is connected to RAPU ASIC.

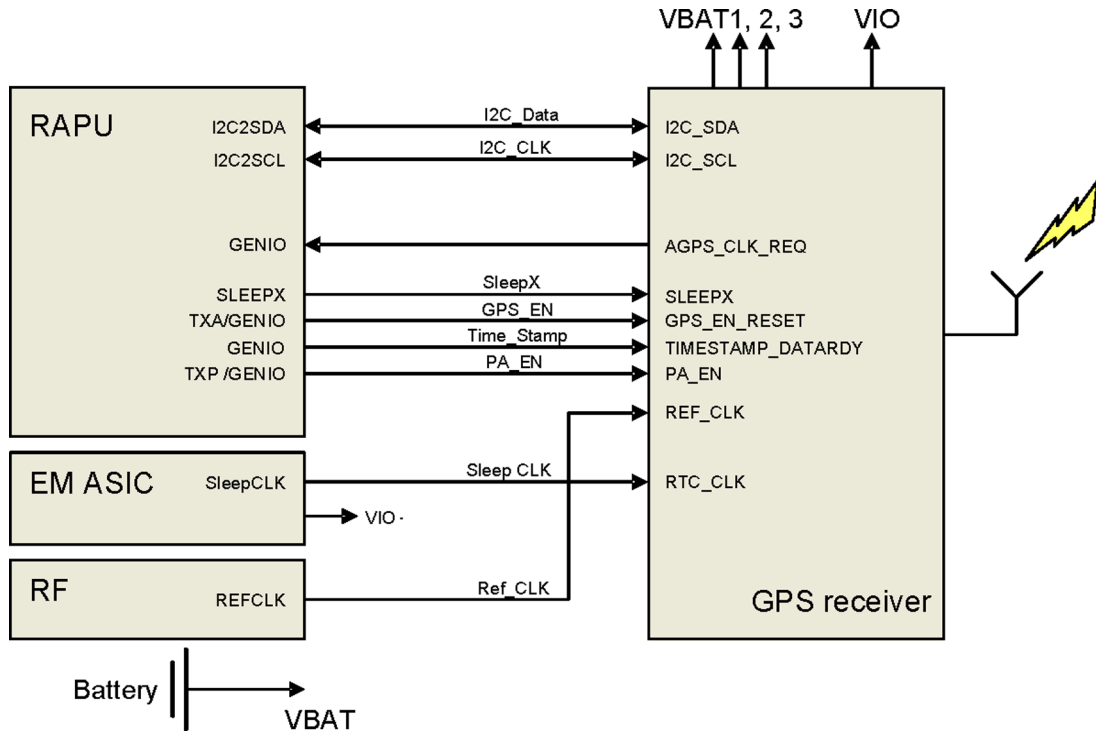


Figure 45 GPS interface

FM radio interface

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

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

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

