Nokia Customer Care

Service Manual

RM-123; RM-145 (Nokia 6233; Nokia 6234)

Mobile Terminal

Part No: 9249152 (Issue 1)

COMPANY CONFIDENTIAL

NOKIA

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Amendment Record Sheet

Amendment No	Date	Inserted By	Comments
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Warnings and cautions

Warnings

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

Cautions

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

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For your safety

QUALIFIED SERVICE

Only qualified personnel may install or repair phone equipment.

ACCESSORIES AND BATTERIES

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

CONNECTING TO OTHER DEVICES

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

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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.

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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.

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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.

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Nokia 6233; Nokia 6234 Service Manual Structure

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4 Service Tools and Service Concepts
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1 — General information

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Product selection

RM-123 (Nokia 6234) and RM-145 (Nokia 6233) are both WCDMA/GSM dual mode phones, supporting WCDMA 2100 (UMTS) and EGSM900/1800/1900 bands.

RM-123 is a special Vodafone customised model. Even though the appearance is different, they both use the same PWB and offer the same features.



RM-123/Nokia 6234 RM-145/Nokia 6233

Key Features:

- Stereo speakers and 3D sound effects
- Up to 70 MB total memory for storing pictures, messages, etc.
- 2-megapixel camera with 8x digital zoom and landscape mode
- Stereo FM radio supporting visual radio
- Music player
- Enhanced Java email client
- Video, MP3, eACC+, and polyphonic ringing tones
- FM visual stereo radio with integrated 3D stereo speakers

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Phone features

Display and keypad features

- 262 K colour QVGA 240 x 320 pixels display
- Active TFT display
- Side volume keys with zoom functionality
- Dedicated camera key

Hardware features

- 2-megapixel camera landscape mode and 8x digital zoom
- PopPortTM™
- 2 mm charger plug interface
- Bluetooth
- USB
- FM radio
- MP3 player
- Internal vibrator
- Plug-in SIM (1.8 V and 3.0 V)
- Real time clock

RF features

- WCDMA 2100
- GSM/EDGE 900/1800/1900
- EDGE*: Class 10
- GPRS: Class 10
- HSCSD

Software and User interface features

Software features

- ISA OS 8.0s Platform
- Nokia Series 40 User interface (UI): Java MIDP 2.0

UI features

Integrated digital camera	• 2-megapixel camera with 8x smooth, digital zoom and dedicated key • Landscape support mode • Full screen viewfinder • Print images directly from the phone over a Bluetooth connection or using an MMC (depending on the printer)

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Multimedia	• Integrated video player for download and playback or for streaming: 3GPP, H.263 video, MPEG-4, and AMR • Add video and music to your caller ID • Interactive 3D games with multi-player support • Music player supports MP3, MP4, eAAC+ and AAC music files • Use pre-loaded polyphonic midi ring tones, MP3, eAAC+, and message alerts • OTA download of ringing tones, themes, wallpapers • Download/upload images and video clips • Kodak Photo services for high-quality, easy printing • Stereo FM Radio • Video Sharing • 3GPP streaming for mobile access to the latest sports, weather, entertainment, and news information
Messaging	• Common inbox (MMS, SMS, e-mail) • Full MMS 1.2 functionality for sending and receiving messages including video, photos, and music • Improved Java email client with easy settings and spam filter • Email: supports SMTP, POP3, and IMAP4 protocols • Text messaging: supports concatenated SMS and picture messaging • Presence: includes Wireless Village and Dynamic phonebook; know someone's status before you call
Memory functions	• Up to 70MB total memory (6MB internal + 64MB memory card) • Supports up to 2GB of expandable, microSD memory • Back up important files such as presentations and documents, or just store images on your personal mobile storage device
Games	• Nokia World Cup, 3D Street Racer, and 3D Snake • Download new Java games
Applications	• Enhanced Java email client with easy settings and spam filter • Data synchronization • Visual Radio • Wireless presenter • Notepad and voice memo recorder • Translator • World Clock II • Converter II • Java MIDP 2.0 with Bluetooth API makes downloading new applications easy • Active standby mode

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Connectivity	• Transfer images, video clips, audio files, and other files • Bluetooth wireless technology: wide range of profiles and APIs for seamless connectivity • Infrared • USB port • Easy remote or local synchronization with a PC or other compatible device • OMA DRM 1.0 protects copyrighted material • Push to talk over cellular (PoC) lets you use your phone like a walkie-talkie
Browsing	• WAP 2.0, XHTML browser over HTTP/TCP/IP stack HSCSD • HSCSD, CSD for browsing and as data modem • 3GPP video streaming
Data transfer	• EDGE Class 10 (4+1, 3+2): speed up to 236.8 kbps • GPRS (General Packet Radio Service) class 10 (4+1, 3+2) • HSCSD (High-Speed Circuit-Switched Data) transfer up to 43.2 kbps in HSCSD networks • DRM 1.0 for secure content downloading • Speech codec support for FR, EFR, AMR • TCP/IP
Call management	• Speed dialing: up to 9 names • Last-number redial from dialed calls list (Dial key brings up the dialed calls list) • Automatic redial (max 10 attempts) • Automatic answer (works with headset or car kit only) • Call waiting, call hold, call divert, call timer • Automatic and manual network selection • Caller identification with image • Closed User Group • Fixed Dialing Number, allows calls only to predefined numbers • Conference call (up to 5 participants) • Vibrating alert
Voice features	• Nokia Push to Talk with dedicated key • Two effect speakers (each 15mm x 11mm) • 3D effect sound • Nokia Express Audio Messaging • 16 voice commands • Integrated Handsfree speakers • Voice dialing, 25 presets

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Accessories

Table 1 Battery and chargers

Type	Name
Note: This phone is charged through the smaller Nokia standard interface (2.0 mm plug). The 3.5 mm standard charger can be used together with the CA-44 charger adapter.	
AC-3	Compact charger
AC-4	Travel performance charger
BP-6M-S	Battery 1100 mAh Li-Ion
CA-44	Charger adapter (from 3.5 mm -> 2 mm)

Table 2 Car accessories

Type	Name
BHF-3	Headrest handsfree
CA-55	Converter
CARK-91	Advanced HF car kit
CK-1W	Wireless car kit
CK-7W	Advanced Car Kit
CK-10	Car kit
CR-56	Mobile holder
DC-4	Mobile charger
HF-3	Plug-in car handsfree
HF-6W	Wireless plug-in handsfree
N616	Car kit
	Nokia universal holder

Table 3 Audio

Type	Name
HDA-10	Phone adapter
HDB-4	Boom headset
HDS-3	Stereo headset
HDW-3	Wireless headset
HS-3	Stereo headset: fashion
HS-4W	Wireless boom headset
HS-5	Headset
HS-6	Display headset

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Type	Name
HS-11W	Wireless headset
HS-21W	Wireless clip-on headset
HS-23	Stereo headset
HS-26W	Wireless headset
HS-31	Fashion stereo headset
HS-36W	Wireless headset
LPS-4	Loopset
MD-1	Music stand

Table 4 Connectivity

Type	Name
CA-53	USB cable

Table 5 Imaging and lifestyle

Type	Name
PT-6	Remote camera

Table 6 Messaging

Type	Name
SU-1B	Digital pen

Table 7 Music

Type	Name
MD-1	Music stand

Technical specifications

General specifications

Unit	Dimension (mm)	Weight (g)	Volume (cc)
RM-123 Transceiver with BP-6M-S 1100 mAh Li-Ion battery pack	108x46.5x17.5	100	76
RM-145 Transceiver with BP-6M-S 1100 mAh Li-Ion battery pack	108x46.5x18	110	81

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Main RF characteristics for triple GSM band and WCDMA band phones (Europe)

Parameter	Unit
Cellular system	GSM/EGSM900,GSM1800/1900 WCDMA2100
Rx frequency band	EGSM900: 925 - 935 MHz
	GSM900: 935 - 960 MHz
	GSM1800: 1805 - 1880 MHz
	GSM1900: 1930 - 1990 MHz
	WCDMA: 2110- 2170 MHz
Tx frequency band	EGSM900: 880 - 890 MHz
	GSM900: 890 - 915 MHz
	GSM1800: 1710 - 1785 MHz
	GSM1900: 1850 - 1910 MHz
	WCDMA: 1920 - 1980 MHz
Output power	GSM900: +5 ... +32.5 dBm
	GSM1800: +0 ... +30 dBm
	GSM1900: +0 ... +30 dBm
	WCDMA2100: 0 ...+24 dBm
Number of RF channels	GSM900: 125
	GSM1800: 375
	GSM1900: 300
	WCDMA2100: 8
Channel spacing	GSM 200 KHz WCDMA 4.8 MHz
Number of Tx power levels	GSM900: 15
	GSM1800: 16
	GSM1900: 16
	WCDMA2100: 12

Battery endurance

Battery	Talk time	Standby time
BP-6M-S 1100 mAh Li-ion	GSM: up to 4 hours WCDMA: up to 3.1 hours	Up to 340 hours

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Note: Variation in operation times will occur depending on SIM card, network settings and usage. Talk time is increased by up to 30% if half rate is active, and reduced by 5% if enhanced full rate is active.

Environmental conditions

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

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2 — Parts and layouts

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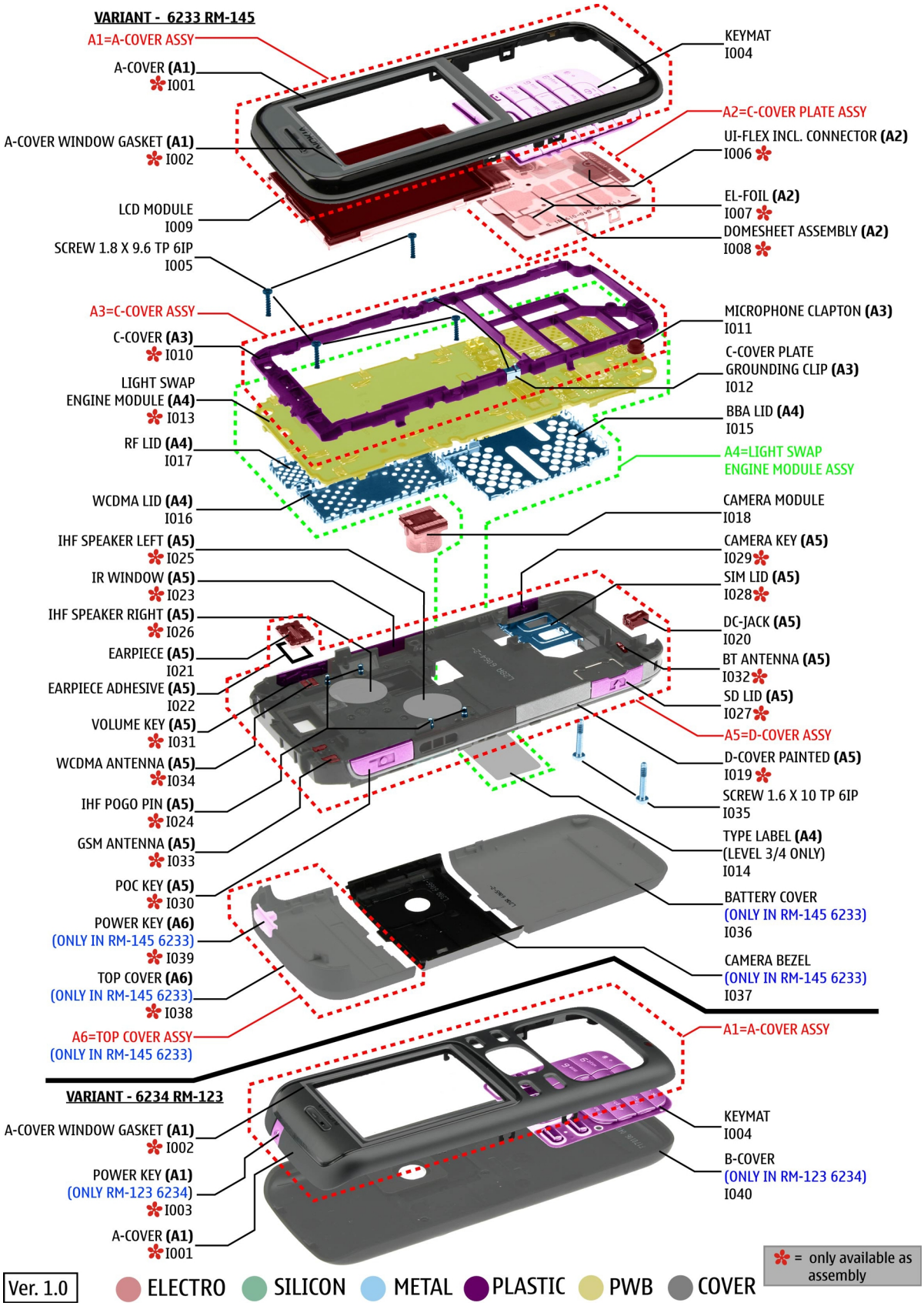
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Exploded view



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Mechanical parts list

Table 8 RM-123 Mechanical parts list

Item	Qty	Description
** = Not available as spare part*		
A1		**A-cover assy**
I001*	1	A-cover (A1)
I002*	1	A-cover window gasket
I003*	1	Power key
I004	1	Keymat
I009	1	LCD module
I005	1	Screw 1.8 x 9.6 TP 6IP
A2		**Cover plate assembly**
I006*	1	UI flex incl connector (A2)
I007*	1	EL-foil (a2)
I008*	1	Domesheet assembly (A2)
A3		**C-cover assembly**
I010*	1	C-cover (A3)
I011	1	Microphone Clapton
I012	1	C-cover plate grounding clip
A4		**Light swap engine module assembly**
I013*	1	Light swap engine module
I014	1	Type label (Level 3/4 only)
I015	1	BBA lid (A4)
I016	1	WCDMA lid
I017	1	RF lid
I018	1	Camera module
A5		**D-cover assembly**
I019*	1	D-cover painted
I020	1	DC jack
I021	1	Earpiece
I022	1	Earpiece adhesive
I023*	1	IR window

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Item	Qty	Description
I024*	1	IHF pogo pin
I025*	1	IHF speaker left
I026*	1	IHF speaker right
I028*	1	SIM lid
I029*	1	Camera key
I030*	1	POC key
I031	1	Volume key
I032*	1	BT antenna
I033*	1	GSM antenna
I034*	1	WCDMA antenna
I035	1	Screw 1.8 x 10 TP 6IP
I040	1	B-cover

Table 9 RM-145 Mechanical parts list

Item	Qty	Description
** = Not available as spare part*		
A1		**A-cover assy**
I001*	1	A-cover (A1)
I002*	1	A-cover window gasket
I004	1	Keymat
I009	1	LCD module
I005	1	Screw 1.8 x 9.6 TP 6IP
A2		**Cover plate assembly**
I006*	1	UI flex incl connector (A2)
I007*	1	EL-foil (a2)
I008*	1	Domesheet assembly (A2)
A3		**C-cover assembly**
I010*	1	C-cover (A3)
I011	1	Microphone Clapton
I012	1	C-cover plate grounding clip
A4		**Light swap engine module assembly**
I013*	1	Light swap engine module

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Item	Qty	Description
I014	1	Type label (Level 3/4 only)
I015	1	BBA lid (A4)
I016	1	WCDMA lid
I017	1	RF lid
I018	1	Camera module
A5		**D-cover assembly**
I019*	1	D-cover painted
I020	1	DC jack
I021	1	Earpiece
I022	1	Earpiece adhesive
I023*	1	IR window
I024*	1	IHF pogo pin
I025*	1	IHF speaker left
I026*	1	IHF speaker right
I028*	1	SIM lid
I029*	1	Camera key
I030*	1	POC key
I031*	1	Volume key
I032*	1	BT antenna
I033*	1	GSM antenna
I034*	1	WCDMA antenna
I035	1	Screw 1.8 x 10 TP 6IP
I036	1	Battery cover
I037	1	Camera bezel
A6		**Top cover assembly**
I038*	1	Top cover
I039*	1	Power key

Swap units

Table 10 RM-123 Swap units

Swap units for RM-123
RM-123 SWAP SOFT BLACK LATIN EURO-C
RM-123 SWAP SOFT BLACK LATIN EURO-C ZA

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Swap units for RM-123
RM-123 SWAP SOFT BLACK LATIN EURO-C FR
RM-123 SWAP SOFT BLACK LATIN EURO-D
RM-123 SWAP SOFT BLACK GREEK EURO-H
RM-123 SWAP SOFT BLACK ARABIC EURO-G

Table 11 RM-145 Swap units

Swap units for RM-145
RM-145 SWAP SILVER ALLOY CYRIL RUSSIA
RM-145 SWAP SILVER ALLOY CYRIL UKRAINE
RM-145 SWAP SILVER ALLOY EU-C TURKEY
RM-145 SWAP SILVER ALLOY LATIN EU-C FRA
RM-145 SWAP SILVER ALLOY LATIN EU-C ZA
RM-145 SWAP CLASSIC BLACK CYRIL UKRAINE
RM-145 SWAP CLASSIC BLACK CYRIL RUS
RM-145 SWAP SILVER ALLOY LATIN EURO-C
RM-145 SWAP CLASSIC BLACK LATIN TURKEY
RM-145 SWAP CLASSIC BLACK LATIN EU-C FRA
RM-145 SWAP CLASSIC BLACK LATIN EU-C ZA
RM-145 SWAP CLASSIC BLACK LATIN EURO-C

Component parts list

Table 12

Item ref		Side	Object Name	Type
A	1000	T	BB SHIELD ASSEMBLY	Shield Assembly
A	1001	T	SIM SUPPORT SHIELD CuNi 18Zn20 F610	Shield
A	1050	B	GE SHIELD	Shield
A	7000	T	RF SHIELD ASSEMBLY	Shield Assembly
A	7001	T	WCDMA SHIELD ASSEMBLY	Shield Assembly
B	2200	T	CRYSTAL 32.768KHZ +/-30PPM 12.5PF	Crystal
C	1000	T	CHIPCAP X5R 1U K 6V3 0603	Ceramic Capacitor
C	1001	T	CHIPCAP X5R 100N K 10V 0402	Ceramic Capacitor
C	1002	T	CHIP ARRAY X5R 2X1U (2x1U2) K 6V3 0405	Ceramic Capacitor
C	1008	T	CHIPCAP X5R 1U K 6V3 0603	Ceramic Capacitor
C	1009	T	CHIPCAP NP0 27P J 50V 0402	Ceramic Capacitor
C	1010	T	CHIPCAP NP0 27P J 50V 0402	Ceramic Capacitor

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Item ref		Side	Object Name	Type
C	1052	B	CHIPCAP X5R 100N K 10V 0402	Ceramic Capacitor
C	1053	B	CHIPCAP X7R 10N K 16V 0402	Ceramic Capacitor
C	1054	B	CHIPCAP X5R 100N K 10V 0402	Ceramic Capacitor
C	1055	B	CHIPCAP X5R 1U K 6V3 0402	Ceramic Capacitor
C	1056	B	CHIPCAP X5R 100N K 10V 0402	Ceramic Capacitor
C	1060	T	CHIPCAP X5R 220N K 6.3V 0402	Ceramic Capacitor
C	1061	B	CHIPCAP X5R 220N K 6.3V 0402	Ceramic Capacitor
C	1062	B	CHIPCAP X5R 4U7 K 6.3V 0603	Ceramic Capacitor
C	1063	B	CHIPCAP X5R 4U7 K 6V3 0805	Ceramic Capacitor
C	1064	B	CHIPCAP X5R 4U7 K 6V3 0805	Ceramic Capacitor
C	1065	B	CHIPCAP X7R 10N K 16V 0402	Ceramic Capacitor
C	1066	B	CHIPCAP X5R 1U K 6V3 0603	Ceramic Capacitor
C	1069	B	CHIPCAP X7R 10N K 16V 0402	Ceramic Capacitor
C	1070	B	CHIPCAP NP0 27P J 50V 0402	Ceramic Capacitor
C	1071	B	CHIPCAP NP0 27P J 50V 0402	Ceramic Capacitor
C	1072	B	CHIPCAP NP0 27P J 50V 0402	Ceramic Capacitor
C	2000	B	CHIPCAP NP0 27P J 50V 0402	Ceramic Capacitor
C	2001	B	CHIPCAP X5R 470N K 25V 0603	Ceramic Capacitor
C	2002	B	CHIPCAP X7R 1N0 K 50V 0402	Ceramic Capacitor
C	2003	B	CHIPCAP FEEDTHRU 100N M 25V 0805	Ceramic Capacitor
C	2004	B	CHIPCAP X5R 4U7 K 6.3V 0603	Ceramic Capacitor
C	2005	B	CHIPCAP X7R 33N K 10V 0402	Ceramic Capacitor
C	2006	T	CHIPCAP X7R 33N K 10V 0402	Ceramic Capacitor
C	2007	B	CHIPCAP X7R 10N K 16V 0402	Ceramic Capacitor
C	2008	B	CHIPCAP X7R 10N K 16V 0402	Ceramic Capacitor
C	2009	B	CHIPCAP X7R 10N K 16V 0402	Ceramic Capacitor
C	2010	B	CHIPCAP X7R 10N K 16V 0402	Ceramic Capacitor
C	2011	B	CHIPCAP NP0 10P J 50V 0402	Ceramic Capacitor
C	2012	B	CHIPCAP NP0 10P J 50V 0402	Ceramic Capacitor
C	2013	B	CHIPCAP NP0 10P J 50V 0402	Ceramic Capacitor
C	2014	B	CHIPCAP NP0 10P J 50V 0402	Ceramic Capacitor
C	2015	B	CHIPCAP NP0 270P J 50V 0402	Ceramic Capacitor
C	2016	B	CHIPCAP X7R 33N K 10V 0402	Ceramic Capacitor
C	2020	B	CHIPCAP X5R 100N K 10V 0402	Ceramic Capacitor
C	2021	B	CHIPCAP X5R 100N K 10V 0402	Ceramic Capacitor

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Item ref		Side	Object Name	Type
C	2071	T	CHIPCAP NP0 27P J 50V 0402	Ceramic Capacitor
C	2100	T	CHIPCAP X7R 33N K 10V 0402	Ceramic Capacitor
C	2101	T	CHIPCAP X7R 33N K 10V 0402	Ceramic Capacitor
C	2102	T	CHIPCAP X5R 4U7 K 6.3V 0603	Ceramic Capacitor
C	2106	T	CHIPCAP NP0 22P J 50V 0402	Ceramic Capacitor
C	2107	T	CHIPCAP NP0 22P J 50V 0402	Ceramic Capacitor
C	2108	T	CHIPCAP X7R 1N0 K 50V 0402	Ceramic Capacitor
C	2109	T	CHIPCAP X7R 1N0 K 50V 0402	Ceramic Capacitor
C	2110	T	CHIPCAP X7R 1N0 K 50V 0402	Ceramic Capacitor
C	2111	T	CHIPCAP NP0 22P J 50V 0402	Ceramic Capacitor
C	2112	T	CHIPCAP NP0 22P J 50V 0402	Ceramic Capacitor
C	2117	T	CHIPCAP X7R 33N K 10V 0402	Ceramic Capacitor
C	2118	T	CHIPCAP X7R 33N K 10V 0402	Ceramic Capacitor
C	2119	T	CHIPCAP X7R 33N K 10V 0402	Ceramic Capacitor
C	2120	T	CHIPCAP X7R 33N K 10V 0402	Ceramic Capacitor
C	2124	T	CHIPCAP X5R 100N K 10V 0402	Ceramic Capacitor
C	2127	T	CHIPCAP X5R 1U K 6V3 0603	Ceramic Capacitor
C	2132	T	CHIPCAP X7R 1N0 K 50V 0402	Ceramic Capacitor
C	2200	T	CHIPCAP X5R 1U K 6V3 0402	Ceramic Capacitor
C	2201	T	CHIPCAP X5R 1U K 6V3 0603	Ceramic Capacitor
C	2202	T	CHIPCAP X7R 1N0 K 50V 0402	Ceramic Capacitor
C	2203	T	CHIPCAP X7R 1N0 K 50V 0402	Ceramic Capacitor
C	2204	T	CHIPCAP X7R 1N0 K 50V 0402	Ceramic Capacitor
C	2205	T	CHIPCAP X7R 1N0 K 50V 0402	Ceramic Capacitor
C	2206	T	CHIPCAP X7R 1N0 K 50V 0402	Ceramic Capacitor
C	2207	T	CHIPCAP X7R 1N0 K 50V 0402	Ceramic Capacitor
C	2208	T	CHIPCAP NP0 27P J 50V 0402	Ceramic Capacitor
C	2209	T	CHIPCAP NP0 22P J 50V 0402	Ceramic Capacitor
C	2210	T	CHIPCAP X5R 1U K 16V 0603	Ceramic Capacitor
C	2211	T	CHIPCAP X5R 4U7 K 10V 0805	Ceramic Capacitor
C	2212	T	CHIPCAP X5R 1U K 6V3 0603	Ceramic Capacitor
C	2215	T	CHIP ARRAY X5R 2X1U (2x1U2) K 6V3 0405	Ceramic Capacitor
C	2217	T	CHIP ARRAY X5R 2X1U (2x1U2) K 6V3 0405	Ceramic Capacitor
C	2220	T	CHIP ARRAY X5R 2X1U (2x1U2) K 6V3 0405	Ceramic Capacitor
C	2221	T	CHIP ARRAY X5R 2X1U (2x1U2) K 6V3 0405	Ceramic Capacitor

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Item ref		Side	Object Name	Type
C	2222	T	CHIP ARRAY X5R 2X1U (2x1U2) K 6V3 0405	Ceramic Capacitor
C	2223	T	CHIPCAP X7R 10N K 16V 0402	Ceramic Capacitor
C	2224	T	CHIPCAP X7R 10N K 16V 0402	Ceramic Capacitor
C	2225	T	CHIP ARRAY X5R 2X1U (2x1U2) K 6V3 0405	Ceramic Capacitor
C	2226	T	CHIP ARRAY X5R 2X1U (2x1U2) K 6V3 0405	Ceramic Capacitor
C	2230	T	CHIP ARRAY X5R 2X1U (2x1U2) K 6V3 0405	Ceramic Capacitor
C	2231	T	CHIPCAP X5R 10U M 6V3 0805	Ceramic Capacitor
C	2236	T	CHIPCAP X7R 1N0 K 50V 0402	Ceramic Capacitor
C	2300	T	CHIPCAP X7R 10N K 16V 0402	Ceramic Capacitor
C	2301	T	CHIPCAP X5R 22U M 6V3 0805	Ceramic Capacitor
C	2302	T	CHIPCAP X5R 22U M 6V3 0805	Ceramic Capacitor
C	2303	T	CHIP ARRAY X5R 2X1U (2x1U2) K 6V3 0405	Ceramic Capacitor
C	2304	T	CHIPCAP X7R 10N K 16V 0402	Ceramic Capacitor
C	2307	T	CHIP ARRAY X5R 2X1U (2x1U2) K 6V3 0405	Ceramic Capacitor
C	2309	T	CHIPCAP X5R 22U M 6V3 0805	Ceramic Capacitor
C	2313	T	CHIPCAP X5R 1U K 6V3 0603	Ceramic Capacitor
C	2405	B	CHIPCAP X5R 1U K 6V3 0603	Ceramic Capacitor
C	2406	B	CHIPCAP X5R 1U K 6V3 0603	Ceramic Capacitor
C	2412	B	CHIP ARRAY X5R 2X1U (2x1U2) K 6V3 0405	Ceramic Capacitor
C	2414	B	CHIPCAP NP0 27P J 50V 0402	Ceramic Capacitor
C	2415	B	CHIPCAP NP0 56P J 50V 0402	Ceramic Capacitor
C	2416	B	CHIPCAP X7R 6N8 K 25V 0402	Ceramic Capacitor
C	2418	B	CHIPCAP X5R 1U K 6V3 0402	Ceramic Capacitor
C	2420	B	CHIPCAP NP0 1N0 K 200V 1206	Ceramic Capacitor
C	2500	B	CHIPCAP X5R 100N M 16V 0402	Ceramic Capacitor
C	2501	B	CHIPCAP NP0 27P J 50V 0402	Ceramic Capacitor
C	2502	B	CHIPCAP X5R 4U7 K 6.3V 0603	Ceramic Capacitor
C	2503	B	CHIPCAP X5R 1U K 25V 0603	Ceramic Capacitor
C	2581	T	CHIPCAP X7R 10N K 16V 0402	Ceramic Capacitor
C	2600	T	CHIPCAP X5R 4U7 K 10V 0805	Ceramic Capacitor
C	2601	T	CHIPCAP NP0 22P J 50V 0402	Ceramic Capacitor
C	2602	T	CHIPCAP X5R 100N K 10V 0402	Ceramic Capacitor
C	2603	T	CHIPCAP X5R 100N K 10V 0402	Ceramic Capacitor
C	2700	T	CHIPCAP X5R 100N K 10V 0402	Ceramic Capacitor
C	2701	T	CHIPCAP NP0 27P J 50V 0402	Ceramic Capacitor

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Item ref		Side	Object Name	Type
C	2800	T	CHIPCAP X5R 100N K 10V 0402	Ceramic Capacitor
C	2801	T	CHIPCAP X5R 100N K 10V 0402	Ceramic Capacitor
C	2802	T	CHIPCAP X5R 100N K 10V 0402	Ceramic Capacitor
C	2803	T	CHIPCAP X5R 100N K 10V 0402	Ceramic Capacitor
C	2804	T	CHIPCAP X5R 100N K 10V 0402	Ceramic Capacitor
C	2805	T	CHIPCAP X5R 100N K 10V 0402	Ceramic Capacitor
C	2806	T	CHIPCAP X5R 100N K 10V 0402	Ceramic Capacitor
C	2807	T	CHIPCAP X5R 1U K 6V3 0603	Ceramic Capacitor
C	2808	T	CHIPCAP X5R 100N K 10V 0402	Ceramic Capacitor
C	2809	T	CHIPCAP X5R 100N K 10V 0402	Ceramic Capacitor
C	2810	T	CHIPCAP X5R 100N K 10V 0402	Ceramic Capacitor
C	2811	T	CHIPCAP X5R 100N K 10V 0402	Ceramic Capacitor
C	2812	T	CHIPCAP X5R 100N K 10V 0402	Ceramic Capacitor
C	2813	T	CHIPCAP X5R 100N K 10V 0402	Ceramic Capacitor
C	2814	T	CHIPCAP X5R 100N K 10V 0402	Ceramic Capacitor
C	2815	T	CHIPCAP X7R 10N K 16V 0402	Ceramic Capacitor
C	2819	T	CHIPCAP NP0 27P J 50V 0402	Ceramic Capacitor
C	3000	T	CHIPCAP X5R 100N M 16V 0402	Ceramic Capacitor
C	3001	T	CHIPCAP X7R 10N K 16V 0402	Ceramic Capacitor
C	3002	T	CHIPCAP X5R 220N K 6.3V 0402	Ceramic Capacitor
C	3003	T	CHIPCAP X7R 10N K 16V 0402	Ceramic Capacitor
C	3004	T	CHIPCAP X5R 220N K 6.3V 0402	Ceramic Capacitor
C	3005	T	CHIPCAP X7R 10N K 16V 0402	Ceramic Capacitor
C	3006	T	CHIPCAP X7R 10N K 16V 0402	Ceramic Capacitor
C	3007	T	CHIPCAP X5R 220N K 6.3V 0402	Ceramic Capacitor
C	3008	T	CHIPCAP X5R 220N K 6.3V 0402	Ceramic Capacitor
C	3009	T	CHIPCAP X7R 10N K 16V 0402	Ceramic Capacitor
C	3010	T	CHIPCAP X7R 10N K 16V 0402	Ceramic Capacitor
C	3100	T	CHIPCAP NP0 27P J 50V 0402	Ceramic Capacitor
C	3200	B	CHIPCAP X5R 100N K 10V 0402	Ceramic Capacitor
C	3201	B	CHIPCAP X5R 1U K 6V3 0603	Ceramic Capacitor
C	3202	B	CHIPCAP X7R 10N K 16V 0402	Ceramic Capacitor
C	3203	B	CHIPCAP X5R 1U K 6V3 0603	Ceramic Capacitor
C	3221	T	CHIPCAP NP0 27P J 50V 0402	Ceramic Capacitor
C	6000	B	CHIPCAP X5R 100N M 16V 0402	Ceramic Capacitor

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Item ref		Side	Object Name	Type
C	6001	B	CHIPCAP X5R 100N M 16V 0402	Ceramic Capacitor
C	6002	B	CHIPCAP X5R 1U K 6V3 0603	Ceramic Capacitor
C	6003	B	CHIPCAP X5R 1U K 6V3 0603	Ceramic Capacitor
C	6004	B	CHIPCAP X5R 100N M 16V 0402	Ceramic Capacitor
C	6005	B	CHIPCAP X5R 100N M 16V 0402	Ceramic Capacitor
C	6010	B	CHIPCAP NP0 4P7 C 50V 0402	Ceramic Capacitor
C	6011	B	CHIPCAP NP0 5P6 C 50V 0402	Ceramic Capacitor
C	6050	B	CHIPCAP X5R 1U K 6V3 0603	Ceramic Capacitor
C	6051	B	CHIPCAP X5R 1U K 6V3 0603	Ceramic Capacitor
C	6052	B	CHIPCAP NP0 15P J 50V 0402	Ceramic Capacitor
C	7500	T	CHIPCAP X5R 4U7 K 6.3V 0603	Ceramic Capacitor
C	7501	T	CHIPCAP X5R 4U7 K 6.3V 0603	Ceramic Capacitor
C	7502	T	CHIPCAP X5R 4U7 K 6.3V 0603	Ceramic Capacitor
C	7503	T	CHIPCAP X5R 4U7 K 6.3V 0603	Ceramic Capacitor
C	7504	T	CHIPCAP X7R 3N9 J 50V 0402	Ceramic Capacitor
C	7505	T	CHIPCAP X7R 10N K 16V 0402	Ceramic Capacitor
C	7506	T	CHIPCAP NP0 47P J 50V 0402	Ceramic Capacitor
C	7507	T	CHIPCAP X5R 100N M 16V 0402	Ceramic Capacitor
C	7508	T	CHIPCAP NP0 10P J 50V 0402	Ceramic Capacitor
C	7509	T	CHIPCAP X5R 100N M 16V 0402	Ceramic Capacitor
C	7510	T	CHIPCAP NP0 470P J 6V3 0402	Ceramic Capacitor
C	7511	T	CHIPCAP X7R 33N K 10V 0402	Ceramic Capacitor
C	7512	T	CHIPCAP NP0 2N2 G 16V 0603	Ceramic Capacitor
C	7514	T	CHIPCAP NP0 2P2 C 50V 0402	Ceramic Capacitor
C	7515	T	CHIPCAP NP0 2P7 C 50V 0402	Ceramic Capacitor
C	7516	T	CHIPCAP NP0 0P5 C 50V 0402	Ceramic Capacitor
C	7521	T	CHIPCAP X5R 4U7 K 6.3V 0603	Ceramic Capacitor
C	7541	T	CHIPCAP X5R 4U7 K 6.3V 0603	Ceramic Capacitor
C	7542	T	CHIPCAP X5R 4U7 K 6.3V 0603	Ceramic Capacitor
C	7543	T	CHIPCAP X5R 4U7 K 6.3V 0603	Ceramic Capacitor
C	7544	T	CHIPCAP X7R 22N K 16V 0402	Ceramic Capacitor
C	7545	T	CHIPCAP NP0 10P J 50V 0402	Ceramic Capacitor
C	7547	T	CHIPCAP NP0 2P7 C 50V 0402	Ceramic Capacitor
C	7597	T	CHIPTCAP 150U M 10V 6X3.2X1.5	Electrolytic Capacitor
D	3000	T	SDRAM 8MX16 1.8V/1.8V FBGA60 PBFREE	Memory IC

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Item ref		Side	Object Name	Type
D	6000	B	BTHFM1.0 ES4 Module	Hybrid
F	2000	B	SM FUSE F 2.0A 32V 0603	Fuse And Protector
G	2200	T	RTC BACKUP CAPAC 311 SIZE FOR 2.6V 4UAH	Battery And Battery Cell
L	1000	T	FERRITE BEAD 0.6R 600R/100MZ 0402	EMC Component
L	1001	T	FERRITE BEAD 0.6R 600R/100MZ 0402	EMC Component
L	1050	B	INDUCT WW 2.2UH 1A2 310 case size	Fixed Inductor
L	1051	B	FERR.BEAD 220R/100M 2A 0R05 0603	EMC Component
L	1067	B	INDUCT WW 2.2UH 1A2 310 case size	Fixed Inductor
L	2002	B	CHIP BEAD ARRAY 2X1000R 0405	EMC Component
L	2003	B	CHIP BEAD ARRAY 2X1000R 0405	EMC Component
L	2004	B	CHIP BEAD ARRAY 2X1000R 0405	EMC Component
L	2006	B	CHIP COIL 68NH J Q12/100MHZ 0603	Fixed Inductor
L	2100	B	CHIP BEAD ARRAY 2X1000R 0405	EMC Component
L	2101	T	FERR.BEAD 220R/100M 2A 0R05 0603	EMC Component
L	2102	T	CHIP COIL 30nH J Q65/500MHz 0805	Fixed Inductor
L	2103	T	CHIP COIL 30nH J Q65/500MHz 0805	Fixed Inductor
L	2104	T	FERR.BEAD 220R/100M 2A 0R05 0603	EMC Component
L	2105	T	FERR.BEAD 220R/100M 2A 0R05 0603	EMC Component
L	2107	T	FERR.BEAD 220R/100M 2A 0R05 0603	EMC Component
L	2108	T	FERR.BEAD 220R/100M 2A 0R05 0603	EMC Component
L	2109	T	CHIP COIL 30nH J Q65/500MHz 0805	Fixed Inductor
L	2110	T	FERR.BEAD 220R/100M 2A 0R05 0603	EMC Component
L	2111	T	FERRITE BEAD 0.6R 600R/100MZ 0402	EMC Component
L	2112	T	CHIP COIL 30nH J Q65/500MHz 0805	Fixed Inductor
L	2120	T	CHIP BEAD ARRAY 2X1000R 0405	EMC Component
L	2202	T	FERR.BEAD 220R/100M 2A 0R05 0603	EMC Component
L	2203	T	FERRITE BEAD 0.6R 600R/100MZ 0402	EMC Component
L	2204	T	FERRITE BEAD 0.6R 600R/100MZ 0402	EMC Component
L	2205	T	FERR.BEAD 220R/100M 2A 0R05 0603	EMC Component
L	2206	T	FERRITE BEAD 0.6R 600R/100MZ 0402	EMC Component
L	2301	T	FERR.BEAD 220R/100M 2A 0R05 0603	EMC Component
L	2302	T	INDUCT WW 10U 0A65 0R35 4X4X1.2	Fixed Inductor
L	2303	T	FERR.BEAD 0R03 42R/100MHZ 3A 0805	EMC Component
L	2304	T	FERRITE BEAD 0.6R 600R/100MZ 0402	EMC Component
L	2400	B	FERRITE BEAD 0.6R 600R/100MZ 0402	EMC Component

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Item ref		Side	Object Name	Type
L	2401	B	FERRITE BEAD 0.6R 600R/100MZ 0402	EMC Component
L	2412	B	COIL 0.47MH 50MA 3.3X3.4X1.4MM	Fixed Inductor
L	2500	B	FERR.BEAD 0R03 42R/100MHZ 3A 0805	EMC Component
L	2501	B	CHOKE 22U M 0R7 0.35A 3.0X3.0X1.5	Fixed Inductor
L	3200	B	FERRITE BEAD 0.6R 600R/100MZ 0402	EMC Component
L	7500	T	FERRITE BEAD 0.6R 600R/100MZ 0402	EMC Component
L	7501	T	CHIP COIL 10N J Q30/800MHZ 0402	Fixed Inductor
L	7502	T	CHIP COIL 10N J Q30/800MHZ 0402	Fixed Inductor
L	7520	T	FERRITE BEAD 0R01 28R/100MHZ 0603	EMC Component
L	7540	T	CHOKE 3U3 1.2A 0R096 3X3X1.5	Fixed Inductor
L	7542	T	CHIP COIL 2N2 +-0N1 Q40/1GHZ 0402	Fixed Inductor
L	7543	T	CHIP COIL 3N9 +-0N3 Q28/800M 0402	Fixed Inductor
M	2100	T	SMD VIBRA MOTOR 1.3V 90MA 9000RPM	Vibrator
N	1050	B	DC/DC CONV TPS62311YZD 1.5V CSP8	Power Management IC
N	1051	B	OMAP DM290 GoldenEye nFBGA	Processor IC
N	1060	T	VREG 2.85/150MA(LP3987-2.85)USMD5	Analog IC
N	2000	B	TI Analog Switch TS5A3159DCKR	Interface And Controller IC
N	2001	B	TI Analog Switch TS5A3159DCKR	Interface And Controller IC
N	2101	T	AF AMP TPA2012D2 77DB/217HZ WCSP16	Analog IC
N	2413	B	EL DRIVER D381B 2-7V MSOP-10	Power Management IC
N	2500	B	WHITE LED DRIVER 4LEDS 500mW 8bump USMD8	Power Management IC
N	2600	T	IRDA 1.15Mbps 2.2mm RoHS	Infrared
N	3200	B	VREG & LEVELSHIFT(LP3928)USMD16	Other IC
N	6050	B	VREG & LEVELSHIFT(LP3928)USMD16	Other IC
N	7500	T	RF SYSTEM MODULE PIHI2.22 9.0 x 9.0 x 1	Hybrid
N	7520	T	PW AMP PF89001 EGSM850/900/DCS/PCS Cut12	Power Amplifier
N	7540	T	PW AMP QCPM-8883 K4-06 WCDMA 2100	Power Amplifier
N	7541	T	DC CONV LM3202TLX NOPB revB µSMD8	Power Management IC
R	1000	T	CHIPRES 0W06 33R J 0402	Fixed Resistor
R	1001	T	CHIPRES 0W06 100R J 0402	Fixed Resistor
R	1051	B	CHIPRES 0W06 100R J 0402	Fixed Resistor
R	1052	B	CHIPRES 0W06 100R J 0402	Fixed Resistor
R	1065	B	CHIPRES 0W06 33R J 0402	Fixed Resistor

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Item ref		Side	Object Name	Type
R	1072	B	CHIPRES 0W06 10K J 0402	Fixed Resistor
R	1078	B	CHIPRES 0W06 33R J 0402	Fixed Resistor
R	1080	B	CHIPRES 0W06 10K J 0402	Fixed Resistor
R	2000	B	ASIP MIC W/ESD RES+CAP+ZDI BGA11	Integrated Discretes
R	2001	B	CHIPRES 0W06 10K J 0402	Fixed Resistor
R	2002	B	CHIPRES 0W06 220R J 0402	Fixed Resistor
R	2003	B	VAR.ARRAY 2X16V 824-915MHZ 0405	Variable Resistor
R	2004	B	CHIPRES 0W06 33K J 0402	Fixed Resistor
R	2005	B	RES NETWORK 0W06 2X22R J 0404	Resistor Network
R	2006	B	RES NETWORK 0W06 2X22R J 0404	Resistor Network
R	2009	B	VAR.ARRAY 2X16V 824-915MHZ 0405	Variable Resistor
R	2010	B	VAR.ARRAY 2X16V 824-915MHZ 0405	Variable Resistor
R	2011	B	ASIP SILIC USB OTG / ESD BGA11	Integrated Discretes
R	2012	B	RES NETWORK 0W06 220K/120K J 0404	Resistor Network
R	2013	B	CHIPRES 0W06 100R J 0402	Fixed Resistor
R	2015	B	CHIPRES 0W06 10R J 0402	Fixed Resistor
R	2016	B	CHIP VARISTOR VWM14V VC50V 0402	Variable Resistor
R	2017	T	CHIPRES 0W06 4K7 J 0402	Fixed Resistor
R	2018	T	CHIPRES JUMPER 0R0 0402	Fixed Resistor
R	2022	B	CHIP VARISTOR VWM14V VC50V 0402	Variable Resistor
R	2023	T	CHIPRES JUMPER 0R0 0403	Fixed Resistor
R	2069	T	CHIPRES JUMPER 0R0 0404	Fixed Resistor
R	2070	T	NTC RES 0W1 47K J B 4050+-3% 0402	Variable Resistor
R	2071	T	CHIP VARISTOR VWM15V VC50V 0402	Variable Resistor
R	2100	T	ASIP MIC W/ESD RES+CAP+ZDI BGA11	Integrated Discretes
R	2101	T	CHIPRES 0W06 220R J 0402	Fixed Resistor
R	2102	T	CHIPRES 0W06 33K J 0402	Fixed Resistor
R	2103	B	VAR.ARRAY 2X16V 824-915MHZ 0405	Variable Resistor
R	2104	T	RES NETWORK 0W06 2X10R J 0404	Resistor Network
R	2117	T	VAR.ARRAY 2X16V 824-915MHZ 0405	Variable Resistor
R	2118	T	VAR.ARRAY 2X16V 824-915MHZ 0405	Variable Resistor
R	2119	T	VAR.ARRAY 2X16V 824-915MHZ 0405	Variable Resistor
R	2121	T	CHIPRES JUMPER 0R0 0405	Fixed Resistor
R	2124	T	CHIPRES JUMPER 0R0 0406	Fixed Resistor
R	2200	T	CHIPRES 0W06 100K J 0402	Fixed Resistor

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Item ref		Side	Object Name	Type
R	2201	T	CHIPRES 0W06 120K J 0402	Fixed Resistor
R	2203	T	CHIPRES 0W06 2M2 J 0402	Fixed Resistor
R	2206	T	CHIPRES 0W06 470R J 0402	Fixed Resistor
R	2223	T	CHIPRES 0W06 220R J 0402	Fixed Resistor
R	2400	B	CHIPRES 0W06 100K J 0402	Fixed Resistor
R	2412	B	CHIPRES JUMPER 0R0 0407	Fixed Resistor
R	2415	B	CHIPRES 0W06 120K J 0402	Fixed Resistor
R	2500	B	CHIPRES 0W06 10K J 0402	Fixed Resistor
R	2501	B	CHIPRES 0W06 33R J 0402	Fixed Resistor
R	2580	T	CHIPRES 0W06 10K J 0402	Fixed Resistor
R	2600	T	CHIPRES 0W125 4R7 J 0805	Fixed Resistor
R	2700	T	ASIP SIM INTERFACE **low cap** BGA8	Integrated Discretes
R	2800	T	CHIPRES 0W06 100K J 0402	Fixed Resistor
R	3000	T	CHIPRES 0W06 4K7 J 0402	Fixed Resistor
R	3200	B	ASIP MMC FILTER *** PB-FREE ***	Integrated Discretes
R	3205	B	CHIPRES 0W06 680R J 0402	Fixed Resistor
R	3221	T	CHIPRES 0W06 100R J 0402	Fixed Resistor
R	6010	B	CHIPRES 0W06 10K J 0402	Fixed Resistor
R	6011	B	CHIPRES 0W06 8K2 J 0402	Fixed Resistor
R	6020	B	CHIPRES JUMPER 0R0 0408	Fixed Resistor
R	6050	T	CHIPRES JUMPER 0R0 0409	Fixed Resistor
R	7500	T	CHIPRES 0W06 22K J 0402	Fixed Resistor
R	7501	T	CHIPRES 0W06 4K7 J 0402	Fixed Resistor
R	7503	T	CHIPRES 0W06 1K0 F 200PPM 0402	Fixed Resistor
R	7504	T	CHIPRES 0W06 8K2 F 0402	Fixed Resistor
R	7505	T	CHIPRES 0W06 5R6 J 0402	Fixed Resistor
R	7520	T	CHIPRES 0W06 27K F 0402	Fixed Resistor
R	7522	T	CHIPRES JUMPER 0R0 0410	Fixed Resistor
R	7540	T	CHIPRES 0W06 47K F 200PPM 0402	Fixed Resistor
R	7541	T	CHIPRES 0W06 1K2 F 250PPM 0402	Fixed Resistor
R	7542	T	CHIPRES JUMPER 0R0 0411	Fixed Resistor
R	7543	T	CHIPRES 0W06 10K J 0402	Fixed Resistor
R	7544	T	CHIPRES 0W06 10R J 0402	Fixed Resistor
S	2580	T	SM SW TACT SPST 12V SIDE KEY 2.2N	Switch And Knob
S	2596	T	SM SW TACT SPST 12V SIDE KEY 2.2N	Switch And Knob

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Item ref		Side	Object Name	Type
S	2597	T	SM SW TACT SPST 12V SIDE KEY 2.2N	Switch And Knob
S	2598	T	SM SW TACT SPST 12V SIDE KEY 2.2N	Switch And Knob
S	2599	T	SM SW TACT SPST 12V SIDE KEY 2.2N	Switch And Knob
T	7500	T	TRANSF BALUN 2134 +/- 30MHZ 0805	Balun
T	7501	T	TRANSF BALUN 3800 +/- 550MHZ 0805	Balun
V	2000	B	ASIP TVS BGA4	Integrated Discretes
V	2412	B	DI FAST 1SS400 75V 0A1 4NS SOD523	Diode
V	2413	B	DI ZEN 100V 6% 0W2 SOD323	Diode
V	2414	B	DI ZEN 100V 6% 0W2 SOD323	Diode
X	1000	T	SM CAMERA MOD SKT 2X8F	Socket
X	2000	T	CONN SYST SM 14POL	System Connector
X	2070	T	SM BATTERY CONN 3POL SPR 12V 2A	Battery Connector
X	2400	B	SM CONN 2X12F P0.4 30V.3A PWB/PWB	Board To Board Connector
X	2411	B	C-SPRING EL FOIL SUS301	Spring
X	2412	B	C-SPRING EL FOIL SUS301	Spring
X	2580	B	SM CONN 2X12F P0.5 PWB/PWB	Multipole Connector
X	2700	T	SM SIM CONN 6POL P2.54 H1.8	Multipole Connector
X	3200	T	CONN SMC TRANSFLASH MMC	Smartcard Connector
X	8000	T	SM CONN RF JACK 50R 2W 6GHZ	Coaxial Connector
X	8001	T	C-SPRING ANTENNA (active)	Spring
X	8002	T	C-SPRING ANTENNA	Spring
X	8003	T	SM CONN RF JACK 50R 2W 6GHZ	Coaxial Connector
X	8004	T	C-SPRING ANTENNA (active)	Spring
X	8005	T	C-SPRING ANTENNA	Spring
X	8006	T	C-SPRING ANTENNA	Spring
X	8007	B	C-SPRING FOR DISPLAY CAN GROUNDING	Spring
X	8008	B	C-SPRING FOR DISPLAY CAN GROUNDING	Spring
X	8009	B	C-SPRING FOR DISPLAY CAN GROUNDING	Spring
X	8010	B	C-SPRING FOR DISPLAY CAN GROUNDING	Spring
X	8011	B	C-SPRING FOR DISPLAY CAN GROUNDING	Spring
X	8012	B	C-SPRING FOR DISPLAY CAN GROUNDING	Spring
X	8013	B	C-SPRING FOR DISPLAY CAN GROUNDING	Spring
X	8014	B	C-SPRING FOR DISPLAY CAN GROUNDING	Spring
X	8015	B	C-SPRING FOR DISPLAY CAN GROUNDING	Spring
X	8016	B	C-SPRING FOR DISPLAY CAN GROUNDING	Spring

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Item ref		Side	Object Name	Type
X	8017	B	C-SPRING FOR DISPLAY CAN GROUNDING	Spring
X	8018	B	C-SPRING FOR DISPLAY CAN GROUNDING	Spring
X	8019	B	C-SPRING FOR DISPLAY CAN GROUNDING	Spring
X	8020	B	C-SPRING FOR DISPLAY CAN GROUNDING	Spring
X	8021	B	C-SPRING FOR DISPLAY CAN GROUNDING	Spring
X	8023	B	C-SPRING GROUNDING C-COVER PLATE SUS301	Spring
Z	2000	B	FERRITE BEAD 0.6R 600R/100MZ 0402	EMC Component
Z	2001	B	FERRITE BEAD 0.6R 600R/100MZ 0402	EMC Component
Z	2005	B	FERRITE BEAD 0.6R 600R/100MZ 0402	EMC Component
Z	2403	B	ASIP 10-CH ESD EMI FILTER BGA25	Integrated Discretes
Z	2404	B	ASIP 10-CH ESD EMI FILTER BGA25	Integrated Discretes
Z	2580	B	ASIP 10-CH ESD EMI FILTER BGA25	Integrated Discretes
Z	2581	B	ASIP 10-CH ESD EMI FILTER BGA25	Integrated Discretes
Z	2597	T	ASIP EMI/ESD FILTER BGA6	Integrated Discretes
Z	2598	T	ASIP EMI/ESD FILTER BGA6	Integrated Discretes
Z	2599	T	ASIP EMI/ESD FILTER BGA6	Integrated Discretes
Z	2600	T	ASIP EMI/ESD FILTER BGA6	Integrated Discretes
Z	7520	T	CER FILT LFL181699TC1 2400-2483MHz 1.6	Ceramic Filter
Z	7540	T	DUPL SAW 1920-1980/2110-2170MHZ 3.8x3.8	Duplexer
			CHIPRES 0W06 180K J 0402	Fixed Resistor
			CHIPCAP NP0 1P2 C 50V 0402	Ceramic Capacitor

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Component layouts

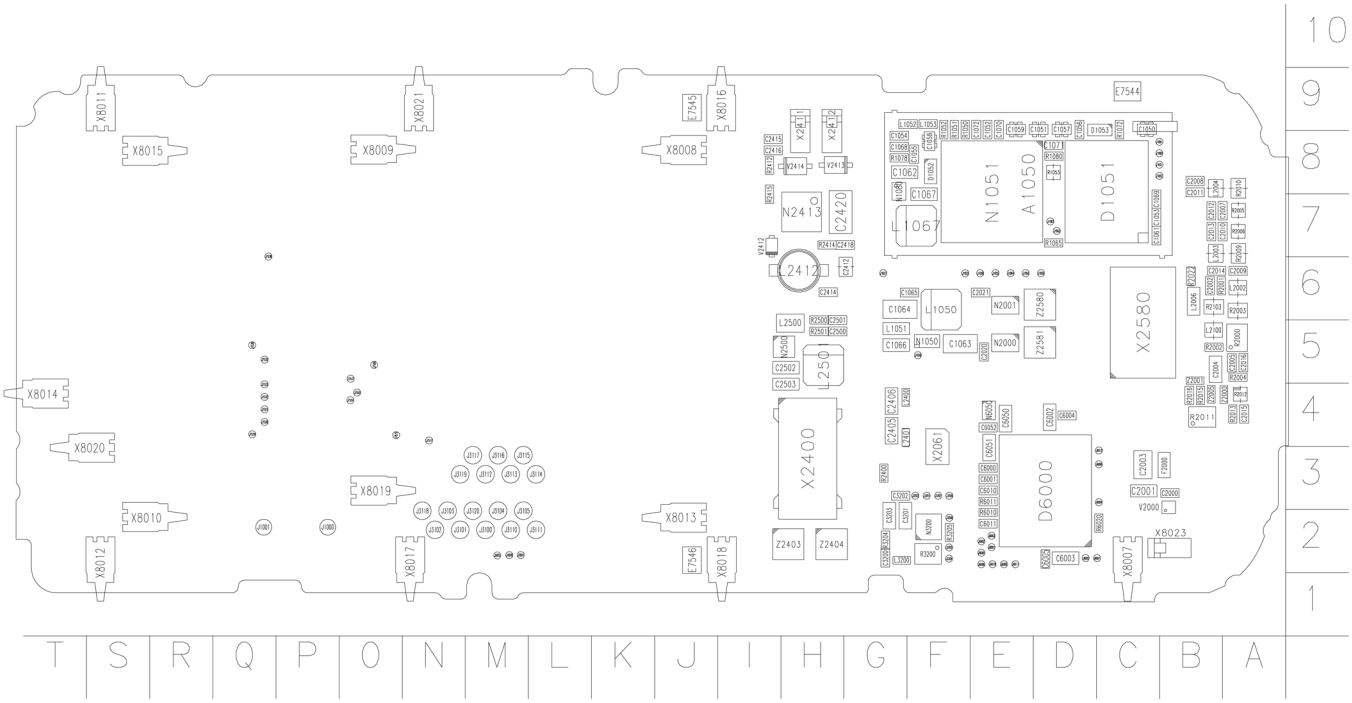


Figure 1 Main board layout, bottom side (1rra_08a)

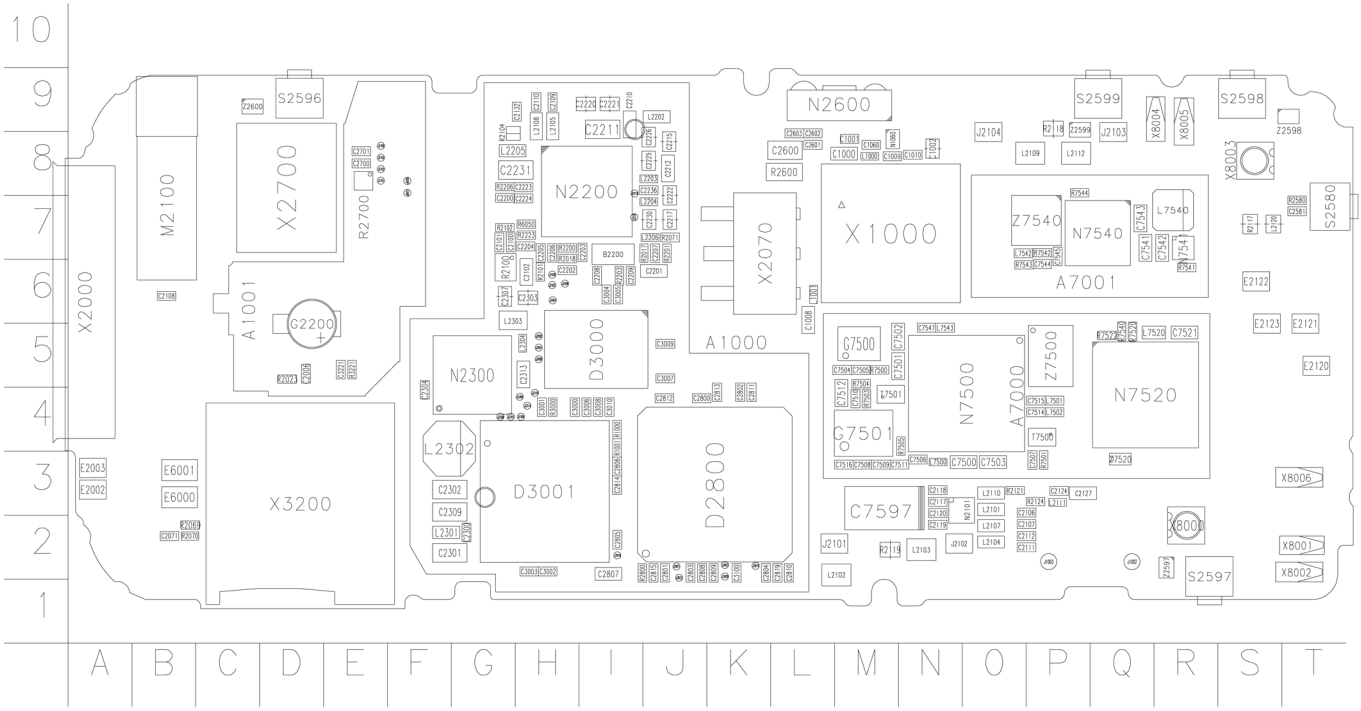


Figure 2 Main board layout, top side (1rra_08a)

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3 — Service Software Instructions

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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).

