Nokia Customer Care

Service Manual

RM-235 (Nokia N78; L3&4)
Mobile Terminal

Part No: (Issue 1)

COMPANY CONFIDENTIAL

NOKIA
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Amendment Record Sheet

Amendment No	Date	Inserted By	Comments
Issue 1	03/2008	A. Salo	

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IMPORTANT

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

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Warnings and cautions

Warnings

- IF THE DEVICE CAN BE INSTALLED IN A VEHICLE, CARE MUST BE TAKEN ON INSTALLATION IN VEHICLES FITTED WITH ELECTRONIC ENGINE MANAGEMENT SYSTEMS AND ANTI-SKID BRAKING SYSTEMS. UNDER CERTAIN FAULT CONDITIONS, EMITTED RF ENERGY CAN AFFECT THEIR OPERATION. IF NECESSARY, CONSULT THE VEHICLE DEALER/ MANUFACTURER TO DETERMINE THE IMMUNITY OF VEHICLE ELECTRONIC SYSTEMS TO RF ENERGY.

- THE PRODUCT MUST NOT BE OPERATED IN AREAS LIKELY TO CONTAIN POTENTIALLY EXPLOSIVE ATMOSPHERES, FOR EXAMPLE, PETROL STATIONS (SERVICE STATIONS), BLASTING AREAS ETC.

- OPERATION OF ANY RADIO TRANSMITTING EQUIPMENT, INCLUDING CELLULAR TELEPHONES, MAY INTERFERE WITH THE FUNCTIONALITY OF INADEQUATELY PROTECTED MEDICAL DEVICES. CONSULT A PHYSICIAN OR THE MANUFACTURER OF THE MEDICAL DEVICE IF YOU HAVE ANY QUESTIONS. OTHER ELECTRONIC EQUIPMENT MAY ALSO BE SUBJECT TO INTERFERENCE.

- BEFORE MAKING ANY TEST CONNECTIONS, MAKE SURE YOU HAVE SWITCHED OFF ALL EQUIPMENT.

Cautions

- Servicing and alignment must be undertaken by qualified personnel only.

- Ensure all work is carried out at an anti-static workstation and that an anti-static wrist strap is worn.

- Ensure solder, wire, or foreign matter does not enter the telephone as damage may result.

- Use only approved components as specified in the parts list.

- Ensure all components, modules, screws and insulators are correctly re-fitted after servicing and alignment.

- Ensure all cables and wires are repositioned correctly.

- Never test a mobile phone WCDMA transmitter with full Tx power, if there is no possibility to perform the measurements in a good performance RF-shielded room. Even low power WCDMA transmitters may disturb nearby WCDMA networks and cause problems to 3G cellular phone communication in a wide area.

- During testing never activate the GSM or WCDMA transmitter without a proper antenna load, otherwise GSM or WCDMA PA may be damaged.

ESD protection

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

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

To replace the covers ESD protection must be applied.

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

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

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

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

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

Care and maintenance

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

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

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

Company Policy

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

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

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Battery information

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

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

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

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

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

Use the battery only for its intended purpose.

Never use any charger or battery which is damaged.

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

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

Do not dispose of batteries in a fire!

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

Nokia N78; L3&4 Service Manual Structure

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1 — General Information

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■ Product selection

The device is a dual mode handportable multimedia computer, supporting GSM/ GPRS/ EGPRS 850/900/1800/1900, with WCDMA 900/2100 HSDPA and WLAN.

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

For 2G and 2.5G networks the device is a Class A EGPRS DTM MSC 11 which means a maximum download speed of up to 296kbit/s with EGPRS, and up to 107kbit/s with GPRS.

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

The device supports two way video calls with two integrated cameras, one on the front and one on the back.

The device is an MMS (Multimedia Messaging Service) enabled multimedia computer with a large 2.4'' QVGA (240 x 320 pixels) TFT colour display capable of displaying 16 million colours and an integrated 3.2 Megapixel auto focus camera. The MMS implementation follows the OMA MMS standard release 1.2. The Browser is a highly advanced internet browser also capable of viewing operator domain XHTML Mobile Profile (MP) content.

The device uses Symbian 9.3 operating system and supports MIDP Java 2.0 & CLDC1.1, providing a good platform for compelling 3rd party applications.

Figure 1 View of RM-235

■ Product features and sales package

Imaging

Main camera:

- Sensor: 3.2 megapixel
- Carl Zeiss Optics: Tessar™ lens
- F number/Aperture: F2.8

- Focal length: 4.6 mm

   35 mm (35 mm equivalent)
- Focus range: 10 cm ~ infinity
- Macro focus distance: 10-50 cm
- Shutter speed: Mechanical shutter 1/1000~1/4 s

Secondary camera:

- Sensor: CIF (352 x 288 pixels)
- F number/Aperture: F2.8
- Focal length: 43 mm (35mm equivalent)
- Focus range: 10 cm ~ infinity

Video:

- Video resolution: QCIF at 15 fps
- Audio recording: AAC (AMR for MMS)
- Video stabilization
- Video clip length: 60 min
- Video file format: .mp4 (default), .3gp (for MMS)
- White balance: automatic, sunny, cloudy, incandescent, fluorescent
- Scene: Auto, Night
- Colour tone: normal, sepia, B&W, vivid, negative
- Zoom (digital): up to 8x

Photo:

- Still image resolutions: up to 3.2 megapixel: 2048 x 1536
- Still image file format: JPEG/EXIF
- Auto focus
- Auto exposure: center weighted AE
- Image orientation: automatic
- Exposure compensation: +2 ~ -2EV at 0.5 step
- White balance: automatic, sunny, cloudy, incandescent, fluorescent
- Scene: auto, sports, portrait, close-up, landscape, night, user defined
- Colour tone: normal, sepia, B&W, vivid, negative
- Zoom (digital): up to 20x

Other camera features:

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

Edit

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

View

- 2.4" QVGA (240 x 320 pixels) 16 million colour TFT display with wide viewing angle and ambient light detector - used to optimize display and keypad backlight brightness and power consumption
- Slideshow from Gallery

Share

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

Print

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

Store

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

Music

- Digital music player: supports MP3/ AAC/ AAC+/ eAAC+/ WMA with playlists, equalizer and album art.
- Synchronise music with Microsoft Windows Media Player 10 & 11
- One click CD ripping, converting and transferring music to your device using Nokia Music Manager
- Stereo FM radio (87.5-108MHz /76-90MHz) with Visual Radio™ support
- Stereo speakers
- Integrated FM transmitter (88.1 – 107.9 MHz)
- Integrated handsfree speaker
- Nokia Stereo Headset (HS-45), in-box

Media

- Full-screen video playback to view downloaded, streamed or recorded video clips
- Supported video formats: MPEG-4 , H.264/AVC, H.263/3GPP, RealVideo 8/9/10

Productivity

Messaging:

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

Office applications:

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

PIM:

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

Synchronization:

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

Call management:

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

- Nokia Push to Talk (PoC)

Connectivity

- WLAN - IEEE802.11 g/b with UPnP support
- Mini USB type B interface with USB 2.0 high speed
- Bluetooth wireless technology 2.0 + EDR
- Nokia 3.5 mm AV connector

Add-on software framework

- Symbian 9.3 OS
- Nokia Series 60, 3rd edition, feature pack 2
- Java: MIDP2.0
- C++ and Java SDKs

Additional technical specifications

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

Sales package

- Transceiver RM-235
- Charger (AC-5)
- Battery (BL-6F)
- Music headset (HS-45/AD-45; HS-45/AD-43; HS-45/AD-54)
- Connectivity cable (CA-101)

■ Mobile enhancements

Table 1 Audio

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

Enhancement	Type
Wireless headset	HS-26W
	HS-36W
Bluetooth headset	BH-100
	MONO BH-200
	BH-201
	BH-202
	BH-203
	BH-205
	BH-206
	BH-207
	BH-300
	BH-301
	BH-302
	BH-303
	STEREO BH-501
	BH-600
	STEREO BH-601
	BH-602
	BH-700
	BH-701
	BH-800
	BH-801
	BH-802
	BH-900
	BH-902
	STEREO BH-903
Wireless stereo gateway	AD-42W
Music headphone	HS-61
Advanced headphone	HS-62
Music speaker	MD-3
Mini speaker	MD-4

Table 2 Car

Enhancement	Type
Nokia Universal Holder	CR-99

Enhancement	Type
Mobile charger	DC-4
Wireless plug-in car handsfree	HF-6W
	HF-33W
	HF-34W
	HF-35W
Car kit	Nokia 616
Multimedia car kit	CK-20W

Table 3 Data

Enhancement	Type
Connectivity cable	CA-101
Video connectivity cable	CA-75U
MicroSD card	128MB upwards

Table 4 GPS

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

Table 5 Messaging

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

Table 6 Power

Enhancement	Type
Battery 1200mAh Li-ion	BL-6F
Travel charger	AC-4
	AC-5
Charger adapter	CA-44

Table 7 Carrying

Enhancement	Type
Universal carrying case	

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■ **Technical specifications**

Transceiver general specifications

Unit	Dimensions (L x W x T) (mm)	Weight (g)	Volume (cm^3)
Transceiver with BL-6F 1200mAh li-ion battery back	113 x 49 x 15.1	~100.8	76.5

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
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 ... +29dBm/3.2mW ... 794mW
	EDGE900: +5 ... +29dBm/3.2mW ... 794mW
	EDGE1800: +0 ... +26dBm/1.0mW ... 400mW
	EDGE1900:+0 ... +26dBm/1.0mW ... 400mW

Parameter	Unit
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

Battery endurance

Battery	Capacity (mAh)	Talk time	Stand-by
BL-6F	1200	up to 190 mins (WCDMA) & 260 mins (GSM)	up to 320 hrs (WCDMA) & 320 hrs (GSM)

Charging times

AC-5
1h 30 min

Environmental conditions

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

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

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2 — Service Tools and Service Concepts

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■ **Service tools**

Product specific tools

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-235. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

FS-58	FS-58	Flash adapter	
	• FS-58 is equipped with a clip interlock system • provides standardised interface towards Control Unit • multiplexing between USB and FBUS media, controlled by VUSB		

MJ-144	MJ-144	Module jig	
	MJ-144 is meant for component level troubleshooting. The jig includes RF interface for Bluetooth, WLAN and GPS. In addition, it has the following features: • Provides mechanical interface with the engine module • Provides galvanic connection to all needed test pads in module • Multiplexing between USB and FBUS media, controlled by Vusb • Duplicated SIM connector • Connector for control unit • Access for Audio-, MMC, and USB connectors		

RJ-178	RJ-178	Soldering jig	
	RJ-178 is a soldering jig used for soldering and as a rework jig for the engine module.		
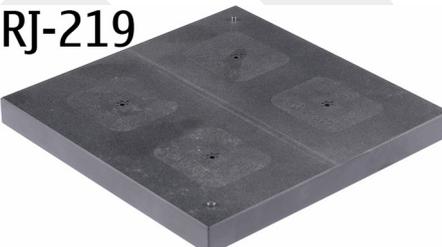
RJ-219	RJ-219	Rework jig	
	RJ-219 is a jig used for soldering and as a rework jig for the FM transmitter chip. It is used together with the ST-69 stencil.		

SA-135	SA-135	RF coupler	
	SA-135 is an RF coupler for WCDMA and GSM RF testing. It is used together with the product-specific flash adapter.		
		Spare locking part for FS-58	
	Spare part for FS-58.		
SS-100	SS-100	Camera removal tool	
	The camera removal tool SS-100 is used to remove/attach a camera module from/to the camera socket of the phone PWB.		
SS-149	SS-149	UI disassembly tool	
	SS-149 is used for removing UI assy when disassembling the phone.		
	SS-153	Superkey pressing tool	
	SS-153 is used to bond the superkey to the UI module when reassembling the device with the new UI module. **Note:** To ensure proper bonding, pressure needs to be applied at least 3 seconds and assembly should be always verified by using phoenix keypad test.		
	SS-159	Window disassembly tool	
	SS-159 is used for removing window assy when disassembling the phone.		

SS-184	Window release tool	
SS-184 is used for removing sub LCD window assy without disassembling the phone.		

ST-69	Rework stencil	
ST-69 is a rework stencil used with RJ-219.		

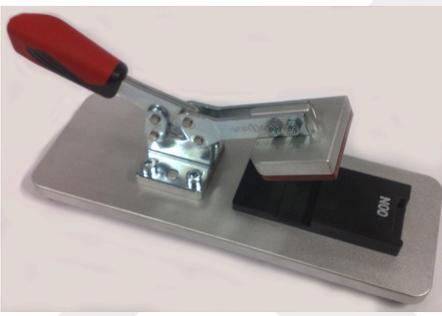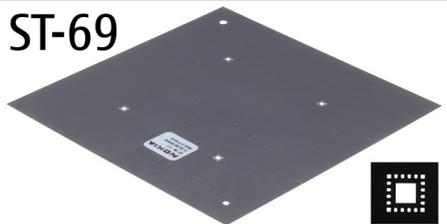## General tools

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-235. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

RJ-196	Rework jig	
RJ-196 is a rework jig used when servicing the BTHFM (D6000) module. It is used together with rework stencil ST-37.		

RJ-209	Rework jig	
RJ-209 is used as a rework jig for the WLAN 4.0 module This stencil takes the WLAN 4.0 module for spreading soldering paste onto the component. This must be used together with the ST-64 rework stencil.		

	RJ-93	Rework jig	
	RJ-93 is a rework jig used with ST-40.		
	ST-37	BTHFM rework stencil	
	ST-37 stencil is used with the RJ-104 rework jig to service the BTHFM (D6000) module.		
	ST-40	Rework stencil	
	ST-40 is a rework stencil and used with RJ-93.		
	ST-64	Rework stencil	
	ST-64 is the stencil used during rework of the WLAN 4.0 module. It must be used together with the RJ-209 rework jig.		
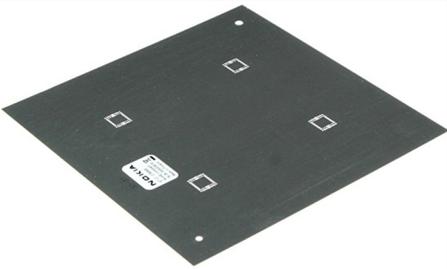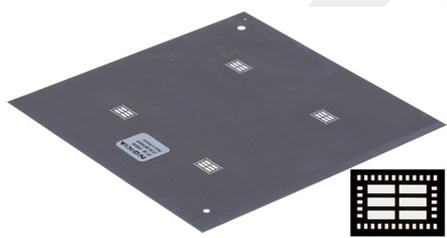
Cables

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-235. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

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

	PCS-1	Power cable	
	The PCS-1 power cable (DC) is used with a docking station, a module jig or a control unit to supply a controlled voltage.		
	XCS-1	Service cable	
	The XCS-1 service cable is used to connect FLS-4S to the POS flash adapter for supplying a controlled operating voltage and data connection.		
	XCS-4	Modular cable	
	XCS-4 is a shielded (one specially shielded conductor) modular cable for flashing and service purposes.		

	XRS-6	RF cable	
	The RF cable is used to connect, for example, a module repair jig to the RF measurement equipment. SMA to N-Connector approximately 610 mm. Attenuation for: • GSM850/900: 0.3+-0.1 dB • GSM1800/1900: 0.5+-0.1 dB • WLAN: 0.6+-0.1dB		

■ Service concepts

POS (Point of Sale) flash concept
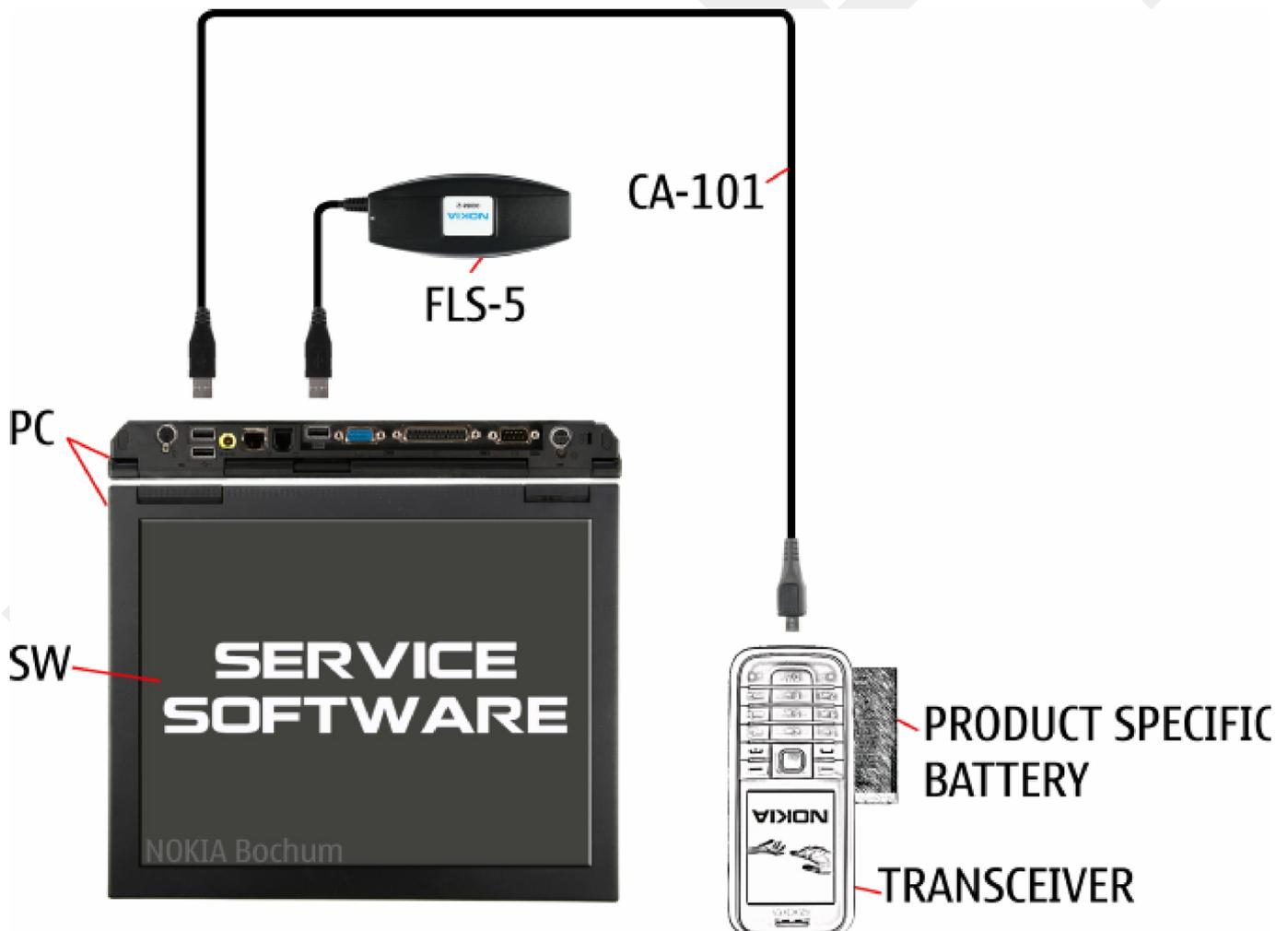
Figure 2 POS flash concept

Type	Description
Product specific tools	

Type	Description
BL-6F	Battery
Other tools	
FLS-5	POS flash dongle
	PC with Phoenix service software
Cables	
CA-101	USB connectivity cable

Flash concept with FPS-10
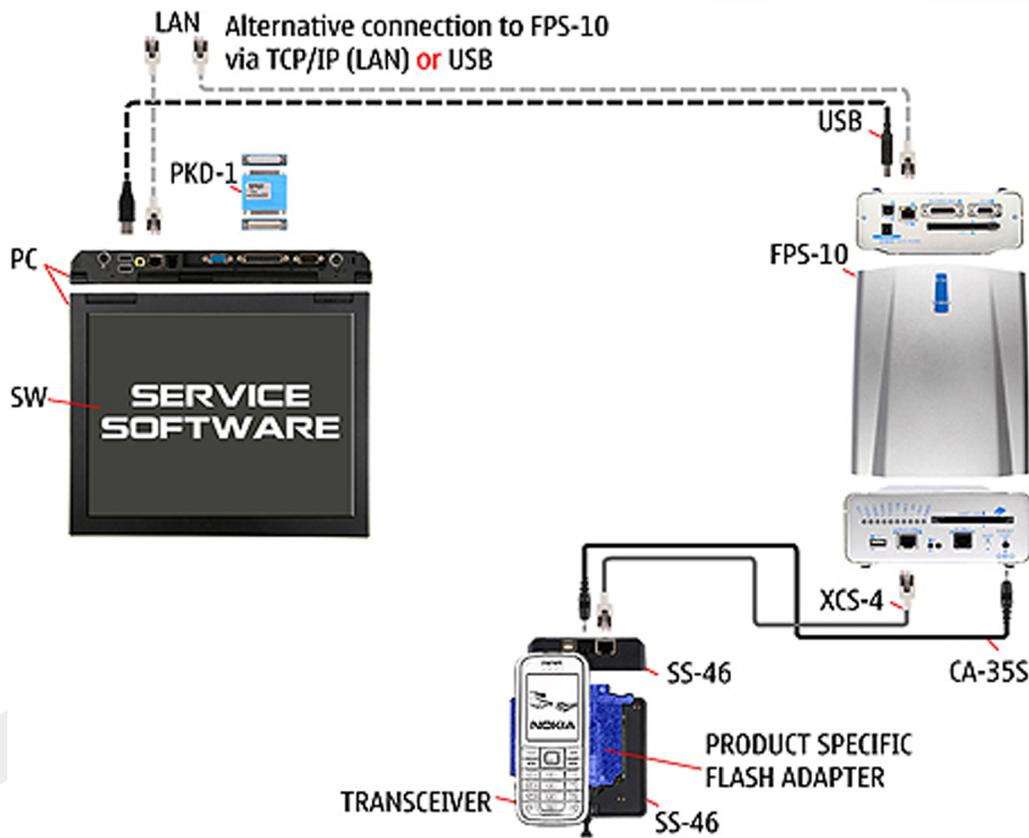
Figure 3 Basic flash concept with FPS-10

Type	Description
Product specific devices	
FS-58	Flash adapter
Other devices	
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-46	Interface adapter
	PC with Phoenix service software
Cables	

Type	Description
XCS-4	Modular cable
CA-35S	Power cable
	USB cable

CU-4 flash concept with FPS-10
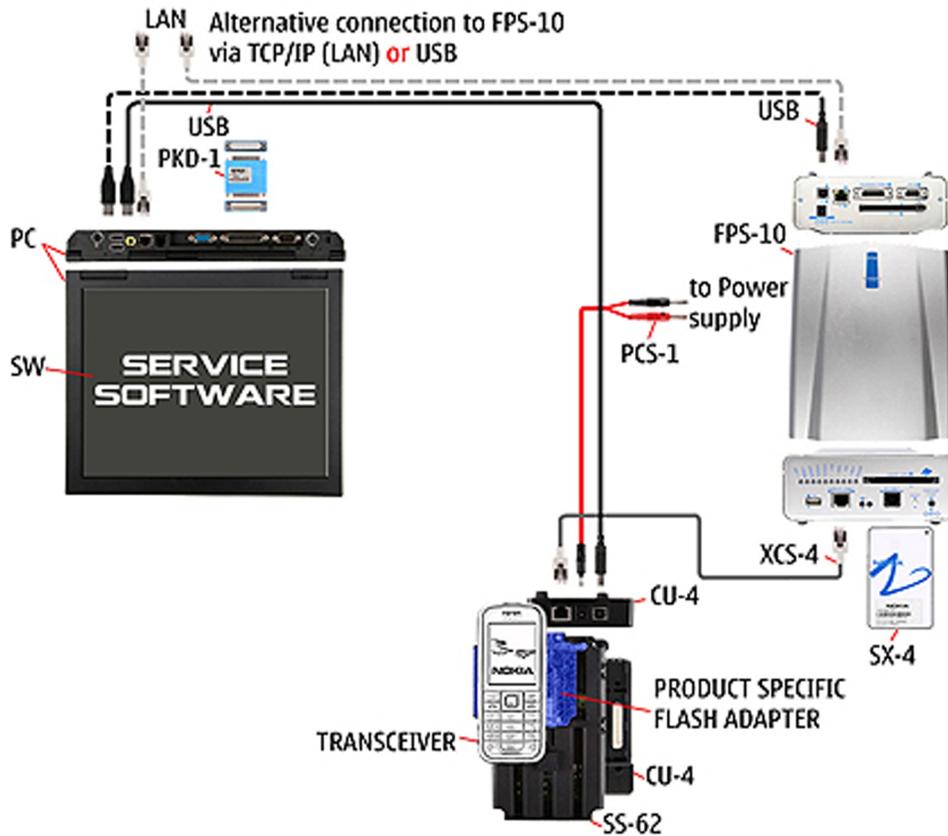
Figure 4 CU-4 flash concept with FPS-10

Type	Description
Product specific devices	
FS-58	Flash adapter
Other devices	
CU-4	Control unit
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-62	Flash adapter base
SX-4	Smart card
	PC with Phoenix service software
Cables	
PCS-1	Power cable

Type	Description
XCS-4	Modular cable
	Standard USB cable
	USB cable

Flash concept with FPS-10 and SB-6
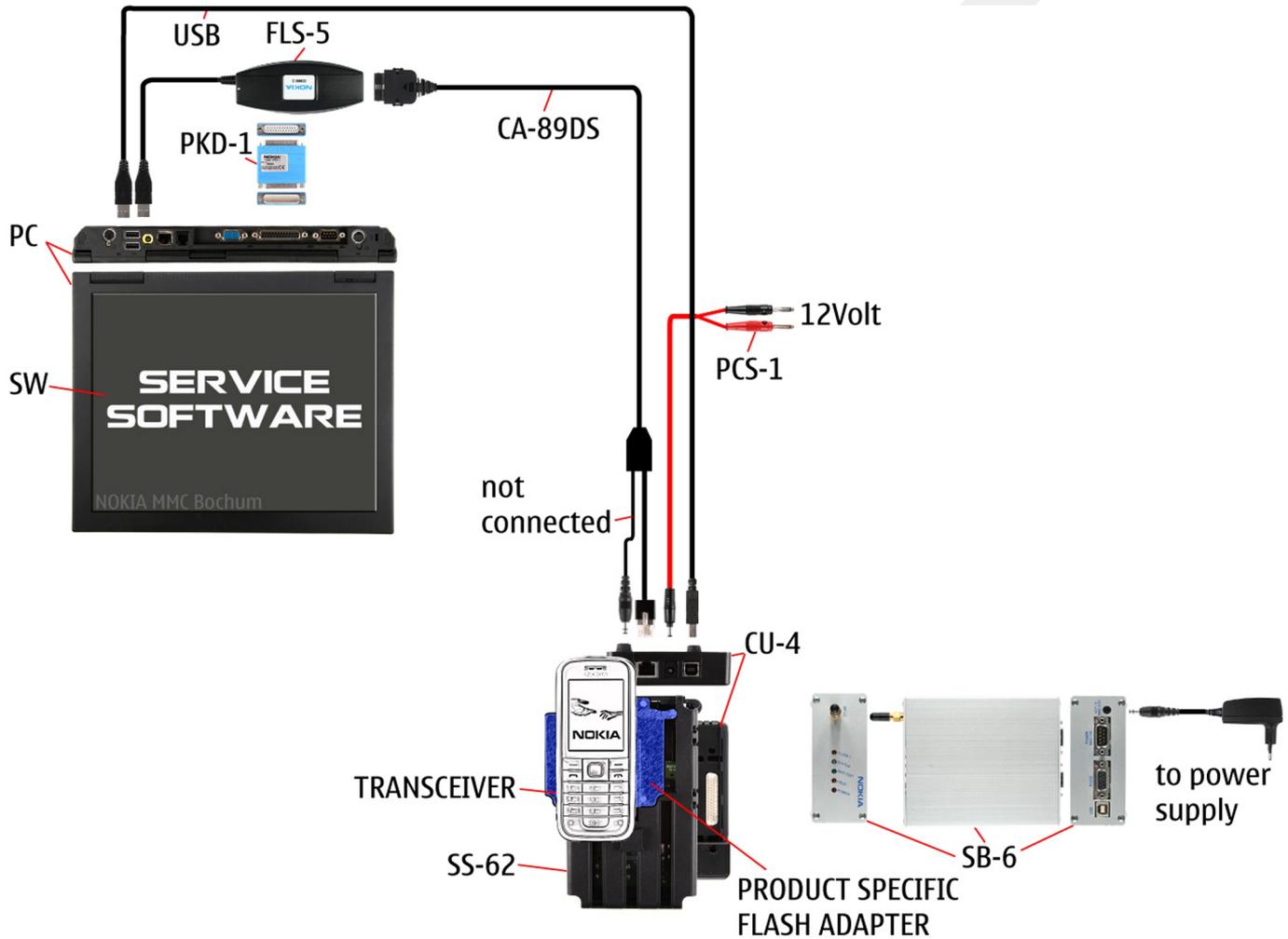
Figure 5 Flash concept with FPS-10 and SB-6

Type	Description
Product specific tools	
FS-58	Flash adapter
Other tools	
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-46	Interface adapter
SB-6	Bluetooth test and interface box

Type	Description
	PC with Phoenix service software
Cables	
XCS-4	Modular cable
CA-35S	Power cable
	USB cable

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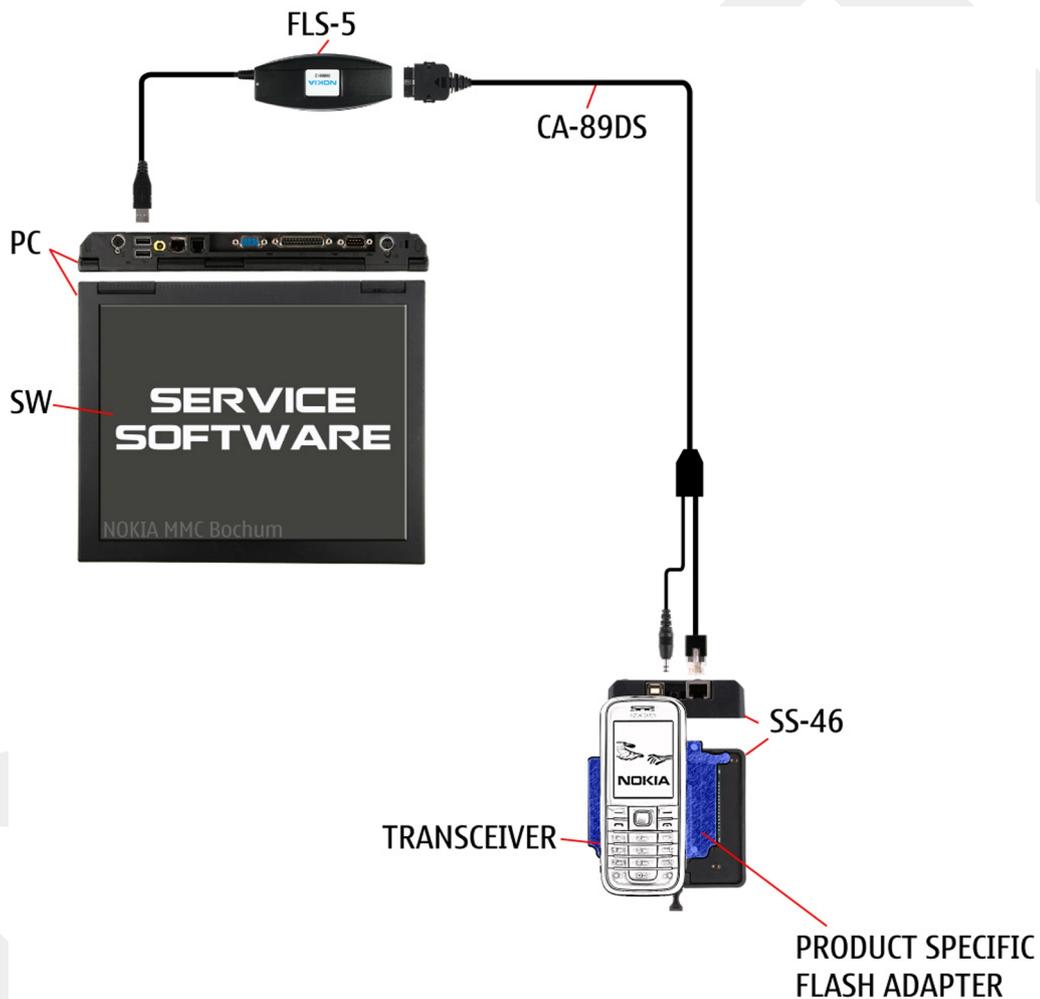
Figure 6 Flash concept with SS-46 and CA-89DS

Type	Description
Product specific tools	
FS-58	Flash adapter
Other tools	
FLS-5	Flash device
SS-46	Interface adapter

Type	Description
	PC with Phoenix service software
Cables	
CA-89DS	Cable

Flash concept with SS-62 and CA-89DS
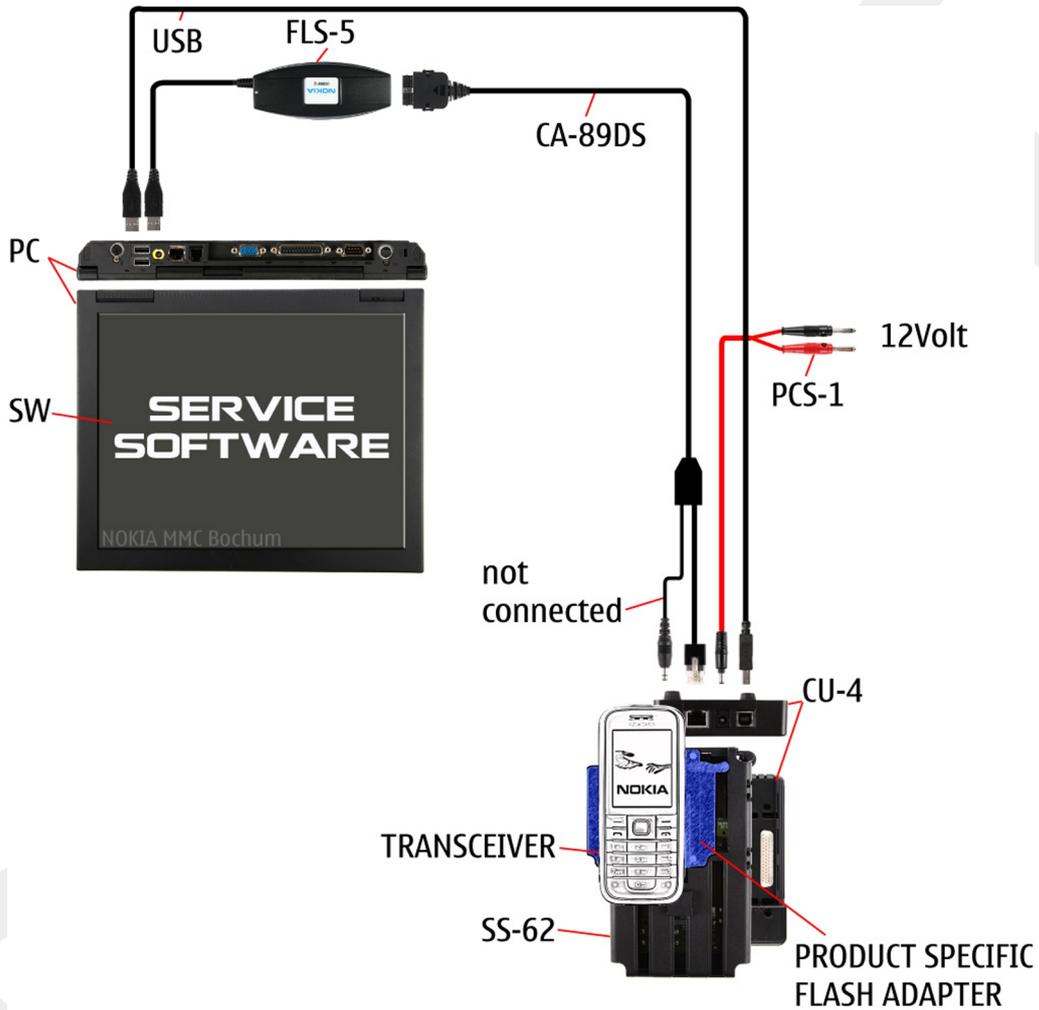
Figure 7 Flash concept with SS-62 and CA-89DS

Type	Description
Product specific tools	
FS-58	Flash adapter
Other tools	
CU-4	Control unit
FLS-5	Flash device
SS-62	Flash adapter base
	PC with Phoenix service software

Type	Description
Cables	
CA-89DS	Cable
PCS-1	Power cable
	USB cable

Flash concept with FPS-10, SS-62 and SB-6
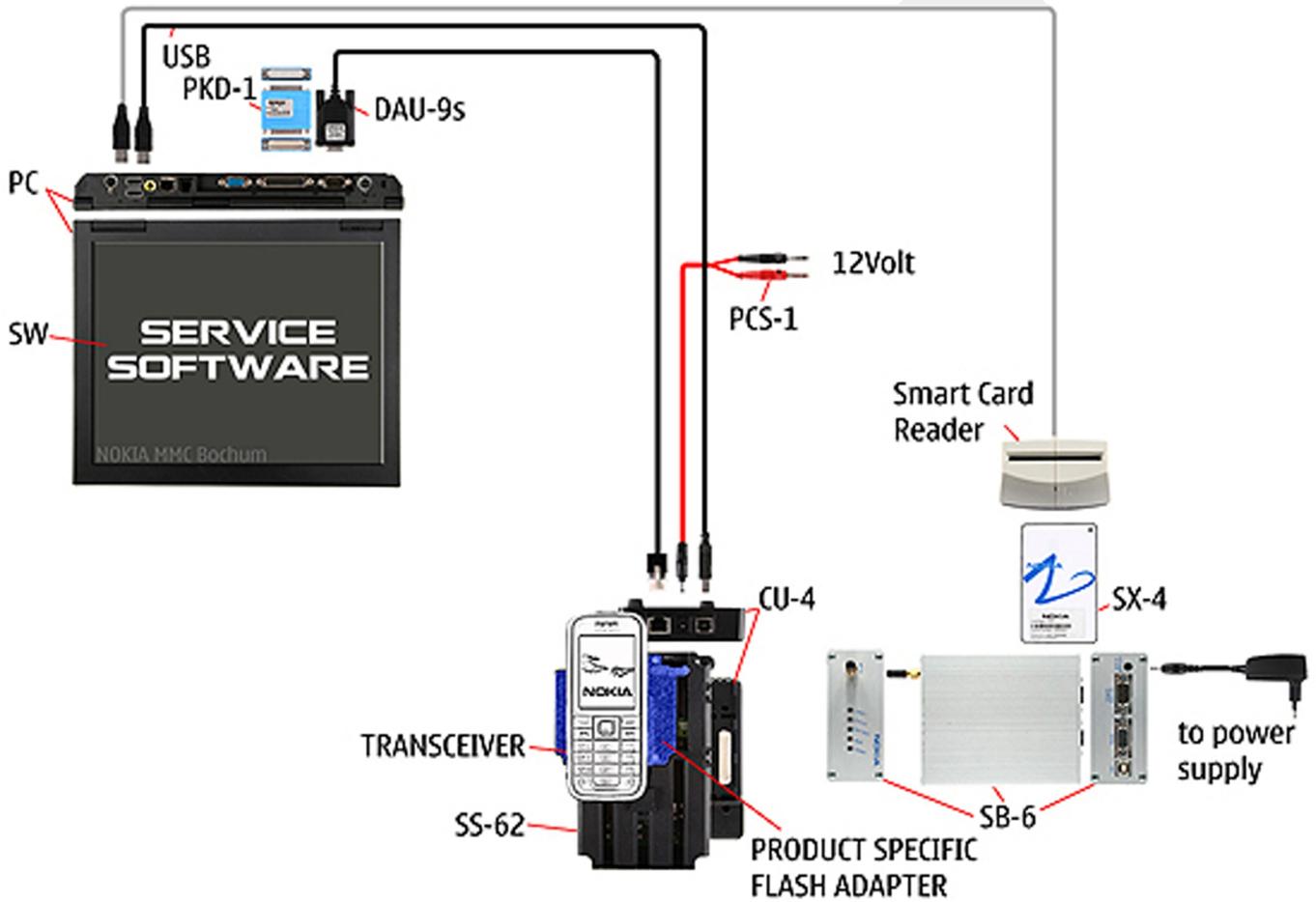
Figure 8 Flash concept with FPS-10, SS-62 and SB-6

Type	Description
Product specific tools	
FS-58	Flash adapter
Other tools	
CU-4	Control unit
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-62	Flash adapter base
SB-6	Bluetooth test and interface box

Type	Description
SX-4	Smart card
	PC with Phoenix service software
Cables	
XCS-4	Modular cable
PCS-1	Power cable
	USB cable

Flash concept with FPS-10, SS-62 and SB-7
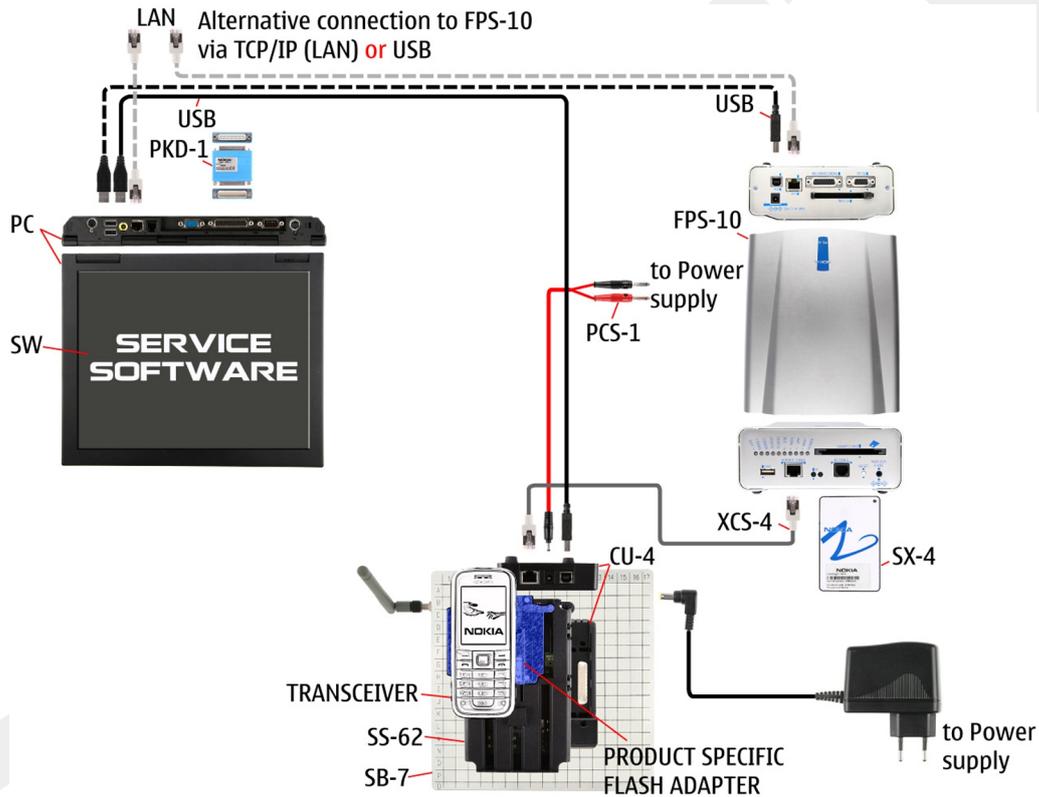
Figure 9 Flash concept with FPS-10, SB-7 and JBT-9

Type	Description
Product specific tools	
FS-58	Flash adapter
Other tools	
CU-4	Control unit
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SB-7	WLAN test box
SS-62	Flash adapter base

Type	Description
SX-4	Smart card
	PC with Phoenix service software
Cables	
XCS-4	Modular cable
PCS-1	Power cable
	USB cable

Module jig service concept
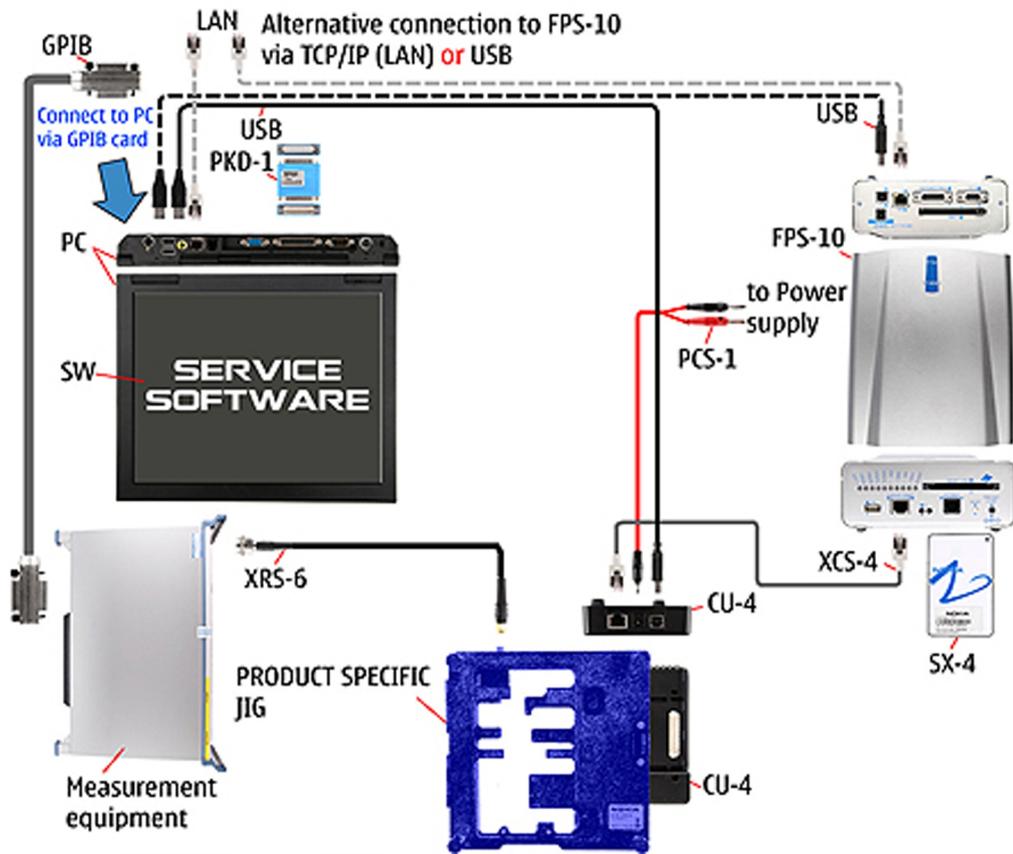
Figure 10 Module jig service concept

Type	Description
Phone specific devices	
MJ-144	Module jig
Other devices	
CU-4	Control unit
FPS-10	Flash prommer box
PK-1	SW security device
SX-4	Smart card

Type	Description
	PC with VPOS and Phoenix service software
	Measurement equipment
Cables	
PCS-1	DC power cable
XCS-4	Modular cable
XRF-1	RF cable
	USB cable
	GPIB control cable

Module jig service concept with SB-6
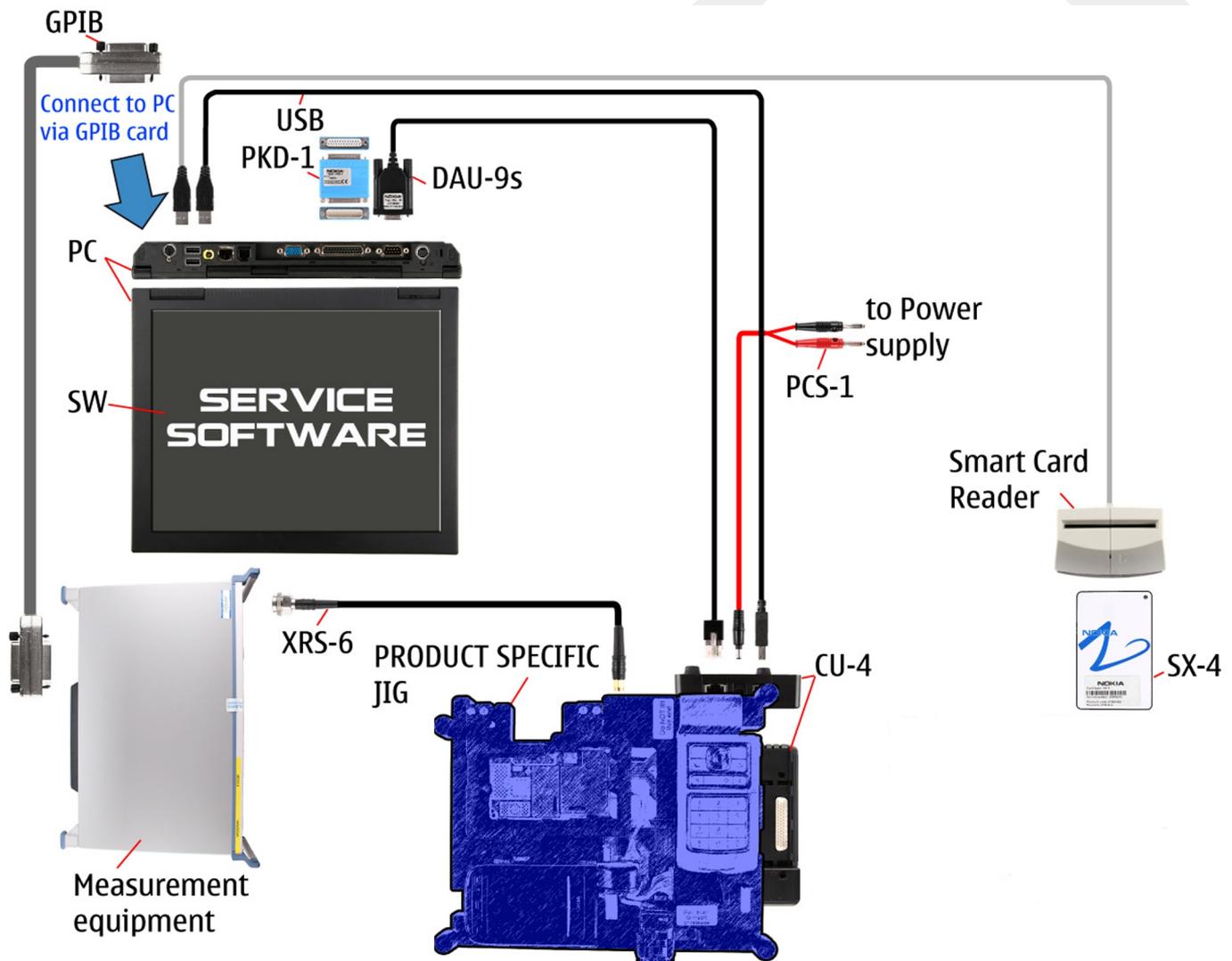
Figure 11 Module jig service concept with SB-6

Type	Description
Product specific tools	

Type	Description
MJ-144	Module jig
Other tools	
CU-4	Control unit
FPS-10	Flash prommer box
SB-6	Bluetooth test and interface box
PKD-1	SW security device
SX-4	Smart card
	Measurement equipment
	PC with Phoenix service software
Cables	
PCS-1	DC power cable
XCS-4	Modular cable
XRS-6	RF cable
	GPIB control cable
	USB cable