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

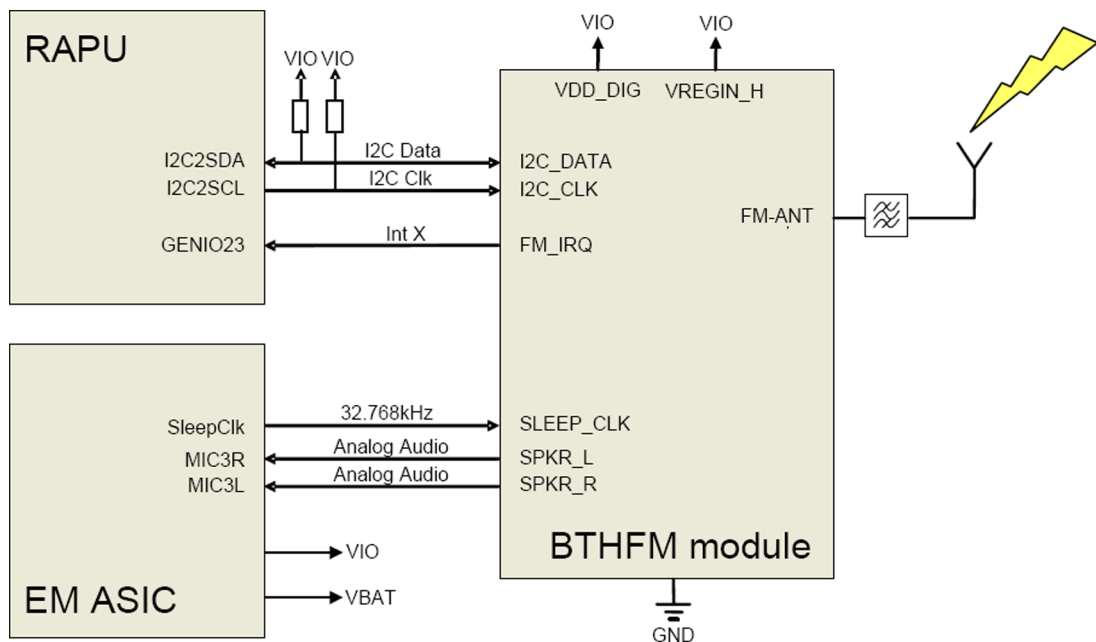


Figure 46 FM radio interface

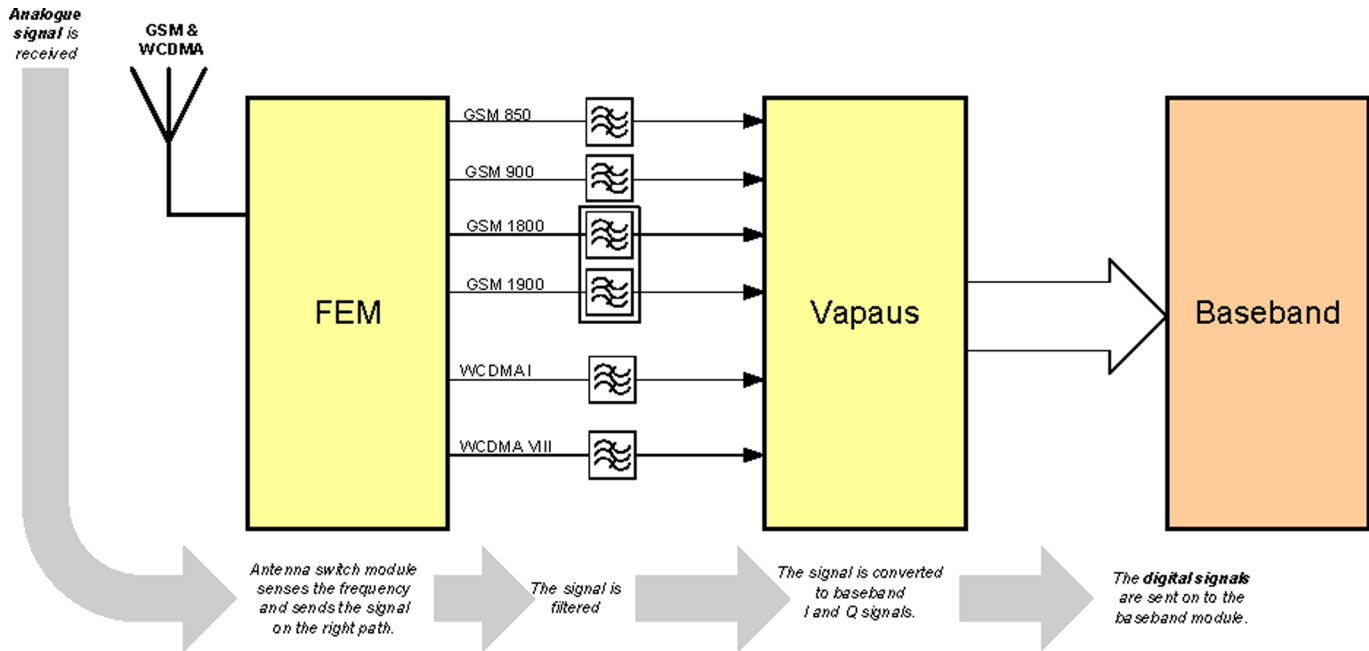
■ RF description

Receiver (RX)

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

The receiver functions are implemented in the RF ASIC.

