Nokia Customer Care

Service Manual

RM-156 (Nokia N93i)

Mobile Terminal

Part No: 9200670 (Issue 1)

COMPANY CONFIDENTIAL

NOKIA

Amendment Record Sheet

Amendment No	Date	Inserted By	Comments
Issue 1	01/2007	M. Hautaniemi	

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IMPORTANT

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

Warnings and cautions

Warnings

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

Cautions

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

ESD protection

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

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

To replace the covers ESD protection must be applied.

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

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

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

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

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

Care and maintenance

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

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

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

Company Policy

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

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

Please state:

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

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Battery information

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

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

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

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

For good operation times with Ni-Cd/NiMh 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 N93i Service Manual Structure

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1 — General Information

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RM-156 product selection

RM-156 is a WCDMA/GSM dual mode handportable phone, supporting WCDMA 2100/EGSM 900/1800/1900.

According to GSM standard 05.05 it responds to class 4 (max. 2 W) in EGSM900, class 1 (1 W) in GSM1800 and class 1 in GSM1900. The device supports EGPRS (EDGE) class B as well as Bluetooth 2.0 + EDR (Enhanced Data Rate) standard. The handset has a full phase 2 Type Approval and it complies with the GSM Type Approval. RM-156 also has a full CE approval and FCC (Federal Communications Commission) approval.

RM-156 supports two-way video calls with two integrated cameras. It is an MMS (Multimedia Messaging Service) enabled phone with a large bright colour display and an integrated 3.0 megapixel rear camera (3x optical zoom) and a CIF digital front camera.

The MMS implementation follows the OMA (Open Mobile Alliance) MMS standard release 1.2.

WAP 2.0 compatible browser supports XHTML Mobile Profile (MP) and uses a TCP/IP stack to communicate with a gateway in network.

RM-156 uses a Symbian 9.1 operating system and support also MIDP (Mobile Information Device Profile) Java 2.0 & CLDC 1.1 (Connected Limited Device Configuration), providing a good platform for 3rd party applications.

Figure 1 View of RM-156

Product features and sales package

Hardware characteristics

- Dual-mode: WCDMA2100/EGSM900/GSM1800/GSM1900 MHz
- Speech Codecs supported: AMR/FR/EFR

- WCDMA 2100 MHz with simultaneous voice and packet data (PS max speed DL/UL= 384/384kbps, CS max speed 64kpbs)
- Dual Transfer Mode (DTM) support for simultaneous voice and packet data connection in GSM/EDGE networks. Simple class A, multi slot class 11, max data speed to be: 177.6/118.4 kbits/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.
- 3.2 megapixel camera (2048 x 1536) with 3x continuous optical zoom and up to 20x digital zoom; High quality lens solution.
- Stereo microphone.
- LED Flash and red recording indicator LED.
- Sub camera, CIF (352 x 288) sensor.
- Large bright 2.4” QVGA (240 x 320 pixels) TFT colour display with 16.7M colours and wide viewing angle. Ambient light detector - used to optimize display brightness and power consumption
- Sub-display – 1.1” PM-OLED colour display (128x36), 65,536 colours.
- Keys : ITU numeric keys, Send/End keys, S60 keys (Application, Edit, Clear, 5-way navi key), Operator/ Multimedia key, Left/Right selection keys, Upper/Lower Landscape selection keys, Shutter key, Zoom key, Side 5-way navi key, Camera mode key, Flash key, Power key.
- 50 Mbytes internal user memory
- Internal antennas
- Integrated handsfree speaker
- Vibrator
- Stereo FM radio
- (U)SIM chip slot (1.8 and 3.0 V)
- TV output support (PAL/NTSC)
- miniSD memory card support (hot swappable)
- Pop-Port™ interface with USB 2.0 connectivity
- WLAN - IEEE802.11 g /b
- Bluetooth wireless technology 2.0
- Infrared

Software platform

- Symbian 9.1
- Nokia Series 60 3.0 User Interface : C++ and Java SDKs

User interface

- **Imaging**
  - **Capture**
    - Video: Record DVD-like MPEG-4 VGA 30 fps movies with stereo audio and stabilization.
    - Photos: Take high quality 3.2 megapixel pictures. User settings for Scene, Flash, White Balance, Exposure and Colour tone. Self timer support.
    - Sequence mode: Capture 6 pictures in 2 seconds.
  - **Edit**
    - Photo editor

        - Video editor
    - **View**
        - Slideshow from Gallery
        - Show photo and videos on TV
    - **Share**
        - Sending via Bluetooth, Infrared, MMS, e-mail
        - Online Album : Image/Video uploading from Gallery
    - **Print**
        - Nokia XpressPrint – direct printing from phone, memory card or via online album.
    - **Store**
        - Gallery with album support
        - Nokia Lifeblog
- **Messaging**
    - - Multimedia Messaging
        - Concatenated SMS (MO/MT)
        - E-mail (SMTP, IMAP4, POP3)
        - Predictive text input
- **Music**
    - Music player : Supports MP3/AAC/WMA with playlists
    - Stereo FM radio + Visual radio support
- **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)
- **Phone**
    - 3GPP Rel '99 compliant
    - Voice dialling (Flexible SIND)
    - Voice commands
    - Push to Talk (PoC)
- **Java:** MIDP2.0
- **Browser :** full web browser
- **Personalization**
    - Themes
    - SP-MIDI (64 polyphonics), True Tones
- **Location based services**
    - MT-LR Control Plane Cell-Id Positioning with DTAP LCS Location Notification

Sales package

- Transceiver with lens cover
- BL-5F li-ion battery cell
- Mini-SD memory card (1GB)
- CA-53 connectivity cable (USB)
- CA-64U video out cable
- AC-4 travel charger
- CP-83 carrying case
- CP-84 wrist strap
- HS-23 stereo headset
- User guide, Quick start guide, and add-on application guide
- DVD-ROM (with PC Suite and other applications)

Mobile enhancements

Table 1 Audio

Enhancement	Type
Headsets	
Wireless Headset	HS-11W
	HS-26W
	HS-37W
	HDW-3
	BH-300 (HS-50W)
	HS-36W
Wireless Clip-on Headset	HS-21W
Wireless Image Headset	HS-13W
Wireless Boom Headset	HS-4W
Bluetooth Headset	BH-800 (HS-24W)
	BH-900 (HS-25W)
	BH-700(HS-57W)
	BH-200 (HS-58W)
	BH-600(HS-59W)
	BH-301 (HS-51W) PR2
	BH-302 (HS-73W)
	BH-202 (HS-38W)
	BH-801 (HS-64W) PR2
	BH-500 (HS-39W) PR2
	BH-501 (HS-71W)

Enhancement	Type
Wireless Stereo Headset	HS-12W (PR-2)
	HS-34W (PR-2)
Boom Headset	HDB-4
Headset	HS-5
Activity Stereo Headset	HS-8
Stereo Headset	HS-23
	HDS-3
Stereo Fashion Headset	HS-3
Activity Stereo Headset	HS-29
Display Headset	HS-6
Music Headset	HS-20
Fashion Stereo Headset	HS-31
Stereo Headset	HDS-3
Music Display Headset	HS-69
Other	
Music Stand	MD-1
Audio Adapter	AD-15
	AD-46
Inductive Loopset	LPS-4
Mini Speaker	MD-4

Table 2 Car

Enhancement	Type
Car kits	
Advanced Car Kit	CK-7W
	CK-20W
Wireless Car Kit	CK-1W
Car Kit	N616
Other car enhancements	
Mobile Charger	DC-4
Headrest Handsfree	BHF-3
Wireless Plug-in Car Handsfree	HF-3
	HF-6W
	HF-35W
	HF-33W (PR2)

Enhancement	Type
Universal Mobile Holder	CR-39
Wireless GPS Module	LD-3W
GPS module	LD-2

Table 3 Carrying

Enhancement	Type
Carrying case	CP-83
Wrist strap	CP-84

Table 4 Data

Enhancement	Type
Connectivity Cable	CA-53
Video out cable	CA-64U
Charging Data Cable	CA-70
Wireless GPS Module	LD-1W
Memory Cards	Mini SD 64MB Mini-SD 128MB Mini-SD 256MB Mini-SD 512MB Mini-SD 1GB Mini SD 2GB MU-36
TTY Adapter	HDA-10

Table 5 Messaging

Enhancement	Type
Wireless Keyboard	SU-8W
Digital Pen	SU-1B
	SU-27W

Table 6 Power

Enhancement	Type
Chargers	
Travel Charger	AC-4
	AC-5
Compact charger	AC-3

Enhancement	Type
Charging Adapter	CA-44
Batteries	
Battery	BL-5F

Technical specifications

Transceiver general specifications

Unit	Dimensions (L x W x T)	Weight (g)	Volume (cm^3)
Transceiver with BL-5F 950 mAh li-ion battery back	46.2 x 40 x 5.4	21	9.98

Main RF characteristics for triple-band (EGSM900/GSM1800/GSM1900) and WCDMA phones

Parameter	Unit
Cellular system	EGSM900, GSM1800/1900 and WCDMA
Rx frequency band	EGSM900: 925 - 960 MHz
	GSM1800: 1805 - 1880 MHz
	GSM1900: 1930 - 1990 MHz
	WCDMA: 2110 - 2170 MHz
Tx frequency band	EGSM900: 880 - 915 MHz
	GSM1800: 1710 - 1785 MHz
	GSM1900: 1850 - 1910 MHz
	WCDMA: 1920 - 1980 MHz
Output power	GSM900: +5 ... +33dBm/3.2mW ... 2W
	GSM1800: +0 ... +30dBm/1.0mW ... 1W
	GSM1900: +0 ... +30dBm/1.0mW ... 1W
	WCDMA -50 ... 21 dBm
Number of RF channels	GSM900: 125
	GSM1800: 375
	GSM1900: 300
	WCDMA: 277
Channel spacing	200 kHz
Number of Tx power levels	GSM900: 15
	GSM1800: 16
	GSM1900: 16

Operating times

Battery	Talk time	Stand-by	Still Images	Video capture	Video call talk time	Video playback time	Music playback time
BL-5F 950 mAh	3.1 - 3.9 hrs (GSM) 1.7 - 3.3 hrs (WCDMA)	9.3 - 11.8 days (GSM) 7.8 - 9.4 days (WCDMA)	up to 291 pictures (3M, flash off)	up to 112 min (VGA, 30fps)	up to 107 min	up to 205 min (VGA, 30fps)	up to 6.3 hours (offline mode)

Note: Operating times with in-box battery. Variation in operation times will occur depending on SIM card, network settings and usage.

Charging times

AC-4
1 h 15 min

Environmental conditions

Table 7 Environmental conditions

Environmental condition	Ambient temperature	Notes
Normal operation	-15ºC...+55ºC	Specifications fulfilled
Reduced performance	-20ºC...-15ºC +35ºC...+55ºC	Main camera performance reduced.
Charging allowed	-25ºC...+50ºC	
Long term storage conditions	0ºC...+85ºC	

2 — Parts Lists and Component Layouts

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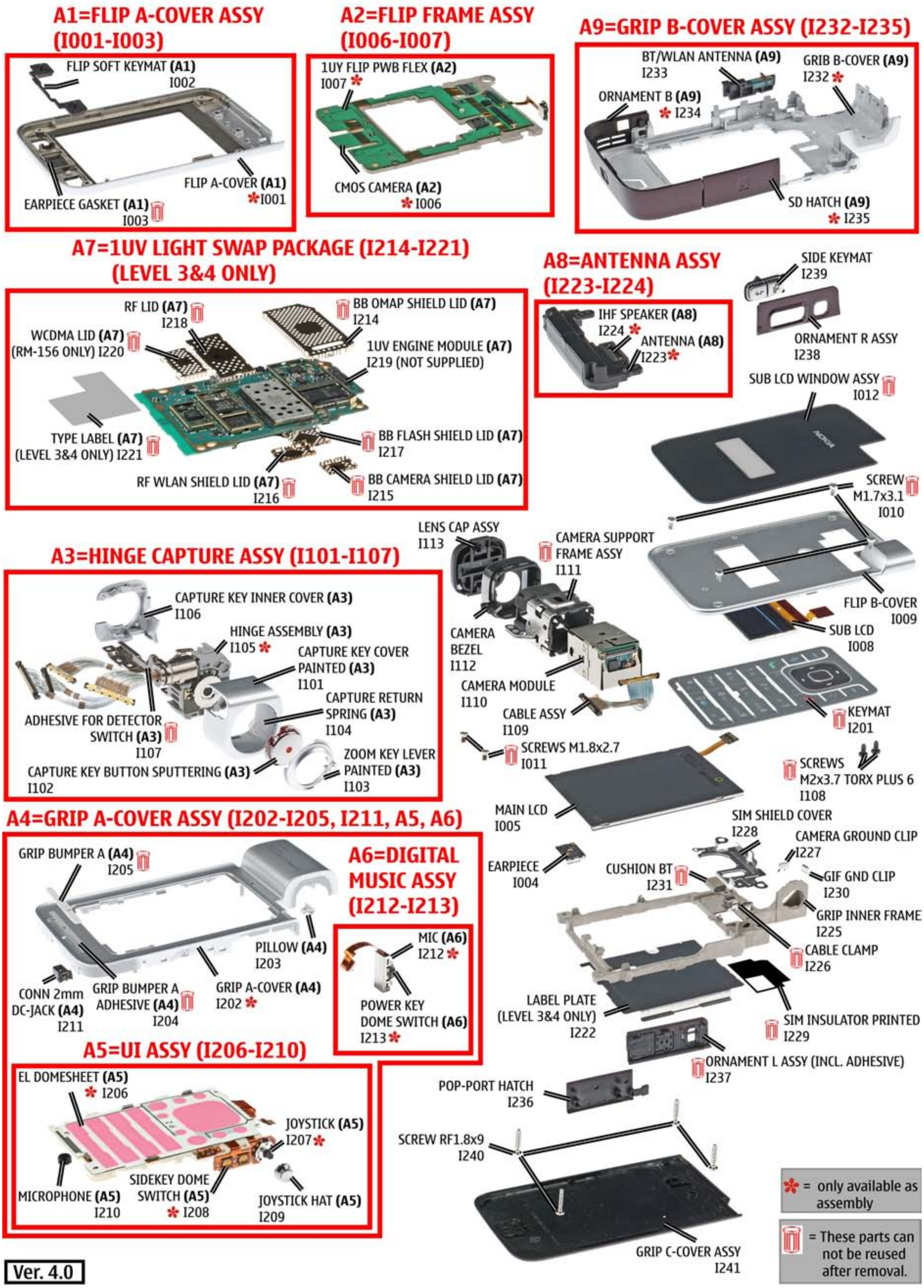
Spare parts overview and exploded view



Mechanical spare parts list

Note: For Nokia product codes, please refer to the latest Service Bulletins on the Partner Website (PWS). To ensure you are always using the latest codes, please check the PWS on a daily basis.

ITEM/ CIRCUIT REF.	QTY	SPARE PART DESCRIPTION
A1	1	FLIP A-COVER ASSY (I001 - I003)
I001	1	FLIP A-COVER
I002	1	FLIP SOFT KEYMAT
I003	1	EARPIECE GASKET
I004	1	EARPIECE
I005	1	MAIN LCD
A2	1	FLIP FRAME ASSY (I006 - I007)
I006	1	CMOS CAMERA
I007	1	1 UY FLIP PWB FLEX
I008	1	SUB LCD
I009	1	FLIP B-COVER
I010	4	SCREW M1.7 x 3.1
I011	2	SCREW M1.8x2.7
I012	1	SUB LCD WINDOW ASSY
A3	1	HINGE CAPTURE ASSY (I101 - I107)
I101	1	CAPTURE KEY COVER PAINTED
I102	1	CAPTURE KEY BUTTON SPUTTERING
I103	1	ZOOM KEY LEVER PAINTED
I104	1	CAPTURE RETURN SPRING
I105	1	HINGE ASSEMBLY
I106	1	CAPTURE KEY INNER COVER
I107	1	ADHESIVE FOR DETECTOR SWITCH
I108	2	SCREW M2X3.7 TORX PLUS 6
I109	1	CABLE ASSY
I110	1	CAMERA MODULE
I111	1	CAMERA SUPPORT FRAME ASSY
I112	1	CAMERA BEZEL
I113	1	LENS CAP ASSY
I201	1	KEYMAT

ITEM/ CIRCUIT REF.	QTY	SPARE PART DESCRIPTION
A4	1	GRIP A-COVER ASSY (I202 - I205, I211, A5, A6)
I202	1	GRIP A-COVER
I203	1	PILLOW
I204	1	GRIP BUMPER A ADHESIVE
I205	1	GRIP BUMPER A
A5	1	UI ASSY (I206 - I210)
I206	1	EL DOMESHEET ASSY
I207	1	JOYSTICK
I208	1	SIDEKEY DOME SWITCH
I209	1	JOYSTICK HAT
I210	1	MICROPHONE
I211	1	CONN 2mm DC-JACK
A6	1	DIGITAL MIC ASSY (I212 - I213)
I212	2	MIC
I213	1	POWER KEY DOME SWITCH
A7	1	1UV LIGHT SWAP PACKAGE (I214 - I221)
I214	1	BB OMAP SHIELD LID
I215	1	BB CAMERA SHIELD LID
I216	1	RF WLAN SHIELD LID
I217	1	BB FLASH SHIELD LID
I218	1	RF LID
I219	1	1UV ENGINE MODULE
I220	1	WCDMA LID (RM-156 only)
I221	1	TYPE LABEL
I222	1	LABEL PLATE
A8	1	ANTENNA ASSY (I223 - I224)
I223	1	ANTENNA
I224	1	IHF SPEAKER
I225	1	GRIP INNER FRAME
I226	1	CABLE CLAMP
I227	1	CAMERA GROUND CLIP
I228	1	SIM SHIELD COVER
I229	1	SIM INSULATOR PRINTED

ITEM/ CIRCUIT REF.	QTY	SPARE PART DESCRIPTION
I230	1	GIF GND CLIP
I231	1	CUSHION BT
A9	1	GRIP B-COVER ASSY (I232 - I235)
I232	1	GRIP B-COVER
I233	1	BT/WLAN ANTENNA
I234	1	ORNAMENT B
I235	1	SD HATCH
I236	1	POP-PORT HATCH
I237	1	ORNAMENT L ASSY (incl. Adhesive)
I238	1	ORNAMENT R ASSY
I239	1	SIDE KEYMAT
I240	4	SCREW RF 1.8X9
I241	1	GRIP C-COVER ASSY

Component parts lists and layouts

Engine PWB component parts list

Table 8 Component parts list 1UV_060a

Note: For Nokia product codes, please refer to the latest Service Bulletins on the Partner Website (PWS). To ensure you are always using the latest codes, please check the PWS on a daily basis.

Item	Side	Grid ref.		Type	Description and value		
A1	Top	G	7	SHIELD_040_0136 93	RF SHIELD ASSEMBLY	~	~
A2	Top	G	4	SHIELD_WCDMA	WCDMA-SHIELD ASSEMBLY	~	~
A3	Bot	F	12	SHIELD_040_0230 57	RF WLAN SHIELD ASSY 040-023057	~	~
A4	Top	F	14	SHIELD_040_0230 51	BB OMAP SHIELD ASSY 040-023051	~	~
A5	Bot	D	14	SHIELD_040_0230 54	BB FLASH SHIELD ASSY 040-023054	~	~
A6	Bot	I	14	SHIELD_040_0230 48	BB CAMERA SHELD ASSY 040-023048	~	~
B8100	Top	D	3	MIC_OBE_415S42_ RC3310CL	CLAPTON EMC MICROPHONE MOD -42DB	~	~
C1001	Top	F	15	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V

Item	Side	Grid ref.		Type	Description and value		
C2000	Top	C	4	0402C	Chipcap 5% NP0	27p	50V
C2002	Bot	D	7	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2003	Bot	D	7	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2033	Bot	C	5	0402C	Chipcap 5% NP0	10p	50V
C2034	Bot	C	5	0402C	Chipcap 5% NP0	10p	50V
C2035	Bot	C	5	0402C	Chipcap 5% NP0	10p	50V
C2036	Bot	C	5	0402C	Chipcap 5% NP0	10p	50V
C2039	Top	C	4	0603C_H0.95	CHIPCAP X5R 470N K 25V 0603	470n	25V
C2041	Top	I	13	0402C	Chipcap 5% NP0	68p	50V
C2042	Top	J	13	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V
C2043	Bot	C	7	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V
C2044	Bot	D	8	0402C	Chipcap 5% NP0	22p	50V
C2045	Bot	D	8	0402C	Chipcap 5% NP0	22p	50V
C2070	Top	C	4	TANT_C_6.2X3.4_H 1.7	CHIPTCAP 150U M 10V 6X3.2X1.5	150u_10V	10V
C2151	Bot	F	4	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2152	Bot	F	5	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2153	Bot	F	5	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2155	Bot	I	4	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2156	Bot	I	4	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2157	Bot	I	4	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2158	Top	E	15	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V
C2165	Top	D	11	0402C	Chipcap 5% X7R	820p	50V
C2170	Top	E	4	0402C	Chipcap 5% NP0	22p	50V
C2171	Bot	J	5	0402C	Chipcap 5% NP0	27p	50V
C2172	Bot	G	5	0402C	Chipcap 5% NP0	27p	50V

Item	Side	Grid ref.		Type	Description and value		
C2750	Bot	H	14	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V
C4200	Top	C	14	0405_DUAL	CHIPCAP NETWORK X5R 2X1U5 K 6V3 0405	2x1u5	6.3V
C4201	Top	D	15	0805C	CHIPCAP X5R 22U M 6V3 0805	22u	6V3
C4203	Top	D	14	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C4204	Top	C	14	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V
C4205	Top	D	13	0805C	CHIPCAP X5R 22U M 6V3 0805	22u	6V3
C4206	Top	C	15	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C4207	Top	I	15	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V
C4208	Top	D	14	0405_DUAL	CHIPCAP NETWORK X5R 2X1U5 K 6V3 0405	2x1u5	6.3V
C4209	Top	D	13	0805C	CHIPCAP X5R 22U M 6V3 0805	22u	6V3
C4211	Top	D	14	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C4212	Top	D	14	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C4213	Top	C	15	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V
C4214	Top	C	15	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C4215	Top	C	15	0405_DUAL	CHIPCAP NETWORK X5R 2X1U5 K 6V3 0405	2x1u5	6.3V
C4216	Top	D	14	0805C	CHIPCAP X5R 22U M 6V3 0805	22u	6V3
C4219	Top	H	15	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V
C4800	Top	F	14	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V
C4801	Top	G	15	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V
C4802	Top	H	12	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V

Item	Side	Grid ref.		Type	Description and value		
C4803	Top	I	13	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V
C4804	Top	F	14	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V
C4806	Top	F	13	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V
C4807	Top	F	12	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V
C4808	Top	G	12	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V
C4813	Top	I	15	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V
C4814	Top	G	12	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C4816	Top	F	13	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V
C4817	Top	G	12	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V
C4818	Top	H	12	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V
C4819	Top	H	12	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V
C4820	Top	F	15	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V
C4821	Top	G	15	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V
C4822	Top	H	15	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V
C4823	Top	I	14	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V
C4824	Top	F	13	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V
C4825	Top	F	15	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C4826	Top	F	14	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C4828	Top	F	15	0402C	Chipcap 5% NP0	22p	50V
C4830	Top	G	15	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V
C4832	Top	I	15	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V

Item	Side	Grid ref.		Type	Description and value		
C4833	Top	I	14	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V
C4834	Top	F	13	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V
C4835	Top	F	14	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C4836	Top	F	14	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V
C4838	Top	H	15	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V
C4840	Top	I	15	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C4841	Top	I	14	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C4850	Top	I	15	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V
C5250	Bot	F	7	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V
C5251	Bot	G	7	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C6100	Top	D	8	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C6101	Top	D	8	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C6150	Top	C	9	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C6151	Top	C	7	0402C	CHIPCAP X5R 1U K 6V3 0402	1u0	6.3V
C6157	Top	C	7	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C6158	Top	C	7	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C6195	Top	C	7	0402C	Chipcap 5% NP0	100p	50V
C6300	Bot	E	12	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C6301	Bot	F	12	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C6302	Bot	D	13	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C6304	Bot	E	11	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V

Item	Side	Grid ref.		Type	Description and value		
C6305	Bot	E	12	0402C	CHIPCAP X7R 33N K 10V 0402	33n	10V
C6306	Bot	E	13	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C6421	Bot	F	13	0402C	CHIPCAP X7R 33N K 10V 0402	33n	10V
C6434	Bot	E	13	0603C	CHIPCAP X5R 2U2 K 6V3 0603	2u2	6V3
C6435	Bot	F	11	0603C_H0.95	CHIPCAP X5R 1U0 K 10V 0603	1u0	10V
C7400	Top	I	8	0402C	CHIPCAP N750 1P8 C 50V 0402	1p8	50V
C7504	Top	J	8	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C7510	Top	H	4	0402C	Chipcap 5% NP0	10p	50V
C7511	Top	G	4	0402C	Chipcap 5% NP0	10p	50V
C7512	Top	F	4	0402C	Chipcap X7R 5% 25V 0402	4n7	25V
C7513	Top	E	7	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C7514	Top	E	8	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C7515	Top	G	6	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C7516	Top	G	6	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C7517	Top	E	7	0402C	Chipcap 5% X7R	3n9	50V
C7518	Top	E	7	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C7520	Top	H	6	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V
C7522	Top	E	7	0603C	CHIPCAP NP0 2N2 G 16V 0603	2n2	16V
C7524	Top	E	6	0402C	Chipcap 5% NP0	10p	50V
C7525	Top	E	7	0402C	CHPCAP NP0 470P J 50V 0402	470p	50V
C7526	Top	E	6	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V
C7530	Top	F	5	0402C	Chipcap X7R 5% 25V 0402	4n7	25V

Item	Side	Grid ref.		Type	Description and value		
C7541	Top	F	5	0603C	CHIPCAP X5R 10UF 6V3 0603	10u	4V
C7587	Top	F	4	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C7600	Top	I	6	0402C	Chipcap 5% NP0	15p	50V
C7612	Top	H	5	0402C	CERCAP X7R 22N K 16V 0402	22n	16V
C7621	Top	E	6	0402C	CHIPCAP X7R 33N K 10V 0402	33n	10V
C7660	Top	J	6	0402C	Chipcap +-0.25pF NP0	1p8	50V
C7663	Top	E	6	0402C	CHIPCAP NP0 0P5 C 50V 0402	0p5	50V
C7664	Top	J	4	0402C	Chipcap 5% NP0	27p	50V
C8521	Top	D	16	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C8522	Bot	K	12	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V
C8704	Bot	I	15	0805C	CHIPCAP X5R 2U2 K 10V 0805	2u2	10V
C8705	Bot	I	14	0402C	Chipcap 5% NP0	27p	50V
C8706	Bot	H	15	0805C	CHIPCAP X5R 2U2 K 10V 0805	2u2	10V
C8707	Bot	I	15	0603C_H0.95	CHIPCAP X5R 1U0 K 10V 0603	1u0	10V
C8708	Bot	I	15	0402C	Chipcap 5% NP0	10p	50V
C8709	Bot	I	15	0603C_H0.95	CHIPCAP X5R 1U0 K 10V 0603	1u0	10V
C8710	Bot	I	14	0603C_H0.95	CHIPCAP X5R 1U0 K 10V 0603	1u0	10V
C8711	Bot	I	14	0402C	Chipcap 5% NP0	10p	50V
C8712	Bot	I	14	0603C_H0.95	CHIPCAP X5R 1U0 K 10V 0603	1u0	10V
C8721	Bot	D	14	0805C	CHIPCAP X5R 22U M 6V3 0805	22u	6V3
C8726	Bot	G	16	0603C	CHIPCAP X5R 10UF 6V3 0603	10u	4V
C8727	Bot	E	16	0603C	CHIPCAP X5R 10UF 6V3 0603	10u	4V
C8728	Bot	F	16	0603C	CHIPCAP X5R 10UF 6V3 0603	10u	4V

Item	Side	Grid ref.		Type	Description and value		
C8729	Bot	F	16	0603C	CHIPCAP X5R 10UF 6V3 0603	10u	4V
C8731	Top	I	14	0402C	Chipcap 5% NP0	10p	50V
C8735	Bot	C	14	0805C	CHIPCAP X5R 2U2 K 25V 0805	2u2	25V
C8900	Bot	I	11	0402C	Chipcap 5% NP0	27p	50V
C8901	Bot	H	11	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C8906	Bot	I	13	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C8908	Bot	I	11	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C8920	Bot	G	12	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C8921	Bot	G	12	0402C	Chipcap 5% NP0	27p	50V
C8922	Top	D	10	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C8923	Top	D	10	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C8924	Bot	H	11	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C8990	Bot	J	11	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C9100	Top	C	11	0402C	CHIPCAP X5R 1U K 6V3 0402	1u0	6.3V
C9101	Top	C	10	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C9106	Top	J	5	0402C	Chipcap 5% NP0	18p	50V
C9107	Top	I	5	0402C	Chipcap 5% NP0	27p	50V
C9300	Top	K	10	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V
C9301	Top	I	5	0402C	Chipcap 5% X7R	1n0	50V
C9302	Top	J	4	0402C	Chipcap 5% X7R	1n0	50V
C9303	Top	J	5	0402C	Chipcap 5% NP0	27p	50V
C9330	Top	E	6	0402C	CHIPCAP NP0 0P5 C 50V 0402	0p5	50V
C9401	Top	F	8	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C9402	Top	F	8	0402C	Chipcap X7R 10% 16V 0402	10n	16V

Item	Side	Grid ref.		Type	Description and value		
C9900	Bot	K	12	0402C	CHIPCAP X5R 1U K 6V3 0402	1u0	6.3V
C9902	Bot	J	13	0402C	Chipcap 5% NP0	68p	50V
C9903	Bot	K	13	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C9905	Top	D	13	0603C_H0.95	CHIPCAP X5R 1U0 K 10V 0603	1u0	10V
C9906	Top	D	12	0402C	Chipcap 5% NP0	10p	50V
C9907	Top	E	12	0805C	CHIPCAP X5R 22U M 6V3 0805	22u	6V3
C9911	Top	F	6	0402C	Chipcap 5% NP0	47p	50V
C9913	Bot	E	5	0402C	Chipcap 5% NP0	27p	50V
C9916	Top	C	13	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V
C9917	Top	D	13	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V
C9918	Top	I	4	0402C	Chipcap +-0.25pF NP0	1p8	50V
C9919	Top	F	8	0402C	Chipcap 5% NP0	15p	50V
C9921	Top	J	5	0402C	Chipcap +-0.25pF NP0	2p2	50V
C9930	Top	J	5	0402C	Chipcap 5% X7R	1n2	50V
C9940	Top	G	8	0402C	Chipcap 5% NP0	15p	50V
C9941	Top	F	8	0402C	CHIPCAP NP0 1P0 B 50V 0402	1p0	50V
C9942	Top	F	8	0402C	Chipcap 5% NP0	15p	50V
C9951	Top	F	6	0402C	Chipcap 5% NP0	33p	50V
C9952	Top	E	5	0402C	Chipcap 5% NP0	47p	50V
C9953	Top	D	5	0402C	Chipcap +-0.25pF NP0	3p3	50V
D1001	Top	G	14	FBGA152_EMPTY	COMBO 1G M3 + 512M DDR DRAM FBGA152	~	~
D2031	Top	I	14	PDSO_G6	VIDEO AMPLIFIER OPA361 3V SC70	~	~
D2032	Bot	C	8	XBGA_N4	TI SINGLE BUFFER SN74LVC1G07YZT	~	~
D4800	Top	G	14	PBGA447	MCU OMAP2420POP PS2.2 N1 PBGA447	~	~
D4801	Top	I	14	XBGA_N6_1.45X0.95_H0.625	IC 2XBUFFER 74LVC2G34YZTR WCSP6	~	~

Item	Side	Grid ref.		Type	Description and value		
D8720	Bot	D	14	XBGA_N5_H0.625	OR-GATE 2INPUT 74LVC1G32YZTR WCSP-5	~	~
D8721	Bot	E	15	XBGA_N5_H0.625	OR-GATE 2INPUT 74LVC1G32YZTR WCSP-5	~	~
D8740	Bot	C	13	QFN16P	WHITE LED DRIVER AN30251A QFN16	~	~
D9300	Top	K	11	XBGA_N6_1.45X0.95_H0.625	IC 2XBUFFER 74LVC2G34YZTR WCSP6	~	~
E1000	Bot	G	3	SPACER_R1.75_H0.33	GROUND SPACER PAD	~	~
E1001	Bot	I	3	SPACER_R1.75_H0.33	GROUND SPACER PAD	~	~
F2000	Top	C	3	0603_FUSE_AVX2MATS	SM FUSE F 2.0A 32V	2A	~
F8720	Bot	D	14	0603_FUSE_AVX2MATS	SM FUSE F 2.0A 32V	2A	~
G7501	Top	E	7	NKG3176B_H1.0	VCTCXO 38.4MHZ 2.5V 2MA	38.4MHz	~
G7502	Top	E	6	VCO_DCS02733	VCO 3296-3980MHZ 4-BAND MATSUSHITA	3296-3980MHz	~
G9400	Top	C	6	BATTER_RB414H	RTC CAPACITOR 15UAH 2.6/3.3V 414-SIZE	3V3	~
L1000	Top	E	15	0603_BLM	FERR.BEAD 220R/100M 1.5A 0R07 0603	220R/100MHz	~
L2000	Top	D	3	0603_BLM	FERR.BEAD 220R/100M 2A 0R05 0603	220R/100MHz	~
L2001	Bot	C	7	0405_2_MATSU	CHIP BEAD ARRAY 2X1000R 0405	2x1000R/100MHz	~
L2030	Bot	C	6	0603_BLM	FERRITE BEAD 0R5 600R/100MHZ 0603	600R/100MHz	~
L2031	Bot	C	7	0603_BLM	FERRITE BEAD 0R5 600R/100MHZ 0603	600R/100MHz	~
L2032	Bot	C	6	0603_BLM	FERRITE BEAD 0R5 600R/100MHZ 0603	600R/100MHz	~
L2033	Bot	C	6	0603_BLM	FERRITE BEAD 0R5 600R/100MHZ 0603	600R/100MHz	~
L2034	Bot	D	5	0402L_XL	CHIP COIL 68N J Q17/300M 0402	68nH	~

Item	Side	Grid ref.		Type	Description and value		
L2152	Bot	F	4	0603_BLM	FERR.BEAD 220R/100M 2A 0R05 0603	220R/ 100MHz	~
L2153	Bot	F	4	0603_BLM	FERR.BEAD 220R/100M 2A 0R05 0603	220R/ 100MHz	~
L2154	Bot	G	4	COIL_LK_1608	CHIP COIL 390N K Q15/25MHZ 0603	390nH	~
L2155	Bot	J	4	COIL_LK_1608	CHIP COIL 390N K Q15/25MHZ 0603	390nH	~
L2156	Top	E	14	0603_BLM	FERR.BEAD 220R/100M 2A 0R05 0603	220R/ 100MHz	~
L2167	Bot	H	5	COIL_LK_1608	CHIP COIL 390N K Q15/25MHZ 0603	390nH	~
L2168	Bot	I	5	COIL_LK_1608	CHIP COIL 390N K Q15/25MHZ 0603	390nH	~
L2170	Top	E	4	0603_BLM	FERR.BEAD 220R/100M 2A 0R05 0603	220R/ 100MHz	~
L4200	Top	D	13	0603_BLM	FERR.BEAD 220R/100M 2A 0R05 0603	220R/ 100MHz	~
L4201	Top	C	15	0603_BLM	FERR.BEAD 220R/100M 2A 0R05 0603	220R/ 100MHz	~
L4203	Top	E	13	CHOKE_SER400	INDUCT WW 4.7UH M 1.15A 0R12 4X4X1.8	4u7H	~
L4205	Top	E	15	CHOKE_SER300_H1 .5	CHOKE 4U7 0.86A 0R2 3X3X1.5	4u7H	~
L4850	Top	I	15	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
L5250	Bot	F	7	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
L6300	Bot	F	12	CHOKE_SER300	INDUCT WW 2.2UH 1A2 0R168 310 CASE SIZE	2u2H	~
L6451	Bot	B	12	0402L_W065_POL	CHIP COIL 3N9 +-0N1 Q28/1GHZ 0402	3n9H	~
L6452	Bot	B	12	0402L_H0.45	CHIP COIL 2N4 +-0N1 Q35/1GHZ 0402	2n4H	~
L7400	Top	I	8	0402L	CHIP COIL 22N0 H Q22/250MHZ 0402	22nH	~
L7515	Top	F	4	CHOKE_SER300_H1 .5	CHOKE 3U3 1.2A 0R096 3X3X1.5	3u3H	~
L7516	Top	G	6	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~

Item	Side	Grid ref.		Type	Description and value		
L7518	Top	J	6	FERRITE_FBMJ1608	FERRITE BEAD 0R01 28R/100MHZ 0603	28R/ 100MHz	~
L7520	Top	E	5	COIL_HK_1608	CHIP COIL 470NH J 0603	470nH	~
L7521	Top	F	6	0402L	CHIP COIL 100N J Q16/300M 0402	100nH	~
L7654	Top	H	6	0402L	CHIP COIL 6N8 J Q27/800M 0402	6n8H	~
L7655	Top	H	7	0402L	CHIP COIL 10N J Q30/800M 0402	10nH	~
L7656	Top	I	4	0402L_W065_POL	CHIP COIL 3N9 +-0N1 Q28/1GHZ 0402	3n9H	~
L7657	Top	F	4	FERRITE_FBMJ1608	FERRITE BEAD 0R01 28R/100MHZ 0603	28R/ 100MHz	~
L7659	Top	I	5	0402L	CHIP COIL 22N J Q28/800M 0402	22nH	~
L7660	Top	J	4	0402_ELJRF	CHIP COIL 47N J Q6/100M 0402	47nH	~
L8700	Top	I	14	0402L	FERRITE BEAD 0R25 120R/100MHZ 0402	120R/ 100MHz	~
L8720	Bot	D	15	CHOKE_SER400	INDUCT WW 4.7UH M 1.15A 0R12 4X4X1.8	4u7H	~
L8903	Bot	H	13	0603_BLM	FERRITE BEAD 0R5 600R/100MHZ 0603	600R/ 100MHz	~
L8904	Bot	I	11	0603_BLM	FERRITE BEAD 0R5 600R/100MHZ 0603	600R/ 100MHz	~
L8910	Bot	G	12	0603_BLM	FERRITE BEAD 0R5 600R/100MHZ 0603	600R/ 100MHz	~
L8911	Bot	H	11	0603_BLM	FERRITE BEAD 0R5 600R/100MHZ 0603	600R/ 100MHz	~
L8990	Bot	J	11	0603_BLM	FERRITE BEAD 0R5 600R/100MHZ 0603	600R/ 100MHz	~
L9900	Bot	K	11	COIL_LPS3015	CHIP COIL 220UH M 9R5 0A15 3X3X1.5	220uH	~
L9902	Bot	G	11	0603_BLM	FERRITE BEAD 0R5 600R/100MHZ 0603	600R/ 100MHz	~
L9928	Bot	G	3	0402L_H0.45	CHIP COIL 3N3 +-0N1 Q30/1GHZ 0402	3n3H	~
L9929	Top	J	5	0402L	CHIP COIL 1N2 +-0N3 Q34/800M 0402	1n2H	~
L9930	Bot	F	3	0402_ELJRF	CHIP COIL 47N J Q6/100M 0402	47nH	~

Item	Side	Grid ref.		Type	Description and value		
L9931	Bot	F	3	0402_ELJRF	CHIP COIL 47N J Q6/100M 0402	47nH	~
L9933	Top	F	8	0402L_H0.45	CHIP COIL 3N3 +-0N1 Q30/1GHZ 0402	3n3H	~
M2150	Bot	E	3	VIBRA_M_KHN4NX 1RA	SMD VIBRA MOTOR 1.3V 90MA 9000RPM	~	~
N2030	Bot	C	7	uBGA_6_1.45X0.9 5	TI ANALOG SWITCH TS5A3159YZTR WCSP06	~	~
N2150	Top	D	11	XBGA_N8_H0.625	TI ANALOG SWITCH SN74LVC2G66YZTR	~	~
N4200	Top	C	14	PBGA_N80	MENELAUS1 V2.2 TWL92230 S-PBGA-N80	~	~
N4850	Top	I	15	XBGA_N6_H0.625	TEMP SENSOR TMP105 12C IF WCSP6	~	~
N6030	Top	C	8	LGA_BTHFM_ES3.6	BTHFM1.0 BALUN ONLY SOLUTION	~	~
N6300	Bot	E	12	XBGA_N8_2.02X1. 02	DC/DC CONV TPS6231YZD 1.5V CSP8	~	~
N6301	Bot	F	13	LLP_6	REG LP3981YDX 2.8/ NOPB 0.3A LLP-6	~	2.8V
N6302	Bot	C	11	LBWA19EBE6	WLAN SIZE3.0 MODULE	~	~
N6303	Bot	F	12	MLF_6	REG MIC5319YML 500MA ADJ MLF6	~	ADJ
N7501	Top	F	7	TFBGA_188_H1.4	PIHI N2.0 RF SYSTEM MODULE	~	~
N7502	Top	I	7	RF9282E3.6	PA RF9282E6.5 GSM/ EDGE 850/900/1800/1900	~	~
N7503	Top	G	4	RF9372_H1.5	PA MODULE RF9372E5.2 WCDMA 1850-1980MHZ	~	~
N7504	Top	F	5	uBGA8_1.849X1.6 96	DC CONV LM3202TLX NOPB REVB USMD8	~	~
N8200	Bot	J	15	R_XBGA_N12_X	DUAL ANALOG SW TS3DS26227 SPDT CSP12	~	~
N8201	Bot	J	15	R_XBGA_N12_X	DUAL ANALOG SW TS3DS26227 SPDT CSP12	~	~

Item	Side	Grid ref.		Type	Description and value		
N8701	Bot	H	14	LLP_6	REG LP3981YDX-3.0 LLP3	~	3V
N8702	Bot	I	15	USMD5_1.47X1.04 _H0.675	VREG LP3985ITLX-3.0 NOPB USMD5	~	3V
N8703	Bot	I	14	USMD5_1.47X1.04 _H0.675	VREG LP3985ITLX-3.0 NOPB USMD5	~	3V
N9100	Top	B	11	IRDA_TFBS_GP2W_ CIM	IRDA MIR XSMALL	~	~
N9101	Top	G	10	CEBB02P_576	CEBB02P RAP3GS PA 128+128	~	~
N9900	Bot	K	12	DFN_10	ELDRIVE D381B 2-7V DFN-10	~	~
N9901	Top	D	12	USMD5_1.47X1.04 _H0.675	VREG LP3985ITLX-3.0 NOPB USMD5	~	3V
N9904	Top	C	13	LFCSP14	ACCELEROMETER 3-AXIS 2.5V LGA14	~	~
R1000	Bot	F	8	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R1001	Bot	F	8	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R1003	Top	E	15	0402R	Resistor 5% 63mW	150R	~
R1010	Bot	G	7	0402R	Chipres 0W06 jumper 0402	0R	~
R1011	Bot	G	6	0402R	Chipres 0W06 jumper 0402	0R	~
R1012	Bot	G	6	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2007	Bot	C	8	uBGA_10_1.7X2.0 5	ASIP USB2 FILTER BGA10**PBFREE**	~	~
R2010	Top	C	3	BGA_4	ASIP TVS BGA4	~	~
R2040	Bot	D	8	0402R	Chipres 0W06 100k F 200ppm 0402	100k	~
R2041	Bot	D	7	0402R	Chipres 0W06 100k F 200ppm 0402	100k	~
R2042	Bot	D	7	0402R	Chipres 0W06 100k F 200ppm 0402	100k	~
R2043	Bot	D	7	0402R	Chipres 0W06 100k F 200ppm 0402	100k	~
R2046	Bot	D	6	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~

Item	Side	Grid ref.		Type	Description and value		
R2048	Bot	C	5	0402R	Chipres 0W06 jumper 0402	0R	~
R2049	Bot	C	5	0402R	Chipres 0W06 jumper 0402	0R	~
R2050	Bot	C	5	0402R	Chipres 0W06 jumper 0402	0R	~
R2051	Bot	D	8	0402R	Resistor 5% 63mW	220k	~
R2060	Bot	E	8	uBGA5	ASIP 4XESD **PB-FREE** BGA5	~	~
R2061	Top	I	13	0603R	Resistor 5% 63mW	68R	~
R2062	Top	I	13	0402R	CHIPRES 0W06 2R2 J 0402	2R2	~
R2063	Top	I	13	0402R	CHIPRES 0W06 2R2 J 0402	2R2	~
R2064	Bot	C	8	0402R	Resistor 5% 63mW	100k	~
R2068	Bot	D	9	0402R	Resistor 5% 63mW	10R	~
R2070	Bot	F	5	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2071	Bot	G	10	0402_NTH5	NTC RES 47K J B=4050 +-3% 0402	47k	~
R2072	Bot	D	4	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2074	Bot	C	9	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2075	Bot	D	7	0402R	Resistor 5% 63mW	22R	~
R2076	Bot	D	7	0402R	Resistor 5% 63mW	22R	~
R2153	Top	E	15	uBGA8_1.47X1.47	ASIP SIM INTERFACE **LOW CAP**BGA8	~	~
R2154	Bot	I	4	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2155	Bot	I	4	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2165	Top	D	11	0402R	Resistor 5% 63mW	10k	~
R2166	Top	E	4	0402_VAR	CHIP VARISTOR VWM15V VC50V 0402	15V/50V	~
R4800	Top	F	13	0402R	Resistor 5% 63mW	10R	~
R4801	Top	F	15	0402R	Resistor 5% 63mW	2k2	~
R4802	Top	F	15	0402R	Resistor 5% 63mW	2k2	~
R4804	Top	C	11	0402R	Resistor 5% 63mW	100k	~

Item	Side	Grid ref.		Type	Description and value		
R5002	Top	I	12	0402R	Resistor 5% 63mW	100k	~
R5004	Top	I	13	0402R	Resistor 5% 63mW	100k	~
R5050	Top	H	16	0402R	Resistor 5% 63mW	100k	~
R5060	Top	I	12	0402R	Resistor 5% 63mW	100k	~
R5063	Top	I	13	0402R	Resistor 5% 63mW	100k	~
R6109	Top	C	7	0603_BLM	FERRITE BEAD 0R5 600R/100MHZ 0603	600R/ 100MHz	~
R6120	Top	B	7	0603_BLM	FERRITE BEAD 0R5 600R/100MHZ 0603	600R/ 100MHz	~
R6121	Top	C	9	0603_BLM	FERRITE BEAD 0R5 600R/100MHZ 0603	600R/ 100MHz	~
R6162	Top	B	7	0402R	Resistor 5% 63mW	100k	~
R6196	Top	C	7	0402R	Resistor 5% 63mW	220R	~
R6303	Bot	E	12	0402R	CHIPRES 0W06 150K F 200PPM 0402	150k	~
R6304	Bot	E	11	0402R	CHIPRES 0W06 270K F 200PPM 0402	270k	~
R6305	Bot	E	11	0402R	Resistor 1% 63mW	12k	~
R6306	Bot	F	11	0402R	Resistor 5% 63mW	1M0	~
R6440	Bot	C	10	0402R	Resistor 5% 63mW	1M0	~
R6491	Bot	E	10	0402R	Resistor 5% 63mW	10k	~
R7504	Top	I	8	0402R	CHIPRES 0W06 27K F 0402	27k	~
R7505	Top	G	4	0402R	Chipres 0W06 47k F 200ppm 0402	47k	~
R7510	Top	H	5	0402R	Resistor 5% 63mW	10k	~
R7512	Top	E	7	0402R	Resistor 5% 63mW	22k	~
R7513	Top	H	6	0402R	Resistor 5% 63mW	4k7	~
R7516	Top	E	7	0402R	CHIPRES 0W06 1K0 F 200PPM 0402	1k0	~
R7517	Top	E	7	0402R	CHIPRES 0W06 8K2 F 0402	8k2	~
R7524	Top	E	5	0402R	CHIPRES 0W06 1K2 F 250PPM 0402	1k2	~
R7528	Top	E	6	0402R	Chipres 0W06 5R6 J 0402	5R6	~
R7531	Top	E	5	0402R	Resistor 5% 63mW	82R	~
R7621	Top	G	4	0402R	Resistor 5% 63mW	10R	~

Item	Side	Grid ref.		Type	Description and value		
R8523	Top	E	16	0402_VAR	CHIP VARISTOR VWM15V VC50V 0402	15V/50V	~
R8700	Bot	D	13	0402R	Resistor 5% 63mW	1M0	~
R8701	Bot	E	15	0402R	Resistor 5% 63mW	10k	~
R8720	Bot	D	13	0402R	Resistor 5% 63mW	10k	~
R8723	Bot	D	13	0805R	CHIPRES 0W125 10R F 0805	10R	~
R8724	Bot	D	14	0402R	Resistor 5% 63mW	150R	~
R8726	Bot	D	14	0402R	Resistor 5% 63mW	10k	~
R8727	Bot	D	14	0402R	Resistor 5% 63mW	150R	~
R8728	Bot	E	16	0402R	Resistor 5% 63mW	1k0	~
R8729	Bot	F	16	0402R	Resistor 5% 63mW	1k0	~
R8732	Top	I	12	0402R	Chipres 0W06 100R F 200ppm 0402	100R	~
R8733	Top	I	12	0402R	Chipres 0W06 100R F 200ppm 0402	100R	~
R8748	Bot	D	13	0402R	Resistor 5% 63mW	10k	~
R8751	Top	B	15	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R8800	Top	F	15	0402R	Resistor 5% 63mW	100k	~
R8801	Top	K	12	0805R	CHIPRES 0W1 3M3 J 0805	3M3	~
R8902	Bot	K	11	0402R	Resistor 5% 63mW	100k	~
R8903	Bot	K	10	0402R	Resistor 5% 63mW	100k	~
R8920	Bot	H	11	0402_VAR	CHIP VARISTOR VWM15V VC50V 0402	15V/50V	~
R8921	Bot	H	12	0402_VAR	CHIP VARISTOR VWM15V VC50V 0402	15V/50V	~
R8922	Bot	I	12	0402_VAR	CHIP VARISTOR VWM15V VC50V 0402	15V/50V	~
R8923	Bot	G	11	0402_VAR	CHIP VARISTOR VWM15V VC50V 0402	15V/50V	~
R8925	Bot	I	12	0402_VAR	CHIP VARISTOR VWM15V VC50V 0402	15V/50V	~
R8932	Top	I	12	0402R	Chipres 0W06 jumper 0402	0R	~
R8933	Top	I	12	0402R	Chipres 0W06 jumper 0402	0R	~

Item	Side	Grid ref.		Type	Description and value		
R8940	Bot	H	12	0402_VAR	CHIP VARISTOR VWM15V VC50V 0402	15V/50V	~
R8941	Bot	J	13	0402R	Resistor 5% 63mW	10k	~
R8942	Bot	K	10	0402R	Resistor 5% 63mW	10k	~
R8949	Bot	G	13	0402R	Resistor 5% 63mW	100k	~
R9077	Bot	G	8	FLIP_CHIP_16_2.01 X2.02_H0.715	MMC ASP HIGH SPEED BGA16	~	~
R9102	Top	C	11	0805R	CHIPRES 0W125 4R7 J 0805	4R7	~
R9105	Top	C	11	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R9133	Top	H	4	0402R	Chipres 0W06 jumper 0402	0R	~
R9404	Top	D	9	0402R	Resistor 5% 63mW	470k	~
R9406	Top	H	8	0402R	Resistor 5% 63mW	3k3	~
R9407	Top	H	8	0402R	Resistor 5% 63mW	3k3	~
R9408	Top	F	8	0402R	Chipres 0W06 jumper 0402	0R	~
R9900	Bot	K	13	0402R	Resistor 5% 63mW	82k	~
R9923	Top	I	8	0402R	Chipres 0W06 jumper 0402	0R	~
R9927	Bot	F	3	0402R	Chipres 0W06 jumper 0402	0R	~
R9928	Top	I	5	0402R	Resistor 5% 63mW	47R	~
R9931	Top	D	5	0402R	Chipres 0W06 jumper 0402	0R	~
R9932	Top	I	6	0404_RAC10	RES NETWORK 0W04 1DB ATT 0404	870R/ 5R77/870 R	~
T7501	Top	H	6	TRANS_LDB15	TRANSF BALUN 2134 +-90MHZ 0805	~	~
T7502	Top	E	7	TRANS_HHM1517A 2	TRANSF BALUN 3800 +-550MHZ 0805	~	~
V6300	Bot	F	11	SC79	SCH DI 1PS79SB31 200MA 30V SOD523	~	~
V6301	Bot	F	11	SC79	SCH DI 1PS79SB31 200MA 30V SOD523	~	~
V8720	Bot	D	14	VMT3	TR 2SC5658QRS N 50V 0A1 0W15 VMT3	~	~

Item	Side	Grid ref.		Type	Description and value		
V8725	Bot	C	15	SMINI_3	MFET N 25V 1A 0R55 VGS12V SOT323	~	~
V8726	Bot	C	15	SMINI_2_F2_TUMD 2	SCH DI MA21D35 30V/ 1A VF=0.49V/1A	~	~
V8727	Bot	B	15	LED_LNJ0F0C7FRA 9	LED FLASH LNJ0F0C7FRA 25MA	~	~
V8730	Top	B	15	LED_CL_270	LED CL270HR RED >5MCD@20MA 90'0603	~	~
V8731	Bot	E	14	SMINI_3	MFET N 25V 1A 0R55 VGS12V SOT323	~	~
X2000	Top	B	3	CON_JACK_HR33NK _2DJA_2S	CONN DC-JACK 2.0MM 3POL SPR 90DEG	~	~
X2001	Bot	B	7	SYSCON_MQ202_N K_14R3	SM SYSTEM CONNECTOR 14POL	~	~
X2060	Bot	J	5	TRACEABILITY_PA D	MODULE ID COMPONENT 2.8X1.8X0.3	~	~
X2070	Bot	E	4	CON_BATT_2_1705 771_5	CONN BATT 3.5V 2A P3.7	~	~
X2750	Bot	G	15	SIM_CONN_C707_1 0M006_140_2	CONN SM SIM 6POL P2.54 H5.0	~	~
X5250	Bot	I	8	CONN_DM2B_DSF W_PEJ	MINISD CONN DM2B-DSFW-PEJ-N 125V 0.5A	~	~
X6402	Bot	B	14	SPRING_WN9149_ N10	C-SPRING ANTENNA active	~	~
X6403	Bot	B	13	SPRING_WN9149_ N10	C-SPRING ANTENNA active	~	~
X6405	Bot	C	10	RF_SWITCH_MS_15 6	SM RF SWITCH MS156 DNS05952 HDC13	~	~
X7605	Bot	F	2	SPRING_WN9149_ N10	C-SPRING ANTENNA active	~	~
X7610	Bot	G	2	SPRING_WN9149_ N10	C-SPRING ANTENNA active	~	~
X8500	Top	K	12	SPRING_DMD1248 2	UI SPRING DMD12482-EN	~	~
X8501	Top	J	12	SPRING_DMD1248 2	UI SPRING DMD12482-EN	~	~
X8700	Bot	F	16	CON_JAE_FI_J25S_V F15	CONN COAX 25PIN RECEPT VERTICAL 50V 0.3A	~	~

Item	Side	Grid ref.		Type	Description and value		
X8902	Bot	H	12	CON_JAE_FI_J25S_VF15	CONN COAX 25PIN RECEPT VERTICAL 50V 0.3A	~	~
X9005	Bot	G	3	RF_SWITCH_MS_156	SM RF SWITCH MS156 DNS05952 HDC13	~	~
X9006	Bot	H	10	CON_JAE_FI_J30S_VF15	CONN COAX 30POL F VERTICAL 50V 0.3A P0.4	~	~
X9900	Top	F	16	MOLEX_SD_51338_0409	SM CONN B2B 2X20 F P0.4	~	~
Z2000	Bot	C	9	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/100MHz	~
Z2001	Bot	C	9	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/100MHz	~
Z2003	Bot	C	9	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/100MHz	~
Z2030	Bot	D	6	BGA11	ASIP 4 LINES AUDIO FILTER BGA11	~	~
Z7501	Top	H	4	P_TC3N_12_1_AGI	DUPL BAW 1920-1980/2110-2170 MHZ 3.8X3.8	1920-1980/2110-2170MHZ	~
Z7503	Top	H	7	MODULE_SP_LMZ_137_H1.35	TX SAW MODULE GSM 850/900MHZ	850/900 MHz	~
Z7600	Top	I	6	FILTER_LFTC10N	CER FILT LFL181699TC1 2400-2480MHZ 1.6	2400-2483MHz	~
Z8801	Top	G	16	uBGA25_2.47X2.47	ASIP 10-CH ESD EMI FILTER BGA25	~	~
Z8802	Top	D	16	uBGA25_2.47X2.47	ASIP 10-CH ESD EMI FILTER BGA25	~	~
Z8900	Bot	H	13	uBGA25_2.47X2.47	ASIP 10-CH ESD EMI FILTER BGA25	~	~
Z8901	Bot	I	13	uBGA25_2.47X2.47	ASIP 10-CH ESD EMI FILTER BGA25	~	~
Z8902	Bot	J	10	uBGA25_2.47X2.47	ASIP 10-CH ESD EMI FILTER BGA25	~	~
Z9064	Bot	G	14	uBGA5	ASIP 4XESD **PB-FREE** BGA5	~	~
Z9065	Top	J	5	CQF12_N2	RF SWITCH SP3T 850/1800/1900MHZ	880-960/1710-1990MHz	~

Engine PWB component layouts

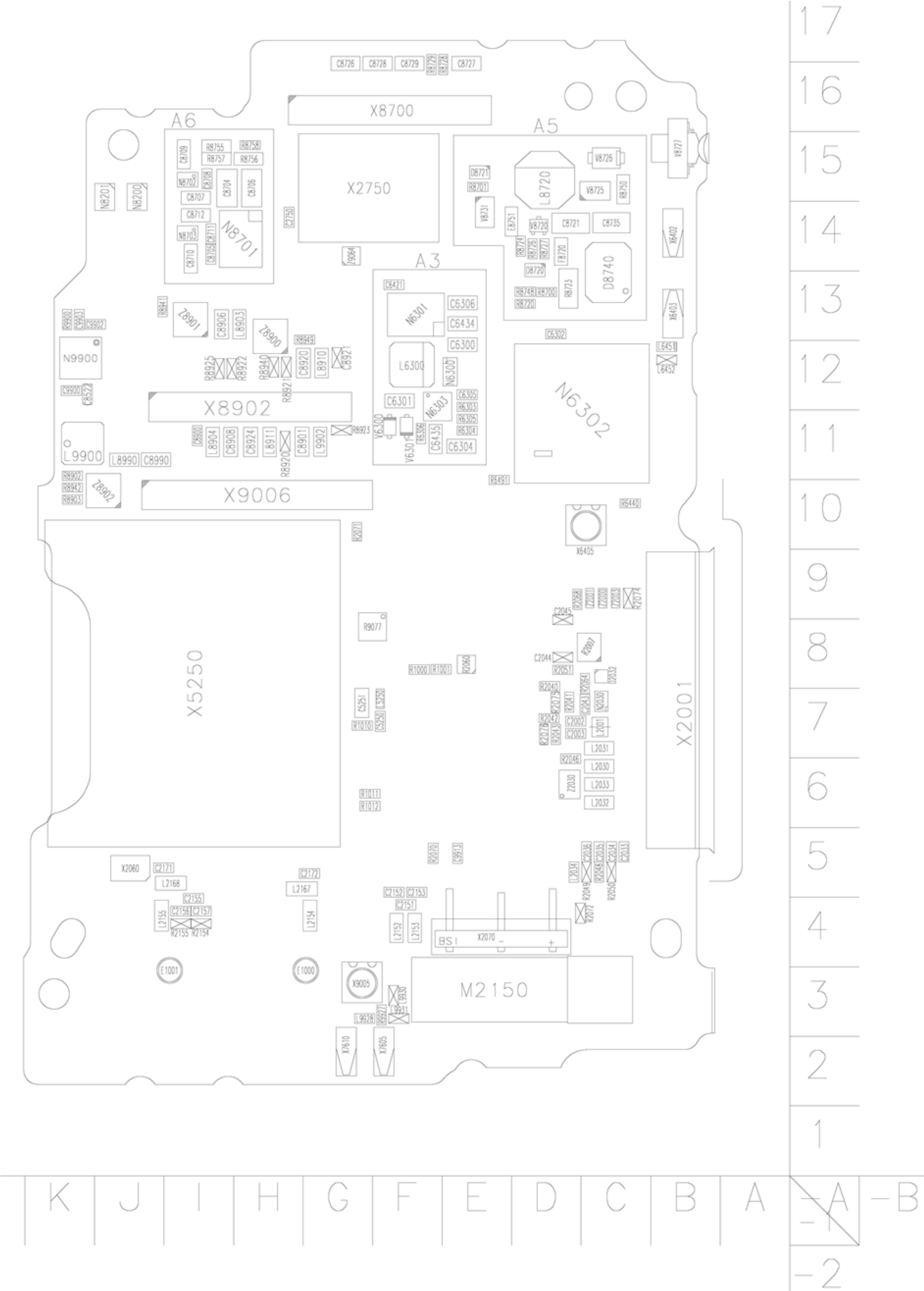


Figure 2 Component layout - Bottom (1UV_060a)

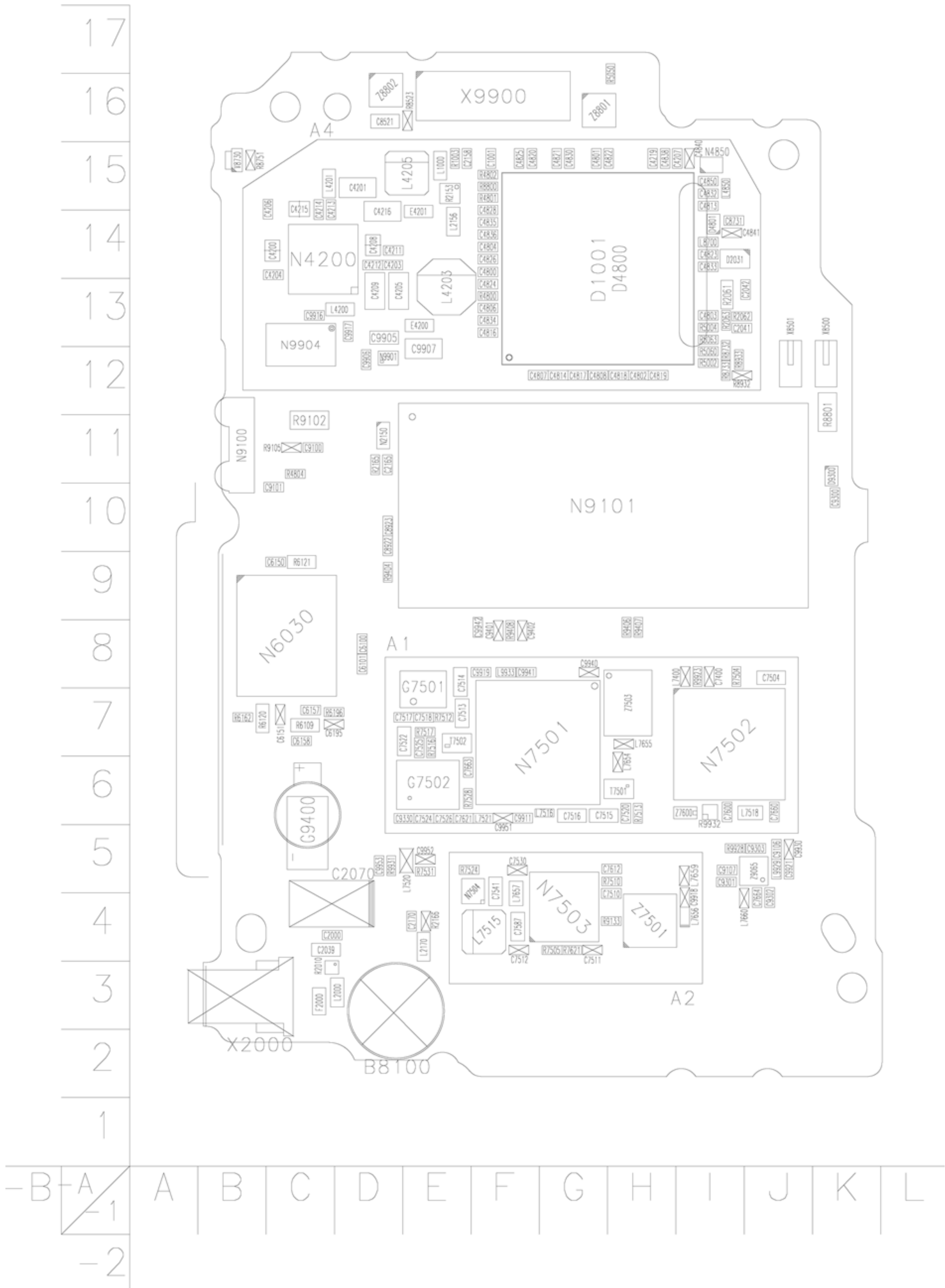


Figure 3 Component layout - Top (1UV_060a)

UI PWB component parts list

Table 9 Component parts list 1UX_030a

Note: For Nokia product codes, please refer to the latest Service Bulletins on the Partner Website (PWS). To ensure you are always using the latest codes, please check the PWS on a daily basis.

Item	Side	Grid ref.		Type	Description and value		
C1	Top	L	10	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
N1	Top	L	11	SENSOR_MR10	MAGNETO RESISTIVE SENSOR MRUS71D SOT4	~	~
R19	Top	L	11	0402_VAR	CHIP VARISTOR VWM15V VC50V 0402	15V/50V	~
S26	Top	M	15	SWITCH_EVQQ7 GC50	5-WAY JOYSTICK	~	~
S27	Top	M	13	SWITCH_EVQP6E	SM DOME SWITCH DC 15V 20MA	~	~
S28	Top	M	12	SWITCH_EVQP6E	SM DOME SWITCH DC 15V 20MA	~	~
X1	Top	F	18	MOLEX_SD_5590 9_0473	SM CONN B2B 2X20M P0.4	~	~

UI PWB component layout

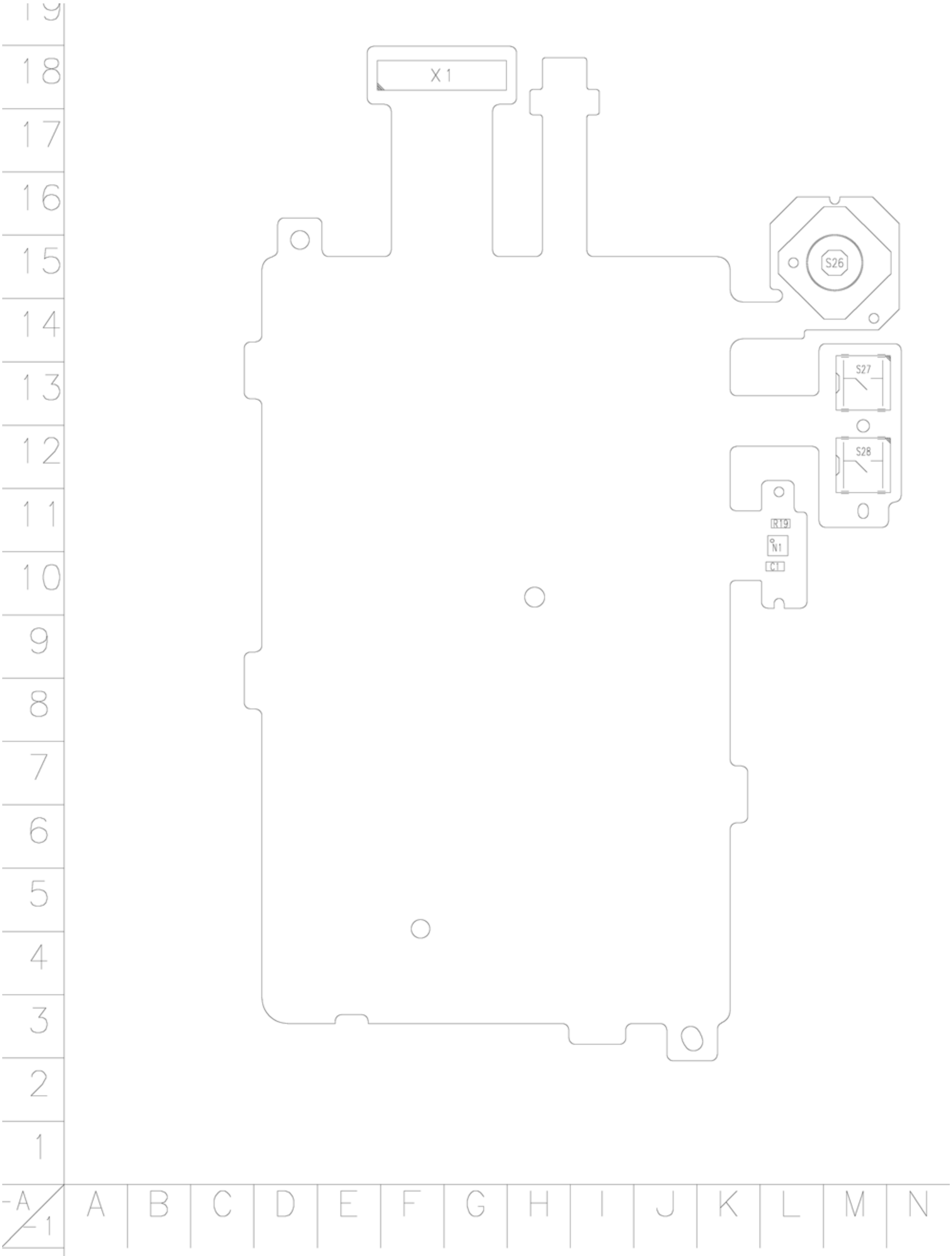


Figure 4 Component layout - Top (1UX_030a)

Flip PWB component parts list

Table 10 Component parts list 1UY_0301a

Note: For Nokia product codes, please refer to the latest Service Bulletins on the Partner Website (PWS). To ensure you are always using the latest codes, please check the PWS on a daily basis.

Item	Side	Grid ref.		Type	Description and value		
C12	Top	G	13	0402C	Chipcap 5% NP0	27p	50V
C15	Top	G	14	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C16	Bot	R	13	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C17	Top	P	13	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C18	Top	P	13	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C19	Top	P	13	0402C	Chipcap 5% X7R	560p	50V
C6	Top	I	16	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C7	Top	I	17	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C8	Top	G	13	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
L3	Top	Q	15	0405_2_MATSU	CHIP BEAD ARRAY 2X1000R 0405	2x1000R/ 100MHz	~
N1	Top	G	14	SOT908_1	COVER LED DRIVER PCA9633 HVSON8	~	~
R1	Bot	S	17	0402_NTH5	NTC RES 47K J B=4050 +-3% 0402	47k	~
R10	Top	Q	15	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R11	Top	I	13	0402R	Chipres 0W06 100R F 200ppm 0402	100R	~
R12	Top	I	13	0402R	Resistor 5% 63mW	33R	~
R13	Top	I	13	0402R	Resistor 5% 63mW	33R	~
R16	Top	Q	18	0402L	FERRITE BEAD 0R25 120R/100MHZ 0402	120R/ 100MHz	~
R17	Top	Q	18	0402R	Chipres 0W06 jumper 0402	0R	~
R2	Bot	R	17	0402R	Resistor 5% 63mW	470k	~
R3	Bot	S	17	0402R	Resistor 5% 63mW	100k	~
R9	Top	Q	15	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~

Item	Side	Grid ref.		Type	Description and value		
S1	Bot	S	12	SWITCH_EVQP6E	SM DOME SWITCH DC 15V 20MA	~	~
S2	Bot	S	18	SWITCH_EVQP6E	SM DOME SWITCH DC 15V 20MA	~	~
S3	Top	D	17	DETECTOR_ESE23J101XDL	SM SW DETECTOR 5.0V 0.01A	~	~
V1	Bot	S	16	TRANS_SFH3710	SILICON PHOTOTRANSISTOR SF3710 SMT 2.1X1.4X	~	~
V2	Top	J	15	LED_CL_502N7_SD_T	LED GRN 125MCD 5MA 25DEG 151306	~	~
V3	Top	I	13	VMT3	TR 2SC5658QRS N 50V 0A1 0W15 VMT3	~	~
X10	Top	I	17	MOLEX_500024_1609	SM CONN B2B 2X8 F P0.4	~	~
X6	Bot	S	13	CAMERA_MODULE_ST_VS6451XXXX	CMOS CAMERA MODULE CIF+ (384x320) ACME	~	~
X7	Top	G	11	CON_24R_JANK_P0.4	CONN BTB 2X12 P0.4 30V 0.2A	~	~
X8	Top	G	14	CON_JAE_FI_J20S_VF15	CONN COAX 20PIN RECEPT VERTICAL 50V 0.3A	~	~
X9	Top	G	17	CON_JAE_FI_J30S_VF15	CONN COAX 30POL F VERTICAL 50V 0.3A P0.4	~	~

Flip PWB component layouts

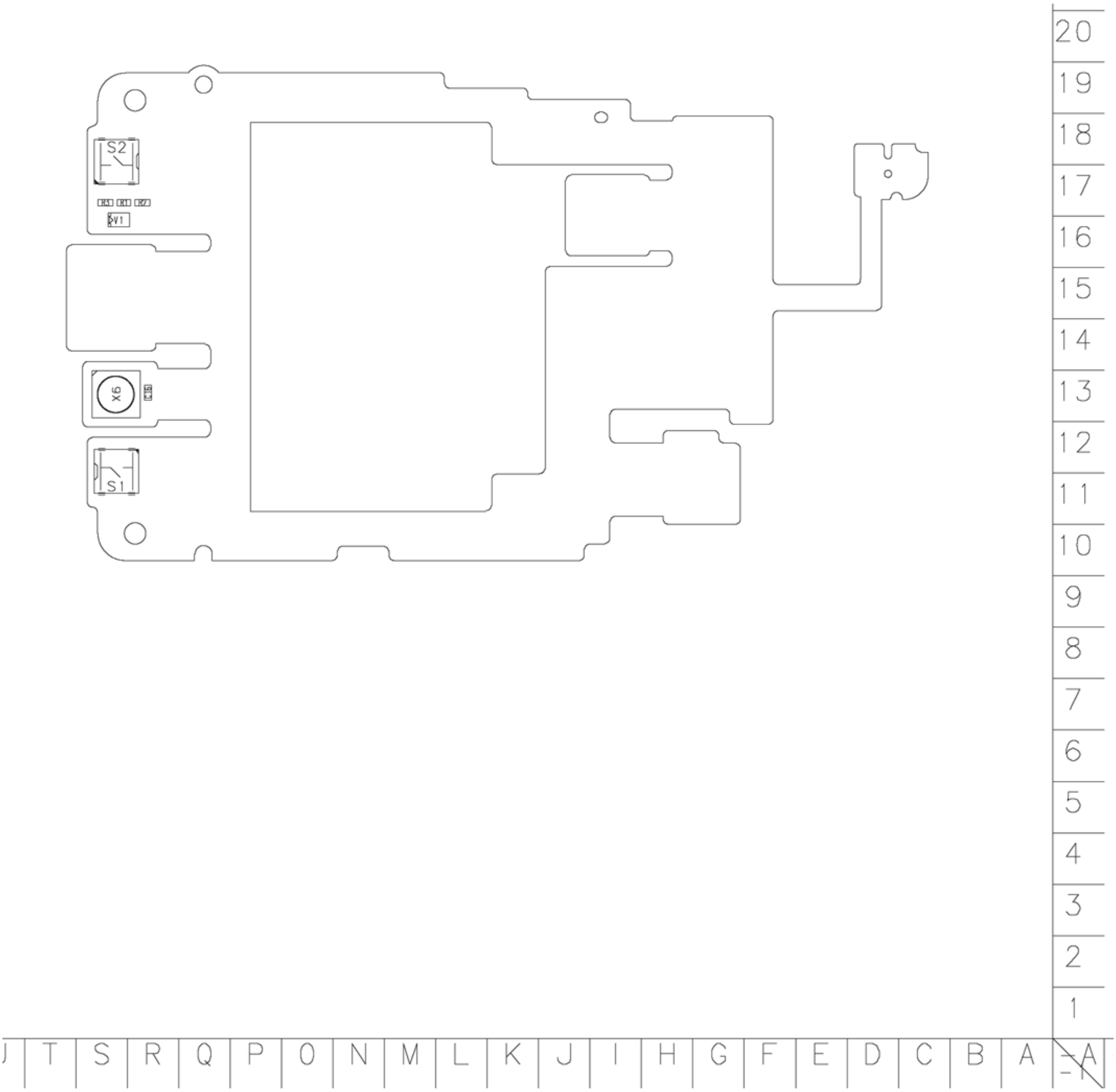


Figure 5 Component layout - Bottom (1UY_0301a)

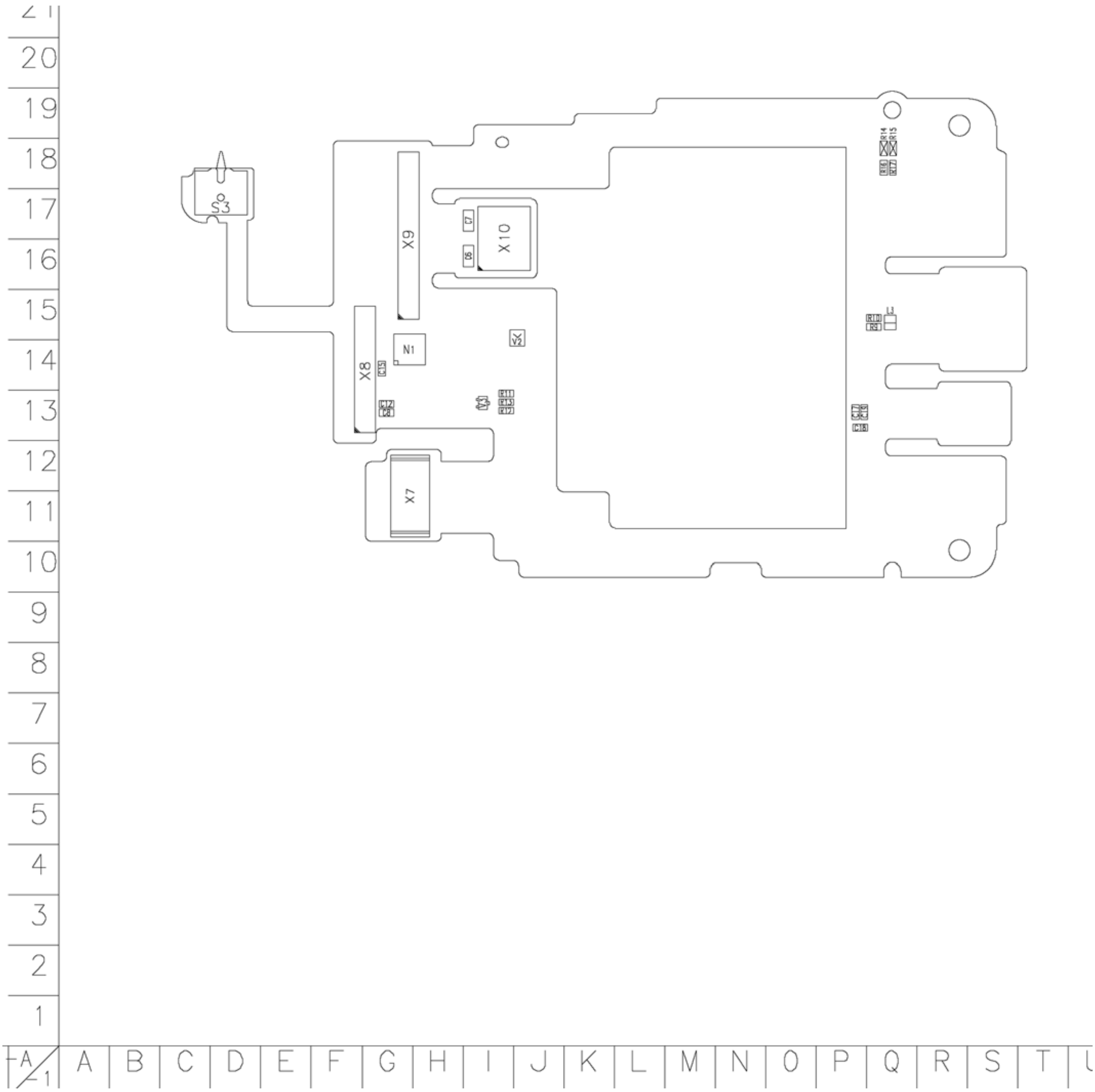


Figure 6 Component layout - Top (1UY_0301a)

Mic PWB component parts list

Table 11 Component parts list 1YQ_030a

Note: For Nokia product codes, please refer to the latest Service Bulletins on the Partner Website (PWS). To ensure you are always using the latest codes, please check the PWS on a daily basis.

Item	Side	Grid ref.		Type	Description and value		
B1	Top	B	9	MIC_43011_300 4710_H0.9	MIC SILICON OMNI 31100-3008062	~	~
B2	Top	B	11	MIC_43011_300 4710_H0.9	MIC SILICON OMNI 31100-3008062	~	~

Item	Side	Grid ref.		Type	Description and value		
C2	Top	C	9	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V
C3	Top	C	10	0402C_H0.6	CHIPCAP X5R 100N K 16V 0402	100n	16V
S29	Top	B	10	SWITCH_EVQP6E	SM DOME SWITCH DC 15V 20MA	~	~
X3	Top	C	3	FLEX_06FHS_RSM 1_G_G	SM FPC ZIF CONN 6POL P0.5	~	~

Mic PWB component layout

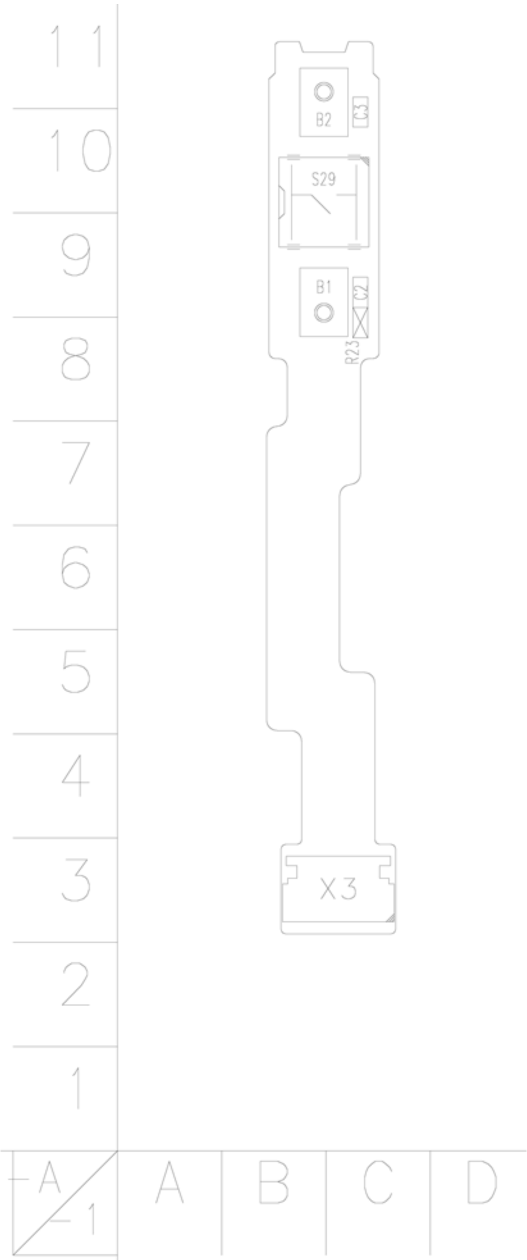


Figure 7 Component layout - Top (1YQ_030a)

3 — Phoenix Service Software Instructions

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Table of Contents

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Phoenix installation steps in brief

Prerequisites

Recommended hardware requirements:

- Computer processor: Pentium 700 MHz or higher
- RAM 256 MB
- Disk space 100-300 MB

Supported operating systems:

- *Windows 2000* Service Pack 3 or higher
- *Windows XP* Service Pack 1 or higher

Context

Phoenix is a service software for reprogramming, testing and tuning phones.

Phoenix installation contains:

- Service software support for all phone models included in the package
- Flash update package files for programming devices
- All needed drivers for:
  - PKD-1 (DK2) dongle
  - DKU-2 USB cable

  Note: Separate installation packages for flash update files and drivers are also available, but it is not necessary to use them unless there are updates between *Phoenix* service software releases. If separate update packages are used, they should be used after *Phoenix* and data packages have been installed.

The phone model specific data package includes all changing product specific data:

- Product software binary files
- Files for type label printing
- Validation file for the faultlog repair data reporting system
- All product specific configuration files for *Phoenix* software components

  Note: *Phoenix* and phone data packages should only be used as complete installation packages. Uninstallation should be made from the *Windows* Control Panel.

To use *Phoenix*, you need to:

Steps

1. Connect a PKD-1 (DK2) dongle to the computer parallel port.
2. Install *Phoenix*.
3. Install the phone-specific data package.
4. Configure users.
5. Manage connection settings (depends on the tools you are using).
   - Update FPS-10 software

     Note: There is no need to activate FPS-10.
   - Activate SX-4 smart card, if you need tuning and testing functions.

     Note: When FPS-10 is used only for product software updates, SX-4 smart card is not needed.

Results

Phoenix is ready to be used with FPS-10 flash prommer and other service tools.

Installing *Phoenix*

Prerequisites

- Check that a dongle is attached to the parallel port of your computer.
- Download the *Phoenix* installation package (for example, *phoenix_service_sw_2004_39_x_xx.exe*) to your computer (in *C:|TEMP*, for instance).
- Close all other programs.
- Depending on your operating system, administrator rights may be required to install *Phoenix*.
- If uninstalling or rebooting is needed at any point, you will be prompted by the InstallShield program.

Context

At some point during the installation procedure, you may get the following message:

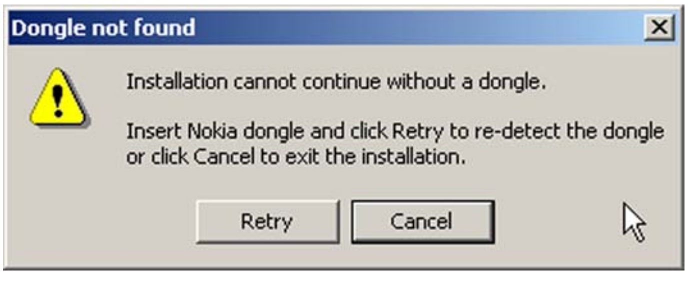


Figure 8 Dongle not found

This may be a result of a defective or too old PKD-1 dongle.

Check the COM/parallel ports used. After correcting the problem, you can restart the installation.

For more detailed information, please refer to *Phoenix* Help files.

> **Tip:** Each feature in *Phoenix* has its own Help function, which can be activated while running the program. Press the **F1** key or the feature's **Help** button to activate a Help file.

Steps

1. To start the installation, run the application file (for example,*phoenix_service_sw_2004_39_x_xx.exe*).
2. In the *Welcome* dialogue, click **Next**.

3. Read the disclaimer text carefully and click **Yes**.

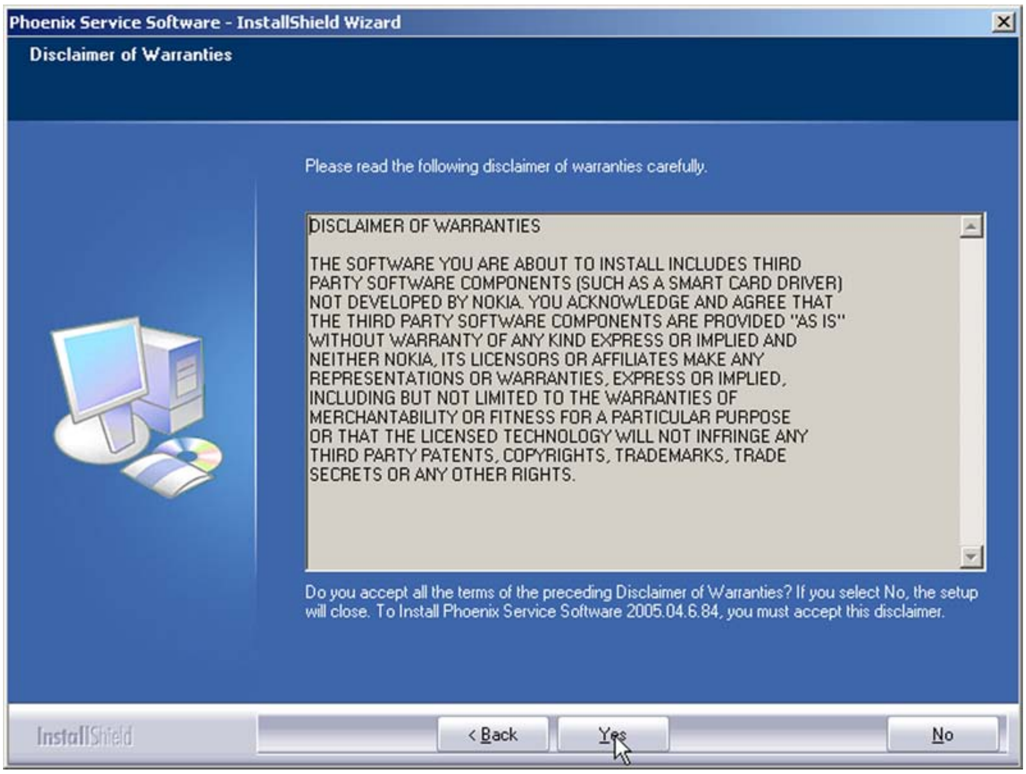


Figure 9 Disclaimer text

4. Choose the destination folder.

   The default folder *C:|ProgramFiles|Nokia|Phoenix* is recommended.
5. To continue, click **Next.**

   To choose another location, click **Browse** (not recommended).
6. Wait for the components to be copied.

   The progress of the installation is shown in the *Setup Status* window.
7. Wait for the drivers to be installed and updated.

   The process may take several minutes to complete.

   If the operating system does not require rebooting, the PC components are registered right away.

   If the operating system requires restarting your computer, the Install Shield Wizard will notifies about it.

   Select **Yes...** to reboot the PC immediately or **No...** to reboot the PC manually afterwards.

   After the reboot, all components are registered.

   Note: *Phoenix* does not work, if the components have not been registered.

8. To end the installation, click **Finish**.

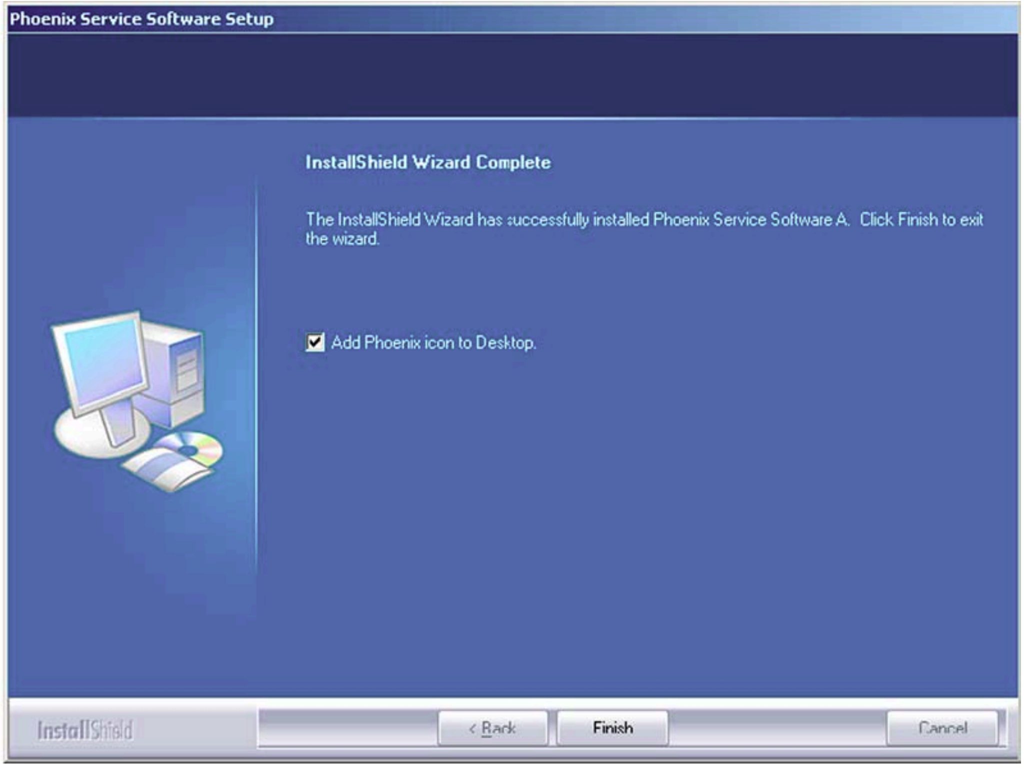


Figure 10 InstallShield Wizard Complete

Next actions

After the installation, *Phoenix* can be used after:

- installing phone model specific data package for *Phoenix*
- configuring users and connections

FPS-10 flash prommer can be used after updating their flash update package files.

Updating *Phoenix* installation

Context

- If you already have the *Phoenix* service software installed on your computer, you need to update the software when new versions are released.
- To update *Phoenix*, you need to follow the same steps as when installing it for the first time.
- When you are updating, for example, from version **a14_2004_16_4_47** to **a15_2004_24_7_55**, the update will take place automatically without uninstallation.
- Always use the latest available versions of both *Phoenix* and the phone-specific data package. Instructions can be found in the phone model specific Technical Bulletins and phone data package *readme.txt* files (shown during installation).
- If you try to update *Phoenix* with the same version you already have (for example, **a15_2004_24_7_55** to **a15_2004_24_7_55**), you are asked if you want to uninstall the existing version. In this case you can choose between a total uninstallation or a repair installation in a similar way when choosing to uninstall the application from the *Windows* Control Panel.
- If you try to install an older version (for example, downgrade from **a15_2004_24_7_55** to **a14_2004_16_4_47**), installation will be interrupted.

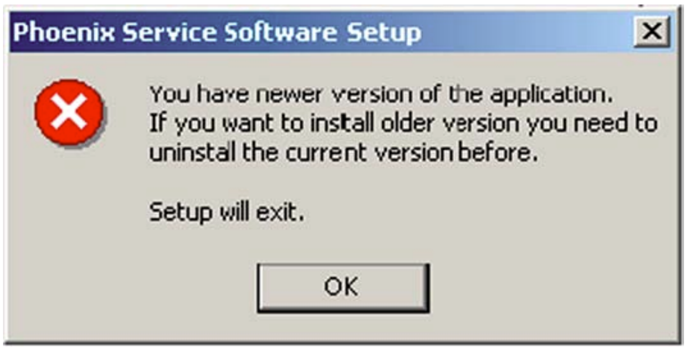


Figure 11 Installation interrupted

- Always follow the instructions on the screen.

Steps

1. Download the installation package to your computer hard disk.
2. Close all other programs.
3. Run the application file (for example, *phoenix_service_sw_2004_39_x_xx.exe*).

Results

A new *Phoenix* version is installed and driver versions are checked and updated.

Uninstalling *Phoenix*

Context

You can uninstall *Phoenix* service software manually from the *Windows* Control Panel.

Steps

1. Open the **Windows Control Panel**, and choose **Add/Remove Programs**.

2. To uninstall *Phoenix*, choose **Phoenix Service Software→Change/Remove→Remove** .

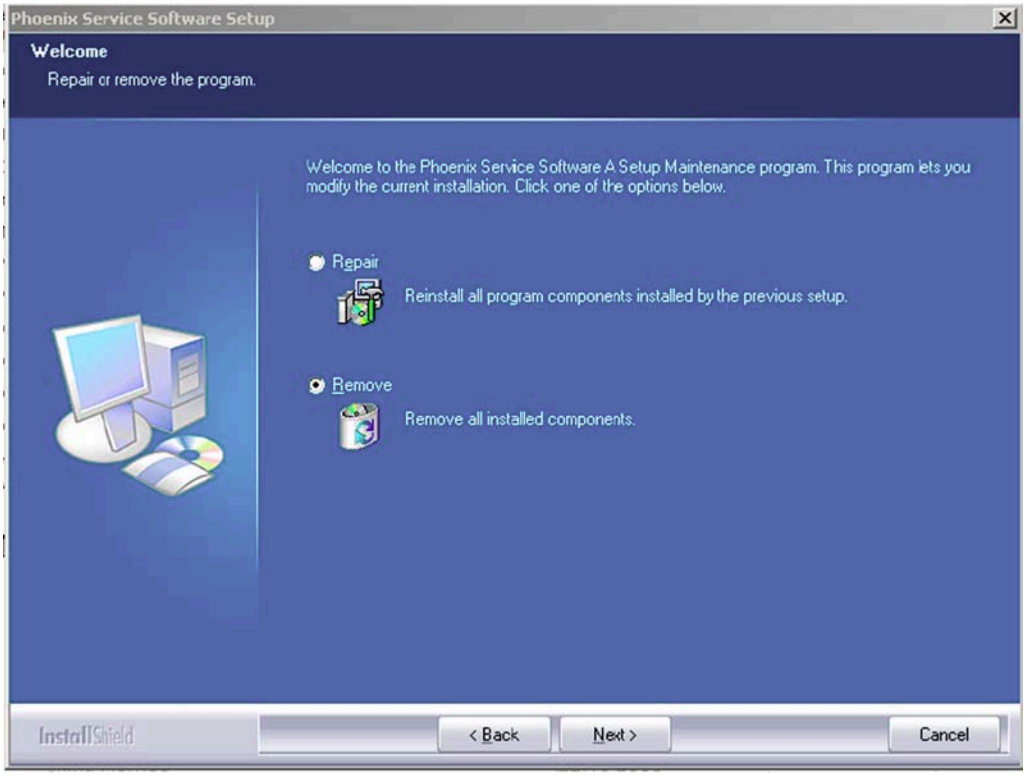


Figure 12 Remove program

The progress of the uninstallation is shown.