RF testing concept with RF coupler
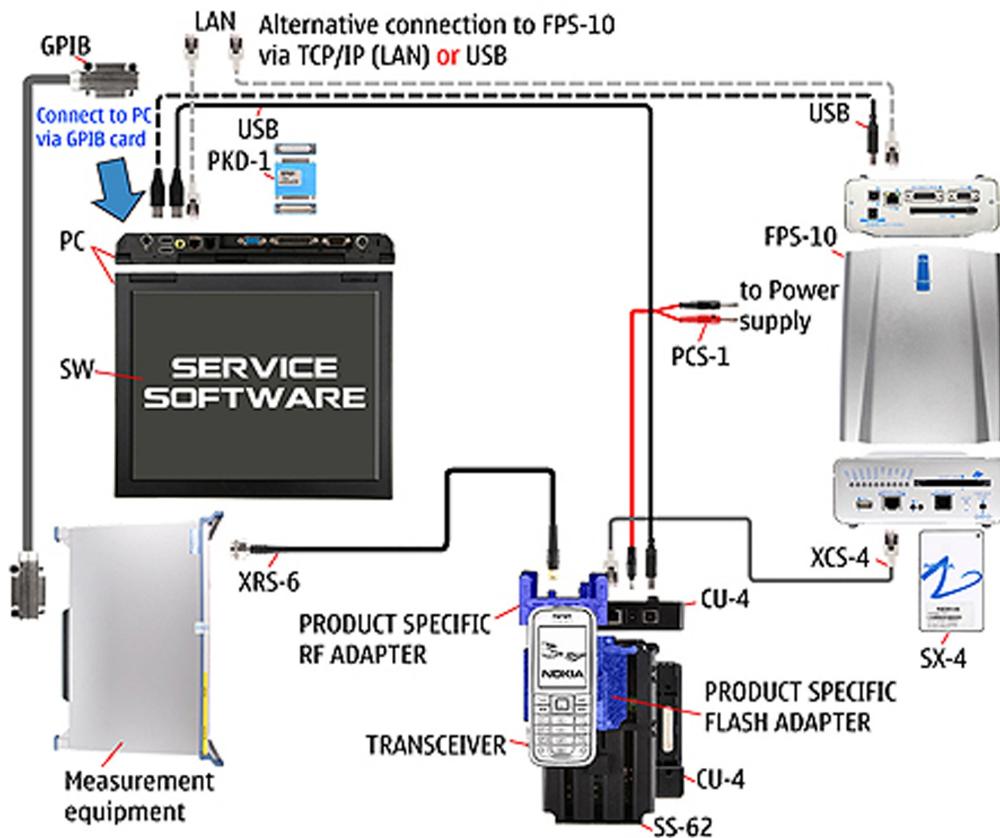
Figure 12 RF testing concept with RF coupler

Type	Description
Product specific devices	
FS-58	Flash adapter
SA-135	RF coupler
Other devices	
CU-4	Control unit
SX-4	Smart card
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-62	Flash adapter base
	Measurement equipment
	PC with Phoenix service software
Cables	
PCS-1	Power cable
XCS-4	Modular cable
XRS-6	RF cable
	GPIB control cable
	USB cable

Service concept for RF testing and RF/BB tuning
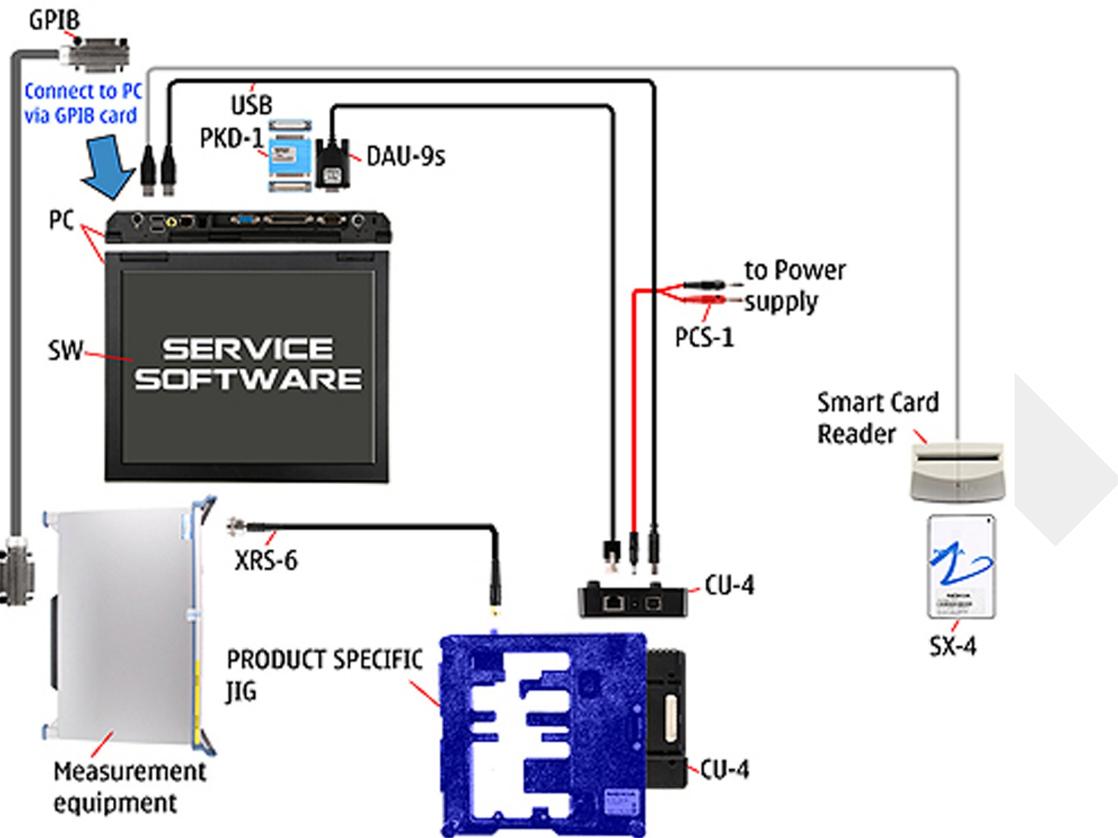
Figure 13 Service concept for RF testing and RF/BB tuning

Type	Description
Product specific devices	
MJ-144	Module jig
Other devices	
CU-4	Control unit
PK-1	SW security device
SX-4	Smart card
	Measurement equipment
	Smart card reader
	PC with Phoenix service software
Cables	
DAU-9S	MBUS cable
PCS-1	DC power cable
XRS-6	RF cable
	GPIB control cable

Type	Description
	USB cable

Nokia Customer Care

3 — BB troubleshooting

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Table of Contents

List of Figures

Baseband main troubleshooting

Troubleshooting flow

```
                    ┌─────────────┐
                    │    Start    │
                    └──────┬──────┘
                           │
                           ▼
```

Start

Phone does not start up or is jammed

Abnormal current consumption → **Dead or jammed device troubleshooting**

Nothing happens When power key is pressed → **Power key troubleshooting**

Normal current consumption

Attempt Phoenix connection

No phoenix connection To the phone

Something happens but phone does not wake up → **Go to General power checking troubleshooting**

Flash the phone

Flashing fails → Flashing, clocking and power troubleshooting page

Phoenix connection works

Flashing succeeded

Run selftests (Both in 'Test' mode and in 'Local' mode)

ST_PWR_KEY_TEST failures

Power consumption normal, no selftest failures → **Display does not work** → Display fault troubleshooting

ST_MAIN_LCD_IF_TEST fails

ST_CURRENT_CONS_TEST failure → Go to General Power Checking Troubleshooting

ST_EAR_DATA_LOOP_TEST failure / Audio(Mic/Earpiece/IHF) does not work → Audio troubleshooting

ST_SIM_CLK_LOOP_TEST or ST_SIM_IO_CTRL_LOOP_ TEST failure/ Phone does not read SIM card → SIM card troubleshooting

ST_BACKUP_BATT_TEST failure → Back-up battery troubleshooting, Replace backup battery

ST_LPRF_IF_TEST, ST_LPRF_AUDIO_LINES_TEST or ST_BT_WAKEUP_TEST fails or Bluetooth does not work → Bluetooth troubleshooting

ST_CAMERA_IF_TEST or ST_CAMERA_AUTOFOCUS_TEST fails or main camera does not work → Camera module troubleshooting

ST_SEC_CAMERA_IF test failure or Sub camera does not work → Camera module troubleshooting

Continue to the next page

```
┌─────────────────────────┐
│ Continued from previous │
│          page           │
└─────────────────────────┘
            │
            ▼
┌─────────────────────────┐      ┌──────────────────────────┐
│ ST_VIBRA_TEST failure   │─────▶│  Vibra troubleshooting   │
│ or vibra does not work  │      └──────────────────────────┘
└─────────────────────────┘
            │
            ▼
┌─────────────────────────┐      ┌──────────────────────────────────┐
│ ST_WLAN_TEST failure or │─────▶│ Troubleshooting flowchart for    │
│   WLAN does not work     │      │ WLAN Interface or WLAN troubleshooting │
└─────────────────────────┘      └──────────────────────────────────┘
            │
            ▼
┌─────────────────────────┐      ┌──────────────────────────┐
│ Phone does not read     │─────▶│      MicroSD card        │
│     MicroSD card        │      │    troubleshooting       │
└─────────────────────────┘      └──────────────────────────┘
            │
            ▼
┌─────────────────────────┐      ┌──────────────────────────┐
│ ST_AMB_LIGHT_SENSOR_    │─────▶│   Ambient light sensor   │
│     TEST fails          │      │    troubleshooting       │
└─────────────────────────┘      └──────────────────────────┘
```

Flashing, clocking and power troubleshooting

```
┌─────────────────────────┐      ┌──────────────────────────┐
│ Flashing does not work  │─────▶│    Go to Flashing        │
│ or the problem is not   │      │   troubleshooting 1      │
│   clearly defined       │      └──────────────────────────┘
└─────────────────────────┘                  │
            │                                 ▼
            ▼                      ┌──────────────────────────┐
┌─────────────────────────┐      │       Flashing           │
│ Attempt Phoenix         │      │   troubleshooting 2      │
│ connection and run      │      └──────────────────────────┘
│ selftests if possible   │                  │
└─────────────────────────┘                  ▼
            │                      ┌──────────────────────────┐
            ▼                      │       Clocking           │
┌─────────────────────────┐      │   troubleshooting        │
│ ST_SLEEPCLK_FREQ_TEST   │─────▶└──────────────────────────┘
│        fails            │                  │
└─────────────────────────┘                  ▼
            │                      ┌──────────────────────────┐
            ▼                      │   CMT Combo memory       │
┌─────────────────────────┐      │   troubleshooting        │
│   ST_SECURITY_TEST      │─────▶└──────────────────────────┘
│        fails            │
└─────────────────────────┘
```

■ General power checking

General power checking

Signal name	Regulator	Sleep	Idle	Nominal voltage	Main user	Notes	Supply
VIO_V	AVILMA	ON	ON	1.82	Vilma I/O, NCW, FMTx		VBAT1
VBACK	AVILMA	ON	ON	2.5	RTC circuitry		
VSIM1	AVILMA	ON	ON	1.8/3,0	SIM card		VBAT3
VAUX	AVILMA	ON	ON	2.78	Displays		VBAT5
VANA	AVILMA	ON	ON	2.5	Vilma internal		VBAT4
VR1	AVILMA	OFF	ON	2.5	VCTCXO		VBAT4

Signal name	Regulator	Sleep	Idle	Nominal voltage	Main user	Notes	Supply
VRFC	AVILMA	OFF	OFF	1.8	RAPIDO converter		
VRCP1	AVILMA	OFF	OFF	4.75	RF module	RF active	VBATCP
VOUT	BETTY	ON	ON	2,5	ALS		VBAT6
VAUD	LP3985			3,0	DAC33	On when used	VBAT
VCAM_1V8	LM3677	OFF	OFF	1,8	Camera HWA , LP5952		VBAT
VCORE_1V3	LP5952	OFF	OFF	1,3	Camera HWA core		LM3677
VCAM_2V8	LP3985	OFF	OFF	2,8	Cameras		VBAT
VCORE	TPS62350	ON	ON	1,2	Rapido core		VBAT
VIO	LM3677	ON	ON	1.8	VIO, VDRAM		VBAT
VDDB	SD levelsifter	OFF	OFF	2,9	SD card	ON when used	VBAT
LEDOUT	TPS61061	OFF			Keyboard and display backlights		VBAT
	TPS61052	OFF	OFF	4,5/5,5	Camera flash, backlights		VBAT
VBAT				3,6			
VCAM_ACT	LP3985	OFF	OFF	3.0	Camera		VBAT
VOut	TK63128	OFF	OFF	2.8	NCW		VBAT
VUI3V3	TK64730	ON	ON	3.3	UI		VBAT

■ Backup battery troubleshooting

Verify that the backup battery G2200 is empty (U<1V). Switch the phone on. Measure voltage of the battery when the main battery is connected to the phone and the phone is switched on. Wait a few minutes and monitor that the backup battery voltage rises. Switch off the phone, disconnect the main battery and monitor that the voltage of the backup battery decreases. Normal behaviour of the voltage is described in the figures below:
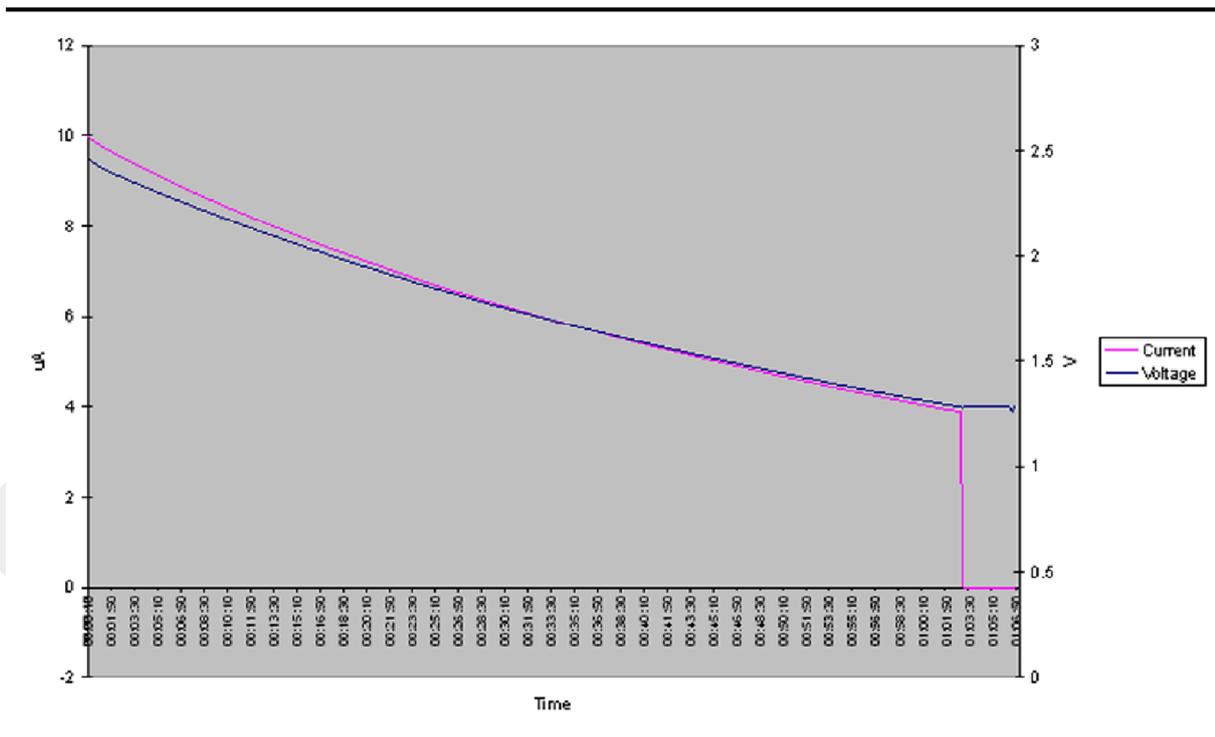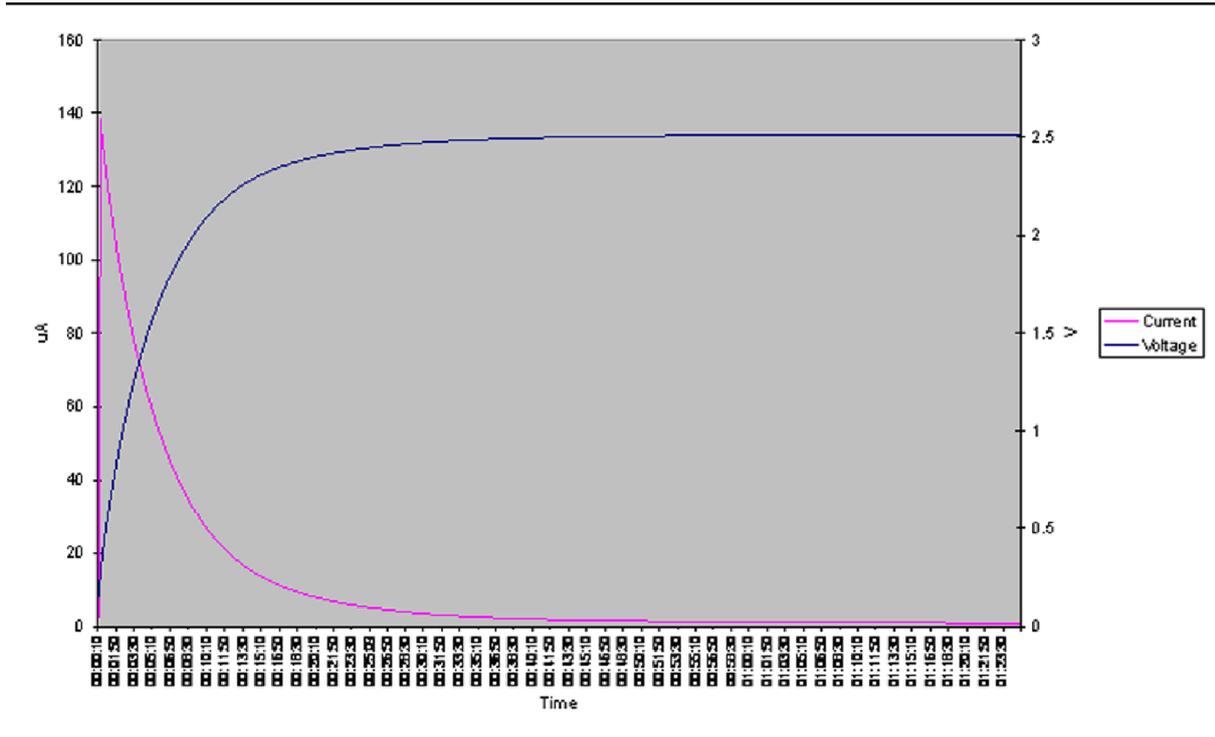
If the voltage rises and falls quickly, check the back-up battery G2200 contacts for loose soldering or short-circuit, and repair or change G2200 if necessary. If the voltage stays ~0V, check resistance VBACK against GND. If there is no shortcircuit, AVILMA N2200 is faulty. Replace N2200.

■ Dead or jammed device troubleshooting

Troubleshooting flow

```
                    ┌─────────────┐
                    │  Phone is   │
                    │  dead or    │
                    │  jammed     │
                    └─────────────┘
                          │
                          ▼
        Press phone's          Check VBat voltage        Is there an          Connect Nokia          Go to charging
        power key -> Is   YES   and contacts in VBat      open circuit    NO   approved charger.  NO   troubleshooting
        phone's current  ────►  line (e.g. battery   ──► somewhere?      ────► Is the phone      ────►
        consumption = 0         connector)                                     charging?

              │ NO                                       │ YES                 │ YES
              ▼                                          ▼                     ▼
        Is phone's                                 Repair the open circuit  Go to power key
        current consumption                        (e.g. by soldering)      troubleshooting
        large (> 400mA)
```

Is phone's current consumption large (> 400mA) — YES → Is some component very hot ? — YES → Short circuit inside or under the component, or some of its loads is short circuited (change the component which is short circuited)

Is some component very hot ? — NO → GO to general power checking troubleshooting

Is phone's current consumption large (> 400mA) — NO → Phoenix connection works ? — NO → Go to general power checking troubleshooting

Phoenix connection works ? — YES → Run BB self-tests Are all those Phoenix tests OK? — NO → Check the fails -> Go to relevant troubleshooting section

Run BB self-tests Are all those Phoenix tests OK? — YES → Is display test in Phoenix OK? (figure in display screen OK?) — NO → Go to display module troubleshooting

Is display test in Phoenix OK? — YES → Flash the phone

Flash the phone → Is phone's flashing working? — NO → Go to flashing troubleshooting

Is phone's flashing working? — YES → Is the phone working? — NO → Go to relevant troubleshooting section

Is the phone working? — YES → END

■ USB troubleshooting

Troubleshooting flow

USB Fault

Connect phone to PC with known good USB cable. PC recognizes phone as USB device? —YES→ END

NO

Make visual inspection of the USB connector X3300. Connector OK? —NO→ Change connector X3300

YES

Measure VBUS at X3300 pin 1 (phone connected with USB cable to PC): 4.75 – 5.25V? —NO→ Check/change L3300, R3302, R3306, R3307, R3308, R3311, C3302, C3305, V3300 and V3301

YES

Measure with ohmmeter data lines D+ and D– from X3300 pins 2 and 3 to Z3301 corresponding solder joints between Z3301 and D3300. Is reading < 2 ohms? —NO→ Change Z3301

YES

Measure voltage of RREF pin from R3300. Voltage 1.22V —NO→ Change R3300

YES

Measure voltages REG3V3 and REG1V8 pins from C3301 and C3304. Voltage stable 3.3V and 1.8V? —NO→ Check/change capacitor C3304

YES

Measure D+ and D– with oscilloscope. Signals present? —NO→ Change D3300

YES

Retest engine. If problem persists D2800 broken. Swap engine.

PIN1   PIN5

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■ **SIM card troubleshooting**

Troubleshooting flow

```
                    ┌──────────────────┐
                    │    SIM card      │
                    │ troubleshooting  │
                    └──────────────────┘
                             │
                             ▼
                    ┌──────────────────┐
                    │ Insert SIM card and │
                    │  power up phone. │
                    └──────────────────┘
                             │
                             ▼
                        ◇ Check SIM              ┌──────────────────────┐
                        ◇ connector (X2700). ── Not ok ▶ │ Check & clean connector │
                        ◇ OK?                    │ contacts & pads. Replace │
                                                 │ connector if necessary.  │
                             │                   └──────────────────────┘
                            ok ◄─────────────────────────┘
                             │
                             ▼
                        ◇ Perform SIM tests      ┌──────────────────────┐
                        ◇ with Phoenix. ──── Not ok ▶ │ Exchange Avilma & retest │
                        ◇ OK?                    │ phone. If problem persists, │
                                                 │ swap engine module.      │
                             │                   └──────────────────────┘
                            ok
                             │
                             ▼
                        ◇ Is the SIM detection    ┌──────────────────────┐
                        ◇ reliable?     ──── NO ─▶ │ Check and clean      │
                                                   │ battery connector    │
                             │                     │ X2070 BSI contact    │
                            YES                    │ and solder joint.    │
                             │                     └──────────────────────┘
                             ▼
                        ◇ Problem solved?  ── NO ─▶ ( Swap engine module )
                             │
                            YES
                             │
                             ▼
                        ┌──────────┐
                        │   END    │
                        └──────────┘
```
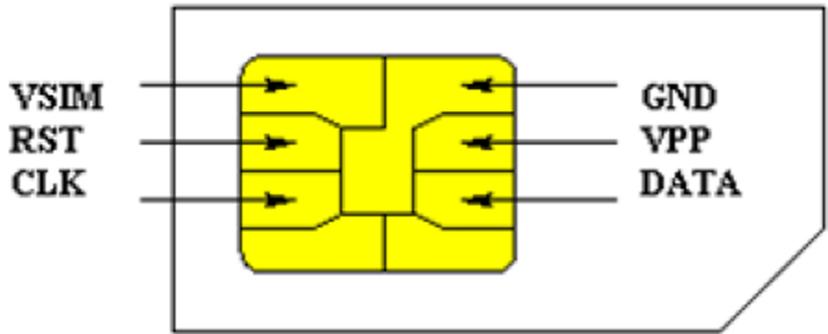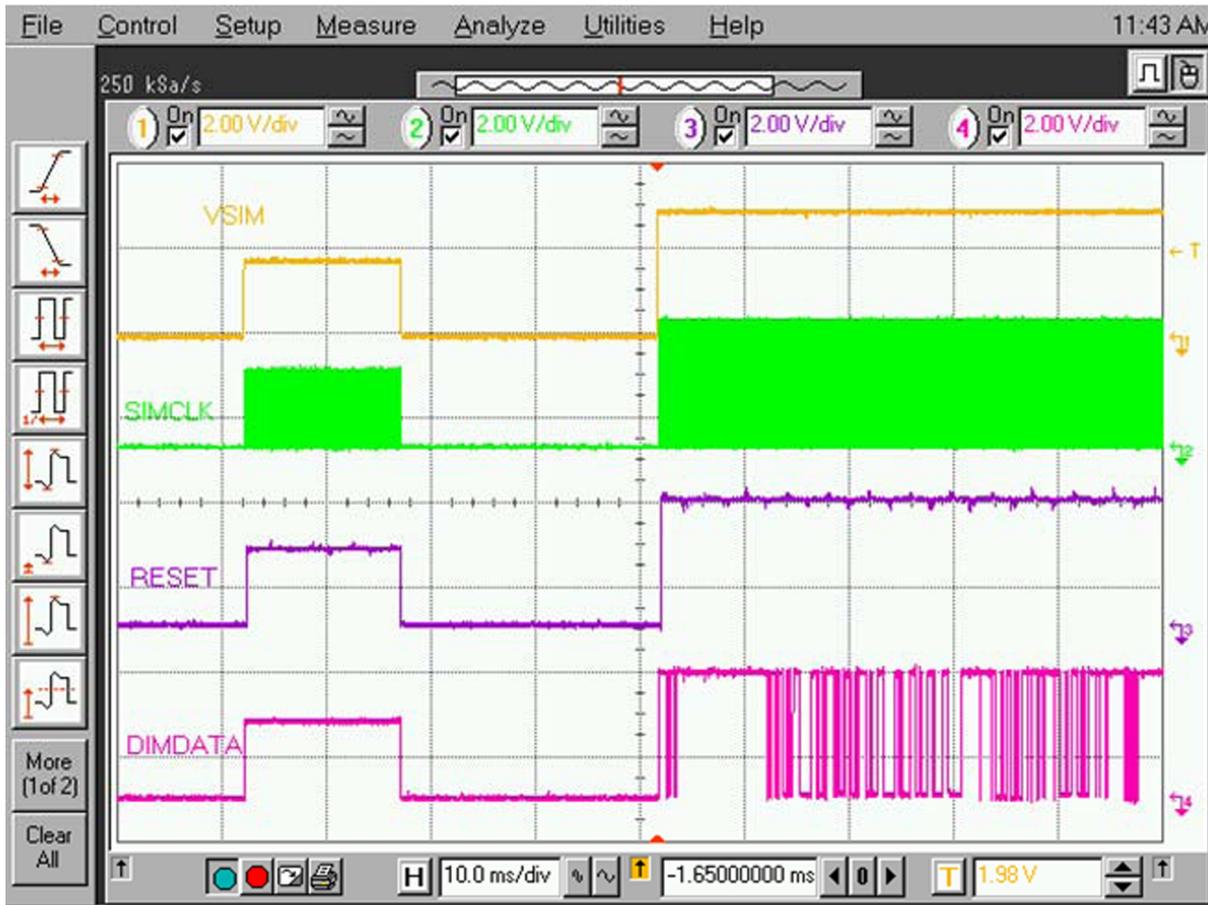
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SIM power-on sequence

Testpoints between
Rapido and AVILMA
J2213 = SIMCLK
J2214 = SIMDATA
J2215 = SIMIOC

Fsimclk = 3.2MHz

VSIM ➝
RST ➝
CLK ➝
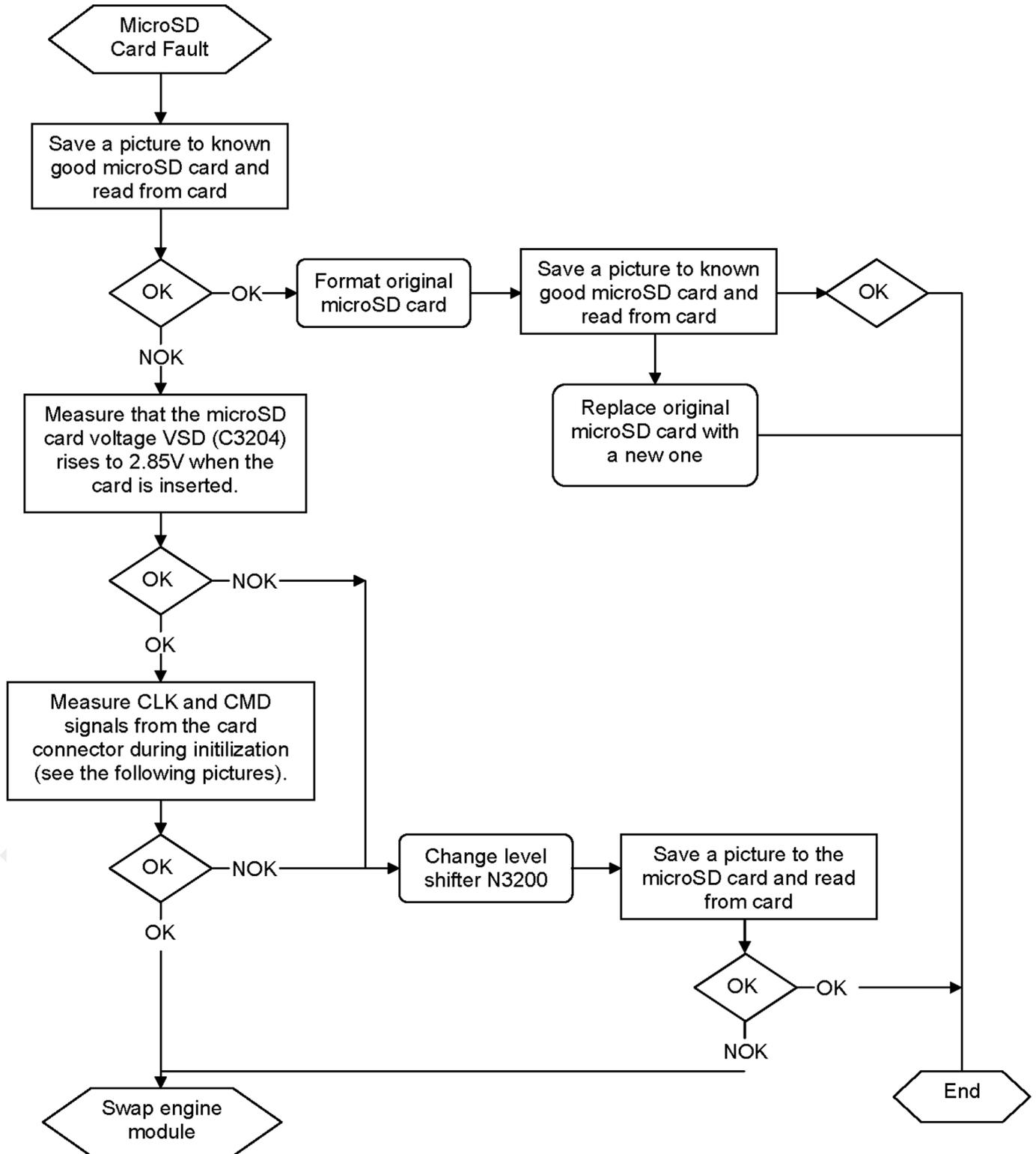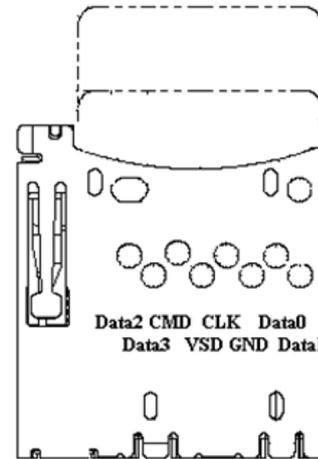➝ GND
➝ VPP
➝ DATA

SIM contacts

SIM power-on sequence on X2700.

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MicroSD card troubleshooting

Troubleshooting flow

```
                    ┌─────────────────┐
                    │   MicroSD       │
                    │   Card Fault    │
                    └─────────────────┘
                            │
                            ▼
            ┌─────────────────────────┐
            │ Save a picture to known │
            │ good microSD card and   │
            │ read from card          │
            └─────────────────────────┘
                            │
                            ▼
                        ◇ OK ◇ ──OK──▶ ┌──────────────┐
                            │           │ Format       │ ──▶ ┌──────────────────┐
                          NOK           │ original     │     │ Save a picture   │ ──▶ ◇ OK ◇
                            │           │ microSD card │     │ to known good    │
                            ▼           └──────────────┘     │ microSD card and │
            ┌─────────────────────────┐                      │ read from card   │
            │ Measure that the microSD│                      └──────────────────┘
            │ card voltage VSD (C3204)│                              │
            │ rises to 2.85V when the │                              ▼
            │ card is inserted.       │                      ┌──────────────────┐
            └─────────────────────────┘                      │ Replace original │
                            │                                 │ microSD card with│
                            ▼                                 │ a new one        │
                        ◇ OK ◇ ──NOK──▶                       └──────────────────┘
                            │
                           OK
                            │
                            ▼
            ┌─────────────────────────┐
            │ Measure CLK and CMD     │
            │ signals from the card   │
            │ connector during        │
            │ initilization (see the  │
            │ following pictures).    │
            └─────────────────────────┘
                            │
                            ▼
                        ◇ OK ◇ ──NOK──▶ ┌──────────────┐ ──▶ ┌──────────────────┐
                            │           │ Change level │     │ Save a picture   │
                           OK           │ shifter N3200│     │ to the microSD   │
                            │           └──────────────┘     │ card and read    │
                            │                                 │ from card        │
                            │                                 └──────────────────┘
                            │                                         │
                            │                                         ▼
                            │                                     ◇ OK ◇ ──OK──▶
                            │                                         │
                            │                                       NOK
                            ▼                                                    ◇ End ◇
                    ┌─────────────────┐
                    │  Swap engine    │
                    │  module         │
                    └─────────────────┘
```

MicroSD interface signals timing when card is inserted.

MicroSD connector

CLK and CMD signals during card initialisation when card is not inserted. Measured from the microSD connector.

CLK and CMD signals during card initialisation when card is not inserted. Measured from the microSD connector
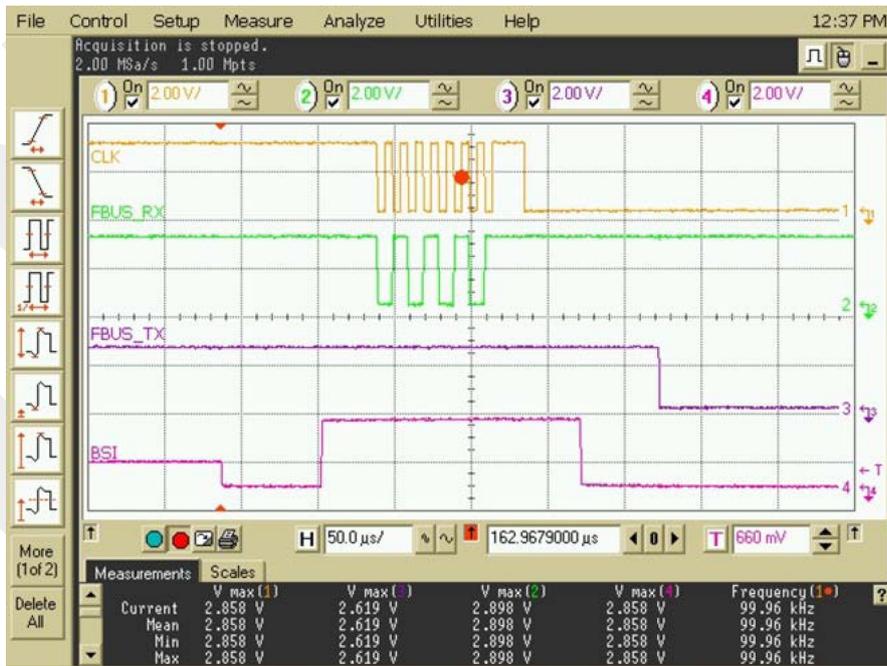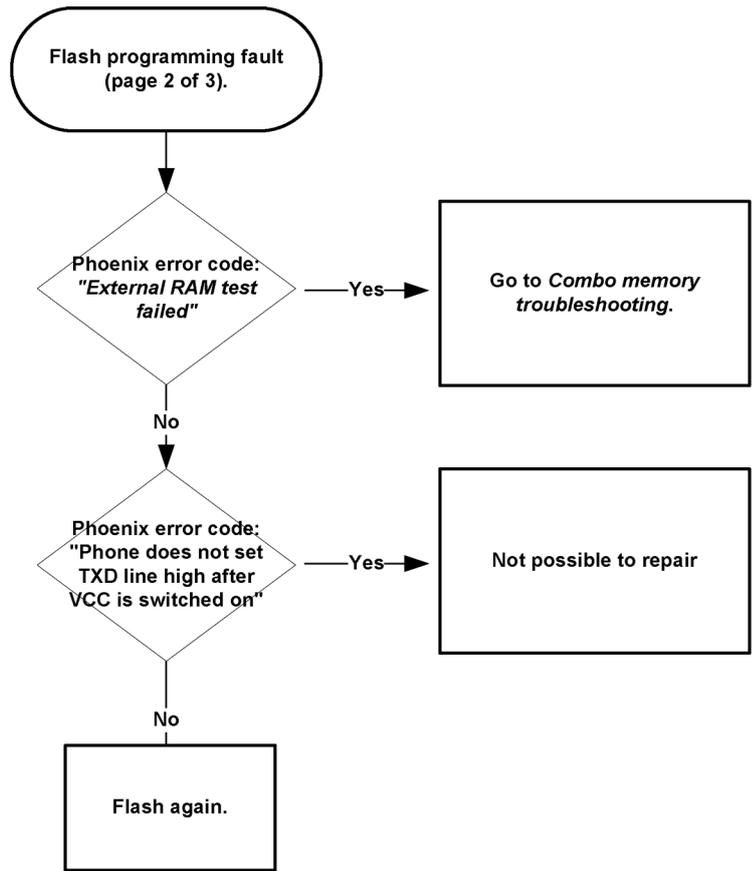
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■ Combo memory troubleshooting

Troubleshooting flow

■ Flash programming troubleshooting

Troubleshooting flow

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Flash programming fault
(page 2 of 3).

Phoenix error code:
*"External RAM test
failed"* ──Yes──▶ Go to *Combo memory
troubleshooting.*

No

Phoenix error code:
"Phone does not set
TXD line high after
VCC is switched on" ──Yes──▶ Not possible to repair

No

Flash again.

Flash programming fault page 3

Is the secondary code downloaded to phone?

No → Go to general power checking troubleshooting

Is the secondary code downloaded to phone?

No → Go to combo memory troubleshooting

Yes

yes

Is the alcorithm code downloaded to phone?

No → Go to Combo memory troubleshooting

yes

Is flash programming succesfull?

No → Go to Combo memory troubleshooting

yes

END

Charging troubleshooting

Troubleshooting flow

Charging does not work when Nokia approved charger is connected

Does charging work with another battery or charger? — YES → Battery/Charger defect

NO

Check the battery connector. OK? — NO → Replace battery connector

YES

Perform EM calibration and verify by Phoenix ADC reading feature. Check if charging works after calibration

Charging OK? — YES → END

NO

Check with Phoenix ADC readings that BTEMP is close to your environmental temperature

BTEMP OK? — NO → Measure voltage at R2071 → ~0.5V@ 25°C? — NO → Check R2071 and change if needed

YES (from ~0.5V@25°C) → Change Avilma N2200

YES (BTEMP OK)

Check with phoenix ADC readings that BSI value is correct. (Charging is possible with 55kΩ...130kΩ)

BSI value OK — NO → Measure voltage at J2071 → ~1V@ BL5C? — NO → Check R2070 and X2070 and change if needed

YES (from ~1V@BL5C) → Change Avilma N2200

YES (BSI value OK)

Measure VCHAR line voltage when charger is connected (over C2000)

VCHAR >3V? — NO → Check F2000, L2000, R2000, C2000, C2001, X2000 and change if needed

YES

Check with Phoenix that ADC readings VCHAR value and measured VCHAR value is same.

Same? — NO → Measure voltage of J2300 It has to be ~1/3*Vchar → Voltage OK — NO → Change Betty N2300

YES (Voltage OK) → Change Avilma N2200

YES (Same?)

Measure charger current

<100mA — NO → Reflash phone

YES

Change Betty N2300

▪ Clocking troubleshooting

Troubleshooting flow

■ Power key troubleshooting

Troubleshooting flow

```
                    ┌──────────────────┐
                   (  Power key does   )
                   (    not work       )
                    └──────────────────┘
                             │
                             ▼
          ┌──────────────────────────────────┐
          │ Disassemble the phone. Check      │
          │ power key contacs and measure     │
          │ that the power key is working.    │
          │ Check also battery contacts.      │
          └──────────────────────────────────┘
                             │
                             ▼
                      ◇ Key and ◇    No    ( Replace the  )
                      ◇ contacts OK? ◇─────▶( damaged      )
                             │              ( component.   )
                            Yes
                             ▼
          ┌──────────────────────────────────┐
          │ Place the phone into              │
          │ the module jig. Turn              │
          │ power on by                       │
          │ connecting flash                  │
          │ programming cable                 │
          │ or pressing jig's                 │
          │ "power on" button.                │
          └──────────────────────────────────┘
                             │
                             ▼
                      ◇ Phone boots ◇  No   ┌──────────────┐
                      ◇ up normally? ◇─────▶│ Go to general│
                             │              │ power checking│
                            Yes             │ troubleshooting│
                             ▼              └──────────────┘
                   ◇ Measure          ◇  No  ( Change Avilma )
                   ◇ voltage at power ◇─────▶( (N2200).      )
                   ◇ key's outer contact. ◇
                   ◇ Is it ~VBAT?     ◇
                             │
                            Yes
                             ▼
                    ┌──────────────┐
                    │ Check and    │
                    │ clear power key│
                    │ contacts     │
                    └──────────────┘
                             │
                             ▼
                      ◇ Problem    ◇   No   ┌──────────────┐
                      ◇ solved?    ◇───────▶│ Go to general│
                             │              │ power checking│
                            Yes             │ troubleshooting│
                             ▼              └──────────────┘
                    ┌──────────────┐
                   (     END       )
                    └──────────────┘
```

■ User interface troubleshooting

Troubleshooting flow

UI FAULT

Do Phoenix UI and keyboard self tests pass?

Cap. UI fault

Keyboard fault

YES → **GO TO ENGINE TROUBLESHOOTING**

Check UI regulator. 3V at C7609? — NO → **Check and replace N2498, L7604**

YES

Check UI level shifter. 3V at X2459 pins 2,3,5,6? — NO → **Replace N2497 and Z7584**

YES

Check reset. 3V at X2459 pin 7? — NO → **Replace V2498 and Z7584**

YES

Check and replace Z7583, Z7584, Z7586

YES

Re-run UI self-test

OK → **FAULT FIXED**

STILL FAULTY → **Replace UI module**

Note: If you replace the UI module, you must follow the procedure to ensure that the correct front panel is attached, and that it has been attached properly.

■ Display technical description and troubleshooting

Display

Display features

- 2.4" Active TFT QVGA display supports up to 16,777,216 colors (320 x 240 pixels, 2.6 inches)
- Wide 160° viewing angle
- Ambient light detector to optimize display brightness and power consumption

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.

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

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

Steps

1. Verify with a working display that the fault is not on the display module itself. The display module cannot be repaired.

2. Check that the cellular engine is working normally.

   i   To check the functionality, connect the phone to a docking station.

   ii   StartPhoenix service software.

   iii Read the phone information to check that also the application engine is functioning normally (you should be able to read the Phone ID).

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

Before going to display troubleshooting flow make sure that engine is working and starting up correctly otherwise go to BB troubleshooting.

Display Failure

↓

Make sure that Display flex is OK and the display connector is properly connected

↓

Turn the backlight on with Phoenix

↓

Check backlight — NOK → Go to backlight troubleshooting

↓ OK

Change to a known good display module and check display — OK → Display is faulty, change display

↓ NOK

Measure VDD(VAUX) and VDDI(VIO) voltages from C2454(~2.5V/2.8V) C2453(~1.8V) — NOK → Go to EM troubleshooting

↓ OK

Check display ASIPs Z2450 and Z2451 — NOK → Change faulty ASIPs and check display image

↓ OK

Check D2800's PCLK(J2460) for signal activity.PCLK is active when updating display->create movement to display e.g. pushing buttons. — NOK → Go to BB troubleshooting

↓ OK

Check D2450's XWE(J2453) for signal activity. XWE is active when updating display->create movement to display e.g. pushing buttons. Check also that D2450's XCS1(J2454) is active (low state) when updating display — NOK → Update SW and if not OK then Change D2450

↓ OK

Beyond Economical repair

END

Display backlight and illumination troubleshooting

Troubleshooting flow

```
┌─────────────────────┐
│   Main/cover display │
│   and  backlights do │
│   not work as expected│
└─────────────────────┘
           │
           ▼
┌─────────────────────┐
│    Turn display      │
│    backlights ON     │
└─────────────────────┘
           │
           ▼
┌─────────────────────┐        ┌─────────────────────┐
│  Display backlights  │──OK►   │         END          │
│         ON           │        │                      │
└─────────────────────┘        └─────────────────────┘
           │ NOK
           ▼
┌─────────────────┐    ┌─────────────────┐    ┌─────────────────┐    ┌─────────────────┐
│ Measure LEDOUT  │─OK►│ Check transistors│─OK►│ Check the display│─OK►│      END         │
│ at capacitor    │    │ V2440, V2441 and │    │ connector for    │    │                  │
│ C2314.          │    │ resistors R2440, │    │ broken solder    │    │                  │
│ 12 – 17.2 V?    │    │ R2441            │    │ joints and       │    │                  │
│                 │    │                  │    │ repair if needed │    │                  │
└─────────────────┘    └─────────────────┘    └─────────────────┘    └─────────────────┘
        │ NOK                  │ NOK                  │ NOK
        ▼                      ▼                      ▼
┌─────────────────┐    ┌─────────────────┐    ┌─────────────────┐
│ Go to           │    │ Replace faulty  │    │ Replace faulty  │
│ main/cover      │    │ component(s)    │    │ display module(s)│
│ display LED     │    │                 │    │                 │
│ driver          │    │                 │    │                 │
│ troubleshooting.│    │                 │    │                 │
└─────────────────┘    └─────────────────┘    └─────────────────┘
```

LED driver troubleshooting

Troubleshooting flow

```
┌─────────────────────┐
│  LED driver does not │
│        work          │
└──────────┬──────────┘
           │
           ▼
┌─────────────────────┐
│  Lights cannot be    │
│     turned ON        │
└──────────┬──────────┘
           │
           ▼
┌─────────────────────┐
│  Disassemble the     │
│ phone to the product │
│  specific module jig │
└──────────┬──────────┘
           │
           ▼
┌─────────────────────┐
│ Check that there is  │
│ no shortcut over the │
│   LED chain (both    │
│    display and       │
│  keyboard), or from  │
│  LED driver output   │
│ (C2314) to ground.   │
└──────────┬──────────┘
           │
           ▼
┌─────────────────────┐
│  Connect Phoenix to  │
│     the phone,       │
│    turn lights on    │
└──────────┬──────────┘
           │
           ▼
┌─────────────────────┐
│  Check L2304 and     │
│   N2301 visually.    │
└──────────┬──────────┘
           │ OK
           ▼
┌─────────────────┐        ┌─────────────────┐
│ Output voltage at│  OK    │  Replace L2304   │
│   C2314 = input  ├───────►│                  │
│ voltage at C2315?│        └────────┬────────┘
└────────┬─────────┘                 │
         │ NOK                        │
         ▼                            │
┌─────────────────┐  NOK   ┌─────────────────┐  OK
│ Set brightness to├──────►│  Replace N2301   ├────►│
│    maximum.      │        │ (SMPS). Backlights│
│  Backlights OK?  │        │      OK?         │
└────────┬─────────┘        └────────┬────────┘
         │ OK                         │ NOK
         │                            ▼
         │                  ┌─────────────────┐
         │                  │  Replace N2300   │
         │                  │     (Betty)      │
         │                  └────────┬────────┘
         ▼                           │
┌─────────────────┐        ┌─────────────────┐
│      END         │        │      END         │
└─────────────────┘        └─────────────────┘
```

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■ Audio Troubleshooting

External earpiece troubleshooting 1 and 2

Troubleshooting flow

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DAC33
troubleshooting

Measure
voltage
VAUD=3V at
C2121.

Voltage
level OK? — NO → Check C2120, C2121,
C2123, N2120. Change
component if needed.

YES

Check DAC33
(N2121).
Change
component if
needed.

Does audio
work during a
call? — NO → Beyond
economical
repair

Problem solved

External microphone troubleshooting

Troubleshooting flow

Internal earpiece troubleshooting

Troubleshooting flow

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Internal handsfree speaker troubleshooting

Troubleshooting flow

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Internal microphone troubleshooting

Troubleshooting flow

■ ALS technical description and troubleshooting

Ambient Light Sensor
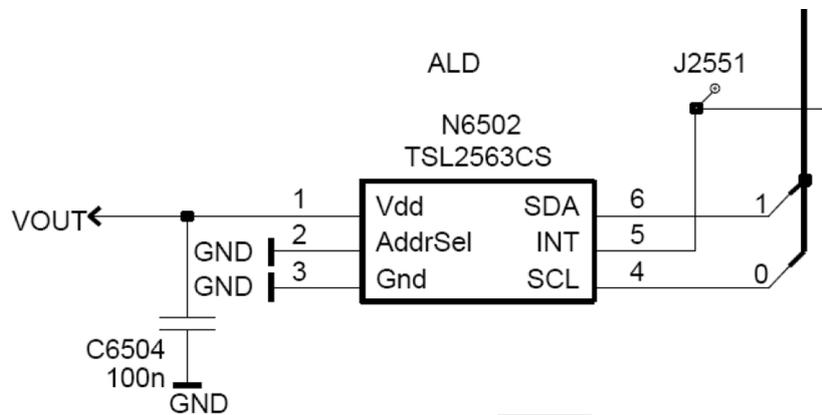
Figure 14 Ambient Light Sensor

Ambient Light Sensor consists of the following components:

- Light guide
- Ambient Light Sensor (ALS)

  ALS is a digital I2C interface component, having two channels with different spectral sensitivities. When combined, the component responds to illuminance similar as human eye.

- Vdd Filtering capacitor C6504

Ambient Light Sensor information is used to control keypad and display brightness of the phone. Keyboard and Display brightness is dimmed, when environment lighting is dark.

Ambient Light Sensor is calibrated in production and can be re-tuned in service points though not recommended unless calibration coefficient are lost for some reason.

ALS troubleshooting

Context

Functionality check:

Steps

1. Connect phone to Phoenix and set the phone (e.g. on the table) so that the amount of ambient light seen by ALS is as stable as possible.

2. Start Phoenix

3. Choose **File -> Scan product**

4. Choose **Testing -> Display Test**

5. Open the **Lights** tab, check Ambient Light Sensor check box, click **Read**, cover the sensor and click **Read** again. When covered, Luminance reading should be less than after clicking **Read** without covering the sensor.