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

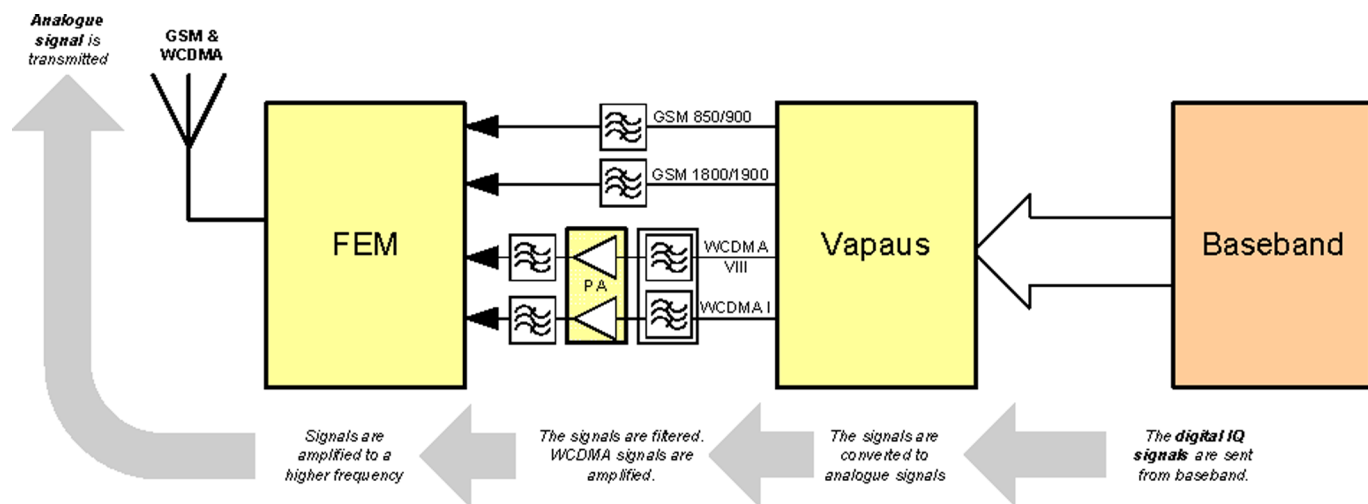


Transmitter (TX)

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

The transmitter functions are implemented in the RF ASIC.

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



■ 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	3518						

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	608	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	1900.4								

WCDMA 2100 Rx frequencies

Ch	RX	VCO RX	Ch	RX	VCO RX	Ch	RX	VCO RX	Ch	RX	VCO RX	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	Ch	Tx	VCO Tx	Ch	Tx	VCO Tx	Ch	Tx	VCO Tx	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			

WCDMA VIII (900) frequencies

Uplink CH (TX)	Freq (MHz)	VCO (MHz)	Downlink CH (RX)	Freq (MHz)	VCO (MHz)
2712	882,4	3529,6	2937	927,4	3709,6
2713	882,6	3530,4	2938	927,6	3710,4
2714	882,8	3531,2	2939	927,8	3711,2
2715	883	3532	2940	928	3712
2716	883,2	3532,8	2941	928,2	3712,8
2717	883,4	3533,6	2942	928,4	3713,6
2718	883,6	3534,4	2943	928,6	3714,4
2719	883,8	3535,2	2944	928,8	3715,2
2720	884	3536	2945	929	3716
2721	884,2	3536,8	2946	929,2	3716,8
2722	884,4	3537,6	2947	929,4	3717,6
2723	884,6	3538,4	2948	929,6	3718,4
2724	884,8	3539,2	2949	929,8	3719,2
2725	885	3540	2950	930	3720
2726	885,2	3540,8	2951	930,2	3720,8
2727	885,4	3541,6	2952	930,4	3721,6
2728	885,6	3542,4	2953	930,6	3722,4
2729	885,8	3543,2	2954	930,8	3723,2
2730	886	3544	2955	931	3724
2731	886,2	3544,8	2956	931,2	3724,8
2732	886,4	3545,6	2957	931,4	3725,6
2733	886,6	3546,4	2958	931,6	3726,4
2734	886,8	3547,2	2959	931,8	3727,2
2735	887	3548	2960	932	3728
2736	887,2	3548,8	2961	932,2	3728,8
2737	887,4	3549,6	2962	932,4	3729,6
2738	887,6	3550,4	2963	932,6	3730,4
2739	887,8	3551,2	2964	932,8	3731,2
2740	888	3552	2965	933	3732
2741	888,2	3552,8	2966	933,2	3732,8
2742	888,4	3553,6	2967	933,4	3733,6
2743	888,6	3554,4	2968	933,6	3734,4
2744	888,8	3555,2	2969	933,8	3735,2