3. If the operating system does not require rebooting, click **Finish** to complete.

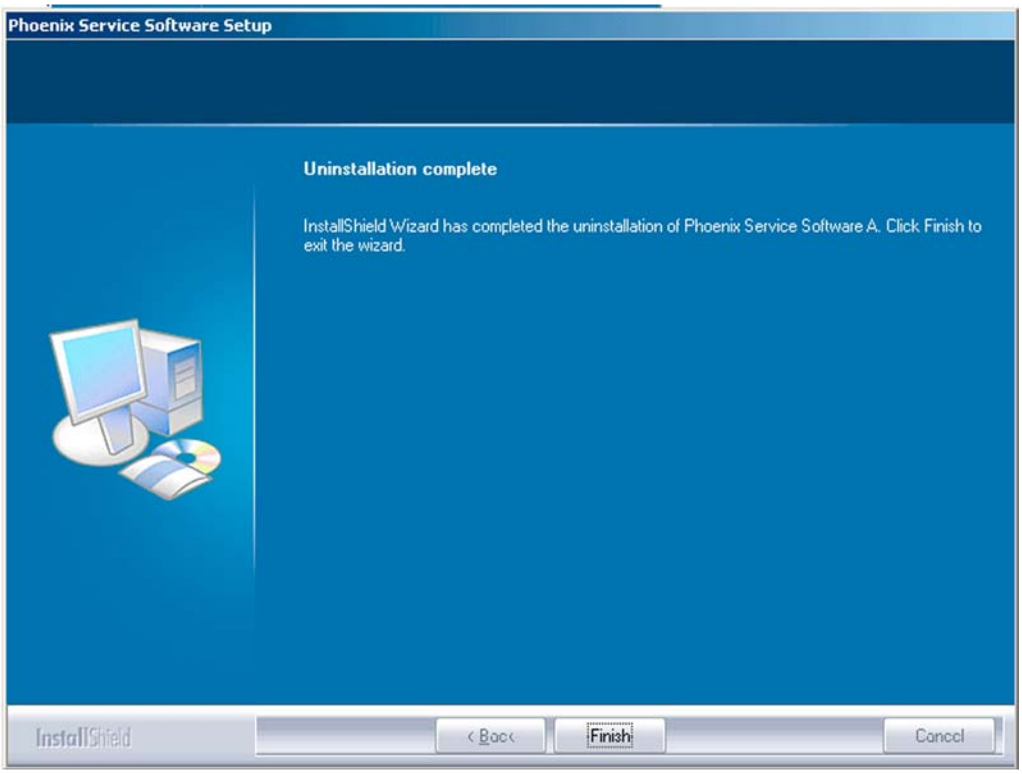


Figure 13 Finish uninstallation

If the operating system requires rebooting, InstallShield Wizard will notify you. Select **Yes...** to reboot the PC immediately and **No...** to reboot the PC manually afterwards.

Repairing *Phoenix* installation

Context

If you experience any problems with the service software or suspect that files have been lost, use the repair function before completely reinstalling *Phoenix*.

Note: The original installation package (for example, *phoenix_service_sw_a15_2004_24_7_55.exe*) must be found on your PC when you run the repair setup.

Steps

1. Open **Windows Control Panel→Add/Remove Programs** .
2. Choose **Phoenix Service Software→Change/Remove** .
3. In the following view, select **Repair**.

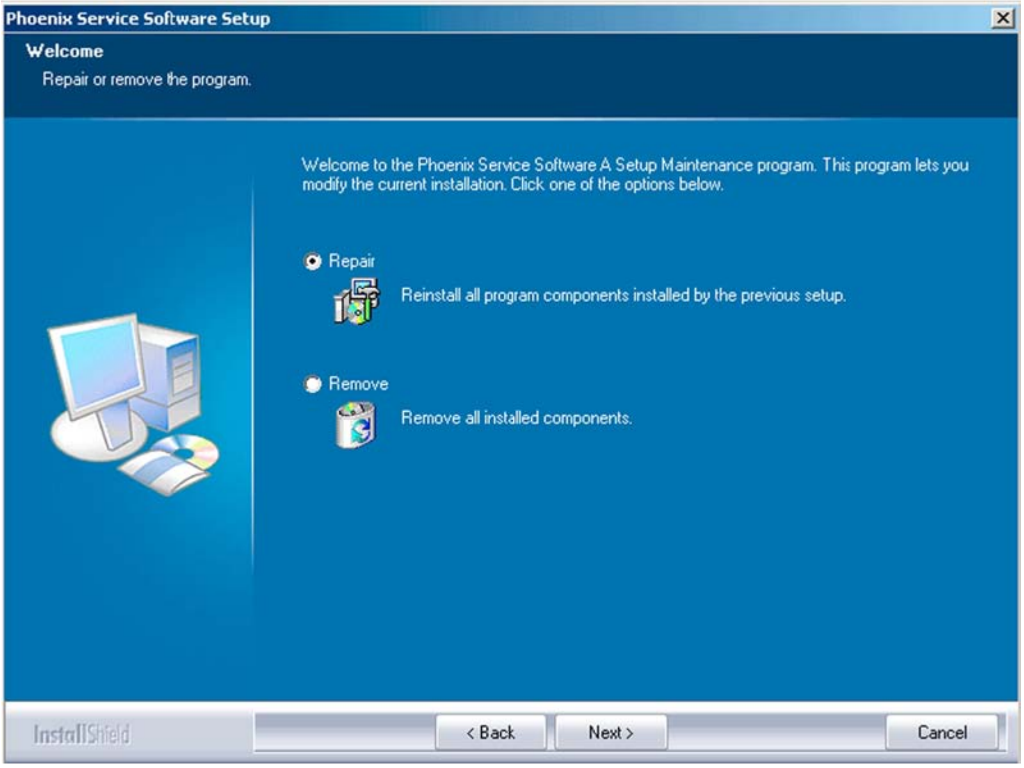


Figure 14 Repair program

Phoenix reinstalls components and registers them.

The procedure is the same as when updating *Phoenix*.

4. To complete the repair, click **Finish**.

Phone data package overview

Each product has its own data package (DP). The product data package contains all product-specific data files to make the Phoenix service software and tools usable with a certain phone model.

The phone data package contains the following:

- Product software binary files

- Files for type label printing
- Validation file for the fault log repair data reporting system
- All product-specific configuration files for Phoenix software components

Data files are stored in **C:\Program Files\Nokia\Phoenix** (default).

Installing phone data package

Prerequisites

- A phone-specific data package contains all data required for the *Phoenix* service software and service tools to be used with a certain phone model.
- Check that a dongle is attached to the parallel port of your computer.
- Install *Phoenix* service software.
- Download the installation package (for example, *XX-XX_dp_EA_v_1_0.exe*) to your computer (for example, in C:\TEMP).
- Close all other programs.

(XX-XX = type designator of the product)

If you already have *Phoenix* installed on your computer, you will need to update it when a new version is released.

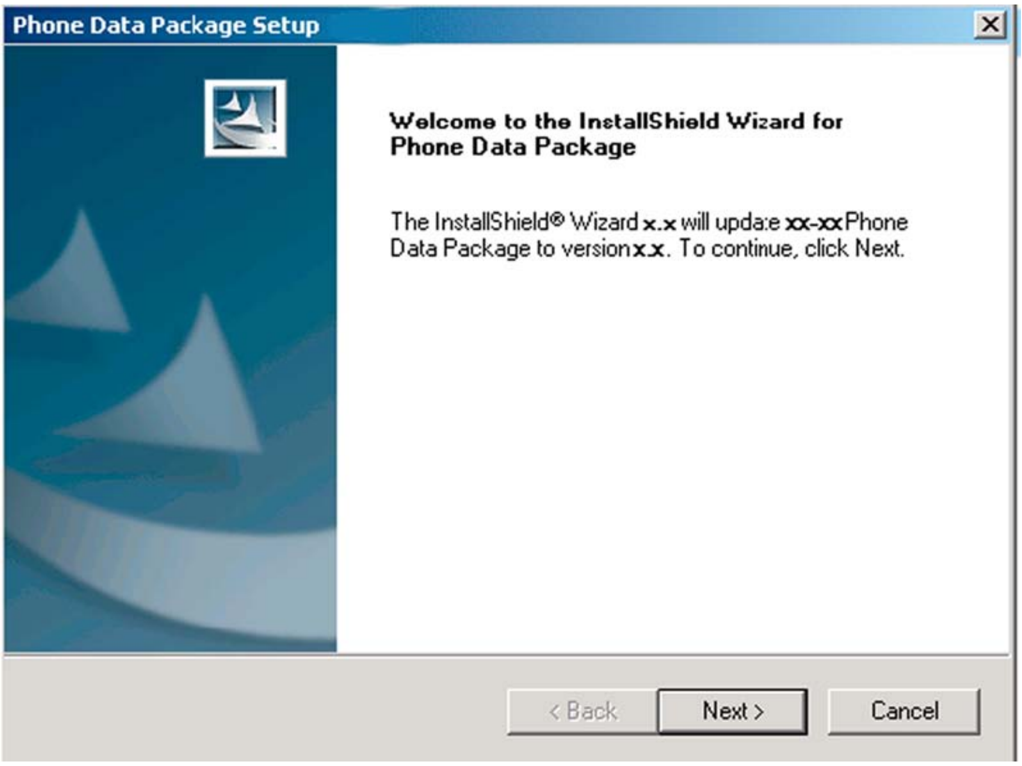
> **Note:** Often *Phoenix* and the phone-specific data package come in pairs, meaning that a certain version of *Phoenix* can only be used with a certain version of a data package. Always use the latest available versions of both. Instructions can be found in phone-specific Technical Bulletins and *readme.txt* files of data packages.

Steps

1. To start the installation, run the application file (for example, *XX-XX_dp_EA_ v_1_0.exe*),

   Wait for the installation files to be extracted.

2. Click **Next**.



3. In the following view you can see the contents of the data package. Read the text carefully. There is information about the *Phoenix* version required with this data package.

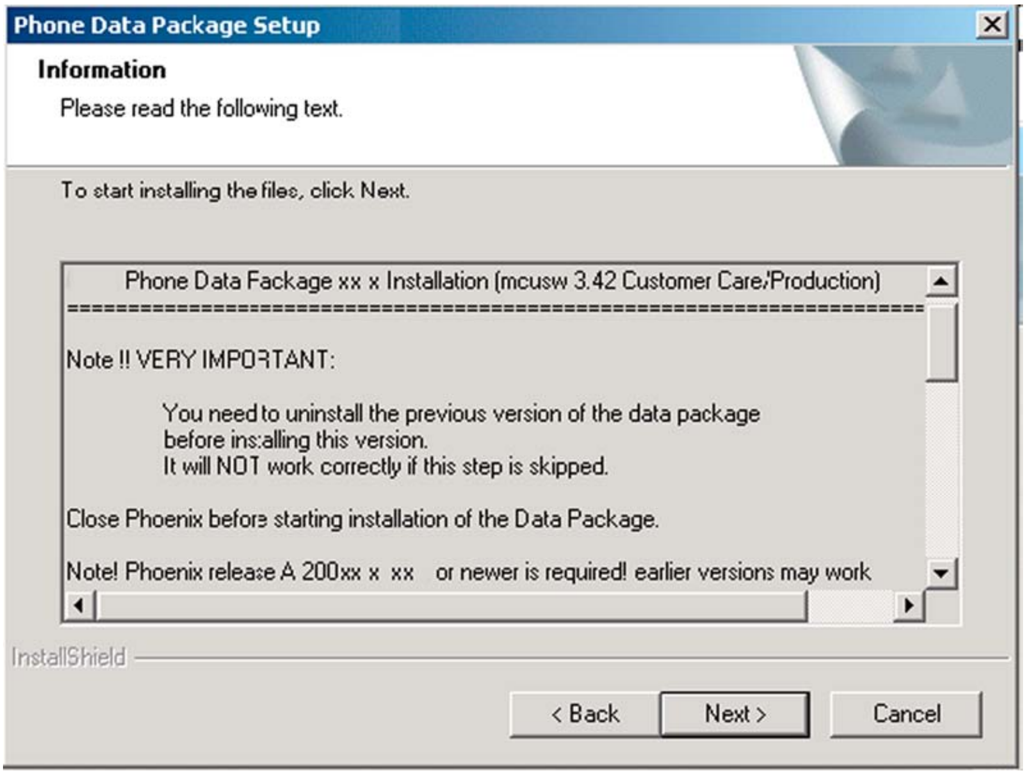


Figure 15 Data package setup information

4. To continue, click **Next**.

5. Choose the destination folder, and click **Next** to continue.

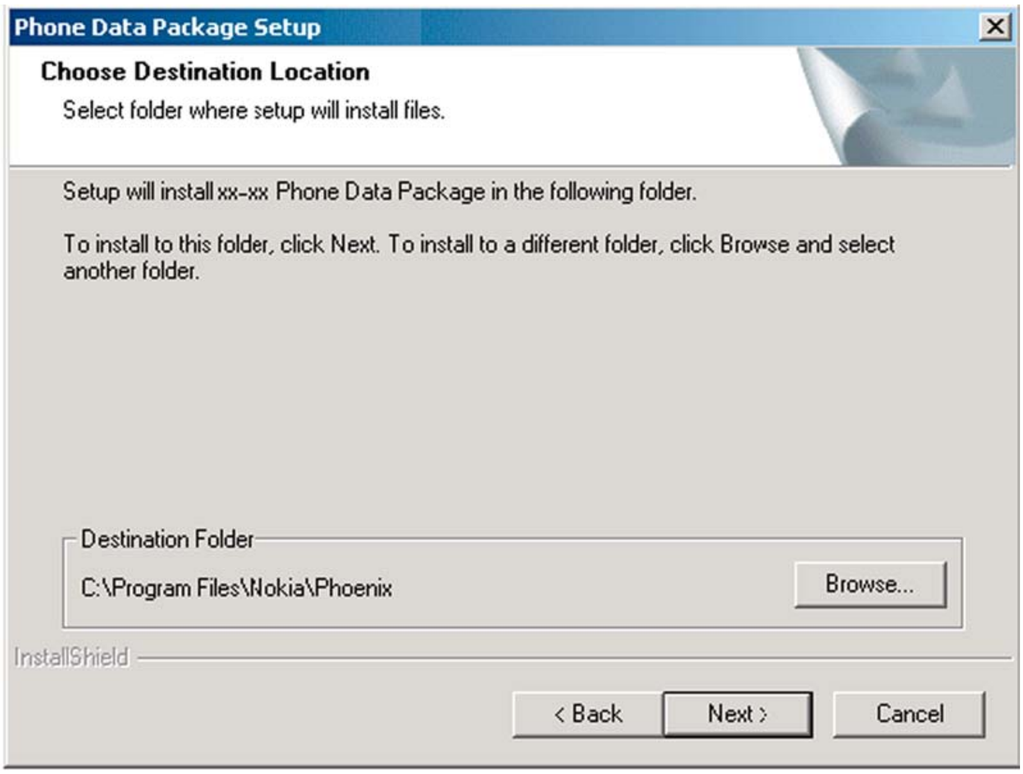
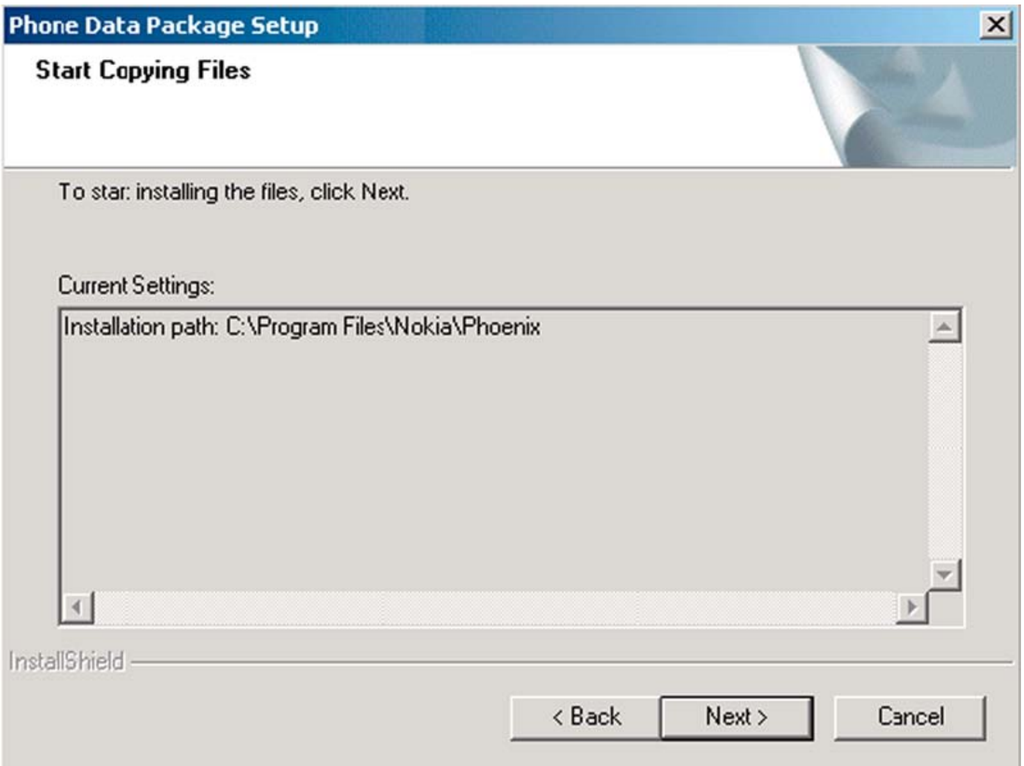


Figure 16 Data package destination folder

The InstallShield Wizard checks where *Phoenix* is installed, and the directory is shown.

6. To start copying the files, click **Next**.



Phone model specific files are installed. Please wait.

7. To complete the installation, click **Finish**.

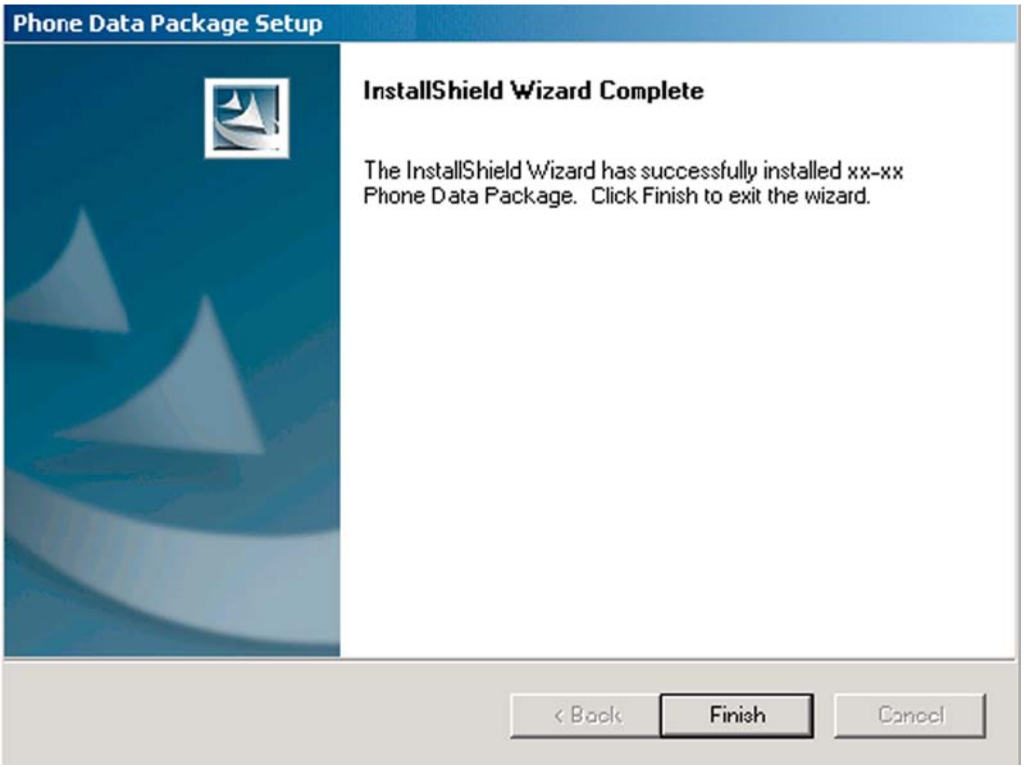


Figure 17 InstallShield Wizard Complete

Next actions

Phoenix can be used for flashing phones and printing type labels after:

- Configuring users
- Managing connections

FPS-10 can be used after updating their flash update package files.

Uninstalling phone data package

Context

There is no need to uninstall an older version of a data package, unless instructions to do so are given in the *readme.txt* file of the data package and bulletins related to the release.

Please read all related documents carefully.

Steps

1. Locate the data package installation file (e.g. *XX-XX_dp_EA_v_1_0.exe*) from your computer.
2. To start the uninstallation procedure, double-click the data package installation file.

3. To uninstall the data package, click **OK** or to interrupt the uninstallation, click **Cancel**.

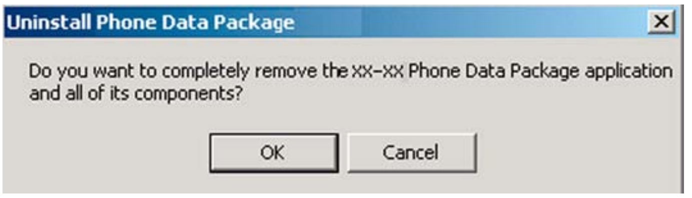


Figure 18 Uninstalling phone data package

4. When the data package is uninstalled, click **Finish**.

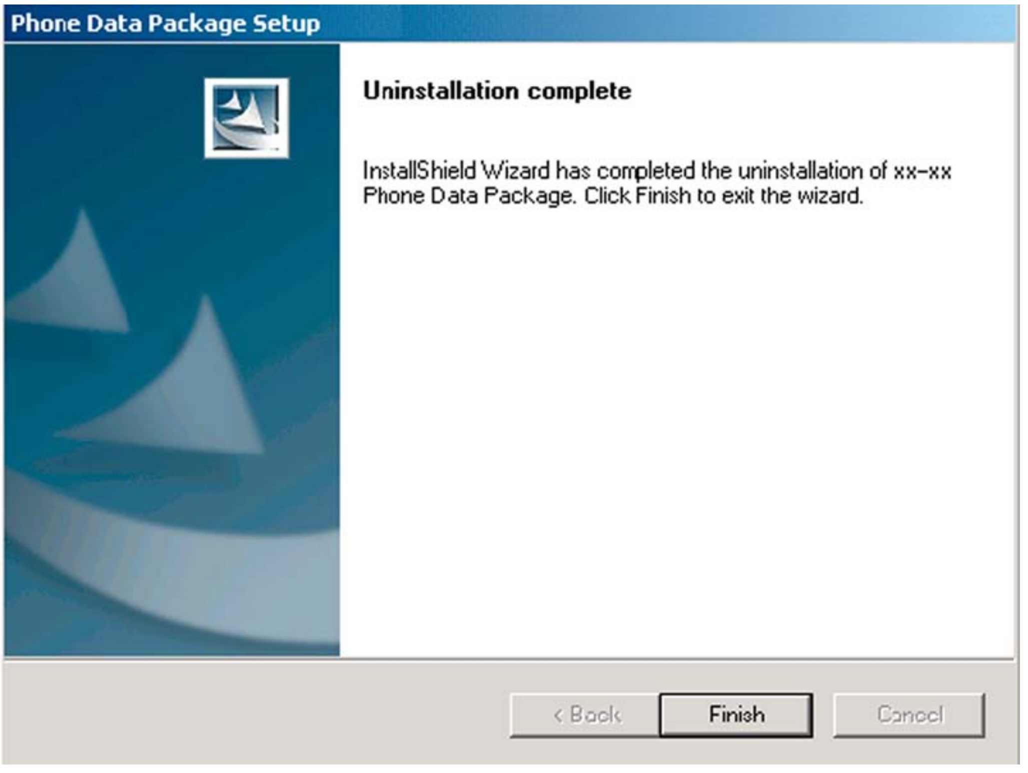


Figure 19 Finishing data package uninstallation

Alternative steps

- You can also uninstall the data package manually from **Control Panel→Add/Remove Programs→xx-xx* Phone Data Package** . (*= type designator of the phone).

Configuring users in *Phoenix*

Steps

1. Start *Phoenix* service software, and log in.

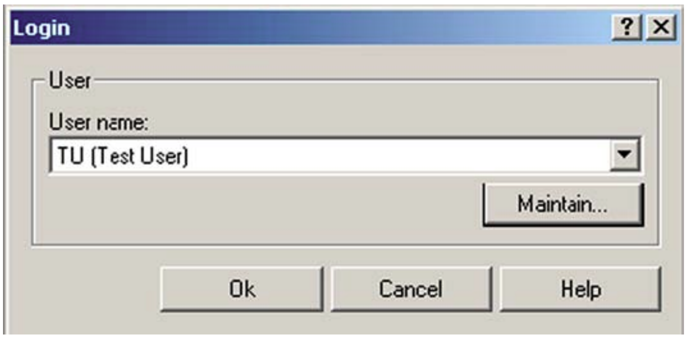


Figure 20 Phoenix login

If the user ID is already configured, select s/he from the *User name* drop-down list, and click **OK**.

2. To add a new user, or to edit existing ones, click **Maintain**.
3. To add a new user, click **New**.
4. Type in the name and initials of the user, and click **OK**.

   The user is added to the user name list.
5. Select the desired user from the *User name* drop-down list, and click **OK**.

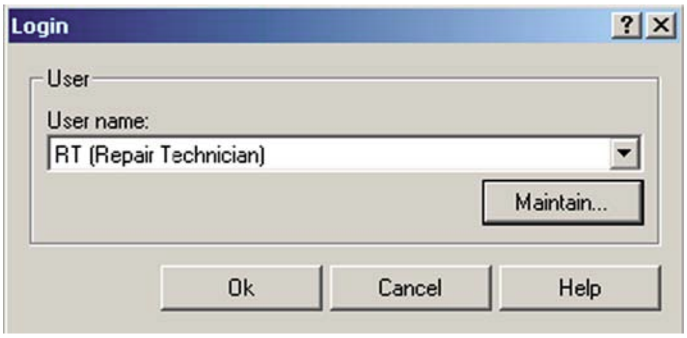


Figure 21 New user configured

Managing connections in *Phoenix*

Context

With the **Manage Connections** feature you can edit and delete existing connections or create new ones.

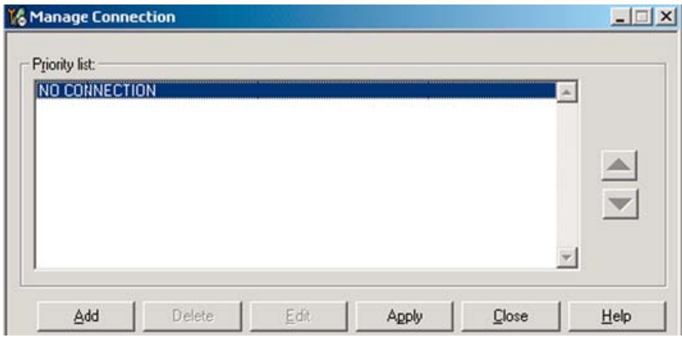
Note: After choosing the desired connection, and connecting the phone to a PC for the first time, allow the PC to install the USB device drivers first. Please note that this may take some time to complete.

If there are problems after the driver installation, check that the USB connection is active from the **Windows Control Panel**. If the problem persists, contact the local PC support.

Steps

1. Start *Phoenix*, and log in.
2. Choose **File→Manage Connections...** .

3. To add a new connection, click **Add**.



4. Select **Manual** mode, and click **Next** to continue.

   If you want to create the connection using the Connection Wizard, connect the tools and a phone to your PC. The wizard will automatically try to configure the correct connection.

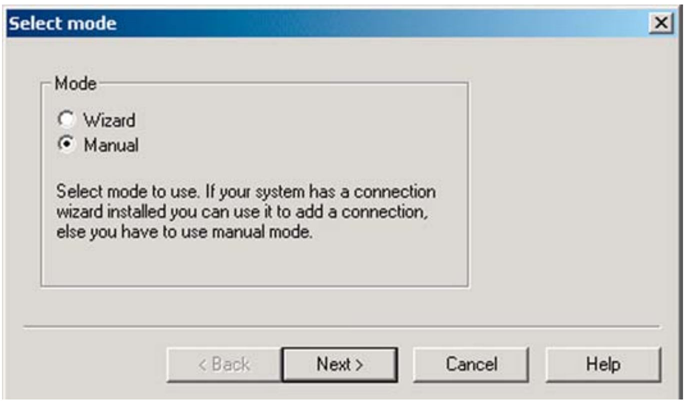


Figure 22 Select mode: Manual

i For an FPS-10 flash prommer with a **USB Connection**, choose the following connection settings:

- Media: **FPS-10 USB**
- DEVICE_INDEX: **0**
- SERIAL_NUM: See Serial No from the label attached to the bottom of FPS-10
- ACTIVE_MEDIA: **USB**

ii For an FPS-10 flash prommer with a **LAN connection**, choose the following connection settings:

- Media: **FPS-10 TCP/IP**
- NET_SERV_NAME: Click **Scan...**. Choose your own FPS-10 device based on the correct MAC address. See Serial No from the label attached to the bottom of your FPS-10.
- PORT_NUM: Use the default value, and click **Next**.
- PROTOCOL_FAMILY: Use the default value, and click **Next**.
- SOCKET TYPE: Use the default value, and click **Next**.
- TX_BUFFER_SIZE: Use the default value, and click **Next**.
- RX_BUFFER_SIZE: Use the default value, and click **Next**.

iii For a plain **USB connection**, choose the following connection settings:

Note: First connect the DKU-2 USB cable between the PC USB port and phone.

- Media: USB

5. To complete the configuration, click **Finish**.

6. Click the connection you want to activate. Use the up/down arrows located on the right hand side to move it on top of the list, then click **Apply**.

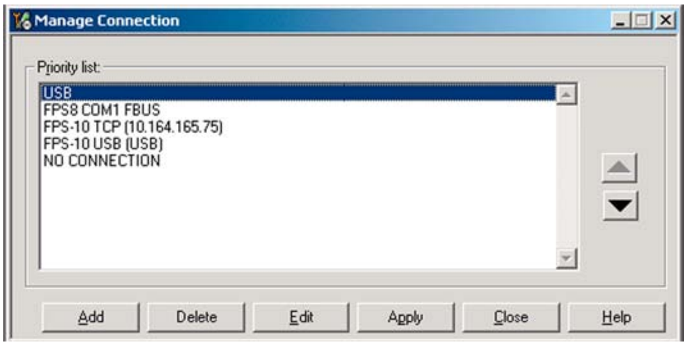


Figure 23 Connections list

The connection is activated, and it can be used after closing the *Manage Connection* window.

The connection information is shown at the right hand bottom corner of the screen.

Figure 24 Connection information

7. To use the connection, connect the phone to your PC with correct service tools. Make sure the phone is switched on, and then choose **File→Scan Product** .

Results

The product support module information appears in the status bar:

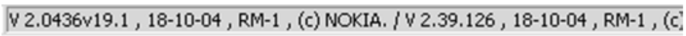


Figure 25 Product support module information (example from RM-1)

Installing flash support files for FPS-10

Prerequisites

Note: You need to install flash support files for FPS-10 only, if you don't have the latest Phoenix available or the flash support files have changed after the latest Phoenix release.

- Flash support files are installed automatically, when you install Phoenix. Use Phoenix packages later than June 2006.
- Normally it is enough to install Phoenix and the phone-specific data package because the Phoenix installation always includes the latest flash update package files for FPS-10.
- A separate installation package for flash support files is available, and the files can be updated according to this instruction, if updates appear between new Phoenix / data package releases

Context

If you are not using a separate installation package, you can skip this section and continue with "Updating FPS-10 flash prommer software" (page 3–22) after installing a new phone data package.

Steps

1. To begin installation, double- click *flash_update_x_yy.exe* .

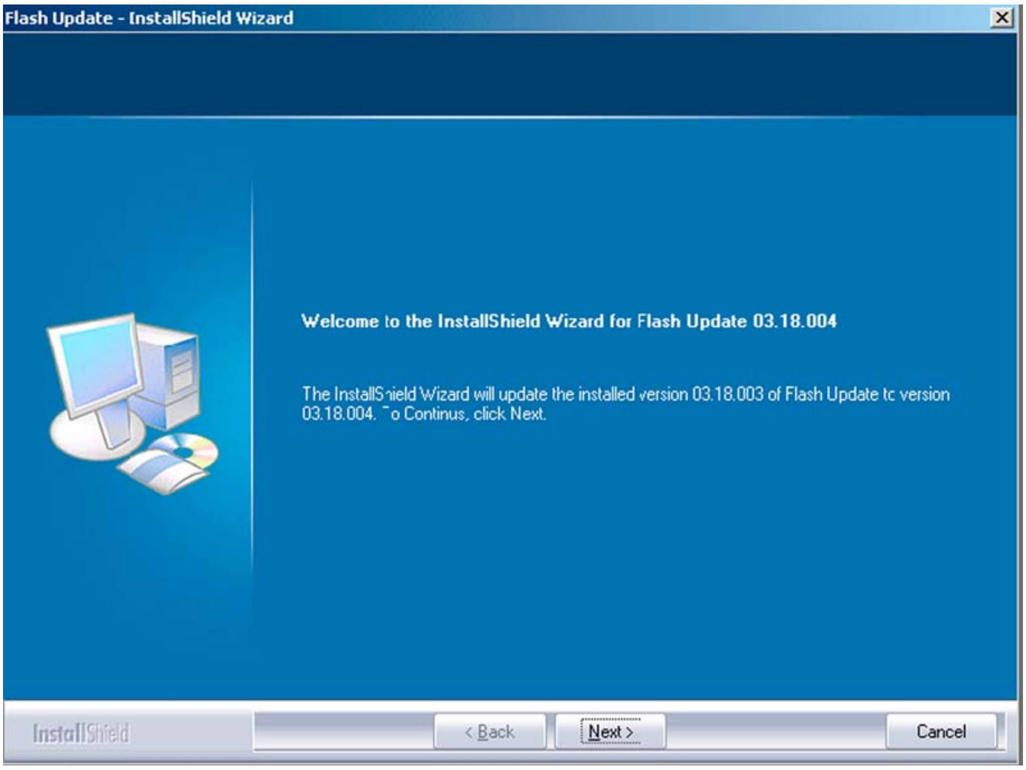


Figure 26 Flash update welcome dialog

   If the same version of Flash Update package already exists, and you want to reinstall it, the previous package is first uninstalled. Restart installation again after that.

2. If you try to downgrade the existing version to older ones, the setup will be aborted. If you really want to downgrade, uninstall newer files manually from **Control Panel** and then rerun the installation again.

Figure 27 Flash installation interrupted

   If an older version exists on your PC and it needs to be updated, click **Next** to continue installation.

3. It is highly recommended to install the files to the default destination folder *C:|Program Files|Nokia |Phoenix*. Click **Next** to continue.

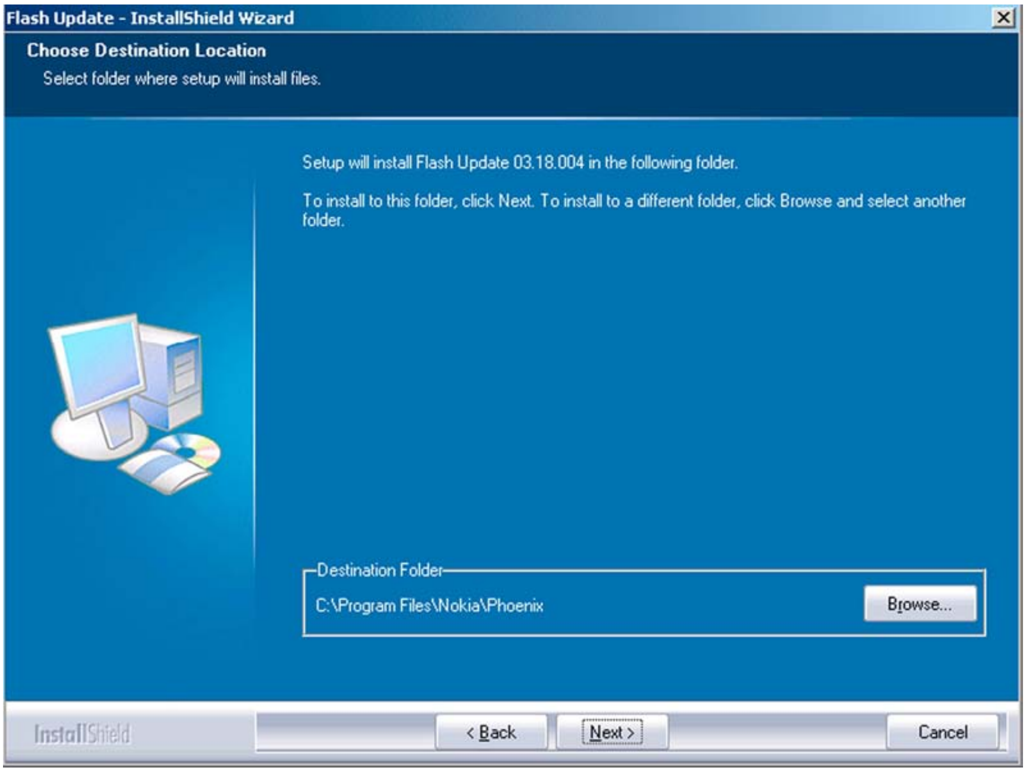


Figure 28 Flash destination folder

When installing the flash update files for the first time you may choose another location by selecting **Browse**. However, this is not recommended.

4. To complete the installation procedure, click **Finish** .

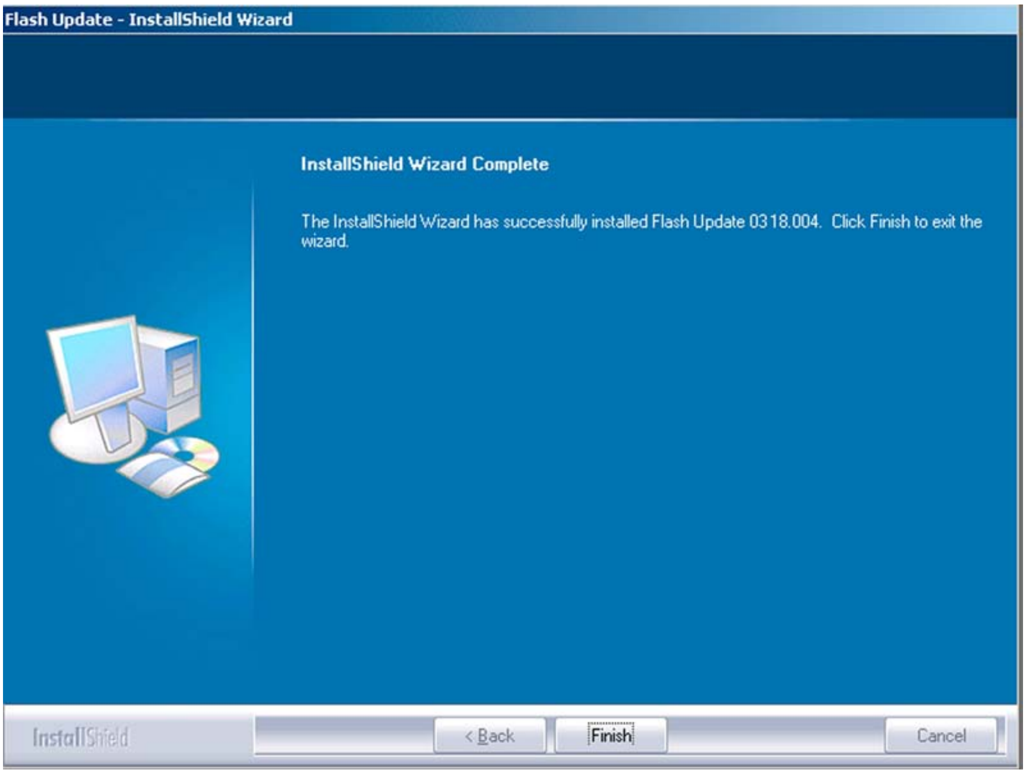


Figure 29 Finish flash update

Next actions

FPS-10 flash prommers must be updated using Phoenix!

Updating FPS-10 flash prommer software

Steps

1. Start *Phoenix Service Software* and log in, manage connection correctly for your flash prommer.
2. Choose **Flashing→Prommer maintenance** .
3. When the new flash update package is installed to the computer you will be asked to update the files to your Prommer. To update the files, click **Yes**. Click **OK** if the computer informs you about an unsafe removal of the device.
4. Alternatively you can update the FPS-10 flash prommer software by clicking the **Update** button.

5. Wait until you are notified that update has been successful; the procedure will take a couple of minutes. Click **OK** to close the *Update Done* window.

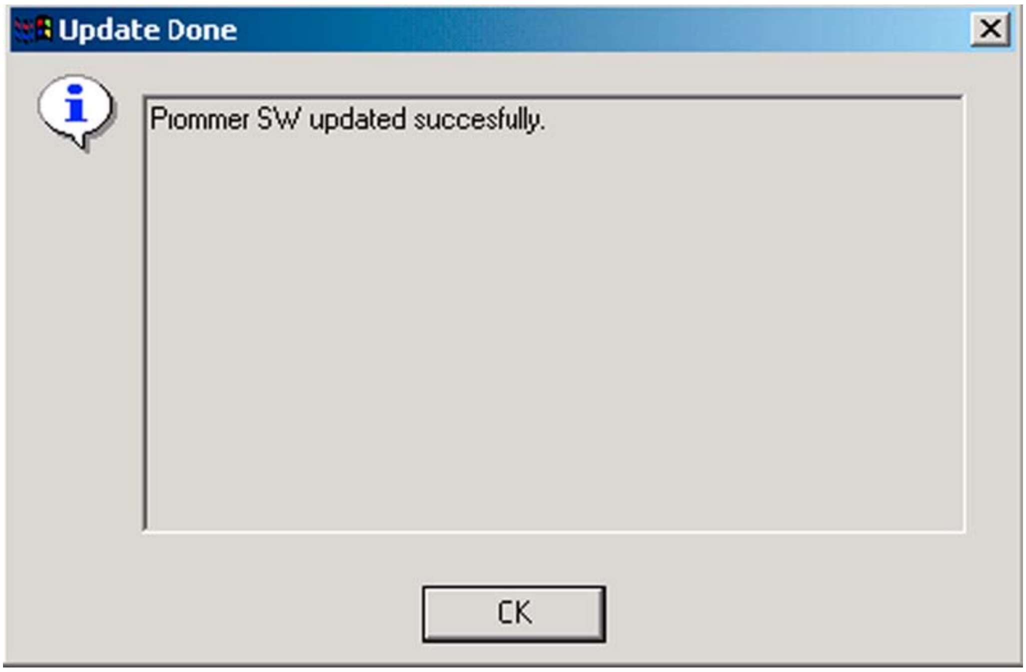


Figure 30 Prommer SW update finished

6. If you are using the FPS-10 flash prommer, check that it is detected from the progress info. Check also the status leds in the FPS-10. The MODE2 led (green), VBAT and POWER leds (red) should be lit. If you are using LAN connection, the LAN led (yellow) should be blinking.
7. Check that your FPS-10 flash prommer has enough memory. Flashing the SU-18 with FPS-10 needs at least 128 MB of SRAM memory in the prommer.

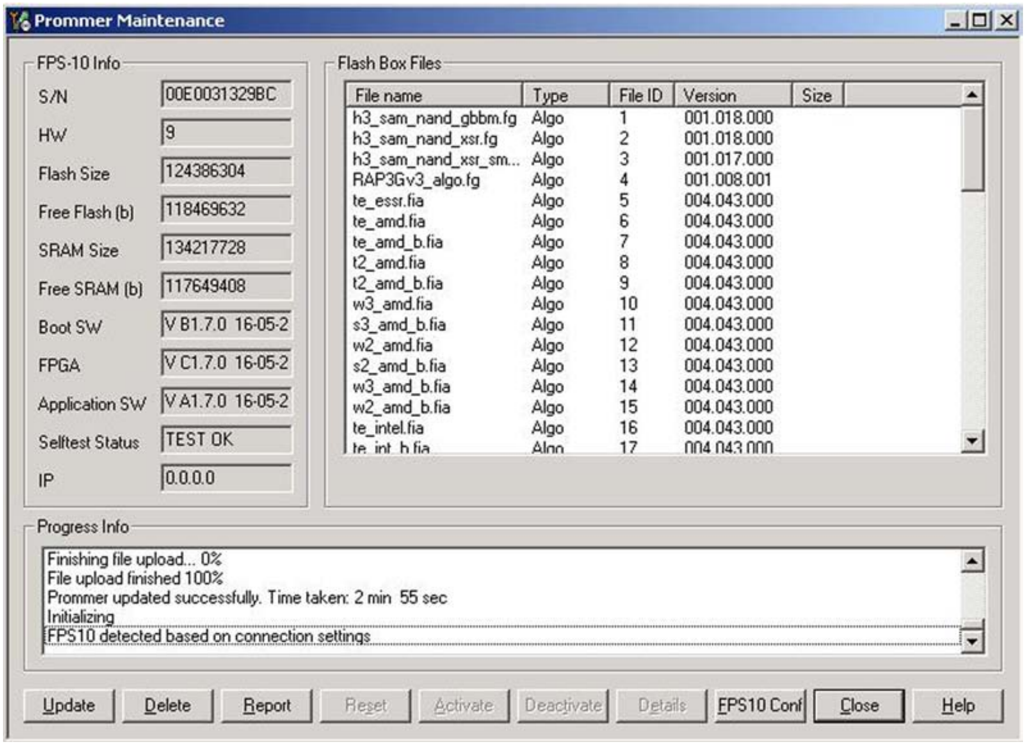


Figure 31 Prommer maintenance window

Alternative steps

- You can update FPS-10 SW by clicking the **Update** button and selecting the appropriate fpsxupd.ini file in *C:|Program Files|Nokia|Phoenix|Flash*.

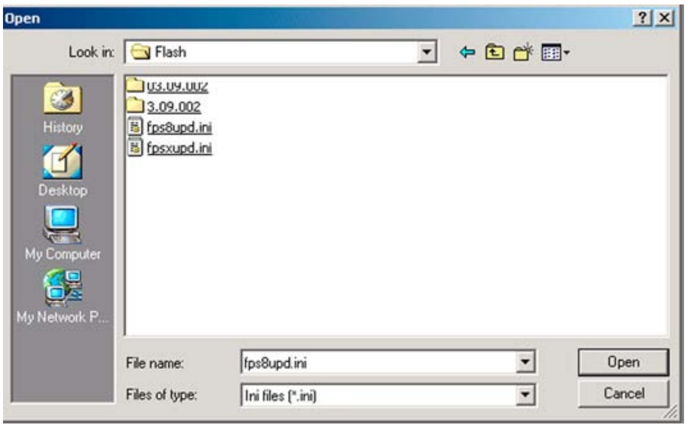


Figure 32 Flash directory window

- All files can be loaded separately to the prommer used. To do this, click the right mouse button in the *Flash box files* window and select the file type to be loaded.

  More information can be found in Phoenix **Help**.

4 — Service Tools and Service Concepts

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Table of Contents

List of Figures

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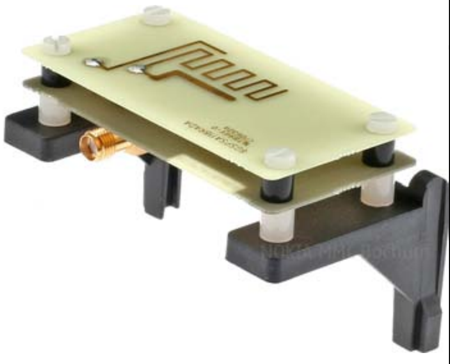
New service tools

The table below gives a short overview of service tools that can be used for testing, error analysis and repair of product RM-156, refer to various concepts.

<table>
<tr><td rowspan="2">
</td><td>FS-22</td><td>Flash adapter</td><td></td></tr>
<tr><td colspan="3">Flash adapter FS-22 is used for phone testing and flashing.
FS-22 is used with the generic flash adapter base SS-60/62 and control Unit CU-4 or interface adapter SS-46. When flashing or system testing the phone, the adapter is attached to replace the phone own battery.
All functions (as well as the calibration voltages, current and the protections for over voltages, over current and voltage polarity), are performed by CU-4.
Flash adapter FS-22 main features:
• VBATT supply interface
• USB / FBUS multiplexed interface to the phone
• Supply voltage for light source</td></tr>
<tr><td rowspan="2"></td><td>MJ-95</td><td>Module jig</td><td></td></tr>
<tr><td colspan="3">MJ-95 is meant for component level troubleshooting.
The jig includes an RF interface for GSM, WCDMA, Bluetooth and WLAN. 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
• UI test interface
• SD interface
• Duplicated SIM connector
• Audio components: IHF, MIC, earpiece
• Connector for control unit
• Access for Pop-Port™ system connector</td></tr>
<tr><td rowspan="2">
</td><td>RJ-110</td><td>Rework jig</td><td></td></tr>
<tr><td colspan="3">RJ-110 is a rework jig used with ST-43.</td></tr>
</table>

	SA-118	RF coupler	
	SA-118 is used for RF testing with FS-22, SS-62 and CU-4.		
	SS-107	Window removal tool	
	SS-107 is used for removing sub LCD window assy without disassembling the phone.		

General service tools

The table below gives a short overview of service tools that can be used for testing, error analysis and repair of product RM-156, refer to various concepts.

	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.		
	CA-53	USB connectivity cable	
	USB to system connector cable.		

<table>
<tr><td rowspan="2"></td><td>CA-58RS</td><td>RF tuning cable</td><td></td></tr>
<tr><td colspan="3">RF tuning cable for use with a flash adapter.
CA-58RS RF cable extends adapter features to allow RF function tests and RF tuning in GSM bands.
Features include:
• easy to use together with flash adapter or even stand alone
• most accurate RF connection to phone module under test
• most accurate RF connection to phone module under test
• low attenuation and small “ripple” over the width of each GSM band
Note: The RF cable must be used for RF tuning.</td></tr>
<tr><td rowspan="2"></td><td>CA-64U</td><td>Video-out cable</td><td></td></tr>
<tr><td colspan="3">CA-64U is used to check TV-out functionality.</td></tr>
</table>

CU-4	Control unit	

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

The unit has the following features:

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

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

Instructions

1 Connect a service tool (jig, flash adapter) to CU-4.

2 Connect CU-4 to your PC with a USB cable.

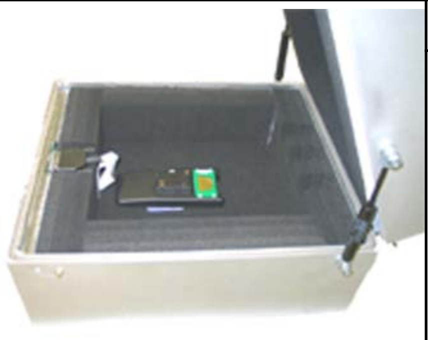
3 Connect supply voltage (12 V)

4 Connect an FBUS cable (if necessary).

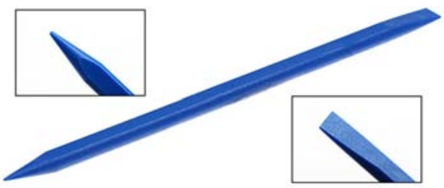
5 Start Phoenix service software.

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

Reconnecting the power supply requires a Phoenix restart.

	DAU-9S	MBUS cable	
	The MBUS cable DAU-9S has a modular connector and is used, for example, between the PC's serial port and module jigs, flash adapters or docking station adapters. **Note:** Docking station adapters valid for DCT4 products.		
	FPS-10	Flash prommer	
	FPS-10 interfaces with: • PC • Control unit • Flash adapter • Smart card FPS-10 flash prommer features: • Flash functionality for BB5 and DCT-4 terminals • Smart Card reader for SX-2 or SX-4 • USB traffic forwarding • USB to FBUS/Flashbus conversion • LAN to FBUS/Flashbus and USB conversion • Vusb output switchable by PC command FPS-10 sales package includes: • FPS-10 prommer • Power Supply with 5 country specific cords • USB cable		
	JXS-1	RF shield box	
	Because the WCDMA network disturbs the RX side testing of the WCDMA phone and the Tx signal of the WCDMA phone can severely disturb the WCDMA network, a shield box is needed in all testing, tuning and fault finding which requires WCDMA RF signal. The shield box is not an active device, it contains only passive filtering components for RF attenuation.		

<table>
<tr><td rowspan="2"></td><td>PCS-1</td><td>Power cable</td><td></td></tr>
<tr><td colspan="3">The PCS-1 power cable (DC) is used with a docking station, a module jig or a control unit to supply a controlled operating voltage.</td></tr>
<tr><td rowspan="2"></td><td>PKD-1</td><td>SW security device</td><td></td></tr>
<tr><td colspan="3">SW security device is a piece of hardware enabling the use of the service software when connected to the parallel (LPT) port of the PC.
Without the device, it is not possible to use the service software.
Printer or any such device can be connected to the PC through the device if needed.</td></tr>
<tr><td rowspan="2"></td><td>SB-6</td><td>Bluetooth tester</td><td></td></tr>
<tr><td colspan="3">The SB-6 test box is a generic device to perform Bluetooth bit error rate testing and doing cordless FBUS connection via Bluetooth.</td></tr>
<tr><td rowspan="2"></td><td>SB-7</td><td>WLAN test box</td><td></td></tr>
<tr><td colspan="3">WLAN test requires defined position for the device.</td></tr>
</table>

<table>
<tr><td rowspan="2"></td><td>SRT-6</td><td>Opening tool</td><td></td></tr>
<tr><td colspan="3">SRT-6 is used to open phone covers and B-to-B connectors.</td></tr>
<tr><td rowspan="2"></td><td>SS-46</td><td>Interface adapter</td><td></td></tr>
<tr><td colspan="3">SS-46 acts as an interface adapter between the flash adapter and FPS-10.</td></tr>
<tr><td rowspan="2"></td><td>SS-62</td><td>Generic flash adapter base for BB5</td><td></td></tr>
<tr><td colspan="3">generic base for flash adapters and couplers
SS-62 equipped with a clip interlock system
provides standardised interface towards Control Unit
provides RF connection using galvanic connector or coupler
multiplexing between USB and FBUS media, controlled by VUSB</td></tr>
<tr><td rowspan="2"></td><td>SS-93</td><td>Opening tool</td><td></td></tr>
<tr><td colspan="3">SS-93 is used for opening JAE connectors.</td></tr>
<tr><td rowspan="2"></td><td>SX-4</td><td>Smart card</td><td></td></tr>
<tr><td colspan="3">SX-4 is a BB5 security device used to protect critical features in tuning and testing.
SX-4 is also needed together with FPS-10 when DCT-4 phones are flashed.</td></tr>
</table>

	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		

Non-standard service tools

The table below gives a short overview of service tools that can be used for testing, error analysis and repair of product RM-156, refer to various concepts.

		PC TV card	

	A PC TV card can be used for testing the TV-out functionality. The minimum requirements for a TV card are the following:
	• Video formats:
	  • NTSC and PAL input support
	• Physical inputs:
	  • female inputs
	  • composite video input
	  • RCA Audio input or an input adaptable to RCA using a converter cable (e.g. 3.5 mm input)
	Different devices are available from various vendors, and can be used without special approval from Nokia.		

<table>
<tr><td rowspan="2"></td><td></td><td>Standard TV set</td><td></td></tr>
<tr><td colspan="3">A standard TV set is used for testing the TV-out functionality of the device. A commercial colour TV set with compatible video formats (NTSC or PAL) can be used in service centers.
Different devices are available from various vendors, and can be used without special approval from Nokia.</td></tr>
</table>

Service concepts

POS (Point of Sale) flash concept

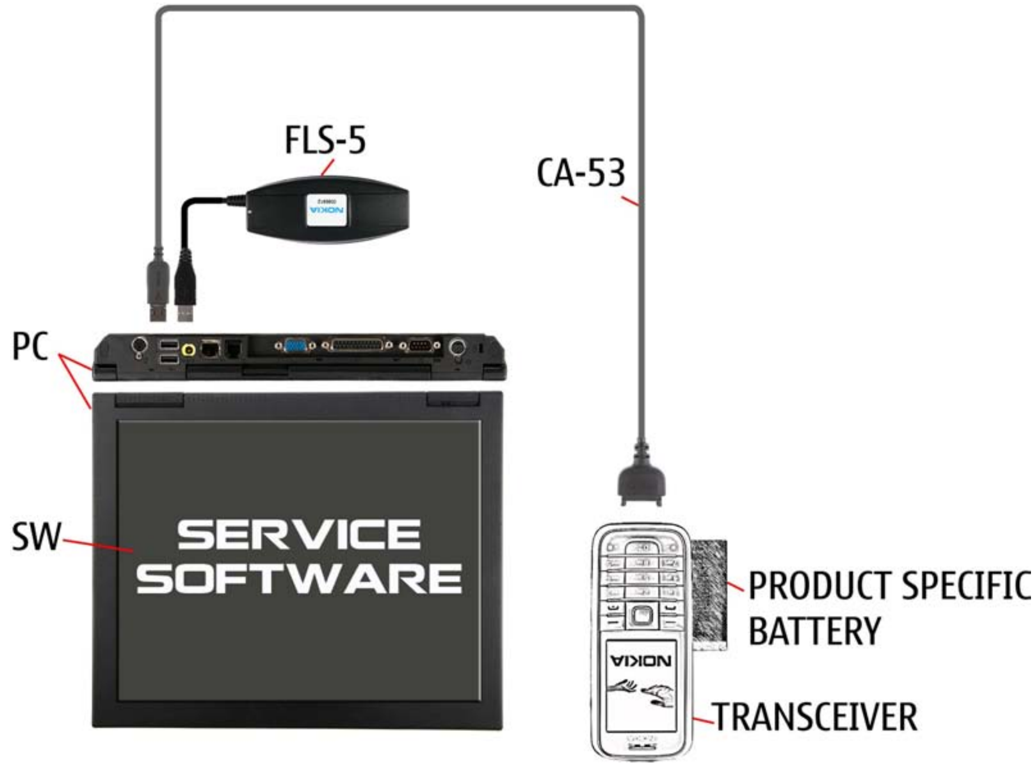


Figure 33 POS flash concept

Type	Description
Product specific tools	
BL-5F	Battery
Other tools	
FLS-4S	POS flash dongle
	PC with Phoenix service software

Type	Description
Cables	
CA-53	USB connectivity cable

CU-4 flash concept with FPS-10

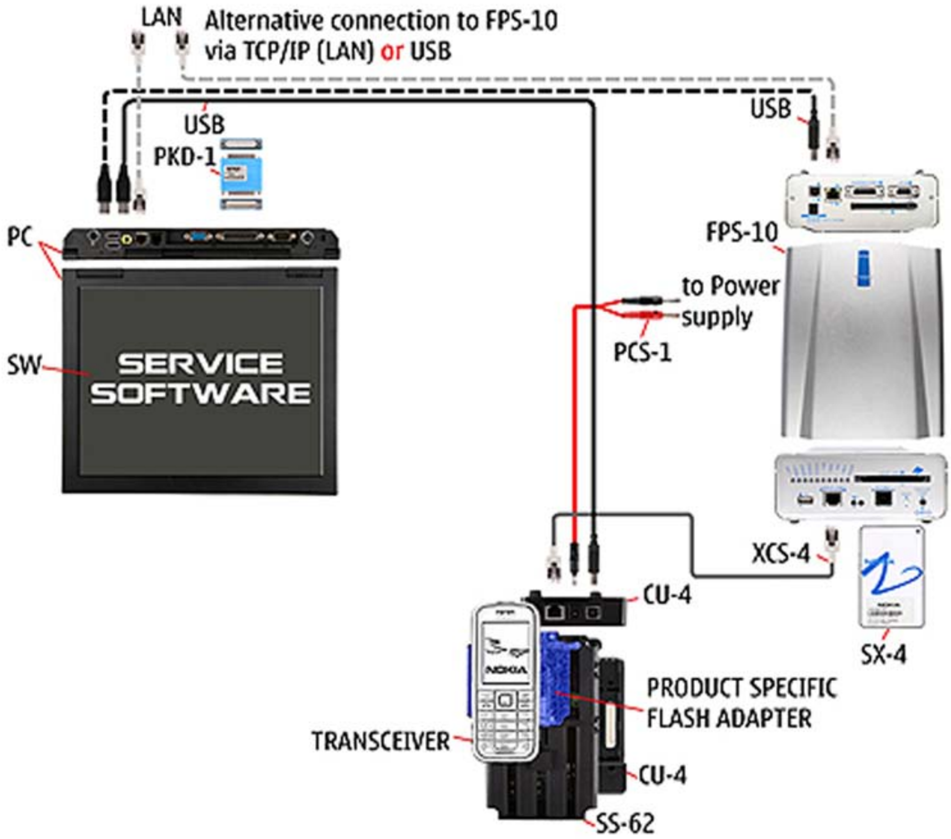


Figure 34 CU-4 flash concept with FPS-10

Type	Description
Product specific tools	
FS-22	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
SX-4	Smart card
	PC with Phoenix service software
Cables	
PCS-1	Power cable
XCS-4	Modular cable

Type	Description
	Standard USB cable
	USB cable

Module jig service concept

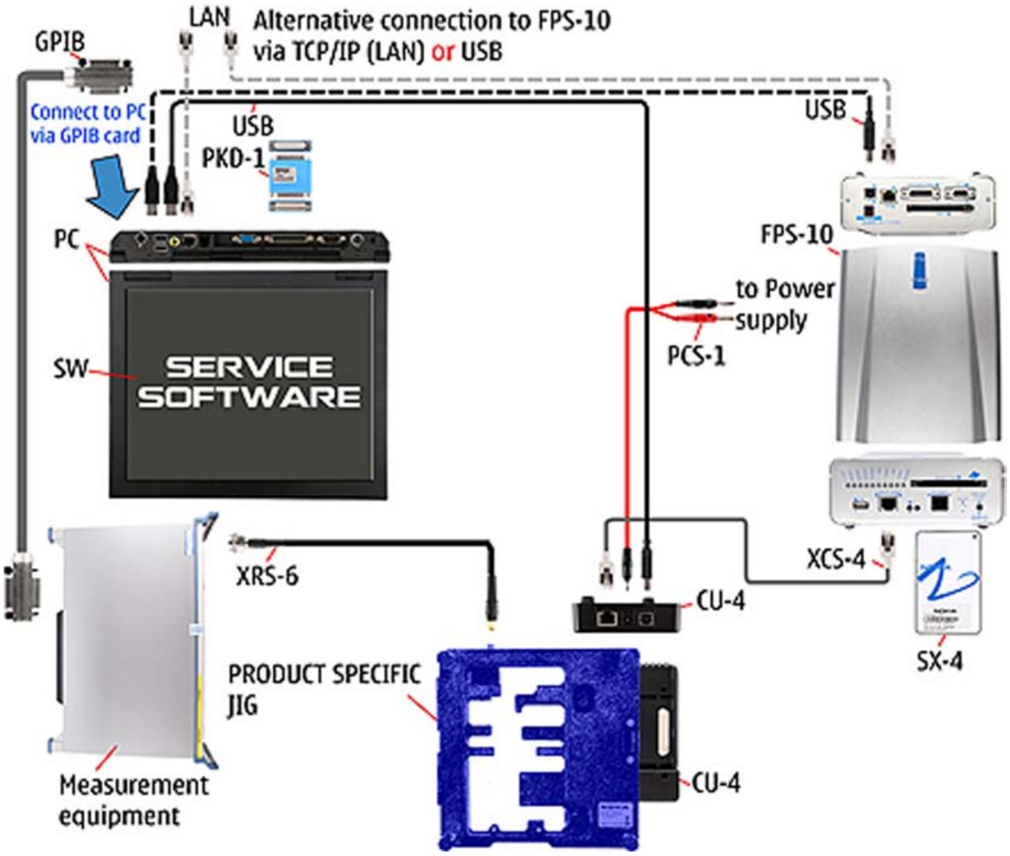


Figure 35 Module jig service concept

Type	Description
Phone specific tools	
MJ-95	Module jig
Other tools	
CU-4	Control unit
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SX-4	Smart card
	PC with Phoenix service software
	Measurement equipment
Cables	
PCS-1	DC power cable

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

RF testing concept with RF coupler

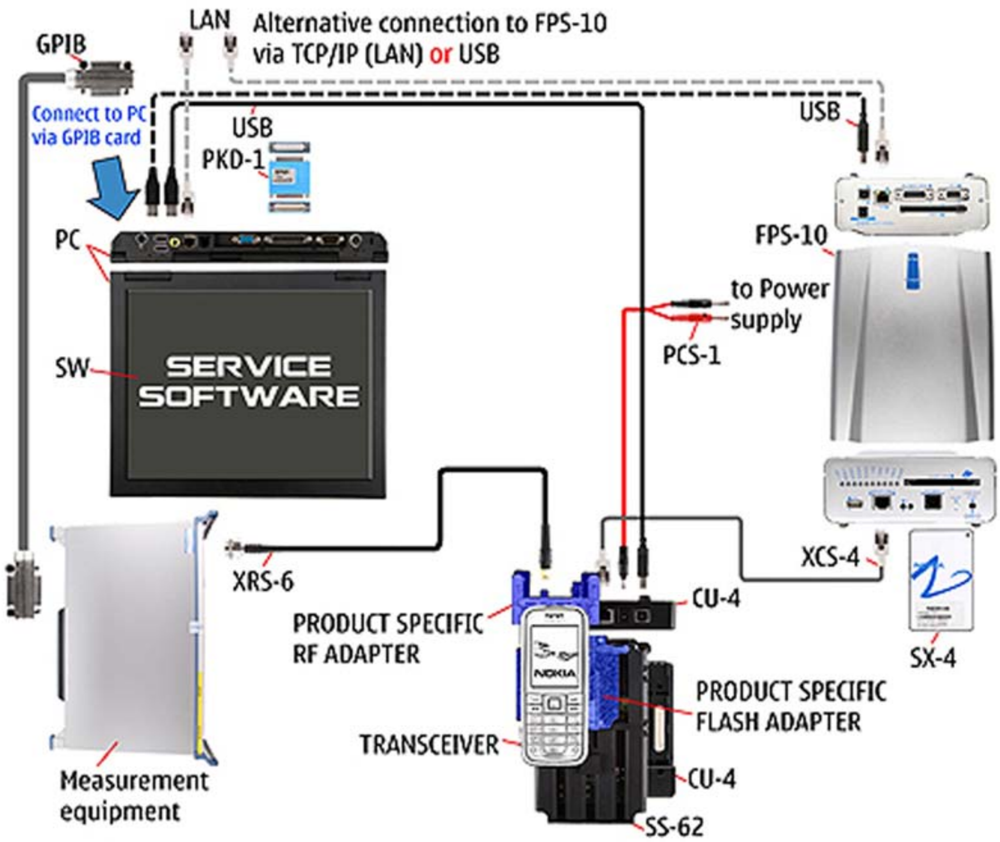


Figure 36 RF testing concept with RF coupler

Type	Description
Product specific tools	
FS-22	Flash adapter
SA-118	RF coupler
Other tools	
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

Type	Description
	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

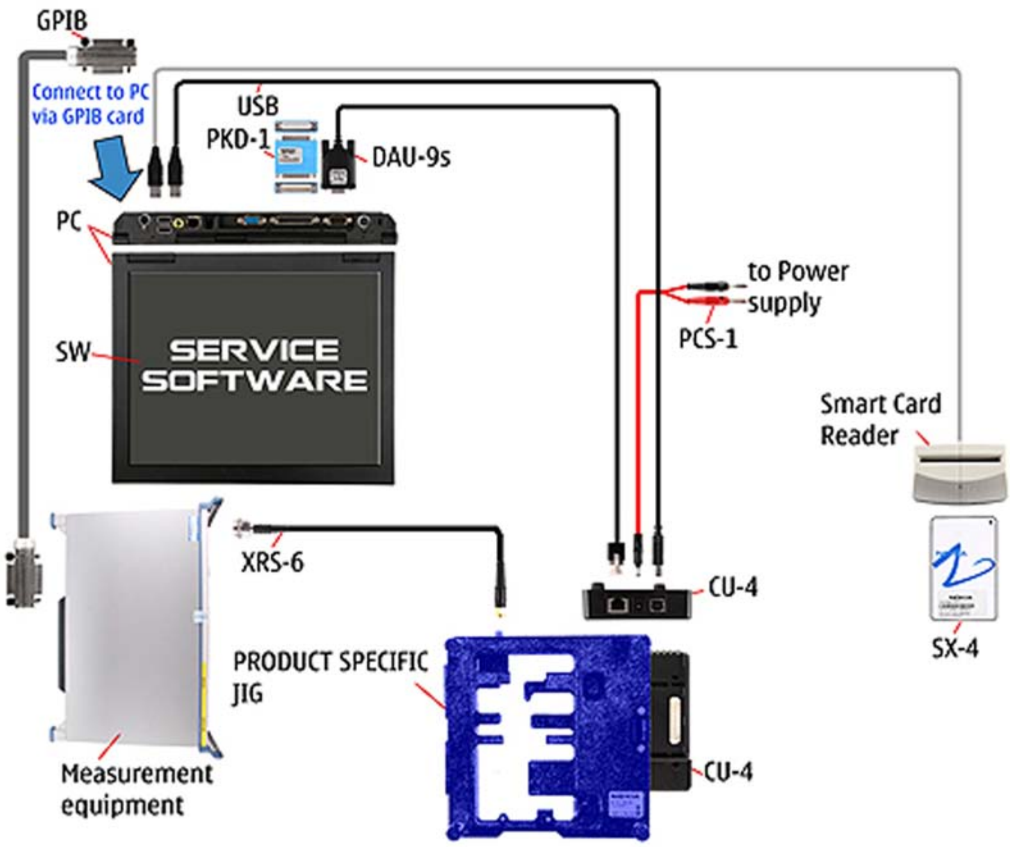


Figure 37 Service concept for RF testing and RF/BB tuning

Type	Description
Product specific tools	
MJ-95	Module jig
Other tools	
CU-4	Control unit
SX-4	Smart card
	Measurement equipment

Type	Description
	Smart card reader
	PC with Phoenix service software
Cables	
DAU-9s	MBUS cable
PCS-1	DC power cable
PKD-1/PK-1	SW security device
XRS-6	RF cable
	GPIB control cable
	USB cable

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

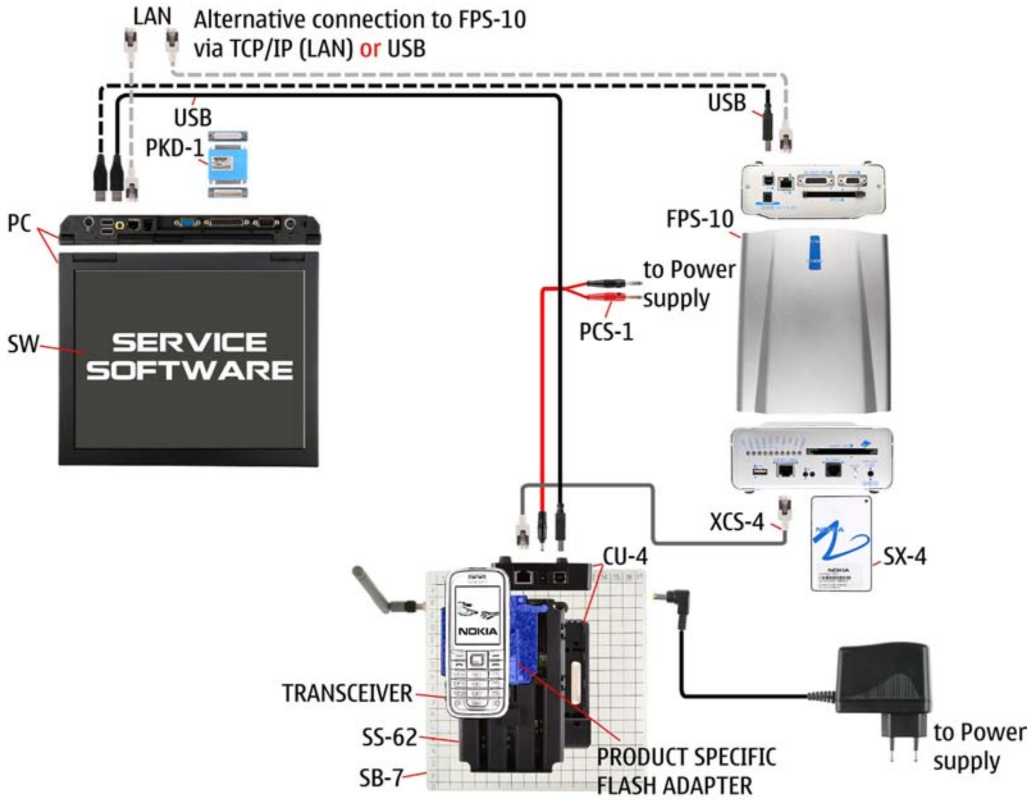
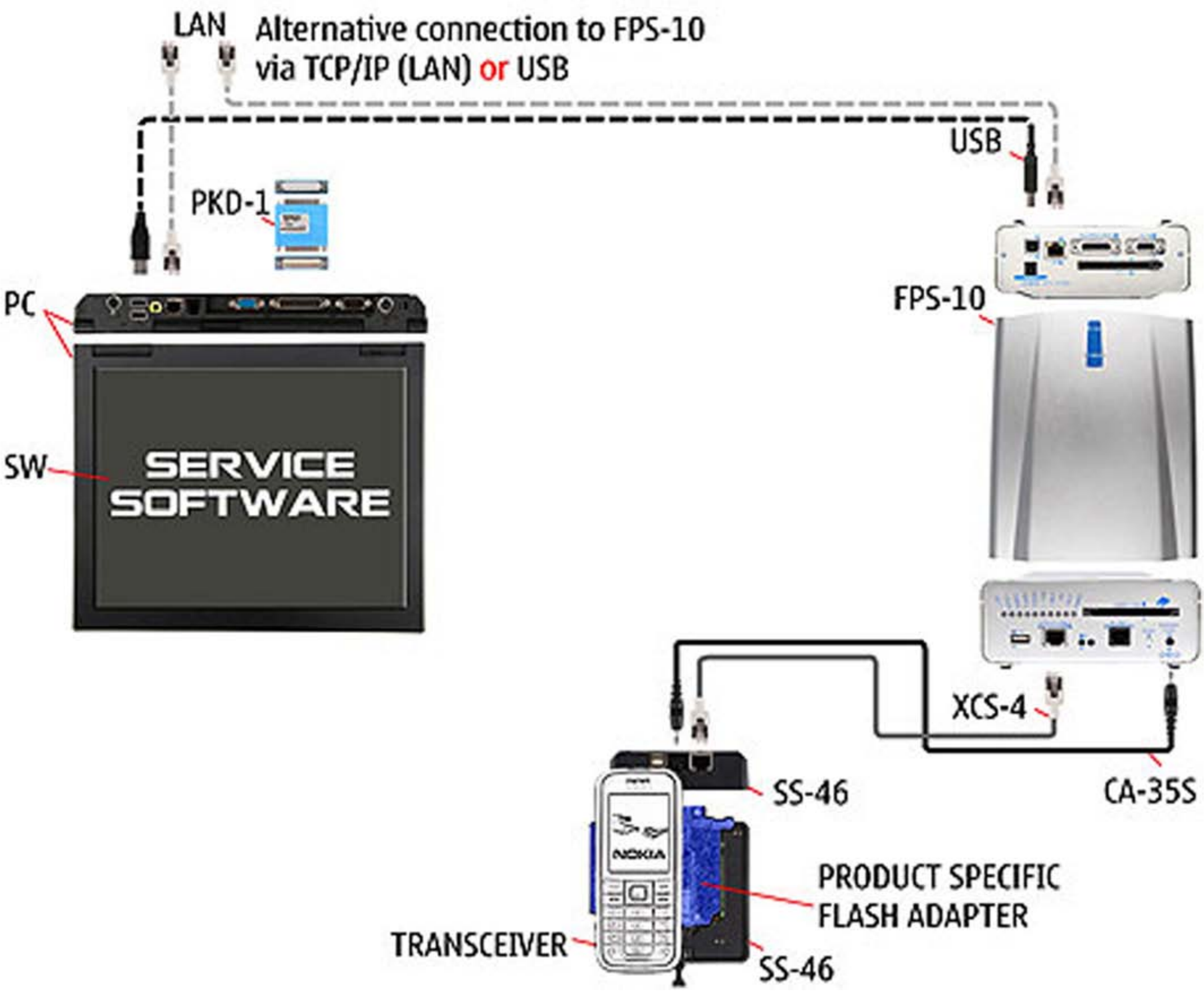


Figure 38 Flash concept with FPS-10, SB-7 and JBT-9

Type	Description
Product specific tools	
FS-22	Flash adapter
Other tools	
CU-4	Control unit
FPS-10	Flash prommer box

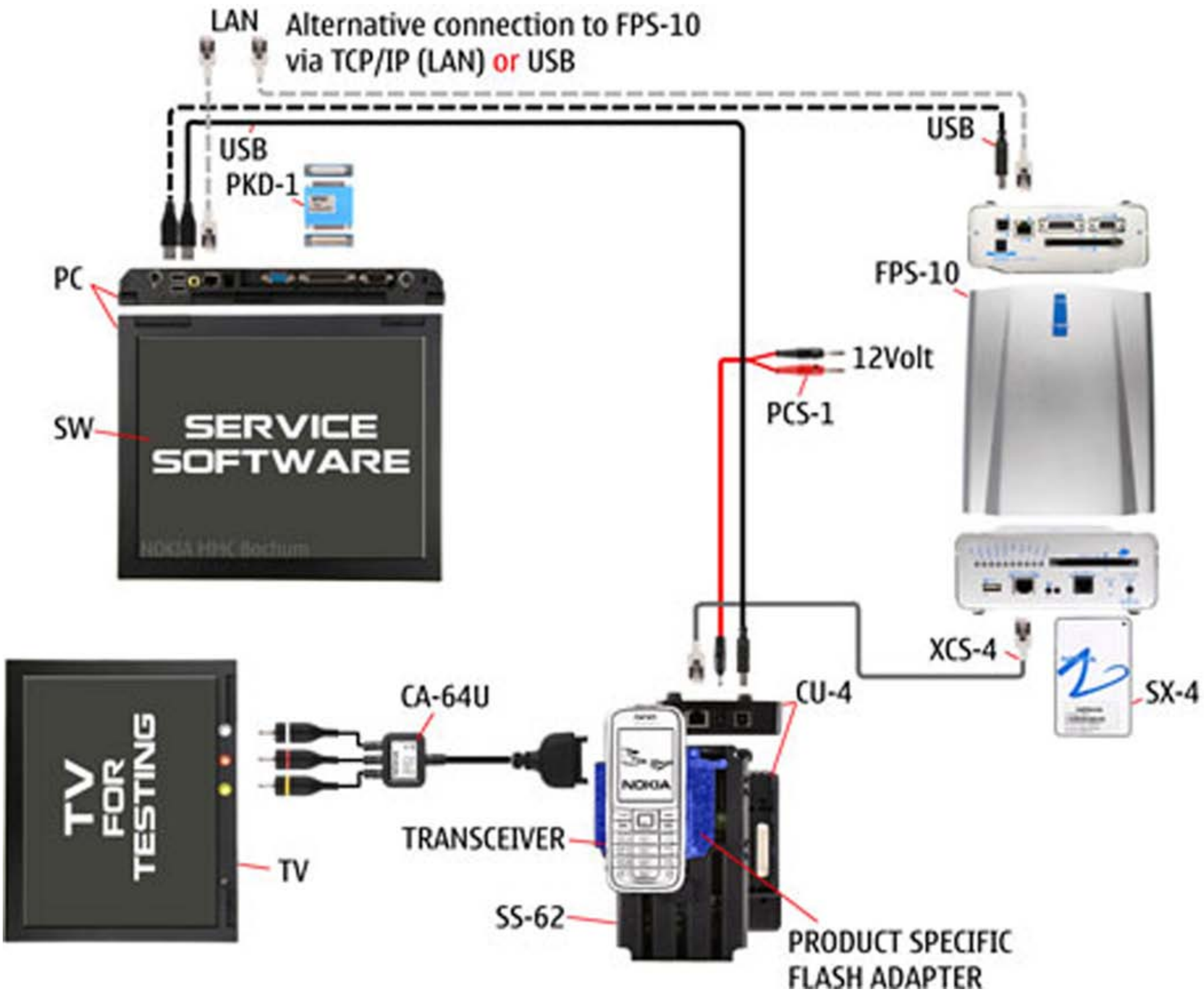
Type	Description
PKD-1/PK-1	SW security device
SB-7	WLAN test box
SS-62	Flash adapter base
SX-4	Smart card
	PC with Phoenix service software
Cables	
XCS-4	Modular cable
PCS-1	Power cable
	USB cable

LAN connection flash concept



Type	Description
Product specific tools	
FS-22	Flash adapter
Other tools	
FPS-10	Flash prommer box
PKD-1	SW security device
SS-46	Interface adapter
Cables	
CA-35S	Power cable
XCS-4	Modular cable
	LAN cable

TV-out testing concept



Type	Description
Product specific tools	
FS-22	Flash adapter
Other tools	
CU-4	Control unit
FPS-10	Flash prommer box
PKD-1	SW security device
SS-62	Flash adapter base
SX-4	Smart card
Cables	
CA-64U	Video-out cable
PCS-1	Power cable
	USB cable
	Standard USB cable

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5 — Disassembly and reassembly instructions

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Upper block disassembly

1. Needed tools: a torx driver, a torque driver, a torx plus size 6 bit, metal tweezers, angled tweezers, a dental pick, a flat bladed screwdriver, the SS-93, the SS-107 vacuum cap and the SRT-6.

2. Remove the battery if inserted.

3. Position the SS-107 on the SUB LCD WINDOW as shown.

4. Press down the lever to create vacuum in the cup.

5. Carefully, pull at the grip to lift a bit the SUB LCD WINDOW.

6. Place the SS-93 between the SUB LCD WINDOW and the FLIP B-COVER and separate the parts from each other.

7. Do not use the window again.

8. Remove the remaining adhesive.

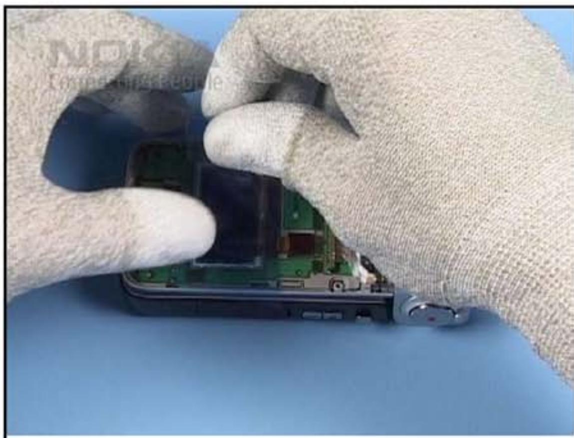
9. Only discard the FLIP B-COVER when the adhesive is gluing strongly and can not be removed completely.

10. Undo the screws in the order shown...

11. ...and remove them.

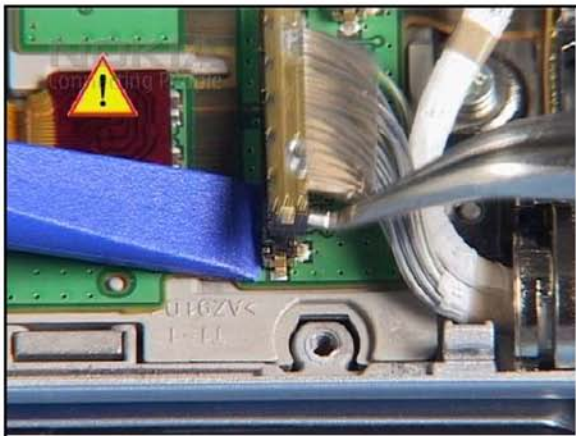
12. Slide the SRT-6 along the sides of the FLIP B-COVER to release all clips.

13. Remove the FLIP B-COVER.



14. Protect the SUB LCD with a protective film.

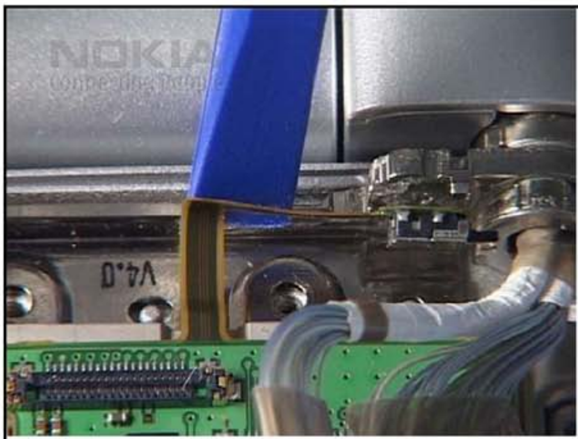
15. Use the SS-93 as a support when opening the HINGE connectors.



16. Carefully lever up both connectors with angled tweezers.

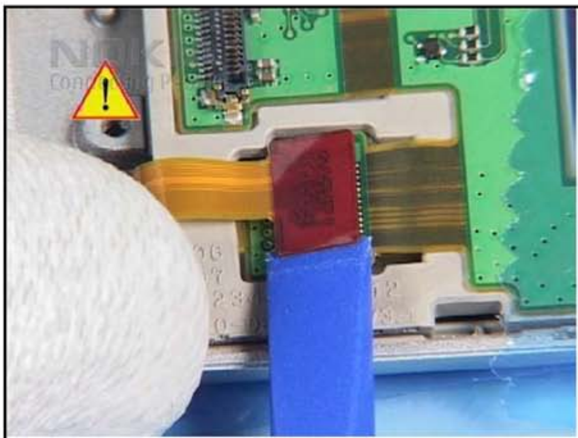
17. Undo the screws in the order shown...

18. ...and discard them.

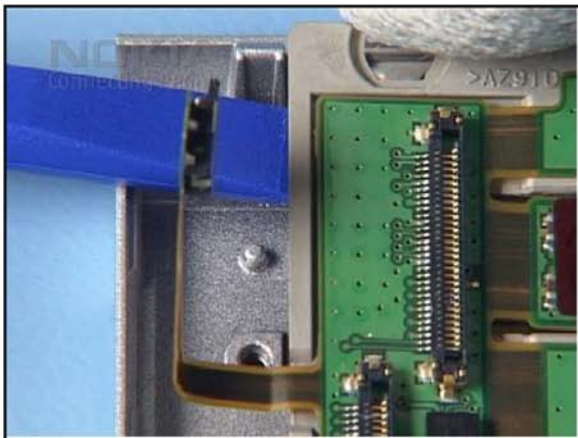


19. Loosen the flex of the DETECTOR SWITCH.

20. Open a bit the HINGE as shown and separate the upper parts from the LOWER BLOCK.



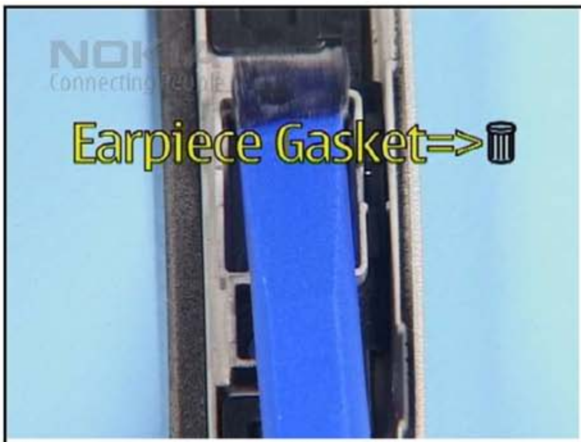
21. Open the MAIN LCD connector.



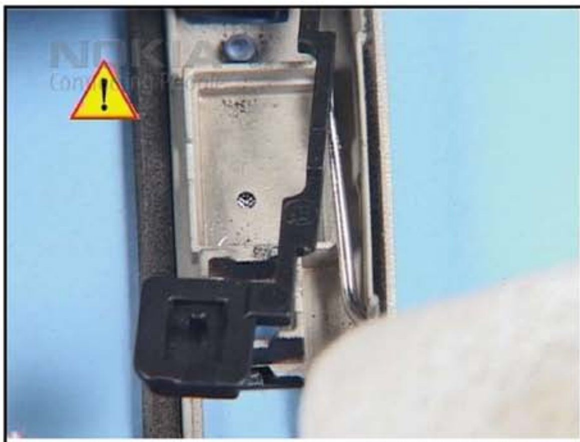
22. Lever up the FLIP FRAME ASSY and remove it from the FLIP A-COVER.

23. Remove the MAIN LCD.

24. Now, lever the EARPIECE from its guidance...

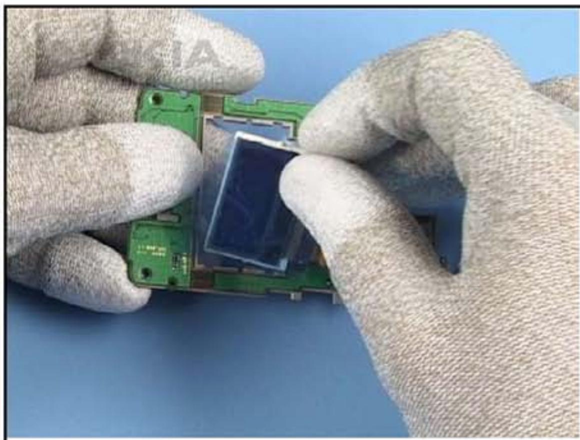


25. ...and remove the EARPIECE GASKET.



26. Use the dental tool to remove the FLIP SOFT KEYMAT.

27. Open the SUB LCD connector...



28. ...and remove the SUB LCD.

29. Now, the disassembly procedure is complete.

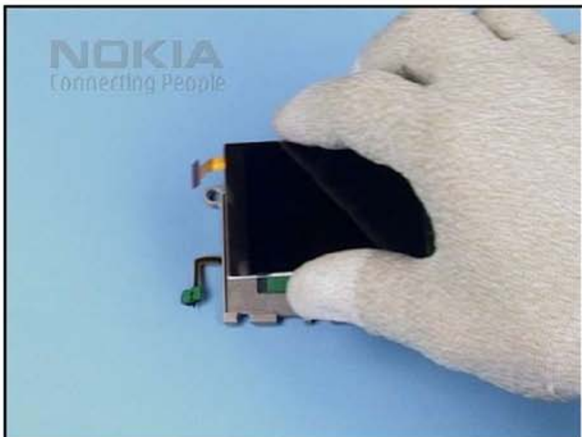
Upper block reassembly

1. Assembly

2. Carefully place the FLIP SOFT KEYMAT into its place.

3. Always use a new EARPIECE GASKET when replacing the EARPIECE.

4. Mind the spring contacts while handling the EARPIECE.



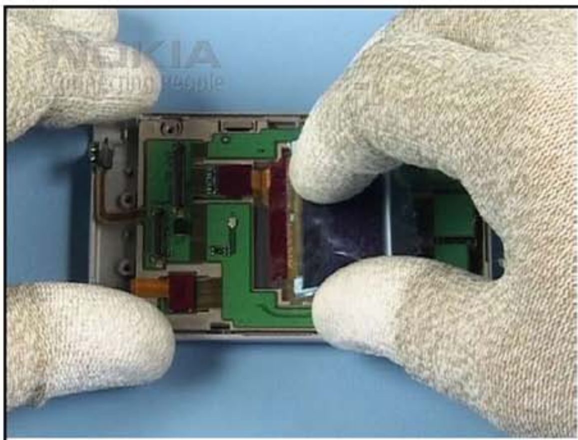
5. Place the MAIN LCD on to the FLIP FRAME ASSY.

6. Aligne the FLIP A-COVER with the FLIP FRAME ASSY...

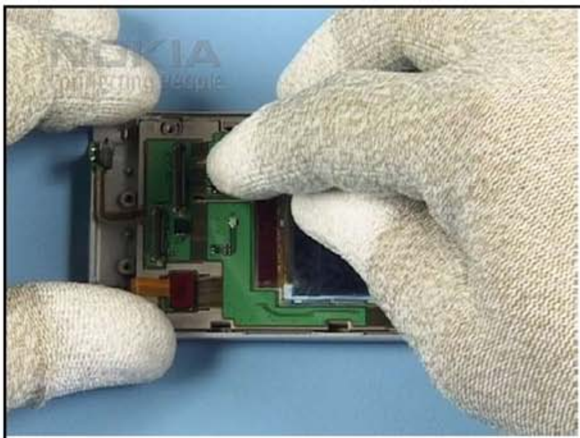
7. ...and cover the MAIN LCD with a protective film.

8. Gently turn the assembly as shown and ensure that the FLIP FRAM ASSY and the MAIN LCD are correctly placed onto the FLIP A-COVER.

9. Close the MAIN LCD connector.

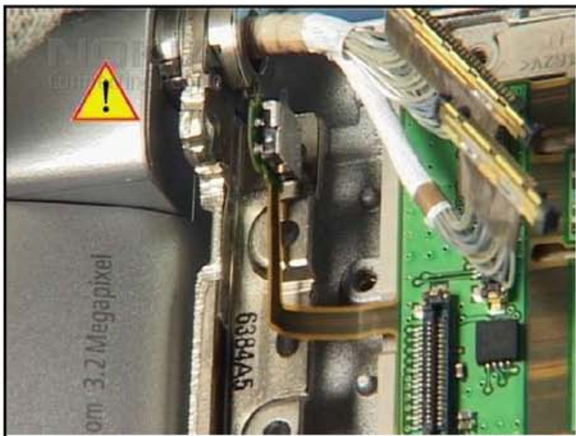


10. Place the SUB LCD on to the FLIP FRAME ASSY...



11. Close the SUB LCD connector.

12. Align the FLIP A-COVER with the HINGE ASSEMBLY.



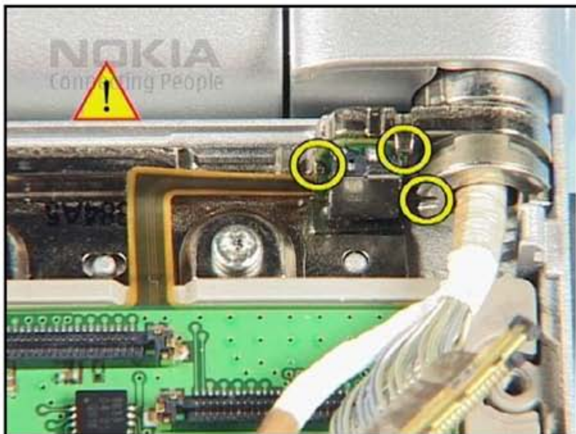
13. Take special care to the flex of the DETECTOR SWITCH.

14. Set the correct torque.

15. Always use new screws...

16. ...and tighten them to the correct torque in the order shown.

17. Fix the DETECTOR SWITCH to its place and adhere the flex as shown.

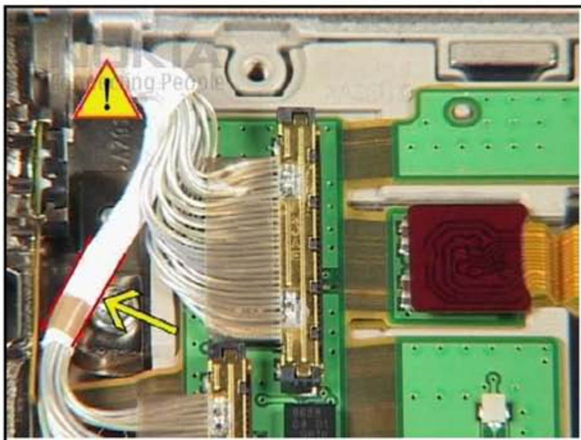


18. Check its correct position.

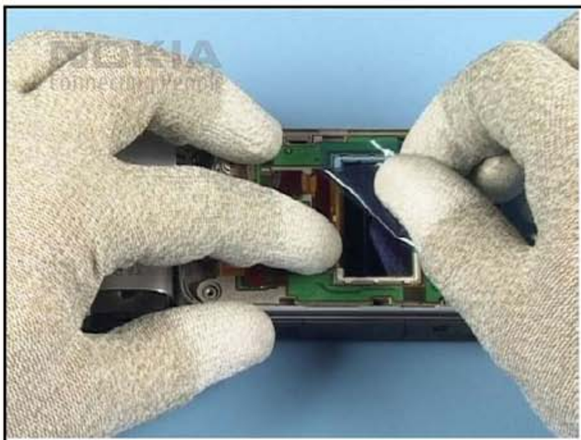
19. Open the unit as shown...

20. ...and check the functionality of the switch by turning the FLIP A-COVER to both directions.

21. Very gently, close the both HINGE connectors.

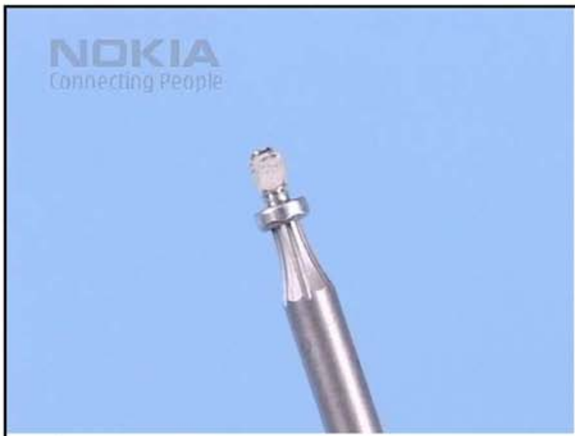


22. Ensure that the cable is not positioned over the screw.



23. Remove the protective film.

24. Align the FLIP B-COVER with the FLIP A-COVER and press them together.



25. Always use new screws...

26. ..and tighten them to the correct torque in the order shown.

27. Remove the protective film from the new SUB LCD WINDOWS ASSY...

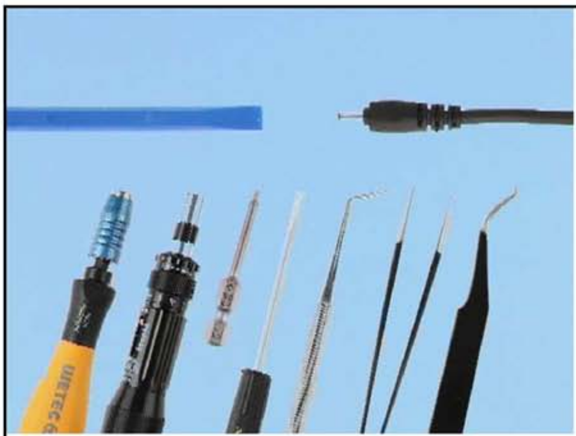
28. and align it exactly with the FLIP B-COVER.