6. If component doesn't give any reading or reading doesn't change when sensor is/is not covered, replace the part.
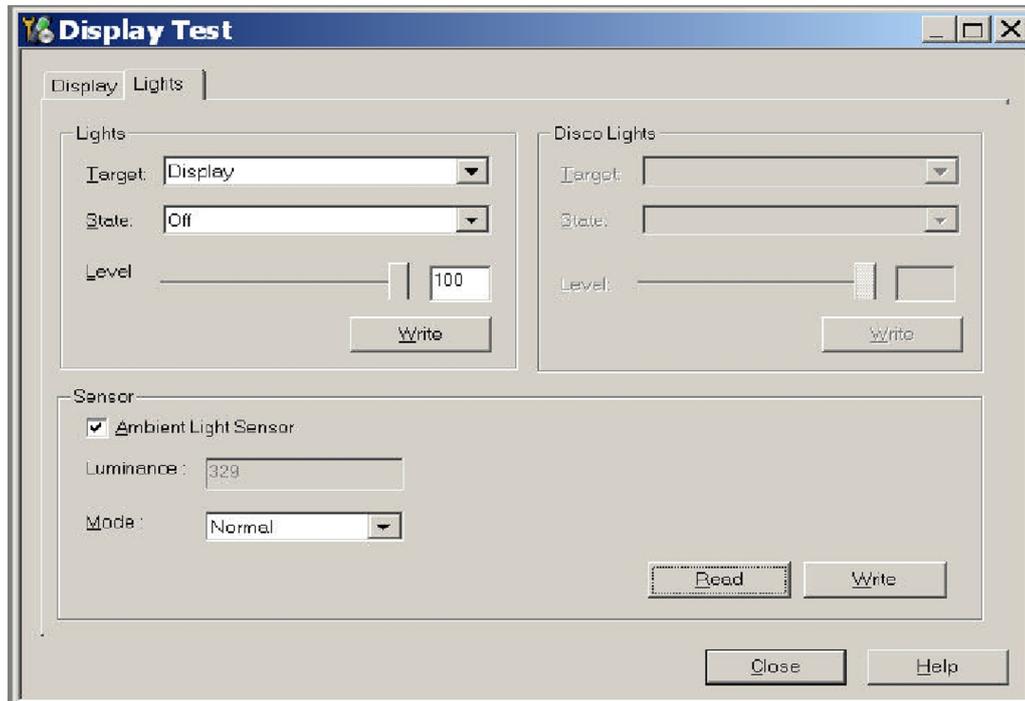
Note: After replacing the ALS. If calibration values of the new sensor are lost or for some other reason, ALS re-tuning is required (see instructions later in this document).

When doing the ALS calibration procedure, it is required to have a reference phone, which includes calibrated ALS. ALS re-tuning instructions show why the reference phone is needed.

Re-tuning ALS

Steps

1. Connect reference phone to Phoenix and set the phone (e.g. on the table) so that the amount of ambient light seen by ALS is as stable as possible.

2. Start Phoenix.

3. Choose **File→Scan Product.**

4. Choose **Tuning -> Ambient Light Sensor Calibration**. You should see the following window:
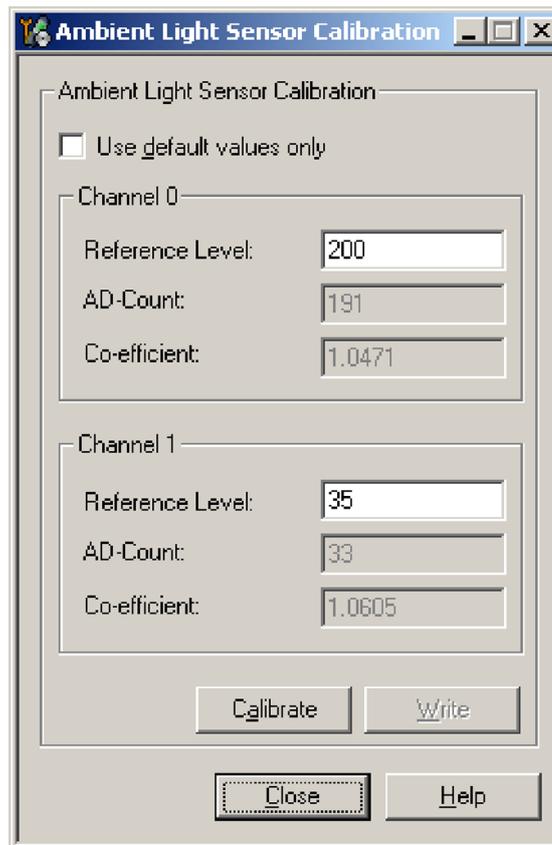
5. Read AD-count values for Channel 0 and Channel 1 by click **Read** button and write them down.

6. Repeat 1-5 for the phone to be calibrated and make sure the phone to be calibrated is located in the same place as reference phone was when luminance reading was taken.

7. Calculate co-efficient from reference phone and phone to be calibrated AD-count values by division: Co-efficient = AD-count(reference phone) / AD-count(phone to be calibrated), write down the calculated co-efficient values.

8. -> Iterate by changing Channel 0 and Channel 1 (reference level) values (remove cross from 'Use default values only'). After writing some value to Channel 0 and Channel 1 (reference value), calibrate button must be pressed. Stop iterating when Co-efficient is equal to Co-efficient calculated in step 7. Note that decimal numbers should be used in the iteration in order to achieve enough precision (e.g. 200.2455)

9. After having same Co-efficient value in "Co-efficient" textbox as the calculated value, make sure that ambient light values (read using **Testing → Display Test → "Luminance"** textbox) are almost the same in reference phone and calibrated phone. Remember that illuminance readings for reference and calibrated phones must be done in the same ambient light conditions. If illuminance values differs a lot (difference max. +- 10%), repeat whole ALS re-tuning procedure.

10. To end the calibration, click Close.

■ **Bluetooth and FM radio troubleshooting**

Introduction to Bluetooth/FM radio troubleshooting

Bluetooth/WLAN/GPS antenna
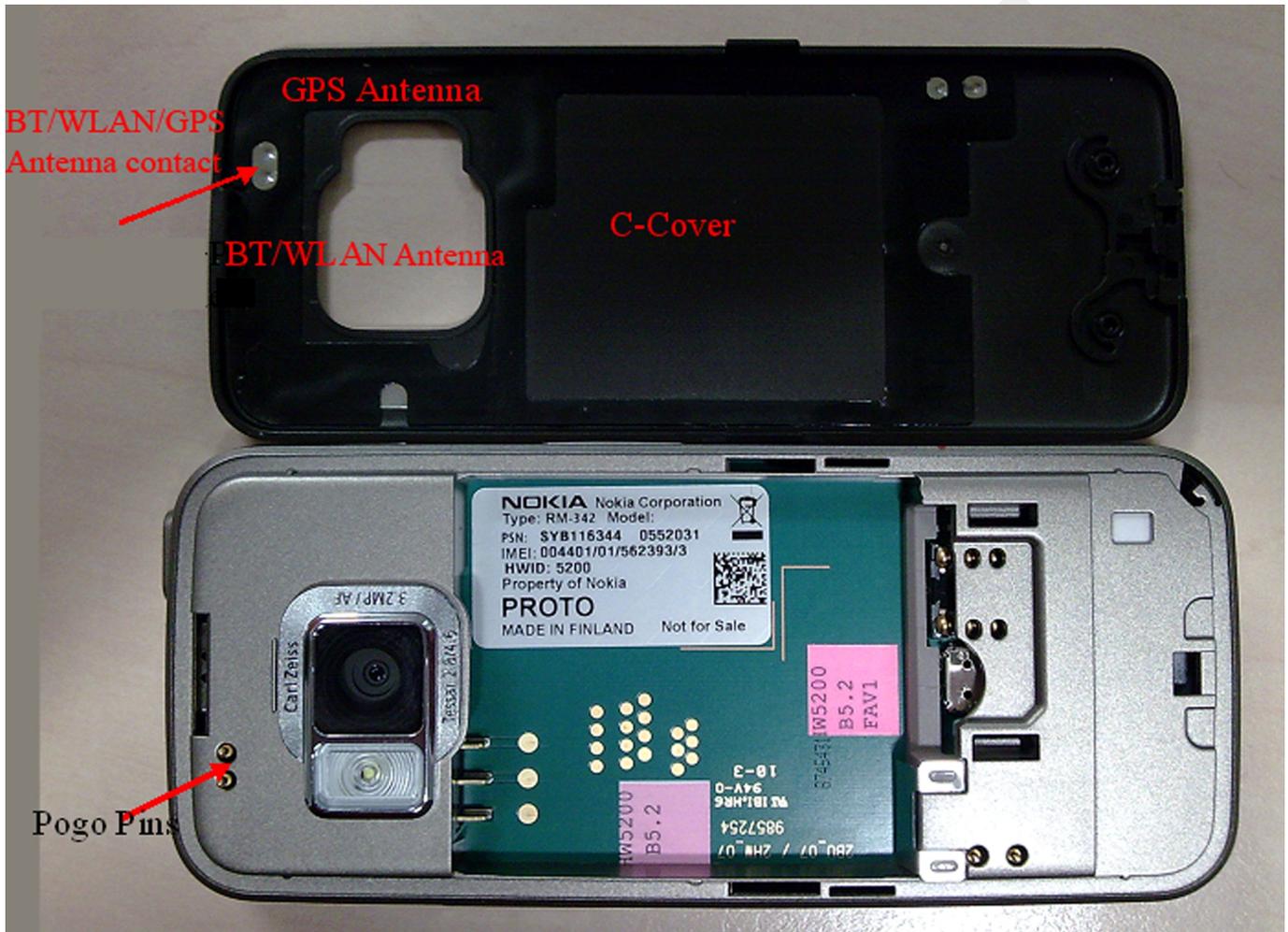
Figure 15 Bluetooth antenna

The BT RF signal is routed from BTFMRDS2.0 through the WLAN module, diplexer to the shared WLAN/BT/GPS antenna in the phone's C-cover. The WLAN RF signal is routed from the WLAN module through the diplexer to the shared WLAN/BT/GPS antenna in the phone's C-cover. The GPS signal is routed through the diplexer into the GPS chip.

Bluetooth/FM radio troubleshooting

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 Bluetooth/FM ASIC/module
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.	Replacement of Bluetooth/FM ASIC/module
Able to switch on Bluetooth on phone user interface, but unable to detect other Bluetooth devices	Open circuit solder joints or Pogo Pins not making contact with c-cover	Repair or replace c-cover
Able to turn on FM radio and Bluetooth on phone user interface, but unable to detect local FM radio stations with Nokia headset inserted	Open circuit solder joints or detached component in FM antenna circuit	Repair of FM antenna connection or FM circuit component
Able to perform scans to detect local FM radio stations with functional Nokia 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 of FM audio circuit

Users may experience the following problems resulting in functional phones being returned to the repair centre:

Symptom	Problem	Repair solution
Bluetooth feature does not operate as desired with another Bluetooth device	Bluetooth Profile implemented in Bluetooth accessory not supported in Nokia phone	Use Bluetooth accessory with Bluetooth profiles supported by phone
Poor FM radio reception (unable to detect many radio stations)	Nokia headset not being used	Use Nokia headset

Test coverage

The tests listed in the table below should be performed to verify whether the Bluetooth and FM receiver and transmitter are functional. The use of Self Tests are described in section *BT and FM Self Tests in Phoenix*

Test	Test Coverage	Repair solution
Blueooth Self Test: ST_LPRF_IF_TEST	Bluetooth-FM ASIC UART interface (controls Bluetooth and FM receiver and transmitter)	Replacement of Bluetooth/FM ASIC (or repair of phone BB)
Bluetooth Self Test: ST_BT_WAKEUP_TEST	Bluetooth ASIC interrupt control interface	Replacement of Bluetooth/FM ASIC (or repair of phone BB)
Bluetooth Self Test: ST_LPRF_AUDIO_LINES_TEST	Bluetooth ASIC PCM interface	Replacement of Bluetooth/FM ASIC (or repair of phone BB)

Test	Test Coverage	Repair solution
Bluetooth Functional Test: BER test with BT-Box or functional test with other Bluetooth device	Bluetooth antenna circuit	Repair of Bluetooth antenna circuit (including RF filter or WLAN switch if fitted)
FM Radio Self Test: ST_RADIO_TEST	FM Radio I2C interface	Replacement of Bluetooth/FM ASIC (or repair of phone BB)
FM Radio Functional Test: Perform scan for local radio stations and check station list displayed on phone	FM receiver antenna circuit	Repair of FM antenna circuit (between BTHFM ASIC and headset connector)
FM Radio Functional Test: Listen to local radio station	FM receiver audio circuit	Repair of FM receiver audio circuit (between BTHFM ASIC and headset connector)

The self tests run from Phoenix software are used for fault diagnosis.

If Phoenix software is not available the functional tests with phone accessories are sufficient to verify the functionality Bluetooth and FM radio receiver and transmitter.

Bluetooth/FM radio component layout and test points

WLAN/BT, GPS Antenna Pads

WLAN/BT, GPS Diplexer
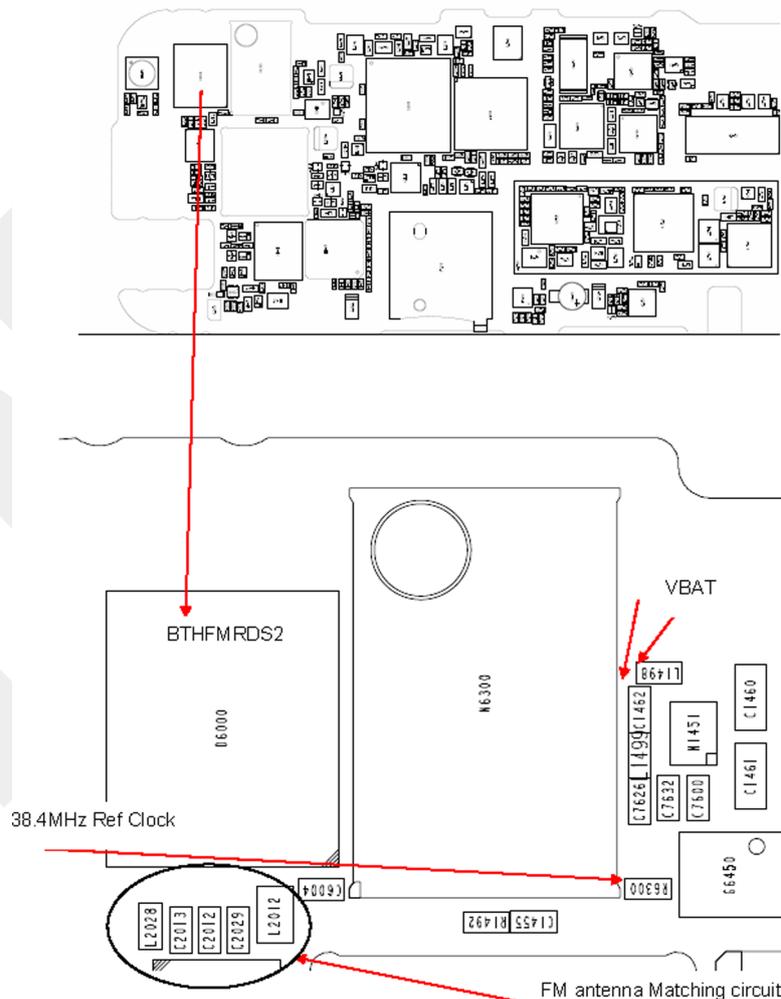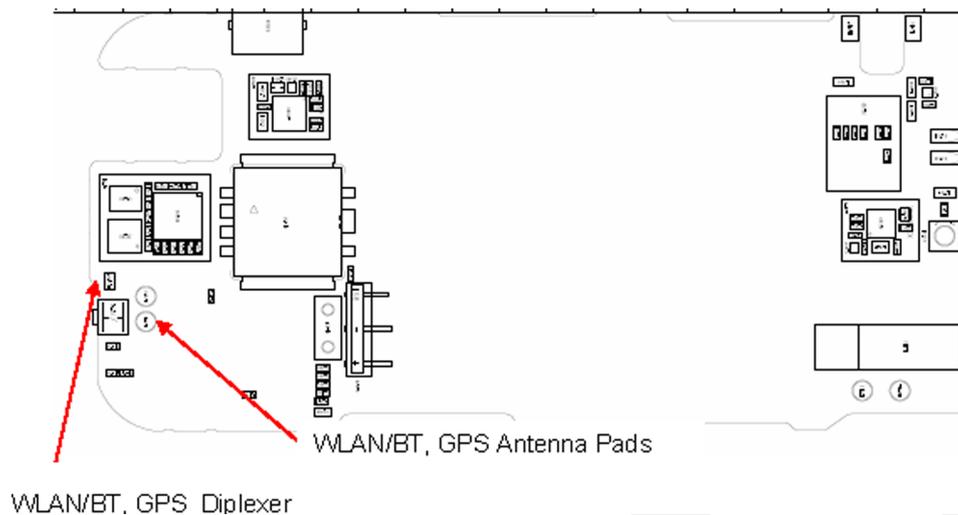
Figure 16 WLAN/BT, GPS diplexer and antenna pads

The Bluetooth antenna is product specific (antenna integrated into phone C cover). On phones with WLAN, the Bluetooth RF signal is routed through a WLAN front-end module and a shared Bluetooth / WLAN antenna is used. The FM RF signal is routed through a product specific FM antenna matching circuit to the phone headset connector. The FM radio audio signal is routed to the headset connector through the BB ASIC shared by the phone audio functions.

Bluetooth BER test

Prerequisites

JBT-9, or SB-6 Bluetooth test box (BT-box) is required to perform a BER test. If a BT-box not available Bluetooth functionality can be checked by transferring a file to another Bluetooth phone. For the BER or file transfer test the C-cover should be fitted as the BT antenna is on the C-cover.

Steps

1. Connect data cable to phone.

2. Start *Phoenix* service software.

3. Choose **File → Scan Product**.

4. Choose **Testing → Bluetooth LOCALS** .

5. Locate the BT-box serial number (12 digits) found in the type label on the back of the JBT-9, or SB-6 Bluetooth test box.

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

7. Place the BT-box near (within 10 cm) of the phone and click **Start BER Test**.

Bluetooth and FM radio self tests in Phoenix

Prerequisites

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 or connect data cable to phone.

2. Start *Phoenix* service software.

3. Choose **File→Scan Product.**

4. From the **Mode** drop-down menu, set mode to **Local**.

5. Choose **Testing→Self Tests.**

6. In the *Self Tests* window check the following Bluetooth and FM radio related tests:
   • **ST_LPRF_IF_TEST**
   • **ST_LPRF_AUDIO_LINES_TEST**
   • **ST_BT_WAKEUP_TEST**
   • **ST_RADIO_TEST**

7. To run the tests, click **Start**.
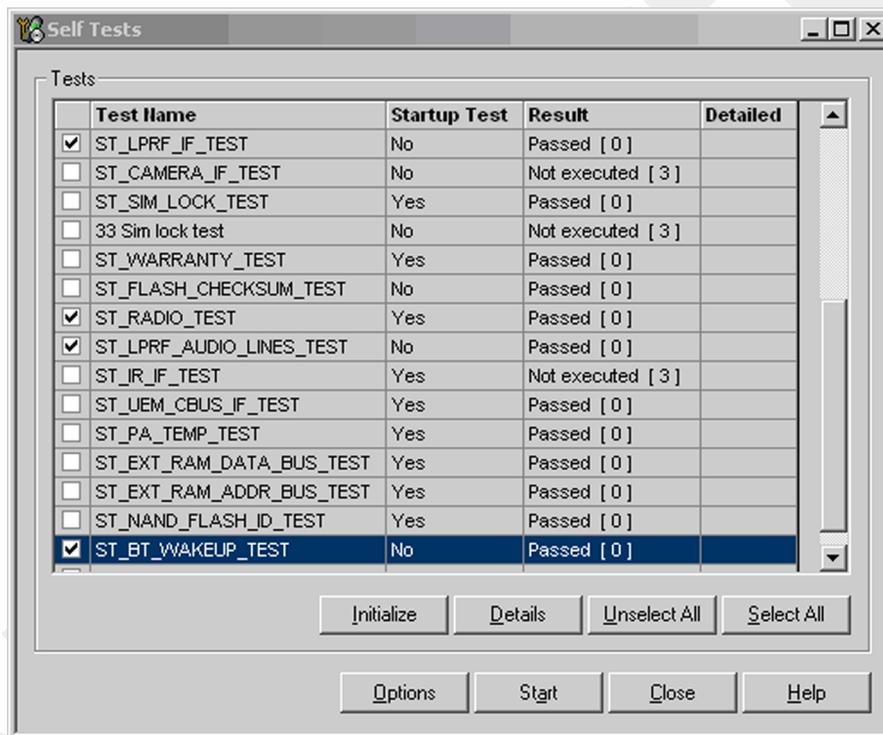
Figure 17 Bluetooth and FM radio self tests in *Phoenix*

FM radio testing

Steps

1. Set signal generator parameters:
   • FM modulation on
   • Frequency 100MHz
   • FM deviation 22kHz
   • Modulation frequency 1kHz
   • RF level should be varied during the test to obtain good audio signal quality
   • Connect suitable antenna to signal generator
      Note: You may alternately use a known good FM radio broadcast as a test signal.

2. Attach the Nokia headset to the phone's AV connector.

3. Use Scroll button to autotune to the radio frequency.

4. Set volume to suitable level.
5. Check audio quality with a headset.

Bluetooth troubleshooting

Troubleshooting flow

```
┌──────────────┐
│   Bluetooth  │
│    failure   │
└──────────────┘
        │
        ▼
┌──────────────┐
│ Perform C-Cover│
│   Inspection   │
└──────────────┘
        │
        ▼
   ╱ Visual ╲        NOK    ┌──────────────┐
  ╱ inspection ╲──────────▶│ Replace C-cover│
  ╲  passed?  ╱            └──────────────┘
   ╲       ╱
     │ OK
     ▼
┌──────────────┐
│Perform Bluetooth│
│ self tests in  │
│    Phoenix     │
└──────────────┘
        │
        ▼
   ╱ Self tests ╲   NOK   ┌──────────────┐          ╱ Self tests ╲   NOK   ┌──────────────┐
  ╱  passed?  ╲─────────▶│ Replace BTHFM │─────────▶╱  passed?  ╲─────────▶│    Goto      │
  ╲         ╱            │ module D6000  │          ╲         ╱            │  Phone BB    │
   ╲     ╱               │  and repeat   │           ╲     ╱              │Troubleshooting│
     │ OK                │ BTH+FM self tests│          │ OK              └──────────────┘
     ▼                   └──────────────┘            
┌──────────────┐
│ Perform BTH BER│
│     Test       │
└──────────────┘
        │
        ▼
   ╱ BER test ╲   NOK   ┌──────────────┐          ╱ BER test ╲   NOK   ┌──────────────┐
  ╱  passed? ╲────────▶│ Replace Z7585 │─────────▶╱ passed?  ╲────────▶│    Goto      │
  ╲         ╱          │ Diplexer or/and│         ╲         ╱          │  Phone BB    │
   ╲     ╱             │  pogo pins    │          ╲     ╱             │Troubleshooting│
     │ OK              └──────────────┘             │ OK             └──────────────┘
     ▼
┌──────────────┐
│ Bluetooth OK │
└──────────────┘
```

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Care

FM radio troubleshooting

Troubleshooting flow

```
        ┌─────────────────┐
        │  FM radio failure │
        └─────────────────┘
                 │
                 ▼
        ┌─────────────────┐
        │ Perform Bluetooth │
        │    & FM radio     │
        │   self tests in   │
        │     Phoenix       │
        └─────────────────┘
                 │
                 ▼
           ◇ Self tests ◇ ──NOK──▶ ┌──────────────┐        ◇ Self tests ◇ ───────▶ ┌──────────────┐
           ◇  passed?   ◇          │ Replace BTHFM │        ◇  passed?   ◇          │    Go to      │
                                    │ module D6000  │                                │   Phone BB    │
               │                    │ and repeat FM │                                │Troubleshooting│
              OK                    │  self tests   │            NOK                 └──────────────┘
               │                    └──────────────┘
               │                          OK
               ▼
        ┌─────────────────┐
        │ Perform FM radio  │
        │     Testing       │
        └─────────────────┘
                 │
                 ▼
          ◇ FM Radio finds ◇ ──NOK──▶ ┌──────────────┐
          ◇   stations?    ◇          │ Check FM radio│
                                       │antenna circuit to│
               │                       │ phone headset │
              OK                       └──────────────┘
               │
               ▼
        ┌─────────────────┐
        │ Listen to FM radio│
        └─────────────────┘
                 │
                 ▼
          ◇ Is FM radio ◇ ──NOK──▶ ┌──────────────┐
          ◇ audio OK?   ◇          │ Check Audio   │
                                    │circuit between│
               │                    │ BTHFM module  │
              OK                    │ and headset   │
               │                    └──────────────┘
               ▼
        ┌─────────────────┐
        │   FM radio OK     │
        └─────────────────┘
```
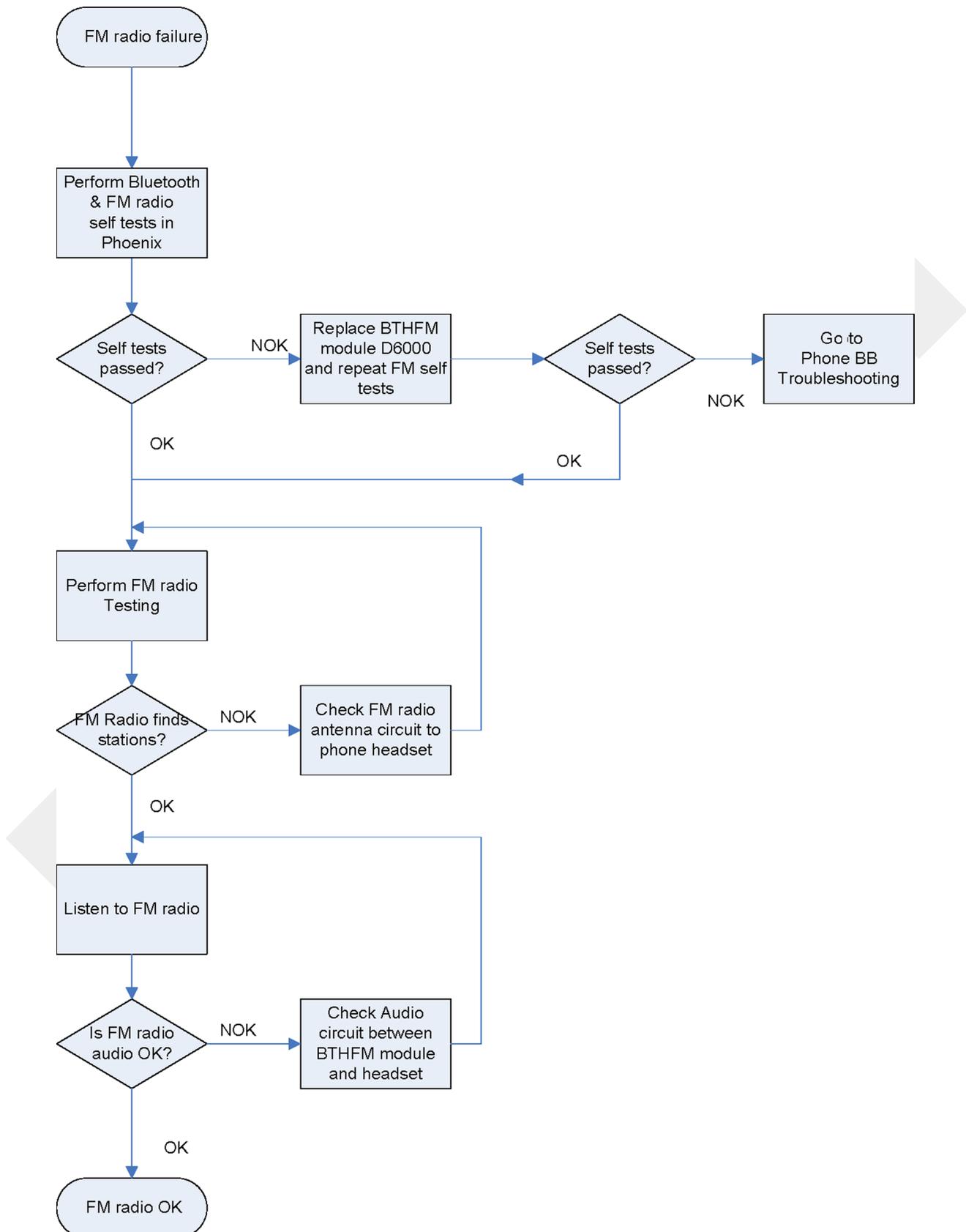
■ GPS troubleshooting

GPS layout and basic test points

The GPS components are located under the shield can A7501. Satellite signals are picked up by the phones GPS antenna in the C-cover. The signal is then routed through a diplexer and filter before being processed by the GPS5300 receiver ASIC.
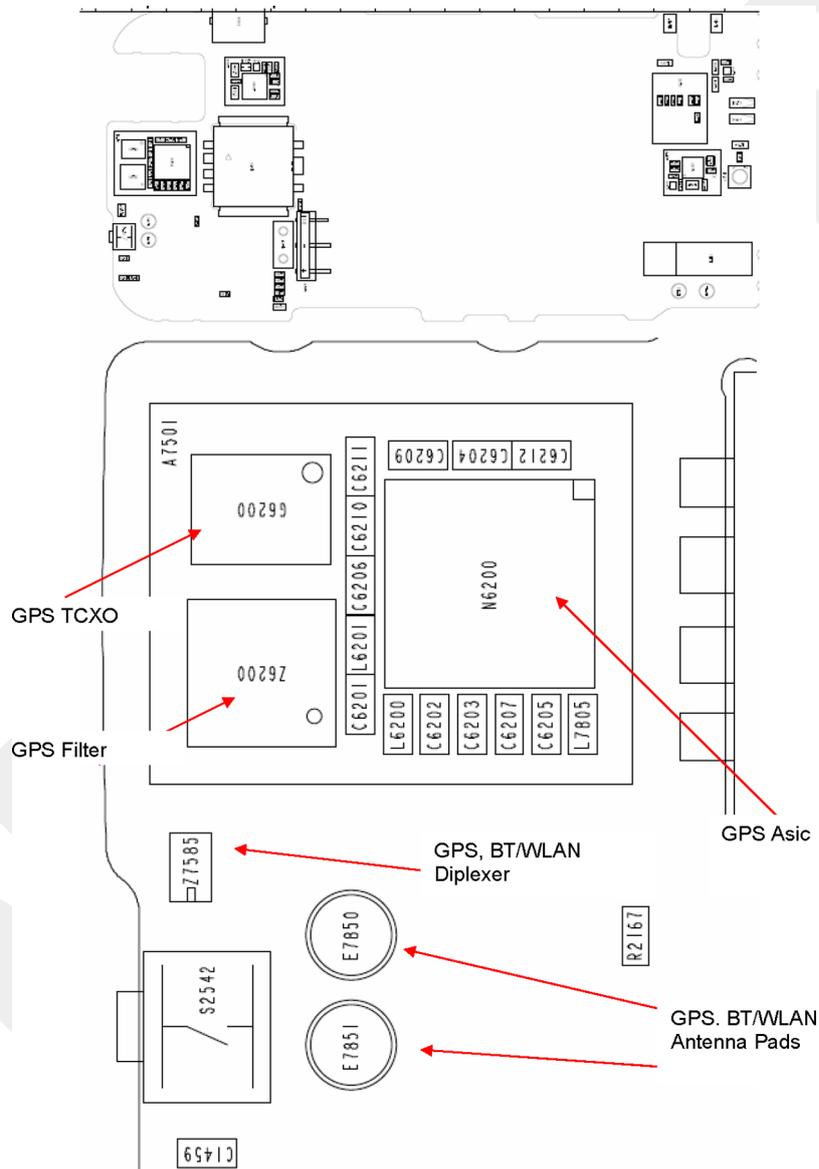
Figure 18 GPS layout and basic test points

GPS settings for Phoenix

GPS control

Prerequisites

A flash adapter with RF coupler connected to a PC with Phoenix service software is required. The GPS signal should be connected to the RF coupler. Calibrate the signal level with a known good phone. Signal level will be high (approx -45dBm) because it is a leakage connection.

Context

Use the following to test GPS using Phoenix.

Steps

1. Place phone to Flash Adaptor.

2. Start Phoenix service software.

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

4. From the **Testing** menu, select **GPS Control**. This opens up *GPS Control* dialogue box, as shown in the figure below, and enables the GPS.
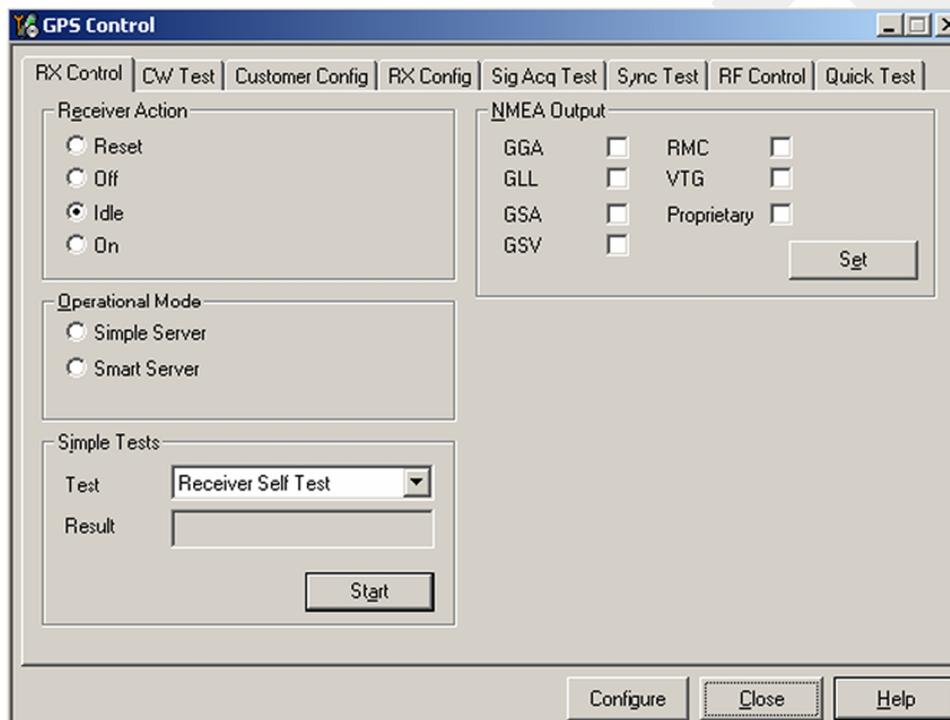
Figure 19 GPS Control dialogue box

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

Receiver On turns on all RF sections of the ASIC and so all LDOs will be on.

Quick Test window

This test will perform 3 tests in one: Self test, Oscillator Test and CW Test and will provide a Pass/Fail Response for each. The HW Self Test confirms basic communication with the GPS ASIC. The oscillator test confirms the frequency accuracy of the GPS TCXO against the Ref_Clk. The CW Test confirms end-to-end connectivity between the GPS antenna pogo pins and the GPS ASIC. It also contains a receive button.

Before this test is performed a known good RM-235 unit should be tested in order to calibrate the setup. The signal level of the Signal Generator should be adjusted so a reading of SNR 40 dB is achieved with the reference unit. A good starting point is to set up the signal generator to -45dBm.

These checks are part of GPS failure troubleshooting (page 3–48).
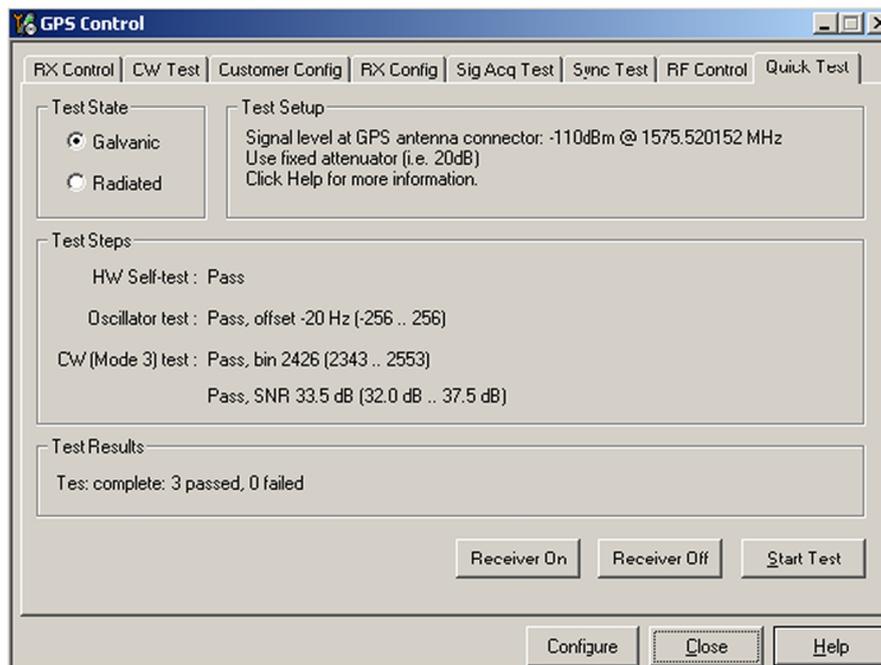
Figure 20 GPS Quick Test window

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Care

GPS failure troubleshooting

Troubleshooting flow
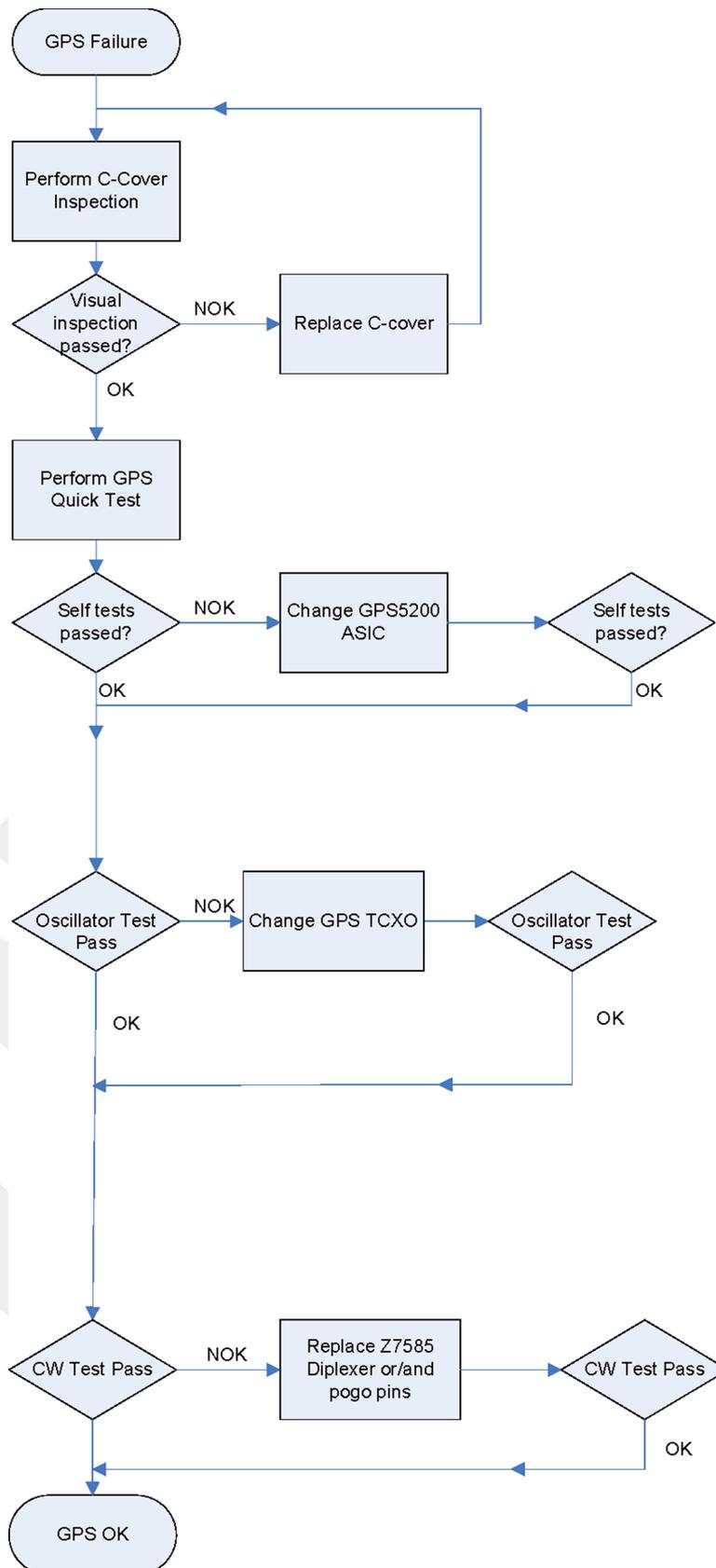
■ **WLAN Troubleshooting**

WLAN component layout and test points
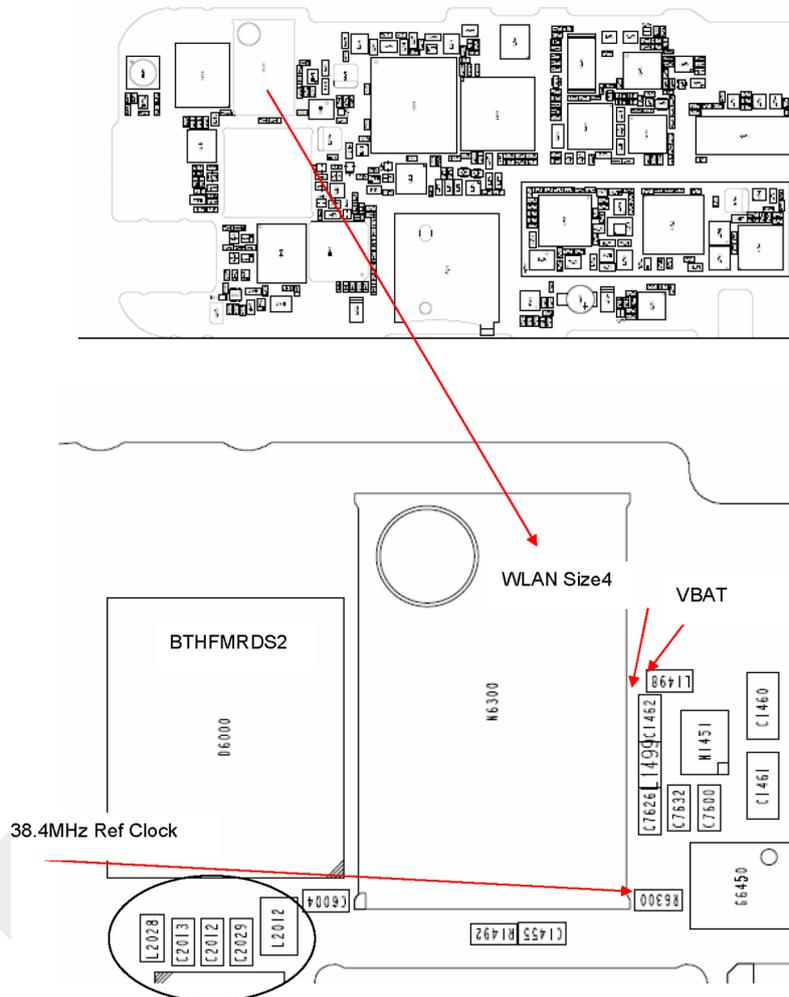
Figure 21 WLAN component layout and test points

The WLAN RF signal is routed from the WLAN module through diplexer to the shared WLAN/BT/GPS antenna in the phone's C-cover.

WLAN selftest and coexistence test in Phoenix

Prerequisites

Connect complete phone assembly with C-cover to a PC with Phoenix service software using a USB data cable.

Use the following to test WLAN using Phoenix:

1 Set phone into Local Mode .

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

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

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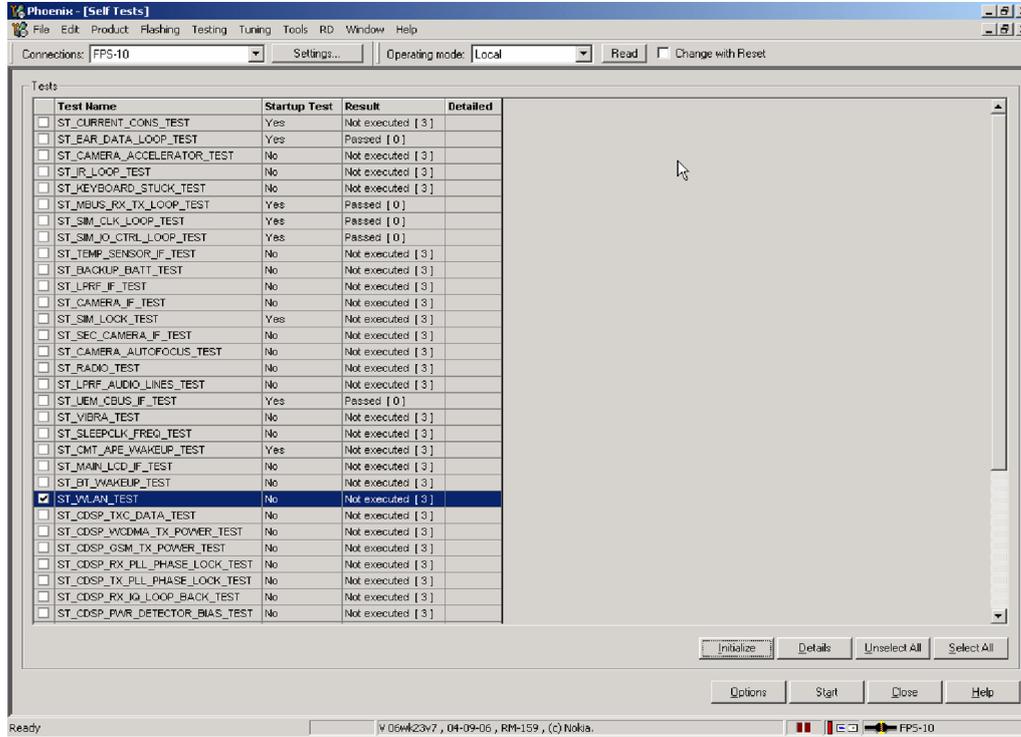
In addition, a test of the WLAN to BTH interface can be done by selecting the **ST_BT_WLAN_COEXISTENCE_TEST** check box and selecting Start button.

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

The co-existence interface comprises BTH Txconfig, BTH RF Active, BTH Priority, and BTH Frequency.
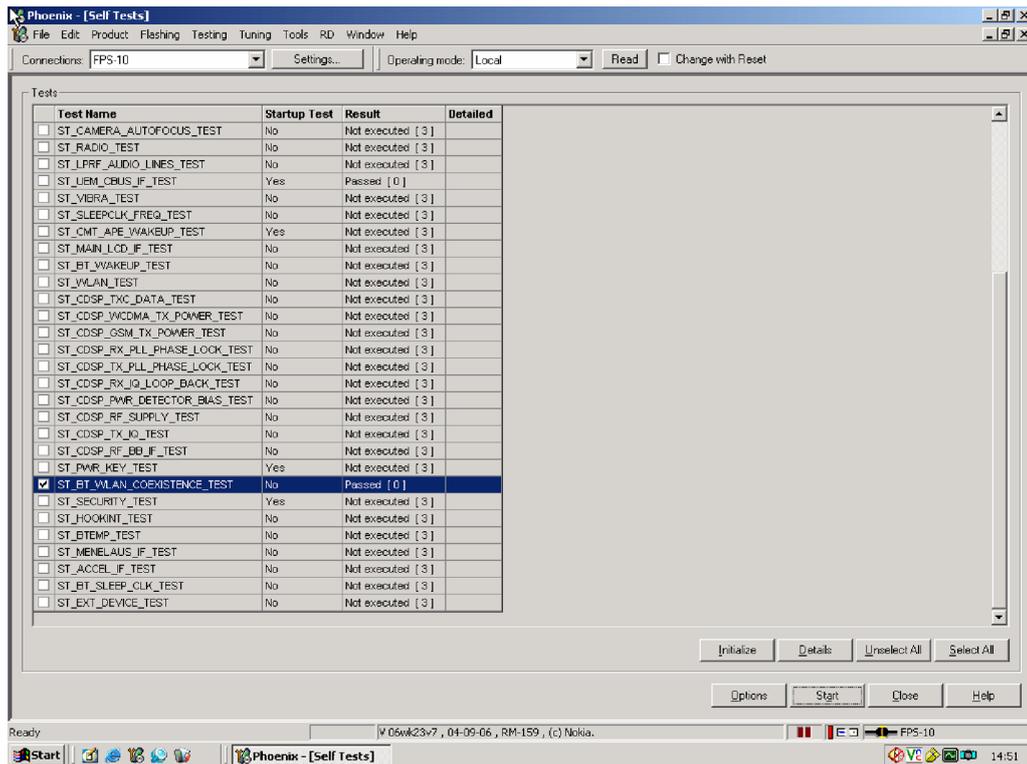
In summary these two Self tests provide a simple means of ensuring the Host engine is able to communicate with the WLAN module and check the interface to BTH. More detailed WLAN performance test is covered in WLAN functional test section.

WLAN functional tests

On/Off test

Prerequisites

A flash adapter connected to a PC with Phoenix service software is required.

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

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

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

The difference between the currents in (1) and (2) should be between 190 to 220mA. When WLAN is ON, the firmware has been downloaded and the WLAN module is in the receive state. When OFF WLAN is powered down.
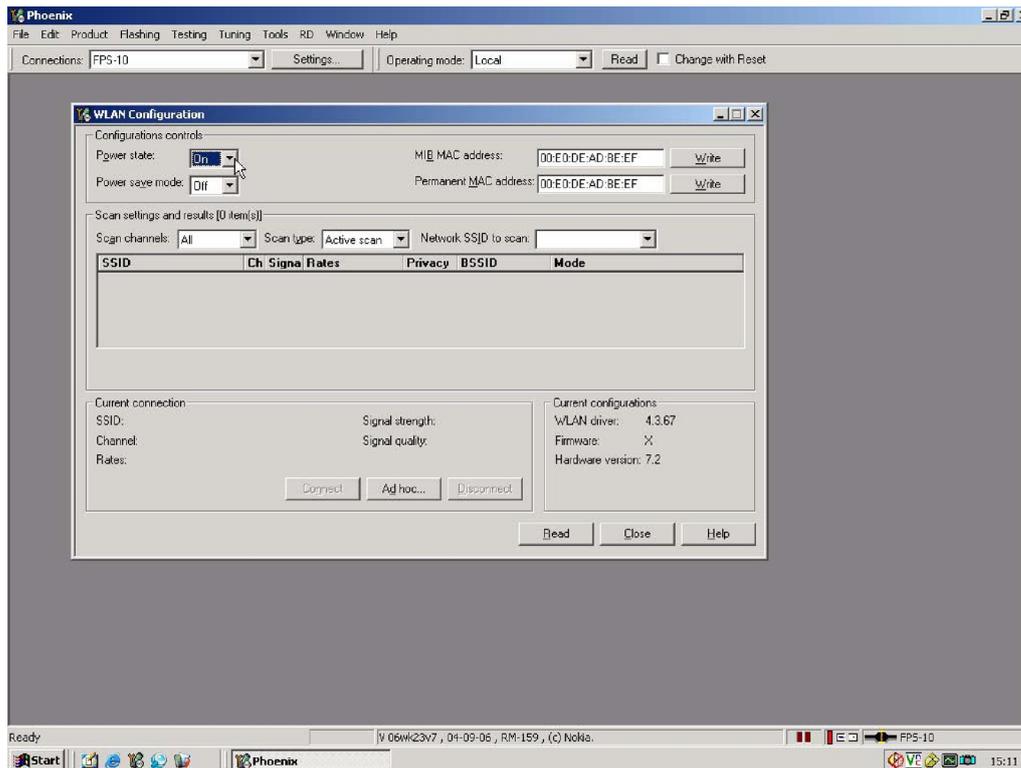
TX tests

Prerequisites

Connect complete phone assembly with C-cover to a PC with Phoenix service software using a USB data cable.