If you use FPS-8:	• Update FPS-8 software • Activate FPS-8

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If you use FPS-10:	• 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-8 or FPS-10 flash prommers 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:

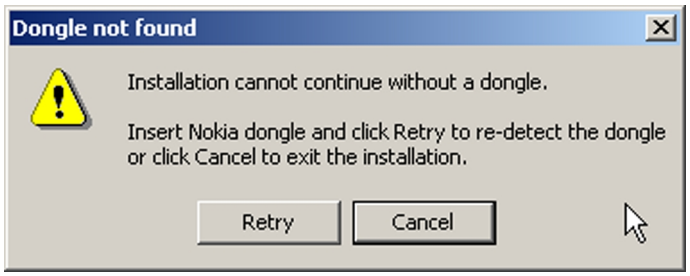


Figure 3 Dongle not found

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**.

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

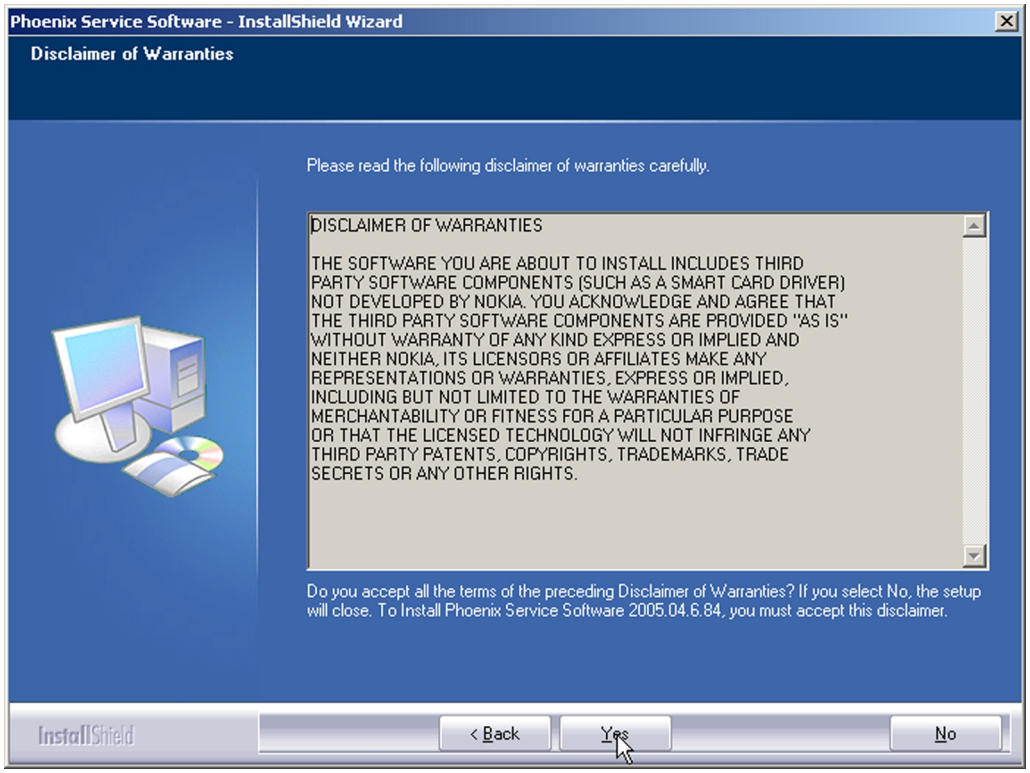


Figure 4 Disclaimer text

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.

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

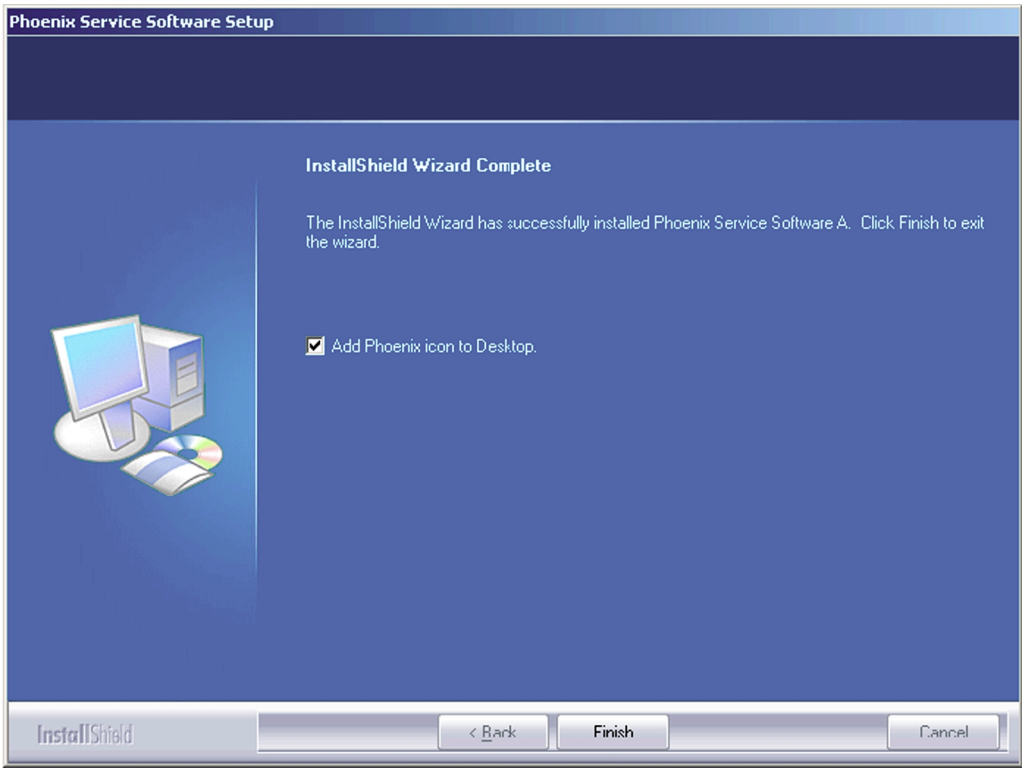


Figure 5 InstallShield Wizard Complete

Next actions

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

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

FPS-8 and FPS-10 flash prommers 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.

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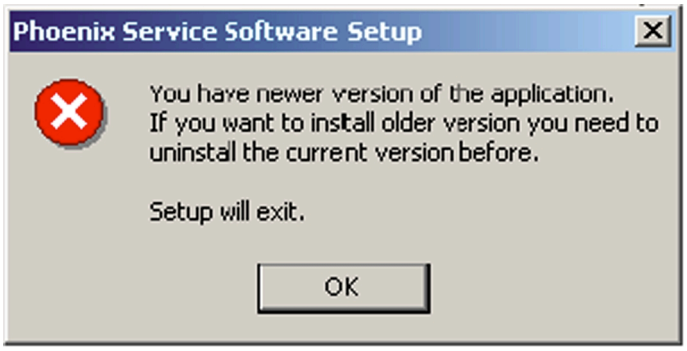


Figure 6 Installation interrupted

- 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**.

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

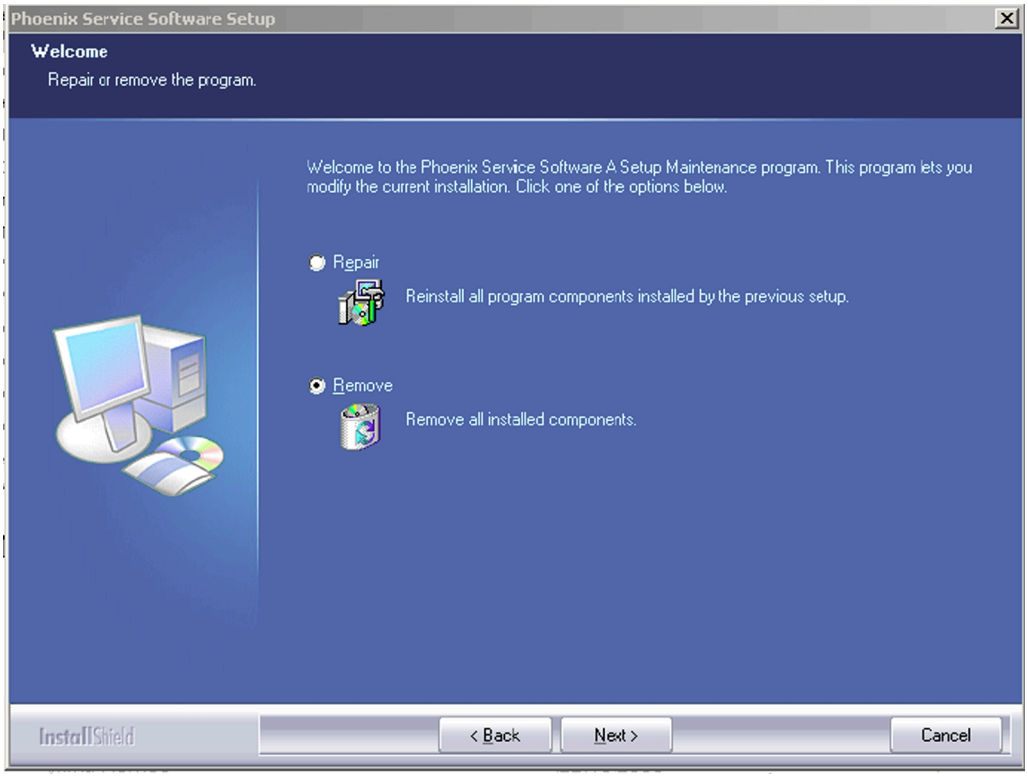


Figure 7 Remove program

The progress of the uninstallation is shown.

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

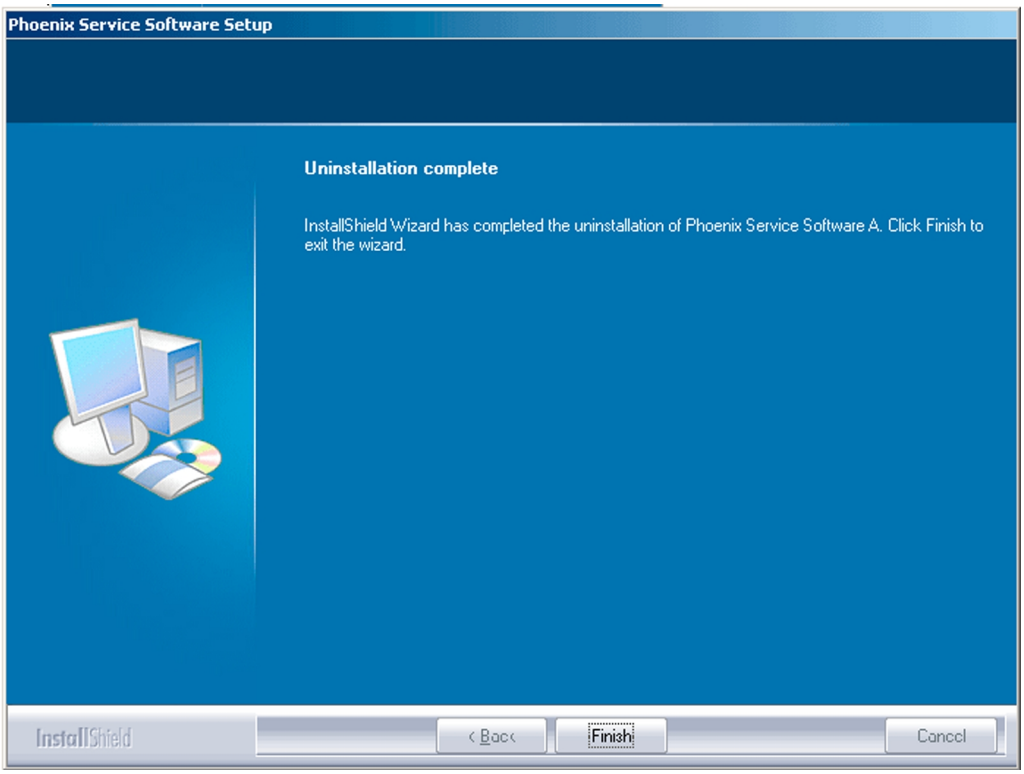


Figure 8 Finish uninstallation

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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**.

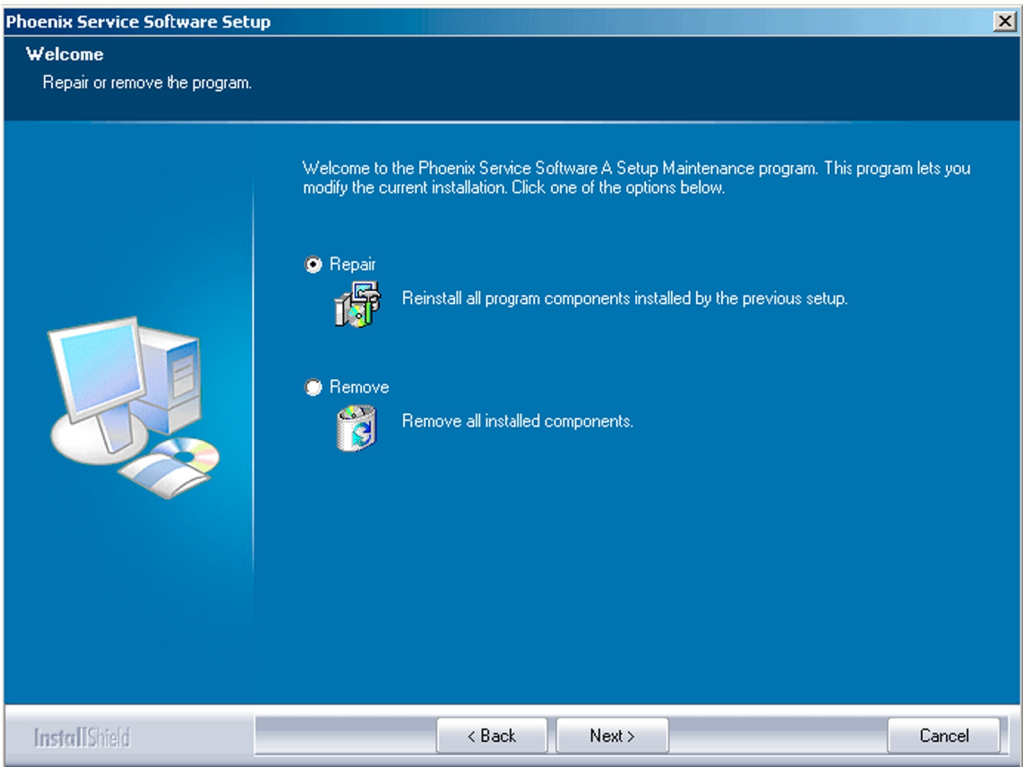


Figure 9 Repair program

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

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- 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.

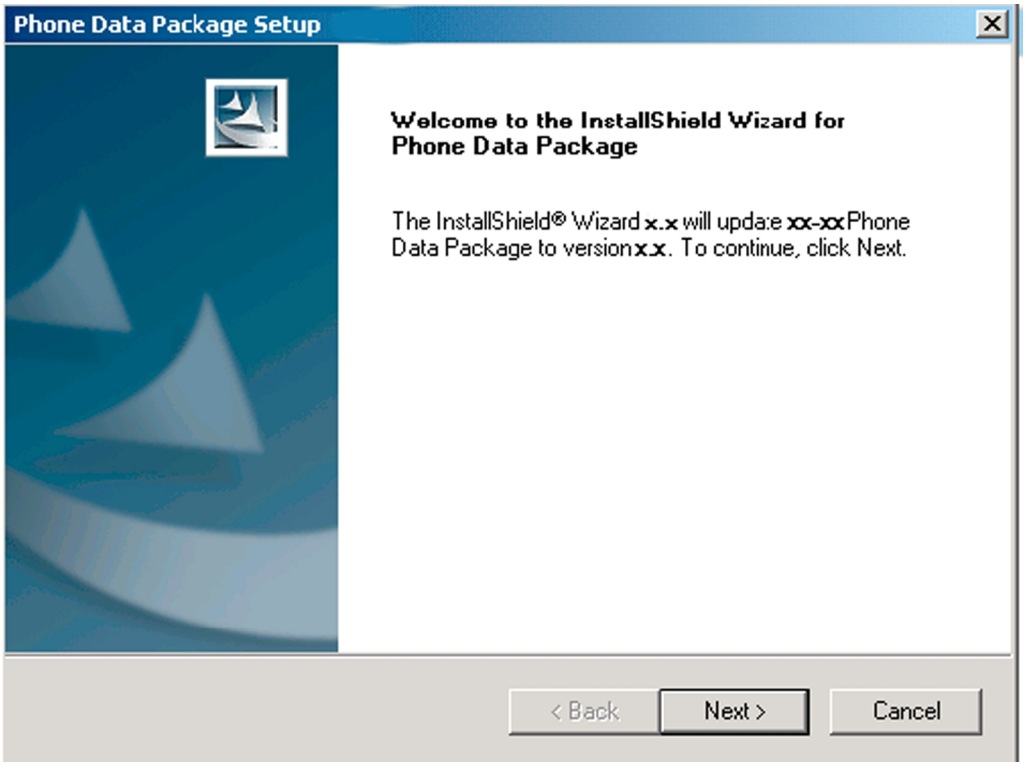
Steps

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.

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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.

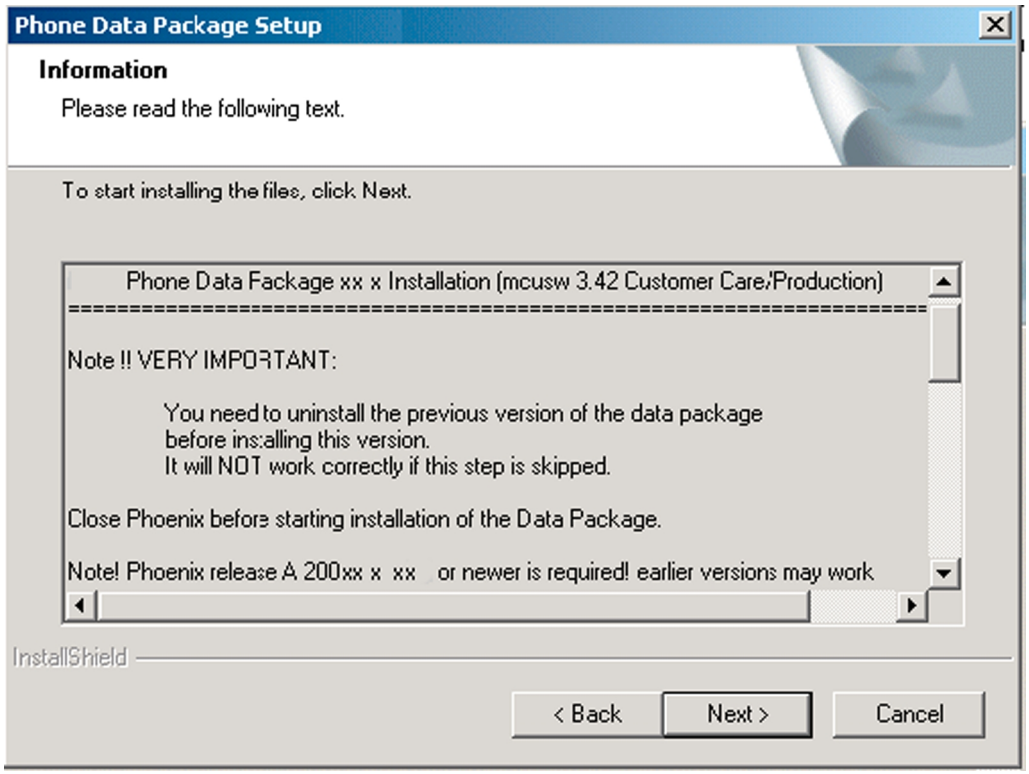


Figure 10 Data package setup information

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

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

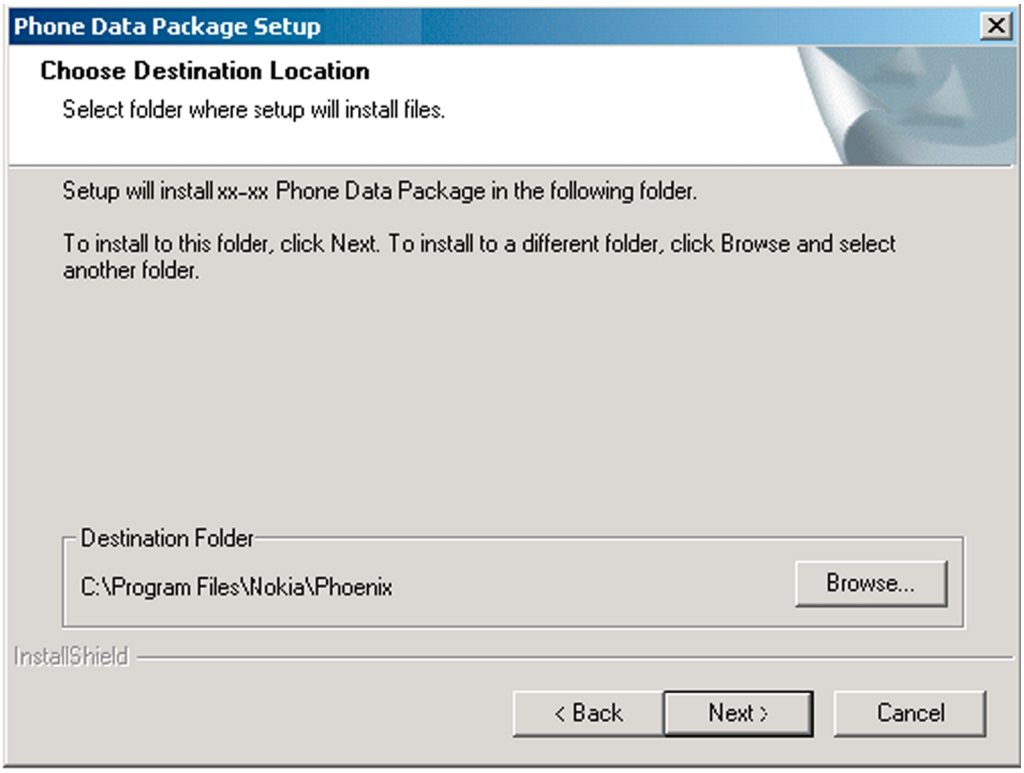
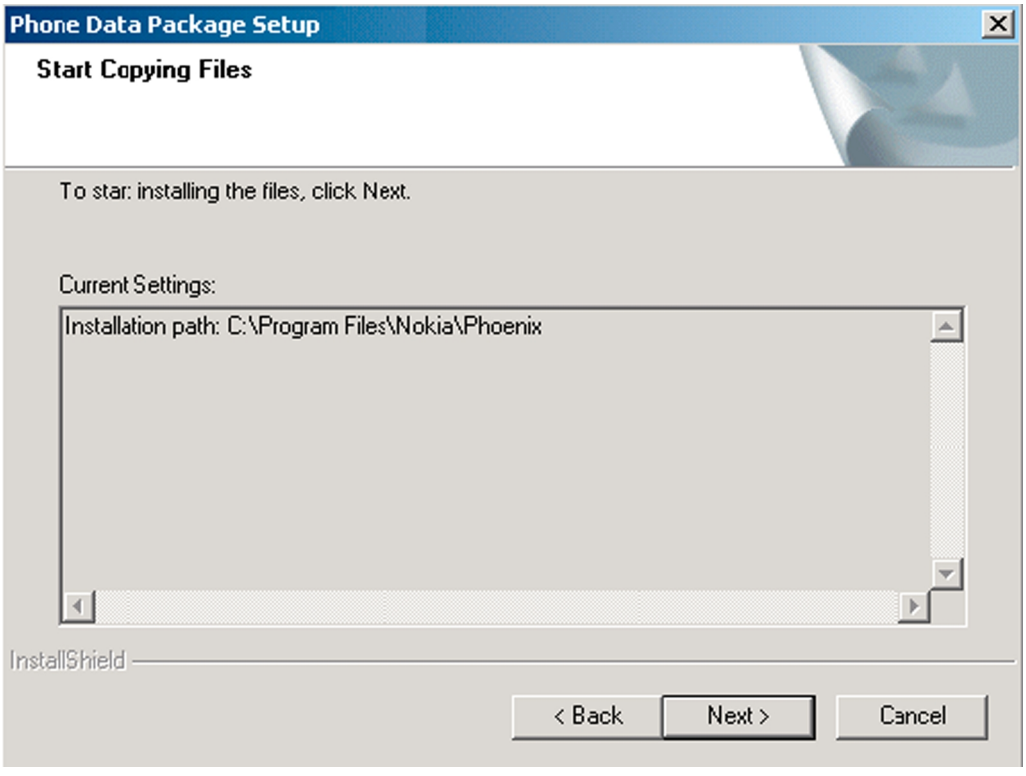


Figure 11 Data package destination folder

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

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



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Phone model specific files are installed. Please wait.

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

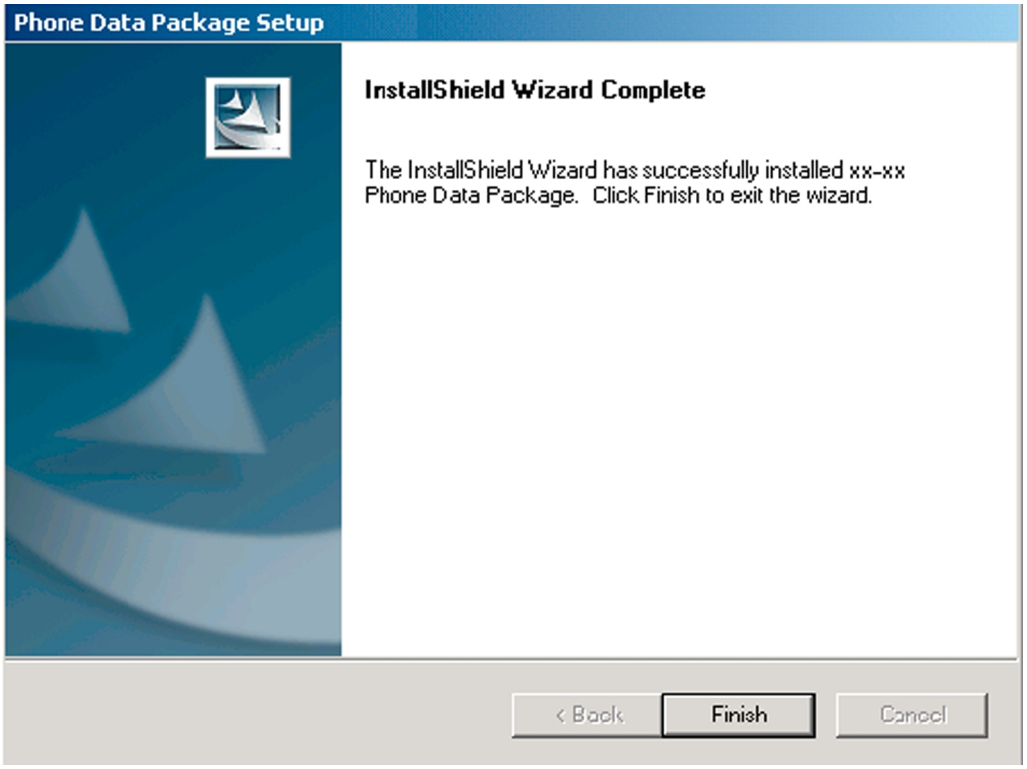


Figure 12 InstallShield Wizard Complete

Next actions

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

- Configuring users
- Managing connections

FPS-8 and 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.

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

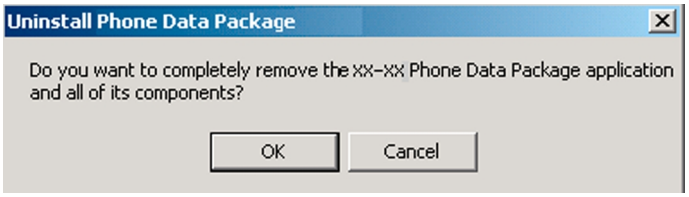


Figure 13 Uninstalling phone data package

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

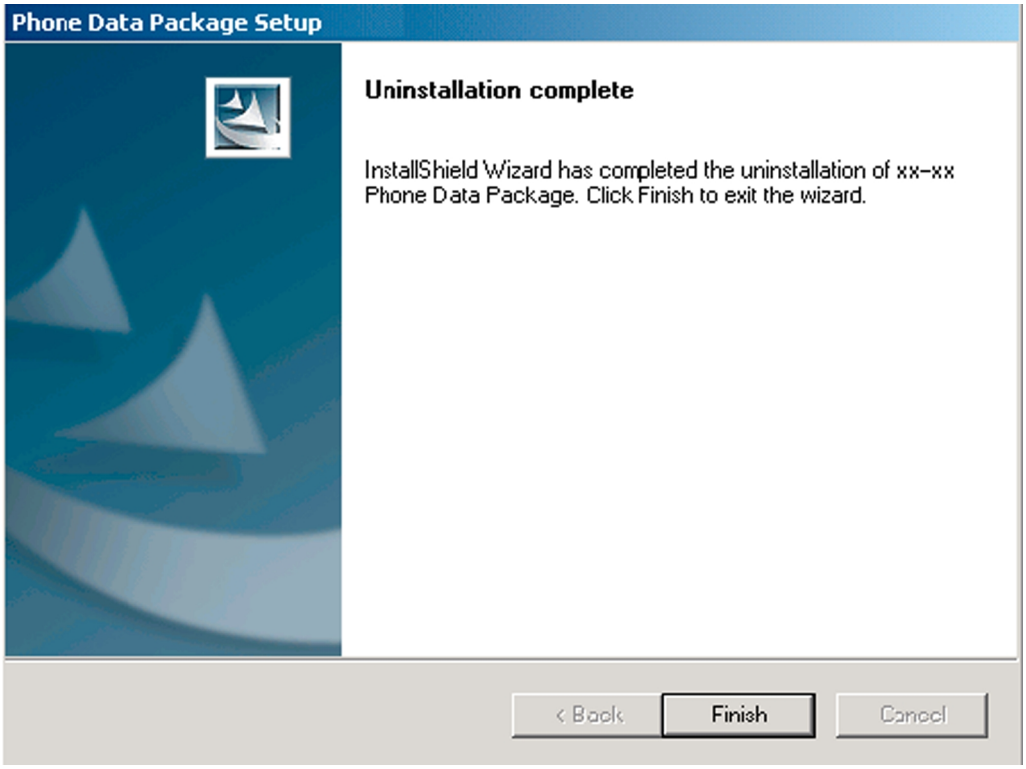


Figure 14 Finishing data package uninstallation

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).

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Configuring users in *Phoenix*

Steps

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

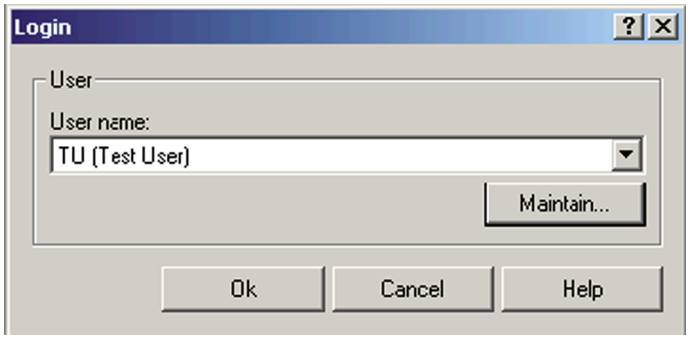


Figure 15 Phoenix login

   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**.

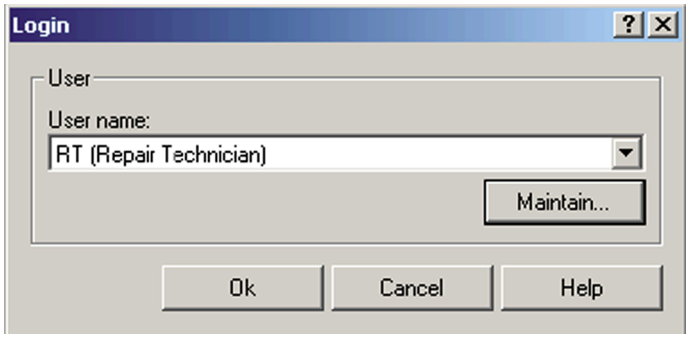


Figure 16 New user configured

Managing connections in *Phoenix*

Context

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

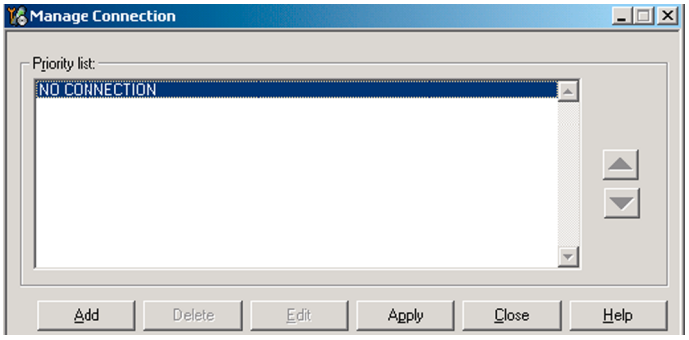
> **Note:** After choosing the desired connection, and connecting the phone to a PC for the first time, allow the PC to install the USB device drivers first. Please note that this may take some time to complete.
>
> If there are problems after the driver installation, check that the USB connection is 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...** .

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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.

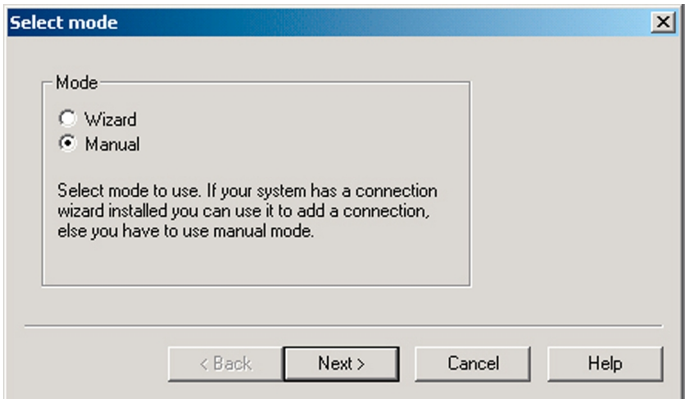


Figure 17 Select mode: Manual

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 an FPS-8 flash prommer, choose the following connection settings:
   - Media: FPS-8
   - PORT_NUM: COM Port where FPS-8 is connected
   - COMBOX_DEF_MEDIA: **FBUS**

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iv 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**.

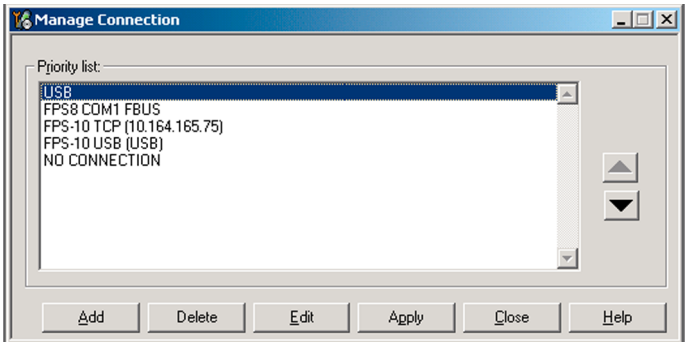


Figure 18 Connections list

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 19 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 20 Product support module information (example from RM-1)

Installing flash support files for FPS-8 and FPS-10

Prerequisites

- Install *Phoenix* service software.
- Install phone model specific data package for *Phoenix*.
- If you want to update the flash support files, they are delivered in the same installation package with *Phoenix* or newer *Phoenix* packages beginning from December 2004.

  In case you want to update the MCU files, install the latest data package (see Technical Bulletins for information on the latest one).

  Normally, it is enough to install *Phoenix* and the phone-specific data package because the installation always includes the latest flash update package files for FPS-8 and FPS-10.
- A separate installation package for flash support files is available. The files can be updated according to these instructions, if updates appear between *Phoenix* data package releases.

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Context

If you are not using a separate installation package, you can skip this section and continue with "Updating FPS-8 and FPS-10 flash prommer software" (page 3–22) after installing a new phone data package.

Steps

1. To begin the installation, double-click the flash update file (for example, *flash_update_03_183_0014.exe*).

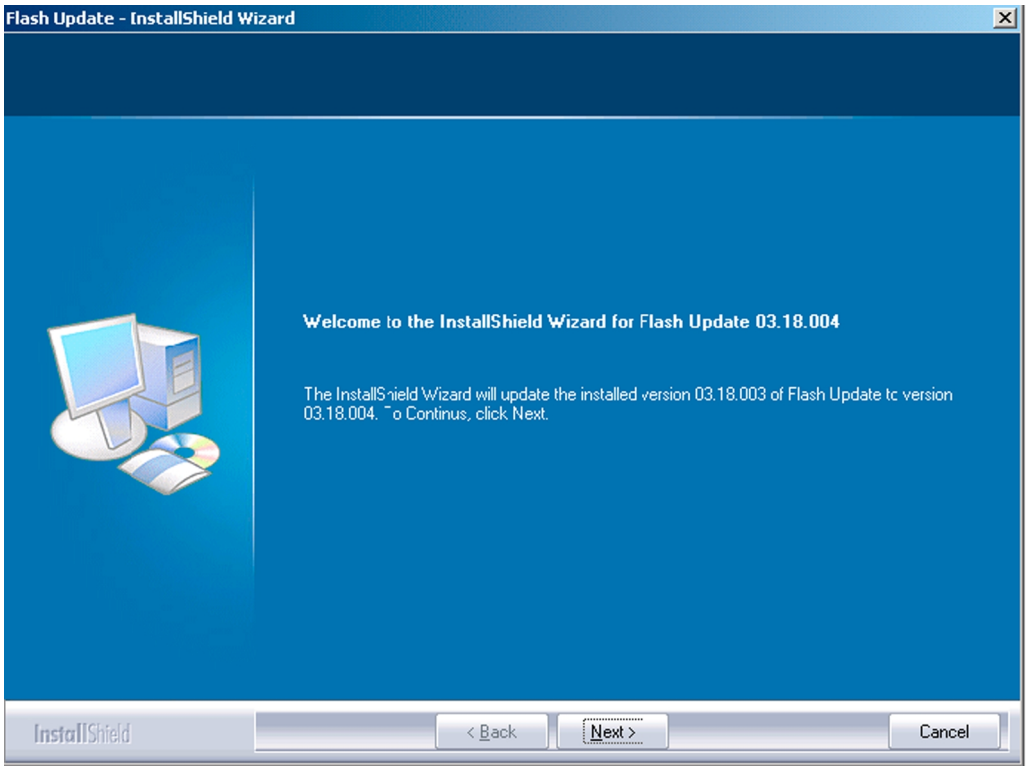


Figure 21 Flash update welcome dialog

If the same version of the flash update package already exists, and you want to reinstall it, the previous package is first uninstalled.

Restart installation again after the uninstallation.

2. If you try to downgrade the existing version to older ones, the setup will be aborted. If there is a need to downgrade the version, uninstall newer files manually from the **Windows Control Panel**, and then rerun the installation.



Figure 22 Flash installation interrupted

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

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

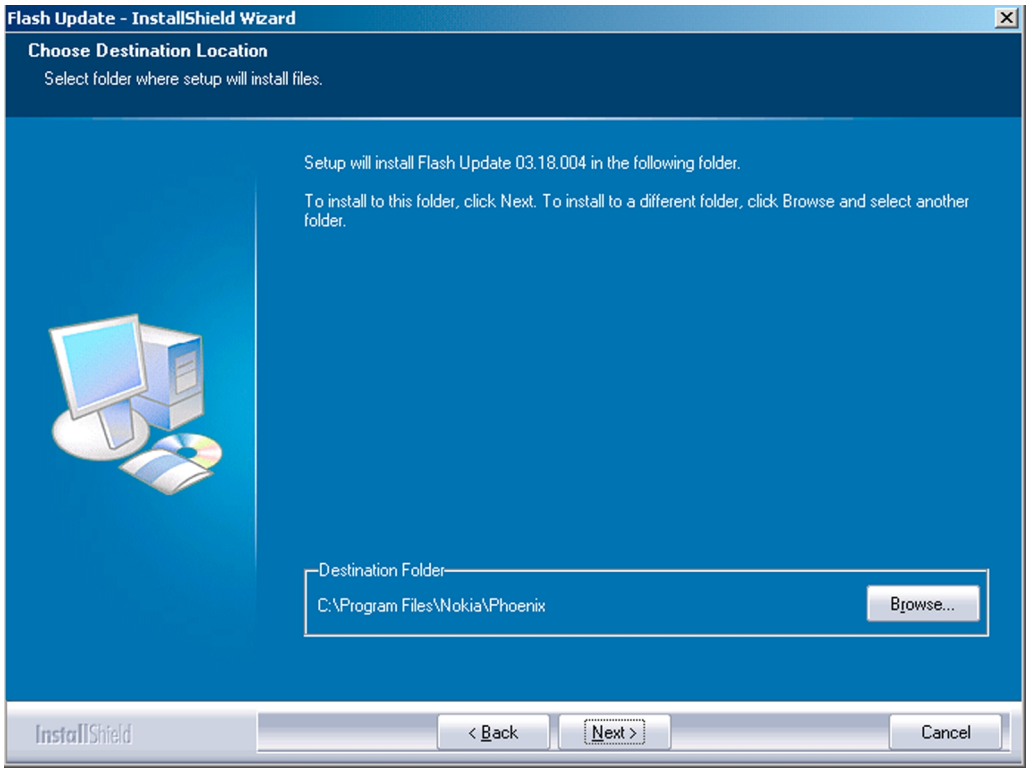


Figure 23 Flash destination folder

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

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

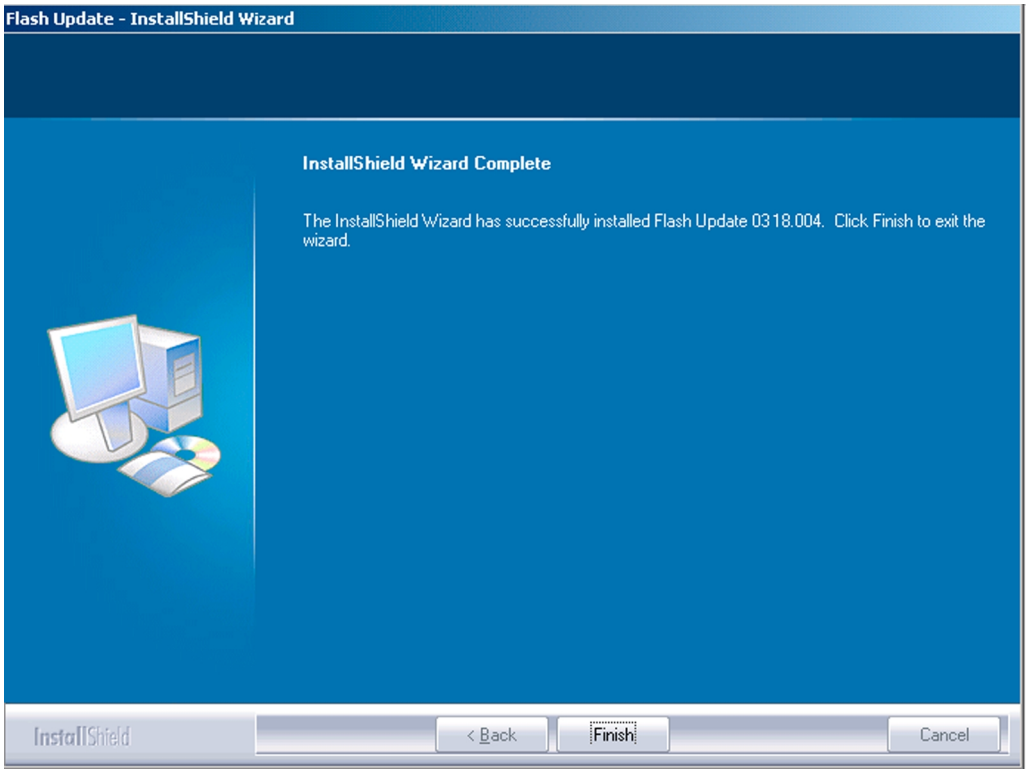


Figure 24 Finish flash update

Next actions

FPS-8 and FPS-10 flash prommers must be updated using *Phoenix*.

Updating FPS-8 and FPS-10 flash prommer software

Steps

1. Start *Phoenix* service software, and log in.
2. Choose the correct connection for your flash prommer: **File→Manage Connections...**
3. Choose **Flashing→Prommer maintenance** .
4. To update the **FPS-8/FPS-10** software, click **Update**, and select the appropriate file *fps8upd.ini* (for FPS-8) or *fpsxupd.ini* (for FPS-10) from *C:|Program Files|Nokia|Phoenix|Flash*.

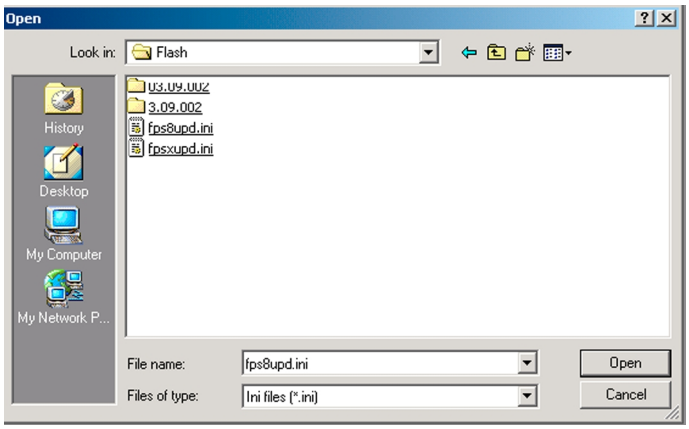


Figure 25 Flash directory window

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Tip: All files can be loaded separately to the prommer used. To do this, click the right mouse button in the *Flash Box Files* pane and select the file type(s) to be loaded.

5. Click **OK**.

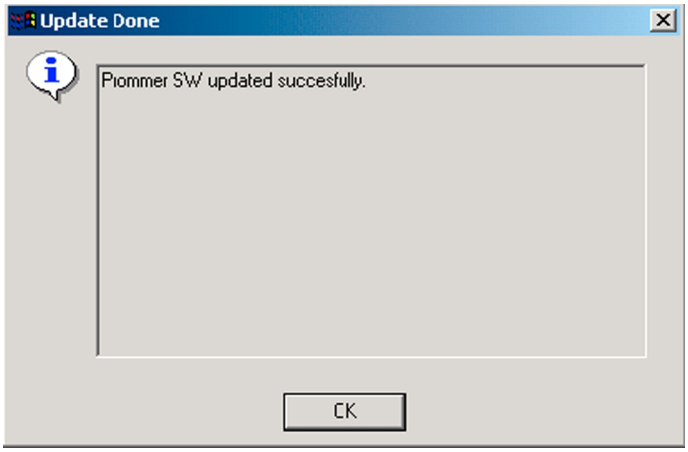


Figure 26 Prommer software update finished

6. To close the *Prommer Maintenance* window, click **Close**.

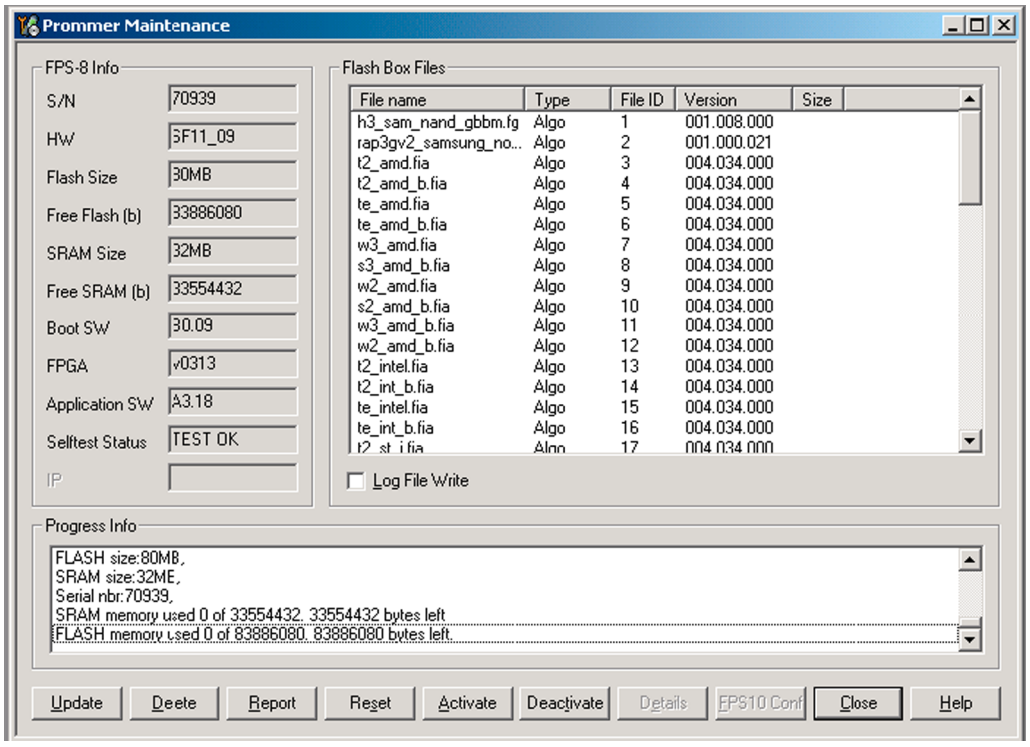


Figure 27 *Prommer Maintenance* window

Activating FPS-8

Context

Before FPS-8 can be successfully used for phone programming, it must first be activated.

First fill in the *FPS-8 activation request* sheet in the FPS-8 sales package, and follow the instructions given.

When activation file is received (for example, *00000.in*), copy it to the *C:|ProgramFiles|Nokia|Phoenix|BoxActivation* directory on your computer (this directory is created when *Phoenix* is installed).

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Steps

1. Start *Phoenix* service software.
2. Choose **Flashing→Prommer Maintenance** .
3. In the *Prommer Maintenance* window, click **Activate**.
4. To find the activation file, click **Browse**.
5. To activate the prommer, select the activation file and click **Open**.

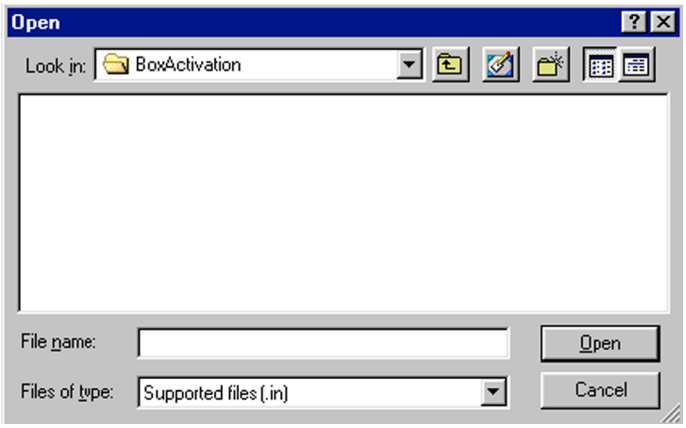


Figure 28 Box activation

6. To complete the activation, restart FPS-8.

Deactivating FPS-8

Context

If there is, for example, a need to send the FPS-8 box for repair, it must be deactivated first.

Steps

1. Start *Phoenix* service software.
2. Choose **Flashing→Prommer Maintenance** .
3. In the *Prommer Maintenance* window, click **Deactivate**.
4. To confirm the deactivation, click **Yes**.

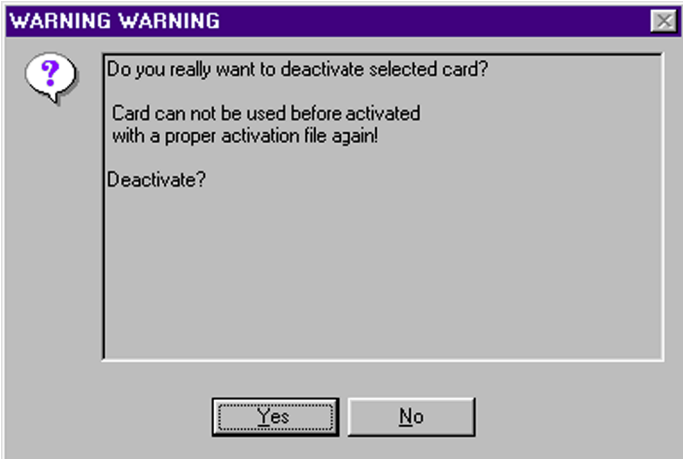


Figure 29 Deactivation warning

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The box is deactivated.