29. Secure the window by pressing it into the FLIP B-COVER.

30. Check that no gaps remain.

31. Finally fit the GRIP C-COVER ASSY.

Lower block disassembly



1. Needed Tools: a Torx driver, a torque driver, a Torx Plus size 6 bit, a flat bladed screwdriver, a dental pick, metal tweezers, angled tweezers, the SS-93 and the DC-plug.

2. Cover all windows with a protective film.

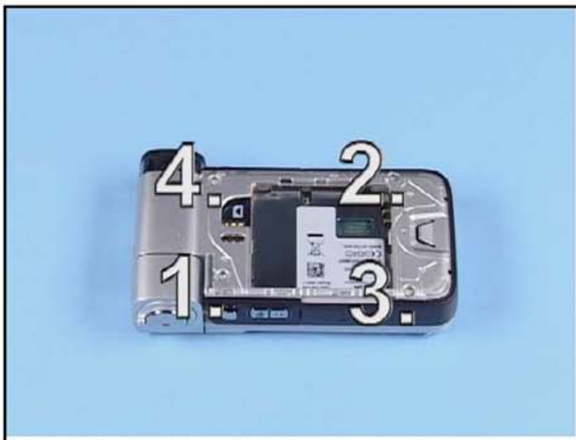
3. Optionally the KEYMAT can be removed now. Lift the KEYMAT with the SS-93 as shown.

4. Loosen it from the GRIP A-COVER...

5. ...and discard it.

6. Ensure that no adhesive residuse.

7. Unlock and remove the GRIP C-COVER.

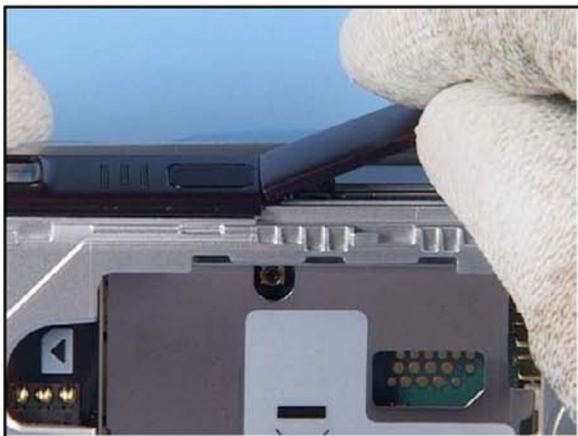


8. Undo the four Torx Plus size 6 screws in the order shown.

9. Remove the screws.

10. Open the SD-HATCH.

11. Unlock and remove the ORNAMENT R ASSY with the SIDE KEYMAT.



12. Open the POP-PORT HATCH.


13. Use the SS-93 as a lever to unglue the ORNAMENT L ASSY (INCL. ADHESIVE). Do not reuse it.

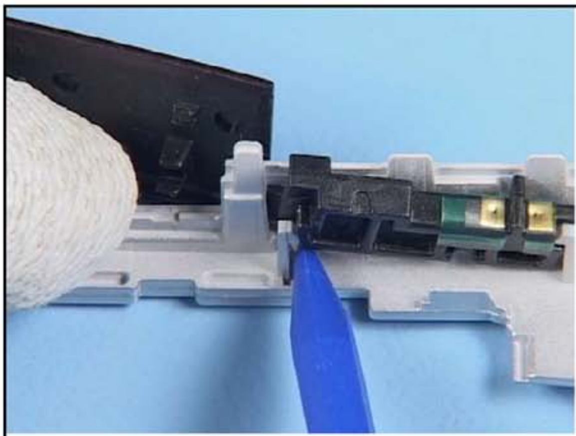

14. Remove the adhesive remain.


15. Open the unit.

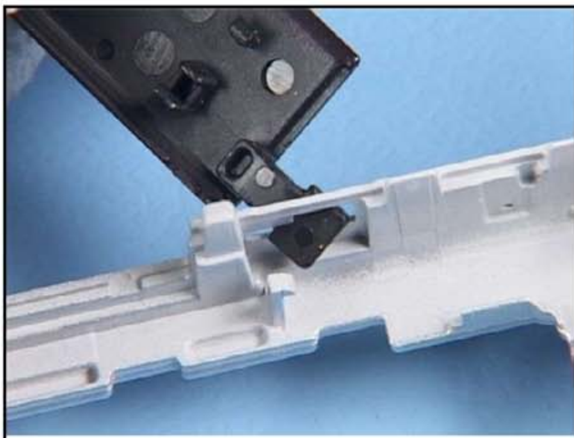

16. Unlock all snaps of the GRIP B-COVER.


17. Close the unit.


18. Unlock the last two snaps on the hinge side and remove the GRIP B-COVER.



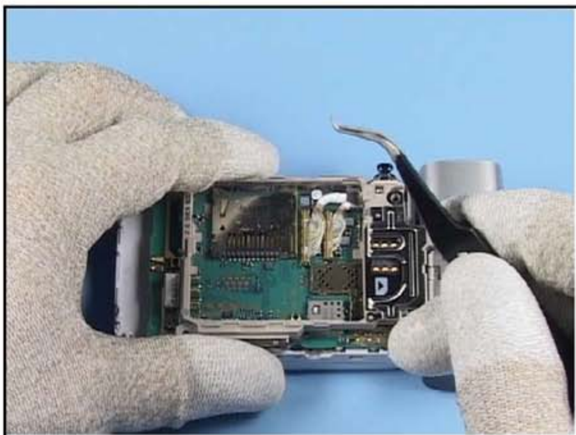
19. Unsnap and remove the BT/WL ANTENNA.



20. Remove the POP-PORT HATCH.

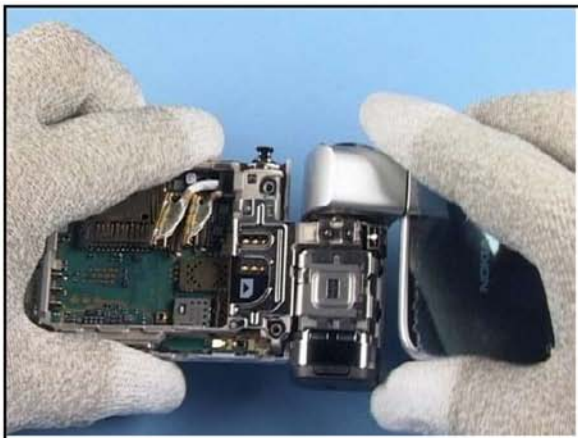
21. Lift the GRIP INNER FRAME a bit and remove the ANTENNA ASSY.

22. Lift up the LABEL PLATE and remove it.



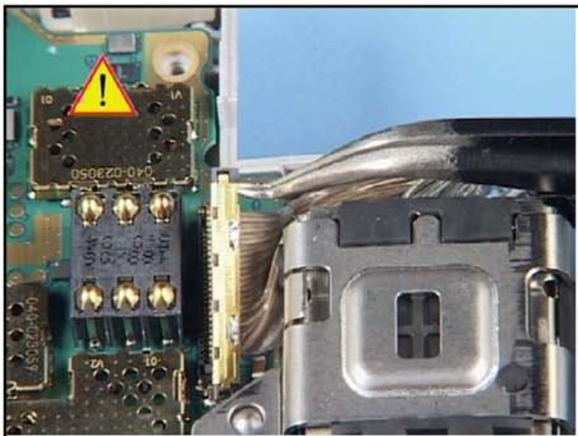
23. Use angled tweezers to open the HINGE connectors.

24. Place the tip of the tweezers exactly under the connector plug and carefully lever it up as shown.

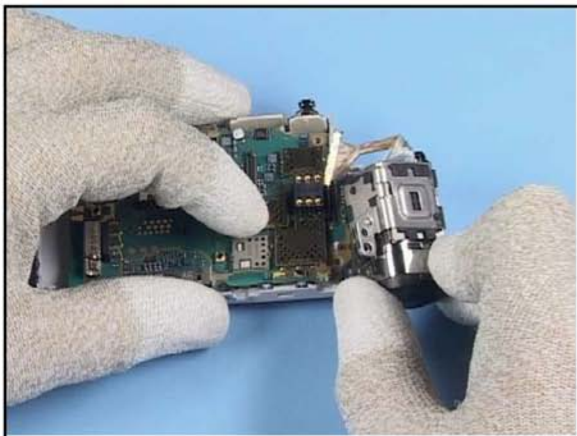


25. Open the handset...

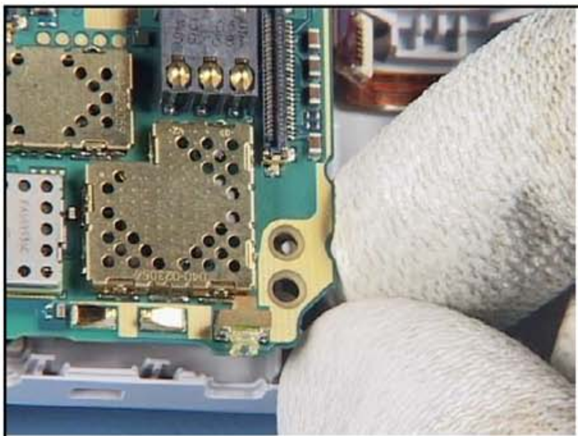
26. ...and gently separate the Upper Block from the Lower parts.



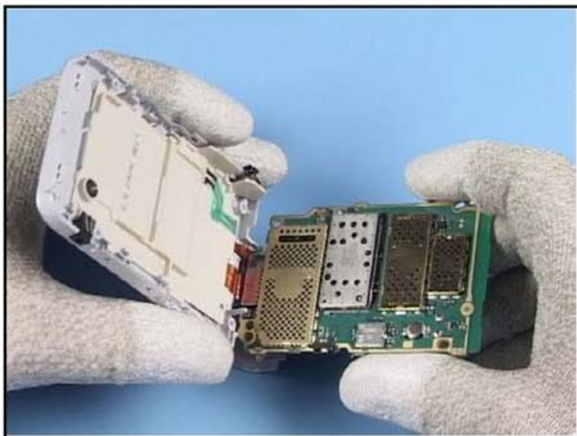
27. Now, open the Camera CABLE ASSY carefully...



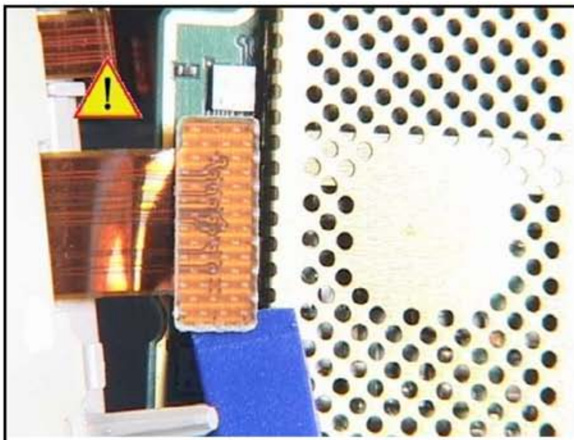
28. ...and remove the CAMERA ASSEMBLY.



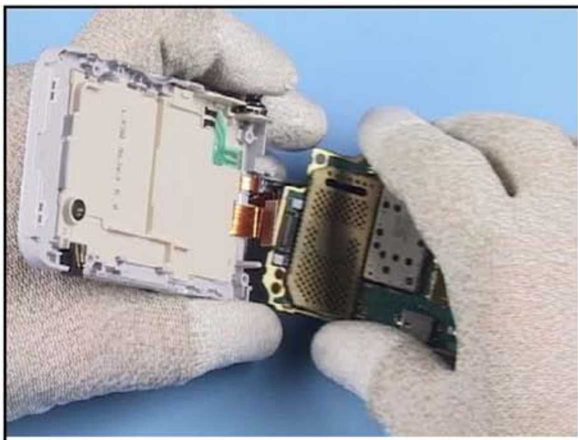
29. Lift the ENGINE MODULE from the GRIP A-COVER...



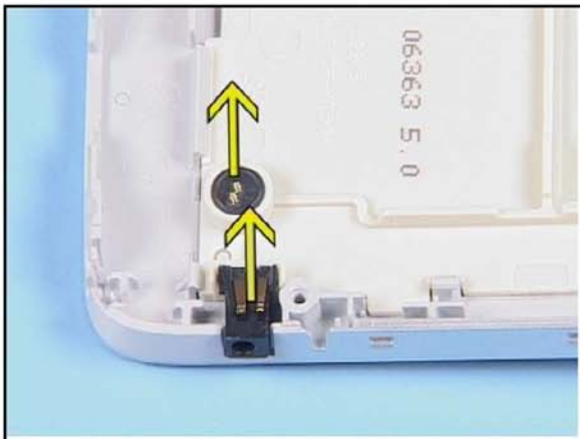
30. ...and turn it to the angle of 90°.



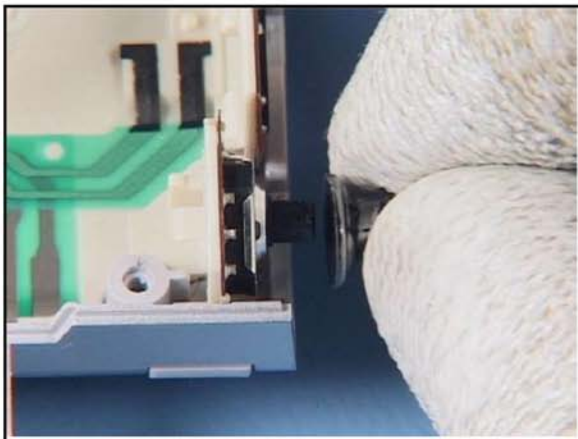
31. Gently open the UI ASSY connector...



32. ...and remove the ENGINE MODULE.

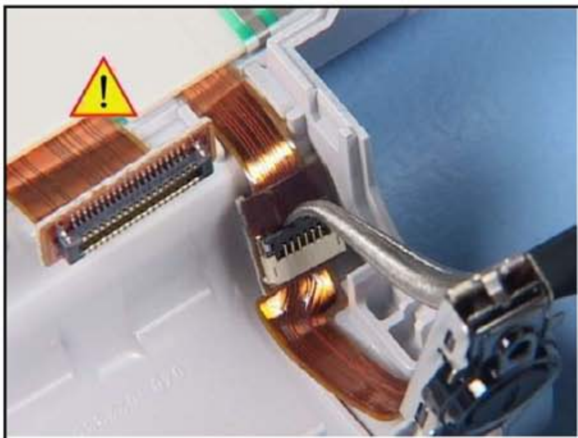


33. The MICROPHONE and the DC-JACK can be removed easily.

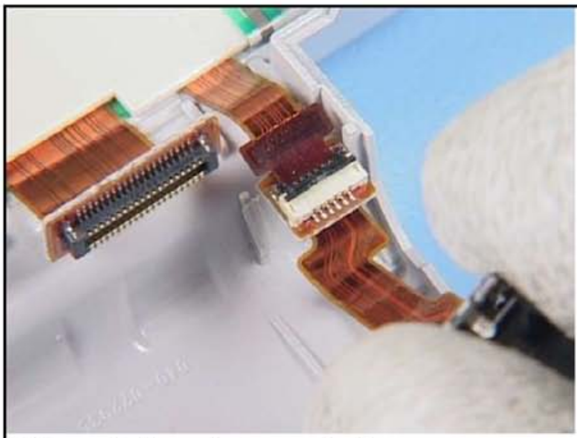


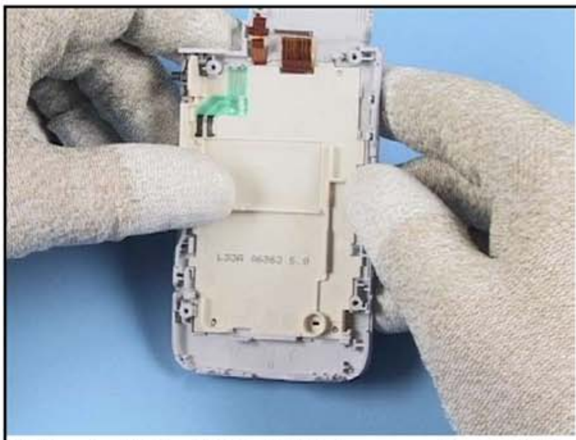
34. Remove the JOYSTICK HAT.

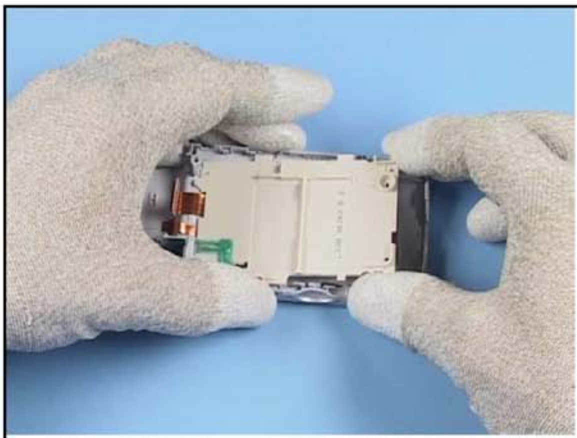
35. Loosen the flex of the DIGITAL MUSIC ASSY...



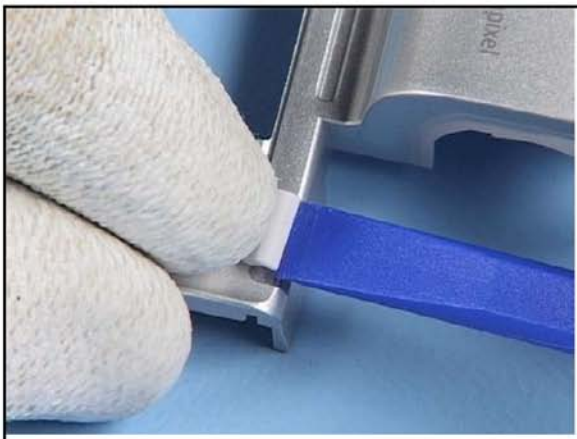
36. ...and gently open the connector.


37. Separate the parts from each other.


38. Bend a bit the GRIP A-COVER to unsnap the UI ASSY.


39. Lift the UI ASSY from the GRIP A-COVER and remove it.

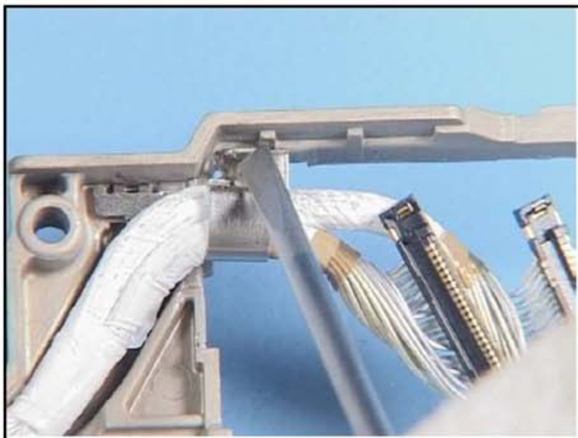
40. Separate the KEYMAT from the GRIP A-COVER and discard it.


41. Remove the PILLOW with the SS-93.

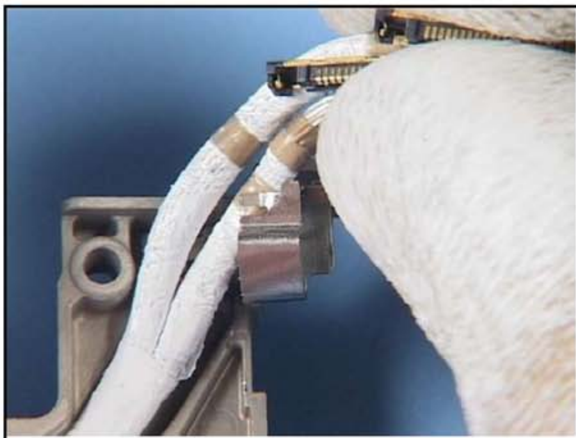

42. Remove the GRIP BUMPER by pushing it out from the inner side of the cover.

43. Unlock the SIM SHIELD COVER with the dental pick...

44. ... and remove it.



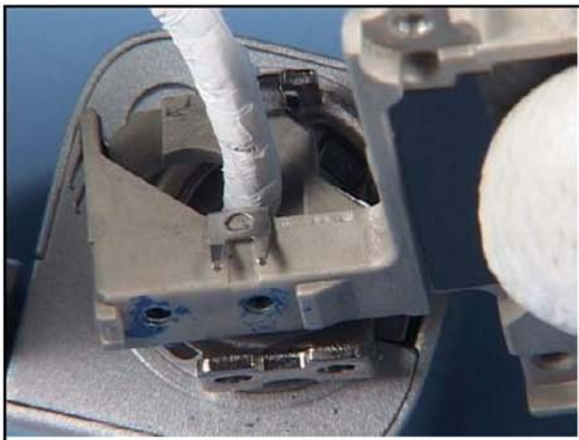
45. Open the CABLE CLAMP...



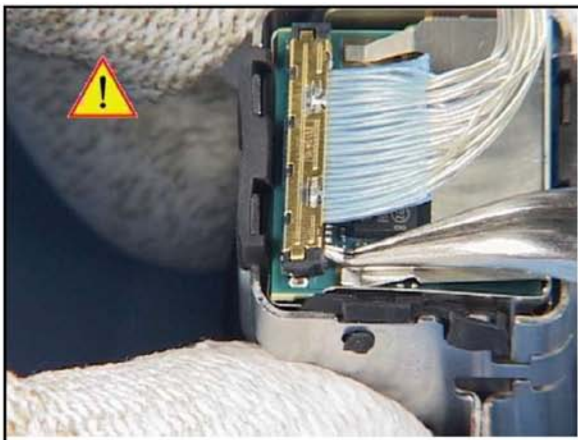
46. ...and take out the hinge cables from their guide.

47. Undo the two Torx Plus size 6 screws in the order shown...

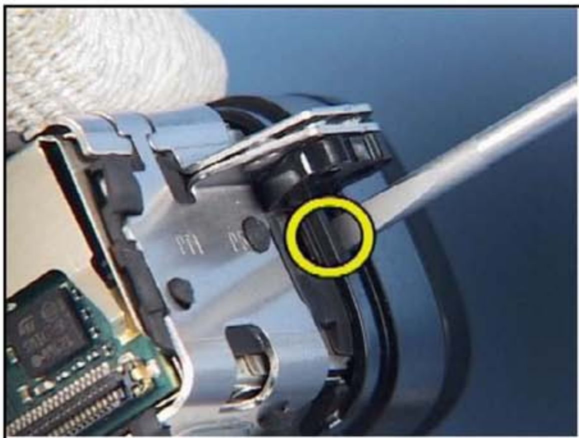
48. ...and discard them.



49. Gently separate the GRIP INNER FRAME from the UPPER BLOCK.

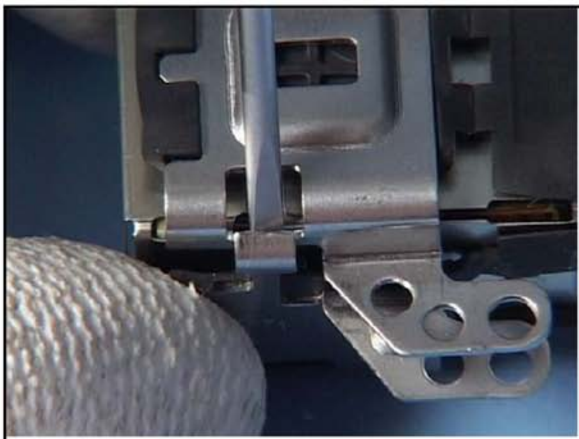


50. Carefully open the CABLE ASSY connector and remove it.



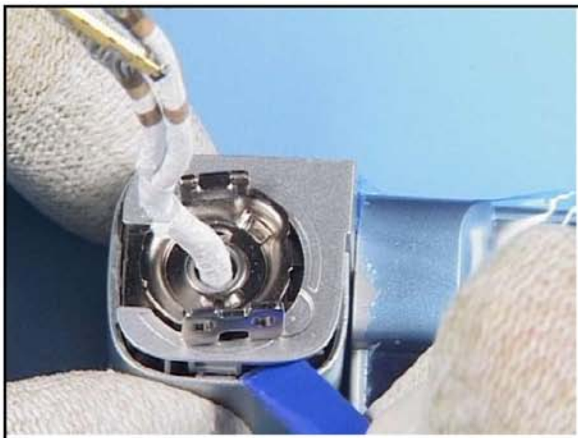
51. Press on the metal hooks on both sides of the CAMERA MODULE.

52. Pull out the CAMERA BEZEL with the LENS CUP ASSY from the CAMERA SUPPORT FRAME ASSY.



53. Unlock the snap...

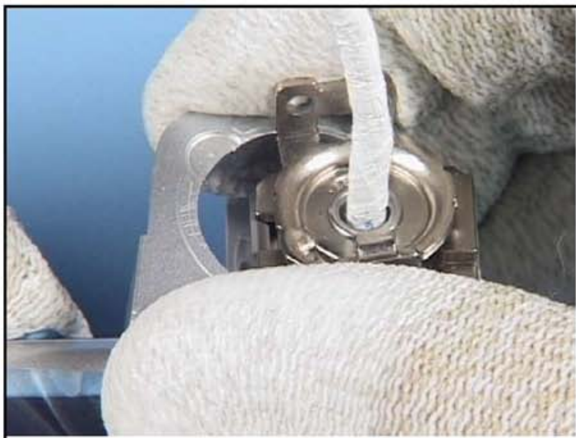
54. ...and separate the CAMERA MODULE from the SUPPORT FRAME ASSY. Do not reuse the CAMERA SUPPORT FRAME ASSY.



55. Release the snaps of the CAPTURE KEY INNER COVER.

56. Now, remove the CAPTURE KEY COVER PAINTED.

57. Remove the CAPTURE KEY BUTTON, ZOOM KEY LEVER and the CAPTURE RETURN SPRING.



58. Remove the CAPTURE KEY INNER COVER.

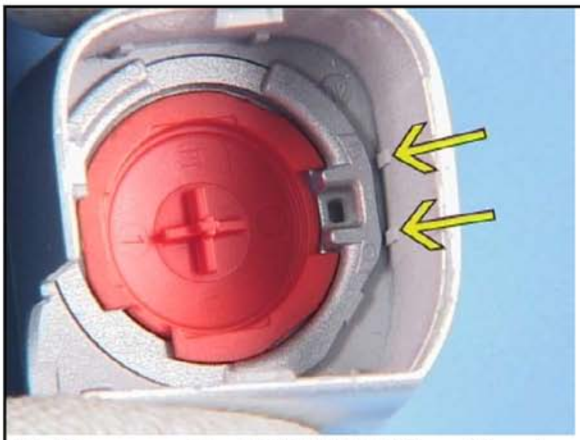
59. Now, the disassembly procedure is complete.

Lower block reassembly

1. Assembly

2. Place the ZOOM KEY LEVER PAINTED into the CAPTURE KEY COVER PAINTED as shown.

3. Place the CAPTURE KEY BUTTON in to its place.



4. Set the recess of the ZOOM KEY LEVER in position shown.

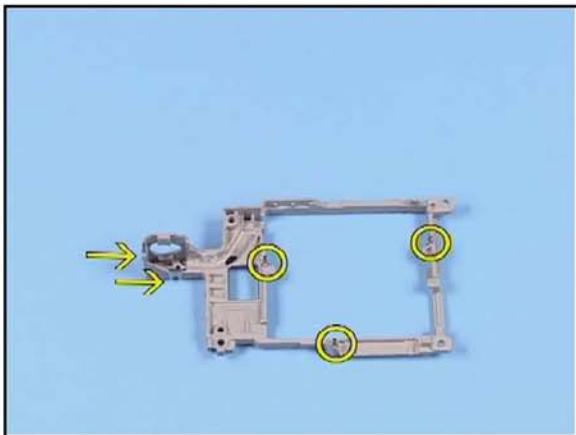
5. Place the CAPTURE RETURN SPRING in to its place.

6. Carefully, press the HINGE ASSEMBLY into the CAPTURE KEY COVER.

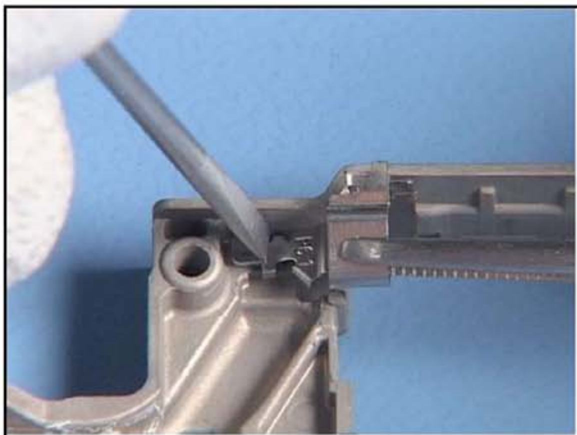
7. Fit the CAPTURE KEY INNER COVER as shown.

8. Now, check the correct position of the ZOOM KEY LEVER...

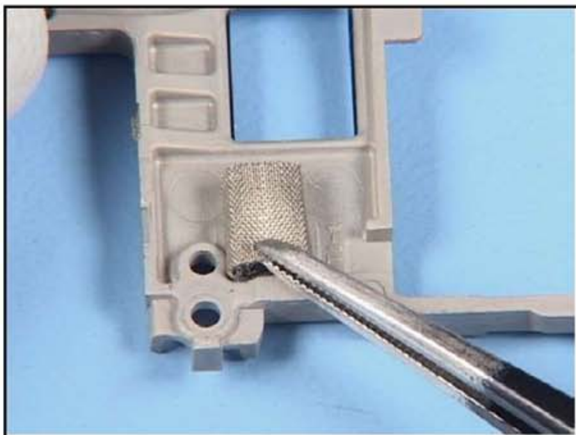
9. ...and secure the parts by pressing them together.



10. Be sure that all GROUND CLIPS are into their places.



11. Always use a new CABLE CLAMP. Align the CABLE CLAMP with the GRIP INNER FRAME and push it into its place.



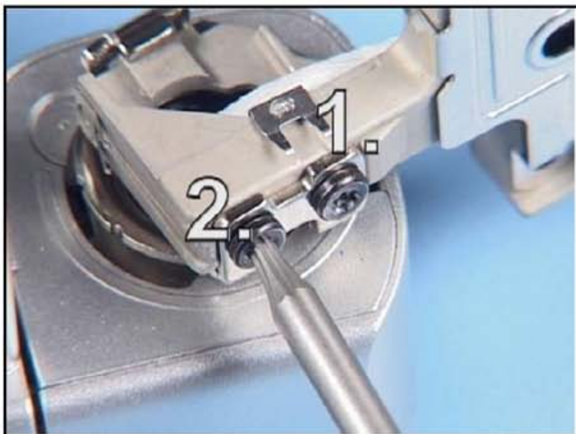
12. Fit a new CUSHION.

13. Feed the HINGE cables into the opening of the GRIP INNER FRAME.

14. Position the GRIP INNER FRAME onto the HINGE ASSEMBLY.

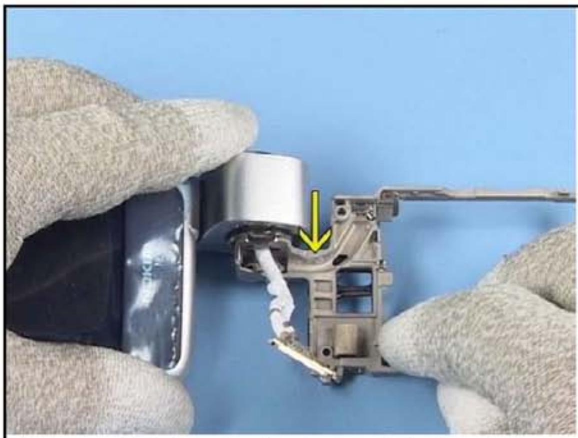
15. Set torque driver to the correct torque.

16. Always use new screws.



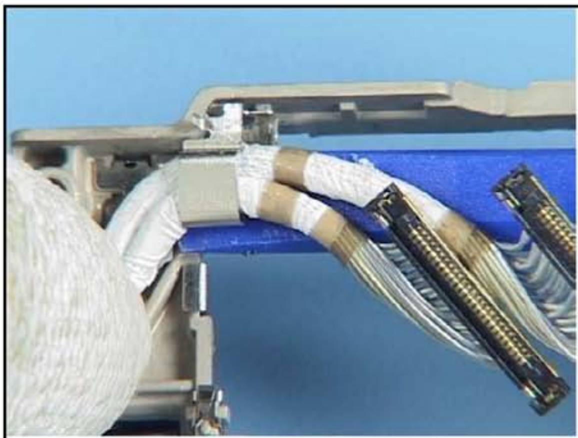
17. Tighten the SCREWS in the order shown.

18. Fit the SIM SHIELD COVER.

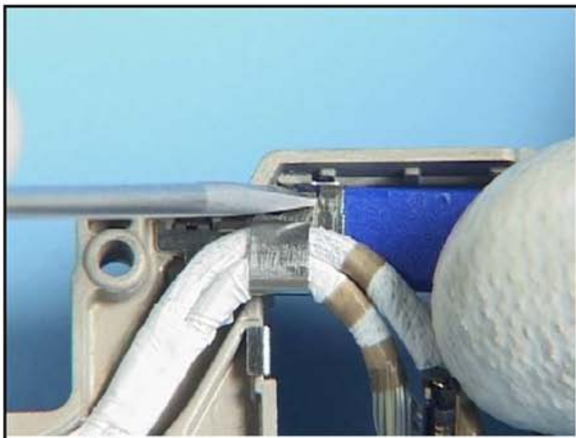


19. Ensure that the adhesive is glued into the shown place.

20. Place the HINGE cables into the guide of the GRIP INNER FRAME.

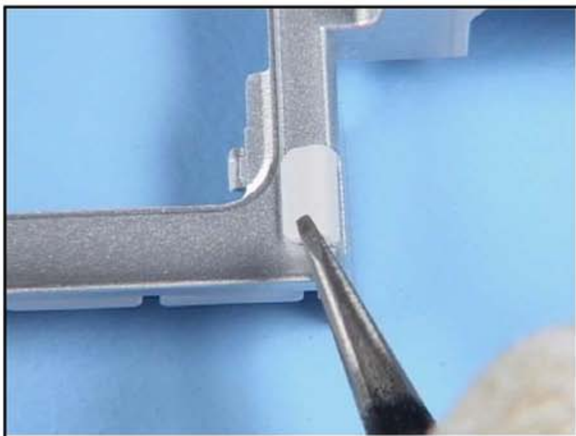


21. Place the SS-93 as a support between the CABLE CLAMP and the GRIP INNER FRAME...

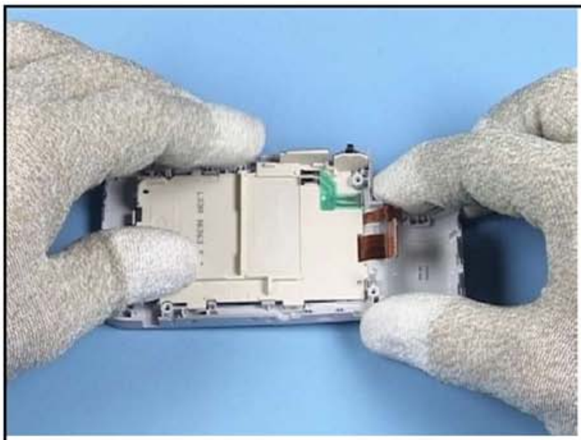


22. ...and close the CABLE CLAMP.

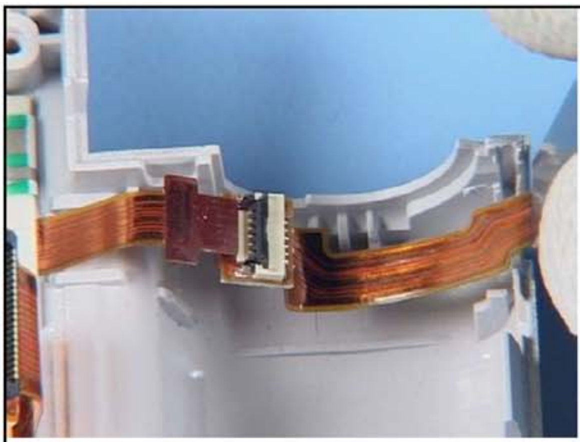
23. Fit a new GRIP BUMPER and secure it by pressing into place.



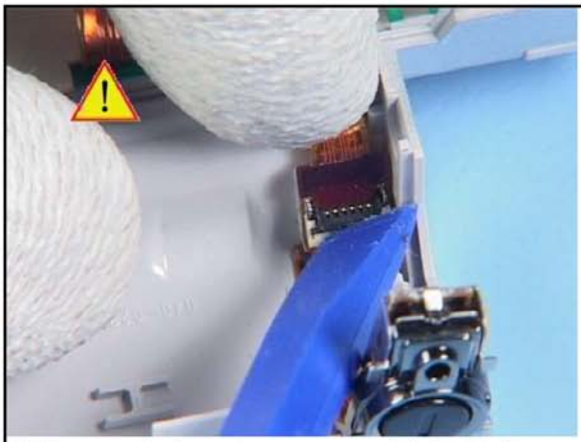
24. Fit the PILLOW.



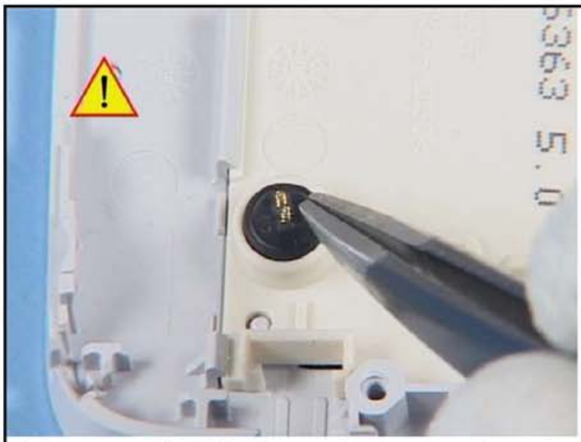
25. Insert the UI ASSY and secure it by closing all snaps.



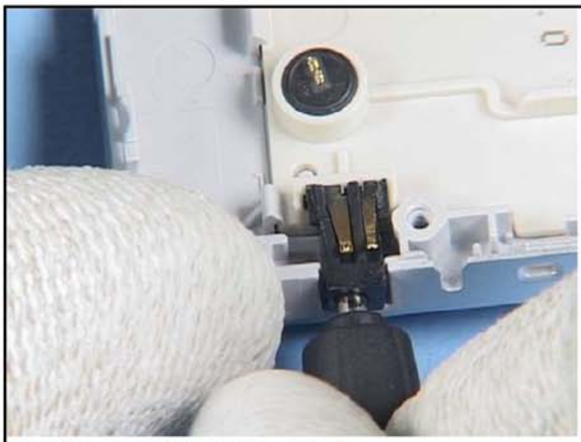
26. Fit the DIGITAL MUSIC ASSY into the GRIP A-COVER.



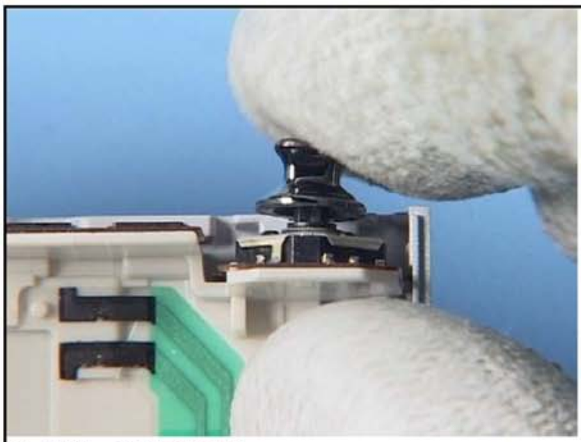
27. Very gently, close the connector with the SS-93.



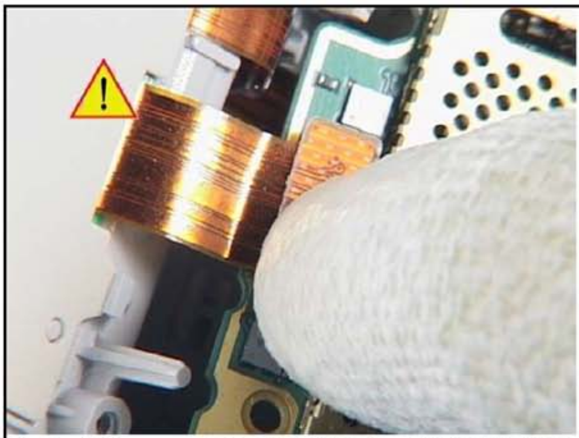
28. Insert the MICROPHONE avoiding bending the spring contacts.



29. Fit the DC-JACK with the DC-plug.

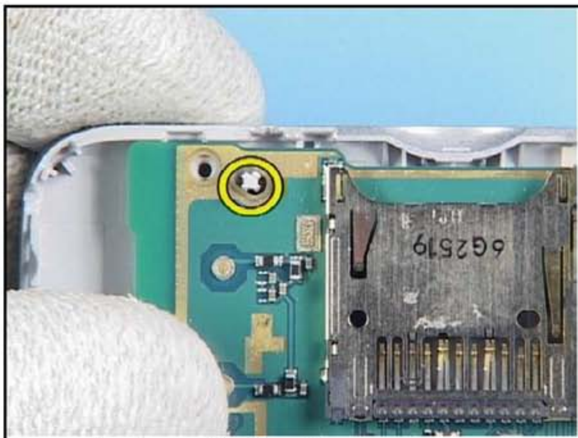


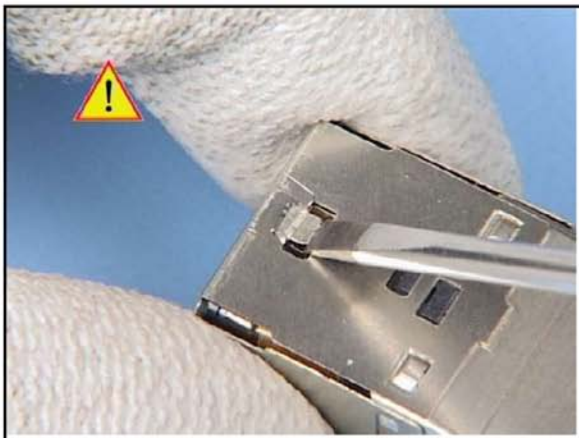
30. Fit the JOYSTICK HAT.


31. Carefully connect the UI ASSY to the ENGINE MODULE.


32. Turn the ENGINE MODULE as shown and align it with the GRIP A-COVER.


33. Note the correct position of the guide pin at the camera side...

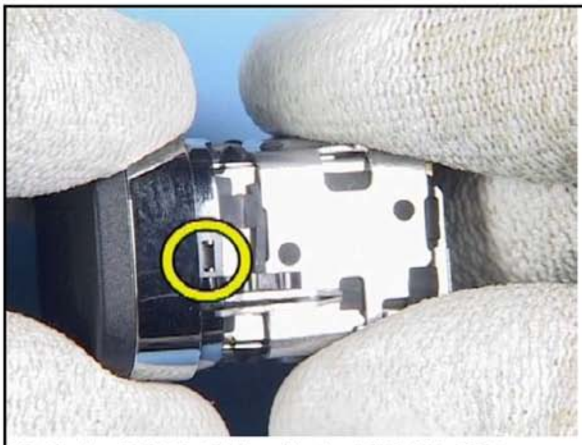

34. ...and at the card holder side.


35. Gently, bend the hooks back into its position as shown.

36. Always use a new CAMERA SUPPORT FRAME ASSY.

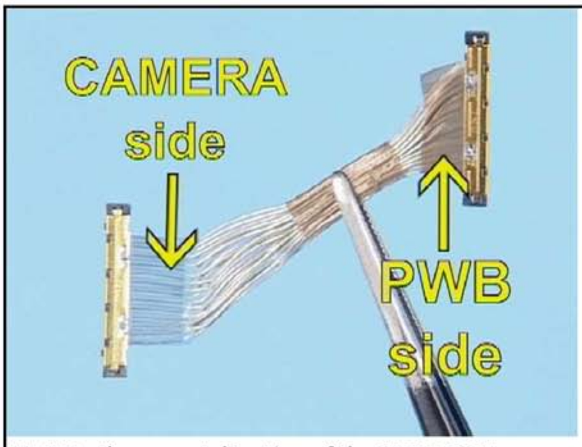
37. Insert the CAMERA MODULE into the FRAME.

38. Squeeze the CAMERA SUPPORT FRAME ASSY until it close.



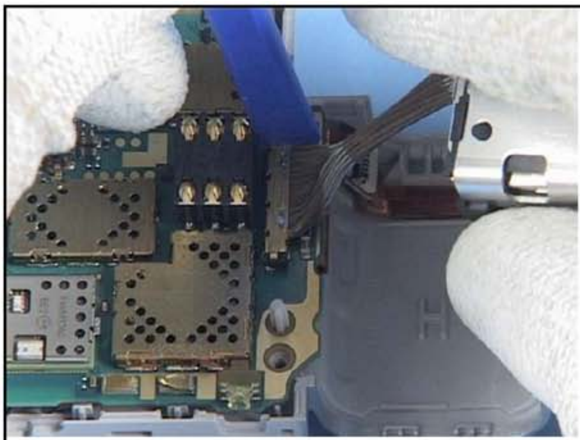
39. Fit the CAMERA BEZEL with the LENS CAP ASSY.

40. Ensure that the hooks hold well the CAMERA BEZEL.

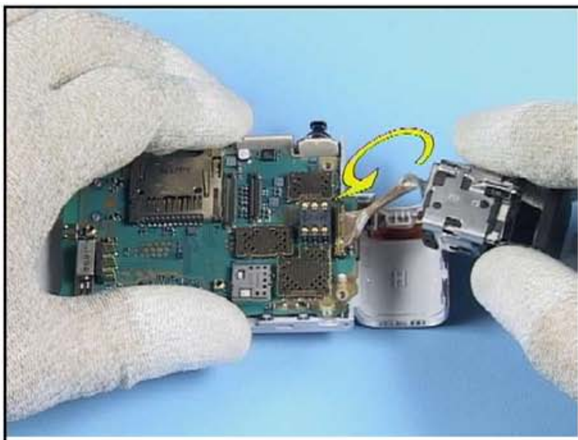


41. Note the correct direction of the CABLE ASSY.

42. Connect the cable side with blue mark to the CAMERA MODULE...

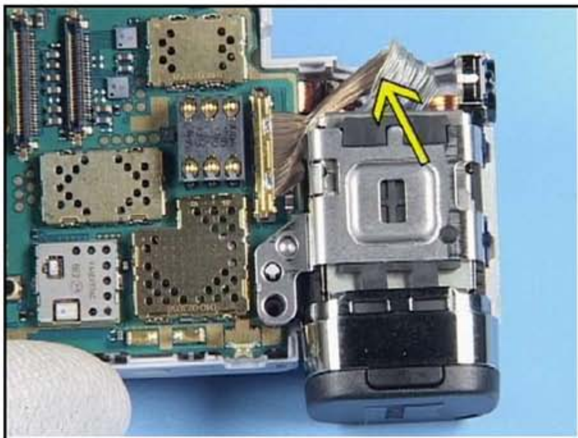


43. ...and the other side of the cable to the ENGINE MODULE.



44. Turn the CAMERA MODULE as shown...

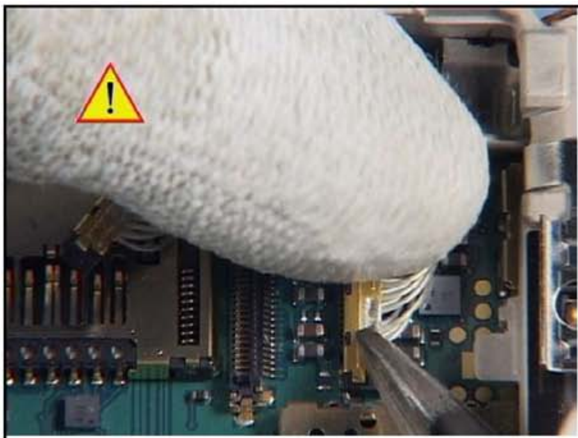
45. ...and place it into position.



46. Check the correct position of the CABLE ASSY.

47. Align the GRIP INNER FRAME with the GRIP A-COVER avoiding squeezing the CABLE ASSY.

48. Close the unit...

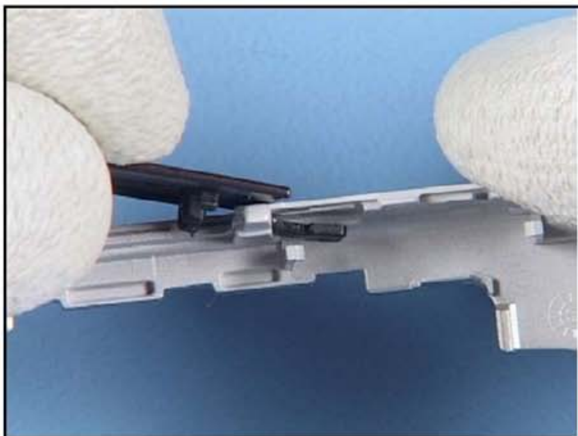


49. ...and carefully close the connectors.

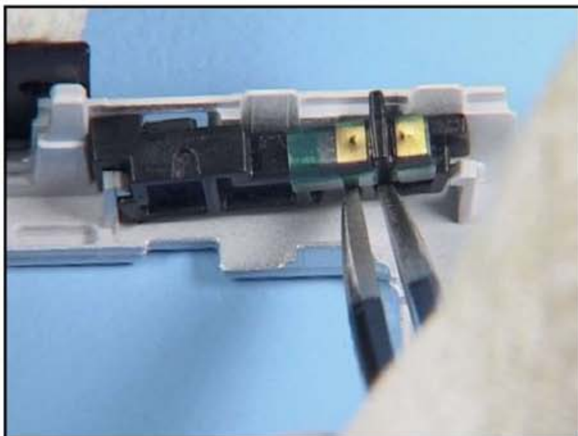
50. Ensure that the cable is positioned correctly to avoid squeezing it when assembling the LABEL PLATE.

51. Fit the LABEL PLATE.

52. Lift the GRIP INNER FRAME a bit and gently place the ANTENNA into its position.



53. Fit the POP-PORT HATCH.



54. Fit the BT WL ANTENNA into its place.

55. Align the GRIP B-COVER with the GRIP A-COVER.

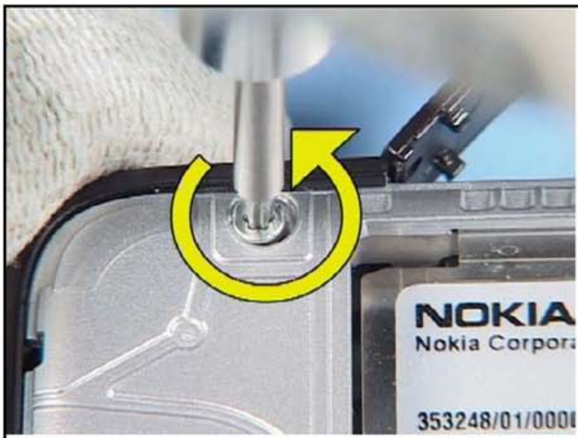
56. First close the snaps on the hinge side.

57. Open the unit...

58. ...and then close the remaining snaps.

59. Insert the screws.

60. Set the torque driver to the correct torque.



61. To prevent damaging the plastic threads, first turn the screws to the left...

62. ... and then tighten them to the correct torque in the order shown.

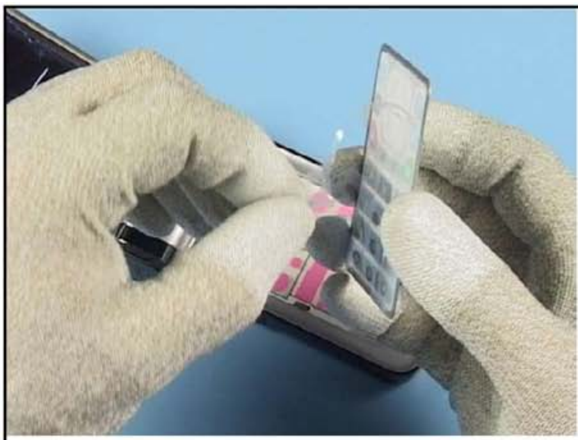
63. Fit the ORNAMENT R ASSY with the SIDE KEYMAT.

64. Close the SD HATCH.

65. Remove the protective film of the ORNAMENT L ASSY...

66. ...and fit the ORNAMENT L ASSY into its place.

67. Open the unit...



68. Always use a new KEYMAT when assembling the unit.

69. Place it exactly into its place...

70. ...and secure by pressing evenly.

71. Check that no gaps remain.

72. Finally fit the GRIP C-COVER ASSY.

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6 — BB Troubleshooting and Tuning Guide

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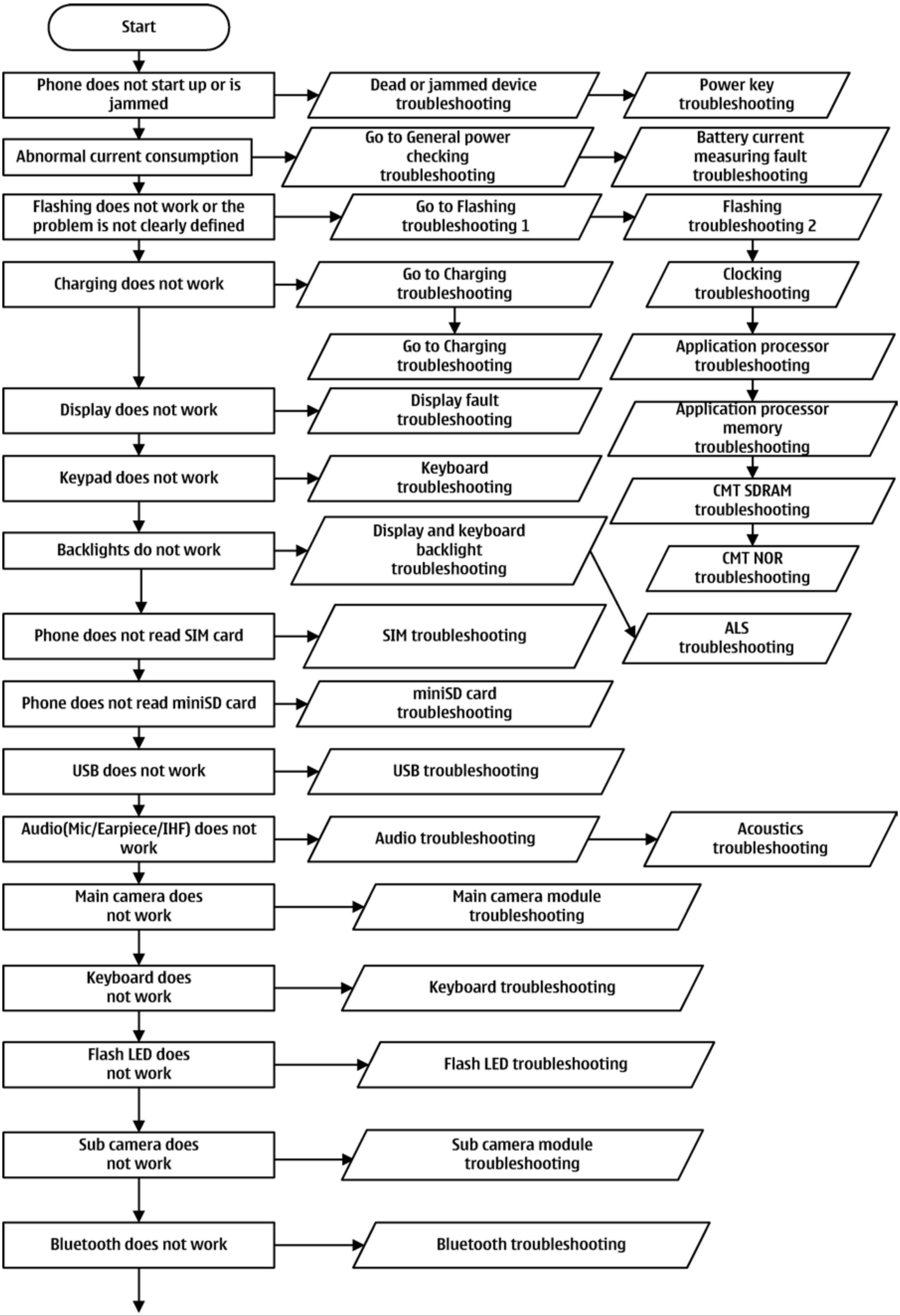
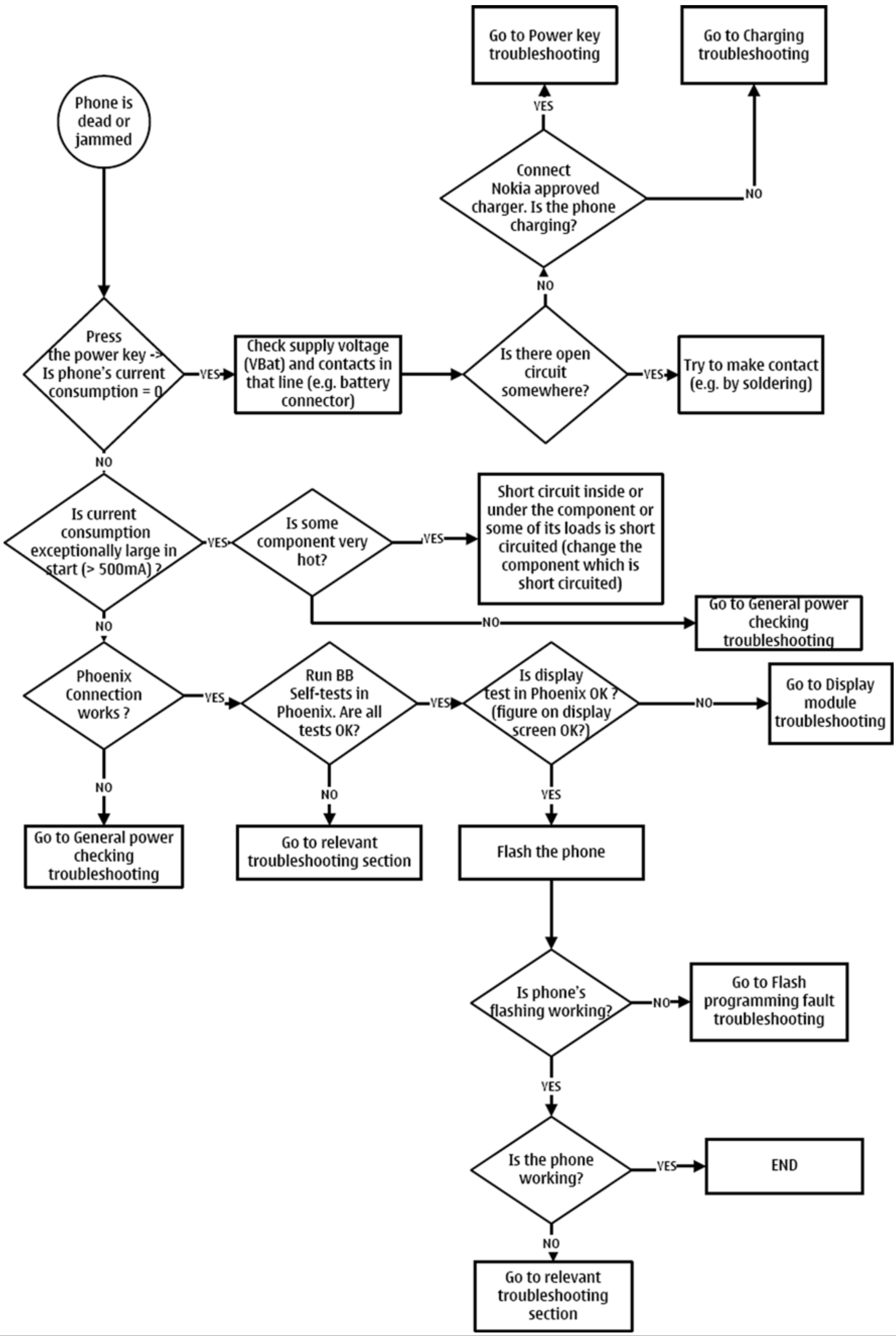


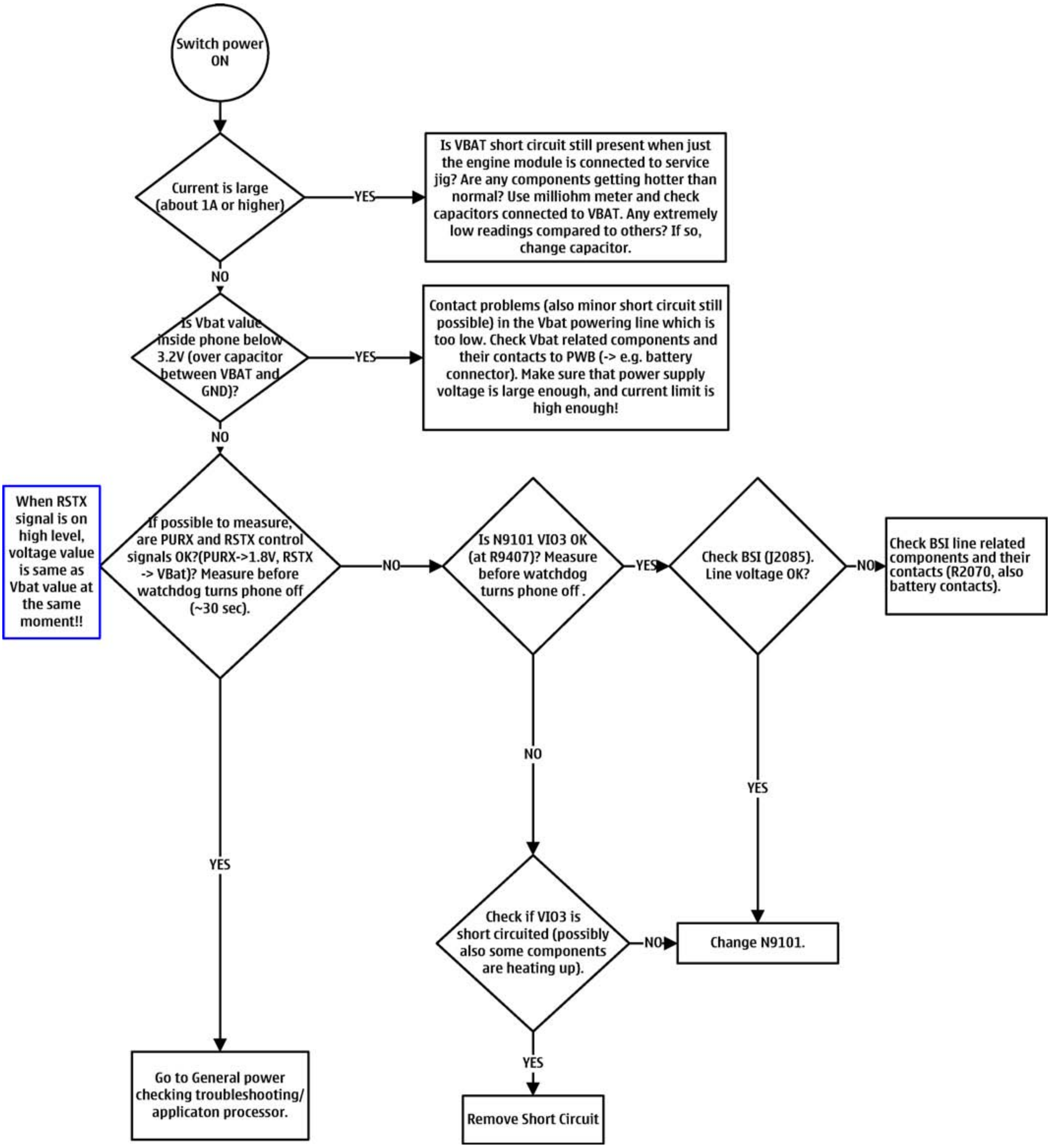
Dead or jammed device troubleshooting

Troubleshooting flow



General power checking troubleshooting - CMT

Troubleshooting flow

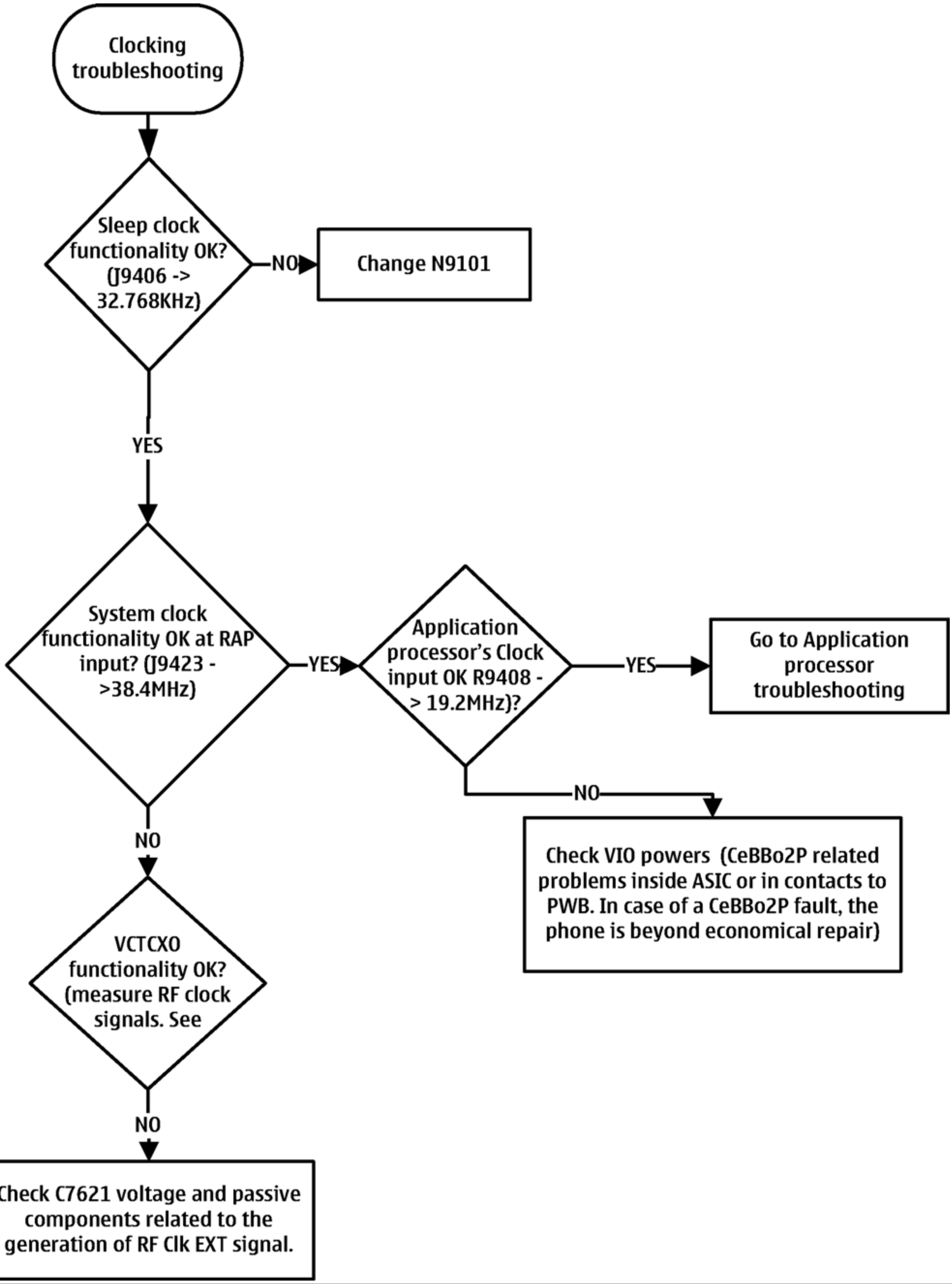


General power checking troubleshooting - APE

Troubleshooting flow

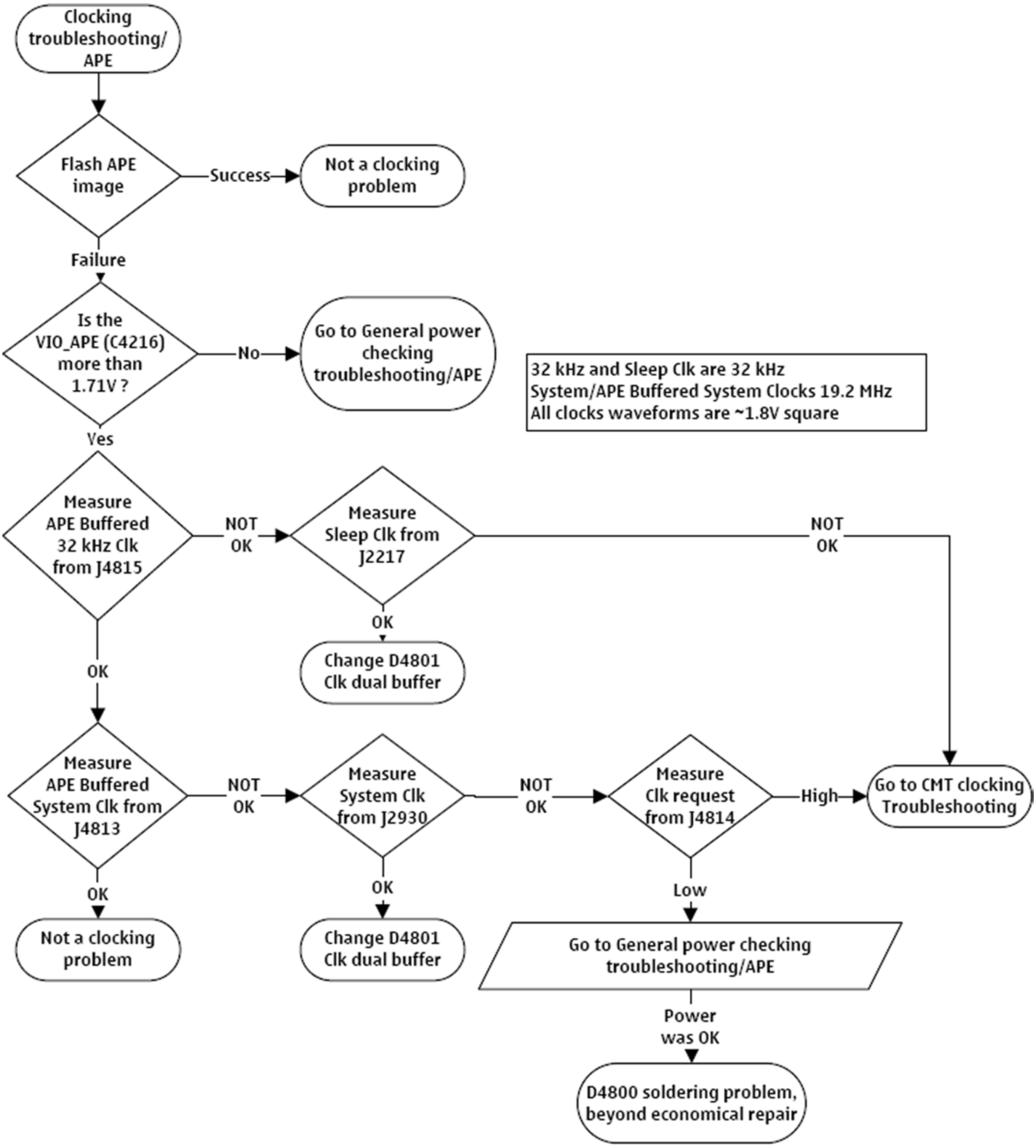
CMT clocking troubleshooting

Troubleshooting flow



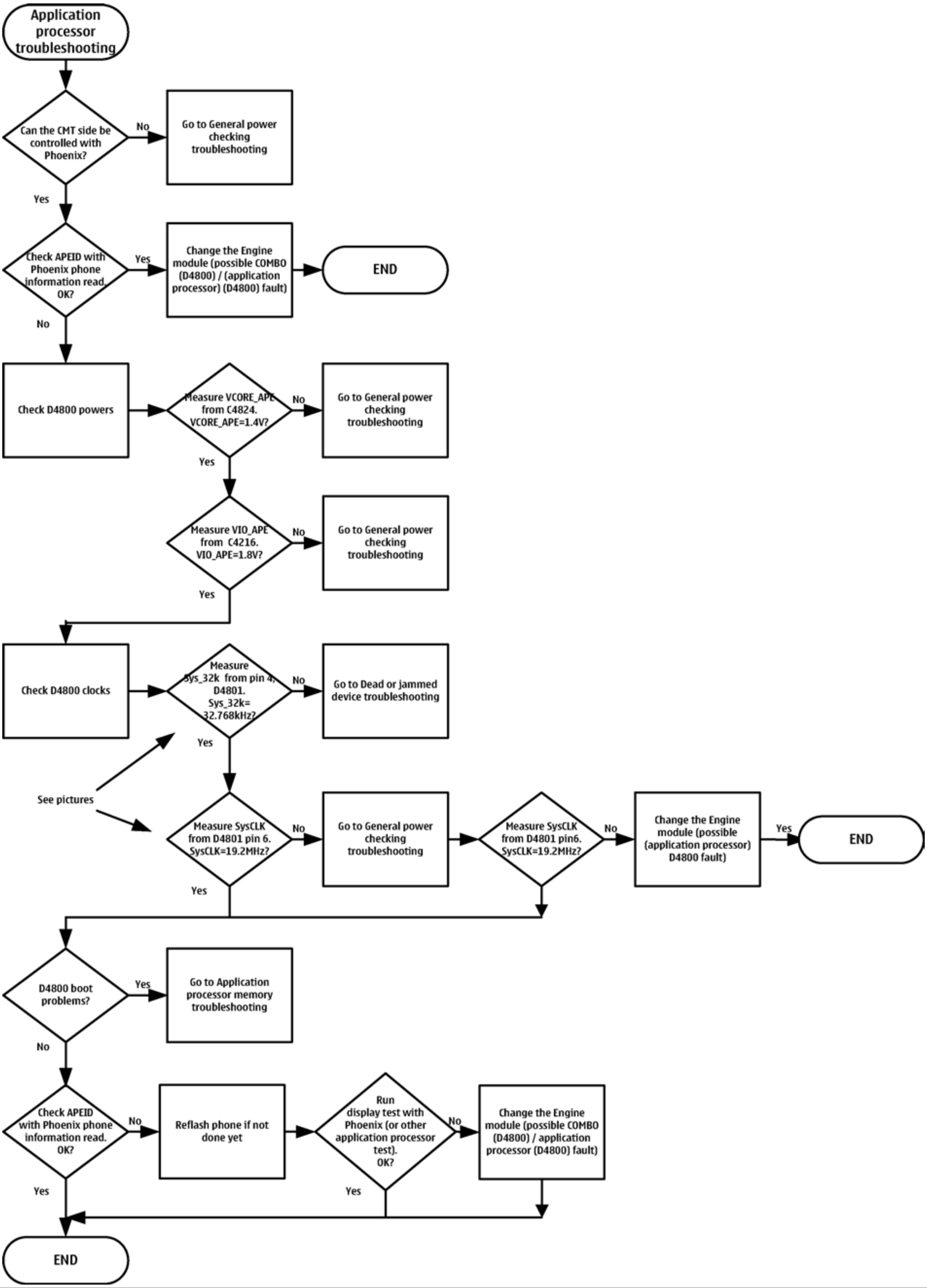
APE clocking troubleshooting

Troubleshooting flow



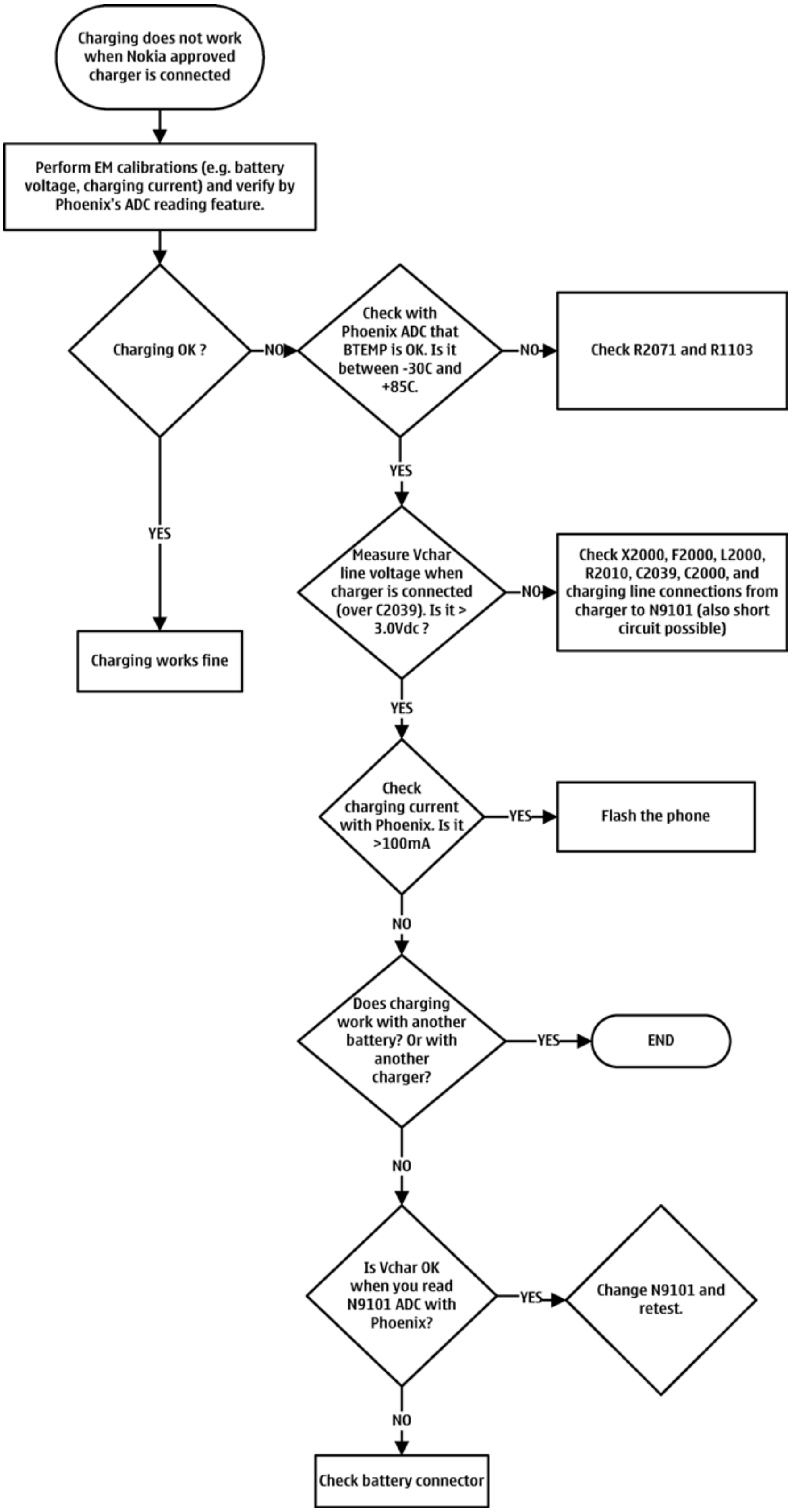
Application processor troubleshooting

Troubleshooting flow



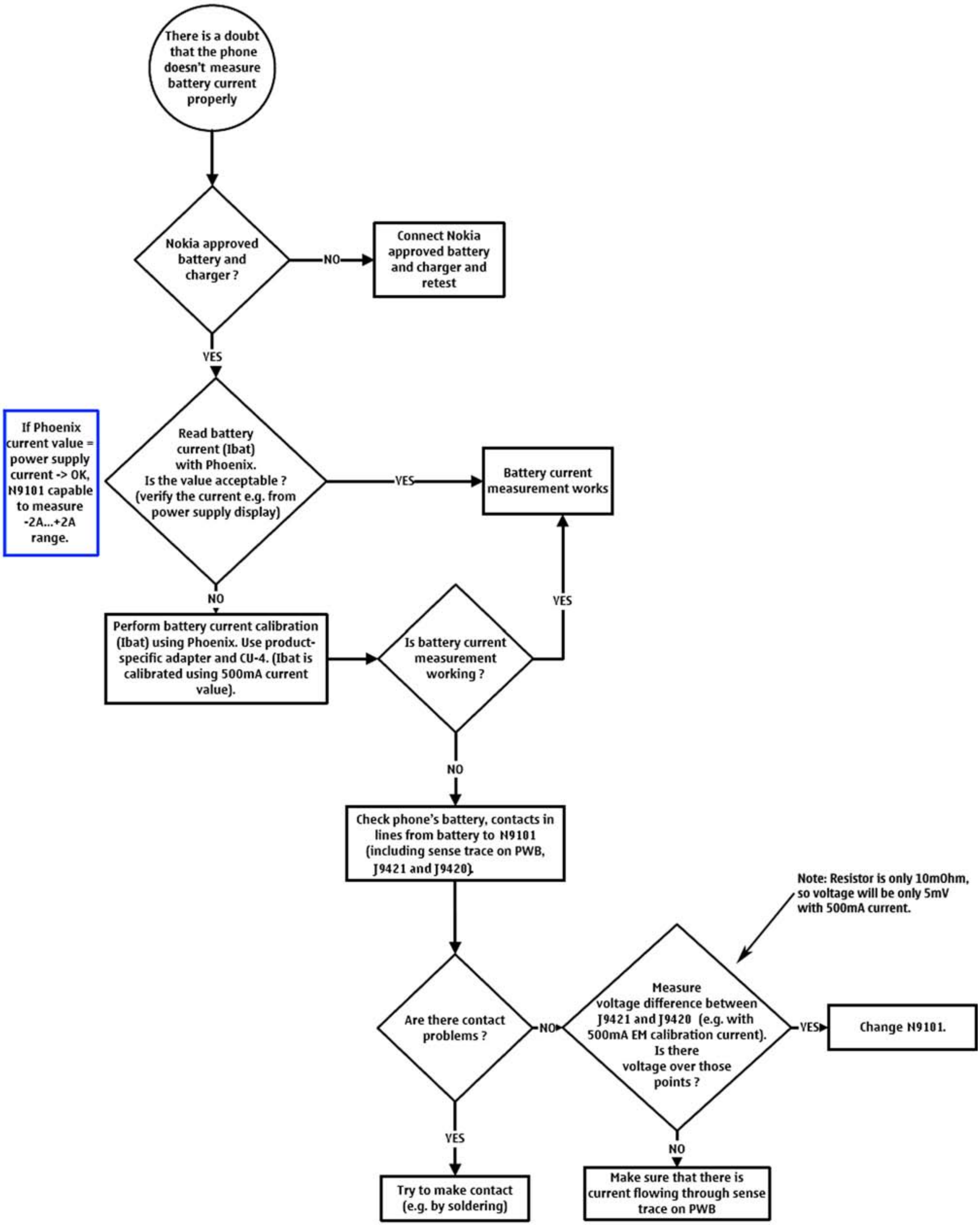
Charging troubleshooting

Troubleshooting flow



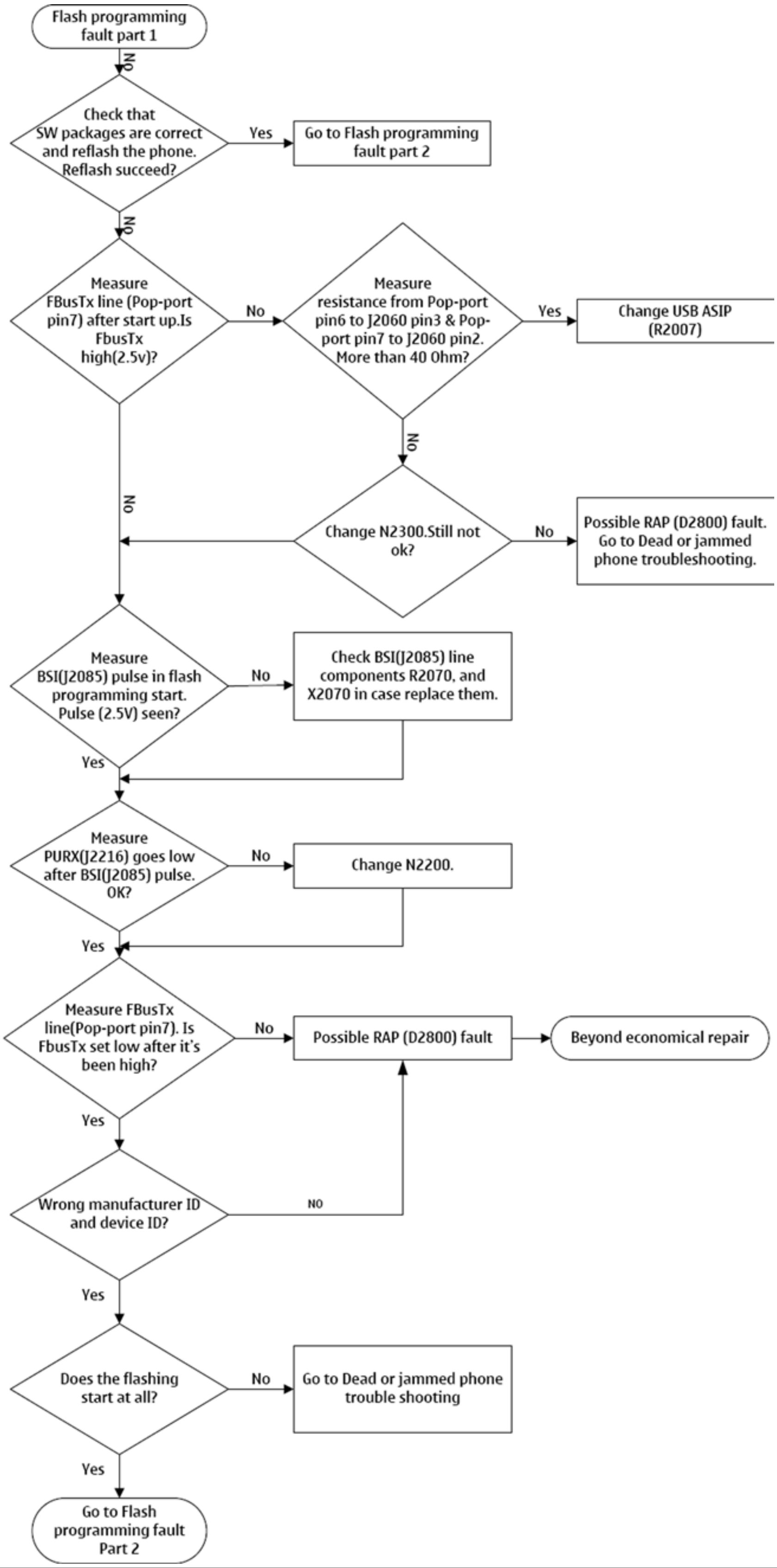
Battery current measuring fault troubleshooting

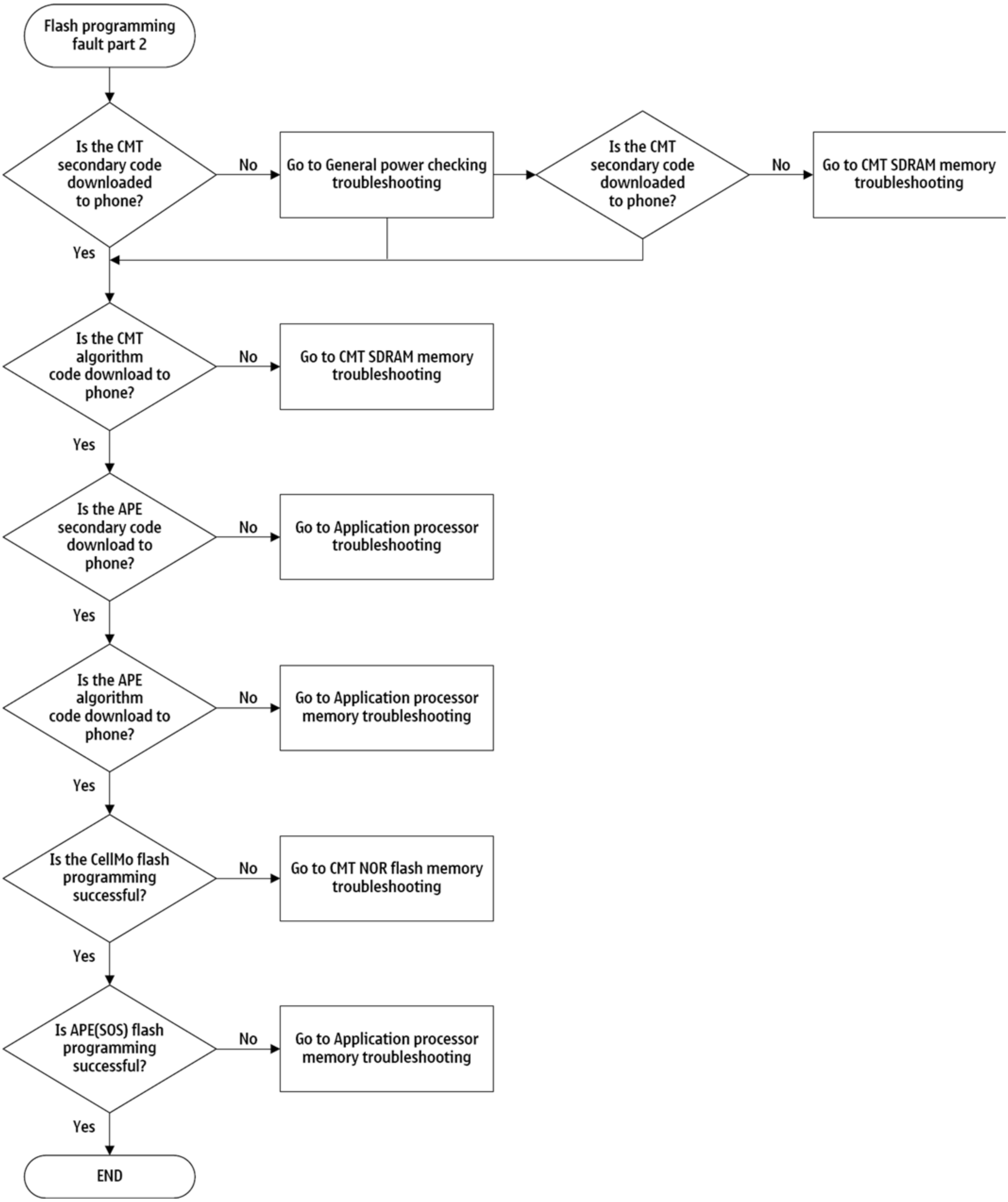
Troubleshooting flow



Flash programming fault troubleshooting

Troubleshooting flow





CMT SDRAM memory fault troubleshooting

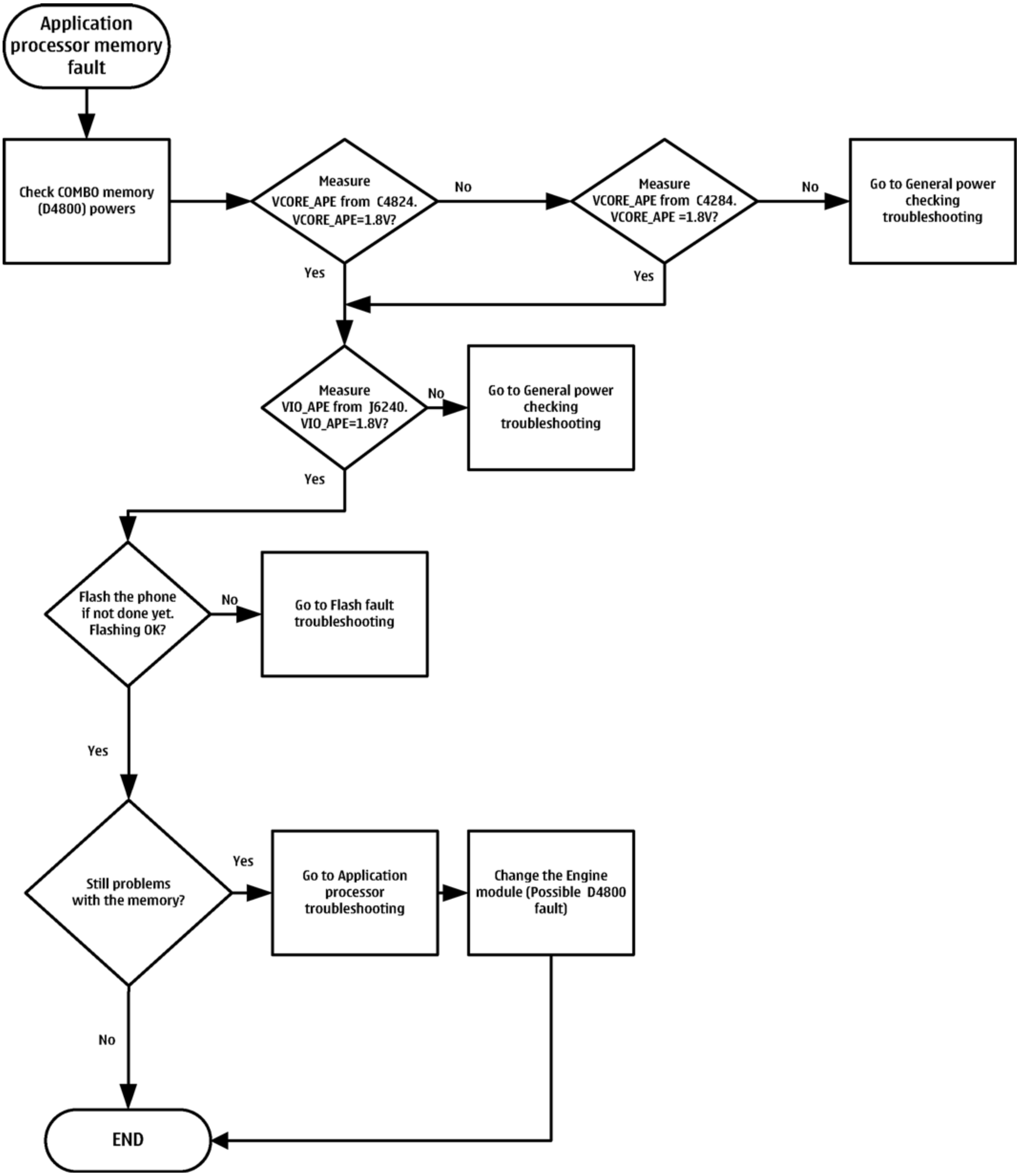
CMT SDRAM memory is located in the CeBBo2P module. If there is a fault in the CMT SDRAM memory, the device is beyond economical repair.

CMT NOR flash memory fault troubleshooting

CMT NOR flash memory is located in the CeBBo2P module. If there is a fault in the CMT NOR flash memory, the device is beyond economical repair.