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

1 Monitor the WLAN TX spectrum on a Spectrum analyser. (When making a radiated test ensure that other WLAN devices are not transmitting as these may be detected as well, confusing the result). A typical 11MBPS TX spectrum is shown in figure below.

2 To finish the test select the Finish option button.

The difference between the two readings should be approximately 150mA and measures the transmit current in 11MBPS, 802.11b mode of operation.
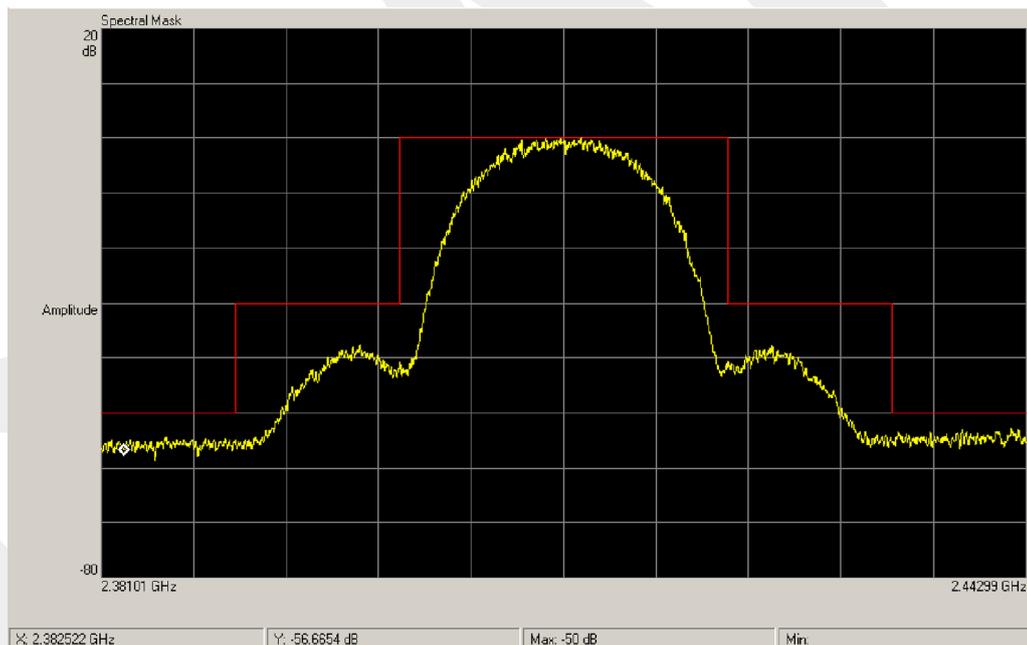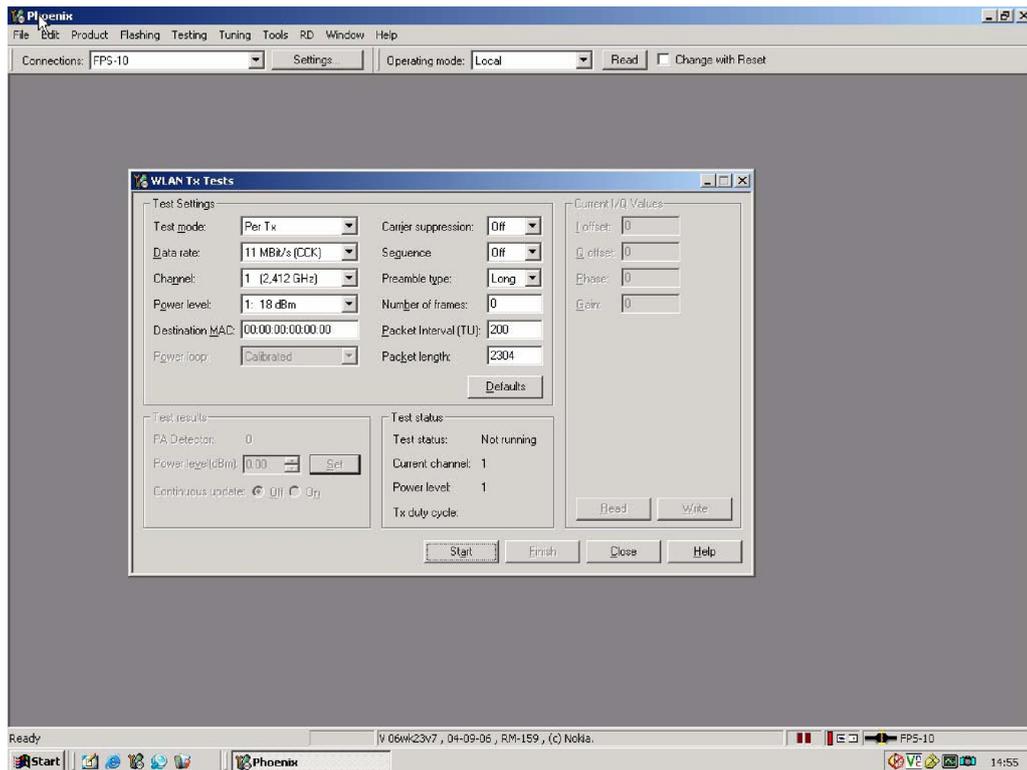
RX Tests

Prerequisites

Connect complete phone assembly with C-cover to a PC with Phoenix service software using a USB data cable.

There are different options available for testing the Rx path. The simplest is to use the WLAN to report Rx packets when operating in an area where there is an active WLAN network. Simply starting an Rx test will show the number of packets detected by the WLAN module as it monitors the network. However, it does require a properly configured WLAN network.

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

To start the test, select the Start option button.

As the WLAN monitors an active WLAN network, the Rx test results window will update and show the number of Frames received, as well as the Packer error rate.

Monitoring the detected frames is a simple method to verify the WLAN antenna and receiver path is working properly.

COMPANY CONFIDENTIAL
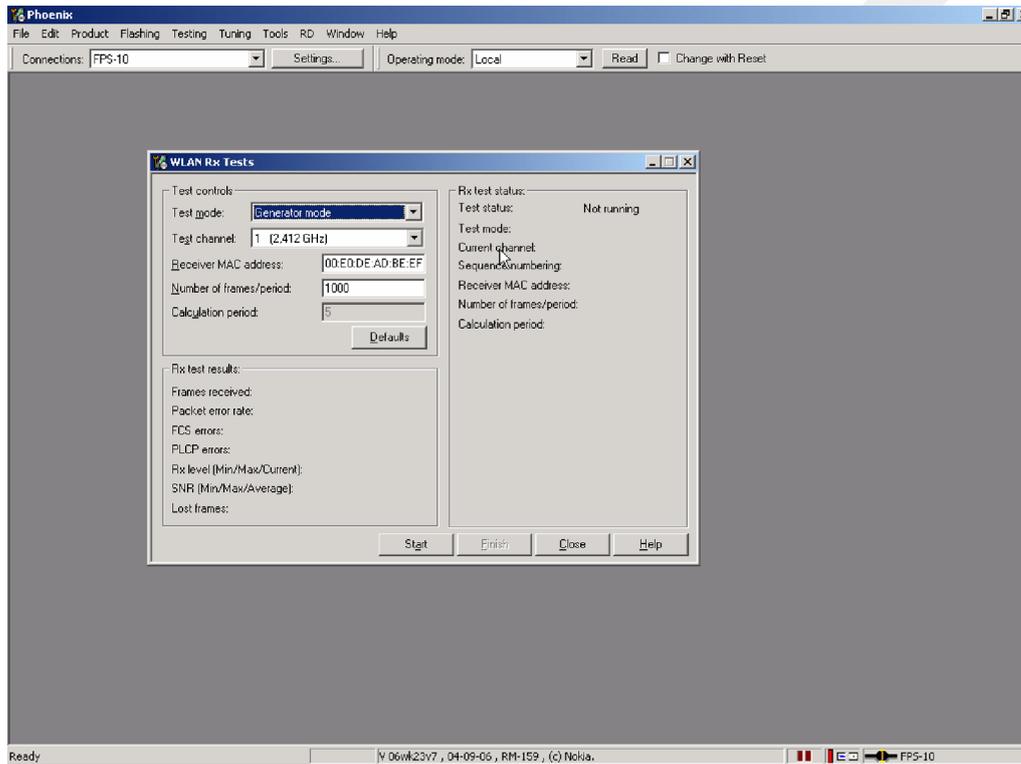
WLAN failure troubleshooting

Troubleshooting flow
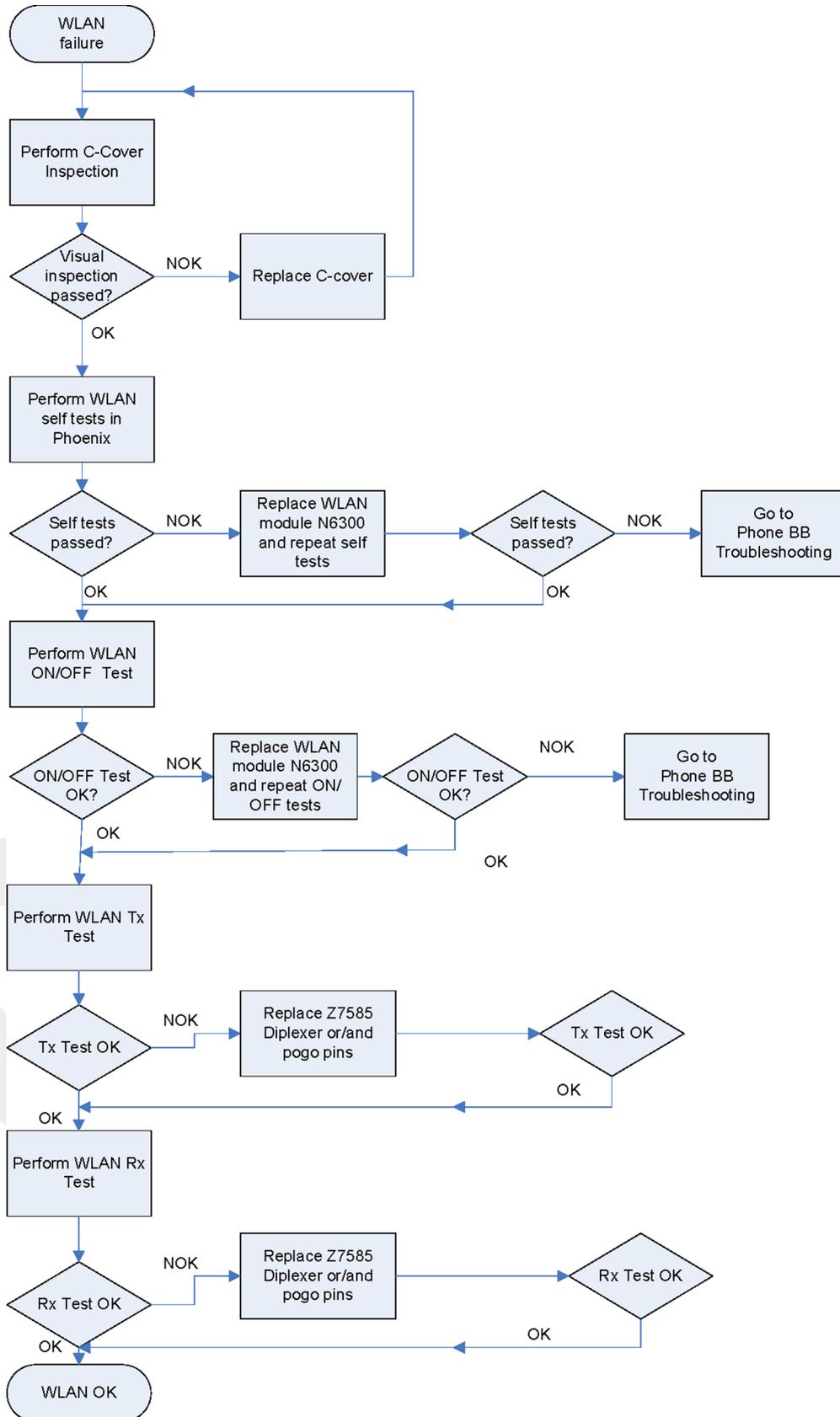
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4 — RF troubleshooting

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Table of Contents

■ General RF troubleshooting

Introduction to RF troubleshooting

Most RF semiconductors are static discharge sensitive

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

Pre-baking

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

- RFIC N7505
- Front End Module (FEM) N7520

Discrete components

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

Capacitors: check for short circuits.

Resistors: check value with an ohm meter.

> **Note:** In-circuit measurements should be evaluated carefully

Measuring equipment

All measurements should be done using:

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

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

> **Note:** All communication Test Set Screen dumps are from CMU200. Other testers are different.

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

Level of repair

The scope of this guideline is to enable repairs at key-component level. Some key-components are not accessible without replacing the whole shield frame (i.e. not replaceable). Please refer to the list of Non-replaceable RF components (page 4–7).

RF key components

Figure 22 RF key components

Non replaceable and replaceable RF components

Below are the lists of non-replaceable and replaceable RF components. If during replacement the shield is damaged, it should be replaced with a new one.

Top of the PWB

Non-Replaceable RF Components	
C7500	L7587
C7507	L7588
C7513	L7590
C7518	L7591
C7519	L7592
C7520	N7540
C7521	N7541
C7523	N7590
C7524	R7501
C7525	R7502
C7543	R7503
C7544	R7509
C7545	R7522
C7547	R7523
C7548	R7524
C7549	R7525
C7550	R7526
C7553	R7527
C7580	R7528
C7581	R7541
C7582	R7543
C7583	R7544
C7590	R7560
C7591	T7502
G7501	T7580
L7500	Z7501
L7501	Z7503
L7502	Z7504
L7503	Z7521
L7506	Z7540
L7510	Z7541
L7540	Z7580
L7550	Z7582
L7586	

N7505

N7520

Replaceable RF Components
N7505
N7520

Note! The RF components listed above can be replaced only by replacing the whole shield frame.

Figure 23 Non-replaceable and replaceable RF components

General voltage checking

Steps

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

#	Signal name	Test point	Voltage (all bands)
1	VCTCXO supply	R7501	2.5 V
2	AHNEUS supply from DC/DC conv	C7590	3.2 V
3	FEM supply	L7510	3.9 V
4	WCDMA PA supply from DC/DC conv	C7543	0 V (1.3 V* when transmitting. Settings as in figure below)
5	Vbat at WCDMA PA	C7547	3.9 V
6	Supply input to DC/DC conv	L7592	3.9 V
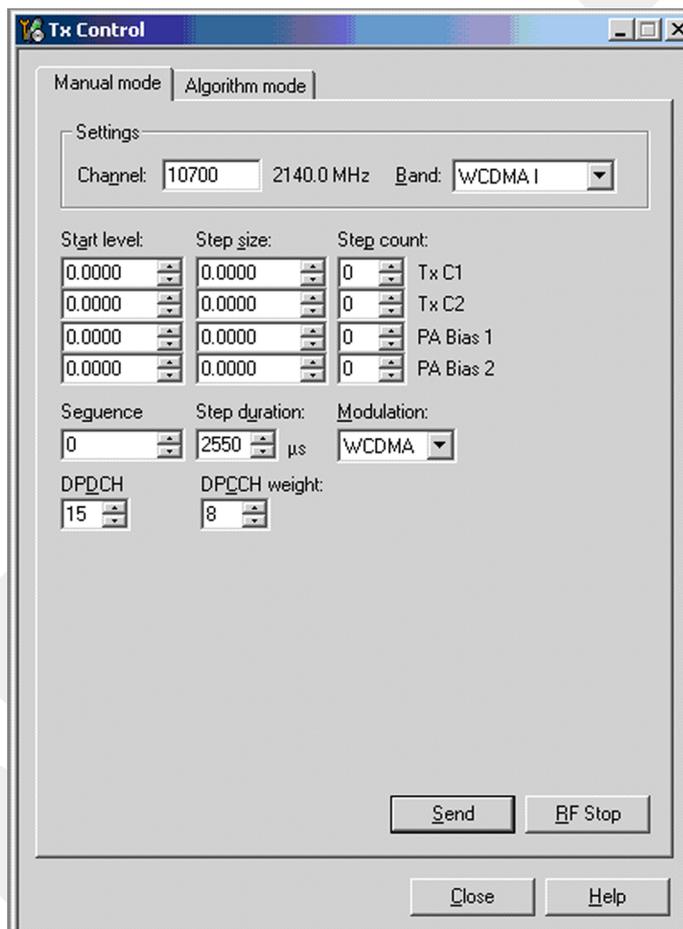
* With these settings, the result should be 1.3 V.

Figure 24 General voltage checking test points

Phoenix self tests

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 the baseband troubleshooting section.

Troubleshooting flow
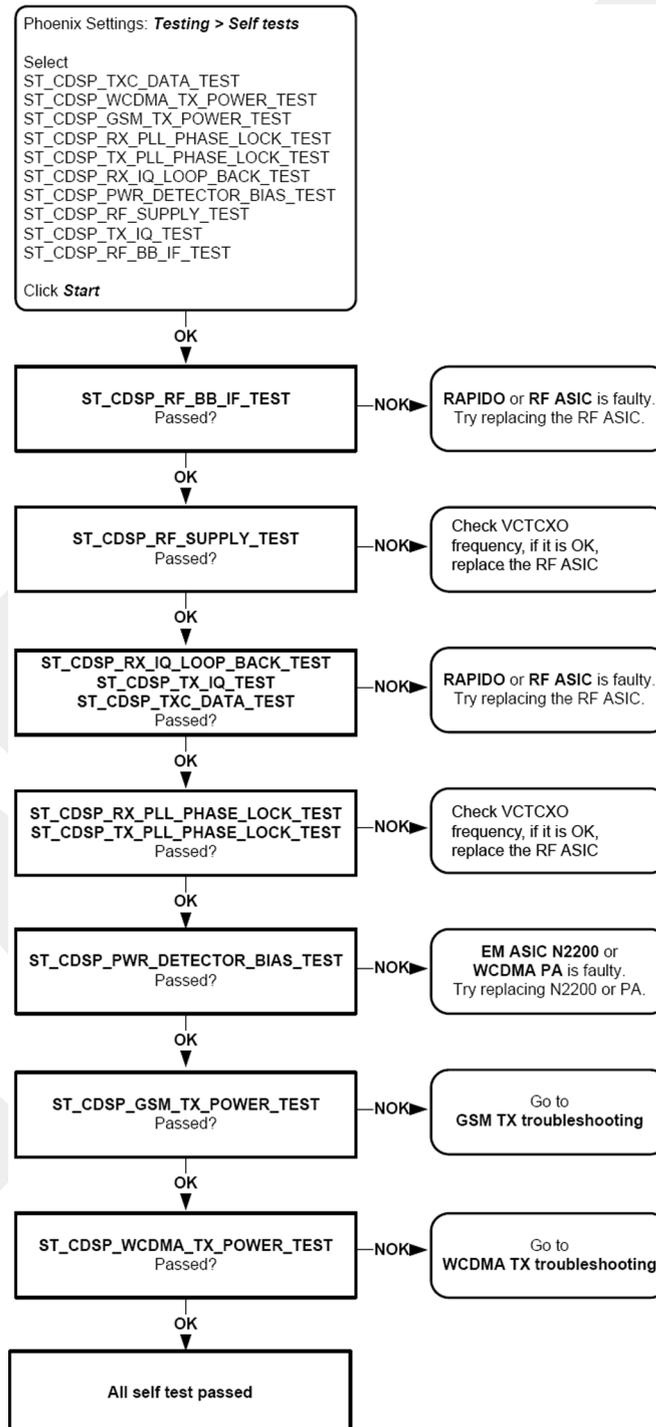
■ Receiver troubleshooting

Introduction to receiver (RX) troubleshooting

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

The main RX troubleshooting measurement is RSSI reading. This test measures the signal strength of the received signal. For GSM RSSI measurements, see GSM RX chain activation for manual measurements / GSM RSSI measurement (page 4–11). For a similar test in WCDMA mode, see WCDMA RSSI measurement (page 4–13).

GSM RX chain activation for manual measurements/GSM RSSI measurement

Prerequisites

Make the following settings in Phoenix service software:

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

Steps

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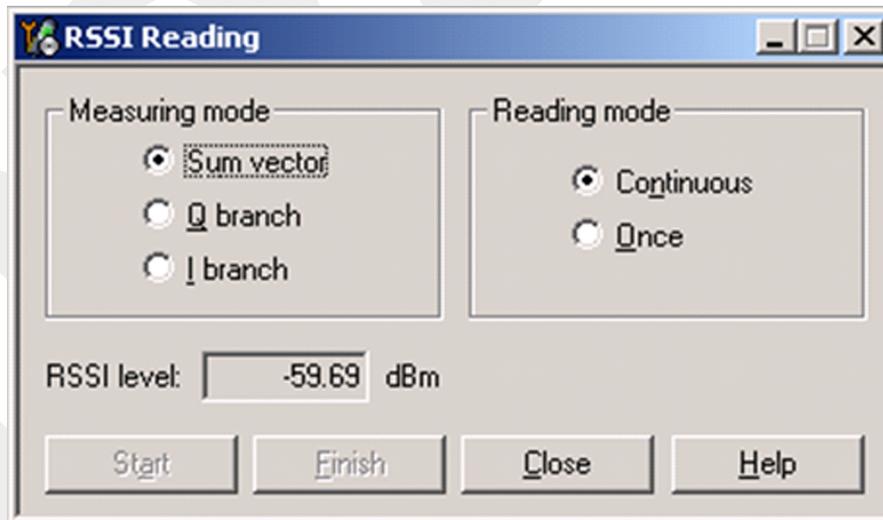
Results

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

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

WCDMA RX chain activation for manual measurement

Prerequisites

Make the following settings in Phoenix service software:

Setting	WCDMA2100	WCDMA900
Phoenix Channel	10700	3012
Signal generator to antenna connector	2140 MHz	942,4 MHz
Band	I	VIII

Steps

1. Via Phoenix Testing menu, choose **WCDMA/RX Control**.

2. In the RX control window, make the following settings:
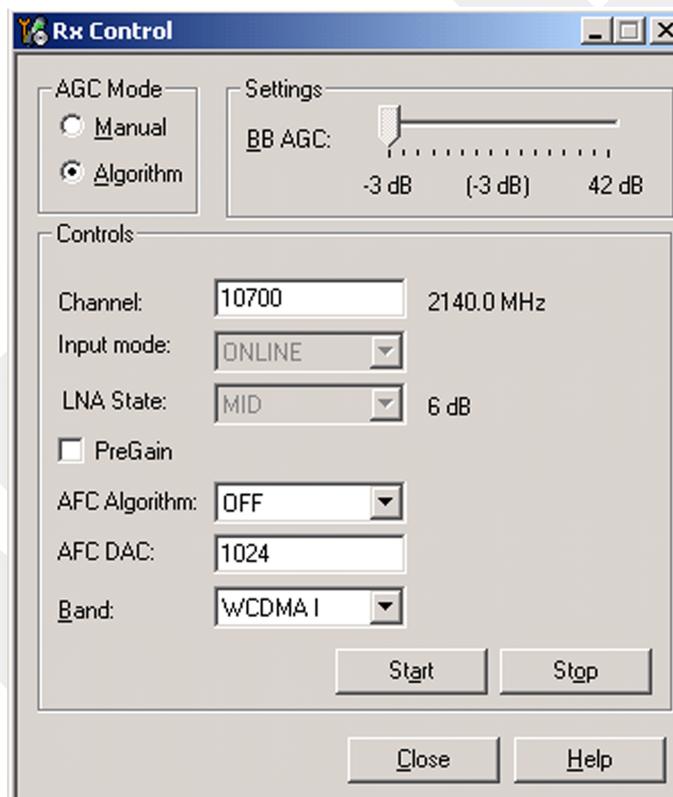
3. Click **Start** to activate the settings.

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

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

4. Set the following RF generator settings:
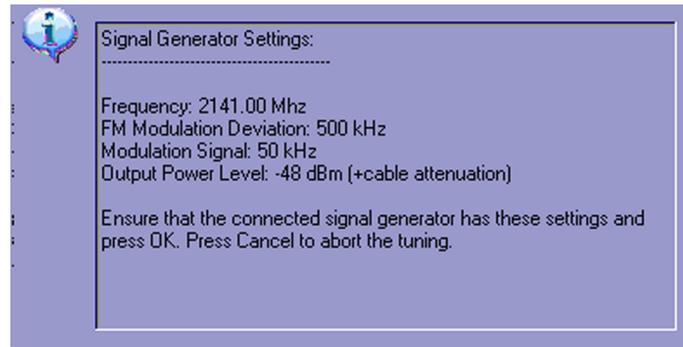
Figure 25 WCDMA RX generator settings

WCDMA RSSI measurement

Prerequisites

WCDMA RX must be activated before RSSI can be measured. For instructions, please refer to WCDMA RX chain activation (page 4–12).

Steps

1. From the Phoenix testing menu, select **WCDMA→RX Power measurement**

2. In the RX Power measurement window, select:

    - Mode: RSSI

    - Continuous mode
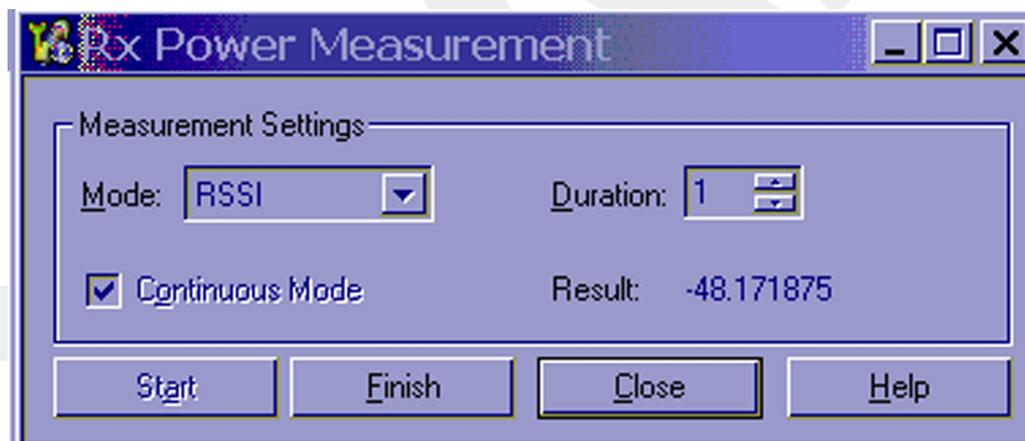
3. Click **Start** to perform the measurement.

■ Transmitter troubleshooting

General instructions for transmitter (TX) troubleshooting

Please note the following before performing transmitter tests:

- TX troubleshooting requires TX operation.

- Do not transmit on frequencies that are in use!

- The transmitter can be controlled in local mode for diagnostic purposes.

- The most useful Phoenix tool for GSM transmitter testing is "RF Controls"; in WCDMA transmitter testing the best tool is "TX Control".

- Remember that re-tuning is not a fix! Phones are tuned correctly in production

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

GSM transmitter troubleshooting

Steps

1. Set the phone to local mode.

2. Activate RF controls in Phoenix (**Testing→GSM→Rf Controls**).

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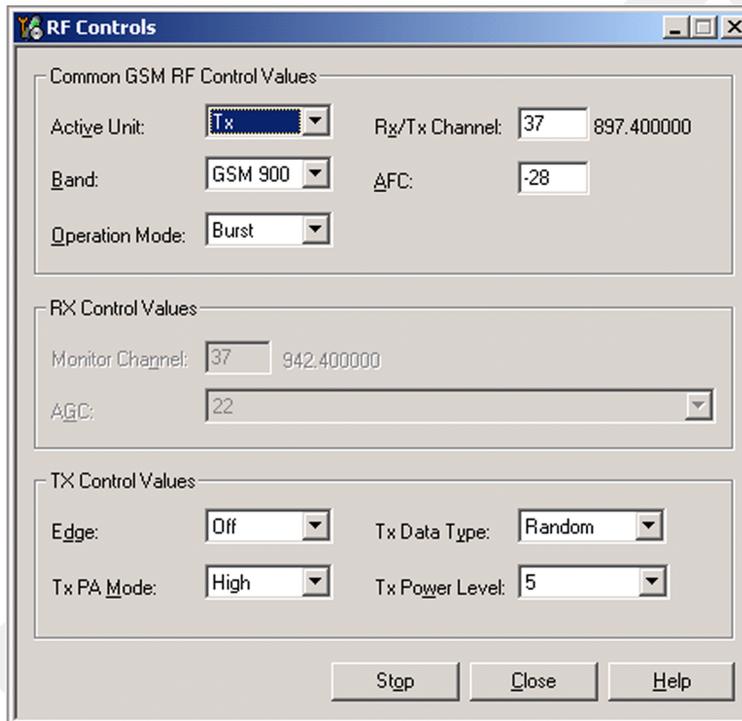
3. Check the basic TX parameters (i.e. power, phase error, modulation and switching spectrum), using a communication analyser (for example CMU200).

   Note: Never set Operation Mode to continuous for any length of time.

Analyser settings

Phase error

Modulation/Switching spectrum

Power/Burst
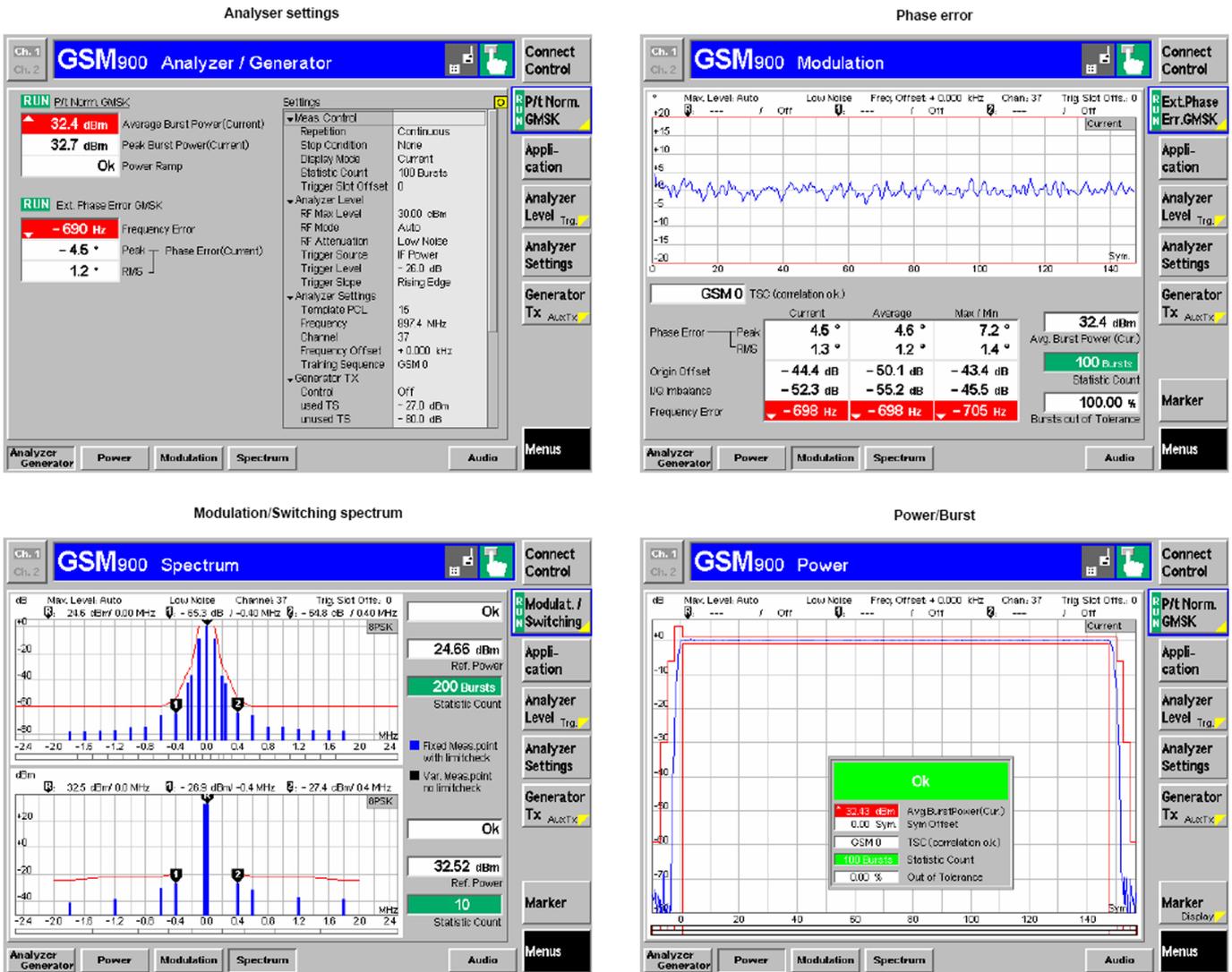
Figure 26 Typical readings

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

Next actions

You can troubleshoot the GSM transmitter for each GSM band separately, one band at a time. If you want to troubleshoot GSM850, GSM1800 or GSM1900, change the band with the RF controls and set the communication analyser accordingly.

GSM transmitter troubleshooting flowchart

Troubleshooting flow

```
Phoenix Settings: Testing > GSM > Tx Control
              Band = GSM850
              Band = GSM900
              Band = GSM1800
              Band = GSM1900
             Active Unit = Tx
             Op Mode = Burst
        Tx Channel = 190 GSM850
         Tx Channel = 37 GSM900
        Tx Channel = 700 GSM1800
        Tx Channel = 661 GSM1900
                Edge = Off
           Tx Data Type = Random
     Power level = 5 for GSM850/GSM900
     Power level = 0 for GSM1800/1900
```

```
Check output signal level from
     Cellular RF connector:

GSM 850 (836.6MHz) 33dBm +2dB        Yes      (  Tx OK  )
GSM 900 (897.4MHz) 33dBm +2dB    ─────────────►
GSM 1800 (1747.8MHz) 30dBm +2dB
GSM 1900 (1880MHz) 30dBm +2dB

            OK?
```

No

```
                    Yes   Check components   No
(Replace faulty  ◄────── between RF ASIC N7505 ──────►  ( Replace RF FEM )
   component)            and RF FEM N7520
                              OK?
```

WCDMA transmitter troubleshooting

Steps

1. Set the phone to local mode.

2. In Phoenix, select **Testing→WCDMA→TX control** .

3. Use the following settings in the TX control window:
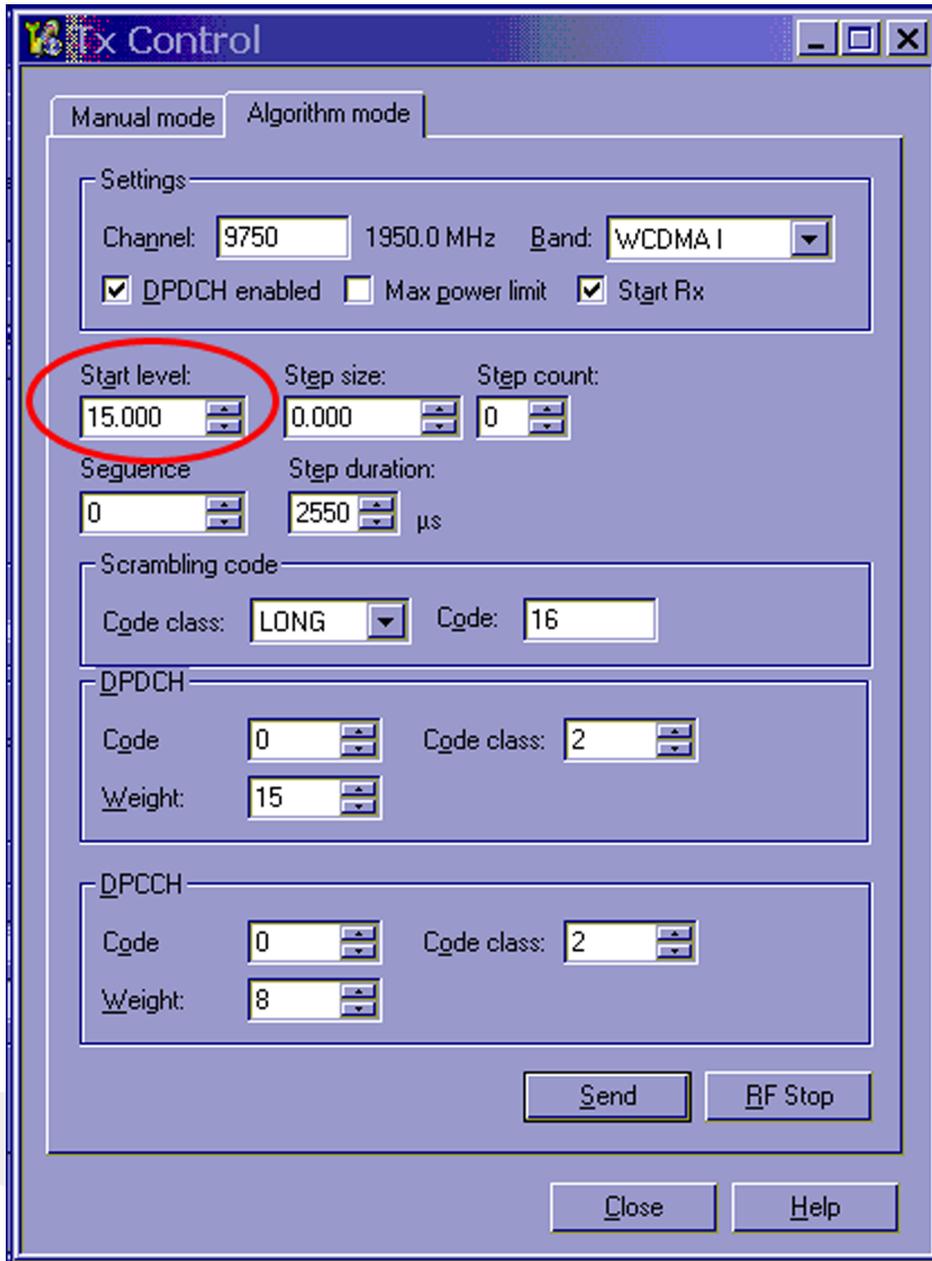
Figure 27 Phoenix WCDMA TX control window

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

4. Click **Send** to enable the settings and activate TX.

   If settings are changed (eg. new channel), you have to click **RF Stop** and **Send** again.

5. Use the CMU200 to check the WCDMA power.
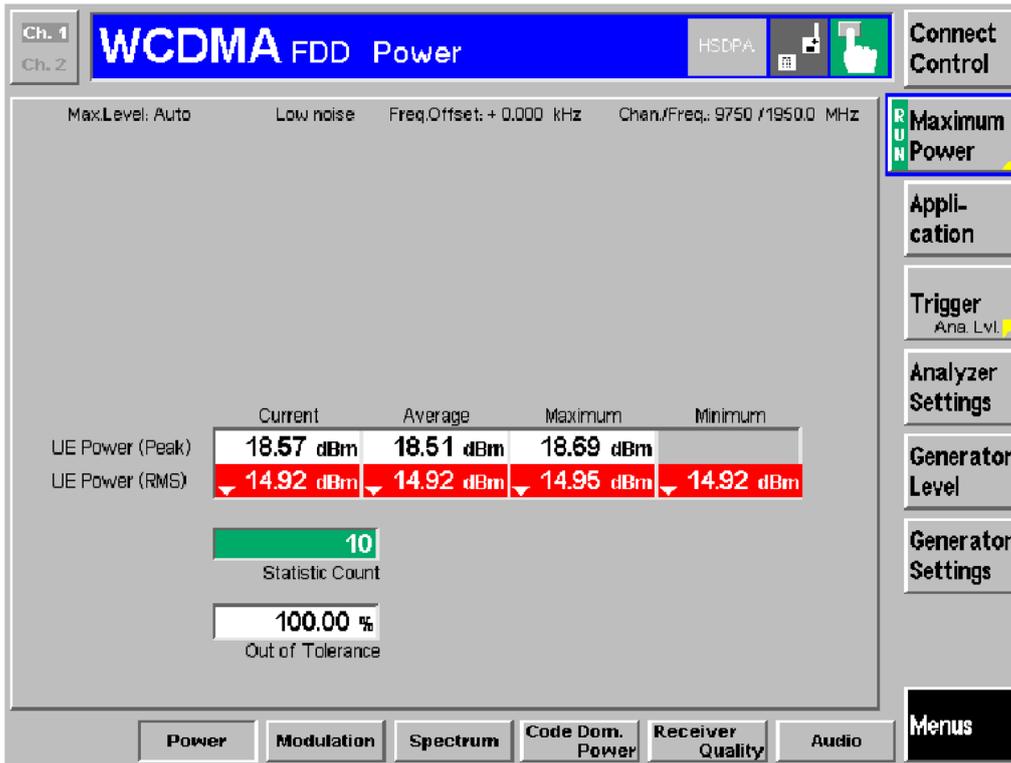
Figure 28 WCDMA power window

WCDMA transmitter troubleshooting flowchart

Troubleshooting flow
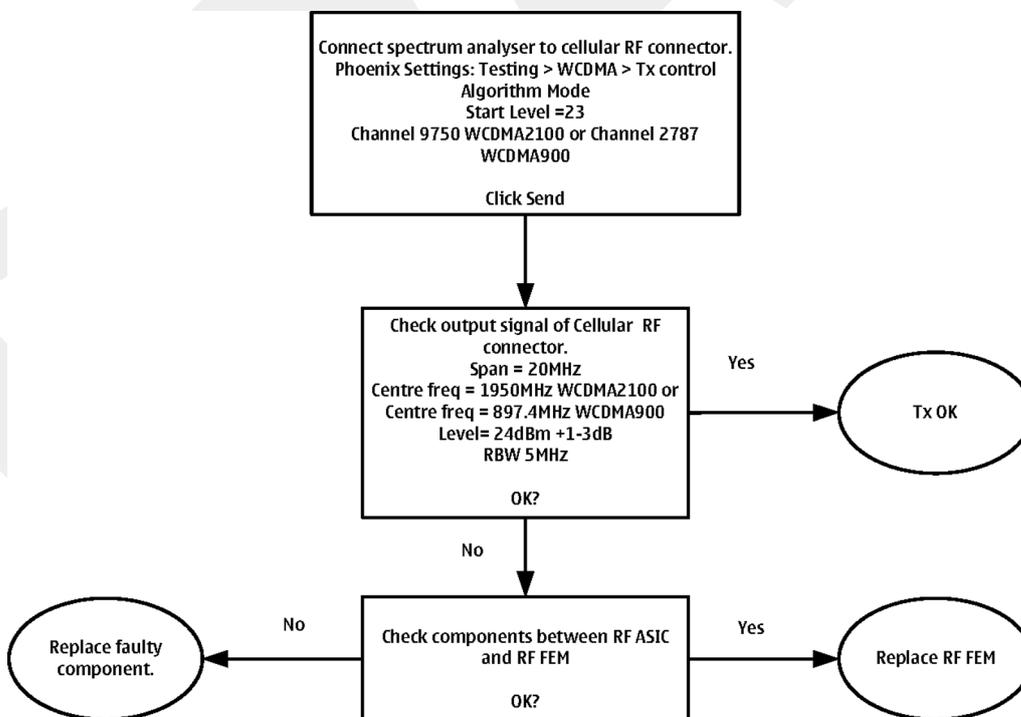
■ **RF tunings**

Introduction to RF tunings

Important: Only perform RF tunings if:

- one or more of the RF components have been replaced
- flash memory chip is replaced or corrupted.

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

Important: After RF component replacements, **always** use autotuning. Manual tunings are only required in rare cases.

Cable and adapter losses

RF cables and adapters have some losses. They have to be taken into account when the phone is tuned. As all RF losses are frequency dependent, the user has to act very carefully and understand the measurement setup.

Autotuning for BB5

This phone can be tuned automatically.

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

Hardware set up

Hardware requirements for auto tuning:

- PC (Windows 2000/XP) with GPIB card
- Power supply
- Product specific module jig
- Cables: XRS-6 (RF cable that requires an additional product-specific adapter cable), USB cable, GPIB cable and DAU-9S
- 6dB attenuator (suitable to cover tuning frequency range) between CMU200 and Module jig (location is close to the module jig). Ensure that the 6dB pad loss is added in the Jig losses.
- Signal analyser (TX), signal generator (RX) and RF-splitter *or* one device including all.
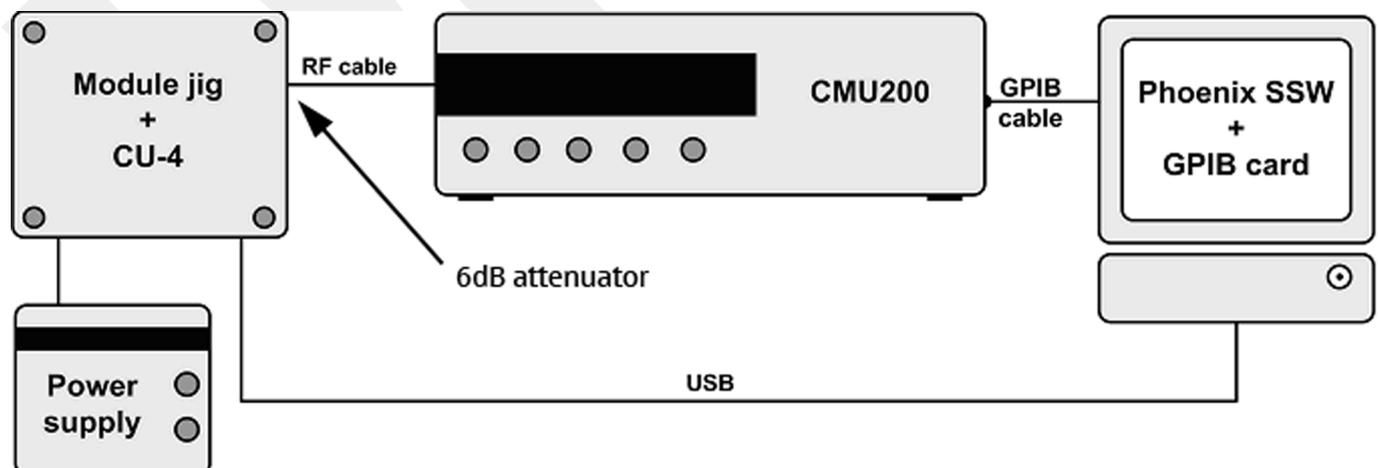
Figure 29 Auto tuning concept with CMU200

Phoenix preparations

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

Auto tuning procedure

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

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

3 Remember to set the correct attenuation values before autotuning.

4 To start autotuning, click the *Tune* button.

■ System mode independent manual tunings

RF channel filter calibration

Context

Rf channel filter calibration tunes the internal low pass filters of the RF ASIC, that limit the bandwidth of BB IQ signals.

Table 8 Rf channel filter calibration tuning limits

	Min	Typ	Max
Tx filter	0	10	31
RX mixer	0	13	31
Rx filter	0	16	31

Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.

2. Choose **Tuning→Rf Channel Filter Calibration** .

3. Click **Tune**.

4. To save the values to the PMM (Phone Permanent Memory) area, click **Write**.

5. To close the *Rf Channel Filter Calibration* window, click **Close**.

Results
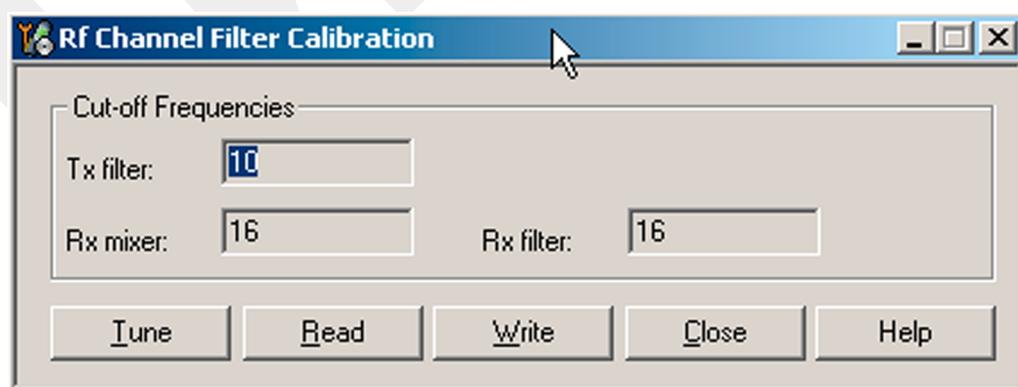
Figure 30 Rf channel filter calibration typical values

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PA (power amplifier) detection

Context

The PA detection procedure detects which PA manufacturer is used for phone PAs.

If a PA is changed or if the permanent memory (PMM) data is corrupted, PA detection has to be performed before Tx tunings.

Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.

2. Choose **Tuning→PA Detection** .

3. Click **Tune**.

4. Check that the detected PA manufacturers are corresponding to the actual chips on the board.

5. To end the procedure, click **Close**.

■ GSM receiver tunings

Rx calibration (GSM)

Context

Rx Calibration is used to find out the real gain values of the GSM Rx AGC system and tuning response of the AFC system (AFC D/A init value and AFC slope)

Steps

1. Connect the GSM connector of the module jig to a signal generator.

2. Start *Phoenix* service software.

3. From the **Operating mode** drop-down menu, set mode to **Local**.

4. Choose **Tuning→GSM→Rx Calibration** .

5. Click **Start**.
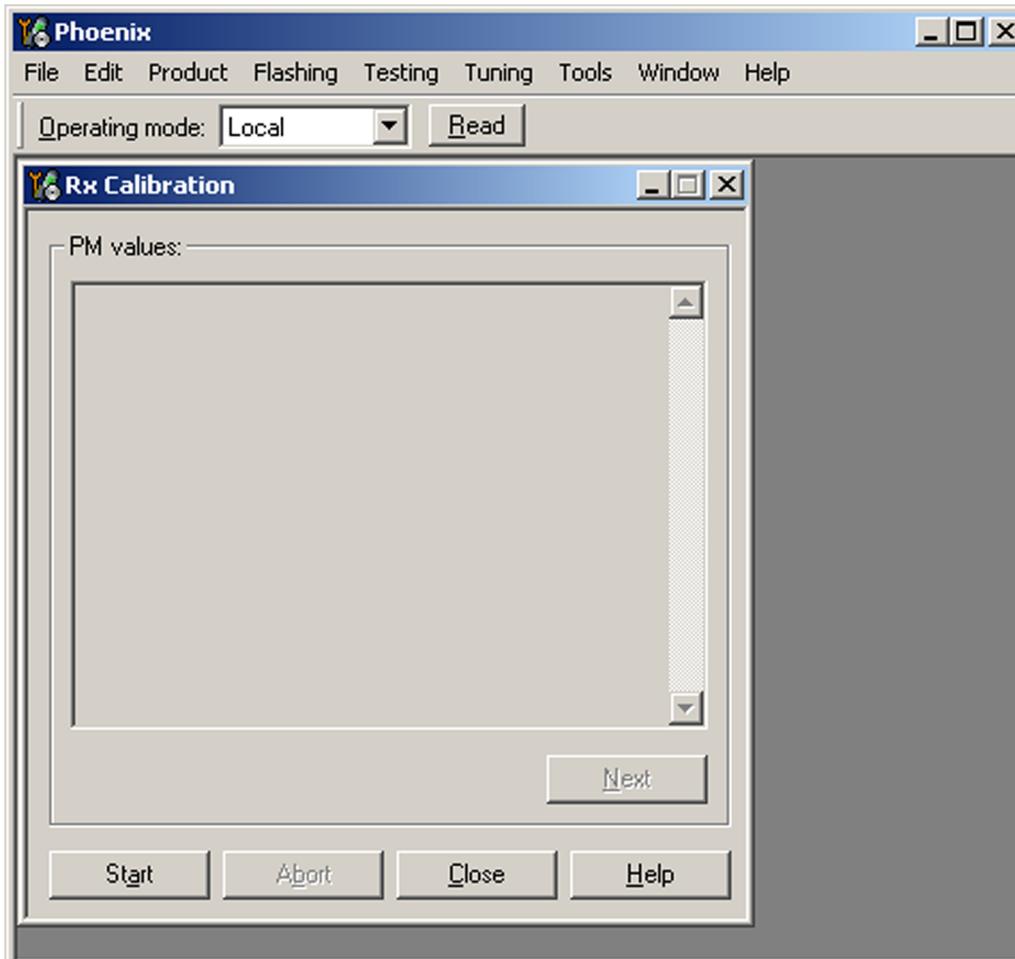
6. Connect the signal generator to the phone, and set frequency and amplitude as instructed in the **Rx Calibration with band EGSM900** (step 1-3) pop-up window.