5. To complete the deactivation, restart FPS-8.

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4 — Service Tools and Service Concepts

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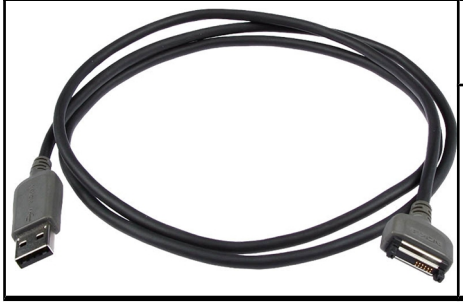
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Service tools

The table below gives a short overview of service tools that can be used for testing, error analysis and repair of product RM-123; RM-145, refer to various concepts.

<table>
<tr><td rowspan="2">  </td><td>CA-31D</td><td>USB cable</td><td></td></tr>
<tr><td colspan="3">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.</td></tr>
<tr><td rowspan="2">  </td><td>CA-35S</td><td>Power cable</td><td></td></tr>
<tr><td colspan="3">CA-35S is a power cable for connecting, for example, the FPS-10 flash prommer to the Point-Of-Sales (POS) flash adapter.</td></tr>
<tr><td rowspan="2">  </td><td>CA-53</td><td>USB connectivity cable</td><td></td></tr>
<tr><td colspan="3">USB to system connector cable.</td></tr>
</table>

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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.

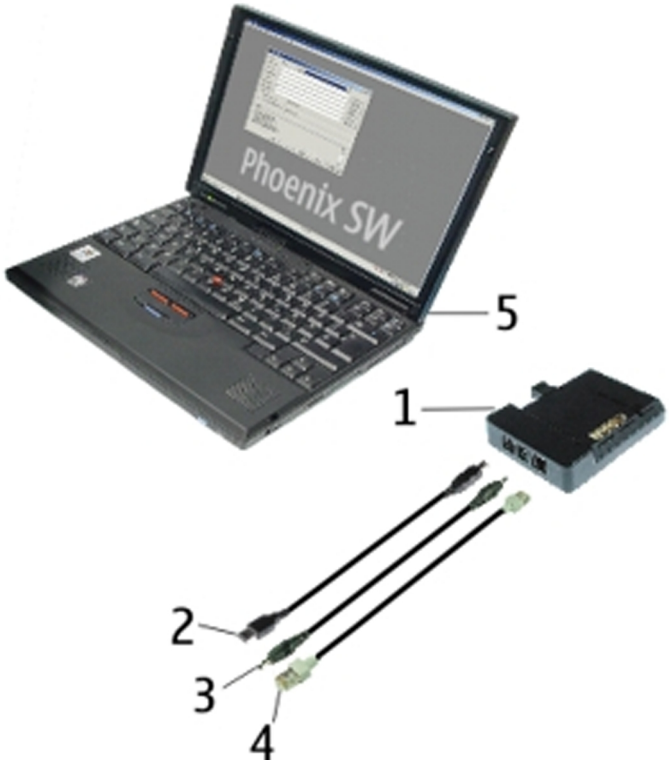
The unit has the following features:

- 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.

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FLS-4S	Flash device	
FLS-4S is a dongle and flash device incorporated into one package, developed specifically for POS use.		



FPS-10	Flash prommer	

FPS-10 interfaces with:

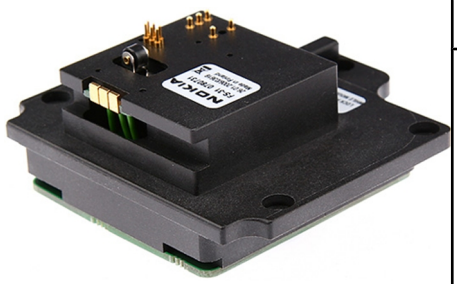
- PC
- Control unit
- Flash adapter
- Smart card

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



FS-31	Flash adapter	

- FS-31 is equipped with a clip interlock system
- provides standardised interface towards Control Unit
- provides RF connection using coupler
- multiplexing between USB and FBUS media, controlled by VUSB



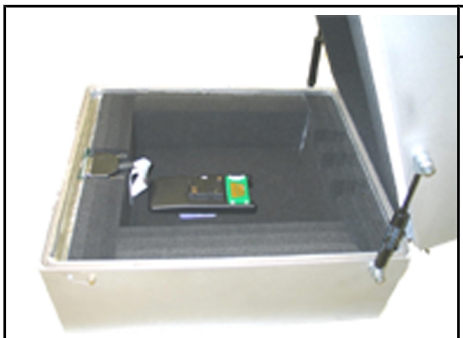
JBT-9	Bluetooth test and interface box (sales package)	

The JBT-9 test box is a generic service device used to perform Bluetooth bit error rate (BER) testing, and establishing cordless FBUS connection via Bluetooth. An ACP-8x charger is needed for BER testing and an AXS-4 cable in case of cordless interface usage testing .

Sales package includes:

- JBT-9 test box
- Installation and warranty information

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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.



MJ-91	Module jig	

MJ-91 is meant for component level troubleshooting.

The jig includes an RF interface for GSM, WCDMA and Bluetooth. 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
- MMC interface
- Duplicated SIM connector
- Connector for control unit
- Access for Pop-Port™ system connector

Note: Be careful when closing the jig, not to harm the display with the screws on the jig!



PCS-1	Power cable	

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



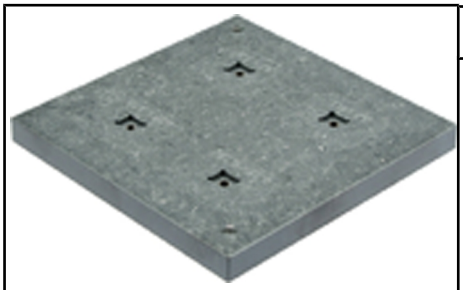
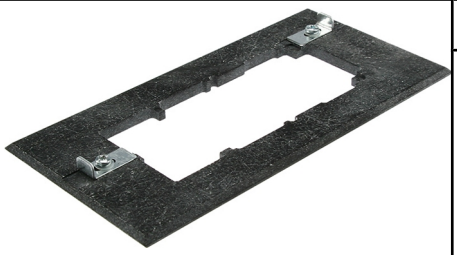
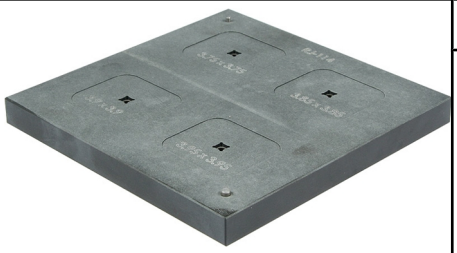
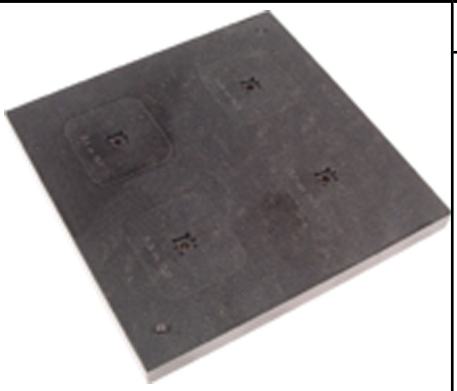
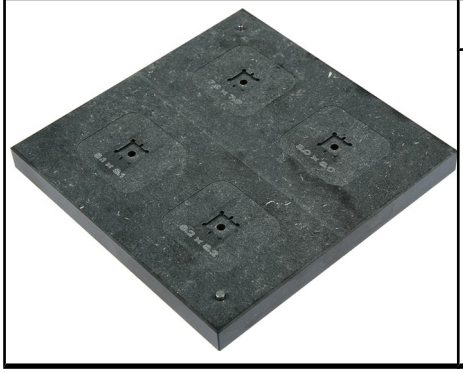
PKD-1	SW security device	

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.

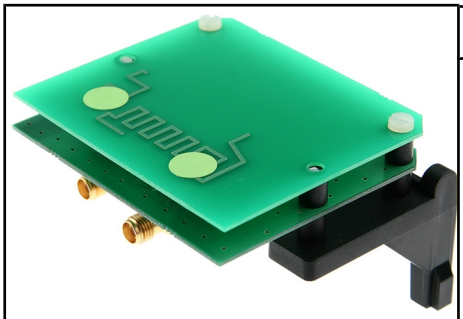
Without the device, it is not possible to use the service software.

Printer or any such device can be connected to the PC through the device if needed.

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	RJ-104	BTHFM rework jig	
	RJ-104 is a rework jig used when servicing the BTHFM module. It is used together with rework stencil ST-37.		
	RJ-108	Soldering jig	
	RJ-108 is a soldering jig used for soldering and as a rework jig for the engine module.		
	RJ-114	Rework jig	
	RJ-114 is a rework jig used with ST-41.		
	RJ-57	Rework jig	
	RJ-57 is a rework jig used with ST-22.		
	RJ-93	Rework jig	
	RJ-93 is used as a rework jig for the engine module. This stencil takes the front end module (FEM) or power amplifier (PA) module for spreading the soldering paste to the component. Must be used together with the ST-40 stencil.		

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SA-103	RF coupler	

SA-103 is an RF coupler for WCDMA and GSM RF testing. It is used together with the product-specific flash adapter.

The following table shows attenuations from the antenna pads of the mobile terminal to the SMA connectors of SA-103:

Frequency	Att. (dB)
GSM900 TX	2,7 dB +/- 0,5 dB
GSM900 RX	2,6 dB +/- 0,7 dB
GSM1800 TX	8,2 dB +/- 2,0 dB
GSM1800 RX	5,3 dB +/- 0,4 dB
GSM1900 TX	5,1 dB +/- 0,1dB
GSM1900 RX	5,2 dB +/- 0,6 dB
WCDMA2100 TX	10,0 dB +/- 0,9dB
WCDMA2100 RX	6,8 dB +/- 0,4 dB



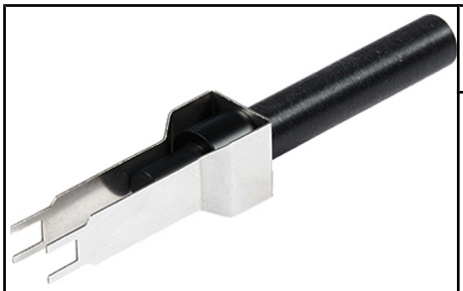
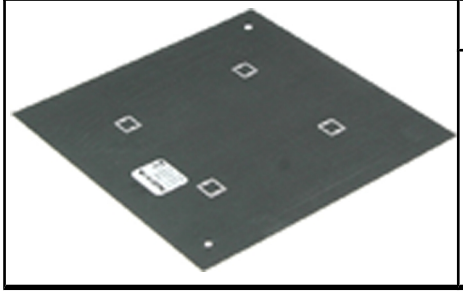
SPS-1	Soldering Paste Spreader	



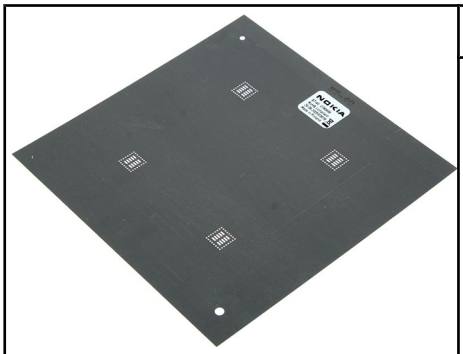
SRT-6	Opening tool	

SRT-6 is used to open phone covers and B-to-B connectors.

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	SS-45	Front camera removal tool	
	The front camera removal tool SS-45 is used to remove/attach the front camera module from/to the socket.		
	SS-46	Interface adapter	
	SS-46 acts as an interface adapter between the flash adapter and FPS-10.		
	SS-51	Front camera removal tool	
	The front camera removal tool SS-51 is used to remove/attach a front camera module from/to the camera socket of the phone PWB.		
	SS-62	Generic flash adapter base for BB5	
	• generic base for flash adapters and couplers • SS-62 equipped with a clip interlock system • provides standardised interface towards Control Unit • provides RF connection using galvanic connector or coupler • multiplexing between USB and FBUS media, controlled by VUSB		
	ST-37	BTHFM rework stencil	
	ST-37 stencil is used with RJ-104 BTHFM rework jig.		

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	ST-40	PA rework stencil	
	This stencil is to be used together with RJ-93 and covering FEM module.		
	ST-41	Rework stencil	
	ST-41 is a rework stencil used with rework jig RJ-114.		
	ST-44	Rework stencil	
	ST-44 is a rework stencil used with rework jig RJ-57.		
	SX-4	Smart card	
	SX-4 is a BB5 security device used to protect critical features in tuning and testing. SX-4 is also needed together with FPS-10 when DCT-4 phones are flashed.		
	XCS-4	Modular cable	
	XCS-4 is a shielded (one specially shielded conductor) modular cable for flashing and service purposes.		

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	XRF-1	RF cable	
	The RF cable is used to connect, for example, a module repair jig to the RF measurement equipment. SMA to N-Connector ca. 610mm. Attenuation for: • GSM850/900: 0.3+-0.1 dB • GSM1800/1900: 0.5+-0.1 dB • WLAN: 0.6+-0.1dB		

Service concepts

Flash concept with FPS-10

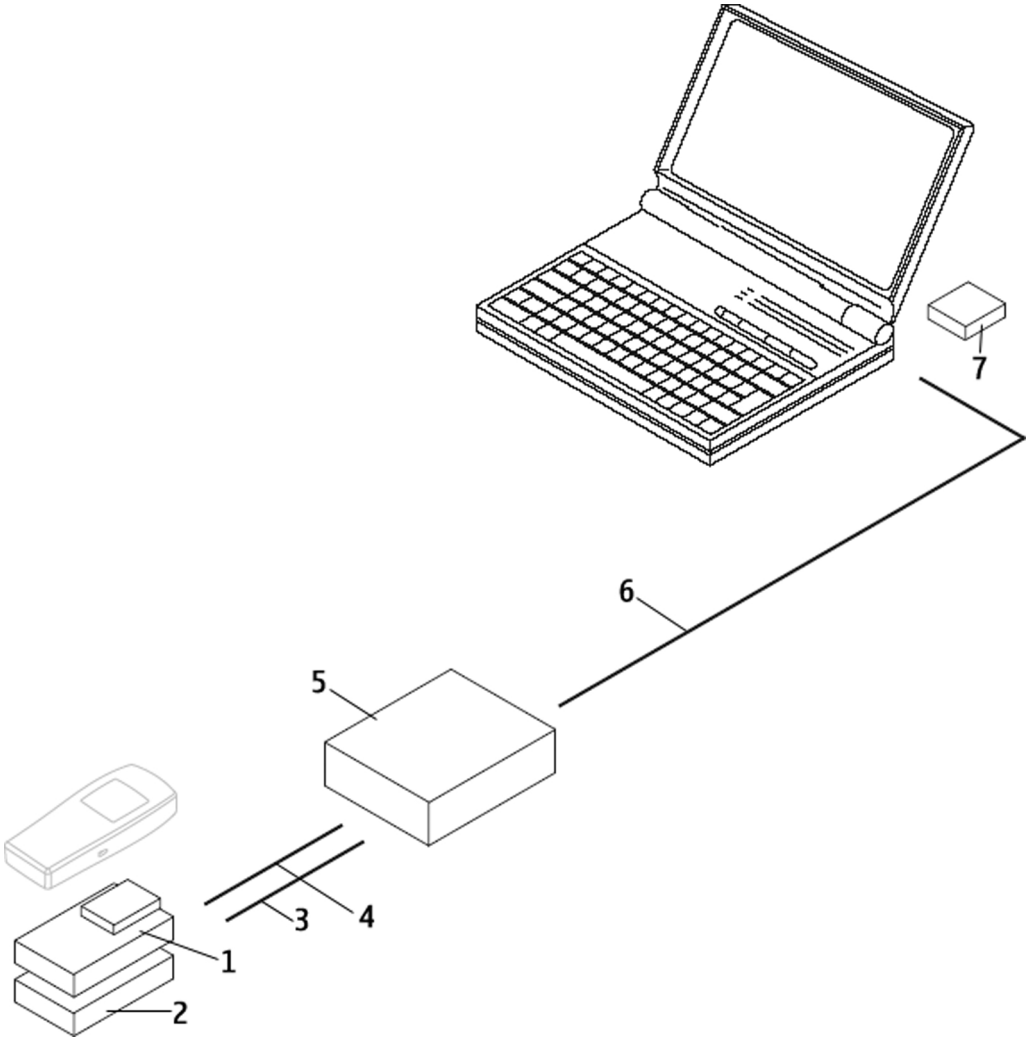


Figure 30 Basic flash concept with FPS-10

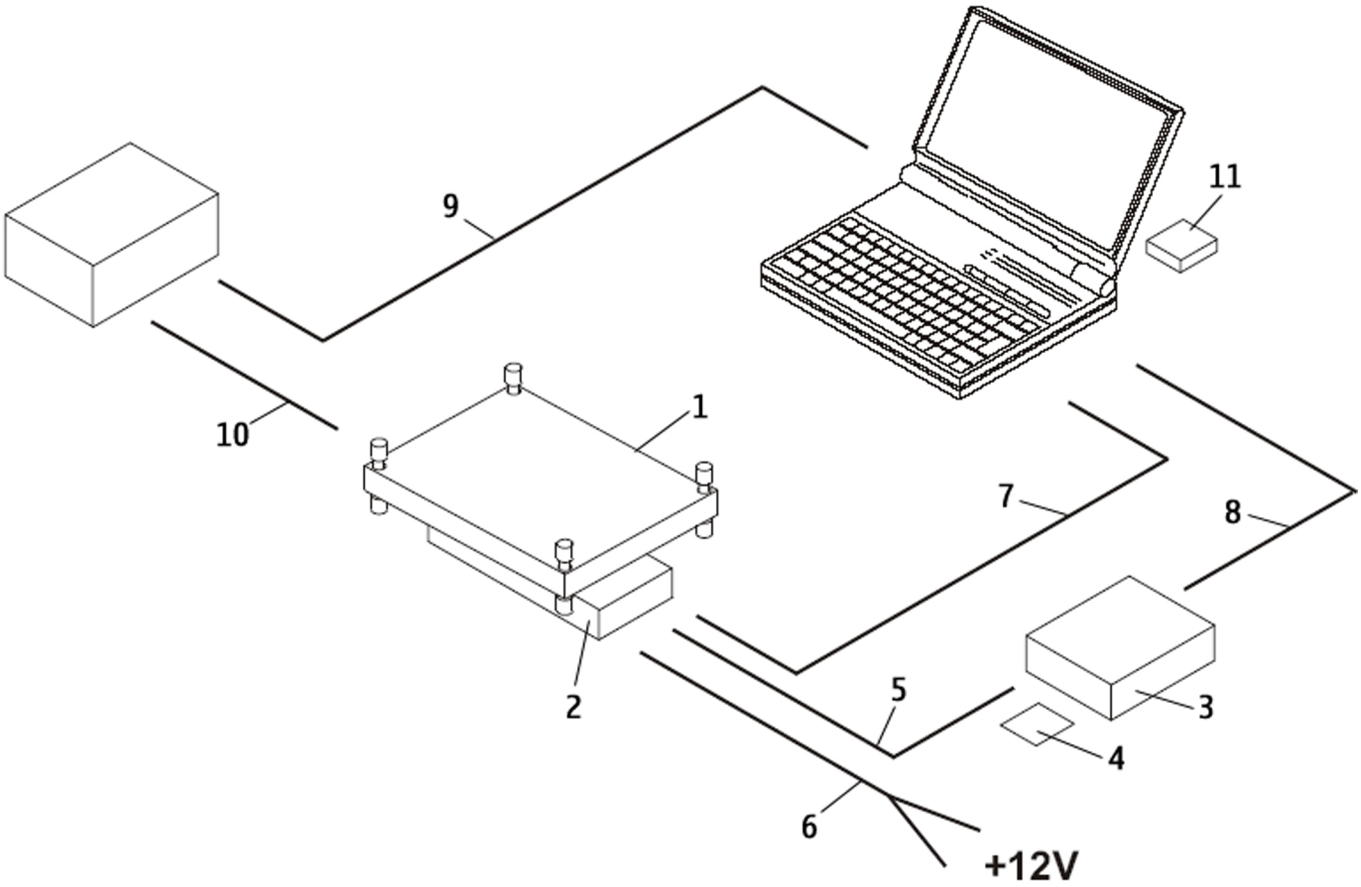
Note: FPS-8 concept can also be used for flashing.

Item	Type	Description
1	FS-31	Flash adapter

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Item	Type	Description
2	SS-46	Interface adapter
3	CA-35S	Power cable
4	XCS-4	Modular cable
5	FPS-10	Flash prommer box
6		Standard USB cable
7	PKD-1	SW security device

Module jig concept



Module jig concept is meant for BB / RF testing + tuning and for flashing purposes.

Figure 31 Module jig service concept

Item	Type	Description
1	MJ-91	Module jig
2	CU-4	Control unit
3	FPS-10	Flash prommer box
4	SX-4	Smart card
5	XCS-4	Modular cable
6	PCS-1	DC power cable

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Item	Type	Description
7		Standard USB cable
8		Standard USB cable
9		GPIB control cable
10	XRS-6	RF cable
11	PKD-1	SW security device
12		RF shield box

Note: Item 12 not shown in the picture.

POS (Point of Sale) flash concept

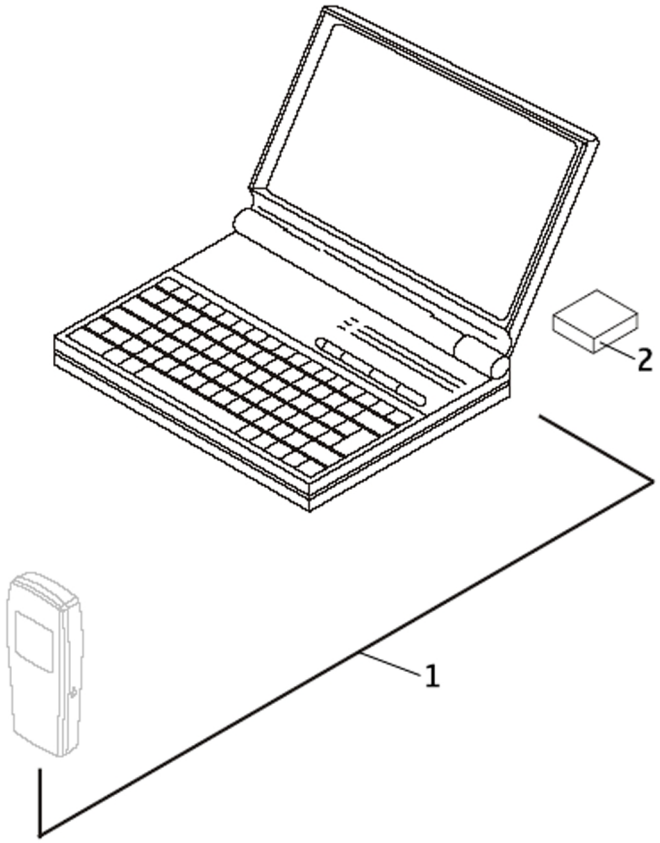


Figure 32 POS flash concept

Item	Type	Description
1	CA-53	USB connectivity cable
2	FLS-4S	POS flash device

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RF testing and BB testing

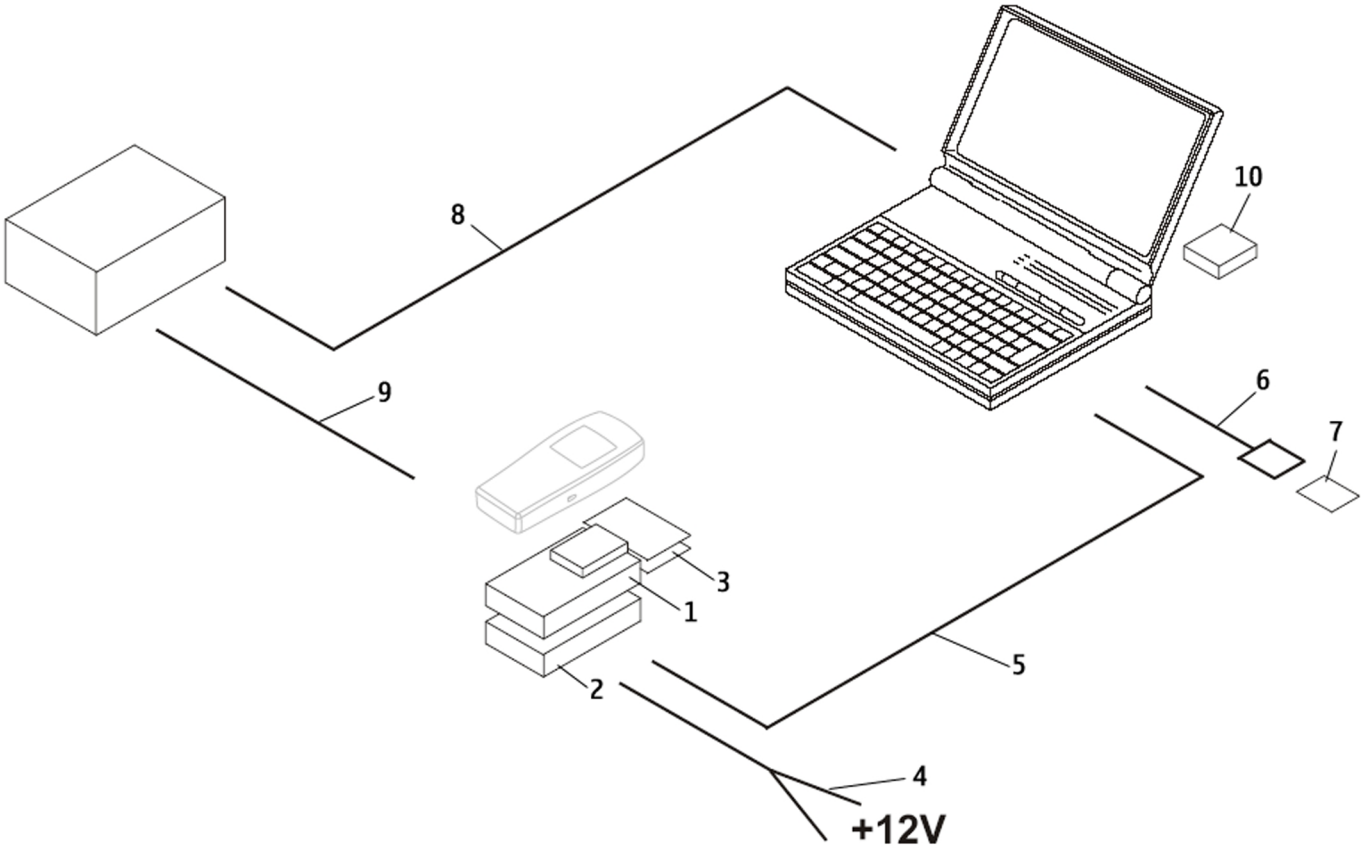


Figure 33 RF testing and BB testing

Item	Type	Description
1	SS-62 SA-103	Flash adapter base Flash adapter
2	CU-4	Control unit
3	SA-103	RF coupler
4	PCS-1	Power cable
5		Standard USB cable
6		Standard USB cable + smart card reader
7	SX-4	Smart card
8		GPIB control cable
9	XRS-6	RF cable
10	PKD-1	SW security device
11		RF shield box

Note: Item 11 is not shown in the figure.

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CU-4 flash concept with FPS-10

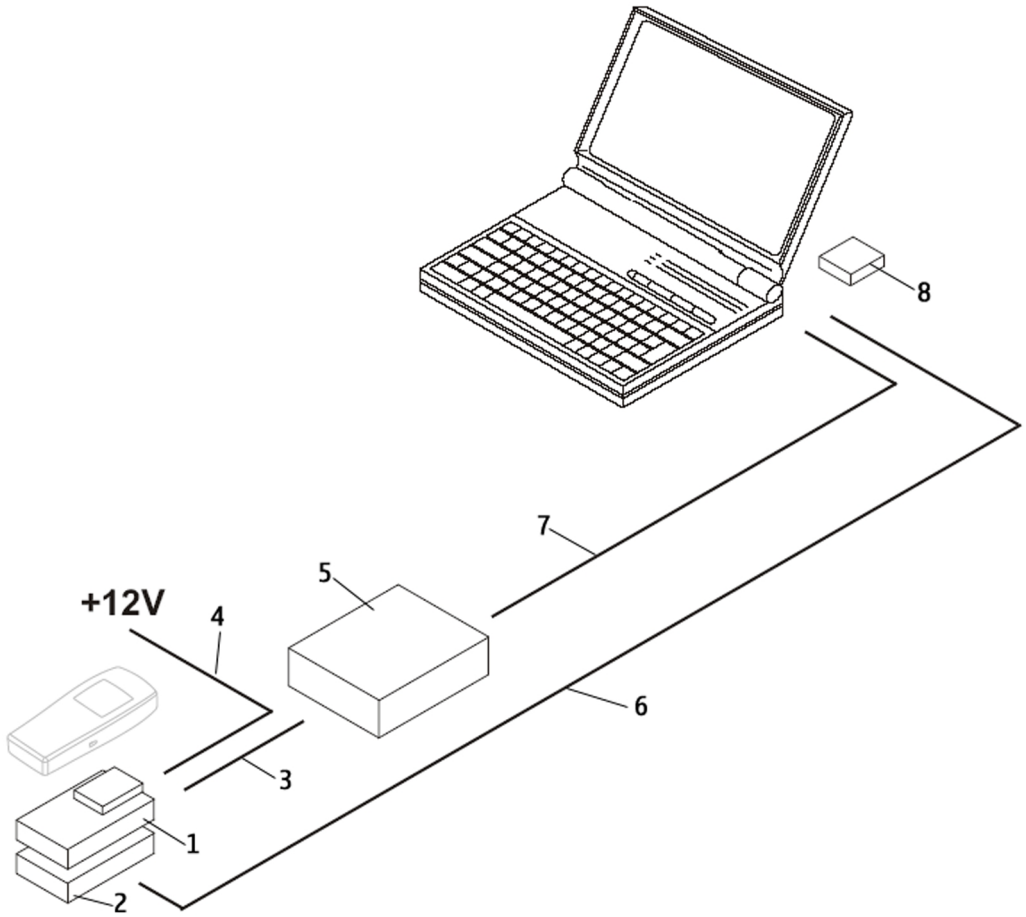


Figure 34 CU-4 flash concept with FPS-10

Note: FPS-8 concept can also be used for flashing.

Item	Type	Description
1	SS-62 FS-31	Flash adapter base Flash adapter
2	CU-4	Control unit
3	XCS-4	Modular cable
4	PCS-1	Power cable
5	FPS-10	Flash prommer box
6		Standard USB cable
7		Standard USB cable
8	PKD-1	SW security device

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Service concept for RF/BB testing and tuning

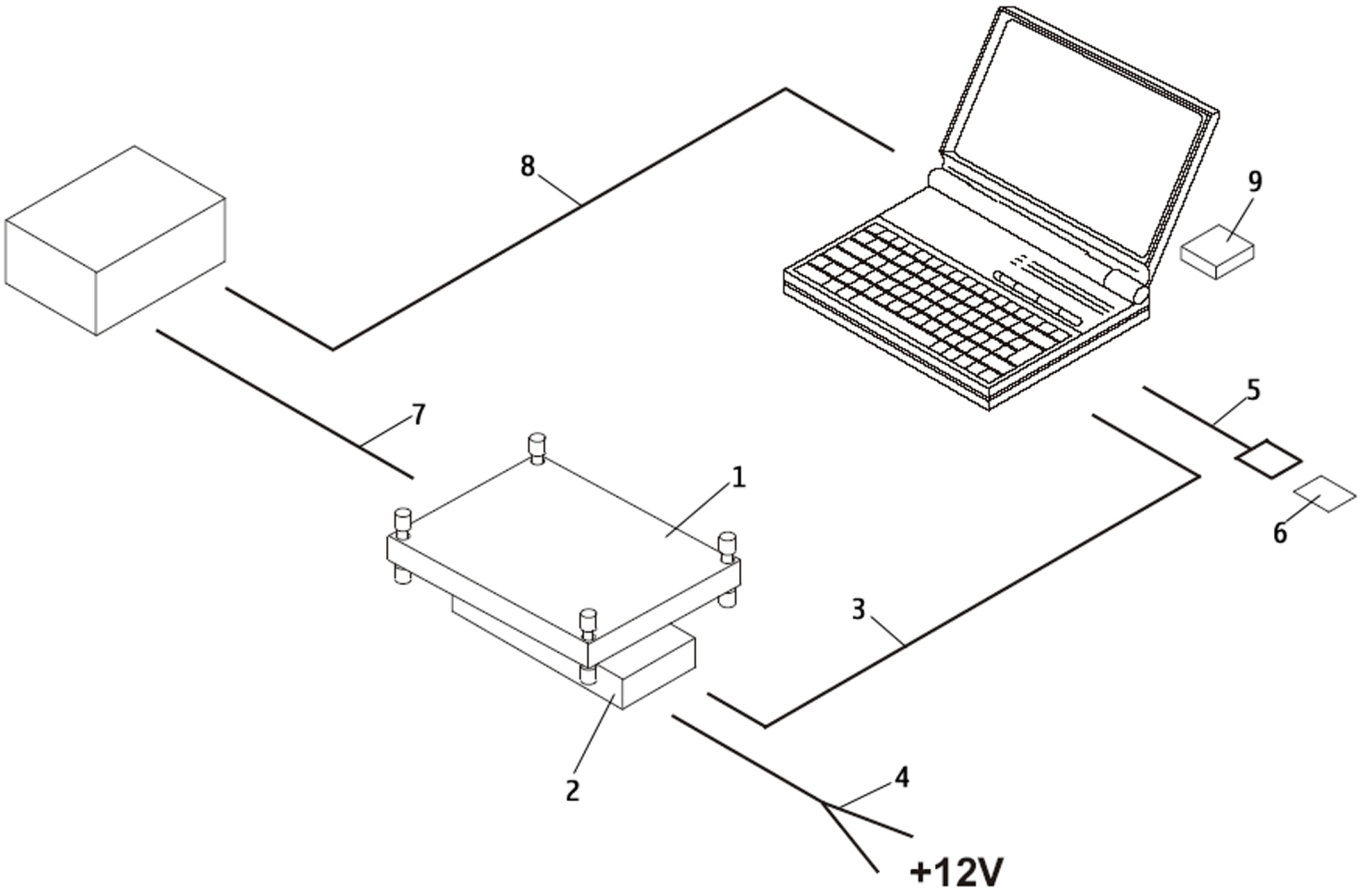


Figure 35 Service concept for RF/BB testing and tuning

Item	Type	Description
1	MJ-91	Module jig
2	CU-4	Control unit
3		Standard USB cable
4	PCS-1	DC power cable
5		Standard USB cable + smart card reader
6	SX-4	Smart card
7	XRS-6	RF cable
8		GPIB control cable
9	PKD-1	SW security device
10		RF shield box

Note: Item 10 not shown in the picture.

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LAN connection flash concept

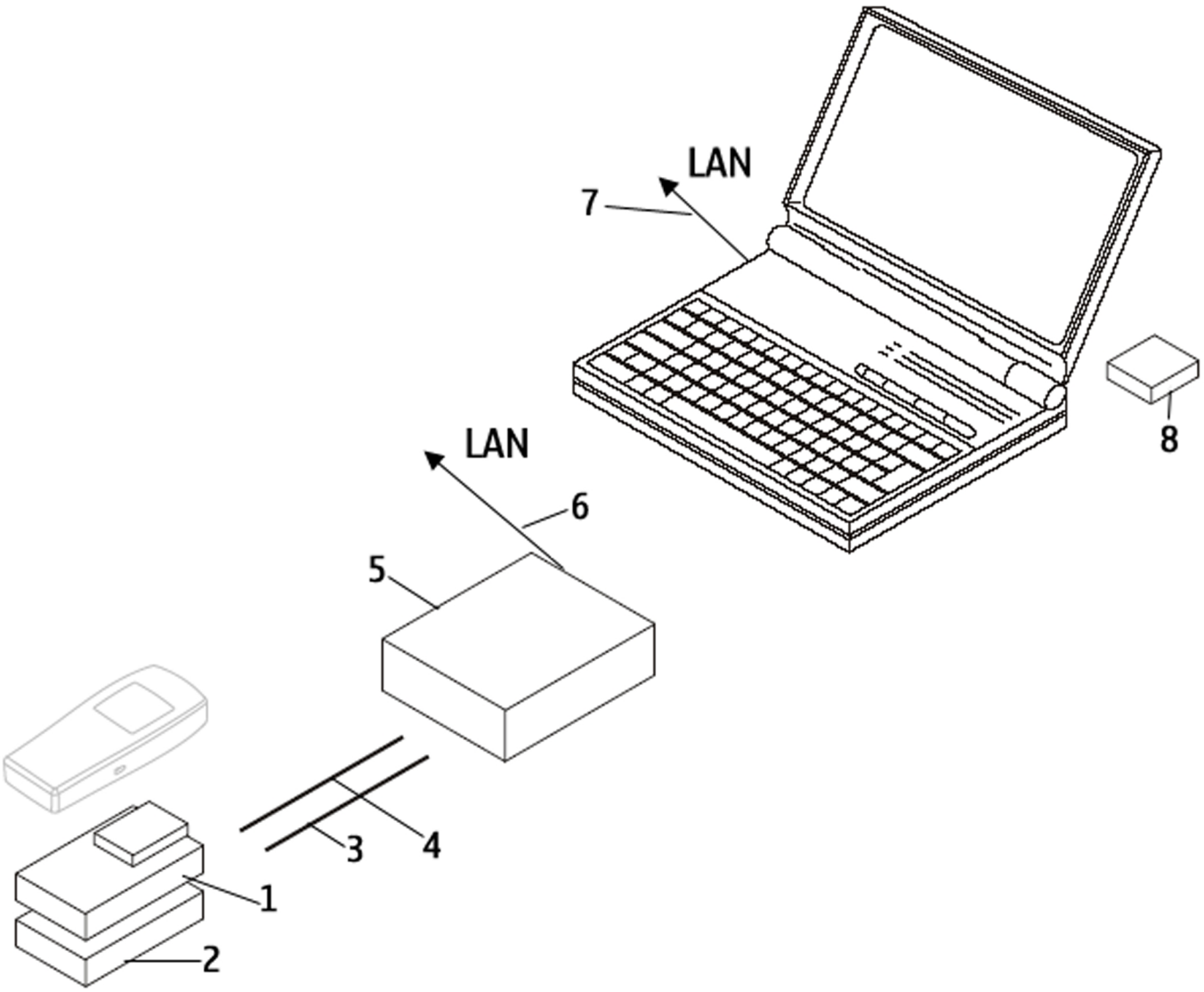


Figure 36 LAN connection flash concept

Item	Type	Description
1	SS-62 FS-31	Flash adapter base Flash adapter
2	SS-46	Interface adapter
3	CA-35S	Power cable
4	XCS-4	Modular cable
5	FPS-10	Flash prommer box
6		LAN cable
7		LAN cable
8	PKD-1	SW security device

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5 — Disassembly and reassembly instructions

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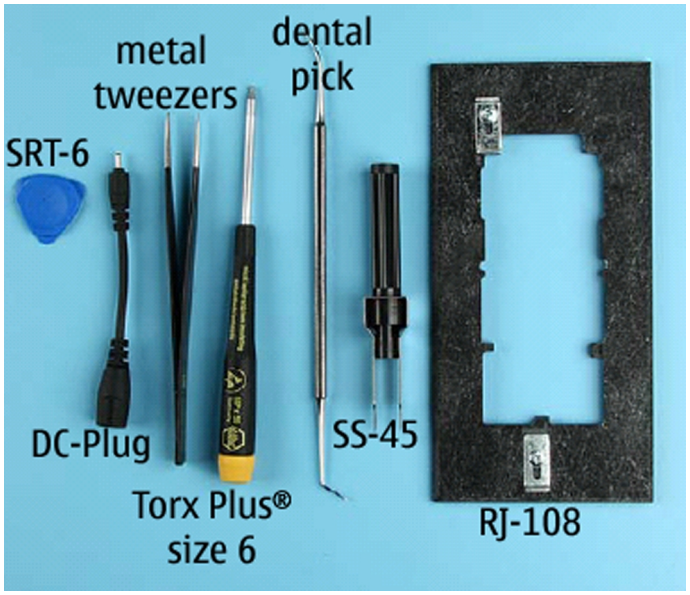
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Disassembly instructions

Steps

1. You will need these tools:



2. Protect the window with a protective film.



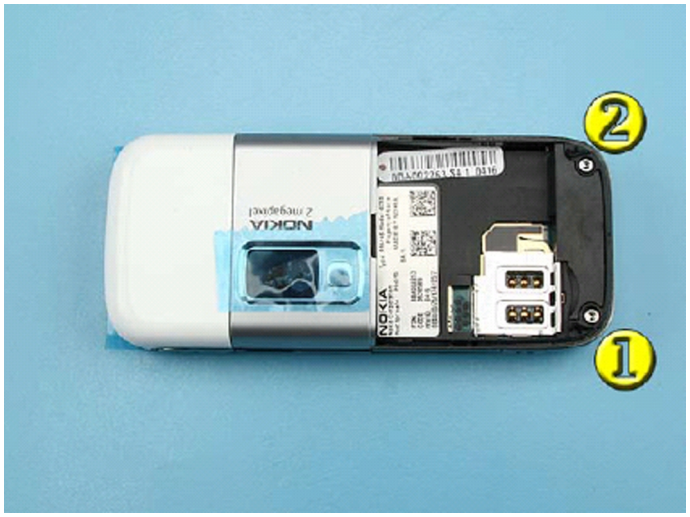
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3. Open the **battery cover** and ensure that a battery is inserted..



4. Undo the Torx Plus size 6 screws in the shown order.

   Note: For assembly, use the reverse order and a torque of 15 Ncm.

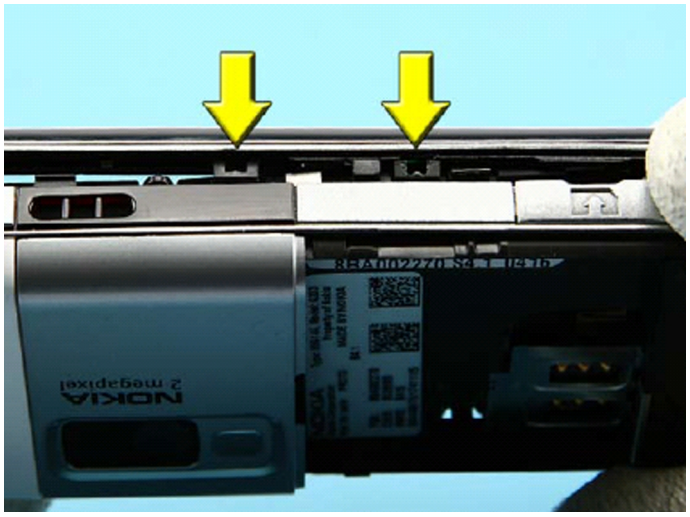


5. Discard the screws and always use new ones because of the locking compound.

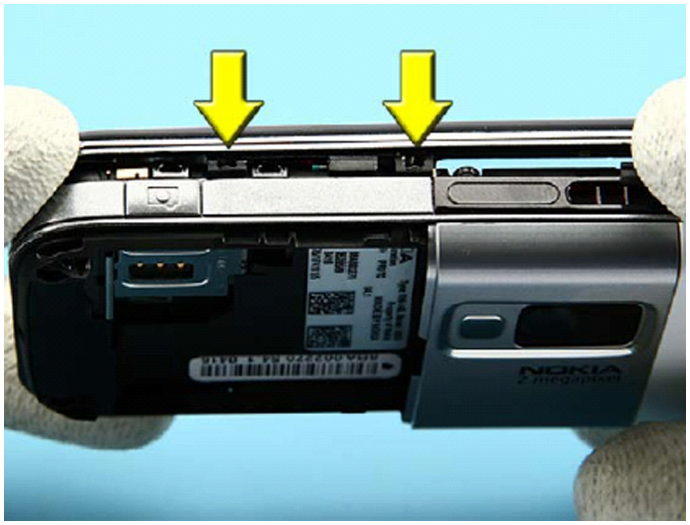


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6. This picture shows the position of the holding clips on the left side unit.



7. This picture shows the position of the holding clips on the right side of the unit.



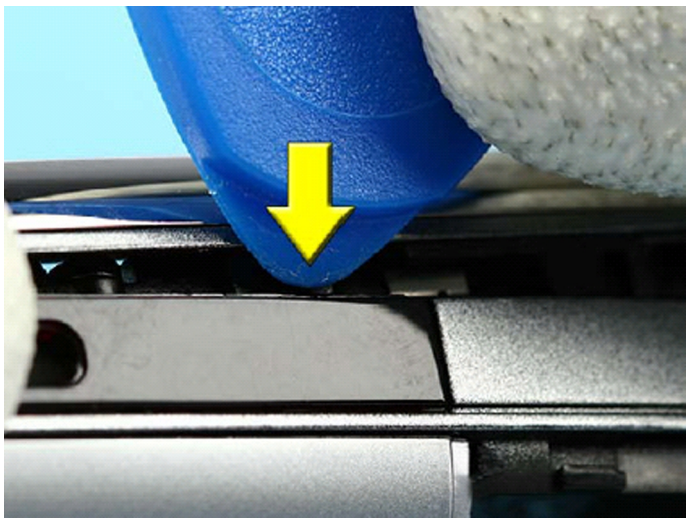
8. Bring the SRT-6 exactly to the position over the (invisible) clips.

   Note: A little sliding motion could be needed (like a 'credit card') when releasing the snaps. Do not damage the edges of the **A-cover**.

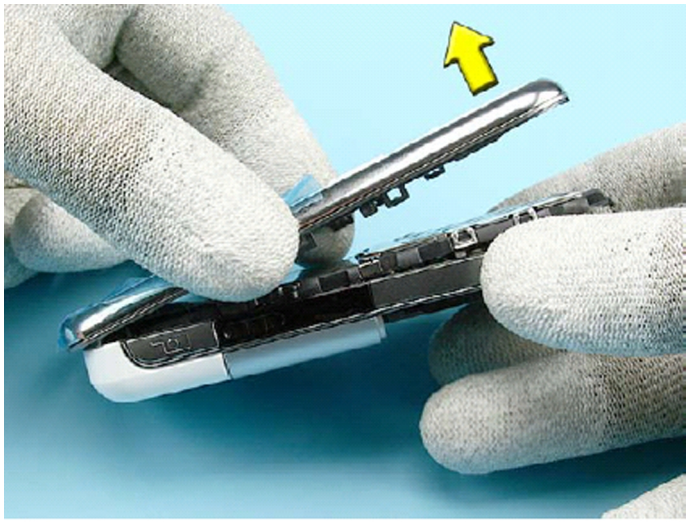
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9. Stick the SRT-6 between the covers and release the four clips.

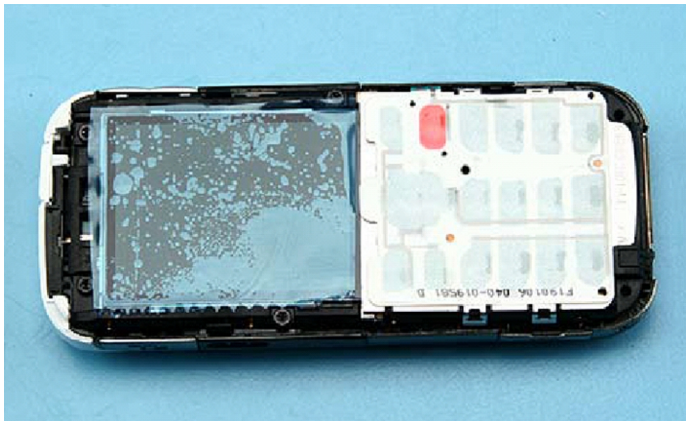


10. Remove the **A-cover** and protect the inner window with a protective film.

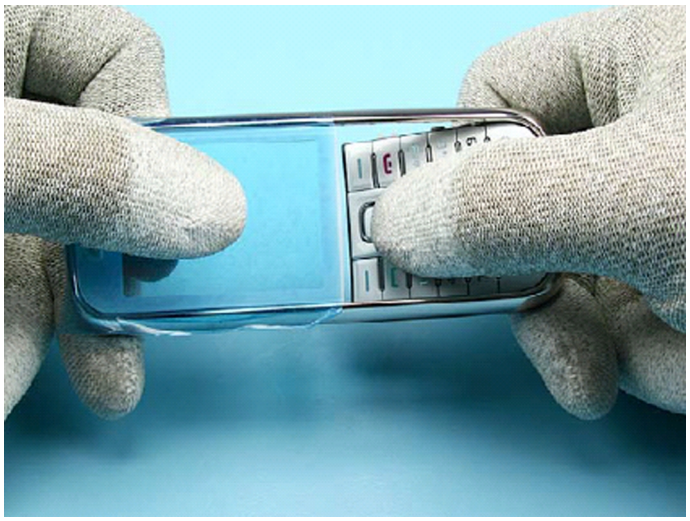


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11. Protect the **LCD module** with a protective film.



12. Press out the **keymat**.

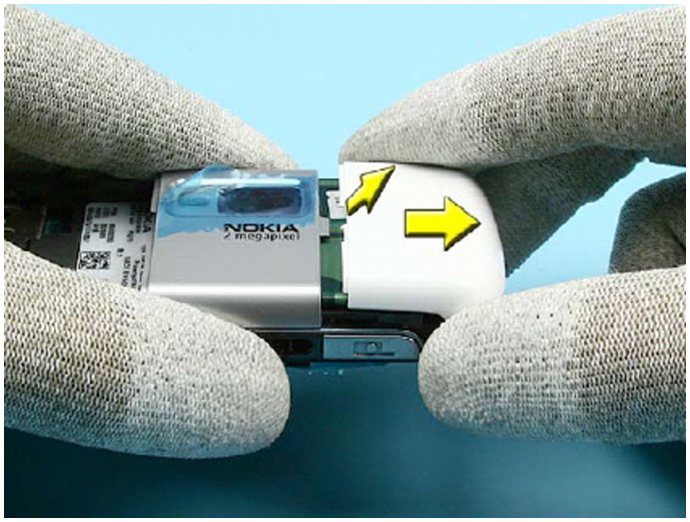


13. Stick the SRT-6 into between the **top cover** and the **camera bezel** and release the **top cover**.

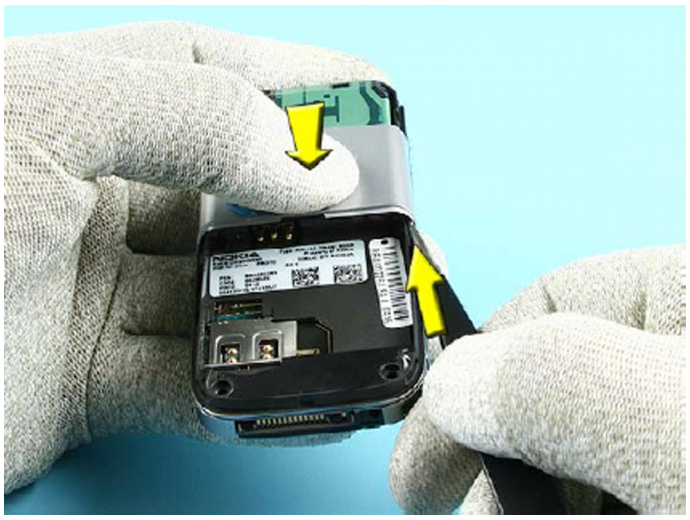


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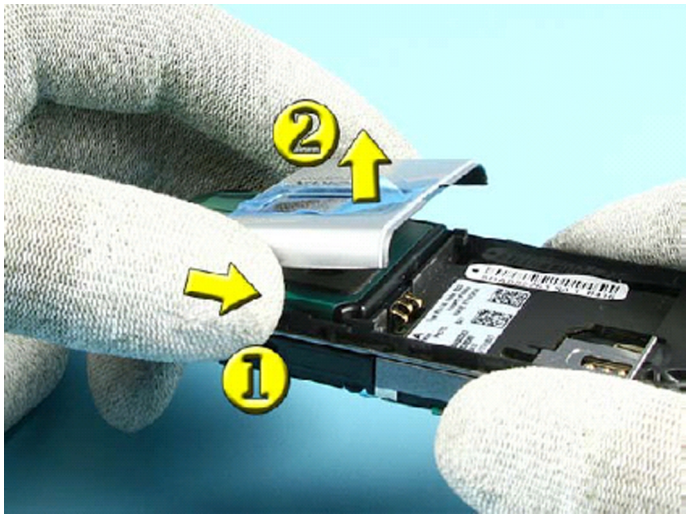
14. Now, remove the **top cover**.



15. To release the **camera bezel**, stick the closed tweezers between the **camera bezel** and the **D-cover**.

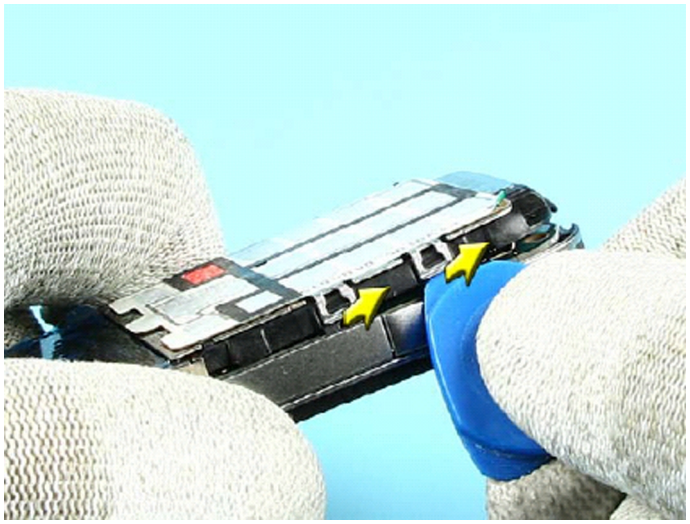


16. Now, remove the **camera bezel**.



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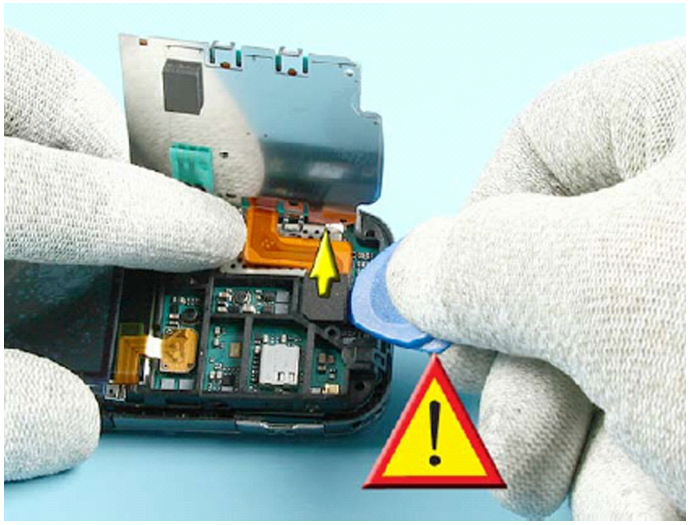
17. Unlock the four clips of the **C-cover plate assy** and loosen it.



18. Flip over the **C-cover plate assy** and pay attention to the flex foil.



19. Carefully open the flex connector with the SRT-6.



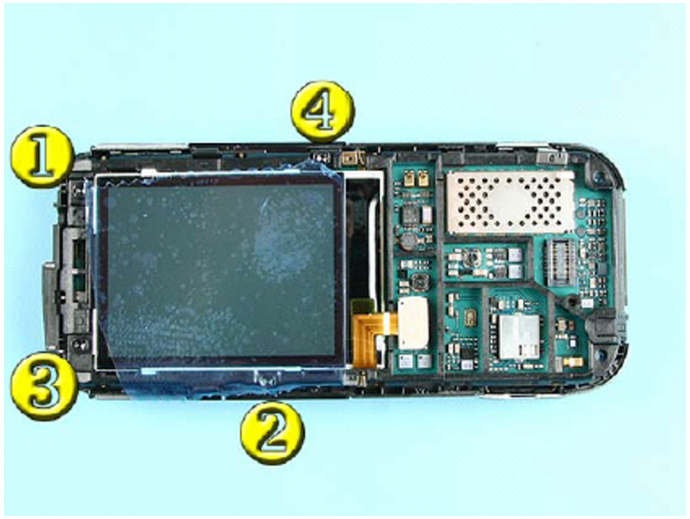
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20. Now, also open the flex connector of the **LCD module**.