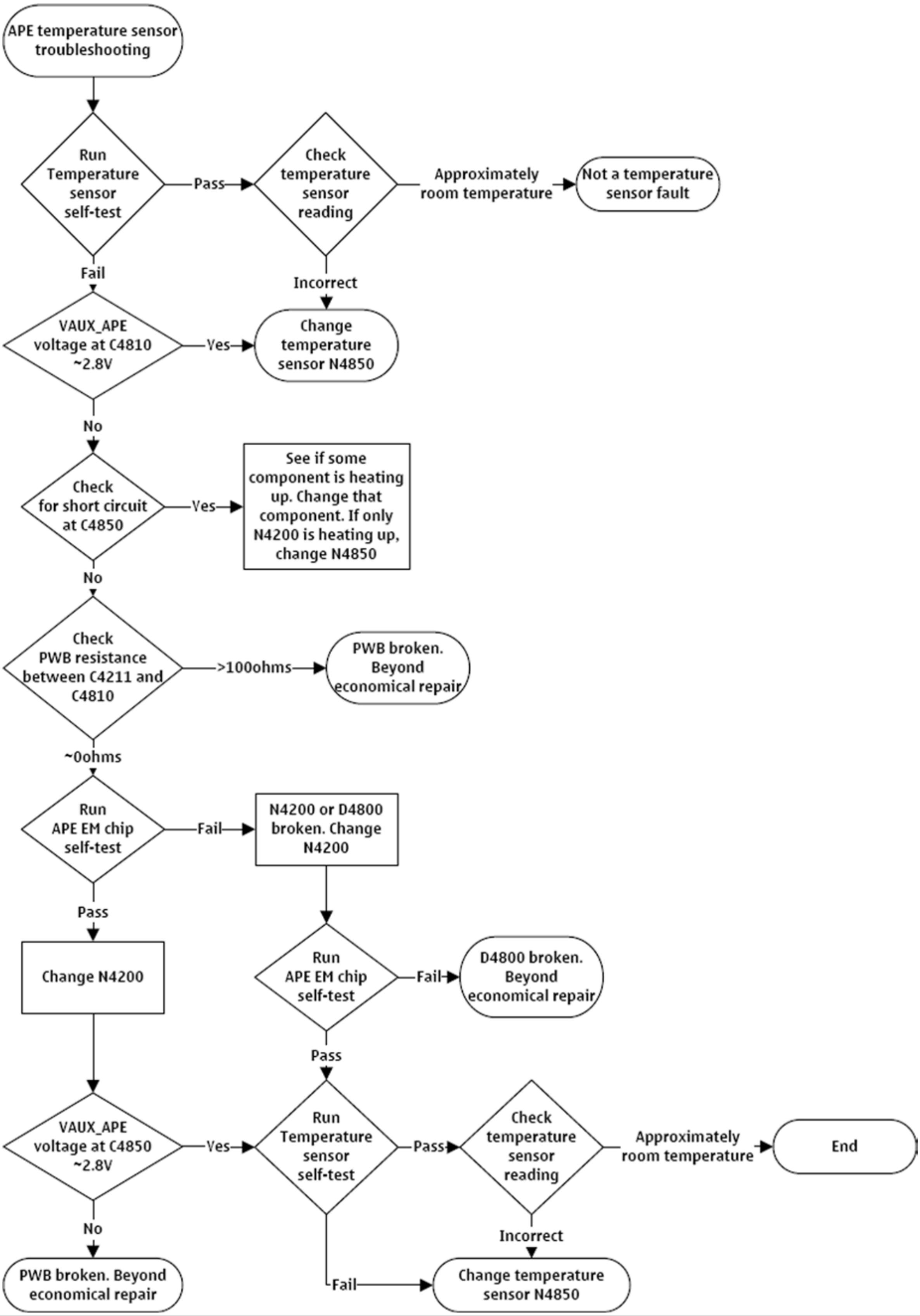
Application processor memory troubleshooting

Troubleshooting flow



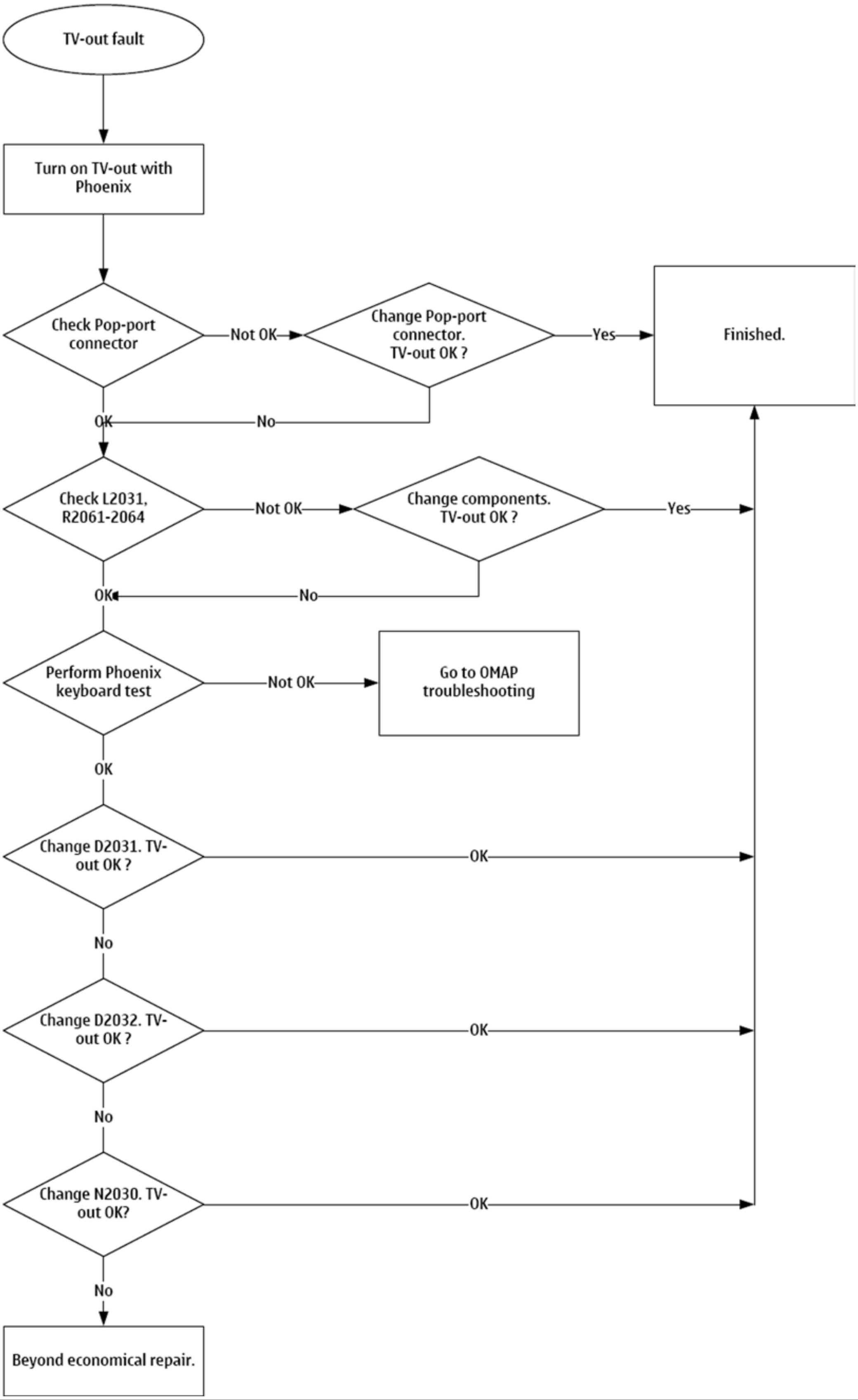
APE temperature sensor troubleshooting

Troubleshooting flow



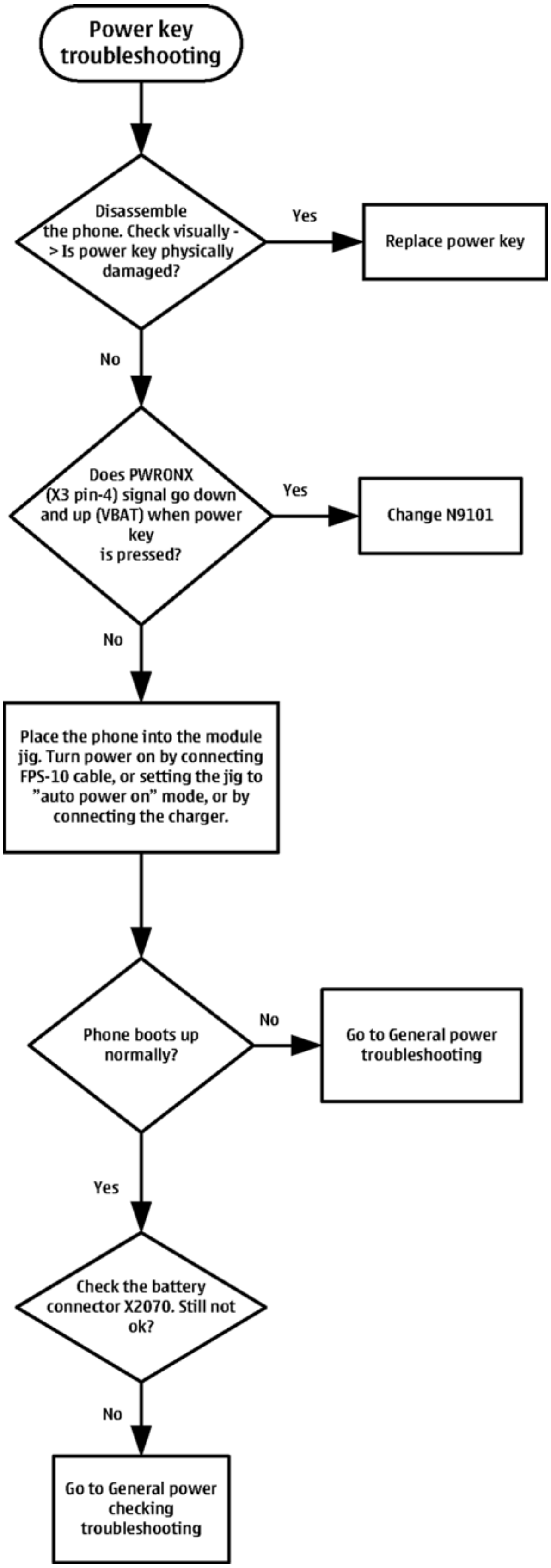
TV-out troubleshooting

Troubleshooting flow



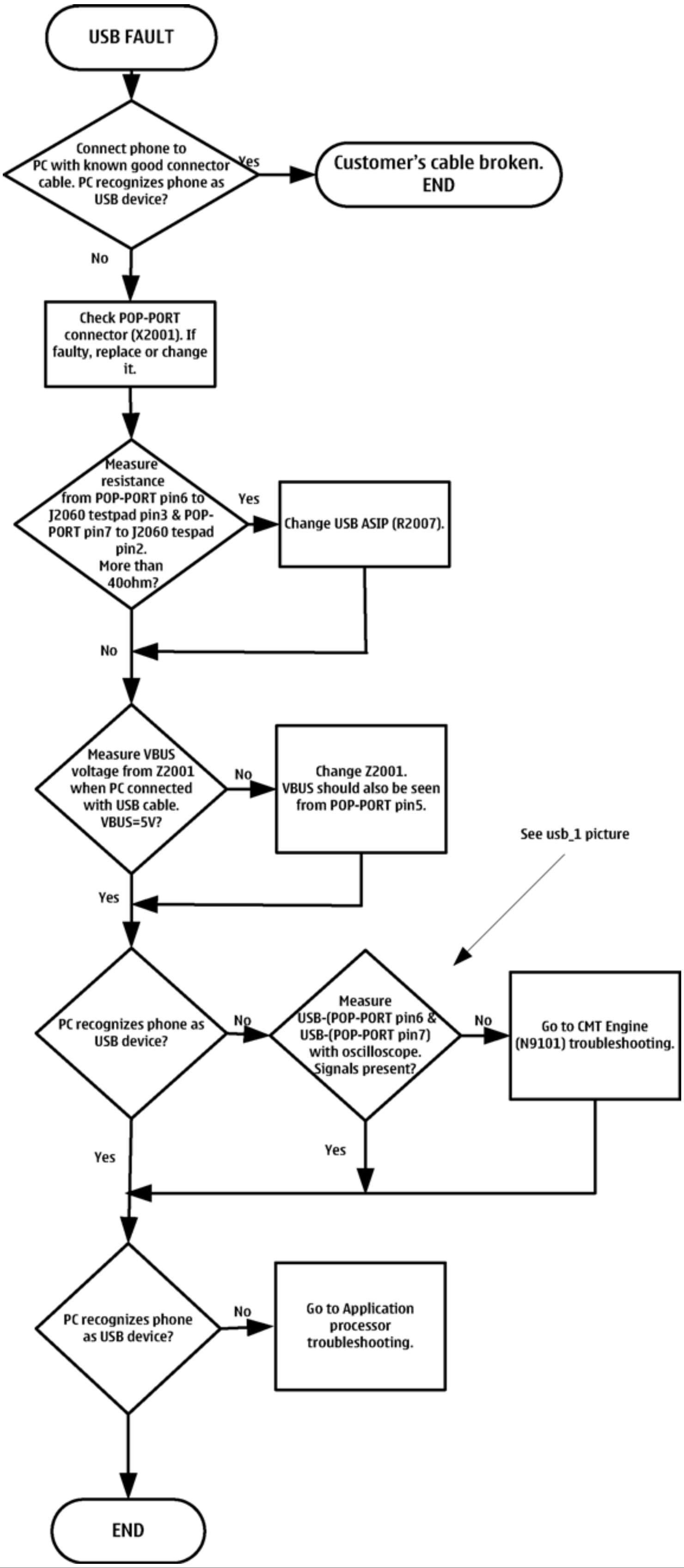
Power key troubleshooting

Troubleshooting flow



USB interface troubleshooting

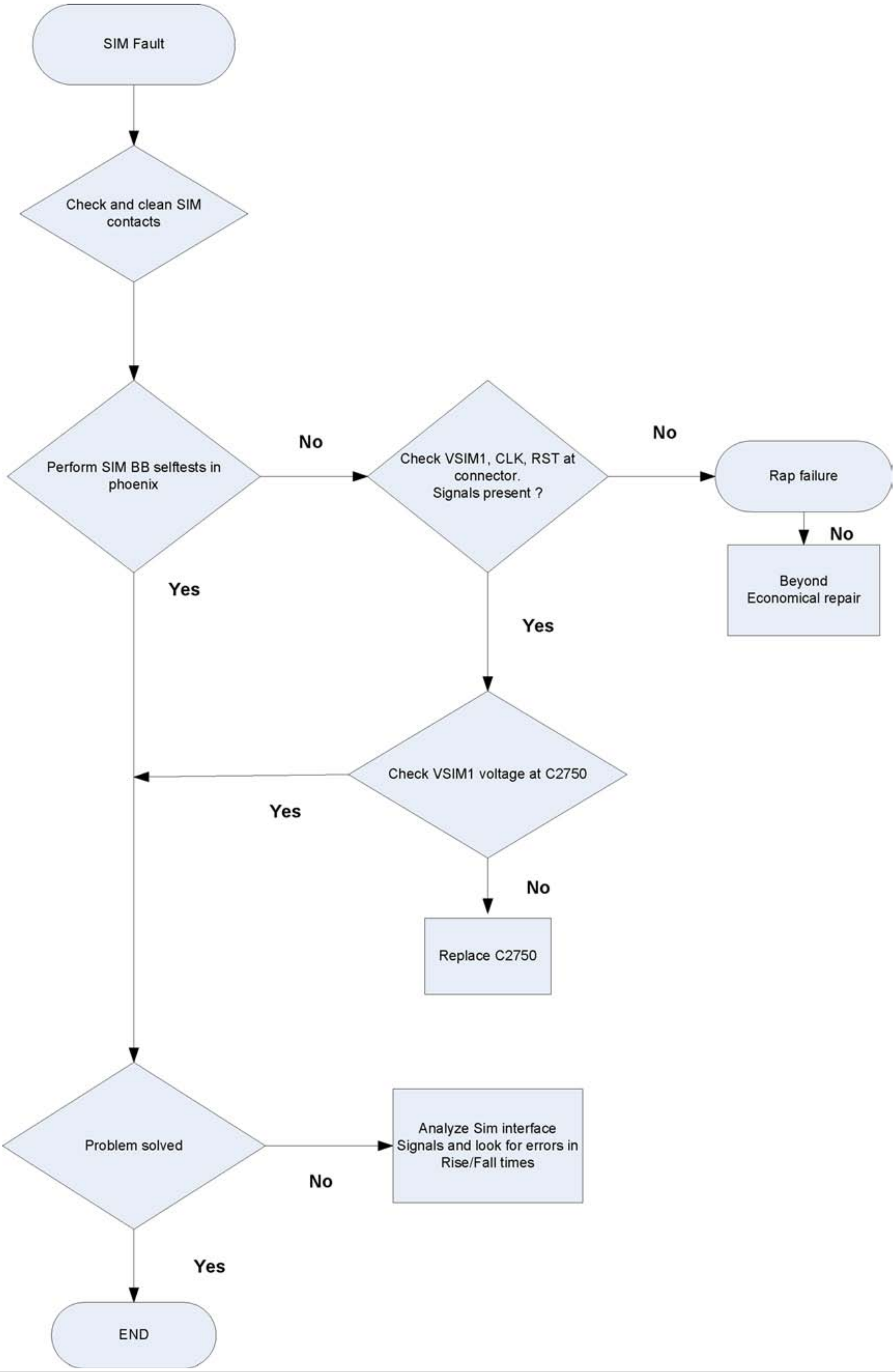
Troubleshooting flow




Saved: 25 MAY 2004 11:50:44
File
Control
Setup
Measure
Analyze
Utilities
Help
11:50 AM
Acquisition is stopped.
2.00 GSa/s 4.10 Mpts
500 mV/
500 mV/
D+RXD
More (1of 2)
Clear All
200 ns/
28.9521130 µs
803 mV
Measurements
Markers
Logic
Scales
X
Y
A——(1) = 24.85663 µs 3.1590 V
B---(1) = 23.50063 µs 3.2590 V
Δ = -1.35600 µs 100.0 mV
1/ΔX = 737.464 kHz

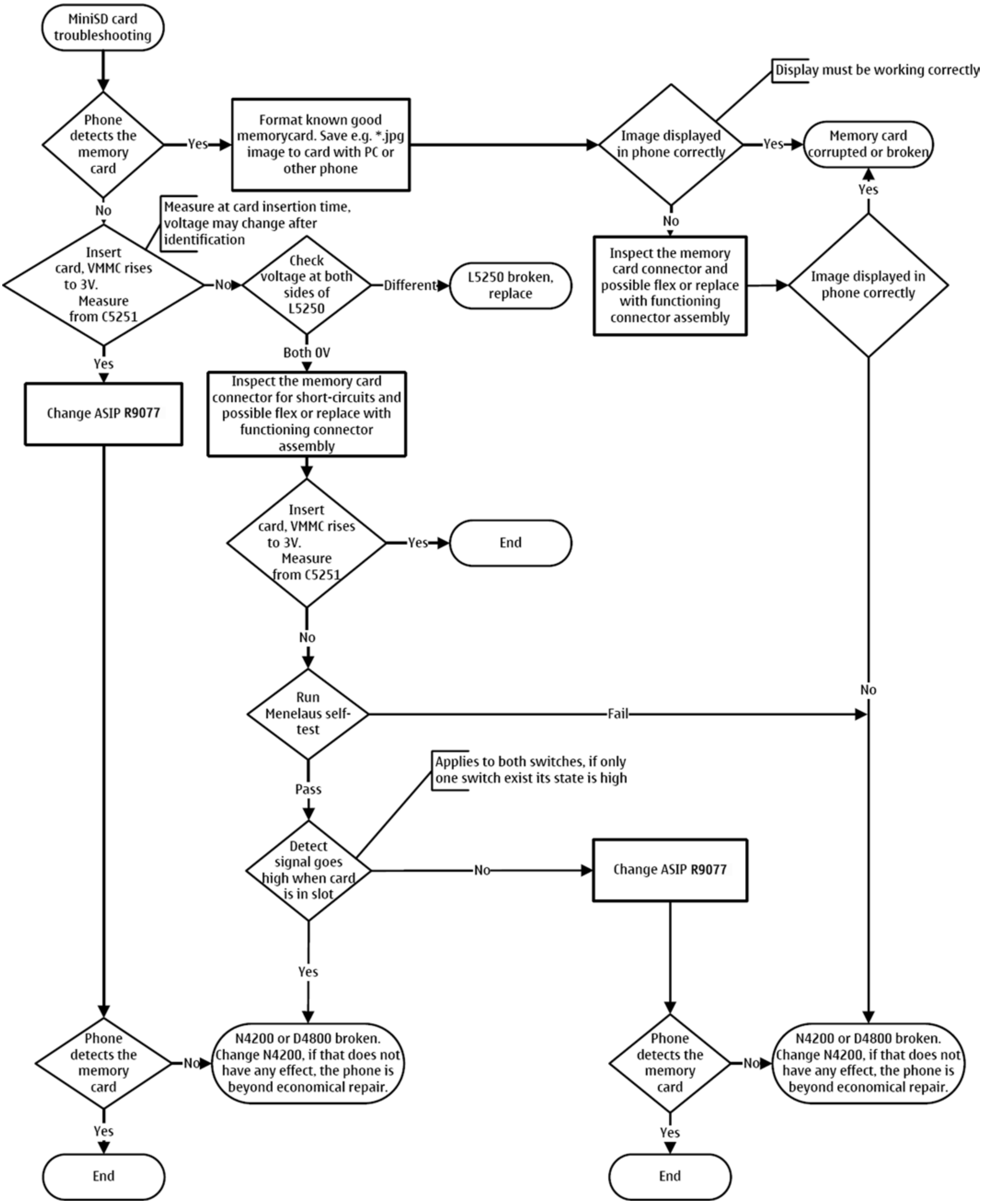
SIM card troubleshooting

Troubleshooting flow



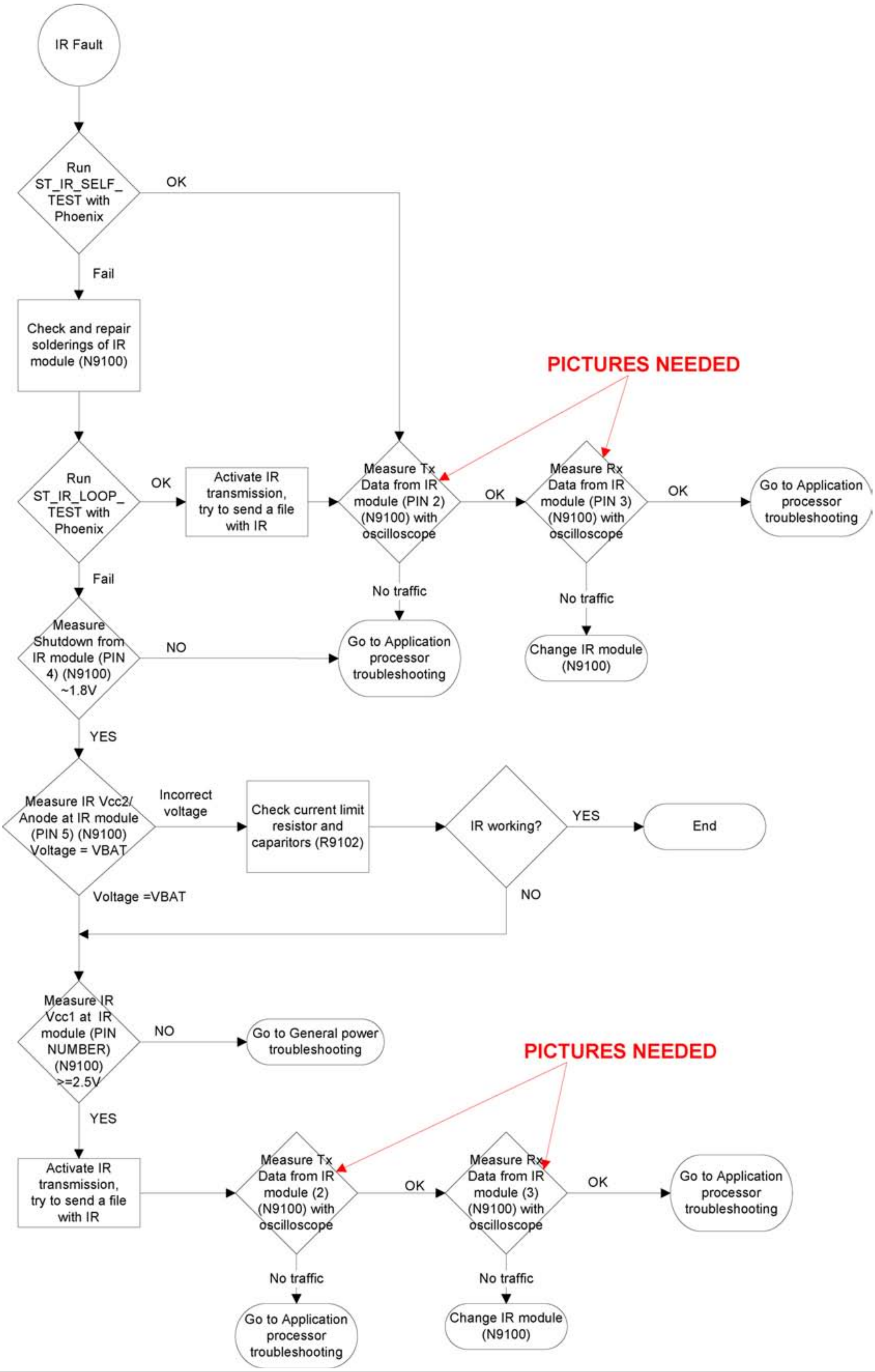
MiniSD troubleshooting

Troubleshooting flow



Irda troubleshooting

Troubleshooting flow



WLAN interface troubleshooting

Troubleshooting flow

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Keyboard troubleshooting

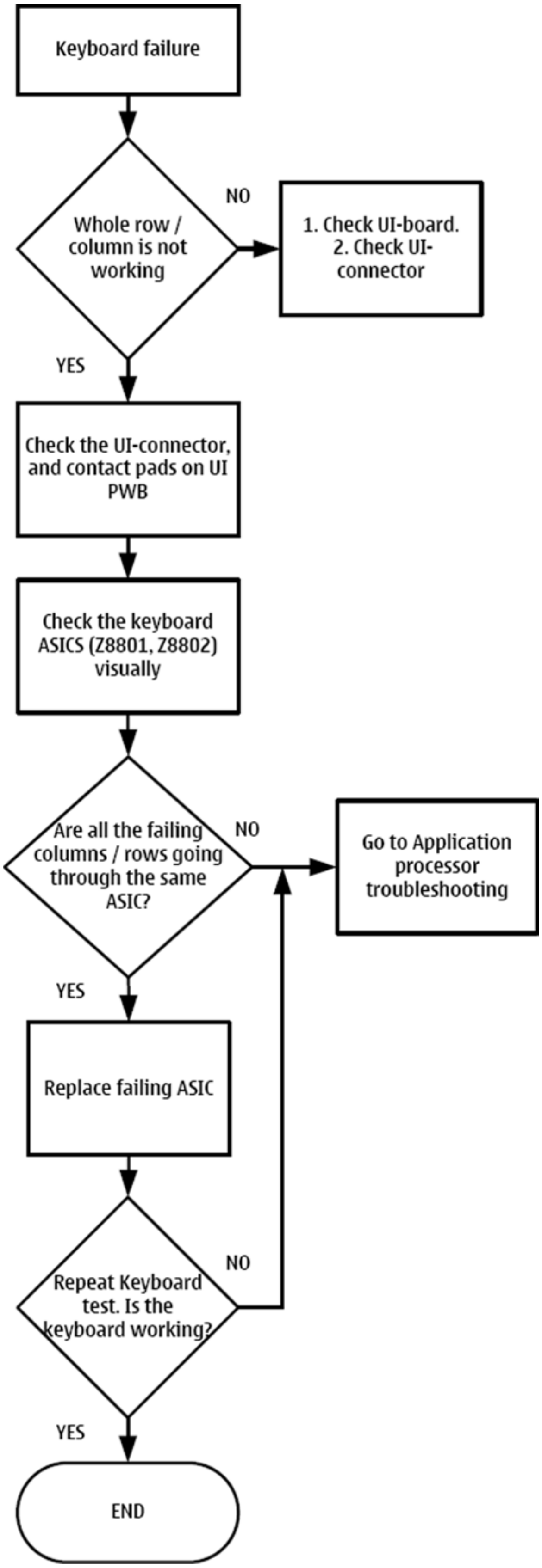
Context

There are two possible failure modes in the keyboard module:

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

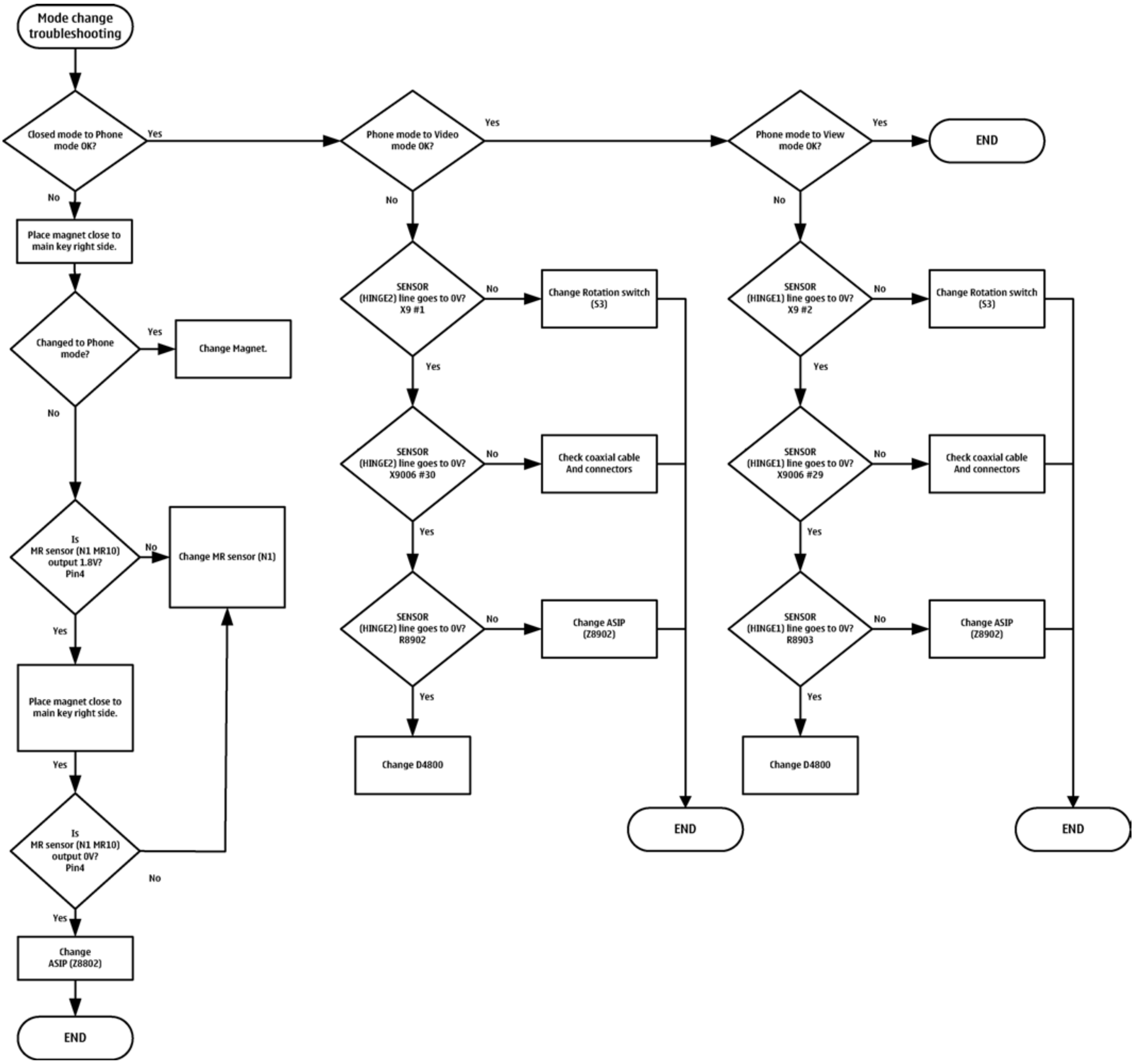
If the failure mode is not clear, start with the **Keyboard Test** in *Phoenix*.

Troubleshooting flow



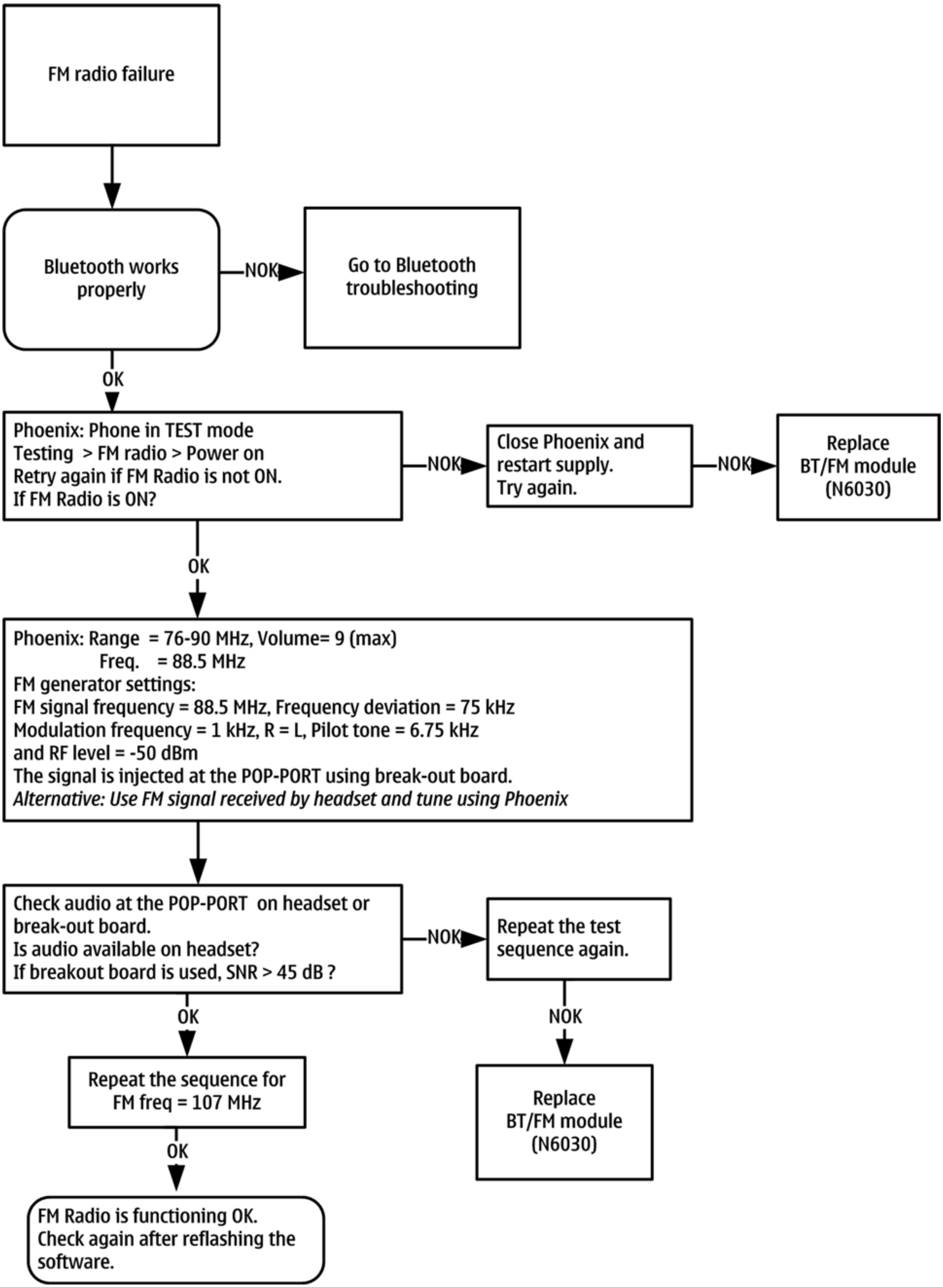
Mode switch troubleshooting

Troubleshooting flow



FM radio troubleshooting

Troubleshooting flow



Certificate restoring for BB5 products

Context

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

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

The procedure for certificate restoring is the following:

- Flash the phone with the latest available software using FPS-8 or FPS-10.

  Note: USB flashing does not work for a dead BB5 phone.
- Create a request file.
- Send the file to Nokia by e-mail. Use the following addresses depending on your location:
  - APAC: sydney.service@nokia.com
  - CHINA: repair.ams@nokia.com
  - E&A: salo.repair@nokia.com
  - AMERICAS: fls1.usa@nokia.com
- When you receive a reply from Nokia, carry out certificate restoring.
- Tune the phone completely.

  Note: SX-4 smart card is needed.
- If the phone resets after certificate restoring, reflash the phone again.

Required equipment and setup:

- *Phoenix* service software v 2004.39.7.70 or newer.
- The latest phone model specific *Phoenix* data package.
- PKD-1 dongle
- SX-4 smart card (Enables BB5 testing and tuning features)
- External smart card reader

  Note: The smart card reader is only needed when FPS-8 is used. FPS-10 has an integrated smart card reader.
- Activated FPS-8 flash prommer **OR** FPS-10 flash prommer
- Flash update package 03.18.004 or newer for FPS-8 or FPS-10 flash prommers
- CU-4 control unit
- USB cable from PC USB Port to CU-4 control unit
- Phone model specific adapter for CU-4 control unit
- PCS-1 cable to power CU-4 from external power supply
- XCS-4 modular cable between flash prommer and CU-4

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

Steps

1. Program the phone software.

   i Start *Phoenix* and login. Make sure the connection has been managed correctly for FPS-8 or FPS-10.

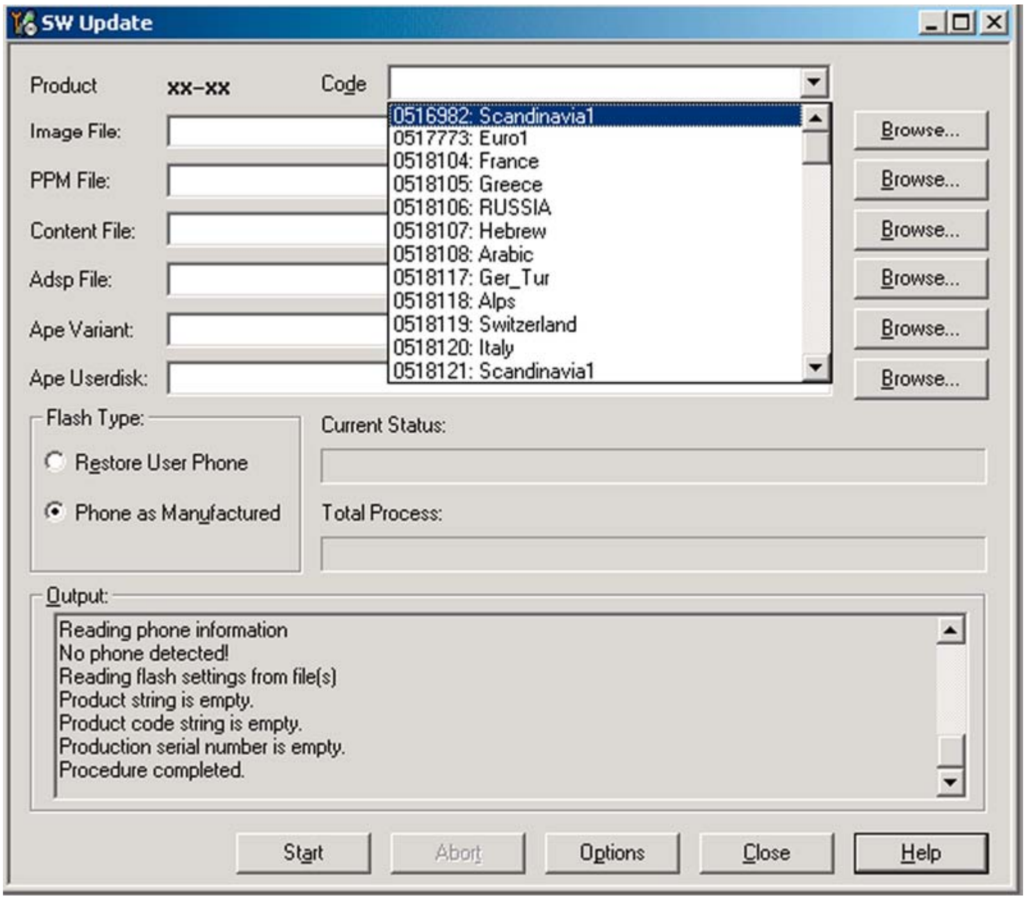
   ii Update the phone MCU software to the latest available version.

   If the new flash is empty and the phone cannot communicate with *Phoenix*, reflash the phone.

iii Choose the product manually from **File→Open Product** , and click **OK**.

Wait for the phone type designator (e.g. "RM-1") to be displayed in the status bar.

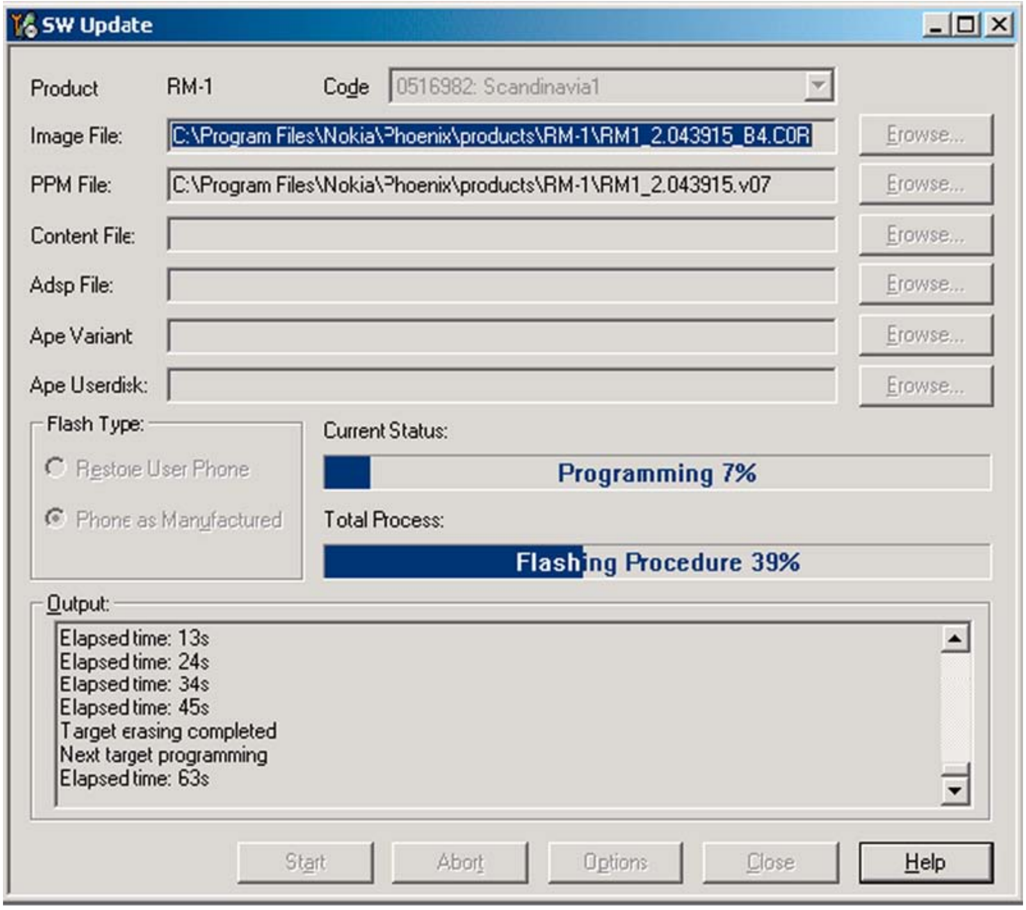
iv Go to **Flashing→SW Update** and wait until *Phoenix* reads the product data as shown in the following picture.



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

v To continue, click **Start**.

Progress bars and messages on the screen show actions during phone programming, please wait.



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

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

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

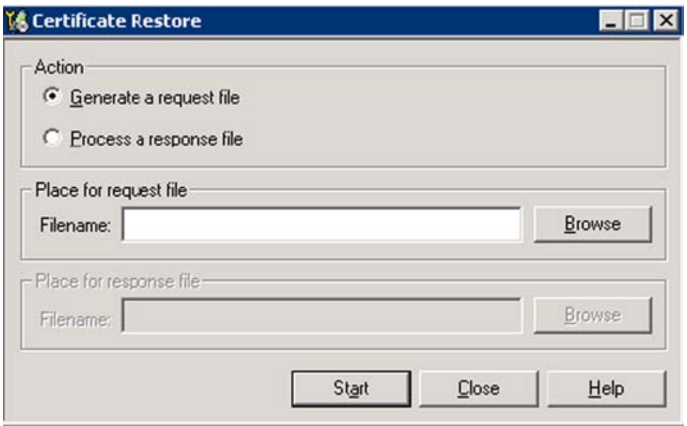
2. Create a *Request* file.

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

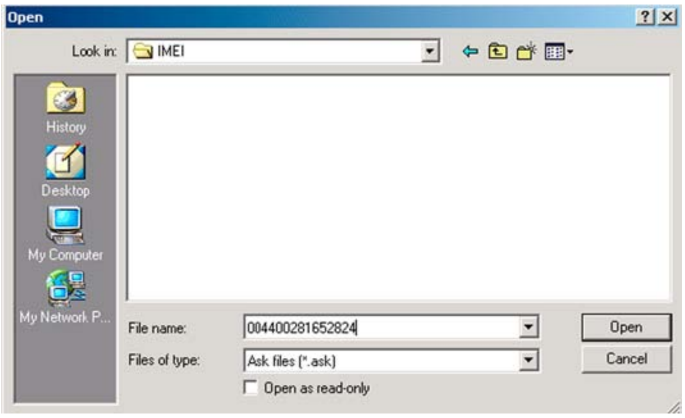
i To connect the phone with *Phoenix*, choose **File→Scan Product** .

ii Choose **Tools→Certificate Restore** .

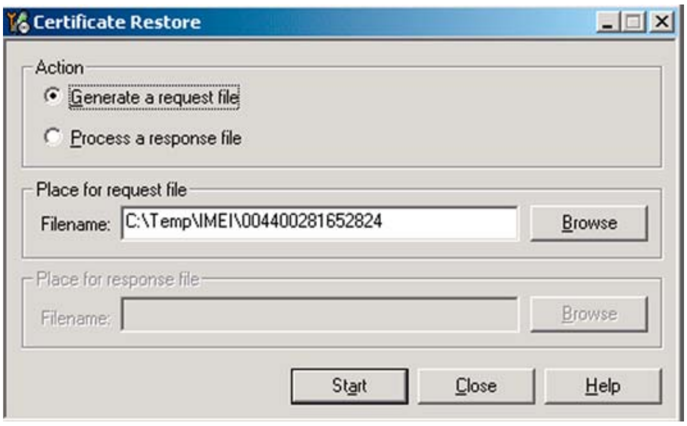
iii To choose a location for the request file, click **Browse**.



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



The name of the file and its location are shown.



v To create the *Request* file, click **Start**.

vi When the file for certificate restore has been created, send it to Nokia as an e-mail attachment.

3. Restore certificate.

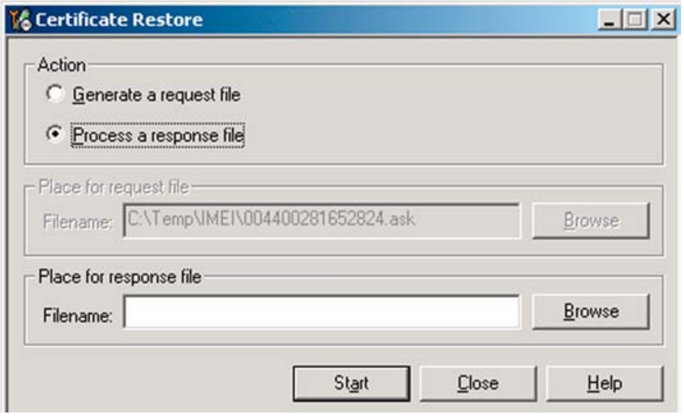
For this procedure, you must supply +12 V to CU-4 from an external power supply.

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

ii Start *Phoenix* service software.

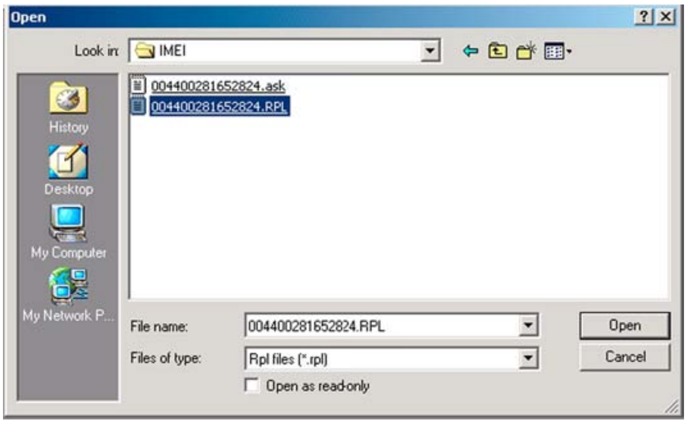
iii Choose **File→Scan Product** .

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



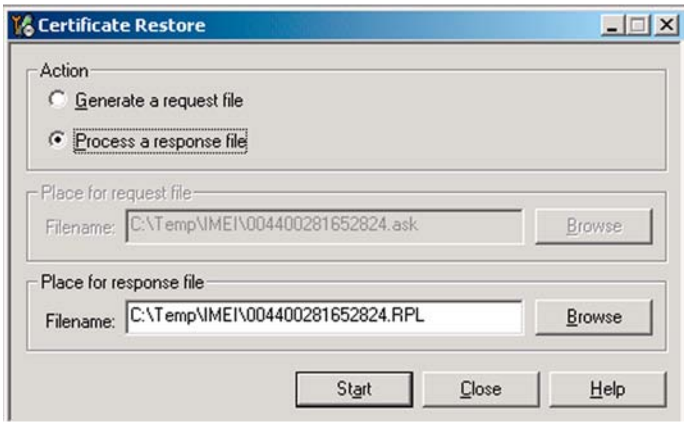
v To choose the location where response file is saved, click **Browse**.

vi Click **Open**.



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

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



Next actions

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

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

Display module troubleshooting

General instructions for display troubleshooting

Context

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

Table 12 Display module troubleshooting cases

Display blank	There is no image on the display. The display looks the same when the phone is on as it does when the phone is off. The backlight can be on in some cases.
Image on the display not correct	Image on the display can be corrupted or a part of the image can be missing. If a part of the image is missing, change the display module. If the image is otherwise corrupted, follow the appropriate troubleshooting diagram.
Backlight dim or not working at all	Backlight LED components are inside the display module. Backlight failure can also be in the connector or in the backlight power source in the main engine of the phone. This means that in case the display is working (image OK), the backlight is faulty.
Visual defects (pixel)	Pixel defects can be checked by controlling the display with Phoenix. Use both colours, black and white, on a full screen. The display may have some random pixel defects that are acceptable for this type of display. The criteria when pixel defects are regarded as a display failure, resulting in a replacement of the display, are presented the following table.

Table 13 Pixel defects

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

Steps

1. Verify with a working display that the fault is not on the display module itself.

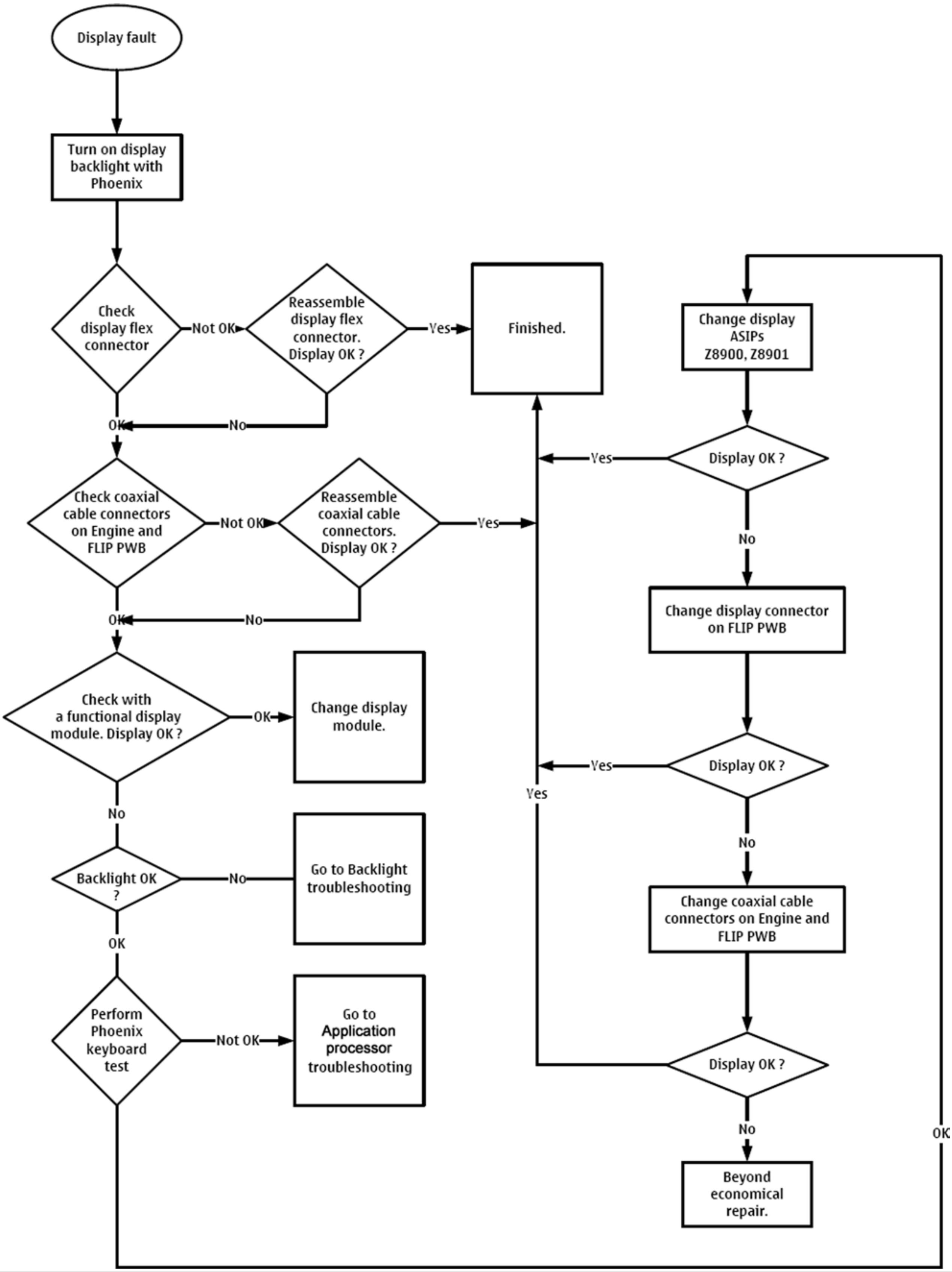
   The display module cannot be repaired.
2. Check that the cellular engine is working normally.
   - i To check the functionality, connect the phone to a docking station.
   - ii Start *Phoenix* service software.
   - iii Read the phone information to check that also the application engine is functioning normally (you should be able to read the APE ID).
3. Verify that there is no coaxial cable breakage by disconnecting the coaxial cable from the display side and the engine side and replacing it with a working cable.

   If the display works, there is a coaxial cable breakage, if not, proceed to the next step.
4. Proceed to the display troubleshooting flowcharts.

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

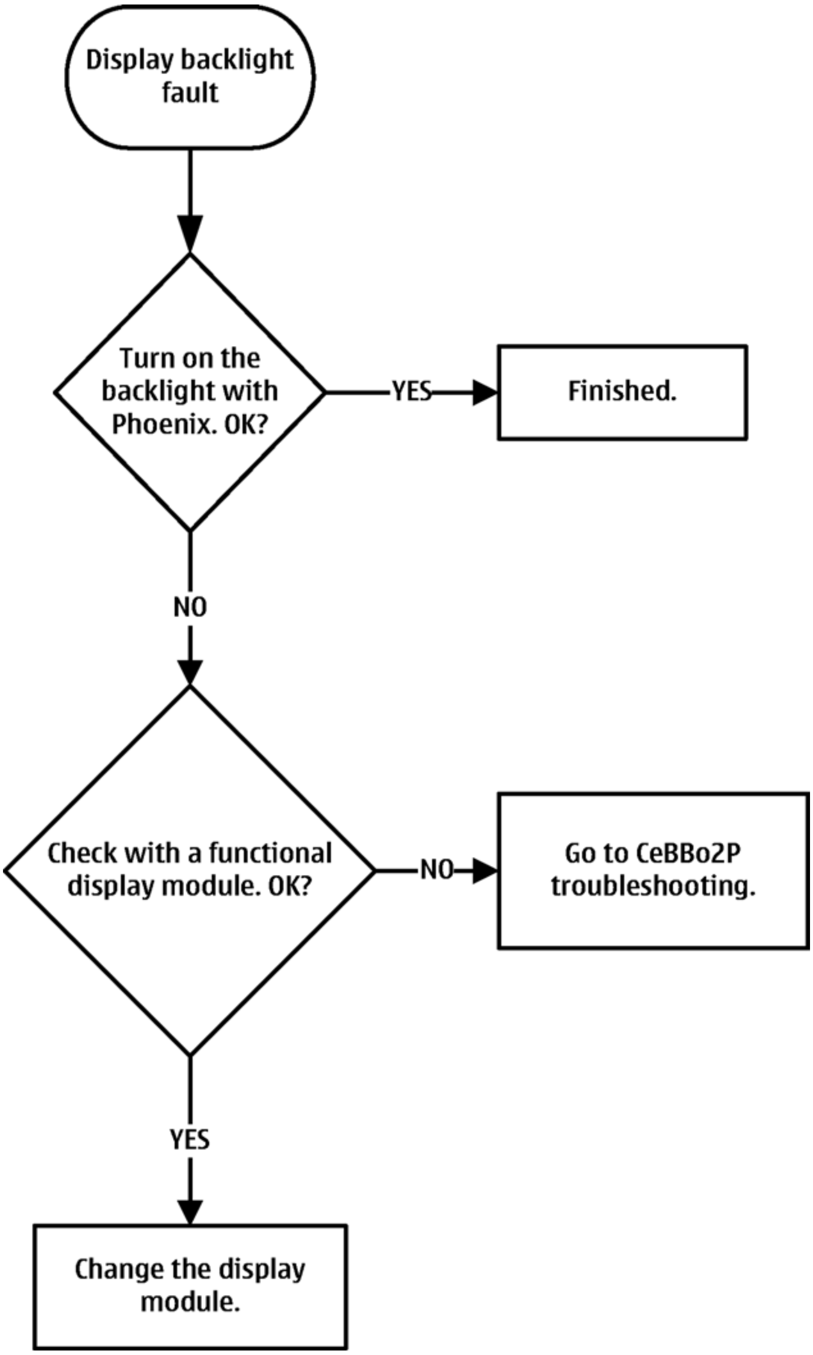
Main display troubleshooting

Troubleshooting flow



Display backlight troubleshooting

Troubleshooting flow

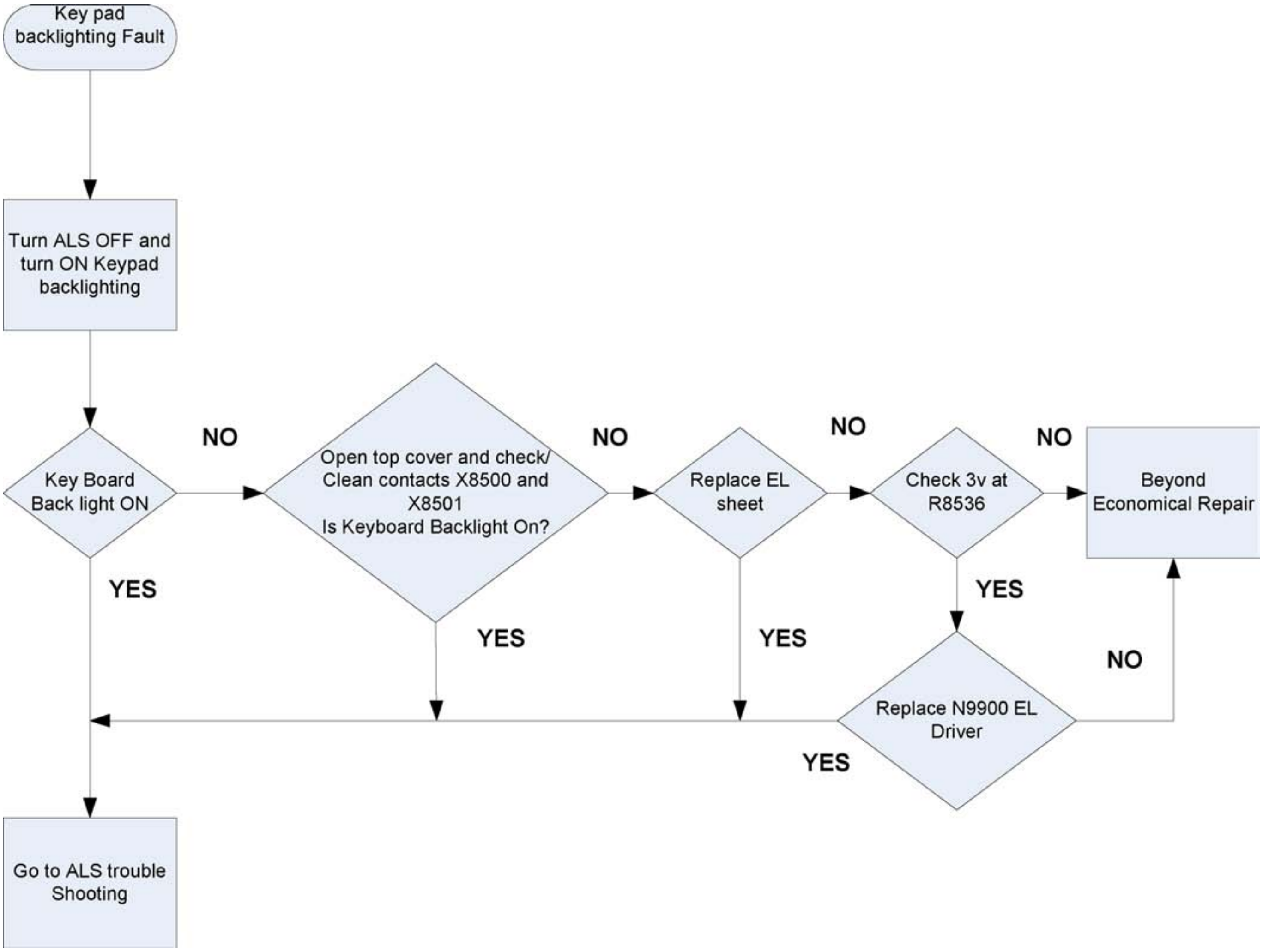


Keyboard backlight troubleshooting

Context

Keyboard backlight is achieved by EL driver on the engine board and EL sheet on the top cover (over keymat). Keyboard backlight is turned ON only in dark conditions. This is controlled by ambient Light Sensor (ALS). ALS and keyboard backlight can be enabled/disabled with the help of Phoenix Service Software.

Troubleshooting flow

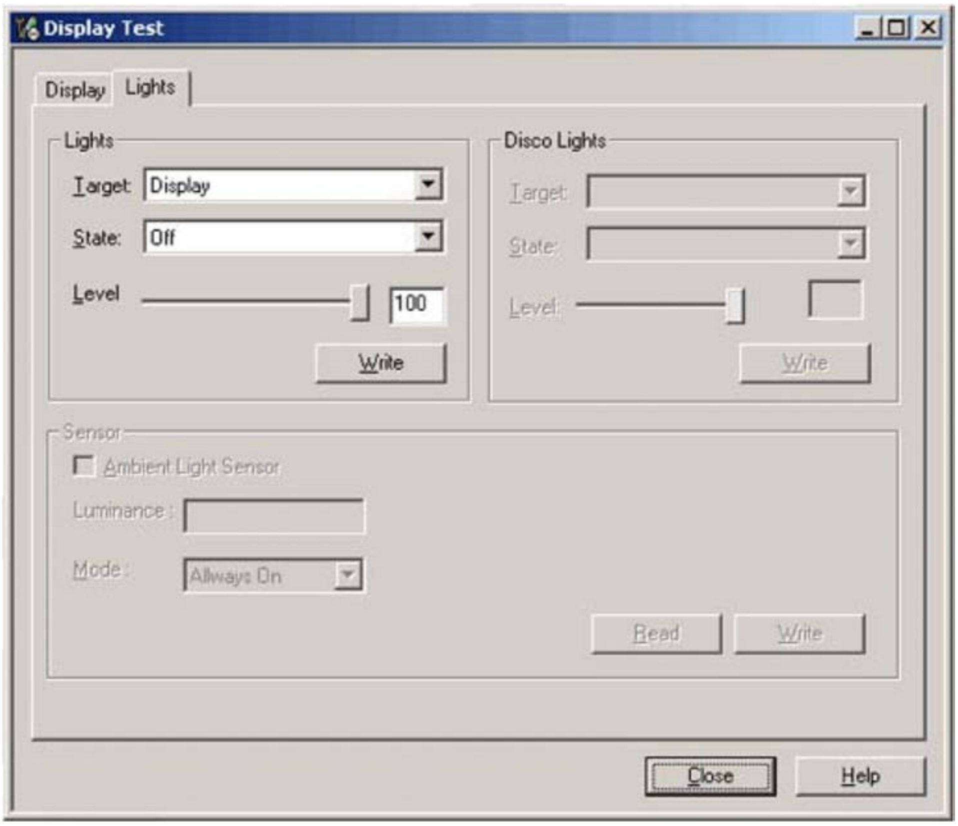


Enabling/disabling keyboard backlights in Phoenix

Steps

1. Open *Phoenix* service software.
2. Choose **File Scan Product**.
3. Choose **Testing→Display Test** .

   Display Test window appears.



4. Click the **Lights** tab to access the keyboard backlight menu .
5. From the **Target** drop-down menu, choose **Keyboard backlight**.
6. Check the state as **ON** and click **Write**.
7. To switch the keyboard backlight off, check state as **OFF** and click **Write**.

ALS troubleshooting

Context

- If a phototransistor is broken, replace it with a typical phototransistor.
- After replacing the phototransistor or if calibration values are lost for some other reason, ALS re-tuning is required.
- Before starting the ALS calibration procedure, perform the 'Pull-up resistor calibration' in dark lighting conditions, and write the measured 'correction' value to the phone. After this ALS calibration procedure is performed, and the default co-efficient value '1' is written to the phone.
- Make sure that you have completed **Display and keypad backlight troubleshooting** first before starting **ALS troubleshooting**.

Here are some hints for ALS troubleshooting; the following troubleshooting diagram refers to these:

- *Phoenix* LED control tool also shows you luminance. The correct luminance in darkness is <20 lx, and in office environment 100-2000 lx. The luminance value depends strongly on the light source and the angle of the phone, so these values are only a rough guideline.
- LED driver control voltage measurement points can be found from the **LED driver troubleshooting** section. When backlight brightness is set to 100%, both GENOUT signals are low, and enable PWM is 100%.
- *Phoenix* has an ambient light sensor calibration tool for changing calibration values. The pull-up resistor calibration is done first. See the following procedure.

Steps

1. Cover the light guide (upper part of the A-Cover).
2. Start *Phoenix*.
3. Choose **File→Scan Product.**
4. Choose **Tuning→Ambient Light Sensor Calibration.**

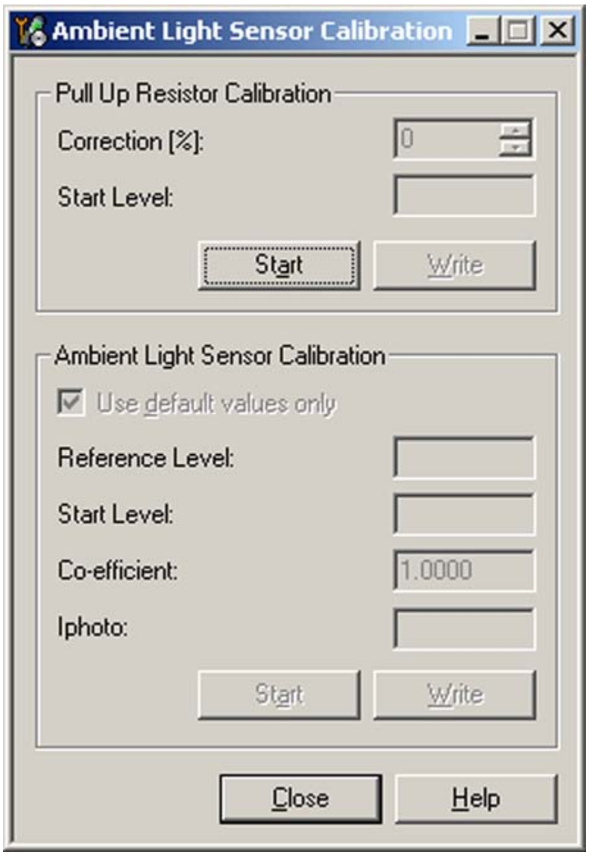
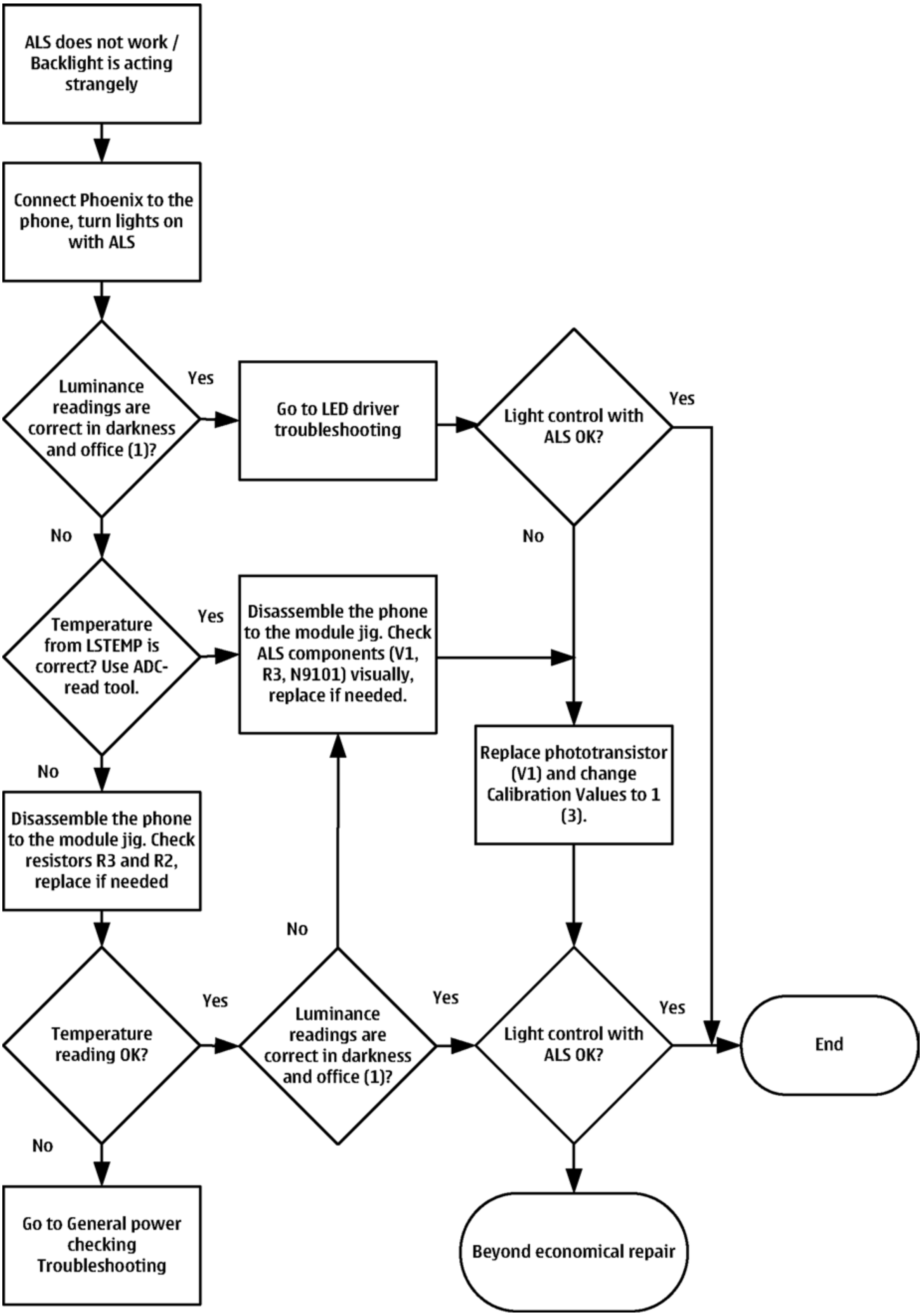


Figure 39 ***Ambient Light Sensor Calibration*** **window**

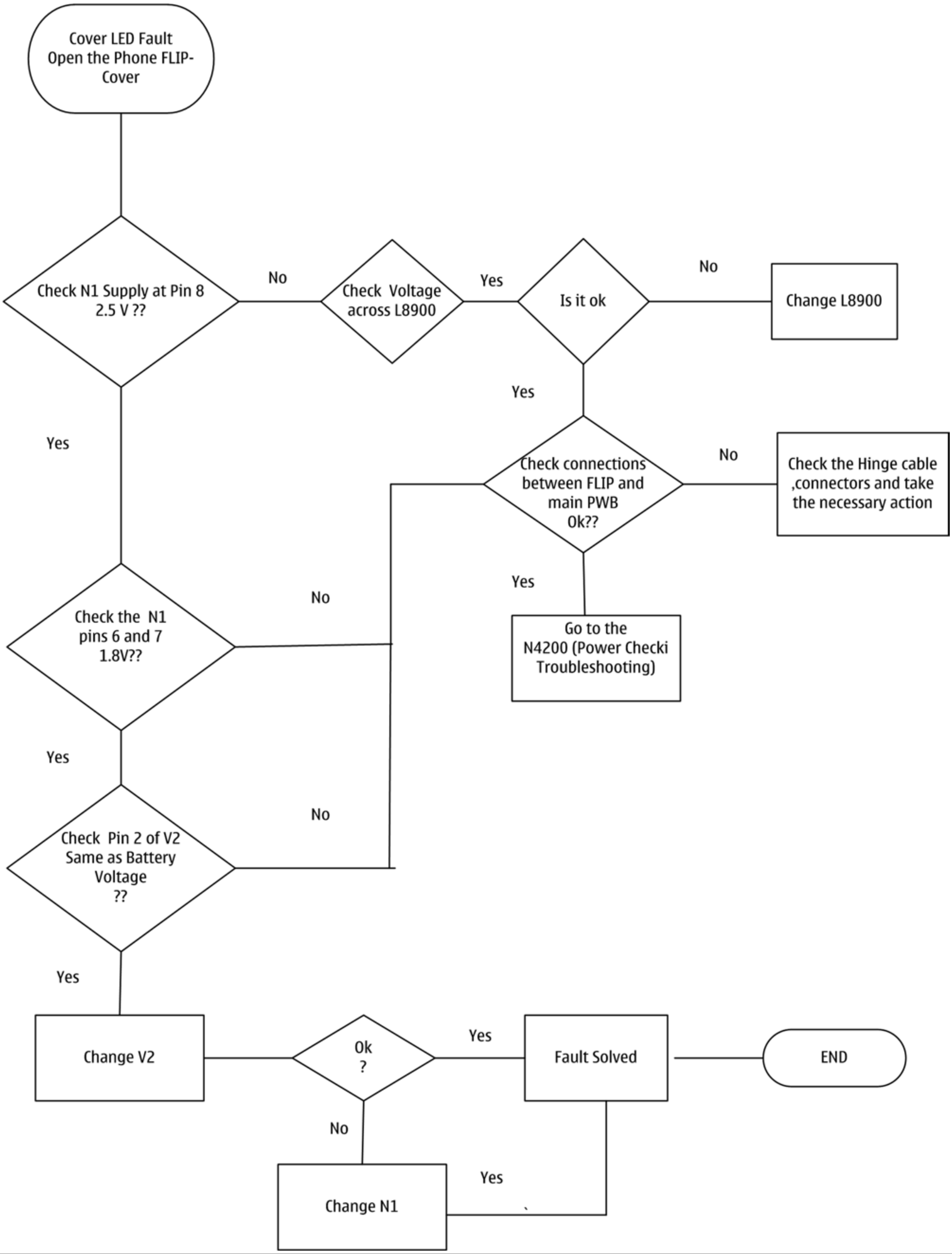
5. In the *Pull Up Resistor Calibration* pane, click **Start**, and **Write**.
6. In the *Ambient Light Sensor Calibration* pane, check the **Use default values only** check box, and click **Write**.
7. To end the calibration, click **Close**.

Troubleshooting flow



Cover LED troubleshooting

Troubleshooting flow



Adjusting LCD and keyboard backlights in Phoenix

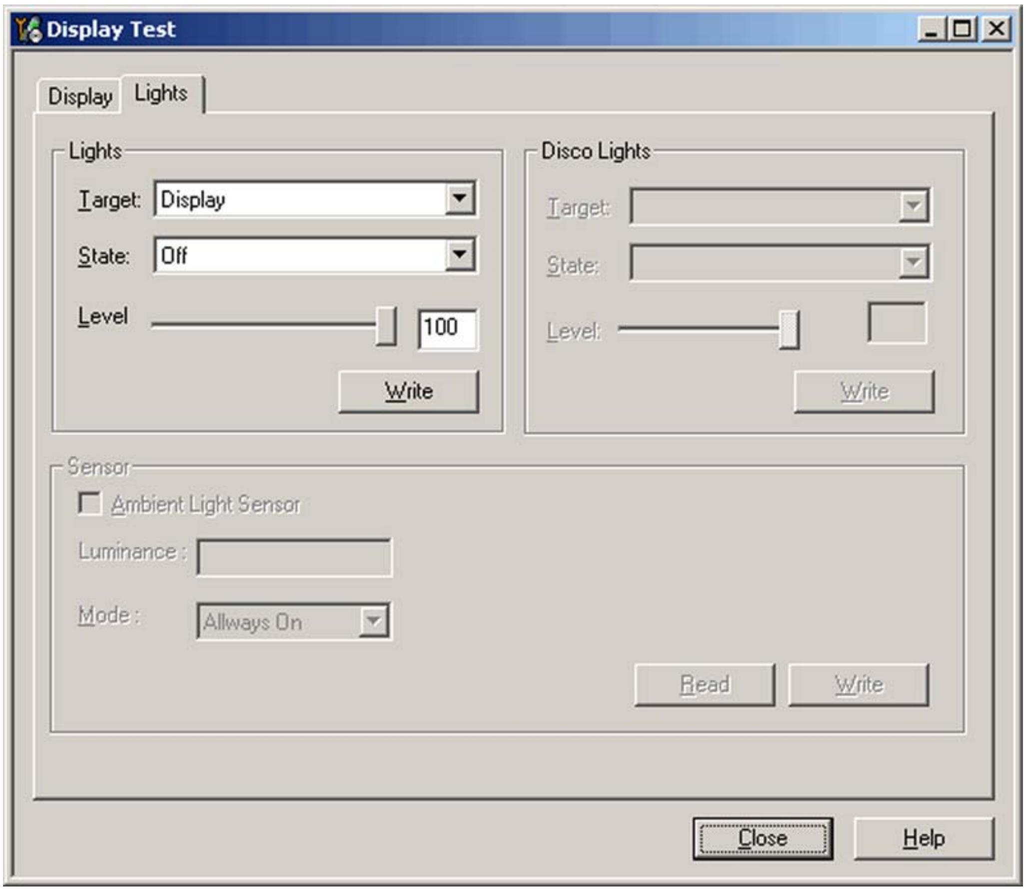
Context

- The sub display doesn't use backlight; the illumination mode is self-emissive lightning. Phoenix allows the display luminance to be set to two different levels (100cd/m2 or 20cd/m2).
- The keyboard backlights can be turned on only when the main LCD backlight is on.
- The brightness level of the keyboard backlights follow the brightness of the main LCD backlight.
- It takes 30 seconds to change the LCD backlight on/off status after clicking the **Write** button. If you need to turn on/off the backlight quickly, use the **Level** field to turn on (100%)/off (0%) the backlight.

Steps

1. Open *Phoenix* service software.
2. Choose **File→Scan Product.**
3. Choose **Testing→Display Test.**

   Display Test window appears.



4. To access the light control menu, click the **Lights** tab.
5. From the **Target** drop-down menu, choose the test target: **Display**, **Display2**, **Keyboard**.

   Display = main display

   Display2 = sub display.

   You can also change the backlight status to **On** or **Off** from the **State** drop-down menu.

6. Click **Write**.

   The selected test target can now be controlled. You can control the brightness by using the **Level** slider.

Examples

1 To turn on/off the main LCD backlight, use the following settings:

- Target: Display
- State: On/Off
- Level: 100

You can turn the LCD backlight on/off by adjusting the **Level** value to be either **100** (On) and **0** (Off).

2 To set the maximum or minimum luminance in the sub LCD, use the following settings:

- Target: Display2
- State: On/Off
- Level: 100 cd/m2 or 20 cd/m2

  No other intermediate level is allowed.

3 To turn on/off the keyboard backlight, use the following settings:

- Target: Keyboard
- State: On/Off
- Level: 100

  Note: The main LCD backlight has to be on in advance.

Bluetooth troubleshooting

Introduction to Bluetooth troubleshooting

There are two main Bluetooth problems that can occur:

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

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

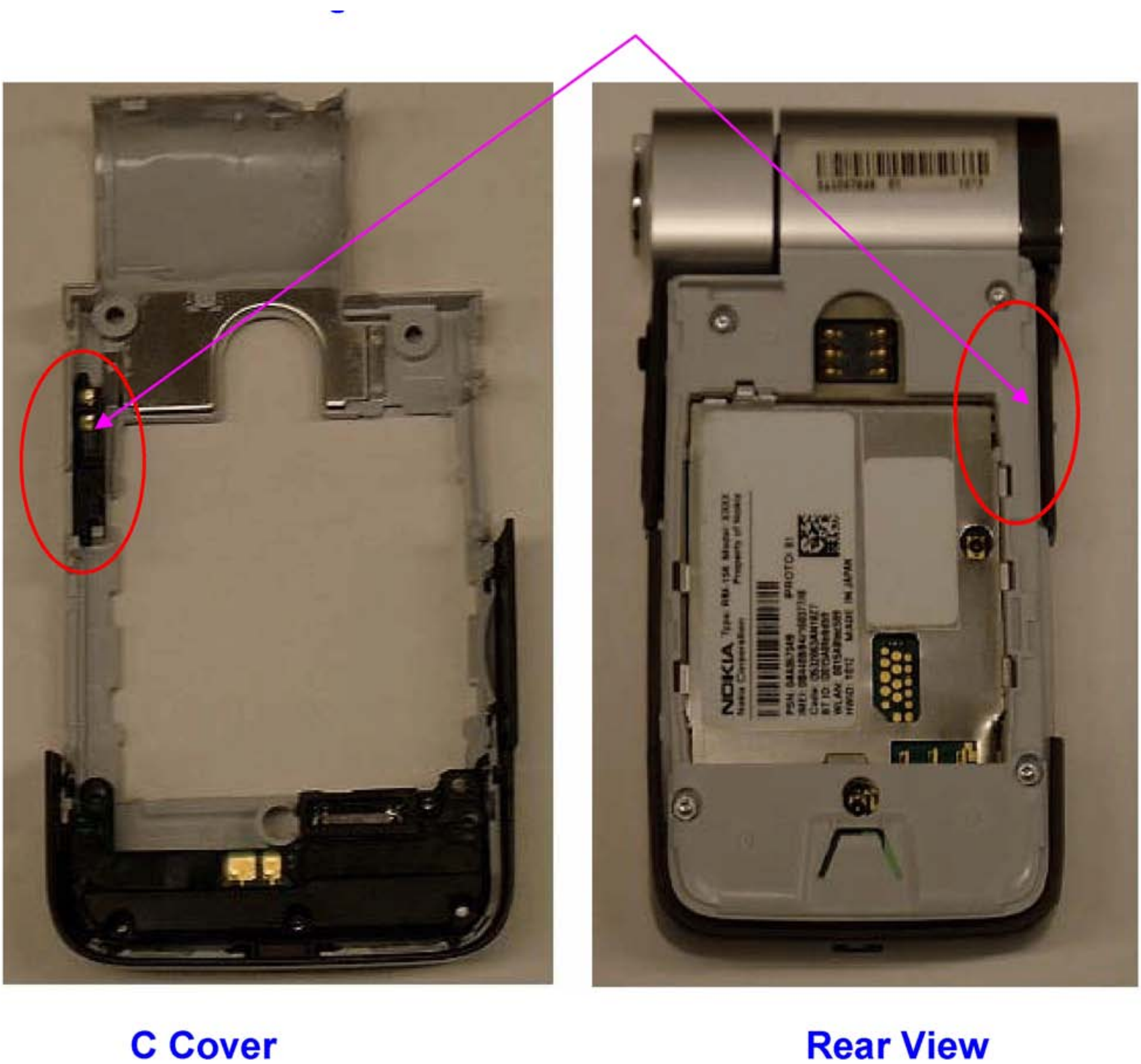


Figure 40 Bluetooth antenna location

Figure 41 Bluetooth antenna module

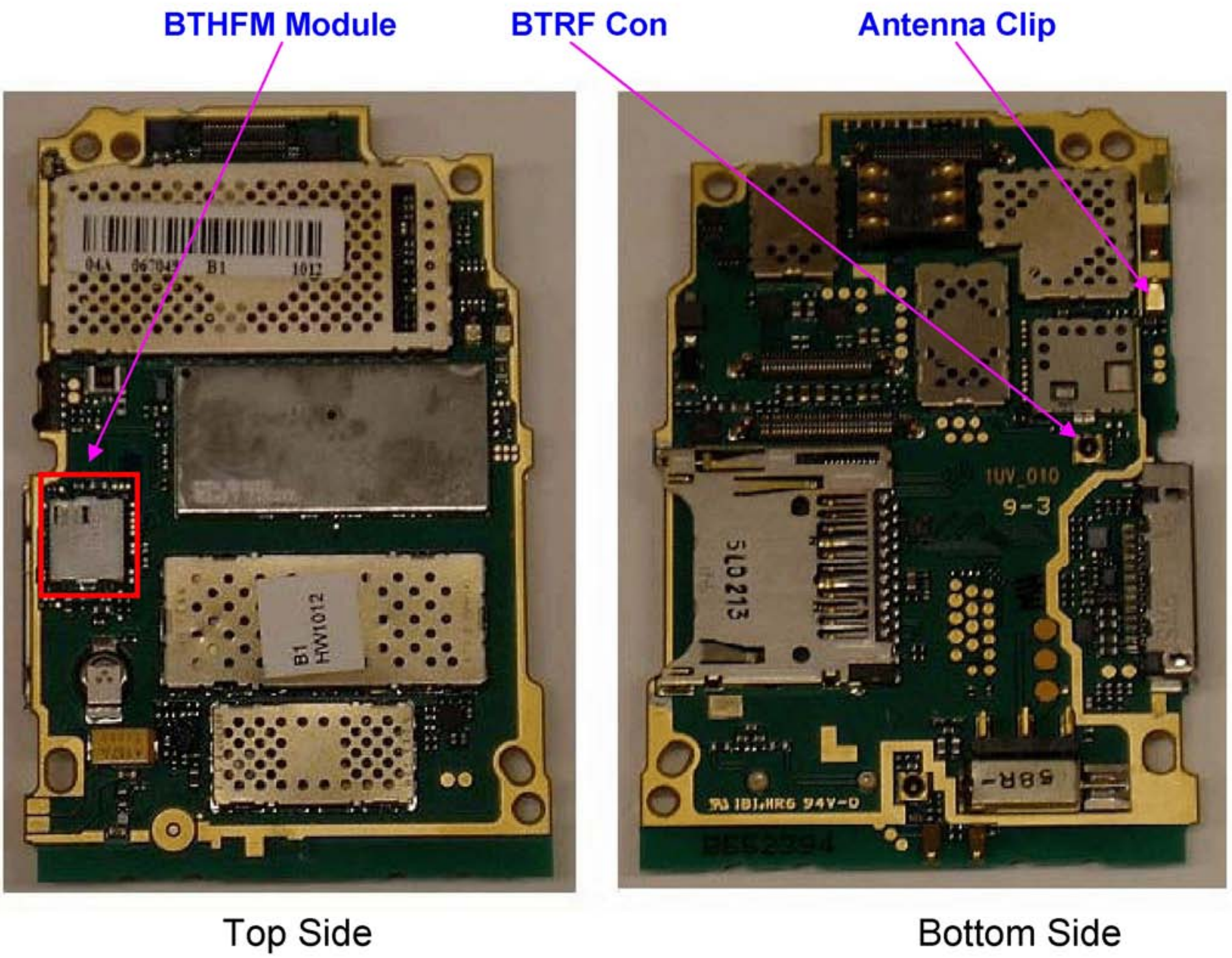


Figure 42 Bluetooth location on PWB

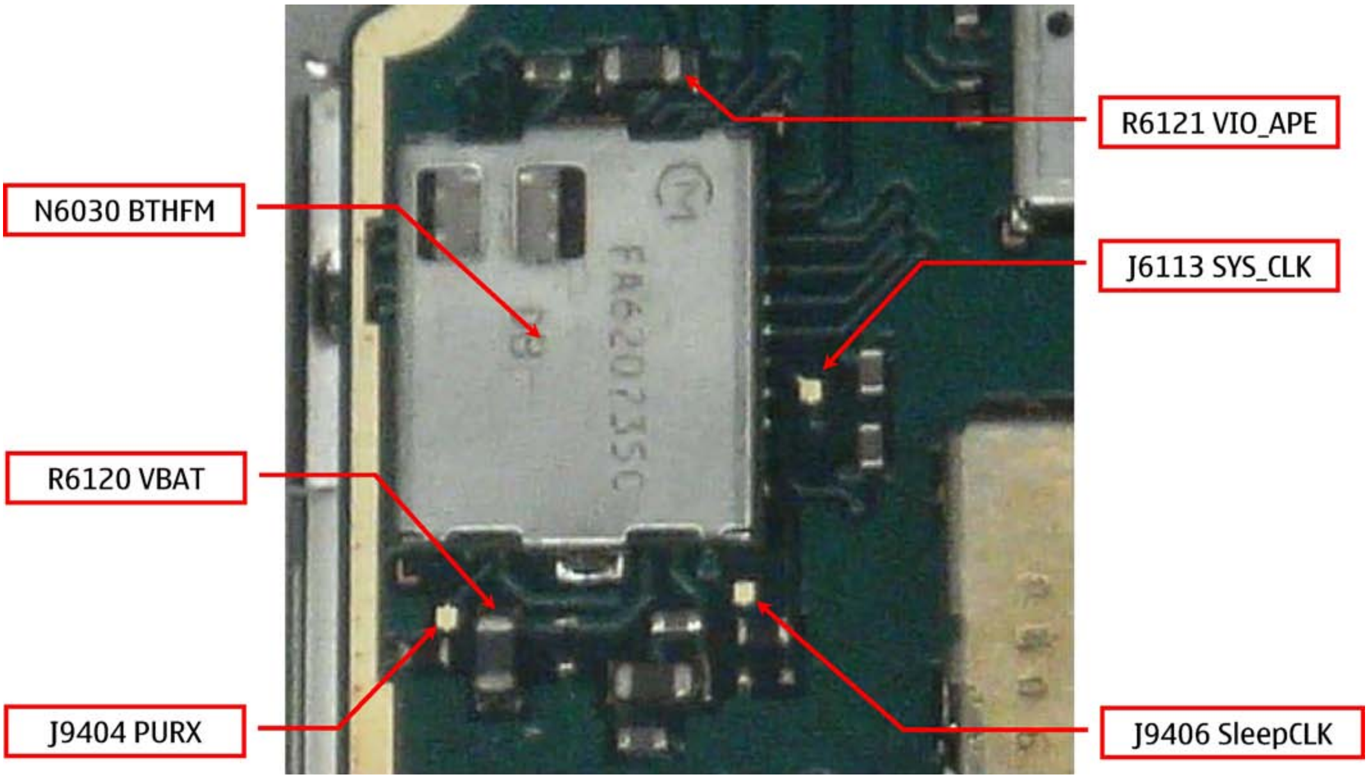


Figure 43 Bluetooth circuitry and test points

Bluetooth settings for Phoenix

Steps

1. Start *Phoenix* service software.
2. From the **File** menu, choose **Open Product**, and then choose the correct type designator from the **Product** list.
3. Place the phone to a flash adapter in the local mode.
4. Choose **Testing→Bluetooth LOCALS** .
5. 5. Locate JBT-9 BT boxe's BT Device Address (12-digits) in the type label on the back of BT box.

   In addition to JBT-9, also SB-6, JBT-3 and JBT-6 Bluetooth test boxes can be used.
6. In the *Bluetooth LOCALS* window, write the 12-digit BT Device Address on the **Counterpart BT Device Address** line.

   This needs to be done only once provided that JBT-9 is not changed.
7. Place the JBT-9 box near (within 10 cm) the BT antenna and click **Run BER Test**.

Results

Bit Error Rate test result is displayed in *Bit Error Rate (BER) Tests* pane in the *Bluetooth LOCALS* window within a couple of seconds.