   Important: The calibration uses a non-modulated CW signal. Increase the signal generator level by cable attenuation and module jig probe attenuation.
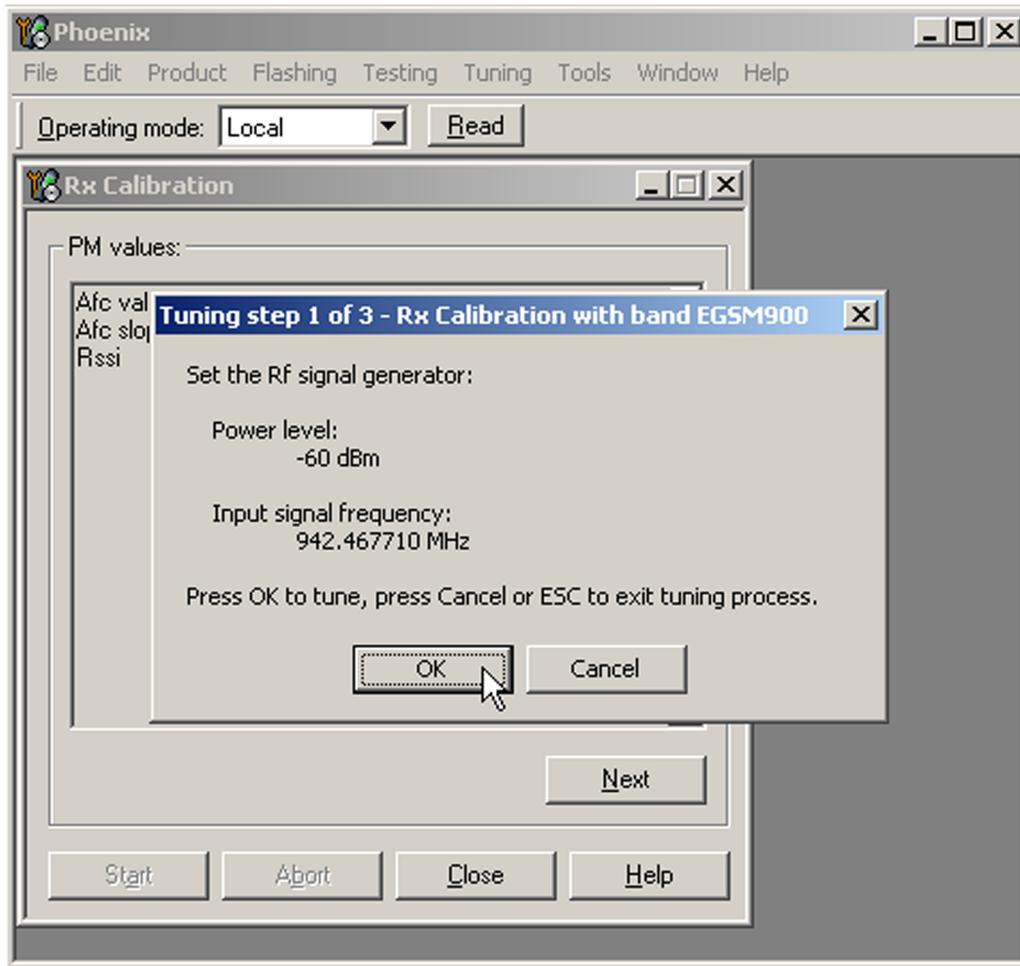
7. To perform the tuning, click **OK**.

8. Check that the tuning values are within the limits specified in the following table:

Table 9 RF tuning limits in Rx calibration

	Min	Typ	Max	Unit
GSM850				
AFC Value (init)	-200	-80..40	200	dB
AFC slope	0	108..121	200	dB
RSSI (AGC-0)	106	107..110	114	dB
GSM900				
AFC Value (init)	-200	-105..62	200	dB
AFC slope	0	122	200	dB
RSSI (AGC-0)	106	107...110	114	dB
GSM1800				
RSSI (AGC-0)	105	105...109	114	dB
GSM1900				
RSSI (AGC-0)	105	105...109	114	dB

9. Click **Next** to continue with GSM1800 Rx tuning.
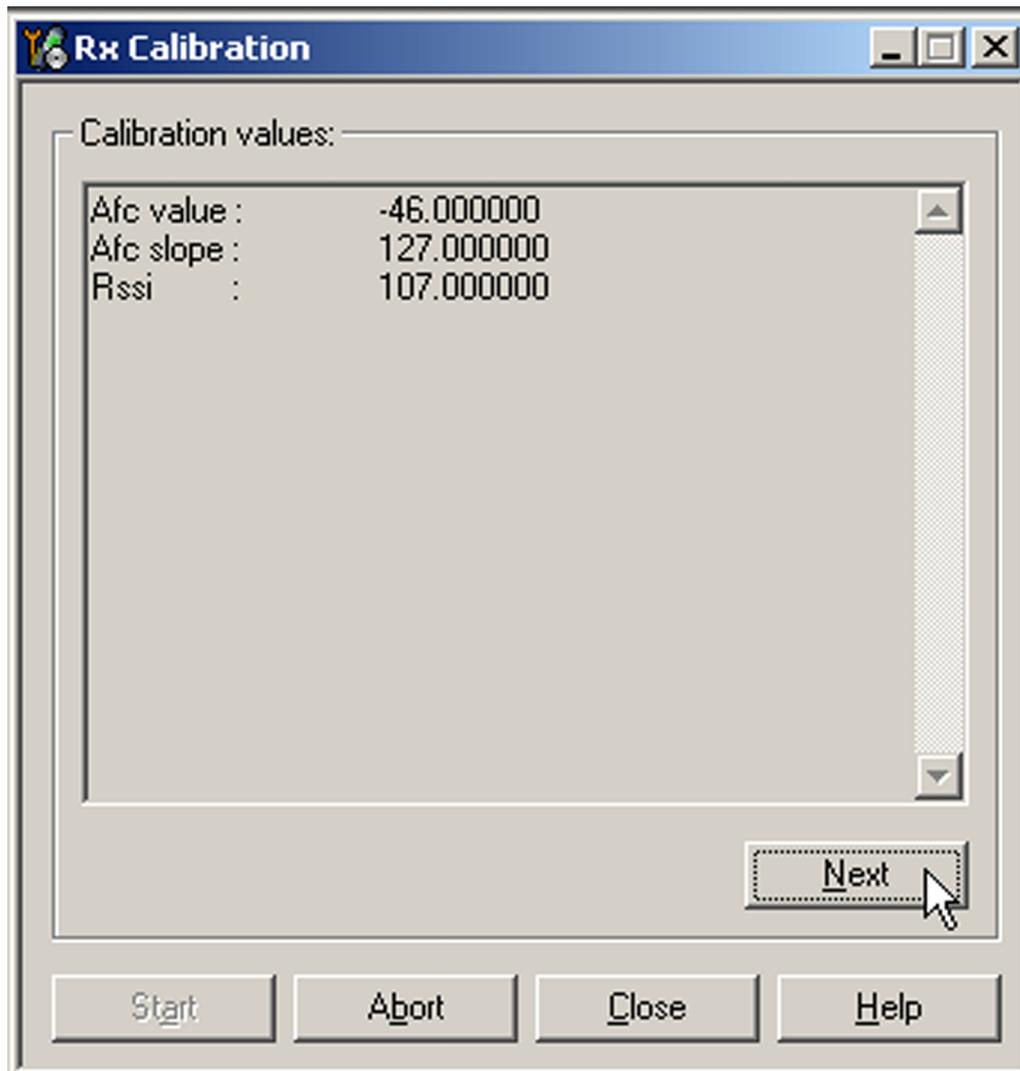
Next actions

Repeat steps 6 to 9for GSM1800 and GSM1900

Rx band filter response compensation (GSM)

Prerequisites

Rx calibration must be performed before the Rx band filter response compensation.

Context

On each GSM Rx band, there is a band filter in front of the RF ASIC front end. The amplitude ripple caused by these filters causes ripple to the RSSI measurement, and therefore calibration is needed.

The calibration has to be repeated for each GSM band.

Steps

1. Connect the GSM connector of the module jig to a signal generator.

2. Start *Phoenix* service software.

3. From the **Operating mode** drop-down menu, set mode to **Local**.

4. Select **GSM900** band.

5. Choose **Tuning→GSM→Rx Band Filter Response Compensation** .

6. Select **Tuning mode: manual**

7. Click **Start**.
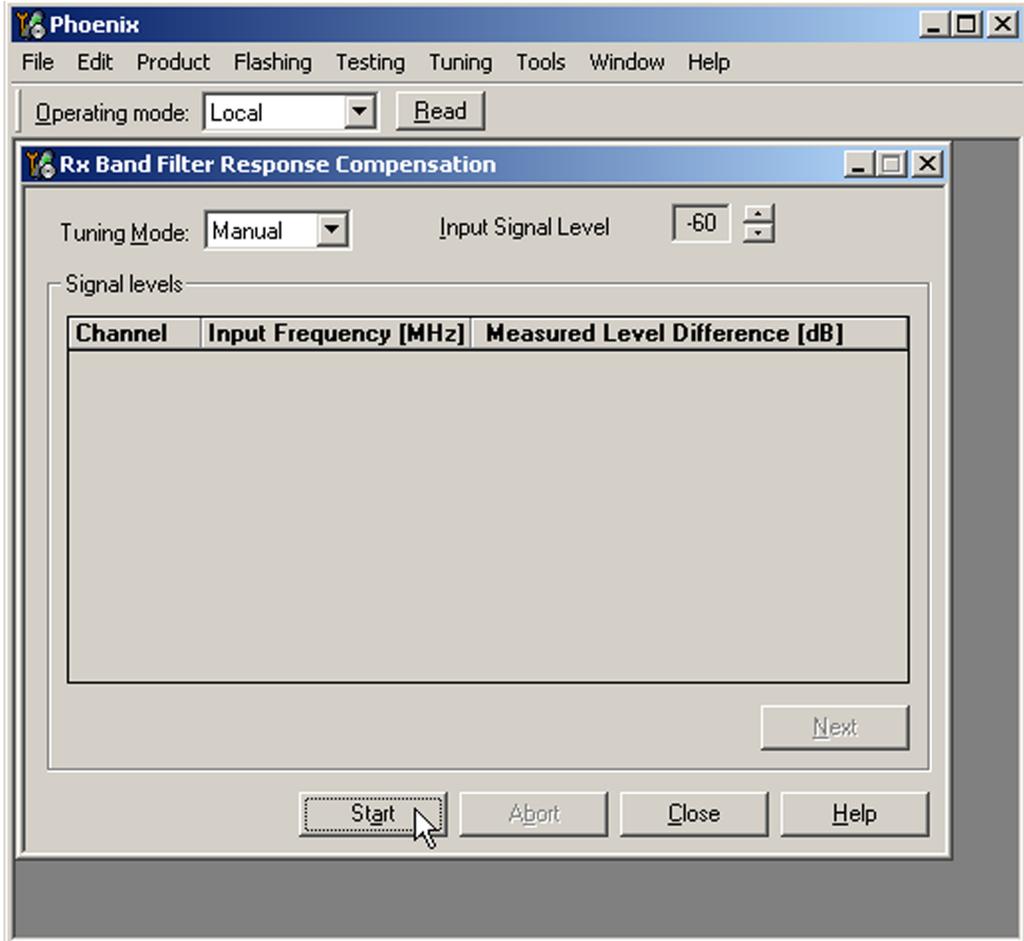
8. Connect the signal generator to the phone, and set frequency and amplitude as instructed in the *Rx Band Filter Response Compensation for EGSM900* pop-up window, step 1-3.
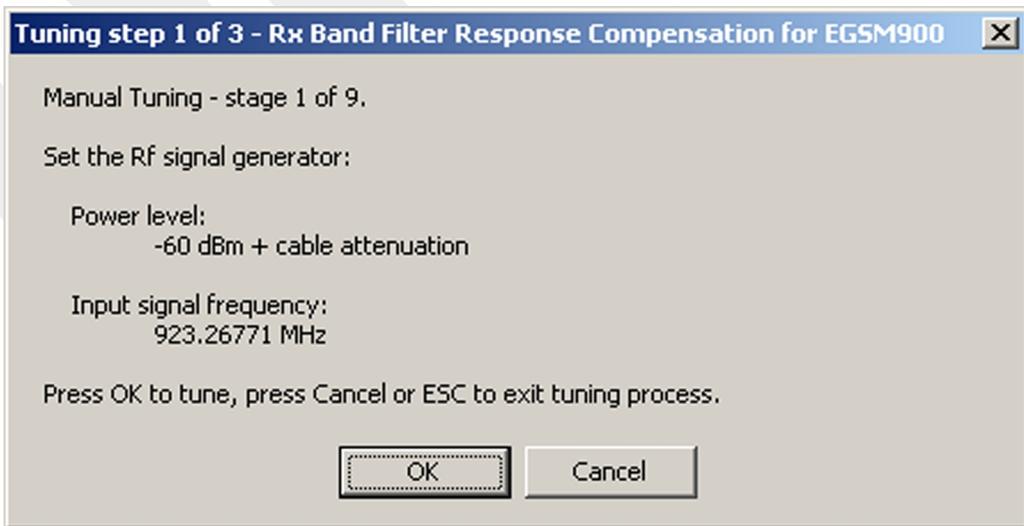
9. To perform tuning, click **OK**.

10. Go through all 9 frequencies. The following table will be shown:
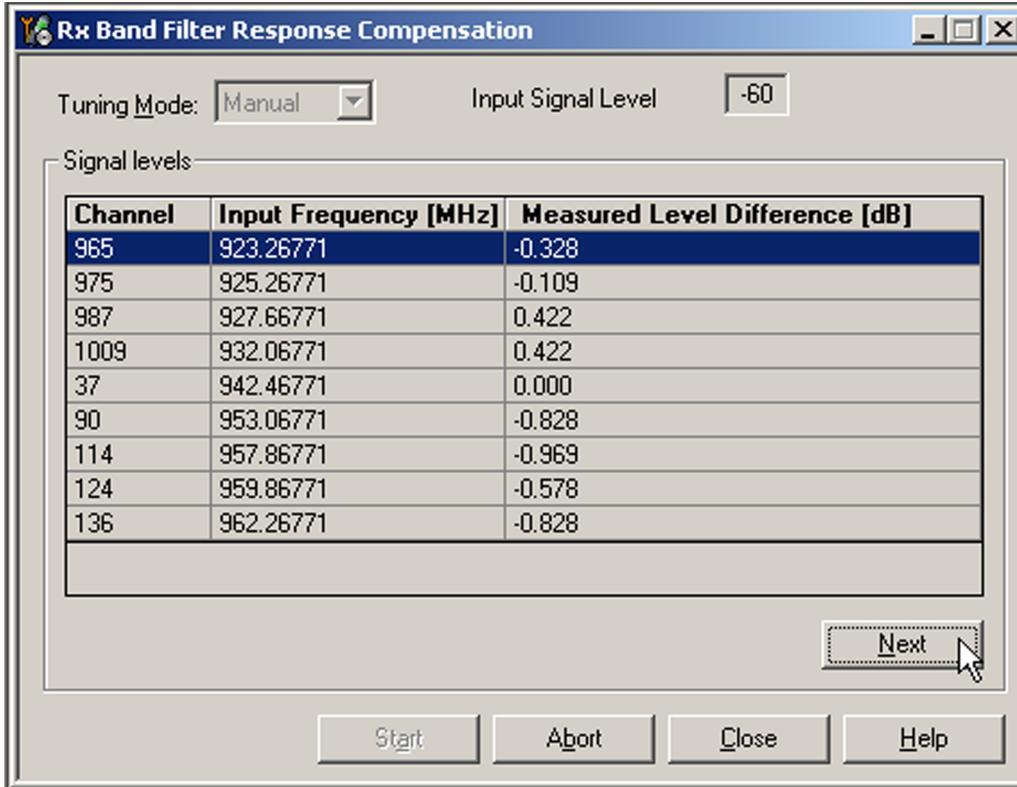
11. Check that the tuning values are within the limits specified in the following table:

	Min	Typ	Max	Unit
GSM850				
Ch. 118/867.26771 MHz	-6	-1	2	dB
Ch. 128/869.26771 MHz	-3	0	2	dB
Ch. 140/871.66771 MHz	-3	0	2	dB
Ch. 172/878.06771 MHz	-2	0	2	dB
Ch. 190/881.66771 MHz	-2	0	2	dB
Ch. 217 / 887.06771 MHz	-2	0	2	dB
Ch. 241/891.86771 MHz	-3	0	2	dB
Ch. 251/893.86771 MHz	-3	0	2	dB
Ch. 261/895.86771 MHz	-6	-1	-2	dB
GSM900				
Ch. 965 / 923.26771 MHz	-6	-1	2	dB
Ch. 975 / 925.26771 MHz	-3	0	2	dB
Ch. 987 / 927.66771 MHz	-3	0	2	dB
Ch. 1009 / 932.06771 MHz	-2	0	2	dB

	Min	Typ	Max	Unit
Ch. 37 / 942.46771 MHz	-2	0	2	dB
Ch. 90 / 953.06771 MHz	-2	0	2	dB
Ch. 114 / 957.86771 MHz	-3	0	2	dB
Ch. 124 / 959.86771 MHz	-3	0	2	dB
Ch. 136 / 962.26771 MHz	-6	-1	2	dB
GSM1800				
Ch. 497 / 1802.26771 MHz	-6	-1	3	dB
Ch. 512 / 1805.26771 MHz	-3	0	3	dB
Ch. 535 / 1809.86771 MHz	-3	0	3	dB
Ch. 606 / 1824.06771 MHz	-3	0	3	dB
Ch. 700 / 1842.86771 MHz	-3	0	3	dB
Ch. 791 / 1861.06771 MHz	-3	0	3	dB
Ch. 870 / 1876.86771 MHz	-3	0	3	dB
Ch. 885 / 1879.86771 MHz	-3	0	3	dB
Ch. 908 / 1884.46771 MHz	-6	-1	3	dB
GSM1900				
Ch. 496 / 1927.06771 MHz	-6	-1	2	dB
Ch. 512 / 1930.26771 MHz	-3	0	2	dB
Ch. 537 / 1935.26771 MHz	-3	0	2	dB
Ch. 586 / 1945.06771 MHz	-3	0	2	dB
Ch. 661 / 1960.06771 MHz	-3	0	2	dB
Ch. 736 / 1975.06771 MHz	-3	0	2	dB
Ch. 794 / 1986.66771 MHz	-3	0	2	dB
Ch. 810 / 1989.86771 MHz	-3	0	2	dB
Ch. 835 / 1994.86771 MHz	-6	-1	2	dB

12. If the values are within the limits, click **Next** to continue to the next band.

Next actions

Repeat the steps 8 to 12 for GSM1800 and GSM1900.

■ **GSM transmitter tunings**

Tx IQ tuning (GSM)

Context

The Tx path branches to I and Q signals at RF I/Q modulator. Modulator and analog hardware located after it cause unequal amplitude and phase disturbance to I and Q signal paths. Tx IQ tuning balances the I and Q branches.

Tx IQ tuning must be performed for all GSM bands.

Steps

1. Start *Phoenix* service software.

2. From the **Operating mode** drop-down menu, set mode to **Local**.

3. Choose **Tuning→GSM→Tx IQ Tuning** .

4. Select **Mode: Automatic**.
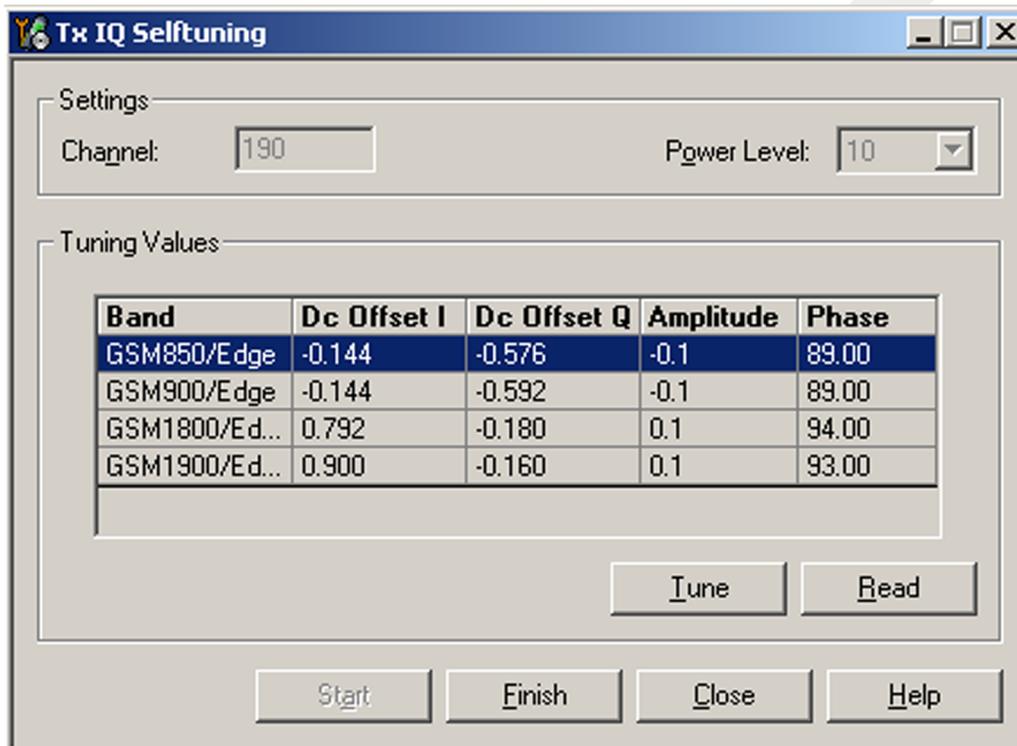
5. Select **Band: GSM900** and click **Start**.

6. Click **Next** to start GSM1800 band TX IQ tuning.

7. Click **Next** to start GSM1900 band TX IQ tuning.

8. Click**Finish** and then **Close**.

Next actions

Tuning sliders should be close to the center of the scale after the tuning and within the limits specified in the following table. If they are not within the limits, check Tx IQ quality manually.

	Min	Typ	Max	Unit
GSM850				
I DC offset / Q DC offset	-6	-4	6	%
Ampl	-1	0	1	dB
Phase	85	90	95	°
GSM900				

	Min	Typ	Max	Unit
I DC offset / Q DC offset	-6	-4	6	%
Ampl	-1	0	1	dB
Phase	85	90	95	°
GSM1800/GSM1900				
I/Q DC	-6	0.5	6	%
Ampl	-1	0	1	dB
Phase	95	100	110	°

Tx power level tuning (GSM)

Context

Because of variations at the IC (Integrated Circuit) process and discrete component values, the actual transmitter RF gain of each phone is different. Tx power level tuning is used to find out mapping factors called 'power coefficients'. These adjust the GSM transmitter output power to fulfill the specifications.

For EDGE transmission, the bias settings of the GSM PA are adjusted in order to improve linearity. This affects the PA gain and hence the power levels have to be aligned separately for EDGE transmission.

Tx power level tuning has to be performed on all GSM bands.

Steps

1. Connect the phone to a spectrum analyzer.

2. Start *Phoenix* service software.

3. From the **Operating mode** drop-down menu, set mode to **Local**.

4. Choose **Tuning→GSM→Tx Power Level Tuning** .

5. Click **Start**.l
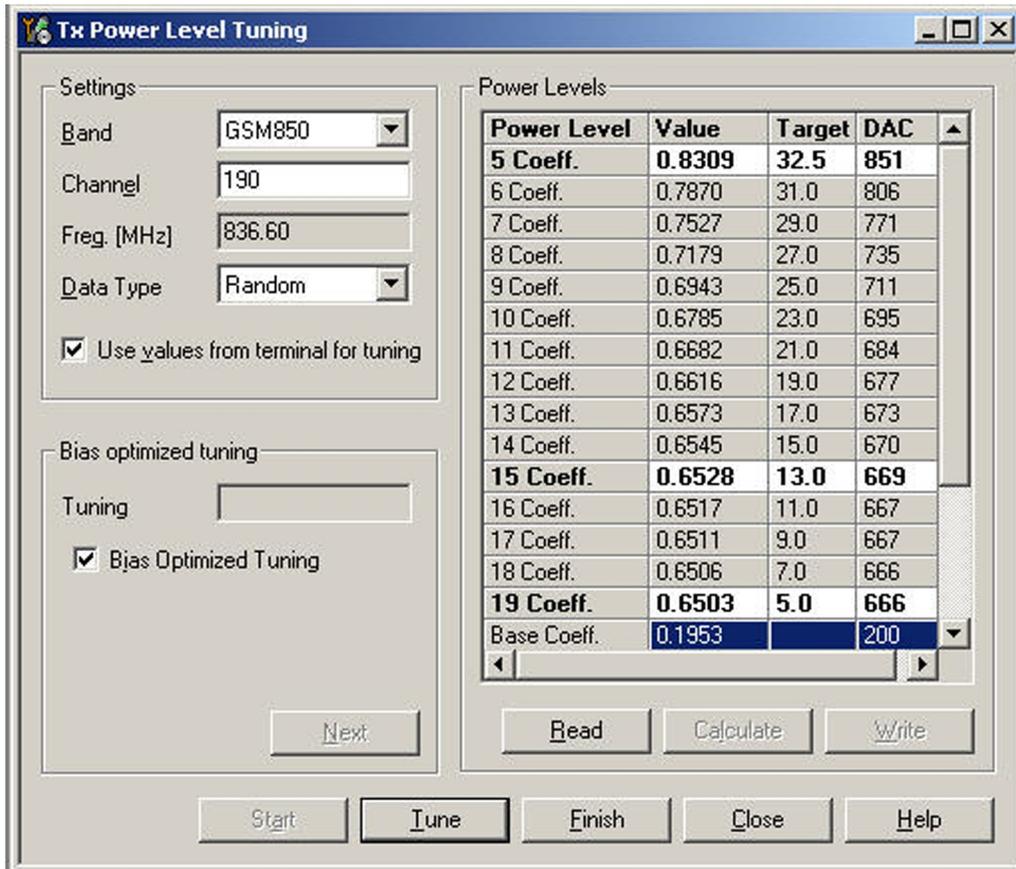
6. Set the spectrum analyzer for power level tuning:

Frequency	Channel frequency:
	• **836.6 MHz GSM850**
	• **897.4MHz GSM900**
	• **1747.8MHz GSM1800**
	• **1880MHz GSM1900**
Span	0 Hz
Sweep time	2ms
Trigger	Video triggering (-10dBm)
Resolution BW	3MHz
Video BW	3MHz
Reference level offset	sum cable attenuation with module jig attenuation
Reference level	33dBm

A power meter with a peak power detector can be also used. Remember to take the attenuations into account.

7. Adjust power for all bold power levels to correspond the **Target dBm** column by pressing **+** or **−** keys.

8. If all bold power levels are adjusted, click **Next** to continue with **GSM850 EDGE**.

9. Adjust power for all bold power levels to correspond the **Target dBm** column by pressing **+** or **–** keys.

Next actions

Continue tuning the bold power levels of the GSM900, GSM1800 and GSM1900 bands. You will see this message, if finished successfully:
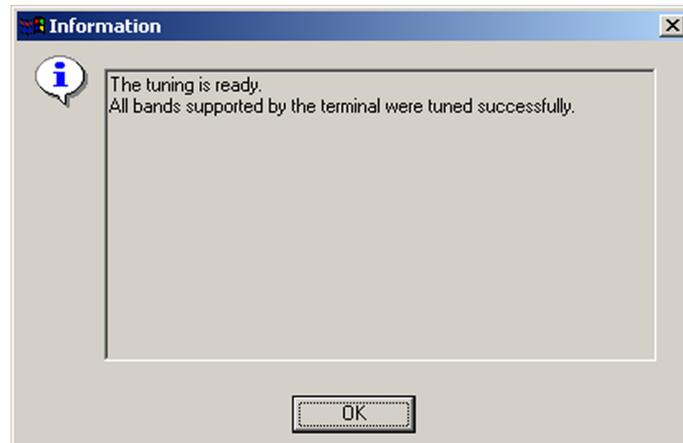
■ WCDMA receiver tunings

RX calibration (WCDMA)

Context

Rx calibration tuning routine calculates the real gain values of the WCDMA Rx AGC system. There is also a SAW filter between front end LNA and mixer in the receive chain, which causes ripple in the RSSI measurement, this is calibrated out. The SAW filter is intergated into RF ASIC N7500.

Rx calibration can be done in two different ways, manual tune and sweep mode tune. If the signal generator in use supports frequency sweep table, the calibration is done in one step.

Steps

1. For manual tuning, set mode to **Local** in the **Operating Mode** dropdown menu.

2. In the **Tuning** menu, choose **WCDMA→Rx Calibration** .

3. Click **Start**.

4. Select Band "WCDMA2100 or WCDMA900".

5. Click **Tune**.

6. Setup the signal generator to correspond with the values on the, *Rx Calibration* pop-up window and click **OK**.
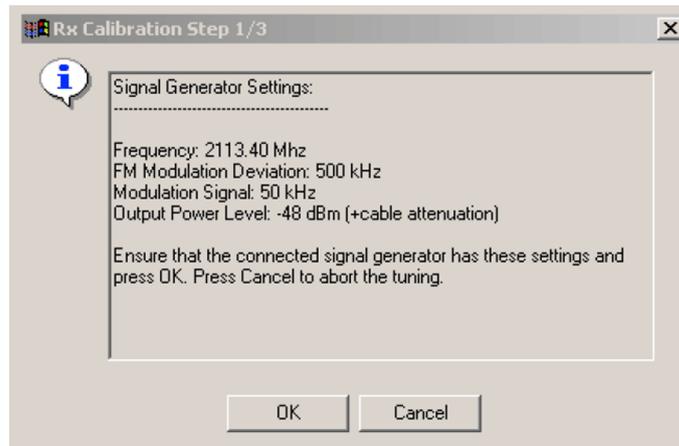
Figure 31 Pop-up window for WCDMA2100

7. Repeat step 6. for Middle and High channels.
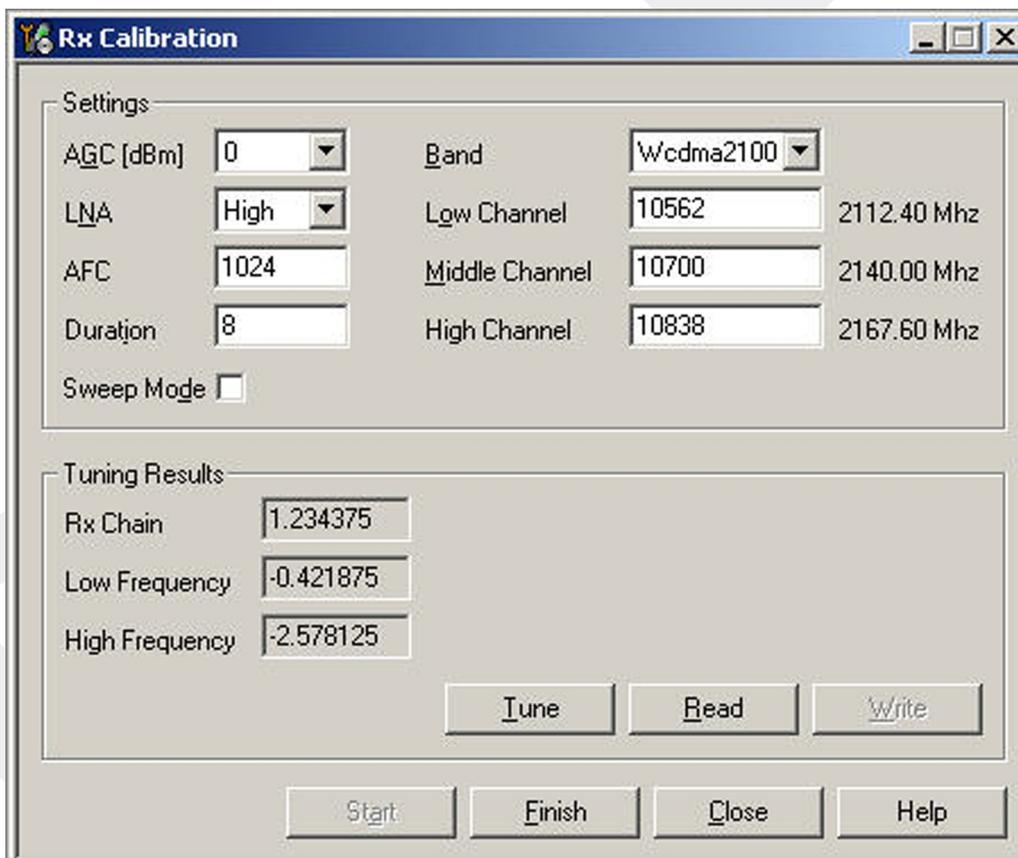
8. Ensure Tuning Results are within limits specified in the table below:

If values are OK, click **Write** to save the values.

NOKIA
Care

	Band	Min	Typ	Max	Unit
Rx chain	2100 or 900	-6	1.5 to 3.5	6	dB
Low Frequency		-5	-0.7 to 4.0	5	
High Frequency		-5	-0.7 to 4.0	5	

Alternative steps

- For sweep mode tuning, set **Mode** to **Local** in the **Operating Mode** dropdown menu.

- In the **Tuning** menu, choose **WCDMA→ Rx Calibration** .

- Click **Start**.

- Select **Band**, "WCDMA2100 or WCDMA900".

- Check the **Sweep Mode** box.

- Click **Tune**.

- Setup the signal generator to correspond with the values on the *Rx Calibration* pop-up window and click **OK**.
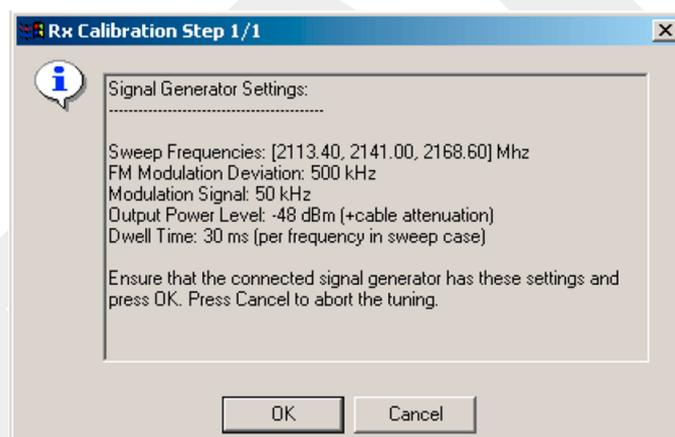
Figure 32 Pop-up window for WCDMA2100

- Ensure Tuning Results are within limits specified in the table above: If values are OK, click **Write** to save the values to the phone.

- Close the tuning window.

■ WCDMA transmitter tunings

Tx AGC & power detector (WCDMA)

Context

Tx AGC & power detector tuning has two purposes:

- to enable the phone to select the correct TxC value accurately in order to produce the required RF level

- to enable the phone to measure its own transmitter power accurately

There are two ways to perform the tuning. For an alternative method, see .

Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.

2. Choose **Tuning→WCDMA→Tx AGC & Power Detector.**

3. Click **Start**.

4. In the *Wide Range* pane, click **Tune** (the leftmost **Tune** button).

5. Set up the spectrum analyzer in the following way:
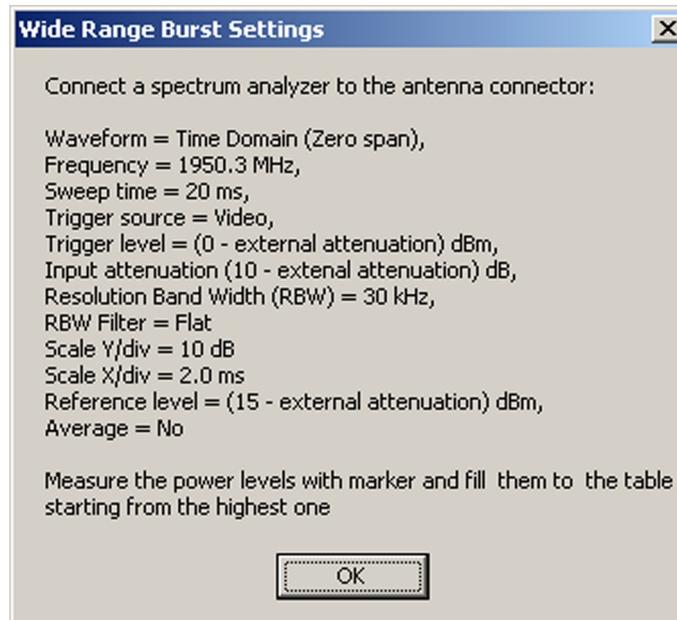
6. After setting the spectrum analyzer, click **OK**.

7. Measure the power levels with a marker.

   Take the first measurement from 250 us after the trigger, the second after 750 us, the third after 1250 us and so on for every 500 us until the table is filled.

   Note: It must be possible to measure power levels down to –68 dBm. The measured power levels must be monotonously decreasing.

   Make sure that the marker is not measuring the level of noise spikes on lower levels.
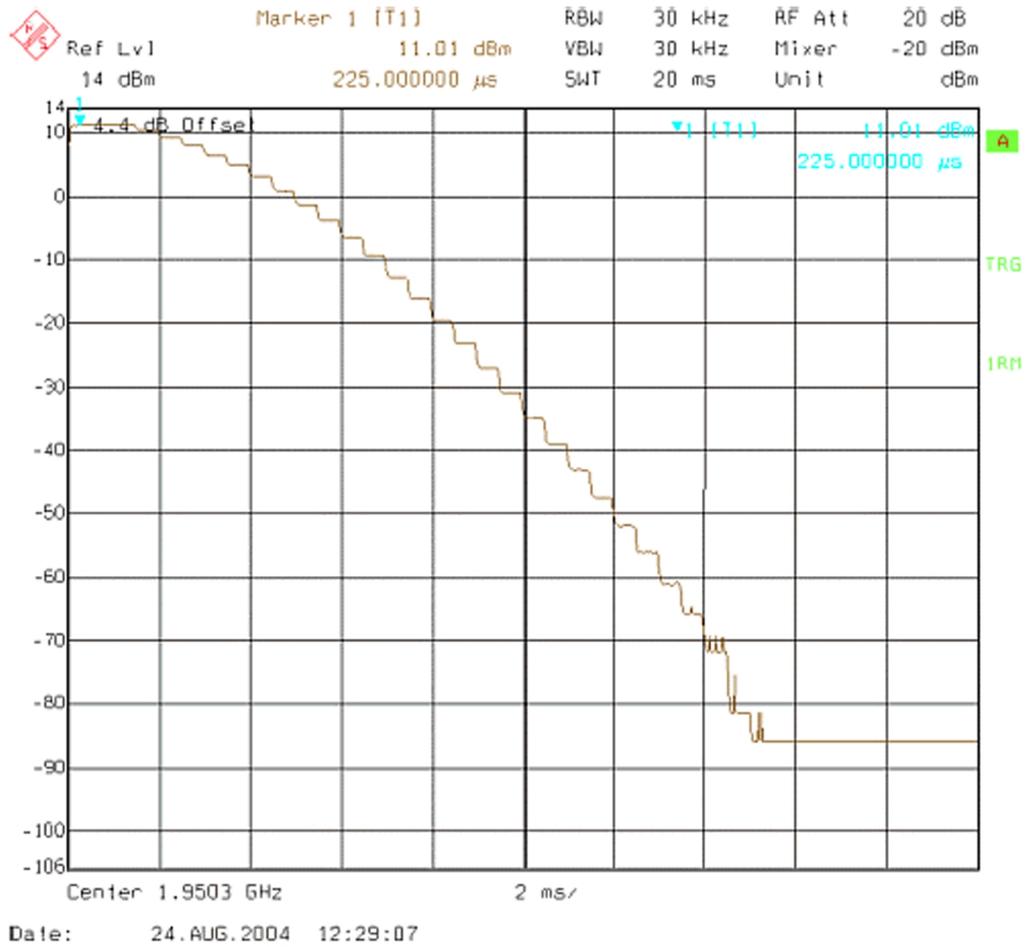
Figure 33 WCDMA power level tuning steps

8. Fill in the power level values (in dBm) to the *Wide Range* table.
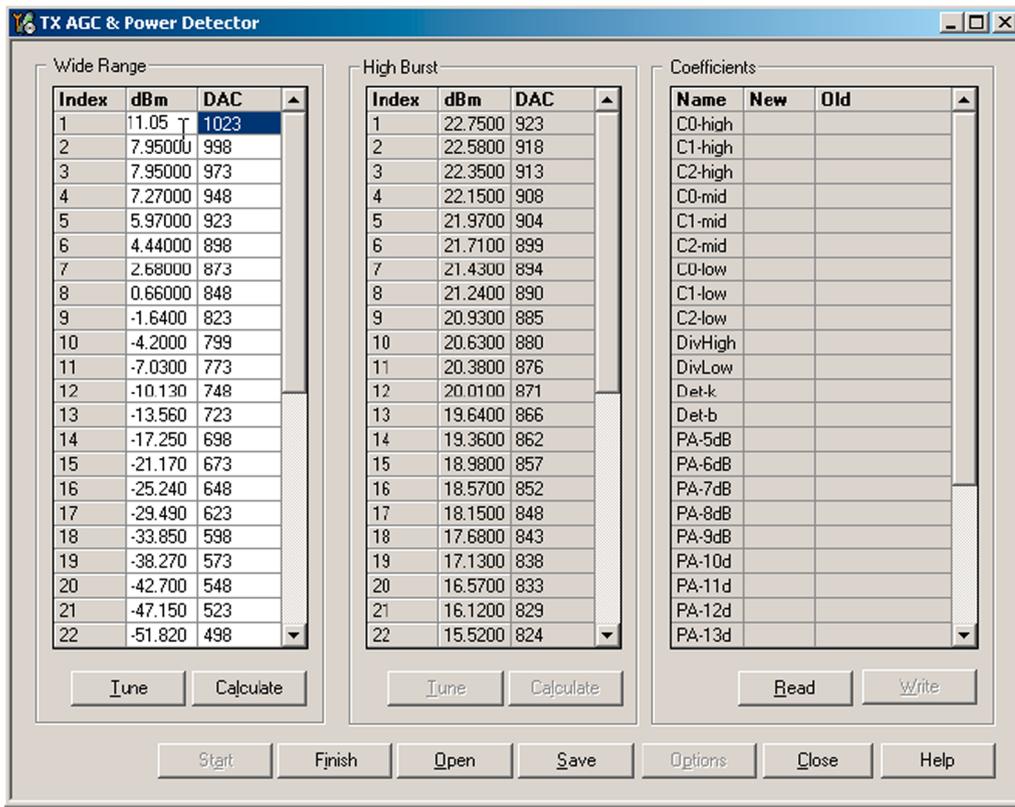
9. In the *Wide Range* pane, click **Calculate**.
10. In the *High Burst* pane, click **Tune**.
11. Adjust the spectrum analyzer according to the following settings:
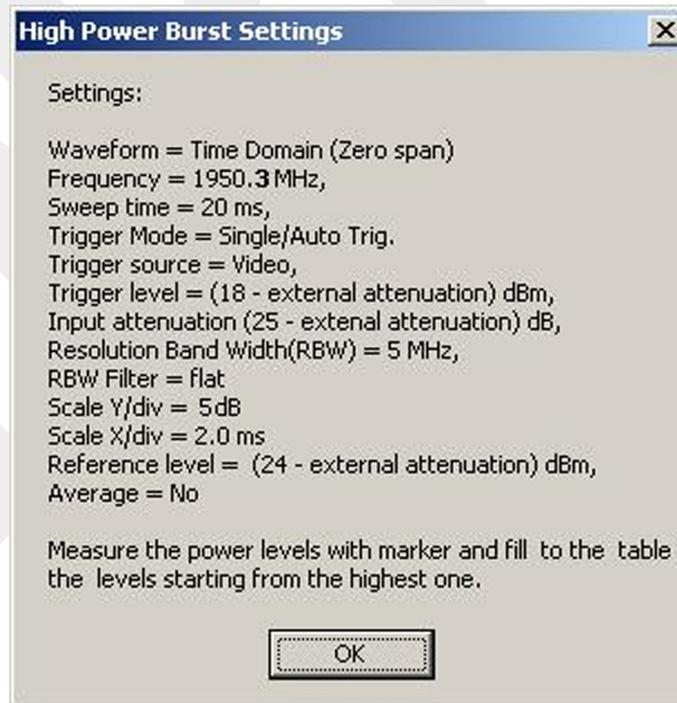
12. Measure the power levels with a marker.

Take the first measurement from 250 us after the trigger, the second after 750 us, the third after 1220 us and so on for every 500 us until the table is filled.
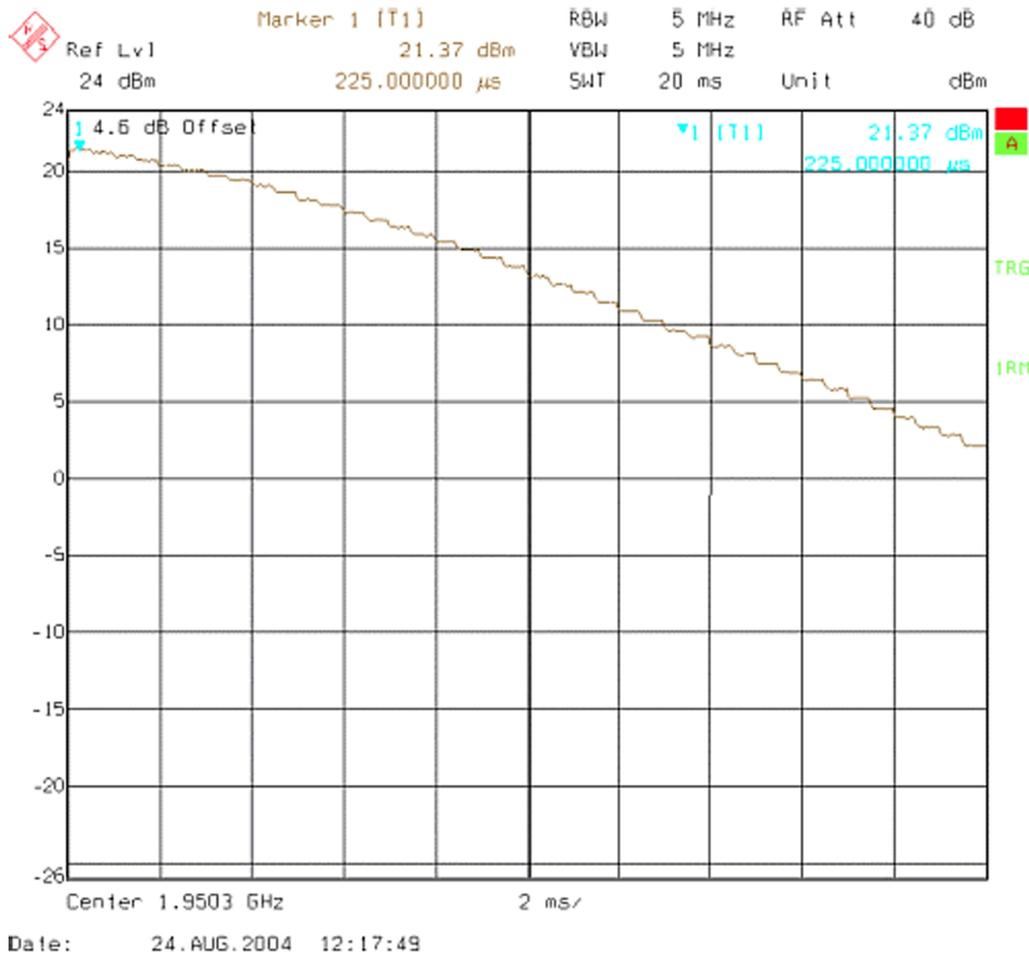
Figure 34 High burst measurement

13. In the *High Burst* pane, click **Calculate**.

14. Check that the calculated values are within the limits specified in the following table:

	Min	**Max**
C0-high	-0.5	5
C1-high	-50	50
C2-high	400	900
C0-mid	-0.7	0.7
C1-mid	0	50
C2-mid	400	900
C0-low	-4	4
C1-low	-400	440
C2-low	-10000	15000

	Min	Max
Det-k	100	220
Det-b	0	150

15. To save the coefficients to the phone, click **Write**.

16. To close the *Tx AGC & Power Detector* window, click **Close**.

17. Choose **Testing→WCDMA→ Tx Control.**

18. Select the *Algorithm* mode tab.
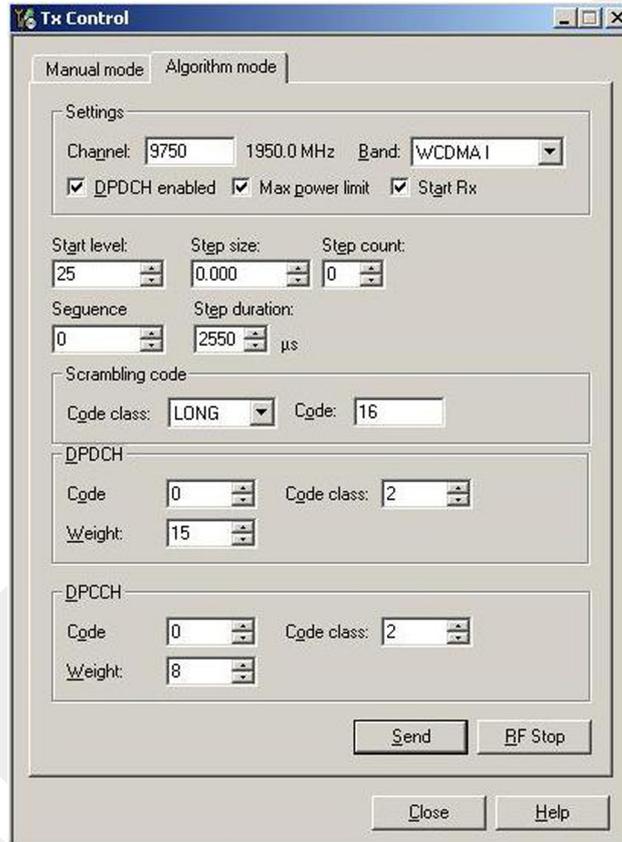
19. Write the target power level 25 dBm to the *Start level* line and check the **Max power limit** check box (detector calibration check).