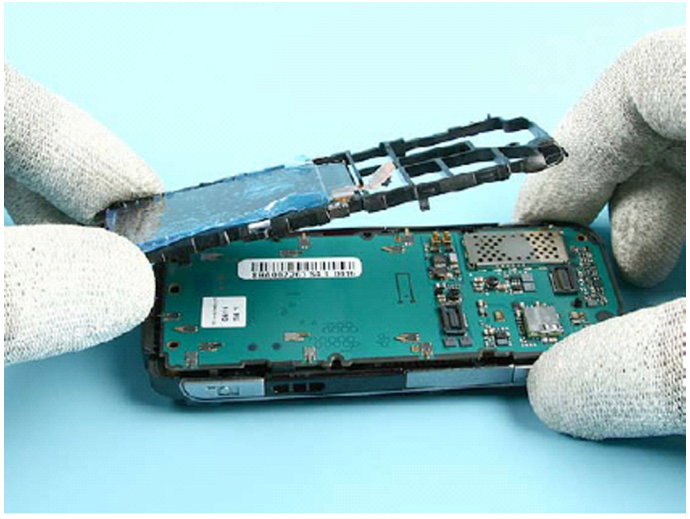


21. Open the Torx Plus size 6 screws in the shown order.

    Note: For assembly, use the reverse order and a torque of 17 Ncm.

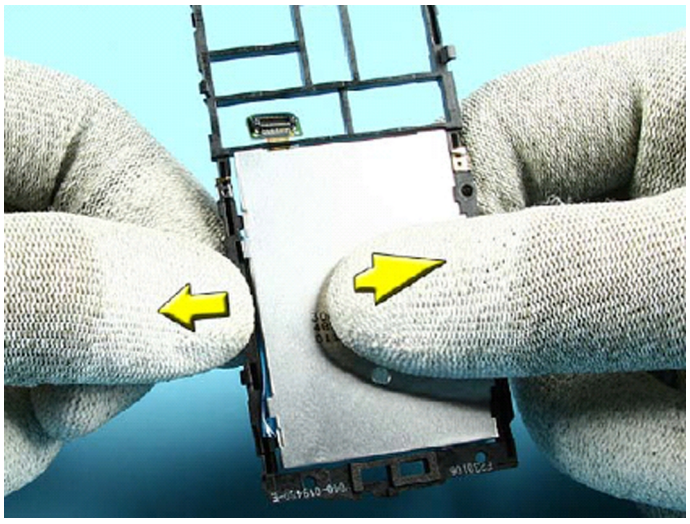


22. Take off the **C-cover assy** with the **LCD module**.

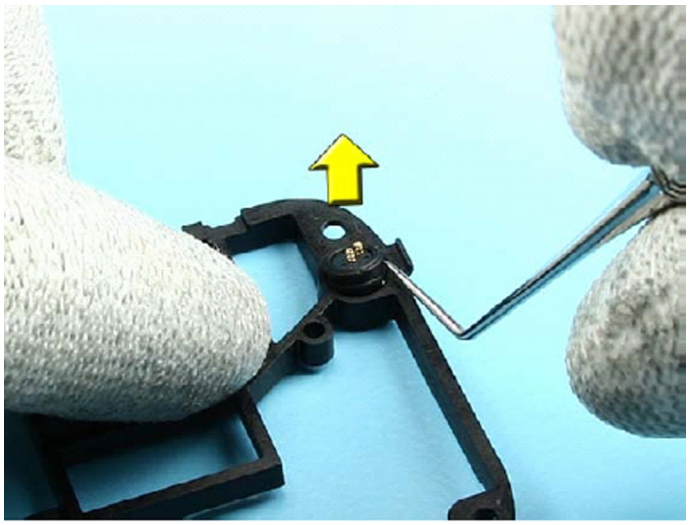


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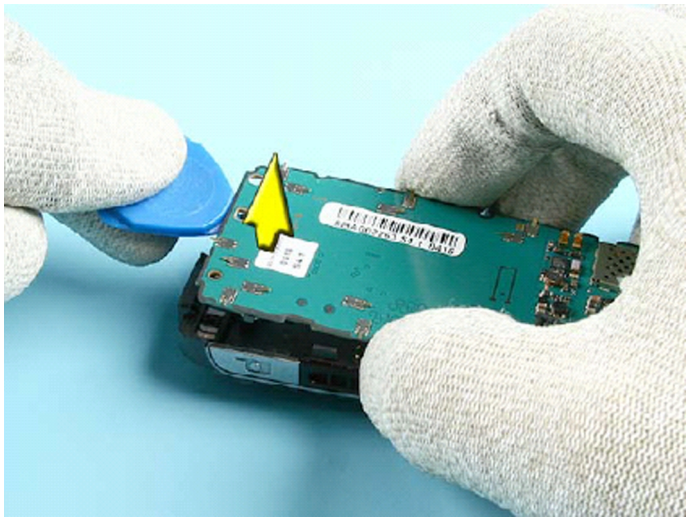
23. Release the **LCD module** from the **C-cover assy** by pushing the edges outwards first. Mind the grounding clips.



24. Remove the **microphone clapton** with the dental pick.

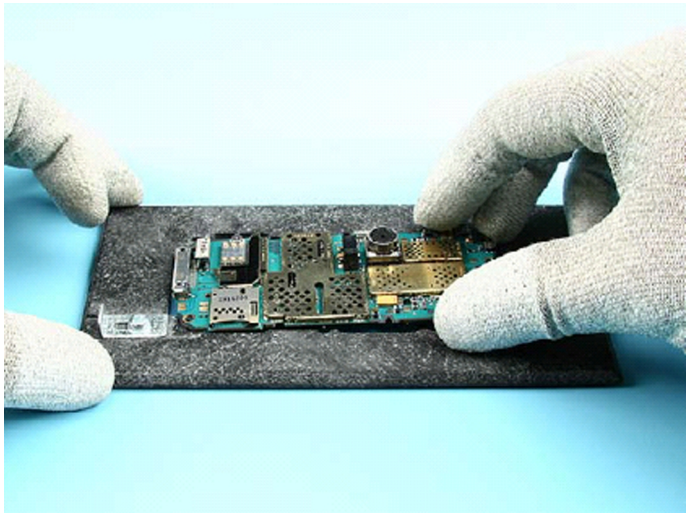


25. Use the SRT-6 as an aid to lift out the **engine module** from the **D-cover assy**.

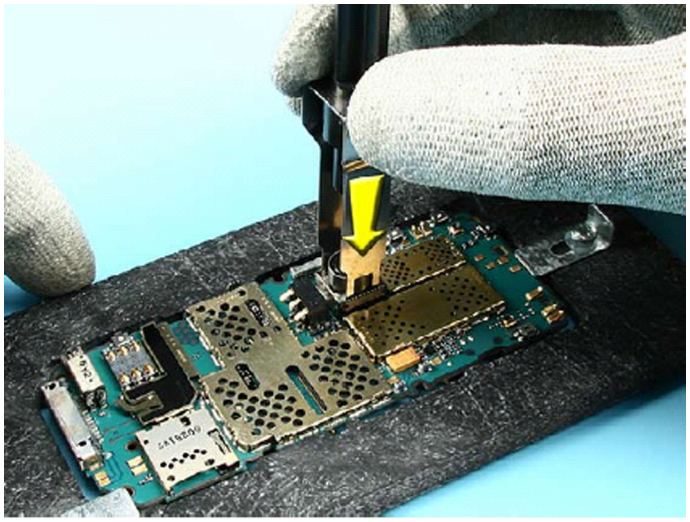


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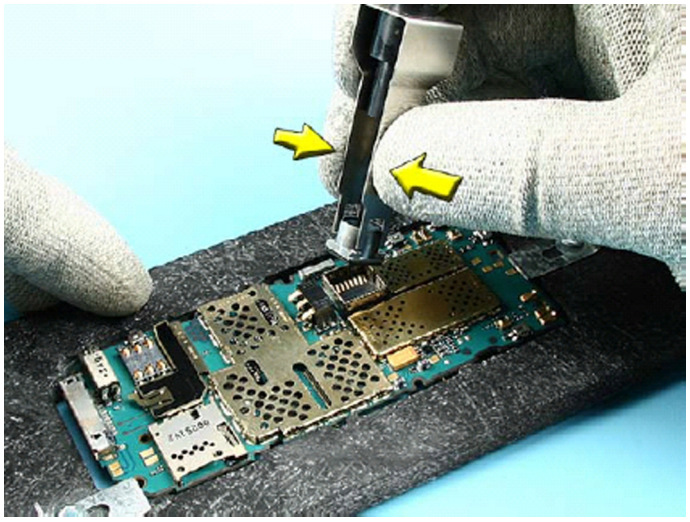
26. Use the soldering jig RJ-108 as a support when working on the **camera module**. This prevents damaging or soiling the underneath spring contacts.



27. Take the SS-45 and fit it between the **camera module** and the shielding.

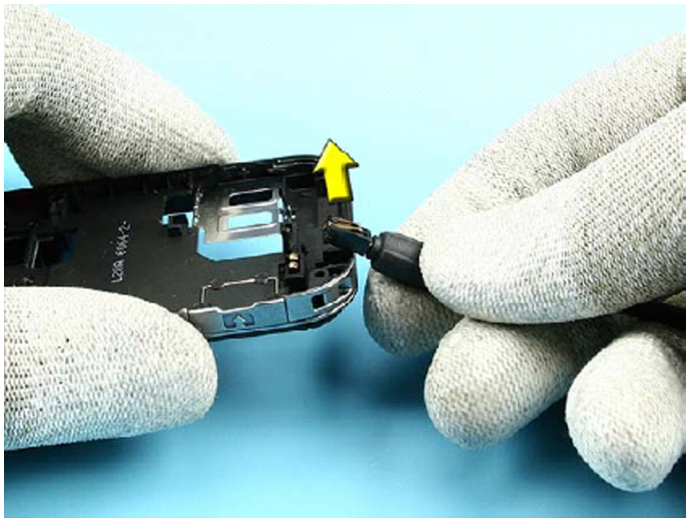


28. Press the tool and pull out the **camera module**.

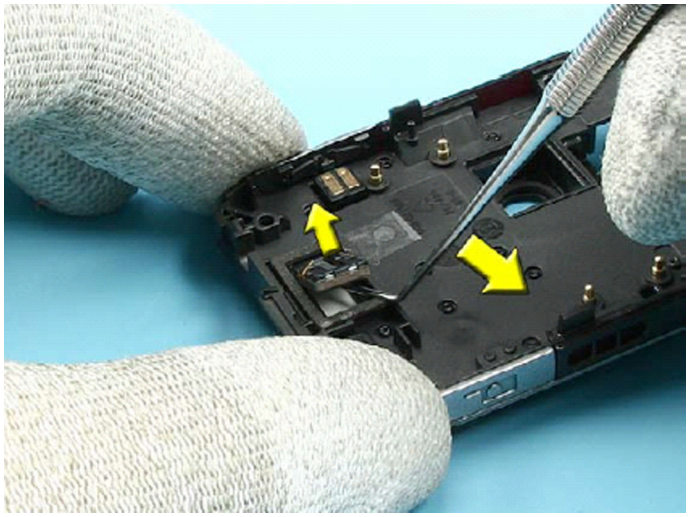


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29. Remove the **DC-jack** with a DC-plug.



30. Carefully remove the **earpiece** with a dental tool. Always use a new adhesive tape when replacing the **earpiece**.



31. The disassembly procedure is now finished.



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Reassembly instructions

Steps

1. Follow the disassembly instructions *in reversed order*.

   Note: Pay special attention to **step 21** and **step 4**!

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6 — BB Troubleshooting and Manual Tuning Guide

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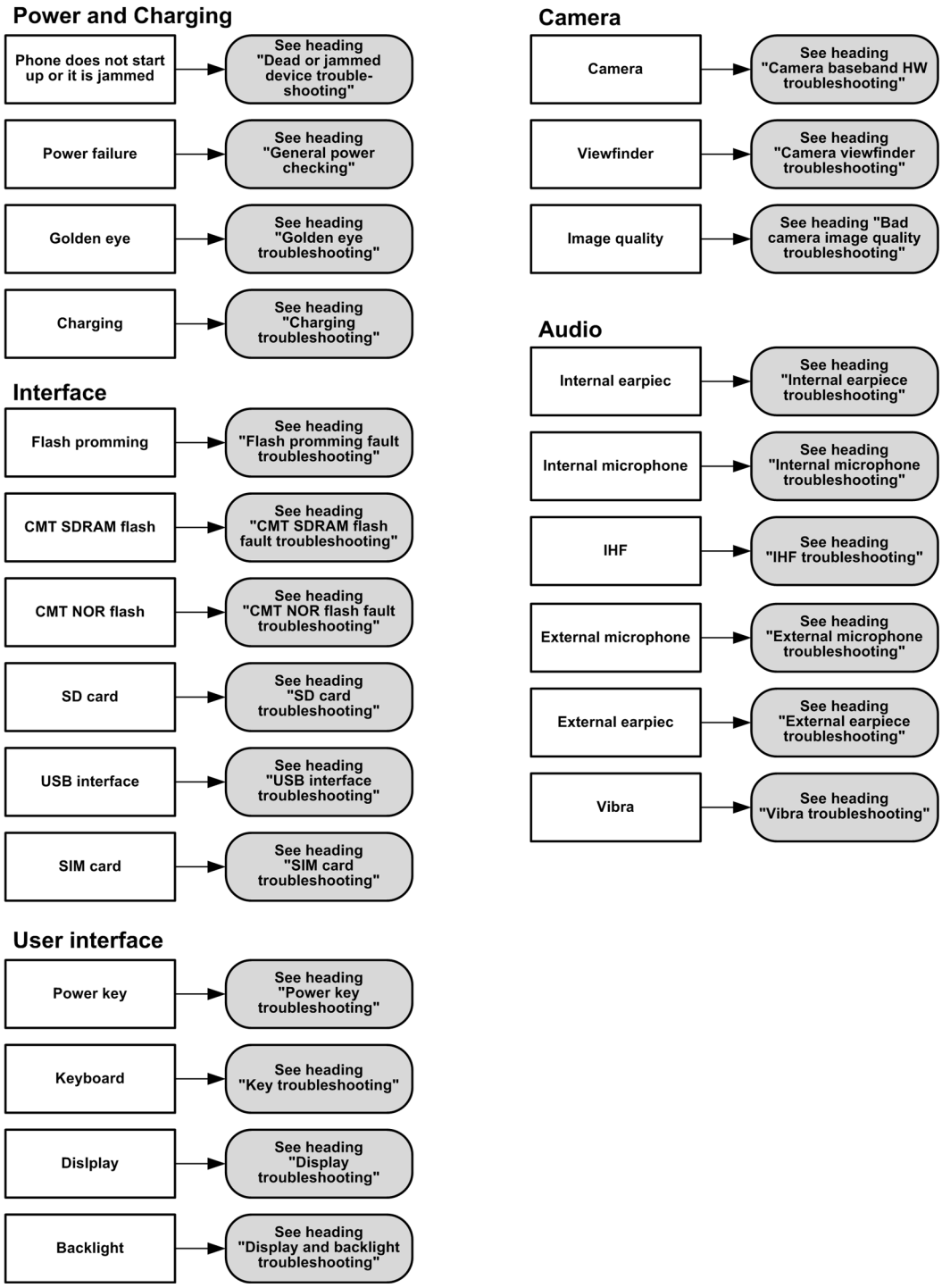
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Troubleshooting overview

For practical reasons, troubleshooting is divided into two sections;

- Baseband troubleshooting, including camera
- RF troubleshooting, including FM radio and Bluetooth

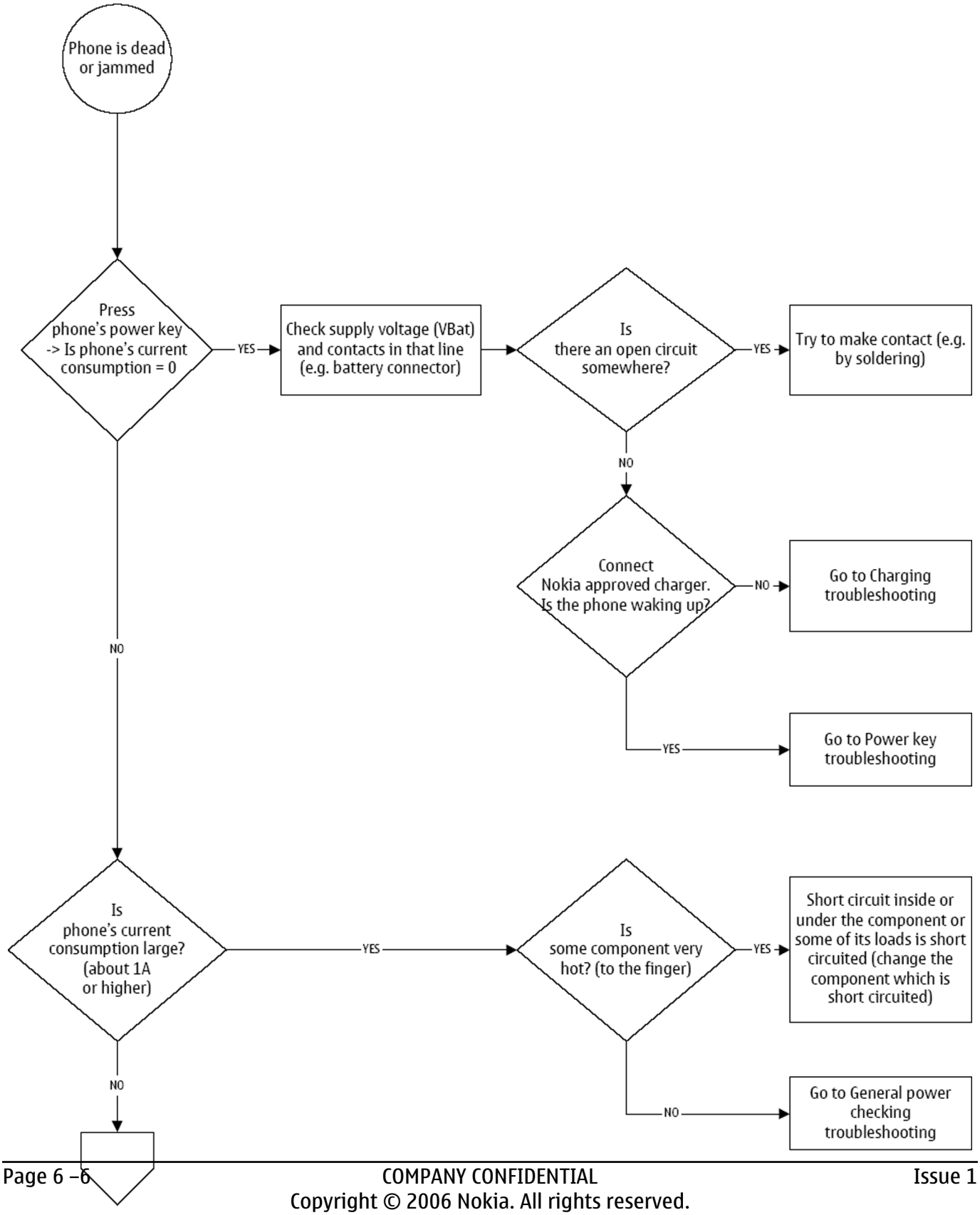


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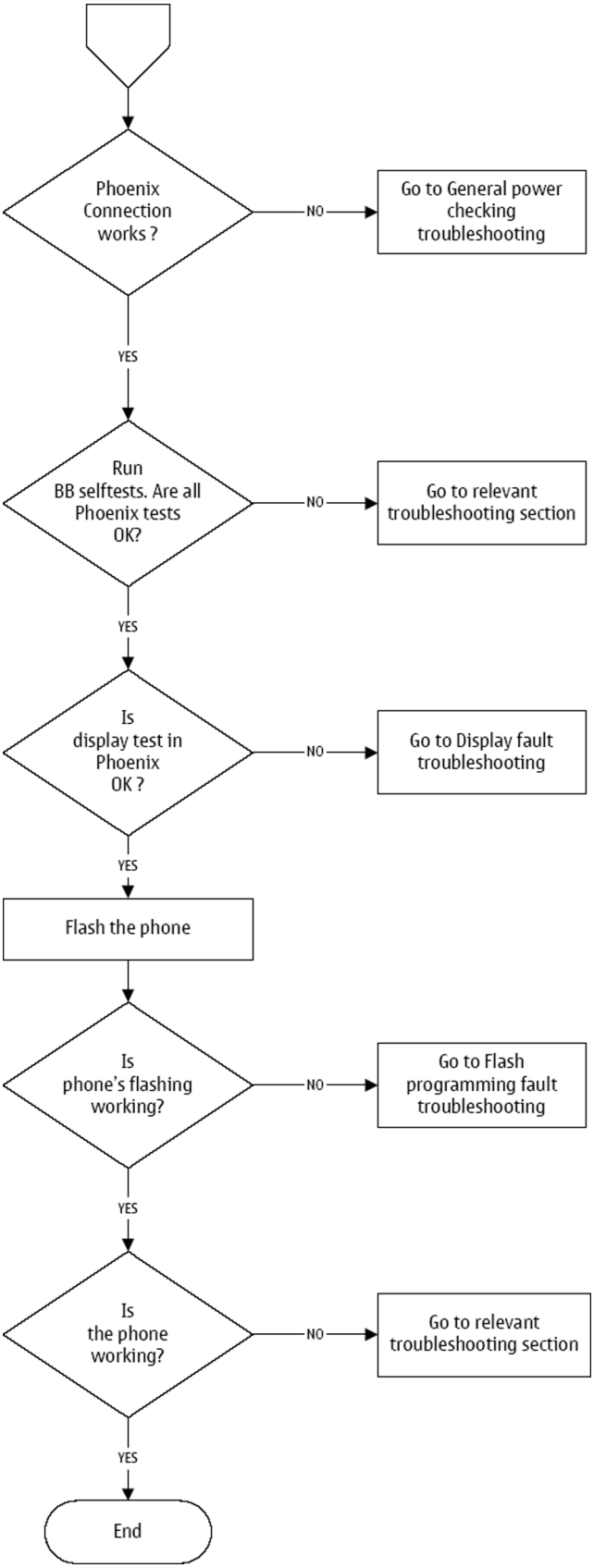
Power and charging troubleshooting

Dead or jammed device troubleshooting

Troubleshooting flow



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General power checking

Voltages

Check the following voltages:

Signal Rename	Regulator	Sleep	Idle	Nominal voltage	Main user	Notes
VIO	RETU	ON	ON	1.82	Memory, I/Os, IrDA, Display	
VBACK	RETU	ON	ON	2.5	Back-up battery	
VSIM1	RETU	ON	ON	1.8/3.0	SIM card	
VSIM2	RETU	OFF	OFF	3.0	Keyboard backlight	EL-foil driver
VDRAM	RETU	ON	ON	1.82	SDRAM	
VAUX	RETU	OFF	OFF	2.5	IrDA	IrDA active
VANA	RETU	ON	ON	2.5	Audio, some pull-ups	
VR1	RETU	OFF	ON	2.5	Crystal oscillators	
VRFC	RETU	OFF	ON	1.8	RAP3G converters	
VRCP1	RETU			4.5	To RF parts	RF active
VRCP2	RETU			4.5	To RF parts	RF active
VREF	RETU	ON	ON	1.35	RF reference	
VCORE	TAHVO	ON	ON	1.4	RAP3G digital	
VOUT	TAHVO	OFF	OFF	2.5		Accessory connected
VCAM_2V8	LP3987ITLX-2.85/N1060	OFF	OFF	2.85	Camera	Camera ON
VCAM_1V8	LM3671TLX-1.82/N1080	OFF	OFF	1.8	Camera	Camera ON
VCAM_1V5	TPS62311YZDR/N1050	OFF	OFF	1.5	Camera	Camera ON
2V8_FM_LCD	LP3985ITLX-2.85/N6050	ON	ON	2.85	FM, LCD, Hall sensor	
VMMC	LP3928TLX-1828/N3200	OFF	OFF	3.0	MCC card	
LCD_LED_OUT	4w_LED_DRIVER	OFF	OFF		LCD Backlight	

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Golden eye troubleshooting

Context

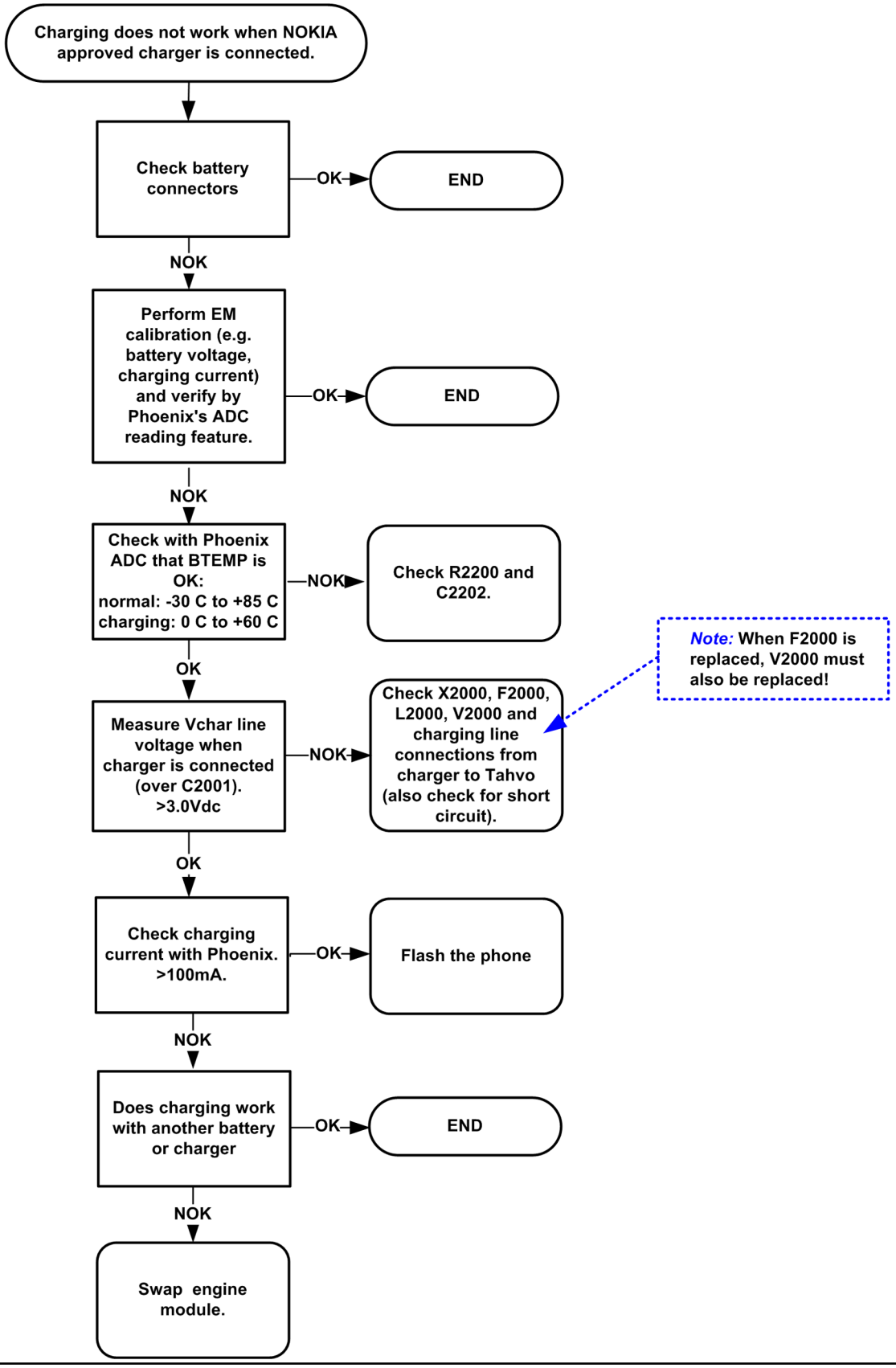
Golden eye is placed under a non removable shield and cannot be replaced.

Please swap the board.

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Charging troubleshooting

Troubleshooting flow

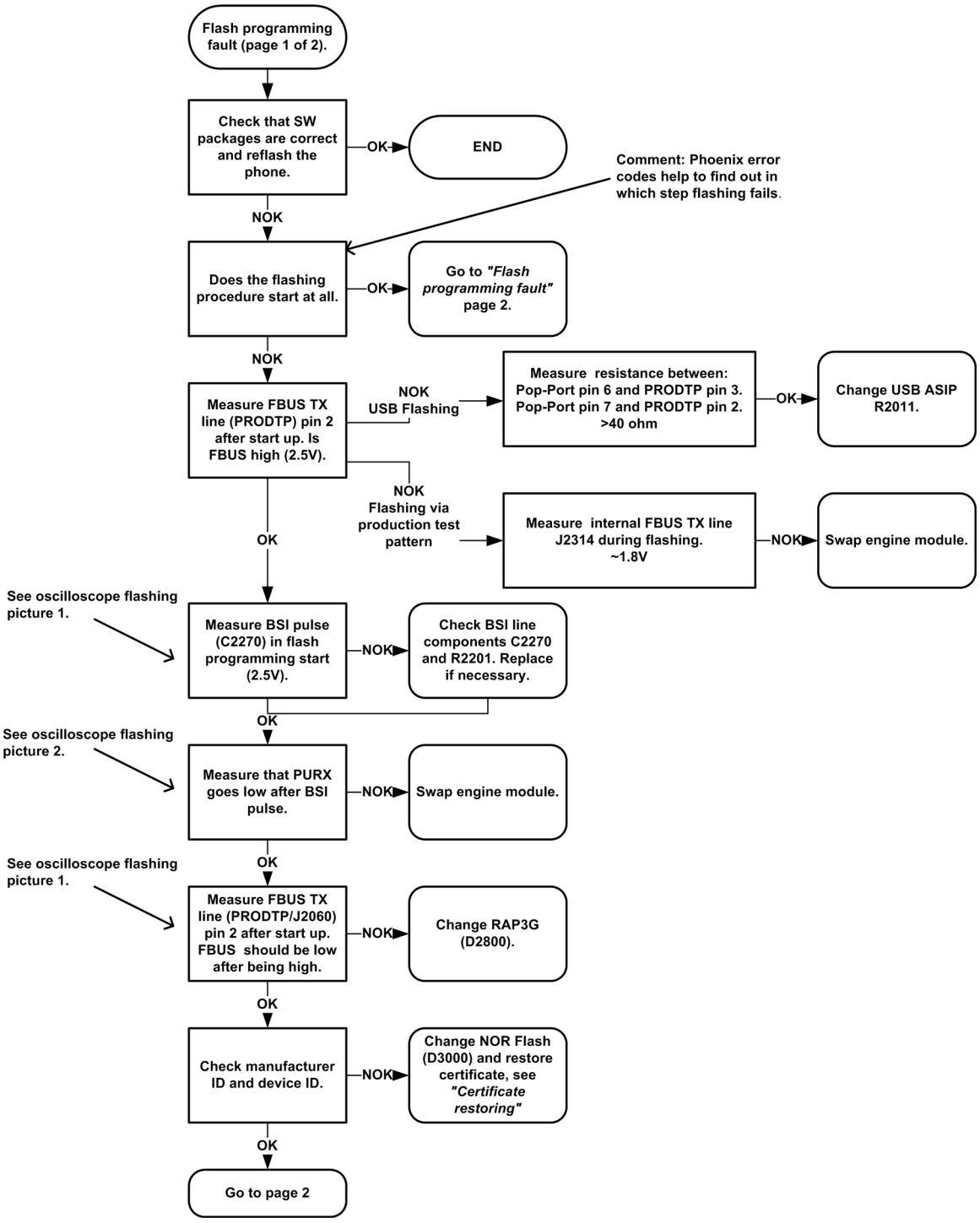


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Interface troubleshooting

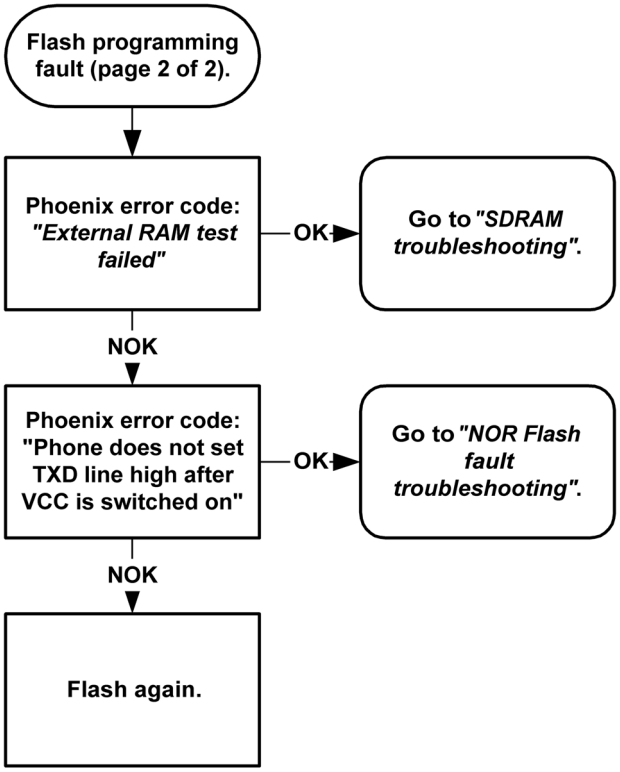
Flash programming fault troubleshooting

Part 1



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Part 2



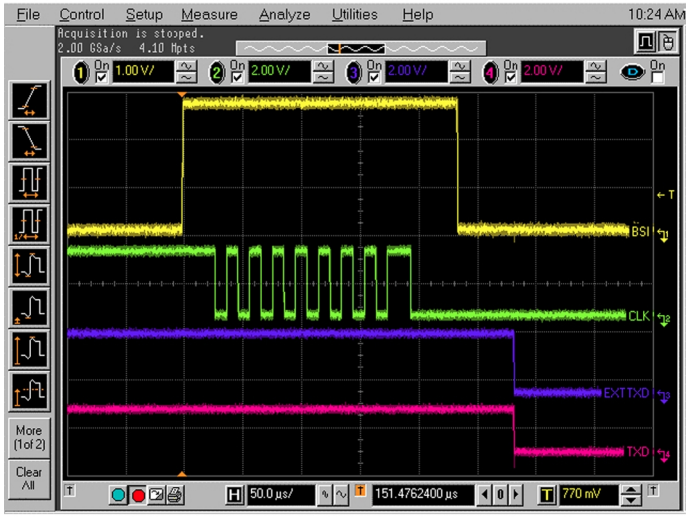


Figure 37 Flashing pic 1. Take single trig measurement for the rise of the BSI signal.

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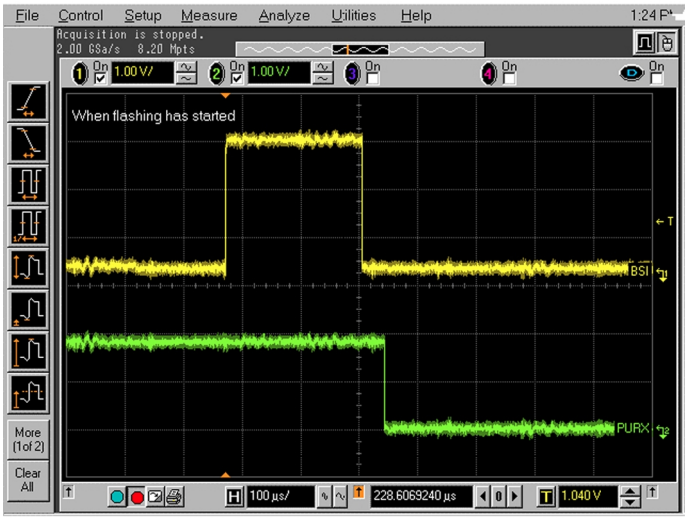
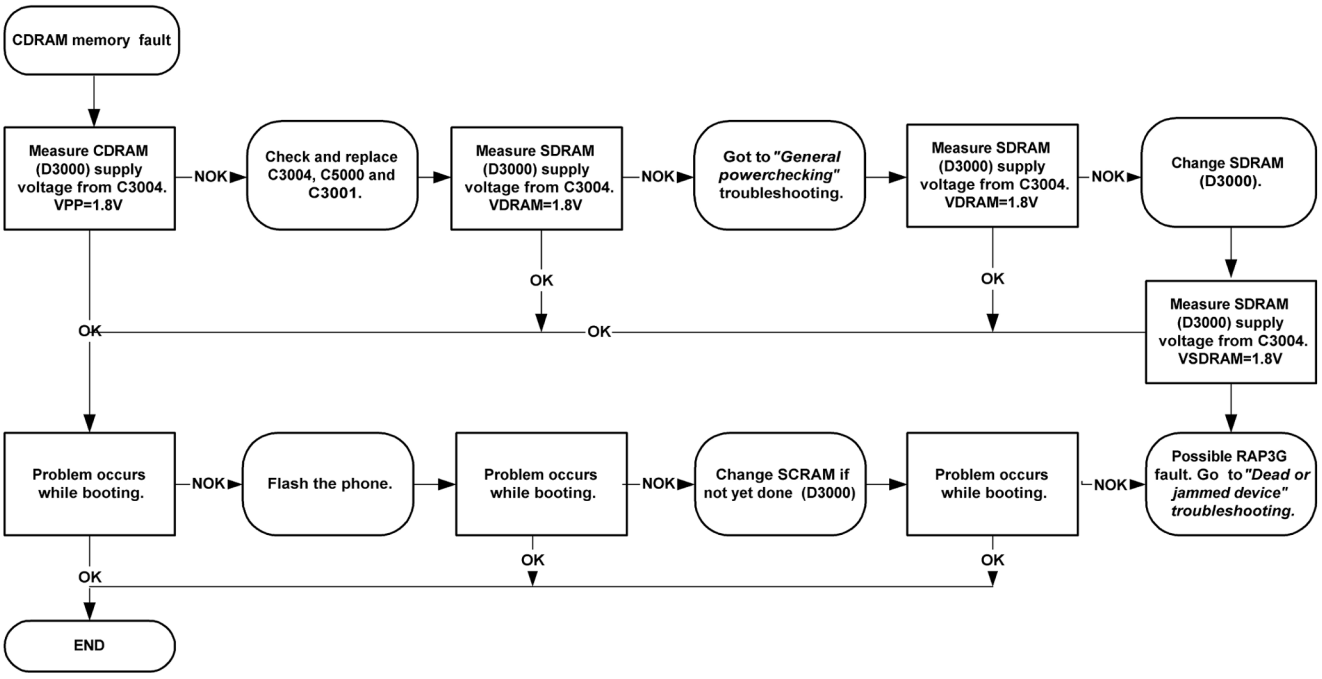


Figure 38 Flashing pic 2. Take single trig measurement for the rise of the BSI signal.

CMT SDRAM memory troubleshooting

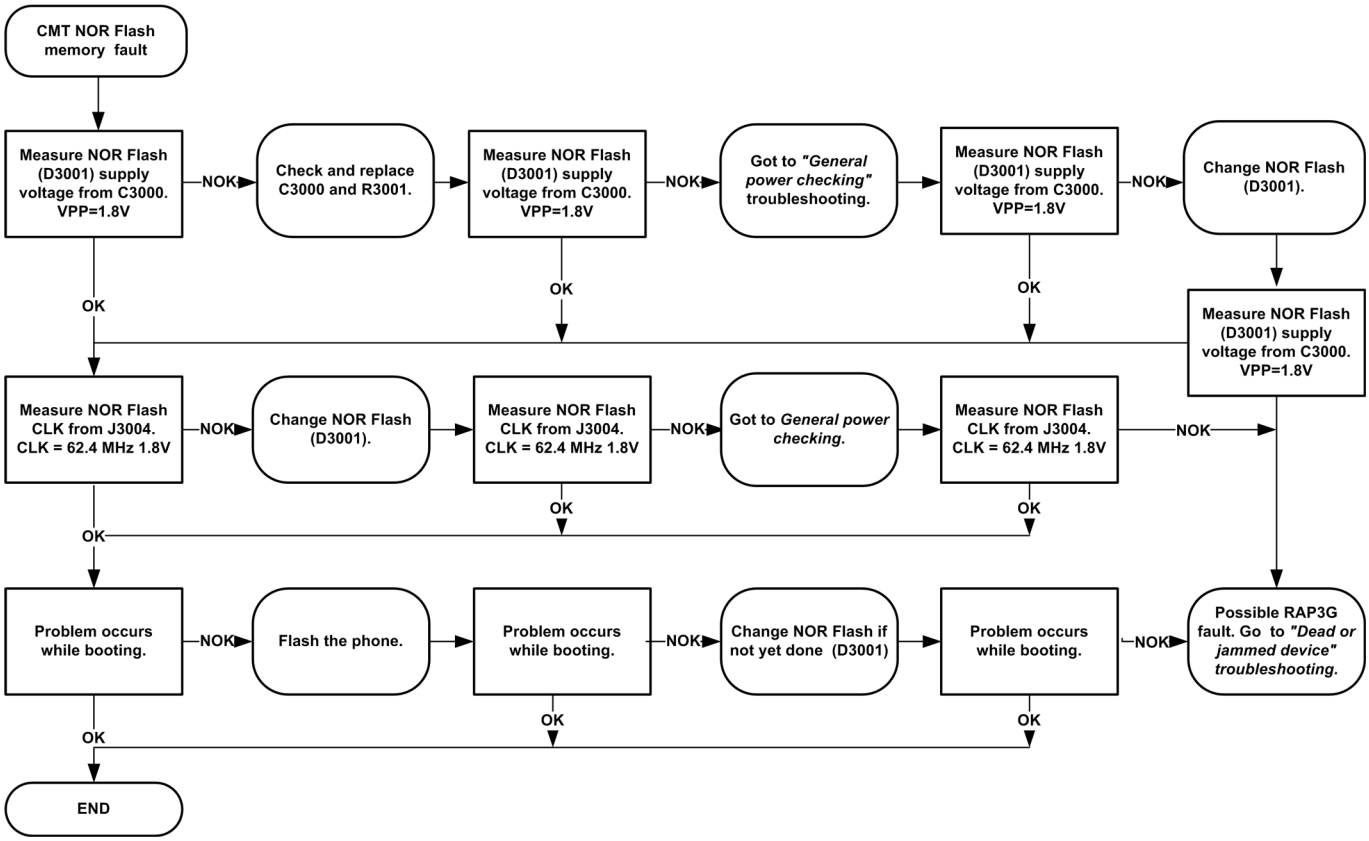
Troubleshooting flow



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CMT NOR flash fault troubleshooting

Troubleshooting flow



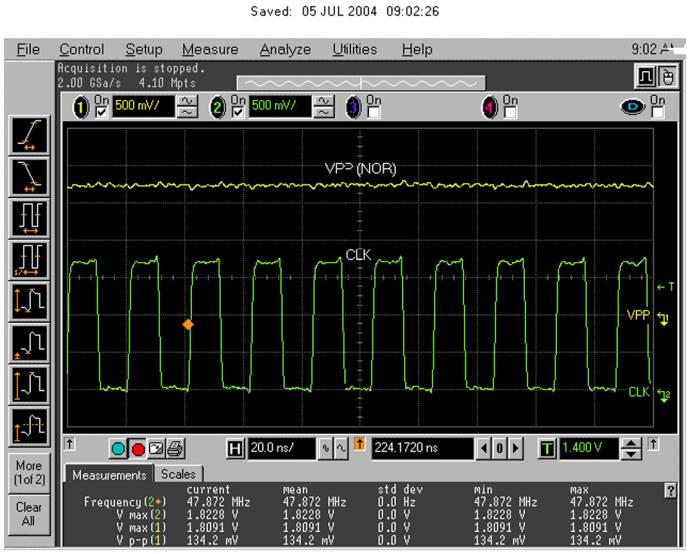
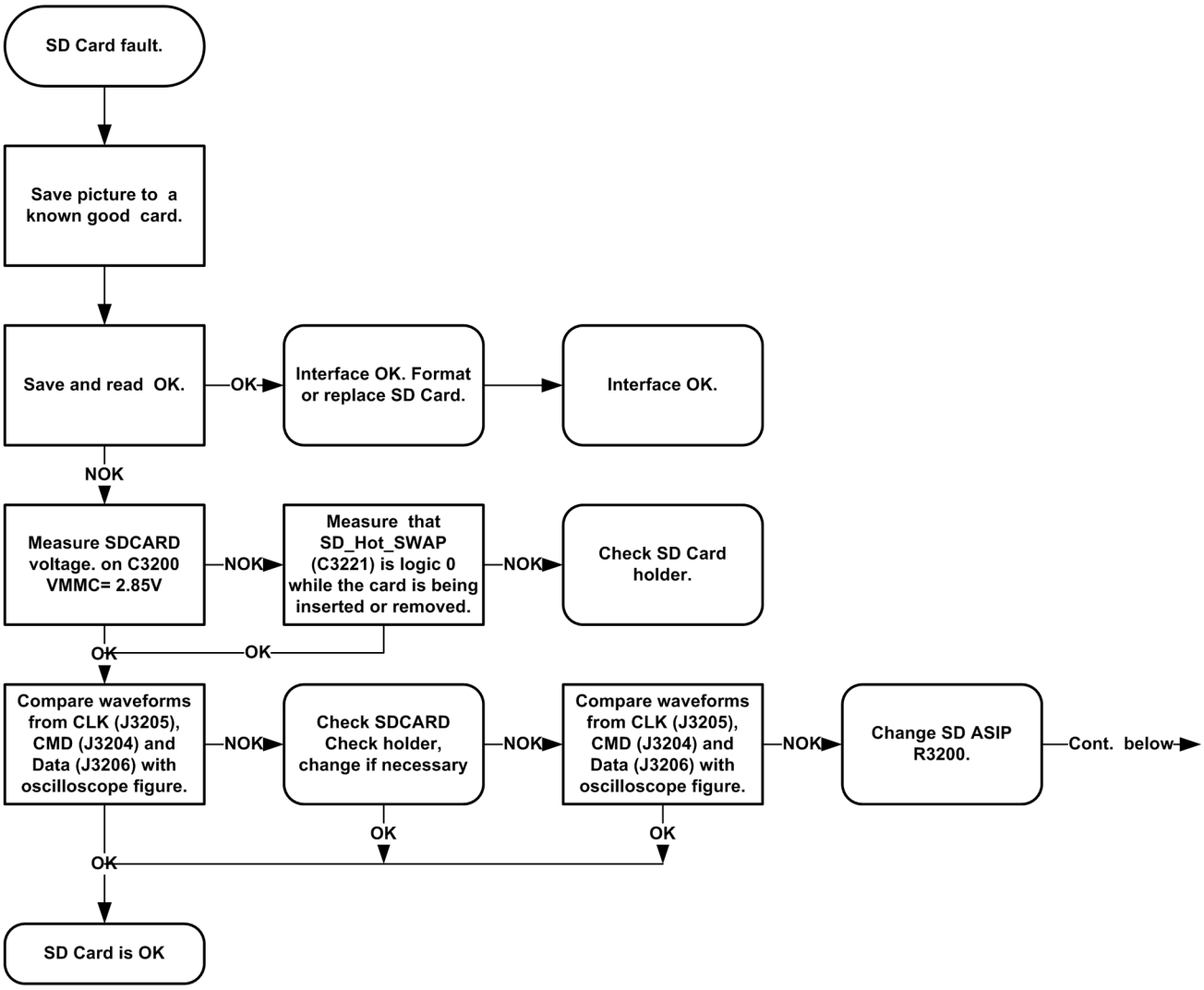


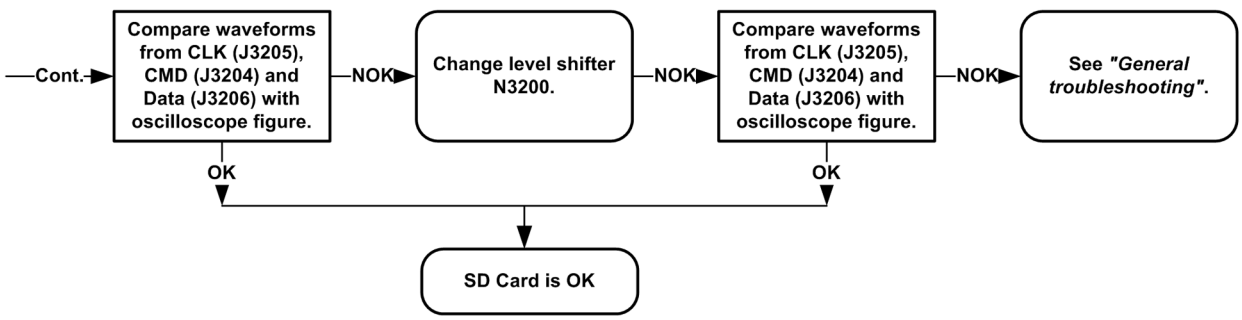
Figure 39 NOR CLK from J3004

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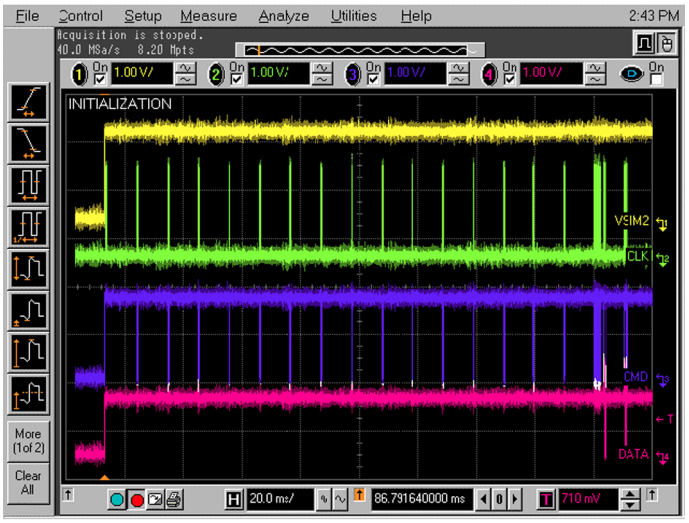
SD card troubleshooting

Troubleshooting flow





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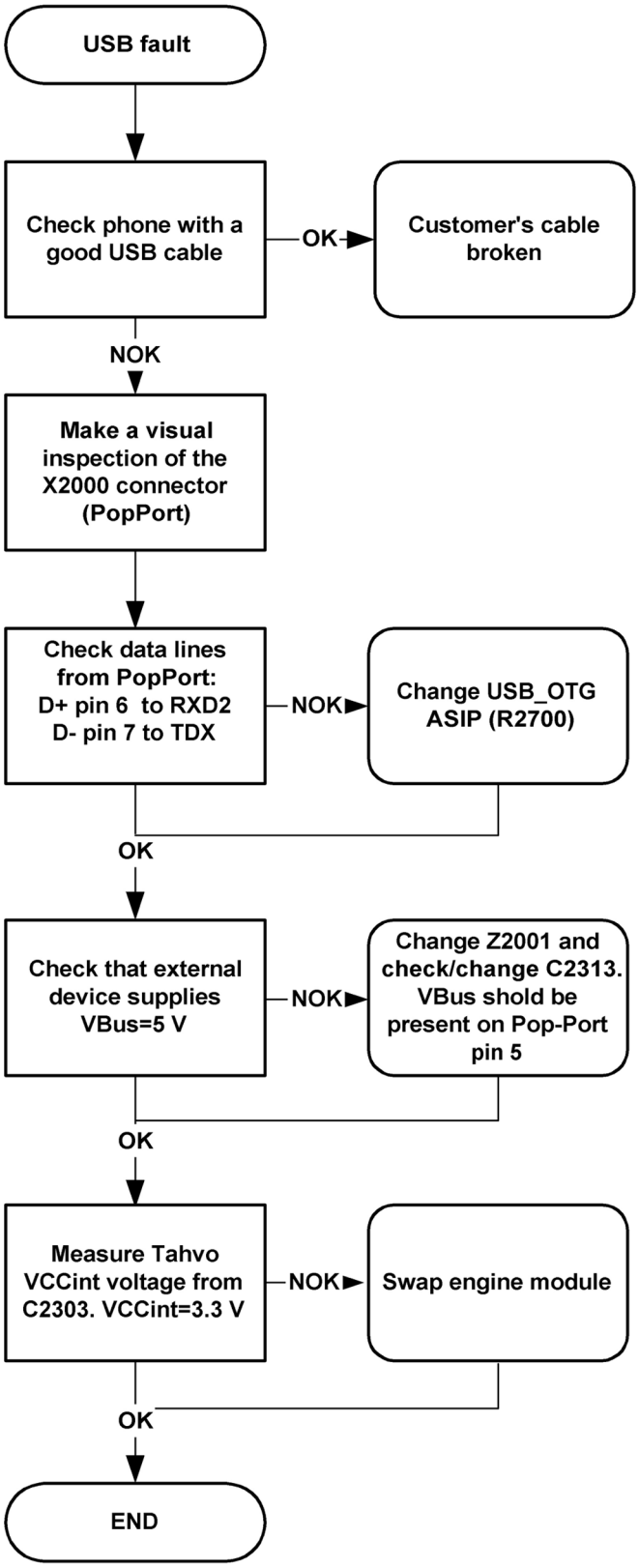
Take single trig measurement on the rising edge of the DAT signal.