Uplink CH (TX)	Freq (MHz)	VCO (MHz)	Downlink CH (RX)	Freq (MHz)	VCO (MHz)
2745	889	3556	2970	934	3736
2746	889,2	3556,8	2971	934,2	3736,8
2747	889,4	3557,6	2972	934,4	3737,6
2748	889,6	3558,4	2973	934,6	3738,4
2749	889,8	3559,2	2974	934,8	3739,2
2750	890	3560	2975	935	3740
2751	890,2	3560,8	2976	935,2	3740,8
2752	890,4	3561,6	2977	935,4	3741,6
2753	890,6	3562,4	2978	935,6	3742,4
2754	890,8	3563,2	2979	935,8	3743,2
2755	891	3564	2980	936	3744
2756	891,2	3564,8	2981	936,2	3744,8
2757	891,4	3565,6	2982	936,4	3745,6
2758	891,6	3566,4	2983	936,6	3746,4
2759	891,8	3567,2	2984	936,8	3747,2
2760	892	3568	2985	937	3748
2761	892,2	3568,8	2986	937,2	3748,8
2762	892,4	3569,6	2987	937,4	3749,6
2763	892,6	3570,4	2988	937,6	3750,4
2764	892,8	3571,2	2989	937,8	3751,2
2765	893	3572	2990	938	3752
2766	893,2	3572,8	2991	938,2	3752,8
2767	893,4	3573,6	2992	938,4	3753,6
2768	893,6	3574,4	2993	938,6	3754,4
2769	893,8	3575,2	2994	938,8	3755,2
2770	894	3576	2995	939	3756
2771	894,2	3576,8	2996	939,2	3756,8
2772	894,4	3577,6	2997	939,4	3757,6
2773	894,6	3578,4	2998	939,6	3758,4
2774	894,8	3579,2	2999	939,8	3759,2
2775	895	3580	3000	940	3760
2776	895,2	3580,8	3001	940,2	3760,8
2777	895,4	3581,6	3002	940,4	3761,6
2778	895,6	3582,4	3003	940,6	3762,4
2779	895,8	3583,2	3004	940,8	3763,2

Uplink CH (TX)	Freq (MHz)	VCO (MHz)	Downlink CH (RX)	Freq (MHz)	VCO (MHz)
2780	896	3584	3005	941	3764
2781	896,2	3584,8	3006	941,2	3764,8
2782	896,4	3585,6	3007	941,4	3765,6
2783	896,6	3586,4	3008	941,6	3766,4
2784	896,8	3587,2	3009	941,8	3767,2
2785	897	3588	3010	942	3768
2786	897,2	3588,8	3011	942,2	3768,8
2787	897,4	3589,6	3012	942,4	3769,6
2788	897,6	3590,4	3013	942,6	3770,4
2789	897,8	3591,2	3014	942,8	3771,2
2790	898	3592	3015	943	3772
2791	898,2	3592,8	3016	943,2	3772,8
2792	898,4	3593,6	3017	943,4	3773,6
2793	898,6	3594,4	3018	943,6	3774,4
2794	898,8	3595,2	3019	943,8	3775,2
2795	899	3596	3020	944	3776
2796	899,2	3596,8	3021	944,2	3776,8
2797	899,4	3597,6	3022	944,4	3777,6
2798	899,6	3598,4	3023	944,6	3778,4
2799	899,8	3599,2	3024	944,8	3779,2
2800	900	3600	3025	945	3780
2801	900,2	3600,8	3026	945,2	3780,8
2802	900,4	3601,6	3027	945,4	3781,6
2803	900,6	3602,4	3028	945,6	3782,4
2804	900,8	3603,2	3029	945,8	3783,2
2805	901	3604	3030	946	3784
2806	901,2	3604,8	3031	946,2	3784,8
2807	901,4	3605,6	3032	946,4	3785,6
2808	901,6	3606,4	3033	946,6	3786,4
2809	901,8	3607,2	3034	946,8	3787,2
2810	902	3608	3035	947	3788
2811	902,2	3608,8	3036	947,2	3788,8
2812	902,4	3609,6	3037	947,4	3789,6
2813	902,6	3610,4	3038	947,6	3790,4
2814	902,8	3611,2	3039	947,8	3791,2

Uplink CH (TX)	Freq (MHz)	VCO (MHz)	Downlink CH (RX)	Freq (MHz)	VCO (MHz)
2815	903	3612	3040	948	3792
2816	903,2	3612,8	3041	948,2	3792,8
2817	903,4	3613,6	3042	948,4	3793,6
2818	903,6	3614,4	3043	948,6	3794,4
2819	903,8	3615,2	3044	948,8	3795,2
2820	904	3616	3045	949	3796
2821	904,2	3616,8	3046	949,2	3796,8
2822	904,4	3617,6	3047	949,4	3797,6
2823	904,6	3618,4	3048	949,6	3798,4
2824	904,8	3619,2	3049	949,8	3799,2
2825	905	3620	3050	950	3800
2826	905,2	3620,8	3051	950,2	3800,8
2827	905,4	3621,6	3052	950,4	3801,6
2828	905,6	3622,4	3053	950,6	3802,4
2829	905,8	3623,2	3054	950,8	3803,2
2830	906	3624	3055	951	3804
2831	906,2	3624,8	3056	951,2	3804,8
2832	906,4	3625,6	3057	951,4	3805,6
2833	906,6	3626,4	3058	951,6	3806,4
2834	906,8	3627,2	3059	951,8	3807,2
2835	907	3628	3060	952	3808
2836	907,2	3628,8	3061	952,2	3808,8
2837	907,4	3629,6	3062	952,4	3809,6
2838	907,6	3630,4	3063	952,6	3810,4
2839	907,8	3631,2	3064	952,8	3811,2
2840	908	3632	3065	953	3812
2841	908,2	3632,8	3066	953,2	3812,8
2842	908,4	3633,6	3067	953,4	3813,6
2843	908,6	3634,4	3068	953,6	3814,4
2844	908,8	3635,2	3069	953,8	3815,2
2845	909	3636	3070	954	3816
2846	909,2	3636,8	3071	954,2	3816,8
2847	909,4	3637,6	3072	954,4	3817,6
2848	909,6	3638,4	3073	954,6	3818,4
2849	909,8	3639,2	3074	954,8	3819,2