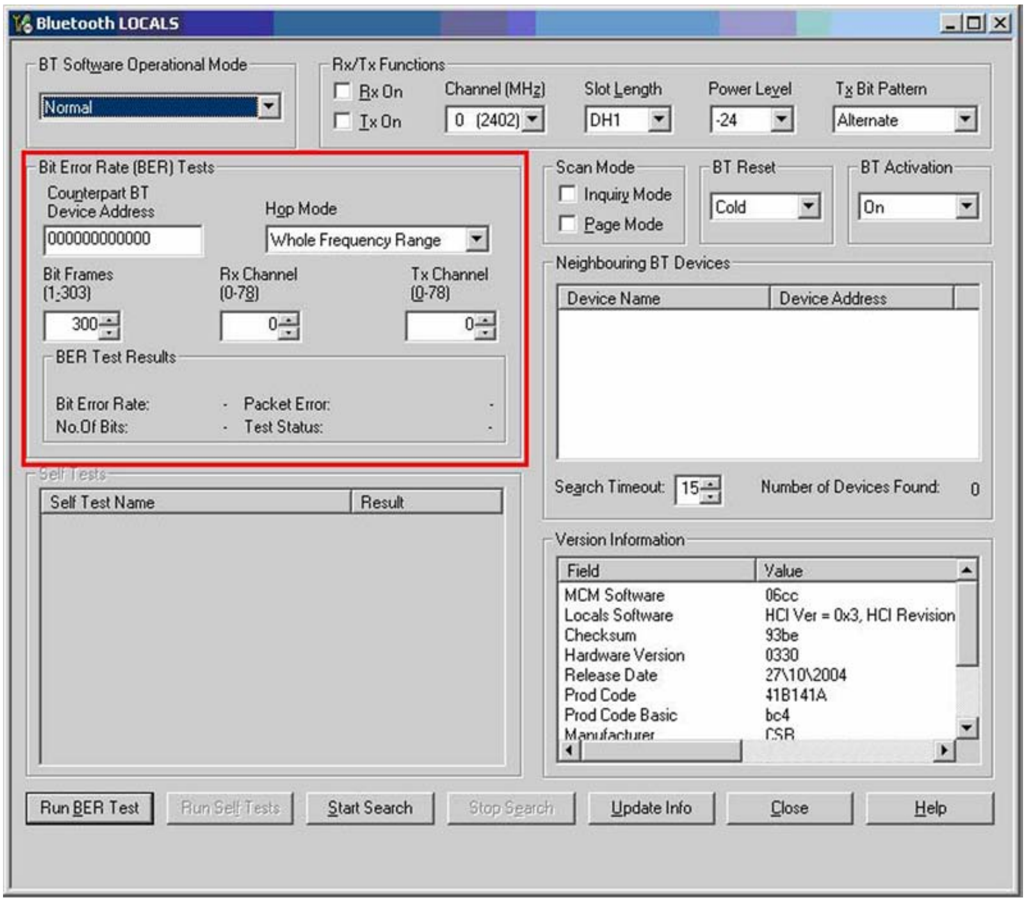


Figure 44 BER test result

Bluetooth self tests in Phoenix

Steps

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

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

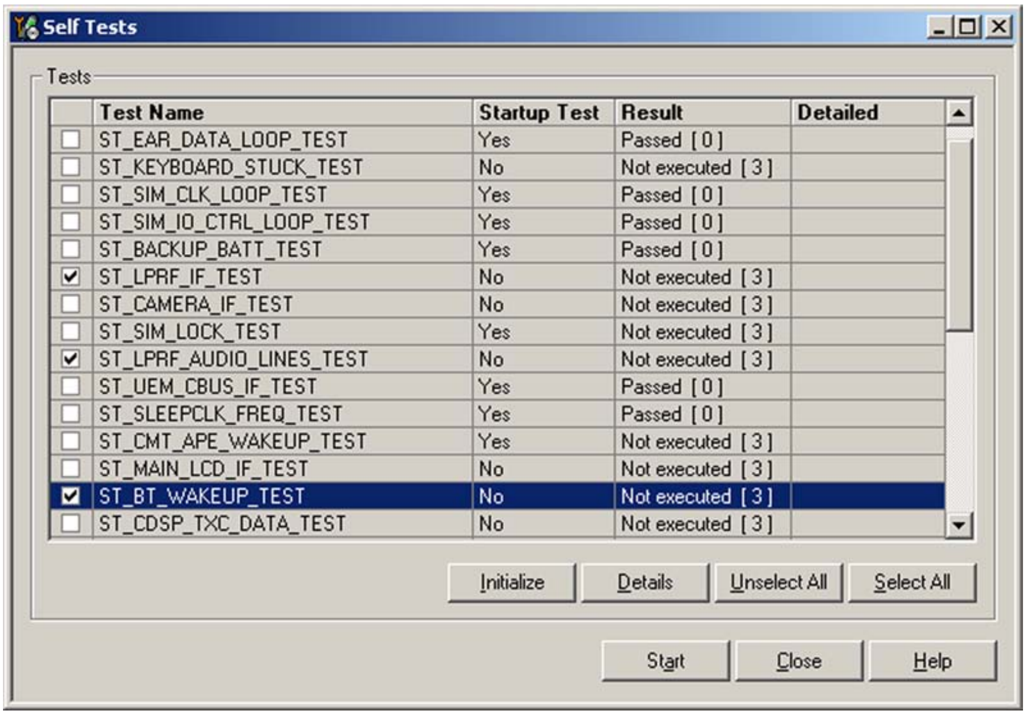
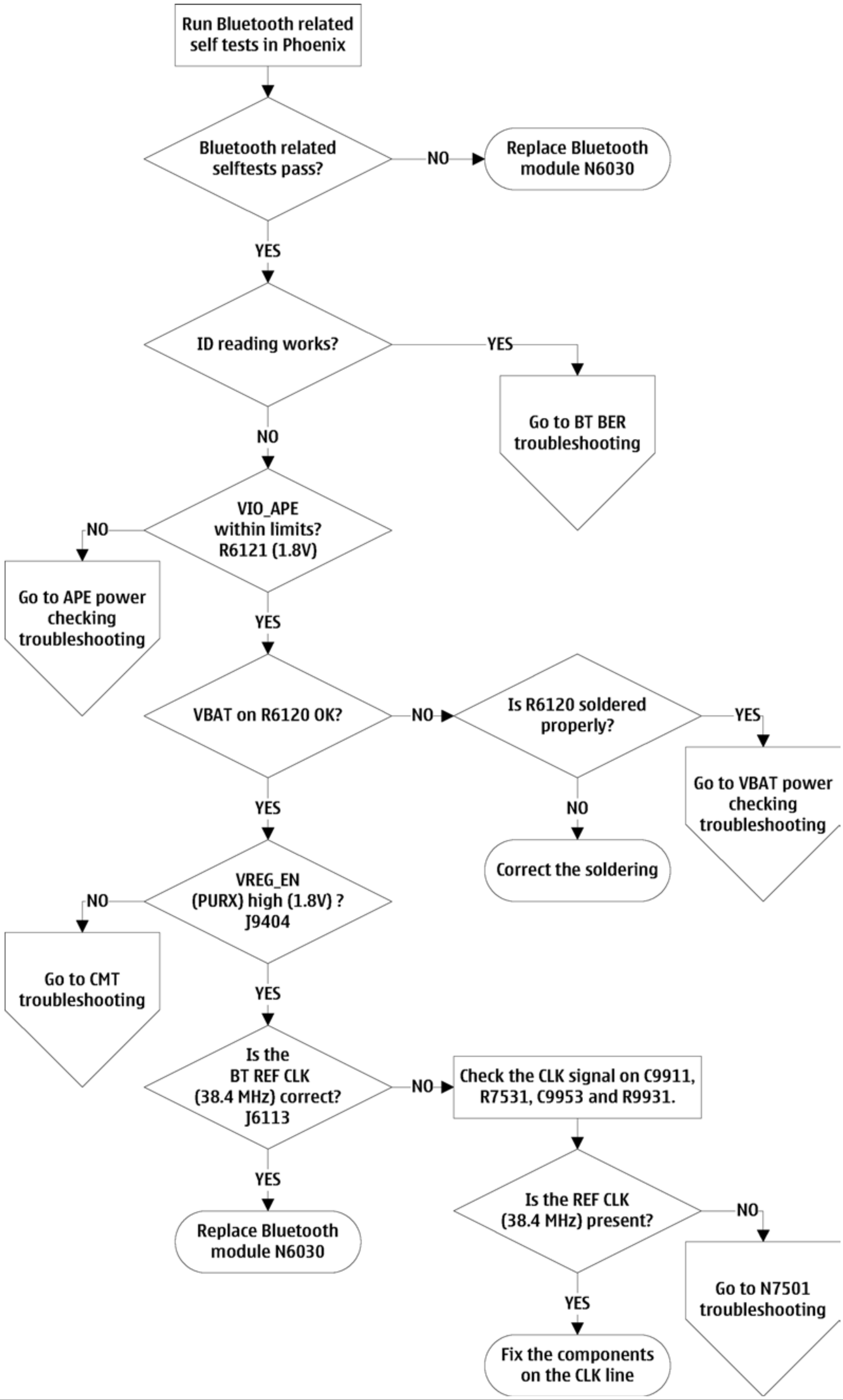


Figure 45 Bluetooth self tests in *Phoenix*

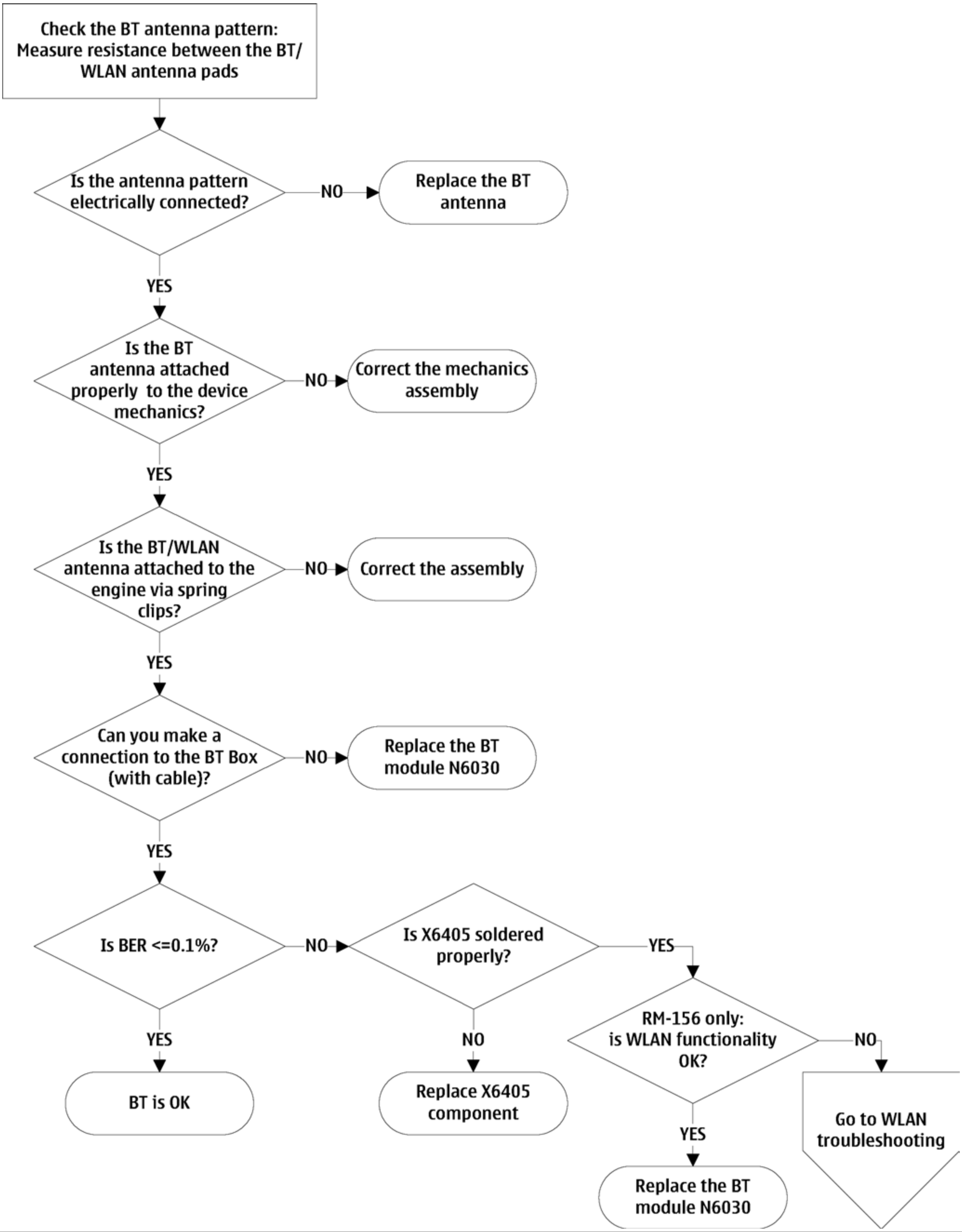
Bluetooth troubleshooting

Troubleshooting flow



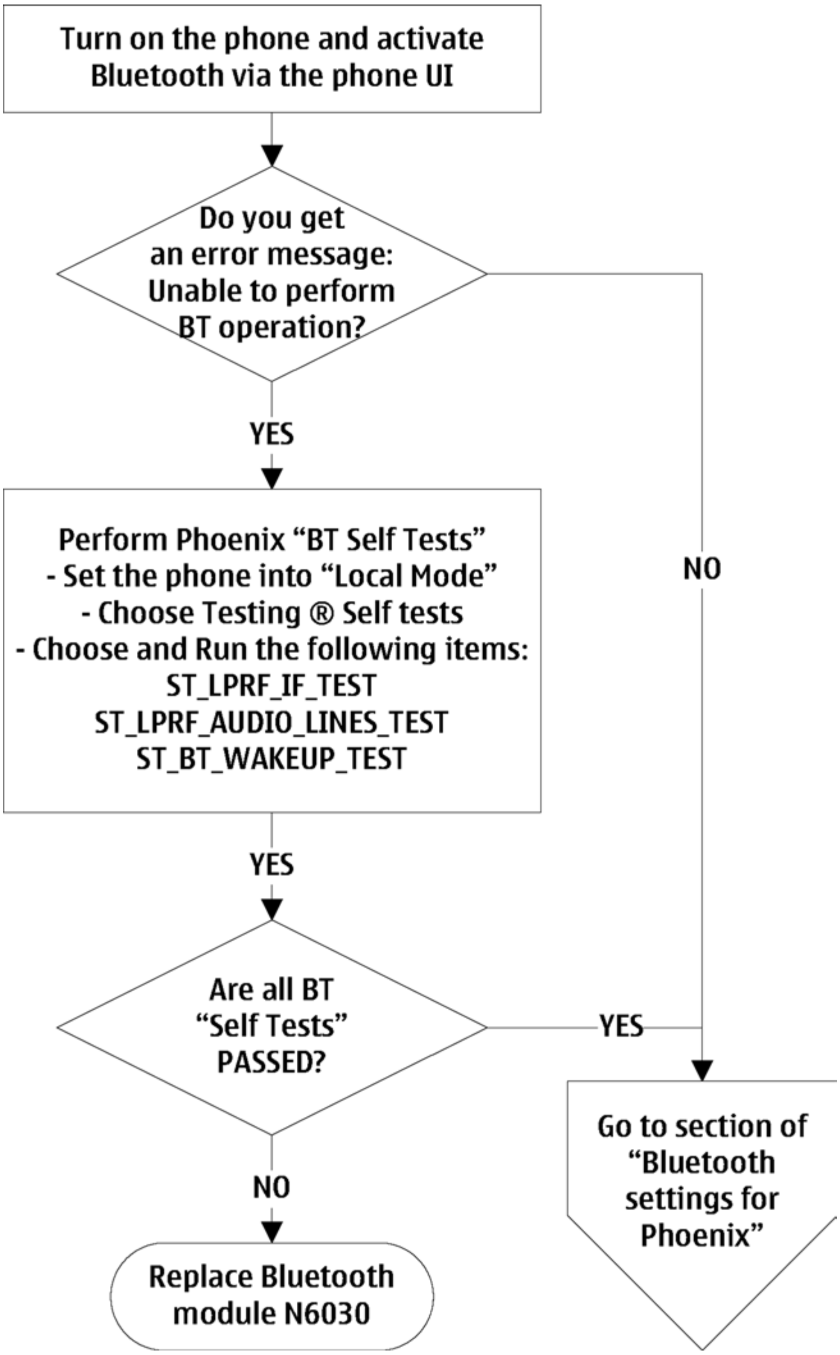
Bluetooth Bit Error Rate failure troubleshooting

Troubleshooting flow



BT audio failure troubleshooting

Troubleshooting flow



Audio troubleshooting

Audio troubleshooting test instructions

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

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

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

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

Required equipment

The following equipment is needed for the tests:

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

Test procedure

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

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

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

Phoenix audio loop tests and test results

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

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

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

Loop test	Input terminal	Output terminal	Path gain [dB] (fixed)	Input voltage [mVp-p]	Differential output voltage [mVp-p]	Output DC level [V]	Output current [mA]
External Mic in External Speaker out	XMICP and GND	HSEAR R P, HSEAR R N and GND	2.9	280	390	1.25	N/A
		HSEAR P, HSEAR N and GND					
	XMICN and GND	HSEAR R P, HSEAR R N and GND					
		HSEAR P, HSEAR N and GND					
External Mic in HP Speaker out	XMICP and GND	EarP and GND	6.9	140	310	1.25	N/A
		EarN and GND					
	XMICN and GND	EarP and GND					
		EarN and GND					
External Mic in Internal Handsfree out	XMICP and GND	B1 pads	11.4	150	560	0	25 mA (calc.)
	XMICN and GND	B1 pads					
Digital Stereo Mic in External Earpiece out	Speaker	HSEAR R P, HSEAR R N and GND	NA	100 dB SPL	NA	1.28	N/A
		HSEAR P, HSEAR N and GND					
Internal Mic in External Earpiece out	Speaker	HSEAR R P, HSEAR R N and GND	N/A	100 dB SPL	N/A	1.28	N/A
		HSEAR P, HSEAR N and GND					

Measurement data

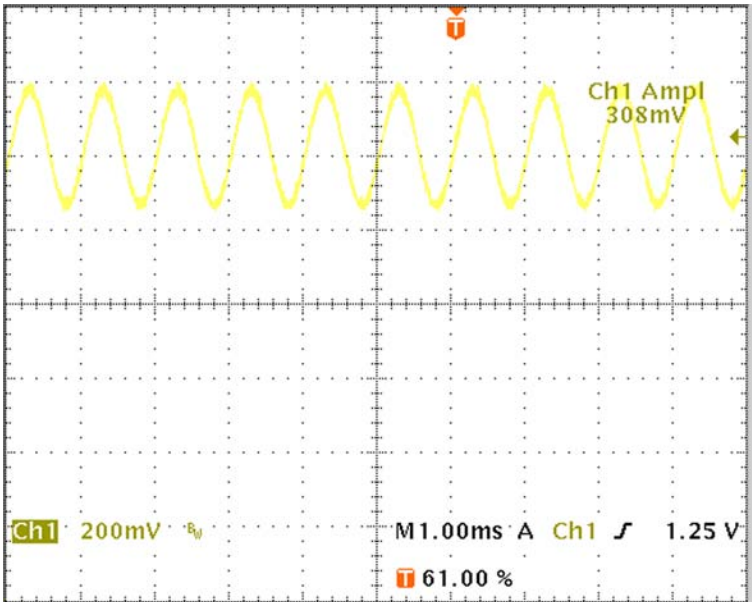
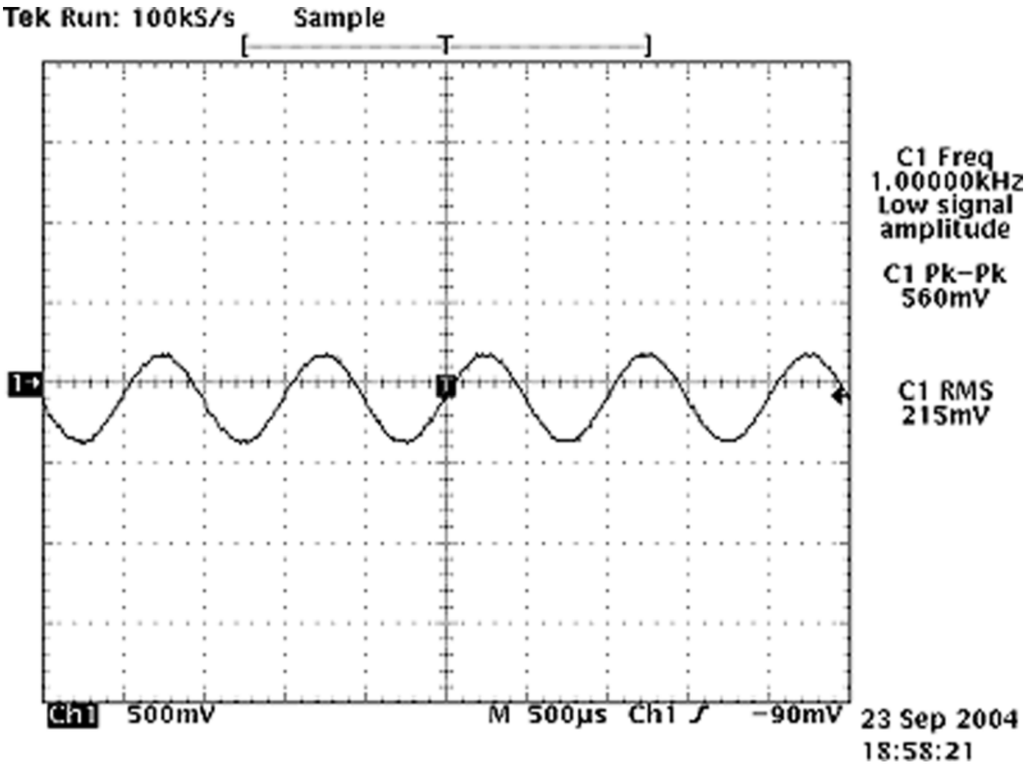


Figure 46 Single-ended output waveform of the Ext_in_HP_out measurement when earpiece is connected.



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

Figure 47 Differential output waveform of the Ext_in_IHF_out out loop measurement when speaker is connected.

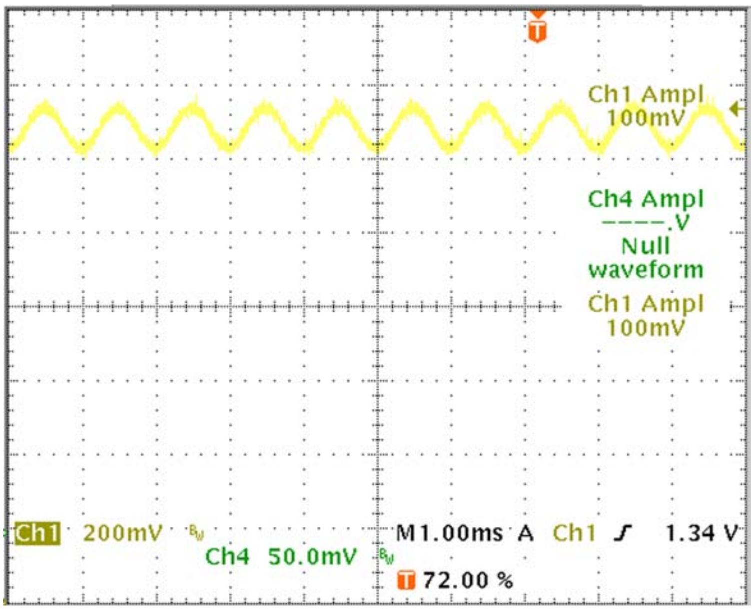
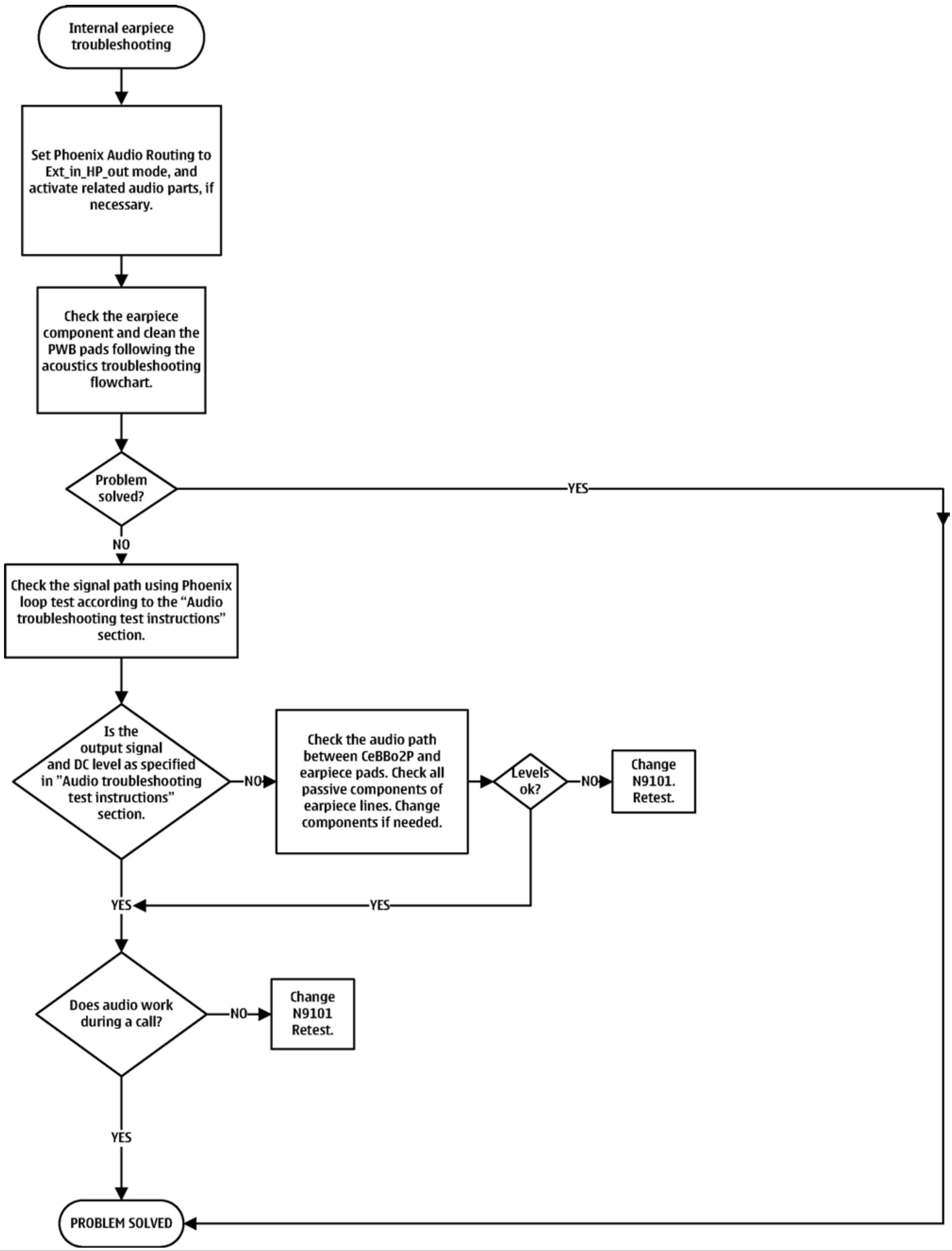


Figure 48 Single-ended output waveform of the HP_in_Ext_out loop when microphone is connected.

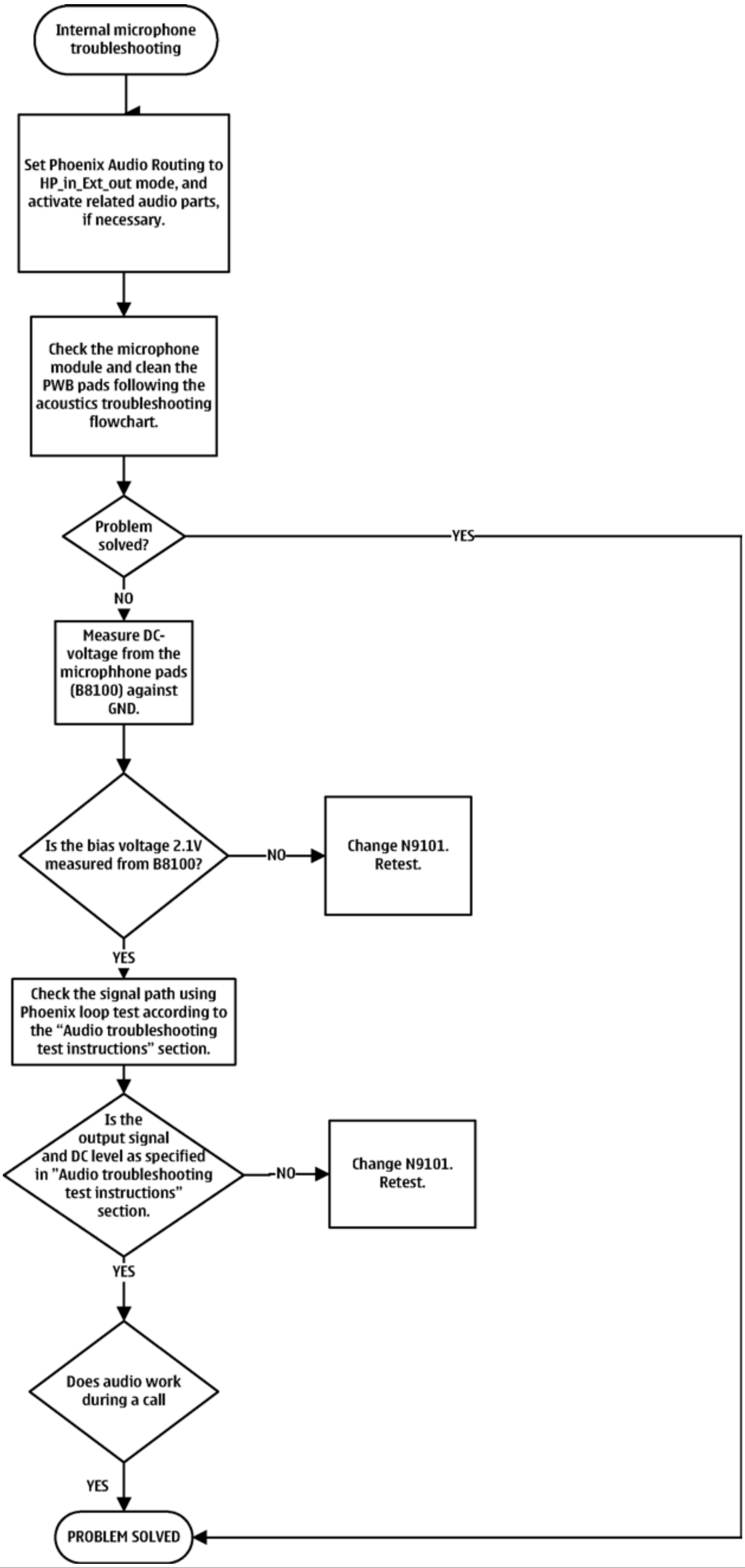
Internal earpiece troubleshooting

Troubleshooting flow



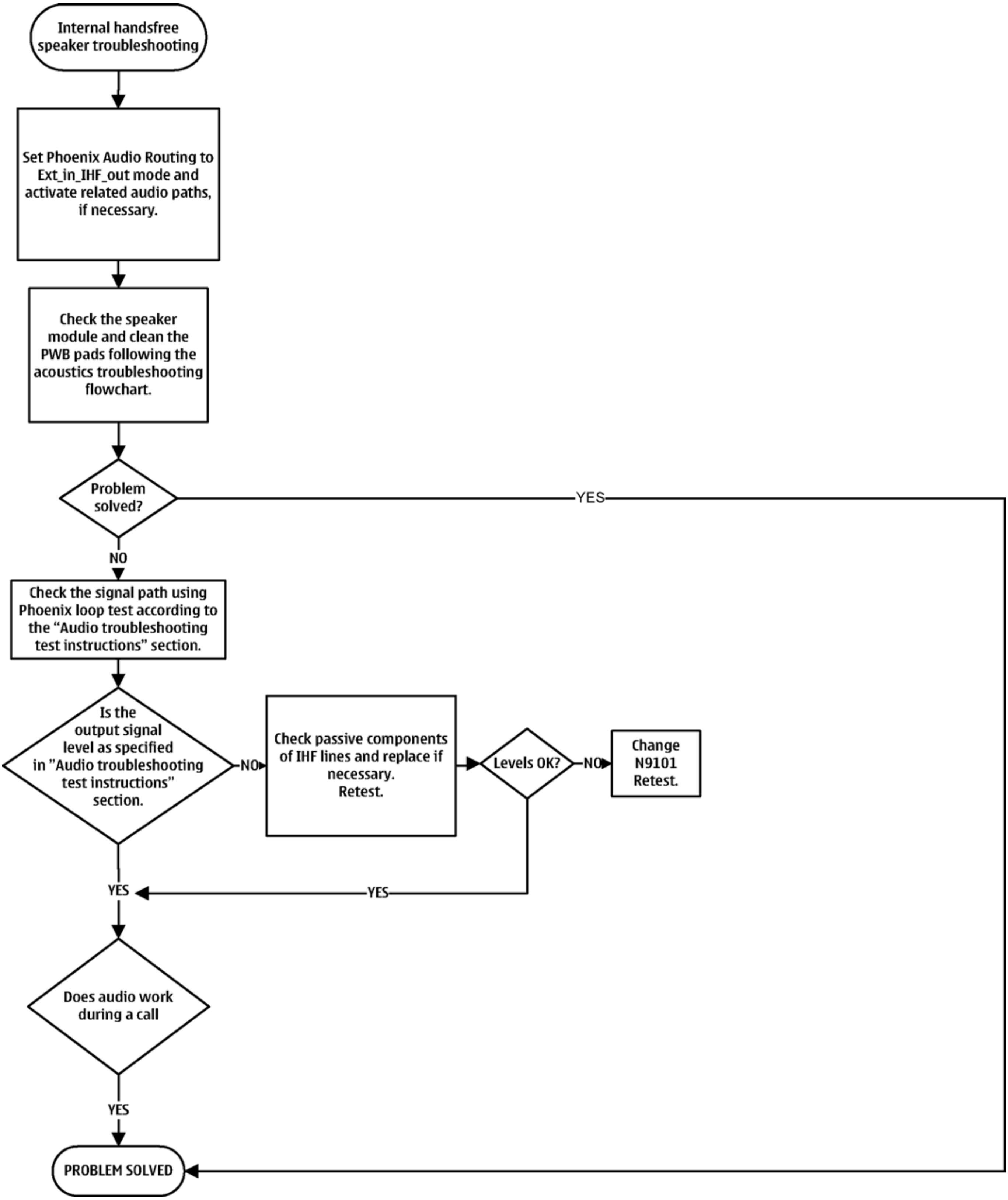
Internal microphone troubleshooting

Troubleshooting flow



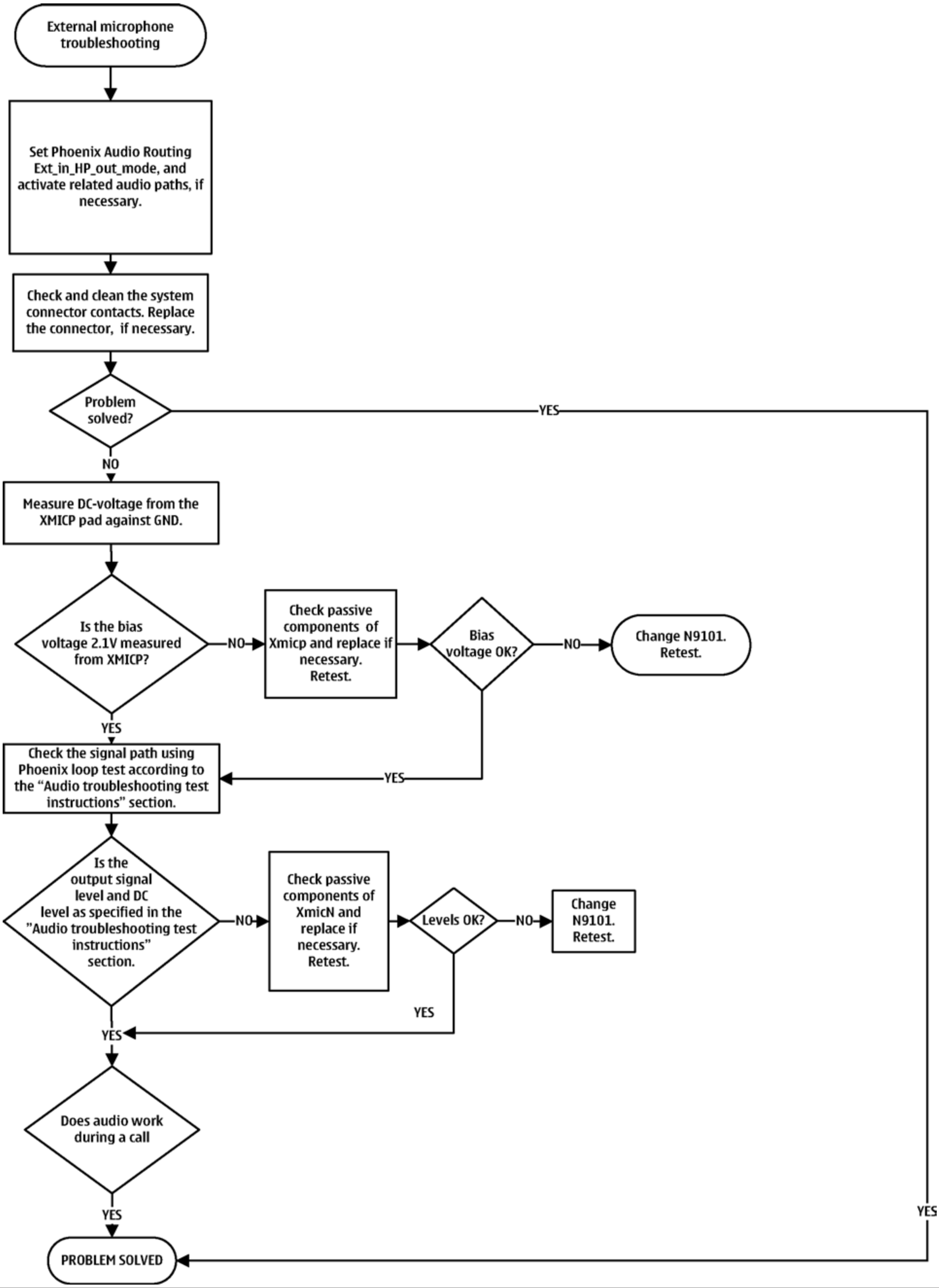
IHF troubleshooting

Troubleshooting flow



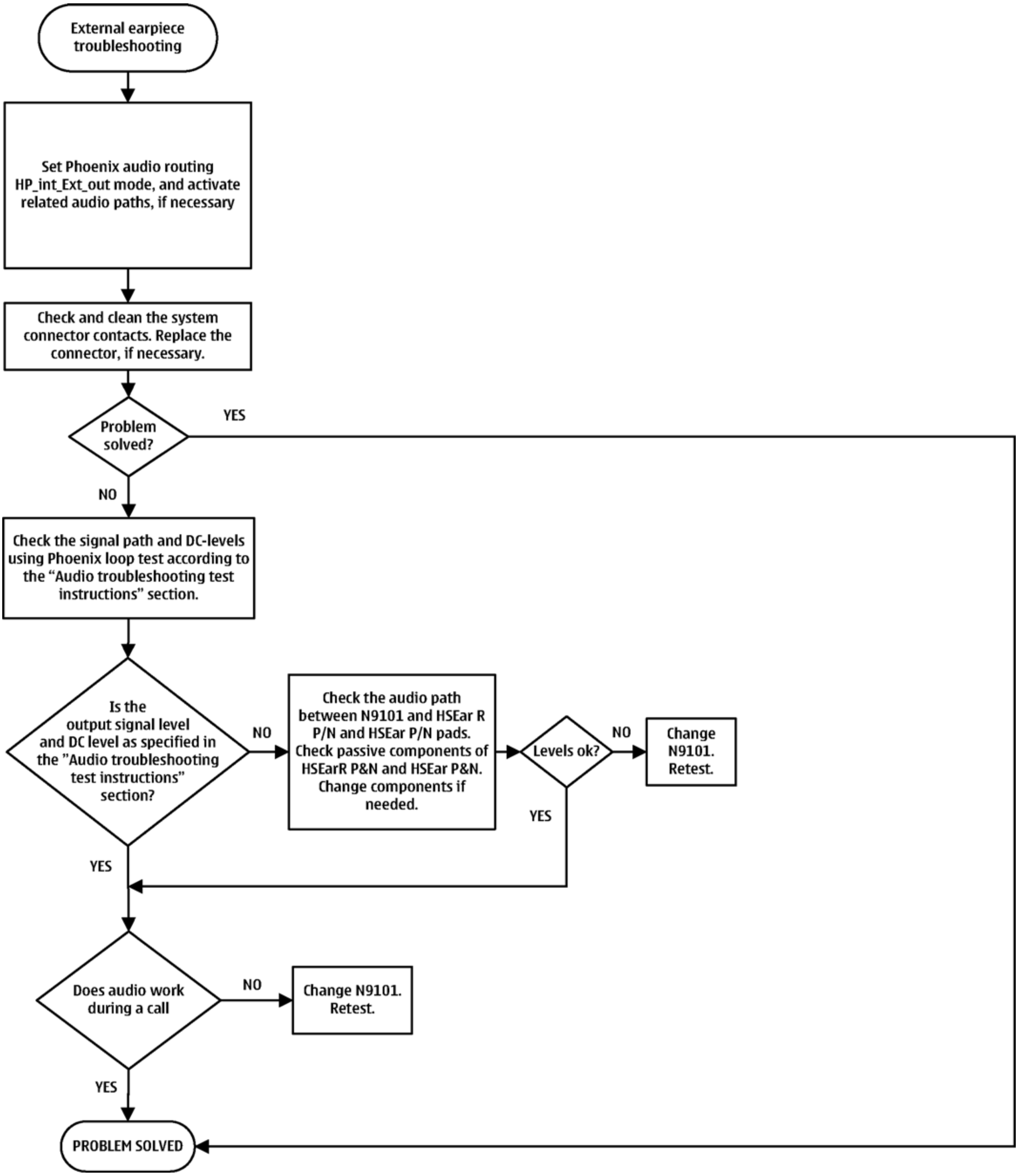
External microphone troubleshooting

Troubleshooting flow



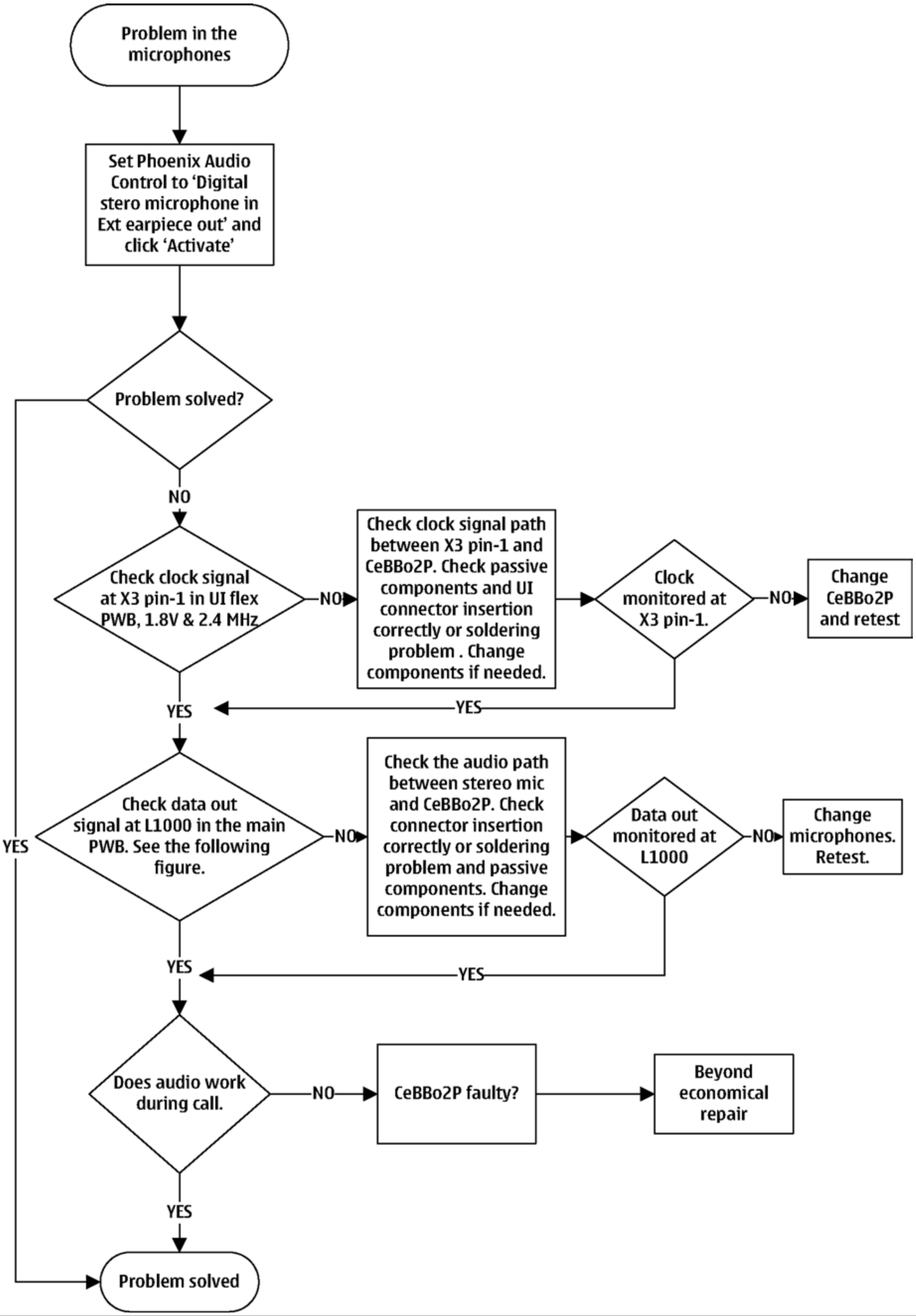
External earpiece troubleshooting

Troubleshooting flow



Digital microphone troubleshooting

Troubleshooting flow



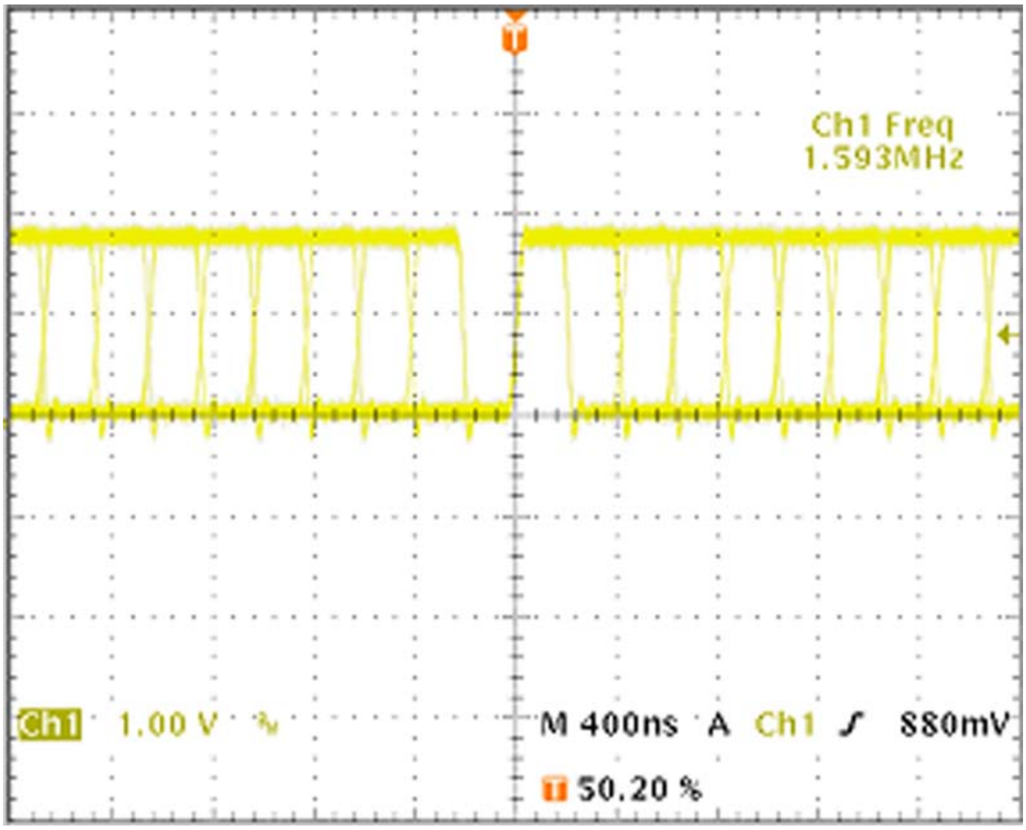
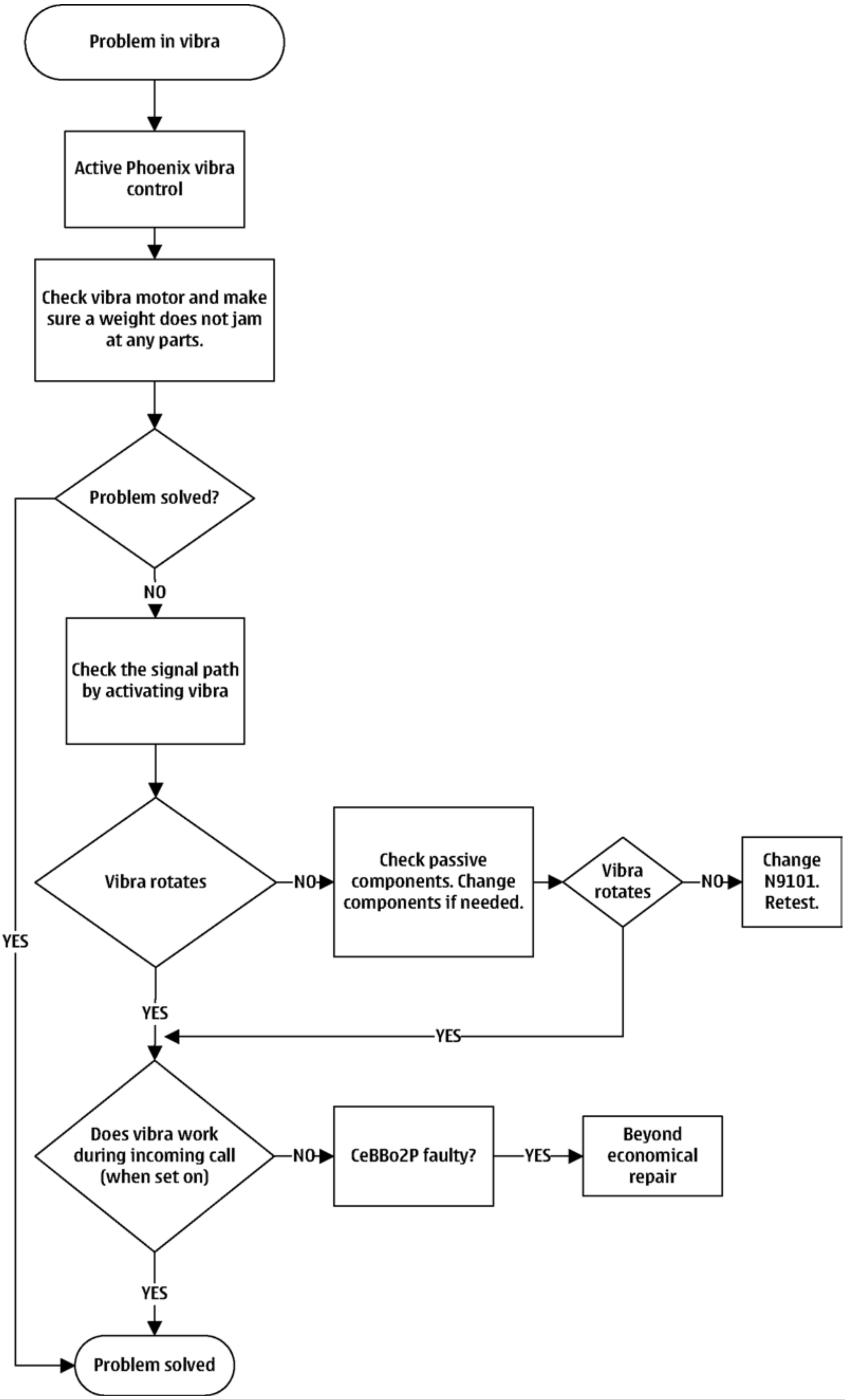


Figure 49 Signal waveform on data out

Vibra troubleshooting

Troubleshooting flow



Baseband manual tuning guide

Energy management calibration

Prerequisites

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

Hardware setup:

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

Steps

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

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

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

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

Table 14 Calibration value limits

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

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

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7 — RF Troubleshooting and Tuning Guide

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Table of Contents

List of Tables

List of Figures

Introduction to RF troubleshooting

The first step in fault finding should always be a visual inspection. Carefully inspect the RF area using a microscope, and look for solder bridges, missing components, short circuits, components that have partially come off and other anomalies. Check capacitors to see if they are not short-circuited, and inductors if they are not open circuits. Also check that power supply lines are not short-circuited, meaning that they are not 0Ω to ground.

All measurements should be done using:

- Multimeter for measuring voltage and resistance
- Spectrum analyzer with a high-frequency, high-impedance probe (LO / reference frequencies and RF power levels)
- Oscilloscope (DC-voltages and low frequency signals)

Caution: Radiated Tx measurements, such as when using an RF coupler, must always be performed inside a shielded room or box. Conducted measurements with power levels higher than 0 dBm must also be conducted inside a shielded box, because some power will inevitably leak to the antenna. Even low Tx power levels may disturb nearby cellular networks and cause problems to network operators.

The cellular RF section of the phone is built around the RF module N7501. This module contains RF Tx and Rx filters as well as an RF IC, which take care of up- and down-conversions and variable gain amplification, for example. Other major RF components include GSM/EDGE PA , WCDMA PA, VCO , and VCTCXO. An SMPS component is used to feed supply voltage to the WCDMA PA for optimized power efficiency. The mode switch connects the antenna to the WCDMA or the GSM path of the RF engine.

Please note that the PAs also have a big grounding pad under the module itself. This pad works to diffuse the heat that is generated inside the module. Because of the heat-spreading properties of this pad, ensure that the soldering is done properly, if you replace either of the two PAs.

Because most RF semiconductors are static discharge sensitive, use ESD protection when handling the electronic components of the phone. Ground straps and ESD soldering irons are mandatory. Some RF components are also moisture sensitive, so they must be pre-baked prior to soldering.

The PWB also contains many discrete components, including resistors, inductors and capacitors. Troubleshooting these components is mainly done by making sure they are properly soldered to the board. Capacitors and resistors can be checked for shorts using an ohm-meter, but be aware that in-circuit resistance and capacitance measurements are typically not very accurate. Also keep in mind that all measured voltages and RF levels in the service manual are approximate figures. Especially RF levels, may vary because of variations in measurement equipment and grounding of the RF probe.

RF key component placement

The RF section of the phone is build around one main RF ASIC N7501.

There are also two PAs on the board: one for GSM (N7502), which contains a GSM quad-band antenna switch module. The other PA is for WCDMA (N7503).

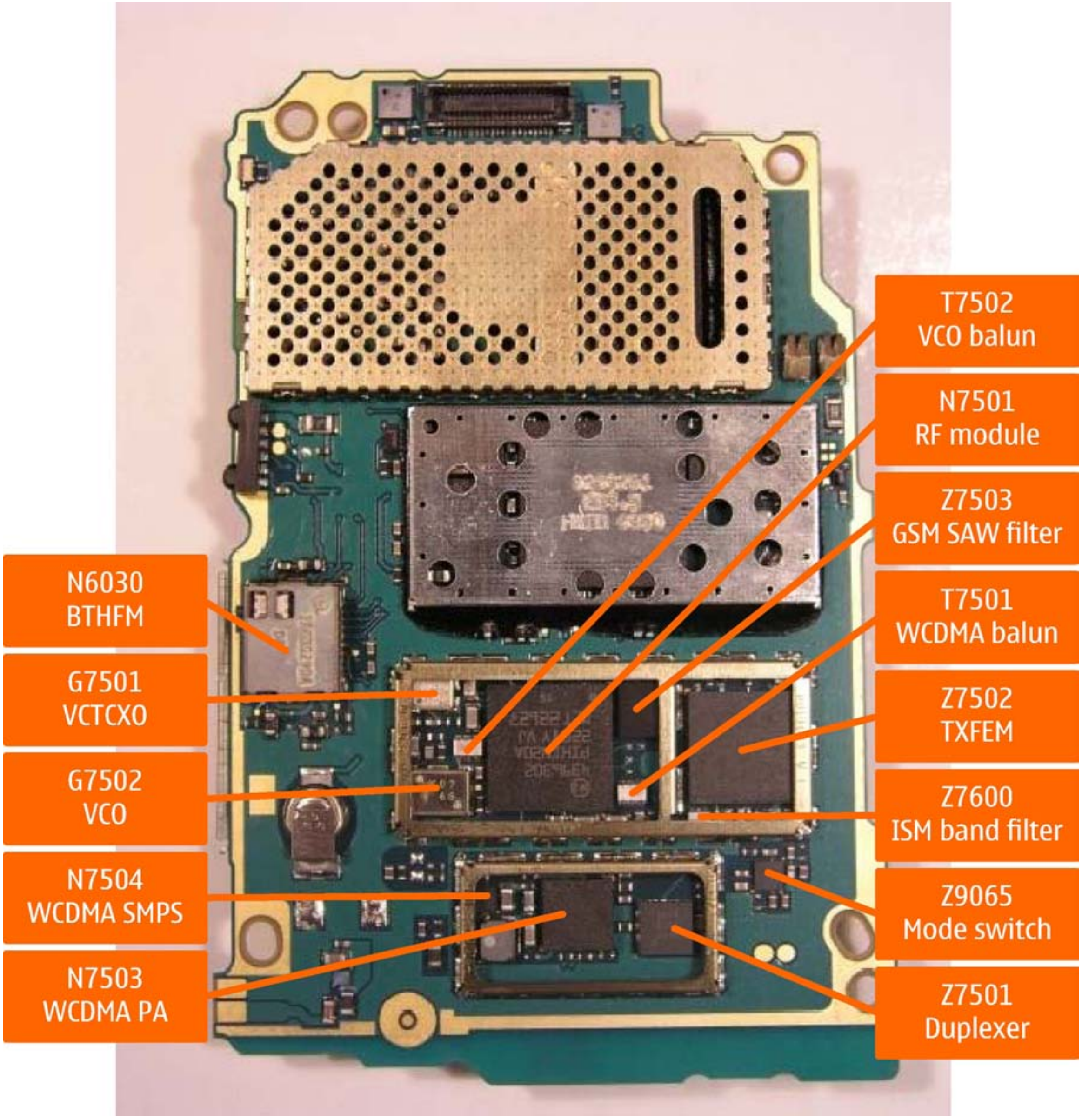


Figure 50 RF key component placement - top

Components on PWB Top Side	Schematics ref.
RF module	N7501
WCDMA PA	N7503
WCDMA SMPS	N7504
WCDMA Duplexer	Z7501
WCDMA Balun	T7501
GSM SAW Filter	Z7503
ISM Filter (ISM band = 2400-2483.5MHz)	Z7600
GSM PA	N7502
VCO	G7502

Components on PWB Top Side	Schematics ref.
VCO Balun	T7502
VCTCXO	G7501
Mode Switch	Z9065
BT & FM Radio	N6030

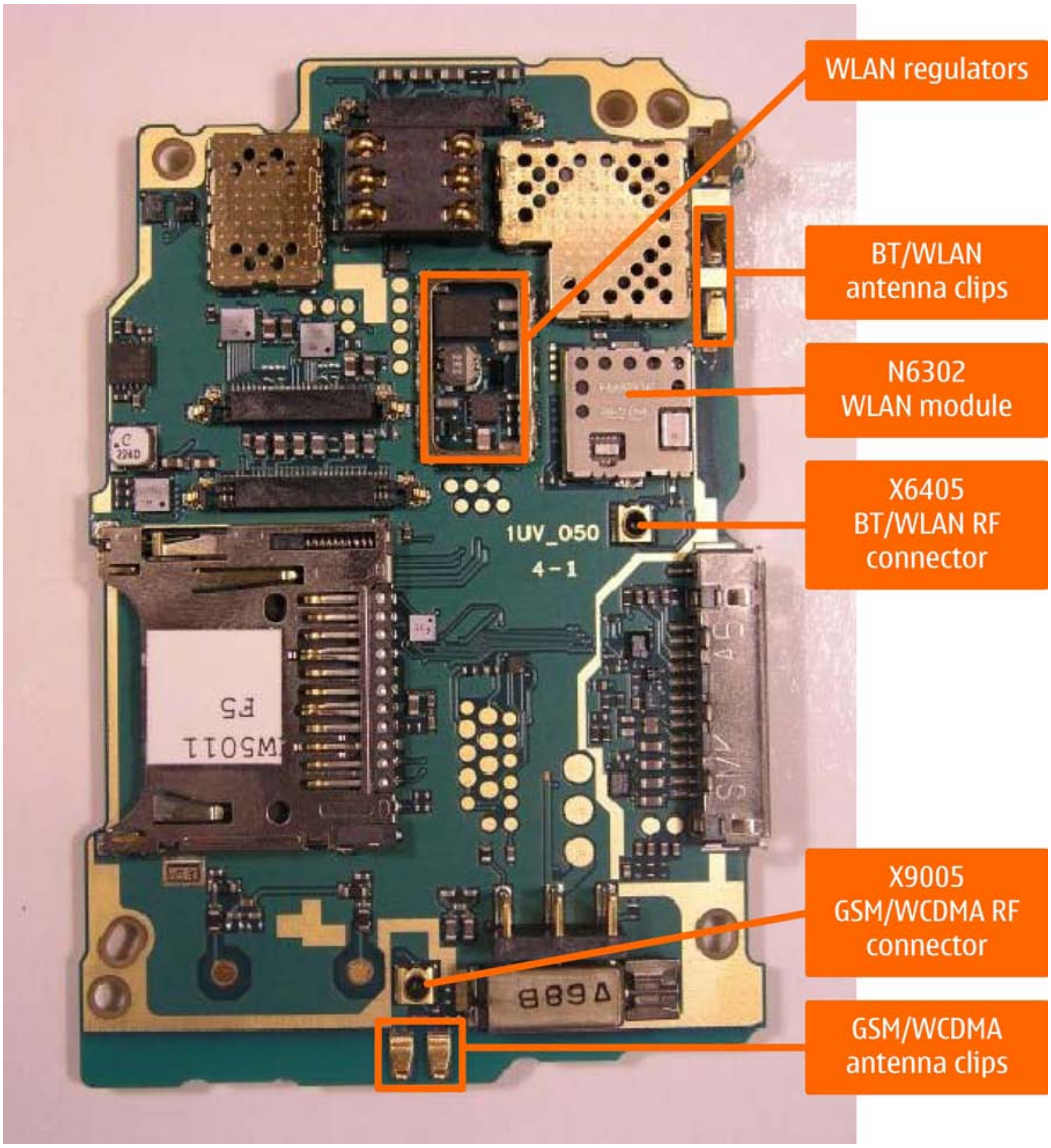


Figure 51 RF key component placement - bottom

Components on PWB Bottom Side	Schematics ref.
WLAN	N6302
WLAN Regulator, 1.5V	N6300

Components on PWB Bottom Side	Schematics ref.
WLAN Regulator, 2.8V	N6301
WLAN Regulator, 3.6V	N6303
Cellular RF Connector	X9005
BT / WLAN RF Connector	X6405
Cellular Antenna Clips	X7605, X7610
BT / WLAN Antenna Clips	X6402, X6403

Troubleshooting test point locations

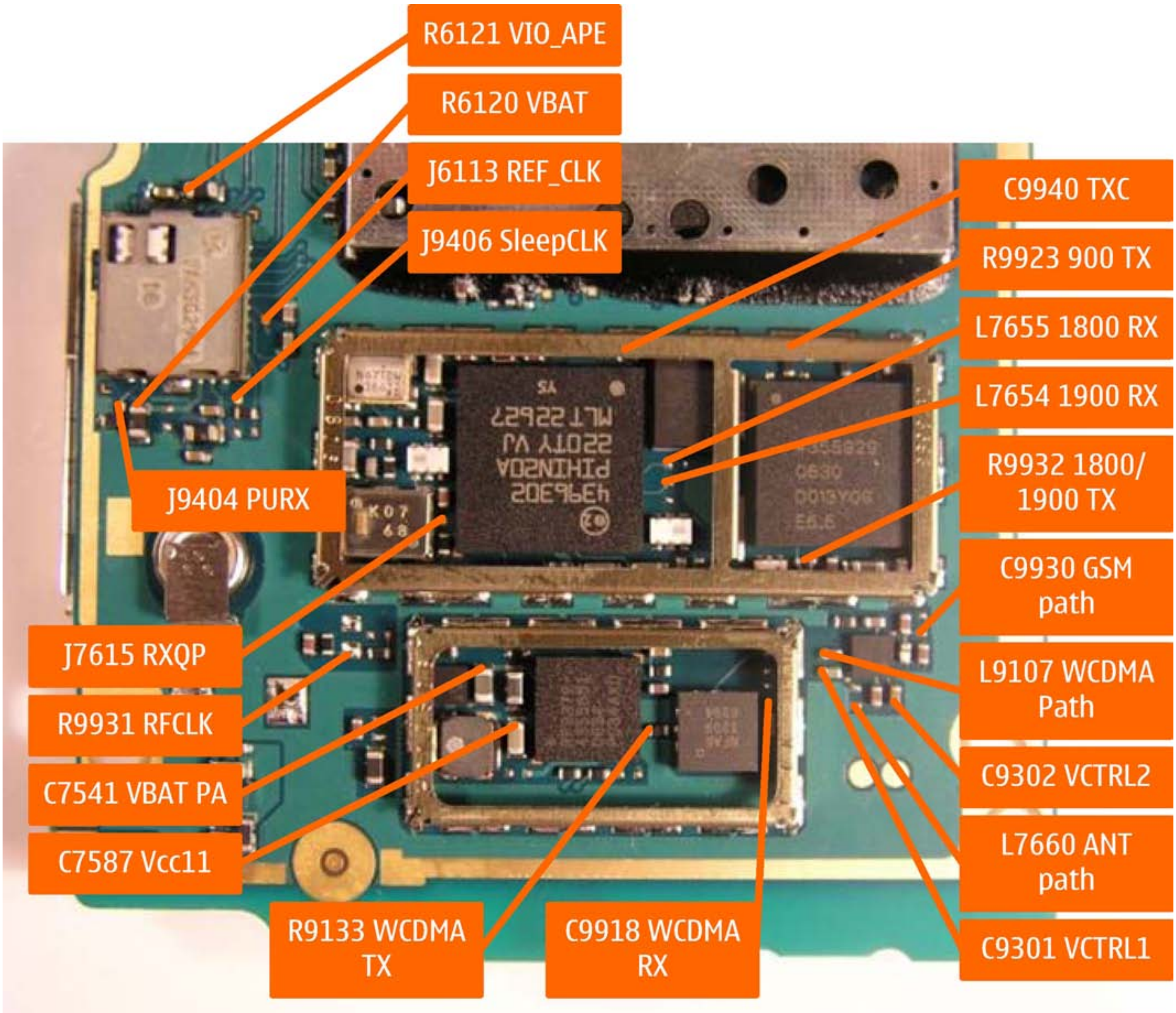


Figure 52 Troubleshooting test points 1

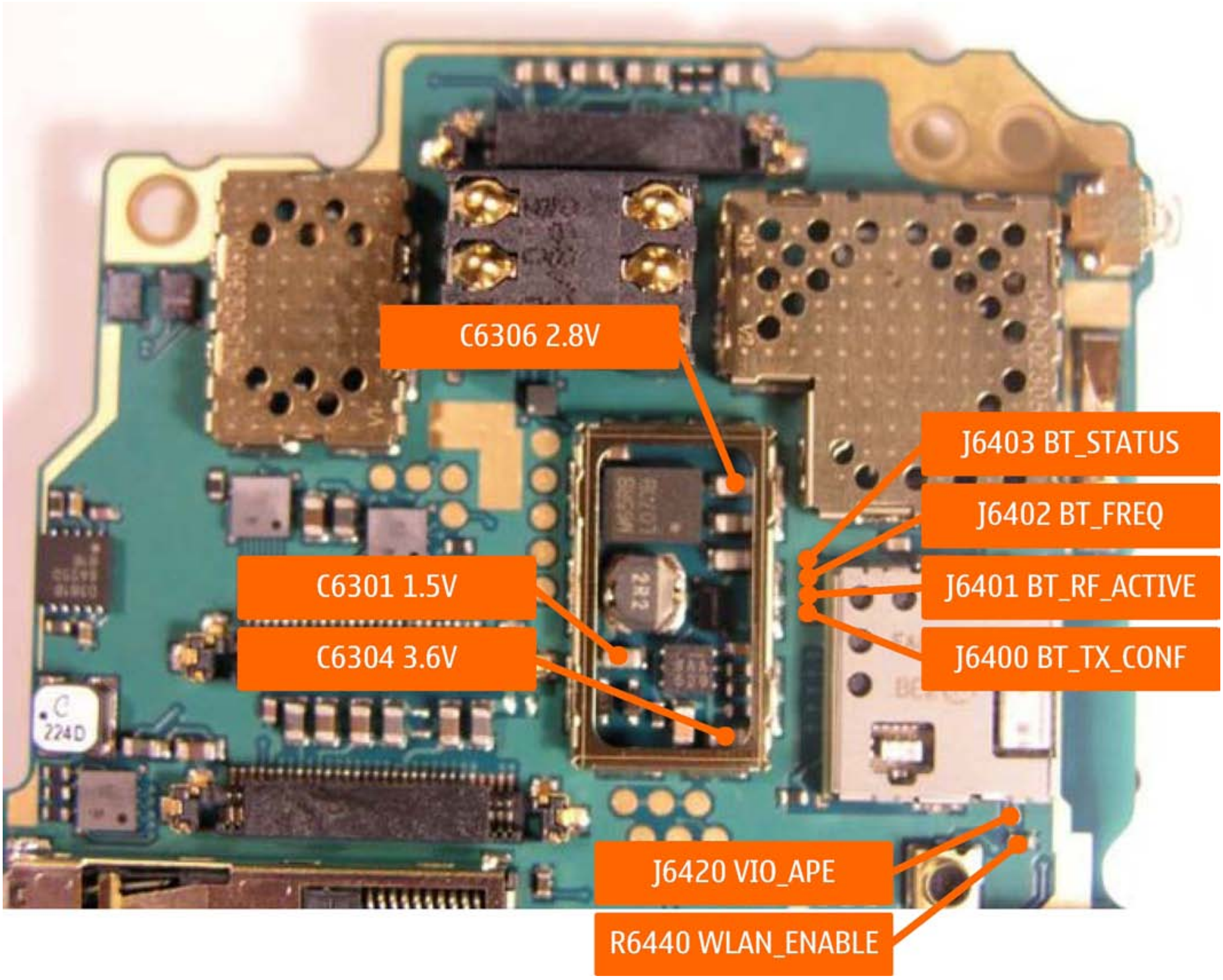
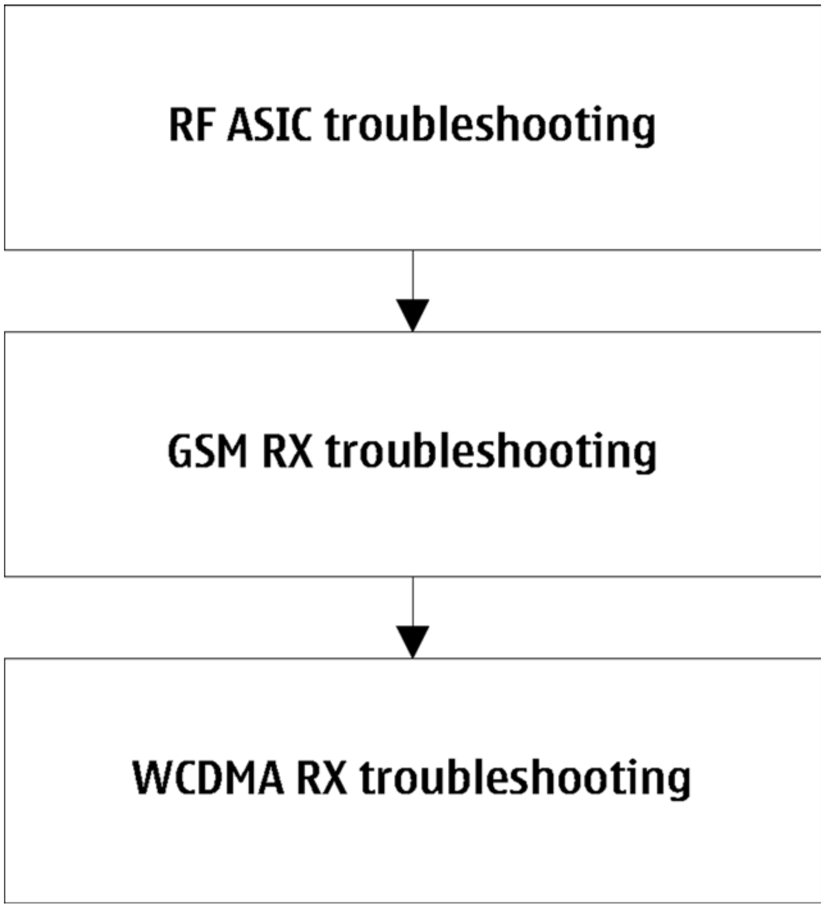


Figure 53 Troubleshooting test points 2

RF troubleshooting

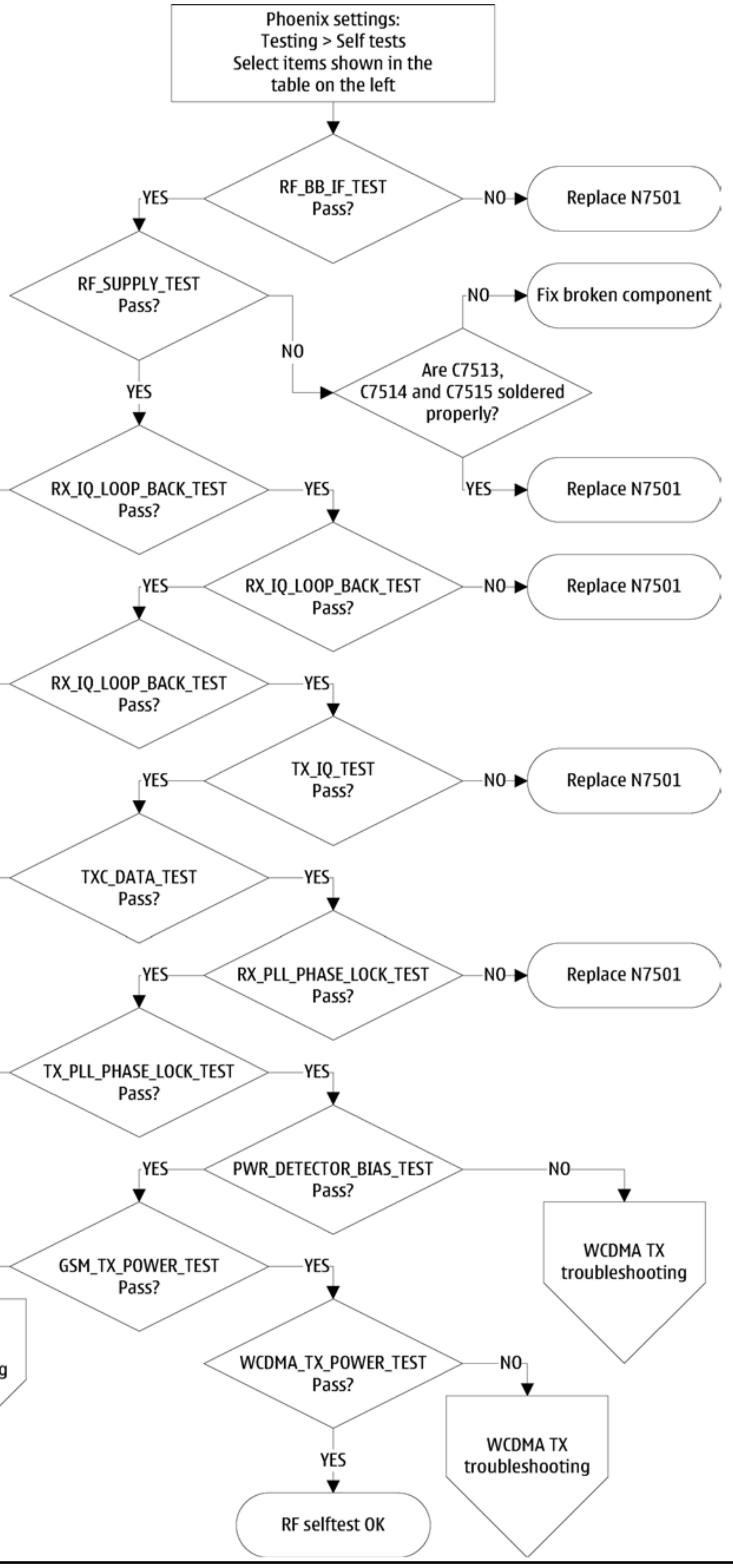
Troubleshooting flow



RF ASIC troubleshooting

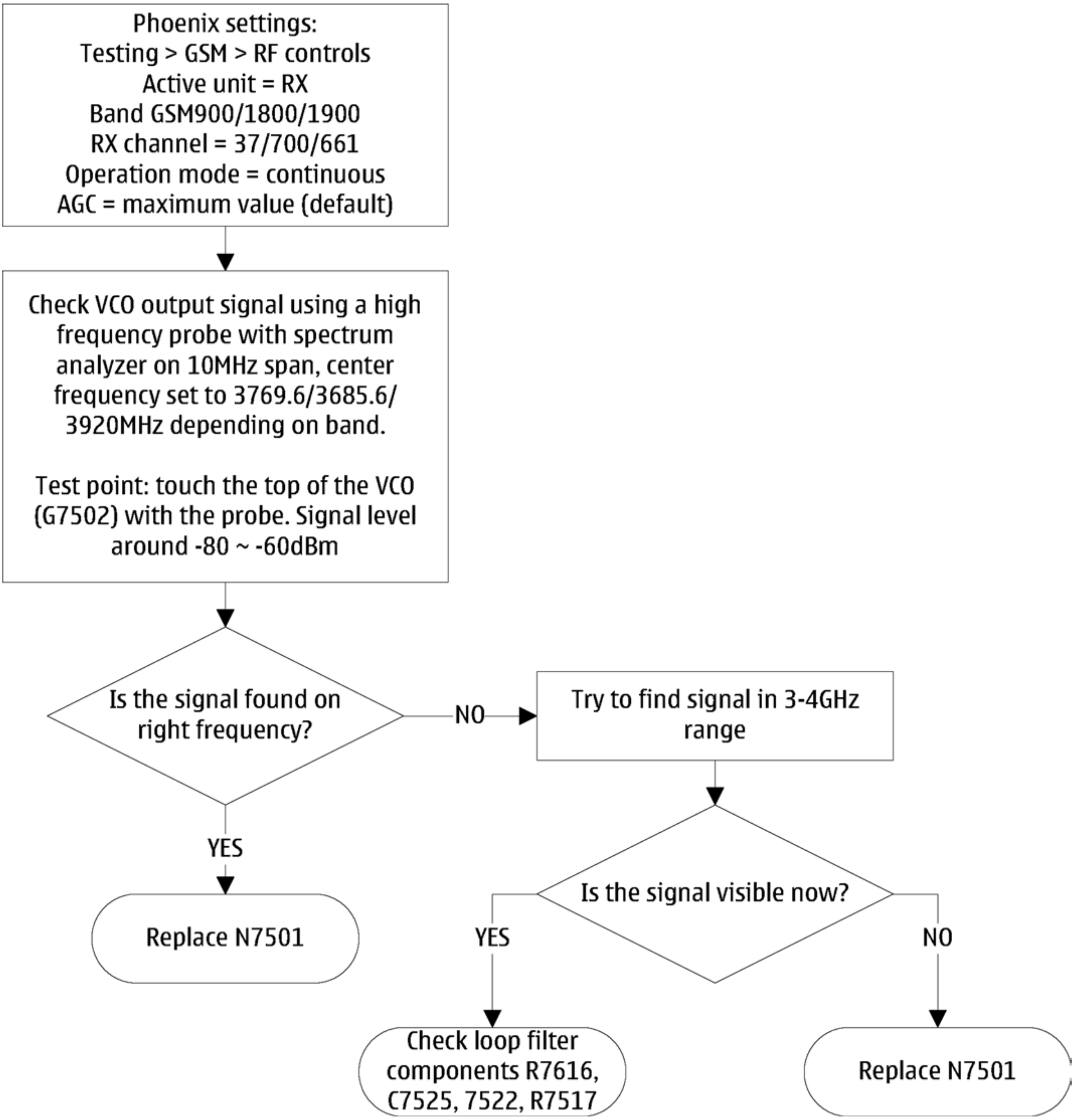
Troubleshooting flow

TEST NAME IN PHOENIX
ST_CDSP_TXC_DATA_TEST
ST_CDSP_WCDMA_TX_POWER_TEST
ST_CDSP_GSM_TX_POWER_TEST
ST_CDSP_RX_PLL_PHASE_LOCK_TEST
ST_CDSP_TX_PLL_PHASE_LOCK_TEST
ST_CDSP_RX_IQ_LOOP_BACK_TEST
ST_CDSP_PWR_DETECTOR_BIAS_TEST
ST_CDSP_RF_SUPPLY_TEST
ST_CDSP_TX_IQ_TEST
ST_CDSP_RF_BB_IF_TEST



Synthesizer troubleshooting

Troubleshooting flow



Synthesizer test points

Measure	Location	Expected Result
VCTXCO output voltage	G7501 pin 3	38.4MHz 800 mVpp

Measure	Location	Expected Result
RFCLKEXT	R9922	38.4MHz 500 mVpp
VCTXCO AFC voltage	C7516	1V

Measure	Location
VCO	G7502

Receiver troubleshooting

Introduction to Rx troubleshooting

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

The primary Rx troubleshooting parameter is RSSI (Received Signal Strength Indicator). For GSM RSSI measurement, see GSM Rx chain activation for manual measurements / GSM RSSI measurement (page 7–16), and for the same measurement in WCDMA, see WCDMA RSSI measurement (page 7–17).

In GSM, the input signal can be either a real GSM signal or a CW (Continuous Wave) signal, which is 67.771 kHz above the carrier frequency.

In WCDMA, the input signal can be either a real WCDMA signal or a CW signal, which is 1 MHz above the carrier frequency.

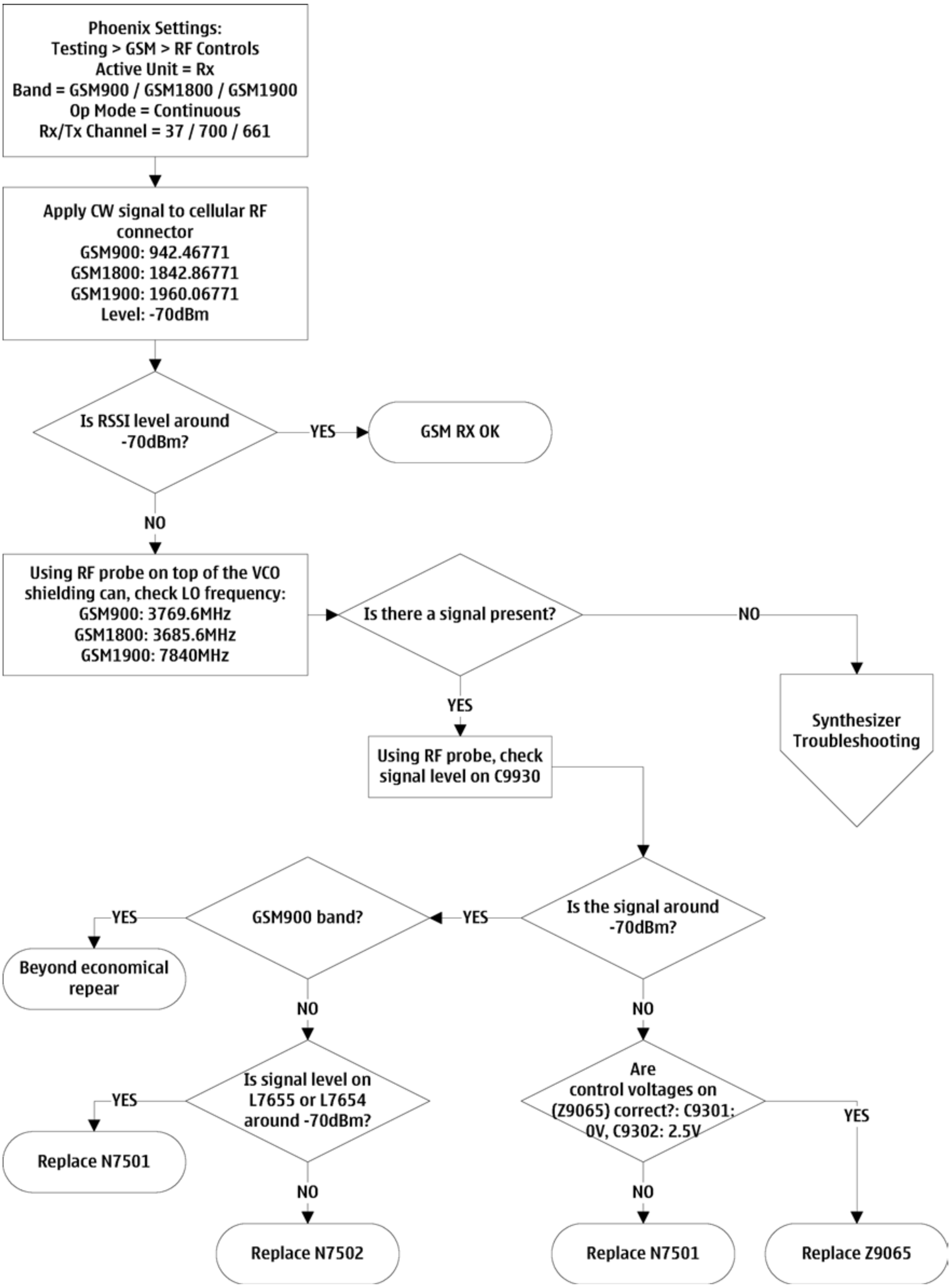
For service tool usage instructions, refer to the section **Service Tools and Service Concepts**.

Related information

- WCDMA Rx chain activation for manual measurement (page 7–16)

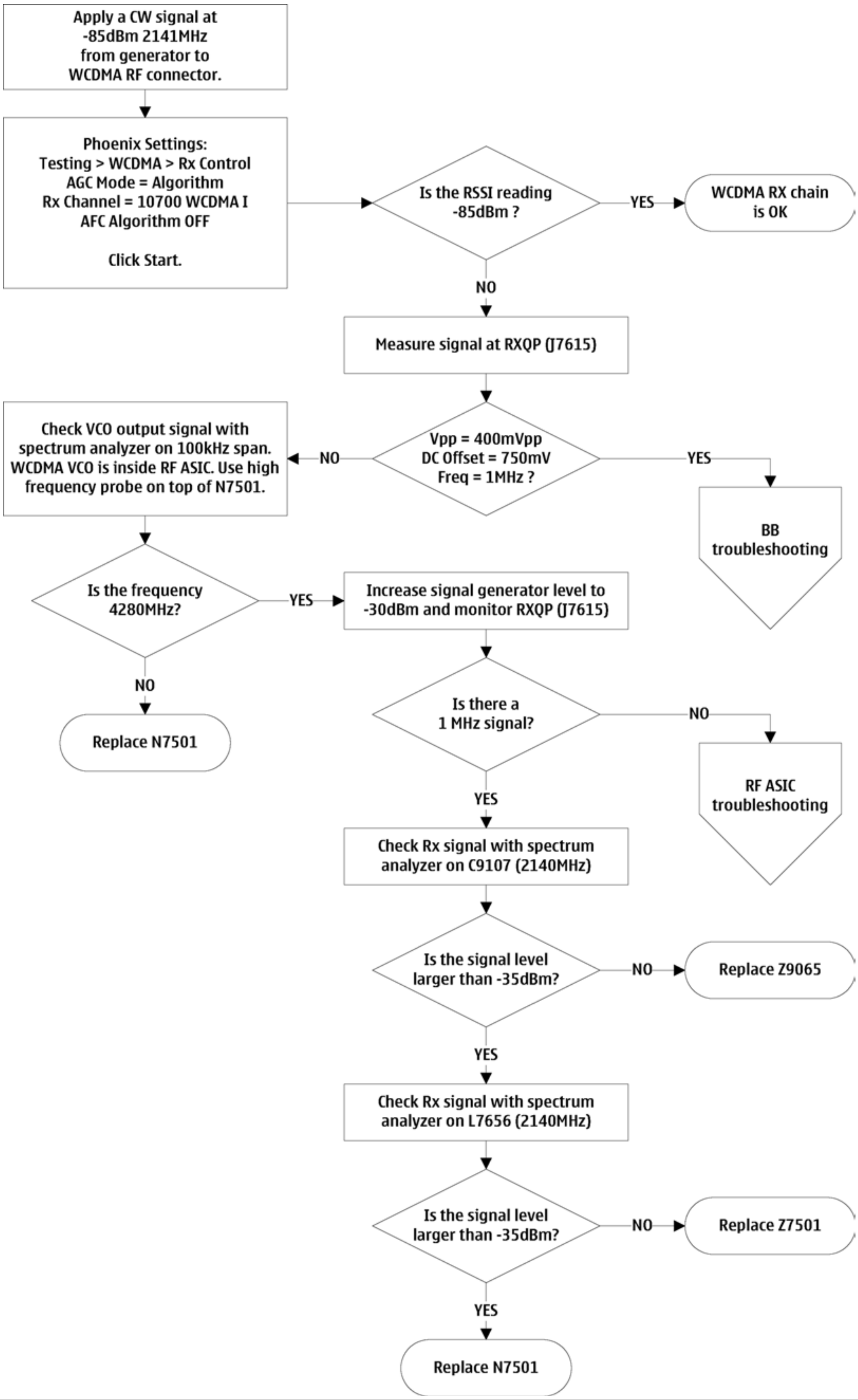
GSM receiver troubleshooting

Troubleshooting flow



WCDMA receiver troubleshooting

Troubleshooting flow



GSM Rx chain activation for manual measurements / GSM RSSI measurement

Context

RSSI signal measurement is the main Rx troubleshooting measurement. The test measures the strength of the received signal.

I and Q branches can be measured separately. In GSM, the input signal can be either a real GSM signal or a CW (Continuous Wave) signal that is 67.771 kHz above the carrier frequency.

Steps

1. Start *Phoenix* service software.
2. Choose **Testing→GSM→RSSI Reading** .
3. Set the RF signal generator for a channel frequency +67.771 kHz in CW mode with a –80 dBm signal level.

   Alternatively set the cellular tester downlink channel to the appropriate channel. Make sure that the tester is set to continuous mode, not to burst mode.
4. In the *RSSI Reading* window, select the appropriate band and channel.

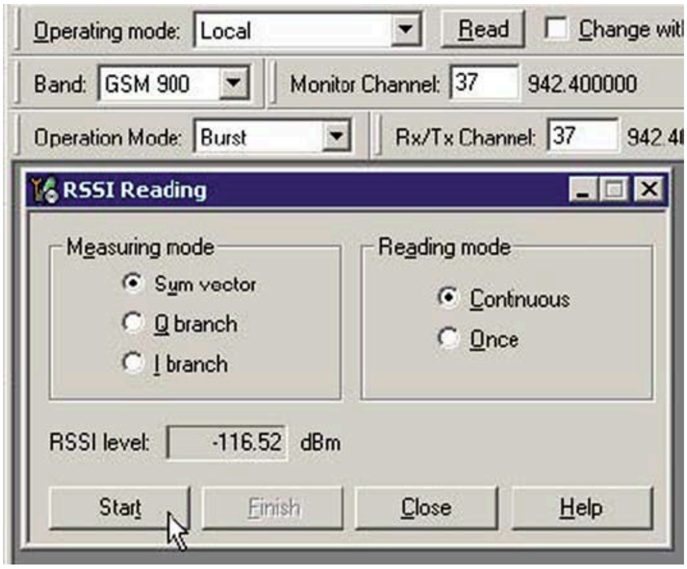


Figure 54 ***RSSI Reading*** **window**

5. To start the measurement, activate GSM Rx chain, click **Start**.

Results

RSSI reading values of the selected band and channel are displayed. The RSSI level must be the same value as that which is set at the signal generator (-80 dBm).

WCDMA Rx chain activation for manual measurement

Steps

1. Start *Phoenix* service software.
2. Choose **Testing→WCDMA→Rx Control** .
3. In the *Rx Control* window:

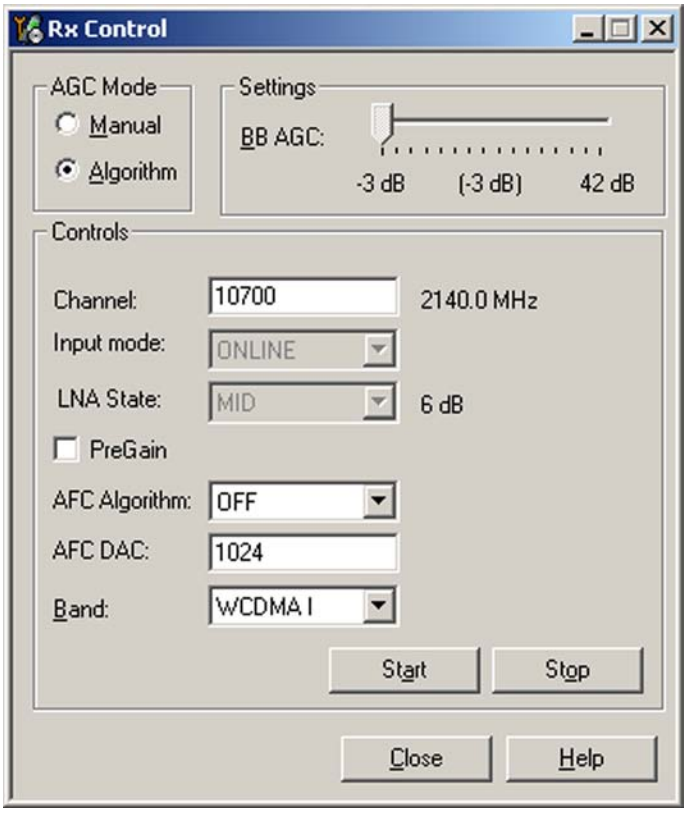


Figure 55 ***Rx Control*** **window**

- Set **AGC Mode** to **Algorithm**.
- Set **Channel** to **10700**.
- Set **AFC Algorithm** to **OFF** (Default = **OFF**).

Next actions

When settings are ready, click **Start** to activate them.

If settings are changed later on (for example, you give a new channel number), you will need to click **Stop** and **Start** again.

Note: Clicking **Stop** also disables **Tx Control** if that was active!

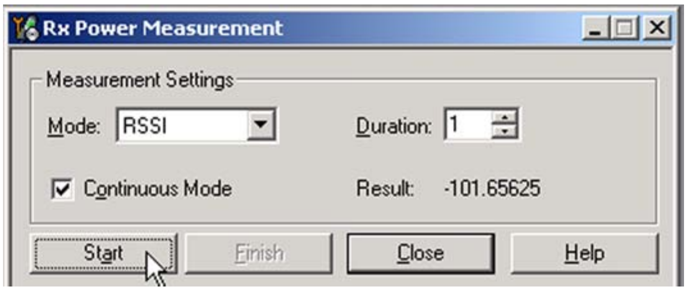
WCDMA RSSI measurement

Prerequisites

WCDMA Rx must be activated before RSSI can be measured. See WCDMA Rx chain activation for manual measurement (page 7–16).

Steps

1. Start *Phoenix* service software.
2. Choose **Testing→WCDMA→Rx Power Measurement** .
3. In the *Rx Power Measurement* window, choose the following settings:
   - Mode: RSSI
   - Continuous Mode



4. To perform the measurement, click **Start**.

Receiver test points

Band	Measure	Location	Expected Result
WCDMA	RXQP output of RF module	J7615	400mVpp, DC offset 750mV, 1MHz
WCDMA	Duplexer input	C9107	-35dBm @ 2140MHz
WCDMA	Duplexer output	L7656	-35dBm @ 2140MHz
WCDMA	Vctrl1 for mode switch	C9301	2.7V
WCDMA	Vctrl2 for mode switch	C9302	0V
GSM	Vctrl1 for mode switch	C9301	0V
GSM	Vctrl2 for mode switch	C9302	2.7V
GSM	Mode switch output	C9930	-70dBm @ 942.4677/1842.86771/1960.06771MHz
GSM1800	RF module input	L7655	-70dBm @ 1842.86771MHz
GSM1900	RF module input	L7654	-70dBm @ 1960.06771MHz

Transmitter troubleshooting

General instructions for Tx troubleshooting

Context

- Tx troubleshooting requires Tx operation.
- Do not transmit on frequencies that are in use.
- Transmitter can be controlled in the local mode for diagnostic purposes.
- The best diagnostic tool for GSM transmitter testing is **RF Controls**, and for the WCDMA transmitter testing **Tx Control**.

  Tx IQ tuning and Tx power tuning can be also used in some cases.
- Remember that retuning is not a repair procedure.

The first set of steps instructs how to assemble the test setup. This setup is general for all Tx troubleshooting tasks.

Alternative steps provide specific troubleshooting instructions for *Phoenix* service software. The first section is for the EGSM900/GSM1800/GSM1900 bands and the latter for WCDMA.

Caution: Never activate the GSM or WCDMA transmitter without a proper antenna load. There should be always 50 ohm load connected to the RF connector (antenna, RF-measurement equipment or at least 2 watts dummy load), otherwise GSM or WCDMA PA may be damaged.

Steps

1. Connect a module jig to a computer with a DAU-9S cable or to a FPS-10 flash prommer with a modular cable.

   Make sure that you have a PKD-1 dongle connected to the computer parallel port.
2. Connect a DC power supply to a product-specific module jig.

   Note: When repairing or tuning a transmitter, use an external DC supply with at least 3 A current capability.

   Set the DC supply voltage to 3.9 V.
3. Connect an RF cable between the RF connector of the product-specific module test jig and measurement equipment or alternatively use a 50 ohms (at least 2 W) dummy load in the module test jig RF connector; otherwise GSM or WCDMA PA may be damaged.

   Note: There are three antenna connectors in the module jig:
   - one for cellular
   - one for Bluetooth and WLAN

   Make sure that all connections are made to the correct RF connector.

   Normally a spectrum analyser is used as measurement equipment.

   Note: The maximum input power of a spectrum analyser is +30 dBm.

   To prevent any damage, it is recommended to use 10 dB attenuator on the spectrum analyzer input.
4. Set Tx on.

   i Place the phone module to the test jig and start *Phoenix* service software.

   ii Initialize connection to the phone (with FPS-10 use FBUS when using a DAU-9S cable and a COMBOX driver).

   iii Choose **File**→**Open Product**→**xx-x*** (* = type designator of the phone) or **File**→**Scan Product.** .

   iv From the toolbar, set **Operating mode** to **Local.**

Alternative steps

- EGSM900/GSM1800/GSM1900 troubleshooting

  i Choose **Testing**→**GSM**→**RF Controls.**

  ii In the *RF Controls* window:
  - Choose **Band**: **GSM900** or **GSM1800** or **GSM1900** (Default = **GSM900**).
  - Set **Rx/Tx channel** in the following way:
    - GSM900: **37**
    - GSM1800: **700**
    - GSM1900: **661**
  - Set **Active unit** to **Tx** (Default = **Rx**).
  - Set **Operation Mode** to **Burst** (Default = **Burst**).
  - Set **Edge** to **Off** (Default).
  - Set **Tx Data Type** to **All 1** (Default = **All 1**).
  - Set **Tx PA Mode** to **High** (Default).

- Set **Tx Power Level** in the following way:
  - GSM900: **5** (Default = **19**)
  - GSM1800: **0** (Default = **15**)
  - GSM1900: **0** (Default = **15**)

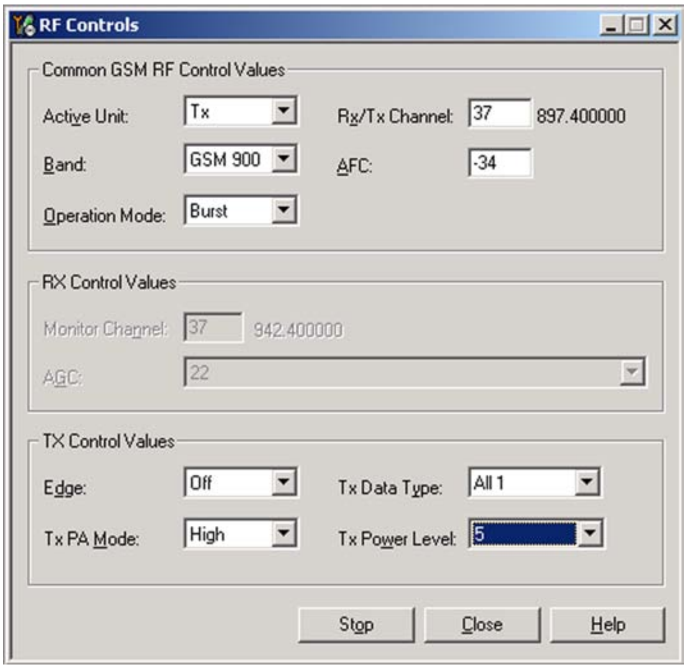


Figure 56 ***RF Controls*** **window**

- WCDMA troubleshooting

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

  ii In the *Tx Control* window:
  - Select the **Algorithm mode** tab.
  - Set **Start level** to **0** dBm (Default = **0**).
  - Set **Step size**, **Step count** and **Sequence** to **0** (Default = **0**).
  - In the **Scrambling code** pane set **Code class** to **LONG** (Default = **LONG**), and **Code** to **16** (Default = **16**).
  - For **DPDCH** set the following values:
    - **Code number**: **0**
    - **Code class**: **2**
    - **Weight**: **15**
  - For **DPCCH** set the following values:
    - **Code number**: **0**
    - **Code class**: **2**
    - **Weight**: **8**
  - Set **Channel** to **9750**.
  - Check the **DPDCH enabled** check box (Default).

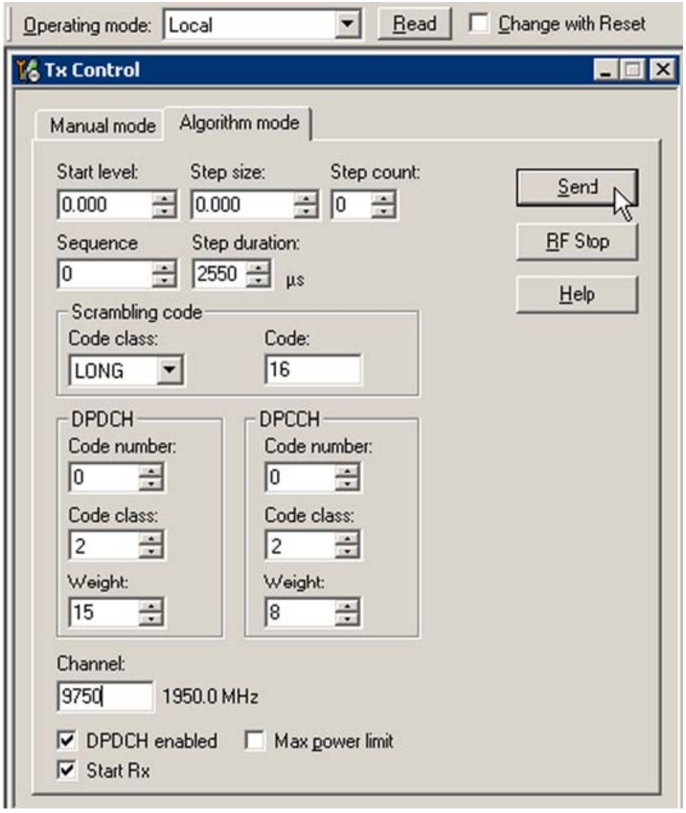


Figure 57 ***Tx Control*** **window**

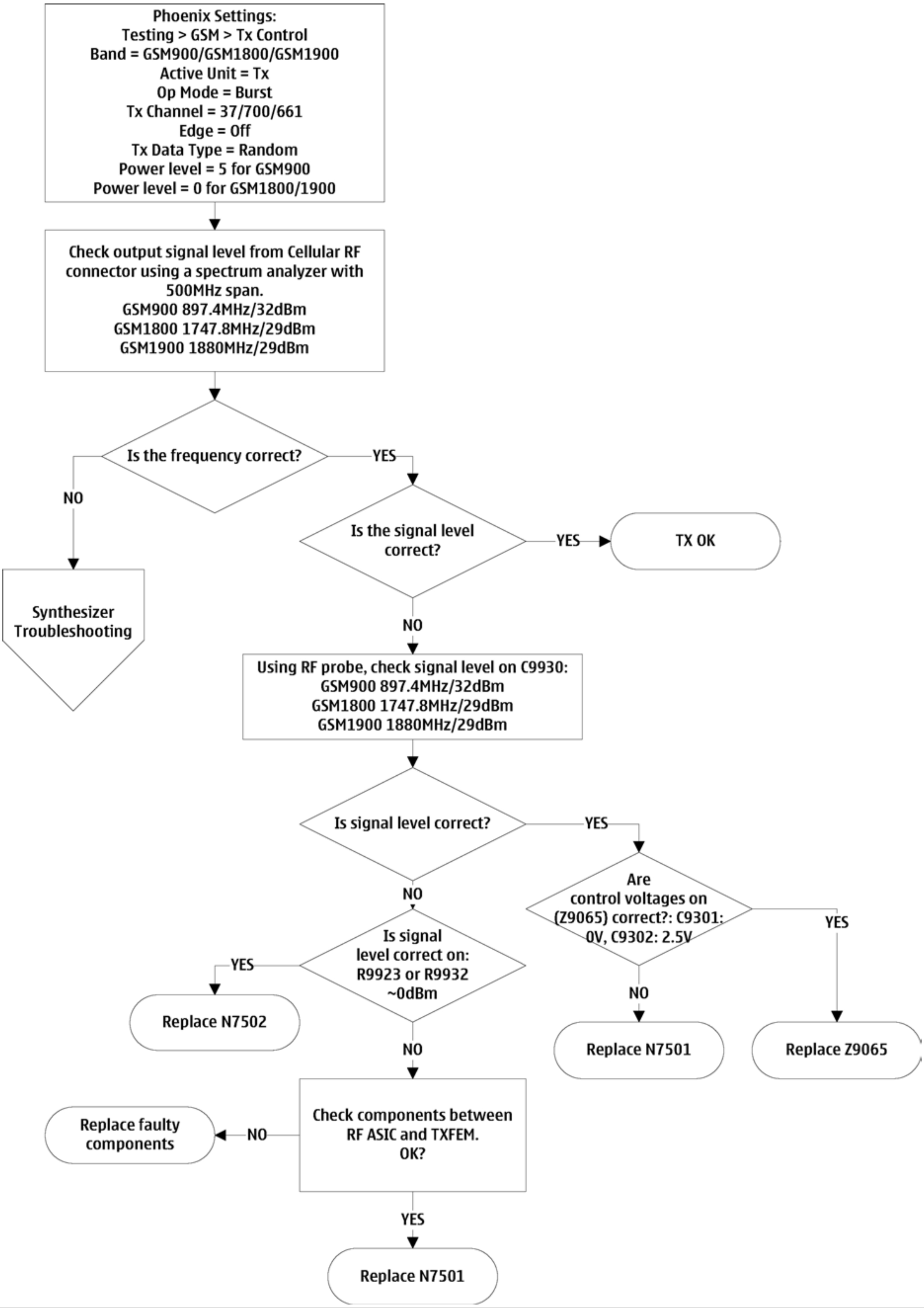
Next actions

When settings are done, click **Send** to enable them.