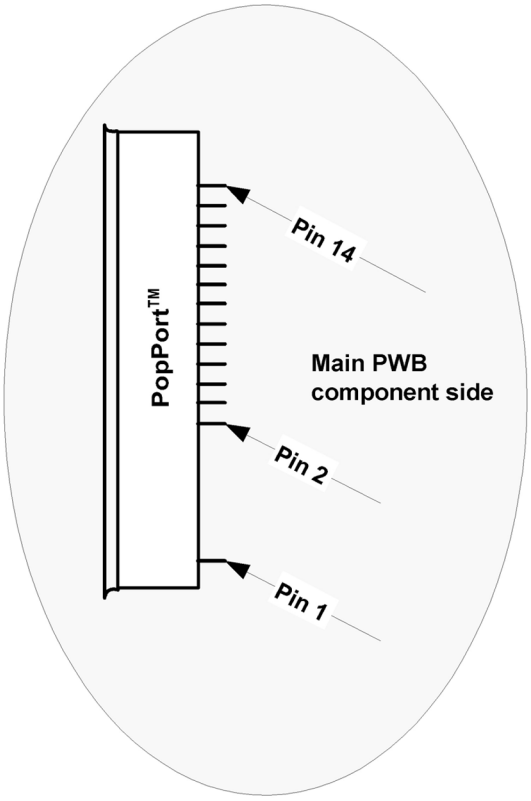
Figure 40 SD card initialization from pin J3206

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USB interface troubleshooting

Troubleshooting flow





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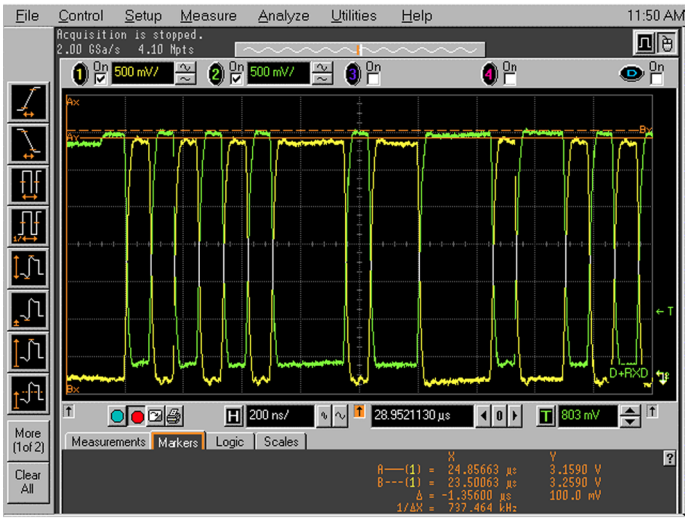
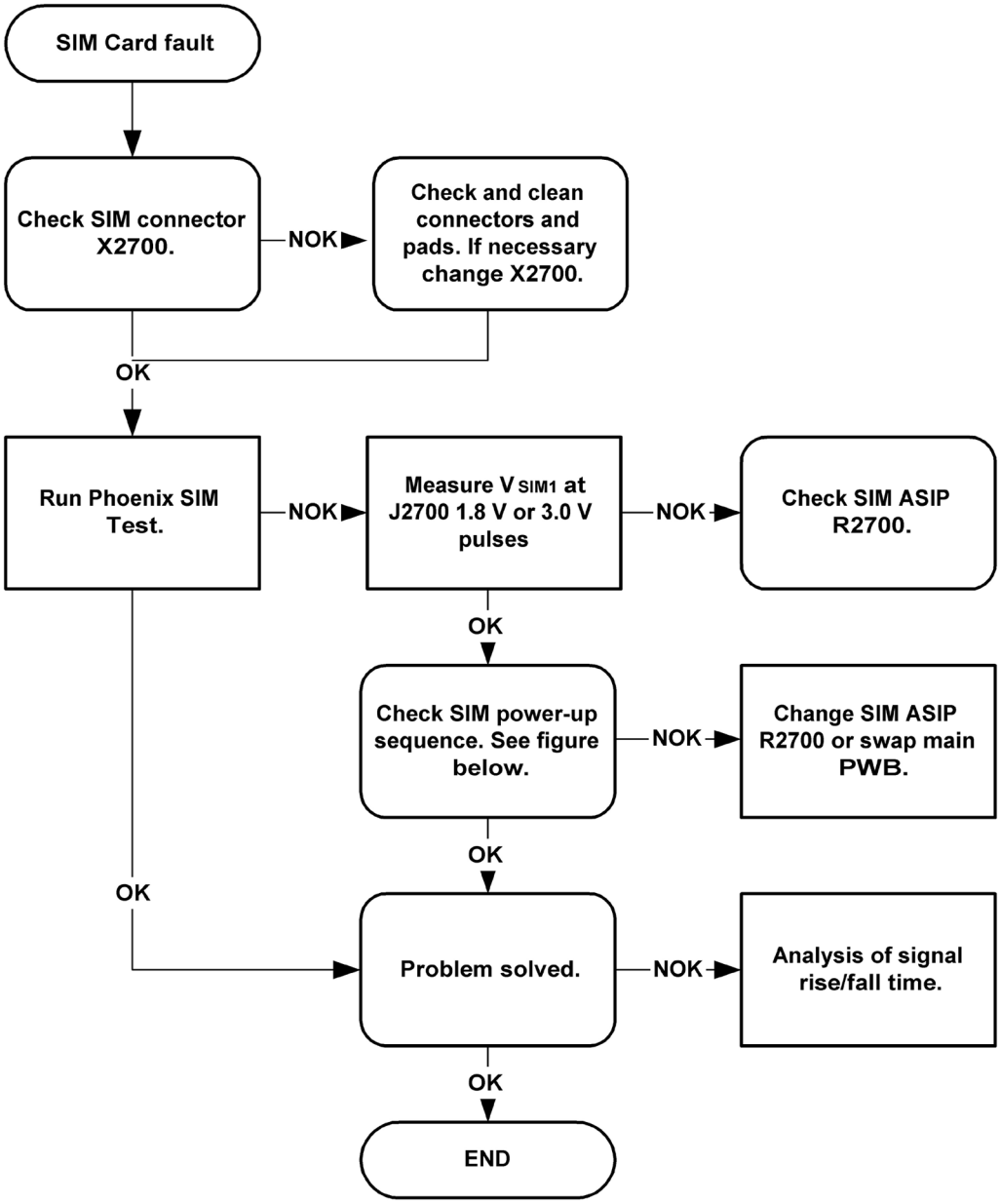


Figure 41 USB 1: D-TXD (PopPort TM™ pin 6) and D+RXD (PopPort TM™ pin 7) voltage levels when USB is connected.

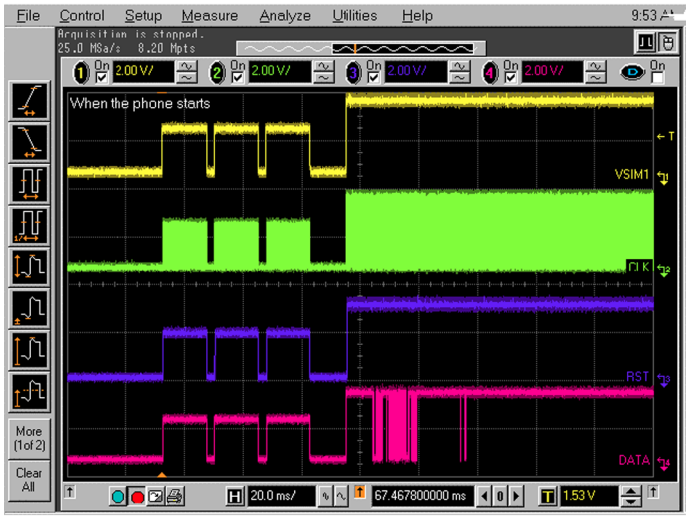
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SIM card troubleshooting

Troubleshooting flow



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SIM CLK frequency = 3.2MHz (Take single triggered measurement in boot on the VSIM1 line).

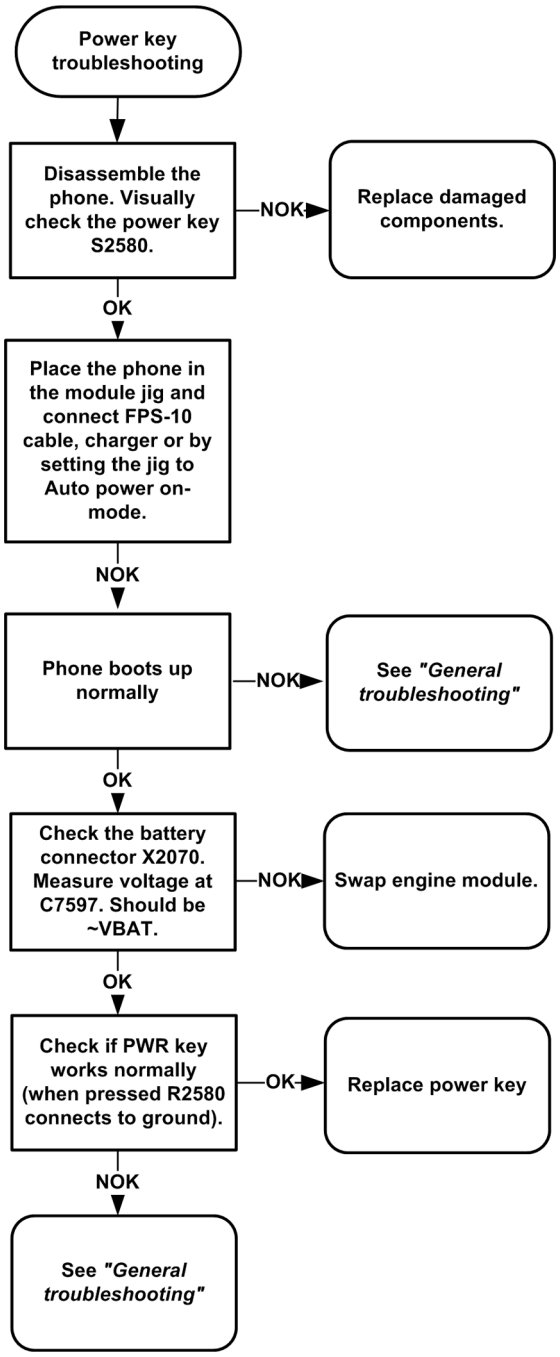
Figure 42 SIM interface signals

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User interface troubleshooting

Power key troubleshooting

Troubleshooting flow



Key troubleshooting

Context

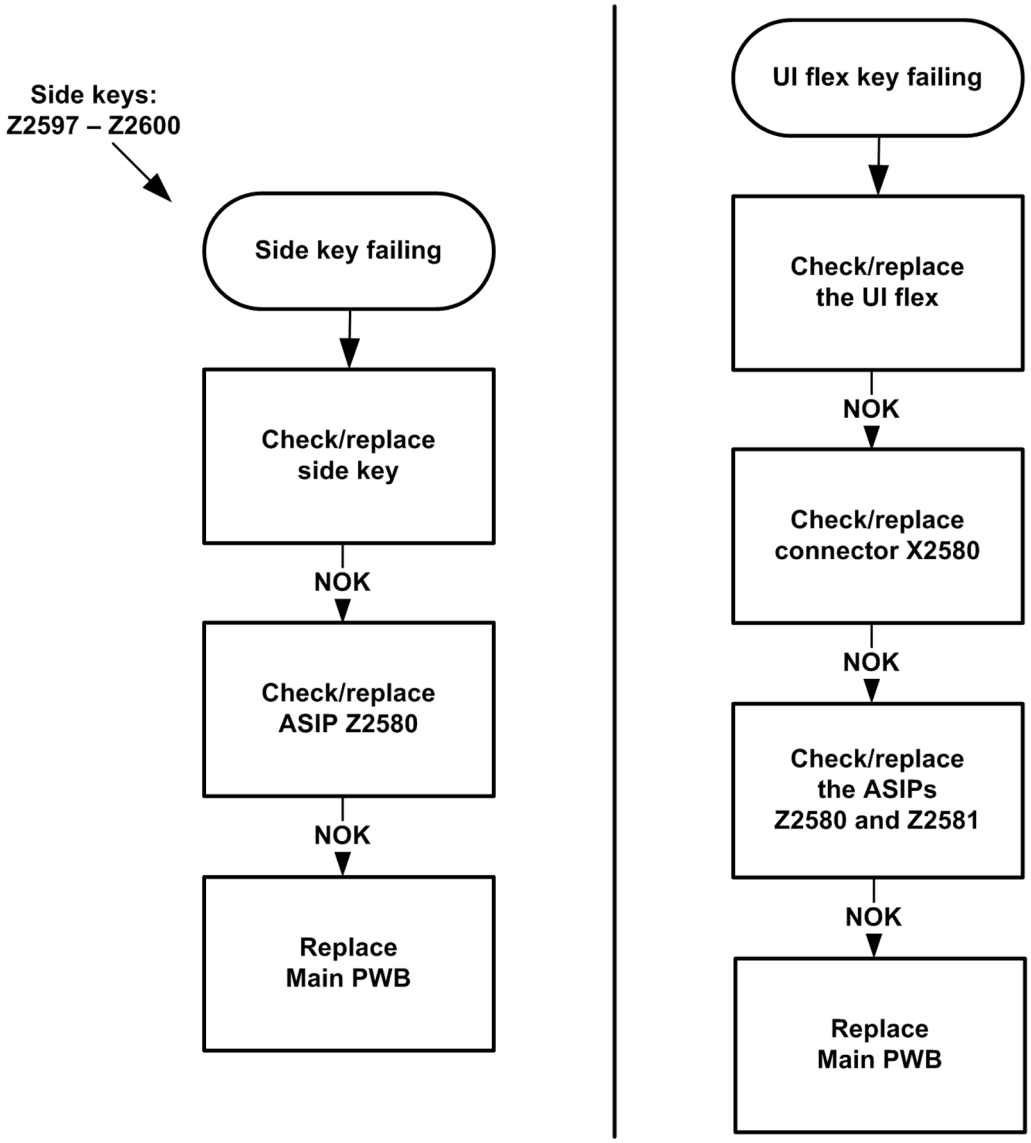
There are two possible failure modes in the keyboard module:

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

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

Troubleshooting flow



Display module troubleshooting

General instructions for display troubleshooting

Context

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

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Table 13 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 14 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).

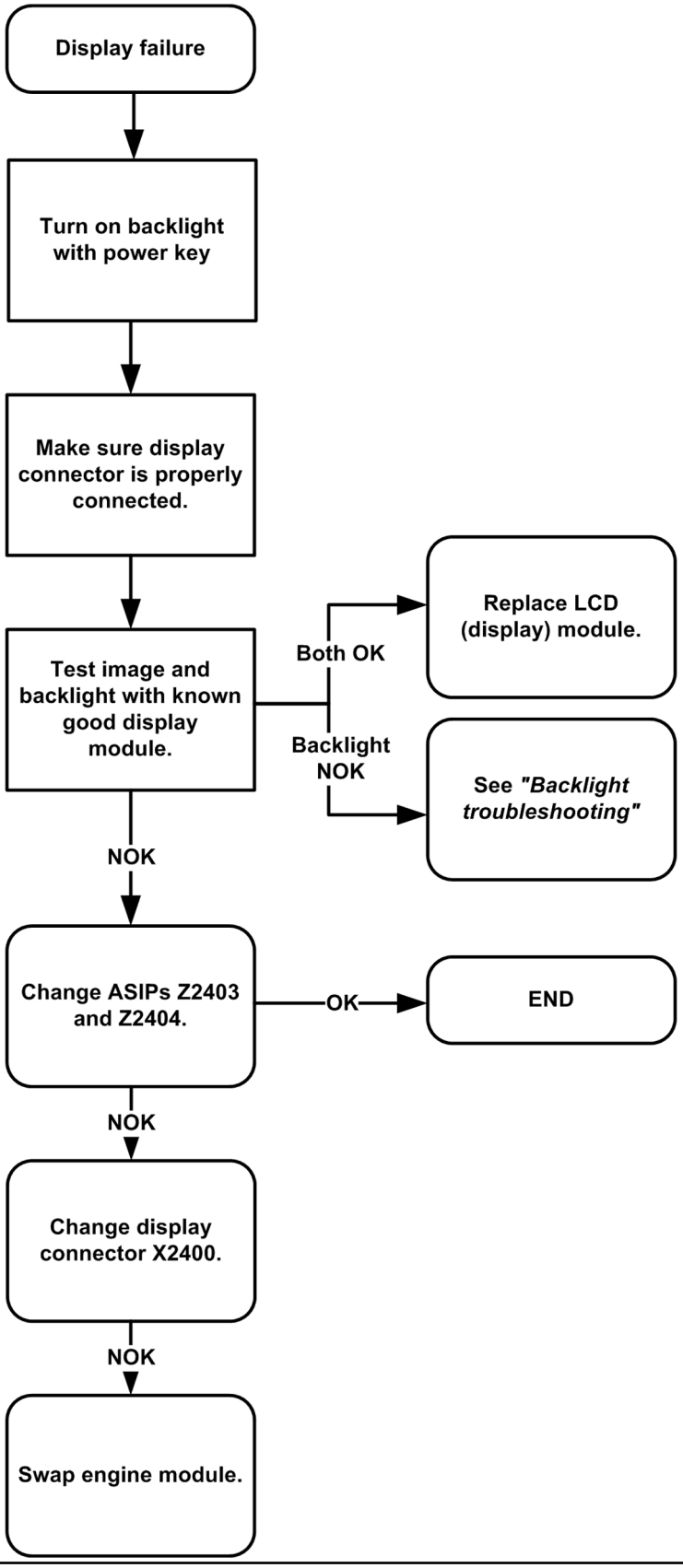
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3. Proceed to the display troubleshooting flowcharts.
   Use the **Display Test** tool in *Phoenix* to find the detailed fault mode.

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Display troubleshooting

Troubleshooting flow



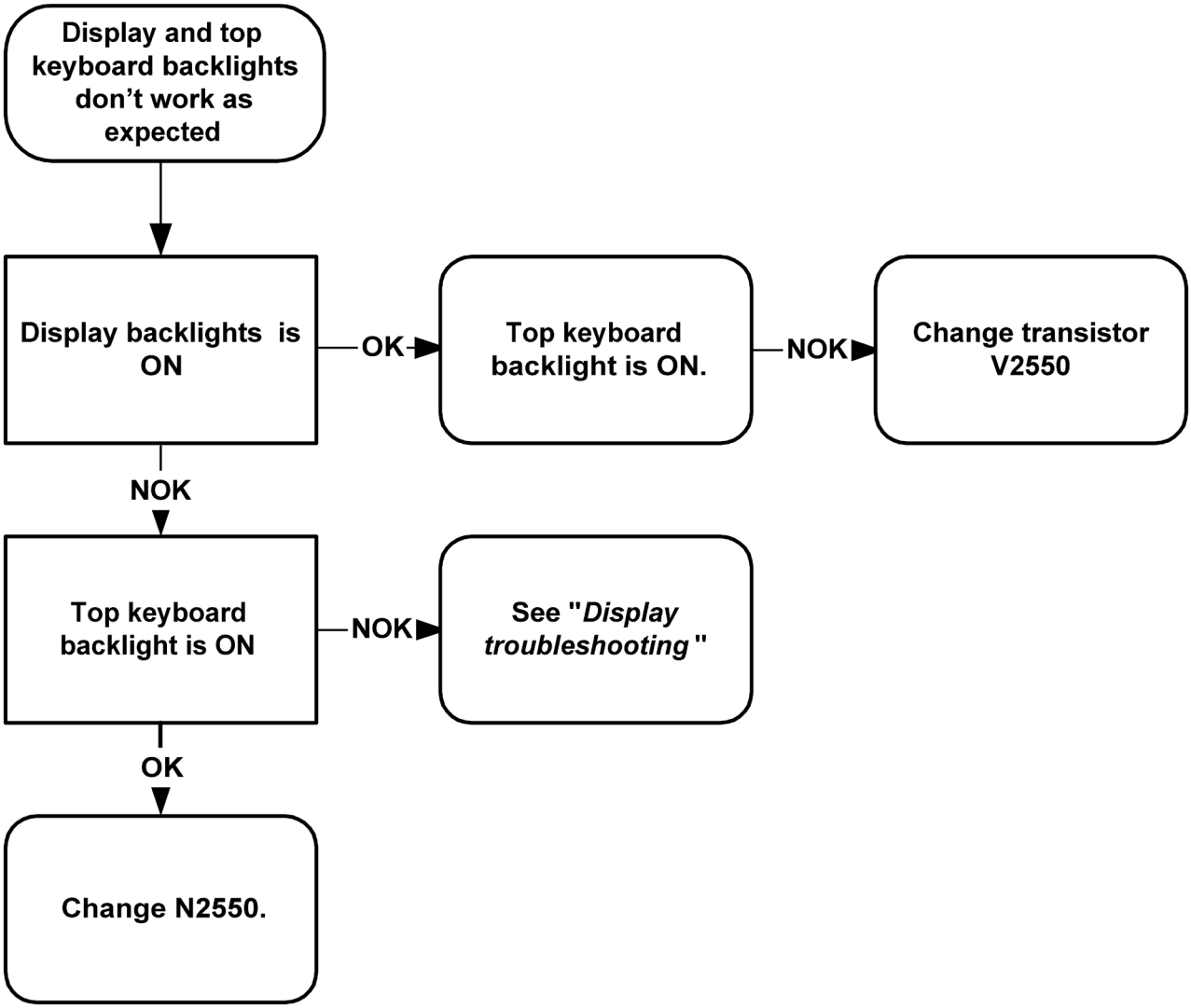
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Display and top keyboard backlight troubleshooting

Context

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

Troubleshooting flow



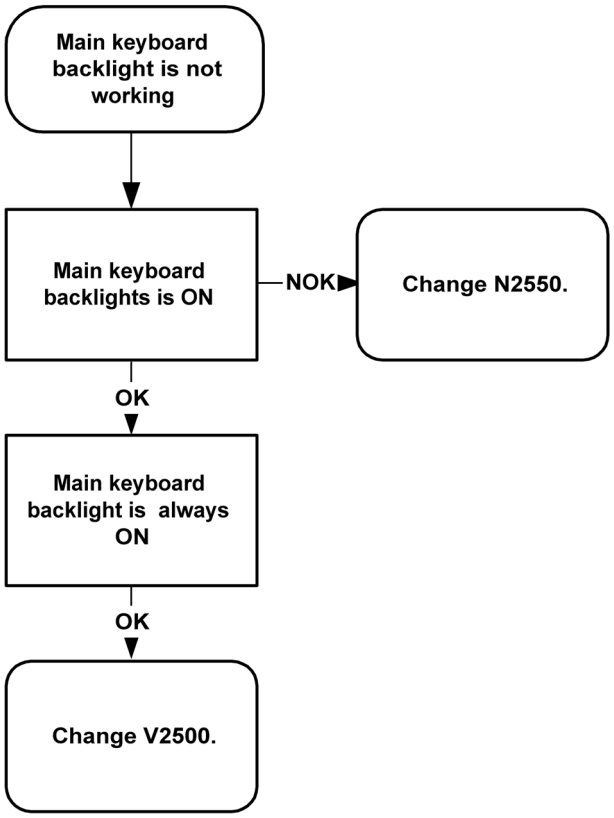
Main keyboard backlight troubleshooting

Context

The device has one LED driver that provides current for the main keyboard backlights.

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Troubleshooting flow



Camera module troubleshooting

Introduction to camera troubleshooting

Bad conditions often cause bad pictures. Therefore, the camera operation has to be checked in constant conditions or by using a second, known-to-be-good Nokia device as reference. Image quality is hard to measure quantitatively, and the difference between a good and a bad picture can be small. Some training or experience may be needed to detect what is actually wrong.

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 are common:

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

Taking and evaluating test pictures

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

- Avoid bright fluorescent light, 50/60Hz electrical network or high artificial illumination levels
- If the phone is hot, let it rest for a while before taking the picture
- Make sure the optical system is clean
- Use highest possible resolution
- Make sure the light is suffiecient (bright office lightning)

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- Do not take the picture towards light source
- Be as still as possible when taking the picture
- Distance should be at least 40cm, 1-2m is recommended

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

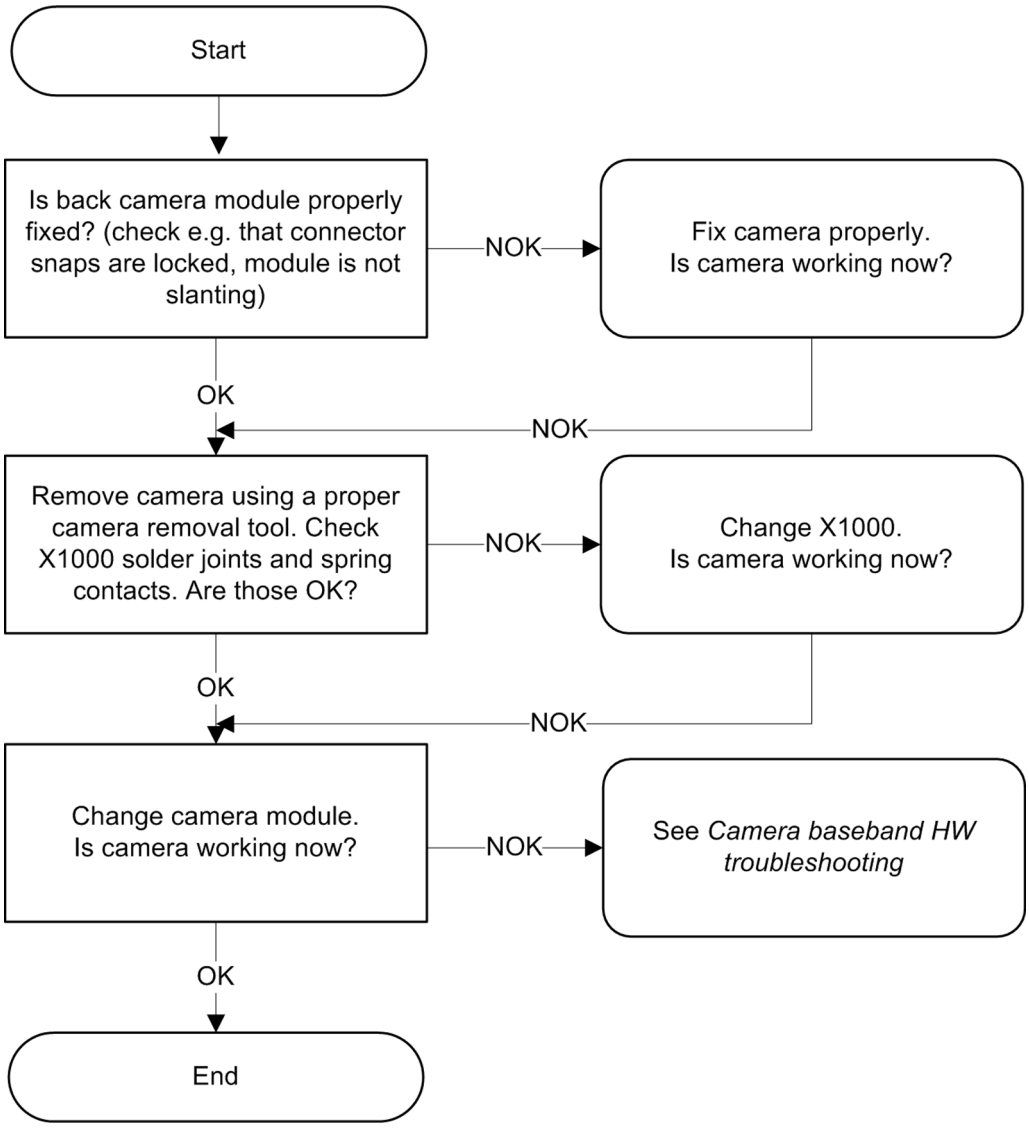
- The center of the picture is sharper than the edges
- The image may be blurred, though it does not show in the viewfinder
- Analyse the picture from your PC monitor, full colour setting is recommended
- If possible, compare with a picture of the same motive taken with a similar Nokia device

Camera hardware failure message troubleshooting

Context

If you get a hardware failure message when using the camera, follow the next troubleshooting flowchart.

Troubleshooting flow



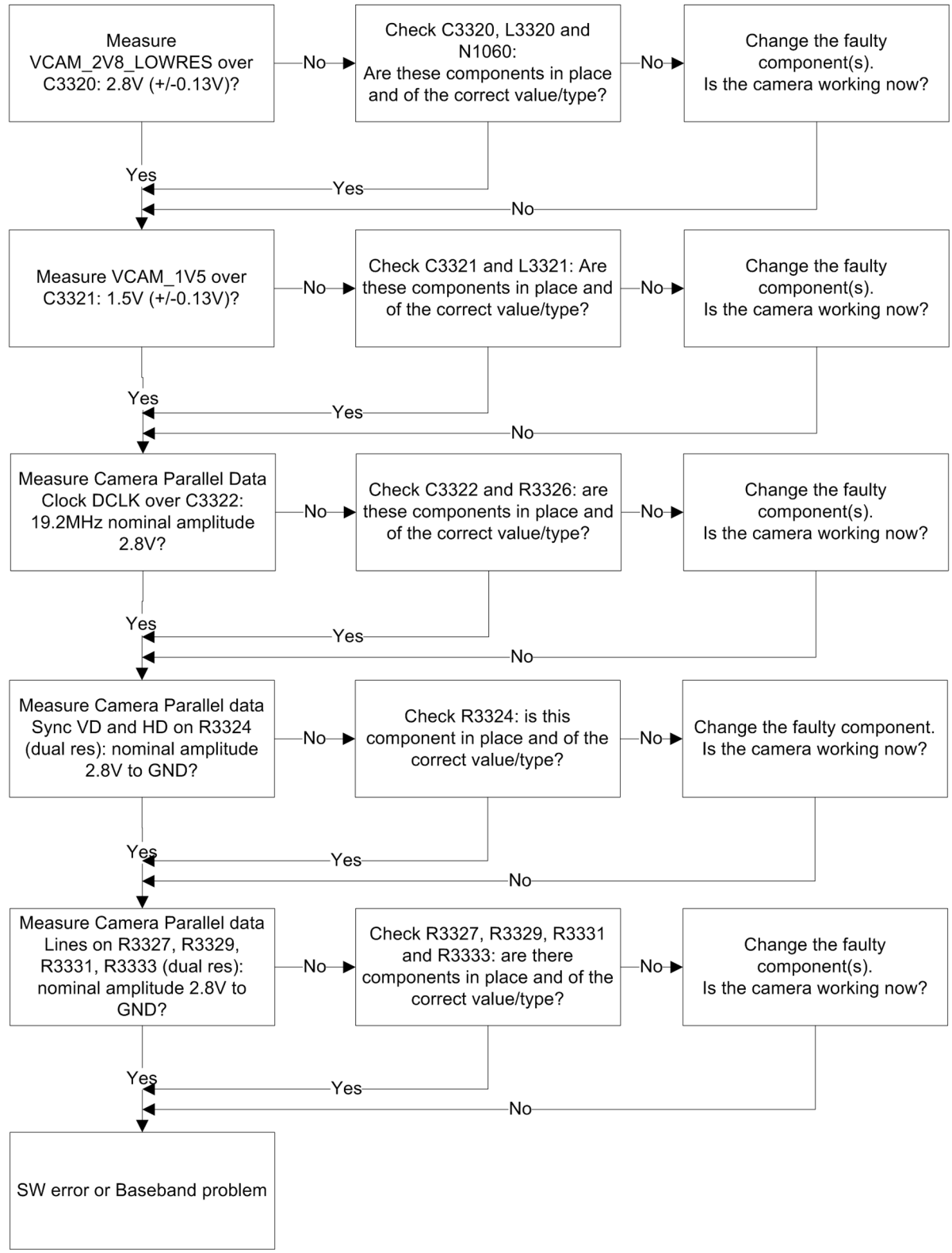
Note: Make sure that the phone has the latest software before continuing.

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Camera baseband HW troubleshooting

Troubleshooting flow

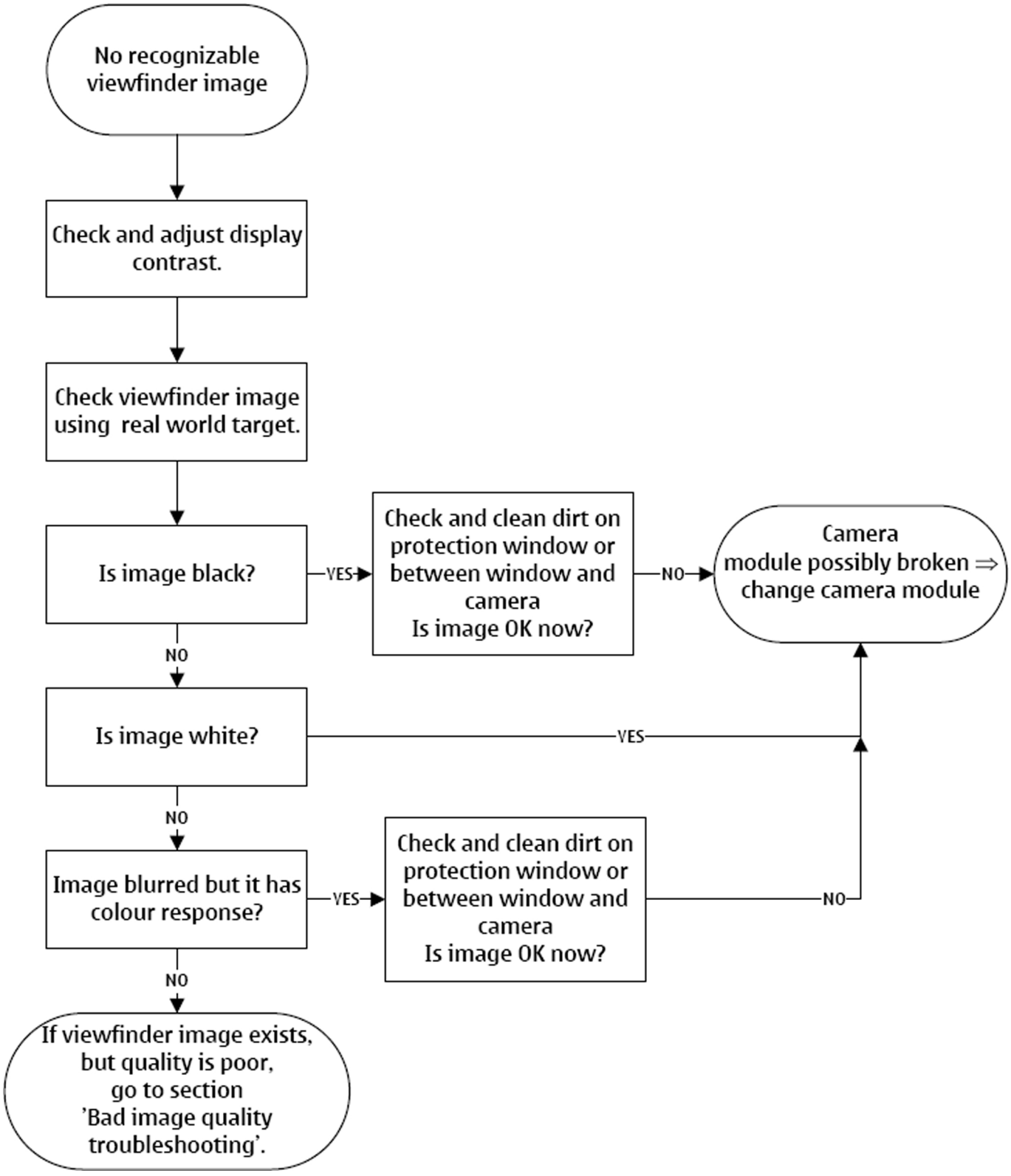
Note: the phone must be in a video call for the front camera to be active with signals and voltages present



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Camera viewfinder troubleshooting

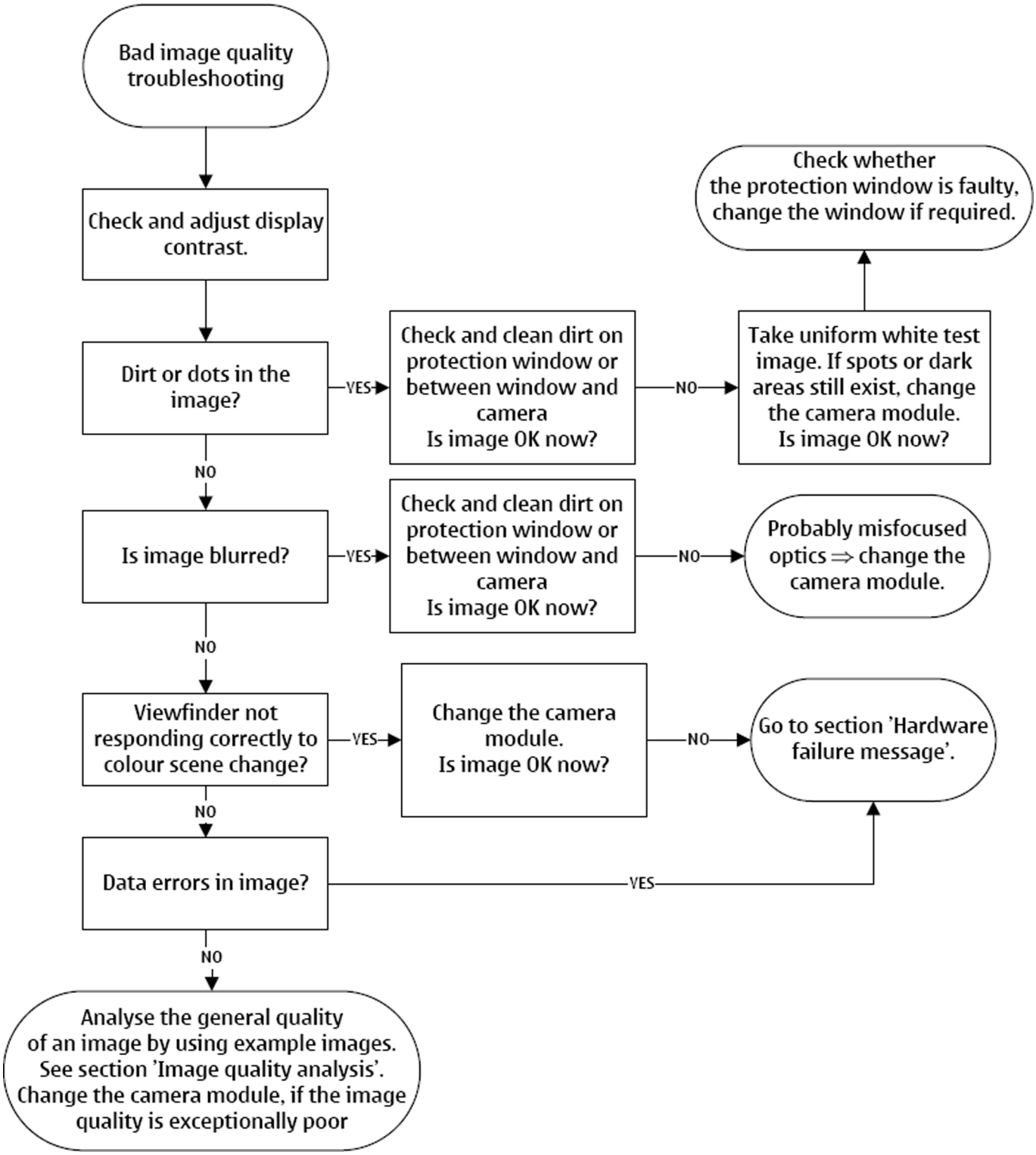
Troubleshooting flow



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Bad camera image quality troubleshooting

Troubleshooting flow



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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 2kHz.

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 3.7V

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

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 3.7V.

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

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

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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 to External Earpiece	XMICP and GND	HSEAR R P, HSEAR R N and GND	-2.9	1000	720	1.2	NA
		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 to Internal Earpiece	XMICP and GND	EarP and GND	-4.5	1000	600	1.2	NA
		EarN and GND					
	XMICN and GND	EarP and GND					
		EarN and GND					
External Mic to Internal handsfree	XMICP and GND	B2102 pads	-5	1000	560	0	25mA (calc.)
	XMICN and GND	B2102 pads					
Internal Mic to External Earpiece	B2100 (OUT/GND)	HSEAR R P, HSEAR R N and GND	22.7	100	1360	1.2	NA
		HSEAR P, HSEAR N and GND					
		HSEAR R P, HSEAR R N and GND					
		HSEAR P, HSEAR N and GND					

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Measurement data

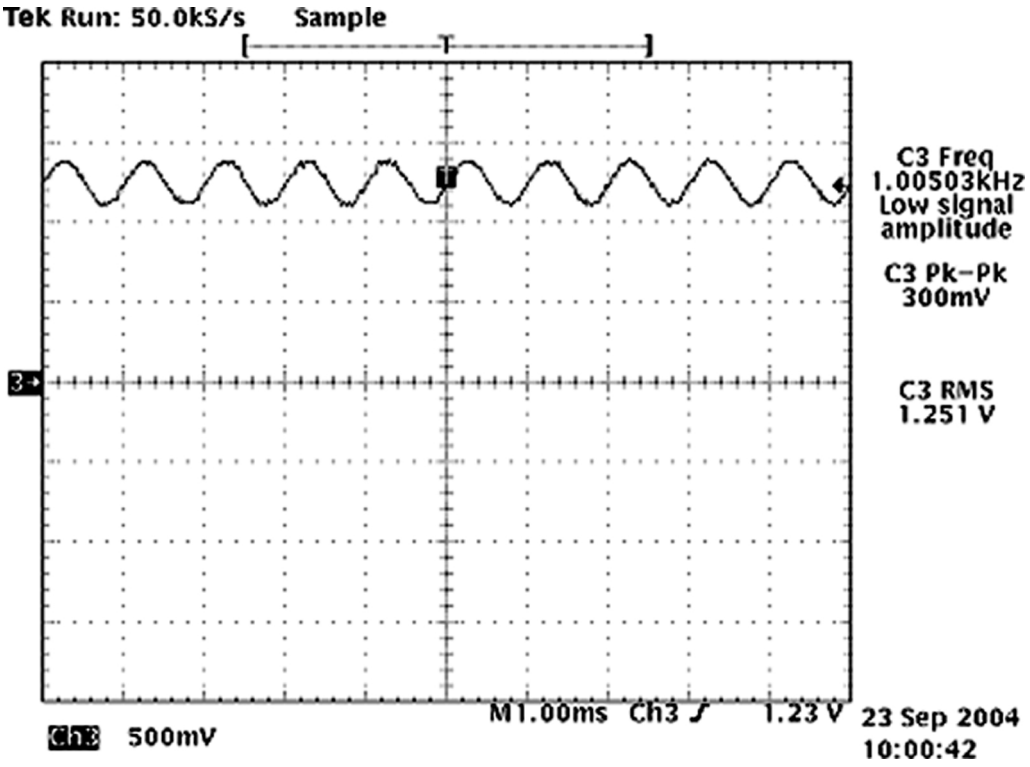
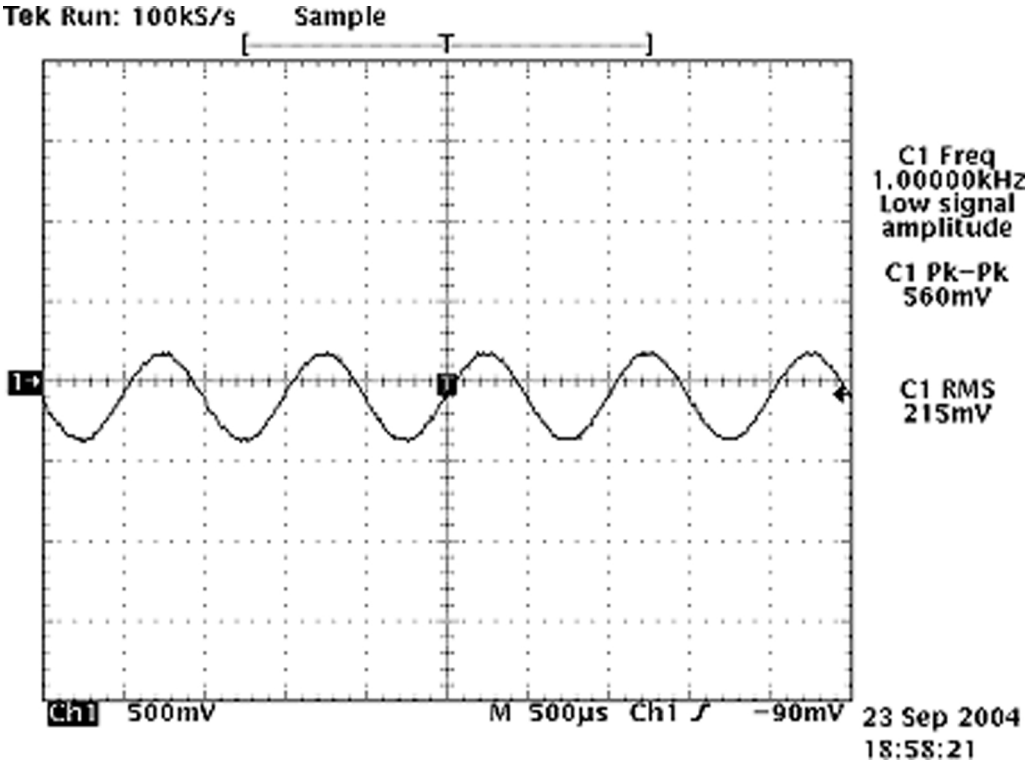


Figure 43 Single-ended output waveform of the Ext_in_HP_out measurement when earpiece is connected.



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

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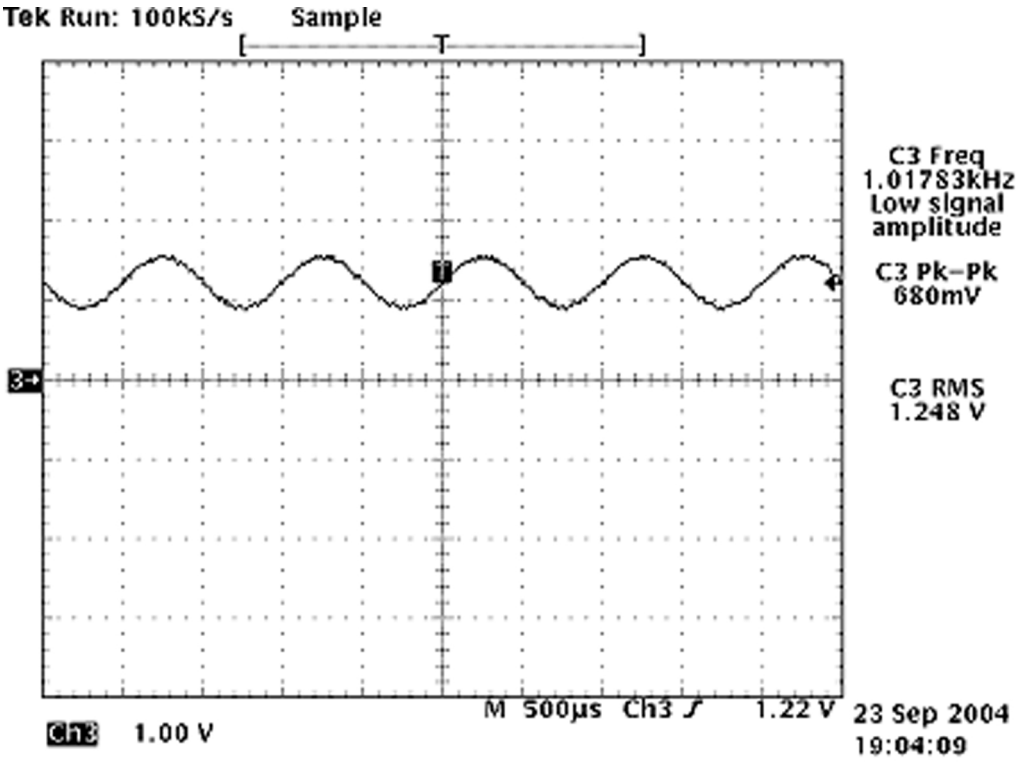
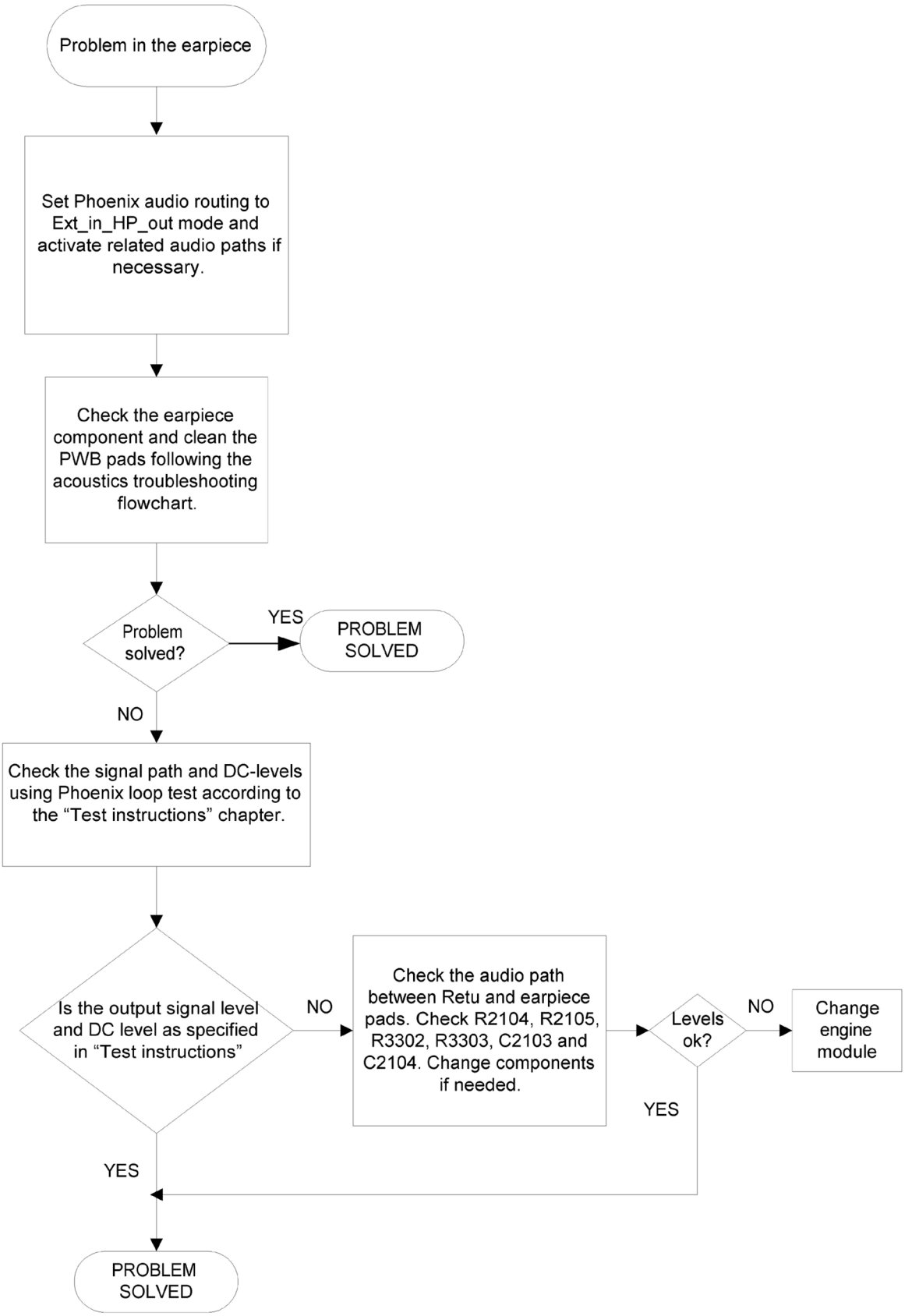


Figure 45 Single-ended output waveform of the HP_in_Ext_out loop when microphone is connected.