20. Setup the spectrum analyzer with the following settings:

Center frequency:	**1950MHz (WCDMA I)** or **897.4MHz (WCDMA VIII)**
Span:	0 Hz
Reference level offset:	Cable attenuations + adapter attenuation
Reference level:	**24 dBm or -20 dBm depending on the level measured**
Input attenuation:	Automatic
Resolution bandwidth:	5 MHz
Video bandwidth:	5 MHz
Sweep time:	20 ms

Detector:	**RMS detector**
Average:	No
Trigger:	Free run

21. Click **Send**.

22. Measure the WCDMA output power.

    It should be around 23 dBm.

23. Click **RF Stop** and uncheck the **Max power limit** check box.

24. Repeat steps **19** to **23** for levels +19, +7, 0, -20 and –40 dBm.

    The measured output power may not differ more than +-2 dB from the requested value at level +19 dBm and no more than +-4 dB on lower levels.

    Remember to stop the RF before sending new data.

Alternative steps

- Measure the wide range levels normally and write down the levels that are possible to measure.
- Click **Finish**.
- Click **Options**.
- Change the first wide range DAC value to 573 and change the number of tuning steps to 21.
- Change the spectrum analyzer reference level to –20 dBm and adjust the input attenuator to the lowest value possible.
- In the *Wide Range* pane, click **Tune** and fill in the rest of values starting from the 19th level.

Tx band response calibration (WCDMA)

Context

The purpose of this tuning operation is to calibrate the WCDMA Tx performance. It defines the power detector and Tx frequency compensation values. However, before starting this tuning procedure, it is necessary to carry out Tx AGC & Power Detector Calibration tuning. This is because its results will be needed for this tuning operation.

- In the *Tuning Settings* pane, it is possible to edit the numbers of channels used in this tuning operation.
- If the **Calibrate Detector Response** check box is checked, only Tx response is calibrated. Zero is written to the power detector compensation values block in the permanent memory (PM) of the terminal.
- **Detector Calibration level** shows the power level used for calibrating the power detector in this tuning procedure.
- **Tx Calibration level** shows the power level used for calibrating tx frequency in this tuning procedure.
- In the *Measured Power Levels* pane, you can insert the dBm values read from the power meter.
- In the *Tuned Values* pane, the values that are stored in the permanent memory (PM) of the terminal in Current columns are shown.
- New values are added to *New* column when the **Calculate** button is clicked.
- The **Abort** button aborts the tuning operation without saving the tuned values.
- The **Read** button reads the tuned values in the PM of the terminal, and displays them in the *Tuned Values* pane in in the *Current* column.

Steps

1. Start *Phoenix* service software.

2. Choose **File→Scan Product** .

3. From the **Operating mode** drop-down menu, set mode to **Local.**

4. Choose **Tuning→WCDMA→Tx Band Response Calibration** .

5. Click **Start**.
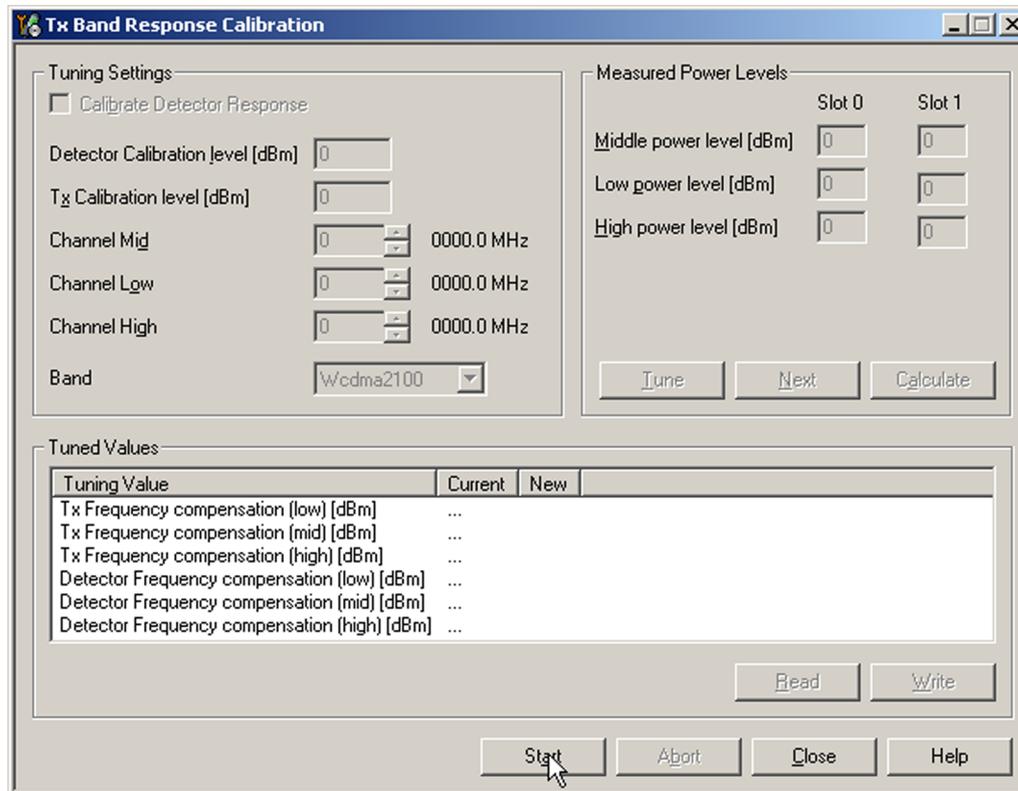
The current values are shown in the *Tuned Values* pane.

6. Click **Tune**.

7. Connect the power meter to the terminal, and set it to **Channel Mid** frequency.

8. Read the values of slot 0 and slot 1 from the power meter and enter them to **Middle power level** fields in the **Measured Power Levels** pane.

    Slot 0 is used for detector calibration and slot 1 for Tx calibration.

9. Click **Next**.

10. Switch the power meter to **Channel Low** frequency.

11. Read the values from the power meter, and enter them to **Low power level** fields.

12. Switch the power meter to **Channel High** frequency.

13. Read the values from the power meter, and enter them to **High power level** fields.

14. Click **Next**.

15. Click **Calculate**.

    The tuned values are shown in the *Tuned Values* pane in the *New* column.

16. Check that the tuned values are within the limits presented in the following table. If they are OK, click **Yes**.

	Min	Max
Tx Freq Comp (the first and last value)	-4	+4

17. To save the tuned values to the terminal, click **Write**.

18. Close the *Tx Band Response Calibration* window.

Tx LO leakage (WCDMA)

Context

The purpose of Tx LO leakage tuning is to minimize the carrier leakage of the IQ-modulator which is caused by the DC offset voltages in the Tx IQ-signal lines and in the actual IQ modulator.

The tuning improves WCDMA Tx AGC dynamics at low power levels. A self-calibration routine selects the best combination for internal control words in order to produce minimum LO leakage.

Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.

2. Choose **Tuning→WCDMA→ Tx LO Leakage** .

3. Click **Tune**.
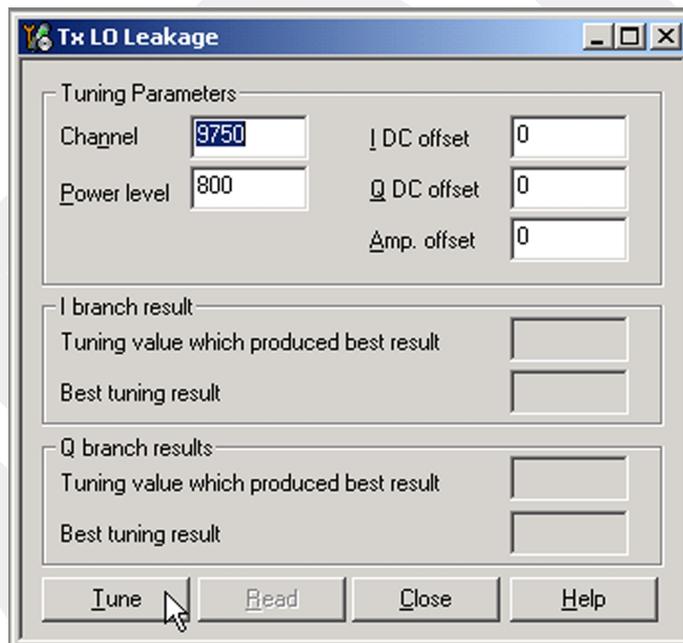
4. To end the tuning, click **Close**.

■ Checking antenna functionality

Antenna overview

1. Cellular antenna

Figure 35 Cellular antenna

1.1. Cellular antenna description

• The phone has one main Cellular antenna covering all GSM and WCDMA bands

• The antenna is located at the bottom of the product in the keypad area

• The antenna comprises a plastic antenna carrier and a flexi circuit foil. The antenna has 2 connections, one is the feed to the antenna the other is a ground connection for a parasitic element

1.2. Cellular antenna fault finding

• The antenna can be checked using the RF test coupler provided. The measurement should be compared to a known working phone. Make the comparison at the GSM1800 band (any freq point will do).

• Please refer to the section on testing using a coupling jig below for more detailed information on good testing techniques

2. Recommendations for using an RF coupler

All coupler measurements should be done as a relative measurement (i.e. compared with a known working phone). An RF coupler is a radiated measurement; as such objects near the measurement can change the results.

Anything metallic or lossy will alter the results if placed nearby including the following;

• Hands

• Antistatic mats

• Antistatic bags

• Metal including tools and table legs etc.

You need to put the test jig on something like a bench or an antistatic mat. This does not matter as long as the jig is kept in the same place as when the reference measurement was done.

To perform a series of measurements do a reference measurement on a known working phone and note down the coupling loss. Then do measurements on the phones under test and compare it to the reference phone. Repeat the reference meas every time you move the jig or if you start to see drift in the results.

The antenna under test should be within 3dB of the reference antenna using the method described above. If it is not repeat the reference measurement to check, then check the RF output power.

3. Non cellular antennas

Figure 36 Non cellular antennas and contact areas

3.1. Non cellular antenna description

• The phone has a pair of non cellular antennas mounted in the C cover of the device under a label.

• At the top of the phone near the power on/off key is a combined GPS/BT/WLAN antenna. This antenna has 1 feed pogo pin and 1 grounded pogo pin.

• Over most of the rest of the C cover there is an FMTx antenna which again has 1 connection pogo pin and 1 grounded pogo pin.

3.2. Non cellular antenna fault finding

• The NCW antennas are in the C cover. This should be inspected visually. Especially check the contact areas (shown in the figure above) for dirt. Some denting of the contacts areas is expected and should not cause a problem.

• Please refer to the RF section for fault finding information for the GPS, WLAN and BT systems.

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5 — Camera troubleshooting

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Table of Contents

List of Figures

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■ Camera subsystem

Introduction

The camera subsystem contains the complete imaging system for the main 3.2 megapixel AF camera.

Key components

• DM299 processor

Controls the 3.2 Mpixel AF main camera (Image capture & Image Quality enhancements)

> **Note:** There is no non-volatile memory (Flash or ROM) for the DM299. Initialisation code is passed from the RapidoYawe at powerup via the SPI interface. Further application code (self-test, image capture, video capture) is transferred depending on the usage case.

Video and still image data is passed to the Rapido for display & storage after processing over a CCP bus (CCP_CMT).

• 64Mbit SDRAM

Connected to DM299 for buffering captured image data & code storage.

• Flash LED

Camera flash LED controlled from the DM299 via the TPS61052 TI driver. Driver has GPIO control for STROBE and I2C bus control for configuring.

• 3.2 Mpixel Camera module.

The camera module is configured by the DM299 using I2C control bus. Includes an EEPROM with calibration values. Image data is transferred to the DM299 over a CCP balanced bus (HIRES_CCP).

Powering

The camera subsystem is powered with discrete regulators (1V3, 1V8, 2V8 and 3V0). 1V3 is created by LP5952 LDO power supply, Vin is connected to 1V8 output. 1V8 is created by LM3677 SMPS power supply, Vin is connected to VBAT. 2V8 and 3V0 are created by LP3985 LDO regulators, both with Vin connected to VBAT. These supplies are turned off when the camera is not used with single GPIO controlled by Rapido host. The LED driver (TPS61052) is supplied by the battery voltage Vbat.
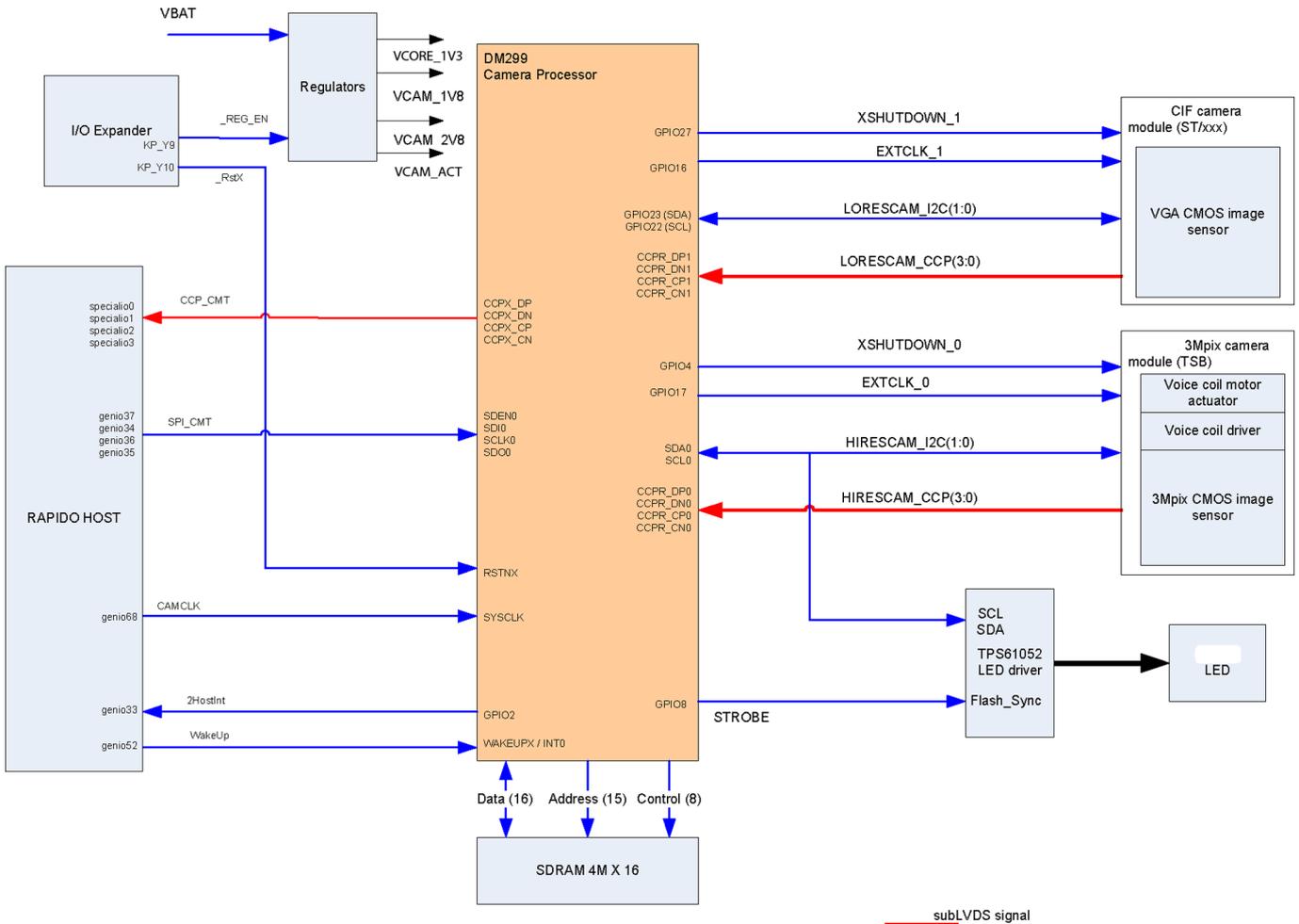
Figure 37 Camera block diagram

Camera layout and basic test points

The key components in the layout picture are accelerator (N1400), SDRAM (D1401), power supplies (N1402, N1403, N1404), 3M camera (X1450), secondary camera (N1450) and flash LED driver (N1451).
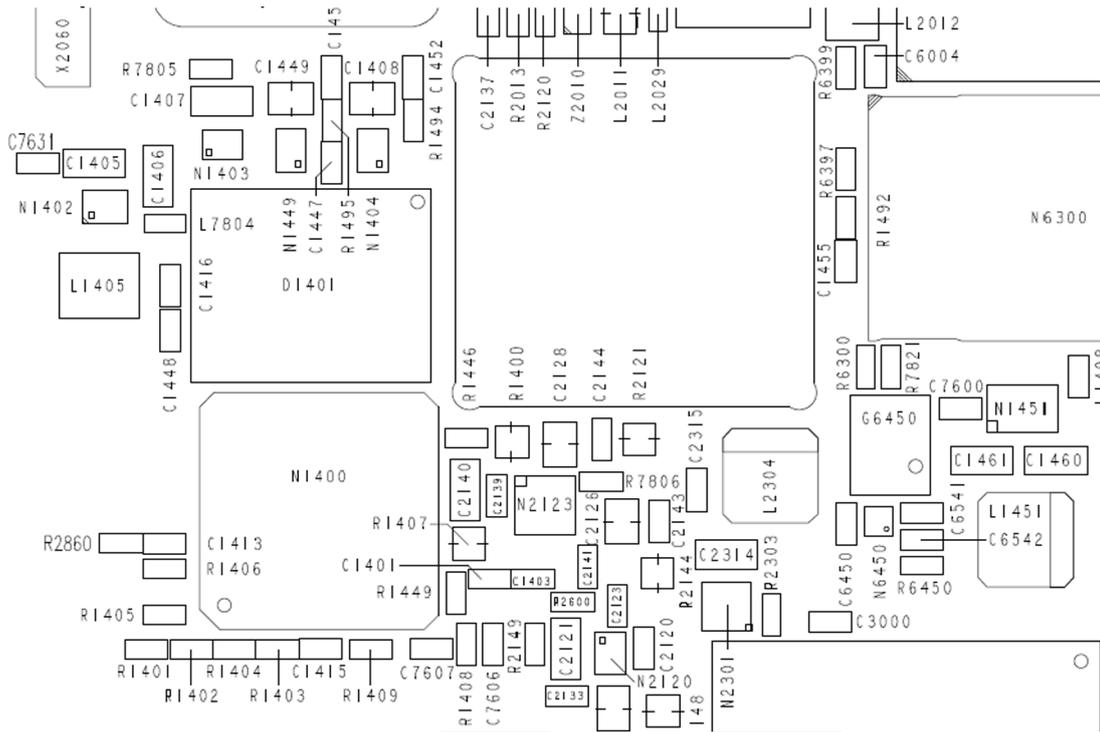
Figure 38 Camera layout

■ Camera tests for Phoenix

Context

Note: R&D Phoenix screenshots in this section must be replaced in PD Phase with Care Phoenix screenshots.

Steps

1. Selftests can be executed from Phoenix test software. Connect product to Phoenix, and select Testing -> Self Tests from menu.
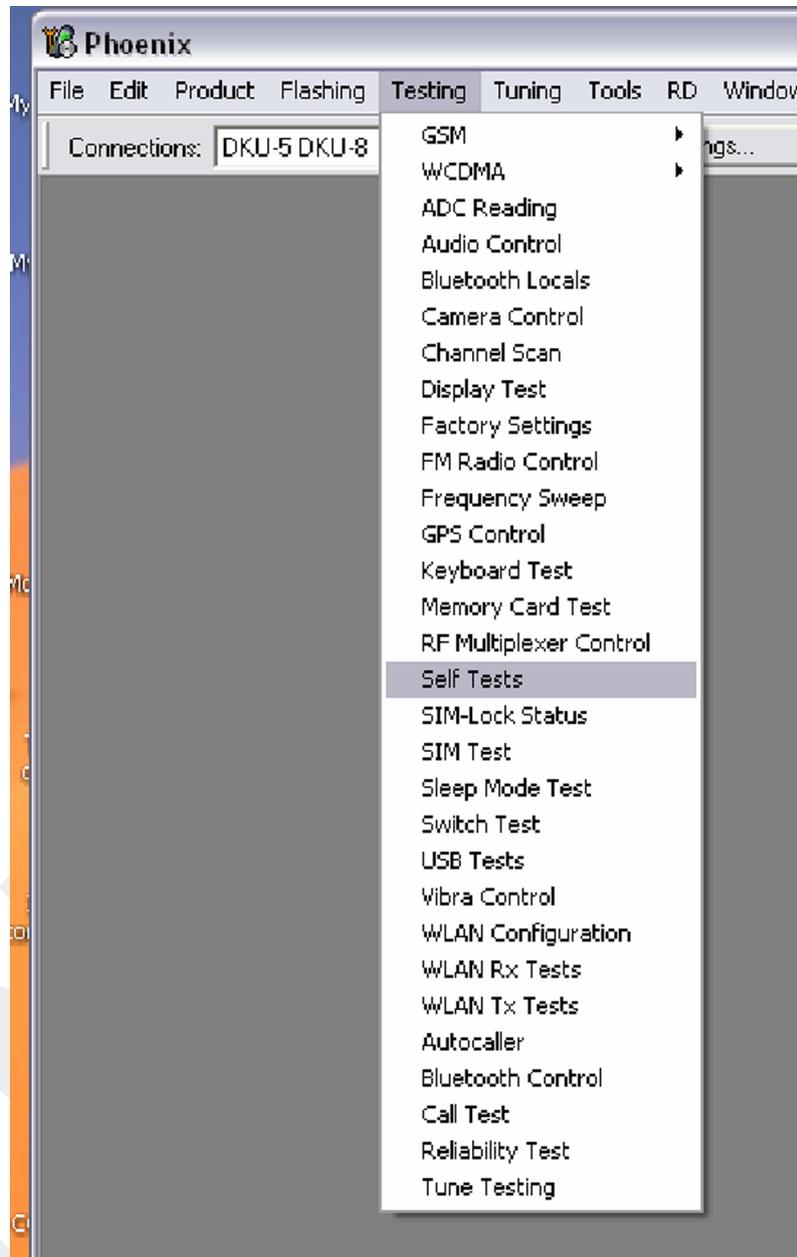
2. Following selection of tests will open (this will depend on product what will be visible).

■ Camera basic check troubleshooting

Troubleshooting flow
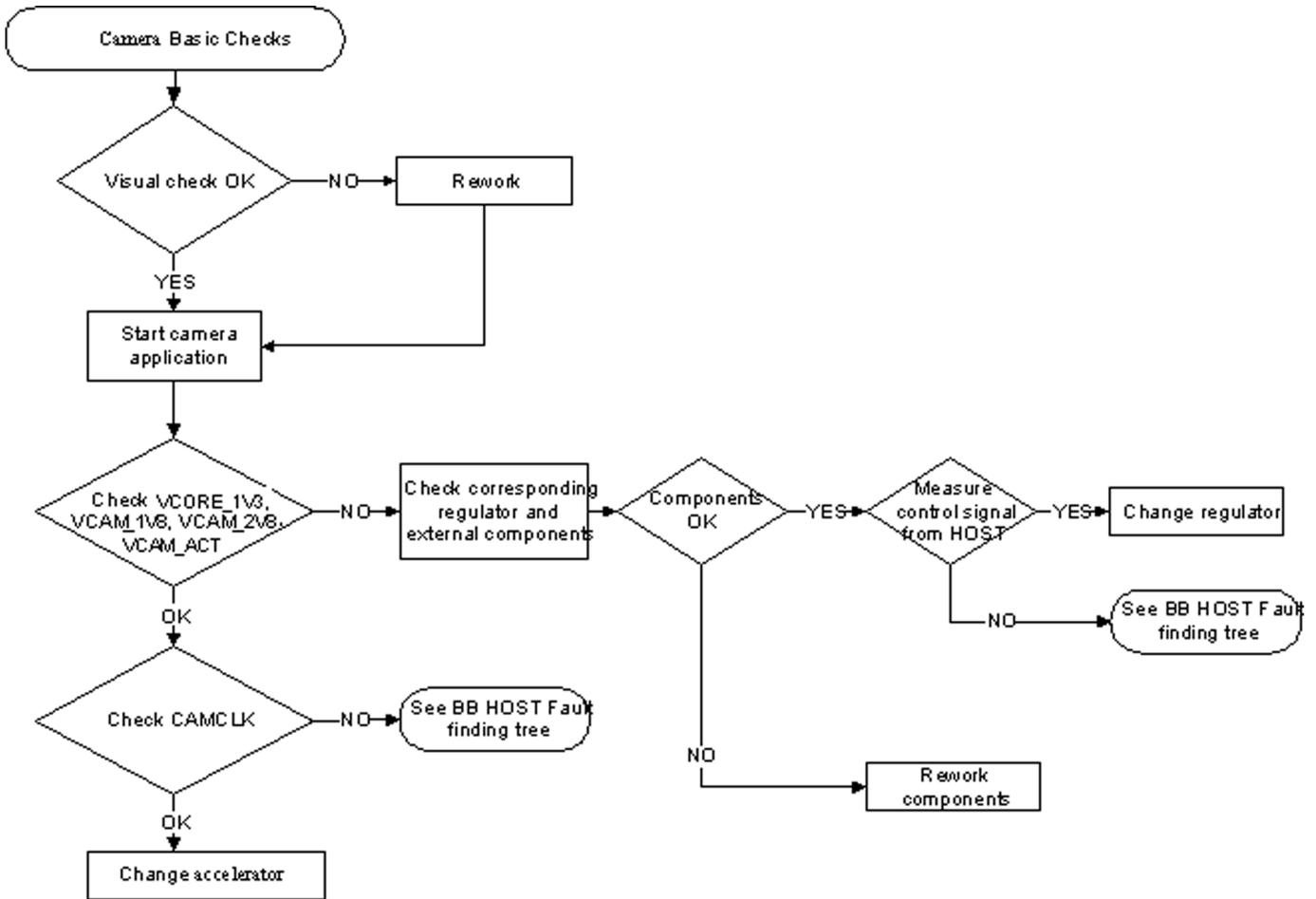
■ Camera failure troubleshooting

Troubleshooting flow
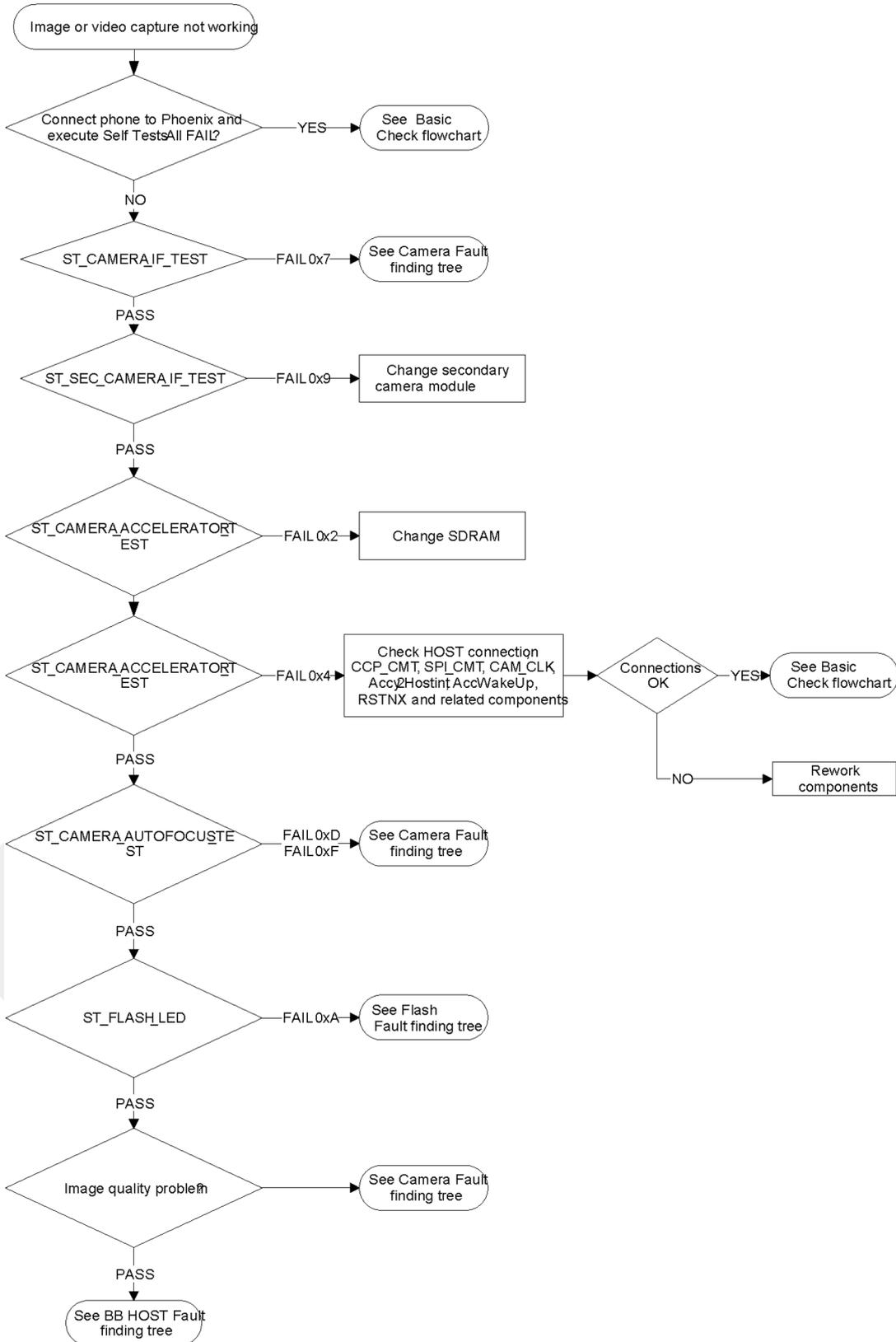
■ Flash troubleshooting

Context

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

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Troubleshooting flow
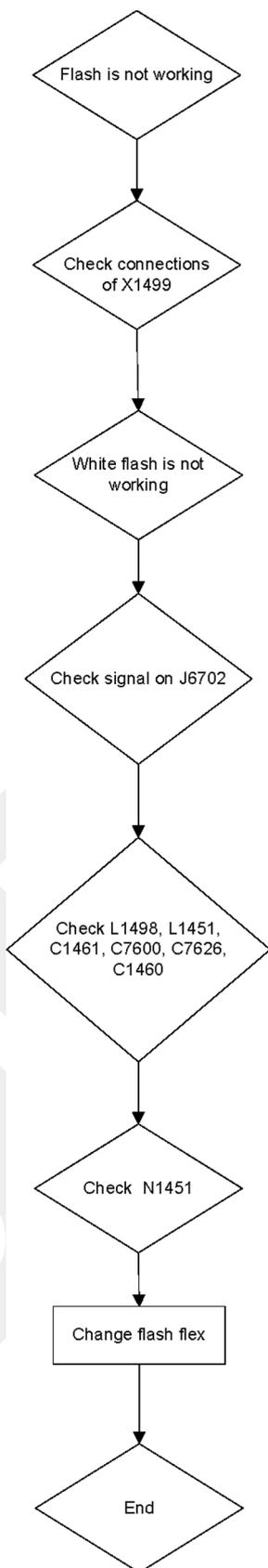
```
        ◇ Flash is not working ◇
                 │
                 ▼
        ◇ Check connections
           of X1499 ◇
                 │
                 ▼
        ◇ White flash is not        White flash can be tested by taking an
           working ◇                image when camera is covered i.e. by
                 │                  hand. Make sure that flash-off is not
                 ▼                  selected from UI.
        ◇ Check signal on J6702 ◇
                 │
                 ▼
        ◇ Check L1498, L1451,
           C1461, C7600, C7626,
           C1460 ◇
                 │
                 ▼
        ◇ Check  N1451 ◇
                 │
                 ▼
        │ Change flash flex │
                 │
                 ▼
        ◇ End ◇
```

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6 — FMTx 2.0 technical description

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■ **Glossary**

AF	Audio Frequency
RF	Radio Frequency
FM	Frequency Modulation
Tx	Transmitter
Rx	Receiver
FMTx	FM Transmitter
LPD	Low Power Device
LNA	Low Noise Amplifier
LDO	Low Drop Out regulator
RSSI	Received Signal Strength Indicator (same as RPS)
RPS	Received Power Scan (Same as RSSI)
QFN	Quad Flat No-Lead

■ **FMTx2.0 HW block**

The FMTx 2.0 implementation is based on the Silicon Laboratories Si4713 low power FM transmitter device. This device has some state of the art features which have been utilised in the Nokia implementation. Apart from having excellent RF transmitter performance and exceptional AF performance the device offers a number of unique features, including the ability to retune the output stage of the device to ensure optimal matching between the Tx antenna and the output stage of the device.

Functional description

The FMTx 2.x solution comprises of the Si4713 device and ten external components. These components consist of:

- A filter - an inductor and a varistor for filtering of emissions from the chip
- ESD protection - a resistor and diode package
- A dual capacitor package which is connected to the analogue audio input pins LIN & RIN. The fundamental purpose of these capacitors is as DC blocking caps
- A filter on the reset line comprising a capacitor and a resistor
- An antenna which also provides the inductive load required by the Si4713 device

The Si4713 device is in a 3 x 3mm 20 pin QFN package.

Current implementations make use of the DAC33 device which allows data to be digitally clocked into the DAC at high data rates, buffered and then streamed out at the correct rate while the rest of the baseband is put to sleep in order to save power. This solution significantly increases playback time of audio content.

The Si4713 device has the following features:

- 88.1MHz – 107.9MHz FM band support.
- Programmable pre-emphasis (50/75us).
- Analogue audio interface
- Audio silence/signal present detection.

- Programmable reference clock.
- RDS/RBDS encoder
- Loop and monopole antenna support with self-calibrated capacitor tuning.
- Programmable transmit level.
- Audio dynamic range control.

System block diagram
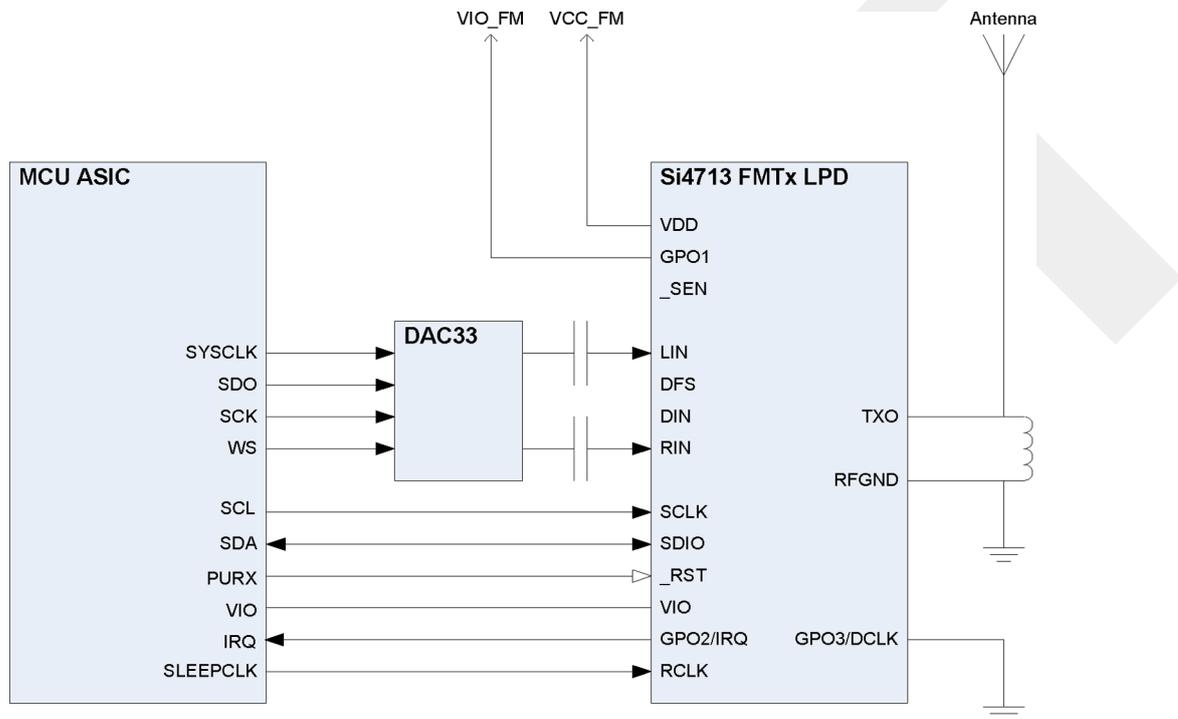
The figure shows a basic system block diagram for the FMTX 2.0 implementation. _SEN is shown here unconnected since this pin decides which I2C address is used depending on if this pin is pulled low or high. On RM-235 the _SEN is pulled high by connecting it to VIO.

RM-235 uses a loop antenna which is located in the removable C-cover of the device. The loop antenna also acts as the tuning inductor which is required by the Si4713 chip. The location of the antenna in the removable cover means that ESD protection is required to prevent damage to the Si4713 device.

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■ **Device pin layout (Si4713-GM) and interfaces**
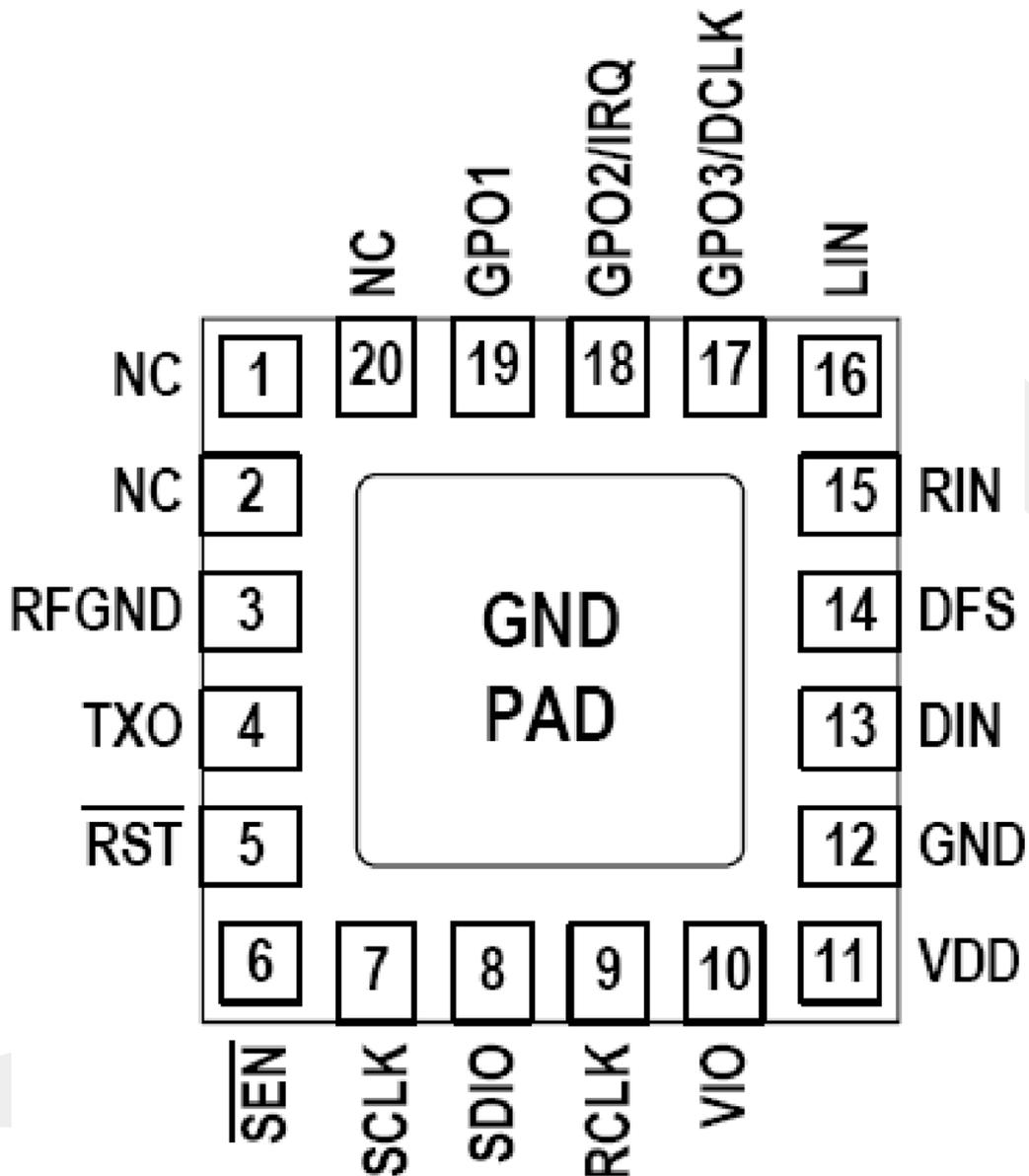
Inteface pin descriptions

Pin Number(s)	Name	Description
1, 2, 20	NC	No connect, left floating.
3	RFGND	RF ground. Connected to ground plane on PCB.
4	TXO	FM transmitter output connection to Tx antenna.
5	RST	Device reset (active low) input.
6	SEN	Serial enable input (active low).
7	SCLK	Serial clock input.

Pin Number(s)	Name	Description
8	SDIO	Serial data input/output.
9	RCLK	External reference oscillator input.
10	VIO	I/O supply voltage.
11	VDD	Supply voltage.
13	DIN	Digital input data.
14	DFS	Digital frame synchronisation.
15	RIN	Right audio line input.
16	LIN	Left audio line input.
17	GPO3/DCLK	General purpose output – Digital bit synchronous clock.
18	GPO2/IRQ	General purpose output – Interrupt request.
19	GPO1	General purpose output.
12, GND PAD	GND	Ground. Connect to ground plane on PCB.

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7 — FMTx 2.0 troubleshooting

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FMTx 2.0 schematic

Figure 39 FMTx 2.0 schematic

The handset uses an antenna that is integral to the removable cover. The connection to the cover is exposed when the cover is removed. The ESD diode package (Z2600) and the resistor (R7825) are fitted to protect against ESD strikes.

The loop antenna requires two connection points (the signal and the ground). It is important to check these connection points for damage or dirt since the performance of the FMTx 2.x implementation will be severely impaired if these connections are not in good condition.

FMTx 2.0 component layout
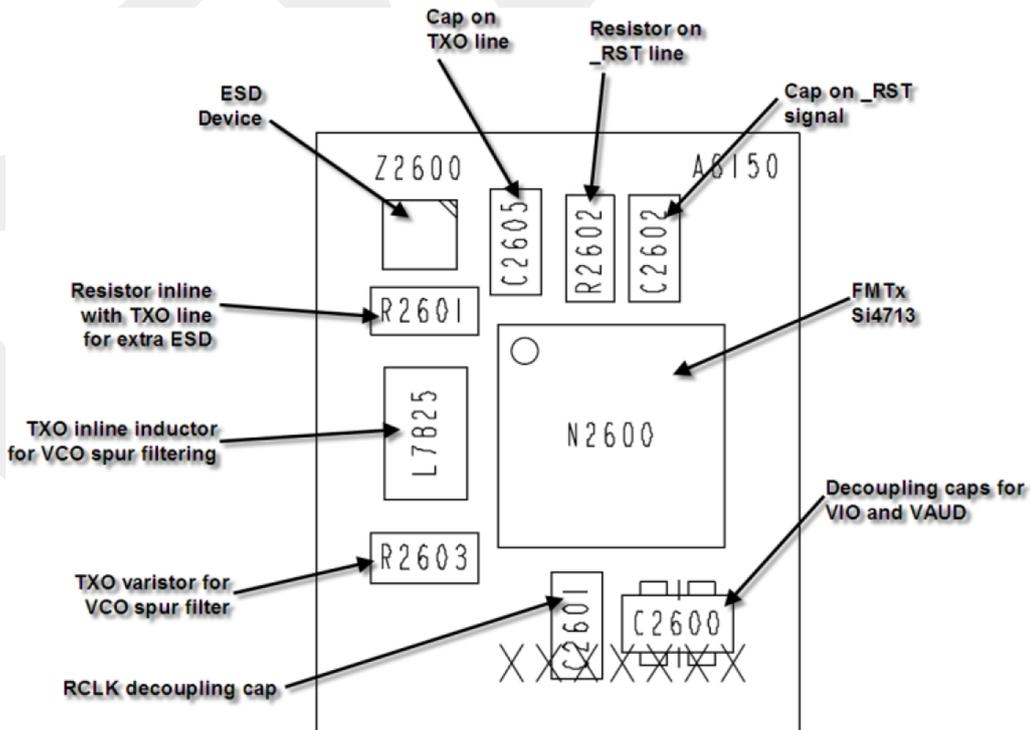
Figure 40 FMTx 2.0 Component References and Location

The main component of the FMTx 2.0 solution is the Si4713 low power transmitter device (N2600). This whole area is likely to be covered in an RF shield (can) and this will need to be removed in order to gain access to these components if required.

The figure below shows the layout of the DC blocking capacitors on the left and right audio path (R2149).
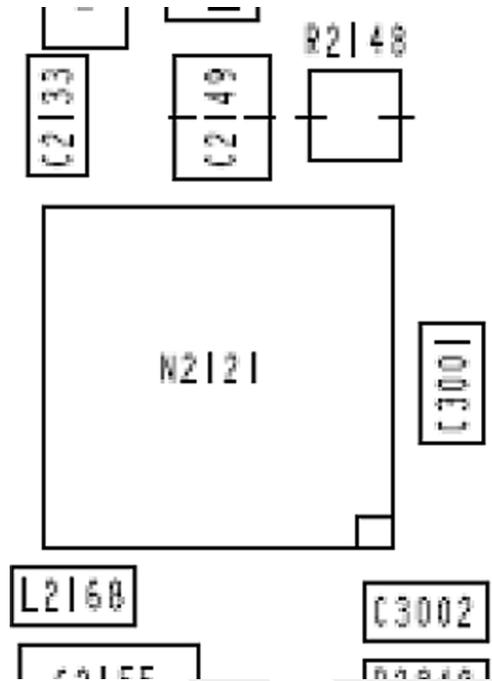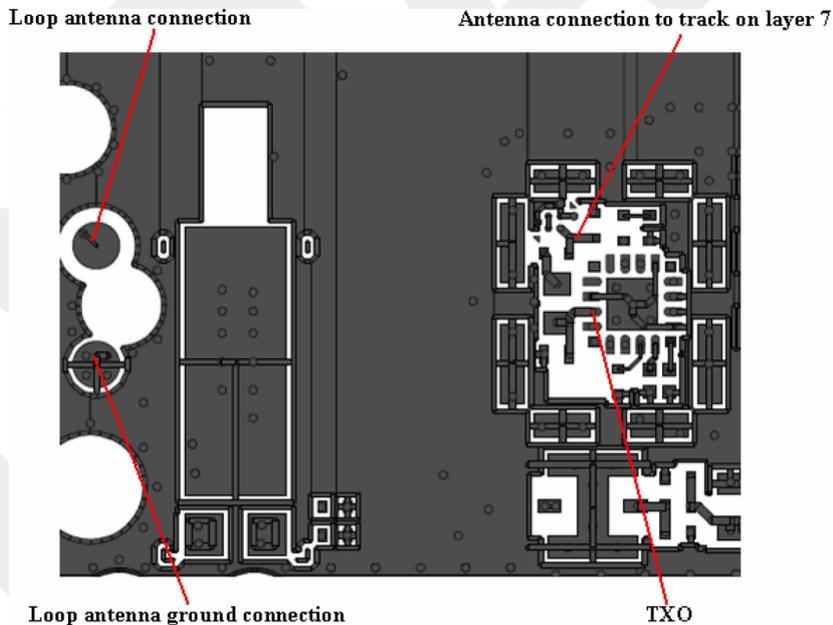
■ FMTx 2.0 PWB traces

Figure 41 FMTx 2.0 layout (Layer 10)

This figure shows pads for pogo pins for a removable loop antenna. This type of antenna is normally located in the back (C) cover of the handset. Since the Si4713 device package that is used for the FMTx 2.0 solution is a QFN package, access to the various pins is good. There are however, a significant number of other access points available due to tracks running from the Si4713 device and also at the edges of some of the external components such as the inductor.
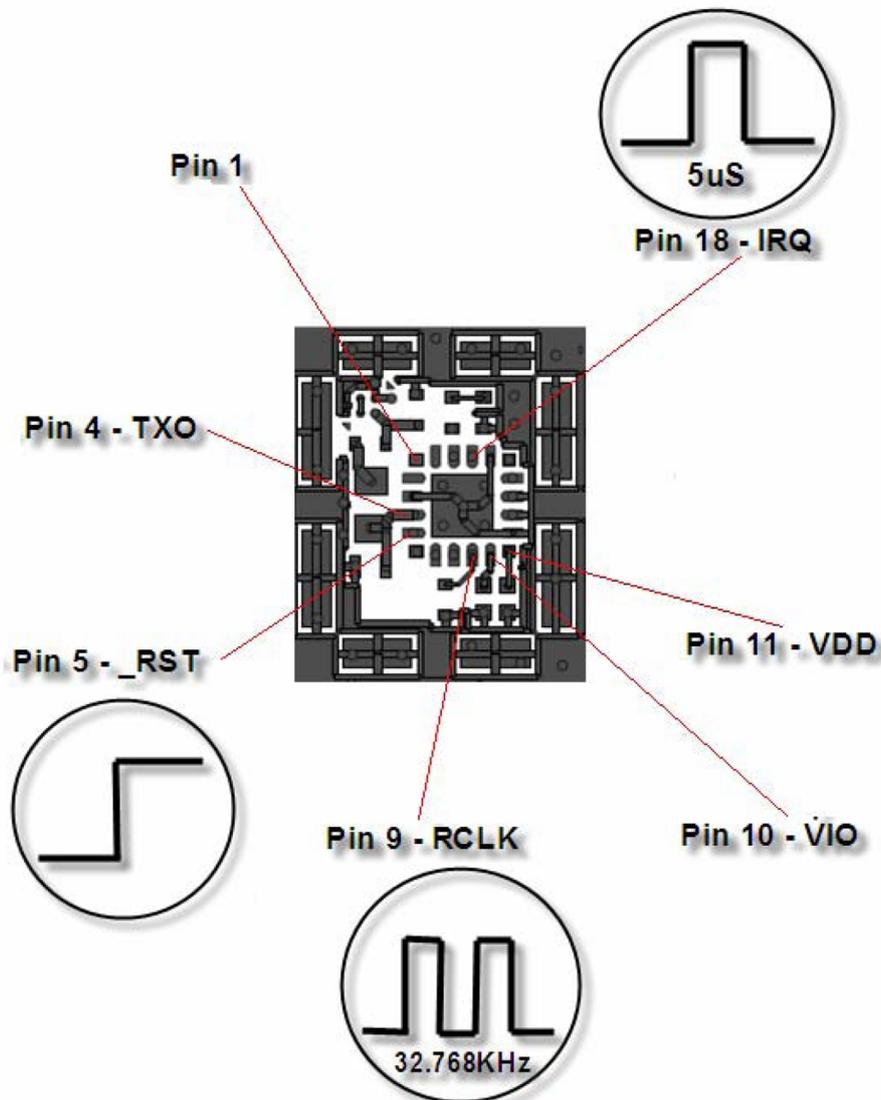
■ Access to signals

Figure 42 Access to signals

Note: Pin 1 has been indicated purely as a reference.