If you change the settings (e.g. give a new channel number), you need to click **Stop** and **Send** again.

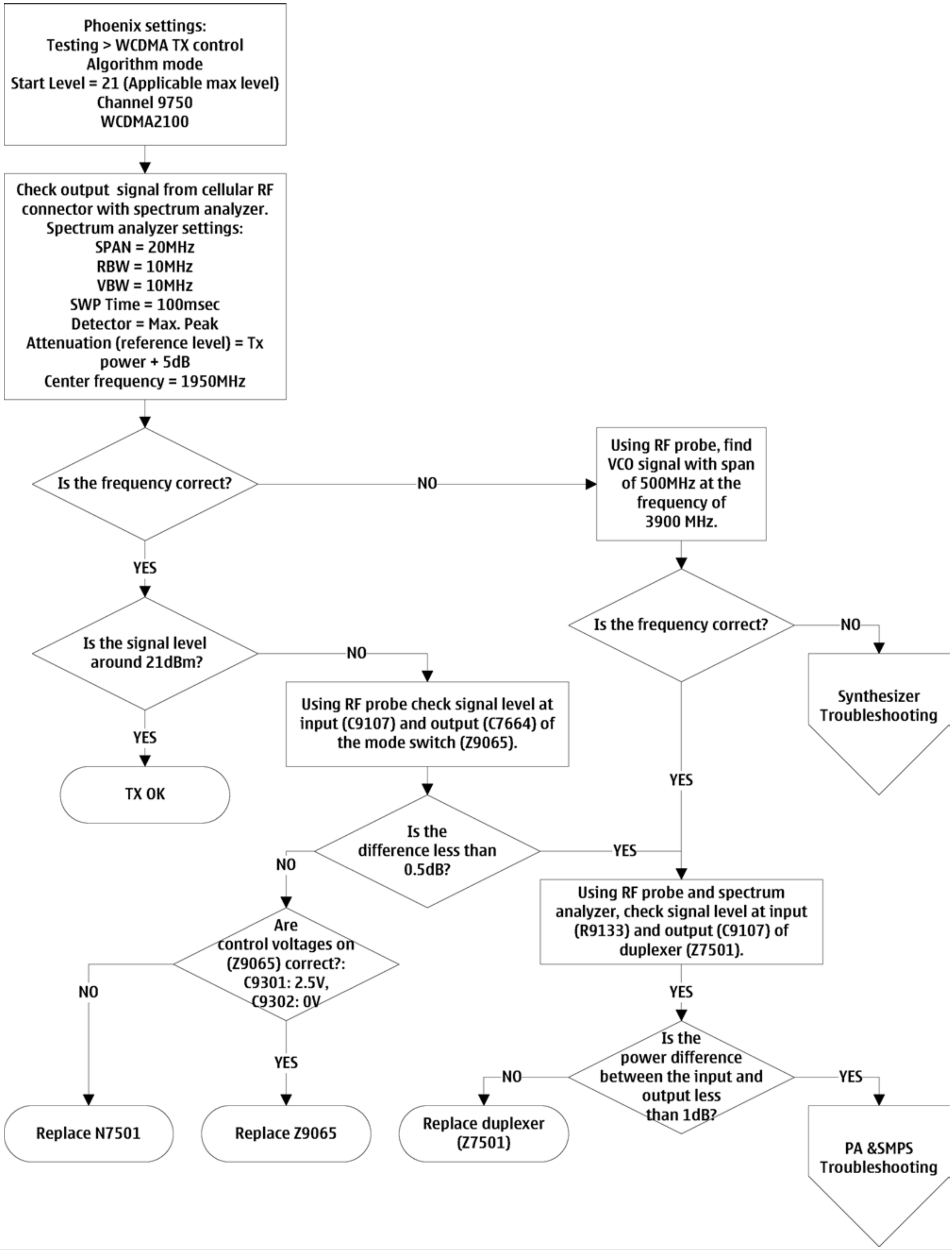
GSM transmitter troubleshooting

Troubleshooting flow



WCDMA transmitter troubleshooting

Troubleshooting flow

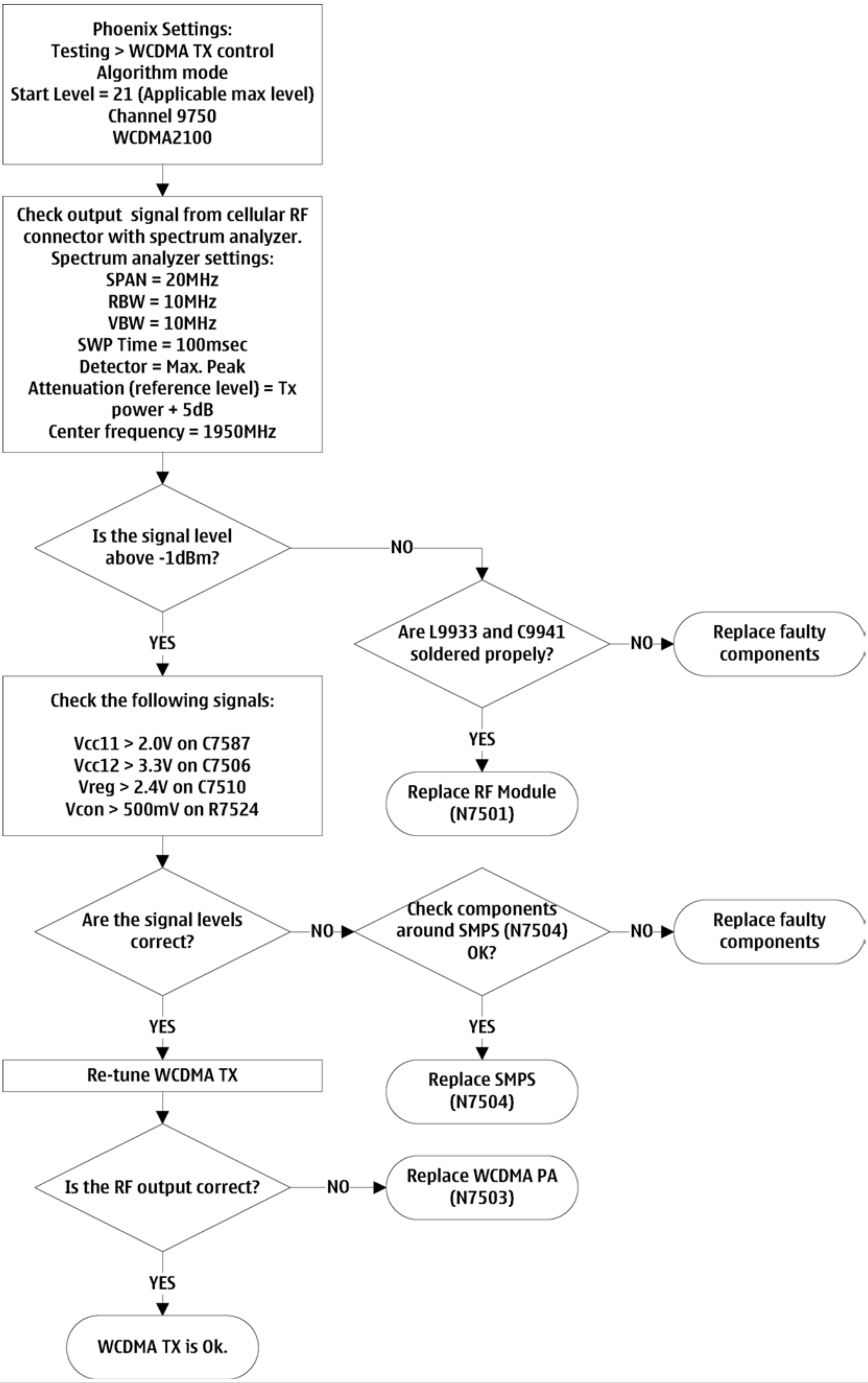


Transmitter test points

Band	Measure	Location	Expected Result
WCDMA	RF module output	C9941/L9933	> -1dBm at 1950MHz
WCDMA	Duplexer input	R9133	21dBm @ 1950MHz
WCDMA	Mode switch input	C9107	21dBm @ 1950MHz
WCDMA	Mode switch output	C7664	21dBm @ 1950MHz
WCDMA	Vcc11 supply of the PA	C7587	2.24V
WCDMA	Vcc12 supply of the PA	C7541	3.3-4.2V (supply from VBAT)
WCDMA	Vreg for PA bias	C7510	2.7V
WCDMA	Vcon SMPS control	R7524	900mV
WCDMA	Vctrl1 for mode switch	C9301	2.7V
WCDMA	Vctrl2 for mode switch	C9302	0V
GSM	Vctrl1 for mode switch	C9301	0V
GSM	Vctrl2 for mode switch	C9302	2.7V
GSM	Mode switch input	C9930	32/29dBm @ 897.4/1747.8/1880MHz
GSM900	RF module output	R9923	0dBm
GSM1800/1900	RF module output	R9932	0dBm

Power amplifier (PA) and switch mode power supply (SMPS) troubleshooting

Troubleshooting flow



RF tunings

Introduction to RF tunings

Only perform RF tunings if:

- one or more of the RF components is changed
- A flash memory chip is changed* (*if allowed) or otherwise corrupted.

Caution: 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 results in a complete mistuning of the RF side.

Important: After RF component changes, **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 the RF losses are frequency dependent, you have to be very careful and understand the measurement setup.

RF autotuning

Prerequisites

For information on the recommended test set-up, refer to the corresponding information on the Partner Website or Nokia Online.

Before you can use the autotuning feature, the GPIB driver from the GPIB card vendor must be installed and running.

The autotune **.xml** file must be in a correct place: **C:\Program Files\Nokia\Phoenix\products\xx-x*\rfconf_xx-x*.xml** (**= indicates the type designator of the phone, e.g. RM-1*)

Context

RF autotuning is performed with the aid of a digital radio communication tester.

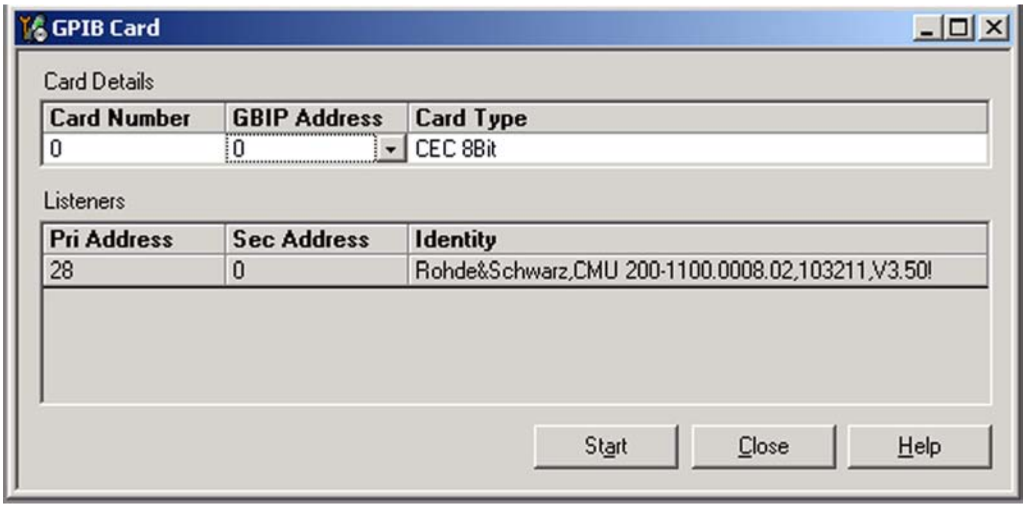
Autotuning covers all RF tunings that are needed to perform after RF component repairs.

Note: Do not perform RF autotuning without a proper reason. Autotuning may only be performed after component repairs or if the RF tuning information is lost.

Steps

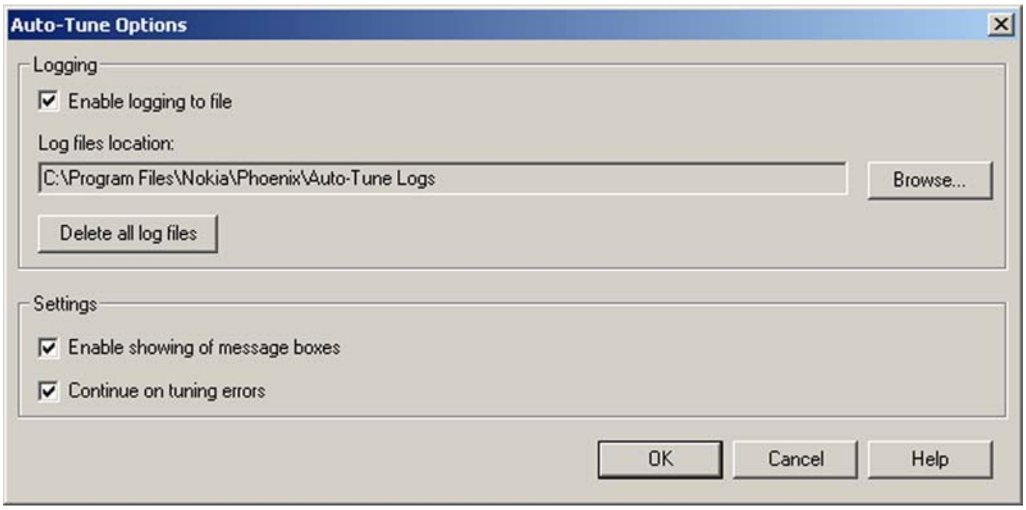
1. Connect the communication tester to the GPIB bus.
2. Start *Phoenix* service software.
3. Choose **Tools→Options→GPIB Card.**
4. From the **Card Type** drop-down menu, choose the GPIB card used, then click **Start**.

   The name of the communication tester appears in the **Listeners** pane.

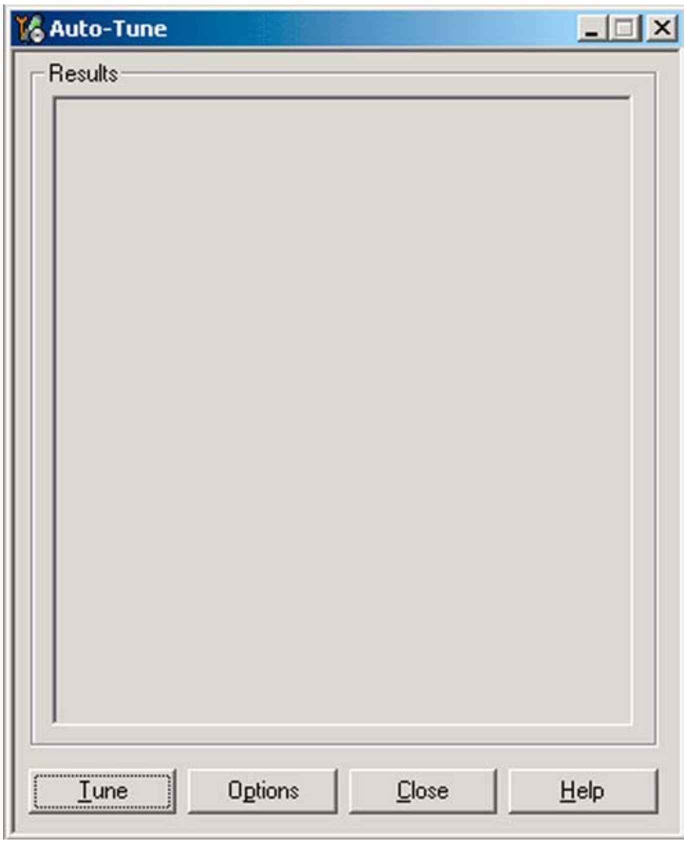


5. To specify the cable loss from a module jig to the communication tester, choose **Set Loss** from the **Tuning** menu.
6. In the *Set Loss* window, click the **Jig** tab, and select the right jig for the phone from the drop-down list.

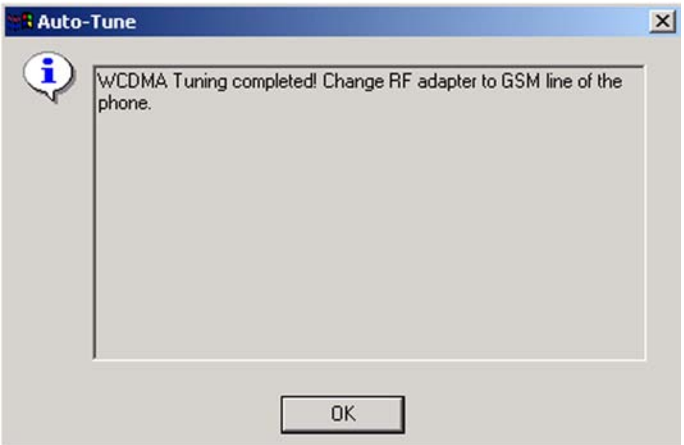
   Alternatively, you can add a new jig by clicking **Add**, and selecting the desired jig from the list.
7. Click the **Cable** tab and add the extra cable attenuation.
8. To start autotuning, choose **Auto-Tune** from the **Tuning** menu.
9. In the *Auto-Tune* window, click **Options**.
10. In the *Auto-Tune options* window, ensure the **Enable showing of message boxes** check box is checked, and click **OK**.



11. Connect the phone cellular RF port to the communication tester, and click **Tune**.

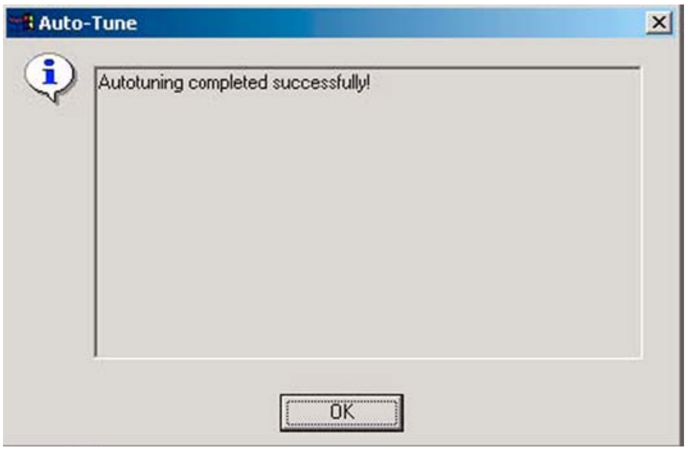


12. Ignore the following message and click **OK**.



Results

Autotuning completed successfully! message appears.



RF manual tuning guide

Required manual tunings after component changes

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

If, however, manual tuning is used, only relevant tunings should be performed. Refer to the following table:

Changed component	Perform the following tunings
RF module, N7501	RF Channel Filter Calibration, Tx IQ Tuning, Tx Power Level Tuning, Temperature Sensor Calibration, TX AGC & Power Detector, Tx Band Response Calibration, Tx LO Leakage
	RF Channel Filter Calibration, Rx Calibration, Rx Band Filter Response Compensation, Rx AGC Alignment, Rx Band Response Calibration
Any component in the GSM Tx RF chain before the PA	Tx IQ Tuning, Tx Power Level Tuning
Any component in the GSM Tx RF chain after the PA or PA	Tx Power Level Tuning
Any component in the WCDMA Tx RF chain before the PA	Tx AGC & Power Detector, Tx Band Response Calibration, Tx LO Leakage
Any component in the WCDMA Tx or Rx chain after the PA, power detector or PA switch mode power supply	Tx AGC & Power Detector, Tx Band Response Calibration, PA Detection
Any component in the GSM Rx chain	Rx Calibration, RX Band Filter Response Compensation
Any component in the WCDMA Rx chain	Rx AGC Alignment, RX Band Response Calibration
VCTCXO	Rx Calibration (GSM850/GSM900 band)

System mode independent manual tunings

Rf channel filter calibration

Context

Rf channel filter calibration tunes the internal low pass filters of Rx and Tx ASICs that limit the bandwidth of BB IQ signals.

One common calibration is made for both GSM and WCDMA.

Table 15 Rf channel filter calibration tuning limits

	Min	Typ	Max
Tx filter	0	10	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 end the tuning, click **Close**.

Results

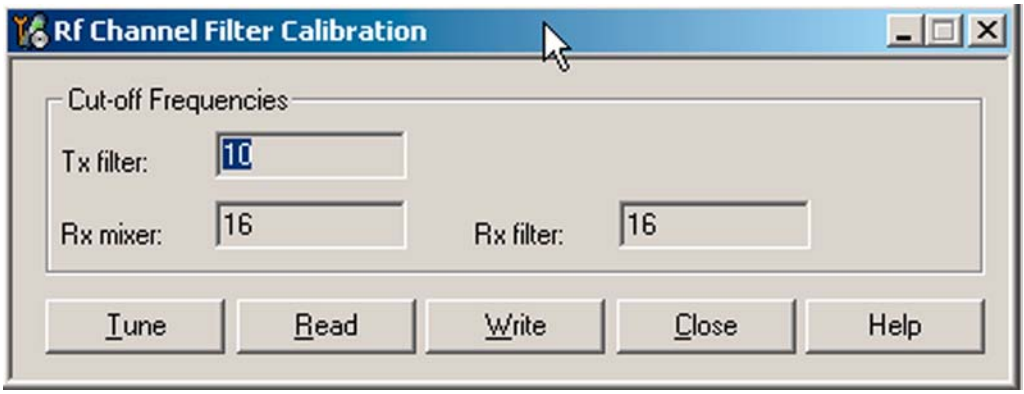


Figure 58 Rf channel filter calibration typical values

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**.

Temperature sensor calibration

Context

There is a temperature sensor integrated into one of the device ASICs. The ASIC provides DC-voltage, which is temperature dependent.

Temperature sensor calibration is done in room temperature, in which offset caused by the ASIC variation and AD-converter are nullified.

The module is able to do this calibration by itself, no external equipment is needed.

The temperature of the module and components must be 23 +/-2 degrees.

Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.
2. Choose **Tuning→Temperature Sensor Calibration** .
3. Click **Tune**.

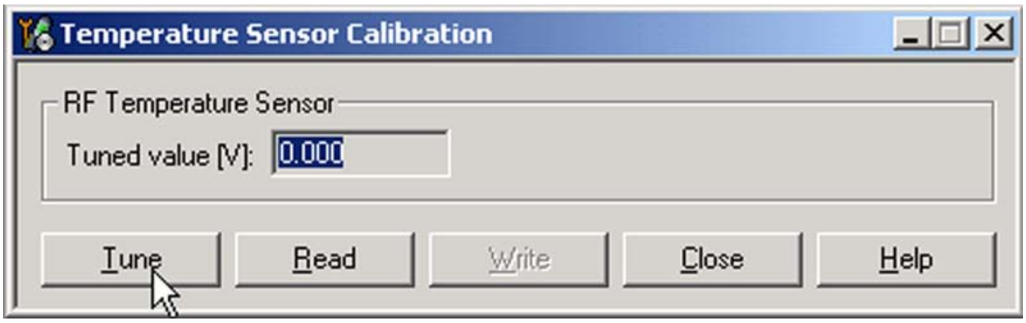


Table 16 Temperature sensor calibration tuning limits

Min	Typ	Max	Unit
-20	-4	20	V

4. To save the calibration values, click **Write**.
5. To finish the calibration, 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)

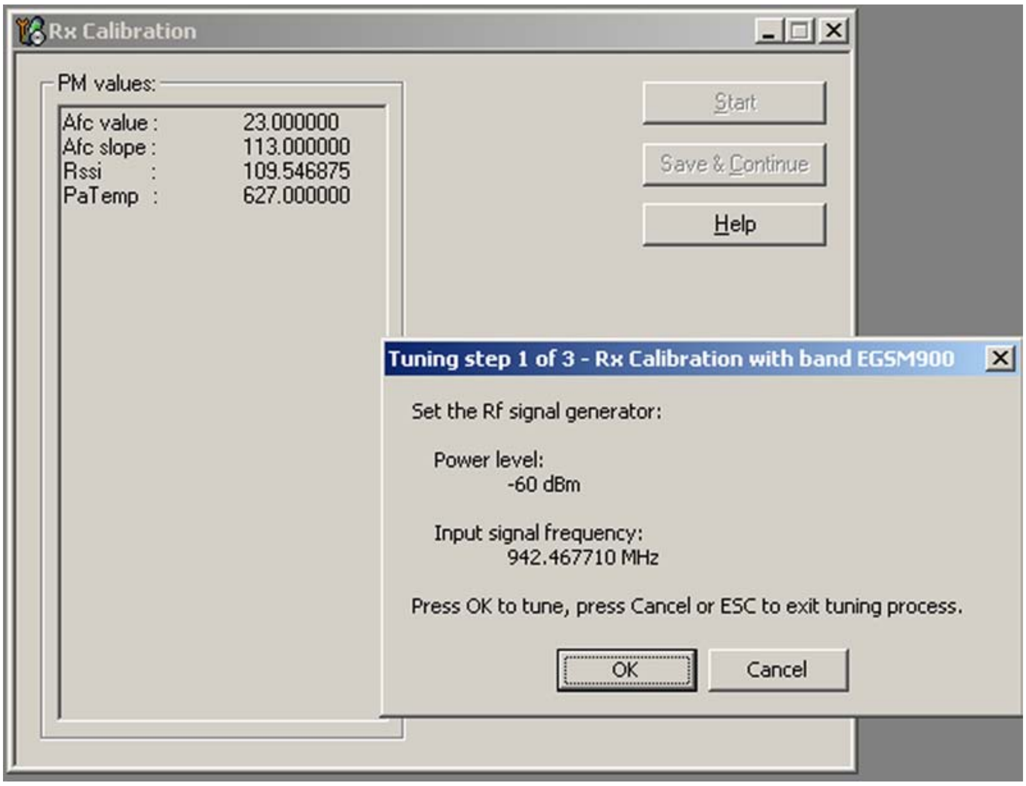
Steps

1. Connect the GSM connector of the module jig to a signal generator.
2. Start *Phoenix* service software.
3. Choose **File→Scan Product.**

4. From the **Operating mode** drop-down menu, set mode to **Local**.
5. Choose **Tuning→GSM→Rx Calibration.**
6. Click **Start**.

7. Connect the signal generator to the phone and set frequency and amplitude as instructed in the *Tuning step 1 of 3 - Rx Calibration with band EGSM900* pop-up window.

   Note: The calibration uses a non-modulated CW signal. Increase the signal generator level by cable attenuation and module jig probe attenuation!



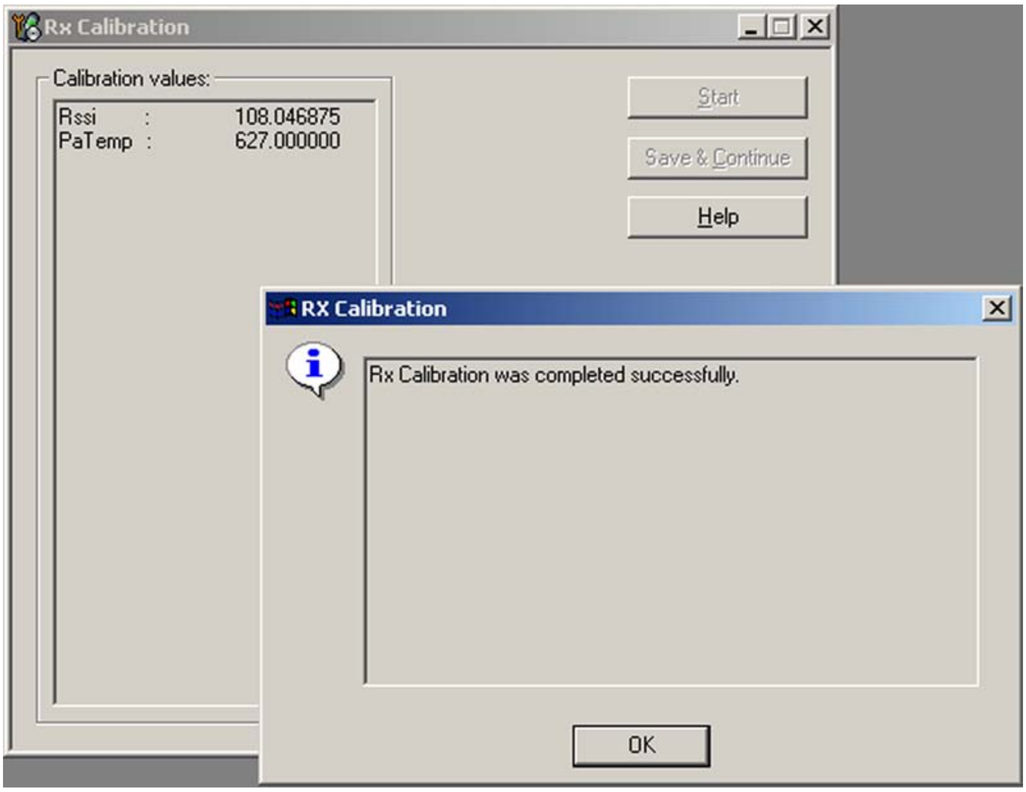
8. To perform the tuning, click **OK**.
9. Check that the tuning values are within the limits specified in the following table:

Table 17 RF tuning limits in Rx calibration

	Min	Typ	Max	Unit
GSM900				
AFC Value	-200	-105...62	200	
AFC slope	0	122	200	
RSSI0	106	107...110	114	dB
GSM1800				
RSSI0	104	104...109	114	dB
GSM1900				
RSSI0	104	104...109	114	dB

10. When the first values have been written to the phone memory, click **Next** to change to the next band.
11. To finish the tuning, go through all bands, and click **Close**.

Results



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 rejecting filter in front of an 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. Choose **File Scan Product**.
4. From the **Operating mode** drop-down menu, set mode to **Local**.
5. Select **GSM900** band.
6. Choose **Tuning→GSM→Rx Band Filter Response Compensation.**
7. From the *Tuning mode* drop-down menu, select **Manual**.

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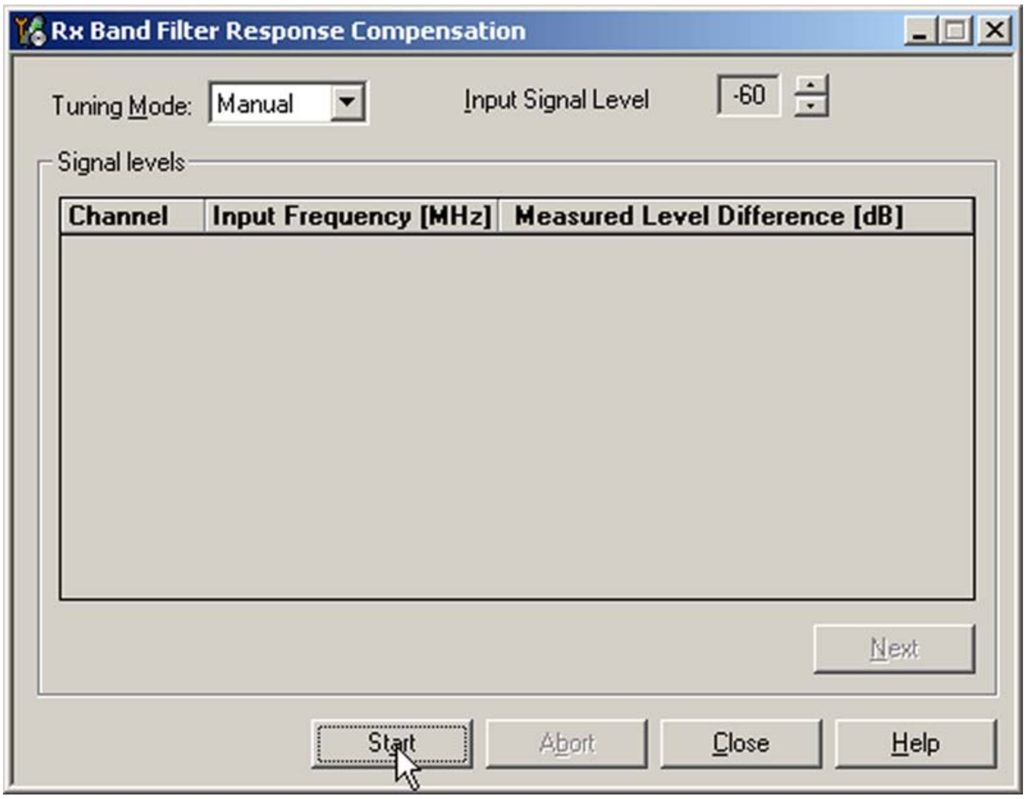
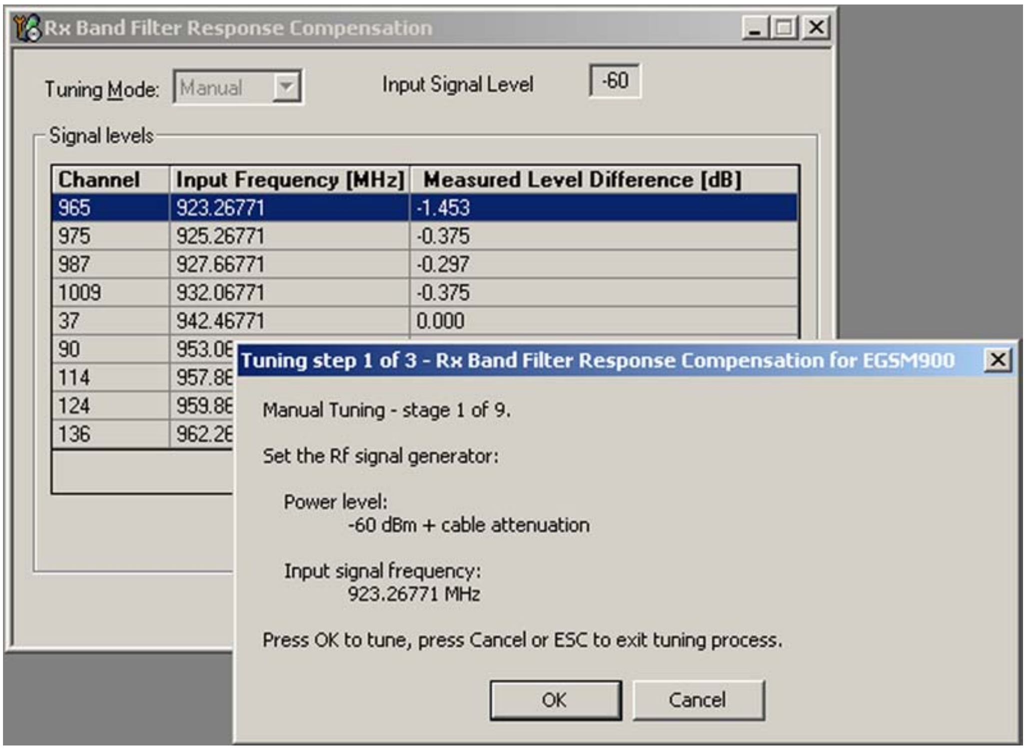
8. Click **Start**.



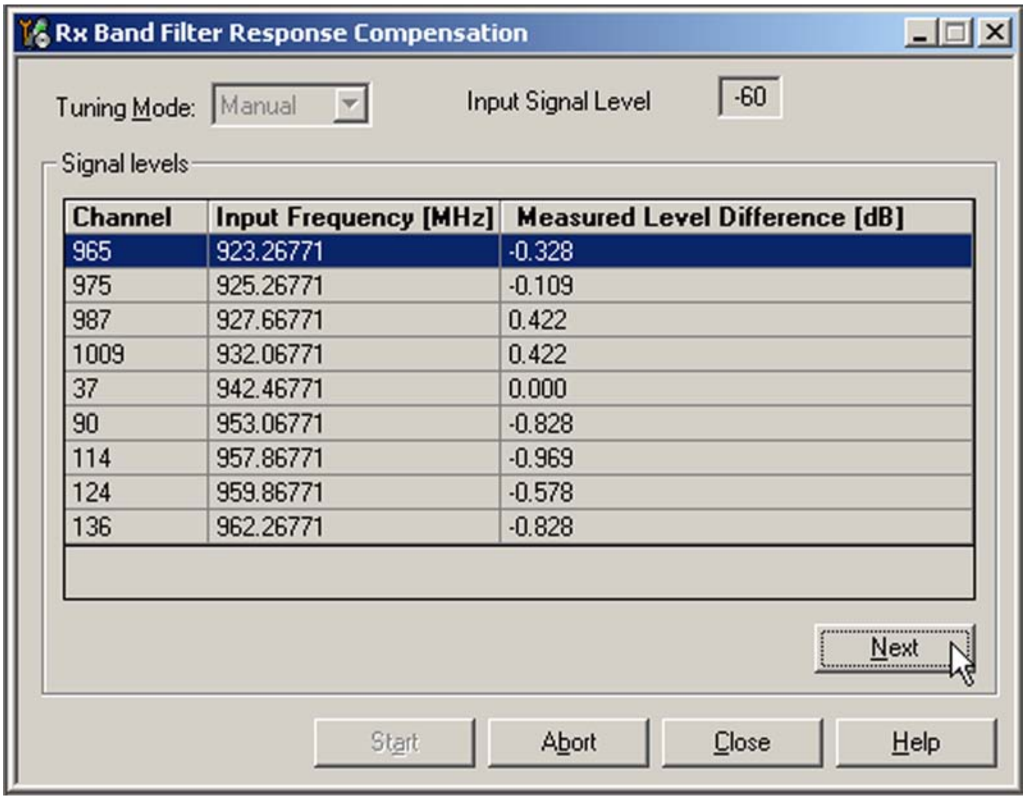
9. Connect the signal generator to the phone and set frequency and amplitude as instructed in the *Tuning step 1 of 3 - Rx Band Filter Response Compensation for EGSM900* pop-up window.



10. To perform the tuning, click **OK**.

11. Go through all 9 frequencies.

    The following window appears, showing signal levels for the input frequencies:



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

	Min	Typ	Max	Unit
GSM900				
Ch. 965 / 923.26771 MHz	-10	-1	5	dB
Ch. 975 / 925.26771 MHz	-3	0	5	dB
Ch. 987 / 927.66771 MHz	-3	0	5	dB
Ch. 1009 / 932.06771 MHz	-3	0	5	dB
Ch. 37 / 942.46771 MHz	-3	0	5	dB
Ch. 90 / 953.06771 MHz	-3	0	5	dB
Ch. 114 / 957.86771 MHz	-3	0	5	dB
Ch. 124 / 959.86771 MHz	-3	0	5	dB
Ch. 136 / 962.26771 MHz	-10	-1	5	dB
GSM1800				
Ch. 497 / 1802.26771 MHz	-10	-1	5	dB
Ch. 512 / 1805.26771 MHz	-3	0	5	dB
Ch. 535 / 1809.86771 MHz	-3	0	5	dB
Ch. 606 / 1824.06771 MHz	-3	0	5	dB

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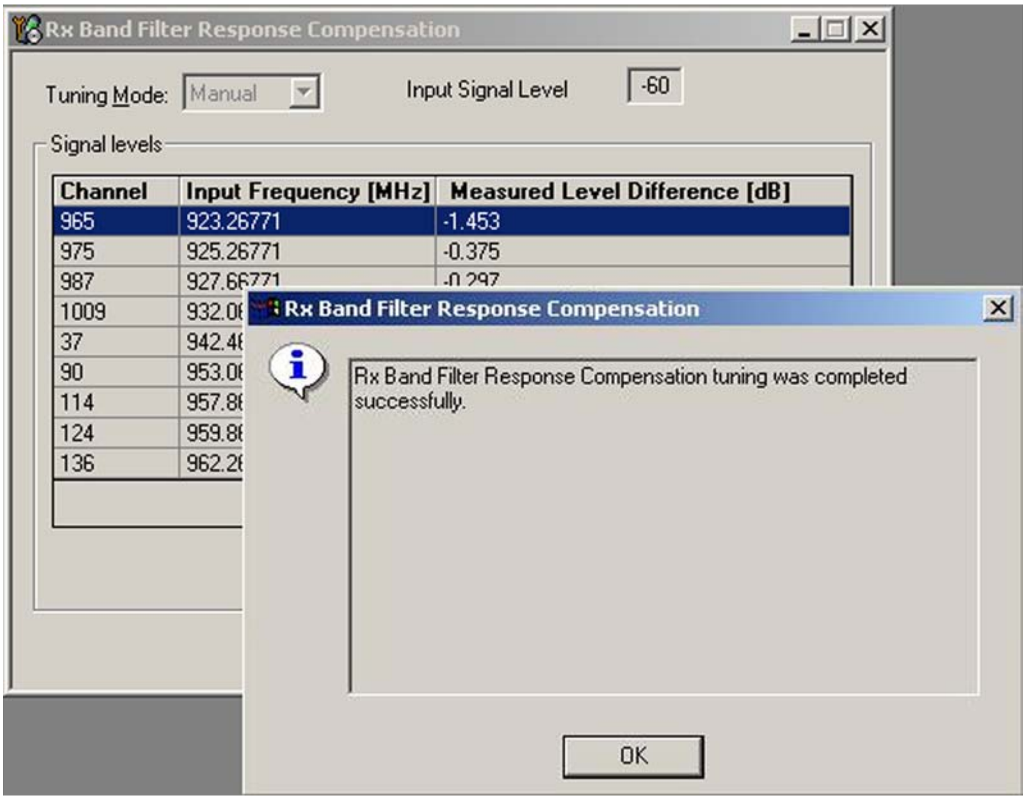
	Min	Typ	Max	Unit
Ch. 700 / 1842.86771 MHz	-3	0	5	dB
Ch. 791 / 1861.06771 MHz	-3	0	5	dB
Ch. 870 / 1876.86771 MHz	-3	0	5	dB
Ch. 885 / 1879.86771 MHz	-3	0	5	dB
Ch. 908 / 1884.46771 MHz	-10	-1	5	dB
GSM1900				
Ch. 496 / 1927.06771 MHz	-10	-1	5	dB
Ch. 512 / 1930.26771 MHz	-3	0	5	dB
Ch. 537 / 1935.26771 MHz	-3	0	5	dB
Ch. 586 / 1945.06771 MHz	-3	0	5	dB
Ch. 661 / 1960.06771 MHz	-3	0	5	dB
Ch. 736 / 1975.06771 MHz	-3	0	5	dB
Ch. 794 / 1986.66771 MHz	-3	0	5	dB
Ch. 810 / 1989.86771 MHz	-3	0	5	dB
Ch. 835 / 1994.86771 MHz	-10	-1	5	dB

13. If the values are within the limits, click **Next** to continue with the next band.
14. Go through all bands, and click **Close** to end the tuning.

Results



Rx AM suppression (GSM)

Rx AM suppression tuning is not required.

GSM transmitter tunings

Tx IQ tuning (GSM)

Context

- The Tx path branches to I and Q signals at the RF I/Q modulator. Modulator and analog hardware located after the modulator 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 on all GSM bands.

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→GSM→Tx IQ Tuning.**
5. From the **Band** drop-down menu, choose **GSM900**.
6. In the *Tx IQ Tuning* window, set mode to **Automatic**.
7. Click **Start**.

   Wait until the automatic tuning feature has finished and moved the sliders.

   Values are written to the phone memory automatically.

   Tuning sliders should be close to the center of the scale after the tuning and within the limits specified in the following table.

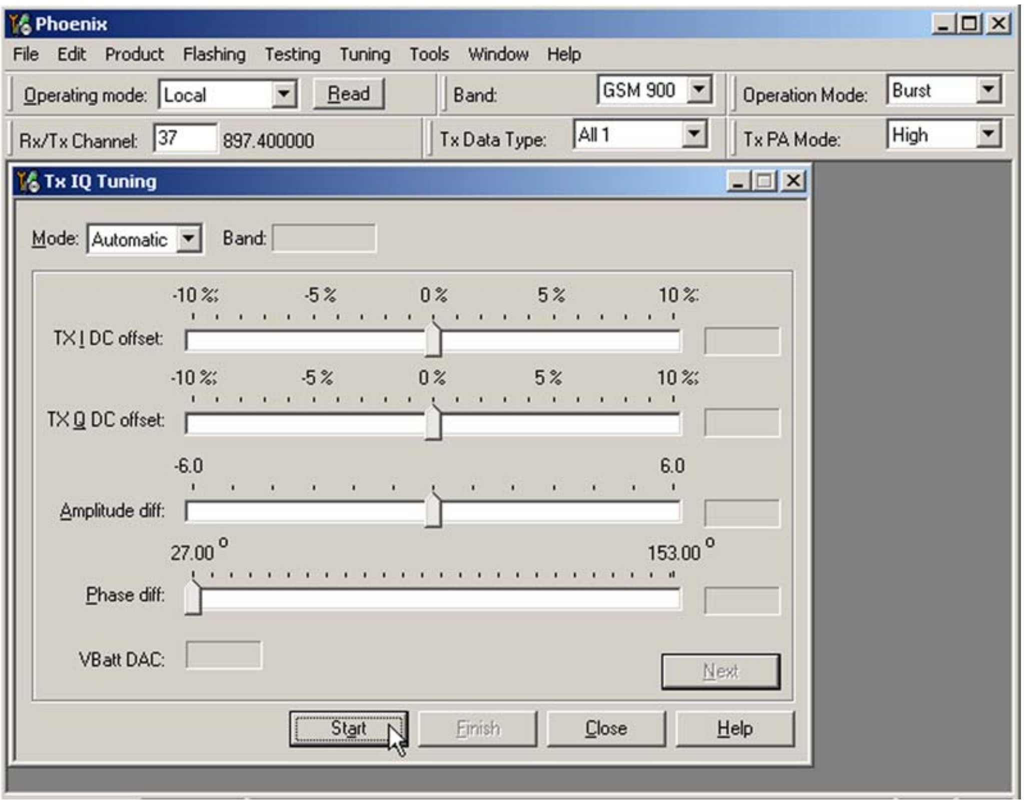
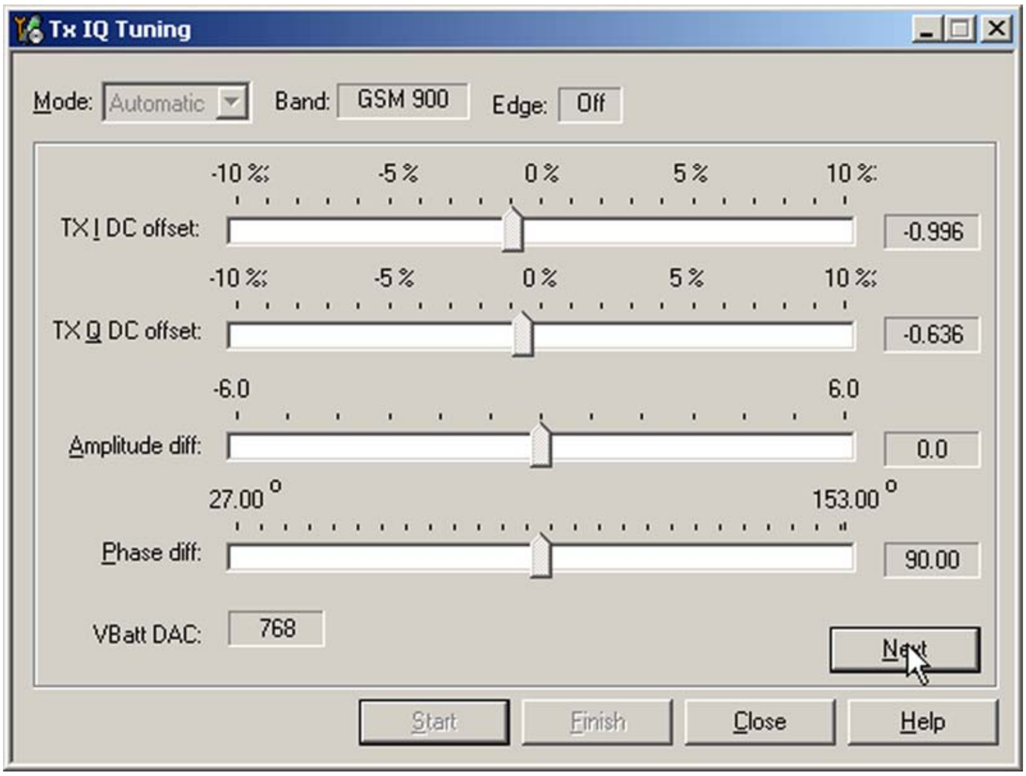


Table 18 Tx IQ tuning limits

	Min	Typ	Max	Unit
GSM900				
I DC offset / Q DC offset	-6	-4/4	6	dB
Ampl	-1	0	1	dB
Phase	85	90	95	dB
GSM1800/GSM1900				
I/Q DC	-6	-0.5/0.5	6	dB
Ampl	-1	0	1	dB
Phase	95	100	110	dB

8. When the first values have been written to the phone memory, click **Next** to continue to the next band.



9. Go through all bands.
10. When all bands have been tuned, click **Finish**, and **Close** to end the tuning procedure.

Next actions

If the tuning values are not within the limits specified in the "Tx IQ tuning limits" table, start the procedure again, and check the Tx IQ quality manually.

Tx power level tuning (GSM)

Context

Because of variations in the 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.

In dual or triple band phones, the power level tuning is made for both high and low PA Modes (Power Amplifier Mode) in the GSM900 band but only for high PA mode in GSM1800/GSM1900 bands

For EDGE transmission, the bias settings of the GSM PA are adjusted in order to improve linearity. This affects the PA gain and therefore 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.**

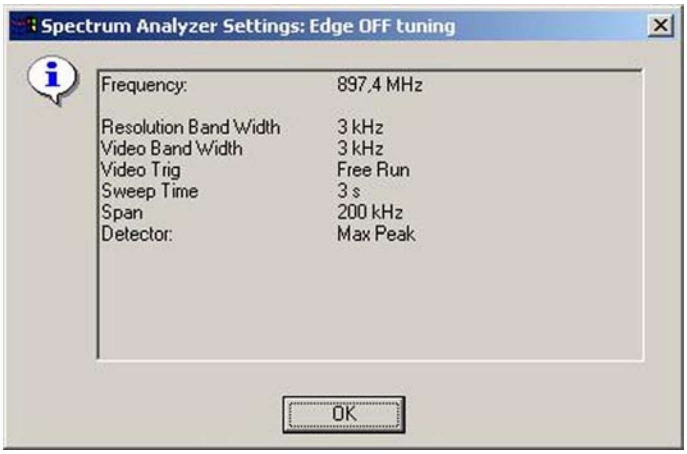
5. Click **Start**.

   The current coefficients saved in the permanent memory (PM) of the terminal are shown.

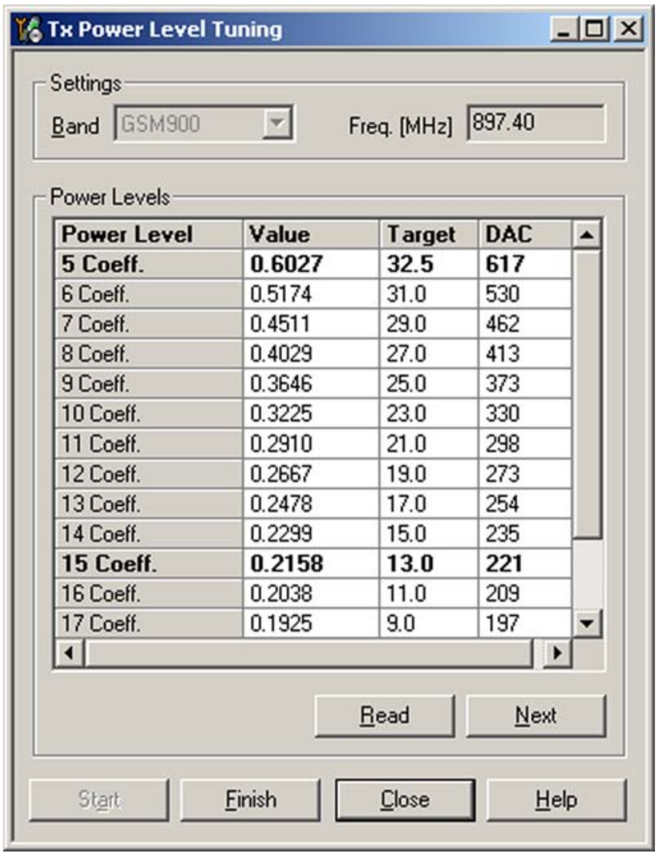
6. Set the spectrum analyzer for power level tuning:

Frequency	channel frequency (897.4MHz GSM900, 1747.8MHz GSM1800, 1880MHz GSM1900)
Span	200 kHz
Sweep time	3s
Trigger	Video triggering: Free run
Resolution BW	3 kHz
Video BW	3 kHz
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 levels **5**, **15** and **19** to correspond the *Target dBm* column by pressing + or – keys.



Check that the coefficient values are within the limits specified in the following table.

	Min	Typ	Max
GSM900 EDGE off			
PL5 coefficient	0.45	0.626	0.73
PL15 coefficient		0.234	
PL19 coefficient	0.12	0.195	0.3
GSM900 EDGE on			
PL8 coefficient	0.35	0.419	0.6
PL15 coefficient		0.247	
PL19 coefficient	0.12	0.204	0.3
GSM1800 EDGE off			
PL0 coefficient	0.45	0.51	0.7
PL11 coefficient		0.219	
PL15 coefficient	0.12	0.185	0.3
GSM1800 EDGE on			
PL2 coefficient	0.35	0.394	0.6
PL11 coefficient		0.23	

	Min	Typ	Max
PL15 coefficient	0.12	0.194	0.3
GSM1900 EDGE off			
PL0 coefficient	0.45	0.482	0.7
PL11 coefficient		0.218	
PL15 coefficient	0.12	0.184	0.3
GSM1900 EDGE on			
PL2 coefficient	0.35	0.377	0.6
PL11 coefficient		0.23	
PL15 coefficient	0.12	0.193	0.3

8. If the values are within the limits, click **Next** to proceed to the next band, and click **Start**.
9. Set **Edge** mode on and start tuning again. Change video averaging to 50.
10. Tune EDGE power levels to the corresponding target power levels.

    Only power levels **8**, **15** and **19** are tuned in GSM900, and **2**, **10** and **15** in GSM1800/1900.
11. When the tuning is completed, close the *Tx Power Level Tuning* window.

WCDMA receiver tunings

Rx calibration (WCDMA)

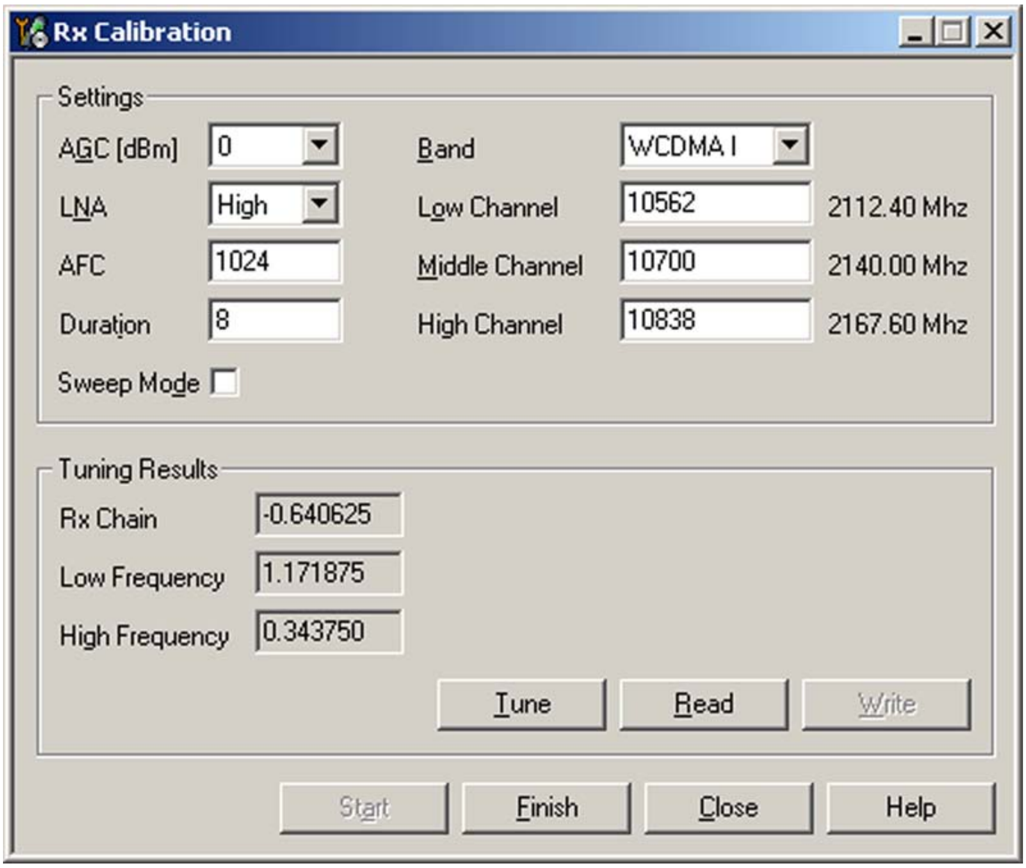
Context

Rx AGC alignment tuning is used to find out the real gain values of the WCDMA Rx AGC system and converters.

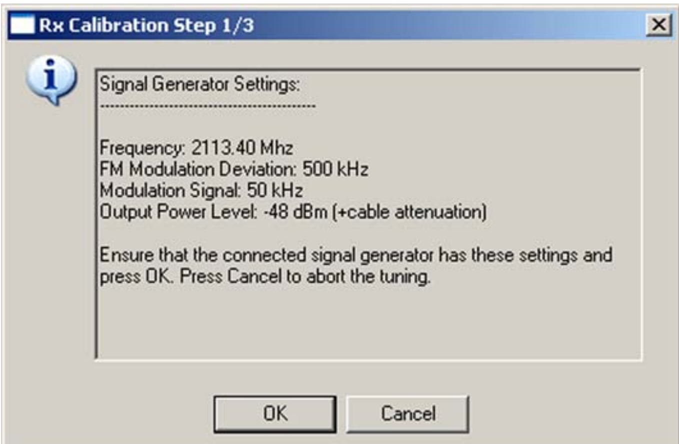
Steps

1. Connect the GSM connector of the module jig to a signal generator.
2. From the **Operating mode** drop-down menu, set mode to **Local**.
3. Choose **Tuning→WCDMA→Rx Calibration** .

4. Click **Start** and **Tune**.



5. Setup the signal generator to correspond the values in the *Rx Calibration Step 1/3* pop-up window, click **OK** and continue to steps 2/3 and 3/3.



Frequency:	2113.40MHz, 2141.00MHz, 2168.6MHz
Level:	–48 dBm + cable and adapter attenuations
Modulation:	FM
Deviation:	500 kHz
Modulation frequency:	50 kHz

6. Check that each value in *Tuning Results* is within the limits presented in the following table.

	Min	Typ	Max	Unit
RX chain	-6	1.5... 3.5	6	dB
Low freq	-5	-0.7... 4.0	5	
High freq	-5	-0.7... 4.0	5	

i If the values are acceptable, click **Yes** to save the results to the phone.

7. To close the *Rx Calibration* window, click **Close**.

WCDMA transmitter tunings

Tx AGC & power detector (WCDMA)

Context

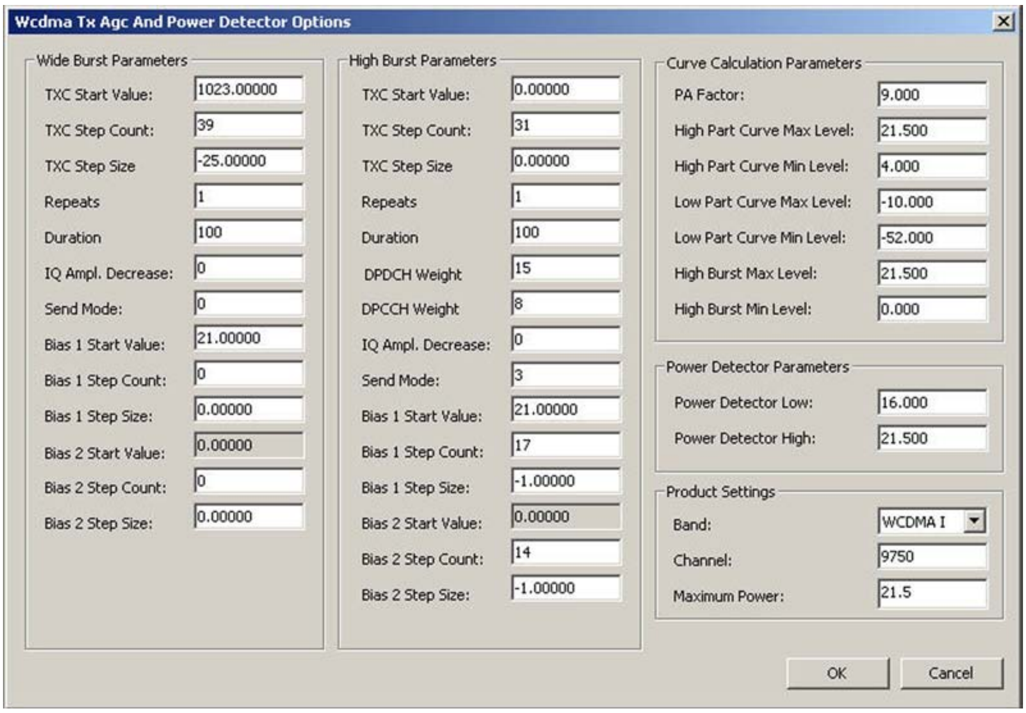
Tx AGC & power detector tuning has two purposes:

- 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 Alternative steps (page 7–51).

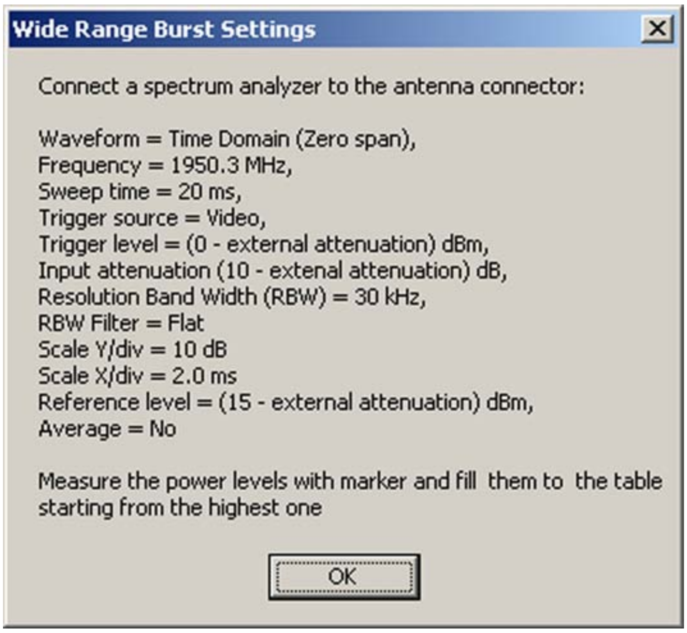
Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.
2. Choose **Tuning→WCDMA→Tx AGC & Power Detector.**
3. Click **Options**.
4. Set the parameters as below.



5. Click **Start**.

6. In the *Wide Range* pane, click Tune (the leftmost Tune button).
7. Set up the spectrum analyzer in the following way:

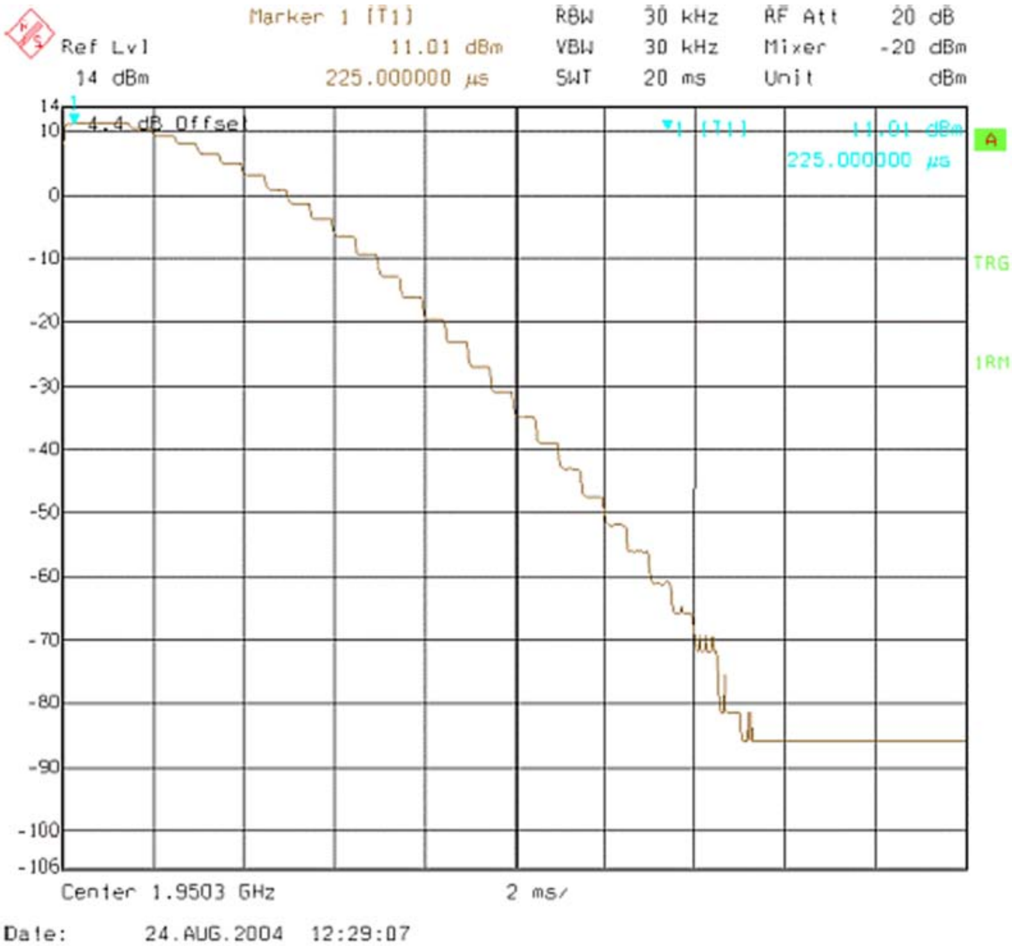


8. After setting the spectrum analyzer, click **OK**.
9. Measure the power levels with a marker.

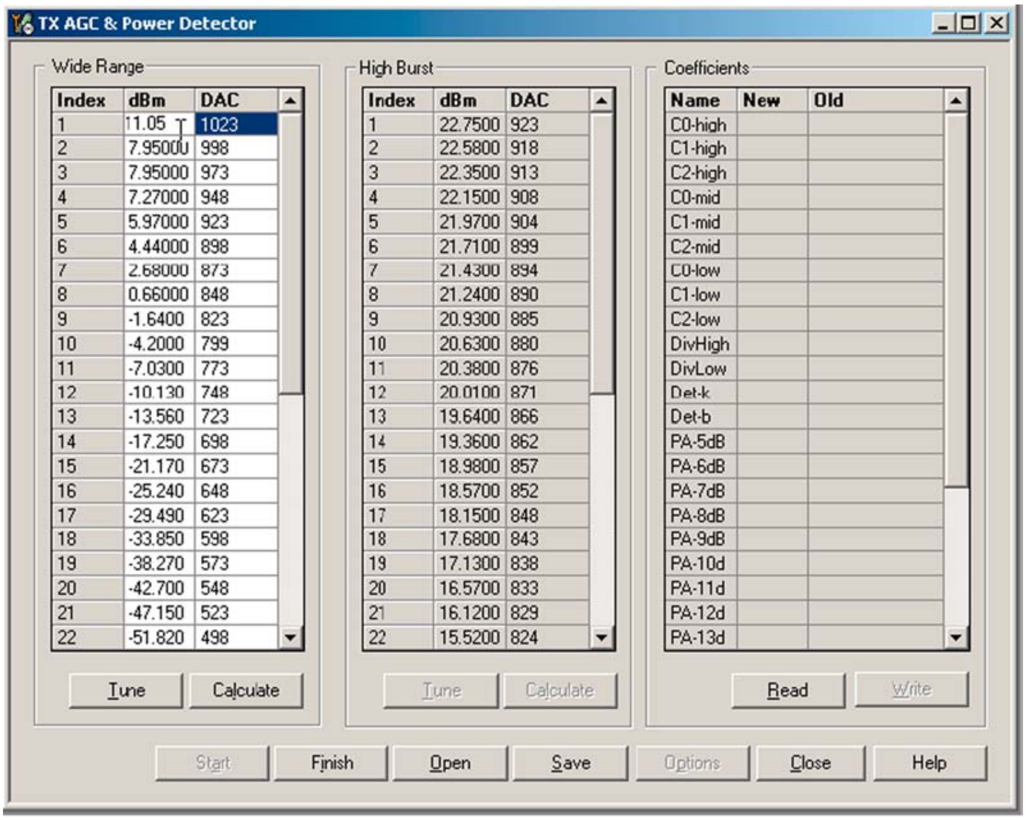
   Take the first measurement from 250 us after the trigger, the second after 750 us, the third after 1220 us and so on for every 500 us until the table is filled.

   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.


Marker 1 [T1]
Ref Lvl
11.01 dBm
14 dBm
225.000000 µs
RBW 30 kHz
VBW 30 kHz
SWT 20 ms
RF Att 20 dB
Mixer -20 dBm
Unit dBm
4.4 dB Offset
1 [T1] 11.01 dBm
225.000000 µs
A
TRG
1RM
14
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-106
Center 1.9503 GHz
2 ms/
Date: 24.AUG.2004 12:29:07

10. Fill in the power level values (in dBm) to the *Wide Range* table.



11. In the *Wide Range* pane, click **Calculate**.
12. In the *High Burst* pane, click **Tune**.
13. Adjust the spectrum analyzer according to the following settings:

14. 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.

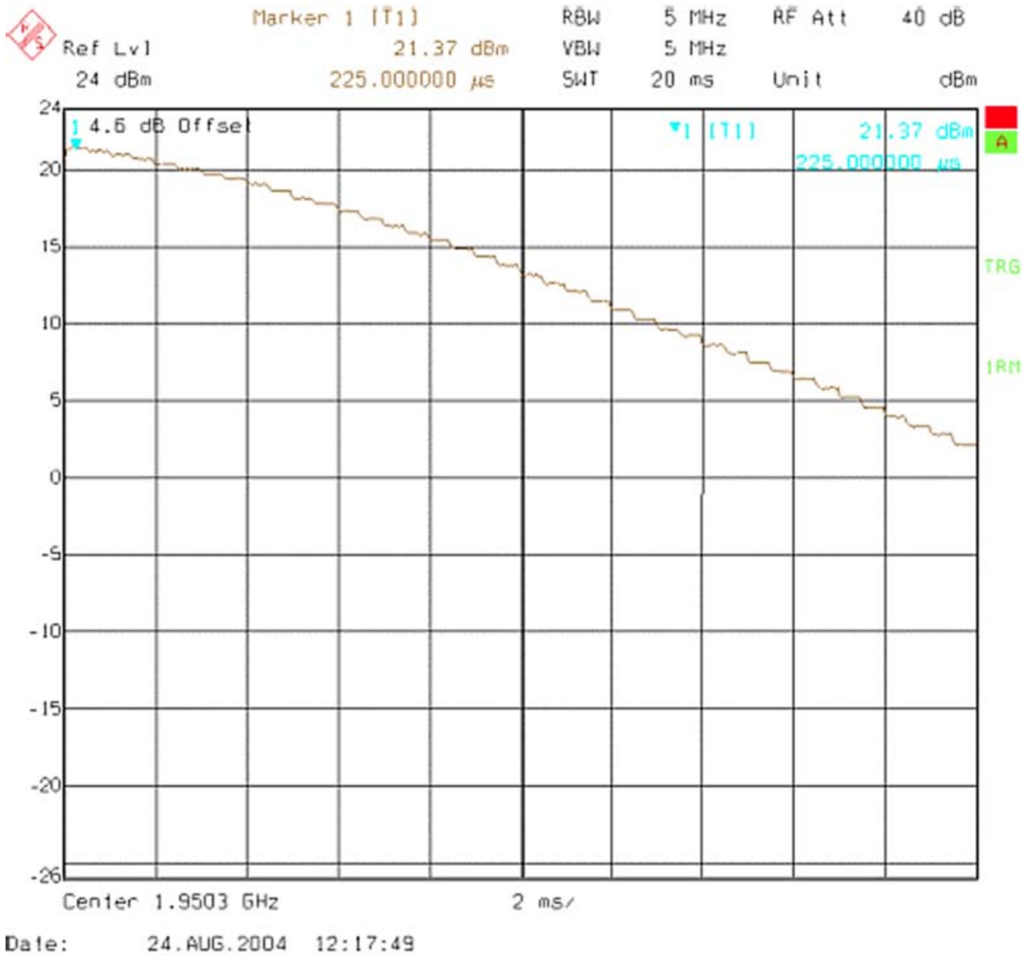


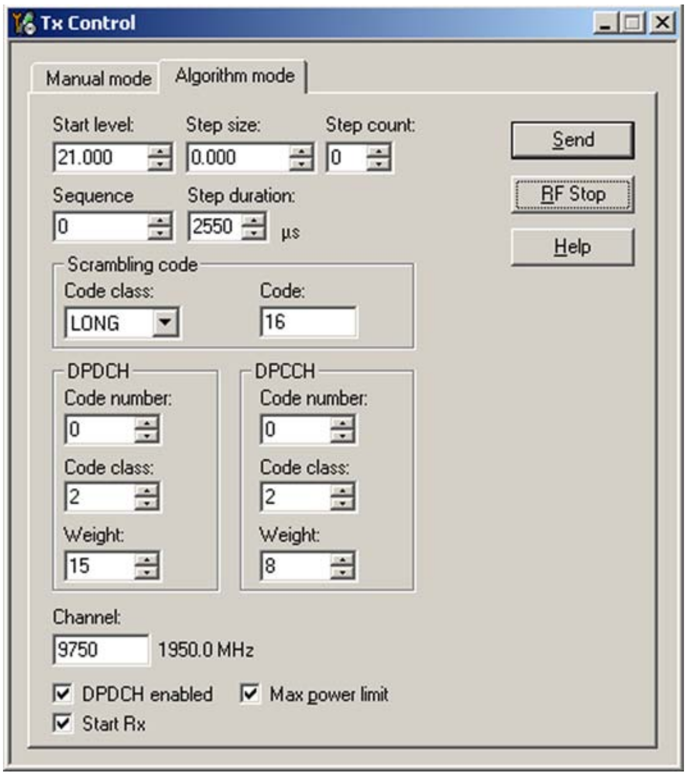
Figure 59 High burst measurement

15. In the *High Burst* pane, click **Calculate**.
16. 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

17. To save the coefficients to the phone, click **Write**.
18. To close the *Tx AGC & Power Detector* window, click **Close**.
19. Choose **Testing→WCDMA→ Tx Control.**
20. Select the *Algorithm* mode tab.



21. Write the target power level 25 dBm to the *Start level* line and check the **Max power limit** check box (detector calibration check).
22. Setup the spectrum analyzer with the following settings:

Center frequency:	**1950.3 MHz**
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

23. Click **Send**.
24. Measure the WCDMA output power.

    It should be around 21 dBm.
25. Click **RF Stop** and uncheck the **Max power limit** check box.
26. 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

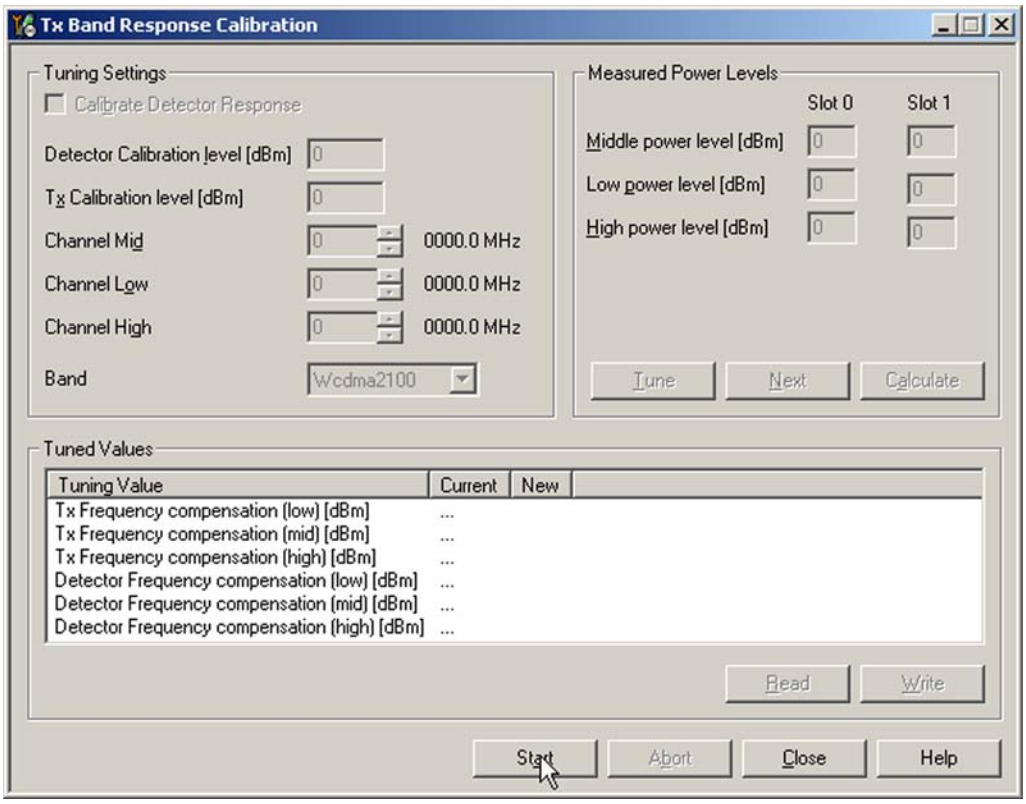
The purpose of this tuning operation is to calibrate the WCDMA Tx performance. It defines the power detector and Tx frequency compensation values. However, before starting this tuning procedure, it is necessary to carry out Tx AGC & Power Detector Calibration tuning. This is because its results will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

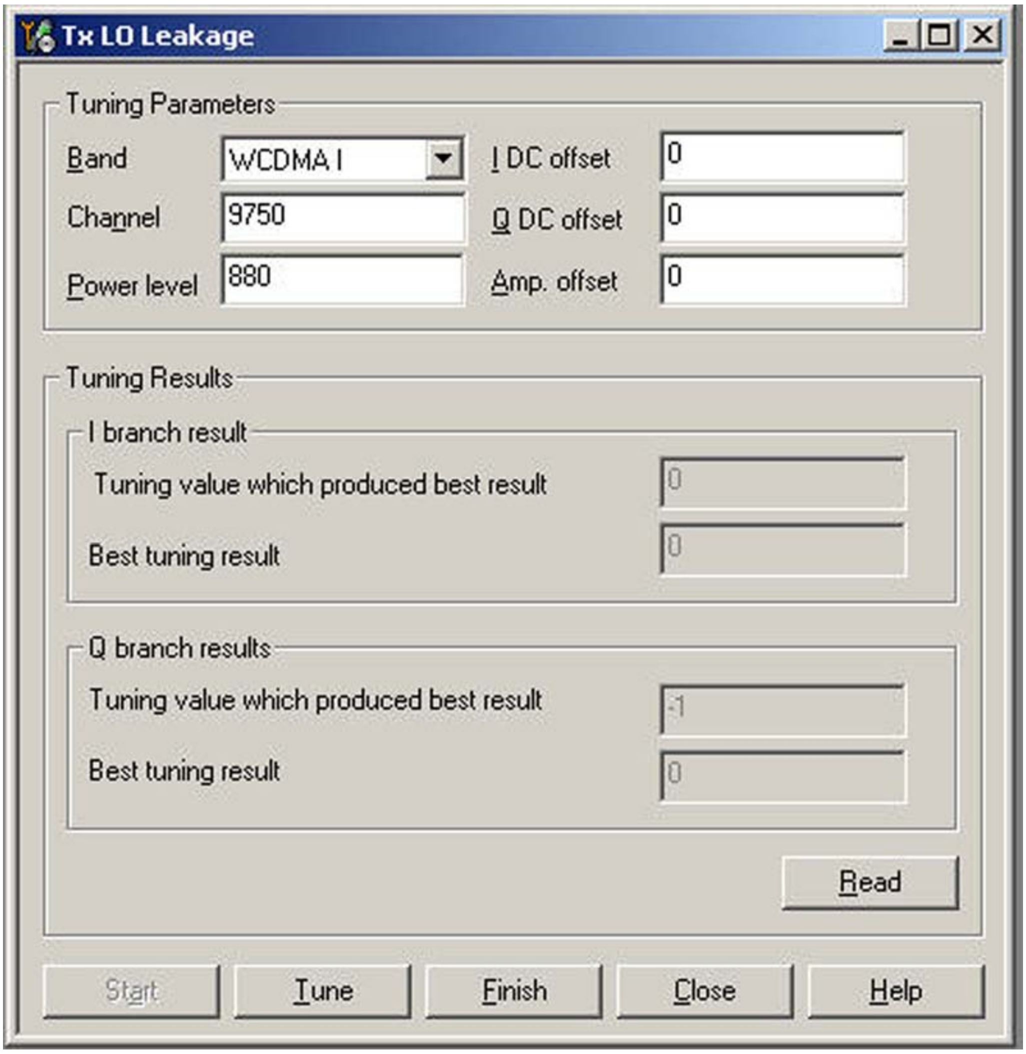
The purpose of Tx LO leakage tuning is to minimize the carrier leakage of the IQ-modulator which is caused by the DC offset voltages in the Tx IQ-signal lines and in the actual IQ modulator.

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. Change power level value to 880.

4. Click **Tune**.



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

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8 — Camera Module Troubleshooting

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Introduction to camera module troubleshooting

Background, tools and terminology

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

1 Camera is not functional at all; no image can be taken.

2 Images can be taken but there is nothing recognizable in them.

3 Images can be taken, and they are recognizable but for some reason the quality of images is seriously degraded.

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

Often subjective evaluation has to be used for finding out if a certain property of the camera is acceptable. Some training or experience of a correctly operating reference device may be needed in order to detect what actually is wrong.

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

Tools

Phoenix service software is not recommended for camera troubleshooting because at the moment it only supports relatively few features of the camera functionality. Instead, use the phone's camera application for functionality checking.

You can use camera application with the product-specific module jig.

Terms

Autofocus (AF)	The camera module contains lens movement mechanics for focus adjustment. Autofocus enables camera to take sharp images of objects positioned between 30 cm to infinity. In the AF mode, the viewfinder image is momentarily blurred as the camera searches for the right focus setting.
Digital Zoom	A digital zoom can be described as a form of cropping the image. When using a digital zoom, the camera enlarges the image area at the centre of the frame and discards the outside edges of the image.
Dynamic range	The ability of the camera to capture details in dark and bright areas of the scene simultaneously.
Distortion	A divergence from rectilinear projection caused by a change in magnification with increasing distance from the optical axis of an optical system. If the magnification increases with distance, it produces pincushion distortion; if it decreases with distance, the effect is barrel distortion.
Exposure time	Camera modules use a silicon sensor to collect light and to form an image. The imaging process roughly corresponds to traditional film photography, in which exposure time means the time during which the film is exposed to light coming through optics. Increasing the time will allow for more light hitting the film and thus results in brighter images. The operation principle is exactly the same with a silicon sensor.

F-number	The f-number or focal ratio of an optical system expresses the diameter of the entrance pupil in terms of the effective focal length of the lens. The f-number of the main camera is F3.3 at wide and F5.9 at tele.
Flare, Ghost	A phenomenon of some images produced by optical systems pointed toward bright sources of light. It is caused by the scattering, reflection, and refraction of light in lens systems. Lenses with large numbers of elements such as zooms tend to exhibit greater lens flare, as there are more surfaces off which reflection can occur.
Flicker	Phenomenon, which is caused by pulsating in scene lighting, typically appearing as wide horizontal stripes in an image.
LED flash	LED is used as strobe flash light. The device implements 2 in 1 type LED flash. The LED flash can be used in flash (brighter) mode when taking still image and in torch (darker) mode when recording video.
Mechanical shutter	The camera module contains a mechanical shutter.
Night mode	Night mode allows bigger analogue gain than normal mode. It is suitable for taking pictures in low ambient light (dark) condition.
Noise	Variation of response between pixels with same level of input illumination.
Optical zoom	The camera module contains lens movement mechanics for up to 2.75x zoom. Optical zoom can be used with digital zoom (up to 20x); the maximum combined zoom ratio is 55x.
Resolution	The amount of pixels in the camera sensor. In some occasions the term resolution is used for describing the sharpness of the images.
Sensitivity	The light sensitivity of the camera. In equivalent illumination conditions, a less sensitive camera needs a longer exposure time to gather enough light in forming a good image. Analogous to ISO speed in photographic film.
Sharpness	Good quality images are 'sharp' or 'crisp', meaning that image details are well visible in the picture. However, certain issues, such as non-idealities in optics, cause image blurring, making objects in picture to appear 'soft'. Each camera type typically has its own level of performance. Image gets softer at increased zoom ratio.
White balance mode	White balance is a technical method to adapt digital cameras and video equipment to the colour temperature of the dominant light sources in the scene. This is done by adjusting the weighting of the output channels of the image sensor (usually RGB), so that a white surface will again appear white in the resulting picture for a given lighting situation. The device supports five white balance modes (Auto, Daylight, Cloudy, Tungsten, Fluorescent). In many cases, "Auto" mode gives best white balance but users can choose dedicated white balance mode under particular lighting condition

The effect of image taking conditions on image quality

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

Distance to target

The lens in the module is specified to operate satisfactorily from 30 cm to infinite distance of scene objects. In practice, the operation is such that close objects may be noticed to get more blurred when distance to them is shorter than 30 cm. The lack of sharpness is first visible in full resolution images. If observing just the viewfinder, even very close objects may seem to appear sharp. This is normal; do not change the camera module.

Figure 60 Blurred image. Target too close.

The amount of light available

In dim conditions camera runs out of sensitivity. The exposure time is long (especially in the night mode) and the risk of getting shaken (= blurred) images increases. In addition, image noise level grows. The maximum exposure time is 1/12 seconds. Therefore, images need to be taken with extreme care and by supporting the phone when the amount of light reflected from the target is low. Because of the longer exposure time and larger gain value, noise level increases in low light conditions. Sometimes blurring may even occur in daytime, if the image is taken very carelessly. Examples of carelessness are handshake introduced by handshake or by shutter button pressing operation. Strength against handshake or shutter button operation depends on product concepts. See the figure below for an example. This is normal; do not change the camera module.

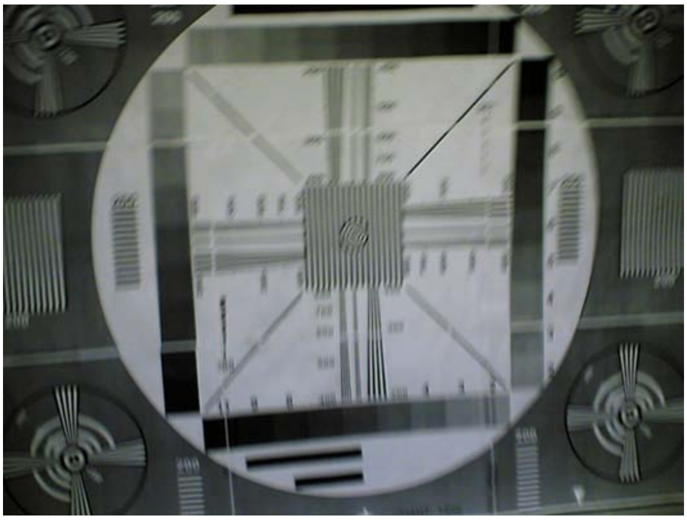


Figure 61 Blurring caused by shaking hands

Movement in bright light

If an image is taken of moving objects or if the device is used in a moving vehicle, object 'skewing' or 'tilting' may occur. This phenomenon is fundamental to most CMOS camera types, and usually cannot be avoided. The movement of camera or object sometimes cause blurring indoors or in dim lighting conditions because of long exposure time. This is normal; do not change the camera module.

Figure 62 Near objects get skewed when taking images from a moving vehicle

Temperature

High temperatures inside the mobile phone cause more noise to appear in images. In the worst case, some colors of image completely change. For example, in +70 degrees (Celsius), the noise level may be very high, and it further grows if the conditions are dim. If the phone processor has been heavily loaded for a long time before taking an image, the phone might have considerably higher temperature inside than in the surrounding environment. This is also normal to camera operation; do not change the camera module.

Figure 63 Noisy image taken in +70 degrees Celsius

Phone display

If the display contrast is set too dark, the image quality degrades: the images may be very dark depending on the setting. If the display contrast is set too bright, image contrast appears bad and "faint". This problem is solved by setting the display contrast correctly. This is normal behaviour; do not change the camera module.

Basic rules of photography

Because of dynamic range limitations, taking images against bright light might cause either saturated image or the actual target appear too dark. In practice, this means that when taking an image indoors and having, for example, a window behind the object, the result is usually poor. Sometimes level of exposure is a preference issue: e.g. overexposed is preferred to take pictures of human to reproduce their face brighter. This is normal behavior; do not change the camera module.

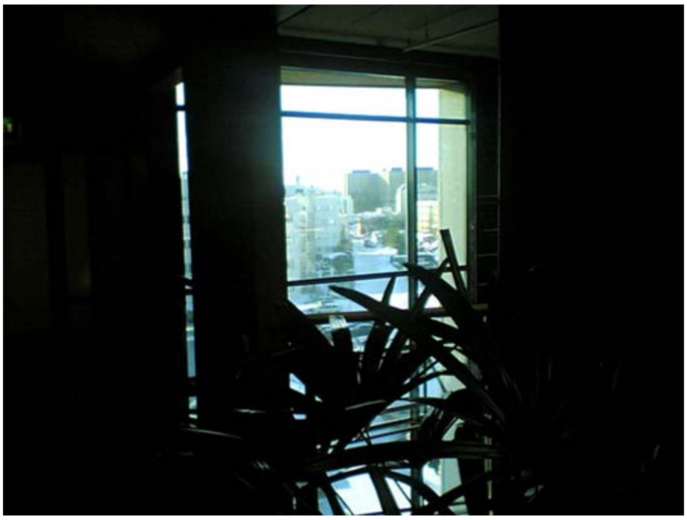


Figure 64 Image taken against light

Flicker

In some occasions a bright fluorescent light may cause flicker in the viewfinder and captured image. This phenomenon may also be a result, if images or video are taken indoors under the mismatch of 50/60 Hz electricity network frequency. The electricity frequency used is automatically detected by the camera module in video mode or specified by the end-user in still mode. In some very few countries, both 50 and 60 Hz networks are present and thus probability for the phenomenon increases. Flickering occurs also under high artificial illumination level. For example, in taking scenes containing PC monitor or high illuminating object based on electrical frequency, not only the brigtheness but also white balance would be drifted and perceived as flickers. This is normal behavior; do not change the camera module.

Figure 65 Flicker in an image; object illuminated by strong fluorescent light

Bright light outside of image view

Especially the sun can cause clearly visible lens glare phenomenon and poor contrast in images. This happens because of undesired reflections inside the camera optics. Generally this kind of reflections are common in all optical systems. In some occasions, incoming light through optics to image sensor are reflected at the microlens on the image sensor, which causes colored reflections like grape. This is normal behavior; do not change the camera module.

Figure 66 A lens reflection effect caused by sunshine

Examples of good quality images

Figure 67 Good image taken indoors

Figure 68 Good image taken outdoors

Main camera construction

This section describes the mechanical construction of the main camera module.

Table 19 Main camera specifications

Sensor type	1/3.2" MOS sensor
Sensor valid pixels	2048 x 1536 (3M)
F number/Aperture	F3.3 (wide) / F5.9 (tele)
Focal length	4.5 mm (wide) / 12.4 mm (tele) 34.25 - 94.1 mm (35 mm equivalent)
Focus range	10/30 cm to infinity (tele/wide)
Still image resolutions	3Mpixels: 2048 x 1536 (print - high) 2Mpixels: 1600 x 1200 (print - standard) 1.3Mpixels: 1280 x 960 (e-mail) VGA: 640 x 480 (MMS)
Video	640 x 480 to 128 x 96
Video frame rate	30 fps

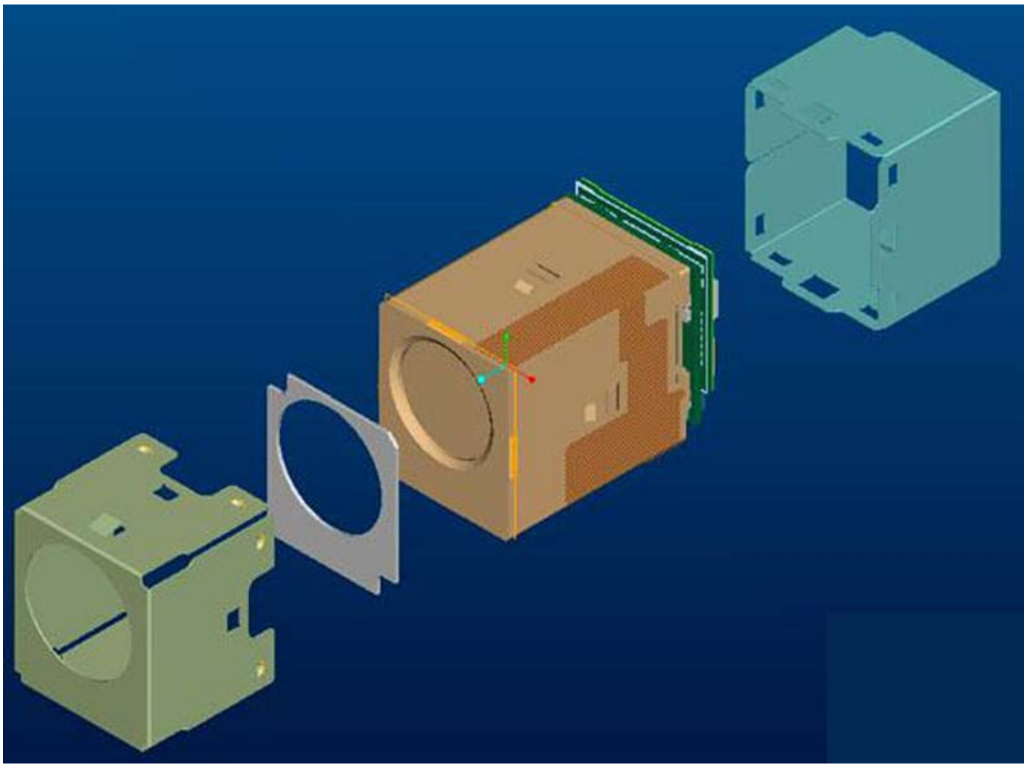


Figure 69 Main camera mechanics

The camera module as a component is not a repairable part, meaning that the components inside the module will not be changed. Cleaning dust from the front face is allowed only. Use clean compressed air.

The camera module uses a socket type connecting. For versioning, laser marked serial numbering is used on the side of the lens housing.