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Internal earpiece troubleshooting

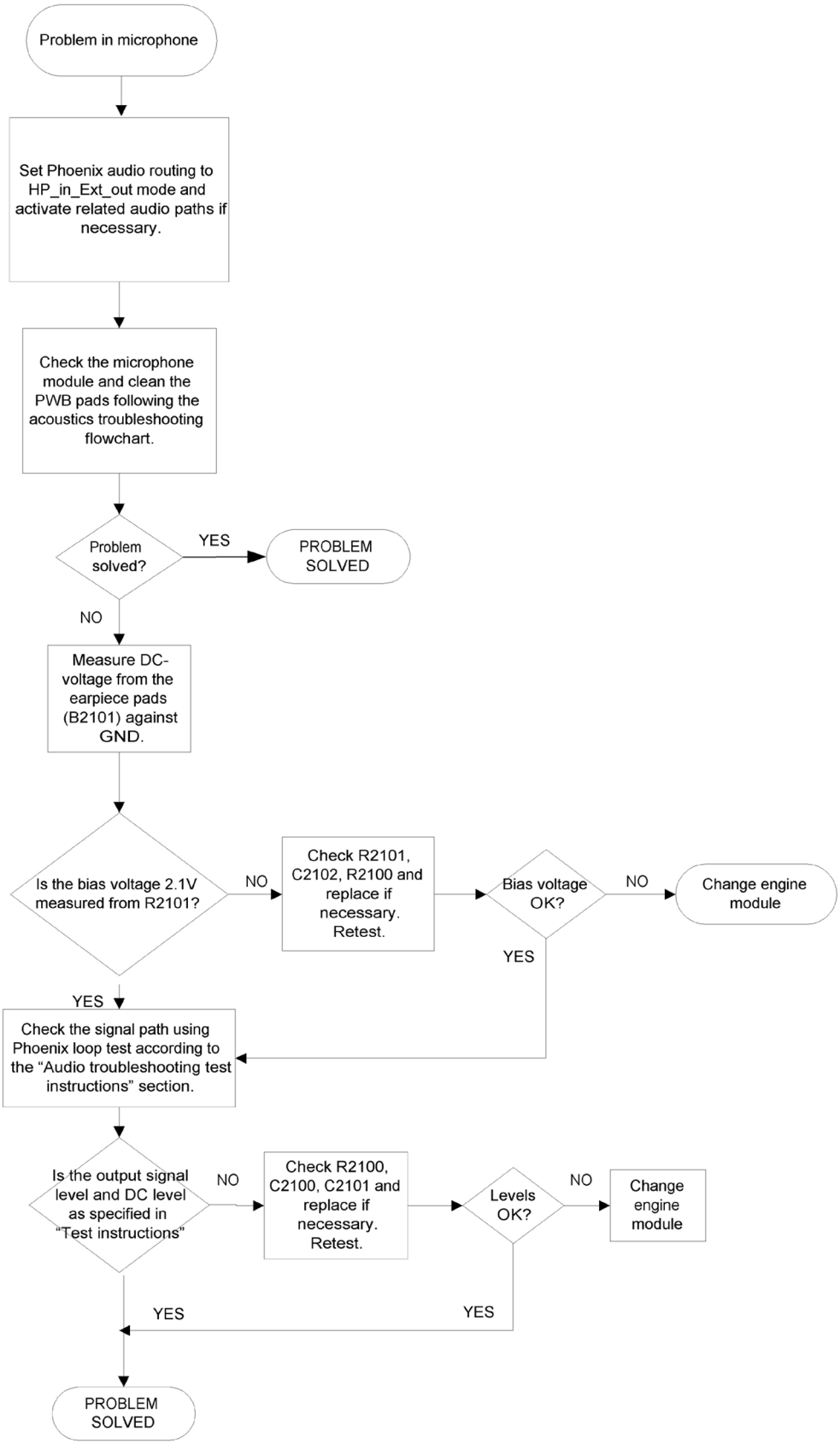
Troubleshooting flow



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Internal microphone troubleshooting

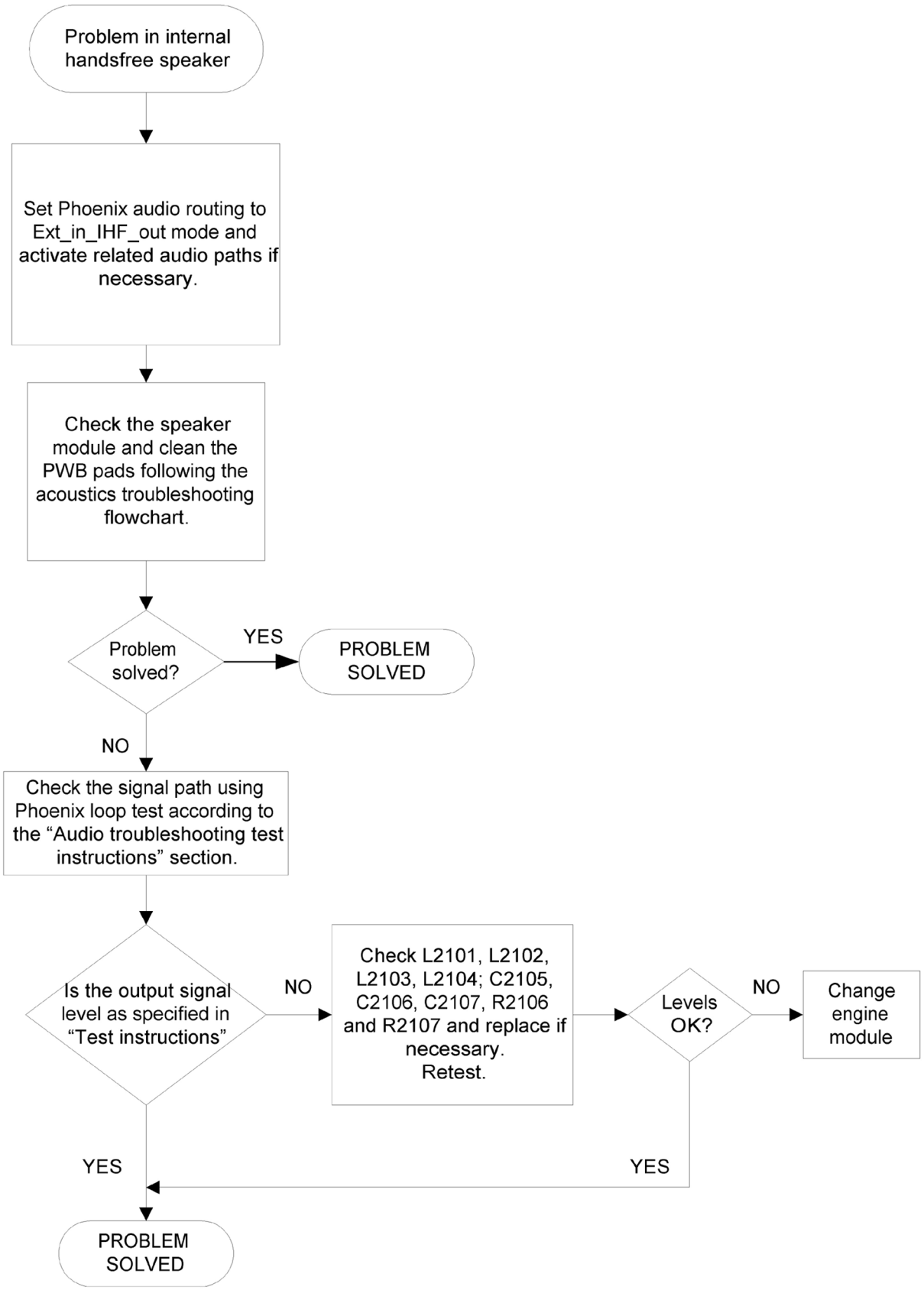
Troubleshooting flow



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IHF troubleshooting

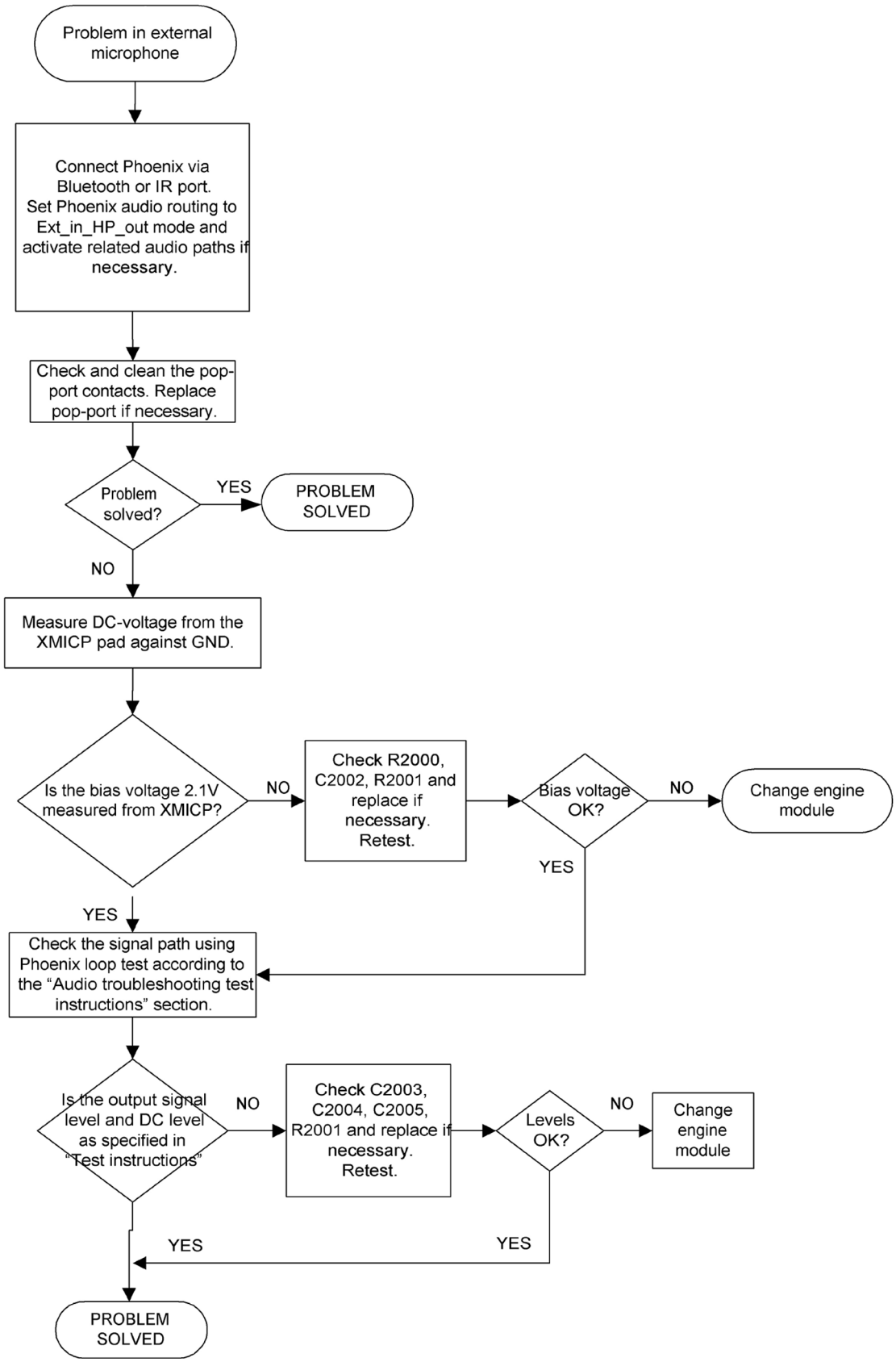
Troubleshooting flow



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External microphone troubleshooting

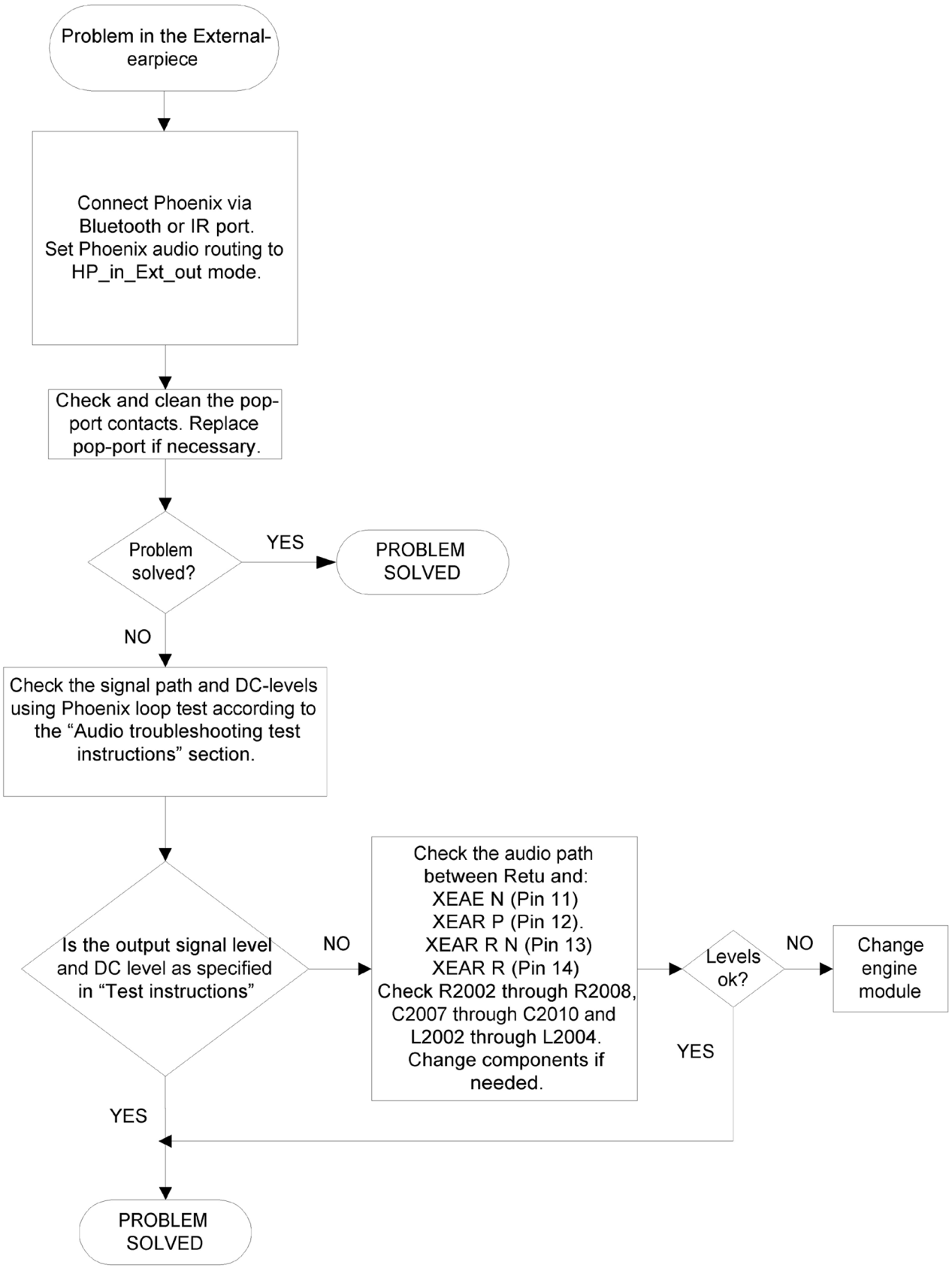
Troubleshooting flow



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External earpiece troubleshooting

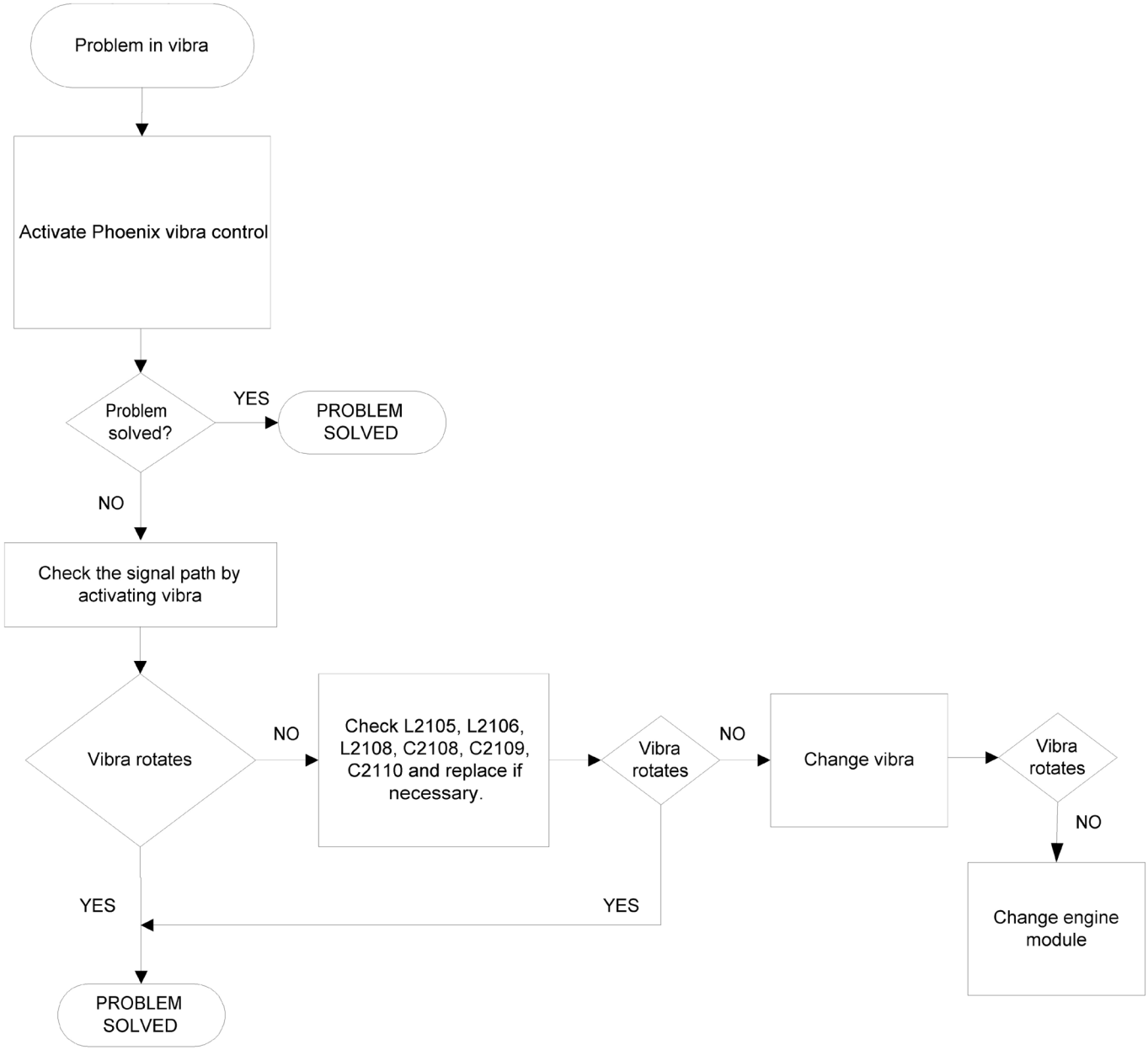
Troubleshooting flow



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Vibra troubleshooting

Troubleshooting flow



Baseband manual tuning guide

Certificate restoring for BB5.0 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.

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Note: USB flashing does not work for a dead BB5.0 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 BB5.0 testing and tuning features)
- External smart card reader

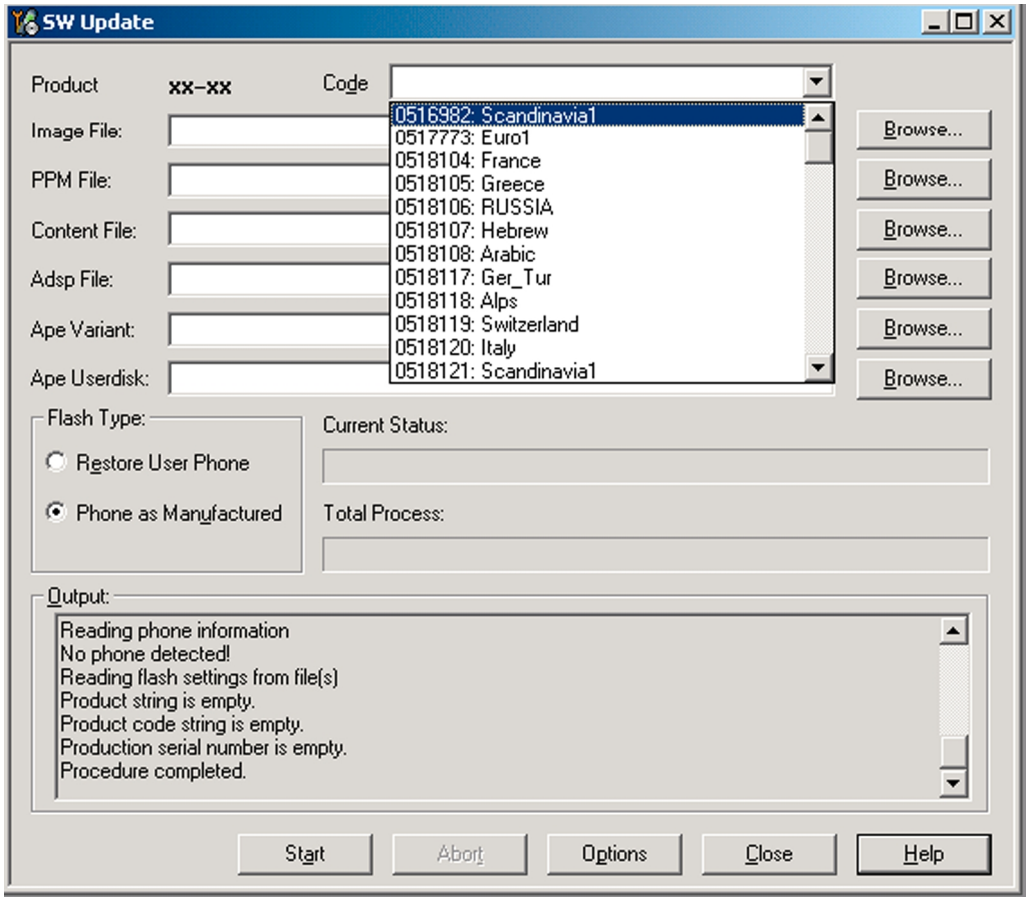
  Note: The smart card reader is only needed when FPS-8 is used. FPS-10 has an integrated smart card reader.
- Activated FPS-8 flash prommer **OR** FPS-10 flash prommer
- Flash update package 03.18.004 or newer for FPS-8 or FPS-10 flash prommers
- CU-4 control unit
- USB cable from PC USB Port to CU-4 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.

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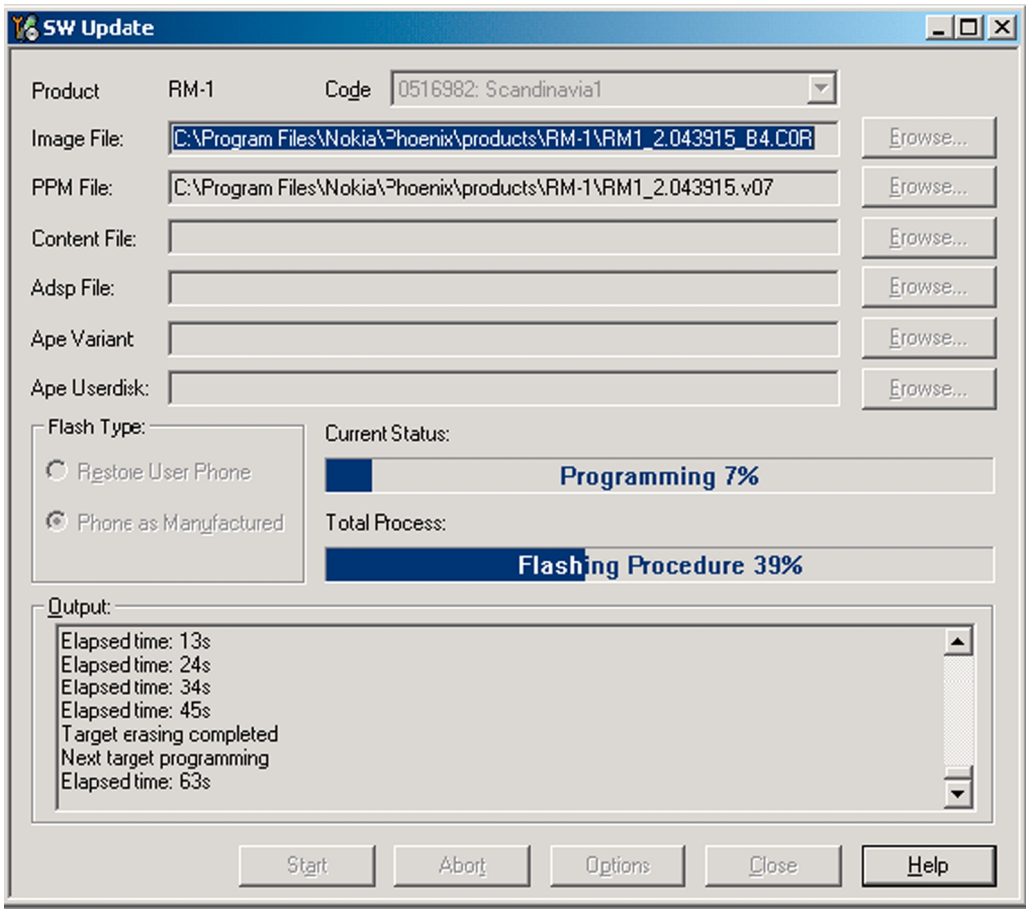


Product	is automatically set according to the phone support module which was opened manually, but the flash files cannot be found because the correct data cannot be read from the phone automatically.
Code	must be chosen manually, it determines the correct flash files to be used. Please choose the correct 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.

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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** .

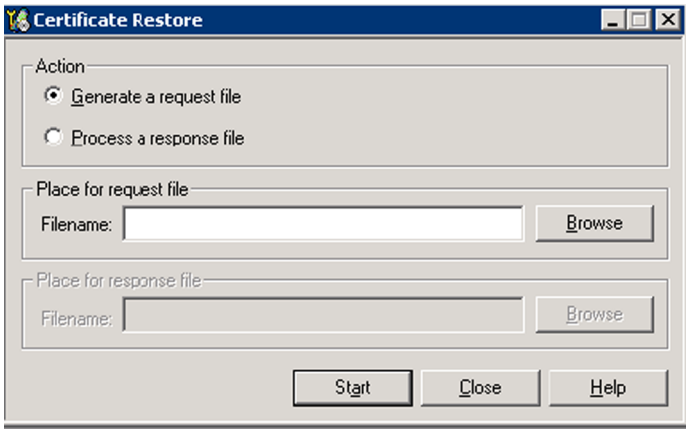
2. Create a *Request* file.

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** .

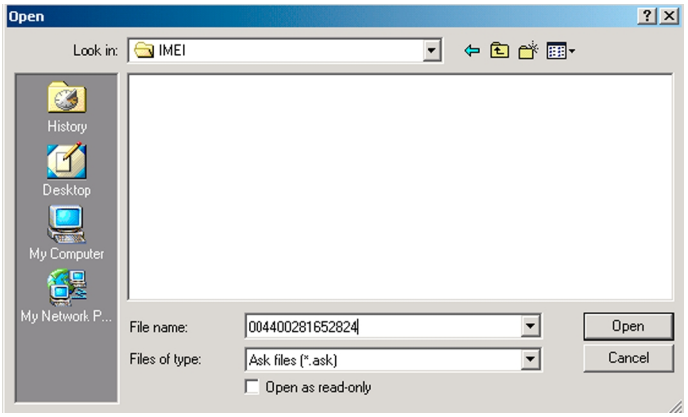
ii Choose **Tools→Certificate Restore** .

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

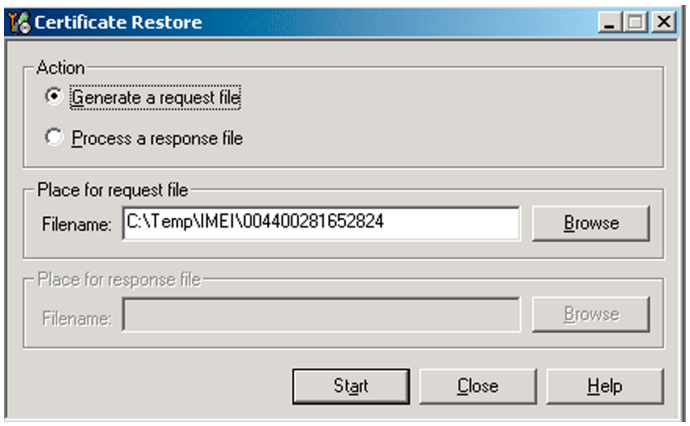


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iv Name the file so that you can easily identify it, and click **Open**.



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.

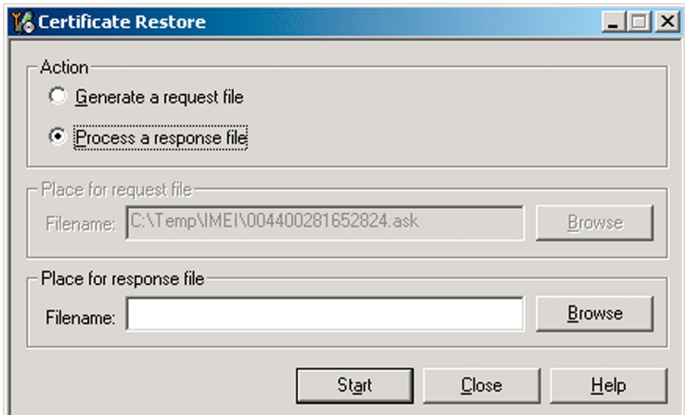
i Save the reply file sent by Nokia to your computer.

ii Start *Phoenix* service software.

iii Choose **File→Scan Product** .

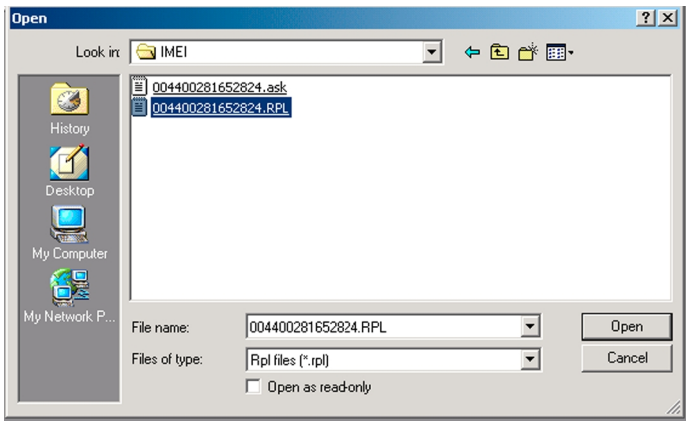
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iv From the **Tools** menu, choose **Certificate Restore** and select **Process a response file** in the *Action* pane.



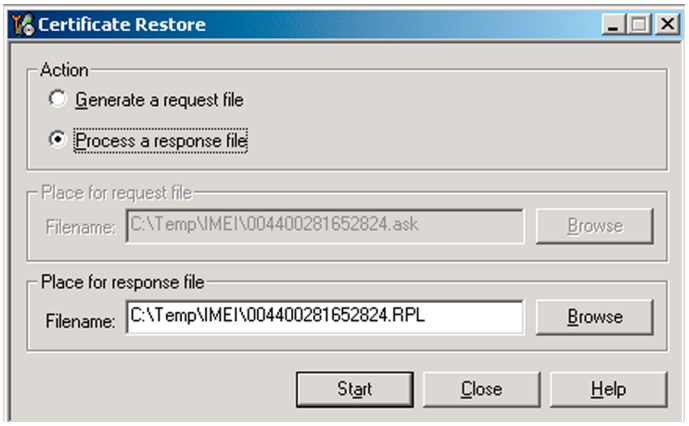
v To choose the location where response file is saved, click **Browse**.

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.

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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 15 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

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General RF troubleshooting

General RF troubleshooting

Most RF semiconductors are static discharge sensitive

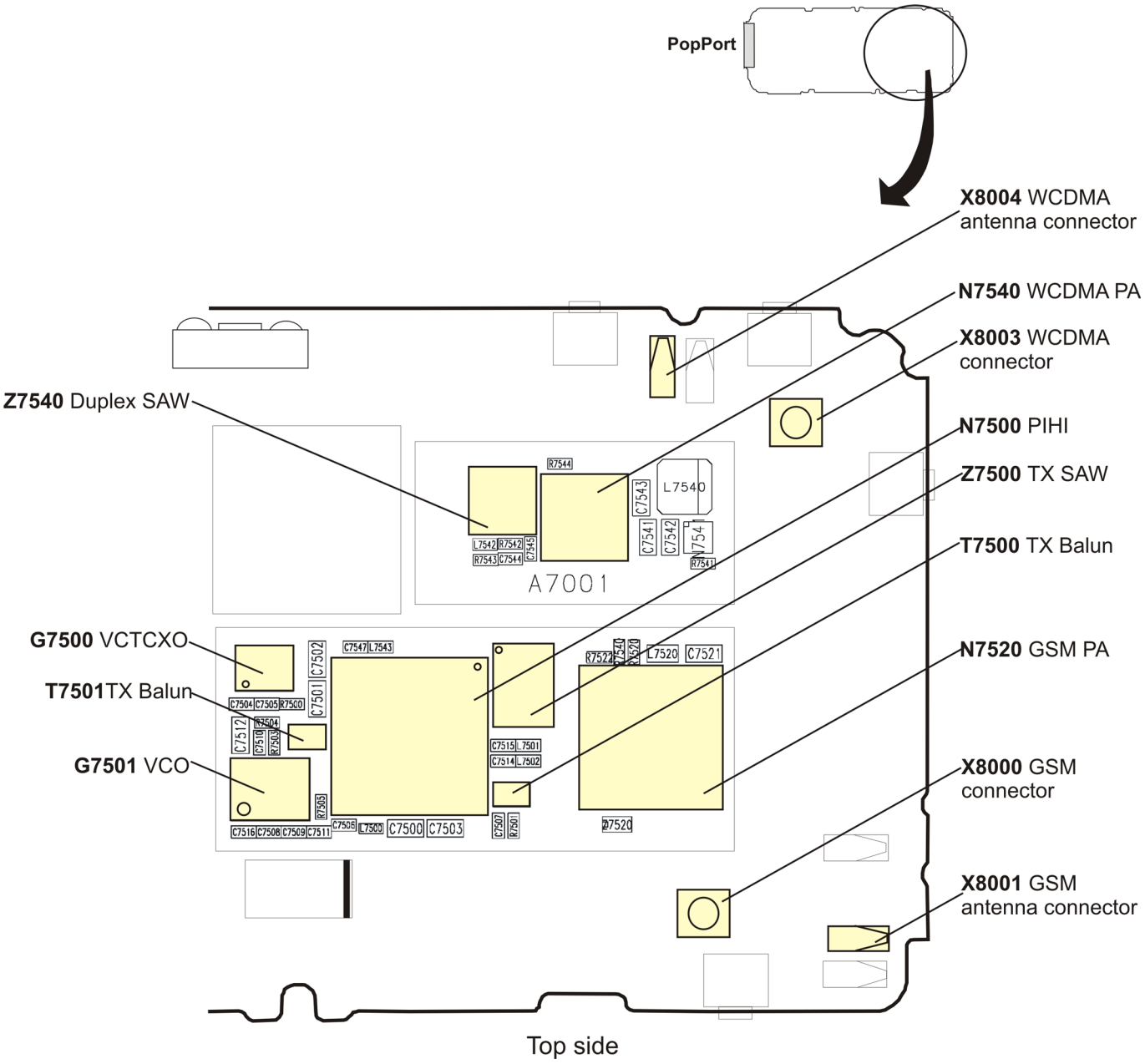
Two types of measurements are used in the following. It will be specified if the measurement type is "RF" or "LF".

- RF measurements are done with a Spectrum Analyzer and a high-frequency 500 ohm passive probe, for example HP54006A. (Note that when measuring with the 500 ohm probe the signal will be around 20 dB attenuated. The values in the following will have these 20 dB subtracted and represent the real value seen on the spectrum analyzer). Note that the testing have some losses which must be taken into consideration when calibrating the test system.
- LF (Low frequency) and DC measurements should be done with a 10:1 probe and an oscilloscope. The probe used in the following is 10 Mohm/8pF passive probe. If using another probe then bear in mind that the voltages displayed may be slightly different. Always make sure the measurement set-up is calibrated when measuring RF parameters on the antenna pad. Remember to include the loss in the module repair jig when realigning the phone.

So ESD protection must be applied during repair (ground straps and ESD soldering irons). RF IC N7500 and Frond end module (N7520) are moisture sensitive so parts must be pre-baked prior to soldering. Apart from key-components described in this document there are a lot of discrete components (resistors, inductors and capacitors) for which troubleshooting is done by checking if soldering of the component is done properly and checking if the component is missing from PWB. Capacitors can be checked for short-circuiting and resistors for value by means of an ohmmeter, but be aware in-circuit measurements should be evaluated carefully. In the following both the name EGSM and GSM 900 will be used for the lower band and both PCN and GSM 1800 will be used for the upper band.

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RF key components



Auto tuning for BB5.0

This phone can be tuned automatically.

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

Hardware set up

Hardware requirements for auto tuning:

- PC (Windows 2000/XP) with GPIB card
- Power supply
- Product specific module jig

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

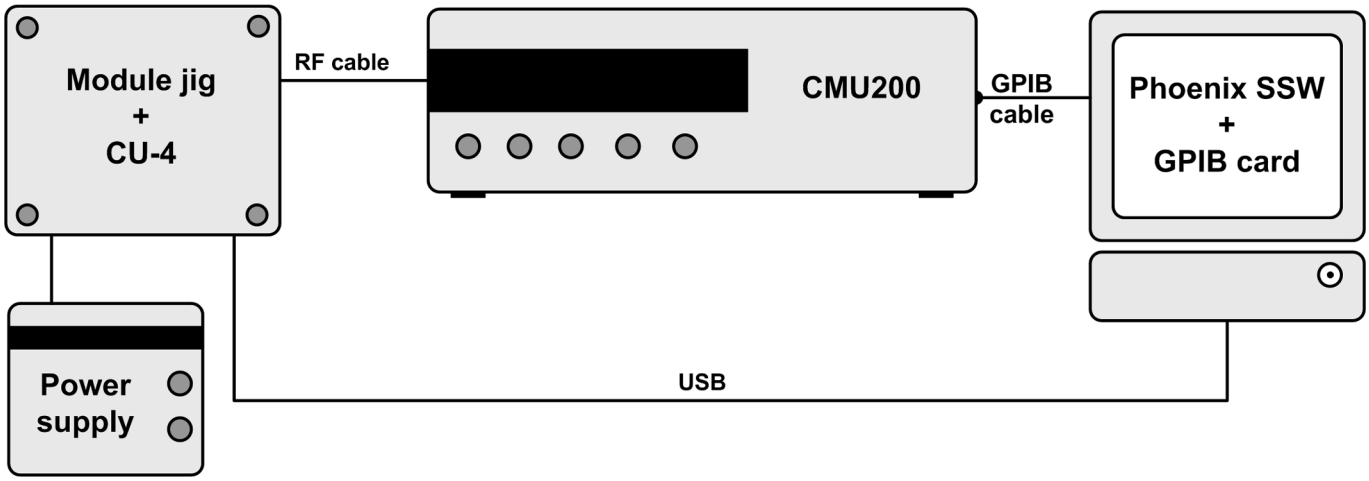


Figure 46 Auto tuning concept with CMU200

Phoenix preparations

Install the phone specific data package, for example *RM-123/145_dp_1.78_sw_sh3.26.exe*. This defines phone specific settings..

Auto tuning procedure

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

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

3 Start autotuning, clicking the *Tune* button.

GSM Receivers

GSM RX Troubleshooting

Preparations

Make the following settings:

Setting	GSM900	GSM1800	GSM1900
Phoenix RF Control	Continues RX and AGC gain step 14		
Phoenix channel	37	700	661
Signal generator to antenna connector	942.46771 MHz (67.71kHz offset) at -60dBm	1842.86771MHz (67.71kHz offset) at -60dBm	1960.06771MHz (67.71kHz offset) at -60dBm
Spectrum analyzer	RBW=500kHz, VBW=500kHz, span=20kHz		
Centre frequency	942MHz	1840MHz	1960MHz

Check the following

Check the levels in the steps below.

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NO.	Signal Name	Test point	GSM900	GSM1800	GSM1900
1	RXIP (out)	J7515	124mVpp, 730mVDC	106mVpp, 760mVDC	100mVpp, 780mVDC
2	RXQP (OUT)	J7517	124mVpp, 730mVDC	106mVpp, 690mVDC	100mVpp, 690mVDC
3	VC1_TXFEM	J7530	0V	0V	0V
4	VC2_TXFEM	J7531	0V	2.7VDC	2.7VDC
5	VC3_TXFEM	J7532	0V	0V	2.7VDC

1 Measure RXIP *1* and RXQP *2*.
2 Measure front end module control signal voltages *3, 4 and 5*.

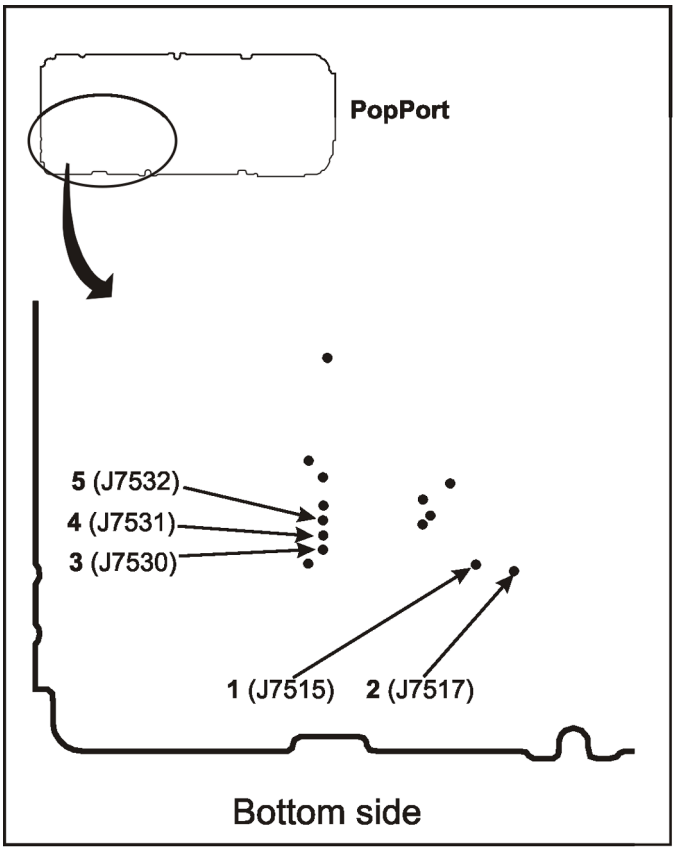


Figure 47 GSM900/1800/1900 RX test points

GSM Transmitters

GSM900/1800/1900 TX Troubleshooting

Preparations

Make the following settings:

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Setting	GSM900	GSM1800	GSM1900
Phoenix RF Control Phoenix Tx Power level	Operational mode = Burst Tx data type = Random		
	10	5	5

Check the following

Check the voltages in the steps below.

NO.	Signal Name	Test point	GSM900	GSM1800	GSM1900
1	V_Det_GSM	J7533	730mVDC	660mVDC	690mVDC
2	PA_supply-VBAT	C7521	3.8VDC	3.8VDC	3.8VDC
3	RF level-ANT_GSM	Conn.	23dBm	20dBm	20dBm
4	Sw cont-VC1_TXFEM	J7530	2.75VDC	2.75VDC	2.75VDC
5	Sw con-VC2_TXFEM	J7531	0V	2.75VDC	2.75VDC
6	Sw con-VC3_TXFEM	J7532	2.75VDC	2.75VDC	2.75VDC
7	Tx-1	R7522	897.4MHz/-28.7 dBm	-	-

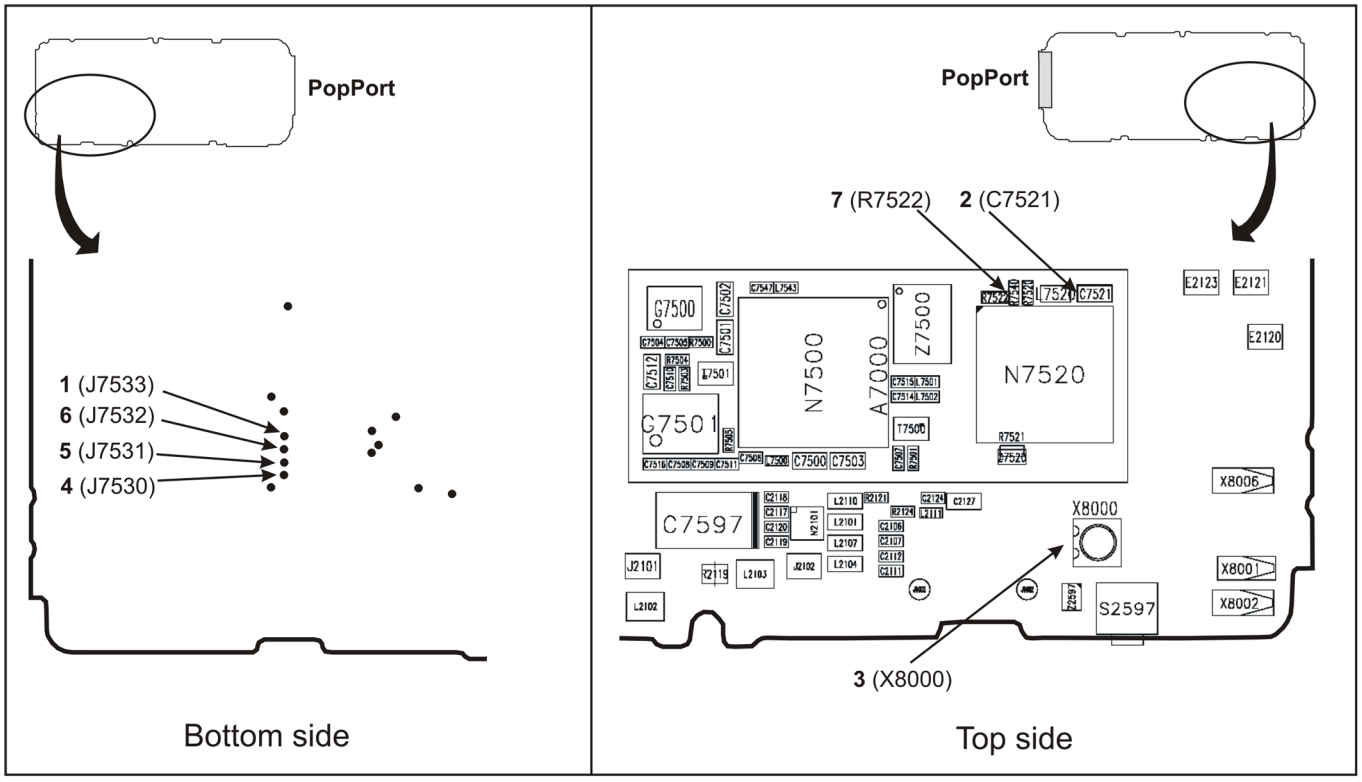


Figure 48 GSM900/1800/1900 TX test points

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WCDMA Receiver

WCDMA RX Troubleshooting

Preparations

Set Phoenix to RF local mode WCDMA RX.

Equipment/Settinig	Unit
Phoenix	
WCDMA	FDD
RF channel	2140MHz ~10700
Frequency offset	+0.000kHz
Output channel power	-60dBm
	P-sch~ -2dB S-sch~ -2dB P-cc pch~ -2dB DPDch~ -7dB
AGCMod*	Algorithm
Channel*	10700
BB AGC*	0dB
Spectrum analyzer*	
Span	~ 20MHz
Centre frequency	2140MHz
VBW	500kHz
RBW	500kHz
Output channel power	-30dB
RF AH	~ 30dB

Check the following

Check the levels in the steps below.

NO.	Signal Name	Test point	Check
1	PXIP (out)	J7515	720mVpp single ended
2	RXQP (OUT)	J7517	720mVpp single ended

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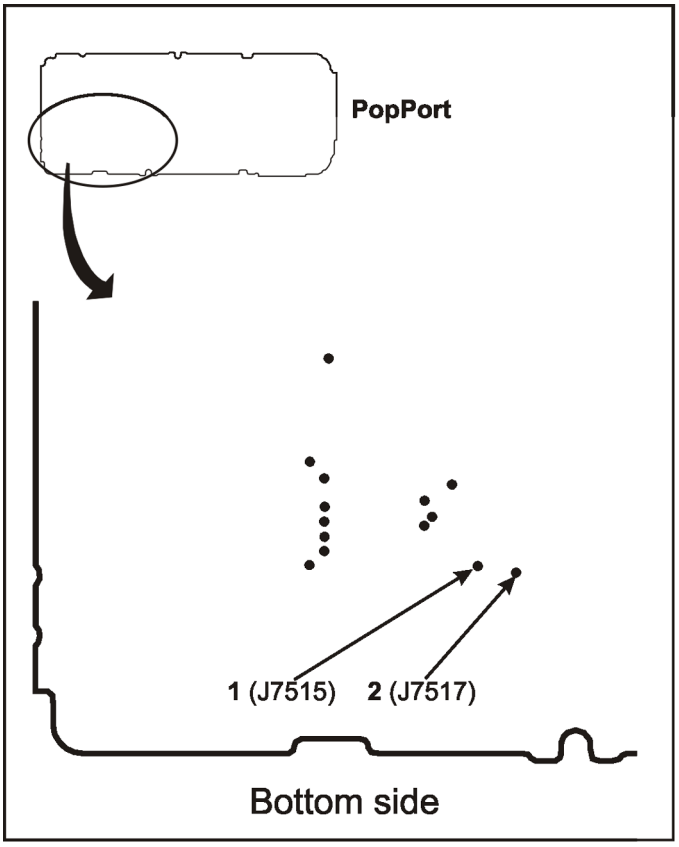


Figure 49 WCDMA RX test points

WCDMA Transmitter

WCDMA TX Troubleshooting

Preparations

Set Phoenix to RF local mode WCDMA TX (Channel 9737, 0 dBm output).

Check the following

Check the levels in the steps below.

NO.	Signal Name	Test point	Check
1	WTXDET	C7544	115mVDC
2	VBAT	C7542	3.82VDC
3	PA supply - Vreg	C7543	~1.3 VDC @ 0dBm
4	RF level - ANT_WCDMA	X8003	0dBm on antenna
6	WDET	C7545	2.75 VDC
7	DAC101	R7541	300 mVDC
8	DAC201	J7538	1.5 VDC

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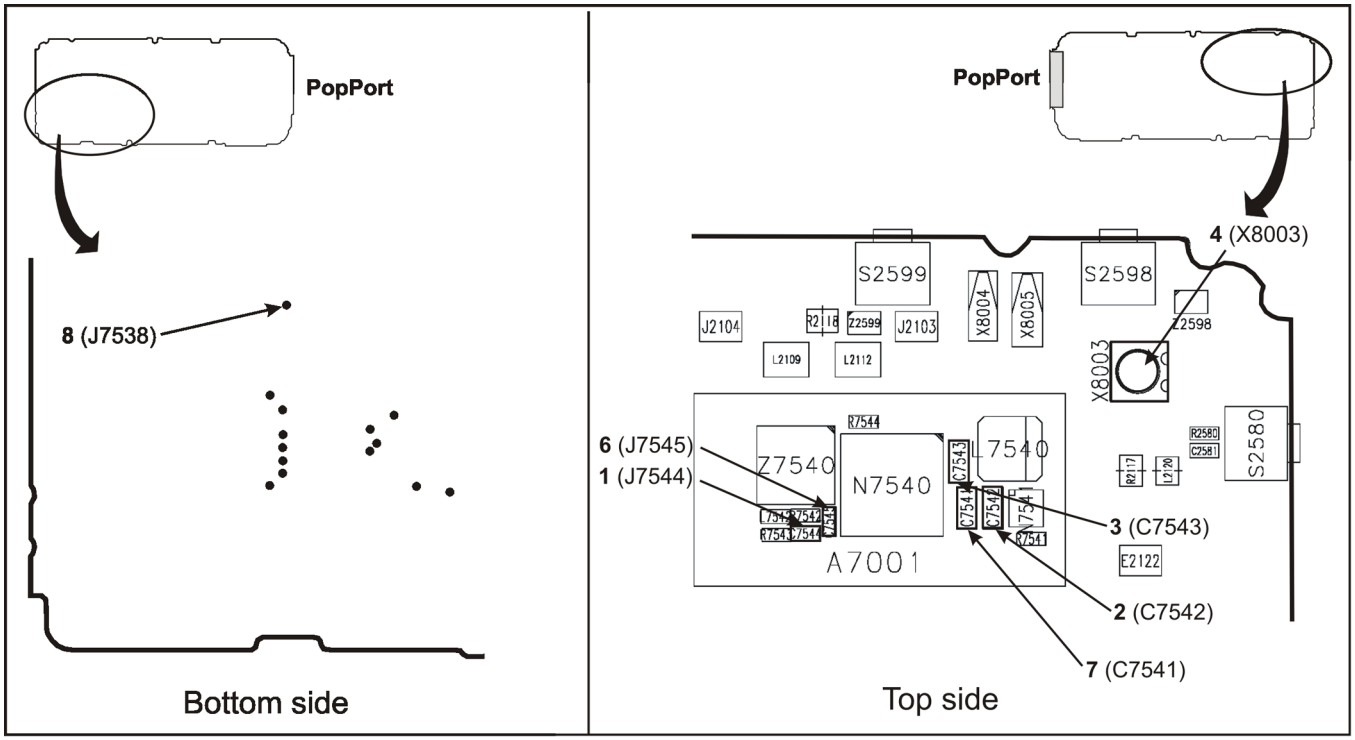


Figure 50 WCDMA TX test points

Synthesizer troubleshooting

PIHI (N7500) Troubleshooting

Preparations

Set Phoenix to RF local mode RX burst.

Check the following

Check the voltages in the steps below.

NO.	Signal Name	Test point	Check GSM900
Suppliers			
1	VBATRF (in)	L7500	3.8VDC
2	VR1_RX (out)	C7503	2.8VDC
3	VR1_TX (out)	C7502	2.8VDC
4	VR2_TX (out)	C7501	2.8VDC
5	VREFRF01 (in) VB_EXT	R7501	1.36VDC
6	VCP1 (in)	C2221	4.76VDC

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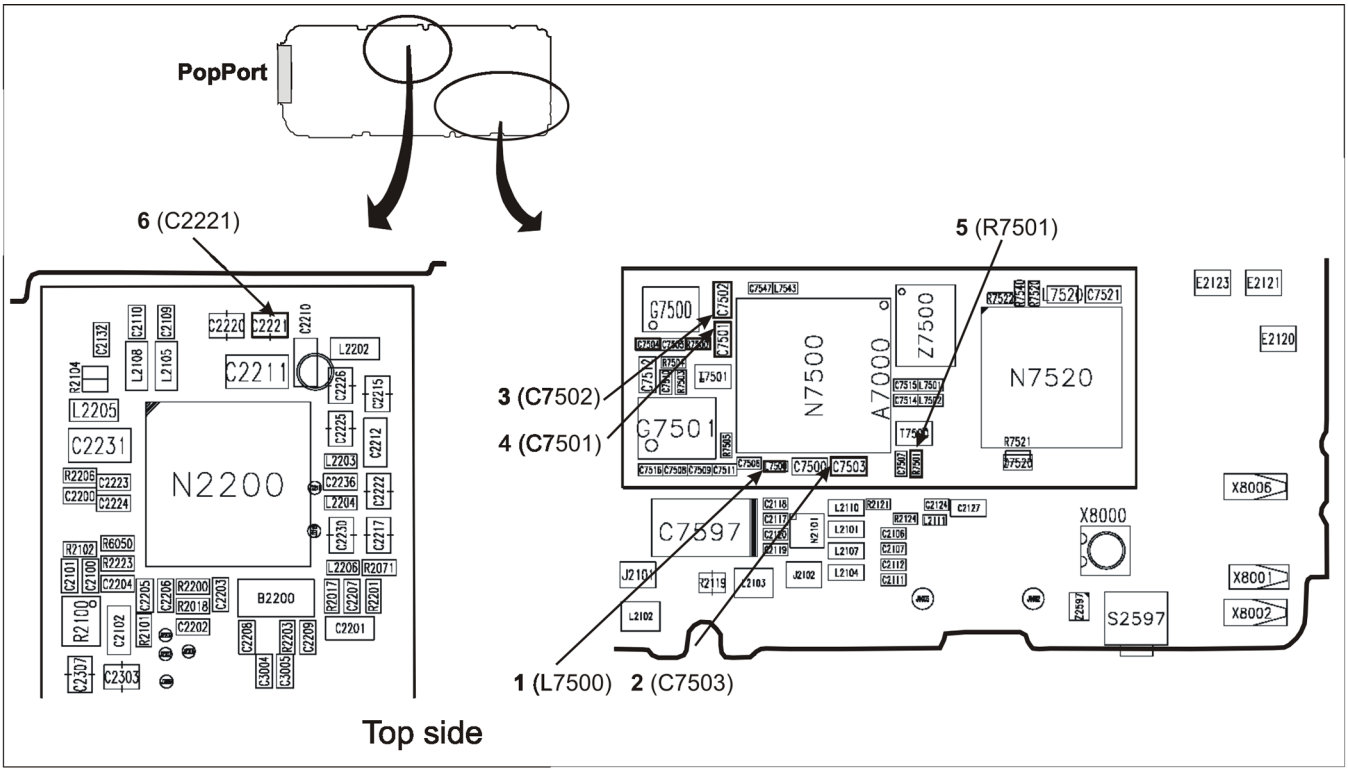


Figure 51 PIHI (N7500) test points

Synthesizer Troubleshooting

Preparations

Set Phoenix to RF local mode RX continuous.

Check the following

Check the levels in the steps below.