Figure shows possible access points for monitoring/measuring the various signals of the FMTx 2.0 solution. Typical voltage levels, waveforms and frequencies have been indicated where appropriate.

■ Specific digital and power supply test points

Using access to signals figure as a reference it can be seen that supplies to the Si4713 device VIO (pin 10) and VDD (pin 11) can be accessed easily. The FMTx 2.0 solution utilises a QFN package. This type of package lends itself well to analysis of signals on the various pins of the device.

VIO & VDD

VIO should be in the range 1.5 to 3.6 Volts.

VDD should be in the range 2.7 to 5.5 Volts.

_RST

Also, the _RST signal to the device can be monitored. This is an active low signal and should only be asserted during power up. The _RST signal is driven by the PURX line.

The state of pins 19 & 18 (GPO1 and GP02 respectively) on the rising edge of the _RST pin determines what interface is selected when the device powers up.

Table 10 Bus mode selection truth table.

Bus Name	Bus Mode	GPO1	GPO2/IRQ
I2C	2-Wire	High	Low
SPI	SPI	High	Low (must drive)
CBus	3-Wire	Low (must drive)	Low

It's possible that if GPO1 and/or GPO2 are not at the correct state when the Si4713 device has power applied then the wrong bus mode could be selected and the handset would be unable to communicate with the device. For RM-235, the bus mode should be I2C.

_SEN

The _SEN pin is used to select one of two possible 7-bit I2C bus addresses. When _SEN is low, the I2C bus address for the Si4713 device is 0010001 (0x11). When _SEN is high, the I2C bus address for the Si4713 is 1100011 (0x63).

If the _SEN signal is not correct (i.e. not selecting the correct I2C address), then this is also another possible reason why control of the FMTx 2.x feature might not be possible. For RM-235 the I2C address used for FMTx 2.x will be 0x63.

Table 11 I2C 7-bit bus address selection summary

I2C address	_SEN
0010001 (0x11).	Low
1100011 (0x63).	High

■ FMTx2.0 specific RF test points

TXO

Pin 4 is the TXO pin. This is the transmitter output pin and probe access can be obtained easily on one side of the large inductor component. (L2600 – see figure 2). Using a high impedance probe and a spectrum analyser it would be possible to examine the TXO pin and check that the transmitter is outputting a signal.

■ Specific clock test points

RCLK

Pin 9 is the RCLK (Reference Clock) input to the device. This is typically 32.768KHz and is driven from the sleep clock from the base band. When measuring this clock frequency, it may be seen to vary by as much as +/- 120 ~ 200ppm. The device can only typically tolerate +/- 20ppm in order to maintain transmit frequency accuracy. To overcome this, the software driver for the device calculates what the actual sleep clock (RCLK) frequency is and periodically programs the device with this frequency.
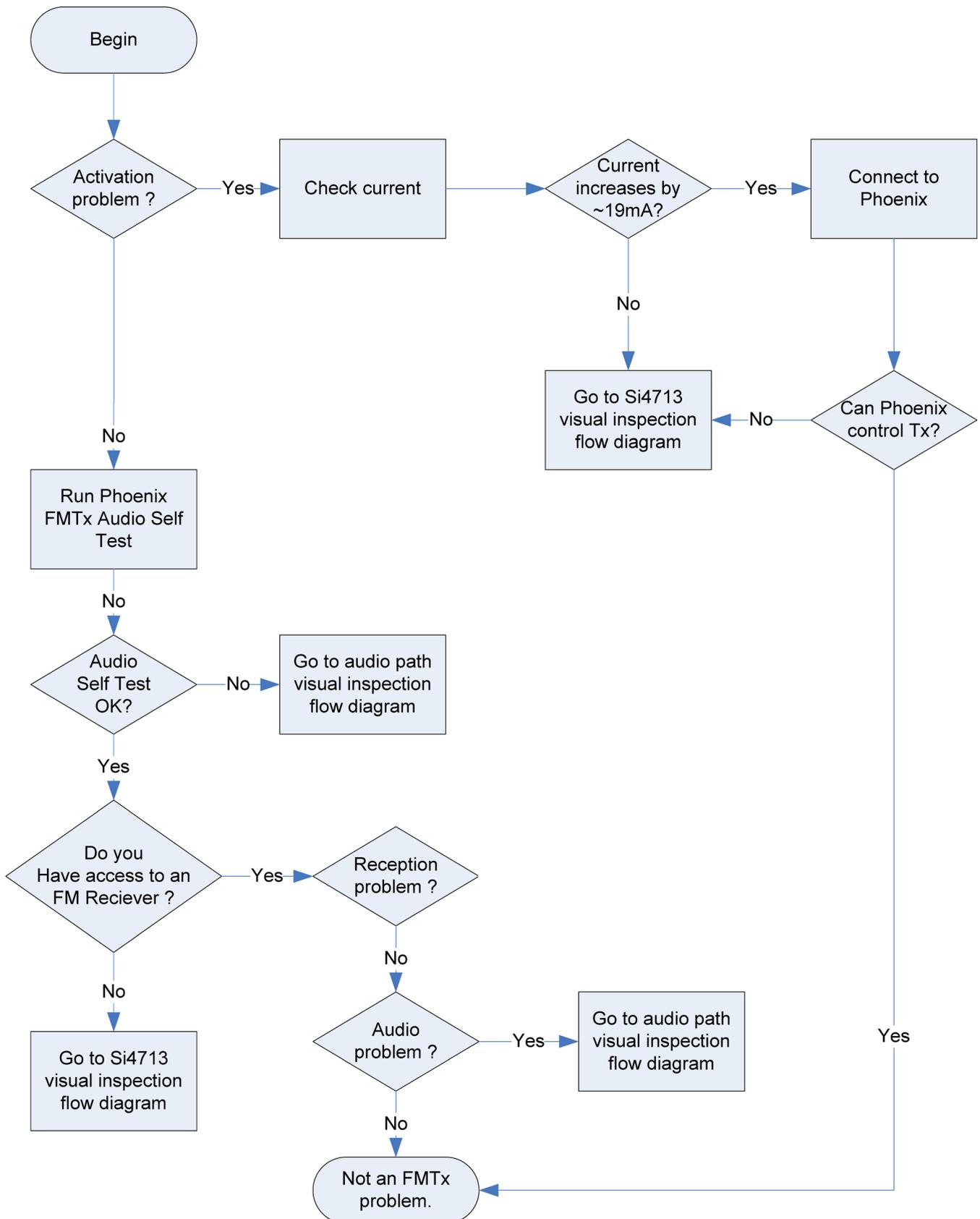
The device then internally adjusts its dividers in order to maintain the required output frequency. Using this method it is possible to reduce the effective ppm of the reference clock down to +/- 14ppm over the full operating temperature range of -15 to +50 degrees Centigrade.

■ General visual inspection guidelines

- If the handset has the FMTx antenna in the back cover then check the condition of the cover, the antenna trace and any mechanical interfaces for the antenna e.g. pogo pins.

- Check that the Si4713 device is placed correctly on the PWB and that there are no obvious signs of damage.

- Check the surrounding components and ensure correct placemen on the PWB and that there is no visual damage. Check that there are no missing components.
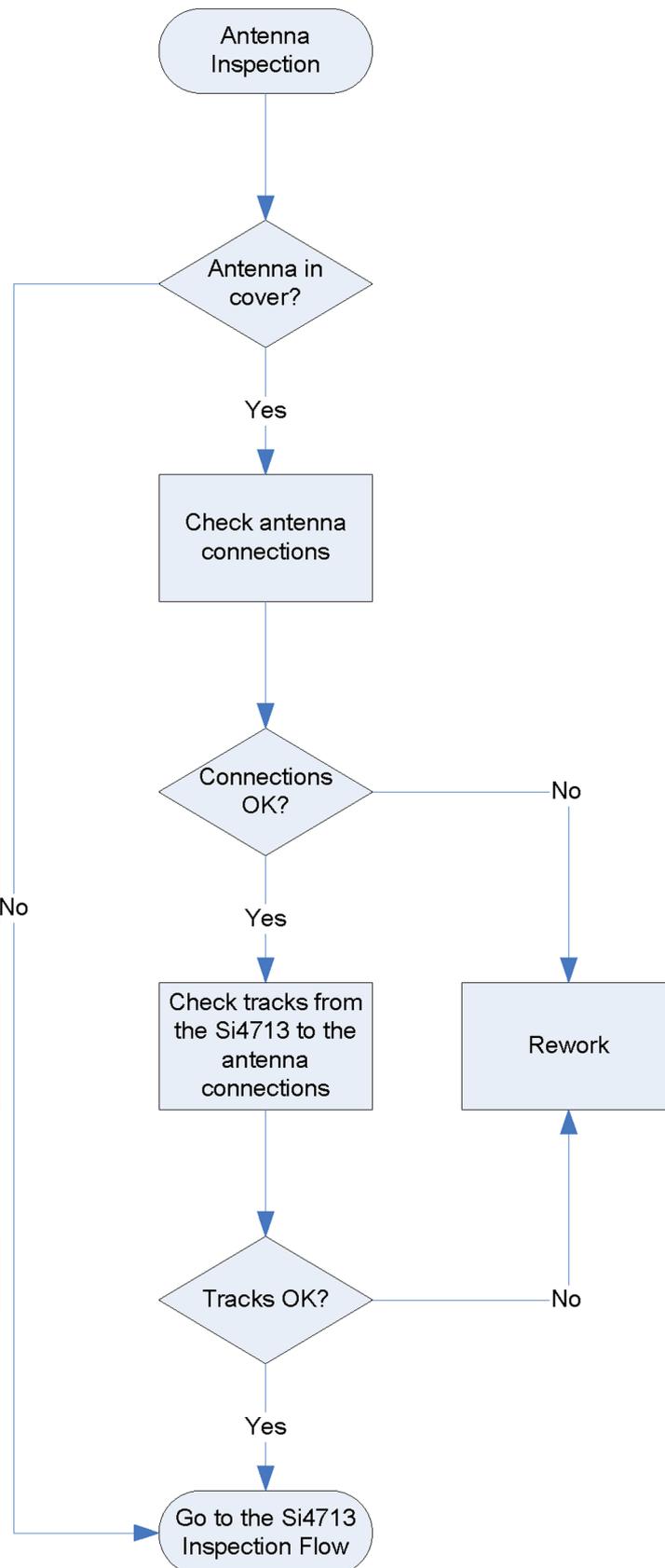
NOKIA Care

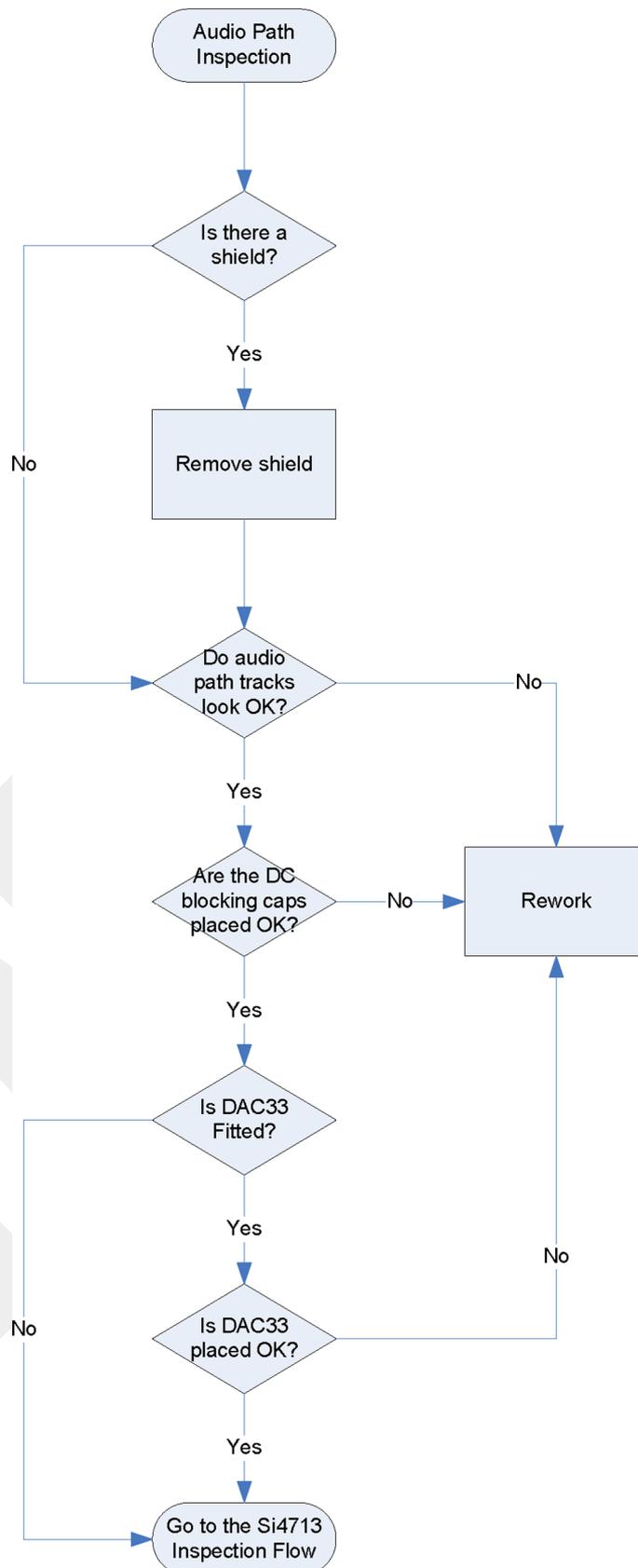## ■ FMTx2.0 troubleshooting

Troubleshooting flow

Begin

Activation problem ? —Yes→ Check current → Current increases by ~19mA? —Yes→ Connect to Phoenix

Current increases by ~19mA? —No→ Go to Si4713 visual inspection flow diagram

Connect to Phoenix → Can Phoenix control Tx? —No→ Go to Si4713 visual inspection flow diagram

Activation problem ? —No→ Run Phoenix FMTx Audio Self Test

Run Phoenix FMTx Audio Self Test —No→ Audio Self Test OK? —No→ Go to audio path visual inspection flow diagram

Audio Self Test OK? —Yes→ Do you Have access to an FM Reciever ? —Yes→ Reception problem ?

Do you Have access to an FM Reciever ? —No→ Go to Si4713 visual inspection flow diagram

Reception problem ? —No→ Audio problem ? —Yes→ Go to audio path visual inspection flow diagram

Audio problem ? —No→ Not an FMTx problem.

Can Phoenix control Tx? —Yes→ Not an FMTx problem.

■ FMTx2.0 antenna visual inspection troubleshooting

Troubleshooting flow

```
                        ╭─────────────────╮
                        │     Antenna     │
                        │   Inspection    │
                        ╰─────────────────╯
                                 │
                                 ▼
                          ╱─────────────╲
                         ╱   Antenna in   ╲
                         ╲     cover?     ╱
                          ╲─────────────╱
                                 │
                                Yes
                                 │
                                 ▼
                        ┌─────────────────┐
                        │  Check antenna  │
                        │   connections   │
                        └─────────────────┘
                                 │
                                 ▼
                          ╱─────────────╲
                         ╱  Connections   ╲────────── No
                         ╲     OK?        ╱
                          ╲─────────────╱
                                 │
                                Yes
                                 │
                                 ▼
                        ┌─────────────────┐      ┌─────────────────┐
                        │ Check tracks from│      │                 │
                        │  the Si4713 to the│      │     Rework      │
                        │     antenna      │      │                 │
                        │   connections    │      └─────────────────┘
                        └─────────────────┘
                                 │
                                 ▼
                          ╱─────────────╲
                         ╱   Tracks OK?   ╲────────── No
                         ╲               ╱
                          ╲─────────────╱
                                 │
                                Yes
                                 │
                                 ▼
                        ╭─────────────────╮
                        │  Go to the Si4713│
                        │  Inspection Flow │
                        ╰─────────────────╯
```

■ FMTx2.0 audio path visual inspection troubleshooting

Troubleshooting flow

```
                    ┌─────────────────┐
                    │   Audio Path    │
                    │   Inspection    │
                    └─────────────────┘
                            │
                            ▼
                       ╱─────────╲
                      ╱ Is there a ╲
              No ────┤   shield?    ├
                      ╲            ╱
                       ╲─────────╱
                            │
                           Yes
                            │
                            ▼
                    ┌─────────────────┐
                    │  Remove shield  │
                    └─────────────────┘
                            │
                            ▼
                       ╱─────────╲
                      ╱  Do audio  ╲
                     ┤ path tracks  ├──── No ────┐
                      ╲  look OK?   ╱            │
                       ╲─────────╱               │
                            │                     │
                           Yes                    │
                            │                     │
                            ▼                     ▼
                       ╱─────────╲        ┌─────────────┐
                      ╱ Are the DC ╲       │             │
                     ┤ blocking caps├─ No ─│   Rework    │
                      ╲ placed OK? ╱       │             │
                       ╲─────────╱         └─────────────┘
                            │                     ▲
                           Yes                    │
                            │                     │
                            ▼                     │
                       ╱─────────╲                │
                      ╱  Is DAC33  ╲              │
              No ────┤   Fitted?    ├             │
                      ╲            ╱              │
                       ╲─────────╱               │
                            │                     │
                           Yes                    │
                            │                    No
                            ▼                     │
                       ╱─────────╲                │
                      ╱  Is DAC33  ╲              │
                     ┤  placed OK?  ├─────────────┘
                      ╲            ╱
                       ╲─────────╱
                            │
                           Yes
                            │
                            ▼
                    ┌─────────────────┐
              No ───│ Go to the Si4713│
                    │  Inspection Flow│
                    └─────────────────┘
```

■ **FMTx2.0 Si4713 visual inspection troubleshooting**

Troubleshooting flow

```
                    ╭──────────────────╮
                    │  Si4713 Inspection │
                    ╰──────────────────╯
                             │
                             ▼
                        ◇ Is there a ◇
                        ◇  shield?  ◇
              No │                    │ Yes
                 │                    ▼
                 │            ┌──────────────┐
                 │            │ Remove shield │
                 │            └──────────────┘
                 │                    │
                 │                    ▼
                 └──────────▶  ◇ Is SI4713 ◇ ──── No ───┐
                              ◇ Placed OK? ◇            │
                                    │ Yes               │
                                    ▼                    ▼
                              ◇ Is area clear ◇ ─ No ─▶ ┌──────────┐
                              ◇  of debris?  ◇          │  Rework  │
                                    │ Yes               └──────────┘
                                    ▼                         ▲
                              ◇ Do tracks ◇ ───── No ─────────┘
                              ◇ look OK ? ◇
                                    │ Yes
                                    ▼
                            ╭──────────────────╮
                            │ Visual Inspection │
                            │        OK         │
                            ╰──────────────────╯
```
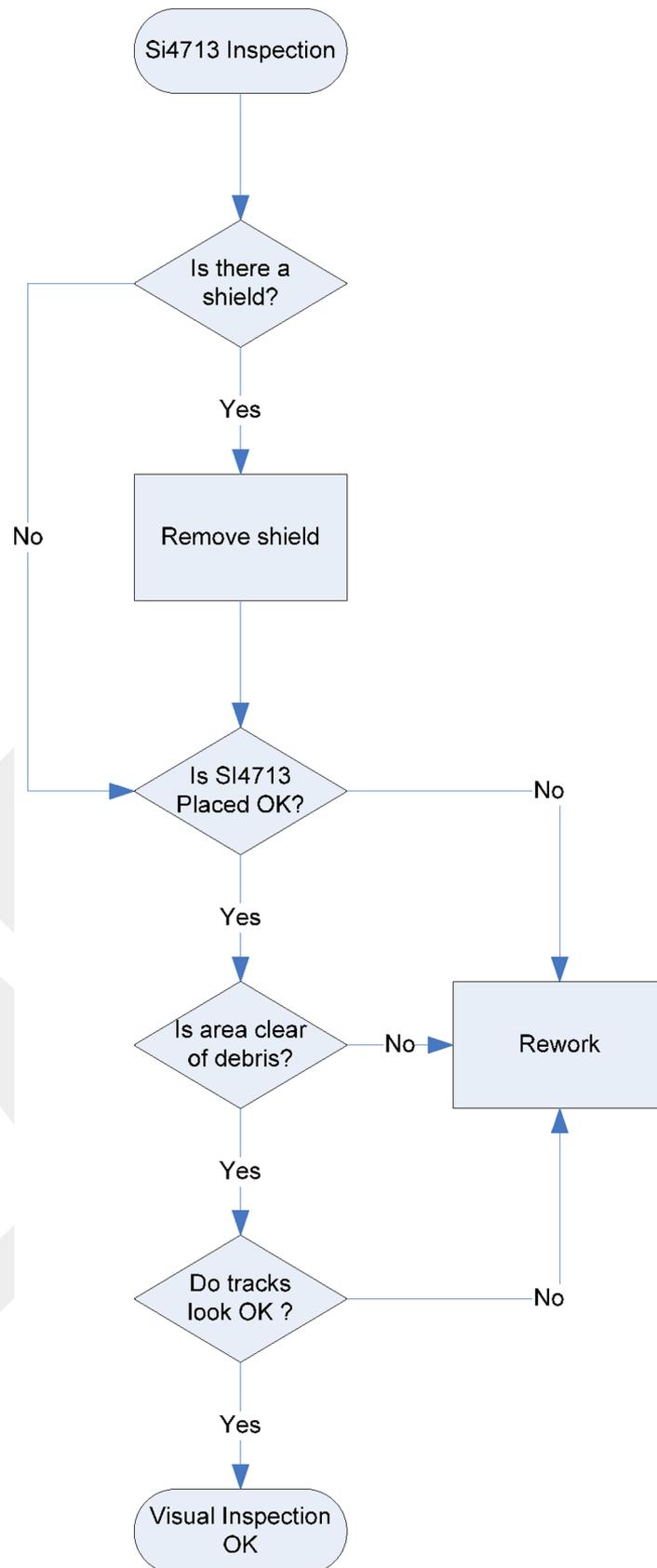
■ Checking validity of signals

Please refer to **Access to signals** figure as a reference. Generally all power supply levels and clocks willbe consistent. Signals on the analogue audio input pins (RIN & LIN – pins 15 and 16 respectively) will be dependant on the audio content being injected to the device. During the audio self test (initiated from Phoenix) it is possible to monitor these pins and check that the DSP generated 1KHz tones can be seen at some point during the test. Check that the signals are clean and that no obvious distortion can be seen such as clipping of the signals. Typical maximum swing of these tones will be ~636mV peak to peak. The maximum swing may vary between Nokia handsets but for the FMTx 2.0 implementation, the swing should not be greater than the aforementioned value.

■ FMTx2.0 troubleshooting faults

Possible faults

Expected fault reports relating to the FMTx 2.0 implementation may consist of one or more of the following;

1 No left audio.

2 No right audio.

3 No audio.

4 Can't start FMTx.

5 Can't locate FM transmission on an FM receiver or no FM transmission.

6 Distortion on audio.

7 Poor reception on FM receive.r

8 No RDS information.

Initial fault analysis

Where possible, attempt to reproduce and verify the reported fault. Intermittent problems are likely to be due to bad connections or broken components/solder joints. Any faults relating to poor FM transmitter performance or frequent failure to locate usable frequencies when performing a scan are likely to be due to some kind of antenna issues.

In handsets that utilise an antenna solution in a removable cover it is likely that the connecting interface pins are either damaged, dirty or that the cover fits poorly perhaps due to broken tabs/latching lugs. Poor audio fault reports may also be due to the above antenna issues.

■ Phoenix PC tool

Setting Up Phoenix

Required equipment;

• A Deskey security dongle for Phoenix to run.

• The latest version of Phoenix that has the FMTx 2.0 GUI installed on a PC (version 2007.21.000.27897 or greater).

• A jig suitable for the handset.

• A cable to connect the jig/handset to the PC. Run Phoenix and select the FMTx panel.

Using the FMTx panel to drive the FMTx 2.0 features
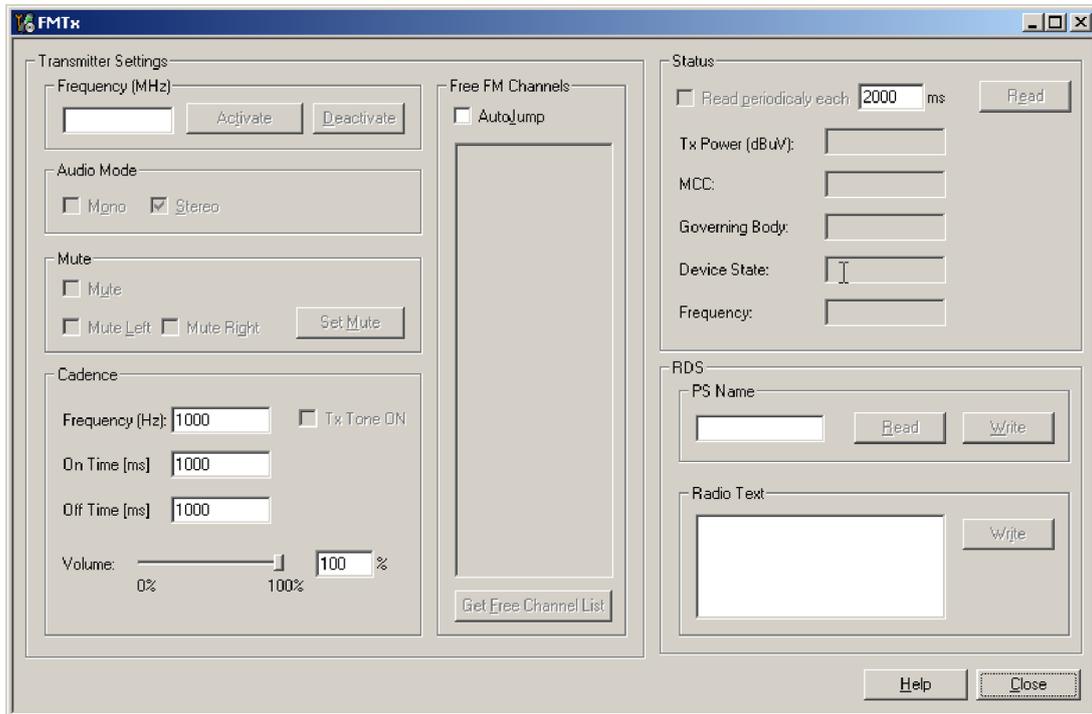
Figure 43 FMTx panel before connection to the handset
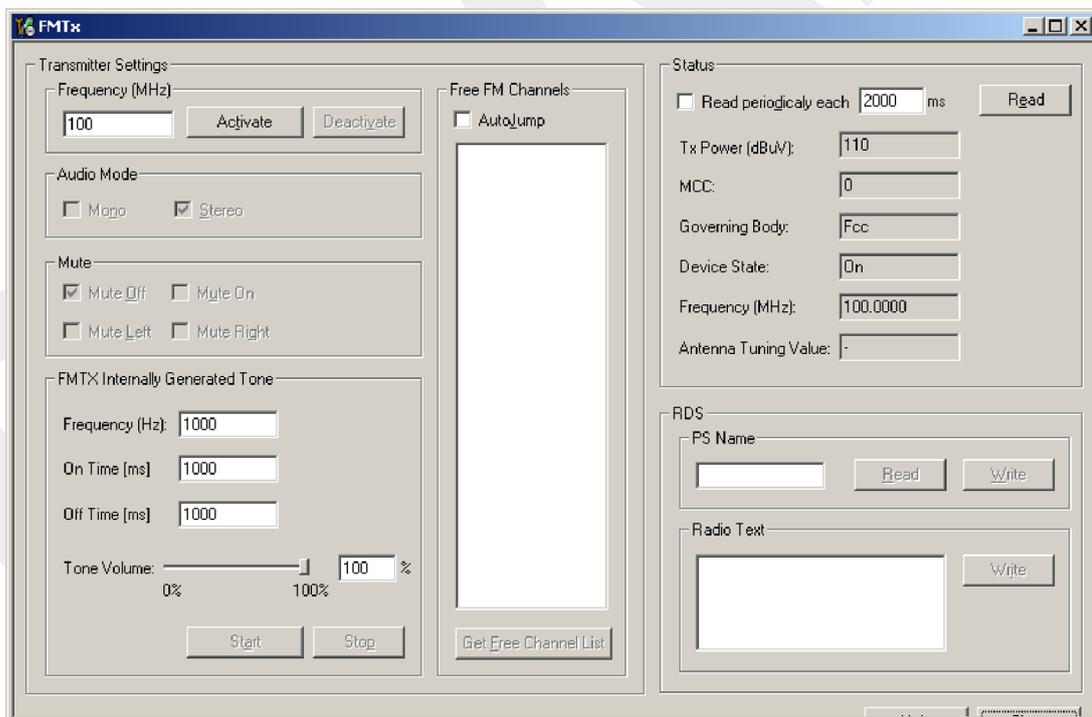
Figure 44 FMTx panel after connection to the handset

Typing in a valid FM transmitter frequency and clicking on 'Activate' will turn on the FMTx feature and will begin transmitting the carrier on the selected frequency. Note: Unless this carrier signal is modulated with some audio (either via the music player or a DSP or Si4713 generated tone) then all that will be heard if an

FM receiver is tuned to the same frequency would be silence. After approximately 10 seconds of silence the handset should begin to 'chirp' periodically with a short 1Khz tone that repeats every 5 seconds. This indicates that there is no audio input and reminds the user that the feature is on.

The Phoenix FMTx 2.0 panel can be used to control the following features;

- Set the FM frequency to transmit on (88.1 to 107.9MHz).

- Select Stereo or Mono mode (generally all Nokia handsets will only use stereo)

- Mute both left and right audio channels.

- Mute only the left or the right audio channels.

- Allow an internal tone to be generated and transmitted from the Si4713 device. The audio frequency of this tone can be selected along with the on/off time and the volume of the tone. Selecting 0 (zero) in either the on or off time will produce a continuous tone.

- Obtain a list of suitable 'quiet or free' channels. This effectively performs an RSSI (RPS) scan to locate quiet channels to transmit on. If the 'AutoJump' tick box is checked then this list will be transmitted to the FM receiver to allow the handset to perform AF jumps. This is dependent on the Nokia handset and if the FM receiver is RDS capable. The use of AF feature allows an RDS capable FM receiver to follow the transmissions of the FM transmitter automatically.

- FMTx 2.0 status panel. This provides information on the state of the FMTx feature. This can be polled by Phoenix at regular intervals defined by the user when the 'Read periodically each...' check box is checked. The status can otherwise be read at any point by clicking on the 'Read' button. The MCC value is the 'Mobile Country Code' and provided the phone is registered on a network will provide the code pertaining to the country in which it resides. The antenna tuning value is a good indicator of the state of the antenna and the other components connected to the TXO pin. The tuning values should be in the range 0 – 80. Any value outside of this range will indicate some problem with the components connected to the TXO pin (including the antenna). In the case of a removable antenna, the cause of the out of range value is like to be because of a poor antenna connection. This might be because of broken or dirty connections between the handset and the cover in which the antenna is fitted.

- The RDS panel can be used to set the PS name and/or to enter a Radio Text (RT) string. If access to an FM receiver is available that supports RDS then these strings can be observed on the display of the FM receiver.
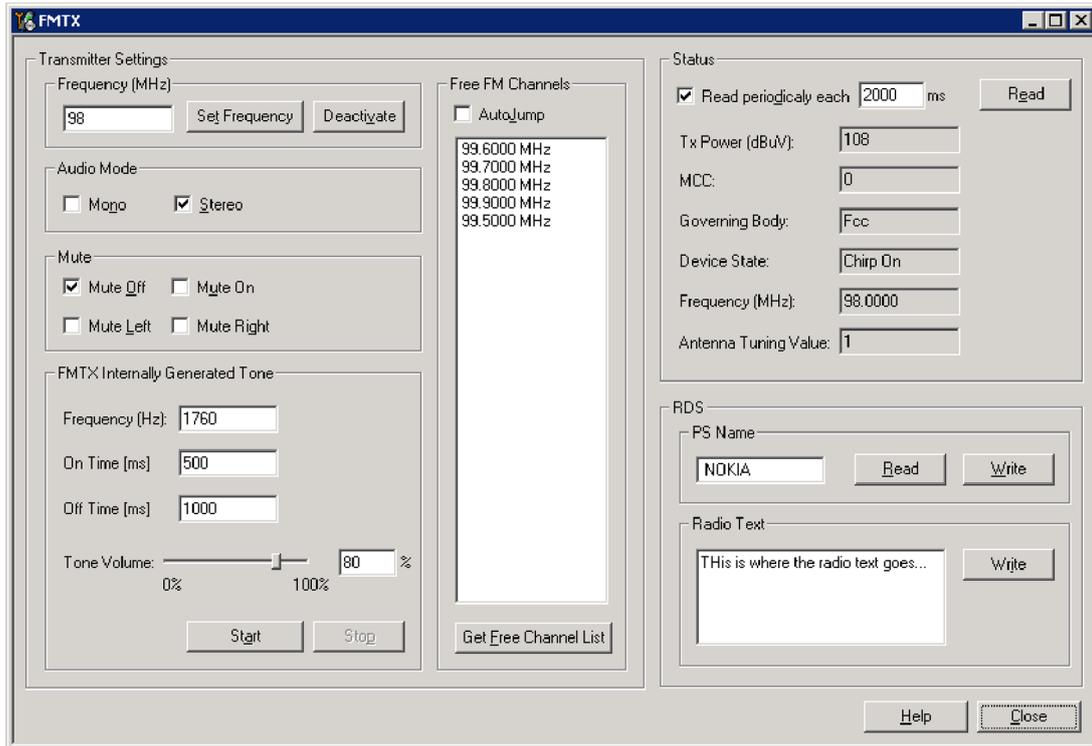
Figure 45 FMTx panel in action

Using the audio self test

The audio self test can be used to quickly determine if the left and right audio paths are intact.

The left and right audio connectivity self test process performs the following steps:

1 Measure and store silence.

2 Inject 1KHz tone (left or right) to give 75KHz deviation. Measure and store.

3 Inject same tone on both left and right analogue audio inputs. Measure and store. Compare result from (2) with result from (1). If the delta is NOT more than a specified threshold level then fail. This would indicate that the selected channel is open circuit. If an over deviation indication is detected on (2), then the audio channels must be shorted together. This is a fail condition. For (3), a returned value of zero is expected. This indicates that there is an over deviation condition which in turn indicates that the 'other' audio input channel is connected correctly.

If on (3) there is no over deviation response, then the 'other' channel must be open circuit at some point in the audio path. This is a fail condition.

The table shows the truth table for the left and right audio self test.

Table 12 Left and right audio self test truth table

LEFT	RIGHT	ASQ Condition	Comment
0	0	0	SILENCE
1	0	0	OPEN/SHORT
1	0	1	OK
1	0	2	SHORT
0	1	X	Don't Care
0	1	X	Don't Care

LEFT	RIGHT	ASQ Condition	Comment
0	1	X	Don't Care
1	1	0	ALL OPEN/SHORT
1	1	1	OPEN
1	1	2	OK

Using the auto tune panel

The Auto Tune panel should only be used if one or more of the following components have been changed:

- The Si4713 device.
- The Inductor connected to the TXO pin 4.
- The inline resistor connected to the TXO pin 4 (if fitted).
- The ESD diode package connected to the TXO pin 4 (if fitted).

This procedure follows the alignment that is done in the factory to ensure that the FMTx 2.0 solution is aligned to provide the correct Tx output power for the relevant legislations such as FCC and ETSI.

8 — System module and user interface

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■ Introduction

Phone description

RAPIDOYAWE is the main digital baseband ASIC in the HW51. It contains functionality for both WCDMA and GSM EDGE.

AVILMA is power management ASIC having voltage regulators and audio tranceiver and BETTY is energy management ASIC having charging switch and FBUS transceiver.

Memory components are internal COMBO 768Mb DDR+ 2Gb M3 and a card reader for MicroSD.

Function	Description	Item ref
EM ASIC	AVILMA	N2200
	BETTY	N2300
System ASIC	RAPIDOYAWE	D2800
Memory	COMBO 768Mb DDR+ 2Gb M3	D3000
Camera accelerator	OMAP-DM299	N1400
Display controller	S1D13747	D2450
Back-up battery	RTC back-up battery 311	G2200
FM-radio with RDS	BTHFMRDS2.0 module	D6000
Bluetooth	BTHFMRDS2.0 module	D6000
WLAN	WLAN Module ENW4Z815	N6300
GPS	GPS5300	N6200
RF ASIC	Ahneus	N7505
GSM PA	TX FEM	N7520
WCDMA PA	850/1900/2100	N7540
Oscillator	VCTCXO 38.4 MHz	G7501
	Chrystal 32.768 kHz	B2200
IO-expander	Basic IO-expander	N2850
SIM card reader		X2700
HS USB tranceiver	ISP1504-1	D3300
FM Transmitter	Si4713	N2600

System module block diagram
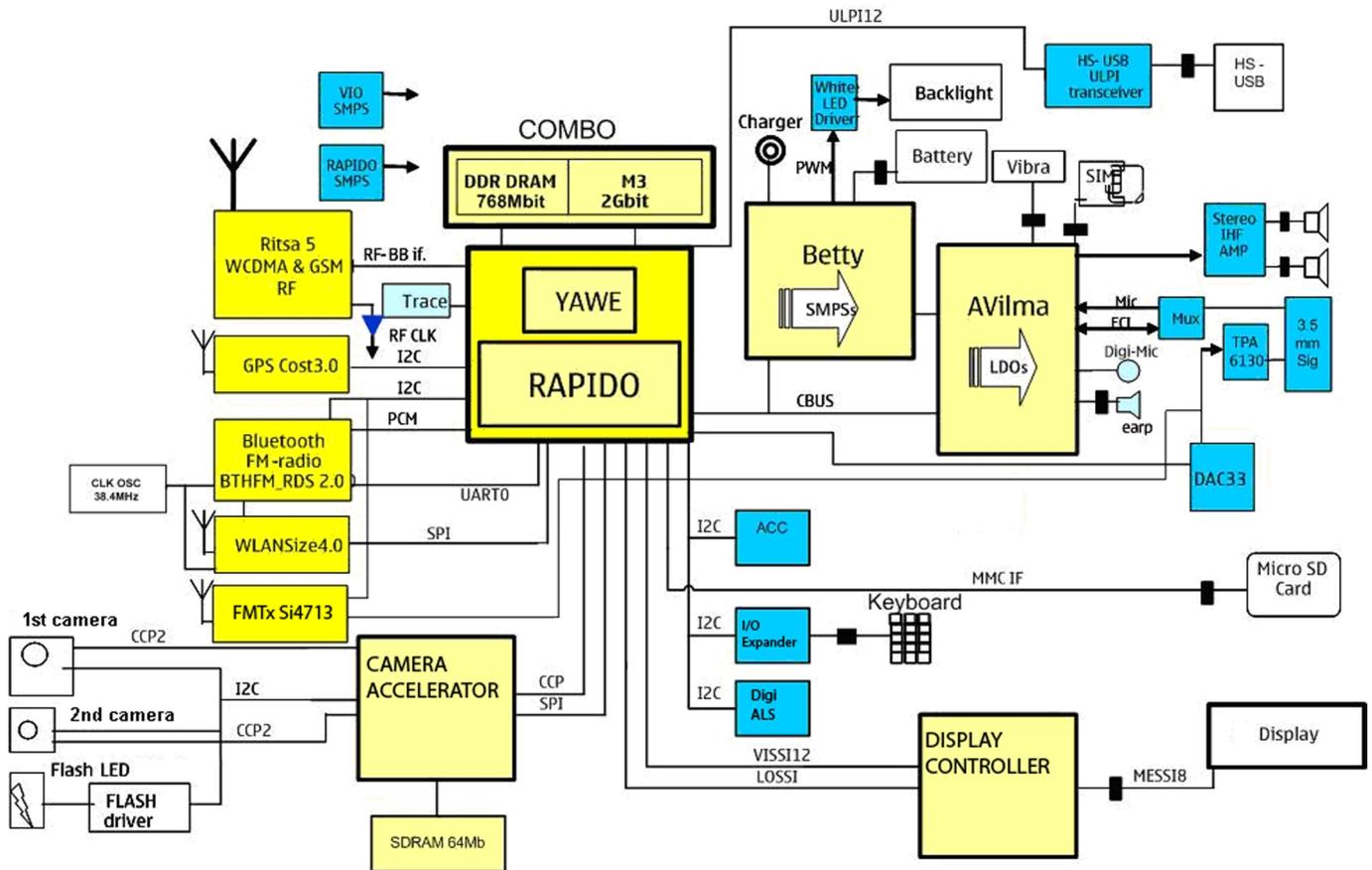
■ Energy management

Battery and charging

Battery

Supported battery type is BL-6F.

Battery connector

Blade battery connector type.

- VBAT (Battery voltage)

- BSI (Battery size indication)
- GND (Battery ground)

Charging

This phone is charged through the smaller Nokia standard interface (2.0 mm plug).

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

Backup battery

When the main battery is not attached EM ASIC (N2200) goes in backup mode using back-up battery that supplies voltage to RTC in EM ASIC (N2200).

Normal and extreme voltages

Energy management is mainly carried out in the two Application Specific Integrated Circuits (ASICs) BETTY and AVILMA. These two circuits contains a number of regulators. In addition there are some external regulators too.

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

Table 13 Nominal voltages

Voltage	Voltage [V]	Condition
General Conditions		
Nominal voltage	3.700	
Lower extreme voltage	3.145	
Higher extreme voltage (fast charging)	4.230	
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-	2.6 ± 0.1	On to off

Power key and system power-up

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

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

Power distribution
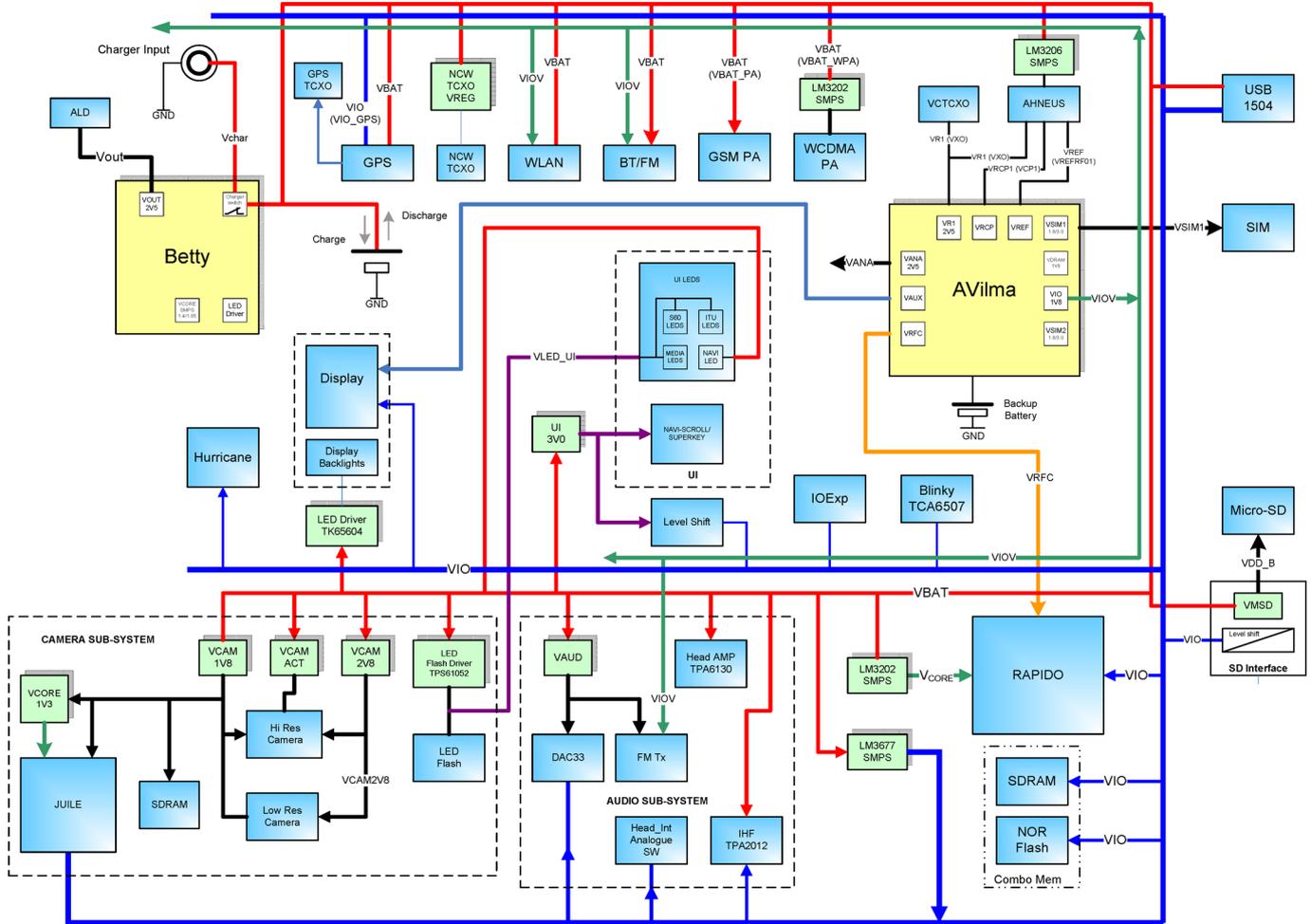
Clocking scheme
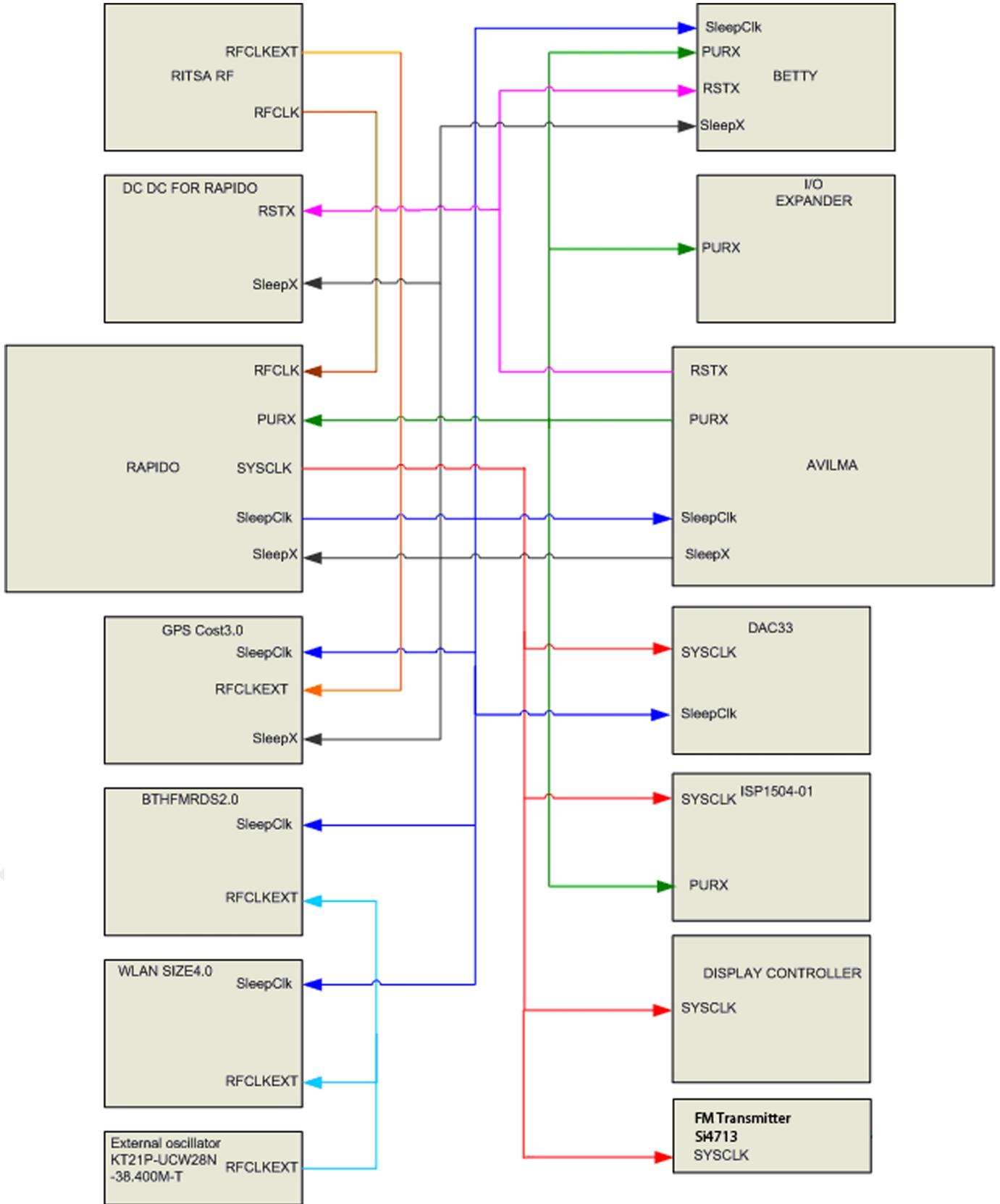
HW 51 engine clocks	
RFCLK	38.4 MHz
SleepClk	32.768kHz
RFCLKEXT	38.4 MHz
SYSCLK	19.2 MHz

■ Bluetooth and FM RDS radio module

Bluetooth and FM radio receiver are provided by the same ASIC (Broadcom BCM2048). The device supports Bluetooth operation and FM radio rececption in both European/USA and Japanese bands (the appropriate region-specific FM radio band is pre-configured in the phone software). The UART interface allows the device to communicate with the phone baseband engine using Bluetooth HCI commands. Commands to the FM radio can also be sent over the I2C interface.

When Bluetooth is switched on, the phone user interface the BT_RESETX line is toggled to reset the Bluetooth device, and commands are sent over the UART interface to configure the device. If UART communication fails (due to a hardware fault) it will not be possible to switch on Bluetooth from the phone user interface.

The device has two clock signals: SYS_CLK (19.2MHz, 26.0MHz, or 38.4MHz supported) and SLEEP_CLK (32.768kHz). The SLEEP_CLK is supplied all the time the phone is switched on. To maximise the phone standby time, it is only necessary to provide a SYS_CLK signal when Bluetooth activity occurs, such as sending Bluetooth data to another device, or checking periodically if there are any other Bluetooth devices attempting to communicate with it. At other times when the Bluetooth device is in standby mode or the FM radio is switched on it is only necessary to provide a SLEEP_CLK signal. The Bluetooth-FM ASIC is powered directly from the phone battery voltage line (VBAT). An internal regulator is enabled when Bluetooth or FM radio is switched on.

Bluetooth audio signals are sent to and from the device using a PCM interface. The Bluetooth RF signal is routed via a buried track to the Bluetooth antenna on the side of the PWB. An RF filter is needed between the Bluetooth antenna and Bluetooth ASIC to prevent interference to and from the celluar phone antenna. Phones that have both Bluetooth and WLAN use a shared antenna, as both services occupy the 2.4GHz ISM frequency band. The co-existence signaling interface between Bluetooth and WLAN ASICs controls the RF activity in the shared frequency band.

The audio signal from the FM radio is routed via the phone Audio ASIC to the phone headset or loudspeaker. The external wired headset is also used as an Antenna for the FM radio. The FM radio receiver RF signal is routed from the ASIC via a buried track to an impedance matching circuit placed near the headset connector.