Uplink CH (TX)	Freq (MHz)	VCO (MHz)	Downlink CH (RX)	Freq (MHz)	VCO (MHz)
2850	910	3640	3075	955	3820
2851	910,2	3640,8	3076	955,2	3820,8
2852	910,4	3641,6	3077	955,4	3821,6
2853	910,6	3642,4	3078	955,6	3822,4
2854	910,8	3643,2	3079	955,8	3823,2
2855	911	3644	3080	956	3824
2856	911,2	3644,8	3081	956,2	3824,8
2857	911,4	3645,6	3082	956,4	3825,6
2858	911,6	3646,4	3083	956,6	3826,4
2859	911,8	3647,2	3084	956,8	3827,2
2860	912	3648	3085	957	3828
2861	912,2	3648,8	3086	957,2	3828,8
2862	912,4	3649,6	3087	957,4	3829,6
2863	912,6	3650,4	3088	957,6	3830,4

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
BA	Board Assembly
BB	Baseband
BC02	Bluetooth module made by CSR
BIQUAD	Bi-quadratic (type of filter function)
BSI	Battery Size Indicator
BT	Bluetooth
CBus	MCU controlled serial bus connected to UPP_WD2, UEME and Zocus
CCP	Compact Camera Port
CDMA	Code division multiple access
CDSP	Cellular DSP (expected to run at low levels)
CLDC	Connected limited device configuration
CMOS	Complimentary metal-oxide semiconductor circuit (low power consumption)
COF	Chip on Foil
COG	Chip on Glass
CPU	Central Processing Unit
CSD	Circuit-switched data
CSR	Cambridge silicon radio
CSTN	Colour Super Twisted Nematic
CTSI	Clock Timing Sleep and interrupt block of Tiku
CW	Continuous wave
D/A-converter	Digital-to-analogue converter
DAC	Digital-to-analogue converter
DBI	Digital Battery Interface
DBus	DSP controlled serial bus connected between UPP_WD2 and Helgo

DCT-4	Digital Core Technology
DMA	Direct memory access
DP	Data Package
DPLL	Digital Phase Locked Loop
DSP	Digital Signal Processor
DTM	Dual Transfer Mode
DtoS	Differential to Single ended
EDGE	Enhanced data rates for global/GSM evolution
EGSM	Extended GSM
EM	Energy management
EMC	Electromagnetic compatibility
EMI	Electromagnetic interference
ESD	Electrostatic discharge
FCI	Functional cover interface
FM	Frequency Modulation
FPS	Flash Programming Tool
FR	Full rate
FSTN	Film compensated super twisted nematic
GMSK	Gaussian Minimum Shift Keying
GND	Ground, conductive mass
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	Multiport control unit
MIC, mic	Microphone
MIDP	Mobile Information Device Profile
MIN	Mobile identification number
MIPS	Million instructions per second
MMC	Multimedia card
MMS	Multimedia messaging service
MP3	Compressed audio file format developed by Moving Picture Experts Group
MTP	Multipoint-to-point connection
NFC	Near field communication
NTC	Negative temperature coefficient, temperature sensitive resistor used as a temperature sensor
OMA	Object management architecture
OMAP	Operations, maintenance, and administration part
Opamp	Operational Amplifier
PA	Power amplifier
PCM	Pulse Code Modulation
PDA	Pocket Data Application
PDA	Personal digital assistant
PDRAM	Program/Data RAM (on chip in Tiku)
Phoenix	Software tool of DCT4.x and BB5
PIM	Personal Information Management
PLL	Phase locked loop
PM	(Phone) Permanent memory
PUP	General Purpose IO (PIO), USARTS and Pulse Width Modulators
PURX	Power-up reset
PWB	Printed Wiring Board

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

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

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