NO.	Signal Name	Test point	Check
VCTCXO			
1	VXO (in)	C7504	2.4VDC
2	OSCIN	G7500	85mVpp at 38.4MHz
3	AFC (in)	R7500	1.2VDC
VCO			
4	VVCO_EXT	R7505	2.72VDC
5	VCO Output	T7501	-17dBm at 3769.6MHz
6	VCO Control	C7510	2.7VDC

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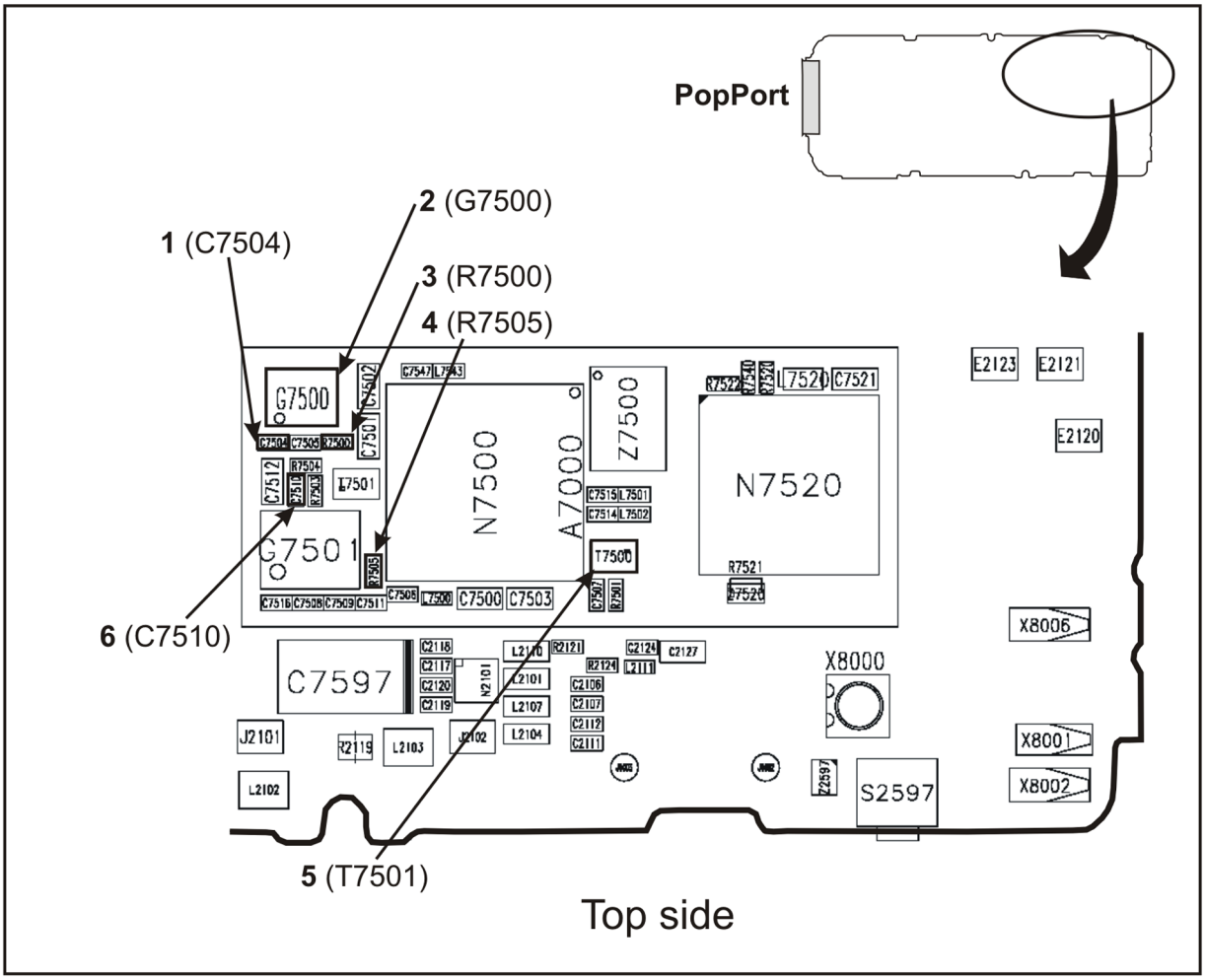


Figure 52 Synthesizer test points

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Bluetooth and FM radio

Bluetooth troubleshooting

Troubleshooting flow

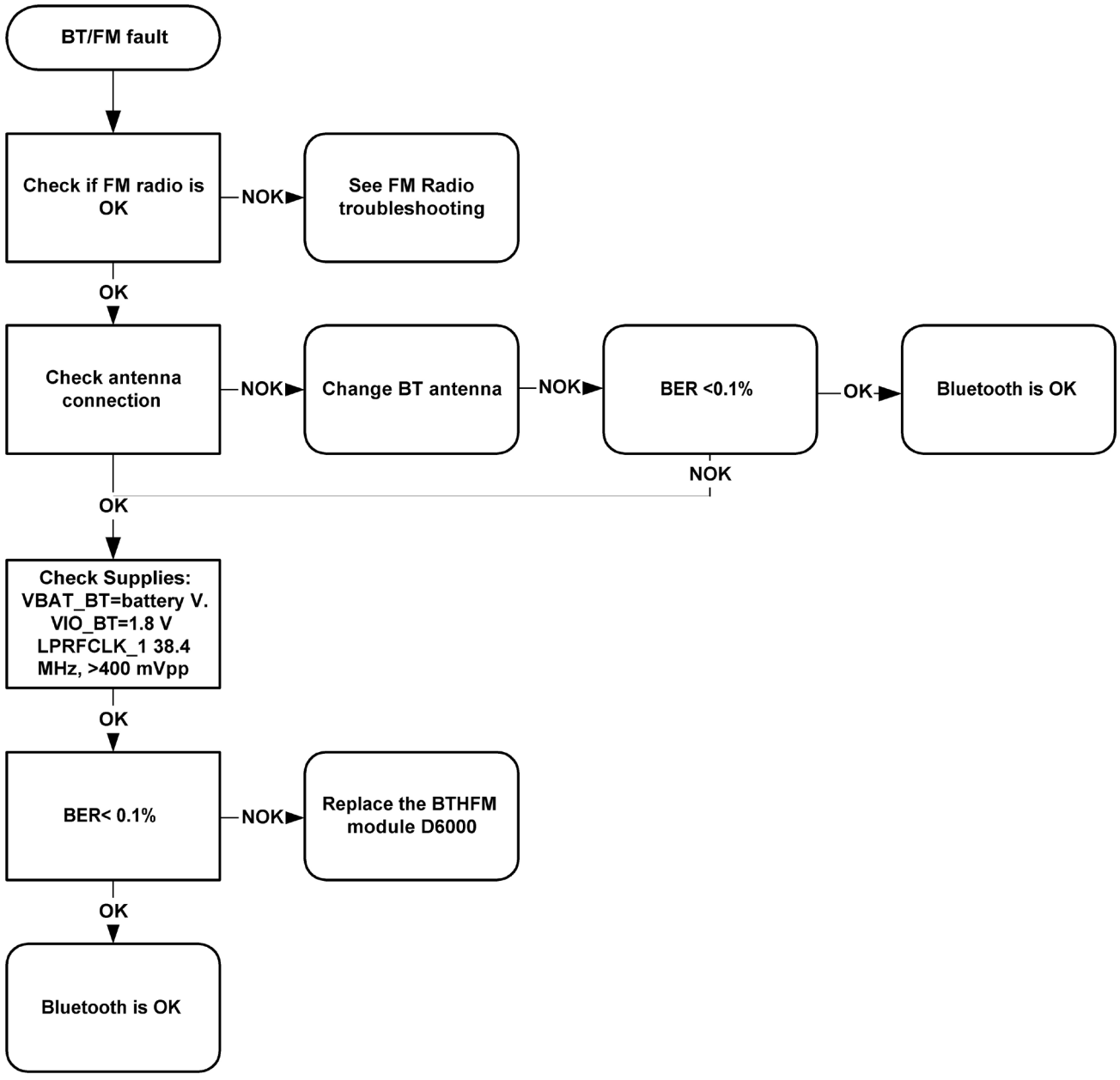


Figure 53 Troubleshooting diagram: Bluetooth

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FM radio troubleshooting

Troubleshooting flow

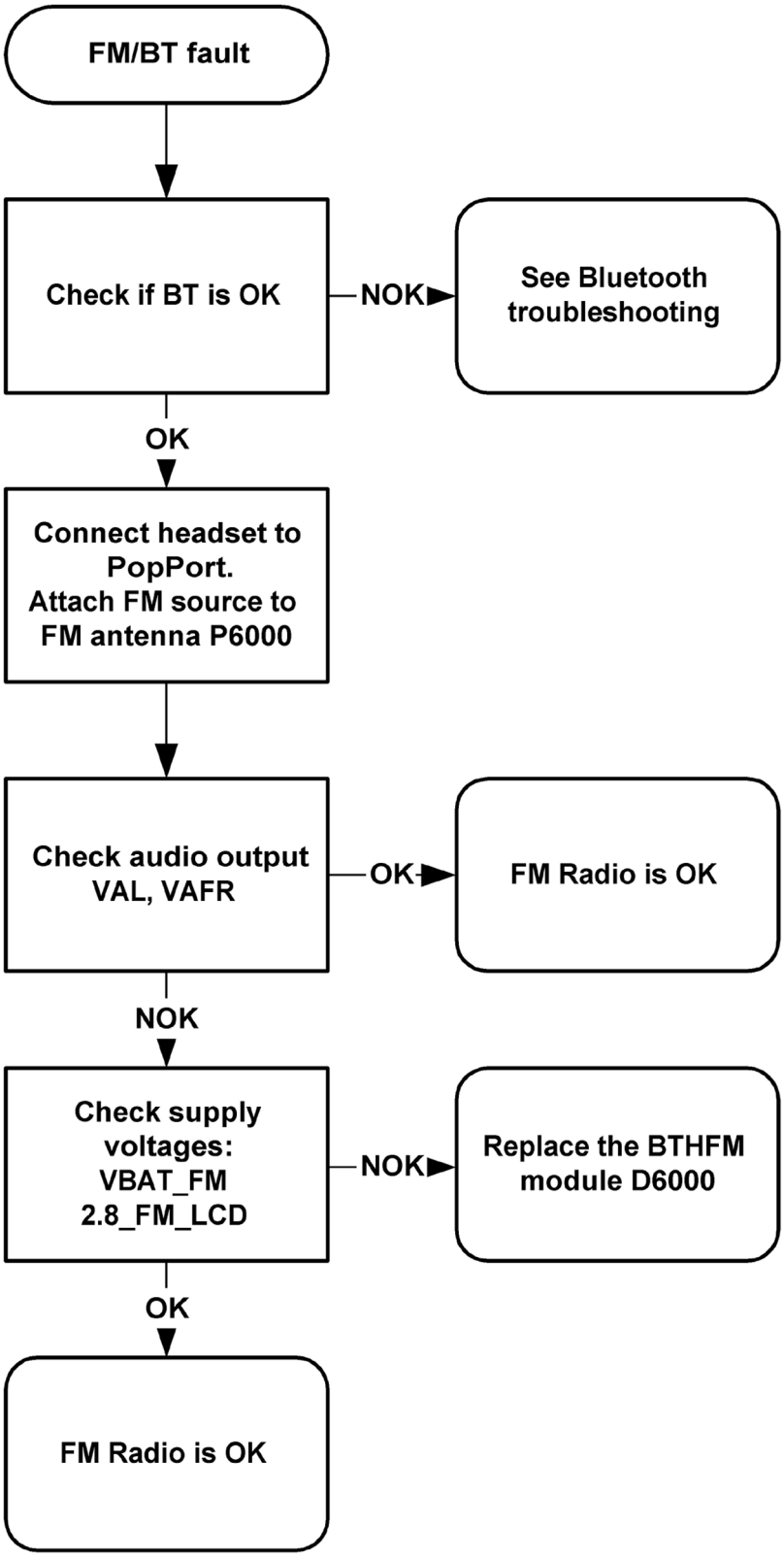


Figure 54 Troubleshooting diagram: FM radio

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8 — System Module

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Introduction

Block diagram

RAP3G is the main digital baseband ASIC in the phone. It contains functionality for both WCDMA and GSM EDGA and the Golden Eye is used as a co-processor.

Retu is mainly the audio ASIC in the phone and Tahvo is basically the energy management controller for the phone.

Bluetooth and stereo FM Radio is integrated in one single ASIC.

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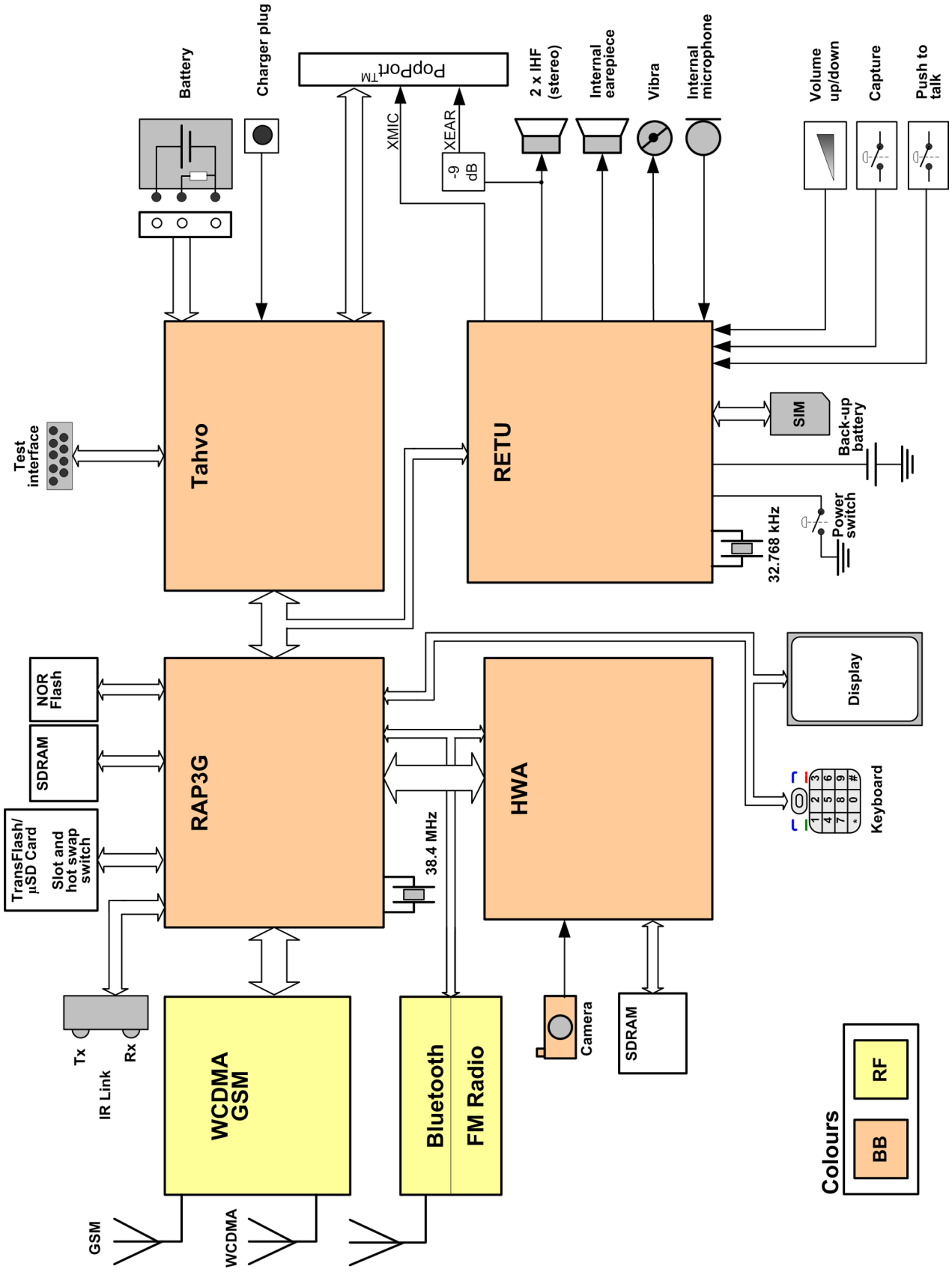


Figure 55 Block diagram

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Energy management

Battery and interface

The phone i powered by a 3-pole BP-6M S-pack 1100 mAh battery. The three poles are named VBAT, BSI and GND where the BSI line is used to recognize the battery capacity. This is done by means of an internal battery pull down resistor.

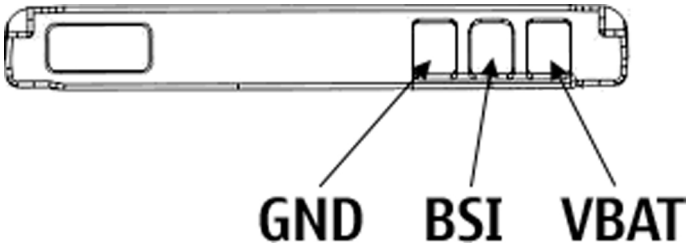


Figure 56 Battery pin order

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 type CA-44.

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

Normal and extreme voltages

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

In the table below normal and extreme voltages are shown when a BP-6M S-pack battery is used.

Table 16 Nominal voltages

Voltage	Voltage [V]	Condition
General Conditions		
Nominal voltage	3.9	
Lower extreme voltage	3.215	
Higher extreme voltage		
(fast charging)	4.23	
HW Shutdown Voltages		
Vmstr+	2.1 ± 0.1	Off to on
Vmstr-	1.9 ± 0.1	On to off
SW Shutdown Voltages		
Sw shutdown	3.1	In call
Sw shutdown	3.2	In idle
Min Operating Voltage		
Vcoff+	2.9 ± 0.1	Off to on

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Voltage	Voltage [V]	Condition
Vcoff-	2.6 ± 0.1	On to off

Power key and system power-up

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

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

Different power-up conditions

Power up can be caused by the following reasons:

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

After that:

- RETU activates sleep clock and VANA, VDRAM, VIO and VR1 regulators.
- Voltage appearing at RETU's RSTX pin is used for enabling TAHVO ASIC.
- TAHVO enables VCORE regulator and its internal RC-oscillator (600kHz).
- VCTCXO regulator is set ON and RF clock (main system clock) is started to produce.
- RETU will release PURX ~ 16ms after power up is enabled (the RF clock is then stable enough).
- Synchronizing clock (2.4MHz) for TAHVO is started to be produced. After PURX is released and two rising edges of 2.4MHz synchronous clock have been detected in SMPSClk input TAHVO 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.

Modes of operation

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

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Power distribution

The power distribution is shown in the diagram below. Current consumption is measured via the Current Gauge Resistor and the battery voltage is stabilized by means of a capacitor. The tables below specifies the voltages.

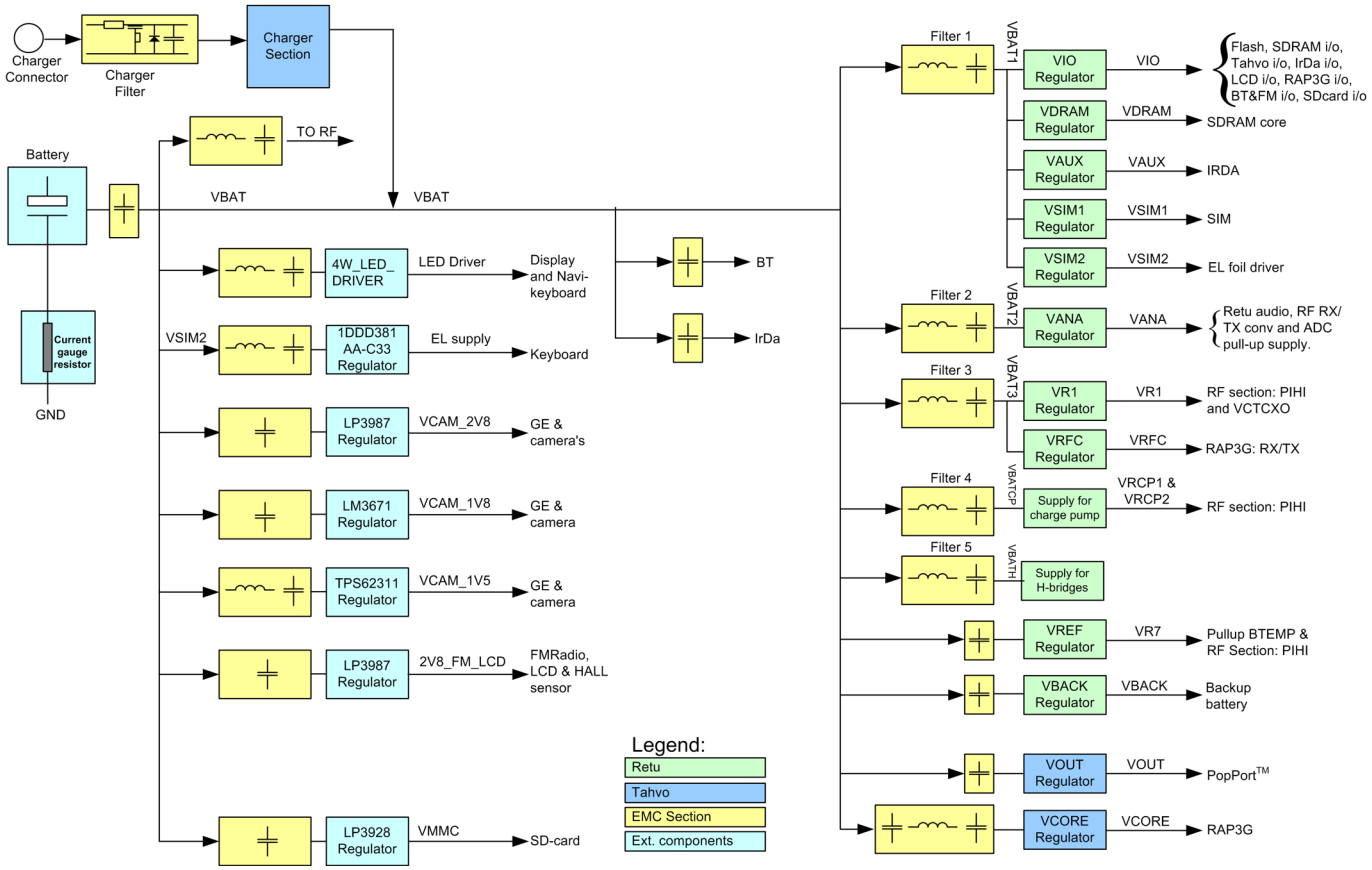


Figure 57 Power regulator diagram

Clocking scheme

In BB5.0, two main clocks are provided to the system: 38.4MHz RF clock produced by VCTCXO in RF section and 32.768kHz sleep clock produced by RETU with an external crystal.

32k Sleep Clock is always powered on after startup. Sleep clock is used by RAP3G and OMAP for low-power operation.

SMPS Clk is 2.4MHz clock line from RAP3G to TAHVO. In deep sleep mode, when VCTCXO is off, this signal is set to '0'-state.

BT Clk is 38.4MHz signal from HINKU ASIC to BT module.

CLK600 is 600KHz signal from TAHVO to APE VCORE SMPS. The clock source is internal RC oscillator in TAHVO (during the power-up sequence) or RAP3G SMPS Clk.

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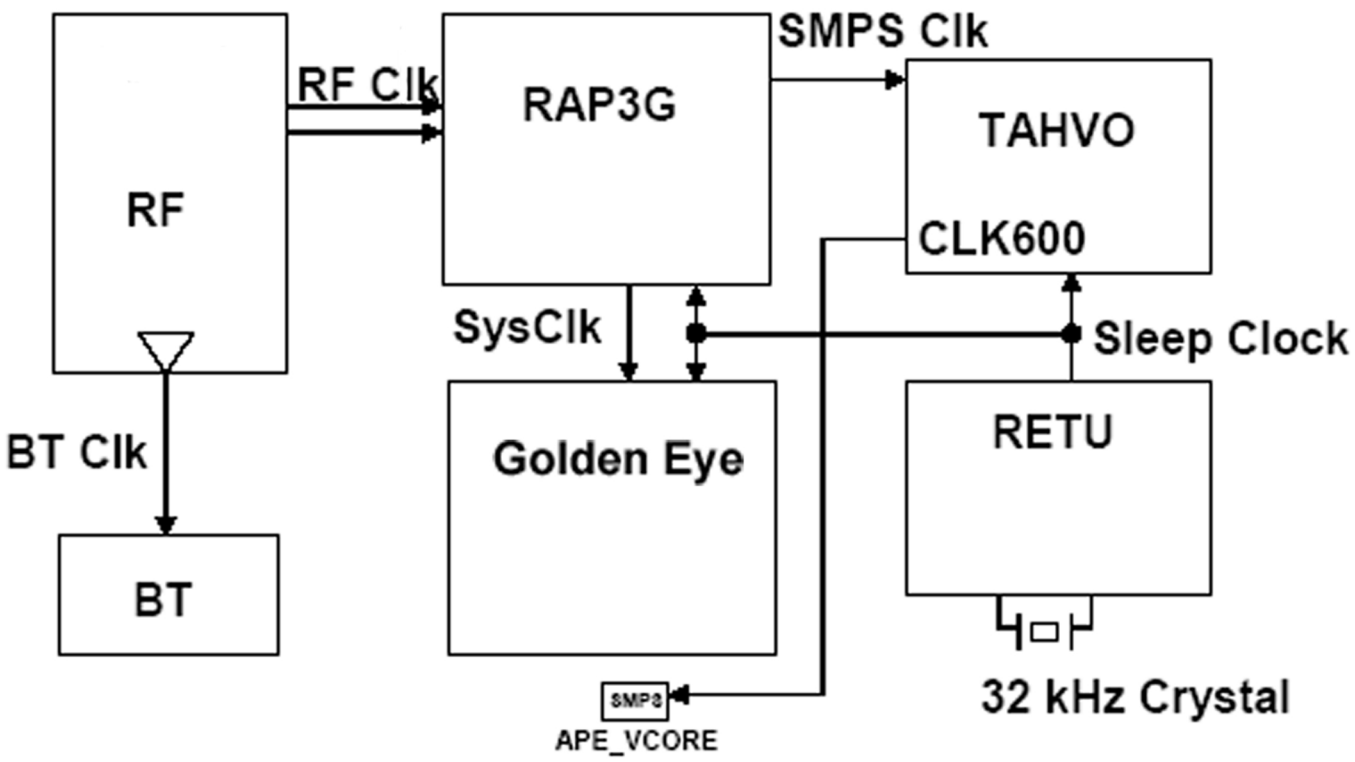


Figure 58 Clocking scheme

USB, SIM, MMC

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.

SIM interface

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

The SIM IF is shown in the following figure:

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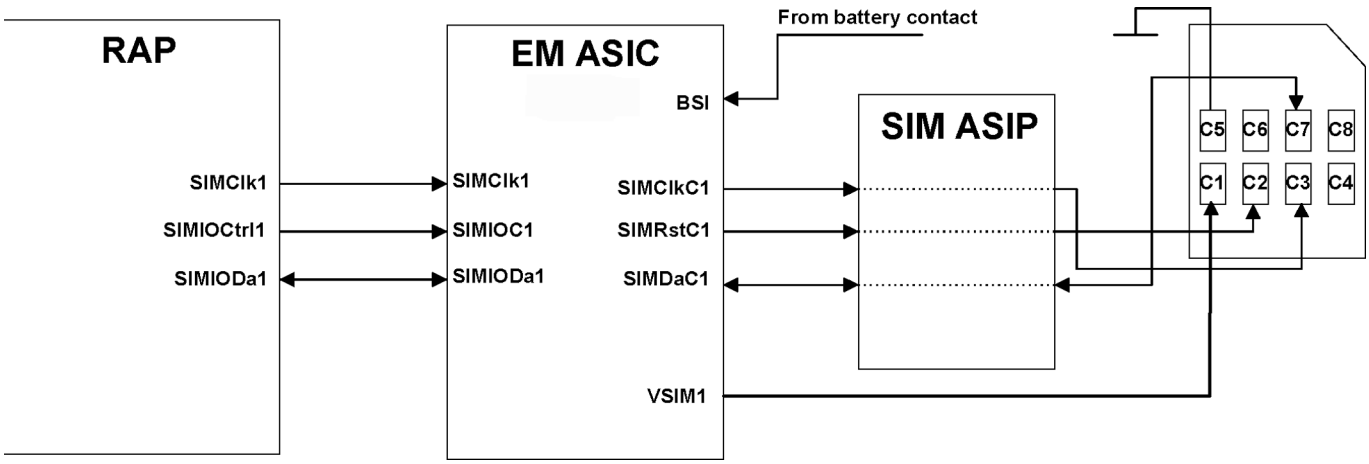
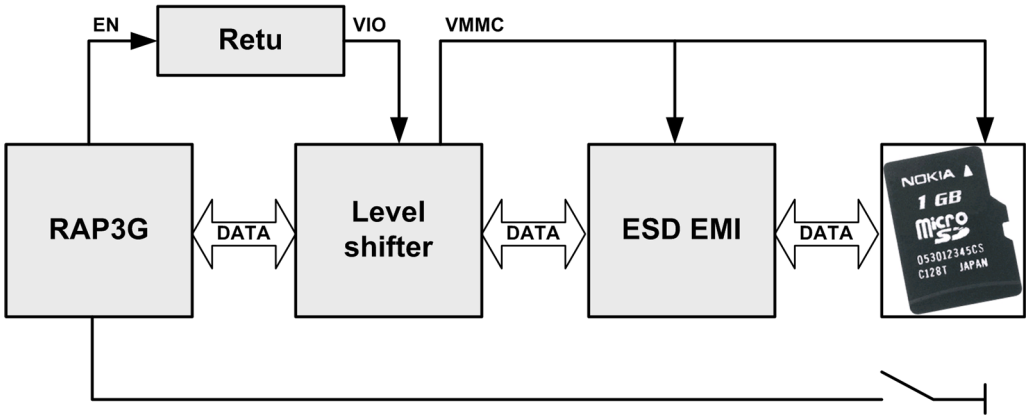


Figure 59 SIM interface

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

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

µSD card interface



The µSD card is connected to the engine by an external level shifter and ESD protection filter. Supplied voltages:

- VMMC: 2.85 V (from level shifter)
- VIO: 1.8 V (from Retu)

The card removal is detected by a push detect switch.

Camera

Camera

The camera uses a 2.0 megapixel camera module with a sensor resolution of 1600 x 1200.

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User interface

Display interface

Display module mechanical concept

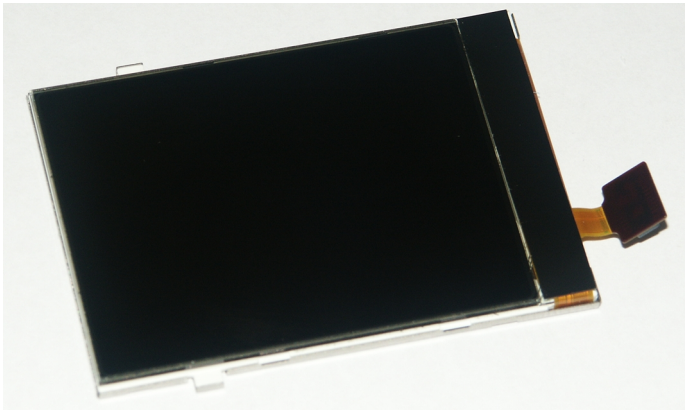


Figure 60 LCD module

Display features:

- 262 k colours
- Partial display function Power saving by pausing display process on part of the screen.
- Built-in RAM capacity 176rows×208lines×16bit = 585,728 bits

The display has two different operating modes:

1 Normal mode, Full screen, 262k colours

2 Normal Partial mode, 262k 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.

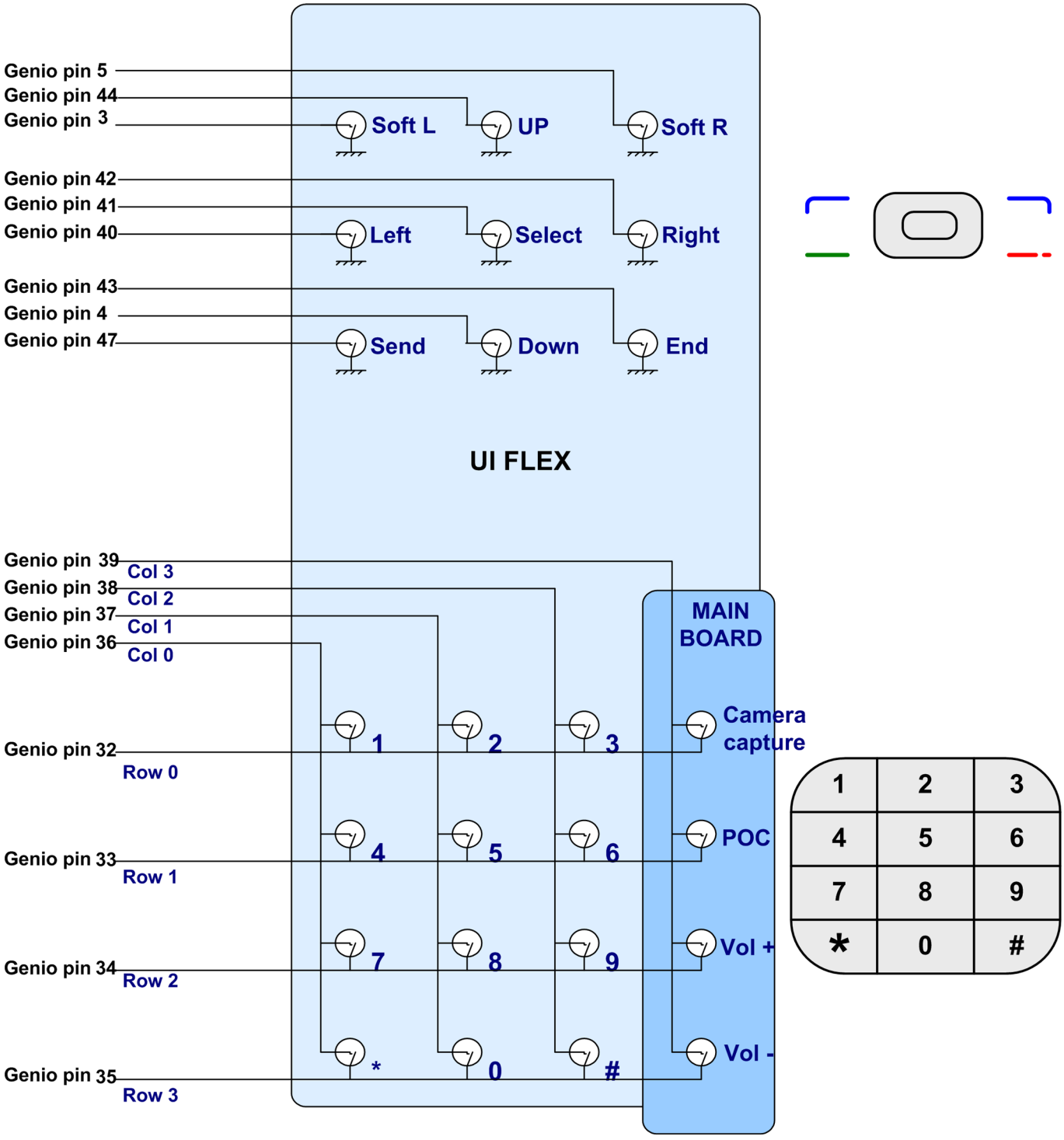
The display module does not require any tuning in service.

Keyboard and side keys

The side keys are placed on the main PWB. The numerical keys and the navigation keys are included in the UI flex on top of the phone.

The numerical keys and the side keys are included in the 4x4 scan matrix. The navigation keys are individually routed.

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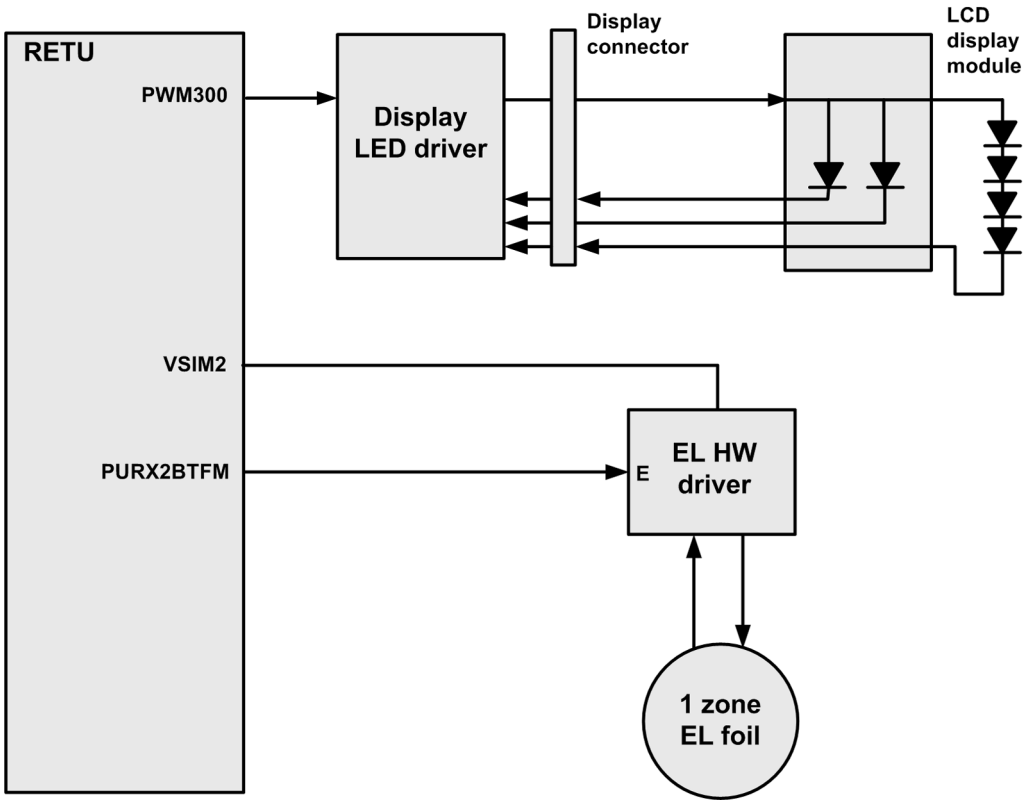


Backlight and illumination

There is backlight illuminating the display.

Behind the keypad there is an electroluminescent (EL) foil, giving the keys a blue lamaninate. The EL foil backlight the keys with blue light for numeric soft keys and green/red for Send/End keys.

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Audio concept

Audio hardware architecture

The functional core of the audio hardware is built around two ASICs: RAPGSM engine ASIC and the mixed-signal ASIC Retu.

Retu provides an interface for the transducers and the accessory connector. Integrated hands free stereo speakers are driven by a D-class audio amplifier.

There are four audio transducers:

- Dynamic earpiece
- Two dynamic speakers
- Microphone module

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

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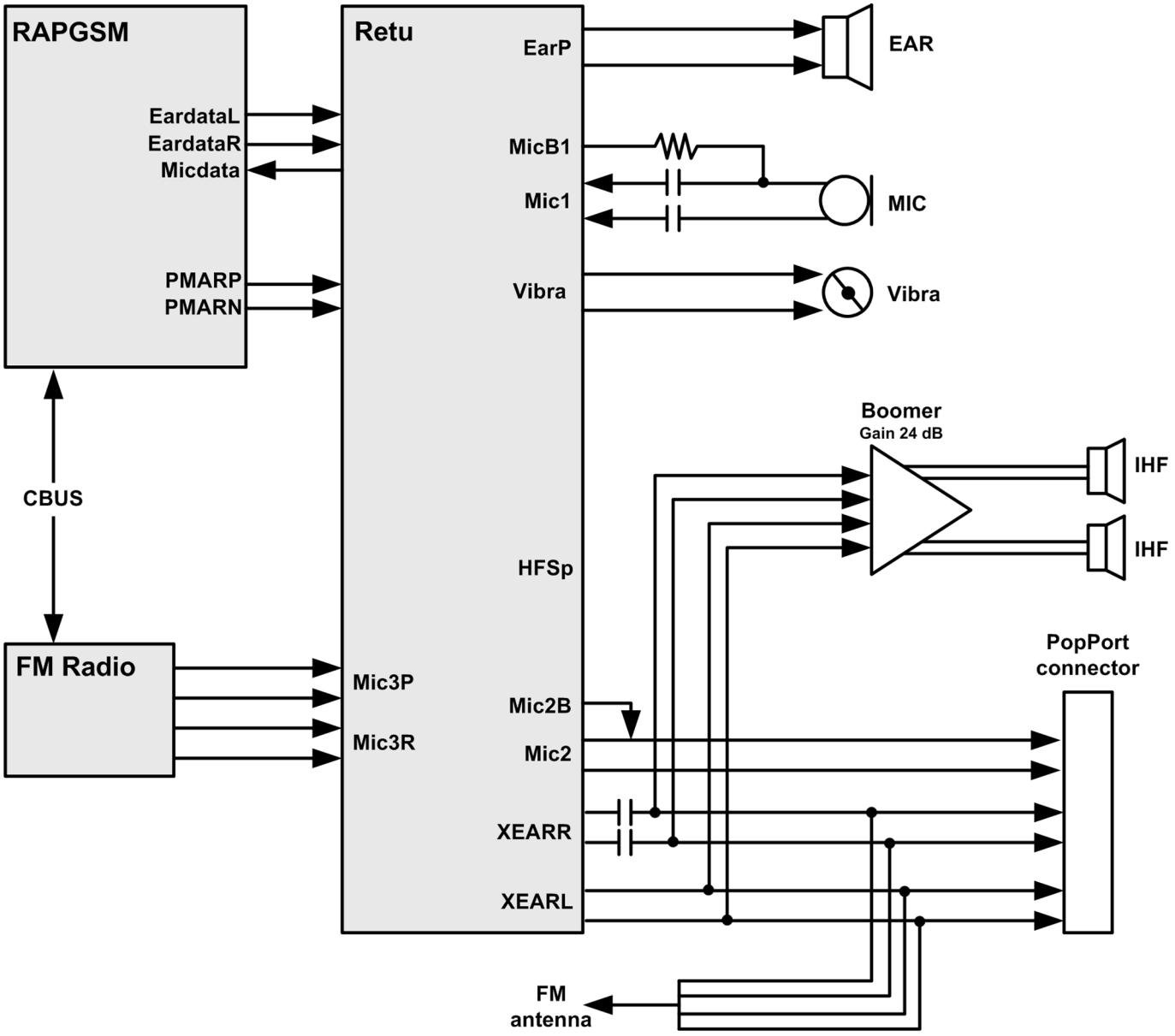


Figure 61 Audio block diagram

Internal microphone

Internal microphone is used for HandPortable (HP) and Internal HandsFree (IHF) call modes.

An analogue electret microphone is connected to N2200 Mic1P and Mic1N inputs via asymmetric electrical connection.

The microphone is biased by N2200 MicB1 bias voltage output.

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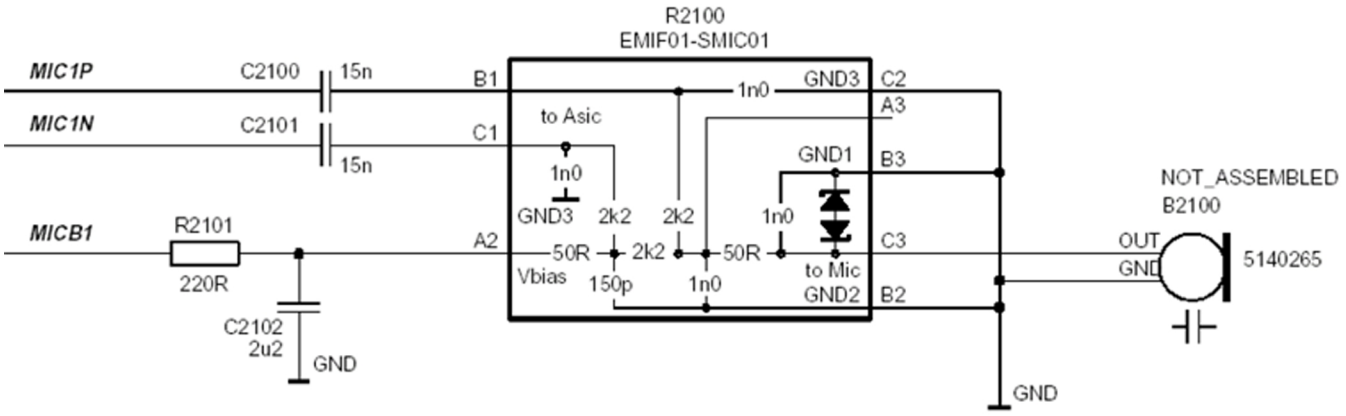


Figure 62 Internal microphone circuitry

External microphone

Galvanic accessories are connected to the system connector.

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

External microphone circuitry is biased by N2200 MicB2 bias voltage output. The circuitry provides a symmetrical connection for the microphone from the system connector connections, XMICN and XMICP, to N2200 inputs, Mic2P and Mic2N.

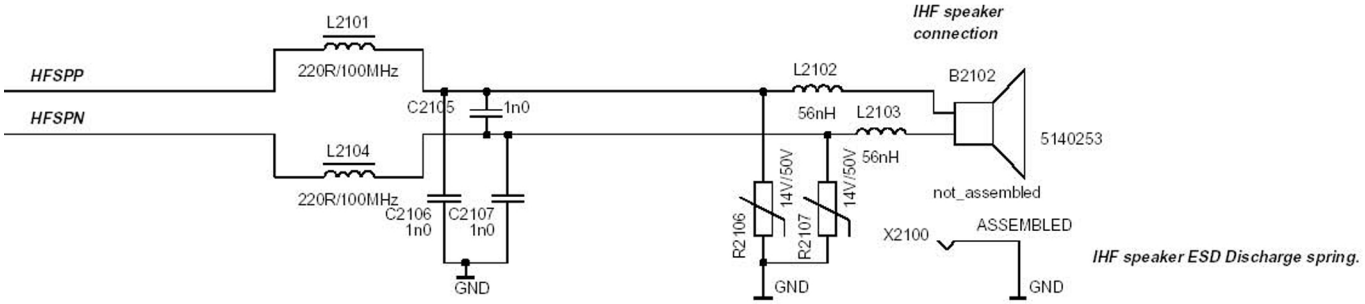


Figure 63 External microphone circuitry (Pop-Port™ connects to the right side)

Internal earpiece

The internal earpiece is used in the HandPortable (HP) call mode. A dynamic 8 mm earpiece capsule is connected to N2200 differential outputs EarP and EarN.

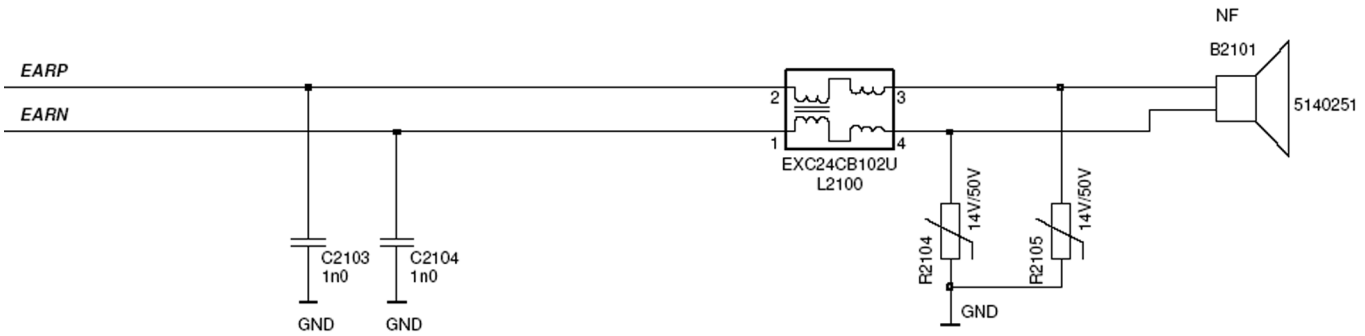


Figure 64 Internal earpiece circuitry

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Internal speaker

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

A dynamic 16 mm speaker is connected to N2200 outputs HFSpP and HFSpN.

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

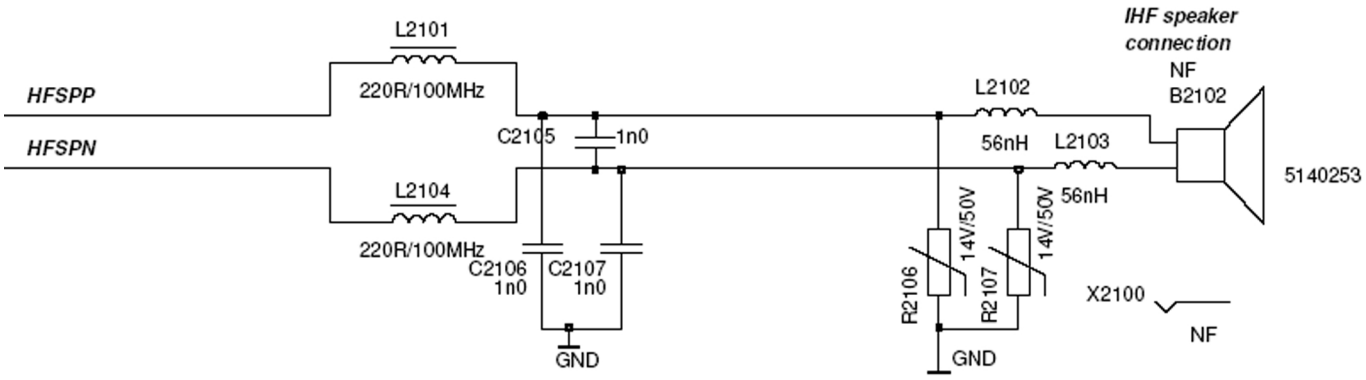


Figure 65 Internal speaker circuitry

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.

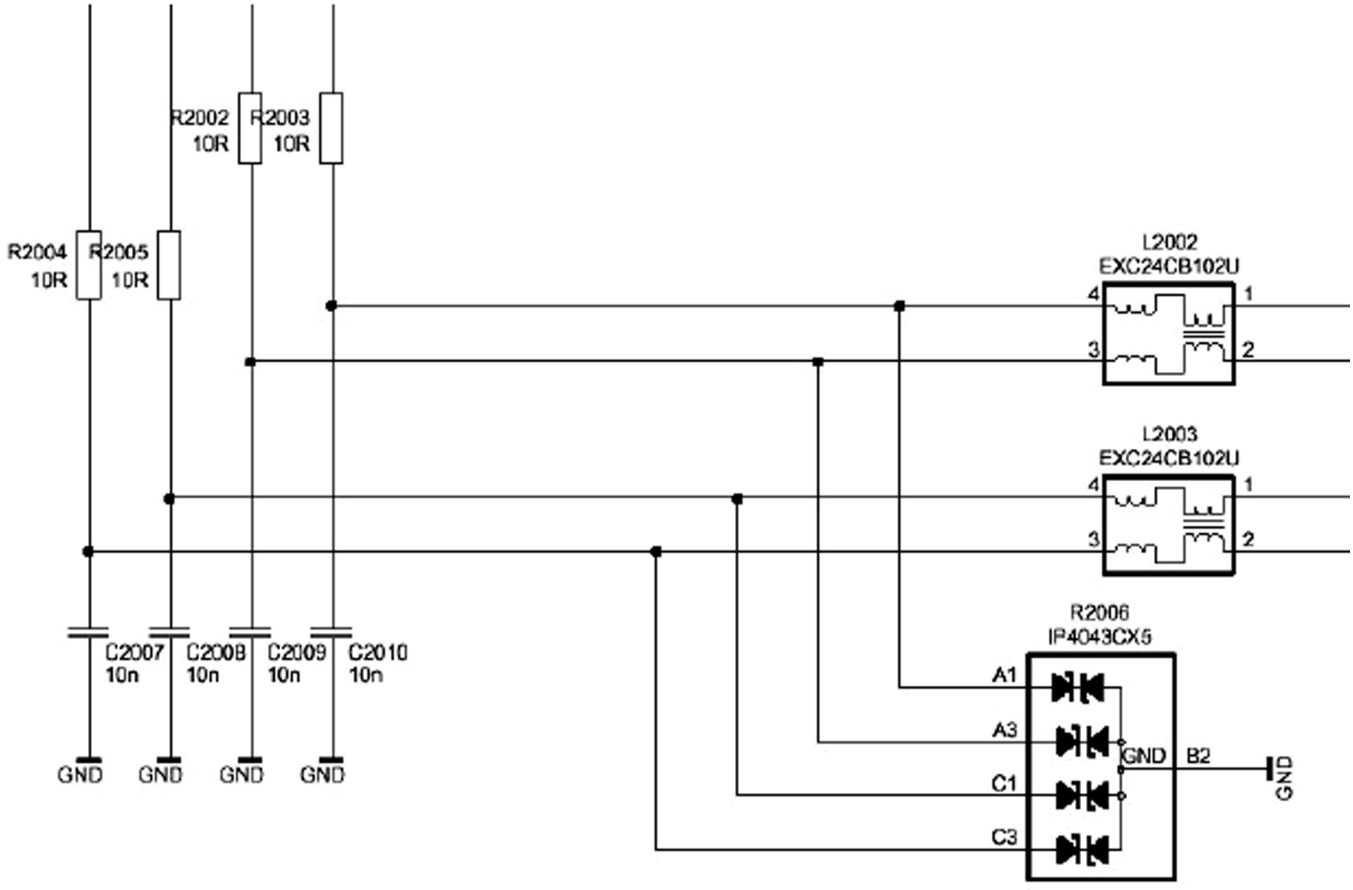


Figure 66 External earpiece circuitry (system connector connected on the right)

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Vibra circuitry

The vibra circuitry 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.

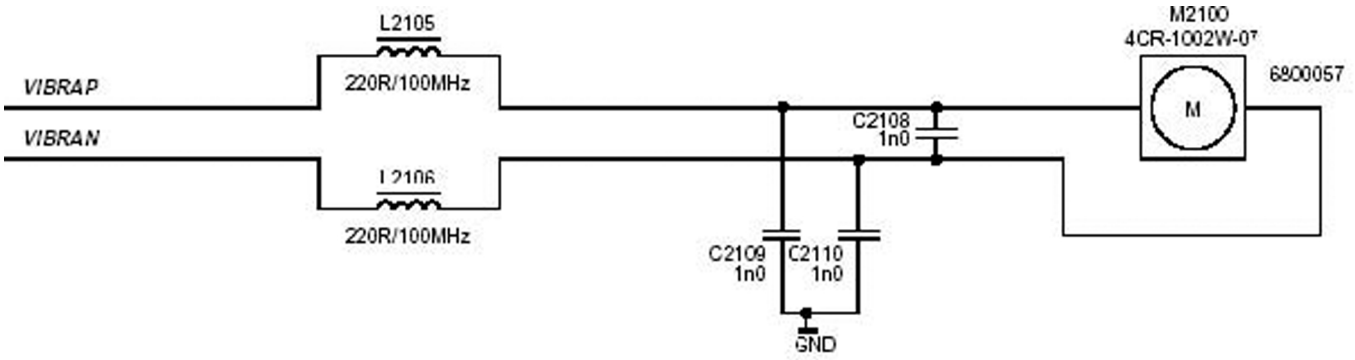


Figure 67 Vibra circuitry

Pop-port™ connector

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

The handsfree driver in Retu 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 earpiece and headset signals are multiplexed so that the outputs cannot be used simultaneously.

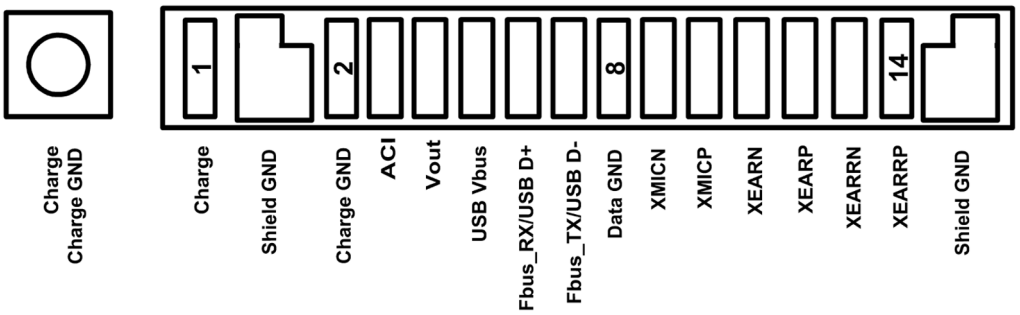


Figure 68 System connector pin layout

Table 17 Pop-Port™ pin and signal table

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

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Pin #/ Signal name	Signal description	Spectral range	Voltage/ Current levels	Max or nominal serial impedance	Notes
4/ Vout	DC out	DC	2.78V 70 mA 2.5V 90mA	100mΩ (PWB+ conn.)	200mW
5/USB Vbus	USB power		4.375-5.25VDC		115.2kbit
6/Fbus_RX/USB D+	Data connection				115.2kbit
7/Fbus_TX/USB D+	Data connection				115.2kbit
8/Data GND	USB Ground				115.2kbit
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 / XEAR N	Audio out	20-20k	1Vpp	10Ω	
12 / XEAR P	Audio out	20-20k	1Vpp	10Ω	
13 / XEAR R N	Audio out	20-20k	1Vpp	10Ω	Not conn. in mono
14 / XEAR R P	Audio out	20-20k	1Vpp	10Ω	Not conn. in mono

Bluetooth and FM radio

Bluetooth

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

The Bluetooth is physically integrated with the FM radio into one single module. From a functional point of view they, however, have nothing in common.

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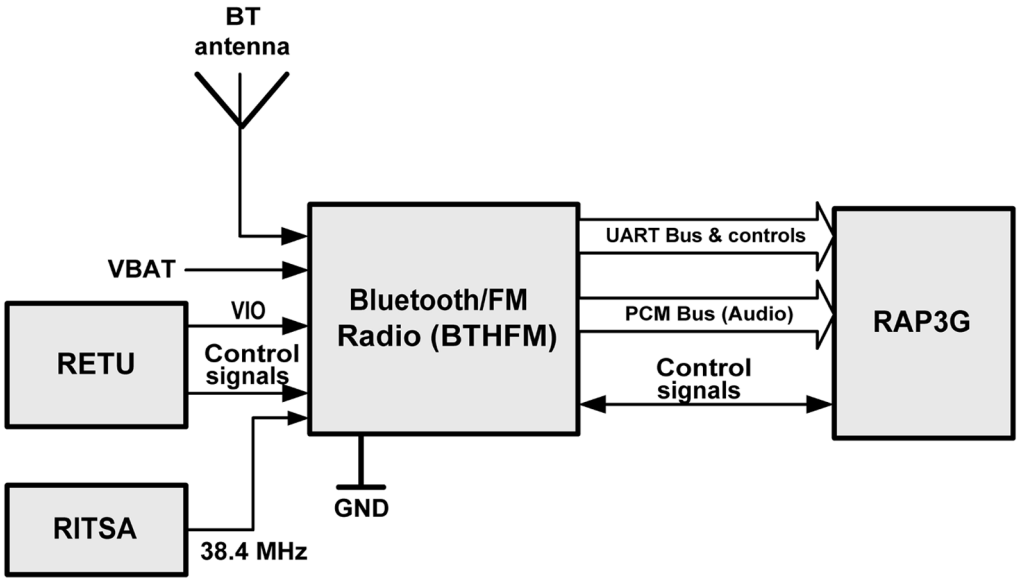


Figure 69 Bluetooth interface

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

FM radio

The FM radio is physically integrated with the Bluetooth into one single module. From a functional point of view they, however, have nothing in common.

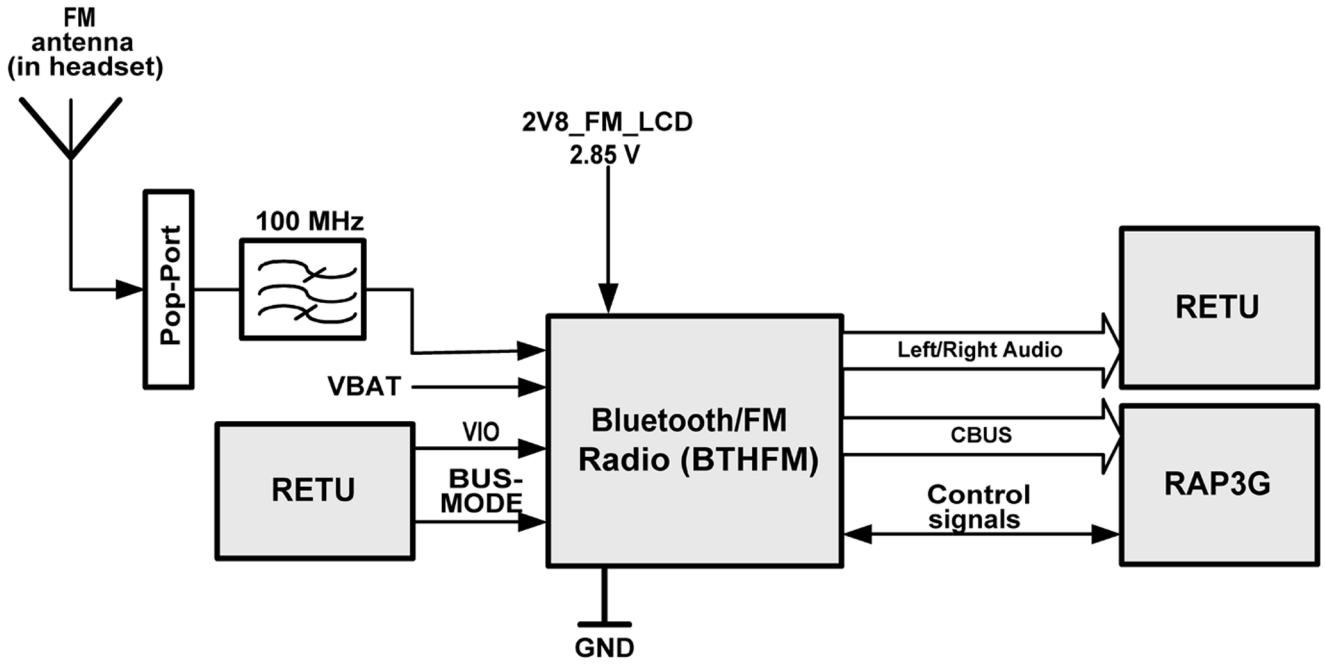


Figure 70 FM interface

The FM radio is an integrated circuit, controlled by MCU software through a serial bus interface. The wires of the headset are used as poles of the antenna, and no other antenna is needed for FM radio reception.