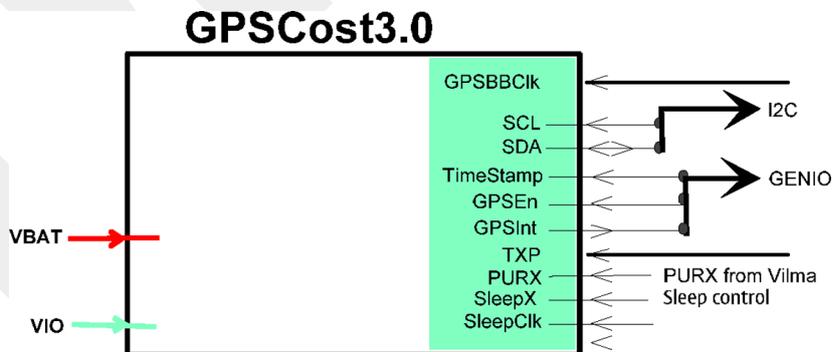The following block diagram shows how Bluetooth-FM is connected to the host engine.
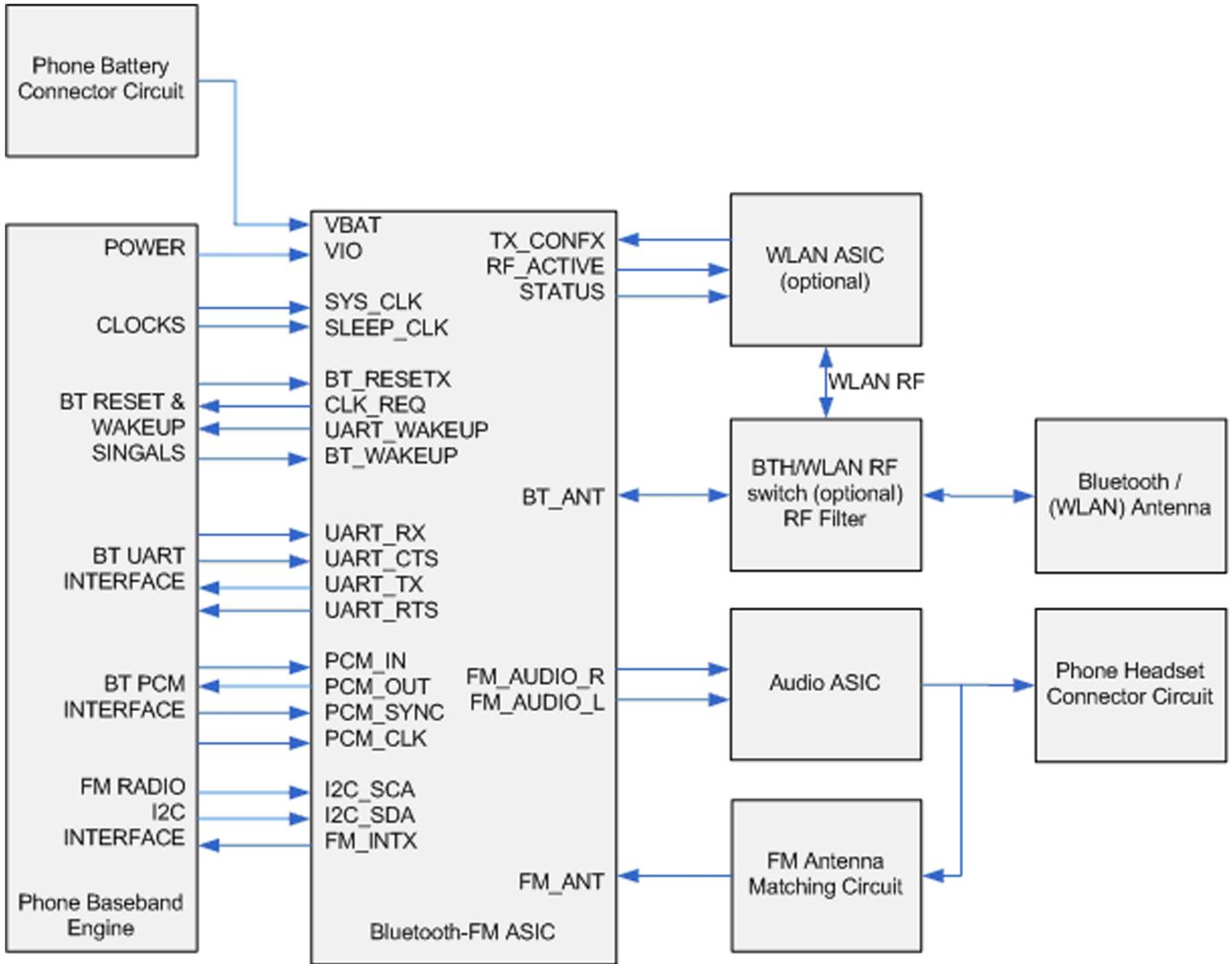
Figure 46 Bluetooth & FM radio block diagram

■ GPS module

HW 51 supports GPSCost3.0 release. GPS module is connected to cellular engine via I2C interface and GenIO control signals. GPS clock configuration includes dedicated GPS TCXO and reference clock from Ahneus.

■ WLAN module

WLAN module HW51 supports WLANSize4.0 release. WLAN module is configured as Cellular engine SPI slave. WLAN and Bluetooth co-existence is supported via BTH-WLAN interface. WLANSize4.0 have reference clock of external oscillator 38.4MHz and it is shared with BTHFMRDS2.0.
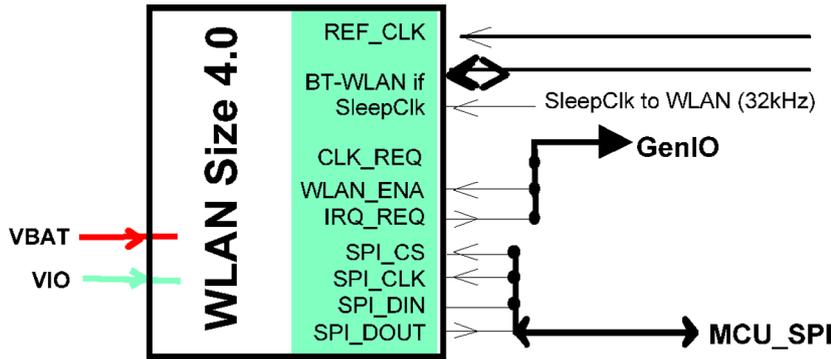
Figure 47 WLAN module

■ FM transmitter module

The FM transmitter module Si4713 is controlled by I2C from RAPIDO with left and right analog audio input from the DAC33.
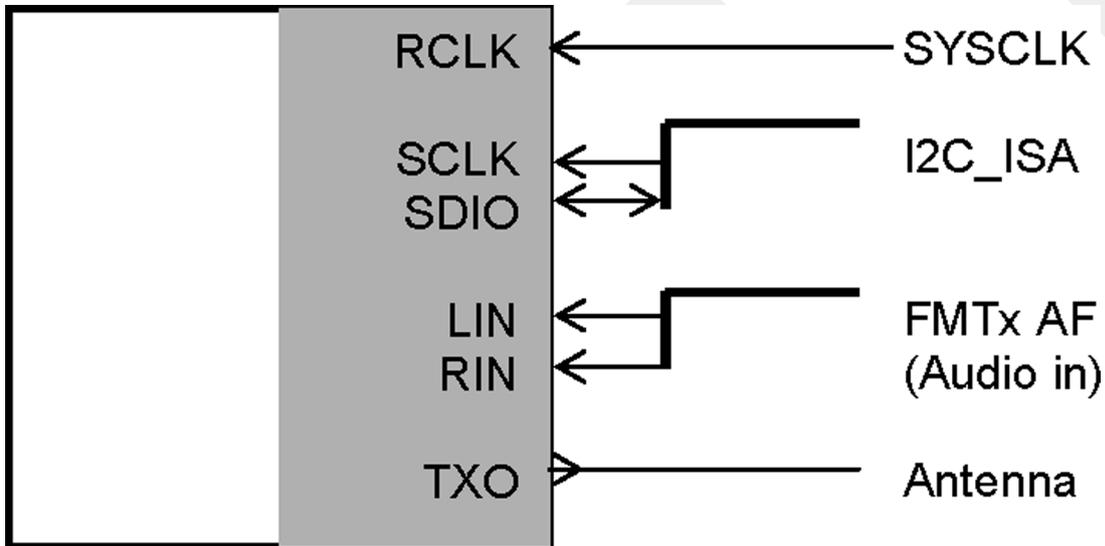
Figure 48 FM transmitter

■ High-speed USB

High-speed USB

The device can transmit and receive USB data at high-speed (480 Mbit/s), full-speed (12 Mbit/s) and low-speed (1.5Mbit/s). The external interface is the micro-B connector X3300. The interface between D3300 USB transceiver and micro-B receptacle is the standard USB interface specified in the Universal Serial Bus specification Rev. 2.0. The USB transfers signal and power over four-wire interface, which carries differential data, Vbus and GND. Signalling occurs over differential data line D+ and D-. The clock is transmitted encoded along with the differential data. ESD protection is done with USB ASIP Z3300. VBUS (+5V) is provided by the host device. The circuit is protected from an overvoltage condition by transistor pair V3300 and reference zenner diode V3301.

■ CBUS interface

CBUS is a "main" system control bus in BB5. RAPIDO controls the functionality of EM ASICs AVilma (N2200) and Betty (N2300) with CBUS.

CBUS is a four-wire half-duplex master-slave interface. In HW51 CBUS clock frequency is 4.39 MHz.

- **FBUS**

FBUS is a 2-wire serial communication bus between HW51engine and service SW.

- **ECI interface**

The ECI (Enhancement Control Interface) is a point-to-point, bi-directional, single line serial bus.

The purpose of the ECI is to identify and authenticate the accessory, and to act as a data bus (intended for control purposes) between the phone and the accessory .

- **Charger interface**

Charging control and charge switch are situated in EM ASIC (N2300).

If the temperature rises too high and the thermal protection is activated, EM ASIC (N2300) goes to protection mode.

- **SIM interface**

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

The SIM IF is shown in the following figure:
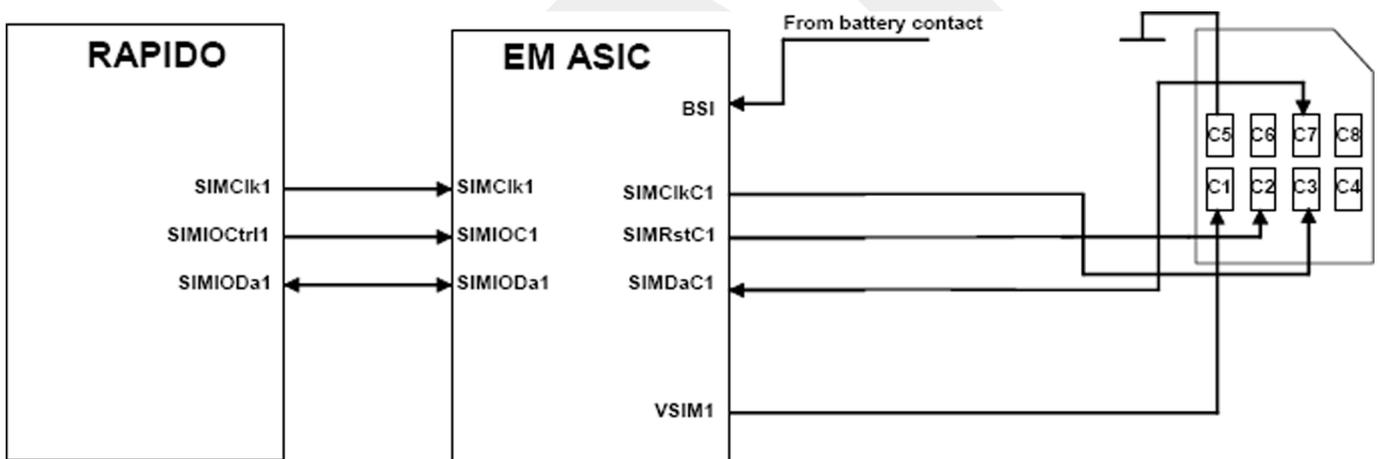
Figure 49 SIM interface

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

The EM ASIC SIM1 interface supports both 1.8 V and 3.0 V SIM cards. The SIM interface voltage is first 1.8 V when the SIM card is inserted, and if the card does not response to the ATR a 3 V interface voltage is used.

■ MicroSD card interface
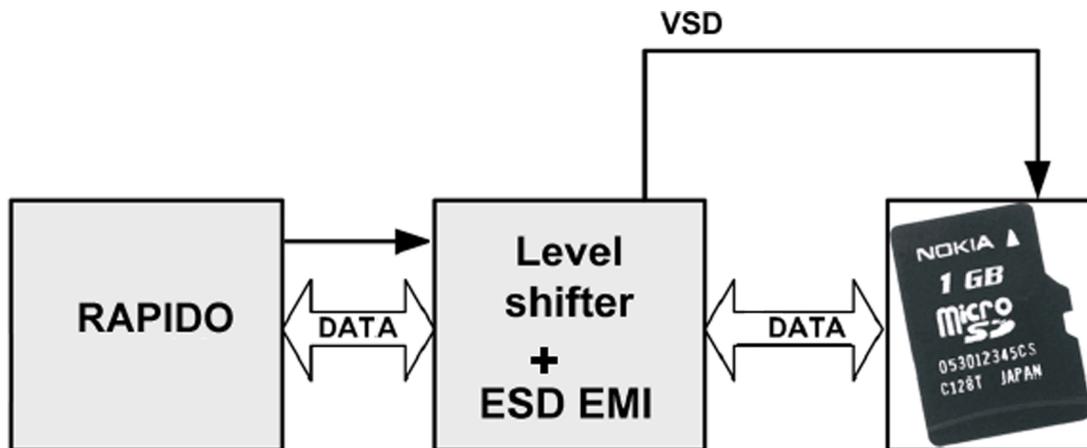
The MicroSD card is connected to the engine by an external level shifter with an ESD protection filter. Supplied voltages:

- VSD: 2.85 V (from level shifter)
- VIO: 1.8 V (from VIO SMPS)

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

■ Camera concept

Camera concept

The camera is supported by DM299 (N1400) Camera accelerator, which is used for image and video processing. DM-299 uses 64Mbit discrete SDRAM. The camera module includes 3MPix main camera, CIF+ secondary camera, Flash LED and TPS61052 LED driver which are connected to DM-299.

NOKIA
Care
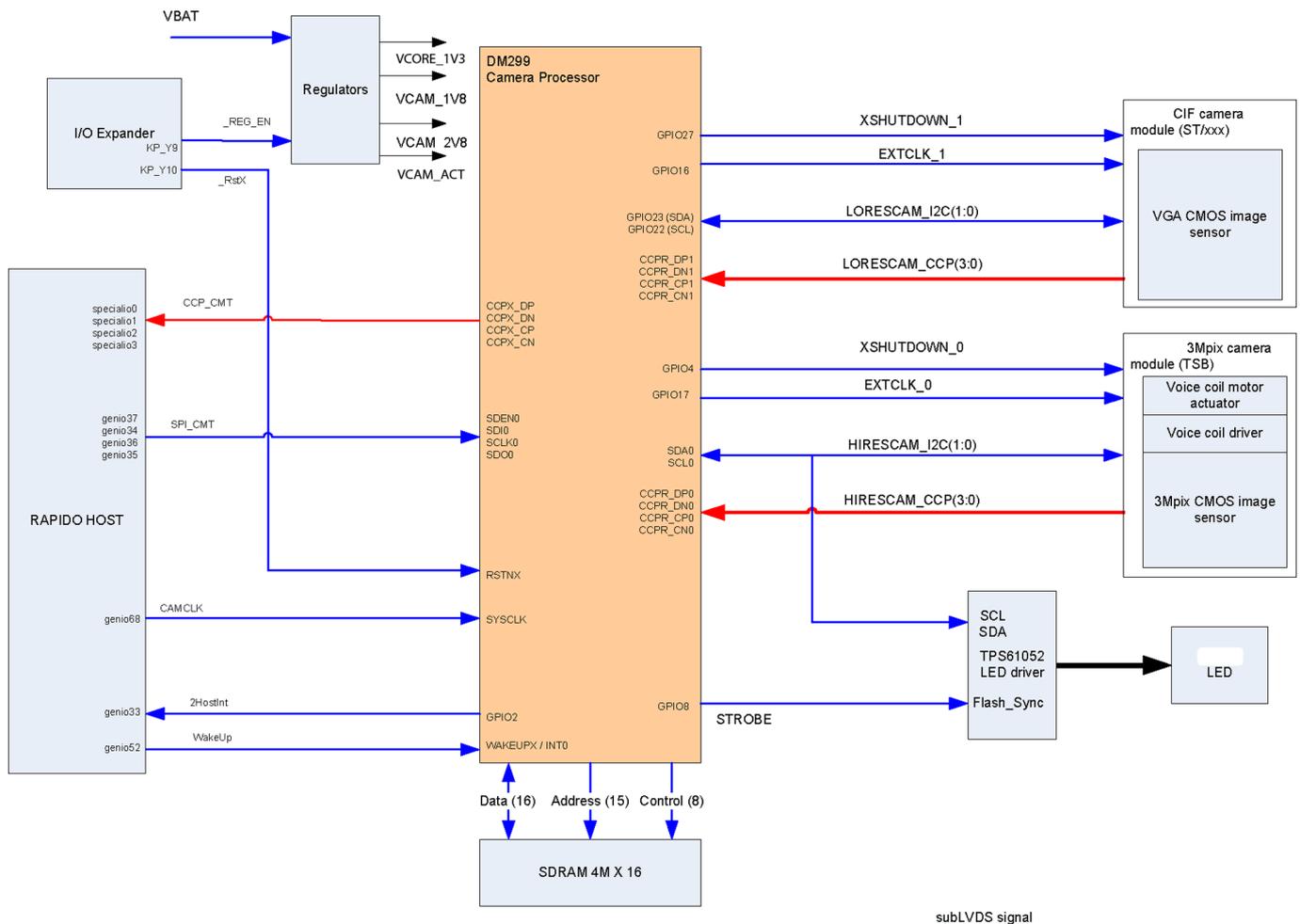
Figure 50 Camera block diagram

■ User interface

User interface

The UI module contains the following main features:

- ITU keypad and five-way cursor control and dedicated multimedia key implemented on a standard cross-point matrix

- Finger position sensing keys for functions not part of the ITU matrix

- Finger position sensing beneath the five-way cursor control for the implementation of scrolling features in the UI

- The handset microphone and one of the IHF speakers

- Various independently controlled lighting zones for the UI features described above

The cross-point matrix, LEDs, microphone and IHF are connected to the handset engine using the I/O expander described below, and the finger position sensing controller is connected via an I2C bus.

A block diagram of the UI module is shown below. For clarity, the filtering components are not shown.
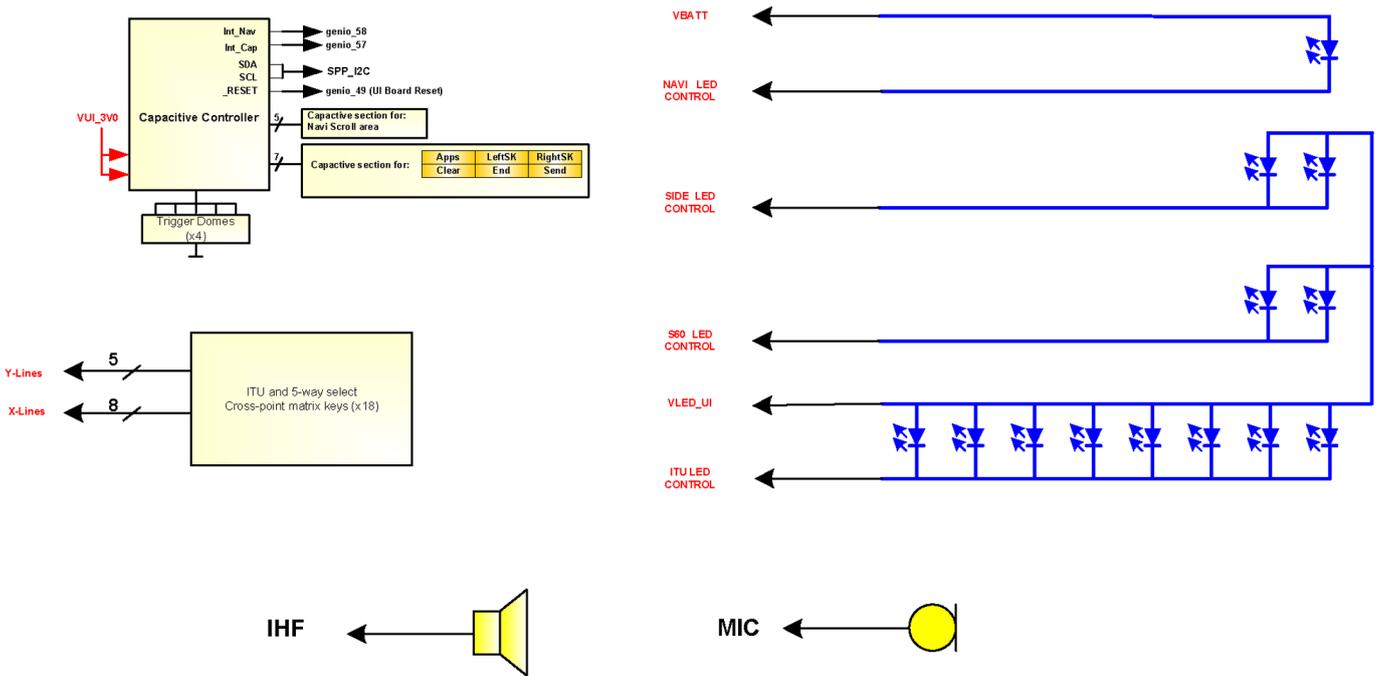
Figure 51 User interface block diagram

The interface to the UI capacitive sensing controller is at 3.0V, which is provided from the engine by a dedicated linear regulator, and a dedicated level shifter provides the interface to allow the otherwise 1.8V logic levels of the engine to be used on the UI.

The capacitive sensors function by sensing changes in the the charge coupled from one electrode to another when the users finger is placed close to the electrodes patterns. There are further mechanical domes associated with this sensing arrangement which only allows the scanning of the charge transfer to occur when the user presses down on the front of the UI module – this is intended to prevent false key-activations.

Due to the construction of the module (it is mostly glued together) service is not possible, and if faultly, must be replaced. This includes any faults that are found in the internal microphone or the lower of the two IHF speakers.

For operational reasons, the modules are supplied unlocalised, and the correct localization front-panel needs to be attached after the 'bare' module has been installed in the handset.

I/O expander and keyboard

HW51 supports I/O Expander. I/O expander is connected to Rapido via I2C bus and one GenIO is used as an interrupt pin. Keyboard matrix 7x6 is connected to I/O expander. In addition to keyboard matrix the I/O expander has general purpose IO:s and PWM-outputs. Camera accelerator RSTX and Regulator enable are connected to I/O expander GPIO:s.
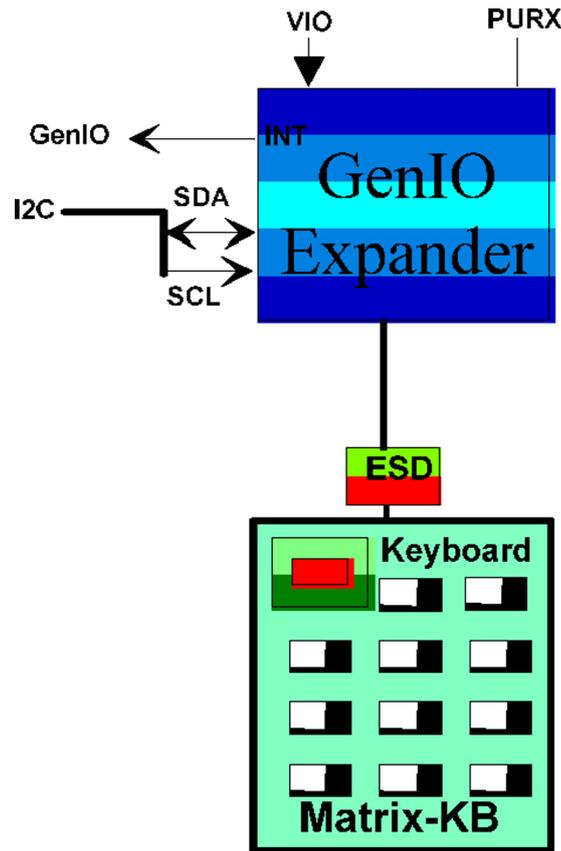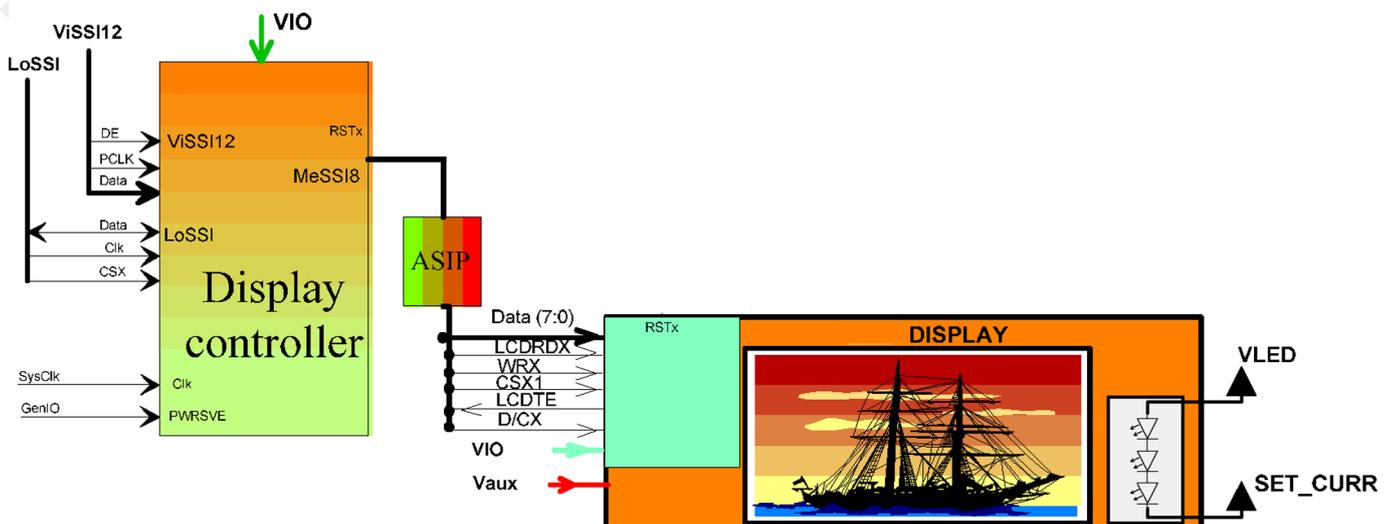
Figure 52 I/O expander and keyboard matrix

Display module

Display module

HW51 supports S1D13747 display controller (D2450). S1D13747 controlling is done via LOSSI IF and data is transferred via VISSI 12 bit IF. The display is connected to display controller shared MESSI 8 bit bus.

Backlight and illumination

When the backlight is enabled, the LED drive TPS65102 (N1451) is set to voltage mode by setting the ENVM input high, this overrides the I2C control from the camera processor and sets the output to a constant 5V. The TCA6507 switches the outputs P0 to P6 low depending on which group of LEDs are required to be on. The current is set by the resistors on these inputs. The driver circuit made up from transistor pair V2499 is required to ensure that the limits of the Navi Key LED forward voltage is achieved as this can not be guaranteed from the TCA6507.

The display backlighting is sourced from the constant current regulator N2301and enabled from the PWM 300 output from Betty. The current is set by the 33R resistor to ground.
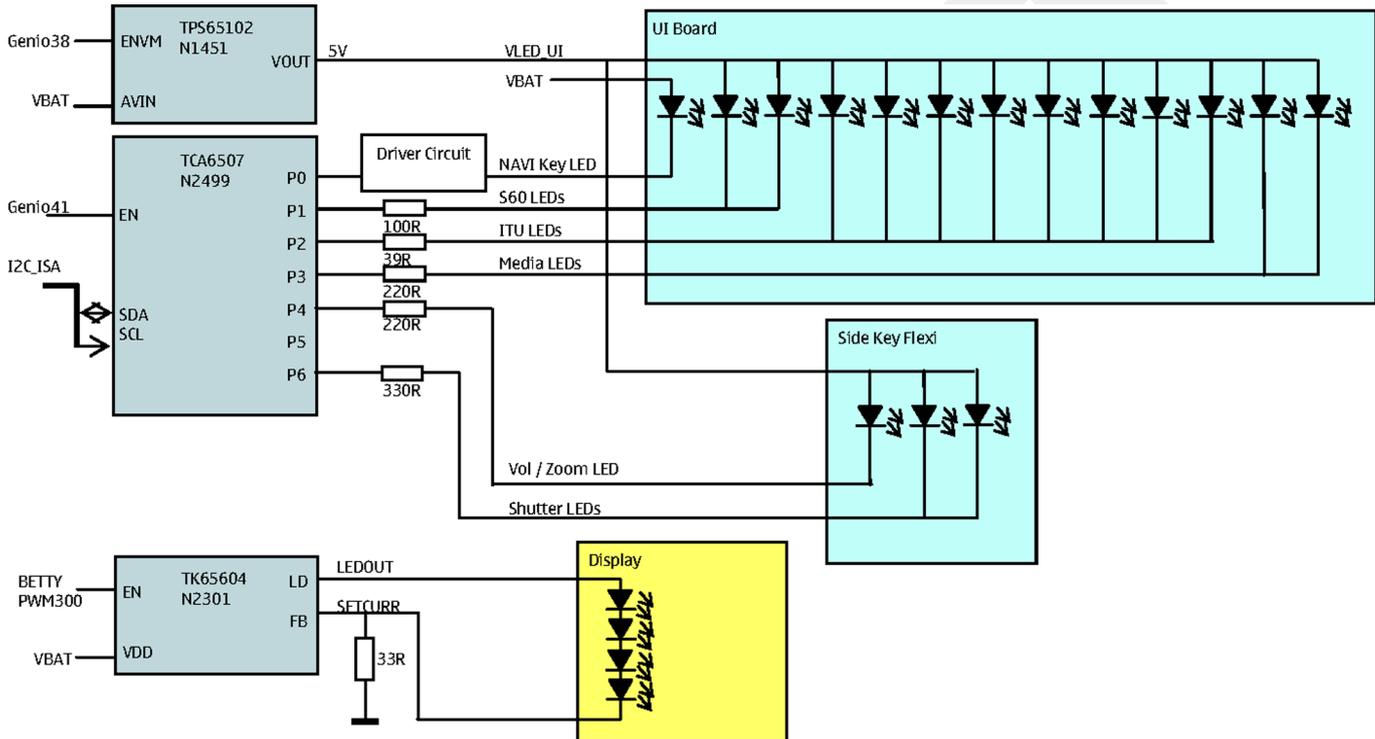

Figure 53 Display backlighting control

Ambient Light Sensor

In order to optimise user interface legibility, the display and UI illumination brightness is controlled by the handset according to the ambient lighting conditions. The ambient light level is measured by the handset using the Ambient Light Sensor/Detector N6502 which communicates to the engine via the I2C interface:
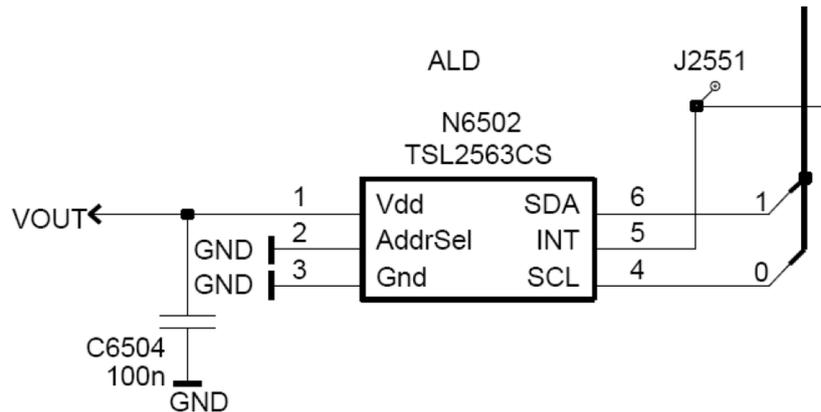
Figure 54 Ambient Light Sensor

The sensor light aperture is on the front of the handset next to the front camera aperture.

■ ASICs

RAPIDOYAWE

RAPIDOYAWE ASIC (D2800) is a die-stacked Processor (RAPIDO) with 3G HDSPA logic (YAWE). RAM memory is integrated into RAPIDO.

EM ASIC BETTY N2300

The EM ASIC (N2300) includes the following functional blocks:

- Core supply generation
- Charge control circuitry
- Level shifter and regulator for USB/FBUS
- Current gauge for battery current measuring
- LED control for display backlighting
- Digital interface (CBUS)

EM ASIC VILMA N2200

The EM ASIC (N2200) includes the following functional blocks:

- Start up logic and reset control
- Charger detection
- Battery voltage monitoring
- 32.768kHz clock with external crystal
- Real time clock with external backup battery
- SIM card interface
- Stereo audio codecs and amplifiers
- A/D converter
- Regulators
- Vibra interface
- Digital interface (CBUS)

EMC ASIP (Appcation Specified Integrated Passive) have been integrated inside the ASIC. It includes biasing passives for microphone , EMC filter for SIM, microphones etc.

■ Device memories

Combo memory

The memory of the device consists of stacked DDR SDRAM and MuxedMassMemory (M3). Combo memory DDR/M3 memory has 768Mb DDR + 2Gb M3.

■ Audio concept

Audio HW architecture

The functional core of the audio hardware is built around three ASICs: RAPIDOYAWE engine ASIC, mixed signal ASIC Avilma and D/A converter DAC33.

DAC33 converts digital audio signal to analog and is routed to the FM Transmitter and amplifier TPA6130 which provides an interface for the transducers and the accessory connector.

Integrated handsfree stereo speakers are driven by a D-class audio amplifier TPA2012D2.

There are two audio transducers:

- 7x11 mm dynamic earpiece
- Two 8X12 mm dynamic speakers

Avilma provides an output for the dynamic vibra component. All galvanic audio accessories are connected to the AV accessory connector.

A Bluetooth audio and FM radio module, which is connected to the RAPIDOYAWE supports Bluetooth audio and FM radio functionality.

Figure 55 Audio system block

Internal microphone

The internal microphone is used for HandPortable (HP) and Internal HandsFree (IHF) call modes and is fitted to the UI assembly.

Figure 56 Internal microphone

Internal earpiece

Internal earpiece is used for the HandPortable (HP) call mode. A dynamic 7x11 mm earpiece capsule is connected to Avilma ASIC's differential output EarP and EarN.
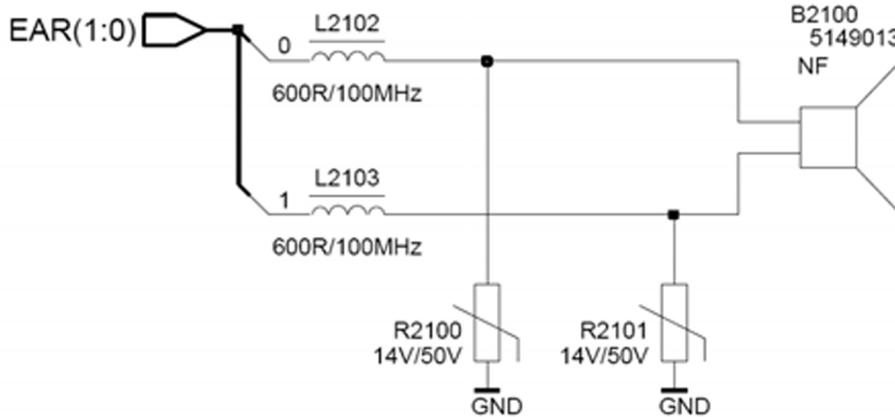

Figure 57 Internal earpiece circuitry

Internal speakers

Internal speakers are used for Internal HandsFree (IHF) call mode, video call, ringing tones, FM radio and music listening. Two dynamic 11x15mm speakers are connected to Avilma ASIC's outputs XearR/XearL via stereo D-class IHF amplifier TPA2012D2. The amplifier has 24 dB fixed gain and it is put to shutdown mode when not in use. Note that one of the speakers (not shown in schematic below) is located on the UI module assembly.
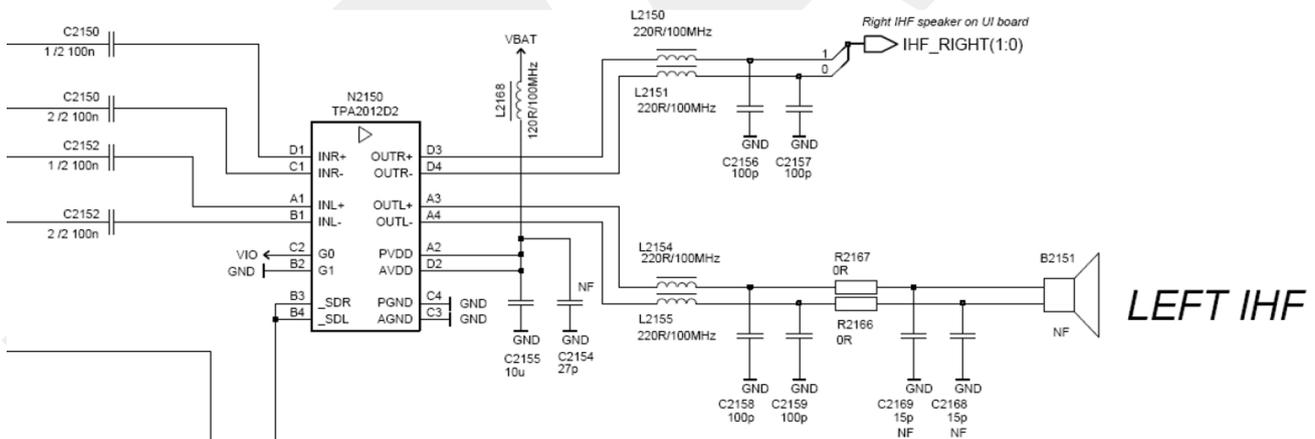

Figure 58 Internal speakers

Vibra circuitry

Vibra is used for the vibra alarm function.

The vibra motor is connected to the Avilma ASIC VibraP and VibraN Pulse Width Modulated (PWM) outputs.
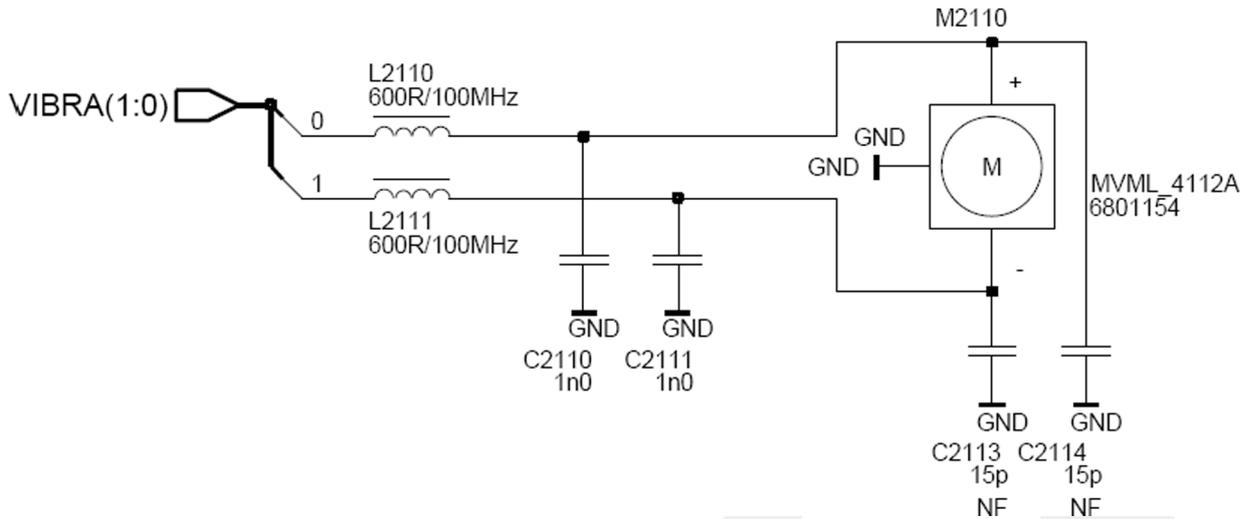
Figure 59 Vibra circuitry

Accessory AV connector

The features that are supported by HW51 accessory interface are the following:

- Audio output (stereo headset/headphones having the impedance >16ohm)
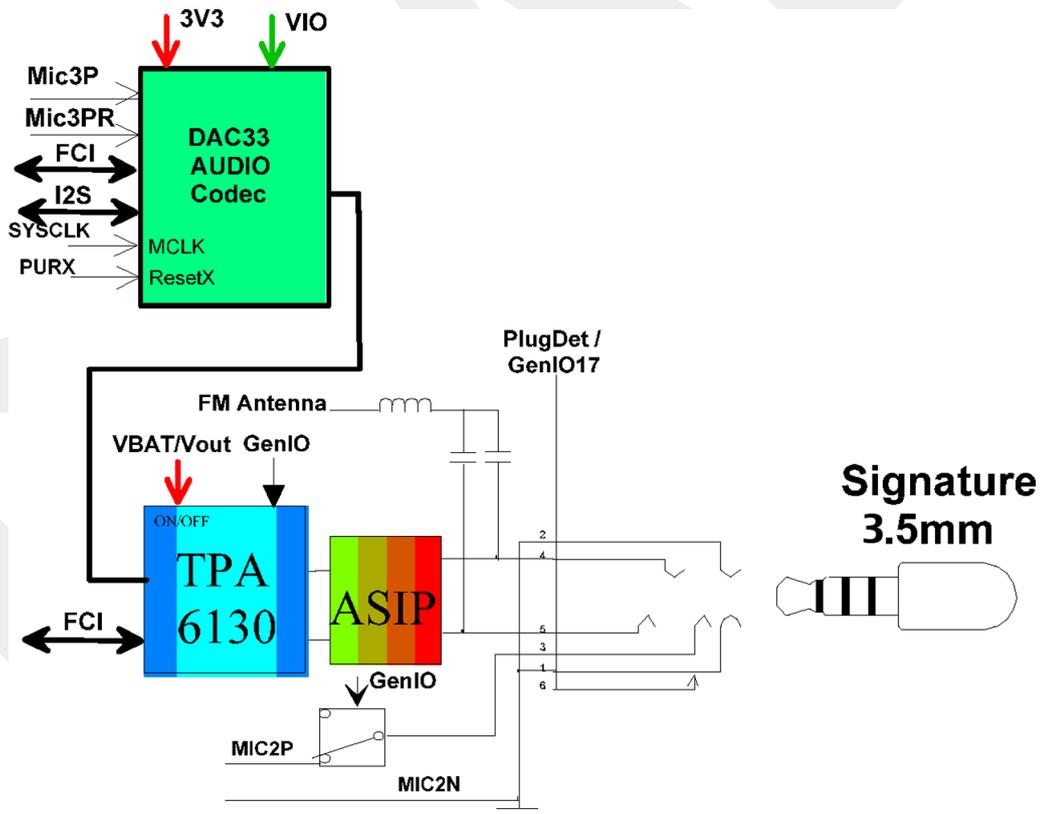- Audio input (mono microphone from headset)
- Control data (ECI)

Figure 60 Accessory (AV) connector with DAC33 and TPA6130 audio enhancements

■ **Baseband technical specifications**

External interfaces

Name of connection	Connector reference
HS USB	X3300
MicroSD card	X3200
Battery connector	X2070
SIM card reader	X2700
Accessory (AV) connector	X2010
Charger	X2000

SIM IF connections

Pin	Signal	I/O	Engine connection		Notes
3	VSIM	Out	EM ASIC N2200	VSIM1	Supply voltage to SIM card, 1.8V or 3.0V.
2	SIMRST	Out	EM ASIC N2200	SIM1Rst	Reset signal to SIM card
1	SIMCLK	Out	EM ASIC N2200	SIM1ClkC	Clock signal to SIM card
7	GND	-	GND		Ground
5	SIMDATA	In/Out	EM ASIC N2200	SIM1DaC	Data input / output

Charger connector and charging interface connections & electrical characteristics
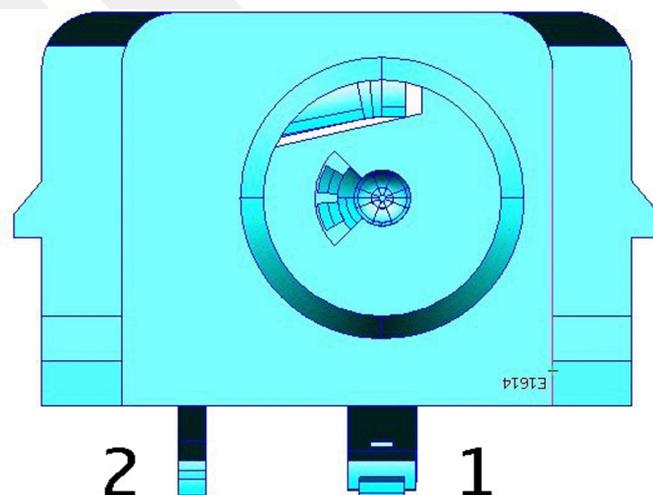

Figure 61 Charger connector

Table 14 Charging interface connections

Pin	Signal	I/O	Engine connection		Notes
1	Vchar	In	N2300	VCharIn1, 2	Charging voltage / charger detection, Center pin
2	Charge GND		Ground		Charger ground

Table 15 Charging IF electrical characteristics

Description	Parameter	Min	Max	Unit	Notes
Vchar	V Charge	0	9	V	Center pin
Vchar	I Charge		0.85	A	Center pin
Charge GND			0.85	A	

Internal interfaces

Name of connection	Component reference
DALS	N6502
Earpiece	B2100
Microphone	B2 (On UI Module)
IHF speakers	B2151 / B1
Main camera socket	X1450
Sub-camera	N1450
Main display connector	X2450
Vibra	M2110

Back-up battery interface electrical characteristics

Table 16 Back-up battery electrical characteristics

| Description	Parameter	Min	Typ	Max	Unit
Back-Up Battery Voltage	Vback	0	2.5	2.7	V

■ RF technical description

Receiver (RX)

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

The receiver functions are implemented in the RF ASIC.

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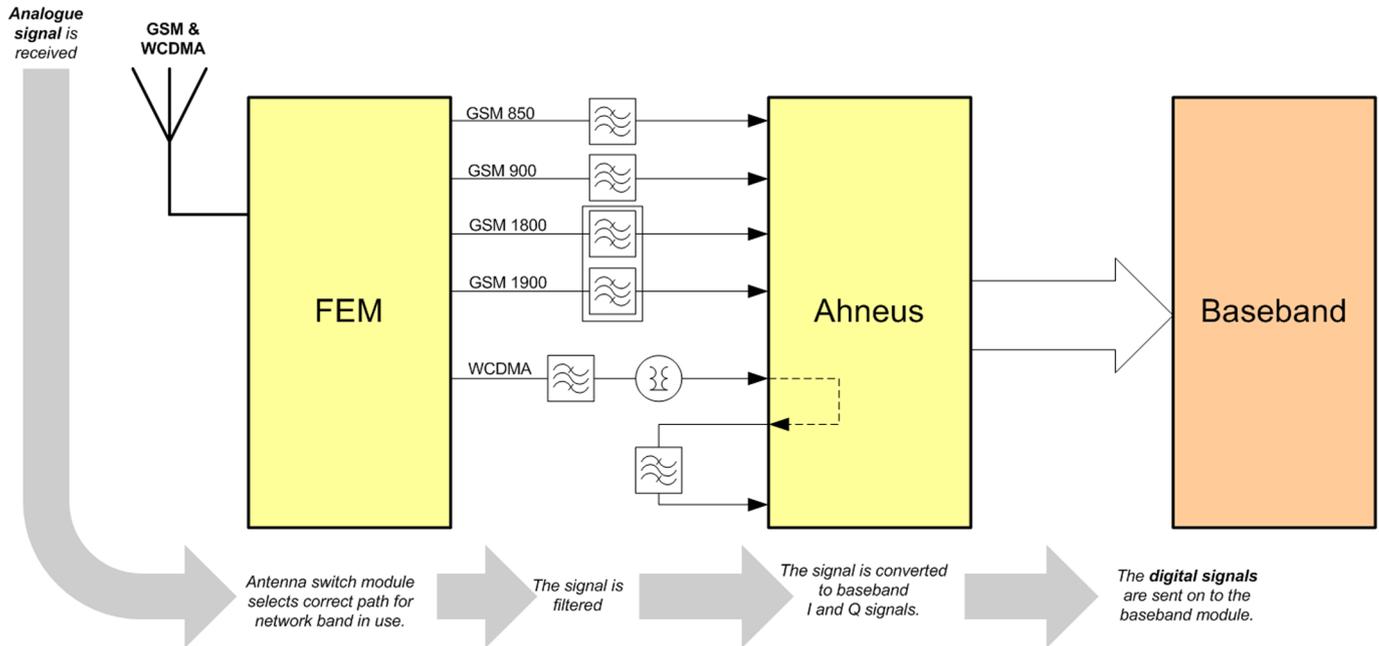
Transmitter (TX)

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

The transmitter functions are implemented in the RF ASIC.

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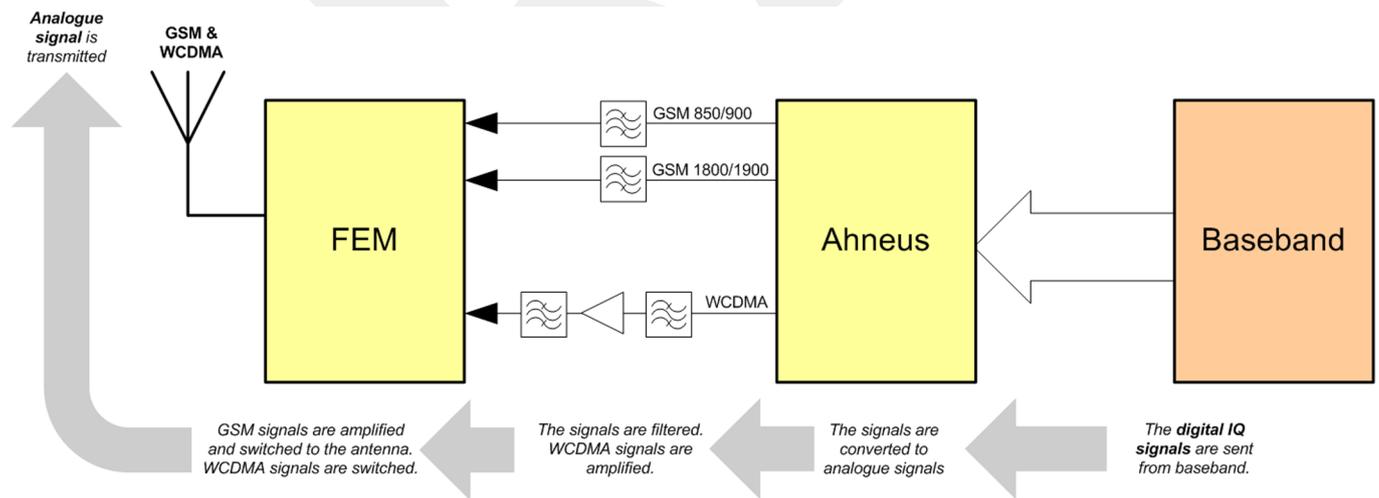
Nokia Customer Care

Glossary

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COMPANY CONFIDENTIAL

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

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

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

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

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

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