The main parts of the module are:

- 1/3.2" 3M sensor
- Two actuators for AF and optical zoom lens movement
- Lens interface IC
- Camera DSP
- Parallel to CCP1 converter IC
- 25-pin micro coaxial connector
- EEPROM: storage for lens characteristic data
- Shield can

Sub camera construction

Table 20 Sub camera specifications

Sensor type	0.18um CMOS sensor
Sensor valid pixels	384 x 320 (123 thousand)
F number	F2.8
Focus range	30cm to infinity
Still image resolutions	352 x 288

Video resolution	352 x 288
Video frame rate	30fps

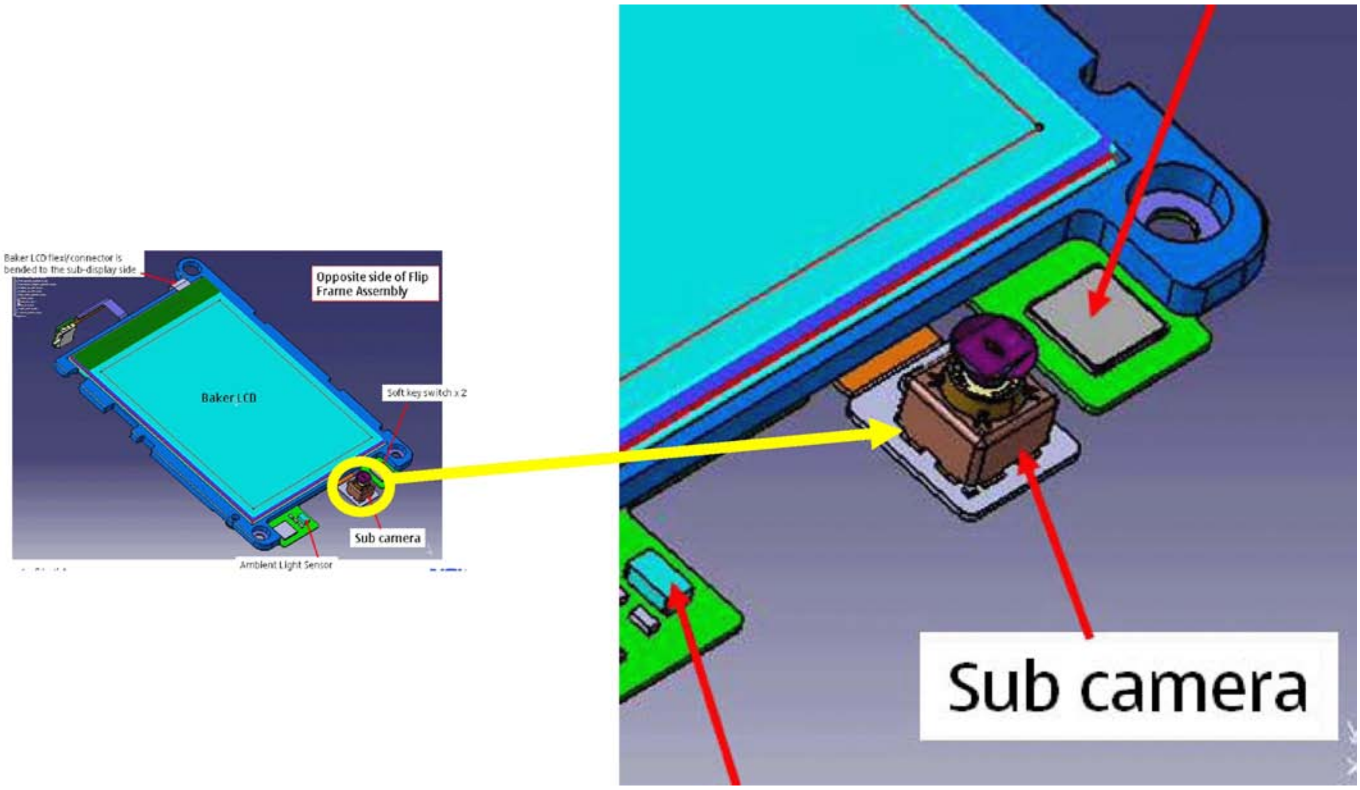


Figure 70 Sub camera mechanics

The sub camera is an SMD component, that set on the Flip FPC. This is a reflowable component, so it is possible to change it by reflow, But an easy way to change it is to use a new flip FPC.

Image quality analysis

Possible faults in image quality

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

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

In addition, there are many other kinds of possibilities for bad image quality, but those are ruled out from the scope of this document since the probability of their appearance is small.

Testing for dust in camera module

Symptoms and diagnosis

For detecting dust problems, take an image of a uniform white surface and analyse it in full resolution. A good quality PC CRT monitor is preferred for analysis (avoid using LCD). Search carefully because finding these defects is not always easy. Figure "Effects of dust on optical path" is an example of an image having easily detectable dust problems.

When taking a white image, use uniformly lightened white paper or white wall. Another option is to use uniform light but in this case make sure that the camera image is not flickering when taking the test image. In case flickering occurs, try to reduce the illumination level. Use JPEG image format for analysing, and set the image quality parameter to 'High Quality'.

Black spots in an image are caused by dirt particles trapped inside the optical system. Clearly visible and sharp edged black dots in an image are typically dust particles on the image sensor. These spots are searched for in the manufacturing phase, but it is possible that the camera body cavity contains a particle, which may move onto the image sensor active surface, for example, when the phone is dropped. Therefore it is also possible that the problem will disappear before the phone is brought to service. The camera should be replaced if the problem is present when the service technician analyses the phone.

If dust particles are lying on the infrared filter surface on either side, they are hard to locate because they are out of focus, and appear in the image as large, grayish and fading-edge 'blobs'. Sometimes they are invisible to the eye, and the user probably does not notice them at all. However, it is possible that a larger particle disturbs the user, causing need for service.

Figure 71 Effects of dust on optical path

If large dust particles get trapped on top of the lens surface in the cavity between the camera window and the lens, they will cause image blurring and poor contrast. If dust stays on the camera module surface, camera cussion, camera bezel or window at assembling, dust may sneak into the optical system as the optical zoom or Auto focus lens moves back and forth. The camera cussion and bezel between the window and the lens unit or camera module should prevent any particles from getting into the cavity after the manufacturing phase.

If dust particles are found on the sensor, this is classified as a manufacturing error of the module, and the camera should be replaced. Any particles inside the cavity between the protection window and the lens have most probably been trapped there in the assembly phase at a Nokia factory. Unauthorized disassembling of the product can also be the root of the problem. However, in most cases it should be possible to remove the particle(s) by using clean compressed air. Never wipe the lens surface before trying compressed air; the possibility of damaging the lens is substantial. Always check the image sharpness after removing dust.

Testing camera image sharpness

Symptoms and diagnosis

If pictures taken with a device are claimed to be blurry, there are five possible sources for the problem:

1 The protection window is fingerprinted, soiled, dirty, visibly scratched or broken.

2 The camera module has failed to focus correctly, producing a blurred image.

3 User has tried to take pictures containing their intended objects, and the images are blurred or not focused in their intended object. Auto focus is calculated in the center of the image and locked by a half press of the shutter button. If the focus is not locked at the user's intended object, the object in the reproduced image is blurred or not focused well. This is not a cause to replace camera module.

4 Sharpness of the images are different depending on the zoom ratio and sharpness in the image is different depending on the location (center to corners), which is a nature of lens unit productions and controlled within a reasonable variations. This is not a cause to replace camera module.

5 User has tried to take pictures and images are blurred due to handshake, shutter button pressing, dark conditions or carelessness.

6 There is dirt between the protection window and the camera lens.

7 The protection window is defective. This can be either a manufacturing failure or caused by the user. The window should be changed.

A quantitative analysis of sharpness is very difficult to conduct in any other environment than optics laboratory. Therefore, subjective analysis should be used.

If no visible defects (items 1-4) are found, a couple of test images should be taken. Generally, a well-illuminated typical indoor scene, such as the one in Figure "Good image taken indoors", can be used as a target. The main considerations are:

- The camera module has to be given time to focus correctly. Correct focusing is normally indicated with a flashing icon or green bracket in the viewfinder. During focusing, the image in the viewfinder moves slightly back and fourth, this is normal and shows that the lens unit is moving. During the movement a faint sound can be heard from the camera head.
- The protection window has to be clean.
- The amount of light (300 – 600 lux (bright office lighting)) is sufficient.
- The scene should contain, for example, small objects for checking sharpness. Their distance should be 1 – 2 meters.
- The focus should be locked to the object containing edges or textures by pointing the object in the center of the image.
- If possible, compare the image to another image of the same scene, taken with a different device. Note that the reference device has to be a similar Nokia phone.

There are several conditions in which AF operation is challenging for the camera module, i.e. failing from time to time. These include:

- Low light scenes and night mode
- Scenes with low contrast
- Short distance to object (less than 30 cm)
- Fast-moving objects

Under low light and night mode the AF function is slower than under good light, it may even fail to find correct focus position. Low contrast scenes or fast moving objects may also slow down or cause AF to fail. This is normal operation, and is not a cause to replace camera.

The operation of AF can be tested by taking images of objects at different distances. Good distances are 30 cm, 60 cm and infinity (>3 m). Any LED or xenon flashes should not be used while taking the images.

The taken images should be analysed on PC screen with full screen. Pay attention to the computer display settings; at least 65000 colours (16-bit) have to be used. 256 (8-bit) colour setting is not sufficient, and true colour (24 bit, 16 million colours) or 32-bit (full colour) setting is recommended.

If the differences are noticeable at a glance and also if the one under investigation is significantly inferior, the module might have a faulty lens. In this case, the module should be changed. Always recheck the resolution after changing the camera module. If a different module produces a clearly noticeable quality gap, the fault is probably in the camera window. Check the window by looking carefully through it when replacing the module. As references Figure "Good image taken indoors" and Figure "Good image taken outdoors" can be used. Another possibility is to use a service point comparison phone, if available.

Dirty camera lens protection window

The following series of images demonstrates the effects of fingerprints on the camera protection window.

It should be noted that the effects of any dirt in images can vary much. It may be difficult to judge whether the window has been dirty or if something else is wrong. Therefore, the cleanness of the protection window should always be checked and the window should be wiped clean with a suitable cloth.

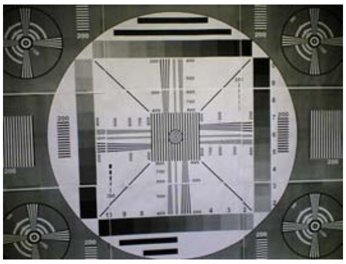


Figure 72 Image taken with clean protection window

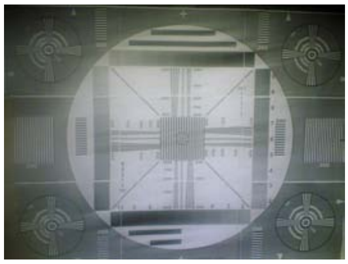


Figure 73 Image taken with greasy protection window

Image bit errors

Bit errors are image defects caused by data transmission errors between the camera module and the phone baseband and/or errors inside the module.

Usually bit errors can be easily detected in images, and they are best visible in full resolution images. A good practice is to use a uniform white test target when analysing these errors. The errors are clearly visible, colourful sharp dots or lines in camera images. See the following figure.

Figure 74 Bit errors caused by JPEG compression

One type of bit error is a lack of bit depth. In this case, the image is almost totally black under normal conditions, and only senses something in very highly illuminated environments. Typically this is a contact problem between the camera module and the phone main PWB. You should check the camera assembly and connector contacts.

If the fault is in the camera module, bit errors are typically visible only when using some specific image resolution. For example, in case of a viewfinder fault, the error might exist but is not visible in a full size image.

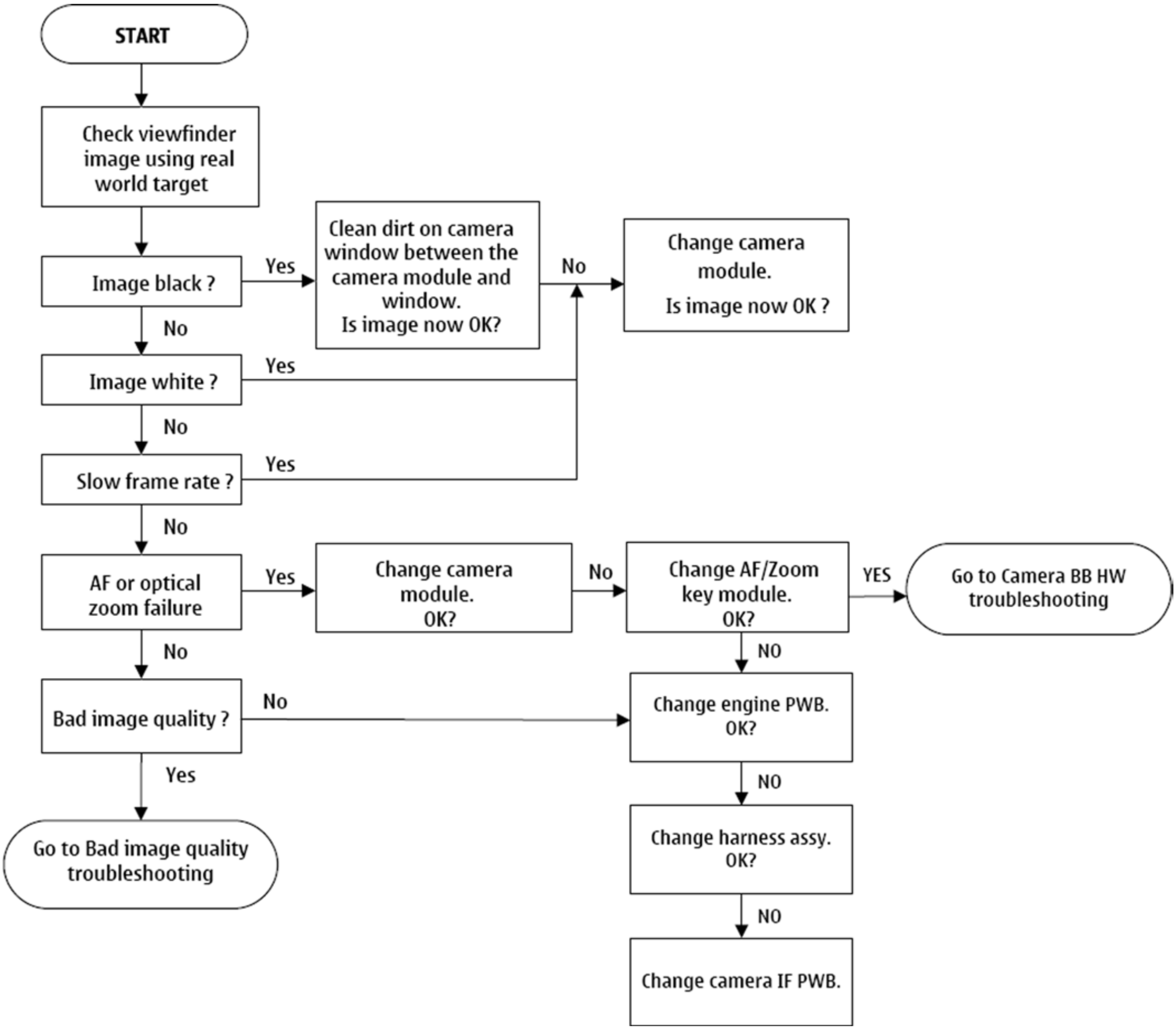
Note: At the most 5 clusters of black dots or blemish are not considered errors, and no reason to replace camera module

Camera troubleshooting flowcharts

Main camera troubleshooting

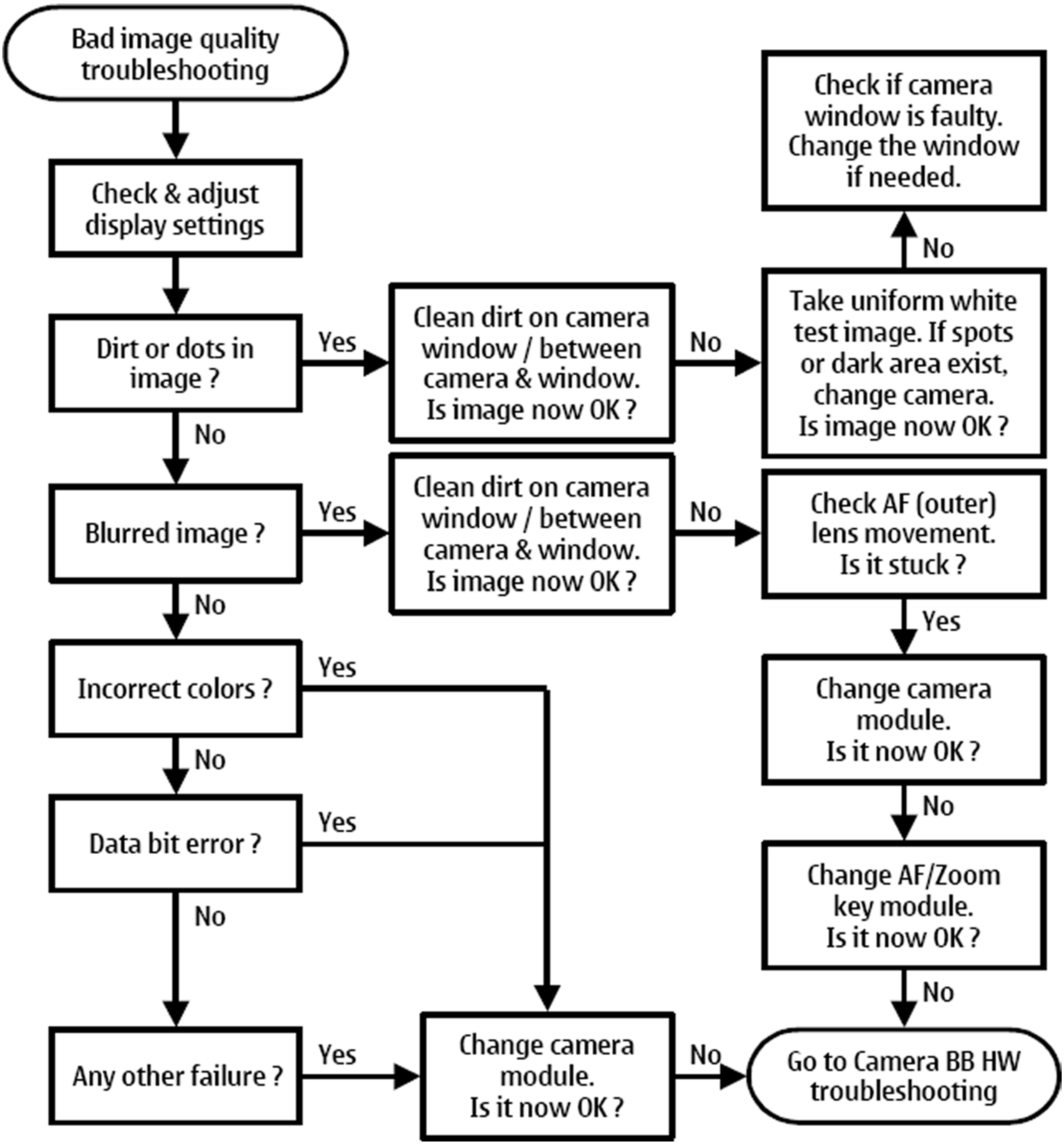
Camera viewfinder troubleshooting

Troubleshooting flow



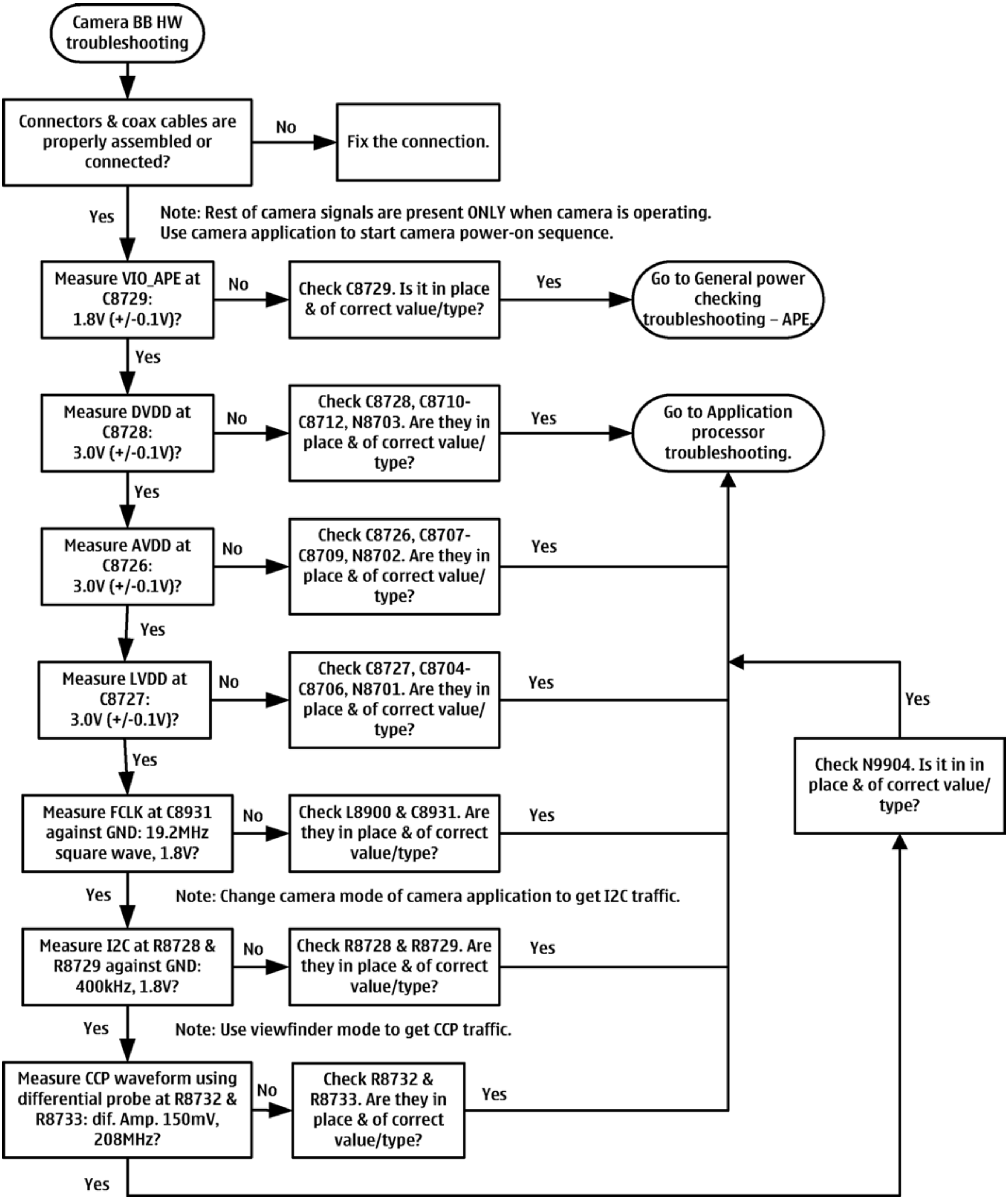
Bad image quality troubleshooting

Troubleshooting flow



Camera baseband HW troubleshooting

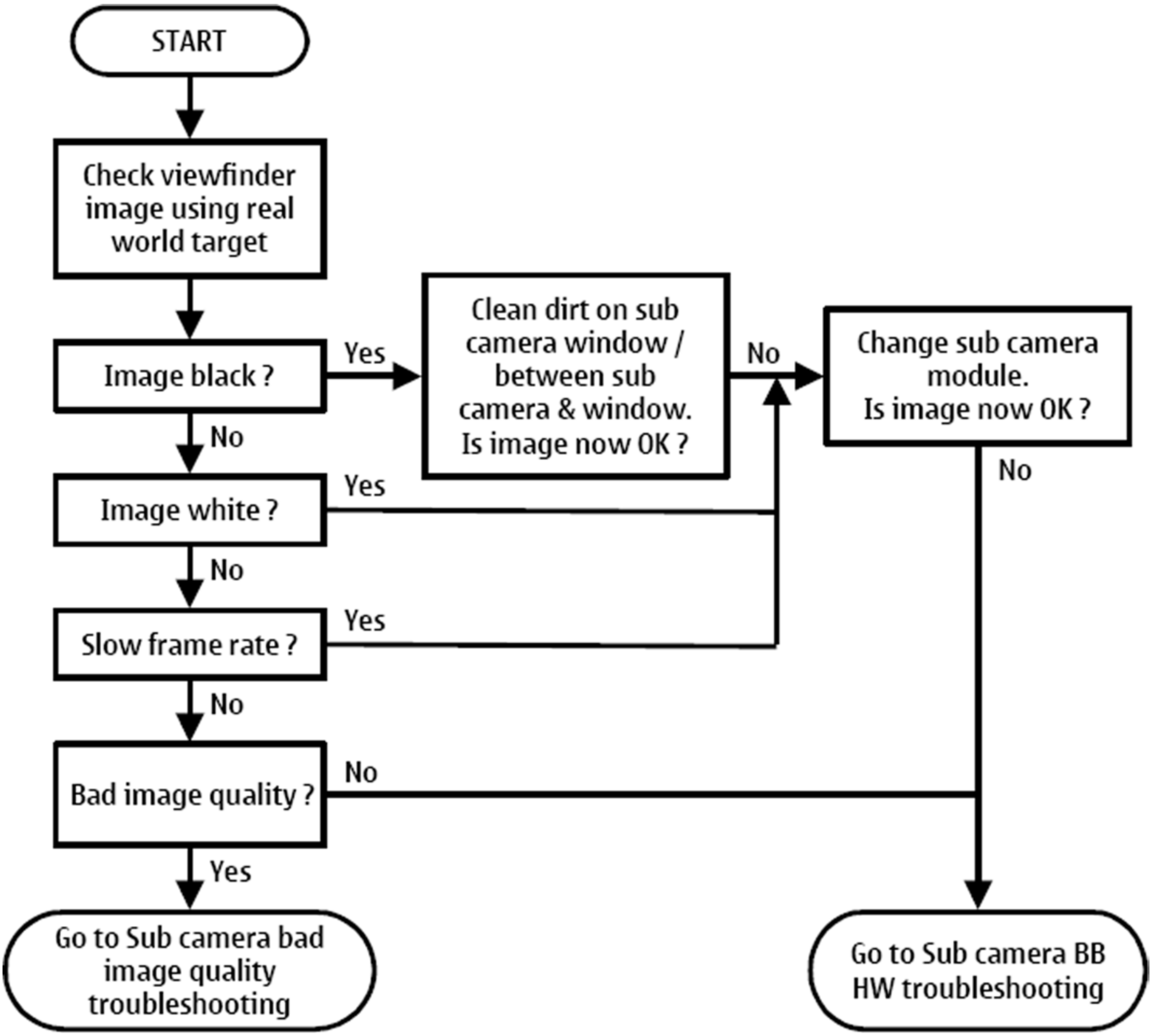
Troubleshooting flow



Sub camera troubleshooting

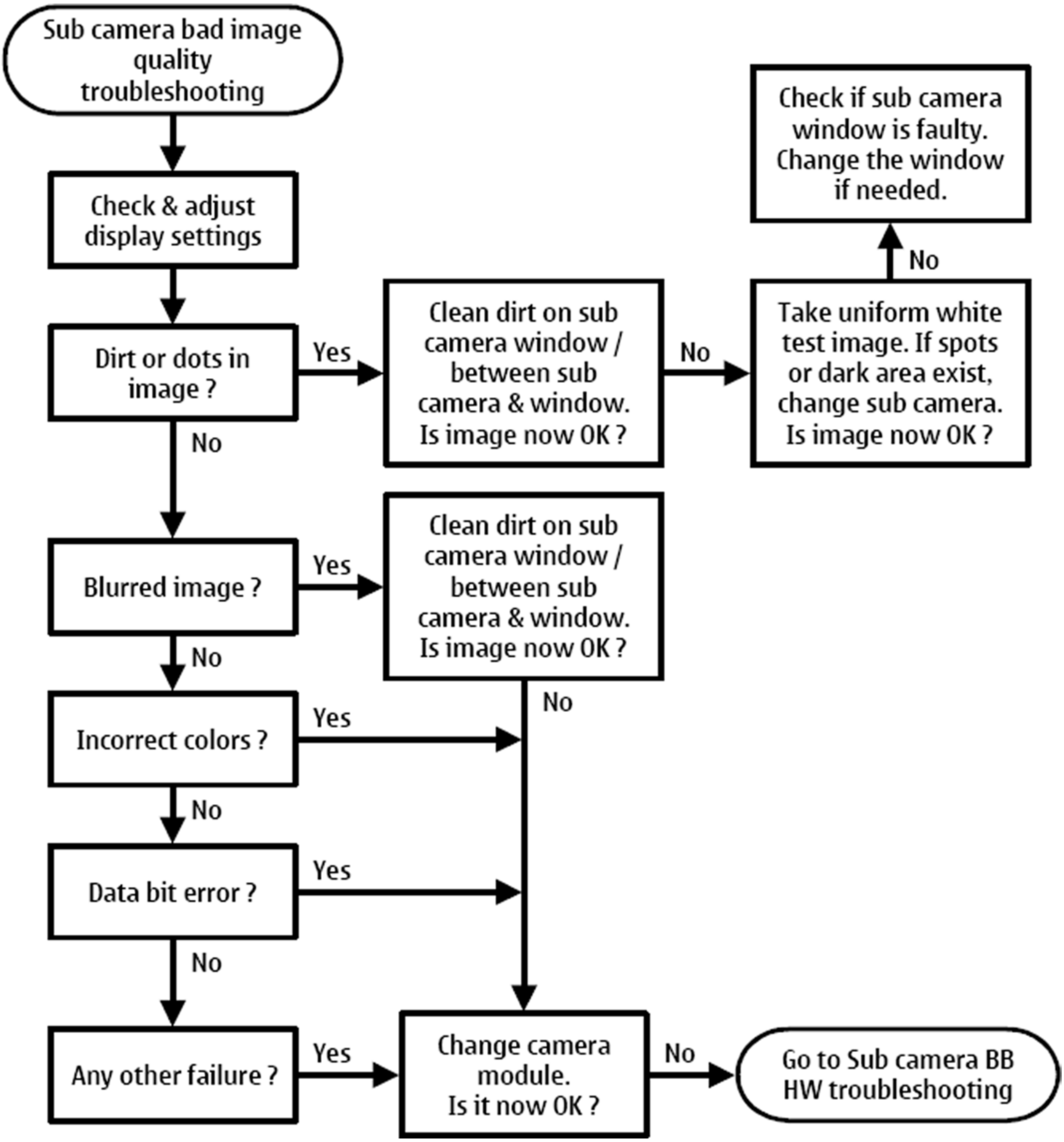
Sub camera viewfinder troubleshooting

Troubleshooting flow



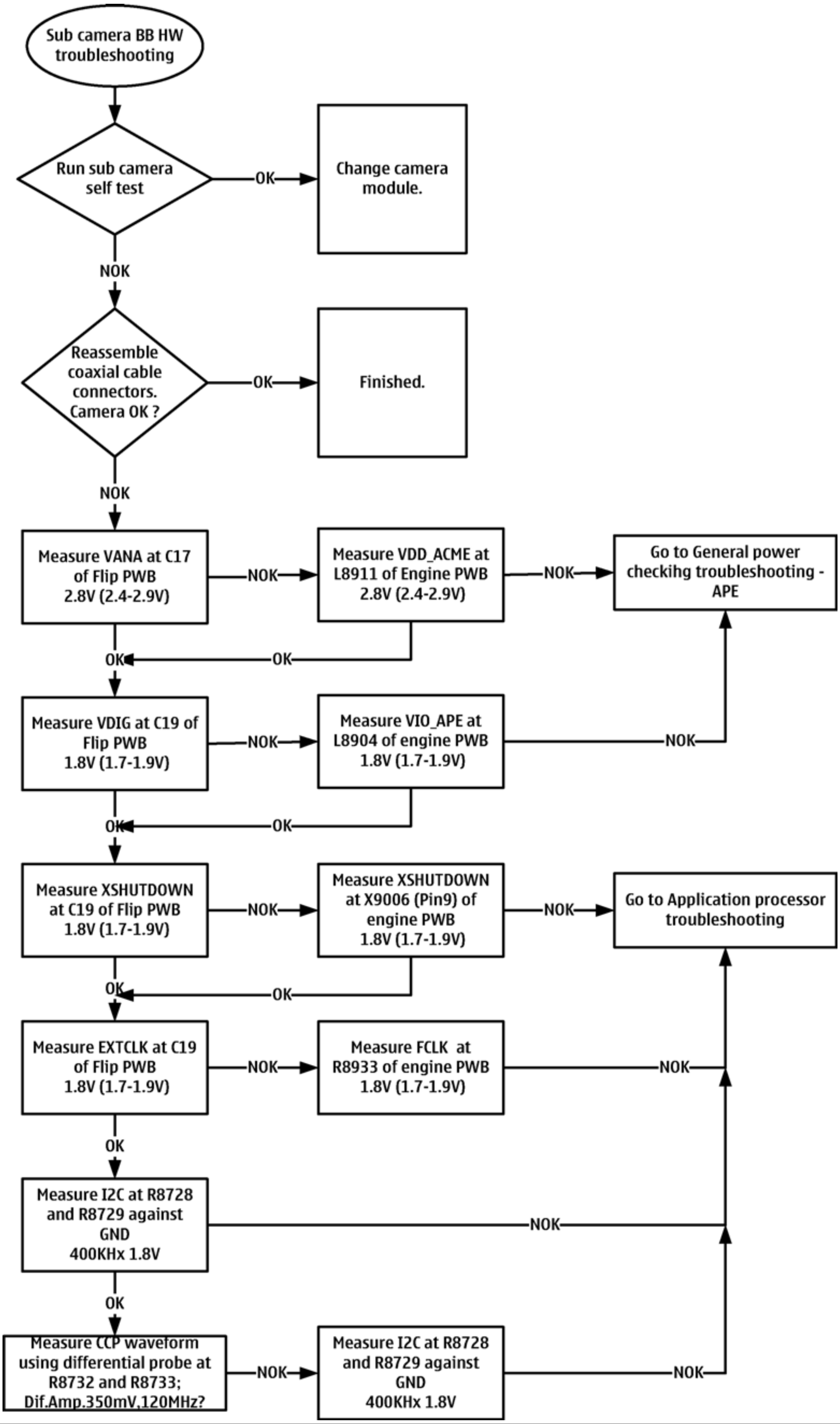
Bad image quality troubleshooting

Troubleshooting flow



Sub camera baseband HW troubleshooting

Troubleshooting flow



Flash LED troubleshooting

Introduction to flash LED troubleshooting

A fault or complaint associated to LED flash operation can be roughly categorized into two subgroups:

1 Flash is not functional at all (no light output at all).

2 Images can be taken and they are recognizable but for some reason the quality of images is degraded.

Examples of quality degradations:

- Brightness is not sufficient.
- Brightness is too much = overexposed.
- Only portions of the image brightness (e.g., left, right, top or bottom) are proper and the rest are not.

The quality of an image is very difficult to measure quantitatively, and even comparative measurements are difficult (comparing two images), if the difference between reference images is small. If a user is not satisfied with his/her device's image quality, it is fairly difficult to accurately test the device and get an exact result, which would tell if the device is working properly.

Often subjective evaluation has to be used for finding out if there is something wrong in the flash. Some training or experience of a correctly operating reference device may be needed in order to detect possible faults. It is easy for a user to take low quality images in bad conditions. Therefore, the camera and flash operation has to be always checked in constant conditions (lighting, temperature) or by using a second, known-to-be good reference device.

Flash LED and image taking conditions

This section describes some of common factors, which may cause poor image quality if not taken into account by end users when taking pictures, and may therefore result in complaints. The items described are normal to the camera and LED flash operation and do not raise a need for servicing the components.

Figure 75 Example of a good quality image taken with the flash LED

Distance to the target (too close)

There is no feedback in the flash system, which means that the light output is constant in every situation. This causes the images to overexposure, when shot from close distance. The flash LED is designed to work optimally between distances of 70 cm – 1.2 m.

This is normal behaviour; do not change the flash module.

Figure 76 overexposed image

Distance to the target (too far away):

The power of the white LED flash is still very modest compared to xenon flash technology. Even with full power, the maximum distance for an acceptable image quality is roughly 1.2 m. If the distance is greater than 1.2 m, the images will appear dark and the noise level increases.

This is normal behaviour; do not change the flash module.

Figure 77 Dark and noisy image

Shaken (= blurred) images

The traditional xenon flash has the advantage of stopping the movement. This is a result of an extremely short and intense light pulse, which makes it possible for a camera to use very short exposure time. Due to the weak output of the LED flash, the exposure time has to be actually increased in the viewfinder mode in total blackness, instead of shortening it. This allows the sensor to integrate longer and collect more light but this also easily creates blurred images if care is not taken.

In addition to the limitation due to small LED flash light, handshake owing to camcoder type product concept and shutter button operation exists. These are not errors but a limitation of the product. No need to change the LED flash module.

Figure 78 Shaken image

Camera white balance failure and overexposure due to presence of ambient light

Because the spectral output of the flash is known, the white balance and the exposure control of the camera work in optimal way with the flash in total blackness. This is why some of the pictures may fail (i.e. images get a bit yellow or reddish, or greenish or bluish, depending on the ambient light characteristics, as well as overexposed or underexposed).

If the flash works correctly in dark conditions, there is no need to change the flash module.

Figure 79 Camera white balance failure and overexposure

Colour difference between different modules

There is some variation in the spectrum of the flash, which derives from the manufacturing process of the white LEDs. Because of this variation, there may be some variation in the colour of the images as well.

This is normal behaviour; do not change the flash module.

Figure 80 Color difference between flash colour limit samples

Flash LED overview

Table 21 Flash LED module specifications

Type	White Light Emitting Diode
Material	GaN

Structure	2 chips in 1 package
Forward Voltage VF	3.4 V (typ at IFDC=20mA/chip)
Luminance Intensity	3800 mcd (typ at IFDC=20mA/chip)

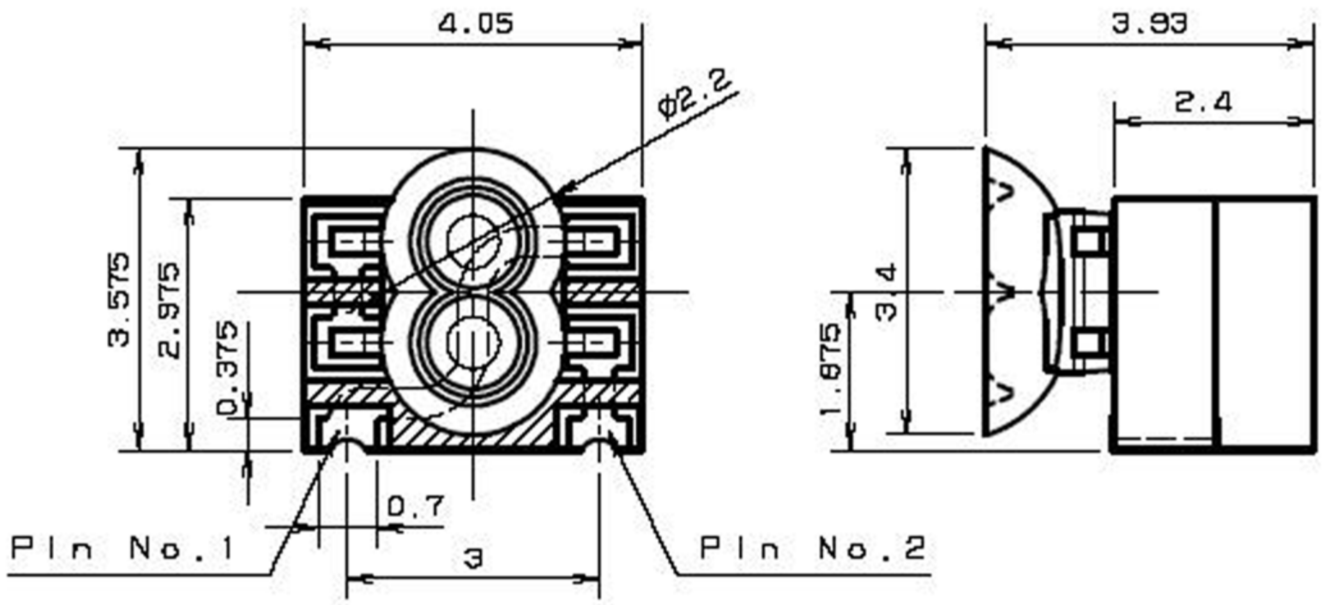


Figure 81 Flash LED mechanics

The flash LED module is not a repairable part, meaning that the components or parts in the module cannot be changed. Only cleaning dust from the lens is allowed; use clean compressed air. The flash LED is soldered to flex-area of the UI PWB.

The main parts of the module are:

- Housing
- Lead frame
- LED chip), which is soldered to the PWB
- Zener diode, which is ESD protection part
- Au wire
- Paste

Image quality analysis

Possible faults in image quality

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

- LED module is not flashing at all
- Image colours are not good
- Flash power is weak

Testing flash module functionality

Context

With the help of this test you can check the flash module's overall functionality.

Always set the flash to FORCED FLASH mode when performing the test. The FORCED FLASH mode enforces the LED module to flash, even if there is some ambient light present.

Steps

1. Take an image with the flash and monitor at same time whether the LED module flashes.

Results

If the LED flashes normally, the overall functionality of the module is OK.

Testing image colours with flash

Context

With the help of this test you can check if the image colours are normal when using the flash.

Steps

1. Take an image of a target, which contains something white in total blackness from less than 1 m range.

Results

If the white target appears to be white, the flash is working correctly. However, remember that there is some variation in the flash colour from module to module.

Testing flash power

Context

With the help of this test you can check if the flash is working with adequate power level.

Steps

1. Take an image with the flash in total blackness (ambient light <1 lux) of a target 80 cm - 1 m away.

Results

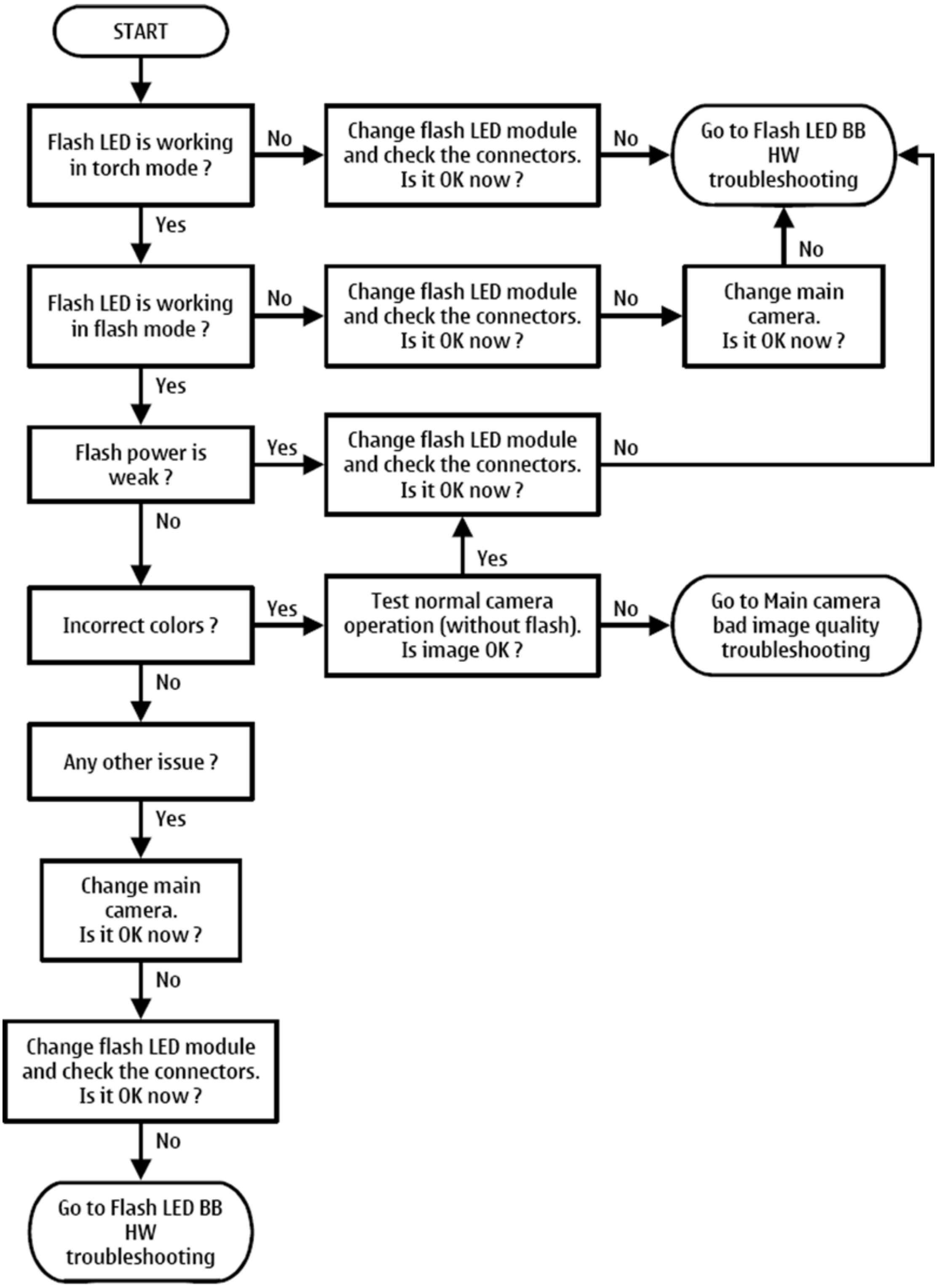
If the flash is working normally with adequate power level, the image is correctly exposed between distances 80 cm to 1 m.

Remember that the brightness level in the corners is always less than in the center of the image because of camera and flash optics.

Flash LED troubleshooting flowcharts

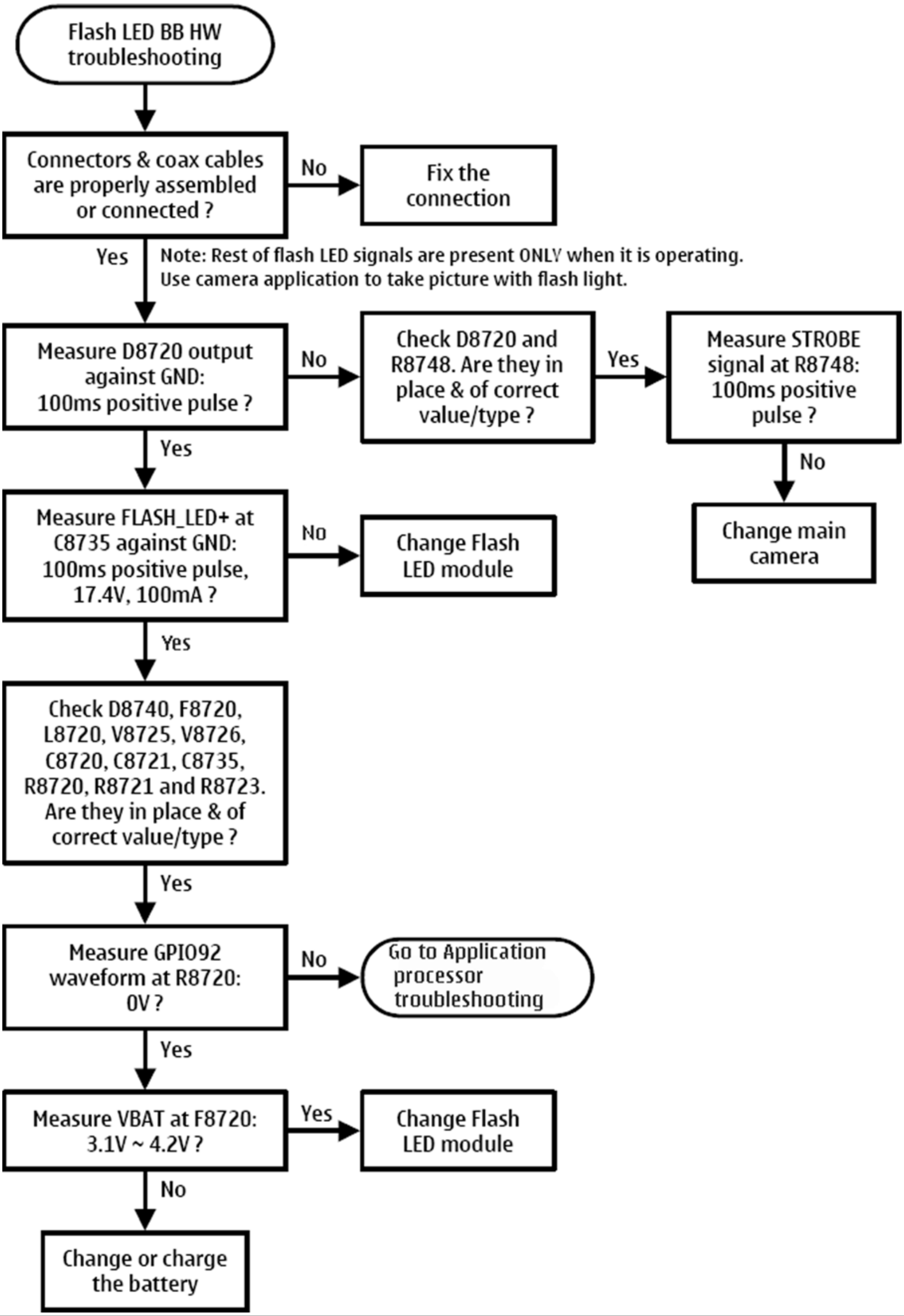
Flash LED functionality troubleshooting

Troubleshooting flow



Flash LED baseband HW troubleshooting

Troubleshooting flow

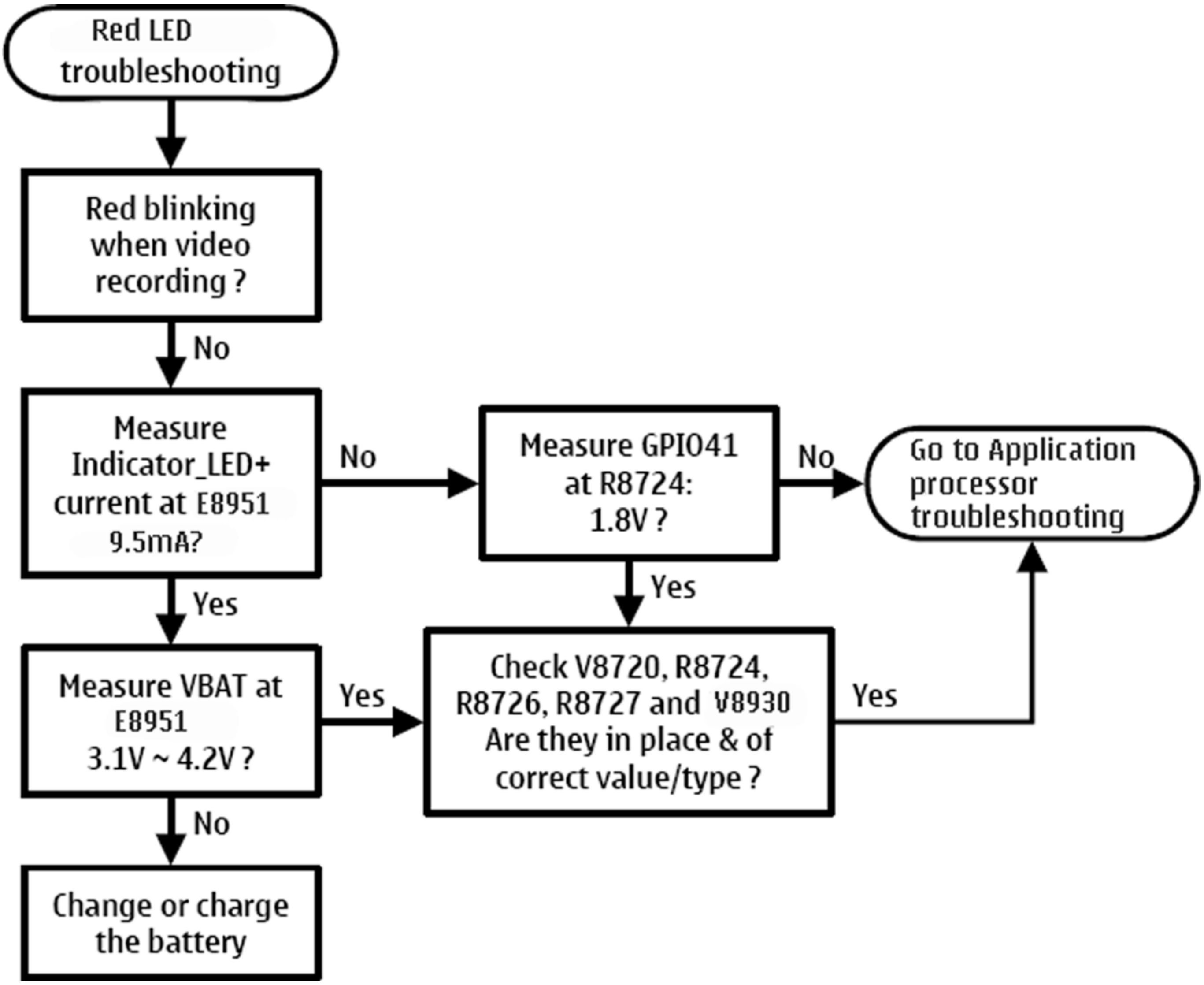


Red LED troubleshooting

Context

For checking the red LED functionality, force the camera application to record a video clip and monitor the red LED at the same time. The red LED notifies video recording operation by red blinking light.

Troubleshooting flow



9 — System Module

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Baseband description

System module block diagram

The device consists of three different main modules: transceiver, UI and flip. The transceiver board consists of baseband and RF components.

The UI board consists of key domes, key backlights, MR sensor, Power-ON switch and microphones for video recording.

The flip board consists of main/sub displays, sub camera, LEDs for some notifications and ALS.

The connection between the UI and the transceiver board is established via a board-to-board connector. The connection between flip and the transceiver is also established by same solution.

> **Note:** In this description, the user interface HW covers display, camera, keyboard, keyboard backlight and ALS.

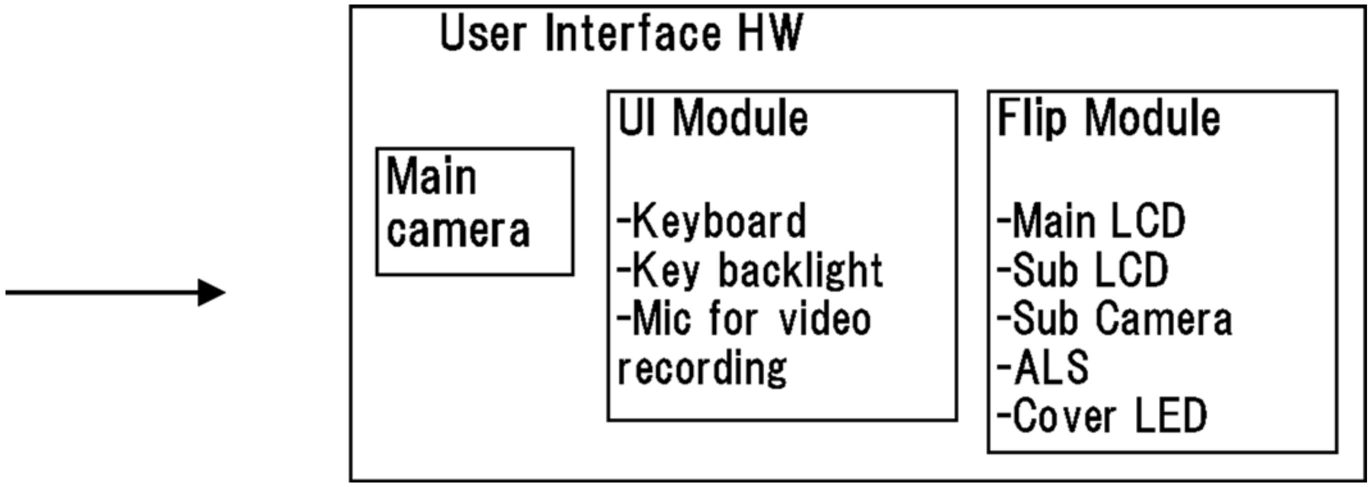


Figure 82 System level block diagram

Baseband functional description

Digital baseband consists of an ISA (Intelligent Software Architecture) based modem and Symbian based application sections. The modem functionality is in RAP, and the application processor acts as a platform for Symbian applications. The terms ISA and Symbian are used refer to the software environment of these devices.

The modem section consists of a RAP ASIC with NOR FLASH and SDRAM memory as the core. RAP supports WCDMA and GSM cellular protocols. The modem DDR SDRAM memory has 128 Mbits of memory and NOR flash has 128 Mbits of memory. RAP operates with the system clock of 38.4 MHz, which comes from the VCTCXO.

The application section includes an application processor ASIC with DDR/NAND combo memory as the core.

Application processor

The application processor is also called an application ASIC because it is processing application SW and handles the UI SW. It consists of the application processor and peripheral subsystems such as camera, display and keyboard driver blocks.

In addition to interfaces mentioned above, the peripherals block includes several different I/O interfaces, for example, for keyboard, modem chip, audio, Bluetooth and so on.

Absolute maximum ratings

Signal	Min	Nom	Max	Unit	Notes
Battery voltage (idle)	-0.3		+4.5	V	Battery voltage maximum value is specified during charging is active
Battery voltage (Call)	+3.2		+4.3	V	Battery voltage maximum value is specified during charging is active
Charger input voltage	-0.3		+20	V	
Back-Up supply voltage	0	2.5	2.6	V	Maximum capacity of the backup power supply assumed to be 10 µAh.

Phone modes of operation

Mode	Description
NO_SUPPLY	(dead) mode means that the main battery is not present or its voltage is too low (below EM ASIC N2200 master reset threshold) and that the back-up battery voltage is too low.
BACK_UP	The main battery is not present or its voltage is too low but back-up battery voltage is adequate and the 32kHz oscillator is running (RTC is on).
PWR_OFF	In this mode (warm), the main battery is present and its voltage is over EM ASIC N2200 master reset threshold. All regulators are disabled, PurX is on low state, the RTC is on and the oscillator is on. PWR_OFF (cold) mode is almost the same as PWR_OFF (warm), but the RTC and the oscillator are off.
RESET	RESET mode is a synonym for start-up sequence. In this mode certain regulators are enabled and after they and RFClk have stabilized, the system reset (PurX) is released and PWR_ON mode entered. RESET mode uses 32kHz clock to count the REST mode delay (typically 16ms).
SLEEP	SLEEP mode is entered only from PWR_ON mode with the aid of SW when the system's activity is low.
FLASHING	FLASHING mode is for SW downloading.

Voltage limits

Parameter	Description	Value
VMSTR	Master reset threshold (N2200)	2.2V (typ.)
VMSTR+	Threshold for charging, rising (N2300)	2.1V (typ.)
VMSTR-	Threshold for charging, falling (N2300)	1.9V (typ.)
VCOFF+	Hardware cutoff (rising)	2.9V (typ.)
VCOFF-	Hardware cutoff (falling)	2.6V (typ.)
SWCOFF	SW cutoff limit	~3.2V

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

Power key

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

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

Power distribution

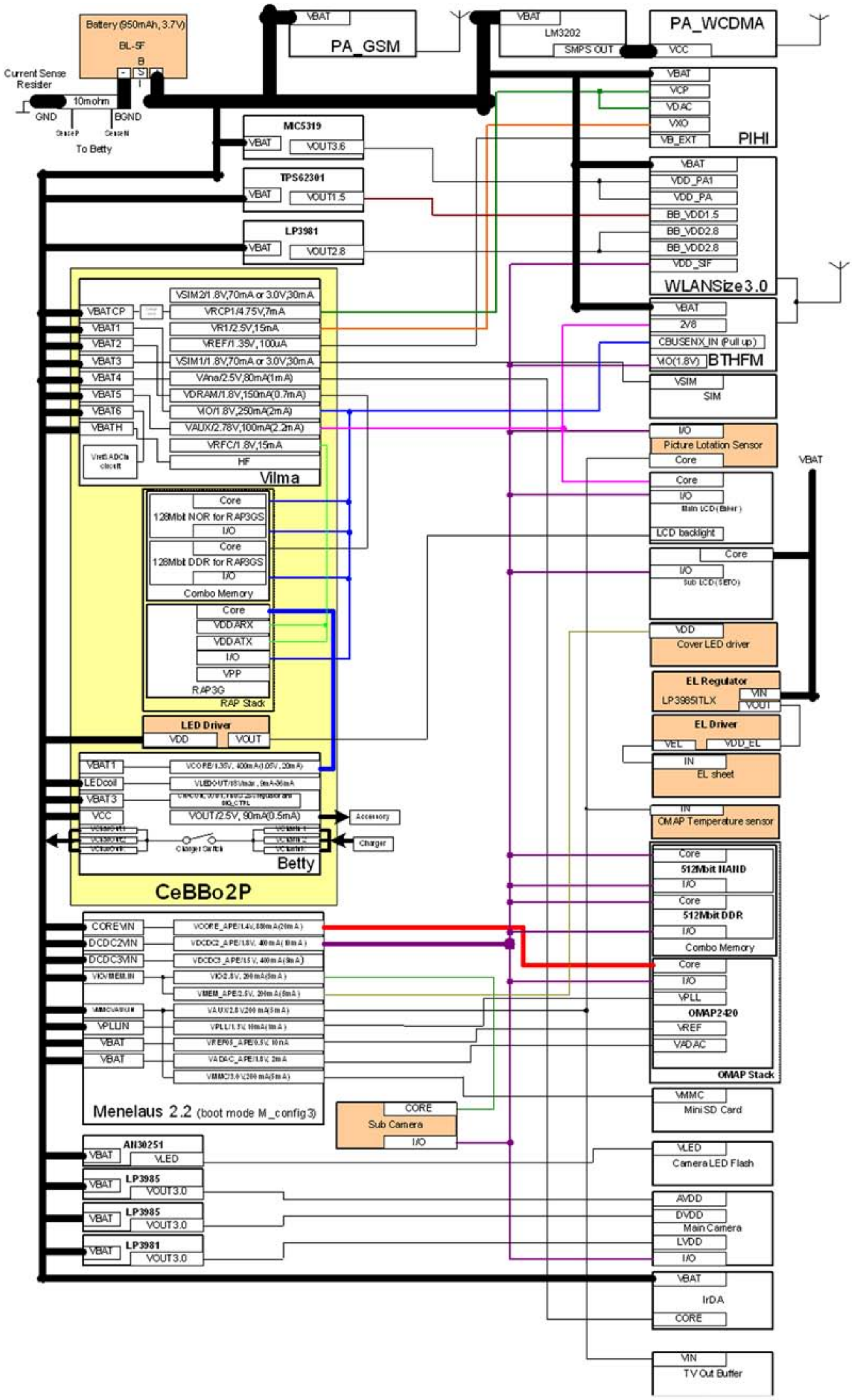


Figure 83 Power distribution diagram

Power supply components:

- CMT module N9101
- EM ASIC N4200
- Application processor VCORE_APE, VIO_APE N4200
- WLAN module supplies: N6303, N6300 and N6301
- Main camera supplies: N8702, N8701 and N8703
- Sub camera suplies: N4200 VDD_ACME
- Mini SD regulator: N4200 VMMC_APE
- Flash LED driver: D8740
- EL driver supplies: N9901 VDD_EL

All the above are powered by the main battery voltage.

Battery voltage is also used on the RF side for power amplifiers (GSM PA & WCDMA PA) and for RF ASICs.

Discrete power supplies are used to generate3.6V/2.8V/1.9V to WLAN, 3.0 V for the camera voltage. The device supports both 1.8 V/3 V SIM cards which are powered by VSIM1.

USB accessories which need power from the device are powered by N9101 / VOUT.

System power-up

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

- Power key is pressed
- Charger is connected
- RTC alarm occurs
- MBUS wake-up

After that:

- N9101 activates sleep clock and VANA, VIO and VR1 regulators.
- Voltage appearing at N9101 RSTX pin is used for enabling other N9101 internal regulators and oscillators.
- VCTCXO regulator is set ON and RF clock (main system clock) is started to produce.
- N9101 will release PURX ~ 16ms after power up is enabled (the RF clock is then stable enough).
- Synchronizing clock (2.4MHz) for N9101 is started to be produced. After PURX is released and two rising edges of 2.4 MHz synchronous clock have been detected in SMPSClk input N9101 is starting to use that instead of 600kHz internal RC-oscillator.
- HW start-up procedure has been finalized and the system is up and running. Now it is possible for SW to switch ON other needed regulators.

Clocking scheme

There are two main clocks in the system: 38.4 MHz RF clock produced by VCTCXO in RF section and 32.768 kHz sleep clock produced by the CMT module N9101 with an internal crystal.

RF clock is generated only when VCTCXO is powered on by the CMT module regulator. Regulator itself is activated by SleepX signals from both RAP and application processor. When both CPUs are on sleep, RF clock is stopped.

RF clock is used by RAP, which provides (divided) 19.2 MHz SysClk further to the application processor. Both RAP and the application processor have internal PLLs which then create clock signals for other peripheral devices/interfaces like RS MMC, SIM, CCP, I2C and memories.

32k Sleep Clock is always powered on after startup. Sleep clock is used by RAP and the application processor for low-power operation.

SMPS Clk is 2.4 MHz clock line from RAP to EM ASIC N2300 used for switch mode regulator synchronizing in active mode. In deep sleep mode, when VCTCXO is off, this signal is set to '0'-state.

BT Clk is 38.4 MHz signal from the RF ASIC to the Bluetooth system.

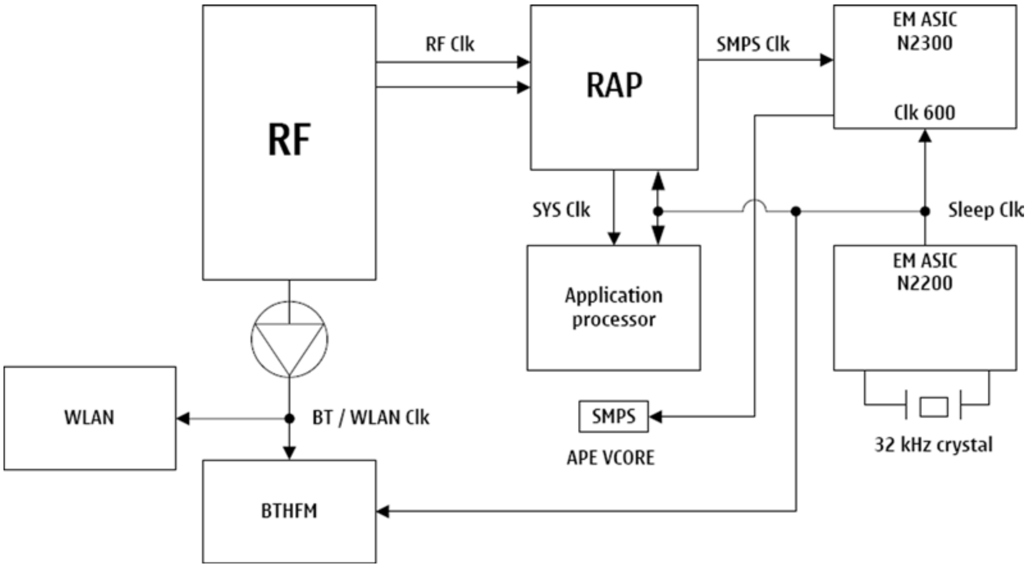


Figure 84 Clocking scheme

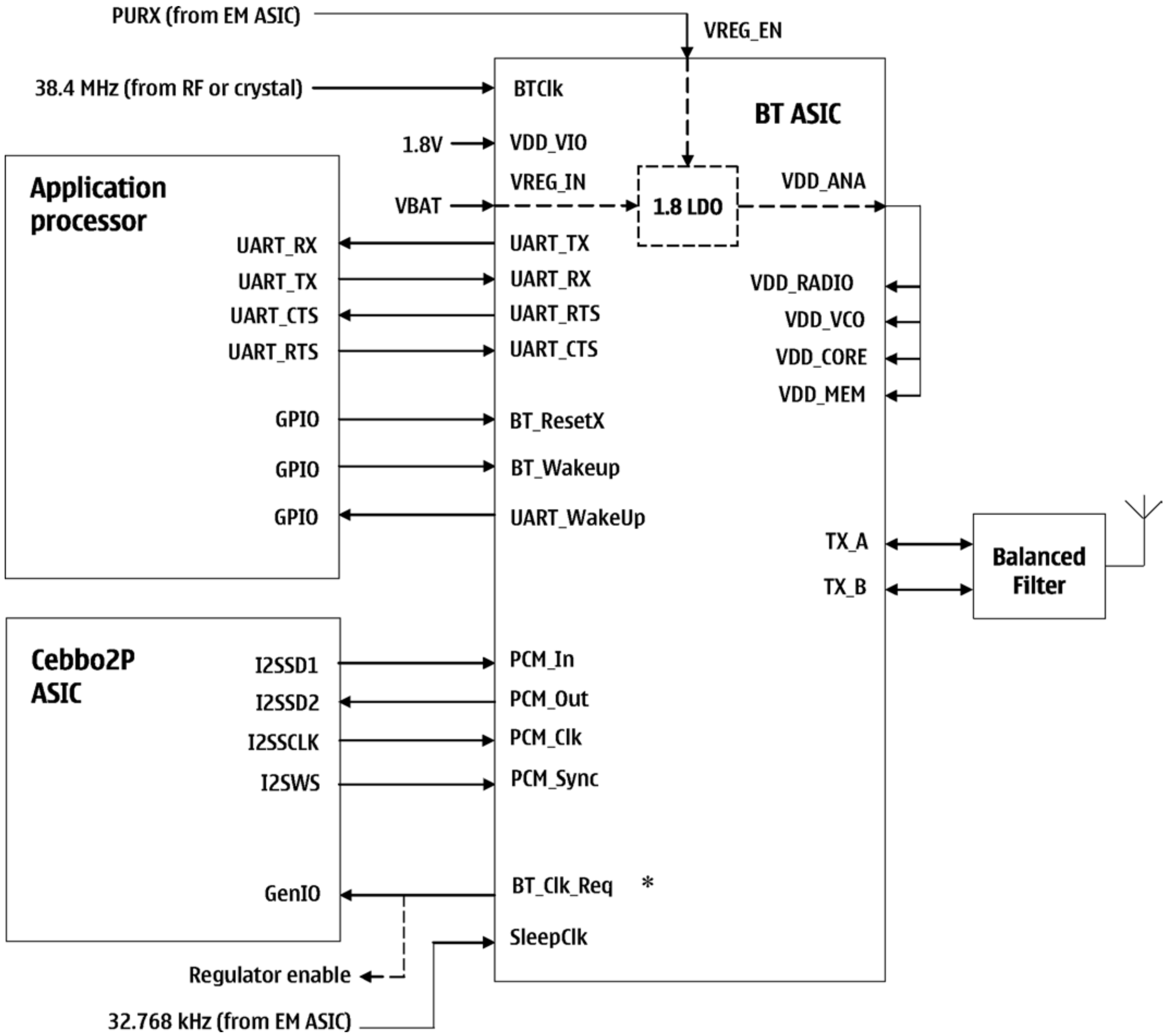
Bluetooth/FM module

The Bluetooth and FM radio solution of the device are realized with a combined BT/FM module. This module has the Bluetooth solution and FM radio solution combined into a single component (BTHFM1.0). However, the two solutions are electrically isolated from one another.

Bluetooth

The first part of the BTHFM1.0 module contains the Bluetooth. Bluetooth provides a fully digital link for communication between a master and one or more slave units. The system provides a radio link that offers a high degree of flexibility to support various applications and product scenarios. Data and control interface for a low power RF module is provided. Data rate is regurated between the master and the slave.

The Bluetooth device is based on the CSR's BC4 ASIC. The UART1 interface handles the transfer of control and data information between the application processor and the Bluetooth system (BC4). The PCM interface is used for audio data transfer between CeBBO2P ASIC and the Bluetooth system (BC4).



FM radio

The second part of the BTHFM module contains the FM radio.

The antenna for the FM radio is provided by plugging in an external wired headset to the system connector. It is not possible to listen to the FM radio without a wired headset connected. The FM radio is controlled by I2C commands coming from RAP. The audio output of the FM radio is fed to the headset via the EM ASIC N2200, so the rest of the phone can sleep while the FM radio is active.

USB

USB (Universal Serial Bus) provides a wired connectivity between a USB host PC and peripheral devices.

USB is a differential serial bus for USB devices. USB controller supports USB specification revision 2.0 with full speed USB (12 Mbps). The device is connected to the USB host through the system connector. The USB bus is hot plugged capable, which means that USB devices may be plugged in/out at any time.

WLAN interface

A Wireless Local Area Network (WLAN) is a flexible data communication system in which a mobile user can connect to a local area network through a wireless connection. The standard, which specifies the technologies for WLAN, is called IEEE 802.11. The device supports both IEEE 802.11.b and 802.11.g standards, so the support data rates are from 1 Mbps to 54 Mbps in 2.4 GHz ISM band.

The WLAN module also requires the reference clock of 38.4 MHz.

The WLAN module uses the same VIO as the application processor.

The same antenna is shared with BT and WLAN. When BT_CLK_REQ is activated and WLANENABLE is disabled, the antenna can be used by BT.

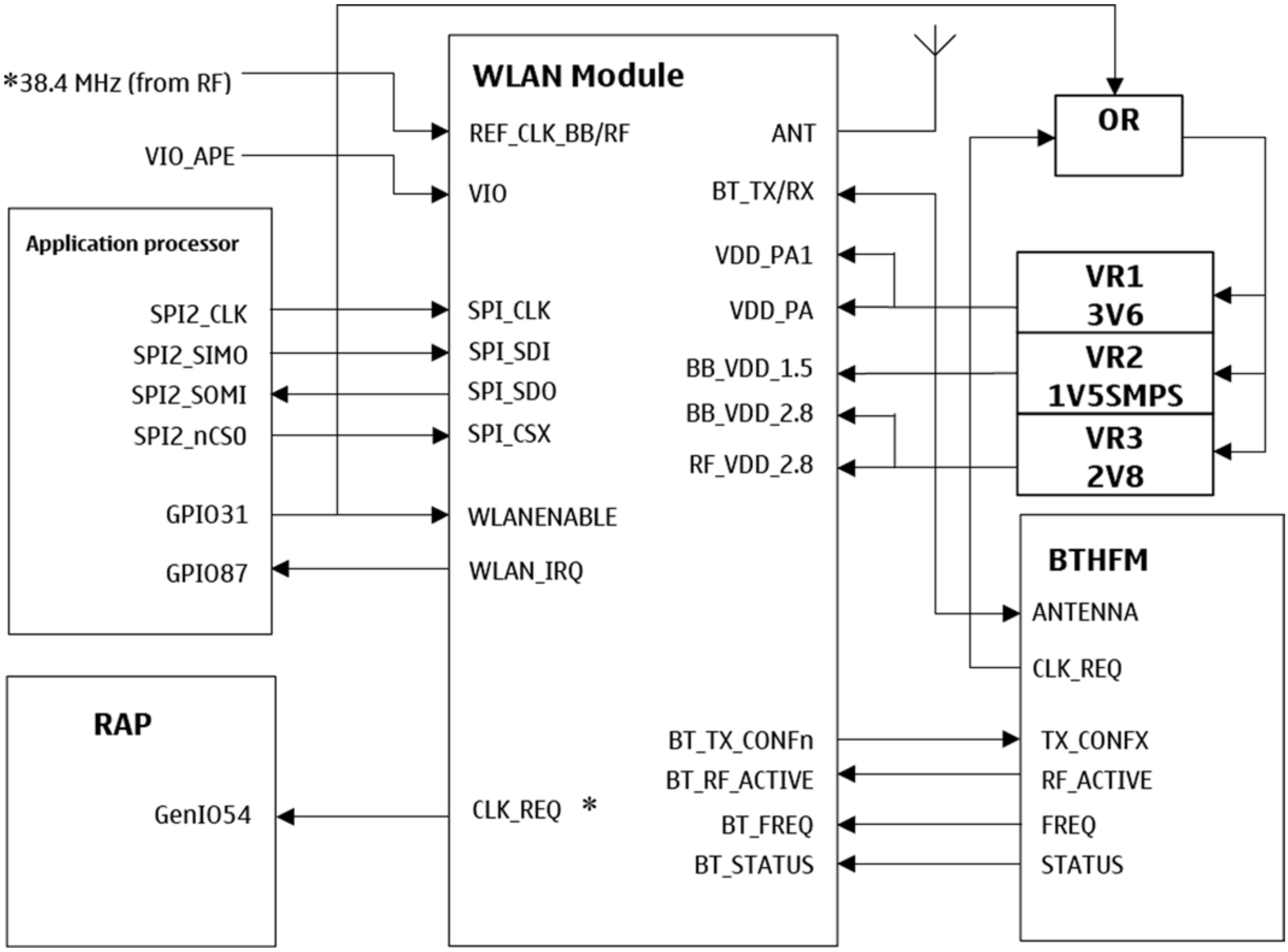


Figure 85 WLAN block diagram

Irda interface

IrDA specifies a low-cost, reliable, fully digital peer-to-peer data link between IrDA units at data rates to 115.2k bits/s. The link is based on the serial transmission of data as pulses of infrared light at the wave length of 870 nm and angles of +-15 degrees at the range 0 - 50 to 100 cm. Because these restrictions and the optical nature of the link, the transmission is not omnidirectional but focused, and only reaches a peer at a limited line-of-sight distance from the transmitter. Therefore, the transmission does not disturb any other units in the neighbourhood.

The IR interface is implemented into the application processor. The processor block uses the UART3 circuit to communicate with a standard IrDA transceiver. The IR transceiver module complies with the IrDA specification version 1.4. The data rates are in the range of 9600 bit/s to 115200 bits/s.

The IR interface in the application processor and the IR transceiver module use the I/O voltage 1.8 V on the Rx (processor receive), Tx (processor send), and SD (IR module shutdown) pins. The IR transmission is powered from the phone battery VBAT (nominal 3.7 V) through a load resistor.

IR communication is half-duplex, meaning that the IR receiver sees its own transmission, and the IR interface is either transmitting or receiving, but not both at the same time. IrDa modules consume current when the IR detector is active.

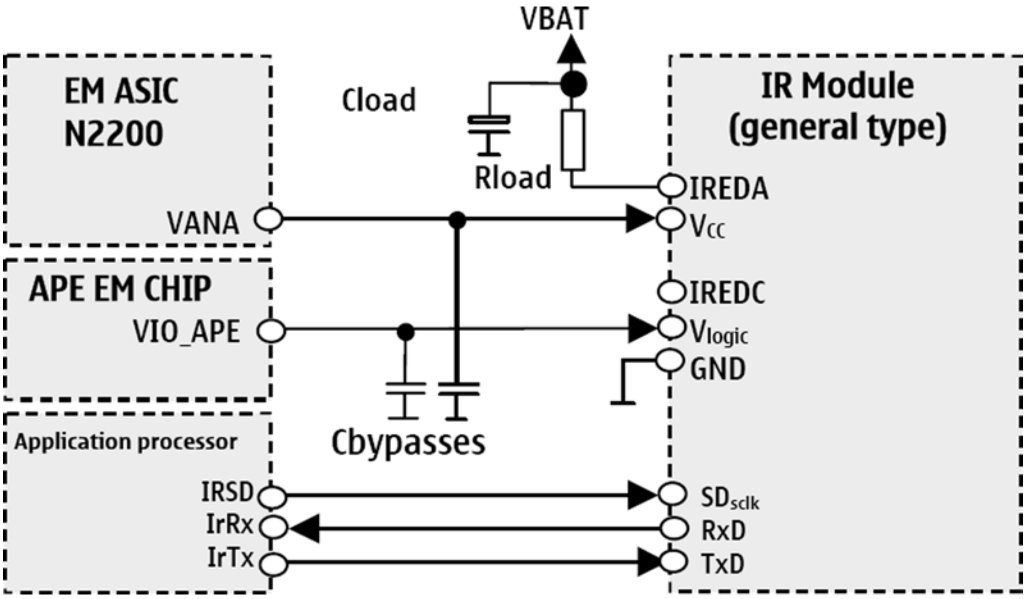


Figure 86 Interconnections between application processor, EM ASICs, and IR module

SIM interface

The device has one SIM (Subscriber Identification Module) Interface. It is accessible only when the battery is removed.

The SIM interface signals consist of data, clk and rst signals which are controlled by CEBB02P (Internally by RAP) and power is taken care by VILMA which is also part of CEBB02P. There is no separate Flexi PWB for SIM and all the signals are directly connected from CEBB02P to SIM connector on the engine PWB.

The SIM IF is shown in the following figure:

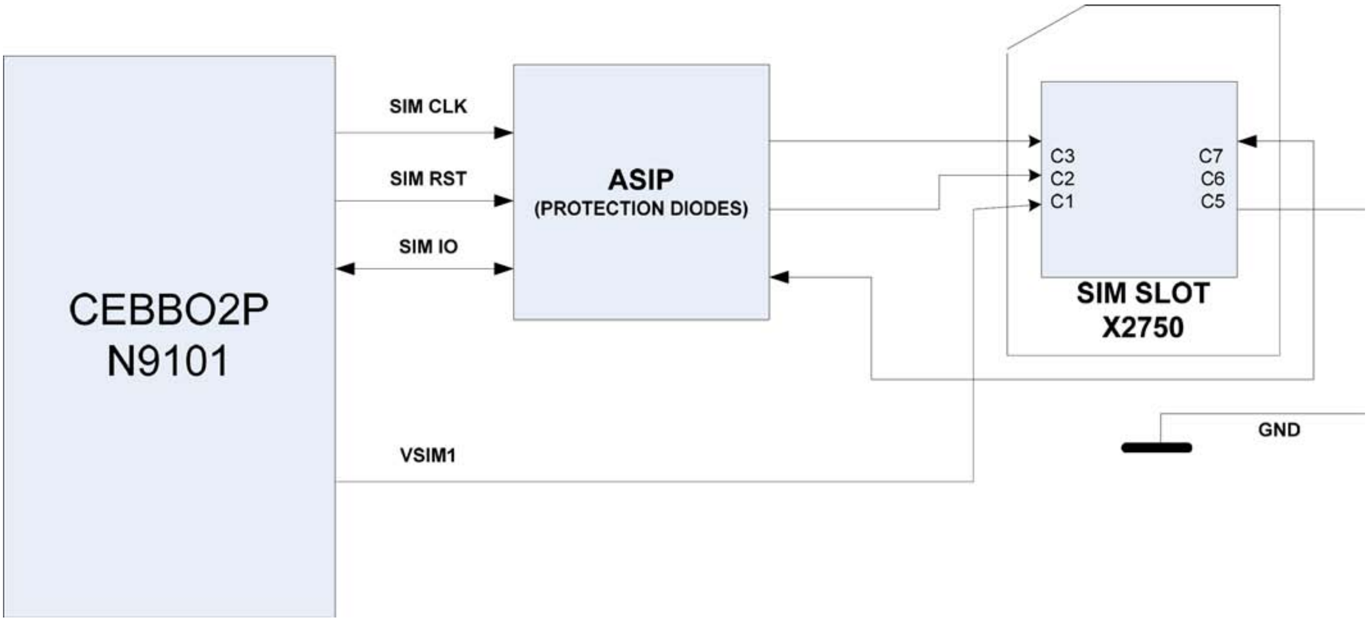


Figure 87 SIM interface

Vilma (energy management ASIC) which is part of CEBBO2P supports both 1.8V and 3.0V SIM cards. The SIM interface voltage is first 1.8V when the SIM card is inserted. If the card does not respond then 3.0V interface voltage is used.

The data communication between the card and the phone is asynchronous half duplex, and the clock supplied to the card is 1-5 MHz, which is 3.2 MHz by default (in GSM system). The baud rate is the SIM clock frequency divided by 372 (by default), 64, 32 or 16.

MiniSD interface

The Secure Digital (SD) card is supplied with 3 V supply voltage. The detection of SD card removal/insertion is done by a switch in the card connector. Removing the SD card while writing to it may corrupt all data in the card.

TV-out interface

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

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

CVBS is a single video signal containing all the necessary information to reproduce a colour picture. The video signal is feed to an external connector.

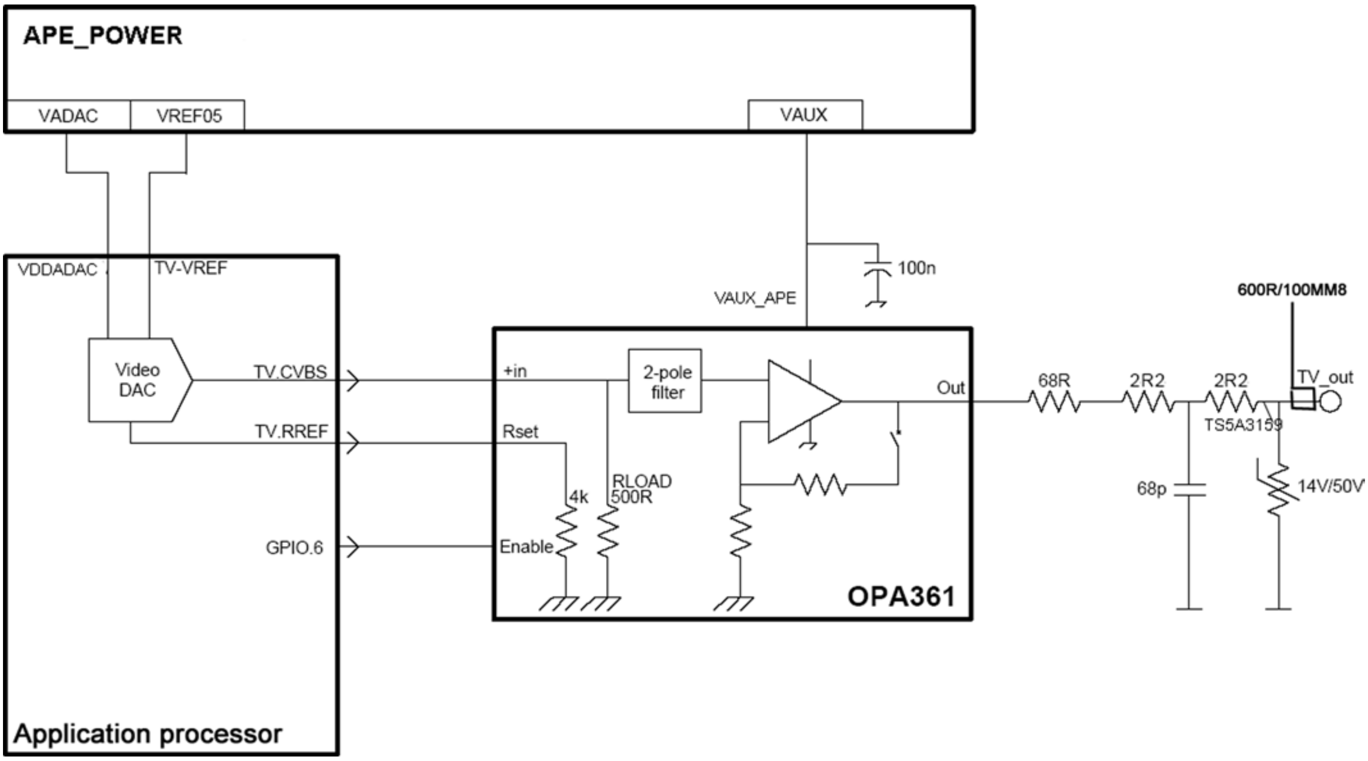


Figure 88 TV-out interface block diagram

Battery interface

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

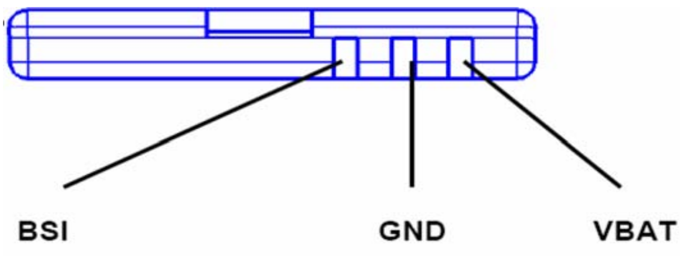


Figure 89 Battery pin order

Battery temperature is estimated by measuring separate battery temperature NTC via the BTEMP line, which is located on the main PWB, at a place where the phone temperature is most stabile.

The connection from the charger connector to the charger is established via a charger adaptor.

For service purposes, the device software can be forced into local mode by using pull down resistors connected to the BSI line.

User interface

Main display

Display module mechanical concept

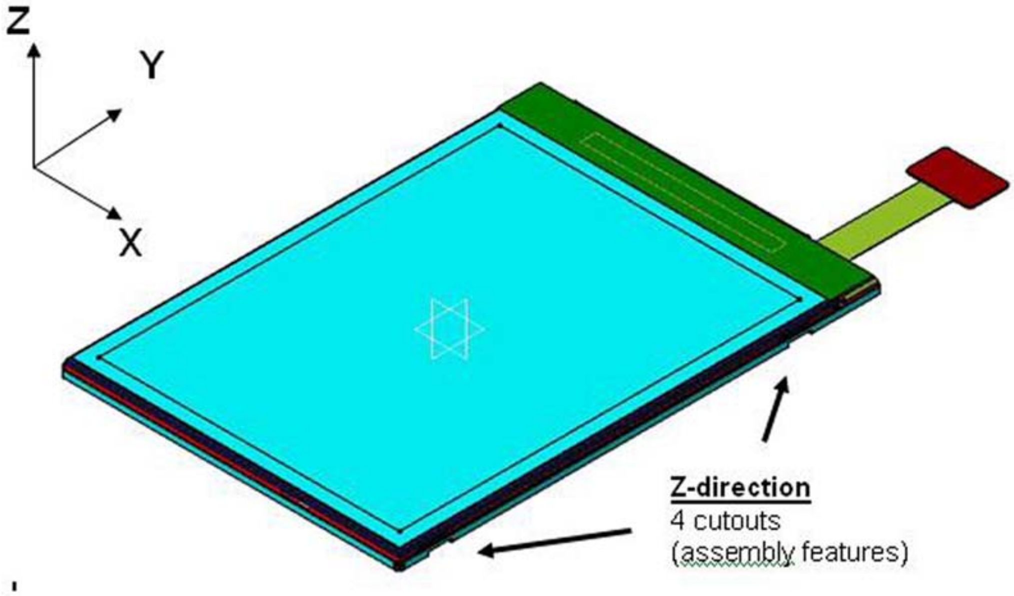


Figure 90 General diagram of the LCD module

Display features:

- Module size (width x height x thickness): 41.82mm x 59.41mm x 1.987mm
- Resolution QVGA
- Numbers of colours up to 16.7M (24bits)
- Partial display function; power saving by pausing display process on part of the screen.
- Built-in RAM capacity 240 columns x 320 rows x 24 bits = 1,382,400 bits

The display has two different operating modes:

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

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

The display is controlled via a MeSSi-16 interface with an 8-bit bus by the application processor. All MeSSi-16 signals go through the EMC filtering ASIPs. The display module does not require any tunings in service.

Keyboard

The device keyboard is connected to the main PWB with a board-to-board connector.

The keyboard has 2 key matrices. The main key pad is in a 5x5 matrix and 5-way key (main) is in another matrix with 5-way key (sub, which is located on the side).

Key	Row# KBC#	Column# Kbr#	Switch Ref
5Way Main Up	C	A	S1

Key	Row# KBC#	Column# Kbr#	Switch Ref
5Way Main Lt	F	A	S2
5Way Main Dn	D	A	S3
5Way Main Rt	E	A	S4
5Way Main Ctr	G	A	S5
softkey1	4	3	S6
Send	3	0	S7
Edit	4	3	S8
1	0	0	S9
4	1	0	S10
7	2	0	S11
*	0	3	S12
Any	4	0	S13
2	0	1	S14
5	1	1	S15
8	2	1	S16
0	1	3	S17
Softkey2	3	3	S18
END	3	1	S19
Clr	3	2	S20
3	0	2	S21
6	1	2	S22
9	2	2	S23
#	2	3	S24
APP	4	1	S25
5Way Side lt	F	B	S26A
5Way Side Dn	D	B	S26B
5Way Side Up	C	B	S26C
5Way Side Rt	E	B	S26D
5Way Side Ctr	G	B	S26E
Mode	1	4	S27
Flash	2	4	S28

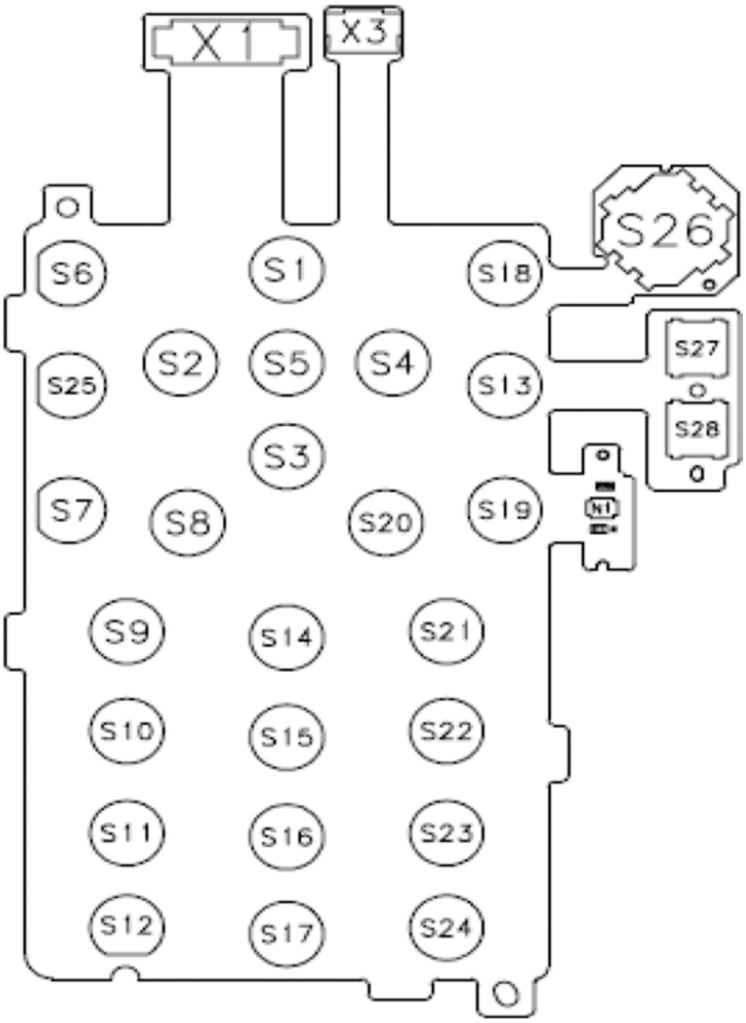


Figure 91 Keyboard layout

Display backlight

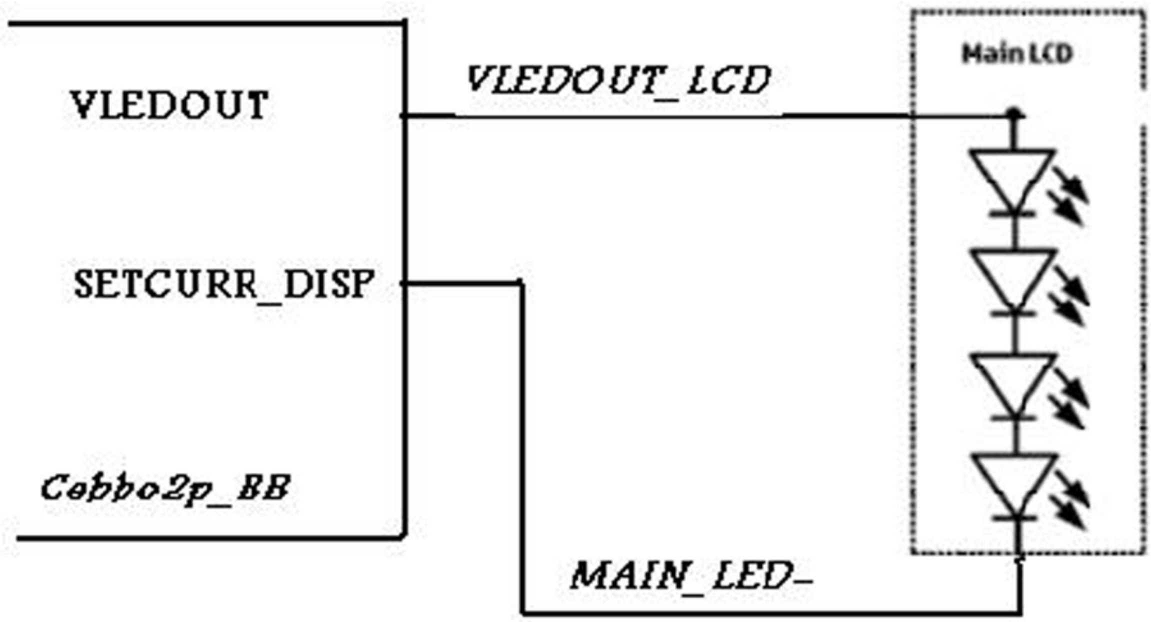


Figure 92 Main display backlight control diagram

Keyboard backlight

The module has an EL (electroluminescent lamp) sheet to achieve keypad backlighting. Keypad backlight is switched ON only in dark ambient light conditions.

Switching ON/OFF of the keyboard backlight is controlled by GENOUT1 pin which is connected to CEBBO2P.

Luminance of keypad backlight is always fixed. The brightness of keypad backlighting can't be varied.