In addition to the Bluetooth unit the FM radio is provided with LDO (low drop out) voltage 2V8_FM_LCD.

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The radio has an automatic band search function, which can search for a strong write/read signal from a certain frequency. When this is found, data is transmitted to the radio. When the signal strength is low, the RETU can read data, which is available until the signal is strong again.

RF description

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.

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.

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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 digital BB, which is first low pass filtered with filter corner frequency set to approximately 200 kHz. After the filter, the signal is 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 via a balun to the GSM PA module. In case of GSM900, the PA module is preceded by a SAW filter. After the filter, the signal is fed to the GSM front end module (FEM). Finally, the signal is routed via FEM to the antenna.

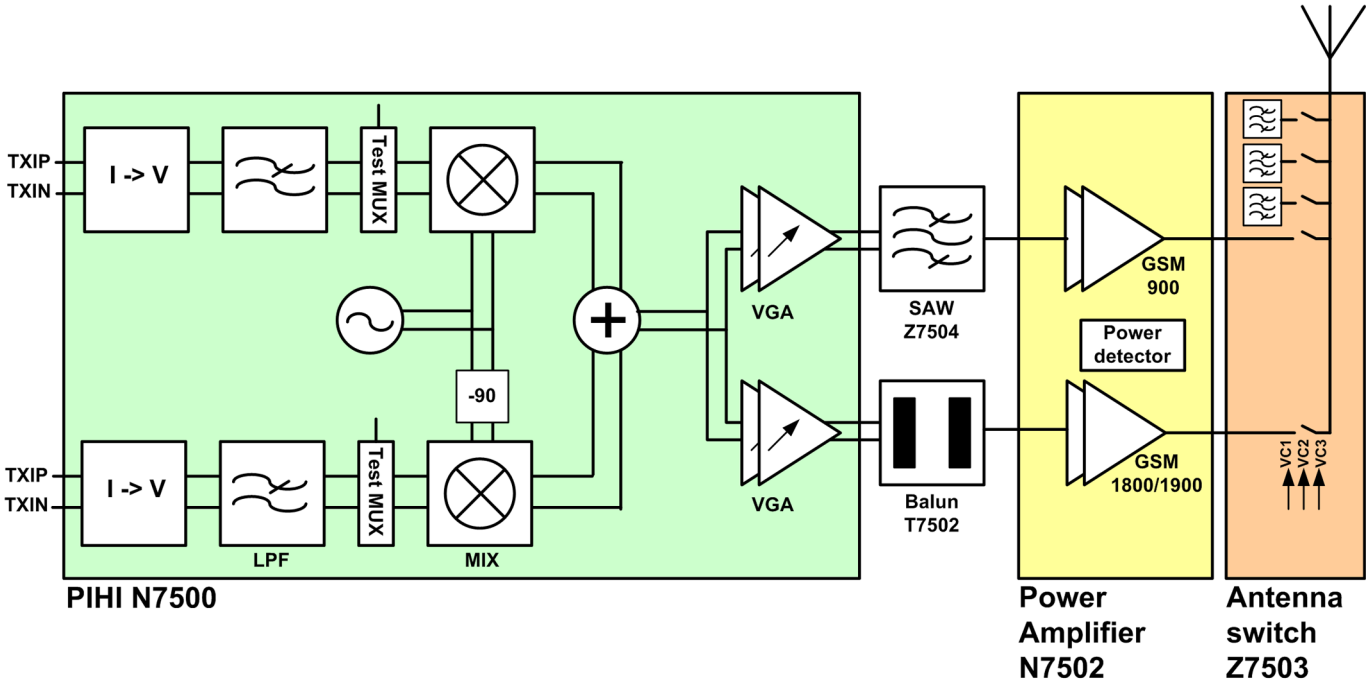


Figure 71 GSM transmitter

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GSM power control

A closed control loop comprise an integrated power detector (in PA module) and an error amplifier. The error amplifier resides in N7500, and it controls the transmitter power of GSM.

GSM PA module

A single GSM/EDGE PA module contains two separate amplifier chains, one for GSM900 and another for GSM1800/1900. Both amplifiers have a battery supply connection and two bias current inputs.

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

RF ASIC contain integrated regulators to supply regulated voltages for their internal circuitry and other RF parts. Rx VCO supply is got via a switch from an RF ASIC VR1 regulator. VCO can be switched on and off by controlling the switch via RFBus.

Supply voltage for the VCTCXO is provided by a BB mixed mode ASIC. The same supply is used for reference clock input buffers, output buffers and for the digital control blocks of both RF ASICs.

Other supplies, like 4.7 V supply for PLL charge pumps and bias reference (VREFRF01) are also provided by the BB mixed mode ASIC.

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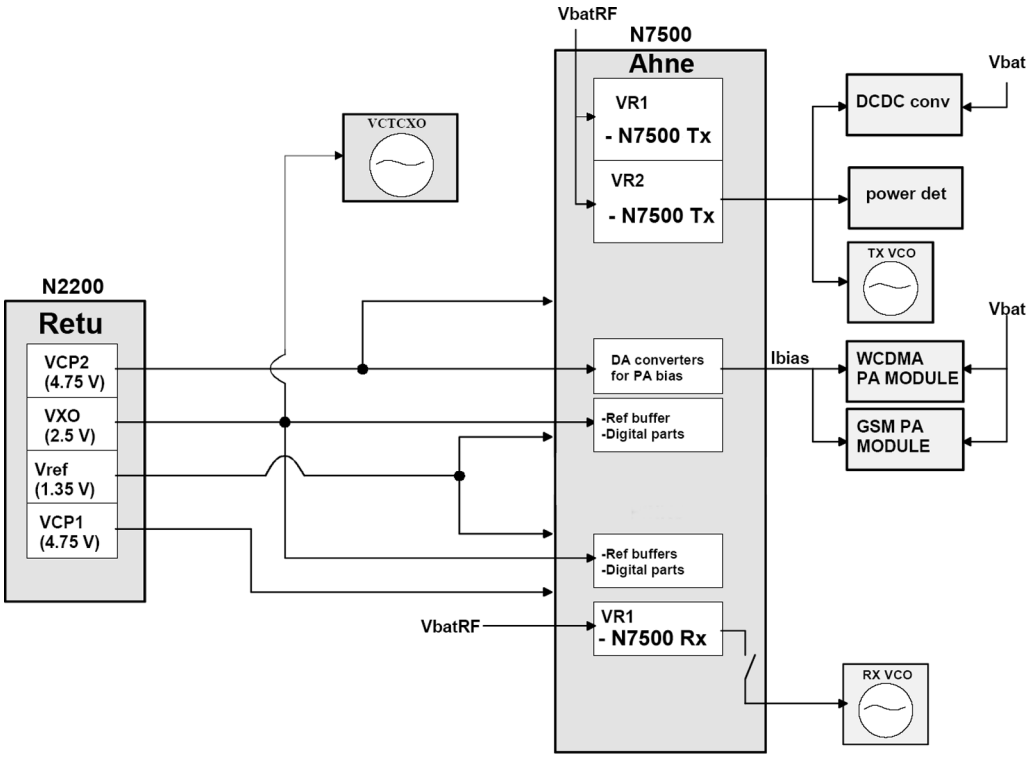


Figure 72 RF supply connections from the BB mixed mode ASIC

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9 — Schematics

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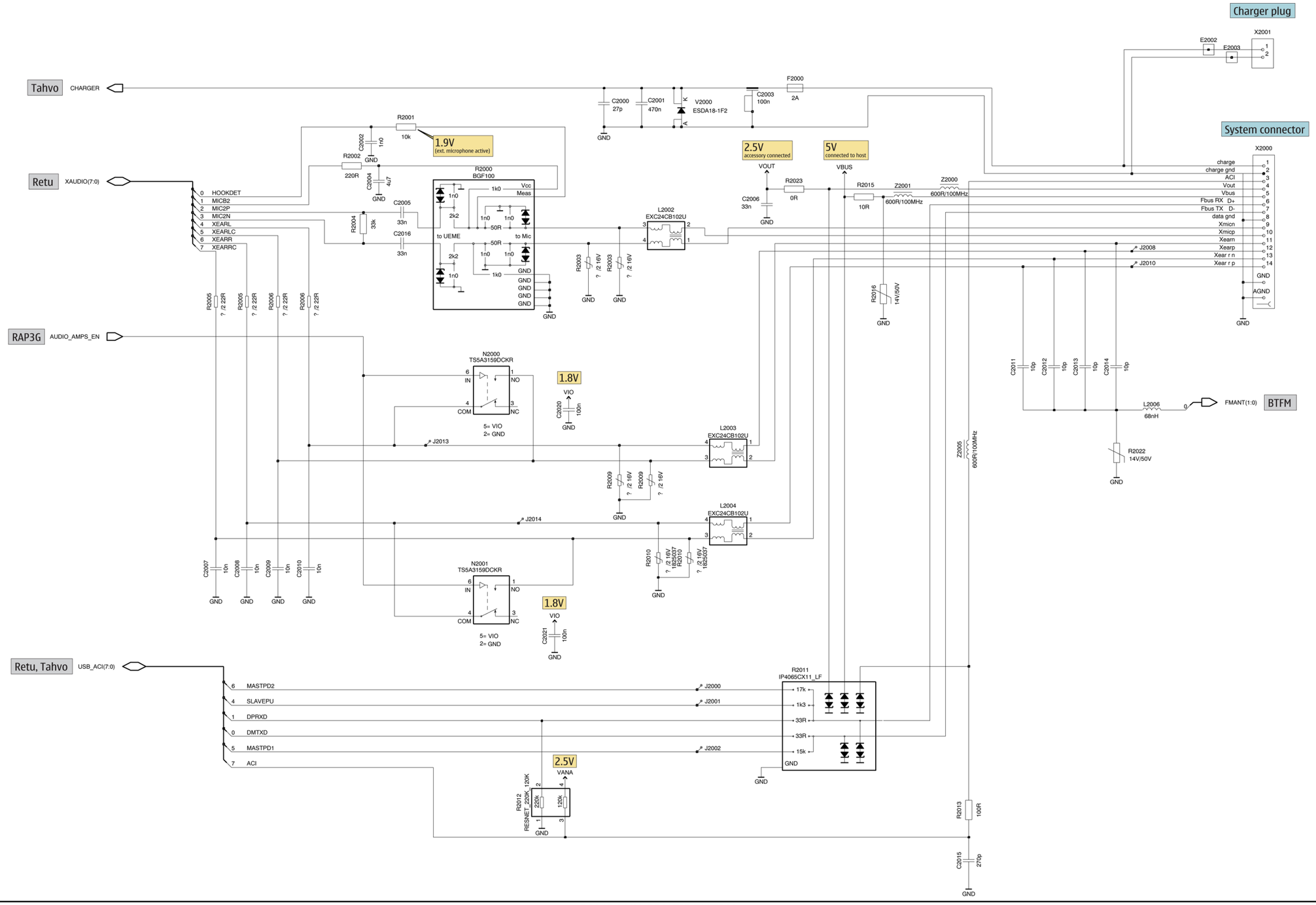
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Schematics.....9–4

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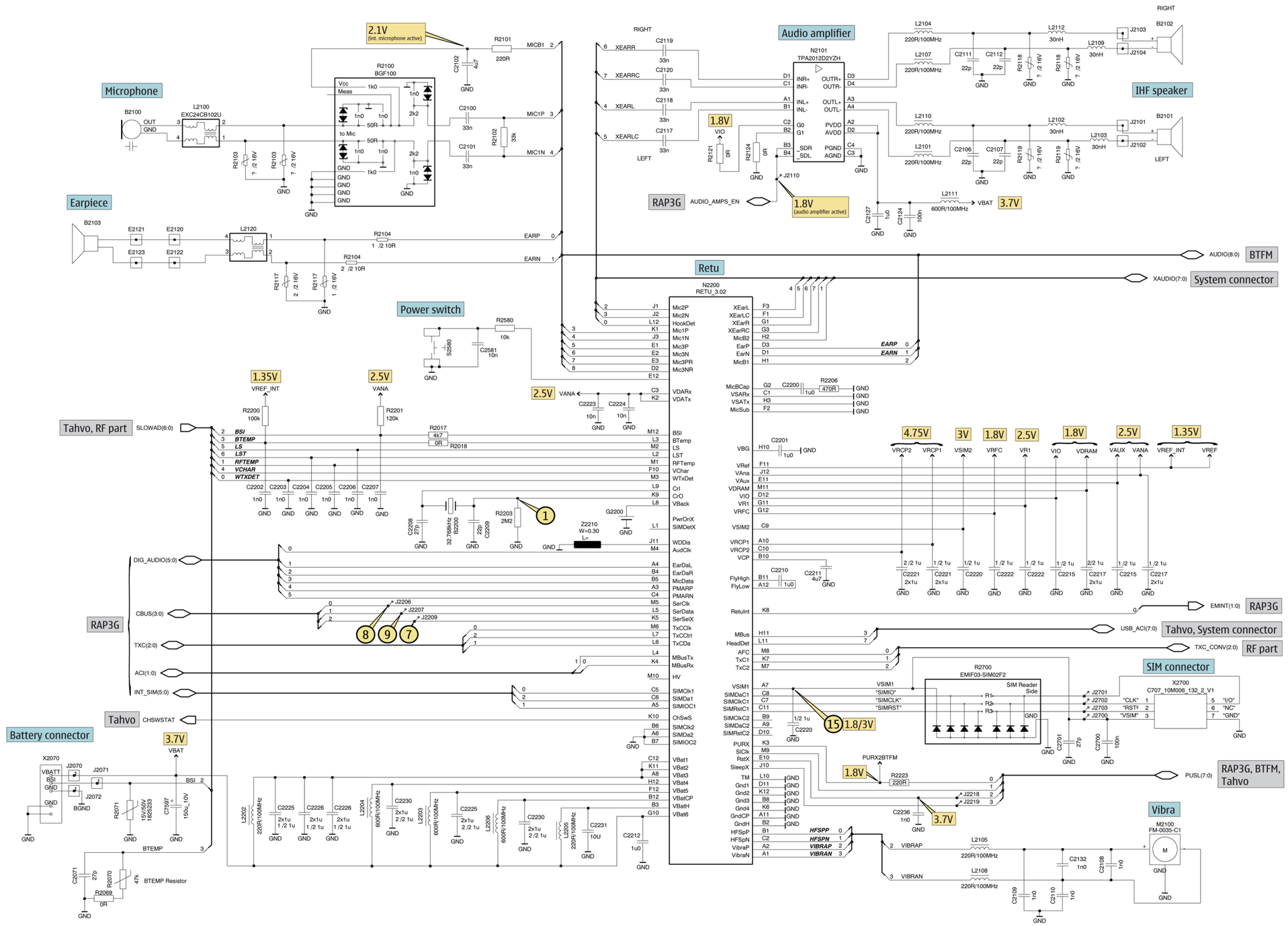
Schematics

System connector



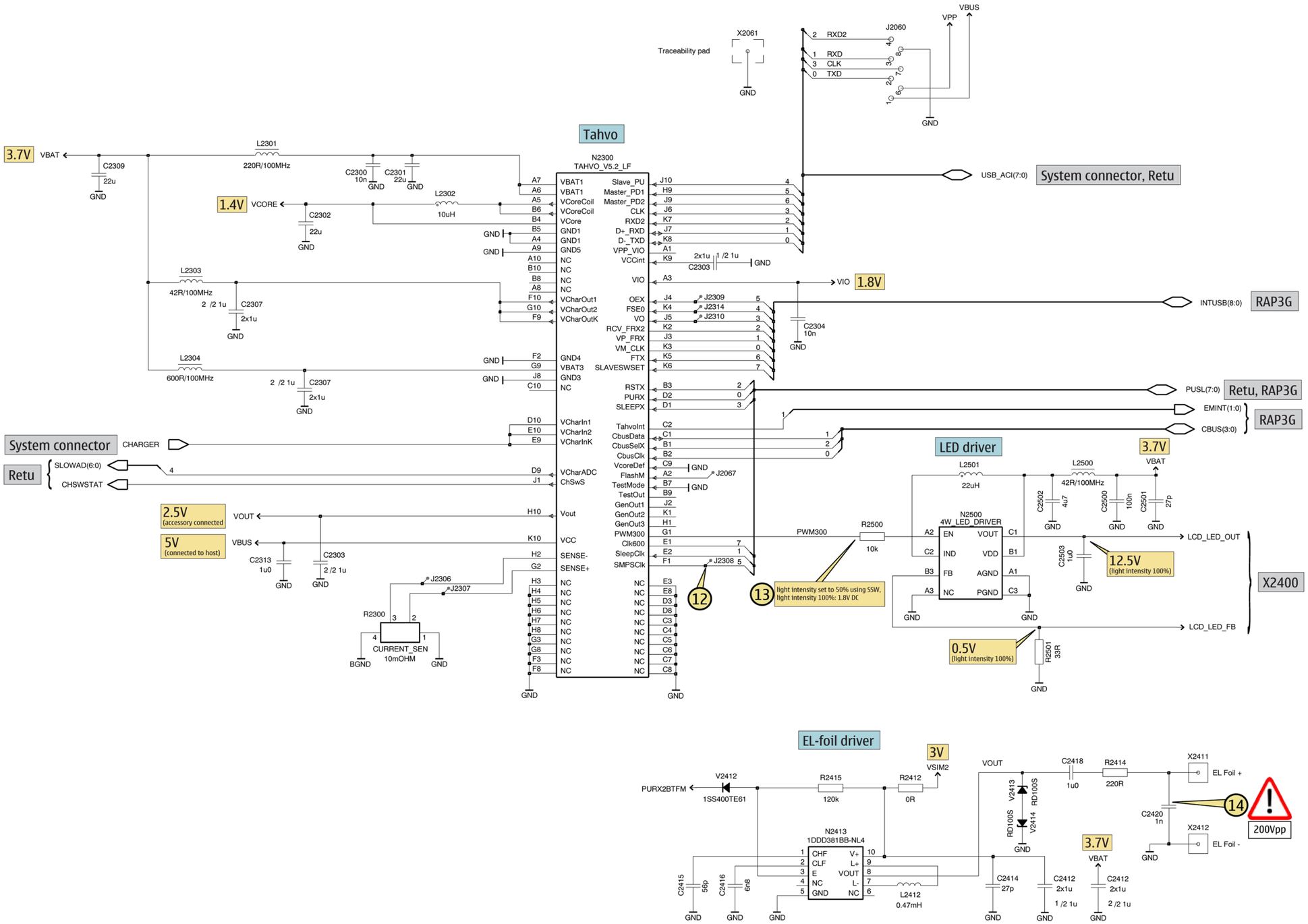
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RETU, SIM, Audio



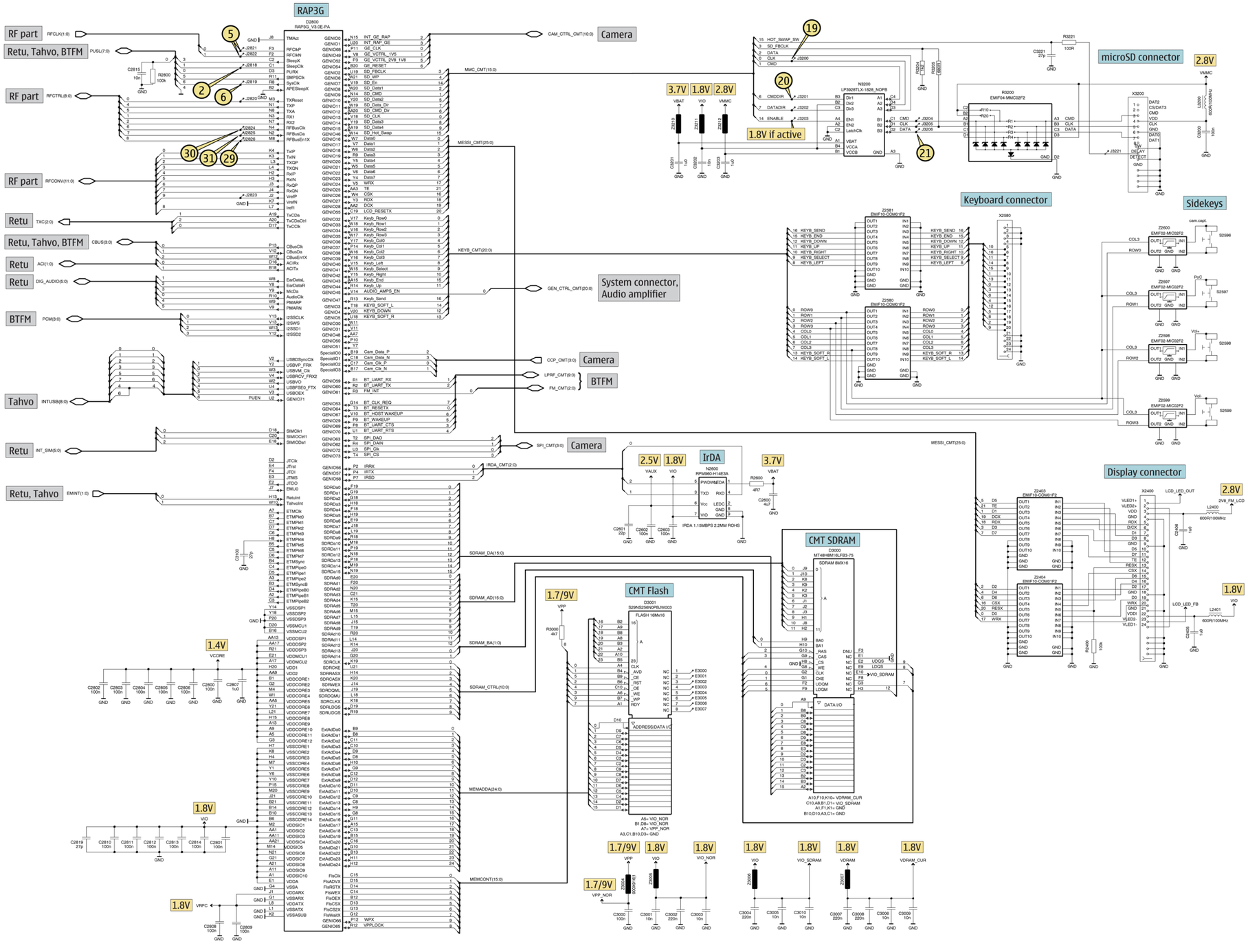
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TAHVO and LED/EL driver



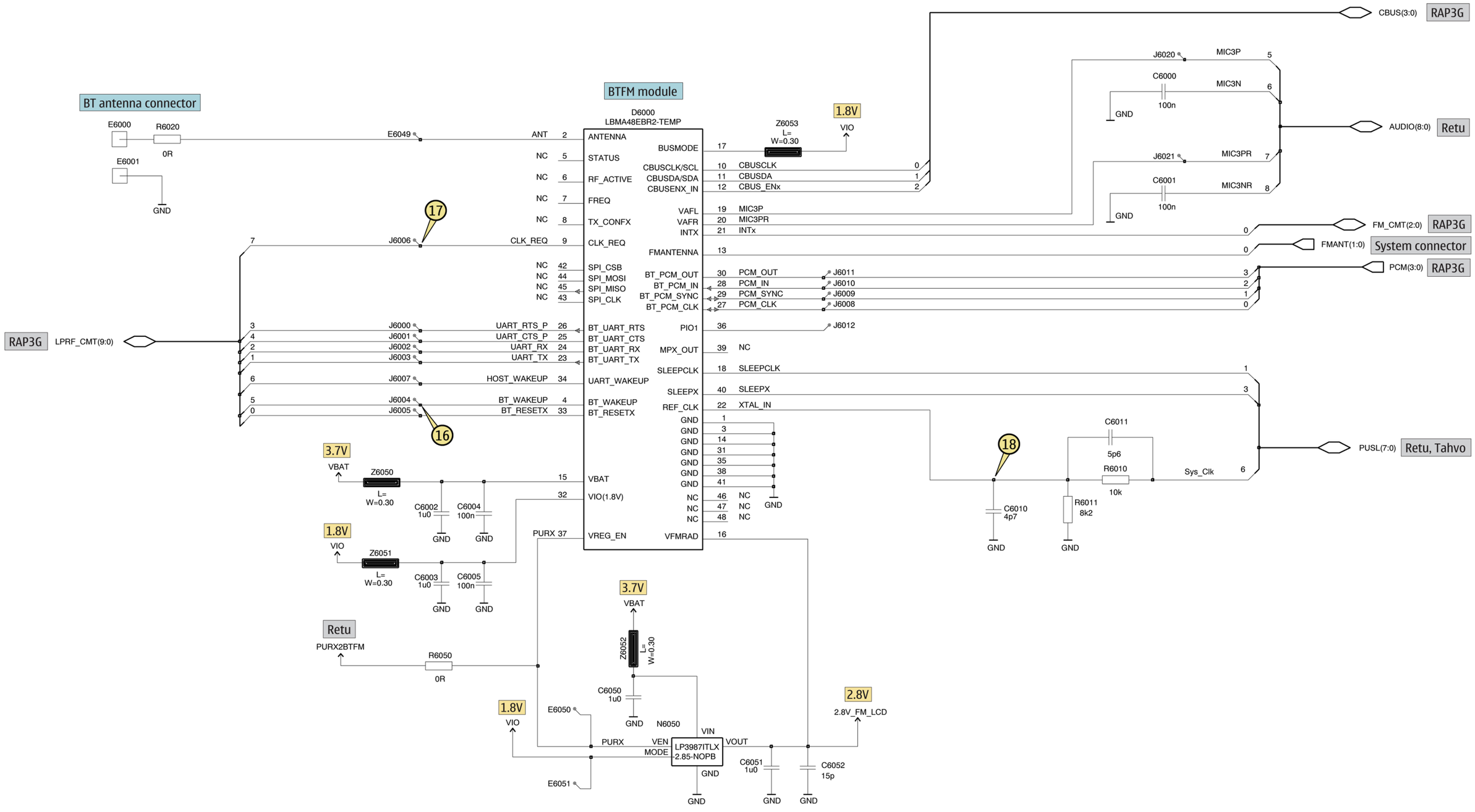
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RAPGSM, Memory, µSD



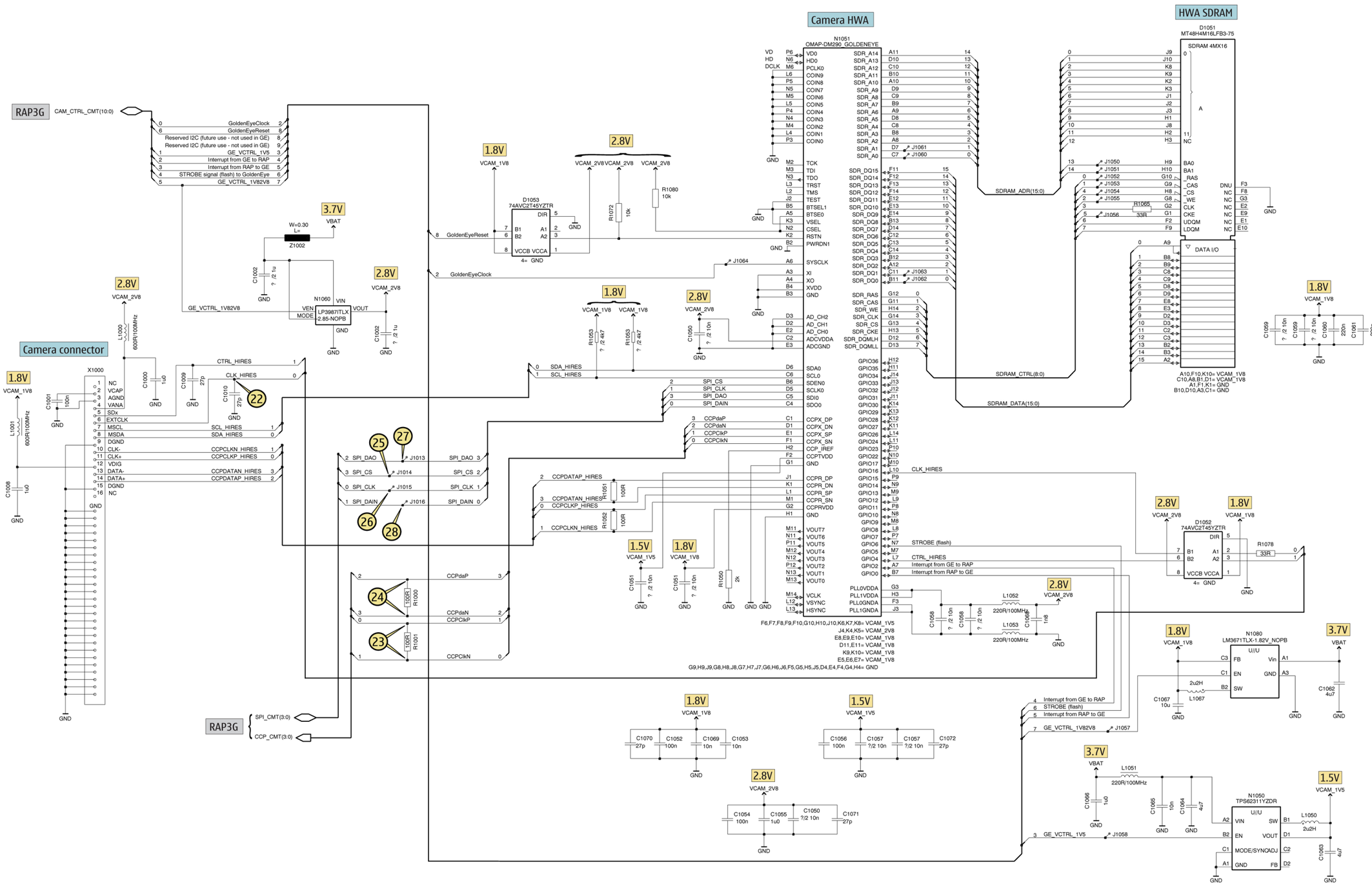
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FM radio, Bluetooth



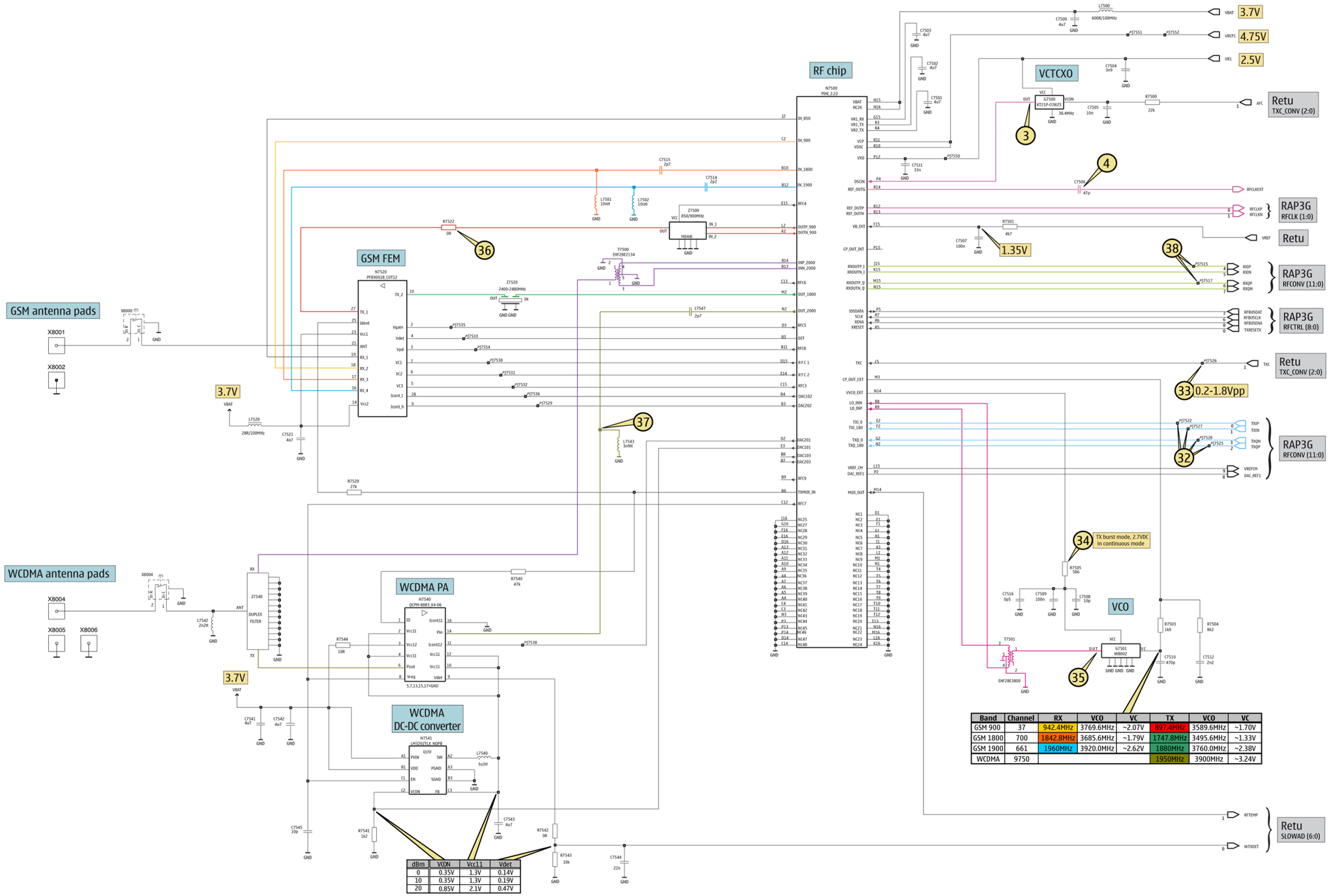
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Camera



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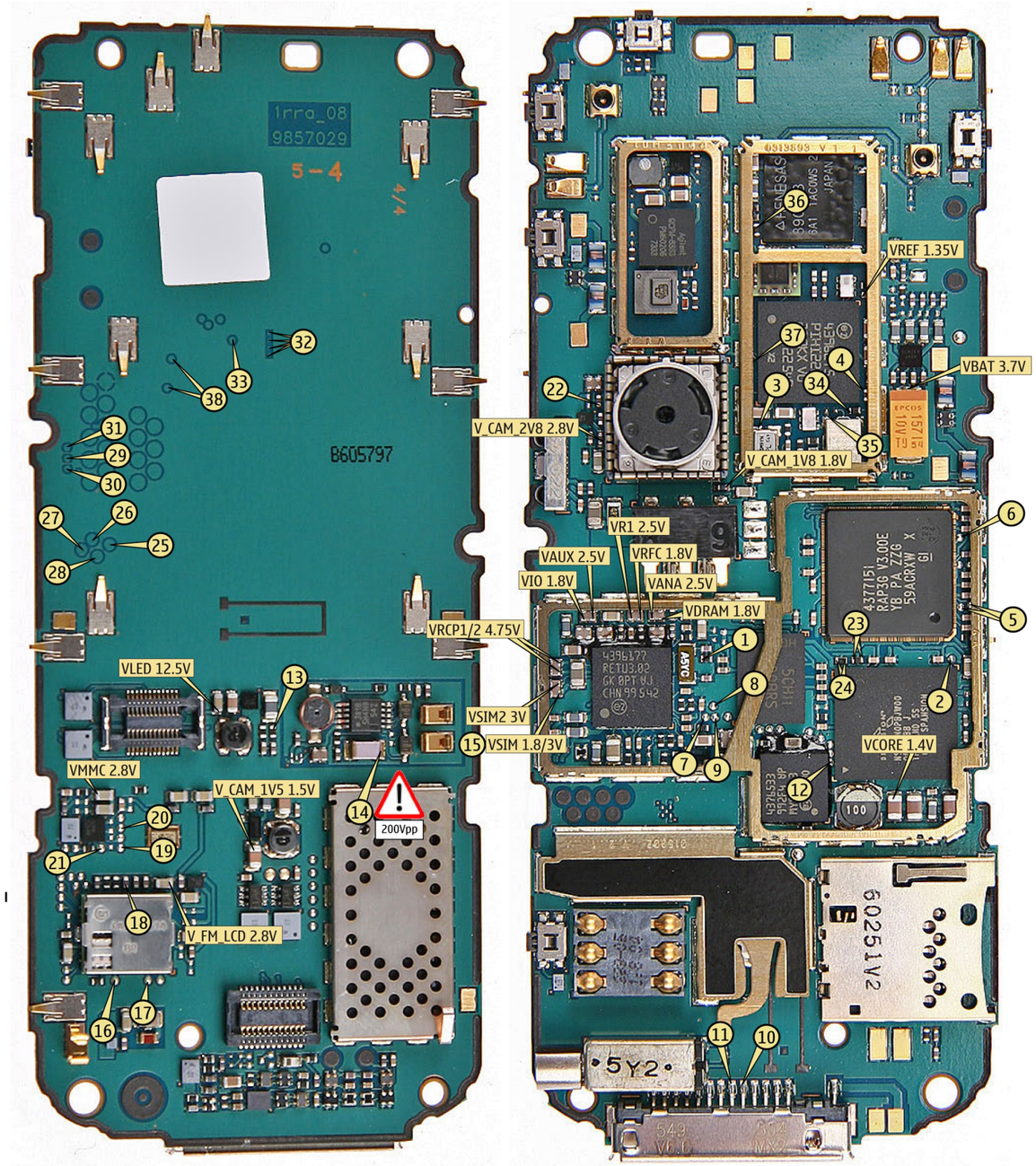
RF part



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Signal overview

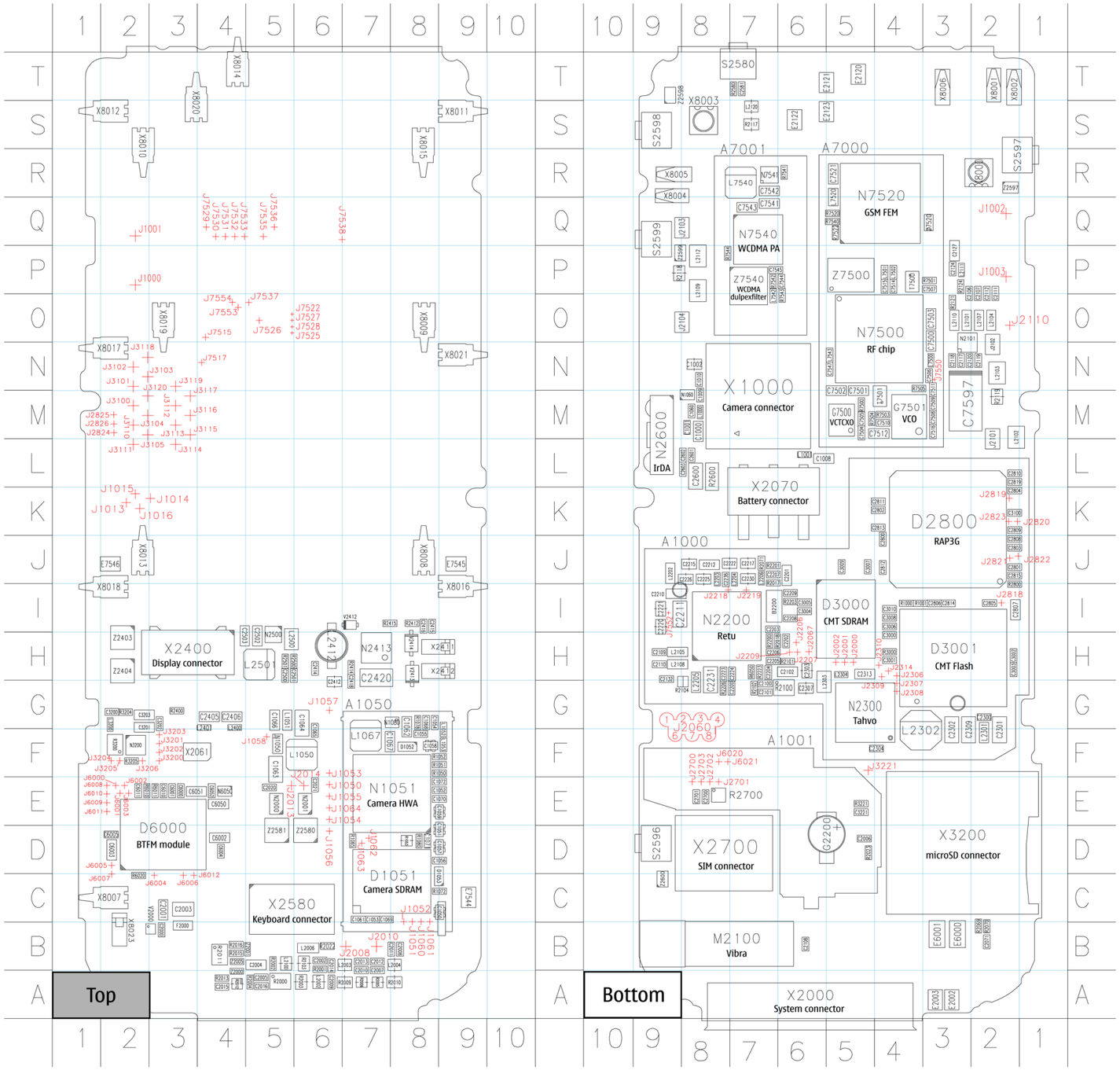
1) 32.768kHz at R2203	2) Sleepclock at J2818	3) G7500 out	4) RFCLKEXT at C7506	5) RFCLK at J2821/J2822
6) SYSCLK at J2819	7) CBUSENA at J2209	8) CBUSCLK at J2206	9) CBUSDATA at J2207	10) USB D+ at X2000
11) USB D- at X2000	12) SMPSCLK at J2308	13) PWM300 at R2500 (50% intensity)	14) VEL at C2420	15) VSIM at C2220
16) BTWAKEUP at J6004	17) BT_CLK_REQ at J6006	18) BT REF_CLK at C6010	19) microSD CLK at J3200	20) microSD CMDDIR at J3201
21) microSD DATA at J3206	22) CLK_HIRES at C1010	23) CCPCLK at R1001	24) CCPData at R1000	25) SPI_CS at J1014
26) SPI_CLK at J1015	27) SPI_DAO at J1013	28) SPI_DAIN at J1016	29) RFBUSENA at J2826	30) RFBUSCLK at J2824
31) RFBUSDATA at J2825	32) TXIQ at J7522/25/27/28	33) TXC at J7526	34) Vcc at R7505 (TX burst mode)	35) G7501 out
36) GSM TX at R7522	37) WCDMA TX at L7543	38) RXIQ at J7515/J7517		



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Component finder

B		C2221	I9	C7504	M5	J2821	J2	L2108	H9	R2102	G7	X8015	S8
B2200	I7	C2222	J8	C7505	M5	J2822	J2	L2109	P8	R2103	B6	X8016	I9
C		C2223	H8	C7506	N3	J2823	K2	L2110	O3	R2104	G8	X8017	N2
C1000	M8	C2224	H7	C7507	P3	J2824	M2	L2111	P3	R2117	S7	X8018	I2
C1001	M8	C2225	J8	C7508	M3	J2825	M2	L2112	P8	R2118	P9	X8019	O3
C1002	N8	C2226	J8	C7509	M3	J2826	M2	L2120	S7	R2119	M2	X8020	S3
C1008	L6	C2230	J7	C7510	M4	J3100	M2	L2202	J9	R2121	O3	X8021	N9
C1009	M8	C2231	H8	C7511	N3	J3101	N2	L2203	J8	R2124	P3	X8023	B2
C1010	N8	C2236	J8	C7512	M4	J3102	N2	L2204	J7	R2200	H7	Z	
C1050	C9	C2300	G2	C7514	P4	J3103	N2	L2205	G8	R2201	J7	Z1002	N8
C1051	D9	C2301	F2	C7515	P4	J3104	M2	L2206	J7	R2203	I6	Z2000	A4
C1052	E9	C2302	F3	C7516	M3	J3105	M2	L2301	F2	R2206	G8	Z2001	B5
C1053	C7	C2303	H6	C7521	R5	J3110	M2	L2302	F4	R2223	H7	Z2005	B4
C1054	G8	C2304	F4	C7541	Q7	J3111	L2	L2303	G6	R2300	K7	Z2210	G7
C1055	F8	C2307	G6	C7542	R7	J3112	M3	L2304	H5	R2400	G3	Z2403	H2
C1056	D9	C2309	F3	C7543	Q7	J3113	M3	L2400	G4	R2412	I8	Z2404	H2
C1057	D9	C2313	H5	C7544	P6	J3114	L3	L2401	G4	R2414	H7	Z2580	D6
C1058	F8	C2405	G4	C7545	P7	J3115	M3	L2412	H6	R2415	I7	Z2581	D5
C1059	E9	C2406	G4	C7547	N5	J3116	M3	L2500	H5	R2500	H6	Z2597	R2
C1060	M8	C2412	G6	C7597	M3	J3117	M3	L2501	H5	R2501	H5	Z2598	T9
C1061	C7	C2414	H6	D		J3118	N2	L3200	G2	R2580	T7	Z2599	P9
C1062	G8	C2415	I8	D1051	C8	J3119	N3	L7500	N3	R2600	L8	Z2600	C9
C1063	F5	C2416	I8	D1052	F8	J3120	M2	L7501	P4	R2700	E8	Z3004	H4
C1064	G6	C2418	G7	D1053	C9	J3200	F3	L7502	P4	R2800	I2	Z3005	H2
C1065	F6	C2420	H7	D2800	K3	J3201	F3	L7520	R5	R3000	H4	Z3006	J6
C1066	G5	C2500	H5	D3000	I5	J3202	F3	L7540	R7	R3200	F2	Z3007	J6
C1067	F7	C2501	H6	D3001	H3	J3203	F3	L7542	O7	R3204	G2	Z3210	G2
C1068	G8	C2502	H5	D6000	D3	J3204	F2	L7543	N5	R3205	F2	Z3211	G3
C1069	C7	C2503	H4	F		J3205	F2	M		R3221	E5	Z3212	G2
C1070	E9	C2581	T7	F2000	B3	J3206	F2	M2100	B7	R6010	E2	Z6050	D4
C1071	D8	C2600	L8	G		J3221	F5	N		R6011	E3	Z6051	E2
C1072	E9	C2601	L8	G2200	D5	J6000	E2	N1050	F5	R6020	C2	Z6052	E4
C2000	B3	C2602	L8	G7500	M5	J6001	E2	N1051	E8	R6050	H7	Z6053	D4
C2001	C3	C2603	L8	G7501	M4	J6002	E2	N1051	E8	R7500	M5	Z7500	P5
C2002	B6	C2700	E8	J		J6003	E2	N1060	M8	R7501	P3	Z7520	Q3
C2003	C3	C2701	E8	J1000	P2	J6004	C3	N1080	G8	R7503	M4	Z7540	P7
C2004	B5	C2800	J4	J1001	Q2	J6005	D2	N2000	E5	R7504	M5		
C2005	A5	C2801	J2	J1002	Q2	J6006	C3	N2001	E6	R7505	N4		
C2006	D5	C2802	K4	J1003	P2	J6007	C2	N2101	N3	R7520	Q5		
C2007	B7	C2803	J2	J1013	K2	J6008	E2	N2200	I8	R7522	Q5		
C2008	B8	C2804	K2	J1014	K3	J6009	E2	N2300	G5	R7540	Q5		
C2009	A6	C2805	I2	J1015	K2	J6010	E2	N2300	G5	R7541	R6		
C2010	B7	C2806	I3	J1016	K2	J6011	E2	N2413	H7	R7542	P7		
C2011	B8	C2807	I2	J1050	E6	J6012	C3	N2500	H5	R7543	O6		
C2012	B7	C2808	J2	J1051	C8	J6020	F8	N2600	M9	R7544	P8		
C2013	B7	C2809	K2	J1052	C8	J6021	F8	N3200	F2	S			
C2014	B6	C2810	L2	J1053	F6	J7515	O4	N6050	E4	S2580	T7		
C2015	A4	C2811	K4	J1054	E6	J7517	N4	N7500	O4	S2596	D9		
C2016	A5	C2812	J4	J1055	E6	J7522	O5	N7520	Q4	S2597	R2		
C2020	E5	C2813	K4	J1056	D6	J7525	O5	N7540	Q7	S2598	S9		
C2021	E6	C2814	I3	J1057	G6	J7526	O5	N7541	R7	S2599	Q9		
C2071	B2	C2815	J2	J1058	F5	J7527	O5	R		T			
C2100	G7	C2819	L2	J1060	C8	J7528	O5	R1000	I4	T7500	P4		
C2101	G7	C3000	H4	J1061	C8	J7529	Q4	R1001	I4	T7501	M4		
C2102	H6	C3001	H4	J1062	D7	J7530	Q4	R1050	F9	V			
C2106	P3	C3002	H2	J1063	D7	J7531	Q4	R1051	F9	V2000	B3		
C2107	P2	C3003	H2	J1064	E6	J7532	Q4	R1052	F9	V2412	I7		
C2108	B6	C3004	I6	J2000	H5	J7533	Q4	R1053	D8	V2413	H8		
C2109	H9	C3005	I6	J2001	H5	J7535	Q5	R1065	D7	V2414	H8		
C2110	H9	C3006	I4	J2002	H5	J7536	Q5	R1072	C9	X			
C2111	P2	C3007	J5	J2008	B7	J7537	O5	R1078	G8	X1000	M7		
C2112	P2	C3008	I4	J2010	B7	J7538	Q6	R1080	D8	X2000	A6		
C2117	N3	C3009	J5	J2013	E5	J7550	N3	R2000	A5	X2061	F3		
C2118	N3	C3010	I4	J2014	E6	J7552	I9	R2001	B6	X2070	K7		
C2119	N2	C3100	K2	J2060	G8	J7553	O4	R2002	B5	X2400	H3		
C2120	N3	C3200	G2	J2067	H6	J7554	O4	R2003	A6	X2411	H8		
C2124	P3	C3201	G2	J2110	O2	L		R2004	A5	X2412	H8		
C2127	P3	C3202	G3	J2206	H6	L1000	M8	R2005	A7	X2580	C5		
C2132	H9	C3203	G2	J2207	H6	L1001	L6	R2006	A7	X2700	D8		
C2200	G7	C3221	E5	J2209	H6	L1050	F6	R2009	A7	X3200	D3		
C2201	J6	C6000	E3	J2218	I8	L1051	G5	R2010	A8	X8000	R2		
C2202	H6	C6001	E3	J2219	I7	L1052	F9	R2011	B4	X8001	T2		
C2203	I7	C6002	D4	J2306	H4	L1053	F9	R2012	A4	X8002	T2		
C2204	H7	C6003	D2	J2307	G4	L1067	F7	R2013	A4	X8003	S8		
C2205	H7	C6004	D4	J2308	G4	L2002	A6	R2015	B4	X8004	R9		
C2206	H7	C6005	D2	J2309	H4	L2003	B7	R2016	B4	X8005	R9		
C2207	J7	C6010	E3	J2310	H4	L2004	B8	R2017	J7	X8006	T3		
C2208	I6	C6011	E2	J2314	H4	L2006	B6	R2018	H7	X8007	C2		
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C2217	J7	C7502	M5	J2819	K2	L2105	H9	R2100	G6	X8013	J2		
C2220	I9	C7503	O3	J2820	K2	L2107	O2	R2101	H6	X8014	T4		



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Glossary

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

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DPLL	Digital Phase Locked Loop
DSP	Digital Signal Processor
DtoS	Differential to Single ended
EDGE	Enhanced data rates for global/GSM evaluation
EGSM	Extended GSM
EM	Energy management
EMC	Electromagnetic compability
EMI	Electromagnetic interference
ESD	Electrostatic discharge
FCI	Functional cover interface
FPS	Flash Programming Tool
FR	Full rate
FSTN	Film compensated super twisted nematic
GND	Ground, conductive mass
GPIB	General-purpose interface bus
GPRS	General Packet Radio Service
GSM	Group Special Mobile/Global System for Mobile communication
HF	Hands free
HFCM	Handsfree Common
HS	Handset
HSCSD	High speed circuit switched data (data transmission connection faster than GSM)
HW	Hardware
I/O	Input/Output
IBAT	Battery current
IC	Integrated circuit
ICHAR	Charger current
IF	Interface
IHF	Integrated hands free
IMEI	International Mobile Equipment Identity
IR	Infrared
IrDA	Infrared Data Associasion
ISA	Intelligent software architecture
JPEG/JPG	Joint Photographic Experts Group
LCD	Liquid Crystal Display
LDO	Low Drop Out
LED	Light-emitting diode

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LPRF	Low Power Radio Frequency
MCU	Micro Controller Unit (microprocessor)
MCU	Multiport control unit
MIC, mic	Microphone
MIDP	Mobile Information Device Profile
MIN	Mobile identification number
MIPS	Million instructions per second
MMC	Multimedia card
MMS	Multimedia messaging service
NTC	Negative temperature coefficient, temperature sensitive resistor used as a temperature sensor
OMA	Object management architechture
OMAP	Operations, maintenance, and administartion part
Opamp	Operational Amplifier
PA	Power amplifier
PDA	Pocket Data Application
PDA	Personal digital assistant
PDRAM	Program/Data RAM (on chip in Tiku)
Phoenix	Software tool of DCT4.x
PIM	Personal Information Management
PLL	Phase locked loop
PM	(Phone) Permanent memory
PUP	General Purpose IO (PIO), USARTS and Pulse Width Modulators
PURX	Power-up reset
PWB	Printed Wiring Board
PWM	Pulse width modulation
RC-filter	Resistance-Capacitance filter
RF	Radio Frequency
RF PopPort TM	Reduced function PopPortTM interface
RFBUS	Serial control Bus For RF
RSK	Right Soft Key
RS-MMC	Reduced size Multi Media Card
RSSI	Receiving signal strength indicator
RST	Reset Switch
RTC	Real Time Clock (provides date and time)
RX	Radio Receiver

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SARAM	Single Access RAM
SAW filter	Surface Acoustic Wave filter
SDRAM	Synchronous Dynamic Random Access Memory
SID	Security ID
SIM	Subscriber Identity Module
SMPS	Switched Mode Power Supply
SNR	Signal-to-noice ratio
SPR	Standard Product requirements
SRAM	Static random access memory
STI	Serial Trace Interface
SW	Software
SWIM	Subscriber/Wallet Identification Module
TCXO	Temperature controlled Oscillator
Tiku	Finnish for Chip, Successor of the UPP, Official Tiku3G
TX	Radio Transmitter
UART	Universal asynchronous receiver/transmitter
UEME	Universal Energy Management chip (Enhanced version)
UEMEK	See UEME
UI	User Interface
UPP	Universal Phone Processor
UPP_WD2	Communicator version of DCT4 system ASIC
USB	Universal Serial Bus
VBAT	Battery voltage
VCHAR	Charger voltage
VCO	Voltage controlled oscillator
VCTCXO	Voltage Controlled Temperature Compensated Crystal Oscillator
VCXO	Voltage Controlled Crystal Oscillator
Vp-p	Peak-to-peak voltage
VSIM	SIM voltage
WAP	Wireless application protocol
WD	Watchdog
XHTML	Extensible hypertext markup language
Zocus	Current sensor, (used to monitor the current flow to and from the battery)

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