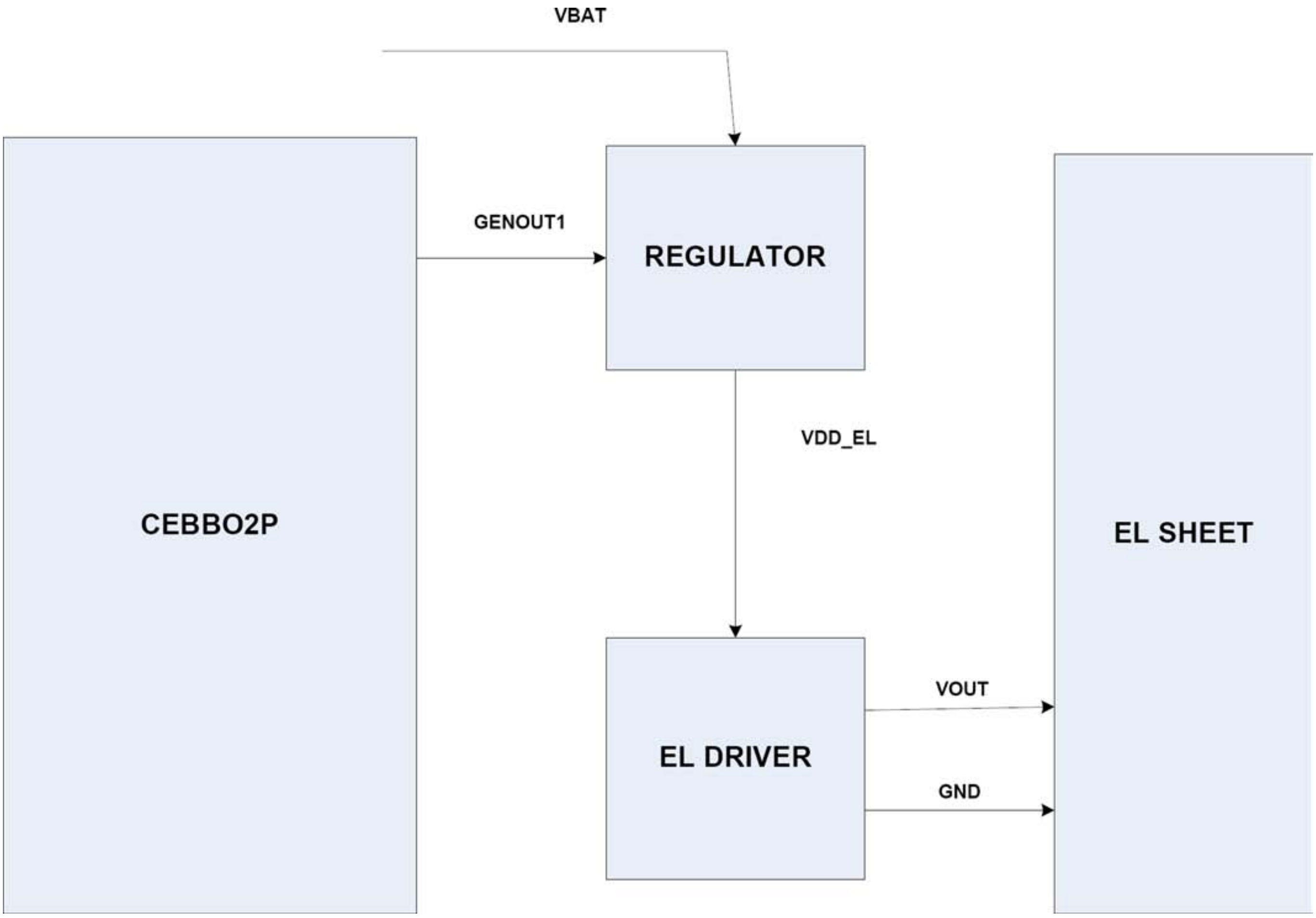


Figure 93 Keyboard backlight block diagram

ALS interface

Ambient Light Sensor (ALS) is located in the flip part of the phone. It consists of the following components:

- lightguide (part of the front cover)
- phototransistor (V1) + resistor (R3)
- NTC + resistor (R2)
- CEBBO2P (N9101)

Information on ambient lighting is used to control the backlights of the phone:

- Keypad lighting is switched on only when the environment is dark / dim
- Display backlights are dimmed, when the environment is dark / dim
- The ambient light sensor itself is a photo transistor, which is temperature-compensated by an external NTC resistor. N9101 reads the light sensor (LS) and temperature (LST) results. ALS calibration is not possible in the service points. ALS is serviced by replacing faulty phototransistors.

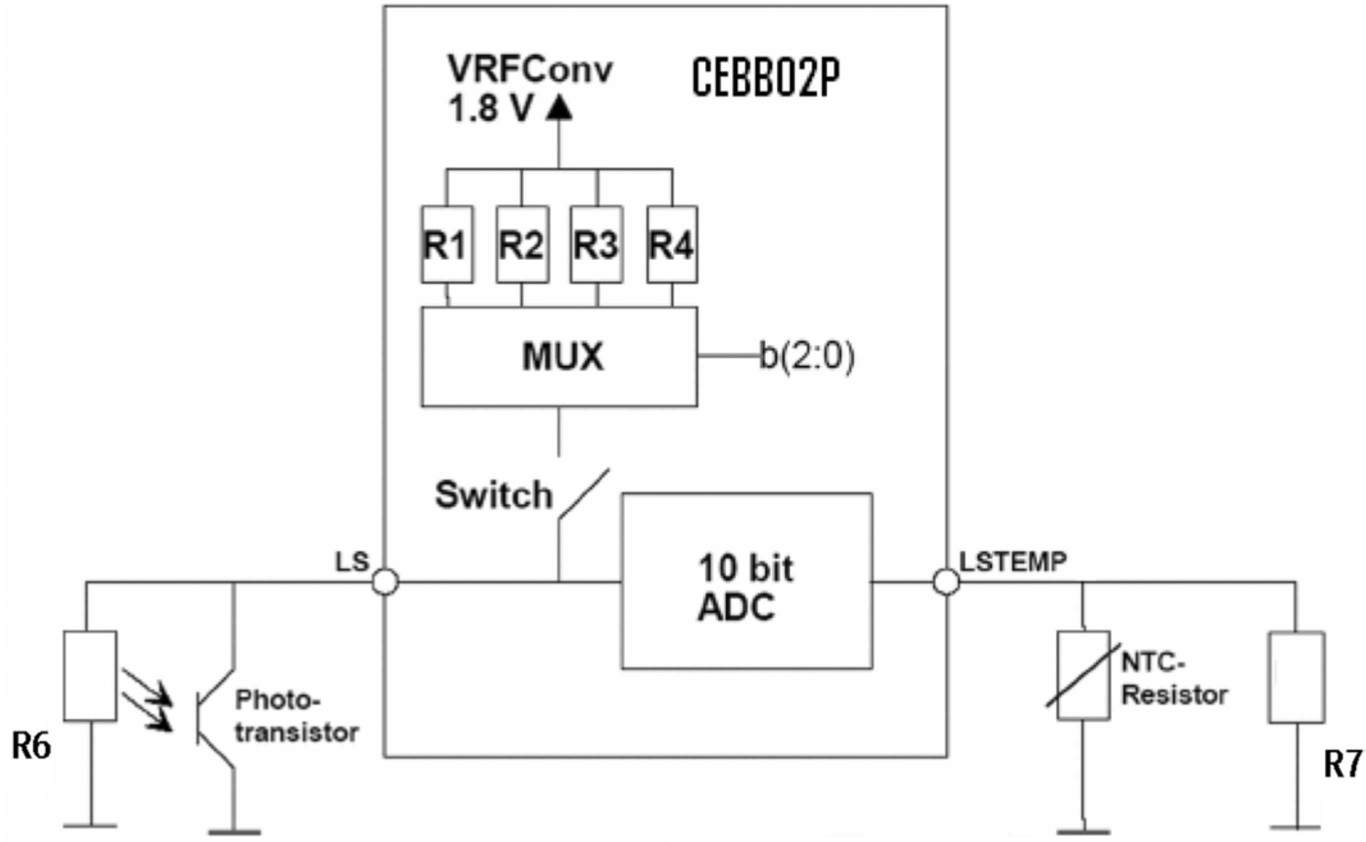


Figure 94 ALS hardware implementation

Table 22 ALS resistor values

Symbol	R1	R2	R3	R4	R6	R7	NTC-res
Value	5 kOhm	15 kOhm	30 kOhm	50 kOhm	100 kohm	470 kohm	47 kOhm

ASICs

Cellular application ASIC, memories, Energy Management ASICs and many passive components are integrated into one module.

The module 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 driver for backlights
- Digital interface (CBUS)
- 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

Device memories

RAP memories NOR flash and SDRAM

Modem memory consists of 128 Mbit SDRAM and 128 Mbit NOR flash memories.

Combo memory

The application memory of the device consists of NAND/DDR combo memory. The stacked DDR/NAND application memory has 512 Mbit of DDR memory and 1024 Mbit of flash memory.

Audio concept

Audio HW architecture

The functional core of the audio hardware is built around two ASICs: RAP CMT engine ASIC and mixed-signal ASIC (N2200).

The mixed-signal ASIC (N2200) provides an interface for the transducers and the accessory connector. Because audio amplifiers are also integrated into the ASIC, the only discrete electronics components needed for audio paths are audio filtering components and EMC/ESD components.

There are three audio transducers:

- 7 x 11 mm dynamic earpiece
- 15 x 11 mm dynamic speaker
- two digital MEMS (Microelectromechanical Systems) microphones
- analog microphone for phone speech

In addition to the audio transducers, N2200 also provides an output for the dynamic vibra component.

All galvanic audio accessories are connected to the system connector.

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

There is also a separate application ASIC for Symbian applications.

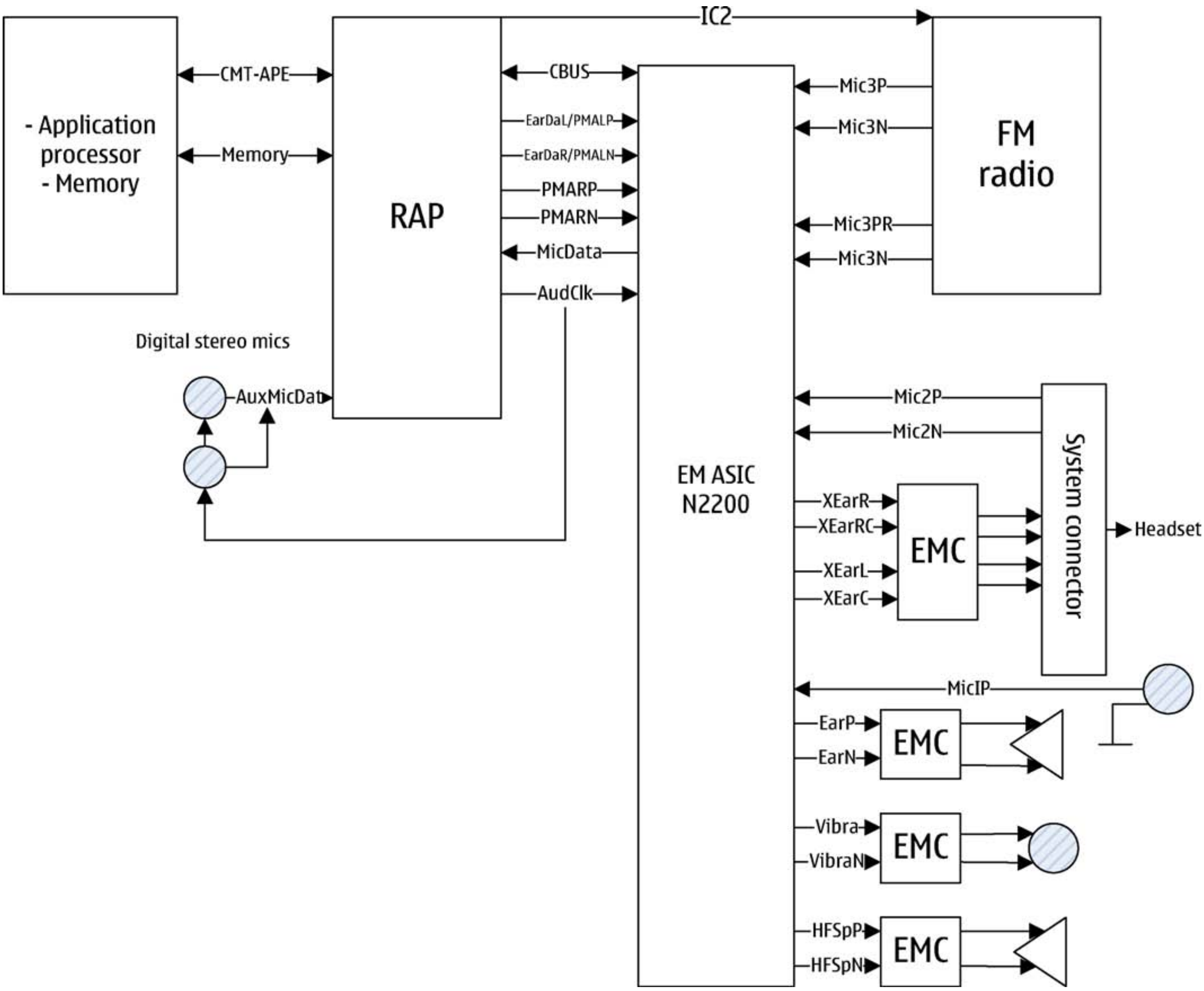


Figure 95 Audio block diagram

Internal digital MEMS microphone

The internal microphone is used for the Internal HandsFree (IHF) call mode, and camcorder stereo recording.

Two digital MEMS microphones are connected to the RAP ASIC (D2800) via an analogue switch IC (N2150). The microphone power and clock signals are controlled by this switch.

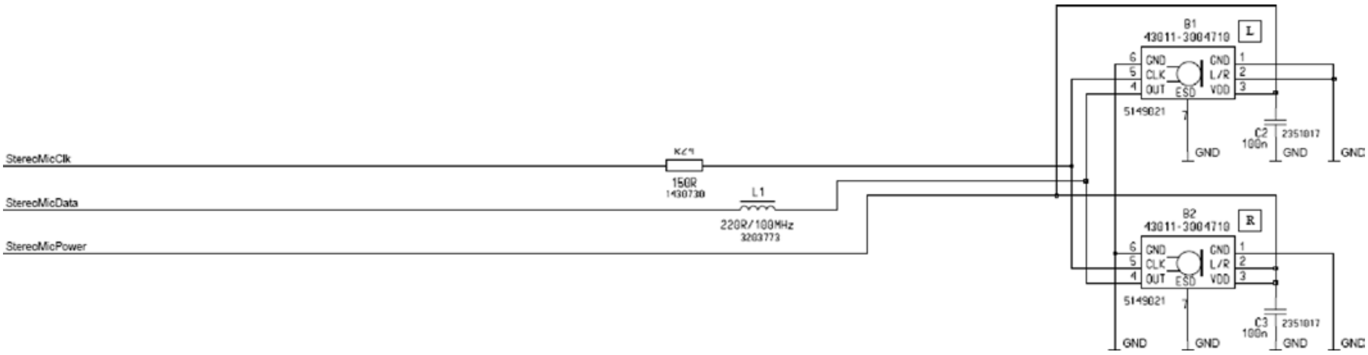


Figure 96 Internal digital microphones circuitry in MicPWR key PWB

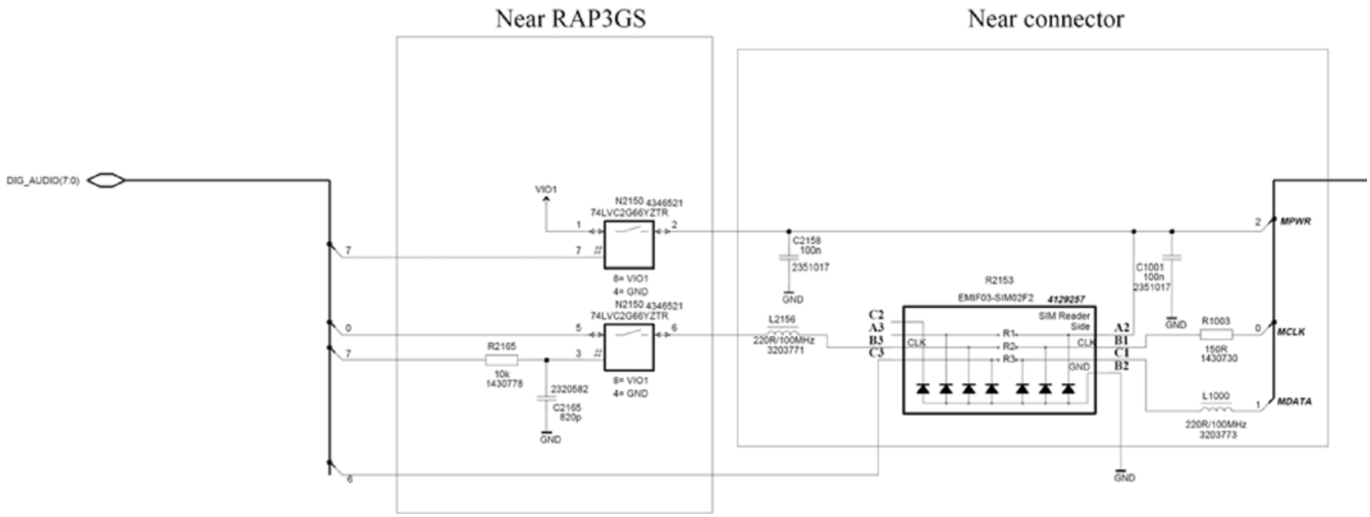


Figure 97 Internal digital microphones circuitry in engine PWB

Internal analog microphone

The internal analog microphone is used for the Handportable (HP) mode.

The microphone is connected to the EM ASIC (N2200) MicIP and GND.

Figure 98 Internal analog microphone circuitry in engine PWB

External microphone

Galvanic accessories are connected to the system connector.

Accessory audio mode is automatically enabled/disabled during connection/disconnection of dedicated phone accessories.

Internal earpiece

The internal earpiece is used in the HandPortable (HP) call mode. A dynamic 7 x 11 mm earpiece capsule is connected directly to the EM ASIC (N2200) differential outputs EarP and EarN through the flip flexi PWB and micro coaxial cable (X6 - X8900).

Internal speaker

The internal speaker is used in Internal HandsFree (IHF) call mode.

A dynamic 15 x 11 mm speaker is connected to the EM ASIC (N2200) outputs HFSpP and HFSpN through the flip flexi PWB and micro coaxial cable (X6 - X8900).

The IHF amplifier integrated in N2200 is a Digital Pulse Modulated Amplifier (DPMA).

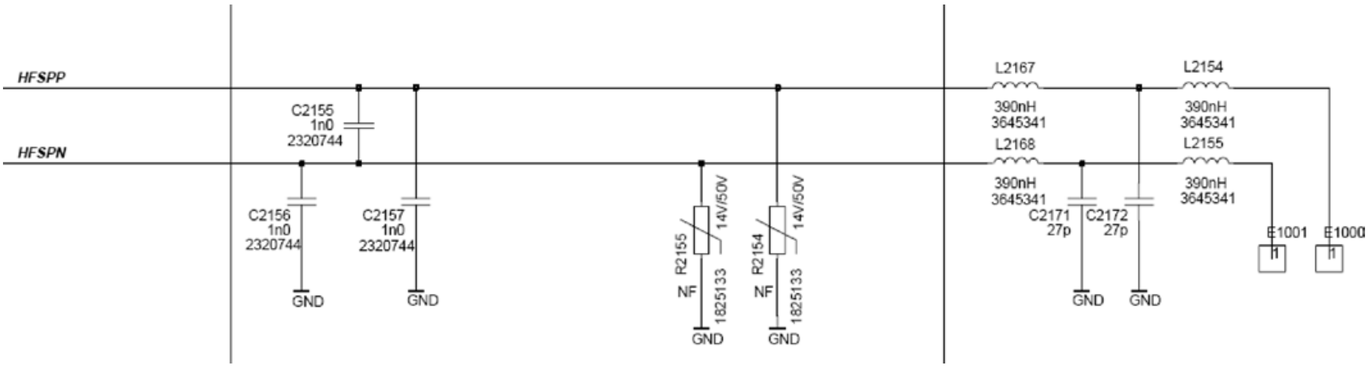


Figure 99 Internal speaker circuitry in engine PWB

External earpiece

All galvanic accessories are connected to the system connector.

The accessory audio mode is automatically enabled/disabled during connection/disconnection of dedicated phone accessories.

The EM ASIC (N2200) provides two output channels in either single-ended or differential format. N2200 outputs XearL and XearLC form the left channel audio output, and XearR and XearRC the right channel audio output. XearLC and XearRC are the ground pins if the output works in a single-ended operation. The XearLC signal is multiplexed with a video output signal coming from the application processor ASIC side.

In the system connector side, HSEAR P and HSEAR N form the left channel output, and HSEAR R P and HSEAR R N the right channel output. Respectively, HSEAR N and HSEAR R N are the ground pins if the output works in a single-ended operation.

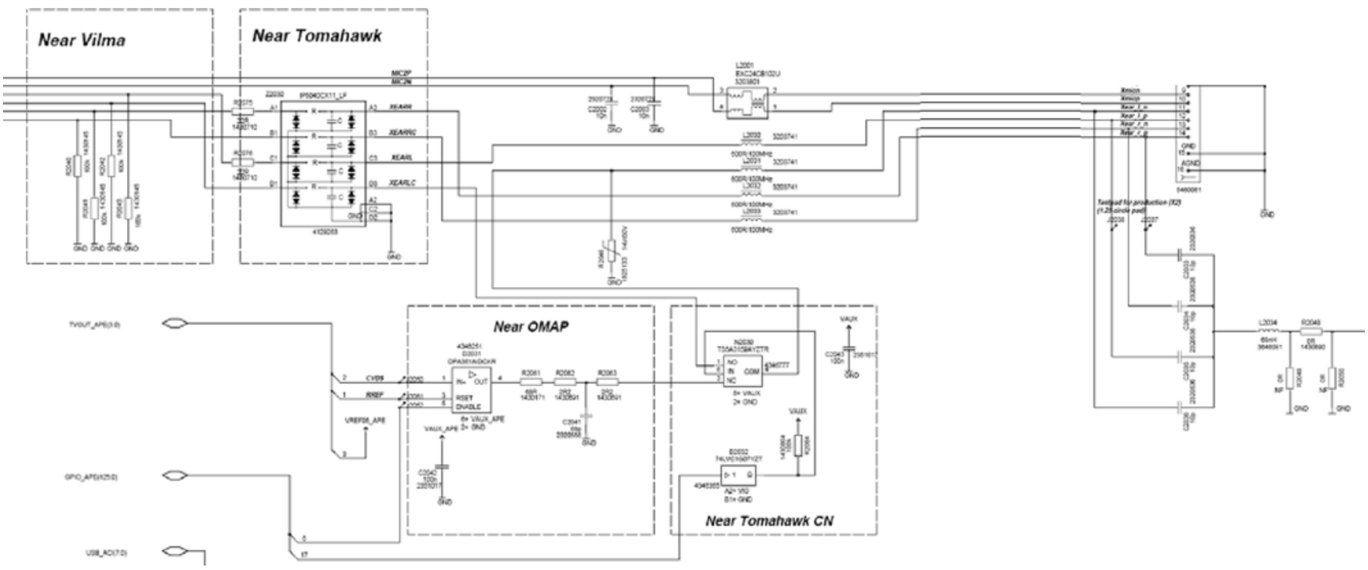


Figure 100 External microphone and earpieces circuitry in engine PWB

SMD microphone handling

The membranes of SMD microphones are fragile and break easily. It is strictly forbidden to expose the membrane to a vacuum or to a "compressed air pistol" during cleaning of the board at any phase without protecting the microphone from the high pressure air.

> **Note:** It is strictly forbidden to touch the membrane. It is recommended that the microphone is not touched manually at all.

Vibra circuitry

Vibra is used for the vibra alarm function.

The vibra motor is connected to the EM ASIC (N2200) VibraP and VibraN Pulse Width Modulated (PWM) outputs.

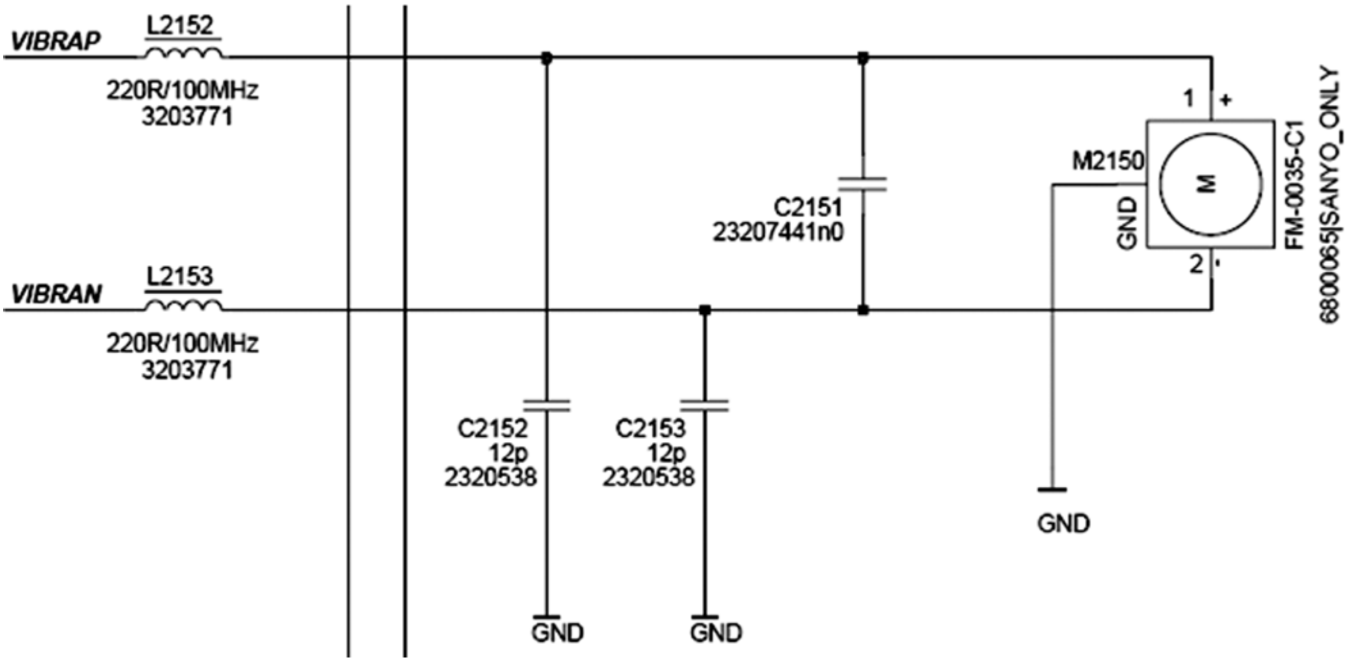


Figure 101 Vibra circuitry

The vibra is connected to the engine PWB through springs attached to the vibra motor body – X2100 and X2101 are hard gold plated contact pads on the PWB.

System connector

The system connector provides a fully differential 4–wire stereo line-level output connection and a fully differential 2-wire mono line-level or microphone level input connection.

The handsfree driver in N2200 is meant for the headset.

The output is driven in a fully differential mode. In the fully differential mode, the handsfree pin is the negative output and the HFCM pin is the positive output. The gain of the handsfree driver in the differential mode is 6 dB.

The HEAR N is multiplexed with a video output signal. When the video out cable is connected, the system detects it via ACI, and switches from Xear N signal to video output automatically.

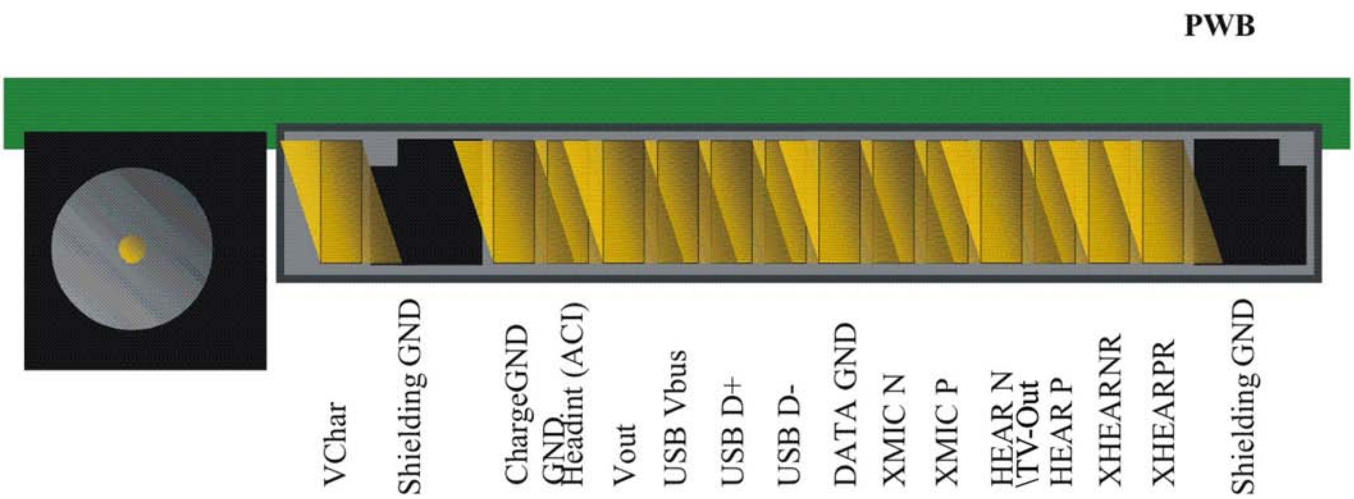


Figure 102 External audio connector

Table 23 Audio connector pin assignments

Pin #/ Signal name	Signal description	Spectral range	Voltage/ Current levels	Max or nominal serial impedance	Notes
1/ Charge	V Charge	DC	0-9V/ 0.85A		
2/ GND	Charge GND	-	0.85A	100mΩ (PWB+ conn.)	
3/ ACI	ACI	1kbits/s	Digital 0 / 2.5-2.78V	47Ω	Insertion & removal detection
4/ Vout	DC out	DC	2.78V 70 mA 2.5V 90mA	100mΩ (PWB+ conn.)	200mW
9 / XMIC N	Audio in	300-8k	1Vpp & 2.5-2.78VDC		
10 / XMIC P	Audio in	300-8k	1Vpp & 2.5-2.78VDC		
11 / HEAR N or video	Audio out or video out	20-20k or 0-6M	1Vpp	10Ω or 75Ω	Audio, video multiplex
12 / HEAR P	Audio out	20-20k	1Vpp	10Ω	
13 / HEAR R N	Audio out	20-20k	1Vpp	10Ω	Not conn. in mono
14 / HEAR R P	Audio out	20-20k	1Vpp	10Ω	Not conn. in mono

Baseband technical specifications

External interfaces

Name of Connection	Connector reference
USB	X2001 (on engine PWB)
Charger	X2000 (on engine PWB)
Headset	X2001
SIM	X2750 (on engine PWB)
Mini SD	X5250 (on engine PWB)
Battery connector	X2070 (on engine PWB)
TV-out	X2001 (on engine PWB)

ACI interface electrical characteristics

Description	Parameter	Min	Typ	Max	Unit	Notes
Accessory detection						
Headset detection threshold		1.75	1.9	2.05	V	
Headset detection hysteresis			25		mV	
Headset detection pull ups		1	2	4	uA	
After Mbus is switched to HeadDet						
High-level input voltage.	V_{IH}	1.9 x V_{DDS}	2.5/2.98	3.0	V	
Low-level input voltage	V_{IL}	0	0.2	0.7 x V_{DDS}	V	
High-level output voltage	V_{OH}	2.4	2.5	2.6	V	
Low-level output voltage	V_{OL}	0		0.3	V	
Rise/fall time	tR/tF			12.5	ns	

VOUT electrical characteristics

Description	Parameter	Min	Max	Typical	Unit	Notes
Vout regulator for external accessories	VOUT	2.43	2.57	2.5	V	Max load 90mA

USB IF electrical characteristics

Description	Parameter	Min	Max	Unit	Notes
Absolute maximum voltage on D+ and D-	$V_{D+/D-}$	-1	4.6	V	USB specification revision 2.0
Supply voltage	VBUS	4.4	5.25	V	
Supply current:					
Functioning	I_{VBUS}		100	mA	
Suspended	I_{VBUS}		500	uA	
Unconfigured	I_{VBUS}		100	mA	
High-level input voltage:				V	
High (driven)	V_{IH}	2			
High (floating)	V_{IHZ}	2.7	3.6		
Low-level input voltage	V_{IL}		0.8	V	
Differential input sensitivity	V_{DI}	0.2		V	|(D+) - (D-)|
Differential input voltage range	V_{CM}	0.8	2.5	V	Included VDI range
Low-level output voltage	V_{OL}	0	0.3	V	
High-level output voltage (driven)	V_{OH}	2.8	3.6	V	
Output signal crossover voltage	V_{CRS}	1.3	2	V	

Irda interface signals

Name	I/O (IR module)	Connection		Description
IREDA		Battery voltage VBAT		IR TX LED anode from VBAT through load resistor
IREDC		Not Connected		IR TX LED cathode
TxD	I	APE SYSTEM ASIC	uart_tx _irtx	Transmit data input to IR Module

Name	I/O (IR module)	Connection		Description
RxD	O	APE SYSTEM ASIC	uart_rx _irrx	Received data output from IR Module
SD (sclk)	I	APE SYSTEM ASIC	uart3_rts_s d	Shutdown
V_{CC}		EM ASIC	VANA	IR Module supply voltage, 2.5 V.
V_{logic}		APE EM chip	VIO_APE	Supply voltage for IR Module I/O and digital parts, 1.8 V
GND		Ground voltage		Ground voltage

Bluetooth signal list

Note: The signal direction is seen from the direction of the Bluetooth system.

Signal name	I/O	From / to	Function
RF - Air			
ANT	I/O	BT antenna	Bluetooth antenna port, 50 W
Power			
VBAT	In	Battery	Phone battery voltage
VIO	In	EM ASIC	I/O-voltage, 1.8V
Clocking			
BTClk	In	RF	System clock, 38.4 MHz
SleepClk	In	EM ASIC	Sleep clock, 32.768 kHz
BT_Clk_Req	Out	RAP ASIC	Clock request signal
Control			
BT_ResetX	In	Application processor	Bluetooth reset (active low)
BT_WakeU p	In	Application processor	Wake up of the Bluetooth ASIC
UART_Wak eUp	Out	Application processor	Wake up of the Application processor
PURX	In	EM ASIC	Enable signal for on-chip regulators
UART			
UART_Rx	In	Application processor	UART receiver
UART_Tx	Out	Application processor	UART transmitter

Signal name	I/O	From / to	Function
UART_CTS	In	Application processor	UART clear to send (active low)
UART_RTS	Out	Application processor	UART request to send (active low)
PCM			
PCM_In	In	RAP ASIC	PCM data in
PCM_Out	Out	RAP ASIC	PCM data out
PCM_Clk	In	RAP ASIC	PCM bit clock, 128 kHz
PCM_Sync	In	RAP ASIC	PCM frame clock, 8 kHz

WLAN module interface signals and supply voltages

Table 24 WLAN module interface signals

Signal name	I/O	From / to	Function
VDD_PA1	In	3.6 V Regulator	Analog power for RF PA
VDD_PA	In	3.6 V Regulator	Analog power for RF PA
BB_VDD_1.5	In	1.5V SMPS Reg.	Digital power for BB
BB_VDD_2.8	In	2.8V Regulator	Digital I/O power for BB
RF_VDD_2.8	In	2.8V Regulator	Digital and Analog power for RF
VIO	In	APE EM ASIC	Power for host interface (1.8V)
REF_CLK_BB/ RF	In	VCTCXO + RF engine (reference clock)	System clock from the RF engine, 38.4 MHz
CLK_REQ	Out	RAP	Clock request signal
WLANENABLE	In	Application processor	WLAN enable/reset
WLAN_IRQ	Out	Application processor	WLAN interrupt request
SPI_CLK	In	Application processor	SPI clock
SPI_SDI	In	Application processor	SPI data in
SPI_SDO	Out	Application processor	SPI data out

Signal name	I/O	From / to	Function
SPI_CSX	In	Application processor	SPI chip select
BT_TX_CONFn	Out	BTHFM	Transmission confirmation to Bluetooth
BT_RF_ACTIVE	In	BTHFM	Bluetooth RF Active
BT_FREQ	In	BTHFM	Bluetooth frequency
BT_STATUS	In	BTHFM	Bluetooth status
BT_TX/RX	In/Out	BTHFM	BT TX/RX port
ANT	In/Out	Antenna	Main ANT, RF Input/Output

Table 25 Power supplies for WLAN module

Power source	Voltage (V)			Load (mA)	Function
	Min.	Typ.	Max.	Max.	
VDD_PA		3.6			Analogue power for RF PA
BB_VDD_1.5		1.5			Digital power for BB
BB		2.8			Power for BB & RF
VIO	1.7	1.8	1.95	10 mA *	I/O voltage for the WLAN baseband

FBUS interface electrical characteristics (between N2300 and Pop-Port)

Description	Parameter	Min	Typ	Max	Unit
High-level input voltage	V_{IH}		2.5		V
Low-level Input voltage	V_{IL}		2.5		V
High-level output voltage	V_{OH}	2.25	2.5	2.57	V
Low-level output voltage	V_{OL}	0		0.15	V

Headset hook detection interface (XMICN) electrical characteristics

Description	Min	Typ	Max	Unit	Notes
Hook detection threshold 1	1.25	1.35	1.45	V	Two fixed thresholds inside N9101. Selectable by SW
Hook detection threshold 2	0.5	0.6	0.7	V	
Hook detection hysteresis		25		mV	

Description	Min	Typ	Max	Unit	Notes
Hook detection pull ups	1	2	4	uA	

Audio signal electrical characteristics

Description	Parameter	Typ	Unit	Notes
XMIC N	Audio in	1	V_{pp}	DC Offset 2.5-2.78V
XMIC P	Audio in	1	V_{pp}	DC Offset 2.5-2.78V
HSEAR N	Audio out	1	V_{pp}	10Ω nominal serial impedance
HSEAR P	Audio out	1	V_{pp}	10Ω nominal serial impedance
HSEAR R N	Audio out	1	V_{pp}	10Ω nominal serial impedance
				Not connected in mono
HSEAR R P	Audio out	1	V_{pp}	10Ω nominal serial impedance
				Not connected in mono

SIM IF connections

Pin	Signal	I/O	Engine connection		Notes
C1	VSIM	Out	EM ASIC	VSIM1	Supply voltage to SIM card, 1.8V or 3.0V.
C2	SIMRST	Out	EM ASIC	SIM1Rst	Reset signal to SIM card
C3	SIMCLK	Out	EM ASIC	SIM1ClkC	Clock signal to SIM card
C5	GND	-	GND		Ground
C7	SIMDATA	In/Out	EM ASIC	SIM1DaC	Data input / output
SW	SIM_DET	In	EM ASIC	SIMDetX	Removal detection

MiniSD interface signals and supply voltages

Table 26 miniSD host and card interface signals

Application processor signal name	I/O	Reset value	Description	miniSD card pin
mmc_clko	0	o, pull down	Card clock signal	4
mmc_clki	I	I, pull down	Return clock	
mmc_cmd	I/O	I, pull down	Card command /response	9
mmc_dat0	I/O	I, pull down	Card data0	2
mmc_dat1	I/O	I, pull down	Card data1	1
mmc_dat2	I/O	I, pull down	Card data2	11
mmc_dat3	I/O	I, pull down	Card data3	10
			Card power supply	5
			Card supply voltage ground Vss1 Vss2	3,8
	I	I,High	Card detection switch	12
mmc_cmddir	0	I, pull down	CMD direction	
mmc_datdir0 -3	0	0	DATA direction 0-3	

Table 27 miniSD interface supply voltages

Parameter	Symbol	min	max	unit	note
Supply voltage (basic CMDs)	Vmmc	2	3.6	V	CMD0, 15, 55, ACMD41 commands
Supply voltage (other CMDs)	VCCSD	2.7	3.6	V	Other commands
Host I/O supply voltage 1.8 V	VIO	1.71	1.89	V	Nominal 1.8 V
Level shifter supply	VIO	1.71	1.89	V	Same as Host supply
	VCCSD				Same as Card supply
Supply voltage differentials (Vss1,2)	GND	-0.3	0.3	V	

TV-out interface signals

Table 28 Signaling interface between application processor and OPA361

Signal name	Application processor pin name	OPA361 pin name [pin number]	Description, application processor pin direction
TV_CVBS	TV.CVBS]	In+ [1]	DAC, output
TV_RREF	TV.RREF	Rset [3]	Reference, output
OPA361_Enable	GPIO.6	Enable [5]	Enable, output

Charger connector and charging interface connections & electrical characteristics

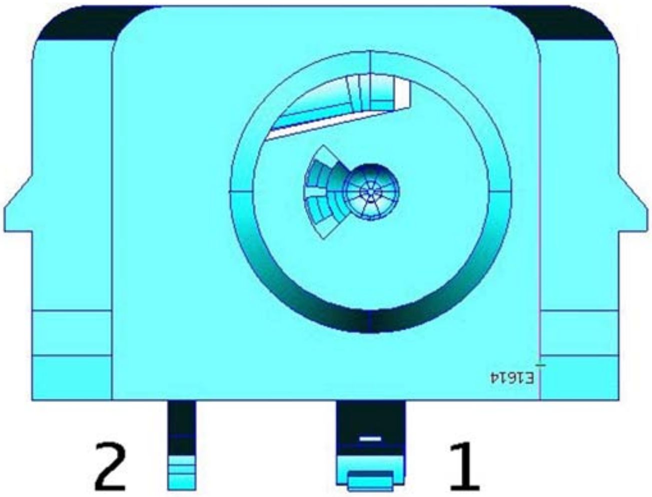


Figure 103 Charger connector

Table 29 Charging interface connections

Pin	Signal	I/O	Engine connection		Notes
1	Vchar	In	N9101	VCharIn1, 2	Charging voltage / charger detection, Center pin
2	Charge GND		Ground		Charger ground

Table 30 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	

Description	Parameter	Min	Max	Unit	Notes
Threshold for charging, rising (N9101)	V_{MSTR+}	2.1		V	Typical value
Threshold for charging, falling (N9101)	V_{MSTR-}	1.9		V	Typical value

Battery connector and interface connections & electrical characteristics

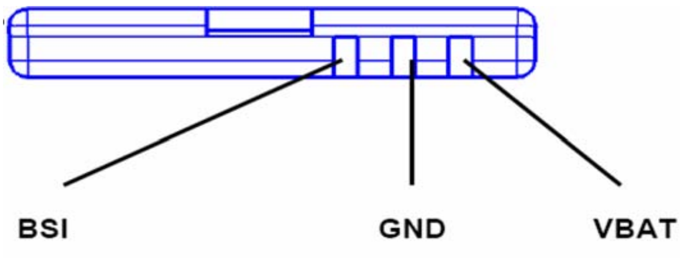


Figure 104 Battery connector

Table 31 Battery interface connections

Pin	Signal	I/O	Engine connection		Notes
1	VBAT	->	N9101	VBAT	Battery voltage
2	BSI	->	N9101	BSI	Battery size indication (fixed resistor inside the battery pack)
3	GND		GND		Ground

Table 32 Battery IF electrical characteristics

Description	Parameter	Max	Unit
Operation voltage	V_{IN}	4.23	VDC
Current rating	I_{IN}	0.9	A

Internal interfaces

Name of Connection	Connector reference
UI connector	X4400
Display	X4401
Main camera	X8901
Sub camera	X8901
ALS	V4400

Name of Connection	Connector reference
Vibra	M2100
Microphone	B2100
Earpiece	B2101
IHF speaker	B2102

UI connections

Table 33 User interface connections

Pin	Signal	I/O	Engine connection		Notes
1	GND		GND		
2	LED+	<-	N2301	VLEDOUT2	Discrete Backlight SMPS (controlled by EM ASIC N2300)
3	Col2	->	D4800	Kbc_2	
4	LED-	->	R2305 + V2300	SETCURR2	Serial resistor + Transistor switch (controlled by EM ASIC N2300)
5	Col1	->	D4800	Kbc_1	Voice switch connection
6	GND		GND		
7	Row3	->	D4800	Kbr_3	
8	Row2	->	D4800	Kbr_2	
9	Row1	->	D4800	Kbr_1	
10	Row6	->	D4800	Kbr_6	
11	Row0	->	D4800	Kbr_0	
12	Col0	->	D4800	Kbc_0	
13	Row5	->	D4800	Kbr_5	Voice switch connection
14	Row4	->	D4800	Kbr_4	
15	GND		GND		
16	Col3	->	D4800	Kbc_3	

Keyboard interface electrical characteristics

Description	Parameter	Min	Typ	Max	Unit	Notes
High-level input voltage	V_{IH}	0.65* V_{DDS}	V_{DDS}	0.3+ V_{DDS}	V	Row

Description	Parameter	Min	Typ	Max	Unit	Notes
Low-level input voltage	V_{IL}	-0.3	0	0.35* V_{DDS}	V	Row
High-level output voltage	V_{OH}	1.62	V_{DDS}	1.98	V	Column
Low-level output voltage	V_{OL}		0	0.45	V	Column
(VDDS = 1.8V)						

Display interface connections

Table 34 Main display connections

Pin name in Engine	Display pin name
VLEDOUT_LCD	(1)VLED+
(Connect to VLED1- on display module)	(2)VLED2+
VAUX	(3)VDD
GND	(4)GND
Dss_pclk(Application processor)	(5)RDX
Dss_acbias(Application processor)	(6)D/CX
Dss_d1(Application processor)	(7)D1
Dss_d3(Application processor)	(8)D3
GND	(9)GND
Dss_d5(Application processor)	(10)D5
Dss_d7(Application processor)	(11)D7
Dss_d16(Application processor)	(12)TE
GPIO30(Application processor)	(13)RESX
Dss_hsync(Application processor)	(14)CSX
Dss_d6(Application processor)	(15)D6
Dss_d4(Application processor)	(16)D4
Dss_d2(Application processor)	(17)D2
GND	(18)GND
Dss_d0(Application processor)	(19)D0
Dss_vsync(Application processor)	(20)WRX
GND	(21)GND
VIO_APE	(22)VDDI
MAIN_LED-	(23)VLED2-

Pin name in Engine	Display pin name
(Connect to VLED2+ on display module)	(24)VLED1-

Table 35 Sub display connections

Pin name in Engine	Display pin name
VIO_APE	(1)VDDI
GPIO15(Application processor)	(2)RESX
Spi1_simo(Application processor)	(3)SDA
Spi1_clk(Application processor)	(4)SCL
Spi1_ncs2(Application processor)	(5)CSX
VAUX	(6)VDD
N.C.	(7)TE
GND	(8)GND
SUB_LED-	(9)LED-
VLEDOUT_LCD	(10)LED+

Camera IF connections and electrical characteristics

Table 36 Camera interface connections

Main Camera		I/O	Camera IF PWB		I/O	The other side				Notes
Pin	Signal		Signal	Part		Signal	Part	Ref	PWB	
1	GND									Ground line
2	CIFVDD	->	CIFVDD	X3	->	VDD	Sub Camera	X10	Flip PWB	Sub camera power supply
3	GND									Ground line
4	CIFVDD	->	CIFVDD	X3	->	VDD	Sub Camera	X10	Flip PWB	Sub camera power supply
5	GND									Ground line
6	CIFEN	->	CIFEN	X3	->	EN	Sub Camera	X10	Flip PWB	Sub camera serial data enable
7	FCLK	<-	FCLK	X4	<-	SYS.CLK OUT	Application processor	D4800	Engine PWB	Main camera system clock
8	CIFSCL	->	CIFSCL	X3	->	CIFSCL	Sub Camera	X10	Flip PWB	Sub camera serial clock
9	GND									Ground line

Main Camera		I/O	Camera IF PWB		I/O	The other side				Notes
10	CIFSDA	->	CIFSDA	X3	->	CIFSDA	Sub Camera	X10	Flip PWB	Sub camera serial data
11	PWDN	<-	PWDN	X4	<-	GPIO45	Application processor	D4800	Engine PWB	Main camera power down control
12	CIFHPA	->	CIFHPA	X3	->	HPA	Sub Camera	X10	Flip PWB	Sub camera horizontal sync
13	AVDD	<-	AVDD	X4	<-	AVDD	Regulator	N8702	Engine PWB	Main camera analog power supply
14	CIFVRR	->	CIFVRR	X3	->	VRR	Sub Camera	X10	Flip PWB	Sub camera vertical sync
15	AVDD	<-	AVDD	X4	<-	AVDD	Regulator	N8702	Engine PWB	Main camera analog power supply
16	CIFESR	->	CIFESR	X3	->	ESR	Sub Camera	X10	Flip PWB	Sub camera shutter control
17	DVDD	<-	DVDD	X4	<-	DVDD	Regulator	N8703	Engine PWB	Main camera digital power supply
18	CIFRESET	->	CIFRESET	X3	->	SRST	Sub Camera	X10	Flip PWB	Sub camera reset control
19	DVDD	<-	DVDD	X4	<-	DVDD	Regulator	N8703	Engine PWB	Main camera digital power supply
20	CIFMCK	->	CIFMCK	X3	->	MCK	Sub Camera	X10	Flip PWB	Sub camera system clock
21	IOVDD	<-	IOVDD	X4	<-	VIO_APE	Menelaus	N4200	Engine PWB	Main camera I/O power supply
22	CIFDATA8	<-	CIFDATA8	X3	<-	D8	Sub Camera	X10	Flip PWB	Sub camera parallel data
23	IOVDD	<-	IOVDD	X4	<-	VIO_APE	Menelaus	N4200	Engine PWB	Main camera I/O power supply
24	CIFDATA7	<-	CIFDATA7	X3	<-	D7	Sub Camera	X10	Flip PWB	Sub camera parallel data
25	RESET	<-	RESET	X4	<-	GPIO42	Application processor	D4800	Engine PWB	Main camera reset control
26	CIFDATA6	<-	CIFDATA6	X3	<-	D6	Sub Camera	X10	Flip PWB	Sub camera parallel data

Main Camera		I/O	Camera IF PWB		I/O	The other side				Notes
27	GND									Ground line
28	CIFDAT A5	<-	CIFDAT A5	X3	<-	D5	Sub Camera	X10	Flip PWB	Sub camera parallel data
29	GND									Ground line
30	CIFDAT A4	<-	CIFDAT A4	X3	<-	D4	Sub Camera	X10	Flip PWB	Sub camera parallel data
31	GND									Ground line
32	CIFDAT A3	<-	CIFDAT A3	X3	<-	D3	Sub Camera	X10	Flip PWB	Sub camera parallel data
33	SCL	<-	SCL	X4	<-	I2C2_SCL	Application processor	D4800	Engine PWB	Main camera I2C serial clock
34	CIFDAT A2	<-	CIFDAT A2	X3	<-	D2	Sub Camera	X10	Flip PWB	Sub camera parallel data
35	SDA	<->	SDA	X4	<->	I2C2_SDA	Application processor	D4800	Engine PWB	Main camera I2C serial data
36	CIFDAT A1	<-	CIFDAT A1	X3	<-	D1	Sub Camera	X10	Flip PWB	Sub camera parallel data
37	GND									Ground line
38	CIFDAT A0	<-	CIFDAT A0	X3	<-	D0	Sub Camera	X10	Flip PWB	
39	CLK+	->	CLK+	X4	->	CLKP	Application processor	D4800	Engine PWB	CCP clock plus
40	LGND									Ground line corresponding to LVDD
41	CLK-	->	CLK-	X4	->	CLKN	Application processor	D4800	Engine PWB	CCP clock minus
42	LGND									Ground line corresponding to LVDD
43	GND									Ground line
44	LGND									Ground line corresponding to LVDD

Main Camera		I/O	Camera IF PWB		I/O	The other side				Notes
45	D+	->	D+	X4	->	DATAP	Application processor	D4800	Engine PWB	CCP data plus
46	STROBE	->	STROBE	X4	->	STROBE	FLED Driver	D8740	Engine PWB	Main camera strobe control
47	D-	->	D-	X4	->	DATAN	Application processor	D4800	Engine PWB	CCP data minus
48	LVDD	<-	LVDD	X4	<-	LVDD	Regulator	N8701	Engine PWB	Main camera lens power supply
49	GND									Ground line
50	LVDD	<-	LVDD	X4	<-	LVDD	Regulator	N8701	Engine PWB	Main camera lens power supply

Table 37 Camera supply voltage characteristics

Description	Parameter	Min	Typ	Max	Unit
Main camera analogue power supply	AVDD	2.9	3.0	3.1	V
Main camera digital power supply	DVDD	2.9	3.0	3.1	V
Main camera I/O power supply	IOVDD	1.7	1.8	1.9	V
Main camera lens power supply	LVDD	2.9	3.0	3.1	V
Sub camera power supply	CIFVDD	2.9	3.0	3.1	V

Flash LED interface and electrical characteristics

Table 38 Flash LED / indicator LED interface connections

Signal name	From	To	Description
GPIO41	D4800	V8720	Indicator LED enable signal
GPIO92	D4800	D8740	Flash LED mode control signal

Signal name	From	To	Description
GPIO44	D4800	D8740	Flash LED enable signal from APE
STROBE	Main camera	D8740	Flash LED enable signal from main camera

Table 39 Flash LED interface electrical characteristics

Description	Description	Parameter	Min	Typ	Max	Unit
GPIO41	Indicator LED enable signal	GPIO output	1.72	1.8	1.92	V
GPIO92	Flash LED mode control signal	GPIO output	1.72	1.8	1.92	V
GPIO44	Flash LED enable signal from APE	GPIO output	1.72	1.8	1.92	V
STROBE	Flash LED enable signal from main camera	Main camera output	2.9	3.0	3.1	V

Back-up battery interface electrical characteristics

Table 40 Back-up battery connections

Pin name	I/O	Connection	Notes
L2207, VBack	->	N2200, VBack	Back-up battery G2200 is connected to N2200 via coil

Table 41 Back-up battery electrical characteristics

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

RF description

Receiver

Introduction to receiver functionality

Receiver functions are implemented in an RF ASIC.

The receiver is a linear direct conversion receiver consisting of separate front ends (LNA (Low Noise Amplifier) and demodulator) for each supported system. After the demodulators, the signal paths are combined to one common BB path.

WCDMA receiver functionality

In the WCDMA mode, the received signal is fed from the antenna to a duplex filter. After the duplex filter the signal goes via a balun to an LNA (Low Noise Amplifier) residing in N7500. From the LNA, the signal goes trough a band pass filter.

After filtering, the signal goes to the down conversion mixer, which converts the signal to baseband I and Q signals. At the BB frequency the signal is amplified, and fed to a low pass filter. The Rx channel filter must be calibrated with an automatic routine whenever the Rx ASIC IC is changed to a phone.

In the WCDMA mode, the corner frequency of the filter is set to approximately 2.1 MHz. The filter is followed by an AGC (Automatic Gain Control) amplifier with an adjustable gain. The signal is further amplified before it is fed to balanced analogue IQ output pins. The analogue output pins are accompanied by reference voltage output, which sets the DC level for the AD converter in the BB ASIC RAP.

The last stage of the RF Rx chain is an output buffer which feeds the signal and a reference voltage (VREFCM) to the BB ASIC.

GSM receiver functionality

As GSM Rx branches are functionally identical, the following description is applicable to all of them.

The received signal goes from the GSM antenna to the antenna switch module.

The antenna switch module is followed by integrated LNAs residing in the Rx ASIC.

The LNAs are followed by demodulators which downconvert the signal to baseband I and Q signals.

After the down conversion mixer, the Rx chain is similar to the WCDMA Rx. The channel select filter is set to 115 kHz in the GSM mode.

Transmitter

Introduction to transmitter functionality

Transmitter functions are implemented in an RF ASIC. The ASIC contains a BB frequency low pass filter, which is tunable according to the signal bandwidth of the system in use.

In addition, the ASIC contains separate RF paths comprising a final frequency IQ modulator and VGA amplifiers.

WCDMA transmitter functionality

In the transmitter side, an analogue I/Q modulated signal is received from digital baseband into an RF ASIC and fed through a low pass filter. After the filter the signal is fed to the IQ modulator, which converts the signal to final Tx frequency. There are two separate I/Q modulators: one for WCDMA and another for GSM signals. The signal then exits the RF ASIC via a balanced line. Next, the signal is band pass filtered by a SAW filter before it is fed to the WCDMA PA module. After the PA, the transmitted WCDMA signal is fed through an isolator and a duplex filter to the antenna.

WCDMA power control

WCDMA Tx power control is accomplished by the two VGA amplifier stages in the Tx ASIC.

The VGAs have a common temperature compensation circuit and one voltage mode analogue input for gain control (TXC).

Another function of the detector voltage is to steer the DC/DC converter, which is providing a variable supply voltage for the WCDMA PA.

WCDMA PA module

The WCDMA PA is housed in a separate module having:

- a variable supply voltage input for the amplifier stages (Vcc11),
- a battery supply voltage for the bias circuits (Vcc12),
- and two bias current inputs.

Bias currents are generated by 5-bit DA converters in the RF ASIC.

If a different manufacturer's PA is changed to the phone, this setting must be set again.

PA DC/DC converter

The control of the DC/DC converter is fed back from the power detector circuit.

GSM transmitter functionality

An RF ASIC receives an analogue IQ modulated signal from the digital BB. The signal is first low pass filtered, and then routed to the GSM modulator. The amplifier gives 40 dB of power control dynamic range.

After the VGA stage the signal exits the RF ASIC. In case of GSM1800/1900 the signal goes directly to the GSM PA module. In case of EGSM900 (and GSM850, if applicable), the PA module is preceded by a SAW filter. After the filter, the signal is fed to the GSM Tx front-end module (TXFEM), which also contains the antenna switch.

GSM power control

A closed control loop comprise an integrated power detector (in PA module) and an error amplifier. The error amplifier resides in N7501, and it controls the transmitter power of GSM.

Detector output from the PA gives a DC level proportional to the output power. The DC voltage is fed to the negative input of the error amplifier, where it is compared to the level of the reference signal, TXC. TXC is received from the BB circuitry. The output of the error amplifier is fed to a buffer amplifier, which in turn steers the VGA amplifier.

The power control loop is enabled and disabled by writing an appropriate register in N7501 RF ASIC. In case of dual slot transmission, the output power is ramped down between the consecutive slots.

GSM PA module

The TXFEM module contains two separate amplifier chains, one for EGSM900 (and GSM850, if applicable) and another for GSM1800/1900. Both amplifiers have a battery supply connection and two bias current inputs.

Antennas

This product has two internal antennas; main antenna and Bluetooth/WLAN antenna. Both antennas are made of flex film radiator, and attached with an adhesive on the plastic block.

Main (GSM/WCDMA) antenna

The Main (GSM/WCDMA) antenna is used for either GSM or WCDMA protocols, enabled by SP3T switch on the engine PWB. The antenna has one feed and one parasitic contacts. The antenna has matching components on the PWB.

Figure 105 Main antenna (GSM/WCDMA)

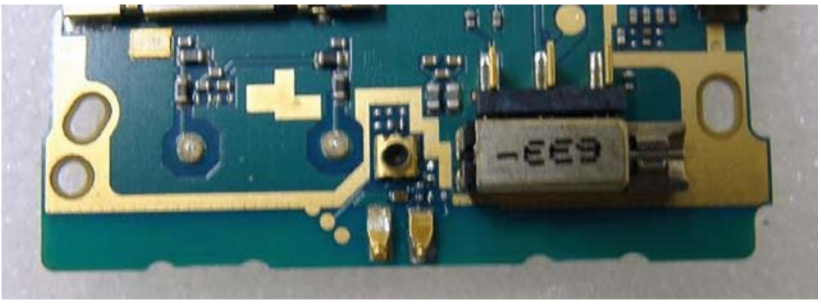


Figure 106 Main antenna contact

Buletooth/WLAN antenna

The Bluetooth/WLAN antenna is used for both Bluetooth and WLAN protocols, enabled by switching inside the WLAN module.

The antenna has one feed and one GND contact.

The antenna has matching components on the PWB.

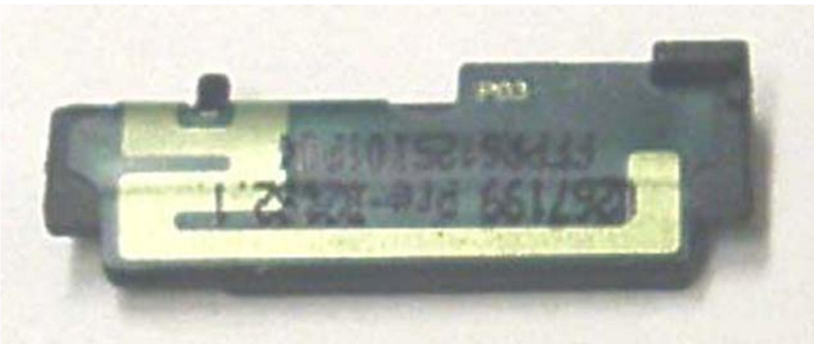


Figure 107 Bluetooth/WLAN Antenna

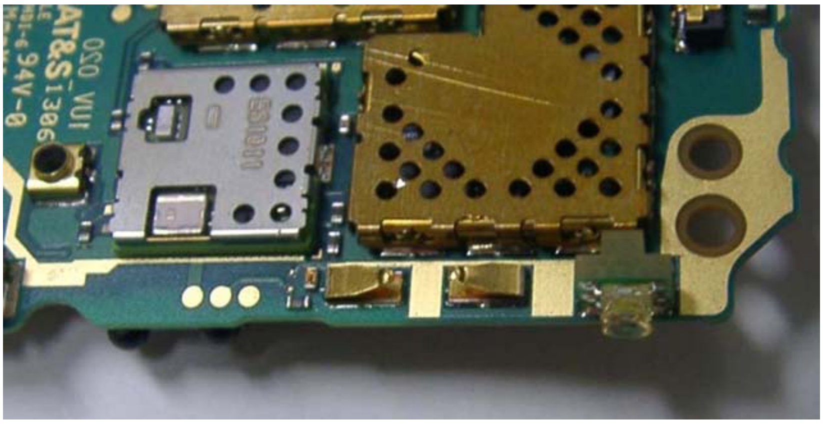


Figure 108 Bluetooth/WLAN contact

Frequency synthesizers

RF has separate synthesizers for Rx and Tx. Both synthesizers consist of:

- PLL (Phase-Locked Loop)
- loop filter
- VCO (Voltage Controlled Oscillator)
- balun

The VCO frequencies are locked by PLLs into a reference oscillator, VCTCXO (Voltage Controlled Temperature Compensated Crystal Oscillator).

The PLLs are located in RF ASICs and controlled via RFBus.

Reference oscillators

A 38.4MHz VCTCXO is used as a reference oscillator for the frequency synthesizers.

Regulators

All RF regulators, except one, are located in the EM ASIC N2200 in the baseband section or in the RF ASIC N7501 of the device. The discreet regulator, N7541 feeds the WCDMA PA. The EM ASIC N2200 has three regulators for RF:

1. 2.78 V regulator VXO
2. 4.75 V regulator VCP (VCP1 & VCP2)
3. 1.35 V regulator, VB_EXT, which is the reference voltage

Frequency mappings

EGSM900 frequencies

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

GSM1800 frequencies

Ch	Tx	Rx	VCO Tx	VCO Rx	Ch	Tx	Rx	VCO Tx	VCO Rx	Ch	Tx	Rx	VCO Tx	VCO Rx	Ch	Tx	Rx	VCO Tx	VCO Rx
512	1710.2	1805.2	3420.4	3610.4	606	1729.0	1824.0	3458.0	3648.0	700	1747.8	1842.8	3495.6	3685.6	793	1766.4	1861.4	3532.8	3722.8
513	1710.4	1805.4	3420.8	3610.8	607	1729.2	1824.2	3458.4	3648.4	701	1748.0	1843.0	3496.0	3686.0	794	1766.6	1861.6	3533.2	3723.2
514	1710.6	1805.6	3421.2	3611.2	608	1729.4	1824.4	3458.8	3648.8	702	1748.2	1843.2	3496.4	3686.4	795	1766.8	1861.8	3533.6	3723.6
515	1710.8	1805.8	3421.6	3611.6	609	1729.6	1824.6	3459.2	3649.2	703	1748.4	1843.4	3496.8	3686.8	796	1767.0	1862.0	3534.0	3724.0
516	1711.0	1806.0	3422.0	3612.0	610	1729.8	1824.8	3459.6	3649.6	704	1748.6	1843.6	3497.2	3687.2	797	1767.2	1862.2	3534.4	3724.4
517	1711.2	1806.2	3422.4	3612.4	611	1730.0	1825.0	3460.0	3650.0	705	1748.8	1843.8	3497.6	3687.6	798	1767.4	1862.4	3534.8	3724.8
518	1711.4	1806.4	3422.8	3612.8	612	1730.2	1825.2	3460.4	3650.4	706	1749.0	1844.0	3498.0	3688.0	799	1767.6	1862.6	3535.2	3725.2
519	1711.6	1806.6	3423.2	3613.2	613	1730.4	1825.4	3460.8	3650.8	707	1749.2	1844.2	3498.4	3688.4	800	1767.8	1862.8	3535.6	3725.6
520	1711.8	1806.8	3423.6	3613.6	614	1730.6	1825.6	3461.2	3651.2	708	1749.4	1844.4	3498.8	3688.8	801	1768.0	1863.0	3536.0	3726.0
521	1712.0	1807.0	3424.0	3614.0	615	1730.8	1825.8	3461.6	3651.6	709	1749.6	1844.6	3499.2	3689.2	802	1768.2	1863.2	3536.4	3726.4
522	1712.2	1807.2	3424.4	3614.4	616	1731.0	1826.0	3462.0	3652.0	710	1749.8	1844.8	3499.6	3689.6	803	1768.4	1863.4	3536.8	3726.8
523	1712.4	1807.4	3424.8	3614.8	617	1731.2	1826.2	3462.4	3652.4	711	1750.0	1845.0	3500.0	3690.0	804	1768.6	1863.6	3537.2	3727.2
524	1712.6	1807.6	3425.2	3615.2	618	1731.4	1826.4	3462.8	3652.8	712	1750.2	1845.2	3500.4	3690.4	805	1768.8	1863.8	3537.6	3727.6
525	1712.8	1807.8	3425.6	3615.6	619	1731.6	1826.6	3463.2	3653.2	713	1750.4	1845.4	3500.8	3690.8	806	1769.0	1864.0	3538.0	3728.0
526	1713.0	1808.0	3426.0	3616.0	620	1731.8	1826.8	3463.6	3653.6	714	1750.6	1845.6	3501.2	3691.2	807	1769.2	1864.2	3538.4	3728.4
527	1713.2	1808.2	3426.4	3616.4	621	1732.0	1827.0	3464.0	3654.0	715	1750.8	1845.8	3501.6	3691.6	808	1769.4	1864.4	3538.8	3728.8
528	1713.4	1808.4	3426.8	3616.8	622	1732.2	1827.2	3464.4	3654.4	716	1751.0	1846.0	3502.0	3692.0	809	1769.6	1864.6	3539.2	3729.2
529	1713.6	1808.6	3427.2	3617.2	623	1732.4	1827.4	3464.8	3654.8	717	1751.2	1846.2	3502.4	3692.4	810	1769.8	1864.8	3539.6	3729.6
530	1713.8	1808.8	3427.6	3617.6	624	1732.6	1827.6	3465.2	3655.2	718	1751.4	1846.4	3502.8	3692.8	811	1770.0	1865.0	3540.0	3730.0
531	1714.0	1809.0	3428.0	3618.0	625	1732.8	1827.8	3465.6	3655.6	719	1751.6	1846.6	3503.2	3693.2	812	1770.2	1865.2	3540.4	3730.4
532	1714.2	1809.2	3428.4	3618.4	626	1733.0	1828.0	3466.0	3656.0	720	1751.8	1846.8	3503.6	3693.6	813	1770.4	1865.4	3540.8	3730.8
533	1714.4	1809.4	3428.8	3618.8	627	1733.2	1828.2	3466.4	3656.4	721	1752.0	1847.0	3504.0	3694.0	814	1770.6	1865.6	3541.2	3731.2
534	1714.6	1809.6	3429.2	3619.2	628	1733.4	1828.4	3466.8	3656.8	722	1752.2	1847.2	3504.4	3694.4	815	1770.8	1865.8	3541.6	3731.6
535	1714.8	1809.8	3429.6	3619.6	629	1733.6	1828.6	3467.2	3657.2	723	1752.4	1847.4	3504.8	3694.8	816	1771.0	1866.0	3542.0	3732.0
536	1715.0	1810.0	3430.0	3620.0	630	1733.8	1828.8	3467.6	3657.6	724	1752.6	1847.6	3505.2	3695.2	817	1771.2	1866.2	3542.4	3732.4
537	1715.2	1810.2	3430.4	3620.4	631	1734.0	1829.0	3468.0	3658.0	725	1752.8	1847.8	3505.6	3695.6	818	1771.4	1866.4	3542.8	3732.8
538	1715.4	1810.4	3430.8	3620.8	632	1734.2	1829.2	3468.4	3658.4	726	1753.0	1848.0	3506.0	3696.0	819	1771.6	1866.6	3543.2	3733.2
539	1715.6	1810.6	3431.2	3621.2	633	1734.4	1829.4	3468.8	3658.8	727	1753.2	1848.2	3506.4	3696.4	820	1771.8	1866.8	3543.6	3733.6
540	1715.8	1810.8	3431.6	3621.6	634	1734.6	1829.6	3469.2	3659.2	728	1753.4	1848.4	3506.8	3696.8	821	1772.0	1867.0	3544.0	3734.0
541	1716.0	1811.0	3432.0	3622.0	635	1734.8	1829.8	3469.6	3659.6	729	1753.6	1848.6	3507.2	3697.2	822	1772.2	1867.2	3544.4	3734.4
542	1716.2	1811.2	3432.4	3622.4	636	1735.0	1830.0	3470.0	3660.0	730	1753.8	1848.8	3507.6	3697.6	823	1772.4	1867.4	3544.8	3734.8
543	1716.4	1811.4	3432.8	3622.8	637	1735.2	1830.2	3470.4	3660.4	731	1754.0	1849.0	3508.0	3698.0	824	1772.6	1867.6	3545.2	3735.2
544	1716.6	1811.6	3433.2	3623.2	638	1735.4	1830.4	3470.8	3660.8	732	1754.2	1849.2	3508.4	3698.4	825	1772.8	1867.8	3545.6	3735.6
545	1716.8	1811.8	3433.6	3623.6	639	1735.6	1830.6	3471.2	3661.2	733	1754.4	1849.4	3508.8	3698.8	826	1773.0	1868.0	3546.0	3736.0
546	1717.0	1812.0	3434.0	3624.0	640	1735.8	1830.8	3471.6	3661.6	734	1754.6	1849.6	3509.2	3699.2	827	1773.2	1868.2	3546.4	3736.4
547	1717.2	1812.2	3434.4	3624.4	641	1736.0	1831.0	3472.0	3662.0	735	1754.8	1849.8	3509.6	3699.6	828	1773.4	1868.4	3546.8	3736.8
548	1717.4	1812.4	3434.8	3624.8	642	1736.2	1831.2	3472.4	3662.4	736	1755.0	1850.0	3510.0	3700.0	829	1773.6	1868.6	3547.2	3737.2
549	1717.6	1812.6	3435.2	3625.2	643	1736.4	1831.4	3472.8	3662.8	737	1755.2	1850.2	3510.4	3700.4	830	1773.8	1868.8	3547.6	3737.6
550	1717.8	1812.8	3435.6	3625.6	644	1736.6	1831.6	3473.2	3663.2	738	1755.4	1850.4	3510.8	3700.8	831	1774.0	1869.0	3548.0	3738.0
551	1718.0	1813.0	3436.0	3626.0	645	1736.8	1831.8	3473.6	3663.6	739	1755.6	1850.6	3511.2	3701.2	832	1774.2	1869.2	3548.4	3738.4
552	1718.2	1813.2	3436.4	3626.4	646	1737.0	1832.0	3474.0	3664.0	740	1755.8	1850.8	3511.6	3701.6	833	1774.4	1869.4	3548.8	3738.8
553	1718.4	1813.4	3436.8	3626.8	647	1737.2	1832.2	3474.4	3664.4	741	1756.0	1851.0	3512.0	3702.0	834	1774.6	1869.6	3549.2	3739.2
554	1718.6	1813.6	3437.2	3627.2	648	1737.4	1832.4	3474.8	3664.8	742	1756.2	1851.2	3512.4	3702.4	835	1774.8	1869.8	3549.6	3739.6
555	1718.8	1813.8	3437.6	3627.6	649	1737.6	1832.6	3475.2	3665.2	743	1756.4	1851.4	3512.8	3702.8	836	1775.0	1870.0	3550.0	3740.0
556	1719.0	1814.0	3438.0	3628.0	650	1737.8	1832.8	3475.6	3665.6	744	1756.6	1851.6	3513.2	3703.2	837	1775.2	1870.2	3550.4	3740.4
557	1719.2	1814.2	3438.4	3628.4	651	1738.0	1833.0	3476.0	3666.0	745	1756.8	1851.8	3513.6	3703.6	838	1775.4	1870.4	3550.8	3740.8
558	1719.4	1814.4	3438.8	3628.8	652	1738.2	1833.2	3476.4	3666.4	746	1757.0	1852.0	3514.0	3704.0	839	1775.6	1870.6	3551.2	3741.2
559	1719.6	1814.6	3439.2	3629.2	653	1738.4	1833.4	3476.8	3666.8	747	1757.2	1852.2	3514.4	3704.4	840	1775.8	1870.8	3551.6	3741.6
560	1719.8	1814.8	3439.6	3629.6	654	1738.6	1833.6	3477.2	3667.2	748	1757.4	1852.4	3514.8	3704.8	841	1776.0	1871.0	3552.0	3742.0
561	1720.0	1815.0	3440.0	3630.0	655	1738.8	1833.8	3477.6	3667.6	749	1757.6	1852.6	3515.2	3705.2	842	1776.2	1871.2	3552.4	3742.4
562	1720.2	1815.2	3440.4	3630.4	656	1739.0	1834.0	3478.0	3668.0	750	1757.8	1852.8	3515.6	3705.6	843	1776.4	1871.4	3552.8	3742.8
563	1720.4	1815.4	3440.8	3630.8	657	1739.2	1834.2	3478.4	3668.4	751	1758.0	1853.0	3516.0	3706.0	844	1776.6	1871.6	3553.2	3743.2
564	1720.6	1815.6	3441.2	3631.2	658	1739.4	1834.4	3478.8	3668.8	752	1758.2	1853.2	3516.4	3706.4	845	1776.8	1871.8	3553.6	3743.6
565	1720.8	1815.8	3441.6	3631.6	659	1739.6	1834.6	3479.2	3669.2	753	1758.4	1853.4	3516.8	3706.8	846	1777.0	1872.0	3554.0	3744.0
566	1721.0	1816.0	3442.0	3632.0	660	1739.8	1834.8	3479.6	3669.6	754	1758.6	1853.6	3517.2	3707.2	847	1777.2	1872.2	3554.4	3744.4
567	1721.2	1816.2	3442.4	3632.4	661	1740.0	1835.0	3480.0	3670.0	755	1758.8	1853.8	3517.6	3707.6	848	1777.4	1872.4	3554.8	3744.8
568	1721.4	1816.4	3442.8	3632.8	662	1740.2	1835.2	3480.4	3670.4	756	1759.0	1854.0	3518.0	3708.0	849	1777.6	1872.6	3555.2	3745.2
569	1721.6	1816.6	3443.2	3633.2	663	1740.4	1835.4	3480.8	3670.8	757	1759.2	1854.2	3518.4	3708.4	850	1777.8	1872.8	3555.6	3745.6
570	1721.8	1816.8	3443.6	3633.6	664	1740.6	1835.6	3481.2	3671.2	758	1759.4	1854.4	3518.8	3708.8	851	1778.0	1873.0	3556.0	3746.0
571	1722.0	1817.0	3444.0	3634.0	665	1740.8	1835.8	3481.6	3671.6	759	1759.6	1854.6	3519.2	3709.2	852	1778.2	1873.2	3556.4	3746.4
572	1722.2	1817.2	3444.4	3634.4	666	1741.0	1836.0	3482.0	3672.0	760	1759.8	1854.8	3519.6	3709.6	853	1778.4	1873.4	3556.8	3746.8
573	1722.4	1817.4	3444.8	3634.8	667	1741.2	1836.2	3482.4	3672.4	761	1760.0	1855.0	3520.0	3710.0	854	1778.6	1873.6	3557.2	3747.2
574	1722.6	1817.6	3445.2	3635.2	668	1741.4	1836.4	3482.8	3672.8	762	1760.2	1855.2	3520.4	3710.4	855	1778.8	1873.8	3557.6	3747.6
575	1722.8	1817.8	3445.6	3635.6	669	1741.6	1836.6	3483.2	3673.2	763	1760.4	1855.4	3520.8	3710.8	856	1779.0	1874.0	3558.0	3748.0
576	1723.0	1818.0	3446.0	3636.0	670	1741.8	1836.8	3483.6	3673.6	764	1760.6	1855.6	3521.2	3711.2	857	1779.2	1874.2	3558.4	3748.4
577	1723.2	1818.2	3446.4	3636.4	671	1742.0	1837.0	3484.0	3674.0	765	1760.8	1855.8	3521.6	3711.6	858	1779.4	1874.4	3558.8	3748.8
578	1723.4	1818.4	3446.8	3636.8	672	1742.2	1837.2	3484.4	3674.4	766	1761.0	1856.0	3522.0	3712.0	859	1779.6	1874.6	3559.2	3749.2
579	1723.6	1818.6	3447.2	3637.2	673	1742.4	1837.4	3484.8	3674.8	767	1761.2	1856.2	3522.4	3712.4	860	1779.8	1874.8	3559.6	3749.6
580	1723.8	1818.8	3447.6	3637.6	674	1742.6	1837.6	3485.2	3675.2	768	1761.4	1856.4	3522.8	3712.8	861	1780.0	1875.0	3560.0	3750.0
581	1724.0	1819.0	3448.0	3638.0	675	1742.8	1837.8	3485.6	3675.6	769	1761.6	1856.6	3523.2	3713.2	862	1780.2	1875.2	3560.4	3750.4
582	1724.2	1819.2	3448.4	3638.4	676	1743.0	1838.0	3486.0	3676.0	770	1761.8	1856.8	3523.6	3713.6	863	1780.4	1875.4	3560.8	3750.8
583	1724.4	1819.4	3448.8	3638.8	677	1743.2	1838.2	3486.4	3676.4	771	1762.0	1857.0	3524.0	3714.0	864	1780.6	1875.6	3561.2	3751.2
584	1724.6	1819.6	3449.2	3639.2	678	1743.4	1838.4	3486.8	3676.8	772	1762.2	1857.2	3524.4	3714.4	865	1780.8	1875.8	3561.6	3751.6
585	1724.8	1819.8	3449.6	3639.6	679	1743.6	1838.6	3487.2	3677.2	773	1762.4	1857.4	3524.8	3714.8	866	1781.0	1876.0	3562.0	3752.0
586	1725.0	1820.0	3450.0	3640.0	680	1743.8	1838.8	3487.6	3677.6	774	1762.6	1857.6	3525.2	3715.2	867	1781.2	1876.2	3562.4	3752.4
587	1725.2	1820.2	3450.4	3640.4	681	1744.0	1839.0	3488.0	3678.0	775	1762.8	1857.8	3525.6	3715.6	868	1781.4	1876.4	3562.8	3752.8
588	1725.4	1820.4	3450.8	3640.8	682	1744.2	1839.2	3488.4	3678.4	776	1763.0	1858.0	3526.0	3716.0	869	1781.6	1876.6	3563.2	3753.2
589	1725.6	1820.6	3451.2	3641.2	683	1744.4	1839.4	3488.8	3678.8	777	1763.2	1858.2	3526.4	3716.4	870	1781.8	1876.8	3563.6	3753.6
590	1725.8	1820.8	3451.6	3641.6	684	1744.6	1839.6	3489.2	3679.2	778	1763.4	1858.4	3526.8	3716.8	871	1782.0	1877.0	3564.0	3754.0
591	1726.0	1821.0	3452.0	3642.0	685	1744.8	1839.8	3489.6	3679.6	779	1763.6	1858.6	3527.2	3717.2	872	1782.2	1877.2	3564.4	3754.4
592	1726.2	1821.2	3452.4	3642.4	686	1745.0	1840.0	3490.0	3680.0	780	1763.8	1858.8	3527.6	3717.6	873	1782.4	1877.4	3564.8	3754.8
593	1726.4	1821.4	3452.8	3642.8	687	1745.2	1840.2	3490.4	3680.4	781	1764.0	1859.0	3528.0	3718.0	874	1782.6	1877.6	3565.2	3755.2
594	1726.6	1821.6	3453.2	3643.2	688	1745.4	1840.4	3490.8	3680.8	782	1764.2	1859.2	3528.4	3718.4	875	1782.8	1877.8	3565.6	3755.6
595	1726.8	1821.8	3453.6	3643.6	689	1745.6	1840.6	3491.2	3681.2	783	1764.4	1859.4	3528.8	3718.8	876	1783.0	1878.0	3566.0	3756.0
596	1727.0	1822.0	3454.0	3644.0	690	1745.8	1840.8	3491.6	3681.6	784	1764.6	1859.6	3529.2	3719.2	877	1783.2	1878.2	3566.4	3756.4
597	1727.2	1822.2	3454.4	3644.4	691	1746.0	1841.0	3492.0	3682.0	785	1764.8	1859.8	3529.6	3719.6	878	1783.4	1878.4	3566.8	3756.8
598	1727.4	1822.4	3454.8	3644.8	692	1746.2	1841.2	3492.4	3682.4	786	1765.0	1860.0	3530.0	3720.0	879	1783.6	1878.6	3567.2	3757.2
599	1727.6	1822.6	3455.2	3645.2	693	1746.4	1841.4	3492.8	3682.8	787	1765.2	1860.2	3530.4	3720.4	880	1783.8	1878.8	3567.6	3757.6
600	1727.8	1822.8	3455.6	3645.6	694	1746.6	1841.6	3493.2	3683.2	788	1765.4	1860.4	3530.8	3720.8	881	1784.0	1879.0	3568.0	3758.0
601	1728.0	1823.0	3456.0	3646.0	695	1746.8	1841.8	3493.6	3683.6	789	1765.6	1860.6	3531.2	3721.2	882	1784.2	1879.2	3568.4	3758.4
602	1728.2	1823.2	3456.4	3646.4	696	1747.0	1842.0	3494.0	3684.0	790	1765.8	1860.8	3531.6	3721.6	883	1784.4	1879.4	3568.8	3758.8
603	1728.4	1823.4	3456.8	3646.8	697	1747.2	1842.2	3494.4	3684.4	791	1766.0	1861.0	3532.0	3722.0	884	1784.6	1879.6	3569.2	3759.2
604	1728.6	1823.6	3457.2	3647.2	698	1747.4	1842.4	3494.8	3684.8	792	1766.2	1861.2	3532.4	3722.4	885	1784.8	1879.8	3569.6	3759.6
605	1728.8	1823.8	3457.6	3647.6	699	1747.6	1842.6	3495.2	3685.2										

GSM1900 frequencies

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
512	1850,2	1930,2	3700,4	3860,4	606	1869,0	1949,0	3738,0	3898,0	700	1887,8	1967,8	3775,6	3935,6	794	1906,6	1986,6	3813,2	3973,2
513	1850,4	1930,4	3700,8	3860,8	607	1869,2	1949,2	3738,4	3898,4	701	1888,0	1968,0	3776,0	3936,0	795	1906,8	1986,8	3813,6	3973,6
514	1850,6	1930,6	3701,2	3861,2	608	1869,4	1949,4	3738,8	3898,8	702	1888,2	1968,2	3776,4	3936,4	796	1907,0	1987,0	3814,0	3974,0
515	1850,8	1930,8	3701,6	3861,6	609	1869,6	1949,6	3739,2	3899,2	703	1888,4	1968,4	3776,8	3936,8	797	1907,2	1987,2	3814,4	3974,4
516	1851,0	1931,0	3702,0	3862,0	610	1869,8	1949,8	3739,6	3899,6	704	1888,6	1968,6	3777,2	3937,2	798	1907,4	1987,4	3814,8	3974,8
517	1851,2	1931,2	3702,4	3862,4	611	1870,0	1950,0	3740,0	3900,0	705	1888,8	1968,8	3777,6	3937,6	799	1907,6	1987,6	3815,2	3975,2
518	1851,4	1931,4	3702,8	3862,8	612	1870,2	1950,2	3740,4	3900,4	706	1889,0	1969,0	3778,0	3938,0	800	1907,8	1987,8	3815,6	3975,6
519	1851,6	1931,6	3703,2	3863,2	613	1870,4	1950,4	3740,8	3900,8	707	1889,2	1969,2	3778,4	3938,4	801	1908,0	1988,0	3816,0	3976,0
520	1851,8	1931,8	3703,6	3863,6	614	1870,6	1950,6	3741,2	3901,2	708	1889,4	1969,4	3778,8	3938,8	802	1908,2	1988,2	3816,4	3976,4
521	1852,0	1932,0	3704,0	3864,0	615	1870,8	1950,8	3741,6	3901,6	709	1889,6	1969,6	3779,2	3939,2	803	1908,4	1988,4	3816,8	3976,8
522	1852,2	1932,2	3704,4	3864,4	616	1871,0	1951,0	3742,0	3902,0	710	1889,8	1969,8	3779,6	3939,6	804	1908,6	1988,6	3817,2	3977,2
523	1852,4	1932,4	3704,8	3864,8	617	1871,2	1951,2	3742,4	3902,4	711	1890,0	1970,0	3780,0	3940,0	805	1908,8	1988,8	3817,6	3977,6
524	1852,6	1932,6	3705,2	3865,2	618	1871,4	1951,4	3742,8	3902,8	712	1890,2	1970,2	3780,4	3940,4	806	1909,0	1989,0	3818,0	3978,0
525	1852,8	1932,8	3705,6	3865,6	619	1871,6	1951,6	3743,2	3903,2	713	1890,4	1970,4	3780,8	3940,8	807	1909,2	1989,2	3818,4	3978,4
526	1853,0	1933,0	3706,0	3866,0	620	1871,8	1951,8	3743,6	3903,6	714	1890,6	1970,6	3781,2	3941,2	808	1909,4	1989,4	3818,8	3978,8
527	1853,2	1933,2	3706,4	3866,4	621	1872,0	1952,0	3744,0	3904,0	715	1890,8	1970,8	3781,6	3941,6	809	1909,6	1989,6	3819,2	3979,2
528	1853,4	1933,4	3706,8	3866,8	622	1872,2	1952,2	3744,4	3904,4	716	1891,0	1971,0	3782,0	3942,0	810	1909,8	1989,8	3819,6	3979,6
529	1853,6	1933,6	3707,2	3867,2	623	1872,4	1952,4	3744,8	3904,8	717	1891,2	1971,2	3782,4	3942,4					
530	1853,8	1933,8	3707,6	3867,6	624	1872,6	1952,6	3745,2	3905,2	718	1891,4	1971,4	3782,8	3942,8					
531	1854,0	1934,0	3708,0	3868,0	625	1872,8	1952,8	3745,6	3905,6	719	1891,6	1971,6	3783,2	3943,2					
532	1854,2	1934,2	3708,4	3868,4	626	1873,0	1953,0	3746,0	3906,0	720	1891,8	1971,8	3783,6	3943,6					
533	1854,4	1934,4	3708,8	3868,8	627	1873,2	1953,2	3746,4	3906,4	721	1892,0	1972,0	3784,0	3944,0					
534	1854,6	1934,6	3709,2	3869,2	628	1873,4	1953,4	3746,8	3906,8	722	1892,2	1972,2	3784,4	3944,4					
535	1854,8	1934,8	3709,6	3869,6	629	1873,6	1953,6	3747,2	3907,2	723	1892,4	1972,4	3784,8	3944,8					
536	1855,0	1935,0	3710,0	3870,0	630	1873,8	1953,8	3747,6	3907,6	724	1892,6	1972,6	3785,2	3945,2					
537	1855,2	1935,2	3710,4	3870,4	631	1874,0	1954,0	3748,0	3908,0	725	1892,8	1972,8	3785,6	3945,6					
538	1855,4	1935,4	3710,8	3870,8	632	1874,2	1954,2	3748,4	3908,4	726	1893,0	1973,0	3786,0	3946,0					
539	1855,6	1935,6	3711,2	3871,2	633	1874,4	1954,4	3748,8	3908,8	727	1893,2	1973,2	3786,4	3946,4					
540	1855,8	1935,8	3711,6	3871,6	634	1874,6	1954,6	3749,2	3909,2	728	1893,4	1973,4	3786,8	3946,8					
541	1856,0	1936,0	3712,0	3872,0	635	1874,8	1954,8	3749,6	3909,6	729	1893,6	1973,6	3787,2	3947,2					
542	1856,2	1936,2	3712,4	3872,4	636	1875,0	1955,0	3750,0	3910,0	730	1893,8	1973,8	3787,6	3947,6					
543	1856,4	1936,4	3712,8	3872,8	637	1875,2	1955,2	3750,4	3910,4	731	1894,0	1974,0	3788,0	3948,0					
544	1856,6	1936,6	3713,2	3873,2	638	1875,4	1955,4	3750,8	3910,8	732	1894,2	1974,2	3788,4	3948,4					
545	1856,8	1936,8	3713,6	3873,6	639	1875,6	1955,6	3751,2	3911,2	733	1894,4	1974,4	3788,8	3948,8					
546	1857,0	1937,0	3714,0	3874,0	640	1875,8	1955,8	3751,6	3911,6	734	1894,6	1974,6	3789,2	3949,2					
547	1857,2	1937,2	3714,4	3874,4	641	1876,0	1956,0	3752,0	3912,0	735	1894,8	1974,8	3789,6	3949,6					
548	1857,4	1937,4	3714,8	3874,8	642	1876,2	1956,2	3752,4	3912,4	736	1895,0	1975,0	3790,0	3950,0					
549	1857,6	1937,6	3715,2	3875,2	643	1876,4	1956,4	3752,8	3912,8	737	1895,2	1975,2	3790,4	3950,4					
550	1857,8	1937,8	3715,6	3875,6	644	1876,6	1956,6	3753,2	3913,2	738	1895,4	1975,4	3790,8	3950,8					
551	1858,0	1938,0	3716,0	3876,0	645	1876,8	1956,8	3753,6	3913,6	739	1895,6	1975,6	3791,2	3951,2					
552	1858,2	1938,2	3716,4	3876,4	646	1877,0	1957,0	3754,0	3914,0	740	1895,8	1975,8	3791,6	3951,6					
553	1858,4	1938,4	3716,8	3876,8	647	1877,2	1957,2	3754,4	3914,4	741	1896,0	1976,0	3792,0	3952,0					
554	1858,6	1938,6	3717,2	3877,2	648	1877,4	1957,4	3754,8	3914,8	742	1896,2	1976,2	3792,4	3952,4					
555	1858,8	1938,8	3717,6	3877,6	649	1877,6	1957,6	3755,2	3915,2	743	1896,4	1976,4	3792,8	3952,8					
556	1859,0	1939,0	3718,0	3878,0	650	1877,8	1957,8	3755,6	3915,6	744	1896,6	1976,6	3793,2	3953,2					
557	1859,2	1939,2	3718,4	3878,4	651	1878,0	1958,0	3756,0	3916,0	745	1896,8	1976,8	3793,6	3953,6					
558	1859,4	1939,4	3718,8	3878,8	652	1878,2	1958,2	3756,4	3916,4	746	1897,0	1977,0	3794,0	3954,0					
559	1859,6	1939,6	3719,2	3879,2	653	1878,4	1958,4	3756,8	3916,8	747	1897,2	1977,2	3794,4	3954,4					
560	1859,8	1939,8	3719,6	3879,6	654	1878,6	1958,6	3757,2	3917,2	748	1897,4	1977,4	3794,8	3954,8					
561	1860,0	1940,0	3720,0	3880,0	655	1878,8	1958,8	3757,6	3917,6	749	1897,6	1977,6	3795,2	3955,2					
562	1860,2	1940,2	3720,4	3880,4	656	1879,0	1959,0	3758,0	3918,0	750	1897,8	1977,8	3795,6	3955,6					
563	1860,4	1940,4	3720,8	3880,8	657	1879,2	1959,2	3758,4	3918,4	751	1898,0	1978,0	3796,0	3956,0					
564	1860,6	1940,6	3721,2	3881,2	658	1879,4	1959,4	3758,8	3918,8	752	1898,2	1978,2	3796,4	3956,4					
565	1860,8	1940,8	3721,6	3881,6	659	1879,6	1959,6	3759,2	3919,2	753	1898,4	1978,4	3796,8	3956,8					
566	1861,0	1941,0	3722,0	3882,0	660	1879,8	1959,8	3759,6	3919,6	754	1898,6	1978,6	3797,2	3957,2					
567	1861,2	1941,2	3722,4	3882,4	661	1880,0	1960,0	3760,0	3920,0	755	1898,8	1978,8	3797,6	3957,6					
568	1861,4	1941,4	3722,8	3882,8	662	1880,2	1960,2	3760,4	3920,4	756	1899,0	1979,0	3798,0	3958,0					
569	1861,6	1941,6	3723,2	3883,2	663	1880,4	1960,4	3760,8	3920,8	757	1899,2	1979,2	3798,4	3958,4					
570	1861,8	1941,8	3723,6	3883,6	664	1880,6	1960,6	3761,2	3921,2	758	1899,4	1979,4	3798,8	3958,8					
571	1862,0	1942,0	3724,0	3884,0	665	1880,8	1960,8	3761,6	3921,6	759	1899,6	1979,6	3799,2	3959,2					
572	1862,2	1942,2	3724,4	3884,4	666	1881,0	1961,0	3762,0	3922,0	760	1899,8	1979,8	3799,6	3959,6					
573	1862,4	1942,4	3724,8	3884,8	667	1881,2	1961,2	3762,4	3922,4	761	1900,0	1980,0	3800,0	3960,0					
574	1862,6	1942,6	3725,2	3885,2	668	1881,4	1961,4	3762,8	3922,8	762	1900,2	1980,2	3800,4	3960,4					
575	1862,8	1942,8	3725,6	3885,6	669	1881,6	1961,6	3763,2	3923,2	763	1900,4	1980,4	3800,8	3960,8					
576	1863,0	1943,0	3726,0	3886,0	670	1881,8	1961,8	3763,6	3923,6	764	1900,6	1980,6	3801,2	3961,2					
577	1863,2	1943,2	3726,4	3886,4	671	1882,0	1962,0	3764,0	3924,0	765	1900,8	1980,8	3801,6	3961,6					
578	1863,4	1943,4	3726,8	3886,8	672	1882,2	1962,2	3764,4	3924,4	766	1901,0	1981,0	3802,0	3962,0					
579	1863,6	1943,6	3727,2	3887,2	673	1882,4	1962,4	3764,8	3924,8	767	1901,2	1981,2	3802,4	3962,4					
580	1863,8	1943,8	3727,6	3887,6	674	1882,6	1962,6	3765,2	3925,2	768	1901,4	1981,4	3802,8	3962,8					
581	1864,0	1944,0	3728,0	3888,0	675	1882,8	1962,8	3765,6	3925,6	769	1901,6	1981,6	3803,2	3963,2					
582	1864,2	1944,2	3728,4	3888,4	676	1883,0	1963,0	3766,0	3926,0	770	1901,8	1981,8	3803,6	3963,6					
583	1864,4	1944,4	3728,8	3888,8	677	1883,2	1963,2	3766,4	3926,4	771	1902,0	1982,0	3804,0	3964,0					
584	1864,6	1944,6	3729,2	3889,2	678	1883,4	1963,4	3766,8	3926,8	772	1902,2	1982,2	3804,4	3964,4					
585	1864,8	1944,8	3729,6	3889,6	679	1883,6	1963,6	3767,2	3927,2	773	1902,4	1982,4	3804,8	3964,8					
586	1865,0	1945,0	3730,0	3890,0	680	1883,8	1963,8	3767,6	3927,6	774	1902,6	1982,6	3805,2	3965,2					
587	1865,2	1945,2	3730,4	3890,4	681	1884,0	1964,0	3768,0	3928,0	775	1902,8	1982,8	3805,6	3965,6					
588	1865,4	1945,4	3730,8	3890,8	682	1884,2	1964,2	3768,4	3928,4	776	1903,0	1983,0	3806,0	3966,0					
589	1865,6	1945,6	3731,2	3891,2	683	1884,4	1964,4	3768,8	3928,8	777	1903,2	1983,2	3806,4	3966,4					
590	1865,8	1945,8	3731,6	3891,6	684	1884,6	1964,6	3769,2	3929,2	778	1903,4	1983,4	3806,8	3966,8					
591	1866,0	1946,0	3732,0	3892,0	685	1884,8	1964,8	3769,6	3929,6	779	1903,6	1983,6	3807,2	3967,2					
592	1866,2	1946,2	3732,4	3892,4	686	1885,0	1965,0	3770,0	3930,0	780	1903,8	1983,8	3807,6	3967,6					
593	1866,4	1946,4	3732,8	3892,8	687	1885,2	1965,2	3770,4	3930,4	781	1904,0	1984,0	3808,0	3968,0					
594	1866,6	1946,6	3733,2	3893,2	688	1885,4	1965,4	3770,8	3930,8	782	1904,2	1984,2	3808,4	3968,4					
595	1866,8	1946,8	3733,6	3893,6	689	1885,6	1965,6	3771,2	3931,2	783	1904,4	1984,4	3808,8	3968,8					
596	1867,0	1947,0	3734,0	3894,0	690	1885,8	1965,8	3771,6	3931,6	784	1904,6	1984,6	3809,2	3969,2					
597	1867,2	1947,2	3734,4	3894,4	691	1886,0	1966,0	3772,0	3932,0	785	1904,8	1984,8	3809,6	3969,6					
598	1867,4	1947,4	3734,8	3894,8	692	1886,2	1966,2	3772,4	3932,4	786	1905,0	1985,0	3810,0	3970,0					
599	1867,6	1947,6	3735,2	3895,2	693	1886,4	1966,4	3772,8	3932,8	787	1905,2	1985,2	3810,4	3970,4					
600	1867,8	1947,8	3735,6	3895,6	694	1886,6	1966,6	3773,2	3933,2	788	1905,4	1985,4	3810,8	3970,8					
601	1868,0	1948,0	3736,0	3896,0	695	1886,8	1966,8	3773,6	3933,6	789	1905,6	1985,6	3811,2	3971,2					
602	1868,2	1948,2	3736,4	3896,4	696	1887,0	1967,0	3774,0	3934,0	790	1905,8	1985,8	3811,6	3971,6					
603	1868,4	1948,4	3736,8	3896,8	697	1887,2	1967,2	3774,4	3934,4	791	1906,0	1986,0	3812,0	3972,0					
604	1868,6	1948,6	3737,2	3897,2	698	1887,4	1967,4	3774,8	3934,8	792	1906,2	1986,2	3812,4	3972,4					
605	1868,8	1948,8	3737,6	3897,6	699	1887,6	1967,6	3775,2	3935,2	793	1906,4	1986,4	3812,8	3972,8					

WCDMA 2100 Rx frequencies

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

WCDMA 2100 Tx frequencies

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

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